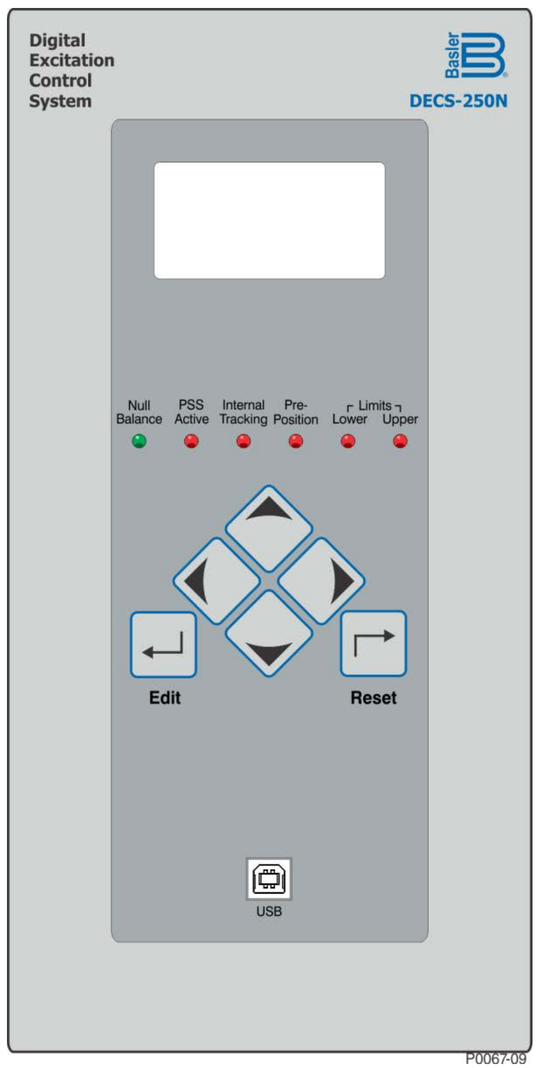
INSTRUCTION MANUAL

FOR

DIGITAL EXCITATION CONTROL SYSTEM

DECS-250N



Basler Electric

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Preface

This instruction manual provides information about the installation and operation of the DECS-250N Digital Excitation Control System. To accomplish this, the following information is provided:

- General Information
- Human-Machine Interface
- Functional Description
- Installation
- BESTCOMS*Plus*® Software
- Setup
- Communication Protocols
- Maintenance
- Specifications
- Expansion Modules

Warning!
To avoid personal injury or equipment damage, only qualified personnel should perform the procedures in this manual.

NOTE
Be sure that the device is hard-wired to earth ground with no smaller than 12 AWG (3.3 mm^2) copper wire attached to the case ground terminal. When the device is configured in a system with other devices, a separate lead should be connected from the ground bus to each device. Current transformer (CT) grounding should be applied in accordance with local codes and conventions.

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Contents

Introduction

DECS-250N Digital Excitation Control Systems offer precise excitation control and machine protection in a compact package. DECS-250N adaptability to many applications is assured through configurable contact inputs and outputs, flexible communication capabilities, and programmable logic implemented with the provided BESTCOMS*Plus*® software.

Features and Functions

DECS-250N features and functions include:

- Five excitation control modes:
    - Automatic Voltage Regulation (AVR)
    - Field Current Regulation (FCR)
    - Field Voltage Regulation (FVR)
    - Power Factor Regulation (PF)
    - Var Regulation (var)
- Three pre-position setpoints for each excitation control mode
- Internal tracking between operating mode setpoints and external tracking of a second DECS excitation setpoint
- Two PID stability groups with Auto Tune feature
- Remote setpoint control input accepts analog voltage or current control signal
- Real-time metering
- Optional automatic synchronizer
- Optional integrated power system stabilizer (PSS)
    - Generator or motor control modes, accommodates phase rotation changes between modes
    - Speed and power sensing or speed-only sensing
    - Two wattmeter or three-wattmeter methods of power measurement
- Soft start and voltage buildup control
- Five limiting functions:
    - Overexcitation: summing point and takeover
    - Underexcitation
    - Stator current
    - Reactive power (var)
    - Underfrequency
- Twenty protection functions:
    - Generator undervoltage (27)
    - Generator overvoltage (59)
    - Loss of sensing (LOS)
    - Overfrequency (81O)
    - Underfrequency (81U)
    - Reverse power (32R)
    - Loss of excitation (40Q)
    - Field overvoltage
    - Field overcurrent
    - Loss of PMG
    - Exciter diode failure
    - Sync-check (25)
    - Eight configurable protection elements
- IRIG or network time synchronization
- Sixteen contact sensing inputs
    - Two fixed-function inputs: Start and Stop
    - Fourteen programmable inputs

- Twelve contact outputs
  - One, fixed-function output: Watchdog (SPDT configuration)
  - Eleven programmable outputs
- Flexible communication
  - Serial communication through front-panel USB port
  - Modbus communication through RS-485 port or Modbus TCP
  - Ethernet communication through an optional copper or fiber optic port
  - CAN communication with an ECU (engine control unit), optional AEM-2020 Analog Expansion Module, or optional CEM-2020 Contact Expansion Module
  - Optional PROFIBUS communication protocol
- Data logging, sequence of events recording, and trending
- Optional CEM-2020 Contact Expansion Module provides:
  - Ten contact inputs
  - Eighteen contact outputs (CEM-2020H) or 24 contact outputs (CEM-2020)
  - Customizable input and output functions assigned through BESTlogic™*Plus* programmable logic
  - Communication via CAN protocol
- Optional AEM-2020 Analog Expansion Module provides:
  - Eight analog inputs
  - Eight resistive thermocouple device (RTD) inputs
  - Two thermocouple inputs
  - Four analog outputs
  - Customizable input and output functions assigned through BESTlogic*Plus* programmable logic
  - Communication via CAN protocol

Application

The DECS-250N is intended for synchronous generator applications where the DECS-250N controls the generator output through the application of regulated excitation power to the field. It provides regulated dc excitation power based on the monitored generator voltage and current and a regulation setpoint established by the user.

Excitation power is supplied from the DECS-250N by means of a six-SCR, full-wave bridge. It is capable of two-quadrant operation; it can produce negative as well as positive output power. With nominal operating voltage applied, the DECS-250N is capable of supplying 20 Adc continuously at a nominal voltage of 32, 63, or 125 Vdc.

Package

A single, compact package contains all excitation control and power components.

A front panel HMI provides local annunciation and control through a backlit liquid crystal display (LCD), light-emitting diodes (LEDs), and pushbuttons. Remote annunciation and control is provided through a flexible communication interface which accommodates Ethernet, Modbus, optional PROFIBUS, and the optional Interactive Display Panel (IDP-800).

Optional Features and Capabilities

DECS-250N optional features and capabilities are defined by a combination of letters and numbers that make up the style number. The model number and style number describe options and characteristics in a specific device and appear on a label affixed to the device.

Style Number

The style number identification chart in Figure 1 defines the electrical characteristics and operational features available in the DECS-250N.

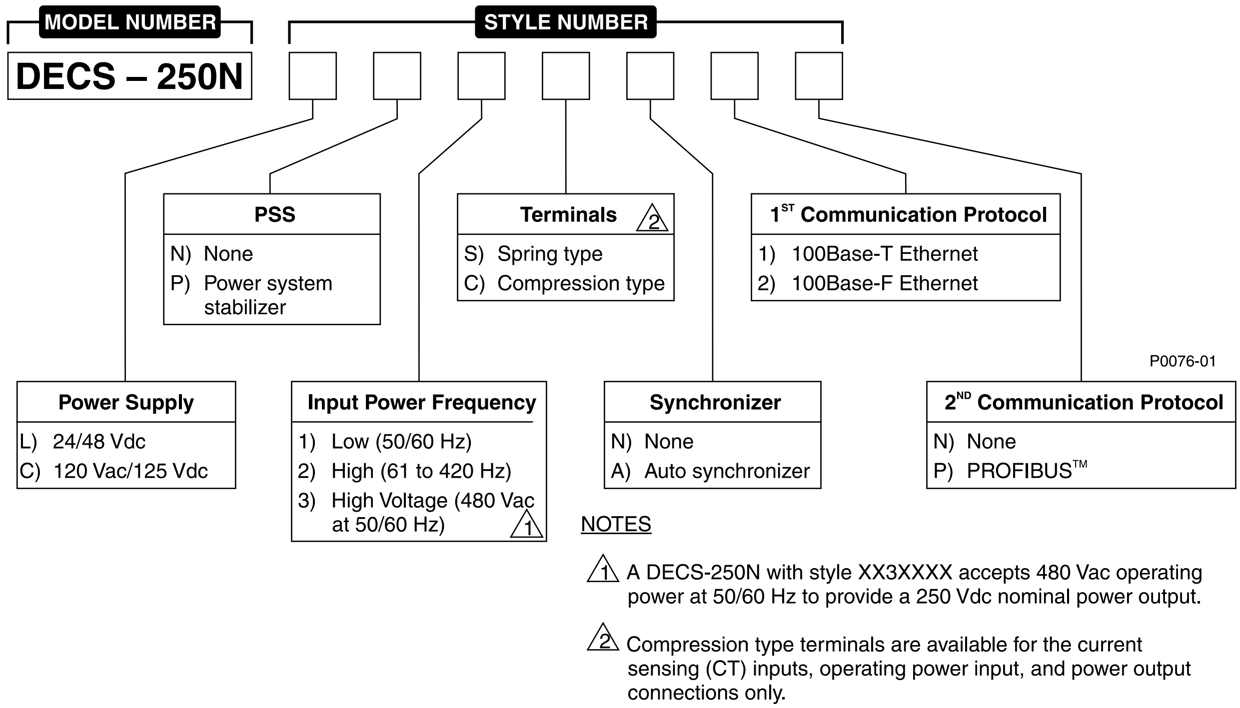


Figure 1. DECS-250N Style Chart

Storage

If a DECS-250N will not be placed in service right away, store it in the original shipping carton in a moisture- and dust-free environment. The temperature of the storage environment must be within the range of –40 to 85°C (–40 to 185°F).

Electrolytic Capacitor Considerations

The DECS-250N contains long-life aluminum electrolytic capacitors. For a DECS-250N kept in storage as a spare, the life of these capacitors can be maximized by energizing the device for 30 minutes once per year. Refer to the energizing procedures provided in *Maintenance*.

Controls and Indicators

All controls and indicators are located on the front panel and consist of pushbuttons, LED indicators, and a liquid-crystal display (LCD).

Front Panel Illustration and Description

DECS-250N controls and indicators are illustrated in Figure 2 and described in Table 1. The locators and descriptions of Table 1 correspond to the locators shown in Figure 2.

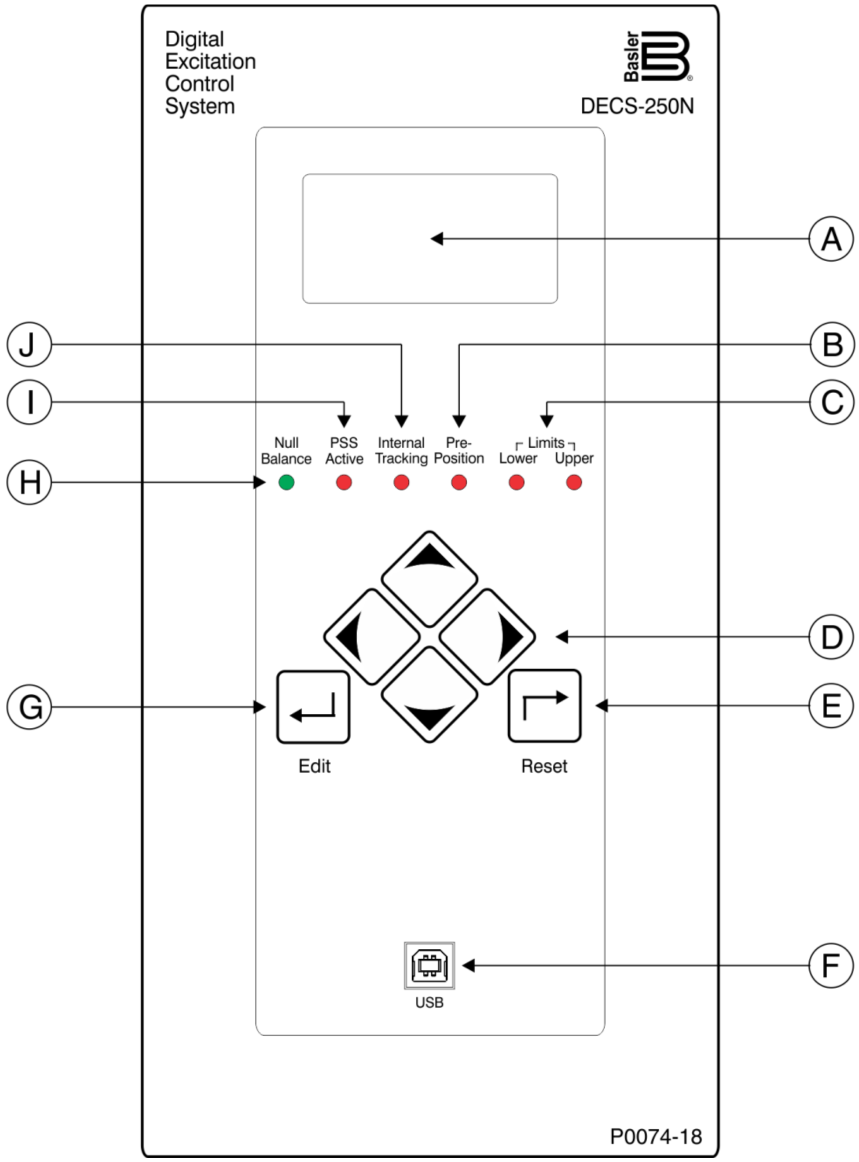


Figure 2. Front Panel Controls and Indicators

Table 1. Front Panel Control and Indicators Descriptions

Locator	Description
A	*Display.* The liquid crystal display (LCD) serves as a local source of information provided by the DECS-250N. The LCD displays operating setpoints, loop gains, metering, protection functions, system parameters, and general settings. The 128 by 64 dot pixel, backlit LCD displays white characters on a blue background.
B	*Pre-Position Indicator.* This red light emitting diode (LED) lights when the active mode setpoint is at any of the three pre-position (predefined) settings.
C	*Limit Indicators.* Two red LEDs indicate when the active mode setpoint reaches the minimum or maximum value.
D	*Scrolling Pushbuttons.* These four buttons are used to scroll up, down, left, and right through the menus displayed on the LCD (locator A). During an editing session, the left and right scrolling pushbuttons select the variable to be changed and the up and down scrolling pushbuttons change the value of the variable.
E	*Reset Pushbutton.* This button cancels editing sessions, resets alarm annunciations and latched alarm relays, and can be used for quick access to the metering screen.
F	*Communication Port.* This type B USB jack connects the DECS-250N with a PC operating BESTCOMS*Plus*® for local communication. BESTCOMS*Plus* is supplied with the DECS-250N. **Caution** In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.
G	*Edit Pushbutton.* Pressing this button starts an editing session and enables changes to DECS-250N settings. At the conclusion of the editing session, the Edit pushbutton is pressed to save the settings changes.
H	*Null Balance Indicator.* This green LED lights when the setpoint of the inactive operating modes (AVR, FCR, FVR, var, and PF) match the setpoint of the active mode.
I	*PSS Active Indicator.* This red LED lights when the integrated power system stabilizer is enabled and can generate a stabilizing signal in response to a power system disturbance.
J	*Internal Tracking Indicator.* This red LED lights when any inactive mode (AVR, FCR, FVR, Var, or Power Factor) is tracking the setpoint of the active mode to achieve a “bumpless” transfer when changing active modes.

Menu Navigation

The DECS-250N provides local access to DECS-250N settings and metering values through a menu structure displayed on the front panel LCD. An overview of the menu structure is illustrated in Figure 3. Movement through the menu structure is achieved by pressing the four scrolling pushbuttons.

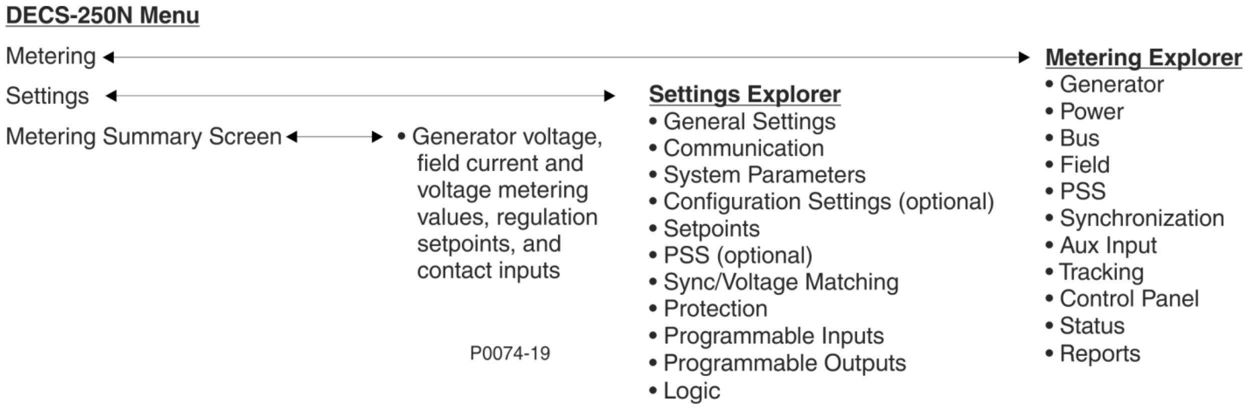


Figure 3. Menu Structure Overview

Adjusting Settings

A setting adjustment is made at the front panel by performing the following steps.

1. Navigate to the screen listing the setting to be changed.
2. Press the Edit button and enter the appropriate username and password to gain the needed level of security access. (Information about implementing and using username and password protection is provided in the *Security* section of this manual.)
3. Highlight the desired setting and press the Edit button to view the setting editing screen. This screen lists the setting range or the permissible setting selection.
4. Use the scrolling pushbuttons to select the setting digits/selections and adjust/change the setting.
5. Press the Edit button to save the change.

Display Setup

BESTCOMS*Plus*® Navigation Path: Settings Explorer, General Settings, Front Panel HMI

HMI Navigation Path: Settings, General Settings, Front Panel HMI

Front panel display appearance and behavior can be customized to meet user preferences and site conditions. These BESTCOMS*Plus* settings are illustrated in Figure 4.

LCD

LCD setup includes a contrast adjustment[A] to suit the viewing angle used or compensate for environmental conditions. The ability to reverse the display colors[B] is provided to accommodate lighting conditions and user preferences.

Sleep Mode

Sleep mode[C] reduces the demand on control power by turning off the LCD backlight when no pushbutton activity is seen for the duration of the LCD Backlight Timeout setting[D].

Language

Language modules are available for the DECS-250N. Once a language module is implemented it can be enabled via the Language Selection setting[E].

Screen Scrolling

The display can be set to automatically scroll through a user-selected list[F] of metered values. This feature is enabled and disabled with the Enable Scroll setting[G]. The rate at which scrolling occurs is configured with the Scroll Time Delay setting[H].

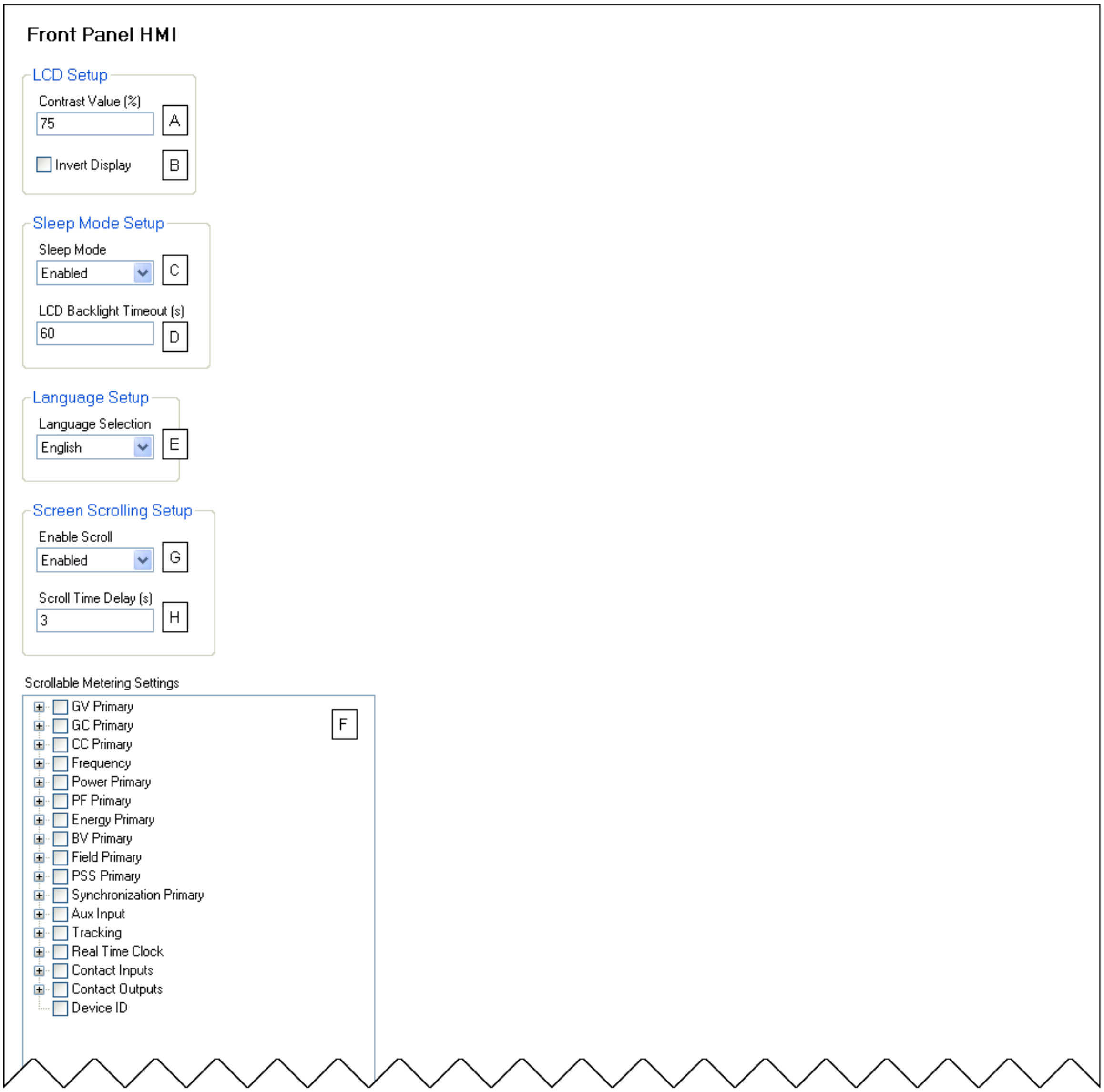


Figure 4. Front Panel HMI Settings

[A] *Contrast Value (%):* Adjustable from 0 to 100 in 1% increments.
[B] *Invert display:* Deselect for white characters on a blue background. Select for blue characters on a white background.
[C] *Sleep Mode:* Enable or disable.
[D] *LCD Backlight Timeout:* Adjustable from 0 to 120 seconds in 1 second increments.
[E] *Language Selection:* Select English, Russian, Spanish, or German.
[F] *Scrollable Metering Settings:* Select from main categories of GV Primary, GC Primary, CC Primary, Frequency, Power Primary, PF Primary, Energy Primary, BV Primary, Field Primary, PSS Primary, Synchronization Primary, Aux Input, Tracking, Real Time Clock, Contact Inputs, Contact Outputs, or Device ID. Follow this selection by the desired parameters within each category.
[G] *Enable Scroll:* Enable or disable.
[H] *Scroll Time Delay (s):* Adjustable from 1 to 600 seconds in 1 second increments.

Power Inputs

Power is applied to two separate inputs: control power and operating power. The control power input supplies power to an internal power supply that provides power for logic, protection, and control functions. The power stage uses the operating power input as the source for the converted excitation power that it applies to the field.

Control Power

Two inputs supply the DECS-250N with control power. One input accepts dc control power and the other input accepts ac control power. The level of acceptable control power voltage is determined by the style number. One of two levels is possible. Style Lxxxxxx indicates a nominal voltage of 24 or 48 Vdc and accepts a voltage range of 16 to 60 Vdc. Style Cxxxxxx indicates a nominal voltage of 120 Vac/125 Vdc and accepts a voltage range of 90 to 150 Vdc and 82 to 132 Vac (50/60 Hz). One input (either dc or ac) is sufficient for operation but two inputs provide redundancy (for style Cxxxxxx only). When both control power inputs are used, an isolation transformer is required for the ac input. DC control power is applied at terminals BATT+ and BATT–. AC control power is applied at terminals L and N.

Operating Power

Operating power is applied at terminals A, B, and C. To achieve the desired level of excitation, the appropriate operating power input voltage must be applied. Table 2 lists the acceptable operating power voltage ranges for the DECS-250N. The operating power frequency range for the DECS-250N is listed in Table 3.

Table 2. DECS-250N Operating Power Specifications

Desired Nominal Excitation Power Voltage	Applied Operating Power Voltage Range
63 Vdc	100 to 139 Vac
125 Vdc	190 to 277 Vac
250 Vdc	380 to 528 Vac, 50/60 Hz (style xx3xxxx)

Table 3. DECS-250N Operating Power Frequency Specifications

DECS-250N Style Number	Operating Power Frequency Range
xx1xxxx	50/60 Hz
xx2xxxx	61 to 420 Hz
xx3xxxx	50/60 Hz (480 Vac input, 250 Vdc output)

Power Stage

The power stage supplies regulated dc excitation power to the field of a brushless exciter. Excitation power is supplied at terminals F+ and F–.

DECS-250N power stage operating power accepts single- or three-phase ac power from a transformer or PMG. Power Stage operating power is applied at terminals A, B, and C. The GND terminal serves as a ground connection.

The DECS-250N power stage employs a six-SCR, full-wave bridge that converts the ac operating power input into dc excitation power. It is capable of two-quadrant operation; it can produce negative as well as positive output power as long as positive current is flowing in the machine field (in excess of the minimum holding current required for the SCRs). The DECS-250N power stage is capable of supplying 20 Adc continuously at nominal voltages of 63, 125, or 250 Vdc.

Nominal DECS-250N operating power levels include 480 Vac for a 250 Vdc continuous exciter field requirement (style XX3XXXX), 240 Vac for a 125 Vdc requirement, or 120 Vac for a 63 Vdc requirement. The frequency range of the operating power voltage is determined by the DECS-250N style number. Style XX1XXXX indicates an operating power frequency of 50 to 60 hertz, style XX2XXXX indicates a frequency of 61 to 420 hertz, and style XX3XXXX limits the frequency to 50 or 60 hertz (for an operating voltage of 480 Vac).

Field Transient Protection

Fault conditions such as generator overloading or loss of synchronism can induce transients into the field circuit. If this energy is not dissipated, it has the potential to damage the power stage SCRs. The DECS-250N has two modes of field transient protection.

Most voltage transients are less than 150 microseconds in duration and are limited to a safe level by internal DECS-250N components.

During major system faults, an SCR crowbar circuit protects the DECS-250N power stage. When field overvoltage is detected, the power stage SCR firing pulses are blocked, the crowbar circuit is energized, and a crowbar annunciation is made. During a normal shutdown, the same actions are taken but no crowbar annunciation is made.

Inverting Style Excitation System Compatibility

The DECS-250N power stage can be configured for operation in the negative direction to supply the control windings of an inverting style excitation system.

Voltage and Current Sensing

The DECS-250N senses generator voltage, generator current, and bus voltage through dedicated, isolated inputs.

Generator Voltage

Three-phase generator sensing voltage is applied to DECS-250N terminals E1, E2, and E3. This sensing voltage is typically applied through a user-supplied voltage transformer, but may be applied directly. These terminals accept three-phase, three-wire connections at terminals E1 (A), E2 (B), and E3 (C) or single-phase connections at E1 (A) and E3 (C).

The generator voltage sensing input accepts a maximum voltage of 600 Vac and has a burden of less than 1 VA.

The transformer primary and secondary winding voltages are entered in settings that the DECS-250N uses to interpret the applied sensing voltage and calculate system parameters. The phase rotation of the generator sensing voltage can be configured as ABC or ACB. Information about configuring the DECS-250N for the generator sensing voltage is provided in the *Configuration* chapter of this manual.

Typical generator voltage sensing connections are illustrated in Figure 5.

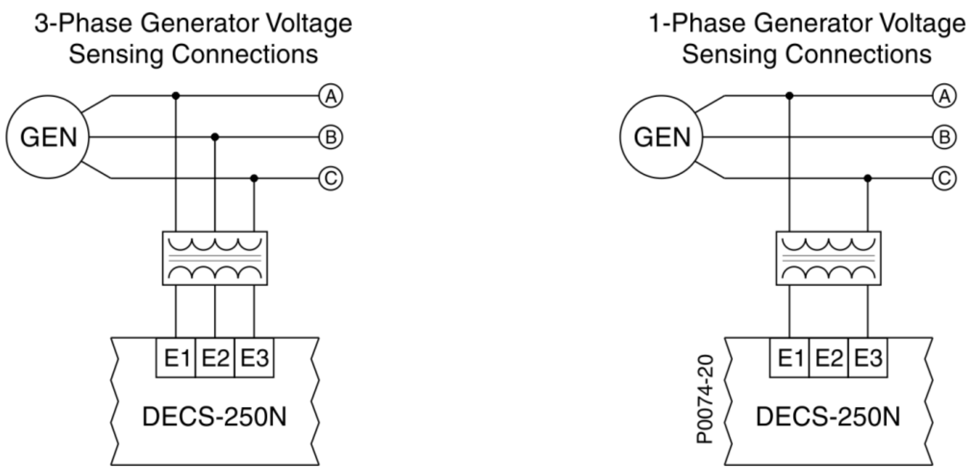


Figure 5. Typical Generator Voltage Sensing Connections

Generator Current

Generator current sensing inputs consist of three phase-sensing inputs and a sensing input for cross-current compensation.

NOTE
Current transformer (CT) grounding should be applied in accordance with local codes and conventions.

Phase Sensing

Three-phase generator sensing current is applied to DECS-250N terminals CTA+ and CTA–, CTB+ and CTB–, and CTC+ and CTC– through user-supplied current transformers (CTs). Single-phase generator sensing current is applied to DECS-250N terminals CTB+ and CTB–. The DECS-250N is compatible with CTs having 5 Aac or 1 Aac nominal secondary ratings. The DECS-250N uses this secondary rating, along with the CT nominal primary ratings to interpret the sensed current and calculate system parameters.

Information about configuring the DECS-250N for the generator sensing voltage is provided in the *Configuration* chapter of this manual. Typical generator phase-current sensing connections are shown in Figure 6.

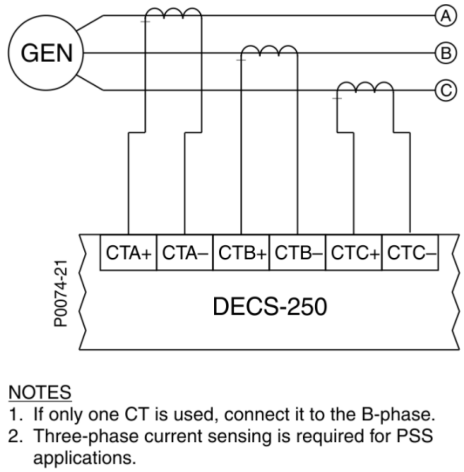


Figure 6. Typical Generator Current Sensing Connections

Cross-Current Compensation

Cross-current compensation (reactive differential) mode allows two or more paralleled generators to share a common load. As shown in Figure 7, each generator is controlled by a DECS-250N using the DECS-250N cross-current compensation input (terminals CCCT+ and CCCT–) and a dedicated, external current transformer (CT) to sense generator current. The resistors shown in Figure 7 are used to set the burden and may be adjusted to suit the application. Ensure that the power rating of the resistors is adequate for the application.

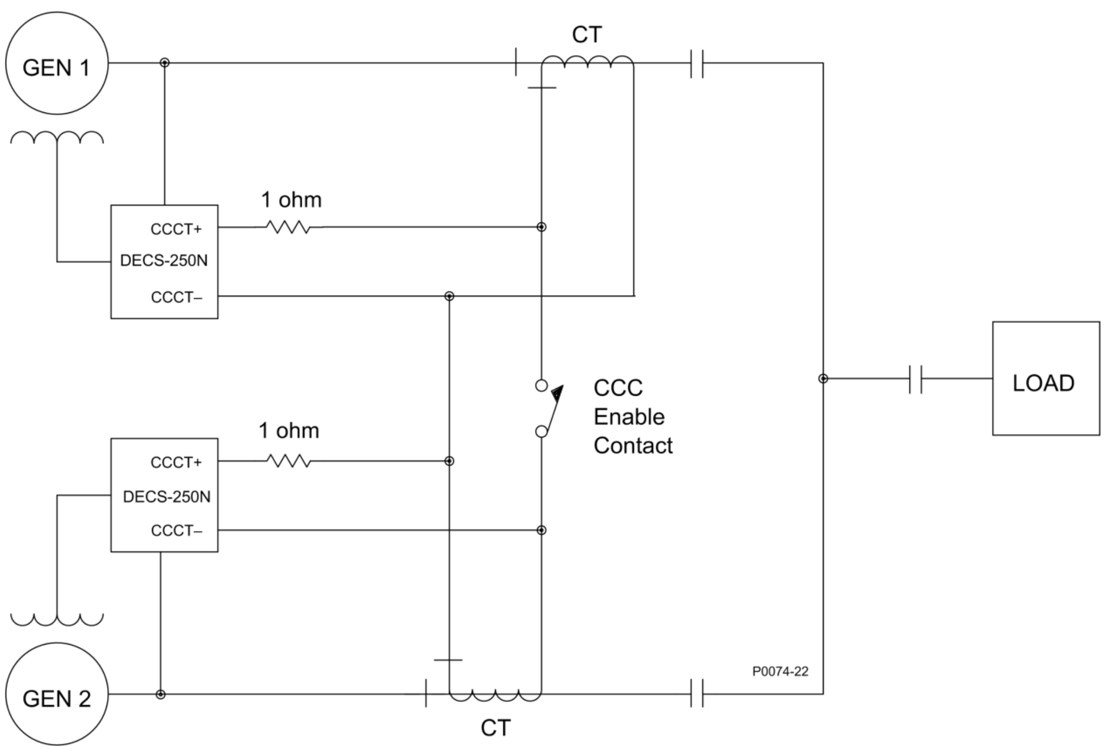


Figure 7. Connections for Cross-Current Compensation

NOTE

If a machine is taken offline, then the secondary winding of that machine's cross-current compensation CT must be shorted. Otherwise, the cross-current compensation scheme will not function.

Bus Voltage

Bus voltage monitoring enables bus failure detection, generator and bus voltage matching, and synchronization of the generator with the utility/bus. These features are discussed in the *Synchronizer* chapter of this manual. Three-phase bus sensing voltage is applied to DECS-250N terminals B1, B2, and B3. This sensing voltage is typically applied through a user-supplied voltage transformer, but may be applied directly. These terminals accept three-phase, three-wire connections at terminals B1 (A), B2 (B), and B3 (C) or single-phase connections at B3 (C) and B1 (A).

The bus voltage sensing input accepts a maximum voltage of 600 Vac and has a burden of less than 1 VA.

The transformer primary and secondary winding voltages are entered in settings that the DECS-250N uses to interpret the applied sensing voltage. Information about configuring the DECS-250N for the bus sensing voltage is provided in the *Configuration* section of this manual.

Typical bus voltage sensing connections are illustrated in Figure 8.

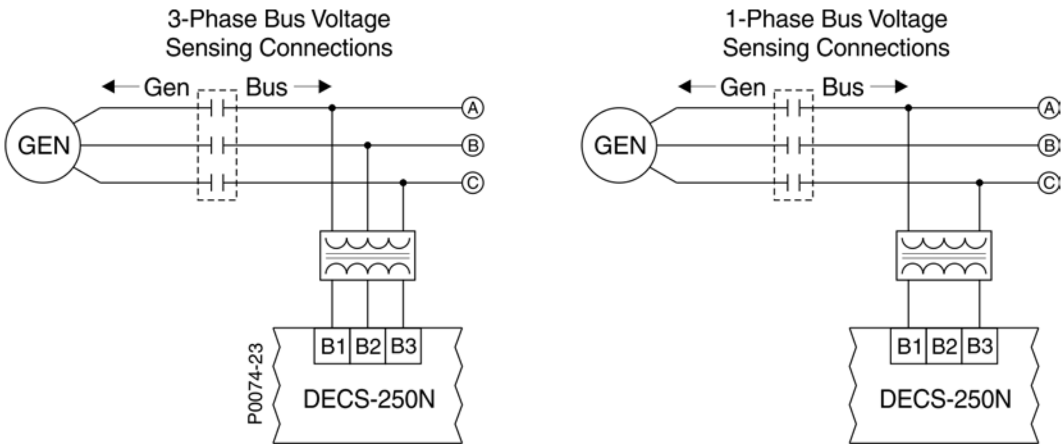


Figure 8. Typical Bus Voltage Sensing Connections

Synchronizer

DECS-250N controllers with a style number of xxxxAxx are equipped with an automatic synchronizer that acts to align the voltage, phase angle, and frequency of the generator with the bus. The synchronizer function includes compensation settings for the generator breaker and bias control settings for the generator governor. Related synchronizer features include voltage matching and bus condition detection.

Generator Synchronization

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Synchronizer/Voltage Matching, Synchronizer
HMI Navigation Path: Settings, Sync/Voltage Matching, Synchronizer

Two modes of generator synchronization are available: phase lock loop and anticipatory[A]. In either mode, the DECS-250N matches the voltage, phase angle, and frequency of the generator with the bus and then connects the generator to the bus by closing the generator breaker. Anticipatory mode has the added capability of compensating for the breaker closing time. (Breaker closing time is the delay between the issuance of a breaker close command and closure of the breaker contacts.) The DECS-250N compensates for the breaker closure time by monitoring the frequency difference between the generator and bus and calculating the advance phase angle required to close the breaker at a zero-degree phase angle.

Frequency Correction

Generator frequency correction is defined by the slip frequency and further refined by the breaker closing angle. The slip frequency setting[B] establishes the maximum allowable deviation of the generator speed (frequency) from the bus frequency. The Min Slip Control Limit setting[C] and Max Slip Control Limit setting[D] are used to calculate the slip frequency error and to provide continuous slip frequency control while in phase lock synchronization. If the slip frequency magnitude is above the Max Slip Control Limit, the error is set equal to the Max Error in the opposite polarity. If the slip frequency magnitude is below the Min Slip Control Limit, the slip frequency error is 0. When it is between the two limits, the error is calculated internally by the DECS-250N. Slip frequency error is shown in Figure 9.

To minimize the impact on the bus during synchronization, the generator frequency can be forced to exceed the bus frequency[E] at the moment of breaker closure. If this is the case, the DECS-250N will drive the generator frequency higher than the bus frequency before closing the breaker. The breaker closing angle setting[F] defines the maximum allowable phase angle difference between the generator and bus. For breaker closure to be considered, the slip angle must remain within this setting for the duration of the sync activation delay[G].

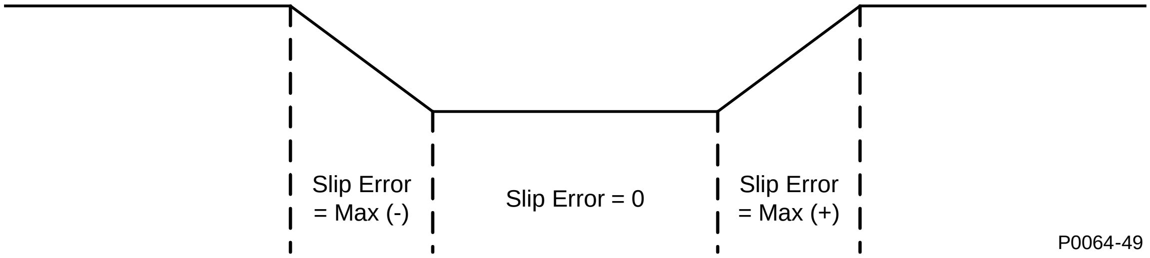


Figure 9. Slip Frequency Error

Voltage Correction

Voltage correction is initiated when the generator voltage is outside the defined voltage window. The voltage window setting[H] is expressed as a percentage of the bus voltage and determines the band of generator voltage surrounding the bus voltage where breaker closure will be considered. Enabling the Vgen>Vbus setting[I] causes the DECS-250N to drive the generator voltage higher than the bus voltage prior to synchronizing. A generator to bus PT matching level[J] setting is provided to compensate for step-up or step-down transformers in the system. The DECS-250N adjusts the sensed generator voltage by this percentage. This setting also appears on the Voltage Matching screen, below. When the value is changed, it is reflected in both places.

Angle Compensation

An angle compensation[K] setting is provided to offset phase shift caused by transformers in the system. The angle compensation value is added only to the bus angle. For example, it is given that the generator and bus are synchronized but the DECS-250N metered slip angle reads –30°. Equation 1, below, illustrates the DECS-250N slip angle calculation. This means that the generator angle is lagging behind the bus angle by 30° due to transformer phase shift. To compensate for this phase shift, the angle compensation setting should contain a value of 330°. This value is added to the metered bus angle resulting in an adjusted slip angle of zero degrees. Only the metered bus angle is affected by the angle compensation setting, the metered generator angle is not biased by the DECS-250N.

$$G - (B + A) = Slip\ Angle$$

Equation 1. DECS-250N Metered Slip Angle

Where:

G = metered generator angle
B = metered bus angle
A = angle compensation value

Failure of Synchronization

Generator synchronization is aborted if generator synchronization fails to occur within a timeframe[L] established by the user.

BESTCOMS*Plus* generator synchronization settings are illustrated in Figure 10.

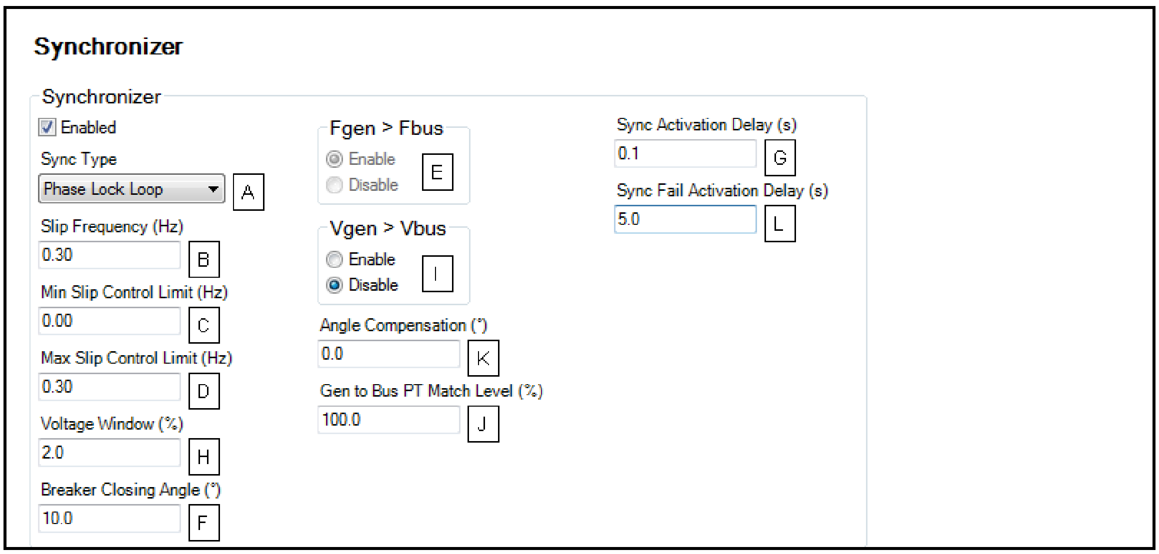


Figure 10. Generator Synchronizer Settings

[A] *Sync Type*: Select Anticipatory or Phase Lock Loop.
[B] *Slip Frequency*: Adjustable from 0.1 to 0.5 Hz in 0.05 Hz increments.
[C] *Min Slip Control Limit:* Adjustable from 0.1 to 2.0 Hz in 0.1 Hz increments.
[D] *Max Slip Control Limit:* Adjustable from 0.1 to 2.0 Hz in 0.1 Hz increments.
[E] *Fgen>Fbus*: Select Enable or Disable.
[F] *Breaker Closing Angle*: Adjustable from 3 to 20° in 0.5° increments.
[G] *Sync Activation Delay*: Adjustable from 0.1 to 0.8 s in 0.1 s increments.
[H] *Voltage Window*: Adjustable from 2 to 15% in 0.5% increments.
[I] *Vgen>Vbus*: Select Enable or Disable.
[J] *Gen to Bus PT Match Level*: Adjustable from 0 to 700% in 0.1% increments.

[K] *Angle Compensation (°)*: Adjustable from 0.0 to 359.9° in 0.1° increments.
[L] *Sync Fail Activation Delay*: Adjustable from 0.1 to 0.8 s in 0.1 s increments.

Voltage Matching

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Synchronizer/Voltage Matching, Voltage Matching

HMI Navigation Path: Settings, Sync/Voltage Matching, Voltage Matching

When enabled[A], voltage matching is active in AVR control mode and automatically adjusts the AVR mode setpoint to match the sensed bus voltage. Voltage matching is based on two parameters: band and matching level.

The voltage matching band[B] defines the window in which the generator voltage must be for voltage matching to occur.

The generator to bus PT matching level[C] defines the percentage of the sensed bus voltage to which the generator sensed voltage will be adjusted.

Voltage matching settings are illustrated in Figure 11.

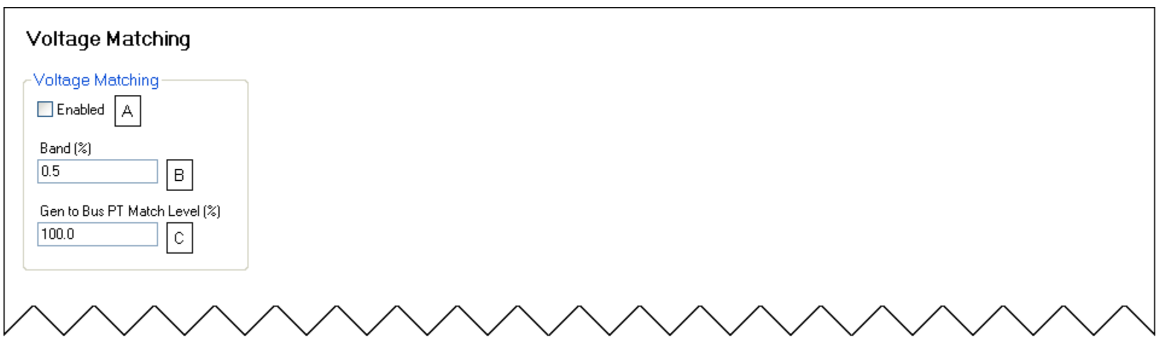


Figure 11. Voltage Matching Settings

[A] *Voltage Matching*: Select Enabled to enable function.
[B] *Band*: Adjustable from 0 to 20% in 0.1% increments.
[C] *Gen to Bus PT Match Level*: Adjustable from 0 to 700% in 0.1% increments.

Breaker Hardware Configuration

BESTCOMS*Plus* Navigation Path: Settings Explorer, Synchronizer/Voltage Matching, Breaker Hardware

HMI Navigation Path: Settings, Sync/Voltage Matching, Breaker Hardware

The DECS-250N can control and monitor a generator breaker. Breaker hardware settings are illustrated in Figure 12.

Breaker Failure

When a close command is issued to the breaker, the DECS-250N monitors the breaker status and annunciates a breaker failure if the breaker does not close within the time defined by the breaker close wait delay[A]. Typically, the wait delay is set to be longer than the actual breaker closing time.

Generator Breaker

The DECS-250N must be configured[B] with the generator breaker characteristics before the breaker can be controlled by the DECS-250N. Breakers controlled by pulse or continuous control inputs[C] are supported. During anticipatory-mode synchronization, if the generator breaker is serving to tie the generator to the bus, the DECS-250N uses the breaker closing time[D] to calculate the optimum time to close the breaker. For a pulse-controlled generator breaker, the breaker open[E] and close[F] pulse times are used by the DECS-250N when issuing open and close commands to the breaker. When setting the pulse times, the open and close times should be set at or longer than the breaker closing time setting.

If desired, breaker closure is possible during a dead bus condition[G] and/or dead generator condition[H].

Caution

Use caution when connecting a "dead" generator to a "dead" bus. Undesired system damage can occur if the bus becomes energized while a "dead" generator is connected to it.

Figure 12. Breaker Hardware Configuration Settings

[A] *Breaker Close Wait Time*: Adjustable from 0.1 to 600 s in 0.1 s increments.
[B] *Gen Breaker*: Select Configured or NOT Configured.
[C] *Contact Type*: Select Pulse or Continuous.
[D] *Breaker Closing Time*: Adjustable from 0 to 800 ms in 5 ms increments.
[E] *Open Pulse Time*: Adjustable from 0.01 to 5 s in 0.01 s increments. Setting is available only when Contact Type is Pulse.
[F] *Close Pulse Time*: Adjustable from 0.01 to 5 s in 0.01 s increments. Setting is available only when Contact Type is Pulse.
[G] *Dead Bus Close*: Select Disabled or Enabled.
[H] *Dean Gen Close Enable*: Select Disabled or Enabled.

Generator and Bus Condition Detection

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Synchronizer/Voltage Matching, Bus Condition Detection

HMI Navigation Path: Settings, Sync/Voltage Matching, Bus Condition Detection

The DECS-250N monitors the voltage and frequency of the generator and bus for determining when a breaker closure is appropriate. Generator and bus condition detection settings are illustrated in Figure 13.

Generator Condition

A dead generator is recognized by the DECS-250N when the generator voltage decreases below the dead generator threshold[A] for the duration of the dead generator activation delay[B].

A failed generator is recognized when the generator voltage or frequency does not meet the established generator stability criteria for the duration of the failed generator activation delay[C]. Generator stability parameters are described in *Generator Stability*.

Generator Stability

Before initiating a breaker closure (tying the generator to a stable or dead bus), the generator voltage must be stable. Several settings are used to determine generator stability. These settings include pickup and dropout levels for overvoltage[D], undervoltage[E], overfrequency[F], and under-frequency[G]. Recognition of generator stability is further controlled by a generator stability activation delay[H]. Breaker closure is not considered if the voltage conditions are not within the stability pickup and dropout settings for the duration of the stability activation delay.

Bus Condition

A dead bus is recognized by the DECS-250N when the bus voltage decreases below the dead bus threshold[I] for the duration of the dead bus activation delay[J].

A failed bus is recognized when the bus voltage or frequency does not meet the established stability criteria for the duration of the failed bus activation delay[K]. Bus stability parameters are described in *Bus Stability*.

Bus Stability

Before initiating a breaker closure (tying the generator to a live bus), the bus voltage must be stable. Several settings are used to determine bus stability. These settings include pickup and dropout levels for overvoltage[L], undervoltage[M], overfrequency[N], and underfrequency[O]. Recognition of bus stability is further controlled by a bus stability activation delay[P]. Breaker closure is not considered if the voltage conditions are not within the stability pickup and dropout settings for the duration of the stability activation delay.

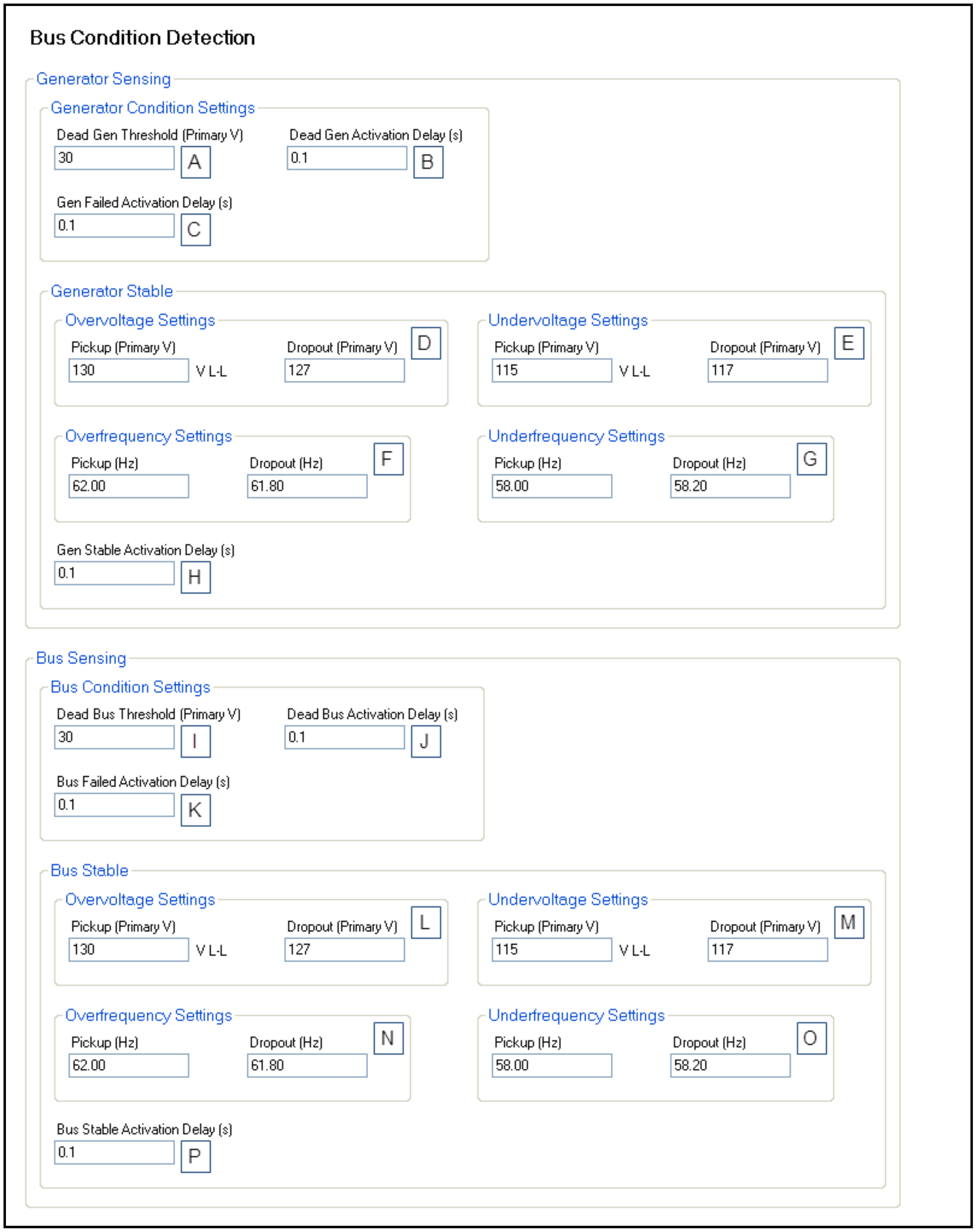


Figure 13. Generator and Bus Condition Detection Settings

[A] *Dead Gen Threshold*: Adjustable from 0 to 600,000 Vac in 1 Vac increments.
[B] *Dead Gen Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.
[C] *Gen Failed Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.
[D] *Generator Stability Overvoltage Pickup and Dropout*: Adjustable from 10 to 600,000 Vac in 1 Vac increments.
[E] *Generator Stability Undervoltage Pickup and Dropout*: Adjustable from 10 to 600,000 Vac in 1 Vac increments.
[F] *Generator Stability Overfrequency Pickup and Dropout*: Adjustable from 46 to 64 Hz in 0.05 Hz increments.
[G] *Generator Stability Underfrequency Pickup and Dropout*: Adjustable from 46 to 64 Hz in 0.05 Hz increments.
[H] *Generator Stability Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.

[I] *Dead Bus Threshold*: Adjustable from 0 to 600,000 Vac in 1 Vac increments.
[J] *Dead Bus Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.
[K] *Bus Failed Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.
[L] *Bus Stability Overvoltage Pickup and Dropout*: Adjustable from 10 to 600,000 Vac in 1 Vac increments.
[M] *Bus Stability Undervoltage Pickup and Dropout*: Adjustable from 10 to 600,000 Vac in 1 Vac increments.
[N] *Bus Stability Overfrequency Pickup and Dropout*: Adjustable from 46 to 64 Hz in 0.05 Hz increments.
[O] *Bus Stability Underfrequency Pickup and Dropout*: Adjustable from 46 to 64 Hz in 0.05 Hz increments.
[P] *Bus Stable Activation Delay*: Adjustable from 0.1 to 600 s in 0.1 s increments.

Generator Governor Control

BESTCOMSPlus Navigation Path: Settings Explorer, Synchronizer/Voltage Matching, Governor Bias Control Settings

HMI Navigation Path: Settings, Sync/Voltage Matching, Governor Bias Control Settings

During synchronization, the DECS-250N adjusts the generator voltage and frequency by issuing speed correction signals to the speed governor. Correction signals are issued in the form of DECS-250N output contact closures. These correction signals may be either continuous or proportional[A]. When proportional correction is selected, the correction pulses are of varying widths[B] and intervals[C]. Initially, long pulses are issued when the frequency difference between the generator and bus is large. As the correction pulses take effect and the frequency difference becomes smaller, the correction pulse widths are proportionally decreased.

Governor bias control settings are illustrated in Figure 14.

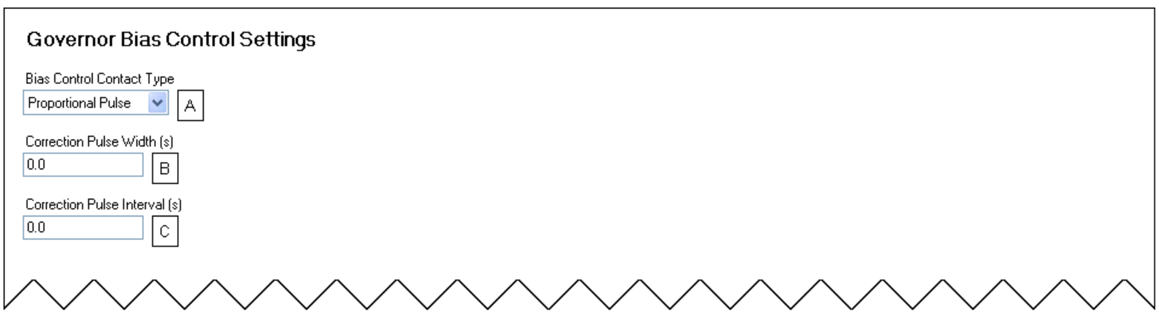


Figure 14. Generator Governor Control Settings

[A] *Bias Control Contact Type:* Select Continuous Pulse or Proportional Pulse.
[B] *Correction Pulse Width*: Adjustable from 0 to 99.9 s in 0.1 s increments.
[C] *Correction Pulse Interval*: Adjustable from 0 to 99.9 s in 0.1 s increments.

Regulation

The DECS-250N precisely regulates the level of supplied excitation power in each of the five available regulation modes. Stable regulation is enhanced by the automatic tracking of the active-mode setpoint by the inactive regulation modes. Pre-position setpoints within each regulation mode enable the DECS-250N to be configured for multiple system and application needs.

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, AVR/FCR/FVR and VAR/PF
HMI Navigation Path: Settings, Operating Settings, AVR/FCR/FVR and VAR/PF

Regulation Modes

The DECS-250N provides five regulation modes: Automatic Voltage Regulation (AVR), Field Current Regulation (FCR), Field Voltage Regulation (FVR), var, and Power Factor (PF).

AVR

When operating in AVR (Automatic Voltage Regulation) mode, the DECS-250N regulates the excitation level in order to maintain the generator terminal voltage setpoint[A] despite changes in load and operating conditions. AVR setpoint (or operating point) adjustment is made through:

- Application of contacts at DECS-250N contact inputs configured for raising and lowering the active setpoint
- Application of an analog control signal at the DECS-250N Auxiliary Control input.
- The BESTCOMS*Plus* Control Panel screen (available in the BESTCOMS*Plus* Metering Explorer)
- A raise or lower command transmitted through the DECS-250N Modbus port

The range of adjustment is defined by Minimum[B] and Maximum[C] settings that are expressed as a percentage of the rated generator voltage. The length of time required to adjust the AVR setpoint from one limit to the other is controlled by a Traverse Rate setting[D]. These settings are illustrated in Figure 15.

FCR

When operating in FCR (Field Current Regulation) mode, the DECS-250N regulates the level of current it supplies to the field based on the FCR setpoint[E]. The setting range of the FCR setpoint depends on the field rated data and other associated settings. FCR setpoint adjustment is made through:

- Application of contacts at DECS-250N contact inputs configured for raising and lowering the active setpoint
- Application of an analog control signal at the DECS-250N Auxiliary Control input
- The BESTCOMS*Plus*® Control Panel screen (available in the BESTCOMS*Plus* Metering Explorer)
- A raise or lower command transmitted through the DECS-250N Modbus port

The range of adjustment is defined by Minimum[F] and Maximum[G] settings that are expressed as a percentage of the rated field current. The length of time required to adjust the FCR setpoint from one limit to the other is controlled by a Traverse Rate setting[H]. These settings are illustrated in Figure 15.

FVR

FVR (Field Voltage Regulation) mode enables generator modeling and validation testing in accordance with WECC testing requirements. FVR mode can also be used to smooth the transfer from the active DECS-250N to a secondary DECS.

When operating in FVR mode, the DECS-250N regulates the level of field voltage it supplies to the field based on the FVR setpoint[I]. The setting range of the FVR setpoint depends on the field rated data and other associated settings. FVR setpoint adjustment is made through:

- Application of contacts at DECS-250N contact inputs configured for raising and lowering the active setpoint
- Application of an analog control signal at the DECS-250N Auxiliary Control input
- The BESTCOMS*Plus* Control Panel screen (available in the BESTCOMS*Plus* Metering Explorer)
- A raise or lower command transmitted through the DECS-250N Modbus port

The range of adjustment is defined by Minimum[J] and Maximum[K] settings that are expressed as a percentage of the rated field voltage. The length of time required to adjust the FVR setpoint from one limit to the other is controlled by a Traverse Rate[L] setting. These settings are illustrated in Figure 15.

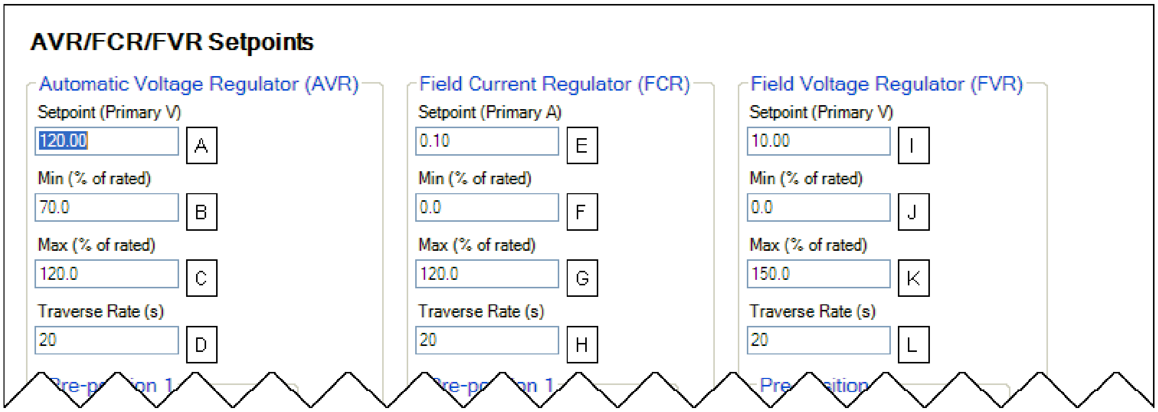


Figure 15. AVR, FCR, and FVR Regulation Settings

[A] *AVR Setpoint*: Range of adjustment is based on the rated generator voltage and limited by the AVR Min (B) and Max (C) settings.
[B] *Min (% of rated)*: Adjustable from 70 to 120% in 0.1% increments.
[C] *Max (% of rated)*: Adjustable from 71 to 120% in 0.1% increments.
[D] *Traverse Rate (s)*: Adjustable from 10 to 200 seconds in 1 second increments.
[E] *FCR Setpoint*: Range of adjustment is based on the rated field current and limited by the FCR Min (F) and Max (G) settings.
[F] *Min (% of rated)*: Adjustable from 0 to 120% in 0.1% increments.
[G] *Max (% of rated)*: Adjustable from 0 to 120% in 0.1% increments.
[H] *Traverse Rate (s)*: Adjustable from 10 to 200 seconds in 1 second increments.
[I] *FVR Setpoint*: Range of adjustment is based on the rated field voltage and limited by the FCR Min (J) and Max (K) settings.
[J] *Min (% of rated)*: Adjustable from 0 to 150% in 0.1% increments.
[K] *Max (% of rated)*: Adjustable from 0 to 150% in 0.1% increments.
[L] *Traverse Rate:* Adjustable from 10 to 200 seconds in 1 second increments.

Var

When operating in var mode, the DECS-250N regulates the reactive power (var) output of the generator based on the var setpoint[A]. The setting range of the var setpoint depends on the generator ratings and other associated settings. Var setpoint adjustment is made through:

- Application of contacts at DECS-250N contact inputs configured for raising and lowering the active setpoint
- Application of an analog control signal at the DECS-250N Auxiliary Control input
- The BESTCOMS*Plus*® Control Panel screen (available in the BESTCOMS*Plus* Metering Explorer)
- A raise or lower command transmitted through the DECS-250N Modbus port

The range of adjustment is defined by Minimum[B] and Maximum[C] settings that are expressed as a percentage of the generator rated kVA output. The length of time required to adjust the Var setpoint from one limit to the other is controlled by a Traverse Rate setting[D]. A Fine Voltage Adjustment Band setting[E] defines the upper and lower boundaries of voltage correction when operating in var or power factor regulation modes. Var mode settings are illustrated in Figure 16.

Power Factor

When operating in Power Factor (PF) mode, the DECS-250N controls the var output of the generator to maintain the Power Factor setpoint[F] as the kW load on the generator varies. The setting range of the PF setpoint is determined by the PF – Leading[G] and PF – Lagging[H] settings. The length of time required to adjust the PF setpoint from one limit to the other is controlled by a Traverse Rate setting[I]. A Fine Voltage

Adjustment Band setting[E] defines the upper and lower boundaries of voltage correction when the DECS-250N is operating in Var or Power Factor regulation modes. PF Active Power Level[J] establishes the level of generator output power (kW) where the DECS-250 switches to/from Droop Compensation/Power Factor mode. If the level of power decreases below the setting, the DECS-250 switches from Power Factor mode to Droop Compensation mode. Conversely, as the level of power increases above the setting, the DECS-250 switches from Droop Compensation mode to Power Factor mode. A setting of 0 to 30% may be entered in 0.1% increments.

Power Factor mode settings are illustrated in Figure 16.

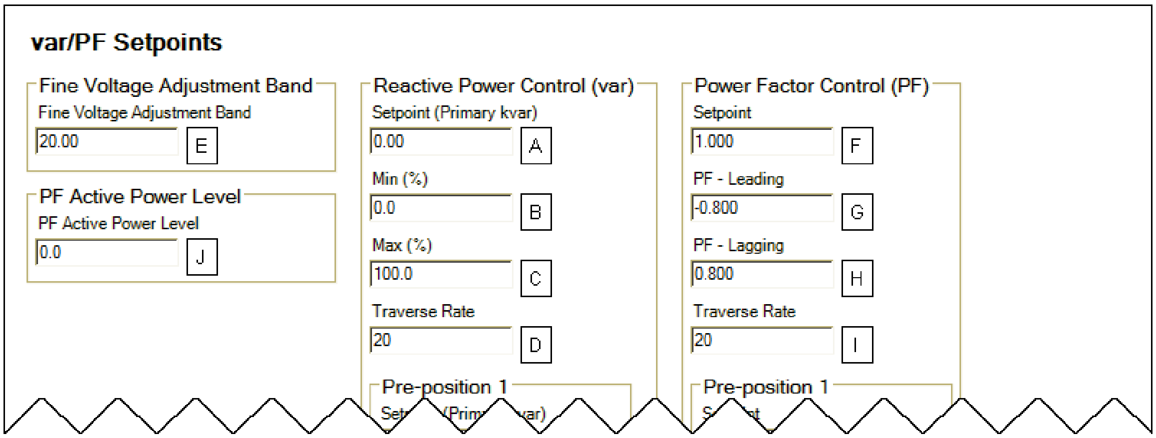


Figure 16. Var and Power Factor Regulation Settings

[A] *Setpoint*: Range of adjustment is based on the generator ratings and limited by the Var Minimum (B) and Var Maximum (C) settings.
[B] *Min (% of rated)*: Adjustable from –100 to 100% in 0.1% increments.
[C] *Max (% of rated)*: Adjustable from 0 to 100% in 0.1% increments.
[D] *Traverse Rate (s)*: Adjustable from 10 to 200 seconds in 1 second increments.
[E] *Fine Voltage Adjustment Band*: Adjustable from 0 to 30% in 0.01% increments.
[F] *PF Setpoint*: Range of adjustment is determined by the PF Min (B) and Max (C) settings.
[G] *PF – Leading*: Adjustable from –1 to –0.5 in 0.005 increments.
[H] *PF – Lagging*: Adjustable from 0.5 to 1 in 0.005 increments.
[I] *Traverse Rate (s)*: Adjustable from 10 to 200 seconds in 1 second increments.
[J] *PF Active Power Level:* Adjustable from 0 to 30% in 0.1% increments.

Pre-Position Setpoints

Each regulation mode has three pre-position setpoints which allow the DECS-250N to be configured for multiple system and application needs. Each pre-position setpoint can be assigned to a programmable contact input. When the appropriate contact input is closed, the setpoint is driven to the corresponding pre-position value. Each pre-position function has two settings: Setpoint and Mode. The setting range of each pre-position setpoint[A] is identical to that of the corresponding control mode setpoint. The Mode[B] setting determines whether or not the DECS-250N will respond to further setpoint change commands while the pre-position command is being asserted. If the pre-position mode is Release, setpoint change commands are accepted to raise and lower the setpoint while the pre-position command is being asserted. Additionally, if the inactive pre-position mode is Release and internal tracking is enabled, the pre-position value will respond to the tracking function. If the pre-position mode is Maintain, further setpoint change commands are ignored while the appropriate contact input is closed. Additionally, if the inactive pre-position mode is Maintain and internal tracking is enabled, the inactive mode will maintain the inactive setpoint at the pre-position value and override the tracking function. A portion of the pre-position setpoints for var and PF modes are illustrated in Figure 17. (Pre-Position Setpoints for AVR, FCR, and FVR modes are similar and not shown here.)

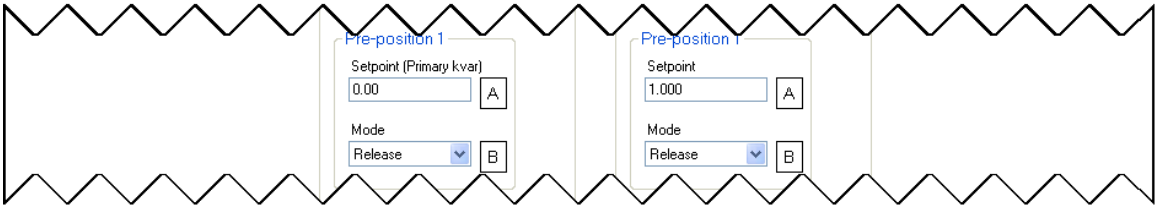


Figure 17. Pre-Position Setpoints

[A] *Setpoint:* Range of adjustment is based on the generator ratings and limited by the Var Minimum and Var Maximum settings.
[B] *Mode*: Select Release or Maintain

Transient Boost

The transient excitation boosting function improves response to successive faults by providing increased excitation support. When a simultaneous line current increase and line voltage decrease occurs, the DECS-250N compensates by elevating the voltage setpoint above the nominal setpoint. When the line voltage recovers, the voltage setpoint is restored to the nominal value.

Fault detection is controlled by a voltage threshold[A] setting, a current threshold[B] setting, and a duration[C] setting. Fault voltage threshold is expressed as a percentage of the AVR setpoint and fault current threshold is expressed as a percentage of the rated field current. The duration setting determines how long a fault condition is tolerated before the setpoint is adjusted.

Setpoint adjustment is controlled by a voltage setpoint boosting level[D], a clearing voltage threshold[E], and a clearing voltage delay[F]. The setpoint boosting level is expressed as a percentage above the AVR setpoint. Transient boost is disabled once the line voltage recovers above the clearing voltage threshold. The clearing voltage threshold is expressed as a percentage below the AVR setpoint. The clearing voltage delay determines how long the line voltage must exceed the clearing voltage threshold before setpoint adjustment is terminated.

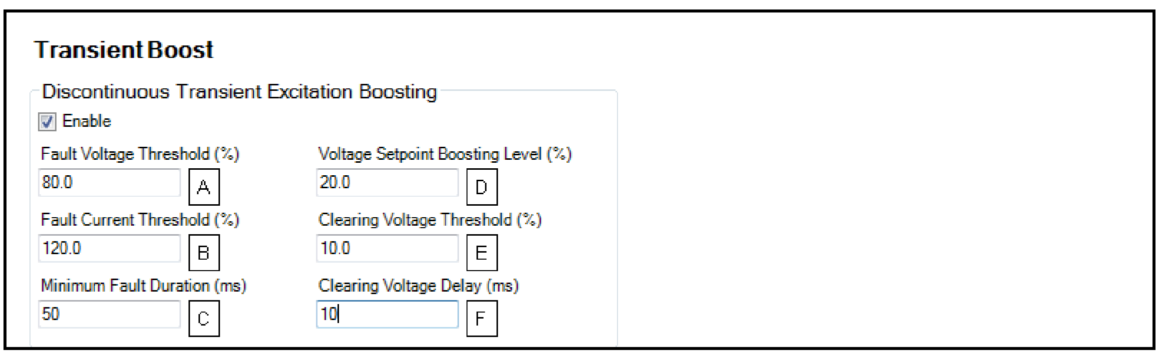


Figure 18. Transient Boost Settings

[A] *Fault Voltage Threshold (%):* Adjustable from 0.0 to 100.0%, in 0.1% increments.
[B] *Fault Current Threshold (%):* Adjustable from 0.0 to 400.0%, in 0.1% increments.
[C] *Minimum Fault Duration (ms):* Adjustable from 0 to 1,000 ms, in 1 ms increments.
[D] *Voltage Setpoint Boosting Level (%):* Adjustable from 0.0 to 100.0%, in 0.1% increments.
[E] *Clearing Voltage Threshold (%):* Adjustable from 0.0 to 50.0%, in 0.1% increments.
[F] *Clearing Voltage Delay (ms):* Adjustable from 0 to 1,000 ms, in increments of 1 ms.

Operation with Paralleled Generators

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Parallel/LineDrop Compensation

HMI Navigation Path: Settings, Operating Settings, Parallel/LineDrop Compensation

The DECS-250N can be used to control the excitation level of two or more generators operating in parallel so that the generators share the reactive load. The DECS-250N can employ either droop compensation or cross-current compensation (reactive differential) schemes for reactive load sharing. A separate load sharing function enables each machine to share the load proportionally without incurring a voltage and frequency droop.

Paralleled generator settings are illustrated in Figure 19 and described in the following paragraphs.

Reactive Droop Compensation

Droop compensation serves as a method of controlling reactive current when the generator is connected in parallel with another energy source. When droop compensation is enabled[A], the generator voltage is adjusted in proportion to the measured generator reactive power. The reactive droop compensation setting[B] is expressed as a percentage of the generator rated terminal voltage.

Note
For droop compensation to operate, the PARALLEL_EN_LM logic block must be set true in BESTlogic*Plus* programmable logic.

Cross-Current Compensation

Cross-current compensation (reactive differential) mode serves as a method of connecting multiple generators in parallel to share reactive load. When reactive load is shared properly, no current is fed into the DECS-250N cross-current compensation input. Improper sharing of reactive load causes a differential current to be fed into the cross-current compensation input. When cross-current compensation is enabled[C], this input causes the DECS-250N to respond with the proper level of regulation. The response of the DECS-250N is controlled by the cross-current compensation gain setting[D] which is expressed as a percentage of the system nominal CT setting.

Application information about cross-current compensation is available in the *Voltage and Current Sensing* section of this manual.

Network Load Sharing

In a multiple-generator application, the load sharing function ensures equal generator reactive-power sharing. It operates in a similar manner to cross-current compensation but without the external hardware requirements and distance limitations. Instead of sharing load based on the CT ratio, load is shared on a per-unit basis calculated from the generator rated data. Sharing of load information between DECS-250N controllers is accomplished through the Ethernet port of each DECS-250N communicating over a peer-to-peer network dedicated for the load sharing function. Each DECS-250N measures the reactive current of its associated generator and broadcasts its measurement to all other DECS-250N controllers on the network. Each DECS-250N compares its level of reactive current to the sum of all measured currents and adjusts its excitation level accordingly.

Network load sharing implements a fading droop function based on the droop setting, washout filter gain, and washout filter time constant. During transients, load sharing will droop according to the droop percentage and washout filter gain settings. The droop characteristic will fade with a time constant according to the washout filter time constant.

A Load Share ID setting identifies the DECS-250N as a load sharing unit in the network. Checking a Load Sharing Unit number box allows any DECS-250N load sharing units on the network with that Load Share ID number to share load with the currently connected DECS-250N. It is not necessary for the Load Share ID to be unique for each unit. This allows for load sharing units to be grouped.

Load sharing settings consist of an Enable checkbox[E] and Droop[F], Gain[G], Washout Filter Time Constant[H], Washout Filter Gain[I] and Load Share ID[J] settings.

Line Drop Compensation

When enabled[K], line drop compensation can be used to maintain voltage at a load located at a distance from the generator. The DECS-250N achieves this by measuring the line current and calculating the voltage for a specific point on the line. Line drop compensation is applied to both the real and reactive portion of the generator line current. It is expressed as a percentage of the generator terminal voltage[L].

Refer to Figure 19 for an illustration of the Line drop compensation settings.

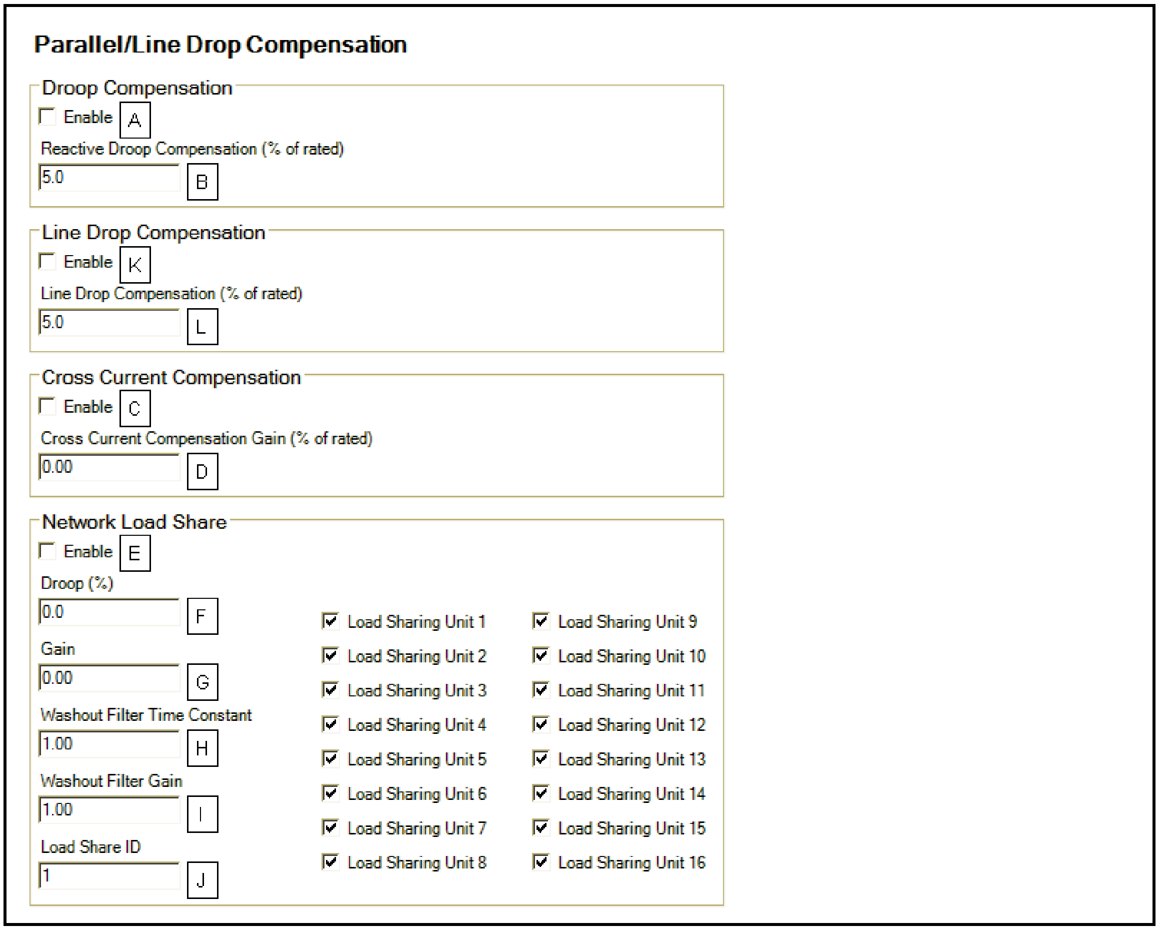


Figure 19. Paralleled Generators and Line Drop Compensation Settings

[A] *Droop Compensation Enable:* Place a check in the checkbox to enable droop compensation.
[B] *Reactive Droop Compensation:* Adjustable from 0 to +30% in 0.1% increments.
[C] *Cross-Current Compensation Enable:* Place a check in the checkbox to enable cross-current compensation.
[D] *Cross-Current Compensation Gain:* Adjustable from –30 to +30% in 0.1% increments.
[E] *Load Share Enable:* Place a check in the checkbox to enable load sharing.
[F] *Load Share Droop:* Adjustable from 0 to 30% in 0.1% increments.
[G] *Load Share Gain:* Adjustable from 0 to 1,000 in increments of 0.01.
[H] *Load Share Washout Filter Time Constant:* Adjustable from 0 to 1 in increments of 0.01.
[I] *Load Share Washout Filter Gain:* Adjustable from 0 to 1,000 in increments of 0.01.
[J] *Load Share ID:* Adjustable from 1 to 16 in increments of 1.
[K] *Line Drop Compensation Enable:* Place a check in the checkbox to enable line drop compensation.
[L] *Line Drop Compensation:* Adjustable from 0 to 30% in increments of 0.1%.

Autotracking

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Autotracking
HMI Navigation Path: Settings, Operating Settings, Autotracking.

Internal regulation mode setpoint tracking and external setpoint tracking are standard features on the DECS-250N. Autotracking settings are illustrated in Figure 20.

Internal Setpoint Tracking

In applications using a single DECS-250N, internal tracking can be enabled[A] so that the inactive regulation modes track the active regulation mode.

The following examples demonstrate the advantages of internal tracking:

- If the excitation system is operating online with internal tracking enabled, a loss of sensing condition could trigger a transfer to FCR mode. Autotracking minimizes the impact that a loss of sensing condition has on the exciter's ability to maintain the proper excitation level.
- While performing routine testing of the DECS-250N in backup mode, the internal tracking feature allows a transfer to an inactive mode that will result in no disturbance to the system.

Two parameters control the behavior of internal tracking. A delay setting[B] determines the time delay between large system disturbance and the start of setpoint tracking. A traverse rate setting[C] configures the length of time for the inactive mode setpoints to traverse the full setting range of the active mode setpoint.

External Setpoint Tracking

For critical applications, a second DECS-250N can provide backup excitation control. The DECS-250N allows for excitation redundancy by providing external tracking and transfer provisions between DECS-250N controllers. The secondary DECS-250N can be configured to track the primary DECS-250N setpoint. Proper redundant excitation system design allows for removal of the failed system.

NOTE
Periodic testing of the backup system must be performed to ensure that it is operational and can be placed in service without warning.

Like internal tracking, external setpoint tracking uses enable/disable[D], delay[E], and traverse rate[F] settings.

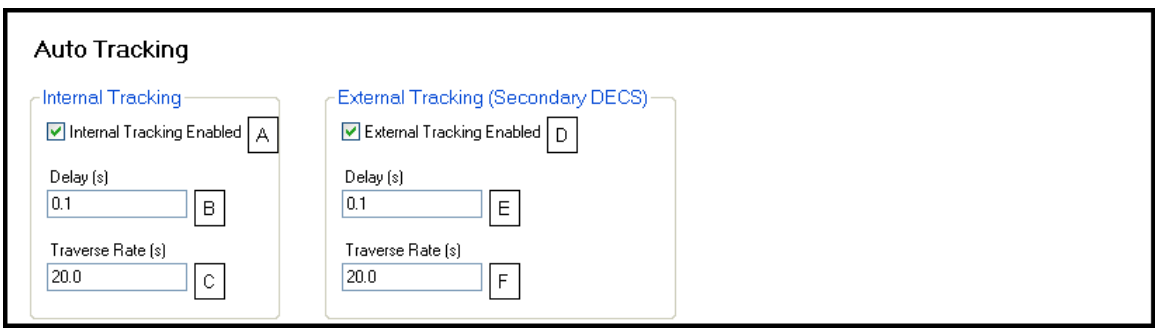


Figure 20. Autotracking Settings

[A] *Internal Tracking Enabled*: Place a check in the checkbox to enable internal tracking.
[B] *Internal Tracking Delay*: Adjustable from 0 to 8 seconds in 0.1 second increments.
[C] *Internal Tracking Traverse Rate*: Adjustable from 1 to 80 seconds in 0.1 second increments.
[D] *External Tracking Enabled*: Place a check in the checkbox to enable external tracking.
[E] *External Tracking Delay*: Adjustable from 0 to 8 seconds in 0.1 second increments.
[F] *External Tracking Traverse Rate*: Adjustable from 1 to 80 seconds in 0.1 second increments.

Setpoint Configure

When the Auto Save setting is enabled, the DECS-250N automatically saves the active setpoint in one-minute intervals. Otherwise, the setpoint which was last sent to the DECS-250N is retained. Figure 21 illustrates the Setpoint Configure screen.

Figure 21. Setpoint Configure Setting

Auxiliary Control

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Auxiliary Inputs

HMI Navigation Path: Settings, Operating Settings, Auxiliary Inputs

The DECS-250N accepts an external analog control signal for auxiliary control of the regulation setpoint. Auxiliary setpoint control is possible in all regulation modes: AVR, PF, Var, FCR, and FVR. The control signal can also be used for limiter scaling or power system stabilizer control. Auxiliary control settings are illustrated in Figure 22.

Auxiliary Control Input Type[A]

Either a voltage or current control signal may be used for auxiliary control. Terminals I+ and I– accept a 4 to 20 mAdc signal. Terminals V+ and V– accept a –10 to +10 Vdc signal. An adjacent terminal labeled GND provides the connection for a recommended cable shield. The input type is selected in BESTCOMS*Plus*.

Auxiliary Control Input Function[B]

The analog control input can be used for auxiliary control of the regulation setpoint, as a power system stabilizer test input, or for limiter scaling.

PSS Test Input

The auxiliary control input can be used for control of the optional power system stabilizer function during testing and validation. More information is provided in the *Power System Stabilizer* section of this manual.

Limiter Scaling

When the auxiliary control input is configured for limiter scaling, the stator current limiter (SCL) and overexcitation limiter (OEL) low-level values can be automatically adjusted. Automatic adjustment of the SCL and OEL is based on six parameters: signal and scale for three points. The signal value for each point represents the accessory input voltage. The scale value defines the limiter low level as a percentage of rated field current for the OEL and rated stator current for the SCL. For accessory input voltages between two of the three defined points, the low-level limiter setting is linearly adjusted between the two scale values. Limiter settings and limiter scaling are discussed in detail in the *Limiters* section of this manual.

Setpoint Limits

Minimum and maximum setpoint limits are observed when the With Limit box is checked.

Auxiliary Control Gains

When a current input type is selected, the input current is converted internally by the DECS-250N into a voltage signal in the range of –10 to +10 Vdc. The DECS-250N uses the following equation when converting the applied current into a voltage.

$$Vaux = (Iaux - 0.004) \times \left(\frac{20.0}{0.016}\right) - 10.0$$

Equation 2. Input Current to Voltage Signal Conversion

Where: Vaux is the calculated voltage signal and Iaux is the applied current in amperes.

For setpoint control, Vaux is multiplied by the appropriate regulation mode auxiliary gain setting.

In AVR mode, the auxiliary control signal is multiplied by the AVR gain setting[C]. The result defines the setpoint change as a percentage of the rated generator voltage. For example, applying +10 Vdc with an AVR gain of 1.0 raises the AVR setpoint 10% of rated generator voltage. This example also applies to the following modes.

In FCR mode, the auxiliary control signal is multiplied by the FCR gain setting[D]. The resulting value relates to a percentage of the rated field current.

In FVR mode, the auxiliary control signal is multiplied by the FVR gain setting[E]. The resulting value relates to a percentage of the rated field voltage.

In Var mode, the auxiliary control signal is multiplied by the Var gain setting[F]. The resulting value relates to a percentage of the rated apparent power (kVA).

In Power Factor mode, the auxiliary control signal is multiplied by the PF gain setting[G] to define the PF setpoint change.

If the auxiliary input is unused, all auxiliary control gains should be set to zero.

Summing Type[H]

The auxiliary control signal can be configured to control the inner or outer regulation control loop. Selecting the inner loop limits auxiliary control to AVR, FCR, and FVR modes. Selecting the outer loop limits auxiliary control to PF and Var modes.

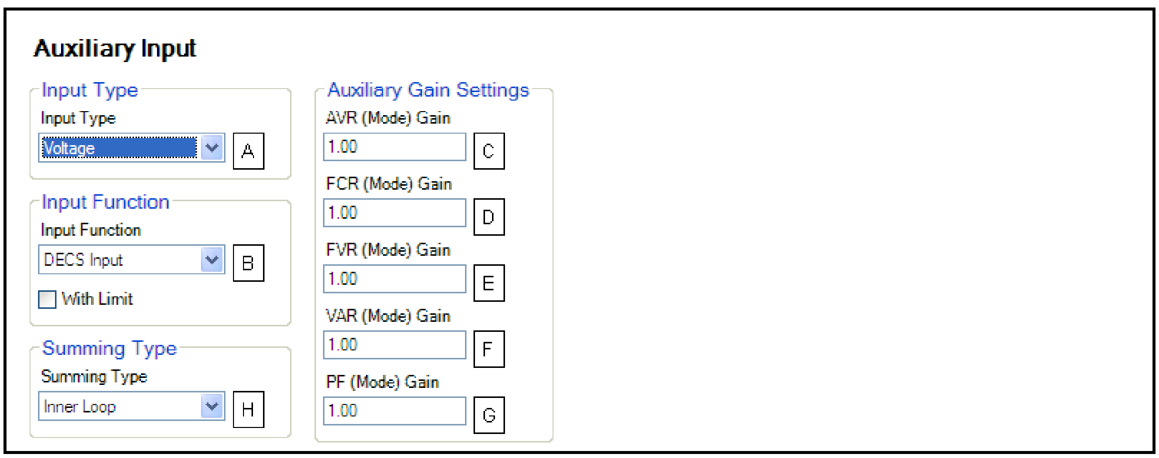


Figure 22. Auxiliary Input Settings

[A] *Input Type*: Select Voltage or Current.
[B] *Input Function*: Select DECS Input, Limiter Scaling, or PSS Test Input.
[C] *AVR (Mode) Gain*: Adjustable from –99 to +99 in 0.01 increments.
[D] *FCR (Mode) Gain*: Adjustable from –99 to +99 in 0.01 increments.
[E] *FVR (Mode) Gain*: Adjustable from –99 to +99 in 0.01 increments.
[F] *Var (Mode) Gain*: Adjustable from –99 to +99 in 0.01 increments.
[G] *PF (Mode) Gain*: Adjustable from –99 to +99 in 0.01 increments.
[H] *Summing Type: Select Inner Loop or Outer Loop.*

Contact Inputs and Outputs

Sixteen isolated, contact sensing inputs are available for initiating DECS-250N actions. Twelve sets of output contacts provide annunciation and control.

Contact Inputs

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Programmable Inputs, Contact Inputs

HMI Navigation Path: Not available through HMI.

Sixteen contact inputs are provided for initiating DECS-250N actions. Two of the contact inputs are fixed-function inputs: Start and Stop. The remaining 14 contact inputs are programmable. An additional 10 contact inputs are available with the optional Contact Expansion Module (CEM-2020). Contact Basler Electric for ordering information.

All contact inputs are compatible with dry relay/switch contacts or open-collector outputs from a PLC. Each contact input has an isolated interrogation voltage and current of 12 Vdc at 4 mAdc. Appropriate switches/contacts should be selected for operation with this signal level.

NOTE
The length of wiring connected to each contact input terminal must not exceed 150 feet (45.7 meters). Longer wiring lengths may allow induced electrical noise to interfere with the recognition of contact inputs.

Start and Stop Inputs

The Start and Stop inputs accept a momentary contact closure that enables (Start) and disables (Stop) the DECS-250N. If the DECS-250N receives Start and Stop contact inputs simultaneously, the Stop input takes priority. Start contact input connections are made at terminals START and COM A. Stop contact input connections are made at terminals STOP and COM A.

Programmable Inputs

The 14 programmable inputs can be connected to monitor the status of excitation system contacts and switches. Then, using BESTlogic™*Plus* programmable logic, these inputs can be used as part of a user-configured logic scheme to control and annunciate a variety of system conditions and contingencies. Information about using the programmable inputs in a logic scheme is provided in *BESTlogicPlus Programmable Logic*.

To make the programmable contact inputs easier to identify, you can assign a custom name[A] that relates to the inputs/functions of your system. Figure 23 shows a portion of the BESTCOMS*Plus* Contact Inputs screen where each of the 14 inputs can be assigned a custom name.

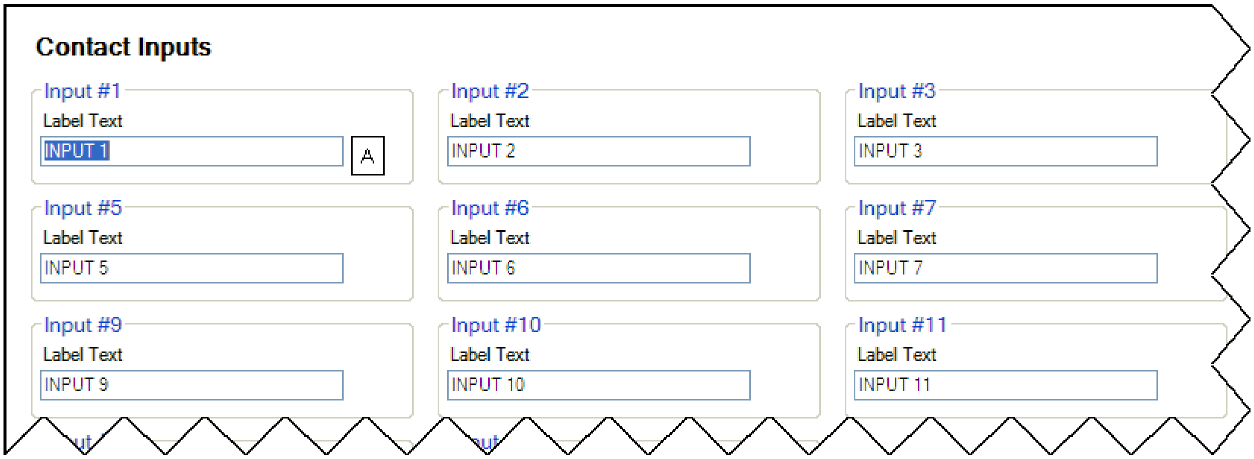


Figure 23. Contact Input Label Text

[A] *Label Text*: Enter a string of up to 64 alphanumeric characters.

See *Terminals and Connectors* for an illustration of the programmable input terminals.

Contact Outputs

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Programmable Outputs, Contact Outputs

HMI Navigation Path: Not available through HMI.

DECS-250N contact outputs consist of a dedicated watchdog output and 11 programmable outputs. An additional 18 contact outputs are available with the optional Contact Expansion Module (CEM-2020H). The optional CEM-2020 provides an additional 24 contact outputs. Contact Basler Electric for ordering information.

Watchdog Output

This SPDT (Form C) output changes state during the following conditions:

- Control power is lost
- Normal firmware execution ceases
- Transfer Watchdog Trip is asserted in BESTlogic*Plus.*

Watchdog output connections are made at terminals WTCHD1 (normally open), WTCHD (common), and WTCHD2 (normally closed).

Programmable Outputs

The 11 programmable, normally-open contact outputs can be configured to annunciate DECS-250N status, active alarms, active protection functions, and active limiter functions. Using BESTlogic*Plus* programmable logic, these outputs can be used as part of a user-configured logic scheme to control and annunciate a variety of system conditions and contingencies. Information about using the programmable outputs in a logic scheme is provided in *BESTlogicPlus Programmable Logic*.

To make the programmable contact outputs easier to identify, you can assign a custom name[A] that relates to the functions of your system. Figure 24 shows the BESTCOMS*Plus* Contact Outputs screen where each of the 11 outputs can be assigned a custom name.

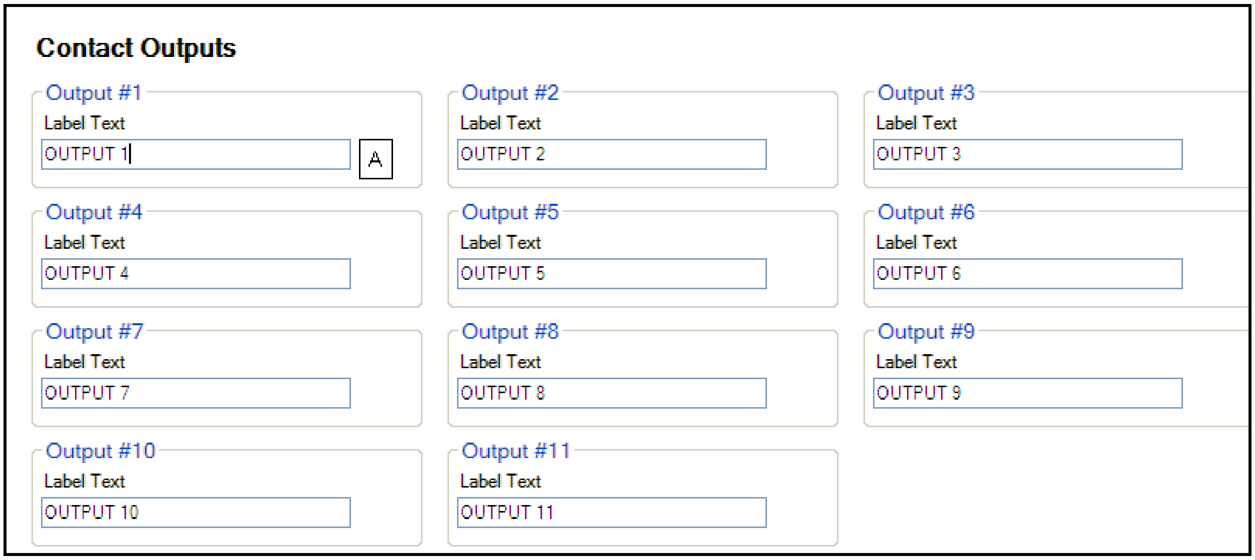


Figure 24. Contact Output Label Text

[A] *Label Text*: Enter a string of up to 64 alphanumeric characters.

See *Terminals and Connectors* for an illustration of the programmable output terminals. Contact output electrical ratings are listed in *Specifications*.

Protection

The DECS-250N offers protection relating to generator voltage, frequency, power, field parameters, rotating exciter diodes, power input failure, and generator-to-bus synchronism. Configurable protection elements supplement this protection with additional, user-defined system parameters that have multiple pickup thresholds per parameter. Most protection functions have two groups of settings labeled Primary and Secondary. Two setting groups enable independent protection coordination which is selectable in BESTlogic™*Plus*.

Voltage Protection

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Protection, Voltage
HMI Navigation Path: Settings, Protection, Voltage Protection

Voltage protection includes overexcitation, generator undervoltage, generator overvoltage, and loss of sensing voltage.

Overexcitation (Volts per Hertz)

Volts per hertz protection is annunciated if the ratio of the per-unit voltage to the per-unit frequency (volts/hertz) exceeds one of the Volts per Hertz Pickup Level[A] settings for a definite amount of time[B]. If the Volts per Hertz Pickup level is exceeded, timing will continue until the volts per hertz ratio drops below the dropout ratio (95%). Volts per hertz protection also guards against other potentially damaging system conditions such as a change in system voltage and reduced frequency conditions that can exceed the system's excitation capability.

Several volts per hertz settings enable the DECS-250N to provide flexible generator and generator step-up transformer overexcitation protection. An inverse square timing characteristic is provided through the Inverse Time Pickup Setpoint[C] and Time Dial[D] settings. These settings enable the DECS-250N to approximate the heating characteristic of the generator and generator step-up transformer during overexcitation. A linear reset characteristic is provided through the Reset Dial[E] setting. Volts per hertz protection can be enabled and disabled[F] without altering the pickup and time delay settings.

Two sets of fixed-time, overexcitation pickup settings are available through the Definite Time Pickup #1, #2 and Definite Time Delay #1, #2 settings.

The following equations represent the trip time and reset time for a constant V/Hz level. Volts per hertz characteristic curves are illustrated in Figure 25 and Figure 26.

$$T_T = \frac{D_T}{\left(\frac{V/Hz_{MEASURED}}{V/Hz_{NOMINAL}} - 1\right)^n}$$

Equation 3. Trip Time

$$T_R = D_R \times \frac{E_T}{FST} \times 100$$

Equation 4. Reset Time

Where:
T_T = time to trip
T_R = time to reset
D_T = time dial trip
D_R = time dial, reset
E_T = elapsed time
n = curve exponent (0.5, 1, 2)[G]
FST=full scale trip time (T_T)
E_T/FST =fraction of total travel toward trip that integration had progressed to. (After a trip, this value will be equal to 1.)

BESTCOMS*Plus* overexcitation settings are illustrated in Figure 27.

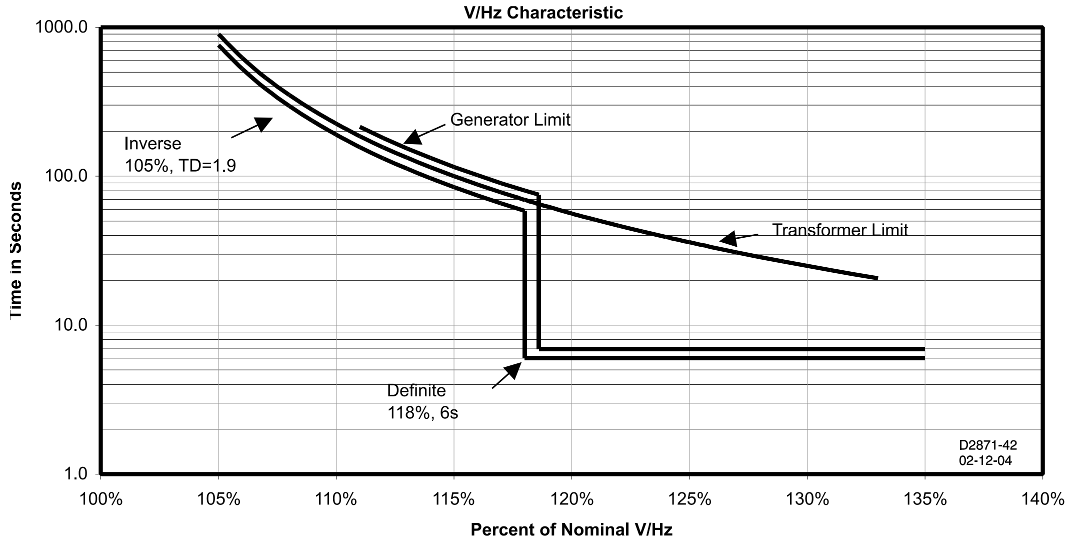


Figure 25. V/Hz Characteristic – Time Shown on Vertical Axis

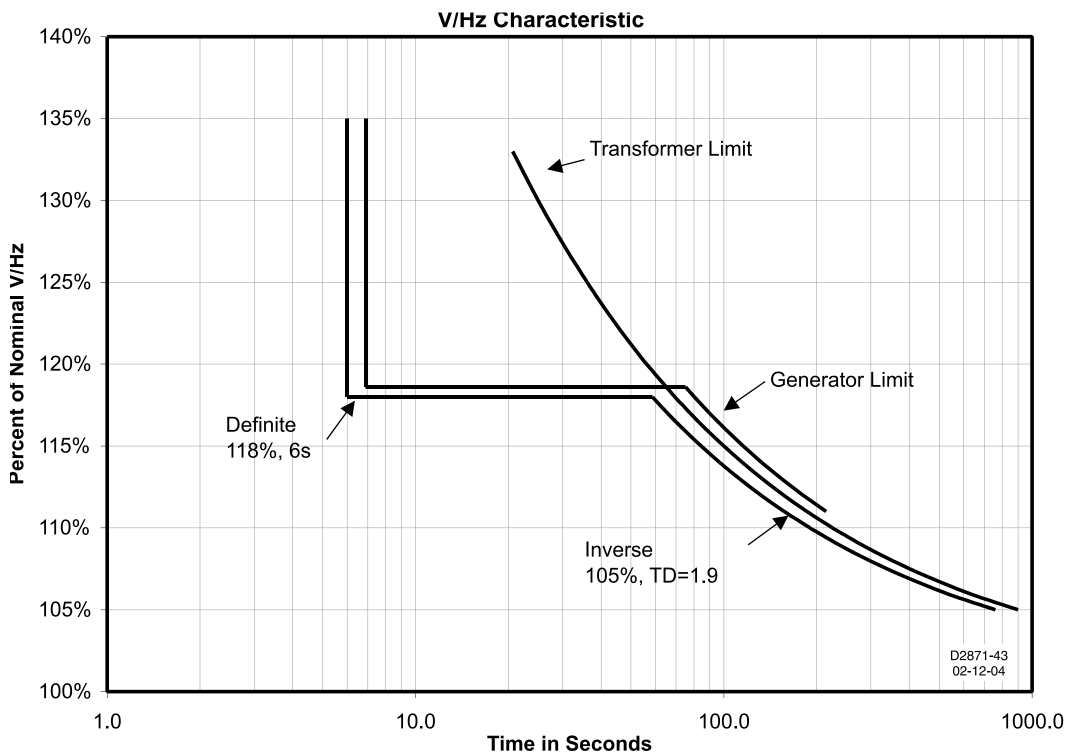


Figure 26. V/Hz Characteristic – Time Shown on Horizontal Axis

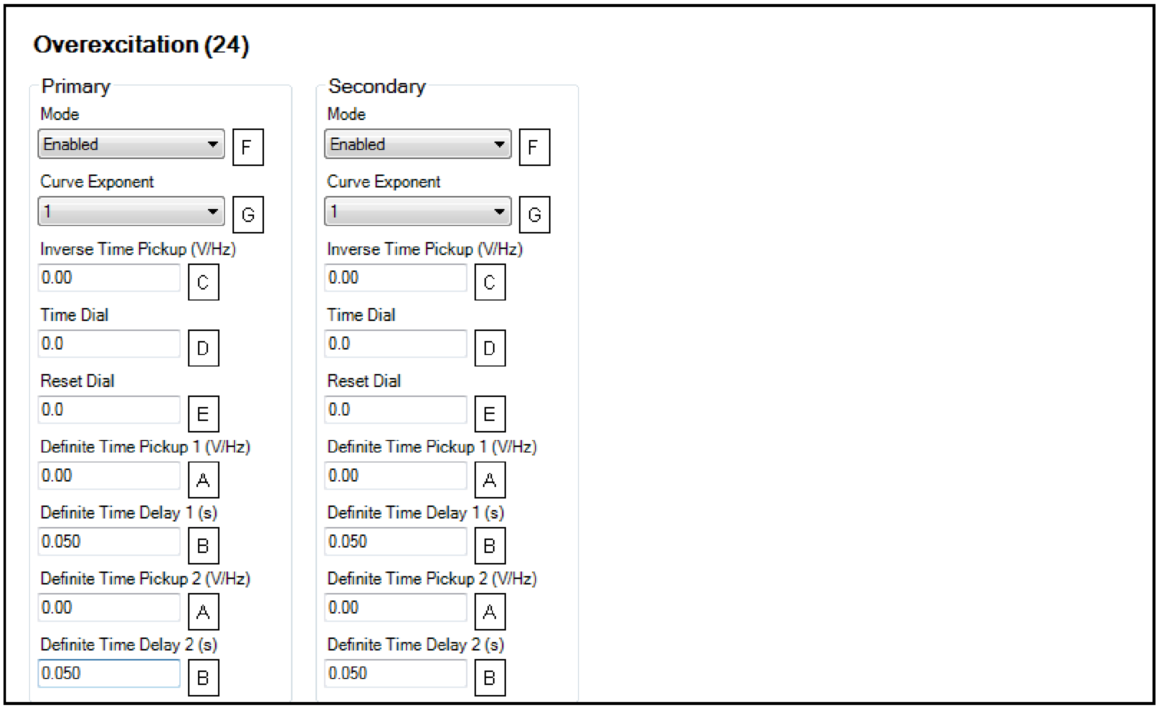


Figure 27. Overexcitation Protection Settings

[A] *Definite Time Pickup*: Adjustable from 0 or 0.5 to 6.00 in increments of 0.01.
[B] *Definite Time Delay*: Adjustable from 0.05 to 600 seconds in increments of 0.001 seconds.
[C] *Inverse Time Pickup*: Adjustable from 0 or 0.5 to 6.00 in increments of 0.01.
[D] *Time Dial*: Adjustable from 0.0 to 9.9 in increments of 0.1.
[E] *Reset Dial*: Adjustable from 0.0 to 9.9 in increments of 0.1.
[F] *Mode*: Select Enabled or Disabled.
[G] *Curve Exponent*: Select 0.5, 1, or 2

Generator Undervoltage

An undervoltage pickup condition occurs when the sensed generator terminal voltage decreases below the pickup setting[A]. An undervoltage trip condition occurs if the generator voltage remains below the pickup threshold for the duration of the time delay setting[B]. Generator undervoltage protection can be enabled and disabled[C] without altering the pickup and time delay settings. Undervoltage pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus* generator undervoltage settings are illustrated in Figure 28.

