ARGUS

Com10 AZ328
Monitoring and Control Module

019-027-B4

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Power

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Com10 AZ328
Monitoring and Control Module

019-027-B4

The following documents and drawings are included in this manual to provide the necessary information required for installation, operation and fault diagnosis of the unit:

- **Important Safety Instructions and Installation:** 019-027-C2
- **Warranty Policy:** 048-507-10
- **Factory Service Information:** 048-527-10

Argus Technologies Ltd. **019-027-B4 Rev H WC**
Printed in Canada.

Warning

REFER TO SPECIFIC SAFETY WARNINGS THROUGHOUT THIS DOCUMENT BEFORE PERFORMING OPERATIONS.

NOTE: FOR EMC COMPLIANCE FIT FERRITE BEADS TO DATA CABLES - REFER TO THE INSTALLATION SECTION OF THIS MANUAL

About this document

Document Part Number: 019-027-C2
Called by Cover Page: 019-027-B4
Revision: H
Issue Date: May 2005

Revision History

Revision	Date	Action
5	2002/06/07	CO P7211. Include requirements for CE
6	2002/11/26	Update menu structure
7	2003/11/26	Update procedure for adding rectifiers Update paragraph number and table of contents
G	2005/04/07	Archive (formerly rev 7)
H	2005/04/07	Update cover page, header, footer for Argus Technologies Ltd. reissue

Typographical Conventions

This manual includes specification, operation, maintenance, installation and repair sections.

Warning Icon

WARNINGS CALL ATTENTION TO INSTRUCTIONS THAT MUST BE FOLLOWED PRECISELY TO AVOID INJURY, AND ARE HIGHLIGHTED BY THE WARNING ICON.

Caution Icon

Cautions highlight danger to equipment, but not personnel. A caution icon accompanies cautions.

Technical Details Icon

The operation section includes information about operation of all standard and optional functions. More detailed technical information that may be useful for troubleshooting is also included and is designated by a technical details icon.

NOTE: *AZ328 menus are shown in* `Courier New` *font.*

TABLE OF CONTENTS

1 Overview

The AZ328 is a versatile, compact monitoring and control module for use with rack power systems of any capacity. Operations, which may be performed, include:

- Observation of system voltages and currents; e.g., load voltage, battery voltage, load current
- Observation of battery temperature
- Investigation of alarm status: the monitoring and control module provides alarms concerning voltage levels, low voltage disconnect status, rectifier status, battery charging status and battery testing status
- Investigation of alarm history and system statistics
- Starting (or interruption of) battery charging cycles
- Starting (or interruption of) battery test cycles
- Unlatching battery test warning or failure alarms which may arise if the battery did not perform satisfactorily at the last battery test
- System reset: if the system has been shut down due to detection of extreme overvoltage, the monitoring and control module is used to start the rectifiers
- Disconnection of battery from (or connection of battery to) the system: some systems are provided with a battery disconnect contactor controlled by the monitoring and control module
- Modification of system parameters that were configured at the commissioning of the system.

Figure 1-1 AZ328 Monitoring and Control Module

2 Installation

This equipment must be connected to protective earth. EMC beads must be fitted.

This section refers to installation of the AZ328 and it's connected equipment only.

2.1 Responsibility

This equipment is designed to be installed in restricted access areas. It is expected that the owner or operator will employ qualified personnel for planning, commissioning, testing and maintaining the complete installation. It is also expected that precautions about restricting access to the installation be addressed by the owner or operator.

2.2 Mounting

The AZ328 is mounted into a standard 19" rack by means of four M6 screws and washers. The unit can be mounted at any position in the rack.

2.3 Connections

Connections are made at the rear of the unit (see Figure 2-1, Figure 2-2 and Figure 2-3). A label on top of the unit explains connection with space provided for user notes. Details of connection points are given in Figures 2-2 and 2-3. Attachment C shows SELV and TNV barriers.

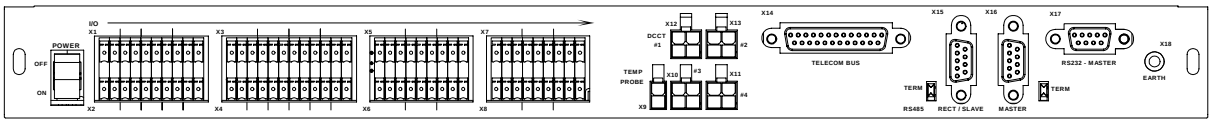


Figure 2-1 Rear of Unit

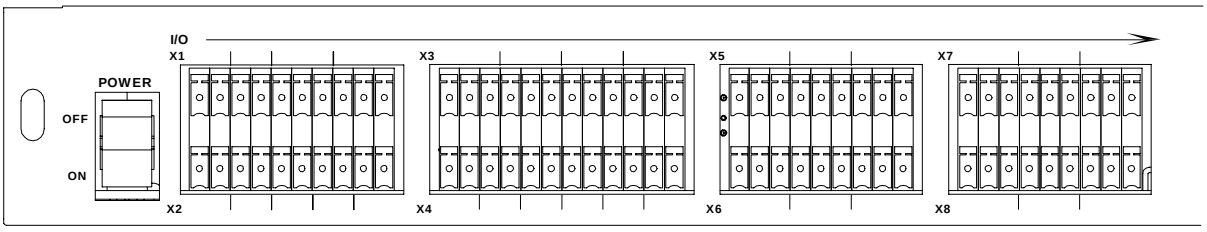


Figure 2-2 Rear Left of Unit

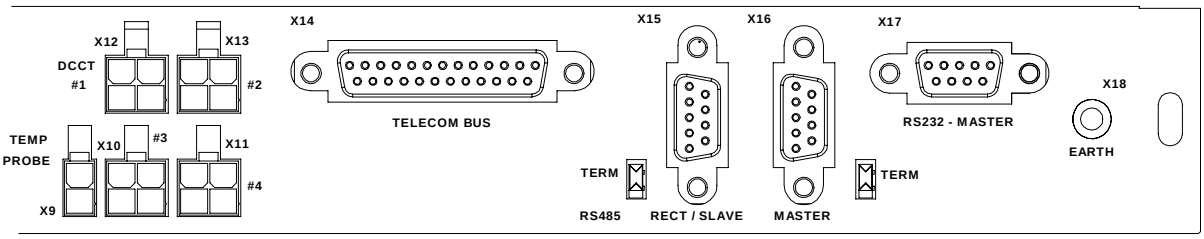


Figure 2-3 Rear Right of unit

The eight green terminal blocks can be removed from the unit for wiring. These terminals accommodate single or multi- core cable 0.14 - 1.5 mm² (28 - 16 AWG) stripped to 9 mm.

2.4 Earthing

This equipment must be connected to protective earth. The connection point for earth is located at the rear left of the unit. The connection is usually made using a crimp terminal that is fastened to the AZ328 using a M4x10mm screw. The DC system earth and AC mains earth must be connected with low impedance for operator safety and to avoid damage to equipment due to transients. Refer to Attachment A.

2.5 Power Cabling

Power for the AZ328 is normally supplied from the 24V or 48V DC bus bars inside the equipment rack. The wiring to the AZ328 must include a protective device to prevent wiring damage from high energy sources present in DC power systems. Recommended connections are shown in Attachment A.

2.6 DC Voltage Sensing Wiring

The AZ328 can monitor up to 3 DC voltage channels. Connection of sensing wiring to DC systems with high energy levels requires protective devices to be fitted near the point of connection. Recommended connections are shown in Attachment A.

2.7 Current Transducer Installation

The DC current transducer uses a Hall effect device requiring power to operate. DC current transducers receive power from their connection to the rear of the AZ328. To protect the AZ328, and the user, current transducers must be able to provide isolation from TNV-1 bus bars in the DC system.

To ensure adequate levels of isolation, use only DC current transducers recommended by the manufacturer. The wiring arrangement for current transducers is shown in Attachment B.

2.8 Battery Temperature Probe

The battery temperature probe connects to the rear of the AZ328. It must be able to provide isolation from TNV-1 bus bars because battery circuits may be subjected to TNV-1 transients. The only probe that can be used here is part number 157589. This probe provides the correct level of isolation.

It is important to locate the probe in a position near the battery and away from other heating or cooling influences. The probe is used for battery temperature compensation.

2.9 Low Voltage Dropout Contactor

This contactor prevents over-discharge of the battery bank during extended AC supply failure. The control circuit from the AZ328 is SELV rated. It is installed according to Attachment A.

2.10 Communications Ports

There are 3 SELV rated communication ports.
a) RS485 for communication with rectifiers.
b) Two RS232 for communication with a modem or computer.

The Master RS-485 serial communications port located on the rear panel is reserved for future development of the system and should not be connected.

The communications circuits are isolated from each other and AZ328 input power. Connect using cable rated at 105degC and 300V.

NOTE: *To maintain proper EMC compliance, data cables (connected to X15 "Rect/Slave" and X17 "RS232 Master" as shown in Figure 2-3) should be fitted with EMC ferrites (Fair-rite 0443167251 or similar) close to the AZ328 rear panel. Fasten to the cable using cable tie supplied.* ***Two ferrites are supplied with each AZ328.***

2.11 User Connections

There are 2 types of user connection, namely Digital Inputs and Relay Outputs. Relay outputs are used for external alarms or controls and digital inputs are used for monitoring relay contacts. An example of a digital input is the monitoring of the status of circuit breakers in the system via an auxiliary contact on the CBs. Digital outputs are rated SELV and digital inputs are rated TNV-1.

For safety and flexibility, digital inputs are isolated by opto couplers and digital outputs are voltage free relay contacts. User inputs must be relay contacts. User alarm equipment must be within relay contact ratings.

2.12 Operation Settings

The AZ328 comes with factory default settings, which are described in the next section. Instructions are given for setting parameters to the requirements of the specific installation. At this stage of installation, the AZ328 is installed and ready for user settings.

3 Operation

This section has information for the user of the AZ328.

NOTE: *AZ328 menus are shown in* `Courier New` *font.*

3.1 Normal System Operation

The AZ328 is powered from the DC system bus bars. The power switch is not user accessible when the unit is rack mounted. Power is turned ON when the system is installed. If power is lost, an alarm is raised (see section 3.8.8). If power needs to be removed from the AZ328, disconnect the rack from AC and DC systems.

Under normal conditions a green LED is lit on the front panel of the MCM. Voltage and current displays provide system-operating conditions and the display shows the system normal default display:

```
COM10 MODULAR RPS
S/N ##### VER #.#
```

In the event of an alarm condition occurring either the yellow or red LED (or sometimes both) will be lit and the audible alarm may sound. The display will provide details of the alarm condition(s).

3.2 Front Panel

Figure 3-1 below shows the features of the monitoring and control module's front panel. The serial communications port is not used in this version of the monitoring and control module.

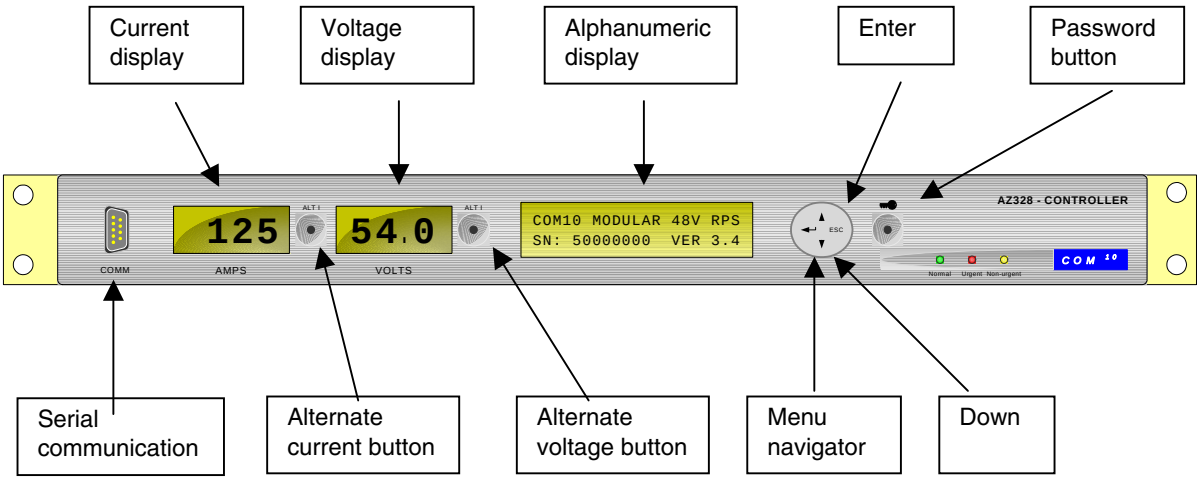


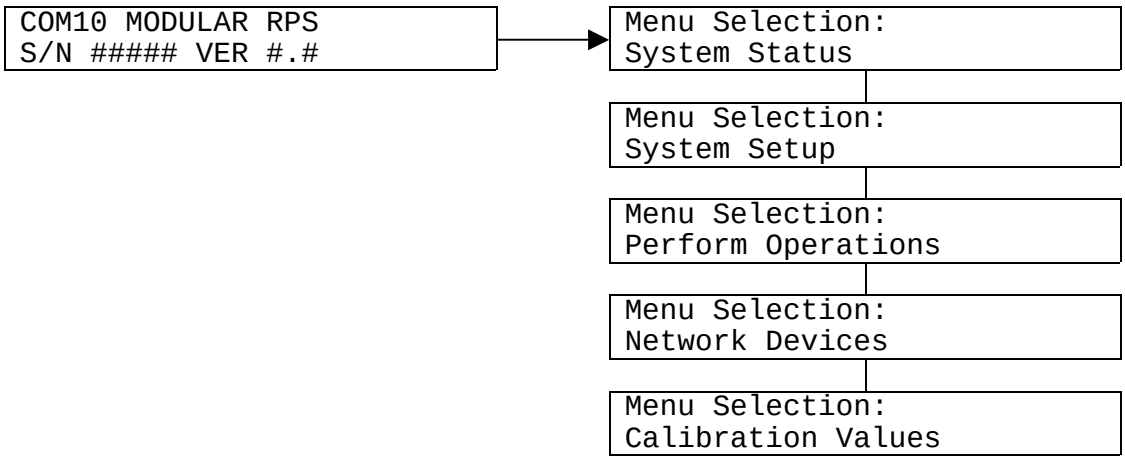
Figure 3-1 MCM Front Panel

3.2.1 Navigating Menus

The user interface uses a hierarchical menu structure to arrange the parameters, information and commands:

- Tilt the navigator up or down to scroll through the set of screens in one menu, or modify values in the appropriate screens.
- Tilt the navigator to the left (↵) to go to the next submenu, or to modify parameters in the appropriate screens.
- Tilt the navigator right (ESC) to return to the higher level or to exit from a procedure.
- The password button is used when entering a password.

The following table shows the start screen and the top menu. Note that the `System Setup` and `Network Devices` screen will only be available if the access level is 1 or higher, and `Calibration Values` menu is only available if the access level is 2. Access control is described in section 3.2.6 below.



3.2.2 Muting the Audible Alarm

Some alarm conditions cause the audible alarm to sound. To mute the alarm, press any button. The alarm status will still be shown at the user interface screen.

3.2.3 Interpreting System Status

Under normal operating conditions the green “Normal” LED is lit. The amber LED indicates a non-urgent alarm condition and the red LED indicates an urgent alarm condition. Individual alarms are discussed in section 3.8 below.

3.2.4 Viewing Alarm Status

When an alarm occurs, the start screen is replaced by an alarm message. If more than one alarm is active simultaneously, the start screen becomes a list of active alarms, which may be scrolled through using the menu navigator.

3.2.5 Entering a Password

Some actions, such as modifying parameters and starting or interrupting charging cycles, require the entry of a password. To enter a password, press the password button on the front panel. The password number may then be entered by tilting the navigator up or down and then pressing the ENTER ↵ key.

3.2.6 Levels of Access

No password is required to gain level 0 access. Under level 0, system status may be viewed and charge or test cycles may be cancelled.

Level 1 and level 2 require separate passwords. Level 1 access allows starting charge and test cycles and viewing of setup parameters, and level 2 access allows all features to be used.

The default passwords can be changed in the `System Setup: General Configuration` menu. See section 3.6 below. Note: Only passwords of the same access level or lower can be changed; i.e. entering the level 1 password will only allow the user to change or view the level 1 password only.

The password for level 1 is ‘20’.

The password for level 2 is ‘40’.

3.2.7 Display Screen Options

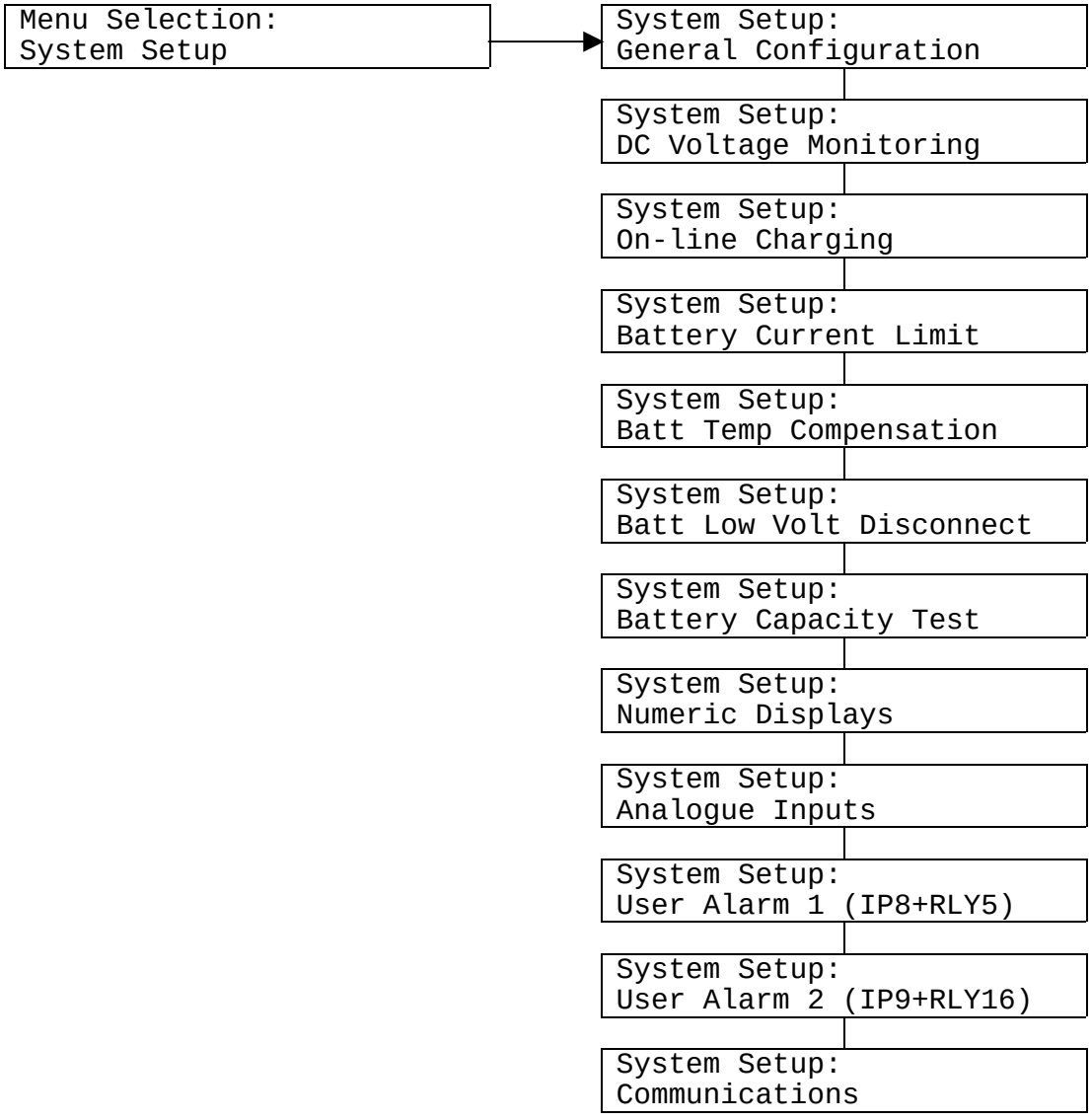
Two parameters in the General Configuration menu (discussed in section 3.6 below) control the alphanumeric LCD display:

- The display contrast can be adjusted
- Menu auto home can be enabled, which makes the alphanumeric display return to the start screen and clears the access level after a period of inactivity.

