# *Data-Voice-Video 3G Power Solutions*

# *Installation and Operation Guide*

Issue: IPN 997-00012-54D

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**Refer to the separate SC200 or SC100 system controller handbook for full details of the system controller operation - dcpower.eaton.com/Manuals.asp**

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# About This Guide

## Purpose

This guide provides instructions to correctly install, commission and operate Eaton Data-Voice-Video 3G Power Solutions (DV2-3G).

## Audience

This guide is intended for use by:

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

## Scope

This guide covers installation, commissioning, operation and maintenance of Eaton Data-Voice-Video 3G 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.
- Installation and configuration of Eaton SiteSure and CellSure modules. For details, refer to the relevant guide listed under Related Information.

## Related Information

- PowerManagerII Online Help
- DCTools Online Help
- SC100 System Controller Operation Handbook – IPN 997-00012-63*
- 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

* Download from: http://dcpower.eaton.com/Manuals.asp.

## Reporting Problems with this Guide

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

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

## For Further Information and Technical Assistance

For further information and technical assistance see Worldwide Support on page 103.



IPN 997-00012-54D November 2012

# Table of Contents

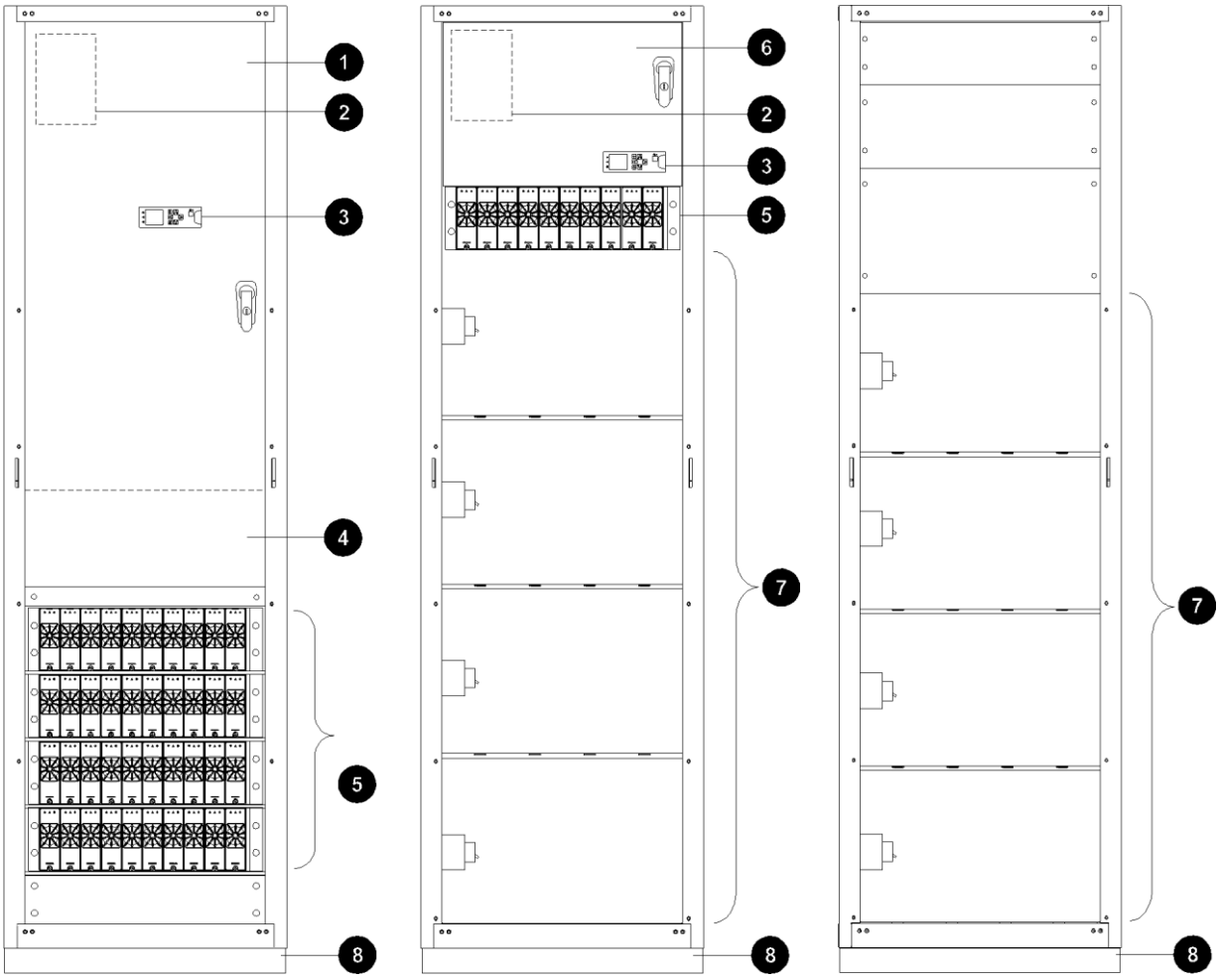
IPN 997-00012-54D November 2012

IPN 997-00012-54D November 2012

# General Description

## Overview

# Typical DV2-3G DC Power Systems




**Typical system (rectifiers only)**

**Typical system with integrated batteries**

**Battery rack (option)**

1. DC distribution section.
2. Input/Output (I/O) board (on back of door). See details on page 6.
3. SC200 or SC100 system controller. See details on page 4. (For more details refer to the relevant system controller handbook listed under Related Information.)
4. AC distribution with isolator switch and surge protection (located behind door in most models).
5. Rectifier magazine(s)* for up to 10 rectifiers per magazine. See details of rectifiers on page 3.
6. Combined ac and dc distribution section.
7. Battery shelves with battery MCBs. (A battery shelf front cover is also supplied, but is not shown.)
8. Optional plinth for use with raised floors (Eaton part number: PLINIR-A00). See details on page 20.
9. 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.*



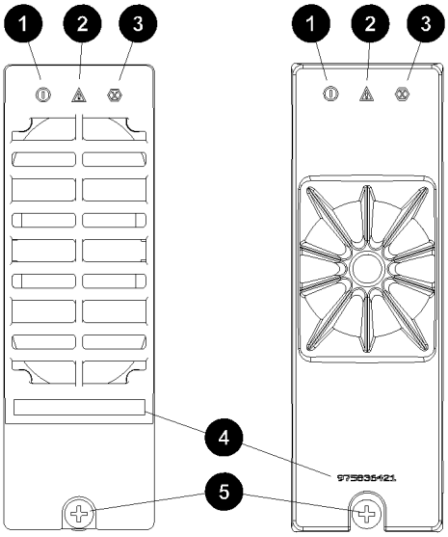


IPN 997-00012-54D November 2012

## Rectifiers

Data-Voice-Video 3G Power Solutions are fitted with either 48V, 2000W (APR48-ES); 48V, 1800W (APR48-3G); or 24V, 1440W (APR24-3G) rectifiers. The rectifiers are fan-cooled and hot-pluggable.

*See Specifications on page 69 for further information. See Troubleshooting on page 52 for details of rectifier alarms.*




Left: APR24-3G and APR48-3G
Right: APR48-ES

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

# System Controller

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

The system controller is supplied pre-configured. Configuration changes can be made with the keypad, or via a PC connected to the USB connector (SC200) or RS232 (SC100) connector. Or changes can be made remotely (see External Communications on page 8).

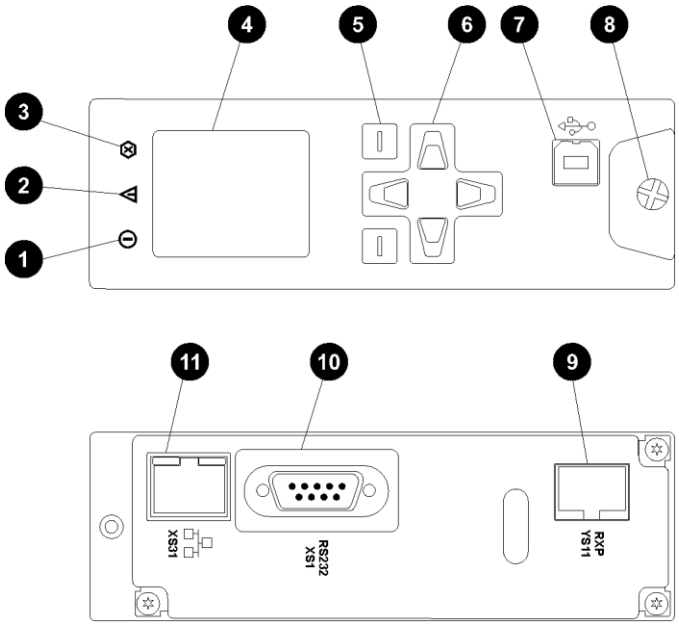
For basic operating information see System Controller on page 43. For further details refer to the System Controller Operation Handbook (see Related Information).

See Troubleshooting on page 52 for details of system controller alarms.

## SC200 System Controller

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

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



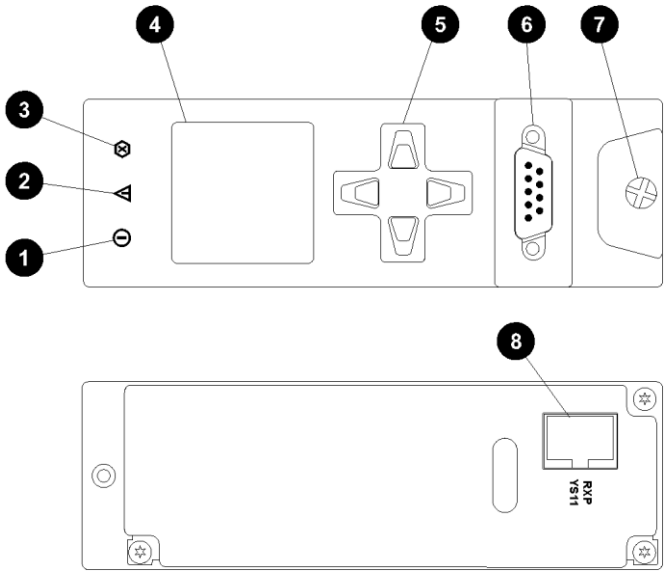

1. Power on LED (green)
2. Minor alarm LED (yellow)
3. Critical/Major alarm LED (red)
4. Color LCD
5. Soft keys (2)
6. Navigation keys (4)
7. USB 1.1 connector (12Mb/s)
8. Retaining screw
9. Power and system communications connector
10. RS232 connector
11. Ethernet connector and status LEDs



IPN 997-00012-54D November 2012

## SC100 System Controller

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




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

## Compatible Software

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

- DCTools Configuration Software. Latest version is available free from dcpower.eaton.com/downloads.
- PowerManagerII Remote Control and Monitoring Software. Contact your Eaton dc product supplier for further information (see Worldwide Support on page 103).
- Recommended web browsers (SC200 only): Microsoft Internet Explorer 8 or later (IE6 is compatible but with reduced performance), Mozilla Firefox 3.0 or later.

## Input/Output Board

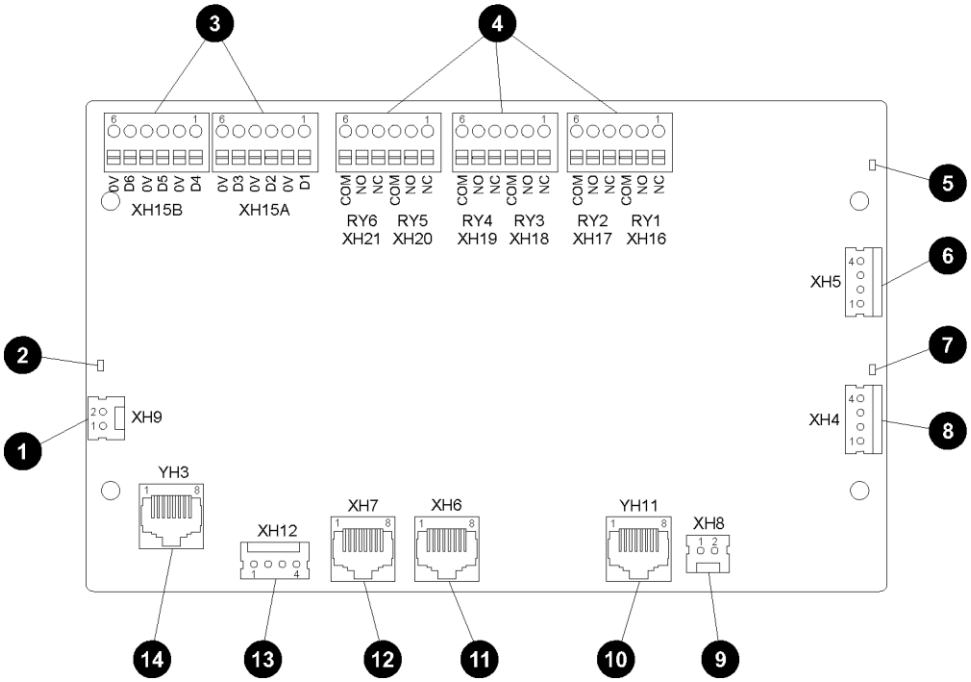
The input/output (I/O) board provides the I/O interfaces and connections for the SC200 or SC100 system controller.

The I/O board 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.