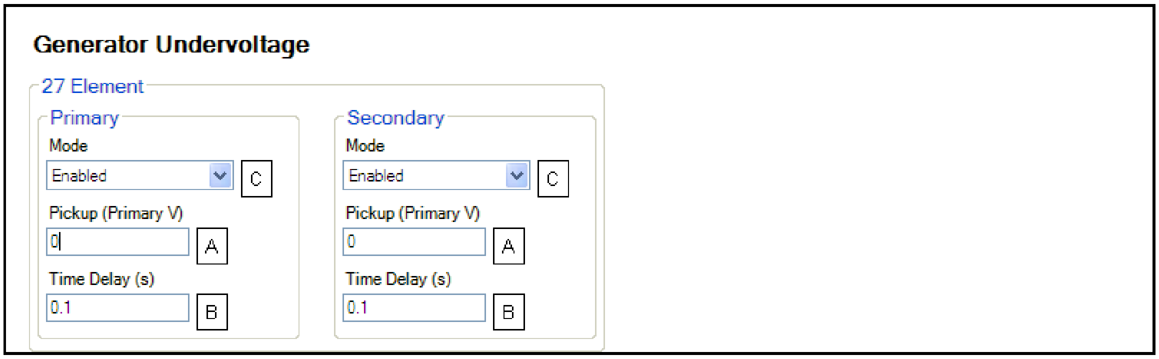


Figure 28. Generator Undervoltage Protection Settings

[A] *Generator Undervoltage Pickup (V)*: Adjustable from 0 to 600,000 Vac in 1 Vac increments.
[B] *Generator Undervoltage Time Delay (s)*: Adjustable from 0.1 to 60 seconds in 0.1 second increments.
[C] *Generator Undervoltage Enable/Disable*: Select Enabled or Disabled.

Generator Overvoltage

An overvoltage pickup condition occurs when the sensed generator terminal voltage increases above the pickup setting[A]. An overvoltage trip condition occurs if the generator voltage remains above the pickup threshold for the duration of the time delay setting[B]. Generator overvoltage protection can be enabled and disabled[C] without altering the pickup and time delay settings. Overvoltage pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus*® generator overvoltage settings are illustrated in Figure 29.

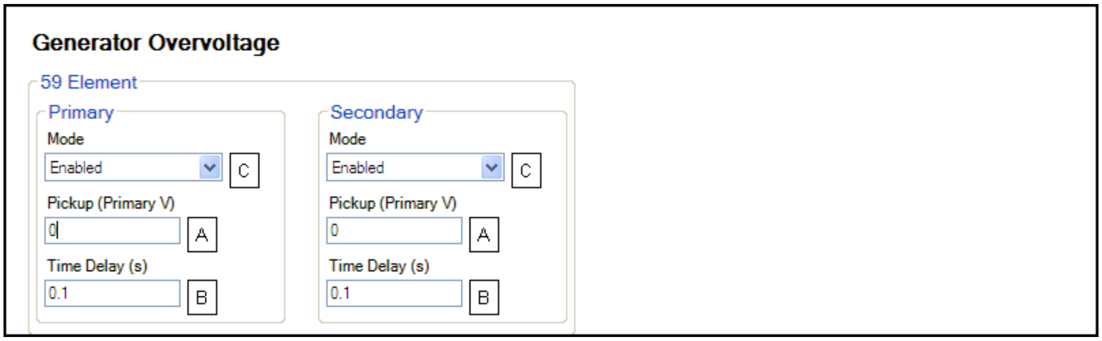


Figure 29. Generator Overvoltage Protection Settings

[A] *Generator Overvoltage Pickup (V)*: Adjustable from 0 to 600,000 Vac in 1 Vac increments.
[B] *Generator Overvoltage Time Delay (s)*: Adjustable from 0.1 to 60 seconds in 0.1 second increments.
[C] *Generator Overvoltage Enable/Disable*: Select Enabled or Disabled.

Loss of Sensing

The generator voltage is monitored for a loss of sensing (LOS) condition. LOS protection settings are illustrated in Figure 30.

In the DECS-250N, a loss of sensing event is calculated using sequence components. A loss of sensing event occurs when the positive sequence voltage drops below the balanced[A] setting percentage of the AVR setpoint, or when the negative sequence voltage increases above the unbalanced[B] setting percentage of the positive sequence voltage. A delay timer[C] is started when the event occurs, delaying the alarm by a predetermined time

A LOS condition can be used to initiate a transfer to manual (FCR) control mode[D]. It also can be configured in BESTlogic*Plus* to initiate other actions. Protection can be enabled and disabled[E] without altering the individual loss of sensing settings.

LOS protection is automatically disabled when a short circuit exists. A short circuit is detected when the measured current is greater than twice the rated current for a single-phase CT connection and when the positive sequence current is greater than twice the rated current for a three-phase CT connection.

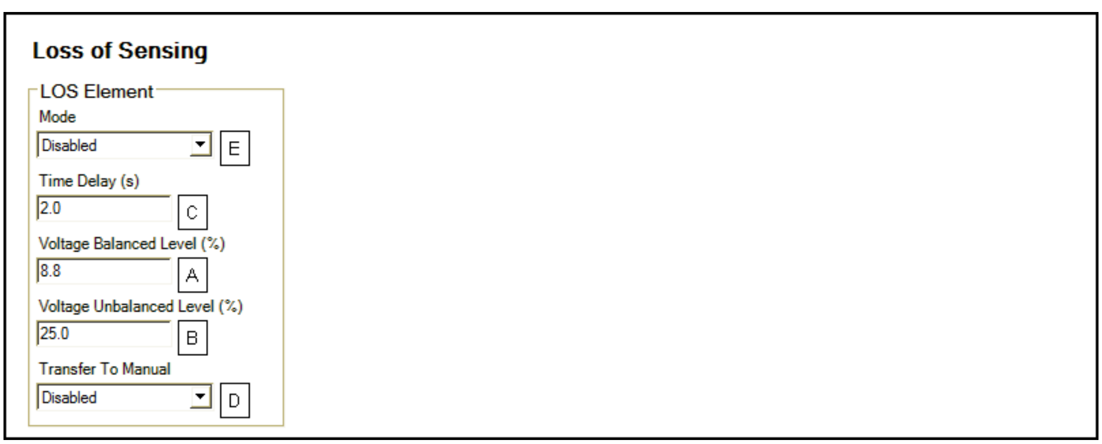


Figure 30. Loss of Sensing Protection Settings

[A] *Voltage Balanced Level:* Adjustable from 0 to 100% in 0.1% increments.
[B] *Voltage Unbalanced Level:* Adjustable from 0 to 100% in 0.1% increments.
[C] *Time Delay:* Adjustable from 0 to 30 seconds in 0.1 second increments.
[D] *Transfer to Manual:* Select Disabled or Enabled.
[E] *Mode:* Select Disabled or Enabled.

Frequency Protection

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Protection, Frequency
HMI Navigation Path: Settings, Protection, Frequency Protection 81

The frequency of the generator terminal voltage is monitored for overfrequency and under-frequency conditions.

Overfrequency

An overfrequency condition occurs when the frequency of the generator voltage exceeds the 81O pickup threshold[A] for the duration of the 81O time delay setting[B]. Overfrequency protection can be enabled and disabled[C] without altering the pickup and time delay settings. Overfrequency pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus* overfrequency settings are illustrated in Figure 31.

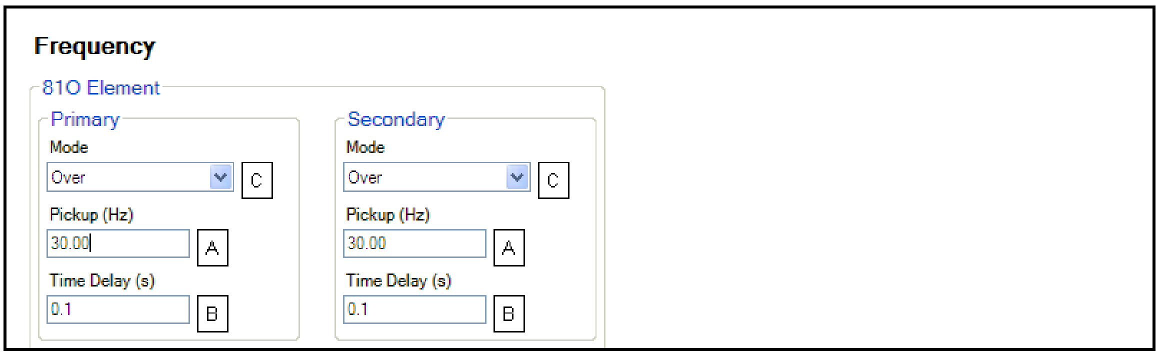


Figure 31. Overfrequency Protection Settings

[A] *Overfrequency (81O) Pickup (Hz)*: Adjustable from 30 to 70 hertz in 0.01 hertz increments.
[B] *Overfrequency (81O) Time Delay (s)*: Adjustable from 0.1 to 300 seconds in 0.1 second increments.
[C] *Overfrequency (81O) Mode*: Select Disabled or Over.

Underfrequency

An underfrequency condition occurs when the frequency of the generator voltage decreases below the 81U pickup threshold[A] for the duration of the 81U time delay setting[B]. A voltage inhibit setting[C], expressed as a percentage of the rated generator voltage, can be implemented to prevent an underfrequency trip from occurring during startup when the generator voltage is rising toward the nominal level. Underfrequency protection can be enabled and disabled[D] without altering the pickup, delay, and inhibit settings. Underfrequency pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus*® underfrequency settings are illustrated in Figure 32.

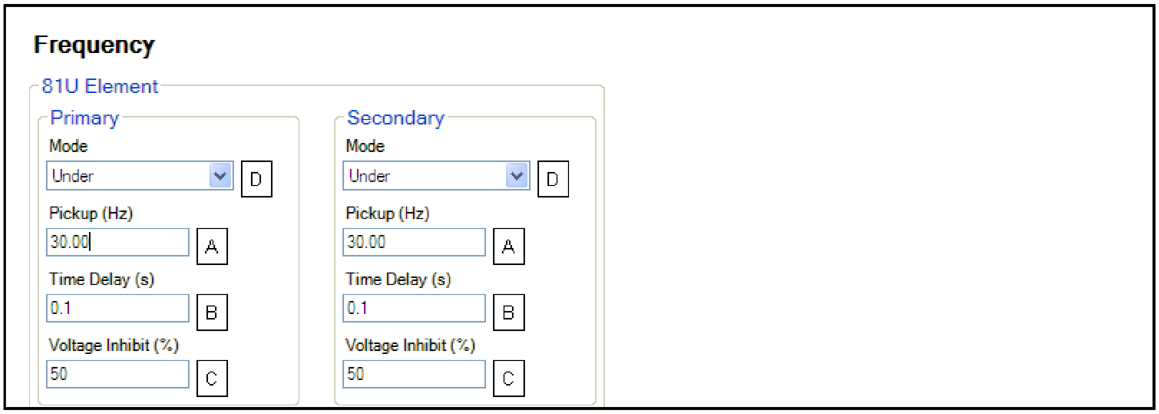


Figure 32. Underfrequency Protection Settings

[A] *Underfrequency (81U) Pickup (Hz)*: Adjustable from 30 to 70 hertz in 0.01 hertz increments.
[B] *Underfrequency (81U) Time Delay (s)*: Adjustable from 0.1 to 300 seconds in 0.1 second increments.
[C] *Underfrequency (81U) Voltage Inhibit (%)*: Adjustable from 50 to 100% in 1% increments.
[D] *Underfrequency (81U) Mode*: Select Disable or Under.

Power Protection

BESTCOMS*Plus* Navigation Path: Settings Explorer, Protection, Power
HMI Navigation Path: Settings, Protection, Power

Generator power levels are monitored to protect against reverse power flow and loss of excitation.

Reverse Power

Reverse power protection guards against reverse power flow that may result from a loss of prime mover torque (and lead to generator motoring). A reverse power condition occurs when the flow of reverse power exceeds the 32R pickup threshold[A] for the duration of the 32R time delay[B]. Reverse power protection can be enabled and disabled[C] without altering the pickup and time delay settings. Reverse power pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus* reverse power protection settings are illustrated in Figure 33.

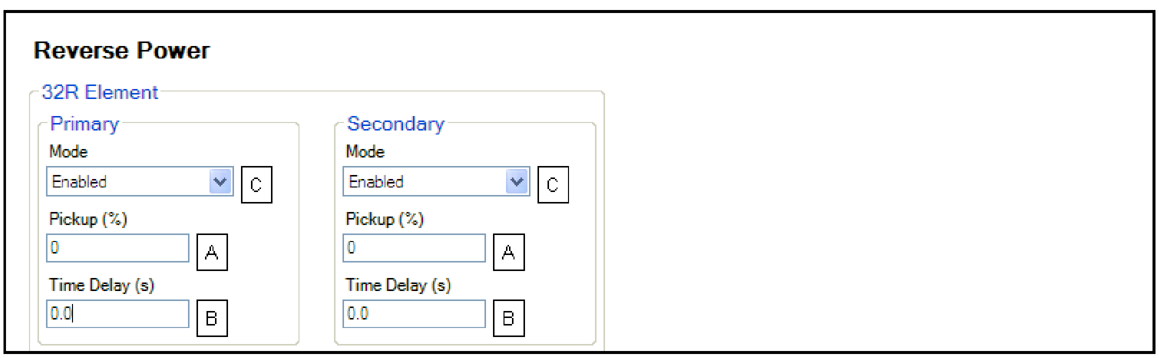


Figure 33. Reverse Power Protection Settings

[A] *Reverse Power (32R) Pickup (%)*: Adjustable from 0 to 150% in 1% increments.
[B] *Reverse Power (32R) Time Delay (s)*: Adjustable from 0 to 300 seconds in 0.1 second increments.
[C] *Reverse Power (32R) Mode*: Select Disabled or Enabled.

Loss of Excitation

The loss of excitation element operates on excessive var flow into the machine, indicating abnormally low field excitation. This element protects controlled generators as well as motors. A diagram of the 40Q pickup response is illustrated in Figure 34. BESTCOMS*Plus* settings are described below and shown in Figure 35.

Generator Protection

During loss of excitation, the generator absorbs reactive power from the power system which can overheat the stator windings. The Loss of Excitation element acts on the principal that if a generator begins to absorb vars outside its steady-state capability curve, it has likely lost its normal excitation supply. The element is always calibrated to the equivalent three-phase power even if the connection is single-phase.

The Loss of Excitation element compares the reactive power to a map of the allowed reactive power as defined by the Pickup setting. The Loss of Excitation element remains in a pickup condition until power flow falls below the dropout ratio of 95% of the actual pickup. A time delay is recommended for tripping. For settings well outside the generator capability curve, adding a 0.5 second time delay helps prevent transient fault conditions. However, recovery from power system swings after a major fault may take several seconds. Therefore, if the unit is to pick up near the steady-state capability curve of the generator, longer time delays are recommended. See Figure 34 for details.

Motor Protection

The DECS-250N compares the real power (kW) flowing into the motor with the reactive power (kvar) being supplied. Operation of synchronous motors drawing reactive power from the system can result in overheating in parts of the rotor that do not normally carry current. The 40Q pickup response is shown in Figure 34.

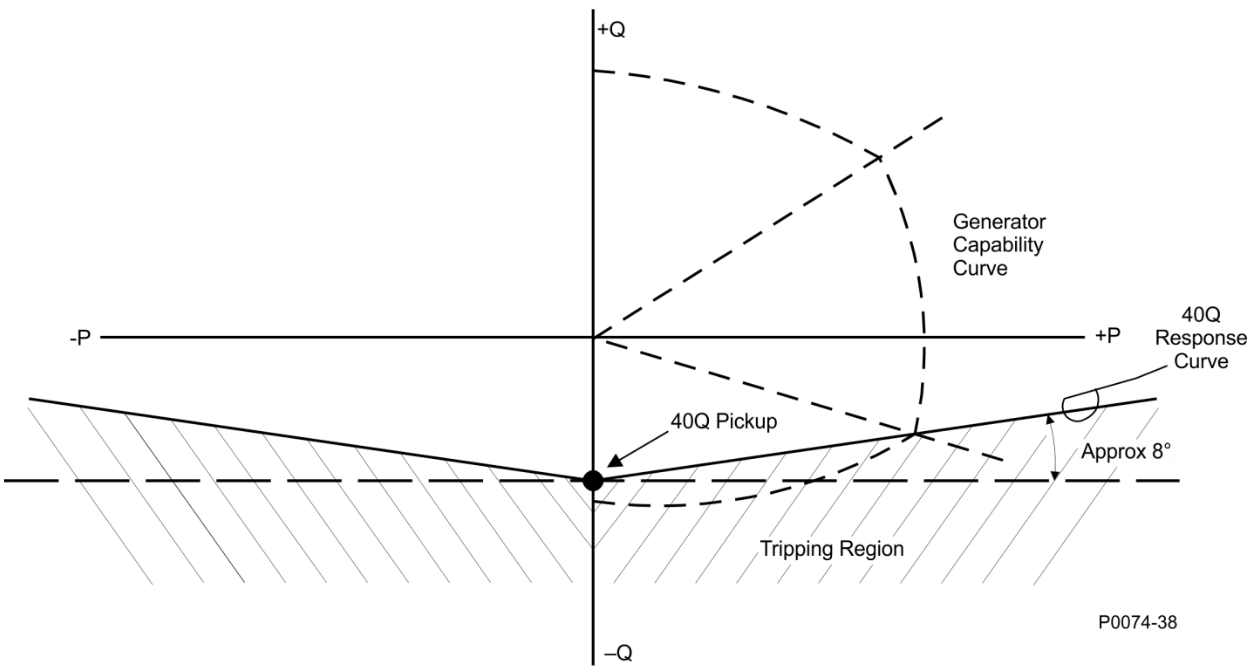


Figure 34. Generator Capability Curve vs. 40Q Response

Pickup and Trip

A loss of excitation condition exists when the level of absorbed vars exceeds the loss of excitation (40Q) threshold[A] for the duration of the 40Q time delay[B]. A time delay setting of zero (0) makes the Loss of Excitation element instantaneous with no intentional time delay. If the pickup condition subsides before the time delay expires, the timer and pickup are reset, no corrective action is taken, and the element is rearmed for any other occurrences of loss of excitation.

The 40Q threshold is expressed as a percentage of the rated var flow for the machine. Loss of excitation protection can be enabled and disabled[C] without altering the pickup and time delay settings. BESTCOMS*Plus*® loss of excitation settings are illustrated in Figure 35.

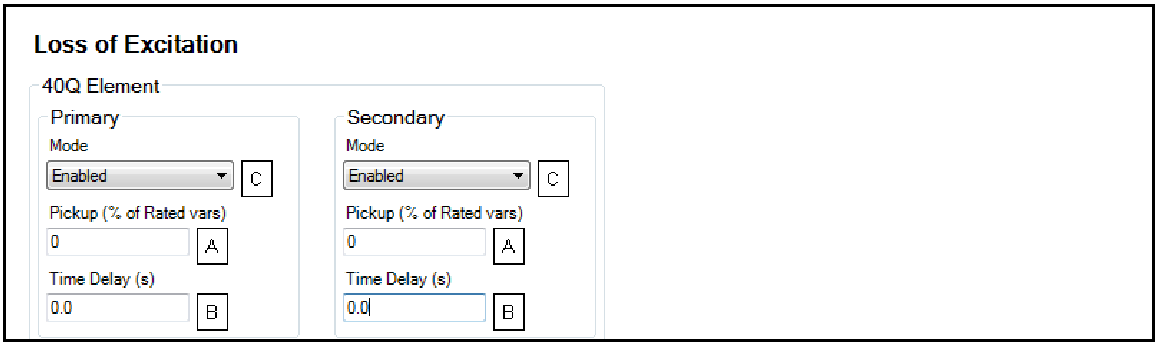


Figure 35. Loss of Excitation Protection Settings

[A] *Pickup (% of rated vars):* Adjustable from 0 to 150% in 1% increments.
[B] *Time Delay:* Adjustable from 0 to 300 seconds in 0.1 second increments.
[C] *Mode:* Select Disabled or Enabled.

Field Protection

BESTCOMS*Plus* Navigation Path: Settings Explorer, Protection, Field

HMI Navigation Path: Settings, Protection, Field

Field protection provided by the DECS-250N includes field overvoltage, field overcurrent, an exciter diode monitor, and power input failure.

Field Overvoltage

A field overvoltage condition occurs when the field voltage exceeds the field overvoltage threshold[A] for the duration of the field overvoltage time delay[B]. Field overvoltage protection can be enabled and disabled[C] without altering the pickup and time delay settings. Field overvoltage pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTlogic*Plus* field overvoltage settings are illustrated in Figure 36.

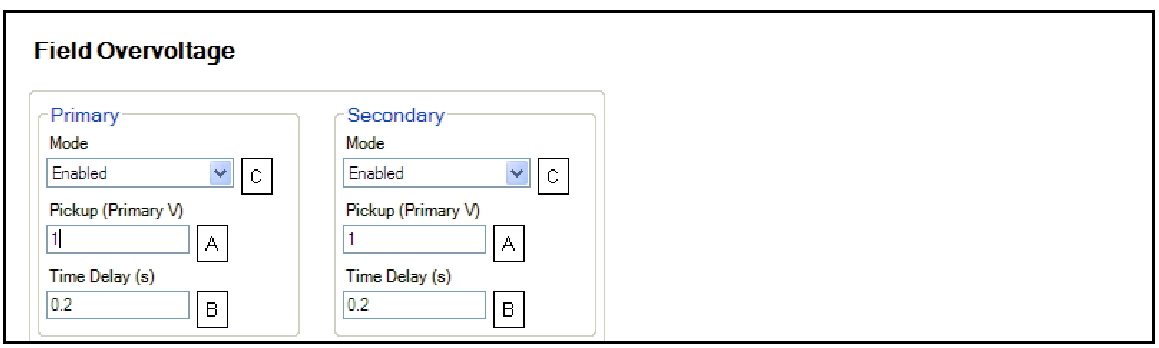


Figure 36. Field Overvoltage Protection Settings

[A] *Field Overvoltage Pickup (V)*: Adjustable from 0 to 325 Vdc in 1 Vdc increments.
[B] *Field Overvoltage Time Delay (s)*: Adjustable from 0.2 to 30 seconds in 0.1 second increments.
[C] *Field Overvoltage Mode*: Select Disabled or Enabled.

Field Overcurrent

A field overcurrent condition is annunciated when the field current exceeds the field overcurrent pickup level[A] for the duration of the field overcurrent time delay. Depending on the selected timing mode[B], the time delay can be fixed or related to an inverse function. Definite timing mode uses a fixed time delay[C]. In inverse timing mode, the time delay is shortened in relation to the level of field current above the pickup level. The time dial[D] setting acts as a linear multiplier for the time to an annunciation. This enables the DECS-250N to approximate the heating characteristic of the generator and generator step-up transformer during overexcitation. The field current must fall below the dropout ratio (95%) for the function to begin timing to reset. The following equations are used to calculate the field overcurrent pickup and reset time delays.

$$t_{pickup} = \frac{A \times TD}{B + \sqrt{C + D \times MOP}}$$

Equation 5. Inverse Field Overcurrent Pickup

Where:

t_{pickup} = time to pick up in seconds
A = -95.908
B = -17.165
C = 490.864
D = -191.816
TD = time dial setting <0.1, 20>
MOP = multiple of pickup <1.03, 205>

$$Time_{reset} = \frac{0.36 \times TD}{(MOP_{reset})^2 - 1}$$

Equation 6. Inverse Field Overcurrent Reset

Where:

$Time_{reset}$ = maximum time to reset in seconds
TD = time dial setting <0.1, 20>
MOP_{reset} = multiple of pickup <1.03, 205>

Primary and secondary setting groups provide additional control for two distinct machine operating conditions.

Field overcurrent protection can be enabled and disabled[E] without altering the pickup and time delay settings. Field overcurrent pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus*® field overcurrent settings are illustrated in Figure 37. In BESTCOMS*Plus,* a plot of the field overcurrent setting curve is displayed. The plot can display the primary or secondary setting curves.

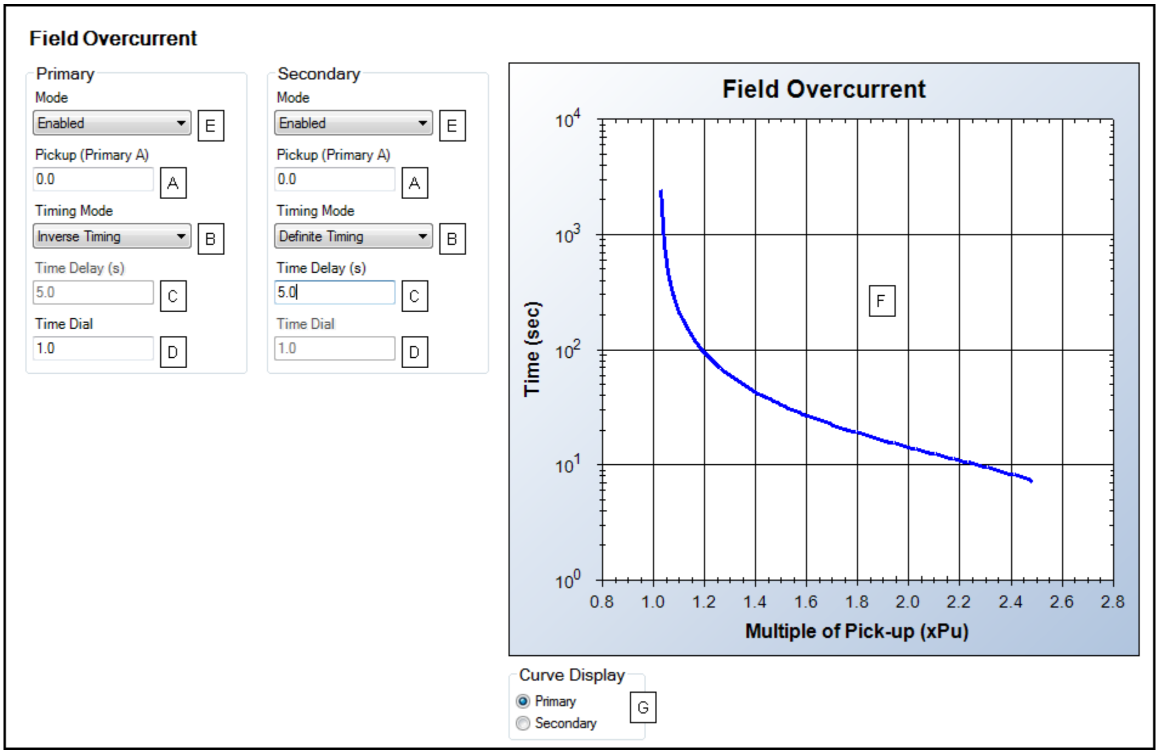


Figure 37. Field Overcurrent Protection Settings

[A] *Field Overcurrent Pickup (A)*: Adjustable from 0 to 22 Adc in 0.1 Adc increments.
[B] *Timing Mode:* Select Definite Timing or Inverse Timing
[C] *Field Overcurrent Time Delay (s)*: Adjustable from 0 or 5 to 60 seconds in 0.1 second increments.
[D] *Field Overcurrent Time Dial:* Adjustable from 0.1 to 20 in increments of 0.1.
[E] *Field Overcurrent Mode*: Select Disabled or Enabled.
[F] Inverse field overcurrent pickup curve.
[G] Curve display selections.

Exciter Diode Monitor

The exciter diode monitor (EDM) monitors the condition of a brushless exciter's power semiconductors by monitoring the exciter field current. The EDM detects both open and shorted rotating diodes in the exciter bridge. EDM settings are illustrated in Figure 38. When implementing the EDM, it is imperative that the user know and specify the number of poles for the exciter armature and the generator rotor. For reliable open diode detection, the exciter to generator pole ratio[A] should be 1.5 or higher and the level of field current should be no less than 1.5 Adc. A pole ratio calculator, available in BESTCOMS*Plus*®, can be used to calculate the pole ratio from the number of exciter armature and generator rotor poles.

NOTE

If the number of poles for the exciter armature and the generator rotor is unknown, the EDM function will still operate. However, only a shorted diode can be detected. If the number of poles is not known, it is best to disable all exciter open diode protection parameters. In this situation, the generator and exciter pole parameters must be set at zero to prevent false tripping.

An open exciter diode may not be detected if the generator frequency and operating power frequency are the same and the DECS-250N operating power is supplied by a single-phase source. Three-phase operating power is recommended for reliable open diode detection. Open diode detection will also be impaired when a permanent magnet generator (PMG) is supplying DECS-250N operating power and the PMG frequency is the same or lower than the generator frequency.

All of the EDM setup guidelines presented here assume that the exciter diodes are not open or shorted at the time of setup and testing.

The EDM estimates the fundamental harmonic of the exciter field current using discrete Fourier transforms (DFTs). The harmonic, expressed as a percentage of the field current, is then compared to the pickup level for open diode detection[B] and shorted diode detection[C]. If the percentage of field current exceeds the open diode or shorted diode pickup level, then the appropriate time delay will begin. After the time delay for the open diode[D] or shorted diode[E] condition expires and if the percentage of field current continues to exceed the open or shorted diode pickup setting, the condition is annunciated. EDM pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to an open or shorted diode condition.

An EDM disable level setting prevents nuisance annunciations due to low excitation current or the generator frequency being out of range. A disable level setting[F] can be used to disable both open- and shorted-diode protection when the rated field current drops below the user-defined percentage. EDM protection can be disabled and enabled[G] by the user without altering the individual protection settings.

Applying EDM Protection

It is especially difficult to detect open diode conditions when the number of generator and exciter poles is unknown. For this reason, the ratio of the number of brushless exciter armature poles to the number of generator rotor poles should be entered to ensure detection of both open and shorted diodes.

Finding the Maximum Field Ripple Current

To set the open diode pickup level and shorted diode pickup level, the maximum ripple current on the field must be known. This can be accomplished by running the generator unloaded and at rated speed. Vary the generator voltage from minimum to maximum while monitoring the EDM ripple level on the HMI display. Record the highest value.

Setting the Pickup Level—Number of Generator Poles Known

Multiply the highest EDM ripple value, obtained in the preceding paragraph, by 2. The result is the open diode pickup level setting. The multiplier can be varied between 1.5 and 5 to increase or decrease the trip margin. However, reducing the multiplier could result in nuisance open diode indications.

Multiply the highest EDM ripple value, obtained in the preceding paragraph by 50. The result is the shorted diode pickup level setting. The multiplier can be varied between 40 and 70 to increase or decrease the trip margin. However, reducing the multiplier could result in nuisance shorted diode indications.

The DECS-250N has fixed EDM inhibit levels to prevent nuisance failed-diode indications while the generator frequency is less than 40 hertz or greater than 70 hertz. EDM operation is also inhibited when the level of field current is below the disable level setting.

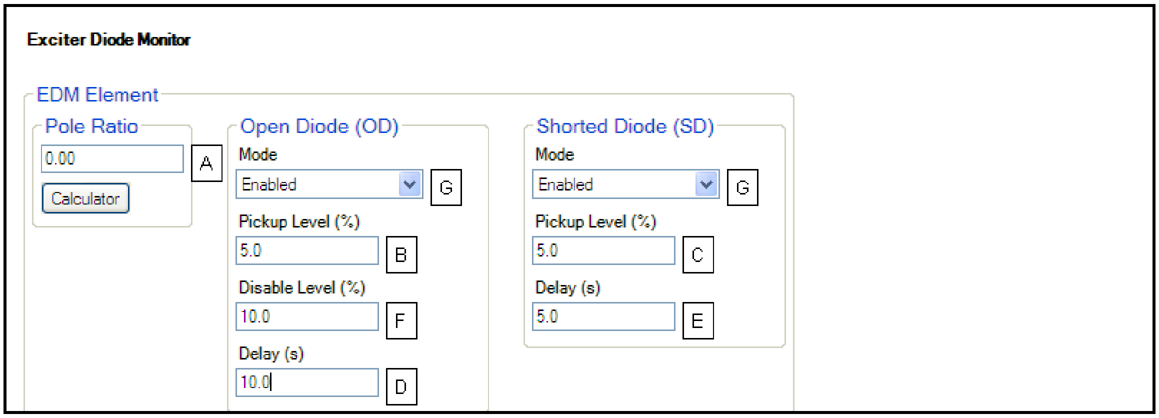


Figure 38. Exciter Diode Monitor Protection Settings

[A] *EDM Pole Ratio*: Adjustable from 0 to 10 in 0.01 increments.
[B] *Open Diode Pickup Level (%)*: Adjustable from 0 to 100% in 0.1% increments.
[C] *Shorted Diode Pickup Level (%)*: Adjustable from 0 to 100% in 0.1% increments.
[D] *Open Diode Delay (s)*: Adjustable from 10 to 60 seconds in 0.1 second increments.
[E] *Shorted Diode Delay (s)*: Adjustable from 5 to 30 seconds in 0.1 second increments.
[F] *Disable Level (%)*: Adjustable from 0 to 100% in 0.1% increments.
[G] *Mode*: Select Disabled or Enabled.

Setting the Pickup Level—Number of Generator Poles Unknown

The DECS-250N can detect shorted diode conditions when the number of generator poles is not known. To provide this protection, disable open diode protection, set the pole ratio at zero, and enable shorted diode protection. Multiply the maximum EDM ripple level, obtained under *Finding the Maximum Field Ripple Current*, by 30. The multiplier can be varied between 20 and 40 to increase or decrease the pickup margin. However, reducing the multiplier could result in nuisance shorted diode indications.

Testing the EDM Settings

Start the generator from rest and increase the speed and voltage to the rated value. load the machine to its rating and confirm that no failed diode annunciations occur. All of the EDM setup guidelines presented here assume that the exciter diodes were not opened or shorted at the time of setup and testing.

Power Input Failure

A power input failure condition exists when any one of the following occurs:

1-Phase Operating Power

- When operating power decreases below 50 Vac, a power input failure condition exists.

3-Phase Operating Power

- All three phases of operating power decrease below 50 Vac
- One or more phases of operating power decreases below 10 Vac
- A phase-to-phase voltage imbalance greater than 20% exists at the operating power input

The DECS-250N settings must be properly set to match the active operating power configuration. For example, if the DECS-250N settings reflect a 3-phase power configuration but the actual operating power configuration is 1-phase then the DECS-250N will interpret the one phase as an imbalance and set an alarm/trip. For more information on 1- and 3-phase operating power settings see *Configuration* and *Specifications*.

Power input failure protection can be used for PMG applications, shunt-, or PMG-powered systems. This protection is only active in *Start* mode and after soft start. A time delay setting[A] delays power input failure annunciations to accommodate transient reductions/imbalances in the operating power input voltage. Power input failure protection can be enabled and disabled[B] without altering the time delay setting. The selected power input configuration[C] is shown as a read-only value. Power input failure pickup and trip elements in BESTlogic*Plus* can be used in a logic scheme to initiate corrective action in response to the condition. BESTCOMS*Plus*® power input failure settings are illustrated in Figure 39.

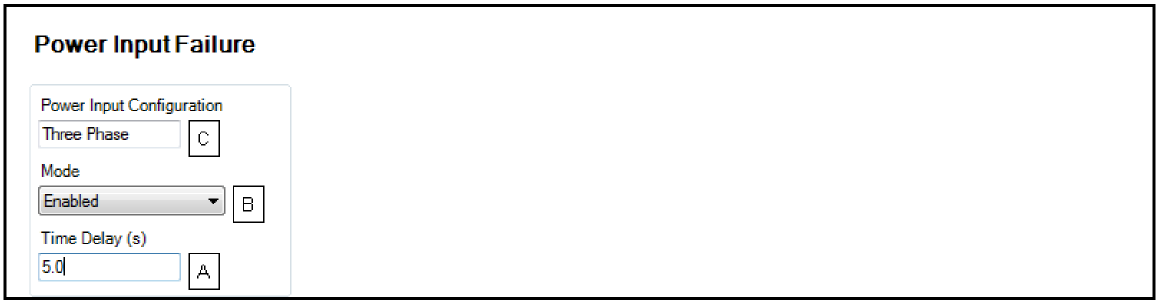


Figure 39. Power Input Failure Protection Settings

[A] *Time Delay (s)*: Adjustable from 0 to 10 seconds in 0.1 second increments.
[B] *Mode*: Select Disabled or Enabled.
[C] *Power Input Configuration:* Read-only value

Sync-Check Protection

BESTCOMS*Plus* Navigation Path: Settings Explorer, Protection, Sync Check (25)
HMI Navigation Path: Settings, Protection, Sync Check (25)

Caution
Because the DECS-250N sync-check and automatic synchronizer functions share internal circuitry, the sync-check function is not available when the automatic synchronizer style option is selected.

When enabled[A], the sync-check (25) function supervises the automatic or manual synchronism of the controlled generator with a bus/utility. During synchronizing, the 25 function compares the voltage[B], slip angle[C], and slip frequency[D] differences between the generator and bus. When the generator/bus differences fall within the setting for each parameter, the 25 status virtual output asserts. This virtual output can be configured (in BESTlogic*Plus*) to assert a DECS-250N contact output. This contact output can, in turn, enable the closure of a breaker tying the generator to the bus.

An angle compensation[E] setting is provided to offset phase shift caused by transformers in the system. For more details on the angle compensation setting, see the *Synchronizer* chapter.

When the Gen Freq > Bus Freq[F] setting box is checked, the 25 status virtual output will not assert unless the generator frequency is greater than the bus frequency. Sync-check protection settings are illustrated in Figure 40.

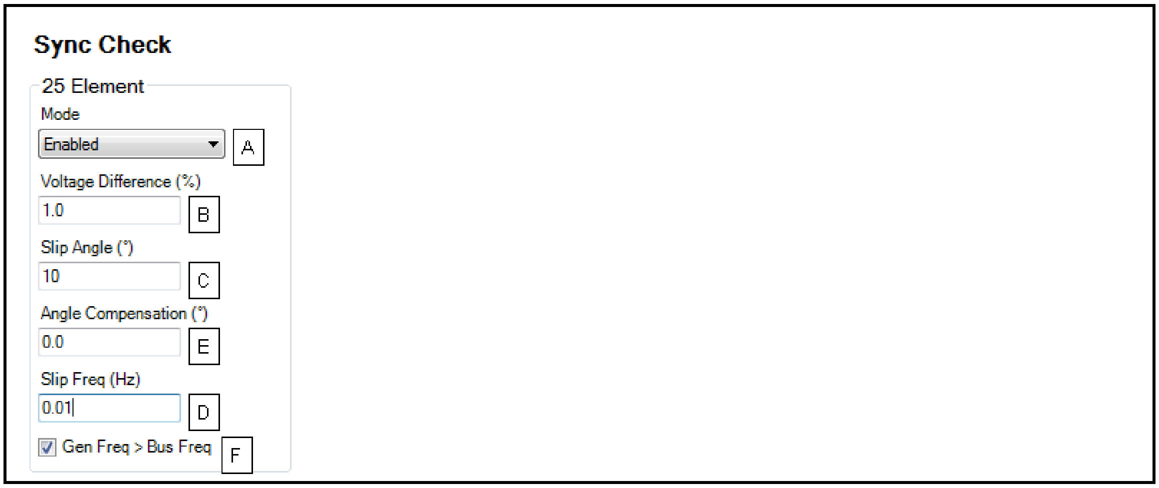


Figure 40. Sync-Check Protection Settings

[A] *Sync-Check Mode*: Select Disabled or Enabled.
[B] *Sync-Check Voltage Difference (%)*: Adjustable from 0 to 50% in 0.1% increments.
[C] *Sync-Check Slip Angle (Degrees)*: Adjustable from 1 to 99° in 0.1° increments.
[D] *Sync-Check Slip Freq (Hz)*: Adjustable from 0.01 to 0.5 Hz in 0.01 Hz increments.
[E] *Angle Compensation (°)*: Adjustable from 0.0 to 359.9° in 0.1° increments.
[F] *Gen Freq > Bus Freq*: Enable (checked) or Disable (unchecked)

Generator Frequency Less Than 10 Hertz

A *Generator Below 10 Hz* condition is annunciated when the generator frequency decreases below 10 Hz or when residual voltage is low at 50/60 Hz. A *Generator Below 10 Hz* annunciation is automatically reset when the generator frequency increases above 10 Hz or the residual voltage increases above the threshold.

Configurable Protection

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Protection, Configurable Protection
HMI Navigation Path: Settings, Protection, Configurable Protection

The DECS-250N has eight configurable protection elements which can be used to supplement the standard DECS-250N protection. BESTCOMS*Plus*® configurable protection settings are illustrated in Figure 41. To make the protection elements easier to identify, each element can be given a user-assigned name[A]. A protection element is configured by selecting the parameter[B] to be monitored and then establishing the operating characteristics for the element. Any one of the following parameters may be selected.

- Analog Input 1, 2, 3, 4, 5, 6, 7, 8
- Auxiliary Input Current (mA)
- Auxiliary Input Voltage
- Bus Frequency
- Bus Voltage: V_{AB}, V_{BC}, or V_{CA}
- EDM Ripple
- Exciter Field Current
- Exciter Field Voltage
- Gen Current: I_A, I_B, I_C, or Average
- Gen Frequency
- Gen Power Factor
- Gen Voltage: V_{AB}, V_{BC}, V_{CA}, or Average
- Kilovarhours

- Kilowatthours
- Negative Sequence Current
- Negative Sequence Voltage
- Positive Sequence Current
- Positive Sequence Voltage
- PSS Output
- RTD Input 1, 2, 3, 4, 5, 6, 7, 8
- Setpoint Position
- Thermocouple 1, 2
- Total kVA
- Total kvar
- Total kW
- Tracking Error

If an optional Analog Expansion Module (AEM-2020) is used, any one of the following analog, RTD, and thermocouple inputs may be selected.

- Analog Input 1, 2, 3, 4, 5, 6, 7, or 8
- RTD Input 1, 2, 3, 4, 5, 6, 7, or 8
- Thermocouple 1 or 2

Protection can be always enabled or enabled only when the DECS-250N is enabled and supplying excitation[C]. When protection is enabled only in Start mode, an arming time delay[D] can be used to delay protection following the start of excitation.

A hysteresis function holds the protection function active for a user-defined percentage[E] above/below the pickup threshold. This prevents repeated pickups and dropouts where the monitored parameter is hovering around the pickup threshold. For example, with a hysteresis setting of 5% on a protection element configured to pick up at 100 Aac of A-phase generator overcurrent, the protection element would pick up when the current rises above 100 Aac and remain picked up until the current decreases below 95 Aac.

Each of the eight configurable protection elements has four individually-adjustable thresholds. Each threshold can be set for pickup when the monitored parameter increases above the pickup setting (Over), pickup when the monitored parameter decreases below the pickup setting (Under), or no pickup (Disabled)[F]. The pickup level for the monitored parameter is defined by a threshold setting[G]. While the threshold setting range is broad, you must use a value within the setting range limits for the monitored parameter. Using an out-of-limits threshold will prevent the protection element from functioning. An activation delay[H] serves to delay a protective trip after the threshold (pickup) level is exceeded.

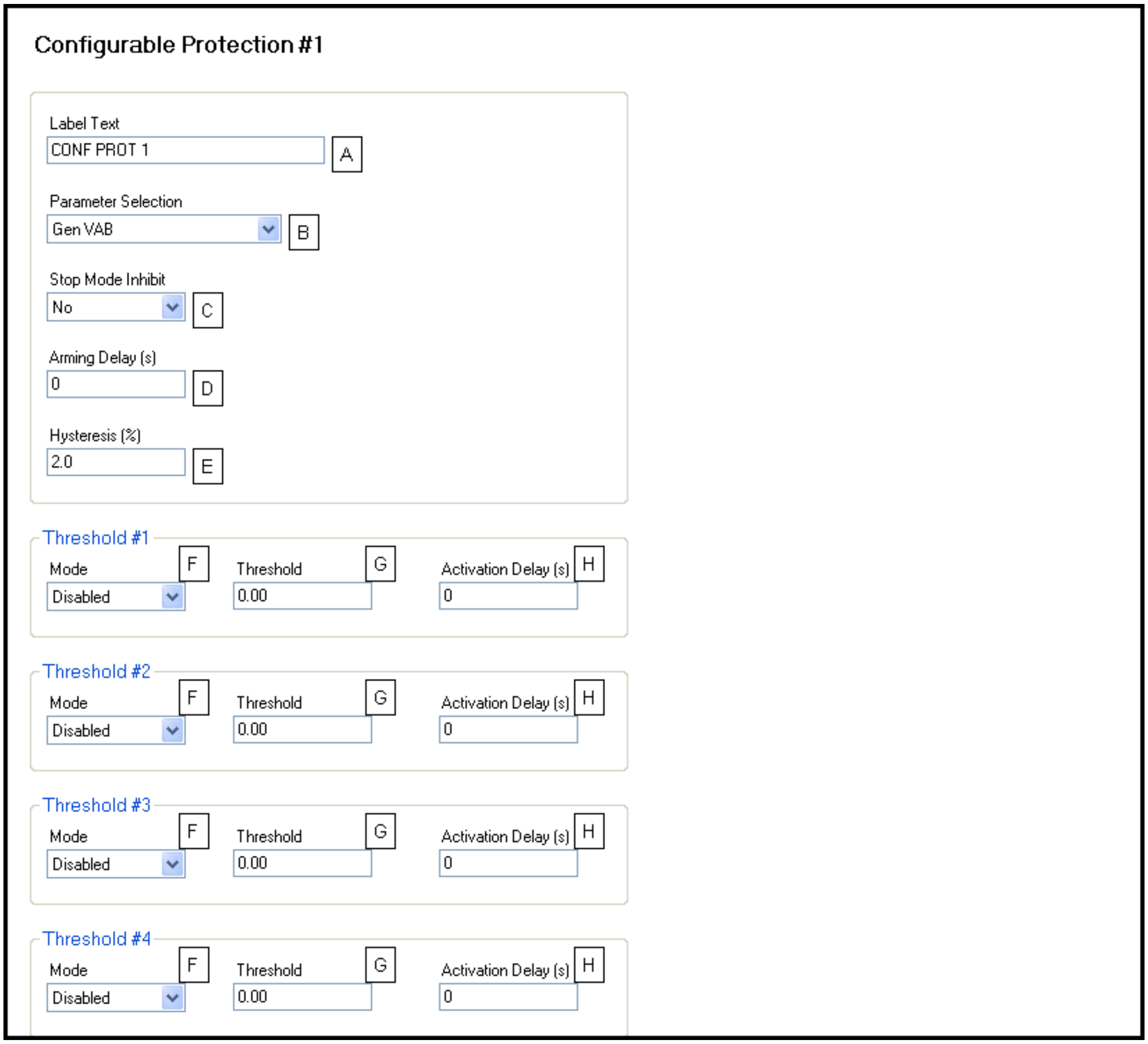


Figure 41. Configurable Protection Settings

[A] *Label Text*: Accepts a maximum of 16 alphanumeric characters.
[B] *Param Selection*: Select Gen VAB, Gen VBC, Gen VCA, Gen V Average, Bus Freq, Bus VAB, Bus VBC, Bus VCA, Gen Freq, Gen PF, KWH, kvarh, Gen IA, Gen IB, Gen IC, Gen I Average, KW Total, KVA Total, kvar Total, EDM Ripple, Exciter Field Voltage, Exciter Field Current, Auxilary Input Voltage, Auxilary Input Current (mA), Setpoint Position, Tracking Error, Negative Sequence Voltage, Negative Sequence Current, Positive Sequence Voltage, Positive Sequence Current, PSS Output, Analog Input 1, Analog Input 2, Analog Input 3, Analog Input 4, Analog Input 5, Analog Input 6, Analog Input 7, Analog Input 8, RTD Input 1, RTD Input 2, RTD Input 3, RTD Input 4, RTD Input 5, RTD Input 6, RTD Input 7, RTD Input 8, Thermocouple 1, or Thermocouple 2.
[C] *Stop Mode Inhibit*: Select Yes or No.
[D] *Arming Delay*: Adjustable from 0 to 300 seconds in 1 second increments.
[E] *Hysteresis:* Adjustable from 0 to 100% of the threshold setting in 0.1% increments.
[F] *Mode*: Select Over, Under, or Disabled.
[G] *Threshold*: Adjustable from –999,999 to +999,999 in 0.01 increments.
[H] *Activation Delay (s)*: Adjustable from 0 to 300 seconds in 1 second increments.

Limiters

DECS-250N limiters ensure that the controlled machine does not exceed its capabilities. Overexcitation, underexcitation, stator current, and reactive power are limited by the DECS-250N. It also limits the voltage during underfrequency conditions.

Overexcitation Limiter

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Limiters, OEL
HMI Navigation Path: Settings, Operating Settings, Limiters, OEL

Operating in the overexcited region of a generator's capability curve can cause excessive field current and field winding heating. The overexcitation limiter (OEL) monitors the level of field current supplied by the DECS-250N and limits it to prevent field overheating.

The OEL can be enabled[A] in all regulation modes. OEL behavior in manual mode can be configured to limit excitation or issue an alarm. This behavior is configured in BESTlogic™*Plus*.

Two styles of overexcitation limiting are available in the DECS-250N: summing point or takeover.[B] OEL settings are illustrated in Figure 45, Figure 46, and Figure 47.

Summing Point OEL

Summing point overexcitation limiting compensates for field overcurrent conditions while the machine is offline or online. Offline and online OEL behavior is dictated by two separate groups of settings. Primary and secondary setting groups (selectable in configurable logic) provide additional control for two distinct machine operating conditions.

Offline Operation

For offline operation, there are two levels of summing-point overexcitation limiting: low and high. Figure 42 illustrates the relationship of the high-level and low-level OEL thresholds.

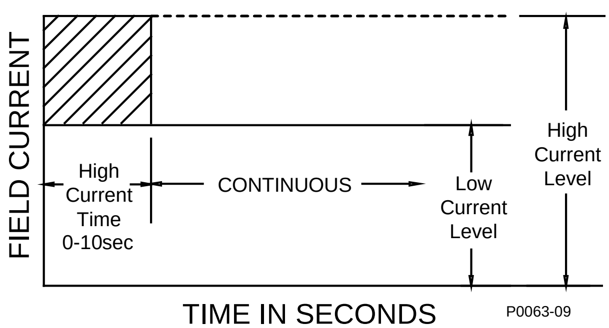


Figure 42. Summing Point, Offline, Overexcitation Limiting

The offline, low-level OEL threshold is determined by the low-level setting[C]. When the excitation level is below the low-level setting, no action is taken by the DECS-250N. The generator is permitted to operate indefinitely with this level of excitation.

The offline, high-level OEL threshold is determined by a high level[D] and high time[E] setting. When the excitation level exceeds the high level setting, the DECS-250N acts to limit the excitation to the value of the high-level setting. If this level of excitation persists for the duration of the high time setting, the DECS-250N acts to limit the excitation to the value of the low-level setting.

Online Operation

For online operation, there are three levels of summing-point overexcitation limiting: low, medium, and high. Figure 43 illustrates the relationship of the low-, medium-, and high-level OEL thresholds.

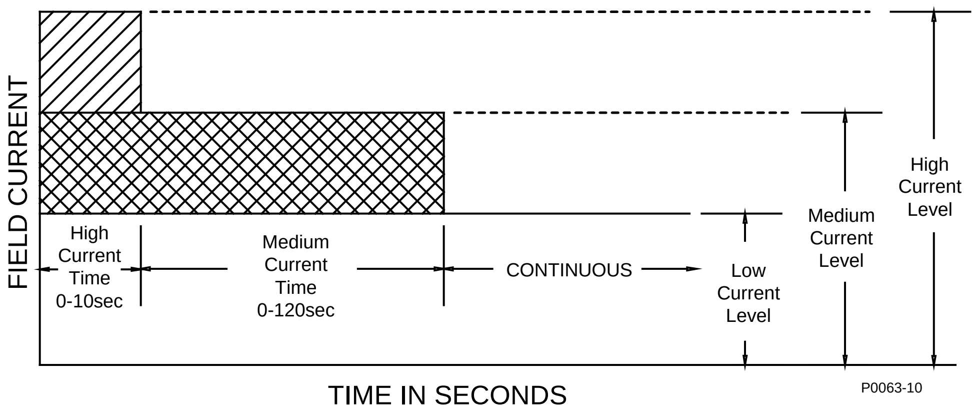


Figure 43. Summing Point, Online, Overexcitation Limiting

The online, low-level OEL threshold is determined by the low-level setting[F]. When the excitation level is below the low-level setting, no action is taken by the DECS-250N. The generator is permitted to operate indefinitely with this level of excitation. When the excitation level exceeds the low-level setting for the duration of the medium time setting, the DECS-250N acts to limit the excitation to the value of the low-level setting.

The online, medium-level OEL threshold is determined by a medium level[G] and medium time[H] setting. When the excitation level exceeds the medium level setting, the DECS-250N acts to limit the excitation to the value of the medium-level setting. If this level of excitation persists for the duration of the high time setting, the DECS-250N acts to limit the excitation to the value of the medium-level setting.

The online, high-level OEL threshold is determined by a high level[I] and high time[J] setting. When the excitation level exceeds the high level setting, the DECS-250N instantaneously acts to limit the excitation to the value of the medium-level setting.

OEL Voltage Dependency

Online OEL operation can be tailored for fault proximity by enabling[K] the OEL voltage dependency function. If a fault is close to the generator, the OEL high-level setting is disabled (based upon the rate of change) and switches to the medium-level setting. If a fault is away from the machine, all three (high, medium, and low) settings remain active. In other words, if the rate of terminal voltage reduction exceeds the OEL voltage dependency setting[L], the high-level setting remains enabled. Otherwise, the high-level setting is disabled.

Takeover OEL

Takeover overexcitation limiting limits the field current level in relation to an inverse time characteristic similar to that shown in Figure 44. Separate curves may be selected for online and offline operation. If the system enters an overexcitation condition, the field current is limited and forced to follow the selected curve. The inverse time characteristic is defined by Equation 7.

$$t_{pickup} = \frac{A \times TD}{B + \sqrt{C + D \times MOP}}$$

Equation 7. Inverse Pickup Time Characteristic

Where:
t_{pickup} = time to pick up in seconds
A = -95.908
B = -17.165
C = 490.864
D = -191.816
TD = time dial setting <0.1, 20>
MOP = multiple of pickup <1.03, 205>

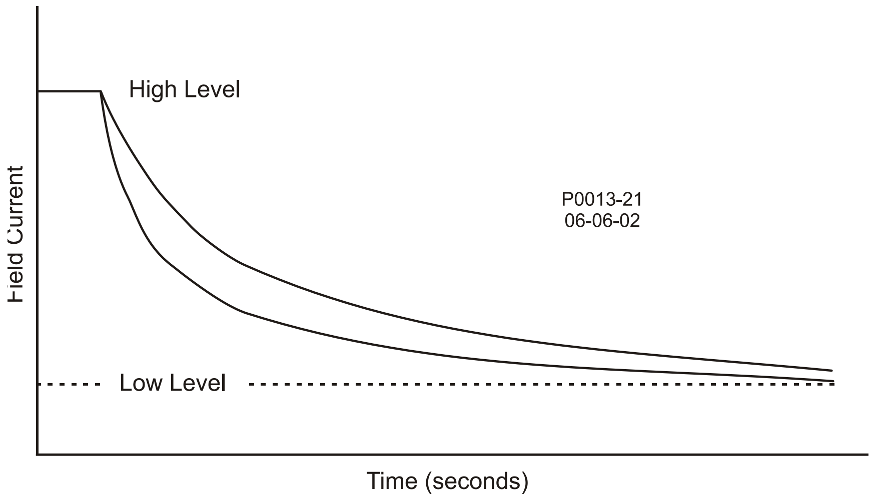


Figure 44. Inverse Time Characteristic for Takeover OEL

Primary and secondary setting groups provide additional control for two distinct machine operating conditions. Each mode of takeover OEL operation (offline and online) has a low-level[M], high-level[N], and time dial[O] setting.

Once the field current decreases below the dropout level (95% of pickup), the function is reset based on the selected reset method[P]. The available reset methods are inverse, integrating, and instantaneous.

Using the inverse method, the OEL is reset based on time versus multiple of pickup (MOP). The lower the field current level, the less time is required for reset. Inverse reset uses the following curve (Equation 8) to calculate maximum reset time.

$$Time_{reset} = \frac{RC \times TD}{(MOP_{reset})^2 - 1}$$

Equation 8. Inverse Reset Time Characteristic

Where:

$Time_{reset}$ = maximum time to reset in seconds
RC = reset coefficient setting[Q] <0.01, 100>
TD = time dial setting <0.1, 20>
MOP_{reset} = multiple of pickup <1.03, 205>

For the integrating reset method, the reset time is equal to the pickup time. In other words, the amount of time spent above the low level threshold is the amount of time required to reset.

Instantaneous reset has no intentional time delay.

In BESTCOMS*Plus*®*,* a plot of the takeover OEL setting curves is displayed. Settings enable selection of the displayed curves. The plot can display the primary or secondary setting curves, the offline or online settings curves, and the pick up or reset settings curves.

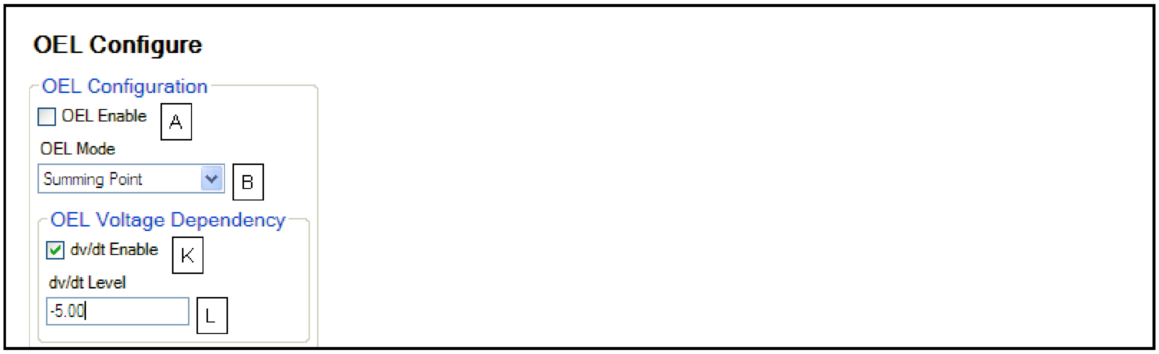


Figure 45. OEL Configuration Settings

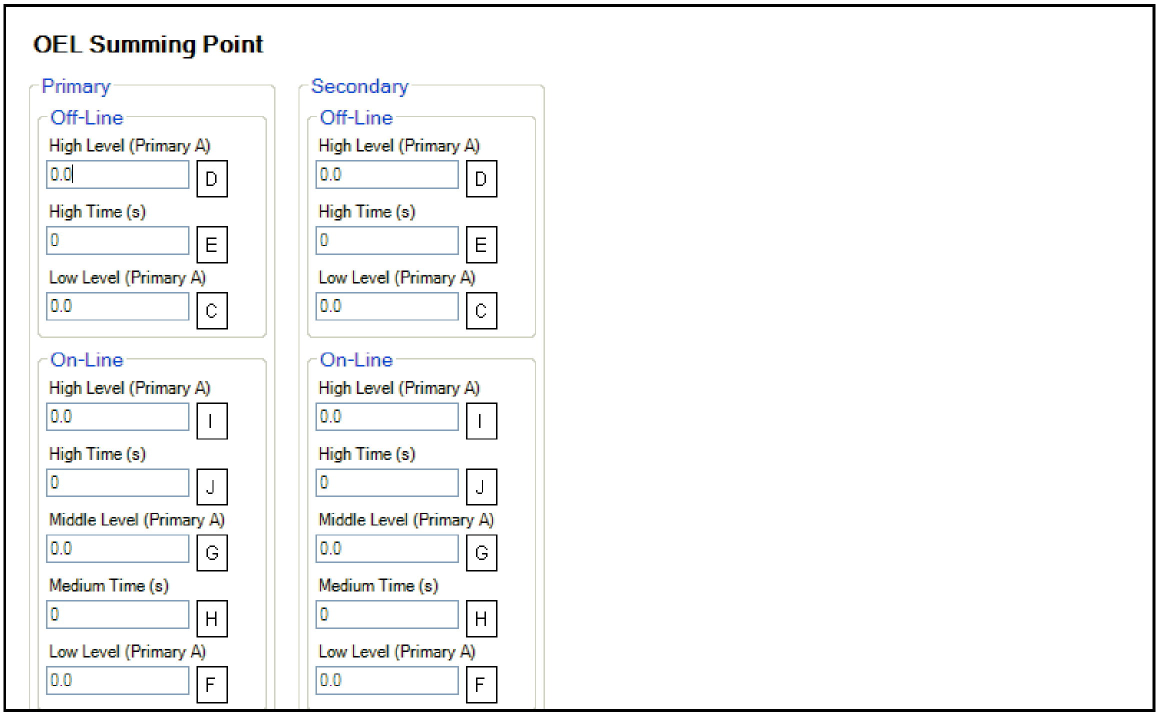


Figure 46. Summing Point OEL Settings

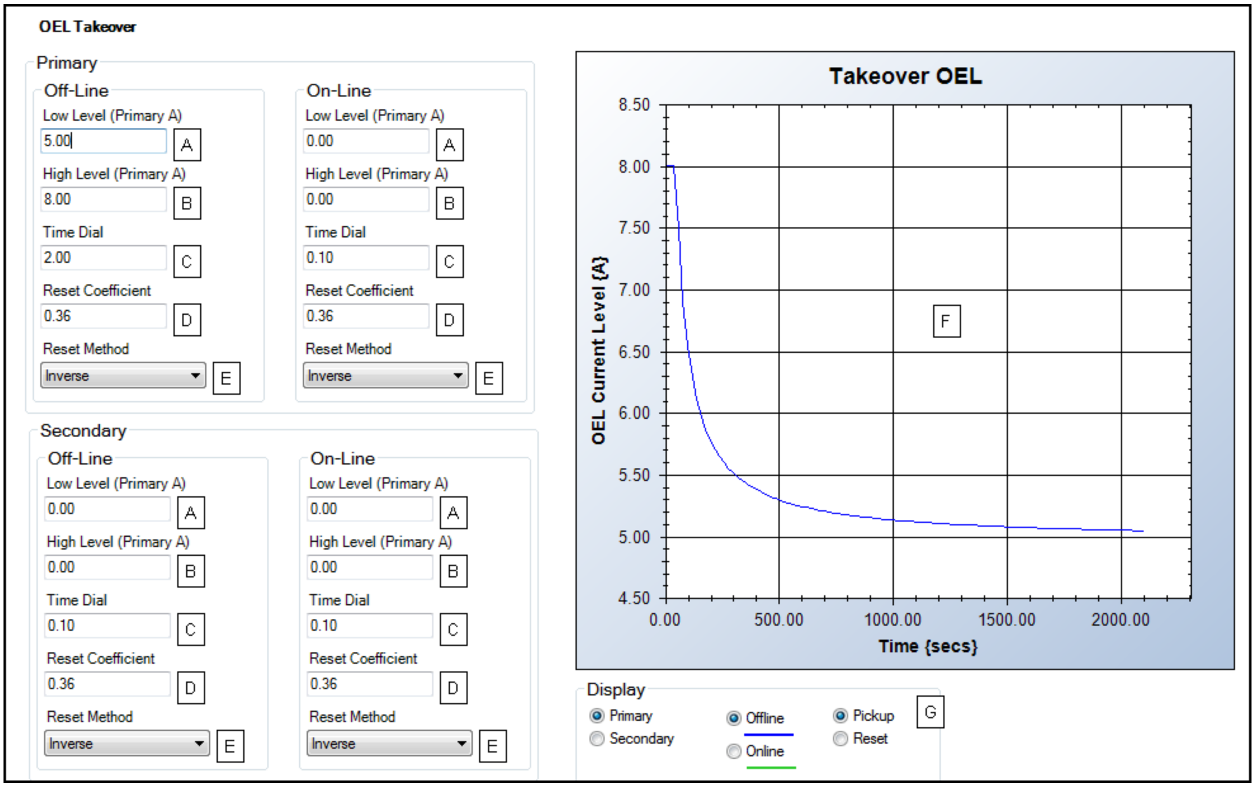


Figure 47. Takeover OEL Settings

[A] *OEL Enable*: Select checkbox to enable OEL.
[B] *OEL Mode:* Select Summing Point or Takeover.
[C] *Summing Point OEL Offline Low Level:* Adjustable from 0 to 20 Adc. The setting increment is 0.01 Adc.
[D] *Summing Point OEL Offline High Level:* Adjustable from 0 to 40 Adc. The setting increment is 0.01 Adc.
[E] *Summing Point OEL Offline High Time:* Adjustable from 0 to 10 s in 1 s increments.
[F] *Summing Point OEL Online Low Level:* Adjustable from 0 to 20 Adc. The setting increment is 0.01 Adc.
[G] *Summing Point OEL Online Medium Level:* Adjustable from 0 to 30 Adc. The setting increment is 0.01 Adc.
[H] *Summing Point OEL Online Medium Time:* Adjustable from 0 to 120 s in 1 s increments.
[I] *Summing Point OEL Online High Level:* Adjustable from 0 to 40 Adc for the DECS-250. The setting increment is 0.01 Adc.
[J] *Summing Point OEL Online High Time:* Adjustable from 0 to 10 s in 1 s increments.
[K] *dv/dt Enable:* Check box to enable OEL voltage dependency.
[L] *dv/dt Level:* Adjustable from –10 to 0 in 0.1 increments (per unit).
[M] *Takeover OEL Low Level:* Adjustable from 0 to 15 Adc in increments of 0.01 Adc.
[N] *Takeover OEL High Level:* Adjustable range varies depending on value of *Low Level* setting.
[O] Takeover OEL Time Dial: Adjustable from 0.1 to 20 in increments of 0.1.
[P] *Reset Method:* Select Inverse, Integrating, or Instantaneous.
[Q] *Reset Coefficient:* Adjustable from 0.01 to 100 in increments of 0.01.
[F] Takeover OEL curve.
[G] Curve display selections/legend.

Underexcitation Limiter

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Limiters, UEL
HMI Navigation Path: Settings, Operating Settings, Limiters, UEL

Operating a generator in an underexcited condition can cause the stator end iron to overheat. Extreme underexcitation may lead to a loss of synchronism. The underexcitation limiter (UEL) senses the leading var level of the generator and limits decreases in excitation to limit end-iron heating. When enabled[A], the

UEL operates in all regulation modes. UEL behavior in manual mode can be configured to limit excitation or issue an alarm. This behavior is configured in BESTlogic*Plus*.

Note
For UEL to operate, the PARALLEL_EN_LM logic block must be set true in BESTlogic*Plus* programmable logic.

UEL settings are illustrated in Figure 48 and Figure 49.

Underexcitation limiting is implemented through an internally-generated UEL curve or a user-defined UEL curve[B]. The internally-generated curve is based on the desired reactive power limit at zero real power with respect to the generator voltage and current rating. The absorbed reactive power axis of the curve on the UEL Custom Curve screen can be tailored[C] for your application.

A user-defined curve can have a maximum of five points[D]. This curve allows the user to match a specific generator characteristic by specifying the coordinates of the intended leading reactive power (kvar) limit at the appropriate real power (kW) level.

The levels entered for the user-defined curve are defined for operation at the rated generator voltage. The user-defined UEL curve can be automatically adjusted based on generator operating voltage by using the UEL voltage dependency real-power exponent[E]. The user-defined UEL curve is automatically adjusted based on the ratio of the generator operating voltage divided by the generator rated voltage raised to the power of the UEL voltage dependency real-power exponent. UEL voltage dependency is further defined by a real power filter time constant[F] that is applied to the low-pass filter for the real power output.

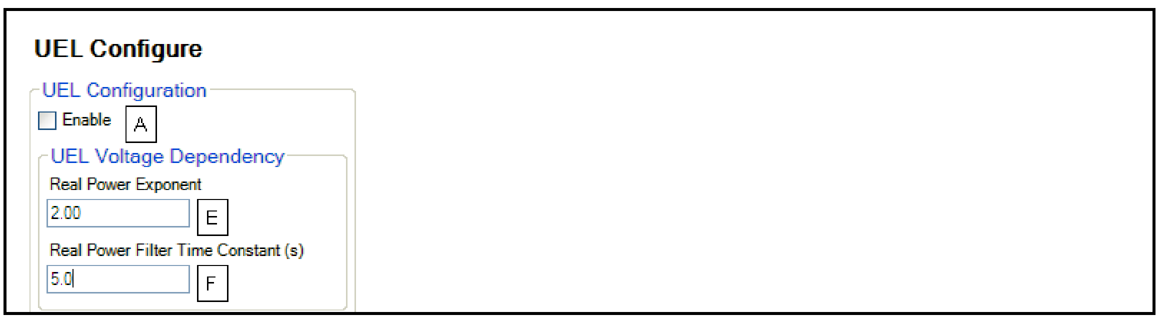


Figure 48. UEL Configuration Settings

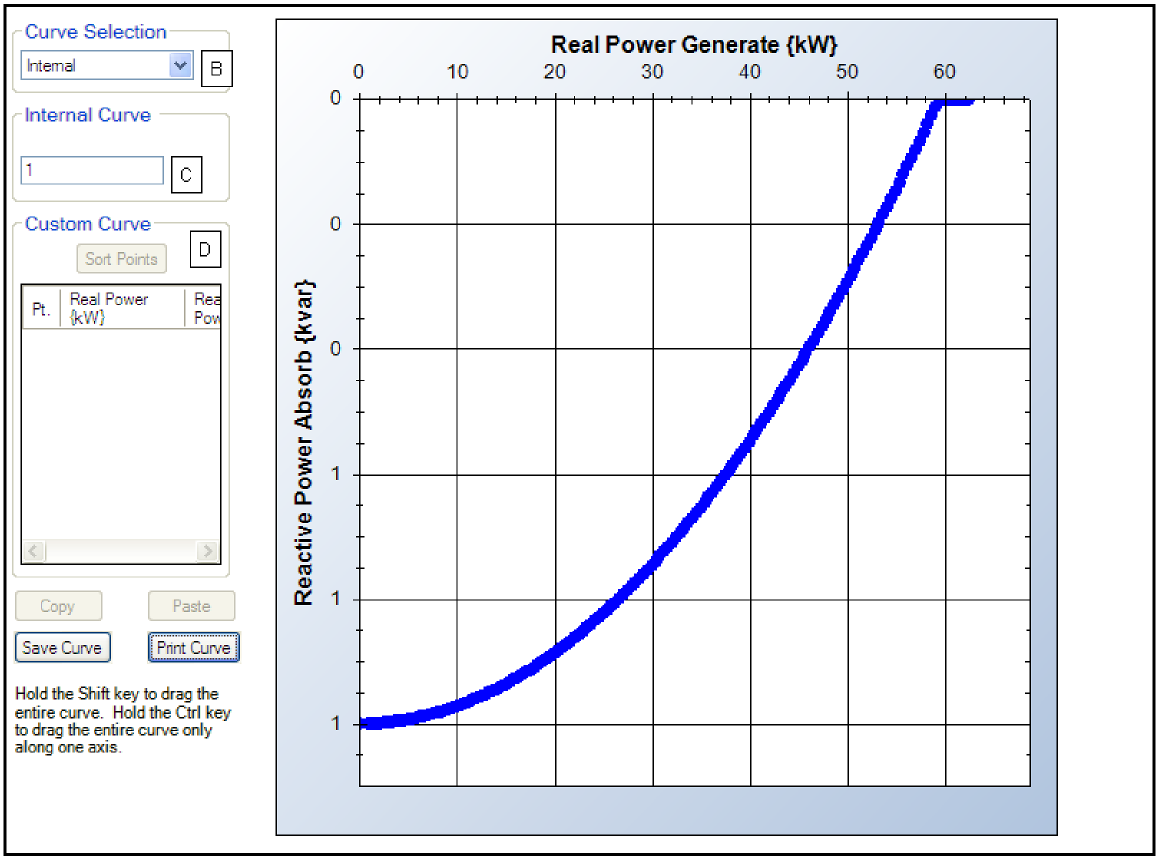


Figure 49. UEL Custom Curve Screen

[A] *UEL Configuration Enable:* Check box to enable underexcitation limiter.
[B] *Curve Selection:* Select Internal or Customized.
[C] *Internal Curve:* Enter number to adjust range of y axis.
[D] *Custom Curve:* Insert, enter, and delete curve data points as needed.
[E] *Real Power Exponent:* Enter a value of 1 or 2.
[F] *Real Power Filter Time Constant:* Enter a value from 0 to 20 seconds in 0.1 second increments.

Stator Current Limiter

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Limiters, SCL
HMI Navigation Path: Settings, Operating Settings, Limiters, SCL

The stator current limiter (SCL) monitors the level of stator current and limits it to prevent stator overheating. To limit the stator current, the SCL modifies the excitation level according to the direction of var flow into or out of the generator. Excessive stator current with leading power factor calls for increased excitation. Excessive stator current with lagging power factor calls for reduced excitation.

The SCL can be enabled[A] in all regulation modes. When operating in Manual mode, the DECS-250N will announce high stator current but will not act to limit it. Primary and secondary SCR setting groups provide additional control for two distinct machine operating conditions. Stator current limiting is provided at two levels: low and high (see Figure 50). SCL settings are illustrated in Figure 51.

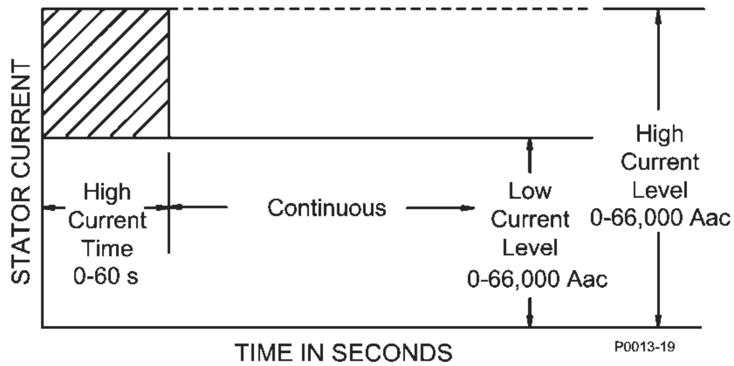


Figure 50. Stator Current Limiting

Low-Level Limiting

When the stator current exceeds the low-level setting[B], the DECS-250N annunciates the elevated level. If this condition persists for the duration of the High SCL Time setting, the DECS-250N acts to limit the current to the low-level SCL Setting. The generator is permitted to operate indefinitely at or below the low-level threshold.

High-Level Limiting

When the stator current exceeds the high-level setting[C], the DECS-250N acts to limit the current to the high-level value. If this level of current persists for the duration of the high-level time setting[D], the DECS-250N acts to limit the current to the low-level SCL setting.

Initial Delay

In the case of low- or high-level stator current limiting, the limiting function will not respond until an initial time delay[E] expires.

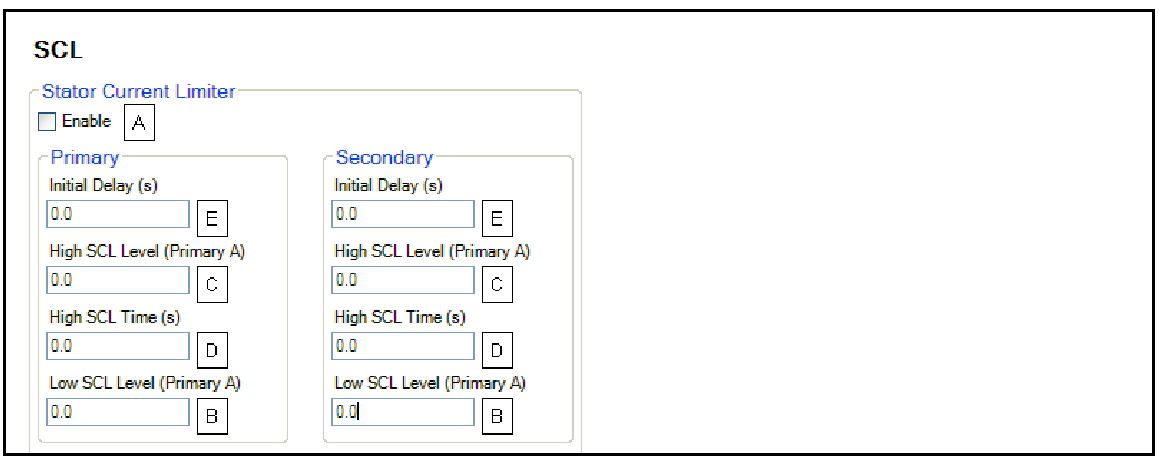


Figure 51. Stator Current Limiter Settings

[A] *Stator Current Limiter Enable:* Check box to enable.
[B] *Low SCL Level:* Adjustable from 0 to 66,000 Aac in 0.1 Aac increments.
[C] *High SCL Level:* Adjustable from 0 to 66,000 Aac in 0.1 Aac increments.
[D] *High SCL Time:* Adjustable from 0 to 60 s in 0.1 s increments.
[E] *Initial Delay:* Adjustable from 0 to 10 s in 0.1 s increments.

Var Limiter

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Limiters, var
HMI Navigation Path: Settings, Operating Settings, Limiters, VAR

The var limiter can be enabled[A] to limit the level of reactive power exported from the generator. Primary and secondary setting groups provide additional control for two distinct machine operating conditions. The var limiter setpoint[B] is expressed as a percentage of the calculated, maximum VA rating for the machine. A delay setting[C] establishes a time delay between when the var threshold is exceeded and the DECS-250N acts to limit the var flow.

Var limiter settings are illustrated in Figure 52.

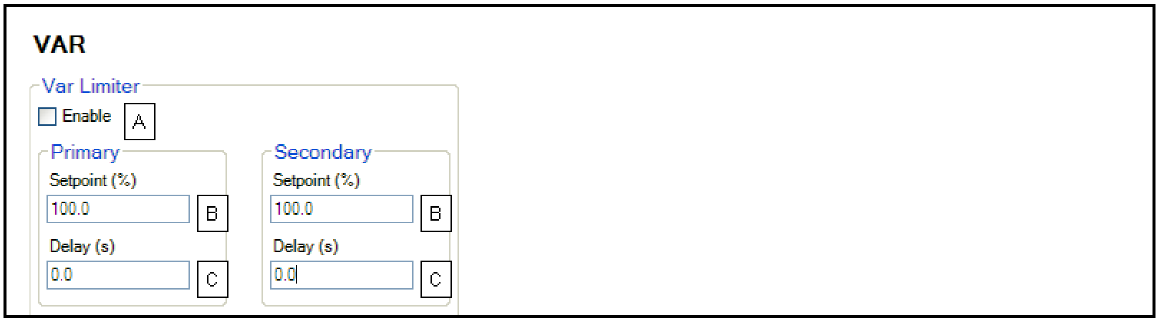


Figure 52. Var Limiter Settings

[A] *Var Limiter Enable:* Select checkbox to enable var limiter.
[B] *Var Limiter Setpoint:* Adjustable from 0 to 200% in 0.1% increments.
[C] *Var Limiter Delay:* Adjustable from 0 to 300 s in 0.1 s increments.

Limiter Scaling

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Limiters, Scaling
HMI Navigation Path: Settings, Operating Settings, Limiters, Scaling

Automatic adjustment (scaling) of the overexcitation limiter and stator current limiter is possible through the DECS-250N auxiliary control input. Limiter scaling settings are illustrated in Figure 53. OEL and SCL scaling may be independently enabled and disabled[A]. Automatic adjustment of the OEL and SCL is based on six parameters: signal and scale for three points (levels).

With the scaling input set to *Auxiliary Input*, the signal value[B] for each point represents the auxiliary control input. This input can be a 4 to 20 mAdc signal applied to terminals I+ and I– or a –10 to +10 Vdc signal applied to terminals V+ and V–. (The input type is selected in BESTCOMS*Plus*). See the *Auxiliary Control* section of this manual for details.

With the scaling input set to *AEM RTD #*, the signal value for each point represents an AEM RTD input in degrees Fahrenheit. See the *Analog Expansion Module* section of the manual for details.

The scale value[C] for each point defines the limiter low level as a percent of rated field current for the OEL and rated stator current for the SCL.

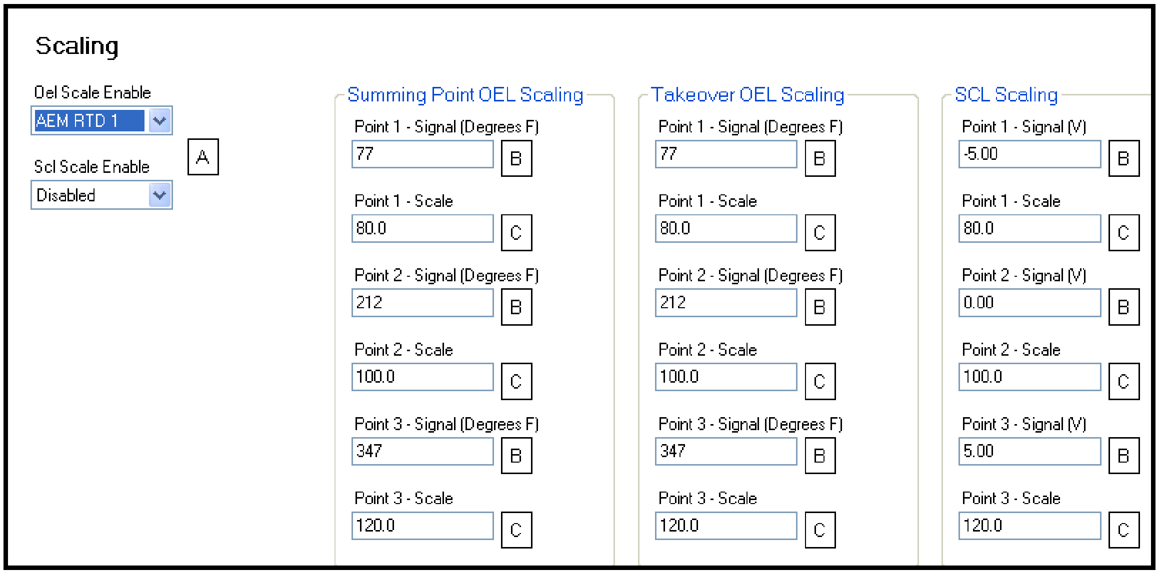


Figure 53. Limiter Scaling Settings

[A] *OEL and SCL Scale Enable:* Select Auxiliary Input, AEM RTD 1 to AEM RTD 8, or Disabled.
[B] *Signal:* Adjustable from –10 to +10 in 0.01 increments when *Auxiliary Input* is selected.
Adjustable from –58 to +482 in increments of 1 when any *AEM RTD* input is selected.
[C] *Scale:* Adjustable from 0 to 200 in increments of 0.1.

Underfrequency Limiter

BESTCOMS*Plus* Navigation Path: Settings Explorer, Operating Settings, Limiters, Underfrequency
HMI Navigation Path: Settings, Operating Settings, Limiters, UEL

The underfrequency limiter is selectable for underfrequency limiting or volts per hertz limiting[A]. These limiters protect the generator from damage due to excessive magnetic flux resulting from low frequency and/or overvoltage.

Underfrequency and volts per hertz limiter settings are illustrated in Figure 56.

If the generator frequency decreases below the corner frequency[B] for the selected underfrequency slope[C] (Figure 54), the DECS-250N adjusts the voltage setpoint so that the generator voltage follows the underfrequency slope. The adjustment range of the corner frequency and slope settings enables the DECS-250N to precisely match the operating characteristics of the prime mover and the loads being applied to the generator.

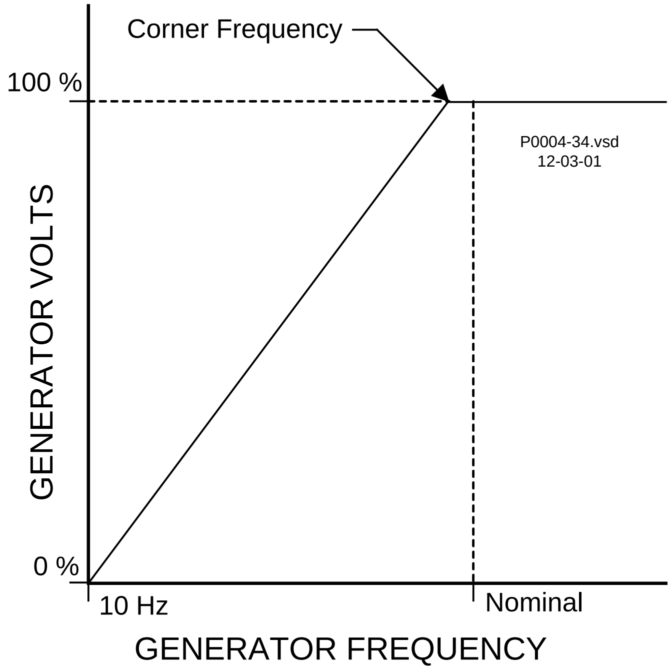


Figure 54. Typical Underfrequency Compensation Curve

Volts per Hertz

The volts per hertz limiter prevents the regulation setpoint from exceeding the volts per hertz ratio defined by the underfrequency slope setting[C]. A typical volts per hertz limiter curve is illustrated in Figure 55.

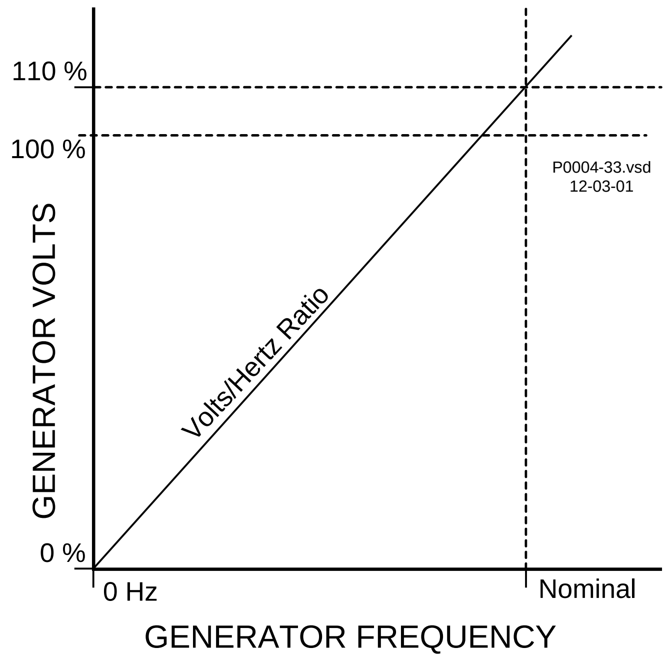


Figure 55. Typical 1.1 PU Volts per Hertz Limiter Curve

Beside the underfrequency slope setting, volts per hertz limiter operation is determined by the high limiter setting, low limiter setting, and time limiter setting. The high limiter setting[D] establishes the maximum threshold for volts per hertz limiting, the low limiter setting[E] establishes the minimum threshold for volts per hertz limiting, and the time limiter setting[F] establishes the time delay for limiting.

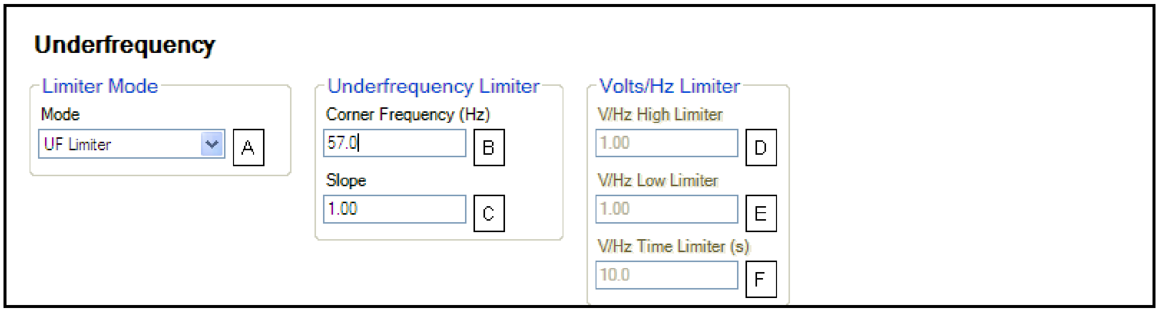


Figure 56. Underfrequency/Volts per Hertz Limiter Settings

[A] *Limiter Mode:* Select UF Limiter or V/Hz Limiter.
[B] *Underfrequency Limiter Corner Frequency:* Adjustable from 40 to 75 Hz in 0.1 Hz increments.
[C] *Underfrequency Limiter Slope:* Adjustable from 0 to 3 in increments of 0.01.
[D] *V/Hz High Limiter:* Adjustable from 0 to 3 in increments of 0.01.
[E] *V/Hz Low Limiter:* Adjustable from 0 to 3 in increments of 0.01.
[F] *V/Hz Time Limiter:* Adjustable from 0 to 10 s in 0.2 s increments.

Metering

The DECS-250N provides comprehensive metering of internal and system conditions. These capabilities include extensive parameter metering, status indication, reporting, and real-time metering analysis.

Metering Explorer

DECS-250N metering is accessed through the metering explorer menu on the front panel HMI or the BESTCOMS*Plus*® metering explorer.

HMI

On the front panel HMI, the metering explorer is accessed through the Metering branch of the HMI menu.

BESTCOMS*Plus*®

In BESTCOMS*Plus*, the metering explorer is located in the upper left portion of the application window.

Metering Screen Docking

A docking feature within the metering explorer allows arrangement and docking of multiple metering screens. Clicking and dragging a metering screen tab displays a blue, transparent square, several arrow boxes, and a tab box. These docking elements are illustrated in Figure 57.

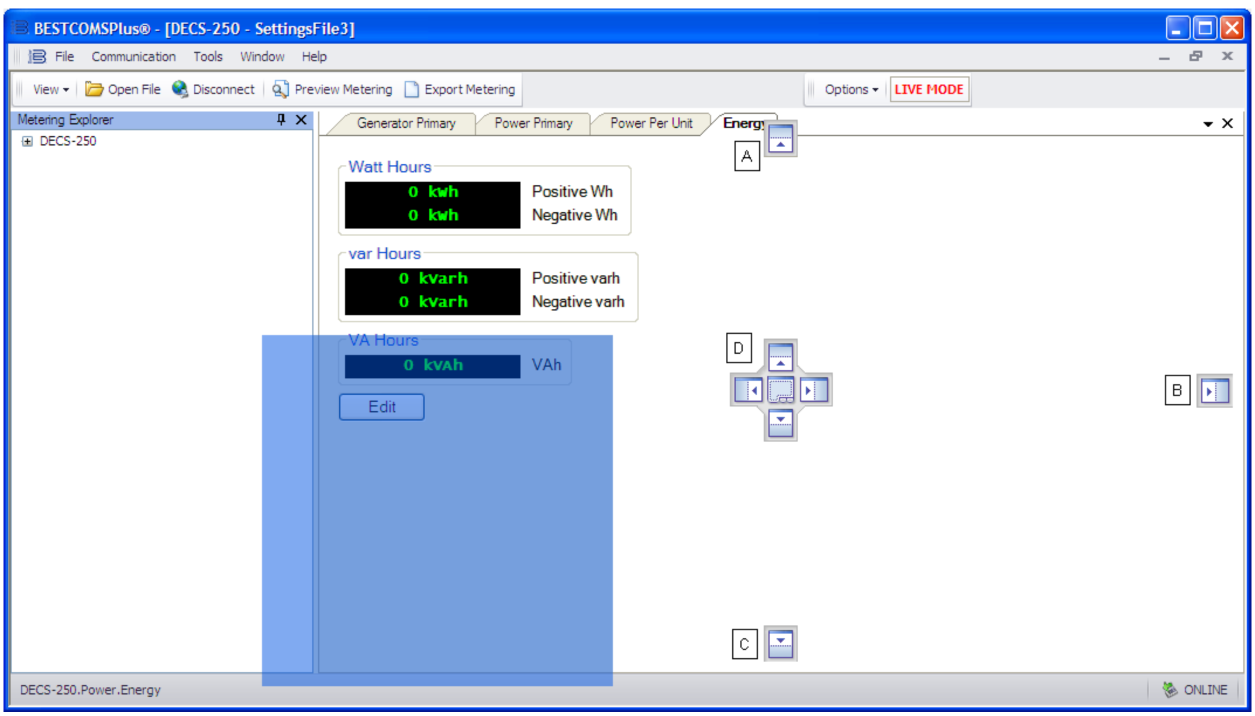


Figure 57. Metering Screen Docking Controls

Dragging the blue square to the "up" (locator A), "right" (locator B), or "down" (locator C) arrow box places the selected metering screen across the top, along the side, or at the bottom of the window. Once placed, the screen's thumbtack icon can be clicked to dock the screen on the corresponding top, right, or lower bar. A docked screen is viewed by hovering the mouse pointer over the docked screen.

Dragging the blue square to one of the four arrow boxes (locator D) places the screen inside the selected window according to the arrow box selected. A metering screen can be placed as a tab inside the selected window by dropping the screen on the tab box at the center of the four arrow boxes.

Dragging the blue square anywhere other than one of the arrow/tab boxes places the selected metering screen as a floating window.

Metered Parameters

DECS-250N metering categories include generator, power, bus, field, power system stabilizer (PSS), and generator synchronization parameters.

Generator

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Generator
HMI Navigation Path: Metering Explorer, Generator

Metered generator parameters include the voltage (magnitude and angle), current (magnitude and angle), and frequency. Primary- and per-unit values are available. Figure 58 illustrates the generator primary-values metering screen.

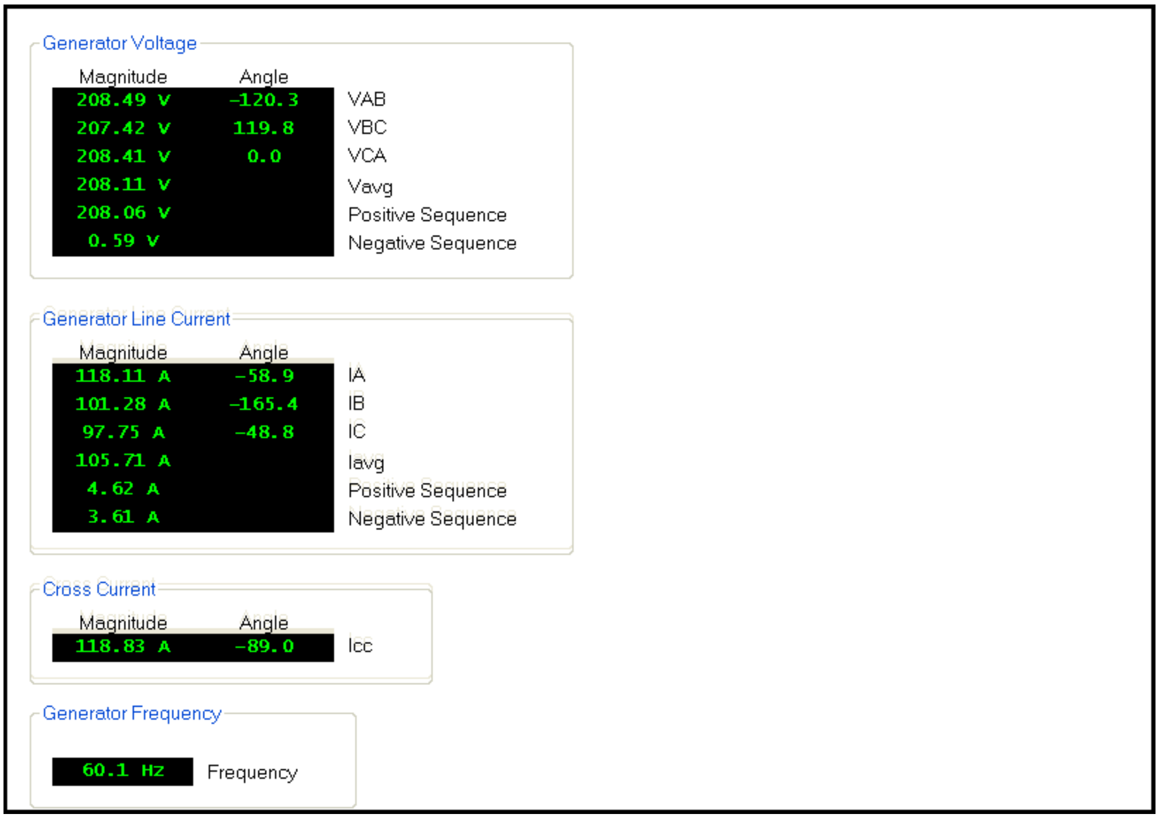


Figure 58. Generator Primary-Values Metering

Power

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Power
HMI Navigation Path: Metering Explorer, Power

Metered power parameters include true power (kW), apparent power (kVA), reactive power (kvar), and machine power factor. Primary- and per-unit values are available. Accumulated watthours (positive and negative kWh), varhours (positive and negative kvarh), and voltampere hours (kVAh) are also metered. Figure 59 illustrates the power primary-values screen and Figure 60 illustrates the energy screen.

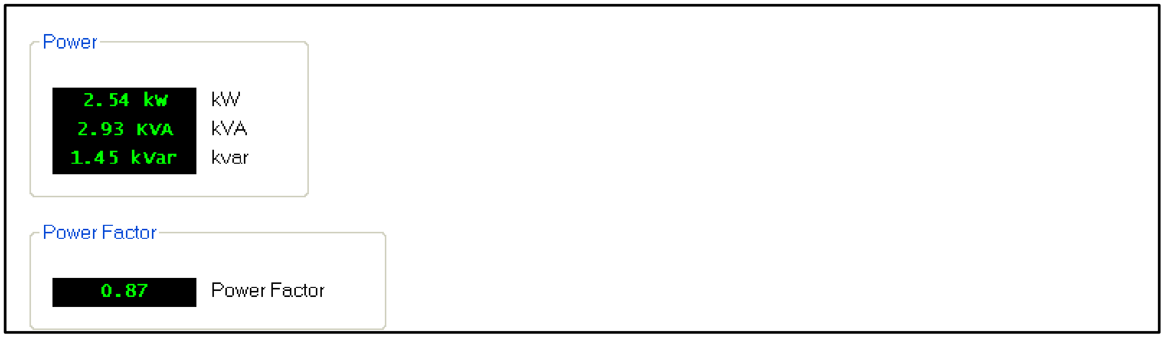


Figure 59. Power Primary-Values

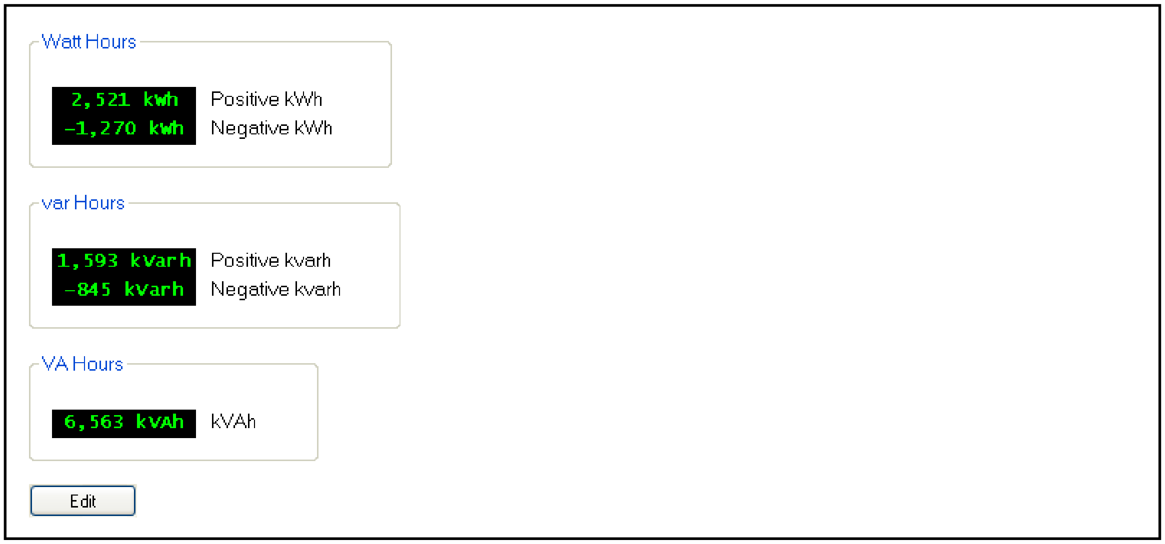


Figure 60. Energy

Bus

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Bus
HMI Navigation Path: Metering Explorer, Bus

Metered bus parameters include the voltage across phases A and B (Vab), phases B and C (Vbc), phases A and C (Vca), and the average bus voltage. The frequency of the bus voltage is also metered. Primary- and per-unit values are available. Figure 61 illustrates the bus primary-values metering screen.

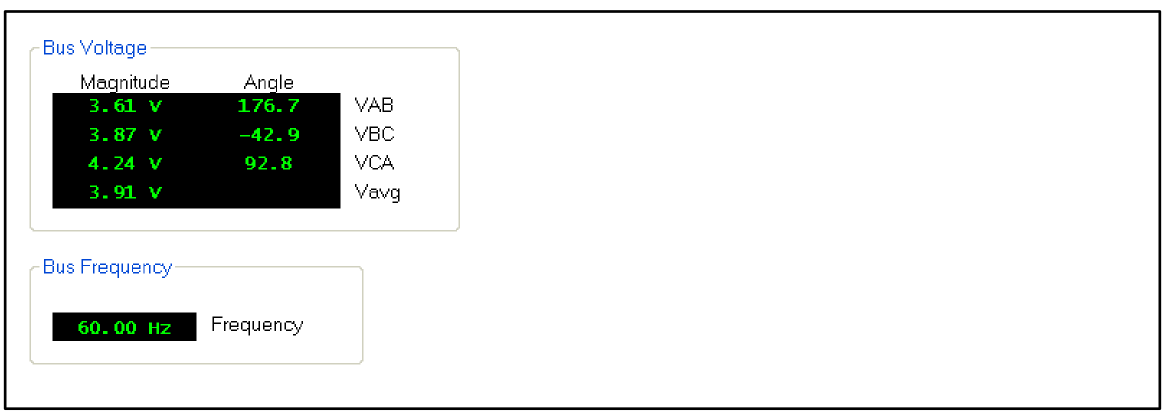


Figure 61. Bus Primary-Values Metering

Field

BESTCOMS*Plus* Navigation Path: Metering Explorer, Field
HMI Navigation Path: Metering Explorer, DECS Output

Metered field parameters include the field voltage (Vfd), current (Ifd), and exciter diode ripple. The exciter diode ripple is reported by the exciter diode monitor (EDM) and is reported as a percentage of the induced ripple in the exciter field current.

To achieve the desired level of excitation, the appropriate level of operating power input voltage must be applied. This value is displayed as the power input voltage.

The level of excitation power supplied to the field is displayed as a percentage, with 0% being the minimum and 100% being the maximum.

Primary- and per-unit values are available. Figure 62 illustrates the field primary-values metering screen.

Figure 62. Field Primary-Values Metering

PSS

BESTCOMS*Plus*® Navigation Path: Metering Explorer, PSS (Power System Stabilizer)
HMI Navigation Path: Metering Explorer, PSS

Values metered by the power system stabilizer function display positive sequence voltage and current, negative sequence voltage and current, terminal frequency deviation, compensated frequency deviation, and the per-unit PSS output level. The PSS function on/off status is also reported. Primary- and per-unit values are available. Figure 63 illustrates the PSS primary-values metering screen.

Figure 63. PSS Primary-Values Metering

Synchronization

BESTCOMS*Plus* Navigation Path: Metering Explorer, Synchronization
HMI Navigation Path: Metering Explorer, Synchronization

Metered generator-to-bus synchronization parameters include the slip frequency, slip angle, and voltage difference. Primary- and per-unit values are available. Figure 64 illustrates the synchronization primary-values metering screen.

Figure 64. Synchronization Primary Values Metering

Auxiliary Control Input

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Aux Input
HMI Navigation Path: Metering Explorer, Aux Input

The control signal applied at the DECS-250N auxiliary control input is indicated on the Aux Input metering screen (Figure 65). As configured in BESTCOMS*Plus*®, a dc voltage or dc current signal may be applied.

Figure 65. Auxiliary Control Input Metering

Tracking

BESTCOMS*Plus* Navigation Path: Metering Explorer, Tracking
HMI Navigation Path: Metering Explorer, Tracking

The metered setpoint tracking error between DECS-250N operating modes is displayed on the Tracking metering screen (Figure 66). Status fields are also provided for the on/off status for internal and external setpoint tracking. An additional status field indicates when the setpoint of an inactive operating mode matches the metered value.

Figure 66. Tracking Metering

Control Panel

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Control Panel

HMI Navigation Path: Metering Explorer, Control Panel

The Control Panel (Figure 67) provides options for changing operating modes, selecting setpoint pre-positions, fine tuning setpoints, and toggling virtual switches. The setpoints for AVR, FCR, FVR, var, and PF are displayed, as well as Alarm status, PSS status, and Null Balance status.

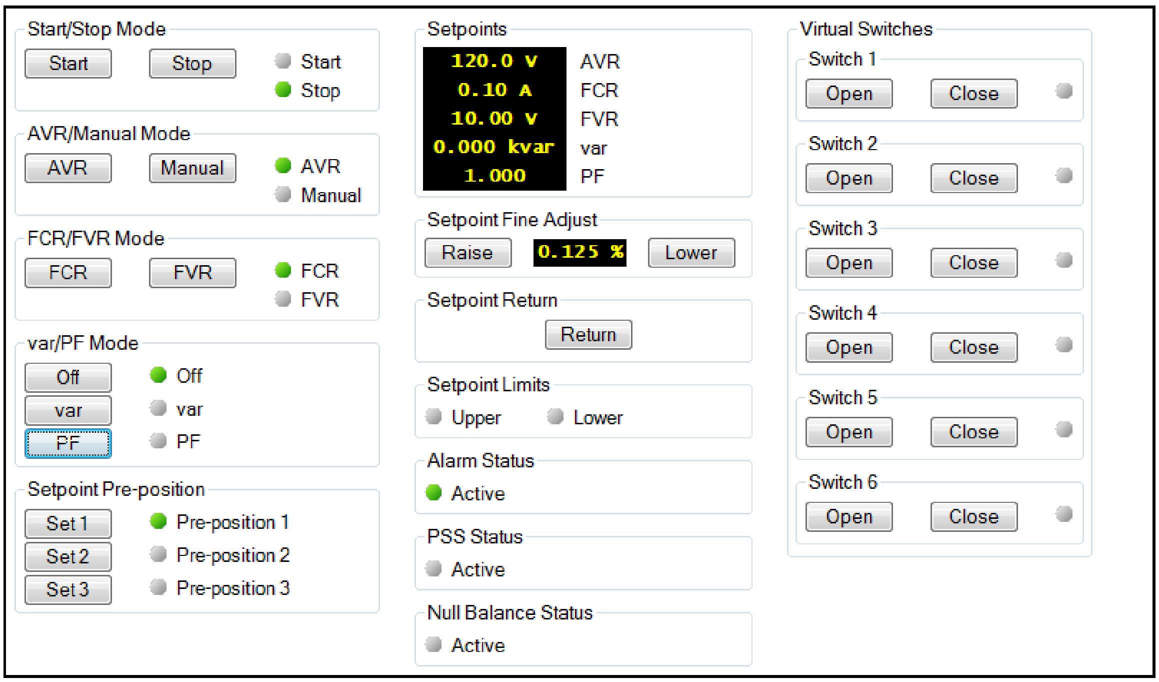


Figure 67. Control Panel

Start/Stop Mode: Two indicators show the start/stop mode of the DECS-250N. In Stop mode, the Stop indicator changes from gray to green. In Start mode the Start indicator changes from gray to green. To select the DECS-250N Start status, click the Start button. Click the Stop button to select DECS-250N Stop status.

AVR/Manual Mode: AVR and Manual Mode status is reported by two indicators. When the DECS-250N is operating in AVR mode, the AVR indicator changes from gray to green. When operating in manual mode, the manual indicator changes from gray to green. AVR mode is selected by clicking the *AVR* button, manual mode is selected by clicking the *Manual* button.

FCR/FVR Mode: FCR and FVR mode status is reported by two indicators. When the DECS-250N is operating in FCR mode, the FCR indicator changes from gray to green. When operating in FVR mode, the FVR indicator changes from gray to green. FCR mode is selected by clicking the *FCR* button. FVR mode is selected by clicking the *FVR* button.

Var/PF Mode: Three indicators report whether Var mode is active, Power Factor mode is active, or neither mode is active. When Var mode is active the var indicator changes from gray to green. When

Power Factor mode is active, the PF indicator changes from gray to green. When neither mode is active, the Off indicator changes from gray to green. Var mode is enabled by clicking the *var* button. Power Factor mode is enabled by clicking the *PF* button. Neither mode is enabled by clicking the *Off* button. Only one mode can be enabled at any time.

Setpoint Pre-position: A control button and indicator is provided for the three setpoint pre-positions. Clicking the *Set 1* button adjusts the excitation setpoint to the Pre-position 1 value and changes the Pre-position 1 indicator to green. Pre-positions 2 and 3 are selected by clicking either the Set 2 or Set 3 button.

Setpoints: Five status fields display the active setpoints for AVR mode, FCR mode, FVR mode, var mode, and Power Factor mode. These active setpoints, represented by a yellow font, are not to be confused with metered analog values which are represented by a green font throughout BESTCOMS*Plus*. For details on operating setpoint settings, see the *Regulation* chapter.

Setpoint Fine Adjust: Clicking the *Raise* button increases the active operating setpoint. Clicking the *Lower* button decreases the active operating setpoint. The raise and lower increment is a function of the setpoint range of adjustment and the active mode traverse rate. The increments are directly proportional to the adjustment range and inversely proportional to the traverse rate.

Alarm Status: The Alarm Status indicator changes from gray to green when there is an active alarm.

PSS Status: The PSS Status indicator changes from gray to green when the PSS is active.

