EATON | Powerware

Data-Voice-Video Power Solutions Installation and Operation Guide

(3G Systems with SC200)

Issue: IPN 997-00012-54A
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About This Guide

Purpose

This guide provides instructions to correctly install, commission and operate Powerware Data-Voice-Video Power Solutions (3G Systems with SC200).

Audience

This guide is intended for use by:

- DC power system 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
- DC power system operators and maintenance staff competent in:
  - operation of DC Power Systems
  - safe working practices for AC and DC powered equipment

Scope

This guide covers installation, commissioning and maintenance of Powerware Data-Voice-Video Power Solutions.

It does not cover:

- System controller operations; installation of external alarm and user digital inputs cabling; or setup of communications options or software. For details refer to the system controller operation handbook listed under Related Information on page i.
- Installation and configuration of Powerware SiteSure and CellSure modules. For details, refer to the relevant guide listed under Related Information on page i.

Related Information

- PowerManagerII Online Help
- DCTools Online Help
- SC200 System Controller Operation Handbook – IPN 997-00012-50
- SiteSure-3G Installation and Operation Guide – IPN 997-00012-51
- CellSure Installation Guide – IPN 997-00012-20

Reporting Problems with this Guide

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

Powerware 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 93.

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General Description

Overview

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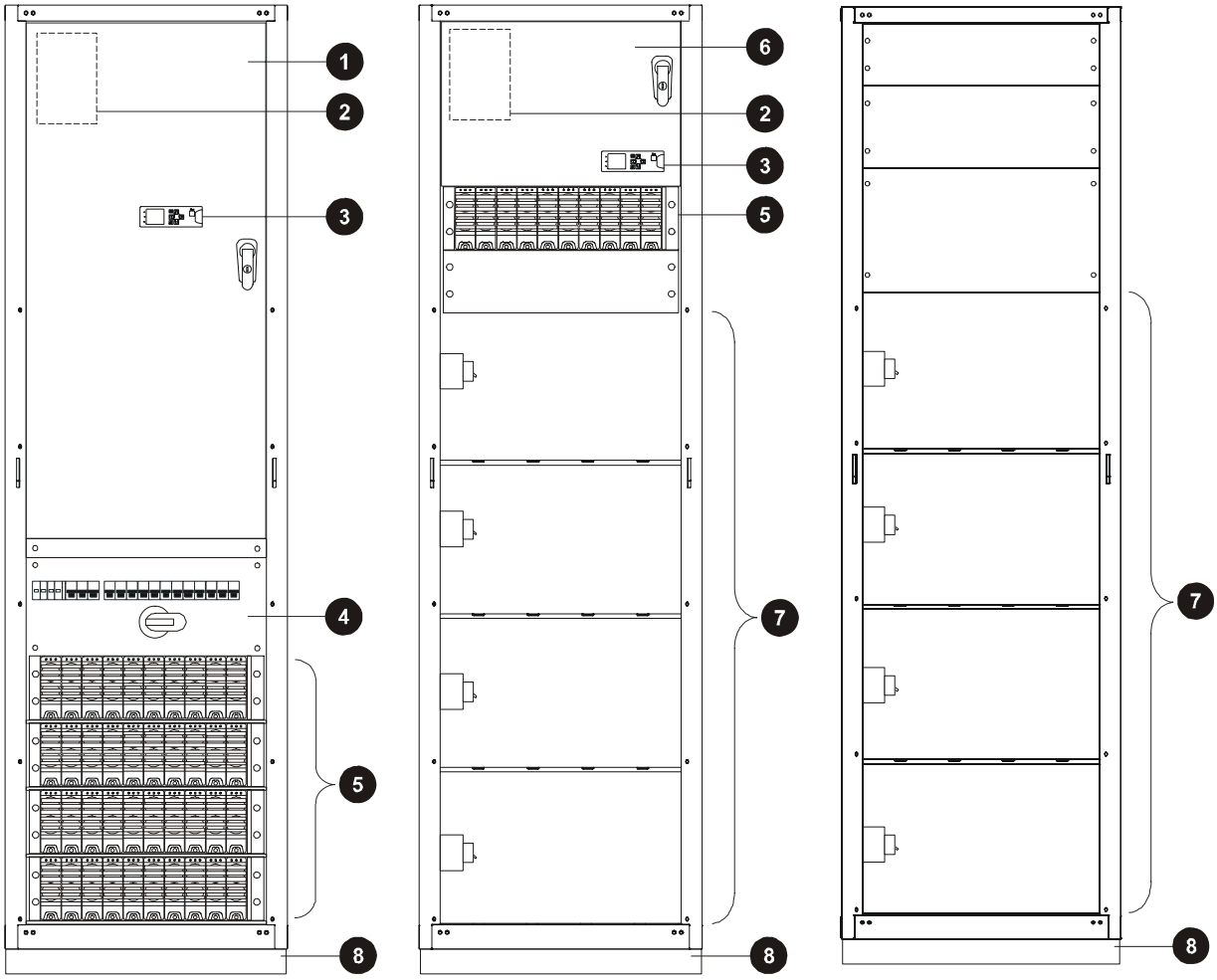
Typical Data-Voice-Video Power Solutions DC Power Systems



Typical system (rectifiers only)

Typical system with integrated batteries

Battery rack (option)

❶ DC distribution section.

❷ Input/Output (I/O) board (on back of door). See details on page 4.

❸ System controller. See details on page 4. (For more details refer to the relevant system controller handbook listed under Related Information on page i.)

❹ AC distribution with isolator switch and surge protection (located behind door on some models).

❺ Rectifier magazine(s)* for up to 10 Access Power Rectifiers (APR24-3G, APR48-3G) per magazine. See details of rectifiers on page 3.

❻ Combined AC and DC distribution section.

❼ Battery shelves with battery MCBs. (A battery shelf front cover is also supplied, but is not shown.)

❽ Optional plinth for use with raised floors (Eaton part number: PLINIR-A00). Refer to details on page 18.

❾ An optional security door (not shown) is also available.

These diagrams show typical layouts of 43U high racks. Actual system configuration may vary from that shown.

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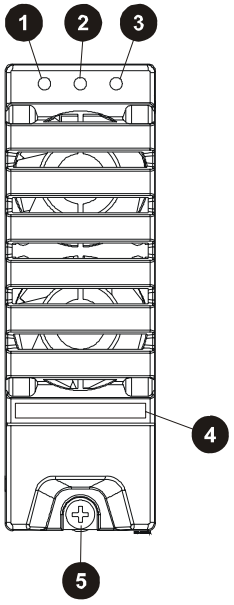
Access Power Rectifiers (APR24-3G/APR48-3G)

Powerware Data-Voice-Video Power Solutions can be fitted with either 24V or 48V Access Power Rectifiers (APR24-3G/APR48-3G). All rectifiers are fan-cooled and hot-pluggable.

See Specifications on page 59 for further information.



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

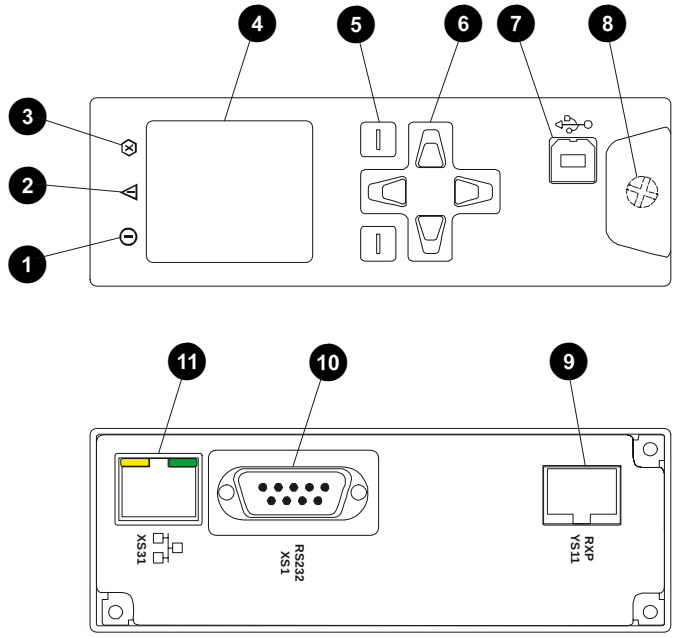
See Troubleshooting on page 44 for details of rectifier alarms.

SC200 System Controller

The SC200 system controller is an advanced control and monitoring solution for the Powerware 3G range of DC power systems.

The SC200 provides a full suite of advanced 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 display
5. Soft keys (2)
6. Navigation keys (4)
7. USB 1.1 connector (12Mb/s)
8. Retaining screw (under cover)
9. Ethernet connector and status LEDs
10. RS232 connector
11. Power and system communications connector

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

See Troubleshooting on page 44 for details of SC200 alarms. For connector pin-outs refer to the SC200 Operation Handbook (see Related Information on page i).

Input/Output Board

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

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

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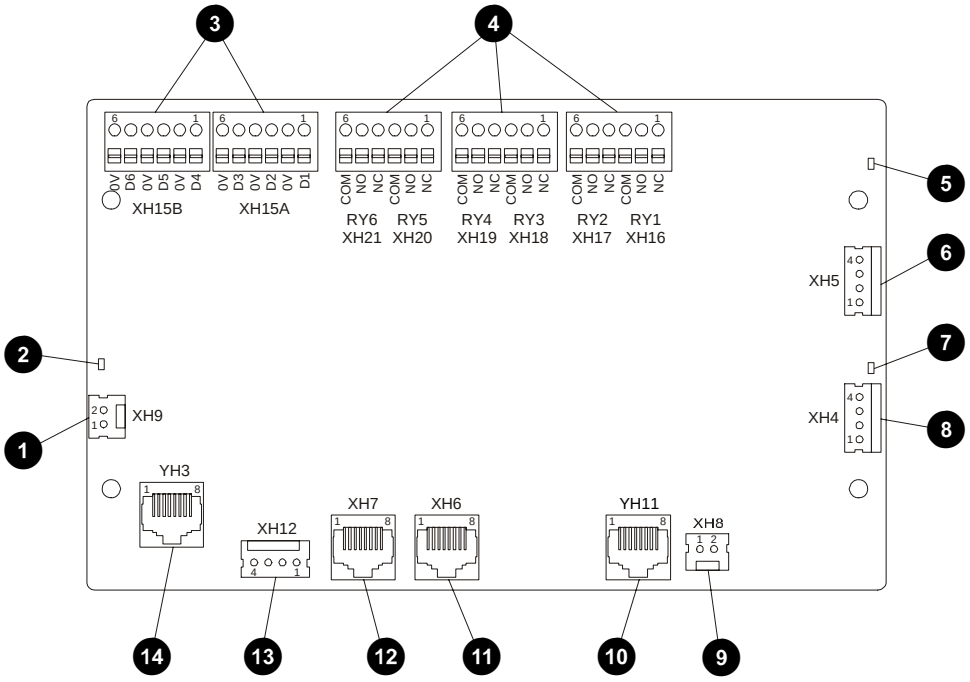
The I/O functions are:

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

For input and output specifications see details on page 61. For connector pin-outs see details on page 64.



1. Bus voltage sense input - XH9
2. Power/Comms OK LED (green)
3. Digital inputs D1-D6 (6 user defined) - XH15A, XH15B
4. Digital (relay) outputs RY1-RY6 (6) - XH16-XH21
5. LVD2 status LED (green)
6. LVD2 control connector - XH5
7. LVD1 status LED (green)
8. LVD1 control connector - XH4
9. LVD power input connector - XH8
10. Power and RXP comms input - YH11
11. Current sense inputs (3) - XH6
12. Temperature sense inputs (2) - XH7
13. Battery mid-point monitoring sense inputs - XH12 (future option)
14. DC power system digital inputs (4 pre-defined: Load Fuse Fail, Battery Fuse Fail, AC Distribution Fan Fail, AC Distribution MOV Fail) - YH3

See Troubleshooting on page 44 for details of I/O board LED signals.

Other Features

External communications

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

- Communication with Powerware DCTools or PowerManagerII software on a PC or Laptop via:
  - USB
  - an external PSTN or GSM modem (dial-in and dial-out on alarm)
  - Ethernet
- Communication with any web browser software on a PC or Laptop via an IP network.
- Communication with a Network Management System (NMS) using SNMP
- 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.

Low Voltage Disconnect (LVD) option

Powerware Data-Voice-Video Power Solutions may be fitted with one or more Low Voltage Disconnects (LVDs). The way LVDs can be connected is determined by the type of DC power system:

- In DC power systems without integrated batteries the LVD(s) can be connected either as load or battery disconnect(s).
- In DC power systems with integrated batteries the LVD(s) can only be connected as a battery disconnect.

LVDs have two purposes:

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

The system controller has two LVD control channels (LVD1 and LVD2.) These can be set to disconnect at specified voltages or can be set to disconnect a specified time interval after an AC fail. Both channels reconnect the battery or load equipment when the AC supply is restored.

Refer to the system controller handbook for information on how to configure the LVD channels.

External current shunts/sensors option

Various models of external current shunts/sensors are available for use with the Powerware Data-Voice-Video Power Solutions to measure battery and/or load currents. The Powerware CS04-A11 current sensor is also available to measure currents in larger systems. See details on page 67.

External current shunts/sensors are connected to the I/O board or to a Powerware SiteSure-3G module.

