Powering Business Worldwide

SC200 System Controller Operation Handbook

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About This Guide

Scope

This guide covers operation of the SC200 system controller with embedded software Version 4.

See SC200 Identity Information on page 14 to determine the version of the embedded software.

Audience

This guide is intended for use by:

- Installers competent in:
  - installing and commissioning dc power systems
  - safe working practices for ac and dc powered equipment
  - the relevant local electrical safety regulations and wiring standards
- Operators and maintenance staff competent in:
  - operation of dc power systems
  - safe working practices for ac and dc powered equipment

Related Information

- *PowerManagerII* Online Help
- *DCTools* Online Help
- SiteSure-3G Installation and Operation Guide – IPN 997-00012-51
- CellSure Installation Guide – IPN 997-00012-20

Reporting Problems with this Guide

Please use this email address to report any problems you find in this guide:

Eaton DC Product Marketing Communications
EMAIL: DCMarketingNZ@eaton.com

For Further Information and Technical Assistance

For further information and technical assistance see Worldwide Support on page 125.

Third Party Software

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

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Chapter 3 System Operation

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General Description

Overview

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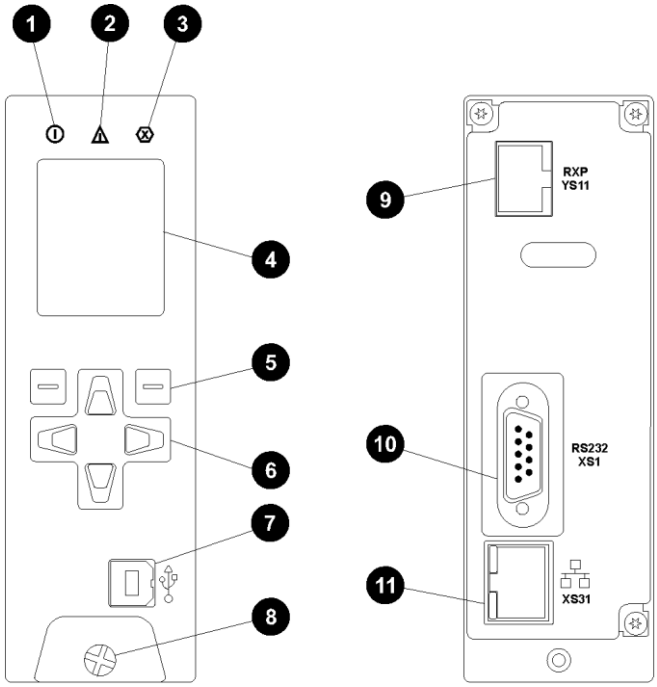
SC200 System Controller

The SC200 system controller is an advanced control and monitoring solution which provides a full suite of communications options, including built-in Ethernet interface, Web server, and SNMP agent.

Alarm notifications may be by Email, SNMP traps, SMS text messaging, dial-out to PowerManagerII remote monitoring software, or relay contact closures.



1. Power on LED (green)
2. Minor alarm LED (yellow)
3. Critical/Major alarm LED (red)
4. Color LCD
5. Soft keys (2)
6. Navigation keys (4)
7. USB 1.1 connector (12Mb/s)
8. Retaining screw
9. Power and system communications connector
10. RS232 connector
11. Ethernet connector and status LEDs

The SC200 is supplied pre-configured with either a default configuration file, or with one factory customized for a particular application. Some configuration file changes can be made with the keypad, or all settings can be changed via a PC connected to the USB interface (see details on page 18).

For connector pin-outs see details on page 113. See Troubleshooting on page 100 for details of SC200 alarm LEDs.

Input/Output Board

The input/output (I/O) board provides the I/O interfaces and connections for the SC200 system controller.

The I/O board includes a range of sense inputs for dc power system control and monitoring. It also allows real time data collection from building services and other external devices, and relay outputs for alarm signals or control of external devices.

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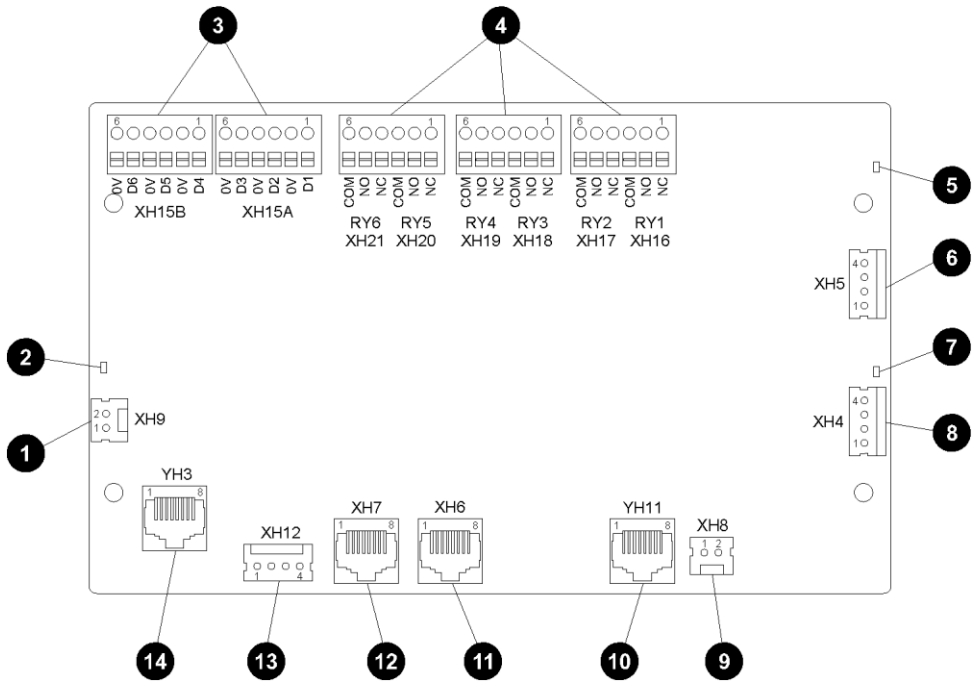
The I/O functions are:

Sensors:	Current - 3, Bus voltage - 1, Temperature - 2, Battery Mid-point - 4
Input/Output:	Digital inputs: 4 pre-defined system functions, 6 user-defined Relay outputs: 6 (one also used as Monitor OK alarm) LVD contactor outputs: 2

*For input and output specifications see details on page **105**. For connector pin-outs see details on page **114**.*

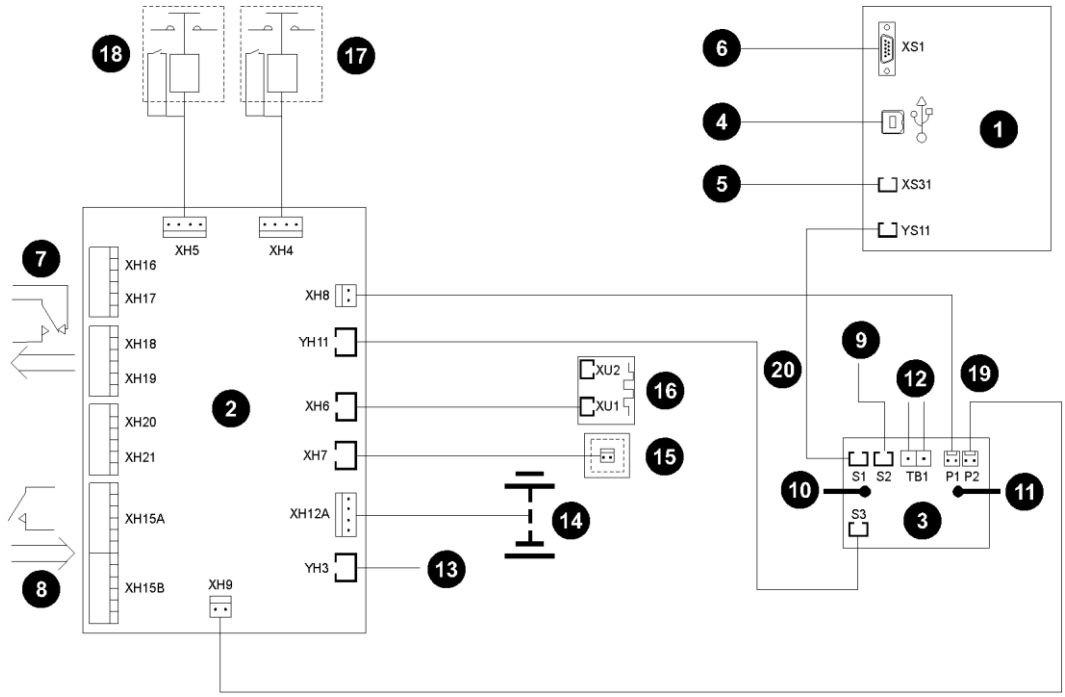


1. Bus voltage sense input - XH9
2. Power/Comms OK LED (green)
3. Digital inputs D1-D6 (6 user defined) - XH15A, XH15B
4. Digital (relay) outputs RY1-RY6 (6) - XH16-XH21
5. LVD contactor 2 status LED (green)
6. LVD contactor 2 connector - XH5
7. LVD contactor 1 status LED (green)
8. LVD contactor 1 connector - XH4
9. LVD power input connector - XH8
10. Power and RXP comms input - YH11
11. Current sense inputs (3) - XH6
12. Temperature sense inputs (2) - XH7
13. Battery Mid-point Monitoring sense inputs - XH12
14. DC power system digital inputs (4 pre-defined: Load Fuse Fail, Battery Fuse Fail, AC Distribution Fan Fail, AC Distribution MOV Fail) - YH3

*See Troubleshooting on page **100** for details of I/O board LED signals.*

Connections

The following diagram shows the connections between the SC200, the I/O board, the other dc power system components and external devices.



1. SC200 system controller
2. I/O board
3. Voltage feed module
4. USB communications
5. Ethernet communications
6. RS232 communications
7. Digital relay outputs (6) to external devices and/or alarm indication system
8. Digital inputs (6) from external voltage-free switches or relay contacts
9. Connection to additional I/O board(s) and/or SiteSure-3G I/O module(s)
10. Connection to dc common bus
11. Connection to dc live bus
12. Communications to rectifiers
13. DC power system digital inputs (Load Fuse Fail, Battery Fuse Fail, AC Distribution Fan Fail, AC Distribution MOV Fail)
14. Connections for battery mid-points (4)
15. Connection for temperature sensors (2)
16. Connection for current sensors (3)
17. Connection for LVD contactor and auxiliary switch
18. Connection for LVD contactor and auxiliary switch
19. Bus voltage sense and LVD power connections
20. I/O and system controller power and RXP comms connections

For connector pin-outs see details on page 114. For input and output specifications see details on page 105.

Compatible Software

The following software is compatible with the SC200 system controller:

- DCTools Configuration Software. Latest version is available free from dcpower.eaton.com/downloads.
- PowerManagerII Remote Control and Monitoring Software. Contact your Eaton dc product supplier for further information (see Worldwide Support on page 125).
- Recommended web browsers: Microsoft Internet Explorer 8 or later (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0 or later.

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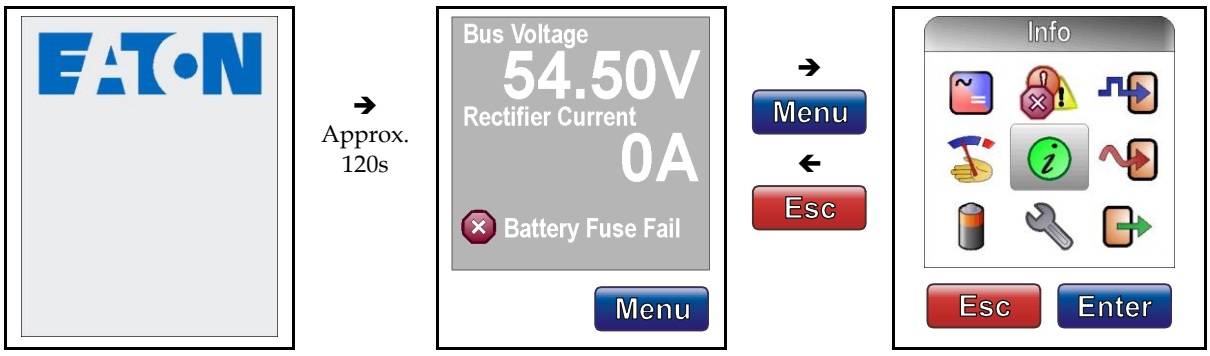
Overview

Starting the SC200

When dc power is applied to the SC200 (via the RXP connector YS11) the start-up sequence begins.



Start-up screen

Main screen

The values shown are configurable, see details on page 11. All active Critical, Major, Minor and Warning alarms are displayed.

Menu screen

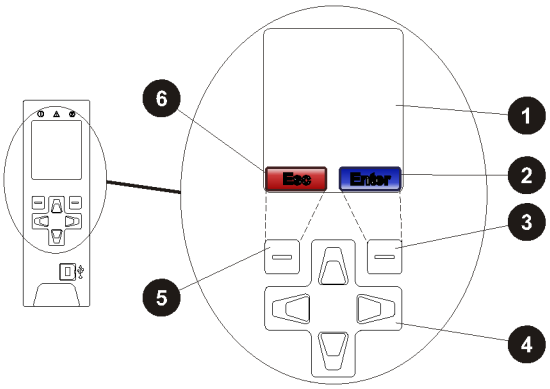
See navigation details on page 8.

If Logon is required see Keypad Access Security on page 10.

Main Screen Shortcut Keys

Key	Function
	From the Main Screen go directly to the *Alarms* screen.
	From the Main Screen go directly to the *Settings* screen.
	From the Main Screen go directly to the *Control Processes* screen.
	From the Main Screen go directly to the *Analogs* screen.

SC200 Operation using the Keypad and Screen



1. LCD
2. Soft key 1 label
3. Soft key 1
4. Navigation keys (Up - Down - Left - Right)
5. Soft key 2
6. Soft key 2 label

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Soft Keys

The function of the soft keys is indicated by the corresponding labels on the LCD screen. The following table shows the most common labels and key functions.

Label	Key function
Menu	Go to menu screen. See details on page 8.
Esc	Go back to parent menu screen.
Enter	Go to sub-menu or configuration screen*.
Save	Save a new configuration setting*.
Cancel	Ignore a new configuration setting*.

* See Changing a Configuration Setting on page 10.

Navigation Keys

Key	Function
	• Move up/down in the menu screen. See details on page 8. • Move up/down in a list (hold to go to the top or bottom of the list). • Select options in a configuration screen. • Increase/decrease a value in a configuration screen.
	• Move left/right in the menu screen. See details on page 8. • Move left/right between tabs in *Rectifiers*, *Alarms*, *Battery* or *Settings* menus. • Move left/right between segments of a multiple segment value in a configuration screen.

Main Menu Navigation

At each menu screen press *Enter* to access the associated configuration menu screen(s).

These menus have multiple configuration menu screens. See details on page 9.

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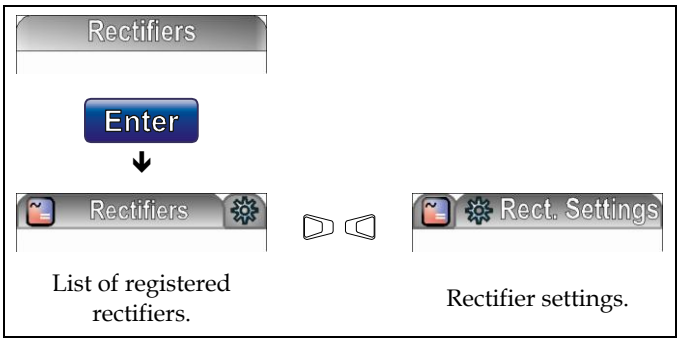
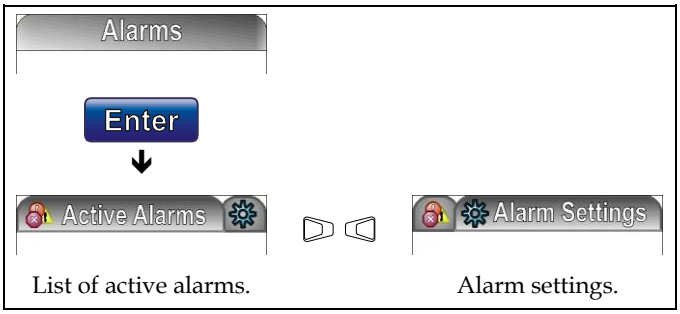
Sub-menu Tabs

The following menu screens have sub-menus accessed via tabs at the top of the screens.

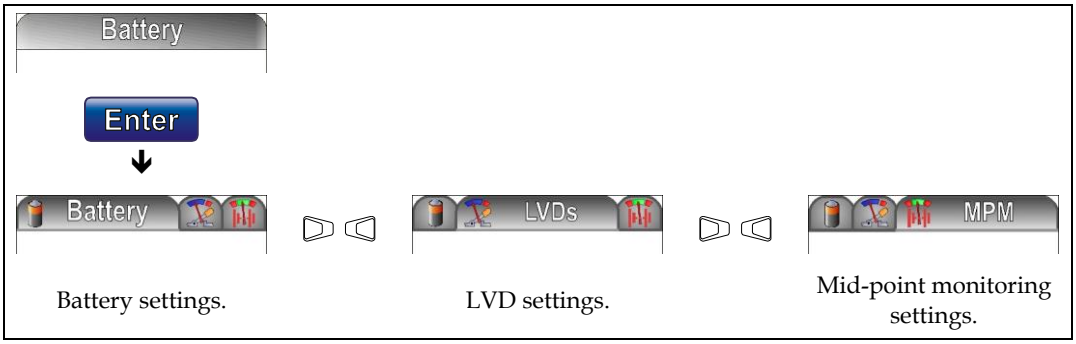
Rectifiers Sub-menus



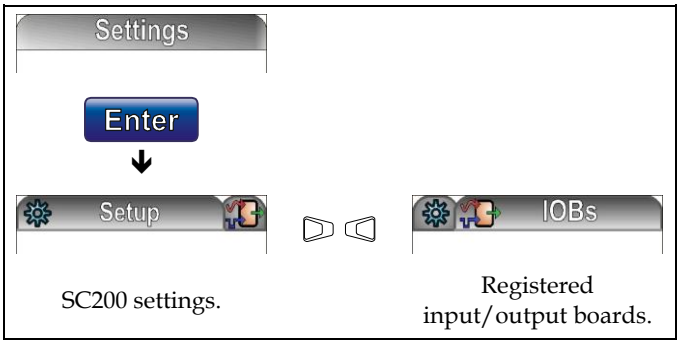
Alarms Sub-menus



Battery Sub-menus

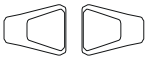


Settings Sub-menus



Changing a Configuration Setting using the Keypad

For the configuration settings that can be changed using the keypad, the keys have the following functions.

Edit	Press to change the setting or activate a control process.
	Press to change the value. Hold key to change at a faster rate.
	Use these keys for values with multiple segments (for example an IP address).
Save	Press to save the new value.
Or	
Cancel	Press to leave the value unchanged.

Keypad Access Security

This feature prevents accidental or unauthorized changes to settings from the SC200 keypad.

All access to change an SC200's settings will be lost if:

- All communications are disabled (see S3P Access on page 95 and HTTP/HTTPS Access on page 96), and
- Keypad access is *Read Only*, or *PIN Protected* and the keypad access PIN is lost.

The SC200 will continue to function, but no configuration changes can be made. Contact your Eaton dc product supplier or Eaton for advice (see Worldwide Support on page 125).

► To use DCTools/Web to enable/disable keypad access

- In DCTools/Web go to *Communications* > *Front Panel*.
- Set *Access* to:
  - *Unprotected* - keypad access is allowed to view and change parameters, or
  - *Read Only* - keypad access is allowed to view parameters only, or
  - *PIN Protected* - keypad access is allowed to view and change parameters if the correct 4-digit number is typed in the *Access PIN* field. Otherwise, *Read Only* access is allowed.

► To use the SC200 when access is set to PIN Protected

- At the Main Screen press *Menu*. The *Logon* screen appears.
- If the *Access PIN* is not known then press *Skip* to use the SC200 with *Read Only* access.
- If the *Access PIN* is known:
  - Use the Left and Right keys to access each digit position. Use the Up and Down keys to change the digits.
  - When the correct digits are entered, press *Logon*.

Keypad access will return to PIN Protected mode when the display returns to the Main Screen.

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Display Settings

► To change the display contrast

- Use the keypad to go to: *Settings* > *Setup* > *Contrast* > *Edit*.

► To change the display language

- See Language Options on page 16.

► To change the display orientation (horizontal/vertical)

Either:

- Use the keypad to go to: *Settings* > *Setup* > *Orientation* > *Edit*.
- Select the required orientation (vertical, horizontal-left or horizontal-right). Press *Save*.

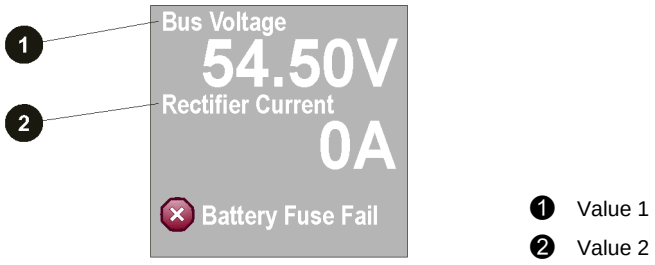
Or:

- In DCTools/Web go to: *Configuration* > *Communications* > *Front Panel*.
- Select the required orientation (vertical, horizontal-left or horizontal-right). Click *Apply*.

The functions of the navigations keys also change to suit the new display orientation.

Main Screen Parameters

The parameters displayed on the SC200 main screen are configurable. Either two large or three small parameters can be displayed. The default settings are two large parameters with the values *Bus Voltage* and *Rectifier Current*.



► To change the parameters displayed on the main screen

Either:

- Use the keypad to go to: *Settings* > *Setup (tab)* > *Display Settings* > *Main Screen Layout*.

Or:

- In DCTools/Web go to: *Configuration* > *Communications* > *Front Panel*.

- Set *Main Screen Layout* to *Two Large* or *Three Small*.
- Select the required parameters (see Note 1) for *Value 1* and *Value 2* (and *Value 3* if *Three Small* is selected).
- For each of *Value 1/2/3 Units*, select *No Units*, e.g. Battery Temp. 25, *With Value*, e.g. Battery Temp. 25°C, or *With Label*, e.g. Battery Temp. (°C) 25.
- If *Analog Input* is selected as a display parameter, then also select a value for *Value 1/2/3 Index*. See Note 2.

Notes:

1. The parameters available are: *Bus Voltage, Rectifier Current, Load Current, Battery Current, Battery Temperature, Load Power, System Power, Analog Input,* or *Ah Discharged*.
2. If *Analog Input* is selected as a display parameter, then also select a value for *Value 1/2/3 Index*. This value is the number of the AI from the *Analog Inputs* table. To view the table in DCTools/Web go to: *Analog Inputs*.

Display Time-out

If there is no keypad activity for 60 seconds the display will go back to the main screen.

Alarm Indicators

Visual indicators

	Power on LED (green)
	Minor Alarm LED (yellow)
	Critical/Major Alarm LED (red)
???	The system value cannot be displayed because of a failed, disconnected or unconfigured sensor.

Audible indicator

- One beep – indicates an invalid key press
- Three beeps every 2 seconds – refer to the alert message on the display
- One beep every 2 seconds – Minor alarm is active
- Continuous sound – Critical/Major alarm is active

Critical/Major alarms always override Minor alarms.

► To stop the audible indicator

- Press any key

The audible indicator will restart at the next active alarm or alert message.

► To enable/disable the audible alarm indicator

Either:

- Use the keypad to go to: Alarms > Alarm Settings (tab) > Audible Alarms > Edit.

Or:

- In DCTools/Web go to: *Alarms* > *Alarm Configuration*.

When Disabled, the audible indicator will still indicate an invalid key press.

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SC200 Operation Using a PC/Laptop

DCTools is configuration software for editing a system controller's configuration file (on-line) and monitoring the operation of Eaton's dc power systems. It is available free from dcpower.eaton.com/downloads.

DCTools can be run on a PC/laptop connected to the SC200's USB port.

DCTools can also be run on a remote PC/laptop connected to the SC200's RS232 serial port (via a modem) or Ethernet port. For remote PC/laptop connection details see Communications Options on page 82.

Before you start you will need:

- The latest version of *DCTools* available from dcpower.eaton.com/downloads.
- A PC/laptop with USB port and USB A/B cable (RadioShack 55010997, Jaycar WC7700, or equivalent).

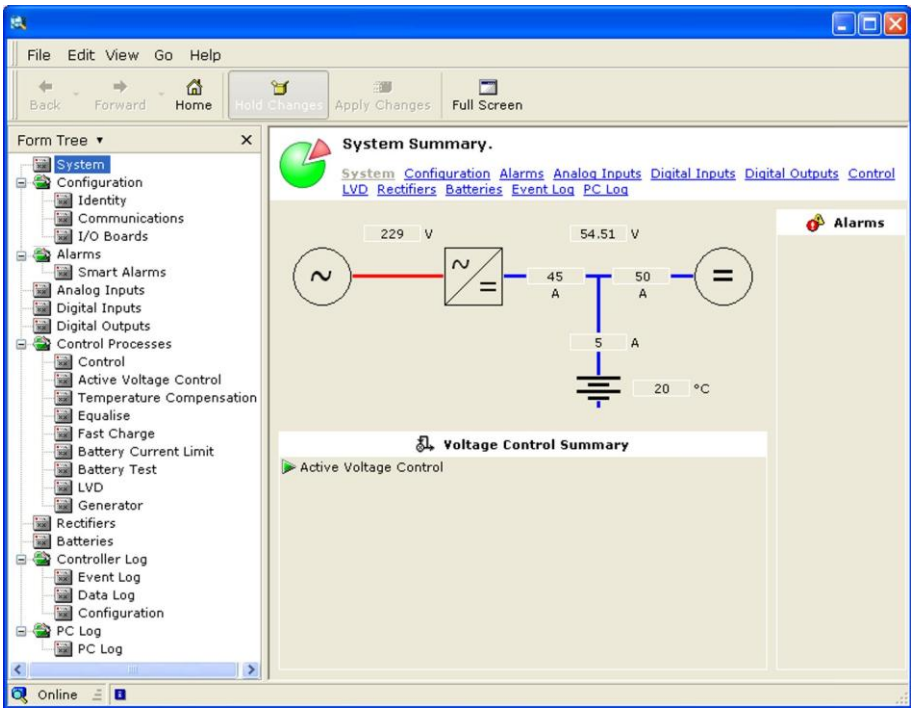
► To connect a PC/laptop to the SC200:

1. Download the latest version of *DCTools* from dcpower.eaton.com/downloads.
2. Install *DCTools* on the PC/laptop.
3. Connect a USB A/B cable from a USB port on the PC/laptop to the USB port on the SC200.

