Testing and Adjusting
Cat® Digital Voltage Regulator
Media Number -RENR7941-12 **Publication Date -2015/06/01** **Date Updated -2019/12/17**

i05769696

Parameter Viewing and Configuration (Caterpillar PC Software)

SMCS - 4467-NQ

In order to view and configure the parameters of the digital voltage regulator, a PC with the Caterpillar PC software is required.

Note: Before performing this procedure, study the list of parameters in order to determine the desired parameter and the corresponding range of values. Some parameters can only be viewed by the user and cannot be configured.

Note: Have the entire list of parameters available while performing the procedure. See System Operation, "Parameters".

The Cat PC software provides the communication link between the voltage regulator and the user. All voltage regulator settings are entered and read through this software. The software provides the option to save the voltage regulator settings in a computer file. The saved files can then be used later in order to configure other units with the same settings.

Cat PC software operates with an IBM compatible personnel computer using a Microsoft Windows 95 or later operating system. The operating requirements are listed below:

- IBM compatible PC, 486DX2, or faster (100 MHz or higher microprocessor is recommended)
- CD-ROM drive
- One available serial port

Installing the Caterpillar PC Software

Cat PC software contains a setup utility that installs the program on the PC. An uninstall utility is loaded with the program that can be used to remove the application from the PC. Use the following procedure to install the PC software.

1. Insert the CD-ROM into the CD-ROM drive of the PC.
2. Click the Windows Start button and then select "Run". In the "Open:" field, enter "D:/Setup.exe", where "D" is the designator letter for your PC CD-ROM drive. Then click "OK".

When Caterpillar PC software is installed, a folder with the name Caterpillar is added to the Windows program menu. This folder is accessed by clicking the "Start" button and pointing to "Programs".

Starting Caterpillar PC Software

The PC software is started by clicking the Windows "Start" button, pointing to "Programs", the "Caterpillar" folder, and then clicking the voltage regulator icon. At startup, a dialog box with the program title and version number is displayed briefly. After this dialog box is displayed, the "System Configuration" screen is displayed.

Establishing Communication

Communication between the voltage regulator and the PC must be established before any settings can be viewed or changed. For more information on establishing communications, see Systems Operation, RENR7941, "Remote Communication".

Changing Settings

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR.

The settings are arranged into the following six groups:

- System configuration
- Setting adjustments
- Control gain settings

- Protections settings
- Metering/operation and alarms
- Group

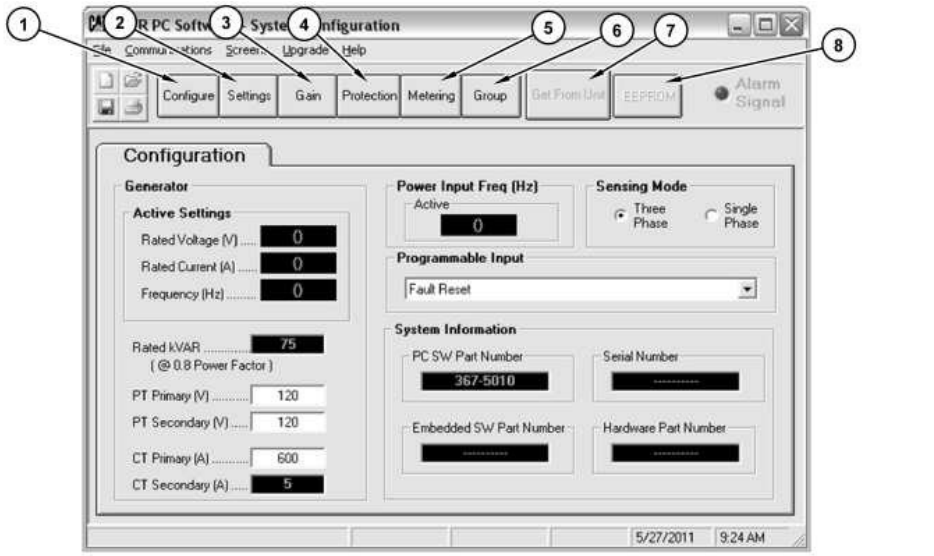

Illustration 1 g02634296

Latest version of systems configuration dialog
(1) System configuration button
(2) Setting adjustment button
(3) Control gain button
(4) Protection setting button
(5) Metering/operation button
(6) Groups
(7) Get from unit button
(8) EEPROM button

Each setting group has a corresponding button that can be selected to access that group of settings. The six setting groups can also be accessed by clicking "Screens" on the menu bar and then selecting the desired setting group from the list. Once a setting group is accessed, the individuals settings of the group can be viewed and changed.

A setting is changed by clicking within the setting field and typing the setting. The minimum, maximum and increments (steps) for a setting are displayed on the status bar when the cursor is placed within that setting field. A changed setting is sent to the voltage regulator when the "Enter" key on the PC is pressed. A setting in a field with the drop-down menu is sent to the voltage regulator when the setting is selected from the drop-down menu.

A setting can be selected from the drop-down menu. The setting can then be sent to the voltage regulator.

Sending and Receiving Settings

When communication is enabled, voltage regulator settings can be sent or received through the PC software.

Sending Settings

Settings changes are sent to the voltage regulator by two methods:

1. Type a value in the setting screen field, then press the "Enter" key.

   Note: Just typing a value in the setting screen field **WILL NOT** send that value to the CDVR. When a value is typed in the setting screen field, the "Enter" key must also be pressed.

2. Select a value from the setting screen pull down menu.

   Note: The selection from the drop-down menu will appear on the setting screen. The setting that is displayed on the setting screen will automatically be sent to the CDVR. The setting will become the voltage regulator setting. There is **NO** need to press the "Enter" key.

Receiving Settings

Voltage regulator settings are retrieved by clicking the "Get From Unit" button (6). The "Get From Unit" function allows the current settings of the voltage regulator to be displayed on the "settings" screen.

Saving Settings to the Memory of the Voltage Regulator

Settings are saved in nonvolatile memory (EEPROM). In the event of a power loss, the settings that are saved in the nonvolatile memory are the settings that will be active at startup. If the settings are changed and sent to the voltage regulator, but not saved to the EEPROM, the new settings will be lost, if the operating power to the voltage regulator is lost.

When exiting an application or closing communication, the software will prompt the user to save the settings to the EEPROM. This question is asked even if no changes were made to the settings. When communication is enabled, setting changes are saved to the EEPROM by clicking the "EEPROM" button (7). The opportunity to save the settings to the EEPROM is also given through a dialog box when the application is exited or communication is closed.

Setting Definitions

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR.

Each of the six setting groups have a corresponding screen in the PC software. The setting of each screen is categorized by one or more tabs. In the following paragraphs, setting are arranged and defined according to the organization of the PC application screens and tabs.

System Configuration

The "System Configuration" screen consists of one tab labeled "Configuration". Click the "Configure" button (1) in order to access the "System Configuration" screen or click "Screens" on the menu bar and click "System Configuration".

Configuration Tab

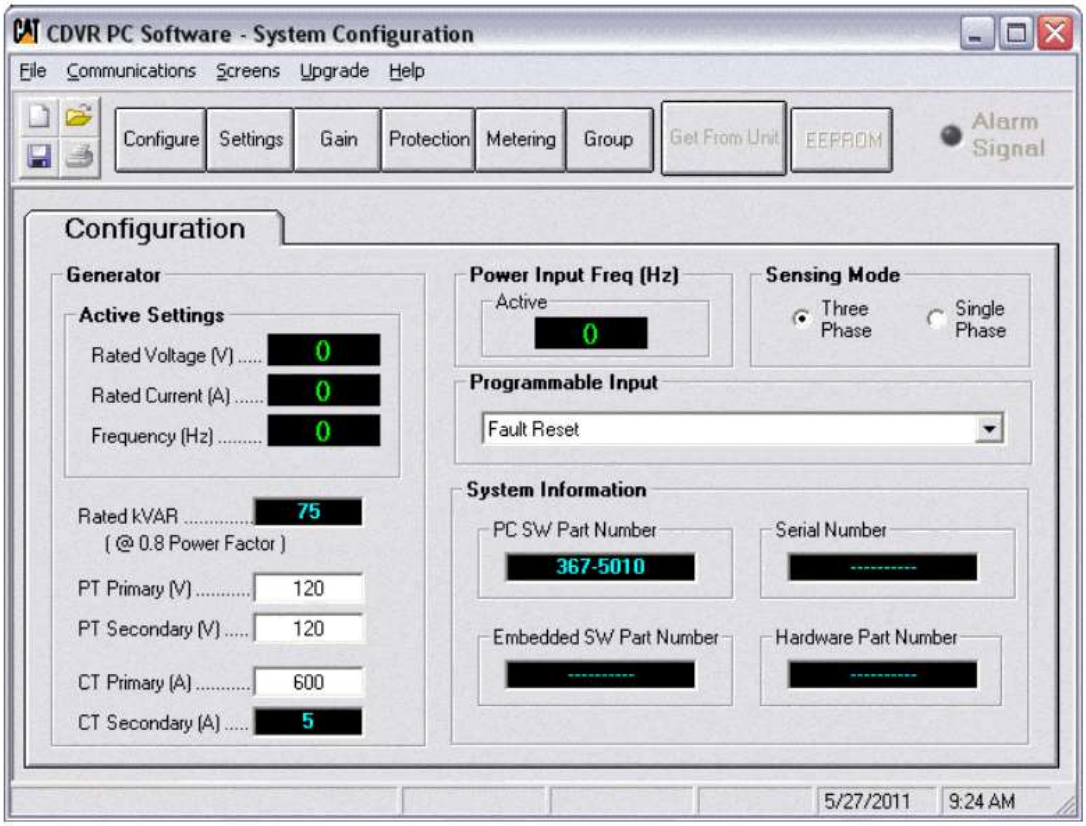

Illustration 2 g02631836
Configuration dialog

Highlighted cells with green numbers cannot be programmed with the configured dialog. The configuration dialog will display the programmed values of the group that is currently active.

If the "Setting Group Support Level" is configured for "Single Group", then the highlighted cells will display programmed values from the "Single Group" set of parameters. If the "Setting Group Support Level" is configured for "Multiple Group", then the highlighted cells will display programmed values from the active group that is being controlled by the EMCP. The active group can be #1, #2, #3, or #4. Refer to Illustration 2.

The following information applies to the latest version of the CDVR PC software. There are differences from the earlier CDVR PC software and the latest version of the CDVR PC software.

Programmable Input - CDVR input that is activated in order to configure the CDVR for a desired response.

Rated Voltage (V) - The rated AC generator voltage is entered in this field. Voltages within the range of 90 to 15000 VAC may be entered in 1 VAC increments.

Rated Current (A) - The maximum rated AC generator current is entered in this setting field. Current values that are up to 9999 amps may be entered in 1 amp increments.

Rated kVAR - The rated kVAR field is a read-only field. The rated kVAR field displays the rated, calculated reactive power. The reactive power is calculated from the values entered in the rated voltage and rated current fields.

Frequency - This setting is used to select a nominal system operating frequency of 50 Hz or 60Hz.

PT Primary (V) - The primary AC voltage rating of the potential transformer (PT) is entered in this field. Voltages within the range of 90 VAC and 15,000 VAC may be entered in 1 VAC increments.

PT Secondary (V) - The secondary AC voltage rating of the PT is entered in this field. Voltages within the range of 90 VAC and 600 VAC may be entered in 1 VAC increments. **Note:** A PT is required if the generator is rated at more than 600 VAC. If no PT is installed, set the PT primary and PT secondary to the expected sensed voltage.

CT Primary - The AC current rating of the primary winding of the CT is entered in this field. Current values that are up to 9999 A may be entered in 1 A increments.

CT Secondary - This field is a read-only field that displays the rated value of the current that is present at the secondary winding of the CT. This regulator is designed for a 5 A secondary winding only.

Power Input Frequency (Hz) - The frequency value of the operating power applied to the voltage regulator is entered in the power input frequency field. The power input frequency is the frequency of the permanent magnet generator or the frequency of the generator in the case of self-excited generator. Frequencies within the range of 50 Hz to 400 Hz may be entered in 1 Hz increments. Refer to table 1 for the correct frequency values.

