EATON | Powerware

Data Power Solutions Installation Guide

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Eaton Corporation
Telecommunications Solutions Division
www.powerware.com
DCinfo@eaton.com

About This Guide

Purpose

This guide provides instructions to correctly install, commission and operate Data Power Solutions.

Audience

This guide is intended for use by IT professionals who have a sound working knowledge of safe working practices.

Scope

This guide covers installation, commissioning and operation of Data Power Solutions, controlled by SM45 supervisory modules.

It does not cover:

- Installation and characterization of batteries.
- Changing the pre-configured configuration values. For full details on changing the pre-configured configuration values, refer to the *SM45 Front Panel Menu Structure* (on the inside back cover) or *DCTools* online help.

Related Information

DCTools Online Help

Application Note AN0080: Ventilation of VRLA Batteries

Reporting Problems with This Guide

Please use the fax or email addresses below to report any problems you find in this guide.

Powerware DC Marketing Services

FAX: ++64 3 343 5660

EMAIL: DCMarketingNZ@eaton.com

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For Further Information and Technical Assistance

Eaton recognizes the need to keep you informed about the availability of current product information.

For up-to-date product information and a complete listing of worldwide sales offices, visit the Powerware website at: **http://www.powerware.com**

For comprehensive product data sheets and application notes please contact your local Powerware DC product representative or email: DCinfo@eaton.com

For technical assistance, contact your local Powerware DC product representative in the first instance, alternatively phone **(++64) 3 343-7448** or email **CustomerServiceNZ@eaton.com**

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Chapter 1

General Description

Overview

Data Power Solutions Product Range

Data Power Solutions provide high reliability 48 V DC power for Power over Ethernet, network, data and telecommunications equipment.

Each power system includes AC/DC rectifier modules, a supervisory module to provide control and communications functions, circuit breakers to protect the output cabling, and output terminals to connect the cables to the DC powered equipment and optional batteries.

Six models (with eight variants each) are available, as shown on the following three pages.

- **APS3-058-x** – rack-mounted version, without battery option
- **APS3-059-x** – rack-mounted version, with battery option
- **APS3-060-x** – desktop version, without battery option
- **APS3-061-x** – desktop version, with battery option
- **APS6-058-x** – rack-mounted version, without battery option
- **APS6-059-x** – rack-mounted version, with battery option

Where "–x" indicates the model variant with the following type and number of circuit breakers:

x	Number of 25A Circuit Breakers	Number of 6A Circuit Breakers
0	4	4
1	5	3
2	6	2
3	7	1
4	8	0
5	3	5
6	2	6
7	1	7
8	0	8

AC Input: Data Power Solutions can be powered by a wide range of AC power distribution systems such as single-phase, two-phase, three-phase (L-N) and three-phase (L-L). Depending on the nominal voltage of the AC supply (120 V or 240 V), the power systems are equipped with either APU48 or APR48 rectifiers. Fused AC power sockets (one per rectifier) are available for connecting the power system to the AC supply.

DC Output: Eight floating DC outlets are available for connecting equipment power cables. Each DC outlet is protected by a corresponding 6 A or 25 A load circuit breaker. Any combination of 6 A or 25 A rated load circuit breakers (up to a maximum of eight) can be fitted, depending on customer requirements.

Battery Option: External VRLA 48 V batteries can be connected to APS3-059, APS3-061 and APS6-059 models to provide backup power during AC outages. The battery float voltage is temperature compensated.

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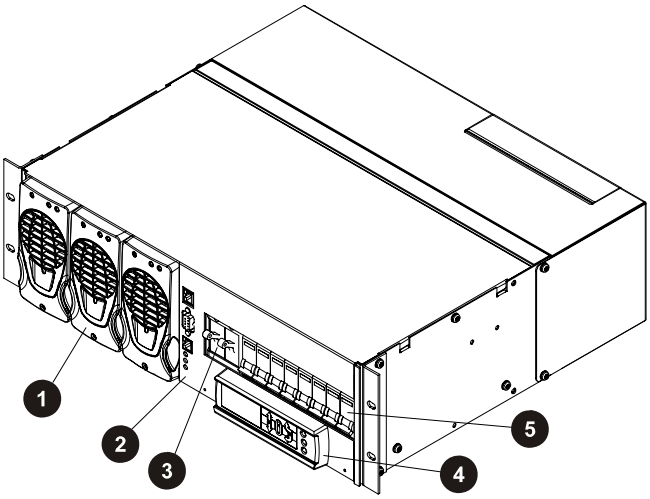
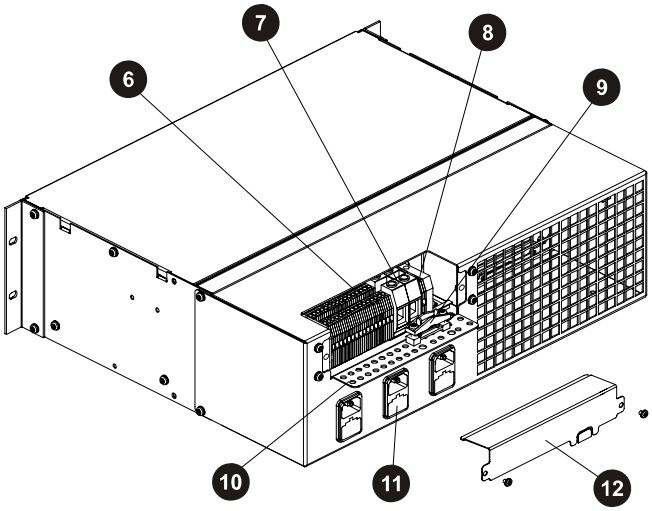
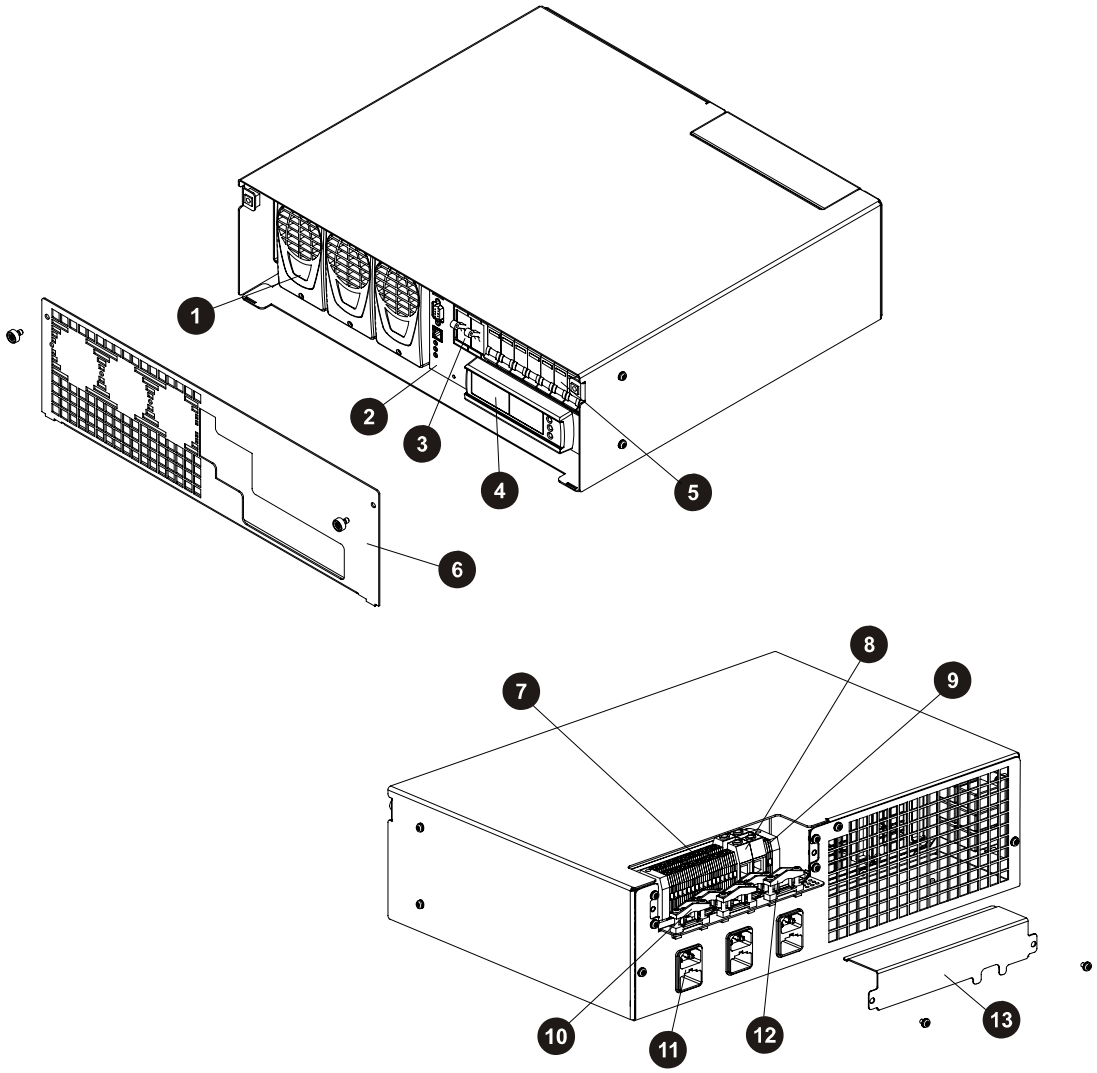
APS3-05X (Rack-Mounted Versions)





1. Up to three Access Power Rectifiers, numbered 1 to 3 from left to right *(see page 1-6)*
2. SM45 Supervisory Module *(see page 1-7)*
3. One 2-pole Battery Circuit Breaker (APS3-059 only)
4. SM45 Display Module with keypad and LED indicators *(see Chapter 5)*
5. Load Circuit Breakers – any combination of 6 A or 25 A rated circuit breakers up to a maximum of eight, depending on customer requirements
6. 16 DC Load Terminal Blocks (2 per DC Outlet)
7. Two Battery Terminal Blocks (APS3-059 only)
8. Two Battery Temperature Sensor Terminal Blocks (APS3-059 only)
9. Battery Cable Clamp (APS3-059 only)
10. Cable Support Bracket
11. Three fused AC Power Sockets (one per rectifier) and labeled K1 to K3. K1 powers Rectifier 1, etc.
12. DC Output Cover (remove to access DC Output terminations)

APS3-06X (Desktop Versions)



1. Up to three Access Power Rectifiers, numbered 1 to 3 from left to right *(see page 1-6)*
2. SM45 Supervisory Module *(see page 1-7)*
3. One 2-pole Battery Circuit Breaker (APS3-061 only)
4. SM45 Display Module with keypad and LED indicators *(see Chapter 5)*
5. Load Circuit Breakers – any combination of 6 A or 25 A rated circuit breakers up to a maximum of eight, depending on customer requirements
6. Front Cover
7. 16 DC Load Terminal Blocks (2 per DC Outlet)
8. Two Battery Terminal Blocks (APS3-061 only)
9. Two Battery Temperature Sensor Terminal Blocks (APS3-061 only)
10. Four Nylon Strain Relief Clamps
11. Three fused AC Power Sockets (one per rectifier) and labeled K1 to K3. K1 powers Rectifier 1, etc.
12. One Battery Cable Clamp (APS3-061 only)
13. DC Output Cover (remove to access DC output terminations)

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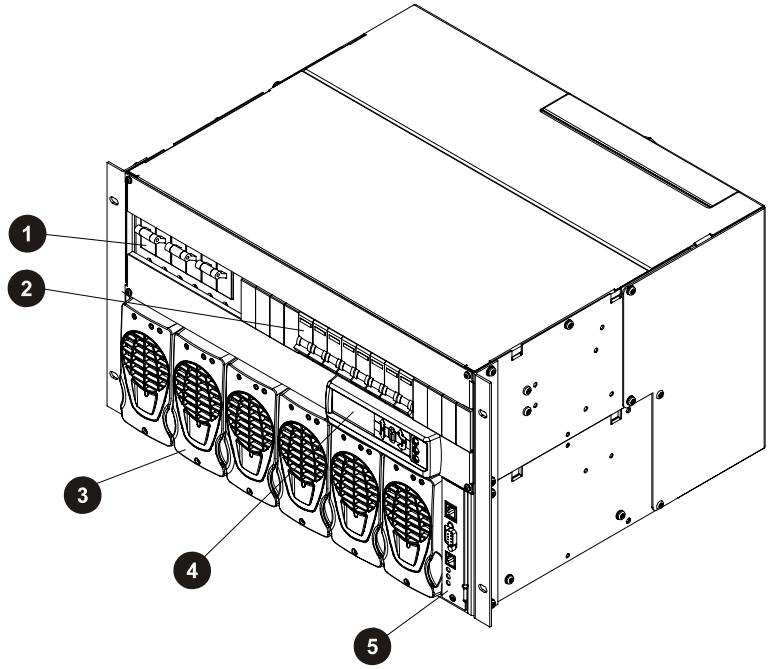
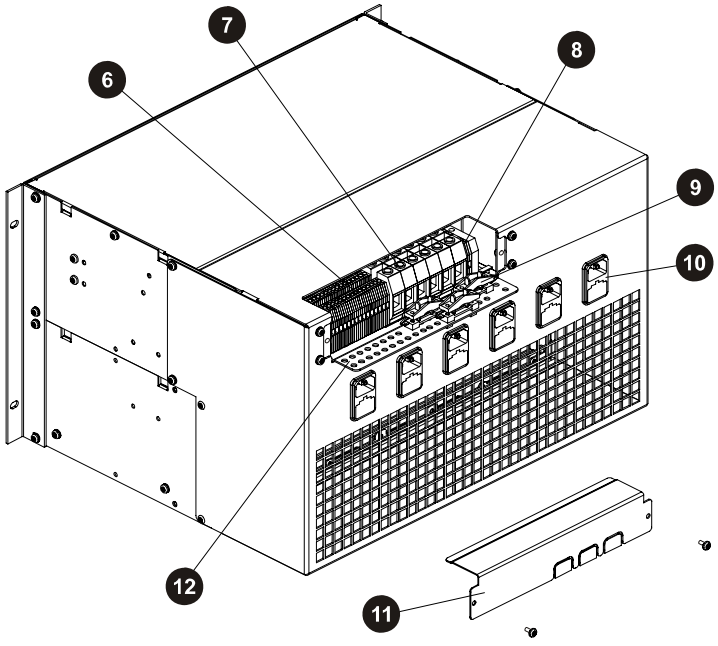
APS6-05X (Rack-Mounted Versions)





1. Three 2-pole Battery Circuit Breakers (APS6-059 only)
2. Load Circuit Breakers – any combination of 6 A or 25 A rated circuit breakers up to a maximum of eight, depending on customer requirements
3. Up to six Access Power Rectifiers, numbered 1 to 6 from left to right *(see page 1-6)*
4. SM45 Display Module with keypad and LED indicators *(see Chapter 5)*
5. SM45 Supervisory Module *(see page 1-7)*
6. 16 DC Load Terminal Blocks (2 per DC Outlet)
7. Six Battery Terminal Blocks (APS6-059 only)
8. Two Battery Temperature Sensor Terminal Blocks (APS6-059 only)
9. Three Battery Cable Clamps (APS6-059 only)
10. Six fused AC Power Sockets (one per rectifier) and labeled K1 to K6. K1 powers Rectifier 1, etc.
11. DC Output Cover (remove to access DC output terminations)
12. Cable Support Bracket

Access Power Rectifiers

Two types of fan-cooled, hot-pluggable Access Power Rectifiers are available.

