

PowerShield Configuration Software

User Manual

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of PowerShield Ltd

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For PowerShield Configuration software version 1.6.x.x and later

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The PowerShield Battery Monitoring System

PowerShield is a permanent battery monitoring system developed by PowerShield Limited. It incorporates hardware consisting of a central monitor [either a *B1000* or *Sentinel*] and *Measurement Modules* [either single or dual], and the following software:

- *Configuration* software for system configuration
- *Link* software for automated multi-site management

Each system consists of at least one monitor, a measurement module for each monoblock being monitored, temperature probes and current transducers. An RS232 serial communication port is provided for use with the Windows based *Link* and *Configuration* software. For larger systems, multiple monitors can be connected together using an RS485 Local area network. Optional communications hardware is also available.

A system can monitor one or more strings of monoblocks. Each monoblock is monitored using a measurement module connected across the monoblock terminals. The *Sentinel* or *B1000* interrogates each measurement module and processes the data, logging information into memory at predefined intervals. Where there are strings of different voltage monoblocks, a single *Sentinel* or *B1000* can monitor the whole battery system.

The PowerShield Configuration Software

The PowerShield Ltd *PowerShield Configuration* software is a Windows based application designed for setting up a *PowerShield* battery monitoring system.

The *PowerShield Configuration* software can be used to configure a *PowerShield* system either using a direct local connection to the Monitoring System, remotely via Modem, or over an Ethernet LAN using TCP/IP.

This Manual

This manual is intended for use with *PowerShield Configuration* software Version 1.4.0.5 and later. If you are running Version 1.0.5.22 or earlier, you should be using Version 1.9 of this manual (Nov 2002). If you are running Version 1.1.0.18, you should be using Document 6300-002B April 04. This manual assumes the use of a *Sentinel* monitor, and the images and explanations reflect this.

This manual explains the operation of the *PowerShield Configuration* software as part of the *PowerShield* battery monitoring system. The manual provides instructions for installing the software and describes the basic operation of the

PowerShield Configuration software User Interface, as well as describing each screen of the *PowerShield Configuration* software in detail. In addition, guidelines for correctly configuring a new *PowerShield* system are given.

Page 56 of this manual is a "Configuration Checklist". It is strongly recommended that this checklist is used following configuration, even for experienced users, to confirm all steps have been completed correctly. It is not intended as a substitute for the remainder of this manual however.

This manual is not intended as an installation guide. For information on installation, refer to the separate manual "*PowerShield Installation and Wiring Manual*".

Note: *The PowerShield system must be correctly installed in order to correctly configure the system. This manual assumes that the physical installation of the system hardware has been carried out by PSL accredited personnel, and is complete and correct.*

Definitions

PSL	PowerShield Limited
<i>PowerShield</i>	Permanent battery monitoring system developed by PSL.
Dual Measurement Module	[a.k.a. dual module] Device for monitoring a pair of monoblocks in series in a single string . Up to 80 dual measurement modules can be connected to each Sentinel in a <i>PowerShield</i> system. Note that a dual module MUST be connected across a pair of monoblocks (MB). For installations containing strings of uneven numbers of MB or where MB layout makes pairs impossible, a one MB single version of the dual module is available.
Monoblock (MB)	Individual unit or cell.
String	A bank of monoblocks connected in series.
Battery	Complete system of connected monoblocks being monitored.
Sentinel/B1000	Central data logger for a <i>PowerShield</i> system.
Bbus	The communication bus connecting the Sentinel with each measurement module.
RS232	Serial Communication standard for connecting two pieces of equipment. An RS232 link is used to connect the Sentinel monitor to a host PC, or to a dial up modem.
RS485	Serial Communication standard for connecting multiple pieces of equipment. If more than one Sentinel is required for a <i>PowerShield</i> system, the Sentinels are networked using an RS485 bus.
TCP/IP	Standard set of communication protocols most famous for their use in the internet. <i>PowerShield Configuration</i>

	software supports communication with <i>PowerShield</i> systems using TCP/IP over an Ethernet LAN
System Form	The System Form is made up of 3 parts, SIF, MMF, SCF, to be completed during installation.
SIF	Site Identification Form. This form summarises site information and overall configuration of the system.
MMF	Monoblock Mapping Form. Details the placement of dual modules to monoblock and Bbus, as installed on site.
SCF	String Configuration Form. Details the arrangement of monoblocks per string, as on site, and identifies PowerShield parts allocated to each string.