Table 1

Operating Frequency	**50HZ**	**60HZ**
Self Excited Generators	50HZ	60HZ
Permanent Magnet Generators Low and Medium Voltage	200HZ	240HZ
6 Pole Generators	133HZ	160HZ
High Voltage 2600 Frame Generators	200HZ	240HZ
High Voltage 2400 and 2800 Frame Generators	150HZ	180Hz

Sensing Mode - This setting is used to configure the voltage regulator for the single-phase or three-phase voltage sensing. **Note:** For single phase sensing, ensure the "C" phase sensing input is connected to pins P12-10 and P12-11. Also, "A" phase sensing input must be connected to pin P12-12.

PC Software Part Number - Read-only field that displays the version of the PC software part number.

Embedded Software Part Number - Read-only field that displays the version of the embedded software part number.

Hardware Part Number - Read-only field that displays the version of the Hardware part number.

Serial Number - Read-only field that displays the serial number of the voltage regulator connected to the PC. Communication between the voltage regulator and the PC must be enabled in order to read the firmware version.

Setting Adjustments

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR.

The "Setting Adjustments" screen consists of two tabs labeled "Setpoint" and "Startup". Click the "Settings" button (2) in order to access the "Setting Adjustments" screen or click "Screens" on the menu bar and click "Setting Adjustments".

Setpoint Tab

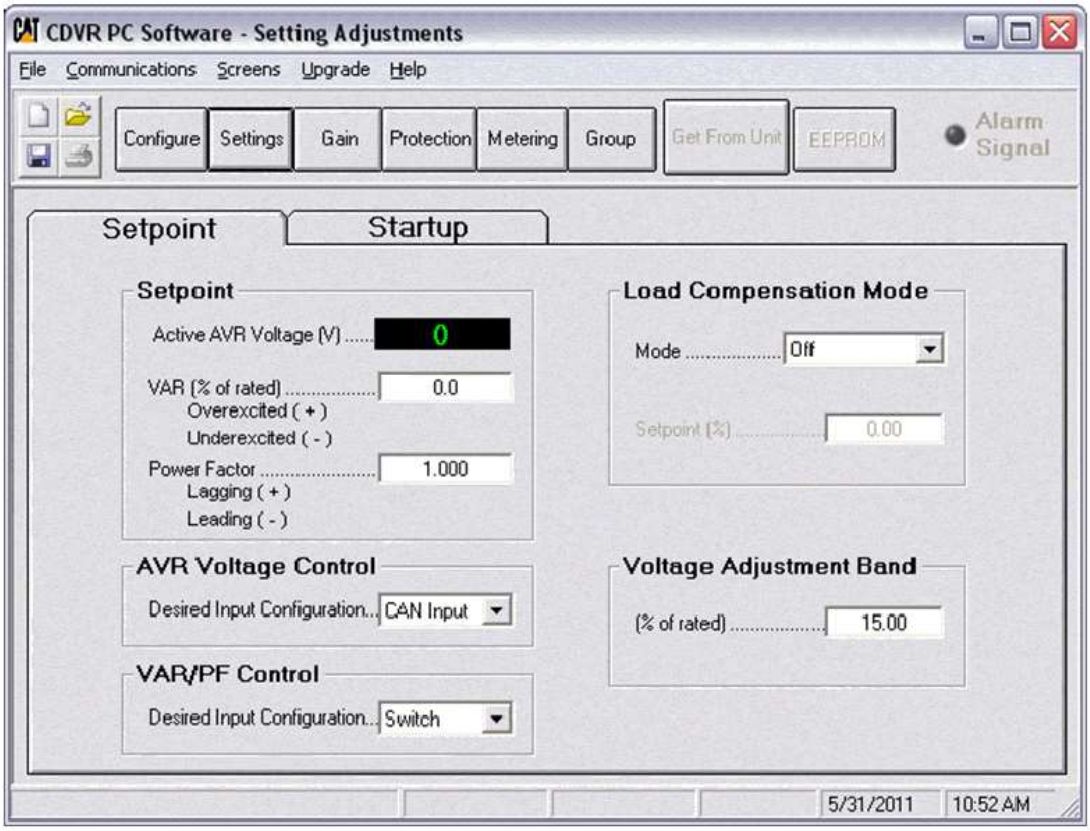

Illustration 3 g02635996

Highlighted cells with green numbers cannot be programmed with the "Setting Adjustments" dialog. The "Setting Adjustments" dialog will display the programmed values of the group that is currently active.

If the "Setting Group Support Level" is configured for "Single Group", then the highlighted cells will display programmed values from the "Single Group" set of parameters. If the "Setting Group Support Level" is configured for "Multiple Group", then the highlighted cells will display programmed values from the active group that is being controlled by the EMCP. The active group can be #1, #2, #3, or #4. Refer to Illustration 3.

AVR Voltage (V) - This setting field is used to enter the desired generator output terminal voltage. The range of voltages is dependent on the value in the "Voltage Adjustment Band (percent of rated)" field. Values may be entered in increments of 0.1 VAC.

Load Compensation Mode - Three settings, "Off", "Droop", "Line Drop" (Line Loss) may be selected from the drop-down menu for the load compensation mode. The programmable input can be configured to force a different load compensation mode from what is configured in Illustration 3 when the input becomes active.

VAR (percent of rated) - Determines the level of generator VARs that are maintained by the voltage regulator. The VAR set point is used when the digital voltage regulator is in the VAR mode. Percentage values within the range of -100 to 100 percent may be entered in increments of 0.1 percent. A setting in the overexcited direction will have a positive value. If the setting is made in the direction that will cause under excitement, the value will have a negative value.

Power Factor - Determines the level of generator power factor that is maintained by the voltage regulator when the voltage regulator is in the power factor mode. Settings within the range of 0.600 lagging to 0.600 leading may be entered in increments of 0.001. A setting in the lagging direction will have a positive value and a setting in the leading direction will have a negative value. **Before setting a leading power factor, consult the reactive capability curve for the generator being used.**

AVR Voltage Control: Desired Input Configuration - "CAN Input" and "Switch" are the two settings that can be selected from the drop-down menu for this configuration. Selecting "CAN Input" configures the voltage regulator to accept changes to the AVR voltage set point **only** from the "CANbus". If an attempt is made to change the AVR set point with this configuration, from the "Settings" screen, with the use of the "Raise" or "Lower" buttons while at the "Metering" screen and with the "Raise" or "Lower" contacts, then the adjustment will have no effect. Selecting "Switch" configures the voltage regulator to accept changes to the AVR voltage set point from the "Settings" screen, the "Raise" or "Lower" buttons in the "Metering" screen, or by the use of the "Raise" or "Lower" contacts. The CANbus will have no effect. If "CAN Input" is selected and the CANbus communication is not available, the voltage regulator will not automatically change to the "Switch" setting. The user must use software to change the setting manually. The setting must be changed to "Switch" in order to have AVR voltage set point control. The AVR set point can be changed using the "Settings" screen or by using the "Raise" or "Lower" buttons of the "Metering" screen.

VAR/PF Control: Desired Input Configuration - "CAN Input" and "Switch" are the two settings that can be selected from the drop-down menu for this configuration. Selecting "CAN Input" configures the voltage regulator to accept changes to the VAR/PF voltage set point **only** from the "CANbus". If an attempt is made to change the VAR/PF set point with this configuration, from the "Settings" screen, with the use of the "Raise" or "Lower" buttons while at the "Metering" screen and with the "Raise" or "Lower" contacts, then the adjustment will have no effect. Selecting "Switch" configures the voltage regulator to accept changes to the VAR/PF voltage set point from the "Settings" screen, with the use of the "Raise" or "Lower" buttons while at the "Metering" screen and with the "Raise" or "Lower" contacts. The CANbus will have no effect. If "CAN Input" is selected and the CANbus communication is not available, the voltage regulator will not automatically change to the "Switch" setting. The user must use software to change this setting manually to "Switch" in order to have VAR/PF voltage set point control. The VAR/PF set point can be changed using the "Settings" screen or by using the "Raise" or "Lower" buttons of the "Metering" screen.

Load Compensation Mode: Mode - Three settings may be selected from the drop-down menu for this operating mode: "Off", "Droop", or "Line Drop" (Line Loss). Selecting "Off" disables all load compensation. Selecting "Droop" enables the reactive droop compensation feature of the voltage regulator. Selecting "Line

Drop" enables the voltage regulator to compensate for a line drop by increasing the generator output voltage as the generator load increases.

When operating in parallel operations, make sure that Droop mode is selected.

"Reactive Droop Compensation" and "Line Drop Compensation" are briefly described below:

Reactive Droop Compensation - The CDVR provides a "Reactive Droop Compensation" feature for three phase generators. The feature assists in the sharing of a reactive load during parallel generator operation. The voltage regulator calculates the reactive portion of the generator load using the sensed generator output voltage and current quantities. The voltage regulator then modifies the voltage regulation set point accordingly.

- A unity power factor generator load results in almost no change in generator output voltage.
- A lagging power factor generator load (inductive) results in a reduction of generator output voltage.
- A leading power factor generator load (capacitive) results in an increase of generator output voltage.

Droop is adjustable up to 10 percent with rated "B phase" line currents and 0.8 power factor. The "B phase" line currents are 5 A applied through terminals P12-1 and P12-2. The droop is adjustable with the use of the communication ports.

"Reactive Droop Compensation" is mutually exclusive to line drop compensation. These two functions work opposite of one another and, therefore, cannot be used at the same time.

In addition, the "Reactive Droop Compensation" feature allows paralleling of three phase generators when connected for "Cross Current Compensation" (CCC). The CCC method of connection allows reactive load shared between generators with little voltage droop. The droop level adjustment acts as the sensitivity adjustment when connected for CCC.

Verify that the system works in reactive droop mode before connecting in CCC mode.

Note: When in CCC mode, kW and/or kVAR may indicate negative values in the "Metering" screen.

Line Drop Compensation - The CDVR provides a "Line Drop Compensation" feature for three phase generators. The feature assists in compensating for voltage drops in the lines between the generator and the load. The voltage regulator calculates the magnitude of generator output current and modifies the voltage set point accordingly. An increase in generator output current results in an increase in generator output voltage. "Line Drop Compensation" is adjustable up to 10 percent with rated "B phase" line currents and 0.8 power factor. The "B phase" line currents are 5 A applied through terminals P12-1 and P12-2. The droop is adjustable with the use of the communication ports. "Line Drop Compensation" is mutually exclusive to "Droop". "Line Drop Compensation" and "Droop" work opposite of one another and, therefore, cannot be used at the same time.

Load Compensation Mode: Setpoint (percent) - The "Load Compensation Mode" setting field is enabled only when "Droop" or "Line Drop" is selected as the "Load Compensation" mode. A percentage of zero to 10.00 percent may be entered in increments of 0.01.

Voltage Adjustment Band (percent of rated) - The "Voltage Adjustment Band" setting is entered as a percentage of the rated generator voltage. "Voltage Adjustment Band" is used to limit the range of the AVR set point. A percentage value of zero to 15.00 percent may be entered in increments of 0.01.

Note: Adjusting the voltage using the DC bias input or the "Fine Adjustment" buttons in the CDVR PC software will only change the voltage set point. Adjusting the voltage using the DC bias input or the "Fine Adjustment" buttons will not change the voltage adjustment band.

