DC Power System

Installation / Operation Manual

Model:
C2RS (-48 VDC and +24 VDC)

Incredible Functionality, Flexibility, and Scalability in a 2 RU, 1.0 to 6.0 Kw DC Power System

- 19", 2U rackmount shelf with integrated power distribution
- 90-250 VAC input, Power Factor Corrected
- 3 power bays accept 1000 or 2000 watt modular rectifiers
- 111 amp, 6000 watt total max. output capacity, (74 Amp, 4000 Watt, N+1) @ - 48 VDC
- Output temperature compensated for precise battery charging
- 16 DC circuit breaker distribution capacity, with tripped breaker alarm
- Master disconnect breakers for two battery banks, with tripped breaker alarm
- Controller with digital display of system parameters with TCP/IP interface and SNMP monitoring/logging
- Alarm contacts monitor major system functions
- Low voltage disconnect built in
- Easily configures to meet site power requirements

System Power Configurations @ -48V*

Watts Per Rectifier	# of Rectifiers Installed		
	1	2	3
2000	37A (2000W)	74A (4000W)	111A (6000W)
1000	18A (1000W)	36A (2000W)	54A (3000W)

System Power Configurations @ +24V*

2000	37A (2000W)	74A (4000W)	111A (6000W)

* @ 230 VAC input, 2Kw: derate 41% @ 110 VAC input; 1Kw: derate 33% @ 110 VAC input

M-C2RS
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NEWMAR®

Powering the Network

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1 RECEIVING INSTRUCTIONS

CAUTION:  For your protection, the following information and the product manual should be read and thoroughly understood before unpacking, installing and using the equipment.

We present all equipment to the delivering carrier securely packed and in perfect condition. Upon acceptance of the package from us, the delivering carrier assumes responsibility for its safe arrival to you. Once you receive the equipment, it is your responsibility to document any damage the carrier may have inflicted, and to file your claim promptly and accurately.

Package Inspection

- Examine the shipping crate or carton for any visible damage: punctures, dents and any other signs of possible internal damage.
- Describe any damage or shortage on the receiving documents and have the carrier sign their full name.

Equipment Inspection

- Within fifteen days, open crate or carton and inspect the contents for damages. While unpacking, be careful not to discard any equipment, parts or manuals. If any damage is detected, call the delivering carrier to determine the appropriate action. They may require an inspection.
  Save all the shipping materials for the inspector to see!
- After the inspection has been made and you have found damage, call us. We will determine if the equipment should be returned to our plant for repair or if some other method would be more expeditious. If it is determined that the equipment should be returned to us, ask the delivering carrier to send the packages back at the delivering carrier's expense.
- If repair is necessary, we will invoice you for the repair so that you may submit the bill to the delivering carrier with your claim forms.
- It is your responsibility to file a claim with the delivering carrier. Failure to properly file a claim for shipping damages may void warranty service for any physical damages later reported for repair.

Handling

Handle the equipment with care. Do not drop or lean on front panel or connectors. Keep away from moisture.

Identification Labels

Model numbers are clearly marked on all equipment. Please refer to these numbers in all correspondence with Newmar.

2 SCOPE

This manual covers essential information for the installation and commissioning of the Centurion II DC Power System

System set-up for the rectifiers, alarms etc., are provided in separate manuals for the SM32 (C2C-32) supervisory module and C2R-1000 and C2R-2000 rectifiers.

All installation and maintenance must be carried out by suitably qualified personnel.

Note: The Centurion II System is available with Positive Earth (-48Vdc, -60Vdc) or Negative Earth (+24Vdc). The installation manual covers both Positive and Negative Earth systems. The standard system is assumed to be a Positive Earth system. Where parameters and settings differ between systems, the Negative Earth system parameters are specified within parenthesis i.e. ().

3 SYSTEM OVERVIEW

The Centurion II DC Power System has a maximum power output of 6.0kW (+24V rated to 3.0kW @ 24V, 3.3kW @ 27V), producing a maximum current output of 125A/-48V (125A/ +27V).

The system is intended to be a complete power system in a box, so no connections need to be made internally. All the AC, DC (Load and Battery) connections are made at the rear of the unit. Alarm connections are accessible from the front by pulling the Supervisory Module forward.

The system is designed to be extremely simple to install and set up.

The following is a summary of the system:

- Overall size is 483mm wide (19" standard mounting) x 88.9mm (3.5") high (2U) x 350mm (13.78") deep
- Up to 3 x 41.7 amp (-48V or +24V) C2R-2000 rectifiers (may be packaged separately) or 3 x 18 amp (-48V) C2R-1000 rectifiers
- SM32 supervisory module (fully integrated in the system)
- Battery Low Voltage Disconnect fitted as standard (125A rating).
- 2x 100A Battery Circuit Breaker, these may be specified as different values (from 2A to 100A) at time of order.
- 8x 10A, 4x 20A, 4x 30A Load Circuit Breakers, these may be specified as different values (from 2A to 30A) at time of order.
- System weight is approximately 8.4kg (18.5 lbs.) without rectifiers, and 13.2kg (29 lbs.) with three rectifiers fitted.
- Single set of 3-phase input terminals (L1, L2, L3, neutral and earth). (**Note: A Link is provided to link L1, L2 and L3 for Single Phase operation**).

Note: This system is supplied with the AC and DC earths connected. The standard -48 VDC system output has the DC Common in the positive side of the circuit (+ve earth system). On +24 VDC systems, the DC Common has the negative side of the circuit (-ve earth system) connected to system chassis/earth. The earth link can be removed from the system to isolate earths. Please see the relevant section.

4 INSTALLATION

4.1 Unpacking & Installing in Frame

Upon unpacking, check that the unit is not damaged, and that you have the required number of rectifiers.

The unit fits into a standard 19" mounting frame. The mounting screws should be #12-24; however #10-32 may be used with washers. Be sure to mount the unit in the 19" frame squarely if #10-32 screws are used.

Please note the complete system weight is 13.2kg. (29 lbs.). Ensure the 19" mounting rails are able to withstand mounting of the system.

4.2 AC Cabling

The AC terminals are clearly marked at the rear of the system as shown in Fig 1.0 & 1.1. The terminals can accept up to 8 AWG/10mm^2 cables.
Once cables are connected, ensure cable connector cover is fitted and secured.

The AC earth terminal earths the System chassis. The AC earth is also internally bonded to the System chassis by earth stud as shown in Fig 1.1.1

DC Common (+ve) is connected to the AC earth as shown in Fig 1.1, but can be removed if output is required to be isolated.

Note: Refer Appendix 3 for AC Input Transient Protection

CAUTION: **For 3 phase operation remove the Single Phase link fitted between the phases.**