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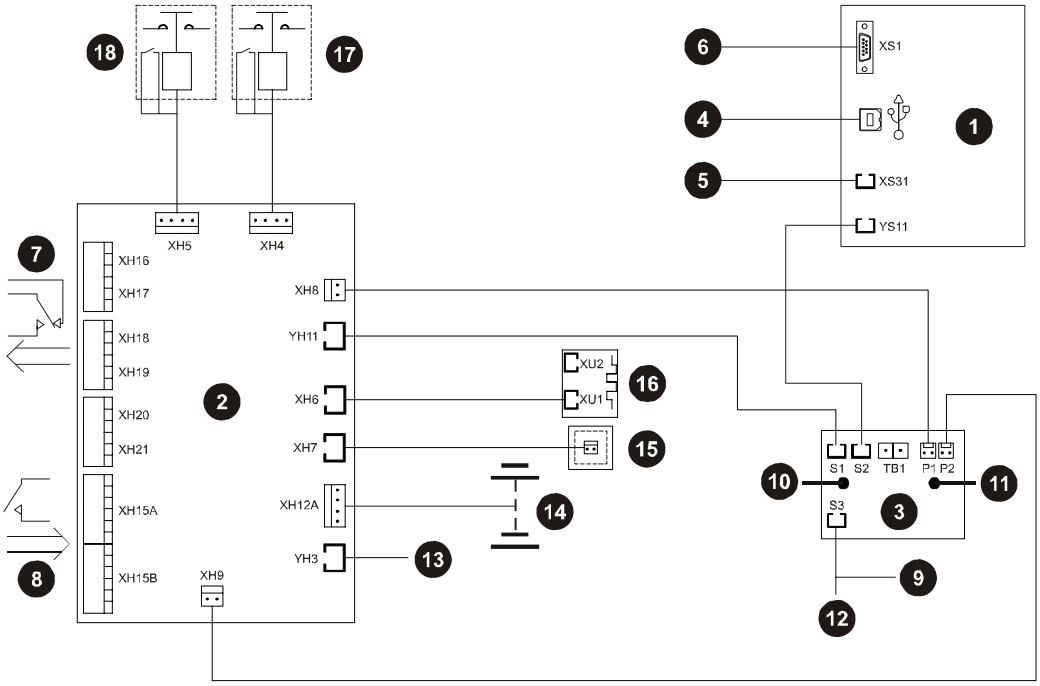
Connections

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



1. SC200 system controller
2. I/O board
3. Voltage feed module
4. USB communications to local PC or laptop
5. Ethernet communications via an IP network
6. RS232 communications via an external modem
7. Digital relay outputs (6) to external devices and/or alarm indication system
8. Digital inputs (6) from external switches or relay contacts
9. Connection to additional I/O board(s) and/or SiteSure-3G I/O module(s) via RJ45 splitter (see details on page 30)
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 to battery mid-points (4) - future option
15. Connection to temperature sensors (2)
16. Connection to current sensors (3)
17. Optional LVD1 contactor and auxiliary switch (see details on page 6)
18. Optional LVD2 contactor and auxiliary switch (see details on page 6)

For connector pin-outs see details on page 64. For input and output specifications see details on page 59.

Compatible Software

The following software is compatible with the SC200 system controller:

- DCTools Configuration Software. Latest version is available free from www.powerware.com/downloads.
- PowerManagerII Remote Control and Monitoring Software. Contact your Powerware DC product supplier or Eaton for further information (refer to Worldwide Support on page 93).

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Overview

Warnings

This section contains important warnings. Read these warnings before installing or operating a Powerware Data-Voice-Video Power Solutions DC power system.

Electrical Safety

- The DC earth/ground link must be rated to carry the combined fault current of battery strings. See details on page 20.
- If the DC power system is to be installed in a location where the ambient temperature may rise above 50°C (122°F), then V110 rated cable must be used for all connections.
- The DC power system is not compatible with IT (Impedance Terra) AC power distribution topologies. For advice refer to Worldwide Support on page 93.
- A registered electrician (or suitably qualified person) must check the integrity of the installed cabling, BEFORE the DC power system is powered up.
- Commissioning must be performed in the sequence documented in this guide.

Location and Environment

- For ease of access and to maintain optimum system cooling observe the clearances stated on page 18.
- Dust build-up within the DC power system 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 DC power system. Do not place objects containing liquid on top of or near the unit.
- 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.

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 this equipment.
- Always use insulated tools.
- Do not short-circuit the live and common bus bars or cables.

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Batteries

- The plastic cases of batteries installed in Powerware 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 a Powerware 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 charge 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 56.

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 100ºC (212ºF), 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 copy of the Equipment Incident Report on page 91.
- Ensure that any upstream Residual Current Devices (RCDs) are appropriately rated for the rectifiers' maximum earth leakage current (see Specifications on page 59 for value).

DC Distribution(s)

- The DC Common of the DC power system can be connected to earth (ground). If this connection is made all of the following conditions must be met:
  - Your equipment and the DC power system must be located within the same premises.
  - No switching or disconnecting devices are allowed in the conductor between the DC common line and the point of connection to the earth electrode conductor.
    Refer to Connecting the DC Output to Earth on page 20 for further information.
- Follow all applicable local and national rules and regulations when making field connections.
- Tighten all electrical connections to the torques stated in this guide or on the manufacturer's label.

Servicing

- The DC power system contains hazardous voltages and hazardous energy levels. Do not attempt to disassemble or service the unit if you are not qualified.

EMC Compliance

- Powerware Data-Voice-Video Power Solutions DC power systems may be used in close proximity to other electronic equipment, provided installation is carried out according to instructions in this guide. However, proper installation and compliance with EMC standards does not guarantee that the DC power system will not respond to electromagnetic disturbances, or will not cause interference to other equipment in a particular installation.
- In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
- This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving antenna.
  - Increase the separation between the equipment and receiver.
  - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Inspecting the Equipment and Reporting Damage

Unpack the equipment and inspect it carefully for possible damage that may have occurred while in transit.

Report any damage immediately, using a copy of the Equipment Incident Report on page 91.

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

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Overview

Installation Tasks

Before starting the installation, review the following information:

- Required Equipment and Tools on page 57
- Warnings and Cautions
- Inspecting the Equipment and Reporting Damage on page 12

DC Installation Practices

Read the following DC Installation Practices before connecting the DC load and battery cables:

- To avoid excessive voltage drop and overheating, ensure that the DC load and battery cables are appropriately sized to handle the maximum DC output current of the specific NPS. We recommend multi-strand cable with insulation rating of 600-1000V.
- Run the DC load and battery cables through cable glands where they pass through metal parts or covers. Also ensure that each cable gland provides firm strain relief and adequate anchorage for the cable.
- Secure and support all DC load and battery cabling (especially at their connection points) to prevent excessive strain on these cables.
- To reduce inductive coupling, separate DC load, battery and control cabling from AC supply cables. If the cables have to cross, run them at right angles to the AC supply cables.
- In order to minimize parasitic cable inductance and reduce electromagnetic interference (EMI), route all DC load cables in close proximity to one another, and avoid large current loops. The same applies to battery cables.
- Ensure that MCBs/fuses in the DC distribution(s) are clearly labeled.
- Only perform electrical insulation and continuity tests, once all DC load and battery cabling are in place and DC Common has been earthed.

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Order of Tasks

Complete the installation tasks in the following order:

Task	Description	Reference
1	Check the AC Supply and Earthing	See details on page 15
2	Fixing the Power System Cabinet(s)	See details on page 18
3	Connect the DC Output to Earth	See details on page 20
4	Connect the DC Load Cables	See details on page 22
5	Connect Battery Cables (if required)	See details on page 23
6	Install the Batteries	See details on page 25
7	Mount the Battery Temperature Sensor	See details on page 28
8	Connect External Current Sensors/Shunts (if required)	See details on page 29
9	Connect Input/Output Cabling (if required)	See details on page 29
10	Connect Additional Input/Output (if required)	See details on page 30
11	Connect to AC Supply	See details on page 31

For installation of external communications refer to Communications Options in the system controller Operation Handbook (see Related Information on page i).

Task 1 - Check the AC Supply and Earthing

It is important that the AC supply for the Data-Voice-Video Power Solutions DC power system includes the correct levels of protection.

Step 1 - Check transient voltage protection at the site

1 Confirm that there is a transient protection plan (compliant with IEC 61643-12) for the site.

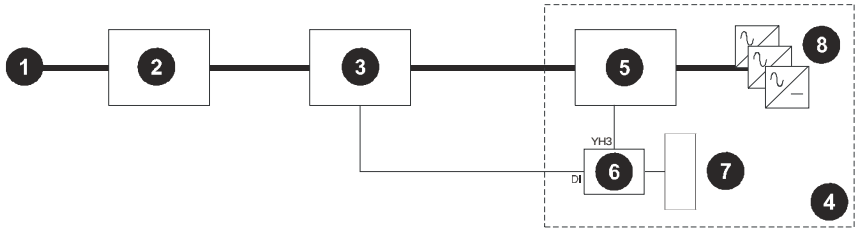
For more information refer to Transient Protection on page 73.

2 If necessary, install suitable transient protection.

Step 2 - Check high AC voltage protection at the site

1. Check if the AC voltage is expected to exceed 275V (L-N).
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 board (see diagram on page 4 for location).

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



1. AC supply
2. Primary transient protection devices
3. High voltage protection unit with alarm output
4. DV2-3G DC power system
5. Secondary transient protection devices (MOVs)
6. I/O board
7. SC200 system controller
8. Rectifiers

Step 3 - Check the type of AC supply, disconnect device and RCDs

1. Check the type of AC supply. Only the types of AC supply listed in the Specifications on page 59 are suitable for the DV2-3G.

Only use a two-phase or three-phase (L-L) AC supply if referenced to earth, or a protection system is in place so that the phase-earth voltage cannot exceed the rating of the rectifier.

2. Check that the DV2-3G will be connected to a suitable upstream AC disconnect device such as Miniature Circuit Breaker(s) (MCB) or fuses.
3. Check the disconnect device will isolate both the phase and neutral conductors in single-phase and three-phase connections, unless the neutral conductor is clearly identified.
4. Check that any Residual Current Devices (RCD) upstream of the DV2-3G are rated for the maximum earth leakage current of the rectifiers. If necessary, install higher rated RCD(s).

The maximum earth leakage current of Access Power Rectifiers is given in the Specifications on page 59.

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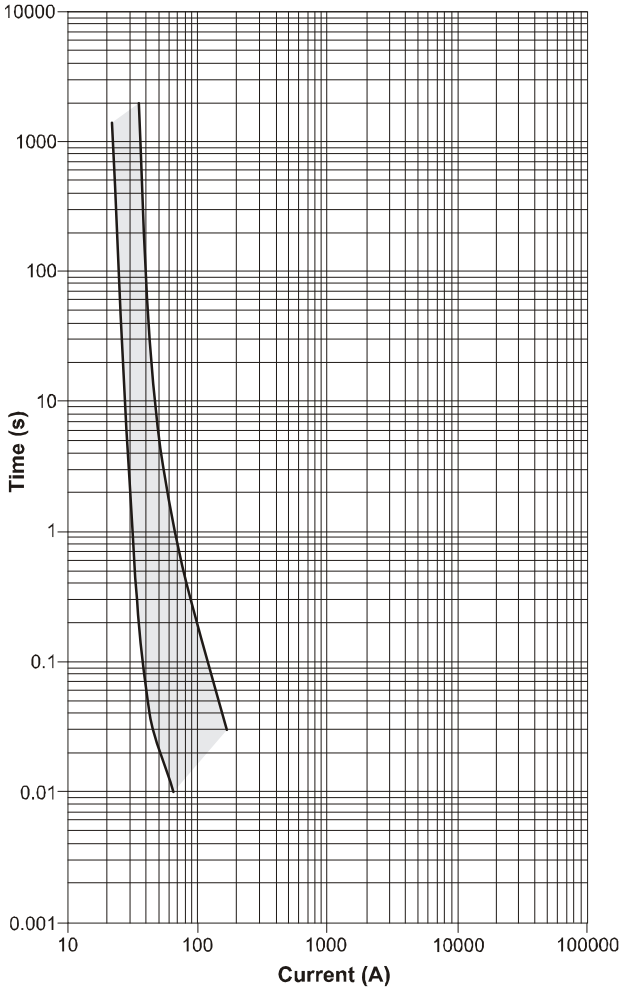
Step 4 - Check AC Discrimination

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 any upstream AC supply-disconnect device then the upstream AC supply-disconnect device will operate before a rectifier fuse blows. This will disconnect the AC supply to all rectifiers.

1 Check the time-current (tripping) curve(s) of all AC supply-disconnect device(s) upstream of the DV2-3G with the following curve for the rectifier fuses.

Refer to the manufacturer's data for tripping curves.



Time-Current Curve (minimum and maximum) for APR-3G internal fuses (IEC 60127-2).

Source: Schurter SP 5x20 Pigtail data sheet.

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.

If necessary, replace the upstream AC supply-disconnect device to achieve adequate discrimination. Or, contact your Eaton DC product supplier for advice (refer to Worldwide Support on page 93).

Step 5 - Check the earthing arrangements at the site

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

For more information refer to Transient Protection on page 73.

Procedure complete

Task 2 - Fixing the Power System Cabinet(s)

- The DC power system must be installed in a location classified as 'Restricted Access'. A key or tool is required to gain access to the power system. A sign must also be displayed, warning that the power system metalwork may be hot.
- The DC power system must meet the fire and electrical enclosure requirements specified in AS/NZS 60950.1, EN 60950-1, IEC 60950-1 and UL 60950-1. To maintain compliance with these requirements, all covers must be fitted (including the bottom cover plate, if bottom cable access is not required.)
- Lifting equipment and at least two people are required to safely move the power system. Without lifting equipment four people are required to move the power system safely.

Powerware Data-Voice-Video Power Solutions racks are supplied completely assembled. Rectifiers and batteries are always shipped separately.