Startup Tab

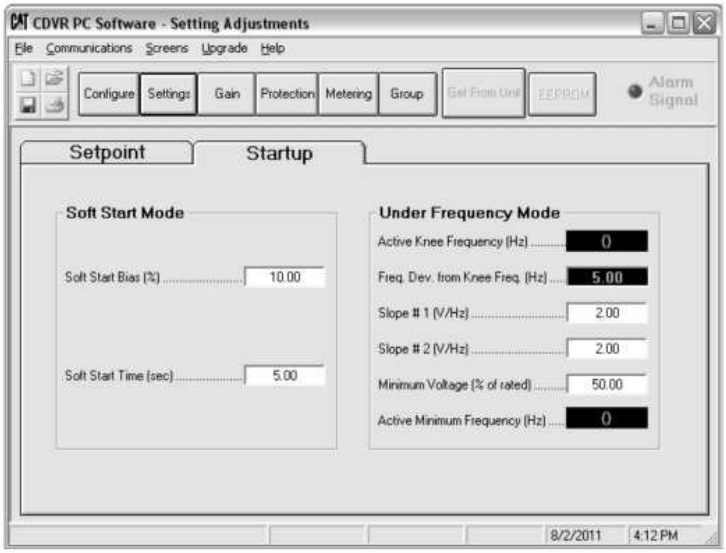

Illustration 4 g02696918

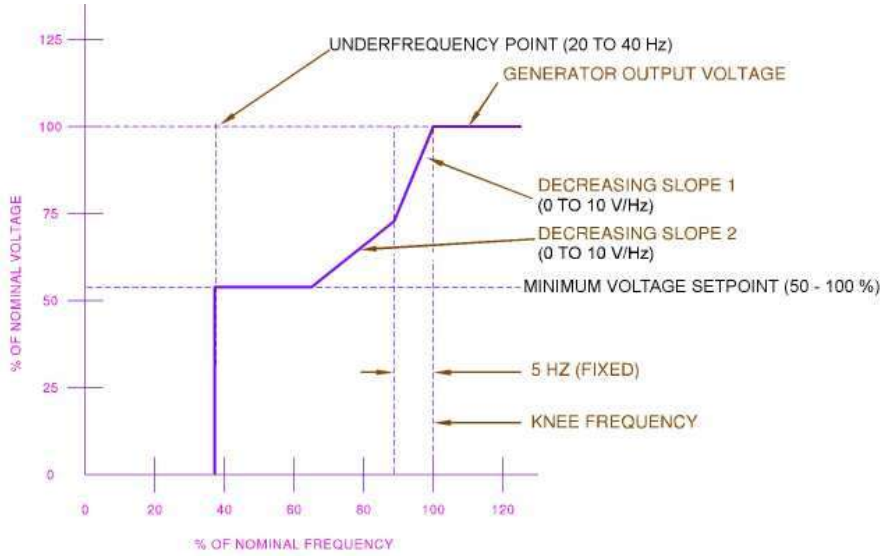

Illustration 5 g01012488

Soft Start Bias (percent) - The Soft Start Bias setting determines the generator voltage offset during start-up as a percentage of the generator rated voltage. The CDVR will raise output voltage to this percentage as quickly as possible. A percentage value of 0.00 to 90.00 may be entered in increments of 0.01 percent.

Soft Start Time (sec.) - The Soft Start Time establishes the length of time for the generator terminal voltage to increase to the generator rated voltage level from the "Soft Start Bias" percent. A value of 0.00 to 120.00 seconds may be entered in increments of 0.01 seconds. If the "Under Frequency Point" is reached before the CDVR reaches the "Soft Start Bias" percent, voltage will build from the "Soft Start Bias" percent. The voltage will build in a linear manner, for the duration of the "Soft Start Time". If the "Under Frequency Point" is reached after the CDVR reaches the "Soft Start Bias" percent, voltage will build from the "Soft Start Bias" percent. The voltage will build in a linear manner, until the "Under Frequency Point" is reached. Voltage will build following a "volts-per-hertz" profile. Refer to Illustration 5.

Knee Frequency (Hz) - The "Knee Frequency" setting defines the value of frequency that causes the voltage regulator to adjust the voltage set point. The voltage set point changes occur so that the generator terminal voltage follows the selected volts per hertz slope. A value of 45.00 to 65.00 Hz may be entered in increments of 0.01 Hz. "Knee Frequency" should typically be set from 0.2 to 2 Hz less than the generator operating frequency. The knee frequency should be adjusted closer to the nominal frequency in applications where the generator engine and governor are slow in recovering frequency during a transient load event.

Frequency Deviation from Corner Frequency (Hz) - This field is a "read-only" field. The fixed value is subtracted from the "Corner Frequency" value. The calculation is used to determine when the generator under frequency operation changes from slope 1 to slope 2.

Slope 1 (V/Hz) - When the generator frequency is between the corner frequency and the corner frequency minus 5 Hz, the voltage set point is automatically adjusted. The automatic adjustment so that the generator voltage follows V/Hz slope 1. Slope 1 is adjusted by this setting field. A setting of zero to 10.00 may be entered in increments of 0.01.

Slope 2 (V/Hz) - When the generator frequency is between the corner frequency minus 5 Hz and the "Minimum Frequency" setting, the voltage set point is automatically adjusted. The voltage set point is automatically adjusted so that the generator voltage follows V/Hz slope 2. Slope 2 is adjusted by this setting field. A setting of zero to 10.00 may be entered in increments of 0.01.

Note: Volts per Hz slope value can be used to improve transient response time.

Minimum Voltage (percent of rated) - The "Minimum Voltage" setting defines the voltage level where the voltage regulator transitions from the under frequency characteristic to a constant voltage characteristic. The "Minimum Voltage" setting is expressed as a percentage of nominal generator voltage. A value of 50.00 to 100.00 percent may be entered in increments of 0.01.

Minimum Frequency (Hz) - The "Minimum Frequency" setting defines the value of the generator frequency where the excitation is removed. A frequency value of 20.00 to 40.00 Hz may be entered in increments of 0.01 Hz.

Control Gain

The "Control Gain" screen consists of a single tab labeled "Control Gain". Click the "Gain" button (3) in order to access the "Control Gain" screen or click "Screens" on the menu bar and click "Control Gain".

Control Gain Tab

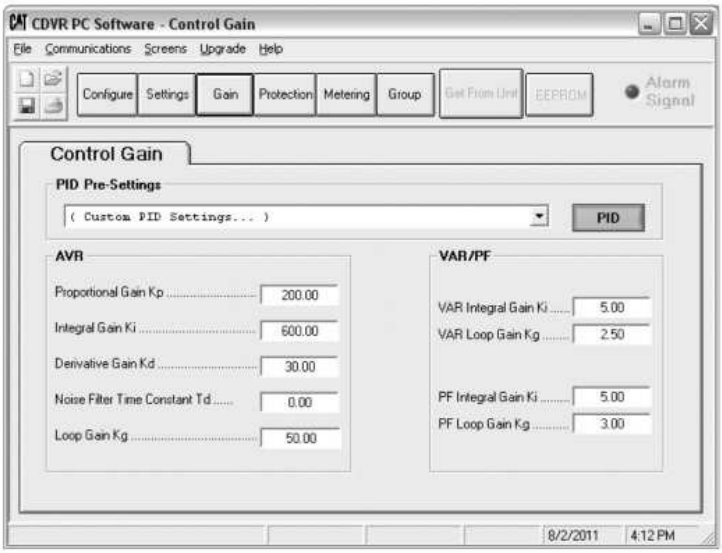

Illustration 6 g02697120

Proportional Gain Kp - This setting selects the proportional constant stability parameter. The voltage regulator supplies a value that is equivalent to Kp multiplied by the error between the voltage set point and the actual generator output voltage. Kp values of 0 to 1,000 may be entered in increments of 0.01.

If the transient response has too much overshoot, then Kp may be decreased. If the transient response is too slow, then Kp may be increased.

Integral Gain Ki - This setting selects the integral constant stability parameter. The voltage regulator supplies a value that is equivalent to Ki multiplied by the integral of the error between the voltage set point and the actual generator output voltage. Ki values of 0 to 1,000 may be entered in increments of 0.01.

Increasing the value of Ki decreases the time required to reach steady state.

Derivative Gain Kd - This setting selects the derivative constant stability parameter. The voltage regulator provides an output value that is equivalent to Kd multiplied by the derivative of the error between the voltage set point and the actual generator output voltage. Kd values of 0 to 1,000 may be entered in increments of 0.01.

Increasing the value of Kd reduces transient response ringing.

Noise Filter Time Constant Td - This setting selects the noise filter time constant and is used in order to reduce high frequency noise. Values of 0.00 to 1.00 may be entered in increments of 0.01.

Loop Gain Kg - This setting adjusts the loop-gain level of the PID algorithm. Loop gain values of 0 to 1,000 may be entered in increments of 0.01. Loop gain Kg is an overall gain multiplier affecting all gain parameters, and should be used as a first gain adjustment. Increasing loop gain may be used to increase transient response and reduce time to steady state. Decreasing loop gain will reduce overshoot but will lengthen time to steady state. For self excited machines, a low value may be required for stability. This value may be as low as 5. Refer to the "Poor Voltage Regulation - Troubleshoot" section.

VAR Integral Gain Ki - This setting adjusts the integral gain and determines the characteristic of the voltage regulator dynamic response to a changed VAR setting. Ki values of 0 to 1,000 may be entered in increments of 0.01.

VAR Loop Gain Kg - This setting adjusts the loop gain level of the PI algorithm for VAR control. Values of 0 to 1,000 may be entered in increments of 0.01.

PF Integral Gain Ki - This setting adjusts the integral gain and determines the characteristic of the voltage regulator dynamic response to a changed power factor setting. Values of 0 to 1,000 may be entered in increments of 0.01.

PF Loop Gain Kg - This setting adjusts the loop gain level of the PI algorithm for power factor control. Values of 0 to 1,000 may be entered in increments of 0.01.

PID Pre-Settings - One of 20 preset stability ranges within the voltage regulator can be selected from this pull down menu. Selection of one of the 20 preset stability ranges disables the "Proportional Gain" (Kp), "Integral Gain" (Ki), and "Derivative Gain" (Kd) settings of the "Control Gain" tab. Selecting "Custom PID Settings" from the "PID Pre-Settings" menu enables the Kp, Ki, and Kd settings. Caterpillar does not recommend using the current "PID Pre-Settings" in the list except the "Custom PID Settings". The default settings from the "Custom PID Settings" will work well for most SR4 and SR4B generator applications. If an adjustment is to be made, the "Loop Gain Kg" should be used as a first adjustment approach.

"PID" Button - Press the PID button in order to open the PID "Calculator" screen. See illustration 7. The PID "Calculator" is used in order to calculate proportional gain (Kp), integral gain (Ki), and derivative gain (Kd) for a PID type controller. The generator and the exciter time constant values are entered into the "PID Calculator" in order to calculate these values. AVR overall gain (Kg) and derivative filter time constant (Td) can be entered and saved in a file. Refer to the "PID Calculator" section for additional information.

PID Calculator

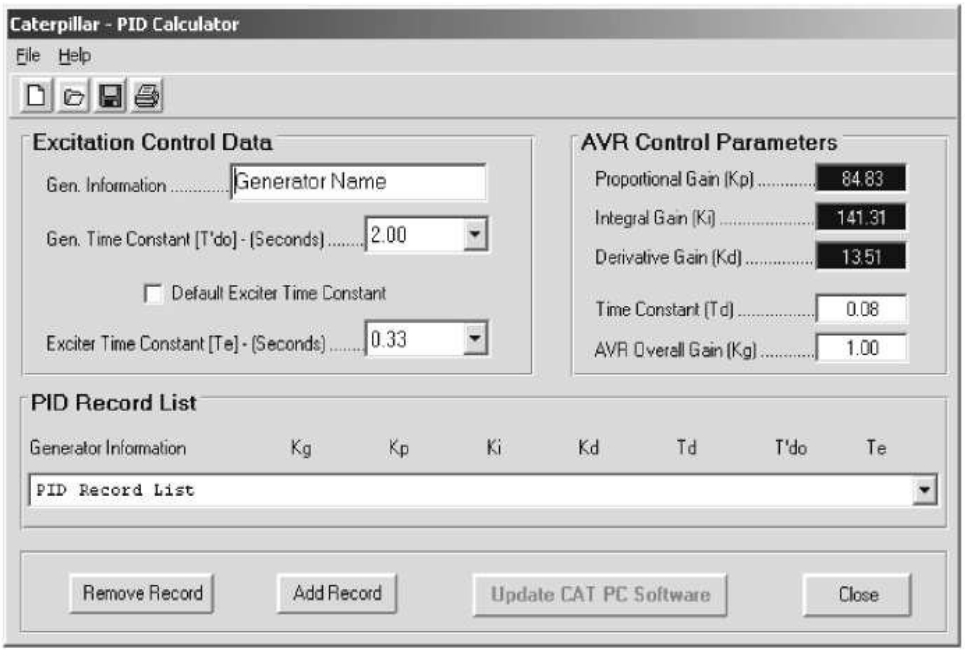

Illustration 7 g01009819

The PID parameters are calculated for the desired system response. The settling time is approximately one third of the generator time constant and about 10 percent overshoot.