See section 3.6 below for setup for the two numeric LCD displays.

3.3 Modifying System Parameters

The system parameters are arranged in a set of submenus under the “System Setup” menu.



Depending on the general configuration settings, some of the above screens will not appear; for example, if on-line charging is disabled, the `System Setup: On-line Charging` screen will not be available.

If a parameter needs to be modified from its commissioned value, use the following procedure:

1. View the parameter screen.

```
High Volts Threshold:
        56.0 V
```

2. Press ENTER ↵.
The present setting is on the left and the new setting is on the right.

```
High Volts Threshold:
     56.0 to 56.0
```

3. Tilt up or down to vary the parameter.

```
High Volts Threshold:
     56.0 to 56.5
```

4. Press ENTER ↵ to accept the change. (To reject the change, press ESC instead). An EEPROM message will be displayed.

```
Store Config to EEPROM?
 ENTER = Yes EXIT = No
```

5. Choose whether to store the change to non-volatile memory.
Press ENTER ↵ to enter the information, or press ESC to exit. (If ENTER is chosen, the MCM will take a few seconds to store the change.)

```
High Volts Threshold:
        56.5 V
```

NOTE: *If ESC is chosen the parameter is changed but will revert to the previous value if the MCM loses power, it is shutdown or reset.*

3.4 Modifying System Voltage

The system voltage can be set from the monitoring and control module in systems using IRC rectifiers. This is done by using the `Nominal System Voltage` screen in the `System Setup: On-line Charging` menu, and modifying the parameter as described above.

CAUTION: A dangerous condition can be created if Normal System Voltage is set to a level that causes excessive hydrogen gassing of batteries.

3.5 Modifying the System Clock

The date and time (shown under the System Status menu) may be altered in a similar way. The time is displayed in 24-hour time, and the date is in the format DD/MM/YY. The clock is used to time stamp alarms and to initialize scheduled operations such as scheduled battery charging.

3.6 General System Configuration

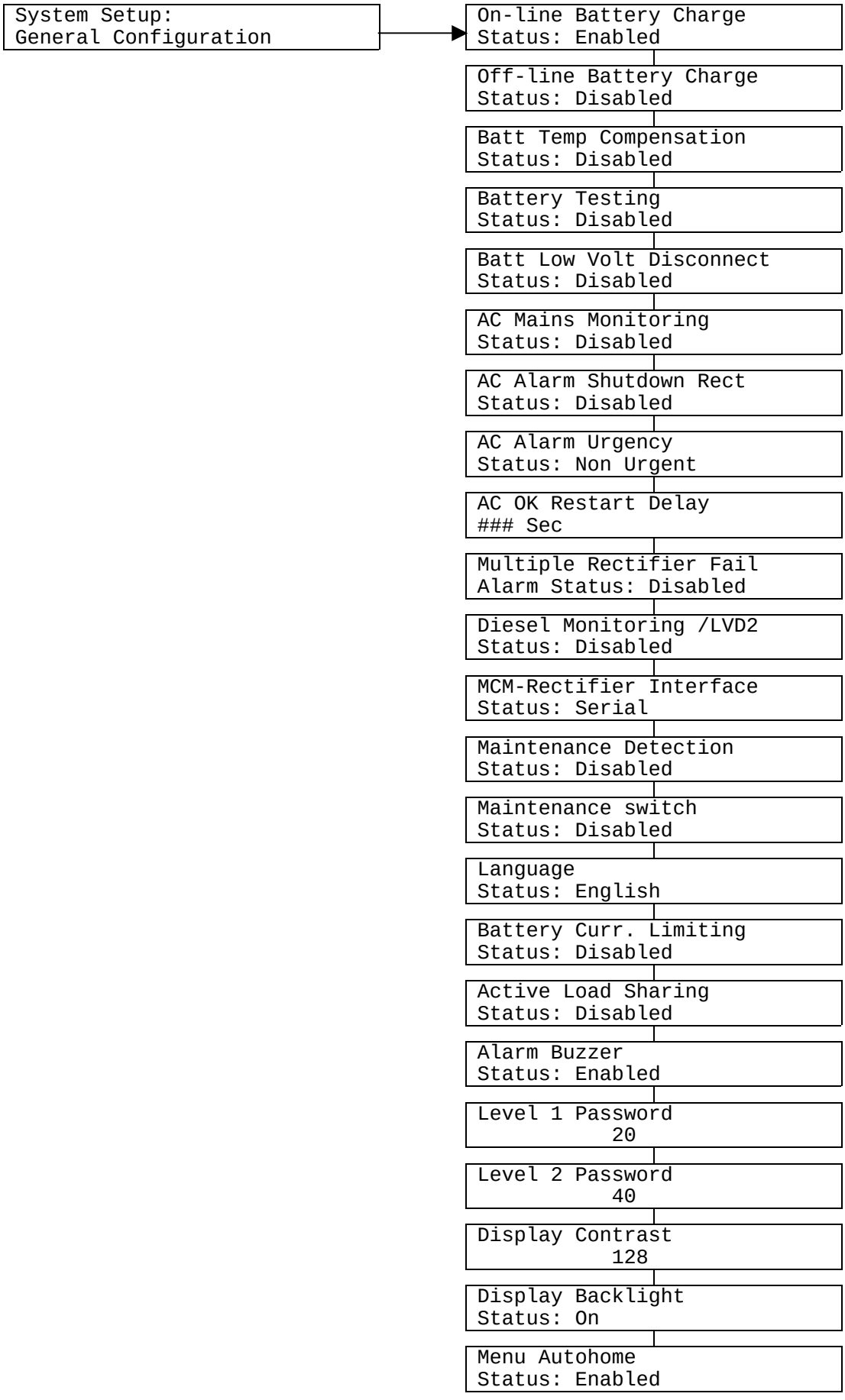
The System Setup: General Configuration menu includes information on which monitoring and control features are enabled:

- On-line battery charging
- Off-line battery charging
- Battery temperature compensation
- Battery testing
- Battery low voltage disconnect
- AC mains monitoring, which enables the AC Abnormal alarm
- Diesel monitoring, which enables the System on Diesel alarm
- Non-critical load shedding control (LVD2)
- Battery current limiting
- Active load sharing
- Alarm buzzer.

It also holds the MCM-Rectifier Interface parameter, which is set to Serial in systems using the Intelligent Remote Control (IRC) communications protocol, and to Parallel for systems using a simple 25-way ribbon cable to control the rectifiers. Throughout the rest of this manual, rectifiers communicating using the IRC protocol will be referred to as IRC rectifiers, and rectifiers using the 25-way cable as non-IRC rectifiers.

The IRC network is connected to the monitoring and control module at the DB9 port marked Rectifiers/Slaves at the rear of the unit. Non-IRC rectifiers are connected in parallel to the DB25 port labeled Telecom Bus.

The General Configuration menu also contains parameters controlling the passwords and display options, as discussed in sections 3.2.6 and 3.2.7 respectively.



3.7 Observing Voltages, Currents and Temperature

The voltage and current displays show the default system voltage and current. Press and hold the alternate voltage button to view the alternate voltage, or the alternate current button to view the alternate current.

The default and alternate voltages are chosen from a set of three possible voltages: output voltage, battery voltage and boost voltage. The default and alternate currents are chosen from a set of four possible currents: load current, battery current, output current and boost current. Refer to the system specification document in the system manual, under the `Numeric Display` menu to see which assignments have been made at this site.

A display showing 'OL' indicates overflow. In this case use the system setup menu to observe voltage or current.

The output current shown by the monitoring and control module refers to the output of the entire suite of racks, where the MCM is being used in a large capacity system.

System currents and voltages are shown in the following figures. Both positive and negative earth systems are shown:

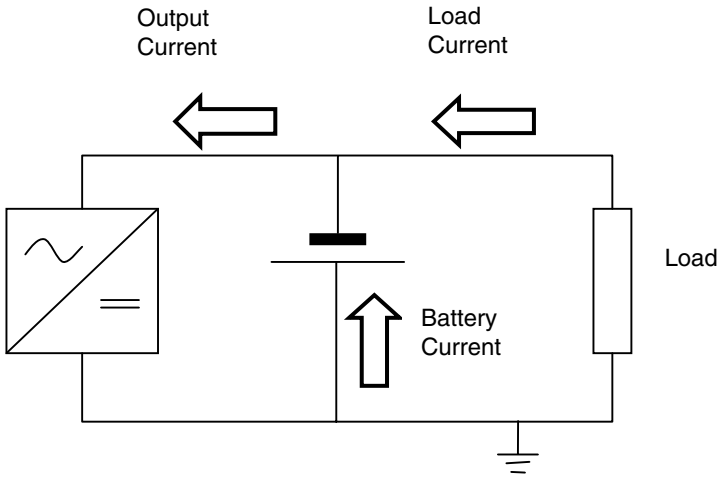


Figure 3-2 System Currents - Positive Earth System

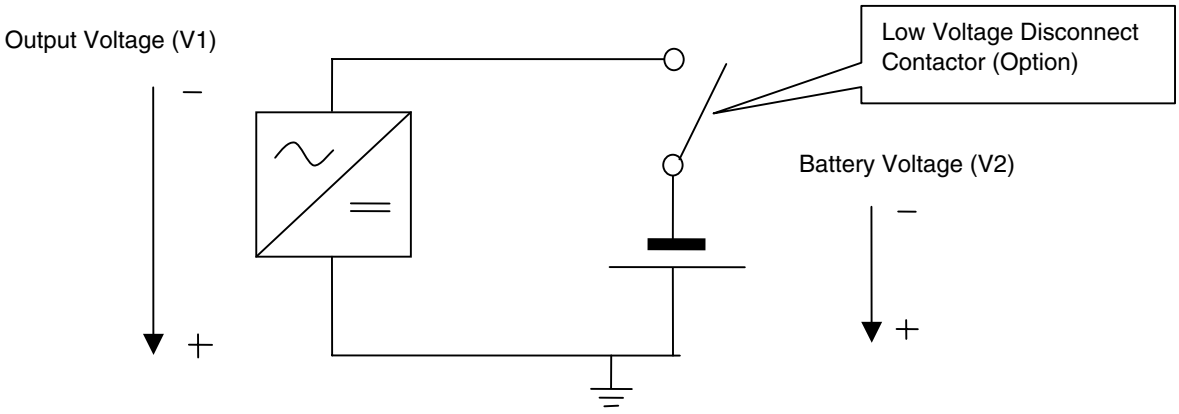


Figure 3-3 System Voltages - Positive Earth System

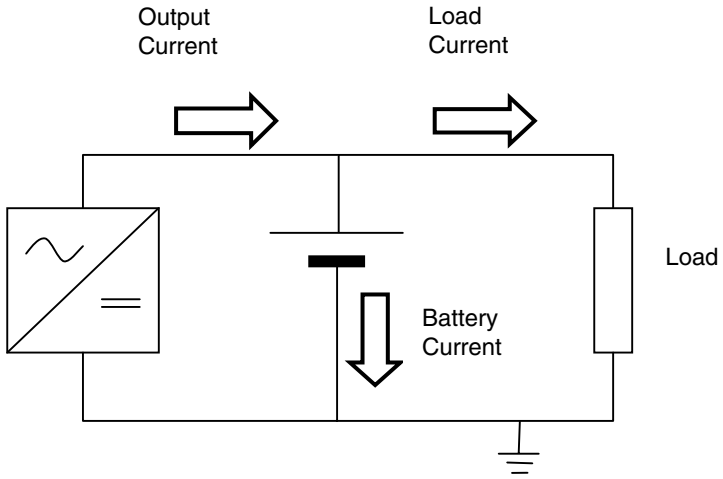


Figure 3-4 System Currents - Negative Earth System

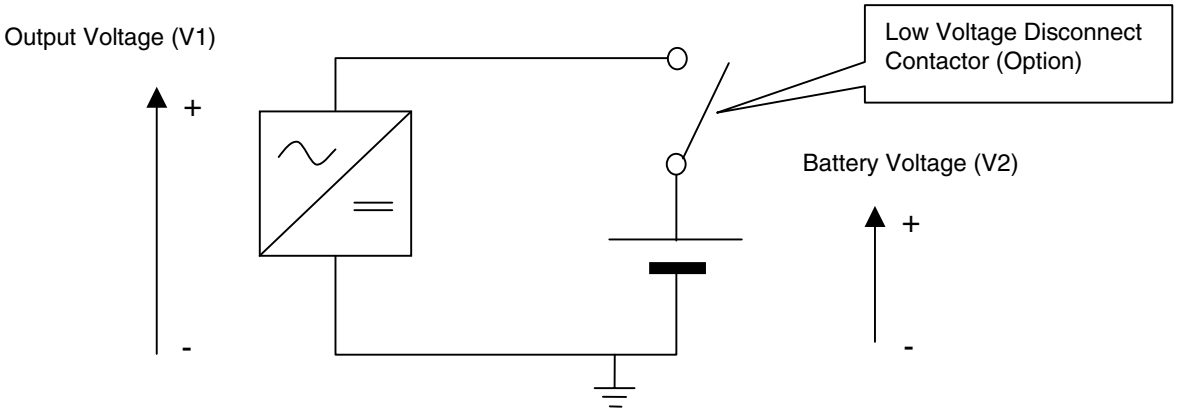
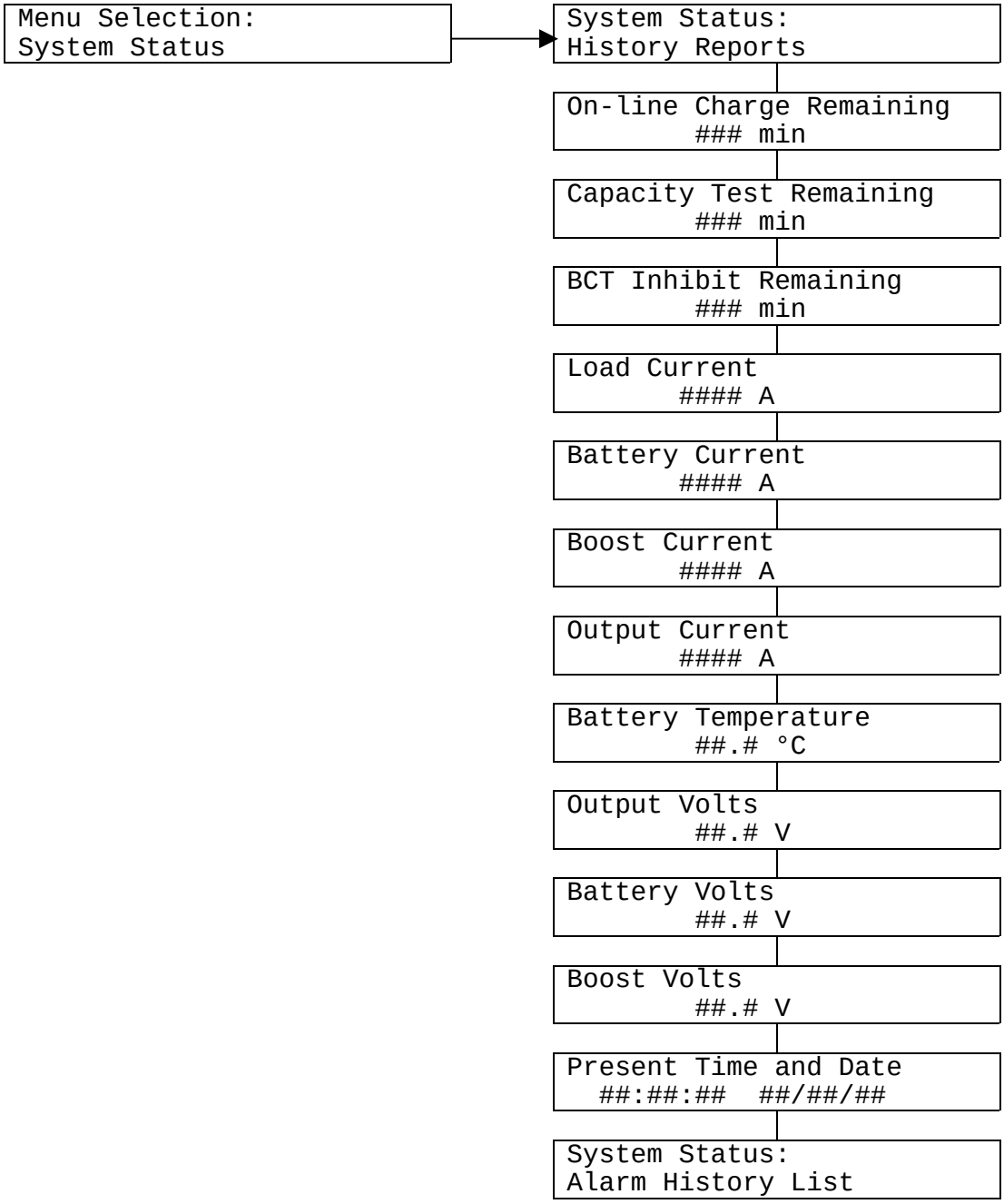


Figure 3-5 System Voltages - Negative Earth System

The complete system status including voltages, currents and temperature may be viewed under the System Status menu. Some of the screens shown below may not be visible at the MCM. This is due to specific parameter selections.

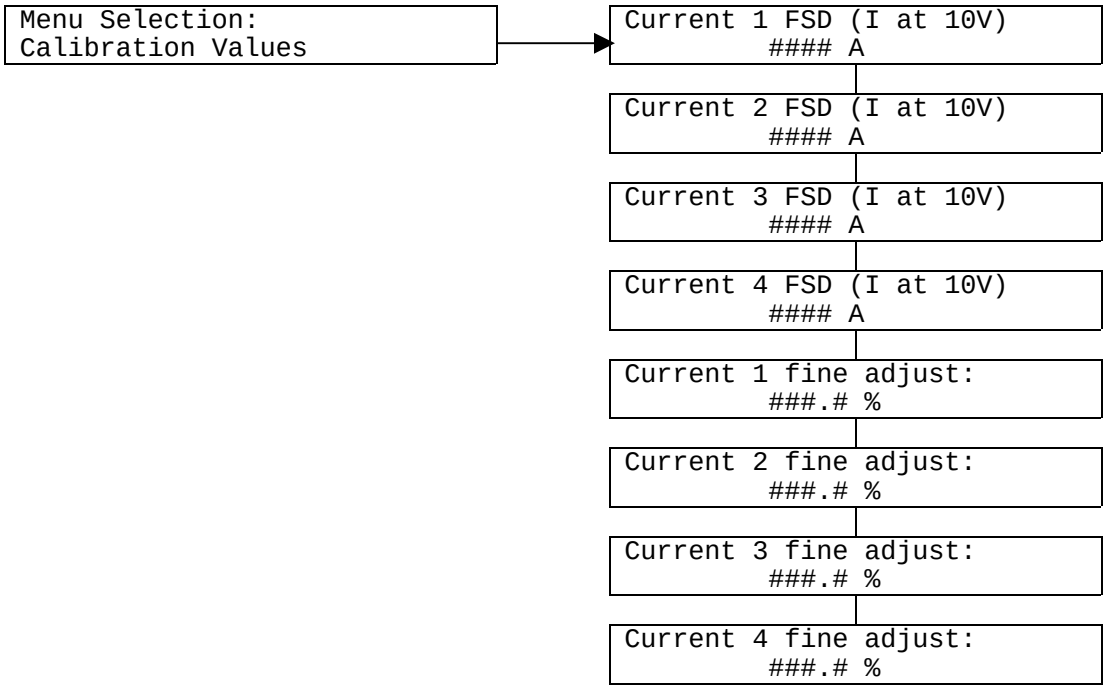


The time is displayed as 24-hour time, and the date is displayed in the format DD/MM/YY.

Three voltage inputs are located at the bare wire terminals at the rear of the unit. Refer to the label on top of the unit for the pin assignments. Voltage measurement is accurate to ± 0.7V. These inputs do not measure negative voltages.

Four inputs for measuring current are located at terminals marked DCCT1 to DCCT4 at the rear of the unit. Use only the manufacturer's supplied or approved cables for connecting these inputs. The inputs are suitable for connection to current transducers. When shunts are used, the shunt is connected via a Shunt Interface Board (SIB) to these inputs. Current measurement is accurate to ± 2.5% of FSD of the connected transducer (not including the error in the transducer).