   See the diagram on page 2 for location of the USB port.
4. *DCTools* will now connect to the SC200.

   If connection is not successful refer to DCTools Help (press F1) or Troubleshooting on page 100.
5. For details of the SC200 control and monitoring functions available via *DCTools see* System Operation on page 21.

   For help using DCTools press F1.



SC200 Identity Information

The following identity information is stored in the SC200.

Parameter	Description	Where to find:
Serial Number	The SC200 serial number (factory set).	SC200: Info
Software Version (App Version)	The version of the embedded software in the SC200 (factory set).	DCTools/Web: Configuration > Identity > Software

If required, the following site specific information can be stored in the SC200 to assist site management.

Parameter	Description	Where to find:
System Manufacturer	The manufacturer of the dc power system.	DCTools/Web: Configuration > Identity
System Type	The dc power system model number.	
System Serial Number	The dc power system serial number.	
System Location	Location of dc power system at the site.	
Site Name	Name of the site.	
Site Address	Address of the site.	
Site Notes	Any notes relevant to site access, location or other matters.	
Contact	Contact name, phone number, and so on.	
Configuration Name	Reference name of the configuration file in the SC200.	

SC200 Internal Clock

The SC200 has a battery-backed clock for time stamping of log entries and Control Processes.

The time and date is factory set. It can also be set manually using a web browser or can be synchronized (either to a PC clock using DCTools or to an SNTP reference time server).

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► To view the SC200 time

Either:

- Use the keypad to go to: *Info*.

  This time is set to Universal Coordinated Time (UTC). DCTools, Web and PowerManagerII convert local PC time to/from UTC for the SC200. For practical purposes UTC is equivalent to Greenwich Mean Time (GMT).

Or:

- In DCTools go to: *Configuration* > *Identity*.

  This time is set to the SC200 time adjusted to the time zone set in the PC.

Or:

- In Web go to: *Configuration* > *Time*.

  This time is set to the SC200 time adjusted to the time zone set in the PC.

► To set the time

1. Connect to the SC200 via a web browser. (See Ethernet Communications on page 82.)
2. Go to *Configuration* > *Time.*
3. Click on the time-date field to select the text.
4. Select the time or date text to be changed and type the correct time/date.
5. Press *Enter* on the keyboard. Then select *Apply* in the *Changes* window.

Time Synchronization

If required, the SC200 time can be synchronized either to the internal time of a PC or laptop, or to a reference time server using SNTP protocol (SC200 must have access to the server).

► To synchronize the SC200 time using *DCTools* or *PowerManagerII*

1. Ensure the time on the PC is correct before synchronizing.

   PowerManagerII can be set to automatically synchronize SC200 clocks.
2. Connect to the SC200 with *DCTools/PowerManagerII*. (See Communications Options on page 82.)
3. Go to *Configuration* >*Identity* > *Time Synchronization*
4. Click *Synchronize* to synchronize the SC200 time to the PC/laptop time.

   DCTools, Web and PowerManagerII convert local PC time to/from UTC for the SC200.

► To synchronize the SC200 time using SNTP

For more information on SNTP, including a list of public SNTP servers, visit www.ntp.org http://www.ntp.org.

Ensure that your network has an internal SNTP server or allows access to an external server. It may be necessary to configure access through your network's firewall.

1. Connect to the SC200 via DCTools/Web.
2. Either:
   In DCTools go to *Configuration* > *Configuration* > *SNTP*, or
   In Web go to *Configuration* > *Time* > *SNTP.*

3 Set the following parameters:

Primary Address	IP address of primary SNTP server.
Backup Address	IP address of backup SNTP server.
UDP Port	Assigned by the time server administrator.
Poll Interval	The time between synchronizations.

The time will update a few seconds after any SNTP parameter change.

Language Options

The SC200 system controller language default is English. Text on the LCD and web pages (see details on page 84) can be shown in other languages by loading the appropriate Translation File (SC200-xx-Vyyy.icp) into the SC200.

Contact Eaton for available Translation Files (see Worldwide Support on page 125).

This process does not change the language in DCTools.

► **To add a new SC200 display/web page language:**

1 Obtain the appropriate Translation File (SC200-xx-Vyyy.icp) from Eaton.
2 Save the file.
3 Connect to the SC200 via an Ethernet connection. See Communications Options on page 82.
4 Open a web browser and browse to the SC200 IP address.
5 Go to *Tools* > *Firmware Upgrade*.
6 Click on *Browse* and select the Translation File (SC200-xx-Vyyy.icp).
7 Click on *Next* then follow the prompts to add the language.

Language selection

An SC200 can hold multiple language files and any of these can be selected for the LCD and Web pages.

► **To see which languages are loaded into an SC200**

Either:

- On the SC200 keypad go to: *Settings* > *Language* > *Edit*.

Or:

- Connect to the SC200 via an Ethernet connection. See Communications Options on page 82.
- On the *Log On* web page, there is a flag icon for each language option available.

► **To select a new language for the Web pages**

- On the *Log On* web page, click on the flag icon for the language you require.
- The web pages will change to this language.

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► **To select a new language for the SC200 display**

Either:

- On the SC200 keypad go to: *Settings* > *Language* > *Edit*.
- Select the required language and press *Save*.

Or:

- In DCTools/Web go to *Communications* > *Front Panel*.
- Type the two letter language code in the *Language Code* field.

  This code is the "xx" in the file name of the Translation File (SC200-xx-Vyyy.icp). For example: zh = Chinese. Clear the Language Code field (blank entry) to revert to English.

- Click *Apply Changes*. The display language will change.

  The message "Waiting for database to become available for update ..." may display for a few seconds.
  If an incorrect or unavailable language code is used the display language will remain/revert to English.

SC200 Firmware Upgrade

If required, the embedded software (firmware) in the SC200 can be upgraded from a PC/laptop via a web browser.

► **To use a web browser for a Firmware Upgrade**

1. Connect to the SC200 via a web browser. (For details see Ethernet Communications on page 82.)
2. Check the SC200 internal clock shows the correct time. If necessary set the correct time. See SC200 Internal Clock on page 14.
3. Go to *Tools*.
4. Select *Firmware Upgrade: Launch*.
5. Select the file (*.icp). Click *Next*, then click *Proceed*.

- Some configuration settings may be lost when the firmware in the SC200 is upgraded. Refer to the new firmware Product Release Notes for details of specific configuration settings that are affected. Check the configuration after upgrading. Backup any changes to the configuration.
- It is likely that configuration settings will be lost if the firmware in the SC200 is downgraded. If a firmware downgrade is required, trial the downgrade and check the configuration before implementing it at a site.

Configuration File

The operational settings of the dc power system are stored in a configuration file loaded into the SC200 system controller.

The SC200 is supplied pre-loaded with a configuration file. If this configuration file has been customized for the site then no further configuration changes will be necessary.

Otherwise, it is important that the settings of this configuration file are checked and changed as required for site-specific conditions. In particular, settings that may affect the performance and life expectancy of the battery must be checked and set according to the battery manufacturer's recommendations.

Some settings in the configuration file can be edited using the system controller's keypad (see details on page 6), or all settings can be edited using a PC/laptop with DCTools/Web (see details on page 13) or remotely, see Communications Options on page 82.

The configuration file settings in the SC200 can be saved to (Backup) or loaded from (Restore) a PC/laptop using DCTools/Web. See Backup and Restore on page 18.

Backup and Restore

The configuration file settings in the SC200 can be saved to (Backup) or loaded from (Restore) a PC/laptop using DCTools/Web.

Backup and Restore can be used to:

- Load a standard (master) configuration file into an SC200 for customization.
- Copy a customized configuration file from one SC200 to others (at similar sites).
- Save a copy of a customized configuration file. This is recommended in case the SC200 has to be replaced.

► To use DCTools for Backup and Restore

1. Connect to the SC200 with DCTools. See Communications Options on page 82.
2. In DCTools go to *File* > *ICE Backup/Restore* and follow the prompts.

The saved file does not include site specific settings including Site Identity, IP Address, S3P Address, battery characterization data.

► To use a web browser for Backup

1. Connect to the SC200 via a web browser. For details see Ethernet Communications on page 82.
2. Go to *Tools*.
3. Select *Backup Tool*.
4. Select the file type:
   - **System Snapshot (*.dcs):** Configuration file including site specific settings.
   - **Configuration (*.dcc):** Configuration file without site specific settings - Site Identity, IP Address, S3P Address, battery characterization data).
5. Click *Proceed* to Backup the configuration.

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► **To use a web browser for Restore**

1. Connect to the SC200 via a web browser. For details see Ethernet Communications on page 82.
2. Go to *Tools*.
3. Select *Restore Tool*.
4. Select the file type:
   - **System Snapshot (*.dcs):** Configuration file including site specific settings.
   - **Configuration (*.dcc):** Configuration file without site specific settings - Site Identity, IP Address, S3P Address, battery characterization data).
   - **Fragment (*.dcf):** Restore part of a configuration file (such as battery characterization data).
5. Click *Next*, and then select a file name to *Restore* a configuration.

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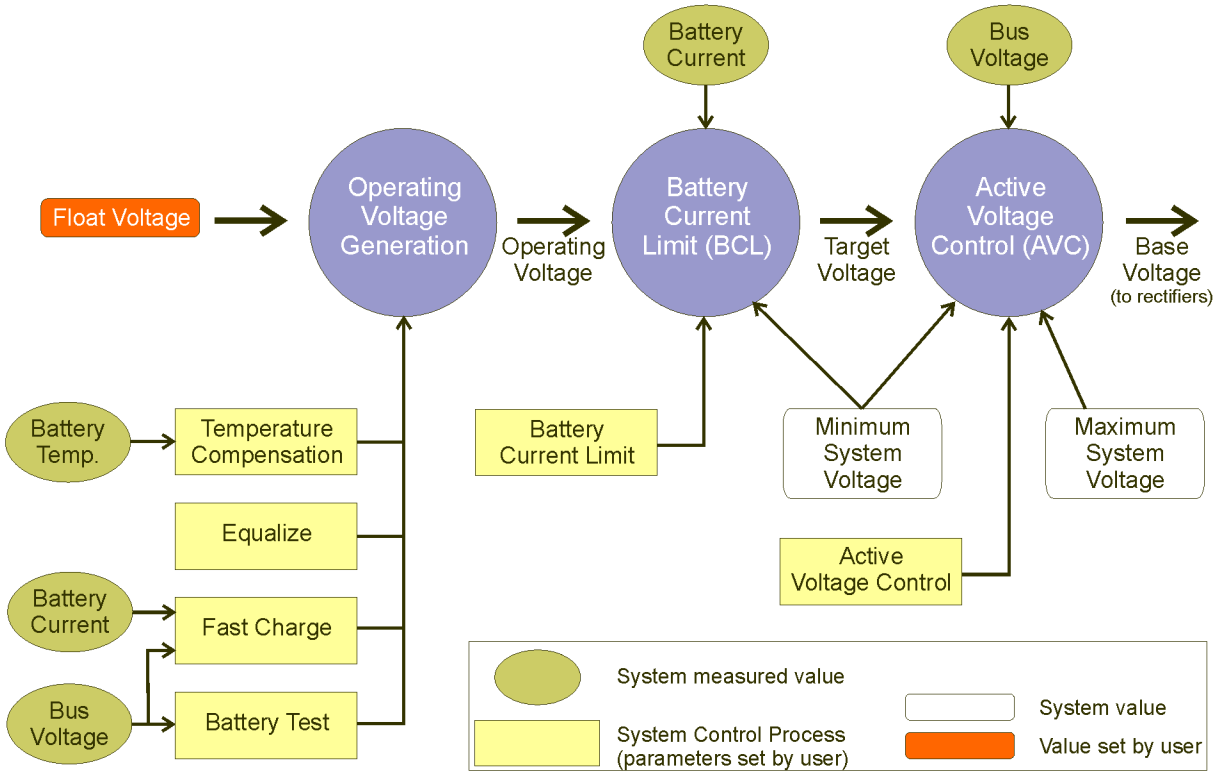
Overview

Voltage Control

The output voltage of the rectifiers is controlled by a number of control processes. The following diagram shows the various control processes, measured values and operating values that determine the rectifier output voltage.

If ac fails then any active control process stops. No control process can start until the ac supply is restored.



Float Voltage

Configuration

Set the following parameter.

Parameter	Description	Where to find:
Float Voltage	Set to the voltage required to maintain optimum battery charge (at the nominal ambient temperature*) as specified by the battery manufacturer. The bus voltage may be adjusted above or below this value by the System Control Processes. *This is the same as the Reference Temperature used by Temperature Compensation. See details on page 30.*	SC200: Control Processes > Voltage Control > Float Voltage DCTools/Web: Control Processes > Voltage Control

The system voltage is limited by maximum and minimum values. The values are viewable in DCTools/Web at Control Processes > Voltage Control. These values are not configurable.

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Active Voltage Control (AVC)

Active Voltage Control maintains a constant float voltage under varying load current by monitoring the bus voltage and adjusting the rectifier output voltage to compensate for any voltage drop. This prevents undercharging the batteries during high load demand.

► **To enable Active Voltage Control**

- Use the SC200 keypad to go to: Control Processes > Voltage Control > AVC.
- Or, in DCTools/Web go to: Control Processes > Voltage Control > Active Voltage Control.

Active Voltage Control is normally enabled. Only disable if there are particular reasons.

Information

The following information is available about AVC.

Parameter	Description	Where to find:
State	Indicates if AVC is active or inactive.	DCTools/Web: Control Processes > Active Voltage Control
Target Voltage	AVC will set the Base Voltage to attempt to maintain the bus voltage to this value.	
Voltage Offset	The difference between the Base Voltage and the Target Voltage.	

Battery Current Limit (BCL)

Battery Current Limit automatically limits the battery recharge current to:

- Prevent excessive battery charge current in under-loaded systems
- Minimize gas release in VRLA batteries
- Reduce the load on a standby generator.

Two current limit values can be set (both are a percentage of the C10 rating of the battery):

Battery Current Limit (Normal Limit): BCL value for use when utility ac is available.

Engine Run Limit (optional): BCL value for use when ac is supplied by a standby generator. This reduces the load on the generator and allows a smaller generator to be used.

Engine Run Limit applies when the SC200 determines that an ac standby generator is running. If an Engine Run Digital Input is available (see below), then the SC200 uses this to determine if the generator is running. If an Engine Run Digital Input is not available then the SC200 uses other values to determine if the generator is running.

► **To enable BCL**

- Use the SC200 keypad to go to: *Control Processes* > *Battery Current Limit.*
- Or, in DCTools/Web go to: *Control Processes* > *Battery Current Limit.*

► **To activate Engine Run BCL**

- If an Engine Run Digital Input is required, connect a voltage free relay contact (that will operate when the standby generator starts) to a Digital Input.
- In DCTools/Web go to *Digital Inputs*.
- Configure the selected Digital Input and set *Function* to *Engine Run*.
- In DCTools/Web go to *Control Processes* > *Battery Current Limit* and set the *Engine Run Limit*.

Information

The following information is available about BCL.

Parameter	Description	Where to find:
State	Indicates if BCL is active or inactive.	SC200: Control Processes > Battery Current Limit. DCTools/Web: Control Processes > Battery Current Limit
Engine Run State	Indicates if Engine Run BCL is active.	DCTools/Web: Control Processes > Battery Current Limit
Voltage Offset	The bus voltage adjustment made by Battery Current Limit is applied to the Operating Voltage to produce the Target Voltage. Target Voltage is used as the input to the AVC function.	

Configuration

Set the following parameters.

Parameter	Description	Where to find:
Battery Capacity	Set to the rated 10 hour capacity of the installed battery strings. Zero means no battery is installed.	SC200: Battery > Battery > Battery Capacity DCTools/Web: Batteries
Normal Limit	BCL maintains the battery current below this value, which is a percentage of the installed C10 Battery Capacity.	DCTools/Web: Control Processes > Battery Current Limit
Engine Run Limit	The Battery Current Limit setting when Engine Run State is active.	

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Battery Test

Battery Test is a preventative maintenance tool that monitors the discharge capabilities to ensure that the condition of the battery has not deteriorated over time.

The SC200 temporarily reduces the output voltage of the rectifiers to just below the bus voltage for a set duration. The battery then supplies power to the load. A battery test passes if the battery voltage remains above a predetermined level for the duration of the test.

Battery Tests can be scheduled to occur at regular intervals, and/or can be started/stopped manually, and/or can be started by an external relay contact or switch.

*Battery Test does **NOT** function during a Fast Charge or Equalize, or during the lock-out period after an ac supply failure.*

If a Digital Input has the function "Start Battery Test" then a Battery Test will start when the Digital Input becomes active.

► To enable Battery Test (or to start or stop a test manually)

- Use the SC200 keypad to go to: *Control Processes* > *Battery Test*.
- Or, in DCTools/Web go to: *Control Processes* > *Battery Test*

► To use an external relay contact to activate a Battery Test (optional)

- Connect a voltage free relay contact or switch to any Digital Input.
- In DCTools/Web go to *Digital Inputs*.
- Configure the selected Digital Input and set *Function* to *Start Battery Test*.

Information

The following information is available about Battery Test.

Parameter	Description	Where to find:
State	Indicates if Battery Test is disabled, locked-out, active or inactive.	SC200: Control Processes > Battery Test DCTools/Web: Control Processes > Battery Test
Next Start Time	The start time of the next scheduled Battery Test. *Time shown on SC200 is UTC. Time on PC running DCTools/Web is local time. See SC200 Internal Clock on page 14.*	
Remaining Time	The time to the end of the currently active Battery Test.	
Battery Test Lockout Remaining	The time remaining until a Battery Test can be started. Battery Tests cannot be started within 48 hours of an ac supply failure.	
Voltage Offset	The adjustment to the bus voltage being applied due to the Battery Test. While a Battery Test is running, the rectifiers are turned down to force the battery to carry the load.	

Configuration

Set the following parameters.

Parameter	Description	Where to find:
First Start Time	The date and time that the first battery test cycle will occur. Subsequent tests will occur at every Battery Test Interval after that.	SC200: Control Processes > Battery Test DCTools/Web: Control Processes > Battery Test
Interval	The time between scheduled battery tests. The interval period begins at the start of a battery test. Zero disables scheduled battery tests. Zero also disables the 48 hour lockout following an ac supply failure, allowing an immediate manual test.	
Test Duration	The maximum time a Battery Test process will be active. The battery test will pass if the bus voltage remains above the Battery Test Termination Voltage for the duration of the test.	
Termination Voltage	If the bus voltages drops below this value during a Battery Test, then the test fails.	

Equalize

Equalize charges batteries at a higher voltage after they have been fully charged to ensure that all individual cell voltages are the same, that electrolyte is distributed evenly, and that sulfate crystal buildup on the plates is reduced.

Equalize can be scheduled to occur at regular intervals and/or can be started/stopped manually.

- *Refer to the battery manufacturer's instructions before using Equalize.*
- *If a Digital Input has the function "Start Equalize" then a manual equalize cycle will start when the Digital Input becomes active.*

If Equalize cannot start at the scheduled time (for example when there is no ac supply) then its state will be Pending and it will start as soon as conditions allow. Use Stop Equalize to cancel a Pending Equalize.

► To enable Equalize (or to start or stop Equalize manually)

- Use the SC200 keypad to go to: *Control Processes* > *Equalize*.
- Or, in DCTools/Web go to: *Control Processes* > *Equalize*.

► To use an external relay contact to activate an Equalize (optional)

- Connect a voltage free relay contact or switch to any Digital Input.
- In DCTools/Web go to: *Digital Inputs*.
- Configure the selected Digital Input and set *Function* to *Start Equalize*.

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Information

The following information is available about Equalize.

Parameter	Description	Where to find:
State	Indicates if Equalize is Disabled, Active, Inactive or Pending.	SC200: Control Processes > Equalize DCTools/Web: Control Processes > Equalize
Next Start Time	The start time of the next scheduled Equalize. *Time shown on SC200 is UTC. Time on PC running DCTools/Web is local time. See SC200 Internal Clock on page 14.*	
Remaining Time	The time to the end of the currently active Equalize.	
Voltage Offset	The adjustment to the bus voltage being applied due to the Equalize.	

Configuration

Set the following parameters.

Parameter	Description	Where to find:
First Start Time	The date and time that the first scheduled Equalize will occur. Subsequent Equalize will occur at every Equalize Interval after that.	SC200: Control Processes > Equalize DCTools/Web: Control Processes > Equalize
Interval	The time between scheduled Equalize. The interval period begins at the start of an Equalize. Zero disables scheduled Equalizes.	
Duration	The duration of a scheduled Equalize. Use the value recommended by the battery manufacturer.	
Equalize Voltage	The bus voltage maintained during an Equalize cycle. Use the value recommended by the battery manufacturer. The bus voltage is further adjusted by Temperature Compensation.	

Equalize may also be used to trigger the Generator Control Output. See details on page 65.

Fast Charge

Fast Charge automatically increases the float voltage of the power system to recharge the batteries as quickly as possible after a prolonged battery discharge.

*Fast Charge does **NOT** function during a Battery Test, Equalize or if the battery current sensor fails.*

If Fast Charge is used then Battery Current Limit (BCL) should also be used. See Battery Current Limit on page 23 for details.

If Fast Charge cannot start at the scheduled time (for example when there is no ac supply) then its state will be Pending and it will start as soon as conditions allow. Use Stop Fast Charge to cancel a Pending Fast Charge.

► **To enable Fast Charge (or to stop Fast Charge manually)**

- Use the SC200 keypad to go to: *Control Processes* > *Fast Charge*.
- Or, in DCTools/Web go to: *Control Processes* > *Fast Charge*.

Information

The following information is available about Fast Charge.

Parameter	Description	Where to find:
State	Indicates if Fast Charge is Disabled, Active, Inactive or Pending.	SC200: Control Processes > Fast Charge DCTools/Web: Control Processes > Fast Charge
Ah Discharged	The current level of battery discharge. A Fast Charge cycle is started if this value is above the Ah Threshold. *See also Reset Battery State on page 63.*	
Maximum Time Remaining	The maximum time to the end of the currently active Fast Charge.	
Voltage Offset	The adjustment to the bus voltage being applied due to the Fast Charge.	

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Configuration

Set the following parameters.

Parameter	Description	Where to find:
Voltage Threshold	If the bus voltage drops below this value during an ac supply failure, then *Fast Charge* starts when the ac supply is restored. Fast charge can also be started based on the *Start Ah Threshold*.	SC200: Control Processes > Fast Charge DCTools/Web: Control Processes > Fast Charge
Start Ah Threshold	If *Ah Discharged* exceeds this value during an ac supply failure, then *Fast Charge* starts when the ac supply is restored. The threshold is given as a percentage of installed C10 battery capacity. *Fast charge* can also be started based on the *Voltage Threshold*.	
Recharge Percentage (%)	The ratio of ampere-hours recharged to the ampere-hours discharged. *Fast Charge* stops either when the Ah recharged equals the Ah discharged x *Recharge Percentage*, or after *Maximum Duration*. *Recharge Percentage* only applies if *Stop Ah Threshold* is set to zero.	
Maximum Duration	Set *Maximum Duration* so that the battery will fully charge but not overcharge.	
Stop Ah Threshold	This value is set so that *Fast Charge* will stop before the battery is fully charged. This is used when *Fast Charge* is used to control a generator and the generator should be stopped before the battery is fully charged (thereby saving fuel). *Stop Ah Threshold* is the discharge percentage at which the charging stops, e.g. 10% means that *Fast Charge* will stop when the battery is 90% charged. If *Fast Charge* is not used to control a generator then this value should be set to zero.	
Fast Charge Voltage	The bus voltage maintained during a *Fast Charge*.	
Battery Capacity	The rated 10 hour capacity of the installed battery strings. Zero means no battery is installed.	SC200: Battery > Battery > Battery Capacity DCTools/Web: Batteries

Fast Charge may also be used to trigger the Generator Control Output. *See details on page 65.*

To avoid excessive fuel use or shortened battery life, it is important that the settings are correct in a hybrid generator/battery power system (cyclic charge/discharge).

- *Voltage Threshold* should be set so that when a fully charged battery is discharged, the *Start Ah Threshold* is reached before the *Voltage Threshold*.
- *Maximum Duration* should be set so that in a typical recharge, *Ah Discharged* reaches zero before *Maximum Duration* is reached.
- Master Configuration files will typically meet these requirements, but the values must be checked against battery discharge/recharge curves in the cyclic application.

So that an incorrect Ah Discharged value does not affect cyclic battery charging in a hybrid generator/battery power system, an incorrect Ah Discharged value will be corrected after one discharge/recharge cycle:

- *Ah Discharged* is set to zero when the recharge reaches *Maximum Duration* (and the battery is assumed to be fully charged).
- *Ah Discharged* is set to the *Start Ah Threshold* when the battery discharges down to the *Voltage Threshold*.