Excitation Control Data

General Information - Up to 20 characters of descriptive text for the generator can be entered in this field. When a PID record is created, this text identifies the record.

Generator Time Constant (T'do) - (Seconds) - The open circuit generator time constant (T'do) can be selected from this pull down menu. Time constant values of 1 to 15 seconds can be entered in 0.05 second increments.

Note: Values for specific generators can be obtained from the "Technical Marketing Information System".

Exciter Time Constant (Te) - (Seconds) - The exciter time constant (Te) can be selected from this pull down menu. The value displayed in this menu depends on the generator time constant (T'do) that is selected. Available values range from one fifth to one half of (T'do) in 0.01 second increments. The maximum exciter time constant is 3 seconds.

Default Exciter Time Constant - When this box is checked, manual selection of the exciter time constant is disabled and Te is set at one-sixth the value of the generator time constant (T'do). Disabling the manual selection of the exciter time constant is not recommended for SR4 and SR4B generators.

AVR Control Parameters

Proportional Gain (Kp) - Kp is a read only value. The value is calculated from the values that are selected from the generator time constant (T'do) and exciter time constant (Te) pull down menus.

Integral Gain (Ki) - Ki is a read only value. The value is calculated from the values that are selected from the generator time constant (T'do) and exciter time constant (Te) pull down menus.

Derivative Gain (Kd) - Kd is a read-only value. The value is calculated from the values selected from the generator time constant (T'do) and exciter time constant (Te) pull down menus.

Time Constant (Td) - The time constant value entered in the time constant field is used to reduce high frequency noise. The Td value entered is recommended to be less than 0.2 (Kd, Kp). Td values from zero to 1.00 may be entered in 0.01 increments. Entering a value of "zero" disables the filtering.

AVR Overall Gain (Kg) - The AVR overall gain is entered in this field. A Kg value of zero to 1000.00 may be entered. **Note:** If the "Update CDVR PC Software" button is pressed, a default value of 1.00 is loaded into this field. Make sure to adjust this value as needed.

PID Record List

The record list area of the PID "Calculator" screen lists all of the saved PID records that are available.

Remove Record Button - Records in the "PID Record List" can be selected and deleted by clicking this button.

Add Record Button - A record containing the excitation control data and AVR control parameters can be added to the "PID Record List" by clicking this button. The "Save" button must be pressed in order to save the record in the list.

Update CAT PC Software Button - Transfers the AVR control parameters calculated in the PID calculator and recorded to the "Control Gain" screen.

Close Button - Clicking this button closes the "PID Calculator" and returns to the "Control Gain" screen.

Table 2

Power Input to Voltage Regulator (PM / SE / IE systems)					Power Input to Exciter					
					Nominal Requirements				Full Forcing Requirements	
	SE/PM Voltage	Input to Regulator	Frequency Range	Number of Phases	Exciter Nominal Voltage Input	Exciter Nominal Current Input	Exciter Resistance	Exciter Time Constant Te	Full Forcing Voltage	Full Forcing Current
Kato 2600/2700 Frame	PM	70 to 105V	240 Hz	3	35V	10A	3.7 ohms	0.22 sec	65V	15A
Kato 2800 Frame	PM	120V	90 Hz	1	50V	5A	10 ohms	0.18 sec	90V	10A
6100	PM	140V	120 Hz	3	40V	4A	10 ohms	0.22 sec	60V	10A
6100	SE	140V	60 Hz	1	40V	4A	10 ohms	0.22 sec	60V	10A
6100	IE	140V	50/180 Hz	2x1	40V	4A	10 ohms	0.22 sec	60V	10A
1400 /4P	PM	180V	200/240 Hz	3	45V	4.5A	11 ohms	0.06 sec	80V	10A
1400 /4P	IE	140V	50/180 Hz	2x1	45V	4.5A	10 ohms	0.06 sec	80V	10A
1600 /4P	PM	180V	200/240 Hz	3	60V	6A	10 ohms	0.094 sec	150V	15A
1600 /4P	IE	240 V	50/180 Hz	2x1	60V	6A	10 ohms	0.094 sec	150V	15A
1800 /4P	PM	180V	240 Hz	3	84V	4A	11 ohms	0.26 sec	190V	8.5A
1800 /4P	AREP	240V	60 Hz	1	84V	4A	11 ohms	0.26 sec	190V	8.5A
SR4/SR4B	PM	70 to 105V	240 Hz	3	35V	10A	3.7 ohms	0.22 sec	65V	15A
SR4/SR4B	SE	240V	60 Hz	1	35V	10A	3.7 ohms	0.22 sec	65V	15A

Protection Settings

The "Protection Settings" screen consists of a single tab labeled "Protection". Click the "Protection" button to access the "Protection Settings" screen or click "Screens" on the menu bar and click "Protection Settings".

Protection Tab

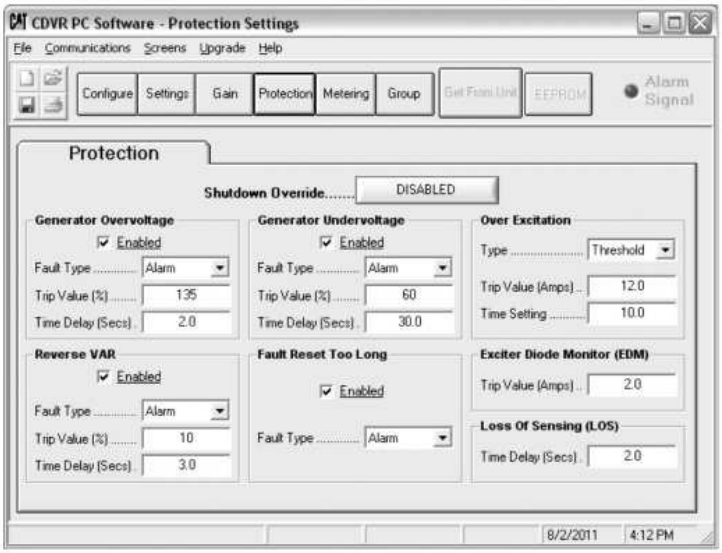

Illustration 8 g02697123

"SHUTDOWN OVERRIDE" Button - This button is used to prevent excitation shutdown for any protected function. The button displays "ENABLED" when selected and the button displays "DISABLED" when the button is deselected. Enabling this button does not disable output drivers or "CANbus" messages. The following protections do not rely on disabling excitation to cause a shutdown and, therefore, are not affected by the "Shutdown Override" button.

- Generator over voltage
- Generator under voltage
- Loss of excitation (reverse VAR)
- Fault reset too long

Note: The position of this button cannot be saved into the EEPROM. The default value of "Disabled" is loaded when power is cycled on the CDVR.

Generator Over voltage: Enabled - Selecting the "Enabled" check box enables generator over voltage protection. Deselecting the "Enabled" check box disables generator over voltage protection and the associated settings.

Generator Over voltage: Fault Type - Two options can be selected from this pull down menu, "Alarm" or "Shutdown". When "Alarm" is selected and a generator over voltage condition is detected, the alarm output driver energizes, a J1939 alarm message is sent via the "CAN" communication port, and the "Fault LED" will be lit constantly. For units equipped with an RS-232 communication port, an Alarm fault will be annunciated via the PC software. When "Shutdown" is selected and a generator over voltage condition is detected, the "Fault Shutdown" output driver energizes, a J1939 shutdown message is sent, and the "Fault LED" will flash. For units equipped with an RS-232 communication port, a "Shutdown" fault will be annunciated via the PC software. **The voltage regulator does NOT disable excitation when a "Generator Over Voltage" fault is detected.**

Generator Over Voltage: Trip Value (percent) - This setting determines the voltage threshold where an over voltage trip will occur. Voltage values of 105 to 135 percent of the rated voltage may be entered in increments of 1 percent.

Generator Over Voltage: Time Delay (Sec.) - This setting assigns the length of time from when an over voltage condition is detected until the voltage regulator issues an alarm or shuts down excitation. A time value of 2.0 to 30 seconds may be entered in 0.1 second increments.

Reverse VAR: Enabled - Selecting the "Enabled" check box enables reverse VAR protection. Deselecting the "Enabled" check box disables reverse VAR protection and the associated settings.

Note: If "Reverse VAR" protection is enabled and the CT connections are reversed, a reverse VAR alarm or shutdown will occur.

Reverse VAR: Fault Type - Two options can be selected from this pull down menu, "Alarm" or "Shutdown". When "Alarm" is selected and loss of excitation is detected, the alarm output driver energizes, a J1939 alarm message is sent via the "CAN" communication port, and the "Fault LED" is lit constantly. For units equipped with an RS-232 communication port, an alarm fault will be annunciated via the PC software. When "Shutdown" is selected and loss of excitation is detected, the "Fault Shutdown" output driver energizes, a J1939 shutdown message is sent via the "CAN" communication port, and the "Fault LED" flashes. For units equipped with an RS-232 communication port, a shutdown fault will be annunciated via the PC software. **The voltage regulator does NOT disable excitation when a Loss of Excitation (Reverse Var) fault is detected.**

Reverse VAR: Trip Value (percent) - This setting determines the level of reverse VAR flow, expressed as a percentage of nominal, positive VAR flow, where a loss of excitation trip occurs. A value of 10 to 100 percent may be entered in increments of 1 percent.

Reverse VAR: Time Delay (Secs) - This setting assigns the length of time from when the reverse VAR trip value is exceeded until the voltage regulator issues an alarm or shuts down. A time value of 0.1 to 9.9 seconds may be entered in 0.1 second increments.

Generator Under Voltage: Enabled - Selecting the "Enabled" check box enables generator under voltage protection. Deselecting the "Enabled" check box disables generator under voltage protection and the associated settings.

Generator Under Voltage: Fault Type - Two options can be selected from this pull down menu, "Alarm" or "Shutdown". When "Alarm" is selected and a generator under voltage is detected, the "Alarm" output driver will energize. A J1939 alarm message is sent via the "CAN" communication port. Also, the "Fault LED" is on constantly. For units that are equipped with an RS-232 communication port, an "Alarm" fault will be annunciated via the PC software. When "Shutdown" is selected and a generator under voltage is detected, the "Shutdown" output driver will energize. A J1939 shutdown message is sent via the CAN communication port. The "Fault LED" will flash. For units that are equipped with an RS-232 communication port, a "Shutdown" fault will be annunciated via the PC software. **The voltage regulator does NOT disable excitation when a "Generator Under Voltage" fault is detected.**

Generator Under Voltage: Trip Value (percent) - This setting determines the level of voltage. The value is expressed as a percentage of nominal generator voltage when a generator under voltage trip occurs. A value of 60 to 95 percent may be entered in 1 percent increments.

Generator Under Voltage: Time Delay (in seconds) - This setting assigns the length of time from when a generator under voltage condition is detected until the voltage regulator issues an alarm or shuts down excitation. A time value of 10.0 to 120.0 seconds may be entered in 0.1 second increments.

Over Excitation: Type - Two options can be selected from this pull down menu. "Inv Time" (for inverse curves) or "Threshold" (for a fixed time delay) can be selected. The voltage regulator disables excitation when an over excitation fault is detected unless a global "Shutdown Override" command is in effect.

Note: Selecting "Inv Time" requires changing the time setting to a suggested value of 2 (based on the time dial settings for the SR4B Generators curve). If this value is changed, over excitation protection may not exist.

