Powering Business Worldwide

Access Power Solutions Installation and Operation Guide

(APS6-400 Series)

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Refer to the separate SC200 or SC100 system controller handbook for full details of the system controller operation - www.powerquality.eaton.com/DC-Manuals.

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About This Guide

Scope

This guide covers installation, operation and maintenance of Access Power Solutions (APS6-400 Series) dc power systems (APS), controlled by the SC200 or SC100 system controller.

Refer to the separate SC200 or SC100 system controller handbook for full details of the system controller operation - www.powerquality.eaton.com/DC-Manuals.

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

- SC100 System Controller Operation Handbook* – IPN 997-00012-63
- SC200 System Controller Operation Handbook* – IPN 997-00012-50
- *PowerManagerII* Online Help
- *DCTools* Online Help
- SiteSure-3G Installation and Operation Guide – IPN 997-00012-51

* Download from: www.powerquality.eaton.com/DC-Manuals
http://powerquality.eaton.com/DC-Manuals.

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 101.

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General Description

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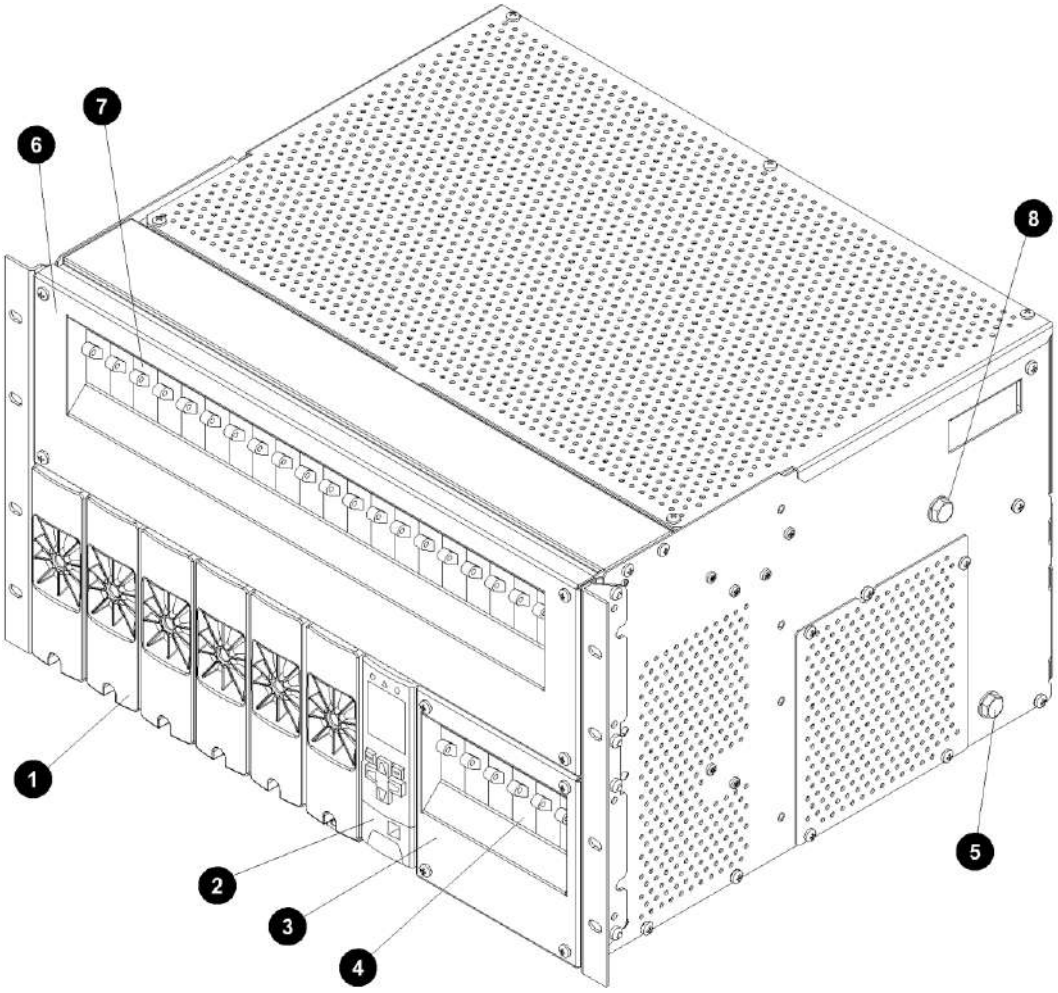
Access Power Solutions DC Power Systems

Front View



1. Rectifier modules (see details on page 4)
2. SC200 or SC100 system controller (see details on page 5)
3. Battery circuit breaker cover
4. Battery circuit breakers (up to 6, alarm on electrical trip or when switched off). Connected to optional battery disconnect LVD (if fitted).
5. Protective earth termination (M10)
6. Load circuit breaker cover
7. Load circuit breakers (up to 20, alarm on electrical trip only). 1-10 connected to optional load disconnect LVD (if fitted) for low-priority loads (see LVD Options on page 7).
8. Telecom ground link terminal (M10, see details on page 25)

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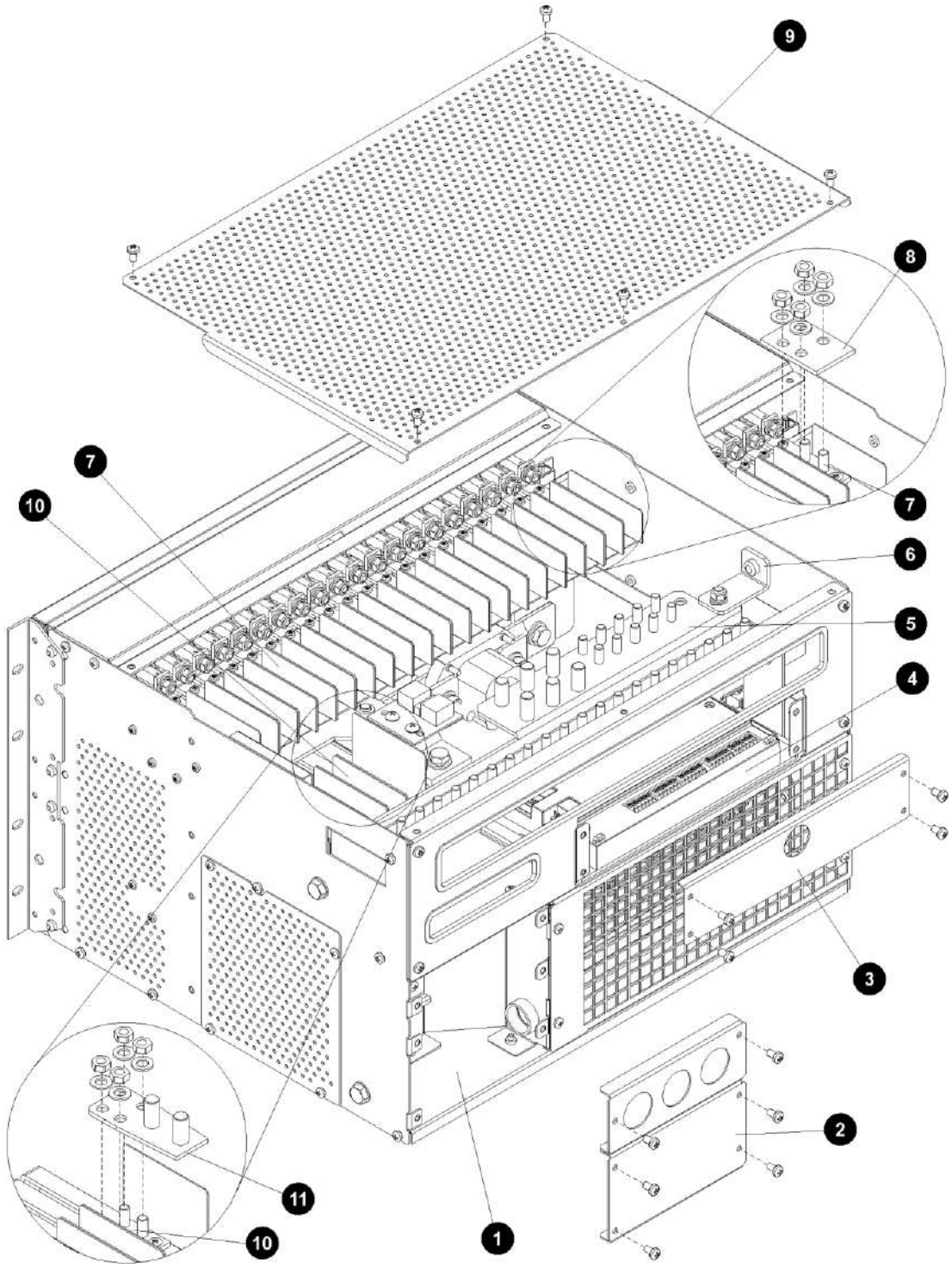
Rear View



❶ AC wiring space (see connection details on page 32).

❷ AC terminal covers with holes to suit up to 1" conduit.

❸ Input/Output (I/O) cover.

❹ I/O Board (see details on page 79).

❺ Load and Battery common bar.

❻ DC common-chassis (ac ground) link (see details on page 23).

❼ Load live cable terminals.

❽ Alternate load terminal bar for 2-pole load circuit breakers.

❾ DC terminal cover.

❿ Battery live cable terminals.

⓫ Alternate battery terminal bar for 2-pole battery circuit breakers.

Model Numbers

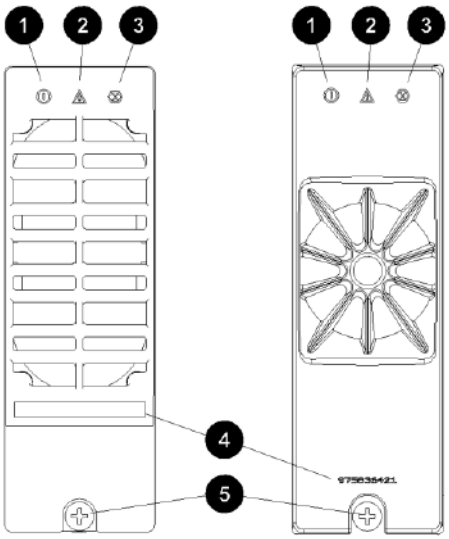
Model Number	System Controller	LVD Contactor(s)
APS6-410	SC100	None *
APS6-411	SC100	Battery only
APS6-41L	SC100	Low-priority load only *
APS6-412	SC100	Battery and low-priority load
APS6-420	SC200	None *
APS6-421	SC200	Battery only
APS6-42L	SC200	Low-priority load only *
APS6-422	SC200	Battery and low-priority load

** In APSs without an internal battery disconnect LVD, either the total battery current must be less than 285A or the APS must be protected by an external battery LVD set to 43V or higher.*

Rectifiers

Access Power Solutions are fitted with 48V, 2000W (APR48-ES) and/or 48V, 1800W (APR48-3G) rectifiers. The rectifiers are fan-cooled and hot-pluggable.

See Specifications on page 69 for further information. See Troubleshooting on page 50 for details of rectifier alarms.



Left: APR48-3G
Right: APR48-ES

1. Power On LED (Green)
2. Minor Alarm LED (Yellow)
3. Major Alarm LED (Red)
4. Serial Number
5. Retaining Screw. Tighten to 1.5Nm (13.3 inch-pounds).

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System Controller

The SC200 or SC100 system controller provides control, communications and alarm functions.

The system controller is supplied pre-configured. Configuration changes can be made with the keypad, or via a PC connected to the USB connector (SC200) or RS232 (SC100) connector. Or changes can be made remotely (see External Communications on page 7).

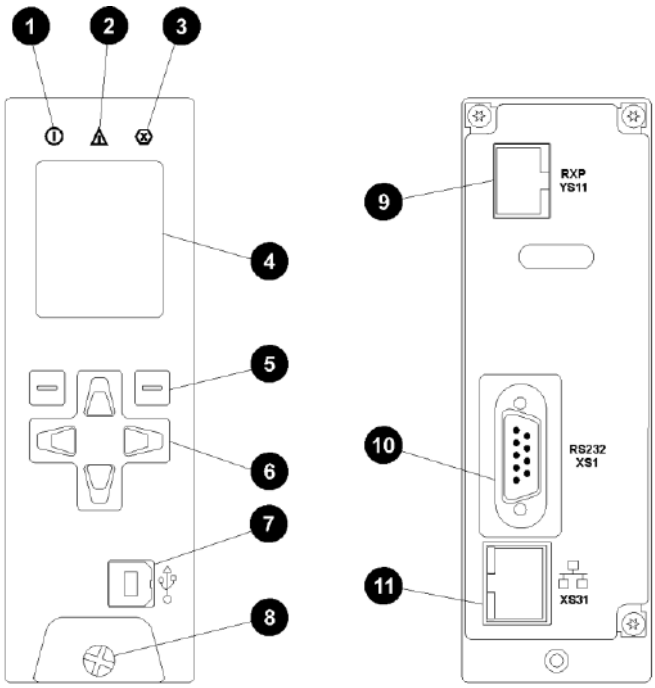
For basic operating information see System Controller on page 41. For further details refer to the System Controller Operation Handbook (see Related Information on page i).

See Troubleshooting on page 53 in the System Controller Operation Handbook for details of system controller alarms.

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.

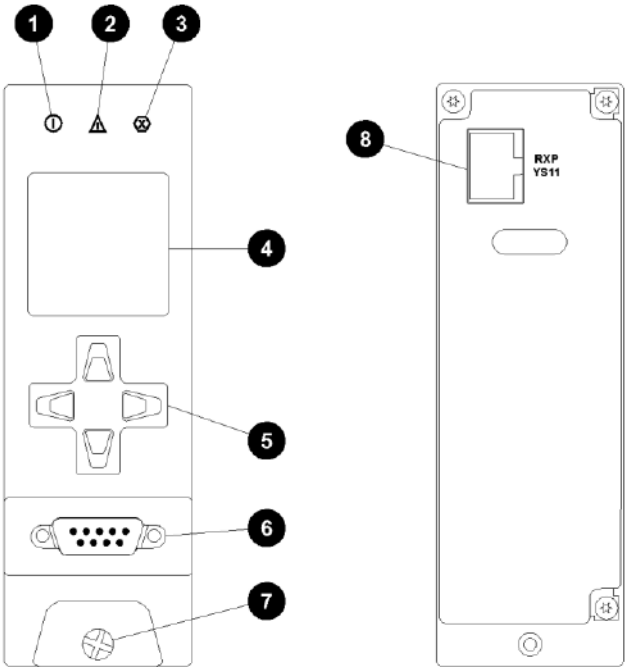
Alarm notifications may be by SNMP traps, SMS text messaging, dial-out to PowerManagerII remote monitoring software, or relay contact closures.



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

SC100 System Controller

The SC100 system controller is a full-featured control and monitoring solution which provides alarm notifications via dial-out modem to PowerManagerII remote monitoring software, SMS text messaging, or by relay contact closures.



1. Power on LED (green)
2. Minor alarm LED (yellow)
3. Critical/Major alarm LED (red)
4. LCD
5. Navigation keys (4)
6. RS232 D9M connector
7. Retaining screw
8. Power and system communications connector

Compatible Software

The following software is compatible with the SC200 or SC100 system controller:

- DCTools Configuration Software. Latest version is available free from www.powerquality.eaton.com/downloads.
- PowerManagerII Remote Control and Monitoring Software. Contact your Eaton dc product supplier for further information (see Worldwide Support on page 101).
- Recommended web browsers (SC200 only): Microsoft Internet Explorer 8 (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0.

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Other Features

External communications

Refer to the system controller handbook for information on these communications options.

Communications options	SC200	SC100
Communication with *DCTools* via USB	✓	-
Communication with *DCTools* or *PowerManagerII* via RS232	✓	✓
Communication with *DCTools* or *PowerManagerII* via an external PSTN or GSM modem (dial-in and dial-out on alarm)	✓	✓
Communication with *DCTools* or *PowerManagerII* via Ethernet	✓	-
Communication with web browser software via an IP network	✓	-
Communication with a Network Management System (NMS) using SNMP	✓	-
Communication with a Building Management System (BMS) using Modbus	✓	-
Alarm and status messages to GSM Short Messaging Service (SMS) text capable cell phones	✓	✓
Communication with an alarm management system using voltage-free relay contacts (on an IOBGP I/O board)	✓	✓

Low Voltage Disconnect Options

The APS can be fitted with one or two Low Voltage Disconnect (LVD) contactors (see Model Numbers on page 4) at the time of installation (see details on page 19).

One of the two LVDs is connected as a battery disconnect and the other as a low-priority load disconnect (connected to circuit breakers 1-10).

See LVD Specifications on page 70 for the current ratings. In APSs without an internal battery disconnect LVD, either the total battery current must be less than 285A or the APS must be protected by an external battery LVD set to 43V or higher.

For information on operation see Low Voltage Disconnect (LVD) in the System Controller Operation Handbook.

Battery Mid-point Monitoring Option (SC200 only)

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 the Battery Mid-point Monitoring option see details on page 30. If a *String Fail* alarm is generated see Troubleshooting on page 50.

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.

Battery Time Remaining

The SC200 or SC100 obtains characterization data from either periodic battery discharges (SC100) or every full battery discharge (SC200), to a specified end voltage.

During a battery discharge, the SC200 or SC100 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.*

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

Parameter	Description	Where to find:
Battery 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).	SC200 or SC100: Menu > Controls > Batt Time Remaining DCTools/Web: Batteries
Estimated State of Charge (SOC)*	The estimated charge left in the battery (Ah).	

- **Values of Battery Time Remaining and SOC are only available during a discharge and if the battery has been characterized*. The values will be N/A when the Battery Charge State is Floating or Charge, or *if the battery has not been characterized.* See Battery Characterization.

For details refer to *Battery Time Remaining* in the SC200 or SC100 System Controller Operation Handbook (see Related Information on page i).

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Warnings

This section contains important warnings. Read these warnings before installing or operating Access Power Solutions dc power systems.

Electrical Safety

- The case of the Access Power Solutions (APS6-400 Series) dc power system is a fire enclosure as specified in UL 60950-1. The system can be installed in an enclosed cabinet or an open relay rack.
- The dc power system may be powered from multiple ac sources. All power sources must be isolated before internally servicing the equipment.
- The dc power system must be connected to a suitable and readily accessible disconnect device(s).
- The dc power system is not compatible with IT (Impedance Terra) ac supply. For advice see Worldwide Support on page 101.
- A registered electrician (or suitably qualified person) must check the integrity of the installed cabling, BEFORE the dc power system is powered up.
- Tasks must be performed in the sequence documented in this guide.

Location and Environment

- The APS must be installed in a Restricted Access Location (dedicated equipment rooms, equipment closets, or similar) in accordance with the U.S. National Electric Code (NEC), ANSI/NFPA No. 70, and according to the applicable local codes.
- For ease of access and to maintain optimum system cooling, observe the clearances stated on page 22.
- Ensure the ambient temperature and humidity are within the ranges in the Specifications on page 70.
- Dust build-up within the APS may cause premature failure. In dusty environments filter the ventilation air entering the equipment room. Ensure regular cleaning of the air filters.
- Do not allow water or any foreign object to enter the APS. Do not place objects containing liquid on top of or near the unit.

Reverse Polarity

- Always check that the battery cables have been terminated to the correct system polarity BEFORE connecting the batteries or closing the battery disconnect device. Connecting batteries to the dc power system with incorrect system polarity will damage the rectifiers and void all warranty claims.

Hazardous Energy Levels

- Rectifiers and batteries contain hazardous energy levels. Only personnel trained and experienced in dc power systems are to service/maintain this equipment.
- Always use insulated tools.
- Do not short-circuit the live and common bus bars or cables.

Battery Current

- In APSs without an internal battery disconnect LVD, either the total battery current must be less than 285A or the APS must be protected by an external battery LVD set to 43V or higher.
- The short circuit current capability of the battery circuit connected to the battery input terminals must not exceed 5,000A.