The MCM uses information shown in the Calibration Values menu to calculate the current represented at these inputs. Each of the first four screens shows the nominal shunt current (current at which shunt voltage is 50mV) or the current at which the transducer outputs 10V.



The final four screens may have been set at commissioning for fine calibration adjustment.

The voltages available to the user, Output Volts, Battery Volts and Boost Volts, are obtained from inputs V1, V2 and V3. Voltage inputs not being used are disabled.

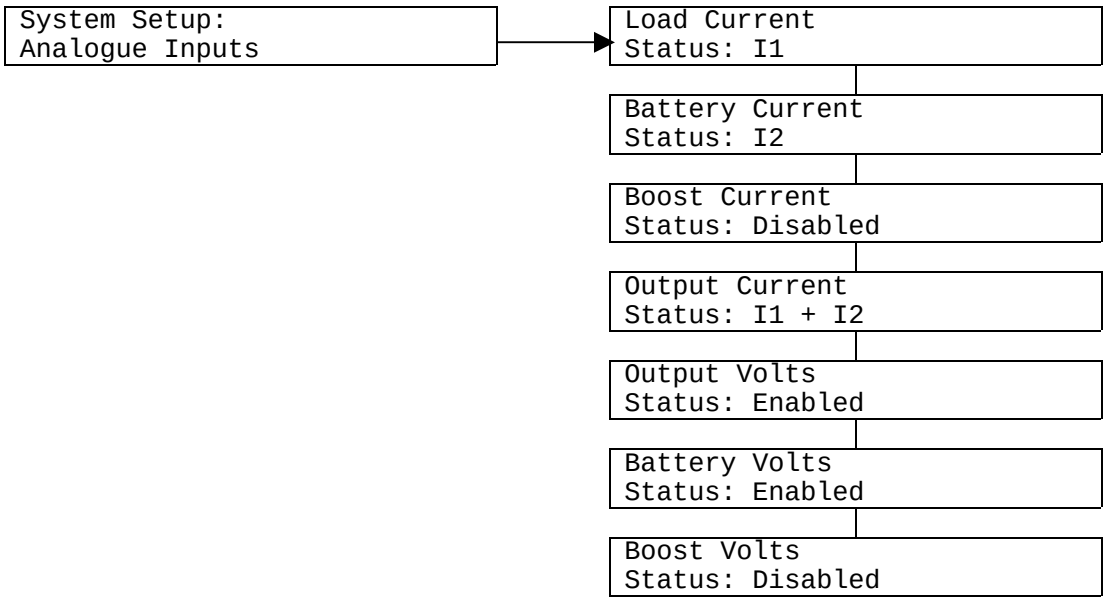
The `System Setup: Analogue Inputs` menu shows which of these are enabled or disabled. Disabled measurements are not shown in the System Status menu.

The four currents available, Load Current, Battery Current, Boost Current and Output Current can be measured from one of the four current inputs I1, I2, I3 and I4 or calculated. Systems using IRC rectifiers can also calculate the output current by summing individual currents measured by the rectifiers. Two current calculations are defined as follows:

I_{ON} = sum of individual output currents of all rectifiers in the system

I_{OFF} = sum of individual output currents of all off-line rectifiers.

The `System Setup: Analogue Inputs` menu shows which of the available currents are disabled and how the remaining ones are calculated. Disabled measurements are not shown in the System Status menu.



The measurement and calculation options for each current are set out in the table below:

	Load Current	Battery Current	Boost Current	Output Current
Options	Input I1 Input I_{ON} - I2 Disabled	Input I2 Input I_{ON} - I1 Disabled	Input I3 Input I_{OFF} Disabled	Input I4 Input I_{ON} Inputs I1 + I2 Disabled

Examples of the use of these alternatives are given here.

Example 1 - IRC rectifier system with one DCCT and no off-line charging.

Output current is calculated from the IRC rectifiers, and is set to I_{ON}. Boost current is disabled. The DCCT is connected to I2 and used for battery current. Load current is calculated as the difference between output current and battery current, and is set to I_{ON} - I2.

Example 2 - Non-IRC rectifier system with three DCCTs and off-line charging.

The DCCTs are connected to I1, I2 and I3 and measure load, battery and boost current. Output current is calculated as the sum of load and battery current, and is set to I1 + I2.

3.8 Responding to Alarm Conditions

The alarms are detailed here in alphabetical order. System setup parameters referred to in the following discussion are shown in `Courier New`. Look up the setting via the user interface or in the system specification document under the submenu nominated.

3.8.1 AC Abnormal

For systems employing an AC Monitoring Unit only. (Under the `General Configuration` menu, AC `mains monitoring` is set to `Enabled`).

The AC mains voltage is too high or too low, or has failed.

The alarm will clear when the mains voltage returns to the allowed range.

This alarm will interrupt or prevent an on-line charging cycle or battery test.

i

The AC abnormal signal from the AC Monitoring Unit is connected to **Digital Input 2**. Refer to the label on top of the unit for the pin assignments. An open circuit indicates the mains are too low or too high. The MCM monitors this input when AC `Monitoring` is set to `Enabled` (under the `General Configuration` menu).

3.8.2 Battery Test Fail

For systems where battery testing is enabled only. (Under the `General Configuration` menu, `Battery Testing` set to `Enabled`).

The result of the last battery test is failure; i.e., the battery voltage dropped below the fail threshold before the battery test duration expired. This indicates that battery capacity may be significantly reduced. View the `Last Battery Discharge` history report (under the `System Status – History Reports` menu) for more information on the last battery test.

This alarm will remain active until it is unlatched (view the alarm screen and press ESC to clear the alarm).

As long as the alarm is latched, no further battery tests will be started.

3.8.3 Battery Test On

For systems where battery testing is enabled only. (Under the `General Configuration` menu, `Battery Testing` set to `Enabled`).

A battery test is in progress; i.e., the rectifiers are being disabled by the MCM and the battery is discharging into the load.

This alarm will clear at the end of the test.

3.8.4 Battery Test Pass

For systems where battery testing is enabled only. (Under the General Configuration menu, Battery Testing set to Enabled).

The result of the last battery test is pass; i.e., the battery voltage remained higher than the warning threshold for the duration of the test. No action is required.

3.8.5 Battery Test Warning

For systems where battery testing is enabled only. (Under the General Configuration menu, Battery Testing set to Enabled).

The result of the last battery test is warning; i.e., the battery voltage dropped below the warning threshold but remained above the fail threshold for the duration of the test. This indicates that battery capacity may be slightly reduced. View the Last Battery Discharge history report (under the System Status – History Reports menu) for more information on the last battery test.

This alarm will remain active until it is unlatched (view the alarm screen and press ESC to clear the alarm).

As long as the alarm is latched, no further battery tests will be started.

3.8.6 CB Open

At least one circuit breaker in the system has been opened/tripped or a fuse has failed.

The alarm will clear when all monitored circuit breakers and fuses are in the normal condition.

Circuit breakers are monitored by means of an auxiliary, or by a DC voltage alarm board housed within the distribution panel or PDU. The auxiliaries and/or alarm board outputs are wired in series and connected to digital input 1 at the rear of the unit. Refer to the label on top of the unit for the pin assignments. An open circuit on this input causes the CB Open alarm. This input cannot be disabled.

3.8.7 Communications Fail

During serial communication with a remote monitoring and control site a malfunction was detected. If this alarm persists, the modems and connections should be checked.

The alarm will clear when communication is restored.

3.8.8 Configuration Fail

A malfunction was sensed during a store configuration or restore configuration operation (including loss of power to the AZ328). If this alarm persists contact the manufacturer. The alarm will clear when a successful store or restore operation is performed.

3.8.9 Lost Slave

For systems using IRC rectifiers or other slave devices.

The specified number of slave devices have stopped communicating with the monitoring and control module. The addresses of these slaves are shown. This may indicate the device has been shut down or has lost power. Refer to the product manual of the slave device for possible causes of loss of communication.

If the slave device has been unlocked from the shelf and either it, or a new device, has been replaced, it is necessary to use the Forget Lost Slaves procedure described in section 3.9.2 below, and then to set up the slave by means of the Add New Slave Device procedure described in section 3.9.1. If this alarm persists, re-commission all slaves by means of the Reset Slave Addresses procedure described in section 3.9.3 . The alarm will clear after the Forget Lost Slaves or the Reset Slave Addresses procedure is used.

If the alarm has not been caused by the unlocking of the slave device from its shelf, the alarm will clear once communication with the slave recommences, for example, when mains power is re-established.

If the alarm persists check the communications cable at the back of the rectifier subrack.

3.8.10 LVD Disconnect

For systems using a battery disconnection contactor only.

The battery disconnection contactor has been opened, either due to a user instruction, or automatically because of low output voltage. In the latter case this is usually because of an extended mains failure, during which the battery voltage has run down to the `LVD Open Threshold` (`System Setup - Batt Low Volt Disconnect` menu). If so, the load is now without power.

The alarm will clear and the contactor will close when given the instruction, or when the output voltage rises above the `LVD Close Threshold` (typically when the mains are restored and the rectifiers are back on line).

The MCM controls the contactor via relay outputs 17 and 18. The alarm indicates that the MCM has operated these relays, energizing relay 17 and de-energizing relay 18. It does not mean that the MCM has detected that the contactor is open. The relay outputs are accessed via the bare wire terminals at the rear of the unit. Refer to the label on top of the unit for the pin assignments.

3.8.11 Off-line Charge On

For systems using off-line charging only. (Under the `General Configuration` menu, `Off-line Battery Charging` is set to `Enabled`).

A battery string is being charged off-line; i.e., a set of rectifiers have been disconnected from the load by the operator and connected to the battery string alone.

This alarm will clear when the battery and rectifiers are switched back to the load.

3.8.12 Off-Normal Alarm

At least one rectifier in the system is in the off-normal status. This may be caused by the system being under very light load, in which case one or more rectifiers may signal off-normal to indicate a “No Load” status. If this is not the case, identify the rectifier raising the alarm and refer to the rectifier manual for remedial action. For IRC rectifiers, the number of rectifiers raising this alarm and their addresses are shown.

Other rectifier alarms that cause the Off-Normal alarm include:

- Current limit
- Low AC mains
- High temperature.

This alarm will clear when the rectifier stops asserting the off-normal condition.

IRC rectifiers indicate the off-normal status to the monitoring and control module via the network.

Non-IRC rectifiers signal “off-normal” to the MCM via the Telecom Bus (25 way ribbon cables). Typically all rectifiers are connected in parallel with the MCM using one cable, but in some large capacity systems the Current Measure Interface PCA is used to relay the signals to the MCM. In this case three types of cables are involved: the rectifier Telecom Bus (wired from the CMI to each rectifier), the MCM to CMI ribbon cable (wired from the CMI to the MCM in the master rack), and the CMI-CMI cable (wired between racks).

3.8.13 On-line Charge On

For systems using on-line charging only. (Under the `General Configuration` menu, `On-line Battery Charging` is set to `Enabled`).

An on-line battery charge is in progress; i.e., the system output voltage has been raised to the charging voltage. This may occur automatically, after a battery discharge has been detected (if `Auto On-line Charging` is set to `Enabled`), or periodically (if `Sched On-line Charging` is set to `Enabled`), or as a result of an instruction from the operator.

The alarm will clear when the charging period expires and the system voltage is returned to normal.

3.8.14 Output Volts High

The system voltage exceeded the high voltage threshold.

In systems where `Action on high volts` is set to `Disable rectifiers` (under the `DC Voltage Monitoring` menu) the rectifiers are disabled when this alarm occurs.

This alarm will remain active until the voltage has dropped below the high voltage threshold (with hysteresis specified in the `DC Voltage Monitoring` menu) and the alarm is unlatched by the operator (view the alarm screen and exit). At this point, the rectifiers are enabled once more.

If `Action on high volts` is set to `Disable rectifiers`, the MCM sends the disable signal to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), SW3 must be set to ON in order to relay the disable signal to the rectifiers. IRC rectifiers receive the disable signal via the network.

Output Volts High alarm should not be set to a level that exposes batteries to excessive hydrogen gassing. In this case no alarm will be raised if this condition occurs.

3.8.15 Output Volts Low

The system voltage is below the low voltage threshold. This may indicate a mains failure, or a reduced mains voltage on any one phase, or an excessive load current.

The alarm will clear when the voltage rises above the low voltage threshold (with the hysteresis specified in the `DC Voltage Monitoring` menu).

This alarm will interrupt or prevent a charging cycle or battery test.

3.8.16 Rectifier Shutdown

At least one rectifier in the system is signaling “Rectifier Shutdown”; i.e. no output. This alarm may occur due to the mains being disconnected from the rectifier. For IRC rectifiers, the alarm will quickly be replaced by the Slave Lost alarm, as the rectifier loses communication with the monitoring and control module.

For systems using IRC rectifiers, the number of rectifiers signaling “Rectifier Shutdown” and their addresses are shown.

For non-IRC rectifiers, identify the rectifiers asserting the alarm by checking the front panel of each rectifier. Disconnect the Telecom Bus from these rectifiers, and check that the alarm clears at the MCM.

Check that operating parameters of the shutdown rectifiers are correct by comparing them with the system specification document. If the parameters are correct, the unit is faulty.

This alarm will clear when the rectifiers stop asserting the fail condition.

IRC rectifiers signal “rectifier shutdown” to the monitoring and control module via the network, while non-IRC rectifiers use the Telecom Bus (25 way ribbon cables).

3.8.17 System on Diesel

For systems using diesel backup and having a diesel generator monitoring signal installed only.

The diesel generator is supplying power to the system.

This alarm will clear when the diesel generator is shut down.

This alarm will interrupt or prevent a charging cycle or battery test.

The diesel generator signal is connected to digital input 3 at the rear of the unit. Refer to the label on top of the unit for the pin assignments. An open circuit indicates the diesel generator is on. The MCM monitors this input when `Diesel Monitoring` is set to `Enabled` (under the `General Configuration` menu).

3.8.18 User Alarm 1

This is a configurable alarm. Refer to section 0 below for the meaning of this alarm.

NOTE: *If the alarm string has been redefined using the IRC, then the alarm shown will be the string defined by the user.*

3.8.19 User Alarm 2

This is a configurable alarm. Refer to section 3.21 below for the meaning of this alarm. Refer to previous note regarding changes to message.

3.8.20 Warning: Volts High

The system voltage exceeds the high volts warning threshold.

The alarm will clear when the system voltage drops below the high volts warning threshold (with the hysteresis specified in the `DC Voltage Monitoring` menu).

3.8.21 Warning: Volts Low

The system voltage is below the low volts warning threshold.

The alarm will clear when the system voltage exceeds the low volts warning threshold (with the hysteresis specified in the `DC Voltage Monitoring` menu).

3.9 Operating IRC Rectifiers and Other Slave Devices

The monitoring and control module uses Intelligent Remote Control (IRC) communications protocol to communicate with slave devices such as rectifier modules. Each slave is assigned an address during commissioning of the system. When slave alarms such as rectifier alarms arise, the monitoring and control module displays the addresses of the slaves originating the alarms.

NOTE: *The serial cable from the rectifiers must be connected to the DB9 connector labeled Rectifiers/Slaves at the rear of the monitoring and control module to allow communication with slave devices.*

Slaves are numbered consecutively, starting with 1. If a slave device stops communicating with the monitoring and control module, the “Slave Lost” alarm will be raised, and the address of the lost slave is displayed. Slave devices store their address data, and can resume communications after a network or power interruption. However, if the rectifier is unlocked from its shelf, its address is lost. When the slave is restored or replaced, it will then need to have an address assigned by the monitoring and control module.

Different procedures exist for different combinations of firmware:

Combination 1: Rectifiers and MCM are on versions earlier than version 3.

Combination 2: Rectifiers are pre-version 3 status but MCM is version 3 or higher.

Combination 3: Rectifiers are version 3 or higher but MCM is pre-version 3.

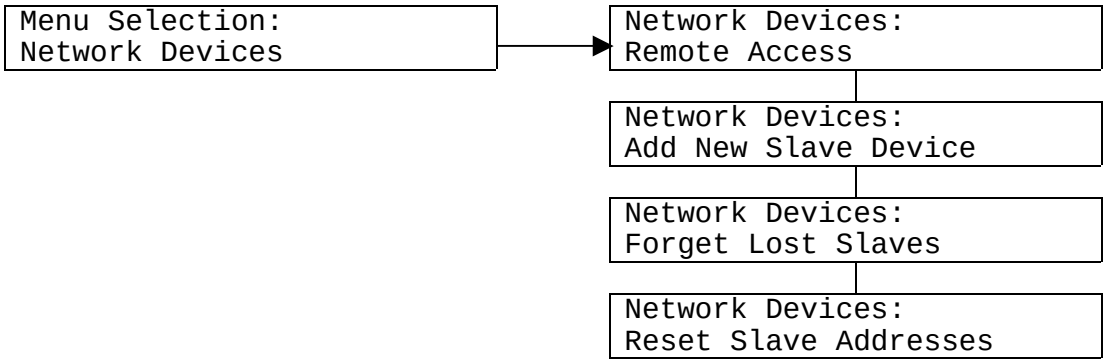
Combination 4: Rectifiers and MCM are version 3 or higher.

Combination 5: AZ475 rectifier and MCM with version 3.2 or higher.

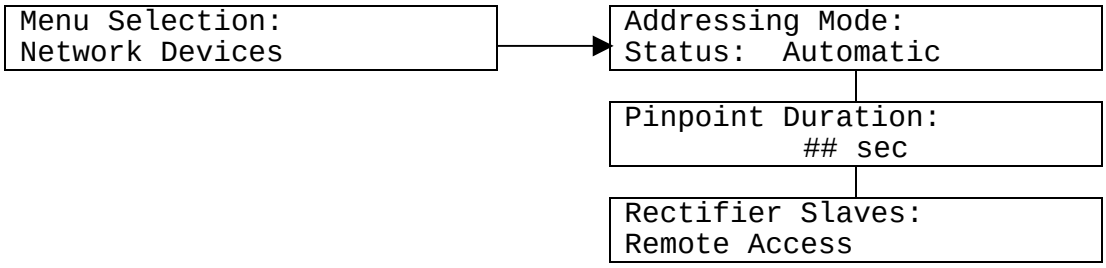
Three procedures shown under the `Network Devices` menu are available for working with the assignment of addresses to slaves (“Remote Access” is a future feature). These are typically used during commissioning or when replacing rectifiers.

Security level 2 must be entered before any operations on the `Network Devices` menus can be performed. See section 3.2.5 above for more information on setting the password.

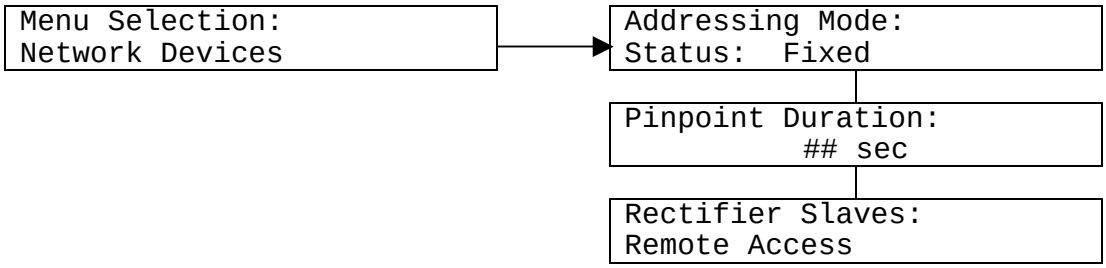
For combinations 1 & 3:



For combinations 2 & 4:



For combination 5:



3.9.1 Adding a New Slave Device

This procedure is used to:

- Add one or more extra slave devices, for example when increasing the capacity of a system by adding rectifiers
- Replace a slave device which has been removed for maintenance
- Commission a new system.

If replacing a rectifier, or setting up a rectifier that has been unlocked from the rack, use the Forget Lost Slaves procedure first so that the monitoring and control module assigns the addresses so as to fill in the blanks. Otherwise, the monitoring and control module will continue to assign consecutive numbers starting after the highest address in the system, and will also continue to show Lost Slave alarms.

The procedure is described below first for medium capacity rectifiers and then for 200A rectifiers.