Null Balance: The Null Balance indicator changes from gray to green when the setpoint of the inactive operating modes (AVR, FCR, FVR, var, and PF) match the setpoint of the active mode.

Virtual Switches: These buttons control the open or closed status of the six virtual switches. Clicking the Open button sets the switch to the open position and changes the switch indicator to gray. Clicking the Close button sets the switch to the closed position and changes the switch indicator to red. A dialog will appear asking if you are sure you want to open or close the switch.

Metering Summary

BESTCOMS*Plus* Navigation Path: Metering Explorer, Summary
HMI Navigation Path: Not available via HMI

All of the metering values displayed on the individual, previously-described metering screens are consolidated on the metering summary screen. Primary- and per-unit values are available. Figure 68 illustrates the primary-values metering summary screen. The primary- and per-unit metering summary screens are available only in BESTCOMS*Plus*.

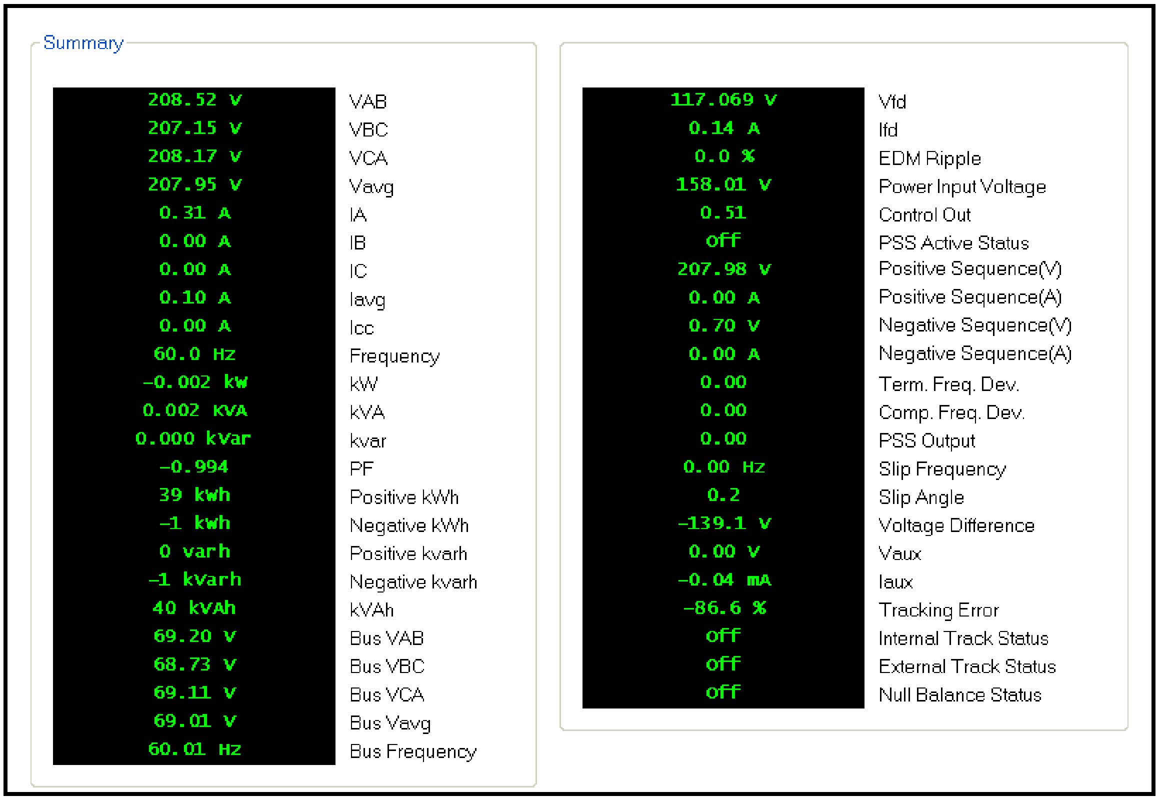


Figure 68. Metering Summary Screen

Status Indication

Status indication is provided for DECS-250N system functions, inputs, outputs, configurable protection, alarms, and the real-time clock.

System Status

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Status, System Status
HMI Navigation Path: Metering Explorer, Status, System Status

When any of the system functions illustrated in Figure 69 are active, the corresponding indicator changes from gray to green. An inactive function is represented by a gray indicator.

Figure 69. System Status Indication Screen

Inputs

BESTCOMS*Plus* Navigation Path: Metering Explorer, Status, Inputs
HMI Navigation Path: Metering Explorer, Status, Inputs

Status annunciation is provided for the DECS-250N and optional Contact Expansion Module (CEM-2020) inputs. Annunciation is also provided for the optional Analog Expansion Module (AEM-2020) inputs.

DECS-250N Contact Inputs

Status indication for the DECS-250N's 16 contact sensing inputs is provided on the BESTCOMS*Plus*™ contact inputs screen illustrated in Figure 70. An indicator changes from gray to red when a closed contact is sensed at the corresponding input.

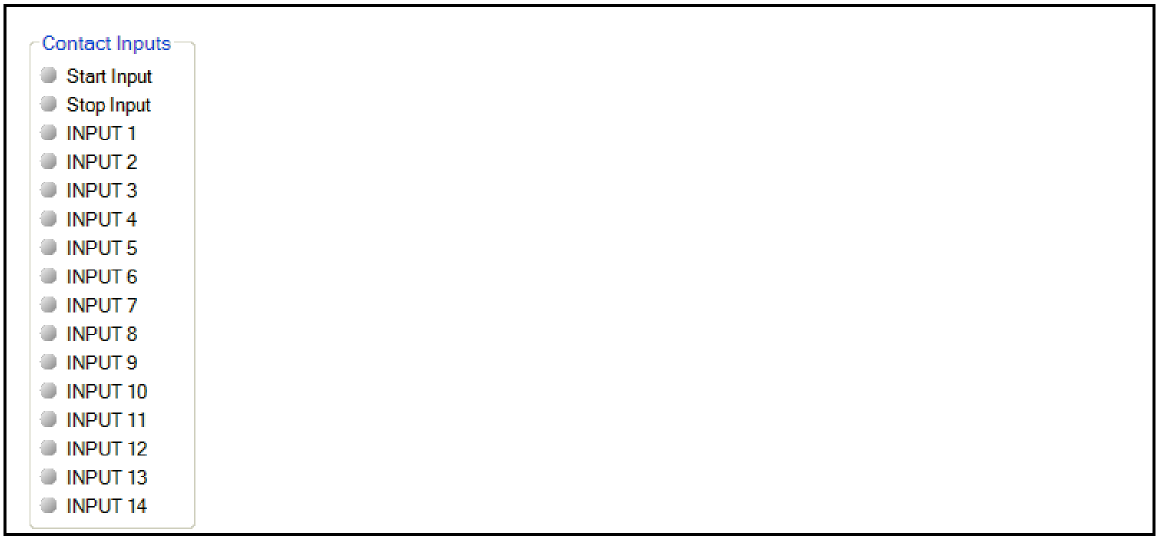


Figure 70. DECS-250 Contact Inputs Status Indication Screen

CEM-2020 Contact Inputs

The status of the 10 contact sensing inputs of the optional CEM-2020 Contact Expansion Module is provided on the BESTCOMS*Plus*® remote contact inputs screen. See the *Contact Expansion Module* section of this manual for a description and illustration of this screen.

AEM-2020 Inputs

Status annunciations for the optional AEM-2020 Analog Expansion Module's analog, RTD, thermocouple, and analog metering inputs are provided on the BESTCOMS*Plus* remote analog inputs, remote RTD inputs, remote thermocouple inputs, and remote analog input values screens. These screens are described and illustrated in the *Analog Expansion Module* section of this manual.

Outputs

BESTCOMS*Plus* Navigation Path: Metering Explorer, Status, Outputs
HMI Navigation Path: Metering Explorer, Status, Outputs

Status annunciation is provided for the DECS-250N contact outputs and optional Contact Expansion Module (CEM-2020) contact outputs. Annunciation is also provided for the optional Analog Expansion Module (AEM-2020) analog outputs.

DECS-250 Contact Outputs

Status indication for the DECS-250N's Watchdog and 11 contact outputs is provided on the BESTCOMS*Plus* contact outputs screen illustrated in Figure 71. An indicator changes from gray to green when the corresponding output changes state (Watchdog output) or closes (Output 1 through 11).

CEM-2020 Contact Outputs

The status of the 24 contact outputs of the optional CEM-2020 Contact Expansion Module is provided on the BESTCOMS*Plus*® remote contact inputs screen. See the *Contact Expansion Module* section of this manual for a description and illustration of this screen.

AEM-2020 Analog Outputs

Metering and status indications provided by the optional AEM-2020 Analog Expansion Module are shown on the BESTCOMS*Plus* remote analog outputs screen. This screen is described and illustrated in the *Analog Expansion Module* section of this manual.

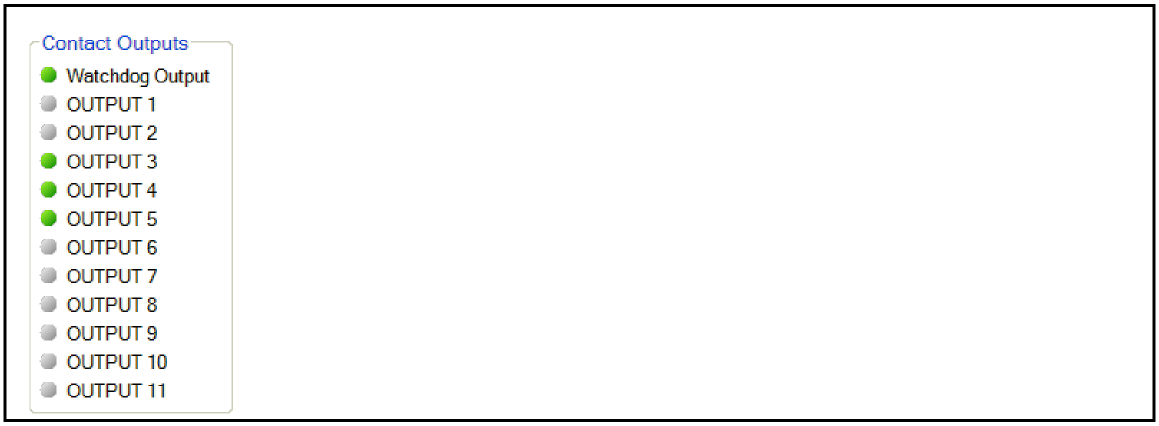


Figure 71. DECS-250 Contact Outputs Status Indication Screen

Configurable Protection

BESTCOMSPlus® **Navigation Path:** Metering Explorer, Status, Configurable Protection
HMI Navigation Path: Metering Explorer, Status, Configurable Protection

Trip status for the eight configurable, supplemental protection elements is annunciated on the BESTCOMS*Plus* configurable protection screen (Figure 72). An indicator for each protection element's four trip thresholds changes from gray to green when the corresponding trip threshold is exceeded.

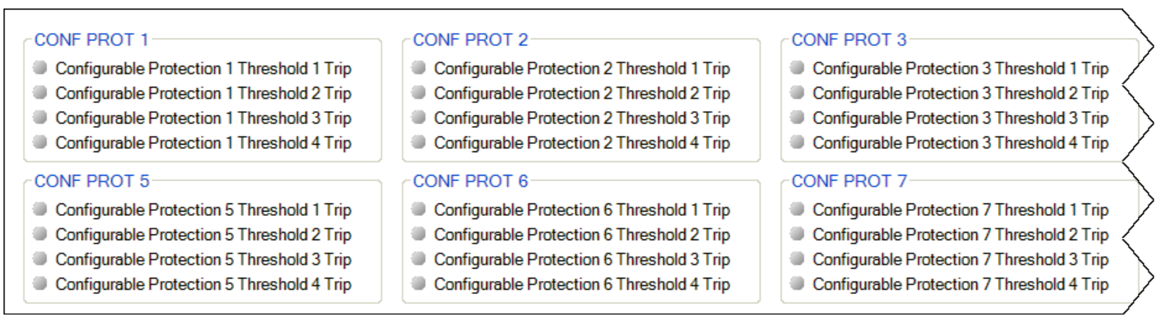


Figure 72. Configurable Protection Indication Status Screen

Alarms

BESTCOMSPlus® **Navigation Path:** Metering Explorer, Status, Alarms
HMI Navigation Path: Alarms automatically displayed when active

System parameters, communication links, protection functions, and remote inputs/outputs are constantly monitored for alarm conditions. Active and previously latched alarms are listed on the front panel display and the Alarms screen of BESTCOMS*Plus*®. At the front panel, an inactive alarm is reset by selecting the alarm and then pressing the Reset pushbutton. A Reset Alarms button on the Alarms screen is clicked to clear all inactive alarms in BESTCOMS*Plus*®. The BESTCOMS*Plus* Alarms screen is illustrated in Figure 73. All possible DECS-250N alarms are listed below.

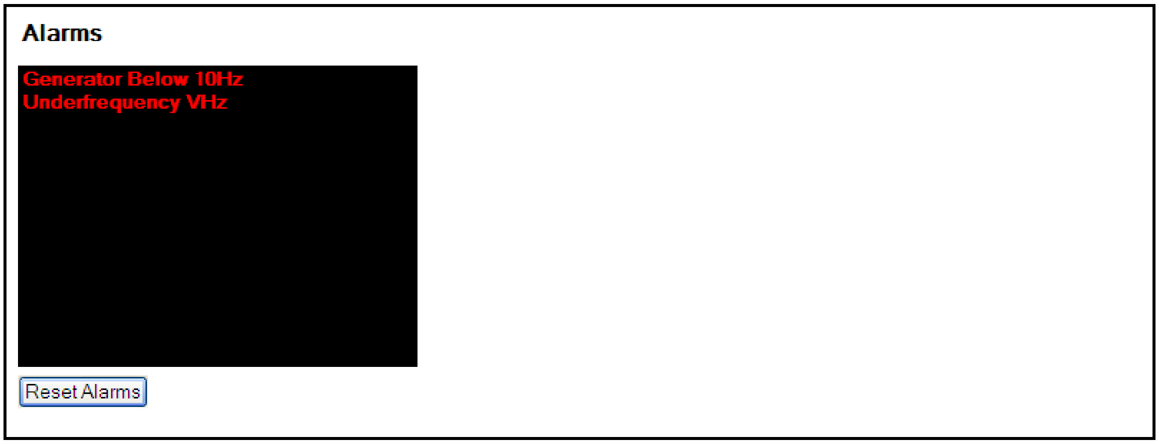


Figure 73. DECS-250N Alarm Annunciation and Reset Screen

27P Protection
32 Protection
40Q
59P Protection
81O Protection
81U Protection
AEM Communication Failure
AEM Input 1 Out of Range
AEM Input 1 Threshold 1 Trip
AEM Input 1 Threshold 2 Trip
AEM Input 1 Threshold 3 Trip
AEM Input 1 Threshold 4 Trip
AEM Input 2 Out of Range
AEM Input 2 Threshold 1 Trip
AEM Input 2 Threshold 2 Trip
AEM Input 2 Threshold 3 Trip
AEM Input 2 Threshold 4 Trip
AEM Input 3 Out of Range
AEM Input 3 Threshold 1 Trip
AEM Input 3 Threshold 2 Trip
AEM Input 3 Threshold 3 Trip
AEM Input 3 Threshold 4 Trip
AEM Input 4 Out of Range
AEM Input 4 Threshold 1 Trip
AEM Input 4 Threshold 2 Trip
AEM Input 4 Threshold 3 Trip
AEM Input 4 Threshold 4 Trip
AEM Input 5 Out of Range
AEM Input 5 Threshold 1 Trip
AEM Input 5 Threshold 2 Trip
AEM Input 5 Threshold 3 Trip
AEM Input 5 Threshold 4 Trip
AEM Input 6 Out of Range
AEM Input 6 Threshold 1 Trip
AEM Input 6 Threshold 2 Trip
AEM Input 6 Threshold 3 Trip
AEM Input 6 Threshold 4 Trip
AEM Input 7 Out of Range
AEM Input 7 Threshold 1 Trip
AEM Input 7 Threshold 2 Trip
AEM Input 7 Threshold 3 Trip
AEM Input 7 Threshold 4 Trip
AEM Input 8 Out of Range
AEM Input 8 Threshold 1 Trip
AEM Input 8 Threshold 2 Trip
AEM Input 8 Threshold 3 Trip
AEM Input 8 Threshold 4 Trip
AEM Output 1 Out of Range
AEM Output 2 Out of Range
AEM Output 3 Out of Range
AEM Output 4 Out of Range
CEM Communications Failure
CEM Communications Failure
CEM Hardware Mismatch
Configurable Protection 1 Threshold 1 Trip
Configurable Protection 1 Threshold 2 Trip
Configurable Protection 1 Threshold 3 Trip
Configurable Protection 1 Threshold 4 Trip
Configurable Protection 2 Threshold 1 Trip
Configurable Protection 2 Threshold 2 Trip
Configurable Protection 2 Threshold 3 Trip
Configurable Protection 2 Threshold 4 Trip
Configurable Protection 3 Threshold 1 Trip
Configurable Protection 3 Threshold 2 Trip
Configurable Protection 3 Threshold 3 Trip
Configurable Protection 3 Threshold 4 Trip
Configurable Protection 4 Threshold 1 Trip
Configurable Protection 4 Threshold 2 Trip
Configurable Protection 4 Threshold 3 Trip
Configurable Protection 4 Threshold 4 Trip
Configurable Protection 5 Threshold 1 Trip
Configurable Protection 5 Threshold 2 Trip
Configurable Protection 5 Threshold 3 Trip
Configurable Protection 5 Threshold 4 Trip
Configurable Protection 6 Threshold 1 Trip
Configurable Protection 6 Threshold 2 Trip
Configurable Protection 6 Threshold 2 Trip
Configurable Protection 6 Threshold 3 Trip
Configurable Protection 6 Threshold 4 Trip
Configurable Protection 7 Threshold 1 Trip
Configurable Protection 7 Threshold 2 Trip
Configurable Protection 7 Threshold 3 Trip
Configurable Protection 7 Threshold 4 Trip
Configurable Protection 8 Threshold 1 Trip

Configurable Protection 8 Threshold 2 Trip
Configurable Protection 8 Threshold 3 Trip
Configurable Protection 8 Threshold 4 Trip
Duplicate AEM
Duplicate CEM
Ethernet Link Lost
Exciter Open Diode
Exciter Shorted Diode
Failed to Build Up Alarm
Field Short Circuit Status
Field Short Circuit Status
Firmware Change
Generator Below 10Hz
IRIG Lost Sync
Loss of Sensing
No Logic
NTP Sync Lost
OEL
Phase Rotation Mismatch
Power Input Failure
Programmable Alarm 1 Name
Programmable Alarm 10 Name
Programmable Alarm 11 Name
Programmable Alarm 12 Name
Programmable Alarm 13 Name
Programmable Alarm 14 Name
Programmable Alarm 15 Name
Programmable Alarm 16 Name
Programmable Alarm 2 Name
Programmable Alarm 3 Name
Programmable Alarm 4 Name
Programmable Alarm 5 Name
Programmable Alarm 6 Name
Programmable Alarm 7 Name
Programmable Alarm 8 Name
Programmable Alarm 9 Name
Protection Field Over Current
Protection Field Over Voltage
RTD Input 1 Out of Range
RTD Input 1 Threshold 1 Trip
RTD Input 1 Threshold 2 Trip
RTD Input 1 Threshold 3 Trip
RTD Input 1 Threshold 4 Trip
RTD Input 2 Out of Range
RTD Input 2 Threshold 1 Trip
RTD Input 2 Threshold 2 Trip
RTD Input 2 Threshold 3 Trip
RTD Input 2 Threshold 4 Trip
RTD Input 3 Out of Range
RTD Input 3 Threshold 1 Trip
RTD Input 3 Threshold 2 Trip
RTD Input 3 Threshold 3 Trip
RTD Input 3 Threshold 4 Trip
RTD Input 4 Out of Range
RTD Input 4 Threshold 1 Trip
RTD Input 4 Threshold 2 Trip
RTD Input 4 Threshold 3 Trip
RTD Input 4 Threshold 4 Trip
RTD Input 5 Out of Range
RTD Input 5 Threshold 1 Trip
RTD Input 5 Threshold 2 Trip
RTD Input 5 Threshold 3 Trip
RTD Input 5 Threshold 4 Trip
RTD Input 6 Out of Range
RTD Input 6 Threshold 1 Trip
RTD Input 6 Threshold 2 Trip
RTD Input 6 Threshold 3 Trip
RTD Input 6 Threshold 4 Trip
RTD Input 7 Out of Range
RTD Input 7 Threshold 1 Trip
RTD Input 7 Threshold 2 Trip
RTD Input 7 Threshold 3 Trip
RTD Input 7 Threshold 4 Trip
RTD Input 8 Out of Range
RTD Input 8 Threshold 1 Trip
RTD Input 8 Threshold 2 Trip
RTD Input 8 Threshold 3 Trip
RTD Input 8 Threshold 4 Trip
SCL
Thermocouple 1 Threshold 1 Trip
Thermocouple 1 Threshold 2 Trip
Thermocouple 1 Threshold 3 Trip
Thermocouple 1 Threshold 4 Trip
Thermocouple 2 Threshold 1 Trip
Thermocouple 2 Threshold 2 Trip
Thermocouple 2 Threshold 3 Trip
Thermocouple 2 Threshold 4 Trip
Transfer Watchdog Alarm
UEL
Underfrequency VHz
Unknown RCC Protocol Version
Var Limiter

Alarm Configuration

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Alarm Configuration, Alarms

Alarms are configured using BESTCOMS*Plus*®. Customize the reporting style of each alarm by choosing *Disabled*, *Latching*, or *Non-Latching*. Latching alarms are stored in nonvolatile memory and are retained even when control power to the DECS-250N is lost. Active alarms are shown on the front panel LCD and in BESTCOMS*Plus*® until they are cleared. Non-latching alarms are cleared when control power is removed. Disabling an alarm affects only the annunciation of the alarm and not the actual operation of the alarm. This means that the alarm will still trip when trip conditions are met and the occurrence will appear on the sequence of events reports.

The BESTCOMS*Plus*® Alarm Settings screen is illustrated in Figure 74 below.

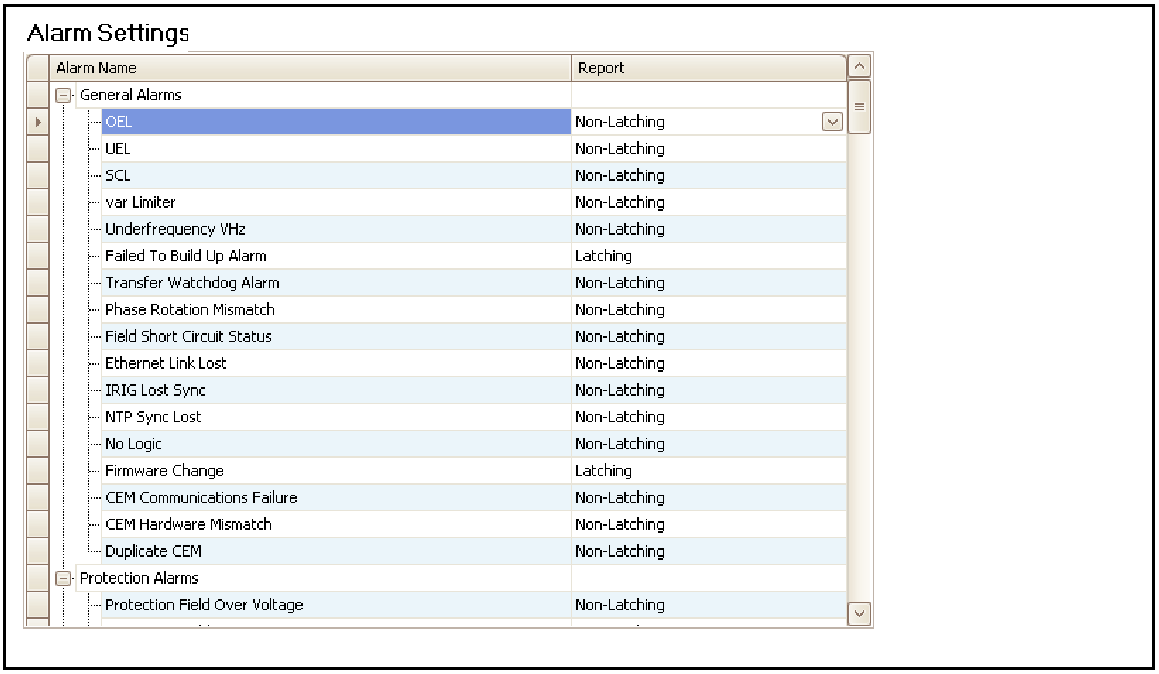


Figure 74. Alarm Settings Screen

User-Programmable Alarms

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Alarm Configuration, User Programmable Alarms

Sixteen user programmable alarms are available. User alarm labels[A] are entered on the User Programmable Alarms screen (Figure 75). If the trip condition exists for the duration of the Activation Delay[B], the alarm is tripped. When active, the label of a user programmable alarm is displayed on the BESTCOMS*Plus*® Alarms screen, on the front panel display, and in the sequence of events reports.

Each alarm provides a logic output that can be connected to a physical output or other logic input using BESTlogic™*Plus* Programmable Logic. Refer to the *BESTlogicPlus* chapter for more information on setting up alarm logic.

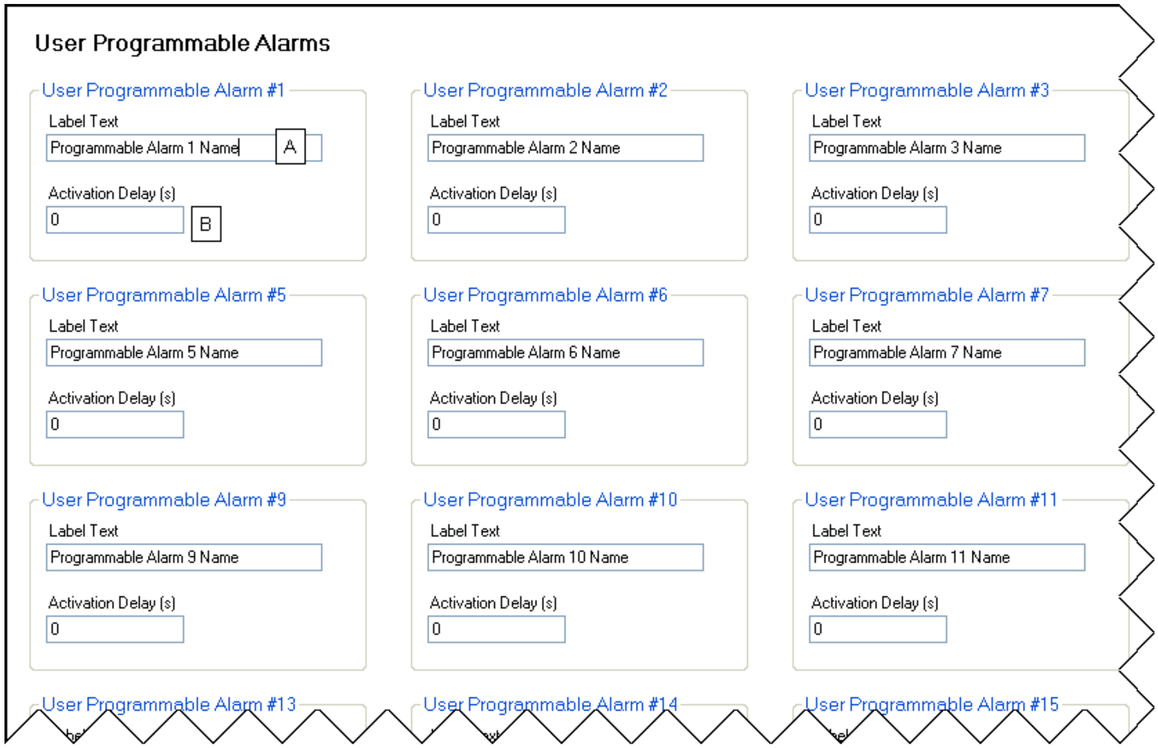


Figure 75. User Programmable Alarms Screen

[A] *Label Text:* Enter a string of alphanumeric characters.
[B] *Activation Delay:* Adjustable from 0 to 300 in 1 second increments.

Retrieving Alarm Information

Alarms are displayed in the sequence of events reports. Alarms are automatically shown on the front panel display when active. To view active alarms using BESTCOMS*Plus*®, use the Metering Explorer to open the Status, Alarms screen. See the *Metering* chapter for more information.

Resetting Alarms

A BESTlogic*Plus* expression can be used to reset the alarms. Use the Settings Explorer within BESTCOMS*Plus*® to open the BESTlogic*Plus* Programmable Logic screen. Select the ALARM_RESET logic block from the list of *Elements*. Use the drag and drop method to connect a variable or series of variables to the *Reset* input. When this input is set TRUE, this element resets all active alarms. Refer to the *BESTlogicPlus* chapter for more information.

Real-Time Clock

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Status, Real Time Clock
HMI Navigation Path: Metering Explorer, Status, Real Time Clock

The DECS-250N time and date is displayed and adjusted on the BESTCOMS*Plus*® Real-Time Clock screen (Figure 76). Manual adjustment of the DECS-250N clock is made by clicking the Edit button. This displays a window where the DECS-250N time and date can be adjusted manually or according to the connected PC clock's date and time.

Advanced clock settings such as time and date format, daylight saving time, network time protocol, and IRIG are described in the *Timekeeping* section of this manual.

Figure 76. Real-Time Clock Screen

Auto Export Metering

Found under the *Tools* menu, the auto export metering function is an automated method for saving multiple metering data files at specific intervals over a period of time while connected to a DECS-250N. The user specifies the *Number of Exports* and the *Interval* between each export. Enter a base filename for the metering data and a folder in which to save. The exports are counted and the count number will be appended to the base filename, making each filename unique. The first export is performed immediately after clicking the *Start* button. Figure 77 illustrates the *Auto Export Metering* screen.

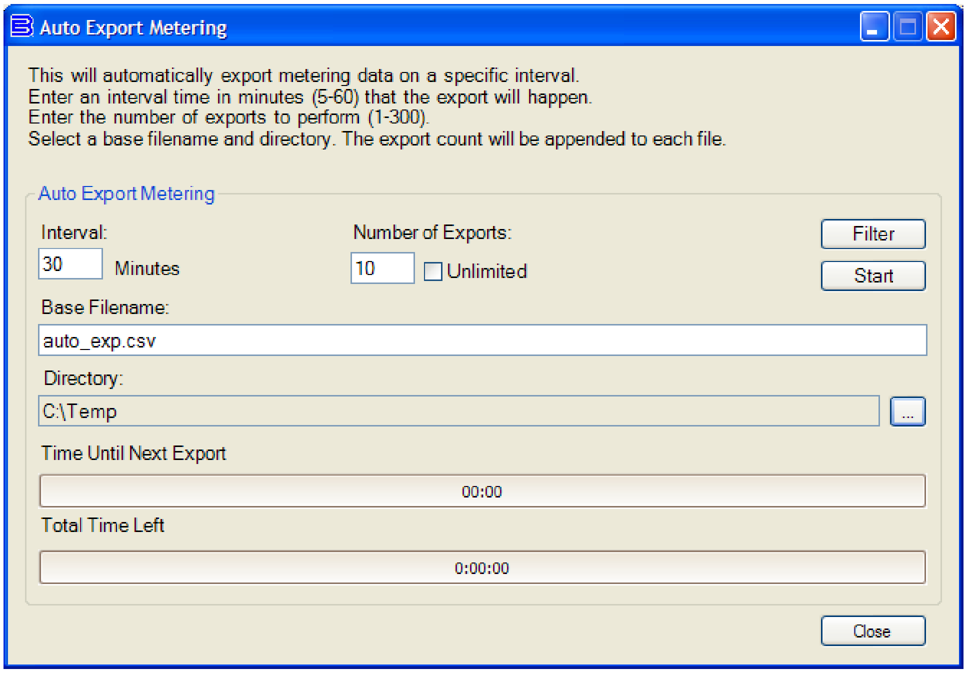


Figure 77. Auto Export Metering

Event Recorder

DECS-250N event recorder functions include sequence-of-events recording (SER), data logging (oscillography), and trending.

Sequence-of-Events Recording

BESTCOMS*Plus*® Navigation Path: Metering Explorer, Reports, Sequence of Events
HMI Navigation Path: Metering Explorer, Reports, Sequence of Events

A sequence of events recorder monitors the internal and external status of the DECS-250N. Events are scanned at four millisecond intervals with 1,023 events stored per record. All changes of state that occur during each scan are time- and date-stamped. Sequence of events reports are available through BESTCOMS*Plus*. Any one of over 400 monitored data/status points can trigger the DECS-250N to record a sequence of events.

Data Logging

BESTCOMS*Plus* Navigation Path: Settings Explorer, Report Configuration, DataLog
HMI Navigation Path: Settings, Configuration Settings, Data Log

The data logging function of the DECS-250N can record up to 6 oscillography records. DECS-250N oscillography records use the IEEE Standard Common Format for Transient Data Exchange (COMTRADE). Each record is time- and date-stamped. After 6 records have been recorded, the DECS-250N begins recording the next record over the oldest record. Because oscillography records are stored in nonvolatile memory, interruptions in DECS-250N control power will not affect the integrity of the records. Data log settings are configured in BESTCOMS*Plus* and illustrated in Figure 78 through Figure 81.

Setup

When oscillography is enabled[A], each record can consist of up to six user-selectable parameters[B] with up to 1,200 data points recorded for each parameter. Data log setup settings are illustrated in Figure 78.

A pre-trigger-points setting[C] enables a user-defined number of data points recorded prior to the event trigger to be included in a data log. The value of this setting affects the duration[D] of the recorded pre-trigger points, the recorded post-trigger points[E], and the duration of the post-trigger points[F]. A sample interval setting[G] establishes the sample rate of the data points recorded. The value of this setting affects the pre- and post-trigger duration values and the total recording duration[H] for a data log.

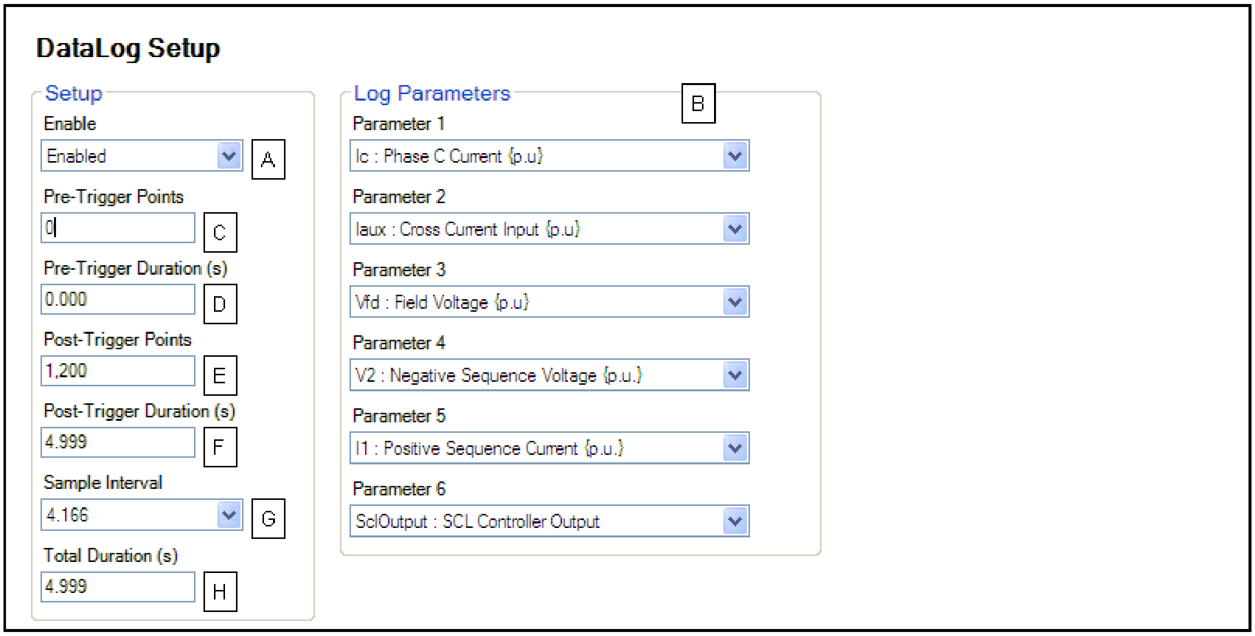


Figure 78. Data Log Setup

[A] *Enable:* Select Enabled or Disabled.
[B] *Log Parameters:* For each of the six parameters, select No Level Trigger, Vab, Vbc, Vca, Vbus, Ia, Ib, Ic, Vave, Iave, Iaux, Vfd, Ifd, Vaux, kW, kvar, kVA, PF, V1, V2, I1, I2, G Hz, B Hz, Test, Ptest, TermF, CompF, PsskW, Vtmag, x2, WashW, x5, WashP, x7, x8, x9, x10, x11, MechP, Synth, Tfltl, x29, x15, x16, x17, x31, Prelim, Post, POut, CntOp, TrnOp, ErrIn, Oel Output, Uel Output, Scl Output, varLimOutput, Null Balance, PositionInd, AvrOut, FcrErr, FcrState, FcrOut, FvrErr, FvrState, FvrOut, var/PfErr, var/PfState, var/PfOut, Oel State, Uel State, Scl State, VarLimState, Droop, Rcc, Oel Ref, Uel Ref, Scl Ref, Scl PfRef, VarLimRef, ProgrammableDiagnostic1, ProgrammableDiagnostic2, ProgrammableDiagnostic3, ProgrammableDiagnostic4, ProgrammableDiagnostic5, ProgrammableDiagnostic6. (Selecting “No Level Trigger” excludes a parameter from data logging.)
[C] *Pre-Trigger Points:* Adjustable from 0 to 1,199 in increments of 1.
[D] *Pre-Trigger Duration:* Read-only value based on the Pre-Trigger Points and Sample Interval settings.
[E] *Post-Trigger Points:* Read-only value based on the Pre-Trigger Points setting.
[F] *Post-Trigger Duration:* Read-only value based on the Pre-Trigger Points and Sample Interval settings.
[G] *Sample Interval:* Adjustable from 4 to 10,000 milliseconds in 4 millisecond increments for 60 Hz nominal generator frequency. Adjustable from 5 to 12,500 milliseconds in 5 millisecond increments for 50 Hz nominal generator frequency.
[H] *Total Duration:* Read-only value is the sum of the pre- and post-trigger duration values.

Triggers

BESTCOMS*Plus* Navigation Path: Settings Explorer, Report Configuration, DataLog

HMI Navigation Path: Settings, Configuration Settings, Data Log

Data logging may be triggered by mode triggers, logic triggers, level triggers, or manually through BESTCOMS*Plus*.

Mode Triggers

Mode triggers initiate data logging as a result of an internal or external DECS-250N status change. A data log can be triggered by any of the following status changes:

- Start or Stop mode selected[A]
- Soft Start mode enabled or disabled[B]
- Underfrequency condition[C]
- Manual or AVR mode selected[D]
- Power Factor or Var mode selected[E]

- Limiter active[F]
- Voltage matching enabled or disabled[G]
- Primary or secondary DECS selected[H]
- PSS enabled or disabled[I]
- Auto Sync enabled or disabled [J]
- FCR or FVR mode selected[K]
- Droop mode enabled or disabled[L]
- Network Load Share enabled or disabled[M]
- Line drop compensation enabled or disabled[N]
- Cross-current compensation enabled or disabled[O]
- Test mode enabled or disabled[P]

Mode trigger settings are illustrated in Figure 79.

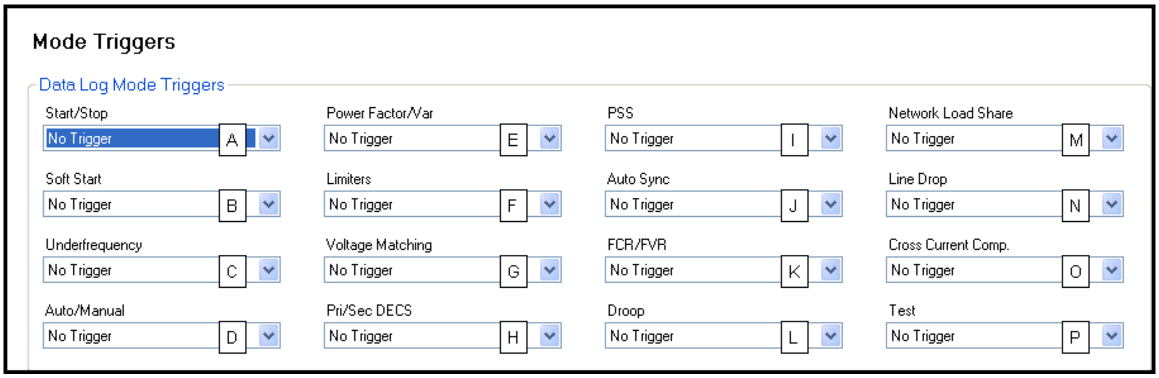


Figure 79. Data Log Mode Triggers

[A] *Start/Stop:* Select Trigger on stop mode, Trigger on start mode, or No Trigger.
[B] *Soft Start:* Select Soft Start Mode Off, Soft Start Mode Active, or No Trigger.
[C] *Underfrequency:* Select Inactive Trigger, Active Trigger, or No Trigger.
[D] *Auto/Manual:* Select Manual Control Trigger, AVR Control Trigger, or No Trigger.
[E] *Var/Power Factor:* Select Operating Mode Off Trigger, Operating Mode PF Trigger, Operating Mode VAR Trigger, or No Trigger.
[F] *Limiters:* Select Limiter Off Trigger, Limiter UEL Trigger, Limiter OEL Trigger, Limiter UEL OEL Trigger, Limiter SCL Trigger, Limiter UEL SCL Trigger, Limiter OEL SCL Trigger,Limiter UEL OEL SCL Trigger, or No Trigger.
[G] *Voltage Matching:* Select VMM Off Trigger, VMM On Trigger, or No Trigger.
[H] *Pri/Sec DECS:* Select Primary Trigger, Secondary Trigger, or No Trigger.
[I] *PSS:* Select Disabled Trigger, Enabled Trigger, or No Trigger.
[J] *Auto Sync:* Select Disabled Trigger, Enabled Trigger, or No Trigger.
[K] *FCR/FVR:* Select FVR Trigger, FCR Trigger, or No Trigger.
[L] *Droop:* Select Disabled Trigger, Enabled Trigger, or No Trigger.
[M] *Network Load Share:* Disabled Trigger, Enabled Trigger, or No Trigger.
[N] *Line Drop Comp.:* Select Disabled Trigger, Enabled Trigger, or No Trigger.
[O] *Cross-Current Comp.:* Select Disabled Trigger, Enabled Trigger, or No Trigger.
[P] *Test:* Select Disabled Trigger, Enabled Trigger, or No Trigger.

Level Triggers

Level triggering initiates a data log based on the value of an internal variable. The variable can be a minimum or maximum value and can be specified to trigger a record when the monitored variable crosses a minimum threshold from above, or a maximum threshold from below. A minimum and maximum threshold may also be selected for the monitored variable, causing the monitored value to trigger a record when it rises above its maximum threshold or decreases below its minimum threshold.

Level triggers are configured in BESTCOMS*Plus*® on the Level Triggers tab (Figure 80) in the Data Log area of the Report Configuration. The Level Triggers tab consists of a list of parameters that can be selected to trigger a data log. Each parameter has a level trigger enable setting which configures triggering of a data log when the parameter increases above the upper threshold setting or decreases below the lower threshold setting. The parameters available to trigger a data log are listed below. The lower and upper threshold of each parameter has a setting range of –2 to +2 with an increment of 0.01.

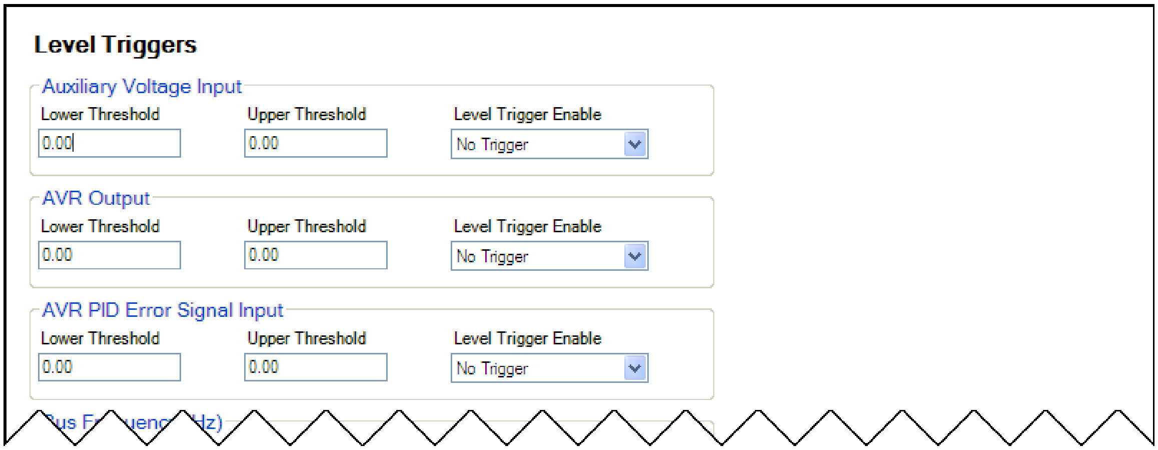


Figure 80. Data Log Level Triggers

- Auxiliary voltage input (V)
- AVR output
- AVR PID error signal input (V)
- Bus frequency (Hz)
- Bus voltage (V)
- Comp. frequency deviation (Hz)
- Control output
- Cross current input (A)
- Droop
- FCR error
- FCR output
- FCR state
- Field current (A)
- Field voltage (V)
- Frequency response (V)
- FVR error
- FVR output
- FVR state
- Generator apparent power (PU)
- Generator average current (kVA)
- Generator average voltage (V)
- Generator current Ia (A)
- Generator current Ib (A)
- Generator current Ic (A)
- Generator frequency (Hz)
- Generator power factor (PF)
- Generator reactive power (kvar)
- Generator real power (kW)
- Generator voltage Vab (V)
- Generator voltage Vbc (V)
- Generator voltage Vca (V)
- Negative sequence current (A)
- Negative sequence voltage (V)
- Null balance level
- OEL controller output (V)
- OEL ref.
- OEL state
- Internal State
- Position Indication
- Positive sequence current (A)
- Positive sequence voltage (V)
- PSS electrical power (PU)
- PSS filtered mech. Power (PU)
- PSS final output (PU)
- PSS lead/lag #1 (PU)
- PSS lead/lag #2 (PU)
- PSS lead/lag #3 (PU)
- PSS lead/lag #4 (PU)
- PSS mechanical power (PU)
- PSS mechanical power LP #1 (PU)
- PSS mechanical power LP #2 (PU)
- PSS mechanical power LP #3 (PU)
- PSS mechanical power LP #4 (PU)
- PSS post-limit output (PU)
- PSS power HP #1 (PU)
- PSS pre-limit output (PU)
- PSS speed HP #1 (PU)
- PSS synthesized speed (PU)
- PSS terminal voltage (PU)
- PSS torsional filter #1 (PU)
- PSS torsional filter #2 (PU)
- PSS washed out power (PU)
- PSS washed out speed (PU)
- Network Load Share
- SCL controller output (V)
- SCL PF ref.
- SCL ref.
- SCL state
- Terminal frequency deviation (Hz)
- Time response (V)
- UEL controller output (V)
- UEL ref.

- UEL state
- Var limit output
- Var limit ref
- Var limit state
- Var/PF error
- Var/PF output
- Var/PF state

Logic Triggers

Logic triggering initiates a data log as a result of an internal or external status change. A data log can be triggered by any combination of alarm, contact output, or contact input state changes. The available logic triggers are illustrated in Figure 81.

Figure 81. Data Log Logic Triggers

Trending

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Report Configuration, Trending
HMI Navigation Path: Settings, Configuration Settings, Trending

The trend log records the activity of DECS-250N parameters over an extended period of time. When enabled[A], up to six selectable parameters[B] can be monitored over a user-defined duration[C] ranging from one to 720 hours. Trend log settings are illustrated in Figure 82.

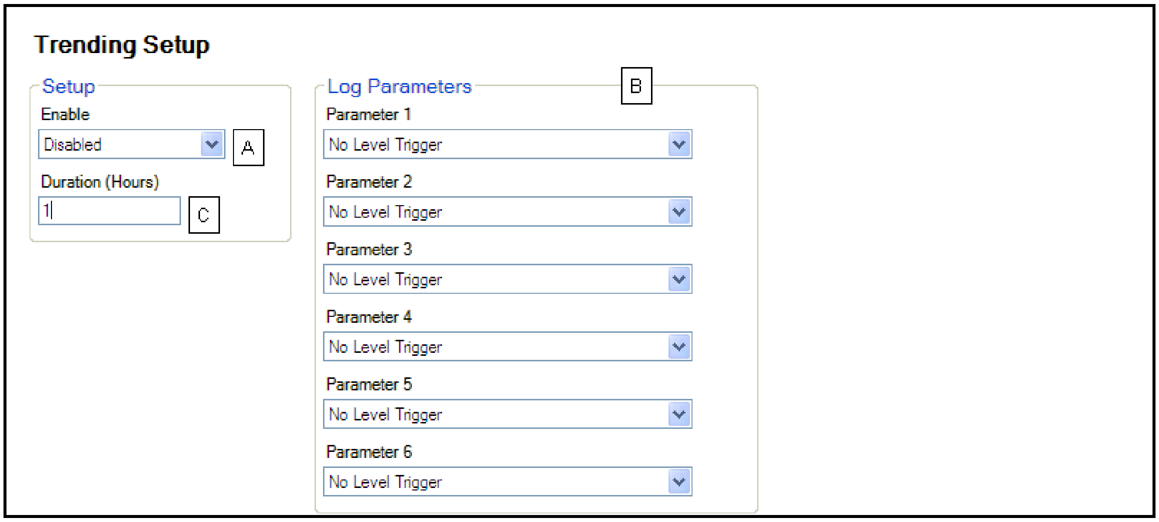


Figure 82. Trend Log Setup

[A] *Trending Enable:* Select Enabled or Disabled.

[B] *Trending Log Parameters:* Select NO Level Trigger, Vab: PhA-PhB L-L Voltage {p.u}, Vbc: PhB-PhC L-L Voltage {p.u}, Vca: PhC-PhA L-L Voltage {p.u}, Vbus: Bus Voltage {p.u}, Ia : Phase A Current {p.u}, Ib: Phase B Current {p.u}, Ic: Phase C Current {p.u}, Vavg: Avg L-L Voltage {p.u}, Iavg: Avg Line Current {p.u}, Iaux: Cross Current Input {p.u}, Vfd: Field Voltage {p.u}, Ifd: Field Current {p.u}, Vaux: Aux Voltage Input {p.u}, kW: Real Power {p.u.}, kvar: Reactive Power {p.u.}, kVA: Total Power {p.u.}, PF: Power Factor, V1: Positive Sequence Voltage {p.u.}, V2: Negative Sequence Voltage {p.u.}, I1: Positive Sequence Current {p.u.}, I2: Negative Sequence Current {p.u.}, G Hz: Generator Frequency (Hz), B Hz: Bus Frequency {Hz}, Test: Frequency Response Signal {p.u.}, or Ptest: Time Response Signal {p.u.}, TermF: Terminal Frequency Deviation {%}, CompF: Compensated Frequency Deviation, PssKW: Pss Electric Power {p.u.}, Vtmag: PSS Term Voltage,x2 : Speed HP #1,WashW : Washed Out Speed {p.u.},x5 : Power HP #1 {p.u.}, WashP: Washed Out Power {p.u.}, x7: Mechanical Power {p.u.}, x8: Mechanical Power LP #1, x9: Mechanical Power LP #2, x10: Mechanical Power LP #3, x11: Mechanical Power LP #4, MechP: Filtered Mechanical Power {p.u.}, Synth: Synthesized Speed {p.u.}, Tflt1: Torsional Filter #1 {p.u.}, x29: Torsional Filter #2 {p.u.}, x15: Lead-Lag #1 {p.u.}, x16: Lead-Lag #2 {p.u.}, x17: Lead-Lag #3 {p.u.}, x31: Lead-Lag #4 {p.u.}, Prelim: Pre-Limit Output {p.u.}, Post: Post-Limit Output {p.u.}, POut: Final PSS Output {p.u.}, CntOp: Control Output {p.u.}, TrnOp: Internal State {p.u.}, ErrIn: Avr Error Signal, OelOutput: OEL Controller Output, UelOutput: UEL Controller Output, SclOutput: SCL Controller Output, varLimOutput: var Limiter Output, NullBalance: Null Balance Level {p.u.}, PositionInd: Position Indication {p.u.}, AvrOut, FcrErr, FcrState, FcrOut, FvrErr, FvrState, FvrOut, var/PfErr, var/PfState, var/PfOut, OelState, UelState, SclState, varLimState, Droop,Rcc, OelRef, UelRef, SclIRef, SclPfRef, varLimRef, ProgrammableDiagnotic1, ProgrammableDiagnotic2, ProgrammableDiagnotic3, ProgrammableDiagnotic4, ProgrammableDiagnotic5, or ProgrammableDiagnotic6.

[C] *Trending Duration:* Adjustable from 1 to 720 hours in 1 hour increments.

Power System Stabilizer

The optional (style xPxxxxx), integrated power system stabilizer (PSS) is an IEEE type PSS2A, dual-input, "integral of accelerating power" stabilizer that provides supplementary damping for low-frequency, local-mode oscillations and power system oscillations.

PSS features include user-selectable, speed-only sensing, two- or three-wattmeter power measurement, optional frequency-based operation, and generator and motor control modes.

PSS settings are configured exclusively through the BESTCOMS*Plus*® interface. These settings are illustrated in Figure 92, Figure 93, Figure 94, and Figure 95.

BESTCOMS*Plus* Navigation Path: Settings Explorer, PSS
HMI Navigation Path: Settings, PSS

Supervisory Function and Setting Groups

A supervisory function enables PSS operation only when a sufficient load is applied to the generator. Two separate groups of PSS settings enable stabilizer operation tailored for two distinct load conditions.

Supervisory Function

When PSS control is enabled[A], a power-on threshold setting[B] determines the level of power where PSS operation is automatically enabled. This threshold is a per-unit setting based on the generator ratings. (The *Configuration* section of this manual provides information about entering the generator and system ratings.) A hysteresis setting[C] provides a margin below the power-on threshold so that transient dips in power will not disable stabilizer operation. This hysteresis is a per-unit setting based on the generator ratings.

Setting Groups

When setting group selection is enabled[D], a threshold setting[E] establishes the power level where the PSS gain settings are switched from the primary group to the secondary group. After a transfer to the secondary gain settings, a hysteresis setting[F] determines the level of (decreasing) power where a transfer back to the primary gain settings will occur.

Theory of Operation

The PSS uses an indirect method of power system stabilization that employs two signals: shaft speed and electrical power. This method eliminates the undesirable components from the speed signal (such as noise, lateral shaft run-out, or torsional oscillations) while avoiding a reliance on the difficult-to-measure mechanical power signal.

PSS function is illustrated by the function blocks and software switches shown in Figure 83. This illustration is also available in BESTCOMS*Plus* by clicking the PSS Model Info button located on the Control tab.

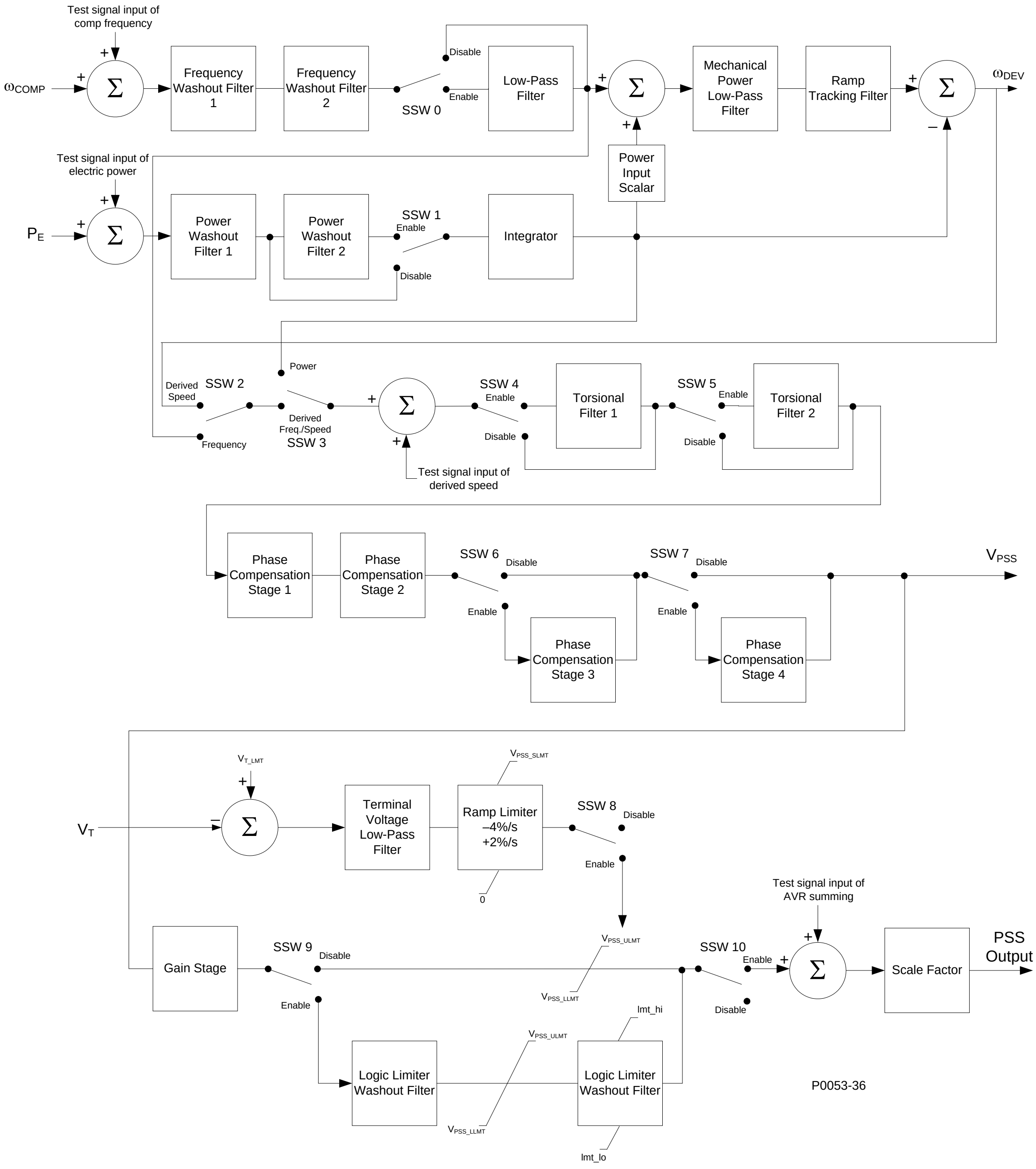


Figure 83. PSS Function Blocks and Software Switches

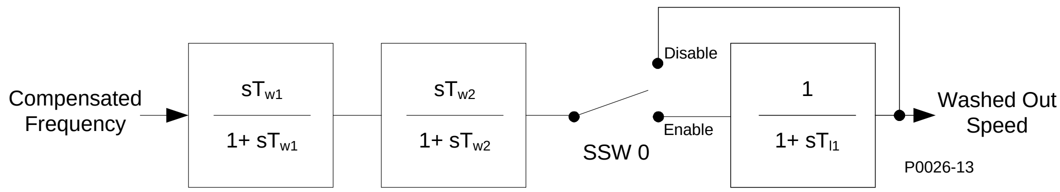
Speed Signal

The speed signal is converted to a constant level that is proportional to the shaft speed (frequency).

Two high-pass (frequency washout) filter stages are applied to the resulting signal to remove the average speed level and produce a speed deviation signal. This ensures that the stabilizer reacts only to changes in speed and does not permanently alter the generator terminal voltage reference.

The frequency washout filter stages are controlled by time constant settings Tw1[G] and Tw2[H]. Low-pass filtering of the speed deviation signal can be enabled or disabled through software switch SSW 0[I]. The low-pass filter time constant is adjusted by the Tl1 setting[J].

Figure 84 shows the high-pass and low-pass filter transfer function blocks in frequency domain form. (The letter s is used to represent the complex frequency of Laplace operator.)



PSS Frequency Input Signal

Figure 84. Speed Signal

Rotor Frequency Calculation

During steady-state conditions, the terminal frequency of the generator is a good measure of rotor speed. However, this may not be the case during low frequency transients, due to the voltage drop across the machine reactance. To compensate for this effect, the DECS-250N first calculates the terminal voltages and currents. It then adds the voltage drop across the quadrature reactance to the terminal voltages to obtain internal machine voltages. These voltages are then used to calculate the rotor frequency. This gives a more accurate measure of rotor speed during low frequency transients when stabilizing action is required.

The quadrature axis compensation used in the rotor frequency calculation is entered through the Quadrature Xq setting[K].

Generator Electrical Power Signal

Figure 85 illustrates the operations performed on the power input signal to produce the integral of electrical power deviation signal.

The generator electrical power output is derived from the generator VT secondary voltages and generator CT secondary currents applied to the DECS-250N.

The power output is high-pass (washout) filtered to produce the required power deviation signal. If additional washout filtering is desired, a second high-pass filter can be enabled by software switch SSW 1[L]. The first high-pass filter is controlled by time constant setting Tw3[M] and the second high-pass filter is controlled by time constant setting Tw4[N].

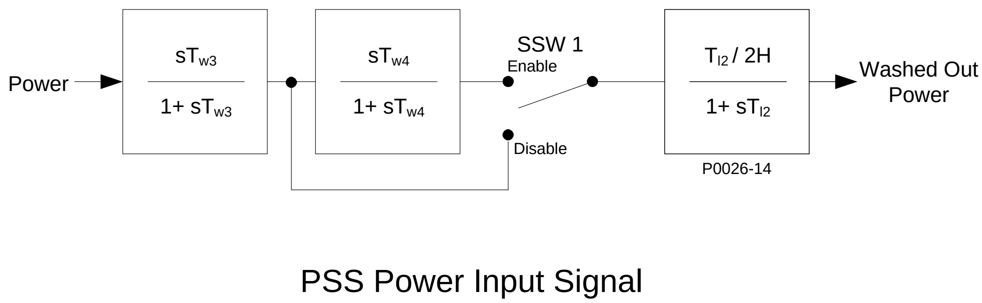


Figure 85. Generator Electrical Power Signal

After high-pass filtering, the electrical power signal is integrated and scaled, combining the generator inertia constant[O] (2H) with the speed signal. Low-pass filtering within the integrator is controlled by time constant TI2[P].

Derived Mechanical Power Signal

The speed deviation signal and integral of electrical power deviation signal are combined to produce a derived, integral of mechanical power signal.

An adjustable gain stage, Kpe[Q], establishes the amplitude of the electrical power input used by the PSS function.

The derived integral of mechanical power signal is then passed through a mechanical-power, low-pass filter and ramp tracking filter. The low-pass filter is controlled by time constant TI3[R] and provides attenuation of torsional components appearing in the speed input path. The ramp tracking filter produces a zero, steady-state error to ramp changes in the integral of electric power input signal. This limits the stabilizer output variation to very low levels for the mechanical power rates of change that are normally encountered during operation of utility-scale generators. The ramp tracking filter is controlled by time constant Tr[S]. An exponent consisting of a numerator[T] and denominator[U] is applied to the mechanical power filter.

Processing of the derived integral of mechanical power signal is illustrated in Figure 86.

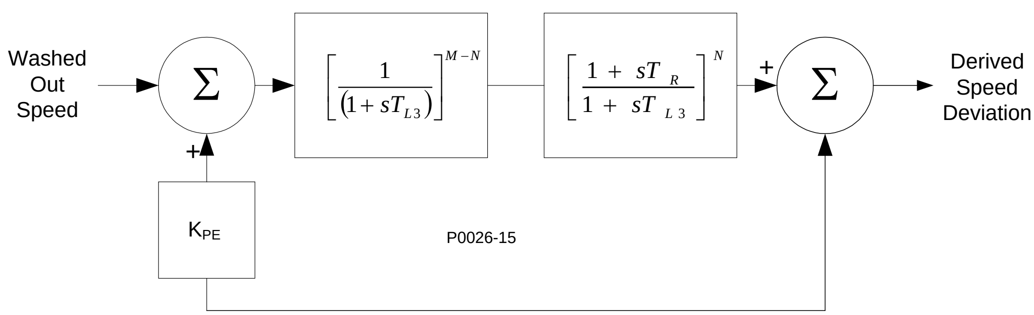


Figure 86. Derived Mechanical Power Signal

Stabilizing Signal Selection

Figure 87 illustrates how software switches SSW 2[V] and SSW 3[W] are used to select the stabilizing signal. Derived speed deviation is selected as the stabilizing signal when the SSW 2 setting is Derived Speed and the SSW 3 setting is Derived Frequency/Speed. Washed out speed is selected as the stabilizing signal when the SSW 2 setting is Frequency and the SSW 3 setting is Derived Frequency/Speed. Washed out power is selected as the stabilizing signal when the SSW 3 setting is Power. (When the SSW 3 setting is Power, the SSW 2 setting has no effect.)

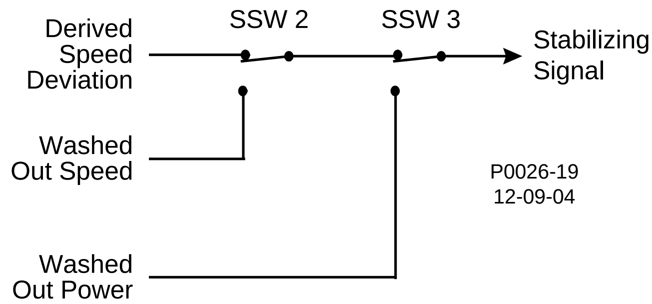


Figure 87. Stabilizing Signal Selection

Torsional Filters

Two torsional filters, shown in Figure 88, are available after the stabilizing signal and before the phase compensation blocks. The torsional filters provide the desired gain reduction at a specified frequency. The filters compensate the torsional frequency components present in the input signal.

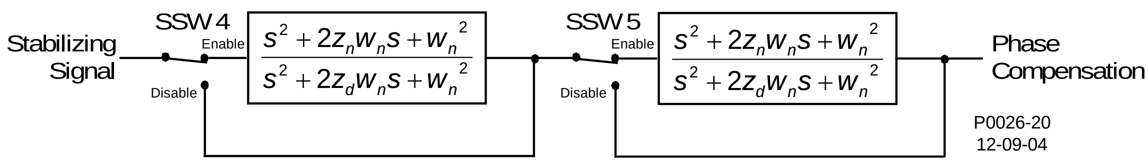


Figure 88. Torsional Filters

Software switch SSW 4[X] enables and disables torsional filter 1 and SSW 5[Y] enables and disables torsional filter 2.

Torsional filters 1 and 2 are controlled by a zeta numerator[Z] (Zeta Num), zeta denominator[AA] (Zeta Den), and a frequency response parameter[BB] (Wn).

Phase Compensation

The derived speed signal is modified before it is applied to the voltage regulator input. Filtering of the signal provides phase lead at the electromechanical frequencies of interest (0.1 to 5 Hz). The phase lead requirement is site-specific and is required to compensate for phase lag introduced by the closed-loop voltage regulator.

Four phase compensation stages are available. Each phase compensation stage has a phase lead time constant[CC] (T1, T3, T5, T7) and a phase lag time constant[DD] (T2, T4, T6, T8). Normally, the first two lead-lag stages are adequate to match the phase compensation requirements of a unit. If needed, the third and fourth stages may be added through the settings of software switches SSW 6[EE] and SSW 7[FF]. Figure 89 illustrates the phase compensation stages and associates software switches.

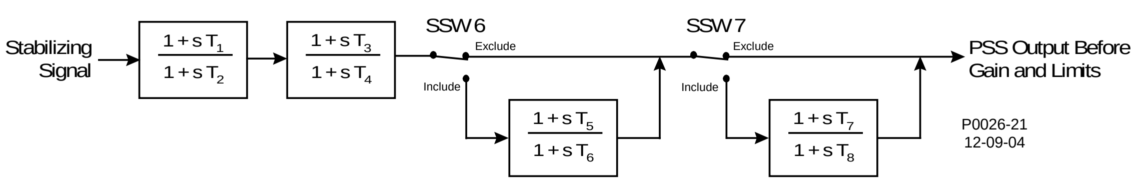


Figure 89. Phase Compensation

Washout Filter and Logic Limiter

The output of the phase compensation stages is connected, through a stabilizer gain stage, to the washout filter and logic limiter.

Software switch SSW 9[GG] enables and bypasses the washout filter and logic limiter. The washout filter has two time constants: normal[HH] and limit[II] (less than normal).

The logic limiter compares the signal from the washout filter with the logic limiter upper[JJ] and lower[KK] limit settings. If the counter reaches the set delay time[LL], the time constant for the washout filter changes from the normal time constant to the limit time constant. When the signal returns to within the specified limits, the counter resets and the washout filter time constant changes back to the normal time constant.

Figure 90 illustrates the washout filter and logic limiter.

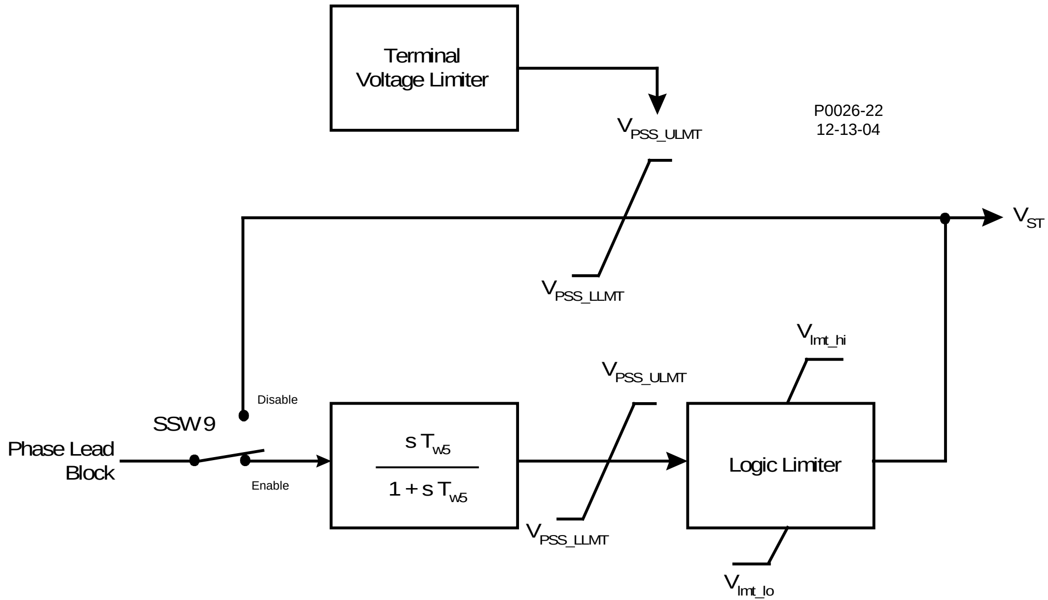


Figure 90. Washout Filter and Logic Limiter

Output Stage

Prior to connecting the stabilizer output signal to the voltage regulator input, adjustable gain[MM] and upper[NN] and lower[OO] limits are applied. The stabilizer output is connected to the voltage regulator input when the software switch SSW 10[PP] setting is On. Processing of the stabilizer output signal is illustrated in Figure 91.

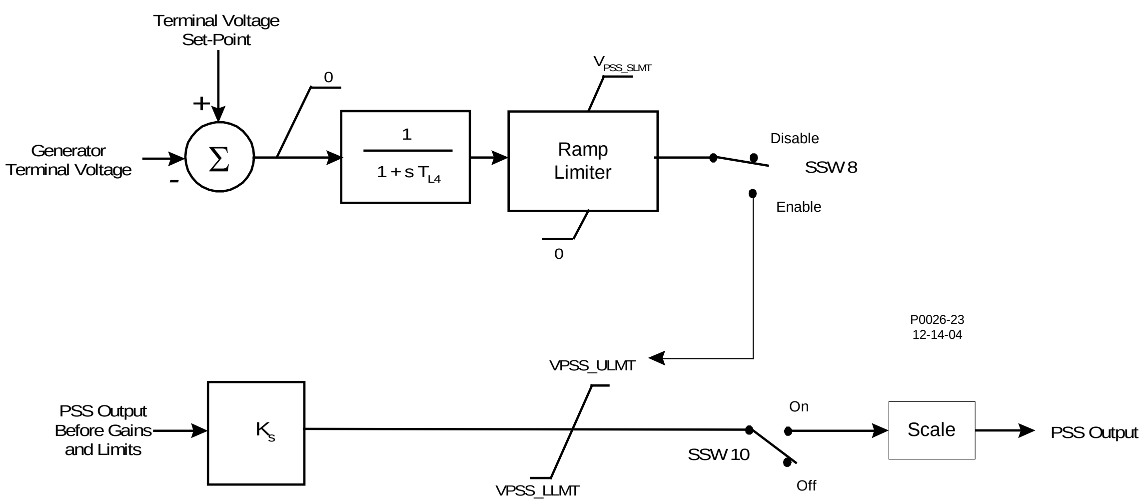


Figure 91. Output Stage

Terminal Voltage Limiter

Since the PSS operates by modulating the excitation, it may counteract the voltage regulator's attempts to maintain terminal voltage within a tolerance band. To avoid creating an overvoltage condition, the PSS has a terminal voltage limiter (shown in Figure 90) that reduces the upper output limit to zero when the generator voltage exceeds the terminal voltage setpoint[QQ]. The terminal voltage limiter is enabled and disabled by software switch SSW 8[RR]. The limit setpoint is normally selected such that the limiter will eliminate any contribution from the PSS before the timed overvoltage or volts per hertz protection operates.

The limiter reduces the stabilizer's upper limit, V_{PSS_ULMT}, at a fixed rate until zero is reached or overvoltage is no longer present. The limiter does not reduce the AVR reference below its normal level; it will not interfere with system voltage control during disturbance conditions. The error signal (terminal voltage minus the limit start point) is processed through a conventional low-pass filter to reduce the effect of measurement noise. The low-pass filter is controlled by a time constant[SS].

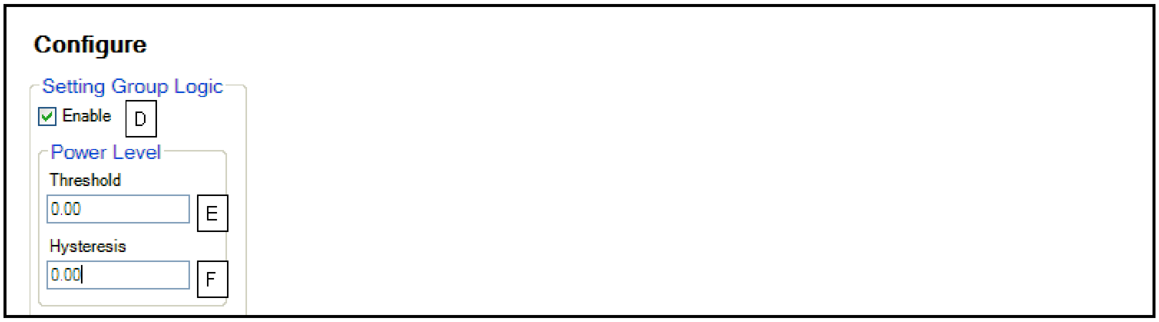


Figure 92. PSS Configuration Settings

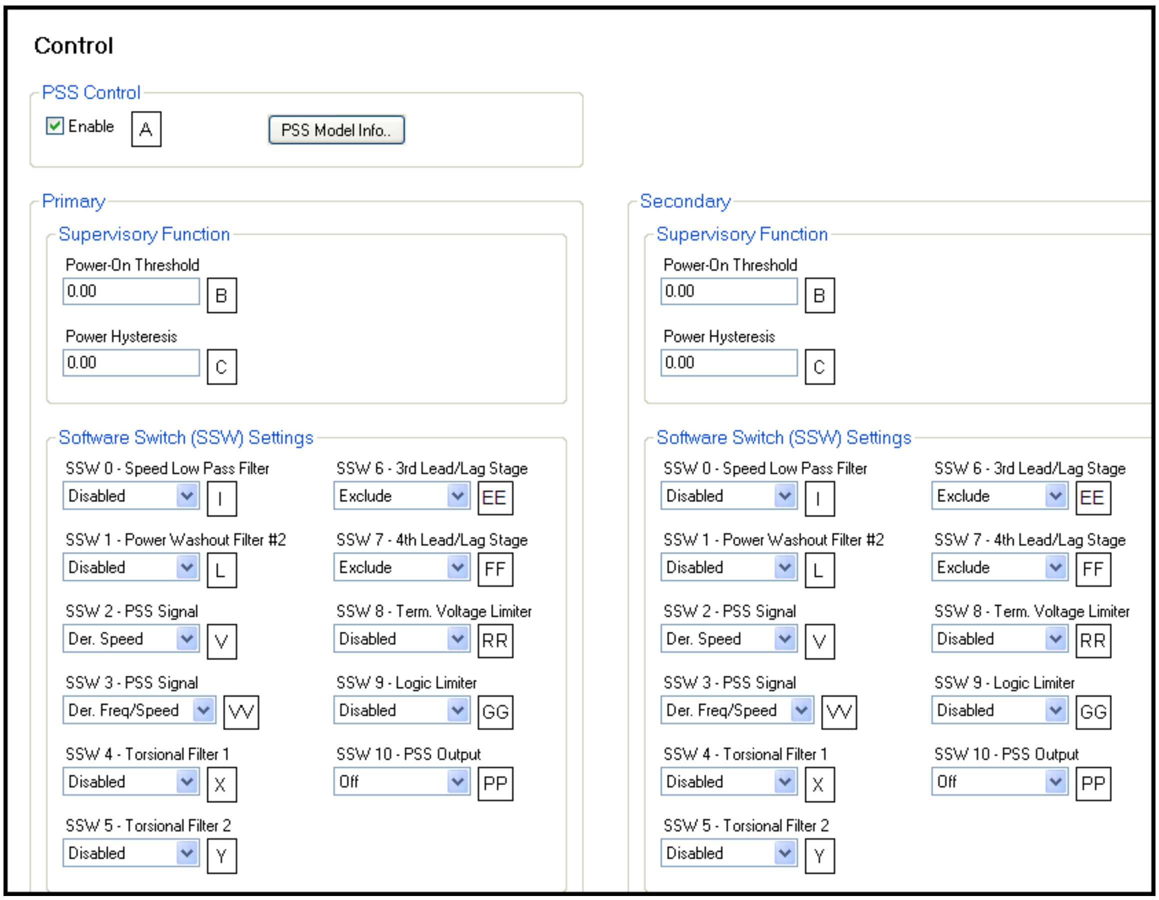


Figure 93. PSS Control Settings

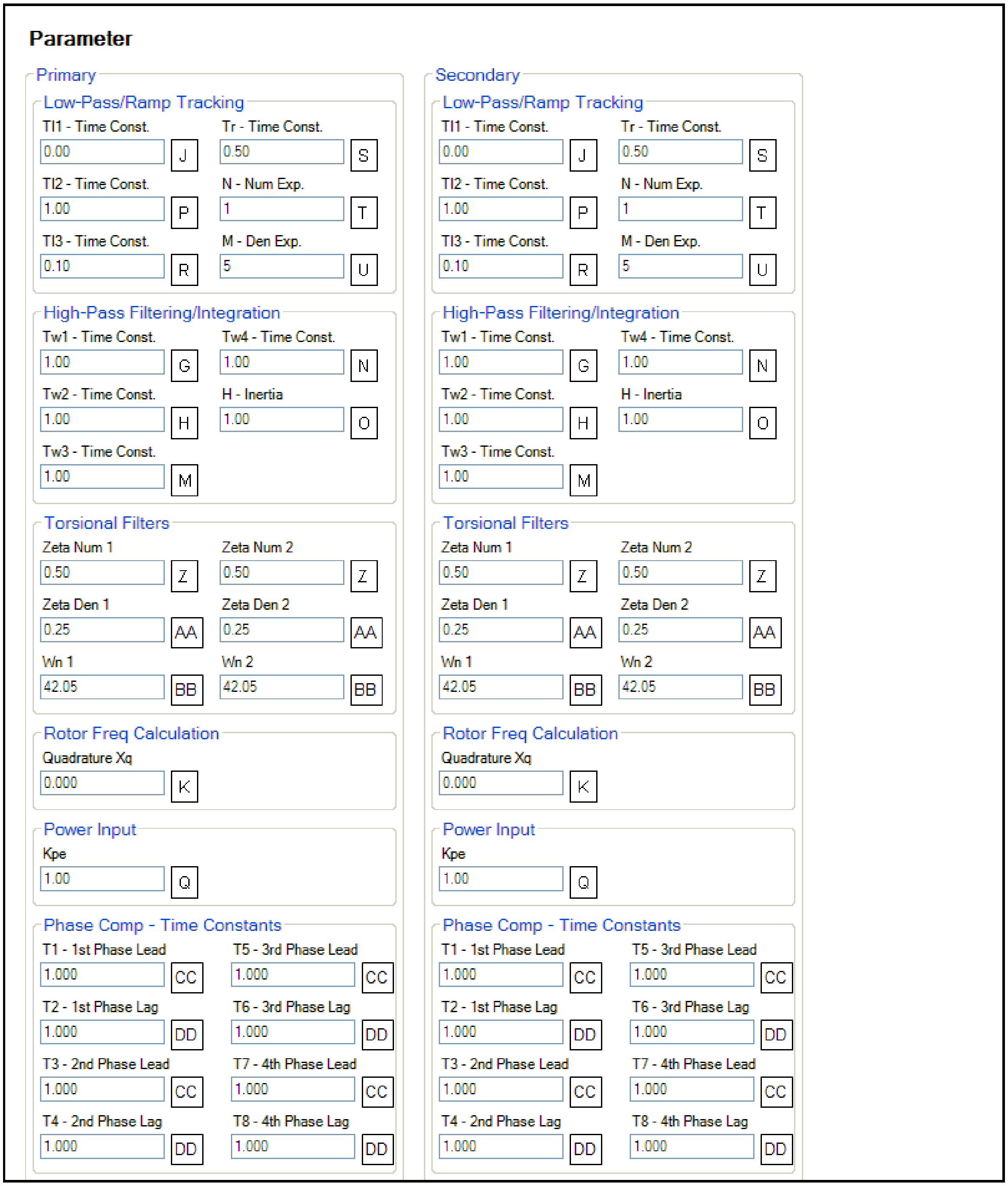


Figure 94. PSS Parameter Settings

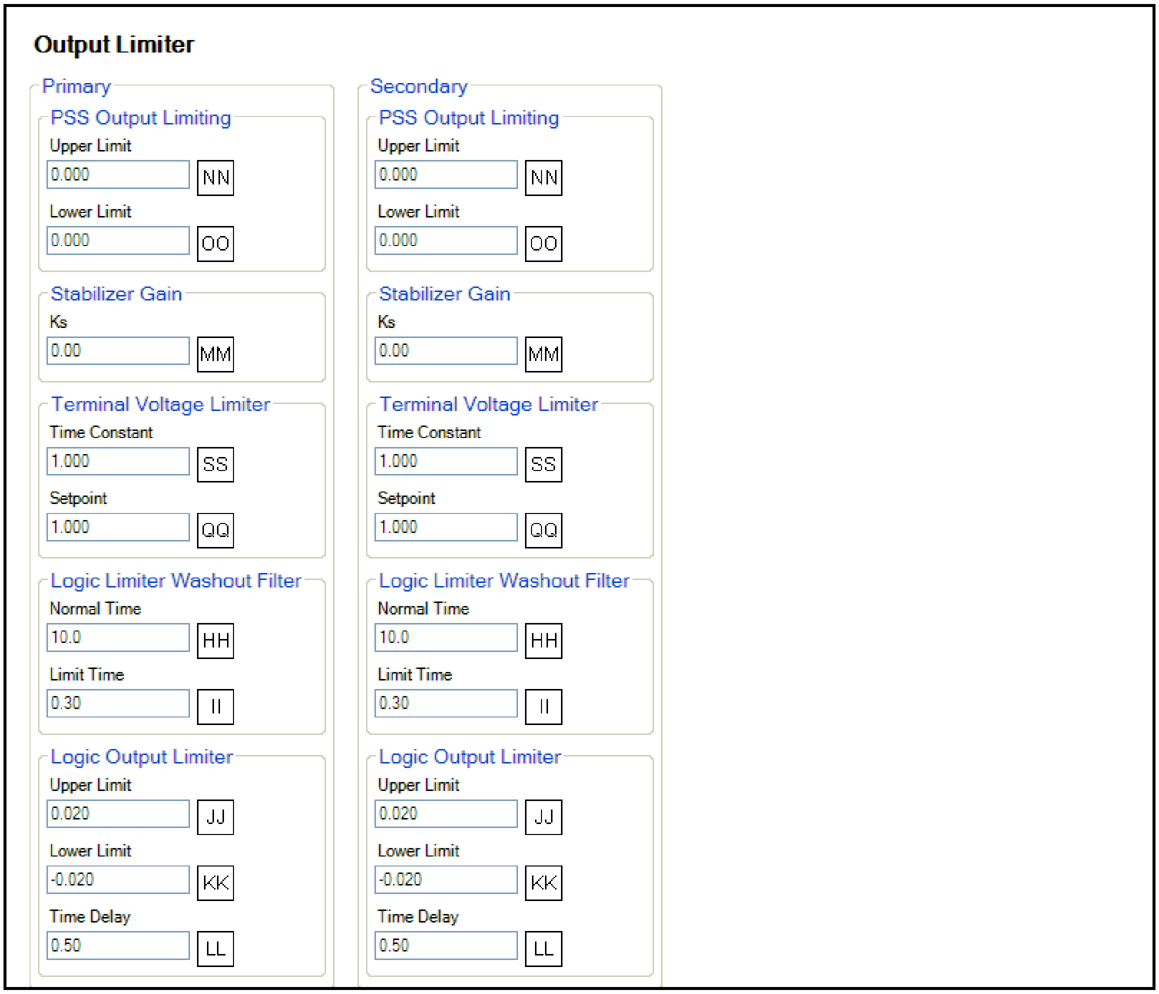


Figure 95. PSS Output Limiter Settings

[A] *PSS Control*: Select Check box to enable.
[B] *Supervisory Function Power-On Threshold*: Adjustable from 0 to 1 in 0.01 increments.
[C] *Supervisory Function Power Hysteresis*: Adjustable from 0 to 1 in 0.01 increments.
[D] *Setting Group Logic*: Check box to enable.
[E] *Power Level Threshold*: Adjustable from 0 to 1 in 0.01 increments.
[F] *Power Level Hysteresis*: Adjustable from 0 to 1 in 0.01 increments.
[G] *High-Pass Filtering/Integration Time Constant Tw1*: Adjustable from 1 to 20 in 0.01 increments.
[H] *High-Pass Filtering/Integration Time Constant Tw2*: Adjustable from 1 to 20 in 0.01 increments.
[I] *Speed Low-Pass Filter Switch SSW 0*: Select Enabled or Disabled.
[J] *Low-Pass/Ramp Tracking Time Constant Tl1*: Adjustable from 1 to 20 in 0.01 increments.
[K] *Rotor Frequency Calculation – Quadrature Xq*: Adjustable from 0 to 5 in 0.001 increments.
[L] *Power Washout Filter #2 Software Switch SSW 1*: Select Enabled or Disabled.
[M] *High-Pass Filtering/Integration Time Constant Tw3*: Adjustable from 1 to 20 in 0.01 increments.
[N] *High-Pass Filtering/Integration Time Constant Tw4*: Adjustable from 1 to 20 in 0.01 increments.
[O] *High-Pass Filtering/Integration Inertia (H)*: Adjustable from 1 to 25 in 0.01 increments.
[P] *Low-Pass/Ramp Tracking Time Constant Tl2*: Adjustable from 1 to 20 in 0.01 increments.
[Q] *Power Input Gain Stage Kpe*: Adjustable from 0 to 2 in 0.01 increments.
[R] *Low-Pass/Ramp Tracking Time Constant Tl3*: Adjustable from 0.05 to 0.2 in 0.01 increments.
[S] *Low-Pass/Ramp Tracking Time Constant Tr*: Adjustable from 0.05 to 1 in 0.01 increments.
[T] *Low-Pass/Ramp Tracking Exponent Numerator*: Adjustable from 0 to 1 in increments of 1.
[U] *Low-Pass/Ramp Tracking Exponent Denominator*: Adjustable from 1 to 5 in increments of 1.
[V] *PSS Signal Software Switch SSW 2*: Select Frequency or Der. Speed.
[W] *PSS Signal Software Switch SSW 3:* Select Power or Der. Freq/Speed.

[X] *Torsional Filter 1 Software Switch SSW 4*: Select Disabled or Enabled.
[Y] *Torsional Filter 2 Software Switch SSW 5*: Select Disabled or Enabled.
[Z] *Torsional Filter Zeta Numerator*: Adjustable from 0 to 1 in 0.01 increments.
[AA] *Torsional Filter Zeta Denominator*: Adjustable from 0 to 1 in 0.01 increments.
[BB] *Torsional Filter Frequency Response Parameter (Wn)*: Adjustable from 10 to 150 in 0.05 increments.
[CC] *Phase Compensation Phase Lead Time Constant*: Adjustable from 0.001 to 6 in 0.001 increments.
[DD] *Phase Compensation Phase Lag Time Constant*: Adjustable from 0.001 to 6 in 0.001 increments.
[EE] *3rd Lead/Lag Stage Software Switch SSW 6*: Select Include or Exclude.
[FF] *4th Lead/Lag Stage Software Switch SSW 7*: Select Include or Exclude.
[GG] *Logic Limiter Software Switch SSW 9*: Select Enabled or Disabled.
[HH] *Logic Limiter Washout Filter Normal Time Constant*: Adjustable from 5 to 30 in 0.1 increments.
[II] *Logic Limiter Washout Filter Limit Time Constant*: Adjustable from 0 to 1 in 0.01 increments.
[JJ] *Logic Output Limiter Upper Limit*: Adjustable from 0.01 to 0.04 in 0.01 increments.
[KK] *Logic Output Limiter Lower Limit*: Adjustable from –0.04 to –0.01 in 0.01 increments.
[LL] *Logic Output Limiter Time Delay*: Adjustable from 0 to 2 in 0.01 increments.
[MM] *Stabilizer Gain (Ks)*: Adjustable from 0 to 50 in 0.01 increments.
[NN] *PSS Output Limiting Upper Limit*: Adjustable from 0 to 0.5 in 0.01 increments.
[OO] *PSS Output Limiting Lower Limit*: Adjustable from –0.5 to 0 in 0.01 increments.
[PP] *PSS Output Software Switch SSW 10*: Select On or Off.
[QQ] *Terminal Voltage Limiter Setpoint*: Adjustable from 0 to 10 in 0.001 increments.
[RR] *Terminal Voltage Limiter Software Switch SSW 8*: Select Enabled or Disabled.
[SS] *Terminal Voltage Limiter Time Constant*: Adjustable from 0.02 to 5 in 0.01 increments.

Stability Tuning

Generator stability tuning in the DECS-250N is achieved through the calculation of PID parameters. PID stands for Proportional, Integral, Derivative. The word proportional indicates that the response of the DECS-250N output is proportional or relative to the amount of change observed. Integral means that the DECS-250N output is proportional to the amount of time that a change is observed. Integral action eliminates offset. Derivative means that the DECS-250N output is proportional to the required rate of excitation change. Derivative action avoids excitation overshoot.

Caution
All stability tuning must be performed with no load on the system or equipment damage may occur.

AVR Mode

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Gain, AVR

HMI Navigation Path: Settings, Operating Settings, Gains, AVR Gains

Two sets of PID settings are provided to optimize performance under two distinct operating conditions, such as with the power system stabilizer (PSS) in or out of service. A fast controller provides optimum transient performance with the PSS in service while a slower controller can provide improved damping of first swing oscillations the PSS offline. BESTCOMS*Plus* primary and secondary AVR stability settings are shown in Figure 96.

Predefined Stability Settings

Twenty predefined sets[A] of stability settings are available with the DECS-250N. Appropriate PID values are implemented based on the nominal generator frequency selected (see the *Configuration* section of this manual) and the combination of generator (T'do) and exciter (Texc) time constants selected from the gain option list. (The default value for the exciter time constant is the generator time constant divided by six.)

Additional settings are available to remove the effects of noise on numerical differentiation (AVR derivative time constant Td)[B] and set the voltage regulator gain level of the PID algorithm (Ka)[C].

Custom Stability Settings

Stability tuning can be tailored for optimum generator transient performance. Selecting a primary gain option of "custom" enables entry of custom proportional (Kp)[D], integral (Ki)[E], and derivative (Kd)[F] gains.

When tuning the stability gain settings, consider the following guidelines

- If the transient response has too much overshoot, decrease Kp. If the transient response is too slow, with little or no overshoot, increase Kp.
- If the time to reach steady-state is too long, increase Ki.
- If the transient response has too much ringing, increase Kd.

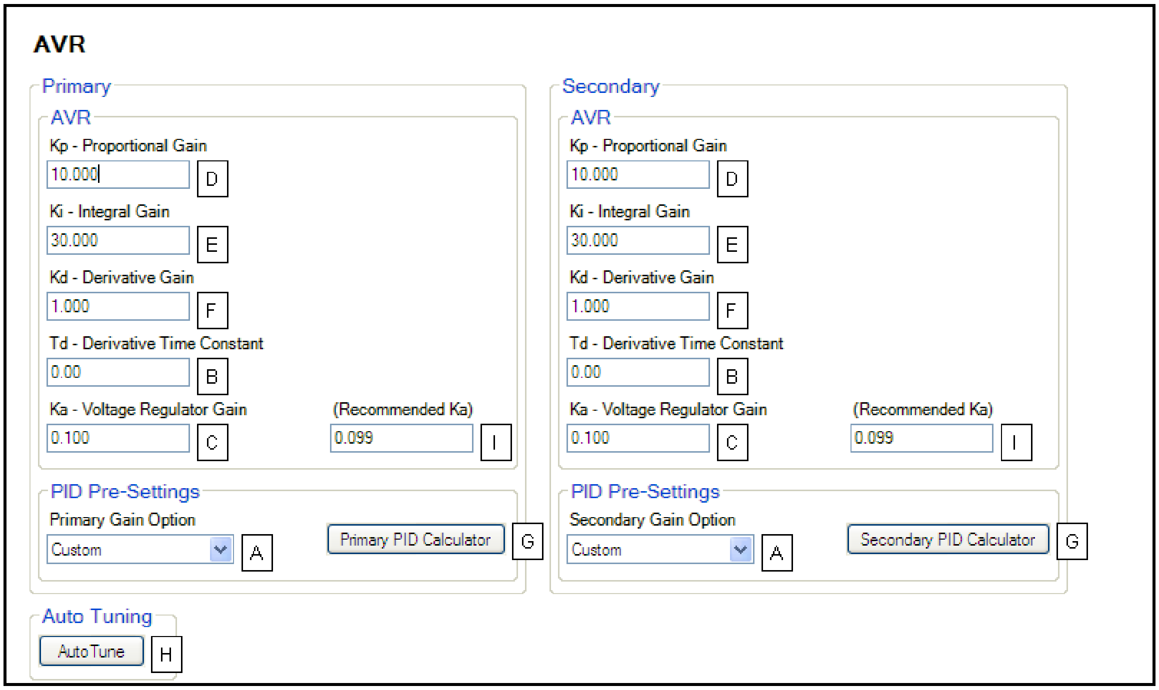


Figure 96. AVR Stability Settings

[A] *Gain Option*: Select T'do=1.0 Te=0.17, T'do=1.5 Te=0.25, T'do=2.0 Te=0.33, T'do=2.5 Te=0.42, T'do=3.0 Te=0.50, T'do=3.5 Te=0.58, T'do=4.0 Te=0.67, T'do=4.5 Te=0.75, T'do=5.0 Te=0.83, T'do=5.5 Te=0.92, T'do=6.0 Te=1.00, T'do=6.5 Te=1.08, T'do=7.0 Te=1.17, T'do=7.5 Te=1.25, T'do=8.0 Te=1.33, T'do=8.5 Te=1.42, T'do=9.0 Te=1.50, T'do=9.5 Te=1.58, T'do=10.0 Te=1.67, T'do=10.5 Te=1.75, or Custom.
[B] *Td – AVR Derivative Time Constant*: Adjustable from 0 to 1 in 0.01 increments.
[C] *Ka – Voltage Regulator Gain*: Adjustable from 0 to 1 in 0.001 increments.
[D] *Kp – Proportional Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[E] *Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[F] *Kd – Derivative Gain*: Adjustable from 0 to 1,000 in 0.1 increments.

PID Calculator

The PID calculator is accessed by clicking the PID calculator button (Figure 96, locator G) and is available only when the primary gain option is “Custom”. The PID calculator (Figure 97) calculates the gain parameters Kp[A], Ki[B], and Kd[C] based on the generator time constants (T'do)[D] and exciter time constant (Te)[E]. If the exciter time constant is not known, it can be forced to the default value[F] which is the generator time constant divided by six. A derivative time constant (Td)[G] setting field enables the removal of noise effects on numerical differentiation. A voltage regulator gain (Ka)[H] setting field sets the voltage regulator gain level of the PID algorithm. Calculated and entered parameters can be applied[I] upon closure[J] of the PID calculator.

A group of settings can be saved with a unique name and added to a list of gain setting records available for application. Upon completion of stability tuning, undesired records can be removed from the record list.

Caution

Calculated or user-defined PID values are to be implemented only after their suitability for the application has been verified by the user. Incorrect PID numbers can result in poor system performance or equipment damage.

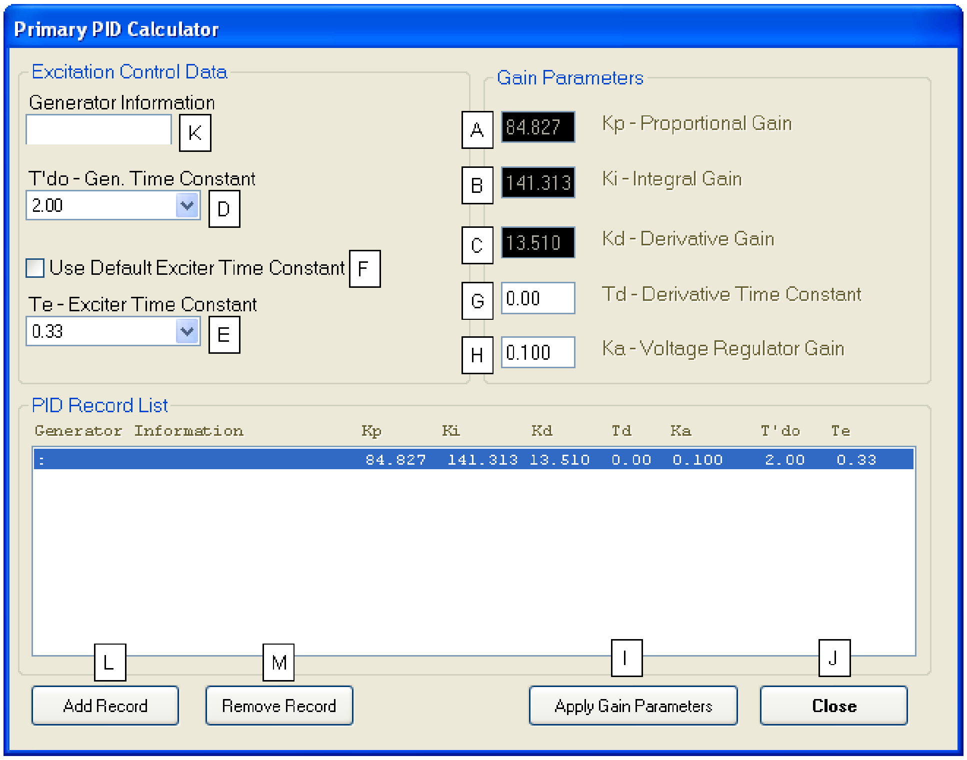


Figure 97. PID Calculator

[A] *Kp – Proportional Gain*: Read-only, calculated gain value.
[B] *Ki – Integral Gain*: Read-only, calculated gain value.
[C] *Kd – Derivative Gain*: Read-only, calculated gain value.
[D] *T'do – Gen. Time Constant:* Select a value within the range of 1 to 15 seconds.
[E] *Te – Exciter Time Constant*: Select a value within the range of 0.04 to 1.0 seconds.
[F] *Use Default Exciter Time Constant*: Select or deselect.
[G] *Td – Derivative Time Constant*: Adjustable from 0 to 1 in 0.01 increments.
[H] *Ka – Voltage Regulator Gain*: Adjustable from 0 to 1 in 0.001 increments.
[I] *Apply Gain Parameters Button*: Click button to apply gain parameters.
[J] *Close Button*: Click button to close PID calculator.

Auto Tuning

During commissioning, excitation system parameters may not be known. These unknown variables traditionally cause the commissioning process to consume large amounts of time and fuel. With the development of auto tuning, the excitation system parameters are now automatically identified and the PID gains are calculated using well-developed algorithms. Automatically tuning the PID controller greatly reduces commissioning time and cost. The auto tuning function is accessed by clicking the *Auto Tune* button (Figure 96, Locator H). BESTCOMS*Plus*® must be in Live Mode in order to begin the auto tuning process. The auto tuning window (Figure 98) provides options for choosing the PID Design Mode[A] and the Power Input Mode[B]. When the desired settings are selected, the *Start Auto Tune*[C] button is clicked to start the process. After the process is complete, click the *Save PID Gains (Primary)*[D] button to save the data.

Caution
PID values calculated by the Auto Tuning function are to be implemented only after their suitability for the application has been verified by the user. Incorrect PID numbers can result in poor system performance or equipment damage.

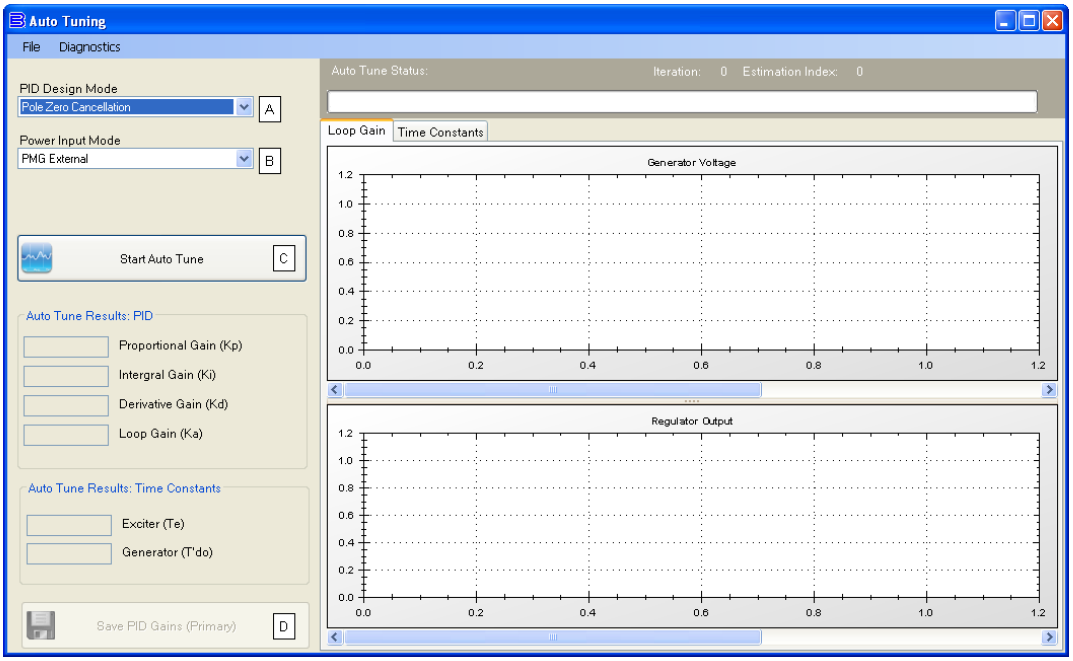


Figure 98. Auto Tuning Window

[A] *PID Design Mode:* Set to either Pole Zero Cancellation or Pole Placement.
[B] *Power Input Mode:* Set to either PMG External or Shunt.
[C] *Start Auto Tune Button:* Begins the auto tuning process.
[D] *Save PID Gains Button:* Saves the calculated PID gains.

The File menu contains options for importing, exporting, and printing a graph (.gph) file.

The Diagnostics menu (Figure 99) contains an option to open the Diagnostic View window. This window displays the generator speed, generator voltage, field voltage, field current, auxiliary input, power input connection, field connection, and generator voltage sensing parameters (Vac, Vab, Vbc). Click *Start* to begin the diagnostics.

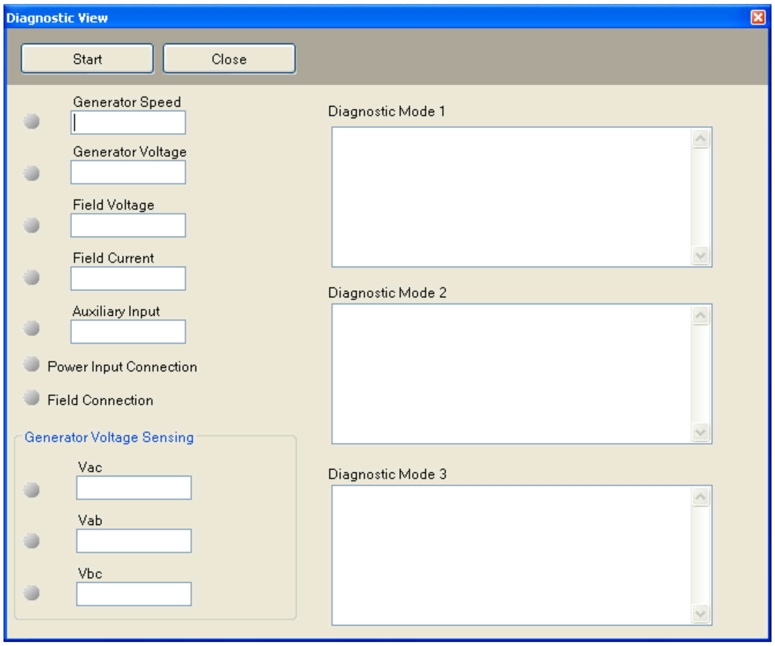


Figure 99. Diagnostic View Window

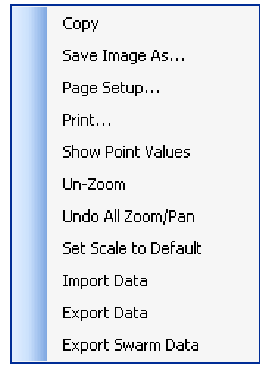


Figure 100. Graph Right-Click Menu

Right-clicking on the graph areas displays options (Figure 100) for copying, saving, printing, importing, and exporting the graph data as well as options for showing/hiding point values, zoom, and resetting to the default scale. Rolling the mouse wheel up or down when the cursor is hovering over the graph area will cause the view to zoom in or out.

FCR and FVR Modes

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Gain, FCR/FVR

HMI Navigation Path: Settings, Operating Settings, Gains, FCR Gains or FVR Gains

Stability tuning can be tailored for optimum performance when operating in field current regulation or field voltage regulation mode. BESTCOMS*Plus* FCR stability settings and FVR stability settings are illustrated in Figure 101.

FCR Mode Stability Settings

The DECS-250N bases its field current output upon the following settings.

The proportional gain (Kp)[A] is multiplied by the error between the field current setpoint and the actual field current value. Decreasing Kp reduces overshoot in the transient response. Increasing Kp speeds the transient response.

The integral gain (Ki)[B] is multiplied by the integral of the error between the current setpoint and the actual field current value. Increasing Ki reduces the time to reach a steady state.

The derivative gain (Kd)[C] is multiplied by the derivative of the error between the current setpoint and the actual field current value. increasing Kd reduces ringing in the transient response.

Additional FCR stability settings remove the noise effect on numerical differentiation (derivative time constant Td)[D] and set the voltage regulator gain level of the PID algorithm (Ka)[E] with recommended gain calculation[F].

FVR Mode Stability Settings

The DECS-250N bases its field voltage output upon the following settings.

The proportional gain (Kp)[G] is multiplied by the error between the field voltage setpoint and the actual field voltage value. Decreasing Kp reduces overshoot in the transient response. Increasing Kp speeds the transient response.

The integral gain (Ki)[H] is multiplied by the integral of the error between the voltage setpoint and the actual field voltage value. increasing Ki reduces the time to reach a steady state.

The derivative gain (Kd)[I] is multiplied by the derivative of the error between the voltage setpoint and the actual field voltage value. increasing Kd reduces ringing in the transient response.

Additional FVR stability settings remove the noise effect on numerical differentiation (derivative time constant Td)[J] and set the voltage regulator gain level of the PID algorithm (Ka)[K] with recommended gain calculation[L].