Temperature Compensation

As the ambient temperature of a battery drops (or rises) the voltage required to maintain full charge increases (or decreases). Temperature Compensation automatically varies the float voltage to cancel the effects of changing temperature.

Enable Temperature Compensation for optimum battery life and battery capacity over a wider temperature range.

*Temperature Compensation does **NOT** function during a Battery Test.*

► To enable Temperature Compensation

- Use the SC200 keypad to go to: *Control Processes* > *Temp. Compensation* > *Enable*.
- Or, in DCTools/Web go to: *Control Processes* > *Temperature Compensation*.

Information

The following information is available about Temperature Compensation.

Parameter	Description	Where to find:
State	Indicates if Temperature Compensation is active or inactive.	SC200: Control Processes > Temp. Compensation > Enable DCTools/Web: Control Processes > Temperature Compensation
Voltage Offset	The adjustment to the bus voltage being applied due to the Temperature Compensation. Offset is zero when the battery temperature equals the reference temperature.	
Battery Temperature	The temperature measured by the battery temperature sensor.	SC200: Analogs > Battery Temperature DCTools/Web: Batteries

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Configuration

Set the following parameters.

Parameter	Description	Where to find:
Cells Per String	The number of 2V cells per battery string (for example: 24 in a 48V nominal system).	SC200: Battery > Battery DCTools/Web: Batteries
Slope	Bus voltage adjustment rate. Use the value recommended by the battery manufacturer.	SC200: Control Processes > Temp. Compensation > Enable DCTools/Web: Control Processes > Temperature Compensation
Reference Temp	The temperature where no voltage adjustment is applied. Refer also to Float Voltage on page 22.	
Upper Limit	No additional voltage adjustment is made above this temperature.	
Lower Limit	No additional voltage adjustment is made below this temperature.	

Rectifiers

The SC200 registers all rectifier modules as they are inserted into the dc power system.

Information

The following information is available about rectifiers.

Parameter	Description	Where to find:
State	Registered - communicating with the SC200. Un-registered - there is a rectifier compatibility or communications problem.	SC200: Rectifiers > Enter (Use Left and Right keys to scroll to other rectifiers) DCTools/Web: Rectifiers
Serial Number (S/N)	Rectifier serial number.	
Load Based Run Time	The time the rectifier has been operating since it was registered.	
AC Voltage	The ac voltage measured by the rectifier (single-phase rectifiers only).	
Phase Voltages	The ac phase voltages measured by the rectifier (three-phase rectifiers only).	
Voltage	Rectifier's dc output voltage.	
Current	Rectifier's output current.	
Heatsink Temp	The measured rectifier heatsink temperature.	
Max Power (Limit)	Rectifier's maximum output power (factory set).	
Power	Rectifier output power as a percentage of Max. Power Limit.	DCTools/Web: Rectifiers
Max Current Limit	The maximum current limit value of the rectifier. ☐ *Adjust Rectifier Current Limit to set a lower operating current limit.*	
Min OVSD Set Point	The minimum Over Voltage Shut Down set point that the rectifier accepts.	
Max OVSD Set Point	The maximum Over Voltage Shut Down set point that the rectifier accepts.	
Status	Information about rectifier alarms.	
Type	Rectifier manufacturer's model number.	SC200: Rectifiers > Enter (Use Left and Right keys to scroll to other rectifiers)
Software Version	Version of rectifier embedded software.	

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Common Rectifier Configuration

The following parameters (common to all rectifiers) can be configured.

Parameter	Description	Where to find:
Rectifier (DC) Current Limit	The output current limit of the rectifier. If set to zero, then the output current limit is maximum.	SC200: Rectifiers > Rect. Settings DCTools/Web: Rectifiers
AC Rectifier Current Limit	The input current limit of the rectifier. If set to zero, then the input current limit is maximum.	
Rectifier Current Share	Current Share ensures that the total output power of the power system is evenly shared between all rectifiers. Set to *Enabled* unless there is a specific reason to disable.	
OVSD Set Point	Over Voltage Shut Down. A rectifier will shut down if its output voltage exceeds this value. *Recommended value is 59.2V for 48V nominal systems, 28.6V for 24V nominal systems.*	DCTools/Web: Rectifiers
Ramp Up Slope	The ramp-up slope of the rectifier, as a percentage of the rectifier rated current.	
Start Up Delay	The delay from ac turn-on before the rectifier output turns on.	

See Voltage Control on page 22 for details of the rectifier's output voltage control.

Identify a Rectifier

The rectifier's registration number does not correspond to a physical position in the dc power system.

► To identify a rectifier

Either:

- On SC200 keypad go to: *Rectifiers* > *Rectifier number*. Press *Enter*.
  The rectifier details screen appears. Use ▷ ◁ to scroll to other rectifiers.
- All LEDs on the selected rectifier will flash for 60 seconds, or press *Esc* to stop.

Or:

- In DCTools/Web go to: *Configuration* > *RXP* > *RXP Devices*.
- DCTools: select *Identify Device* or Web: click on *Start Identifying*.
- All LEDs on the selected rectifier will flash for 60 seconds.

Rectifier serial numbers are printed on a label on the front of each rectifier.

Rectifier Comms Lost Alarm

When a rectifier is removed (or a fault interrupts rectifier communications), the SC200 will display an alert message and sound an alert alarm (if *Audible Alarms* are enabled). After the *Alarm Recognition Period*, a *Rectifier Comms Lost* alarm will activate.

A Multiple Rectifier Comms Lost alarm will activate (after the Alarm Recognition Period) *if more than one rectifier is affected.*

► To prevent a *Rectifier Comms Lost* alarm when a rectifier is removed

Press any key within the *Alarm Recognition Period*, to cancel the alert.

Rectifier Shutdown

Rectifier shutdown can be disabled, controlled manually, or controlled automatically based on the total rectifier load current (see Load Based Rectifier Shutdown on page 35).

► To disable Rectifier Shutdown

- Use the SC200 keypad to go to: Rectifiers > Settings (tab) > set Rectifier Shutdown to Disabled.
- Or, in DCTools/Web go to: Rectifiers > Configuration> set Shutdown to Disabled.

Manual Rectifier Shutdown

► To shut down a rectifier

- In DCTools/Web go to: *Rectifiers* > *Configuration*.
- Set *Shutdown* to *Manual*.
- In the *Rectifiers* table select the *Shutdown* check box (DCTools) or click Shutdown (Web).
- The rectifier will shut down and the yellow LED will be on.

This function will normally only be used for testing purposes. When the testing is complete, set Shutdown *back to its previous setting (*Disabled *or* Automatic*).*

Rectifier Restart

► To restart all shutdown rectifiers

- Use the SC200 keypad to go to: Rectifiers > Rect. Settings (tab) > Restart All Rectifiers.
- Or, in DCTools/Web go to: *Rectifiers*. Click *Restart All.*

► To restart individual rectifiers

- In DCTools/Web go to: *Rectifiers*.
- For each rectifier clear the *Shutdown* check box (DCTools) or click Startup (Web).

The rectifier(s) will then resume normal operation.

The SC200 will restart any shutdown rectifiers if: ac has failed, or more than one rectifier has failed, or the bus voltage is below the Low Load threshold, or Rectifier Shutdown is set to Disabled, or Rectifier Shutdown is set to Automatic.

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Load Based Rectifier Shutdown

Load Based Rectifier Shutdown is not available with APR48-3G (prior to PR5), EPR48-3G, APR24-3G and CR48-3G rectifiers.

If Load Based Rectifier Shutdown (LBRS) is enabled by setting *Shutdown* to *Automatic* then the SC200 automatically shuts down rectifiers when the total load current is significantly less than the total rectifier capacity.

This raises the average load on the remaining rectifiers which will then operate at a higher efficiency. This results in a decrease in system power consumption.

The SC200 shuts down APR48-3G PR5 rectifiers before the more efficient APR48-ES rectifiers.

The run time of all rectifiers is recorded and the usage within each group of rectifiers (APR48-3G PR5s and APR48-ESs) is balanced to ensure even aging.

The SC200 will progressively restart rectifiers (starting with any shut down APR48-ES rectifiers) if the load increases.

Rectifiers shut down by LBRS will have the yellow LED on.

At least two rectifiers will always be on to maintain N+1 rectifier redundancy. Therefore, LBRS has no effect in dc power systems with only one or two rectifiers.

The SC200 will automatically restart all rectifiers if ac supply has failed, or more than one rectifier has failed, or Battery Test / Equalize / Fast Charge are active, or the bus voltage is below the Low Load threshold.

► To enable Load Based Rectifier Shutdown

- Use the SC200 keypad to go to: Rectifiers > Settings (tab) > set Rectifier Shutdown to Automatic.
- Or, in DCTools/Web go to: Rectifiers > set Shutdown to Automatic.

Ensure that Rectifier Start Up Delay is less than 30 seconds. See information on page 33. LBRS will not function correctly if the start up delay is more than 30 seconds.

Information

The following information is available about Load Based Rectifier Shutdown.

Parameter	Description	Where to find:
Load Based Run Time	The run time of each rectifier	DCTools/Web: Rectifiers

Configuration

The following parameters must be configured to set Load Based Rectifier Shutdown.

Parameter	Description	Where to find:
Reset Run Times	Sets the run time of all rectifiers to zero.	SC200: Rectifiers > Settings (tab) > LBRS DCTools/Web: Rectifiers > Load Based Rectifier Shutdown
High Threshold	LBRS restarts all rectifiers if the load is more than this percentage of the total rectifier capacity. Typical: 60%.	
Low Threshold	LBRS shuts down rectifiers if the load is less than this percentage of the total rectifier capacity. Typical: 40%.	
Interval	The time interval that the SC200 will cycle rectifiers when the LBRS process is active.	

Low Voltage Disconnect (LVD)

Low Voltage Disconnects may be connected either as load disconnect or battery disconnect depending on the dc power system model. They have two purposes:

- to protect a VRLA battery from deep discharge and premature failure, and/or
- to reduce the load on a battery under discharge so that high priority equipment operates for a longer time after an ac supply failure.

The SC200 has 16 independent LVD control channels (LVD 1 to LVD 16). Each channel can control one or more of up to 16 contactors, with coil voltages from 12V to 48V nominal.

There are two contactor connectors on an IOBGP input/output board. Additional contactors are controlled by additional IOBGP-01 input/output boards. If required, refer to the dc power system Installation and Operation Guide for details on how to connect additional IOBGP-01 input/output boards to the SC200.

LVD Disconnect Modes

The LVD control channels can have any combination of the following modes of operation:

1. **Voltage Based Disconnect**: The LVD control channel will disconnect its contactor(s) based on the bus voltage.
2. **AC Timer Based Disconnect**: The LVD control channel will disconnect its contactor(s) after a specified period of ac supply failure.
3. **Smart Alarm Disconnect**: The LVD control channel will disconnect its contactor(s) according to the state of a specified *Smart Alarm*. See *Smart Alarm Disconnect* on page 42.

If *Chained to Previous* is enabled, the LVD control channel will only disconnect its contactor(s) if one of its disconnect conditions is *True*, and the preceding control channel has been disconnected for the *Recognition Time*.

Chained to Previous does not apply to LVD 1.

LVD Default and Custom Configuration

If factory-fitted in the dc power system, the LVD contactors will be characterized and the LVD control channels will have default configuration settings for *Voltage Based Disconnect*. Custom configuration will only be necessary if:

- contactors are connected to the dc power system on site (see LVD Characterization on page 37 and LVD Setup on page 39)
- different disconnect conditions are required (see LVD Configuration on page 41).

Typical LVD Arrangements

The simplest use of an LVD is a single battery disconnect contactor.

The following diagram shows a typical arrangement of two LVDs. This arrangement allows lower priority loads to be disconnected first (contactor controlled by control channel LVD 1), either at a specified battery voltage or a specified time interval after an ac supply failure. This then prolongs battery power for the highest priority loads (contactor controlled by control channel LVD 2). The battery will be disconnected when the battery voltage reaches its minimum preset voltage.

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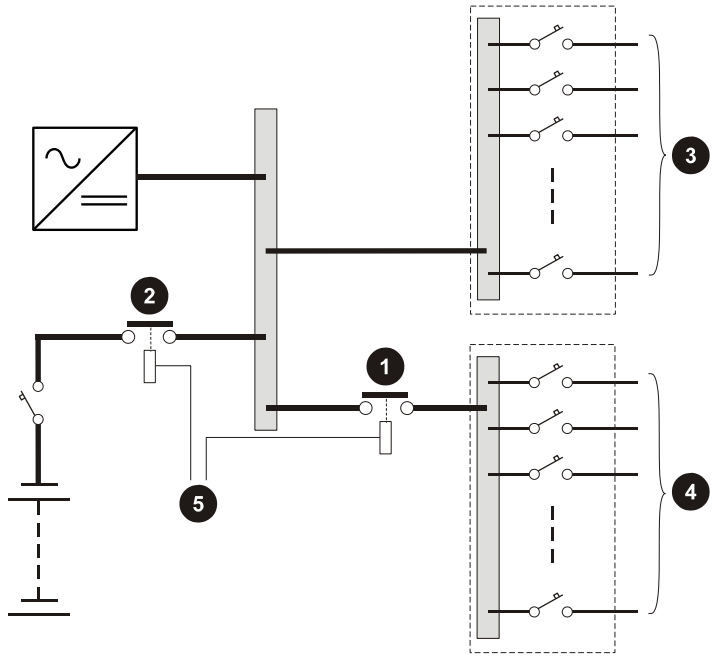

1. Contactor controlled by LVD 1 - low priority load disconnect (disconnects first).
2. Contactor controlled by LVD 2 - battery disconnect (only disconnects after LVD 1)
3. Connections to high priority loads (for example transmission equipment).
4. Connections to low priority loads.
5. Connection to the SC200 system controller via the I/O board.

More complex arrangements with up to 16 contactors and a selection of disconnection criteria, are possible with the SC200 system controller. The exact arrangement(s) used in a particular Eaton dc power system will be described in the Installation and Operation Guide.

Characterization

If auxiliary contacts are fitted to the LVD contactor(s)*, then the LVD Characterization process determines the optimum operating voltages to suit the contactor(s) coil voltage. These values are stored in the SC200 and on the I/O board.

An *LVD Characterization Error* alarm will be activated if the SC200 detects that the characterization values stored in the SC200 and on the I/O board are different. This happens when:

- The SC200 is replaced.
- The I/O Board is replaced.
- Both the SC200 and the I/O Board are replaced.

LVD Characterization Error alarms can only be cleared from the SC200 front panel, not using DCTools/Web.

- To clear the alarm when the SC200 is replaced, on the SC200 go to *Alarms*, select the *LVD Character. Err.* active alarm and press *Details*, select *Clear* and press *Enter*, select *Characterize with IOB Values* and press *Save*.
- To clear the alarm when the I/O Board is replaced, on the SC200 go to *Alarms*, select the *LVD Character. Err.* active alarm and press *Details*, select *Clear* and press *Enter*, select *Characterize with SC Values* and press *Save*.
- To clear the alarm when both the SC200 and the I/O Board are replaced, go to *Alarms*, select the *LVD Character. Err.* active alarm and press *Details*, select *Clear* and press *Enter*, select *Characterize Contactor* and press *Start*.

  When a contactor is re-characterized it will disconnect and re-connect several times. Refer to Maintenance in the dc power system Installation and Operation Guide for full instructions.

Factory-fitted contactors will be characterized at the factory. If an existing contactor is replaced, characterize the new contactor from the SC200.

In this case, there will be no LVD Characterization Error alarm.

- To characterize the new contactor, go to *Battery*, go to the *LVDs* tab, select the appropriate LVD channel and press *Details*, select the appropriate contactor and press *Edit,* select *Characterization* and press *Enter*, select *Characterize Contactor* and press *Start*.

** LVD Characterization is only available for LVD contactors with auxiliary contacts. If auxiliary contacts are not fitted then the nominal LVD coil voltage must equal the dc power system nominal bus voltage. See LVD Specifications on page* ***107****.*

LVD Operation

► To allow access to LVD functions from the SC200 keypad

- In DCTools/Web go to: *Control Processes* > *LVD*.
- Select the *Allow Front Panel LVD Control* check box.

If the check box is cleared LVD functions can only be accessed using DCTools/Web.

► To manually connect or disconnect an LVD control channel

- Use the SC200 keypad to go to: *Battery* > *LVDs* > *LVD 1 - LVD 16* > *Details* > *Manual Control.*
- Select *Connect or Disconnect* to connect or disconnect the channel (and all mapped contactors).

  The contactor(s) will remain in the selected state until another state or Auto is selected.
- Select *Auto* to return the LVD control channel to automatic operation.

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Information

The following information is available about LVD control channels and contactors.

Parameter	Description	Where to find:
LVD Control Channel State	**Connected:** all of the channel's disconnect conditions are false. All mapped contactors are connected (contacts closed). **Disconnected:** one of the channel's disconnect conditions is true. All mapped contactors are disconnected (contacts open). **Manual:** The LVD is under manual control from the SC200 keypad (see previous section). **No Contactors:** there are no contactors mapped to this channel. **Idle:** The LVD has not yet connected or disconnected.	SC200: Battery > LVDs DCTools/Web: Control Processes > LVD
LVD Control Channel Inhibited	Indicates if the LVD cannot change state due to the *Inhibit Period*.	
Contactor State	**Disabled:** contactor cannot be operated **Connected**: contactor is connected (contacts closed) **Disconnected:** contactor is disconnected (contacts open) **Failed:** contactor is not connected to the I/O board or is faulty. **Conflict:** two contactors are mapped to the same I/O board connector. **Not Characterized:** the contactor must be characterized (see details on page 37).	

LVD Setup

Use the following procedures to enable or add an LVD control channel.

☐ *For SC200s upgraded from software v2.57 or earlier only:*
The software upgrade preserves the original LVD1 and LVD2 alarms (for backwards compatibility). However, these alarms will not operate with LVD 3 or higher. Before adding LVD 3, 4 and so on., enable and configure the generic LVD alarms (LVD Manual, LVD Fail, LVD Disconnected, LVD Characterization) and disable the specific LVD1 and LVD2 alarms.

► To Enable (Add) an LVD control channel using the SC200 keypad

Control and configuration of LVDs and contactors is only available from the SC200 keypad if Allow Front Panel LVD Control is TRUE. See LVD Operation on page 38.

1. Go to: *Battery* > *LVDs*.
2. If there are no LVD control channels (LVD 1, LVD 2, ...) listed then go to Step 4.
3. For each LVD control channel select *Details*. Note the contactors operated by each channel.

   The contactor numbers (1-1, 1-2, ...) indicate the existing IOB Number - IOB Connector Number combinations.
4. Go to: *Battery* > *LVDs* > *Add LVD*.
5. From the list of registered I/O boards, select a board connected to a contactor to be operated by this LVD control channel. Select *Next*.
6. For IOBGP I/O boards (see Input/Output Board on page 2) select:
   - 1, if the contactor is connected to XH4
   - 2, if the contactor is connected to XH5.

   Warning: Do not select an existing *IOB Number - IOB Connector Number* combination (see Step 3). This will cause a conflict.
7. Select *Next*.
8. Select contactor type:
   - *Normally Open* if contacts are open when coil voltage is zero.
   - *Normally Closed* if contacts are closed when coil voltage is zero.
9. Characterize the contactor (see LVD Characterization on page 37).
10. To add additional contactors to the LVD control channel, go to *Battery* > *LVDs* > *LVD x* > *Add Contactor. Repeat Steps 5-9.*

► To Enable an LVD control channel using DCTools/Web

1. In DCTools/Web go to: *Control Processes* > *LVD*. Expand the *Logical LVDs* table:
2. Select a spare LVD control channel and configure as required. See LVD Configuration on page 41.
3. Expand the *Physical Contactors* table.
4. Select and configure the contactor(s) to be operated by the LVD control channel. See Contactor Configuration on page 42.

General Configuration Settings

Parameter	Description	Where to find:
Inhibit Period	The minimum time an LVD stays connected or disconnected before it can change state. Does not apply to manual operation.	SC200: Battery > LVDs DCTools/Web: Control Processes > LVD
Allow Front Panel LVD Control	Disables LVD control from the system controller front panel.	DCTools/Web: Control Processes > LVD

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Control Channel Configuration

Parameter	Description	Where to find:
Voltage Based Disconnect	If *Enabled*, the LVD will disconnect if the bus voltage has been below the *Disconnect Voltage* for the *Recognition Time* and reconnect if the bus voltage has been above the *Reconnect Voltage* for the *Recognition Time.*	SC200: Battery > LVDs > LVD x > Settings DCTools/Web: Control Processes > LVD > Logical LVDs
Disconnect Voltage	See *Voltage Based Disconnect*.	
Reconnect Voltage*	See *Voltage Based Disconnect*.	
Recognition Time	See *Voltage Based Disconnect* and *Chained To Previous*.	
AC Timer Based Disconnect	If *Enabled*, then during an ac supply failure the LVD will disconnect after the *AC Timer Delay*, even if the *Disconnect Voltage* has not been reached.	
AC Timer Delay	See *AC Timer Based Disconnect*.	
Smart Alarm Based Disconnect	If *Enabled*, the LVD will disconnect when the *Smart Alarm* specified by *Smart Alarm Index* becomes active. *See Smart Alarm Disconnect on page 42.*	
Smart Alarm Index	See *Smart Alarm Based Disconnect*.	
Chained To Previous (Chaining)	If *Enabled*, the LVD channel will only disconnect if one of its disconnect conditions is true and the preceding LVD channel has been disconnected for the *Recognition Time.* This applies in reverse when reconnecting. *Does not apply to LVD 1.*	

** If the LVD channel operates contactors used as a load-disconnect, ensure the Reconnect Voltage is set higher than the expected open-circuit recovery voltage of the discharged batteries.*

Contactor Configuration

Parameter	Description	Where to find:
LVD Num	Set to the number of the LVD control channel that will operate this contactor. *In DCTools/Web, number is from first column of the* Logical LVDs *table.*	SC200: See LVD Setup on page 39. DCTools/Web: Control Processes > LVD > Physical Contactors
Enable	Set to *Enabled* for this contactor to be operated (connected and disconnected). *If a connected contactor (contacts closed) is Disabled, it will remain connected unless the coil is disconnected from the I/O board or the I/O board loses power.*	
IOB Number (On IOB)	Set to the number of the I/O board from the *I/O Board to Serial Number Mapping* table. *See I/O Board Mapping on page 119.*	SC200: Battery > LVDs > LVD x > Contactors (x-1, x-2, ...) > Edit DCTools/Web: Control Processes > LVD > Physical Contactors
IOB LVD Number (LVD Connector)	For IOBGP I/O boards, set to: • 1, if the contactor is connected to XH4 • 2, if the contactor is connected to XH5. *See Input/Output Board on page 2.*	
Type	Set according to the type of contactor: • *Normally Open* if contacts are open when coil voltage is zero. • *Normally Closed* if contacts are closed when coil voltage is zero. *Normally closed LVD contacts require special system wiring when used to disconnect the battery.*	

Smart Alarm Disconnect

An LVD control channel can be set to disconnect if a specified *Smart Alarm* becomes active. For example, a battery LVD can be set to disconnect if the battery temperature is too high, or a load LVD can be set to disconnect when *Ah Discharged* exceeds a defined value.

- An unnecessary LVD disconnect may occur if *Smart Alarm Disconnect* uses a sensor which becomes faulty or disconnected.
- An unnecessary LVD disconnect may occur if *Battery Time Remaining* is used as a source for Smart Alarm Disconnect.

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► **To configure a Smart Alarm Disconnect**

1. In DCTools/Web go to: *Alarms* > *Smart Alarms*. Configure a *Smart Alarm* as described on page 50.
2. Note the *SA Number* (first column of the *Smart Alarm States* table).
3. Go to: *Control Processes* > *LVD*.
4. For the required LVD control channel:
   - Set *Smart Alarm Index* to the *SA Number* (first column of the *Smart Alarm States* table).
   - Set *Smart Alarm based Disconnect* to *Enabled*.

The LVD control channel will disconnect its contactor(s) if the *Smart Alarm* becomes active.

Except, if Chained to Previous *is enabled then the preceding LVD control channel must be disconnected first.*

Alarms

An SC200 supplied with a standard configuration file (see details on page 18) has a standard set of alarms configured and enabled. This will be sufficient for standard dc power system operation.

For specific alarm arrangements all SC200 alarms can be individually enabled or disabled and are configurable.

Types of Alarms

The SC200 provides five types of alarms:

Alarm type	Description	Configuration
System alarms	Generated by the operating values of dc power system (voltages, currents, temperatures, and so on) and the operation of power system modules (rectifiers, circuit breakers, fuses, and so on). The SC200 system alarms are listed in Alarm Descriptions on page 109.	See details on page 46.
Analog Input (AI) High alarms	Activated when the input value of an AI is above the alarm threshold.	See details on page 71.
Analog Input (AI) Low alarms	Activated when the input value of an AI is below the alarm threshold.	See details on page 71.
Digital Input (DI) alarms	Activated when a DI is in its active state.	See details on page 74.
Smart Alarms	Software simulation of logic gates to allow the logical combination of other alarms, time schedules and/or system values.	See details on page 49.