- **APU48** – 48 V, 720 W, (120 - 240 V AC)
- **APR48** – 48 V, 1500 W, (208 - 240 V AC)

There are three status indicator LEDs on the Access Power Rectifier front panel (Power On, Urgent Alarm and Non-Urgent Alarm).

Details about replacing a rectifier can be found in Chapter 7.

❶ Power On LED (Green) – indicates that the rectifier is powered.

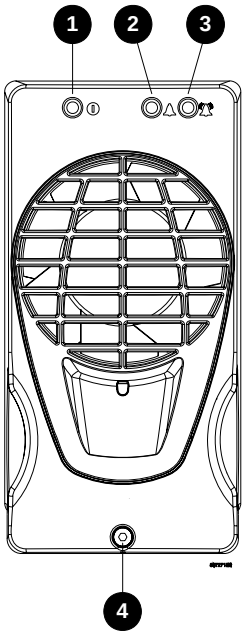
❷ Non-Urgent Alarm LED (Yellow) – indicates non-critical conditions, such as:

- Rectifier in power/current limit mode *(This normally happens for a short period of time when the batteries are recharging.)*
- Rectifier operating in temperature turndown mode, because of high ambient temperature or low AC supply voltage

❸ Urgent Alarm LED (Red) – indicates critical fault conditions, that require urgent attention, such as:

- Rectifier failed
- Rectifier shut down
- AC supply failed (green LED off)
- Very high AC supply voltage
- DC overvoltage

❹ Retaining Screw (loosen to remove rectifier)



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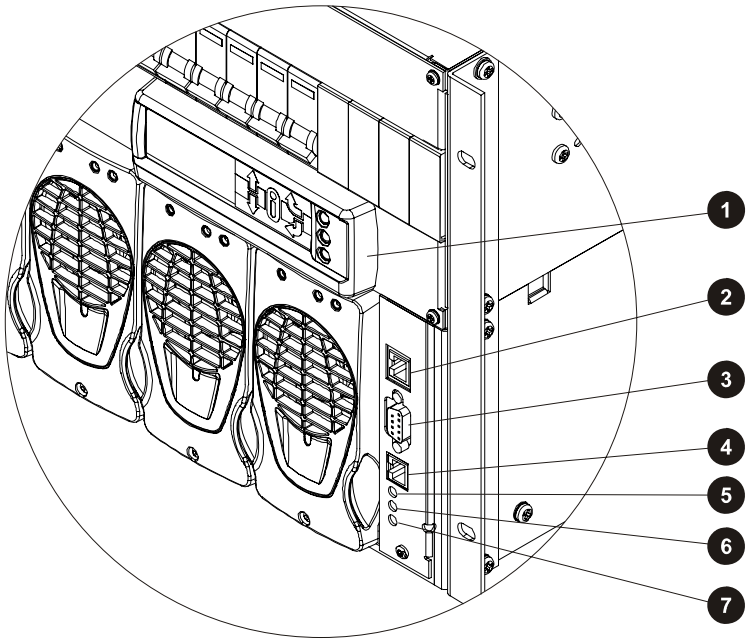
SM45 Supervisory Module

The SM45 supervisory module is an advanced control and monitoring solution for Data Power Solutions.

It provides a full suite of advanced communications options, including built-in Ethernet interface, Web server and SNMP agent. Details about the communications options can be found in Chapter 6.

Alarm notifications may be by SNMP traps.

The SM45 has an onboard audible indicator and two alarm LEDs. Details about the SM45 front panel can be found in Chapter 5.



1. Display Module with Keypad *(see Chapter 5)*
2. Ethernet Interface
3. RS-232 Serial Interface
4. Not used
5. Power On LED (green)
6. Non-urgent Alarm LED (yellow)
7. Urgent Alarm LED (red)

Low Voltage Disconnect (if applicable)

APS3-059, APS3-061 and APS6-059 models are equipped with a Low Voltage Disconnect (LVD) module.

The LVD disconnects the batteries at the LVD disconnect voltage to prevent damage to the batteries due to excessive deep discharge. After the batteries are disconnected, they recover to their open-circuit voltage. The LVD reconnects the batteries automatically after the AC supply is restored. After the batteries are reconnected, the power system recharges the batteries and powers the loads.

Both the LVD disconnect and reconnect voltages are configurable. The default LVD disconnect voltage is set to 44 V and the reconnect voltage to 48 V. This hysteresis band ensures that the open-circuit recovery of the discharged batteries does not rise above the LVD reconnect voltage.

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Overview

Warnings

This section contains important warnings relating to:

- AC Inputs
- Equipment Classification
- Batteries (if applicable)
- DC Outputs
- Rectifiers
- Location and Environment
- Servicing
- EMC Compliance

AC Inputs

- Desktop Versions:
  Pluggable Type A: Except for 120V input, if APS3-06X power systems are fitted with three rectifiers, then only two AC power cords may be connected to one building branch circuit. The third AC power cord must be connected to a separate building branch circuit. Failure to do so voids all safety approvals.
- The maximum earth leakage current of each Access Power Rectifier is 1.5 mA. Ensure that any upstream Residual Current Devices (RCDs) are appropriately rated.
- The AC power cords (supplying the power system) must be suitably rated for the environment and AC power distribution system. In addition, these AC power cords must be approved and installed to comply with local wiring regulations.
- The earth conductor of each AC power cord must have a minimum cross sectional area of 1 mm^2 (0.00155 in^2).
- The maximum length of each AC power cord should not exceed 3m (10 feet), unless local wiring regulations permit otherwise.
- Ensure that the AC supply is disconnected from those fused AC power sockets before checking or replacing their respective fuses.
- Each socket, K1 to K3 (APS3), and K1 to K6 (APS6), contain two fuses, FS1 and FS2. **CAUTION: DOUBLE-POLE / NEUTRAL FUSING**
- Use only 15 A, 250 VAC, 6.3 x 32 mm, fast-acting fuses of the same type (Bussman ABC-15 or Littelfuse 314-015 Type 3AB) for continued protection against risk of fire.

Equipment Classification

- Data Power Solutions are classified as “Class 1” equipment that must be provided with an earth connected to the “Protective Earthing Conductor” in the building wiring. The earth conductor of each AC power cord must be connected to the “Protective Earthing Conductor” in the building wiring.
- APS3-06X (desktop versions) are classed as “Pluggable equipment Type A” and intended for use as “Desktop units”. All other units, APS3-05X and APS6-05X are “Pluggable Equipment Type B” or for “Permanently connection” in host equipment.

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Batteries (if applicable)

- Always install the batteries according to the relevant battery manufacturer's instructions.
- 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.
- Batteries are heavy, awkward to handle and can cause personal injury. To prevent back injury, use correct lifting and bending techniques when moving batteries. If the batteries are too heavy to move, request assistance. Always comply with the relevant company rules or local regulations.
- Remove or cover rings, wristwatch and other metal jewelry that might be exposed to battery terminals, before installing batteries.
- Do not wear synthetic clothing when installing batteries.
- Always use insulated tools.
- Only use a clean soft damp cloth for cleaning the batteries. Do not use cleaning detergents or chemicals.
- When unpacking the batteries inspect them carefully for leaks, corrosion and possible damage. Report any damage or other battery related problems immediately to your battery supplier.
- Do not remove the factory-fitted transit insulation covers from the batteries until access to the battery terminals is required.
- 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 the 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.
- Always ensure that any shrouding supplied with the batteries is correctly fitted to cable connectors.

DC Outputs

- The DC outlets are floating to meet the isolation requirements for powering *Power over Ethernet IEEE802.3af* compatible devices.
  In non-*Power over Ethernet* applications the positive or negative output of the DC outlets can be referenced to earth, if required.
- On APS3-06X (desktop versions), run the load cables through the supplied nylon strain relief clamps. Failure to fit the strain relief clamps and using the incorrect torque setting for tightening their captive screws voids all safety approvals.

Rectifiers

- To reduce the risk of electric shock and maintain optimum system cooling, always cover empty rectifier slots with blanking panels (Part Number: IPN 621-05722-63A).
- To avoid electrical shock, do not place hands inside the rectifier shelf.
- Rectifier cases may exceed 100ºC (212ºF), especially after prolonged operation. Use suitable gloves to remove the hot rectifier.
- Do not attempt to disassemble rectifiers. Return them, (in their original packaging) along with the completed Equipment Incident Report, to your local Powerware DC product representative for replacement or repair.

Location and Environment

- Data Power Solutions (rack-mounted and desktop versions) meet the safety and fire enclosure requirements (as specified in AS / NZS 60950.1, EN 60950-1, IEC 60950-1 and UL 60950-1). Always mount APS3-05X and APS6-05X powers systems in 19-inch wide host equipment racks (enclosed or open type) securely bolted to the floor and position the desktop versions (APS3-06X) on a surface that supports the weight (12kg / 26lb) of the power system.
- To maintain optimum system cooling, keep the front and rear of the power system clear from walls or other equipment. The minimum recommended clearance distance at the front and rear of the power system is 50 mm (2”). No top and bottom clearance is required.
- The location must provide adequate airflow around the unit, in an atmosphere free from excessive dust, corrosive fumes or conductive contaminants.
- 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 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, or refer to Application Note AN0080 available from Eaton.

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Servicing

- Data Power Solutions contain hazardous voltages. Do not attempt to disassemble or service the unit if you are not qualified. Only service personnel of Eaton Corporation's Telecommunications Solutions Division or their authorized service agents are permitted to service the unit.
- If the power system requires servicing other than external battery or rectifier replacement, isolate the unit first, as follows:

  1 Unplug the AC supply cords from the AC power outlets.

  2 Disconnect the external batteries, by switching off the battery circuit breakers.

EMC Compliance

- Data Power Solutions may be used in close proximity to other electronic equipment provided installation is carried out according to instructions in this manual. However, proper installation and compliance with EMC standards does not guarantee that the power system will not respond to electromagnetic disturbances, or will not cause interference to other equipment in a particular installation.
- Data Power Solutions comply with part 15 of the FCC (Federal Communications Commission) rules. Operation is subject to the following two conditions:

  1 This device may not cause harmful interference, and

  2 This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications to Data Power Solutions not approved by Eaton Corporation could void FCC authority to operate that equipment.
- Data Power Solutions have been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. 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 power system and inspect it carefully for possible damage that may have occurred while in transit.

Next, check the equipment against the packing list (supplied with the equipment) and ensure that you have received the correct type of Access Power Rectifiers (either APR48 or APU48).

Report any damage or incorrect shipment immediately, using a copy of the Equipment Incident Report (at the back of this guide) to supply all relevant details. Fax the completed form to your local Powerware DC product representative.

Keep the original packaging. You will need it if any equipment needs to be returned to your local Powerware DC product representative.

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Overview

Mounting the Power System

Location and Environment

Data Power Solutions (rack-mounted and desktop versions) meet the safety and fire enclosure requirements (as specified in AS / NZS 60950.1, EN 60950-1, IEC 60950-1 and UL 60950-1).

- **Rack-Mounted Versions:** APS3-05X and APS6-05X series power systems may be mounted in 19-inch wide host equipment racks (enclosed or open type) securely bolted to the floor.
- **Desktop Versions:** APS3-06X series power systems may be positioned on any surface that supports the weight of the power system.

The location must provide adequate airflow around the unit, (as per *Clearance Requirements* below) in an atmosphere free from excessive dust, corrosive fumes, or conductive contaminants.

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.

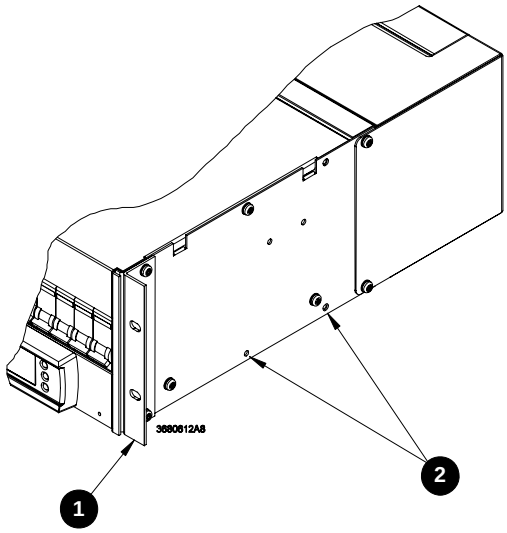
VRLA lead acid batteries can emit explosive gases and must be installed with adequate ventilation. Refer to the battery manufacturer or supplier for advice on minimum ventilation levels, or refer to Application Note AN0080 available from Eaton.