The I/O functions are:

| | |
|---|---|
| Sensors: | Current - 3, Bus voltage - 1, Temperature - 2, Battery Mid-point - 4 (SC200 only) |
| Input/Output: | Digital inputs: 4 pre-defined system functions, 6 user-defined<br>Relay outputs: 6 (one also used as Monitor OK alarm)<br>LVD contactor outputs: 2 |

*For input and output specifications see details on page 73. For connector pin-outs see details on page 80.*




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

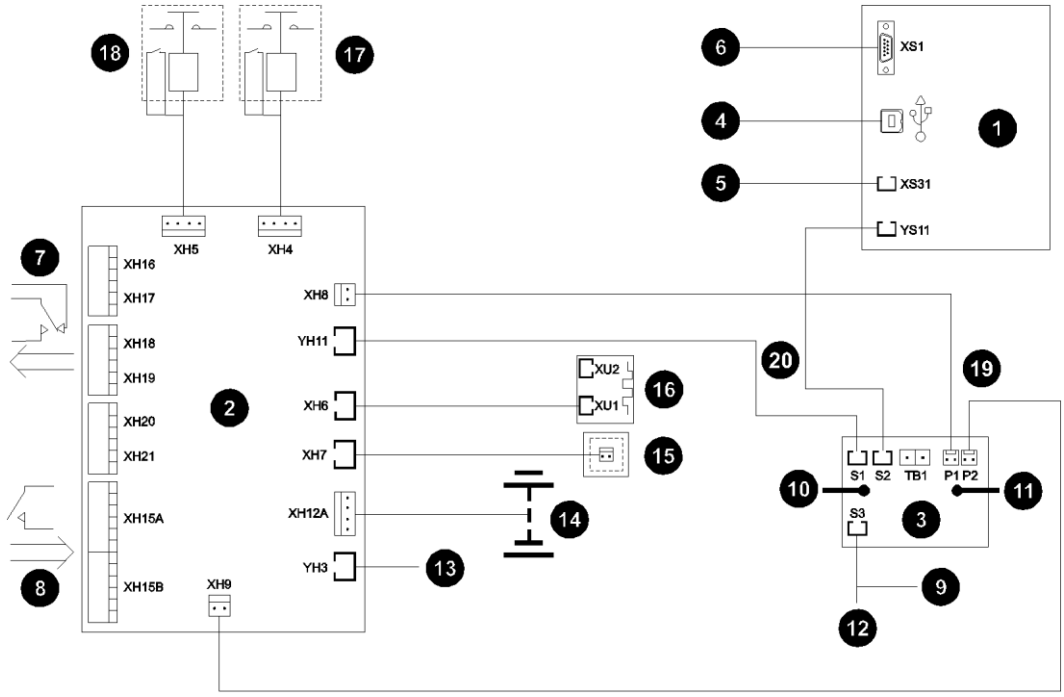
*See Troubleshooting on page 52 for details of I/O board LED signals.*



IPN 997-00012-54D November 2012

## Connections

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




1. SC200 or SC100 system controller
2. I/O board
3. Voltage feed module
4. USB communications (SC200 only)
5. Ethernet communications (SC200 only)
6. RS232 communications
7. Digital relay outputs (6) to external devices and/or alarm indication system
8. Digital inputs (6) from external voltage-free switches or relay contacts
9. Connection to additional I/O board(s) and/or SiteSure-3G I/O module(s) via RJ45 splitter (see details on page 32) (SC200 only)
10. Connection to dc common bus
11. Connection to dc live bus
12. Communications to rectifiers
13. DC power system digital inputs (Load Fuse Fail, Battery Fuse Fail, AC Distribution Fan Fail, AC Distribution MOV Fail)
14. Connections to battery mid-points (4) (SC200 only)
15. Connection to temperature sensors (2)
16. Connection to current sensors (3)
17. Optional LVD contactor and auxiliary switch (see details on page 8)
18. Optional LVD contactor and auxiliary switch (see details on page 8)
19. Bus voltage sense and LVD power connections
20. I/O and system controller power and RXP comms connections

*For connector pin-outs see details on page 80. For input and output specifications see details on page 69.*

# Other Features

## External communications

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

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

## Low Voltage Disconnect (LVD) option

Data-Voice-Video 3G 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 supply failure.

Refer to the SC200 or SC100 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 Data-Voice-Video 3G Power Solutions to measure battery and/or load currents. The Eaton CS04-A11 current sensor is also available to measure currents in larger systems. See details on page 83.

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



IPN 997-00012-54D November 2012

## Battery Mid-point Monitoring Description (SC200 only)

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

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

To connect Battery Mid-point Monitoring see details on page 27. If a *String Fail* alarm is generated see Troubleshooting on page 52.

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

## Battery Time Remaining

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

During a battery discharge, the SC200 or SC100 uses this characterization data to calculate an estimated time until the battery will reach the specified end voltage.

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

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

IPN 997-00012-54D November 2012

## Overview

# Warnings

This section contains important warnings. Read these warnings before installing or operating Data-Voice-Video 3G Power Solutions dc power systems.

### Electrical Safety

- The dc earth/ground link must be rated to carry the combined fault current of battery strings. See details on page 22.
- If the dc power system is to be installed in a location where the ambient temperature may rise above 45ºC (113ºF), then 105°C rated cable rated cable must be used for all connections.
- The dc power system is not compatible with IT (Impedance Terra) ac supply. For advice see Worldwide Support on page 103.
- 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 20.
- 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/maintain this equipment.
- Always use insulated tools.
- Do not short-circuit the live and common bus bars or cables.



IPN 997-00012-54D November 2012

### Batteries

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

### Rectifiers

- Only operate the rectifiers when the surrounding area is clean and 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 completed Equipment Incident Report on page **101**.
- Ensure that any upstream Residual Current Devices (RCDs) are appropriately rated for the rectifiers' maximum earth leakage current (see Specifications on page **69** for value).

### DC Distribution(s)

- The dc common bus 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.
- 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 and Maintenance

- The DV2-3G contains hazardous voltages and hazardous energy levels. Before undertaking any maintenance task refer to the Warnings on page 12.
- If a maintenance task must be performed on a "live" system then take all necessary precautions to avoid short-circuits or disconnection of the load equipment, and follow any "live-working" instructions applicable to the site.
- Only perform the maintenance tasks described in the Maintenance chapter. All other tasks are classified as Servicing. Servicing must only be performed according to specific instructions and only by personnel authorized by Eaton. This includes disassembly and/or servicing of any modules.
- For further information on Servicing contact your local Eaton dc product supplier, or refer to the contact details on page 103.

### EMC Compliance

- This dc power system 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. Do not use any damaged equipment.

Report any damage immediately, using a completed Equipment Incident Report on page 101.

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



IPN 997-00012-54D November 2012

## Overview

# Installation Tasks

Before starting the installation, review the following information:

- Required Equipment and Tools on page 65
- Warnings and Cautions on page 12
- Inspecting the Equipment and Reporting Damage on page 14

## 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. Also refer to the table of minimum cable sizes for specific MCBs or fuses on page 75. 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 bus has been earthed.



IPN 997-00012-54D November 2012

## 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 17 |
| 2 | Fixing the Power System Cabinet(s) | See details on page 20 |
| 3 | Connect the Output to Earth | See details on page 22 |
| 4 | Connect the dc Load Cables | See details on page 24 |
| 5 | Connect Battery Cables (if required) | See details on page 25 |
| 6 | Install the Batteries | See details on page 27 |
| 7 | Mount the Battery Temperature Sensor | See details on page 30 |
| 8 | Connect External Current Sensors/Shunts (if required) | See details on page 31 |
| 9 | Connect Input/Output Cabling (if required) | See details on page 31 |
| 10 | Connect Additional Input/Output (if required) | See details on page 32 |
| 11 | Connect Battery Fuse Fail (if required) | See details on page 32 |
| 12 | Connect to AC Supply | See details on page 33 |

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

# Task 1 - Check the AC Supply and Earthing

It is important that the ac supply for the Data-Voice-Video 3G 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.

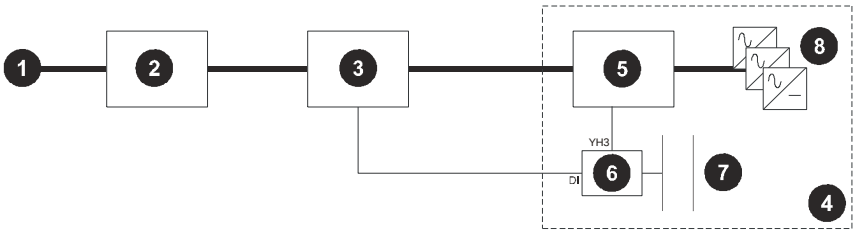
   *For more information see Transient Protection on page 85.*

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 the diagram on page 6 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 or SC100 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 69 are suitable for the DV2-3G.

   *Only use a delta (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(s).
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 the rectifiers is given in the Specifications on page 69.*



IPN 997-00012-54D November 2012

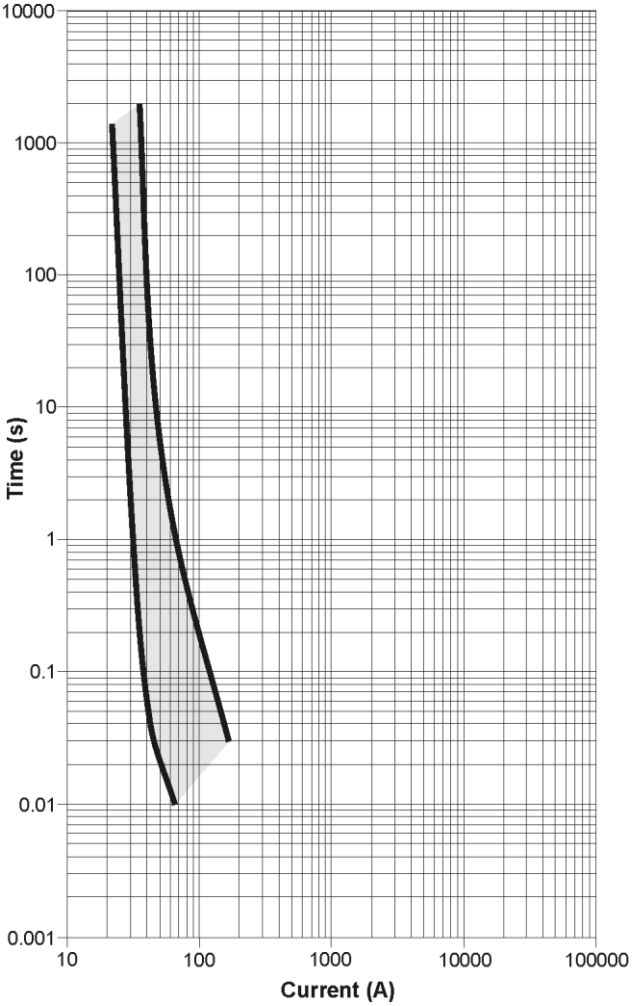
## Step 4 - Check ac discrimination

Each rectifier has 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 internal rectifier 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 (see Worldwide Support on page 103).

**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 see Transient Protection on page 85.*

**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.

Data-Voice-Video 3G 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.



IPN 997-00012-54D November 2012

## 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 completed Equipment Incident Report on page 101.

## 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.

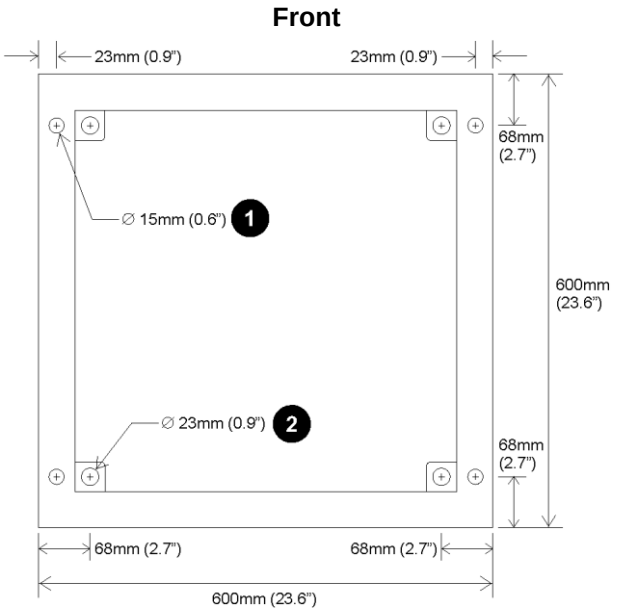
3 Before moving the cabinet(s), ensure that:

- 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.




1 Recommended fixing holes. Remove cabinet side panels to access.

2 Alternate fixing holes. Bottom rectifier magazine must be removed to access front two holes.

### 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 Output to Earth

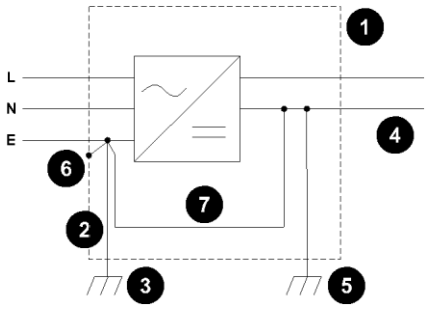
### Step 1 - Connect dc common busbar to earth

Install a separate conductor from the dc common busbar to the customer dc 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.*

### Step 2 - Check ac-dc Earth Link

A 50 $mm^2$ yellow/green ac-dc earth link is factory fitted in the dc power system as shown in the following diagram.




1. Rack cabinet
2. AC earth link
3. AC earth / communications earth
4. DC common bus
5. Customer dc earth
6. Cabinet bond
7. Factory fitted ac-dc earth link

If your installation uses a mesh earth, then Eaton recommends that this factory fitted ac-dc earth link is retained. No further action is then required (ignore Step 3).

However, if your policy is not to bond the ac/communications earth and dc earth, then go to Step 3.



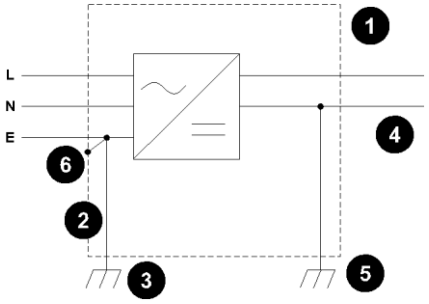
IPN 997-00012-54D November 2012

## Step 3 - Remove or replace the ac-dc Earth Link (if required)

**Ignore this Step if the factory fitted ac-dc earth link is used.**

There are two options if the ac-dc earth link cannot be retained. Either:

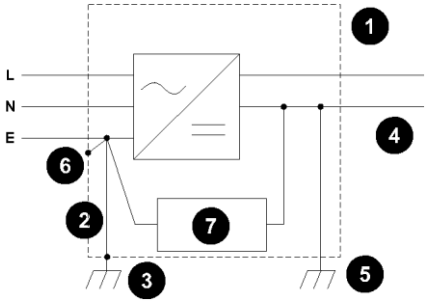
- If the site surge protection is designed to limit transient ac earth - dc earth voltages to less than 1500V at the dc power system, then remove the ac-dc earth link.




1. Rack cabinet
2. AC earth link
3. AC earth / communications earth
4. DC common bus
5. Customer dc earth
6. Cabinet bond

- Or, if the site surge protection is not designed to limit transient ac earth - dc earth voltages to less than 1500V at the dc power system, then replace the ac-dc earth link with a surge protection device.

*The transient protective device bonds the ac and dc earths during transient activity to prevent damage to the rectifiers. The preferred transient protective device is a transient earth clamp (TEC).*




1. Rack cabinet
2. AC earth link
3. AC earth / communications earth
4. DC common bus
5. Customer dc earth
6. Cabinet bond
7. Transient earth clamp surge protection device

*The path between ac earth and dc common bus (via the transient earth clamp) must be as short and straight as possible, preferably less than 500mm (20").*

The transient earth clamp must have the following minimum specifications.

| | |
|---|---|
| • Nom. dc Spark-over Voltage | 600V |
| • Impulse Spark-over Voltage at 1 kV/µs | < 1400V |
| • Nom. Impulse Discharge Current – 8/20µs wave shape | 20kA |
| • Insulation Resistance at 100V | $\geq 10^{10}\ \Omega$ |
| • Capacitance | < 1.5pF |

*A larger transient earth clamp with a high kA rating must be used if the potential severity of a lightning strike is high.*

## Procedure complete

# Task 4 - Connect the DC Load Cables

A wide range of dc distribution modules is available for Data-Voice-Video 3G Power Solutions with MCBs or fuses or both.