Active Alarm Indications

All alarms have a configured *Severity:*

Critical Major Minor Warning ✓ Control

The *Severity* determines how an active alarm is indicated:

Severity	Alarm indications	Details
	SC200 Major alarm LED will turn on.	See details on page 12.
	SC200 Minor alarm LED will turn on.	See details on page 12.
	If the SC200 audible indicator is enabled, it will sound until a key is pressed.	See details on page 12.
	The alarm name and severity icon will be displayed on the SC200 main screen.	See details on page 6.
	The *Event Log* will record the alarm activation.	See details on page 77.
	If configured, an Email message will be sent to one or more Email addresses.	See details on page 87.
	If configured, an SMS text message will be sent to one or more cell phones.	See details on page 93.
	If configured, PowerManagerII control and monitoring software will be notified by modem callback. PowerManagerII can initiate various actions when it receives an alarm notification.	Refer to the PowerManagerII online Help.
	In DCTools/Web (if connected), the alarm name and severity icon will be displayed in the *Alarms* list on the *System* page.	See DCTools screen on page 13, Web screen on page 84.
	If configured, an SNMP Trap will be sent to a network management system (NMS).	See details on page 85.
	If configured, a note will be displayed on the SC200 and included in the SNMP trap (if used).	Refer to the alarm's configuration details.
✓	If configured, one or two digital outputs (relays) will be operated.	Refer to the alarm's configuration details.

► **To view a list of active alarms**

- Use the SC200 keypad to go to: *Alarms*.
- Or, in DCTools/Web go to *System*.

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Common Alarm Parameters

The following parameters are common to multiple alarms.

Parameter	Description	Where to find:
Enable Audible Alarm Indication	Enable or disable the audible alarm indicator.	SC200: Alarms > Alarm Settings > Global Settings DCTools/Web: Alarms > Alarm Configuration
Alarm Recognition Period	All alarms (except those listed below) are activated only after the alarm condition is present for this period. *These alarms have individual recognition periods: AC Fail, System Overload, Generator Fail.* *These alarms do not have recognition periods: Battery Test Fail, Configuration Error, Missing Hardware, Standby Mode, String Fail, Unknown Hardware, Unmapped IOB Found, and all LVD alarms.*	

System Alarm Configuration

The following system alarm parameters can be configured.

Parameter	Description	Where to find:
Severity	Set to the required alarm priority. This determines how the alarm is indicated. See details on page 44. If set to *Disabled* then the alarm will not activate.	SC200: Alarms > Alarm Settings (tab) > System Alarm. Select an alarm. *Use ▷ ◁ to scroll to other alarms.* DCTools/Web: Alarms > Alarm States
DO Mapping A	If required, select a digital output (relay) that will be operated when the alarm is active.	
DO Mapping B	If required, select a second digital output (relay) that will be operated when the alarm is active.	
Send Trap	An SNMP Trap will be sent for this alarm, if *Send Trap* is *True* and the alarm's *Severity* matches the setting of the SNMP Trap Level (see details on page 86).	
Notes	Type any required description. When the alarm is active the text will be displayed on the SC200 and included in the SNMP trap (if used). The notes can provide instructions about what action to take when the alarm occurs.	
Recognition Period	The following alarms have individual recognition periods: AC Fail, System Overload, Generator Fail. *All other system alarms either use the standard Alarm Recognition Period or do not have a recognition period. See details on page 45.*	SC200: Alarms > Alarm Settings (tab) > System Alarm. Select an alarm. *Use ▷ ◁ to scroll to other alarms.* DCTools/Web: Alarms > Alarm Configuration
High or Low Threshold	The following alarms have a high or low threshold: High Float, Low Float, High Load, Low Load, Battery Temperature High, Battery Temperature Low. The alarm will be activated if the measured value is above or below this value, as applicable.	
Enable High Float Tracking	If enabled, the High Float alarm threshold will be increased when the operating voltage is increased by a voltage control process.	
Enable Low Float Tracking	If enabled, the Low Float alarm threshold will be decreased when the operating voltage is decreased by a voltage control process.	
AC Alarm Thresholds	Used in CR48-3G systems, AC Phase 1/2/3 Fail and AC Phase 1/2/3 Voltage alarms have % deviation thresholds from the *Nominal AC Voltage*. For each of these alarms, a common threshold applies for all phases.	SC200: Alarms > Alarm Settings (tab) > System Alarms DCTools/Web: Alarms > Alarm Configuration > AC Alarm Thresholds
Nominal AC Voltage	Used by the AC Phase 1/2/3 Fail and AC Phase 1/2/3 Voltage alarms.	SC200: Alarms > Alarm Settings (tab) DCTools/Web: Alarms > Alarm Configuration > AC Alarm Thresholds

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The following system alarms have particular configuration settings:

- System Overload alarm. See details on page 47.
- Battery Mid-point monitoring. See details on page 57.

Alarm Inhibiting

To prevent a single series of faults triggering multiple alarms, an alarm is inhibited by another active alarm if the conditions that trigger the inhibiting alarm include the conditions that trigger the inhibited alarm. However, the inhibiting alarm only inhibits if it is set to a level of severity that is equal to or higher than the alarm being inhibited.

For example, *Partial AC Fail* is inhibited if *AC Fail* is active and *AC Fail* is set to a level of severity that is equal to or higher than *Partial AC Fail*.

Alarm Descriptions on page 109 lists the inhibiting alarms that can inhibit each alarm.

System Overload Alarm

The System Overload alarm activates if the total system load exceeds a percentage of the installed rectifier capacity for a specified period (or if the total system load exceeds a percentage of the installed rectifier capacity minus the capacity of the largest rectifier if *System Overload Type* is set to *Redundancy*). This indicates that additional rectifiers need to be installed. This is useful at sites where there is ongoing installation of additional load equipment.

► To enable System Overload

- In DCTools/Web go to: *Alarms* > *Alarm States*. Enable and configure *System Overload* alarm. See System Alarm Configuration on page 46.
- Go to: *Alarms* > *Alarm Configuration*. Configure the *System Overload* alarm parameters. See details on page 48.

Information

The following information is available about System Overload.

Parameter	Description	Where to find:
System Power	The output power of the system as a percentage of the total nominal power the system is capable of supplying.	SC200: Analogs DCTools/Web: Analog Inputs

Configuration

Set the following parameters.

Parameter	Description	Where to find:
System Overload alarm parameters	See System Alarm Configuration on page 46.	DCTools/Web: Alarms > Alarm States
System Overload Threshold	The System Overload alarm activates if the load is above this threshold continuously for the *System Overload Recognition Period*. Measured as a percentage of total rectifier capacity.	DCTools/Web: Alarms > Alarm Configuration
System Overload Recognition Period	The System Overload alarm activates if the load is above the threshold continuously for this time. It is normally set to several hours so that the alarm does not operate during a normal battery recharge.	
System Overload Type	The System Overload alarm can be based on either *Total Capacity* or *Redundancy*. If the system overload type is based on *Total Capacity* then the alarm will trigger when the load is above the *System Overload Threshold* for the *System Overload Recognition Period*. If the system overload type is *Redundancy* then the alarm will trigger when the load is above the total current capacity of the system minus the current capacity of the largest rectifier, for the *System Overload Recognition Period*. *An alarm will always activate if the system overload type is set to Redundancy when there is only one rectifier installed.*	

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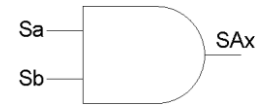
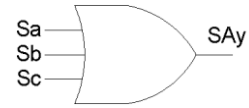
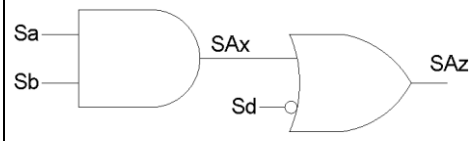
Smart Alarms

Smart Alarms are a software simulation of logic gates to allow the logical combination of other alarms, time schedules and/or system values. Up to 32 *Smart Alarms* can be configured.

A single *Smart Alarm* is the equivalent of a multi-input AND, OR or XOR logic gate. More complex logic arrangements are created by using one *Smart Alarm* as an input into another. For example:

Two input AND gate: SAx = Sa AND Sb	
Three input OR gate: SAy = Sa OR Sb OR Sc	
Multi-gate logic: SAz = SAx OR NOT Sd *One input is Smart Alarm SAx (output from another gate). The other input is negated. This is available with Alarm Sources only.*	

Key:

SAx, SAy, SAz are *Smart Alarms* (entered in the *Smart Alarms* table).

Sa, Sb, Sc, Sd are the *Sources* (entered in the *Alarm Sources*, *Schedule Sources* or *System Value Sources* tables).

Smart Alarms also have optional activation and deactivation delays. When activated they can cause alarm indications (unless *Severity* is set to *Control*) and can activate one or two digital outputs (in the same way as other alarms).

For more information and application examples contact your Eaton DC product supplier and request Eaton Application Note AN0106, SC200 Version 3 Advanced Alarm Features.

Sources

The inputs to *Smart Alarms* are called *Sources.*

Sources can be any combination of:

- **Alarm Sources** (up to 64):

  System Alarms, Analog Input High alarms, Analog Input Low alarms, Digital Input alarms, Other Smart Alarms

  Alarm Sources can either use the alarm's recognition period,or be triggered immediately. Alarm Sources can also be triggered either when the source alarm becomes active or when it becomes inactive.

- **Time Schedules** (up to 20)

  Time schedules can repeat for a fixed number of times, or indefinitely.

- **System Values** (up to 20):

  Bus Voltage, Rectifier Current, Load Current, Battery Current, Battery Temperature, Load Power, System Power, Ah Discharged, Number Of Rectifiers Failed, Number Of Rectifiers Comms Lost, AC Voltage, Battery Time Remaining, Alternative Source Current, Highest Rectifier Heatsink Temperature, Fuel Level, Generator Backup Time, Fuel Remaining Time.

System Value Sources are active either when the system value is above or below a defined threshold value.

Configuration

Information

The following information is available about *Smart Alarms* and *Sources*.

Parameter	Description	Where to find:
Smart Alarm State	The present state of the *Smart Alarm*. If *Enabled* and active, this will be the alarm's *Severity*. If Dis*abled,* or *Enabled* but inactive, the state is shown as "-".	DCTools/Web: Alarms > Smart Alarms > Smart Alarm States
Source Triggered	The present state of the source: ✓ = *Enabled* and active "-" = Dis*abled,* or *Enabled* but inactive. = There is an invalid dependency, or the source *Index* is invalid. = The source is part of a circular dependency.	DCTools/Web: Alarms > Smart Alarms > Sources
Next Activation	The date and time this schedule will next activate.	DCTools/Web: Alarms > Smart Alarms > Schedule Sources
Schedule End	The date and time this schedule will activate for the last time.	

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► To create a Smart Alarm

1 Determine the equivalent logic gate arrangement for the *Smart Alarm*.

Smart Alarms can be regarded as logic gates. Each gate (AND, OR or XOR) is an entry in the Smart Alarm States table. The gate inputs are entries in the Alarm Sources, Scheduled Sources or System Value Sources tables.

2 Configure the Smart Alarm(s):

- In DCTools/Web go to: *Alarms* > *Smart Alarms*.
- Expand the *Smart Alarm States* table and configure a *Smart Alarm* and configure the following parameters.

To change a setting, double-click and select from drop down list or edit the text.

Parameter	Setting
Name	Type the name of the alarm.
Severity	Set to the required alarm priority. This determines how the alarm is indicated. See details on page 44. If set to *Disabled* then the alarm will not activate.
Operator	Determines how the sources will be logically combined (AND, OR or XOR).
Recognition Period	The alarm will activate when the logical combination of the sources has been true for this period.
Deactivation Recognition Period	The alarm will deactivate when the logical combination of the sources has been false for this period.
Digital Output Mapping A	If required, select a relay that will be operated when the alarm is active.
Digital Output Mapping B	If required, select a second relay that will be operated when the alarm is active.
Send Trap	An SNMP Trap will be sent for this alarm, if *Send Trap* is *True* and the alarm's *Severity* matches the setting of the SNMP Trap Level (see details on page 86).
Trap Origin	Sent in the Trap Origin field.
Group	Set to 0 unless using Groups in PowerManagerII. See PowerManagerII online help for details.
Notes	Type any required description. When the alarm is active the text will be displayed on the SC200 and included in the SNMP trap (if used).

► To configure the Source(s) for a Smart Alarm

Configure the following parameters for the source(s) for each *Smart Alarm*.

Every Smart Alarm must have at least one Source assigned to it.

Alarm Sources

Parameter	Setting
SA Num	Type the number (from the *Smart Alarm States* table) of the *Smart Alarm* for which this source is an input.
Status	Set to *Enabled*.
Logic	Set to either: • **EQUAL** - the Alarm Source will become active when the source alarm is Triggered or Active. • **NOT** - the Alarm Source will become active when the source alarm is Inactive.
Trigger When Source Is	Set to either: • **Triggered** - the Alarm Source will become active immediately when the conditions for this alarm become true (or false when *Logic* is set to NOT). The alarm does not have to be *Enabled*. *Do not use Triggered when Type is set to Smart Alarm.* • **Active** - the Alarm Source will become active when the alarm becomes active (or inactive when *Logic* is set to NOT), after the alarm recognition time, and only if the alarm is *Enabled*.
Type	Set to the appropriate source type: *System Alarm*, *Analog Input High*, *Analog Input Low*, *DI*, *Smart Alarm*.
Index	Identify the alarm: • *Source Type* = *System Alarm*: DCTools - type the alarm number from the *Alarm States* table. Web - select the name of the system alarm from the list. • *Source Type* = *AI High/AI Low* - type the alarm number from the *Analog Input High Alarms* or the *Analog Input Low Alarms* table. • *Source Type* = *DI* - type the alarm number from the *Digital Input Alarms* table. • *Source Type* = *Smart Alarm* - type the alarm number from the *Smart Alarm States* table.

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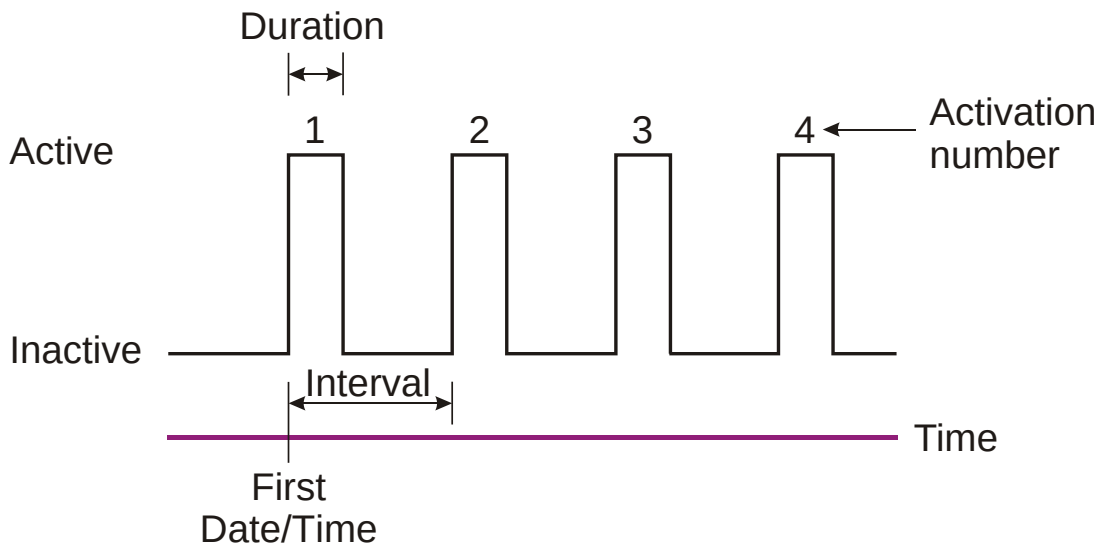
Scheduled Sources

Parameter	Setting
SA Num	Type the number (from the *Smart Alarm States* table) of the *Smart Alarm* for which this source is an input.
Status	Set to *Enabled*.
First Date / Time	Set to the date and time when the *Schedule Source* will activate for the first time (see the diagram below).
Duration	Set to the length of time that the *Schedule Source* will remain active each time it activates (see the diagram below).
Interval	Set to the time interval between the start of each activation (see the diagram below).
Number of Activations	Set the number of activations. *If set to zero then there is no limit to the number of activations.*

Scheduled Sources Operation



System Value Sources

Parameter	Setting
SA Num	Type the number (from the *Smart Alarm States* table) of the *Smart Alarm* for which this source is an input.
Status	Set to *Enabled*.
System Value	Set to the required value (*Bus Voltage, Rectifier Current, Load Current, Battery Current, Battery Temperature, Load Power, System Power, Ah Discharge, Number Of Rectifiers Failed, Number Of Rectifiers Comms Lost*).
Threshold Type	Set to either: • **High** - the System Value Source will be true when the System Value goes above the Threshold. • **Low** – the System Value Source will be true when the System Value goes below the Threshold.
Threshold	The System Value Source will be true when the System Value goes above or below (depending on the Threshold Type) this value.
Hysteresis	Determines when an active *System Value Source* will become false: If *Threshold Type* is set to *Low* the *System Value Source* will become false when the *System Value* goes above *Threshold + Hysteresis*. If *Threshold Type* is set to *High* the *System Value Source* will become false when the *System Value* goes below *Threshold - Hysteresis*.

Latched Smart Alarm

A *Smart Alarm* can be latched so that once it become active it must be cleared manually.

► To Create a latched Smart Alarm

1 Configure a *Smart Alarm* with the following parameter settings:

Operator: OR

Severity: Select the level for the required alarm indications (see details on page 44).

Set other parameters as required (see details on page 50).

2 Configure an *Alarm Source* with the following parameter settings:

SA Num: The number of the *Smart Alarm* configured in step 1.

Status: *Enabled*

Logic: *EQUAL*

Trigger When Source Is: *Active*

Type: *Smart Alarm*

Index: The number of the *Smart Alarm* configured in step 1.

3 Configure a second source (*Alarm Source*, *Schedule Source* or *System Value Source*) with the following parameter settings:

SA Num: The number of the *Smart Alarm* configured in step 1.

Status: *Enabled*

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Set other parameters as required (see details on page 50).

The *Smart Alarm* will activate when the source (configured in step 3) becomes active. The *Smart Alarm* will then remain active until it is manually cleared (see next), even if the source is deactivated.

► To Clear a latched Smart Alarm

Either:

- Use SC200 keypad to go to: *Alarms*. Select the active alarm. Press *Details* > *Clear*.

Or:

- In DCTools/Web go to: *Alarms* > *Smart Alarms*. Click the *Clear* button.

AC High and AC Low Alarms

AC High and AC Low are examples of useful alarms that can be set up using *Smart Alarms*.

► To Create an AC High Smart Alarm

1 Configure a *Smart Alarm* with the following parameter settings:

Name:	AC High
Operator:	OR
Severity:	Minor (or a different severity if required).

Set other parameters as required (see details on page 50).

2 Configure a *System Values Source* with the following parameter settings:

SA Num:	The number of the *Smart Alarm* configured in step 1.
Status:	*Enabled*
System Value:	*AC Voltage*
Threshold Type:	*High*
Threshold:	275 (or a different value if required)
Hysteresis:	5 (or a different value if required)

► To Create an AC Low Smart Alarm

1 Configure a *Smart Alarm* with the following parameter settings:

Name:	AC Low
Operator:	OR
Severity:	Minor (or a different severity if required).

Set other parameters as required (see details on page 50).

2 Configure a *System Values Source* with the following parameter settings:

SA Num:	The number of the *Smart Alarm* configured in step 1.
Status:	*Enabled*
System Value:	*AC Voltage*

Threshold Type:	Low
Threshold:	185 (or a different value if required)
Hysteresis:	5 (or a different value if required)

Batteries

The following information is available about the batteries connected to the dc power system.

Parameter	Description	Where to find:
Battery Charge State	• **Charge** - the battery current is above the *Battery State Threshold.* • **Discharge -** the battery current is below -1 * *Battery State Threshold.* • **Floating -** the battery current is between ± *Battery State Threshold.* • **Unavailable** - the battery current is not available. *See SC200 or DCTools/Web displays ??? or N/A on page 101.*	SC200: Battery > Battery DCTools/Web: Batteries
Battery Temperature	The temperature measured by the battery temperature sensor.	
Ah Discharged	The current level of battery discharge. *See also Reset Battery State on page 63.*	

Batteries Configuration

The following battery parameters must be configured.

Parameter	Description	Where to find:
Cells Per String	The number of 2V cells per battery string (for example: 24 in a 48V nominal system).	SC200: Battery > Battery (tab) DCTools/Web: Batteries
Battery Capacity	Set to the rated 10 hour capacity of the installed battery strings.	
Battery State Threshold	Used to determine the *Battery Charge State*. See *Battery Charge State* on page 56.	DCTools/Web: Batteries
Battery Type	An optional text field for the name or type of battery.	
Battery Current Sensor Fail Recognition Period	An optional battery current sensor fail delay. Set if momentary battery current sensor fail conditions stop battery related control processes.	

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Battery Mid-point Monitoring (MPM)

Battery Mid-point Monitoring provides a cost-effective method for the early detection of internal battery faults. The voltages of the two halves of a battery string are measured and the system controller generates an alarm signal if a voltage imbalance is detected.

A voltage imbalance is an indication that one or more cells has an internal fault. Further investigation can then isolate the faulty cell(s) and action can be taken to correct the problem and prevent a total battery failure.

To connect Battery Mid-point Monitoring see details in the dc power system Installation and Operation Guide. If a *String Fail* alarm is generated see Troubleshooting on page 100.

To ensure reliable operation Mid-point Monitoring operates only when the battery is in float charge and after a configurable lockout period since the last battery discharge, Fast Charge, Equalize or Battery Test.

► To enable *Battery Mid-point Monitoring (MPM)*

If any of the mid-point monitoring analog inputs are used for Reverse Battery Detection (see details on page 64) then they are not available for MPM.

1. Connect the mid-point monitoring sense wires to the batteries. Refer to the dc power system Installation and Operation Guide.

   There are four mid-point monitoring analog inputs on an IOBGP input/output board (for four battery strings). Up to 20 additional battery strings can be monitored if additional IOBGP input/output boards are connected. Refer to the dc power system Installation and Operation Guide for details on how to connect additional IOBGP input/output boards to the SC200.

2. In DCTools/Web go to *Batteries*.
3. Set *Cells Per String* to the number of 2V cells per string (for example: 24 for 48V nominal system).
4. Expand the *Mid-point Monitoring* table.
5. Set *MPM Enable* to *Enabled* and check the configuration settings (see details on page 59).
6. Go to *Analog Inputs* and *Enable* the mid-point monitoring analog inputs (one per battery string) as required.

   Battery strings 1-4 will be connected to IOB Number 1, IOB AI Numbers 2-5. Battery strings 5-8 will be connected to IOB Number 2, IOB AI Numbers 2-5. And so on, as required up to string 24.

7. Go to *Alarms* > *Alarm States*. Enable and configure the *String Fail* alarm. See System Alarm Configuration on page 46.

► To clear a *String Fail* alarm

1. In DCTools/Web go to *Batteries* > *Mid-point Battery Monitoring* (expand the table).
2. Click on *Clear String Fail*.

Information

The following information is available about Battery Mid-point Monitoring.

Parameter	Description	Where to find:
MPM State	**Disabled:** MPM is *Disabled*. **Unable To Start:** MPM is *Enabled* but either: *Cells per String* is zero; the bus voltage sensor has failed; ac supply has failed; the battery is in discharge state; Fast Charge, Equalize or Battery Test is active; or the battery fuse has failed. **Locked Out:** MPM is within the *MPM Lockout Period*. No *String Fail* alarm will become active in this period. **Converging:** MPM is outside the *MPM Lockout Period* but is within *MPM Convergence Period*. **Stable:** MPM is outside the *MPM Convergence Period*.	SC200: Battery > MPM DCTools/Web: Batteries > Mid-point Monitoring
Time In This State	The time period MPM has been in the current state.	
Current MPM Threshold	When MPM state is *Converging* this value is between *MPM Start Threshold* and *MPM Stable Threshold*. When MPM state is *Stable* this value is the *MPM Stable Threshold*.	
Reference Voltage	The calculated mid-point reference voltage (50% of the bus voltage for even number of cells).	
String State	**OK:** MPM is in the state *Converging* or *Stable* and the string's *Imbalance* is below the current threshold. **Unavailable:** The MPM is not in state *Converging* or *Stable*, or the string's mid-point voltage is unavailable. **Pending Fail:** The string's *Imbalance* is above the current threshold, but has not yet been so continuously for the *String Fail Recognition Period*. **Fail:** The string's *Imbalance* has been above the *Current MPM Threshold* for longer than the *String Fail Recognition Period*. This will activate a *String Fail* alarm. **Not Configured:** No analog input is mapped to this string.	
Mid-point Voltage	Shows the mid-point voltage reading for the string or *N/A* if no analog input channel is mapped to this string.	
Imbalance	The percentage imbalance of the *Mid-point Voltage*.	

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Configuration

Set the following parameters.

Parameter	Description	Where to find:
String Fail alarm parameters	See System Alarm Configuration on page 46.	DCTools/Web: Alarms > Alarm States
MPM Enable	Enable/disable Mid-point Monitoring.	SC200: Battery > MPM > Settings DCTools/Web: Batteries > Mid-point Monitoring
MPM Lockout Period*	Time from when MPM is able to start until the start of the *MPM Convergence Period*.	
MPM Convergence Period*	Time from the end of the *MPM Lockout Period* until *MPM State* is *Stable*. During this period the *Current MPM Threshold* is calculated using linear interpolation between *Start Threshold* and *Stable Threshold* and the *MPM State* is defined as *Converging*. After this period the *MPM State* is defined as *Stable* and the *MPM Stable Threshold* applies.	
String Fail Recognition Period	If the mid-point *Imbalance* percent of a battery string exceeds the *MPM Threshold* for this period of time the *String State* is set to *Fail* and the *String Fail* alarm is activated.	
MPM Start Threshold*	Mid-point *Imbalance* percent threshold at the start of the *MPM Convergence Period*.	
MPM Stable Threshold*	Mid-point *Imbalance* percent threshold after the convergence period.	

* A dynamic alarm threshold is used to give the best possible battery fault detection:

1. After the end of a discharge, Fast Charge or Equalize cycle, MPM does not start until the end of the *MPM Lockout Period*, to ensure the system is in float charge.
2. At this point, the battery cell voltages are expected to be widely spread, so the alarm threshold is set high (*MPM Start Threshold*).
3. The alarm threshold is then progressively reduced over the *MPM Convergence Period*.
4. After the end of the *MPM Convergence Period*, cell imbalance is assumed to be stable, and a fixed threshold is used (*MPM Stable Threshold*).