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Batteries

- The plastic cases of batteries installed in Eaton dc power system racks must have a flammability rating of UL 94-V2 or better.
- Flooded cell lead acid batteries must be installed in a battery room. Do not install flooded lead acid batteries in an Eaton dc power system rack.
- Flooded cell and VRLA lead acid batteries can emit explosive gases and must be installed with adequate ventilation. Refer to the battery manufacturer or supplier for advice on minimum ventilation levels.
- Do not wear a synthetic dust-coat or overalls. Synthetic fabrics can hold static electric charges that create sparks during discharge.
- Remove rings, wristwatch and other metal jewelry that might be exposed to battery terminals, before installing batteries.
- Batteries are powerful sources of energy and present a potential electrical shock and energy hazard. The energy hazard is always present, even if the batteries are not connected. Avoid short circuiting terminals of opposite polarity.
- Always use insulated tools.
- Do not place tools, loose cables or metal objects (such as interconnecting bars) on top of batteries.
- Do not drop tools, loose cables or metal objects onto intercell connections or terminals of opposite polarity.
- Only terminate cables and interconnecting bars after confirming that the termination will not create a short circuit.
- Always tighten battery terminal bolts according to the battery manufacturer's specification. Failing to do so can cause erratic battery performance, possible damage to the battery, and/or personal injury.
- There is a risk of electric shock if a battery is replaced by an incorrect type.
- Dispose of batteries according to the instructions on page **64**.

Rectifiers

- Do not install the rectifiers until the room has been cleaned and is dust free.
- To reduce the risk of electric shock and maintain optimum system cooling, always cover empty rectifier slots with blanking panels.
- To avoid electrical shock, do not place hands inside the rectifier magazine.
- Rectifier cases may exceed 100°C (212°F), especially after prolonged operation. Use suitable gloves when removing a rectifier from the magazine.
- Do not attempt to disassemble faulty rectifiers. Return them (in their original packaging) with a completed Equipment Incident Report on page **99**.

Servicing and Maintenance

- The APS contains hazardous voltages and hazardous energy levels. Before undertaking any maintenance task refer to the Warnings on page **10**.
- 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 **101**.

Telecom Ground and dc Supply Bond to Chassis

- CAUTION: This equipment has a connection between the earthed conductor of the dc supply circuit and the earthing conductor.
  Cet appareil comporte une connexion entre le conducteur relié à la terre du circuit d'alimentation c.c. et son conducteur de terre.
- All of the following installation conditions must be met:
  - This equipment shall be connected directly to the dc supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the dc supply system earthing electrode conductor is connected.
  - This equipment shall be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same dc supply circuit and the earthing conductor, and also the point of earthing of the dc system. The dc system shall not be earthed elsewhere.
  - The dc supply source shall be located within the same premises as this equipment.
  - Switching or disconnecting devices shall not be in the earthed circuit conductor between the dc source and the point of the connection of the earthing electrode conductor.
- *Ce matériel doit être raccordé directement au conducteur de la prise de terre du circuit d'alimentation c.c. ou à une tresse de mise à la masse reliée à une barre omnibus de terre laquelle est raccordée à l'électrode de terre du circuit d'alimentation c.c. Les appareils dont les conducteurs de terre respectifs sont raccordés au conducteur de terre du même circuit d'alimentation c.c. doivent être installés à proximité les uns des autres (p.ex., dans des armoires adjacentes) et à proximité de la prise de terre du circuit d'alimentation c.c. Le circuit d'alimentation c.c. ne doit comporter aucune autre prise de terre. La source d'alimentation du circuit c.c. doit être située dans la même pièce que le matériel. Il ne doit y avoir aucun dispositif de commutation ou de sectionnement entre le point de raccordement au conducteur de la source d'alimentation c.c. et le point de raccordement à la prise de terre.*

EMC Compliance

- This Eaton product ("the equipment") has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the Federal Communications Commission (FCC) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
- The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions in this installation guide, may cause harmful interference to radio communications.
- Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- Changes or modifications to the equipment not approved by Eaton Corporation could void the FCC authority to operate the equipment.

Inspecting the Equipment and Reporting Damage

Unpack the equipment and inspect it carefully for possible damage that may have occurred while in transit. Do not use any damaged equipment.

Report any damage immediately, using a completed Equipment Incident Report on page 99.

Keep the original packaging to use if any item needs to be returned for replacement or repair.

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Installation Tasks

Before starting the installation, review the following information:

- Required Equipment and Tools on page 65
- Warnings and Cautions on page 10
- Inspecting the Equipment and Reporting Damage on page 12

Complete the Installation tasks in the following order:

Task	Description	Reference
1	Check the AC Supply and Grounding	See details on page 14
2	Customize the APS	See details on page 16
3	Mount the APS in the Rack	See details on page 22
4	Connect External Input/Output Cabling (if required)	See details on page 25
5	Connect the DC Load and Battery Cables	See details on page 28
6	Install the Batteries	See details on page 30
7	Mount the Battery Temperature Sensor	See details on page 31
8	Connect the AC Supply Cable	See details on page 32

Task 1 - Check the AC Supply and Grounding

It is important that the ac supply for the Access Power Solutions dc power system includes the correct levels of protection.

Step 1 - High ac voltage protection at the site

1. Check if the ac voltage is expected to exceed 275V (L-N or L1-L2).
2. If so, then it is strongly recommended that an external high voltage protection unit (HVPU) be installed. This will automatically disconnect the ac at high voltage and reconnect it at normal voltage.
3. Install the HVPU as in the following diagram.
4. Connect the High VAC alarm output to one of the Digital Inputs on the I/O Interface Board (see the diagram on page 79 for location).

   The High VAC alarm signal lines must be isolated from the ac supply by a voltage-free relay contact.

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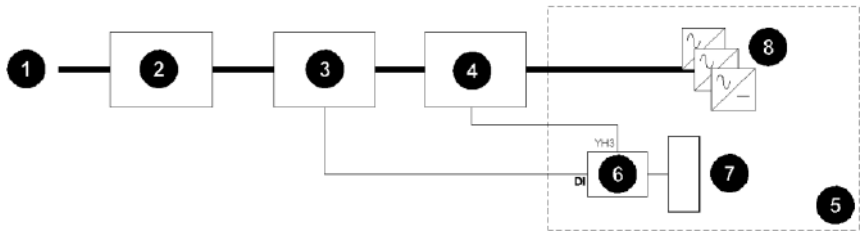


1. AC supply
2. Primary transient protection devices
3. High voltage protection unit with alarm output
4. Secondary transient protection devices (MOVs)
5. DC power system
6. I/O Interface board
7. SC200 or SC100 system controller
8. Rectifiers

Step 2 - Check the type of ac supply

Check the type of ac supply required (see Specifications on page 69). The APS can be configured for supply from either two or three ac feeds, L-L or L-N.

Only use an ac supply referenced to ground, or with a protection system so that the phase-ground voltage cannot exceed the rating of the rectifier.

Step 3 - Disconnect device and overcurrent protection

1. Confirm that the following requirements are complied with:
   - A readily accessible disconnect device shall be incorporated external to the APS.
   - The disconnect devices (one per ac input feed) shall be circuit breakers suitable for Branch Circuits and rated:
     Three ac feeds: 40A
     Two ac feeds: 50A.
2. The external circuit breaker(s) must be two-pole type wired in each conductor, if:
   - the ac supply is 2W (see Specifications on page 69), or
   - the ac supply is 1W+N but the neutral is not clearly identified.

Step 4 - Check ac discrimination

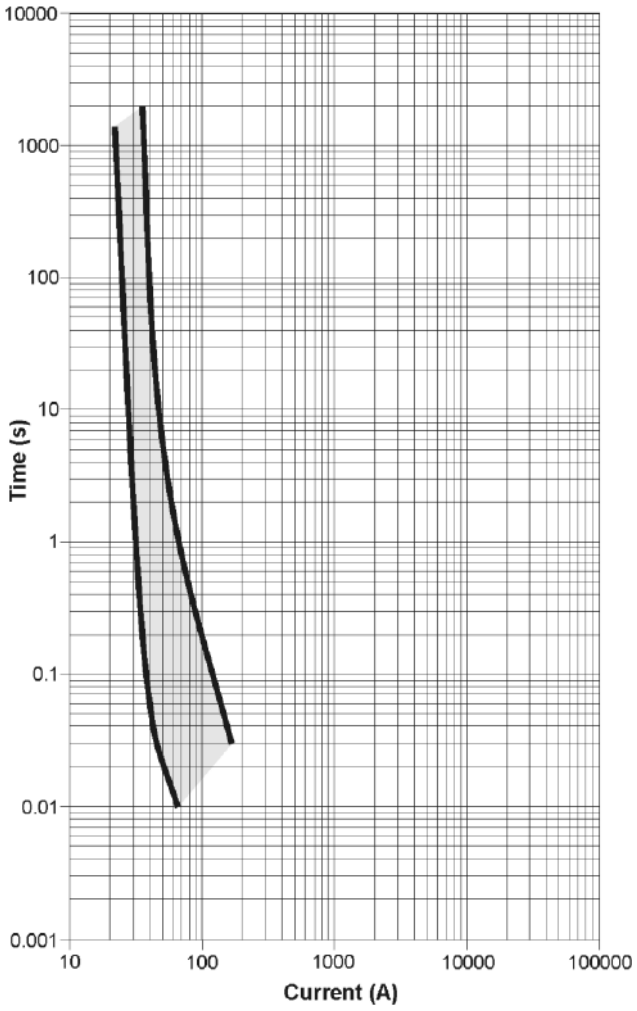
Each rectifier has two internal fast-acting fuses. Under certain internal fault conditions these fuses will blow.

If there is insufficient discrimination between these fuses and an upstream ac supply-disconnect device supplying the APS then the ac supply to all rectifiers will be disconnected if a rectifier fuse blows.

1. Check the time-current (tripping) curve(s) of all ac supply-disconnect device(s) upstream of the APS with the following curve for the rectifier fuses.

   Refer to the manufacturer's data for tripping curves.
2. No action is required if the time-current curves of the upstream ac supply-disconnect devices are entirely to the right of the curves for the rectifier fuses.
3. If the curve of an upstream ac supply-disconnect device crosses the curve for the rectifier fuse there may not be adequate discrimination. Contact your Eaton dc product supplier for advice (see Worldwide Support on page 101).

   There is a maximum rating for the first upstream circuit breaker(s). See Step 3.



Rectifier internal fuses (IEC 60127-2) Time-Current Curve (minimum and maximum)

Sources:

Schurter SP 5x20 Pigtail data sheet.

Step 5 - Check the grounding arrangements at the site

Confirm that all grounds are brought together at one "star" point so that surge currents cannot flow in "ground loops" and create large voltages.

Procedure complete

Task 2 - Customize APS

Step 1 - Change mounting brackets if required

APSs are pre-assembled with 19-inch rack-mounting brackets.

If required, the brackets can be moved for relay-rack mounting and/or replaced with brackets for use in 23-inch wide racks (supplied):

1. Undo the screws holding each bracket.
2. Relocate to the alternate position or attach the replacement brackets. Tighten the screws.

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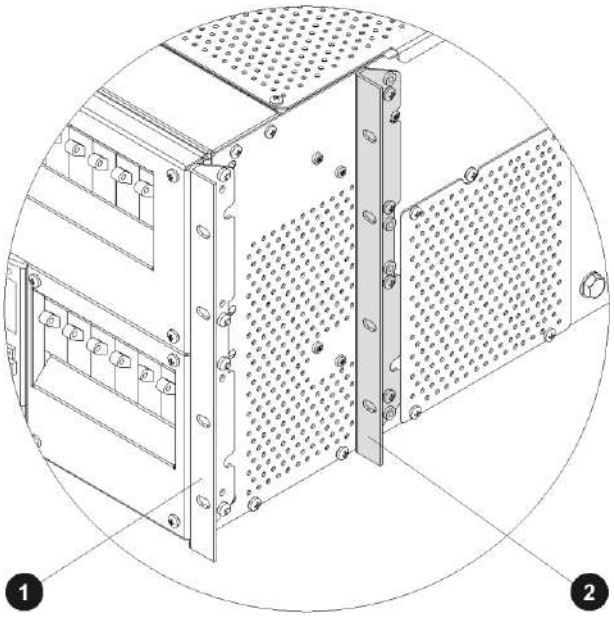


1. 19-inch (or 23-inch), front mounted brackets.
2. Alternate bracket position for relay-rack mounting.

Step 2 - Install Load and Battery circuit breakers (if required)

Ignore this Step if the Load and Battery circuit breakers are already fitted.

1 Remove the dc circuit breaker cover (see following diagram).

2 Starting at the left-hand end, push in the load circuit breakers*.
Leave a space either side of any 80A or 100A circuit breakers, to maintain their thermal performance.

Use only Heinemann UL Listed DIVQ circuit breakers. See the following table for part numbers. Pay particular attention to the derating factors.

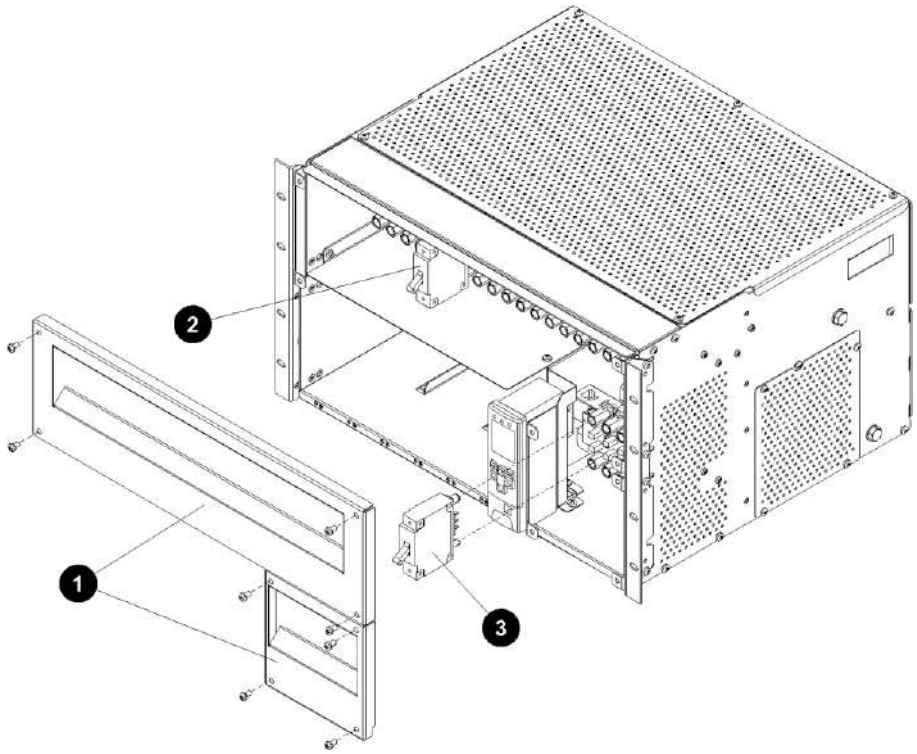
3 Push in the battery circuit breakers*.

Use only Heinemann (UL Listed DIVQ) circuit breakers. See the following table for part numbers.

4 Fit circuit breaker blank panels to cover any unused positions.

5 Replace the dc circuit breaker cover.

6 Switch all circuit breakers to the OFF ("0") position.



❶ Circuit breaker cover
❷ Load circuit breaker*
❸ Battery circuit breaker*

** Be careful to insert circuit breakers the right way up.*

Load Circuit Breakers

Item	Description	Part Number
1	5A, 1-pole, 80V dc (derates to 4A)	Heinemann AMA1R-B2-AI-20-D-DU-52-5-1
2	10A, 1-pole, 80V dc (derates to 8A)	Heinemann AMA1R-B2-AI-20-D-DU-52-10-1
3	15A, 1-pole, 80V dc (derates to 12A)	Heinemann AMA1R-B2-AI-20-D-DU-52-15-1
4	20A, 1-pole, 80V dc (derates to 16A)	Heinemann AMA1R-B2-AI-20-D-DU-52-20-1
5	25A, 1-pole, 80V dc (derates to 20A)	Heinemann AMA1R-B2-AI-20-D-DU-52-25-1
6	30A, 1-pole, 80V dc (derates to 24A)	Heinemann AMA1R-B2-AI-20-D-DU-52-30-1
7	40A, 1-pole, 80V dc (derates to 32A)	Heinemann AMA1R-B2-AI-20-D-DU-52-40-1
8	50A, 1-pole, 80V dc (derates to 40A)	Heinemann AMA1R-B2-AI-20-D-DU-52-50-1
9	60A, 1-pole, 80V dc (derates to 48A)	Heinemann AMA1R-B2-AI-20-D-DU-52-60-1
10	80A, 1-pole, 80V dc (derates to 64A) *	Heinemann AMA1R-B2-AI-20-D-DU-52-80-1
11	100A, 1-pole, 80V dc (derates to 70A at 45°C, 75A at 40°C, 80A at 35°C) *	Heinemann AMA1R-B2-AI-20-D-DU-52-100-1
12	100A, 2-pole, 80V dc (derates to 80A) *	Heinemann AMA2R-B2-LI-20-D-DU-52-100-1
13	120A, 2-pole, 80V dc (derates to 96A) *	Heinemann AMA2R-B2-LI-20-D-DU-52-120-1

** Circuit breaker must have adjacent space. Refer to the installation instructions.*

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Battery Circuit Breakers

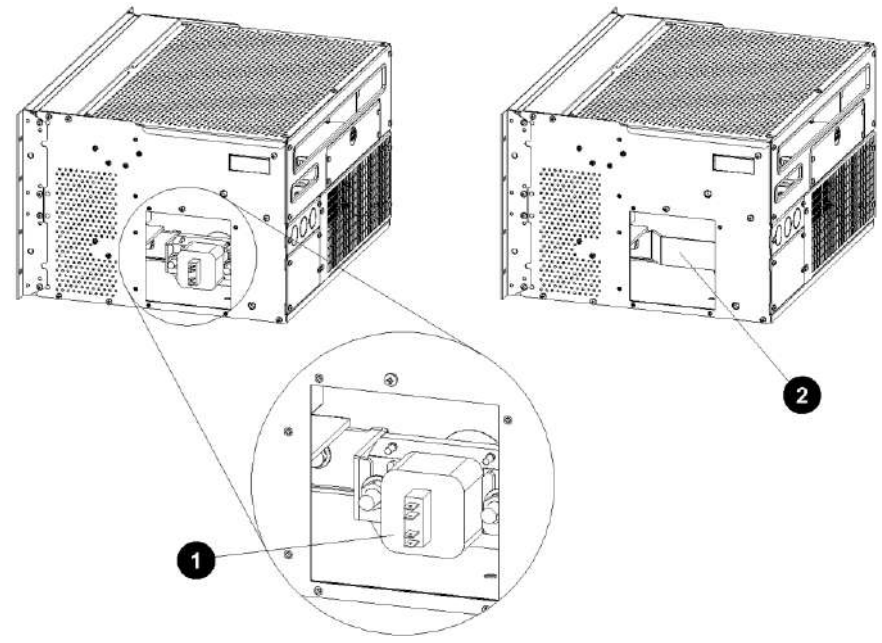
Item	Description	Part Number
1	80A, 1-pole, 80V dc	Heinemann AM1R-B39-AJ-20-D-DU-52-80-251
2	100A, 1-pole, 80V dc	Heinemann AM1R-B39-AJ-20-D-DU-52-100-251
3	100A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-100-251
4	120A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-120-251
5	150A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-150-251
6	200A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-200-251

Step 3 - Link Load and/or Battery circuit breaker terminals (if required)

For each 2-pole load or battery circuit breaker (if any) fitted:

1. Undo the screws and remove the 1-pole plastic insulators.
2. Install the supplied 2-pole plastic insulator and 2-pole load/battery terminal bar (see diagram on page 3).
3. Tighten the terminals to 3.9 - 4.5Nm (35 - 39 inch-pounds).

Step 4 - Fit or remove the battery disconnect LVD (if required)



❶ Battery disconnect LVD contactor.

❷ Link bar (in place of contactor).