Clearance Requirements

All Data Power Solutions (rack-mounted and desktop versions) require the following minimum clearances:

- **Front and Rear Clearance** – 50 mm (2”) from walls and other equipment, required for optimum system cooling and access.
- **Top and Bottom Clearance** – None

Rack Installation (rack-mounted versions only)



1. APS3-05X and APS6-05X power systems come pre-assembled with two 19-inch rack-mounting brackets.
2. The two rack-mounting brackets can be moved backwards and lined up with alternative bracket-mounting holes, to provide greater mounting flexibility. Ensure the same screws are used.

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Important Notes for Rack Mounted Systems:

- If this DC power system is installed in a closed or multi-unit rack assembly ensure that the ambient temperature is less than 40°C.
- Ensure that the air flow is not restricted.
- Ensure that the system's weight is adequately and evenly supported.
- Take note of the maximum AC current stated on the nameplate. Ensure that the AC supply is correctly rated.
- Ensure that reliable earthing is maintained. Carefully check earth continuity from the branch circuit to the DC power system.

DC Installation Practices

Before you start connecting the DC load and battery cables (if applicable) to a power system, please read the following DC Installation Practices:

- On APS3-06X (desktop versions), run the DC load cables through the supplied nylon strain relief clamps at the rear. (See page 3-5 for details.) Failure to fit the strain relief clamps and using the incorrect torque setting for tightening their captive screws voids all safety approvals.
- To easily distinguish between positive and negative load cables, we recommend using cables with different colors (as specified by local wiring regulations). The same applies to battery cables (if applicable).
- To reduce inductive coupling, separate DC load, battery and communications 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), all DC load cables should be routed in close proximity to one another, and large current loops should be avoided. The same applies to battery cables (if applicable).

Connecting the DC Load Cables

Eight DC outlets (labeled 1 to 8) are available for connecting your equipment power cables. Each DC outlet is protected by a corresponding 6 A or 25 A circuit breaker (accessible from the DC distribution at the front). The current rating of the corresponding circuit breaker determines the current rating of a DC outlet.

The DC outlets are floating to meet the isolation requirements for powering *Power over Ethernet IEEE802.3af* compatible devices. In non-*Power over Ethernet* applications the positive or negative output of the DC outlets can be referenced to earth, if required.

DC Load Cable Specifications

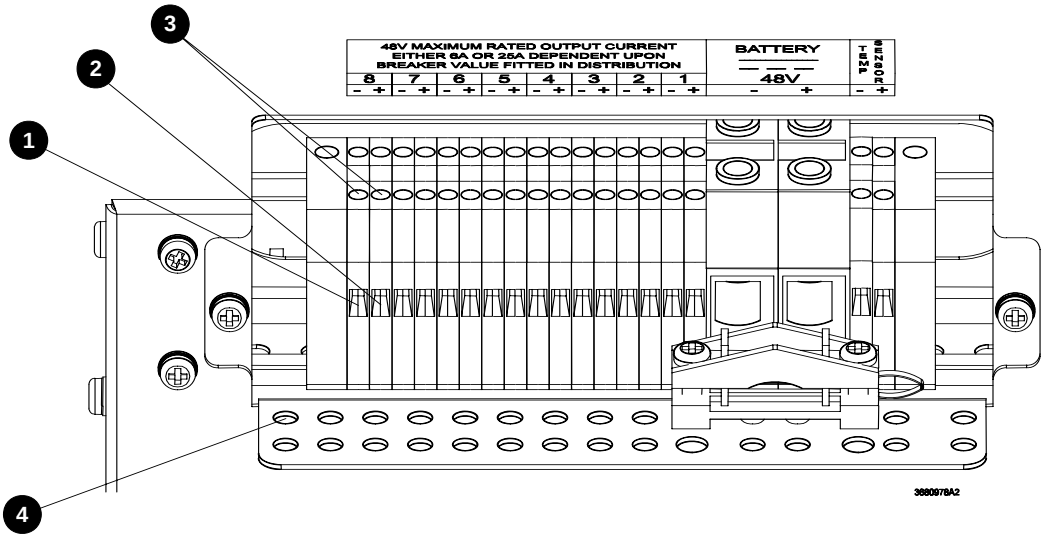
No DC load cables are supplied.

DC load cables are sized differently, depending on whether you connect to 6A or 25A DC outlets. All DC load cables must meet the following specifications and no other cable sizes must be used.

6 A DC Outlets:	UL 1015*, 18 AWG (1mm^2), multi-strand cable
25 A DC Outlets:	UL 1015*, 12 AWG (4mm^2), multi-strand cable
Cable Length:	3m (10 feet) maximum

**Required to maintain approval compliance.*

APS3-05X and APS6-05X (Rack-Mounted Versions)



❶ Terminate the **negative** load cable(s) at the **(-)** terminal block(s) of the DC outlet(s).

❷ Terminate the **positive** load cable(s) at the **(+)** terminal block(s) of the DC outlet(s).

Ensure that the polarity at the DC outlet(s) matches the power input polarity of your equipment. Connecting reverse polarity equipment power cables to the DC outlets of a power system might cause damage to your equipment. Such damage is not covered by our warranty.

Ensure that the correct cable sizes have bee used (18 AWG for 6 A outlets and 12 AWG for 25 A outlets).

❸ To ensure reliable connections at the terminal blocks of the DC outlets, torque the clamp-screws 0.4 – 0.6 Nm (3.5 – 5.3 lb-in).

❹ Use cable-ties (not supplied) and the provided cable-tie holes on the cable support bracket to tie down the load cables.

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APS3-06X (Desktop Versions)

Before proceeding check you have:

- 4 x load cable clamps
- 8 x 25mm blunt ended screws
- 8 x 5mm and 4 x 10mm cable sleeves (50mm long)

  Depending on the cables sizes, not all sleeves will be required.

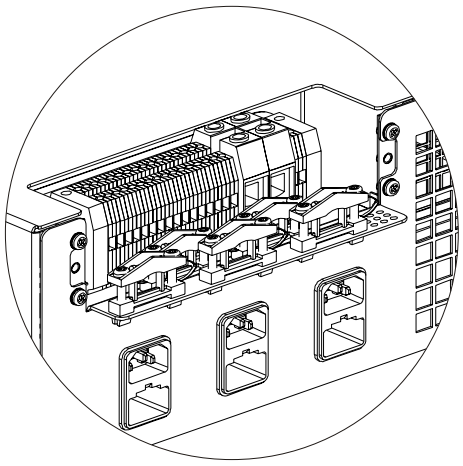
- 1mm² (18 AWG) cable for connection to 6A outlets
- 4mm² (12 AWG) cable for connection to 25A outlets

Step 1 - Fit load cable clamps

Insert the square ends of the load cable clamps into the holes in the back of the system.

Engage two turns of each retaining screw. This will ensure that the clamp does not move when the wires and sleeves are inserted.

Fit all clamps even if you do not use them all. Tighten unused clamps to prevent access to the DC outputs.



Step 2 - Strip cable ends

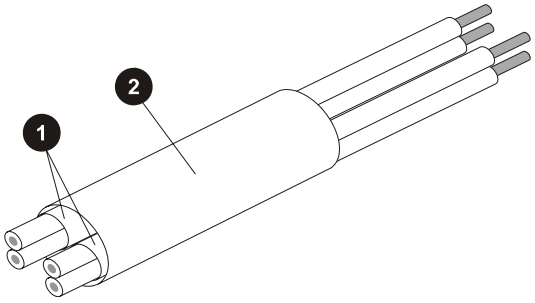
Strip approximately 10mm ($^3/_8$") from the cable ends. We recommend fitting cable ferrules over the cable ends.

Step 3 – Fit cables and sleeves

To maintain safety approvals insert only the following numbers of cables per clamp, with sleeves where applicable. This will ensure that cables are retained correctly in their clamps.

Feed the cables through the clamps as follows, depending on cable size:

1mm^2 (18 AWG) – 2 cable pairs* per clamp:



❶ 2 x 5mm sleeves

❷ 10mm sleeve

* If only one cable pair is required then use a dummy pair with sleeves to make up the space.

4mm^2 (12 AWG) – 1 or 2 cable pairs per clamp

Do not tighten the clamps at this stage.

Step 4 – Terminate cables

Terminate the **negative** load cable(s) at the (**-**) terminal block(s) of the DC outlet(s).

Terminate the **positive** load cable(s) at the (**+**) terminal block(s) of the DC outlet(s).

Tighten the terminal screws. Required torque: 0.4 – 0.6 Nm (3.5 – 5.3 lb-in).

Ensure that the polarity at the DC outlet(s) matches the power input polarity of your equipment. Connecting reverse polarity equipment power cables to the DC outlets of a power system might cause damage to your equipment. Such damage is not covered by our warranty.

Ensure that the correct cable sizes have been used (1mm^2/18 AWG for 6 A outlets and 4mm^2/12 AWG for 25 A outlets).

Step 5 – Arrange sleeves and tighten clamp screws

Arrange the sleeves so that they are all within 10mm ($^3/_8$") of the terminals.

Tighten all cable clamp screws. Required torque: 1.5 – 2 Nm (13.2 – 17.7 lb-in).

Tighten the screws of any unused clamps to prevent access to the DC output terminations.

Procedure complete

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Installing the External Batteries (if applicable)

This section applies to APS3-059, APS3-061 and APS6-059 power systems only.

One 48 V battery string can be connected to APS3-059 and APS3-061 and up to three 48 V battery strings to APS6-059 power systems.

A 48 V battery string consists of either:

- 24 Valve Regulated Lead Acid (VRLA) 2 V cells or
- Four VRLA 12 V monoblocs

Because of the wide range of battery types and sizes available, we do not supply batteries with the above mentioned power systems and therefore do not cover battery installation in this guide. Always install batteries according to the relevant battery manufacturer's instructions.

Battery Sizing

Battery manufacturers provide various types of information for sizing batteries such as constant current discharge and constant power discharge data. Your battery supplier will be able to assist you with sizing the battery for your application.

Before a battery can be sized, the following information is required.

- Required backup time
- Minimum cell voltage (typically 1.83 V per Cell)
- Load profile
- Operating temperature

In telecommunications and data applications most loads are constant power for a specified backup time. Therefore, for sizing a battery for the required backup time, constant power discharge data should be used.

For charging the battery, constant current discharge data should be used. When charging the battery, battery current limit should be used to set the battery charge to no more than the maximum recharge specified by the battery manufacturer.

Batteries for use in North America must be a UL recognized type, category BAZR2.

Battery Location

Valve Regulated Lead Acid (VRLA) batteries emit very small amounts of hydrogen gas into the surrounding atmosphere under normal float charging conditions. For that reason batteries should never be installed in a sealed enclosure or cabinet.

Install the batteries in a well-ventilated location to prevent accumulation of hydrogen gas to flammable or explosive levels.

Building air conditioning and ventilation systems already in place for optimum equipment operation and comfort of personnel usually meet or exceed VRLA battery ventilation requirements. For specific battery ventilation requirements, always refer to the battery manufacturer's installation instructions.

Avoid:

- Installing the batteries next to any heating source or under air ducts.
- Exposing part of a battery string to direct sunlight.
- Any other locations that would cause temperature variations within the batteries.

Battery Fault Protection

A fault protection device (such as a circuit breaker or fuse) must be fitted in series with one of the battery cables of each battery string.

The fault protection device must be:

- Located as close as practical to the corresponding battery string output terminal and
- Capable of disconnecting the potential fault current of the battery string.

The battery circuit breaker(s) of the power system can not be considered as the fault protection device for the battery string(s) and associated wiring.

The interrupt rating of the battery circuit breaker(s) fitted within the power systems is 10 kA. Therefore, the maximum potential short-circuit current of a 48 V battery string must be limited to less than 10 kA or the total internal impedance of the battery string should be greater than 5.7 mΩ.

If a smaller rated external fault protection device is used, then batteries with appropriate internal impedance need to be selected.

Connecting the Battery Cables (if applicable)

This section applies to APS3-059, APS3-061 and APS6-059 power systems only.

Before You Start

Ensure that all the circuit breakers at the front of the power system and the external battery circuit breaker (close to the battery output terminals) are switched OFF.

Before proceeding check you have:

- Battery cable clamp(s) (one for APS3 models, three for APS6-059)
- 2 x 25mm blunt ended screws per clamp
- 1 x 16mm cable sleeve (50mm long) per clamp
- Battery cable (see specifications below).

Battery Cable Specifications

No battery cables are supplied with APS3-059, APS3-061 and APS6-059 power systems. All battery cables must meet the following specifications and no other cable sizes must be used.

Cable Style and Size:	UL 1283*, 4 AWG (25mm^2), multi-strand cable
Cable Length:	3m (10 feet) maximum

**Required to maintain approval compliance.*

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Step 1 - Prepare cable clamp

Cut off the two inside posts of the battery cable clamp to enable the battery cables and sleeve to fit.

Step 2 – Strip cable and fit sleeve

Strip approximately 17mm ($^3/_4$") of the insulation from the cable ends. We recommend fitting cable ferrules over the cable ends.

Feed both battery cables through the 16mm sleeve.