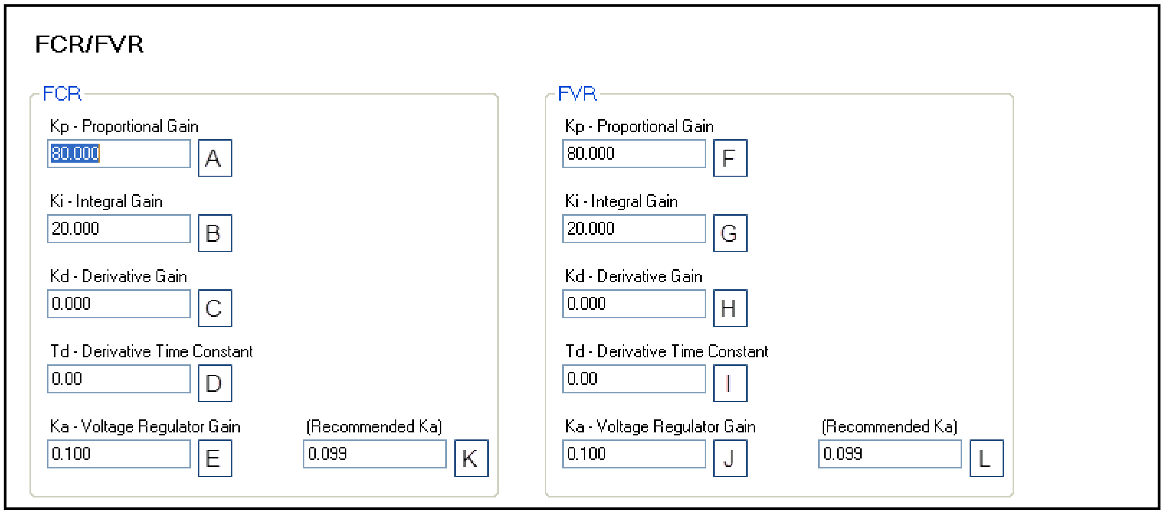


Figure 101. FCR and FVR Gain Settings

[A] *Kp – Proportional Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[B] *Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[C] *Kd – Derivative Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[D] *Td – Derivative Time Constant*: Adjustable from 0 to 1,000 in 0.1 increments.
[E] *Ka –Voltage Regulator Gain*: Adjustable from 0 to 1 in 0.001 increments.
[F] *Kp – Proportional Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[G] *Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[H] *Kd – Derivative Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[I] *Td – Derivative Time Constant*: Adjustable from 0 to 1,000 in 0.1 increments.
[J] *Ka –Voltage Regulator Gain*: Adjustable from 0 to 1 in 0.001 increments.
[K] *FCR Recommended Ka:* Recommended Ka based on calculation using no load field voltage and operating power input voltage.
[L] *FVR Recommended Ka:* Recommended Ka based on calculation using no load field voltage and operating power input voltage.

Other Modes and Functions

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Gain, var, PF, OEL, UEL, SCL, VAR Limiter

HMI Navigation Path: Settings, Operating Settings, Gains, Other Gains

Settings for stability tuning of the Var and Power Factor modes are provided in the DECS-250N along with settings for stability tuning of limiters, the voltage matching function, and main field voltage response. Figure 102 illustrates these settings as they appear in BESTCOMS*Plus*.

Var Mode

The integral gain (Ki)[A] adjusts the Var mode integral gain which determines the characteristic of the DECS-250N dynamic response to a changed var setpoint.

The loop gain (Kg)[B] adjusts the coarse loop-gain level of the PI algorithm for var control.

Power Factor Mode

The integral gain (Ki)[C] adjusts the integral gain which determines the characteristic of the DECS-250N dynamic response to a changed power factor setpoint.

The loop gain (Kg)[D] adjusts the coarse loop-gain level of the PI algorithm for power factor control.

Overexcitation Limiter (OEL)

The integral gain (Ki)[E] adjusts the rate at which the DECS-250N responds during an overexcitation condition.

The integral loop gain (Kg)[F] adjusts the coarse loop-gain level of the PI algorithm for the overexcitation limiter function.

Underexcitation Limiter (UEL)

The integral gain (Ki)[G] adjusts the rate at which the DECS-250N responds during an underexcitation condition.

The loop gain (Kg)[H] adjusts the coarse loop-gain level of the PI algorithm for the underexcitation limiter function.

Stator Current Limiter (SCL)

The integral gain (Ki)[I] adjusts the rate at which the DECS-250N limits stator current.

The loop gain (Kg)[J] adjusts the coarse loop-gain level of the PI algorithm for the stator current limiter function.

Var Limiter

The integral gain (Ki)[K] adjusts the rate at which the DECS-250N limits reactive power.

The loop gain (Kg)[L] adjusts the coarse loop-gain level of the PID algorithm for the reactive power limiter function.

Voltage Matching

The integral gain (Ki)[M] adjusts the rate at which the DECS-250N matches the generator voltage to the bus voltage.

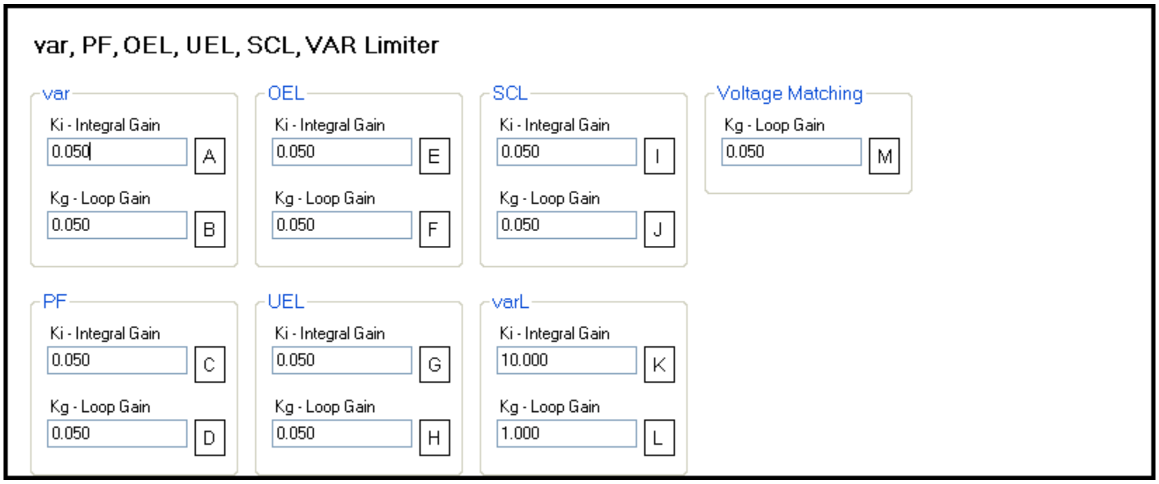


Figure 102. Other Mode and Function Gain Settings

[A] *Var Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[B] *Var Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[C] *PF Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[D] *PF Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[E] *OEL Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[F] *OEL Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[G] *UEL Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[H] *UEL Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[I] *SCL Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[J] *SCL Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.001 increments.
[K] *VARL Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[L] *VARL Kg – Loop Gain*: Adjustable from 0 to 1,000 in 0.1 increments.
[M] *Voltage Matching Ki – Integral Gain*: Adjustable from 0 to 1,000 in 0.1 increments.

Mounting

As delivered, the DECS-250N is configured for projection (wall) mounting. Front panel mounting is possible with an optional escutcheon plate mounting kit (DECS-250N P/N 9440506100).

Mounting Considerations

DECS-250N heat sink orientation necessitates vertical mounting for maximum cooling. Any other mounting angle will reduce heat dissipation and possibly lead to premature failure of critical components.

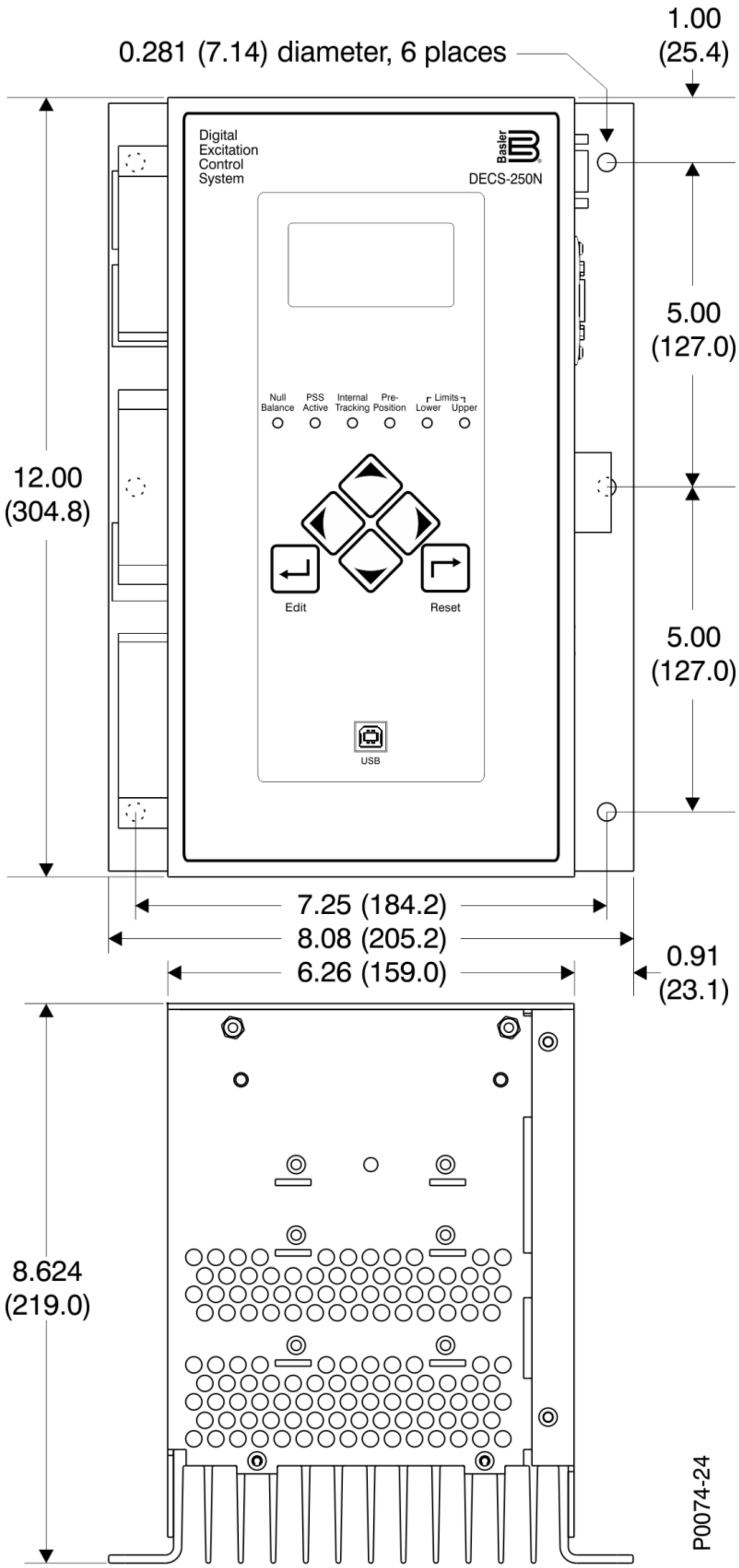
The DECS-250N may be mounted anywhere the ambient temperature does not exceed the maximum operating temperature as listed in the *Specifications* chapter.

Projection Mounting

Figure 103 illustrates the mounting dimensions for projection (wall) mounting of the DECS-250N.

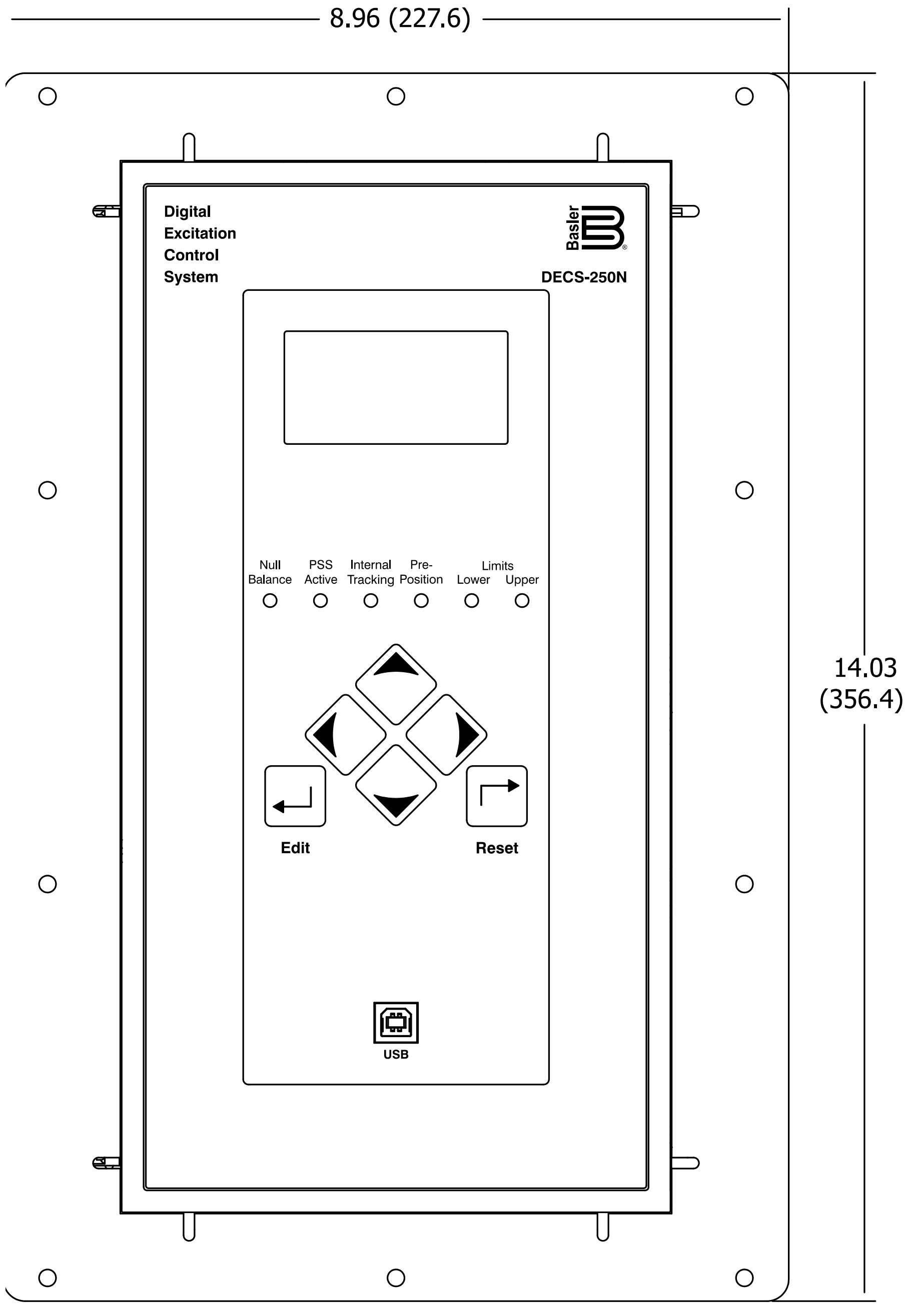
Behind-the-Panel Mounting

Figure 104 shows the front dimensions of the optional escutcheon mounting plate for the DECS-250N. Panel cutting and drilling dimensions for panel mounting are shown in Figure 105.



Note: All dimensions are in inches (millimeters).

Figure 103. Overall and Projection Mounting Dimensions



Note: All dimensions are in inches (millimeters). P0067-47

Figure 104. DECS-250N Escutcheon Plate Dimensions

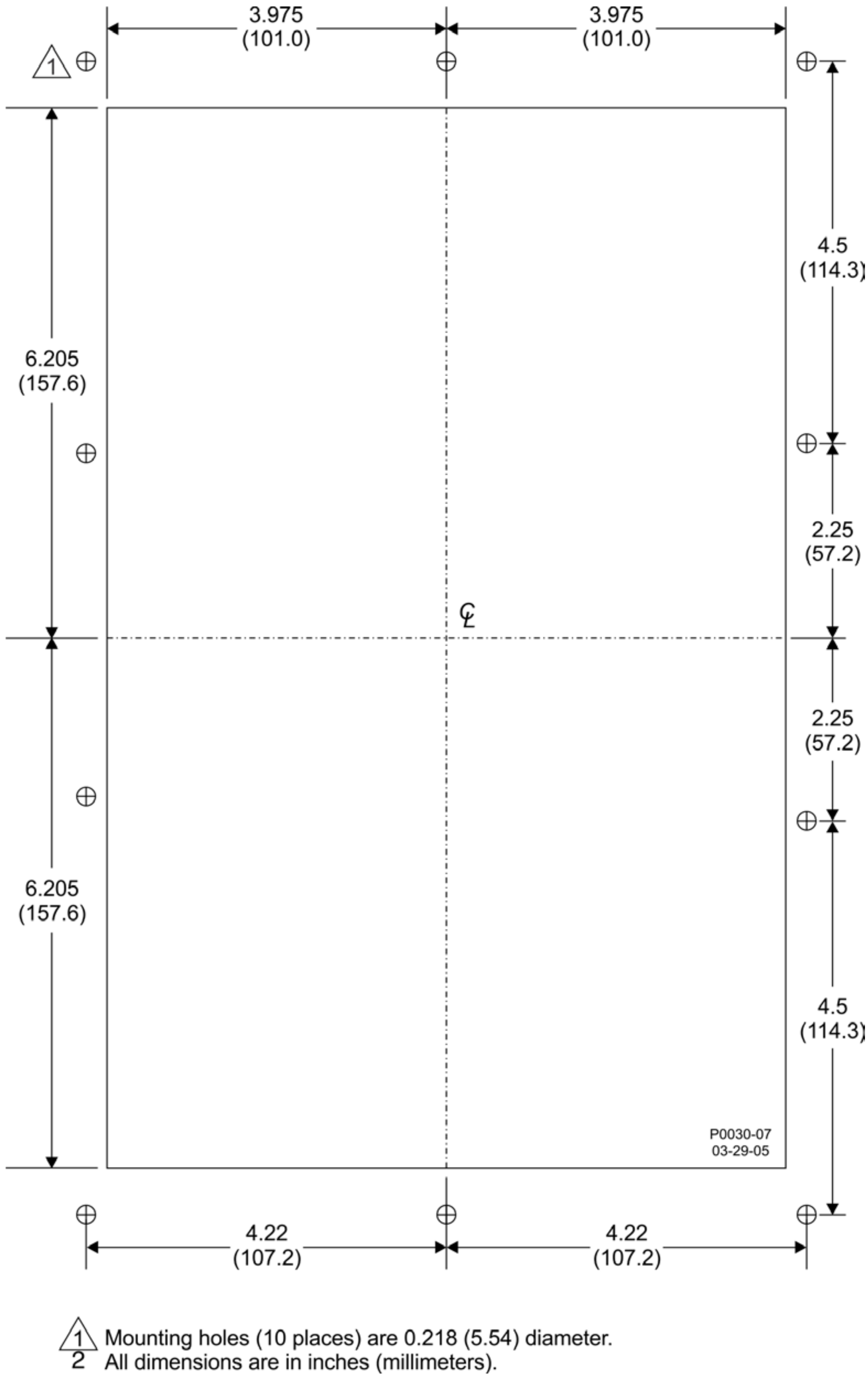


Figure 105. Panel Cutting and Drilling Dimensions for DECS-250N Panel Mounting

Terminals and Connectors

DECS-250N terminals and connectors are located on the left side panel, front panel, and right side panel. DECS-250N terminals consist of single-row, multiple-pin headers that mate with removable connectors wired by the user. DECS-250N connectors vary according to their function and the specified options.

Overview

Figure 106 illustrates the left side panel terminals and Figure 107 illustrates the right side panel connectors and terminals. Locator letters in each illustration correspond to the terminal block and connector descriptions in Table 4 and Table 5. The front-panel USB jack is illustrated and described in the *Controls and Indicators* section of this manual.

Caution
In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.

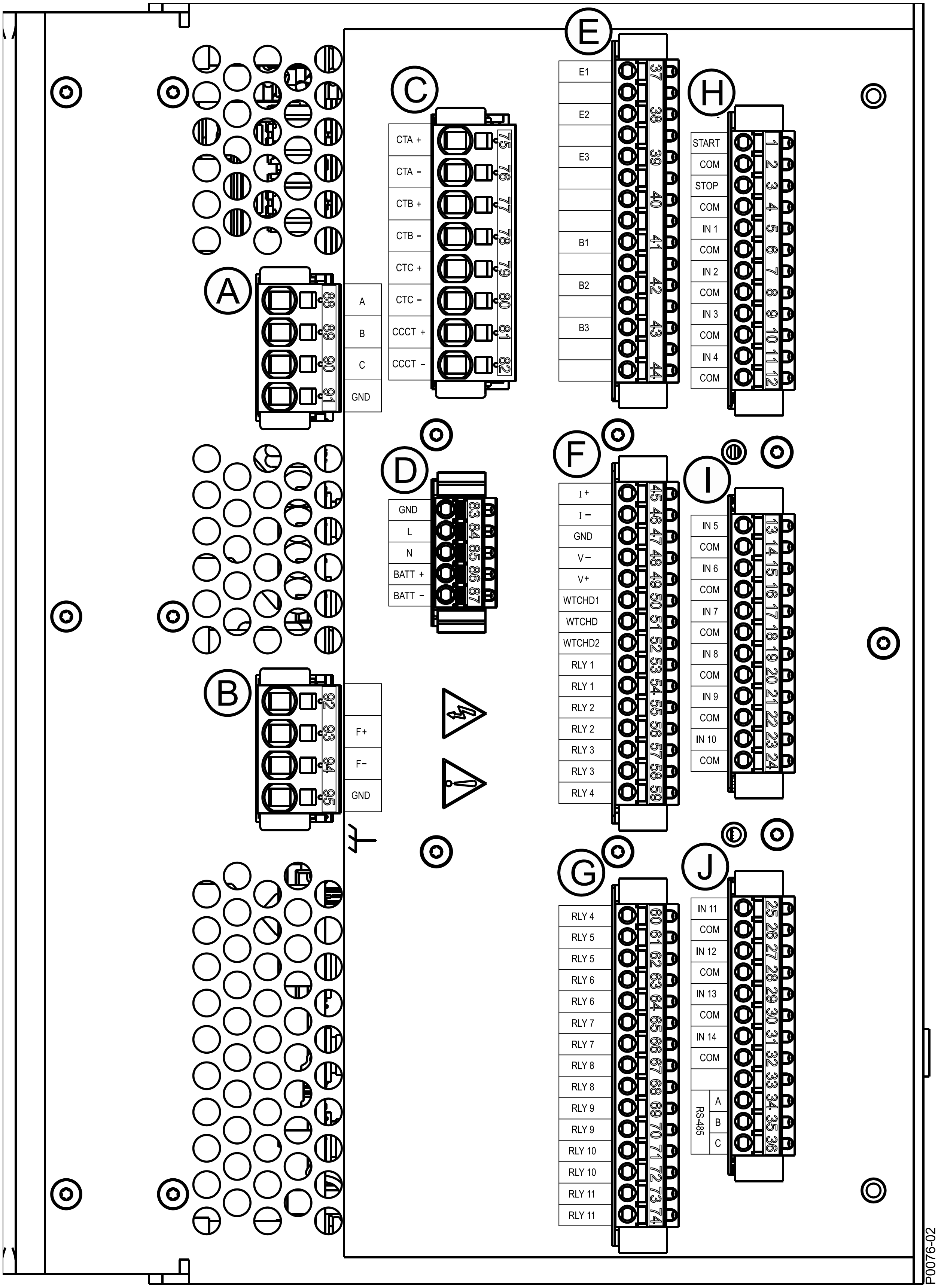


Figure 106. Left Side Panel Terminals

Table 4. Left Side Terminal and Connector Descriptions

Locator	Description
A	These terminals accept three-phase operating power for the excitation power stage of the DECS-250N. A ground for the operating power connections is provided at terminal GND.
B	Excitation power is supplied to the field through the terminals labeled F+ and F–. The GND terminal serves as the chassis ground for the DECS-250N.
C	These terminals connect to user-supplied current transformers (CTs) providing three phases of generator sensing current and a cross-current compensation signal.
D	Two terminal sets accept ac and/or dc control power to enable DECS-250N operation.
E	Three-phase generator and bus sensing voltage, obtained from user-supplied voltage transformers (VTs), connect to these terminals.
F	A portion of this terminal block accepts an external analog control signal for auxiliary control of the regulation setpoint. Terminals I+, I–, V+, and V– are used for external control of the regulation setpoint with the GND terminal serving as a cable shield connection. The remaining terminal block pins serve as connections for the Watchdog and programmable relay outputs 1 through 4.
G	Relay contact outputs for programmable relay outputs 4 through 11 connect to these terminals.
H	Contact inputs for the Start and Stop functions and programmable contact inputs 1 through 4 are applied to these terminals.
I	Programmable contact inputs 5 through 10 are applied to these terminals.
J	A portion of these terminal block pins accept connections for programmable contact inputs 11 through 14. The remaining terminal block pins serve as connections for RS-485 communication.

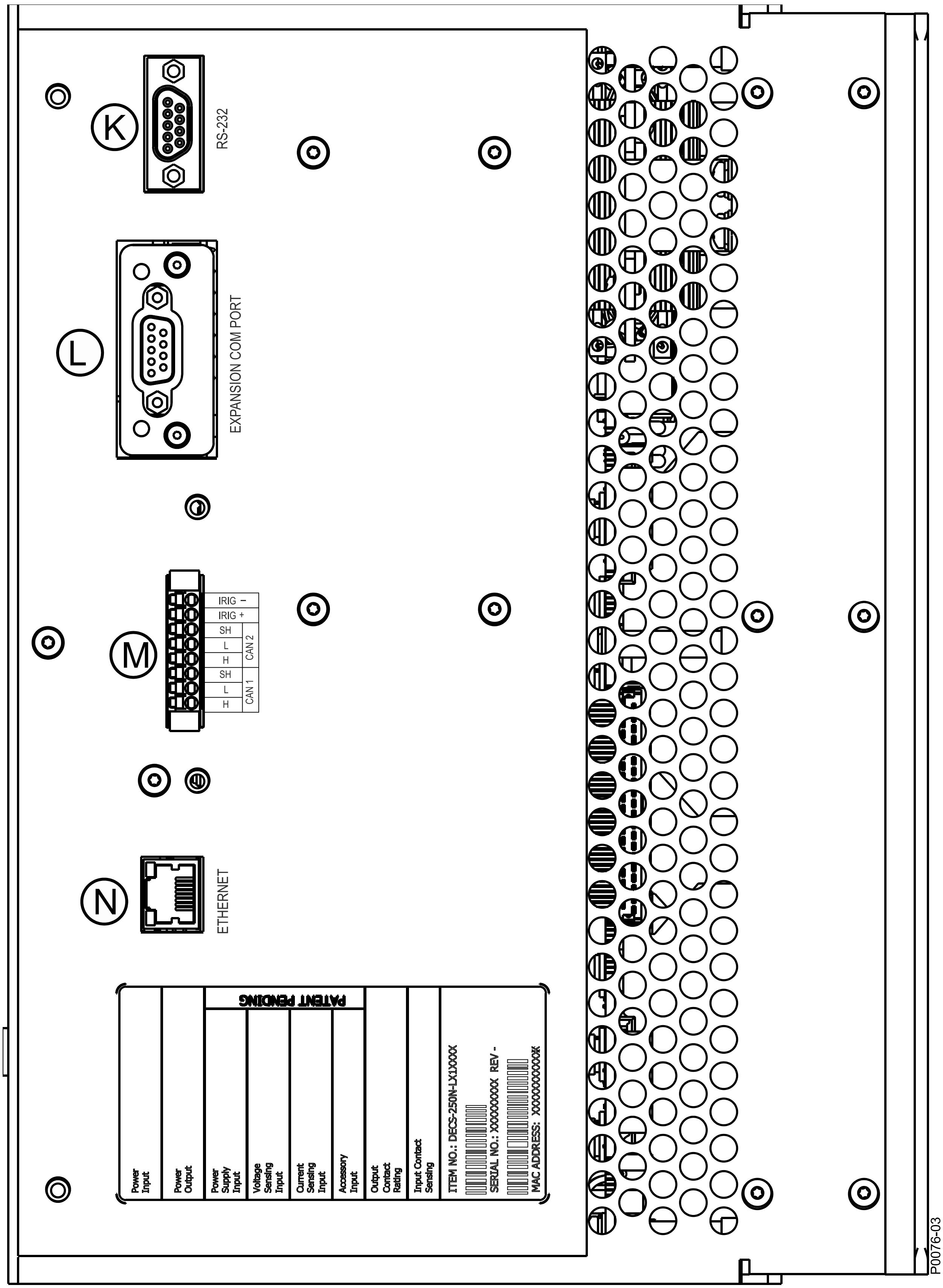


Figure 107. Right Side Connectors and Terminals

Table 5. Right Side Terminal and Connector Descriptions

Locator	Description
K	A second DECS-250N connects through a standard serial cable to this DB-9 connector for the purpose of setpoint tracking. Setpoint tracking between a DECS-250N and DECS-200N is possible.
L	This DB-9 connector is provided for PROFIBUS communication (style xxxxxxP) and the future implementation of other communication protocols. Contact Basler Electric for protocol availability.
M	Three terminal sets within this block include two CAN communication ports and an IRIG input. The IRIG terminals connect to an IRIG source for synchronization of DECS-250N timekeeping with the IRIG source. Both CAN ports are SAE J1939 compliant. CAN 1 is used to connect add-on modules such as the Basler Electric CEM-2020 and AEM-2020. CAN 2 is used to communicate with a genset engine controller.
N	This optional Ethernet communication port uses the Modbus TCP protocol to provide remote metering, annunciation, and control. A copper (100Base-T) port (style xxxxx1X) uses a standard RJ45 jack while a fiber optic (100Base-FX) port (style xxxxx2x) uses two fiber optic connectors (not shown).

Terminal Types

Spring terminals are supplied on DECS-250N controllers with a style number of xxxSxxx. These removable connectors secure each wire with a spring-loaded contact.

Compression terminals are supplied for the operating power terminals (locator A), field power output terminals (locator B), and current sensing terminals (locator C) when a style number of xxxCxxx is specified. The remaining connectors use spring terminals.

Table 6 lists the acceptable wire sizes, strip lengths, and screw torques (compression terminals only) for each terminal block. The locator letters used in Table 6 correspond to the locator letters shown in Figure 106 and Figure 107.

Table 6. Connector Wiring Specifications

Terminal Block	Maximum Wire Size	Compression Terminals		Spring Terminals
		Strip Length	Maximum Screw Torque	Strip Length
A, B, C	10 AWG 10 mm^2 (solid) 6 mm^2 (stranded)	0.4 in (10 mm)	6.64 in-lb (0.75 N•m)	0.6 in (15 mm)
D	10 AWG 10 mm^2 (solid) 6 mm^2 (stranded)	N/A	N/A	0.6 in (15 mm)
E, F, G, H, I, J	12 AWG 2.5 mm^2 (solid and stranded)	N/A	N/A	0.4 in (10 mm)
M	16 AWG 1.5 mm^2 (solid and stranded)	N/A	N/A	0.35 in (9 mm)

Spring terminal connector blocks identified by locators A through J and M are held in place by retaining clips.

Connectors identified by locators A, B, E, and J are keyed to avoid misconnections.

Typical Connections

Typical connection diagrams are provided in this chapter as a guide when wiring the DECS-250N for communication, contact inputs, contact outputs, sensing, and operating power.

Typical connections for applications which use three-phase wye generator voltage sensing are illustrated in Figure 108. Typical connections for applications which use three-phase wye PMG voltage sensing are illustrated in Figure 109. Locators in Figure 108 and Figure 109 correspond to the descriptions found in Table 7.

Note
Field wires, connected to terminals F+ and F–, must be twisted pair with approximately one turn per inch for an EMC compliant installation.

Table 7. Typical Connection Drawing Descriptions

Locator	Description
1	Operating (bridge) power input. For single-phase power, omit one phase connection. See *Power Inputs* or *Specifications* for operating power ratings.
2	Generator voltage sensing input. Potential transformer required if line voltage exceeds 600 Vac.
3	Cross-current compensation input, 1 Aac or 5 Aac.
4	Connections required only if voltage matching, sync-check, or auto synchronizer functions are used.
5	Labels indicate the functions assigned by the default programmable logic to the contact inputs and outputs.
6	See the *Power Inputs* or *Specifications* chapter for control power input ratings.
7	RS-232 port used for communication with another DECS in a redundant DECS system.
8	Optional communication port (style xxxxxxP) uses Profibus protocol.
9	IRIG time synchronization input.
10	Ethernet communication port can be copper (style xxxxx1x) or fiber optic (style xxxxx2x) and uses Modbus communication protocol.
11	Type B USB jack for temporary, local communication. **Caution** In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.
12	This input/output is unassigned by default if the DECS-250N is not equipped with the optional PSS (style number xPxxxxx).
13	RS-485 port uses the Modbus RTU protocol for communication with other networked devices.

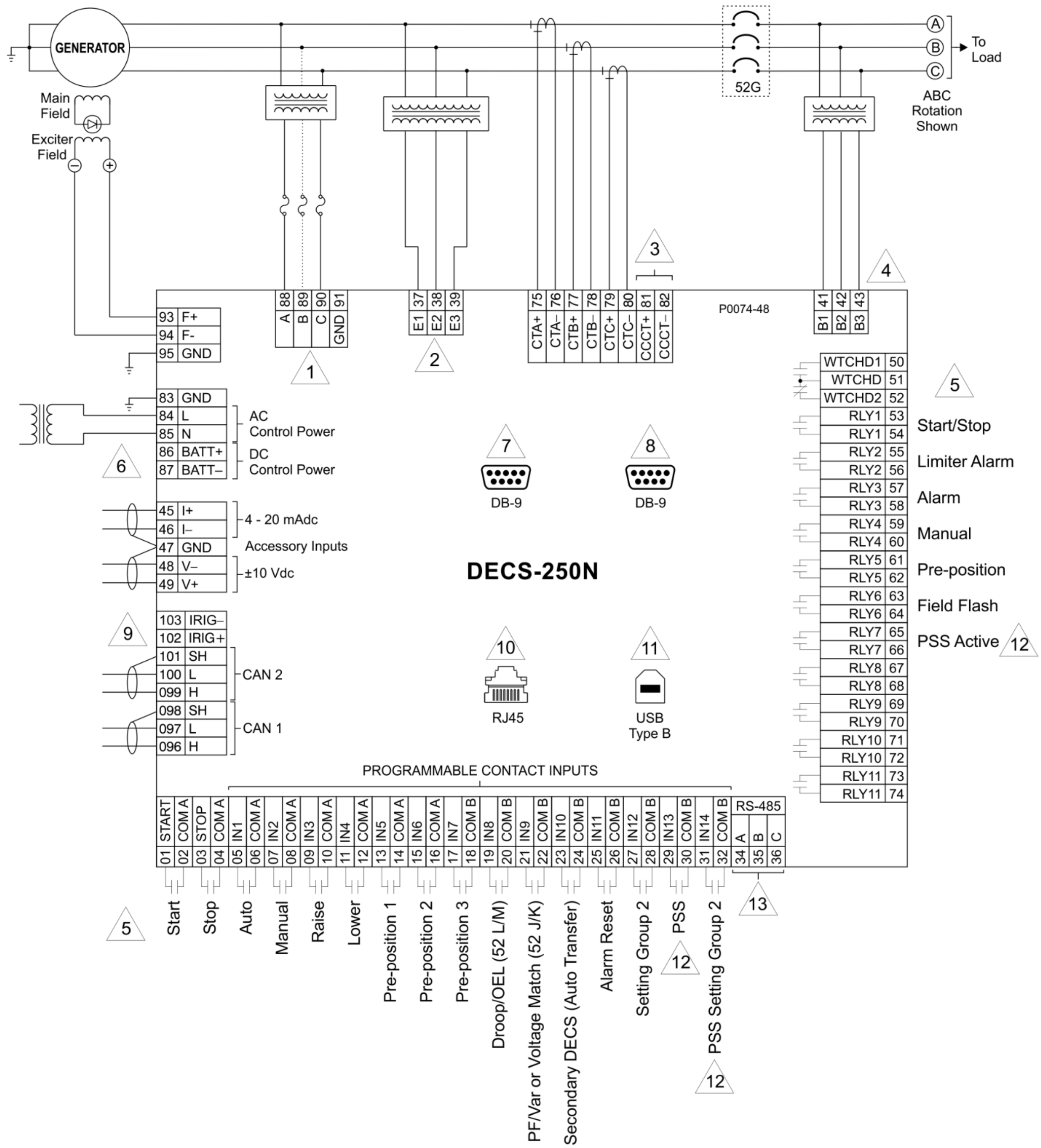


Figure 108. Typical DECS-250N Connections

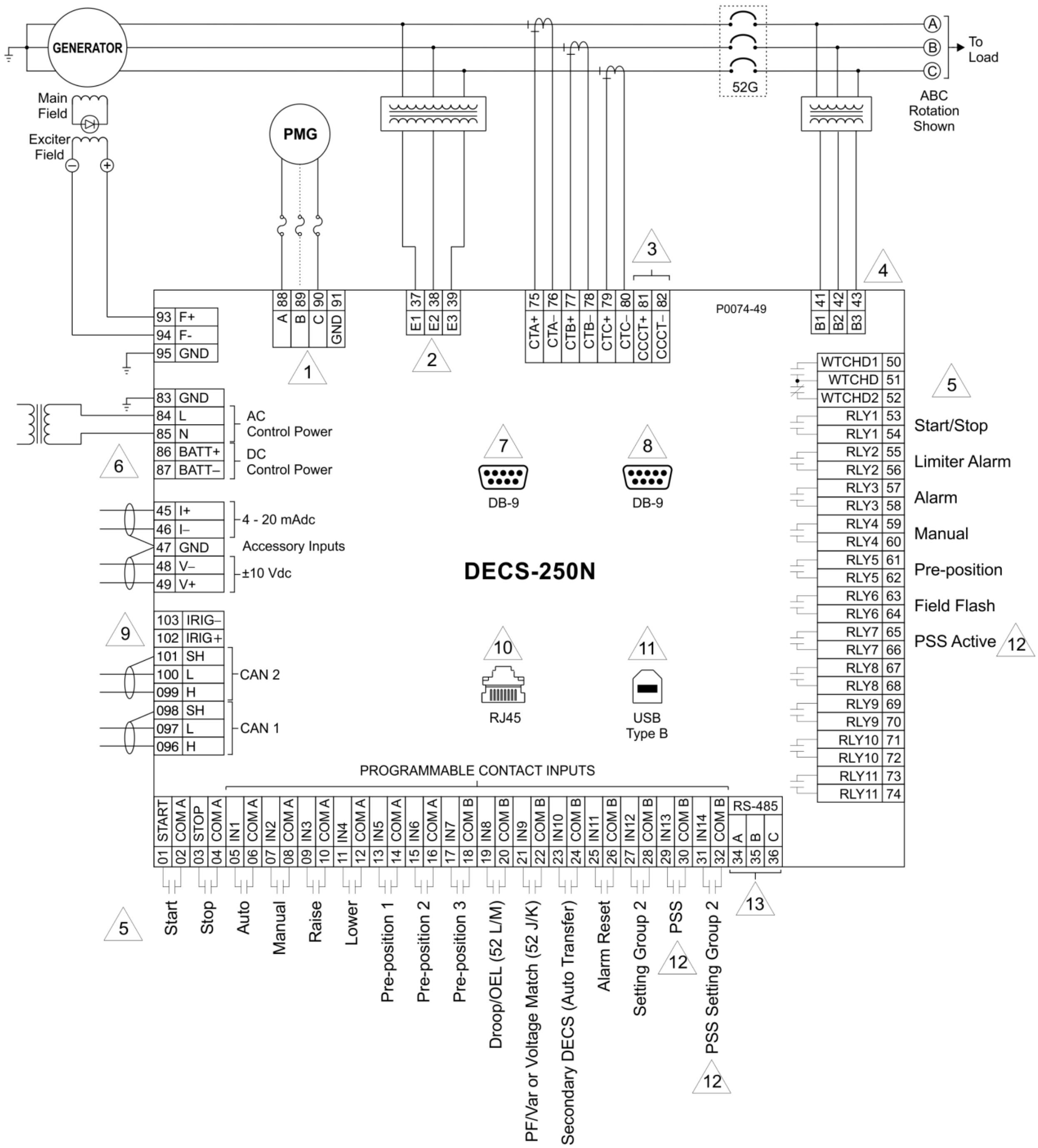


Figure 109. Typical DECS-250N PMG Connections

BESTCOMS*Plus*® Software

General Description

BESTCOMS*Plus*® is a Windows®-based, PC application that provides a user-friendly, graphical user interface (GUI) for use with Basler Electric communicating products. The name BESTCOMS*Plus* is an acronym that stands for Basler Electric Software Tool for Communications, Operations, Maintenance, and Settings.

BESTCOMS*Plus* provides the user with a point-and-click means to set and monitor the DECS-250N. The capabilities of BESTCOMS*Plus* make the configuration of one or several DECS-250N controllers fast and efficient. A primary advantage of BESTCOMS*Plus* is that a settings scheme can be created, saved as a file, and then uploaded to the DECS-250N at the user's convenience.

BESTCOMS*Plus* uses plugins allowing the user to manage several different Basler Electric products. The DECS-250N plugin must be activated before use. The plugin can be activated automatically by connecting to a DECS-250N or activated manually by requesting an activation key from Basler Electric.

The DECS-250N plugin opens inside the BESTCOMS*Plus* main shell. The same default logic scheme that is shipped with the DECS-250N is brought into BESTCOMS*Plus* by downloading settings and logic from the DECS-250N. This gives the user the option of developing a custom setting file by modifying the default logic scheme or by building a unique scheme from scratch.

BESTlogic™*Plus* Programmable Logic is used to program DECS-250N logic for protection elements, inputs, outputs, alarms, etc. This is accomplished by the drag-and-drop method. The user can drag elements, components, inputs, and outputs onto the program grid and make connections between them to create the desired logic scheme.

BESTCOMS*Plus* also allows for downloading industry-standard COMTRADE files for analysis of stored oscillography data. Detailed analysis of the oscillography files can be accomplished using BESTwave™ software.

Figure 110 illustrates the typical user interface components of the DECS-250N plugin with BESTCOMS*Plus*.

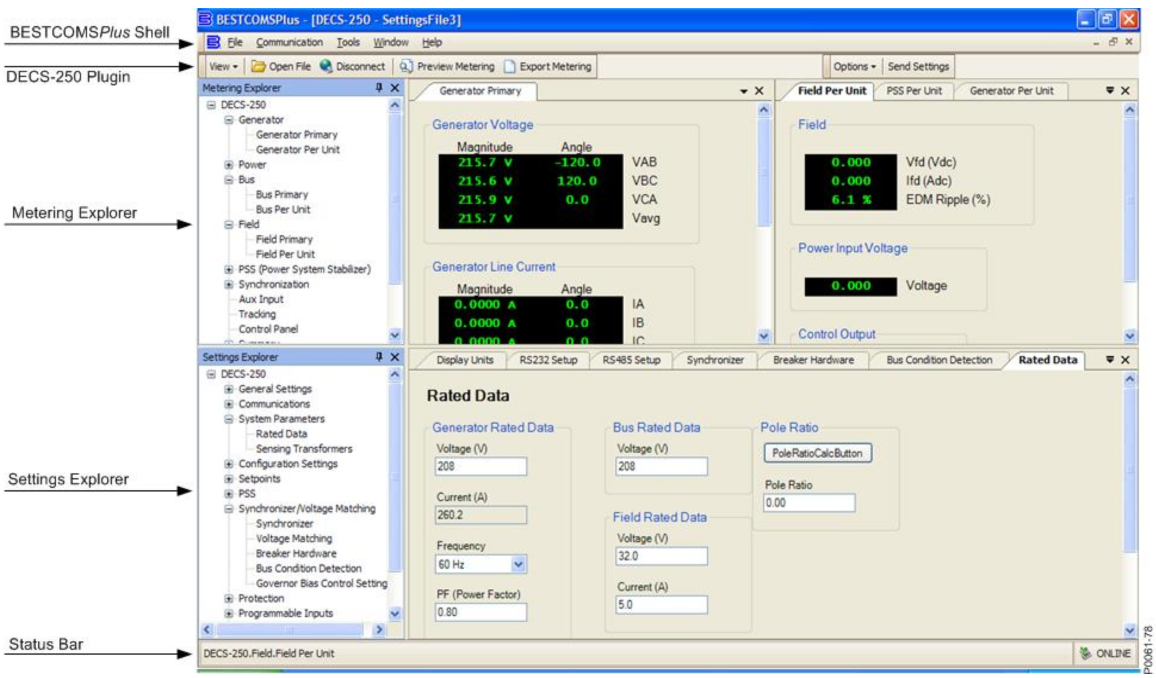


Figure 110. Typical User Interface Components

Installation

BESTCOMS*Plus*® software is built on the Microsoft® .NET Framework. The setup utility that installs BESTCOMS*Plus* on your PC also installs the DECS-250N plugin and the required version of .NET Framework (if not already installed). BESTCOMS*Plus* operates with systems using Windows® XP 32-bit SP2/SP3, Windows Vista 32-bit (all editions), Windows 7 32-bit (all editions), Windows 7 64-bit (all editions) and Windows 8. Microsoft Internet Explorer 5.01 or later must be installed on your PC before installing BESTCOMS*Plus*. System recommendations for the .NET Framework and BESTCOMS*Plus* are listed in Table 8.

Table 8. System Recommendations for BESTCOMS*Plus* and the .NET Framework

System Type	Component	Recommendation
32/64 bit	Processor	2.0 GHz
32/64 bit	RAM	1 GB minimum, 2 GB recommended
32 bit	Hard Drive	100 MB (if .NET Framework is already installed on PC.)
		950 MB (if .NET Framework is not already installed on PC.)
64 bit	Hard Drive	100 MB (if .NET Framework is already installed on PC.)
		2.1 GB (if .NET Framework is not already installed on PC.)

To install and run BESTCOMS*Plus*, a Windows user must have Administrator rights. A Windows user with limited rights might not be permitted to save files in certain folders.

Install BESTCOMS*Plus*®

NOTE

Do not connect a USB cable until setup completes successfully. Connecting a USB cable before setup is complete may result in unwanted or unexpected errors.

1. Insert the BESTCOMS*Plus* CD-ROM into the PC CD-ROM drive.
2. When the BESTCOMS*Plus* Setup and Documentation CD menu appears, click the *Install* button for the BESTCOMS*Plus* application. The setup utility installs BESTCOMS*Plus*, the .NET Framework (if not already installed), the USB driver, and the DECS-250N plugin for BESTCOMS*Plus* on your PC.

When BESTCOMS*Plus* installation is complete, a Basler Electric folder is added to the Windows programs menu. This folder is accessed by clicking the Windows *Start* button and then accessing the Basler Electric folder in the *Programs* menu. The Basler Electric folder contains an icon that starts BESTCOMS*Plus* when clicked.

Activation of the DECS-250N Plugin for BESTCOMSPlus®

The DECS-250N plugin is a module that runs inside the BESTCOMS*Plus* shell. The DECS-250N plugin contains specific operational and logic settings for only the DECS-250N. Uploading settings to the DECS-250N is possible only after activating the DECS-250N plugin.

The DECS-250N plugin can be activated automatically or manually. Automatic activation is achieved by using a USB cable to establish communication between the DECS-250N and BESTCOMS*Plus*. Manual activation is initiated by contacting Basler Electric for an activation key and entering the key into BESTCOMS*Plus*. Manual activation is useful if you want to create a settings file prior to receiving your digital excitation system. Note that if a DECS-250N is not connected, you will not be able to configure certain Ethernet settings. Ethernet settings can be changed only when an active USB or Ethernet connection is present. Refer to *Manual Activation of DECS-250N Plugin.*

Connect a USB Cable

The USB driver was copied to your PC during BESTCOMS*Plus*® installation and is installed automatically after powering the DECS-250N. USB driver installation progress is shown in the Windows Taskbar area. Windows will notify you when installation is complete.

Connect a USB cable between the PC and your DECS-250N. Apply operating power (per style chart in the *Introduction* section) to the DECS-250N at rear terminals A, B, and C. Wait until the boot sequence is complete.

Caution
In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.

Start BESTCOMS*Plus*® and Activate DECS-250N Plugin Automatically

To start BESTCOMS*Plus*, click the *Start* button, point to *Programs*, *Basler Electric*, and then click the *BESTCOMSPlus* icon. During initial startup, the *BESTCOMSPlus Select Language* screen is displayed (Figure 111). You can choose to have this screen displayed each time BESTCOMS*Plus* is started, or you can select a preferred language and this screen will be bypassed in the future. Click *OK* to continue. This screen can be accessed later by selecting *Tools* and *Select Language* from the menu bar.

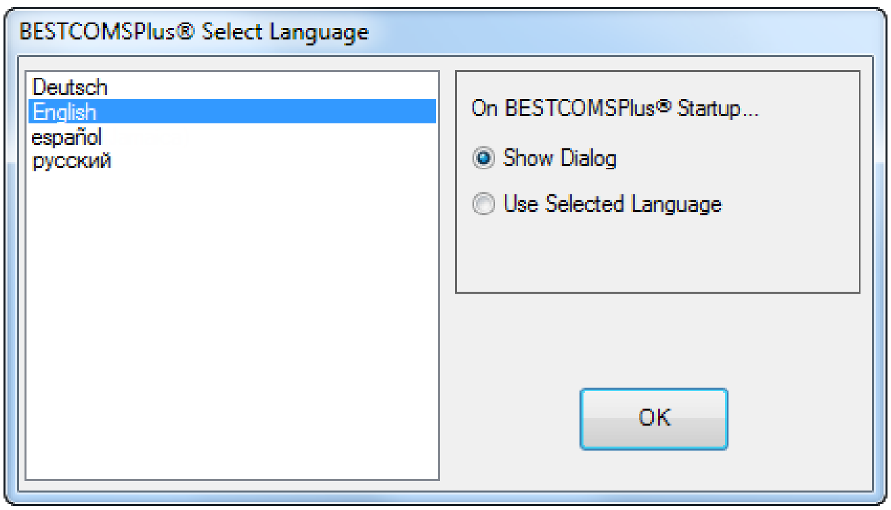


Figure 111. BESTCOMS*Plus* Select Language Screen

The BESTCOMS*Plus* splash screen is shown for a brief time. See Figure 112.

Figure 112. BESTCOMS*Plus* Splash Screen

The BESTCOMS*Plus*® platform window opens. Select *New Connection* from the *Communication* pull-down menu and select *DECS-250N*. See Figure 113. The DECS-250N plugin is activated automatically after connecting to a DECS-250N.

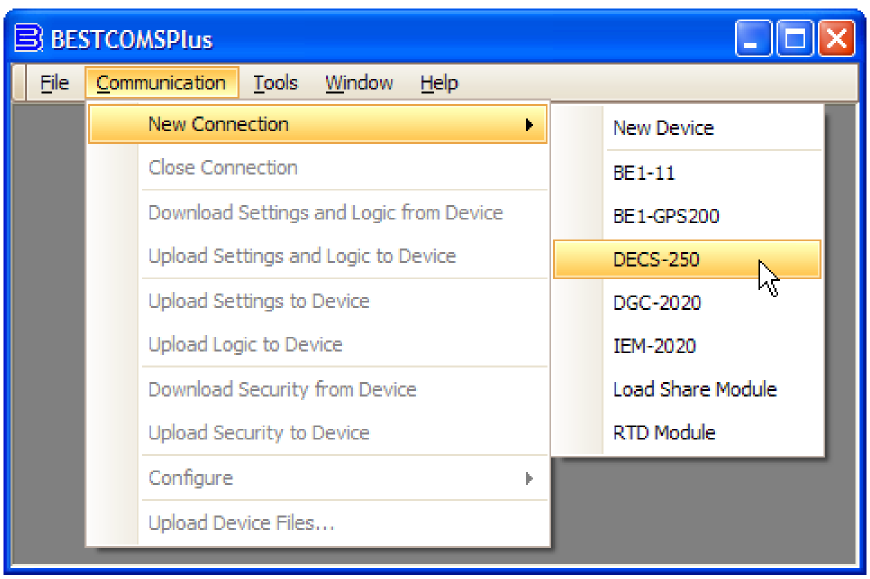


Figure 113. Communication Pull-Down Menu

The *DECS-250N Connection* screen shown in Figure 114 appears. Select *USB Connection* and click *Connect*.

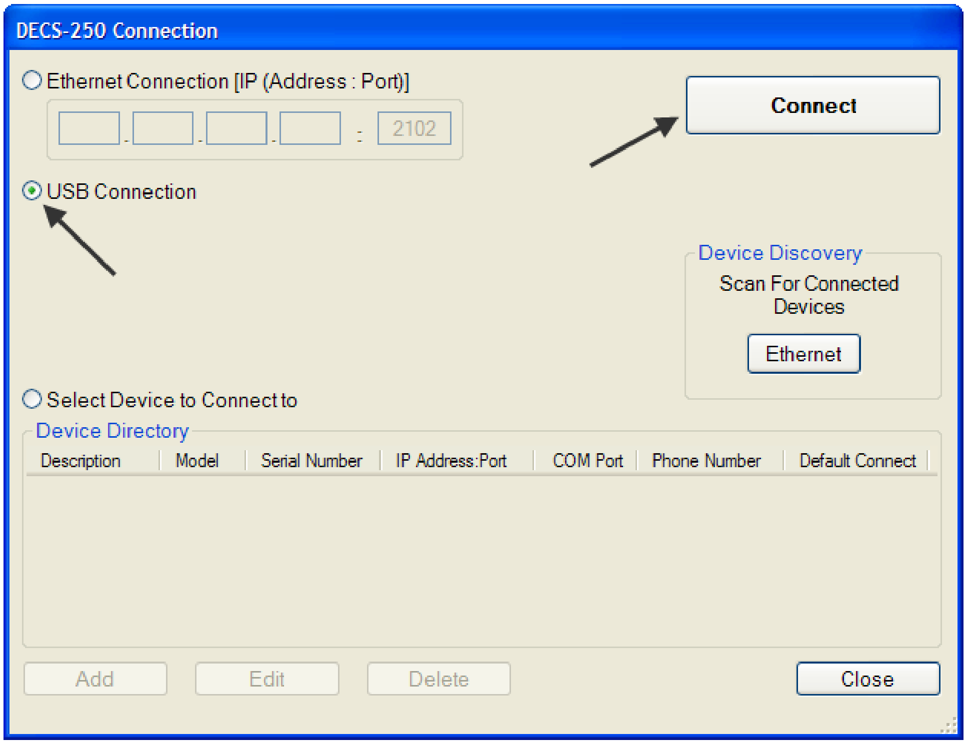


Figure 114. DECS-DECS-250N Connection Screen

The DECS-250N plugin opens indicating that activation was successful. You can now configure the DECS-250N communication ports and other DECS-250N settings.

Manual Activation of the DECS-250N Plugin

Manual activation of the DECS-250N plugin is required only if your initial use of BESTCOMS*Plus*® will be on a PC that is not connected to a DECS-250N. Manual activation is described in the following paragraphs.

Requesting an Activation Key

When initially running the DECS-250N, the *Activate Device Plugin* pop-up appears. You must contact Basler Electric for an activation key before you can activate the DECS-250N plugin. You can request an activation key through email or the Basler Electric website. Click either the *Website* or *Email* button. Click the *Activate* button when you are ready to enter the activation key you received from Basler Electric. The *Activate Device Plugin* pop-up appears. Refer to Figure 115.

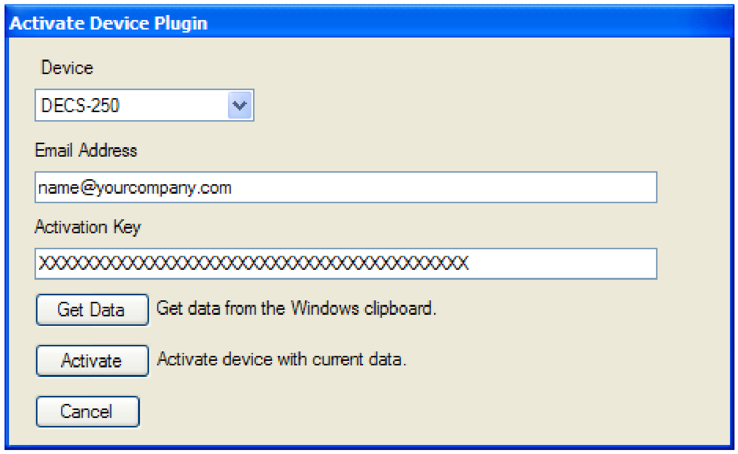


Figure 115. Activate Device Plugin Screen

Entering an Activation Key

Select DECS-250N from the *Device* pull-down menu. Enter your *Email Address* and *Activation Key* provided by Basler Electric. If you received an email containing the *Activation Key*, you can select all of the text in the email and copy it to the Windows clipboard using normal Windows techniques. The *Get Data* button extracts the *Device, Email Address,* and *Activation Key* from the Windows clipboard and pastes it into the appropriate fields. Click the *Activate* button to continue. The *Activate Device Plugin* screen is also found by selecting *Activate Device* from the *Tools* pull-down menu of the BESTCOMS*Plus* main screen.

Establishing Communication

Communication between BESTCOMS*Plus* and the DECS-250N is established by clicking the *Connect* button on the *DECS-250N Connection* screen (see Figure 114) or by clicking the *Connect* button on the lower menu bar of the main BESTCOMS*Plus* screen (Figure 110). If you receive an “Unable to Connect to Device” error message, verify that communications are configured properly. Only one Ethernet connection is allowed at one time. Download all settings and logic from the relay by selecting *Download Settings and Logic* from the *Communication* pull-down menu. BESTCOMS*Plus* will read all settings and logic from the DECS-250N and load them into BESTCOMS*Plus* memory. See Figure 116.

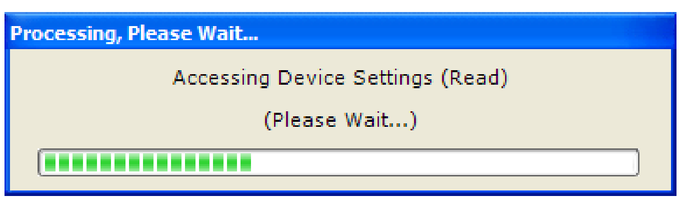


Figure 116. Processing, Please Wait…

Menu Bars

The menu bars are located near the top of the BESTCOMS*Plus*® screen (see Figure 110). The upper menu bar has five pull-down menus. With the upper menu bar, it is possible to manage settings files, configure communication settings, upload and download settings and security files, and compare settings files. The lower menu bar consists of clickable icons. The lower menu bar is used to change BESTCOMS*Plus* views, open a settings file, connect/disconnect, preview metering printout, switch to live mode, and send settings after a change is made when not in live mode.

Upper Menu Bar (BESTCOMS*Plus*® Shell)

Upper menu bar functions are listed and described in Table 9.

Table 9. Upper Menu Bar (BESTCOMS*Plus*® Shell)

Menu Item	Description
File	
New	Create a new settings file
Open	Open an existing settings file
Open File As Text	Generic file viewer for *.csv, *,txt, etc. files
Close	Close settings file
Save	Save settings file
Save As	Save settings file with a different name
Export To File	Save settings as a *.csv file
Print Preview	Preview a settings file printout
Print To File	Save as rich text file type (*.rtf)
Print	Send a settings file to printer
Properties	View properties of a settings file
History	View history of a settings file
Recent Files	Open a previously opened file
Exit	Close BESTCOMS*Plus* program
Communication	
New Connection	Choose new device or DECS-250
Close Connection	Close communication between BESTCOMS*Plus* and DECS-250
Download Settings and Logic from Device	Download operational and logic settings from the device
Upload Settings and Logic to Device	Upload operational and logic settings to the device
Upload Settings to Device	Upload operational settings to the device
Upload Logic to Device	Upload logic settings to the device
Download Security from Device	Download security settings from the device
Upload Security to Device	Upload security settings to the device
Configure	Ethernet settings
Upload Device Files	Upload firmware to the device
Tools	
Check for Updates	Check for BESTCOMS*Plus*® updates via the internet
Select Language	Select BESTCOMS*Plus* language
Activate Device	Activate the DECS-250 plugin
Set File Password	Password protect a settings file
Compare Settings Files	Compare two settings files
Auto Export Metering	Exports metering data on a user-defined interval
Event Log - View	View the BESTCOMS*Plus* event log
Event Log - Clear	Clear the BESTCOMS*Plus* event log
Event Log - Set New File Name	Set a new file name for event log
Window	
Cascade All	Cascade all windows
Tile	Tile horizontally or vertically

Menu Item	Description
Maximize All	Maximize all windows
Help	
About	View general, detailed build, and system information

Lower Menu Bar (DECS-250 Plugin)

Lower menu bar functions are listed and described in Table 10.

Table 10. Lower Menu Bar (DECS-250 Plugin)

Menu Button	Description
View	Enables you to view the Metering Panel, Settings Panel, or Show Settings Information.
Open File	Opens a saved settings file.
Connect/Disconnect	Opens the *DECS-250N Connection* screen which enables you to connect to the DECS-250N via USB or modem. Also used to disconnect a connected DECS-250N.
Preview Metering	Displays the *Print Preview* screen where a preview of the Metering printout is shown. Click on the printer button to send to a printer.
Export Metering	Enables all metering values to be exported into a *.csv file.
Options	Displays a drop-down list entitled *Live Mode Settings* which enables *Live* mode where settings are automatically sent to the device in real time as they are changed.
Send Settings	Sends settings to the DECS-250N when BESTCOMS*Plus* is not operating in Live Mode. Click on this button after making a setting change to send the modified setting to the DECS-250N.

Settings Explorer

The Settings Explorer is a convenient tool within BESTCOMS*Plus*® used to navigate through the various settings screens of the DECS-250N plugin. Descriptions of these configuration settings are organized as follows:

- General Settings
- Communications
- System Parameters
- Report Configuration
- Setpoints
- PSS
- Synchronizer/Voltage Matching
- Protection
- Programmable Inputs
- Programmable Outputs
- Alarm Configuration
- BESTlogic*Plus* Programmable Logic

Logic setup will be necessary after making certain setting changes. For more information, refer to the *BESTlogicPlus* section.

Metering Explorer

The Metering Explorer is used to view real-time system data including generator voltages and currents, input/output status, alarms, reports, and other parameters. Refer to the *Metering* section for full details about the Metering Explorer.

Settings File Management

A settings file contains all DECS-250N settings including logic. A settings file assumes a file extension of "∗.bstx". It is possible to save the logic only as a separate logic library file on the *BESTlogicPlus Programmable Logic* screen. This function is helpful when similar logic is required for several devices. A logic library file assumes a file extension of "∗.bslx". It is important to note that settings and logic can be uploaded to the device separately or together, but are always downloaded together. For more information on logic files, refer to the *BESTlogicPlus* section.

Opening a Settings File

To open a DECS-250N settings file with BESTCOMS*Plus*, pull down the *File* menu and choose *Open*. The *Open* dialog box appears. This dialog box allows you to use normal Windows techniques to select the file that you want to open. Select the file and choose *Open*. You can also open a file by clicking on the *Open File* button on the lower menu bar. If connected to a device, you will be asked to upload the settings and logic from the file to the current device. If you choose *Yes*, the settings displayed in BESTCOMS*Plus* instance will be overwritten with the settings of the opened file.

Saving a Settings File

Select *Save* or *Save As* from the *File* pull-down menu. A dialog box pops up allowing you to enter a filename and location to save the file. Select the *Save* button to complete the save.

Upload Settings and/or Logic to Device

To upload a settings file to the DECS-250N, open the file or create a new file through BESTCOMS*Plus*. Then pull down the *Communication* menu and select *Upload Settings and Logic to Device.* If you want to upload operational settings without logic, select *Upload Settings to Device*. If you want to upload logic without operational settings, select *Upload Logic to Device*. You are prompted to enter the username and password. The default username is "**A**" and the default password is "**A**". If the username and password are correct, the upload begins and the progress bar is shown.

Download Settings and Logic from Device

To download settings and logic from the DECS-250N, pull down the *Communication* menu and select *Download Settings and Logic from Device*. If the settings in BESTCOMS*Plus*® have changed, a dialog box will open asking if you want to save the current settings changes. You can choose *Yes* or *No*. After you have taken the required action to save or discard the current settings, downloading begins. BESTCOMS*Plus* reads all settings and logic from the DECS-250N and loads them into BESTCOMS*Plus* memory. See Figure 117.

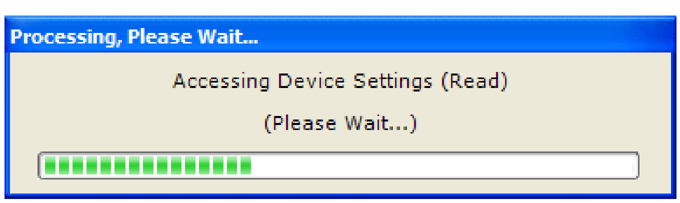


Figure 117. Processing, Please Wait…

Printing a Settings File

To view a preview of the settings printout, select *Print Preview* from the *File* pull-down menu. To print the settings, select the printer icon in the upper left corner of the *Print Preview* screen.

You can skip the print preview and go directly to print by pulling down the *File* menu and selecting *Print*. A *Print* dialog box opens with the typical Windows choice to setup the properties of printer. Execute this command, as necessary, and then select *Print*.

Comparing Settings Files

BESTCOMS*Plus* has the ability to compare two settings files. To compare files, pull down the *Tools* menu and select *Compare Settings Files*. The *BESTCOMSPlus Settings Compare Setup* dialog box appears (Figure 118). Select the location of the first file under *Left Settings Source* and select the location of the second file under *Right Settings Source*. If you are comparing a settings file located on your PC hard drive or portable media, click the folder button and navigate to the file. If you want to compare settings downloaded from a unit, click the *Select Unit* button to set up the communication port. Click the *Compare* button to compare the selected settings files.

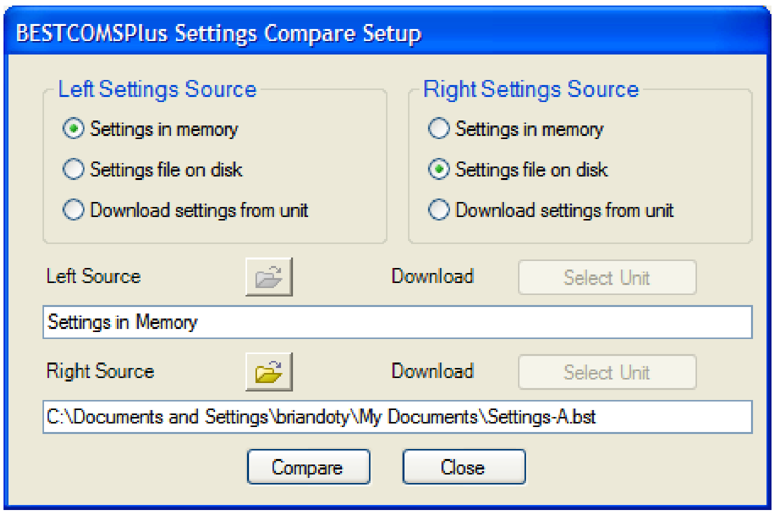


Figure 118. BESTCOMS*Plus* Settings Compare Setup

A dialog box will appear and notify you if any differences were found. The BESTCOMS*Plus*® *Settings Compare* dialog box (Figure 119) is displayed where you can view all settings (*Show All Settings*), view only the differences (*Show Settings Differences*), view all logic *(Show All Logic Paths),* or view only logic differences *(Show Logic Path Differences).* Select *Close* when finished.

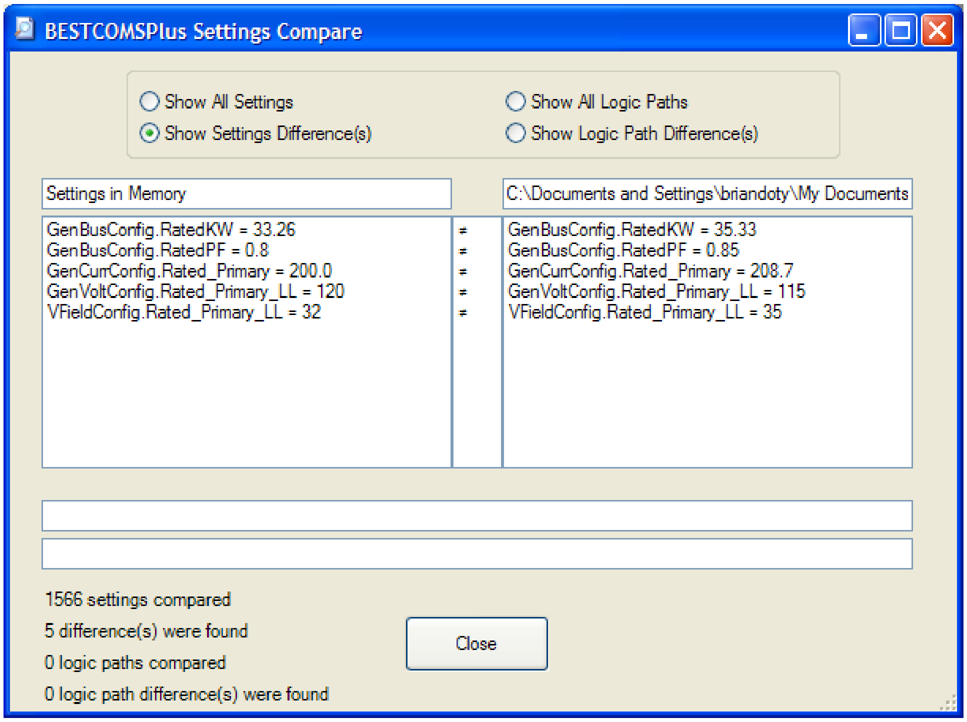


Figure 119. BESTCOMS*Plus*® Settings Compare

Automatic Metering Export

The auto export metering function automatically exports metering data over a user-defined period when a DECS-250N connection is active. The user specifies the *Number of Exports* and the *Interval* between each export. Enter a filename for the metering data and a folder in which to save. The first export is performed immediately after clicking the *Start* button. Click the *Filter* button to select specific metering screens. Figure 120 illustrates the *Auto Export Metering* screen.

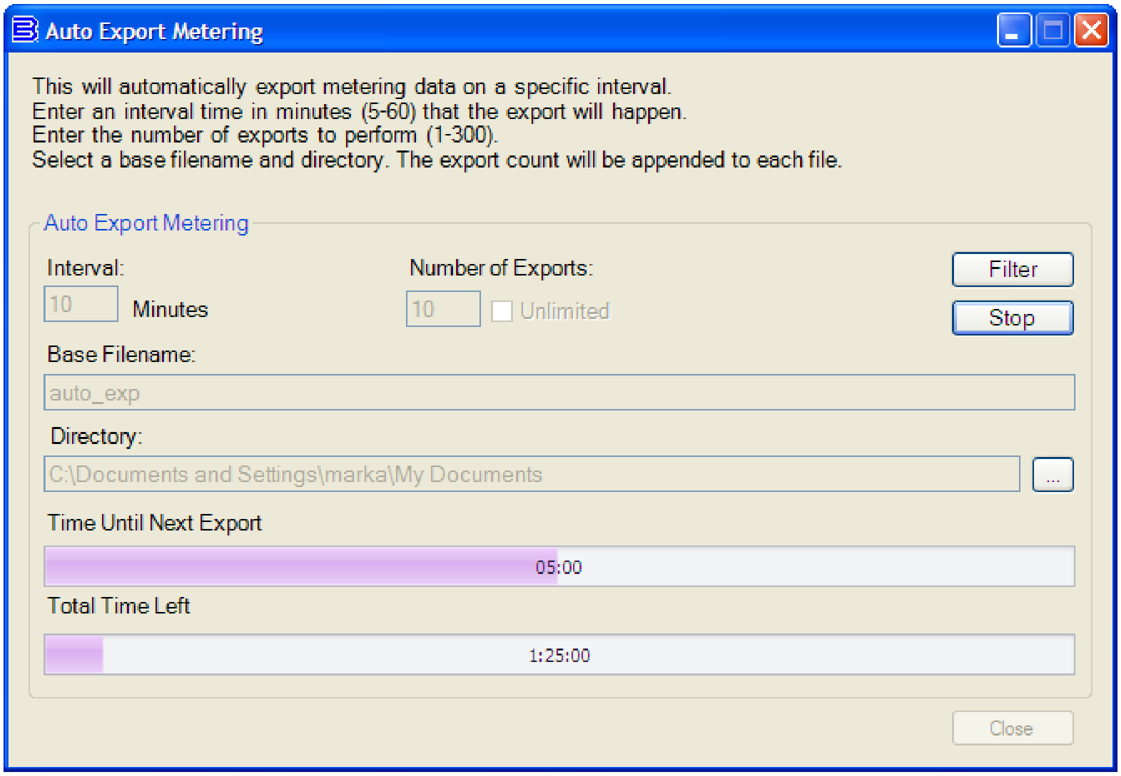


Figure 120. Auto Export Metering Screen

Firmware Updates

Future enhancements to the DECS-250N functionality may require a firmware update. Because default settings are loaded when DECS-250N firmware is updated, your settings should be saved in a file prior to upgrading firmware.

Warning!
Before performing any maintenance procedures, remove the DECS-250N from service. Refer to the appropriate site schematics to ensure that all steps have been taken to properly and completely de-energize the DECS-250N.

Caution – Settings will be lost!
Default settings will be loaded into the DECS-250N, reports and events will be cleared, and the DECS-250N will reboot when firmware is updated. BESTCOMS*Plus*® can be used to download settings and save the settings in a file so that they can be restored after updating firmware. Refer to *Settings File Management* for help with saving a settings file.

Note

The latest version of BESTCOMS*Plus* software should be downloaded from the Basler Electric website and installed before performing a firmware upgrade.

A device package contains firmware for the DECS-250N, the optional Contact Expansion Module (CEM-2020), and the optional Analog Expansion Module (AEM-2020). Embedded firmware is the operating program that controls the actions of the DECS-250N. The DECS-250N stores firmware in nonvolatile flash memory that can be reprogrammed through the communication ports. It is not necessary to replace EPROM chips when updating the firmware with a newer version.

The DECS-250N can be used in conjunction with CEM-2020 or AEM-2020 expansion modules which expand the DECS-250N capabilities. When upgrading the firmware in any component of this system, the firmware in ALL of the components of the system should be upgraded to ensure compatibility of communications between the components.

Caution

The order in which the components are upgraded is critical. Assuming a system of a DECS-250N and expansion module(s) is in a state where the DECS-250N is communicating with the system expansion module(s), **the expansion module must be upgraded before the DECS-250N.** This is necessary because the DECS-250N must be able to communicate with the expansion module(s) before the DECS-250N can send firmware to it. If the DECS-250N were upgraded first, and the new firmware included a change to the expansion module communication protocol, it is possible that the expansion module(s) could no longer communicate with the upgraded DECS-250N. Without communications between the DECS-250N and the expansion module(s), upgrading the expansion module(s) is not possible.

Note

If power is lost or communication is interrupted during file transfer to the DECS-250N, the firmware upload will fail. The device will continue to use the previous firmware. Once communication has been restored, the user must start the firmware upload again. Select Upload Device Files from the Communication pull-down menu and proceed normally.

Upgrading Firmware in Expansion Modules

The following procedure is used to upgrade firmware in the expansion modules. This must be completed before upgrading firmware in the DECS-250N. If no expansion module is present, proceed to *Upgrading Firmware in the DECS-250N.*

1. Remove the DECS-250N from service. Refer to the appropriate site schematics to ensure that all steps have been taken to properly and completely de-energize the DECS-250N.
2. Apply only control power to the DECS-250N.
3. Enable the expansion modules that are present in the system. If they have not already been enabled, enable the expansion modules in the BESTCOMS*Plus* Settings Explorer, Communications, CAN Bus, Remote Module Setup screen.
4. Verify that the DECS-250N and the associated expansion modules are communicating. This can be verified by examining the alarm status using the Metering Explorer in BESTCOMS*Plus* or from

the front panel by navigating to Metering > Status > Alarms. When communications are functioning properly, there should be no active AEM or CEM Communications Failure alarms.

5. Connect to the DECS-250N through the USB or Ethernet port if not already connected.
6. Select Upload Device Files from the Communication pull-down menu.
7. You will be asked to save the current settings file. Select Yes or No.
8. When the Basler Electric Device Package Uploader screen (Figure 121) appears, click on the Open button to browse for the device package you have received from Basler Electric. The Package Files along with File Details are listed. Place a check in the boxes next to the individual files you want to upload.

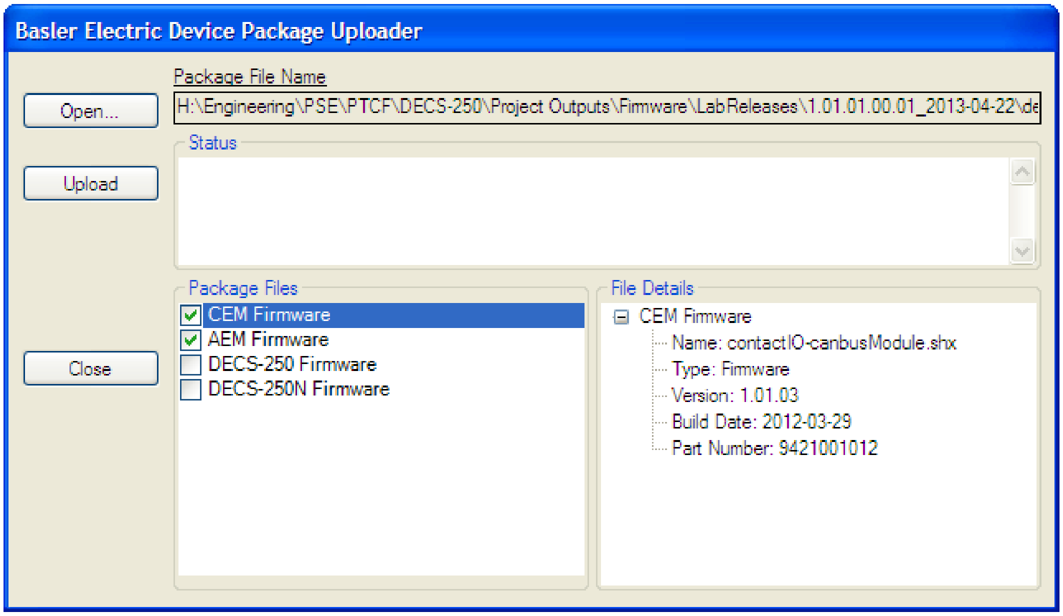


Figure 121. Basler Electric Device Package Uploader

9. Click on the Upload button and the Proceed with Device Upload screen will appear. Select Yes or No.
10. After selecting Yes, the DECS-250N Selection screen will appear. Select either USB or Ethernet.
11. After file(s) have been uploaded, click the *Close* button on the Basler Electric Device Package Uploader screen and disconnect communication to the DECS-250N.

Upgrading Firmware in the DECS-250N

The following procedure is used to upgrade firmware in the DECS-250N. This must be completed after upgrading firmware in any expansion modules.

1. Remove the DECS-250N from service. Refer to the appropriate site schematics to ensure that all steps have been taken to properly and completely de-energize the DECS-250N.
2. Apply only control power to the DECS-250N.
3. Connect to the DECS-250N with BESTCOMS*Plus*. Check the firmware Application Version on the General Settings > Device Info screen.
4. Select Upload Device Files from the Communication pull-down menu. You do not have to be connected to the DECS-250N at this time. Save settings when prompted, if desired.
5. Open the desired device package file (decs-250.bef).
6. Check the box for DECS-250N Firmware. Note the version number of the DECS-250N firmware; this is the version that will be used to set the Application Version in the settings file in a later step.

7. Click the Upload button and follow the instructions that appear to begin the upgrade process.
8. After the upload is complete, disconnect communication to the DECS-250N.
9. Load the saved settings file into the DECS-250N.
    a. Close all settings files.
    b. From the File pull-down menu, select New, DECS-250N.
    c. Connect to the DECS-250N.
    d. Once all settings have been read from the DECS-250N, open the saved settings file by selecting File, Open File in the BESTCOMS*Plus* menu. Then browse for the file to upload.
    e. When BESTCOMS*Plus* asks if you wish to upload settings and logic to the device, click Yes.
    f. If you are receiving upload failures and indications that the logic is incompatible with the firmware version, check that the DECS-250N style number in the saved file matches that of the DECS-250N into which the file is being uploaded. The style number in the settings file is found under General Settings > Style Number in BESTCOMS*Plus*.
    g. If the style number of the settings file does not match that of the DECS-250N into which it is to be loaded, disconnect from the DECS-250N, then modify the style number in the settings file. Then repeat the steps titled *Load the Saved Settings File into the DECS-250N.*

BESTCOMSPlus® Updates

Enhancements to DECS-250N firmware typically coincide with enhancements to the DECS-250N plugin for BESTCOMS*Plus*®. When a DECS-250N is updated with the latest version of firmware, the latest version of BESTCOMS*Plus* should also be obtained.

- If you obtained a CD-ROM containing a firmware update from Basler Electric, then that CD-ROM will also contain the corresponding version of BESTCOMS*Plus* software.
- You can check for BESTCOMS*Plus* updates at www.basler.com.
- You can use the manual "check for updates" function in BESTCOMS*Plus* to ensure that the latest version is installed by selecting *Check for Updates* in the *Tools* drop-down menu. (An internet connection is required.)

BESTlogic™*Plus*

Introduction

BESTlogic™*Plus* Programmable Logic is a programming method used for managing the input, output, protection, control, monitoring, and reporting capabilities of Basler Electric's DECS-250N Digital Excitation Control System. Each DECS-250N has multiple, self-contained logic blocks that have all of the inputs and outputs of its discrete component counterpart. Each independent logic block interacts with control inputs and hardware outputs based on logic variables defined in equation form with BESTlogic*Plus*. BESTlogic*Plus* equations entered and saved in the DECS-250N system's nonvolatile memory integrate (electronically wire) the selected or enabled protection and control blocks with control inputs and hardware outputs. A group of logic equations defining the logic of the DECS-250N is called a logic scheme.

Two default active logic schemes are preloaded into the DECS-250N. One default logic scheme is tailored for a system with the PSS option disabled and the other is for a system with PSS enabled. The proper default logic scheme is loaded depending on the PSS option selected in the system style number. These schemes are configured for a typical protection and control application of a synchronous generator and virtually eliminates the need for "start-from-scratch" programming. The default logic schemes are similar to that of a DECS-200N. BESTCOMS*Plus*® can be used to open a logic scheme that was previously saved as a file and upload it to the DECS-250N. The default logic schemes can also be customized to suit your application. Detailed information about logic schemes is provided later in this section.

BESTlogic*Plus* is not used to define the operating settings (modes, pickup thresholds, and time delays) of the individual protection and control functions. Operating settings and logic settings are interdependent but separately programmed functions. Changing logic settings is similar to rewiring a panel and is separate and distinct from making the operating settings that control the pickup thresholds and time delays of a DECS-250N. Detailed information about operating settings is provided in other sections of this instruction manual.

Overview of BESTlogic™Plus

Use BESTCOMS*Plus* to make BESTlogic*Plus* settings. Use the Settings Explorer to open the *BESTlogicPlus Programmable Logic* tree branch as shown in Figure 122.

The *BESTlogicPlus Programmable Logic* screen contains a logic library for opening and saving logic files, tools for creating and editing logic documents, and protection settings.

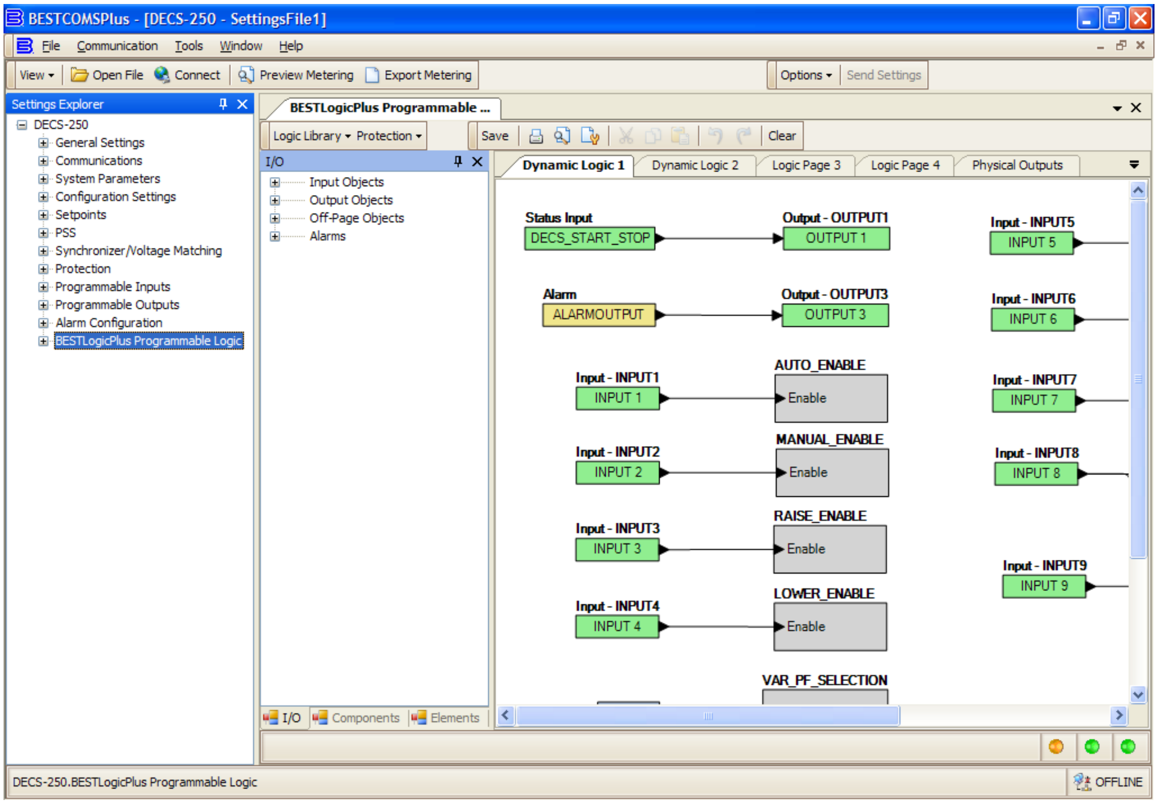


Figure 122. BESTlogic*Plus* Programmable Logic Tree Branch

BESTlogic™*Plus* Composition

There are three main groups of objects used for programming BESTlogic*Plus*. These groups are *I/O, Components,* and *Elements.* For details on how these objects are used to program BESTlogic*Plus*, see the paragraphs on *Programming BESTlogicPlus.*

I/O

This group contains Input Objects, Output Objects, Off-Page Objects, and Alarms. Table 11 lists the names and descriptions of the objects in the *I/O* group.

Table 11. I/O Group, Names and Descriptions

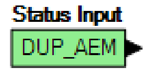
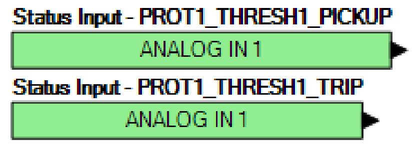
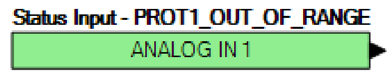
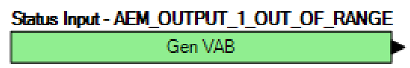
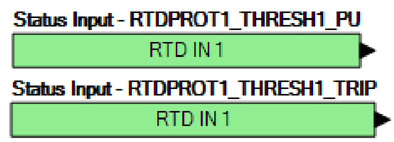
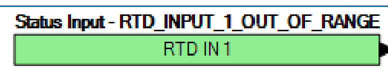
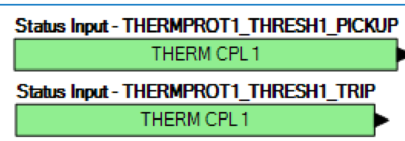
Name	Description	Symbol
Input Objects		
Logic 0	Always false (Low).	Fixed 0
Logic 1	Always true (High).	Fixed 1
Physical Inputs		
Start Input	True when the physical Start input is active.	Input - STARTINPUT STARTINPUT
Stop Input	True when the physical Stop input is active.	Input - STOPINPUT STOPINPUT
IN1 - IN14	True when Physical Input x is active.	Input - INPUT1 INPUT 1

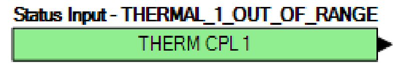
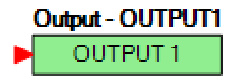
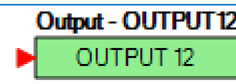
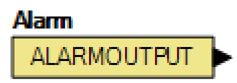
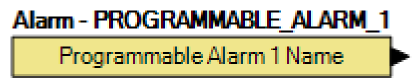
Name	Description	Symbol
Remote Inputs		
IN15 - IN24	True when Remote Input x is active. (Available when an optional CEM-2020 is connected.)	Input - IN15 INPUT 15
Virtual Inputs		
VIN1 - VIN6	True when Virtual Input x is active.	Input - VIRTUALSWITCH1 VIRTUALSWITCH1
Status Inputs		
Anticipatory Sync Selected	True when Anticipatory is selected. (Synchronizer screen)	Status Input ANTICIPATORY_SYNC_SELECT
Auto Mode Active	True when the unit is in Auto mode (AVR).	Status Input AUTO_ACTIVE
Bus Dead	True when the Bus Dead condition settings have been exceeded. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input BUS_DEAD
Bus Failed	True when the Bus Stable condition settings are not met. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input BUS_FAILED
Bus Stable	True when the Bus Stable condition settings have been exceeded. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input BUS_STABLE_COND
Auto Sync Enabled	True when DECS auto-sync is enabled. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input DECS_AUTOSYNC_ENABLE
Crowbar Activated	True when the crowbar is active.	Status Input CROWBARACTIVATED
Dead Bus Close Request	True when this option is user-enabled; a dead bus is closed automatically upon detection. False when this option is disabled; a dead bus will remain open. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input DEAD_BUS_CLOSE_REQUEST
External Tracking Active	True when external tracking is running.	Status Input EXT_TRACKING_ACTIVE
Failed To Buildup	True when the Failed to Buildup alarm is active.	Status Input FAILEDTOBUILDUP
FCR Active	True when the unit is in FCR mode.	Status Input FCR_Active
Field Flash Active	True when field flash is active.	Status Input FIELD_FLASH_ACTIVE
Field Short Circuit Status	True when a field short circuit condition is detected.	Status Input FIELDSHORTCIRCUITSTATUS
FVR Active	True when the unit is in FVR mode.	Status Input FVR_Active

Name	Description	Symbol
Gen Breaker Fail to Open	The generator breaker did not open in the close wait time period. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_BREAKER_FAIL_TO_OPEN
Gen Breaker Fail to Close	The generator breaker did not close in the close wait time period. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_BREAKER_FAIL_TO_CLOSE
Gen Breaker Sync Fail	True when generator breaker sync has failed. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_BREAKER_SYNC_FAIL
Gen Dead	True when the Generator Breaker Dead condition settings have been exceeded. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_DEAD
Gen Failed	True when the Generator Breaker Stable condition settings are not met. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_FAILED
Gen Stable	True when the Generator Breaker Stable condition settings have been exceeded. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)	Status Input GEN_STABLE
Gov Contact Type Proportional	True when this option is selected. (Governor Bias Control Settings screen)	Status Input CONTACT_TYPE_PROPORTIONAL
Internal Tracking Active	True when internal tracking is running.	Status Input INT_TRACKING_ACTIVE
Irig Sync Lost	True when IRIG signal is not being received.	Status Input IRIG_SYNC_LOST_ALM
Manual Mode Active	True when the unit is in Manual mode (FCR/FVR).	Status Input MANUAL_ACTIVE
Network Load Share Receiving ID 1 - 16	True when data is being received from a specific unit on the load share network.	Status Input RCC_RECEIVING_ID_1
No Network Load Share Data Received	True when Network Load Sharing is enabled but there is no data being received from other network load sharing devices.	Status Input NO_NETWORK_LOADSHARE_DATA
NTP Sync Lost	True when NTP server has lost communications.	Status Input NTP_SYNC_LOST_ALM
Null Balance	True when Null Balance is achieved in both external and internal tracking.	Status Input NULL_BALANCE
OEL	True when the Overexcitation Limiter is active.	Status Input OEL
PF Controller Active	True when the unit is in PF mode.	Status Input PF_Active
PLL Sync Selected	True when phase locked loop (PLL) is selected. (Synchronizer screen)	Status Input PLL_SYNC_SELECTED

Name	Description	Symbol
Preposition Active	True when any preposition is active.	Status Input DECS_PREPOSITION
Preposition 1 Active	True when Preposition 1 is active.	Status Input PREPOSITION_1_ACTME
Preposition 2 Active	True when Preposition 2 is active.	Status Input PREPOSITION_2_ACTME
Preposition 3 Active	True when Preposition 3 is active.	Status Input PREPOSITION_3_ACTME
PSS Active (Optional)	True when the power system stabilizer (PSS) is turned on and running.	Status Input PSS_ACTIVE
PSS Current Unbalanced (Optional)	True when the phase current is unbalanced and the PSS is active.	Status Input PSSCURRENTUNBALANCED
PSS Power Below Threshold (Optional)	True when the input power is below the Power Level threshold and the PSS is active.	Status Input PSSPOWERBELOWTHRESHOLD
PSS Speed Failed (Optional)	True when the frequency is out of range for a length of time calculated internally by the DECS-250N and the PSS is active.	Status Input PSSSPEEDFAILED
PSS Test On (Optional)	True when the power system stabilizer test signal (Frequency Response) is active.	Status Input PSS_TEST_MODE
PSS Voltage Limit (Optional)	True when the calculated terminal voltage upper or lower limit is reached and the PSS is active.	Status Input PSSVOLTAGELIMIT
PSS Voltage Unbalanced (Optional)	True when the phase voltage is unbalanced and the PSS is active.	Status Input PSSVOLTAGEUNBALANCED
SCL	True when the Stator Current Limiter is active.	Status Input SCL
Setpoint at Lower Limit	True when the active modes setpoint is at the lower limit.	Status Input Setpoint_At_Lower_Limit
Setpoint at Upper Limit	True when the active modes setpoint is at the upper limit.	Status Input Setpoint_At_Upper_Limit
Soft Start Active	True during softstart.	Status Input SOFTSTART_ACTME
Start Status	True when the unit is in Start mode.	Status Input DECS_START_STOP
Sync Active	True when synchronization is active.	Status Input SYNC_ACTIVE
Transfer Watchdog	True when watchdog has timed out and system control will switch to an alternate redundant DECS-250N.	Status Input TRANSFERWATCHDOG
UEL	True when the Under Excitation Limiter is active.	Status Input UEL

Name	Description	Symbol
Under Frequency V/Hz	True when the Under Frequency or the Volts/Hz Limiter is active.	Status Input UNDERFREQUENCYVHZ
Unknown Network Load Share Protocol Version	True when there is another unit on the network whose load share protocol version is not the same as this units load share protocol version.	Status Input UNKNOWN_LOAD_SHARE_VER
VAR Controller Active	True when the unit is in VAR mode.	Status Input VAR_Active
VAR Limiter Active	True when the Var Limiter is active.	Status Input VAR_LIMITER_ACTIVE
Voltage Matching Active	True when Voltage Matching is active.	Status Input VOLTAGE_MATCHING_ACTIVE
Protection	Several protection status alarms are available. The 25 Sync-Check Status Alarm input is shown to the right. These elements are true when the pickup threshold is exceeded for the duration of the time delay.	Status Input PROTECTION25STATUS
Configurable Protection 1-8	There are four thresholds for each of the eight Configurable Protection blocks. Each threshold can be set to Over or Under mode and the threshold limit and activation delay can each be set. See section, *Protection* in this manual for more details. Each threshold has a separate logic block for the pickup and the trip. Configurable Protection #1 with its Threshold #1 Pickup and Trip blocks is shown to the right. The pickup block is true when the threshold is exceeded. The trip block is true when the corresponding pickup block threshold is exceeded for the duration of the time delay.	Status Input ConfProt1Thresh1Pickup Status Input ConfProt1Thresh1Trip
Contact Expansion Module, CEM Connected	Contact Expansion Module Connected. True when an optional CEM-2020 is connected to the DECS-250N.	Status Input CEM_CONNECTED
Contact Expansion Module, Comms Failure	True when there is no communication from the CEM.	Status Input CEM_COMMS_FAILURE
Contact Expansion Module, Duplicate CEM	True when more than one CEM is detected. Only one CEM is supported at a time.	Status Input CEM_DUP_CEM
Contact Expansion Module, Hardware Mismatch	True when selected CEM type differs from detected CEM type. Go to *Settings Explorer, Communications, CANBus, Remote Module Setup* to select the CEM type (18 or 24 contacts).	Status Input CEM_HW_MISMATCH
Analog Expansion Module, Connected	Analog Expansion Module Connected. True when an optional AEM-2020 is connected to the DECS-250N.	Status Input AEM_CONNECTED
Analog Expansion Module, Comms Failure	True when there is no communication from the AEM.	Status Input AEM_COMMS_FAILURE

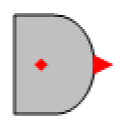
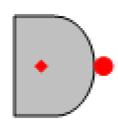
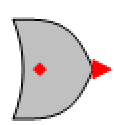
Name	Description	Symbol
Analog Expansion Module, Duplicate AEM	True when more than one AEM is detected. Only one AEM is supported at a time.	
Analog Expansion Module, Remote Analog Inputs 1-8	There are four thresholds for each of the eight Remote Analog Input blocks. Each threshold has a separate logic block for the pickup and the trip. Remote Analog Input #1 with its Threshold #1 Pickup and Trip blocks is shown to the right. For more details on configuring the Remote Analog Inputs, see Section, *Analog Expansion Module* in this manual. The pickup block is true when the threshold is exceeded. The trip block is true when the corresponding pickup block threshold is exceeded for the duration of the time delay.	
Analog Expansion Module Remote Analog Inputs, Out of Range 1-8	Each Remote Analog Input has one Out of Range Block. True when parameters exceed out of range threshold. This function alerts the user of an open or damaged analog input wire.	
Analog Expansion Module Remote Analog Outputs 1-4	True when the analog output connection is open.	
Analog Expansion Module Remote RTD Inputs 1-8	There are four thresholds for each of the eight Remote RTD Input blocks. Each threshold has a separate logic block for the pickup and the trip. Remote RTD Input #1 with its Threshold #1 Pickup and Trip blocks is shown to the right. For more details on configuring the Remote RTD Inputs, see Section, *Analog Expansion Module* in this manual. The pickup block is true when the threshold is exceeded. The trip block is true when the corresponding pickup block threshold is exceeded for the duration of the time delay.	
Analog Expansion Module Remote RTD Inputs, Out of Range 1-8	Each Remote RTD Input has one Out of Range Block. True when parameters exceed out of range threshold. This function alerts the user of an open or damaged analog input wire.	
Analog Expansion Module Remote Thermocouple Inputs 1-2	There are four thresholds for both of the Remote Thermocouple Input blocks. Each threshold has a separate logic block for the pickup and the trip. Remote Thermocouple Input #1 with its Threshold #1 Pickup and Trip blocks is shown to the right. For more details on configuring the Remote Thermocouple Inputs, see Section, *Analog Expansion Module* in this manual. The pickup block is true when the threshold is exceeded. The trip block is true when the corresponding pickup block threshold is exceeded for the duration of the time delay.	

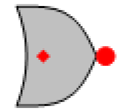
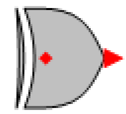
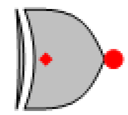
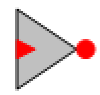
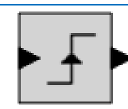
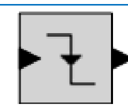
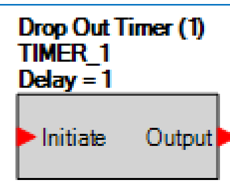
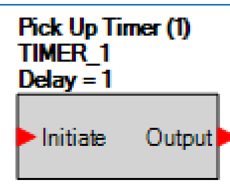
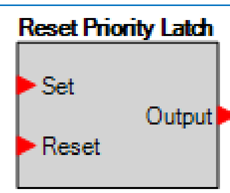
<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td>Analog Expansion Module
Remote Thermocouple Inputs, Out of Range 1-2</td><td>Each Remote Thermocouple Input has one Out of Range Block. True when parameters exceed out of range threshold. This function alerts the user of an open or damaged analog input wire.</td><td>
</td></tr>
<tr><td colspan="3">Output Objects</td></tr>
<tr><td>Physical Outputs
OUT1 - OUT11</td><td>Physical Outputs 1 through 11.</td><td>
</td></tr>
<tr><td>Remote Outputs
OUT12 - OUT35</td><td>Remote Outputs 12 through 35.
(Available when an optional CEM-2020 is connected.)</td><td>
</td></tr>
<tr><td colspan="3">Alarms</td></tr>
<tr><td>Global Alarm</td><td>True when one or more alarms are set.</td><td>
</td></tr>
<tr><td>Programmable Alarms 1 - 16</td><td>True when a programmable alarm is set.</td><td>
</td></tr>
</table>

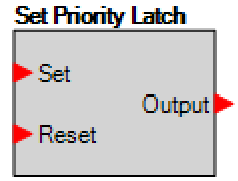
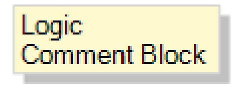
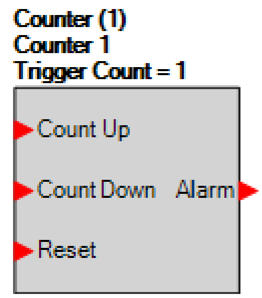
Components

This group contains Logic Gates, Pickup and Dropout Timers, Latches, and Comment Blocks. Table 12 lists the names and descriptions of the objects in the *Components* group.

Table 12. Components Group, Names and Descriptions

<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td colspan="3">Logic Gates</td></tr>
<tr><td>AND</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td></tr>
<tr><td>NAND</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>OR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td></tr>
</table>

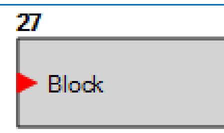
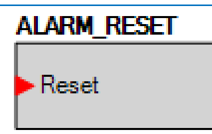
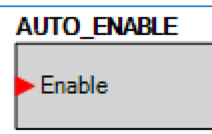
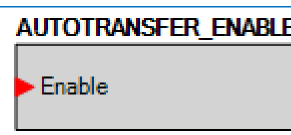
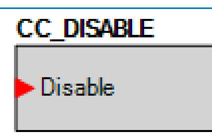
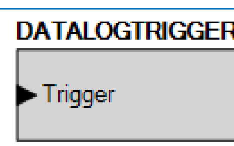
<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td>NOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>XOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>XNOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td></tr>
<tr><td>NOT
(INVERTER)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>Rising Edge</td><td>The output is true when the rising edge of a pulse is detected on the input signal.</td><td></td></tr>
<tr><td>Falling Edge</td><td>The output is true when the falling edge of a pulse is detected on the input signal.</td><td></td></tr>
<tr><td colspan="3">Pickup and Dropout Timers</td></tr>
<tr><td>Drop Out Timer</td><td>Used to set a delay in the logic.
For more information, refer to Programming BESTlogicPlus, Pickup and Dropout Timers, later in this section.</td><td>
</td></tr>
<tr><td>Pick Up Timer</td><td>Used to set a delay in the logic.
For more information, refer to Programming BESTlogicPlus, Pickup and Dropout Timers, later in this section.</td><td>
</td></tr>
<tr><td colspan="3">Latches</td></tr>
<tr><td>Reset Priority Latch</td><td>When the Set input is on and the Reset input is off, the latch will go to the SET (ON) state. When the Reset input is on and the Set input is off, the latch will go to the RESET (OFF) state. If both the Set and Reset inputs are on at the same time, a reset priority latch will go to the RESET (OFF) state.</td><td>
</td></tr>
</table>

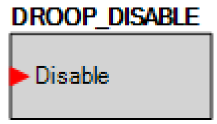
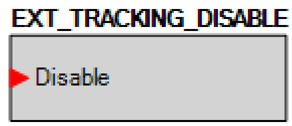
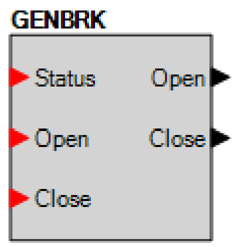
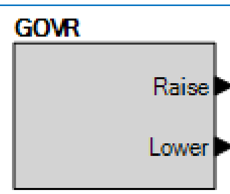
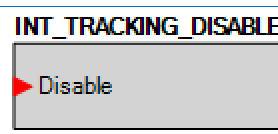
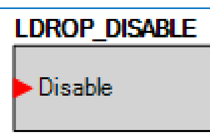
Name	Description	Symbol
Set Priority Latch	When the Set input is on and the Reset input is off, the latch will go to the SET (ON) state. When the Reset input is on and the Set input is off, the latch will go to the RESET (OFF) state. If both the Set and Reset inputs are on at the same time, a set priority latch will go to the SET (ON) state.	
Other		
Comment Block	Enter user comments.	
Counter	True when the count reaches a user-selected number. Count Up increments the count when a true is received. Count Down decrements the count when a true is received. Reset resets the count to zero when a true is received. OUTPUT is true when the count reaches the trigger count. The trigger count is set by the user and is found in *Settings Explorer, BESTlogicPlus Programmable Logic, Logic Counters*.	

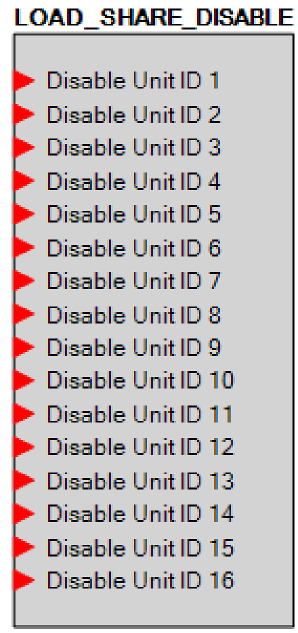
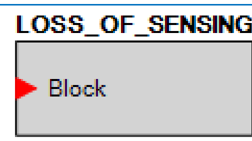
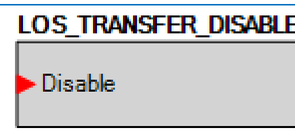
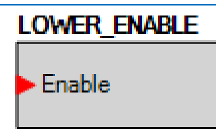
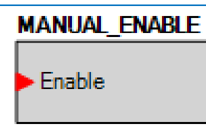
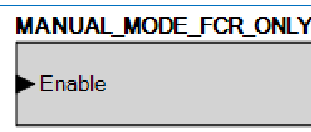
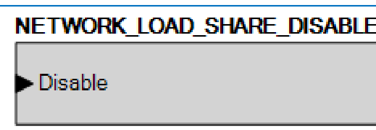
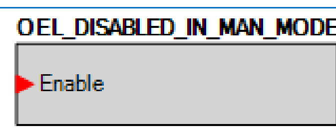
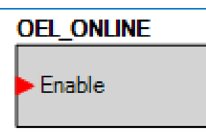
Elements

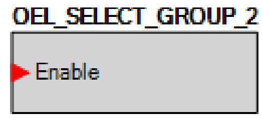
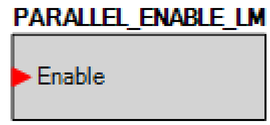
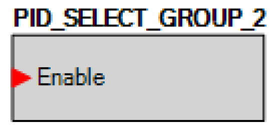
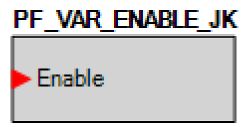
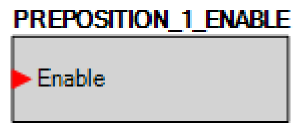
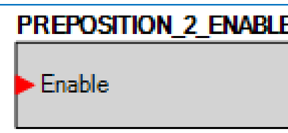
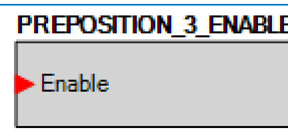
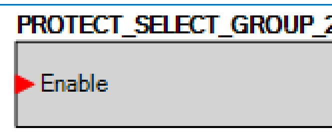
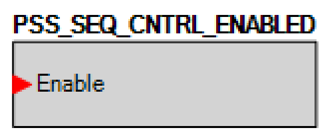
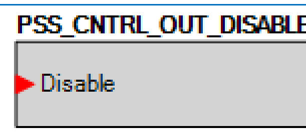
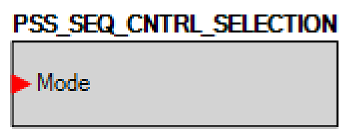
Table 13 lists the names and descriptions of the elements in the *Elements* group.

Table 13. Elements Group, Names and Descriptions

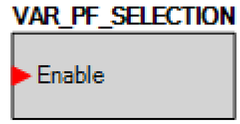
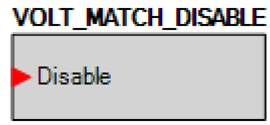
Name	Description	Symbol
27	When true, this element blocks, or disables, the 27 undervoltage protection function.	
ALARM RESET	When true, this element resets all active alarms.	
AUTO ENABLE	When true, this element sets the unit in Auto mode (AVR).	
AUTO TRANSFER ENABLE	When true, this element sets the unit as secondary. When false, the unit is primary.	
CROSS CURRENT COMPENSATION DISABLE	When true, this element disables cross current compensation.	
DATALOG TRIGGER	When true, this element triggers the datalog to begin recording data.	