Over Excitation: Trip Value (Amps) - This setting determines the level of field current that will cause an over excitation trip. Values of 0 to 12.0 A may be entered in 0.1 A increments. When in "Threshold" mode, the suggested value for the SR4 and SR4B generators is 12 A. When in "Inv Time" mode, the value entered should be determined by the full load excitation level of the generator and application. This entered value becomes a "per unit" value. For example, if a value of 12 is entered and a time setting of 2 is chosen, then 2.0 on the "Field Current" axis of the "Inverse Time" curve corresponds to 24 amps, that is, 2.0 x 12. The process will give the CDVR approximately 17 seconds before shutdown (provided the same level of current exists). If a trip value lower than the full load excitation level is entered, the CDVR will allow less time before shutdown for a given current level. **Excitation will be disabled instantly if the field current reaches 28 amps, regardless of the "Over Excitation" time setting. This event will indicate in the "Metering" screen as "Field Over Current" and is separate from the "Over Excitation" alarm.**

Over Excitation: Time Setting - This setting assigns the length of time from when an over excitation condition is detected and when the voltage regulator issues an alarm or shuts down the excitation. A time value of 1.0 to 10.0 seconds may be entered in 0.1 second increments. The required value for the SR4 and SR4B generators is 10 seconds. If "Inv Time" is selected, this value becomes the time dial setting for the generator. See Illustration 9.

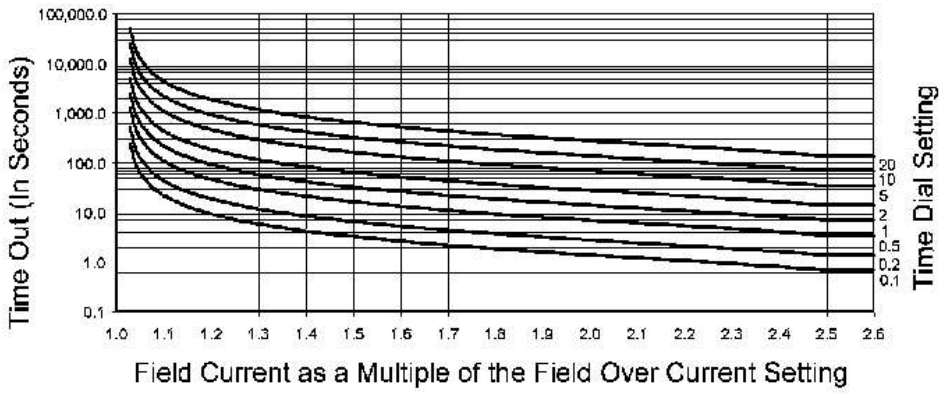

Illustration 9 g01119160

Inverse Time Characteristic for Over Excitation Limiter

Exciter Diode Monitor (EDM): Trip Value (Amps) - This setting determines the level of current that is indicative of a failed exciter diode. The RMS ripple current of the field is measured. If the current level exceeds the diode fault threshold set point for 5 seconds, a diode fault is detected. The voltage regulator disables excitation when a diode fault is detected unless a global "Shutdown Override" command is in effect. A value of 1.0 to 10.0 A may be entered in 0.1 A increments. If the regulator shuts down on instantaneous "Field Over Current" of 28 amps or more, then the EDM alarm LED will not illuminate in the "Metering" screen.

Loss of Sensing (LOS): Time Delay (Secs) - The value of this setting determines the time delay between the time a loss of sensing voltage is recognized and the time the voltage regulator responds by removing the field excitation. For single phase sensing, 50 percent of voltage set point is interpreted as an LOS. For three phase sensing, a total loss of one of the phases or an imbalance totaling 20 percent of the voltage set point is interpreted as an LOS. A time value of zero to 25.0 seconds may be entered in 0.1 second increments. The voltage regulator disables excitation when a loss of "Generator Sensing" fault is detected unless a global "Shutdown Override" command is in effect.

Fault Reset Too Long: Enabled - Selecting the "Enabled" check box enables the voltage regulator to issue an alarm or a shutdown fault if the fault reset input is closed longer than 10 seconds.

Fault Reset Too Long: Fault Type - Two options can be selected from this pull down menu, "Alarm" or "Shutdown". When "Alarm" is selected and the "Fault Reset" contact input remains closed for more than 10 seconds, the alarm output driver energizes, a J1939 alarm message is sent via the "CAN" communication port, and the "Fault LED" lights constantly. For units that are equipped with an RS-232 communication port, an alarm fault will be annunciated via the PC software. When "Shutdown" is selected and the "Fault Reset" contact input remains closed for more than 10 seconds, the "Fault Shutdown" output driver energizes, a J1939 alarm message is sent via the "CAN" communication port, and the "Fault LED" will flash. For units that are equipped with an RS-232 communication port, the voltage regulator will attempt to annunciate the "Shutdown" fault via the PC software. **The voltage regulator does NOT disable excitation when a "Fault Reset Closed Too Long" condition is detected.**

Metering, Operation, and Alarms

The "Metering, Operation, and Alarms" screen consists of a single tab labeled "Metering". Click the "Metering" button to access the "Metering, Operation, and Alarms" screen or click "Screens" on the menu bar and click "Metering/Operation".

Metering Tab

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR.

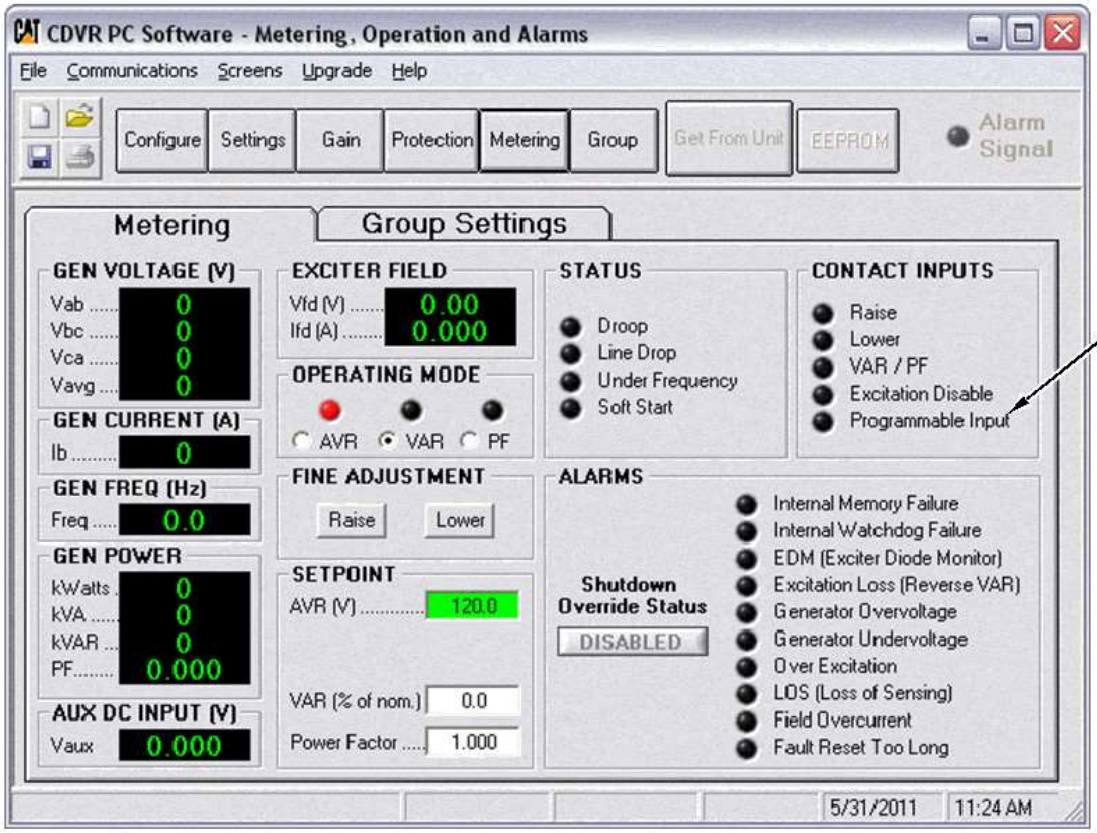

Illustration 10 g02646559

(15) Programmable input indicator

Note: The latest version of the CDVR has updated the contact inputs for the "Metering" tab. "Fault Reset" has been replaced with "Programmable Input" (15). The "Programmable Input" is used to indicate the active status of the programmable input.

Note: When communication is established, a "Metering" choice becomes available in the menu bar. Metering can be disabled by selecting "Disable Metering" from this choice. When metering is disabled, contact inputs will still work normally, but will not indicate. "Alarms" will still work normally and indicate. The raise and lower buttons will still work and show a changed set point. If another tab is selected when metering is disabled, then the "Metering" tab is selected, metering will become enabled automatically.

GEN VOLTAGE (V): Vab - This field is a read-only field that displays the phase-to-phase voltage of phase A and phase B.

GEN VOLTAGE (V): Vbc - This field is a read-only field that displays the phase-to-phase voltage of phase B and phase C.

GEN VOLTAGE (V): Vca - This field is a read-only field that displays the phase-to-phase voltage of phase C and phase A.

GEN VOLTAGE (V): Vavg - This field is a read-only field that displays the average value of the three phase-to-phase voltages.

GEN CURRENT (A): Ib - This field is a read-only field that displays the value of the current on the B phase of the generator.

GEN FREQ (Hz): Freq - This field is a read-only field that displays the value of the frequency of the generator voltage.

GEN POWER: kWatts - This field is a read-only field that displays the value of real power that is being output from the generator.

GEN POWER: kVA - This field is a read-only field that displays the value of apparent power that is being output by the generator.

GEN POWER: kVAR - This field is a read-only field that displays the value of reactive power that is being output by the generator.

GEN POWER: PF - This field is a read-only field that displays the value of the power factor that the generator is operating at.

AUX DC INPUT (V): Vaux - This field is a read-only field that displays the level of dc control voltage that is applied from a remote device to the voltage regulator terminals "P12-3" (B) and "P12-6" (A).

Note: The "Aux DC Input" terminals can be used as an alternate method of adjusting voltage in "AVR" mode or adjusting PF or VAR in PF or VAR mode when used with an existing remote VAR/PF controller. A DC input on these pins acts as a DC bias. When the CDVR is in "AVR" mode, a 1 VDC change on the terminals corresponds to a 1 percent change in the voltage set point. A 1 VDC change gives a 10 percent VAR change (in "VAR" mode) and a 0.04 PF change (in "PF" mode). If the DC voltage is removed from the ±10 VDC control input, the operating set point will return to the original value regardless of pressing the EEPROM button.

Note: Adding a DC voltage when the operating set point is near the voltage adjust band limit may allow the regulator to operate outside of the voltage adjust band.

EXCITER FIELD: Vfd (V) - This field is a "read-only" field that displays the value of the exciter field voltage.

EXCITER FIELD: Ifd (A) - This field is a "read-only" field that displays the value of the exciter field current.

OPERATING MODE - One of three operating modes may be selected as active: "AVR", "VAR", or "PF". When an operating mode is active, the corresponding indicator color changes from black to red for "AVR" mode. When an operating mode is active, the corresponding indicator color changes from black to green for the "VAR" mode and the "PF" mode.

Note: When either KVAR or PF mode are selected, the appropriate button must be selected and the auxiliary breaker contact that is connected to "P9-6" (KVAR/PF enable contact) and "P9-9" (contact sense common) must be closed.

Note: "Droop" should be enabled whenever the CDVR is operated in PF or VAR mode. The newest version of the CDVR PC firmware will not allow the operator to select PF or VAR mode unless "Droop" is selected in the "Settings" menu first. The "Droop" setting can be set to 0 percent.

FINE ADJUSTMENT - The "Raise" and "Lower" buttons control the fine adjustment of the operating set point. These buttons perform the same function as closing the appropriate set of contacts connected to the "Contact Sense – Raise" input (terminal P9-5) and "Contact Sense - Lower" input (terminal P9-4) of the voltage regulator. Each click of the "Raise" button increases the voltage set point by 0.1 V, each click of the "Lower" button decreases the voltage set point by 0.1 V.

Note: The PT ratio will affect this setting.

Note: An alternate method of adjusting voltage is to adjust the DC voltage between terminals "P12-3" and "P12-6".

SET POINT: AVR (V) - This setting field is used to enter the desired generator terminal voltage. The background color of this field is green when the voltage regulator is in AVR mode.

Note: The PT ratio will affect this setting.

SET POINT: VAR (percent of nominal) - This setting determines the level of generator VARs maintained by the voltage regulator when operating in VAR mode. The background color of this field is green when the voltage regulator is regulating the VAR set point. A percentage value of zero to 100.0 may be entered in 0.1 percent increments.