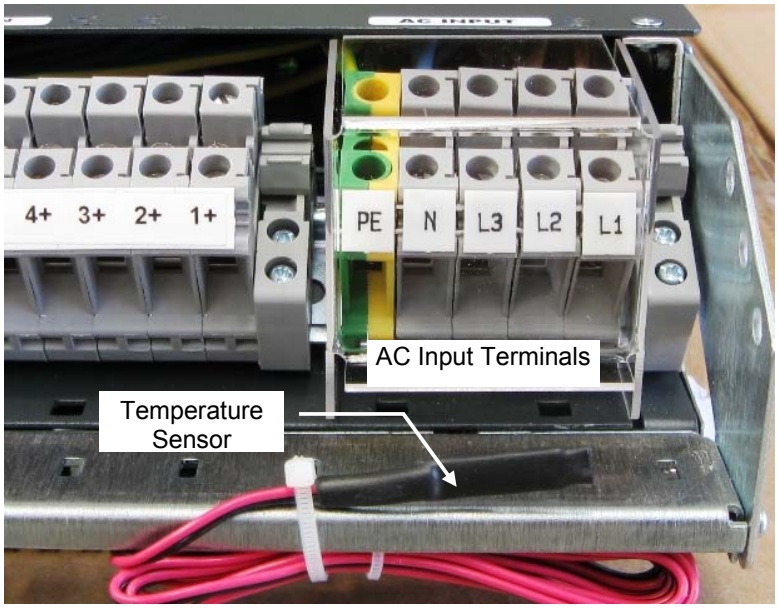


Fig.1.0 AC Input Terminals

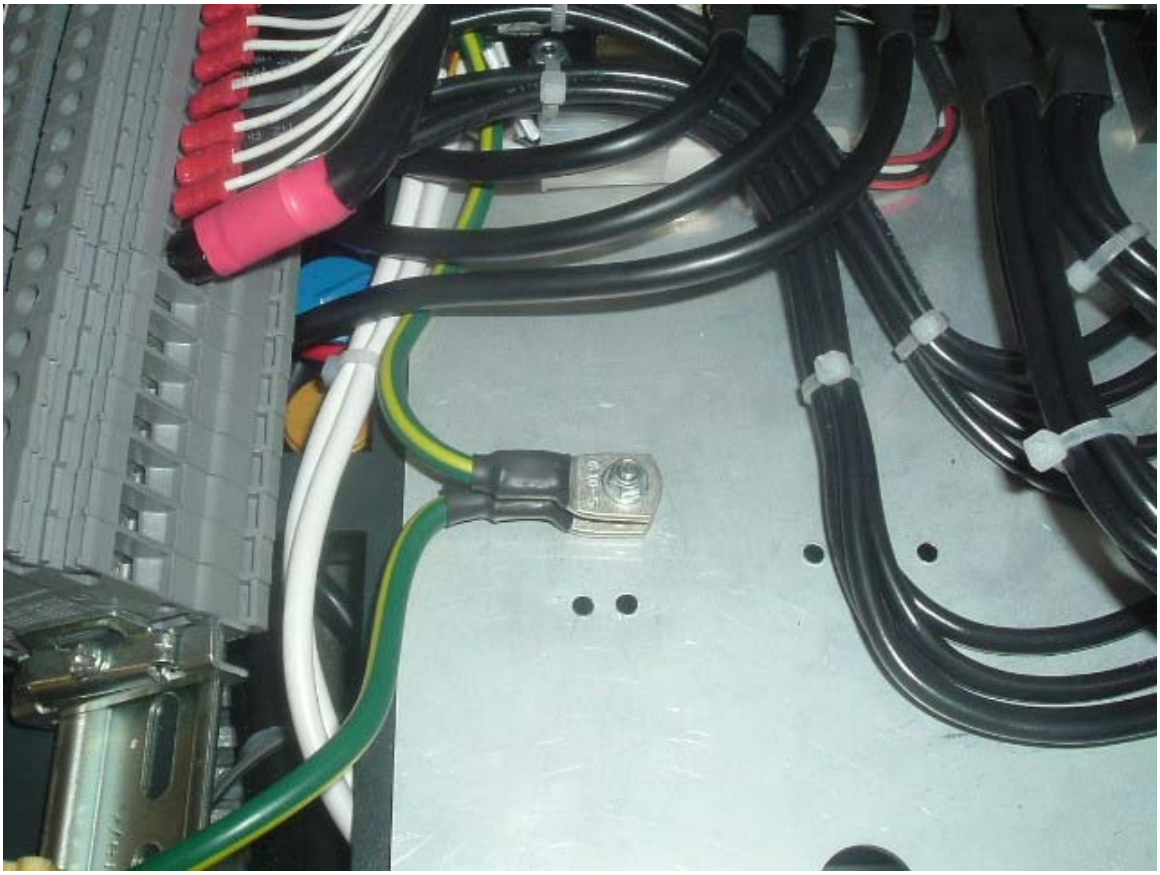


Fig.1.1 AC – DC Earth Link

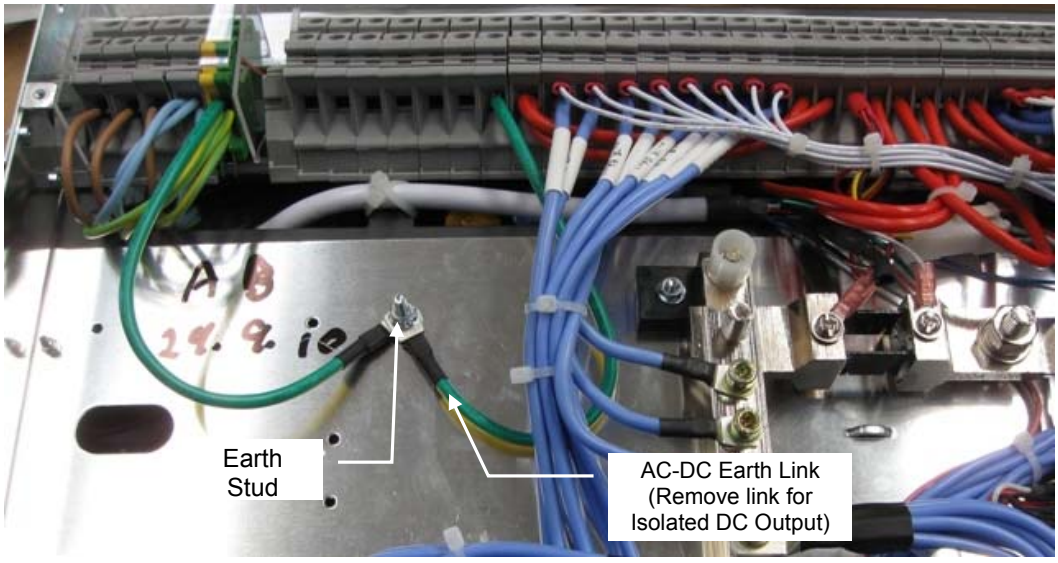


Fig.1.1.1 AC – DC Earth Link

Note: Please refer Appendix 3 for AC Input Transient Protection.

4.2.1 Upstream Over-current Protection

There are two considerations to take into account when selecting an appropriate fuse/circuit breaker.

- The upstream protection should protect the downstream cable from overload situations.
- Discrimination should be maintained with the downstream device fuses.

(i) Cable Rating

The maximum current drawn by the DC power system is 12.5A per phase with 2kW rectifiers (6.2A for 24V system and 48 VDC/1 kW rectifier modules) from a 3-phase supply, or 37.3A (18.7A for 24V system and 48 VDC/1 kW rectifier modules) from a single phase supply (12.5A (6.2A for 24V System) per rectifier at a minimum input voltage of $175V_{ac}$ and full output power). The upstream protection device must be able to supply this load under all conditions without tripping. Therefore, typically at least 20% headroom is allowed for in the protection device, making its minimum rating 15A/ph (7.5A) or 44.8A (22.5A) for single phase input.

Note: The current carrying capacity of cables is dependent on the type of cable used. Please check with your local supplier and local regulations for appropriate sizing.

(ii) Discrimination

Discrimination ensures that the upstream circuit breaker or fuse does not blow if a rectifier input fails (short circuit). Therefore it is important to ensure the upstream protection discriminates with the internal fuse of the rectifier. The fuse used in the RM2048/24/C2R-2000 is a slow-blow 15A fuse. The tripping curve for this is shown in Appendix 4 at the rear of this manual.

A minimum circuit breaker to use for this system is a 20A, D-curve (note, a 20A C-curve breaker will **not** discriminate with the rectifier fuse). Therefore, when used with the $2.5mm^2$ cable supplied, a 20A, D-curve breaker should be used.

Alternatively, a 32A C-curve breaker, or greater, can be used. However, AC cable provided may have to be replaced for a larger cable[1].

If a fuse is used upstream, then any BS88 or NH g style fuse, of 20A or greater rating will discriminate.

4.3 DC Cabling

CAUTION: Use extreme care when fitting batteries & their connections. Remove all jewellery and rings from oneself prior to commencing the installation. Always use insulated tools when fitting batteries and take extreme care not to short terminals when working on them.

[1] NOTE: A larger breaker may be used even though in theory it may appear that the $2.5mm^2$ wire is not fully protected. In fact it is protected on two accounts. Firstly it is protected by the rectifier input fuse (which is only a short distance away). Secondly, the rectifiers are power-limited on their input. Therefore, they can never be overloaded. As a result, the wire can never be over-loaded by the rectifier – it can only see fault current. As a result, depending on local authorities, only fault current protection may be catered for by the upstream protective device.

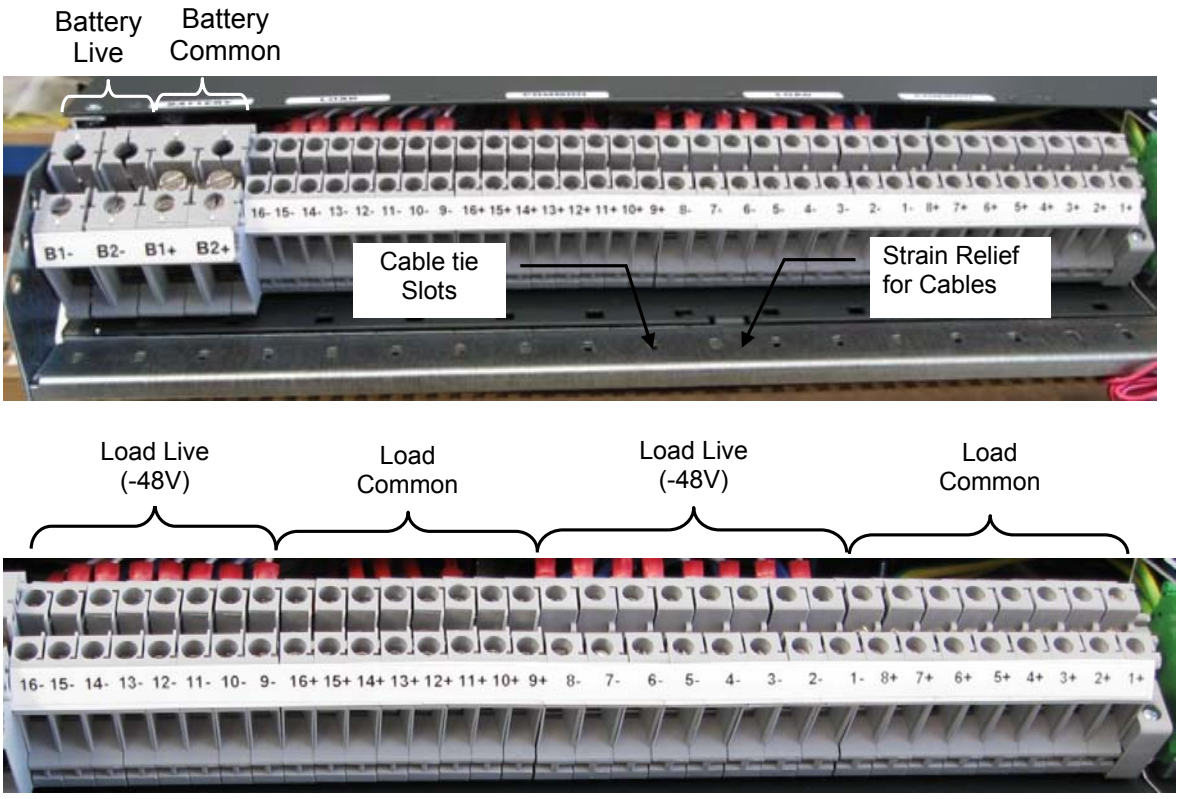


Fig. 2 DC Output Terminals (+ve Earth System, -48V or -60V)