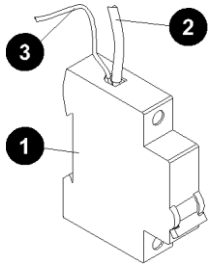
## Step 1 - Access MCBs and/or fuses

☐ *See the diagram on page 2 for location of the dc distribution with the load MCBs/fuses.*

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

**Ignore this Step if the dc distribution does not have load MCBs.**

1. Switch off all load MCBs.
2. Terminate the load live cable(s) at the load MCB(s).
   - ☐ *The current rating of the MCBs must be derated to 80%.*
   - ☐ *Refer to the table of minimum cable sizes for specific MCBs on page 75.*
   - ☐ *Ensure that the fuse fail detection wires are properly terminated as shown.*
3. Terminate the load common cable(s) at the dc common bar.

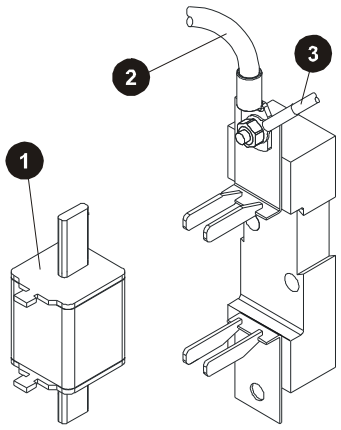



1. Load MCB
2. Load live cable
3. Fuse fail detection wire

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

**Ignore this Step if the dc distribution does not have load fuses.**

1. Remove all load fuse links.
2. Terminate the load live cable(s) at the load fuse(s).
   - ☐ *The current rating of the fuses must be derated to 75%.*
   - ☐ *Refer to the table of minimum cable sizes for specific fuses on page 75.*
   - ☐ *Ensure that the fuse fail detection wires are properly terminated as shown.*
3. Terminate the load common cable(s) at the dc common bar.




1. Load fuse link
2. Load live cable
3. Fuse fail detection wire

## Procedure complete





IPN 997-00012-54D November 2012

# 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)

**Ignore this Step if the dc distribution has battery MCBs or fuses (go to Step 2). 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 battery fuses (if required)

**Ignore this Step if the dc distribution does not have battery fuses. See the diagram on page 2 for location of the dc distribution.**

1. Remove all battery fuse links.

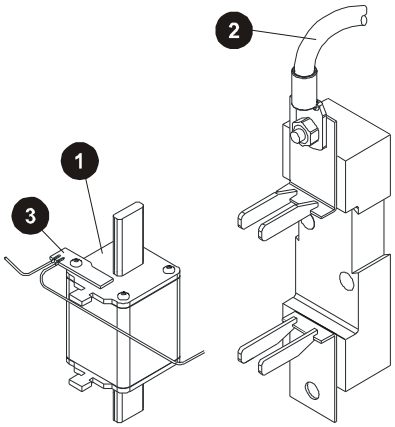
   *Ensure that the fuse fail detection boards are fitted as shown.*
   *(When a fuse link is replaced ensure the board is removed from the blown fuse and re-fitted to a new striker type fuse link).*

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

   *The current rating of the fuses must be derated to 75%.*

   *Refer to the table of minimum cable sizes for specific fuses on page 75.*

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

**Step 3 - Connect battery cables to battery MCBs (if required)**

**This Step only applies to a rectifier cabinet without integrated battery shelves. Ignore this Step if the dc distribution does not have battery MCBs. See the diagram on page 2 for location of the dc distribution.**

1. Switch off all battery MCBs.
2. Terminate the battery live cable(s) at the battery MCB(s).
   - *The current rating of the MCBs must be derated to 80%.*
   - *Refer to the table of minimum cable sizes for specific MCBs on page 75.*
3. Terminate the battery common cable(s) at the dc common bar.

**Procedure Complete**



IPN 997-00012-54D November 2012

## 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.
- See Warnings on page 12.

The following are recommended Battery Installation Practices. These supplement any specific installation instructions from the battery manufacturer.

**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 strings 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.

**Connecting the Batteries**

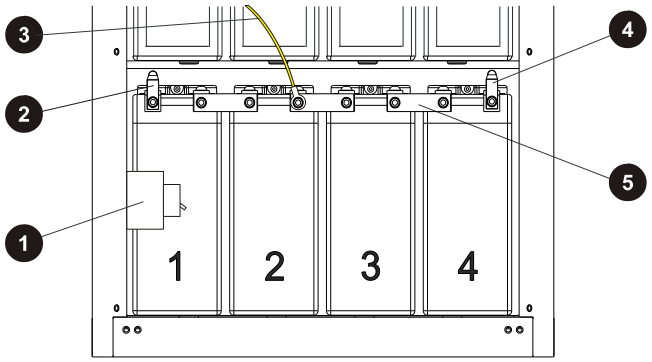
- Only terminate battery cables and interconnecting bars after confirming that the termination will not create a short circuit.
- Always use insulated tools.
- Always tighten battery terminal bolts according to the battery manufacturer's specification. Failing to do so can cause erratic battery performance, 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.
- Check that loose cables cannot make contact with other cables or terminals which may be live.

### Installation procedure

The following procedure applies to batteries installed in the Data-Voice-Video 3G 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.




1. Battery MCB
2. Live (negative) lead
3. Battery Mid-point Monitoring sense wire (SC200 only)
4. Common (positive) lead
5. Interconnecting links

**Typical battery arrangement (-48V)**

## 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.
5. If required, route one of the Battery Mid-point Monitoring sense wires from XH12A on the input/output board (see location on page 2) to the battery shelf (SC200 only).

   *Connect the wire from XH12A pin 1 to string 1, and so on.*

## 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).



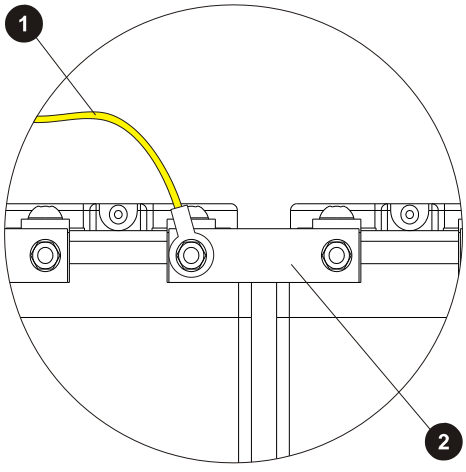
IPN 997-00012-54D November 2012

## 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 connect the Mid-point monitoring sense wire (SC200 only).
7. Repeat procedure for batteries 1 and 2.




1. Mid-point sense wire from XH12A on the input/output board (SC200 only)
2. Middle interconnecting link

## 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 - Insulate any unconnected sense wires (SC200 only)**

Insulate and secure any un-connected Battery Mid-point Monitoring sense wires.

**Step 9 - Replace the battery shelf front cover(s)**

**Procedure complete**

## Task 7 - Mount the Battery Temperature Sensor

The DV2-3G is supplied with a battery temperature sensor and standard 8m (26 feet) long RJ45 cable, already connected to the IOBGP input/output (I/O) board to measure the ambient air temperature around the batteries. This is required for the temperature compensation control process.

**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 or the middle of the external battery stand.

   *Do not run the sensor cable along ac supply cables. Interference may cause false readings.*



IPN 997-00012-54D November 2012

**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 SiteSure-3G module.

See External Current Shunts/Sensors on page 83 for further installation information.

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

See Connect Additional Input/Output on page 32 for information on installing SiteSure-3G modules.

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

Refer to Input/Output Board on page 6 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 - Route cable to the I/O board**

See the diagram on page 2 for the location of the I/O board.

**Step 2 - Terminate the cabling**

- Connect only voltage-free switch or relay contacts to Digital Inputs.
- Do not exceed the voltage and current limits of the relay contacts.
- For wire size and I/O ratings see Specifications on page 73.

1. Terminate the cable as in the diagram on page 6.
2. Use cable ties to secure the cable and prevent strain on the connectors.

**Step 3 - Set up SC200 or SC100**

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).*

**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.

## 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 the 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. See Related Information.

# Task 11 - Connect Battery Fuse Fail (if required)

*This Task only applies to a system with one or more additional battery cabinets with MCBs.*

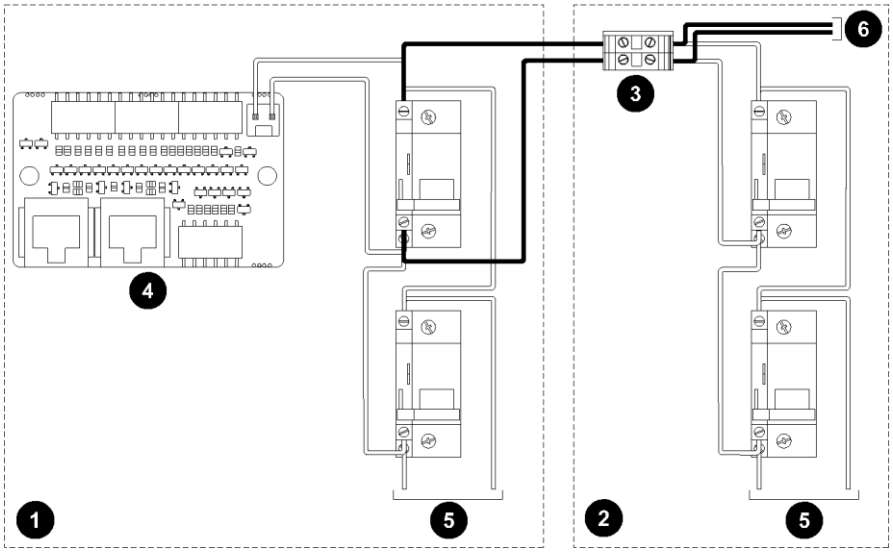
## Step 1 - Connect battery MCB fuse fail detect wires (if required)

Use 2-core 0.5mm² flex (or similar) to connect from the terminal block in the battery cabinet to the auxiliary switch on the first battery MCB in the rectifier rack (see following diagram).

*All auxiliary switches are connected in parallel. The auxiliary switch contacts will close when an MCB is OFF.*



IPN 997-00012-54D November 2012




1. Rectifier cabinet with integrated battery shelves.
2. Additional battery cabinets with MCBs.
3. Battery MCB fuse fail detect wires connected to terminal block in the battery cabinet.
4. Fuse fail detect board in Rectifier cabinet.
5. Fuse fail detect wires to other battery MCBs.
6. Connection to other battery cabinets (if required).

**Step 2 - Connect to other battery cabinets (if required)**

Extend the wiring to the terminal block(s) in any additional battery cabinets.

**Procedure complete**

## Task 12 - 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 105°C rated cable rated cable must be used for all connections.
- Only use a three-phase (Δ) ac supply 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)**

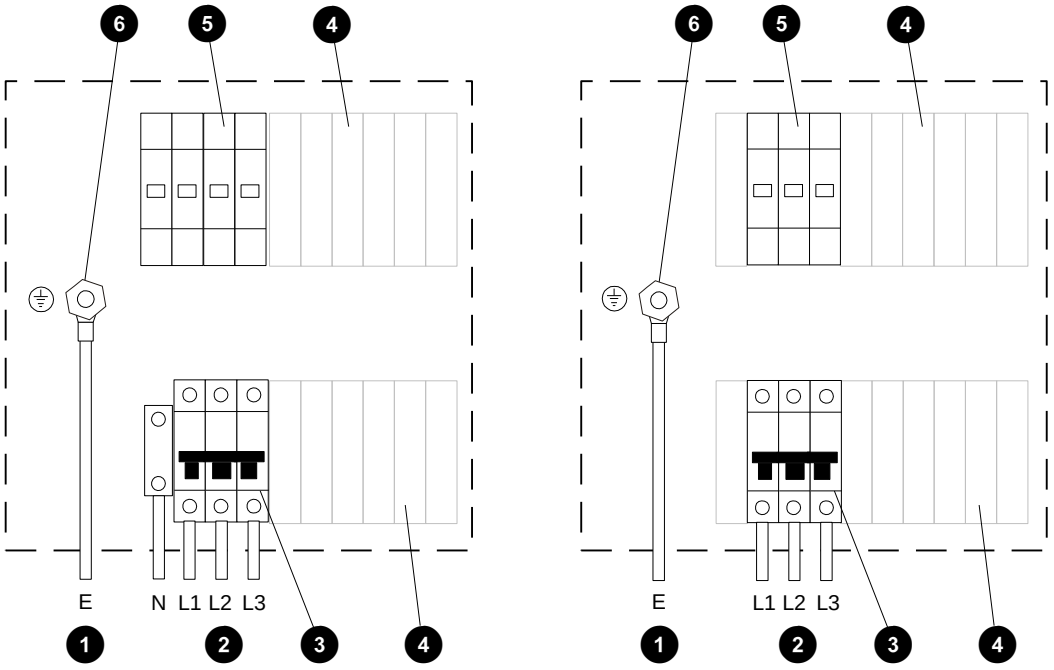
**Ignore this Step if system does not have integrated battery shelves (go to Step 2).**

*1* The ac MCBs are fitted in the combined ac and dc distribution section. See 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.




**Typical arrangement with Neutral**

**Typical arrangement without Neutral**

1. Earth cable to rack earth stud.
2. Phase and Neutral (if fitted) cables.
3. AC isolator switch (1, 2 or 3-phase as required). May be fitted next to MOVs depending on model.
4. Rectifier or magazine MCBs (arrangement depends on model)
5. Surge protection MOVs (2, 3 or 4 as required).
6. AC earth termination point.

*Other cables not shown for clarity.*

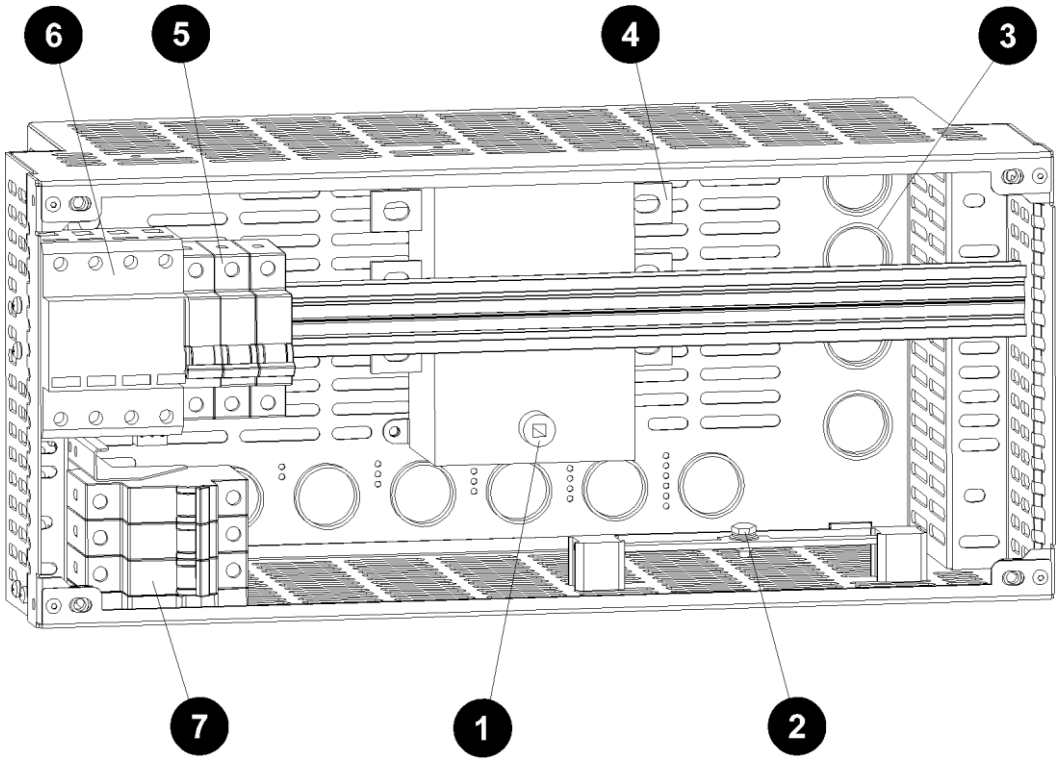
## Step 2 - Access ac MCBs (systems without integrated battery shelves)

**Ignore this Step if system has integrated battery shelves (see Step 1).**

1. The ac MCBs are fitted in the ac distribution. See 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.



IPN 997-00012-54D November 2012




❶ AC isolator switch (shaft not shown)
❷ Neutral bar termination (if fitted)
❸ AC cable entry glands
❹ Isolator switch terminals
❺ Rectifier MCBs (3 only shown)
❻ Surge protection MOVs
❼ MOV MCB (located next to MOVs 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 3G 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) |

**See Specifications on page 69 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 69) 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, 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.