Battery Time Remaining

The SC200 obtains characterization data from every full battery discharge, to a specified end voltage.

During a battery discharge, the SC200 uses this characterization data to calculate an estimated time until the battery will reach the specified end voltage.

- *If a battery disconnect LVD is fitted then the end voltage will usually be the voltage at which the LVD disconnects the battery.*
- *Battery Time Remaining is designed for a constant power load. The accuracy of the time remaining calculation will be reduced if the dc power system is connected to a predominantly resistive (constant current) load.*
- *The time remaining calculation will not be correct if a non-essential load is disconnected during the battery discharge.*

Configuration

- It will take at least 10 hours to characterize a battery.
- When a battery is characterized it is discharged. The bus voltage will gradually reduce to the battery end voltage. Ensure that this will not affect the operation of any equipment connected to the dc power system.

Use the following procedure to configure *Battery Time Remaining* for the first time, or if a previously characterized battery is changed.

Battery Characterization is not necessary if a previously saved battery characterization data file is available. Refer to Characterization Data Management on page 63. Only use characterization data for an identical type and size of battery.

► To configure *Battery Time Remaining*

1. Check that all battery strings are connected and all LVD contactors (if any) are connected.

   During a battery characterization, LVD contactor disconnection is inhibited. If any LVD contactor is configured to connect during a battery discharge then set it to Manual Connect to prevent operation during the battery characterization.

2. Check that all battery strings are fully charged.

   When a battery is fully charged, the Battery Charge State will be Float and Ah Discharged will be zero. See Batteries on page 56.

3. Check that all battery parameters are set to the correct values. See Batteries Configuration on page 56.

4. Check that the load current is at least 2% of the C10 capacity of the batteries (*Battery Capacity*) and 150% of the *Battery State Threshold*. See Batteries Configuration on page 56.

   If the load current is less than 10% of the C10 capacity of the batteries, then Battery Characterization will take longer than 10 hours.

5. Either, in DCTools/Web go to *Batteries* > *Battery Time Remaining,* or use the SC200 keypad to go to *Battery*. Set *End Voltage* to the voltage per cell when the battery is regarded as fully discharged.

   In general set the end voltage to the same value as for the LVD Disconnect Voltage (see LVD Configuration on page 41). End Voltage must be at least 0.02V/Cell above the Minimum System Voltage (per cell). The Minimum System Voltage is viewable in DCTools/Web at Control Processes. It is not configurable.

6. Enable *Battery Current Limit* (see details on page 23).

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► **To Characterize the Battery**

1 Either:

- Manually start a Characterization:
  On the SC200 go to: *Battery* > *Characterize* > *Start*.
  Or, in DCTools/Web go to: *Battery* > *Battery Time Remaining*. Click *Characterize*.

  If "Characterize" is not present on the SC200 or the "Characterize" button is inactive in DCTools/Web, then check all configuration settings. In DCTools/Web, the hover text will indicate why the characterization cannot start.
- Or, use *Automatic Characterization to start a characterization automatically when all conditions are correct and stable*:
  In DCTools/Web go to: *Battery* > *Battery Time Remaining*.
  Set *Automatic Characterization* to *Enabled* and set *Automatic Characterization Delay* to the required time that the conditions must be stable.

2 The characterization process will take at least 10 hours, depending on the load current.

During characterization the rectifier output voltage is varied to maintain a constant power discharge.

3 When the characterization has finished, the *Characterization Result* will be *Updated*.

If any other Characterization Result is shown, refer to BTR Operation on page 62.

4 The rectifiers will return to float voltage and the battery will start to recharge. If required, start a manual Equalize (see details on page 26) to reduce the battery recharge time.

5 Restore any changed LVD operation back to the original settings. If no longer required, disable *Battery Current Limit*.

Battery Time Remaining is now operational. During any battery discharge an estimate of time remaining will be displayed.

Operation

The following information is available about *Battery Time Remaining*.

Parameter	Description	Where to find:
Time Remaining	During a battery discharge, this is the estimated time until the battery voltage will be equal to the *End Voltage,* at the present battery current. Time remaining will be re-calculated if the load current varies during discharge (for example, when a load disconnect LVD operates). *Time Remaining is only available when Battery Time Remaining State is Active.*	SC200: Battery DCTools/Web: Batteries
Battery State Of Health	The approximate battery capacity measured during the last battery characterization, as a percentage of the configured *Battery Capacity*.	DCTools/Web: Batteries
State	**Inoperative:** The battery characterization data is not loaded, *End Voltage* is below the characterization end point, or the bus voltage or battery current is unavailable. **Inactive:** *Battery Charge State* is *Float* or *Charge*. *See* Battery Charge State on page 56. **Characterizing:** Battery characterization is in progress. **Active:** The battery has been characterized and *Battery Charge State* is *Discharge.* *See* Battery Charge State on page 56.	
Lowest End Voltage	The end voltage used for the last battery characterization.	
Characterization Result	**Not Yet Run:** The battery has not been characterized since the last restart of the SC200. **Active:** The SC200 is collecting the characterization data. **Complete:** The SC200 has collected the characterization data and is updating its database. **Updated:** The SC200 has updated its database. **Sensor Failed:** Data from the last characterization was not saved because the bus voltage sensor failed or the battery current became unavailable. **Not Fully Charged:** Characterization did not start because the battery was not fully charged when discharge started. **Unstable Battery Current Pending:** The battery current has varied more than the tolerance for an accurate characterization. Characterization will continue if the battery current is in tolerance within one minute. Otherwise, data from this discharge will not be saved. **Unstable Battery Current:** Data from the last characterization was not saved because the battery current varied more than the tolerance, for more than one minute.	SC200: Battery DCTools/Web: Batteries > Battery Time Remaining

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Voltage Step Detected: Data from the last characterization was not saved because of a change in the bus voltage (possibly caused by a load disconnect).

Canceled: Data from the last characterization was not saved because the characterization was stopped manually.

Characterization Data Management

Battery characterization data can be saved to file for later use. This is useful if several sites use batteries of the same type and size. However, characterization of each battery will provide the most accurate estimate of *Time Remaining*.

► To save characterization data to a file

1. In Web go to *Batteries* > *Battery Time Remaining*.
2. When the battery characterization is completed, click on *Characterization Data: Download*.
3. Click *Save*. Type a file name (*.dcf) and browse to the required location. Click *Save*.

► To load battery characterization data into the SC200

Use Web to restore the *.dcf (configuration fragment) file previously saved. Refer to Backup and Restore on page 18.

Reset Battery State

The SC200 monitors battery discharge and maintains a value called *Ah Discharged*. In a new SC200 *Ah Discharged* is set to zero. During operation of the dc power system the value is increased as the battery is discharged, and reduced as the battery is recharged.

The value of *Ah Discharged* is used to start the *Fast Charge* control process. See details on page 27.

► To view current value of Ah Discharged

- Use the SC200 keypad to go to: Battery > Battery > Ah Discharged
- Or, in DCTools/Web go to: Batteries.

If a battery or the SC200 is changed, then reset the value of *Ah Discharged* to zero (when the battery is fully charged).

► To set the value of Ah Discharged back to zero

- Use the SC200 keypad to go to: Battery > Battery > Reset State > Enter > Reset.
- Or, in DCTools/Web go to: Batteries. Click Reset Battery State.

Any active or pending Fast Charge or Equalize will be cancelled.

Reverse Battery Detection

If *Reverse Battery Detection* is enabled and a battery is connected with the incorrect polarity, the SC200 will:

- activate a *Wrong Battery Polarity* alarm, and
- prevent any LVD from connecting.

Reverse Battery Detection uses the battery mid-point monitoring (MPM) analog inputs on an IOBGP input/output board. Any of the mid-point monitoring analog inputs used for Reverse Battery Detection are not available for MPM (see details on page 57).

► To enable *Reverse Battery Detection*

1 Before the batteries are connected to the dc power system, connect the mid-point monitoring sense wires to the battery sides of the battery fuses/disconnect devices (leave the fuses/disconnect devices open). Refer to the dc power system Installation and Operation Guide.

There are four mid-point monitoring analog inputs on an IOBGP input/output board (for four battery fuses/disconnect devices). Up to 20 additional battery fuses/disconnect devices can be connected if additional IOBGP-01 input/output boards are connected. Refer to the dc power system Installation and Operation Guide for details on how to connect additional IOBGP-01 input/output boards to the SC200.

2 In DCTools/Web go to *Analog Inputs* and for each mid-point monitoring analog inputs used (one per battery fuses/disconnect devices) set the following parameters.

To change a setting, double-click and select from drop down list or edit the text.

Parameter	Setting
Status	Set to *Enable*.
Name	Set to: *Battery Polarity Detect 1*, *Battery Polarity Detect 2*, ...
Function	Set to *Reverse Battery Detection*.
Units	Set to *Volts*.
IOB Number	Set to 1 for battery fuses/disconnect devices 1-4. Set to 2 for battery fuses/disconnect devices 5-8. ...
IOB AI Number	Set to 2 for battery fuses/disconnect devices 1, 5, 9 ... Set to 3 for battery fuses/disconnect devices 2, 6, 10 ... ...
Gain	Set to 1.
Offset	Set to 0.
Group	Set to 0 unless using Groups in PowerManagerII. See PowerManagerII online help for details.

Wrong Battery Polarity Alarm

If *Reverse Battery Detection* is connected and enabled, the SC200 will activate a *Wrong Battery Polarity* alarm if it detects that one or more of the batteries are connected with the wrong polarity.

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Generator Control

Generator Control is used to delay the start of a standby ac generator until the batteries are partially discharged (rather than immediately after the ac supply fails). This can save fuel by preventing the generator running during short ac supply failures. It can also be used to control a generator in a hybrid power system (cyclic charge/discharge).

Generator Control uses a digital output (relay) which is connected in series with the generator run signal of the generator controller. The relay contacts interrupt the generator run signal until the *Generator Control* is active.

The *Generator Control* output is activated and deactivated depending on the setting of *Automatic Control Mode*. The options are:

- *Disabled* – The controller will not activate the generator control relay based on control functions. However, alarms mapped to the same relay will activate and deactivate the relay.
- *Fast Charge Only* – The controller will activate the generator control relay while *Fast Charge* is active or pending, and deactivate it when the *Fast Charge* cycle ends.
- *Fast Charge or Equalize* – The controller will activate the generator control relay while either *Fast Charge* or *Equalize* is active or pending, and deactivate it when the *Fast Charge* or *Equalize* cycle ends.
- *Every Mains Failure* – The controller will activate the generator control relay as soon as an ac supply failure is detected, and deactivate it when the ac supply is restored.

A *Generator Fail* alarm is activated if the SC200 does not detect that the ac supply is present (rectifiers have turned on) after the *Generator Fail Alarm Recognition Period* following *Generator Control* becoming active.

The generator can also be started and stopped manually.

► To manually start the generator

- Make sure that *Maximum Run Time* has been set to a value greater than zero.
- Use the SC200 keypad to go to: Control Processes > Generator Control > Settings (tab) and select *Start Manual Run*.
- In DCTools/Web go to Control Processes > Generator Control and click *Start*.

► To manually stop the generator after a manual start

- Use the SC200 keypad to go to: Control Processes > Generator Control > Settings (tab) and select *Cancel Manual Run*.
- In DCTools/Web go to Control Processes > Generator Control and click *Cancel*.

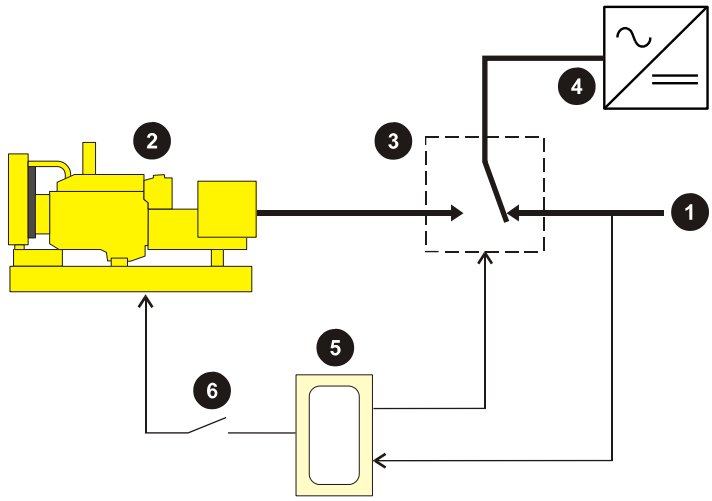
This will not stop the generator if it is running due to a Fast Charge, Equalize, or AC failure.

When the generator has been started manually, *Generator Run Time Remaining* shows the time remaining for the generator to run.

► To view Generator Run Time Remaining

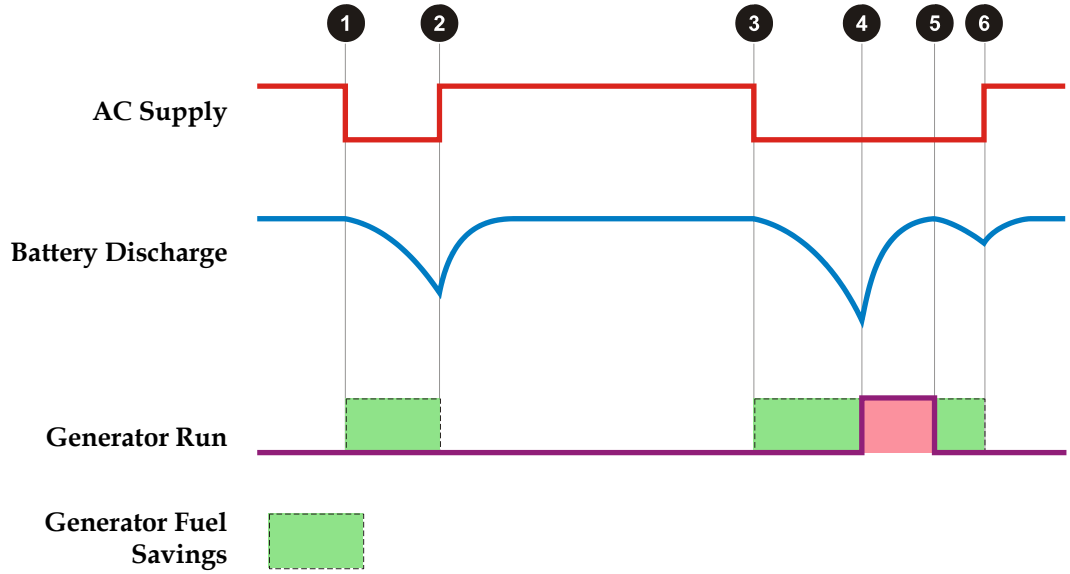
- Use the SC200 keypad to go to: Control Processes > Generator Control.
- In DCTools/Web go to Control Processes > Generator Control.

Single line diagram



1. AC utility supply
2. Generator
3. AC change-over switch
4. Rectifiers
5. Generator control panel
6. Normally open (NO) relay contacts on I/O board interrupt Generator Run signal.

Typical operation for systems with an ac supply



1. AC supply failure. Battery starts to discharge.
2. AC supply restored. Battery begins to recharge. Battery discharge did not reach the Ah Threshold. The Generator Control output was not active (relay contacts did not close) so the generator did not run.
3. AC supply failure. Battery starts to discharge.
4. Battery discharge reaches the Ah Threshold. The Generator Control output becomes active and the relay contacts close. The Generator Run circuit is completed allowing the generator to start. Battery begins to recharge.
5. Battery recharge is complete. The Generator Control output becomes inactive and the relay contacts open. The Generator Run circuit is interrupted causing the generator to stop. Battery begins to discharge.
6. AC supply restored. Battery begins to recharge. Battery discharge did not reach the Ah Threshold. The Generator Control output was not active (relay contacts did not close) so the generator did not run.

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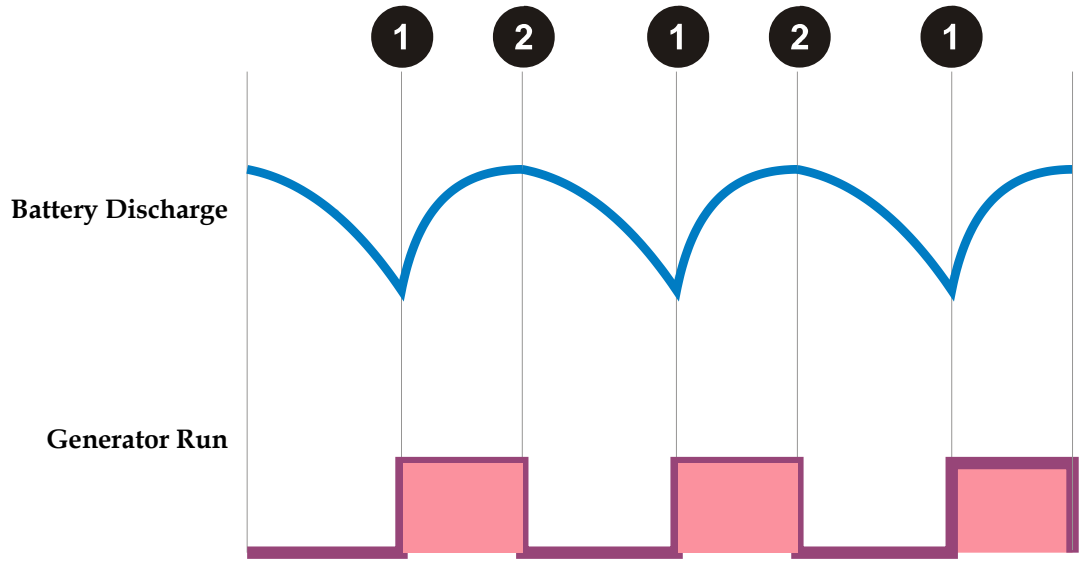
Typical operation for hybrid power systems



❶ Battery discharge reaches the Ah Threshold. The Generator Control output becomes active and the relay contacts close. The Generator Run circuit is completed allowing the generator to start. Battery begins to recharge.

❷ Battery recharge is complete. The Generator Control output becomes inactive and the relay contacts open. The Generator Run circuit is interrupted causing the generator to stop. Battery begins to discharge.

Configuration

► **To set up Generator Control:**

- Connect from the normally open (NO) contacts of an unused digital output relay on the I/O board to the generator run circuit.

  Ensure that no alarms are mapped to this relay.

- In DCTools/Web go to *Digital Outputs* and configure the digital output as *Active State Energized*. See Digital Outputs on page 75.
- Check that *Fast Charge* is enabled, and check the Fast Charge configuration settings. See Fast Charge Configuration on page 29.
- Set the following parameters:

Parameter	Description	Where to find:
Control Relay	The relay used to control the generator startup and shutdown. If this is set to None, the generator control process is disabled.	SC200: Control Processes > Generator Control > Settings (tab) DCTools/Web: Control Processes > Generator Control
Can run with mains present	Indicates whether the wiring between the controller and the generator allows the controller to start the generator even when the ac supply has not failed.	
Automatic control mode	This determines which control functions, if any, will cause the controller to automatically start the generator when necessary. In addition to these, smart alarms may be used to activate the generator control output when necessary. See Smart Alarms on page 49.	
Battery capacity	The rated 10 hour (C10) capacity of the installed battery strings. Should already have been set in SC200: Battery > Battery or DCTools/Web: Batteries.	
Manual generator run time	The maximum time the generator is permitted to run following a manual start.	
Generator Fail Alarm Recognition Period	A *Generator Fail* alarm is activated after this time if the Generator Control output is active but the ac supply has not been restored.	

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Fuel Management

The SC200 can monitor the use of fuel by a standby generator.

► **To set up fuel management**

- Connect a fuel level sensor to an analog input.
- In DCTools/Web go to: *Analog Inputs*.
- Configure the selected Analog Input and set *Function* to *Fuel Level*.
- Go to: *Control Processes* > *Generator Control* and set *Fuel Tank Volume*.

The following information is available about fuel usage.

Parameter	Description	Where to find:
Fuel Level	The volume of fuel in the generator's fuel tank.	SC200: Control Processes > Generator Control DCTools/Web: Control Processes > Generator Control
Generator Refuel Date	The time and date the generator was last refueled.	
Generator Refuel Volume	The amount of fuel added to the generator's fuel tank during the last refuel.	
Generator Backup Time	The estimated time for which the generator could continuously run based on the current fuel level and historical fuel consumption.	
Tank Empty Date	The best current estimate of the date the fuel tank will run dry if the current characteristics of generator usage and fuel consumption do not change. This is useful for installations that run the generator regularly and with a reasonably constant duty cycle.	

The time remaining estimates will not be accurate if the generator has been replaced or if the typical usage pattern has changed. If this happens, the fuel consumption history can be cleared manually.

Clearing the fuel consumption history will cause the time remaining estimates to be inaccurate or not available until enough information about the new generator has been collected.

► **To clear the fuel consumption history**

- In DCTools/Web go to: *Control Processes* > *Generator Control* > *Clear Fuel Consumption History*.

Smart Alarms based on System Value Sources can be used to configure alarms based on:

- Fuel Level.
- Generator Backup Time.
- Fuel Remaining Time (this is the estimated *Tank Empty Date*).

See Smart Alarms on page 49 for details of how to set Smart Alarms.

Alternative Energy Input Metering

The SC200 can meter currents supplied to the DC bus from alternative energy sources such as solar or wind. This means that it can calculate currents to and from the DC bus correctly, even when both rectifiers and alternative energy sources are providing power.

► **To set up alternative energy input metering**

- For each alternative energy source, connect a current sensor from the energy source to an analog input.
- In DCTools/Web go to: *Analog Inputs*.
- Configure the selected Analog Inputs and set *Function* to *Alternative Energy Source Current*.

The alternative energy source current is calculated as the sum of the currents of all analog inputs configured as *Alternative Energy Source Current*.

Smart Alarms based on System Value Sources can be used to configure alarms based on the *Alternative Energy Source Current*.

See Smart Alarms on page 49 for details of how to set Smart Alarms.

The System Summary displayed in DCTools and the System Schematic shown in the SC200 web page displays the source current values (rectifiers and alternative energy sources) and load current values (load and batteries). If one of these values is not available, it is calculated from the other system current values.

Input/Output (I/O)

The following section describes the I/O functions available with a single IOBGP I/O board.

Also see I/O Board Mapping on page 119.

Optional SiteSure-3G input/output (I/O) modules or additional IOBGP I/O boards can be connected to the SC200 to provide additional I/O to monitor and control external devices. For details refer to the SiteSure-3G Installation Guide (see Related Information on page i).

Identify an I/O Board

Input/Output (I/O) boards and SiteSure-3G modules are referenced by their serial numbers.

► **To identify a particular I/O board or SiteSure-3G module**

Either:

- On SC200 keypad go to: *Settings* > *IOBs* and select a module or board. Press *Enter*.

  The I/O board details screen appears. Use ▷ ◁ to scroll to other I/O boards.
- The Power-on LED on the selected I/O board or SiteSure-3G module will flash for 60 seconds (or press *Esc* to stop).

Or:

- In DCTools/Web go to: *Configuration* > *RXP* > *RXP Devices*.
- DCTools: select *Identify Device* or Web: click on *Start Identifying*.
- The Power-on LED on the selected I/O board or SiteSure-3G module will flash for 60 seconds.

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Analog System Values

The SC200 provides access to the following system analog values.

Parameter	Description	Where to find:
Bus Voltage	The average of all analog inputs configured as *Bus Voltage*. Otherwise, the system bus voltage is determined from the rectifier output voltages.	SC200: Analogs DCTools/Web: Analog Inputs > System Values
Load Current	The sum of any analog inputs configured as *Load Current*. Otherwise, if *Battery Current* is available, the *Load Current* is calculated as *Rectifier Current - Battery Current*. Otherwise it is unavailable.	
Battery Current	The sum of any analog inputs configured as *Battery Current*. Otherwise, if *Load Current* is available, the *Battery Current* is calculated as *Rectifier Current - Load Current*. Otherwise it is unavailable. If positive, the battery is being charged.	
Battery Temperature	The average of all analog inputs configured as *Battery Temperature*.	
Rectifier Current	The sum of any analog inputs configured as *Rectifier Current*. Otherwise, if there are *Battery* and *Load Currents*, the *Rectifier Current* is calculated as *Battery Current* + *Load Current*. Otherwise, *Rectifier Current* is determined as the sum of all reported rectifier output currents.	
Load Power	The power being supplied to the load. *Load Current* x *Bus Voltage.*	
System Power	The output power of the system as a percentage of the total nominal power of the registered rectifiers.	
AC Voltage	The average of the ac voltage measured by single-phase rectifiers. Or, if 3-phase rectifiers are fitted then the average of the ac phase voltages is shown.	

Analog Inputs

The analog inputs (AI) monitor variable dc voltages (bus voltage sense, general purpose analog inputs, current sensors or temperature sensors). See Specifications on page 105 for details.

Generally, the system analog inputs (as indicated by the "Function" field) are configured at the factory and do not need to be changed.

► To configure an analog input

1 In DCTools/Web go to *Analog Inputs*. Expand the *Analog Inputs* table.

The table shows the maximum number of analog inputs. The actual number of analog inputs available depends on the number of I/O boards or modules connected.

2 Select an Analog Input. The analog inputs are mapped to specific I/O connectors and are of three types (voltage/general purpose, current or temperature). See mapping tables on page 119.

If needed, more than one analog input can be mapped to the same connector so that the sensor can trigger more than one Analog Input High and/or Low Alarm. In this case, no more than one analog input can be assigned to a system function.

3 Configure the following parameters to suit the application.

To change a setting, double-click and select from drop down list or edit the text.