System Overview

The *PowerShield Configuration* software is used to configure and calibrate each component that goes to make up a *PowerShield* Battery Monitoring System.

During the installation of the *PowerShield* system, each monoblock or pair of monoblocks should have been fitted with a measurement module. Current transducers and temperature probes will also have been fitted, measuring string current, and ambient or pilot monoblock temperature.

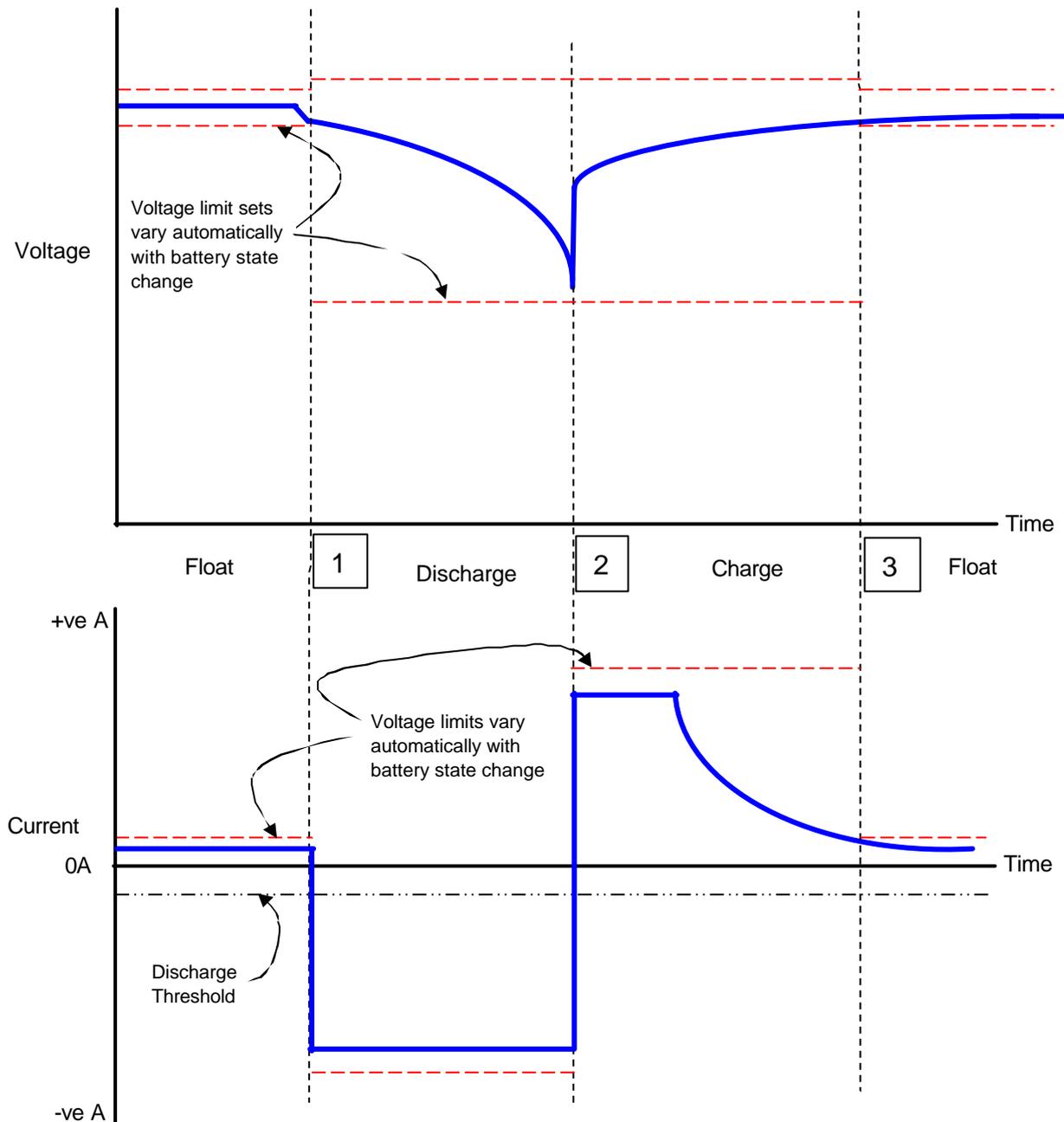
The measurement modules, current transducers and temperature transducers will have been wired to one or more Sentinels. Systems with more than 160 monoblocks, 5 current transducers or 5 temperature transducers require more than one monitor. In this case, the Sentinels will be networked together using an RS485 bus.