### 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. Follow the instructions in Start-Up on page 38 to make the system operational.



IPN 997-00012-54D November 2012

## 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 39 |
| 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.

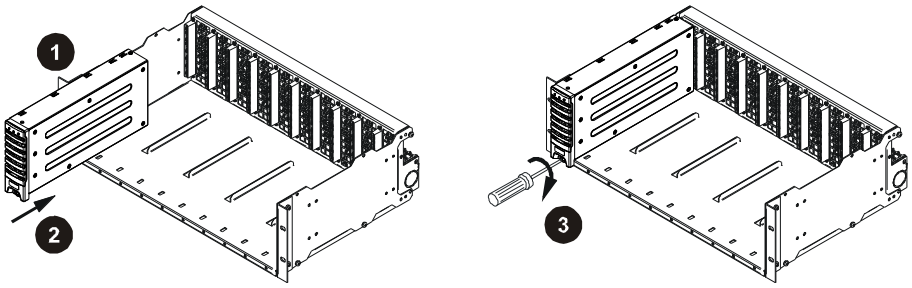
## Step 1 - Unpack the rectifiers

Unpack the rectifiers and inspect them carefully for possible transport damage. Report any damage immediately using a completed Equipment Incident Report on page 101.

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

## Step 2 - Fit first rectifier

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






IPN 997-00012-54D November 2012

**Step 3 - Repeat for other rectifiers or fit blank panels**

1. Fit the rectifiers in positions 1-4-7-2-5-8-3-6-9-10 to balance the load on the three ac phases.
2. Fit rectifier blank panels in any vacant rectifier positions.

**Procedure complete**

## Task 2 - Pre-Power-Up Checklist

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

| | |
|---|---|
| ☐ | All cabling is installed, securely tied and correctly insulated |
| ☐ | Upstream surge protection is fitted (see Input Transient Protection on page 85) |
| ☐ | Earth bonding is correct (see details on page 22) |
| ☐ | 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 (or the first, if more than one).
   - Rectifier(s) start up (after the startup delay).
   - The rectifier alarm LEDs will turn on for a short time.
   - The SC200 or SC100 system controller will turn on (green Power On LED is on) when dc power is available from the rectifier(s).
   - During start-up of the SC200 or SC100 system controller, the yellow alarm LED on the rectifier(s) will flash until rectifier registration is completed.

4 After start-up of the SC200 or SC100:

- Press any key to silence the alarm.

  *Depending on the configuration file settings, the alarm LED(s) may be on and the SC200 or SC100 will display some system alarm messages. This is normal. For an explanation of alarm messages see Alarm Descriptions in the System Controller Operation Handbook.*

- The LCD module shows the default screen. See details on page 45.

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

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

5 Check for correct operation of the rectifier(s). Check only the green Power On LED(s) are on (no alarm LEDs).

- Use the SC200 or SC100 keypad to check that all rectifiers are registered. See details in the System Controller Operation Handbook.

6 If any problems see Troubleshooting on page 52. Otherwise switch on all remaining rectifiers.

## Task 4 - Configuring the DC Power System

The operational settings of the dc power system are stored in a configuration file loaded into the SC200 or SC100 system controller. See details on page 44.

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

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

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

| Parameter | Action | Where to find | |
|---|---|---|---|
| Float Voltage | Set to the value recommended by the battery manufacturer. | SC100: | Menu > Configuration > System > Edit > Float Voltage |
| | | SC200: | Control Processes > Voltage Control > Float Voltage |
| | | DCTools: | Control Processes > Voltage Control > Float Voltage |
| Battery Capacity | Set to the rated 10 hour capacity of the installed battery strings, or set to zero if no battery connected. | SC100: | Menu > Configuration > System > Edit > Battery Capacity >Edit |
| | | SC200: | Battery > Battery > Battery Capacity |
| | | DCTools: | Batteries |
| Cells Per String | Set to the number of cells in each battery string (if battery connected). | SC100: | Menu > Configuration > Temp Compensation > Edit > Cells Per String |
| | | SC200: | Battery > Battery > Cells Per String |
| | | DCTools: | Batteries |



IPN 997-00012-54D November 2012

| Parameter | Action | Where to find | |
|---|---|---|---|
| Temperature Compensation | Enable (if battery and battery temperature sensor connected) and check the settings. | SC100: | Menu > Configuration > Temp Compensation > Edit |
| | | SC200: | Control Processes > Temp. Compensation > Enable |
| | | DCTools: | Control Processes > Temperature Compensation |
| Low Voltage Disconnect (LVD) | Enable (if LVD(s) installed and battery connected) and check the settings. | SC100: | Menu > Configuration > LVD1/LVD2 |
| | | SC200: | Battery > LVDs > LVD x |
| | | DCTools: | Control Processes > LVD |
| System controller time (SC200 only) | Connect using Web to set correct time manually or connect using DCTools to synchronize to PC time. See details in the System Controller Operation Handbook. | Web: | Configuration > Time |
| | | DCTools: | Configuration > Time > Time Synchronization |

## Task 5 - 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 and does not exceed the maximum load rating (see details on page 69).

**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).

   *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 see the Commissioning check lists on page 89.

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

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

For information on alarms, or operation problems see Maintenance on page 51.



IPN 997-00012-54D November 2012

# Configuration File

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

The SC200 or SC100 is supplied pre-loaded with a configuration file. If this configuration file has been customized for the site then no further configuration changes will be necessary.

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

Some settings in the configuration file can be edited using the system controller's keypad (see details on page 46), or all settings can be edited using a PC/laptop with DCTools (see details on page 48) or remotely, see Communications Options in the System Controller Operation Handbook.

## Backup and Restore

The configuration file settings in the SC200 or SC100 can be saved to (Backup) or loaded from (Restore) a PC/laptop using DCTools.

Backup and Restore can be used to:

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

### ► To use DCTools for Backup and Restore

1. Connect to the SC200 or SC100 with DCTools. See Communications Options in the System Controller Operation Handbook.
2. In DCTools go to *File* > *ICE Backup/Restore* and follow the prompts.

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

### ► To use a web browser for Backup (SC200 only)

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



IPN 997-00012-54D November 2012

► **To use a web browser for Restore (SC200 only)**

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

2 Go to *Tools*.

3 Select *Restore Tool*.

4 Select the file type:

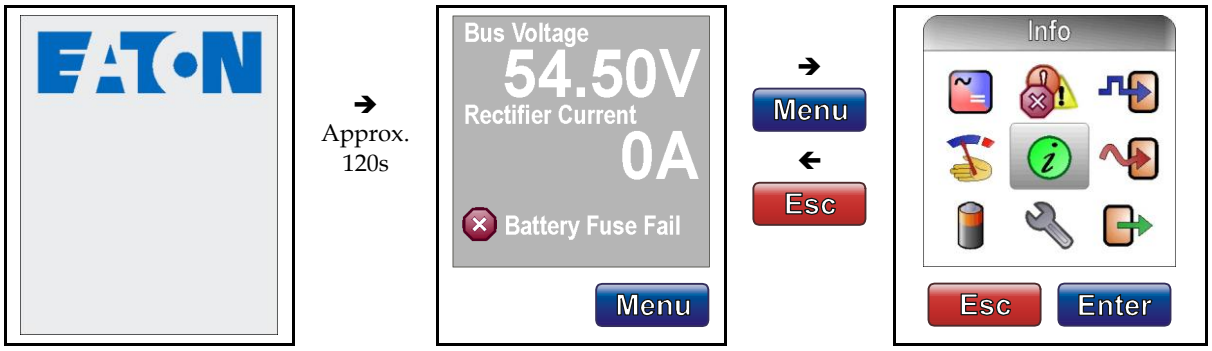
- **System Snapshot (*.dcs):** Configuration file including site specific settings.
- **Configuration (*.dcc):** Configuration file without site specific settings - Site Identity, IP Address, S3P Address, battery characterization data).
- **Fragment (*.dcf):** Restore part of a configuration file (such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

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

## Starting the SC200 or SC100

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

### SC200




**Start-up screen**

**Main screen**

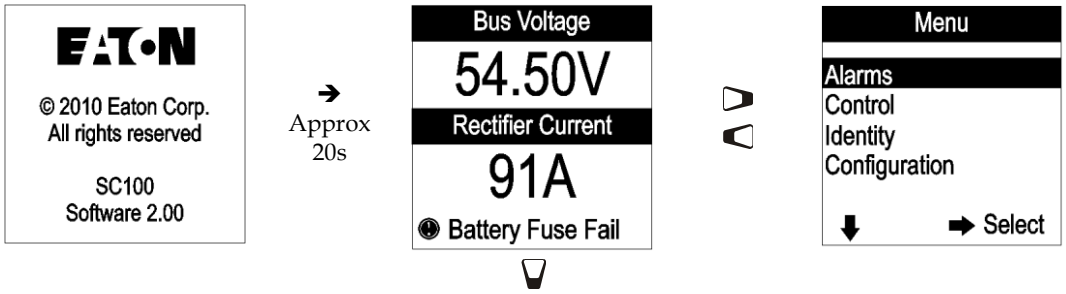
*The values shown are configurable, see details in the System Controller Operation Handbook. All active Critical, Major, Minor and Warning alarms are displayed.*

**Menu screen**

*See navigation details on page 77.*

*If Logon is required see Keypad Access Security on page 46.*

### SC100




**Start-up screen**

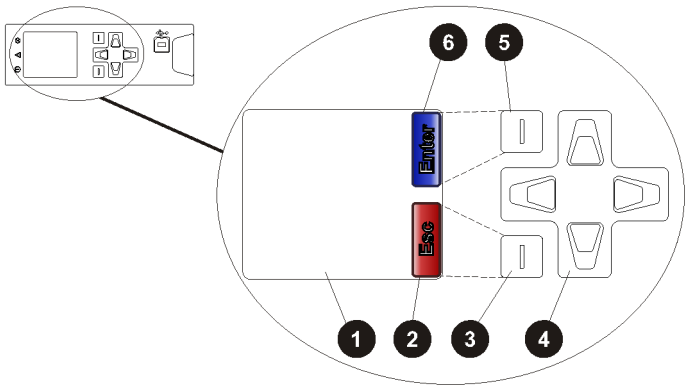
**First status screen**

*All active alarms are displayed.*

**Main menu**

*See details on page 78.*

# SC200 or SC100 Operation using the Keypad and Screen




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

## Keypad Access Security

### SC200 System Controller

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

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

- All communications are disabled (see S3P Access and HTTP/HTTPS Access in the System Controller Operation Handbook), and
- Keypad access is *Read Only*, or *PIN Protected* and the keypad access PIN is lost.

The SC200 will continue to function, but no configuration changes can be made. Contact your Eaton dc product supplier or Eaton for advice (see Worldwide Support on page 103).

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

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

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

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

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



IPN 997-00012-54D November 2012

### SC100 System Controller

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

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

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

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

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

  *Keypad access is now temporarily enabled. Keypad access control reverts back to Protected mode after the display goes back to the Summary screen.*

## Alarm Indicators

#### Visual indicators

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

#### Audible indicator

- One beep – indicates an invalid key press
- Three beeps every 2 seconds – refer to the alert message on the display (SC200 only)
- One beep every 2 seconds – Minor alarm is active
- Continuous sound – Critical/Major alarm is active

  *Critical/Major alarms always override Minor alarms.*

► **To stop the audible indicator**

- Press any key

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

► **To enable/disable the audible alarm indicator**

Either:

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

Or:

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

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

# SC200 or SC100 Operation Using a PC/Laptop

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

## Using DCTools via USB (SC200 only)

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

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

Before you start you will need:

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

► **To connect a PC/laptop to the SC200:**

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

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

   *If connection is not successful refer to DCTools Help (press F1) or Troubleshooting on page 52.*
5. For details of the SC200 control and monitoring functions available via *DCTools see* System Operation in the System Controller Operation Handbook.

   *For help using DCTools press F1.*

## Using DCTools via RS232

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

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

Before you start you will need:

- The latest version of *DCTools* available from: dcpower.eaton.com/downloads.
- A PC/laptop with USB port (for use with SC200) or RS232 port (for use with SC100)



IPN 997-00012-54D November 2012

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

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

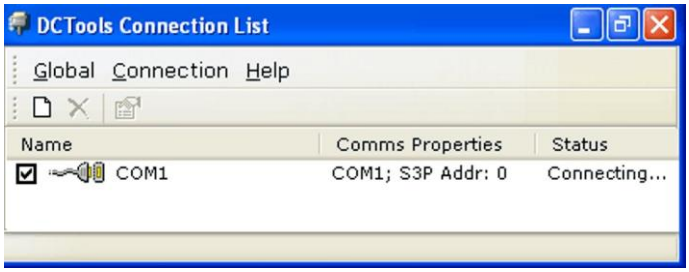
2 Install *DCTools* on the PC/laptop.