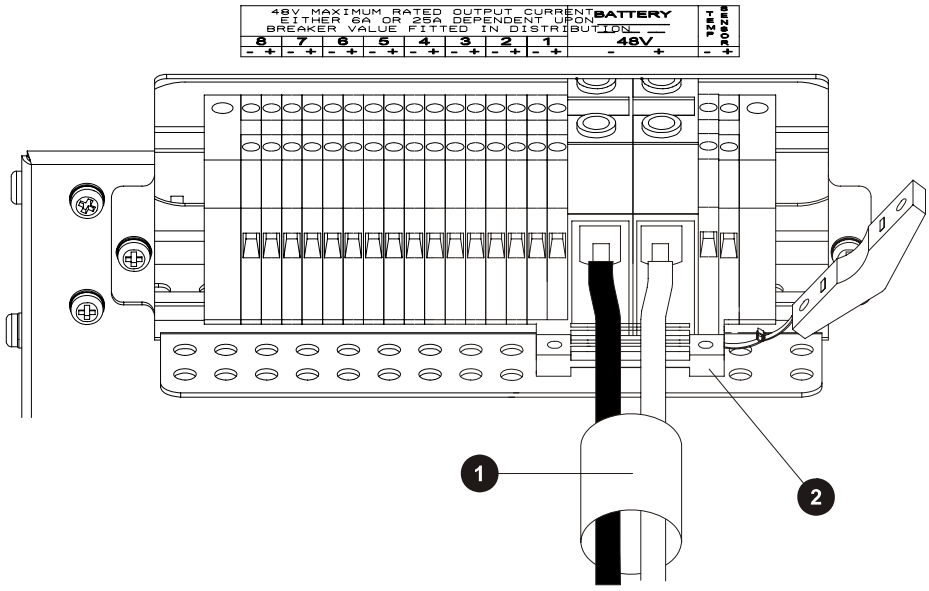
Step 3 – Terminate cable

Terminate the **positive** battery cable at the Battery (**+**) terminal block.

Terminate the **negative** battery cable at the Battery (**-**) terminal block.

Tighten the terminal screws. Required torque: 2.5 - 3 Nm (22.1 – 26.5 lb-in).

Ensure that the polarity at the battery terminal blocks matches the polarity of the external battery. Connecting a reverse polarity battery to a power system will cause damage to the rectifier modules. Such damage may not be covered by the warranty.



❶ 16mm battery cable sleeve.

❷ Battery cable clamp with posts removed.

Step 4 – Arrange sleeve and clamp the battery cables

Arrange the cable sleeve so that it is within 10mm ($^3/_8$") of the terminals.

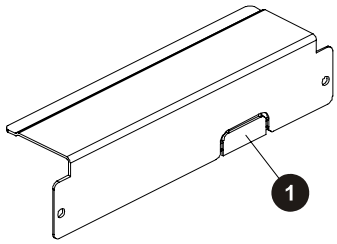
Tighten the cable clamp screws. Required torque: 1.5 – 2 Nm (13.2 – 17.7 lb-in).

Step 5 – Repeat for other battery cables (if required)

Repeat the above procedure to connect up to three battery strings to an APS6-059 power system.

Step 6 – Remove knockout and fit cover

Remove the battery cable knockout(s) on the DC output cover.



❶ Battery cable knockout.

Remove any sharp edges, in particular the remaining knock-out webs.

Fit the DC output cover.

Procedure complete

Installing the Battery Temperature Sensor (if batteries are fitted)

This section applies to APS3-059, APS3-061 and APS6-059 power systems only.

Each APS3-059, APS3-061 and APS6-059 power system is supplied with a battery temperature sensor and standard 2 m (6.5 feet) long cable (factory-fitted to the sensor).

Longer cables are available from your local Powerware DC product representative or you can make up your own. We strongly recommend limiting the maximum cable length of the battery temperature sensor to 20 m (65 feet) because of noise considerations.

Connecting the Battery Temperature Sensor Cable

There are two screw-clamp terminal blocks at the rear of APS3-059, APS3-061 and APS6-059 power systems for terminating the battery temperature sensor cable, as shown below.

The two terminal blocks are labeled TEMP SENSOR (+) and TEMP SENSOR (-).

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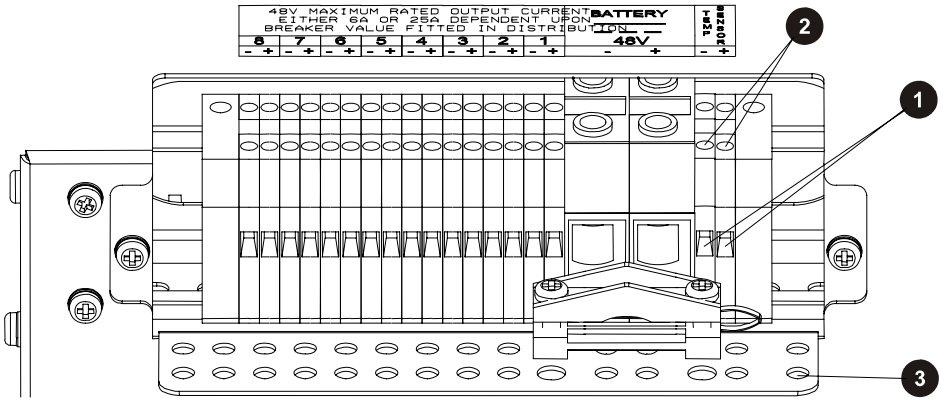

1. Terminate the **Black/White** wire at TEMP SENSOR (+) and the **Black** wire at TEMP SENSOR (-), as shown.
2. To ensure reliable connections at the battery temperature sensor terminal blocks, torque the clamp-screws 0.4 – 0.6 Nm (3.5 – 5.3 lb-in).
3. Use cable-ties (not supplied) and the provided cable-tie holes on the cable support bracket to tie down the battery temperature sensor cable.

On APS3-061 power systems, there is a cable-tie hole on the bracket behind the battery cable clamp, to tie down the battery temperature sensor cable.

Mounting the Battery Temperature Sensor

The battery temperature sensor is designed to measure the average ambient temperature around the batteries. It is important to mount the battery temperature sensor at a location that truly reflects the average ambient temperature of the batteries.

Attaching the battery temperature sensor to the battery stand (centered and above the batteries) may provide the most reliable temperature reading.

If possible, avoid:

- Placing the battery temperature sensor on top of battery cases.
- Attaching the battery temperature sensor to battery cables, terminals or interconnecting bars.
- Exposing the battery temperature sensor to direct sunlight and drafts from the air-conditioning system or open windows.
- Running the battery temperature sensor cable along power or earth cables.

Connecting the Power System to the AC Supply

Data Power Solutions can be connected to single-phase (L-N), two-phase (L-L), three-phase (L-N) and three-phase (L-L) AC power distribution systems.

Fused AC power sockets (one per rectifier) are available for connecting the power system to the AC supply. These fused AC power sockets are labeled K1 to K3 on APS3 and K1 to K6 on APS6 power systems. AC power socket K1 powers Rectifier 1, etc. (See Chapter 1 for location of Rectifier 1.)

No AC power cords are supplied with the power systems.

AC Supply Requirements

- **AC Power Cords** – The AC power cords (supplying the power system) must be suitably rated for the environment and AC distribution system. In addition, these AC power cords must be approved and installed to comply with local wiring regulations. (See Appendix C for maximum AC input current specifications.)

  The earth conductor of each AC power cord must have a minimum cross sectional area of 1 mm^2 (0.00155 in^2).

  The maximum length of each AC power cord should not exceed 3m (10 feet), unless local wiring regulations permit otherwise.

- **Desktop Versions** – If APS3-06X power systems are fitted with three rectifiers, then only two AC power cords may be connected to one building branch circuit. The third AC power cord must be connected to a separate building branch circuit. Failure to do so voids all safety approvals.

- **Earthing** – Data Power Solutions are classified as "Class 1" equipment that must be provided with an earth connected to the "Protective Earthing Conductor" in the building wiring. The earth conductor of each AC power cord must be connected to the "Protective Earthing Conductor" in the building wiring.

- **Earth Leakage Current** – The maximum earth leakage current of each Access Power Rectifier is 1.5 mA. Ensure that any upstream Residual Current Devices (RCDs) are appropriately rated.

AC Installation

Install all AC cabling between the AC power source and the power system according to the AC Supply Requirements above, but do NOT switch on the AC supply at this stage.

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Inserting the Access Power Rectifiers

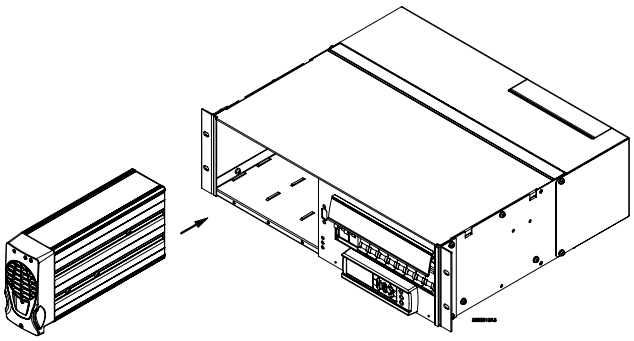
Do NOT switch on the AC supply at this stage.

Step 1 – Unpack the rectifiers

Unpack the rectifiers and inspect them carefully for possible damage that may have occurred in transit. Report any damage immediately, using a copy of the Equipment Incident Report (located at the back of this guide) to supply all relevant details. Fax the completed form to your local Powerware DC product representative.

Keep the original packaging. You will need this if any equipment needs to be returned to your nearest authorized service agent for replacement or repair.

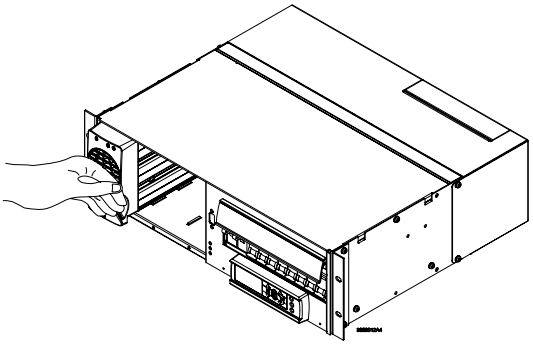
Step 2 – Align the rectifier with the burst-out guides in the shelf



Step 3 – Push in the rectifier

To avoid injury to your hands, keep your fingers clear, as shown in the diagram below.

1 Slowly push in the rectifier, sliding it along the burst-out guides, as shown below, until it plugs firmly into the backplane connector.



2 Tighten the rectifier retaining screw with a Pozidriv® screwdriver.

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Pre-Power-Up Check

Use the checklist below to complete initial checks before progressing further.

Checklist

- ☐ All AC and DC cabling is installed
- ☐ All cabling is neat and correctly insulated
- ☐ DC battery and load cabling has the correct polarity
- ☐ All panels are in place and all empty rectifier slots are covered with blanking panels
- ☐ The AC supply to the power system is switched OFF
- ☐ All circuit breakers at the front of the power system are switched OFF
- ☐ Batteries (if fitted) are isolated from the power system

Applying AC Power

1. Switch on the AC supply.
2. Check that each rectifier starts up and that the green ⏻ Power On LED is on and both the red urgent 🔔 and yellow 🔔 non-urgent alarm LEDs are off. (If not consult the troubleshooting section in Chapter 7).
3. Check that the SM45 supervisory module has powered up and that the green ⏻ Power On LED on both the SM45 and the display module is on.

   Depending on your configuration settings, the urgent and/or non-urgent alarm LED(s) may also be on.

4. Check that all installed rectifiers are communicating and that the SM45 supervisory module has correctly registered all rectifiers, by viewing the individual rectifier currents in Main Display Mode. (See front panel menu structure on inside front cover or *Viewing System Values* in Chapter 5 for details.)

   If no load is connected each rectifier will show 0 A.

Configuring the Power System for Operation

Each power system is supplied with a pre-loaded configuration file.

It is important that the settings of this configuration file are checked / verified 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.

Only those configuration parameters that are most likely to be changed on-site can be configured from the front panel. For entering and editing of all other configuration parameters (such as mapping of alarms to relays and setting up communications) a laptop computer and the latest version of *DCTools* is required. The latest version of *DCTools* can be downloaded from **http://www.powerware.com/downloads**

We recommend using *DCTools* for configuring your power system for operation.

Using the Front Panel Keypad

Scroll through the SM45's Configuration Mode and change the configuration settings as required.

A list of all the configuration settings that can be changed from the front panel can be found on the inside back cover.

For details about changing configuration settings from the front panel, see *Viewing and Editing Configuration Parameters* in Chapter 5.