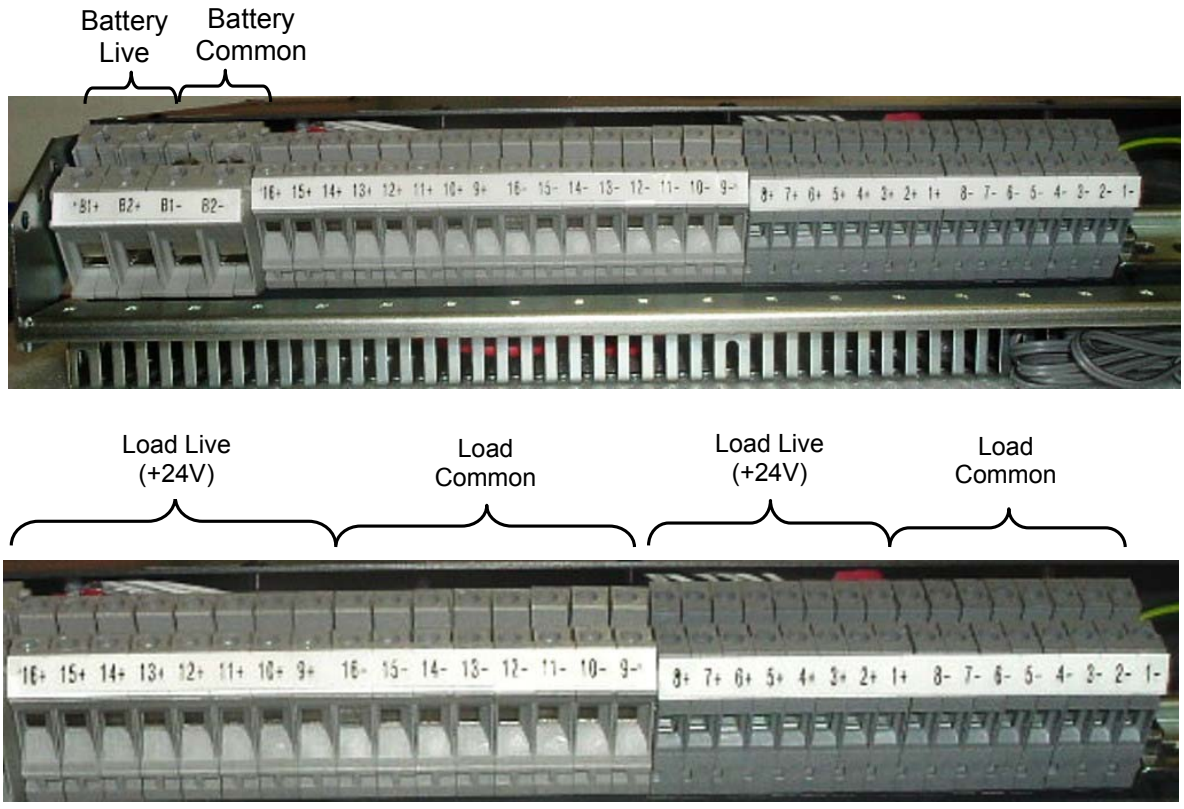


Fig. 2.1 DC Output Terminals (-ve Earth System, +24V)

All live DC and Common connections are made to the connectors at the rear of the unit as shown in Fig 2 and Fig 2.1.

For 8x 10A load breakers, 10 AWG/6mm^2 terminals are used whereas for 4x 20A/15A and 4x 30A load breakers, 8 AWG/10mm^2 terminals as shown in Fig 2 and Fig 2.1.

The battery terminals shown can accept cables up to 2 AWG/35mm^2.

The internal battery cabling goes directly to the circuit breaker, then via a Low Voltage Disconnect relay and current shunt to the internal live bus. This can be seen on the wiring diagram at the rear of this manual & in Fig 4.

Ensure cables are strain relieved by utilising the cable tie wraps and tie slots provided as shown in Fig 2.

4.4 Alarm/Ancillary Cabling

Alarm and communication cables terminate directly into the rear of the Supervisory Module. These terminals are accessible by pulling the monitor forward to expose connections as shown in Fig 3 and Fig 3.1

Fig 3 For removal, unlock SM32 by lifting green locking tab.

When routing the cables, ensure they are kept away from the AC and DC power cables when possible.

The relay states labelled Normally Open or Normally Closed are for their de-energised state. If an alarm is programmed for the relay to be normally energised (as may be possible in the case of a low voltage alarm where loss of power will put the alarm into its active state), then be sure to connect the remote wiring appropriately.

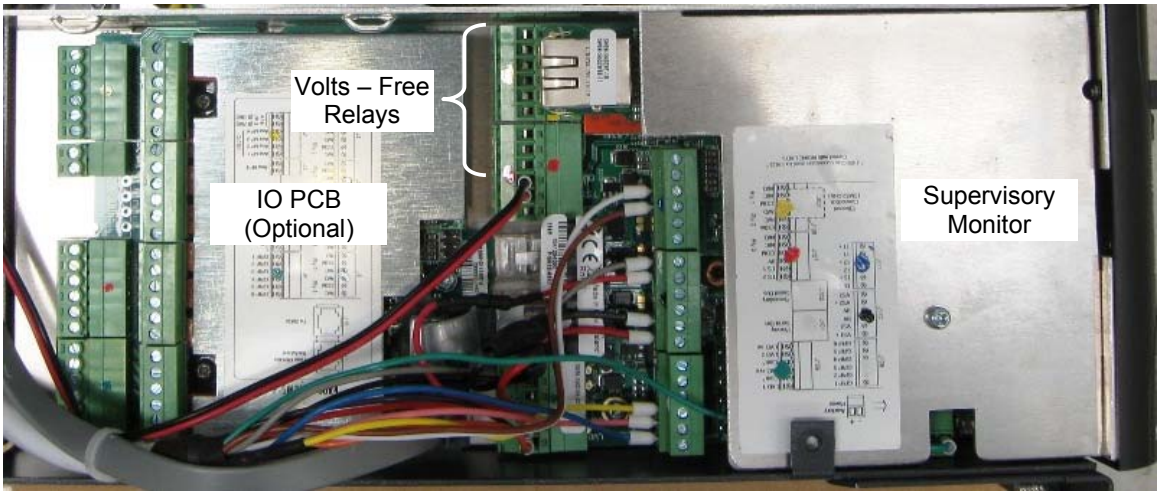


FIG. 3.1 Monitor Cabling

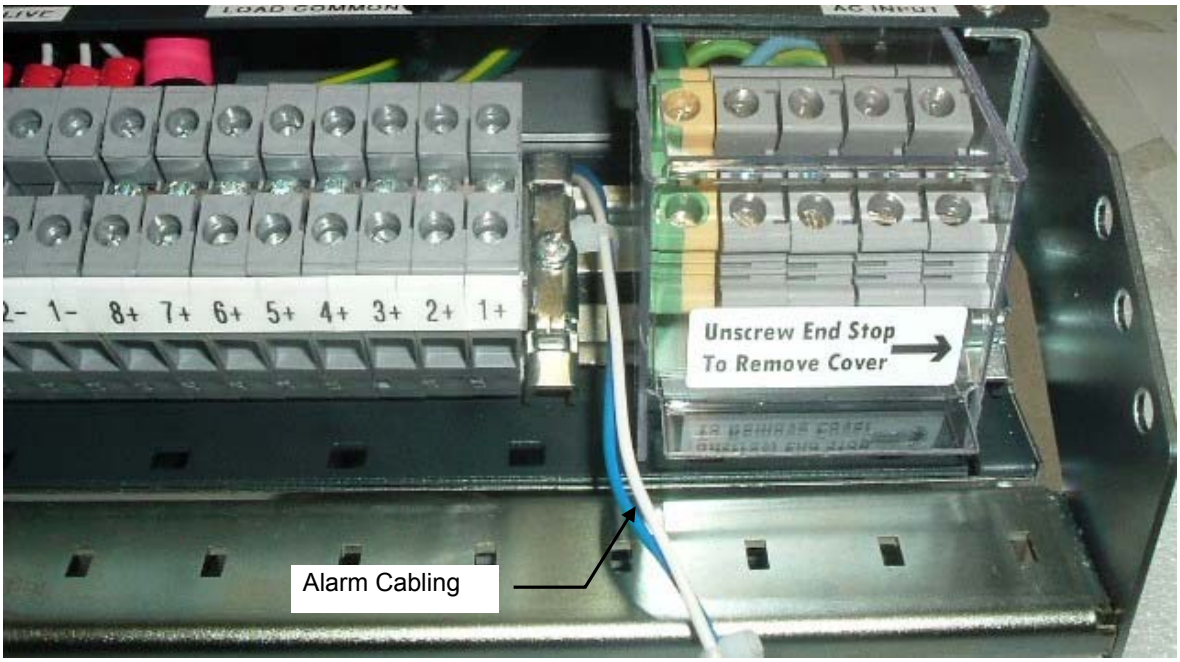


FIG. 3.2 Feeding additional alarm cables

For accessing the unused SM32 alarm inputs and relays, cables may be fed from the rear of the unit as shown as Fig's 3.1 & 3.2. These terminals are accessible by pulling the monitor forward to expose connections, see Fig's 3 & 3.1.

For full SM32 functionality and operation information, refer to the SM32 Manual.

Temperature Sensors

Uncoil the battery temperature sensor tie wrapped to rear of shelf and place in the middle of the middle battery string. If the lead is not long enough, ordinary 2-core copper (approx. 18 AWG/0.75mm^2) wire can be used as an extension. The purpose of the battery temperature sensor is to monitor the ambient temperature of the batteries over long periods of time and adjust the rectifier output (float) voltage accordingly. As a result, it is not necessary to have the temperature sensor touching the batteries. If the Battery Temperature Sensor is removed a "battery temp fault" alarm is generated.

The "Ambient" temperature sensor (optional) can be used to monitor the temperature in another location if required.

Connecting via Computer

For remote communications and direct computer connection to the Compact System, refer to the SM32 Manual. These connections can be made via the mini-USB port on the front panel of the monitor (computer connection to the SM32, USB cable included) and the Ethernet port (SM32 web-based communications only). The Ethernet port has been extended to the rears of the shelf via a patch cord and RJ45 coupler for installer convenience.

When a laptop/pc is connected for the first time to the SM32, you the USB drivers will have to be installed on the connected computer. See the SM32 manual for details.

Alarm Mapping to Volts-free Relays

The SM32 has three voltage-free alarm relay outputs as standard. If required, extra relay outputs can be gained by adding an I/O PCB as shown in Fig 3.1.