After the initial wiring installation, information about each monoblock must be entered into the *PowerShield* system. This includes the identification (ID) of the measurement module connected to each monoblock, and the monitor address and local channel number with which each measurement module is associated.

The monoblocks can then be grouped into strings, and limits can be set for voltage, current and temperature. Memory trigger levels and sample rates must also be configured before full system operation, monitoring and discharge testing can begin.

Refer to the diagram “PowerShield System and Battery State Change – Voltage and Current” on the following page for an explanation of battery states and how the *PowerShield* system changes operation to suit.

PowerShield System and Battery State Change – Voltage and Current



Battery State Changes

1. String Voltage must drop below Minimum String Float Voltage Limit, and String Current must drop below Discharge Threshold for system to recognize a **Discharge**.
2. Current must change from negative to positive for system to recognize a state change to **Charge**.
3. String Voltage must rise above Minimum String Float Voltage Limit, and the String Current must stay below Maximum String Float Current Limit for 30 seconds, for system to recognize a state change to **Float**.

PowerShield Configuration QuickGuide

This Configuration QuickGuide is intended as a summary only, it is not to be used as a substitute for a full and complete understanding of the entire Manual.

- ❑ Ensure installation is fully completed and the master Sentinel is powered and ready for connection.
- ❑ Ensure all parts of the System Forms (SIF, SCF, MMF) are present and readable. Configuration cannot proceed without appropriate site information.
- ❑ Install PowerShield Configuration software on the PC to be used, if not already installed.
- ❑ Connect to the Sentinel to be configured using PowerShield Configuration software via any of the Port 1 Comm options, however use of the service port is recommended for convenience.
- ❑ Reset the Sentinel configuration to defaults
- ❑ Create a new configuration, allocate sitename, set time and date.
- ❑ Detect measurement modules
- ❑ Map measurement modules to monoblocks
- ❑ Configure strings and assign string limits
- ❑ Configure and calibrate current sensors (Ensure any current switching is completed at an appropriate time.)
- ❑ Configure temperature sensors.
- ❑ Configure memories
- ❑ Configure alarms
- ❑ Configure communication parameters
- ❑ Confirm configuration is saved and complete
- ❑ Backup configuration to disk (optional but strongly recommended)

Software Installation and Setup

System Requirements

PC - Pentium computer running Microsoft Windows 98, 2000 or XP.

Hard Disk space: 10 MB

RAM: 32MB

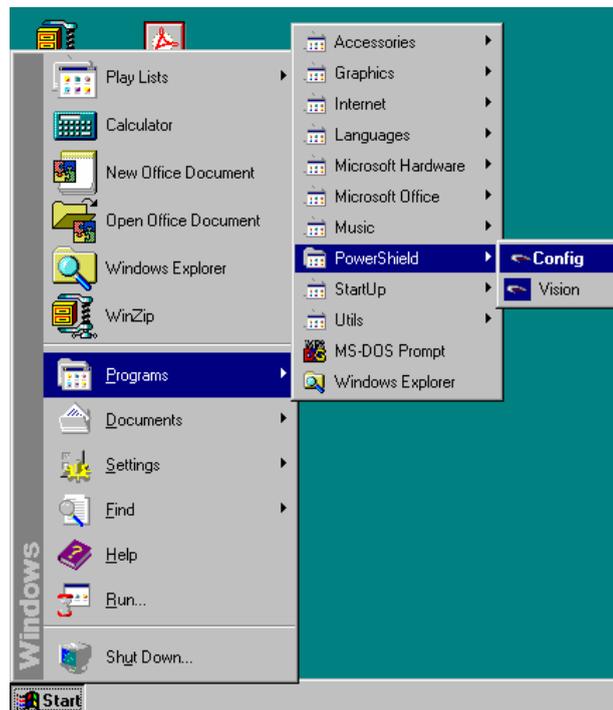
Installing the PowerShield Configuration Software

The *PowerShield Configuration* software is supplied on a CD-ROM. Insert the CD-ROM into your CD-ROM drive, and access it via Windows Explorer

Run the program “Config Installer.exe”. The “InstallShield Wizard” program will then guide you through the installation process.