1 Remove the access panel on the side of the APS.

2 Either:

To fit the battery LVD contactor:

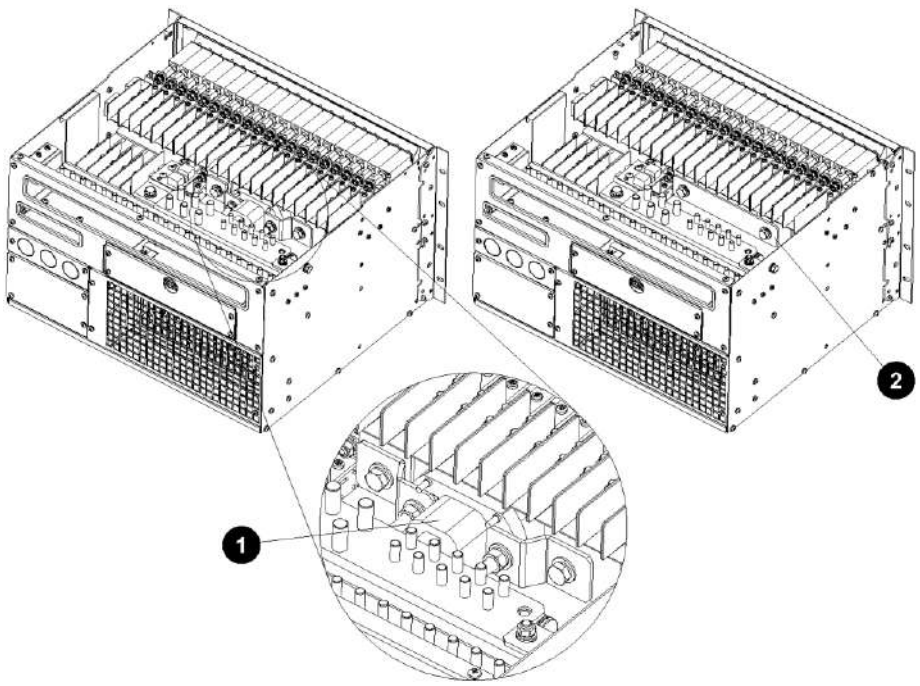
- Undo the two bolts and remove the link bar.
- Fit the two pieces of bus work. Tighten the M8 bolts to 9.5 - 11.1Nm (85 - 98 inch-pounds).
- Fit the contactor and tighten the M10 nuts to 18.7 - 21.9Nm (166 - 194 inch-pounds).
- Connect the contactor control cable to the contactor.

Or, to remove the battery LVD contactor:

- Disconnect the contactor control cable from the contactor.
- Undo the two nuts and remove the contactor.
- Undo the two bolts and remove the two pieces of bus work.
- Fit the link bar and tighten the M8 bolts to 9.5 - 11.1Nm (85 - 98 inch-pounds)

3 Replace the access panel.

Step 5 - Fit or remove the low-priority load disconnect LVD (if required)



❶ Load disconnect LVD contactor.

❷ Link bar (in place of contactor).

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1 Remove the top cover of the APS.

2 Either:

To fit the load LVD contactor:

- Undo the two bolts and remove the link bar.
- Fit the two pieces of bus work to the contactor. Tighten the M10 nuts to 18.7 - 21.9Nm (166 - 194 inch-pounds).
- Fit the contactor (with bus work) and tighten the M8 bolts to 9.5 - 11.1Nm (85 - 98 inch-pounds).
- Connect the contactor control cable to the contactor.

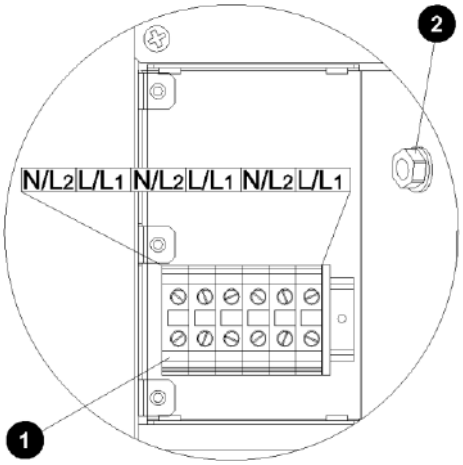
Or, to remove the load LVD contactor:

- Disconnect the contactor control cable from the contactor.
- Undo the two bolts and remove the contactor and bus work.
- Fit the link bar and tighten the M8 bolts to 9.5 - 11.1Nm (85 - 98 inch-pounds).

3 Replace the top cover.

Step 6 - Change the ac wiring configuration (if required)

The APS can be configured for supply from either two or three ac feeds, L-L or L-N. The ac terminals are located behind the cover on the rear of the APS (see location on page 3).

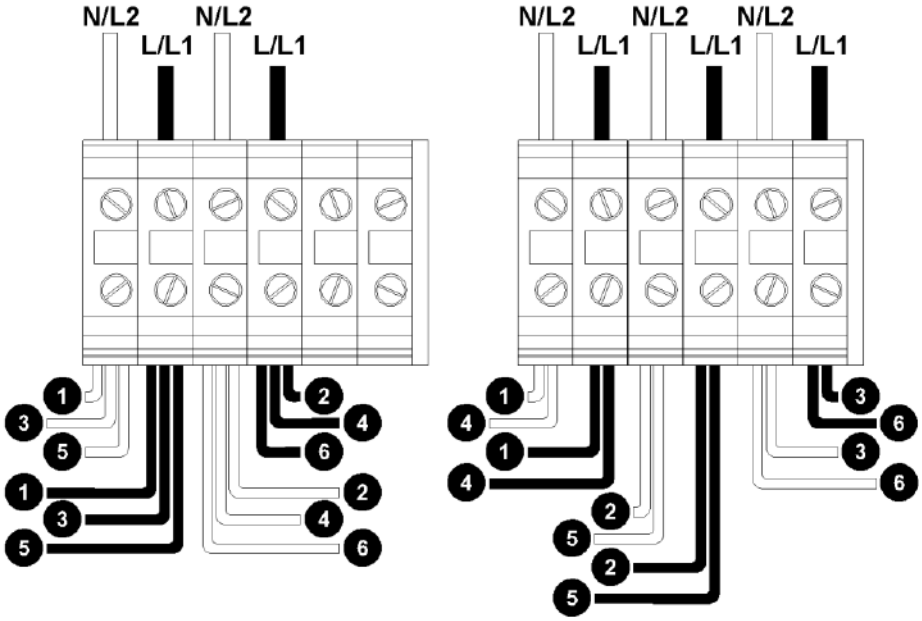


1 AC terminals (4 used for 2-wire, 6 used for 3-wire ac supply)

2 Ground stud (M6)

1 Remove the ac terminal cover.

2 If necessary, change the live/neutral connections to the rectifiers to suit the ac supply as shown in the following diagrams.



Rectifier connections for 2 x 1W+N or 2 x 2W ac supply

Rectifier connections for 3 x 1W+N or 3 x 2W -wire ac supply

❶ N/L2-L/L1 to Rectifier 1
❷ N/L2-L/L1 to Rectifier 2
❸ N/L2-L/L1 to Rectifier 3
❹ N/L2-L/L1 to Rectifier 4
❺ N/L2-L/L1 to Rectifier 5
❻ N/L2-L/L1 to Rectifier 6

Procedure complete

Task 3 - Mount the APS in the Rack

Step 1 - Check clearances

APSs require the following minimum clearances for access and/or adequate air flow:

Front: 24" (600mm)

Rear: If top access is unrestricted: 4″ (100mm)
If top access is restricted: 24" (600mm)

Top: 3" (75mm) minimum from other equipment in the rack.

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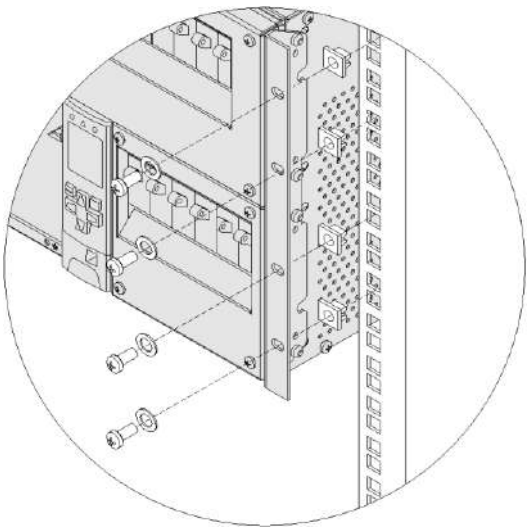
Step 2 - Fit cage nuts

Fit cage nuts in the correct positions to match the screw holes in the APS rack mounting brackets.



Step 3 - Mount the APS

1. Remove the ground connection bolts on the sides of the APS to allow clearance to mount in rack.
2. Lift the APS to the correct position in the rack.

   A suitable mechanical support or a second person must support the weight of the APS.
3. Attach the APS using four rack mounting screws. Tighten the screws.

Step 4 - Grounding

The grounding arrangement of your communications equipment determines how the dc common bus of the dc power system is referenced to ground.

There are two options, Either:

- the dc supply is referenced (bonded) to a telecom ground electrode (Step 4A), or
- the dc supply is referenced (bonded) to the ac ground, via the chassis (Step 4B).

The APS is supplied with the dc common bar bonded to the chassis via a link on the dc common bar.

Step 4A - Bond dc output to a telecom ground electrode (if required)

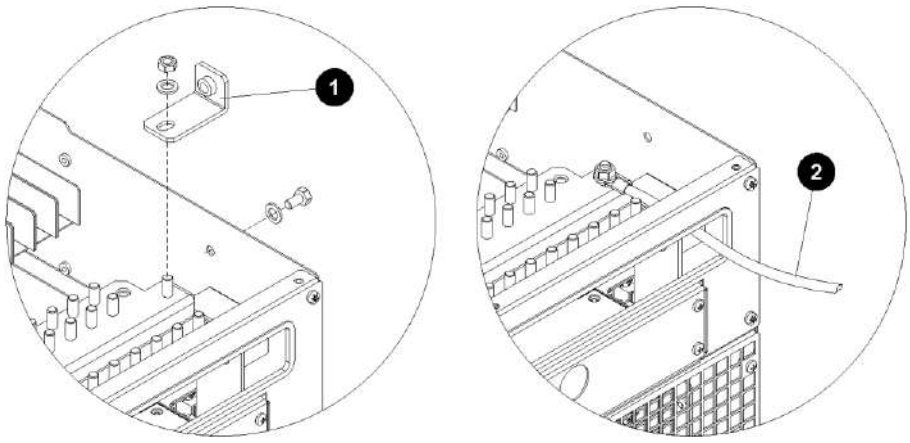
Ignore this Step if the dc supply must be referenced (bonded) to the ac ground, via the chassis (see Step 4B).

If the grounding policy at the site requires that the dc supply must be referenced to a telecom ground electrode, then:

1. Remove the link that bonds the dc common bar to the chassis.
2. Connect a telecom ground link cable to the dc common bar as shown in the following diagram. Use:

Wire:	Multi-strand, copper conductor, 3/0 AWG* with green/yellow insulation
Strip length:	5/8" (16mm)
Crimp lug:	FCI-Burndy type YAV27L-TC14-FX
Crimp tool:	FCI-Burndy type MY29-11

   ** If 3/0 AWG cable is not available, use 2/0 AWG cable and appropriate UL-Listed Crimp Lug.*
3. Tighten terminal to 3.9 - 4.5Nm (35 - 39 inch-pounds).
4. Terminate the cable at the site's telecom ground electrode directly or via the site's telecom ground bus bar, if provided.



❶ Remove link between dc common bar and chassis.

❷ Telecom ground link cable to site's telecom ground electrode (3/0 AWG*)

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Step 4B - Bond ac ground and dc output to telecom ground electrode (if required)

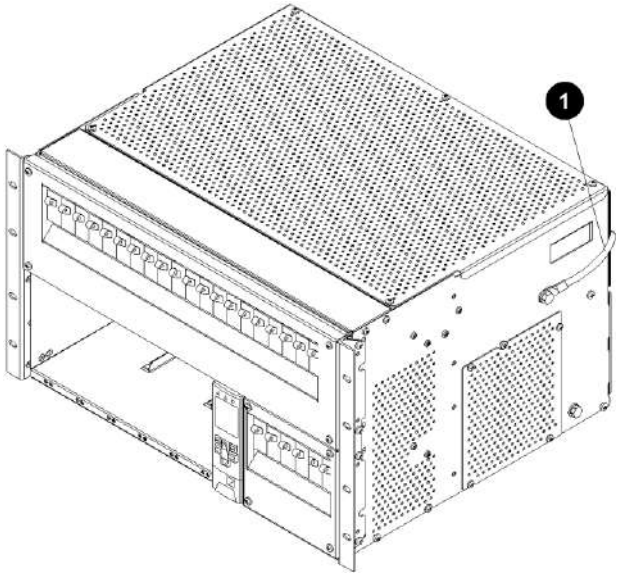
Ignore this Step if the DC common bar must be connected directly to the telecom ground electrode (see Step 4A on page 23).

1. Connect a telecom ground link cable to the chassis of the APS as shown in the following diagram. Use:

Wire:	Multi-strand, copper conductor, 3/0 AWG* with green/yellow insulation
Strip length:	5/8" (16mm)
Crimp lug:	FCI-Burndy type YAV27L-TC12-FX, or YAV27L-TC12-45, or YAV27L-TC12-90
Crimp tool:	FCI-Burndy type MY29-11

   ** If 3/0 AWG cable is not available, use 2/0 AWG cable and appropriate UL-Listed Crimp Lug.*

2. Tighten terminal to 18.7 - 21.9Nm (166 - 194 inch-pounds).
3. Terminate the cable at the site's telecom ground electrode directly or via the site's telecom ground bus bar, if provided.



1 Telecom ground link cable to site's telecom ground electrode (3/0 AWG*)

Procedure complete

Task 4 - Connect External Input/Output Cabling (if required)

The APS is fitted with an input/output (I/O) board. This provides a number of digital inputs and digital outputs (relays). See Input/Output Board on page 79 for details of how the I/O board can control and monitor external devices.

If no external devices are to be connected then ignore this task.

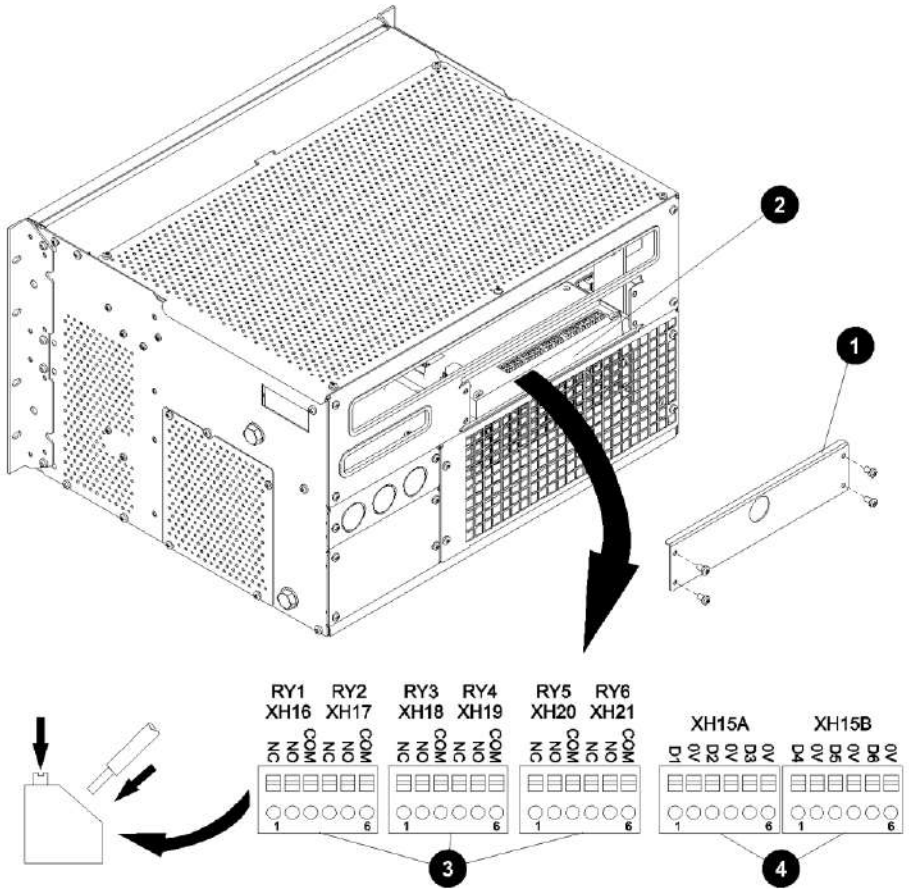
Step 1 - Access the I/O terminals

Remove the Input/Output cover (see the diagram on page 3) and partly withdraw the I/O board.

Step 2 - Terminate the cabling

- Connect only voltage-free switch or relay contacts to Digital Inputs.
- Do not exceed the voltage and current limits of the relay contacts.
- For wire size and I/O ratings see Specifications on page 70.

1. Route the cabling through the access hole in the Input/Output cover to the terminal blocks on the I/O board.
2. Test the insulation and continuity of the cabling.
3. Terminate the wires into the push-connect terminals (see following diagram).
4. Replace the I/O board.



1. Input/Output (I/O) cover.
2. I/O board.
3. Digital input terminals (push-connect type).
4. Alarm relay (digital output) terminals (push-connect type).

Step 3 - Replace the cover and secure cables

1. Replace the Input/Output (I/O) cover.
2. Use cable ties to secure the cable(s) and prevent strain on the connections.

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Step 4 - Set up SC200 or SC100

Configure the inputs and outputs after completing the installation and all the Startup Tasks on page 36.

For configuration details see Digital Inputs and Digital Outputs in the System Controller Operation Handbook. For details about setting up and testing see Input/Output (I/O) in the System Controller Operation Handbook.

Step 5 - Connect SiteSure-3G input/output module(s), if required (SC200 only)

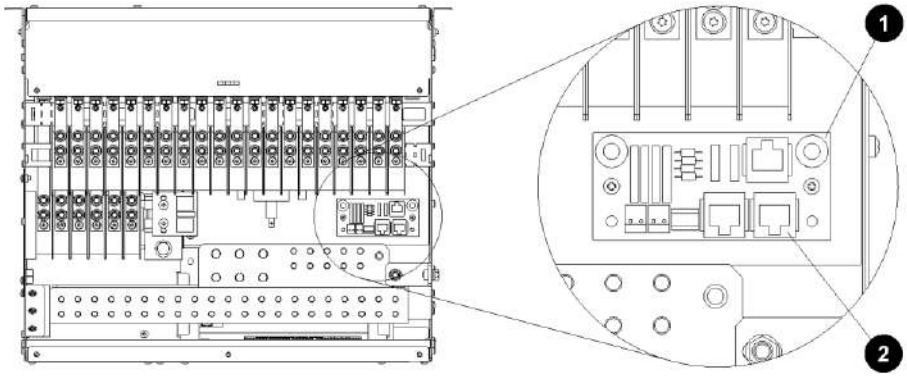
If additional input/outputs are required then connect SiteSure-3G modules to the dc power system. A SiteSure-3G input/output module has the following features:

Digital Inputs	10
Digital Outputs (relays)	6
Analog Inputs (-10V to +10V)	4
Current Sense Inputs	3
Temperature Sense Inputs	2
Bus Voltage Input (0-60V)	1

1. Route CAT 3 patch cable (4 pair, 26AWG, UTP, 75°C) from the SiteSure-3G module to the rear of the dc power system.
2. Terminate the cable with RJ45 plugs.
3. Test the insulation and continuity of the conductors.
4. Connect the cable to a spare RJ45 socket (S1, S2 or S3) on the Voltage Feed Module board (see following diagram).

   If additional SiteSure-3G input/output modules are to be connected then use an RJ45 splitter.
5. Use cable ties to secure the cable and prevent strain on the connectors.
6. Connect the cable to socket YH11 on the SiteSure-3G module.
7. Replace the APS covers.