Step 1 - Check route and clearances

1. Check the route of the power system to its final position. Check for:
   - clearances at doorways and other points
   - that the floor can support the weight of the rack and lifting equipment
   - that protective floor coverings are available (if required).
2. Check there will be the following minimum clearances around the power system in its final position:
   - Front Clearance – 600mm (24") from walls and other equipment required for access.
   - Top Clearance – 200mm (8") from ceilings or overhead cable trays/ducting, required for optimum system cooling.
   - Single Side or Back Clearance – 600mm (24") from walls and other equipment recommended to assist access.
   - Back Clearance – 600mm (24") from walls if the vented back panel is fitted.

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Step 2 - Unpack the power system

1 Before the DC power system is unpacked, ensure that:

- The site has been thoroughly cleaned and is dust free. (It is strongly recommended that you do NOT unpack the power system until all building work at the site has been completed. If building work is still in progress, store the power system in its original packaging in a dry and level location inside the building.)
- Lifting equipment and at least two people are available. (Without lifting equipment four people are required to move the power system safely.)

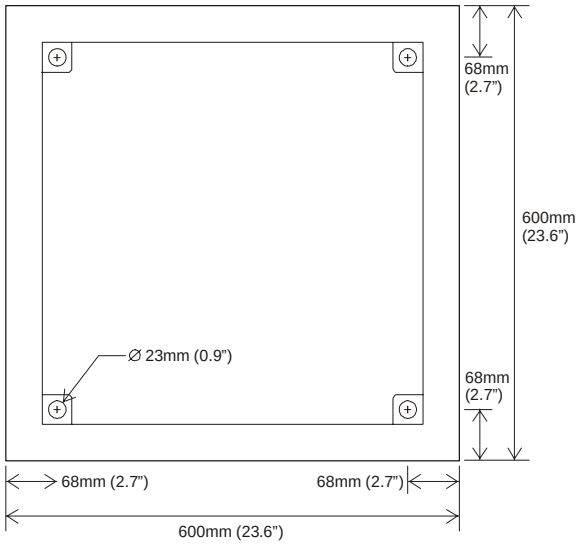
2 When the site is clean and dust free, remove the packaging from the power system and stand the rack upright.

3 Carefully inspect the power system for possible damage that may have occurred while in transit. Report any damage immediately, using a copy of the Equipment Incident Report on page 91.

Step 3 - Fix the cabinet(s) directly to the floor (if required)

Ignore this step if the site has a raised floor.

1 Mark the positions of fixing holes on the floor using the following template. Allow for the required clearances (see Step 1).



2 Drill the mounting holes. Remove any shavings and dust.

3 Before moving the cabinet(s), ensure that:

- protective floor coverings are in place (if required)
- the floor can support the weight of the power system.

4 Move the cabinet(s) into position.

Use lifting equipment and at least two people (or four people without lifting equipment) to move a power system safely.

5 Bolt the cabinet(s) to the floor using fasteners to suit the weight of the cabinet and type of floor.

Step 4 - Fix the cabinet(s) on a raised floor (if required)

Ignore this step if the cabinet is fixed directly to the floor.

1 Assemble the plinth(s) (Eaton part number: PLINIR-A00).

2 Remove the appropriate floor tile(s).

3 Fix the plinth(s) to the floor support pillars.

4 Before moving the cabinet(s), ensure that:

- protective floor coverings are in place (if required)
- the floor can support the weight of the power system.

5 Move the cabinet(s) into position on the plinth.

Use lifting equipment and at least two people (or four people without lifting equipment) to move a power system safely.

6 Bolt the cabinet(s) to the plinth(s) using bolts supplied.

Procedure complete

Task 3 - Connect the DC Output to Earth

Step 1 - Connect DC common busbar to earth

Install a cable from the DC common busbar to earth. This conductor must be rated to carry the combined fault current of all battery strings.

If this conductor is not installed then battery fault current will be carried by the AC-DC earth link and the AC earth conductor which are typically too small for such currents.

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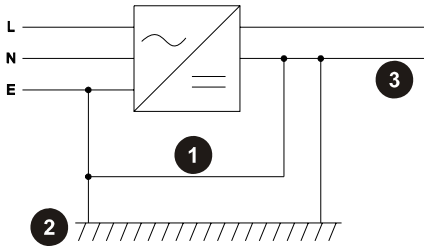
Step 2 - Check AC-DC earth connection

An AC-DC earth link is factory fitted in the DC power system as shown in the following diagram.



1. Factory installed AC-DC Earth Link
2. Mesh earth (ground)
3. DC Common

If this AC-DC earth link conforms to the earthing arrangements at the site then no further action is required (ignore Step 3).

If this AC-DC earth link does not conform to the earthing arrangements at the site then go to Step 3.

Step 3 - Installing a Surface Protection Device between AC and DC Earth (if required)

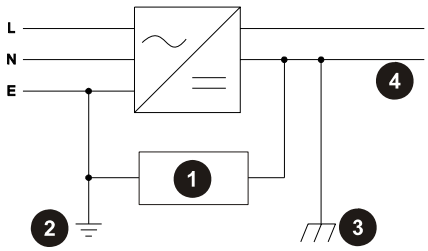
Ignore this step if the direct AC-DC earth link is used.

If a direct AC-DC earth link is not allowed at the site then:

1 Remove the factory-fitted AC-DC earth link cable.

2 Install a surge protection device in place of the AC-DC earth link cable, as shown in the following diagram.

The surge protection device bonds the AC and DC earth during transient activity to prevent damage to the rectifiers. The preferred transient protective device is a transient earth clamp (TEC).



1. Transient earth clamp (TEC) surge protection device
2. AC earth
3. DC earth / communications earth
4. DC Common

Procedure complete

Task 4 - Connect the DC Load Cables

A wide range of DC distribution modules is available for Powerware Data-Voice-Video Power Solutions with MCBs or fuses or both.

Step 1 - Access MCBs and/or fuses

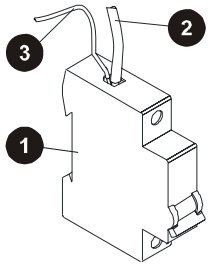
See the diagram on page 2 for location of the DC distributions with the load MCBs/fuses.

Step 2 - Connect load cables to load MCBs (if required)

If the DC distribution does not have load MCBs then ignore this step.

1. Switch off all load MCBs.
2. Terminate the load live cable(s) at the load MCB(s).

   Ensure that the fuse fail detection wires are properly terminated as shown.
3. Terminate the load common cable(s) at the DC common bar.



❶ Load MCB

❷ Load live cable

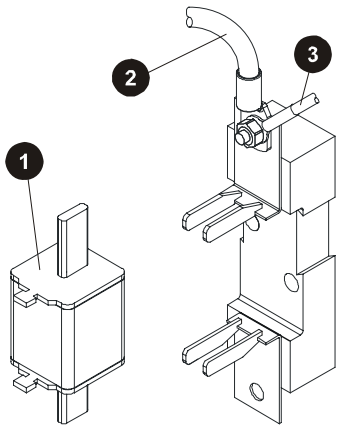
❸ Fuse fail detection wire

Step 3 - Connect load cables to load fuses (if required)

If the DC distribution does not have load fuses then ignore this step.

1. Remove all load fuse links.
2. Terminate the load live cable(s) at the load fuse(s).

   Ensure that the fuse fail detection wires are properly terminated as shown.
3. Terminate the load common cable(s) at the DC common bar.



❶ Load fuse link

❷ Load live cable

❸ Fuse fail detection wire

Procedure complete

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Task 5 - Connect Battery Cables (if required)

Ignore this task if the DC power system is a single cabinet with integrated battery shelves (no separate battery cabinets or racks).

There are two options for the connection of battery cables from a separate battery cabinet or rack:

1. Connect battery cables direct to bus bars (via LVD if fitted) in the DC power system cabinet.

   Battery MCBs or fuses must be fitted at the separate battery cabinet or rack to protect the battery cables.

2. Connect battery cables to MCBs or fuses in the DC power system cabinet.

Step 1 - Connect battery cables direct to bus bars (if required)

If the DC distribution has battery MCBs or fuses then ignore this step. See the diagram on page 2 for location of the DC distribution.

1. Switch off all battery MCBs or remove fuse links to isolate the batteries.
2. Route the battery cables to the DC power system.
3. Terminate the battery live cable(s) at the battery bus bar.
4. Terminate the battery common cable(s) at the common bus bar.
5. Secure all cables to prevent strain on the terminals.

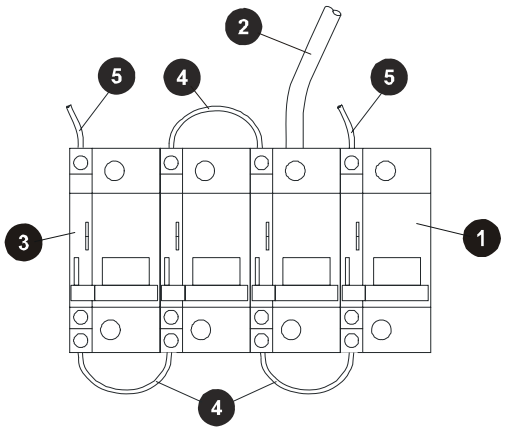
Step 2 - Connect battery cables to MCBs (if required)

If the DC distribution does not have battery MCBs then ignore this step. See the diagram on page 2 for location of the DC distribution.

1. Switch off all battery MCBs.
2. Terminate the load live cable(s) at the battery MCB(s).

   Ensure that the fuse fail detection wires are connected as shown. Use the battery fuse fail detect links to connect the auxiliary switches in series. Use the auxiliary switch terminals that will be closed when the MCB is ON.

3. Terminate the battery common cable(s) at the DC common bar.



1. Battery MCBs
2. Battery live cable (one only shown)
3. Auxiliary switches
4. Fuse fail detection links between auxiliary switches
5. Fuse fail detection wires to fuse fail detection board

Step 3 - Connect battery cables to battery fuses (if required)

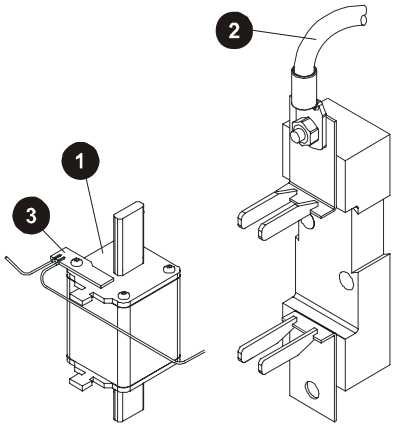
If the DC distribution does not have battery fuses then ignore this step. See the diagram on page 2 for location of the DC distribution.

1 Remove all battery fuse links.

Ensure that the fuse fail detection boards are fitted as shown. (When a fuse link is replaced ensure the board is removed from the blown fuse and re-fitted to a new striker type fuse link).

2 Terminate the battery live cable(s) at the battery fuse(s).

3 Terminate the battery common cable(s) at the DC common bar.



1. Battery fuse link (striker type)
2. Battery live cable
3. Fuse fail detection board

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Step 4 - Connect together battery MCB fuse fail detect wires (if required)

Ignore this step if there is no separate battery cabinet with MCBs.

1. Ensure that MCB auxiliary switches (on the rectifier cabinet and the optional additional battery cabinet) are connected together in series.
2. Use the auxiliary switch terminals that will be closed when the MCB is ON.

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.

The following are our recommended Battery Installation Practices. These supplement the specific installation instructions of the relevant battery manufacturer.

Battery Installation Practices

General

- Do not wear a synthetic dust-coat or overalls. Synthetic fabrics can hold a static electric charge, creating sparks during discharge.
- Remove rings, wristwatch and other metal jewelry that might be exposed to battery terminals, before installing batteries.
- Only use a clean soft damp cloth for cleaning the batteries. Do not use cleaning detergents or chemicals.
- 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.
- Ensure that the battery shelves are disconnected from the DC power system, by switching off all battery MCBs or removing all battery fuses.

Unpacking and Inspecting the Batteries

- Unpack the batteries and inspect them carefully for leaks, corrosion and possible damage. Report any damage or other battery related problems immediately to the battery supplier.
- Do not remove the factory-fitted transit insulation covers from the batteries until access to the battery terminals is required.

Interconnecting the Batteries

- Only terminate battery cables and interconnecting bars after confirming that the termination will not create a short circuit.
- Always use insulated tools.
- 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 batteries, and/or personal injury.
- 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.

Installation procedure

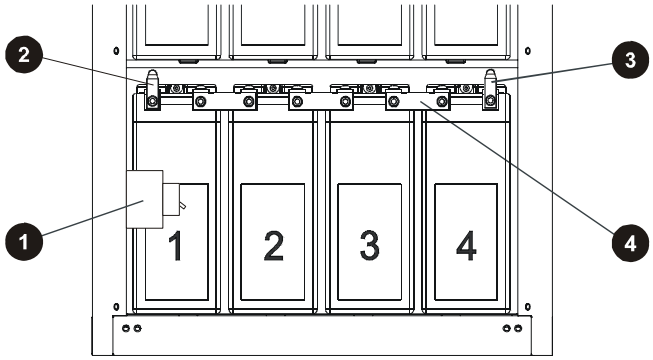
The following procedure applies to batteries installed in the Data-Voice-Video Power Solutions integrated battery shelves or the optional additional battery racks only. For batteries installed in separate battery racks consult the manufacturer's installation instructions.