SET POINT: Power Factor - This setting determines the level of power factor regulation maintained by the voltage regulator. The background color of this field is green when the voltage regulator is regulating the power factor set point. A power factor value of –0.600 to 0.600 may be entered in 0.001 increments.

STATUS - Four indicators indicate the operating status of the voltage regulator: "Droop", "Line Drop", "Under Frequency" and "Soft Start".

The "Droop" indicator turns red when the "Reactive Droop Compensation" feature is selected. The "Reactive Droop Compensation" feature is used during parallel generator operation to assist in the sharing of reactive load.

The "Line Drop" indicator turns red when the "Line Drop Compensation" feature is selected The "Line Drop Compensation" feature is used to compensate for voltage drops in the lines between the generator and the load.

The "Under Frequency" indicator turns red when the generator frequency decreases below the "Knee Frequency" setting and excitation is terminated.

The "Soft Start" indicator turns red when the "Soft Start" feature is active to control the time for generator voltage to ramp up during startup.

CONTACT INPUTS - Five indicators provide the status of the voltage regulator switch inputs: "Raise", "Lower", "VAR / PF", "Excitation Disable" and "Programmable Input".

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR for the "Contact Inputs".

The "Raise" indicator turns red when contact closure at terminals "P9-5" "Contact Sense - Raise" and "P9-6" "Contact Sense - Common" is detected.

The "Lower" indicator turns red when contact closure at terminals "P9-4" "Contact Sense - Lower" and "P9-6" "Contact Sense - Common" is detected.

The "Var/PF" indicator turns red when contact closure at terminals "P9-9" "Contact Sense - Var/PF Enable" and "P9-6" "Contact Sense - Common"is detected.

The "Excitation Disable" indicator turns red when contact closure at terminals "P9-7" "Contact Sense – Excitation Disable" and "P9-6" "Contact Sense - Common" is detected.

The "programmable input" indicator turns red when contact closure at terminals "P9-8" "Contact Sense - Fault Reset" and "P9-6" "Contact Sense - Common"is detected.

ALARMS - Ten indicators annunciate alarm conditions. Alarm indicators include the following alarms: "Internal Memory Failure", "Internal Watchdog Failure", "Exciter Diode Monitor", "Excitation Loss", "Generator Over voltage", "Generator Undervoltage", "Over excitation", "Loss of Sensing", "Field Over current (28 Amps instantaneous shutdown)" and "Fault Reset Too Long". When the voltage regulator detects an alarm condition, the appropriate indicator changes from black to red.

ALARMS: Shutdown Override Status - This indication provides the status (position) of the "Shutdown Override Button". The button displays "ENABLED" when selected and "DISABLED" when deselected.

The CDVR does some diagnostic code logging and diagnostic code broadcasting. These codes are transmitted over CANbus. When the CDVR is operating, any active diagnostic codes will be transmitted along with a description of that code and the occurrence count.

If power is removed from the CDVR, the nonvolatile memory will retain the following information for each of the ten alarms if any codes have been logged:

- Code
- Description
- Service meter hours first
- Service meter hours last

- Real-time clock first
- Real-time clock last
- Occurrence count

Note: The CDVR does not know the actual time. The CDVR only knows the elapsed time from CDVR power up.

Metering - Group Settings

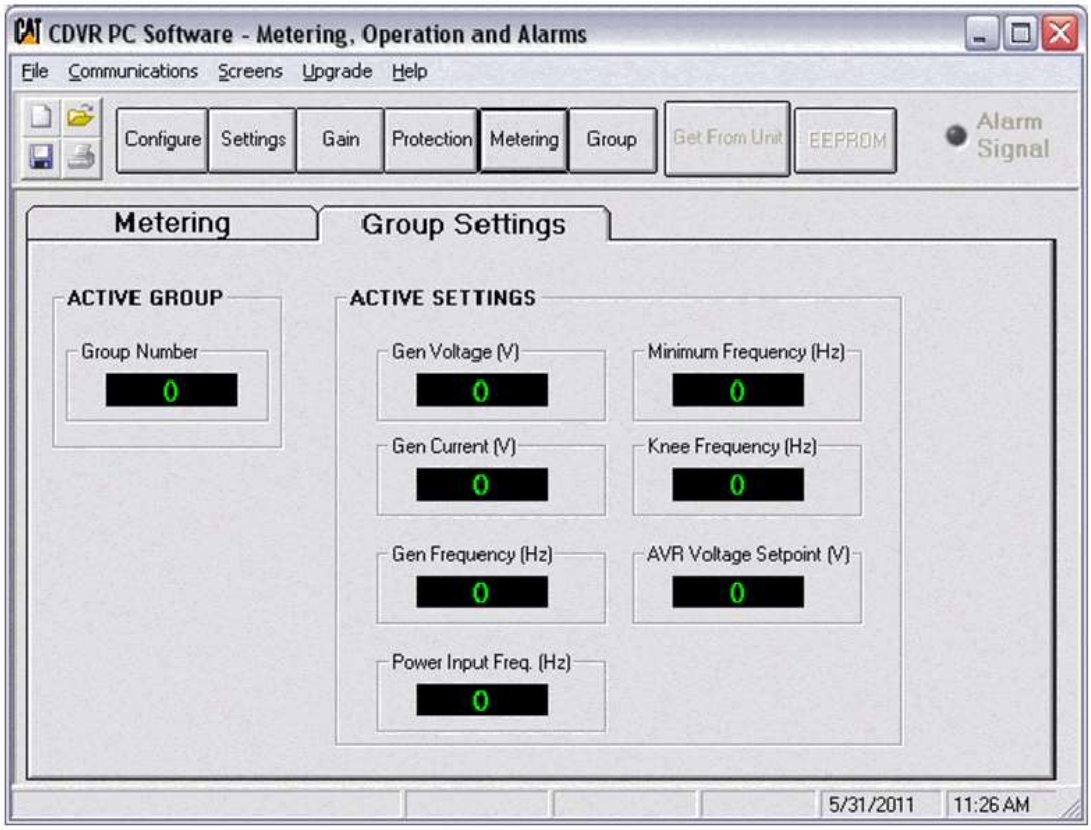

Illustration 11 g02646583

The "Group Settings" metering dialog consists of two parts. One part of the dialog displays the active group number that the EMCP controller is communicating to the CDVR via the CAN communications port. The other part of this dialog displays the parameter values from the active group.

Setting Group

The "Setting Group" dialog consists of three tabs that are labeled as follows:

- Group selection, single
- Multi-group #1, #2
- Multi-group #3, #4

Refer to Illustrations 12, 14, and 15.

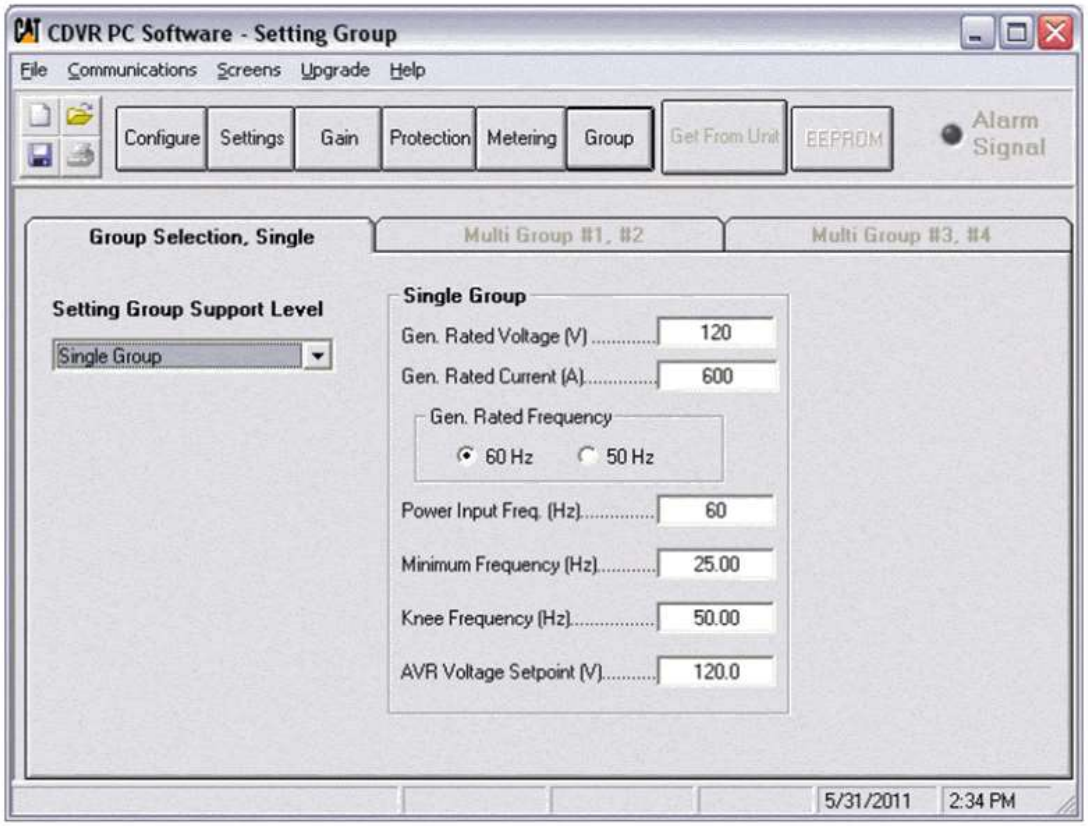

Illustration 12 g02631840

Group selection, single dialog

If the "Setting Group Support Level" parameter is changed to "multiple group", two additional screens will be available. When the "Setting Group Support Level" parameter is changed to "multiple group", the other parameters on the dialog become unavailable. Refer to Illustration 13.