To add one or more new slave devices - IRC rectifiers:

For combinations 1 & 3:

1. View the Add New Slave Device menu item

```
Network Devices:
Add New Slave Device
```

2. Press ENTER ↵.
The Add New Slave Device screen appears.

```
Add New Slave Device
Press ENTER to Start
```

3. Press ENTER ↵.
A confirmation message appears.

```
Add New Slave Device
Press ENTER to Confirm
```

4. Press ENTER ↵.
A message regarding 200A rectifiers appears.
Disregard the message and press ENTER ↵.

```
Set slave addr. to 128
and then plug in to MCM
```

5. Press in and hold the Setup button of the new slave rectifier until the confirmation message appears.

```
Found AM425
Set to address 1
```

The model of the slave (e.g. AM414, AM425) and the newly assigned address will be shown.

Each transaction between the monitoring and control module and a slave will take a few seconds.

6. Repeat step 5 for each new slave.

If all new slaves have been found, press ESC to skip further searching by the monitoring and control module.

7. An EEPROM message will be displayed.

```
Store Config to EEPROM?
 ENTER = Yes EXIT = No
```

8. Choose whether to store the change to non-volatile memory.

```
Add New Slave Device
Press ENTER to Start
```

Press ENTER ↵ to store, or press ESC to exit.
(If enter is chosen, the MCM will take a few seconds to store the change).

For combination 2:

This is a semi automatic procedure between the AZ328 and the rectifier. To add a new slave, simply insert the rectifier into the shelf and turn on the relevant AC circuit breaker. The rectifier will start up.

Press in and hold the setup button and the AZ328 will respond with the following message:

```
Found AM###
Set to address ##
```

If replacing a rectifier, or setting up a rectifier which has been unlocked from the rack, use the Forget Lost Slaves procedure first otherwise, the monitoring and control module will continue to show Lost Slave alarms.

For combinations 4 & 5:

This is a fully automatic procedure between the AZ328 and the rectifier. To add a new slave, simply insert the rectifier into the shelf and turn on the relevant AC circuit breaker. The rectifier will start up and the AZ328 will respond with the following message:

```
Found AM475
Set to address ##
```

In the case of the AZ475, the address number will indicate the shelf position.

If replacing a rectifier, or setting up a rectifier which has been unlocked from the rack, use the Forget Lost Slaves procedure first otherwise, the monitoring and control module will continue to show Lost Slave alarms.

To add one or more new slave devices - 200A rectifier:

1. View the Add New Slave Device menu item

```
Network Devices:
Add New Slave Device
```

2. Press ENTER ↵.
The Add New Slave Device screen appears.

```
Add New Slave Device
Press ENTER to Start
```

3. Press ENTER ↵.
A confirmation message appears.

```
Add New Slave Device
Press ENTER to Confirm
```

4. Press ENTER ↵.
Check that the Slave Address at each new rectifier is 128 and modify if required.
Refer to the 200A rectifier manual for details of this operation.
Then connect the "communications" port of each 200A rectifier to the serial cable.

```
Set slave addr. to 128
and then plug in to MCM
```

5. Wait for the confirmation message.

```
Found AM217
Set to address 1
```

The model of the slave (e.g. AM217) and the newly assigned address will be shown.
As each new slave is connected, a further confirmation message will appear.

Each transaction between the monitoring and control module and a slave will take a few seconds.

If all new slaves have been found, press ESC to skip further searching by the monitoring and control module.

6. An EEPROM message will be displayed.

```
Store Config to EEPROM?
 ENTER = Yes EXIT = No
```

7. Choose whether to store the change to non-volatile memory.

```
Add New Slave Device
Press ENTER to Start
```

Press ENTER ↵ to store, or press ESC to exit.
(If enter is chosen, the MCM will take a few seconds to store the change).

NOTE: *The monitoring and control module may time out while waiting for new slaves to communicate. If this occurs, save the configuration to the EEPROM and then begin the procedure once more, starting from the next rectifier that is to be connected.*

3.9.2 Forgetting Lost Slaves

This procedure is used when individual slaves have been unlocked from the shelf, replaced or removed for maintenance. The procedure will turn off all active Lost Slave alarms. When the Add New Slave Device procedure is next used, the monitoring and control module assigns addresses so as to fill in the blanks, rather than continuing to assign consecutive numbers starting after the highest address in the system.

For combinations 1 and 3:

Use the Forget Lost Slaves menu item to start this procedure.

For combinations 3, 4 and 5:

Upon removal of the slave the AZ328 will respond with the message:

```
Rectifier(s) removed?
ENTER=Yes EXIT=No
```

And will alternate the display with the Slave lost alarm message.

```
1 SLAVE LOST
2.
```

Press the Yes (Enter) button to acknowledge the removal of the rectifier. The AZ328 will display the following message.

```
Removed Slaves
forgotten
```

3.9.3 Reset Slave Addresses

This procedure is used to commission a new system, or to reset an entire existing system.

This procedure is only required on Combinations 1 and 3. For combinations 2, 4 and 5 respond with a Yes to the Forget lost slaves prompt. This will clear all lost slaves and reset slave addresses.

To reset slave addresses:

1. View the Reset Slave Addresses menu item.

```
Network Devices:
Reset Slave Addresses
```

2. Press ENTER ↵.
The Reset Slave Addresses screen appears.

```
Reset Slave Addresses
Press ENTER to Start
```

3. Press ENTER ↵.
A confirmation message appears.

```
Reset Slave Addresses
Press ENTER to Confirm
```

4. Press ENTER ↵.
A message regarding 200A rectifiers appears.

```
Unplug all slaves
and then press ENTER
```

For medium capacity rectifiers, disregard the message. The slave rectifiers are now in "No Setup" mode. For 200A rectifiers, disconnect the D9 connector from the port marked "communications" at each rectifier in the system.

5. Press ENTER ↵.
No network addresses are assigned.
A message regarding 200A rectifiers appears.

```
Please plug slaves in
one at a time
```

6. For medium capacity rectifiers, press in and hold the Setup button of the first rectifier in the system until the confirmation message appears. For 200A rectifiers, connect the serial cable to the "communications" port of the first rectifier in the system. The model of the slave (e.g. AM414, AM425, AM217) and the newly assigned address will be shown.

```
Found AM425
Set address to 1
```

Each transaction between the monitoring and control module and a slave will take a few seconds.

7. Repeat step 6 for each new slave, in order.

If all new slaves have been found, press ESC to skip further searching by the monitoring and control module.

8. An EEPROM message will be displayed.

```
Store Config to EEPROM?
 ENTER = Yes EXIT = No
```

9. Choose whether to store the change to non-volatile memory.

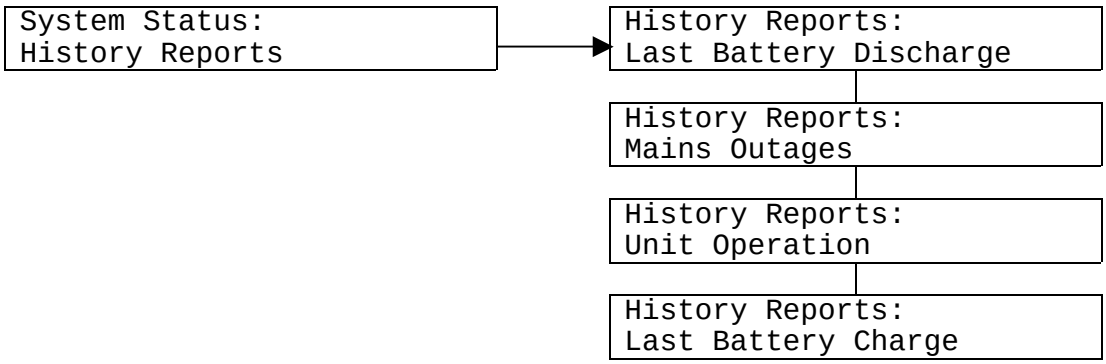
```
Add New Slave Device
Press ENTER to Start
```

Press ENTER ↵ to store, or press ESC to exit.
(If enter is chosen, the MCM will take a few seconds to store the change).

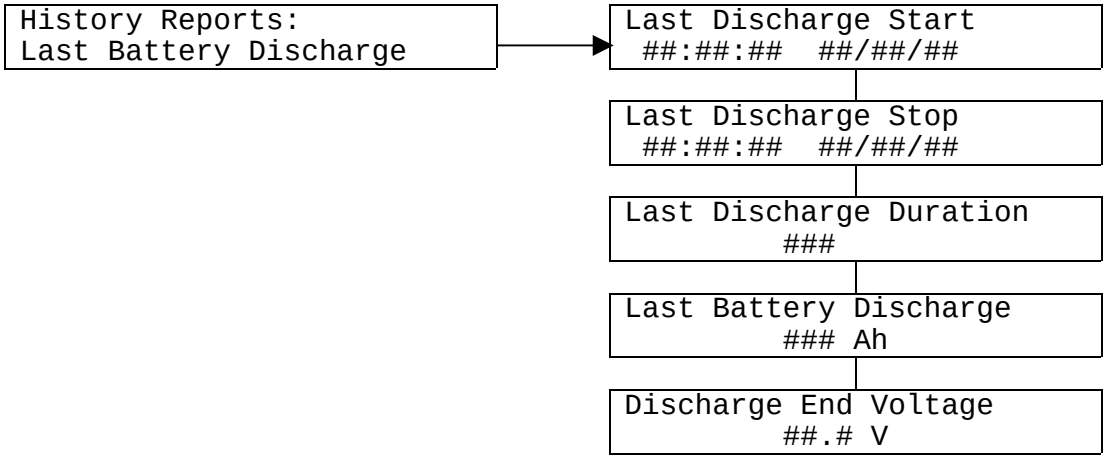
3.10 Using 'History Reports' to Monitor Battery Performance and Mains Reliability

The monitoring and control module keeps various statistics about system operation. These may assist in faultfinding and monitoring battery condition.

The information is shown as a series of screens under the `History Reports` menu (accessible from the `System Status` menu). Information is provided on battery discharges and charges, mains outages and the operation of the monitoring and control module.

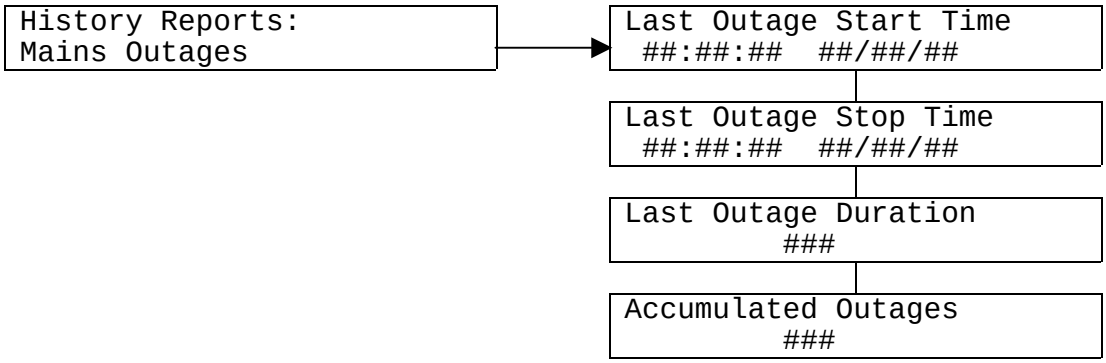


For systems where a battery current measurement is installed (refer to the `System Setup: Analogue Inputs` menu item `Battery Current`), information is provided on the last battery discharge. The starting and ending times of the discharge, the duration of the discharge, and the size of the discharge in ampere-hours are shown. The system voltage just before the end of the discharge is also shown.



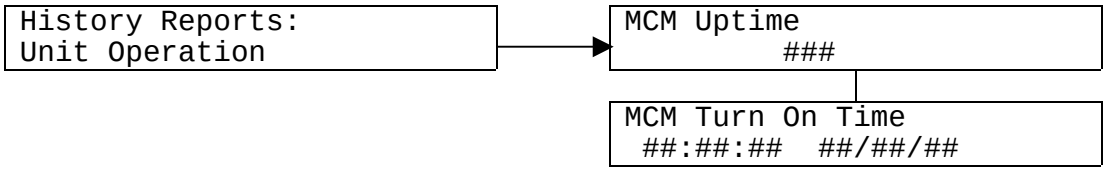
The duration is shown in minutes, hours or days. If there has been no battery discharge since the system was last turned on, these screens show "N/A". The relative error in the discharge measurement is 2.5%.

Mains outage information is provided for systems where mains monitoring is installed (under the `General Configuration` menu, `AC mains monitoring` is set to `Enabled`).

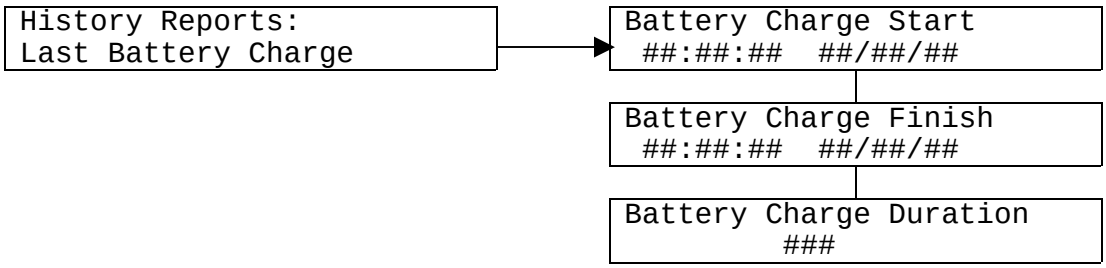


The duration and accumulated total are shown in seconds, minutes, hours or days. If there have been no mains outages since the system was last turned on, the screens will show "N/A".

The uptime in hours and the turn on time of the monitoring and control module are recorded:



For systems where battery charging is used, either on-line or off-line, information about the last battery charge is provided.



The duration is shown in minutes, hours or days. If there have been no battery charge cycles since the system was last turned on, the screens will show "N/A".

3.11 Using Alarm History to Investigate Problems

A history of the last 300 alarms is kept by the MCM for use in fault diagnosis. To read the list view the `System Status: Alarm History List` screen in the `System Status` menu and press ENTER ↵. The list of alarms can then be scrolled through using the up or down button. Each alarm is shown with the time at which it became active. To view the time at which the alarm became inactive, press ENTER ↵ while viewing the alarm.

The last 30 alarms can be viewed from the AZ328 Front Panel. To view all 300 alarms require the use of the IRC software, where it can be viewed and saved on a PC.

3.12 Remote Monitoring and Control

Sixteen output relays with voltage free contacts may be used to signal the alarm states of the MCM to a remote site. These digital outputs are connected at the rear of the monitoring and control module. A label on the top of the unit shows the assignment of each relay.

Monitoring and control of the system from a remote PC is possible using the optional Intelligent Remote Control (IRC) software. Refer to the IRC manual for details.

The serial communication line to a remote monitoring and control PC using IRC is connected to the DB9 port labeled RS232 at the rear of the MCM.

3.13 Using Active Load Sharing

Active load sharing is a completely automatic function of the MCM. The MCM uses the Intelligent Remote Control (IRC) communications protocol to force load sharing among the rectifiers to within 2 A.

Active load sharing is activated when `Active Load Sharing` is set to `Enabled` under the `General Configuration` menu.

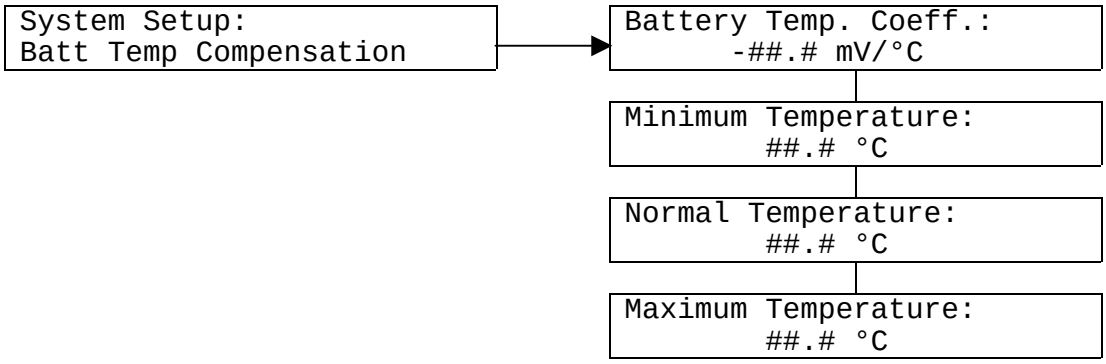
3.14 Using Battery Temperature Compensation

Battery temperature compensation is an automatic function of the MCM. The output voltage of the rectifiers is varied according to the temperature of the battery.

Battery temperature compensation is designed to extend battery life and is applied when `Batt Temp Compensation` is set to `Enabled` (under the `General Configuration` menu). Battery temperature is monitored by a probe located close to the battery, which is connected to the terminal marked Temp Probe at the rear of the unit. The sensor can measure temperature over the range of -5°C to 55°C and the MCM will read -5°C if the temperature sensor is disconnected. Battery temperature is measured with an accuracy of ± 0.8 °C.

The compensation parameters are shown in the `Batt Temp Compensation` menu. The parameters and the mechanism for compensation differ between systems using IRC rectifiers and systems using non-IRC rectifiers.

3.14.1 IRC Rectifier Systems



The correction to the system output voltage is $(T_b - T_n) \times k$ mV, where T_b is the battery temperature, T_n is the normal temperature and *k* is the battery temperature coefficient (in mV/°C). This correction is applied for measured temperatures between the minimum and maximum temperatures. Outside this range the compensation levels off. The voltage correction is communicated to the rectifiers over the network.

Figure 3-6 illustrates battery temperature compensation.

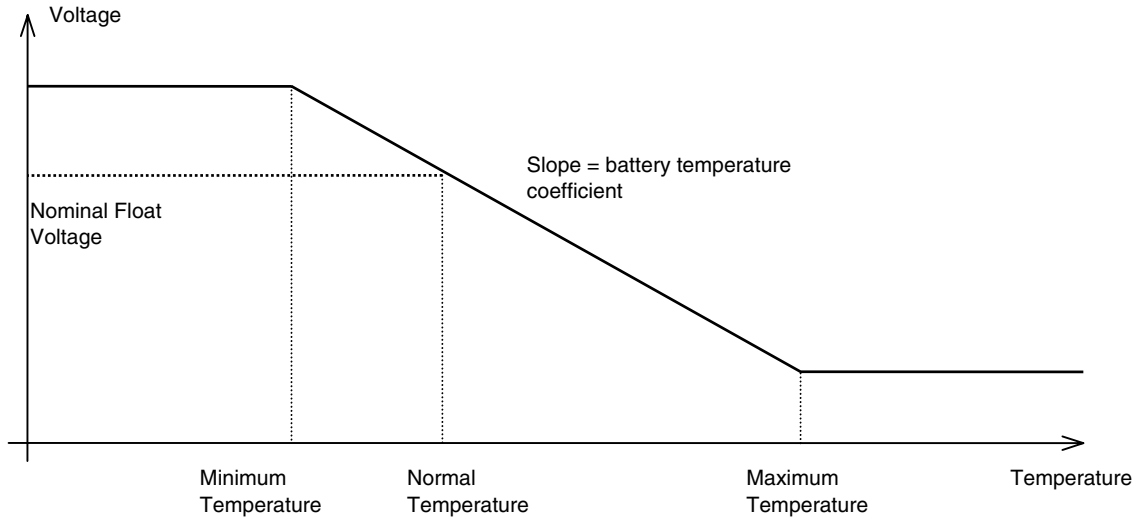
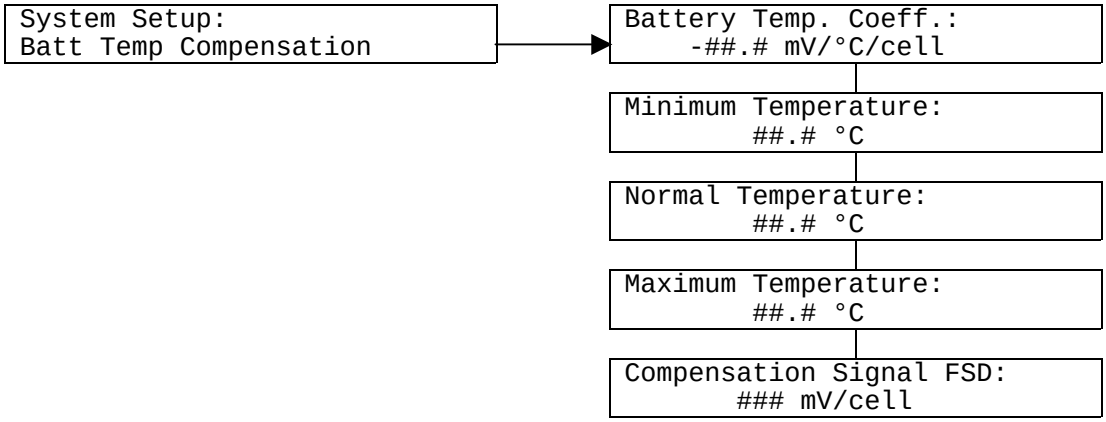


Figure 3-6 Battery Temperature Compensation

3.14.2 Non-IRC Rectifier Systems

Non-IRC rectifier systems introduce the concept of the number of cells in the battery string.