Parameter	Setting
Status	Set to *Enabled*.
Name	Type the name of the input or use the default value.
Function	Set to *User Defined*. Or to a particular system function if the input is to be associated with that function.
Units	Select the units to match the type of analog value.
IOB Number	The number of the I/O board or module. *Generally, do not change this mapping. See point 2.*
IOB AI Number	The number of the AI on the I/O board or module. *Generally, do not change this mappings. See point 2.*
Gain	A scaling factor applied to the raw measured value.
Offset	A fixed value added to the raw measured value (after any Gain is applied).
Group	Set to 0 unless using Groups in PowerManagerII. Refer to PowerManagerII online help.

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Analog Input High and Low Alarms

Any analog input that is *Enabled* in the *Analog Inputs* table can activate a high and/or low alarm.

The Alarm Recognition Period (see details on page 45) applies to analog input alarms.

Configure the following parameters in the *Analog Input High Alarms* and/or *Analog Input Low Alarms* tables to suit the application.

To change a setting, double-click and select from drop down list or edit the text.

Parameter	Setting
Severity	Set to the required alarm priority. This determines how the alarm is indicated. See details on page 44. If set to *Disabled* then the alarm will not activate.
Threshold	An analog input high/low alarm is activated if the scaled input is greater than/less than or equal to this value.
Hysteresis	The amount of hysteresis applied to the input before an active alarm is deactivated.
Digital Output Mapping A	If required, select a relay that will be operated when the alarm is active.
Digital Output Mapping B	If required, select a second relay that will be operated when the alarm is active.
Send Trap	An SNMP Trap will be sent for this alarm, if *Send Trap* is *True* and the alarm's *Severity* matches the setting of the SNMP Trap Level (see details on page 86).
Notes	Type any required description. When the alarm is active the text will be displayed on the SC200 and included in the SNMP trap (if used).

System States

The SC200 monitors the following system states to provide an overview of the dc power system's operation. States displayed will depend on the dc power system model.

Name	Description	Where to find:
Fan	Indicates if any digital input with *Function* set to "ACD Fan Fail" is active (only used in systems with ac distribution fans).	SC200: Digitals DCTools/Web: Digital Inputs
Cabinet Fan	Indicates if any digital input with *Function* set to "Cabinet Fan Fail" is active (only used in systems with cabinet fans).	
Mains Fail	Indicates if any digital input with *Function* set to "AC Fail" is active.	
MOV Fail	Indicates if any digital input with *Function* set to "MOV Fail" is active (only used in systems with MOV surge protection).	
Load Fuse Fail	Indicates if any digital input with *Function* set to "Load Fuse Fail" is active.	
Battery Fuse Fail	Indicates if any digital input with *Function* set to "Battery Fuse Fail" is active.	
Phase Fail	Indicates if any digital input with *Function* set to "Phase Fail" is active.	

Notes:

1. See the related Alarm Descriptions on page 109.
2. A value of *Unavailable* indicates that a System State is not configured for this dc power system.
3. A value of *Missing* indicates that the I/O board has been disconnected or is faulty, or the connector mapping is incorrect.

Digital Inputs

The input/output (I/O) board is fitted with a number of configurable digital inputs (DI) which can monitor external voltage-free relay contacts or switches. See Input/Output Board on page 2 for details.

► To configure a digital input

1. In DCTools/Web go to *Digital Inputs*. Expand the *Digital Inputs* table.
2. Digital Input 1-6 are available for configuration.
   - *Digital Input 7-10 (on I/O board 1) are used for system alarms.*
   - *If additional I/O boards and/or SiteSure-3G modules are connected there will be more configurable Digital Inputs. See details in the dc power system Installation and Operation Guide.*

   The last four digital inputs are the pre-assigned Digital System States (see details on page 74). Do not change these settings.
3. Select a configurable Digital Input.
4. Configure the following parameters to suit the application.
   - *To change a setting, double-click and select from drop down list or edit the text.*

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Parameter	Setting
Status	Set to *Enabled*.
Name	Type the name of the input.
Function	Set to *User Defined*.
IOB Number	The number of the I/O board (or SiteSure-3G module if connected). Do not change.
IOB DI Number	The number of the DI on the I/O board (or SiteSure-3G module if connected). Do not change.
Active State	Select the state of the input that will activate the DI.
Group	Set to 0 unless using Groups in PowerManagerII. See PowerManagerII online help for details.

Digital Input Alarms

Any digital input that is *Enabled* in the *Digital Inputs* table can activate an alarm.

Configure the following parameters in the *Digital Input Alarms* table to suit the application.

To change a setting, double-click and select from drop down list or edit the text.

Parameter	Setting
Severity	Set to the required alarm priority. This determines how the alarm is indicated. See details on page 44. If set to *Disabled* then the alarm will not activate.
Recognition Period	The alarm will activate only after the digital input is active for this period.
Deactivation Recognition Period	The alarm will deactivate only after the digital input is inactive for this period.
Digital Output Mapping A	If required, select a relay that will be operated when the alarm is active.
Digital Output Mapping B	If required, select a second relay that will be operated when the alarm is active.
Send Trap	An SNMP Trap will be sent for this alarm, if *Send Trap* is *True* and the alarm's *Severity* matches the setting of the SNMP Trap Level (see details on page 86).
Notes	Type any required description. When the alarm is active the text will be displayed on the SC200 and included in the SNMP trap (if used).

Digital Outputs

The input/output (I/O) board is fitted with a number of digital outputs (relays) which can control external equipment or alarm systems. See Input/Output Board on page 2 for details.

Digital outputs are operated by a mapping from a digital input alarm (see details on page 74), an analog input high or low alarm (see details on page 71), or a system alarm (see details on page 43).

► To manually control a digital output

Either:

- In DCTools/Web go to *Digital Outputs*:
  - Expand the *Digital Outputs* table.
  - In the *Control State* column of the required digital output, select *Active* or *Inactive*.
- Or, use the SC200 keypad to go to *Digital Outputs*:
  - Select the required digital output. Press *Edit*.
  - Select *Active* or *Inactive*. Press *Save*.

- The *DO Manual* alarm (if enabled) will activate.
- The corresponding digital output will Energize or De-Energize, as selected in the *Active State* column of the *Digital Outputs* table.

While Active *or* Inactive is selected, t*he DO will not be operated by any active alarms mapped to it. Set Control State back to Automatic to allow mapped alarms to operate the digital output.*

► To set the state of a digital output from PowerManagerII

- In *DCTools*, set the *Group* of one or more digital outputs to a non-zero value.

  Only digital outputs with a non-zero Group are visible in PowerManagerII
- In *PowerManagerII* select the SiteManager group item.
- Click on the *Realtime* tab.
- From the drop down list beside the digital output select *Active Manual* or *Inactive Manual*.
- The *DO Manual* alarm (if enabled) will activate.
- The corresponding digital output will Energize or De-Energize, according to its *Active State.*

While Active Manual *or* Inactive Manual is selected, t*he DO will not be operated by any active alarms mapped to it. Set Control State back to Automatic to allow mapped alarms to operate the digital output.*

► To configure a digital output

1 In DCTools/Web go to *Digital Outputs*. Expand the *Digital Outputs* table.

2 Select a Digital Output (1-6*).

Other Digital Outputs will be available if additional I/O boards and/or SiteSure-3G modules are connected. See details in the dc power system Installation and Operation Guide.

3 Configure the following parameters to suit the application.

To change a setting, double-click and select from drop down list or edit the text.

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Parameter	Setting
Control State	Set to *Automatic*.
Status	Set to *Enabled*.
Name	Type the name of the output.
IOB Number	The number of the I/O board (or SiteSure-3G module). Do not change.
IOB DO Number	The number of the DO on the I/O board (or SiteSure-3G module). Do not change.
Active State	Select the state of the output when the DO is active*.
Group	Set to 0 unless using Groups in PowerManagerII. See PowerManagerII online help for details.

** Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200.*

Data Logging

The SC200 has the following data logging functions.

Event Log

The Event Log records every system event. See System Event Types on page 117 for a description of event log entries.

The most recent Event Log entries are shown by the SC200 web view, on the Log screen. See Communication via Web Browser on page 84.

► To view and save the Event Log

- To view the log entries, either:
  - In DCTools go to: *Controller Log* > *Data Log* , or
  - In Web go to *Logs* > *Log Management* and click *Event Log (CSV): Download* to view the log entries in a new browser window.
- Wait for the log entries to download from the SC200.
- To save the log to a file, either:
  - In DCTools click on *Save to File ...* , or
  - In Web go to *File* > *Save As...*
  - Type a file name, select a file type, and browse to a location to save the file.

► To configure the size of the Event Log

- Either:
  - In DCTools go to: *Controller Log* > *Configuration*, or
  - In Web go to *Logs* > *Event Log Config*.
- Type the required number of Event Log entries (up to 10,000). Memory will be allocated for at least this number of entries. When the memory is full the oldest record will be over-written.

► To clear the Event Log

- In Web go to *Logs* > *Log Management* or in DCTools go to *Controller Log* > *Configuration* > *Log Management*.
- Click *Clear Logs*.

  This will also clear the Data Log.

Data Log

The Data Log records several system parameters (AC Voltage, Bus Voltage, Load Current, Rectifier Current, Battery Current, Battery Temperature) at specified intervals. The rate of recording increases (interval is reduced) when the bus voltage differs from the float voltage by more than a specified value.

Data log entries are also written whenever a system event occurs (as for the Event Log).

► To view and save the Data Log

- To view the log entries, either:
  - In DCTools go to: *Controller Log* > *Event Log* , or
  - In Web go to *Logs* > *Log Management* and click *Data Log (CSV): Download* to view the log entries in a new browser window.
- Wait for the log entries to download from the SC200.
- To save the log to a file, either:
  - In DCTools click on *Save to File ...* , or
  - In Web go to *File* > *Save As...*
- Type a file name, select a file type, and browse to a location to save the file.

► To configure the Data Log

- Either:
  - In DCTools go to: *Controller Log* > *Configuration*, or
  - In Web go to *Logs* > *Data Log Config*.
- The following parameters must be configured.

Parameter	Description	Where to find:
Normal Interval	The time between each data log record when the Bus Voltage differs from the Float Voltage by less than the Off-Normal Offset Voltage.	Web: Logs > Data Log Config DCTools: Controller Log > Configuration > Data Log Config
Off-Normal Interval	The time between each log record when the Bus Voltage differs from the Float Voltage by more than the Data Log Off-Normal Offset Voltage.	
Off-Normal Offset Voltage	The Off Normal Log Interval will apply when bus voltage is outside the range: Float Voltage ± Off-Normal Offset Voltage. Off-normal condition transitions are recognized within 10 seconds.	
Maximum Number of Log Entries	Memory will be allocated for at least this number of Data Log entries (up to 10,000). When the memory is full the oldest record will be over-written.	

► To clear the Data Log

- In Web go to *Logs* > *Log Management* or in DCTools go to *Controller Log* > *Configuration* > *Log Management*.
- Click *Clear Logs*.

  This will also clear the Event Log.

PC Log

The PC Log allows a continuous streaming of system data (Bus Voltage, Load Current, Battery Current, Battery Temperature, Rectifier Current, Load Power, System Power) from the SC200 directly into a specified file.

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► **To configure and activate the PC Log**

1. In DCTools go to *PC Log*.
2. At *File Name*, click on the button to type a file name, select a file type, and browse to a location to save the file.
3. Select the required interval between log entries (from 5s to 60 minutes).
4. Click on *Start* to begin the log.
5. Click on *Stop* to end the log.

PC Log is only available through DCTools, not through the SC200 web server.

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Overview

Communications Options

The SC200 system controller has a standard USB interface, a standard RS232 serial interface (XS1) and an Ethernet 10BaseT interface (XS31) for communication with a local or remote PC or laptop, or a Network Management System (NMS). See the diagrams on page 2 for locations of these connectors.

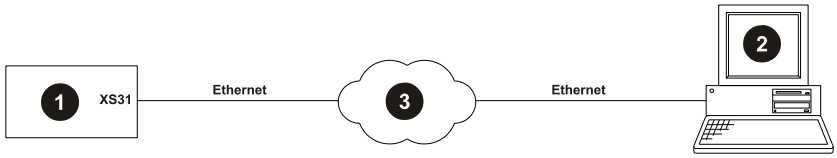
The standard communications options for an SC200 system controller are described in the following sections. For other communications options contact your Eaton dc product supplier or see Worldwide Support on page 125.

Direct (USB) Communications

See SC200 Operation Using a PC/Laptop on page 13.

Ethernet Communications

Connections



❶ SC200 system controller

❷ PC/laptop with:

- PowerManagerII and/or DCTools (see details on page 83), and/or
- Web browser (see details on page 84), and/or
- Network Management System using SNMP (see details on page 85), and/or
- Building management System using Modbus-TCP (see details on page 88).

❸ Communications network. Protocol: TCP/IP

MAC Address

► To view the MAC Address of the SC200

Either:

- Use the SC200 keypad to go to: *Info*

Or:

- In DCTools/Web go to: *Configuration* > *Communications* > *Ethernet*

The Media Access Control (MAC) address is the SC200's unique Ethernet address assigned by the manufacturer.

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SC200 Setup

The network administrator must assign a unique IP address to each SC200 to be connected to the TCP/IP network.

► To configure an SC200 for Ethernet communications from the keypad

- Go to *Settings* > *Setup*
- Enter the *IP Address*, *Subnet Mask* and *Gateway Address* assigned by the network administrator.
- If required, set *HTTP Access* to *Enabled* for web browser access, or set *HTTPS Access* to *Enabled* for secure web access.

► To configure an SC200 for Ethernet communications using *DCTools*

- Connect using USB (see details on page 13).
- In DCTools go to *Configuration* > *Communications*.
- Under *Ethernet*, type the *IP Address*, *Subnet Mask* and *Gateway Address* assigned by the network administrator.
- If required, under *HTTP (Web)*, set *HTTP Access* to *Enabled* for web browser access, or set *HTTPS Access* to *Enabled* for secure web access.

DCTools or PowerManagerII Communications Setup (if required)

► To connect to the SC200 with DCTools or PowerManagerII:

1. Install DCTools/PowerManagerII on the PC/laptop.
2. Double-click the DCTools/PowerManagerII icon to open the connection manager.
3. Go to *Connection* > *New* to open a new connection dialog box.
4. Enter:

Connection Name:	<as required>
Comms Enabled:	True
Protocol:	S3P
Connect Using:	Ethernet
S3P Address:	0 (0 = Broadcast, 1-65279 = individual address)
Server IP Address:	Allocated by network administrator
Server Port:	Allocated by network administrator
Telnet	Cleared

5. Press OK. DCTools/PowerManagerII will now connect to the SC200.
6. See System Operation on page 21 for details of the SC200 control and monitoring functions available via DCTools.

   For help using DCTools press F1.
7. If required, access to the SC200 via DCTools or PowerManagerII can be password controlled. See Write Access Password on page 95.

Communication via Web Browser

The SC200 system controller has an in-built web server. This allows a PC/laptop with a standard web browser to control and monitor the SC200 via an IP network.

► **To connect to the SC200 with web browser:**

1 Set up Ethernet communications and connect the SC200 to the IP network. See Ethernet Communications on page 82.

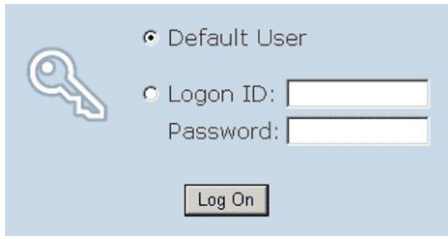
2 Open a web browser window.

Recommended web browsers: Microsoft Internet Explorer 8 or later (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0 or later.

3 Type the IP Address of the SC200 into the address bar of the browser.

If HTTPS Access has been enabled and you wish to use secure web communication (see details on page 96) then type "https://" before the IP Address.

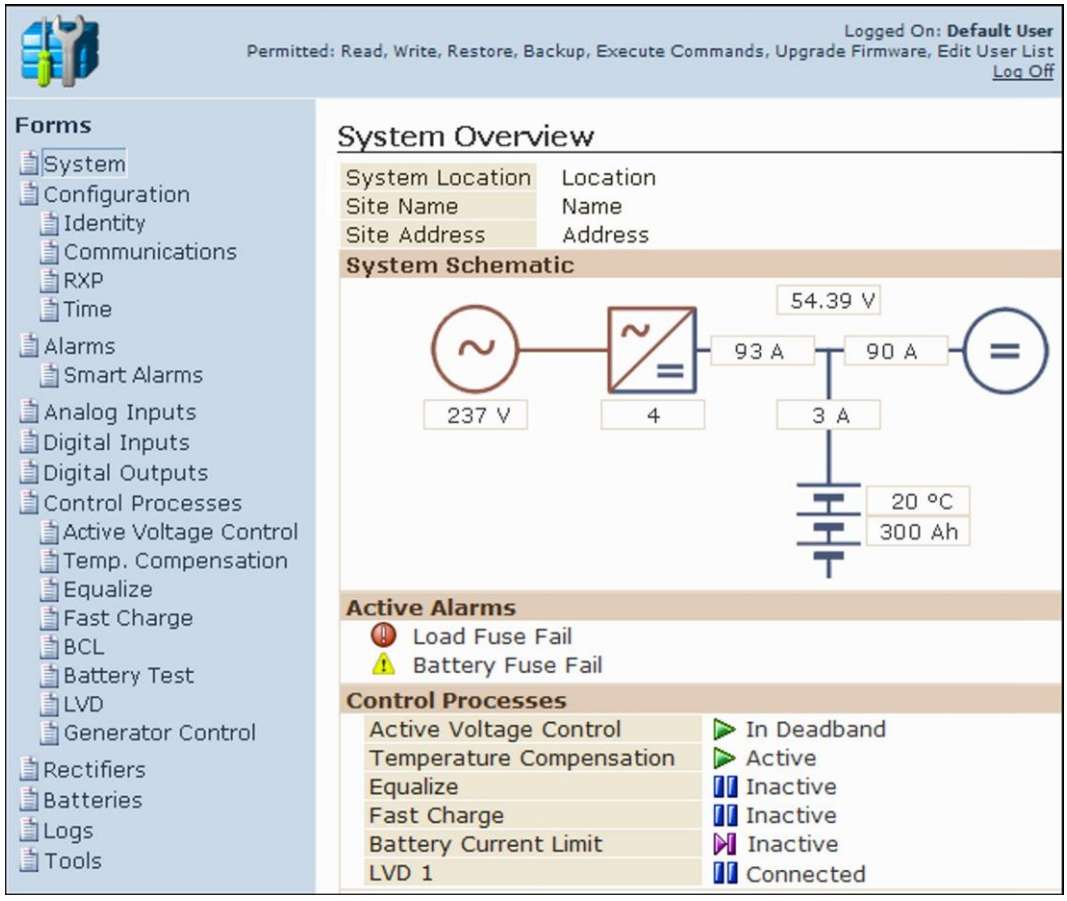
4 The SC200 web server *Log On* page will appear.



5 If required, type a Logon ID and Password. Otherwise select *Default User*.

Administration of Logon IDs and Passwords is available in DCTools/Web. See Web Access Security on page 96.

6 Click *Log On*. The SC200 web system page will be displayed.



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7 Go to the Forms for details of the SC200 control and monitoring functions available via the web.

8 To change a setting click the text field, type the new value, then press *Enter* on the PC keyboard. Then click *Apply* in the *Changes* window.

Hold the mouse pointer over any field for help.

9 Click *Log Off* (top right of window) to log out.

Communication via a Network Management System using SNMP

The SC200 system controller can be configured to allow access by a Network Management System (NMS), and/or to send alarms as SNMP traps to up to eight different SNMP trap receivers on an NMS.

► To allow SMNP access to the SC200

1 Set up Ethernet Communications (see details on page 82).

2 In *DCTools/Web* go to *Configuration* > *Communications* > *SNMP*.

3 Set the following parameters:

SNMP Access:	**Disabled:** NMS access to the SC200 is not allowed. **All:** the NMS has full access to the SC200. **Read Only:** the NMS has read only access to the SC200. **V3 Only:** SNMP v3 access is allowed.
Read Community, Write Community:	Do not change the default settings unless requested by the network administrator.
Authentication Password (SHA):	Only used with SNMP v3. Set if the NMS requires an authentication password.
Privacy Password (DES):	Only used with SNMP v3 and if an authentication password is set. Set if the NMS uses encryption.
System Object ID:	This is a unique Object Identifier that allows the NMS to identify the type of device (in this case a power system) on the network. Objects are named in the iso.org.dod.internet.private.enterprises (1.3.6.1.4.1) sub-tree for enterprise-specific objects. The default Object Identifier for an SC200-based dc power system is: 1.3.6.1.4.1.1918.2.13 A network administrator can specify a new Object Identifier within the (1.3.6.1.4.1) sub-tree, if required. Do not enter the sub-tree integers 1.3.6.1.4.1 into the System Object ID field.

► To send alarms as SNMP traps

1 Set up Ethernet Communications (see details on page 82).

2 In *DCTools* go to *Configuration* > *Communications* > *SNMP*.

3 Set the following parameters:

System Object ID:	See: To Allow NMS Access to a SC200 on page 85.
Trap Version:	Set to *SNMP V1*, *V2*, *V3* as required.

Trap Format:	Set to *Eaton* or *X.733* as appropriate . "Eaton" format uses different trap numbers according to the alarm source. X.733 format uses a single trap number for all alarm sources.
Enable Generic Traps, Trap Repeat and Trap Repeat Rate	Configure as appropriate.

4 For each SNMP trap receiver (up to 8) , configure the following parameters.

Parameter	Configuration Guidelines
Name	Type the name of the SNMP trap receiver (20 bytes maximum). *This allows 20 ASCII characters, but less for languages with multi-byte characters.*
Level	SNMP Trap Level – controls reporting of specific events for each receiver: • Select **All Alarms And Warnings** to receive Critical, Major and Minor alarms, and Warnings. (Typically Warnings are status messages such as Equalize Active.) • Select **Minor And Above** to receive Critical, Major and Minor alarms. • Select **Major And Above** to receive only Critical and Major alarms. • Select **Critical Only** to receive only Critical alarms. • Select **Disabled** to disable notifications to the receiver. *To prevent an SNMP Trap for an individual alarm, set Send Trap to False in the alarm's configuration.*
IP Address	IP address of the trap receiver assigned by the network administrator.
Port	The default setting is 162. Do not change this setting, unless requested by the network administrator.
Trap Community	A form of password. Use **public**, unless the network administrator has assigned a new password.
Mode	Select: • **Normal Traps** for sending traps to any network management system, except *PowerManagerII* • **Acknowledged Summary Trap** for sending traps to *PowerManagerII* only

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Communication via Email

The SC200 system controller can be configured to send Email alarm messages when an alarm occurs.

► **To set up Email communications:**

1. Set up Ethernet communications and connect the SC200 to the IP network. See Ethernet Communications on page 82.
2. In DCTools/Web go to *Configuration* > *Communications* > *Email Notifications*.
3. Enable *Email Notifications*.
4. Set the following parameters:

SMTP Server IP Address and Port:	The details of the mail server that will be used to send the Emails.
Return Address:	If not blank, any delivery failure notifications will be sent to this address.
Subject Prefix:	An Email subject prefix that will be added to each Email's subject to allow automatic processing of the Email.

5. For each Email recipient (up to 6), set the following parameters:

Address:	The recipient's Email address.
Level:	The severity of alarms that are to be reported to this recipient. • Select *Warnings And Above* to send an Email when an alarm with a severity of *Warning* or above changes state. • Select *Minor And Above* to send an Email when an alarm with a severity of *Minor* or above changes state. • Select *Major And Above* to send an Email when an alarm with a severity of *Major* or above changes state. • Select *None* to send no Emails. • Select *Critical Only* to send an Email when an alarm with a severity of *Critical* changes state.
Delay:	The alarm Email will be delayed by this length of time. During this delay, the SC200 will collate all the events that occur into a single Email.

Test Emails can be sent to test the Email Communication setup.

► **To send a test Email:**

1. In DCTools/Web go to *Configuration* > *Communications* > *Email Notifications*.
2. Click the *Send Test Email* button on the row of the Email address to be tested.

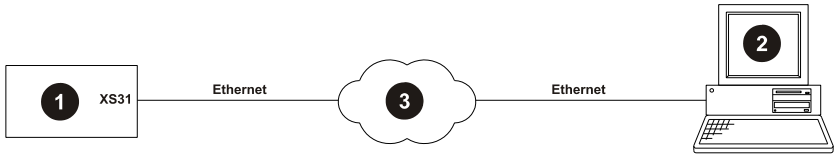
► **Diagnostics**

1. In DCTools/Web go to *Configuration* > *Communications* > *Email Notifications*.
2. The result of the most recent SMTP operation affecting each recipient is shown on the row containing the recipient's Email address. The last three digits represent the SMTP reply codes defined in RFC 821 and its extensions. A code of 250 indicates that the most recent email was delivered successfully. The SC200 will set the result to 9999 if communication with the SMTP server has failed.

Modbus-TCP Communications

Modbus-TCP* Connections

The SC200 only accepts one Modbus-TCP connection at a time, on the reserved Modbus-TCP port of 502.



❶ SC200 system controller

❷ PC/laptop with Building Management System using Modbus-TCP.

❸ Communications network. Protocol: TCP/IP

SC200 Setup

1. Setup Ethernet Communications (see details on page 82).
2. Set the following Modbus-TCP* parameters:

Parameter	Description	Where to find:
Modbus Access	Set to *Enabled*.	SC200: Settings > Modbus DCTools/Web: Configuration > Communications > Remote Access Protocols > Modbus
Address	Set to 1 for Modbus-TCP.	

** The SC200 also supports Modbus-RTU via the RS232 serial port (XS1). For details request Application Note AN0107 from your Eaton dc product supplier.*

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Diagnostics

The following diagnostic information is available.