Notes:

1 Check that loose cables cannot make contact with other cables or terminals which may be live.

2 Always equip the lowest battery shelf in a rack first to ensure rack stability.

3 The following order of connection must be followed.



Typical battery arrangement (-48V)

❶ Battery MCB

❷ Live (negative) lead

❸ Common (positive) lead

❹ Interconnecting links

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Step 1 - Inspect first (lowest) battery shelf and prepare cables

1. Remove the battery shelf front cover.
2. Check the first (lowest) battery shelf in the rack is clean and clear of obstruction.
3. Pull both cables to the front of the rack in preparation for fitting the batteries.
4. Check the battery MCB is OFF.

Step 2 - Fit the batteries

1. Slide a battery to the left hand side of the shelf (position 1).

   Use a suitable mechanical lifting aid to fit batteries in the rack.
2. Slide another battery to the right hand side of the shelf (position 4).
3. Slide the third battery next to the battery on the left hand side (position 2).
4. Slide in the last battery (position 3).

Step 3 - Connect cables

1. Connect the positive battery cable to the positive terminal of the battery in position 4.
2. Tighten the bolt on the battery terminal to the torque recommended by the battery manufacturer.
3. Connect the negative battery cable (connected to the MCB) to the negative terminal of the battery in position 1.
4. Tighten the bolt on the battery terminal to the torque recommended by the battery manufacturer.
5. Check that the battery terminal connections are not touching metalwork and that there is a sufficient gap between the terminals and the rack sides. Do not proceed until this has been checked and corrected if necessary.

Step 4 - Interconnect batteries

1. Remove the covers from batteries 3 and 4.
2. Connect the first interconnecting link between the positive (+ve) terminal of battery 4 and the negative (–ve) terminal of battery 3.
3. Adjust the battery positions so that the connection places no strain on the terminal screw in any direction.
4. Tighten according to the manufacturer's recommended torque settings.
5. Replace the cover on battery 4.
6. Repeat procedure for batteries 2 and 3, and 1 and 2.

Step 5 - Check voltage and polarity

1. Remove the covers from batteries 1 and 4.
2. Check with a voltmeter that the negative terminal of battery 4 is more than 48V negative of the positive terminal of battery 1.
3. Check all terminal covers are in place.

Step 6 - Check terminals

Check that the battery terminal connections are not touching metalwork and that there is a sufficient gap between the terminals and the rack. Do not proceed until this has been checked and corrected if necessary.

Step 7 - Install remaining batteries

1. Repeat the above procedure for the remaining battery shelves to be populated. Work from the bottom to top shelf.
2. Repeat for additional battery racks if required.

Step 8 - Replace the battery shelf front cover(s)

Procedure complete

Task 7 - Mount the Battery Temperature Sensor

The DC power system is supplied with a battery temperature sensor and standard 8 m (26 feet) long RJ45 cable, already connected to the supervisory module to measure the ambient air temperature around the batteries. This is required for the temperature compensation control function.

Step 1 - Connect and route cable

1. Connect the temperature sensor cable supplied to socket XH7 on the I/O board.

   If required extend the cable using an RJ45 patch cable and in-line joiner. Recommended maximum cable length is 20m (65 feet) because of noise considerations.

2. Route the temperature sensor cable to the middle battery shelf (in systems with integrated battery shelves) or the middle of an external battery stand.

   Do not run the sensor cable along AC power cables. Interference may cause false readings.

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Step 2 - Fix sensor

Fix the sensor above the batteries. To avoid false readings:

- Do not attach the sensor to a battery case, battery cables, terminals or interconnecting bars.
- Do not expose the sensor to direct sunlight, or air movements from air-conditioning systems or open windows.

Procedure Complete

Task 8 - Connect External Current Sensors/Shunts (if required)

External current shunts/sensors are connected to the system controller either directly (depending on the number of internal current shunts/sensors fitted) or through a Powerware SiteSure-3G module.

Refer to External Current Shunts/Sensors on page 67 for further installation information.

Refer to the System Controller Operation Handbook for details of connection of external current shunts/sensors. See Related Information on page i.

Refer to the Connect Additional Input/Output on page 30 for information on installing SiteSure-3G modules.

Task 9 - Connect Input/Output Cabling (if required)

The input/output (I/O) board provides a number of digital inputs and digital outputs (relays). Refer to Input/Output Board on page 4 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.

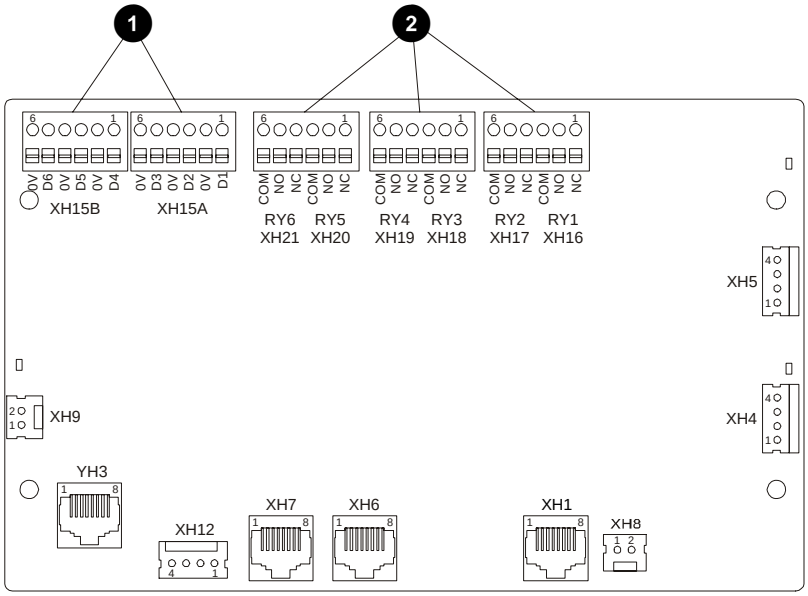
Step 1 - Access the I/O board

The I/O board is located on the back of the DC distribution door. See diagram on page 2.

Step 2 - Terminate the cabling

1. Route the cabling to the terminal blocks on the I/O board.
2. Visually check the cable for damage.
3. Test the insulation and continuity of the cabling.
4. Terminate the cabling as in the following diagrams.

   For alarm relay and digital input specifications see Specifications on page 59.
5. Use cable ties to secure the cable and prevent strain on the connector.



❶ Digital input terminals (push-connect type).

❷ Alarm relay (digital output) terminals (push-connect type).

Step 3 - Set up SC200

Configure the inputs and outputs after completing the installation and all the Startup Tasks on page 38.

For configuration details refer to Digital Inputs and Digital Outputs in the System Controller Operation Handbook (see Related Information on page i).

Procedure complete

Task 10 - Connect Additional Input/Output (if required)

If additional input/outputs are required then SiteSure-3G modules can be connected 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
Enclosure:	Wall or panel mounting plastic case

Use the following procedure to connect a SiteSure-3G input/output module, if required.

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Step 1 - Route and connect cable to DV2-3G

1. Route an RJ45 patch cable from the SiteSure-3G module to the DV2-3G.
2. Connect the cable to an RJ45 socket (S1, S2 or S3) on the Voltage Feed Module board via an RJ45 splitter. See diagram on page 7 for socket location.
3. Use cable ties to secure the cable and prevent strain on the connectors.
4. Test the insulation and continuity of the conductors.

Step 2 - Connect the cable to socket YH11 on the SiteSure-3G module

Procedure complete

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

Task 11 - Connect to the AC Supply

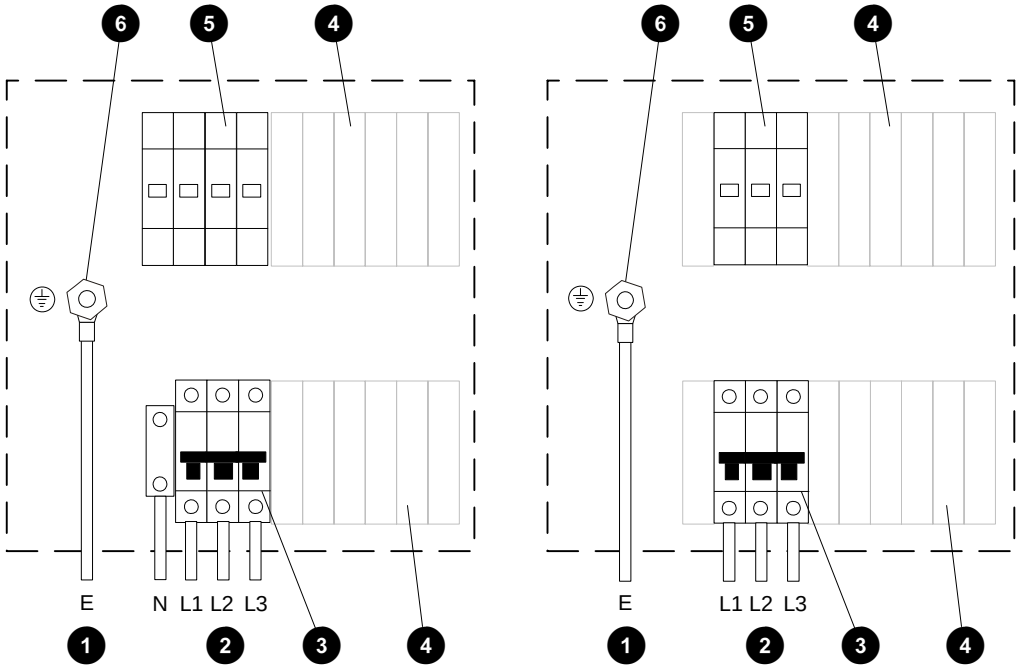
- If the DC power system is to be installed in a location where the ambient temperature may rise above 50ºC (122ºF), then V110 rated cable must be used for all connections.
- Only use a three-phase (Δ) AC power source that is referenced to earth, or has a protection system in place to prevent the phase-earth voltage exceeding the rating of the rectifier.

Step 1 - Access AC MCBs (systems with integrated battery shelves)

Ignore this step if system does not have integrated battery shelves.

1. The AC MCBs are fitted in the combined AC and DC distribution section. Refer to the diagram on page 2 for location. The layout of the AC MCBs is shown in the following diagram.
2. To access the MCBs:
   - Open AC/DC distribution space door.
   - Switch the AC isolator to the OFF position.
   - Undo the four screws securing the perspex cover and remove the cover.
3. Go to Step 3.

Systems with integrated battery shelves



Typical arrangement with Neutral

Typical arrangement without Neutral

❶ Earth cable to rack earth stud.

❷ Phase and Neutral (if fitted) cables.

❸ AC isolator switch (1, 2 or 3-phase as required). May be fitted next to MOVs depending on model.

❹ Rectifier or magazine MCBs (arrangement depends on model)

❺ Surge protection MOVs (2, 3 or 4 as required).

❻ AC earth termination point.

Other cables not shown for clarity.

Step 2 - Access AC MCBs (systems without integrated battery shelves)

Ignore this step if system has integrated battery shelves.

1 The AC MCBs are fitted in the AC Distribution. Refer to the diagram on page 2 for location. The layout of the MCBs is shown in the following diagram.

2 To access the MCBs:

- Switch the isolator to the OFF position.
- Undo the four screws holding the front panel.
- Remove the front cover and isolator switch handle.

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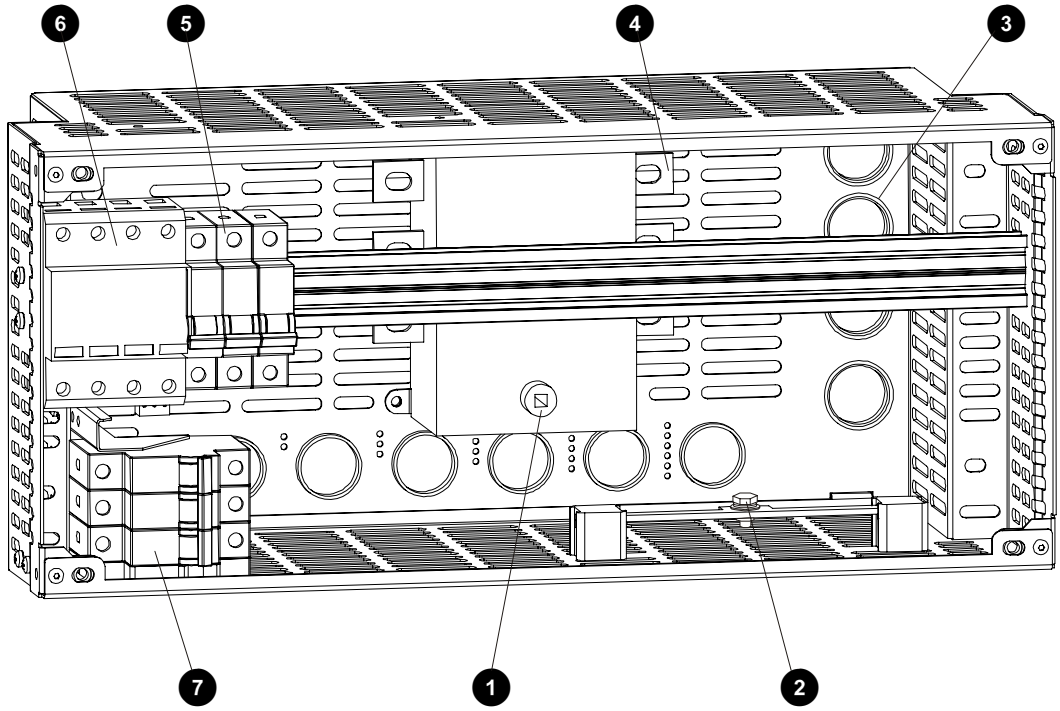
Systems without integrated battery shelves



1. AC isolator switch (shaft not shown)
2. Neutral bar termination (if fitted)
3. AC cable entry glands
4. Isolator switch terminals
5. Rectifier MCBs (3 only shown)
6. Surge protection MOVs
7. MOV MCB (located next to rectifier MCBs in some models)

Step 3 - Check the connection of the AC terminals

Check the AC terminals on the DV2-3G are connected to suit the type of AC supply. Data-Voice-Video Power Solutions DC power systems can only be connected to one of the following:

AC source	Voltage (nominal)*	AC MCB (if fitted)
1-phase, neutral and Protective Earth (PE)	220-240V phase-neutral	1-pole
2-phase and PE	208V phase-phase	2-pole (linked)
3-phase, neutral and PE	220-240V phase-neutral	3-pole
3-phase and PE	208V phase-phase	3-pole (linked)

**Refer to the Specifications on page 59 for the AC voltage range and AC input current.*

Step 4 - Prepare the AC supply cable

1. Select AC supply cable to suit the AC supply source, the maximum AC current (see Specifications on page 59) and in accordance with the local wiring regulations.
2. Route the AC supply cable from the AC supply point into the top or bottom of the cabinet as required.