In this case the correction to the system output voltage is $(T_b - T_n) \times k \times n$ mV, where T_b is the battery temperature, T_n is the normal temperature, *k* is the battery temperature coefficient (in mV/°C/cell) and *n* is the number of cells. This correction is applied for measured temperatures between the minimum and maximum temperatures. Outside this range the compensation levels.

A 24 cell battery string is assumed for this calculation, irrespective of the "Number of cells" parameter found in the manufacturer's 200A rectifiers used in large capacity systems.

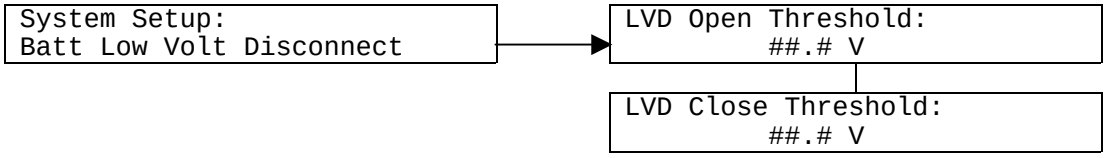
In parallel systems, the MCM does not control rectifier output voltage absolutely, but by an offset. The maximum size of this offset is given by the `Compensation Signal` FSD parameter, which must be set according to the rectifier model. Refer to the system specification document in the system manual.

The offset is communicated to non-IRC rectifiers by a PWM signal on the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), switches SW1 and SW2 must be set to ON at each CMI in order to relay the PWM signal to each rectifier.

3.15 Using the Battery Disconnection Contactor

The following applies to systems with battery disconnection contactor installed only.

The battery disconnection contactor may be set up to operate automatically in the event of very low system voltage (under the `General Configuration` menu, `Batt Low Volt Disconnect` is set to `Automatic`). In this case the MCM will open the contactor when the system voltage drops below the `LVD Open Threshold`, and will close it when the system voltage exceeds the `LVD Close Threshold`. (These parameters are under the `System Setup: Batt Low Volt Disconnect` menu).



This is an automatic operation intended to save the battery from excessive discharge during extended mains failure.

The contactor may also be operated manually, via the `Batt Low Volt Disconnect` screen under the `System Setup: General Configuration` menu.

Opening the contactor removes the battery backup from the system.

Open or close the contactor by setting the parameter to `Open` or `Closed`.
Various conditions prevent the contactor from opening:

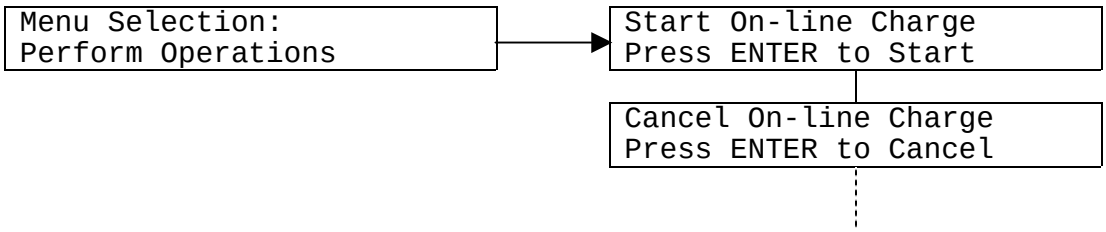
- The off-line charging battery switch is open,
- A battery test is in progress,
- A battery test just completed less than 20 seconds ago.

Refer to the technical details in section 3.8.10 for information on the control signals for the contactor.

3.16 Charging Batteries On-line

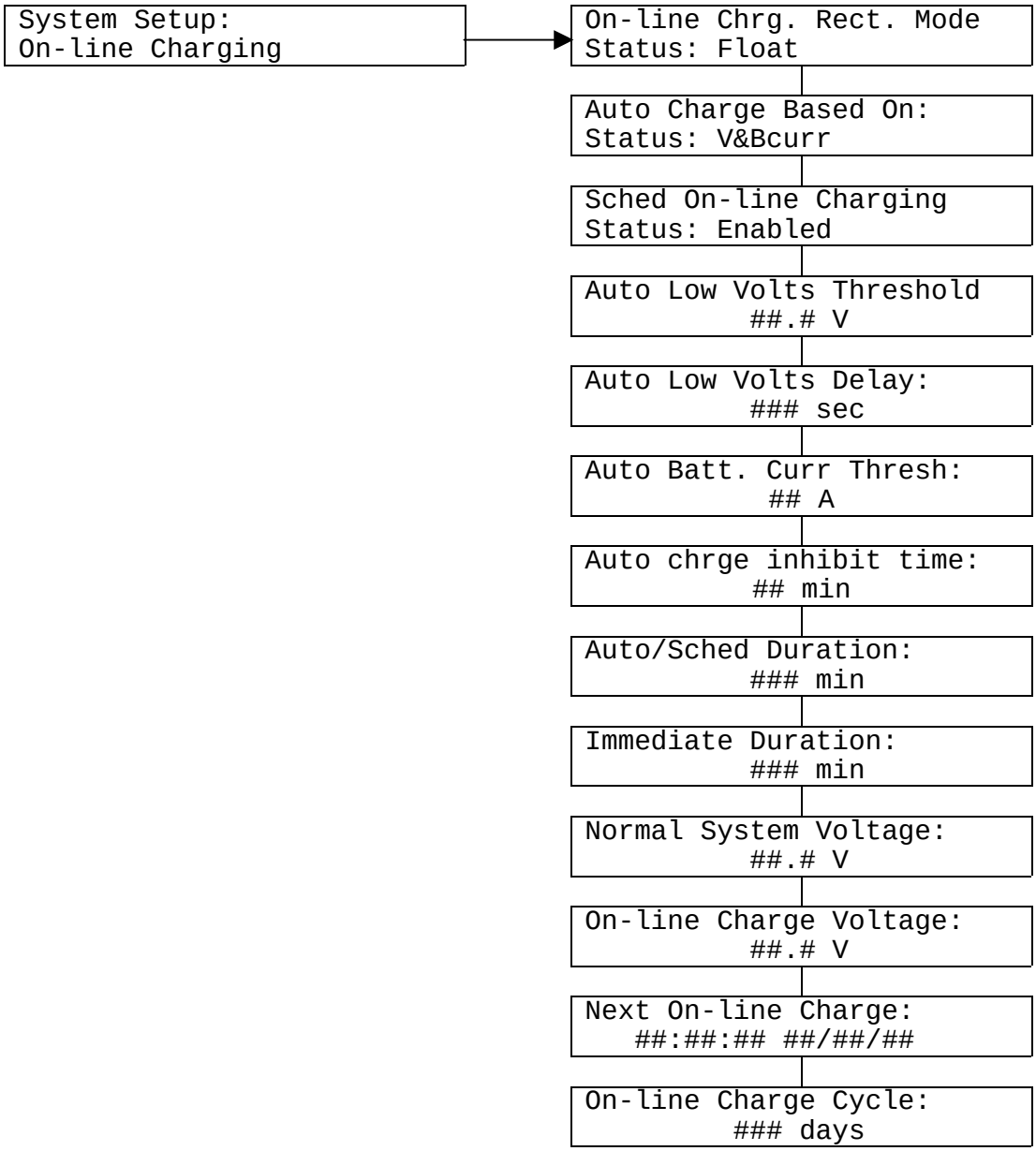
On-line battery charging (i.e. charging of the batteries while they are connected to the load) may be set up as an automatic function that occurs after a battery discharge is detected or periodically. The output voltage of the rectifiers is elevated for a set duration by the MCM.

Battery charging may also be initiated manually, in two ways: either by pressing the “start on-line charge” switch (where installed), or via the `Start On-line Charge` screen in the `Perform Operations` menu. The `Cancel On-line Charge` screen allows a battery charge to be interrupted.



The screens in the `System Status: On-line Charging` menu give information about the duration of the charge and the elevated system voltage. The screens differ slightly between systems using IRC rectifiers and systems using parallel rectifiers.

3.16.1 IRC Rectifier Systems



The duration of the battery charge started manually is given by the Immediate Duration screen. The system voltage will rise from the Normal System Voltage to the On-line System Voltage during the charge cycle.

Five different mechanisms can trigger an automatic charge:

1. Voltage. If the discharge voltage falls below the Auto low Volts Thresh value for more than Auto Low Volts Delay time, an On-line charge is triggered.
2. Discharge current. If the discharge current is larger than the Auto DisChrg curr Tre an On-line charge is triggered. The On-line charge will be inhibited for the time specified in Auto chrg. Inhibit time.
3. Battery current.
4. Voltage and Discharge current.
5. Voltage and Battery current.

Various conditions prevent a charge cycle from starting:

- An AC ABNORMAL or SYSTEM ON DIESEL alarm is active;
- The battery disconnection contactor or battery switch is open;
- A battery charge cycle is already in progress;
- A battery test is in progress.

3.16.2 Non-IRC Rectifier Systems

The monitoring and control module cannot directly control the output voltage of non-IRC rectifiers. Instead, the charge voltage is given (nominally) by multiplying the On-line System Voltage by the number of cells per battery string. The actual charge voltage may differ depending on the float voltage settings of the rectifiers.

```
On-line Chrg. Rect. Mode
Status: Float
```

```
Nominal Charge Voltage:
       ##.# mV/cell
```

i

The “start on-line charge switch” is connected to digital input 6 at the rear of the unit. Refer to the label on top of the unit for the pin assignments. The input is short circuit active.

The Next On-line Charge and On-line Charge Cycle parameters are used for scheduled on-line charging. The duration of a charge started by schedule or automatically is the Auto/Sched Duration.

If automatic on-line charging is enabled, a charge cycle will be performed after a battery discharge is sensed. The MCM detects a battery discharge when the system voltage falls below the Auto Low Volts Threshold for at least the time specified in Auto Low Volts Delay. The charge cycle will start after the voltage rises above the threshold once more. Alternatively, for systems with battery shunt or CT installed, a battery discharge is defined as battery current being less than -2.5 % of FSD for more than 30 seconds.

There are three modes that the monitoring and control module can use to control the on-line charging voltage of the rectifiers. One of these applies to IRC rectifiers, and the other two apply to non-IRC rectifiers.

IRC Rectifier Systems

In IRC rectifier systems, On-line Charging Mechanism is set to Float. The monitoring and control module communicates the change in output voltage to the rectifiers via the network.

Non-IRC Rectifier Systems

The monitoring and control module can use either of two modes to increase the output voltage of the rectifiers:

i. by PWM signal
ii. Boost.

The latter mode can be useful for systems in which the battery requires quite a large increase in voltage.

If On-line Charging Mechanism is set to by PWM signal, the monitoring and control module makes use of the parameters Normal System Voltage and On-line Charge Voltage. The MCM does not control the normal system voltage of systems using non-IRC rectifiers, so the Normal System Voltage parameter should be set to the float voltage of the rectifiers in the system (in mV/cell). During a charge cycle, the MCM instructs the rectifiers to raise their output by *(On-line Charge Voltage – Normal System Voltage) * (number of cells per battery string)*. The maximum size of this offset is given by the Compensation Signal FSD parameter, which must be set according to the rectifier model. Refer to the system specification document in the system manual.

The offset is communicated to non-IRC rectifiers by a PWM signal on the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), switches SW1 and SW2 must be set to ON at each CMI in order to relay the PWM signal to each rectifier.

If On-line Charging Mechanism is set to by boost signal, the MCM puts the rectifiers into boost mode, and the charge voltage is defined by the boost voltage set at the rectifiers. In this mode, the Nominal Charge Voltage and Nominal Float Voltage parameters will have no effect. The boost signal is carried to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), switch SW4 must be set to ON at each CMI in order to relay the boost signal to each rectifier.

3.17 Using Battery Current Limiting

For systems with Battery Current Limiting enabled only (under the General Configuration menu, Battery Curr. Limiting is set to Enabled).

Battery Current Limiting is used to protect the system battery from excessive charge currents after the system recovers from a prolonged power outage.

Battery current limiting is a completely automatic function of the MCM. The MCM monitors battery current and adjusts the output current limit of the rectifiers so that the battery current remains below the set limit. Battery current limiting can only be used with IRC rectifiers.

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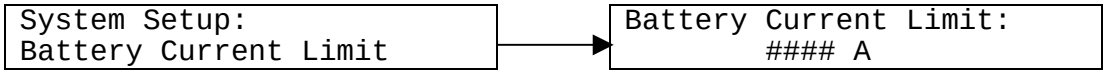
The MCM calculates current limits and sends the information to the rectifiers over the network.

The relevant parameters are shown in the System Setup: Battery Current Limit menu. When battery current exceeds the limit, the MCM reduces each rectifier's output current limit so that battery current is reduced. The monitoring and control module continues to control the current limit of each rectifier so that battery current does not exceed the specified limit.

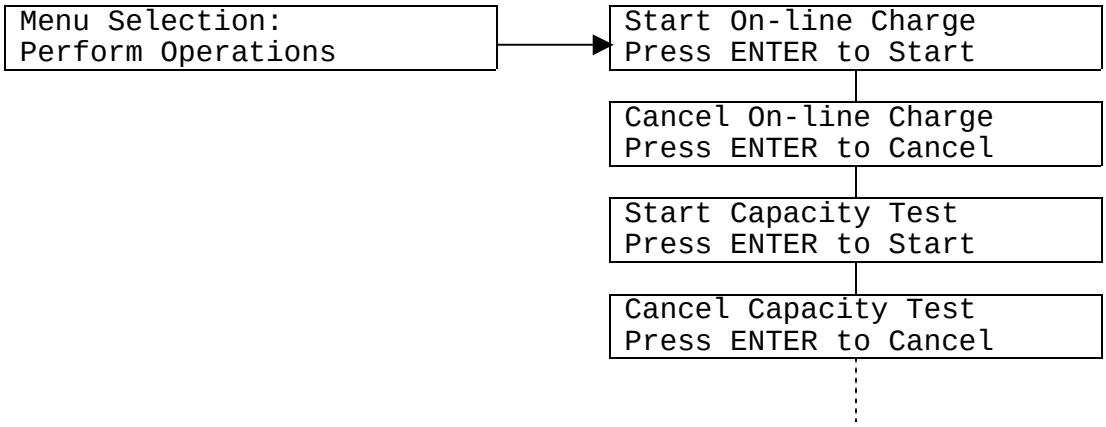


3.18 Testing Battery Capacity

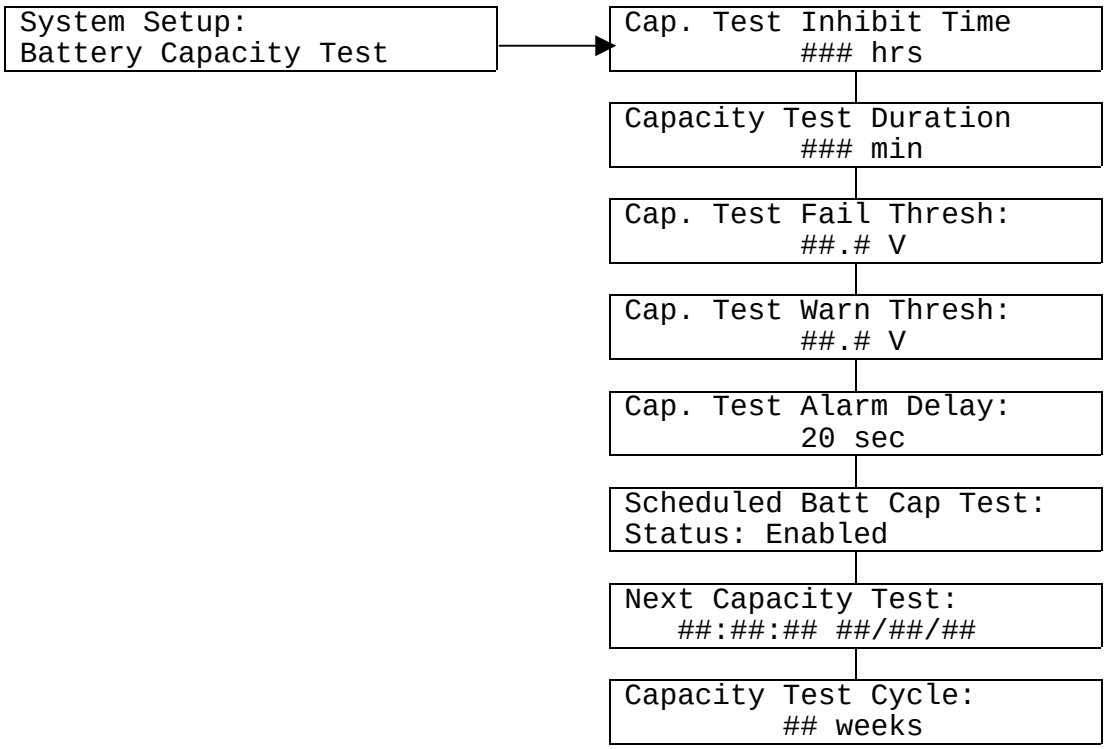
Battery capacity is tested by disabling the rectifiers for a set period. The system voltage is measured while the battery discharges into the load.

The test may be set up to occur regularly (under Battery Capacity Test menu, Scheduled Batt Cap Test is set to Enabled) or a test may be started by the operator.

To start a test, use the Start Capacity Test screen in the Perform Operations menu. The Cancel Capacity Test screen allows a battery test to be interrupted.



The MCM will then disable the rectifiers and test the battery in accordance with the parameters listed in the System Setup: Battery Capacity Test menu.



The battery will discharge into the load for the specified duration. If the system voltage remains above the Cap. Test Warn Threshold for the duration of the test, a pass message will be displayed at the start screen. If the system voltage drops below the warning threshold but remains above the Cap. Test Fail Threshold, a warning message will be displayed at the start screen. If the system voltage drops below the fail threshold, the test will terminate immediately and a fail message will be displayed at the start screen.

All three alarms are latching and will remain in the active alarm list until cleared by the operator (view the alarm screen and exit).

In addition to the alarm state at the end of the test, information about battery capacity can be gained by looking up the Last Battery Discharge statistics in the History Reports menu.

Various conditions prevent a test from starting:

- Any one of the following alarms is active: BCT FAIL, BCT WARNING, LOW VOLTS, AC ABNORMAL, SYSTEM ON DIESEL;
- The battery disconnection contactor or battery switch is open;
- A battery charge cycle is in progress;
- A battery test is already in progress;
- The battery capacity inhibit time has not expired.

The Cap. Test Inhibit Time is the minimum allowed time between battery capacity tests. The status of this timer may be viewed under the System Status menu.

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To carry out battery capacity testing, the MCM sends the disable signal to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), SW3 must be set to ON in order to relay the disable signal to the rectifiers. IRC rectifiers receive the disable signal via the network.

3.19 Charging Batteries Off-line

For systems where off-line battery charging switchgear is installed.

The off-line charging switchgear allows off-line charging of up to two battery strings.

There are two switches, one for the rectifiers and one for the batteries. The battery switch has three positions, one for the normal float condition, one for off-line charging of battery string 1, and one for off-line charging battery string 2. In systems with only one battery string, the “Battery 2” position is not connected.

Some subsets of the rectifiers in the system have been designated for off-line charging.

To start off-line charging a battery string:

1. Switch the rectifier switch over to the “Boost” position.
2. Switch the battery switch over to the “Battery 1” or “Battery 2” position.
3. Check the boost voltage at the monitoring and control module.

Do not leave the battery charging for longer than the specified time.

Under various conditions the MCM prevents the rectifiers from going into boost mode:

- Either the AC ABNORMAL or SYSTEM ON DIESEL alarm is active;
- The battery disconnection contactor is open;
- A battery charge cycle is in progress.