Note that on all systems, Relay 1 is pre-configured as the "Monitor Fail" alarm. This alarm activates if the monitor has a hardware fault or if software becomes corrupted.

All other relays can be mapped to different alarm conditions. The SM32 Manual details how these may be changed. On the standard Centurion II Systems alarms are preconfigured as follows:

Relay 2: Summary Non-urgent alarm

Relay 3: Summary Urgent alarm

As mentioned, if these mappings are not appropriate, they can be changed in the field to suit customer requirements.

Circuit Breaker Fail Monitoring

Load circuit breakers are monitored electronically via a diode to a digital input on the SM32. The digital input will trigger an alarm when it is pulled to the system Common (positive) rail. This means that to operate, the load must be connected. In this way, false alarms are avoided when no load is connected and the load circuit breaker is in the "off" position.

Note: This means that a residual voltage will be measured at the load terminal even when the circuit breaker is turned off. This is high impedance and does not present a hazard to the user

The battery circuit breakers however, use auxiliary contacts to detect tripping or whether they are turned off. This is because when a battery breaker is tripped, there may be very little voltage difference, making electronic fail detection problematic. Hence, if only one battery is connected, both breakers must be "on" to clear the Battery Breaker Fail alarm.

5 LVD OPERATION

This system is configured with one Low Voltage Disconnect contactor, in the battery side of the circuit as shown below & in the Wiring Schematic at rear of this manual.

The SM32 Supervisory Monitor unit is powered from both the rectifier side of the battery LVD contactor and battery source. Therefore when the low voltage threshold of Battery LVD is reached, the LVD disconnects the battery and the SM32 will lose voltage sense (as voltage sense is measuring rectifier bus voltage) but still maintains operation for system monitoring. The Battery LVD contactor will not re-engage until the rectifier power is restored (i.e., until the DC bus voltage is restored).

LVD adjustments/settings are all made from the SM32. See the SM32 manual for details.

The LVD contactor is a bi-stable, magnetically latched contactor. This means that failure of power or removal of the SM32 from a live system will not cause the contactor to change state.

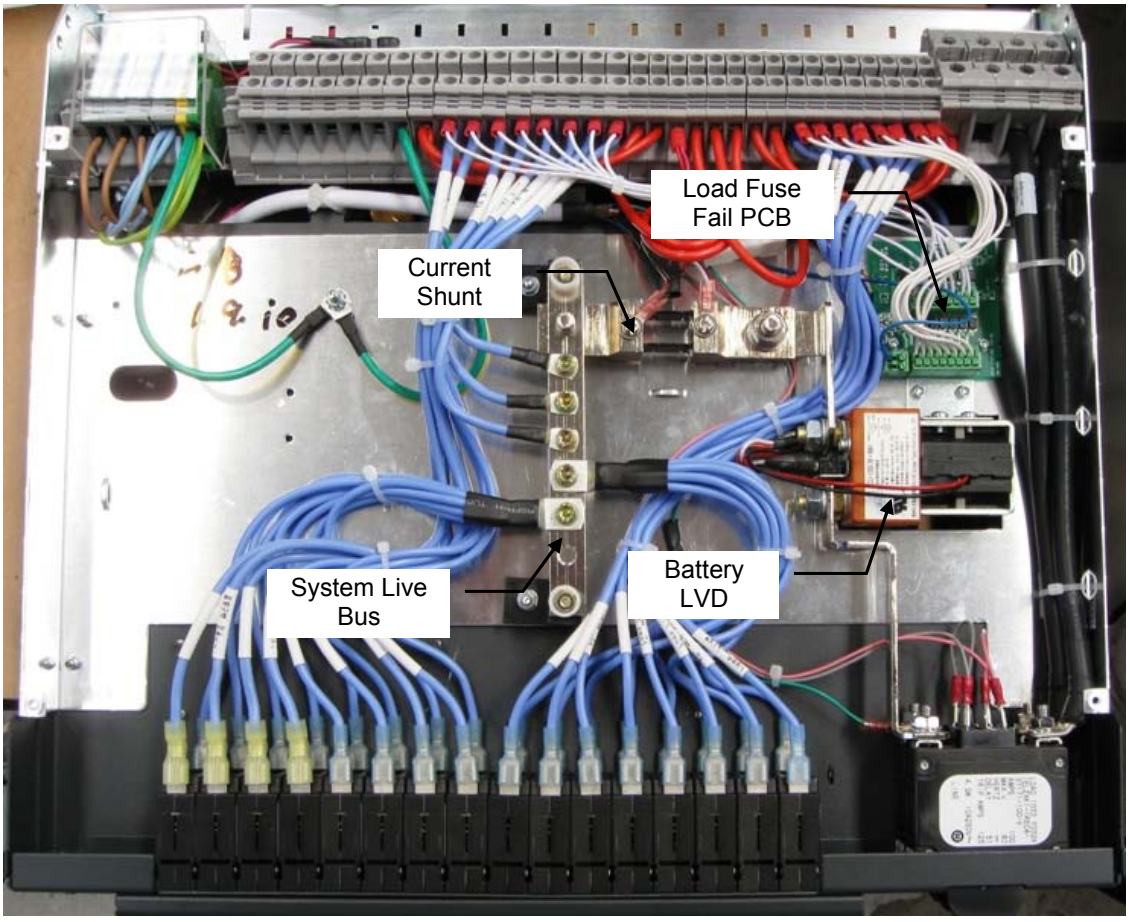


FIG. 4 System Internal View

6 COMMISSIONING

Use the following set of instructions as a guide, unless different procedures are recommended by local authorities.

Note: Refer to Appendix 1 to check important System Set-up parameters while commissioning.

Pre-check:

1. No more building work to be carried out in site to avoid concrete and plaster dust being ingested into rectifiers and systems.
2. System installation is completed.
3. Battery and load circuit breakers are turned off, and upstream AC has been turned off (i.e., system is completely de-powered).
4. Rectifier modules have been fitted into their shelf positions, and pulled forward enough to disconnect them from the system.

Note: This system is supplied with the AC and DC earths connected. This system has DC Common in the Positive side of the circuit (+ve earth system or -48 VDC). Before connecting the Batteries or Rectifiers ensure that Earthing is correct for your application (24 VDC are normally wired for –ve earth system or +24 VDC).

5. Turn on AC upstream and check that voltages from phase to neutral are as expected.

Rectifier Start-up

1. Turn the upstream AC circuits on.
2. Fully insert first rectifier, wait for the rectifier to start and its power on LED to remain green.
3. Check the SM32 powers up, and indicates the system default float voltage (approx. 54V on its display). If the audible alarm activates, press any SM32 button to silence it.
4. If a different system float voltage has been specified, set this at this time using the procedure specified in the SM32 Manual (either from the front panel or connected computer).
5. Fully insert the rest of the rectifiers ensuring they power up with only their green “power on” LED illuminated.
6. Check that the load and battery currents on the SM32 are 0 amps (+/- 1 or 2 amps).
7. Check that all SM32 configuration settings are correct (as per customer specification) with respect to:
   - Voltage levels
   - Alarm settings
   - Alarm mappings to the volts-free relays

   (refer to the SM32 manual for information on how to check these via the front panel or locally connected computer).

Battery Start-up

Note: It is preferable that battery circuit breaker connections should be made when the rectifiers are turned on and the system is “live”. This is because the system voltage and battery voltages will be similar, thus minimising any arcing during connection. This also prevents high current arcing due to the charging of the rectifier output capacitors.

1. Power up only one rectifier initially (to limit any damage if any connections are incorrect).
2. Measure the voltage across each battery string at the terminals of the Compact System. Ensure that the reading from the DC Common bus to the Battery Live Terminals is -48V as per System specification.
3. Turn on battery circuit breaker measuring the battery voltage. Ensure that the voltage increases slightly to the system Float Voltage (typically the voltage will increase from 2 to 3V

below float voltage. At this point the batteries will be drawing some current to bring them to a full state of charge.

Load Start-up

1. Ensure downstream load connections have been made and there are no loose/floating load cables.
2. Turn on load circuit breaker, ensuring that the downstream equipment is being powered up as expected.
3. Ensure the system float voltage on the SM32 is at the level previously noted.
4. Ensure the load current is at a level expected (could be zero if loads downstream have not been connected).

Note: Prior to leaving the system after it has been commissioned, ensure all AC, DC *and* battery circuits are off. If it is required that the system is to be left on (to power load equipment, ensure rectifiers are left in their powered up state, and batteries are in circuit. This will prevent anyone leaving the batteries only powering the load (in which case the batteries would go flat).

DC System Commissioning Check List

Note that the values in the following check-boxes are for a 48V nominal system, and are for example only. Values for a 24V system are proportionately lower.

This check-list can be altered and printed off for use as required.

DC SYSTEM COMMISSIONING CHECK-LIST				
Site Name:_____			Date:_____	
Tests Without Batteries Connected		**Measured/ Setting**	**Results**	
	Check Float Voltage	Meter:_____	_____ V	✓ / ×
	Check Load Current	Meter:_____	_____ A	✓ / ×
	Alarms:			
	Voltage thresholds can either be checked using an external power supply, or by adjusting the SM32 float voltage 0.1V above (or below for the low voltage alarms). It is recommended to have the batteries **disconnected**. 1. Adjust the supply/float voltage to 55.7V & observe the "High Float" alarm. 2. Adjust the supply/float voltage to 57.7V & observe the "High Load" alarm. 3. Adjust the supply/float voltage to 52.7V & observe the "Low Float" alarm. 4. Adjust the supply/float voltage to 46.9V & observe the "Low Load" alarm.			
	High Load Volts (urgent)	57.6V	_____ V	✓ / ×
	High Float Volts (non-urgent)	55.6V	_____ V	✓ / ×
	Low Float Volts (non-urgent)	52.8V	_____ V	✓ / ×
	Low Load Volts (urgent)	47.0V	_____ V	✓ / ×
	Depending on the test load available, it may be necessary to adjust the High Load Current alarm threshold down to suit. For example, with the 70A test load, adjust the High Load Current threshold (use SM32 Config. software, click on the "Alarms/(Levels)") to 60A. Then simply apply the 70A load and observe the alarm change state. Once the test is complete, be sure to rest the High Load Current to its previous value (or check with the customer for the correct value they require).			
	High Load Current (urgent)		_____ A	✓ / ×
	Temperature alarm tests are performed by heating up (using a heat gun or other source) and cooling down (using an aerosol can of freeze, or a tub of ice) the temperature sensors. Note that when the Battery Condition Monitor is used, there is one sensor per battery string. The SM32 uses the average of these temperatures as the "Battery Temperature". Therefore, all the sensors need to be heated / cooled at the same time.			