   Do not terminate at the AC supply point at this stage.
3. At the DV2-3G end, cut the conductors to suit the positions of the AC MCB(s).

   Ensure the earth conductor is 30-50mm (1¼ - 2 inches) longer than the longest phase or neutral conductor.

Step 5 - Terminate the earth conductor at DV2-3G

1. Terminate the earth conductor with an M6 (1/4") crimp lug.

   Ensure the ferrule of the crimp lug covers all strands of wire.
2. Connect the earth conductor to the AC earth termination point.

Step 6 - Terminate the phase and neutral (if used) conductor(s) at DV2-3G

1. Connect the phase conductor(s) to the MCB(s).
2. If fitted, terminate the neutral conductor with an M4 (3/16") crimp lug and connect to the neutral terminal or neutral bar.

   Ensure the ferrules of the crimp lug covers all strands of wire.

Step 7 - Connect at the AC supply point

1. Check the AC supply point is isolated.
2. Connect the cable to the AC supply point.

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

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Step 8 - Check terminations, secure cables and test insulation

1. Check all terminations are correct and are tightened.
2. Secure the cable with cable ties to ensure there is no strain on terminals.
3. Test the insulation resistance of the conductors according to local AC wiring regulations.
4. Replace all covers/panels.

Procedure complete

Installation Completed

Installation of the DV2-3G is now complete.

Now follow the instructions in Start-Up on page 38 to make the system operational.

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Overview

Start-Up Tasks

Complete all the Installation tasks (see details) 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 38
2	Complete the Pre-Power-Up Checklist	See details on page 39
3	Apply AC Power	See details on page 40
4	Configure the DC Power System	See details on page 40
5	Apply DC Power to Battery and Load	See details on page 41

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.

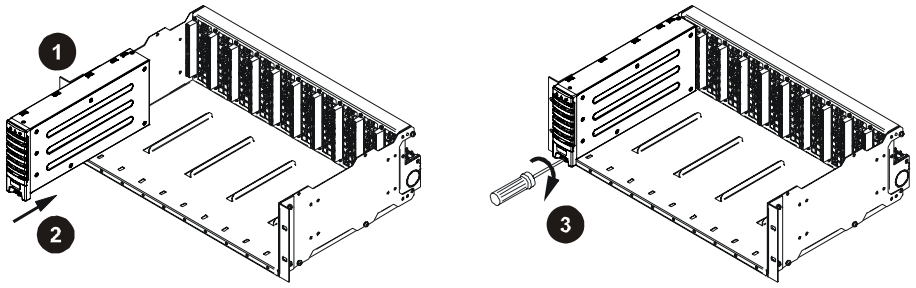
Step 1 - Unpack the rectifiers

Unpack the rectifiers and inspect them carefully for possible transport damage. Report any damage immediately using a copy of the Equipment Incident Report on page 91.

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. 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

If not already fitted, 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
☐	Upstream surge protection is fitted (see Input Transient Protection on page 73)
☐	Earth bonding is correct (see details on page 20)
☐	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
☐	AC isolator and all AC MCBs are switched off
☐	All DC Distribution MCBs 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 Ensure all AC MCBs are off.

2 Switch on the AC supply.

3 Switch on the AC MCB for one rectifier or rectifier shelf.

- Rectifier(s) start up (after the startup delay).
- The rectifier alarm LEDs will turn on for a short time.
- The SC200 system controller will turn on (green Power On LED is on) when the rectifiers start.
- During bootup of the SC200 system controller the rectifier yellow alarm LEDs will flash until the rectifiers are registered.

4 After bootup of the SC200:

- Press any SC200 key to silence the alarm.

Depending on the configuration file settings, the alarm LED(s) may be on and the SC200 will display some system alarm messages. This is normal. For an explanation of alarm messages refer to Alarm Descriptions in the System Controller Operation Handbook (see Related Information).

- The LCD display module shows the summary screen. See details in the System Controller Operation Handbook (see Related Information).

If no load or battery is connected the current will be 0A.

- If fitted and enabled, the LVD(s) operate.

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

- On the SC200 keypad select *Menu* > *Rectifiers*. See details in the System Controller Operation Handbook (see Related Information). Check that all rectifiers are registered.

6 If any problems see Troubleshooting on page 44. Otherwise switch on all remaining rectifiers.

Task 4 - Configure the DC Power System

The operational settings of the DC power system are stored in a configuration file loaded into the SC200 system controller. Refer to the System Controller Operation Handbook for details (see Related Information on page i).

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

If the configuration file is not fully customized for the site then check the following settings and change if necessary. It is important that these settings are correct before progressing further.

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Parameter	Action	SC200 Navigation*
Float Voltage	Set to the value recommended by the battery manufacturer.	Menu > Voltage Controls > Voltage Control
Battery Capacity	Set to the rated 10 hour capacity of the installed battery strings. Zero means no battery is installed.	Menu > Settings > Battery
Cells Per String	Set to the number of cells in each battery string.	Menu > Settings > Battery
Temperature Compensation	Enable (if required) and check the settings.	Menu > Voltage Controls > Temperature Compensation
Low Voltage Disconnect (LVD)	Enable (if LVD installed) and check the settings.	Menu > LVD > LVD

* Refer to the System Controller Operation Handbook for navigation details (see *R*elated Information *on page i*).

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.

Task 5 - Apply 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 MCB(s) and/or fit the battery fuses.
3. Check the Battery Fuse Fail alarm clears.

   All Battery MCBs (including any unused MCBs) 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 MCB(s) and/or fit the Load fuses.
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 for details (see Related Information on page i).

   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 DV2-3G is now complete and the system is operational.

If a formal commissioning test is required then refer to the Commissioning on page 77.

The System Controller Operation Handbook (see Related Information on page i) describes how to use the SC200 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 43.

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Overview

Troubleshooting

Use the table to troubleshoot minor installation and operational problems. For additional assistance see Worldwide Support on page 93. Return items for replacement or repair with a copy of the Equipment Incident Report on page 91.

Problem	Possible Cause	Required Action
SC200 alarm.		Refer to Troubleshooting in the SC200 Operation Handbook.
All rectifiers are off (no LEDs on) and system controller display is blank.	AC power to the system is off and the batteries are fully discharged or disconnected.	Restore AC power.
Green LED of one or more rectifiers is off.	AC power to rectifier(s) off or one or more phases are off.	Restore AC power.
	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, the first rectifier is faulty and must be returned for service.
All rectifier LEDs flash.	The rectifier *Identify* function.	Normal operation. See details.
Rectifier yellow LED flashes	SC200 is starting.	Wait for SC200 to complete bootup.
	Rectifier has not registered with the SC200.	Remove 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.
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 function.
	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 59.

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Problem	Possible Cause	Required Action
Rectifier yellow LED on and rectifier clicks every 6 seconds.	Rectifier has been shut down.	Normal operation. See details. 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 59.
	DC overvoltage	Remove and re-insert rectifier(s) or shut down and restart using *DCTools*.
	Rectifier failed	Replace the rectifier.
Low system output voltage (rectifiers not in current limit.)	Rectifiers off.	Restore AC power.
	Battery Test and/or Temperature Compensation is active.	Disable active function(s) if not required.
	Incorrect float voltage setting at system controller.	Check 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 power outage.	Check battery has recharged within expected time.
High system output voltage.	Equalize, Fast Charge and/or Temperature Compensation is active.	Disable active function(s) if not required.
	Incorrect float voltage setting at system controller.	Check 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.

Problem	Possible Cause	Required Action
System has no DC output (rectifiers are on)	Load fuse or MCB open.	Check the load fuses or MCBs.
	LVD has disconnected 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 LVD is connected.)
		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 7.
		Check the connections from the live bus to the LVD.
		Check LVD contactor coil.
		Replace I/O board.
System has no battery input	Battery fuse or MCB open.	Check the battery fuses or MCBs.
	LVD has disconnected battery.	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 LVD is connected.)
		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 7.
		Check the connections from the battery bus to the LVD.
		Check LVD contactor coil.
		Replace I/O board.

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Problem	Possible Cause	Required Action
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 7. Replace I/O board if faulty.
I/O board Power/Comms OK LED is flashing.	I/O board is responding to an *Identify* command from the SC200.	None, this is normal operation.
LVD1 and/or LVD2 Status LEDs (on I/O board) are on.	LVD is connected (contactor closed).	None, this is normal operation.
LVD1 and/or LVD2 Status LEDs are off (I/O board Power On LED is on).	LVD is disconnected (contactor open).	None, this is normal operation.
LVD1 and/or LVD2 Status LEDs are flashing.	The LVD contactor is in the wrong state (SC200 internal state does not match signal from LVD auxiliary switch).	Check the electrical and mechanical operation of the contactor and auxiliary switch. Check all wiring and connectors. See Connections on page 7.
LVD contactor(s) not operating.	LVD settings incorrect or LVD contactor is disconnected.	Use *DCTools to c*heck LVD is enabled and set to correct values. Check that the LVD manual control is set to AUTO. See details. Check that the LVD is correctly mapped to the I/O board. See details. Check that the LVD control and DC power cables are connected. See details on page 7.
MOV Fail Alarm active.	One or more MOVs have failed because of lightning strike(s) or AC transients.	Check the visual indicators on all the MOVs. If a visual indicator indicates a failed MOV, replace all the MOVs as soon as possible. See Monitoring and Replacing Transient Protective Devices on page 73, on page 56.
	One or more MOV cartridges not properly fitted.	Check that the MOV cartridges are properly inserted in the MOV cartridge holders.
	Faulty MOV Fail alarm wiring.	Check the MOV Fail alarm wiring.
All other SC200 problems.		Refer to Troubleshooting in the SC200 Operation Handbook.

Replacing 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 copy of the Equipment Incident Report on page 91.

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

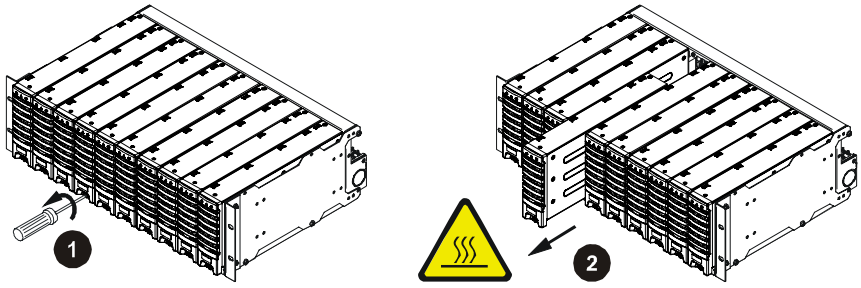
Removing a Rectifier

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 (RMB1U-00).

Procedure complete

Installing a Replacement Rectifier

Step 1 - Align the rectifier with the guides

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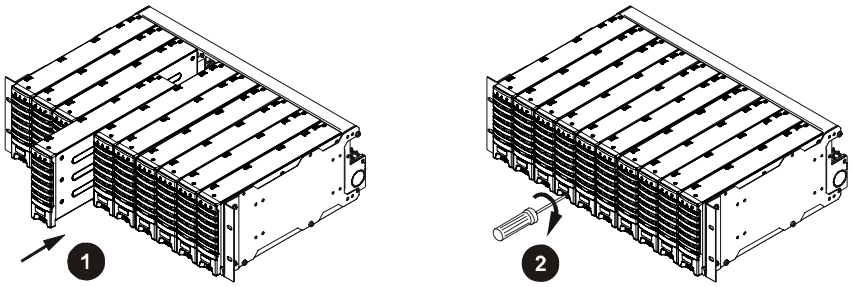
Step 2 - Push in the rectifier

1. Push in the rectifier until the retaining screw contacts the shelf.
2. Tighten the retaining screw to 1.5Nm (13.3 inch-pounds). This will locate the rectifier in its rear connector.
3. 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.



Procedure complete

Replacing or Adding a Load MCB

Step 1 - Access MCBs

1. The load MCBs are located in the distribution space. See diagram on page 2.

Step 2 - Remove existing MCB (if required)

1. Disconnect the load cable and the fuse fail detect wire from the MCB top terminal. Insulate the ends of both the cable and the wire.
2. Undo the bottom MCB terminal
3. Unclip the MCB from the DIN rail and remove the MCB.

Step 3 - Fit new MCB

1. Undo the bottom MCB terminal.
2. Insert the new MCB onto the tooth-comb bus and clip onto the DIN rail.
3. Tighten the bottom MCB terminal.

Step 4 - Fit a fuse fail detect wire

1. Place a spare fuse fail detect wire into the top terminal of the MCB.
2. Tighten the top MCB terminal.

Step 5 - Connect load cable (if required)

Follow the procedure on page 22.