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Using DCTools

Before you start, you need

- A PC (preferably a laptop) with the latest version of *DCTools* installed.
- A null modem cable

Step 1 – Connect a PC to the RS-232 port of the APS DC power system

1 Connect the null modem cable between the RS-232 port of the power system and the serial port of your laptop or PC.

2 Start *DCTools* by double clicking on the *DCTools* icon on the desktop.

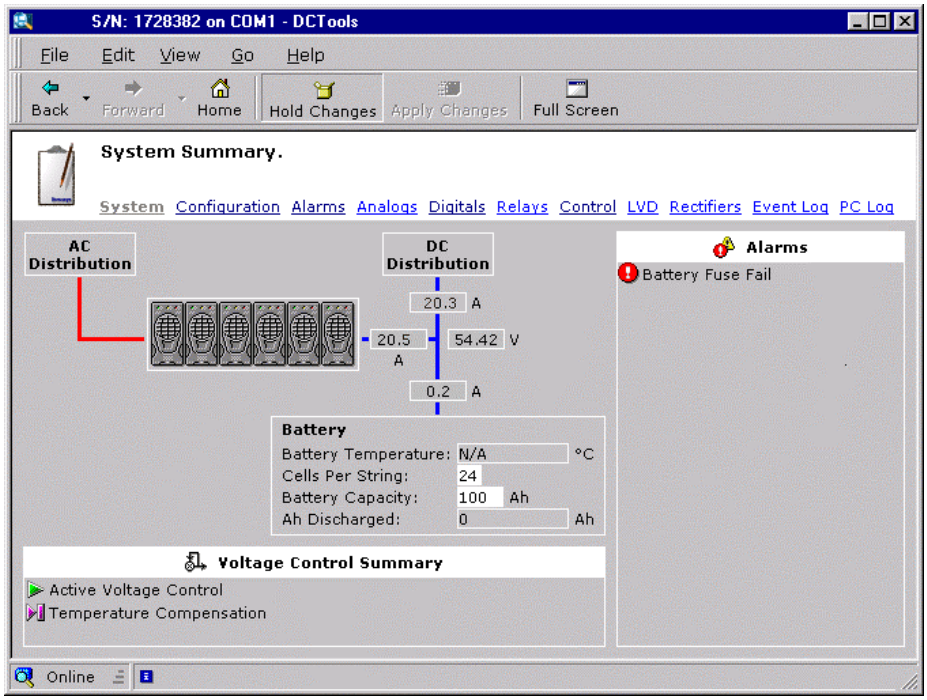
Step 2 – Check that your PC port is specified correctly

1 Double-click on the *DCTools* icon in the Windows™ task bar to display the DCTools Connection List. The default connection is **COM1**.

2 If the port properties are correct, enable the connection by selecting the Active check box ☑ of that connection.
The correct port properties are, (**Protocol**: S3P and **S3P Address**: 0).

If the port properties are incorrect, select the relevant connection from the Connection List and click the toolbar button. In the Comms Properties dialog, edit the properties as necessary and click **OK**.

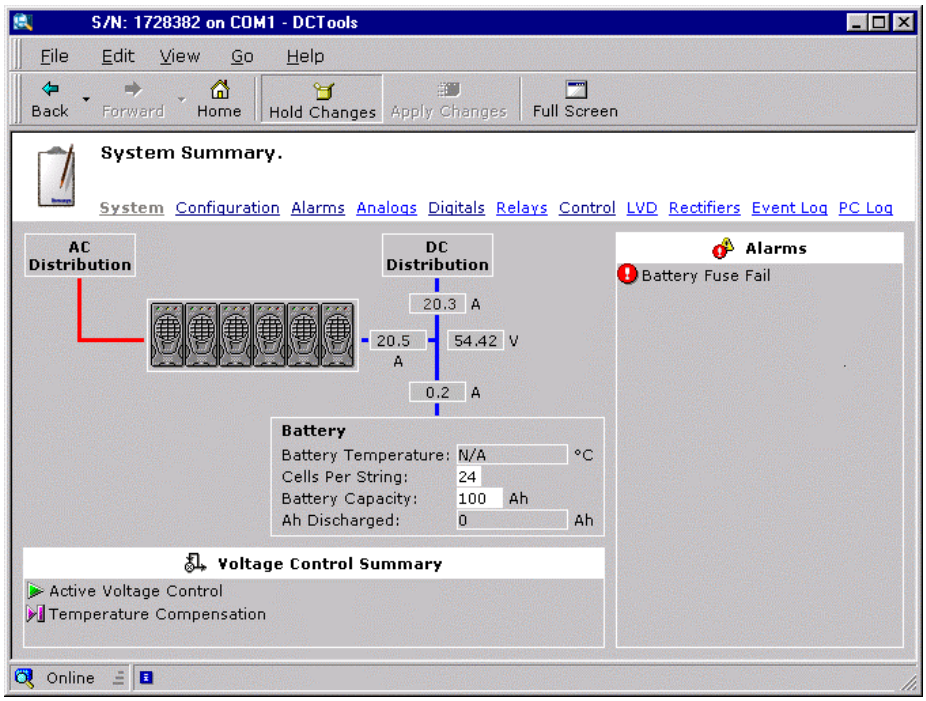
If the connection is successful, the *DCTools* System Summary (Home) screen is displayed as shown.



Step 3 – Check through the loaded configuration and make changes as required

Check through the loaded configuration in *DCTools* by clicking on the hotlinks at the top of the *DCTools* System Summary (Home) screen and make changes as required.

The *DCTools* System Summary (Home) screen below shows the main configuration hotlinks, followed by a list of what can be configured under each hotlink.



Hotlink	Click to …
Configuration	Enter site specific information and synchronize the SM45 real-time clock with the internal UTC time of your PC under Identity
	Set up Ethernet communications and SNMP traps under Communications, and sysObjectID under SNMP
Alarms	Configure system alarms *(see Example 1)*
Analogs	Configure analog inputs, current inputs and external analog inputs
Digitals	Set-up user alarms
Relays	Toggle relay states when performing a Relay Test and configure external digital inputs
Control	Configure the settings of control functions such as Manual Equalize, Temperature Compensation, Battery Test, Fast Charge, Battery Current Limit and Active Voltage Control.
LVD	Enable / disable LVD(s) and to configure the LVD settings
Rectifiers	Configure rectifier settings

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Example 1 ***Reconfiguring System Alarms***

In general reconfiguring system alarms requires the following:

- Changing the urgency (Disabled, Relay Only, Urgent or Non Urgent)
- Setting the alarm thresholds and recognition times

For example, to reconfigure an alarm, follow the steps below.

1 From the *DCTools* System Summary (Home) screen, click the **Alarms** hotlink. The Alarm Table screen is then displayed.

2 To change the urgency of an alarm, double-click on the Urgency for that alarm, then click the ▼ button and select the new urgency from the popup list.

3 To change alarm thresholds and recognition times, click the + button to the left of **Alarm Configuration** at the bottom of the Alarm Table screen and change the settings as required.

Applying DC Power to the Load

1. Check the DC output voltage and polarity of the power system and battery string(s).
2. Switch on the Battery MCB(s) (if fitted) and check that the Battery Fuse Fail alarm clears.

   When connecting multiple battery strings in parallel to the system DC bus, ensure that the individual strings are of similar voltage.

3. Check the Battery Current reading, if batteries are fitted. (The actual value depends on the state of charge of the batteries.)
4. Switch on the Load MCB(s). Check that the load (the equipment) powers up and that the Load Fuse Fail alarm clears.
5. Check the rectifier currents and verify that the load current is representative of what the load draws and also that the power system has sufficient capacity.
6. Charge the batteries (if fitted) according to the battery manufacturer's recommendations. Manual Equalize can be started from *DCTools* or the front panel.

   Manual Equalize increases the system voltage to the pre-configured equalize voltage for the pre-configured equalize duration. After the pre-configured equalize duration has expired, the power system voltage reverts back to normal battery float voltage automatically.

7. Fit the DC output cover.

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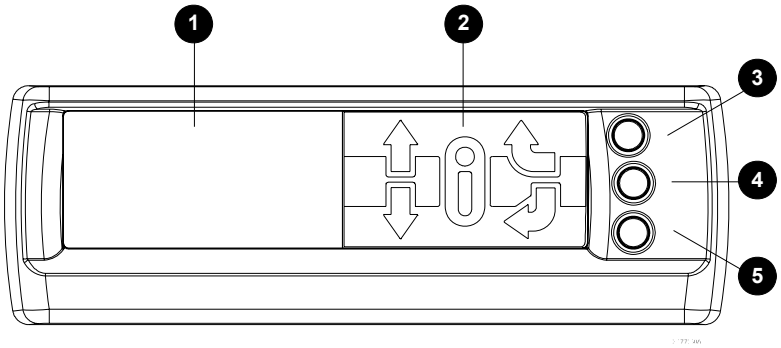
Overview

About the SM45 Front Panel

The Keypad and LED Indicators



❶ Backlit LCD Display

❷ Keypad

❸ Power On LED (green) – indicates that the SM45 is powered

❹ Non-urgent Alarm LED (yellow) – indicates one or more active non-urgent alarms

❺ Urgent Alarm LED (red) – indicates one or more active urgent alarms

⇧ ⇩ **Scroll Keys:** Press these keys to scroll through lists and menus and to increase or decrease configuration values.

Information Key: Press this key to view status messages and a list of active alarms in Status View Mode.

Enter Key: Press this key to go to Configuration Mode and Edit Mode, save configuration changes, clear alarms or toggle relay states.

Escape Key: Press this key to go to Main Display Mode or cancel configuration changes.

The Display Indicators

The following display indicators may appear on the screen from time to time.

Indicates an urgent alarm.

Indicates a non-urgent alarm.

??? Indicates that the system value cannot be displayed, because of a failed, disconnected or unconfigured sensor.

⬆ ⬇ ⬍ Indicates which scroll key to press, to view further display items.

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The Audible Indicator

The SM45 has an onboard audible indicator.

The audible indicator informs you about pressing invalid keys and active alarms as follows:

- One beep every 2 seconds - indicates that a non-urgent alarm is active
- A continuous sound - indicates that an urgent alarm is active

An urgent alarm always overrides a non-urgent alarm.

► To disable the audible indicator (when an alarm is active)

- Press any key

At the next active alarm, the audible indicator is automatically enabled again.

Display Time-out

The SM45 has a display time-out function – that is, if no keys are pressed for a predetermined time interval, the SM45 reverts back to the default display (total rectifier current).

The predetermined time interval varies (according to the display mode you are in) as follows:

- Edit Mode – no time-out
- All other display modes – 2 minutes

Changing the Display Contrast

The display contrast can be adjusted from 0 (lowest contrast) to 63 (highest contrast).

► To change the display contrast

1. Press the ⏎ key to enter Configuration Mode.
2. Press the ⇩ key to scroll down to Display Contrast.
3. Press the ⏎ key to enter Edit Mode.
4. Press either the ⇩ or ⇧ key to change the display contrast as appropriate. (Contrast changes are immediately visible.)
5. Press the ⏎ key to save the new value.
6. Press the ⏎ key to return to Main Display Mode.

About Display Modes

The SM45 front panel menu structure consists of four display modes:

- **Main Display Mode** – for viewing system values
- **Status View Mode** – for viewing system statuses as well as viewing and clearing alarms
- **Configuration Mode** – for viewing settings of configurable parameters
- **Edit Mode** – for editing the configurable parameters in Configuration Mode

For quick and easy reference, graphical representations of the menu structure are printed on the inside front and back covers.

Changing Display Modes

► **To enter a display mode**

- From Main Display Mode, press the key to enter Status View Mode and Alarm Mode.
- From Main Display Mode, press the key to enter Configuration Mode and Edit Mode.

► **To exit a display mode**

- Press the key to return from any mode to Main Display Mode.

Scrolling within a Display Mode

► **To scroll within a display mode**

- Press the key to scroll up within a display mode.
- Press the key to scroll down within a display mode.

To scroll through a display mode faster, hold down the or key.

Using Edit Mode

For details about viewing and editing configuration parameters, see page 2-7.

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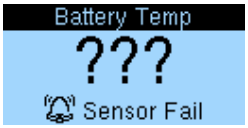
Viewing System Values (Main Display Mode)

Nine system values (as at right) can be viewed in Main Display Mode.

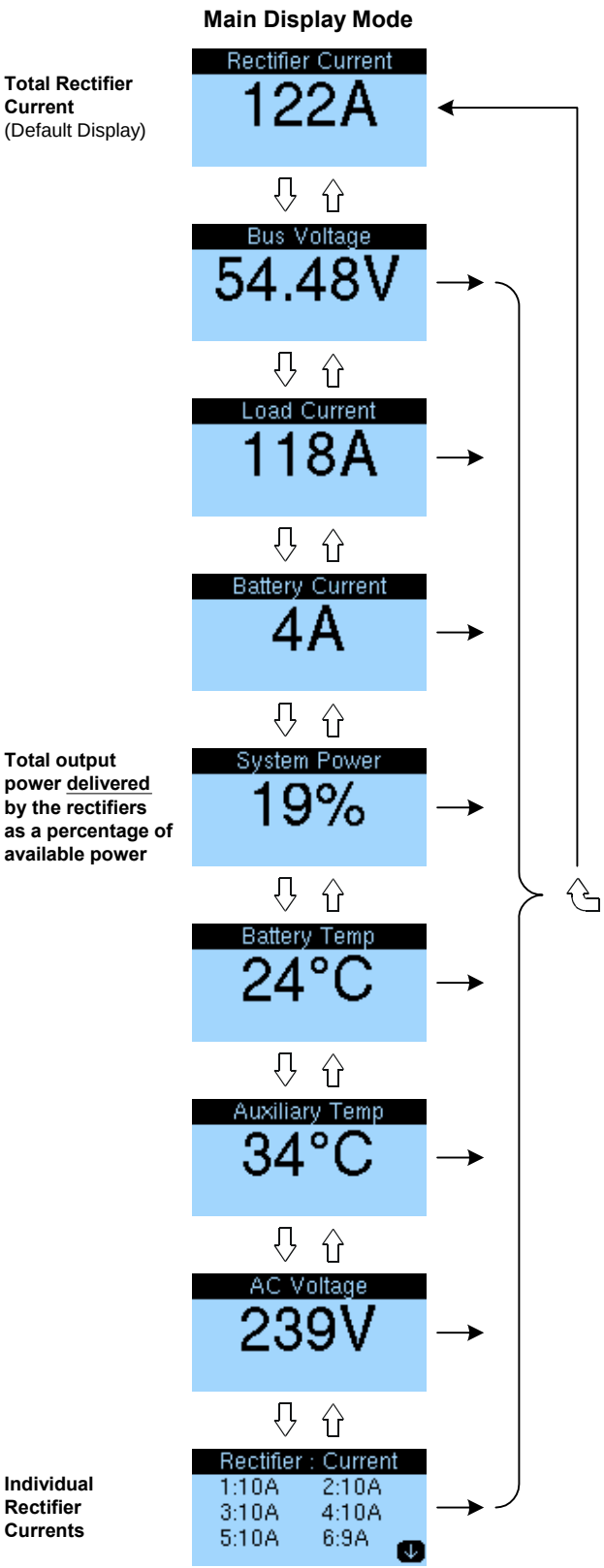
If a system value is not available (for example, because of an incorrectly configured or disconnected battery temperature sensor), the following is displayed.