<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td>DROOP DISABLE</td><td>When true, this element disables droop when the unit is operating in AVR mode.</td><td>
</td></tr>
<tr><td>EXTERNAL TRACKING DISABLE</td><td>When true, this element disables external tracking.</td><td>
</td></tr>
<tr><td>GENERATOR BREAKER</td><td>This element is used to connect the breaker open and close output signals from the DECS-250N to physical output contacts to open and close the generator breaker, and map breaker status feedback to a contact input. In addition, contact inputs can be mapped to allow switches to be implemented to manually initiate breaker open and close requests. (Available when the controller is equipped with the optional Auto synchronizer, style number xxxxAxx)</td><td>
</td></tr>
<tr><td colspan="2"><u>GENERATOR BREAKER Inputs</u>
Status: This input allows a contact input to be mapped that will provide breaker status feedback to the DECS-250N. When the contact input is closed, the breaker is indicated to be closed. When the contact input is open, the breaker is indicated to be open.
Open: This input allows a contact input to be mapped that can be used to initiate a manual breaker open request. When this input is pulsed closed, the breaker opens.
Close: This input allows a contact input to be mapped that can be used to initiate a manual breaker close request. When this input is pulsed and the generator is stable, a close request is initiated. If the Dead Bus Close Enable parameter is TRUE, and the bus is dead, the breaker will close. If the bus is stable, the DECS-250N will synchronize the generator to the bus, and then close the breaker.</td><td><u>GENERATOR BREAKER Outputs</u>
The outputs must be mapped to the contact outputs of the DECS-250N that will be used to drive the breaker.
Open: This output is pulsed TRUE (closes the output contact it is mapped to) when the DECS-250N is providing a signal to the breaker to open. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Synchronizer/Voltage Matching in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Generator Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed.
Close: This output is pulsed TRUE (closes the output contact it is mapped to) when the DECS-250N is providing a signal to the breaker to close. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Synchronizer/Voltage Matching in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Generator Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed.</td></tr>
<tr><td>GOVERNOR</td><td>Can be connected to inputs of other logic blocks. When the Governor is being raised, the Raise output is true. When being lowered, the Lower output is true. (Available when the controller is equipped with the optional Auto synchronizer, style xxxxAxx)</td><td>
</td></tr>
<tr><td>INTERNAL TRACKING DISABLE</td><td>When true, this element disables internal tracking.</td><td>
</td></tr>
<tr><td>LINE DROP DISABLE</td><td>When true, this element disables line drop when the unit is operating in AVR mode.</td><td>
</td></tr>
</table>

Name	Description	Symbol
LOAD SHARE DISABLE	This element allows load sharing with specific units on the network to be disabled. When an input to this block is true, load share data received from that unit is ignored by the DECS-250N.	
LOSS OF SENSING DISABLE	When true, this element disables the Loss of Sensing function.	
LOSS OF SENSING TRANSFER DISABLE	When true, this element disables the transfer to Manual mode during a Loss of Sensing condition.	
LOWER ENABLE	When true, this element lowers the active setpoint.	
MANUAL ENABLE	When true, this element switches the unit to Manual mode.	
MANUAL MODE FCR ONLY	When true, this element switches the Manual mode to FCR.	
NETWORK LOAD SHARE DISABLE	When true, this element disables network load sharing.	
OEL DISABLED IN MANUAL MODE	When true, this element disables OEL when the unit is operating in Manual mode.	
OEL ONLINE	When true, this element enables the use of OEL when the unit is considered online.	

Name	Description	Symbol
OEL SELECT SECONDARY SETTINGS	When true, this element selects the secondary settings for OEL.	
PARALLEL ENABLE LM	When true, this element informs the unit that it is online. The element should be enabled when the 52LM is closed. This element also allows UEL and droop compensation to operate when true.	
PID SELECT SECONDARY SETTINGS	When true, this element selects secondary settings on the PID.	
PF/VAR ENABLE	When true, this element enables the PF and Var controller, and informs the unit that it is online. The Var/PF Selection element must be set to true to use var or PF mode. This element should be enabled when the 52JK is closed.	
PREPOSITION 1 ENABLE	When true, this element informs the unit to use setpoints for Preposition 1.	
PREPOSITION 2 ENABLE	When true, this element informs the unit to use setpoints for Preposition 2.	
PREPOSITION 3 ENABLE	When true, this element informs the unit to use setpoints for Preposition 3.	
PROTECTION SELECT SECONDARY SETTINGS	When true, this element informs the unit to use secondary values for protection.	
PSS SEQ CNTRL ENABLED	When true, PSS sequence (phase rotation) control is enabled. (Available when the controller is equipped with the optional Power System Stabilizer, style number xPxxxxx)	
PSS OUTPUT DISABLE	When true, this element disables the output of the PSS. The PSS continues to run, but the output is not used. (Available when the controller is equipped with the optional Power System Stabilizer, style number xPxxxxx)	
PSS SEQ CNTRL SELECTION	When true, phase rotation is selected to be ACB. False when phase rotation is selected to be ABC. (Available when the controller is equipped with the optional Power System Stabilizer, style number xPxxxxx)	

Name	Description	Symbol
PSS MOTOR	When true, the PSS is in motor mode. False when in generator mode. (Available when the controller is equipped with the optional Power System Stabilizer, style number xPxxxxx)	PSS_MOTOR Mode
PSS SELECT SECONDARY SETTINGS	When true, this element selects secondary settings for the PSS. (Available when the controller is equipped with the optional Power System Stabilizer, style number xPxxxxx)	PSS_SELECT_GROUP_2 Enable
RAISE ENABLE	When true, this element raises the active setpoint.	RAISE_ENABLE Enable
SCL SELECT SECONDARY SETTINGS	When true, this element selects the secondary settings for SCL.	SCL_SELECT_GROUP_2 Enable
SOFT START SELECT SECONDARY SETTINGS	When true, this element selects the secondary settings for softstart.	SOFT_START_SELECT_GROUP_2 Enable
START ENABLE	When true, this element starts the unit.	START_ENABLE Enable
STOP ENABLE	When true, this element stops the unit.	STOP_ENABLE Enable
Transfer Watchdog Trip	When true, this element opens the transfer watchdog output.	TransferWatchdogTrip Trip
UEL DISABLED IN MANUAL MODE	When true, this element disables UEL when the unit is operating in Manual mode.	UEL_DISABLED_IN_MAN_MODE Enable
UEL SELECT SECONDARY SETTINGS	When true, this element selects secondary settings for UEL.	UEL_SELECT_GROUP_2 Enable
USER PROGRAMMABLE ALARM 1 - 16	When true, this element triggers a programmable alarm.	USERALM1 Programmable Alarm 1 Name Trigger
VAR LIMITER SELECT SECONDARY SETTINGS	When true, this elements selects the secondary settings on the Var limiter.	VAR_LIM_SELECT_GROUP_2 Enable

Name	Description	Symbol
VAR/PF SELECTION	When true, this element allows the selection of Var and PF.	
VOLTAGE MATCHING DISABLE	When true, this element disables voltage matching when the unit is operating in AVR mode.	

Logic Schemes

A logic scheme is a group of logic variables written in equation form that defines the operation of a DECS-250N Digital Excitation System. Each logic scheme is given a unique name. This gives you the ability to select a specific scheme and be confident that the selected scheme is in operation. One logic scheme is configured for a typical protection and control application of a synchronous generator and is the default active logic scheme. Only one logic scheme can be active at a given time. In most applications, preprogrammed logic schemes eliminate the need for custom programming. Preprogrammed logic schemes may provide more inputs, outputs, or features than are needed for a particular application. This is because a preprogrammed scheme is designed for a large number of applications with no special programming required. Unneeded logic block outputs may be left open to disable a function or a function block can be disabled through operating settings.

When a custom logic scheme is required, programming time is reduced by modifying the default logic scheme.

The Active Logic Scheme

The DECS-250N must have an active logic scheme in order to function. All DECS-250N controllers are delivered with a default, active logic scheme preloaded in memory. The functionality of this logic scheme is similar to the scheme provided with the DECS-200N. If the function block configuration and output logic of the default logic scheme meet the requirements of your application, then only the operating settings (system parameters and threshold settings) need to be adjusted before placing the DECS-250N in service.

Sending and Retrieving Logic Schemes

Retrieving a Logic Scheme from the DECS-250N

To retrieve settings from the DECS-250N, the DECS-250N must be connected to a computer through a communications port. Once the necessary connections are made, settings can be downloaded from the DECS-250N by selecting *Download Settings and Logic* on the *Communication* pull-down menu.

Sending a Logic Scheme to the DECS-250N

To send settings to the DECS-250N, the DECS-250N must be connected to a computer through a communications port. Once the necessary connections are made, settings can be uploaded to the DECS-250N by selecting *Upload Settings and Logic* on the *Communication* pull-down menu.

Caution

Always remove the DECS-250N from service prior to changing or modifying the active logic scheme. Attempting to modify a logic scheme while the DECS-250N is in service could generate unexpected or unwanted outputs.

Modifying a logic scheme in BESTCOMS*Plus*® does not automatically make that scheme active in the DECS-250N. The modified scheme must be uploaded into the DECS-250N. See the paragraphs on *Sending and Retrieving Logic Schemes* above.

Default Logic Schemes

The default logic scheme for PSS-disabled systems is shown in Figure 123 through Figure 125 and the default logic scheme for PSS-enabled systems is shown in Figure 126 through Figure 129.

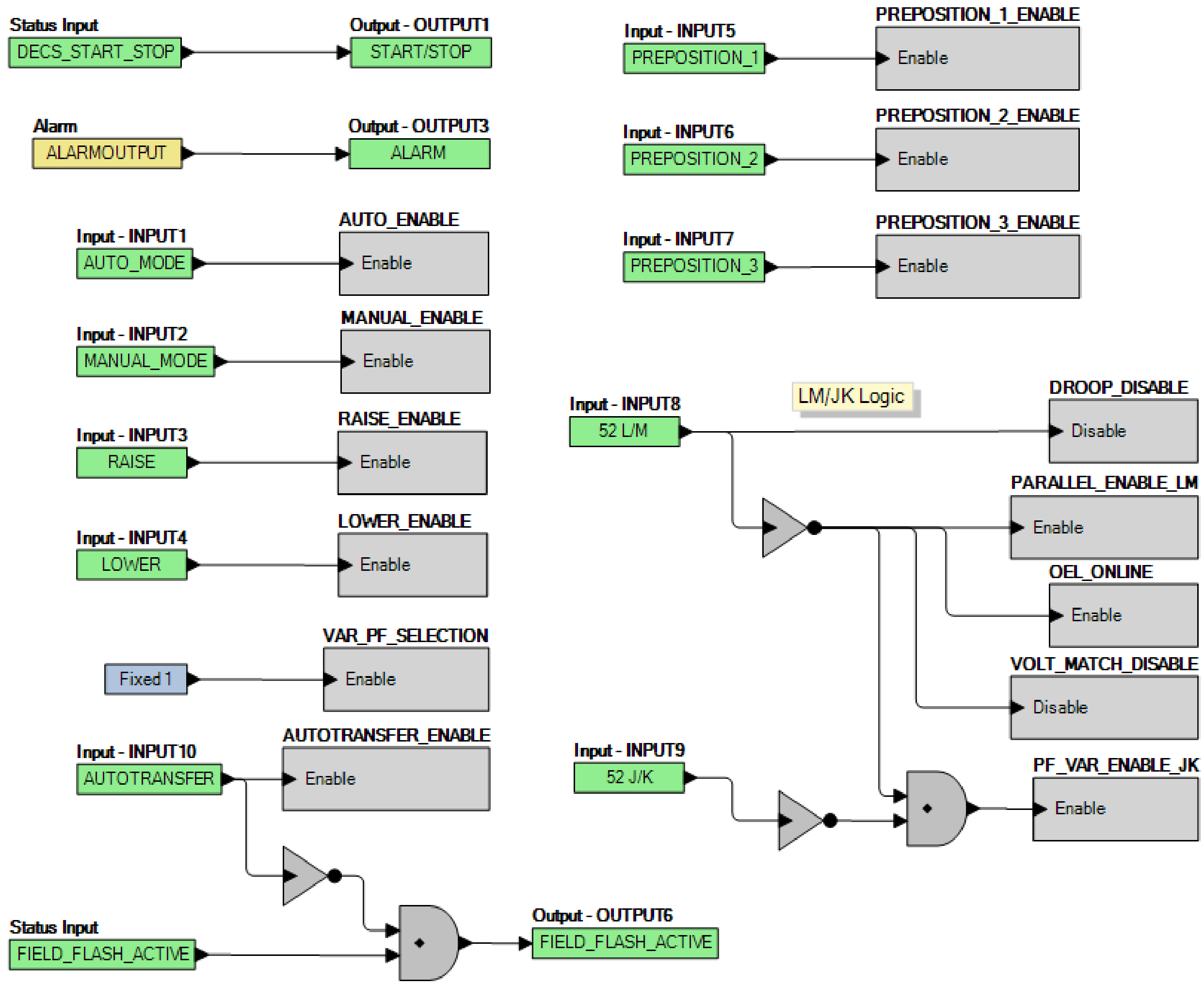


Figure 123. PSS-Disabled Default Logic – Logic Page 1 Tab

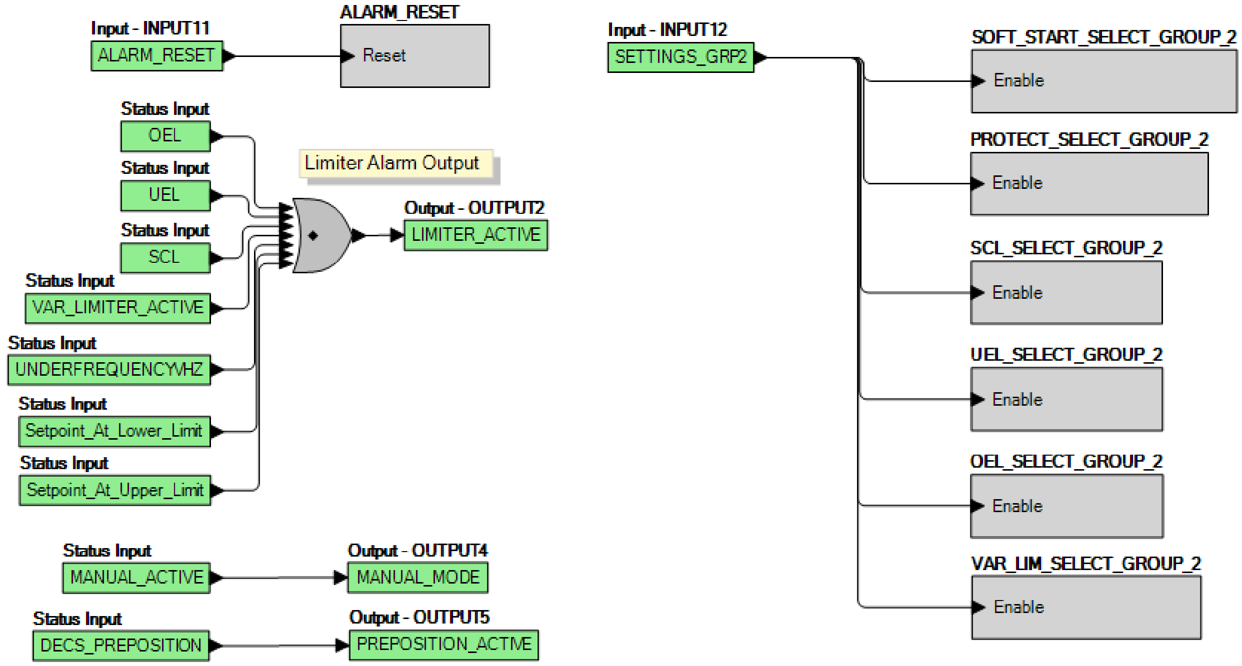


Figure 124. PSS-Disabled Default Logic - Logic Page 2 Tab

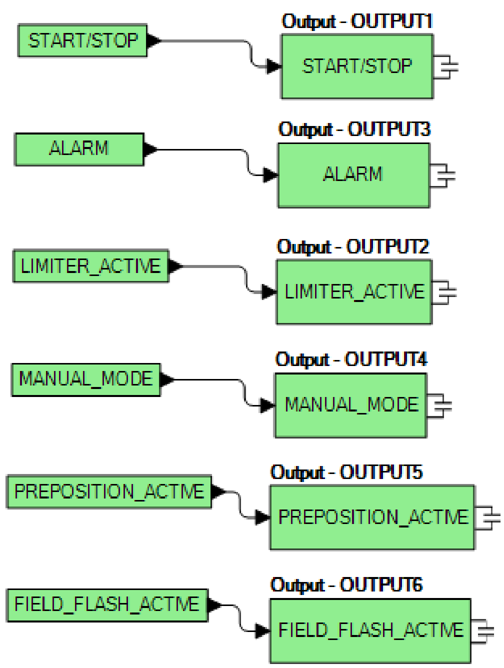


Figure 125. PSS-Disabled Default Logic - Physical Outputs Tab

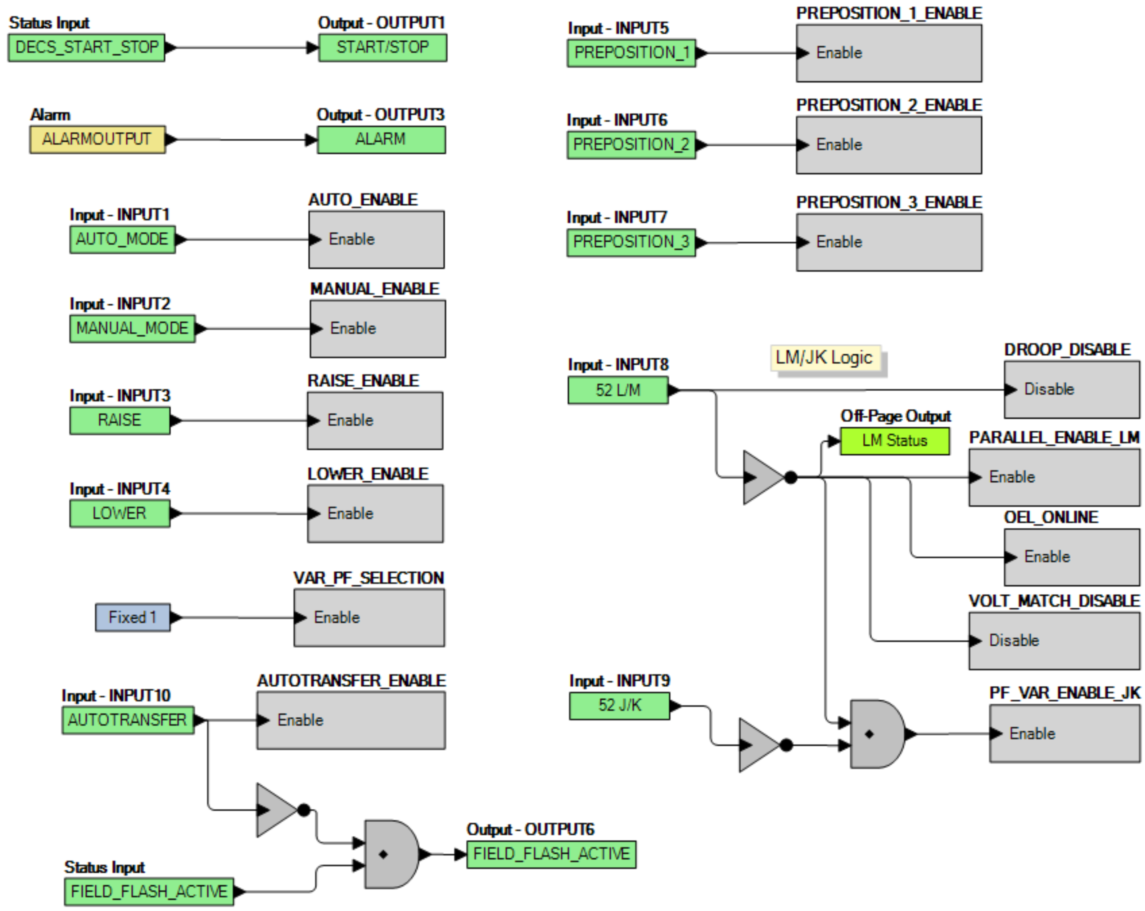


Figure 126. PSS-Enabled Default Logic - Logic Page 1 Tab

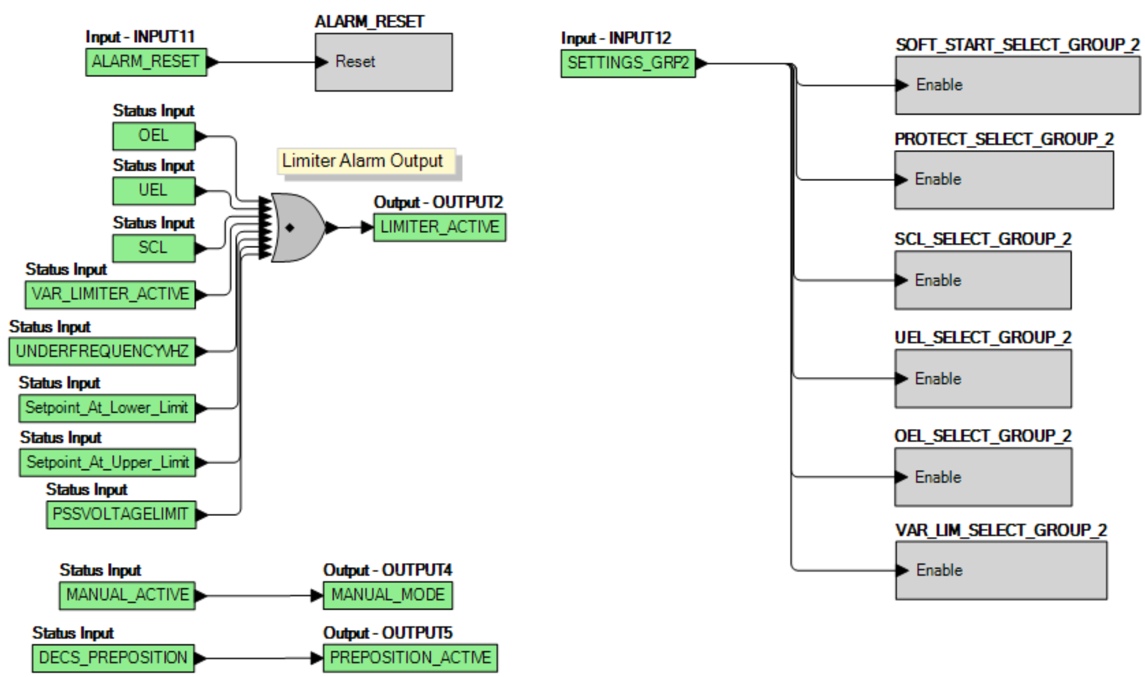


Figure 127. PSS-Enabled Default Logic - Logic Page 2 Tab

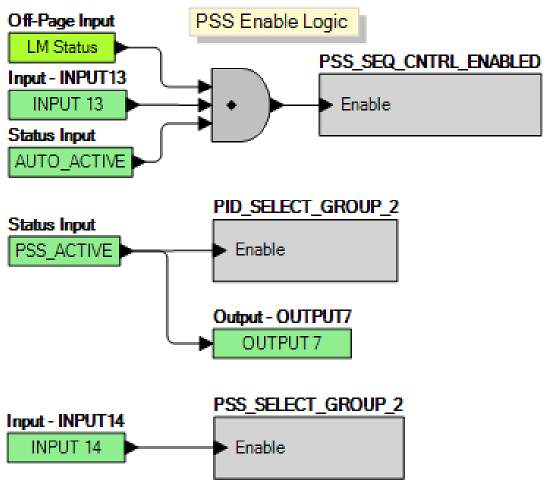


Figure 128. PSS-Enabled Default Logic – Logic Page 3 Tab

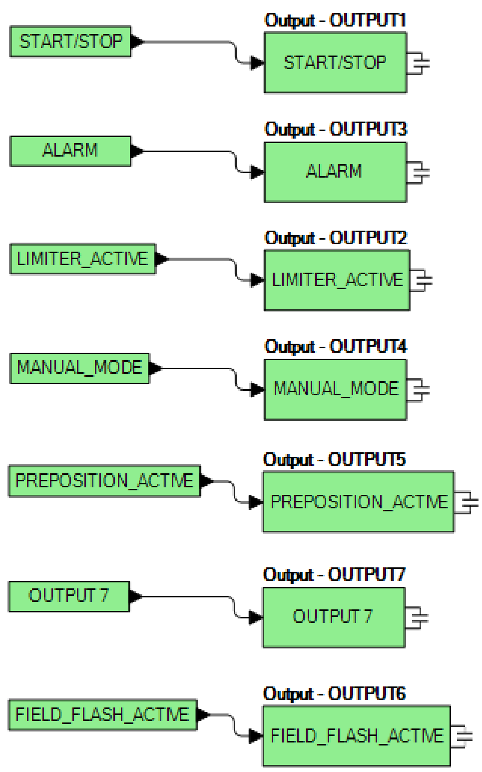


Figure 129. PSS-Enabled Default Logic - Physical Outputs Tab

Programming BESTlogic™Plus

Use BESTCOMS*Plus*® to program BESTlogic*Plus*. Using BESTlogic*Plus* is analogous to physically attaching wire between discrete DECS-250N terminals. To program BESTlogic*Plus*, use the Settings Explorer within BESTCOMS*Plus* to open the *BESTlogicPlus Programmable Logic* tree branch as shown in Figure 122.

The drag and drop method is used to connect a variable or series of variables to the logic inputs, outputs, components, and elements. To draw a wire/link from port to port (triangles), click the left mouse button on a port, pull the wire onto another port, and release the left mouse button. A red port indicates that a connection to the port is required or missing. A black port indicates that a connection to the port is not required. Drawing wires/links from input to input or output to output is not allowed. Only one wire/link can be connected to any one output. If the proximity of the endpoint of the wire/link is not exact, it may attach to an unintended port.

If an object or element is disabled, it will have a yellow X on it. To enable the element, navigate to the settings page for that element. A red X indicates that an object or element is not available per the style number of the DECS-250N.

The view of the Main Logic and Physical Outputs can be automatically arranged by clicking the right mouse button on the window and selecting *Auto-Layout.*

The following must be met before BESTCOMS*Plus* will allow logic to be uploaded to the DECS-250N:

- A minimum of two inputs and a maximum of 32 inputs on any multi-port (AND, OR, NAND, NOR, XOR, and XNOR) gate.
- A maximum of 32 logic levels for any particular path. A path being an input block or an output side of an element block through gates to an output block or an input side of an element block. This is to include any OR gates on the Physical Outputs page, but not the matched pairs of Physical Outputs blocks.
- A maximum of 256 gates per logic level with a maximum of 256 gates allowed per diagram. All output blocks and input sides of element blocks are at the maximum logic level of the diagram. All gates are pushed forward/upwards in logic levels and buffered to reach the final output block or element block if needed.

Three status LEDs are located in the lower right corner of the BESTlogic*Plus* window. These LEDs show the *Logic Save Status*, *Logic Diagram Status*, and *Logic Layer Status*. Table 14 defines the colors for each LED.

Table 14. Status LEDs

LED	Color	Definition
Logic Save Status (Left LED)	Orange	Logic has changed since last save.
	Green	Logic has NOT changed since last save.
Logic Diagram Status (Center LED)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.
Logic Layer Status (Right LED)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.

Pickup and Dropout Timers

A pickup timer produces a TRUE output when the elapsed time is greater than or equal to the Pickup Time setting after a FALSE to TRUE transition occurs on the Initiate input from the connected logic. Whenever the Initiate input status transitions to FALSE, the output transitions to FALSE immediately.

A drop out timer produces a TRUE output when the elapsed time is greater than or equal to the Dropout Time setting after a TRUE to FALSE transition occurs on the Initiate input from the connected logic. Whenever the Initiate input transitions to TRUE, the output transitions to FALSE immediately.

Refer to Figure 130, *Pickup and Dropout Logic Timer Blocks.*

To program logic timer settings, use the Settings Explorer within BESTCOMS*Plus*® to open the *BESTlogicPlus Programmable Logic/Logic Timers* tree branch. Enter a *Name* label that you want to appear on the timer logic block. The *Time Delay* value range is 0 to 250 hours in 1 hour increments, 0 to 250 minutes in 1 minute increments, or 0 to 1,800 seconds in 0.1 second increments.

Next, open the *Components* tab inside the BESTlogic*Plus* window and drag a timer onto the program grid. Right click on the timer to select the timer you want to use that was previously set on the *Logic Timers* tree branch. The *Logic Timer Properties Dialog Box* will appear. Select the timer you want to use.

Timing accuracy is ±15 milliseconds.

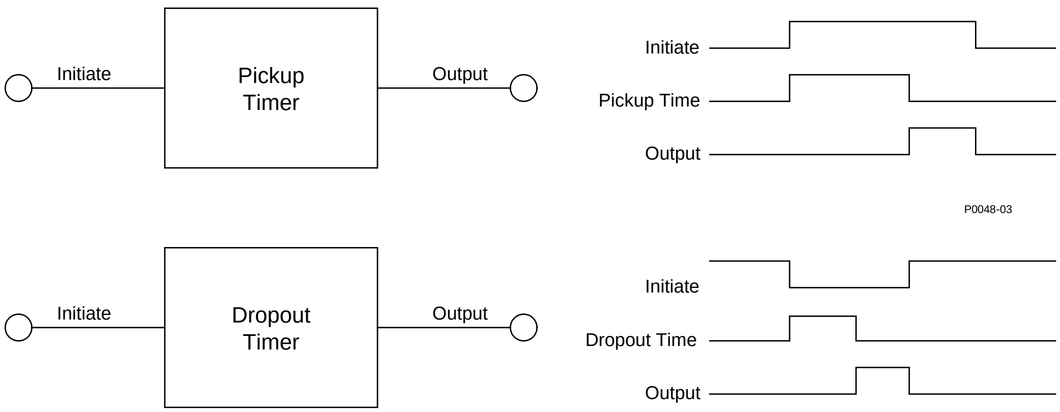


Figure 130. Pickup and Dropout Timer Logic Blocks

BESTlogic™Plus File Management

To manage BESTlogic*Plus* files, use the Settings Explorer to open the *BESTlogicPlus Programmable Logic* tree branch. Use the BESTlogic*Plus* Programmable Logic toolbar to manage BESTlogic*Plus* files. Refer to Figure 131. For information on Settings Files management, refer to the *BESTCOMSPlus Software* section.

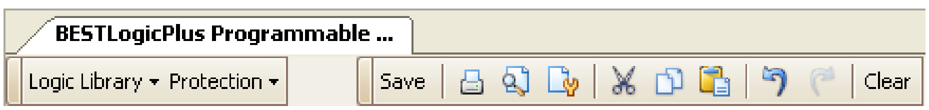


Figure 131. BESTlogic*Plus* Programmable Logic Toolbar

Saving a BESTlogic*Plus* File

After programming BESTlogic*Plus* settings, click on the *Save* button to save the settings to memory.

Before the new BESTlogic*Plus* settings can be uploaded to the DECS-250N, you must select *Save* from the *File* pull-down menu located at the top of the BESTCOMS*Plus* main shell. This step will save both the BESTlogic*Plus* settings and the operating settings to a file.

The user also has the option to save the BESTlogic*Plus* settings to a unique file that contains only BESTlogic*Plus* settings. Click on the *Logic Library* drop-down button and select *Save Logic Library File.* Use normal Windows® techniques to browse to the folder where you want to save the file and enter a filename to save as.

Opening a BESTlogic*Plus* File

To open a saved BESTlogic*Plus* file, click on the *Logic Library* drop-down button on the BESTlogic*Plus* Programmable Logic toolbar and select *Open Logic Library File.* Use normal Windows techniques to browse to the folder where the file is located.

Protecting a BESTlogic*Plus* File

Objects in a logic diagram can be locked so that when the logic document is protected these objects cannot be changed. Locking and protecting is useful when sending logic files to other personnel to be modified. The locked object(s) cannot be changed. To view the lock status of the object(s), select *Show Lock Status* from the *Protection* drop-down menu. To lock object(s), use the mouse to select object(s) to be locked. Right click on the selected object(s) and select *Lock Object(s).* The gold colored padlock next to the object(s) will change from an open to a locked state. To protect a logic document, select *Protect Logic Document* from the *Protection* drop-down button. Establishing a password is optional.

Uploading a BESTlogic*Plus* File

To upload a BESTlogic*Plus* file to the DECS-250N, you must first open the file through BESTCOMS*Plus*® or create the file using BESTCOMS*Plus*. Then pull down the *Communication* menu and select *Upload Logic.*

Downloading a BESTlogic*Plus* File

To download a BESTlogic*Plus* file from the DECS-250N, you must pull down the *Communication* menu and select *Download Settings and Logic from Device*. If the logic in your BESTCOMS*Plus* has changed, a dialog box will open asking you if want to save the current logic changes. You may choose *Yes* or *No*. After you have taken the required action to save or not save the current logic, the downloading is executed.

Copying and Renaming Preprogrammed Logic Schemes

Copying a saved logic scheme and assigning a unique name is accomplished by first loading the saved logic scheme into BESTCOMS*Plus.* Click on the *Logic Library* drop-down button and select *Save Logic Library File.* Use normal Windows® techniques to browse to the folder where you want to save the new file and enter a filename to save as. Changes are not activated until the new settings have been saved and uploaded to the device.

Printing a BESTlogic*Plus* File

To view a preview of the printout, click on the *Print Preview* icon located on the BESTlogic*Plus* Programmable Logic toolbar. If you wish to print to a printer, select the printer icon in the upper left corner of the *Print Preview* screen.

You may skip the print preview and go directly to print by clicking on the *Printer* icon on the BESTlogic*Plus* Programmable Logic toolbar. A dialog box, *Select Views to Print* opens allowing you to check which views you would like to print. Next, the *Print* dialog box opens with the typical Windows choice to setup the properties of printer. Execute this command, as necessary, and then select *Print*.

A *Page Setup* icon is also provided on the BESTlogic*Plus* Programmable Logic toolbar allowing you to select *Paper Size, Paper Source, Orientation,* and *Margins.*

Clearing the On-Screen Logic Diagram

Click on the *Clear* button to clear the on-screen logic diagram and start over.

BESTlogic™Plus Examples

Example 1 - GOVR Logic Block Connections

Figure 132 illustrates the GOVR logic block and two output logic blocks. Output 6 is active while the governor is being raised and Output 9 is active while the governor is being lowered.

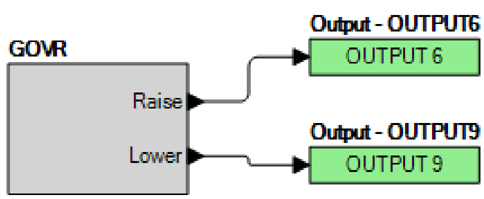


Figure 132. Example 1 - GOVR Logic Block Connections

Example 2 - AND Gate Connections

Figure 133 illustrates a typical AND gate connection. In this example, Output 11 will become active when the bus and the generator are dead.

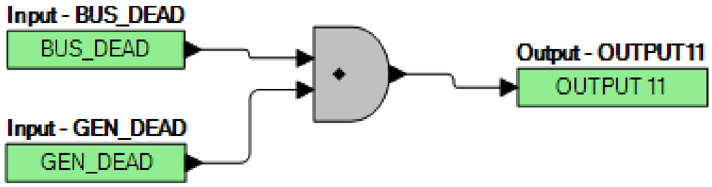


Figure 133. Example 2 - AND Gate Connections

Communication

Local Communication

A type B, USB port connects the DECS-250N with a PC operating BESTCOMS*Plus*® for local, short- term communication. This mode of communication is useful for settings configuration and system commissioning. The USB port is located on the front panel and illustrated in the *Controls and Indicators* section of this manual. A USB device driver for the DECS-250N is automatically installed on your PC during the installation of BESTCOMS*Plus*. Information about establishing communication between BESTCOMS*Plus* and the DECS-250N is provided in the *BESTCOMSPlus Software* chapter of this manual.

Caution
In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.

Communication with a Second DECS

BESTCOMS*Plus* Navigation Path: Settings Explorer, Communications, RS232 Setup

HMI Navigation Path: Settings, Communications, RS232 Setup.

Communication with a second DECS enables regulation setpoint tracking to occur in a dual, or redundant, DECS application. External setpoint tracking is possible between a DECS-250N and second DECS-250N or a DECS-250N and DECS-200N.

All DECS controllers mentioned here use a female DB-9 (RS-232) connector for communication with a second DECS. On the DECS-250N, this connector is located on the right side panel and is illustrated in the *Terminals and Connectors* section of this manual. A five-foot (1.5 meter) cable, part number 9310300032, is available for interconnecting two DECS controllers.

RS-232 port communication settings are illustrated in Figure 134 and consist of the baud rate[A], number of bits per character[B], parity[C], and the number of stop bits[D]. When connecting the DECS-250N to a DECS-200N, you must ensure that the communication settings of the DECS-200N match those of the DECS-250N.

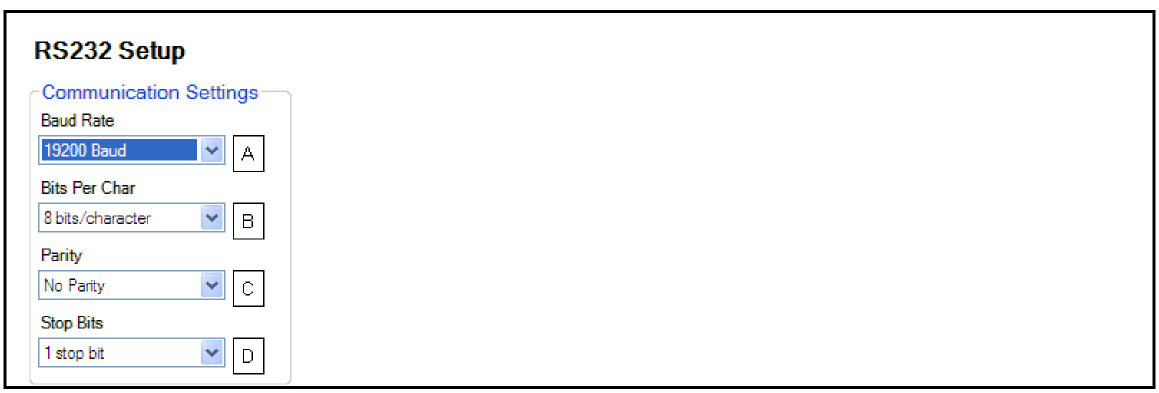


Figure 134. RS232 Setup

[A] *Baud Rate:* Select 4800, 9600, 19200, 38400, 57600, or 115200.
[B] *Bits Per Char:* Select 7 or 8 bits/character.
[C] *Parity:* Select Even, Odd, or No parity.
[D] *Stop Bits:* Select 1 or 2 stop bits.

Modbus™ Communication

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, Modbus Setup

HMI Navigation Path: Not available through HMI.

DECS-250N systems support the RS-485 mode and Modbus/TCP (Ethernet) mode at the same time. DECS-250N Modbus communication registers are listed and defined in the *Modbus Communication* section of this manual.

Modbus settings for RS-485 and Ethernet are illustrated in Figure 135 and consist of RS-485 Unit ID[A], RS-485 Response Delay[B], and Ethernet Unit ID[C].

Figure 135. Modbus Setup

[A] *RS-485 Unit ID:* Adjustable from 1 to 247 in increments of 1.
[B] *RS-485 Response Delay:* Adjustable from 10 to 10,000 ms in 10 ms increments.
[C] *Ethernet Unit ID:* Adjustable from 1 to 247 in increments of 1.

RS-485 Port

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, RS-485 Setup

HMI Navigation Path: Settings, Communications, RS-485 Setup

An RS-485 port uses the Modbus RTU (remote terminal unit) protocol for polled communication with other networked devices or remote annunciation and control with an IDP-800 Interactive Display Panel. RS-485 port terminals are located on the left side panel and are identified as RS-485 A, B, and C. Terminal A serves as the send/receive A terminal, terminal B serves as the send/receive B terminal, and terminal C serves as the signal ground terminal. Figure 136 illustrates typical RS-485 connections for multiple DECS-250N controllers communicating over a Modbus network.

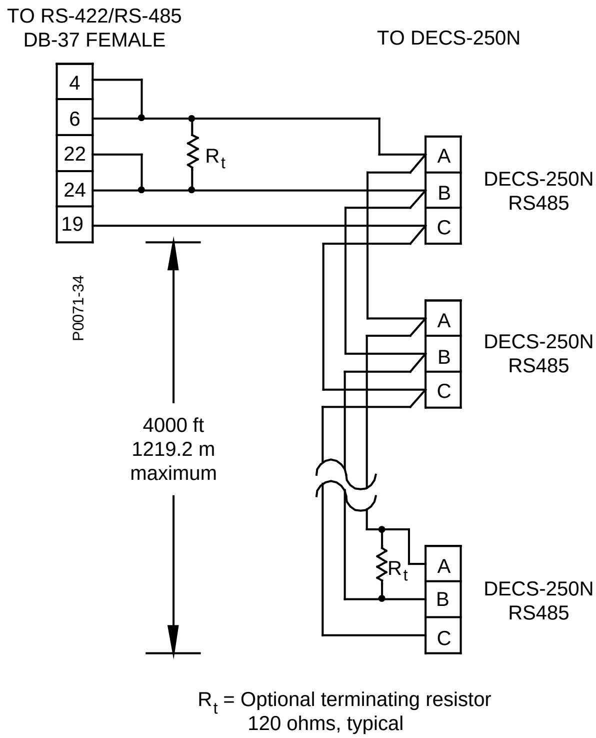


Figure 136. Typical RS-485 Connections

RS-485 port communication settings are illustrated in Figure 137 and consist of the baud rate[A], number of bits per character[B], parity[C], and the number of stop bits[D].

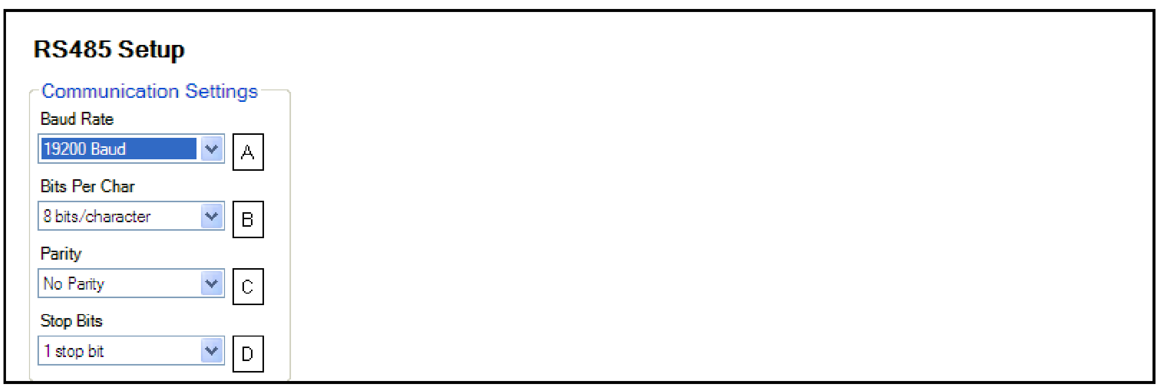


Figure 137. RS-485 Port Communication Settings

[A] *Baud Rate:* Select 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.
[B] *Bits Per Char:* Select 7 or 8 bits/character.
[C] *Parity:* Select Even, Odd, or No parity.
[D] *Stop Bits:* Select 1 or 2 stop bits.

Ethernet Port

An Ethernet port uses the Modbus/TCP protocol for polled communication with other networked devices or remote annunciation and control with an IDP-800 Interactive Display Panel.

CAN Communication

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, CAN Bus, CAN Bus Setup

HMI Navigation Path: Settings, Communications, CAN Bus, CAN Bus Setup

One CAN (controller area network) interface (CAN 1) facilitates communication between the DECS-250N and optional modules such as the contact expansion module (CEM-2020) and analog expansion module (AEM-2020).

A second CAN interface (CAN 2) enables the DECS-250N to provide generator and system parameters to a generator controller such as the Basler DGC-2020. CAN 2 also permits DECS-250N setpoint and mode control from an external device connected to the CAN.

Both CAN bus interfaces utilize the SAE J1939 messaging protocol.

DECS-250N CAN parameters are listed and defined in the *CAN Communication* section of this manual.

Connections

DECS-250N CAN connections should be made with twisted-pair, shielded cable. Each CAN port (designated CAN 1 and CAN 2) has a CAN high (H) terminal, a CAN low (L) terminal, and a CAN drain (SH) terminal. CAN port terminals are illustrated in the *Terminals and Connectors* section of this manual.

Port Configuration

Each DECS-250N CAN port must be identified by a unique address number[A]. The baud rate[B] of each port can be configured for 125 kbps or 250 kbps. Port configuration settings are illustrated in Figure 138.

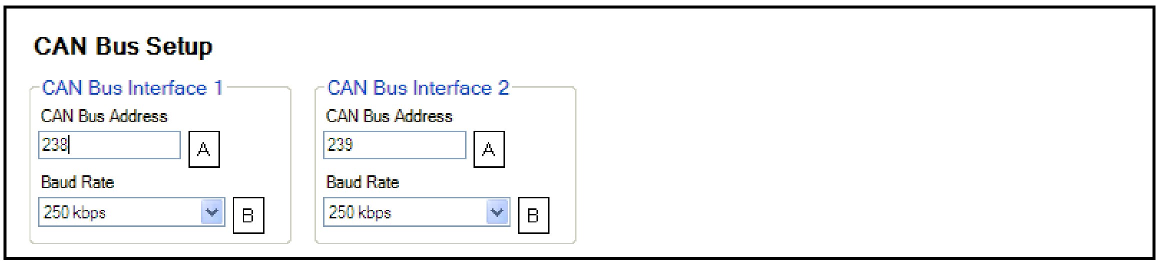


Figure 138. CAN Port Configuration Settings

[A] *CAN bus Address:* Adjustable from 1 to 253.
[B] *Baud Rate:* Select 125 kbps or 250 kbps.

Remote Module Setup

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, CAN Bus, Remote Module Setup

HMI Navigation Path: Settings, Communications, CAN Bus, Remote Module Setup

Optional, external modules, such as the contact expansion module (CEM-2020) and analog expansion module (AEM-2020), communicate via the DECS-250N CAN 1 interface and are configured through the DECS-250N BESTCOMS*Plus* interface. These settings are illustrated in Figure 139.

Contact Expansion Module

When enabled[A] for operation, the CEM-2020 CAN address[B] is assigned a unique number and the number of outputs[C] is selected. Standard module (CEM-2020) provides 24 output contacts and high-current module (CEM-2020H) provides 18 output contacts.

Analog Expansion Module

When enabled[D] for operation, the AEM-2020 CAN address[E] is assigned a unique address for communication on the network.

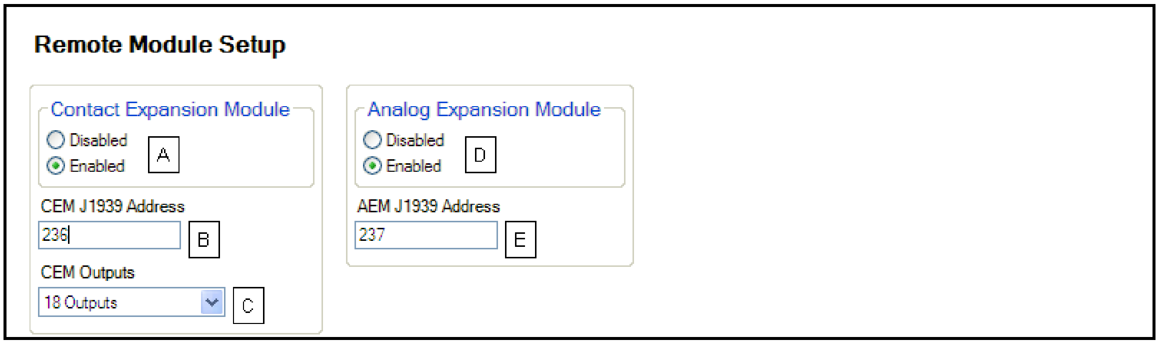


Figure 139. Remote Module Setup

[A] *Contact Expansion Module Enable/Disable:* Select Enabled or Disabled.
[B] *CEM J1939 Address:* Adjustable from 1 to 253.
[C] *CEM Outputs:* Select 18 Outputs (CEM-2020H) or 24 Outputs (CEM-2020).
[D] *Analog Expansion Module Enable/Disable:* Select Enabled or Disabled.
[E] *AEM J1939 Address:* Adjustable from 1 to 253.

Ethernet Communication

Depending upon the style number, each DECS-250N is equipped with a copper (100Base-T) Ethernet communication port (style xxxxx1x) or a fiber optic (100Base-FX) Ethernet communication port (style xxxxx2x). The copper or fiber optic Ethernet connector is located on the right side panel. DECS-250N metering, annunciation, and control is provided through the Ethernet port using the Modbus TCP protocol. DECS-250N Modbus communication registers are listed and defined in the *Modbus Communication* section of this manual.

NOTE
Industrial Ethernet devices designed to comply with IEC 61000-4 series of specifications are recommended.

Ethernet Connection

1. Connect the DECS-250N to the PC using a standard Ethernet cable.
2. In BESTCOMS*Plus*®, click *Communication, New Connection, DECS-250N*, or click the *Connection* button on the lower menu bar. The DECS-250 Connection window appears. (Figure 140)
3. If you know the IP address of the DECS-250N, click the radio button for the Ethernet Connection IP at the top of the DECS-250N Connection window, enter the address into the fields and click the *Connect* button.
4. If you don't know the IP address, you can perform a scan (Figure 141) to search for all connected devices by clicking the *Ethernet* button in the Device Discovery box. After the scan is complete, a window containing the connected devices will be displayed. (Figure 142)

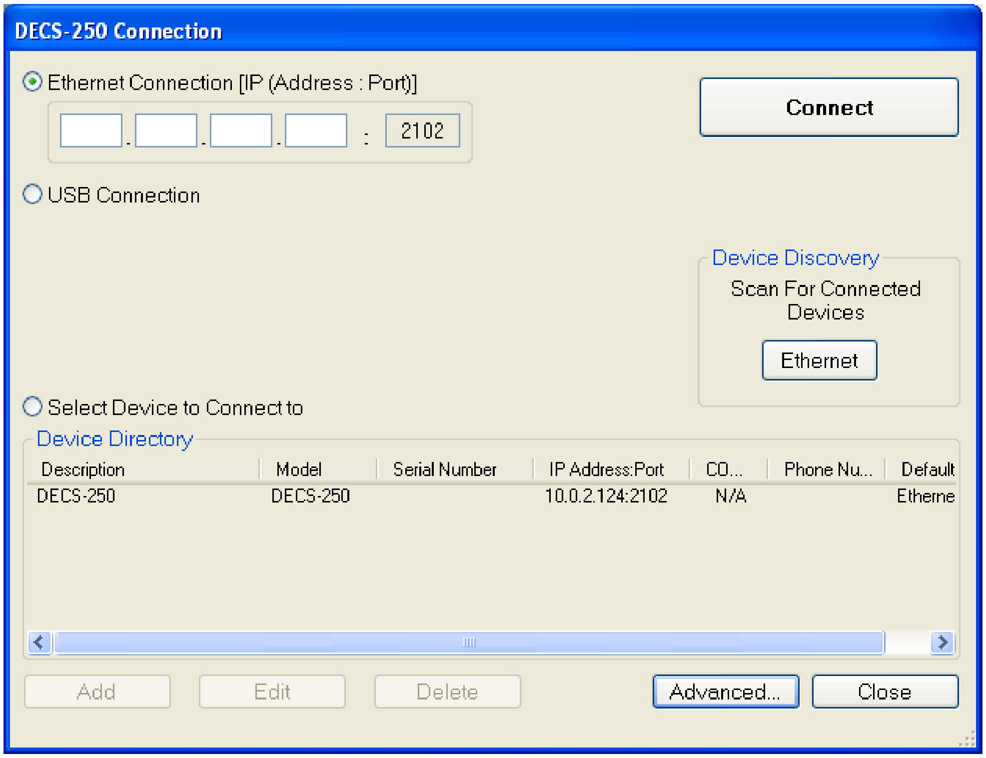


Figure 140. DECS-250 Connection Window

Figure 141. Scanning for Connected Devices

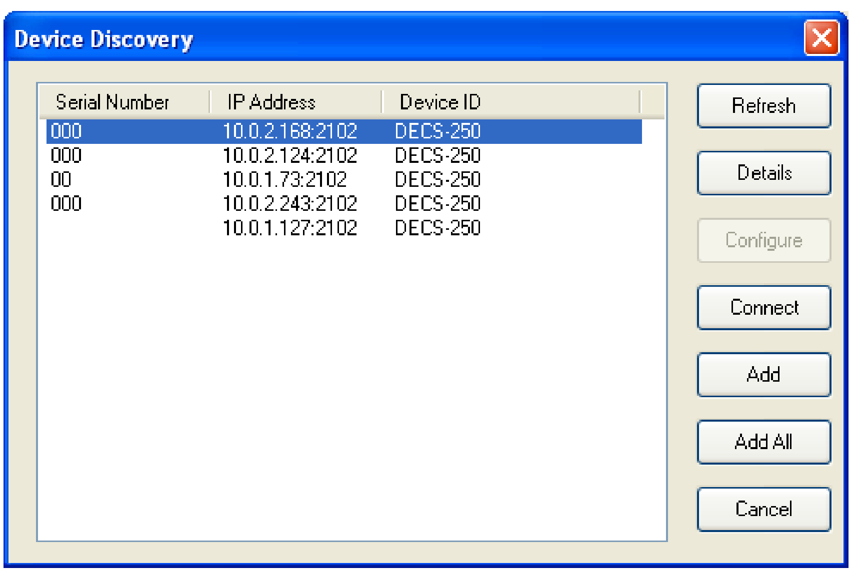


Figure 142. Device Discovery Window

5. At this point you can also add any or all of the detected devices to the Device Directory. This prevents the need to scan for connected devices each time a connection is desired. Simply select a device from the list and click *Add*. Clicking *Add All* will add all detected devices from the list to the Device Directory. The Device Directory stores the name, model, and address of devices you have added. Click the radio button for *Select Device to Connect to*, select the device from the Device Directory list, and click the *Connect* button at the top of the DECS-250N Connection window.
6. Choose the desired device from the list and click *Connect.* Wait for connection to complete (Figure 143).

Figure 143. Waiting for Connection

7. The *Advanced* button displays the following window. It contains options for enabling Auto Reconnect, the delay between retries (in milliseconds), and the maximum number of attempts. (Figure 144)

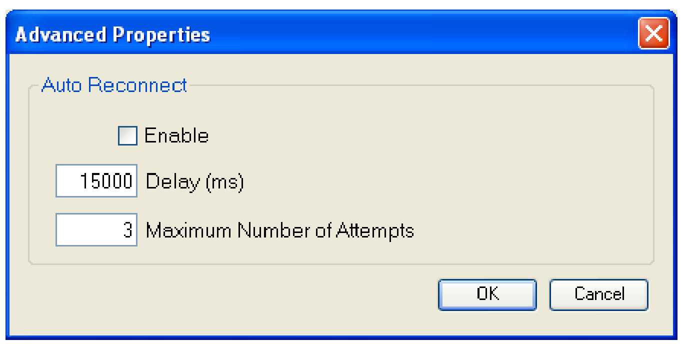


Figure 144. Advances Properties, Auto Reconnect

NOTE

The PC running BESTCOMS*Plus*® software must be configured correctly to communicate with the DECS-250N. The PC must have an IP address in the same subnet range as the DECS-250N if the DECS-250N is operating on a private, local network.

Otherwise, the PC must have a valid IP address with access to the network and the DECS-250N must be connected to a properly configured router. The network settings of the PC depend on the operating system installed. Refer to the operating system manual for instructions.

On most Microsoft Windows based PCs, the network settings can be accessed through the *Network Connections* icon located inside the Control Panel.

PROFIBUS Communication

BESTCOMS*Plus* Navigation Path: Settings Explorer, Communications, Profibus Setup

HMI Navigation Path: Settings, Communications, Profibus

On units equipped with the PROFIBUS communication protocol (style xxxxxxP), the DECS-250N sends and receives PROFIBUS data through a DB-9 port located on the right side panel. DECS-250N PROFIBUS communication parameters are listed and defined in the *PROFIBUS Communication* section of this manual.

DB-9 port communication settings are illustrated in Figure 145 and consist of the address[A] and network byte order[B].

Figure 145. Profibus Setup

[A] *Address:* Adjustable from 0 to 126 in increments of 1.
[B] *Network Byte Order:* MSB First or LSB First.

Configuration

Before the DECS-250N is placed in service, it must be configured for the controlled equipment and application.

Generator, Field, and Bus Ratings

BESTCOMS*Plus*® Navigation Path: Settings Explorer, System Parameters, Rated Data
HMI Navigation Path: Settings, System Parameters, Rated Data

Generator, field, and bus rating settings are illustrated in Figure 146.

For proper excitation control and protection, the DECS-250N must be configured with the ratings of the controlled generator and field. These ratings are typically shown on the generator nameplate or can be obtained from the generator manufacturer. Required generator ratings include the voltage[A], frequency[B], power factor[C], and apparent power[D] (kVA). Generator current[E],real power[F] (kW), and reactive power (kvar)[G] are listed with the other generator ratings as read-only settings. These values are automatically calculated from the other generator ratings entered by the user. Required field ratings include the no load dc voltage[H] and current[I] and full load voltage[J] and current[K].

The ratio[L] of exciter poles to generator poles is used by the exciter diode monitor (EDM) function to detect open and shorted exciter diodes. The calculated value can be entered directly or calculated using the pole calculator[M]. A minimum ratio of 1.5 is recommended to ensure consistent EDM operation.

In applications where the generator will be synchronized/paralleled with a bus, the DECS-250N must be configured with the rated bus voltage[N].

The nominal operating power input voltage[O] is used to calculate the recommended Ka (Loop Gain) value. This value is also used in metering calculations.

When using the DECS-250N with an exciter requiring an inverted output, check this box[P] to enable the inverting of the DECS-250N control output.

Caution

Enabling inverted bridge output with an exciter which does not require inverted bridge output will result in equipment damage.

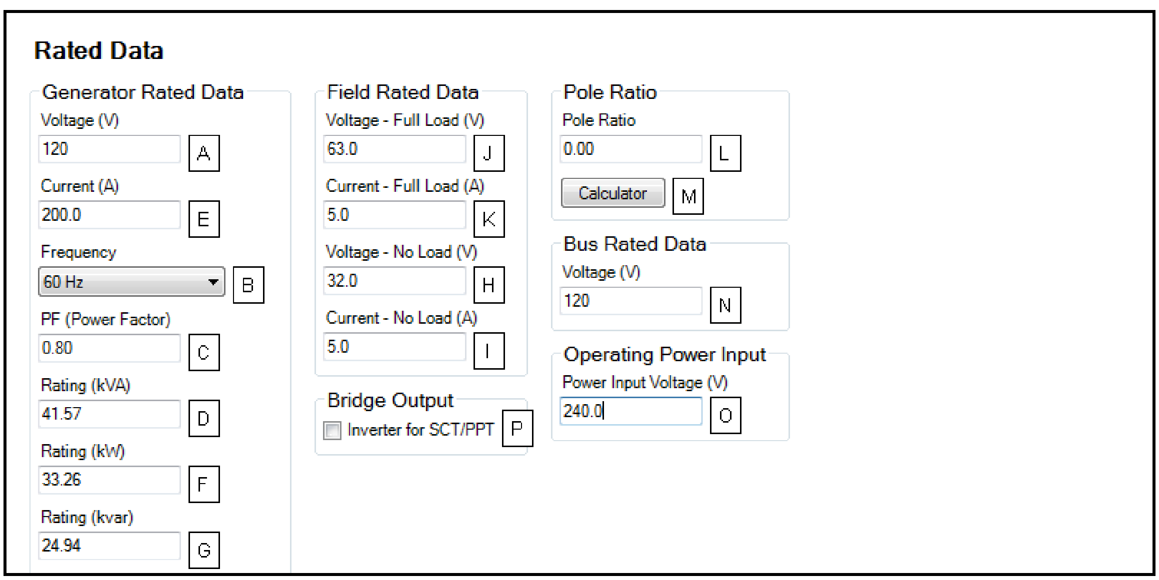


Figure 146. Generator, Bus, Field, and Pole Ratio Ratings

[A] *Generator Voltage Rating*: Adjustable from 1 to 500,000 Vac in 1 Vac increments.
[B] *Generator Frequency Rating*: Select 50 or 60 Hz.
[C] *Generator PF (Power Factor)*: Adjustable from –0.5 to 0.5 in 0.001 increments.
[D] *Generator Voltamperes*: Adjustable from 0 to 1,000,000 kVA in 0.01 kVA increments.
[E] *Generator Current*: Read-only value calculated from the generator VA and voltage.
[F] *Generator Power*: Read-only value calculated from the generator voltage, current, and PF.
[G] *Generator Reactive Power:* Read-only value calculated from the generator VA and PF.
[H] *Field Voltage No Load*: Adjustable from 1 to 264 Vdc in 0.1 Vdc increments.
[I] *Field Current No Load*: Adjustable from 0.1 to 20 Adc in 0.1 Adc increments.
[J] *Field Voltage Full Load*: Adjustable from 1 to 264 Vdc in 0.1 Vdc increments.
[K] *Field Current Full Load*: Adjustable from 0.1 to 20 Adc in 0.1 Adc increments.
[L] *Pole Ratio:* Adjustable from 0 to 10 in 0.01 increments.
[M] *Calculator*: Choose number of exciter and generator poles to calculate pole ratio.
[N] *Bus Voltage*: Adjustable from 1 to 500,000 Vac in 1 Vac increments.
[O] *Power Input Voltage*: Adjustable from 1 to 480 V in .01 increments.
[P] *Inverted Output*: Check box to enable inversion, uncheck to disable inversion.

Sensing Transformer Ratings and Configuration

BESTCOMS*Plus*® Navigation Path: Settings Explorer, System Parameters, Sensing Transformers
HMI Navigation Path: Settings, System Parameters, Sensing Transformers

DECS-250N configuration includes entry of the primary and secondary values for the transformers that supply generator and bus sensing values to the DECS-250N. These configuration settings are illustrated in Figure 147.

Generator PT

Voltage settings for the generator PT primary[A] and secondary[B] windings establish the nominal PT voltages expected by the DECS-250N. ABC or ACB phase rotation[C] can be accommodated. Options for the generator voltage sensing connections[D] include single-phase (across phases C and A) and three-phase sensing using three-wire connections.

Generator CTs

Current settings for the generator CT primary[E] and secondary[F] windings establish the nominal CT current values expected by the DECS-250N. DECS-250N sensing current can be obtained from a single phase or all three generator phases[G].

Bus PT

Voltage settings for the bus PT primary[H] and secondary[I] windings establish the nominal bus PT voltages expected by the DECS-250N. Options for the bus voltage sensing connections[J] include single-phase (across phases A and C) and three-phase sensing using three-wire delta connections.

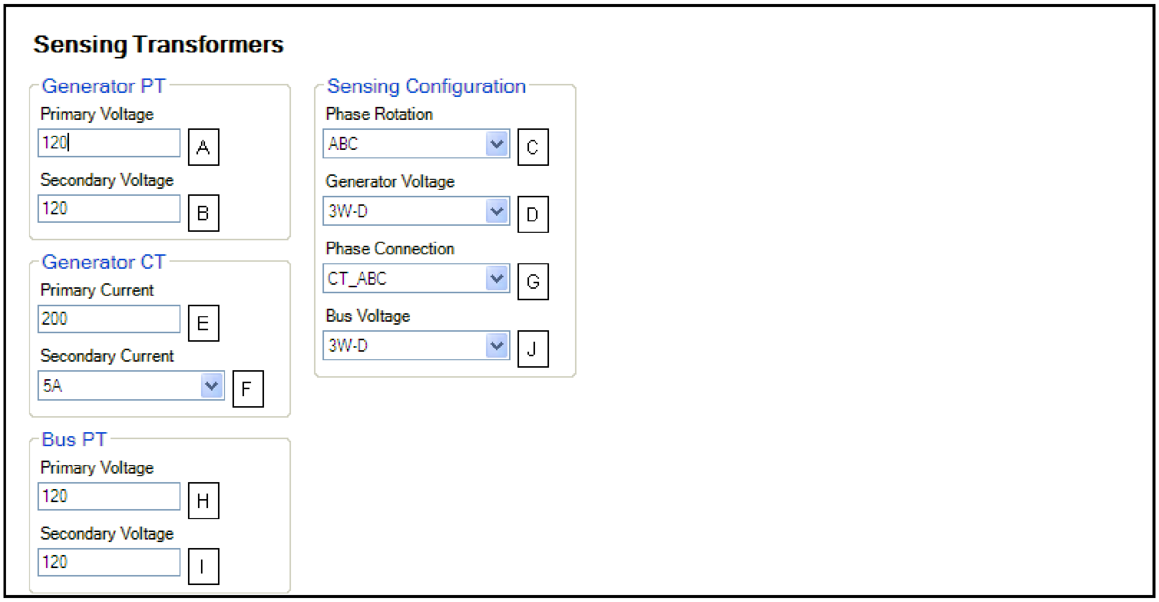


Figure 147. Sensing Transformer Ratings and Configuration

[A] *Generator PT Primary Voltage*: Adjustable from 1 to 500,000 Vac in 1 Vac increments.
[B] *Generator PT Secondary Voltage*: Adjustable from 1 to 600 Vac in 1 Vac increments.
[C] *Generator PT Phase Rotation*: Select ABC or ACB rotation.
[D] *Generator Voltage Connections*: Select CA or 3W-D.
[E] *Generator CT Primary Current*: Adjustable from 1 to 99,999 Aac in 1 Aac increments.
[F] *Generator CT Secondary Current*: Select 1 or 5 Aac.
[G] *Generator CT Configuration*: Select B or CT_ABC.
[H] *Bus PT Primary Voltage*: Adjustable from 1 to 500,000 Vac in 1 Vac increments.
[I] *Bus PT Secondary Voltage*: Adjustable from 1 to 600 Vac in 1 Vac increments.
[J] *Bus Voltage Sensing Connections*: Select CA or 3W-D.

Bridge Operating Power Configuration

BESTCOMS*Plus*® Navigation Path: Settings Explorer, System Parameters, Bridge
HMI Navigation Path: Settings, System Parameters, Bridge

DECS-250N bridge operating power configuration includes selection of the input voltage range and mode of operation. These settings are illustrated in Figure 148.

Operating Power Input

AC voltage range[A] settings for bridge operating power establish the values expected by the DECS-250N.

Modes of Operation

Firing Pulse Mode

Firing Pulse Mode[B] settings for the bridge operating power establish the number of phases expected by the DECS-250N.

Single-Phase Selection

Single-phase[C] settings establish which pair of phases the DECS-250N expects to supply bridge operating power. This option is disabled when *Three Phase* is the selected firing pulse mode.

Rated Frequency

A Rated Frequency[D] setting establishes the rated operating power frequency to be expected by the DECS-250N.

Maximum Over-Speed

The Maximum Over-Speed[E] setting establishes the maximum frequency to be expected by the DECS-250N during an over-speed condition.

Figure 148. Bridge Operating Power Configuration

[A] *Voltage:* Select 100-139 or 190-277.
[B] *Firing Pulse Mode:* Select Single Phase or Three Phase
[C] *Single Phase Selection:* Select A-B, B-C, or A-C.
[D] *Rated Frequency:* Adjustable from 20 to 60 Hz, or 61 to 420 Hz in 1 Hz increments depending on style.
[E] *Maximum Over-Speed:* Adjustable from 50 to 320% in 1% increments.

Startup Functions

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Operating Settings, Startup
HMI Navigation Path: Settings, Operating Settings, Startup

DECS-250N startup functions consist of soft start and field flashing. These settings are illustrated in Figure 149.

Soft Start

During startup, the soft start function prevents voltage overshoot by controlling the rate of generator terminal voltage buildup (toward the setpoint). Soft start is active in AVR, FCR, and FVR regulation modes. Soft start behavior is based on two parameters: level and time. The soft start level[A] is expressed as a percentage of the nominal generator terminal voltage and determines the starting point for generator voltage buildup during startup. The soft start time[B] defines the amount of time allowed for the buildup of generator voltage during startup. Two groups of soft start settings (primary and secondary) provide for independent startup behavior which is selectable through BESTlogic™*Plus*.

Field Flashing

To ensure generator voltage buildup, the field flashing function applies and removes flashing power from an external field flashing source. Field flashing is active in AVR, FCR, and FVR control modes. During system startup, the application of field flashing is based on two parameters: level and time.

The field flash dropout level[C] determines the level of generator voltage where field flashing is withdrawn. In AVR mode, the field flash dropout level is expressed as a percentage of the generator terminal voltage. In FCR mode, the level is expressed as a percentage of the field current. And in FVR mode, the level is expressed as a percentage of the field voltage.

The field flash time[D] defines the maximum length of time that field flashing may be applied during startup.

To use the field flashing function, one of the DECS-250N programmable contact outputs must be configured as a field flashing output.

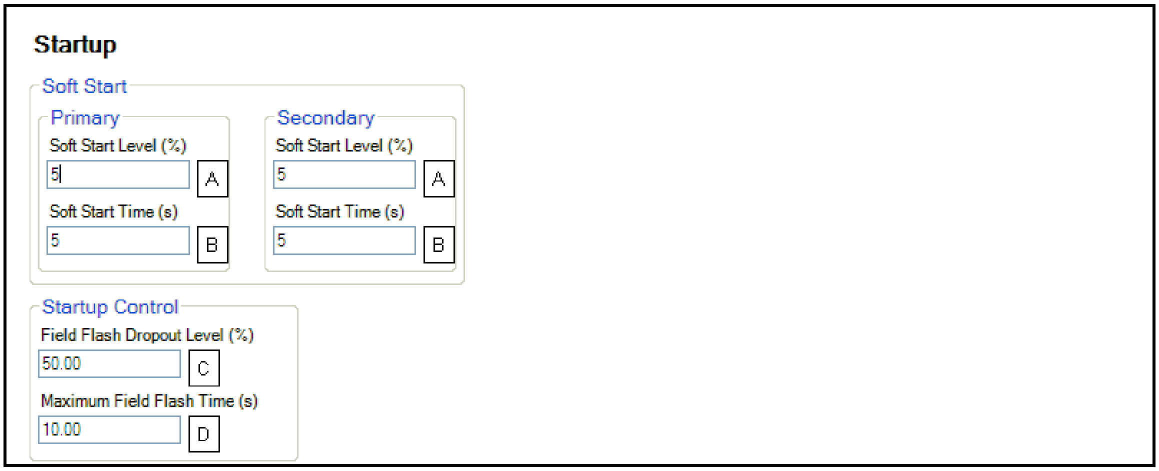


Figure 149. Startup Function Settings

[A] *Soft Start Level (%)*: Adjustable from 0 to 90% in 1% increments.
[B] *Soft Start Time (s)*: Adjustable from 1 to 7,200 seconds in 1 second increments.
[C] *Field Flash Dropout Level*: Adjustable from 0 to 100% in 1% increments.
[D] *Maximum Field Flash Time*: Adjustable from 1 to 50 seconds in 1 second increments.

Device Information

BESTCOMS*Plus*® Navigation Path: Settings Explorer, General Settings, Device Info
HMI Navigation Path: Settings, General Settings, Device Information, DECS-250N

Device information includes user-assigned identification labeling and read-only firmware version information and product information. Device information (Figure 150) is provided for the DECS-250N, CEM-2020 Contact Expansion Module, and AEM-2020 Analog Expansion Module.

Firmware and Product Information

Firmware and product information can be viewed on the HMI display and Device Info tab of BESTCOMS*Plus*.

Firmware Information

Firmware information is provided for the DECS-250N, optional CEM-2020, and optional AEM-2020. This information includes the application part number[A], version number[B], and build date[C]. Also included is the version of the boot code[D]. When configuring settings in BESTCOMS*Plus* while disconnected from a DECS-250N, an Application Version Number setting[E] is available to ensure compatibility between the selected settings and the actual settings available in the DECS-250N.

Product Information

Product information for the DECS-250N, CEM-2020, and AEM-2020 includes the device model number[F] and serial number[G].

Device Identification

The user-assigned *Device ID*[H] can be used to identify DECS-250N controllers in reports and during polling.

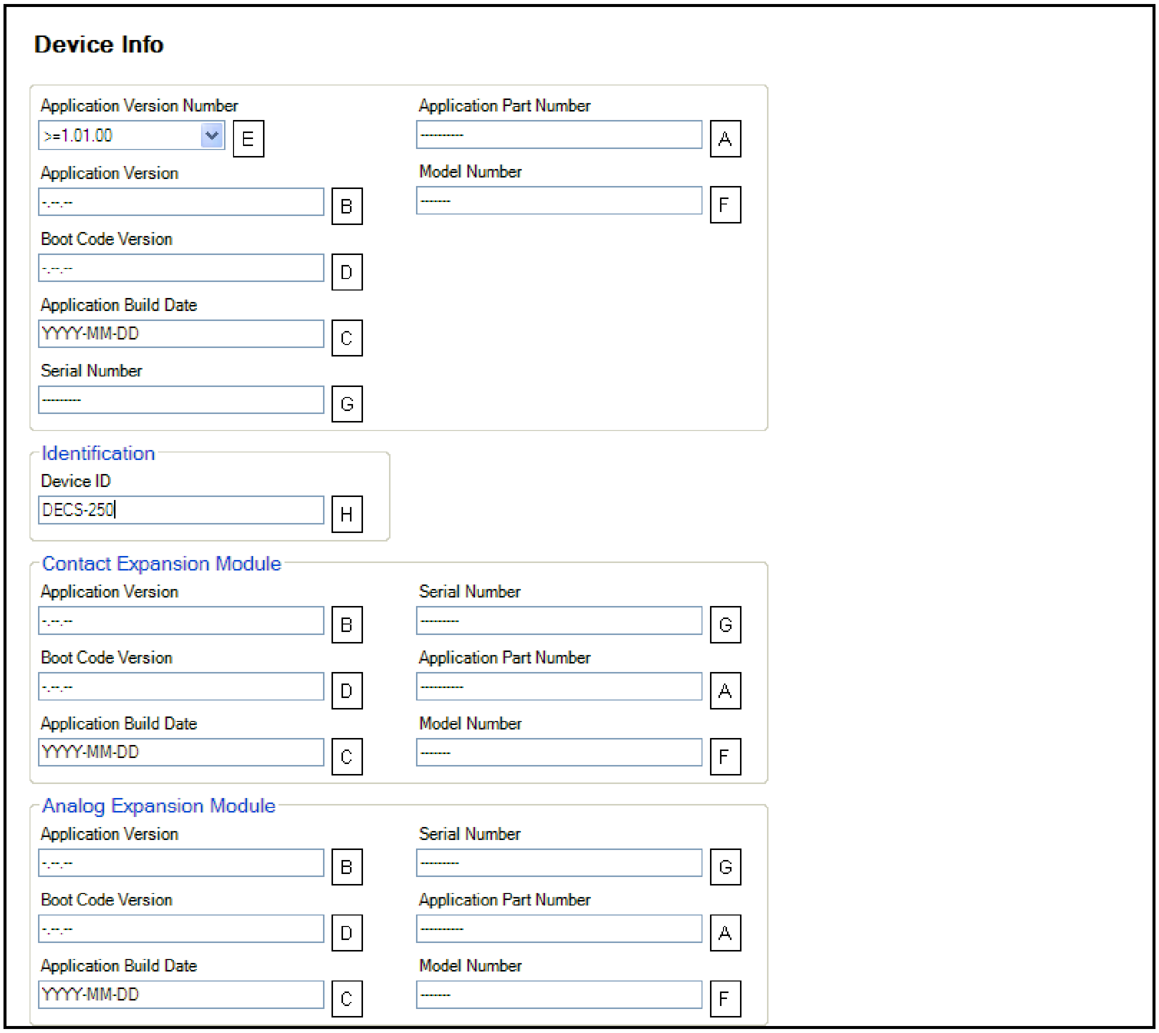


Figure 150. Device Information

[A] *Application Part Number:* Read-only field indicates the firmware file part number.
[B] *Application Version:* Read-only field indicates the firmware version number.
[C] *Application Build Date:* Read-only field indicates the release date of the device firmware.
[D] *Boot Code Version:* Read-only field indicates the version of hardware boot code.
[E] *Application Version Number:* When configuring settings offline, select the appropriate firmware version to ensure settings/features compatibility with the DECS-250N.
[F] *Model Number:* Read-only field displays the product model number.
[G] *Serial Number:* Read-only field displays the serial number of the product.
[H] *Device ID:* Enter up to 60 alphanumeric characters.

Display Units

BESTCOMS*Plus*® Navigation Path: General Settings, Display Units
HMI Navigation Path: N/A

When working with DECS-250N settings in BESTCOMS*Plus*, you have the option of viewing the settings in English or Metric[A] units and as primary units or per-unit values[B]. When per-unit values are selected, settings are entered as per-unit values and BESTCOMS*Plus* converts the per-unit inputs to high-side values based on the generator rated data. The *display units* setting is illustrated in Figure 151 and is not available for settings shown on the front panel display.

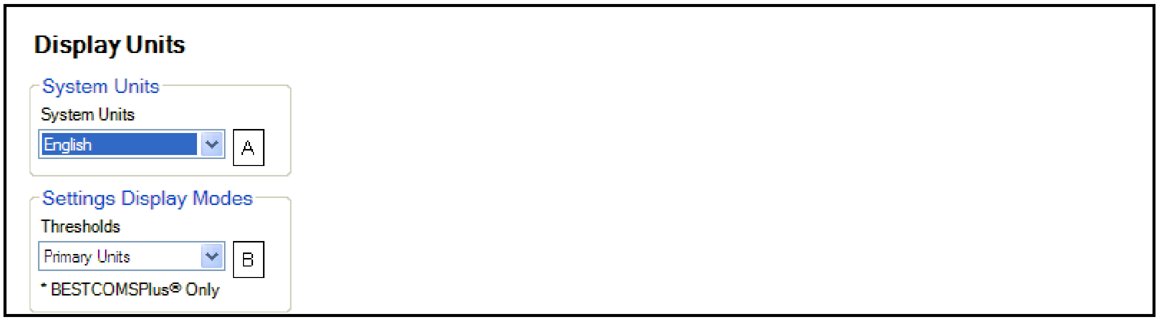


Figure 151. Display Units

[A] *System Units:* Select English or Metric
[B] *Thresholds:* Select Primary Units or Per Unit.

Security

DECS-250N security is provided in the form of passwords which control the type of operations allowed by a particular user. Passwords can be tailored to provide access to specific operations. Additional security is available by controlling the type of operations allowed through certain DECS-250N communication ports.

Security settings are uploaded and downloaded separately from the settings and logic. See the *BESTCOMSPlus*® chapter for more information on uploading and downloading security.

Password Access

BESTCOMS*Plus* Navigation Path: Settings Explorer, General Settings, Device Security Setup, User Name Setup

A username and password can be established for one of six functional access areas within the DECS-250N. These access areas are listed in Table 15 according to rank. A username and password with higher access can be used to gain access to operations controlled by a password with lower access. For example, a settings-level username and password has access to operations protected by the settings-, operator-, control-, and read-level usernames and passwords. This screen cannot be accessed when in Live Mode.

Table 15. Password Access Levels and Descriptions

Access Level	Description
Admin	Highest access level. Usernames and passwords can be created, edited, and deleted.
Design	Programmable logic can be created or edited.
Settings	All setting values can be changed. Logic cannot be edited or deleted.
Operator	Date and time can be set, accumulated values can be reset, and event data can be erased.
Control	Real-time controls can be operated.
Read	All system parameters can be read but no changes or operations are permitted.
None	Lowest access level. All access is denied.

Password Creation and Configuration

Usernames and passwords are created and configured in BESTCOMS*Plus*® on the Username Setup tab (Figure 152) of the Device Security Setup area. To create and configure a username and password, perform the following steps.

1. In the BESTCOMS*Plus* settings explorer, select *User Name Setup*. This selection is located under *General Settings, Device Security Setup*. When prompted, enter a username of “A” and a password of “A” and log on. This factory-default username and password allows administrator-level access. It is highly recommended that this factory-default password be changed immediately to prevent undesired access.
2. Highlight an “UNASSIGNED” entry in the user list[A]. (Highlighting a previously-established username will display the password and access level for the user. This enables the password and access level for an existing user to be changed.)
3. Enter the desired username[B].
4. Enter the desired password for the user[C].
5. Reenter the password created in step 4 to verify the password[D].

6. Select the maximum allowed access level[E] for the user.
7. If a maximum duration is desired for the user's access, enter the limit[F] (in days). Otherwise, leave the expiration value at zero.
8. Click the Save User button[G] to save the user settings.
9. Open the *Communication* menu*,* and click *Upload Security to Device*.
10. BESTCOMS*Plus*® notifies you when the security upload is successful.

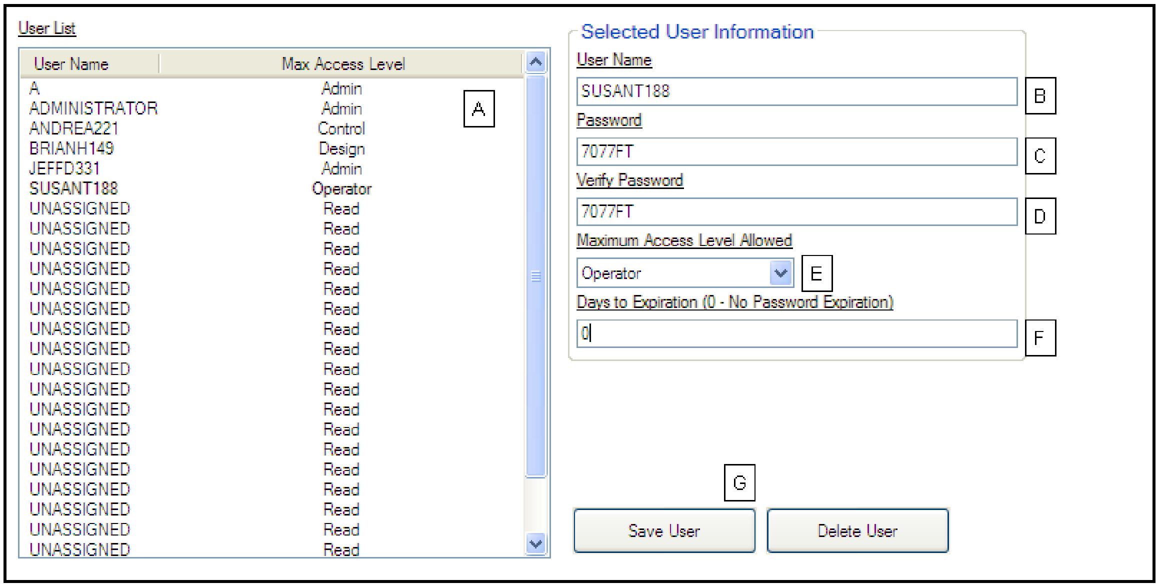


Figure 152. Password Access Settings

[A] *User List:* Displays 26 usernames and the corresponding maximum access levels.
[B] *User Name:* Accepts up to a 16 character label that may include upper and lowercase letters, numbers, and special characters.
[C] *Password:* Accepts up to a 16 character label that may include upper and lowercase letters, numbers, and special characters.
[D] *Verify Password:* Accepts up to a 16 character label that may include upper and lowercase letters, numbers, and special characters.
[E] *Maximum Access Level Allowed:* Select Read, Control, Operator, Settings, Design, or Admin.
[F] *Days to Expiration:* Adjustable from 0 to 50,000 days in 1 day increments. 0 disables setting.
[G] *Save User:* Click button to save username and password settings.

Port Security

BESTCOMS*Plus* Navigation Path: Settings Explorer, General Settings, Device Security Setup, Port Access Setup

An additional dimension of security is provided by the ability to restrict the control available through the DECS-250N communication ports. At any given time, only one port can be in use with read or higher access. For example, if a user gains settings access at one port, users at other ports will be able to gain no higher than read access until the user with settings access logs off. This screen cannot be accessed when in Live Mode.

Port Access Configuration

Communication port access is configured in BESTCOMS*Plus*® on the Port Access Setup tab (Figure 153) of the Device Security Setup area. To configure communication port access, perform the following steps.

1. In the BESTCOMS*Plus* settings explorer, select *Port Access Setup*. This selection is located under *General Settings, Device Security Setup*. When prompted, enter a username of “A” and a password of “A” and log on. This factory-default username and password allows administrator-level access. It is highly recommended that this factory-default password be changed immediately to prevent undesired access.
2. Highlight the desired communication port in the port list[A].
3. Select the unsecured access level[B] for the port.
4. Select the secured access level[C] for the port.
5. Save the configuration by clicking the Save port button[D].
6. Open the *Communication* menu, and click *Upload Security to Device*.
7. BESTCOMS*Plus*® notifies you when the security upload is successful.

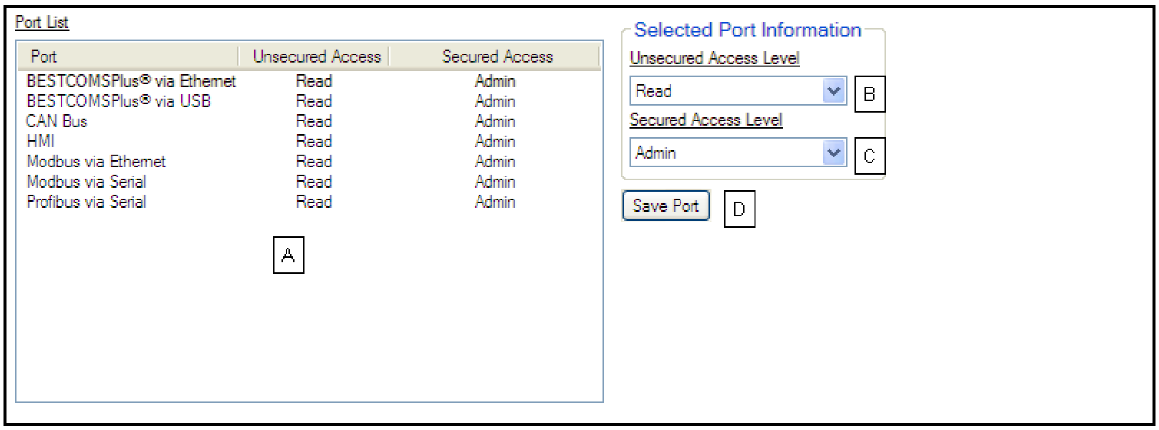


Figure 153. Port Access Configuration Settings

[A] *Port List:* Displays available communication ports and the corresponding access levels.
[B] *Unsecured Access Level:* Select None, Read, Control, Operator, Settings, Design, or Admin.
[C] *Secured Access Level:* Select None, Read, Control, Operator, Settings, Design, or Admin.
[D] *Save Port:* Click button to save port access settings.

Login and Access Controls

BESTCOMS*Plus* Navigation Path: Settings Explorer, General Settings, Device Security Setup, Access Control

Additional controls are available to limit login time and login attempts. These control settings are illustrated in Figure 154.

Access Timeout

The access timeout setting[A] maintains security by automatically withdrawing password access if a user neglects to log out. If no activity is seen for the duration of the access timeout setting, password access is automatically withdrawn.

Login Failure

A login attempts setting[B] limits the number of times that login can be attempted. A login time window[C] limits the length of time permitted during the login process. If login is unsuccessful, access is blocked for the duration of the login lockout time setting[D].

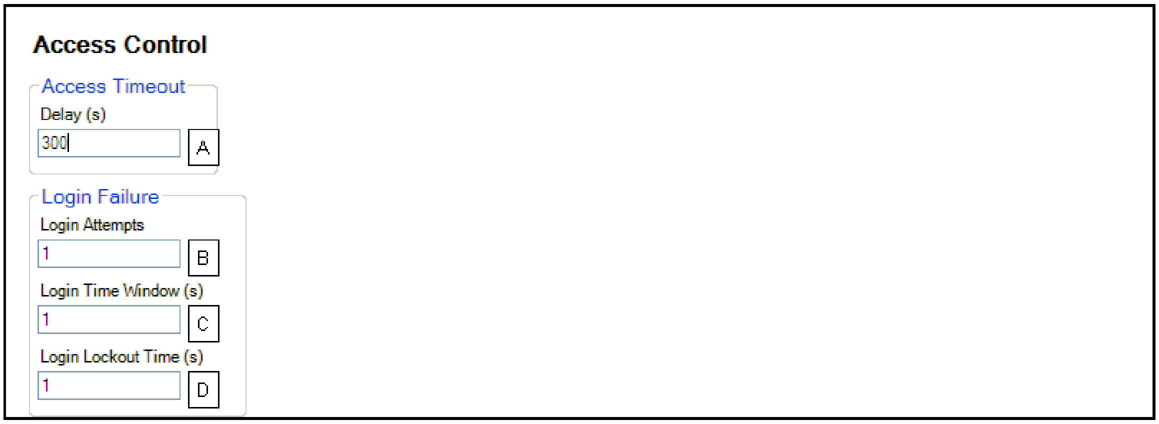


Figure 154. Login and Access Control Settings

[A] *Access Timeout:* Adjustable from 10 to 3,600 s in 1 s increments.
[B] *Login Attempts:* Adjustable from 1 to 10 in increments of 1.
[C] *Login Time Window:* Adjustable from 1 to 99,999 s in 1 s increments.
[D] *Login Lockout Time:* Adjustable from 1 to 99,999 s in 1 s increments.

Timekeeping

The DECS-250N clock is used by the logging functions to timestamp events. DECS-250N timekeeping can be self-managed by the internal clock or coordinated with an external source through a network or IRIG device.

BESTCOMS*Plus*® Timekeeping settings are shown in Figure 155.

BESTCOMS*Plus* Navigation Path: Settings Explorer, General Settings, Clock Setup
HMI Navigation Path: Settings, General Settings, Clock Setup

Time and Date Format

Clock display settings enable you to configure the time and date reported by the DECS-250N to match the conventions used in your organization/facility. The reported time can be configured for either the 12- or 24-hour format[A] with the Time Format setting. The Date Format setting[A] configures the reported date for one of three available formats: MM-DD-YYYY, DD-MM-YYYY, or YYYY-MM-DD.

Daylight Saving Time Adjustments

The DECS-250N can automatically compensate for the start and end of daylight saving time (DST) on a fixed- or floating-date basis[B]. A fixed-date, for example, is March 2, and an example of a floating-date is, "Second Sunday of March". DST compensation can be made in respect to your local time or coordinated universal time (UTC)[C]. DST start[D] and end[E] points are fully configurable and include a bias adjustment[F].

Network Time Protocol (NTP)

When connected to an Ethernet network, the DECS-250N can use NTP to assure accurate, synchronized timekeeping. By synchronizing with a radio, atomic, or other clock located on the internet/intranet, each DECS-250N maintains accurate timekeeping that is coordinated with the time source.

NTP Settings

NTP is enabled in the DECS-250N by entering the internet protocol (IP) address of the network timeserver in the four decimal-separated fields of the NTP Address setting[G]. Time zone offset settings[H] provide the necessary offset from the coordinated universal time (UTC) standard. Central standard time is six hours and zero minutes behind (–6, 0) UTC and is the default setting.

The Time Priority Setup must be used to enable a connected time source. When multiple time sources are connected, the Time Priority Setup[I] can be used to rank the sources according to their priority.

IRIG

When the IRIG source is enabled, through the Time Priority Setup, it begins synchronizing the DECS-250N internal clock with the time code signal.

Some older IRIG receivers may use a time code signal compatible with IRIG standard 200-98, format B002, which does not contain year information. To use this standard, select the *IRIG without Year* radio button in the *IRIG Decoding* box[J]. Year information is stored in nonvolatile memory so the year is retained during a control power interruption.

The IRIG input accepts a demodulated (dc level-shifted) signal. For proper recognition, the applied IRIG signal must have a logic high level of no less than 3.5 Vdc and a logic low level that is no higher than 0.5 Vdc. The input signal voltage range is –10 Vdc to +10 Vdc. Input resistance is nonlinear and approximately 4 kΩ at 3.5 Vdc and 3 kΩ at 20 Vdc. IRIG signal connections are made at terminals IRIG+ and IRIG– which are located on the right side panel.

The Time Priority Setup must be used to enable a connected time source. When multiple, time sources are connected, the Time Priority Setup[I] can be used to rank the sources according to their priority.

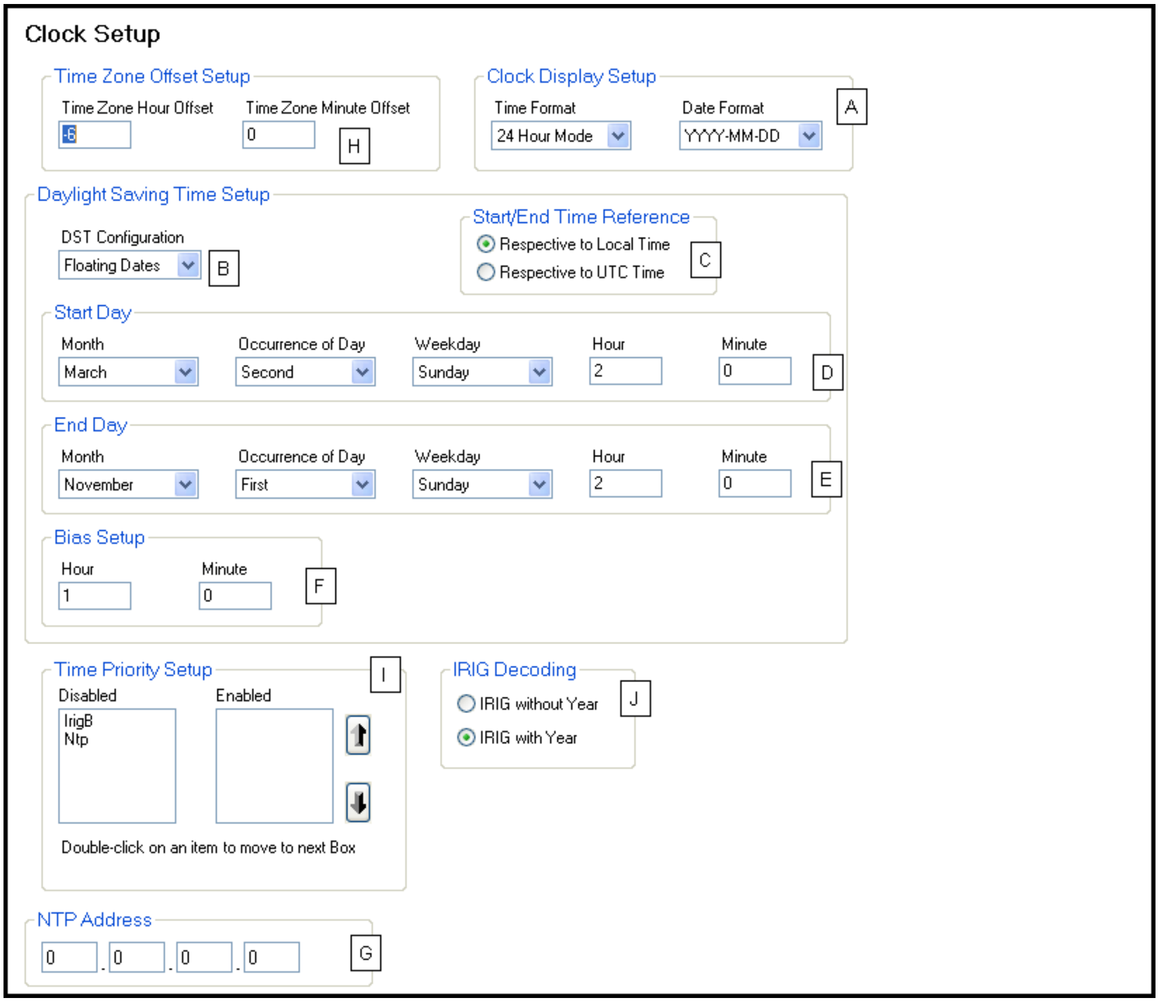


Figure 155. Clock Setup

[A] *Time Format and Date Format:* Time format is 12- or 24-hour mode. Date format is MM-DD-YYYY, DD-MM-YYYY, or YYYY-MM-DD.

[B] *DST Config:* Select Disabled, Floating Dates, or Fixed Dates.

[C] *Start/End Time Reference:* Select “Respective to Local Time” or “Respective to UTC Time”.

[D] For Floating Date DST Configuration:

DST Start Month: Select desired month for DST start.
DST Start Week of Month: Select First, Second, Third, Fourth, or Last.
DST Start Day of Week: Select desired day of the week for DST start.
DST Start Hour: Adjustable from hour 0 to 23 in 1 hour increments.
DST Start Minutes: Adjustable from minute 0 to 59 in 1 minute increments.

For Fixed Date DST Configuration:

DST Start Month: Select desired month for DST start.
<Day>: Select desired day (number) of month.
DST Start Hour: Adjustable from hour 0 to 23 in 1 hour increments.
DST Start Minutes: Adjustable from minute 0 to 59 in 1 minute increments.

[E] For Floating Date DST Configuration:

DST Stop Month: Select desired month for DST stop.
DST Stop Week of Month: Select First, Second, Third, Fourth, or Last.
DST Stop Day of Week: Select desired day of the week for DST stop.
DST Stop Hour: Adjustable from hour 0 to 23 in 1 hour increments.
DST Stop Minutes: Adjustable from minute 0 to 59 in 1 minute increments.

For Fixed Date DST Configuration:

DST Stop Month: Select desired month for DST stop.

<Day>: Select desired day (number) of month.

DST Stop Hour: Adjustable from hour 0 to 23 in 1 hour increments.

DST Stop Minutes: Adjustable from minute 0 to 59 in 1 minute increments.

[F] *DST Bias Hours:* Adjustable from –12 to 12 hours in 1 hour increments.

DST Bias Minutes: Adjustable from –59 to 59 minutes in 1 minute increments.

[G] *NTP Address:* Four decimal-separated numbers determined by the IP address of the networked time source.

[H] *Time Zone hour and Minute Offset:* Hour offset is adjustable over the range of –12 to 12 hours in 1 hour increments. Minute offset is adjustable over the range of –59 to 59 minutes in 1 minute increments.

[I] *Time Priority Setup:* Sort available time sources using the two arrow buttons.

[J] *IRIG Decoding:* Select IRIG without Year or IRIG with Year.

Testing

Testing of the DECS-250N's regulation and optional power system stabilizer (style XPXXXXX) performance is possible through the integrated analysis tools of BESTCOMS*Plus*®.

Real-Time Metering Analysis

BESTCOMS*Plus* Navigation Path: Metering Explorer, Analysis
HMI Navigation Path: Analysis functions are not available through HMI.

Proper voltage regulator performance is critical to power system stabilizer performance. Step response measurements of the voltage regulator should be performed to confirm the AVR gain and other critical parameters. A transfer function measurement between terminal voltage reference and terminal voltage should be performed with the machine operating at very low load. This test provides an indirect measurement of the PSS phase requirement. As long as the machine is operating at very low load, the terminal voltage modulation does not produce significant speed and power changes.

The BESTCOMS*Plus* Real-Time Metering Analysis screen can be used to perform and monitor on-line AVR and PSS testing. Six plots of user-selected data can be generated and the logged data can be stored in a file for later examination. BESTCOMS*Plus* must be in *Live Mode* in order to start plotting. Live Mode is found under the *Options* menu on the lower menu bar. RTM Analysis screen controls and indications are illustrated in Figure 156.

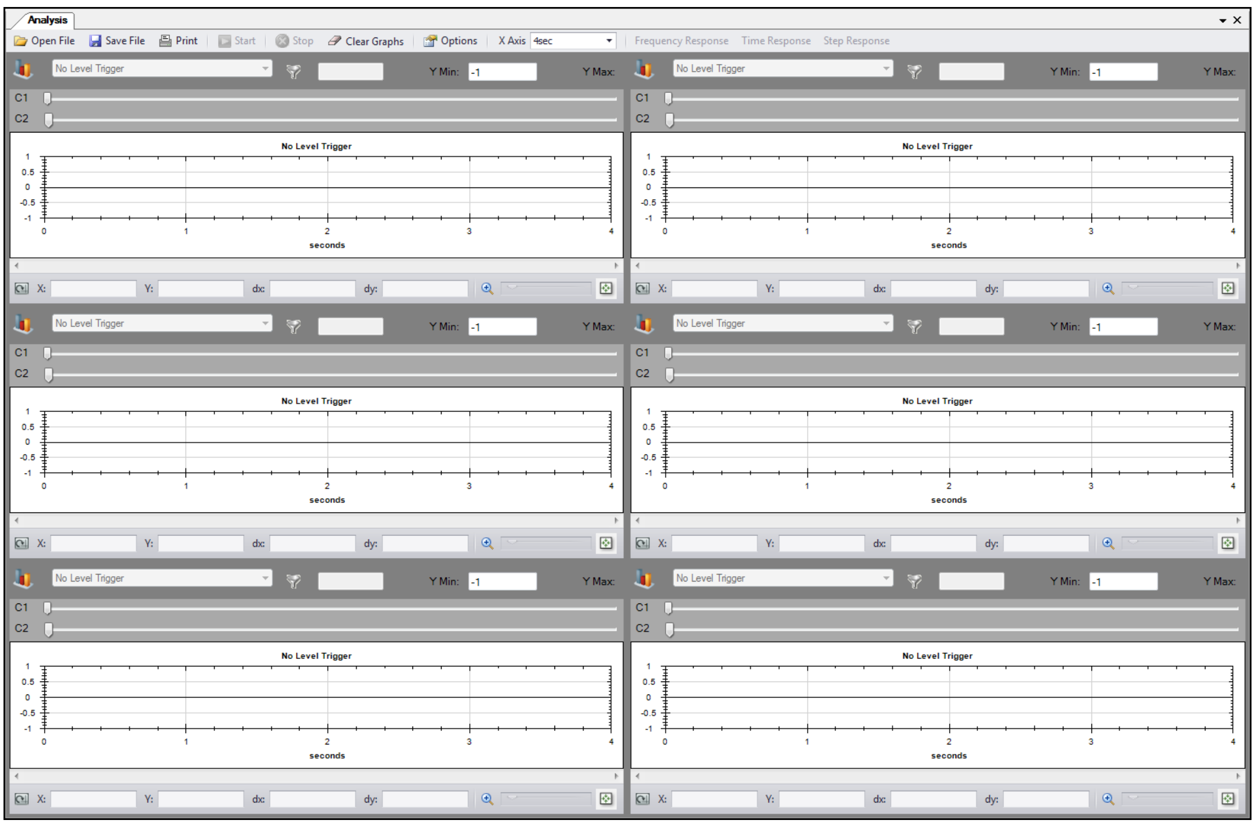


Figure 156. RTM Analysis Screen

With the RTM Analysis screen controls, you can:

- Select the parameters to be graphed
- Adjust the resolution of the graph x axis and the range of the graph y axis
- Start and stop plot captures
- Open an existing graph file, save a captured plot in a graph file, and print a captured graph

Graph Parameters

Any two of the following parameters may be selected for plotting in the graph areas.

- Auxiliary voltage input (Vaux)
- Average line current (Iave)
- Average line-to-line voltage (Vave)
- AVR error signal (ErrIn)
- AVR output
- Bus frequency (B Hz)
- Bus voltage (Vbus)
- Compensated frequency deviation (CompF)
- Control output (CntOp)
- Cross-current input (Iaux)
- Droop
- FCR error
- FCR state
- FCR output
- Field current (Ifd)
- Field voltage (Vfd)
- Filtered mechanical power (MechP)
- Final PSS output (Pout)
- Frequency response signal (Test)
- FVR error
- FVR state
- FVR output
- Generator frequency (G Hz)
- Internal state (TrnOp)
- Lead-lag #1 (x15)
- Lead-lag #2 (x16)
- Lead-lag #3 (x17)
- Lead-lag #4 (x31)
- Mechanical power (x10)
- Mechanical power (x11)
- Mechanical power (x7)
- Mechanical power (x8)
- Mechanical power (x9)
- Negative sequence current (I2)
- Negative sequence voltage (V2)
- Network Load Share
- Null Balance Level (Null Balance)
- Null Balance State (Null State)
- OEL controller output (OelOutput)
- OEL reference
- OEL state
- Phase A current (Ia)
- Phase A to B, line-to-line voltage (Vab)
- Phase B current (Ib)
- Phase B to C, line-to-line voltage (Vbc)
- Phase C current (Ic)
- Phase C to A, line-to-line voltage Vca
- Position Indication (PositionInd)
- Positive sequence current (I1)
- Positive sequence voltage (V1)
- Post-limit output (Post)
- Power factor (PF)
- Power HP #1 (x5)
- Pre-limit output (Prelim)
- PSS electrical power (PSSkW)
- PSS terminal voltage (Vtmag)
- Reactive power (kvar)
- Real power (kW)
- SCL controller output (SclOutput)
- SCL reference
- SCL state
- SCL PF reference
- Speed HP #1 (x2)
- Synthesized speed (Synth)
- Terminal frequency deviation (TermF)
- Time response signal (Ptest)
- Torsional filter #1 (Tflt1)
- Torsional filter #2 (x29)
- Total power (kVA)
- UEL controller output (UelOutput)
- UEL reference
- UEL state
- Var limiter output (VArLimOutput)
- Var limiter reference
- Var limiter state
- Var/PF error
- Var/PF state
- Var/PF output
- Washed out power (WashP)
- Washed out speed (WashW)

Frequency Response

Frequency response testing functions are available by clicking the RTM Analysis screen Frequency Response button. Frequency Response screen functions are illustrated in Figure 157 and described as follows.

Test Mode

Frequency response testing may be performed in Manual or Auto mode. In Manual mode, a single frequency can be specified to obtain the corresponding magnitude and phase responses. In Auto mode, BESTCOMS*Plus*® will sweep the range of frequencies and obtain the corresponding magnitude and phase responses.

Manual Test Mode Options

Manual test mode options include settings to select the frequency and magnitude of the applied test signal. A time delay setting selects the time after which the magnitude and phase response corresponding to the specified frequency is computed. This delay allows transients to settle before computations are made.

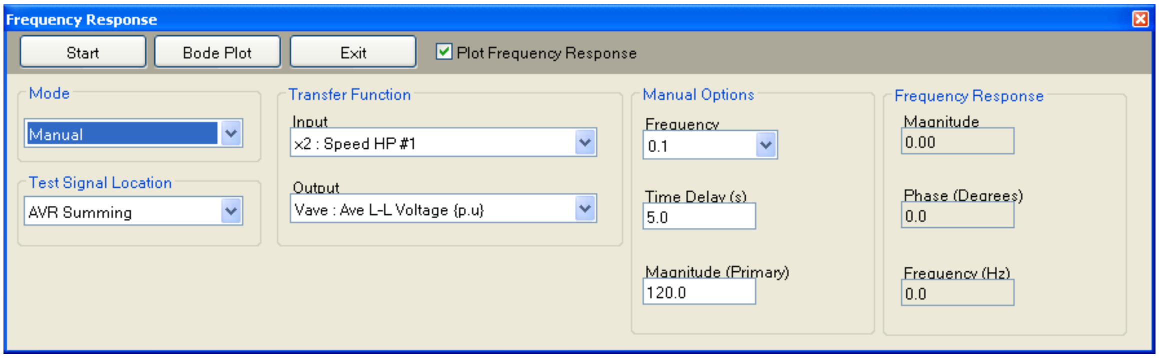


Figure 157. Frequency Response Screen

Auto Test Mode Options

Automatic test mode options include settings to select the minimum frequency, maximum frequency, and magnitude of the sinusoidal wave that is applied during a frequency response test.

Bode Plotting

A Bode plot can be printed, opened, and saved in graph (.gph) format.

Transfer Function

The point in the DECS-250N logic circuitry where a signal is injected for analysis of magnitude and phase responses is selectable. Signal points include PSS Comp Frequency, PSS Electric Power, AVR Summing, AVR PID Input, and Manual PID Input.

The type of input signal to be injected and output point are selectable, and include:

- AvrOut
- B Hz: Bus Frequency {Hz}
- CntOp: Control Output {pu}
- CompF: Compensated Frequency Deviation
- Droop
- ErrIn: AVR Error Signal
- FcrErr
- FcrOut
- FcrState
- FvrErr
- FvrOut
- FvrState
- G Hz: Generator Frequency {Hz}
- I1: Positive Sequence Current {pu}
- I2: Negative Sequence Current {pu}
- Ia: Phase A Current {pu}
- Iaux: Cross Current Input {pu}
- Iave: Ave Line Current{pu}
- Ib: Phase B Current {pu}
- Ic: Phase C Current {pu}
- Ifd: Field Current {pu}
- kVA: Total Power {pu}
- kvar: Reactive Power {pu}
- kW: Real Power {pu}
- MechP: Filtered Mechanical Power
- Network Load Share
- NullBalance: Null Balance Level
- OelOutput: OEL Controller Output
- OelRef
- OelState
- PF: Power Factor
- PositionInd: Position Indication {pu}
- Post: Post-Limit Output {pu}
- POut: Final PSS Output {pu}
- Prelim: Pre-Limit Output {pu}
- PsskW: PSS Electric Power {pu}
- Ptest: Time Response Signal {pu}
- SclOutput: SCL Controller Output
- SclRef

- SclPfRef
- SclState
- Synth: Synthsized Speed {pu}
- TermF: Terminal Frequency Deviation
- Test: Frequency Response Signal {pu}
- Tflt1: Torsional Filter #1 {pu}
- TrnOp: Internal State {pu}
- UelOutput: UEL Controller Output
- UelRef
- UelState
- V1: Positive Sequence Voltage {pu}
- V2: Negative Sequence Voltage {pu}
- Vab: PhA-PhB L-L Voltage {pu}
- Var/PfErr
- Var/PfOut
- Var/PfState
- VarLimOutput: Var Limiter Output
- VarLimRef
- VarLimState
- Vaux: Aux Voltage Input {pu}
- Vave: Ave L-L Voltage {pu}
- Vbc: PhB-PhC L-L Voltage {pu}
- Vbus: Bus Voltage {pu}
- Vca: PhC-PhA L-L Voltage {pu}
- Vfd: Field Voltage {pu}
- Vtmag: PSS Term Voltage
- WashP: Washed Out Power
- WashW: Washed Out Speed {pu}
- x10: Mechanical Power LP #3
- x11: Mechanical Power LP #4
- x15: Lead-Lag #1 {pu}
- x16: Lead-Lag #2 {pu}
- x17: Lead-Lag #3 {pu}
- x2: Speed HP #1
- x29: Torsional Filter #2 {pu}
- x31: Lead-Lag #4 {pu}
- x5: Power HP #1 {pu}
- x7: Mechanical Power {pu}
- x8: Mechanical Power LP #1
- x9: Mechanical Power LP #2

Frequency Response

Read-only frequency response fields indicate the magnitude response, phase response, and test signal frequency. The magnitude response and phase response corresponds to the test signal previously applied. The test frequency value reflects the frequency of the test signal currently being applied.

Caution
Exercise caution when performing frequency response testing on a generator connected to the grid. Frequencies that are close to the resonant frequency of the machine or neighboring machines are to be avoided. Frequencies above 3 Hz may correspond to the lowest shaft torsional frequencies of a generator. A torsional profile for the machine should be obtained from the manufacturer and consulted before conducting any frequency response tests.

Time Response

Tests should be performed at various load levels to confirm that the input signals are calculated or measured correctly. Since the PSS function uses compensated terminal frequency in place of speed, the derived mechanical power signal should be examined carefully to ensure that it does not contain any components at the electromechanical oscillation frequencies. If such components are present, it indicates that the frequency compensation is less than ideal, or that the machine inertia value is incorrect.

PSS test signal configuration settings are provided on the Time Response screen shown in Figure 158. Click the RTM Analysis screen's Time Response button to access this screen.