For details on setup refer to the SiteSure-3G Installation Guide. See Related Information on page i.



❶ Voltage feed module ❷ RJ45 sockets (S1, S2 and S3)

Step 6 - Connect external communications cables (if required)

See System Controller on page 5 and External Communications on page 7.

SC100: Connect RS232 communications cable to the front connector.

Ensure the cable is secured so that no force is applied to the RS232 connector as this may damage the connector.

SC200: Connect Ethernet and/or RS232 communications cables to the rear connectors:

1. Undo the retaining screw and partly withdraw the SC200.
2. Route the communications cable(s) from the SC200 position, through the APS to the I/O panel cable access hole at the rear.
3. Connect the communications cable(s) to the connector(s) on the rear of the SC200.

   RS232 connection access is restricted. If necessary, use a DB9 ribbon cable extension (Farnell part number 869-6411 or similar).
4. Replace the SC200 and tighten the retaining screw.

For details on setup refer to Communications in the SC200 or SC100 Operation Handbook. See Related Information on page i.

Procedure complete

Task 5 - Connect the DC Load and Battery Cables

Step 1 - Connect battery cables

- Always check that the battery cables have been terminated to the correct system polarity BEFORE connecting the batteries or closing the battery disconnect device.
- Connecting batteries to the system with incorrect system polarity will void all warranty claims.

1. Switch OFF all circuit breakers.
2. Select battery cable to suit the battery circuit breaker (refer to following table).
3. Route the battery cables to the APS.
4. Terminate the battery live and common cable(s) with suitable crimp lugs (refer to the following table).
5. Connect the battery common cable(s) on the common bar at the battery termination points.
6. Terminate the battery live cable(s) at the battery circuit breaker terminal(s) and tighten:
   - all 1/4" terminations to 3.9 - 4.5Nm (35 - 39 inch-pounds).
   - all 3/8" terminations to 18.7 - 21.9Nm (166 - 194 inch-pounds).
7. Secure the cables to the tie bar.

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Battery CB	Cable size (Note 1)	2-hole or 3-hole Crimp Lug (¼" studs, 5/8" spacing) (Note 2)	Crimping tool (Note 2)
80A	2 AWG	YA2CL-2TC14	Y1MR
100A	1 AWG	YA1CL-2TC14	
120A	1 AWG	YA1CL-2TC14	
150A	1/0 AWG	YAV25L-2TC	Y81KFT, Y81KFTMBH, PAT81KFT18V
175A	2/0 AWG	YAV26L-2TC	
200A	3/0 AWG (Note 3)	YAV25L-2TC	

Notes:

1 Minimum cable size. Does not allow for excessive voltage drop in long cable runs at high current.

2 Part numbers are for FCI-BURNDY® products. In US/Canada use these parts or equivalent UL-listed crimp lugs.

3 If 3/0 AWG cable is not available, use 2/0 AWG cable and appropriate UL-Listed Crimp Lug.

Step 2 - Connect load cables

1 Select load cable to suit the load circuit breaker (refer to following table).

2 Route the load cables to the APS.

3 Terminate the load live and common cable(s) with suitable crimp lugs (refer to the following table).

4 Connect the load common cable(s) on the common bar at the load termination points.

5 Terminate the load live cable(s) at the load circuit breaker terminal(s).

6 Tighten all terminations to 3.9 - 4.5Nm (35 - 39 inch-pounds).

7 Secure the cables to the tie bar.

Load CB Rating (Note 1)	Cable size (Note 2)	2-hole Crimp Lug (¼" studs, 5/8" spacing) (Note 3)	Crimping tool (Note 3)
5-15A	14 AWG	YAV10-2TC14	Y8MRB-1
20A	12 AWG		
25-30A	10 AWG		
40A	8 AWG	YA8CL-2TC14	Y1MR
50A	6 AWG	YA6CL-2TC14	
60A	4 AWG	YA4CL-2TC14	
80A	3 AWG (Note 4)	YA3CL-2TC14	
100A	1 AWG	YA1CL-2TC14	
120A	1 AWG	YA1CL-2TC14	

Notes:

1. See load circuit breaker derating factors on page 69.
2. Minimum cable size. Does not allow for excessive voltage drop in long cable runs at high current.
3. Part numbers are for FCI-BURNDY® products. In US/Canada use these parts or equivalent UL-listed crimp lugs.
4. If 3 AWG cable is not available use 2 AWG cable and YA2CL-2TC14 crimp lug (Y1MR crimping tool).

Step 3 - Check terminations, secure cables and test insulation

1. Check all terminations are correct and are tightened.
2. Secure the cables with cable ties to ensure there will be no strain on the terminals.
3. Test the insulation resistance of the cables.

Procedure complete

Task 6 - Install the Batteries

- Always check that the battery cables have been terminated to the correct system polarity BEFORE connecting the batteries or closing the battery disconnect device.
- Connecting batteries to the system with incorrect system polarity will void all warranty claims.

Installation procedure

Step 1 - Install the batteries

Follow the battery supplier's/manufacturer's installation instructions.

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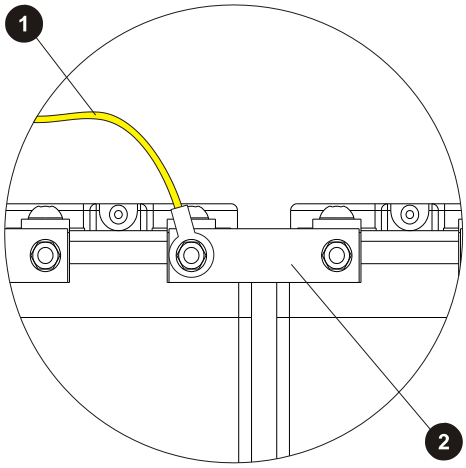
Step 2 - Connect Mid-point Monitoring sense wires (SC200 only)

The Mid-point Monitoring sense wires must have short-circuit protection fitted close to the battery terminals. Use the Battery Mid-point Monitoring kits from Eaton (see Spare Parts on page 67) or equivalent.

1. Connect a Mid-point Monitoring sense wire to the middle interconnecting link on each string of batteries (see following diagram).
   - *Connect the wire from XH12A pin 1 to string 1, and so on.*
   - *If there are an odd number of 2V cells per string, then connect the sense wires to the interconnecting link on the side of the central cell closer to the Common battery terminal.*
2. Tighten the terminals according to the battery supplier's/manufacturer's installation instructions.
3. Insulate any un-connected sense wires.
4. Secure all sense wires to avoid any strain on the terminations.



1. Mid-point Monitoring sense wire from XH12A on the input/output board
2. Middle interconnecting link

Procedure complete

Task 7 - Mount the Battery Temperature Sensor

The dc power system is supplied with a battery temperature sensor and standard 2m (6.5 feet) long cable, already connected to the IOBGP input/output (I/O) board.

If required, longer cables are available (see Worldwide Support on page 101) or you can make up your own. We recommend a maximum cable length of 20m (65 feet) because of noise considerations.

The battery temperature sensor measures the ambient temperature around the batteries and is required for the temperature compensation control process (see details in the System Controller Operation Handbook).

The best location for the battery temperature sensor is in the middle of the battery stand above the batteries.

To avoid false readings do not:

- Place the sensor on a battery case.
- Attach the sensor to battery cables, terminals or interconnecting bars.
- Expose the sensor to direct sunlight or air movements from air-conditioning systems or open windows.

Run the sensor cable along ac supply cables.

Task 8 - Connect the AC Supply Cable

Step 1 - Access ac terminals

1. Remove ac terminal cover to access the ac wiring space. See the diagram on page 3.
2. Check that the APS is correctly wired for either two or three ac feeds, as required. See details on page 21.

Step 2 - Route the ac wiring

1. Use:
   Two ac feeds: 8 AWG wire, rated 90ºC.
   Three ac feeds: 10 AWG wire, rated 90ºC.
2. Route the ac wires to the rack via suitable conduit.
3. At the APS end, cut the conductors to suit the positions of the ac terminals.

Step 3 - Connect at APS

1. Connect the line/neutral wires to the ac terminals.
2. Tighten terminals to 10.6 - 12.4 in-lb (1.2 - 1.4Nm).
3. Connect the ground wires to the ground stud. Use:

Wire:	Multi-strand, copper conductor, 8 or 10 AWG (to match live conductors) with green/yellow insulation	
Strip length:	7/16"	
Crimp lug:	8 AWG:	FCI-Burndy type YA8CL1-BOX
	10 AWG:	FCI-Burndy type YAV10T3-BOX
Crimp tool:	8 AWG:	FCI-Burndy type MY29-11
	10 AWG:	FCI-Burndy type Y8MRB-1

4. Tighten the ground stud to 3.9 - 4.5Nm (35 - 39 inch-pounds).

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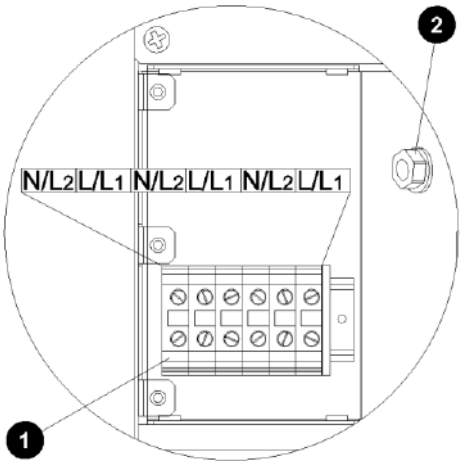

1. AC terminals (4 used for two feeds, 6 used for three feeds)
2. Ground stud (M6)

Step 4 - Replace ac terminal cover

Step 5 - Connect at the ac supply point

1. Check the ac supply point is isolated.
2. Connect the conduit wires to the ac supply point, as required.

   Follow the manufacturer's instructions and local wiring regulations.
3. Label the connection at the ac supply point.

Step 4 - Check terminations, secure cable and test insulation

1. Check all terminations are correct and are tightened.
2. Secure the cord(s) or cable to ensure there is no strain on the terminals.
3. Test the insulation resistance of the conductors according to local ac wiring regulations.

Procedure complete

Installation Completed

Installation of the APS is now complete. Follow the instructions in Start-Up on page 36 to make the system operational.

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Overview

Topic	Page
Start-Up Tasks	36
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Task 2 - Pre-Power-Up Checklist	37
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Start-Up Tasks

Complete all the Installation tasks (see details on page 14) before starting these Start-Up tasks. Complete the Start-Up tasks in the following order:

Task	Description	Reference
1	Insert the Rectifiers	See details on page 36
2	Complete the Pre-Power-Up Checklist	See details on page 37
3	Apply AC Power	See details on page 37
4	Configure the dc power system	See details on page 38
5	Apply DC Power to Battery and Load	See details on page 39

Task 1 - Inserting the Rectifiers

- Do NOT install the rectifiers until the room has been cleaned and is dust free.
- Do NOT switch on the ac supply at this stage.

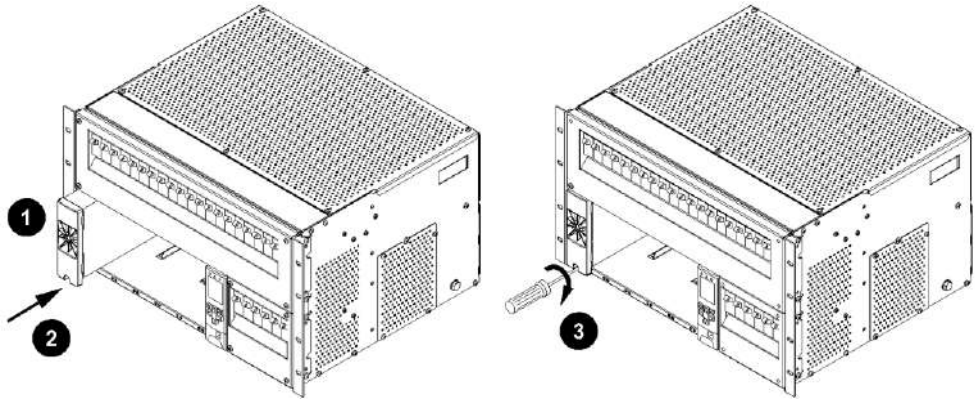
Step 1 - Unpack the rectifiers

Unpack the rectifiers and inspect them carefully for possible transport damage. Report any damage immediately using a completed Equipment Incident Report on page 99.

Keep the original packaging to return a rectifier for replacement or repair, if required.

Step 2 - Fit first rectifier

1. Align the rectifier with the left side of the shelf.
2. Push in the rectifier until the retaining screw contacts the shelf.
3. Check the rectifier's rear connector is correctly aligned with the shelf connector, or damage may occur.
4. Tighten the retaining screw to 1.5Nm (13.3 inch-pounds). This will locate the rectifier in its rear connector.



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Step 3 - Repeat for other rectifiers or fit blank panels

1. Fit the remaining rectifiers.
2. Fit rectifier blank panels in any vacant rectifier positions.

Procedure complete

Task 2 - Pre-Power-Up Checklist

Complete the checklist to confirm initial work is complete before progressing further.

☐	All cabling is installed, securely tied and correctly insulated
☐	Ground bonding is correct (see details on page 16)
☐	DC battery and load cabling has the correct polarity
☐	A registered electrician or other suitable approved person has checked the integrity of the installed cabling
☐	All panels are in place and all empty rectifier slots are covered with blanking panels
☐	All dc circuit breakers are switched off and/or fuses removed
☐	AC supply is isolated at each point of isolation leading back to the ac supply point
☐	Batteries are electrically isolated from the dc power system
☐	The site is clean.

Task 3 - Applying AC Power

- A registered electrician (or suitably qualified person) must check the integrity of the installed cabling, BEFORE the dc power system is powered up.

1. Switch on the AC supply.
   - All rectifiers start up (after the startup delay).
   - The rectifier alarm LEDs will turn on for a short time.
   - The SC200 or SC100 system controller will turn on (green Power On LED is on) when the rectifiers start.
   - During start-up of the system controller the rectifier yellow alarm LEDs will flash until the rectifiers are registered.
2. After start-up of the system controller:
   - Press any key on the system controller to silence the alarm.

   Depending on the configuration file settings, one or both alarm LED(s) may be on and the system controller may display some system alarm messages. This is normal. For an explanation of alarm messages see Alarm Descriptions in the System Controller Operation Handbook.
   - The LCD module shows the summary screen. See details on page 43.

   If no load or battery is connected the current will be 0A.
   - If fitted and enabled, the LVD(s) operate.

3 Check all rectifiers are running and only the rectifier green Power On LEDs are on (no alarm LEDs).

- On the system controller keypad select *Menu* > *Rectifiers.* See details on page 73. Check that all rectifiers are registered.

If any problems see Troubleshooting on page 50.

Task 4 - Configuring the DC Power System

The operational settings of the dc power system are stored in a configuration file loaded into the SC200 or SC100 system controller. See details on page 42.

The system controller 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.

If the configuration file has not been customized for the site, then check the following settings and change if necessary.

Other configuration settings can be changed after all Start-Up tasks are complete. Refer to the System Controller Operation handbook (see Related Information on page i) for details on how to customize the system's configuration.

Parameter	Action	Where to find	
Float Voltage	Set to the value recommended by the battery manufacturer.	SC100:	Menu > Configuration > System > Edit > Float Voltage
		SC200:	Control Processes > Voltage Control > Float Voltage
		DCTools:	Control Processes > Voltage Control > Float Voltage
Battery Capacity	Set to the rated 10 hour capacity of the installed battery strings, or set to zero if no battery connected.	SC100:	Menu > Configuration > System > Edit > Battery Capacity >Edit
		SC200:	Battery > Battery > Battery Capacity
		DCTools:	Batteries
Cells Per String	Set to the number of cells in each battery string (if battery connected).	SC100:	Menu > Configuration > Temp Compensation > Edit > Cells Per String
		SC200:	Battery > Battery > Cells Per String
		DCTools:	Batteries
Temperature Compensation	Enable (if battery and battery temperature sensor connected) and check the settings.	SC100:	Menu > Configuration > Temp Compensation > Edit
		SC200:	Control Processes > Temp. Compensation > Enable
		DCTools:	Control Processes > Temperature Compensation
Low Voltage Disconnect (LVD)	Enable (if LVD(s) installed and battery connected) and check the settings.	SC100:	Menu > Configuration > LVD1/LVD2
		SC200:	Battery > LVDs > LVD x
		DCTools:	Control Processes > LVD

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Parameter	Action	Where to find	
System controller time (SC200 only)	Connect using Web to set correct time manually or connect using DCTools to synchronize to PC time. See details in the System Controller Operation Handbook.	Web:	Configuration > Time
		DCTools:	Configuration > Time > Time Synchronization

Task 5 - Applying DC Power to Battery and Load

Reverse Polarity

- Always check that the battery cables have been terminated to the correct system polarity BEFORE connecting the batteries or closing the battery disconnect device. Connecting batteries to the dc power system with incorrect system polarity will damage the rectifiers and void all warranty claims.

Step 1 - Check dc voltage and polarity

Check the dc output voltage and polarity of the power system and the battery string(s).

Step 2 - Connect batteries

1. If connecting multiple battery strings then check the individual strings are of similar voltage.
2. Switch on all Battery circuit breaker(s).
3. Check the *Battery Fuse Fail* alarm clears.

   All Battery circuit breakers (including any unused circuit breakers) must be switched on to clear the alarm.
4. Check the battery current. The actual value depends on the state of charge of the batteries.

Step 3 - Connect load

1. Switch on the Load circuit breaker(s).
2. Check the equipment powers up and the *Load Fuse Fail* alarm clears.

Step 4 - Check the rectifier currents

1. Check the rectifier currents.
2. Verify the load current is as expected for the load and battery size.

Step 5 - Charge the batteries

1. Charge the batteries according to the battery manufacturer's recommendations.
2. If an *Equalize* charge is recommended by the battery manufacturer then follow the instructions in the System Controller Operation Handbook.

   Equalize increases the system voltage to the Equalize voltage for the Equalize duration. After the Equalize duration has expired, the dc power system voltage reverts to float voltage automatically.

Procedure complete

Start-Up Completed

Start-Up of the APS is now complete and the system is operational.

If a formal commissioning test is required then see the Commissioning check lists on page 83.

The System Controller Operation Handbook (see Related Information on page i) describes how to use the SC200 or SC100 system controller. See:

- *System Operation* to customize the system configuration settings, and
- *Communications* to setup the remote communications options.

For information on alarms, or operation problems see Maintenance on page 49.

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SC200 or SC100 Operation using the Keypad and Screen	44
SC200 or SC100 Operation Using a PC/Laptop	46
SC200 or SC100 Identity Information	48

Configuration File

The operational settings of the dc power system are stored in a configuration file loaded into the SC200 or SC100 system controller.

The SC200 or SC100 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 44), or all settings can be edited using a PC/laptop with DCTools/Web (see details on page 46) or remotely, see Communications Options in the System Controller Operation Handbook.

Backup and Restore

The configuration file settings in the SC200 or SC100 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 or SC100 for customization.
- Copy a customized configuration file from one SC200 or SC100 to others (at similar sites).
- Save a copy of a customized configuration file. This is recommended in case the SC200 or SC100 has to be replaced.

► To use DCTools for Backup and Restore

1. Connect to the SC200 or SC100 with DCTools. See Communications Options in the System Controller Operation Handbook.
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 (SC200 only)

1. Connect to the SC200 via a web browser. For details see Ethernet Communications in the System Controller Operation Handbook.
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 (SC200 only)**

1 Connect to the SC200 via a web browser. For details see Ethernet Communications in the System Controller Operation Handbook.