Illustration 13 g02697142

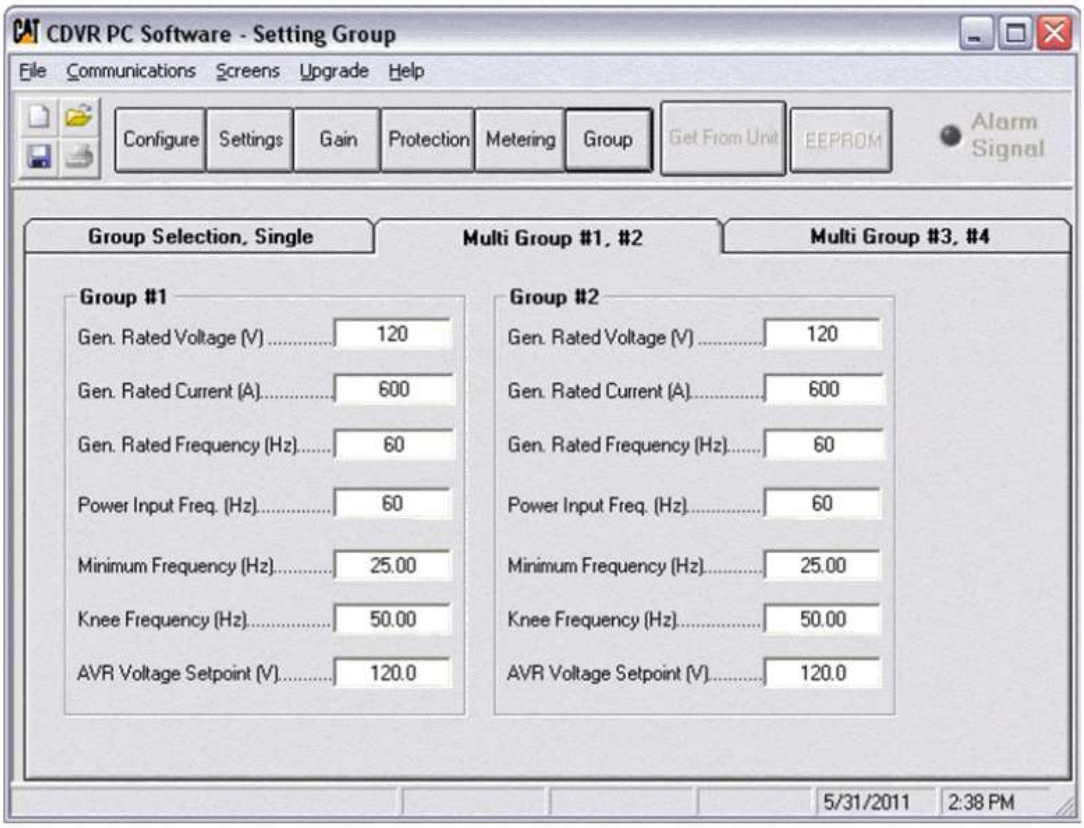

Illustration 14 g02631841
Multi group #1, #2 dialog

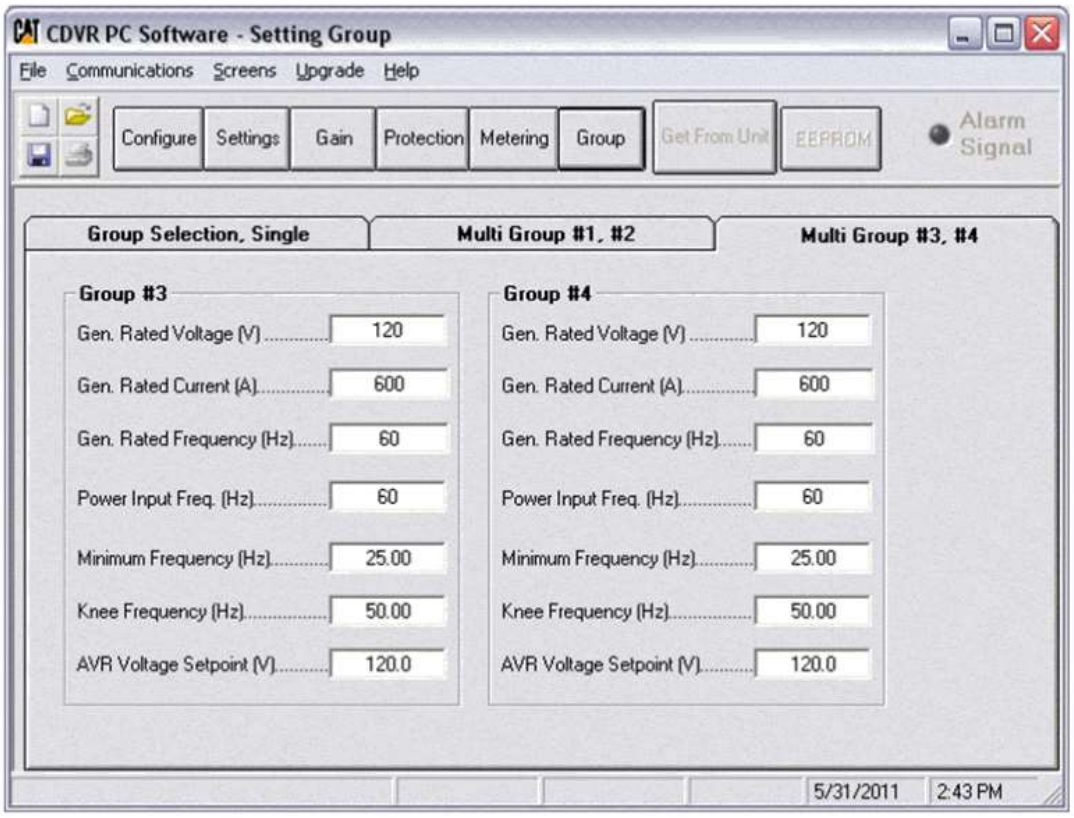

Illustration 15 g02631842
Multi group #3, #4 dialog

Click the "Group" button in order to access the "Setting Group" screen or click "Screens" on the menu bar and click "Group".

The "Group Selection, Single" tab, contains the parameter "Setting Group Support Level" which can be configured for either "Single Group" or "Multiple Group".

1. Selecting "Single Group" will allow the following.
   a. Adjustments are allowed for any of the parameters that are listed in the single group.
   b. Selecting single group will enable the parameters in the voltage regulator.
   c. All of the multi group parameters will be grayed out. The multi group parameters that are grayed out cannot be edited.
2. Selecting "Multiple Group" will allow the following.
   a. Adjustments are allowed to any of the parameters in any of the four groups that are listed under the other two tabs. The groups included "Multi Group #1, #2", and "Multi Group #3, #4".
   b. The multiple group selection will allow the active group number, that is received from the EMCP controller, to activate the appropriate setting group.
   c. The single group parameters will all be grayed out. The single group parameters cannot be edited.

Settings Files

Cat PC software enables you to print a list of voltage regulator settings, save voltage regulator settings in a file, and open a settings file in order to upload those settings to a voltage regulator. A settings file may also be opened and edited with any text editing software.

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR.

Printing the Settings Files

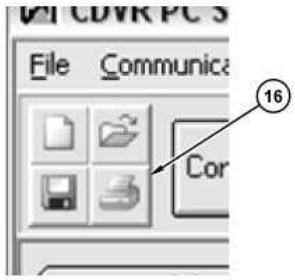

Illustration 16 g02697151
Printer icon

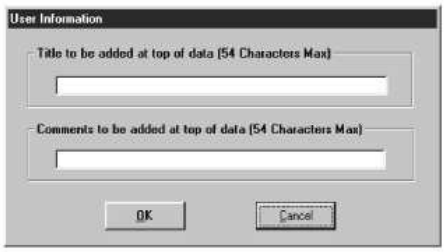

Illustration 17 g02697161
User information dialog

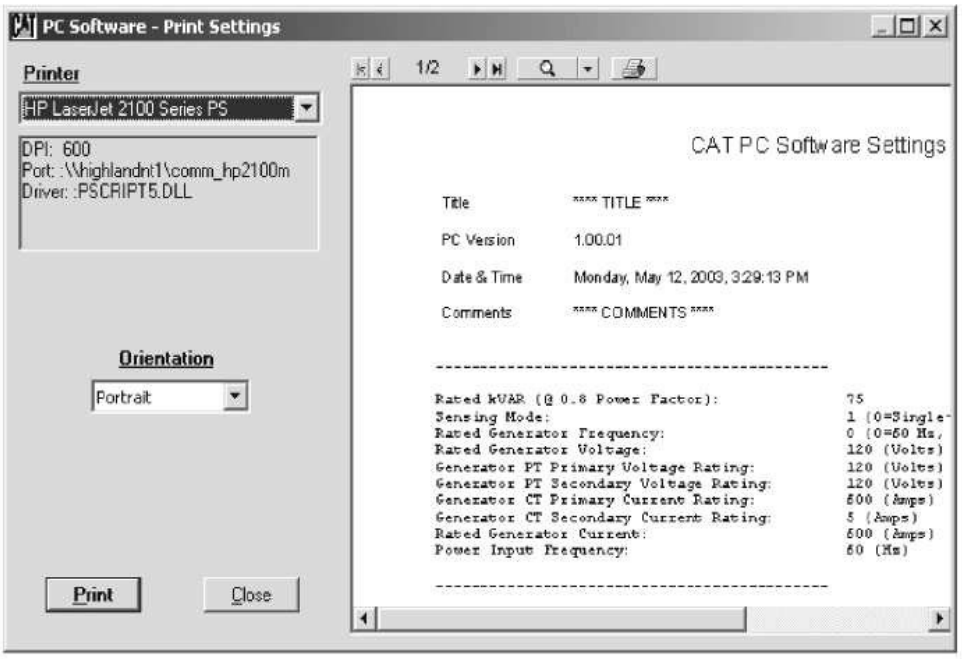

Illustration 18 g01016741

A printout of voltage regulator settings can be useful for record keeping or comparison purposes. The voltage regulator settings can be printed by clicking the print icon (16) or clicking "File" on the menu bar and then clicking "Print". When the print command is given, a dialog box provides the opportunity to add a title and comments to the settings list. Each entry is limited to a maximum of 54 characters. After this information is entered, click on "OK". The "Print Settings" dialog will appear. Refer to illustration 18. This dialog box is used in order to select the desired printer, change and verify the printer settings, and preview the printed settings list. Click on the "Print" button in order to print the settings list.

Saving the Settings Files

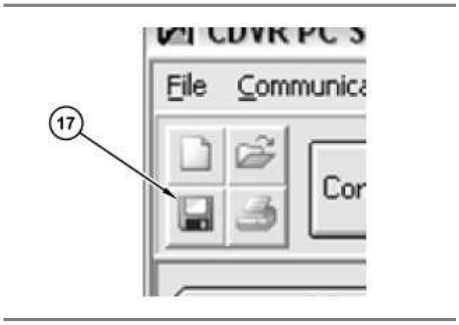

Illustration 19 g02697176
Save file icon

Caterpillar recommends that the settings for the voltage regulator be saved to a file. In order to save setup time when configuring multiple units with the same settings, the saved settings can be uploaded to other voltage regulator units.

A settings file can also be created in the PC software without being connected to a voltage regulator. The settings of the desired screens can be changed. The settings can then be saved to a file. Once a settings file is created, the file can be edited with the use of any text editing software. The file can then be saved for uploading.

A settings file is created by clicking the save icon (1) or by clicking "File" on the menu bar and then clicking "Save". When the command is given, a "Save As" dialog box is displayed where the settings are assigned a file name and then saved. All voltage regulator settings files are automatically given a ".dv2" extension.

Uploading the Settings Files to the Voltage Regulator

Refer to Specifications, Systems Operation, Testing and Adjusting, RENR7941, "Earlier CDVR Dissimilarities " for information relevant to the earlier version of the CDVR software settings.

A voltage regulator settings file downloaded from a voltage regulator or created within the PC software can be uploaded to multiple voltage regulator units. Only a voltage regulator settings file with a ".dv2" extension can be uploaded to a voltage regulator unit. Before uploading a file, communication must be initiated with the voltage regulator that is to receive the settings. See Systems Operation, "Remote Communication".

The upload process is started by clicking the open icon or clicking "File" on the menu bar and then clicking "Open". An "Open" dialog box is then displayed where the desired settings file is navigated to and selected. Clicking "Open" uploads the settings file. The default settings for the CDVR are stored in a file called

"Defaults. DV2" in the "CDVR PC Software" folder on the PC.

The defaults are displayed here for reference.

Table 3

Setting Group Support Level	Single
Generator Rated Voltage #1	120
Generator Rated Frequency #1	0
Generator Rated Current #1	600
Generator Nominal Output Voltage #1	120
Voltage Regulator Corner Frequency #1	50
Voltage Regulator Minimum Frequency Threshold #1	25
Voltage Regulator Power Input Frequency Configuration #1	60
Generator Rated Voltage #2	120
Generator Rated Frequency #2	0
Generator Rated Current #2	600
Generator Nominal Output Voltage #2	120
Voltage Regulator Corner Frequency #2	50
Voltage Regulator Minimum Frequency Threshold #2	25
Voltage Regulator Power Input Frequency Configuration #2	60
Generator Rated Voltage #3	120
Generator Rated Frequency #3	0
Generator Rated Current #3	600
Generator Nominal Output Voltage #3	120
Voltage Regulator Corner Frequency #3	50
Voltage Regulator Minimum Frequency Threshold #3	25
Voltage Regulator Power Input Frequency Configuration #3	60
Generator Rated Voltage #4	120
Generator Rated Frequency #4	0
Generator Rated Current #4	600
Generator Nominal Output Voltage #4	120
Voltage Regulator Corner Frequency #4	50
Voltage Regulator Minimum Frequency Threshold #4	25
Voltage Regulator Power Input Frequency Configuration #4	60
Rated Generator Voltage	120 V
Rated Generator Current	600 A
Rated Generator Frequency	60 Hz
Generator PT Primary Voltage Rating	120 V
Generator PT Secondary Voltage Rating	120 V
Generator CT Primary Current Rating	600 A
Power Input Frequency	60 Hz
Sensing Mode	3 Phase
AVR Voltage (V)	120 V
VAR (% of Rated)	0.00 %
Power Factor	1
AVR Voltage Control Desired Input Configuration	CAN input

VAR/PF Control Desired Input Configuration	Switch
Load Compensation Mode	Off
Load Compensation Mode Setpoint (%)	0 %
Voltage Adjustment Band Limit	15 %
Voltage Regulator Programmable Digital Input Function Configuration	Fault Reset
Soft Start Bias	10 %
Soft Start Time	5 s
Knee Frequency	50 Hz
Decreasing Slope #1	2 V/Hz
Decreasing Slope #2	2 V/Hz
Minimum Voltage	50 %
Minimum Frequency	33 Hz
Pre-defined PID Gains	21
AVR Proportional Gain Kp	200
AVR Integral Gain Ki	600
AVR Derivative Gain Kd	30
Noise Filter Time Constant Td	0
Loop Gain Kg	50
VAR Integral Gain Ki	5
VAR Loop Gain Kg	2.5
PF Integral Gain Ki	5
PF Loop Gain Kg	3
Shutdown Override Flag	0
Generator Over voltage	1
Generator Over voltage Fault Type	0
Generator Over voltage Trip Value	135 %
Generator Over voltage Time Delay	2 s
Reverse VAR	1
Reverse VAR Fault Type	0
Reverse VAR Trip Value	10 %
Reverse VAR Time Delay	3 s
Generator Under Voltage	1
Generator Under Voltage Fault Type	0
Generator Under Voltage Trip Value	60 %
Generator Under Voltage Time Delay	30 s
Fault Reset Too Long	1
Fault Reset Too Long Fault Type	0
Over Excitation Type	0
Over Excitation Trip Value	12 A
Over Excitation Time Setting	10
Exciter Diode Monitor Trip Value	2 A
Loss of Sensing Time Delay	2 s

Uploading Embedded Firmware Using the CDVR PC Software

Embedded firmware is the operating program that controls the actions of the CDVR. The CDVR stores firmware in nonvolatile flash memory that can be reprogrammed through the RS-232 communication port. It is not necessary to replace EPROM chips when replacing the firmware with a newer version.