Running the PowerShield Configuration Software

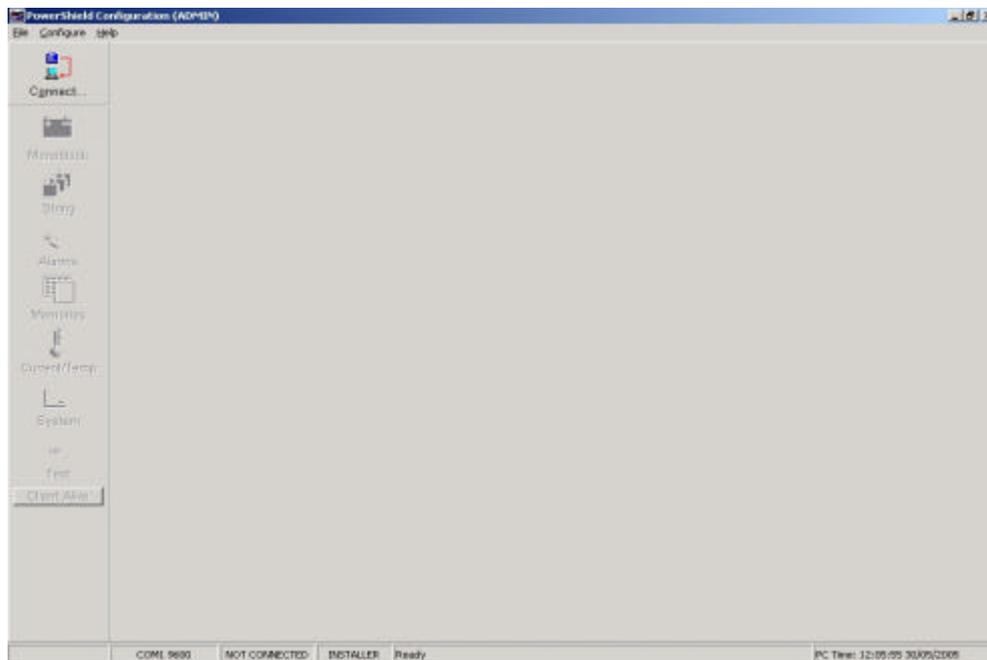
The “InstallShield” program creates a short cut to the *Configuration* software in the Windows start menu. Run the *Configuration* software by clicking on this short cut.



Basic Operation

Screen Layout

When the *PowerShield Configuration* software is opened, the following screen appears.



The *PowerShield Configuration* software is set out in seven main screens, each accessed by clicking the appropriate button; *MONOBLOCK*; *STRING*; *ALARMS*; *MEMORIES*; *CURRENT/TEMP*; *SYSTEM* and *TEST*. These seven buttons, as well as the *CONNECTION* button, are permanently displayed at the left of the Configuration Software window, and are used to move between screens.

Initially, all of the buttons, except the *CONNECTION* button, will be disabled. This is because a connection has not yet been established between the PC and a monitor. The first step is, therefore, to establish a connection.

Connecting to the PowerShield System

This section assumes that the required communication cabling has been installed to correspond with the desired connection method. See separate document *Installation & Wiring Manual, 6300-011C* for more information.

Each time the *Configuration* software is opened, a connection between the PC and the Master Monitor in the *PowerShield* system must be established to allow communication.

To make this connection, click the *CONNECTION* button at the top left of the main window, or select *Connect/Disconnect* from the File menu. The *Connect*

to *Battery Monitor* dialogue box that opens, displays the communication status, port information, and details of the software and hardware revisions.



Click on the *SELECT DEVICE* button to select the appropriate device to use to connect to the *PowerShield* system. *PowerShield* systems can be set up to communicate via a direct serial link, a modem, or over an Ethernet LAN using TCP/IP.

If you are connecting to a Monitor using a direct link, select the PC COM port that the Monitor is connected to.

If you are connecting to a remote Monitor via a Modem connection, the name of the Modem installed in your computer should be displayed in the selection box. Select this Modem. You will also need to enter the telephone number of the remote Monitor in the *Telephone Number* edit box.

Note: If the name of a Modem does not appear in the “*Select Device*” dialog box, your Modem may not be installed correctly. You will need to consult your Windows documentation and install the Modem correctly.

If you are connecting to a Monitor using TCP/IP, select the “TCP/IP Link” option. For more information on communicating using TCP/IP, see the separate manual “*Connecting PowerShield to an Ethernet LAN*”.