	Battery Temperature High (urgent)		_____°C	✓ / ×
	Battery Temperature Low (non-urgent)		_____°C	✓ / ×
	Room Temperature High (non-urgent)		_____°C	✓ / ×
	Room Temperature Low (non-urgent)		_____°C	✓ / ×
	When an AC Monitoring PCB is not fitted at system level (as in most cases), the AC Fail alarm is generated from the rectifiers. The rectifiers sense if AC is present, and extend an AC fail alarm to the SM32. Therefore, to test this alarm, simply turn off the rectifier AC breakers. To allow the monitor to continue to read alarms there must be DC present on the output of the system. As this causes the rectifier output to cease, a Rectifier Fail alarm is also generated. To generate the Urgent Rectifier Fail, turn off the required number to make this occur (Usually set to 1, but check via the SM32 Config software for the setting (under the "Rectifier Control" section of the "Power Module Control" tab)).			
	AC Fail (urgent)		Urgent	✓ / ×
	Rectifier Fail (non-urgent)		Non-urgent	✓ / ×
	Urgent Rectifier Fail (urgent)		No. Modules:____	✓ / ×
	To check Load MCB Open, connect a load, but with no load turned on. Then switch the breaker to it's off position and turn on some load (any amount will do). This will cause the alarm to occur as the load side to the circuit will be taken to system common voltage. Turn off the load, and then return the breaker to its ON position.			
	Load MCB Open (urgent)			✓ / ×
	The battery circuit breakers use auxiliary contacts to detect tripping or whether they are turned off. This is because when a battery breaker is tripped, there may be very little voltage difference, making electronic fail detection problematic. Hence, if only one battery is connected, both breakers must be "on" to clear the Battery Breaker Fail alarm. To check Battery MCB open alarm, turn off the battery circuit breaker.			
	Battery MCB Open (urgent)			✓ / ×
	To check the Surge Protection Failed alarm, simply pull the MOV out. This switches a micro-switch within the SPD unit. Once pulled, observe the alarm, and re-insert the MOV block and observe the alarm clear. (Only available when SPD is fitted in the system).			
	MOV (SPD) Fail (urgent)			✓ / ×
	A Rectifier Off Normal alarm is generated with the rectifier enters a state that may degrade its performance (e.g., a single fan fail), or a state that is outside of normal operating conditions (e.g., high temperature, or current limit). You can observe an Off Normal alarm when the system is placed in current limit, or you may wish to stop a fan to generate the alarm. The best way to stop a fan is to use a small cable tie (non-metallic), and push it approximately 1cm through the rectifier grille.			

	Rectifier Off Normal (e.g., fan failed) (non-urgent)			✓ / ✗
Tests with Batteries				
	• Set V_f to equal battery voltage • Connect battery/batteries • Check the correct Battery Capacity (Ahrs) has been entered (SM32 Config., "Charge" tab). This is the total capacity, so for 100Ahr string, this should be 100. Go to SM32 Config, "Control" tab. Set the Battery Charge Current Limit to "Enabled" (middle right of screen). Also check Battery Current Limit (BCL) is set to desired level (usually $0.25C_{10}$, (25%)). This means that for a single 100Ahr battery, the BCL will be 25A, or if two 100Ahr batteries are connected in parallel, the BCL will be 50A. • Go to SM32 Config. "Battery Monitoring" tab. "Tick" Logging Enabled. Set: - Status Log Sampling Interval to 7 days (provides a "snapshot" of the battery state every 7 days) - Discharge Log Sampling Interval to 1 minute - Discharge Log Continuation Time to 5 minutes (this is the length of time logging continues for after AC power is returned) • Connect load (but turn off). • Set V_f to 54.0V. • Turn on Battery Breaker/s			
	Check Battery current is positive if charging			✓ / ✗
	For systems fitted with Battery Monitoring (BCM) cards: Go to SM32 Config., "Battery Monitoring" tab and "tick" start scanning. Check that the all the battery cell voltages are approximately the same, at about 2.25V (or 13.5V for 12V monoblocs). If any are out by a large amount, then check the BCM sense wiring is correct			
	Set load to required level (e.g., 50A), Initiate Battery Discharge Test (from SM32 Config., "Charge" tab, click "Battery Test Enabled")		Check operates	✓ / ✗
	Check Battery Current is negative (discharging)			✓ / ✗
	Check Battery Current	Meter:_____	_____ A	✓ / ✗
	After several minutes or until the battery voltage has dropped below approx. 47V, "un-tick" (stop) Battery Test (from SM32 Config., "Charge" tab). During this time the			

	Battery Condition Monitor (if fitted) will be logging every minute.			
	Battery Current Limit (BCL) Check that the battery recharge current is limited to the Battery Current Limit level (usually between $0.25C_{10}$, (25%)) Note: as the BCL is based on fine voltage control of the system bus, the BCL make take one or two minutes to "settle", i.e., you may observe a brief excursion of the battery recharge current beyond the BCL setting.		BCL functions _____%	Yes/No
	Check Manual Equalise (if configured)			✓ / ✗
Temperature Compensation				
	Ensure Temperature Compensation Enabled			Yes/No
	Apply heat or cold to the Battery Temperature Sensor/s. Check the float voltage moves up or down as expected.			Yes/No
	If actual measurement is required, apply a known heat or cold to the sensor. Allow it to fully come to temperature, and record the amount of voltage movement.		Temp._____°C Voltage offset: _____ V OK?	Yes/No
Check Alarm Relay Contacts				
	To generate these alarms, refer to the procedures described earlier in the Commissioning Check-list. Spare relays will not be able to be tested unless an alarm is mapped to them. As these are tested in the factory, it is not essential to test them at time of commissioning.			
	Relay 1 (Monitor Fail) (pull out the RJ45 lead connecting the monitor to the system rectifier shelf – this simply de-powers the monitor)			✓ / ✗
	Relay 2 (Summary Non-urgent)			✓ / ✗
	Relay 3 (Summary Urgent)			✓ / ✗

7 APPENDIX 1 – NEWMAR ESSENTIAL SYSTEM SET – UP PARAMETERS

The following items 1 though 5 are system settings that **MUST** be checked for **EACH** system installed, at the time of commissioning.

WARNING: Failure to correctly follow the procedures in items 1 to 5 below may at least cause incorrect system function, and at worst **ruin** your battery (**without** the ability to claim battery replacement under warranty).

PRIOR to making any changes to settings, ensure that you back up the Configuration settings that the SM32 is supplied with. To do this, go to the Setup page and click on the "Save Variable to File" button. The filename is saved with a ".SM3x" extension.

Note that the values in the following check-boxes are for a 48V nominal system, and are for example only. Values for a 24V system are proportionately lower.

1. Check/Set Float Voltage

Consult battery manufacturer's data for proper setting.
The Float voltage is for 25°C reference temperature in Newmarsystems.
SM32 Config Page: Power Module Control

Rectifier Float Voltage Setpoint	54.00	V

Done: ☐

2. Set Battery Settings

Temperature Compensation
You **must** consult the battery manufacturer's data to obtain the correct Slope setting.
SM32 Config Page: Charge

Temperature Compensation

☑ Enabled

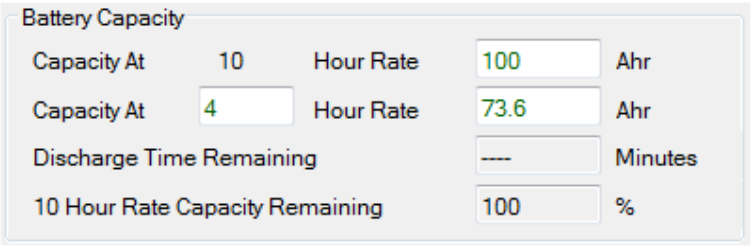
Temperature Slope Compensation	-3.0	mV/°C/Cell
Temperature Min Control limit	0.0	°C
Temperature Max Control Limit	50.0	°C
Number of Cells	24	

Done: ☐

If you choose **not** to enable Temperatue Compensation, then set the Rectifier Float Voltage to that required by the battery manufacturer for the average long-term temperature you anticipate your system to operate at.

3. Battery Size

For the SM32 to set the correct Battery Current Limit current, it is essential that this is filled out correctly. These figures are also used for estimating the Battery Time Remaining during a discharge.
For Telecom applications, the 10 hour rate is usually the name-plate rating of the battery. However, once again, check the battery manufacturer's data sheets as some manufacturers state the 20 hour rate (which is usually a little more "optimistic").
The second rate is required specifically for the time-remaining algorithm. A 4 hour rate is usually a good one to use. This information is available from the battery manufacturer's data sheet.
SM32 Config Page: Charge

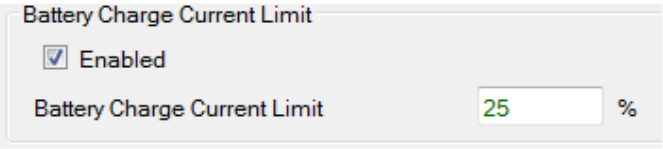


Done: ☐

Note – you need to change both the 10 hour and 4 hour rates at the same time. The rates need to be reasonably accurate (in terms of the proportion of 4 hour to 10 hour rates), otherwise the SM32 may not accept the settings.