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

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

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

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

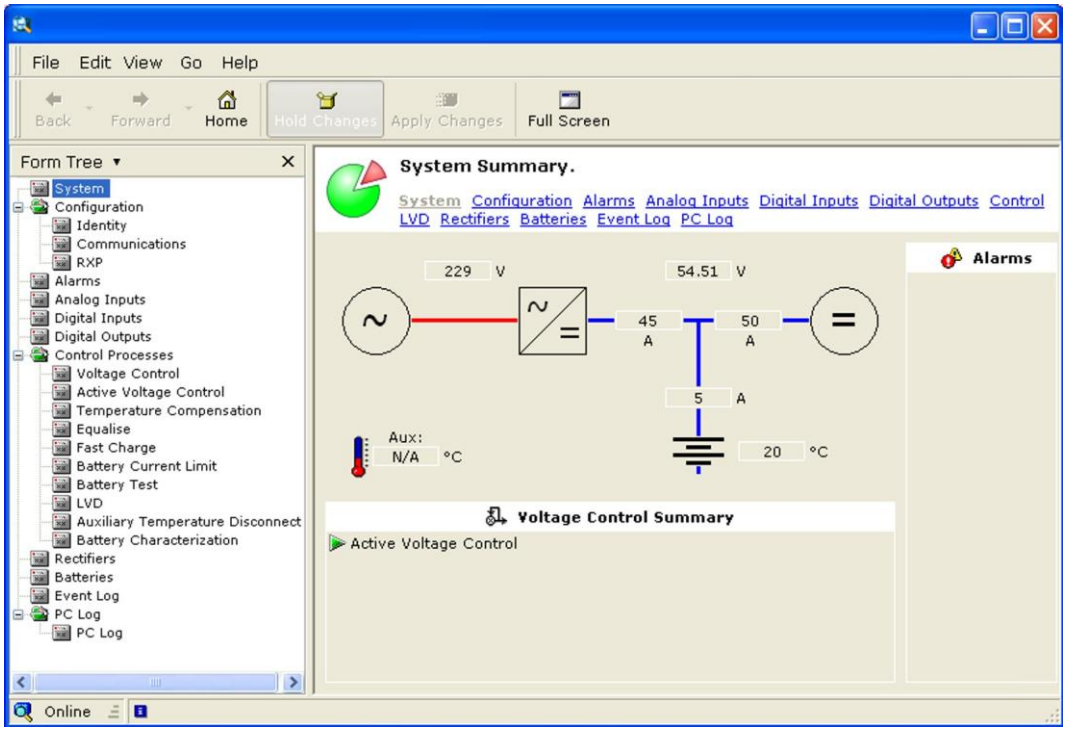



5 *DCTools* will now connect to the SC200 or SC100.

*If connection is unsuccessful refer to DCTools help (press F1) or Troubleshooting on page 52.*

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

*For help using DCTools press F1.*



## SC200 or SC100 Identity Information

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

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

If required, the following site specific information can be stored in the SC200 or SC100 to assist site management.

| Parameter | Description | Where to find: |
|---|---|---|
| System Manufacturer | The manufacturer of the dc power system. | DCTools: Configuration > Identity |
| System Type | The DV2-3G model number. | |
| System Serial Number | The DV2-3G serial number. | |
| System Location | Location of DV2-3G at the site. | |
| Site Name | Name of the site. | |
| Site Address | Address of the site. | |
| Site Notes | Any notes relevant to site access, location or other matters. | |
| Contact | Contact name, phone number, and so on. | |
| Configuration Name | Reference name of the configuration file in the SC200 or SC100. | |



IPN 997-00012-54D November 2012

## Overview

- The DV2-3G contains hazardous voltages and hazardous energy levels. Before undertaking any maintenance task refer to the Warnings on page 12.
- If a maintenance task must be performed on a "live" system then take all necessary precautions to avoid short-circuits or disconnection of the load equipment, and follow any "live-working" instructions applicable to the site.
- Only perform the maintenance tasks described in the Maintenance chapter. All other tasks are classified as Servicing. Servicing must only be performed according to specific instructions and only by personnel authorized by Eaton. This includes disassembly and/or servicing of any modules.
- For further information on Servicing contact your local Eaton dc product supplier, or refer to the contact details on page 103.

# Troubleshooting

Use the table to troubleshoot minor installation and operational problems. For additional assistance see contact details on page 103. Return items for replacement or repair with a completed Equipment Incident Report on page 101.

| Problem | Possible Cause | Required Action |
|---|---|---|
| SC200 or SC100 alarm. | | See Troubleshooting in the SC200 or SC100 Operation Handbook. |
| All rectifiers are off (no LEDs on) and system controller display is blank. | AC supply to the system is off and the batteries are fully discharged or disconnected. | Restore ac supply. |
| Green LED of one or more rectifiers is off. | AC supply to rectifier(s) off or one or more phases are off. | Restore the ac supply. |
| | Rectifier(s) not fully inserted. | Insert rectifier and tighten retaining screw. |
| | Internal rectifier fault. | Remove the rectifier and insert another one in the same slot. If second rectifier fails to start then there is a fault with the rectifier position. Check ac connections.<br>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 in the System Controller Operation Handbook. |
| Rectifier yellow LED flashes | The system controller is starting. | Wait for system controller to complete start-up. |
| | Rectifier has not registered with the system controller. | Remove, and then re-insert the rectifier.<br>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.<br>If second rectifier registers, then first rectifier is faulty and must be returned for service. |



IPN 997-00012-54D November 2012

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

| Problem | Possible Cause | Required Action |
|---|---|---|
| High system output voltage. | Temperature Compensation is active and the battery temperature is below the reference temperature. | None. This is normal operation (if batteries are connected). Disable Temperature Compensation if no batteries connected. |
| | Equalize or Fast Charge is active. | None. Output voltage will return to normal when Equalize or Fast Charge is completed. |
| | Incorrect float voltage setting at system controller. | Correct the float voltage setting of the system controller.<br>Record new setting. |
| | Faulty rectifier. | Locate the rectifier with the highest output current and remove this one first.<br>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.)<br>Replace faulty rectifier with one that is working.<br>Return the faulty rectifier for service. |
| System has no dc output (rectifiers are on). | Load fuse or MCB open. | Check for open fuse or MCB. |
| | LVD contactor has disconnected the load. | Use *DCTools to c*heck LVD is enabled and set to correct values. (LVD status LED on the I/O board is on when contactor is energized.)<br>Check that the I/O board is connected (Power LED is on).<br>Check that the LVD control and power cables connections on page 7.<br>Check the connections from the load bus to the LVD. |
| System has no battery input | Battery MCBs or fuses open. | Check for open battery MCBs or fuses. |
| | LVD has disconnected the battery because ac supply is off and the battery is fully discharged. | None. The battery will be automatically reconnected when the ac supply is restored. |
| | LVD contactor is open. | Use *DCTools to c*heck LVD is enabled and set to correct values. (LVD status LED on the I/O board is on when contactor is energized.)<br>Check that the I/O board is connected (Power LED is on).<br>Check that the LVD control and power cables are connected. See Connections on page 7.<br>Check the connections from the battery bus to the LVD. |



IPN 997-00012-54D November 2012

| Problem | Possible Cause | Required Action |
|---|---|---|
| String Fail Alarm (SC200 only) | The Battery Mid-point Monitoring system has detected a voltage imbalance in one of the battery strings. | See Battery Mid-point Monitoring on page 63. |
| | A Battery Mid-point Monitoring sense wire is disconnected. | Check the sense wires. |
| I/O board Power/Comms OK LED is off | I/O board is not powered or faulty. | Check connection to YH3 on I/O board. See Connections on page 7.<br>Replace I/O board if faulty. |
| I/O board Power/Comms OK LED is flashing. | I/O board is responding to an *Identify* command from the SC200 or SC100. | None, this is normal operation. See details in the System Controller Operation Handbook. |
| LVD Status LED(s) (on I/O board) are on. | LVD contactor is energized. | None, this is normal operation. |
| LVD Status LED(s) are off (I/O board Power On LED is on). | LVD contactor is de-energized. | None, this is normal operation. |
| LVD Status LED(s) flashing. | The contactor is in the wrong state (SC200 or SC100 internal state does not match signal from contactor auxiliary switch). | Check the electrical and mechanical operation of the contactor and auxiliary switch.<br>Check all wiring and connectors. See Connections on page 7. |
| | *LVD Type* setting is incorrect. | Check *LVD Type* setting. |
| LVD contactor(s) not operating. | LVD settings incorrect. | Check LVD is enabled and set to correct values. See details in the System Controller Operation Handbook.<br>Check that the LVD manual control is set to AUTO. See details in the System Controller Operation Handbook.<br>Check that the contactor is correctly configured and mapped to the I/O board. See details in the System Controller Operation Handbook (SC200 only). |
| | Contactor is disconnected. | Check the control and dc power cables are connected. See details on page 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 63, on page 85. |
| | 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 or SC100 problems. | | See Troubleshooting in the SC200 or SC100 Operation Handbook. |

# Replacing or Adding a Rectifier

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

- To reduce the risk of electric shock and maintain optimum system cooling, always cover empty rectifier slots with blanking panels.
- To avoid electric shock do not place hands inside the rectifier shelf.
- Do not attempt to disassemble faulty rectifiers. Return them (in their original packaging) with a completed Equipment Incident Report on page 101.

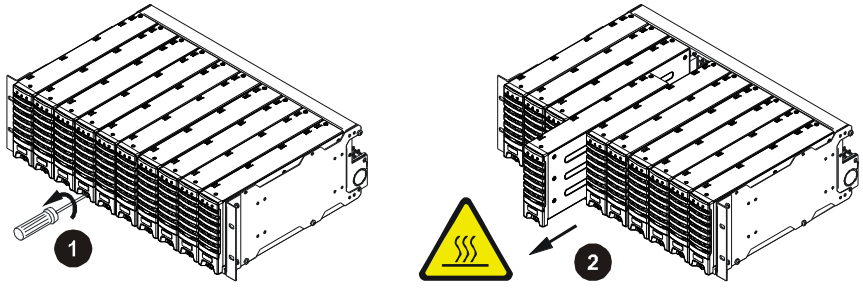
### Removing a Rectifier

**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.




**Step 3 - Replace rectifier or fit blank panel**

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

**Procedure complete**

### Installing a Replacement Rectifier

**Step 1 - Remove rectifier blank panel (if fitted)**

**Step 2 - Align the rectifier with the guides**

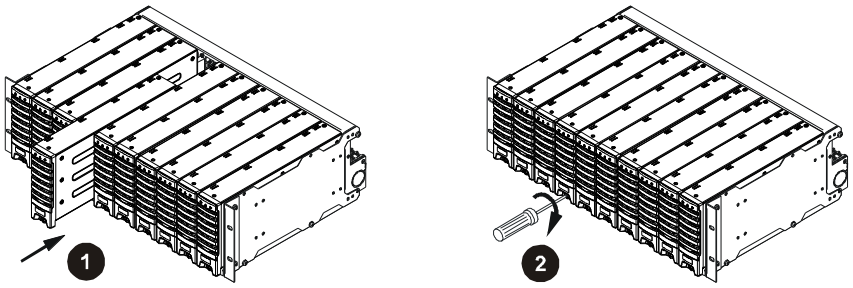


IPN 997-00012-54D November 2012

**Step 3 - Push in the rectifier**

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

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




**Procedure complete**

## Replacing or Adding a Load MCB

**Step 1 - Access MCBs**

1. The load MCBs are located in the distribution space. See the 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**

*The dc distribution can use either Chint or Schneider circuit breakers. However, Chint and Schneider circuit breakers are not interchangeable. When replacing existing circuit breakers or fitting new ones, use the type that is already in use (see Spare Parts on page 66 for ordering details).*

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 24, ensuring that the load cable size is sufficient for the MCB (see details on page 75).

**Procedure complete**

## Replacing a Load or Battery Fuse Link

**Step 1 - Access the fuses**

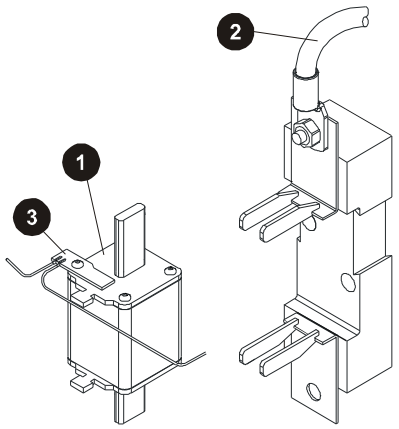
The load fuses are located in the distribution space. See the diagram on page 2.

**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**



IPN 997-00012-54D November 2012

# Adding a Load Fuse

### Step 1 - Access the fuses

1. The load fuses are located in the distribution space. See the 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 67.

### 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 24, ensuring that the load cable size is sufficient for the fuse (see details on page 75).

### Procedure complete

# Replacing the System Controller

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

Before you start you will require:

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

  **See Communications Options in the System Controller Operation Handbook.*
- A replacement SC200 or SC100 system controller.

  *A new system controller is factory loaded with a 48V (nominal) default configuration file. DCTools (SC200 only) can be used to modify the configuration file already loaded in a system controller. However, a system controller configured for a particular nominal system voltage (48V or 24V) can only be converted to the other nominal system voltage by loading a new configuration file.*
- A copy of the appropriate configuration file, either:
  - use the configuration file saved from the existing system controller, or
  - contact your Eaton dc power system supplier to obtain a master configuration file to suit the dc power system. This file will have to be customized for the site.

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

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

*See Backup and Restore on page 44.*

### Step 2 - Remove the system controller

1. Open the distribution space door to access the rear of the system controller.
2. Label, and then disconnect the cables from the rear connectors.

   *When the system controller stops communicating the rectifier output voltage will be unchanged for 2 minutes. After 2 minutes the rectifier output voltage will change to the Float Voltage and the rectifier yellow LEDs will flash.*
3. Undo the four retaining screws.
4. Remove the SC200 or SC100.

### Step 3 - Insert the new SC200 or SC100

1. Insert the SC200 or SC100 and tighten the retaining screws.
2. Connect the cables to the rear connectors.

   *The system controller will start. See Starting the SC200 or SC100 on page 45. Various alarms may appear because of incorrect configuration file settings. Press any key to silence the alarm.*

### Step 4 - Download the configuration file

1. Connect to the system controller with *DCTools*. See details on page 48 in the System Controller Operation Handbook.
2. If a copy of the old configuration file, or a master configuration file is available, then use *DCTools* to restore (download) it to the new system controller.

   *See Backup and Restore on page 44 in the System Controller Operation Handbook.*

   *If you receive an error message about the MIB file version, please contact your Eaton dc product supplier for advice.*
3. If a copy of the old configuration file, or a master configuration file is not available, then use the keypad or *DCTools* to change the configuration settings to the correct values (provided the system controller is set for the correct nominal system voltage).

### Step 5 - Check the system controller operation

1. Map the I/O board (SC200 only):
   - In DCTools go to: *RXP*.
   - Copy the I/O board serial number(s) from the *RXP Devices* table to the *I/O Board to Serial Number Mapping* table to map an *IOB Number* to each I/O board (overwrite an existing serial number if required).

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



IPN 997-00012-54D November 2012

### Step 6 - LVD Characterization Alarm

If LVD(s) are fitted the system controller may indicate an LVD Characterization alarm.

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

1. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
2. If available, select *Characterize With IOB Values*. Press *Enter*. Repeat for other LVD(s) if fitted. No further action is required.
3. If *Characterize With IOB Values* is not available, the LVD(s) must be characterized. This will cause the LVD(s) contactor(s) to disconnect for a few seconds:
   - If a battery disconnect LVD is fitted, then the load equipment will continue to be powered by the rectifiers.
   - If a load disconnect LVD is fitted, then connect a temporary bridge cable from the rectifier bus to the load bus to power the low priority load equipment when the load LVD disconnects. See Replacing the Input/Output Board.
4. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
   - Select *Characterize*. Press Enter.