Procedure complete

Replacing a Load or Battery Fuse Link

Step 1 - Access the fuses

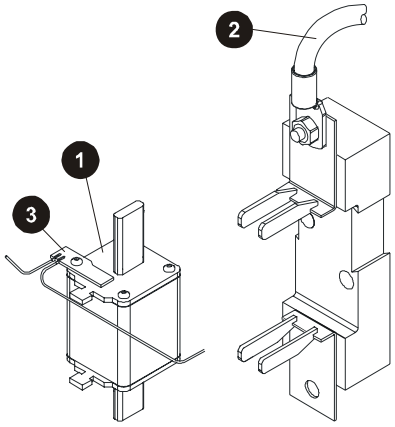
The load fuses are located in the distribution space. See diagram on page 2.

Step 2 - Remove blown fuse link

1. Identify the blown fuse.
2. For battery fuses disconnect the fuse fail detect wires.
3. Remove the fuse link using the tool provided.

Step 3 - Fit new fuse link

1. Use the tool supplied to fit a new fuse link of the required rating.
2. For battery fuses only:
   - Use a striker type fuse link.
   - Remove the fuse fail detection board from the old fuse and fit to new fuse.
   - Re-connect the fuse fail detect wires.



1. Fuse link (striker type for battery fuses only)
2. Live cable
3. Fuse fail detection board (battery fuses only)

Procedure complete

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Adding a Load Fuse

Step 1 - Access the fuses

1. The load fuses are located in the distribution space. See diagram on page 2.

Step 2 - Fit new fuse base and link

1. Bolt the new fuse base to the live bus.
2. Tighten the bolt according to the Standard Torque Settings on page 58.

Step 3 - Fit a fuse fail detect wire

1. Place a spare fuse fail detect wire into the top terminal of the fuse.
2. Tighten the top terminal.

Step 4 - Connect load cable (if required)

Follow the procedure on page 22.

Procedure complete

Replacing the System Controller

The SC200 system controller can be replaced without switching off the DV2-3G and disconnecting the equipment it powers.

Before you start, you need

- A PC with the latest version of *DCTools* software installed.
- A copy of the appropriate SC200 configuration file, which can be one of the following:
  - the old configuration file, or
  - a backed-up configuration file, or
  - a customized standard (master) configuration file
- A USB A/B cable.
- A replacement SC200 system controller.

Step 1 - Backup the configuration file of the old SC200

If the old SC200 is still operational use DCTools to backup its configuration file.

Refer to Backup and Restore in the System Controller Operation Handbook (see Related Information).

Step 2 - Remove the SC200

1. Open the distribution space door to access the rear of the SC200.
2. Label then disconnect the cables from the rear connectors.

   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.

3. Undo the four retaining screws.
4. Remove the SC200.

Step 3 - Insert the new SC200

1. Insert the SC200 and tighten the retaining screws.
2. Connect the cables to the rear connectors.

   The SC200 will start its bootup process. Refer to Starting the SC200 in the System Controller Operation Handbook (see Related Information).

3. When bootup is complete check that the SC200 has registered all rectifiers.

   Missing Hardware and New Hardware alarms will appear because of the I/O board mapping change. Other alarms may also appear because of incorrect configuration file settings. Press any key to silence the alarm.

Step 4 - Restore the configuration file settings

1. If a copy of the old configuration file, a backed-up configuration file or a modified default configuration file is available, then use *DCTools* to restore (download) it to the new SC200.

   Refer to Backup and Restore in the System Controller Operation Handbook (see Related Information).

   If you receive an error message about the MIB file version, please contact your local Powerware DC product supplier for advice.

   If a copy of the old configuration file, a backed-up configuration file or a modified default configuration file is not available, then use the keypad or *DCTools* to change the configuration settings to the correct values.

2. Check all control functions, alarms and current measurement.
3. Check the power system identification parameters and communications settings.
4. Change the configuration file as required to ensure that the SC200 operates as intended.

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Step 5 - Map I/O board serial number(s)

1. In DCTools go to: *I/O Board* > *I/O Board to Serial Number Mapping*.
2. Copy the I/O board serial number(s) from the *RXP Bus Slaves* table to the *I/O Board to Serial Number Mapping* table.

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 (see Related Information).

Step 6 - LVD Characterization Alarm

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

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

1. Press any SC200 key to silence the alarm.
2. On the SC200 go to: LVD > LVD1 > Options
3. Select *Characterize With IOB Values* if available. Press Enter. Repeat for LVD2 if fitted. No further action is required.
4. If *Characterize With IOB Values* if 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 connect a temporary cable from the rectifier bus to the load bus to power the low priority load equipment when the load LVD disconnects.
5. On the SC200 go to: LVD > LVD1 > Options
   - Select *Characterize*. Press Enter.

     The LVD contactor will disconnect and connect.
   - Repeat for LVD2 if fitted.
   - Remove the LVD bridge cable if fitted.

Procedure Complete

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 this LVD must be bridged so that the low priority loads are not disconnected when the I/O board is removed.

Before you start you will require:

- A replacement I/O board (IOBGP-00).
- An LVD bridge cable if a load disconnect LVD is fitted.

Step 1 - Bridge load disconnect LVD(s) (if fitted)

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

1. Connect suitable cable(s) from the rectifier bus to the load bus to bridge the load disconnect LVD(s).
2. Tighten the bolts according to the standard torque settings on page 58.

Step 2 - Remove the I/O board

1. The I/O board is located on the back of the distribution space door. See diagram on page 2.
2. Label then disconnect all I/O board cables.

   Any LVDs fitted will disconnect. A Missing Hardware and other alarms will appear. Press any key to silence the alarm.
3. Remove the I/O board.
4. Place the board in an anti-static bag and return for service. Refer to Equipment Incident Report on page 91.

Step 3 - Fit the new I/O board

1. Reconnect all cables.
2. Check the I/O board Power On LED is on. If not refer to Troubleshooting on page 44.

Some alarms will clear. The Missing Hardware and LVD alarms (if LVDs are fitted) will still be present. A New Hardware alarm will appear because of the I/O board mapping change. Press any key to silence the alarm.

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Step 4 - Update I/O board mapping

1. In DCTools go to: *I/O Board* > *I/O Board to Serial Number Mapping*.
2. Copy the I/O board serial number from the *RXP Bus Slaves* table to the *I/O Board to Serial Number Mapping* table.

   The alarms (except LVD alarms, if LVDs are fitted) will clear.

Step 5 - Clear LVD Characterization alarm(s) (if required)

If there is no LVD Characterization Error alarm then ignore this step.

1. If there is an *LVD Characterization Error* alarm for LVD1 then on the SC200 go to: *LVD* > *LVD1* > *Options*.
2. Select *Use SC Values*. Press *Enter*. No further action is required - go to (3).

   If *Use SC Values* is not available then the LVD must be characterized. This will cause the LVD contactor(s) to disconnect for a few seconds.

   - If LVD1 is a battery disconnect LVD then the load equipment will continue to be powered by the rectifiers.
   - If LVD1 is a load disconnect LVD then the low priority load equipment will continue to be powered via the LVD bridge cable.
   - On the SC200 go to: *LVD* > *LVD1* > *Options*. Select *Characterize*. Press *Enter*.

     The LVD1 contactor will disconnect and connect. When the characterization is complete the LVD1 Characterization Error alarm will clear.
3. If there is an *LVD Characterization Error* alarm for LVD2 then on the SC200 go to: *LVD* > *LVD2* > *Options*.
4. Select *Use SC Values*. Press *Enter*. No further action is required - go to next Step.

   If *Use SC Values* is not available then the LVD must be characterized. This will cause the LVD contactor(s) to disconnect for a few seconds.

   - If LVD2 is a battery disconnect LVD then the load equipment will continue to be powered by the rectifiers.
   - If LVD2 is a load disconnect LVD then the low priority load equipment will continue to be powered via the LVD bridge cable.
   - On the SC200 go to: *LVD* > *LVD2* > *Options*. Select *Characterize*. Press *Enter*.

     The LVD2 contactor will disconnect and connect. When the characterization is complete the LVD2 Characterization Error alarm will clear.

Step 6 - Remove the LVD bridge cable(s) (if fitted)

Ignore this step if no LVD bridge cable was fitted.

Procedure complete

Monitoring and Replacing Transient Protective Devices

For information on transient protection devices refer to Input Transient Protection on page 73.

Metal oxide varistors (MOVs) are the most widely used transient protective devices. MOVs are generally fitted in the main AC switchboard of the building for primary transient protection, and in the DC power system's AC distribution module or AC sub-switchboard for secondary transient protection.

Monitoring the MOVs

MOVs are fitted with alarm contacts and visual indicators. Connect these alarms to the supervisory module and from there extended to the building or network management system. If the MOVs are not monitored automatically, then regular visual inspections must be carried out.

Replacing the MOVs

MOVs must be functional at all times. In practice, it is impossible to predict when a MOV will fail. That depends entirely on the number and magnitude of the transients sustained.

For that reason we recommend the following, depending on how accessible the site is.

- **For easily accessible sites –** If a MOV has failed (as indicated by a MOV Fail alarm or the visual indicator), then replace all the MOVs as soon as possible.
- **For remote sites with difficult access –** Replace all the MOVs during scheduled maintenance visits, whether they have failed or not.

We strongly recommend inspecting the MOVs in the main AC switchboard at the same time and replacing them as appropriate.

If any MOV or other transient protection device has failed then the design of the primary and secondary transient protection systems, and the maintenance plan, at that site must be reviewed.

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 refer to Worldwide Support on page 93.

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Safety Equipment

Use approved safety equipment as required by local health and safety regulation 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
  - USB A/B cable (RadioShack 55010997, Jaycar WC7700 or similar)
  - DCTools software (download from www.powerware.com/downloads).
- Test load (to suit maximum output of DC power supply)
- 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.

For battery terminals use the torque values specified by the battery manufacturer.

Fastener Size ISO Coarse	Torque (Nm / inch-pounds)		
	Minimum	Typical	Maximum
M2.5	0.18 / 1.6	0.27 / 2.4	0.37 / 3.3
M3	0.32 / 2.8	0.49 / 4.3	0.66 / 5.9
M4	0.78 / 6.9	1.14 / 10.1	1.5 / 13.3
M5	1.55 / 13.8	2.32 / 20.6	3.1 / 27.5
M6	2.7 / 24	4 / 35.5	5.4 / 48
M8	6.3 / 56	9.4 / 83	12.5 / 111
M10	12.5 / 111	18.7 / 166	25 / 222
M12	22.5 / 200	33.7 / 299	45 / 399
M16	64 / 568	95.5 / 848	127 / 1127

Notes:

1. Torque range is 40% to 80% proof stress grade 4.6 unlubricated zinc-plated steel.
2. When a bolt and nut is torqued use a spanner to prevent rotation.
3. Use the minimum torque values if resilient materials (such as plastic bushes) are included in the bolted joint.

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System AC Input

AC Input Voltage	220-240V (nominal L-N) 208V (nominal L-L)
AC Input Voltage Range	L-N: 175 – 275V L-L: 175 – 275V
AC Input Current (maximum) (per phase @ V = 175V)	**Systems with integrated batteries:** 1P+N+PE (220-240V nom.): 120A 2P+PE (208V nom.): 120A/ph 3P+N+PE (220-240V nom.): 48A/ph 3P+PE (208V nom.): 73A **Systems without integrated batteries:** 3P+N+PE (220-240V nom.): 168A/ph 3P+PE (208V nom.): 280A/ph
Frequency Range	45-66Hz
Earth Leakage Current (maximum)	1.3mA per rectifier

System DC Output

DC Output Voltage (nominal)	24V / 48V (dependent on rectifier model)
DC Output Power (maximum)	**Systems with integrated batteries:** 24V: APR24-3G rectifiers: 14.4kW 48V: APR48-3G rectifiers: 18kW **Systems without integrated batteries:** 24V: APR24-3G rectifiers: 57.6kW 48V: APR48-3G rectifiers: 72kW
DC Output Voltage Range	21.5 - 29V / 43 - 57.5V

Rectifiers

Operating Ranges	
Rated:	175 – 275V *Full output up to 50°C [122°F]*
Extended:	90 – 300V *Reduced output power below 175V*
AC Input Current (maximum)	APR24-3G: 9.5A APR48-3G: 12A *175V AC, 20°C [68°F]*
Rated Output Power	APR24-3G: 1440W APR48-3G: 1800W
Rated Output Current	APR24-3G: 50A @ 28.8V APR48-3G: 37.5A @ 48V 31.25A @ 57.6V
Preset Voltage	APR24-3G: 27V ± 0.1 APR48-3G: 54.5V ± 0.1V
Rectifier AC Fuses (internal)	16A, 250V

Environment

Ambient Temperature Range *(operating)*	-5°C to 50°C [23°F to 122°F]
Relative Humidity *(operating and storage)*	<95% (non condensing)

Dimensions H, W, D

Cabinets	43U racks: 2000mm [78.7"], 600mm [23.6″], 600mm [23.6″]
Rectifiers	3U: 133mm [5.25"], 42mm [1.65″], 266mm [10.45″] overall

Weight

Excluding rectifiers and batteries	**Systems with integrated batteries:** 85kg [188 lb] typical **Systems without integrated batteries:** 120kg [264 lb] typical **Additional battery rack option:** 85kg [188 lb] typical
Rectifier	1.7kg [3.7 lb]

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Alarm Relays (IOBGP)

Number of Relays	6 (one also used for Monitor OK alarm)
Contact Arrangement	One changeover contact per relay
Contact Rating	1A @ 30V DC 0.3A @ 60V DC
Connectors	Screwless terminal blocks
Wire Size	0.5 - 2.0mm^2 [20 - 14 AWG]
Isolation	Relay connections are isolated to 500V DC from all other circuitry, earth and system common.