NOTICE

If power is lost or communication is interrupted during file transfer, the CDVR will not recover and will cease to be operational.

Note: Communication must be closed prior to uploading embedded firmware to the CDVR. Refer to the "Terminating Communication" section for information about closing CDVR communication.

In order to flash the CDVR, the following materials are needed:

- CDVR
- CDVR PC software
- Firmware as a .s19 file
- Computer with communication port
- A "pass through" **1U-9484** Cable or equivalent RS-232 "pass through" cable with one end that has a male connector and the other cable end with a female connector
- 24 V power to the CDVR

Flash the CDVR

1. Apply power to the CDVR.
2. Connect a communication cable between the RS-232 connector (J4) of the CDVR and the appropriate communication port of your PC.
3. Start the CDVR PC software.
4. Click "Upgrade" on the "Menu" bar. Click "Upload Embedded Software". Refer to Illustration 20. If this menu selection is grayed out, close CDVR communication. Refer to the "Terminating Communication" section for information about closing CDVR communication.

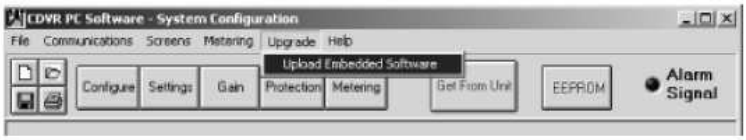

Illustration 20 g01408125
Upload Embedded Software

5. When "Upload Embedded Software" is clicked, a dialog box appears and verifies your intent to update the firmware. Click "Yes" to proceed. When "Yes" is clicked, the "CDVR Embedded Program Loader" screen will appear. Refer to Illustration 21.

Note: Uploading firmware may replace some user adjusted settings with factory default settings.

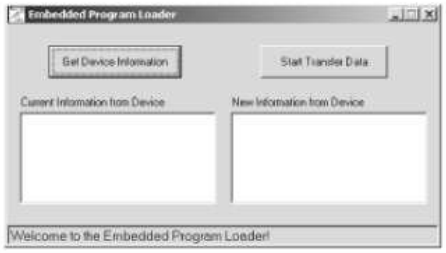

Illustration 21 g01408128

6. Click the "Get Device Information" button. The "CDVR Embedded Program Loader" will retrieve and will display the CDVR model number. The information will be displayed in the left-hand column as shown in Illustration 22.

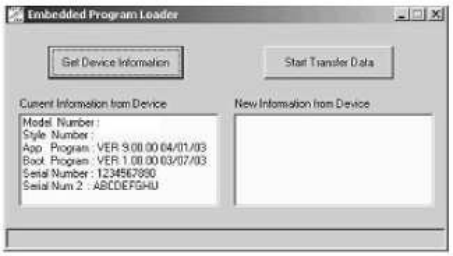

Illustration 22 g01408132

7. Click the "Start Transfer Data" button in order to proceed with software uploading. Illustration 23 will appear. Illustration 23 recommends that the CDVR settings be saved in a file that can be uploaded to the CDVR after the embedded firmware is updated.

Illustration 23 g01408133

8. Click "No" in order to exit the upload process and in order to create a CDVR settings file. Refer to the "Settings Files" section for information about creating a settings file. Click "Yes" in order to continue with the upload process and in order to display the "Open" dialog box that is shown in Illustration 24. The "Open" dialog box is used in order to locate and select the appropriate file for uploading to the CDVR. Only files with the .s19 extension is displayed in the "Open" dialog box.

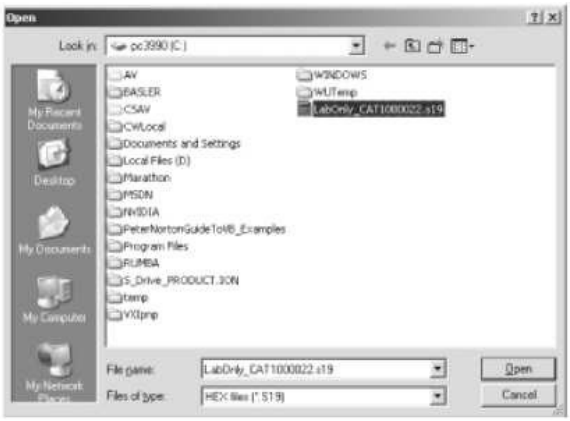

Illustration 24 g01408135

9. Select the appropriate file for uploading. Click the "Open" button in order to start the file transfer. If the dialog box appears that is shown in Illustration 25, then software is asking for the serial number of the CDVR. Enter the eight (8) numerical digits of the serial number exactly as numbers appear on the upper right-hand corner of the label on the CDVR. Ignore the letters GD. **Do not use the CDVR serial number that is shown in the PC software. Do not use spaces, dashes, or any other symbols.** Press "Enter".

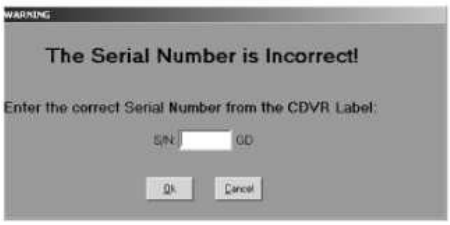

Illustration 25 g01408137
Serial number change

10. A dialog box will appear in order to indicate the progress of the file transfer. Refer to Illustration 26.

Illustration 26 g01408138

11. Once the transfer is complete, the device information is displayed in the right-hand column of the "Embedded Program Loader". Refer to Illustration 27. The displayed program version number indicates the version and the date of the firmware that was loaded.

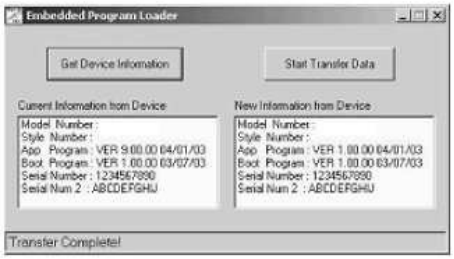

Illustration 27 g01408140
CDVR Information After Upload

12. Close the "Embedded Program Loader". The default settings are loaded into the CDVR and are checked.

    If desired, the settings can be reloaded into the regulator from the saved settings file. Refer to the "Settings Files" section for information about loading a settings file.

Flash the CDVR Using Cat ET Software

The following items are needed in order to flash the CDVR with Cat ET:

- CDVR
- Cat ET software
- Power to the CDVR
- Computer with a serial port
- Communication Adapter II (**171-4400** Communication Adapter Group)

Follow the steps below to flash the CDVR with Cat ET:

1. Follow steps 1 through 6 in the "Parameter Viewing and Configuration-Caterpillar Electronic Technician" section.
2. Disconnect communication if necessary.
3. Click on the "Flash Memory" button. Refer to Illustration 28.

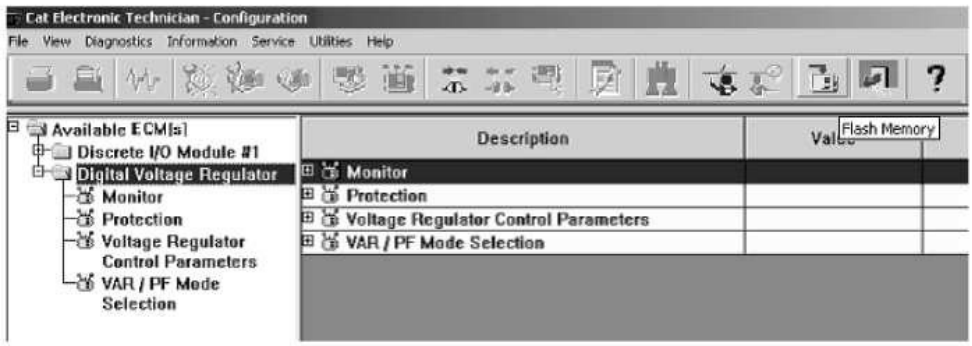

Illustration 28 g01425391

4. The "WinFlash" screen will appear. Refer to Illustration 29.

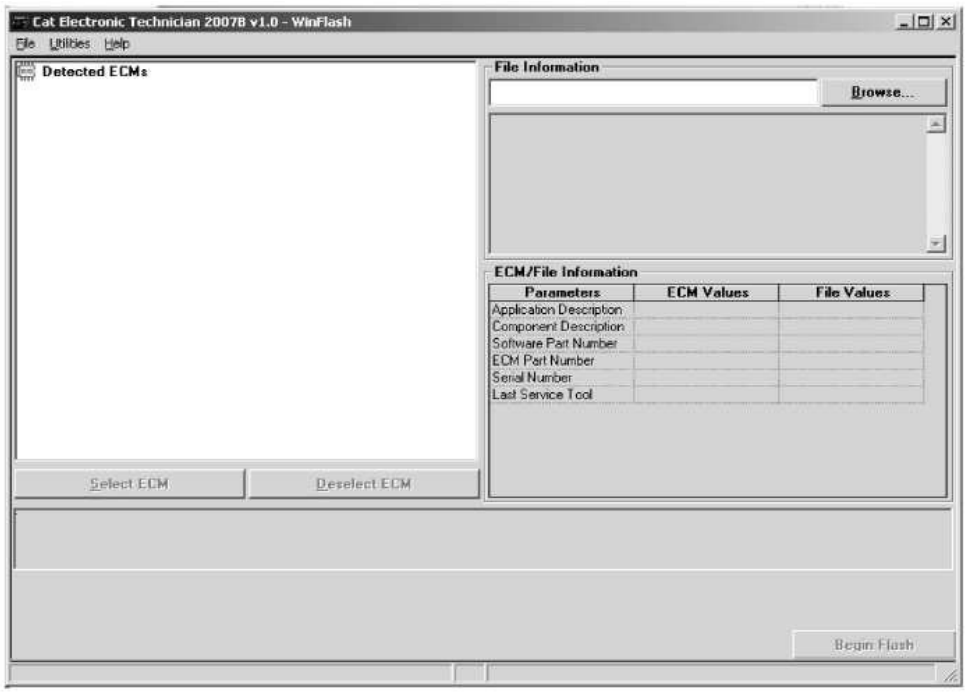

Illustration 29 g01425392

5. Select the CDVR in the list. Click "Browse" that is located in the upper right corner of the screen. Browse to the appropriate .fls file. Select "Open".

6. When the "Winflash" screen appears, select "Begin Flash" in order to flash the selected file into the CDVR. "Begin Flash" is located in the lower right corner of the screen.