     *The LVD contactor will disconnect and connect.*
   - Repeat for other LVD(s) if fitted.
5. Remove the LVD bridge cable if fitted.

### Procedure Complete

Return the faulty system controller with a completed Equipment Incident Report on page 101.

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

  **See Communications Options in the System Controller Operation Handbook.*
- A replacement input/output board.
- An anti-static wrist strap to prevent damage to the static sensitive components on the input/output board.
- 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 67.

## Step 2 - Remove the I/O board

1. The I/O board is located on the back of the distribution space door. See the 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. See Equipment Incident Report on page 101.

## 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 see Troubleshooting on page 52.

*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.*

## Step 4 - Update I/O board mapping (SC200 only)

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

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

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

**Ignore this Step if there is no LVD Characterization Error alarm.**

1. On the SC200 go to: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2
2. 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 LVD is a battery disconnect LVD then the load equipment will continue to be powered by the rectifiers.
   - If LVD 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: Battery > LVDs > LVD x > Not Characterized > Edit, or on the SC100 go to: Menu > Configuration > LVD1/LVD2

   *The LVD contactor will disconnect and connect. When the characterization is complete the LVD Characterization Error alarm will clear.*
3. Repeat for other LVD(s) if fitted.



IPN 997-00012-54D November 2012

**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 see Input Transient Protection on page 85.

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 ac sub-switchboard or dc power system's ac distribution module for secondary transient protection.

### *Monitoring the MOVs*

MOVs are fitted with alarm contacts and visual indicators. Connect these alarms to the system controller 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 Mid-point Monitoring (String Fail) Alarm (SC200 only)

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

**Step 1 - Identify the faulty battery string**

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

**Step 2 - Check cell/monobloc voltages**

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

**Step 3 - Check cell/monobloc terminals**

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

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

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

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

**Procedure complete**

## Battery Disposal and Recycling

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

For assistance contact your local hazardous waste facility or Worldwide Support on page 103.





IPN 997-00012-54D November 2012

# Equipment and Tools

## Safety Equipment

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

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

## Essential Tools

Standard electrical toolkit with insulated tools, plus:

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

## Recommended Tools

- Laptop with:
  - USB port (for use with SC200) or RS232 port (for use with SC100)
  - DCTools software (download from dcpower.eaton.com/downloads).
- Test load (to suit maximum output of dc power system)
- Labeling tool and labels
- Clamp-on ammeter

## Spare Parts

| Item | Description | Part Number |
|---|---|---|
| 1 | Rectifier<br>See replacement procedure on page 56. | 48V, 2000W: Eaton APR48-ES<br>48V, 1800W: Eaton APR48-3G<br>24V, 1440W: Eaton APR24-3G |
| 2 | Rectifier blank panel<br>(to cover un-used rectifier positions) | Eaton RMB1U-00 |
| 3 | System controller<br>See replacement procedure on page 59. | Eaton SC100-00 or SC200-00 |
| 4 | Input/Output Board.<br>See replacement procedure on page 61. | Eaton IOBGP-01 |
| 5 | USB A/B cable for use with SC200 system controller | RadioShack 55010997, Jaycar WC7700, or equivalent. |
| 6 | RS232 DB9 F/F Null-modem cable - for use with SC100 system controller | RadioShack 55010600, Jaycar WC7513, or equivalent.<br>(Cross-over connections: 5-5, 2-3, 3-2) |
| 7 | SiteSure-3G Input/Output Module (optional)<br>(SC200 only) | Eaton IOBSS-00. See details on page 32. |
| 8 | Dual temperature sensors (2m leads) | Eaton TS2-200 |
| 9 | Battery Mid-point Monitoring connection kit for use with SC200 (for two battery strings) | Eaton MPTLOOM-3300 (2 x 3m sense wires), or<br>Eaton MPTLOOM-7600 (1 x 7m, 1 x 6m sense wires) |
| 10 | Chint or Schneider circuit breakers | Contact Eaton |



IPN 997-00012-54D November 2012

## 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.

| Thread Size ISO Coarse | Minimum - Maximum Torque |
|---|---|
| M2.5 | 0.3 - 0.4Nm (2.7 - 3.5 inch-pounds) |
| M3 | 0.5 - 0.6Nm (4.5 - 5.3 inch-pounds) |
| M4 | 1.1 - 1.3Nm (9.8 - 11.5 inch-pounds) |
| M5 | 2.3 - 2.7Nm (20.5 - 23.9 inch-pounds) |
| M6 | 3.9 - 4.5Nm (35 - 39 inch-pounds) |
| M8 | 9.5 - 11.1Nm (85 - 98 inch-pounds) |
| M10 | 18.7 - 21.9Nm (166 - 194 inch-pounds) |
| M12 | 32.8 - 38.4Nm (292 - 340 inch-pounds) |
| M16 | 81.5 - 95.1Nm (724 - 844 inch-pounds) |

**Notes:**

1. Torque settings are for mild steel, brass and stainless steel.
2. Torque is based on 60% of yield stress of the material. Yield for the purposes of this chart is 240MPa.
3. Tolerance range is 60 - 70 % of yield.
4. When a bolt and nut is torqued use a spanner to prevent rotation.
5. Use hand tools when loosening and tightening stainless steel fasteners. Lubricate bolts before tightening to prevent them locking up.

IPN 997-00012-54D November 2012

## System Input

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

## System Output

| | |
|---|---|
| Output Voltage (nominal) | 24V / 48V (dependent on rectifier model) |
| Output Power (maximum) | **Systems with integrated batteries:**<br>24V: APR24-3G rectifiers: 14.4kW*<br>48V: APR48-3G rectifiers: 18kW*<br>APR48-ES rectifiers: 20kW*<br>**Systems without integrated batteries:**<br>24V: APR24-3G rectifiers: 57.6kW*<br>48V: APR48-3G rectifiers: 72kW*<br>APR48-ES rectifiers: 80kW* |
| Output Voltage Range | 21.5 - 32V / 43 - 57.5V |

** subject to the maximum load currents as follows*

## Load Currents

| Module Type Number | Description | Load Current (Maximum) |
|---|---|---|
| DCDIX1618-010 | DV2-3G Distribution with Load MCBs - 16 x 18mm, Battery fuses - 2 x DIN02, Battery Shunt x 1. 600A capacity. | Load: 600A<br>Battery: 500A |
| DCDIX2418-101 | DV2-3G Distribution with Load MCBs - 12 x 18mm priority and 12 x 18mm non-priority, Load LVD x 1. 400A + 400A capacity. | 2*400A |
| DCMIX2418-000 | DV2-3G Distribution with Load MCBs - 24 x 18mm. 1000A capacity. | 1000A |
| DCMIX1627-000 | DV2-3G Distribution with Load MCBs – 16 x 27mm. 1000A capacity. | 1000A |
| DCFIX1000-000 | DV2-3G Distribution with Load fuses – 10 x DIN00. 1200A capacity. | 1200A |

| | | |
|---|---|---|
| DCFIX0602-000 | DV2-3G Distribution with Load fuses – 6 x DIN02. 1500A capacity. | 1500A |
| DCFIX0403-000 | DV2-3G Distribution with Load fuses – 4 x DIN03. 1500A capacity. | 1500A |
| DCFIX0404-000 | DV2-3G Distribution with Load fuses – 4 x DIN04. 2400A capacity. | 2400A |
| DCF14TPS-00 | DV2-3G Distribution with Load fuses – 14 x TPS. 600A capacity. | 600A |
| LVDIX0601-211 | DV2-3G LVD with Single 600A Contactor, Battery fuses – DIN03 x 2, Battery Current Shunt. | Load: 330A<br>Battery: 450A |
| LVDIX0602-211 | DV2-3G LVD with Dual 600A Contactors, Battery fuses – DIN03 x 2, Battery Current Shunt. | Load: 2*300A<br>Battery: 2*400A |
| LVDIX0602-011 | DV2-3G LVD with Dual 600A Contactors, CS04-A11 Current Shunt. | Load: 2*400A<br>Battery: 2*475A |
| LVDIX1001-000 | DV2-3G LVD with Single 1000A Contactor. | 800A |
| LVDIX1002-000 | DV2-3G LVD with Dual 1000A Contactors. | 2*800A |
| LVDIX2001-000 | DV2-3G LVD with Single 2000A Contactor. | 1600A |
| LVDIX2002-000 | DV2-3G LVD with Dual 2000A Contactors. | 2*1600A |
| DCFIX0203-001 | DV2-3G Distribution with fuses – 2 x DIN03, 945A capacity. | 2*472.5A |
| DCFIX0204-001 | DV2-3G Distribution with fuses – 2 x DIN04, 1875A capacity. | 2*937.5A |
| DCFIX0204A-010 | DV2-3G Distribution with fuses – 2 x EFEN 04A, 1 for Load, 1 for Battery with CS04-A11, Feed from -V00 | Load: 1200A<br>Battery: 1200A |
| DCFIX0204A-011 | DV2-3G Distribution with fuses – 2 x EFEN 04A For Loads, Feed from -HL0 | 2*1200A |
| DV2-A10B-400 | +E, RACKIX200, DOORIX8 (DCDIR1, No LVD, ACDIR410), RM10(x1), BTRAYIX(x4) | Max current per DCD and total load current: 337.5A |
| DV2-A10B-401 | +E, RACKIX200, DOORIX8 (DCDIR1, LVDIX401, ACDIR410), RM10(x1), BTRAYIX(x4) | Max current per DCD and total load current: 337.5A |
| DV2-A10B-402 | +E, RACKIX200, DOORIX8 (DCDIR1, LVDIX402, ACDIR410), RM10(x1), BTRAYIX(x4) | Max current per DCD and total load current: 337.5A |
| DV2-A20-4000 | +E, APR48-3G or APR48-ES, 3P+N+PE Star, RACKIX200, DOORIX34, (SC200, ACDIX425-10000), 1U, RM10(x2), 2U | 750A or 832A |
| DV2-A20-3000 | +E, APR48-3G or APR48-ES,3P+PE Delta, RACKIX200, DOORIX34,(SC200,ACDIX425-10000),1U,RM10(x2),2U | 750A or 832A |
| DV2-A40-4000 | +E, APR48-3G or APR48-ES, 3P+N+PE Star, RACKIX200, DOORIX28,(SC200,ACDIX425-10000),1U,RM10(x4),2U | 1500A or 1664A |



IPN 997-00012-54D November 2012

| | | |
|---|---|---|
| DV2-A40-3000 | +E, APR48-3G or APR48-ES,3P+PE Delta, RACKIX200, DOORIX28,(SC200,ACDIX425-10000),1U,RM10(x4),2U | 1500A or 1664A |
| DV2-A60-4000 | +E, APR48-3G or APR48-ES, 3P+N+PE Star, RACKIX200, DOORIX22,(SC200,ACDJX425-10000),1U,RM10(x6),2U | 2250A or 2496A |
| DV2-C12-4000 | +E,CR48-3G, 3P+N+PE Star, RACKIX200, DOORIX28,(SC200,ACDJX425-10000),1U,3U,RMC4(x3),2U | 1440A |
| DV2-C12-3000 | +E,CR48-3G, 3P+PE Delta, RACKIX200, DOORIX28,(SC200,ACDJX440-10000),1U,3U,RMC4(x3),2U | 1440A |
| DV2-C16-4000 | +E,CR48-3G, 3P+N+PE Star, RACKIX200, DOORIX28,(SC200,ACDJX425-10000),1U,RMC4(x4),2U | 1920A |
| DV2-C16-3000 | +E,CR48-3G, 3P+PE Delta, RACKIX200, DOORIX28,(SC200,ACDJX440-10000),1U,RMC4(x4),2U | 1920A |
| DV2-C20-4000 | +E,CR48-3G, 3P+N+PE Star, RACKIX200, DOORIX22,(SC200,ACDJX440-10000),1U,3U,RMC4(x5),2U | 2400A |
| DV2-C24-4000 | +E,CR48-3G, 3P+N+PE Star, RACKIX200, DOORIX22,(SC200,ACDJX440-10000),1U,RMC4(x6),2U | 2880A |

## Rectifiers

| | | |
|---|---|---|
| Operating Ranges<br>APR24-3G/APR48-3G: | Rated:<br>175 – 275V *Full output up to 50°C [122°F]*<br>Extended:<br>90 – 300V *Reduced output power below 175V* | |
| APR48-ES: | Rated:<br>185 – 275V *Full output up to 50°C [122°F]*<br>Extended:<br>90 – 300V *Reduced output power below 185V* | |
| Input Current (maximum)<br>*20°C [68°F]* | APR24-3G:<br>APR48-3G:<br>APR48-ES: | 9.5A @ 175V ac<br>12A @ 175V ac<br>12A @ 185V ac |
| Rated Output Power | APR24-3G:<br>APR48-3G:<br>APR48-ES: | 1440W<br>1800W<br>2000W |
| Rated Output Current | APR24-3G:<br>APR48-3G:<br>APR48-ES: | 50A @ 28.8V<br>37.5A @ 48V<br>41.7A @ 48V |
| Preset Voltage | APR24-3G:<br>APR48-3G:<br>APR48-ES: | 27V ± 0.1V<br>54.5V ± 0.1V<br>54.5V ± 0.1V |
| Rectifier Input 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:**<br>85kg [188 lb] typical<br>**Systems without integrated batteries:**<br>120kg [264 lb] typical<br>**Additional battery rack option:**<br>85kg [188 lb] typical |
| Rectifier module | 1.7kg [3.7 lb] |



IPN 997-00012-54D November 2012

### Digital Outputs/Alarm Relays (IOBGP)

| | |
|---|---|
| Number of Digital Outputs/Relays | 6 (one also used for Monitor OK alarm)* |
| Contact Arrangement | One changeover contact per relay |
| Contact Rating | 0.1A @ 60V dc maximum |
| Connectors | Screwless terminal blocks |
| Wire Size | 0.5 - 2.0mm$^2$ [20 - 14 AWG] |
| Maximum Cable Length | 20m (65 feet) |
| Isolation | Relay connections are isolated to 500V dc from all other circuitry, earth and system common. |

** Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200 or SC100.*

### Digital Inputs (IOBGP)

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

### Temperature Sense Inputs (IOBGP)

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

### Current Sense Inputs (IOBGP)

| | |
|---|---|
| Number of Current Sense Inputs | 3 (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 |
| Maximum Cable Length | 10m (32 feet) |
| Connector | RJ45 |

### Battery Mid-point Monitoring (SC200 only)

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

### Low Voltage Disconnect (IOBGP)

| | |
|---|---|
| Number of contactor connections | 2 per IOBGP I/O board |
| Number of LVD channels | SC100 systems: 2, SC200 systems: 16 |
| Contactor Type | Normally Open (NO) or Normally Closed (NC)*, with or without auxiliary contacts.<br>* For NC contactor operation the SC100 and IOBGP must be powered from the battery side of the LVD. |
| Contactor Coil Voltage (nominal) | With auxiliary contacts: 12V, 24V or 48V<br>Without auxiliary contacts: Equal to nominal system voltage |
| Maximum Hold-in Current | 1.2A (per contactor) |
| Maximum Cable Length | 3m (10 feet) |
| Connector | MTA156 (4-way) |