Digital Inputs (IOBGP)

Number of Digital Inputs	6
Connectors	Screwless terminal blocks
Wire Size	0.5 - 2.0mm^2 [20 - 14 AWG]

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

Communications

USB	Version: Speed: Connector:	1.1 Full Speed (12Mbits/s) USB B (female)
RS232	Interface: Connectors:	RS-232 (DTE) DB9M
Ethernet	Interface: Connector: Protocols:	10baseT RJ-45 TCP/IP, SNMP, S3P over IP, http (Web), https (secure Web)
External modem options	Type: Operation:	PSTN or GSM Dial in/Dial out on alarm*

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

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Connector Pin-outs

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

I/O Board Connector Pin-outs

Connector	Type	Purpose	Pin	Description
XH4	RJ45	LVD1 Interface	1	+12V out
			2	0V out
			3	LVD1 auxiliary switch
			4	Ground
XH5	RJ45	LVD2 Interface	1	+12V out
			2	0V out
			3	LVD2 auxiliary switch
			4	Ground
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	1	-
			2	-
			3	-
			4	Temp Sense 1+
			5	Temp Sense 1-
			6	-
			7	Temp Sense 2+
			8	Temp Sense 2-
XH8		LVD power	1	Bus live
			2	Common
XH9		Bus voltage sense	1	Monitor reference
			2	Monitor sense
XH12		Battery mid-point monitoring sense (future option)	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

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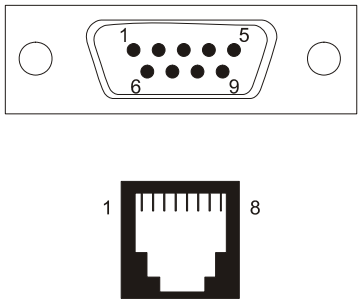
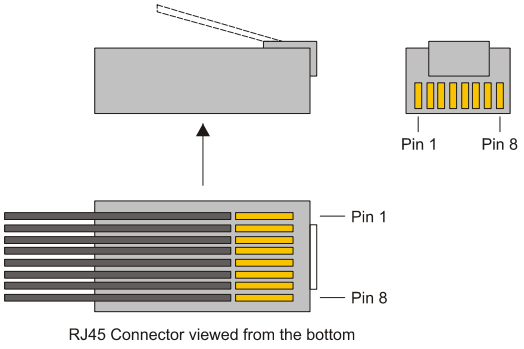
Connector	Type	Purpose	Pin	Description
			4	0V
			5	D3 input
			6	0V
XH15B		Digital inputs D4-D6	1	D4 input
			2	0V
			3	D5 input
			4	0V
			5	D6 input
			6	0V
XH16/XH17		Digital relay outputs 1-2	1	Relay 1 normally closed (NC)
			2	Relay 1 normally open (NO)
			3	Relay 1 Common
			4	Relay 2 normally closed (NC)
			5	Relay 2 normally open (NO)
			6	Relay 2 Common
XH18/XH19		Digital relay outputs 3-4	1	Relay 3 normally closed (NC)
			2	Relay 3 normally open (NO)
			3	Relay 3 Common
			4	Relay 4 normally closed (NC)
			5	Relay 4 normally open (NO)
			6	Relay 4 Common
XH20/XH21		Digital relay outputs 5-6	1	Relay 5 normally closed (NC)
			2	Relay 5 normally open (NO)
			3	Relay 5 Common
			4	Relay 6 normally closed (NC)
			5	Relay 6 normally open (NO)
			6	Relay 6 Common
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
			7	-
			8	MON sense

Connector	Type	Purpose	Pin	Description
YH11	RJ45	RXP System Communications	1	+24/48V (System bus voltage)
			2	+24/48V (System bus voltage)
			3	-
			4	A
			5	B
			6	-
			7	0V
			8	0V



RS232 D9M and RJ45 connector pin-outs



RJ45 plug pin-outs

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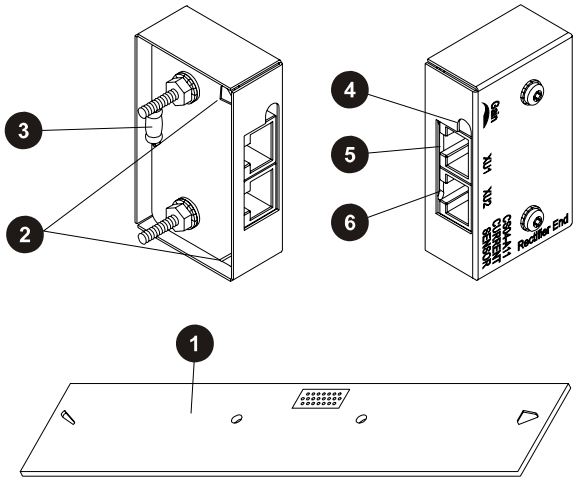
External Current Sensors

CS04-A11 current sensor

Current rating:	> 500A
Mounting:	Screws (supplied) in the LIVE bus
Current sense signal:	60mV at maximum rated current
Communication cable:	8m (26′) RJ45 (supplied)
Extension PCB:	For measurement on very large busbars
Busbar material:	Copper or Aluminum



1. CS04 Current Sensor Extension PCB (optional)
2. Current Sensor Pickup Contacts
3. Input inductor
4. Potentiometer for fine-tuning the Current Sensor Gain
5. RJ45 Current Sense Signal Output (XU1) – to supervisory module (via intermediate current sensor, if fitted)
6. RJ45 Current Sense Signal Input (XU2) – from other current sensor (if fitted)

Using the CS04 Current Sensor Extension PCB

The CS04 current sensor extension PCB increases the distance between the two pickup points of the CS04-A11 current sensor. Use the CS04 current sensor extension PCB if:

- measuring current flow in very large bus bars, or
- the required gain of the current sensor is greater than 40.

Current Sensor Preparation

Step 1 – Calculate the required gain of the CS04 current sensor

$$\text{Gain} = -\text{Constant} \times (\text{CSA} / I_{MAX})$$

Where: CSA = Cross sectional area of the bus bar (mm^2)

I_{MAX} = Maximum expected current through the bus bar (A)

Constant = $68.24 V \cdot \Omega^{-1} \cdot mm^{-2}$ (for copper bus bars)

= 43.57V·Ω^{-1}·mm^{-2} (for aluminum bus bars)

Step 2 – Determine the need for a CS04 current sensor extension PCB

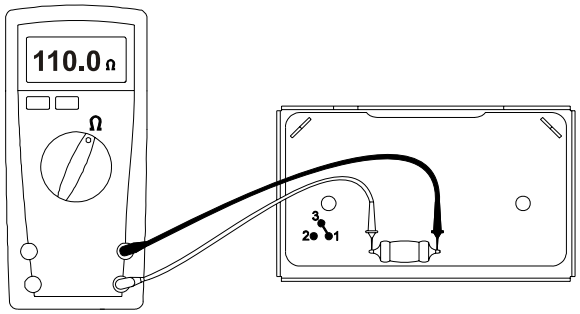
If the required gain of the current sensor is greater than 40, then calculate the new required gain of the current sensor as follows:

Gain = - Constant x (CSA / I_{MAX}) x (51/150)

And use the CS04 current sensor extension PCB.

Step 3 – Resistance measurement

Measure the resistance of the inductor located at the back of the CS04 current sensor PCB as shown.



Step 4 – Set the gain range of the CS04 current sensor

The gain range of the CS04 current sensor depends on:

- The required gain, as calculated in step 1 or step 2
- The resistance value of the input inductor, as measured in step 3

1 Select the required gain range and jumper configuration for the CS04 current sensor from the following table.

2 Connect the jumper(s) according to the selected jumper configuration.

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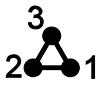
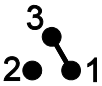
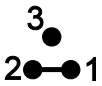
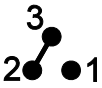
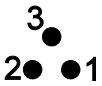
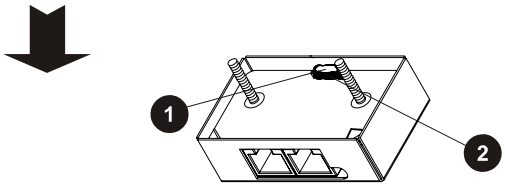
Gain Range – for input inductor resistance values of …			Jumper Configuration
90Ω	**110Ω**	**120Ω**	
16 – 21	13 – 18	12 – 16	
19 – 29	16 – 24	15 – 22	
27 – 52	22 – 42	20 – 39	
38 – 132	31 – 108	29 – 99	
40 – 160	33 – 130	30 – 120	

The jumper connection points are located on the back of the CS04-A11 current sensor PCB. To obtain the required jumper configuration, you might have to break the track between connection points 1 and 3 and solder additional jumpers between connection points.

Step 5 – Apply heat sink compound as shown



1. Input inductor
2. Heat sink compound to ensure good thermal contact between the input inductor and the busbar.

Procedure complete

Mounting the CS04-A11

The CS04-A11 is supplied with M3x35 mm screws to attach the CS04-A11 current sensor to a bus bar.

This section covers the following mounting options:

- Through-hole mounting
- Threaded-hole mounting

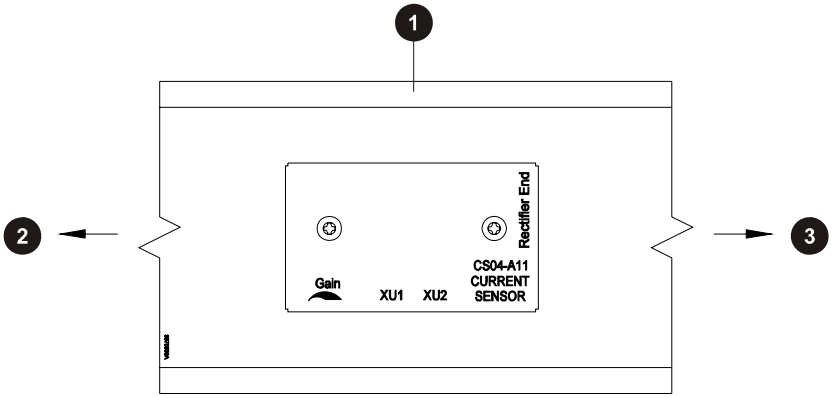
Step 1 – CS04-A11 placement and orientation

CS04-A11 current sensors must always be mounted onto the LIVE bus bar. (See following diagram.)

Wherever possible, do not mount the CS04-A11 current sensor closer than 150mm (6″) from:

- A bus bar joint
- Termination bolts
- Bolts joining laminated bus bars

Ensure correct orientation of the CS04-A11 current sensor before drilling the mounting holes into the bus bar. (See following diagram.)



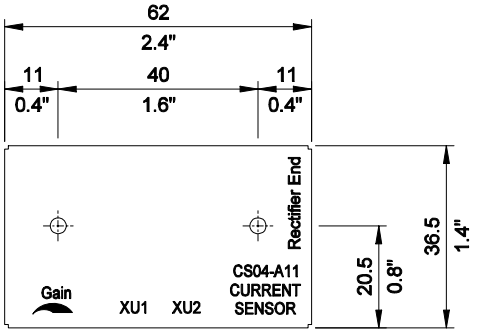
❶ Live bus

❷ To load or battery

❸ To rectifiers

Step 2 – Drill the mounting holes

Drill two mounting holes according to the template below and tap if the threaded-hole mounting option is used.



	Through-hole	Threaded-hole
Drill size	M3.5	M2.5
Thread size and pitch	-	M3 x 0.5 ISO Coarse

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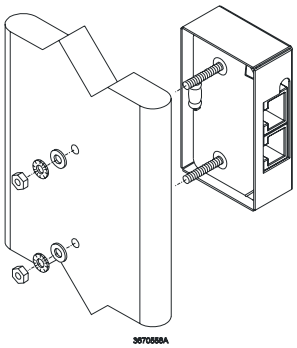
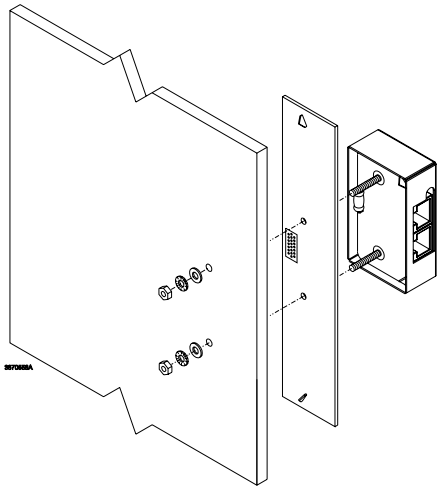
Step 3A – Mounting a CS04-A11 – through-hole mounting option

Mount the CS04-A11 current sensor as shown in the following diagrams.

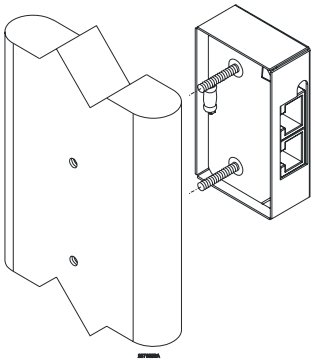
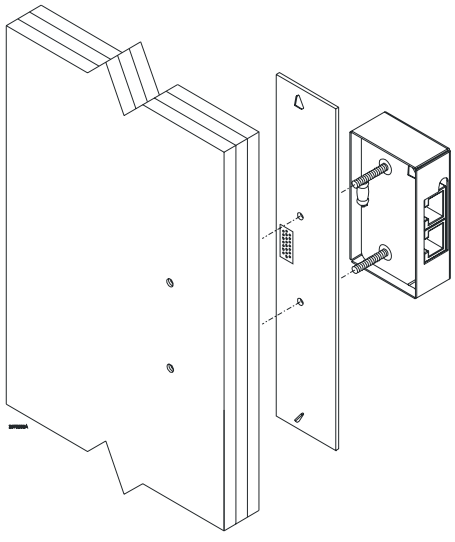
Ensure correct orientation of the CS04-A11 (see Step 1 for details).