Signal Input

Signal input selections determine the point in the PSS circuitry where the test signal is applied. Test points include AVR Summing, PSS Comp Frequency, PSS Electric Power, PSS Derived Speed, Manual Summing, and var/PF.

A time delay is provided to delay the start of a PSS test after the Time Response screen Start button is clicked.

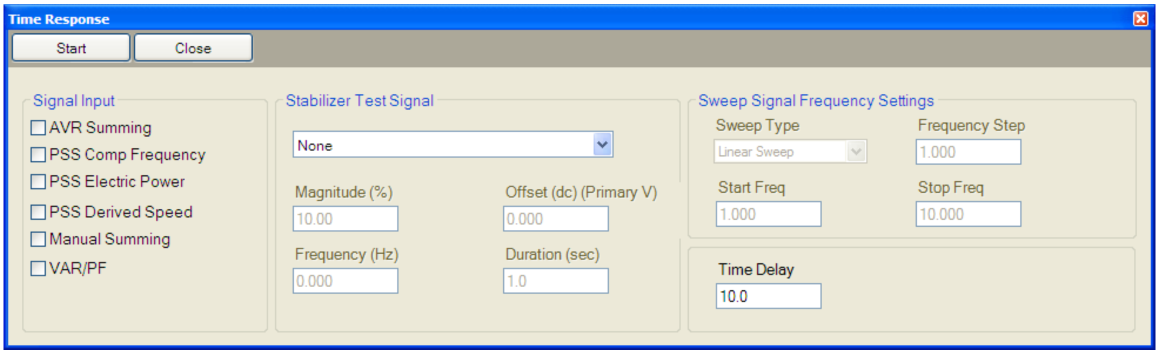


Figure 158. Time Response Screen

Test Signal Characteristics

Test signal characteristics (magnitude, offset, frequency, and duration) can be adjusted according to the type of test signal selected.

Magnitude

The test signal magnitude is expressed as a percentage and excludes the gain of externally-applied signals.

Offset

A dc offset can be applied to the PSS test signal. The offset is expressed as a per-unit value used in proper context wherever the test signal is applied. A dc offset cannot be applied to a Step test signal.

Frequency

The test signal frequency can be adjusted as desired for Step and Sine test signals. See *Swept Sine Test Signal* for information about configuring the frequency attributes of swept sine test signals.

Duration

A duration setting controls the total test duration for Sine and External test signals. For Step test signals, the duration setting determines the “on” period of the signal. The duration setting does not apply to Swept Sine signals.

Swept Sine Test Signals

Swept Sine test signals employ a unique set of characteristics that include the sweep style, frequency step, and start/stop frequencies.

Sweep Type

A Swept Sine test signal can be configured as linear or logarithmic.

Start and Stop Frequencies

The range of a Swept Sine test signal is determined by Start Frequency and Stop Frequency settings.

Frequency Step

The frequency of a Swept Sine test signal is incremented according to the sweep type used. For linear sweeps, the test signal frequency is incremented by “step” every half-cycle of the system frequency. For logarithmic sweeps, the test signal frequency is multiplied by 1.0 + step every half-cycle of the system frequency.

Step Response Analysis

A standard technique for verifying overall system response is through step response measurements. This involves exciting the local electromechanical oscillation modes through a fixed step change in the AVR reference. Damping and frequency of oscillation can be measured directly from recordings of generator speed and power for different operating conditions and settings. Normally this test is performed with variations of the following:

- Generator active and reactive power loading
- Stabilizer gain
- System configuration (e.g., lines out of service)
- Stabilizer parameters (e.g., phase lead, frequency compensation)

As the stabilizer gain is increased, the damping should increase continuously while the natural frequency of oscillation should remain relatively constant. Large changes in the frequency of oscillation, a lack of improvement in damping, or the emergence of new modes of oscillation are all indications of problems with the selected settings.

Step response testing is performed using the Step Response Analysis screen. This screen (Figure 159) is accessed by clicking the Step Response button in the RTM Analysis window. The Step Response Analysis screen consists of:

- Metering fields: generator VA, total vars and PF, field voltage, and field current
- An alarms window that displays any active alarms triggered by a step change
- Control buttons to start and stop step response analysis and a button to close the screen
- A checkbox to select triggering of a data record when a setpoint step change is performed
- Tabs for controlling the application of step changes to the AVR, FCR, FVR, var, and PF setpoints. Tab functions are described in the following paragraphs.

NOTE

If logging is in progress, another log cannot be triggered.

Response characteristics displayed on the Step Response Analysis screen are not automatically updated when the DECS-250N operating mode is switched externally. The screen must be manually updated by exiting and then reopening the screen.

AVR, FCR, and FVR Tabs

The AVR, FCR, and FVR tabs are similar in their controls that enable the application of step changes to their respective setpoints. AVR tab controls are illustrated in Figure 159. AVR, FCR, and FVR tab controls operate as follows.

Step changes that increase or decrease the setpoint are applied by clicking the increment (up arrow) or decrement (down arrow) button. Step-change setting fields (one for increase and one for decrease) establish the percent change in the setpoint that occurs when the increment or decrement button is clicked. A read-only setpoint field indicates the current setpoint and what the setpoint will be when a step change occurs. A button is provided to return the setpoint to its original value before any step changes were invoked. This original value is the setpoint established in the Setpoints section of the BESTCOMS*Plus*® settings explorer and is displayed in the read-only field adjacent to the button.

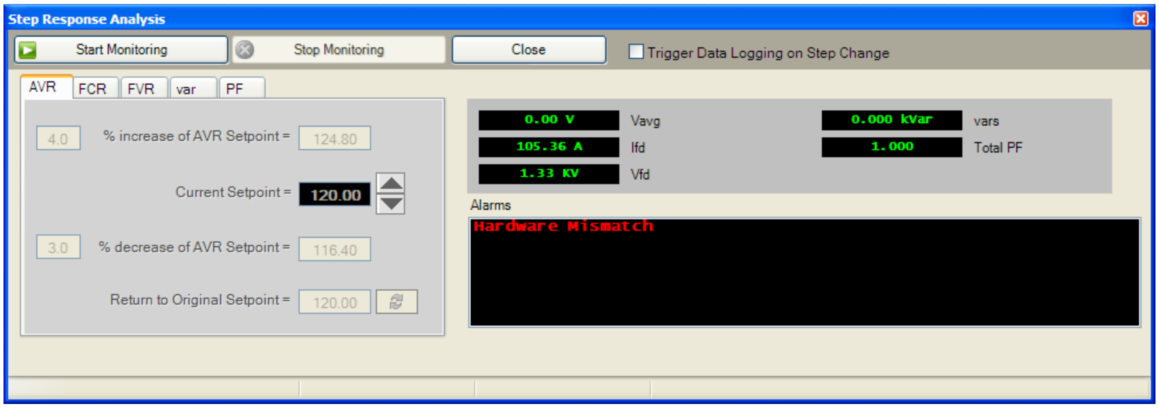


Figure 159. Step Response Analysis - AVR Tab

Var and PF Tabs

The var and PF tabs are similar in their controls that enable the application of step changes to their respective setpoints. PF tab controls are illustrated in Figure 160. Var and PF tab controls operate as follows.

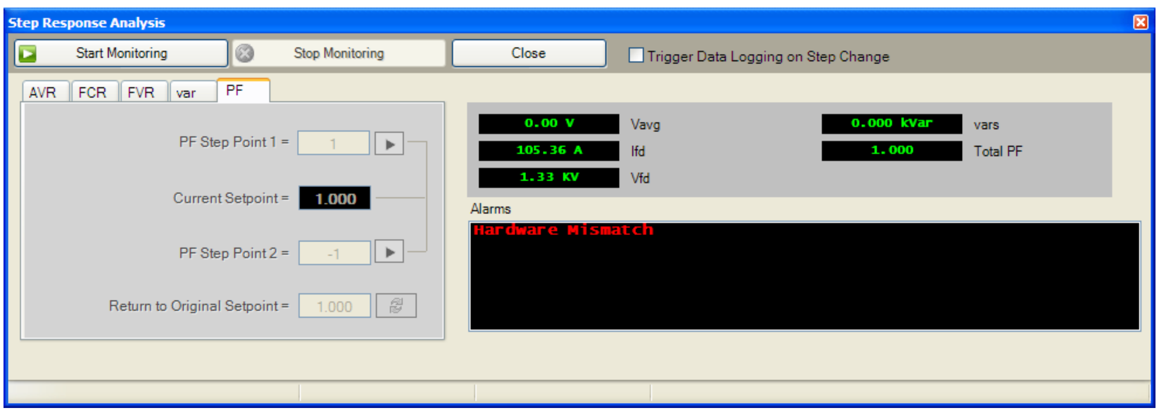


Figure 160. Step Response Analysis - PF Tab

Step changes that increase or decrease the setpoint can be applied by clicking the increment (up arrow) or decrement (down arrow) button. Step-change setpoints can be entered in two setting fields. Clicking the right-arrow button beside one of the two fields initiates a step change to the corresponding setpoint value. A button is provided to return the setpoint to its original value before any step changes were invoked. This original value is the setpoint established in the Setpoints section of the BESTCOMS*Plus*® settings explorer and is displayed in the read-only field adjacent to the button.

Analysis Options

Options are provided to arrange the layout of plots and adjust graph display.

Layout Tab

Up to six data plots may be displayed in three different layouts on the RTM screen. See Figure 161.

Graph Display Tab

Options are provided to adjust graph history and poll rate. Graph height sets the displayed graphs to a fixed height in pixels. When the Auto Size box is checked, all displayed graphs are automatically sized to equally fit the available space. History length is selectable from 1 to 30 minutes. Poll rate is adjustable between 100 to 500 milliseconds. Lowering the history and poll rate may also result in improved PC performance while plotting. See Figure 162.

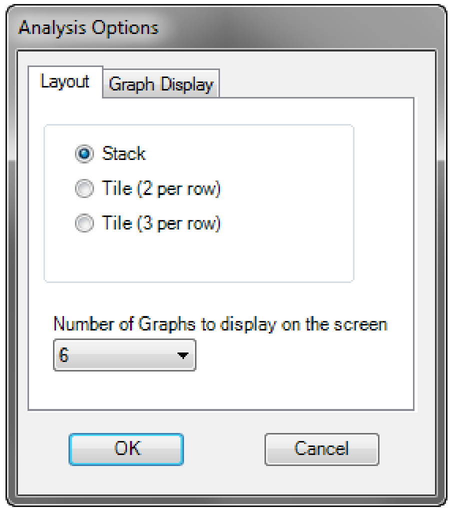


Figure 161. Analysis Options Screen, Layout Tab

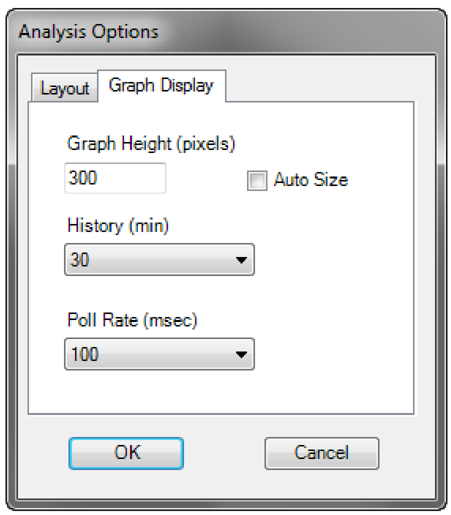


Figure 162. Analysis Options Screen, Graph Display Tab

CAN Communication

Introduction

CAN bus interface 1 facilitates communication between the DECS-250N and optional modules such as the contact expansion module (CEM-2020) and analog expansion module (AEM-2020). Refer to the sections *Contact Expansion Module* and *Analog Expansion Module* for more information.

CAN bus interface 2 enables the DECS-250N to provide generator and system parameters to a generator controller such as the Basler DGC-2020. CAN 2 also permits DECS-250N setpoint and mode control from an external device connected to the CAN. The parameters sent over CAN 2 are listed in this section.

Both CAN bus interfaces utilize the SAE J1939 messaging protocol.

Refer to the *Communication* section for CAN port configuration and the *Terminals and Connectors* section for wiring.

CAN Parameters

Supported CAN parameters are listed in Table 16. The first column contains the parameter group number (PGN), the second column contains the parameter name, the third column contains the unit of measurement for a parameter, the fourth column contains the suspect parameter number (SPN), and the fifth column contains the broadcast rate for a parameter.

Table 16. CAN Parameters

PGN	Name	Units	SPN	Broadcast Rate
0xFDA6	Generator Excitation Field Voltage	Volts	3380	100 ms
	Generator Excitation Field Current	Amps	3381	
	Generator Output Voltage Bias Percentage	Percent	3382	
0xFDA7	Voltage Regulator Load Compensation Mode	n/a	3375	1 s
	Voltage Regulator var/PF Operating Mode	n/a	3376	
	Voltage Regulator Underfrequency Compensation Enabled	n/a	3377	
	Voltage Regulator Soft Start State	n/a	3378	
	Voltage Regulator Enabled	n/a	3379	
0xFDFD	Generator Phase CA L-L AC RMS Voltage	Volts	2443	100 ms
	(Unsupported)	n/a	2247	
	Generator Phase C AC RMS Current	Amps	2451	
0xFE00	Generator Phase BC L-L AC RMS Voltage	Volts	2442	100 ms
	(Unsupported)	n/a	2446	
	Generator Phase B AC RMS Current	Amps	2450	
0xFE03	Generator Phase AB L-L AC RMS Voltage	Volts	2441	100 ms
	(Unsupported)	n/a	2445	
	Generator Phase A AC RMS Current	Amps	2249	
0xFE06	Generator Average L-L AC RMS Voltage	Volts	2440	100 ms
	(Unsupported)	n/a	2444	
	Generator Average AC Frequency	Hertz	2436	
	Generator Average AC RMS Current	Amps	2448	
0xFE04	Generator Total Reactive Power	var	2456	100 ms
	Generator Overall PF	n/a	2464	
	Generator Overall PF Lagging	n/a	2518	

PGN	Name	Units	SPN	Broadcast Rate
0xFE05	Generator Total Real Power	Watts	2452	100 ms
	Generator Total Apparent Power	VA	2460	
0xFF00	Contact I/O Status Start Input - Byte 0, bits 0,1 Stop Input - Byte 0, bits 2,3 Input 1 - Byte 0, bits 4,5 Input 2 - Byte 0, bits 6,7 Input 3 - Byte 1, bits 0,1 Input 4 - Byte 1, bits 2,3 Input 5 - Byte 1, bits 4,5 Input 6 - Byte 1, bits 6,7 Input 7 - Byte 2, bits 0,1 Input 8 - Byte 2, bits 2,3 Input 9 - Byte 2, bits 4,5 Input 10 - Byte 2, bits 6,7 Input 11 - Byte 3, bits 0,1 Input 12 - Byte 3, bits 2,3 Input 13 - Byte 3, bits 4,5 Input 14 - Byte 3, bits 6,7 Watchdog Output - Byte 4, bits 0,1 Output 1 - Byte 4, bits 2,3 Output 2 - Byte 4, bits 4,5 Output 3 - Byte 4, bits 6,7 Output 4 - Byte 5, bits 0,1 Output 5 - Byte 5, bits 2,3 Output 6 - Byte 5, bits 4,5 Output 7 - Byte 5, bits 6,7 Output 8 - Byte 6, bits 0,1 Output 9 - Byte 6, bits 2,3 Output 10 - Byte 6, bits 4,5 Output 11 - Byte 6, bits 6,7 Notes 0 = Open 1 = Closed 2 = Reserved 3 = Reserved	n/a	n/a	100 ms
0xFF01	Requested Generator Excitation Field Voltage (FVR Setpoint)	Volts	3380	n/a
	Requested Generator Excitation Field Current (FCR Setpoint)	Amps	3381	n/a
0xFF02	Requested Operating Mode Byte 0, Bits 0-2 Notes 1 = FCR 2 = AVR 3 = VAR 4 = PF 5 = FVR Will not override if held by logic. Byte 0, Bits 3-7 unused Bytes 1-7 unused	n/a	n/a	100 ms
0xF015	Requested Generator Total AC Reactive Power (var Setpoint)	var	3383	n/a
	Requested Generator Overall PF (PF Setpoint)	n/a	3384	n/a
	Requested Generator Overall PF Lagging (PF Setpoint)	n/a	3385	n/a
0xF01C	Requested Generator Average L-L AC RMS Voltage (AVR Setpoint)	Volts	3386	n/a

Diagnostic Trouble Codes (DTCs)

The DECS-250N will send an unsolicited message of a currently active diagnostic trouble code (DTC). Previously active DTCs are available upon request. Active and previously active DTCs can be cleared on request. Table 17 lists the diagnostic information that the DECS-250N obtains over the CAN bus interface.

DTCs are reported in coded diagnostic information that includes the Suspect Parameter Number (SPN), Failure Mode Identifier (FMI), and Occurrence Count (OC) as listed in Table 3. All parameters have an SPN and are used to display or identify the items for which diagnostics are being reported. The FMI defines the type of failure detected in the subsystem identified by an SPN. The reported problem may not be an electrical failure but a subsystem condition needing to be reported to an operator or technician. The OC contains the number of times that a fault has gone from active to previously active.

Table 17. Diagnostic Information Obtained Over CAN bus Interface 2

PGN	Name
0xEA00	Request DTCs
0xFECA	Currently Active DTCs
0xFECB	Previously Active DTCs
0xFECC	Clear Previously Active DTCs
0xFED3	Clear Active DTCs

Table 18. Reported DTCs

SPN hex (decimal)	Name	FMI hex (decimal) *
0x263 (611)	Loss of Sensing Fault	0x00 (0)
0x264 (612)	EDM Fault	0x0E (14)
0xD34 (3380)	Field Overvoltage Fault	0x00 (0)
0xD35 (3381)	Field Overcurrent Fault	0x00 (0)
0x988 (2440)	Overvoltage Fault	0x0F (15)
0x988 (2440)	Undervoltage Fault	0x11 (17)
0x998 (2456)	Loss of Excitation Fault	0x11 (17)

* 0 = Data valid but above normal range, most severe.
14 = Special instructions.
15 = Data valid but above normal range, least severe.
17 = Data valid but below normal range, least severe.

Modbus™ Communication

Introduction

This document describes the Modbus™ communications protocol employed by DECS-250N systems and how to exchange information with DECS-250N systems over a Modbus network. DECS-250N systems communicate by emulating a subset of the Modicon 984 Programmable Controller.

Modbus communications use a master-slave technique in which only the master can initiate a transaction. This transaction is called a query. When appropriate, a slave (DECS-250N) responds to the query. When a Modbus master communicates with a slave, information is provided or requested by the master. Information residing in the DECS-250N is grouped categorically as follows:

- General
- Binary Points
- Metering
- Limiters
- Setpoints
- Global Settings
- Relay Settings
- Protection Settings
- Gains
- Legacy Modbus

All supported data can be read as specified in the Register Table. Abbreviations are used in the Register Table to indicate the register type. Register types are:

- Read/Write = RW
- Read Only = R

When a slave receives a query, the slave responds by either supplying the requested data to the master or performing the requested action. A slave device never initiates communications on the Modbus and will always generate a response to the query unless certain error conditions occur. The DECS-250N is designed to communicate on the Modbus network only as slave devices.

Refer to the *Communication* section for Modbus communication setup and the *Terminals and Connectors* section for wiring.

Message Structure

Device Address Field

The device address field contains the unique Modbus address of the slave being queried. The addressed slave repeats the address in the device address field of the response message. This field is 1 byte.

Although Modbus protocol limits a device address from 1 - 247. The address is user-selectable at installation and can be altered during real-time operation.

Function Code Field

The function code field in the query message defines the action to be taken by the addressed slave. This field is echoed in the response message and is altered by setting the most significant bit (MSB) of the field to 1 if the response is an error response. This field is 1 byte in length.

The DECS-250N maps all available data into the Modicon 984 holding register address space supports the following function codes:

- Function 03 (03 hex) - read holding registers
- Function 06 (06 hex) - preset single register
- Function 08 (08 hex), subfunction 00 - diagnostics: return query data

- Function 08 (08 hex), subfunction 01 - diagnostics: restart communications option
- Function 08 (08 hex), subfunction 04 - diagnostics: force listen only mode
- Function 16 (10 hex) - preset multiple registers

Data Block Field

The query data block contains additional information needed by the slave to perform the requested function. The response data block contains data collected by the slave for the queried function. An error response will substitute an exception response code for the data block. The length of this field varies with each query.

Error Check Field

The error check field provides a method for the slave to validate the integrity of the query message contents and allows the master to confirm the validity of response message contents. This field is 2 bytes.

Modbus Modes of Operation

A standard Modbus network offers the remote terminal unit (RTU) transmission mode and Modbus/TCP mode for communication. DECS-250N systems support the Modbus/TCP mode and RS-485 mode at the same time. To enable editing over Modbus TCP, or RS-485, the unsecured access level for the port must be configured to the appropriate access level. See the *Security* section of this manual for more information on security and access levels. These two modes of operation are described below.

A master can query slaves individually or universally. A universal ("broadcast") query, when allowed, evokes no response from any slave device. If a query to an individual slave device requests actions unable to be performed by the slave, the slave response message contains an exception response code defining the error detected. Exception response codes are quite often enhanced by the information found in the "Error Details" block of holding registers.

The Modbus protocol defines a simple Protocol Data Unit (PDU) independent of the underlying communication layers. The mapping of the Modbus protocol on specific buses or networks can introduce some additional fields on the Application Data Unit (ADU). See Figure 163.

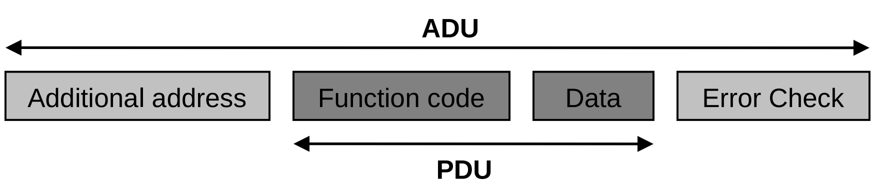


Figure 163. General Modbus Frame

The client that initiates a Modbus transaction builds the Modbus Application Data Unit. The function code indicates to the server which kind of action to perform.

Modbus™ Over Serial Line

Message Structure

Master initiated queries and DECS-250N responses share the same message structure. Each message is comprised of four message fields. They are:

- Device Address (1 byte)
- Function Code (1 byte)
- Data Block (n bytes)
- Error Check field (2 bytes)

Each 8-bit byte in a message contains two 4-bit hexadecimal characters. The message is transmitted in a continuous stream with the LSB of each byte of data transmitted first. Transmission of each 8-bit data byte occurs with one start bit and either one or two stop bits. Parity checking is performed, when enabled, and can be either odd or even. The transmission baud rate is user-selectable, and can be set at installation and altered during real-time operation. The DECS-250N Modbus supports baud rates up to 115200. The factory default baud rate is 19200.

DECS-250N systems support RS-485 compatible serial interfaces. This interface is accessible from the left side panel of the DECS-250N.

Message Framing and Timing Considerations

When receiving a message via the RS-485 communication port, the DECS-250N requires an inter-byte latency of 3.5 character times before considering the message complete.

Once a valid query is received, the DECS-250N waits a specified amount of time before responding. This time delay is set on the Modbus Setup screen under Communications in BESTCOMS*Plus*®. This parameter contains a value from 10 - 10,000 milliseconds. The default value is 10 milliseconds.

Table 19 provides the response message transmission time (in seconds) and 3.5 character times (in milliseconds) for various message lengths and baud rates.

Table 19. Timing Considerations

Baud Rate	3.5 Character Time (ms)	Message Tx Time(s)	
		128 Bytes	256 Bytes
2400	16.04	0.59	1.17
4800	8.021	0.29	0.59
9600	4.0104	0.15	0.29
19200	2.0052	0.07	0.15

Modbus on TCP/IP

Application Data Unit

The following describes the encapsulation of a Modbus request or response when it is carried on a Modbus TCP/IP network. See Figure 164.

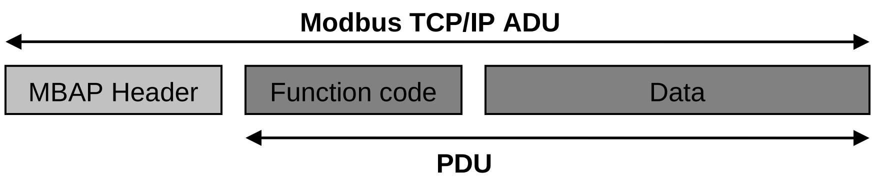


Figure 164. Modbus Request/Response Over TCP/IP

A dedicated header is used on TCP/IP to identify the Modbus Application Data Unit. It is called the MBAP header (Modbus Application Protocol header).

This header provides some differences compared to the Modbus RTU application data unit used on a serial line:

- The Modbus 'slave address' field usually used on Modbus Serial Line is replaced by a single byte 'Unit Identifier' within the MBAP header. The 'Unit Identifier' is used to communicate via devices such as bridges, routers, and gateways that use a single IP address to support multiple independent Modbus end units.
- All Modbus requests and responses are designed in such a way that the recipient can verify that a message is finished. For function codes where the Modbus PDU has a fixed length, the function code alone is sufficient. For function codes carrying a variable amount of data in the request or response, the data field includes a byte count.
- When Modbus is carried over TCP, additional length information is carried in the MBAP header to allow the recipient to recognize message boundaries even if the message has been split into

multiple packets for transmission. The existence of explicit and implicit length rules and use of a CRC-32 error check code (on Ethernet) results in an infinitesimal chance of undetected corruption to a request or response message.

MBAP Header Description

The MBAP Header contains the fields listed in Table 20.

Table 20. MBAP Header Fields

Fields	Length	Description	Client	Server
Transaction Identifier	2 Bytes	Identification of a Modbus request/response transaction.	Initialized by the client.	Recopied by the server from the received request.
Protocol Identifier	2 Bytes	0 = Modbus protocol.	Initialized by the client.	Recopied by the server from the received request.
Length	2 Bytes	Number of following bytes.	Initialized by the client (request).	Initialized by the server (response).
Unit Identifier	1 Byte	Identification of a remote slave connected on a serial line or on other buses.	Initialized by the client.	Recopied by the server from the received request.

The header is 7 bytes long:

- *Transaction Identifier* – Used for transaction pairing, the Modbus server copies in the response the transaction identifier of the request.
- *Protocol Identifier* – Used for intra-system multiplexing. The Modbus protocol is identified by the value 0.
- *Length* – A byte count of the following fields, including the Unit Identifier and data fields.
- *Unit Identifier* – Used for intra-system routing purpose. It is typically used to communicate to a Modbus or a Modbus serial line slave through a gateway between an Ethernet TCP/IP network and a Modbus serial line. This field is set by the Modbus Client in the request and must be returned with the same value in the response by the server.

Note: All Modbus/TCP ADU are sent via TCP on registered port 502.

Error Handling and Exception Responses

Any query received that contains a non-existent device address, a framing error, or CRC error is ignored. No response is transmitted. Queries addressed to the DECS-250N with an unsupported function or illegal values in the data block result in an error response message with an exception response code. The exception response codes supported by the DECS-250N are provided in
Table 21.

Table 21. Supported Exception Response Codes

Code	Name	Description
01	Illegal Function	The query Function/Subfunction Code is unsupported; query read of more than 125 registers; query preset of more than 100 registers.
02	Illegal Data Address	A register referenced in the data block does not support queried read/write; query preset of a subset of a numerical register group.
03	Illegal Data Value	A preset register data block contains an incorrect number of bytes or one or more data values out of range.

DECS-250N Modbus™ via Ethernet

Modbus can communicate through Ethernet if the IP address of the DECS-250N is configured as described in the *Communications* section of this manual.

Detailed Message Query and Response for RTU Transmission Mode

A detailed description of DECS-250N supported message queries and responses is provided in the following paragraphs.

Read Holding Registers

Query

This query message requests a register or block of registers to be read. The data block contains the starting register address and the quantity of registers to be read. A register address of N will read holding register N+1. If the query is a broadcast (device address = 0), no response message is returned.

Device Address
Function Code = 03 (hex)
Starting Address Hi
Starting Address Lo
No. of Registers Hi
No. of Registers Lo
CRC Hi error check
CRC Lo error check

The number of registers cannot exceed 125 without causing an error response with the exception code for an illegal function.

Response

The response message contains the data queried. The data block contains the block length in bytes followed by the data (one Data Hi byte and one Data Lo byte) for each requested register.

Reading an unassigned holding register returns a value of zero.

Device Address
Function Code = 03 (hex)
Byte Count
Data Hi (For each requested register, there is one Data Hi and one Data Lo.)
Data Lo
.
.
Data Hi
Data Lo
CRC Hi error check
CRC Lo error check

Return Query Data

This query contains data to be returned (looped back) in the response. The response and query messages should be identical. If the query is a broadcast (device address = 0), no response message is returned.

Device Address	
Function Code =	08 (hex)
Subfunction Hi =	00 (hex)
Subfunction Lo =	00 (hex)
Data Hi =	xx (don't care)
Data Lo =	xx (don't care)
CRC Hi error check	
CRC Lo error check	

Restart Communications Option

This query causes the remote communications function of the DECS-250N to restart, terminating an active listen only mode of operation. No effect is made upon primary relay operations. Only the remote communications function is affected. If the query is a broadcast (device address = 0), no response message is returned.

If the DECS-250N receives this query while in the listen only mode, no response message is generated. Otherwise, a response message identical to the query message is transmitted prior to the communications restart.

Device Address	
Function Code =	08 (hex)
Subfunction Hi =	00 (hex)
Subfunction Lo =	01 (hex)
Data Hi =	xx (don't care)
Data Lo =	xx (don't care)
CRC Hi error check	
CRC Lo error check	

Listen Only Mode

This query forces the addressed DECS-250N to the listen only mode for Modbus communications, isolating it from other devices on the network. No responses are returned.

While in the listen only mode, the DECS-250N continues to monitor all queries. The DECS-250N does not respond to any other query until the listen only mode is removed. All write requests with a query to Preset Multiple Registers (Function Code = 16) are also ignored. When the DECS-250N receives the restart communications query, the listen only mode is removed.

Device Address	
Function Code =	08 (hex)
Subfunction Hi =	00 (hex)
Subfunction Lo =	04 (hex)
Data Hi =	xx (don't care)
Data Lo =	xx (don't care)
CRC Hi error check	
CRC Lo error check	

Preset Multiple Registers

A preset multiple registers query could address multiple registers in one slave or multiple slaves. If the query is a broadcast (device address = 0), no response message is returned.

Query

A Preset Multiple Register query message requests a register or block of registers to be written. The data block contains the starting address and the quantity of registers to be written, followed by the Data Block byte count and data. The DECS-250N will perform the write when the device address in query is a broadcast address or the same as the DECS-250N Modbus Unit ID (device address).

A register address of N will write Holding Register N+1.

Data will cease to be written if any of the following exceptions occur.

- Queries to write to Read Only registers result in an error response with Exception Code of "Illegal Data Address".
- Queries attempting to write more than 100 registers cause an error response with Exception Code "Illegal Function".
- An incorrect Byte Count will result in an error response with Exception Code of "Illegal Data Value".
- There are several instances of registers that are grouped together to collectively represent a single numerical DECS-250N data value (i.e. - floating point data, 32-bit integer data, and strings). A query to write a subset of such a register group will result in an error response with Exception Code "Illegal Data Address".
- A query to write a not allowed value (out of range) to a register results in an error response with Exception Code of "Illegal Data Value".

Device Address	
Function Code =	10 (hex)
Starting Address Hi	
Starting Address Lo	
No. of Registers Hi	
No. of Registers Lo	
Byte Count	
Data Hi	
Data Lo	
.	
.	
Data Hi	
Data Lo	
CRC Hi error check	
CRC Lo error check	

Response

The response message echoes the starting address and the number of registers. There is no response message when the query is a broadcast (device address = 0).

Device Address	
Function Code =	10 (hex)
Starting Address Hi	
Starting Address Lo	
No. of Registers Hi	
No. of Registers Lo	
CRC Hi Error Check	
CRC Lo Error Check	

Preset Single Register

A Preset Single Register query message requests a single register to be written. If the query is a broadcast (device address = 0), no response message is returned.

Note: Only data types INT16, INT8, UINT16, UINT8, and String (not longer than 2 bytes), can be preset by this function.

Query

Data will cease to be written if any of the following exceptions occur.

- Queries to write to Read Only registers result in an error response with Exception Code of “Illegal Data Address”.
- A query to write an unallowed value (out of range) to a register results in an error response with Exception Code of “Illegal Data Value”.

Device Address
Function Code = 06 (hex)
Address Hi
Address Lo
Data Hi
Data Lo
CRC Hi error check
CRC Lo error check

Response

The response message echoes the Query message after the register has been altered.

Data Formats

DECS-250N systems support the following data types:

- Data types mapped to 2 registers
  - Unsigned Integer 32 (Uint32)
  - Floating Point (Float)
  - Strings maximum 4 characters long (String)
- Data types mapped to 1 register
  - Unsigned Integer 16 (Uint16)
  - Unsigned Integer 8 (Uint8)
  - Strings maximum 2 characters long (String)
- Data types mapped to more than 2 registers
  - Strings longer than 4 characters (String)

Floating Point Data Format (Float)

The Modbus floating point data format uses two consecutive holding registers to represent a data value. The first register contains the low-order 16 bits of the following 32-bit format:

- MSB is the sign bit for the floating-point value (0 = positive).
- The next 8 bits are the exponent biased by 127 decimal.
- The 23 LSBs comprise the normalized mantissa. The most-significant bit of the mantissa is always assumed to be 1 and is not explicitly stored, yielding an effective precision of 24 bits.

The value of the floating-point number is obtained by multiplying the binary mantissa times two raised to the power of the unbiased exponent. The assumed bit of the binary mantissa has the value of 1.0, with the remaining 23 bits providing a fractional value. Table 22 shows the floating-point format.

Table 22. Floating Point Format

Sign	Exponent + 127	Mantissa
1 Bit	8 Bits	23 Bits

The floating-point format allows for values ranging from approximately $8.43X10^{-37}$ to $3.38X10^{38}$. A floating-point value of all zeroes is the value zero. A floating-point value of all ones (not a number) signifies a value currently not applicable or disabled.

Example: The value 95,800 represented in floating-point format is hexadecimal 47BB1C00. This number will read from two consecutive holding registers as follows:

Holding Register	Value
K (Hi Byte)	hex 1C
K (Lo Byte)	hex 00
K+1(Hi Byte)	hex 47
K+1(Lo Byte)	hex BB

The same byte alignments are required to write.

Long Integer Data Format (Uint32)

The Modbus long integer data format uses two consecutive holding registers to represent a 32-bit data value. The first register contains the low-order 16 bits and the second register contains the high-order 16 bits.

Example: The value 95,800 represented in long integer format is hexadecimal 0x00017638. This number will read from two consecutive holding registers as follows:

Holding Register	Value
K (Hi Byte)	hex 76
K (Lo Byte)	hex 38
K+1(Hi Byte)	hex 00
K+1(Lo Byte)	hex 01

The same byte alignments are required to write.

Integer Data Format (Uint16) or Bit-Mapped Variables in Uint16 Format

The Modbus integer data format uses a single holding register to represent a 16-bit data value.

Example: The value 4660 represented in integer format is hexadecimal 0x1234. This number will read from a holding register as follows:

Holding Register	Value
K (Hi Byte)	hex 12
K (Lo Byte)	hex 34

The same byte alignments are required to write.

The Uint16 Data Format is listed in *Binary Points* (Table 25), below.

Example: Register 900 occupies 16 rows in the Register Table where each row gives the name of specific bit-mapped data such as 900-0 indicates bit 0 of register 900 is mapped to RF-TRIG.

Short Integer Data Format/Byte Character Data Format (Uint8)

The Modbus short integer data format uses a single holding register to represent an 8-bit data value. The holding register high byte will always be zero.

Example: The value 132 represented in short integer format is hexadecimal 0x84. This number will read from a holding register as follows:

Holding Register	Value
K (Hi Byte)	hex 00
K (Lo Byte)	hex 84

The same byte alignments are required to write.

String Data Format (String)

The Modbus string data format uses one or more holding registers to represent a sequence, or string, of character values. If the string contains a single character, the holding register high byte will contain the ASCII character code and the low byte will be zero.

Example: The string “PASSWORD” represented in string format will read as follows:

Holding Register	Value
K (Hi Byte)	‘P’
K (Lo Byte)	‘A’
K+1(Hi Byte)	‘S’
K+1(Lo Byte)	‘S’
K+2(Hi Byte)	‘W’
K+2(Lo Byte)	‘O’
K+3(Hi Byte)	‘R’
K+3(Lo Byte)	‘D’

Example: If the above string is changed to “P”, the new string will read as follows:

Holding Register	Value
K (Hi Byte)	‘P’
K (Lo Byte)	hex 00
K+1(Hi Byte)	hex 00
K+1(Lo Byte)	hex 00
K+2(Hi Byte)	hex 00
K+2(Lo Byte)	hex 00
K+3(Hi Byte)	hex 00
K+3(Lo Byte)	hex 00

The same byte alignments are required to write.

CRC Error Check

This field contains a two-byte CRC value for transmission error detection. The master first calculates the CRC and appends it to the query message. The DECS-250N system recalculates the CRC value for the received query and performs a comparison to the query CRC value to determine if a transmission error has occurred. If so, no response message is generated. If no transmission error has occurred, the slave calculates a new CRC value for the response message and appends it to the message for transmission.

The CRC calculation is performed using all bytes of the device address, function code, and data block fields. A 16-bit CRC-register is initialized to all 1's. Then each eight-bit byte of the message is used in the following algorithm:

First, exclusive-OR the message byte with the low-order byte of the CRC-register. The result, stored in the CRC-register, will then be right-shifted eight times. The CRC-register MSB is zero-filled with each shift. After each shift, the CRC-register LSB is examined. If the LSB IS a e CRC-register is then exclusive-ORed with the fixed polynomial value A001 (hex) prior to the next shift. Once all bytes of the message have undergone the above algorithm, the CRC-register will contain the message CRC value to be placed in the error check field.

Secure DECS-250N Login via Modbus

To login to the DECS-250N via Modbus, write the string *username|password* to the Secure Login register (40500). Substitute “username” with the user name of the desired access level, include the pipe “|” character, and substitute “password” with the password of the chosen access level. To view the current access level, read the Current Access register (40520). Write any value to the Logout register (40517) to log out of the DECS-250N. Upon disconnecting from Modbus over TCP/IP, the user is automatically logged out of the DECS-250N. However, upon disconnecting from Modbus over serial line, the user remains logged in.

Modbus Parameters

General

General parameters are listed in Table 23.

Table 23. General Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
System Data	Model Number	40001	String	64	R	N/A	0 - 64
System Data	App Version Information	40033	String	64	R	N/A	0 - 64
System Data	App Sub-version Version	40065	String	64	R	N/A	0 - 64
System Data	Boot Version Information	40097	String	64	R	N/A	0 - 64
System Data	Firmware Part Number	40129	String	64	R	N/A	0 - 64
Time	Date	40161	String	16	R	N/A	0 - 16
Time	Time	40169	String	16	R	N/A	0 - 16
Unit Information	Style Number	40177	String	32	R	N/A	0 - 32
Unit Information	Serial Number	40193	String	32	R	N/A	0 - 32
DECS Control	Control Output Var PF	40209	Float	4	R	N/A	N/A
DECS Control	Control Output OEL	40211	Float	4	R	N/A	N/A
DECS Control	Control Output UEL	40213	Float	4	R	N/A	N/A
DECS Control	Control Output SCL	40215	Float	4	R	N/A	N/A
DECS Control	Control Output AVR	40217	Float	4	R	N/A	N/A
DECS Control	Control Output FCR	40219	Float	4	R	N/A	N/A
DECS Control	Control Output FVR	40221	Float	4	R	N/A	N/A
DECS Control	Invert Output (SCT/PPT)	40223	Uint	4	RW	N/A	Disabled=0 Enabled=1

Security

Table 24. Security Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Security	Secure Login	40500	String	34	RW	N/A	0 – 34
Security	Logout	40517	String	5	RW	N/A	0 – 5
Security	Current Access	40520	Uint32	4	R	N/A	No Access=0, Read Access=1 Control Access=2 Operator Access=3 Setting Access=4 Design Access=5 Administrator Access=6

Binary Points

Table 25. Binary Point Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
System Data	RF trig	40900	Uint16	2	R	N/A	N/A
System Data	PU logic	40900	Uint16	2	R	N/A	N/A
System Data	Trip logic	40900	Uint16	2	R	N/A	N/A
System Data	Logic trig	40900	Uint16	2	R	N/A	N/A
System Data	Breaker Status	40900	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Alarms	Real Time Clock Alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Date Time Set Alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Firmware Change Alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Freq out of range alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Eth link lost alarm	40900	Uint16	2	R	N/A	N/A
Alarms	USB com alarm	40900	Uint16	2	R	N/A	N/A
Alarms	IRIG sync lost alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Logic equal none alarm	40900	Uint16	2	R	N/A	N/A
Alarms	No user setting alarm	40900	Uint16	2	R	N/A	N/A
Alarms	NTP sync lost alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Microprocessor Reset Alarm	40900	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 1	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 2	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 3	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 4	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 5	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 6	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 7	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 8	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 9	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 10	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 11	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 12	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 13	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 14	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 15	40901	Uint16	2	R	N/A	N/A
Alarms	Programmable Alarm 16	40901	Uint16	2	R	N/A	N/A
Alarms	Underfrequency V/Hz Alarm	40902	Uint16	2	R	N/A	N/A
Alarms	OEL alarm	40902	Uint16	2	R	N/A	N/A
Alarms	UEL alarm	40902	Uint16	2	R	N/A	N/A
Alarms	Failed to build up alarm	40902	Uint16	2	R	N/A	N/A
Alarms	SCL alarm	40902	Uint16	2	R	N/A	N/A
Alarms	PSS voltage unbalanced alarm	40902	Uint16	2	R	N/A	N/A
Alarms	PSS current unbalanced alarm	40902	Uint16	2	R	N/A	N/A
Alarms	PSS power below threshold alarm	40902	Uint16	2	R	N/A	N/A
Alarms	PSS speed failed alarm	40902	Uint16	2	R	N/A	N/A
Alarms	PSS voltage limit alarm	40902	Uint16	2	R	N/A	N/A
Alarms	Transfer watchdog alarm	40902	Uint16	2	R	N/A	N/A
Alarms	Crowbar activated	40902	Uint16	2	R	N/A	N/A
Alarms	Var limiter active alarm	40902	Uint16	2	R	N/A	N/A
Alarm Report	Alarm Output	40902	Uint16	2	R	N/A	N/A
HardwarePorts	Field Short Circuit Status	40902	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
DECS Control	Autotransfer enable	40902	Uint16	2	R	N/A	N/A
DECS Control	Var PF selection	40903	Uint16	2	R	N/A	N/A
DECS Control	DECS start stop (external)	40903	Uint16	2	R	N/A	N/A
DECS Control	Pre-position 1 active	40903	Uint16	2	R	N/A	N/A
DECS Control	Pre-position 2 active	40903	Uint16	2	R	N/A	N/A
DECS Control	Pre-position 3 active	40903	Uint16	2	R	N/A	N/A
DECS Control	Auto active	40903	Uint16	2	R	N/A	N/A
Field Overvoltage	Block	40903	Uint16	2	R	N/A	N/A
Field Overvoltage	Pickup	40903	Uint16	2	R	N/A	N/A
Field Overvoltage	Trip	40903	Uint16	2	R	N/A	N/A
Field Overcurrent	Block	40903	Uint16	2	R	N/A	N/A
Field Overcurrent	Pickup	40903	Uint16	2	R	N/A	N/A
Field Overcurrent	Trip	40903	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Block open diode	40903	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Pickup open diode	40903	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Trip open diode	40903	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Block shorted diode	40903	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Pickup shorted diode	40904	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Trip shorted diode	40904	Uint16	2	R	N/A	N/A
Power Input Failure	Block	40904	Uint16	2	R	N/A	N/A
Power Input Failure	Pickup	40904	Uint16	2	R	N/A	N/A
Power Input Failure	Trip	40904	Uint16	2	R	N/A	N/A
Loss Of Sensing	Block	40904	Uint16	2	R	N/A	N/A
Loss Of Sensing	Pickup	40904	Uint16	2	R	N/A	N/A
Loss Of Sensing	Trip	40904	Uint16	2	R	N/A	N/A
25	Block	40904	Uint16	2	R	N/A	N/A
25	Status	40904	Uint16	2	R	N/A	N/A
25	Vm1 status	40904	Uint16	2	R	N/A	N/A
27P	Block	40904	Uint16	2	R	N/A	N/A
27P	Pickup	40904	Uint16	2	R	N/A	N/A
27P	Trip	40904	Uint16	2	R	N/A	N/A
59P	Block	40904	Uint16	2	R	N/A	N/A
59P	Pickup	40904	Uint16	2	R	N/A	N/A
59P	Trip	40905	Uint16	2	R	N/A	N/A
81O	Block	40905	Uint16	2	R	N/A	N/A
81O	Pickup	40905	Uint16	2	R	N/A	N/A
81O	Trip	40905	Uint16	2	R	N/A	N/A
81U	Block	40905	Uint16	2	R	N/A	N/A
81U	Pickup	40905	Uint16	2	R	N/A	N/A
81U	Trip	40905	Uint16	2	R	N/A	N/A
Gen Below 10 Hz	Block	40905	Uint16	2	R	N/A	N/A
Gen Below 10 Hz	Pickup	40905	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Gen Below 10 Hz	Trip	40905	Uint16	2	R	N/A	N/A
40Q	Block	40905	Uint16	2	R	N/A	N/A
40Q	Pickup	40905	Uint16	2	R	N/A	N/A
40Q	Trip	40905	Uint16	2	R	N/A	N/A
32R	Block	40905	Uint16	2	R	N/A	N/A
32R	Pickup	40905	Uint16	2	R	N/A	N/A
32R	Trip	40905	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 1 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 1 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 2 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 2 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 3 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 3 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 4 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 1	Configurable Protection Threshold 4 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 1 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 1 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 2 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 2 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 3 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 3 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 4 Pickup	40906	Uint16	2	R	N/A	N/A
Configurable Protection 2	Configurable Protection Threshold 4 Trip	40906	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 1 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 1 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 2 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 2 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 3 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 3 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 4 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 3	Configurable Protection Threshold 4 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 1 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 1 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 2 Pickup	40907	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Configurable Protection 4	Configurable Protection Threshold 2 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 3 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 3 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 4 Pickup	40907	Uint16	2	R	N/A	N/A
Configurable Protection 4	Configurable Protection Threshold 4 Trip	40907	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 1 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 1 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 2 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 2 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 3 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 3 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 4 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 5	Configurable Protection Threshold 4 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 1 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 1 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 2 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 2 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 3 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 3 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 4 Pickup	40908	Uint16	2	R	N/A	N/A
Configurable Protection 6	Configurable Protection Threshold 4 Trip	40908	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 1 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 1 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 2 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 2 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 3 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 3 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 4 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 7	Configurable Protection Threshold 4 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 1 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 1 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 2 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 2 Trip	40909	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Configurable Protection 8	Configurable Protection Threshold 3 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 3 Trip	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 4 Pickup	40909	Uint16	2	R	N/A	N/A
Configurable Protection 8	Configurable Protection Threshold 4 Trip	40909	Uint16	2	R	N/A	N/A
Synchronizer	Sync Failed Alarm	40910	Uint16	2	R	N/A	N/A
Network Load Share	Unknown Network Load Share Protocol Version	40910	Uint16	2	R	N/A	N/A
Alarms	Voltage Matching Active	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Start Input	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Stop Input	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 1	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 2	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 3	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 4	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 5	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 6	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 7	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 8	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 9	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 10	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 11	40910	Uint16	2	R	N/A	N/A
Contact Inputs	Input 12	40911	Uint16	2	R	N/A	N/A
Contact Inputs	Input 13	40911	Uint16	2	R	N/A	N/A
Contact Inputs	Input 14	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Watchdog Output	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 1	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 2	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 3	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 4	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 5	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 6	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 7	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 8	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 9	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 10	40911	Uint16	2	R	N/A	N/A
Contact Outputs	Output 11	40911	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 1	40911	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 2	40912	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 3	40912	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 4	40912	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 5	40912	Uint16	2	R	N/A	N/A
Virtual Switch	Virtual Switch 6	40912	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
DECS Control	Manual FCR Only	40912	Uint16	2	R	N/A	N/A
DECS Control	Droop Disable	40912	Uint16	2	R	N/A	N/A
DECS Control	CC Disable	40912	Uint16	2	R	N/A	N/A
DECS Control	Line Drop Disable	40912	Uint16	2	R	N/A	N/A
DECS Control	Parallel Enable	40912	Uint16	2	R	N/A	N/A
DECS Control	Soft Start Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	PSS Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	OEL Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	UEL Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	SCL Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	Protect Select Group 2	40912	Uint16	2	R	N/A	N/A
DECS Control	PID Select Group 2	40913	Uint16	2	R	N/A	N/A
DECS Control	DECS Manual Auto	40913	Uint16	2	R	N/A	N/A
DECS Control	Null Balance	40913	Uint16	2	R	N/A	N/A
DECS Control	DECS Pre-position	40913	Uint16	2	R	N/A	N/A
DECS Control	Var Limiter Select Group 2	40913	Uint16	2	R	N/A	N/A
DECS Control	Var Active	40913	Uint16	2	R	N/A	N/A
DECS Control	PF Active	40913	Uint16	2	R	N/A	N/A
DECS Control	FVR Active	40913	Uint16	2	R	N/A	N/A
DECS Control	FCR Active	40913	Uint16	2	R	N/A	N/A
DECS Control	Manual Active	40913	Uint16	2	R	N/A	N/A
DECS PSS Meter	PSS Active	40913	Uint16	2	R	N/A	N/A
DECS Regulator Meter	Setpoint at Lower Limit	40913	Uint16	2	R	N/A	N/A
DECS Regulator Meter	Setpoint at Upper Limit	40913	Uint16	2	R	N/A	N/A
Exciter Diode Monitor	Trip Open or Shorted Diode	40913	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 1	40913	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 2	40913	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 3	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 4	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 5	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 6	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 7	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 8	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 9	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Input 10	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 1	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 2	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 3	40914	Uint16	2	R	N/A	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Contact Expansion Module	Output 4	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 5	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 6	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 7	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 8	40914	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 9	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 10	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 11	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 12	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 13	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 14	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 15	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 16	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 17	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 18	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 19	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 20	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 21	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 22	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 23	40915	Uint16	2	R	N/A	N/A
Contact Expansion Module	Output 24	40915	Uint16	2	R	N/A	N/A
Network Load Share	Network Load Share Disable	40916	Uint16	2	R	N/A	N/A
Alarms	Invalid Logic Alarm	40916	Uint16	2	R	N/A	N/A
24	Block	40916	Uint16	2	R	N/A	N/A
24	Pickup	40916	Uint16	2	R	N/A	N/A
24	Trip	40916	Uint16	2	R	N/A	N/A
24	Reserved	40916	Uint16	2	R	N/A	N/A
DECS Control	Transient Boost Active	40916	Uint16	2	R	N/A	N/A

Metering

Table 26. Metering Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Field Voltage Meter	V_X	41000	Float	4	R	Volt	-1000 - 1000
Field Current Meter	I_X	41002	Float	4	R	Amp	0 - 2000000000
DECS PSS Meter	Terminal Frequency Deviation	41004	Float	4	R	No Unit	N/A
DECS PSS Meter	Compensated Frequency Deviation	41006	Float	4	R	No Unit	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
DECS PSS Meter	PSS output	41008	Float	4	R	No Unit	N/A
DECS Regulator Meter	Tracking error	41010	Float	4	R	Percent	N/A
DECS Regulator Meter	Control output PU	41012	Float	4	R	No Unit	N/A
DECS Regulator Meter	Exciter Diode Monitor Ripple Percent	41014	Float	4	R	Percent	N/A
DECS Regulator Meter	Power Input	41016	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Mag1	V_{AB}	41018	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Mag1	V_{BC}	41020	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Mag1	V_{CA}	41022	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Mag1	V_{AVG} LL	41024	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Pri1	V_{AB}	41026	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Pri1	V_{BC}	41028	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Pri1	V_{CA}	41030	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Pri1	V_{AVG} LL	41032	Float	4	R	Volt	0 - 2000000000
Gen Voltage Meter Ang1	V_{AB}	41034	Float	4	R	Degree	0 - 360
Gen Voltage Meter Ang1	V_{BC}	41036	Float	4	R	Degree	0 - 360
Gen Voltage Meter Ang1	V_{CA}	41038	Float	4	R	Degree	0 - 360
Gen Voltage Meter MagAng1	V_{AB}	41040	String	24	R	No Unit	0 - 24
Gen Voltage Meter MagAng1	V_{BC}	41052	String	24	R	No Unit	0 - 24
Gen Voltage Meter MagAng1	V_{CA}	41064	String	24	R	No Unit	0 - 24
Gen Voltage Meter PriAng1	V_{AB}	41076	String	24	R	No Unit	0 - 24
Gen Voltage Meter PriAng1	V_{BC}	41088	String	24	R	No Unit	0 - 24
Gen Voltage Meter PriAng1	V_{CA}	41100	String	24	R	No Unit	0 - 24
Bus Voltage Meter Mag1	V_{AB}	41112	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Mag1	V_{BC}	41114	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Mag1	V_{CA}	41116	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Mag1	V_{AVG} LL	41118	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Pri1	V_{AB}	41120	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Pri1	V_{BC}	41122	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Pri1	V_{CA}	41124	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Pri1	V_{AVG} LL	41126	Float	4	R	Volt	0 - 2000000000
Bus Voltage Meter Ang1	V_{AB}	41128	Float	4	R	Degree	0 - 360
Bus Voltage Meter Ang1	V_{BC}	41130	Float	4	R	Degree	0 - 360
Bus Voltage Meter Ang1	V_{CA}	41132	Float	4	R	Degree	0 - 360
Bus Voltage Meter MagAng1	V_{AB}	41134	String	24	R	No Unit	0 - 24
Bus Voltage Meter MagAng1	V_{BC}	41146	String	24	R	No Unit	0 - 24
Bus Voltage Meter MagAng1	V_{CA}	41158	String	24	R	No Unit	0 - 24
Bus Voltage Meter PriAng1	V_{AB}	41170	String	24	R	No Unit	0 - 24
Bus Voltage Meter PriAng1	V_{BC}	41182	String	24	R	No Unit	0 - 24
Bus Voltage Meter PriAng1	V_{CA}	41194	String	24	R	No Unit	0 - 24
Gen Current Meter Mag1	I_A	41206	Float	4	R	Amp	0 - 2000000000

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Gen Current Meter Mag1	I_B	41208	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Mag1	I_C	41210	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Mag1	I_{AVG}	41212	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Pri1	I_A	41214	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Pri1	I_B	41216	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Pri1	I_C	41218	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Pri1	I_{AVG}	41220	Float	4	R	Amp	0 - 2000000000
Gen Current Meter Ang1	I_A	41222	Float	4	R	Degree	0 - 360
Gen Current Meter Ang1	I_B	41224	Float	4	R	Degree	0 - 360
Gen Current Meter Ang1	I_C	41226	Float	4	R	Degree	0 - 360
Gen Current Meter MagAng1	I_A	41228	String	24	R	No Unit	0 - 24
Gen Current Meter MagAng1	I_B	41240	String	24	R	No Unit	0 - 24
Gen Current Meter MagAng1	I_C	41252	String	24	R	No Unit	0 - 24
Gen Current Meter PriAng1	I_A	41264	String	24	R	No Unit	0 - 24
Gen Current Meter PriAng1	I_B	41276	String	24	R	No Unit	0 - 24
Gen Current Meter PriAng1	I_C	41288	String	24	R	No Unit	0 - 24
Icc Current Meter Mag1	I_X	41300	Float	4	R	Amp	0 - 2000000000
Icc Current Meter Pri1	I_X	41302	Float	4	R	Amp	0 - 2000000000
Power Meter	Total watts meter	41304	Float	4	R	Watt	N/A
Power Meter	Total watts avg	41306	Float	4	R	Watt	N/A
Power Meter	Total vars meter	41308	Float	4	R	VAr	N/A
Power Meter	Total vars avg	41310	Float	4	R	VAr	N/A
Power Meter	Total S	41312	Float	4	R	VA	N/A
Power Meter	Total S avg	41314	Float	4	R	VA	N/A
Power Meter	Total PF	41316	Float	4	R	PF	-1 - 1
Power Meter	Total PF avg	41318	Float	4	R	PF	-1 – 1
Power Meter	Pos. watt-hour total	41320	Float	4	RW	WattHour	0.00E+00 - 1.00E+09
Power Meter	Pos var-hour total	41322	Float	4	RW	VArHour	0.00E+00 - 1.00E+09
Power Meter	Neg. watt-hour total	41324	Float	4	RW	WattHour	-1.00E+09 - 0.00E+00
Power Meter	Neg. var-hour total	41326	Float	4	RW	VArHour	-1.00E+09 - 0.00E+00
Power Meter	VA hour total	41328	Float	4	RW	VAHour	0.00E+00 - 1.00E+09
Energy Meter	Pos. watt-hour total	41330	Float	4	RW	WattHour	0.00E+00 - 1.00E+09
Energy Meter	Pos. var-hour total	41332	Float	4	RW	VArHour	0.00E+00 - 1.00E+09
Energy Meter	Neg. watt-hour total	41334	Float	4	RW	WattHour	-1.00E+09 - 0.00E+00
Energy Meter	Neg. var-hour total	41336	Float	4	RW	VArHour	-1.00E+09 - 0.00E+00
Energy Meter	VA hour total	41338	Float	4	RW	VAHour	0.00E+00 - 1.00E+09
Sync Meter1	Slip Angle	41340	Float	4	R	Degree	-359.9 – 359.9
Sync Meter1	Slip Frequency	41342	Float	4	R	Hertz	N/A

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Sync Meter1	Voltage Difference	41344	Float	4	R	Volt	N/A
GENFREQUENCYMETER1	Frequency	41346	Float	4	R	Hertz	10 - 180
BUSFREQUENCYMETER1	Frequency	41348	Float	4	R	Hertz	10 - 180
AuxInputVoltage1	Value	41350	Float	4	R	Volt	-9999999 - 9999999
AuxInputCurrent1	Value	41352	Float	4	R	Amp	-9999999 - 9999999
AEM Metering	RTD Input 1 Raw Value	41354	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 2 Raw Value	41356	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 3 Raw Value	41358	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 4 Raw Value	41360	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 5 Raw Value	41362	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 6 Raw Value	41364	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 7 Raw Value	41366	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 8 Raw Value	41368	Float	4	R	Ohm	N/A
AEM Metering	RTD Input 1 Scaled Value	41370	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 2 Scaled Value	41372	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 3 Scaled Value	41374	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 4 Scaled Value	41376	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 5 Scaled Value	41378	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 6 Scaled Value	41380	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 7 Scaled Value	41382	Float	4	R	Deg F	N/A
AEM Metering	RTD Input 8 Scaled Value	41384	Float	4	R	Deg F	N/A
DECS Regulator Meter	Control Output	41386	Float	4	R	Percent	N/A
AEM Metering	RTD Input 1 Metric Value	41388	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 2 Metric Value	41390	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 3 Metric Value	41392	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 4 Metric Value	41394	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 5 Metric Value	41396	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 6 Metric Value	41398	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 7 Metric Value	41400	Float	4	R	Deg C	N/A
AEM Metering	RTD Input 8 Metric Value	41402	Float	4	R	Deg C	N/A
AEM Metering	Therm Input 1 Metric Value	41404	Float	4	R	Deg C	N/A
AEM Metering	Therm Input 2 Metric Value	41406	Float	4	R	Deg C	N/A

Limiters

Table 27. Limiter Group Parameters

Name	Register	Type	Bytes	R/W	Unit	Range
OEL Primary Current Hi	41700	Float	4	R W	Amp	0 - 30
OEL Primary Current Mid	41702	Float	4	R W	Amp	0 - 20
OEL Primary Current Lo	41704	Float	4	R W	Amp	0 - 15
OEL Primary Time Hi	41706	Float	4	R W	Second	0 - 10
OEL Primary Time Mid	41708	Float	4	R W	Second	0 - 120
OEL Primary Current Hi Off	41710	Float	4	R W	Amp	0 - 30

Name	Register	Type	Bytes	R/W	Unit	Range
OEL Primary Current Lo Off	41712	Float	4	R W	Amp	0 - 15
OEL Primary Current Time Off	41714	Float	4	R W	Second	0 - 10
OEL Primary Takeover Current Max Off	41716	Float	4	R W	Amp	0 - 30
OEL Primary Takeover Current Min Off	41718	Float	4	R W	Amp	0 - 15
OEL Primary Takeover Time Dial Off	41720	Float	4	R W	No Unit	0.1 - 20
OEL Primary Takeover Current Max On	41722	Float	4	R W	Amp	0 - 30
OEL Primary Takeover Current Min On	41724	Float	4	R W	Amp	0 - 15
OEL Primary Takeover Time Dial On	41726	Float	4	R W	No Unit	0.1 - 20
OEL Primary Dvdt Enable	41728	Uint32	4	R W	No Unit	Disabled=0 Enabled=1
OEL Primary Dvdt Ref	41730	Float	4	R W	No Unit	-10 - 0
OEL Secondary Current Hi	41732	Float	4	R W	Amp	0 - 30
OEL Secondary Current Mid	41734	Float	4	R W	Amp	0 - 20
OEL Secondary Current Lo	41736	Float	4	R W	Amp	0 - 15
OEL Secondary Time Hi	41738	Float	4	R W	Second	0 - 10
OEL Secondary Time Mid	41740	Float	4	R W	Second	0 - 120
OEL Secondary Current Hi Off	41742	Float	4	R W	Amp	0 - 30
OEL Secondary Current Lo Off	41744	Float	4	R W	Amp	0 - 15
OEL Secondary Current Time Off	41746	Float	4	R W	Second	0 - 10
OEL Secondary Takeover Current Max Off	41748	Float	4	R W	Amp	0 - 30
OEL Secondary Takeover Current Min Off	41750	Float	4	R W	Amp	0 – 15
OEL Secondary Takeover Time Dial Off	41752	Float	4	R W	No Unit	0.1 – 20
OEL Secondary Takeover Current Max On	41754	Float	4	R W	Amp	0 – 30
OEL Secondary Takeover Current Min On	41756	Float	4	R W	Amp	0 – 15
OEL Secondary Takeover Time Dial On	41758	Float	4	R W	No Unit	0.1 – 20
OEL Scale Enable	41760	Uint32	4	R W		Disabled=0 Auxiliary Input=1 AEM RTD 1=2 AEM RTD 2=3 AEM RTD 3=4 AEM RTD 4=5 AEM RTD 5=6 AEM RTD 6=7 AEM RTD 7=8 AEM RTD 8=9
OEL Scale Takeover Signal 1	41762	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Takeover Signal 2	41764	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Takeover Signal 3	41766	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Takeover Scale 1	41768	Float	4	R W	Percent	0 – 200
OEL Scale Takeover Scale 2	41770	Float	4	R W	Percent	0 – 200
OEL Scale Takeover Scale 3	41772	Float	4	R W	Percent	0 – 200

Name	Register	Type	Bytes	R/W	Unit	Range
OEL Scale Summing Signal 1	41774	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Summing Signal 2	41776	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Summing Signal 3	41778	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41760. -10 – 10 V when 41760 = 1 -58 – 482°F when 41760 = 2-8
OEL Scale Summing Scale 1	41780	Float	4	R W	Percent	0 – 200
OEL Scale Summing Scale 2	41782	Float	4	R W	Percent	0 – 200
OEL Scale Summing Scale 3	41784	Float	4	R W	Percent	0 – 200
UEL Primary Curve X1	41786	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Primary Curve X2	41788	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Primary Curve X3	41790	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Primary Curve X4	41792	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Primary Curve X5	41794	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Primary Curve Y1	41796	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Primary Curve Y2	41798	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Primary Curve Y3	41800	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Primary Curve Y4	41802	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Primary Curve Y5	41804	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Primary Power Filter TC	41806	Float	4	R W	Second	0 – 20
UEL Primary Volt Dep Exponent	41808	Float	4	R W	No Unit	0 – 2
UEL Secondary Curve X1	41810	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Secondary Curve X2	41812	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Secondary Curve X3	41814	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Secondary Curve X4	41816	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Secondary Curve X5	41818	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
UEL Secondary Curve Y1	41820	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Secondary Curve Y2	41822	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Secondary Curve Y3	41824	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Secondary Curve Y4	41826	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
UEL Secondary Curve Y5	41828	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
SCL Primary Reference Hi	41830	Float	4	R W	Amp	0 - 66000
SCL Primary Reference Lo	41832	Float	4	R W	Amp	0 - 66000
SCL Primary Time Hi	41834	Float	4	R W	Second	0 - 60
SCL Primary No Response Time	41836	Float	4	R W	Second	0 - 10
SCL Secondary Reference Hi	41838	Float	4	R W	Amp	0 - 66000
SCL Secondary Reference Lo	41840	Float	4	R W	Amp	0 - 66000
SCL Secondary Time Hi	41842	Float	4	R W	Second	0 - 60
SCL Secondary No Response Time	41844	Float	4	R W	Second	0 - 10

Name	Register	Type	Bytes	R/W	Unit	Range
SCL Scale Enable	41846	Uint32	4	R W		Disabled=0 Auxiliary Input=1 AEM RTD 1=2 AEM RTD 2=3 AEM RTD 3=4 AEM RTD 4=5 AEM RTD 5=6 AEM RTD 6=7 AEM RTD 7=8 AEM RTD 8=9
SCL Scale Signal1	41848	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41846. -10 – 10 V when 41846 = 1 -58 – 482°F when 41846 = 2-8
SCL Scale Signal2	41850	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41846. -10 – 10 V when 41846 = 1 -58 – 482°F when 41846 = 2-8
SCL Scale Signal3	41852	Float	4	R W	Limiter Scale Volt or Deg F	Adjustment range is determined by register 41846. -10 – 10 V when 41846 = 1 -58 – 482°F when 41846 = 2-8
SCL Scale Point1	41854	Float	4	R W	Percent	0 - 200
SCL Scale Point2	41856	Float	4	R W	Percent	0 - 200
SCL Scale Point3	41858	Float	4	R W	Percent	0 - 200
Var Limit Enable	41860	Uint32	4	R W		Disabled=0 Enabled=1
Var Limit Primary Delay	41862	Float	4	R W	Second	0 - 300
Var Limit Primary Setpoint	41864	Float	4	R W	Percent	0 - 200
Var Limit Secondary Delay	41866	Float	4	R W	Second	0 - 300
Var Limit Secondary Setpoint	41868	Float	4	R W	Percent	0 - 200
Var Limit Enable Status	41870	Uint32	4	R		Off=0 On=1
OEL Primary Takeover Reset Time Coefficient Off	41872	Float	4	R W		0.01 – 100
OEL Primary Takeover Reset Time Coefficient On	41874	Float	4	R W		0.01 – 100
OEL Secondary Takeover Reset Time Coefficient Off	41876	Float	4	R W		0.01 – 100
OEL Secondary Takeover Reset Time Coefficient On	41878	Float	4	R W		0.01 – 100
OEL Primary Takeover Reset Type Off	41880	Uint32	4	R W		Inverse=0,Integrating=1,Instantaneous=2
OEL Primary Takeover Reset Type On	41882	Uint32	4	R W		Inverse=0,Integrating=1,Instantaneous=2
OEL Secondary Takeover Reset Type Off	41884	Uint32	4	R W		Inverse=0,Integrating=1,Instantaneous=2
OEL Secondary Takeover Reset Type On	41886	Uint32	4	R W		Inverse=0,Integrating=1,Instantaneous=2

Setpoints

Table 28. Setpoint Group Parameters

Name	Register	Type	Bytes	R/W	Unit	Range
Field Current Regulation Setpoint	42200	Float	4	R W	Amp	Setpoint adjustment range determined by registers 42212 and 42214.
Field Current Regulation Traverse Rate	42202	Float	4	R W	Second	10 – 200
Field Current Regulation Pre-position Mode 1	42204	Uint32	4	R W		Maintain=0 Release=1
Field Current Regulation Pre-position 1	42206	Float	4	R W	Amp	Setpoint adjustment range determined by registers 42212 and 42214.

Name	Register	Type	Bytes	R/W	Unit	Range
Field Current Regulation Pre-position Mode 2	42208	Uint32	4	R W		Maintain=0 Release=1
Field Current Regulation Pre-position 2	42210	Float	4	R W	Amp	Setpoint adjustment range determined by registers 42212 and 42214.
Field Current Regulation Minimum Setpoint Limit	42212	Float	4	R W	Percent	0 – 120
Field Current Regulation Maximum Setpoint Limit	42214	Float	4	R W	Percent	0 – 120
Generator Voltage Setpoint	42216	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42228 and 42230.
Generator Voltage Traverse Rate	42218	Float	4	R W	Second	10 – 200
Generator Voltage Pre-position Mode 1	42220	Uint32	4	R W		Maintain=0 Release=1
Generator Voltage Pre-position 1	42222	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42228 and 42230.
Generator Voltage Pre-position Mode 2	42224	Uint32	4	R W		Maintain=0 Release=1
Generator Voltage Pre-position 2	42226	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42228 and 42230.
Generator Voltage Minimum Setpoint Limit	42228	Float	4	R W	Percent	70 - 120
Generator Voltage Maximum Setpoint Limit	42230	Float	4	R W	Percent	70 - 120
Generator var Setpoint	42232	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 42244 and 42246.
Generator var Traverse Rate	42234	Float	4	R W	Second	10 - 200
Generator var Pre-position Mode 1	42236	Uint32	4	R W		Maintain=0 Release=1
Generator var Pre-position 1	42238	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 42244 and 42246.
Generator var Pre-position Mode 2	42240	Uint32	4	R W		Maintain=0 Release=1
Generator var Pre-position 2	42242	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 42244 and 42246.
Generator var Minimum Setpoint Limit	42244	Float	4	R W	Percent	-100 – 100
Generator var Maximum Setpoint Limit	42246	Float	4	R W	Percent	-100 – 100
Generator PF Setpoint	42248	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 42260 and 42262.
Generator PF Traverse Rate	42250	Float	4	R W	Second	10 – 200
Generator PF Pre-position Mode 1	42252	Uint32	4	R W		Maintain=0 Release=1
Generator PF Pre-position 1	42254	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 42260 and 42262.
Generator PF Pre-position Mode 2	42256	Uint32	4	R W		Maintain=0 Release=1
Generator PF Pre-position 2	42258	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 42260 and 42262.
Generator PF Minimum Setpoint Limit	42260	Float	4	R W	PowerFactor	0.5 – 1
Generator PF Maximum Setpoint Limit	42262	Float	4	R W	PowerFactor	-1 – -0.5
FVR Setpoint	42264	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42276 and 42278.

Name	Register	Type	Bytes	R/W	Unit	Range
FVR Traverse Rate	42266	Float	4	R W	Second	10 – 200
FVR Pre-position Mode 1	42268	Uint32	4	R W		Maintain=0 Release=1
FVR Pre-position 1	42270	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42276 and 42278.
FVR Pre-position Mode 2	42272	Uint32	4	R W		Maintain=0 Release=1
FVR Pre-position 2	42274	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42276 and 42278.
FVR Minimum Setpoint Limit	42276	Float	4	R W	Percent	0 - 150
FVR Maximum Setpoint Limit	42278	Float	4	R W	Percent	0 - 150
Droop Value	42280	Float	4	R W	Percent	0 - 30
L-Drop Value	42282	Float	4	R W	Percent	0 - 30
Auxiliary Limit Enable	42284	Int32	4	R W		Disabled=0 Enabled=1
Field Current Regulation Pre-position Mode 3	42286	Uint32	4	R W		Maintain=0 Release=1
Field Current Regulation Pre-position 3	42288	Float	4	R W	Amp	Setpoint adjustment range determined by registers 42212 and 42214.
Generator Voltage Pre-position Mode 3	42290	Uint32	4	R W		Maintain=0 Release=1
Generator Voltage Pre-position 3	42292	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42228 and 42230.
Generator var Pre-position Mode 3	42294	Uint32	4	R W		Maintain=0 Release=1
Generator var Pre-position 3	42296	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 42244 and 42246.
Generator PF Pre-position Mode 3	42298	Uint32	4	R W		Maintain=0 Release=1
Generator PF Pre-position 3	42300	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 42260 and 42262.
FVR Pre-position Mode 3	42302	Uint32	4	R W		Maintain=0 Release=1
FVR Pre-position 3	42304	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42276 and 42278.
Active Field Current Regulation Setpoint	42306	Float	4	R W	Amp	Setpoint adjustment range determined by registers 42212 and 42214.
Active Generator Voltage Setpoint	42308	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42228 and 42230.
Active Generator var Setpoint	42310	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 42244 and 42246.
Active Generator PF Setpoint	42312	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 42260 and 42262.
Active FVR Setpoint	42314	Float	4	R W	Volt	Setpoint adjustment range determined by registers 42276 and 42278.
Transient Boost Enable	42316	Int32	4	R W		Disabled=0,Enabled=1
Transient Boost, Fault Voltage Threshold	42318	Float	4	R W	Percent	0 – 100
Transient Boost, Fault Current Threshold	42320	Float	4	R W	Percent	0 – 400
Transient Boost, Minimum Fault Duration	42322	Float	4	R W	Second	0 – 1

Name	Register	Type	Bytes	R/W	Unit	Range
Transient Boost, Voltage Setpoint Boosting Level	42324	Float	4	R W	Percent	0 – 100
Transient Boost, Clearing Voltage Threshold	42326	Float	4	R W	Percent	0 – 50
Transient Boost, Clearing Voltage Delay	42328	Float	4	R W	Second	0 – 1

Global Settings

Table 29. Global Settings Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
PLC Timed Element Settings	Logic Timer 1 Output Timeout	42400	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 2 Output Timeout	42402	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 3 Output Timeout	42404	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 4 Output Timeout	42406	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 5 Output Timeout	42408	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 6 Output Timeout	42410	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 7 Output Timeout	42412	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 8 Output Timeout	42414	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 9 Output Timeout	42416	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 10 Output Timeout	42418	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 11 Output Timeout	42420	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 12 Output Timeout	42422	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 13 Output Timeout	42424	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 14 Output Timeout	42426	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 15 Output Timeout	42428	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Logic Timer 16 Output Timeout	42430	Float	4	R W	Sec	0 - 1800
PLC Timed Element Settings	Counter 1 Output Timeout	42432	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 2 Output Timeout	42434	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 3 Output Timeout	42436	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 4 Output Timeout	42438	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 5 Output Timeout	42440	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 6 Output Timeout	42442	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 7 Output Timeout	42444	Float	4	R W	No Unit	0 - 1800
PLC Timed Element Settings	Counter 8 Output Timeout	42446	Float	4	R W	No Unit	0 - 1800
DECS PSS	PSS Enable	42448	Uint32	4	R W		Disabled=0 Enabled=1
DECS PSS	PSS Enable Status	42450	Uint32	4	R		Off=0 On=1
Synchronizer	Sync Type	42452	Uint32	4	R W		Anticipatory=0 Phase Lock Loop=1
Synchronizer	Slip Frequency	42454	Float	4	R W	Hz	0.1 - 0.5
Synchronizer	Generator Frequency Greater Than Bus Frequency	42456	Uint32	4	R W		Disabled=0 Enabled=1
Synchronizer	Breaker Closing Angle	42458	Float	4	R W	Deg	3 - 20
Synchronizer	Sync Activation Delay	42460	Float	4	R W	Sec	0.1 - 0.8
Synchronizer	Generator Voltage Greater Than Bus Voltage	42462	Uint32	4	R W		Disabled=0 Enabled=1
Synchronizer	Sync Fail Activation Delay	42464	Float	4	R W	Sec	0.1 - 600

Group	Name	Register	Type	Bytes	R/W	Unit	Range
Synchronizer	Sync Speed Gain	42466	Float	4	R W	No Unit	0.001 - 1000
Synchronizer	Sync Voltage Gain	42468	Float	4	R W	No Unit	0.001 - 1000
Synchronizer	Voltage Window	42470	Float	4	R W	%	2 - 15
Synchronizer	Sys Option Input AutoSync Enabled	42472	Uint32	4	R W		Disabled=0 Enabled=1
Synchronizer	Max Slip Control Limit Hz	42474	Float	4	R W	Hz	0 - 2
Synchronizer	Min Slip Control Limit Hz	42476	Float	4	R W	Hz	0 - 2
Network Load Share	Load Share Enable	42478	Uint32	4	R W		Disabled=0 Enabled=1
Network Load Share	Load Share Droop Percent	42480	Float	4	R W	%	0 - 30
Network Load Share	Load Share Gain	42482	Float	4	R W	No Unit	0 - 1000
Network Load Share	Washout Filter Time Constant	42484	Float	4	R W	No Unit	0 - 1
Network Load Share	Washout Filter Gain	42486	Float	4	R W	No Unit	0 - 1000
Generator Current Configuration	Rotation	42488	Uint32	4	R W		Forward=0 Reverse=1
Synchronizer	Angle Compensation	42490	Float	4	R W	Degree	0 – 359.9

Relay Settings

Table 30. Relay Settings Group Parameters

Group	Name	Register	Type	Bytes	R/W	Unit	Range
System Configuration	Nominal Frequency	42600	Uint32	4	R W		50 Hz=50 60 Hz=60
System Configuration	DECS Auxiliary Summing Mode	42602	Uint32	4	R W		Voltage=0 Var=1
System Configuration	DECS Auxiliary Input Mode	42604	Uint32	4	R W		Voltage=0 Current=1
System Configuration	DECS Auxiliary Input Function	42606	Uint32	4	R W		DECS Input=0 PSS Test Input=1 Limiter Selection=2
System Configuration	DECS Auxiliary Voltage Gain	42608	Float	4	R W	No Unit	-99 – 99
System Configuration	DECS AutoTrack TDelay	42610	Float	4	R W	Second	0 - 8
System Configuration	DECS AutoTrack TRate	42612	Float	4	R W	Second	1 - 80
System Configuration	DECS Null Balance Level	42614	Float	4	R W	Percent	0 - 9999
System Configuration	DECS Auto Trans TDelay	42616	Float	4	R W	Second	0 - 8
System Configuration	DECS Auto Trans TRate	42618	Float	4	R W	Second	1 - 80
Gen Volt Configuration	Ratio Primary	42620	Float	4	R W	No Unit	1 - 500000
Gen Volt Configuration	Ratio Secondary	42622	Float	4	R W	No Unit	1 - 600
Gen Volt Configuration	Rated Primary LL	42624	Float	4	R W	Volt	1 - 500000
Bus Volt Configuration	Ratio Primary	42626	Float	4	R W	No Unit	1 - 500000
Bus Volt Configuration	Ratio Secondary	42628	Float	4	R W	No Unit	1 - 600
Bus Volt Configuration	Rated Primary LL	42630	Float	4	R W	Volt	1 - 500000
Gen Current Configuration	Ratio Primary	42632	Float	4	R W	No Unit	1 - 99999
Gen Current Configuration	Ratio Secondary	42634	Int32	4	R W		1=1 5=5
Gen Current Configuration	Rated Primary	42636	Float	4	R	Amp	0 - 180000

Group	Name	Register	Type	Bytes	R/W	Unit	Range
DECS Control	Start Stop Request	42638	Uint32	4	R W		Stop=0 =1 Start =2
DECS Control	Sys Option Underfrequency Hz	42640	Float	4	R W	Hertz	40 - 75
DECS Control	Sys Input COM Port Manual Enabled	42642	Uint32	4	R W		Manual=1 Automatic=2
DECS Control	Sys Input COM Port PF var Enabled	42644	Uint32	4	R W		Off=0 PF=1 Var=2
DECS Control	Sys Input COM Port Ext Track Enabled	42646	Uint32	4	R W		Disabled=0 Enabled=1
DECS Control	Sys Input COM Port Pre-position Enabled	42648	Uint32	4	R W		=0 SET=1
DECS Control	Sys Input COM Port Pre-position Enabled 2	42650	Uint32	4	R W		=0 SET=1
DECS Control	Sys Input COM Port Raise Enabled	42652	Uint32	4	R W		=0 Raise=1
DECS Control	Sys Input COM Port Lower Enabled	42654	Uint32	4	R W		=0 Lower=1
DECS Control	Sys Option Input Voltage Match Enabled	42656	Uint32	4	R W		Disabled=0 Enabled=1
DECS Control	Sys Option Underfrequency Mode	42658	Uint32	4	R W		UF Limiter=0 V/Hz Limiter=1
DECS Control	Sys Option Limiter Mode	42660	Uint32	4	R W		Off=0 UEL=1 OEL=2 UEL & OEL=3 SCL=4 UEL & SCL=5 OEL & SCL=6 UEL & OEL & SCL=7
DECS Control	Sys Option Voltage Match Band	42662	Float	4	R W	Percent	0 - 20
DECS Control	Sys Option Voltage Match Reference	42664	Float	4	R W	Percent	0 - 700
DECS Control	Sys Option Underfrequency Slope	42666	Float	4	R W	No Unit	0 - 3
DECS Control	Startup Primary Soft-start Bias	42668	Float	4	R W	Percent	0 - 90
DECS Control	Startup Primary Soft-start Time	42670	Float	4	R W	Second	1 - 7200
DECS Control	Startup Secondary Soft-start Bias	42672	Float	4	R W	Percent	0 - 90
DECS Control	Startup Secondary Soft-start Time	42674	Float	4	R W	Second	1 - 7200

Protection Settings

Table 31. Protection Settings Group Parameters

Group	Name	Register	Type	Sz	R/W	Unit	Range
Field Overvoltage	Primary Mode	43100	Uint32	4	R W		Disabled=0 Enabled=1
Field Overvoltage	Primary Pickup	43102	Float	4	R W	V	Disabled=0, 1 - 325
Field Overvoltage	Primary Time Delay	43104	Float	4	R W	ms	Instantaneous=0, 200 - 30000
Field Overvoltage	Secondary Mode	43106	Uint32	4	R W		Disabled=0 Enabled=1
Field Overvoltage	Secondary Pickup	43108	Float	4	R W	V	Disabled=0, 1 - 325
Field Overvoltage	Secondary Time Delay	43110	Float	4	R W	ms	Instantaneous=0, 200 - 30000
Field Overcurrent	Primary Mode	43112	Uint32	4	R W		Disabled=0 Enabled=1
Field Overcurrent	Primary Pickup	43114	Float	4	R W	Amp	Disabled=0, 0 - 22
Field Overcurrent	Primary Time Delay	43116	Float	4	R W	ms	Instantaneous=0, 5000 - 60000
Field Overcurrent	Secondary Mode	43118	Uint32	4	R W		Disabled=0 Enabled=1
Field Overcurrent	Secondary Pickup	43120	Float	4	R W	Amp	Disabled=0, 0 - 22
Field Overcurrent	Secondary Time Delay	43122	Float	4	R W	ms	Instantaneous=0, 5000 - 60000
Exciter Diode Monitor	Exciter Open Diode Enable	43124	Uint32	4	R W		Disabled=0 Enabled=1
Exciter Diode Monitor	Exciter Shorted Diode Enable	43126	Uint32	4	R W		Disabled=0 Enabled=1
Exciter Diode Monitor	Exciter Diode Disable Level	43128	Float	4	R W	%	0 - 100
Exciter Diode Monitor	Exciter Open Diode Pickup	43130	Float	4	R W	%	0 - 100

Group	Name	Register	Type	Sz	R/W	Unit	Range
Exciter Diode Monitor	Exciter Open Diode Time Delay	43132	Float	4	R W	Sec	10 – 60
Exciter Diode Monitor	Exciter Shorted Diode Pickup	43134	Float	4	R W	%	0 - 100
Exciter Diode Monitor	Exciter Shorted Diode Time Delay	43136	Float	4	R W	Sec	5 – 30
Exciter Diode Monitor	Exciter Pole Ratio	43138	Float	4	R W	No Unit	Disabled=0, 1 – 10
Power Input Failure	Mode	43140	Uint32	4	R W		Disabled=0 Enabled=1
Power Input Failure	Time Delay	43142	Float	4	R W	Sec	0 - 10
Loss Of Sensing	Mode	43144	Uint32	4	R W		Disabled=0 Enabled=1
Loss Of Sensing	Time Delay	43146	Float	4	R W	Sec	0 - 30
Loss Of Sensing	Voltage Balanced Level	43148	Float	4	R W	%	0 - 100
Loss Of Sensing	Voltage Unbalanced Level	43150	Float	4	R W	%	0 - 100
25	Mode	43152	Uint32	4	R W		Disabled=0 Enabled=1
25	Slip Angle	43156	Float	4	R W	Deg	1 - 99
25	Slip Frequency	43158	Float	4	R W	Hz	0.01 - 0.5
25	Voltage Difference	43160	Float	4	R W	%	0.1 - 50
25	Generator Frequency Greater Than Bus Frequency	43162	Uint32	4	R W		Disabled=0 Enabled=1
25	Dead Voltage	43164	Float	4	R W	%	Disabled=0, 10 – 90
25	Live Voltage	43166	Float	4	R W	%	Disabled=0, 10 – 90
25	Dropout Delay	43168	Float	4	R W	ms	50 – 60000
25	Angle Compensation	43170	Float	4	R W	Deg	0 – 359.9
25	VMM Dead Line, Dead Aux	43172	Uint32	4	R W		Disabled=0 Enabled=1
25	VMM Dead Line, Live Aux	43174	Uint32	4	R W		Disabled=0 Enabled=1
25	VMM Live Line, Dead Aux	43176	Uint32	4	R W		Disabled=0 Enabled=1
27P	Primary Mode	43178	Uint32	4	R W		Disabled=0 Enabled=1
27P	Primary Pickup	43180	Float	4	R W	V	Disabled=0, 1 - 600000
27P	Primary Time Delay	43182	Float	4	R W	ms	100 - 60000
27P	Secondary Mode	43184	Uint32	4	R W		Disabled=0 Enabled=1
27P	Secondary Pickup	43186	Float	4	R W	V	Disabled=0, 1 - 600000
27P	Secondary Time Delay	43188	Float	4	R W	ms	100 - 60000
59P	Primary Mode	43190	Uint32	4	R W		Disabled=0 Enabled=1
59P	Primary Pickup	43192	Float	4	R W	V	Disabled=0, 0 - 600000
59P	Primary Time Delay	43194	Float	4	R W	ms	100 - 60000
59P	Secondary Mode	43196	Uint32	4	R W		Disabled=0 Enabled=1
59P	Secondary Pickup	43198	Float	4	R W	V	Disabled=0, 0 - 600000
59P	Secondary Time Delay	43200	Float	4	R W	ms	100 - 60000
81O	Primary Mode	43202	Uint32	4	R W		Disabled=0 Over=1
81O	Primary Pickup	43204	Float	4	R W	Hz	Disabled=0, 30 - 70
81O	Primary Time Delay	43206	Float	4	R W	ms	100 - 300000
81O	Secondary Mode	43208	Uint32	4	R W		Disabled=0 Over=1
81O	Secondary Pickup	43210	Float	4	R W	Hz	Disabled=0, 30 - 70
81O	Secondary Time Delay	43212	Float	4	R W	ms	100 - 300000
81U	Primary Mode	43214	Uint32	4	R W		Disabled=0 Under=2

Group	Name	Register	Type	Sz	R/W	Unit	Range
81U	Primary Pickup	43216	Float	4	R W	Hz	Disabled=0, 30 - 70
81U	Primary Time Delay	43218	Float	4	R W	ms	100 - 300000
81U	Primary Voltage Inhibit	43220	Float	4	R W	%	Disabled=0, 50 - 100
81U	Secondary Mode	43222	Uint32	4	R W		Disabled=0 Under=2
81U	Secondary Pickup	43224	Float	4	R W	Hz	Disabled=0, 30 - 70
81U	Secondary Time Delay	43226	Float	4	R W	ms	100 - 300000
81U	Secondary Voltage Inhibit	43228	Float	4	R W	%	Disabled=0, 50 - 100
40Q	Primary Mode	43230	Uint32	4	R W		Disabled=0 Enabled=1
40Q	Primary Pickup	43232	Float	4	R W	%	Disabled=0, 0 - 150
40Q	Primary Time Delay	43234	Float	4	R W	ms	Instantaneous=0, 0 - 300000
40Q	Secondary Mode	43236	Uint32	4	R W		Disabled=0 Enabled=1
40Q	Secondary Pickup	43238	Float	4	R W	%	Disabled=0, 0 - 150
40Q	Secondary Time Delay	43240	Float	4	R W	ms	Instantaneous=0, 0 - 300000
32R	Primary Mode	43242	Uint32	4	R W		Disabled=0 Enabled=4
32R	Primary Pickup	43244	Float	4	R W	%	Disabled=0, 0 - 150
32R	Primary Time Delay	43246	Float	4	R W	ms	Instantaneous =0, 0 - 300000
32R	Secondary Mode	43248	Uint32	4	R W		Disabled=0 Enabled=4
32R	Secondary Pickup	43250	Float	4	R W	%	Disabled=0, 0 - 150
32R	Secondary Time Delay	43252	Float	4	R W	ms	Instantaneous=0, 0 - 300000
Field Overcurrent	Timing Mode, PP	43254	Uint32	4	R W		Definite Timing=0 Inverse Timing=1
Field Overcurrent	Time Dial, PP	43256	Float	4	R W		0.1 – 20
Field Overcurrent	Timing Mode, PS	43258	Uint32	4	R W		Definite Timing=0 Inverse Timing=1
Field Overcurrent	Time Dial, PS	43260	Float	4	R W		0.1 – 20
24	Primary Mode	43262	Uint32	4	R W		Disabled=0,Enabled=1
24	Primary Definite Time Pickup 1	43264	Float	4	R W		0.5 – 6
24	Primary Definite Time Pickup 2	43266	Float	4	R W		0.5 – 6
24	Primary Definite Time Delay 1	43268	Float	4	R W	ms	50 – 600000
24	Primary Definite Time Delay 2	43270	Float	4	R W	ms	50 – 600000
24	Primary Inverse Time Pickup	43272	Float	4	R W		0.5 – 6
24	Primary Time Dial Trip	43274	Float	4	R W		0 – 9.9
24	Primary Time Dial Reset	43276	Float	4	R W		0 – 9.9
24	Primary Curve Exponent	43278	Uint32	4	R W		0.5=0,1=1,2=2
24	Secondary Mode	43280	Uint32	4	R W		Disabled=0,Enabled=1
24	Secondary Definite Time Pickup 1	43282	Float	4	R W		0.5 – 6
24	Secondary Definite Time Pickup 2	43284	Float	4	R W		0.5 – 6
24	Secondary Definite Time Delay 1	43286	Float	4	R W	ms	50 – 600000
24	Secondary Definite Time Delay 2	43288	Float	4	R W	ms	50 – 600000
24	Secondary Inverse Time Pickup	43290	Float	4	R W		0.5 – 6
24	Secondary Time Dial Trip	43292	Float	4	R W		0 – 9.9
24	Secondary Time Dial Reset	43294	Float	4	R W		0 – 9.9

Group	Name	Register	Type	Sz	R/W	Unit	Range
24	Curve Exponent	43296	Uint32	4	R W		0.5=0,1=1,2=2

Gains Settings

Table 32. Gains Settings Group Parameters

Name	Register	Type	Bytes	R/W	Unit	Range
Primary Gain Option	43800	Uint32	4	R W		T'do=1.0 Te=0.17=1 T'do=1.5 Te=0.25=2 T'do=2.0 Te=0.33=3 T'do=2.5 Te=0.42=4 T'do=3.0 Te=0.50=5 T'do=3.5 Te=0.58=6 T'do=4.0 Te=0.67=7 T'do=4.5 Te=0.75=8 T'do=5.0 Te=0.83=9 T'do=5.5 Te=0.92=10 T'do=6.0 Te=1.00=11 T'do=6.5 Te=1.08=12 T'do=7.0 Te=1.17=13 T'do=7.5 Te=1.25=14 T'do=8.0 Te=1.33=15 T'do=8.5 Te=1.42=16 T'do=9.0 Te=1.50=17 T'do=9.5 Te=1.58=18 T'do=10.0 Te=1.67=19 T'do=10.5 Te=1.75=20 Custom=21
Secondary Gain Option	43802	Uint32	4	R W		T'do=1.0 Te=0.17=1 T'do=1.5 Te=0.25=2 T'do=2.0 Te=0.33=3 T'do=2.5 Te=0.42=4 T'do=3.0 Te=0.50=5 T'do=3.5 Te=0.58=6 T'do=4.0 Te=0.67=7 T'do=4.5 Te=0.75=8 T'do=5.0 Te=0.83=9 T'do=5.5 Te=0.92=10 T'do=6.0 Te=1.00=11 T'do=6.5 Te=1.08=12 T'do=7.0 Te=1.17=13 T'do=7.5 Te=1.25=14 T'do=8.0 Te=1.33=15 T'do=8.5 Te=1.42=16 T'do=9.0 Te=1.50=17 T'do=9.5 Te=1.58=18 T'do=10.0 Te=1.67=19 T'do=10.5 Te=1.75=20 Custom=21
AVR Kp Primary	43804	Float	4	R W	No Unit	0 - 1000
AVR Ki Primary	43806	Float	4	R W	No Unit	0 - 1000
AVR Kd Primary	43808	Float	4	R W	No Unit	0 - 1000
AVR Td Primary	43810	Float	4	R W	No Unit	0 - 1
FCR Kp	43812	Float	4	R W	No Unit	0 - 1000
FCR Ki	43814	Float	4	R W	No Unit	0 - 1000
FCR Kd	43816	Float	4	R W	No Unit	0 - 1000
FCR Td	43818	Float	4	R W	No Unit	0 - 1
FVR Kp	43820	Float	4	R W	No Unit	0 - 1000
FVR Ki	43822	Float	4	R W	No Unit	0 - 1000
FVR Kd	43824	Float	4	R W	No Unit	0 - 1000
FVR Td	43826	Float	4	R W	No Unit	0 - 1
PF Ki	43828	Float	4	R W	No Unit	0 - 1000
PF Kg	43830	Float	4	R W	No Unit	0 - 1000
Var Ki	43832	Float	4	R W	No Unit	0 - 1000
Var Kg	43834	Float	4	R W	No Unit	0 - 1000
OEL Ki	43836	Float	4	R W	No Unit	0 - 1000
OEL Kg	43838	Float	4	R W	No Unit	0 - 1000
UEL Ki	43840	Float	4	R W	No Unit	0 - 1000
UEL Kg	43842	Float	4	R W	No Unit	0 - 1000
SCL Ki	43844	Float	4	R W	No Unit	0 - 1000
SCLKg	43846	Float	4	R W	No Unit	0 - 1000
Vm Kg	43848	Float	4	R W	No Unit	0 - 1000
Inner Loop Kp	43850	Float	4	R W	No Unit	0 - 1000
Inner Loop Ki	43852	Float	4	R W	No Unit	0 - 1000
AVR Kp Secondary	43854	Float	4	R W	No Unit	0 - 1000

Name	Register	Type	Bytes	R/W	Unit	Range
AVR Ki Secondary	43856	Float	4	R W	No Unit	0 - 1000
AVR Kd Secondary	43858	Float	4	R W	No Unit	0 - 1000
AVR Td Secondary	43860	Float	4	R W	No Unit	0 - 1
Var Limit Ki	43862	Float	4	R W	No Unit	0 - 1000
Var Limit Kg	43864	Float	4	R W	No Unit	0 - 1000
AVR Pri Ka	43866	Float	4	R W	No Unit	0 - 1
AVR Secondary Ka	43868	Float	4	R W	No Unit	0 - 1
FCR Ka	43870	Float	4	R W	No Unit	0 - 1
FVR Ka	43872	Float	4	R W	No Unit	0 - 1

Legacy Modbus

Table 33. Legacy Modbus Parameters

Name	Register	Type	Bytes	R/W	Unit	Range
Model Info Char 1	47001	Uint8	1	R	No Unit	N/A
Model Info Char 2	47002	Uint8	1	R	No Unit	N/A
Model Info Char 3	47003	Uint8	1	R	No Unit	N/A
Model Info Char 4	47004	Uint8	1	R	No Unit	N/A
Model Info Char 5	47005	Uint8	1	R	No Unit	N/A
Model Info Char 6	47006	Uint8	1	R	No Unit	N/A
Model Info Char 7	47007	Uint8	1	R	No Unit	N/A
Model Info Char 8	47008	Uint8	1	R	No Unit	N/A
Model Info Char 9	47009	Uint8	1	R	No Unit	N/A
App Program Version Char 1	47010	Uint8	1	R	No Unit	N/A
App Program Version Char 2	47011	Uint8	1	R	No Unit	N/A
App Program Version Char 3	47012	Uint8	1	R	No Unit	N/A
App Program Version Char 4	47013	Uint8	1	R	No Unit	N/A
App Program Version Char 5	47014	Uint8	1	R	No Unit	N/A
App Program Version Char 6	47015	Uint8	1	R	No Unit	N/A
App Program Version Char 7	47016	Uint8	1	R	No Unit	N/A
App Program Version Char 8	47017	Uint8	1	R	No Unit	N/A
App Version Date Char 1	47018	Uint8	1	R	No Unit	N/A
App Version Date Char 2	47019	Uint8	1	R	No Unit	N/A
App Version Date Char 3	47020	Uint8	1	R	No Unit	N/A
App Version Date Char 4	47021	Uint8	1	R	No Unit	N/A
App Version Date Char 5	47022	Uint8	1	R	No Unit	N/A
App Version Date Char 6	47023	Uint8	1	R	No Unit	N/A
App Version Date Char 7	47024	Uint8	1	R	No Unit	N/A
App Version Date Char 8	47025	Uint8	1	R	No Unit	N/A
App Version Date Char 9	47026	Uint8	1	R	No Unit	N/A
Reserved	47027-43	Uint8	1	R	No Unit	0 - 255
Boot Program Version Char 1	47044	Uint8	1	R	No Unit	N/A
Boot Program Version Char 2	47045	Uint8	1	R	No Unit	N/A

Name	Register	Type	Bytes	R/W	Unit	Range
Boot Program Version Char 3	47046	Uint8	1	R	No Unit	N/A
Boot Program Version Char 4	47047	Uint8	1	R	No Unit	N/A
Boot Program Version Char 5	47048	Uint8	1	R	No Unit	N/A
Boot Program Version Char 6	47049	Uint8	1	R	No Unit	N/A
Boot Program Version Char 7	47050	Uint8	1	R	No Unit	N/A
Boot Program Version Char 8	47051	Uint8	1	R	No Unit	N/A
Reserved	47052-64	Uint8	1	R	No Unit	0 - 255
RMS Generator Volts Phase A to B	47251	Float	4	R	No Unit	N/A
RMS Generator Volts Phase B to C	47253	Float	4	R	No Unit	N/A
RMS Generator Volts Phase C to A	47255	Float	4	R	No Unit	N/A
Avg RMS L-L Volts	47257	Float	4	R	No Unit	N/A
Generator Current Ib in amps	47259	Float	4	R	No Unit	N/A
Generator Apparent Power in kVA	47261	Float	4	R	No Unit	N/A
Generator Real Power in kW	47263	Float	4	R	No Unit	N/A
Generator Reactive Power in kvar	47265	Float	4	R	No Unit	N/A
Power Factor	47267	Float	4	R	No Unit	N/A
Generator Frequency in Hertz	47269	Float	4	R	No Unit	N/A
Bus Frequency in Hertz	47271	Float	4	R	No Unit	N/A
RMS Bus Voltage in Volts	47273	Float	4	R	No Unit	N/A
Field Voltage in Volts	47275	Float	4	R	No Unit	N/A
Field Current in Amps	47277	Float	4	R	No Unit	N/A
Var/PF Controller Output in Volts	47279	Float	4	R	Per Unit	N/A
Phase Angle Between Phase B Voltage and Current	47281	Float	4	R	No Unit	N/A
Auxiliary Input in Volts	47283	Float	4	R	No Unit	N/A
Current Input for Load Compensation	47285	Float	4	R	No Unit	N/A
Null Balance in Percent	47287	Float	4	R	No Unit	N/A
Error Signal to Autotracking Loop	47289	Float	4	R	No Unit	N/A
Active Controller Output	47291	Float	4	R	No Unit	N/A
PF State	47293	Uint16	2	R	No Unit	N/A
Generator State	47294	Uint16	2	R	No Unit	N/A
Status of Front Panel LEDs	47295	Uint16	2	R	No Unit	(bit flags, 0 = off, 1 = on for all LEDs except Null Balance and Internal Tracking, which are reversed): b0 = Null Balance, b1 = Tracking, b2 = Pre-position, b3 = Upper Limit, b4 = Lower Limit, b5 = Edit, b6-b15 = unassigned
Voltage Matching Status	47296	Uint16	2	R	No Unit	N/A

Name	Register	Type	Bytes	R/W	Unit	Range
Protection Status Bit Flags 1	47297	Uint16	2	R	No Unit	(0 = clear, 1 = condition present): b0 = field overvoltage, b1 = field overcurrent, b2 = gen. Undervoltage, b3 = gen. overvoltage, b4 = underfrequency, b5 = in OEL, b6 = in UEL, b7 = in FCR mode, b8 = loss of sensing voltage, b9 = setpoint at lower limit, b10 = setpoint at upper limit, b11 = gen. failed to build up, b12 = gen. below 10Hz, b13 = unassigned, b14 = exciter diode open, b15 = exciter diode shorted.
Reserved	47298	Float	4	R	No Unit	N/A
Active Operating Setpoint in Percent	47300	Float	4	R	No Unit	N/A
Contact Input States	47302	Uint16	2	R	No Unit	N/A
Annunciation Status Bit Flags 1	47303	Uint16	2	R	No Unit	(0 = clear, 1 = annunciation present): b0 = field overvoltage, b1 = field overcurrent, b2 = gen. undervoltage, b3 = gen. overvoltage, b4 = underfrequency, b5 = in OEL, b6 = in UEL, b7 = in FCR, b8 = loss of sensing voltage, b9 = setpoint at lower limit, b10 = setpoint at upper limit, b11 = gen. failed to build up, b12 = gen. below 10Hz, b13 = unassigned, b14 = exciter diode open, b15 = exciter diode shorted
Reserved 3	47304	Float	4	R	No Unit	N/A
Protection Status Bit Flags 2	47306	Uint16	2	R	No Unit	(0 = clear, 1 = condition present) b0 = loss of field, b1 = in SCL, b2 – b15 are unassigned
Annunciation Status Bit Flags 2	47307	Uint16	2	R	No Unit	(0 = clear, 1 = condition present) b0 = loss of field, b1 = in SCL, b2 – b15 are unassigned
Reserved 4	47308-375	C2 Filler	136	N/A	No Unit	N/A
Reserved 5	47376-499	C3 Filler	248	N/A	No Unit	N/A
Auxiliary Input Function	47500	Uint16	2	N/A	No Unit	DECS Input=0 PSS Test Input=1 Limiter Selection=2
Generator Rated Frequency	47501	Uint32	4	R W		50 Hz=50 60 Hz=60
Generator PT Primary Voltage Rating	47503	Float	4	R W	No Unit	1 - 500000
Generator PT Secondary Voltage Rating	47505	Float	4	R W	No Unit	1 - 600
Generator CT Primary Current Rating	47507	Float	4	R W	No Unit	1 - 99999
Generator CT Secondary Current Rating	47509	Int32	4	R W		1=1 5=5
Not used in DECS-250N	47511	Float	4	R W	No Unit	
Reserved Float 1	47513	Float	4	R	No Unit	0 - 10000
Bus Sensing PT Primary Rating	47515	Float	4	R W	No Unit	1 - 500000
Bus Sensing PT Secondary Rating	47517	Float	4	R W	No Unit	1 - 600
Reserved 6	47519	Float	4	R	No Unit	N/A
Reserved 7	47521	Float	4	R	No Unit	N/A
Generator Rated Voltage	47523	Float	4	R W	Volt	1 - 500000
Generator Rated Current	47525	Float	4	R	Amp	0 – 180000
Generator Rated Field Voltage	47527	Float	4	R W	Volt	1 – 125 or 1 – 250 if the unit is a DECS-250N with power configuration style #3.
Generator Rated Field Current	47529	Float	4	R W	Amp	1 – 15 (DECS-250) 1 – 20 (DECS-250N)

Name	Register	Type	Bytes	R/W	Unit	Range
Nominal Bus Voltage	47531	Float	4	R W	Volt	1 - 500000
Auxiliary Input Gain for AVR Mode	47533	Float	4	R W	No Unit	-99 – 99
Time Delay Before Autotracking	47535	Float	4	R W	Second	0 – 8
Traverse Rate of Autotracking	47537	Float	4	R W	Second	1 – 80
Not used in DECS-250N	47539	Float	4	R W	No Unit	
Gain for Cross Current Compensation	47541	Float	4	R W	Percent	-30 – 30
Sensing Mode	47543	Uint16	2	R W		1-phase (A-C)=0 3-phase=1
Auxiliary Input Summing Mode	47544	Uint16	2	R W		Voltage=0 Var=1
Not used in DECS-250N	47545	Uint16	2	R	No Unit	N/A
Reserved 8	47546	Uint16	2	R	No Unit	N/A
Auxiliary Input Mode	47547	Uint16	2	R W		Voltage=0 Current=1
For Future Use	47548	Uint16	2	R	No Unit	N/A
External Tracking Time Delay	47549	Float	4	R W	Second	0 - 8
External Tracking Traverse Rate	47551	Float	4	R W	Second	1 – 80
Reserved 29	47553	Uint16	2	R	No Unit	N/A
Auxiliary Input Gain for FCR Mode	47554	Float	4	R W	No Unit	-99 – 99
Auxiliary Input Gain for VAR Mode	47556	Float	4	R W	No Unit	-99 – 99
Auxiliary Input Gain for PF Mode	47558	Float	4	R W	No Unit	-99 – 99
Reserved 9	47560	Uint16	2	R	No Unit	N/A
Unit Mode Virtual Toggle	47561	Uint16	2	R W		An entry of '1' toggles through the following modes: Stop, Start
Control Mode Virtual Toggle	47562	Uint16	2	R W		An entry of '1' toggles through the following modes: Manual, Automatic
Operating Mode Virtual Switch	47563	Uint16	2	R W		Off=0 PF=1 Var=2
AutoTrack Enabled Status	47564	Uint16	2	R W		Disabled=0 Enabled=1
Pre-position Enable	47565	Uint16	2	R W		=0 SET=1
Raise Enabled Status	47566	Uint16	2	R W		=0 Raise=1
Lower Enabled Status	47567	Uint16	2	R W		=0 Lower=1
External Tracking Enable Status	47568	Uint16	2	R	No Unit	Off=0 Enabled=1
Limiter Mode Options	47569	Uint16	2	R W		Off=0 UEL=1 OEL=2 UEL & OEL=3 SCL=4 UEL & SCL=5 OEL & SCL=6 UEL & OEL & SCL=7
Voltage Match Mode	47570	Uint16	2	R W		Disabled=0 Enabled=1
Operating Mode Status	47571	Uint16	2	R	No Unit	N/A
Unit Mode Status	47572	Uint16	2	R	No Unit	N/A
Control Mode Status	47573	Uint16	2	R	No Unit	FCR=1 AVR=2
Internal Tracking Status	47574	Uint16	2	R	No Unit	Off=0 Enabled=1
Pre-position Enable Status	47575	Uint16	2	R	No Unit	N/A
Autotransfer Status	47576	Uint16	2	R	No Unit	Primary=0 Secondary=1
Load Compensation Mode Status	47577	Uint16	2	R	No Unit	Off=0 Droop=1 Line Drop=2
Load Compensation Mode Select	47578	Uint16	2	R W		Disabled=0 Enabled=1
Alarm Reset Enable	47579	Uint16	2	R W		Disabled=0 Enabled=1

Name	Register	Type	Bytes	R/W	Unit	Range
Loss-of-Sensing Detection Enable	47580	Uint16	2	R W		Disabled=0 Enabled=1
Loss-of-Sensing Triggered Transfer-to-FCR-mode Enable	47581	Uint16	2	R W		Disabled=0 Enabled=1
Underfrequency or V/Hz Mode Enable	47582	Uint16	2	R W		UF Limiter=0 V/Hz Limiter=1
External Tracking Enabled	47583	Uint16	2	R W		Disabled=0 Enabled=1
OEL Style Virtual Toggle	47584	Uint16	2	R W		Summing=0 Takeover=1
Reserved 16bit 32	47585	Uint16	2	R W	No Unit	0 - 65535
PF/var Option Status	47586	Uint16	2	R	No Unit	Off=0 PF=1 var=2
Reserved 10	47587-620	C5 Filler	68	N/A	No Unit	N/A
FCR Mode Setpoint	47621	Float	4	R W	Amp	Setpoint adjustment range determined by registers 47655 and 47663.
AVR Mode Setpoint	47623	Float	4	R W	Volt	Setpoint adjustment range determined by registers 47657 and 47665.
Var Mode Setpoint in kvar	47625	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 47659 and 47667.
PF Mode Setpoint	47627	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 47661 and 47669.
Droop Setting in Percent	47629	Float	4	R W	Percent	0 - 30
FCR Mode Traverse Rate	47631	Float	4	R W	Second	10 - 200
AVR Mode Traverse Rate	47633	Float	4	R W	Second	10 - 200
Var Mode Traverse Rate	47635	Float	4	R W	Second	10 - 200
PF Mode Traverse Rate	47637	Float	4	R W	Second	10 - 200
FCR Mode Setpoint Pre-Position	47639	Float	4	R W	Amp	Setpoint adjustment range determined by registers 47655 and 47663.
AVR Mode Setpoint Pre-Position	47641	Float	4	R W	Volt	Setpoint adjustment range determined by registers 47657 and 47665.
Var Mode Setpoint Pre-Position in kvar	47643	Float	4	R W	KiloVar	Setpoint adjustment range determined by registers 47659 and 47667.
PF Mode Setpoint Pre-Position	47645	Float	4	R W	PowerFactor	Setpoint adjustment range determined by registers 47661 and 47669.
FCR Mode Setpoint Step Size	47647	Float	4	R	No Unit	N/A
AVR Mode Setpoint Step Size	47649	Float	4	R	No Unit	N/A
Var Mode Setpoint Step Size	47651	Float	4	R	No Unit	N/A
PF Mode Setpoint Step Size	47653	Float	4	R	No Unit	N/A
FCR Mode Setpoint Adjustable Minimum	47655	Float	4	R W	Percent	0 - 120
AVR Mode Setpoint Adjustable Minimum	47657	Float	4	R W	Percent	70 - 120
Var Mode Setpoint Adjustable Minimum	47659	Float	4	R W	Percent	-100 – 100
PF Mode Setpoint Adjustable Minimum	47661	Float	4	R W	PowerFactor	0.5 - 1
FCR Mode Setpoint Adjustable Maximum	47663	Float	4	R W	Percent	0 - 120
AVR Mode Setpoint Adjustable Maximum	47665	Float	4	R W	Percent	70 - 120
Var Mode Setpoint Adjustable Maximum	47667	Float	4	R W	Percent	-100 – 100
PF Mode Setpoint Adjustable Maximum	47669	Float	4	R W	PowerFactor	-1 – -0.5
Minimum Value for FCR Adjustable Maximum	47671	Float	4	R	No Unit	N/A
Minimum Value for AVR Adjustable Maximum	47673	Float	4	R	No Unit	N/A

Name	Register	Type	Bytes	R/W	Unit	Range
Minimum Value for Var Adjustable Maximum	47675	Float	4	R	No Unit	N/A
Mini Value for PF Adjustable Max	47677	Float	4	R	No Unit	N/A
Max Value for FCR Adjustable Max	47679	Float	4	R	No Unit	N/A
Max Value for AVR Adjustable Max	47681	Float	4	R	No Unit	N/A
Max Value for Var Adjustable Max	47683	Float	4	R	No Unit	N/A
Max Value for PF Adjustable Max	47685	Float	4	R	No Unit	N/A
Step Size for FCR Adjustable Max	47687	Float	4	R	No Unit	N/A
Step Size for AVR Adjustable Max	47689	Float	4	R	No Unit	N/A
Step Size for Var Adjustable Max	47691	Float	4	R	No Unit	N/A
Step Size for PF Adjustable Max	47693	Float	4	R	No Unit	N/A
FCR Pre-Position Mode	47695	Uint16	2	R W		Maintain=0 Release=1
AVR Pre-Position Mode	47696	Uint16	2	R W		Maintain=0 Release=1
Var Pre-Position Mode	47697	Uint16	2	R W		Maintain=0 Release=1
PF Pre-Position Mode	47698	Uint16	2	R W		Maintain=0 Release=1
FCR Minimum Setpoint	47699	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47655 and 47529.
AVR Minimum Setpoint	47701	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47657 and 47525.
Var Minimum Setpoint	47703	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47659 and Rated VA.
PF Minimum Setpoint	47705	Float	4	R	No Unit	Range determined by register 47661.
FCR Maximum Setpoint	47707	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47663 and 47529.
AVR Maximum Setpoint	47709	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47665 and 47525.
Var Maximum Setpoint	47711	Float	4	R	No Unit	Setpoint adjustment range determined by registers 47667 and Rated VA.
PF Maximum Setpoint	47713	Float	4	R	No Unit	Range determined by register 47669.
Reserved 11	47715-740	C6 Filler	52	N/A	No Unit	N/A
Soft Start Threshold	47741	Float	4	R W	Percent	0 - 90
Soft Start Duration	47743	Float	4	R W	Second	1 - 7200
Underfrequency Corner Frequency	47745	Float	4	R W	Hertz	40 - 75
Slope of Underfrequency Curve	47747	Float	4	R W	No Unit	0 - 3
Width of Voltage Matching Window	47749	Float	4	R W	Percent	0 - 20
Voltage Matching Reference	47751	Float	4	R W	Percent	0 - 700
Fine Voltage Adjust Band	47753	Float	4	R W	Percent	0 - 30
Time Required for Loss of Sensing	47755	Float	4	R W	Second	0 - 30
Loss of Sensing Level Under Balanced Conditions	47757	Float	4	R W	Percent	0 - 100
Loss of Sensing Level Under Unbalanced Conditions	47759	Float	4	R W	Percent	0 - 100
Reserved 12	47761-800	C7 Filler	80	N/A	No Unit	N/A
On-line High OEL Level	47801	Float	4	R W	Amp	0 - 30

Name	Register	Type	Bytes	R/W	Unit	Range
Time Allowed for On-line High OEL Level	47803	Float	4	R W	Second	0 - 10
On-line Medium OEL Level	47805	Float	4	R W	Amp	0 - 20
Time Allowed for On-line Medium OEL Level	47807	Float	4	R W	Second	0 - 120
On-line Low OEL Level	47809	Float	4	R W	Amp	0 - 15
Reserved 13	47811	Float	4	R W	var	0 - 99
Time Allowed for Off-line High OEL	47813	Float	4	R W	Second	0 - 10
Off-line High OEL Level	47815	Float	4	R W	Amp	0 - 30
Off-line Low OEL Level	47817	Float	4	R W	Amp	0 - 15
First UEL Point kW Value	47819	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
Second UEL Point kW Value	47821	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
Third UEL Point kW Value	47823	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
Fourth UEL Point kW Value	47825	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
Fifth UEL Point kW Value	47827	Float	4	R W	KiloWatt	0 – 1.5 • Rated kVA
First UEL Point kvar Value	47829	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
Second UEL Point kvar Value	47831	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
Third UEL Point kvar Value	47833	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
Fourth UEL Point kvar Value	47835	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
Fifth UEL Point kvar Value	47837	Float	4	R W	KiloVar	0 – 1.5 • Rated kVA
SCL High Limit Level	47839	Float	4	R W	Amp	0 - 66000
Time Allowed at SCL High Limit Level	47841	Float	4	R W	Second	0 - 60
SCL Low Limit Level	47843	Float	4	R W	Amp	0 - 66000
Takeover OEL Offline High Limit Level	47845	Float	4	R W	Amp	0 - 30
Takeover OEL Offline Low Limit Level	47847	Float	4	R W	Amp	0 - 15
Takeover OEL Offline Time Dial	47849	Float	4	R W	No Unit	0.1 - 20
Takeover OEL Online High Limit Level	47851	Float	4	R W	Amp	0 - 30
Takeover OEL Online Low Limit Level	47853	Float	4	R W	Amp	0 - 15
Takeover OEL Online Time Dial	47855	Float	4	R W	No Unit	0.1 - 20
Reserved 14	47857-860	C8 Filler	8	N/A	No Unit	N/A
Index into Table of Gain Constants	47861	Float	4	R W	No Unit	1 - 21
Primary AVR Mode Proportional Gain	47863	Float	4	R W	No Unit	0 - 1000
Primary AVR Mode Integral Gain	47865	Float	4	R W	No Unit	0 - 1000
Primary AVR Mode Derivative Gain	47867	Float	4	R W	No Unit	0 - 1000
OEL Integral Gain: Ki	47869	Float	4	R W	No Unit	0 - 1000
PF Mode Integral Gain: Ki	47871	Float	4	R W	No Unit	0 - 1000
Var Mode Integral Gain: Ki	47873	Float	4	R W	No Unit	0 - 1000
FCR Mode Loop Gain: Ka	47875	Float	4	R W	No Unit	0 - 1000
Primary AVR Mode Loop Gain: Ka	47877	Float	4	R W	No Unit	0 - 1000
Var Mode Loop Gain: Kg	47879	Float	4	R W	No Unit	0 - 1000

Name	Register	Type	Bytes	R/W	Unit	Range
PF Mode Loop Gain: Kg	47881	Float	4	R W	No Unit	0 - 1000
OEL Loop Gain: Kg	47883	Float	4	R W	No Unit	0 - 1000
UEL Loop Gain: Kg	47885	Float	4	R W	No Unit	0 - 1000
UEL Integral Gain: Ki	47887	Float	4	R W	No Unit	0 - 1000
Voltage Matching Loop Gain: Kg	47889	Float	4	R W	No Unit	0 - 1000
Primary AVR Mode Derivative Time Constant: Td	47891	Float	4	R W	No Unit	0 - 1
Secondary Gain Option Index	47893	Uint32	4	R W		T'do=1.0 Te=0.17=1 T'do=1.5 Te=0.25=2 T'do=2.0 Te=0.33=3 T'do=2.5 Te=0.42=4 T'do=3.0 Te=0.50=5 T'do=3.5 Te=0.58=6 T'do=4.0 Te=0.67=7 T'do=4.5 Te=0.75=8 T'do=5.0 Te=0.83=9 T'do=5.5 Te=0.92=10 T'do=6.0 Te=1.00=11 T'do=6.5 Te=1.08=12 T'do=7.0 Te=1.17=13 T'do=7.5 Te=1.25=14 T'do=8.0 Te=1.33=15 T'do=8.5 Te=1.42=16 T'do=9.0 Te=1.50=17 T'do=9.5 Te=1.58=18 T'do=10.0 Te=1.67=19 T'do=10.5 Te=1.75=20 Custom=21
Secondary AVR Mode Proportional Gain - Kp	47895	Float	4	R W	No Unit	0 - 1000
Secondary AVR Mode Integral Gain - Ki	47897	Float	4	R W	No Unit	0 - 1000
Secondary AVR Mode Derivative Gain - Kd	47899	Float	4	R W	No Unit	0 - 1000
Secondary AVR Mode Loop Gain - Kg	47901	Float	4	R W	No Unit	0 - 1000
Secondary AVR Derivative Time Constant - Td	47903	Float	4	R W	No Unit	0 - 1
Active Gain Setting Group	47905	Uint16	2	R	No Unit	N/A
SCL Loop Gain - Kg	47906	Float	4	R W	No Unit	0 - 1000
SCL Integral Gain - Ki	47908	Float	4	R W	No Unit	0 - 1000
Reserved 14	47910-920	C9 Filler	22	N/A	No Unit	N/A
Field Overvoltage Level	47921	Float	4	R W	Volt	Disabled=0, 1 - 325
Field Overcurrent Base Level	47923	Float	4	R W	Amp	Disabled=0, 0 - 22
Stator Undervoltage Level	47925	Float	4	R W	Volt	Disabled=0, 1 - 600000
Stator Overvoltage Level	47927	Float	4	R W	Volt	Disabled=0, 0 - 600000
Field Overvoltage Delay	47929	Float	4	R W	Millisecond	Disabled=0, 200 - 30000
Overcurrent Delay	47931	Float	4	R W	Millisecond	Disabled=0, 5000 - 60000
Stator Undervoltage Delay	47933	Float	4	R W	Millisecond	100 - 60000
Stator Overvoltage Delay	47935	Float	4	R W	Millisecond	100 - 60000
Field Overvoltage Alarm Enable	47937	Uint16	2	R W		Disabled=0 Enabled=1
Field Overcurrent Alarm Enable	47938	Uint16	2	R W		Disabled=0 Enabled=1
Stator Undervoltage Alarm Enable	47939	Uint16	2	R W		Disabled=0 Enabled=1
Stator Overvoltage Alarm Enable	47940	Uint16	2	R W		Disabled=0 Enabled=1
Reserved 15	47941	Float	4	R	No Unit	N/A
Reserved 16	47943	Float	4	R	No Unit	N/A
Reserved 17	47945	Uint16	2	R	No Unit	N/A
Exciter Open Diode Ripple Pickup Level	47946	Float	4	R W	Percent	0 - 100
Exciter Open Diode Time Delay	47948	Float	4	R W	Second	10 - 60

Name	Register	Type	Bytes	R/W	Unit	Range
Exciter Open Diode Protection Enable	47950	Uint16	2	R W		Disabled=0 Enabled=1
Exciter Shorted Diode Ripple Pickup Level	47951	Float	4	R W	Percent	0 - 100
Exciter Shorted Diode Time Delay	47953	Float	4	R W	Second	5 - 30
Exciter Shorted Diode Protection Enable	47955	Uint16	2	R W		Disabled=0 Enabled=1
EDM Protection Disable Level	47956	Float	4	R W	Percent	0 - 100
Loss of Field Alarm Enable	47958	Uint16	2	R W		Disabled=0 Enabled=1
Loss of Field Pickup Level	47959	Float	4	R W	Percent	Disabled=0, 0 - 150
Loss of Field Time Delay	47961	Float	4	R W	Millisecond	Instantaneous=0, 0 - 300000
Reserved 18	47963-980	C10 Filler	36	N/A	No Unit	N/A
Reserved 19	47981-8040	C11 Filler	120	N/A	No Unit	N/A
Reserved 16bit 1	48041	Uint16	2	R W	No Unit	0 - 65535
Reserved 16bit 2	48042	Uint16	2	R W	No Unit	0 - 65535
Reserved 20	48043-056	Annun Filler	28	R	No Unit	N/A
Output for Relay 1	48057	Uint16	2	R	No Unit	N/A
Reserved	48058-76	Uint16	2	R W	No Unit	0 - 65535
Output for Relay 2	48077	Uint16	2	R	No Unit	N/A
Reserved	48078-96	Uint16	2	R W	No Unit	0 - 65535
Output for Relay 3	48097	Uint16	2	R	No Unit	N/A
Reserved 16bit 13	48098-116	Uint16	2	R W	No Unit	0 - 65535
Output for Relay 4	48117	Uint16	2	R	No Unit	N/A
Reserved 16bit 18	48118-136	Uint16	2	R W	No Unit	0 - 65535
Output for Relay 5	48137	Uint16	2	R	No Unit	N/A
Reserved 16bit 23	48138-141	Uint16	2	R W	No Unit	0 - 65535
Reserved 16bit 26	48161	Uint16	2	R	No Unit	0 - 65535
Reserved 16bit 27	48162	Uint16	2	R	No Unit	0 - 65535
RS-232 Baud Rate	48163	Uint16	2	R W		1200 Baud=1200 2400 Baud=2400 4800 Baud=4800 9600 Baud=9600 19200 Baud=19200 38400 Baud=38400 57600 Baud=57600
RS-485 Baud Rate	48164	Uint16	2	R W		1200 Baud=1200 2400 Baud=2400 4800 Baud=4800 9600 Baud=9600 19200 Baud=19200 38400 Baud=38400 57600 Baud=57600
RS485 Parity	48165	Uint16	2	R W		Even Parity=0 Odd Parity=1 No Parity=2
RS485 Stop Bits	48166	Uint16	2	R W		1 Stop Bit=1 2 Stop Bits=2
DECS-250N Polling Address	48167	Uint16	2	R W	No Unit	1 - 247
Modbus Response Time Delay	48168	Uint16	2	R W	Millisecond	10 - 10000
Reserved 26	48169-220	C13 Filler	104	N/A	No Unit	N/A
Reserved 16bit 29	48221-223	Uint16	2	R W	No Unit	0 - 65535

Name	Register	Type	Bytes	R/W	Unit	Range
Reserved	48224-250	C14 Filler		N/A	No Unit	N/A
Reserved	48251-508	C15 Filler		N/A	No Unit	N/A
Pole Ratio	48509-510	Float	4	R W	No Unit	Disabled=0, 1 - 10

PROFIBUS Communication

On units equipped with the PROFIBUS communication protocol (style xxxxxxP), the DECS-250N sends and receives PROFIBUS data through a DB-9 port located on the right side panel.