4. Battery Current Limit

The Battery Current Limit is set as a percentage of the 10 hour rate entered in step 3.
SM32 Config Page: Control

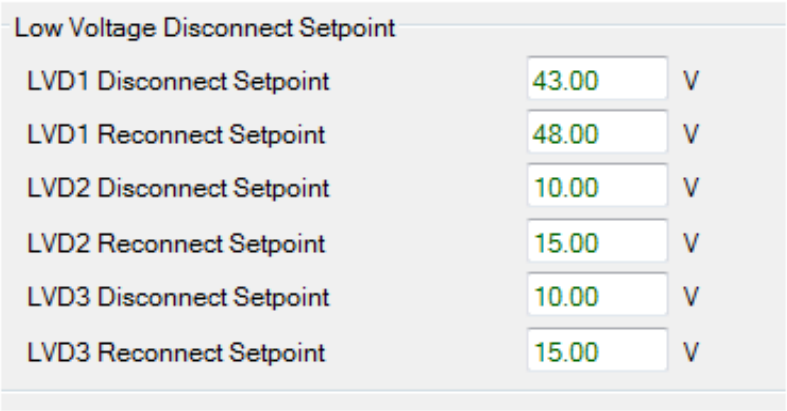


Done: ☐

Newmarrecommends that you set this value at the highest rate possible to ensure the battery is recharged as fast as possible (this could be as high as 30%, depending on the manufacturer). However, especially in large systems, this may be more limited by the number of rectifiers available, rather than this particular setting. For telco settings, this is often set to 10% (or $0.1C_{10}$, so for a 100Ahr battery, the current limit is 10A). This is more typical of a design parameter than the need for the setting to be at this level. So a setting higher than this level should be considered to enable the fastest recharge possible. However, consult the battery manufacturer data to find the maximum value.

5. Low Voltage Disconnect Settings

SM32 Config Page: Alarms (Levels)



Done: ☐

This is usually a customer generated setting. Normally, the longer the discharge, the higher the end voltage. So, for a discharge of <1hr, this may be 1.75Vpc (42.0V for a “48V” battery), or for an 8 hour discharge, it may be 1.85Vpc (44.4V for a “48V” battery).
Note that if only one LVD is fitted, then the other thresholds (of LVD2 & LVD3) are normally set well outside of possible tripping voltages. Although not essential, and those LVDs will not be enabled anyway, it serves to avoid any confusion over which LVD signal is actually being used.

8 APPENDIX 2 – MAINTENANCE

As NEWMAR Power Systems are state of the art electronic systems, very little routine maintenance is required

System

During normal operation the cable entries to the MCB's may loosen over time due to movement in the cable strands.

To avoid damage to the MCB's and cable entries due to heat build-up and arching, it is recommended that the retaining torque is periodically checked at least annually.

MCB's should be maintained at a torque of 2Nm

All other connections should also be checked at this time.

Monitor

The monitor can give a good indication of the condition of the system. Alarm logs can show issues with the system and rectifiers and should be regularly checked.

As a minimum check ensure the float voltage and load current is as expected.

If the batteries are fully charged, check the battery current is zero or near to zero amps.

Rectifiers

During normal operation some dust will build-up on the front of the rectifiers. This should be kept to a minimum by regularly wiping the rectifiers to avoid accumulation within the rectifiers and blocking the airflow to the units. The positioning of the system and surroundings will determine the regularity of this requirement.

In extremely dusty positions it is recommended that the units are removed and cleaned with compressed air to prevent airflow blockages.

Batteries

Battery maintenance will depend on the individual manufacturer's specification, please contact the battery supplier for recommendations.

9 APPENDIX 3 – AC INPUT TRANSIENT PROTECTION

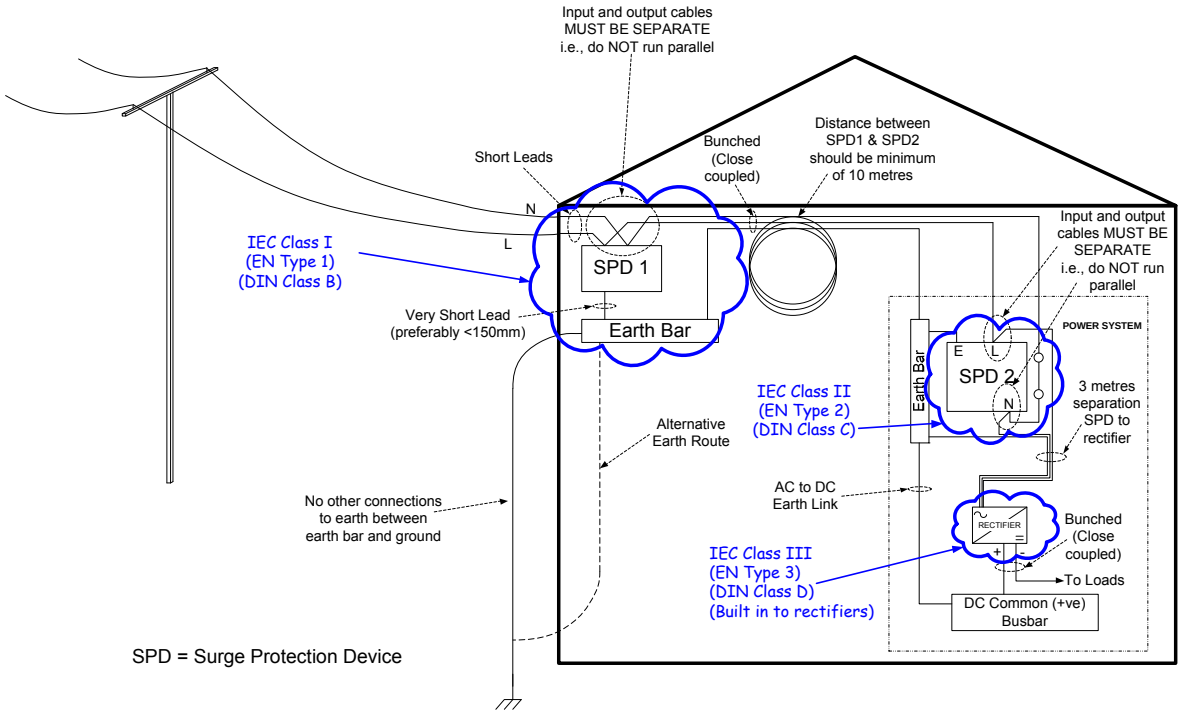
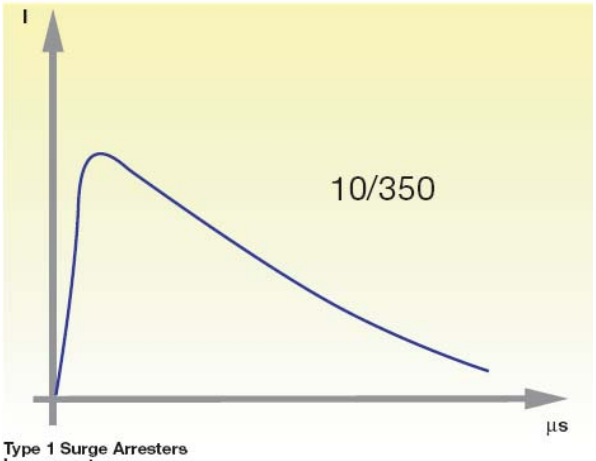


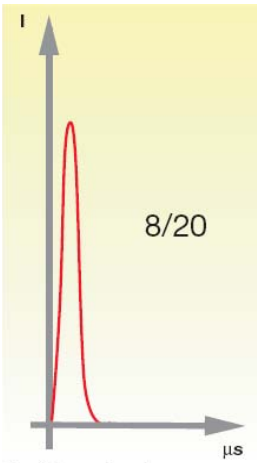
Fig 5.0 Illustrates the surge protection installation principles.

The **Type 1** surge arrester, fitted in the installation's main incoming electrical switchboard, is capable of deviating the energy of a direct lightning strike. This is the first stage of the electrical network's protection. It is important that upstream Type 1 protection is provided on site.

10/350 wave as shown below is the current waveform which passes through equipment when subjected to an overvoltage due to a direct lightning strike.



Type 1 Surge Arresters
I_{imp}: current wave



Type 2 Surge Arresters
I_{max}: current wave

A **Type 2** surge arrester should be used in coordination with the incoming surge arrester. This is the second stage of protection. Type 2 Surge arrester is designed to run-off energy caused by an overvoltage comparable to that of an indirect lightning strike or an operating overvoltage.

Some of the Newmar Power System models are provided with Type 2 Surge Protection Devices (SPDs) (as defined by IEC 61643-11). These devices are rated for repeated strikes of 20kA (8/20µs waveform as shown above), and single shot protection of 40kA.

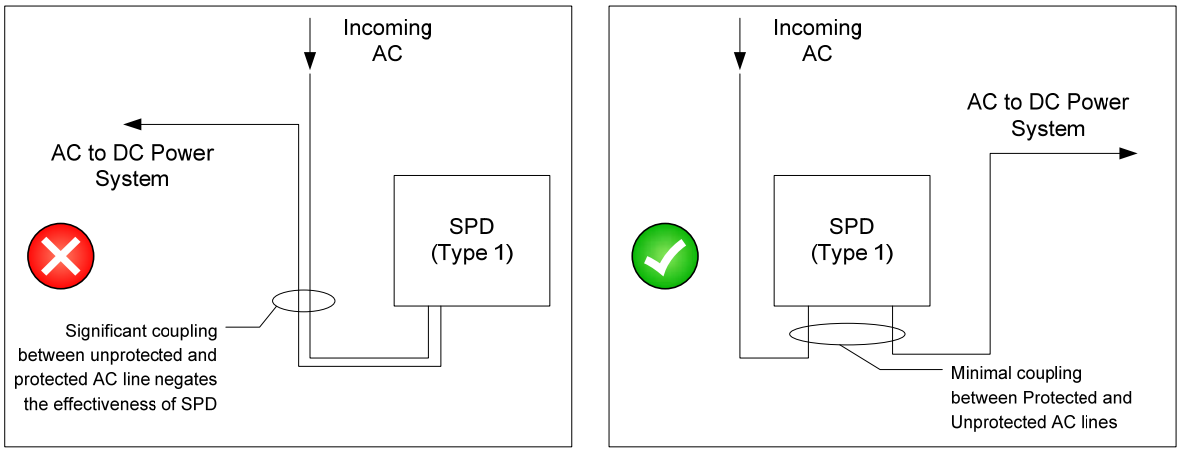
Note: Newmar Rectifiers are compliant with EN6100-4-5, Level 4 without any external/upstream surge suppression. To maintain a coordinated approach to surge suppression, Type 2 SPD should be installed upstream if not fitted in the system.