Parameter	Description	Where to find:
Bus Message Count	Number of messages. Does not include messages with bad CRC.	DCTools/Web: Communications > Modbus > Diagnostics
Bus Communication Error Count	Number of CRC errors.	
Slave Exception Error Count	Number of exception errors.	
Slave Message Count	Number of messages to the SC200.	
Slave No Response Count	Number of messages received for which no response was sent.	
Bus Character Overrun Count	Number of messages received with more than 256 characters.	

All counts are since the last SC200 restart or since counter was reset.

Serial (RS232) Communications

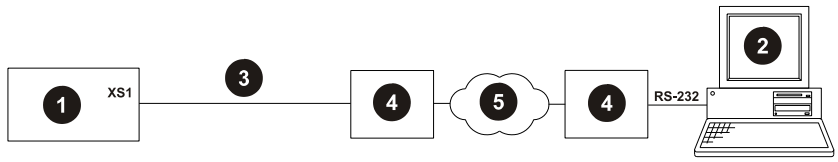
The parameters of the RS232 serial port can be configured, if required for a specific RS232 device. However, for most applications use the default settings.

Parameter	Description	Where to find:
Baud Rate	Default: 19200	SC200: Settings > Serial Port Settings DCTools/Web: Configuration > Communications > Serial > Port Settings
Parity	Default: None	
Stop Bits	Default: One	

PSTN Modem Communications

Connections

The PC modem may be external to the PC (as shown) or internal.



1. SC200 system controller
2. PC/laptop with PowerManagerII and/or DCTools.
3. RS232 modem cable (straight-thru). If access to XS1 is restricted use a DB9 ribbon cable extension (Farnell part number 869-6411).
4. PSTN modem
5. PSTN network.

SC200 Setup

Not all modems are suitable. If your modem does not operate correctly check the modem setup string. Contact your Eaton dc product supplier or Eaton for further assistance. See Worldwide Support on page 125.

► **To enable modem communications**

1. Connect to the SC200 with *DCTools/Web*.
2. Go to *Communications*.
3. Click on **+** to expand **Serial**. Configure the following settings:

Enable Modem:	Enabled
Modem Power Reset:	Optional. If this is enabled, then the SC200 will attempt to reset a non-operating modem by turning its power supply off and on using digital output 2.
Modem Set Up String:	The string sent to the modem on reset. The modem AT command should not be included as it is automatically sent. The Auto-Answer Rings parameter is also sent, so it does not need to be included here. For complete details of appropriate commands, consult your modem documentation.
Modem Auto Answer Rings:	Number of rings before an incoming call is answered. Setting this parameter to zero disables incoming calls (the modem can still be used for alarm reporting).

4. If the SC200 is to report alarms to PowerManagerII then click on + to expand PowerManager Callback. Configure the following settings:

Alarm Report:	Select the type of event(s) that will initiate the dial-out process.
Report Maximum Retries:	Set to the number of times the SC200 is to try to connect with a remote modem, if the first attempt fails.

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After this number of retries the SC200 will try the next number in the Dial Out Numbers table.

Dialing will stop if none of the numbers in the Dial Out Number Table connect.

Report Retry Interval: Set to the required interval between retries.

Dial Out Number(s): Type the telephone number(s) to be called.

Consult the modem documentation for appropriate dial modifiers.

DCTools or PowerManagerII Communications Setup

► **To connect to the SC200 with DCTools or PowerManagerII:**

1. If not already installed, install the PC modem (hardware and software) according to the manufacturer's instructions.
2. Install *DCTools/PowerManagerII* on the PC/laptop.
3. Double-click the *DCTools/PowerManagerII* icon to open the *Connection Manager* window.
4. Go to *Connection* > *New* to open a new connection dialog box.
5. Enter:

Connection Name:	<as required>
Comms Enabled:	True
Protocol:	S3P
Connect Using:	Select the COM port used by the modem (if external) or the modem name.
S3P Address:	0 (0 = Broadcast, 1-65279 = individual address)
Phone Number:	The number of the PSTN line used by the modem.
Modem Logon:	Clear if a logon script is not required for the modem. Select if a logon script is required. Click *Logon Script* to define. For more details, see DCTools/PowerManagerII online help (press F1).

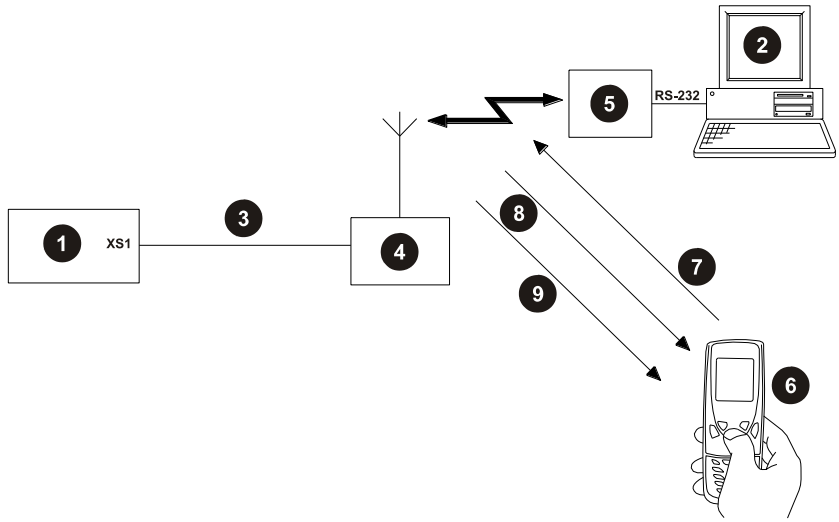
6. Press OK. *DCTools/PowerManagerII* will now connect to the SC200.
7. See System Operation on page 21 for details of the SC200 control and monitoring functions available via *DCTools*.

   For help using DCTools press F1.
8. If required, access to the SC200 via *DCTools or PowerManagerII* can be password controlled. See Write Access Password on page 95.

GSM Modem Communications

Connections

The PC modem may be external to the PC (as shown) or internal.



1. SC200 system controller
2. PC/laptop with DCTools.
3. RS232 modem cable (straight-thru). If access to XS1 is restricted use a DB9 ribbon cable extension (Farnell part number 869-6411).
4. GSM modem
5. Modem

Optional:

6. SMS text capable GSM cell phone or SMS-Email Gateway (if available)
7. SMS text message "P" or "p"
8. Power status text messages
9. Alarm text messages

SC200 Setup

Not all modems are suitable. If your modem does not operate correctly check the modem setup string. Contact your Eaton dc product supplier or Eaton for further assistance. See Worldwide Support on page 125.

► **To enable modem communications**

1. Connect to the SC200 with *DCTools* (see details on page 13).
2. Go to *Communications*.
3. Click on **+** to expand **Serial**. Configure the following settings:

Enable Modem:	Enabled
Modem Power Reset:	Optional. If this is enabled, then the SC200 will attempt to reset a non-operating modem by turning its power supply off and on using digital output 2.
Modem Set Up String:	The string sent to the modem on reset. The modem AT command should not be included as it is automatically sent. The Auto-Answer Rings parameter is also sent, so it does not need to be included here. For complete details of appropriate commands, consult your modem documentation.
Modem Auto Answer Rings:	Number of rings before an incoming call is answered. Setting this parameter to zero disables incoming calls (the modem can still be used for alarm reporting).

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DCTools Communications Setup

► **To connect to the SC200 with DCTools:**

1. If not already installed, install the PC modem (hardware and software) according to the manufacturer's instructions.
2. Install *DCTools* on the PC/laptop.
3. Double-click the *DCTools* icon to open the *Connection Manager* window.
4. Go to *Connection* > *New* to open a new connection dialog box.
5. Enter:

Connection Name:	<as required>
Comms Enabled:	True
Protocol:	S3P
Connect Using:	Select the COM port used by the modem (if external) or the modem name.
S3P Address:	0 (0 = Broadcast, 1-65279 = individual address)
Phone Number:	The number of the PSTN line used by the modem.
Modem Logon:	Clear if a logon script is not required for the modem. Select if a logon script is required. Click *Logon Script* to define. For more details, see DCTools online help (press F1).

6. Press OK. *DCTools* will now connect to the SC200.
7. See System Operation on page 21 for details of the SC200 control and monitoring functions available via *DCTools*.

   For help using DCTools press F1.
8. If required, access to the SC200 via *DCTools* can be password controlled. See Write Access Password on page 95.

SMS Text Messaging Setup (if required)

For additional information see Application Note AN0112. To receive application notes see Worldwide Support on page 125.

► **To enable SMS alarm messages**

1. Connect to the SC200 with DCTools/Web.
2. Go to *Configuration* > *Communications* > *Serial*.
3. Click on ⊞ to expand **SMS Notifications**.
4. For each cellphone to receive SMS alarm messages set the *Phone Number* and other details as required.
5. Type the required *Prefix* string if alarm messages are to be sent to an email address.

   This requires a GSM-Email Gateway connected to the GSM network. Contact the GSM network operator for details of the Prefix string required at the beginning of the SMS message.

   Emails can also be sent via an IP network. See details on page 87.

► **To check the dc power system status using SMS**

1 From any cellphone write a SMS (text) message starting with "P" or "p" (any following characters are ignored).

2 Send the message to the SC200 GSM modem telephone number.

The SC200 will reply with a dc power system status message. This will include: Number of active alarms, bus voltage, load current, ac voltage, battery current, battery temperature, battery time remaining (if available).

Serial Server

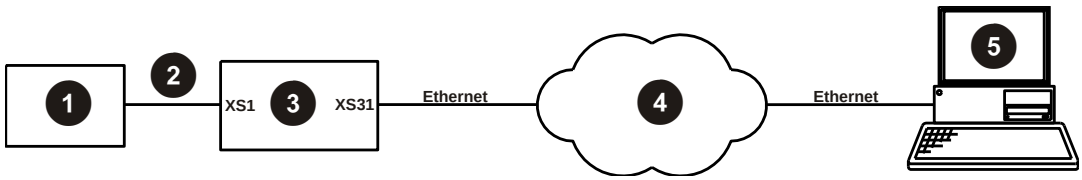
The SC200's Serial Server function makes the SC200's RS232 port available to any software via Ethernet. For example, use Serial Server to connect DCTools to a CellSure Battery Controller (CBC) connected to the SC200.

For information refer to the CellSure Installation Guide (see Related Information on page i).

For another example, use Serial Server to connect Winpower to a Matrix Controller connected to the SC200.

For details request AN0117, Communicate with Matrix Controllers through an SC200, from your Eaton dc product supplier.

Connections



1. External device.
2. RS232 modem cable. For the SC200's RS232 port, see details on page 113. For details of the external device's RS232 port and whether the cable should be straight-through or crossed (null modem), see the external device's documentation.
3. SC200 system controller.
4. Communications network. Protocol TCP/IP.
5. PC/laptop with PowerManagerII and/or DCTools, or other software with a port redirector.

► **SC200 Setup**

1 Configure the SC200 for Ethernet communications. See details on page 82.

2 Either:

- On the SC200 keypad go to *Settings* > *Setup* > *Serial Server*. Select *Enabled*.
  Or:
- Use DCTools/Web to go to *Configuration* > *Communications* > *Remote Access Protocols* > *Serial Server*.
- Set *Access* to *Enabled*.

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DCTools or PowerManagerII Setup

Use similar settings for other software.

1. Install DCTools/PowerManagerII on the PC/laptop.
2. Double-click the DCTools/PowerManagerII icon to open the connection manager.
3. Go to *Connection* > *New* to open a new connection dialog box.
4. Enter:

Connection Name:	<as required>
Comms Enabled:	True
Protocol:	S3P
Connect Using:	Local Network
S3P Address:	0 (0 = Broadcast, 1-65279 = individual address)
Server IP Address:	The IP Address of the SC200. Allocated by network administrator.
Server Port:	15000
Telnet	Cleared

5. Press OK. DCTools/PowerManagerII will now connect to the device connected to the SC200's RS232 port.

Communications Security

SC200 settings cannot be changed if:

- All communications are disabled (see S3P Access on page 95 and HTTP/HTTPS Access on page 96), and
- Keypad access (see details on page 10) is *Read Only*, or PIN Protected and the keypad access PIN is lost.

In this situation the SC200 will continue to function, but no configuration changes can be made. Contact your Eaton dc product supplier or Eaton for advice (see Worldwide Support on page 125).

Serial Communications (USB/RS232/Ethernet) Security

S3P Access

S3P is the serial communications protocol used by the SC200 to communicate with *DCTools* or *PowerManagerII* via the USB, RS232 or Ethernet port.

S3P Protocol is not used by the web server.

► To Enable/Disable S3P access

- On the SC200 keypad go to *Settings* > *Setup* > *S3P*. Select *Enabled* or *Disabled*.

Or:

1. Connect to the SC200 with a web browser (see details on page 82).
2. Go to *Configuration* > *Communications* > *Remote Access Protocols* > *S3P*.
3. Set *Access* to *Enabled* or *Disabled*.

Write Access Password

The Write Access Password prevents unauthorized changes to the SC200 configuration (using *DCTools* or *PowerManagerII*).

When a Write Access Password is set serial communications access to the SC200 (using DCTools or PowerManagerII) is read only. The password must be entered before any setting can be changed.

If a Write Access Password is lost, clear it from the SC200 keypad and type a new password in DCTools, or change it via the Web.

► To set a Write Access Password

1. Connect to the SC200 with DCTools/Web (see details on page 82).
2. Go to *Configuration* > *Communications* > *Remote Access Protocols* > *S3P*
3. Type a password into the *Write Access Password* field.

   Passwords are case sensitive, maximum 32 characters.
4. Click the *Apply Changes* button.

► To clear or change a Write Access Password

1. Connect to the SC200 with DCTools/Web (see details on page 82).
2. Go to *Configuration* > *Communications* > *Remote Access Protocols* > *S3P*
3. Type a new password into the *Write Access Password* field or leave the field blank for no password control.
4. Click the *Apply Changes* button.
5. DCTools only: Type the old password.

► To clear a Write Access Password from the SC200

1. Use SC200 keypad to go to *Settings* > *Setup* > *Clear Write Access Password*
2. Press *Enter*.

The password is now permanently cleared. If required, reset the password with DCTools/Web.

Web Access Security

Server Access

Access to the SC200 web server can be disabled or set for secure access using Secure Sockets Layer (SSL) protocol.

SSL is a protocol for transmitting encrypted data over the Internet. URLs that require an SSL connection start with https: instead of http:. If the network is insecure, Eaton recommends that you disable HTTP Access.

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► To change access to the web server

Set the following parameters as required.

Parameter	Description	Where to find:
HTTP Access	Enable to allow un-encrypted access to the SC200 web server. Disable to prevent un-encrypted access to the SC200 web server.	SC200: Settings > Setup DCTools/Web: Communications > HTTP (Web)
HTTPS Access	Enable to allow encrypted access to the SC200 web server. *HTTPS access will be slower than HTTP because of the encryption process.* Disable to prevent encrypted access to the SC200 web server.	

User Setup

► To setup specific users and control their access levels

For each user, set the following parameters as required.

If there are no active users then web access is disabled. Use DCTools to set up an active user.

Parameter	Description	Where to find:
User Name	This is not used in the login process (except for "Default User"). It is displayed at the top-right of the Web view screen.	DCTools/Web: Communications > HTTP (Web)
Logon ID*	The logon name of the user.	
Password*	The password of the user. *Lost passwords cannot be recovered. If a password is lost then set a new password.*	
Read	Allows the user to view configuration settings only.	
Write	Allows the user to change configuration settings.	
Backup	Allows the user to download configuration or snapshot files.	
Restore	Allows the user to upload configuration or snapshot files.	
Execute Commands	Allows the user to stop and start control processes.	
Upgrade Firmware	Allows the user to upgrade firmware.	
Edit User List	Allows the user to edit the user list and change user access settings.	

**Leave both fields blank to allow Default User (anonymous) log on.*

CSP

These are parameters for specific protocols. Contact Eaton for further details.

If these protocols are not used then leave the parameters at their default values.

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Overview

- The dc power system contains hazardous voltages and hazardous energy levels. Before undertaking any maintenance task refer to the Warnings in the dc power system Installation and Operation Guide.
- If a maintenance task must be performed on a "live" system then take all necessary precautions to avoid short-circuits or disconnection of the load equipment, and follow any "live-working" instructions applicable to the site.
- Only perform the maintenance tasks described in the Maintenance chapter. All other tasks are classified as Servicing. Servicing must only be performed according to specific instructions and only by personnel authorized by Eaton. This includes disassembly and/or servicing of any modules.
- For further information on Servicing contact your local Eaton dc product supplier, or refer to the contact details on page 125.

Troubleshooting

Use the table to troubleshoot minor installation and operational problems. For additional assistance see contact details on page 125. Return items for replacement or repair with a completed Equipment Incident Report on page 123.

Problem	Possible Cause	Required Action
SC200 displays a dc power system alarm message.		See Alarm Descriptions on page 109.
SC200 LCD is blank and green Power On LED is off.	RXP/power cable is disconnected from the SC200.	Connect cable from connector YS11 to the dc power system voltage feed module (see Connections on page 3). Wait for start-up to complete.
	The ac supply is off and the batteries are not connected because the Low Voltage Disconnect (LVD) has disconnected.	None. The power system including the SC200 will return to normal operation when the ac supply is within its specified voltage range.
	Faulty Voltage Feed Module (VFM) or faulty SC200.	Replace faulty unit.
SC200 LCD is blank and green Power On LED is on.	SC200 is in start-up mode	Wait for start-up to complete. See Starting the SC200 on page 6.
	Faulty SC200	Replace faulty SC200.
SC200 Red LED or Yellow LED is on.	An alarm is active.	Check the type of alarm on the LCD or with *DCTools/Web* or *PowerManagerII*. See Alarm Descriptions on page 109.
Unable to change settings from SC200 keypad.	Keypad access is set to *Read Only* or *PIN Protected*.	See Keypad Access Security on page 10.
Rectifier does not shutdown when LBRS is enabled.	Load Based Rectifier Shutdown is not available with APR48-3G (prior to PR5), EPR48-3G, APR24-3G and CR48-3G rectifiers.	See Load Based Rectifier Shutdown on page 35.
Monitor OK relay (RLY6) is de-energized.	An active alarm, digital input or analog input is mapped to this relay.	Check relay mapping. See Digital Outputs on page 75.
	Problem with power or communications to I/O board.	Check all connections (see Connections on page 3).
	SC200 or I/O board software corrupt or hardware fault.	Replace faulty unit.
Incorrect battery or load current readings.	Bus voltage sense polarity is incorrect.	Check the bus voltage sense polarity and correct if necessary.
	Incorrectly configured shunt inputs.	Check shunt mapping and gain is correct.
	Current is within the *Battery State Threshold*. See details on page 56.	None, normal operation.

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Problem	Possible Cause	Required Action
Battery test will not run. The cause indicated in DCTools/Web is "Alarms Active" but there are no active alarms.	Battery test will not run if a relevant alarm is active or pending even if the alarm is disabled. Examples of relevant alarms are: *Battery Fuse Fail*, *Rectifier No Load* and *System Overload*.	Clear the cause of the alarm.
	Battery test will not run if the *System Overload* alarm is set to "Redundancy" and only one rectifier is installed.	Set the *System Overload* alarm to "Total Capacity" or install another rectifier.
SC200 or DCTools/Web displays **???** or **N/A**	Failed, disconnected or unconfigured sensor.	Replace, connect or configure sensor.
	Faulty or disconnected voltage feed module.	Replace or connect voltage feed module.
	Incorrect I/O board mapping.	Check I/O board mapping. See details on page 119.
DCTools connection problem (*Target Failed to Respond* error)	Connection problem	Refer to following communications problems.
Modem/RS232 communications problem.	Incorrect, disconnected or faulty cable.	Check an RS232 straight-thru cable is plugged into XS1 and the modem. Replace faulty cable.
	Access to RS232 connector XS1 is restricted.	Use a DB9 ribbon cable extension (Farnell part number 869-6411).
	Incorrect communications settings.	See PSTN Modem Communications on page 90 or GSM Modem Communications on page 92.
	Incorrect modem setup string.	Refer to the AT command section in the modem's manual.
	Modem not powered or other modem problem.	Refer to the modem's manual.
	Incompatible modem.	Contact your Eaton dc product supplier or Eaton for advice. See Worldwide Support on page 125.
	Password required to change settings.	See Write Access Password on page 95.
Serial communications are disabled	*S3P Access* is disabled.	*Set S3P Access* to Enabled. See details in the System Controller Operation Handbook.

Problem	Possible Cause	Required Action
Ethernet communications problem	Incorrect, disconnected or faulty cable.	Check a network patch cable is connected from XS31 to a live network outlet. Replace faulty cable.
	Ethernet link is not active.	On the Ethernet connector (XS31) check: Yellow LED is continuously lit to show link is active. Green LED flashes to show traffic is reaching the SC200. See the diagrams on page 2 for position of the Ethernet connector.
	Incorrect communications settings.	See Ethernet Communications on page 82.
	SC200 serial communications are disabled.	Check *S3P Access* is enabled. See details on page 95.
	Password required to change settings (using DCTools or PowerManagerII).	See Write Access Password on page 95.
Web communications problem	Ethernet communications problem.	See previous entry.
	Cannot connect to web server.	Check IP address and other settings in SC200 are correct. Check correct IP address is used in web browser address bar. See Ethernet Communications on page 82. Check *HTTP Access* or *HTTPS Access* is enabled. See Web Access Security on page 96.
	Cannot log on to web server.	Incorrect Logon ID or Password, or no active users setup. Use DCTools to set up an active user. See Web Access Security on page 96.
	Web communications lost (*Comms Lost* error message).	Check that the SC200 is operating. Check the Ethernet communications connections. See previous entry. Check web browser type and version. See Compatible Software on page 4.
	Lost Logon ID and/or Password.	Use DCTools to set up a new Logon ID and/or Password. See Web Access Security on page 96.
	Default User log on is not available.	*Default User* is not setup or not active. Use DCTools to set up a *Default User*. See Web Access Security on page 96.
	A user cannot change settings, Backup or Restore, Execute Commands, Upgrade Firmware, or Edit User List.	Check the user's access levels. See Web Access Security on page 96.

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USB communications problem	Incorrect, disconnected or faulty cable.	Check a USB A/B cable is plugged into the USB port and a PC USB port. Replace faulty cable.
	SC200 serial communications are disabled.	Check *S3P Access* is enabled. See details on page 95.
	DCTools not installed on PC or wrong version.	Install latest version of DCTools. Download from dcpower.eaton.com/downloads.
	Password required to change settings.	See Write Access Password on page 95.
SC200 time/date is incorrect	Time/date is different on SC200 compared to DCTools/Web.	None. Time shown on SC200 is UTC. Time on PC running DCTools/Web is local time.
	Time needs to be set.	See SC200 Internal Clock on page 14.
	SC200 time can be set, but is incorrect when SC200 restarts.	Internal battery is dead. Return SC200 for service. (If removed, the battery must be disposed of according to the manufacturer's instructions.)
String Fail Alarm	The Battery Mid-point Monitoring system has detected a voltage imbalance in one of the battery strings.	See Battery Mid-point Monitoring in the dc power system Installation and Operation Guide.
	A Battery Mid-point Monitoring sense wire is disconnected.	Check the sense wires.
I/O board Power/Comms OK LED is off	I/O board is not powered or faulty.	Check connection to YH3 on I/O board. See Connections on page 3. Replace I/O board if faulty.
I/O board Power/Comms OK LED is flashing.	I/O board is responding to an *Identify* command from the SC200.	None, this is normal operation. See details on page 70.
LVD Status LED(s) (on I/O board) are on.	LVD contactor is energized.	None, this is normal operation.
LVD Status LED(s) are off (I/O board Power On LED is on).	LVD contactor is de-energized.	None, this is normal operation.
LVD Status LED(s) flashing.	The contactor is in the wrong state (SC200 internal state does not match signal from contactor auxiliary switch).	Check the electrical and mechanical operation of the contactor and auxiliary switch. Check all wiring and connectors. See Connections on page 3.
	LVD Type setting is incorrect.	Check *LVD Type* setting.

Problem	Possible Cause	Required Action
LVD contactor(s) not operating.	LVD settings incorrect.	Check LVD is enabled and set to correct values. See details on page 41. Check that the LVD manual control is set to AUTO. See details on page 38. Check that the contactor is correctly configured and mapped to the I/O board. See details on page 42.
	Contactor is disconnected.	Check the control and dc power cables are connected. See details on page 3.
System has no dc output (rectifiers are on).	Load fuse or disconnect device open.	Check for open fuse or disconnect device.
	LVD contactor has disconnected the load.	Use *DCTools/Web to c*heck LVD is enabled and set to correct values. (LVD status LED on the I/O board is on when contactor is energized.) Check that the I/O board is connected (Power LED is on). Check that the LVD control and power cables connections on page 3. Check the connections from the load bus to the LVD.
System has no battery input	Battery disconnect device or fuse open.	Check for open battery disconnect device or fuse.
	LVD has disconnected the battery because ac supply is off and the battery is fully discharged.	None. The battery will be automatically reconnected when the ac supply is restored.
	LVD contactor is open.	Use *DCTools/Web to c*heck LVD is enabled and set to correct values. (LVD status LED on the I/O board is on when contactor is energized.) Check that the I/O board is connected (Power LED is on). Check that the LVD control and power cables are connected. See Connections on page 3. Check the connections from the battery bus to the LVD.

Replacing the System Controller or I/O Board

The SC200 system controller or the I/O board can be replaced without switching off the dc power system and disconnecting the equipment it powers.

The specific procedures depend on the system configuration. Refer to the dc power system Installation and Operation Guide.