Refer to the *Communication* chapter for PROFIBUS communication settings in BESTCOMS*Plus*® and the *Terminals and Connectors* chapter for wiring.

The DECS-250N utilizes PROFIBUS DP (Decentralized Peripherals) to operate sensors and actuators via a centralized controller in production (factory) automation applications.

Per IEC 61158, PROFIBUS, consists of digitized signals transmitted over a simple, two-wire bus. It is intended to replace the industry-standard, 4 to 20 mA signal used in the transmission of system parameters. PROFIBUS expands the amount of information shared by system devices and makes the exchange of data faster and more efficient.

Data Types

Float/UINT32

Parameters listed in Table 39 as Float or UINT32 types are “Input 2 word” (4 byte) parameters. The Network Byte Order setting allows the byte order of these parameters to be set to MSB first or LSB first. This setting can be found by using the following navigation paths.

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, Profibus Setup
HMI Navigation Path: Settings, Communications, Profibus Setup

UINT8

Parameters listed in Table 39 as UINT8 types are bit-packed binary data. This allows transmission of up to eight single-bit parameters in each byte of data. When configuring an instance of UINT8 type parameters, the data type is “Input 1 byte” and the size is determined by the number of parameters in the instance divided by eight, rounding up to the next integer. Table 34 illustrates the sizes of the UINT8 cyclic data instances.

Table 34. Instance Data Size Calculation

Instance Number	Number of Parameters in the Instance	Number of Parameters Divided by Eight	Total Data Size
6	5	0.625	1 byte
7	7	0.875	1 byte
8	5	0.625	1 byte
9	6	0.75	1 byte
10	16	2	2 bytes
11	12	1.5	2 bytes
12	8	1	1 byte

Within these instances, the data is packed in the order listed in Table 39. The first item is the lowest bit of the first byte. If there are unused bits, they are filled with a value of zero. Parameters of UINT8 type are not affected by the DECS-250N Network Byte Order setting. The examples, below, show the bit packing order for instances 8 (Controller Status Cyclic) and 11 (Local Contact Outputs Cyclic).

Example 1: Bit Packing Order for Instance 8

The total data size of Instance 8 is one byte. Table 35 shows the parameters of instance 8 as they appear in Table 39. The first parameter in instance 8, with key name DECSCONTROL_IN_AVR_MODE, is represented by the lowest bit in the byte (bit 0). Bit 1 represents the next parameter with key name DECSCONTROL_IN_FCR_MODE and so on. The three highest bits in this instance are unused and thus always return a value of zero.

Table 35. Instance 8 Parameters

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_AVR_MODE		Not in AVR mode=0, In AVR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_FCR_MODE		Not in FCR mode=0, In FCR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_FVR_MODE		Not in FVR mode=0, In FVR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_PF_MODE		Not in PF mode=0, In PF mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_VAR_MODE		Not in var mode=0, In var mode=1

Table 36 shows the bit number of each parameter in instance 8 and an example packet returned from a DECS-250N. Reading a value of 0x02 (0000 0010) for instance 8 indicates that the device is operating in FCR mode.

Table 36. Instance 8 Bit Order

Instance Number	Bit Number	Key Name	Packet Returned from DECS-250N
8	0	DECSCONTROL_IN_AVR_MODE	0
	1	DECSCONTROL_IN_FCR_MODE	1
	2	DECSCONTROL_IN_FVR_MODE	0
	3	DECSCONTROL_IN_PF_MODE	0
	4	DECSCONTROL_IN_VAR_MODE	0
	5	0 (unused)	0
	6	0 (unused)	0
	7	0 (unused)	0

Example 2: Bit Packing Order for Instance 11

The total size of Instance 11 is two bytes. Table 37 shows the parameters of instance 11 as they appear in Table 39. The first parameter in instance 11, with key name CONTACTOUTPUTS_WATCHDOGOUTPUT, is represented by the lowest bit in the first byte (bit 0). The ninth parameter, with key name CONTACTOUTPUTS_OUTPUT8, is represented by the lowest bit in the second byte (bit 0). The four highest bits in the second byte are unused and thus always return a value of zero.

Table 37. Instance 11 Parameters

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_ WATCHDOGOUTPUT		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT1		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT2		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT3		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT4		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT5		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT6		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT7		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT8		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT9		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT10		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT11		Open=0, Closed=1

Table 38 shows the bit number of each parameter in instance 11 and an example packet returned from a DECS-250N. Reading a value of 0xA4 06 (1010 0100 0000 0110) for instance 11 indicates that contact outputs 2, 5, 7, 9, and 10 are closed. The first byte is 1010 0100 and the second is 0000 0110.

Table 38. Instance 11 Bit Order

Instance Number	Byte Number	Bit Number	Key Name	Packet Returned from DECS-250N
11	1	0	CONTACTOUTPUTS_WATCHDOG	0
		1	CONTACTOUTPUTS_OUTPUT1	0
		2	CONTACTOUTPUTS_OUTPUT2	1
		3	CONTACTOUTPUTS_OUTPUT3	0
		4	CONTACTOUTPUTS_OUTPUT4	0
		5	CONTACTOUTPUTS_OUTPUT5	1
		6	CONTACTOUTPUTS_OUTPUT6	0
		7	CONTACTOUTPUTS_OUTPUT7	1
	2	0	CONTACTOUTPUTS_OUTPUT8	0
		1	CONTACTOUTPUTS_OUTPUT9	1
		2	CONTACTOUTPUTS_OUTPUT10	1
		3	CONTACTOUTPUTS_OUTPUT11	0
		4	0 (unused)	0
		5	0 (unused)	0
		6	0 (unused)	0
		7	0 (unused)	0

Setup

The following steps are provided to assist in setting up the DECS-250N as a slave on a PROFIBUS network. Please refer to the documentation included with your PLC configuration software for installation and operation instructions.

1. Download the DECS-250N GSD file from the Basler website: www.basler.com
2. Using PLC configuration software, import the DECS-250N GSD file. This allows the DECS-250N to be included in the bus configuration as a slave.
3. Assign a unique PROFIBUS address to the DECS-250N. This allows the master to exchange data with the DECS-250N.
4. Select modules from the DECS-250N GSD file to be part of the data exchange. Selecting the cyclic parameters is recommended. The cyclic parameters are comprised of the first 12 instances in the PROFIBUS parameters table (Table 39). The first 25 parameters, which make up the first five instances, are float types. The next 59 parameters, which make up the last seven instances of cyclic parameters, are UINT8 types.
5. Set each selected module to an address in the master's memory bank.
6. Compile and download the configuration to the master before going online.

When the PROFIBUS network is initialized, the master connects to each slave checking for address mismatches and sending configuration data. The configuration data is sent so that the master and slave agree on the data exchange to occur. Then, the master begins polling each slave in a cyclic order.

Note
It is not possible to write a portion of an instance by specifying a length smaller than the size of the instance. To modify a single parameter, read the entire instance, update the desired parameter, and write the entire instance back to the device.

PROFIBUS Parameters

PROFIBUS parameters are listed in Table 39. Instances with names ending in “cyclic” are automatically transmitted at a periodic rate. All other instances are acyclic and transmitted only when requested by the PLC.

Table 39. PROFIBUS Parameters

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Gen Metering Cyclic	1	Float	R	VAB_GG	V	0 - 2000000000
Gen Metering Cyclic	1	Float	R	VBC_GG	V	0 - 2000000000
Gen Metering Cyclic	1	Float	R	VCA_GG	V	0 - 2000000000
Gen Metering Cyclic	1	Float	R	IA_GG	Amp	0 - 2000000000
Gen Metering Cyclic	1	Float	R	IB_GG	Amp	0 - 2000000000
Gen Metering Cyclic	1	Float	R	IC_GG	Amp	0 - 2000000000
Gen Metering Cyclic	1	Float	R	Freq_GG	Hz	10 - 180
Gen Metering Cyclic	1	Float	R	TOTAL_WATTS_AVG_GG	Watt	-3.00E+14 - 3.00E+14
Gen Metering Cyclic	1	Float	R	TOTAL_VARS_AVG_GG	Var	-3.00E+14 - 3.00E+14
Gen Metering Cyclic	1	Float	R	TOTAL_S_GG	VA	-3.00E+14 - 3.00E+14
Gen Metering Cyclic	1	Float	R	TOTAL_PF_GG	PF	-1 - 1
Bus Metering Cyclic	2	Float	R	VAB_GG	V	0 - 2000000000

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Bus Metering Cyclic	2	Float	R	VBC_GG	V	0 - 2000000000
Bus Metering Cyclic	2	Float	R	VCA_GG	V	0 - 2000000000
Bus Metering Cyclic	2	Float	R	Freq_GG	Hz	10 - 180
Field Metering Cyclic	3	Float	R	VX_GG	V	-1000 - 1000
Field Metering Cyclic	3	Float	R	IX_GG	Amp	0 - 2000000000
Setpoint Metering Cyclic	4	Float	R	GenVolSetpoint_GG	V	84 - 144
Setpoint Metering Cyclic	4	Float	R	ExcCurSetpoint_GG	Amp	0 - 12
Setpoint Metering Cyclic	4	Float	R	ExcVolSetpoint_GG	V	0 - 75
Setpoint Metering Cyclic	4	Float	R	GenVarSetpoint_GG	kvar	0 – 41.57
Setpoint Metering Cyclic	4	Float	R	GenPfSetpoint_GG	PF	0.5 – -0.5
Synchronizer Metering Cyclic	5	Float	R	SlipAngle_GG	Deg	-359.9 - 359.9
Synchronizer Metering Cyclic	5	Float	R	SlipFreq_GG	Hz	n/a
Synchronizer Metering Cyclic	5	Float	R	VoltageDiff_GG	V	n/a
Limiter Status Cyclic	6	UINT8	R	ALARMS_OEL_ALM		Not Active=0, Active=1
Limiter Status Cyclic	6	UINT8	R	ALARMS_UEL_ALM		Not Active=0, Active=1
Limiter Status Cyclic	6	UINT8	R	ALARMS_SCL_ALM		Not Active=0, Active=1
Limiter Status Cyclic	6	UINT8	R	ALARMS_VAR_ LIMITER_ACTIVE		Not Active=0, Active=1
Limiter Status Cyclic	6	UINT8	R	ALARMS_ UNDERFREQUENCYVHZ_ ALM		Not Active=0, Active=1
HMI Indicators Cyclic	7	UINT8	R	DECSCONTROL_ DECS_NULL_BALANCE		Not Active=0, Active=1
HMI Indicators Cyclic	7	UINT8	R	DECSPSSMETER_ DECS_PSS_ACTIVE		Not Active=0, Active=1
HMI Indicators Cyclic	7	UINT8	R	DECSREGULATORMETER_DECS_ INTERNAL_TRACKING_ACTIVE		Not Active=0, Active=1
HMI Indicators Cyclic	7	UINT8	R	DECSCONTROL_DECS_PREPOSITION		Active setpoint is not at a pre-position value=0, Active setpoint is at a pre-position value=1
HMI Indicators Cyclic	7	UINT8	R	DECSREGULATORMETER_SETPOINT_ AT_LOWER_LIMIT		Active setpoint is not at minimum value=0, Active setpoint is at minimum value=1
HMI Indicators Cyclic	7	UINT8	R	DECSREGULATORMETER_SETPOINT_ AT_UPPER_LIMIT		Active setpoint is not at maximum value=0, Active setpoint is at maximum value=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_AVR_MODE		Not in AVR mode=0, In AVR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_FCR_MODE		Not in FCR mode=0, In FCR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_FVR_MODE		Not in FVR mode=0, In FVR mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_PF_MODE		Not in PF mode=0, In PF mode=1
Controller Status Cyclic	8	UINT8	R	DECSCONTROL_IN_VAR_MODE		Not in var mode=0, In var mode=1
System Status Cyclic	9	UINT8	R	DECSCONTROL_DECS_START_STOP		Stopped=0, Started=1
System Status Cyclic	9	UINT8	R	ALARMS_IFLIMIT		No field short circuit condition=0, Field short circuit condition=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
System Status Cyclic	9	UINT8	R	DECSCONTROL_DECS_ SOFT_START_ACTIVE		Not in soft start=0, In soft start=1
System Status Cyclic	9	UINT8	R	ALARMREPORT_ALARMOUTPUT		No active alarms=0, Active alarms=1
System Status Cyclic	9	UINT8	R	DECSCONTROL_DECS_PF_VAR_ ENABLE_52_J_K_		PF/var not enabled via PLC=0, PF/var enabled via PLC=1
System Status Cyclic	9	UINT8	R	DECSCONTROL_DECS_PARALLEL_ ENABLE_52_L_M_		Parallel not enabled via PLC=0, Parallel enabled via PLC=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_STARTINPUT		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_STOPINPUT		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT1		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT2		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT3		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT4		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT5		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT6		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT7		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT8		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT9		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT10		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT11		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT12		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT13		Open=0, Closed=1
Local Contact Inputs Cyclic	10	UINT8	R	CONTACTINPUTS_INPUT14		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_ WATCHDOGOUTPUT		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT1		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT2		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT3		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT4		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT5		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT6		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT7		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT8		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT9		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT10		Open=0, Closed=1
Local Contact Outputs Cyclic	11	UINT8	R	CONTACTOUTPUTS_OUTPUT11		Open=0, Closed=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_SOFT_START_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_PSS_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_OEL_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_UEL_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_SCL_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_PROTECT_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_PID_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Settings Group Indication Cyclic	12	UINT8	R	DECSCONTROL_DECS_VAR_LIMITER_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
Gen Metering	16	Float	R	VAB_GG (Gen Voltage Magnitude)	V	0 - 2000000000
Gen Metering	16	Float	R	VBC_GG (Gen Voltage Magnitude)	V	0 - 2000000000
Gen Metering	16	Float	R	VCA_GG (Gen Voltage Magnitude)	V	0 - 2000000000
Gen Metering	16	Float	R	VAB_GG (Gen Voltage Angle)	Deg	0 - 360
Gen Metering	16	Float	R	VBC_GG (Gen Voltage Angle)	Deg	0 - 360
Gen Metering	16	Float	R	VCA_GG (Gen Voltage Angle)	Deg	0 - 360
Gen Metering	16	Float	R	IA_GG (Gen Current Magnitude)	Amp	0 - 2000000000
Gen Metering	16	Float	R	IB_GG (Gen Current Magnitude)	Amp	0 - 2000000000
Gen Metering	16	Float	R	IC_GG (Gen Current Magnitude)	Amp	0 - 2000000000
Gen Metering	16	Float	R	IA_GG (Gen Current Angle)	Deg	0 - 360
Gen Metering	16	Float	R	IB_GG (Gen Current Angle)	Deg	0 - 360
Gen Metering	16	Float	R	IC_GG (Gen Current Angle)	Deg	0 - 360
Gen Metering	16	Float	R	IAVG_GG	Amp	0 - 2000000000
Gen Metering	16	Float	R	Freq_GG	Hz	10 - 180
Gen Metering Per Unit	17	Float	R	vab_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	vbc_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	vca_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	vavg_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	ia_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	ib_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	ic_pu_GG	No Unit	-10 - 10
Gen Metering Per Unit	17	Float	R	iavg_pu_GG	No Unit	-10 - 10
Power Metering	18	Float	R	TOTAL_WATTS_AVG_GG	Watt	-3.00E+14 - 3.00E+14
Power Metering	18	Float	R	TOTAL_VARS_AVG_GG	Var	-3.00E+14 - 3.00E+14
Power Metering	18	Float	R	TOTAL_S_GG	VA	-3.00E+14 - 3.00E+14
Power Metering	18	Float	R	TOTAL_PF_GG	PF	-1 - 1
Power Metering	18	Float	R	POS_WATT_HOUR_TOTAL_GG	Wh	0.00E+00 - 1.00E+09
Power Metering	18	Float	R	POS_VAR_HOUR_TOTAL_GG	VARh	0.00E+00 - 1.00E+09
Power Metering	18	Float	R	NEG_WATT_HOUR_TOTAL_GG	Wh	-1.00E+09 - 0.00E+00
Power Metering	18	Float	R	NEG_VAR_HOUR_TOTAL_GG	VARh	-1.00E+09 - 0.00E+00
Power Metering Per Unit	19	Float	R	kw_pu_GG	No Unit	-10 - 10
Power Metering Per Unit	19	Float	R	kva_pu_GG	No Unit	-10 - 10
Power Metering Per Unit	19	Float	R	kvar_pu_GG	No Unit	-10 - 10
Bus Metering	20	Float	R	VAB_GG (Bus Voltage Magnitude)	V	0 - 2000000000
Bus Metering	20	Float	R	VBC_GG (Bus Voltage Magnitude)	V	0 - 2000000000

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Bus Metering	20	Float	R	VCA_GG (Bus Voltage Magnitude)	V	0 - 2000000000
Bus Metering	20	Float	R	VAB_GG (Bus Voltage Angle)	Deg	0 - 360
Bus Metering	20	Float	R	VBC_GG (Bus Voltage Angle)	Deg	0 - 360
Bus Metering	20	Float	R	VCA_GG (Bus Voltage Angle)	Deg	0 - 360
Bus Metering	20	Float	R	Freq_GG	Hz	10 - 180
Bus Metering Per Unit	21	Float	R	bus_vab_pu_GG	No Unit	-10 - 10
Bus Metering Per Unit	21	Float	R	bus_vbc_pu_GG	No Unit	-10 - 10
Bus Metering Per Unit	21	Float	R	bus_vca_pu_GG	No Unit	-10 - 10
Bus Metering Per Unit	21	Float	R	bus_vavg_pu_GG	No Unit	-10 - 10
Field Metering	22	Float	R	VX_GG	V	-1000 - 1000
Field Metering	22	Float	R	IX_GG	Amp	0 - 2000000000
Field Metering	22	Float	R	EDM_RIPPLE_PERCENT_GG	%	n/a
PSS Metering	23	Float	R	V1_GG	V	0 - 2000000000
PSS Metering	23	Float	R	V2_GG	V	0 - 2000000000
PSS Metering	23	Float	R	I1_GG	Amp	0 - 2000000000
PSS Metering	23	Float	R	I2_GG	Amp	0 - 2000000000
PSS Metering	23	Float	R	TERM_FREQ_DEV_GG	No Unit	n/a
PSS Metering	23	Float	R	COMP_FREQ_DEV_GG	No Unit	n/a
PSS Metering	23	Float	R	PSS_OUTPUT_GG	No Unit	n/a
PSS Metering Per Unit	24	Float	R	pos_seq_v_pu_GG	No Unit	-10 - 10
PSS Metering Per Unit	24	Float	R	neq_seq_v_pu_GG	No Unit	-10 - 10
PSS Metering Per Unit	24	Float	R	pos_seq_i_pu_GG	No Unit	-10 - 10
PSS Metering Per Unit	24	Float	R	neq_seq_i_pu_GG	No Unit	-10 - 10
Synchronization	25	Float	R	SlipAngle_GG	Deg	-359.9 - 359.9
Synchronization	25	Float	R	SlipFreq_GG	Hz	n/a
Synchronization	25	Float	R	VoltageDiff_GG	V	n/a
Aux Input Metering	26	Float	R	Value_GG (Aux Input Voltage)	V	-9999999 - 9999999
Aux Input Metering	26	Float	R	Value_GG (Aux Input Current)	Amp	-9999999 - 9999999
Tracking	27	Float	R	TRACKING_ERROR_GG	%	n/a
Tracking Status	28	UINT8	R	DECSREGULATORMETER_DECS_ INTERNAL_TRACKING_ACTIVE		Not active=0, Active=1
Tracking Status	28	UINT8	R	DECSREGULATORMETER_DECS_ EXTERNAL_TRACKING_ACTIVE		Not active=0, Active=1
Tracking Status	28	UINT8	R	DECSCONTROL_DECS_NULL_BALANCE		Not active=0, Active=1
Control Panel Setpoint Metering	29	Float	R	GenVolSetpoint_GG	V	84 - 144
Control Panel Setpoint Metering	29	Float	R	ExcCurSetpoint_GG	Amp	0 - 12
Control Panel Setpoint Metering	29	Float	R	ExcVolSetpoint_GG	V	0 - 75
Control Panel Setpoint Metering	29	Float	R	GenVarSetpoint_GG	kvar	0 – 41.57
Control Panel Setpoint Metering	29	Float	R	GenPfSetpoint_GG	PF	0.5 – -0.5
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_START_STOP		Stopped=0, Started=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_IS_IN_ AUTOMATIC_MODE		Not in automatic=0, In automatic=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_IS_IN_ MANUAL_MODE		Not in manual=0, In manual=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_FCR_ CONTROLLER_ACTIVE		FCR not active=0, FCR active=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_FVR_ CONTROLLER_ACTIVE		FVR not active=0, FVR active=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_VAR_ CONTROLLER_ACTIVE		VAR not active=0, VAR active=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_PF_ CONTROLLER_ACTIVE		PF not active=0, PF active=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_ PREPOSITION_1_ACTIVE		Active setpoint is not at pre-position 1 value=0, Active setpoint is at pre-position 1 value=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_ PREPOSITION_2_ACTIVE		Active setpoint is not at pre-position 2 value=0, Active setpoint is at pre-position 2 value=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_ PREPOSITION_3_ACTIVE		Active setpoint is not at pre-position 3 value=0, Active setpoint is at pre-position 3 value=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH1		Open=0, Closed=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH2		Open=0, Closed=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH3		Open=0, Closed=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH4		Open=0, Closed=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH5		Open=0, Closed=1
Control Panel Status	30	UINT8	R	VIRTUALSWITCH_VIRTUALSWITCH6		Open=0, Closed=1
Control Panel Status	30	UINT8	R	ALARMREPORT_ALARMOUTPUT		No active alarms=0, Active alarms=1
Control Panel Status	30	UINT8	R	DECSPSSMETER_DECS_PSS_ACTIVE		PSS not active=0, PSS active=1
Control Panel Status	30	UINT8	R	DECSCONTROL_DECS_ NULL_BALANCE		Not active=0, Active=1
System Status	31	UINT8	R	ALARMS_OEL_ALM		Not active=0, Active=1
System Status	31	UINT8	R	ALARMS_UEL_ALM		Not active=0, Active=1
System Status	31	UINT8	R	ALARMS_SCL_ALM		Not active=0, Active=1
System Status	31	UINT8	R	ALARMS_VAR_LIMITER_ACTIVE		Not active=0, Active=1
System Status	31	UINT8	R	ALARMS_VOLTAGE_ MATCHING_ACTIVE		Not active=0, Active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_ SOFT_START_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_PSS_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_OEL_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_UEL_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_SCL_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_PROTECT_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_PID_ SELECT_SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_VAR_ LIMITER_SELECT_ SECONDARY_SETTINGS		Primary settings active=0, Secondary settings active=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
System Status	31	UINT8	R	DECSCONTROL_DECS_PREPOSITION		Active setpoint is not at a pre-position value=0, Active setpoint is at a pre-position value=1
System Status	31	UINT8	R	DECSCONTROL_DECS_VAR_CONTROLLER_ACTIVE		VAR not active=0, VAR active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_PF_CONTROLLER_ACTIVE		PF not active=0, PF active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_AUTO_MODE_ENABLE		Auto mode not enabled via PLC=0, Auto mode enabled via PLC=1
System Status	31	UINT8	R	DECSCONTROL_DECS_MANUAL_MODE_ENABLE		Manual mode not enabled via PLC=0, Manual mode enabled via PLC=1
System Status	31	UINT8	R	DECSCONTROL_DECS_FVR_CONTROLLER_ACTIVE		FVR not active=0, FVR active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_FCR_CONTROLLER_ACTIVE		FCR not active=0, FCR active=1
System Status	31	UINT8	R	DECSCONTROL_DECS_FIELD_FLASHING_IN_PROGRESS		Field flashing not in progress=0, Field flashing in progress=1
System Status	31	UINT8	R	DECSCONTROL_DECS_IS_IN_MANUAL_MODE		Not in manual=0, In manual=1
System Status	31	UINT8	R	DECSCONTROL_DECS_IS_IN_AUTOMATIC_MODE		Not in automatic=0, In automatic=1
System Status	31	UINT8	R	DECSCONTROL_DECS_PSS_OUTPUT_DISABLE		PSS not disabled via PLC=0, PSS disabled via PLC=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_STARTINPUT		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_STOPINPUT		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT1		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT2		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT3		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT4		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT5		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT6		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT7		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT8		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT9		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT10		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT11		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT12		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT13		Open=0, Closed=1
Contact Input Status	32	UINT8	R	CONTACTINPUTS_INPUT14		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_1		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_2		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_3		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_4		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_5		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_6		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_7		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_8		Open=0, Closed=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
CEM Input Status	33	UINT8	R	CEM_INPUT_9		Open=0, Closed=1
CEM Input Status	33	UINT8	R	CEM_INPUT_10		Open=0, Closed=1
AEM Analog Input Meter	34	Float	R	AnalogInput1RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput2RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput3RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput4RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput5RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput6RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput7RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput8RawValue_GG	V / mA	0 - 10 V or 4 - 20 mA
AEM Analog Input Meter	34	Float	R	AnalogInput1ScaledValue_GG	No Unit	-9999 - 9999
AEM Analog Input Meter	34	Float	R	AnalogInput2ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput3ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput4ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput5ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput6ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput7ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Meter	34	Float	R	AnalogInput8ScaledValue_GG	No Unit	-9999 – 9999
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_1_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_2_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_3_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_4_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_5_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_6_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_7_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMCONFIG_AEM_INPUT_8_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION1_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION1_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION1_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION1_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION2_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION2_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION2_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION2_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION3_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION3_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION3_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION3_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION4_THRESH1_TRIP		Not tripped-0, Tripped=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION4_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION4_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION4_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION5_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION5_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION5_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION5_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION6_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION6_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION6_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION6_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION7_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION7_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION7_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION7_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION8_THRESH1_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION8_THRESH2_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION8_THRESH3_TRIP		Not tripped-0, Tripped=1
AEM Analog Input Status	35	UINT8	R	AEMPROTECTION8_THRESH4_TRIP		Not tripped-0, Tripped=1
AEM RTD Input Meter	36	Float	R	RtdInput1RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput2RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput3RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput4RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput5RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 ohms (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput6RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput7RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 ohms (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput8RawValue_GG	Ohm	7.1 – 18.73 or 80.31 – 194.1 (cu or pt)
AEM RTD Input Meter	36	Float	R	RtdInput1ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput2ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput3ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput4ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput5ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput6ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput7ScaledValue_GG	Deg F	n/a
AEM RTD Input Meter	36	Float	R	RtdInput8ScaledValue_GG	Deg F	n/a
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_1_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_2_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_3_ OUT_OF_RANGE		Value in range=0, Value out of range=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_4_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_5_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_6_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_7_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	AEMCONFIG_RTD_INPUT_8_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION1_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION1_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION1_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION1_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION2_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION2_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION2_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION2_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION3_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION3_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION3_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION3_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION4_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION4_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION4_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION4_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION5_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION5_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION5_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION5_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION6_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION6_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION6_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION6_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION7_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION7_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION7_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION7_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION8_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION8_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION8_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM RTD Input Status	37	UINT8	R	RTDPROTECTION8_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM TC Input Meter	38	Float	R	ThermInput1RawValue_GG	mV	n/a
AEM TC Input Meter	38	Float	R	ThermInput2RawValue_GG	mV	n/a
AEM TC Input Meter	38	Float	R	ThermInput1ScaledValue_GG	Deg F	n/a

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
AEM TC Input Meter	38	Float	R	ThermInput2ScaledValue_GG	Deg F	n/a
AEM TC Input Status	39	UINT8	R	AEMCONFIG_THERMAL_COUPLE_1_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM TC Input Status	39	UINT8	R	AEMCONFIG_THERMAL_COUPLE_2_OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION1_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION1_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION1_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION1_THRESH4_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION2_THRESH1_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION2_THRESH2_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION2_THRESH3_TRIP		Not tripped=0, Tripped=1
AEM TC Input Status	39	UINT8	R	THERMPROTECTION2_THRESH4_TRIP		Not tripped=0, Tripped=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_WATCHDOGOUTPUT		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT1		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT2		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT3		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT4		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT5		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT6		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT7		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT8		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT9		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT10		Open=0, Closed=1
Contact Output Status	40	UINT8	R	CONTACTOUTPUTS_OUTPUT11		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_1		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_2		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_3		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_4		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_5		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_6		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_7		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_8		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_9		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_10		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_11		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_12		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_13		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_14		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_15		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_16		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_17		Open=0, Closed=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
CEM Output Status	41	UINT8	R	CEM_OUTPUT_18		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_19		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_20		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_21		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_22		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_23		Open=0, Closed=1
CEM Output Status	41	UINT8	R	CEM_OUTPUT_24		Open=0, Closed=1
AEM Analog Output Meter	42	Float	R	AnalogOutput1RawValue_GG	No Unit	0 – 10 V or 4 – 20 mA
AEM Analog Output Meter	42	Float	R	AnalogOutput2RawValue_GG	No Unit	0 – 10 V or 4 – 20 mA
AEM Analog Output Meter	42	Float	R	AnalogOutput3RawValue_GG	No Unit	0 – 10 V or 4 – 20 mA
AEM Analog Output Meter	42	Float	R	AnalogOutput4RawValue_GG	No Unit	0 – 10 V or 4 – 20 mA
AEM Analog Output Meter	42	Float	R	AnalogOutput1ScaledValue_GG	No Unit	n/a
AEM Analog Output Meter	42	Float	R	AnalogOutput2ScaledValue_GG	No Unit	n/a
AEM Analog Output Meter	42	Float	R	AnalogOutput3ScaledValue_GG	No Unit	n/a
AEM Analog Output Meter	42	Float	R	AnalogOutput4ScaledValue_GG	No Unit	n/a
AEM Analog Output Status	43	UINT8	R	REMOTEANALOGOUTPUT1_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Output Status	43	UINT8	R	REMOTEANALOGOUTPUT2_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Output Status	43	UINT8	R	REMOTEANALOGOUTPUT3_ OUT_OF_RANGE		Value in range=0, Value out of range=1
AEM Analog Output Status	43	UINT8	R	REMOTEANALOGOUTPUT4_ OUT_OF_RANGE		Value in range=0, Value out of range=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT1_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT1_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT1_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT1_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT2_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT2_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT2_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT2_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT3_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT3_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT3_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT3_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT4_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT4_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT4_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT4_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config. Prot. Status	44	UINT8	R	CONFIGPROT5_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT5_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT5_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT5_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT6_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT6_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT6_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT6_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT7_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT7_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT7_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT7_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT8_ CONFPROTTHRESH1TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT8_ CONFPROTTHRESH2TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT8_ CONFPROTTHRESH3TRIP		Not tripped=0, Tripped=1
Config. Prot. Status	44	UINT8	R	CONFIGPROT8_ CONFPROTTHRESH4TRIP		Not tripped=0, Tripped=1
Real Time Clock	45	String	R	Date_GG		0 – 25 characters
Real Time Clock	45	String	R	Time_GG		0 – 25 characters
Front Panel Settings	46	UINT32	R	LCDContrast_GG	%	0 - 100
Front Panel Settings	46	UINT32	R	LCDInvertDisplay_GG	No Unit	NO=0 YES=1
Front Panel Settings	46	UINT32	R	LCDSleepMode_GG	No Unit	DISABLED=0 ENABLED=1
Front Panel Settings	46	UINT32	R	LCDBacklightTimeout_GG	Sec	1 - 120
Front Panel Settings	46	UINT32	R	LCDLanguageSelection_GG	No Unit	English=0 Russian=2 Spanish=4 German=5
Front Panel Settings	46	UINT32	R	EnableScroll_GG	No Unit	DISABLED=0 ENABLED=1
Front Panel Settings	46	UINT32	R	ScrollTimeDelay_GG	Sec	1 - 600

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
250 Device Info App Version	47	String	R	ExternalVersion_GG	No Unit	0 - 25 characters
250 Device Info Boot Version	48	String	R	ExternalBoot Version_GG	No Unit	0 - 25 characters
250 Device Info App Build Date	49	String	R	AppBuildDate_GG	No Unit	0 - 25 characters
250 Device Info Serial	50	String	R	SerialNum_GG	No Unit	0 - 25 characters
250 Device Info App Part Num	51	String	R	FirmwarePart Number_GG	No Unit	0 - 25 characters
250 Device Info Model	52	String	R	ModelNumber_GG	No Unit	0 - 25 characters
AEM Device Info App Version	53	String	R	AppVersionNum_GG	No Unit	0 - 25 characters

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
AEM Device Info Boot Version	54	String	R	BootVersionNum_GG	No Unit	0 - 25 characters
AEM Device Info Build Date	55	String	R	AppBuildDate_GG	No Unit	0 - 25 characters
AEM Device Info Serial	56	String	R	SerialNum_GG	No Unit	0 - 25 characters
AEM Device Info App Part Num	57	String	R	AppPartNum_GG	No Unit	0 - 25 characters
AEM Device Info Model	58	String	R	ModelNum_GG	No Unit	0 - 25 characters
CEM Device Info App Version	59	String	R	AppVersionNum_GG	No Unit	0 - 25 characters
CEM Device Info Boot Version	60	String	R	BootVersionNum_GG	No Unit	0 - 25 characters
CEM Device Info App Build Date	61	String	R	AppBuildDate_GG	No Unit	0 - 25 characters
CEM Device Info Serial	62	String	R	SerialNum_GG	No Unit	0 - 25 characters
CEM Device Info App Part Num	63	String	R	AppPartNum_GG	No Unit	0 - 25 characters
CEM Device Info Model	64	String	R	ModelNum_GG	No Unit	0 - 25 characters
System Param	65	UINT32	R/W	NOM_FREQ_GG	No Unit	50 Hz=50 60 Hz=60
System Param	66	Float	R/W	Rated Primary LL_GG (Gen Voltage Config)	V	1 – 500000
System Param	66	Float	R/W	Rated Primary LL_GG (Bus Voltage Config)	V	1 - 500000
System Param	66	Float	R/W	RatedPF_GG	PF	0.5 – -0.5
System Param	66	Float	R/W	RatedKVA_GG	KVA	1 - 1000000
System Param	66	Float	R/W	Rated Field Volt FullLoad_GG	V	1 - 250
System Param	66	Float	R/W	Rated Field Volt NoLoad_GG	V	1 - 250
System Param	66	Float	R/W	Rated Field Curr FullLoad_GG	Amp	0.1 - 15
System Param	66	Float	R/W	Rated Field Curr NoLoad_GG	Amp	0.1 - 15
System Param	66	Float	R/W	ExciterPoleRatio_GG	No Unit	1 - 10
AVR Setpoints	67	UINT32	R/W	GenVolPrepos Mode1_GG	No Unit	Maintain=0 Release=1
AVR Setpoints	67	UINT32	R/W	GenVolPrepos Mode2_GG	No Unit	Maintain=0 Release=1
AVR Setpoints	67	UINT32	R/W	GenVolPrepos Mode3_GG	No Unit	Maintain=0 Release=1
AVR Setpoints	68	Float	R/W	GenVol TraverseRate_GG	Sec	10 - 200
AVR Setpoints	68	Float	R/W	GenVolSetpoint_GG	V	84 - 144
AVR Setpoints	68	Float	R/W	GenVolMinSetpoint Limit_GG	%	70 - 120
AVR Setpoints	68	Float	R/W	GenVolMaxSetpoint Limit_GG	%	70 - 120
AVR Setpoints	68	Float	R/W	GenVol Preposition1_GG	V	84 - 144
AVR Setpoints	68	Float	R/W	GenVol Preposition2_GG	V	84 - 144
AVR Setpoints	68	Float	R/W	GenVol Preposition3_GG	V	84 - 144
FCR Setpoints	69	UINT32	R/W	ExcCurPrepos Mode1_GG	No Unit	Maintain=0 Release=1
FCR Setpoints	69	UINT32	R/W	ExcCurPrepos Mode2_GG	No Unit	Maintain=0 Release=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
FCR Setpoints	69	UINT32	R/W	ExcCurPrepos Mode3_GG	No Unit	Maintain=0 Release=1
FCR Setpoints	70	Float	R/W	ExcCur TraverseRate_GG	Sec	10 - 200
FCR Setpoints	70	Float	R/W	ExcCurSetpoint_GG	Amp	0 - 12
FCR Setpoints	70	Float	R/W	ExcCurMinSetpoint Limit_GG	%	0 - 120
FCR Setpoints	70	Float	R/W	ExcCurMaxSetpoint Limit_GG	%	0 - 120
FCR Setpoints	70	Float	R/W	ExcCur Preposition1_GG	Amp	0 - 12
FCR Setpoints	70	Float	R/W	ExcCur Preposition2_GG	Amp	0 - 12
FCR Setpoints	70	Float	R/W	ExcCur Preposition3_GG	Amp	0 - 12
FVR Setpoints	71	UINT32	R/W	ExcVolPrepos Mode1_GG	No Unit	Maintain=0 Release=1
FVR Setpoints	71	UINT32	R/W	ExcVolPrepos Mode2_GG	No Unit	Maintain=0 Release=1
FVR Setpoints	71	UINT32	R/W	ExcVolPrepos Mode3_GG	No Unit	Maintain=0 Release=1
FVR Setpoints	72	Float	R/W	ExcVolTraverseRate_GG	Sec	10 - 200
FVR Setpoints	72	Float	R/W	ExcVolSetpoint_GG	V	0 - 75
FVR Setpoints	72	Float	R/W	ExcVolMinSetpoint Limit_GG	%	0 - 150
FVR Setpoints	72	Float	R/W	ExcVolMaxSetpoint Limit_GG	%	0 - 150
FVR Setpoints	72	Float	R/W	ExcVol Preposition1_GG	V	0 - 75
FVR Setpoints	72	Float	R/W	ExcVol Preposition2_GG	V	0 - 75
FVR Setpoints	72	Float	R/W	ExcVol Preposition3_GG	V	0 - 75
VAR Setpoints	73	UINT32	R/W	GenVarPrepos Mode1_GG	No Unit	Maintain=0 Release=1
VAR Setpoints	73	UINT32	R/W	GenVarPrepos Mode2_GG	No Unit	Maintain=0 Release=1
VAR Setpoints	73	UINT32	R/W	GenVarPrepos Mode3_GG	No Unit	Maintain=0 Release=1
VAR Setpoints	74	Float	R/W	SysOptionFineAdjust Band_GG	%	0 - 30
VAR Setpoints	74	Float	R/W	GenVarTraverse Rate_GG	Sec	10 - 200
VAR Setpoints	74	Float	R/W	GenVarSetpoint_GG	kvar	0 – 41.57
VAR Setpoints	74	Float	R/W	GenVarMinSetpoint Limit_GG	%	-100 - 100
VAR Setpoints	74	Float	R/W	GenVarMaxSetpoint Limit_GG	%	-100 - 100
VAR Setpoints	74	Float	R/W	GenVar Preposition1_GG	kvar	0 – 41.57
VAR Setpoints	74	Float	R/W	GenVar Preposition2_GG	kvar	0 – 41.57
VAR Setpoints	74	Float	R/W	GenVar Preposition3_GG	kvar	0 – 41.57
PF Setpoints	75	UINT32	R/W	GenPfPrepos Mode1_GG	No Unit	Maintain=0 Release=1
PF Setpoints	75	UINT32	R/W	GenPfPrepos Mode2_GG	No Unit	Maintain=0 Release=1
PF Setpoints	75	UINT32	R/W	GenPfPrepos Mode3_GG	No Unit	Maintain=0 Release=1
PF Setpoints	76	Float	R/W	GenPfTraverseRate_GG	Sec	10 - 200

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
PF Setpoints	76	Float	R/W	GenPfSetpoint_GG	PF	0.5 – -0.5
PF Setpoints	76	Float	R/W	GenPfMinSetpoint Limit_GG	PF	0.5 – 1
PF Setpoints	76	Float	R/W	GenPfMaxSetpoint Limit_GG	PF	-1 - -0.5
PF Setpoints	76	Float	R/W	GenPfPreposition1_GG	PF	0.5 – -0.5
PF Setpoints	76	Float	R/W	GenPfPreposition2_GG	PF	0.5 – -0.5
PF Setpoints	76	Float	R/W	GenPfPreposition3_GG	PF	0.5 – -0.5
Aux Input Settings	77	UINT32	R/W	Decs_AuxInput Mode_GG	No Unit	Voltage=0 Current=1
Aux Input Settings	77	UINT32	R/W	Decs_AuxSumming Mode_GG	No Unit	Voltage=0 Var=1
Aux Input Settings	77	UINT32	R/W	Decs_AuxInput Function_GG	No Unit	DECS_Input=0 PSS_Test_Input=1 Limiter_Selection=2
Aux Input Settings	78	Float	R/W	Decs_AuxVolGain_GG	No Unit	-99 - 99
Aux Input Settings	78	Float	R/W	Decs_AuxFcrGain_GG	No Unit	-99 - 99
Aux Input Settings	78	Float	R/W	Decs_AuxFvrGain_GG	No Unit	-99 - 99
Aux Input Settings	78	Float	R/W	Decs_AuxVarGain_GG	No Unit	-99 - 99
Aux Input Settings	78	Float	R/W	Decs_AuxPfGain_GG	No Unit	-99 - 99
Parallel/Line Drop	79	UINT32	R/W	SysOptionInputDroop Enabled_GG	No Unit	DISABLED=0 ENABLED=1
Parallel/Line Drop	79	UINT32	R/W	SysOptionInputLDrop Enabled_GG	No Unit	DISABLED=0 ENABLED=1
Parallel/Line Drop	79	UINT32	R/W	SysOptionInputCC Enabled_GG	No Unit	DISABLED=0 ENABLED=1
Parallel/Line Drop	80	Float	R/W	DroopValue_GG	%	0 - 30
Parallel/Line Drop	80	Float	R/W	LDropValue_GG	%	0 - 30
Parallel/Line Drop	80	Float	R/W	Decs_AuxAmp Gain_GG	%	-30 - 30
Load Share	81	UINT32	R/W	LSEnable_GG	No Unit	DISABLED=0 ENABLED=1
Load Share	82	Float	R/W	LSDroopPercent_GG	%	0 - 30
Load Share	82	Float	R/W	LSGain_GG	No Unit	0 - 1000
Load Share	82	Float	R/W	WashoutFilter TimeConst_GG	No Unit	0 - 1
Load Share	82	Float	R/W	WashoutFilter Gain_GG	No Unit	0 - 1000
Auto Tracking	83	UINT32	R/W	SysInputComportInt TrackEnabled_GG	No Unit	DISABLED=0 ENABLED=1
Auto Tracking	83	UINT32	R/W	SysInputComportExt TrackEnabled_GG	No Unit	DISABLED=0 ENABLED=1
Auto Tracking	84	Float	R/W	Decs_AutoTrack TDelay_GG	Sec	0 - 8
Auto Tracking	84	Float	R/W	Decs_AutoTrack TRate_GG	Sec	1 - 80
Auto Tracking	84	Float	R/W	Decs_AutoTrans TDelay_GG	Sec	0 - 8
Auto Tracking	84	Float	R/W	Decs_AutoTrans TRate_GG	Sec	1 - 80
Startup	86	Float	R/W	StartupPriSoft StartBias_GG	%	0 - 90
Startup	86	Float	R/W	StartupPriSoft StartTime_GG	Sec	1 - 7200
Startup	86	Float	R/W	StartupSecSoft StartBias_GG	%	0 - 90
Startup	86	Float	R/W	StartupSecSoft StartTime_GG	Sec	1 - 7200

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Startup	86	Float	R/W	Decs_FieldFlash Level_GG	No Unit	0 - 100
Startup	86	Float	R/W	Decs_FieldFlash Time_GG	No Unit	1 - 50
AVR Gains	87	UINT32	R/W	PrimaryGain Option_GG	No Unit	TpdoEQ1pt0_TeEQ0pt17=1 TpdoEQ1pt5_TeEQ0pt25=2 TpdoEQ2pt0_TeEQ0pt33=3 TpdoEQ2pt5_TeEQ0pt42=4 TpdoEQ3pt0_TeEQ0pt50=5 TpdoEQ3pt5_TeEQ0pt58=6 TpdoEQ4pt0_TeEQ0pt67=7 TpdoEQ4pt5_TeEQ0pt75=8 TpdoEQ5pt0_TeEQ0pt83=9 TpdoEQ5pt5_TeEQ0pt92=10 TpdoEQ6pt0_TeEQ1pt00=11 TpdoEQ6pt5_TeEQ1pt08=12 TpdoEQ7pt0_TeEQ1pt17=13 TpdoEQ7pt5_TeEQ1pt25=14 TpdoEQ8pt0_TeEQ1pt33=15 TpdoEQ8pt5_TeEQ1pt42=16 TpdoEQ9pt0_TeEQ1pt50=17 TpdoEQ9pt5_TeEQ1pt58=18 TpdoEQ10pt0_TeEQ1pt67=19 TpdoEQ10pt5_TeEQ1pt75=20 Custom=21
AVR Gains	87	UINT32	R/W	SecondaryGain Option_GG	No Unit	TpdoEQ1pt0_TeEQ0pt17=1 TpdoEQ1pt5_TeEQ0pt25=2 TpdoEQ2pt0_TeEQ0pt33=3 TpdoEQ2pt5_TeEQ0pt42=4 TpdoEQ3pt0_TeEQ0pt50=5 TpdoEQ3pt5_TeEQ0pt58=6 TpdoEQ4pt0_TeEQ0pt67=7 TpdoEQ4pt5_TeEQ0pt75=8 TpdoEQ5pt0_TeEQ0pt83=9 TpdoEQ5pt5_TeEQ0pt92=10 TpdoEQ6pt0_TeEQ1pt00=11 TpdoEQ6pt5_TeEQ1pt08=12 TpdoEQ7pt0_TeEQ1pt17=13 TpdoEQ7pt5_TeEQ1pt25=14 TpdoEQ8pt0_TeEQ1pt33=15 TpdoEQ8pt5_TeEQ1pt42=16 TpdoEQ9pt0_TeEQ1pt50=17 TpdoEQ9pt5_TeEQ1pt58=18 TpdoEQ10pt0_TeEQ1pt67=19 TpdoEQ10pt5_TeEQ1pt75=20 Custom=21
AVR Gains	88	Float	R/W	AvrKpPri_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrKiPri_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrKdPri_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrTdPri_GG	No Unit	0 - 1
AVR Gains	88	Float	R/W	AvrKgPri_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrKpSec_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrKiSec_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrKdSec_GG	No Unit	0 - 1000
AVR Gains	88	Float	R/W	AvrTdSec_GG	No Unit	0 - 1
AVR Gains	88	Float	R/W	AvrKgSec_GG	No Unit	0 - 1000
FCR Gains	90	Float	R/W	FcrKp_GG	No Unit	0 - 1000
FCR Gains	90	Float	R/W	FcrKi_GG	No Unit	0 - 1000
FCR Gains	90	Float	R/W	FcrKd_GG	No Unit	0 - 1000
FCR Gains	90	Float	R/W	FcrTd_GG	No Unit	0 - 1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
FCR Gains	90	Float	R/W	FcrKg_GG	No Unit	0 - 1000
FVR Gains	92	Float	R/W	FvrKp_GG	No Unit	0 - 1000
FVR Gains	92	Float	R/W	FvrKi_GG	No Unit	0 - 1000
FVR Gains	92	Float	R/W	FvrKd_GG	No Unit	0 - 1000
FVR Gains	92	Float	R/W	FvrTd_GG	No Unit	0 - 1
FVR Gains	92	Float	R/W	FvrKg_GG	No Unit	0 - 1000
VAR Gains	94	Float	R/W	VarKi_GG	No Unit	0 - 1000
VAR Gains	94	Float	R/W	VarKg_GG	No Unit	0 - 1000
PF Gains	96	Float	R/W	PfKi_GG	No Unit	0 - 1000
PF Gains	96	Float	R/W	PfKg_GG	No Unit	0 - 1000
OEL Gains	98	Float	R/W	OelKi_GG	No Unit	0 - 1000
OEL Gains	98	Float	R/W	OelKg_GG	No Unit	0 - 1000
UEL Gains	100	Float	R/W	UelKi_GG	No Unit	0 - 1000
UEL Gains	100	Float	R/W	UelKg_GG	No Unit	0 - 1000
SCL Gains	102	Float	R/W	SclKi_GG	No Unit	0 - 1000
SCL Gains	102	Float	R/W	SclKg_GG	No Unit	0 - 1000
VAR Limiter Gains	104	Float	R/W	VarLimitKi_GG	No Unit	0 - 1000
VAR Limiter Gains	104	Float	R/W	VarLimitKg_GG	No Unit	0 - 1000
Voltage Match Gains	106	Float	R/W	VmKi_GG	No Unit	0 - 1000
Voltage Match Gains	106	Float	R/W	VmKg_GG	No Unit	0 - 1000
OEL Configure	107	UINT32	R/W	SysOptionInput OelEnabled_GG	No Unit	DISABLED=0 ENABLED=1
OEL Configure	107	UINT32	R/W	SysOptionInputOel StyleEnabled_GG	No Unit	Summing=0 Takeover=1
OEL Configure	107	UINT32	R/W	OelPriDvdtEnable_GG	No Unit	DISABLED=0 ENABLED=1
OEL Configure	108	Float	R/W	OelPriDvdtRef_GG	No Unit	-10 - 0
OEL Summing Point	110	Float	R/W	OelPriCurHi_GG	Amp	0 - 30
OEL Summing Point	110	Float	R/W	OelPriCurMid_GG	Amp	0 - 20
OEL Summing Point	110	Float	R/W	OelPriCurLo_GG	Amp	0 - 15
OEL Summing Point	110	Float	R/W	OelPriTimeHi_GG	Sec	0 - 10
OEL Summing Point	110	Float	R/W	OelPriTimeMid_GG	Sec	0 - 120
OEL Summing Point	110	Float	R/W	OelPriCurHiOff_GG	Amp	0 - 30
OEL Summing Point	110	Float	R/W	OelPriCurLoOff_GG	Amp	0 - 15
OEL Summing Point	110	Float	R/W	OelPriCurTimeOff_GG	Sec	0 - 10
OEL Summing Point	110	Float	R/W	OelSecCurHi_GG	Amp	0 - 30
OEL Summing Point	110	Float	R/W	OelSecCurMid_GG	Amp	0 - 20
OEL Summing Point	110	Float	R/W	OelSecCurLo_GG	Amp	0 - 15
OEL Summing Point	110	Float	R/W	OelSecTimeHi_GG	Sec	0 - 10
OEL Summing Point	110	Float	R/W	OelSecTimeMid_GG	Sec	0 - 120
OEL Summing Point	110	Float	R/W	OelSecCurHiOff_GG	Amp	0 - 30
OEL Summing Point	110	Float	R/W	OelSecCurLoOff_GG	Amp	0 - 15
OEL Summing Point	110	Float	R/W	OelSecCurTimeOff_GG	Sec	0 - 10

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
OEL Takeover	112	Float	R/W	OelPriTakeover CurMaxOff_GG	Amp	0 - 30
OEL Takeover	112	Float	R/W	OelPriTakeover CurMinOff_GG	Amp	0 - 15
OEL Takeover	112	Float	R/W	OelPriTakeover TimeDialOff_GG	No Unit	0.1 - 20
OEL Takeover	112	Float	R/W	OelPriTakeover CurMaxOn_GG	Amp	0 - 30
OEL Takeover	112	Float	R/W	OelPriTakeover CurMinOn_GG	Amp	0 - 15
OEL Takeover	112	Float	R/W	OelPriTakeover TimeDialOn_GG	No Unit	0.1 - 20
OEL Takeover	112	Float	R/W	OelSecTakeover CurMaxOff_GG	Amp	0 - 30
OEL Takeover	112	Float	R/W	OelSecTakeover CurMinOff_GG	Amp	0 - 15
OEL Takeover	112	Float	R/W	OelSecTakeover TimeDialOff_GG	No Unit	0.1 - 20
OEL Takeover	112	Float	R/W	OelSecTakeover CurMaxOn_GG	Amp	0 - 30
OEL Takeover	112	Float	R/W	OelSecTakeover CurMinOn_GG	Amp	0 - 15
OEL Takeover	112	Float	R/W	OelSecTakeover TimeDialOn_GG	No Unit	0.1 - 20
UEL Configure	113	UINT32	R/W	SysOptionInput UelEnabled_GG	No Unit	DISABLED=0 ENABLED=1
UEL Configure	114	Float	R/W	UelPriPowFilterTC_GG	Sec	0 - 20
UEL Configure	114	Float	R/W	UelPriVoltDep Exponent_GG	No Unit	0 - 2
UEL Curve Float Primary	116	Float	R/W	UelPriCurveX1_GG	KW	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveX2_GG	KW	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveX3_GG	KW	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveX4_GG	KW	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveX5_GG	KW	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveY1_GG	kvar	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveY2_GG	kvar	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveY3_GG	kvar	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveY4_GG	kvar	0 - 62
UEL Curve Float Primary	116	Float	R/W	UelPriCurveY5_GG	kvar	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveX1_GG	KW	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveX2_GG	KW	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveX3_GG	KW	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveX4_GG	KW	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveX5_GG	KW	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveY1_GG	kvar	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveY2_GG	kvar	0 - 62

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveY3_GG	kvar	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveY4_GG	kvar	0 - 62
UEL Curve Float Secondary	118	Float	R/W	UelSecCurveY5_GG	kvar	0 - 62
SCL Settings	119	UINT32	R/W	SysOptionInputScl Enabled_GG	No Unit	DISABLED=0 ENABLED=1
SCL Settings	120	Float	R/W	SclPriRefHi_GG	Amp	0 - 66000
SCL Settings	120	Float	R/W	SclPriRefLo_GG	Amp	0 - 66000
SCL Settings	120	Float	R/W	SclPriTimeHi_GG	Sec	0 - 60
SCL Settings	120	Float	R/W	SclPriNoResponse Time_GG	Sec	0 - 10
SCL Settings	120	Float	R/W	SclSecRefHi_GG	Amp	0 - 66000
SCL Settings	120	Float	R/W	SclSecRefLo_GG	Amp	0 - 66000
SCL Settings	120	Float	R/W	SclSecTimeHi_GG	Sec	0 - 60
SCL Settings	120	Float	R/W	SclSecNoResponse Time_GG	Sec	0 - 10
SCL Settings	120	Float	R/W	Reserved	n/a	n/a
SCL Settings	120	Float	R/W	Reserved	n/a	n/a
SCL Settings	120	Float	R/W	Reserved	n/a	n/a
SCL Settings	120	Float	R/W	Reserved	n/a	n/a
SCL Settings	120	Float	R/W	Reserved	n/a	n/a
VAR Limiter Settings	121	UINT32	R/W	VarLimitEnable_GG	No Unit	DISABLED=0 ENABLED=1
VAR Limiter Settings	122	Float	R/W	VarLimitPriDelay_GG	Sec	0 - 300
VAR Limiter Settings	122	Float	R/W	VarLimitPri Setpoint_GG	%	0 - 200
VAR Limiter Settings	122	Float	R/W	VarLimitSecDelay_GG	Sec	0 - 300
VAR Limiter Settings	122	Float	R/W	VarLimitSec Setpoint_GG	%	0 - 200
OEL Scaling	123	UINT32	R/W	OelScaleEnable_GG	No Unit	DISABLED=0 Auxiliary Input=1 AEM RTD 1=2 AEM RTD 2=3 AEM RTD 3=4 AEM RTD 4=5 AEM RTD 5=6 AEM RTD 6=7 AEM RTD 7=8 AEM RTD 8=9
OEL Scaling	124	Float	R/W	OelScaleSumming Signal1_GG	V	-10 - 10
OEL Scaling	124	Float	R/W	OelScaleSumming Signal2_GG	V	-10 - 10
OEL Scaling	124	Float	R/W	OelScaleSumming Signal3_GG	V	-10 - 10
OEL Scaling	124	Float	R/W	OelScaleSumming Scale1_GG	%	0 - 200
OEL Scaling	124	Float	R/W	OelScaleSumming Scale2_GG	%	0 - 200
OEL Scaling	124	Float	R/W	OelScaleSumming Scale3_GG	%	0 - 200
OEL Scaling	124	Float	R/W	OelScaleTakeover Signal1_GG	V	-10 - 10
OEL Scaling	124	Float	R/W	OelScaleTakeover Signal2_GG	V	-10 - 10

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
OEL Scaling	124	Float	R/W	OelScaleTakeover Signal3_GG	V	-10 - 10
OEL Scaling	124	Float	R/W	OelScaleTakeover Scale1_GG	%	0 - 200
OEL Scaling	124	Float	R/W	OelScaleTakeover Scale2_GG	%	0 - 200
OEL Scaling	124	Float	R/W	OelScaleTakeover Scale3_GG	%	0 - 200
SCL Scaling	125	UINT32	R/W	SclScaleEnable_GG	No Unit	DISABLED=0 Auxiliary Input=1 AEM RTD 1=2 AEM RTD 2=3 AEM RTD 3=4 AEM RTD 4=5 AEM RTD 5=6 AEM RTD 6=7 AEM RTD 7=8 AEM RTD 8=9
SCL Scaling	126	Float	R/W	SclScaleSignal1_GG	V	-10 - 10
SCL Scaling	126	Float	R/W	SclScaleSignal2_GG	V	-10 - 10
SCL Scaling	126	Float	R/W	SclScaleSignal3_GG	V	-10 - 10
SCL Scaling	126	Float	R/W	SclScalePoint1_GG	%	0 - 200
SCL Scaling	126	Float	R/W	SclScalePoint2_GG	%	0 - 200
SCL Scaling	126	Float	R/W	SclScalePoint3_GG	%	0 - 200
Underfreq/Volts per hertz	127	UINT32	R/W	SysOptionUnderFreq Mode_GG	No Unit	UF_Limiter=0 V2H_Limiter=1
Underfreq/Volts per Hertz	128	Float	R/W	SysOptionUnderFreq Hz_GG	Hz	40 - 75
Underfreq/Volts per Hertz	128	Float	R/W	SysOptionUnderFreq Slope_GG	No Unit	0 - 3
Underfreq/Volts per Hertz	128	Float	R/W	SysOptionVolPerHz SlopeHi_GG	No Unit	0 - 3
Underfreq/Volts per Hertz	128	Float	R/W	SysOptionVolPerHz SlopeLo_GG	No Unit	0 - 3
Underfreq/Volts per Hertz	128	Float	R/W	SysOptionVolPerHz SlopeTime_GG	Sec	0 - 10
PSS Configure	129	UINT32	R/W	SysOptionPss PowerLevel Enable_GG	No Unit	DISABLED=0 ENABLED=1
PSS Configure	130	Float	R/W	PssPriPowerLevel Percentage_GG	No Unit	0 - 1
PSS Configure	130	Float	R/W	PssPriPowerLevel Hysteresis_GG	No Unit	0 - 1
PSS Control Primary	131	UINT32	R/W	PssEnable_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch10_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch11_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch3_GG	No Unit	Frequency=0 Der. Speed=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch4_GG	No Unit	Power=0 Der. Freq/Speed=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch0_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch1_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch5_GG	No Unit	Exclude=0 Include=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch9_GG	No Unit	Exclude=0 Include=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch6_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch8_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	131	UINT32	R/W	PssPriSwitch7_GG	No Unit	OFF=0 ON=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
PSS Control Primary	131	UINT32	R/W	PssPriSwitch2_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Primary	132	Float	R/W	PssPriPowerOn Threshold_GG	No Unit	0 - 1
PSS Control Primary	132	Float	R/W	PssPriPower Hysteresis_GG	No Unit	0 - 1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch10_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch11_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch3_GG	No Unit	Frequency=0 Der. Speed=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch4_GG	No Unit	Power=0 Der. Freq/Speed=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch0_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch1_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch5_GG	No Unit	Exclude=0 Include=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch9_GG	No Unit	Exclude=0 Include=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch6_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch8_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch7_GG	No Unit	OFF=0 ON=1
PSS Control Secondary	133	UINT32	R/W	PssSecSwitch2_GG	No Unit	DISABLED=0 ENABLED=1
PSS Control Secondary	134	Float	R/W	PssSecPowerOn Threshold_GG	No Unit	0 - 1
PSS Control Secondary	134	Float	R/W	PssSecPower Hysteresis_GG	No Unit	0 - 1
PSS Filter Parameter Primary Int	135	UINT32	R/W	PssPriRampFltM_GG	No Unit	1 - 5
PSS Filter Parameter Primary Int	135	UINT32	R/W	PssPriRampFltN_GG	No Unit	0 - 1
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTlpf1_GG	Sec	0 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTlpf2_GG	Sec	1 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTlpf3_GG	Sec	0.05 - 0.2
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTr_GG	Sec	0.05 - 1
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTw1_GG	Sec	1 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTw2_GG	Sec	1 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTw3_GG	Sec	1 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriTw4_GG	Sec	1 - 20
PSS Filter Parameter Primary Float	136	Float	R/W	PssPriH_GG	No Unit	1 - 25
PSS Parameter Primary Float	138	Float	R/W	PssPriZn1_GG	No Unit	0 - 1
PSS Parameter Primary Float	138	Float	R/W	PssPriZn2_GG	No Unit	0 - 1
PSS Parameter Primary Float	138	Float	R/W	PssPriZd1_GG	No Unit	0 - 1
PSS Parameter Primary Float	138	Float	R/W	PssPriZd2_GG	No Unit	0 - 1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
PSS Parameter Primary Float	138	Float	R/W	PssPriWn1_GG	No Unit	10 - 150
PSS Parameter Primary Float	138	Float	R/W	PssPriWn2_GG	No Unit	10 - 150
PSS Parameter Primary Float	138	Float	R/W	PssPriXq_GG	No Unit	0 - 5
PSS Parameter Primary Float	138	Float	R/W	PssPriKpe_GG	No Unit	0 - 2
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT1_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT2_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT3_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT4_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT5_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT6_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT7_GG	Sec	0.001 - 6
PSS Parameter Primary Phase Comp Float	140	Float	R/W	PssPriT8_GG	Sec	0.001 - 6
PSS Parameter Secondary Filters Int	141	UINT32	R/W	PssSecRampFltM_GG	No Unit	1 - 5
PSS Parameter Secondary Filters Int	141	UINT32	R/W	PssSecRampFltN_GG	No Unit	0 - 1
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTlpf1_GG	Sec	0 - 20
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTlpf2_GG	Sec	1 - 20
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTlpf3_GG	Sec	0.05 - 0.2
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTr_GG	Sec	0.05 - 1
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTw1_GG	Sec	1 - 20
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTw2_GG	Sec	1 - 20
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTw3_GG	Sec	1 - 20
PSS Parameter Secondary Filters Float	142	Float	R/W	PssSecTw4_GG	Sec	1 - 20
PSS Parameter Secondary Float	144	Float	R/W	PssSecZn1_GG	No Unit	0 - 1
PSS Parameter Secondary Float	144	Float	R/W	PssSecZn2_GG	No Unit	0 - 1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
PSS Parameter Secondary Float	144	Float	R/W	PssSecZd1_GG	No Unit	0 - 1
PSS Parameter Secondary Float	144	Float	R/W	PssSecZd2_GG	No Unit	0 - 1
PSS Parameter Secondary Float	144	Float	R/W	PssSecWn1_GG	No Unit	10 - 150
PSS Parameter Secondary Float	144	Float	R/W	PssSecWn2_GG	No Unit	10 - 150
PSS Parameter Secondary Float	144	Float	R/W	PssSecXq_GG	No Unit	0 - 5
PSS Parameter Secondary Float	144	Float	R/W	PssSecKpe_GG	No Unit	0 - 2
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT1_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT2_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT3_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT4_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT5_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT6_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT7_GG	Sec	0.001 - 6
PSS Parameter Secondary Phase Comp Float	146	Float	R/W	PssSecT8_GG	Sec	0.001 - 6
PSS Output Limiter Primary	148	Float	R/W	PssPriLimitPlus_GG	No Unit	0 - 0.5
PSS Output Limiter Primary	148	Float	R/W	PssPriLimitMinus_GG	No Unit	-0.5 - 0
PSS Output Limiter Primary	148	Float	R/W	PssPriKs_GG	No Unit	0 - 50
PSS Output Limiter Primary	148	Float	R/W	PssPriEtLmtTlpf_GG	Sec	0.02 - 5
PSS Output Limiter Primary	148	Float	R/W	PssPriEtLmtVref_GG	No Unit	0 - 10
PSS Output Limiter Primary	148	Float	R/W	PssPriTw5Normal_GG	No Unit	5 - 30
PSS Output Limiter Primary	148	Float	R/W	PssPriTw5Limit_GG	No Unit	0 - 1
PSS Output Limiter Primary	148	Float	R/W	PssPriLmtVhi_GG	No Unit	0.01 - 0.04
PSS Output Limiter Primary	148	Float	R/W	PssPriLmtVlo_GG	No Unit	-0.04 - -0.01
PSS Output Limiter Primary	148	Float	R/W	PssPriLmtTDelay_GG	No Unit	0 - 2
PSS Output Limiter Secondary	150	Float	R/W	PssSecLimitPlus_GG	No Unit	0 - 0.5
PSS Output Limiter Secondary	150	Float	R/W	PssSecLimitMinus_GG	No Unit	-0.5 - 0
PSS Output Limiter Secondary	150	Float	R/W	PssSecKs_GG	No Unit	0 - 50
PSS Output Limiter Secondary	150	Float	R/W	PssSecEtLmtTlpf_GG	Sec	0.02 - 5

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
PSS Output Limiter Secondary	150	Float	R/W	PssSecEtLmtVref_GG	No Unit	0 - 10
PSS Output Limiter Secondary	150	Float	R/W	PssSecTw5Normal_GG	No Unit	5 - 30
PSS Output Limiter Secondary	150	Float	R/W	PssSecTw5Limit_GG	No Unit	0 - 1
PSS Output Limiter Secondary	150	Float	R/W	PssSecLmtVhi_GG	No Unit	0.01 - 0.04
PSS Output Limiter Secondary	150	Float	R/W	PssSecLmtVlo_GG	No Unit	-0.04 - -0.01
PSS Output Limiter Secondary	150	Float	R/W	PssSecLmtTDelay_GG	No Unit	0 - 2
Synchronizer	151	UINT32	R/W	SyncType_GG	No Unit	Anticipatory=0 PhaseLockLoop=1
Synchronizer	151	UINT32	R/W	Fgen_GT_Fbus_GG	No Unit	DISABLED=0 ENABLED=1
Synchronizer	151	UINT32	R/W	Vgen_GT_Vbus_GG	No Unit	DISABLED=0 ENABLED=1
Synchronizer	152	Float	R/W	SlipFrequency_GG	Hz	0.1 - 0.5
Synchronizer	152	Float	R/W	VoltageWindow_GG	%	2 - 15
Synchronizer	152	Float	R/W	BreakerClosing Angle_GG	Deg	3 - 20
Synchronizer	152	Float	R/W	SyncActivation Delay_GG	Sec	0.1 - 0.8
Synchronizer	152	Float	R/W	SyncFailActivation Delay_GG	Sec	0.1 - 600
Synchronizer	152	Float	R/W	SyncSpeedGain_GG	No Unit	0.001 - 1000
Synchronizer	152	Float	R/W	SyncVoltageGain_GG	No Unit	0.001 - 1000
Voltage Matching	153	UINT32	R/W	SysOptionInputVolt MatchEnabled_GG	No Unit	DISABLED=0 ENABLED=1
Voltage Matching	154	Float	R/W	SysOptionVolMatch Band_GG	%	0 - 20
Voltage Matching	154	Float	R/W	SysOptionVolMatch Ref_GG	%	0 - 700
Breaker Hardware	155	UINT32	R/W	GenBreaker_GG	No Unit	Not Configured=0 Configured=1
Breaker Hardware	155	UINT32	R/W	GenContactType_GG	No Unit	Pulse=0 Continuous=1
Breaker Hardware	155	UINT32	R/W	DeadBusClose Enable_GG	No Unit	DISABLED=0 ENABLED=1
Breaker Hardware	155	UINT32	R/W	DeadGenClose Enable_GG	No Unit	DISABLED=0 ENABLED=1
Breaker Hardware	156	Float	R/W	BreakerClose WaitTime_GG	Sec	0.1 - 600
Breaker Hardware	156	Float	R/W	GenOpenPulse Time_GG	Sec	0.01 - 5
Breaker Hardware	156	Float	R/W	GenClosePulse Time_GG	Sec	0.01 - 5
Bus Condition Detection (Gen Sensing)	158	Float	R/W	DeadGen Threshold_GG	V	0 - 600000
Bus Condition Detection (Gen Sensing)	158	Float	R/W	DeadGen TimeDelay_GG	Sec	0.1 - 600
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableOver VoltagePickup_GG	V	10 - 600000
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableOver VoltageDropout_GG	V	10 - 600000
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableUnder VoltagePickup_GG	V	10 - 600000

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableUnder VoltageDropout_GG	V	10 - 600000
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStable OverFrequency Pickup_GG	Hz	46 - 64
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStable OverFrequency Dropout_GG	Hz	46 - 64
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStable UnderFrequency Pickup_GG	Hz	46 - 64
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStable UnderFrequency Dropout_GG	Hz	46 - 64
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableActivation Delay_GG	Sec	0.1 - 600
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenFailedActivation Delay_GG	Sec	0.1 - 600
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableLowLine ScaleFactor_GG	No Unit	0.001 - 3
Bus Condition Detection (Gen Sensing)	158	Float	R/W	GenStableAlternate Frequency ScaleFactor_GG	No Unit	0.001 - 100
Bus Condition Detection (Bus Sensing)	160	Float	R/W	DeadBus Threshold_GG	V	0 - 600000
Bus Condition Detection (Bus Sensing)	160	Float	R/W	DeadBus TimeDelay_GG	Sec	0.1 - 600
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable OverVoltage Pickup_GG	V	10 - 600000
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable OverVoltage Dropout_GG	V	10 - 600000
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable UnderVoltage Pickup_GG	V	10 - 600000
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable UnderVoltage Dropout_GG	V	10 - 600000
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable OverFrequency Pickup_GG	Hz	46 - 64
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable OverFrequency Dropout_GG	Hz	46 - 64
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable UnderFrequency Pickup_GG	Hz	46 - 64
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStable UnderFrequency Dropout_GG	Hz	46 - 64
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStableActivation Delay_GG	Sec	0.1 - 600
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusFailedActivation Delay_GG	Sec	0.1 - 600

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStableLowLine ScaleFactor_GG	No Unit	0.001 - 3
Bus Condition Detection (Bus Sensing)	160	Float	R/W	BusStableAlternate FrequencyScale Factor_GG	No Unit	0.001 - 100
Governor Bias Control	161	UINT32	R/W	ControlContact Type_GG	No Unit	Continuous=0 Proportional=1
Governor Bias Control	162	Float	R/W	CorrectionPulse Width_GG	Sec	0 - 99.9
Governor Bias Control	162	Float	R/W	CorrectionPulse Interval_GG	Sec	0 - 99.9
Gen Undervolt	163	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=1
Gen Undervolt	163	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=1
Gen Undervolt	164	Float	R/W	Pickup_PP	V	1 - 600000
Gen Undervolt	164	Float	R/W	Time_Delay_PP	ms	100 - 60000
Gen Undervolt	164	Float	R/W	Pickup_PS	V	1 - 600000
Gen Undervolt	164	Float	R/W	Time_Delay_PS	ms	100 - 60000
Gen Overvolt	165	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=1
Gen Overvolt	165	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=1
Gen Overvolt	166	Float	R/W	Pickup_PP	V	0 - 600000
Gen Overvolt	166	Float	R/W	Time_Delay_PP	ms	100 - 60000
Gen Overvolt	166	Float	R/W	Pickup_PS	V	0 - 600000
Gen Overvolt	166	Float	R/W	Time_Delay_PS	ms	100 - 60000
Loss of Sensing	167	UINT32	R/W	Mode_GG	No Unit	DISABLED=0 ENABLED=1
Loss of Sensing	167	UINT32	R/W	SysOptionNoSenseTo ManualMode_GG	No Unit	DISABLED=0 ENABLED=1
Loss of Sensing	168	Float	R/W	Time_Delay_GG	Sec	0 - 30
Loss of Sensing	168	Float	R/W	Voltage Balanced Level_GG	%	0 - 100
Loss of Sensing	168	Float	R/W	Voltage Unbalanced Level_GG	%	0 - 100
81O	169	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 OVER=1
81O	169	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 OVER=1
81O	170	Float	R/W	Pickup_PP	Hz	30 - 70
81O	170	Float	R/W	Time_Delay_PP	ms	100 - 300000
81O	170	Float	R/W	Pickup_PS	Hz	30 - 70
81O	170	Float	R/W	Time_Delay_PS	ms	100 - 300000
81O	170	Float	R/W	Voltage_Inhibit_PP	%	5 – 100
81O	170	Float	R/W	Voltage_Inhibit_PS	%	5 – 100
81U	171	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 UNDER=2
81U	171	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 UNDER=2
81U	172	Float	R/W	Pickup_PP	Hz	30 - 70
81U	172	Float	R/W	Time_Delay_PP	ms	100 - 300000
81U	172	Float	R/W	Voltage_Inhibit_PP	%	5 - 100
81U	172	Float	R/W	Pickup_PS	Hz	30 - 70
81U	172	Float	R/W	Time_Delay_PS	ms	5 - 300000
81U	172	Float	R/W	Voltage_Inhibit_PS	%	50 - 100

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Reverse Power	173	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=4
Reverse Power	173	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=4
Reverse Power	174	Float	R/W	Pickup_PP	%	0 - 150
Reverse Power	174	Float	R/W	Pickup_PS	%	0 - 150
Reverse Power	174	Float	R/W	Time_Delay_PP	ms	0 - 300000
Reverse Power	174	Float	R/W	Time_Delay_PS	ms	0 - 300000
Loss of Excitation	175	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=1
Loss of Excitation	175	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=1
Loss of Excitation	176	Float	R/W	Pickup_PP	%	0 - 150
Loss of Excitation	176	Float	R/W	Time_Delay_PP	ms	0 - 300000
Loss of Excitation	176	Float	R/W	Pickup_PS	%	0 - 150
Loss of Excitation	176	Float	R/W	Time_Delay_PS	ms	0 - 300000
Field Overvolt	177	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=1
Field Overvolt	177	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=1
Field Overvolt	178	Float	R/W	Pickup_PP	V	1 - 325
Field Overvolt	178	Float	R/W	Time_Delay_PP	ms	200 - 30000
Field Overvolt	178	Float	R/W	Pickup_PS	V	1 - 325
Field Overvolt	178	Float	R/W	Time_Delay_PS	ms	200 - 30000
Field Overcurrent	179	UINT32	R/W	Mode_PP	No Unit	DISABLED=0 ENABLED=1
Field Overcurrent	179	UINT32	R/W	Mode_PS	No Unit	DISABLED=0 ENABLED=1
Field Overcurrent	180	Float	R/W	Pickup_PP	Amp	0 - 22
Field Overcurrent	180	Float	R/W	Time_Delay_PP	ms	5000 - 60000
Field Overcurrent	180	Float	R/W	Pickup_PS	Amp	0 - 22
Field Overcurrent	180	Float	R/W	Time_Delay_PS	ms	5000 - 60000
Power Input Failure	181	UINT32	R/W	Mode_GG	No Unit	DISABLED=0 ENABLED=1
Power Input Failure	182	Float	R/W	Time_Delay_GG	Sec	0 - 10
Exciter Diode Monitor	183	UINT32	R/W	ExciterOpen DiodeEnable_GG	No Unit	DISABLED=0 ENABLED=1
Exciter Diode Monitor	183	UINT32	R/W	ExciterShorted DiodeEnable_GG	No Unit	DISABLED=0 ENABLED=1
Exciter Diode Monitor	184	Float	R/W	ExciterDiodeInhibit Threshold_GG	%	0 - 100
Exciter Diode Monitor	184	Float	R/W	ExciterOpen DiodePickup_GG	%	0 - 100
Exciter Diode Monitor	184	Float	R/W	ExciterOpenDiode TimeDelay_GG	Sec	10 - 60
Exciter Diode Monitor	184	Float	R/W	ExciterShorted DiodePickup_GG	%	0 - 100
Exciter Diode Monitor	184	Float	R/W	ExciterShortedDiode TimeDelay_GG	Sec	5 - 30
Exciter Diode Monitor	184	Float	R/W	ExciterPoleRatio_GG	No Unit	1 - 10
Sync Check	185	UINT32	R/W	Mode_GG	No Unit	DISABLED=0 ENABLED=1
Sync Check	186	Float	R/W	Phase_Angle_GG	Deg	1 - 99
Sync Check	186	Float	R/W	Slip_Freq_GG	Hz	0.01 - 0.5
Sync Check	186	Float	R/W	Volt_Mag_Error_ Percent_GG	%	0.1 - 50

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 1	187	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 1	187	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 1	187	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 1	187	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 1	187	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 1	187	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 1	188	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 1	188	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 1	188	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 1	188	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 1	188	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 1	188	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 1	188	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 1	188	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 1	188	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 1	188	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Config Prot 2	189	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 2	189	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 2	189	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 2	189	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 2	189	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 2	189	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 2	190	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 2	190	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 2	190	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 2	190	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 2	190	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 2	190	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 2	190	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 2	190	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 2	190	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 2	190	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Config Prot 3	191	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 3	191	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 3	191	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 3	191	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 3	191	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 3	191	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 3	192	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 3	192	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 3	192	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 3	192	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 3	192	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 3	192	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 3	192	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 3	192	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 3	192	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 3	192	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 4	193	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 4	193	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 4	193	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 4	193	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 4	193	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 4	193	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 4	194	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 4	194	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 4	194	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 4	194	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 4	194	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 4	194	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 4	194	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 4	194	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 4	194	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 4	194	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Config Prot 5	195	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 5	195	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 5	195	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 5	195	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 5	195	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 5	195	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 5	196	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 5	196	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 5	196	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 5	196	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 5	196	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 5	196	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 5	196	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 5	196	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 5	196	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 5	196	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Config Prot 6	197	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 6	197	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 6	197	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 6	197	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 6	197	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 6	197	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 6	198	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 6	198	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 6	198	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 6	198	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 6	198	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 6	198	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 6	198	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 6	198	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 6	198	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 6	198	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 7	199	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 7	199	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 7	199	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 7	199	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 7	199	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 7	199	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 7	200	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 7	200	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 7	200	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 7	200	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 7	200	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 7	200	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 7	200	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 7	200	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 7	200	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 7	200	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Config Prot 8	201	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Config Prot 8	201	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Config Prot 8	201	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 8	201	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 8	201	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Config Prot 8	201	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Config Prot 8	202	Float	R/W	Hysteresis_GG	%	0 - 100
Config Prot 8	202	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Config Prot 8	202	Float	R/W	Threshold1Pickup_GG	No Unit	-999999 - 999999
Config Prot 8	202	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Config Prot 8	202	Float	R/W	Threshold2Pickup_GG	No Unit	-999999 - 999999
Config Prot 8	202	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Config Prot 8	202	Float	R/W	Threshold3Pickup_GG	No Unit	-999999 - 999999
Config Prot 8	202	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Config Prot 8	202	Float	R/W	Threshold4Pickup_GG	No Unit	-999999 - 999999
Config Prot 8	202	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 1	203	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 1	203	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 1	203	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 1	203	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 1	203	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 1	203	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 1	204	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 1	204	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 1	204	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 1	204	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 1	204	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 1	204	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 1	204	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 1	204	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 1	204	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 1	204	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 1	204	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 2	205	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 2	205	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 2	205	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 2	205	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 2	205	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 2	205	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog In 2	206	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 2	206	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 2	206	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 2	206	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 2	206	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 2	206	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 2	206	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 2	206	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 2	206	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 2	206	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 2	206	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 3	207	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 3	207	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 3	207	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 3	207	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 3	207	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 3	207	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 3	208	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 3	208	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 3	208	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 3	208	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 3	208	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 3	208	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 3	208	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 3	208	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 3	208	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 3	208	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 3	208	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 4	209	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog In 4	209	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 4	209	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 4	209	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 4	209	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 4	209	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 4	210	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 4	210	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 4	210	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 4	210	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 4	210	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 4	210	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 4	210	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 4	210	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 4	210	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 4	210	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 4	210	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 5	211	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 5	211	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 5	211	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 5	211	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 5	211	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 5	211	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 5	212	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 5	212	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 5	212	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 5	212	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 5	212	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 5	212	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 5	212	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 5	212	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 5	212	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 5	212	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 5	212	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 5	212	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog In 5	212	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 5	212	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 5	212	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 5	212	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 6	213	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 6	213	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 6	213	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 6	213	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 6	213	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 6	213	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 6	214	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 6	214	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 6	214	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 6	214	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 6	214	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 6	214	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 6	214	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 6	214	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 6	214	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 6	214	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 6	214	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 7	215	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 7	215	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 7	215	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 7	215	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 7	215	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 7	215	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 7	216	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 7	216	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 7	216	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 7	216	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 7	216	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 7	216	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 7	216	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog In 7	216	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 7	216	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 7	216	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 7	216	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 7	216	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 7	216	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 7	216	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 7	216	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 7	216	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog In 8	217	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote Analog In 8	217	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 8	217	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 8	217	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 8	217	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote Analog In 8	217	UINT32	R/W	Type_GG	No Unit	Voltage=0 Current=1
Remote Analog In 8	218	Float	R/W	Hysteresis_GG	%	0 - 100
Remote Analog In 8	218	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote Analog In 8	218	Float	R/W	Threshold1Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 8	218	Float	R/W	Threshold2Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 8	218	Float	R/W	Threshold3Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 8	218	Float	R/W	Threshold4Pickup_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog In 8	218	Float	R/W	ParamMin_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	ParamMax_GG	No Unit	-9999 - 9999
Remote Analog In 8	218	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog In 8	218	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog In 8	218	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog In 8	218	Float	R/W	VoltageMax_GG	V	0 - 10
Remote RTD In 1	219	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 1	219	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 1	219	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 1	219	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 1	219	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 1	219	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 1	220	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 1	220	Float	R/W	Hysteresis_GG	%	0 - 100

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote RTD In 1	220	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 1	220	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 1	220	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 1	220	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 1	220	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 1	220	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 1	220	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 1	220	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 1	220	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 2	221	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 2	221	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 2	221	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 2	221	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 2	221	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 2	221	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 2	222	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 2	222	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 2	222	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 2	222	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 2	222	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 2	222	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 2	222	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 2	222	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 2	222	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 2	222	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 2	222	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 3	223	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 3	223	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 3	223	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 3	223	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 3	223	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 3	223	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 3	224	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 3	224	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 3	224	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 3	224	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 3	224	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 3	224	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote RTD In 3	224	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 3	224	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 3	224	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 3	224	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 3	224	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 4	225	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 4	225	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 4	225	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 4	225	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 4	225	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 4	225	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 4	226	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 4	226	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 4	226	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 4	226	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 4	226	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 4	226	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 4	226	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 4	226	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 4	226	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 4	226	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 4	226	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 5	227	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 5	227	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 5	227	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 5	227	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 5	227	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 5	227	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 5	228	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 5	228	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 5	228	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 5	228	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 5	228	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 5	228	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 5	228	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 5	228	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 5	228	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 5	228	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote RTD In 5	228	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 6	229	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 6	229	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 6	229	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 6	229	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 6	229	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 6	229	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 6	230	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 6	230	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 6	230	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 6	230	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 6	230	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 6	230	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 6	230	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 6	230	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 6	230	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 6	230	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 6	230	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 7	231	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 7	231	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 7	231	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 7	231	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 7	231	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 7	231	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 7	232	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 7	232	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 7	232	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 7	232	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 7	232	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 7	232	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 7	232	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 7	232	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 7	232	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 7	232	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 7	232	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 8	233	UINT32	R/W	Type_GG	No Unit	_10_Ohm_Cu=0 _100_Ohm_Pt=1
Remote RTD In 8	233	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote RTD In 8	233	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 8	233	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote RTD In 8	233	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 8	233	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote RTD In 8	234	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote RTD In 8	234	Float	R/W	Hysteresis_GG	%	0 - 100
Remote RTD In 8	234	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote RTD In 8	234	Float	R/W	Threshold1Pickup_GG	Deg F	-58 - 482
Remote RTD In 8	234	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 8	234	Float	R/W	Threshold2Pickup_GG	Deg F	-58 - 482
Remote RTD In 8	234	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 8	234	Float	R/W	Threshold3Pickup_GG	Deg F	-58 - 482
Remote RTD In 8	234	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote RTD In 8	234	Float	R/W	Threshold4Pickup_GG	Deg F	-58 - 482
Remote RTD In 8	234	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote TC In 1	235	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote TC In 1	235	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 1	235	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 1	235	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 1	235	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 1	236	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote TC In 1	236	Float	R/W	Hysteresis_GG	%	0 - 100
Remote TC In 1	236	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote TC In 1	236	Float	R/W	Threshold1Pickup_GG	Deg F	32 - 2507
Remote TC In 1	236	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300
Remote TC In 1	236	Float	R/W	Threshold2Pickup_GG	Deg F	32 - 2507
Remote TC In 1	236	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote TC In 1	236	Float	R/W	Threshold3Pickup_GG	Deg F	32 - 2507
Remote TC In 1	236	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote TC In 1	236	Float	R/W	Threshold4Pickup_GG	Deg F	32 - 2507
Remote TC In 1	236	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote TC In 2	237	UINT32	R/W	StopModeInhibit_GG	No Unit	NO=0 YES=1
Remote TC In 2	237	UINT32	R/W	Threshold1Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 2	237	UINT32	R/W	Threshold2Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 2	237	UINT32	R/W	Threshold3Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 2	237	UINT32	R/W	Threshold4Type_GG	No Unit	Disabled=0 Over=1 Under=2
Remote TC In 2	238	Float	R/W	CalOffset_GG	Deg F	-99999 - 99999
Remote TC In 2	238	Float	R/W	Hysteresis_GG	%	0 - 100
Remote TC In 2	238	Float	R/W	ArmingDelay_GG	Sec	0 - 300
Remote TC In 2	238	Float	R/W	Threshold1Pickup_GG	Deg F	32 - 2507
Remote TC In 2	238	Float	R/W	Threshold1 ActivationDelay_GG	Sec	0 - 300

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote TC In 2	238	Float	R/W	Threshold2Pickup_GG	Deg F	32 - 2507
Remote TC In 2	238	Float	R/W	Threshold2 ActivationDelay_GG	Sec	0 - 300
Remote TC In 2	238	Float	R/W	Threshold3Pickup_GG	Deg F	32 - 2507
Remote TC In 2	238	Float	R/W	Threshold3 ActivationDelay_GG	Sec	0 - 300
Remote TC In 2	238	Float	R/W	Threshold4Pickup_GG	Deg F	32 - 2507
Remote TC In 2	238	Float	R/W	Threshold4 ActivationDelay_GG	Sec	0 - 300
Remote Analog Out 1	239	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Remote Analog Out 1	239	UINT32	R/W	OutputType_GG	No Unit	Voltage=0 Current=1
Remote Analog Out 1	240	Float	R/W	OutOfRange ActivationDelay_GG	Sec	0 - 300
Remote Analog Out 1	240	Float	R/W	ParamMin_GG	No Unit	-99999 - 99999
Remote Analog Out 1	240	Float	R/W	ParamMax_GG	No Unit	-99999 - 99999
Remote Analog Out 1	240	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog Out 1	240	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog Out 1	240	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog Out 1	240	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog Out 2	241	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Remote Analog Out 2	241	UINT32	R/W	OutputType_GG	No Unit	Voltage=0 Current=1
Remote Analog Out 2	242	Float	R/W	OutOfRange ActivationDelay_GG	Sec	0 - 300

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog Out 2	242	Float	R/W	ParamMin_GG	No Unit	-99999 - 99999
Remote Analog Out 2	242	Float	R/W	ParamMax_GG	No Unit	-99999 - 99999
Remote Analog Out 2	242	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog Out 2	242	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog Out 2	242	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog Out 2	242	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog Out 3	243	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Remote Analog Out 3	243	UINT32	R/W	OutputType_GG	No Unit	Voltage=0 Current=1
Remote Analog Out 3	244	Float	R/W	OutOfRange ActivationDelay_GG	Sec	0 - 300
Remote Analog Out 3	244	Float	R/W	ParamMin_GG	No Unit	-99999 - 99999
Remote Analog Out 3	244	Float	R/W	ParamMax_GG	No Unit	-99999 - 99999
Remote Analog Out 3	244	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog Out 3	244	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog Out 3	244	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog Out 3	244	Float	R/W	VoltageMax_GG	V	0 - 10
Remote Analog Out 4	245	UINT32	R/W	ParamSelection_GG	No Unit	Gen VAB=0 Gen VBC=1 Gen VCA=2 Gen V Average=3 Bus Freq=4 Bus VAB=5 Bus VBC=6 Bus VCA=7 Gen Freq=8 Gen PF=9 KWH=10 KVARH=11 Gen IA=12 Gen IB=13 Gen IC=14 Gen I Average=15 KW Total=16 KVA Total=17 KVAR Total=18 EDM Ripple=19 Exciter Field Voltage=20 Exciter Field Current=21 Auxilary Input Voltage=22 Auxilary Input Current (mA)=23 Setpoint Position=24 Tracking_Error=25 Neg_Seq_V=26 Neg_Seq_I=27 Pos_Seq_V=28 Pos_Seq_I=29 PSS_Output=30 Analog Input 1=31 Analog Input 2=32 Analog Input 3=33 Analog Input 4=34 Analog Input 5=35 Analog Input 6=36 Analog Input 7=37 Analog Input 8=38 RTD Input 1=39 RTD Input 2=40 RTD Input 3=41 RTD Input 4=42 RTD Input 5=43 RTD Input 6=44 RTD Input 7=45 RTD Input 8=46 Thermocouple 1=47 Thermocouple 2=48
Remote Analog Out 4	245	UINT32	R/W	OutputType_GG	No Unit	Voltage=0 Current=1

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Remote Analog Out 4	246	Float	R/W	OutOfRange ActivationDelay_GG	Sec	0 - 300
Remote Analog Out 4	246	Float	R/W	ParamMin_GG	No Unit	-99999 - 99999
Remote Analog Out 4	246	Float	R/W	ParamMax_GG	No Unit	-99999 - 99999
Remote Analog Out 4	246	Float	R/W	CurrentMin_GG	mA	4 - 20
Remote Analog Out 4	246	Float	R/W	CurrentMax_GG	mA	4 - 20
Remote Analog Out 4	246	Float	R/W	VoltageMin_GG	V	0 - 10
Remote Analog Out 4	246	Float	R/W	VoltageMax_GG	V	0 - 10
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm1 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm2 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm3 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm4 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm5 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm6 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm7 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm8 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm9 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm10 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm11 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm12 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm13 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm14 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm15 Delay_GG	Sec	0 - 300
User Programmable Alarms	248	Float	R/W	ProgrammableAlarm16 Delay_GG	Sec	0 - 300
Logic Timers	250	Float	R/W	Logic Timer 1 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 2 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 3 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 4 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 5 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 6 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 7 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 8 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 9 Output Timeout_GG	Sec	0 - 1800

Instance Name	Inst. #	Type	RW	Key Name	Unit	Range
Logic Timers	250	Float	R/W	Logic Timer 10 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 11 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 12 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 13 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 14 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 15 Output Timeout_GG	Sec	0 - 1800
Logic Timers	250	Float	R/W	Logic Timer 16 Output Timeout_GG	Sec	0 - 1800
Logic Counters	252	Float	R/W	Counter 1 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 2 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 3 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 4 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 5 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 6 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 7 Output Timeout_GG	No Unit	0 - 1800
Logic Counters	252	Float	R/W	Counter 8 Output Timeout_GG	No Unit	0 - 1800
AEM RTD TC Metric Meter	253	Float	R	RTD Input 1 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 2 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 3 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 4 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 5 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 6 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 7 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	RTD Input 8 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	Therm Input 1 Metric Value_GG	Deg C	n/a
AEM RTD TC Metric Meter	253	Float	R	Therm Input 2 Metric Value_GG	Deg C	n/a

Maintenance

Warning!
These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the operating instructions unless you are qualified to do so. Before performing any maintenance procedures, remove the DECS-250N from service. Refer to the appropriate site schematics to ensure that all steps have been taken to properly and completely de-energize the DECS-250N.

Caution
In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.

Storage

If the unit is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Preventive Maintenance

Connections

Periodically check the connections of the DECS-250N to ensure they are clean and tight and remove any accumulation of dust.

Electrolytic Capacitors

The DECS-250N contains long-life aluminum electrolytic capacitors. For a DECS-250N kept in storage as a spare, the life of these capacitors can be maximized by energizing the device for 30 minutes once per year. The energizing procedure for the DECS-250N is shown below.

1. Apply control power as indicated by the device style number. For this maintenance procedure, it is recommended that the applied voltage not exceed the nominal value.
   - Style Lxxxxxx: 24/48 Vdc (16 to 48 Vdc)
   - Style Cxxxxxx: 120 Vac (82 to 120 Vac at 50/60 Hz) or 125 Vdc (90 to 125 Vdc)

It is not necessary to apply operating power to the bridge as this circuitry contains no electrolytic capacitors.

Cleaning the Front Panel

Only a soft cloth and water-based solutions should be used to clean the front panel. Do not use solvents.

Troubleshooting

The following troubleshooting procedures assume the excitation system components are properly matched, fully operational, and correctly connected. If you do not obtain the results that you expect from the DECS-250N, first check the programmable settings for the appropriate function.

DECS-250N Appears Inoperative

If the DECS-250N does not power up (no backlighting on front panel display), ensure that the control power applied to the unit (AC input terminals L and N, DC input terminals BATT+ and BATT–) is at the correct level. If dc control power is being used, verify that the polarity is correct. Units with style number Lxxxxxx have an input voltage range of 16 to 60 Vdc. Units with style number Cxxxxxx have an input voltage range of 90 to 150 Vdc or 82 to 132 Vac (50/60 Hz).

> **NOTE**
>
> When both ac and dc control power is used, an isolation transformer must be connected between the ac voltage source and the ac control power terminals of the DECS-250N.

Display Blank or Frozen

If the front panel display (LCD) is blank or frozen (does not scroll), remove control power for about 60 seconds and then reapply control power. If the problem occurred during software uploading, repeat the upload procedures as described in the associated instructions.

Generator Voltage Does Not Build

Check the DECS-250N settings and system voltages for the following:

a. Generator potential transformer (PT) primary voltage
b. Generator PT secondary voltage
c. AC voltage on the DECS-250N operating (bridge) power terminals (C5 (A), C6 (B), and C7 (C))

Check the DECS-250N soft start bias and soft start time settings. If necessary, increase the generator soft start bias and decrease the generator soft start time.

If the generator voltage still does not build, increase the value of Kg.

Temporarily disable the overexcitation limiter.

Low Generator Voltage in AVR Mode

Check the following DECS-250N settings and system parameters:

a. AVR voltage setpoint
b. Generator potential transformer (PT) primary voltage
c. Generator PT secondary voltage
d. Overexcitation limiter (not activated)
e. Accessory inputs (should be zero)
f. Var/PF and droop (should be disabled)
g. Cut-in underfrequency setting (should be below the generator operating frequency)

If the problem persists, contact the Basler Electric Technical Sales Support department for advice.