To ensure correct operation of the SPDs, at least 10m of AC feeder cable is fitted between the Type 1 and Type 2 protection. If the distance is less than 10m, then loop the cable until at least 10m of cable is used. This ensures correct de-coupling of the SPD devices.

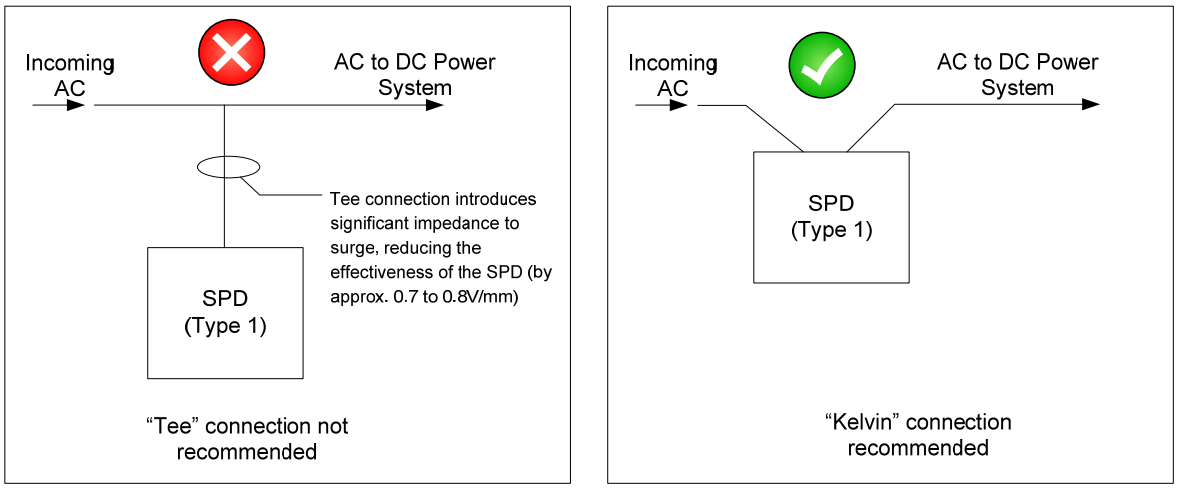
Notes on AC cable installation and SPDs

The following precautions must be adhered to when installing AC cabling.