To return the battery to float condition, return the battery switch to the “Float” position and the rectifier switch to its “Float” position. Check that all rectifier output currents are within 15% of their average.

Two digital inputs are used by the MCM to monitor the state of the off-line charging switches. An open circuit at digital input 4 indicates the battery is off-line. An open circuit at digital input 5 indicates the rectifiers are off-line. The MCM monitors these inputs when `Off-line Battery Charge` is set to `Enabled`. When both inputs are open circuit, the MCM will signal the rectifiers to go into boost mode. The digital inputs are located at the bare wire terminals at the rear of the unit. Refer to the label on top of the unit for the pin assignments.

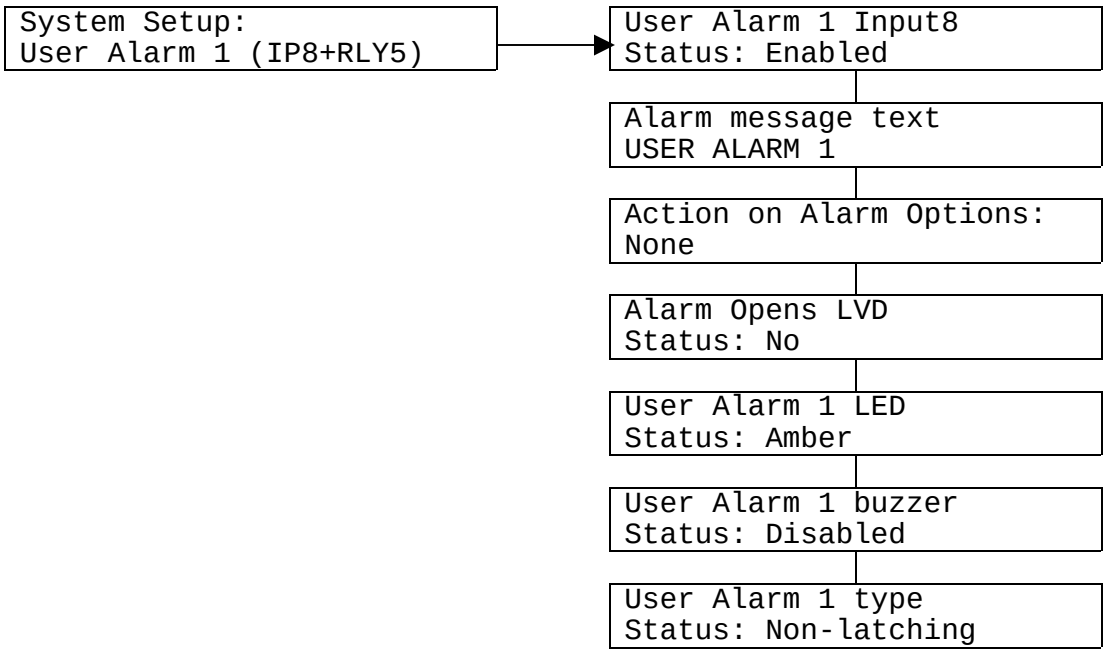
The boost signal is carried to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), switch SW4 must be set to ON at each CMI in order to relay the boost signal to each rectifier. IRC rectifiers receive the boost instruction via the network.

3.20 User Alarm 1

For systems using user alarm 1 (under the `System Setup: User Alarm 1` menu, `Status` is set to one of `Summary`, `Short ckt -> Act` or `Open ckt -> Act`).

Digital input 8 can be used to activate User Alarm 1. The settings for this alarm can be viewed under the `System Setup: User Alarm 1` menu.

If `User Alarm 1 Input8` is set to `Summary`, the alarm becomes a summary of the alarm status of the monitoring and control module, activating whenever any other alarm is active, with the exception of Battery Test Warning and Battery Test Pass.



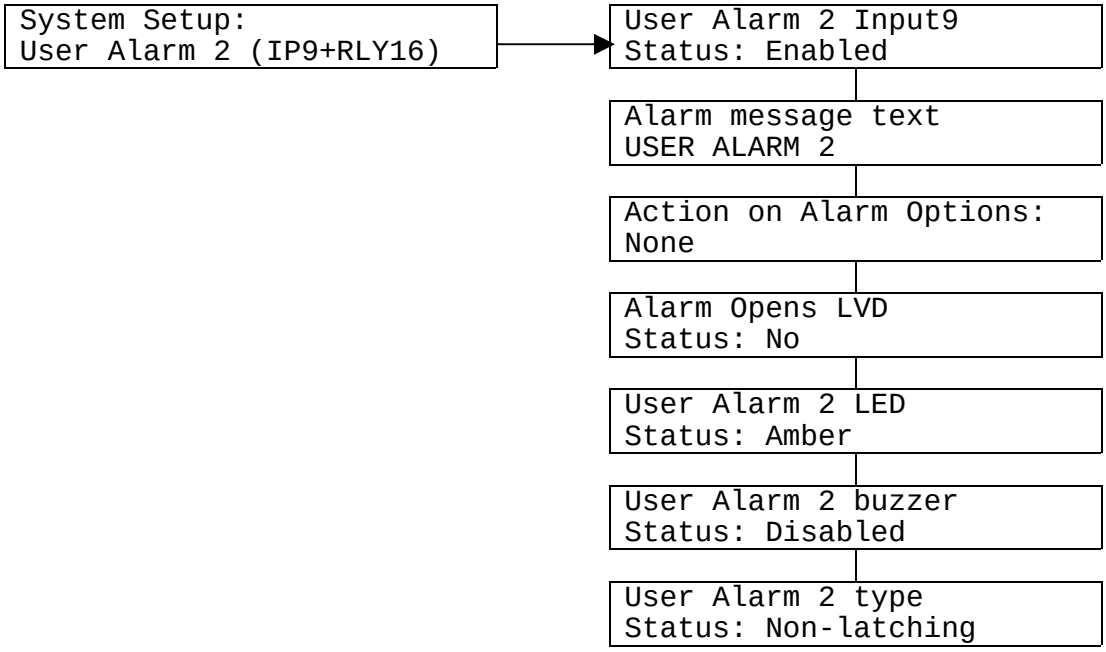
If `Alarm disables rectifiers` is set to `yes`, the MCM sends the disable signal to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), SW3 must be set to ON in order to relay the disable signal to the rectifiers. IRC rectifiers receive the disable instruction via the network.

Description and action for User Alarm 1:

3.21 User Alarm 2

For systems using user alarm 2 (under the System Setup: User Alarm 2 menu, Status is set to one of Summary, Short ckt -> Act or Open ckt -> Act).

Digital input 9 is used for User Alarm 2. The settings for this alarm can be viewed under the System Setup: User Alarm 2 menu. For a description of the Summary alarm, refer to User Alarm 1 above.



If Alarm disables rectifiers is set to yes, the MCM sends the disable signal to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), SW3 must be set to ON in order to relay the disable signal to the rectifiers. IRC rectifiers receive the disable instruction via the network.

Description and action for User Alarm 2:

3.22 Resetting the Monitoring and Control Module

If the MCM fails to respond for an extended period of time, the microprocessor can be reset by pressing all three pushbuttons (alternate voltage, alternate current and password) simultaneously.

When saving parameter information to the non-volatile memory, the user interface may fail to respond to input. This can take up to 15 seconds.

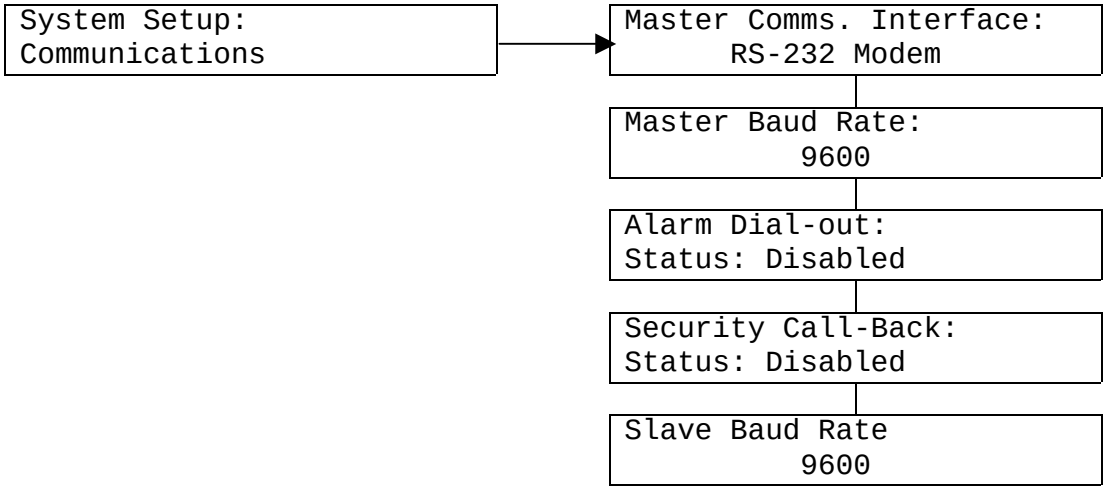
3.23 Communicating with the Monitoring and Control Module using Remote Management Software

The monitoring and control module can be used with data management software available from the manufacturer to provide remote monitoring and control from a PC. Refer to the documentation included with the IRC software package. The following sections describe alternative configurations for using the monitoring and control module with IRC, and lists the data that can be obtained from slave devices.

3.23.1 Communicating between the PC and the Monitoring and Control Module

The monitoring and control module can be connected to the PC over the telephone lines or by direct connection. To communicate over the telephone lines, `Master Comms. Interface` is set to `RS-232 Modem` in the `System Setup - Communications` menu. The master baud rate should be set to 9600, as the monitoring and control module does not currently support higher rates (the RS-232 port is located at the rear of the unit).

To communicate directly to a PC, use `RS-232 Null Modem`, or `RS-232 Modem`. The `IrDA` and `RS-485` options are not currently supported.



3.23.2 Dialing in to the Monitoring and Control Module

Using IRC, the monitoring and control module can be dialed from the PC. Refer to the IRC manual. The IRC software can be used to set the monitoring and control module into Alarm Dial Out mode or Security Call Back mode.

3.23.3 Alarm Dial Out

If the monitoring and control module is communicating with the PC via modem, the alarm dial out feature can be used. This feature allows the monitoring and control module to alert the IRC software when alarms occur.

The IRC software is used to program the monitoring and control module with a primary and secondary telephone number. The monitoring and control module will then dial the primary number in the event of an alarm. If no link is established, the number will be tried up to three more times, and then the second number will be tried. If this number also fails, a Dial Out Unsuccessful alarm will be raised at the monitoring and control module.

When communication is established, the monitoring and control module will remain connected until the operator of the IRC software terminates the connection. If the MCM is not connected when an alarm clears, or if another alarm occurs, then the MCM will again attempt to dial out.

If `Alarm Dial-out` is set to `enabled`, the dial out numbers must be entered using the IRC software. It cannot be entered or changed from the MCM.

3.23.4 Security Call Back

If the monitoring and control module is communicating with the PC via modem, the security call back feature can be used. This feature is used to prevent unauthorized persons calling up the monitoring and control module and attempting to execute commands.

In this mode the monitoring and control module will not answer the ring signal, but, after a short delay, will dial back to the remote PC using a Call Back telephone number, programmed into the monitoring and control module using the IRC software.

If `Security Call back` is set to `enabled`, the call back number must be entered using the IRC software. It cannot be entered or changed from the MCM.

3.23.5 Communicating with IRC rectifiers or other Slave Devices via the Monitoring and Control Module

When the monitoring and control module is using the Intelligent Remote Control (IRC) communications protocol to communicate with slave devices such as rectifier modules, the following control operations are available from the remote PC running the IRC software:

- Enter disable mode
- Enter float mode
- Enter shutdown mode
- Change advanced parameters.

Changing advanced parameters is available in selected rectifiers. Refer to the rectifier manual for further details.

The remote PC running IRC can obtain the following information from individual rectifier modules via the monitoring and control module:

- Output current
- Float current limit
- Output voltage
- Current rectifier alarms
- Firmware revision number
- Serial number
- Rectifier model number
- Heatsink/inlet temperature
- Fan current
- Advanced parameters.

Heatsink/inlet temperature, fan current and advanced parameters are available in selected rectifiers. Refer to the rectifier manual for further details.

4 Specification

4.1 Electrical Specification

Power input:	20 – 60VDC 1.0A max. Polarity independent.
Voltage Sense Inputs: **(TNV isolated)**	Three (3) inputs rated at 20-60VDC. Inputs individually isolated and polarity dependent.
Current Sense Inputs:	Four (4) non-isolated current inputs rated at +/- 10V for connection to DC current transducers. Optional interface for use with shunts.
Relay Outputs:	18 output relays with voltage free contacts, contact rating 1A at 30VDC/AC, maximum contact voltage is 60VDC (max) / 42VAC (peak) as a safety requirement for SELV circuits. Rating is SELV.
Digital Inputs:	9 user inputs to the AZ328 arranged as isolated pairs, for connection to relay contacts or auxiliary contacts on circuit breakers. Rating is TNV-1.
Clock:	Accurate to ± 12 minutes/year
Temperature Measurement:	-5°C to +55°C ± 0.8°C
Operating Temperature:	0°C to +50°C
Safety:	IEC950, EN60950 Amdts 1,2,3,4, AS3260:1993
EMC:	ETSI EN300386 V1.3.1, FCC Part15 class A, AS3548 (CISPR22) Class A, EN61000-4-2, 4-3, 4-4, 4-6
Approvals:	CE, C_tick

4.2 Mechanical Specification

Width:	Standard IEC 19” rack system
Height:	1 RU
Depth:	185mm
Mass:	3 kg

5 Tables of System Defaults

The following table lists default settings for monitoring and control module parameters. Turn to the section number referenced for further information on any parameter.

5.1 Setup Menu

Menu	Parameter	Allowable values	Default	Section
General Configuration				
	On-line Battery Charge	Enabled, Disabled	Enabled	3.16
	Off-line Battery Charge	Enabled, Disabled	Disabled	0
	Batt Temp Compensation	Enabled, Disabled	Disabled	3.14
	Battery Testing	Enabled, Disabled	Disabled	3.18
	Batt Low Volt Disconnect	Not Installed, Automatic, Open, Closed	Not Installed	3.15
	AC Mains Monitoring	Enabled, Disabled	Disabled	3.8.1
	Diesel Monitoring	Enabled, Disabled	Disabled	3.8.17
	MCM-Rectifier Interface	Serial, Parallel	Serial	3.6
	Battery Curr. Limiting	Enabled, Disabled	Disabled	3.17
	Active Load Sharing	Enabled, Disabled	Disabled	3.13
	Alarm Buzzer	Enabled, Disabled	Enabled	3.2.2
	Level 1 Password	0 – 999	20	3.2.6
	Level 2 Password	0 – 999	40	
	Display Contrast	0 – 128	128	3.2.7
	Display Backlight	On, Off	On	
	Menu Autohome	Enabled, Disabled	Enabled	
DC Voltage Monitoring				
	Action on High Volts	None, Disable rectifiers	None	3.8.14
	High Volts Threshold	15.0 – 70.0V	57.6V	
	High Volts Warn Thresh.	15.0 – 70.0V	55.2V	3.8.20
	Low Volts Warn Thresh.	15.0 – 70.0V	51.6V	3.8.21
	Low Volts Threshold	15.0 – 70.0V	46.8V	3.8.15
	Hysteresis	0.0 – 0.5V	0.3V	3.8.14

Menu	Parameter	Allowable values	Default	Section
On-line Charging				
	On-line Chrg. Rect. Mode	Float, Boost, by PWM	Float	3.16
	Auto On-line Charging	Enabled, Disabled	Disabled	
	Sched On-line Charging	Enabled, Disabled	Disabled	
	Auto Low Volts Thresh	15.0 – 70.0V	47.5V	
	Auto Low Volts Delay	10 – 300s	60s	
	Auto/Sched Duration	0 – 2000 minutes	120 minutes	
	Immediate Duration	0 – 20160 minutes	150 minutes	
	Normal System Voltage	15.0 – 70.0V	54.0V	
	On-line Charge Voltage	15.0 – 70.0V	56.4V	
	Next On-line Charge	00:00:00 1/1/1992 – 23:59:59 31/12/2091	-	
	On-line Charge Cycle	1 – 255 days	2 days	
Battery Current Limit				
	Battery Current Limit	0 – 7000A	500A	3.17
Batt Temp Compensation				
	Battery Temp. Coeff.	IRC rectifier system: -200 to 0mV/°C Non-IRC rectifier system: -8.0 to 0.0mV/°C/cell	-96mV/°C -4.4mV/°C/cell	3.14
	Minimum Temperature	0 – 50°C	15°C	
	Normal Temperature	0 – 50°C	20°C	
	Maximum Temperature	0 – 50°C	30°C	
	Compensation Signal FSD	80, 125, 250, 280mV/cell	125mV/cell	
Batt Low Volt Disconnect				
	LVD Open Threshold	15.0 – 70.0V	45.0V	3.15
	LVD Close Threshold	15.0 – 70.0V	51.0V	
Battery Capacity Test				
	Cap. Test Inhibit Time	0 – 255 hours	96 hours	3.18
	Capacity Test Duration	0 – 2000 minutes	100 minutes	
	Cap. Test Fail Thresh	0.0 – 70.0V	43.2V	
	Cap. Test Warn Thresh	0.0 – 70.0V	49.2V	
	Cap. Test Alarm Delay	20s	20s	
	Scheduled Batt Cap Test	Enabled, Disabled	Disabled	
	Next Capacity Test	00:00:00 1/1/1992 – 23:59:59 31/12/2091	-	
	Capacity Test Cycle	1 – 255 weeks	2 weeks	

Menu	Parameter	Allowable values	Default	Section
Numeric Displays				
	Current Display Default	Load, Battery, Boost, Output Current	Load Current	3.7
	Curr. Display Alternate	Load, Battery, Boost, Output Current	Battery Current	
	Voltage Display Default	Output, Battery, Boost Volts	Output Volts	
	Volts Display Alternate	Output, Battery, Boost Volts	Battery Volts	
Analogue Inputs				
	Load Current	Input I1, Input I_{ON}-I2, Disabled	Input I1	3.7
	Battery Current	Input I2, Input I_{ON}-I1, Disabled	Input I2	
	Boost Current	Input I3, Input I_{OFF}, Disabled	Disabled	
	Output Current	Input I4, Input I_{ON}, Inputs I1+I2, Disabled	Disabled	
	Output Volts	Input V1, Disabled	Input V1	
	Battery Volts	Input V2, Disabled	Input V2	
	Boost Volts	Input V3, Disabled	Disabled	
User Alarm 1				
	User Alarm 1 Input 8	Disabled, Summary, Short ckt -> Act or Open ckt -> Act	Disabled	0
	Alarm Message Text	(Not programmable from the user interface)	USER ALARM 1	
	Action on Alarm	None, Shutdown or disable rectifiers	None	
	Alarm opens LVD	Yes, No	No	
	User Alarm 1 LED	Green, Amber, Red	Amber	
	User Alarm 1 Buzzer	Enabled, Disabled	Disabled	
	User Alarm 1 Type	Latching, Non-latching	Non-latching	
User Alarm 2				
	User Alarm 2 Input 9	Disabled, Summary, Short ckt -> Act or Open ckt -> Act	Disabled	3.21
	Alarm Message Text	(Not programmable from the user interface)	USER ALARM 2	
	Action on Alarm	None, Shutdown or disable rectifiers	None	
	Alarm opens LVD	Yes, No	No	
	User Alarm 2 LED	Green, Amber, Red	Amber	
	User Alarm 2 Buzzer	Enabled, Disabled	Disabled	
	User Alarm 2 Type	Latching, Non-latching	Non-latching	
Communications				
	Master Comms. Interface	RS-232 Modem, RS-232 Null Modem, IrDA, RS-485	RS-232 Null Modem	3.23.1
	Master Baud Rate	9600, 19200, 38400, 57600, 115200, 230400	9600	
	Slave Baud Rate	9600, 19200, 38400, 57600, 115200, 230400	9600	

5.2 Calibration Values Menu

	Parameter	Range	Default	Section
	Current 1 FSD	25 – 7000A	1000A	3.7
	Current 2 FSD	25 – 7000A	1000A	
	Current 3 FSD	25 – 7000A	1000A	
	Current 4 FSD	25 – 7000A	1000A	
	Current 1 fine adjust	96.0 – 104.0%	100.0%	
	Current 2 fine adjust	96.0 – 104.0%	100.0%	
	Current 3 fine adjust	96.0 – 104.0%	100.0%	
	Current 4 fine adjust	96.0 – 104.0%	100.0%	

6 Table of Inputs and Outputs

The following table summarizes all of the inputs and outputs of the monitoring and control module, together with references to sections of this manual.