Details about the other display indicators can be found on page 2-2.

► To view system values

1. Press the ⇩ or ⇧ key to scroll through the system values in Main Display Mode.
2. Only six individual rectifier currents are displayed at once. If more than six rectifiers are installed, press the ⇩ or ⇧ key to scroll through the list.
3. Press the ⇦ key to return to the top of the list – total rectifier current.



Viewing Alarms and System Status Messages (Status View Mode)

Status View Mode displays alarm and status messages.

The appearance of one of the following display indicators in Main Display Mode indicates the presence of an alarm message.

indicates an urgent alarm

indicates a non-urgent alarm

Details about the other display indicators can be found on page 2-2.

Rules for displaying alarms and system status

- Active alarms are always displayed before status messages.
- Urgent alarms are always displayed before non-urgent alarms.
- Alarms with their urgency set to **Disabled** are not displayed.

Important note about Rect Comms Lost alarm

If a rectifier is removed, a Rectifier Comms Lost alarm is displayed after 10 seconds. The operator or installer then has the opportunity to clear the alarm immediately to prevent triggering an external alarm device. The alarm must be cleared within the configurable Alarm Recognition Time (default is 10 seconds), otherwise an external alarm is generated.

Rects Comms Lost is remotely displayed as Multiple Rectifier Comms Lost.

► To view and clear alarms

1. From Main Display Mode, press the key to enter Status View Mode.
2. Press the ⇩ key to scroll through the list of alarms.
3. Press the ↵ key to clear the alarms. (Only three alarms can be cleared – Rect Comms Lost, Rects Comms Lost and Battery Test Fail.)
4. Press the ⇦ key to return to Main Display Mode.

For a comprehensive list of alarms (that can be displayed in Status View Mode) see Appendix A.

► To view system status messages

1. Press the key to enter Status View Mode.

   If there are active alarms, press the ⇩ key to scroll to the bottom of the alarm list. The control status list is displayed after the last alarm.
2. Press the ⇩ or ⇧ key to scroll through the list of status messages.
3. Press the ⇦ key to return to Main Display Mode.

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Viewing and Editing Configuration Parameters

Configuration Mode displays only those configuration parameters that are most likely to be changed on-site. Configuration parameters configurable from the front panel are changed in Edit Mode.

For viewing and editing all other configuration parameters a laptop computer or remote access is required. See Chapter 3 for details about the standard communications options.

► To view and edit a configuration parameter

1. From Main Display Mode, press the ⏎ key to enter Configuration Mode.
2. Press the ⇩ key to scroll down to the required parameter.
3. Press the ⏎ key to enter Edit Mode.
4. Press either the ⇩ or ⇧ key to change the value as appropriate.
5. Press the ⏎ key to save the new value and return to Configuration Mode, or
6. Press the ⇦ key to cancel the change and return to Configuration Mode.
7. Press the ⇦ key to return to Main Display Mode.

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Overview

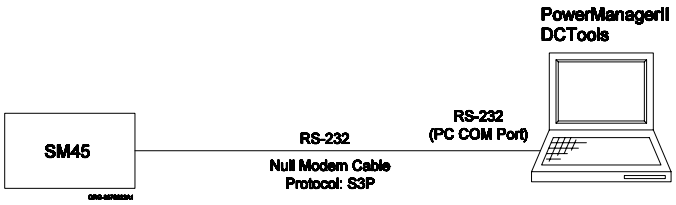
Communications Options

The SM45 supervisory module communicates to a designated PC (running the *DCTools* software) via a:

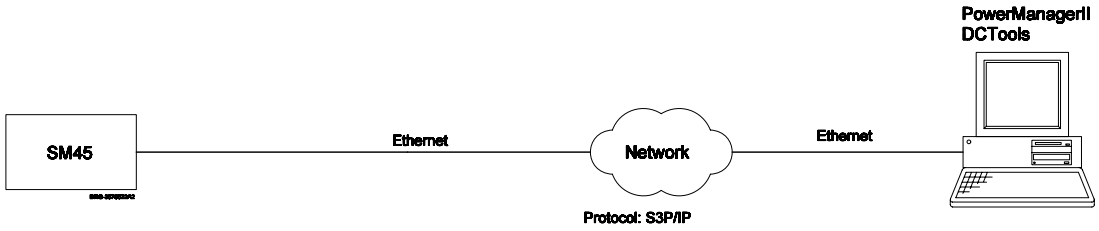
- Standard RS-232 serial interface, or
- Ethernet 10BaseT interface, both accessible from the front panel

Shown below are the two standard communications options.

Direct Connection



Ethernet



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DCTools Setup

For your chosen communications option, configure the communications settings, in *DCTools* according to the table below.

Then check that *DCTools* communicates correctly.

Properties	Direct Connection	Ethernet
Comms Enabled	True	True
Protocol	S3P	S3P
Connect Using	COM1	Local Network
S3P Address	0	0
Server IP Address	–	10.64.129.1 *(See Note 1)*
Server Port	–	14000
Telnet	–	Cleared

Note 1: Allocated by network administrator

SM45 Ethernet Setup

Before an SM45 supervisory module can communicate over an IP network with *DCTools*, the SM45 must be set up for Ethernet communications.

Use the front panel or *DCTools* for configuring the SM45 supervisory module for Ethernet communications.

Setup of Ethernet communications requires the following:

- The network administrator assigning a unique IP address to each SM45 supervisory module to be connected to the IP network
- Setting the assigned IP address for each SM45
- Setting the net mask / subnet mask and gateway address for each SM45 as appropriate

► To configure the SM45 for Ethernet communications using *DCTools*

1. From the *DCTools* System Summary (Home) screen, click the **Configuration** hotlink and then **Communications** to display the Communications view.
2. Under Ethernet, enter the assigned IP address, subnet mask and gateway address.

Setting Up SNMP Traps

The SM45 supervisory module can be configured to send alarms as SNMP traps to up to eight different SNMP trap receivers.

To send alarms as SNMP traps, first set up Ethernet communications (see page 6-3 for details), and then use *DCTools* to set up SNMP traps as follows:

1. From the *DCTools* System Summary (Home) screen, click the **Configuration** and then **Communications** hotlink to display the Communications view.
2. Click the + button to the left of **SNMP** to display the SNMP configuration view.
3. Do not change the default settings of **SNMP Read Community** (public) **and SNMP Write Community** (private), unless requested by the network administrator.
4. Configure **Trap Repeat** and **Trap Repeat Rate** as appropriate.
5. For each receiver, configure the following parameters using the configuration guidelines.

Parameter	Configuration Guidelines
Name	Enter the name of the SNMP trap receiver (20 characters maximum).
Level	SNMP Trap Level – controls reporting of specific events for each receiver as follows: • Select **All Events And Alarms** to receive events and urgent and non-urgent alarms. (Typically events are status messages such as Equalize Active.) • Select **Urgent And Non Urgent Alarms** to receive both urgent and non-urgent alarm notifications. • Select **Urgent Alarms Only** to receive only urgent alarm notifications. • Select **Disabled** to temporarily disable notifications to the receiver.
IP Address	Enter the IP address of the trap receiver that has been assigned by the network administrator.
Port	Enter the port number of the trap receiver that has been assigned by the network administrator.
Trap Community	A form of password. Use **public**, unless the network administrator has assigned a new password.
Mode	Select: • **Normal Traps** for sending traps to any network management system, except *PowerManagerII* • **Acknowledged Summary Trap** for sending traps to *PowerManagerII* only

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Entering the "sysObjectID" of a Power System

"sysObjectID" is a unique identifier that allows the network management system to identify an item (in this case a power system) on the network.

The unique identifiers are listed in the table below.

APS3-058:	1.3.6.1.4.1.1918.10.1
APS3-059:	1.3.6.1.4.1.1918.10.2
APS3-060:	1.3.6.1.4.1.1918.10.3
APS3-061:	1.3.6.1.4.1.1918.10.4
APS6-058:	1.3.6.1.4.1.1918.10.5
APS6-059:	1.3.6.1.4.1.1918.10.6

► To enter the "sysObjectID" of a power system using *DCTools*

1 From the *DCTools* System Summary (Home) screen, click the **Configuration** hotlink and then **Communications** to display the Communications view.

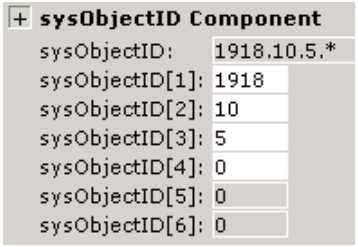
2 Click the + button to the left of SNMP and scroll down to the bottom of the SNMP view.

3 Click the + button to the left of sysObjectID Component to display the sysObjectID entry view.

4 Enter only the last three parts of the power system's unique identifier into the appropriate sysObjectID fields. (See Example 1 below.)

Example 1 The unique identifier of an APS6-058 power system is 1.3.6.1.4.1.1918.10.5.

The last three parts (1918.10.5) are entered as shown below.



Synchronizing the SM45 Real-time Clock

The SM45 features a battery-backed real-time clock for accurate date-time stamping of all alarms and control processes. Battery back up ensures that the date and time is maintained while the SM45 is not powered.

The real-time clock is set to Coordinated Universal Time (UTC) during manufacture. If required, the time can be corrected by synchronizing it with the internal UTC time of your PC.

PC real-time clocks are not always accurate. Ensure that the time of your PC is correct before synchronizing.

► To synchronize the SM45 real-time clock using *DCTools*

1. Ensure that the SM45 is powered and connected to *DCTools*.
2. From the *DCTools* System Summary (Home) screen, click the **Configuration** hotlink and then **Identity** to display the System Identification view.
3. Under Time Synchronization, click the Synchronize button to synchronize the real-time clock.

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Overview

Troubleshooting

Use the table below to troubleshoot minor power system installation and operational problems. If you still cannot solve a problem, contact your local Powerware DC product representative for assistance.

Problem	Possible Cause/s	Required Action
All rectifiers are off (no LEDs on) and SM45 display is blank	AC power to the system is off and the batteries are fully discharged or disconnected.	Restore AC power.
Green LED of one or more rectifiers is off	AC power to rectifier(s) off or one or more phases are off	Restore AC power.
	Rectifier is not fully inserted.	Check that the rectifier is fully inserted.
	Internal rectifier fault	Remove the rectifier and insert another one in the same slot. If the second rectifier operates normally, the first rectifier is faulty and must be returned to your local Powerware DC product representative.
Rectifier red LED on	Very low AC voltage or AC supply failed	Check the AC supply. The power system will return to normal operation when the AC supply has returned to within its specified AC input voltage range. See Appendix C.
	AC overvoltage	None. The power system will return to normal operation when the AC supply has returned to within its specified AC input voltage range, as specified in Appendix C.
	Rectifier shut down	Check if a rectifier has in fact been shut down, using *DCTools*. If yes, turn on the rectifier using *DCTools*.
	Rectifier(s) failed	Use *DCTools* to determine if a rectifier has failed or has been shut down. If a rectifier has failed, replace it. If a rectifier has been shut down, refer to required action for Rectifier Shut Down.
	DC overvoltage	Remove and re-insert rectifier(s) after approximately 5 seconds.

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Problem	Possible Cause/s	Required Action
Rectifier yellow LED on	Rectifier power limit is active.	Check if the power system is recovering from a recent AC power outage. The power system may still be charging the batteries after the power outage. No further action is required. Check that the rectifier capacity of the power system is not exceeded. Additional rectifiers may be required.
	Rectifier temperature turndown is active, due to low AC supply voltage or excessive ambient temperature.	None. The power system will return to normal operation when the AC supply has returned to within its rated AC input voltage or operating temperature range, as specified in Appendix C.
High system output voltage	Equalize, Fast Charge and / or Temperature Compensation process is active	Disable active processes if not required.
	Incorrect float voltage setting at supervisory module	Check the float voltage setting of the supervisory module. Record new setting.
	Faulty rectifier	Remove rectifier modules one at a time. (The output voltage returns to normal when faulty rectifier is removed.) Replace faulty rectifier.
Low system output voltage (rectifiers not in current limit)	Rectifiers not on	Restore AC power.
	Battery Test and / or Temperature Compensation process is active.	Disable active processes if not required.
	Incorrect float voltage setting at supervisory module.	Check the float voltage setting of the supervisory module. 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.	Reduce load or add rectifier modules.
	Battery is recharging after AC power outage.	Check battery has recharged within expected time.

continued

Problem	Possible Cause/s	Required Action
SM45 does not correctly register the current shunts and the displayed values are over range.	Local / External current shunt selector switches in the wrong position.	Contact your local Powewrware DC product representative.
SM45 display is blank.	Faulty SM45 display or disconnected display loom.	Contact your local Powewrware DC product representative.
SM45 green ⏻ Power On LED off.	SM45 is not powered	Check the SM45 card is fully inserted into the backplane.
	SM45 is faulty.	Contact your local Powerware DC product representative.
SM45 red 🔔 LED on	SM45 “Urgent Alarm” is active.	Check the type of “Urgent Alarm” using *DCTools* or press the ⓘ key on the SM45 front panel.
SM45 yellow 🔔 LED on	SM45 “Non-Urgent Alarm” is active.	Check the type of “Non-urgent Alarm” using *DCTools* or press the ⓘ key on the SM45 front panel.
No Ethernet communications between SM45 and local PC	Wrong IP address, netmask and / or incompatible network Gateway may be required	Check the settings with the network administrator.
	Faulty communications cable	Replace faulty cable.
	The Telnet Active check box in the *DCTools* Comms Properties dialog is enabled.	Disable the Telnet Active check box in the *DCTools* Comms Properties dialog.
No communications between SM45 and local PC	Incorrect cable	Check that a null modem cable has been used.
	Null modem cable not plugged into PC or plugged into the wrong port.	Check that the null modem cable is plugged into the PC and into the correct port.
	Communications port settings of PC do not match that of the RS-232 serial port of the power system.	Reconfigure the PC port properties (19K2 8 N 1).
	Incorrect S3P address.	Check that the S3P address in *DCTools* is set to 0.

continued

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Problem	Possible Cause/s	Required Action
SM45 displays **Config Error**	Missing configuration	Download the appropriate configuration file into the SM45.
	Invalid configuration	Contact your local Powerware DC product representative.
	Incorrect number of cells in a battery string – a result of a mismatch between string voltage and nominal rectifier output voltage.	Check the number of cells in a battery string, nominal voltage of each cell and the nominal voltage of the rectifiers.
SM45 displays **???**	Incorrectly configured, disconnected or failed sensor	Configure, connect or replace sensor.