2 Go to *Tools*.

3 Select *Restore Tool*.

4 Select the file type:

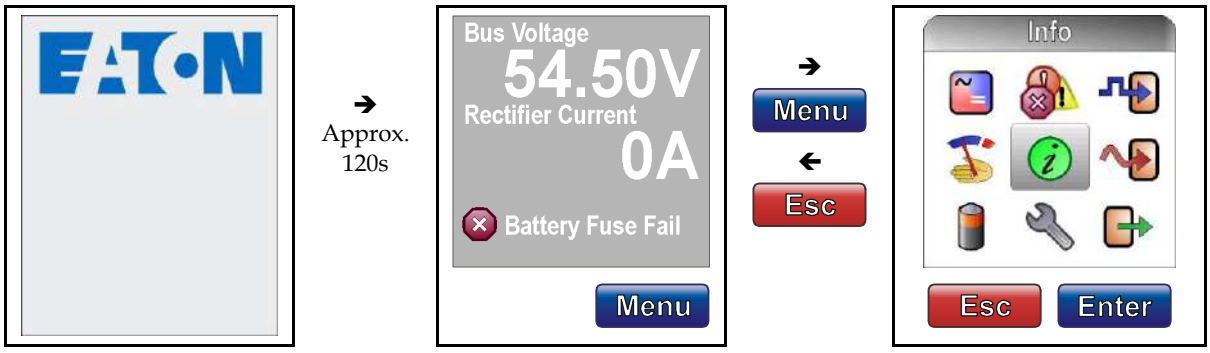
- **System Snapshot (*.dcs):** Configuration file including site specific settings.
- **Configuration (*.dcc):** Configuration file without site specific settings - Site Identity, IP Address, S3P Address, battery characterization data).
- **Fragment (*.dcf):** Restore part of a configuration file (such as battery characterization data).

5 Click *Next*, and then select a file name to *Restore* a configuration.

Starting the SC200 or SC100

When dc power is applied to the SC200 or SC100 (via the RXP connector YS11) the start-up sequence begins.

SC200



Start-up screen

Main screen

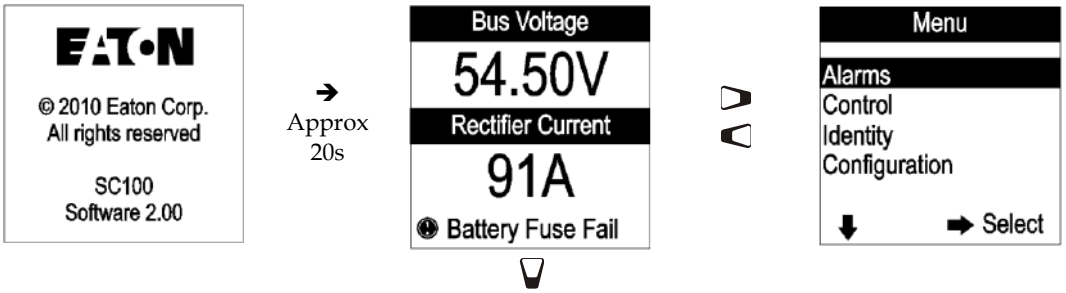
The values shown are configurable, see details in the System Controller Operation Handbook. All active Critical, Major, Minor and Warning alarms are displayed.

Menu screen

See navigation details on page 73.

If Logon is required see Keypad Access Security on page 44.

SC100



Start-up screen

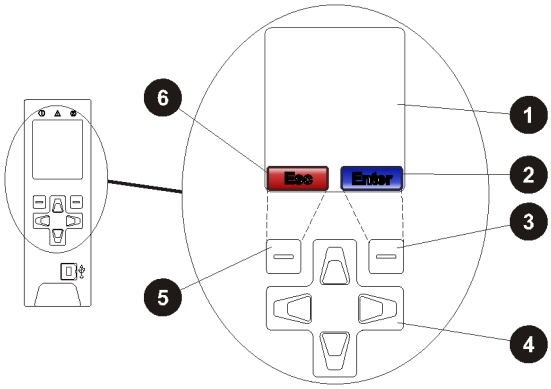
First status screen

All active alarms are displayed.

Main menu

See details on page 74.

SC200 or SC100 Operation using the Keypad and Screen



1. LCD
2. Soft key 1 label (SC200 only)
3. Soft key 1 (SC200 only)
4. Navigation keys (Up - Down - Left - Right)
5. Soft key 2 (SC200 only)
6. Soft key 2 label (SC200 only)

Keypad Access Security

SC200 System Controller

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 and HTTP/HTTPS Access in the System Controller Operation Handbook), 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 101).

► 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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SC100 System Controller

This feature prevents accidental or unauthorized changes to settings from the SC100 keypad.

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

- In DCTools/Web go to *Communications*.
- Set *UI Access* to:
  - *Unprotected* - keypad access is allowed, or
  - *Protected* - keypad access is denied (can be temporarily over-ridden, see below).

► **To temporarily enable keypad access at the SC100 when access is set to Protected**

- Press *Up* and *Down* keys together for 5 seconds.

  Keypad access is now temporarily enabled. Keypad access control reverts back to Protected mode after the display goes back to the Summary 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 (SC200 only)
- 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:

- On SC200 go to: Alarms > Alarm Settings > Audible Alarms > Edit.
- or on SC100 go to: Menu > Configuration > Audible Alarm.

Or:

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

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

SC200 or SC100 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 www.powerquality.eaton.com/downloads.

Using DCTools via USB (SC200 only)

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 in the System Controller Operation Handbook.

Before you start you will need:

- The latest version of *DCTools* available from www.powerquality.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 www.powerquality.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 5 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 50.
5. For details of the SC200 control and monitoring functions available via *DCTools see* System Operation in the System Controller Operation Handbook.

   For help using DCTools press F1.

Using DCTools via RS232

DCTools can be run on a PC/laptop connected to the SC200 or SC100's RS232 port.

For remote PC/laptop connection details see Communications Options in the System Controller Operation Handbook.

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Before you start you will need:

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

► To connect a PC/laptop to the SC200 or SC100:

1 Download the latest version of *DCTools* from: www.powerquality.eaton.com/downloads.

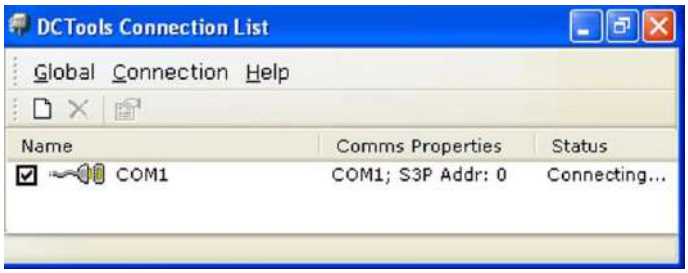
2 Install *DCTools* on the PC/laptop.

3 Connect a null-modem cable from the COM1 RS232 port on the PC/laptop to the RS232 connector on the SC200 or SC100.

Ensure the cable is secured so that no force is applied to the RS232 connector as this may damage the connector.

If COM1 port is not available or for more details see Direct RS232 Communications in the System Controller Operation Handbook.

4 Start DCTools to open the Connection List. Check the box for the *COM1* connection.

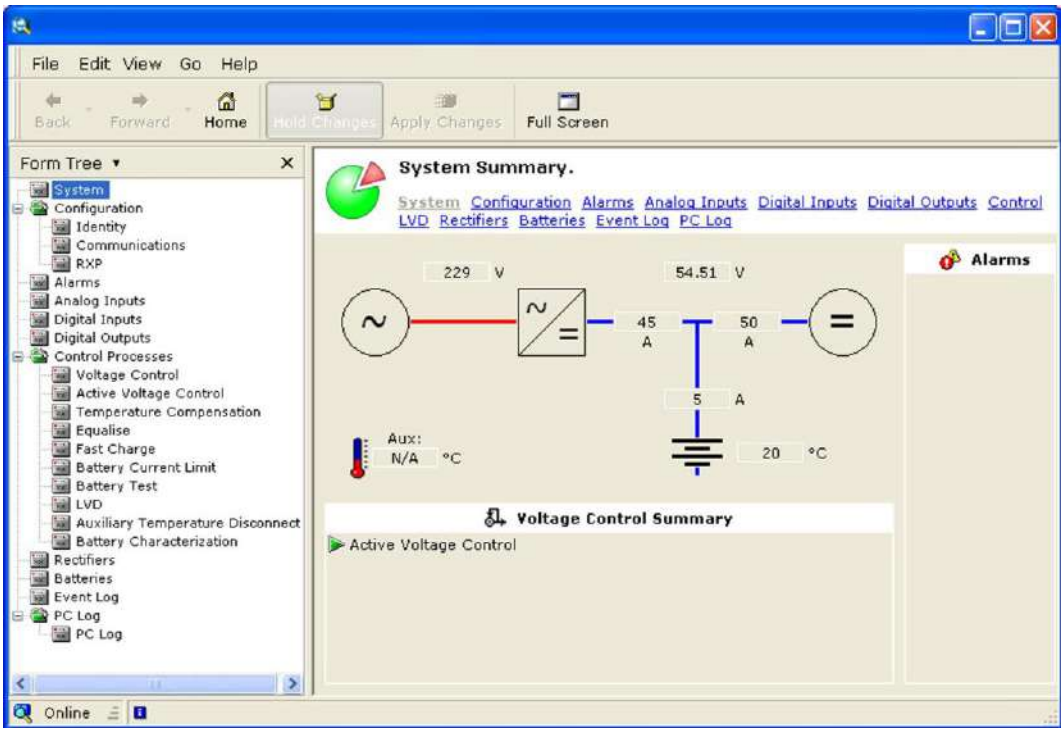


5 *DCTools* will now connect to the SC200 or SC100.

If connection is unsuccessful refer to DCTools help (press F1) or Troubleshooting on page 50.

6 For details of the SC200 or SC100 control and monitoring functions available via *DCTools see* System Operation in the System Controller Operation Handbook.

For help using DCTools press F1.



SC200 or SC100 Identity Information

The following identity information is stored in the SC200 or SC100.

Parameter	Description	Where to find:
Serial Number	The SC200 or SC100 serial number (factory set).	SC100: Menu > Identity >SC100 Identity SC200: Info DCTools/Web: Configuration > Identity
Software Version (App Version)	The version of the embedded software in the SC200 or SC100 (factory set).	

If required, the following site specific information can be stored in the SC200 or SC100 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 APS model number.	
System Serial Number	The APS serial number.	
System Location	Location of APS 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 or SC100.	

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Overview

- The APS contains hazardous voltages and hazardous energy levels. Before undertaking any maintenance task refer to the Warnings on page 10.
- 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 101.

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Replacing or Adding a Load circuit breaker	59
Replacing the System Controller	60
Replacing the Input/Output Board	62
Battery Mid-point Monitoring (String Fail) Alarm (SC200 only)	64
Battery Disposal and Recycling	64

Troubleshooting

Use the table to troubleshoot minor installation and operational problems. For additional assistance see contact details on page 101. Return items for replacement or repair with a completed Equipment Incident Report on page 99.

System Problems

Problem	Possible Cause	Required Action
All rectifiers are off (no LEDs on) and system controller display is blank.	AC supply to the system is off and batteries are not connected or are fully discharged.	Restore ac supply.
Green LED of one or more rectifiers is off.	AC supply to rectifier(s) off or one or more phases are off.	Restore ac supply.
	Rectifier(s) not fully inserted.	Insert rectifier and tighten retaining screw.
	Internal rectifier fault.	Remove the rectifier and insert another one in the same slot. If second rectifier fails to start, then there is a fault with the rectifier position. Check ac connections. If the second rectifier operates normally, then the first rectifier is faulty and must be returned for service.
All rectifier LEDs flash.	The rectifier is responding to an *Identify* command from the system controller.	None, this is normal operation. See details in the System Controller Operation Handbook.
Rectifier yellow LED flashes	The system controller is starting.	Wait for system controller to complete start-up.
	Rectifier has not registered with the system controller.	Remove, and then re-insert the rectifier. Replace the rectifier with another rectifier. If second rectifier fails to register, then there is a fault with the rectifier position. Check rectifier comms bus wiring. If second rectifier registers, then first rectifier is faulty and must be returned for service.

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Problem	Possible Cause	Required Action
Rectifier yellow LED on.	Rectifier power limit or current limit is active.	Power system is charging the batteries. If required, activate the Battery Current Limit control process.
	Load current exceeds the total rectifier capacity.	Install additional rectifiers.
	Rectifier temperature turndown is active due to low ac supply voltage or high ambient temperature.	Power system will return to normal operation when the ac supply voltage and/or ambient temperature are within the specified ranges. See Specifications on page 69.
	System controller has shut down the rectifier. (Depending on model, rectifier may also click every 5-15 seconds.)	Normal operation. See Rectifier Shutdown in the System Controller Operation Handbook. If required, restart the rectifier.
Rectifier red LED on.	Very high or low ac voltage, or ac supply failed.	Power system will return to normal operation when the ac supply voltage is within the specified range. See Specifications on page 69.
	DC overvoltage	Remove and re-insert rectifier(s) or shut down and restart using *DCTools/Web*.
	Internal rectifier fault.	Replace the rectifier.
Low system output voltage (rectifiers not in current limit).	Rectifiers off.	Restore the ac supply.
	Temperature Compensation is active and the battery temperature is above the reference temperature.	None. This is normal operation (if batteries are connected). Disable Temperature Compensation if no batteries connected.
	Battery Test or Battery Characterization is active.	None. Output voltage will return to normal when Battery Test or Battery Characterization is completed.
	Incorrect float voltage setting at system controller.	Correct the float voltage setting of the system controller. Record new setting.
Low system output voltage and rectifier yellow LEDs are on (rectifiers are in current limit).	Load is too high for rectifier capacity.	Install additional rectifiers.
	Battery is recharging after ac supply failure.	Check battery has recharged within expected time.

Problem	Possible Cause	Required Action
High system output voltage.	Temperature Compensation is active and the battery temperature is below the reference temperature.	None. This is normal operation (if batteries are connected). Disable Temperature Compensation if no batteries connected.
	Equalize or Fast Charge is active.	None. Output voltage will return to normal when Equalize or Fast Charge is completed.
	Incorrect float voltage setting at system controller.	Correct the float voltage setting of the system controller. Record new setting.
	Faulty rectifier.	Locate the rectifier with the highest output current and remove this one first. If the first rectifier removed is not faulty, remove each of the remaining rectifier modules one at a time, until the faulty rectifier is found. (The output voltage returns to normal when faulty rectifier is removed.) Replace faulty rectifier with one that is working. Return the faulty rectifier for service.
System has no dc output (rectifiers are on).	Load circuit breaker open.	Check for open circuit breaker.
	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 **81**. Check the connections from the load bus to the LVD.
System has no battery input	Battery circuit breaker open.	Check for open battery circuit breaker.
	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 **81**. Check the connections from the battery bus to the LVD.

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Problem	Possible Cause	Required Action
String Fail Alarm (SC200 only)	The Battery Mid-point Monitoring system has detected a voltage imbalance in one of the battery strings.	See Battery Mid-point Monitoring on page 64.
	A Battery Mid-point Monitoring sense wire is disconnected.	Check the sense wires.

System Controller Problems

Problem	Possible Cause	Required Action
SC200 or SC100 displays a dc power system alarm message.		See Alarm Descriptions in the System Controller Operation Handbook.
SC200 or SC100 LCD is blank and green Power On LED is off.	RXP/power cable is disconnected from the SC200 or SC100.	Connect cable from connector YS11 to the dc power system voltage feed module (see Connections on page 81). 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 or SC100 will return to normal operation when the ac supply is within its specified voltage range.
	Faulty Voltage Feed Module (VFM) or faulty SC200 or SC100.	Replace faulty unit.
SC200 or SC100 LCD is blank and green Power On LED is on.	SC200 or SC100 is in start-up mode	Wait for start-up to complete. See Starting the SC200 or SC100 on page 43.
	Faulty SC200 or SC100	Replace faulty SC200 or SC100.
SC200 or SC100 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 in the System Controller Operation Handbook.
Unable to change settings from SC200 or SC100 keypad.	Keypad access is set to *Read Only* or *PIN Protected*.	See Keypad Access Security on page 44.
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 in the System Controller Operation Handbook.
	Problem with power or communications to I/O board.	Check all connections (see Connections on page 81).
	SC200 or SC100 or I/O board software corrupt or hardware fault.	Replace faulty unit.

Problem	Possible Cause	Required Action
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 in the System Controller Operation Handbook.	None, normal operation.
SC200 or SC100 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 (SC200 only).	Check I/O board mapping. See details in the System Controller Operation Handbook.
SC200 or SC100 displays **Config Error**	Missing or invalid configuration file.	Either: Load a valid configuration file into the SC200 or SC100. See Backup and Restore on page 42, or Change one or more configuration settings using the SC200 or SC100 keypad or DCTools.
	Incorrect rectifier voltage, because installed rectifiers have different output voltages.	Check that all rectifiers are of the same type and replace as necessary.
DCTools connection problem (*Target Failed to Respond* error)	Connection problem	Refer to following communications problems.
USB communications problem (SC200 only)	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 or SC100 serial communications are disabled.	Check *S3P Access* is enabled. See details in the System Controller Operation Handbook.
	DCTools not installed on PC or wrong version.	Install latest version of DCTools. Download from www.powerquality.eaton.com/downloads.
	Password required to change settings.	See Write Access Password in the System Controller Operation Handbook.

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Problem	Possible Cause	Required Action
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 or GSM Modem Communications in the System Controller Operation Handbook.
	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 101.
	Password required to change settings.	See Write Access Password in the System Controller Operation Handbook.
Serial communications are disabled (SC200 only)	*S3P Access* is disabled.	*Set S3P Access* to Enabled. See details in the System Controller Operation Handbook.
Ethernet communications problem (SC200 only)	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 5 for position of the Ethernet connector.
	Incorrect communications settings.	See Ethernet Communications in the System Controller Operation Handbook.
	SC200 serial communications are disabled.	Check *S3P Access* is enabled. See details in the System Controller Operation Handbook.
	Password required to change settings (using DCTools or PowerManagerII).	See Write Access Password in the System Controller Operation Handbook.

Problem	Possible Cause	Required Action
Web communications problem (SC200 only)	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 in the System Controller Operation Handbook. Check *HTTP Access* or *HTTPS Access* is enabled. See Web Access Security in the System Controller Operation Handbook.
	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 in the System Controller Operation Handbook.
	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 6.
	Lost Logon ID and/or Password.	Use DCTools to set up a new Logon ID and/or Password. See Web Access Security in the System Controller Operation Handbook.
	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 in the System Controller Operation Handbook.
	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 in the System Controller Operation Handbook.
SC200 time/date is incorrect (SC200 only)	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 in the System Controller Operation Handbook.
	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.)
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 81. 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 or SC100.	None, this is normal operation. See details in the System Controller Operation Handbook.

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Problem	Possible Cause	Required Action
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 or SC100 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 81.
	LVD Type setting is incorrect.	Check *LVD Type* setting.
LVD contactor(s) not operating.	LVD settings incorrect.	Check LVD is enabled and set to correct values. See details in the System Controller Operation Handbook. Check that the LVD manual control is set to AUTO. See details in the System Controller Operation Handbook. Check that the contactor is correctly configured and mapped to the I/O board. See details in the System Controller Operation Handbook (SC200 only).
	Contactor is disconnected.	Check the control and dc power cables are connected. See details on page 81.

Replacing or Adding a Rectifier

Rectifiers can be replaced without switching off the dc power system and disconnecting the equipment it powers.

- To reduce the risk of electric shock and maintain optimum system cooling, always cover empty rectifier slots with blanking panels.
- To avoid electric shock do not place hands inside the rectifier shelf.
- Do not attempt to disassemble faulty rectifiers. Return them (in their original packaging) with a completed Equipment Incident Report on page 99.