Interface	Description	For further information refer to section:
Power Input		
PWR	Power Input	4 Specification
Digital Inputs		
IP 1	CB Open	3.8.6 CB Open
IP 2	AC Abnormal	3.8.1 AC Abnormal
IP 3	System on diesel	3.8.17 System on Diesel
IP 4	Battery off line	3.19 Charging Batteries Off-line
IP 5	Rectifiers off line	
IP 6	Start on line charge	3.16 Charging Batteries On-line
IP 7	Not used	
IP 8	User alarm 1	3.20 User Alarm 1
IP 9	User alarm 2	3.21 User Alarm 2
Voltage inputs		
V1	Voltage measurement input 1. Output voltage by default.	3.7 Observing Voltages, Currents and Temperature
V2	Voltage measurement input 2. Battery voltage by default.	
V3	Voltage measurement input 3. Disabled by default.	
DCCT Inputs		
I1	Current measurement input 1. Load current by default.	3.7 Observing Voltages, Currents and Temperature
I2	Current measurement input 1. Battery current by default.	
I3	Current measurement input 1. Disabled by default.	
I4	Current measurement input 1. Disabled by default.	
Temperature Probe Input		
Temperature measurement	Temperature measurement	3.14 Using Battery Temperature Compensation
Relay Outputs		
OP 1	Output Volts High	3.8.14 Output Volts High
OP 2	Output Volts Low	3.8.15 Output Volts Low
OP 3	AC Abnormal	3.8.1 AC Abnormal
OP 4	LVD Disconnect	3.8.10 LVD Disconnect
OP 5	User Alarm 1/System Shutdown	3.20 User Alarm 1
OP 6	Rectifier Fail	3.8.16 Rectifier
OP 7	CB Open	3.8.6 CB Open
OP 8	Communications Fail/ Configuration Fail	3.8.7 Communications Fail, 3.8.8 Configuration Fail and 3.8.9 Lost Slave
OP 9	System on Diesel	3.8.17 System on Diesel
OP 10	Warning: Volts High	3.8.20 Warning: Volts High
OP 11	Warning: Volts Low	3.8.21 Warning: Volts Low
OP 12	Off-normal Alarm	3.8.12 Off-Normal Alarm
OP 13	On-line Charge On/Off-line Charge On	3.8.13 On-line Charge On and 3.8.11 Off-line Charge On
OP 14	Battery Test On	3.8.3 Battery Test On
OP 15	Battery Test Fail	3.8.2 Battery Test Fail
OP 16	User Alarm 2	3.21 User Alarm 2
OP 17	LVD contactor control 1	3.8.10 LVD Disconnect
OP 18	LVD contactor control 2	
Communications ports		
Telecom bus	Communications with non-IRC rectifiers	3.6 General System Configuration
Master	This feature is not supported.	
Rectifiers/ Slaves	RS-485 communications with IRC rectifiers or other slave devices	3.6 General System Configuration
RS-232	RS-232	3.23.1 Communicating between the PC and the Monitoring and Control Module

7 Operation Conflict Management

To avoid conflict between the various operations that can be performed, the monitoring and control module may cancel an operation or prevent an operation from starting depending on monitored conditions. For example, the monitoring and control module will not allow low voltage disconnection while off-line charging is in progress. The conditions under which an operation can begin and continue are detailed in section 3, Operation.

Conditions which can prevent or cancel any of the five operations off-line charging, on-line charging, battery capacity test, automatic battery disconnection and battery temperature compensation are also summarized in the table below. In each case, any condition that cancels an operation will also prevent it from starting.

Condition	**Off-line charging**	**On-line charging**	**Battery capacity test**	**Automatic battery disconnection**	**Battery temperature compensation**
Battery capacity test in progress		prevents	prevents	prevents	
Battery disconnection contactor open	cancels	cancels	prevents	prevents	
Off-line charging in progress	prevents	cancels	cancels	prevents	
On-line charging in progress	cancels	prevents	prevents		cancels
Temperature compensation enabled					prevents
AC Abnormal alarm active	cancels	cancels	cancels		
System on diesel alarm active	cancels	cancels	cancels		
System voltage below On-line charge auto low volts threshold			prevents		
Battery test fail alarm active			prevents		
Battery test warning alarm active			prevents		
Battery capacity inhibit time has not yet expired			prevents		
Battery test completed within the last 20 seconds				prevents	

8 Troubleshooting

8.1 Displays, User Interface, LEDs and Buzzer Problems

The screen described in the user manual is not visible from the user interface.

- Some screens are hidden at level 0 and level 1 access. Enter the level 1 or level 2 password to view the screen. Refer to section 3.2.6 Levels of Access for further information.
- Some screens are hidden when the feature that they describe has been disabled. For example, if On-line Charging is disabled under the System Setup: General Configuration menu, the System Setup: On-line Charging menu items will not appear.

The system is functioning but the monitoring and control module has no power.

- Check the monitoring and control module is switched on. The power switch is at the rear of the unit on the right (looking from the front of the unit), and is in the downward position for ON.
- Check the power connection to the monitoring and control module. This is located at the rear of the unit in the first terminal block. Refer to the wiring label on top of the unit for details. If the module is receiving power and switched on but still fails to show any LCD outputs, return the unit to the manufacturer for repair.

Voltage or current measurements have large errors.

- Check the settings under the System Setup: Analogue Inputs menu. In particular, check that calculated currents are using the correct formula. Refer to the technical details under section 3.7 Observing Voltages, Currents and Temperature.
- Check that the FSD settings for each current measured are correct, under the System Setup: Calibration Values menu. Refer to the technical details under section 3.7 Observing Voltages, Currents and Temperature.
- Check that each DCCT or shunt has been wired in the correct orientation. The current direction conventions are shown in figures 3-2 to 3-5 in section 3.7 Observing Voltages, Currents and Temperature. Voltages wired in the reverse polarity will read as zero.
- Calibration on analogy inputs can be lost if the non-volatile memory has failed. To confirm memory failure, check that the serial number, displayed on the start screen, has also been lost. Return the unit to the manufacturer for repair.

Buzzer never sounds.

- The alarm buzzer can be disabled at the Alarm Buzzer screen in the System Setup: General Configuration menu screen.
- Note that the buzzer only sounds on urgent alarms. Output Volts High, Output Volts Low, AC Abnormal, Rectifier Fail, CB Open, Battery Test Fail. User alarm 1 and User Alarm 2 can be configured to sound the buzzer.
- If the buzzer is enabled but still not sounding on important alarms, perform the Indicator test under the Perform Operations menu.

Poor visibility of the user interface LCD screen.

- Consider using the backlight or adjusting the display contrast. These options are available under the System Setup: General Configuration menu. Refer to section 3.2.7 Display Screen Options.
- If it is suspected that the user interface LCD is faulty, run the Display Test under the Perform Operations menu.

Current display shows '----'.

- The current display LCD can show a maximum of 8999A and a minimum of –999A. For higher or lower currents refer to the System Status menu.

An alarm LED is not working.

- Note that the red, amber and green LEDs only light under certain operating conditions. The red LED lights for urgent alarms Output Volts High, Output Volts Low, AC Abnormal, Rectifier Fail, CB Open, LVD Disconnect and Battery Test Fail. The amber LED lights for non-urgent alarms Configuration Fail, Communications Fail, System on Diesel, Warning: Volts High, Warning: Volts Low, Off-Normal Alarm, Off-line Charge On, On-line Charge On, Battery Test On, Battery Test Warning and Battery Test Pass. User alarm 1 and User Alarm 2 can be configured to light the amber or red LEDs. The green LED is lit when there are no high priority alarms.
- If any of the LEDs are not lighting when expected, perform the Indicator test under the Perform Operations menu. If the LEDs fail the test, return the unit to the manufacturer for repair.

Current or voltage display has lost segments.

- If it is suspected that the current or voltage LCD is faulty, run the Display Test under the Perform Operations menu.

8.2 Alarm Condition Problems

AC Abnormal alarm is constantly active despite the mains being OK.

- If the system has not been installed with an AC Monitoring Unit (relay contact going to MCM digital input rated at TNV-1), the AC Abnormal alarm must be disabled by setting AC mains monitoring to disabled under the System Setup: General Configuration menu.

ENSURE THAT MAINS POWER IS DISCONNECTED BEFORE ATTEMPTING TO REMOVE THE AC MONITORING UNIT OR CORRECT ITS CABLING.

- If the system has been installed with an AC monitoring unit, disconnect the signal from the AC unit and connect a short circuit to digital input 2. If the alarm does not clear, the monitoring and control module should be returned to the manufacturer for repair. If the alarm clears, the fault may be with the AC monitoring unit.

NOTE: *CB Open alarm is constantly active despite all circuit breakers being closed and no fuses blown.*

- If the monitoring and control module is not monitoring any circuit breakers, digital input 1 must be wired with a short circuit to disable the alarm.
- Test that the monitoring and control module is not faulty by applying a short circuit to digital input 1. The alarm should clear. If it does not clear, return the unit to the manufacturer for repair.
- Check the wiring of the circuit breaker monitoring signal, connected to digital input 1. For further information refer to section 3.8.6 CB Open.

The lost slave alarm is constantly active, although all slave rectifiers are working normally.

- This may be the result of a rectifier having been unlocked from the rack for replacement or maintenance. Use the forget lost slaves procedure described in section 3.9.2 Forgetting Lost Slaves.

Remote alarms signal incorrectly.

- Check the wiring to each remote alarm. Both NC and NO contacts are available for each alarm. Refer to the wiring label on top of the unit for details of alarm assignments to relay outputs.
- Relay operation can be checked by running the Relay test under the Perform Operations menu. Note that this test will toggle each relay output, causing every remotely monitored alarm to activate. Warn the remote site or disconnect remote monitoring prior to running this test.

8.3 System Function and System Settings Problems

LVD contactor will not open.

- Note that the LVD cannot be opened while the off-line charging switch is open, while a battery test is in progress and for a short time after a battery test.
- Check that the LVD parameters are set correctly: Batt Low Volt Disconnect under the System Setup: General Configuration menu, and the open and close thresholds under the System Setup: Batt Low Volt Disconnect menu.
- Check the wiring between the contactor driver or LVD auxiliary relay and the monitoring and control module's relay outputs 17 and 18 are correct. Refer to section 3.8.10 LVD Disconnect.
- Check the power wiring to the auxiliary relay (where installed).

On-line charging cycle will not start

- Note that an on-line charging cycle will not start when the System on Diesel or AC Abnormal alarms are active, while a battery capacity test is in progress, while the LVD contactor is open, and for a short time after a battery test.

On-line charging is in progress but the rectifiers have not raised the system voltage.

- Check whether the rectifiers are in current limit. With a heavy load, or after a substantial battery discharge, it may take several hours to charge the batteries sufficiently to raise the system voltage to the specified charge voltage.
- Check the system parameters controlling the on-line charging voltage under the System Setup: On-line Charging menu. Refer to section 3.16 Charging Batteries On-line.
- If the on-line charge rectifier mode is boost, check the boost voltage settings of the individual rectifiers. Refer to the rectifier manual for further information. Also refer to the trouble shooting suggestions for "Off-line charging is in progress but the rectifiers have not raised the battery voltage".
- For IRC rectifiers, verify that the monitoring and control module is communicating properly with all rectifiers, by checking that there are no active Lost Slave alarms.
- For non-IRC rectifiers where the on-line charge mode is "by PWM", check the Compensation Signal FSD parameter under the System Setup: Batt Temp Compensation menu, and check the wiring of the Telecom

Bus to each rectifier. Note that in large capacity systems using the current measurement interface PCA (CMI), switches SW1 and SW2 must be set to ON at each CMI in order to relay the PWM signal to each rectifier.

The system is switched over for off-line charging, but the boost rectifiers do not raise the boost voltage.

- Check whether the rectifiers are in current limit. After a substantial battery discharge, it may take several hours to charge the batteries sufficiently to raise the boost voltage to the specified charge voltage.
- Note that off-line charging will not start when the AC Abnormal or System on Diesel alarm is active or while the battery disconnection contactor is open.
- Check the boost voltage setting at the rectifiers. Refer to the rectifier manual for further information.
- For IRC rectifiers, verify that the monitoring and control module is communicating properly with all rectifiers, by checking that there are no active Lost Slave alarms.
- For non-IRC rectifiers, check the wiring of the Telecom Bus to each rectifier. The boost signal is carried to non-IRC rectifiers via the Telecom Bus. For large capacity systems using the current measure interface PCA (CMI), switch SW4 must be set to ON at each CMI in order to relay the boost signal to each rectifier.

Disable off-line charging prior to removing the wiring to digital inputs 4 and 5 for testing. Open circuiting both inputs while off-line charging is enabled will cause the boost rectifiers to raise their output voltage, which can damage the load.

- Check that digital inputs 4 and 5 are receiving an open circuit signal from the boost switch when the switch is in the battery 1 or battery 2 position. If either signal is a short circuit, check the wiring of the input. If both inputs are open circuit, return the monitoring and control module to the manufacturer for repair.

A battery test will not start.

- Note that a battery test will not start when the AC Abnormal, System on Diesel, Battery Test Warning or Battery Test Fail alarms are active, while the battery disconnection contactor is open, while a charging cycle is in progress, while the system voltage is below the on-line charging auto low volts threshold, and while the battery test inhibit time has not yet expired.

A battery test is in progress but the rectifiers are still powering the load.

- For IRC rectifiers, verify that the monitoring and control module is communicating properly with all rectifiers, by checking that there are no active Lost Slave alarms.
- For non-IRC rectifiers, check the wiring of the Telecom Bus to each rectifier. For large capacity systems using the current measure interface PCA (CMI), SW3 must be set to ON in order to relay the disable signal to the rectifiers.

Rectifiers are not sharing the load equally.

- If the system is using active load sharing, note that this function only forces the rectifiers to share to within 5% of rectifier full current.
- For IRC rectifiers using active load sharing, verify that the monitoring and control module is communicating properly with all rectifiers, by checking that there are no active Lost Slave alarms.
- For older 200A rectifiers only: If the system is using passive load sharing, the rectifiers can be expected to share to within ± 15% of the average rectifier current. The following procedure can be used to improve rectifier sharing which is worse than 15%, but can only be used when the system current is greater than 25% of total rated output.
    1. Determine the average rectifier output by dividing the output current, available at the monitoring and control module, by the number of rectifiers in the system.
    2. Take note of the current output of each rectifier in the system.
    3. Determine the rectifier whose current is above or below the majority of the other rectifiers.
    4. Decrease (if current above) or increase (if current below) that rectifier's float voltage via the FINE VOLTAGE potentiometer or adjustment screen until the rectifier is providing approximately the average rectifier current.
    5. Repeat steps 3 and 4 until all rectifier currents are within 15% of the average rectifier output.

After a system power down, the monitoring and control module has forgotten all of its commissioned settings.

- This may be caused by faulty EEPROM. To verify EEPROM operation, run the EEPROM test under the Perform Operations menu. If the EEPROM is not functioning, return the unit to the manufacturer for repair.
- This may also be caused by not saving the configuration after making a change to the settings. After changing a setting the AZ328 will prompt the user to save to EEPROM. If the user presses ESC or doesn't press anything for approximately 20 seconds the AZ328 returns to the previous screen and doesn't save the changes. The configuration can be manually saved using `Perform Operations: Store Configuration`.

9 Menu Structures

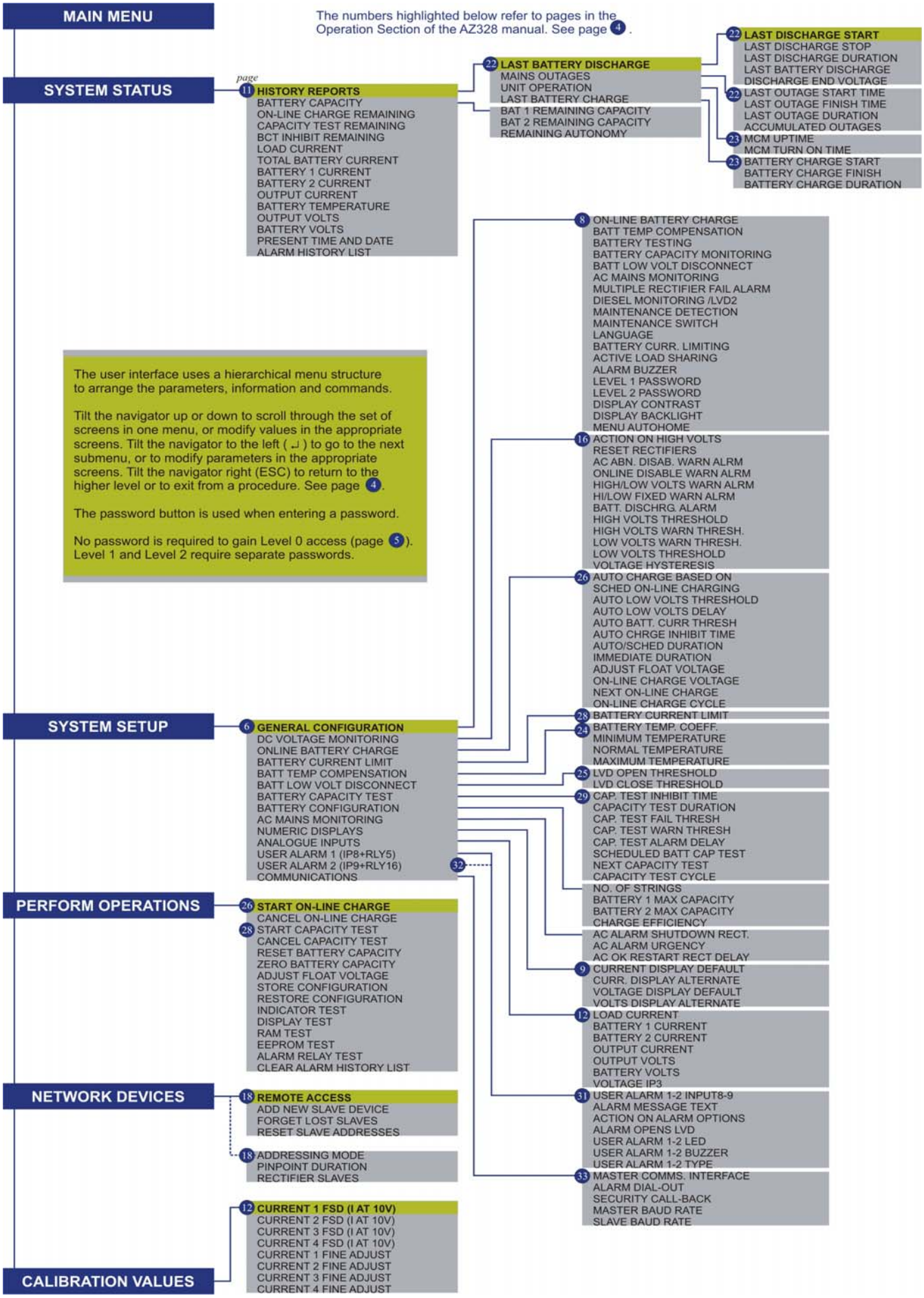


Table 9 AZ328 Menu Structure

Online Chrg Rect Mode Status: Float	Online Chrg Rect Mode Status: Float	Online Chrg Rect Mode Status: Float	Online Chrg Rect Mode Status: Float	Online Chrg Rect Mode Status: Float	Online Chrg. Rect. Mode Status: Float
Auto Charge Based On *Status:* ***Disabled***	*Auto Charge Based On* *Status:* ***Volt***	*Auto Charge Based On* *Status:* ***DschCur***	*Auto Charge Based On* *Status:* ***BCurrt***	*Auto Charge Based On* *Status:* ***V&DschCur***	*Auto Charge Based On* *Status:* ***V&Bcur***
Sched Online Charging Status: Enabled	Sched Online Charging Status: Enabled	Sched Online Charging Status: Enabled	Sched Online Charging Status: Enabled	Sched Online Charging Status: Enabled	Sched Online Charging Status: Enabled
HIDDEN	*Auto Low Volts Thresh:* *##.# V*	*Auto DisChrg. Curr. Tre* *# %*	*Auto Batt. Curr. Thresh:* *## A*	*Auto Low Volts Thresh:* *##.# V*	*Auto Low Volts Thresh:* *##.# V*
HIDDEN	*Auto Low Volts Delay:* *### sec*	*Auto chrg. Inhibit Time:* *## min*	*Auto chrg. Inhibit Time:* *## min*	*Auto Low Volts Delay:* *### sec*	*Auto Low Volts Delay:* *### sec*
HIDDEN	HIDDEN	HIDDEN	HIDDEN	*Auto DisChrg. Curr. Tre* *# %*	*Auto Batt. Curr Thresh:* *## A*
HIDDEN	HIDDEN	HIDDEN	HIDDEN	*Auto chrg. Inhibit Time:* *## min*	*Auto chrg. Inhibit Time:* *## min*
Auto/Sched Duration: ### min	Auto/Sched Duration: ### min	Auto/Sched Duration: ### min	Auto/Sched Duration: ### min	Auto/Sched Duration: ### min	Auto/Sched Duration: ### min
Hidden if Sched Online Charging Status: Disabled			Hidden if Sched Online Charging Status: Disabled		Hidden if Sched Online Charging Status: Disabled
Immediate Duration: ### min	Immediate Duration: ### min	Immediate Duration: ### min	Immediate Duration: ### min	Immediate Duration: ### min	Immediate Duration: ### min
Normal System Voltage ##.# V	Normal System Voltage ##.# V	Normal System Voltage ##.# V	Normal System Voltage ##.# V	Normal System Voltage ##.# V	Normal System Voltage ##.# V
Online Charge Voltage ##.# V	Online Charge Voltage ##.# V	Online Charge Voltage ##.# V	Online Charge Voltage ##.# V	Online Charge Voltage ##.# V	Online Charge Voltage ##.# V
Next Online Charge: ##:##:## ##/##/####	Next Online Charge: ##:##:## ##/##/####	Next Online Charge: ##:##:## ##/##/####	Next Online Charge: ##:##:## ##/##/####	Next Online Charge: ##:##:## ##/##/####	Next Online Charge: ##:##:## ##/##/####
Online Charge Cycle # days	Online Charge Cycle # days	Online Charge Cycle # days	Online Charge Cycle # days	Online Charge Cycle # days	Online Charge Cycle # days

Table 9a AZ328 Online charge menu

10 Maintenance

This section is for the information of qualified service personnel only.