### Communications

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

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



IPN 997-00012-54D November 2012

### 18 mm DIN rail MCB's

| Eaton Part Number* | Chint NB1 Series | Max Load Current 80% of Current Rating | Minimum cable size |
|---|---|---|---|
| 307-900600-61 | Chint, NB1-63 UL Series, 6A, Curve | 4.8A | 1mm² / 16AWG |
| 307-901000-61 | Chint, NB1-63 UL Series, 10A, Curve | 8A | 1.25mm² / 16AWG |
| 307-901600-61 | Chint, NB1-63 UL Series, 16A, Curve | 12.8A | 2.5mm² / 12AWG |
| 307-902000-61 | Chint, NB1-63 UL Series, 20A, Curve | 16A | 4mm² / 10AWG |
| 307-902500-61 | Chint, NB1-63 UL Series, 25A, Curve | 20A | 4mm² / 10AWG |
| 307-903200-61 | Chint, NB1-63 UL Series, 32A, Curve | 25.6A | 6mm² / 8AWG |
| 307-904000-61 | Chint, NB1-63 UL Series, 40A, Curve | 32A | 10mm² / 6AWG |
| 307-905000-61 | Chint, NB1-63 UL Series, 50A, Curve | 40A | 16mm² / 4AWG |
| 307-906300-61 | Chint, NB1-63 UL Series, 63A, Curve | 50.4A | 16mm² / 4AWG |

### 27 mm DIN rail MCB's

| Eaton Part Number* | Chint DZ158-125 Series | Max Load Current 80% of Current Rating | Minimum cable size |
|---|---|---|---|
| 307-908019-61 | Chint, DZ158-125 Series, 80A, Curve | 64A | 25mm² / 2AWG |
| 307-910019-61 | Chint, DZ158-125 Series, 100A, Curve | 80A | 35mm² / 1AWG |
| 307-912519-61 | Chint, DZ158-125 Series, 125A, Curve | 100A | 50mm² / 0AWG |

** or local equivalent. Please contact your local Eaton sales office.*

### DIN Fuse Links

| Eaton Part Number | DIN Fuses | Max Load Current 75% of Current Rating | Minimum cable size |
|---|---|---|---|
| 305-910034-00 | DIN00 Fuse link, 100A | 75A | 35mm² / 1AWG |
| 305-912534-00 | DIN00 Fuse link, 125A | 93A | 50mm² / 0AWG |
| 305-916034-00 | DIN00 Fuse link, 160A | 120A | 70mm² /000AWG |
| 305-920034-02 | DIN02 Fuse link, 200A | 150A | 120mm² / 250KCMIL |
| 305-925034-02 | DIN02 Fuse link, 250A | 187A | 150mm² / 300KCMIL |
| 305-931534-02 | DIN02 Fuse link, 315A | 236A | 240mm² / 500KCMIL |
| 305-940034-02 | DIN02 Fuse link, 400A | 300A | 300mm² / 600KCMIL |
| 305-940034-03 | DIN03 Fuse link, 400A | 300A | 300mm² / 600KCMIL |
| 305-950034-03 | DIN03 Fuse link, 500A | 375A | 2*150mm² / 2*300KCMIL |
| 305-963034-03 | DIN03 Fuse link, 630A | 472A | 2*240mm² / 2*500KCMIL |
| 305-980034-04 | DIN04 Fuse link, 800A | 600A | 2*300mm² / 2*600KCMIL |
| 305-910034-04 | DIN04 Fuse link, 1000A | 750A | 4*150mm² / 4*300KCMIL |
| 305-912534-04 | DIN04 Fuse link, 1250A | 937A | 4*240mm² / 4*500KCMIL |
| 305-916034-05 | DIN04A Fuse link, 1600A | 1200A | 4*300mm² / 4*600KCMIL |
| 305-916037-00 | EFEN Fuse, NH-SI 4A 1600A, P/N 35097.0110 | 1200A | 4*300mm² / 4*600KCMIL |



IPN 997-00012-54D November 2012

## SC200 Menu

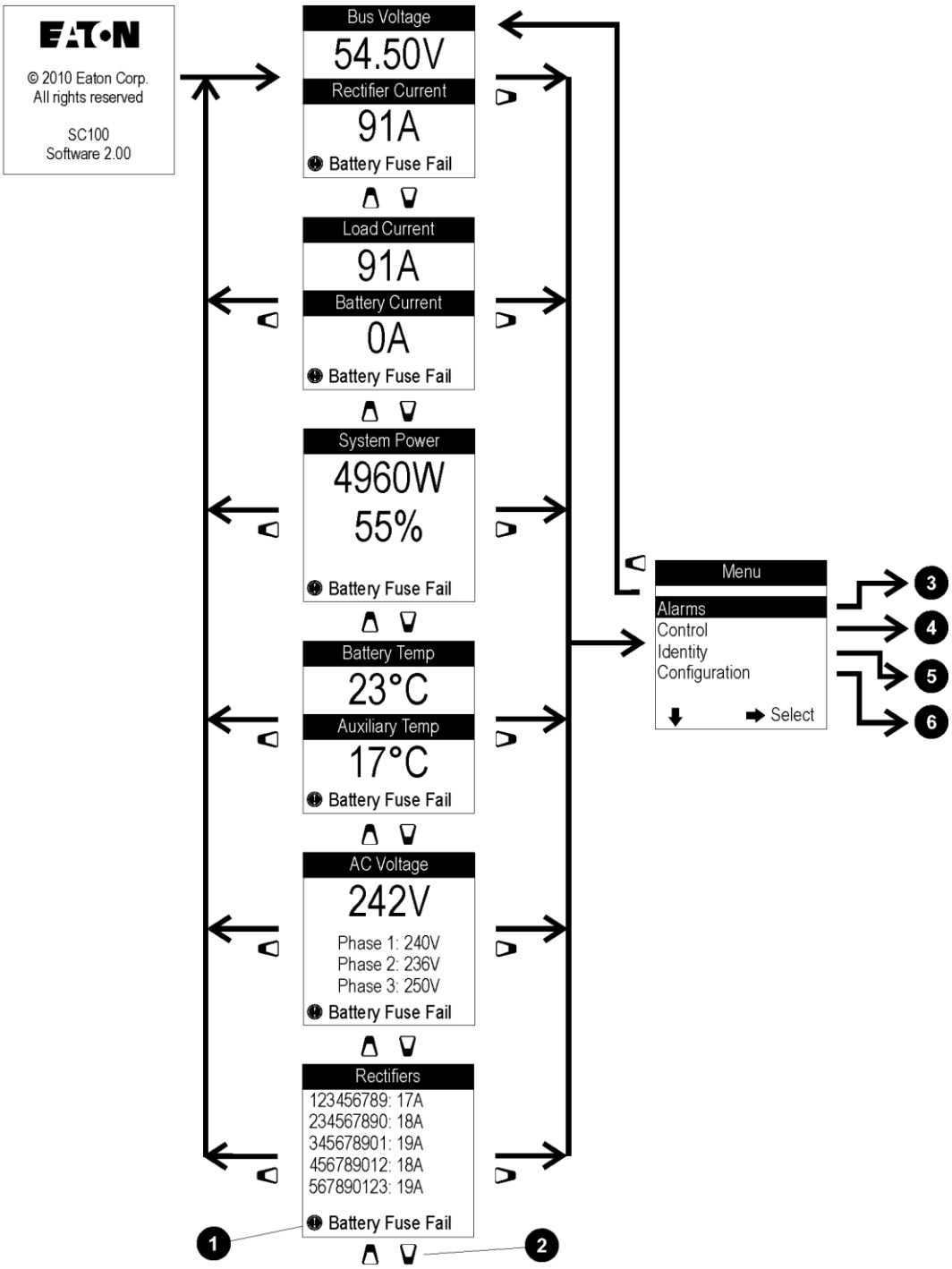

At each menu screen press *Enter* to access the associated configuration menu screen(s).

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

## SC100 Menu

The following diagram shows the Status Screens and main navigation.

*See Analog System Values for details of the values displayed.*




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

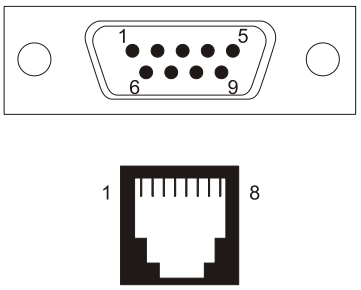




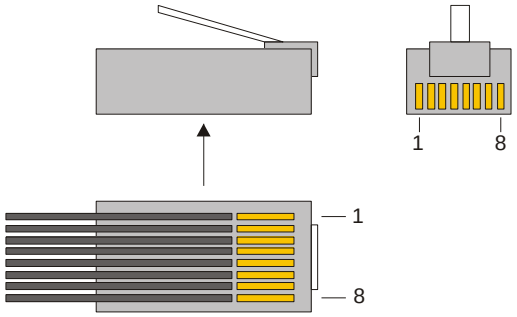
IPN 997-00012-54D November 2012

## System Controller Connector Pin-outs

| Connector | Type | Purpose | Pin | Description |
|---|---|---|---|---|
| XS1 | DB9M | RS232 Serial Interface | 1 | - |
| | | | 2 | RD (Receive Data) |
| | | | 3 | TD (Transmit Data) |
| | | | 4 | DTR (Data Terminal Ready) |
| | | | 5 | Common (Ground) |
| | | | 6 | - |
| | | | 7 | RTS (Request to Send) |
| | | | 8 | - |
| | | | 9 | - |
| XS31 (SC200 only) | RJ45 | Ethernet Interface | 1 | Rx |
| | | | 2 | Rx |
| | | | 3 | Tx |
| | | | 4 | - |
| | | | 5 | - |
| | | | 6 | Tx |
| | | | 7 | - |
| | | | 8 | - |
| YS11 | RJ45 | RXP System Communications | 1 | +24/48V (System bus voltage) |
| | | | 2 | +24/48V (System bus voltage) |
| | | | 3 | - |
| | | | 4 | RS485-A |
| | | | 5 | RS485-B |
| | | | 6 | - |
| | | | 7 | 0V |
| | | | 8 | 0V |
| USB (SC200 only) | USB B | USB Serial Interface | 1 | VCC (+5 V dc) |
| | | | 2 | Data - |
| | | | 3 | Data + |
| | | | 4 | Ground |




RS232 D9M and RJ45 connector pin-outs




RJ45 plug pin-outs

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

See input and output specifications on page 69.

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



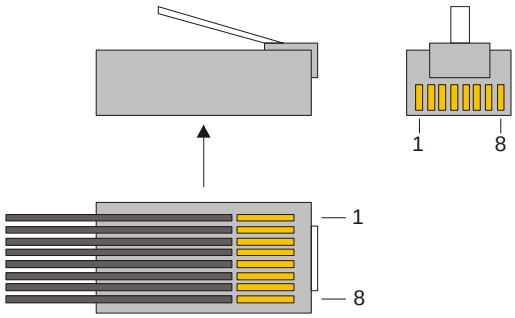
IPN 997-00012-54D November 2012

| Connector | Type | Purpose | Pin | Description |
|---|---|---|---|---|
| XH8 | MTA 156 | LVD Power | 1 | Bus live |
| | | | 2 | Common |
| XH9 | MTA 156 | Bus Voltage Sense Input | 1 | Controller reference (Live) |
| | | | 2 | Controller sense (Com) |
| XH12A | MTA 156 | Battery Mid-point Monitoring sense inputs (SC200 only) | 1 | String 1 Mid-point |
| | | | 2 | String 2 Mid-point |
| | | | 3 | String 3 Mid-point |
| | | | 4 | String 4 Mid-point |
| XH15A | | Digital inputs D1-D3 | 1 | D1 input |
| | | | 2 | 0V |
| | | | 3 | D2 input |
| | | | 4 | 0V |
| | | | 5 | D3 input |
| | | | 6 | 0V |
| XH15B | | Digital inputs D4-D6 | 1 | D4 input |
| | | | 2 | 0V |
| | | | 3 | D5 input |
| | | | 4 | 0V |
| | | | 5 | D6 input |
| | | | 6 | 0V |
| XH16/XH17 | | Digital relay outputs 1-2 | 1 | Relay 1 normally closed (NC) |
| | | | 2 | Relay 1 normally open (NO) |
| | | | 3 | Relay 1 Common (COM) |
| | | | 4 | Relay 2 normally closed (NC) |
| | | | 5 | Relay 2 normally open (NO) |
| | | | 6 | Relay 2 Common (COM) |
| XH18/XH19 | | Digital relay outputs 3-4 | 1 | Relay 3 normally closed (NC) |
| | | | 2 | Relay 3 normally open (NO) |
| | | | 3 | Relay 3 Common (COM) |
| | | | 4 | Relay 4 normally closed (NC) |
| | | | 5 | Relay 4 normally open (NO) |
| | | | 6 | Relay 4 Common (COM) |

| Connector | Type | Purpose | Pin | Description |
|---|---|---|---|---|
| XH20/XH21 | | Digital relay outputs 5-6* | 1 | Relay 5 normally closed (NC) |
| | | | 2 | Relay 5 normally open (NO) |
| | | | 3 | Relay 5 Common (COM) |
| | | | 4 | Relay 6 normally closed (NC) |
| | | | 5 | Relay 6 normally open (NO) |
| | | | 6 | Relay 6 Common (COM) |
| YH3 | RJ45 | DC power system digital inputs | 1 | Load Fuse Fail |
| | | | 2 | Battery Fuse Fail |
| | | | 3 | +12V out |
| | | | 4 | AC Distribution Fan Fail |
| | | | 5 | AC Distribution MOV Fail |
| | | | 6 | 0V out (system live - protected) |
| | | | 7 | - |
| | | | 8 | System common - protected |
| YH11 | RJ45 | RXP System Communications | 1 | +24/48V (System bus voltage) |
| | | | 2 | +24/48V (System bus voltage) |
| | | | 3 | - |
| | | | 4 | RS485-A |
| | | | 5 | RS485-B |
| | | | 6 | - |
| | | | 7 | 0V |
| | | | 8 | 0V |

** Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200 or SC100.*


**RJ45 connector pin-outs**




**RJ45 plug pin-outs**



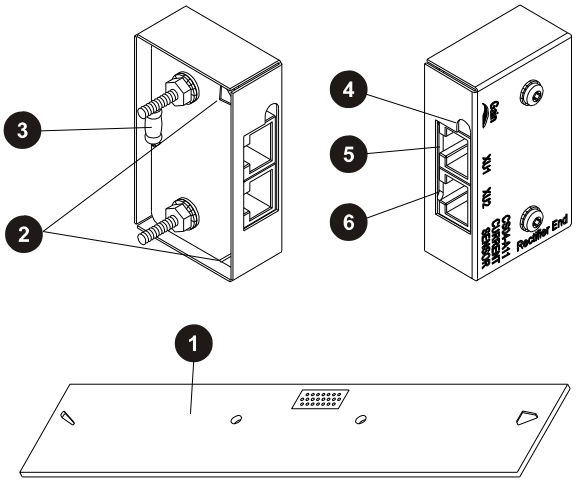


IPN 997-00012-54D November 2012

## External Current Sensors

### CS04-A11 current sensor

| | |
|---|---|
| Current rating: | > 500A |
| Mounting: | Screws (supplied) to the LIVE bus |
| Output 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. Temperature sensing 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)

For full information on installing the CS04-A11 Current Sensors see Application Note AN0046.