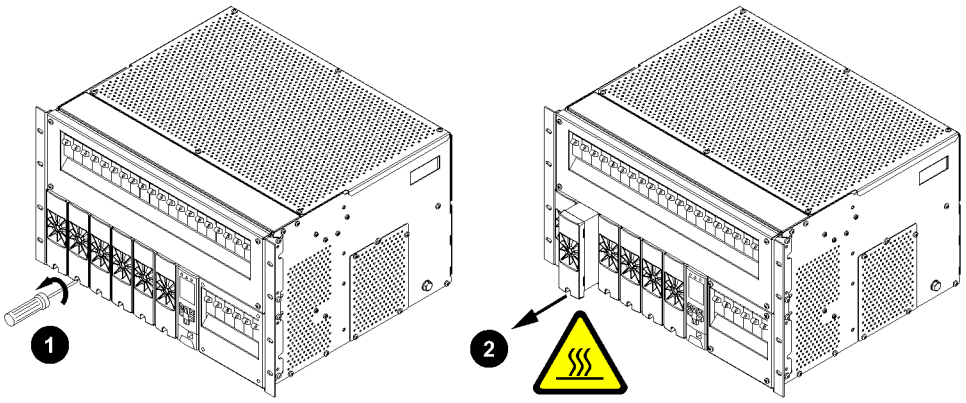
Removing a Rectifier

Step 1 - Undo the rectifier retaining screw

This will release the rectifier from its rear connector.

Step 2 - Pull out the rectifier

- The rectifier may be hot, especially after prolonged operation. Use suitable gloves.
- To avoid damage do not rest the rectifier on its connector.



Step 3 - Replace rectifier or fit blank panel

Insert a replacement rectifier into the empty slot (see details in following section), or fit a blank panel.

Procedure complete

Installing a Replacement Rectifier

Step 1 - Remove rectifier blank panel (if fitted)

Step 2 - Align the rectifier with the guides

Step 3 - Push in the rectifier

1. Push in the rectifier until the retaining screw contacts the shelf.
2. Check the rectifier's rear connector is correctly aligned with the shelf connector, or damage may occur.
3. Tighten the retaining screw to 1.5Nm (13.3 inch-pounds). This will locate the rectifier in its rear connector.
4. Check that the rectifier's Power On LED turns on (after the startup delay) and the alarm LEDs turn off.

   The rectifier will automatically register with the system controller and download its operating parameters. No adjustments are required.

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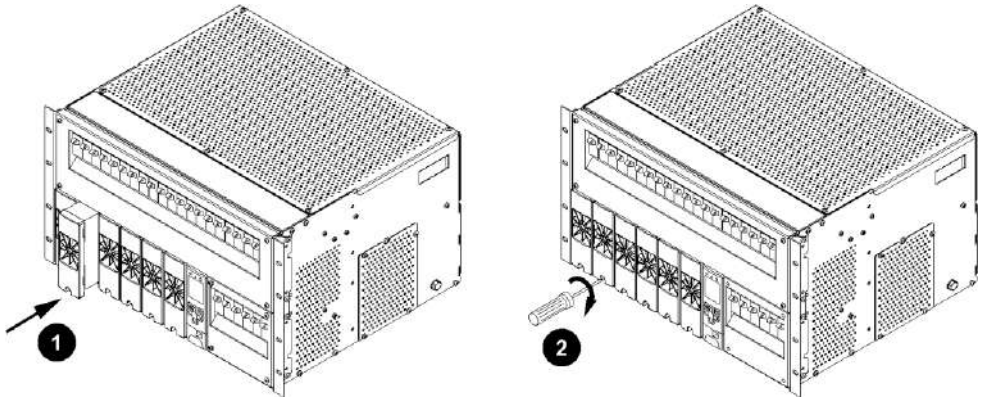

Procedure complete

Replacing or Adding a Load circuit breaker

Step 1 - Remove dc circuit breaker cover

See the diagram on page 2.

Step 2 - Remove existing circuit breaker (if required)

Pull circuit breaker forward to remove.

Step 3 - Plug in new circuit breaker

☐ *Remove circuit breaker blank panel if fitted.*

Follow the procedure on page 17. See Spare Parts on page 67 for available types and part numbers.

Step 4 - Replace dc circuit breaker cover

Step 5 - Connect load cable (if required)

Follow the procedure on page 28.

Procedure complete

Replacing the System Controller

The SC200 or SC100 system controller can be replaced without switching off the dc power system and disconnecting the equipment it powers.

Before you start you will require:

- A PC/Laptop with *DCTools** connected to the system controller or (SC200 only) a web browser* connected to the system controller via an IP network.

  **See Communications Options in the System Controller Operation Handbook.*

- A replacement SC200 or SC100 system controller.

  A new system controller is factory loaded with a 48V (nominal) default configuration file. DCTools/Web (SC200 only) can be used to modify the configuration file already loaded in a system controller. However, a system controller configured for a particular nominal system voltage (48V or 24V) can only be converted to the other nominal system voltage by loading a new configuration file.

- A copy of the appropriate configuration file, either:
  - use the configuration file saved from the existing system controller, or
  - contact your Eaton dc power system supplier to obtain a master configuration file to suit the dc power system. This file will have to be customized for the site.

Step 1 - Backup the configuration file of the old SC200 or SC100 if possible

If the old system controller is still operational use DCTools/Web to backup its configuration file.

See Backup and Restore on page 42.

Step 2 - Remove the system controller

1. Undo the system controller retaining screw. See the diagram on page 5.
2. Partly withdraw the system controller.
3. Label, and then disconnect the cable(s) from the rear connectors.

   When the system controller stops communicating the rectifier output voltage will be unchanged for 2 minutes. After 2 minutes the rectifier output voltage will change to the Float Voltage and the rectifier yellow LEDs will flash.

Step 3 - Insert the new system controller

1. Connect the cable(s) to the rear connectors.

   The system controller will start. See Starting the SC200 or SC100 on page 43. Various alarms may appear because of incorrect configuration file settings. Press any key to silence the alarm.

2. Insert the system controller and tighten the retaining screw.

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Step 4 - Download the configuration file

1. Connect to the system controller with *DCTools/Web*. See details on page 46.
2. If a copy of the old configuration file, or a master configuration file is available, then use *DCTools* to restore (download) it to the new system controller.
   - *See Backup and Restore on page 42.*
   - *If you receive an error message about the MIB file version, please contact your Eaton dc product supplier for advice.*
3. If a copy of the old configuration file, or a master configuration file is not available, then use the keypad or *DCTools/Web* to change the configuration settings to the correct values (provided the system controller is set for the correct nominal system voltage).

Step 5 - Check the system controller operation

1. Map the I/O board (SC200 only):
   - In DCTools/Web go to: *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 connected use the I/O board Identify function to physically identify each module. See details in the System Controller Operation Handbook.*
2. Check that the system controller has registered all rectifiers.
3. Check all control processes, alarms and current measurement(s).
4. Check the power system identification parameters and communications settings.
5. Change the configuration file as required to ensure that the system controller operates as intended.
6. Check the system controller time (SC200 only). See details in the System Controller Operation Handbook.

Step 6 - LVD Characterization Alarm

If LVD(s) fitted the SC200 or SC100 may indicate an LVD Characterization alarm.

- *If there is no alarm then no further action is required.*

1. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
2. If available, select *Characterize With IOB Values*. Press *Enter/Save*. Repeat for the second LVD if fitted. No further action is required.
3. If *Characterize With IOB Values* is not available, the LVD(s) must be characterized. This will cause the LVD(s) contactor(s) to disconnect for a few seconds:
   - If a battery disconnect LVD is fitted then the load equipment will continue to be powered by the rectifiers.
   - If a load disconnect LVD is fitted then load equipment connected to circuit breakers 1-10 will be disconnected. Either, arrange to switch off this equipment or connect a temporary external power source to power the equipment when the load LVD disconnects.

4 On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2

- Select *Characterize*. Press *Enter/Save*.

  The LVD contactor will disconnect and connect.

- Repeat for the second LVD if fitted.

Procedure Complete

Return the faulty SC200 or SC100 with a completed Equipment Incident Report on page 99.

Replacing the Input/Output Board

- When the I/O board is removed any LVD fitted will disconnect:
  - If a battery disconnect LVD is fitted the battery will be disconnected when the I/O board is removed (the load equipment will continue to operate from the rectifiers).
  - If a load disconnect LVD is fitted then the equipment connected to circuit breakers 1-10 will be disconnected when the I/O board is removed.

Before you start you will require:

- A PC/Laptop with *DCTools** connected to the system controller or (SC200 only) a web browser* connected to the system controller via an IP network.

  **See Communications Options in the System Controller Operation Handbook.*

- A replacement input/output board.
- An anti-static wrist strap to prevent damage to the static sensitive components on the input/output board.

Step 1 - Load disconnect LVD (if fitted)

Ignore this step if there is no load disconnect LVD fitted.

If a load disconnect LVD is fitted then load equipment connected to circuit breakers 1-10 will be disconnected. Either, arrange to switch off this equipment or connect a temporary external power source to power the equipment when the load LVD disconnects.

Step 2 - Remove cover to access I/O board

1 See the diagram on page 3 for location of I/O board.

2 Remove the Input/Output (I/O) cover.

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Step 3 - Replace I/O board

1. Slide out the I/O board.
2. Label then disconnect all cables.

   If an LVD is fitted it will disconnect. The load equipment will be powered by the rectifiers. The SC200 or SC100 will show various alarms. Press any button to silence the alarm.
3. Return the board for service. See Equipment Incident Report on page 99.
4. Connect all cables to the new I/O board.
5. Check the I/O board Power On LED is on. If not see Troubleshooting on page 50.
6. Slide in the I/O board. Replace the cover.
7. SC200 only:
   - In *DCTools/Web* go to: *RXP*.
   - Copy the I/O board serial number from the *RXP Devices* table to the *I/O Board to Serial Number Mapping* table to map an *IOB Number* to the I/O board (overwrite existing serial number).

   The Missing Hardware alarm will clear.

Step 4 - Characterize LVD(s) (if required)

Ignore this Step if there is no LVD Characterization alarm.

1. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
2. If available, select *Characterize With SC Values*. Press *Enter/Save*. Repeat for the second LVD if fitted. No further action is required.
3. If *Characterize With SC Values* is not available, the LVD(s) must be characterized. This will cause the LVD(s) contactor(s) to disconnect for a few seconds:
   - If a battery disconnect LVD is fitted then the load equipment will continue to be powered by the rectifiers.
   - If a load disconnect LVD is fitted then load equipment connected to circuit breakers 1-10 will be disconnected. Either, arrange to switch off this equipment or connect a temporary external power source to power the equipment when the load LVD disconnects.
4. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
   - Select *Characterize*. Press *Enter/Save*.

   The LVD contactor will disconnect and connect.
5. Repeat for the second LVD if fitted.

Procedure complete

Battery Mid-point Monitoring (String Fail) Alarm (SC200 only)

Use the following procedure if a *String Fail* alarm is generated.

Step 1 - Identify the faulty battery string

1. Press any button on the SC200 to silence the alarm.
2. Connect to the SC200 using DCTools/Web. Go to *Batteries* > *Mid-point Monitoring*.
3. Click + to expand the *Mid-point Monitoring* table to identify which battery string has failed.

Step 2 - Check cell/monobloc voltages

1. Use a suitable voltmeter to measure the individual cell/monobloc voltages. Measure on the cable lugs and inter-connecting bars so that loose connections will also be detected.
2. The faulty or poorly connected cell/monobloc has the voltage with the greatest deviation from the average.

Step 3 - Check cell/monobloc terminals

1. Check the terminal connections of the cell/monobloc are correctly tightened and clean.

   Refer to the battery manufacturer's instructions for correct terminal torque settings.
2. In DCTools/Web go to *Batteries* > *Mid-point Monitoring*. Click *Clear String Fail*.
3. If the alarm clears then the fault is fixed. No further action is required.

Step 4 - Service or replace faulty cell/monobloc (if required)

1. If the alarm is still present then follow the battery manufacturer's instructions on servicing or replacing the faulty cell/monobloc.
2. After the faulty cell/monobloc has been serviced or replaced clear the alarm (see Step 3).

Procedure complete

Battery Disposal and Recycling

Follow Environmental Protection Agency (EPA) guidelines or the equivalent local regulations to dispose of all batteries. Please remember that the owner is responsible and liable to ensure those EPA guidelines or equivalent local regulations are followed.

For assistance contact your local hazardous waste center or Worldwide Support on page 101.

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Equipment and Tools

Safety Equipment

Use approved safety equipment as required by local health and safety regulations including (but not restricted to):

- Safety glasses
- Safety gloves
- Safety footwear
- Appropriate handling equipment for batteries and other heavy items
- Appropriate platform(s) and access for working at height (if required)

Essential Tools

Standard electrical toolkit with insulated tools, plus:

- Cable crimping tool and crimp lugs suitable for all cable sizes and connectors used
- Torque wrench with pivot head and insulated handle
- Heatshrink tubing and heat gun
- Digital multimeter
- Insulation tester
- Non-static clothing

Recommended Tools

- Laptop with:
  - USB port and USB A/B cable (RadioShack 55010997, Jaycar WC7700 or similar)
  - DCTools software (download from www.powerquality.eaton.com/downloads).
- Test load (to suit maximum output of dc power system)
- Labeling tool and labels
- Clamp-on ammeter

Standard Torque Settings

Use the following torque settings unless specific values are stated on the fastener or elsewhere.

Fastener	Torque
1/4" cable terminals	3.9 - 4.5Nm (35 - 39 inch-pounds)
3/8" cable terminals	18.7 - 21.9Nm (166 - 194 inch-pounds)
#6-32 nuts	1.1Nm (10 inch-pounds)
#10-32 screw for ac and dc covers	3.9Nm (35 inch-pounds)
#12-24 rack/frame-mounting screws	3.9Nm (35 inch-pounds)

Notes:

1. When a bolt and nut is torqued use a spanner to prevent rotation.
2. For battery terminals use the torque values specified by the battery manufacturer.

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Spare Parts Lists APS6-400

System Modules and Miscellaneous

Item	Description	Part Number
1	Rectifier module. See replacement procedure on page 57.	48V, 1800W: Eaton APR48-3G 48V, 2000W: Eaton APR48-ES
2	Rectifier blank panel (to cover un-used rectifier positions)	Eaton RMB-09
3	System controller. See replacement procedure on page 60.	Eaton SC200-00 or SC100-00
4	Input/Output Board. See replacement procedure on page 62.	Eaton IOBGP-01
5	Circuit breaker blank panel (to cover un-used circuit breaker positions)	Eaton 621-05985-45
6	Crimp lugs for load and battery cables	See details on page 28.
7	2-pole load circuit breaker linking bus	Eaton 621-107095-71
8	2-pole battery circuit breaker linking bus	Eaton 621-10999-03
9	USB A/B cable	RadioShack 55010997, Jaycar WC7700, or equivalent.
10	Battery Mid-point Monitoring connection kit for use with SC200 (for two battery strings)	Eaton MPTLOOM-3300 (2 x 3m sense wires), or Eaton MPTLOOM-7600 (1 x 7m, 1 x 6m sense wires)
11	200A Low Voltage Disconnect (LVD) kit for load disconnect	Eaton KLVD200-002
12	400A Low Voltage Disconnect (LVD) kit for battery disconnect	Eaton KLVD400-002
13	200A LVD link (to replace 200A load LVD)	Eaton 621-107095-70
14	400A LVD link (to replace 400A battery LVD)	Eaton 621-107095-69

Load Circuit Breakers

Item	Description	Part Number
1	5A, 1-pole, 80V dc (derates to 4A)	Heinemann AMA1R-B2-AI-20-D-DU-52-5-1
2	10A, 1-pole, 80V dc (derates to 8A)	Heinemann AMA1R-B2-AI-20-D-DU-52-10-1
3	15A, 1-pole, 80V dc (derates to 12A)	Heinemann AMA1R-B2-AI-20-D-DU-52-15-1
4	20A, 1-pole, 80V dc (derates to 16A)	Heinemann AMA1R-B2-AI-20-D-DU-52-20-1
5	25A, 1-pole, 80V dc (derates to 20A)	Heinemann AMA1R-B2-AI-20-D-DU-52-25-1
6	30A, 1-pole, 80V dc (derates to 24A)	Heinemann AMA1R-B2-AI-20-D-DU-52-30-1
7	40A, 1-pole, 80V dc (derates to 32A)	Heinemann AMA1R-B2-AI-20-D-DU-52-40-1
8	50A, 1-pole, 80V dc (derates to 40A)	Heinemann AMA1R-B2-AI-20-D-DU-52-50-1
9	60A, 1-pole, 80V dc (derates to 48A)	Heinemann AMA1R-B2-AI-20-D-DU-52-60-1
10	80A, 1-pole, 80V dc (derates to 64A) *	Heinemann AMA1R-B2-AI-20-D-DU-52-80-1
11	100A, 1-pole, 80V dc (derates to 70A at 45°C, 75A at 40°C, 80A at 35°C) *	Heinemann AMA1R-B2-AI-20-D-DU-52-100-1
12	100A, 2-pole, 80V dc (derates to 80A) *	Heinemann AMA2R-B2-LI-20-D-DU-52-100-1
13	120A, 2-pole, 80V dc (derates to 96A) *	Heinemann AMA2R-B2-LI-20-D-DU-52-120-1

** Circuit breaker must have adjacent space. Refer to the installation instructions.*

See replacement procedure on page 59.

Battery Circuit Breakers

Item	Description	Part Number
1	80A, 1-pole, 80V dc	Heinemann AM1R-B39-AJ-20-D-DU-52-80-251
2	100A, 1-pole, 80V dc	Heinemann AM1R-B39-AJ-20-D-DU-52-100-251
3	100A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-100-251
4	120A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-120-251
5	150A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-150-251
6	200A, 2-pole, 80V dc	Heinemann AM2R-B39-LJ-20-D-DU-52-200-251

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System Input

Input Voltage	120V, 208-240V (nominal)	
Frequency	50-60Hz	
Input Current Rating (maximum)		
120V:	2 x (1W + N + PE)	36A/phase
	3 x (1W + N + PE)	24A/phase
208 - 240V:	2 x (2W + PE)	36A/phase
	3 x (2W + PE)	24A/phase
AC wire size	See details on page 32.	
Up-stream circuit breaker	Two ac feeds:	50A
	Three ac feeds:	40A
Maximum Ground Leakage Current	1.3mA per rectifier	
Rectifier Input Fuses (internal)	16A, 250V	

System Output

Output Voltage (nominal)	48V	
Output Voltage		
Range	43 - 58V	
Preset Voltage	54.5V ± 0.1V	
Total Output (maximum)		
APR48-ES rectifiers	120V ac:	7.2kW/150A max.
	208-240V ac:	12.0kW/250A max.
APR48-3G rectifiers	120V ac:	6.6kW/137.4A max.
	208-240V ac:	10.8kW/225A max.

Output Circuit Breakers

Ratings and model numbers	See Spare Parts on page 67	
Load circuit breaker derating factors	5 - 80A, 1-pole:	80% of CB rating
	100A, 1-pole:	70% of CB rating at 45°C
		75% of CB rating at 40°C
		80% of CB rating at 35°C
	100A, 2-pole:	80% of CB rating
	120A, 2-pole:	80% of CB rating
Circuit breaker spacing	80-120A load circuit breaker must have adjacent space. Refer to the installation instructions on page 17.	

LVD Specifications APS6-400

Low Voltage Disconnect (LVD) Contactors

Battery Disconnect	400A
Low-priority Load Disconnect	200A

In APSs without an internal battery disconnect LVD, either the total battery current must be less than 285A or the APS must be protected by an external battery LVD set to 43V or higher.

Fuses

Rectifier (internal) ac input fuses (F1, F2)	16A, 250Vac, fast acting
Rectifier (internal) auxiliary fuse (F3)	250mA, 250Vac, fast acting, interrupt rating 1500A min.