Replacing a Rectifier

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

Only service personnel should replace faulty rectifiers.

This section covers the following procedures.

- Removing a Rectifier
- Inserting a Rectifier

Removing a Rectifier

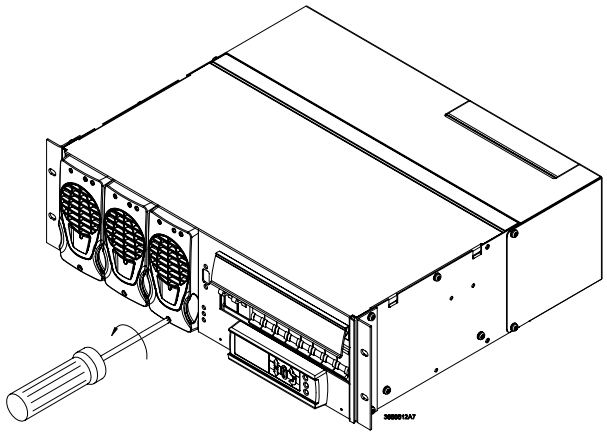
To reduce the risk of electric shock and maintain optimum system cooling, always cover empty rectifier slots with blanking panels.

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) along with the completed Equipment Incident Report, to your nearest authorized service agent for replacement or repair.

This note applies to APS3-06X desktop versions only:
To gain access to the rectifiers, remove the front cover of the APS3-06X power system first.

Step 1 – Loosen the rectifier retaining screw with a Pozidriv® screwdriver



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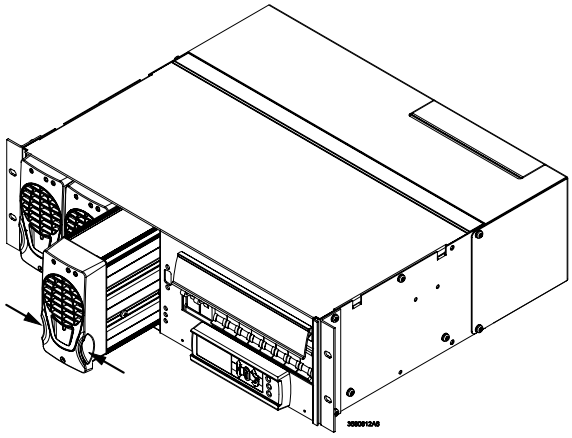
Step 2 – Pull out the rectifier

Rectifier cases may exceed 100°C (212°F), especially after prolonged operation. Use suitable gloves to remove the hot rectifier.

Grip the rectifier front panel with one hand as indicated by the arrows in the diagram below and slowly pull it out from the shelf, supporting the base of the rectifier with your other hand.



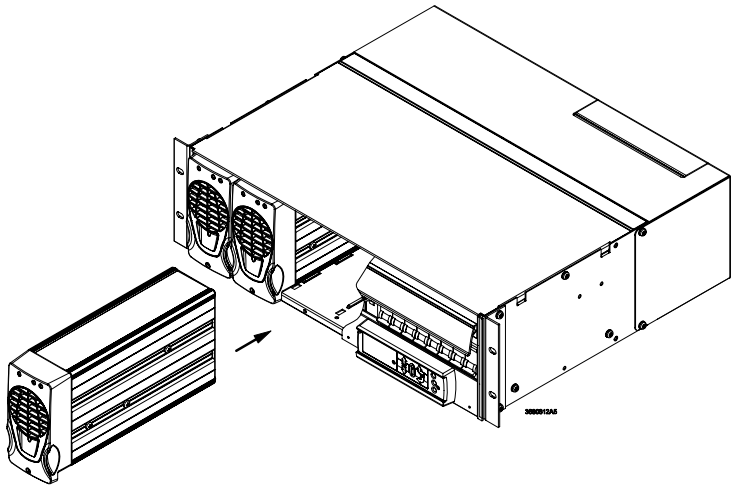
To avoid damage to the connector do not rest the rectifier on its connector, once it has been removed from the shelf.

Procedure complete

You must now insert a replacement rectifier into the empty slot (see page 7-8), or fit a blanking panel (Part Number: IPN 621-05722-63A).

Inserting a Rectifier

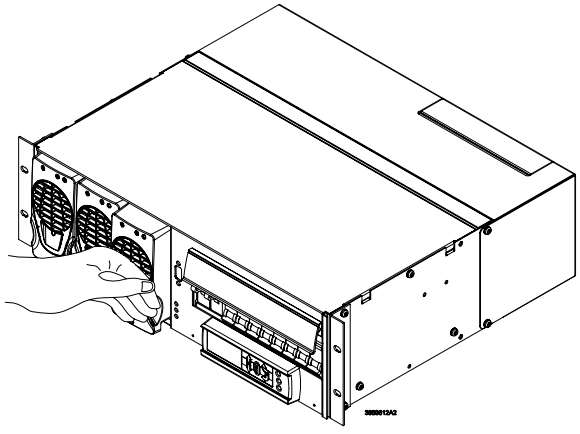
Step 1 – Align the new rectifier with the burst-out guides in the shelf



Step 2 – Push in the rectifier

To avoid injury to your hands, keep your fingers clear, as shown in the diagram below.

1 Slowly push in the rectifier, until the rear connector of the rectifier engages fully with the backplane connector.



2 Tighten the rectifier retaining screw.

3 Check that the rectifier's ⏻ Power On LED turns on and the 🔔 and 🔔 alarm LEDs are off.

The 🔔 alarm LED turns on for about 1 second when the rectifier powers up.

4 Fit the front cover (APS3-06X desktop versions only).

Procedure complete

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Replacing AC Input Fuses

Each AC power socket has two fuses (one in the phase (L) and another in the neutral (N) AC input line) to protect the power system against certain internal fault conditions.

Only service personnel should replace the AC input fuses.

Ensure that the AC supply is disconnected from those fused AC power sockets before checking or replacing their respective fuses.
CAUTION: DOUBLE-POLE / NEUTRAL FUSING

Use only 15 A, 250 VAC, 6.3 x 32 mm, fast-acting fuses of the same type (Bussman ABC-15 or Littelfuse 314-015 Type 3AB) for continued protection against risk of fire.

► To check and replace AC input fuses

1. Disconnect the AC power cord from the fused AC power socket of the rectifier that is not operating.

   The fused AC power sockets of APS3 power systems are labeled (K1 to K3) and (K1 to K6) on APS6 power systems. AC power socket K1 powers Rectifier 1. (See Data Power Solutions diagrams in Chapter 1 for location of Rectifier 1.)

2. With a suitable flat-blade screwdriver, press down the fuse drawer tab to release it from the fuse holder.
3. Remove the fuse drawer and check both fuses.
4. Replace any blown fuses only with 15 A, 250 VAC, 6.3 x 32 mm, fast-acting fuses of the same type (Bussman ABC-15 or Littelfuse 314-015 Type 3AB).
5. Re-insert the fuse drawer into the fuse holder and press the fuse drawer until it locks into position.
6. Reconnect the AC power cord.
7. Check if the affected rectifier powers up and that its green ⏻ Power On LED is on.

   If not, then that rectifier is faulty and needs to be replaced. (See page 7-6 for details about replacing a rectifier.)

   If the faulty rectifier has been replaced once and the fuses of that AC power socket blow again, then there is a problem with the internal wiring of the power system. In that instance, contact your local Powerware DC product representative for assistance.

Replacing the SM45 Real-time Clock Battery

A 3.6 V lithium battery provides power to the real-time clock when the SM45 is not powered.

Only service personnel should replace the real-time clock battery.

The battery can be replaced with a Tadiran TL-5902/S, or equivalent ½AA non-rechargeable lithium battery.

There is a risk of explosion if the used battery is replaced with an incorrect type. Dispose of the used battery according to the battery manufacturer's instructions.

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Glossary of Alarms

AC Fail	All rectifiers are reporting loss of AC power.
ACD Fan Fail	The AC Distribution cooling system or fan controller has failed.
Aux Temp High	The auxiliary temperature sensor is at a temperature above the high temperature set point.
Aux Temp Low	The auxiliary temperature sensor is at a temperature below the low temperature set point.
Aux Temp Sensor Fail	The auxiliary temperature sensor is incorrectly configured, disconnected, not fitted or faulty.
Batt Temp High	This alarm indicates either thermal runaway of the batteries or that the batteries are operating at a temperature that may cause reduced battery life.
Batt Temp Low	This alarm indicates a risk to the battery standby power system. Note that lower temperatures reduce the battery capacity.
Battery Fuse Fail (displayed as Batt Fuse Fail)	The batteries may no longer be powering the load.
Battery Test Active	A Battery Test is active.
Battery Test Fail	The batteries do not have the required capacity or are not operating in a fully charged state.
Equalize Active	An Equalize process is active.
Fast Charge Active	A Fast Charge process is active.
High Float	The float voltage is above its normal range.
High Load	The bus voltage is higher than the range that is safe for a reliable load.
In Discharge	The batteries are discharging.
Load Fuse Fail	The Load Fuse Fail digital input to the SM45 is active.
Low Float	The float voltage is below its normal range.
Low Load	The bus voltage is below its normal range.

LVD1 Disconnect	The operating conditions of the power system have automatically triggered a low voltage disconnect.
LVD1 Fail	LVD1 is faulty.
LVD1 Manual	A local operator has manually triggered LVD1. (APS6-059 only)
LVD2 Disconnect	The operating conditions of the power system have automatically triggered a low voltage disconnect.
LVD2 Fail	LVD2 is faulty.
LVD2 Manual	A local operator has manually triggered LVD2. (APS6-059 only)
MOV Fail	The surge protection system has failed. One or more MOV cartridges may need to be replaced.
Multiple Rectifier Comms Lost (displayed as Rects Comms Lost)	Normally this alarm indicates that multiple rectifiers have been removed during routine maintenance. However, faulty rectifier communications or losing the rectifier communications bus can also trigger this alarm. If removing multiple rectifiers triggers this alarm, you can reset it from the front panel before it triggers an external alarm.
Multiple Rectifier Fail (displayed as Mult. Rect Fail)	Multiple rectifiers are faulty or their AC power has been removed without causing partial or total AC failure.
Partial AC Fail	More than 20% of the rectifiers are reporting loss of AC power or loss of a phase.
Rectifier Comms Lost (displayed as Rect Comms Lost)	A rectifier has been removed during routine maintenance. However, faulty rectifier communications or losing the rectifier communications bus can also trigger this alarm. If removing a rectifier triggers this alarm, you can reset it from the front panel before it triggers an external alarm.
Rectifier Fail	A rectifier is faulty or its AC power has been removed without causing partial or total AC failure. You can reset a Rectifier Fail alarm from the front panel before it triggers an external alarm.
Sensor Fail	The current, temperature or voltage sensing system is faulty.
System Overload	The power system is operating close to its maximum capacity and more rectifiers may need to be inserted. The System Overload threshold is configurable.

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Control Function Glossary

Battery Current Limit (BCL)

Battery Current Limit automatically limits the battery charge current within a configured range (a percentage of the C10 rating of the battery) by varying the system voltage.

Enable Battery Current Limit to prevent:

- Overcharging of the batteries in under-loaded systems
- Overgassing of the batteries

BCL Engine Run Limit limits the battery charge current to a preset value, when the power system is powered by a standby engine/alternator during an extended AC power outage. A smaller engine/alternator set can therefore be used without excessively pulling down the alternator voltage.

If BCL Engine Run Limit is enabled, then:

- The battery current limit process will use the Engine Run Limit as the charge parameter rather than Battery Current Limit, and
- The User Digital Input and User Alarm number (as specified by the Engine Run Digital Input number) will not be available. (The default setting is Digital Input 1.)

Battery Test

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

The SM45 supervisory module temporarily reduces the output voltage of the rectifiers just below the bus voltage for a set duration. The battery now supplies power to the load. A battery test passes if the battery capacity remains above a predetermined level for the duration of the test.

Battery Test does NOT function during a Fast Charge or Equalize process or during the first 48 hours after an AC power outage.

Equalize

Equalize charges the batteries at a higher voltage after they have been fully charged to ensure that all individual cell voltages are the same.

Battery manufacturers recommend that batteries be equalized periodically. Refer to the battery manufacturer's instructions, before equalizing the batteries.

Low Volts Disconnect

Low Voltage Disconnect disconnects the batteries (Battery Disconnect) or the load (Load Disconnect), at the preset LVD disconnect voltage. This prevents damage to the batteries due to excessive deep discharge. The LVD reconnects the batteries or loads after the AC power is restored.

When configuring the LVD reconnect voltage, ensure that the expected open-circuit recovery voltage of the discharged batteries does not rise above the LVD reconnect voltage.