High Generator Voltage in AVR Mode

Check the following DECS-250N settings and system parameters:

a. AVR voltage setpoint
b. Generator potential transformer (PT) primary voltage
c. Generator PT secondary voltage
d. Accessory inputs (should be zero)
e. Var/PF and droop (should be disabled)

If the problem persists, contact the Basler Electric Technical Sales Support department for advice.

Generator Voltage Unstable (Hunting)

Verify that the exciter power converter is working correctly by substituting the appropriate battery voltage in place of the DECS-250N drive voltage. If the problem is caused by the DECS-250N, check the gain settings for the specific mode of operation selected.

If the problem persists, contact the Basler Electric Technical Sales Support department for advice.

Protection or Limit Annunciation

If a protection function or limiting function is annunciated, check the associated setting values.

If the problem persists, contact the Basler Electric Technical Sales Support department for advice.

HMI Meter Readings Incorrect

If your PF, var, or watt readings are significantly different from the expected readings for a known load, verify that the B-phase current sensing input of the DECS-250N is connected to a CT on phase B and not phases A or C.

No Communication

If communication with the DECS-250N cannot be initiated, check the connections at the communication ports, the baud rate, and supporting software.

DECS-250N Reboots Frequently

If a single DECS-250N control power source is used and the power source is supplying less than the minimum required voltage or is fluctuating below the minimum required voltage, the DECS-250N will reboot. Increase the control power source voltage so that it is within the specified operating range. Units with style number Lxxxxxx have an input voltage range of 16 to 60 Vdc. Units with style number Cxxxxxx have an input voltage range of 90 to 150 Vdc or 82 to 132 Vac (50/60 Hz).

Support

Contact the Basler Electric Technical Services Department at (618) 654-2341 for troubleshooting support or to receive a return authorization number.

Specifications

DECS-250N electrical and physical characteristics are listed in the following paragraphs.

Operating Power

Voltage Range

For 63 Vdc Excitation Power............ 100 to 139 Vac 50/60 Hz or 61-420 Hz
For 125 Vdc Excitation Power.......... 190 to 277 Vac 50/60 Hz or 61-420 Hz
For 250 Vdc Excitation Power.......... 380 to 528 Vac 50/60 Hz

Frequency Range (Style Dependent)

Style xx1xxxx .... 50/60 Hz
Style xx2xxxx .... 61 to 420 Hz
Style xx3xxxx .... 50/60 Hz (480 Vac input, 250 Vdc output)

Table 40 lists the required nominal operating power voltage and configuration required to obtain 63, 125, and 250 Vdc continuous field power for the DECS-250N.

Table 40. Operating Power Requirements

Excitation Power	Input Power Configuration	Nominal Input Voltage	Minimum Residual Voltage for Buildup	Operating Power Input Burden at 20 Adc Excitation Output
63 Vdc	1-Phase	208 Vac	12 Vac	4,160 VA
	3-Phase	120 Vac	12 Vac	3,400 VA
125 Vdc	1-Phase	Not Recommended		
	3-Phase	240 Vac	24 Vac	6,800 VA
250 Vdc*	1-Phase	Not Recommended		
	3-Phase	480 Vac	48 Vac	13,600 VA

* Style number DECS-250N-XX3XXXX required for this application.

Control Power

Two control power inputs enable continued operation if one of the two inputs is lost. The control power voltage rating is determined by the device style number.

Style LXXXXXX

DC Input

Nominal Input .... 24 or 48 Vdc
Input Range..................................... 16 to 60 Vdc
Burden.. 30 W

Style CXXXXXX

AC Input

Nominal Input .... 120 Vac, 50/60 Hz
Input Range..................................... 82 to 132 Vac, 50/60 Hz
Burden.. 50 VA

DC Input

Nominal Input .... 125 Vdc
Input Range..................................... 90 to 150 Vdc
Burden... 30 W

Terminals

AC Input: .... L, N
DC Input: .... BATT+, BATT–

Generator and Bus Voltage Sensing

Type .... 1-phase or 3-phase–3-wire
Burden... <1 VA per phase

Terminals

Generator Voltage Sensing............. E1, E2, E3
Bus Voltage Sensing....................... B1, B2, B3

50 Hz Sensing Voltage Nominal Input, Range

100 Vac .... 90 to 110 Vac
200 Vac .... 180 to 220 Vac
400 Vac .... 360 to 440 Vac

60 Hz Sensing Voltage Nominal Input, Range

120 Vac .... 108 to 132 Vac
240 Vac .... 216 to 264 Vac
480 Vac .... 432 to 528 Vac
600 Vac .... 540 to 660 Vac

Generator Current Sensing

Configuration................................... 4 inputs: A-, B-, C-phase, and cross-current compensation CT input
Type .... 1-phase (B-phase), 1-phase with cross-current compensation, 3-phase, 3-phase with cross-current compensation
Range.. 1 Aac or 5 Aac nominal
Frequency .... 50/60 Hz

Burden

1 Aac Sensing .... <5 VA
5 Aac Sensing .... <10 VA

Terminals

A-Phase.. CTA+, CTA–
B-Phase.. CTB+, CTB–
C-Phase .... CTC+, CTC–
Cross-Current Compensation .... CCCT+, CCCT–

Accessory Inputs

Current Input

Range.. 4 to 20 mAdc
Burden... Approximately 500 Ω

Terminals.. I+, I–

Voltage Input

Range... –10 to +10 Vdc
Burden.. >20 kΩ
Terminals.. V+, V–

Contact Inputs

Type .... Dry contact, accept PLC open-collector outputs
Interrogation Voltage....................... 12 Vdc

Terminals

Start.. START, COM A
Stop .... STOP, COM A
Programmable Input 1...................... IN 1, COM A
Programmable Input 2...................... IN 2, COM A
Programmable Input 3...................... IN 3, COM A
Programmable Input 4...................... IN 4, COM A
Programmable Input 5...................... IN 5, COM A
Programmable Input 6...................... IN 6, COM A
Programmable Input 7...................... IN 7, COM B
Programmable Input 8...................... IN 8, COM B
Programmable Input 9...................... IN 9, COM B
Programmable Input 10.................... IN 10, COM B
Programmable Input 11.................... IN 11, COM B
Programmable Input 12.................... IN 12, COM B
Programmable Input 13.................... IN 13, COM B
Programmable Input 14.................... IN 14, COM B

Communication Ports

Universal Serial Bus (USB)

Interface .... USB type B port
Location... Front panel

Caution

In accordance with the guidelines defined in USB standards, the USB port on this device is not isolated. To prevent damage to a connected PC or laptop, the DECS-250N must be properly tied to ground.

RS-232

Type .... RS-232 (for external autotracking)
Interface .... DB-9 connector
Location... Right side panel

RS-485

Type .... RS-485, half duplex
Interface .... Spring type terminals
Location... Left side panel
Terminals.. RS-485 A, B, C

Ethernet

Type .... 100Base-T copper (style xxxxx1x) or
100Base-FX (style xxxxx2x)
Interface .... RJ45 jack (style xxxxx1x) or locking duplex ST (straight tip) receptacle (style xxxxx2x)
Location... Right-side panel

Controller Area Network (CAN)

Type .... SAE J1939 message protocol
Interface .... Spring (style xxxSxxx) or compression (style xxxCxxx) type terminals
Location... Right side panel
Terminals... CAN 1 H, L, SH
CAN 2 H, L, SH
Differential Bus Voltage.................... 1.5 to 3 Vdc
Maximum Voltage .... –32 to +32 Vdc
Communication Rate........................ 250 kb/s

IRIG Time Synchronization Input

Standard.. 200-98, Format B002
Input Signal .... Demodulated (dc level-shifted signal)
Logic High Level............................... 3.5 Vdc, minimum
Logic Low Level .... 0.5 Vdc, maximum
Input Voltage Range .... –10 to +10 Vdc
Input Resistance .... Nonlinear, approximately 4 kΩ at 3.5 Vdc,
3 kΩ at 20 Vdc
Response Time .... <1 cycle
Terminals... IRIG+, IRIG–

Contact Outputs

Make and Break Ratings (Resistive)
- 24 Vdc....................................... 7.0 Adc
- 48 Vdc....................................... 0.7 Adc
- 125 Vdc..................................... 0.2 Adc
- 120/240 Vac.............................. 7.0 Aac

Carry Ratings (Resistive)
- 24/48/125 Vdc............................ 7.0 Adc
- 120/240 Vac.............................. 7.0 Aac

Terminal Assignments
- Watchdog.................................. WTCHD1, WTCHD, WTCHD2
- Relay Output 1........................... RLY 1, RLY 1
- Relay Output 2........................... RLY 2, RLY 2
- Relay Output 3........................... RLY 3, RLY 3
- Relay Output 4........................... RLY 4, RLY 4
- Relay Output 5........................... RLY 5, RLY 5
- Relay Output 6........................... RLY 6, RLY 6
- Relay Output 7........................... RLY 7, RLY 7
- Relay Output 8........................... RLY 8, RLY 8
- Relay Output 9........................... RLY 9, RLY 9
- Relay Output 10......................... RLY 10, RLY 10
- Relay Output 11......................... RLY 11, RLY 11

Field Power Output

Continuous Rating............................ 20 Adc
Forcing Rating.................................. 40 Adc for 10 s, 30 Adc for 120 s
Terminals... F+, F–

Minimum Field Resistance

63 Vdc Application .... 3.15 Ω
125 Vdc Application .... 6.25 Ω
250 Vdc Application .... 12.5 Ω

Regulation

FCR Operating Mode

Setpoint Range .... 0 to 18 Adc, in increments of 0.1%
Regulation Accuracy .... ±1.0% of the nominal value for 10% of the power input voltage change or 20% of the field resistance change. Otherwise, ±5.0%

FVR Operating Mode

Setpoint Range .... 0 to 270 Vdc, in increments of 0.1%

Regulation Accuracy .... ±1.0% of the nominal value for 10% of the power input voltage change or 20% of the field resistance change. Otherwise, ±5.0%

AVR Operating Mode

Setpoint Range .... 70 to 120% of rated generator voltage, in increments of 0.1%
Regulation Accuracy .... ±0.25% over load range at rated PF with constant generator frequency and ambient temperature
Steady-State Stability...................... ±0.25% at rated PF with constant generator frequency and ambient temperature
Temperature Drift .... ±0.5% between 0 and 40°C at constant load and generator frequency

Var Operating Mode

Setpoint Range .... –100% (leading) to +100% (lagging) of the generator nominal apparent power in increments of 0.1%
Regulation Accuracy .... ±2.0% of the nominal generator apparent power rating at the rated generator frequency

Power Factor Operating Mode

Setpoint Range .... 0.5 to 1.0 (lagging) and –0.5 to -1.0 (leading), in increments of 0.005
Regulation Accuracy .... ±0.02 PF of the PF setpoint for the real power between 10 and 100% at the rated frequency

Parallel Compensation

Modes... Reactive Droop, Line Drop, and Reactive Differential (Cross-Current)
Cross-Current Input Burden .... Can exceed 1 VA if external resistors are added to the CT circuit for cross-current compensation
Cross-Current Input Terminals......... CCCT+, CCCT–

Setpoint Range

Reactive Droop .... 0 to +30% of Rated Voltage
Line Drop... 0 to 30% of Rated Voltage
Cross-Current.................................. –30 to +30% of Primary CT Current

Generator Protection Functions

Overvoltage (59) and Undervoltage (27)

Pickup

Range... 1 to 600,000 Vac
Increment .... 1 Vac

Time Delay

Range... 0.1 to 60 s
Increment .... 0.1 s

Loss of Sensing

Time Delay

Range... 0 to 30 s
Increment .... 0.1 s

Voltage Balanced Level

Range... 0 to 100% of Positive Sequence Voltage
Increment 0.1%

Voltage Unbalanced Level

Range... 0 to 100% of Positive Sequence Voltage
Increment 0.1%

Overfrequency (81O) and Underfrequency (81U)

Pickup

Range... 30 to 70 Hz
Increment .... 0.01 Hz

Time Delay

Time Delay Range .... 0 to 300 s
Increment .... 0.1 s

Voltage Inhibit (81U only)

Range... 50 to 100% of Rated Voltage
Increment 1%

Reverse Power (32R)

Pickup

Range... 0 to 150% of Rated Watts
Increment 1%

Time Delay

Range... 0 to 300 s
Increment .... 0.1 s

Loss of Excitation (40Q)

Pickup

Range... 0 to 150% of Rated kvars
Increment 1%

Time Delay

Range... 0 to 300 s
Increment .... 0.1 s

Field Protection Functions

Field Overvoltage

Pickup
Range.. 1 to 325 Vdc
Increment .... 1 Vdc

Time Delay
Range.. 0.2 to 30 s
Increment .... 0.1 s

Field Overcurrent

Pickup
Range.. 0 to 22 Adc
Increment .... 0.1 Adc

Time Delay
Range.. 5 to 60 s
Increment .... 0.1 s

Loss of PMG

Pickup
Single-Phase Source .... <10 Vac
Three-Phase Source .... <50 Vac or a phase-to-phase imbalance >20%

Time Delay
Range.. 0 to 10 s
Increment .... 0.1 s

Exciter Diode Monitor (EDM)

Pole Ratio
Range.. 0 to 10
Increment 0.01

Pickup Level
Open and Shorted Diode .... 0 to 100% of Metered Field Current
Increment 0.1%

Delay
Open Diode Protection..................... 10 to 60 s
Shorted Diode Protection................. 5 to 30 s
Increment .... 0.1 s

Synchronism Check (25) Protection

Voltage Difference

Range.. 1 to 50%
Increment 1%

Slip Angle

Range.. 1 to 99°
Increment .... 0.1°

Slip Frequency

Range.. 0.01 to 0.5 Hz
Increment .... 0.01 Hz

Startup

Soft Start Level

Range .... 0 to 90% of Rated Gen Voltage
Increment 1%

Soft Start Time

Range .... 1 to 7,200 s
Increment .... 1 s

Field Flash Dropout Level

Range .... 0 to 100% of Rated Gen Voltage
Increment 1%

Maximum Field Flash Time

Range .... 1 to 50 s
Increment .... 1 s

Voltage Matching

Accuracy... Generator rms voltage is matched with the bus rms voltage to within ±0.5% of the generator voltage.

On-Line Overexcitation Limiting

High Current Level

Pickup

Range .... 0 to 40 Adc
Increment .... 0.1 Adc

Time

Range .... 0 to 10 s
Increment .... 1 s

Medium Current Level

Pickup

Range .... 0 to 30 Adc
Increment .... 0.1 Adc

Time

Range .... 0 to 120 s
Increment .... 1 s

Low Current Level

Pickup

Range .... 0 to 20 Adc
Increment .... 0.1 Adc

Off-Line Overexcitation Limiting

High Current Level

Pickup Range .... 0 to 40 Adc
Pickup Range Increment.................. 0.1 Adc
Time Delay Range .... 0 to 10 s
Time Delay Increment...................... 1 s

Low Current Level

Pickup Range .... 0 to 20 Adc
Pickup Increment .... 0.1 Adc

Sequence of Events Recording (SER)

Over 1,000 records are stored in nonvolatile memory (retrievable via BESTCOMS*Plus*®). The SER can be triggered by: Input/Output status changes, system operating status changes, or alarm annunciations.

Data Logging (Oscillography)

Up to 6 variables can be logged. The sampling rate is 1,200 data points per log, up to 1,199 pre-trigger, 4 ms to 10 s intervals, (4.8 s to 12,000 s total log duration).

Environment

Temperature

Operating Range................................ –40 to +60°C (–40 to +140°F)
Storage Range .... –40 to +85°C (–40 to +185°F)

Humidity

MIL-STD-705B, Method 711-1C

Salt Fog

IEC 60068-2-52, Level 2 Severity

Type Tests

Shock

Withstands 15 G in 3 perpendicular planes.

Vibration

IEC 60068-2-6, Endurance by sweeping with the following parameters:

- 3 hours per plane
- 3 to 25 Hz, 1.5mm fixed displacement
- 25 to 2,000 Hz, 5 G acceleration
- Sweep Rate: 0.45 octaves per minute

Impulse

IEC 60255-5

Transients

EN61000-4-4

Static Discharge

EN61000-4-2

Radio Interference

Type tested using a 5 W, hand-held transceiver operating at random frequencies centered around 144 MHz and 440 MHz with the antenna located within 150 mm (6 inches) of the device in both vertical and horizontal planes.

HALT (Highly Accelerated Life Testing)

HALT is used by Basler Electric to prove that our products will provide the user with many years of reliable service. HALT subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter period. HALT allows Basler Electric to evaluate all possible design elements that will add to the life of this device. As an example of some of the extreme testing conditions, the DECS-250N was subjected to temperature tests (tested over a temperature range of –100 to +120°C (–148 to +248°F)), vibration tests (of 5 to 45 G at +20°C (68°F)), and temperature/vibration tests (tested at 40 G over a temperature range of –100 to +120°C (–148 to +248°F)). Combined temperature and vibration testing at these extremes proves that the DECS-250N is expected to provide long-term operation in a rugged environment. Note that the vibration and temperature extremes listed in this paragraph are specific to HALT and do not reflect recommended operation levels.

Patent

Patent pending.

Physical

Dimensions...................................... Refer to the *Mounting* section.
Weight .... 6.75 kg (14.9 lb)

Regulatory Standards

UL Approval

This product is recognized to applicable Canadian and US safety standards and requirements by UL.

Standards used for evaluation:

- UL 6200

CSA Certification

This product was tested and has met the certification requirements for electrical, plumbing, and/or mechanical products.

Standards used for evaluation:

- CSA C22.2 No. 0
- CSA C22.2 No. 14

CE Compliance

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation.

EC Directives:

- LVD 2014/35/EU
- EMC 2004/108/EC

Harmonized standards used for evaluation:

- EN 50178 – Electronic Equipment for use in Power Installations
- EN 61000-6-4 – Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments
- EN 61000-6-2 – Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments

GOST-R Certification

GOST-R certified per the relevant standards of Gosstandart of Russia.

Analog Expansion Module

General Information

The optional AEM-2020 is a remote auxiliary device that provides additional DECS-250N analog inputs and outputs.

Features

The AEM-2020 has the following features:

- Eight Analog Inputs
- Eight RTD Inputs
- Two Thermocouple Inputs
- Four Analog Outputs
- Functionality of Inputs and Outputs assigned by BESTlogic™*Plus* programmable logic
- Communications via CAN bus

Specifications

Operating Power

Nominal ....12 or 24 Vdc
Range..8 to 32 Vdc (Withstands ride-through down to 6 Vdc for 500 ms.)
Maximum Consumption ....5.1 W

Analog Inputs

The AEM-2020 contains eight programmable analog inputs.

Rating ....4 to 20 mA or 0 to 10 Vdc (user-selectable)
Burden
  4 to 20 mA ....470 Ω maximum
  0 to 10 Vdc...........................9.65k Ω minimum

RTD Inputs

The AEM-2020 contains eight programmable RTD inputs.

Rating ....100 Ω Platinum or 10 Ω Copper (user-selectable)
Setting Range ....–50 to +250°C or –58 to +482°F
Accuracy (10 Ω Copper).............±0.044 Ω @ 25°C, ±0.005 Ω/°C drift over ambient temperature
Accuracy (100 Ω Platinum).........±0.39 Ω @ 25°C, ±0.047Ω/°C drift over ambient temperature

Thermocouple Inputs

The AEM-2020 contains two thermocouple inputs.

Rating ....2 K Type Thermocouples
Setting Range ....0 to 1,375°C or 0 to 2,507°F
Display Range............................Ambient to 1,375°C or Ambient to 2,507°F
Accuracy....................................±40uV @ 25°C, ±5 uV/°C drift over ambient temperature

Analog Outputs

The AEM-2020 contains four programmable analog outputs.

Rating ....4 to 20 mA or 0 to 10 Vdc (user-selectable)

Communication Interface

The AEM-2020 communicates with the DECS-250N through CAN1.

CAN bus

Differential Bus Voltage.............1.5 to 3 Vdc
Maximum Voltage ....–32 to +32 Vdc with respect to negative battery terminal
Communication Rate.................125 or 250 kb/s

Type Tests

Shock

Withstands 15 G in 3 perpendicular planes.

Vibration

Swept over the following ranges for 12 sweeps in each of three mutually perpendicular planes with each 15-minute sweep consisting of the following:

5 to 29 to 5 Hz............................1.5 G peak for 5 min.
29 to 52 to 29 Hz........................0.036” Double Amplitude for 2.5 min.
52 to 500 to 52 Hz......................5 G peak for 7.5 min.

HALT (Highly Accelerated Life Testing)

HALT is used by Basler Electric to prove that our products will provide the user with many years of reliable service. HALT subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter period span. HALT allows Basler Electric to evaluate all possible design elements that will add to the life of this device. As an example of some of the extreme testing conditions, the AEM-2020 was subjected to temperature tests (tested over a temperature range of –80°C to +130°C), vibration tests (of 5 to 50 G at +25°C), and temperature/vibration tests (tested at 10 to 20 G over a temperature range of –60°C to +100°C). Combined temperature and vibration testing at these extremes proves that the AEM-2020 is expected to provide long-term operation in a rugged environment. Note that the vibration and temperature extremes listed in this paragraph are specific to HALT and do not reflect recommended operation levels. These operational ratings are included in the *Specifications* section of this manual.

Environment

Temperature
Operating ....–40 to +70°C (–40 to +158°F)
Storage ....–40 to +85°C (–40 to +185°F)
Humidity ....IEC 68-2-38

UL Approval

This product is recognized to applicable Canadian and US safety standards and requirements by UL.

Standards used for evaluation:

- UL6200

CSA Certification

This product was tested and has met the certification requirements for electrical, plumbing, and/or mechanical products.

Standards used for evaluation:

- CSA C22.2 No. 0
- CSA C22.2 No. 14

CE Compliance

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation.
EC Directives:

- LVD 2014/35/EU
- EMC 2004/108/EC

Harmonized standards used for evaluation:

- EN 50178
- EN 61000-6-4
- EN 61000-6-2

Physical

Weight .... 1.80 lb (816 g)
Dimensions................................ See *Installation* later in this chapter.

Installation

Analog Expansion Modules are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a module, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office, your sales representative, or a sales representative at Basler Electric, Highland, Illinois USA.

If the device is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Mounting

Analog Expansion Modules are contained in a potted plastic case and may be mounted in any convenient position. The construction of an Analog Expansion Module is durable enough to mount directly on a genset using ¼-inch hardware. Hardware selection should be based on any expected shipping/transportation and operating conditions. The torque applied to the mounting hardware should not exceed 65 in-lb (7.34 N•m).

See Figure 165 for AEM-2020 overall dimensions. All dimensions are shown in inches with millimeters in parenthesis.

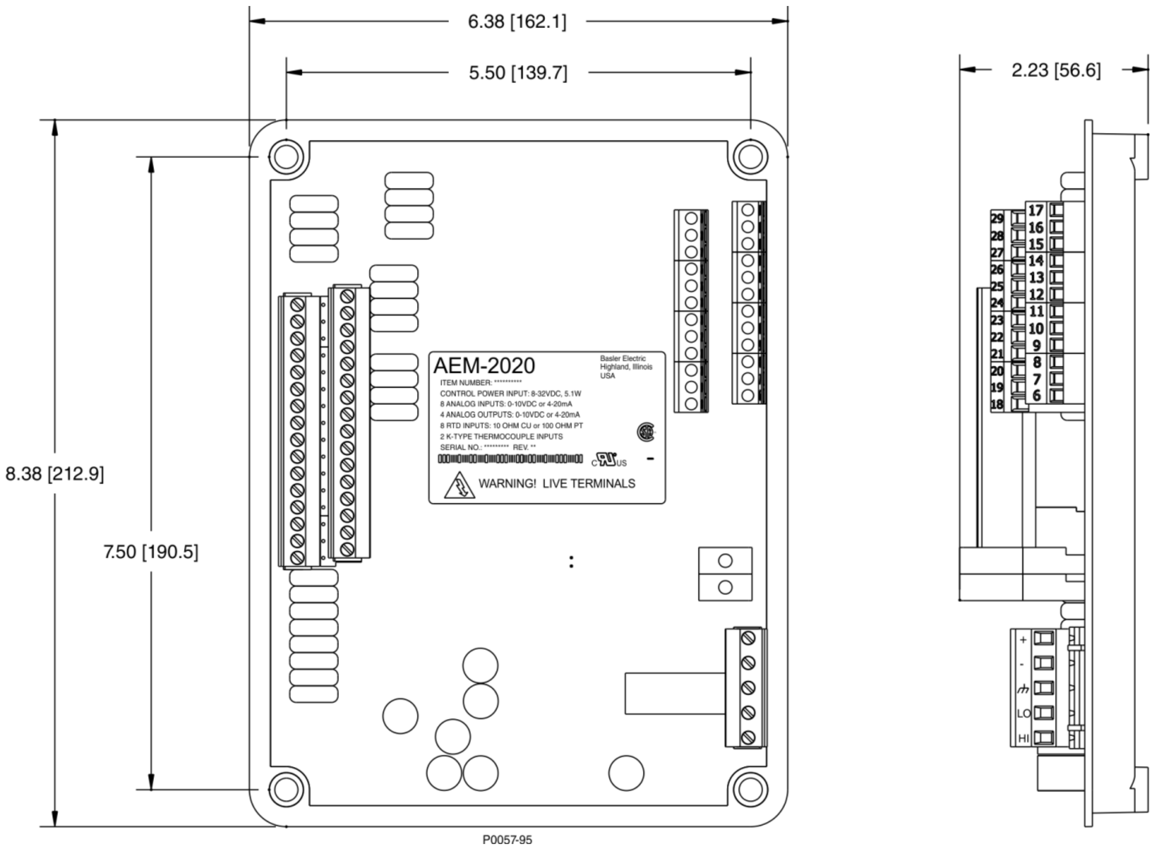


Figure 165. AEM-2020 Overall Dimensions

Connections

Analog Expansion Module connections are dependent on the application. Incorrect wiring may result in damage to the module.

NOTE
Operating power from the battery must be of the correct polarity. Although reverse polarity will not cause damage, the AEM-2020 will not operate. Be sure that the AEM-2020 is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal on the module.

Terminations

The terminal interface consists of both plug-in connectors and a permanently mounted connector with screw-down compression terminals.

AEM-2020 connections are made with one 5-position connector, two 12-position connectors, two 16-position connectors, and two 2-position thermocouple connectors. The 16, 5, and 2-position connectors plug into headers on the AEM-2020. The connectors and headers have dovetailed edges that ensure proper connector orientation. Also, the connectors and headers are uniquely keyed to ensure that the connectors mate only with the correct headers. The 12-position connector is not a plug-in connector and is mounted permanently to the board.

Connectors and headers may contain tin- or gold-plated conductors. Tin-plated conductors are housed in a black plastic casing and gold-plated conductors are housed in an orange plastic casing. Mate connectors to headers of the same color only.

Caution
By mating conductors of dissimilar metals, galvanic corrosion could occur which deteriorates connections and leads to signal loss.

Connector screw terminals accept a maximum wire size of 12 AWG. Thermocouple connectors accept a maximum thermocouple wire diameter of 0.177 inches (4.5 mm). Maximum screw torque is 5 in-lb (0.56 N•m).

Operating Power

The Analog Expansion Module operating power input accepts either 12 Vdc or 24 Vdc and tolerates voltage over the range of 6 to 32 Vdc. Operating power must be of the correct polarity. Although reverse polarity will not cause damage, the AEM-2020 will not operate. Operating power terminals are listed in Table 41.

It is recommended that a fuse be added for additional protection for the wiring to the battery input of the Analog Expansion Module. A Bussmann ABC-7 fuse or equivalent is recommended.

Table 41. Operating Power Terminals

Terminal	Description
P1- ⏚ (SHIELD)	Chassis ground connection
P1- – (BATT–)	Negative side of operating power input
P1- + (BATT+)	Positive side of operating power input

AEM-2020 Inputs and Outputs

Input and output terminals are shown in Figure 166 and listed in Table 42.

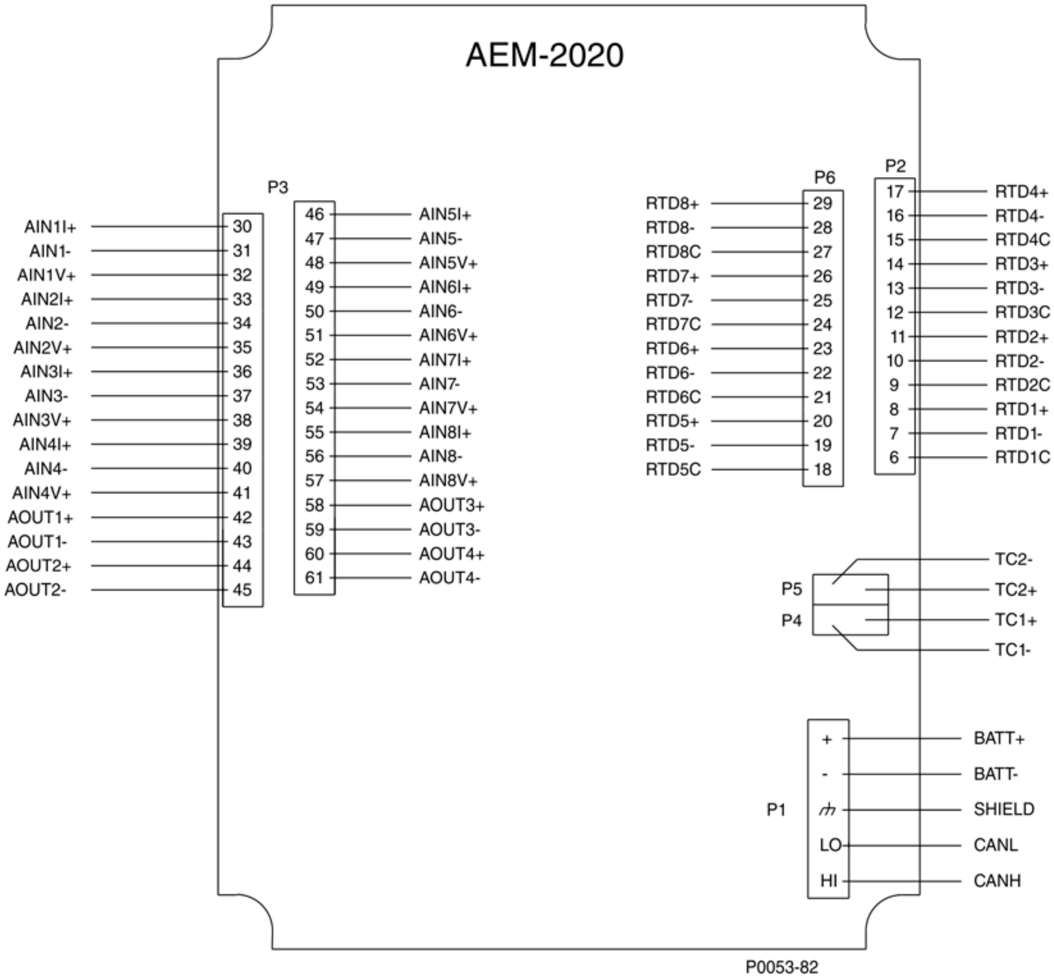


Figure 166. Input and Output Terminals

Table 42. Input and Output Terminals

Connector	Description
P1	Operating Power and CAN bus
P2	RTD Inputs 1 - 4
P3	Analog Inputs 1 - 8 and Analog Outputs 1 - 4
P4	Thermocouple 1 Input
P5	Thermocouple 2 Input
P6	RTD Inputs 5 - 8

External Analog Input Connections

Voltage input connections are shown in Figure 167 and current input connections are shown in Figure 168. When using the current input, AIN V+ and AIN I+ must be tied together.

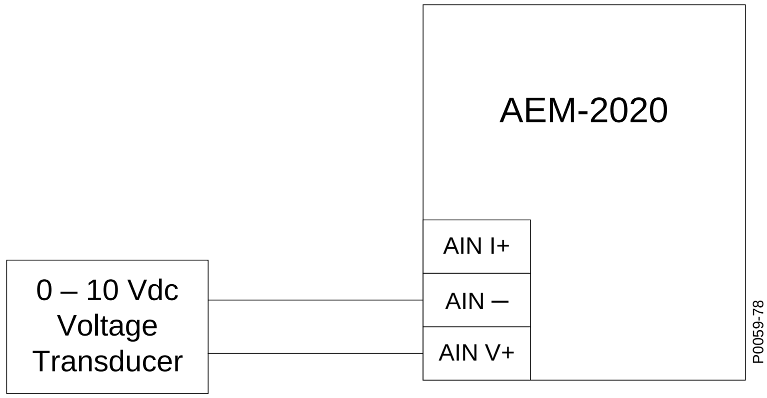


Figure 167. Analog Inputs - Voltage Input Connections

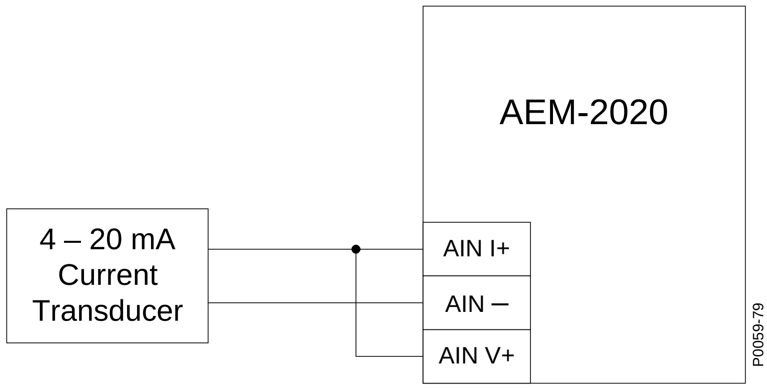


Figure 168. Analog Inputs - Current Input Connections

External RTD Input Connections

External 2-wire RTD input connections are shown in Figure 169. Figure 170 shows external 3-wire RTD input connections.

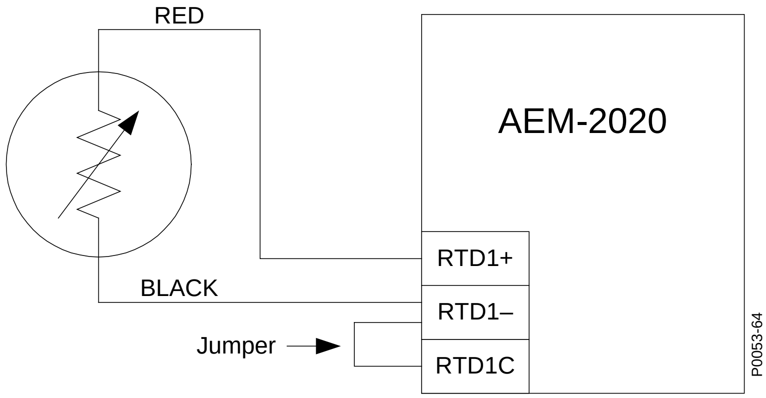


Figure 169. External Two-Wire RTD Input Connections

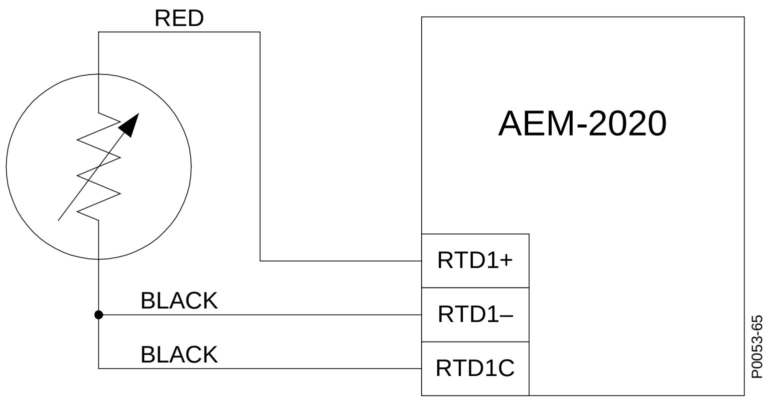


Figure 170. External Three-Wire RTD Input Connections

CAN bus Interface

These terminals provide communication using the SAE J1939 protocol and provide high-speed communication between the Analog Expansion Module and the DECS-250N. Connections between the AEM-2020 and DECS-250N should be made with twisted-pair, shielded cable. CAN bus interface terminals are listed in Table 43. Refer to Figure 171 and Figure 172.

Table 43. CAN bus Interface Terminals

Terminal	Description
P1- HI (CAN H)	CAN high connection (yellow wire)
P1- LO (CAN L)	CAN low connection (green wire)
P1- ⏚ (SHIELD)	CAN drain connection

NOTE

1. If the AEM-2020 is providing one end of the J1939 bus, a 120 Ω, ½ watt terminating resistor should be installed across terminals P1- LO (CANL) and P1- HI (CANH).
2. If the AEM-2020 is not part of the J1939 bus, the stub connecting the AEM-2020 to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the AEM-2020.

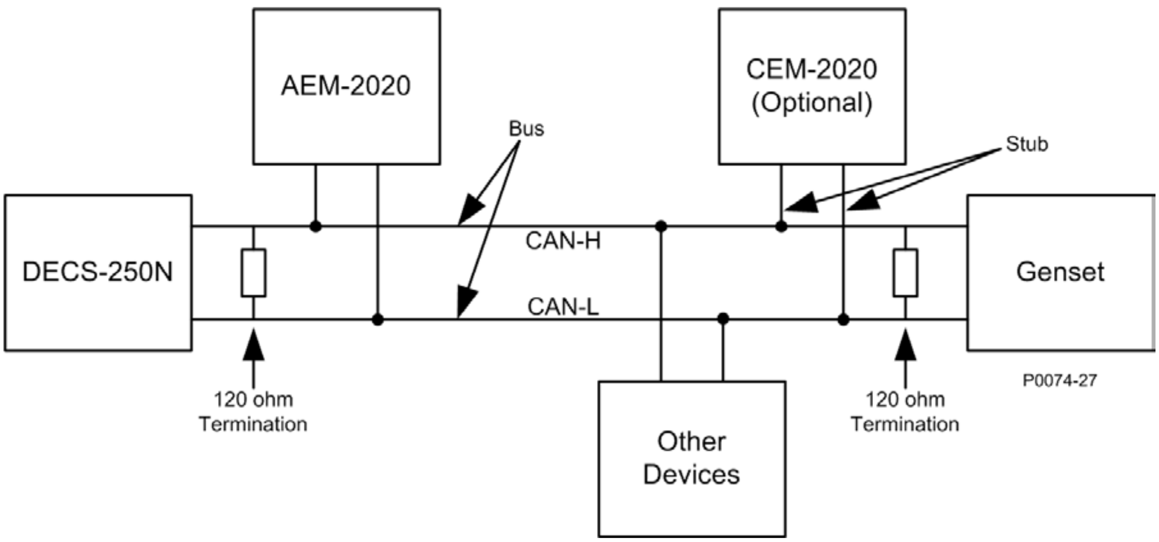


Figure 171. CAN bus Interface with AEM-2020 providing One End of the Bus

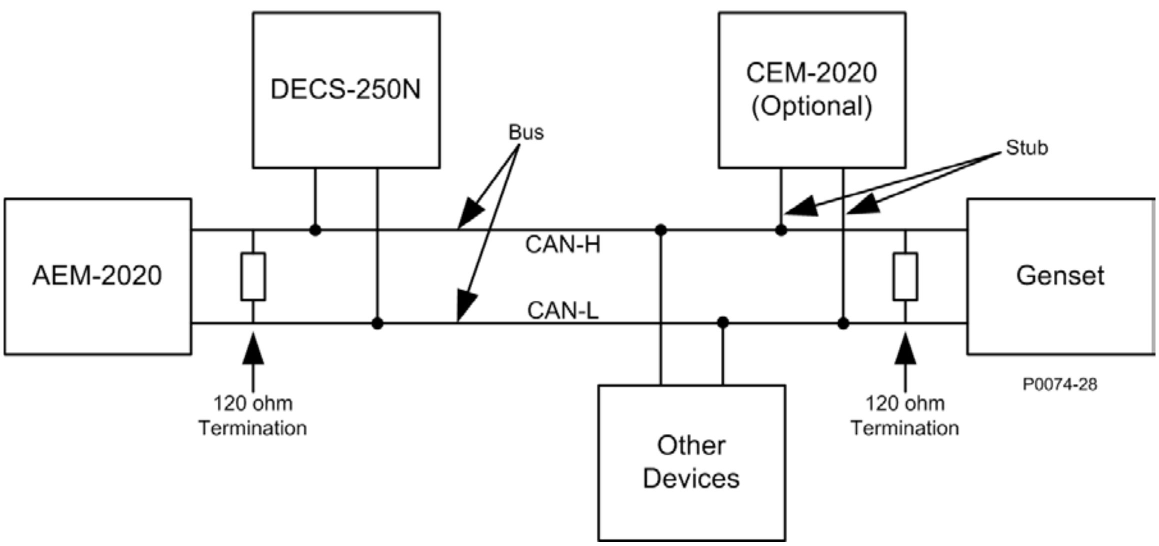


Figure 172. CAN bus Interface with DECS-250N providing One End of the Bus

Communications

BESTCOMS*Plus*® Navigation Path: Settings, Communications, CAN bus, Remote Module Setup
HMI Navigation Path: Settings, Communication, CAN bus, Remote Module Setup, Analog Expansion Module

The analog expansion module must be enabled with the correct J1939 address. A Control Area Network (CAN) is a standard interface that enables communication between the AEM-2020 and the DECS-250N. The Remote Module Setup screen is illustrated in Figure 173.

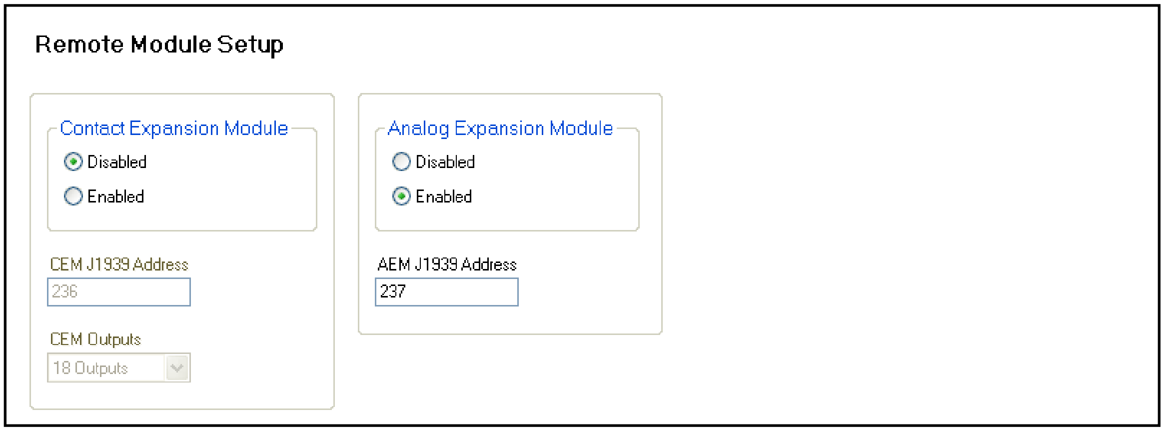


Figure 173. Remote Module Setup

Functional Description

Analog Inputs

BESTCOMS*Plus* Navigation Path: Settings, Programmable Inputs, Remote Analog Inputs
HMI Navigation Path: Settings, Programmable Inputs, Remote Analog Inputs

The AEM-2020 provides eight analog inputs that can annunciate a latching or non-latching alarm. The analog inputs are always monitored and their status is displayed on the appropriate metering screens. To make identifying the analog inputs easier, a user-assigned name[A] can be given to each input.

Select the input type[B]. Select the amount of hysteresis[C] needed to prevent rapid switching of the alarm. A user-adjustable arming delay[D] allows configuration of the analog input threshold monitoring in one of two ways. (1) When the arming delay is set to zero, threshold monitoring is performed all the time, whether or not excitation is enabled. (2) When the arming delay is set to a non-zero value, threshold monitoring begins when the arming delay time has expired after system startup is complete. An out-of-range alarm, configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*, alerts the user of an open or damaged analog input wire. When enabled, Stop Mode Inhibit[E] turns off analog input protection when excitation is stopped.

Ranges must be set for the selected input type. Param Min[F] correlates to Min Input Current[G] or Min Input Voltage[H] and Param Max[I] correlates to Max Input Current[J] or Max Input Voltage[K].

Each analog input can be independently configured for over or under mode[L] to annunciate an alarm when the analog input signal falls beyond the threshold[M]. Alarms are configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*. A user-adjustable activation delay[N] setting delays alarm annunciation after the threshold has been exceeded.

The remote analog inputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the *BESTlogicPlus* section.

BESTCOMS*Plus* settings for remote analog inputs are illustrated in Figure 174. Remote Analog Input #1 is shown.

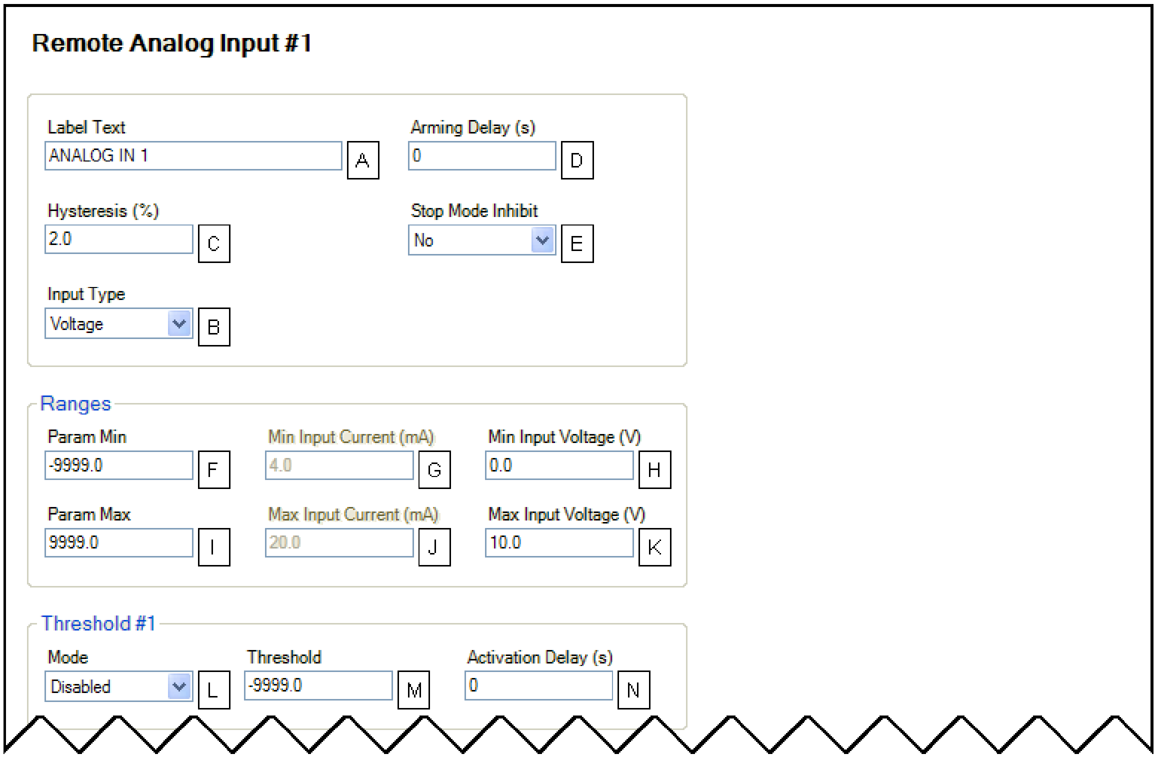


Figure 174. Remote Analog Input Settings

[A] *Label Text:* An alphanumeric character string with a maximum of 64 characters.
[B] *Input Type:* Voltage or Current.
[C] *Hysteresis:* Adjustable from 0 to 100% in 0.1% increments.
[D] *Arming Delay:* Adjustable from 0 to 300 s in 1 s increments.
[E] *Stop Mode Inhibit:* Yes or No.
[F] *Param Min:* Adjustable from –9999.0 to +9999.0 in increments of 0.1
[G] *Min Input Current:* Adjustable from 4 to 20 mA in 0.1 mA increments.
[H] *Min Input Voltage:* Adjustable from 0 to 10 V in 0.1 V increments.
[I] *Param Max:* Adjustable from –9999.0 to +9999.0 in increments of 0.1.
[J] *Max Input Current:* Adjustable from 4 to 20 mA in 0.1 mA increments.
[K] *Max Input Voltage:* Adjustable from 0 to 10 V in 0.1 V increments.
[L] *Mode:* Disabled, Over, or Under.
[M] *Threshold:* Adjustable from –9999.0 to +9999.0 in increments of 0.1.
[N] *Activation Delay:* Adjustable from 0 to 300 s in 1 s increments.

RTD Inputs

BESTCOMS*Plus*® Navigation Path: Settings, Programmable Inputs, Remote RTD Inputs
HMI Navigation Path: Settings, Programmable Inputs, Remote RTD Inputs

The AEM-2020 provides eight user-configurable RTD inputs that can annunciate a latching or non-latching alarm. The RTD inputs are always monitored and their status is displayed on the appropriate metering screens. To make identifying the RTD inputs easier, a user-assigned name[A] can be given to each input.

Select the amount of hysteresis[B] needed to prevent rapid switching of the alarm. Select the RTD type[C]. A user-adjustable arming delay[D] allows configuration of the RTD input threshold monitoring in one of two ways. (1) When the arming delay is set to zero, threshold monitoring is performed all the time, whether or not excitation is enabled. (2) When the arming delay is set to a non-zero value, threshold monitoring begins when the arming delay time has expired after system startup is complete. An out-of-range alarm, configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*, alerts the user of an open or damaged RTD input wire. When enabled, Stop Mode Inhibit[E] turns off RTD input protection when excitation is stopped.

Each RTD input can be independently configured for over or under mode[F] to annunciate an alarm when the RTD input signal falls beyond the threshold[G]. Alarms are configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*. A user-adjustable activation delay[H] setting delays alarm annunciation after the threshold has been exceeded.

The remote RTD inputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the *BESTlogicPlus* section.

BESTCOMS*Plus*® settings for remote RTD inputs are illustrated in Figure 175. Remote RTD Input #1 is shown.

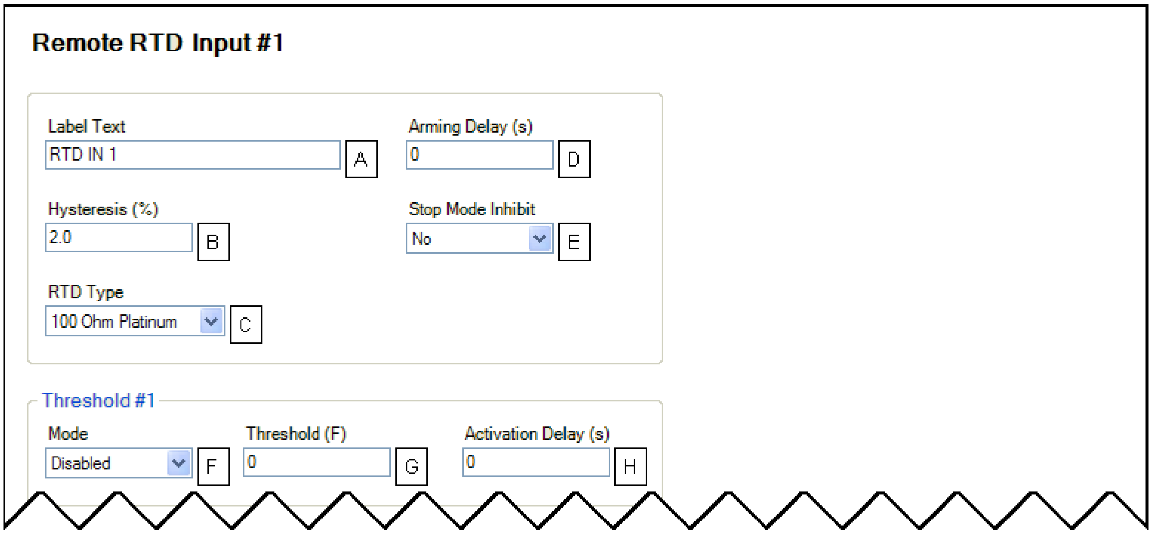


Figure 175. Remote RTD Input Settings

[A] *Label Text:* An alphanumeric character string with a maximum of 64 characters.
[B] *Hysteresis:* Adjustable from 0 to 100% in 0.1% increments.
[C] *RTD Type:* 100 Ohm Platinum or 10 Ohm Copper.
[D] *Arming Delay:* Adjustable from 0 to 300 s in 1 s increments.
[E] *Stop Mode Inhibit:* Yes or No.
[F] *Mode:* Disabled, Over, or Under.
[G] *Threshold:* –58 to +482°F in 1°F increments.
[H] *Activation Delay:* Adjustable from 0 to 300 s in 1 s increments.

Thermocouple Inputs

BESTCOMS*Plus* Navigation Path: Settings, Programmable Inputs, Remote Thermocouple Inputs
HMI Navigation Path: Settings, Programmable Inputs, Remote Thermocouple Inputs

The AEM-2020 provides two thermocouple inputs. The thermocouple inputs are always monitored and their status is displayed on the appropriate metering screens. To make identifying the thermocouple inputs easier, a user-assigned name[A] can be given to each input.

Select the amount of hysteresis[B] needed to prevent rapid switching of the alarm. A user-adjustable arming delay[C] allows configuration of the thermocouple input threshold monitoring in one of two ways. (1) When the arming delay is set to zero, threshold monitoring is performed all the time, whether or not excitation is enabled. (2) When the arming delay is set to a non-zero value, threshold monitoring begins when the arming delay time has expired after system startup is complete. An out-of-range alarm, configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*, alerts the user of an open or damaged thermocouple input wire. When enabled, Stop Mode Inhibit[D] turns off thermocouple input protection when excitation is stopped.

Each thermocouple input can be independently configured for over or under mode[E] to annunciate an alarm when the thermocouple input signal falls beyond the threshold[F]. Alarms are configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*. A user-adjustable activation delay[G] setting delays alarm annunciation after the threshold has been exceeded.

The remote thermocouple inputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the *BESTlogicPlus* section.

BESTCOMS*Plus*® settings for remote thermocouple inputs are illustrated in Figure 176. Remote Thermocouple Input #1 is shown.

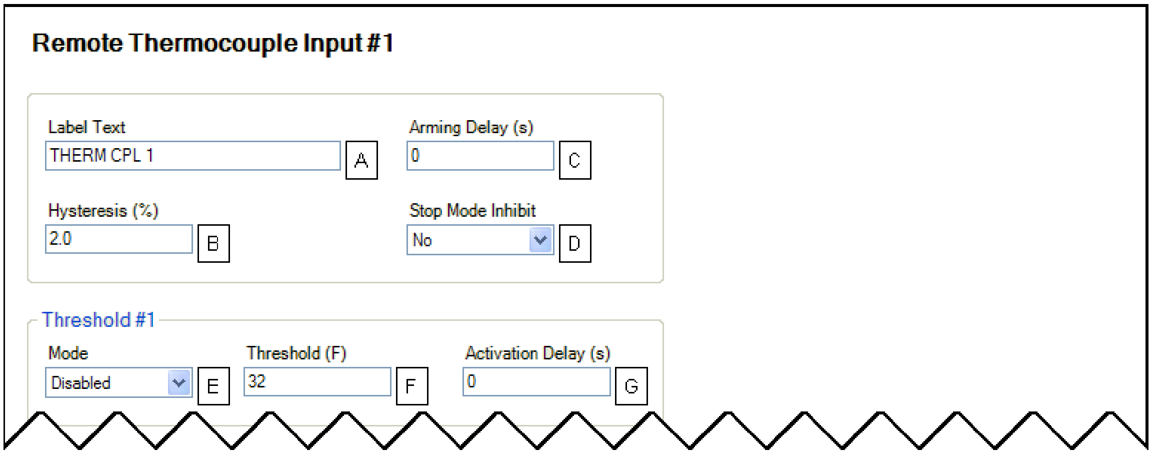


Figure 176. Remote Thermocouple Input Settings

[A] *Label Text:* An alphanumeric character string with a maximum of 64 characters.
[B] *Hysteresis:* Adjustable from 0 to 100% in 0.1% increments.
[C] *Arming Delay:* Adjustable from 0 to 300 s in 1 s increments.
[D] *Stop Mode Inhibit:* Yes or No.
[E] *Mode:* Disabled, Over, or Under.
[F] *Threshold:* Adjustable from 32 to 2,507°F in 1°F increments.
[G] *Activation Delay:* Adjustable from 0 to 300 s in 1 s increments.

Analog Outputs

BESTCOMS*Plus* Navigation Path: Settings, Programmable Outputs, Remote Analog Outputs
HMI Navigation Path: Settings, Programmable Outputs, Remote Analog Outputs

The AEM-2020 provides four analog outputs.

Make a parameter selection[A] and select the output type[B]. An out-of-range alarm configured on the *Alarm Configuration, Alarms* screen in BESTCOMS*Plus*, alerts the user of an open or damaged analog output wire. An out-of-range activation delay[C] setting delays alarm annunciation.

Ranges must be set for the selected output type. Param Min[D] correlates to Min Output Current[E] or Min Output Voltage[F] and Param Max[G] correlates to Max Output Current[H] or Max Output Voltage[I].

The remote analog outputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the *BESTlogicPlus* section.

BESTCOMS*Plus* settings for remote analog outputs are illustrated in Figure 177. Remote Analog Output #1 is shown.

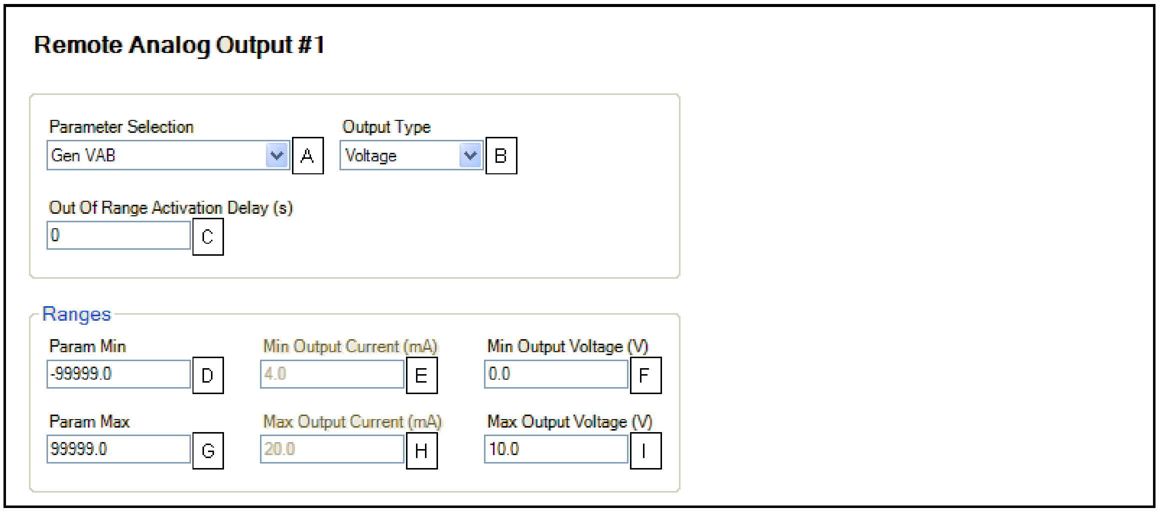


Figure 177. Remote Analog Output Settings

[A] *Parameter Selection:* Gen VAB, Gen VBC, Gen VCA, Gen V Average, Bus Freq, Bus VAB, Bus VBC, Bus VCA, Gen Freq, Gen PF, kWh, kvarh, Gen IA, Gen IB, Gen IC, Gen I Average, kW Total, kVA Total, kvar Total, EDM Ripple, Exciter Field Voltage, Exciter Field Current, Auxiliary Input Voltage, Auxiliary Input Current, Setpoint Position, Tracking Error, Negative Sequence Voltage, Negative Sequence Current, Positive Sequence Voltage, Positive Sequence Current, PSS Output, Analog Input 1-8, RTD Input 1-8, or Thermocouple 1-2.
[B] *Output Type:* Voltage or Current.
[C] *Out of Range Activation Delay:* Adjustable from 0 to 300 s in 1 s increments.
[D] *Param Min:* Adjustable from –99,999.0 to +99,999.0 in increments of 0.1.
[E] *Min Output Current:* Adjustable from 4 to 20 mA in 0.1 mA increments.
[F] *Min Output Voltage:* Adjustable from 0 to 10 V in 0.1 V increments.
[G] *Param Max:* Adjustable from –99,999.0 to +99,999.0 in increments of 0.1.
[H] *Max Output Current:* Adjustable from 4 to 20 mA in 0.1 mA increments.
[I] *Max Output Voltage:* Adjustable from 0 to 10 V in 0.1 V increments.

Metering

Analog Inputs

BESTCOMS*Plus*® Navigation Path: Metering, Status, Inputs, Remote Analog Inputs
HMI Navigation Path: Metering, Status, Inputs, Remote Analog Input Values

The value and status of the remote analog inputs are shown on this screen. The status is TRUE when the corresponding LED is green. Refer to Figure 178. Remote Analog Input #1 is shown.

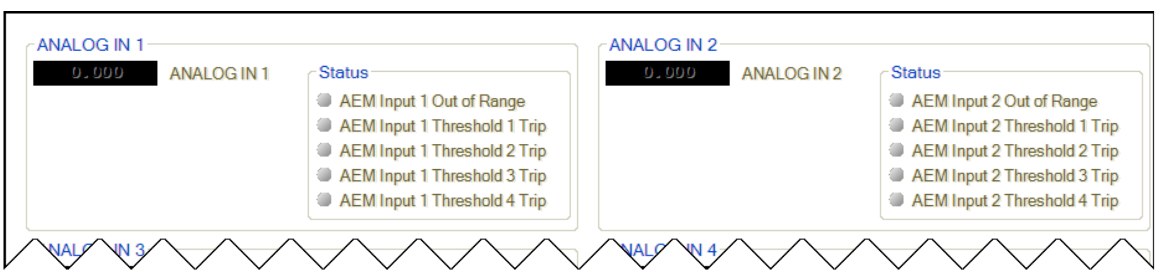


Figure 178. Remote Analog Inputs Metering

RTD Inputs

BESTCOMS*Plus* Navigation Path: Metering, Status, Inputs, Remote RTD Inputs
HMI Navigation Path: Metering, Status, Inputs, Remote Analog Input Values

The value and status of the remote RTD inputs are shown on this screen. The status is TRUE when the corresponding LED is green. Refer to Figure 179. Remote RTD Input #1 is shown.

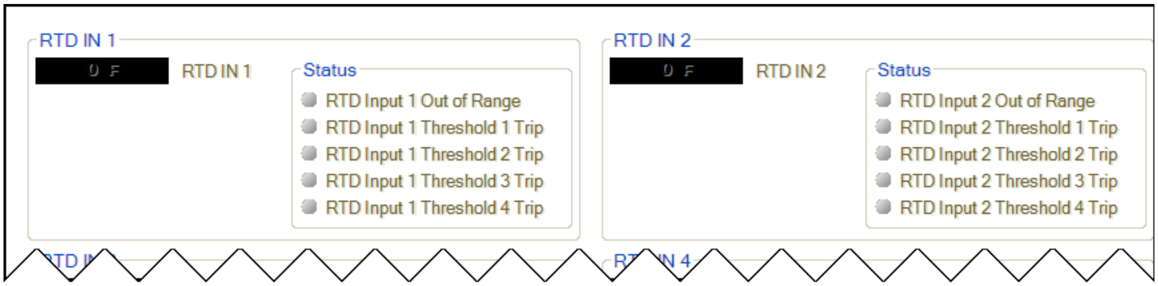


Figure 179. Remote RTD Inputs Metering

Thermocouple Inputs

BESTCOMS*Plus*® Navigation Path: Metering, Status, Inputs, Remote Thermocouple Inputs
HMI Navigation Path: Metering, Status, Inputs, Remote Analog Input Values

The value and status of the remote thermocouple inputs are shown on this screen. The status is TRUE when the corresponding LED is green. Refer to Figure 180. Remote Thermocouple Input #1 is shown.

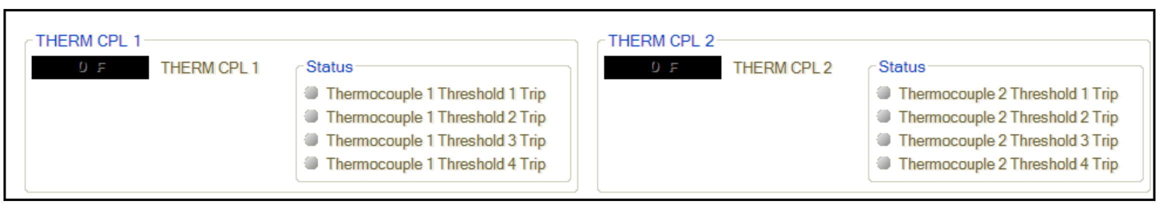


Figure 180. Remote Thermocouple Inputs Metering

Analog Input Values

BESTCOMS*Plus* Navigation Path: Metering, Status, Inputs, Remote Analog Input Values
HMI Navigation Path: Metering, Status, Inputs, Remote Analog Input Values

The values of the scaled analog inputs, raw analog inputs, RTD input temperatures, raw RTD inputs, thermocouple input temperatures, and raw thermocouple inputs are shown on this screen.

For each analog input, the raw metered input value is displayed, and the scaled metered input value. This is useful to check if the AEM-2020 is seeing a valid raw input value (i.e. the raw 0 to 10 volt voltage input or 4 to 20 mA current input). The scaled value is the raw input scaled up to the range specified by the Parameter Minimum and Parameter Maximum value parameters in the Remote Analog Input settings. Refer to Figure 181.

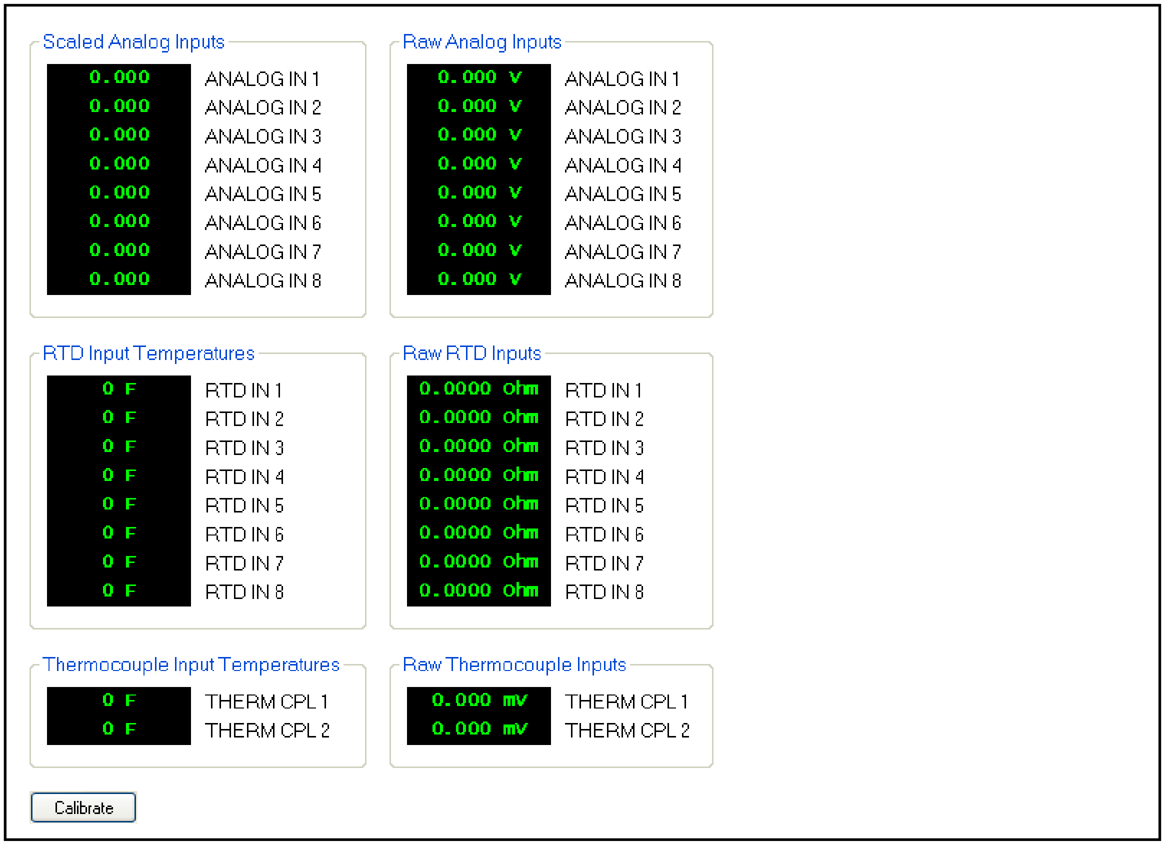


Figure 181. Remote Analog Input Values Metering

When connected to a DECS-250N, the *Calibrate* button shown on the Remote Analog Input Values screen opens the Analog Input Temperature Calibration screen shown in Figure 182. This screen is used to calibrate RTD inputs 1 through 8 and thermocouple inputs 1 and 2.

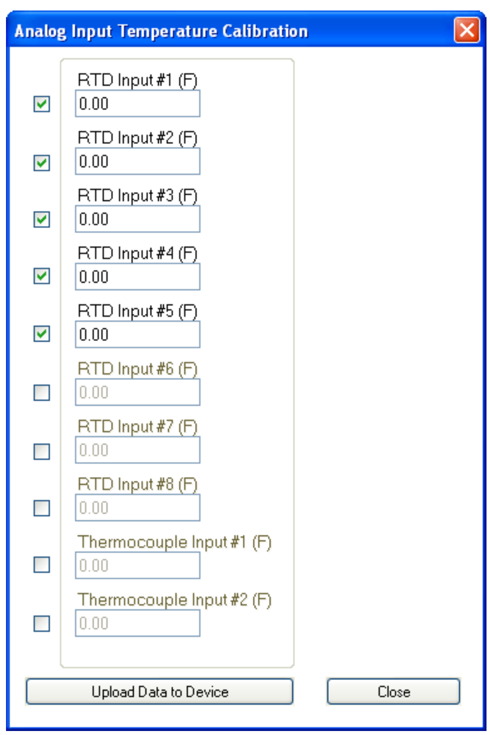


Figure 182. Remote Analog Input Temperature Calibration

Analog Outputs

BESTCOMS*Plus*® Navigation Path: Metering, Status, Outputs, Remote Analog Outputs
HMI Navigation Path: Metering, Status, Outputs, Remote Analog Outputs

The status of the remote analog outputs, scaled analog output values, and raw analog output values are shown on this screen. Parameter selections are made on the Remote Analog Outputs screen under settings in BESTCOMS*Plus*. The status is TRUE when the corresponding LED is green. Refer to Figure 183.

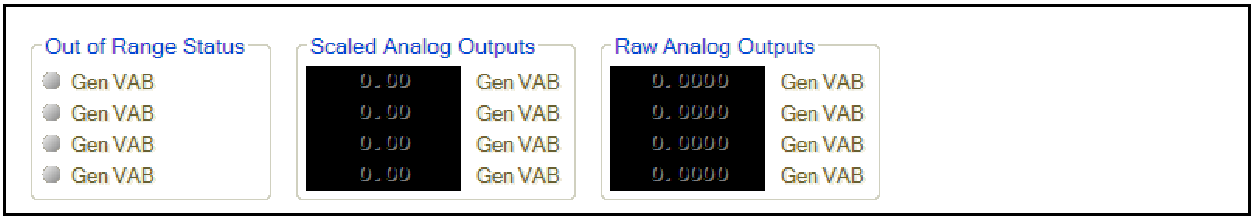


Figure 183. Remote Analog Outputs Metering

Maintenance

Preventive maintenance consists of periodically checking that the connections between the AEM-2020 and the system are clean and tight. Analog Expansion Modules are manufactured using state-of-the-art surface-mount technology. As such, Basler Electric recommends that no repair procedures be attempted by anyone other than Basler Electric personnel.

Firmware Updates

Refer to the BESTCOMS*Plus*® chapter for instructions on updating firmware in the AEM-2020.

Contact Expansion Module

General Information

The optional CEM-2020 is a remote auxiliary device that provides additional DECS-250N contact inputs and outputs. Two types of modules are available. A standard module (CEM-2020) provides 24 contact outputs and a high current module (CEM-2020H) provides 18 contact outputs.

Features

CEM-2020s have the following features:

- 10 Contact Inputs
- 18 Contact Outputs (CEM-2020H) or 24 Contact Outputs (CEM-2020)
- Functionality of Inputs and Outputs assigned by BESTlogic™*Plus* programmable logic
- Communications via CAN bus

Specifications

Operating Power

Nominal ....12 or 24 Vdc
Range.......................................8 to 32 Vdc (Withstands ride-through down to 6 Vdc for 500 ms.)

Maximum Consumption
CEM-2020...........................14 W
CEM-2020H........................8 W

Contact Inputs

The CEM-2020 contains 10 programmable inputs that accept normally open and normally closed, dry contacts.

Contact Outputs

Ratings
CEM-2020
Outputs 12 through 23 ..1 Adc at 30 Vdc, Form C, gold contacts
Outputs 24 through 35 ..4 Adc at 30 Vdc, Form C
CEM-2020H
Outputs 12 through 23 ..2 Adc at 30 Vdc, Form C, gold contacts
Outputs 24 through 29 ..10 Adc at 30 Vdc, Form C

Communication Interface

The CEM-2020 communicates with the DECS-250N through CAN1.

CAN bus

Differential Bus Voltage..............1.5 to 3 Vdc
Maximum Voltage ....–32 to +32 Vdc with respect to negative battery terminal
Communication Rate..................125 or 250 kb/s

Type Tests

Shock

Withstands 15 G in 3 perpendicular planes.

Vibration

Swept over the following ranges for 12 sweeps in each of three mutually perpendicular planes with each 15-minute sweep consisting of the following:

5 to 29 to 5 Hz............................1.5 G peak for 5 min.
29 to 52 to 29 Hz........................0.036" Double Amplitude for 2.5 min.
52 to 500 to 52 Hz......................5 G peak for 7.5 min.

HALT (Highly Accelerated Life Testing)

HALT is used by Basler Electric to prove that our products will provide the user with many years of reliable service. HALT subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter period span. HALT allows Basler Electric to evaluate all possible design elements that will add to the life of this device. As an example of some of the extreme testing conditions, the CEM-2020 was subjected to temperature tests (tested over a temperature range of –80°C to +130°C), vibration tests (of 5 to 50 G at +25°C), and temperature/vibration tests (tested at 10 to 20 G over a temperature range of –60°C to +100°C). Combined temperature and vibration testing at these extremes proves that the CEM-2020 is expected to provide long-term operation in a rugged environment. Note that the vibration and temperature extremes listed in this paragraph are specific to HALT and do not reflect recommended operation levels. These operational ratings are included in the *Specifications* section of this manual.

Environment

Temperature

Operating.............................–40 to +70°C (–40 to +158°F)
Storage................................–40 to +85°C (–40 to +185°F)

Humidity....................................IEC 68-2-38

UL Approval (CEM-2020 and CEM-2020H)

This product is recognized to applicable Canadian and US safety standards and requirements by UL.

Standards used for evaluation:

- UL6200

CSA Certification

This product was tested and has met the certification requirements for electrical, plumbing, and/or mechanical products.

Standards used for evaluation:

- CSA C22.2 No. 0
- CSA C22.2 No. 14

CE Compliance

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation.

EC Directives:

- LVD 2014/35/EU
- EMC 2004/108/EC

Harmonized standards used for evaluation:

- EN 50178
- EN 61000-6-4
- EN 61000-6-2

Physical

Weight

CEM-2020............................2.25 lb (1.02 kg)
CEM-2020H.........................1.90 lb (0.86 kg)

Dimensions.................................See *Installation* later in this section.

Installation

Contact Expansion Modules are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a module, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office, your sales representative, or a sales representative at Basler Electric, Highland, Illinois USA.

If the device is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Mounting

Contact Expansion Modules are contained in a potted plastic case and may be mounted in any convenient position. The construction of a Contact Expansion Module is durable enough to mount directly on a genset using ¼-inch hardware. Hardware selection should be based on any expected shipping/transportation and operating conditions. The torque applied to the mounting hardware should not exceed 65 in-lb (7.34 N•m).

See Figure 184 for CEM-2020 overall dimensions. All dimensions are shown in inches with millimeters in parenthesis.

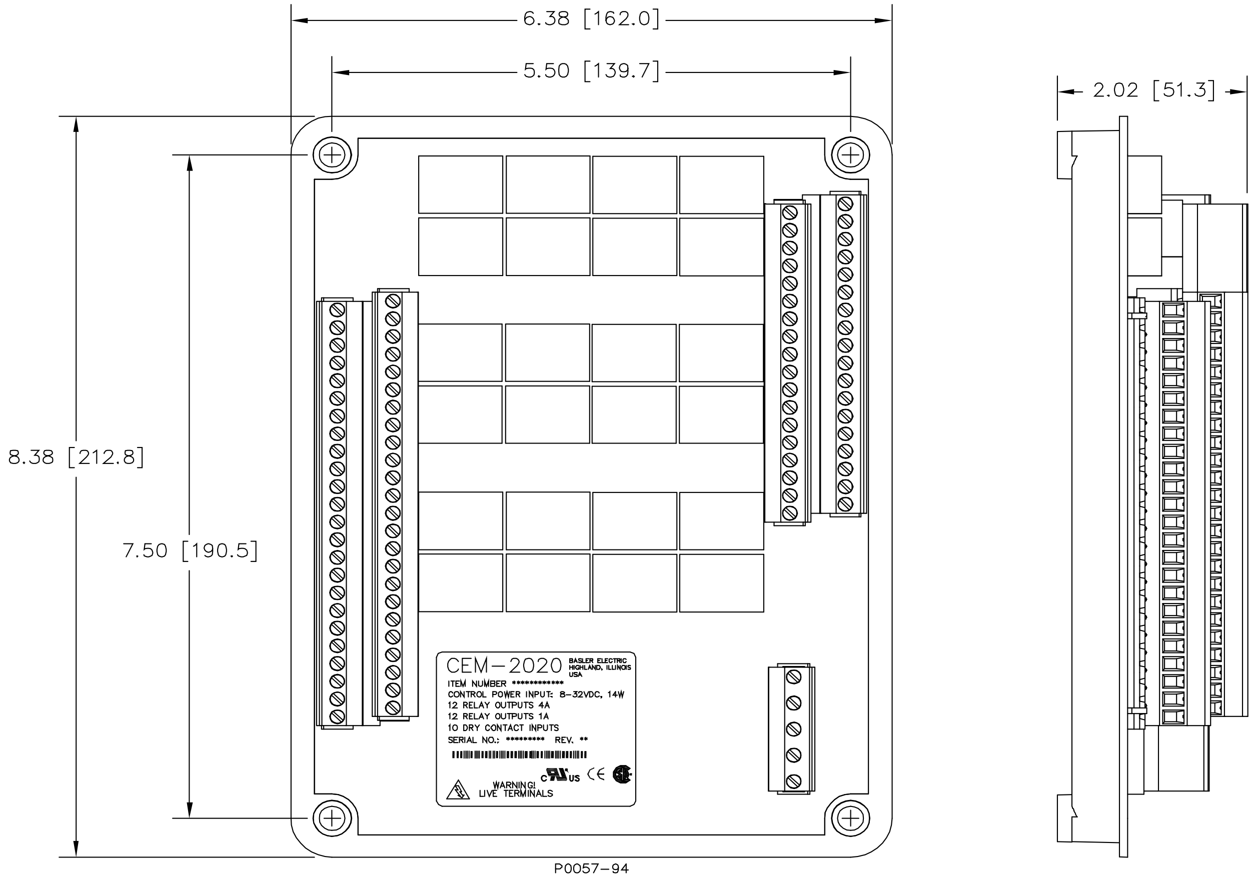


Figure 184. CEM-2020 Overall Dimensions

See Figure 185 for CEM-2020H overall dimensions. All dimensions are shown in inches with millimeters in parenthesis.

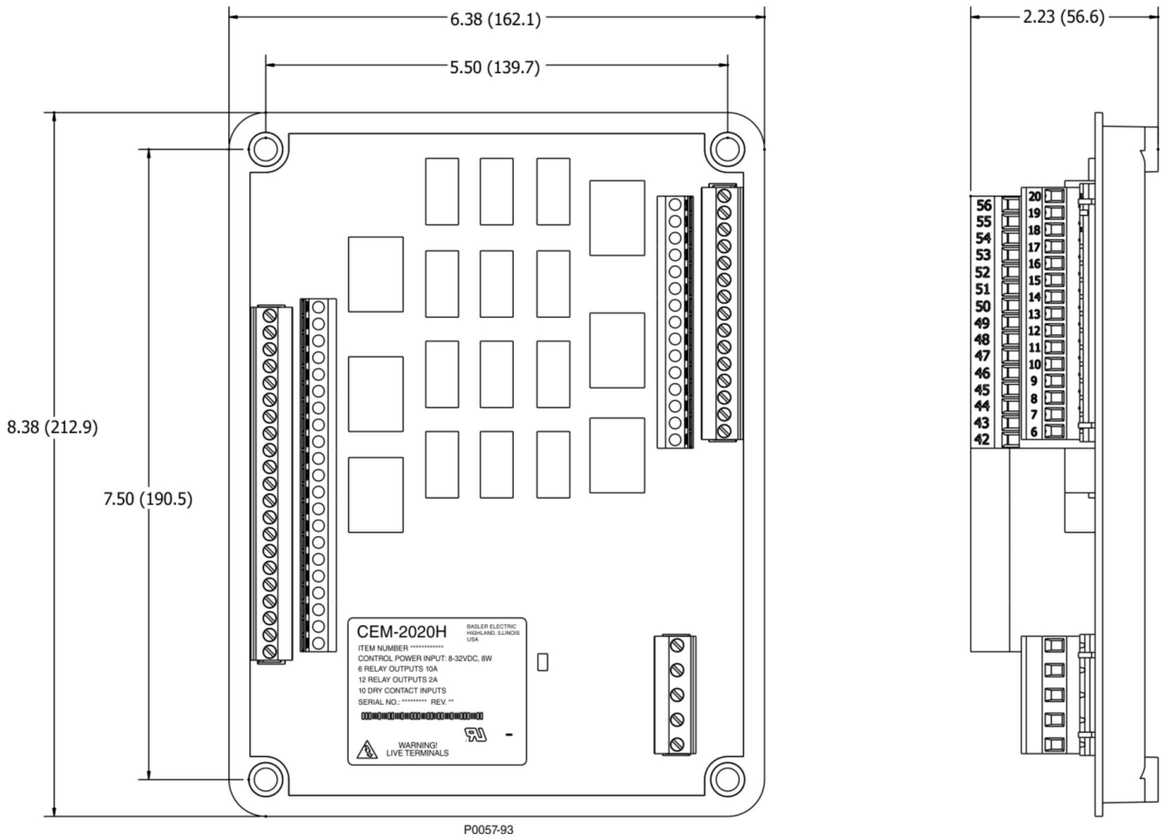


Figure 185. CEM-2020H Overall Dimensions

Connections

Contact Expansion Module connections are dependent on the application. Incorrect wiring may result in damage to the module.

> **NOTE**
>
> Operating power from the battery must be of the correct polarity. Although reverse polarity will not cause damage, the CEM-2020 will not operate.
>
> Be sure that the CEM-2020 is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal on the module.

Terminations

The terminal interface consists of plug-in connectors with screw-down compression terminals.

CEM-2020 connections are made with one 5-position connector, two 18-position connectors, and two 24-position connectors with screw-down compression terminals. These connectors plug into headers on the CEM-2020. The connectors and headers have dovetailed edges that ensure proper connector orientation. Also, the connectors and headers are uniquely keyed to ensure that the connectors mate only with the correct headers.

Connectors and headers may contain tin- or gold-plated conductors. Tin-plated conductors are housed in a black plastic casing and gold-plated conductors are housed in an orange plastic casing. Mate connectors to headers of the same color only.

Caution
By mating conductors of dissimilar metals, galvanic corrosion could occur which deteriorates connections and leads to signal loss.

Connector screw terminals accept a maximum wire size of 12 AWG. Maximum screw torque is 5 in-lb (0.56 N•m).

Operating Power

The Contact Expansion Module operating power input accepts either 12 Vdc or 24 Vdc and tolerates voltage over the range of 6 to 32 Vdc. Operating power must be of the correct polarity. Although reverse polarity will not cause damage, the CEM-2020 will not operate. Operating power terminals are listed in Table 44.

It is recommended that a fuse be added for additional protection for the wiring to the battery input of the Contact Expansion Module. A Bussmann ABC-7 fuse or equivalent is recommended.

Table 44. Operating Power Terminals

Terminal	Description
P1- ⏚ (SHIELD)	Chassis ground connection
P1- – (BATT–)	Negative side of operating power input
P1- + (BATT+)	Positive side of operating power input

Contact Inputs and Contact Outputs

The CEM-2020 (Figure 186) has 10 contact inputs and 24 contact outputs. The CEM-2020H (Figure 187) has 10 contact inputs and 18 contact outputs.

NOTE
To follow UL guidelines, a fuse must be implemented in the 2Adc contact circuits (Outputs 12 through 23) of the CEM-2020H used in hazardous locations. The suggested fuse size in Adc = (100/Contact Voltage) with a maximum fuse size of 5Adc.

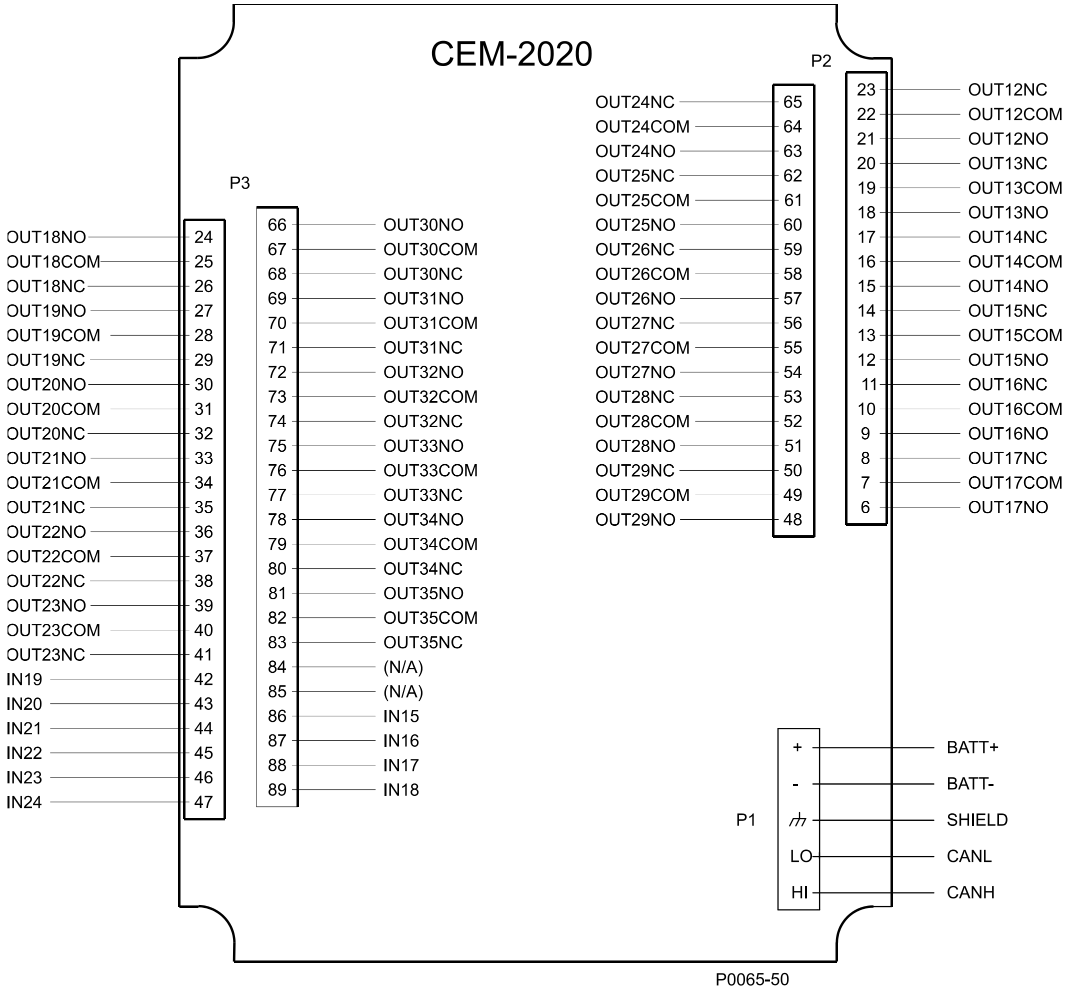


Figure 186. CEM-2020 Input Contact and Output Contact Terminals

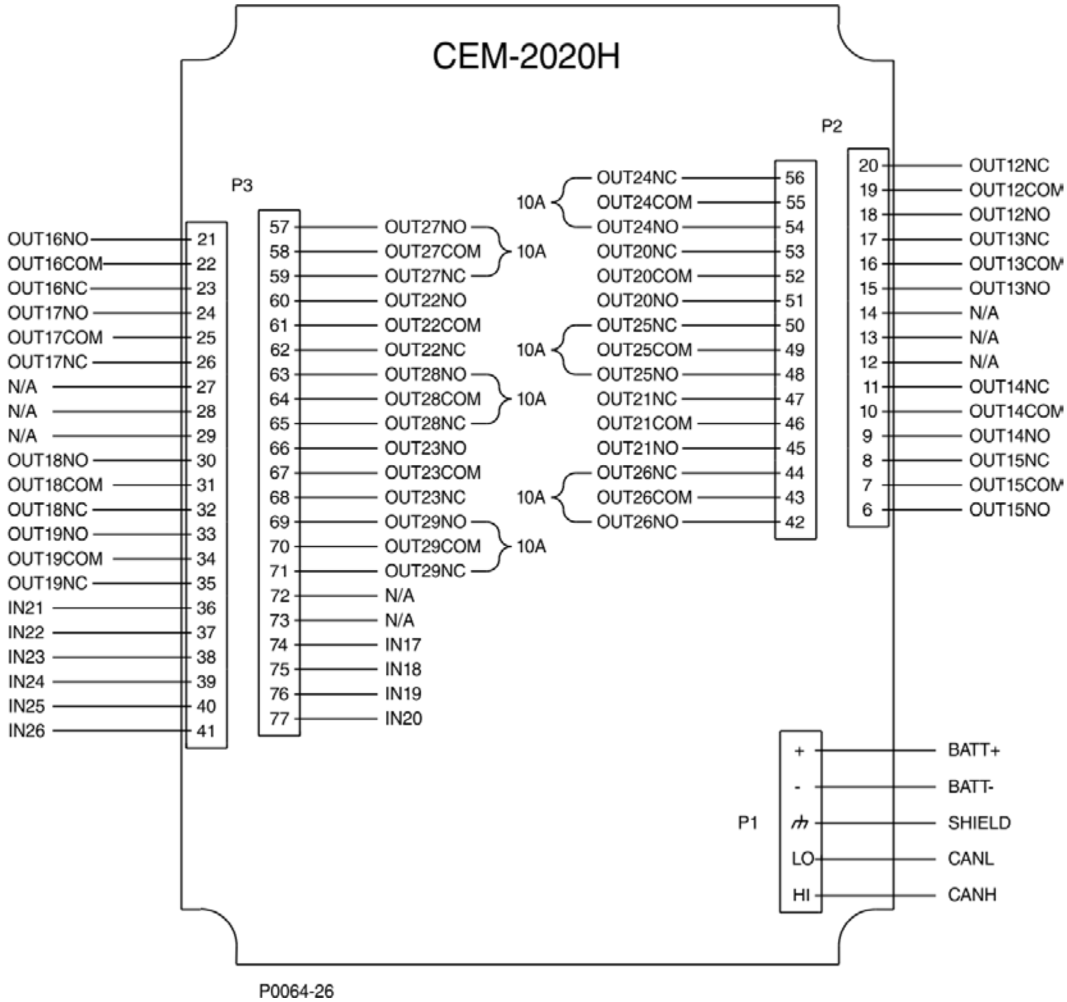


Figure 187. CEM-2020H Input Contact and Output Contact Terminals

CAN bus Interface

These terminals provide communication using the SAE J1939 protocol and provide high-speed communication between the Contact Expansion Module and the DECS-250N. Connections between the CEM-2020 and DECS-250N should be made with twisted-pair, shielded cable. CAN bus interface terminals are listed in Table 45. Refer to Figure 188 and Figure 189.

Table 45. CAN bus Interface Terminals

Terminal	Description
P1- HI (CAN H)	CAN high connection (yellow wire)
P1- LO (CAN L)	CAN low connection (green wire)
P1- ⏚ (SHIELD)	CAN drain connection

NOTE

1. If the CEM-2020 is providing one end of the J1939 bus, a 120 Ω, ½ watt terminating resistor should be installed across terminals P1- LO (CANL) and P1- HI (CANH).
2. If the CEM-2020 is not part of the J1939 bus, the stub connecting the CEM-2020 to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the CEM-2020.

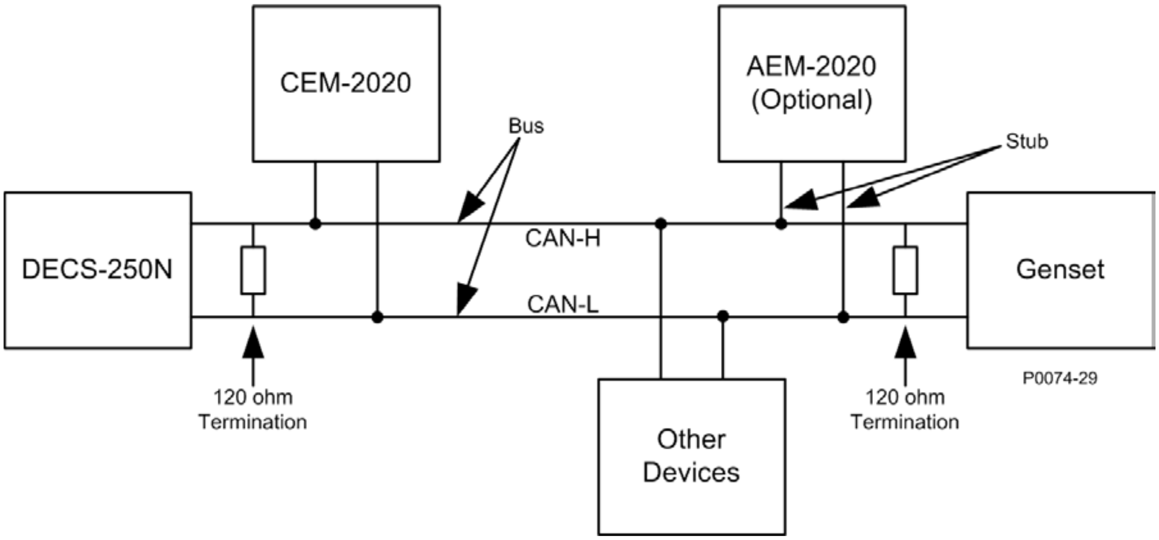


Figure 188. CAN bus Interface with CEM-2020 providing One End of the Bus

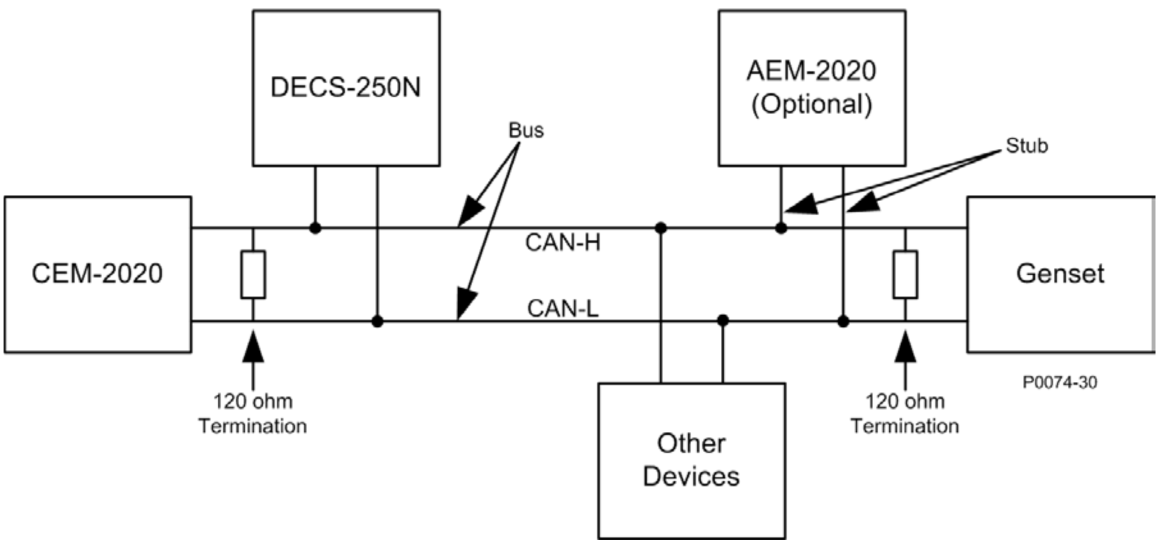


Figure 189. CAN bus Interface with DECS-250 providing One End of the Bus

Communications

BESTCOMS*Plus*® Navigation Path: Settings, Communications, CAN bus, Remote Module Setup
HMI Navigation Path: Settings, Communication, CAN bus, Remote Module Setup, Contact Expansion Module

The contact expansion module must be enabled with the correct J1939 address. A Control Area Network (CAN) is a standard interface that enables communication between the CEM-2020 and the DECS-250N. The Remote Module Setup screen is illustrated in Figure 190.

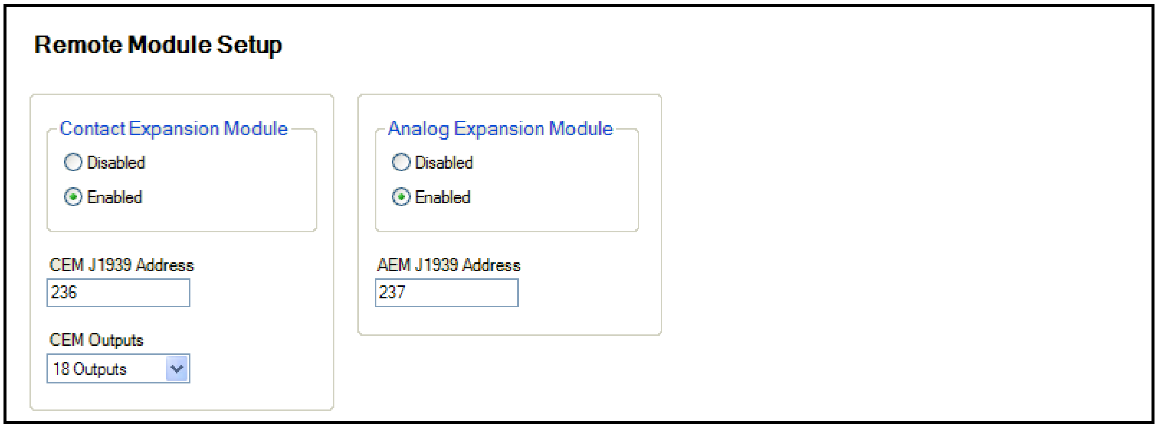


Figure 190. Remote Module Setup

Functional Description

Contact Inputs

BESTCOMS*Plus* Navigation Path: Settings, Programmable Inputs, Remote Contact Inputs
HMI Navigation Path: Settings, Programmable Inputs, Remote Contact Inputs

The CEM-2020 provides 10 programmable contact inputs with the same functionality as the contact inputs on the DECS-250N. The label text of each contact input is customizable and accepts an alphanumeric character string with a maximum of 64 characters.

The remote contact inputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the BESTlogic*Plus* section.

BESTCOMS*Plus* settings for remote contact inputs are illustrated in Figure 191.

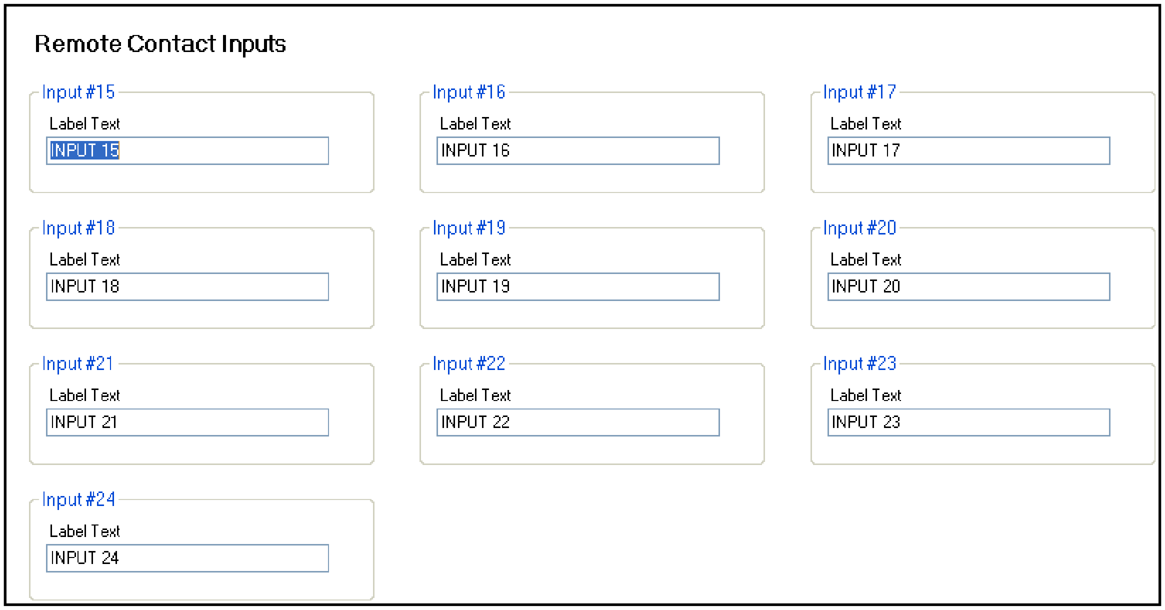


Figure 191. Remote Contact Inputs Settings

Contact Outputs

BESTCOMS*Plus*® Navigation Path: Settings, Programmable Outputs, Remote Contact Outputs
HMI Navigation Path: Settings, Programmable Outputs, Remote Contact Outputs

The CEM-2020 provides 24 programmable contact outputs with the same functionality as the contact outputs on the DECS-250N. Outputs 12 through 23 can carry 1 A. Outputs 24 through 35 can carry 4 A.

The CEM-2020H provides 18 programmable contact outputs with the same functionality as the contact outputs on the DECS-250N. Outputs 12 through 23 can carry 2 A. Outputs 24 through 29 can carry 10 A.

The label text of each contact output is customizable and accepts an alphanumeric character string with a maximum of 64 characters.

The remote analog outputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the BESTlogic*Plus* section.

BESTCOMS*Plus* settings for remote contact outputs are illustrated in Figure 192.

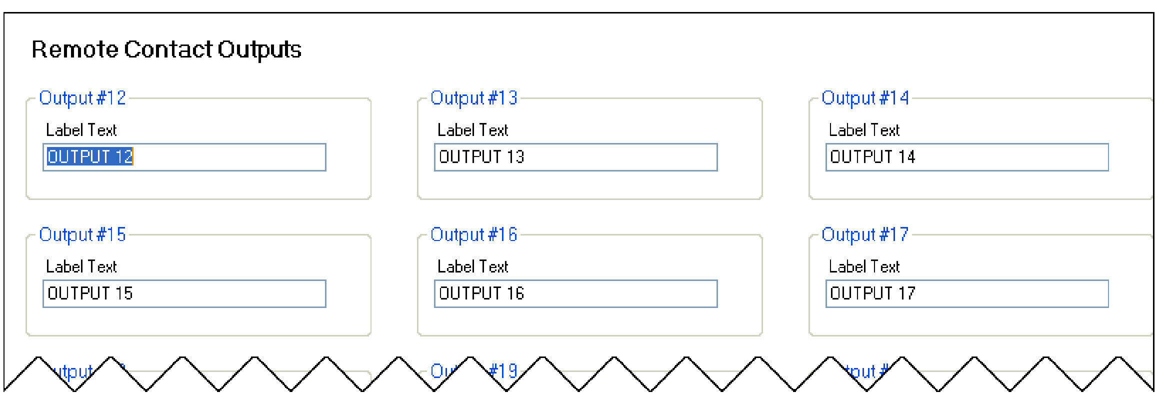


Figure 192. Remote Contact Outputs Settings

Metering

Contact Inputs

BESTCOMS*Plus* Navigation Path: Metering, Status, Inputs, Remote Contact Inputs
HMI Navigation Path: Metering, Status, Inputs, Remote Contact Input Values

The value and status of the remote contact inputs are shown on this screen. The status is TRUE when the corresponding LED is green. Refer to Figure 193.

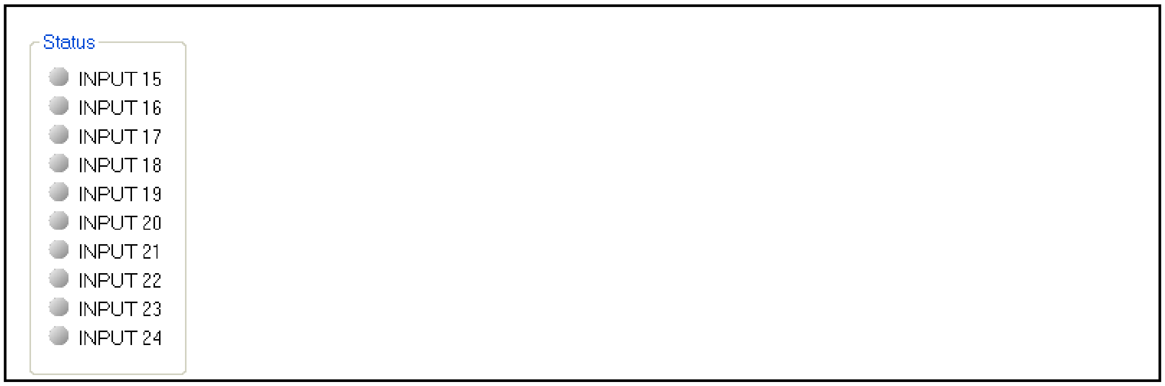


Figure 193. Remote Contact Inputs Metering

Contact Outputs

BESTCOMS*Plus*® Navigation Path: Metering, Programmable Outputs, Remote Contact Outputs
HMI Navigation Path: Metering, Status, Outputs, Remote Contact Outputs

The value and status of the remote contact outputs are shown on this screen. The status is TRUE when the corresponding LED is green. Refer to Figure 194.

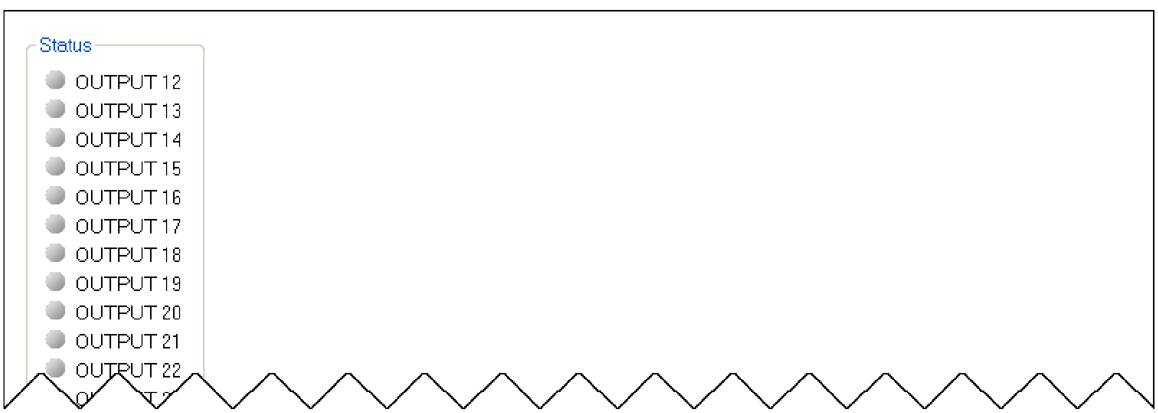


Figure 194. Remote Contact Outputs Metering

Maintenance

Preventive maintenance consists of periodically checking that the connections between the CEM-2020 and the system are clean and tight. Contact Expansion Modules are manufactured using state-of-the-art surface-mount technology. As such, Basler Electric recommends that no repair procedures be attempted by anyone other than Basler Electric personnel.

Firmware Updates

Refer to the BESTCOMS*Plus*® chapter for instructions on updating firmware in the CEM-2020.

Revision History

Table 46 provides a historical summary of the changes made to the DECS-250N hardware. Firmware changes are listed in Table 47 and software changes are listed in Table 48. The corresponding revisions made to this instruction manual are summarized in Table 49. Revisions are listed in chronological order.

Table 46. Hardware Revision History

Hardware Version and Date	Change
A, 01/14	• Initial release
B, 04/14	• Removed unused pins on ribbon cable to prevent hipot failure

Table 47. Firmware Revision History

Firmware Version and Date	Change
1.01.05, 03/14	• Initial release
1.02.00, 05/14	• Added Russian language support. • Added overexcitation (24) protection. • Added transient excitation boosting function. • Added loss of excitation (40Q) protection for motors. • Added integrating reset method to takeover OEL. • Added angle compensation to synchronizer and sync check (25). • Increased available real-time monitoring plots from two to six.

Table 48. Software Revision History

Software Version and Date	Change
3.05.03, 03/14	• Initial Release
3.06.00, 04/14	• Updated to support firmware version 1.02.00.

Table 49. Instruction Manual Revision History

Manual Revision and Date	Change
A, 01/14	• Initial release
B, 05/14	• Added Russian language support. • Added overexcitation (24) protection. • Added transient excitation boosting function. • Added loss of excitation (40Q) protection for motors. • Added integrating reset method to takeover OEL. • Added angle compensation to synchronizer and sync check (25). • Increased available real-time monitoring plots from two to six. • Minor text edits throughout manual.

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