Without Extension PCB	With Extension PCB
	

Step 3B – Mounting a CS04-A11 – threaded-hole mounting option

Mount the CS04-A11 current sensor as shown in the following diagrams.

Ensure correct orientation of the CS04-A11 (see Step 1 for details).

Without Extension PCB	With Extension PCB
	

Procedure complete

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Transient Protection

To prevent damage to Powerware Data-Voice-Video Power Solutions from lightning and transient over-voltages, structural lightning protection and transient protection must be installed at each site.

Transient protection will also protect against other sources of transients, such as:

- Circuit or grid switching by the power company
- Electrical switching of large inductive loads (such as motors, transformers, and electrical drives) or capacitive loads (such as power factor correction) or manufacturing equipment.

Use a suitably qualified consultant to develop a transient protection plan (compliant with IEC 61643-12) for the equipment to be installed at the site. The transient protection plan and associated installation must:

1. Capture the lightning strike at a known and preferred point outside the building
2. Conduct the main lightning energy safely to earth
3. Dissipate the lightning energy into a low impedance earthing system
4. Eliminate earth potential differences inside the building
5. Protect the AC supply using a coordinated transient voltage surge suppression plan, that includes:
   - Primary surge protection
   - Secondary surge protection
   - Primary / secondary surge decoupling coils
   - Secondary / tertiary surge decoupling coils
6. Protect the data and control lines using a coordinated transient voltage surge suppression plan

Earthing (Grounding)

The most important aspect of any power system installation at a site is the integrity of the earthing systems. Effective earthing will significantly increase site protection. Most sites have a number of earthing systems such as:

- AC Power earth
- DC Power earth
- Tower / building lightning protection earth

For optimum protection, all earths must be brought together at one "star" point. Otherwise, surge currents can flow within the system creating large voltages. These can cause damage to equipment that does not normally require surge protection, such as rectifier outputs and communications interfaces.

If there is a tower on the site then use the tower earth as the "star" point. This is because it conducts the majority of the surge to earth, especially if the site is lightning-prone. For other sites, a 'direct-lightning' earth will not be available therefore a structural or power system earth will be used. In multi-floor buildings, always try to use structural earths if the common earth point cannot be found at ground level. For basements / single floor buildings, the AC power earth is usually the most appropriate.

Primary Transient Protection

Primary transient protection must be considered at all sites. Eaton recommends, primary transient protection on the incoming AC supply either at the main AC switchboard or sub-switchboard.

In the absence of sufficient information, primary transient protective devices with a minimum repeat strike rating of 100kA (8/20µs wave shape) are recommended.

In addition, primary transient protection must be coordinated with downstream secondary transient protection via suitably rated surge decoupling coils. These should have been specified as part of the transient protection plan for the site. If no surge decoupling coils were specified, then air-core 15µH surge decoupling coils are suitable.

Secondary Transient Protection

Secondary transient protection (downstream from the primary transient protection) must be present at all sites to protect the DC power system from transients.

Powerware Data-Voice-Video Power Solutions are factory-fitted with secondary transient protection. These will protect the power system from a limited number of repeated 15kA transients (8/20µs wave shape).

Factory-fitted secondary transient protection consists of:

- Phase-to-neutral metal oxide varistors (MOVs) with a voltage rating of 440V, capable of withstanding temporary over-voltages
- A neutral-to-earth spark gap (gas discharge tube)
- Surge decoupling coils

If secondary transient protection is not fitted inside the Powerware Data-Voice-Video Power Solutions, then external secondary transient protection must be installed in the AC switchboard that supplies the DC power system.

Carefully consider the residual voltage seen by the DC power system (maximum 6kV) and the decoupling between the transient protection system and the DC power system. Transients must be limited to less than 2kA.

Tertiary Transient Protection

Powerware rectifiers are fitted with 6kV/3kA transient protection. This is designed to protect the rectifiers from voltage spikes generated during operation of the upstream transient protection system. Do not install rectifiers without adequate upstream surge protection.

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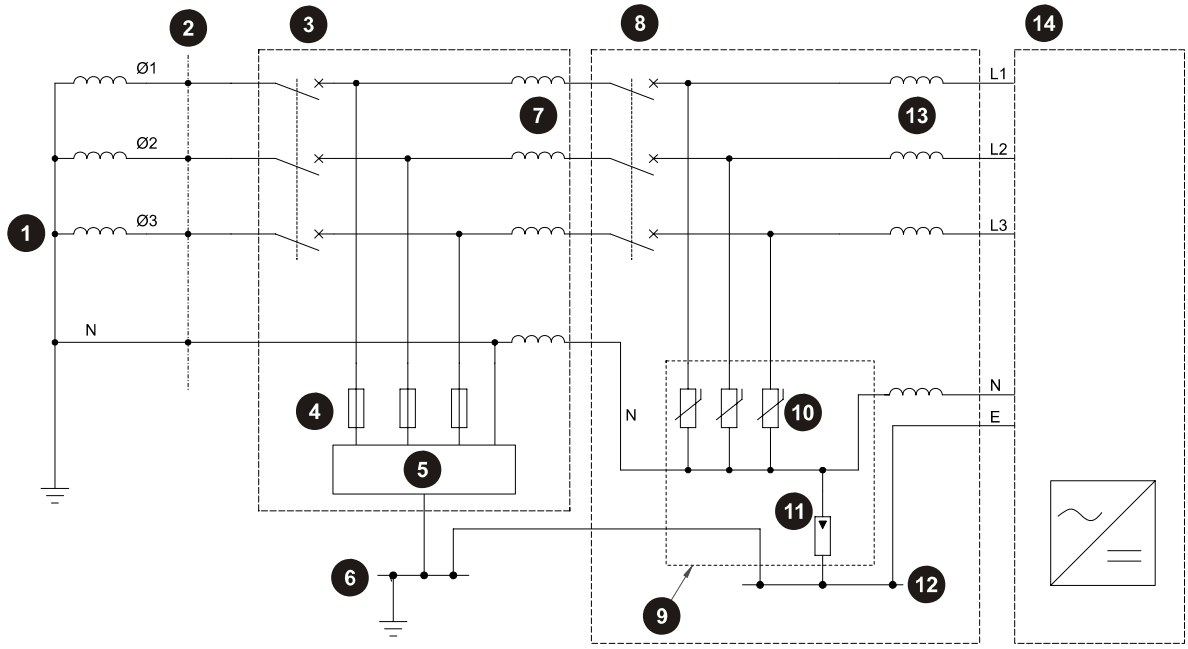
Installation

Install the transient protection according to the following diagram.



1. Supply transformer
2. Building entrance
3. Main switchboard
4. Fuses
5. Primary transient protection (refer to text for rating)
6. Building earth/ground busbar
7. Primary/secondary surge decoupling coils (4, refer to text for rating)
8. AC sub-switchboard or APS DC power system
9. Secondary transient protection
10. MOVs (3, phase-neutral, refer to text for rating)
11. Spark gap (neutral-earth)
12. Switchboard earth/ground busbar
13. Secondary/Tertiary surge decoupling coils (4 x 11μH minimum)
14. Access Power Rectifiers

Transient protective devices are fitted with alarm contacts and visual indicators. Monitor the status of all externally installed transient protective devices. Either:

- Regularly inspect the visual indicators
- Connect the alarm contacts to the MOV Fail termination on the I/O board (preferred option) or to the building management system. See the Connections diagram on page 7 for location of MOV Fail termination (YH3) and connector pin-outs on page 64.

The alarm signal lines of the external transient protective devices must be isolated from the AC supply (by voltage-free relay contacts) before connecting these signal lines to the APS DC power system.

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Commissioning

Before starting these Commissioning tasks:

- Complete all the Installation tasks (see details)
- Complete all the Start-Up tasks (see details on page 38)
- 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 78
2	System Controls	See details on page 80
3	System Alarms	See details on page 85
4	Digital Inputs	See details on page 89
5	Digital Outputs (Relays)	See details on page 89

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 display and in DCTools 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 and in DCTools 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
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 and in DCTools 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.
Total System Current (High current test)	• Repeat the load test. • Ensure the system current displayed on the SC200 and in DCTools is within specification.	None
Load Current (No current test)	• Disconnect the load bank from the system. • Ensure the load current displayed on the SC200 and in DCTools is 0 amps.	Adjust the current offset setting of the SC200.
Battery Current (No current test)	• Disconnect the load bank from the system. • Ensure the battery current displayed on the SC200 and in DCTools is 0 amps.	Adjust the current offset setting of the SC200.
Total System Current (No current test)	• Disconnect the load bank from the system. • Ensure the total system current displayed on the SC200 and in DCTools is 0 amps.	None
Temperature	• With thermometer, measure the temperature at the power system temperature sensor. • Ensure the temperature input displayed on the SC200 and in DCTools 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 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 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

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Test	Test procedure	Adjustment
Generator Start Option 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 Start*. • Ensure the *Generator Start* digital output activates. • Turn on the AC. • Ensure the *Generator Start* 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. • Monitor the battery current to ensure the *Battery Current Limit* control function is operating.	None
Current Share Note 6	• View the individual rectifier currents with the SC200 or DCTools. • 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

Test	Test procedure	Adjustment
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 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. • Ensure the *Battery Test* stops and the system voltage returns to the float voltage setting. • Clear the *Battery Test Fail* alarm in DCTools. • 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 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

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Test	Test procedure	Adjustment
Low Voltage Disconnect – Manual Operation Note 7	• Set the LVD manual control to *CONNECT*. • Ensure the LVD contactor is connected. • Ensure the SC200 displays an *LVD Manual* alarm. • Ensure the I/O board LVD LED is on. • Set the LVD manual control to AUTO. • Ensure the SC200 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 displays an LVD Manual alarm. • Ensure the I/O board LVD LED is off. • Set the LVD manual control to *AUTO*. • Ensure the LVD connects. • Ensure the SC200 shows no LVD alarms. • Ensure the I/O board LVD LED is on.	None
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 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 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 displays an *LVD Fail* alarm. • Ensure the I/O board LVD LED is flashing. • Reconnect the cables. • Ensure the LVD connects. • Ensure the SC200 shows no LVD alarms. • Ensure the I/O board LVD LED is on.	None

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 function may have to be turned off to allow the Fast Charge voltage to reach its value within the 1 minute test duration.
4. Refer to Generator Start Option for details.
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 function 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 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.
   For an explanation of LVD LED indications see Troubleshooting on page 44.

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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 LED status.
	  • SC200 display indication.
	  • DCTools alarm indication
	  • Remote alarm indication (PowerManagerII, SNMP traps, etc)
	  • 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 MCB (if fitted). • The rectifier will turn off. • Ensure alarm operates.	

Test	Test procedure	Adjustment
Multiple rectifier fail	• Turn off the AC MCBs to 2 rectifiers (if fitted). • The rectifiers will turn off. • Ensure alarm operates.	
Rectifier comms lost	• Remove a rectifier from the system. • 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 MCB feeding the load bank. • Ensure alarm operates.	
Battery Fuse Fail	• Turn off a Battery MCB or remove a Battery Fuse. • Ensure alarm operates.	
Battery Test Fail	• See Battery Test 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 80 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.	

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Test	Test procedure	Adjustment
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.	
Equalize	• For details see Equalize test in System Controls on page 80.	
Fast Charge	• For details see Fast Charge test in System Controls on page 80.	
Battery Test	• For details see Battery Test in System Controls on page 80.	
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 89.	
Battery Current Limit	• For details see Battery Current Limit test in System Controls on page 80.	
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.	

Test	Test procedure	Adjustment
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 alarms operates. • Increase the *Low AC Threshold* above the existing AC voltage. • Ensure alarms 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.	

Notes

1 Ensure Alarm Tracking is disabled. Ensure Temperature Compensation is enabled.

2 If the load is not connected to the load MCBs and if an electronic Fuse Fail detect circuits is installed, this test can also be performed as follows:

- Turn off the load MCB
- Connect a high impedance path >100kΩ) between the end load side of the MCB 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.

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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	• Set the *Test State* to *Relay Active* or *Relay Inactive*. • Ensure the digital output changes state and any remote alarms are extended. • Wait for the *Relay Test Duration* time. • Ensure the digital output state and any extended alarms 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 This digital output is typically configured as the *Monitor OK* relay. 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 to change any configuration file settings that were noted as incorrect during the Commissioning tests.

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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 Powerware DC product supplier or Eaton Corporation, Telecommunications Solutions Division. Telephone: +64 3 343 7448, Fax: +64 3 343 7446. Or email: CustomerServiceNZ@eaton.com

Date: _____

Customer Information

Company: _____

Postal Address: _____

_____

Return Address: _____
(Not PO Box)

_____

Telephone: _____ Fax: _____ Email: _____

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: _____

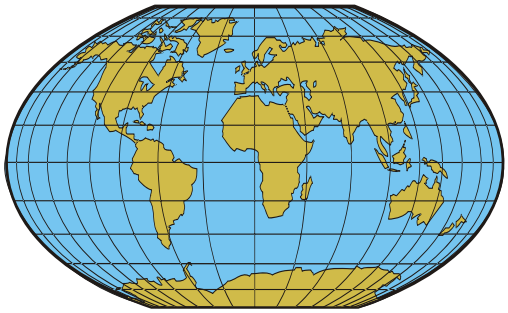
INFORMATION continued (fault details, circumstances, consequences, actions)

SG/03 ISS04

Worldwide Support

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

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



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