Environment

Ambient Temperature Range:	-40°F to 113°F [-40°C to 45°C]
Relative Humidity *(operating and storage)*	<95% (non condensing)

Dimensions H, W, D

APS6-400	6U, 19" or 23" mounting, 15.3" [390 mm]*

** Additional clear air space is required at rear for rectifier exhaust air venting. See details on page 22.*

Weight

APS6-400	46.3 lb [21kg]*
Rectifier module	3.7 lb [1.7kg]

** weight of a typical configuration, excluding rectifiers*

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]
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 or SC100.*

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Digital Inputs (IOBGP)

Number of Digital Inputs	6
Connectors	Screwless terminal blocks
Wire Size	0.5 - 2.0mm² [20 - 14 AWG]
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 (one used for internal current shunt)
Range	–50 to +50mV
Resolution	<50µV
Accuracy	±0.5% at 25°C [77°F], ±1% over rated temperature range
Connector	RJ45

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
Connector	MTA156 (2-way)

Battery Mid-point Monitoring (SC200 only)

Number of Strings	Standard: Maximum:	4 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	

Communications

USB (SC200 only)	Version: Connector:	1.1 (12Mbits/s) USB B (female)
RS232	Interface: Connector:	RS232 (DTE) DB9M
Ethernet (SC200 only)	Interface: Connector: Protocols: MAC Address: Web browser:	10baseT RJ45 TCP/IP, SNMP, S3P over IP, http (Web), https (secure Web), SNTP, Modbus-TCP, Serial Server See details in the System Controller Operation Handbook. Microsoft Internet Explorer 8 (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0.
External modem options	Type: Operation:	PSTN or GSM Dial in/Dial out on alarm*

** Can operate as a backup for Ethernet communications (SC200 only).*

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SC200 Menu

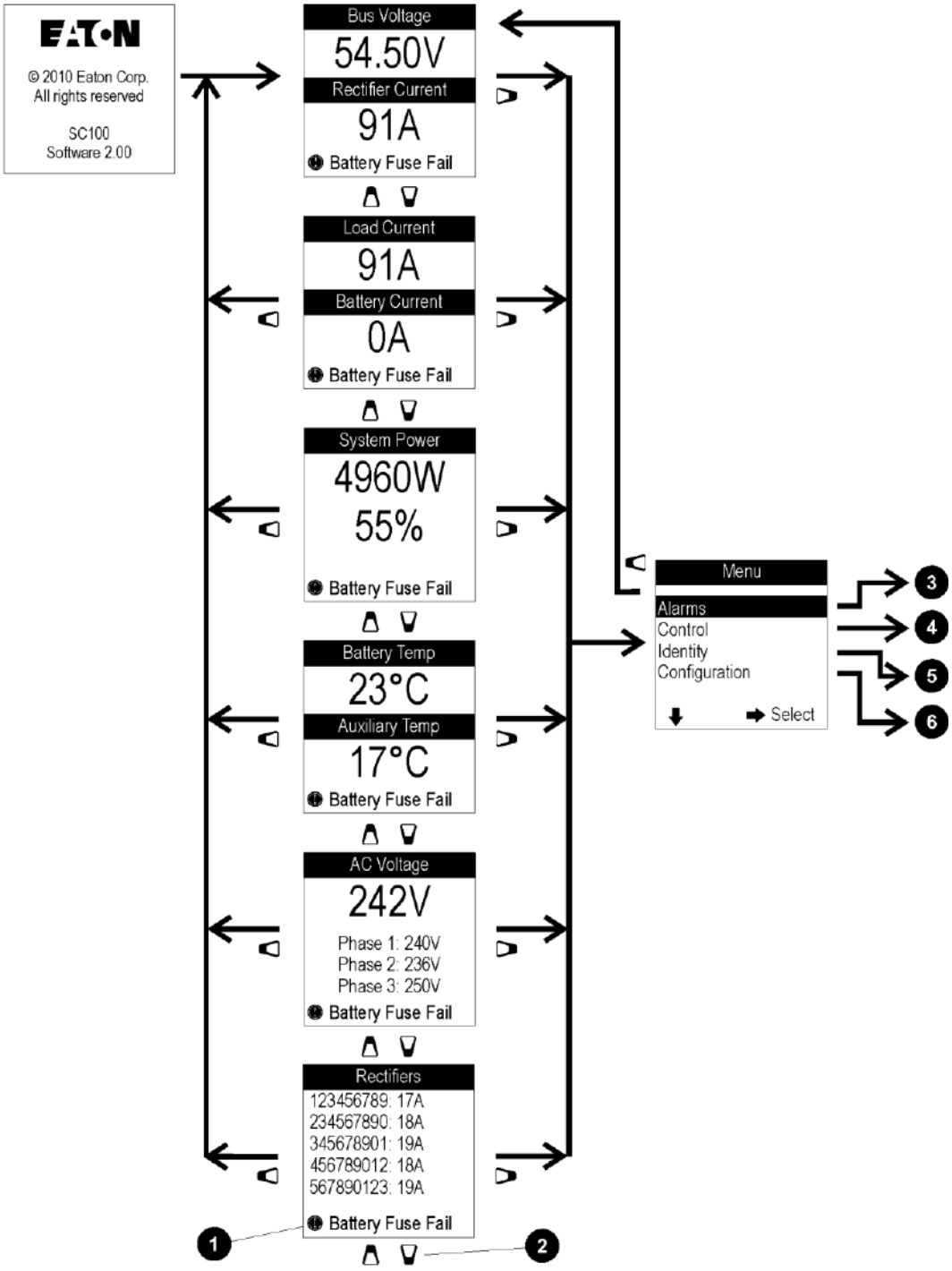
At each menu screen press *Enter* to access the associated configuration menu screen(s).

These menus have multiple configuration menu screens. See details in the System Controller Operation Handbook.

SC100 Menu

The following diagram shows the Status Screens and main navigation.

See Analog System Values for details of the values displayed.



1. Any active alarms are displayed in rotation.
2. Scroll to show any other rectifiers.
3. List of any active alarms.
4. Operate control processes.
5. SC100, I/O board and rectifier identity information.
6. Configure control processes.

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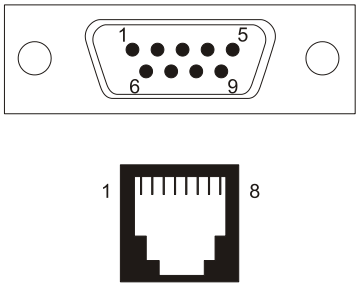
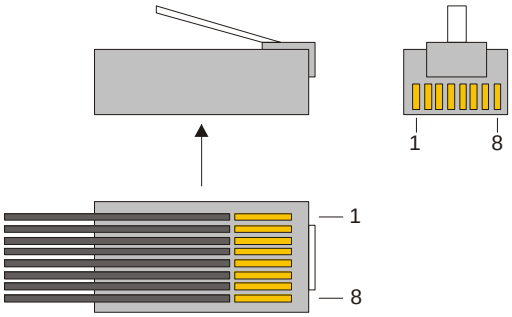
System Controller Connector Pin-outs

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 (SC200 only)	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 (SC200 only)	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

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

See input and output specifications on page 69.

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-
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

Connector	Type	Purpose	Pin	Description
			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)
			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)

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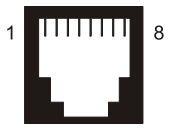
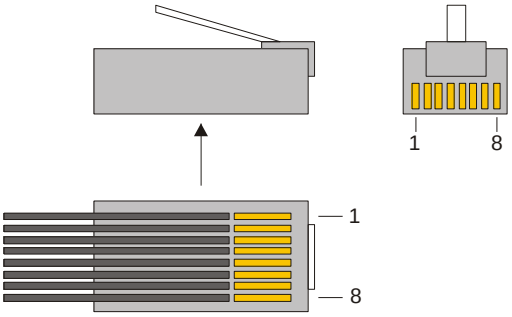
Connector	Type	Purpose	Pin	Description
			3	-
			4	RS485-A
			5	RS485-B
			6	-
			7	0V
			8	0V

** 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 or SC100.*



RJ45 connector pin-outs



RJ45 plug pin-outs

Input/Output Board

The input/output (I/O) board provides the I/O interfaces and connections for the SC200 or SC100 system controller.

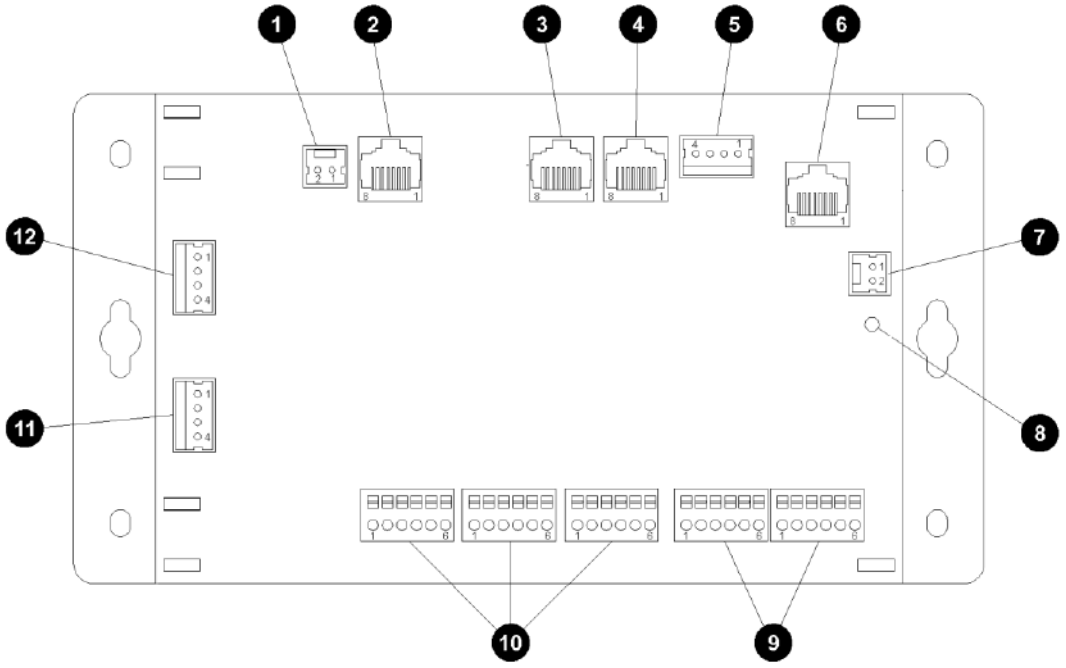
The I/O board allows real time data collection from building services and other external devices, and relay outputs for alarm signals or control of external devices.

The I/O functions are:

Sensors: DC Current - 3, dc voltage - 1, Temperature - 2, Battery Mid-Point - 4 (SC200 only)

Input/Output: Digital inputs: 6
Relay outputs: 6 (one also used as Monitor OK alarm)

For input and output specifications see details on page 70. For connector pin-outs see details on page 77.



1. LVD Power - XH8
2. Power and RXP comms input - YH11
3. Current sense input - XH6
4. Temperature sense input - XH7
5. Battery Mid-point Monitoring sense inputs - XH12 (SC200 only)
6. DC power system digital inputs - YH3
7. Bus voltage sense input - XH9
8. Power/Comms OK LED (green)
9. Digital inputs D1-D6 (6 user defined) - XH15A, XH15B
10. Digital (relay) outputs RY1-RY6 (6) - XH16-XH21
11. LVD 2 control connector - XH5
12. LVD contactor 1 connector - XH4

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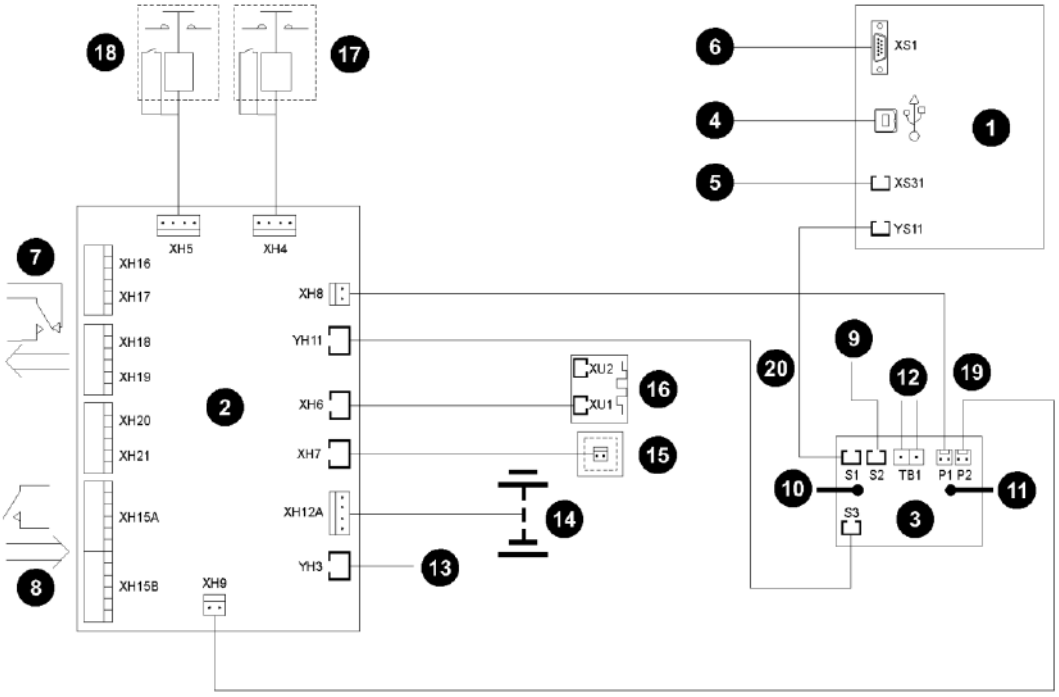
Connections

The following diagram shows the connections between the SC200 or SC100, the I/O board, the other dc power system components and external devices.



1. SC200 or SC100 system controller
2. I/O board
3. Voltage feed module
4. USB communications (SC200 only)
5. Ethernet communications (SC200 only)
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) (SC200 only)
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) (SC200 only)
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 77. For input and output specifications see details on page 69.

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Complete the tasks in this appendix only if a formal commissioning test is required.

Before starting these Commissioning tasks:

- Complete all the Installation tasks (see details on page 14)
- Complete all the Start-Up tasks (see details on page 36)
- Save a copy of the configuration file.

Complete the Commissioning tasks in the following order:

During the testing, note any changes to the configuration file that are incorrect.

Task	Description	Reference
1	Analog Inputs	See details on page 84
2	System Controls	See details on page 86
3	System Alarms	See details on page 90
4	Digital Inputs	See details on page 93
5	Digital Outputs (Relays)	See details on page 94

Analog Inputs

Equipment required:

- Digital Voltmeter
- DC Load bank
- DC Current Clamp meter
- Trim pot adjustment tool
- Thermometer

Test	Test procedure	Adjustment
DC Voltage	• Measure the dc voltage across the dc bus. • Ensure the bus voltage on the SC200 or SC100 display and in DCTools/Web is within specifications.	None
Battery Current (High current test) Note 1	• Conduct the load test and turn off the rectifiers. • Measure the load current with a dc clamp meter. • Ensure the current displayed on the SC200 or SC100 and in DCTools/Web is within specification. • Ensure the current is the correct polarity.	Adjust the gain setting on the current sensor by moving the trim pot. Adjust the gain setting in the SC200 or SC100
Load Current (High current test) Note 2	• Connect a load bank to the dc load connection • Apply a high load to the system • Measure the load current with a dc clamp meter • Ensure the load current displayed on the SC200 or SC100 and in DCTools/Web is within specification. • Ensure the current is the correct polarity.	Adjust the gain setting on the current sensor by moving the trim pot. Adjust the gain setting in DCTools/Web.
Total System Current (High current test)	• Repeat the load test. • Ensure the system current displayed on the SC200 or SC100 and in DCTools/Web is within specification.	None
Load Current (No current test)	• Disconnect the load bank from the system. • Ensure the load current displayed on the SC200 or SC100 and in DCTools/Web is 0 amps.	Adjust the current offset setting of the SC200 or SC100.
Battery Current (No current test)	• Disconnect the load bank from the system. • Ensure the battery current displayed on the SC200 or SC100 and in DCTools/Web is 0 amps.	Adjust the current offset setting of the SC200 or SC100.
Total System Current (No current test)	• Disconnect the load bank from the system. • Ensure the total system current displayed on the SC200 or SC100 and in DCTools/Web is 0 amps.	None
Temperature	• With thermometer, measure the temperature at the power system temperature sensor. • Ensure the temperature input displayed on the SC200 or SC100 and in DCTools/Web is within specification. • Test each temperature input.	Some temperature sensors have an adjustable trim pot.
User assigned Analog Inputs Note 3	• Test the accuracy and alarm mapping for all analog inputs. • Check the name, severity and alarm thresholds are correct.	See Note 3.

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Notes

1. When the rectifiers are turned off, the battery current will supply all the current to the load. At this time the battery current will equal the load current.
   This test assumes there is a current sensor on the dc Load Bus. If batteries are not installed on the system, connect the load bank to the battery bus.
   If the battery current is determined by a summation, conduct the load current test before the battery current test.
2. The test should be done at the maximum expected system load current.
   This test assumes there is a current sensor on the dc load bus.
3. As the analog inputs can be configured for many different types of analog signal, tests have not been detailed on this test sheet.
   User assigned analog inputs are not available on all systems.

System Controls

Equipment Required:

- DC Load bank

Test	Test procedure	Adjustment
Voltage Control Note 1	• Apply a load to the power system. • With *DCTools*, ensure the bus voltage matches the *Target Voltage* as shown on the Voltage Control Summary of *DCTools*.	None
Temperature Compensation Note 2	• Heat the battery temperature sensor. • Ensure the system voltage changes in accordance with the configured slope.	None
Equalize	• Set the *Equalize Duration* to 1 minute. • Start an *Equalize*. • Ensure the system voltage increases to the *Equalize Voltage*. • Ensure the SC200 or SC100 indicates an *Equalize* has started. • Ensure the *Equalize* stops after the 1 minute duration. • Return the *Equalize* duration to the original setting.	None
Fast Charge Note 3	• Set the *Fast Charge Max Duration* to 1 minute. • Set the *Fast Charge Voltage Threshold* to a value approximately 1V below the system float voltage. • Connect load to the system. • Turn off the ac to the system. • Allow the system voltage to fall below the *Fast Charge Voltage Threshold.* • Turn on the ac. • Ensure the system performs a *Fast Charge.* • Ensure the SC200 or SC100 indicates a *Fast Charge* has started. • Ensure the *Fast Charge Voltage* is correct. • Ensure the *Fast Charge* stops after 1 minute. • Return the *Fast Charge* settings to the original values.	None
Generator Control Option (SC200 only) Note 4	• Set the *Voltage Threshold* to a value approximately 1V below the system float voltage. • Connect load to the system. • Turn off the ac to the system. • Allow the system voltage to fall below the *Voltage Threshold*. • Ensure the system performs a *Fast Charge.* • Ensure the SC200 indicates a *Generator Enable*. • Ensure the *Generator Enable* digital output activates. • Turn on the ac. • Ensure the *Generator Enable* stops after 1 minute. • Return the settings to the original values.	None
Battery Current Limit Note 5	• Reduce the *Battery Current Limit* setting to 5%. • Connect load to the system. • Turn off the ac to the system. • Allow the battery to discharge for a period. • Turn on the ac.	None

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Test	Test procedure	Adjustment
	• Monitor the battery current to ensure the *Battery Current Limit* control process is operating.	
Current Share Note 6	• View the individual rectifier currents with the SC200 or SC100 or DCTools/Web. • Ensure the currents are all at 0 amps. • Connect load to the system. • Ensure that all rectifiers share the load evenly and any variation is within specification.	None
Battery Test	• Set the *Battery Test Interval* to 0 days. • Set the *Battery Test Duration* to 30 minutes • Set the *Battery Test Termination Voltage* to a value approximately 2 volts below the float voltage. • Connect load to the system. • Start the *Battery Test*. • Ensure the SC200 or SC100 indicates that a *Battery Test* has started. • Wait until the system voltage reduces below the *Termination Voltage*. • Confirm the *Battery Test* fails. • Ensure the *Battery Test Fail* alarm is displayed on the SC200 or SC100. • Ensure the *Battery Test* stops and the system voltage returns to the float voltage setting. • Clear the *Battery Test Fail* alarm in DCTools/Web. • Set the *Battery Test Duration* to 1 minute. • Set the *Battery Test Termination Voltage* to a value approximately 10 volts below the float voltage. • Connect load to the system. • Start the *Battery Test*. • Ensure the SC200 or SC100 indicates that a *Battery Test* has started. • Wait for the *Battery Test Duration* time to expire. • Confirm the *Battery Test* passes. • Ensure the *Battery Test* stops and the system voltage returns to the float voltage setting. • Reset the *Battery Test* settings to the original values.	None
Low Voltage Disconnect – Manual Operation Note 7	• Set the LVD manual control to *CONNECT*. • Ensure the LVD contactor is connected. • Ensure the SC200 or SC100 displays an *LVD Manual* alarm. • Ensure the I/O board LVD LED is on. • Set the LVD manual control to AUTO. • Ensure the SC200 or SC100 shows no LVD alarms. • Ensure the I/O board LVD LED is on. • Set the LVD manual control to *DISCONNECT*. • Ensure the LVD contactor disconnects. • Ensure the SC200 or SC100 displays an LVD Manual alarm. • Ensure the I/O board LVD LED is off.	None