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SC200 system controller

Communications

USB	Version:	1.1 (12Mbits/s)
	Connector:	USB B (female)
RS232	Interface:	RS232 (DTE)
	Connector:	DB9M
Ethernet	Interface:	10baseT
	Connector:	RJ45
	Protocols:	TCP/IP, SNMP, S3P over IP, http (Web), https (secure Web), SNTP, Modbus-TCP, Serial Server
	MAC Address:	See details on page 82.
	Web browser:	Microsoft Internet Explorer 8 or later (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0 or later.
External modem options	Type:	PSTN or GSM
	Operation:	Dial in/Dial out on alarm*

** Can operate as a backup for Ethernet communications.*

IOBGP-00, -01 I/O Board

The following specifications apply to a single IOBGP-00, -01 I/O board connected to the SC200 system controller.

Digital Outputs/Alarm Relays (IOBGP)

Number of Digital Outputs/Relays	6 (one also used for Monitor OK alarm)*
Contact Arrangement	One changeover contact per relay
Contact Rating	0.1A @ 60V dc maximum
Connectors	Screwless terminal blocks
Wire Size	0.5 - 2.0mm² [20 - 14 AWG]
Maximum Cable Length	20m (65 feet)
Isolation	Relay connections are isolated to 500V dc from all other circuitry, earth and system common.

** Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200.*

Battery Mid-point Monitoring

Number of Strings	Standard: 4 Maximum: 24 (with additional IOBGP-01 I/O boards)
Range	–35V to +35V
Resolution	<30mV
Accuracy	±0.5% at 25°C [77°F], ±1% over rated temperature range
Maximum Cable Length	20m (65 feet)

Digital Inputs (IOBGP)

Number of Digital Inputs	6
Connectors	Screwless terminal blocks
Wire Size	0.5 - 2.0mm^2 [20 - 14 AWG]
Maximum Cable Length	20m (65 feet)
Input Types	Voltage-free switch or relay contacts only
Input Range	Live Bus to Live Bus + 5V
Input Common	Same bus as used for current shunts (Live bus is standard)
Input Protection	Protected against damage from short circuit to live or common bus

Temperature Sense Inputs (IOBGP)

Number of Temperature Sense Inputs	2 *One only connected as standard. Second input available (requires additional temperature sensor).*
Range	2.53V to 3.43V (-20 to +70°C [-4 to +158°F])
Resolution	< 0.01V (< 1°C [1.8°F])
Accuracy	±1°C [1.8°F] at 25°C [77°F], ±2°C [3.6°F] over rated temperature range
Maximum Cable Length	20m (65 feet)
Connector	RJ45

Current Sense Inputs (IOBGP)

Number of Current Sense Inputs	3
Range	–50 to +50mV
Resolution	<50µV
Accuracy	±0.5% at 25°C [77°F], ±1% over rated temperature range
Maximum Cable Length	10m (32 feet)
Connector	RJ45

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Bus Voltage Sense Input (IOBGP)

Number of Bus Voltage Sense Inputs	1
Range	–60V to +60V
Resolution	30mV
Accuracy	±0.5% at 25°C [77°F], ±1% over rated temperature range
Maximum Cable Length	3m (10 feet)
Connector	MTA156 (2-way)

Low Voltage Disconnect (IOBGP)

Number of contactor connections	2 per IOBGP I/O board
Number of LVD channels	16
Contactor Type	Normally Open (NO) with auxiliary contacts only.
Contactor Coil Voltage (nominal)	12V, 24V or 48V
Maximum Hold-in Current	1.2A (per contactor)
Maximum Cable Length	3m (10 feet)
Connector	MTA156 (4-way)

Power and RXP Comms

Maximum Cable Length (from Voltage Feed Module)	24V Systems - 100m (325 feet) 48V Systems - 200m (650 feet)
Connector	RJ45

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Alarm Descriptions

AC Fail	All rectifiers report ac supply failure or a digital input with *Function* set to "AC Fail" is active.
AC Phase 1/2/3 Fail	Phase 1/2/3 of the ac input, as measured by CR48-3G rectifiers, has failed, i.e. it deviates from the *Nominal AC Voltage* by more than the *AC Phase Fail Threshold*. Not available in systems with other rectifier models.
AC Phase 1/2/3 Voltage	Phase 1/2/3 of the ac input, as measured by CR48-3G rectifiers, deviates from the *Nominal AC Voltage* by more than the *AC Phase Voltage Threshold*. Not available in systems with other rectifier models.
ACD Fan Fail	The ac distribution cooling system or fan controller has failed (indicated by an active digital input with *Function* set to "ACD Fan Fail".
Auxiliary Sensor Fail	An I/O board has an analog input with Function *User Defined* and the input is either out of range or unavailable.
Battery Current Limit	Battery Current Limit (BCL) is active. See Battery Current Limit on page 23.
Battery Fuse Fail	A battery fuse has blown or a battery disconnect device has operated (indicated by an active digital input with *Function* "Battery Fuse Fail").
Battery Temperature High	The analog input with *Function* set to "Battery Temperature" has a value above the *Battery Temperature High Threshold*. This alarm indicates either thermal runaway of the batteries or that the batteries are operating at a temperature that may cause reduced battery life.
Battery Temperature Low	The analog input with *Function* set to "Battery Temperature" has a value below the *Battery Temperature Low Threshold*. This alarm indicates a risk to the standby power system battery as lower temperatures reduce the battery capacity.
Battery Test	The Battery Test control process is active. See Battery Test on page 25.
Battery Test Fail	The batteries do not have the required capacity or are not fully charged. See Battery Test on page 25.
Cabinet Fan Fail	A cabinet fan has failed (indicated by an active digital input with *Function* set to "Cabinet Fan Fail").
Configuration Error	One of the following is true: • The Rectifier Current Limit is set higher than the Maximum Current Limit of all the registered rectifiers. See details on page 33. • The OVSD Set Point is out of the range of any registered rectifiers. See details on page 33. • More than one digital output are mapped to the same relay on an I/O board or SiteSure-3G Module. See details on page 75. • An LVD contactor is in *Conflict* state. See details on page 42. • *Smart Alarm Based Disconnect* is *Enabled*, but the corresponding *Smart Alarm* is *Disabled*. See details on page 42. • A *Smart Alarm* source has an invalid *Source Triggered* setting.
DO Manual	A digital output is set to manual control (control state is set to *Active* or *Inactive*). See Digital Outputs on page 75.
Equalize	The Equalize control process is active. See Equalize on page 26.
Fast Charge	The Fast Charge control process is active. See Fast Charge on page 27.

Generator Fail	*Generator Control* is active but the SC200 has not detected that the ac supply is present (rectifiers have not turned on) after the *Generator Fail Alarm Recognition Period*.
High Float	The bus voltage is above its normal range (set by the *High Float Threshold*).
High Load	The bus voltage is higher than the safe range for the load and/or battery (set by the *High Load Threshold*).
In Discharge	*Battery Charge State* is *Discharge* (see details on page 56).
Load Fuse Fail	A load fuse has blown or a load disconnect device has operated (indicated by an active digital input with *Function* "Load Fuse Fail").
Low Float	The bus voltage is below its normal range (set by the *Low Float Threshold*).
Low Load	The bus voltage is lower than the safe range for the load and/or battery (set by the *Low Load Threshold*).
LVD Characterization Error	An LVD contactor must be characterized. See Low Voltage Disconnect on page 38.
LVD Disconnected	An LVD contactor has disconnected the battery or load. See Low Voltage Disconnect on page 38.
LVD Fail	An LVD contactor is faulty or the control cable from the I/O board is disconnected. See Low Voltage Disconnect on page 38.
LVD Manual	An LVD is set to MANUAL CONNECT or MANUAL DISCONNECT. See Low Voltage Disconnect on page 38.
Missing Hardware	The SC200 has lost communication with a mapped I/O board or SiteSure-3G module. Or, an input or output is mapped to an invalid I/O board or SiteSure-3G module. See I/O Board Mapping on page 119.
MOV Fail	One or more MOV cartridges have failed and must be replaced (indicated by an active digital input with *Function* set to "MOV Fail").
Multiple Rectifier Comms Lost	More than one rectifier has lost communications. See also Rectifier Comms Lost on page 110.
Multiple Rectifier Fail	Multiple rectifiers are faulty or their ac supply has failed without causing partial or total ac supply failure. Inhibited by: *AC Fail* and *Partial AC Fail* (if no more than one rectifier has failed while still detecting the AC supply). See details of Alarm Inhibiting on page 47.
Partial AC Fail	A digital input with *Function* set to "Phase Fail" is active, or more than 20% of single-phase rectifiers are reporting ac supply failure, or all 3-phase rectifiers are reporting loss of the same phase. Inhibited by: *AC Fail*. See details of Alarm Inhibiting on page 47.
Rectifier Comms Lost	Normally this alarm indicates that a rectifier has been removed during routine maintenance. However, faulty rectifier communications or losing the rectifier communications bus can also trigger this alarm. If removing multiple rectifiers triggers this alarm, reset it from the keypad before it triggers an external alarm. Inhibited by: *Multiple Rectifier Comms Lost*. See details of Alarm Inhibiting on page 47.
Rectifier Current Limit	Rectifier(s) in current limit.
Rectifier Fail	A rectifier is faulty or its ac supply has failed without causing partial or total ac supply failure. Inhibited by: *Multiple Rectifier Fail*, *AC Fail* and *Partial AC Fail* (if no rectifiers have failed while still detecting the AC supply). See details of Alarm Inhibiting on page 47.

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Rectifier No Load	The total rectifier current is less than 2% of the maximum system output current or is less than 2A. Inhibited by: *AC Fail*. See details of Alarm Inhibiting on page 47.
Rectifier Over Temperature	Rectifier(s) operating in temperature turndown mode, because of high ambient temperature or low ac supply voltage.
Sensor Fail	The current, temperature or voltage sensing system is faulty, or the I/O board mapping is incorrect.
Standby Mode	The SC200 is on but inactive. Another system controller controls the dc power system. If the other system controller fails or is disconnected then the SC200 in Standby Mode will become active (after a short delay).
String Fail	There is a voltage imbalance in one of the battery strings. See Battery Mid-point Monitoring on page 57.
System Overload	The power system is operating close to its maximum capacity and more rectifiers are needed. The System Overload threshold is configurable. See System Overload Alarm on page 47. Inhibited by: *AC Fail*. See details of Alarm Inhibiting on page 47.
Unknown Hardware	The SC200 has detected an unknown type of device on the RXP bus. Contact your Eaton DC product supplier for advice.
Unmapped IOB Found	An I/O board or SiteSure-3G module is connected to the SC200, but its serial number is not in the *I/O Board to Serial Number Mapping* table. See I/O Board Mapping on page 119.
Wrong Battery Polarity	An analog input with *Function* set to "Reverse Battery Detect" has a value above the *Bus Voltage*. This alarm indicates the battery is connected with wrong polarity. See Reverse Battery Detection on page 64.

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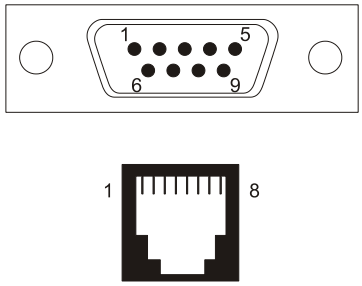
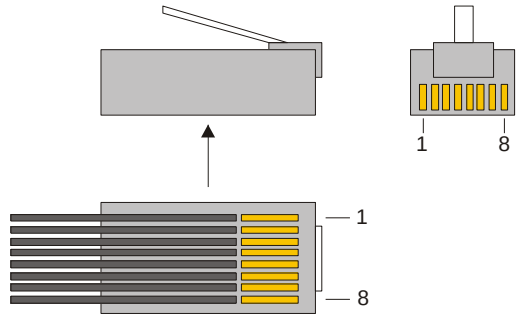
System Controller Connector Pin-outs

Connector	Type	Purpose	Pin	Description
XS1	DB9M	RS232 Serial Interface	1	-
			2	RD (Receive Data)
			3	TD (Transmit Data)
			4	DTR (Data Terminal Ready)
			5	Common (Ground)
			6	-
			7	RTS (Request to Send)
			8	-
			9	-
XS31	RJ45	Ethernet Interface	1	Rx
			2	Rx
			3	Tx
			4	-
			5	-
			6	Tx
			7	-
			8	-
YS11	RJ45	RXP System Communications	1	+24/48V (System bus voltage)
			2	+24/48V (System bus voltage)
			3	-
			4	RS485-A
			5	RS485-B
			6	-
			7	0V
			8	0V
USB	USB B	USB Serial Interface	1	VCC (+5 V dc)
			2	Data -
			3	Data +
			4	Ground



RS232 D9M and RJ45 connector pin-outs



RJ45 plug pin-outs

I/O Board (IOBGP-00, -01) Connector Pin-outs

See input and output specifications on page 105.

Connector	Type	Purpose	Pin	Description
XH4	MTA 156	LVD 1 Interface	1	Coil -
			2	Coil +
			3	LVD 1 auxiliary switch
			4	Auxiliary switch common
XH5	MTA 156	LVD 2 Interface	1	Coil -
			2	Coil +
			3	LVD 2 auxiliary switch
			4	Auxiliary switch common
XH6	RJ45	Current Sense Inputs	1	Current Input 1 Common
			2	Current Input 1
			3	+12V out
			4	Current Input 2 Common
			5	Current Input 2
			6	0V out
			7	Current Input 3 Common
			8	Current Input 3
XH7	RJ45	Temperature Sense Inputs	1	-
			2	-
			3	-
			4	Temp Sense 1+
			5	Temp Sense 1-
			6	-
			7	Temp Sense 2+
			8	Temp Sense 2-

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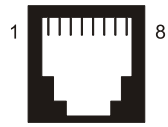
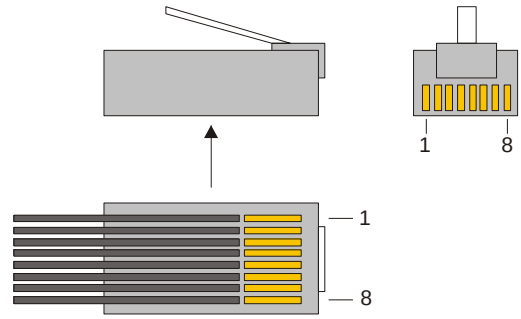
Connector	Type	Purpose	Pin	Description
XH8	MTA 156	LVD Power	1	Bus live
			2	Common
XH9	MTA 156	Bus Voltage Sense Input	1	Controller reference (Live)
			2	Controller sense (Com)
XH12A	MTA 156	Battery Mid-point Monitoring sense inputs	1	String 1 Mid-point
			2	String 2 Mid-point
			3	String 3 Mid-point
			4	String 4 Mid-point
XH15A		Digital inputs D1-D3	1	D1 input
			2	0V
			3	D2 input
			4	0V
			5	D3 input
			6	0V
XH15B		Digital inputs D4-D6	1	D4 input
			2	0V
			3	D5 input
			4	0V
			5	D6 input
			6	0V
XH16/XH17		Digital relay outputs 1-2	1	Relay 1 normally closed (NC)
			2	Relay 1 normally open (NO)
			3	Relay 1 Common (COM)
			4	Relay 2 normally closed (NC)
			5	Relay 2 normally open (NO)
			6	Relay 2 Common (COM)
XH18/XH19		Digital relay outputs 3-4	1	Relay 3 normally closed (NC)
			2	Relay 3 normally open (NO)
			3	Relay 3 Common (COM)
			4	Relay 4 normally closed (NC)
			5	Relay 4 normally open (NO)
			6	Relay 4 Common (COM)
XH20/XH21		Digital relay outputs 5-6*	1	Relay 5 normally closed (NC)
			2	Relay 5 normally open (NO)
			3	Relay 5 Common (COM)
			4	Relay 6 normally closed (NC)
			5	Relay 6 normally open (NO)

Connector	Type	Purpose	Pin	Description
			6	Relay 6 Common (COM)
YH3	RJ45	DC power system digital inputs	1	Load Fuse Fail
			2	Battery Fuse Fail
			3	+12V out
			4	AC Distribution Fan Fail
			5	AC Distribution MOV Fail
			6	0V out (system live - protected)
			7	-
			8	System common - protected
YH11	RJ45	RXP System Communications	1	+24/48V (System bus voltage)
			2	+24/48V (System bus voltage)
			3	-
			4	RS485-A
			5	RS485-B
			6	-
			7	0V
			8	0V

** Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200.*



RJ45 connector pin-outs



RJ45 plug pin-outs

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Event Type	Description	Additional Event Information
AI High Activation	An analog input high threshold alarm has become active.	Analog input number (DCTools) or name (Web).
AI High Deactivation	An analog input high threshold alarm has become inactive.	Analog input number (DCTools) or name (Web).
AI Low Activation	An analog input low threshold alarm has become active.	Analog input number (DCTools) or name (Web).
AI Low Deactivation	An analog input low threshold alarm has become inactive.	Analog input number (DCTools) or name (Web).
Alarm Activation	An alarm has become active.	Alarm number (DCTools) or name (Web).
Alarm Deactivation	An alarm has become inactive.	Alarm number (DCTools) or name (Web).
Clock Change From	The clock was changed to this new Event Log Time from the old Event Information time. When the clock is changed, two event log entries are recorded. The first is the Clock Change To event and the second is the Clock Change From event.	
Clock Change To	The clock was changed to the new Event Information time from the old Event Log Time. When the clock is changed, two event log entries are recorded. The first is the Clock Change To event and the second is the Clock Change From event.	
Configuration Change	The configuration database was changed.	
DI Activation	A digital input alarm has become active.	Digital input number (DCTools) or name (Web).
DI Deactivation	A digital input alarm has become inactive.	Digital input number (DCTools) or name (Web).
DO Control Activation	A digital output has been manually activated.	Digital output number (DCTools) or name (Web).
DO Control Deactivation	A digital output has been manually deactivated.	Digital output number (DCTools) or name (Web).
Logs Cleared	The event and data logs have been cleared.	
Manual Equalize Start	An Equalize cycle has been manually started.	

Event Type	Description	Additional Event Information
Manual Equalize Stop	An Equalize cycle has been manually stopped.	
Manual Fast Charge Start	A Fast Charge cycle has been manually started.	
Manual Fast Charge Stop	A Fast Charge cycle has been manually stopped.	
Rectifier Restart	A rectifier was started manually. This excludes events where a rectifier starts due to Load-Based Rectifier Shutdown or after the removal of a fault condition.	
Rectifier Shutdown	A rectifier was shut down manually. This excludes events where a rectifier shuts down due to Load-Based Rectifier Shutdown or a fault condition.	
Reset Battery State	The battery state has been reset, setting the value of Ah Discharged back to zero.	
Start Up	Records when the controller started running.	
Smart Alarm Activation	A smart alarm has become active.	Smart Alarm number (DCTools) or name (Web).
Smart Alarm Deactivation	A smart alarm has become inactive.	Smart Alarm number (DCTools) or name (Web).

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The SC200 uses mappings to allow it to associate internal functions, alarms and physical I/O devices.

A default mapping is set at the factory before delivery. Usually this default mapping will not need to be changed.

I/O Board Mapping

The serial numbers of an I/O board and SiteSure-3G modules, and the physical connectors on the board/modules are mapped to logical numbers in the SC200. This allows the physical inputs and outputs (including LVD contactors) to be recognized by the SC200.

I/O Board serial number mapping

Each I/O board serial number must be mapped to a logical *IOB Number*.

Usually, I/O board serial number mappings only need to be changed if:

- The I/O board is changed or added. See details on page 104.
- The SC200 is changed and/or a new configuration file is loaded into the SC200. See details on page 104.

This mapping is not included in configuration files and must be set if an SC200 is changed or loaded with a new configuration file. Input/output, sensors and most voltage control processes are only available if this mapping is set.

► To map I/O boards

Either:

- Use the SC200 keypad to go to: Settings > IOBs. The serial numbers of registered input/output boards are displayed.
- Select an unmapped Input/Output board (identified as *New*). Press *Enter*. Identity information is displayed and the I/O board LED will flash.
- Press *Map* and select an unused IOB Number (or one marked as *Missing*, if replacing an I/O board). Press *Enter*.

Or:

- In DCTools/Web go to: *Configuration* > *RXP*
- Copy the I/O board serial number(s) from the *RXP Devices* table to the *I/O Board to Serial Number Mapping* table to map an *IOB Number* to each I/O board (overwrite an existing serial number if required).

  If multiple SiteSure-3G modules are installed use the I/O board Identify function to physically identify each board. See details on page 70.

I/O connector mapping

Each I/O connector (analog input, digital input and digital output) on an I/O board must be mapped to a logical *IOB Number* and *IOB AI*, *IOB DI* or *IOB DO Number*.

► To map I/O connectors

See Analog Inputs on page 71, Digital Inputs on page 74 and Digital Outputs on page 75.

The following tables show the default connector mappings:

Analog Input	Name	Function*	IOB Number	IOB AI Number	Connector
1	IOBGP 1 Bus Voltage	Bus Voltage	1	1	XH9
2	IOBGP 1 Mid-point 1	Battery Mid-point	1	2	XH12A
3	IOBGP 1 Mid-point 2	Battery Mid-point	1	3	XH12A
4	IOBGP 1 Mid-point 3	Battery Mid-point	1	4	XH12A
5	IOBGP 1 Mid-point 4	Battery Mid-point	1	5	XH12A
6	Battery Current	Battery Current	1	6	XH6
7	Current 2	User Defined	1	7	XH6
8	Current 3	User Defined	1	8	XH6
9	Battery Temperature	Battery Temperature	1	9	XH7
10	Temperature 2	User Defined	1	10	XH7

Digital Input	Name	Function*	IOB Number	IOB DI Number	Connector
1	Digital Input 1	User Defined	1	1	XH15A
2	Digital Input 2	User Defined	1	2	XH15A
3	Digital Input 3	User Defined	1	3	XH15A
4	Digital Input 4	User Defined	1	4	XH15B
5	Digital Input 5	User Defined	1	5	XH15B
6	Digital Input 6	User Defined	1	6	XH15B
7	Load Fuse Fail	Load Fuse Fail	1	7	YH3
8	Battery Fuse Fail	Battery Fuse Fail	1	8	YH3
9	ACD Fan Fail	ACD Fan Fail	1	9	YH3
10	MOV Fail	MOV Fail	1	10	YH3

* *Function* is an internal analog or digital input value used by the SC200 for voltage control processes, and/or to generate System States, and/or to generate system alarms.

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Digital Output	Name	IOB Number	IOB DO Number	Connector
1	Summary Non Urgent	1	1	XH16
2	Low/High Load	1	2	XH17
3	Rectifier Fail	1	3	XH18
4	AC Fail	1	4	XH19
5	Load/Batt Disconnect	1	5	XH20
6	IOBGP 1 RY6/Mon OK	1	6	XH21

Digital outputs are activated by mappings from alarms (see Digital Output (Relay) Mapping on page 121) or by a test (see Digital Outputs on page 75).

LVD connector mappings

For details refer to LVD Configuration on page 41.

Digital Output (Relay) Activation

Any alarm can activate one or two digital outputs (A and B).

► **To map digital outputs**

- See System Alarms on page 46, Smart Alarms on page 49, Analog Inputs on page 71, Digital Inputs on page 74 and Digital Outputs on page 75.

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Powering Business Worldwide

EQUIPMENT INCIDENT REPORT

Please enter as much information as you can. Send the completed form, together with the item for repair to your nearest authorized service agent. NOTE: Only one fault to be recorded per form.

For further information contact your local Eaton dc product supplier or Eaton (see contact details on page 125). Or email: CustomerServiceNZ@eaton.com

Date: _____

Customer Information

Company: _____

Postal Address: _____

_____

Return Address: _____
(Not PO Box)

_____

Telephone: _____ Fax: _____ Email: _____

Contact Name: _____

Location of Failure

Product code: _____ Serial number: _____ Document number: _____

System type installed in: _____ Serial number: _____

Site name or location: _____

Fault discovered

☐ Delivery ☐ Unpacking ☐ Installation

☐ Initial test ☐ Operation after _____ years ☐ Other _____

Failure source

☐ Design ☐ Manufacturing ☐ Documentation

☐ Transportation ☐ Installation ☐ Handling

☐ _____

Effect on system operation ☐ None ☐ Minor ☐ Major ☐ _____

INFORMATION (fault details, circumstances, consequences, actions)

_____

_____

_____

_____

_____

Internal use only.

Reference No: _____ RMA: _____ NCR: _____ Signature: _____ Date: _____

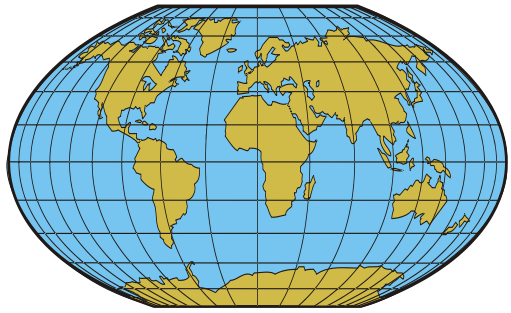
INFORMATION continued (fault details, circumstances, consequences, actions)

SG/03 ISS06

Worldwide Support

For product information and a complete listing of worldwide sales offices, visit Eaton's website at: **dcpower.eaton.com** or email: **DCinfo@eaton.com**

For technical support contact either your local Eaton dc product representative, the closest office from the following list, telephone **(+64) 3 343-7448,** or email **CustomerServiceNZ@eaton.com**



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Central America:	+52 55 9000 5252
China:	+86-571-8848-0166 +86-571-8848-0366
Europe / Middle East / Africa:	+44-1243-810-500
Hong Kong / Korea / Japan:	+852-2745-6682
India:	+91-11-4223-2325
New Zealand	0800 DC Power (0800 327-693)
Singapore / South East Asia:	+65 6825 1668
South America:	+54-11-4124-4000
South Pacific:	+64-3-343-7448
Taiwan:	+886-2-6600-6688 or free call 0800-038-168
United States of America (Toll Free):	1-800-843-9433 - option 2 - option 6

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