1. Avoid running input and output cables from AC Surge Protection Devices together:

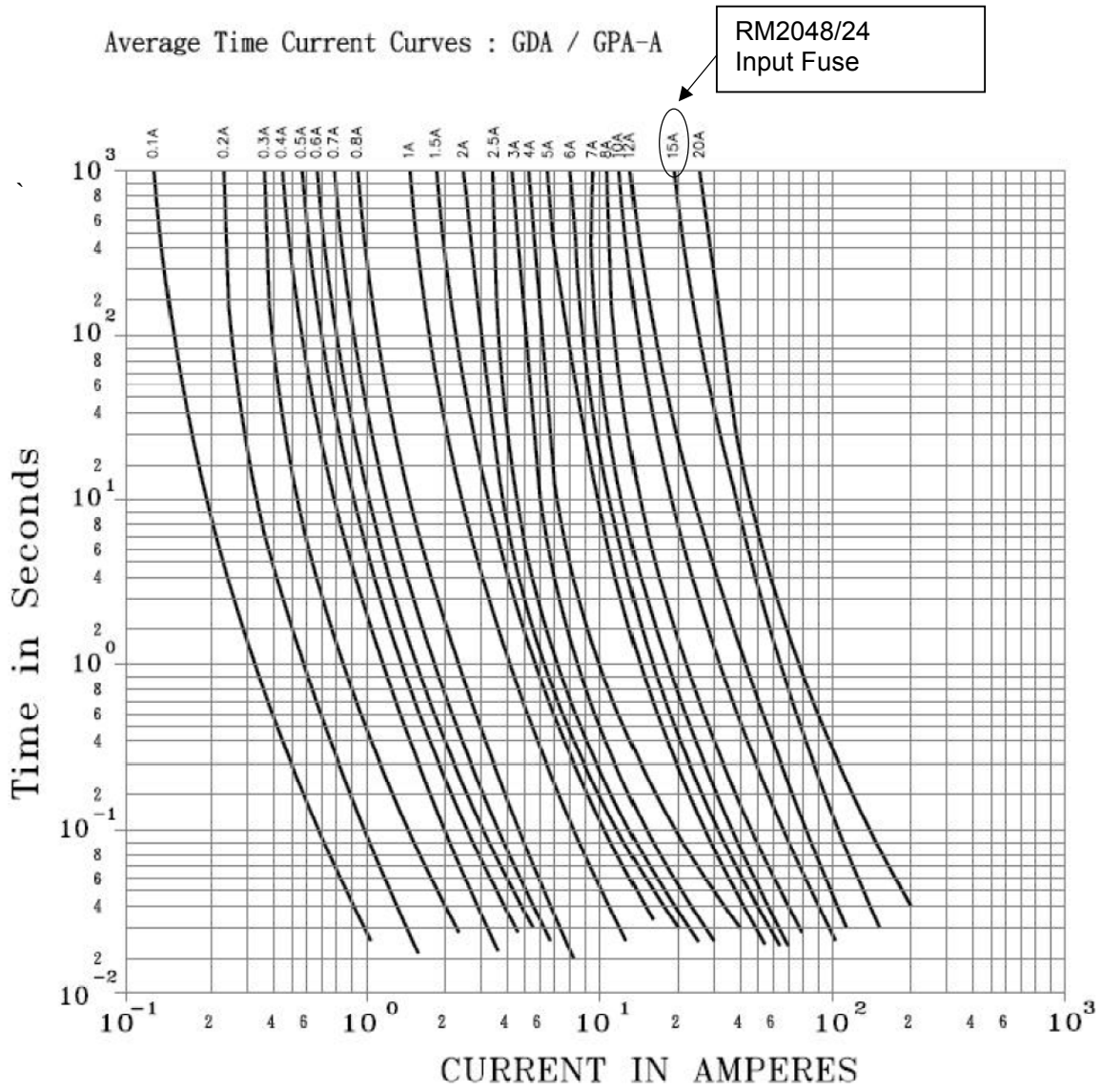


2. Avoid “Tee’d” Connections:



10 APPENDIX 4 – RECTIFIER INPUT FUSE CURVES

* The curves are average value, for reference only *



11 APPENDIX 5 – INSTALLATION OF AC INPUT COVER

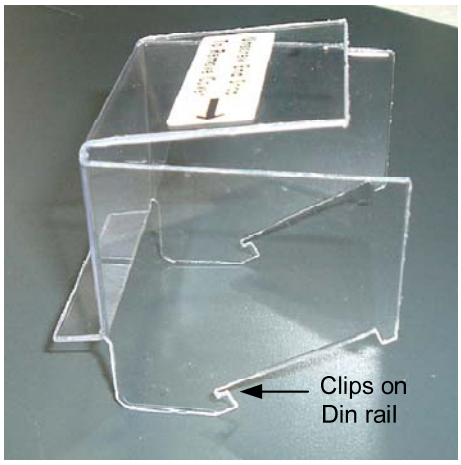


FIG. A

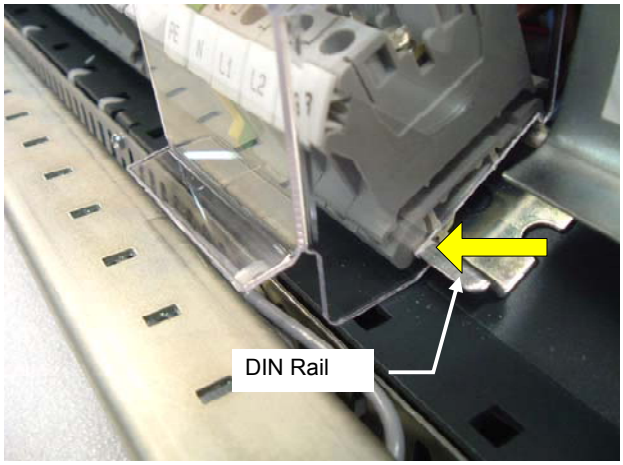


FIG. B

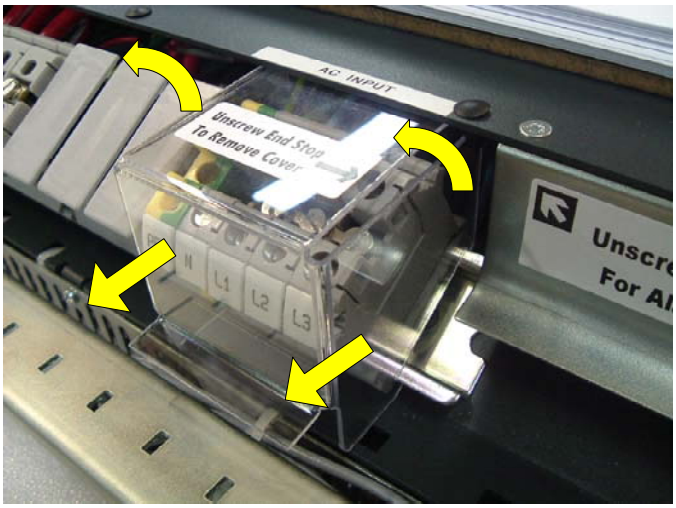


FIG. C

1. Unscrew the end stop. The end stop is shown in Fig. 1

2. Fig. A and Fig. B shows the bottom edge of AC cover, which clips on the Din rail.

3. To remove the AC cover, lift the cover up as shown by the arrows pointing up in Fig. C

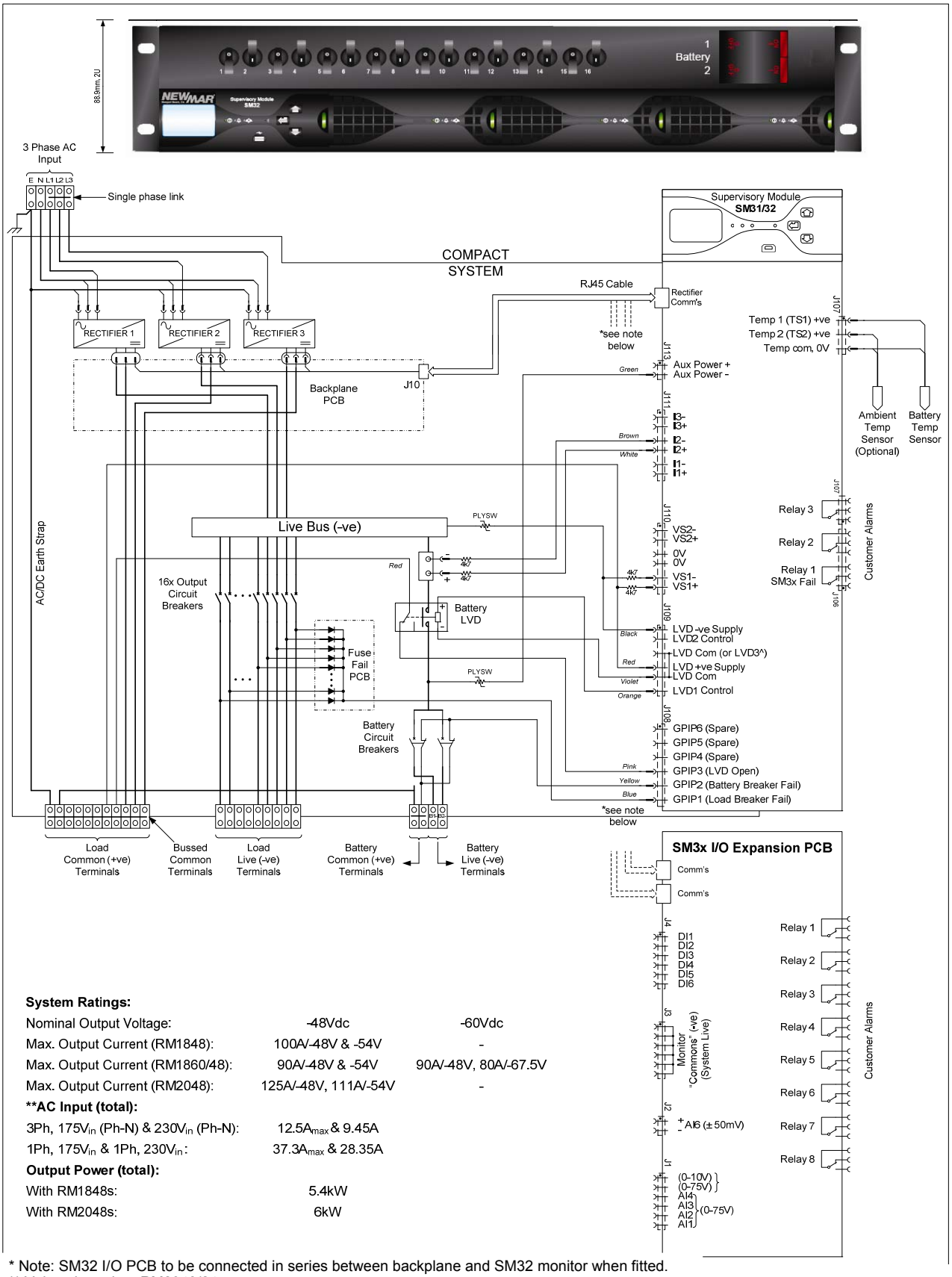
4. Once the upper end is released from the top of Din rail, pull the cover out as shown by the arrows pointing out in Fig C.

5. To put the cover back on the AC input terminals, clip the bottom of the AC cover on the Din rail as shown in Fig. B.

6. Once the cover is clipped on the Din rail, push the upper end of the cover under the top lid of the system. Make sure the AC cover is sitting correctly on the Din rail.

7. Screw the end stop back on the Din rail as shown in Fig. 1.

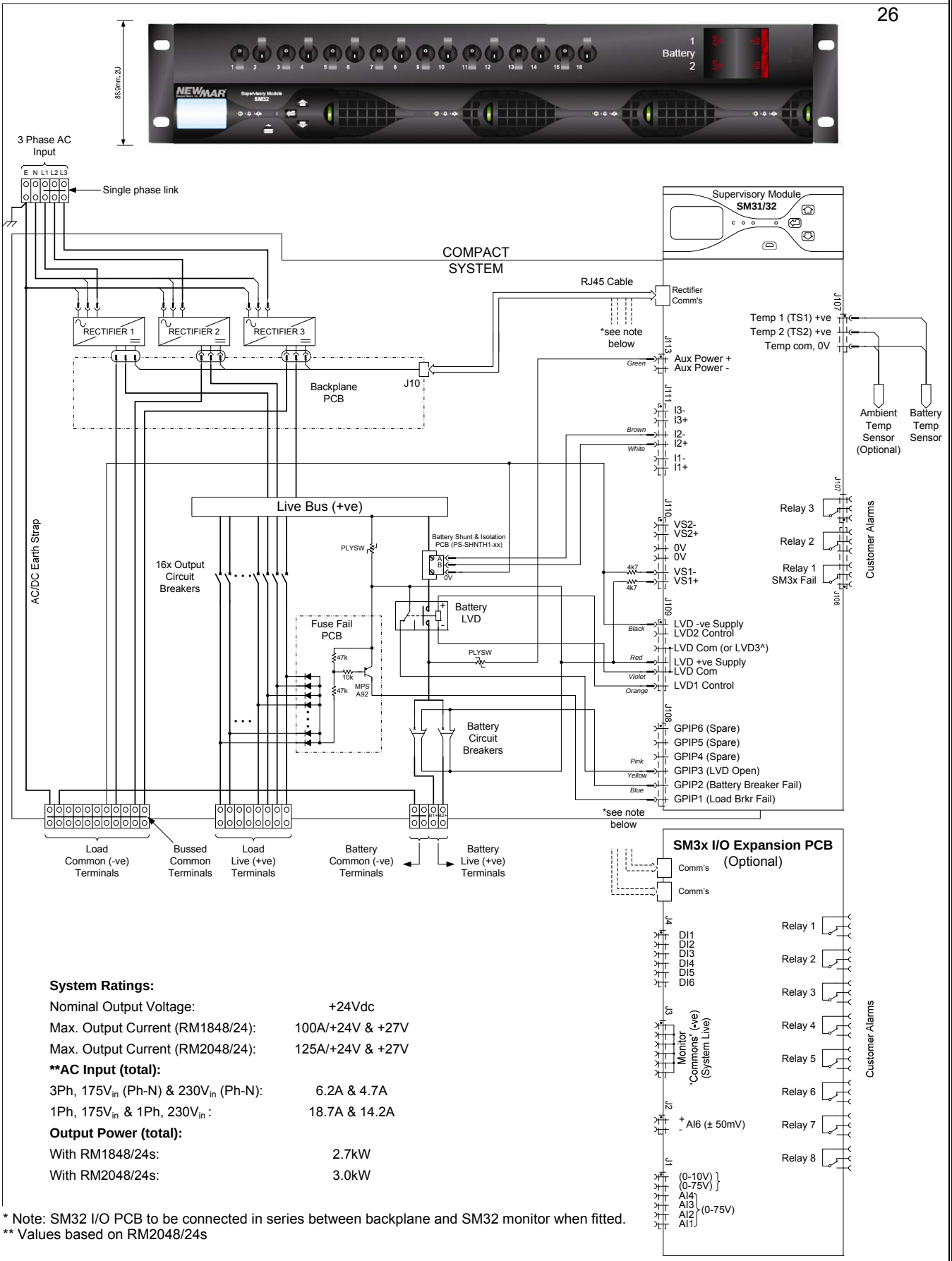
12 APPENDIX 6 – SYSTEM WIRING DIAGRAMS



System Ratings:

Nominal Output Voltage:	-48Vdc	-60Vdc
Max. Output Current (RM1848):	100A/-48V & -54V	-
Max. Output Current (RM1860/48):	90A/-48V & -54V	90A/-48V, 80A/-67.5V
Max. Output Current (RM2048):	125A/-48V, 111A/-54V	-
****AC Input (total):**		
3Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N):	12.5A_{max} & 9.45A	
1Ph, 175V_{in} & 1Ph, 230V_{in}:	37.3A_{max} & 28.35A	
Output Power (total):		
With RM1848s:	5.4kW	
With RM2048s:	6kW	

* Note: SM32 I/O PCB to be connected in series between backplane and SM32 monitor when fitted.
** Values based on RM2048/24s



System Ratings:

Nominal Output Voltage:	+24Vdc
Max. Output Current (RM1848/24):	100A/+24V & +27V
Max. Output Current (RM2048/24):	125A/+24V & +27V
****AC Input (total):**	
3Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N):	6.2A & 4.7A
1Ph, 175V_{in} & 1Ph, 230V_{in} :	18.7A & 14.2A
Output Power (total):	
With RM1848/24s:	2.7kW
With RM2048/24s:	3.0kW

* Note: SM32 I/O PCB to be connected in series between backplane and SM32 monitor when fitted.
** Values based on RM2048/24s

Centurion II Power System, +24V (-ve earth)