The following maintenance items require the MCM top cover to be removed. Installation design should include clear access to the area immediately above the MCM. As an alternative, the wiring harness to the connectors at the rear of the MCM should be made with sufficient length to allow the MCM to be withdrawn from the rack/mounting arrangement.

Updating the software will generally result in all user settings returning to default values. Record any non-default settings before updating software.

After installation, some MCM circuitry remains at SELV live potential regardless of the power switch being "on/OFF". This is true whilst any of the system wiring harness connectors are inserted into the MCM.

Static sensitive parts – the Monitoring and Control PCAs and the EPROM are static-sensitive. TAKE ESD PRECAUTIONS.

10.1 Changing the Flash EEPROM in the Monitoring and Control Module

Replacement of the EEPROM is required to upgrade software.

1. Remove the Telecom Bus cable from the rear of the controller (if used).
2. Turn off the MCM by means of the on/off switch at the rear of the unit.
   Ensure that the wiring blocks, DCCT cables and communications cables are clearly labeled, and then disconnect each cable and plug from the MCM.
   NOTE: The MCM rear power switch (S1) opens only one leg of the input power connection. As the power input is non-polarized, the input power circuit may still be live when S1 is on the "OFF" position.
3. Remove the top cover of the MCM (seven M3 screws). To do this either:
   a) Remove MCM from the rack for access (four M6 screws) or
   b) Remove the cover with the AZ328 in the rack.
4. Remove the flash EPROM at U67 on the left hand PCA using an IC removing tool. Be very careful extracting the IC. Insert the new EPROM, taking care not to bend any pins.
5. Replace the top cover and seven M3 screws.
6. Replace the wiring blocks and other connections at the rear of the unit, and replace the MCM into the rack and fasten with the four M6 screws and washers, if necessary.

Turn on the MCM by means of the on/off switch at the rear of the unit and verify that the MCM is functional.

10.2 Changing the Fuse Inside the MCM

Fuse failure indicates a problem with the MCM. Perhaps the fuse failed from a surge alone, so follow the procedure below.

1. Remove cabling as described in 10.1 Changing the flash EEPROM.
2. Remove the top cover (seven M3 screws)
3. Remove the fuse cover. Remove fuse F1 located at right hand end (viewed from the front) of the printed circuit assembly.
4. Replace F1 with correct type and size. (T2.0A delay, M205 size measuring 20 x 5 mm.)

Re-assemble in the reverse order of the steps above.

10.3 Battery Replacement

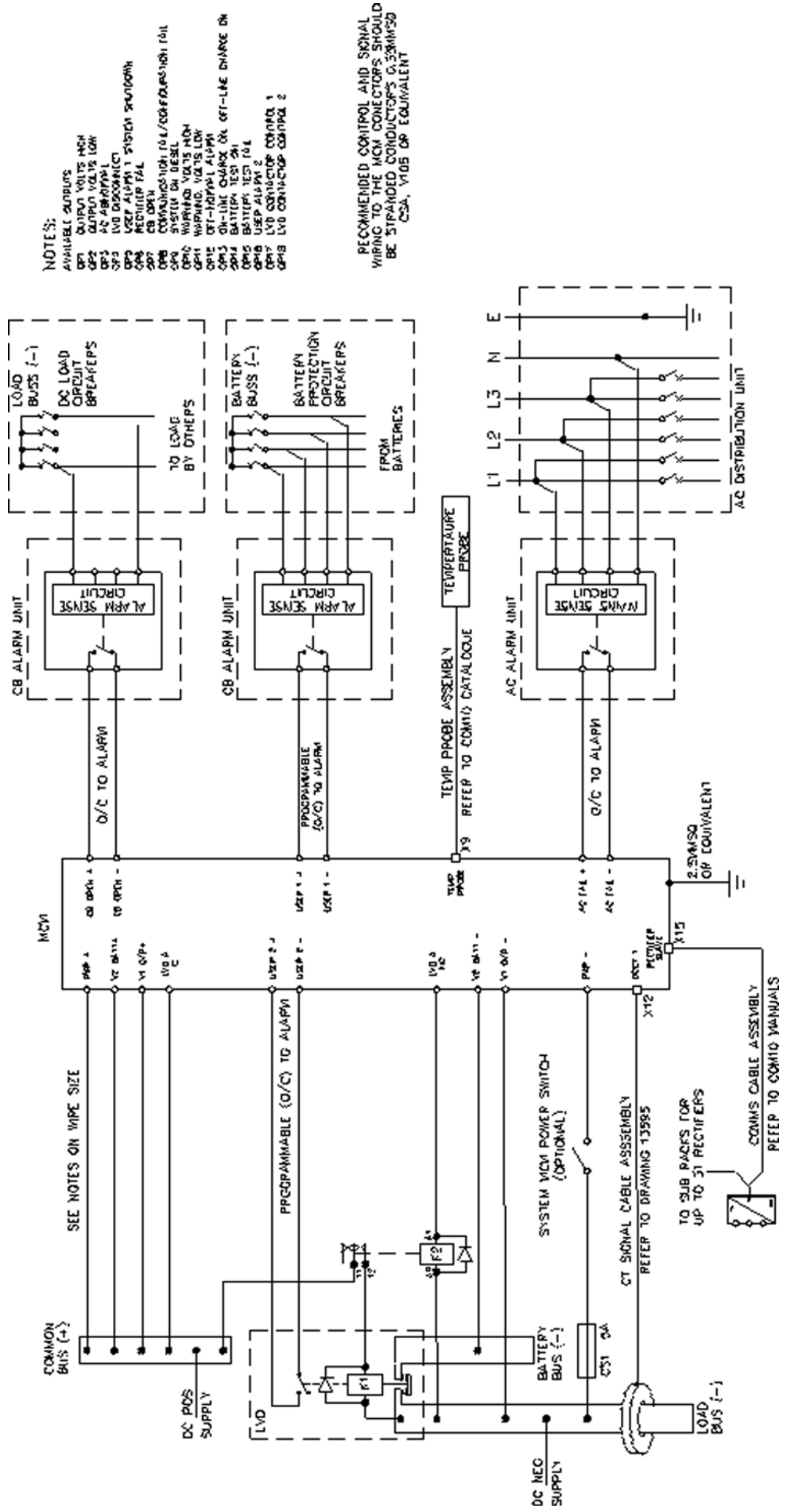
Replace only with CR2450. There is danger of explosion if the battery is incorrectly replaced. Dispose of battery in trash with terminal parts covered with tape or the like.

The manufacturer recommends that only authorized service personnel replace the battery. The battery is a standard lithium button cell and will last at least 10 years under operating conditions. The battery is soldered to the MCB. To replace the battery, the following sequence must be carried out.

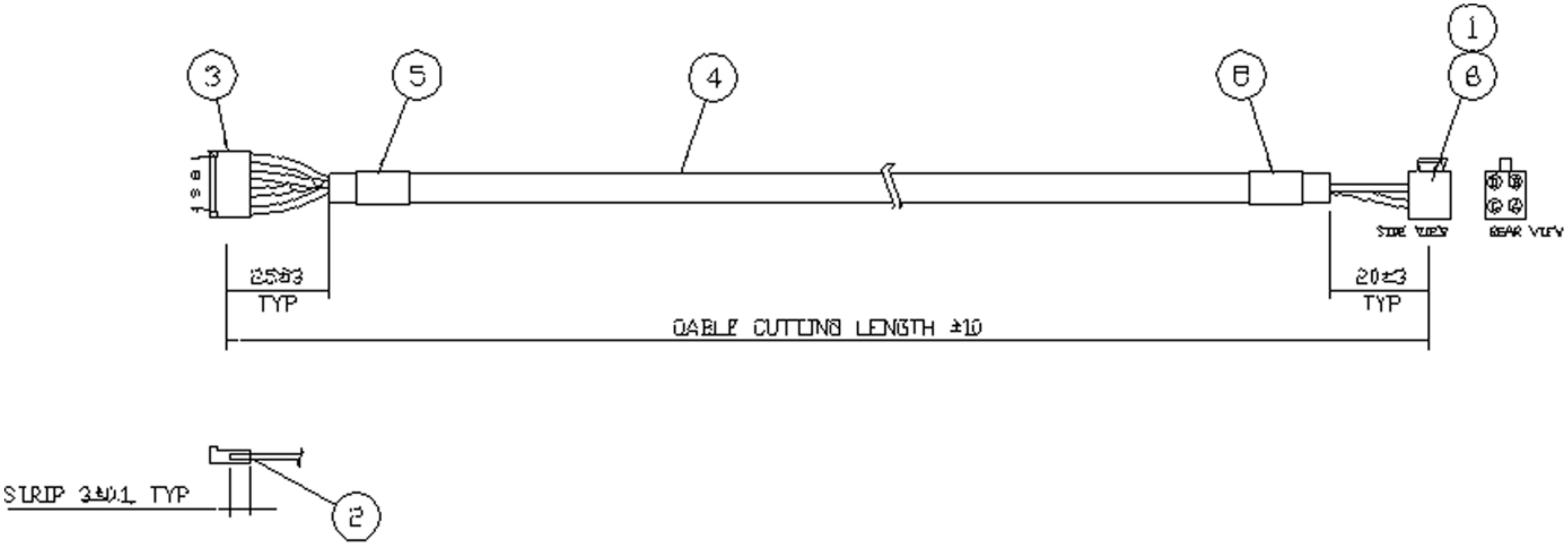
Disassemble and remove from rack as described in Section 10.1 Changing the Flash EEPROM.

1. Remove the rear panel by first removing the two M4 screws.
2. Remove all M3 screws securing the circuit boards marked RIB and MCB.
3. Remove both PC boards together. Separate the MCB at the connector.
4. Unsolder the battery and clear holes, avoiding damage to the PC board.
5. Replace the battery with the correct type noting polarity.
   DAMAGE TO THE MCB WILL OCCUR IF POLARITY IS WRONG.
6. Resolder the new battery and re-assemble the unit. (Operations above reversed).

Attachment A – Isolation Barriers for AZ328, Part 1 of 2



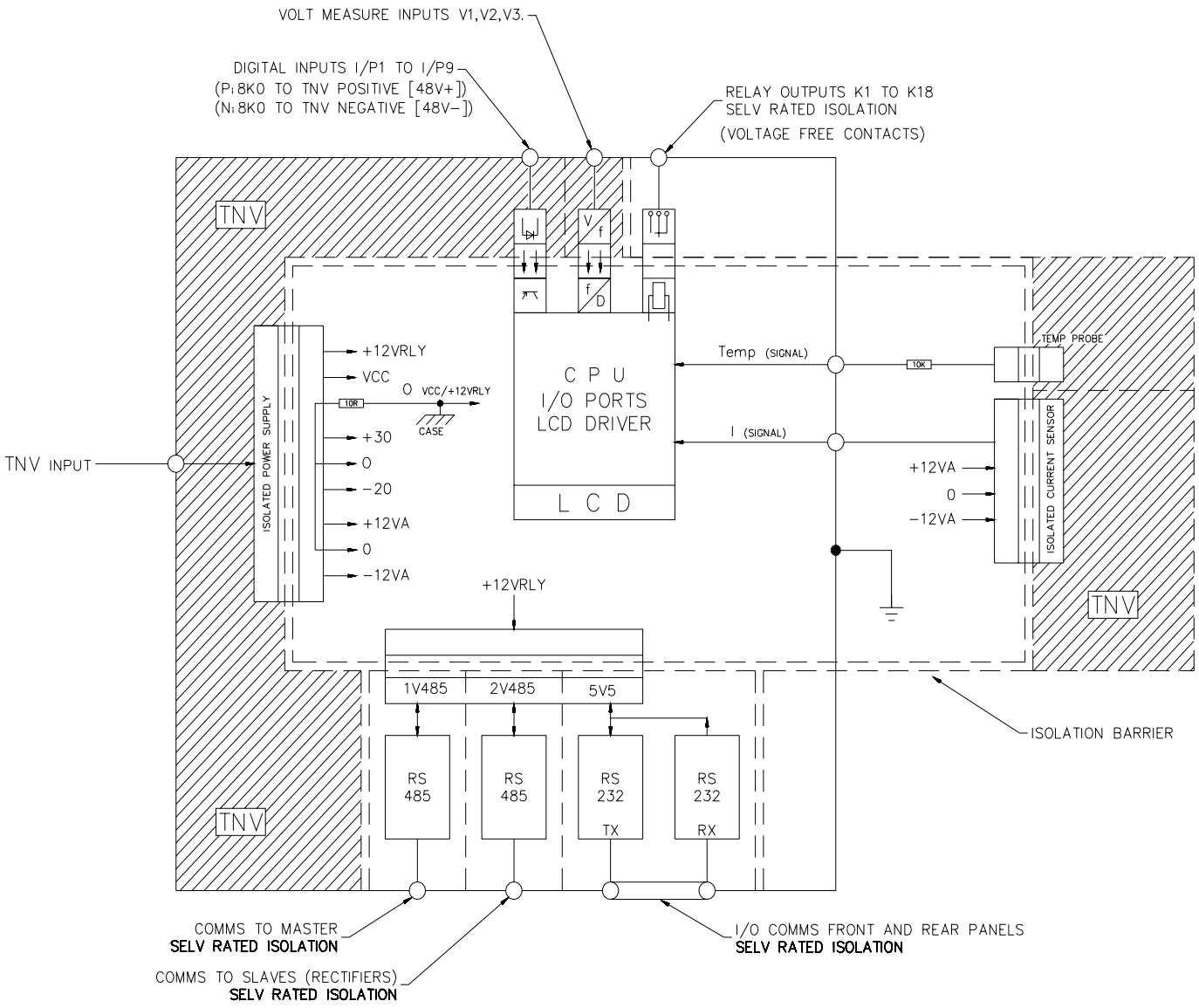
Attachment B – Typical CT Signal Assembly for AZ328



WIRING CONNECTIONS			
ITEM 3 PIN No	WIRE COLOUR	ITEM 1 PIN No	FUNCTION
1	RED	C	+15 V
3	YELLOW	B	SIGNAL
4	BLACK OR GREEN	A	0V
2	BLUE	D	-15 V

PARTS LIST	
ITEM No	DESCRIPTION
1	HOUSING 4 WAY. MOLEX 39-01-2040
2	PIN. ULLUX ME759-T
3	HOUSING 4 WAY. MOLEX 22-01-2045
4	CABLE 4 X 7/8 MM SQ SHEATHED
5	LABEL ID
6	PIN. MOLEX 39-00-0038

Attachment C – Isolation Barriers for AZ328, Part 2 of 2



WARRANTY AND REPAIR INFORMATION

Warranty Policy

Argus Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, excluding third party OEM materials (example: air conditioners, batteries), for a period of two years from the date of shipment from the factory. For third party products the OEM's warranty shall apply. The liability of Argus applies solely to repairing, replacing or issuing credit (at Argus' sole discretion) for any equipment manufactured by it and returned by the customer during the warranty period. The terms of the warranty are Ex Works (EXW) from Argus' factory service location.

Argus reserves the right to void the warranty if:

(1) identification marks or serial numbers are removed or altered in any way,
(2) invoice is unpaid, or
(3) defect is the result of misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration or accident.

Argus shall not be liable to the customer or other parties for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. There shall be no other obligations either expressed or implied. Argus will not honor warranties for batteries and other third party products without prior written Argus authorization.

Freight Policy

Customer is responsible for all shipping and handling charges (COD and freight collect will not be accepted without prior approval from Argus Technologies).

Terms of Payment (North America)

Payment terms are net 30 days subject to prior credit approval. All other orders require payment before shipping.

Terms of Payment (International)

Payment terms are subject to prior approval and are typically through Tele-Transfer.

Return Material Policy

Our RMA policy is designed to ensure prompt, efficient and high quality factory service. A Return Material Authorization (RMA) number must be obtained before products can be accepted for servicing by the Argus factory. For returns to an authorized service center (refer to "Authorized Service Centers" for locations), please consult the individual service center for specific return policies and instructions.

To obtain a RMA number for a factory return, customers must call the appropriate location with the product serial and model number, as well as a brief description of the problem, shipment instructions and billing details.

The original packing container should be used whenever possible. Both the shipping documents and the outside of the box must have the RMA # clearly marked and the product shipped prepaid to the Argus factory service center. Argus will endeavor to repair products within five working days of receipt. Repairs to the returned product are warranted for a period of six months. A service charge may be applied if no fault is found in the returned product. Argus will not accept products without an RMA number.

Business Hours

Argus North American office hours are 7:30 am to 5:00 pm (Pacific Standard Time) Monday to Friday.

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FACTORY SERVICE INFORMATION

Technical Support

Technical support staff are available for answering general questions related to installation, operation and maintenance of Argus products. In Canada and the USA, call Argus toll free 7:30 am to 5:00 pm Pacific Standard Time at:

+1-888 GO ARGUS

(+1-888-462-7487)

For emergencies, call +1-888-GO-ARGUS 24 hours a day, seven days a week.
Customers outside Canada and the USA, call +1-604-436-5547 for technical support.

Training

Argus offers various levels of product and technical training. These workshops provide a mix of theory and hands on application for qualified customers. Please consult your sales representative for course schedules, locations and costs, or visit our website at ***www.argusdcpower.com***.

Factory Repair and Servicing

All service, beyond initial adjustments, should be carried out by qualified factory service personnel. For these procedures, please contact Argus Technologies at the locations listed to the right.

Product Returns

Before returning any product for service, please obtain a Return Material Authorization (RMA) number from an Argus factory service representative. The representative will require the model and serial number, as well as a brief description of the problem prior to issuing the RMA number. All material must be pre-authorized before being returned.
See document 048-507-10 "Warranty and Repair Information" for more details.

Moving and Storage

Units must be suitably packed in the original shipping container (or equivalent) prior to re-shipping. The box should be completely enclosed and constructed of wood or double-wall, corrugated cardboard. At least 3" of foam or shock absorbing packing material must surround the unit.

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048-527-10-I1 Rev L (09/2007)