Temperature Compensation

Temperature Compensation automatically varies the float voltage to cancel the effects of increasing or decreasing ambient battery temperature.

As the ambient temperature of the batteries increases, the voltage required to maintain it in a fully charged state decreases.

Enable Temperature Compensation to help maintain optimum battery capacity over a wider temperature range, which in turn extends battery life.

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System AC Input

AC Input Voltage Range	APU48 rectifiers: 95 – 275 V_{rms} (L-N) APR48 rectifiers: 185 – 275 V_{rms} (L-N)
Rated AC Input Current	
@ 120 V_{rms} with APU48 rectifiers	APS3: 21 A *(7 A per AC power cord)* APS6: 42 A *(7 A per AC power cord)*
@ 240 V_{rms} with APU48 rectifiers	APS3: 10.5 A *(3.5 A per AC power cord)* APS6: 21 A *(3.5 A per AC power cord)*
@ 208-240 V_{rms} with APR48 rectifiers	APS3: 24 A *(8 A per AC power cord)* APS6: 48 A *(8 A per AC power cord)*
Frequency Range	45-66 Hz
Maximum Earth Leakage Current	1.5 mA *(per Access Power Rectifier)*

System DC Output

DC Output Voltage (nominal)		48 V
DC Output Power (maximum)		
	APS3-058 & APS3-060	2.16 kW *(with 3 APU48 rectifiers)* 4.50 kW *(with 3 APR48 rectifiers)*
	APS3-059 & APS3-061	1.70 kW *(with 3 APU48 rectifiers)* 3.00 kW *(with 3 APR48 rectifiers)*
	APS6-058	4.32 kW *(with 6 APU48 rectifiers)* 9.00 kW *(with 6 APR48 rectifiers)*
	APS6-059	3.40 kW *(with 6 APU48 rectifiers)* 7.10 kW *(with 6 APR48 rectifiers)*
DC Output Voltage Range		43 - 57.5 V
Over Voltage Shutdown Trip Point		58 V

Environment

Ambient Temperature Range *(operating)*	-10°C to +40°C [+14°F to +104°F]
Relative Humidity *(operating and storage)*	<95% (non condensing)

Dimensions H, W, D

APS3-058 and APS3-059	3U, 19” mounting, 390 mm [15.35”]*
APS3-060 and APS3-061	150 mm, 465 mm, 415 mm [5.9”, 18.31”, 16.34”]*
APS6-058 and APS6-059	6U, 19” mounting, 390 mm [15.35”]*
Access Power Rectifier	3U, 66 mm [2.6”], 280 mm [11”]

** Additional clear air space is required at rear for rectifier exhaust air venting.*

Weight

APS3	6 kg [13 lb]*
APS6	10 kg [22 lb]*
Access Power Rectifier	1.9 kg [4.2 lb]

** typical configuration, excluding rectifiers*

APR48 Rectifiers

AC Input Voltage Range	185 – 275 V_{rms} *Full output up to 50°C [122°F]* 150 – 185V_{rms} *Full output up to 30°C [86°F]*
Maximum AC Input Current	12 A_{rms} @ 150 V_{rms}
Rated Output Power	1500 W
Rated Output Current	31 A @ 48V
Preset Voltage	54.5 V

APU48 Rectifiers

AC Input Voltage Range	95 – 275 V_{rms} *Full output up to 50°C [122°F]*
Maximum AC Input Current	10 A_{rms} @ 95 V_{rms}
Rated Output Power	720 W
Rated Output Current	15 A @ 48V
Preset Voltage	54.5 V

Comprehensive SM45 supervisory module and Access Power Rectifier product data sheets are available. Please contact your local Powerware DC product representative or email **DCinfo@eaton.com**

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EQUIPMENT INCIDENT REPORT

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

For further information contact the Powerware DC Product Services Division
Telephone:++64 3 343 3314 or Fax: ++64 3 343 7446.

Date: .....

Customer Information

Company: .....

Postal Address: .....

.....

Return Address (Not PO Box): .....

.....

Telephone: ..... Facsimile: ..... E-mail: .....

Contact Name: .....

Location of Failure

Product code..... Serial number..... Document No.....

System type installed in..... Serial number.....

Site name or location.....

Fault discovered ☐ Delivery ☐ Unpacking ☐ Installation ☐ Initial test ☐ Operation after.....years ☐ .....

Failure source ☐ Design ☐ Manufacturing ☐ Documentation ☐ Transportation ☐ Installation ☐ Handling ☐ .....

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

INFORMATION (fault details, circumstances, consequences, actions)

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Internal use only.

Reference No:..... RMA: ..... NCR: ..... Signature: ..... Date: .....

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

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Worldwide Support

For technical support, contact one of the numbers below and for a complete list of our worldwide sales offices, visit our website **http://www.powerware.com** or email DCinfo@eaton.com

Australia	Tel. +61-2-9693-9366
Canada	Tel. 1-800-461-9166
Central America	Tel. +52-55-5488-5252
China	Tel. +86-571-8848-0166
Europe / Middle East / Africa	Tel. +44-1243-810-500
Hong Kong / Korea / Taiwan	Tel. +852-2745-6682
India	Tel. +91-11-2649-9414 to 18
New Zealand / Pacific	Tel. +64-3-343-7448
Singapore / South East Asia	Tel. +65-6829-8888
South America	Tel. +55-11-3616-8500
	Tel: +54-11-4343-6323
United States of America	Tel. 1-800-843-9433 (Toll Free)

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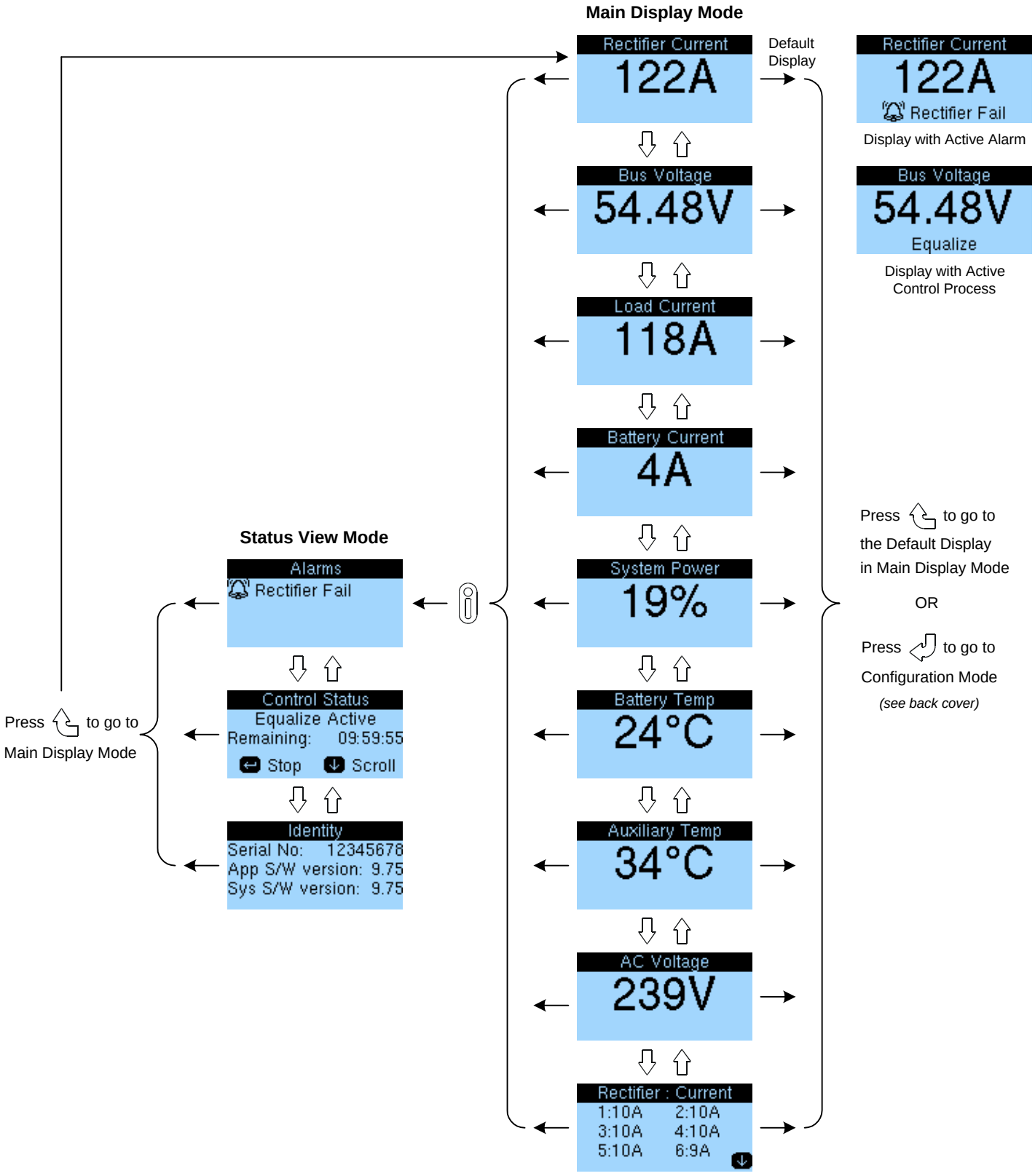
SM45 Front Panel Menu Structure



Enter Key: go to Configuration Mode and Edit Mode, save configuration changes, clear alarms or toggle relay states

Up Key: scroll up lists and menus and increase configuration values

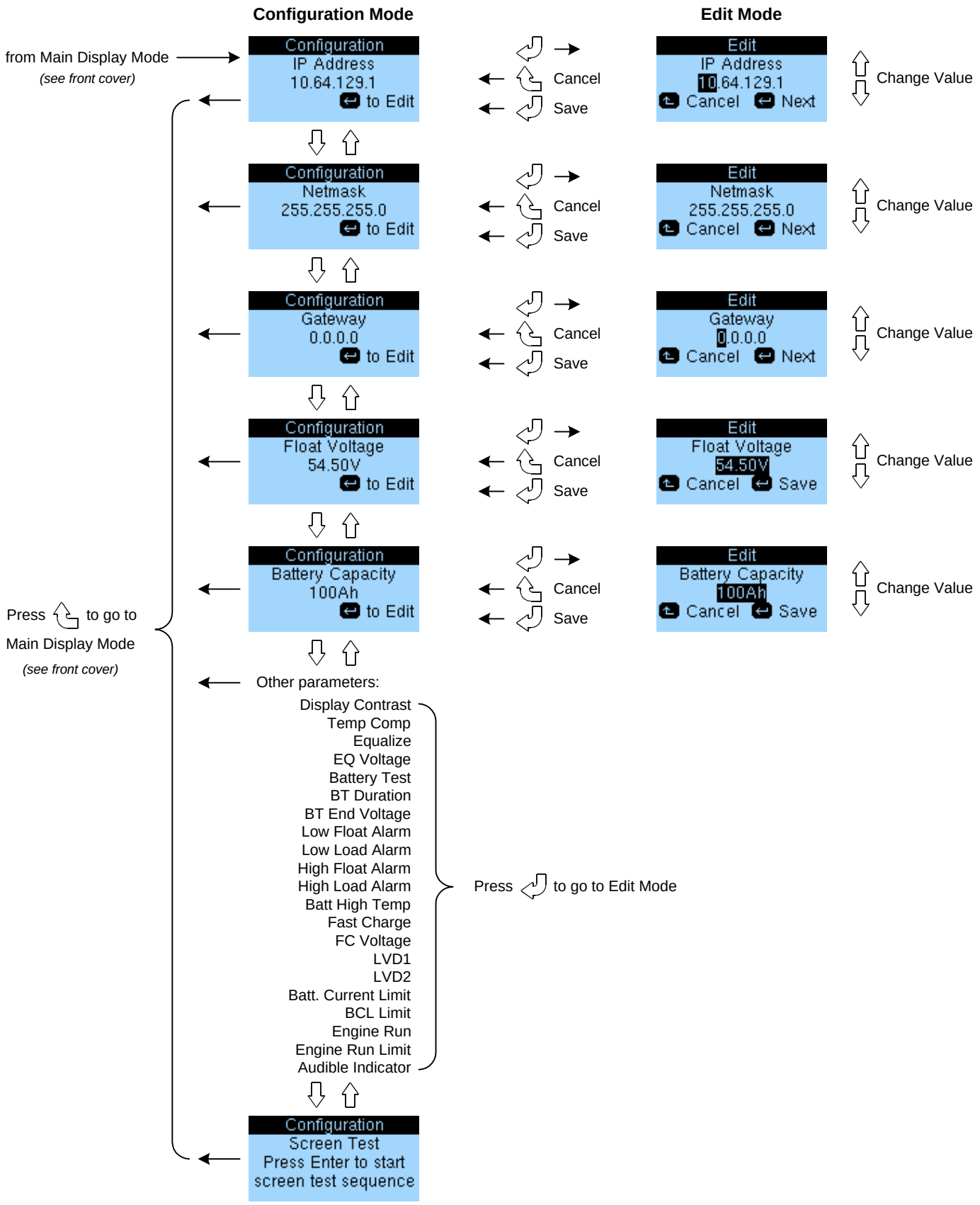
Information Key: view status messages and a list of active alarms in Status View Mode

Escape Key: go to Main Display Mode or cancel configuration changes

Down Key: scroll down lists and menus and decrease configuration values

Display Time-out:
Edit Mode - no time-out
Other modes - 2 minutes

SM45 Front Panel Menu Structure



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Up Key: scroll up lists and menus and increase configuration values

Information Key: view status messages and a list of active alarms in Status View Mode

Escape Key: go to Main Display Mode or cancel configuration changes

Down Key: scroll down lists and menus and decrease configuration values

Display Time-out:
Edit Mode - no time-out
Other modes - 2 minutes