Test	Test procedure	Adjustment
	• Set the LVD manual control to *AUTO*. • Ensure the LVD connects. • Ensure the SC200 or SC100 shows no LVD alarms. • Ensure the I/O board LVD LED is on.	
Low Voltage Disconnect – Automatic Operation Note 7	• Check the LVD contactor is connected. • Increase the *LVD Disconnect Voltage Threshold*. • Reduce the system voltage below the *LVD Disconnect Voltage Threshold*. • Wait for the configured *Recognition Period.* • Ensure the LVD disconnects. • Ensure the SC200 or SC100 displays an *LVD Disconnected* alarm • Ensure the I/O board LVD LED is off. • Increase the system voltage above the configured *Reconnect Voltage*. • Wait for the configured *Recognition Period.* • Ensure the LVD connects. • Ensure the SC200 or SC100 shows no LVD alarms. • Ensure the I/O board LVD LED is on.	None
Low Voltage Disconnect – Alarms Note 7	• Disconnect each LVD control cable from the I/O board. • Ensure the SC200 or SC100 displays an *LVD Fail* alarm. • Ensure the I/O board LVD LED is flashing. • Reconnect the cables. • Ensure the LVD connects. • Ensure the SC200 or SC100 shows no LVD alarms. • Ensure the I/O board LVD LED is on.	None

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Notes

1. AVC must be enabled. Allow up to 1 minute for the system to stabilize after load or voltage changes.
2. Breathing on the sensor can increase the temperature.
3. Battery Current Limit control process may have to be turned off to allow the Fast Charge voltage to reach its value within the 1 minute test duration.
4. For details see Generator Control Option in the System Controller Operation Handbook.
5. There may be slight current fluctuations above and below the configured current limit setting. This can be due to the current control within the factory preset deadband. Confirmation of this control process may be witnessed in the Fast Charge test.
6. There may be a delay of up to 2 minutes before the currents stabilize between rectifiers.
7. There may be a delay of up to 10 seconds before the LVD changes state.
   APS systems may not display a Manual Connect alarm on the SC200 or SC100 if the system voltage is above the LVD disconnect voltage.
   Perform the test on each LVD control module within the system.
   For manual LVD operation see details in the System Controller Operation Handbook.
   For an explanation of LVD LED indications see Troubleshooting on page 50.

System Alarms

Equipment Required:

- dc load bank
- dc power supply

Test	Test procedure	Adjustment

General notes about alarm testing	• For all alarms check the following where applicable:
	  • SC200 or SC100 LED status.
	  • SC200 or SC100 display indication.
	  • DCTools/Web alarm indication
	  • Remote alarm indication (PowerManagerII, SNMP traps, and so on)
	  • Digital outputs (relays).
	• Reducing the alarm recognition time will reduce the alarm testing time.
	• There may be more than 1 method to perform the following alarm tests.	

Low Float Note 1	• Increase the *Low Float Threshold* to just below the float voltage. • Reduce the system voltage by heating the battery temperature sensor - or - • Disconnect the battery from the system. • Start a *Battery Test*. • The system voltage will fall. • Ensure alarm operates.	
Low Load	• Test as for the *Low Float* test. Note that the *Low Load Threshold* is lower than the *Low Float threshold.* • Ensure alarm operates.	
High Float Note 1	• Set the system *Float Voltage* above the *High Float Threshold.* - or - • Reduce the *High Float Threshold* and increase the system voltage by starting an *Equalize*. - or - • Reduce the *High Float Threshold* and increase the system voltage by cooling the battery temperature sensor. • Ensure alarm operates.	
High Load	• Increase the system voltage. • Test as for the High Float test. *Note the High Load Threshold is higher than the High Float Threshold* • Ensure alarm operates.	
Rectifier Fail	• Turn off a rectifier ac circuit breaker (if fitted). • The rectifier will turn off. • Ensure alarm operates.	
Multiple rectifier fail	• Turn off the ac circuit breakers to 2 rectifiers (if fitted). • The rectifiers will turn off. • Ensure alarm operates.	
Rectifier comms lost	• Remove a rectifier from the system.	

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Test	Test procedure	Adjustment
	• Ensure alarm operates.	
Multiple Rectifier comms lost	• Remove 2 rectifiers from the system. • Ensure alarm operates.	
Partial AC Fail	• Turn off the ac to more than 20% of the rectifiers in the system. • Ensure alarm operates.	
AC Fail	• Turn off all ac to the system. • Ensure alarm operates.	
System Overload	• Reduce the *System Overload Recognition Period* to 0 minutes. • Apply load to the system. • Turn off rectifiers until the *System Overload Threshold* is exceeded. • Ensure alarm operates.	
Load Fuse Fail Note 2	• Apply load to the system. • Turn off the circuit breaker feeding the load bank. • Ensure alarm operates.	
Battery Fuse Fail	• Turn off a Battery circuit breaker or remove a Battery Fuse. • Ensure alarm operates.	
Battery Test Fail	• See Battery Test in the System Controller Operation Handbook for details.	
MOV Fail	• Remove a MOV cartridge from the MOV housing (if fitted). • Ensure alarm operates.	
ACD Fan Fail	• Stop the ACD Fan (if fitted). • Ensure alarm operates.	
LVD alarms	• See LVD test on page 86 for details.	
Battery Temperature Low	• Increase the *Battery Temperature Low Threshold* above the current temperature. - or - • Cool the temperature sensor until the threshold is exceeded. • Ensure alarm operates.	
Battery Temperature High	• Reduce the *Battery Temperature High Threshold* below the current temperature. - or - • Heat the battery temperature sensor until the threshold is exceeded. • Ensure alarm operates.	
Sensor Fail	• Disconnect the battery temperature sensor from the I/O board (XH7). • Ensure alarm operates. • Replace the battery temperature sensor. • Disconnect the current sensor (XH6). • Ensure alarm operates. • Replace the current sensor. • Disconnect the voltage sensor (XH9). • Ensure alarm operates. • Replace the voltage sensor.	

Test	Test procedure	Adjustment
Equalize	• For details see Equalize test in System Controls on page 86.	
Fast Charge	• For details see Fast Charge test in System Controls on page 86.	
Battery Test	• For details see Battery Test in System Controls on page 86.	
In Discharge Note 3	• Connect load to the system. • Turn off the ac supply to the rectifiers. • Allow the battery to start discharging. • Ensure alarm operates.	

Config Error
Note 4
	• Load incorrect configuration file.
	- or -
	• Remove all rectifiers from the system.
	• Apply an incorrect external voltage to the system:
	  • 24V for a 48V system
	  • 48V for a 24V system
	• Ensure alarm operates.	

User Assigned Alarms	• See User Digital Input test on page 93.	
Battery Current Limit	• For details see Battery Current Limit test in System Controls on page 86.	
Rectifier No Load	• Ensure the dc load and batteries are isolated from the system. • Ensure alarm operates.	
Rectifier Current Limit	• Apply a dc load to the system. • Turn off rectifiers until the remaining rectifiers reach the *Rectifier Current Limit* threshold. - or - • Set the *Rectifier Current Limit* slightly below the existing rectifier current being delivered to the load. • Ensure alarm operates.	
High Rectifier Temperature Note 5	• Unable to test.	
AC Phase 1/2/3 Fail Note 6	• Turn off ac phase 1 to the power system. • Ensure alarm operates. • Repeat for phase 2 and phase 3.	
AC Phase 1/2/3 Voltage Note 6	• Reduce the *High AC Threshold* below the existing ac voltage. • Ensure alarm operates. • Increase the *Low AC Threshold* above the existing ac voltage. • Ensure alarm operates.	
AC Frequency Note 6	• Change the Nominal AC Frequency setting. • Change the AC Frequency Threshold. • Ensure alarm operates.	
Engine Run Option Note 7	• Change the state of the digital input with *Engine Run* function. • Ensure alarm operates.	

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Notes

1. Ensure Alarm Tracking is disabled. Ensure Temperature Compensation is enabled.
2. If the load is not connected to the load circuit breakers and if an electronic Fuse Fail detect circuits is installed, this test can also be performed as follows:
   - Turn off the load circuit breaker
   - Connect a high impedance path >100kΩ) between the end load side of the circuit breaker and the Common Bus. (The impedance path can also be created by touching these points with your hand.)
3. Ensure the battery discharge is high enough. Allow for the recognition time.
4. This alarm will be displayed if the incorrect configuration or incorrect rectifiers are used in the system. It is not recommended that this be tested as it is very unlikely for an incorrect configuration to be installed after commissioning.
5. This alarm is originated from the rectifier. It can only be tested by increasing the internal temperature of the rectifier.
6. These alarms are only available with the external ac metering option.
7. A digital input must be configured for this test to function. See details in the System Controller Operation Handbook.

Digital Inputs

Test	Test procedure	Adjustment
Digital Input 1	• Change the state of the Digital input. • Ensure any alarms mapped to the digital output (relay) activate. • Ensure the Digital Input Alarm Name is correct.	
Digital Input 2	As for Digital Input 1.	
Digital Input 3	As for Digital Input 1.	
Digital Input 4	As for Digital Input 1.	
Digital Input 5	As for Digital Input 1.	
Digital Input 6	As for Digital Input 1.	
User Assigned Digital Inputs Note 1	• As for Digital Input 1. • Check the severity and digital output (relay) mapping is correct.	

Notes

1. As the Digital Inputs can be configured for many different digital input devices, specific tests have not been detailed on this test sheet.

Digital Outputs (Relays)

Test	Test procedure	Adjustment
Digital Output 1 Note 1	• Refer to *Digital Outputs* in the SC200 or SC100 handbook. Follow the instructions to manually change the state of the digital output. • When the digital output is *Active,* check any remote alarms are extended. • When the digital output is *Inactive,* check any remote alarms are return to their original state.	
Digital Output 2	As for Digital Output 1.	
Digital Output 3	As for Digital Output 1.	
Digital Output 4	As for Digital Output 1.	
Digital Output 5	As for Digital Output 1.	
Digital Output 6 Note 2	As for Digital Output 1.	
User assigned Digital Outputs	As for Digital Output 1.	

Notes

1. Digital Outputs can also be checked as other system tests are performed.
2. 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 or SC100. Test extended alarms by removing the power to the I/O board. This will de-energize the relay.

Commissioning Completed

Restore the original (backed-up prior to the testing) configuration file.

Use DCTools/Web to change any configuration file settings that were noted as incorrect during the Commissioning tests.

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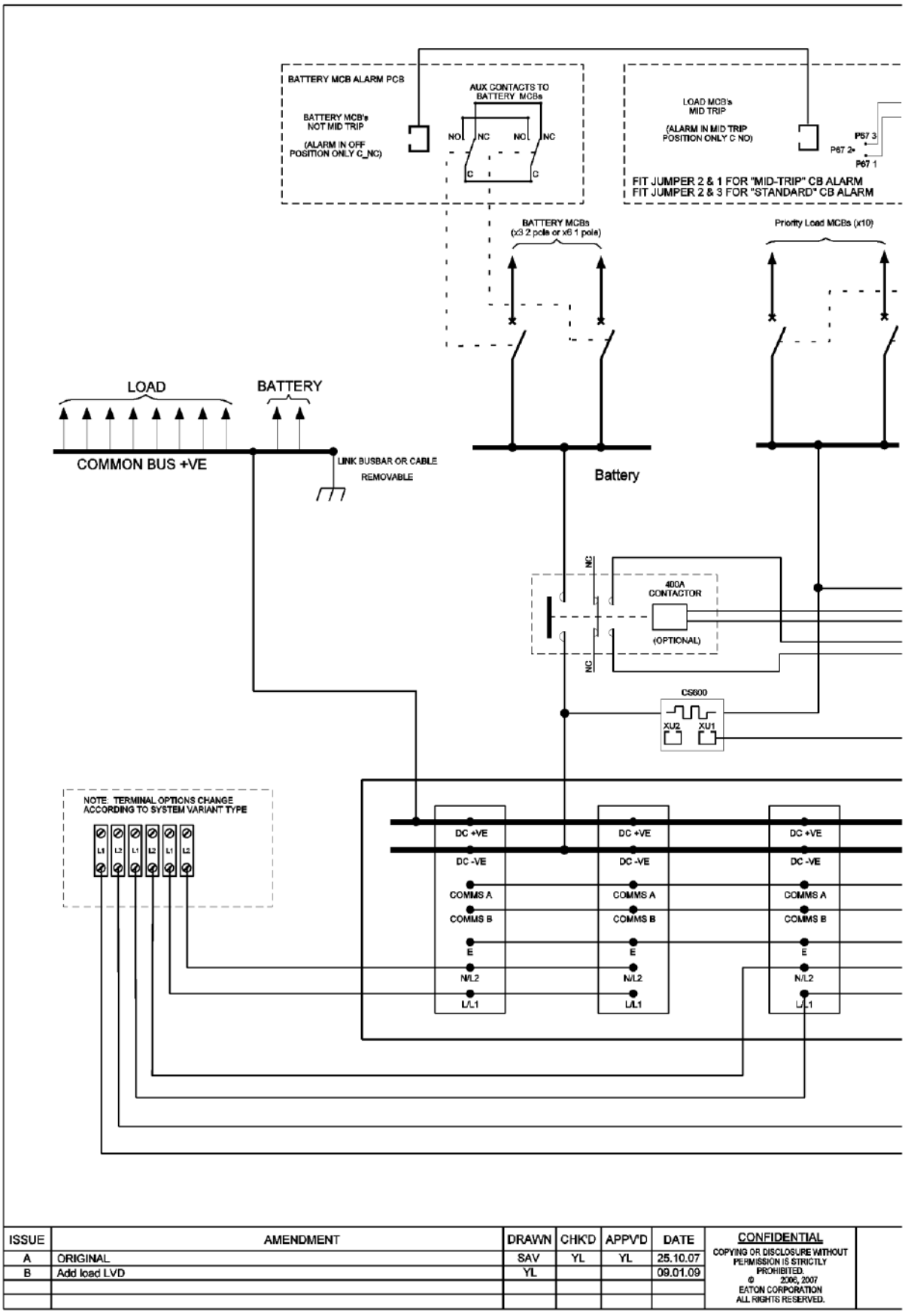
Drawing Number	Issue	Title
3700272	B	WIRING DIAGRAM APS6-4XX +VE EARTH



ISSUE	AMENDMENT	DRAWN	CHK'D	APPV'D	DATE	CONFIDENTIAL
A	ORIGINAL	SAV	YL	YL	25.10.07	COPYING OR DISCLOSURE WITHOUT PERMISSION IS STRICTLY PROHIBITED. © 2006, 2007 EATON CORPORATION ALL RIGHTS RESERVED.
B	Add load LVD	YL			09.01.09	

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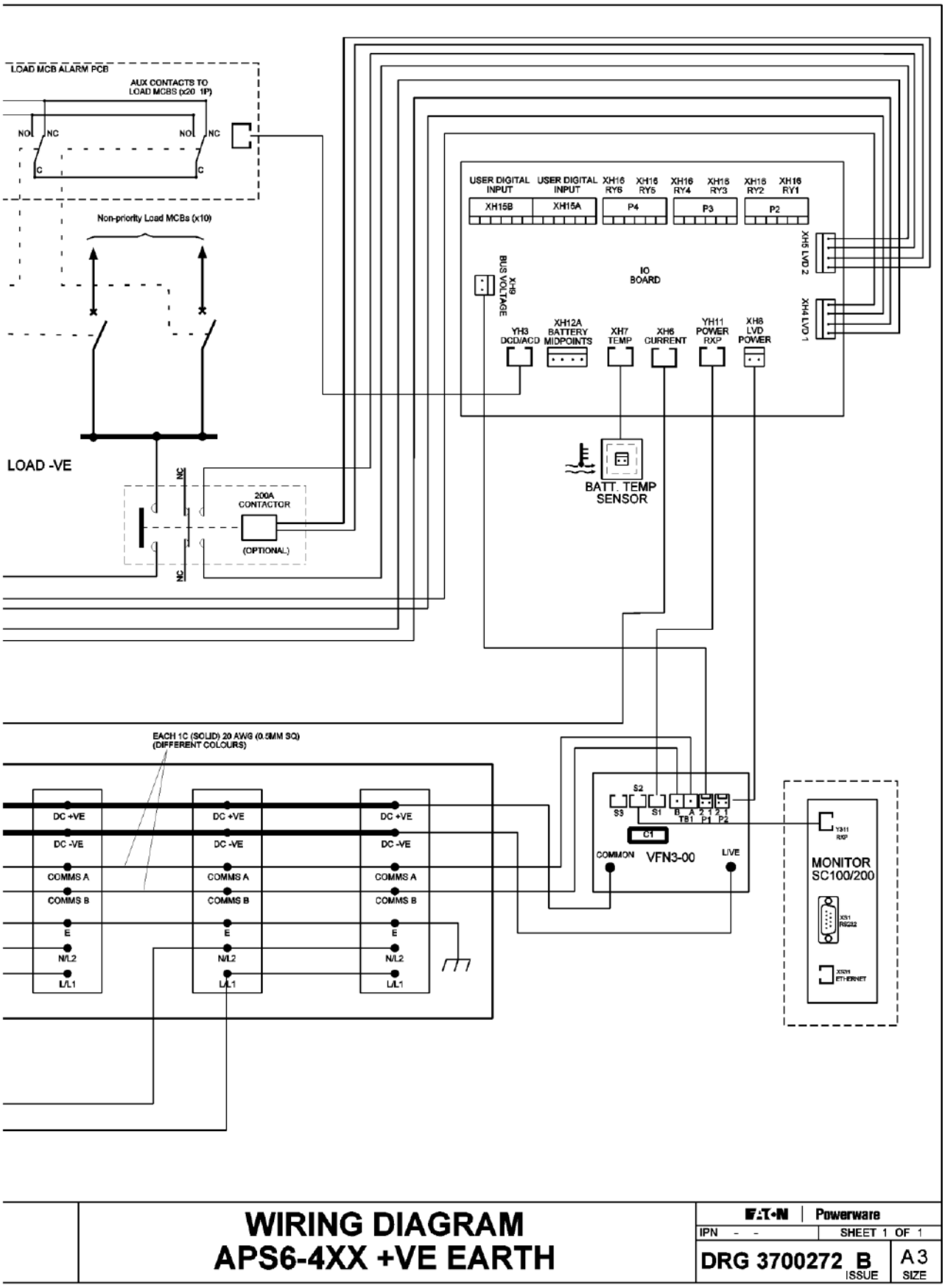

	WIRING DIAGRAM **APS6-4XX +VE EARTH**	EATON | Powerware IPN - - SHEET 1 OF 1 DRG 3700272 B ISSUE A3 SIZE

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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 101). 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

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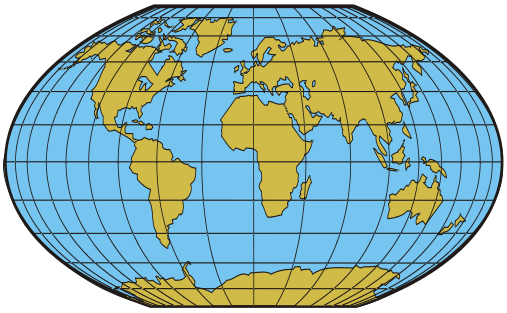

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