*To receive application notes see Worldwide Support on page 103.*

IPN 997-00012-54D November 2012

# Transient Protection

To prevent damage to Eaton Data-Voice-Video 3G 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 supply earth is usually the most appropriate.

### *Primary Transient Protection*

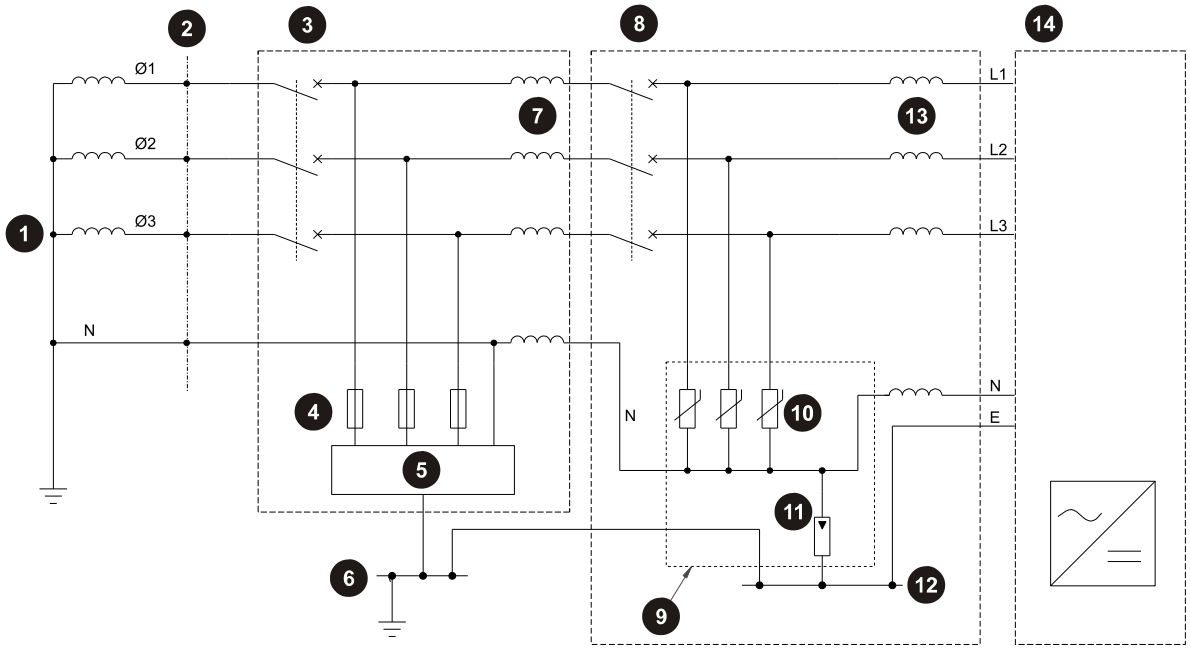
Primary transient protection must be considered at all sites. Eaton recommends primary transient protection on the incoming ac supply either at the main ac switchboard or sub-switchboard.

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.

### *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 DV2-3G 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



IPN 997-00012-54D November 2012

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 80.

*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 DV2-3G dc power system.*

#### 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.

Data-Voice-Video 3G Power Solutions are factory-fitted with secondary transient protection. This 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 Data-Voice-Video 3G 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

Eaton 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.

IPN 997-00012-54D November 2012

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

Before starting these Commissioning tasks:

- Complete all the Installation tasks (see details)
- 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 90 |
| 2 | System Controls | See details on page 92 |
| 3 | System Alarms | See details on page 95 |
| 4 | Digital Inputs | See details on page 98 |
| 5 | Digital Outputs (Relays) | See details on page 99 |

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



IPN 997-00012-54D November 2012

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



IPN 997-00012-54D November 2012

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

| Test | Test procedure | Adjustment |
|---|---|---|
| Low Voltage Disconnect – Automatic Operation<br>Note 7 | • Check the LVD contactor is connected.<br>• Increase the *LVD Disconnect Voltage Threshold*.<br>• Reduce the system voltage below the *LVD Disconnect Voltage Threshold*.<br>• Wait for the configured *Recognition Period.*<br>• Ensure the LVD disconnects.<br>• Ensure the SC200 or SC100 displays an *LVD Disconnected* alarm<br>• Ensure the I/O board LVD LED is off.<br>• Increase the system voltage above the configured *Reconnect Voltage*.<br>• Wait for the configured *Recognition Period.*<br>• Ensure the LVD connects.<br>• Ensure the SC200 or SC100 shows no LVD alarms.<br>• Ensure the I/O board LVD LED is on. | None |
| Low Voltage Disconnect – Alarms<br>Note 7 | • Disconnect each LVD control cable from the I/O board.<br>• Ensure the SC200 or SC100 displays an *LVD Fail* alarm.<br>• Ensure the I/O board LVD LED is flashing.<br>• Reconnect the cables.<br>• Ensure the LVD connects.<br>• Ensure the SC200 or SC100 shows no LVD alarms.<br>• 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 process may have to be turned off to allow the Fast Charge voltage to reach its value within the 1 minute test duration.

***4*** For details see Generator Control Option in the System Controller Operation Handbook.

***5*** There may be slight current fluctuations above and below the configured current limit setting. This can be due to the current control within the factory preset deadband. Confirmation of this control process may be witnessed in the Fast Charge test.

***6*** There may be a delay of up to 2 minutes before the currents stabilize between rectifiers.

***7*** There may be a delay of up to 10 seconds before the LVD changes state.
APS systems may not display a Manual Connect alarm on the SC200 or SC100 if the system voltage is above the LVD disconnect voltage.
Perform the test on each LVD control module within the system.
For manual LVD operation see details in the System Controller Operation Handbook.
For an explanation of LVD LED indications see Troubleshooting on page 52.



IPN 997-00012-54D November 2012

## 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:<br>  • SC200 or SC100 LED status.<br>  • SC200 or SC100 display indication.<br>  • DCTools alarm indication<br>  • Remote alarm indication (PowerManagerII, SNMP traps, and so on)<br>  • Digital outputs (relays).<br>• Reducing the alarm recognition time will reduce the alarm testing time.<br>• There may be more than 1 method to perform the following alarm tests. | |
| Low Float<br>Note 1 | • Increase the *Low Float Threshold* to just below the float voltage.<br>• Reduce the system voltage by heating the battery temperature sensor<br>- or -<br>• Disconnect the battery from the system.<br>• Start a *Battery Test*.<br>• The system voltage will fall.<br>• Ensure alarm operates. | |
| Low Load | • Test as for the *Low Float* test.<br>Note that the *Low Load Threshold* is lower than the *Low Float threshold.*<br>• Ensure alarm operates. | |
| High Float<br>Note 1 | • Set the system *Float Voltage* above the *High Float Threshold.*<br>- or -<br>• Reduce the *High Float Threshold* and increase the system voltage by starting an *Equalize*.<br>- or -<br>• Reduce the *High Float Threshold* and increase the system voltage by cooling the battery temperature sensor.<br>• Ensure alarm operates. | |
| High Load | • Increase the system voltage.<br>• Test as for the High Float test.<br>  *Note the High Load Threshold is higher than the High Float Threshold*<br>• Ensure alarm operates. | |
| Rectifier Fail | • Turn off a rectifier ac MCB (if fitted).<br>• The rectifier will turn off.<br>• Ensure alarm operates. | |
| Multiple rectifier fail | • Turn off the ac MCBs to 2 rectifiers (if fitted).<br>• The rectifiers will turn off.<br>• Ensure alarm operates. | |
| Rectifier comms lost | • Remove a rectifier from the system.<br>• Ensure alarm operates. | |

| Test | Test procedure | Adjustment |
|---|---|---|
| Multiple Rectifier comms lost | • Remove 2 rectifiers from the system.<br>• Ensure alarm operates. | |
| Partial AC Fail | • Turn off the ac to more than 20% of the rectifiers in the system.<br>• Ensure alarm operates. | |
| AC Fail | • Turn off all ac to the system.<br>• Ensure alarm operates. | |
| System Overload | • Reduce the *System Overload Recognition Period* to 0 minutes.<br>• Apply load to the system.<br>• Turn off rectifiers until the *System Overload Threshold* is exceeded.<br>• Ensure alarm operates. | |
| Load Fuse Fail<br>Note 2 | • Apply load to the system.<br>• Turn off the MCB feeding the load bank.<br>• Ensure alarm operates. | |
| Battery Fuse Fail | • Turn off a Battery MCB or remove a Battery Fuse.<br>• Ensure alarm operates. | |
| Battery Test Fail | • See Battery Test in the System Controller Operation Handbook for details. | |
| MOV Fail | • Remove a MOV cartridge from the MOV housing (if fitted).<br>• Ensure alarm operates. | |
| ACD Fan Fail | • Stop the ACD Fan (if fitted).<br>• Ensure alarm operates. | |
| LVD alarms | • See LVD test on page 92 for details. | |
| Battery Temperature Low | • Increase the *Battery Temperature Low Threshold* above the current temperature.<br>- or -<br>• Cool the temperature sensor until the threshold is exceeded.<br>• Ensure alarm operates. | |
| Battery Temperature High | • Reduce the *Battery Temperature High Threshold* below the current temperature.<br>- or -<br>• Heat the battery temperature sensor until the threshold is exceeded.<br>• Ensure alarm operates. | |
| Sensor Fail | • Disconnect the battery temperature sensor from the I/O board (XH7).<br>• Ensure alarm operates.<br>• Replace the battery temperature sensor.<br><br>• Disconnect the current sensor (XH6).<br>• Ensure alarm operates.<br>• Replace the current sensor.<br><br>• Disconnect the voltage sensor (XH9).<br>• Ensure alarm operates.<br>• Replace the voltage sensor. | |
| Equalize | • For details see Equalize test in System Controls on page 92. | |



IPN 997-00012-54D November 2012

| Test | Test procedure | Adjustment |
|---|---|---|
| Fast Charge | • For details see Fast Charge test in System Controls on page 92. | |
| Battery Test | • For details see Battery Test in System Controls on page 92. | |
| In Discharge<br>Note 3 | • Connect load to the system.<br>• Turn off the ac supply to the rectifiers.<br>• Allow the battery to start discharging.<br>• Ensure alarm operates. | |
| Config Error<br>Note 4 | • Load incorrect configuration file.<br>- or -<br>• Remove all rectifiers from the system.<br>• Apply an incorrect external voltage to the system:<br>  • 24V for a 48V system<br>  • 48V for a 24V system<br>• Ensure alarm operates. | |
| User Assigned Alarms | • See User Digital Input test on page 98. | |
| Battery Current Limit | • For details see Battery Current Limit test in System Controls on page 92. | |
| Rectifier No Load | • Ensure the dc load and batteries are isolated from the system.<br>• Ensure alarm operates. | |
| Rectifier Current Limit | • Apply a dc load to the system.<br>• Turn off rectifiers until the remaining rectifiers reach the *Rectifier Current Limit* threshold.<br>- or -<br>• Set the *Rectifier Current Limit* slightly below the existing rectifier current being delivered to the load.<br>• Ensure alarm operates. | |
| High Rectifier Temperature<br>Note 5 | • Unable to test. | |
| AC Phase 1/2/3 Fail<br>Note 6 | • Turn off ac phase 1 to the power system.<br>• Ensure alarm operates.<br>• Repeat for phase 2 and phase 3. | |
| AC Phase 1/2/3 Voltage<br>Note 6 | • Reduce the *High AC Threshold* below the existing ac voltage.<br>• Ensure alarm operates.<br>• Increase the *Low AC Threshold* above the existing ac voltage.<br>• Ensure alarm operates. | |
| AC Frequency<br>Note 6 | • Change the Nominal AC Frequency setting.<br>• Change the AC Frequency Threshold.<br>• Ensure alarm operates. | |
| Engine Run Option<br>Note 7 | • Change the state of the digital input with *Engine Run* function.<br>• 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 in the System Controller Operation Handbook.

## Digital Inputs

| Test | Test procedure | Adjustment |
|---|---|---|
| Digital Input 1 | • Change the state of the Digital input.<br>• Ensure any alarms mapped to the digital output (relay) activate.<br>• 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<br>Note 1 | • As for Digital Input 1.<br>• 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.



IPN 997-00012-54D November 2012

## Digital Outputs (Relays)

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

**Notes**

1. Digital Outputs can also be checked as other system tests are performed.
2. Digital Output 6 is also used as the Monitor Fail alarm relay. It will de-energize if the I/O board loses power or loses communication with the SC200 or SC100. Test extended alarms by removing the power to the I/O board. This will de-energize the relay.

## Commissioning Completed

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

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

IPN 997-00012-54D November 2012

# EQUIPMENT INCIDENT REPORT

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

For further information contact your local Eaton dc product supplier or Eaton (see contact details on page 103). Or email: CustomerServiceNZ@eaton.com

Date: _____

**Customer Information**

Company: _____

Postal Address: _____

_____

Return Address: _____
(Not PO Box)
_____

Telephone: _____ Fax: _____ Email: _____

Contact Name: _____

**Location of Failure**

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

System type installed in: _____ Serial number: _____

Site name or location: _____

**Fault discovered**

☐ Delivery ☐ Unpacking ☐ Installation
☐ Initial test ☐ Operation after _____ years ☐ Other _____

**Failure source**

☐ Design ☐ Manufacturing ☐ Documentation
☐ Transportation ☐ Installation ☐ Handling
☐ _____

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

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

_____

_____

_____

_____

_____

Internal use only.

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

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

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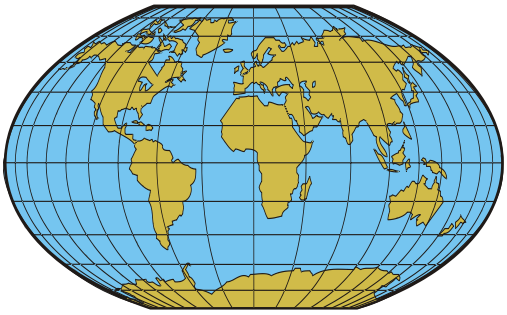
IPN 997-00012-54D November 2012

# Worldwide Support

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

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



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| **Taiwan:** | +886 2-6600-6688 or free call 0800-038-168 |
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IPN 997-00012-54D November 2012

## ?



## A



## B



## C



## D

IPN 997-00012-54D November 2012

## U



## V



## W





IPN 997-00012-54D November 2012