To establish a connection to the Monitor, click *CONNECT*. When a connection is made, the six buttons below the *CONNECTION* button on the main form will become active. The hardware and software revision numbers, as well as the site name will be displayed in the *Connect to Battery Monitor* dialog box.

Once connected, the *Connect to Battery Monitor* dialogue box will automatically close. While connected, the *CONNECTION* button changes to *DISCONNECT*.

To close the connection between PC and Monitor, press the *DISCONNECT* button.

A status bar at the bottom of the screen displays connection information during use.

Note: *If you cannot successfully connect to the PowerShield system, you should check the communications cables, and also the communications options that have been set up. See “Appendix C – Advanced Comms Options” on page 66.*

Access Level

The *PowerShield Configuration* software has two different access levels, *USER* and *INSTALLER*.

The *USER* level allows access to non-essential system entries, but prevents access to important configuration information, displaying it in a read-only format. If an attempt is made to edit this information, an alert message will notify the user that access is restricted.

The *INSTALLER* level allows full read/write access to all aspects of the *PowerShield* configuration. The *INSTALLER* level is password protected.

If you want to set up a new *PowerShield* site, or significantly alter an existing configuration, you will need to set the access level to *INSTALLER*.

If you only want to view the configuration, or change alarm limits, then set the access level to *USER*. This will prevent you from inadvertently modifying any important configuration information.

To change access levels select *Set Access Level* from the File menu. The *Set Access Level* dialog box will then be displayed.



Click on the desired access type, enter the password, and click *OK*. If an incorrect password is entered, the software will automatically default to *USER* level.

The access level can be changed at any time during configuration, regardless of whether a connection has been made to the Monitor.

Creating a New Configuration

Resetting the Configuration

System screen / System tab

Before creating a new configuration, it is recommended that the present configuration be reset to its default setting. This removes any existing configuration information in the *PowerShield* system, and allows you to start with a “clean slate”.

The configuration can be reset to factory defaults from the *System* screen. Perform the following steps:

- Ensure the access level is set to *INSTALLER*. See the section “Access Level” on page 15 for a description of how to change the access level.
- Activate the System screen by pressing the *System* button, or by selecting the *Configure/System* menu option.
- Press the button labelled *Load Factory Defaults*.

A message box will be displayed asking you to confirm that you want to reset the configuration to defaults.

Note: When the configuration is reset to defaults, you will lose all monoblock, string and alarm configuration information presently stored on the system.

Steps required to create a New Configuration

The following sections in this manual describe in detail how to use the various screens that make up the *PowerShield Configuration* software. The list below describes the steps involved in creating a new configuration from scratch.

- Configuring the Site and Saving. This involves setting the date and time, specifying a site name and saving the configuration to non-volatile memory. See the section “Configuring System Information” on page 20.
- Configuring Monoblocks. This involves detecting the measurement modules attached to each Monitor, mapping each measurement module to a monoblock number.
- Configuring Strings. This involves specifying the monoblocks contained in each string, as well as the Current and Temperature transducers for each

string. Voltage limits for the strings also need to be set. See the section “Setting String Voltage Limits” on page 35.

- **Configuring Current and Temperature Sensors.** This involves calibrating the current sensors, and setting current and temperature limits. In some cases, where more than one string is to be assigned to a single current or temperature sensor, it also involves mapping sensors to multiple channels. See the section “Configuring Current and Temperature Sensors” on page 37.
- **Configuring Memories.** This involves formatting the memories, setting up the memory trigger thresholds and logging intervals. See the section “Configuring Memories” on page 42.
- **Configuring Alarms.** This involves specifying how alarms will be communicated to the user. See the section “Configuring Alarms” on page 49.

***Note:** In order to carry out the configuration of a new system, you will need the “System Form” (SF) that was filled in during the installation of the system. This form identifies which measurement module is attached to each monoblock in the system, as well as listing the calibration values for each module, and the current and temperature transducer configurations.*

If all three parts of the System Form (SIF, MMF, SCF) have not been filled out or are not available, you will need to create one to successfully configure the system. See the “PowerShield Installation and Wiring Manual” for more information on how to do this.

Saving the Configuration

System screen / System tab

Once you have successfully created a new configuration, it is important to save the configuration to the non-volatile memory of the monitors in the system.

If you do not do this, the configuration will be lost if power to the system is lost.

It is also a good idea to periodically save to non-volatile memory during the configuration process, so you do not lose your configuration changes if the power is lost at any stage.

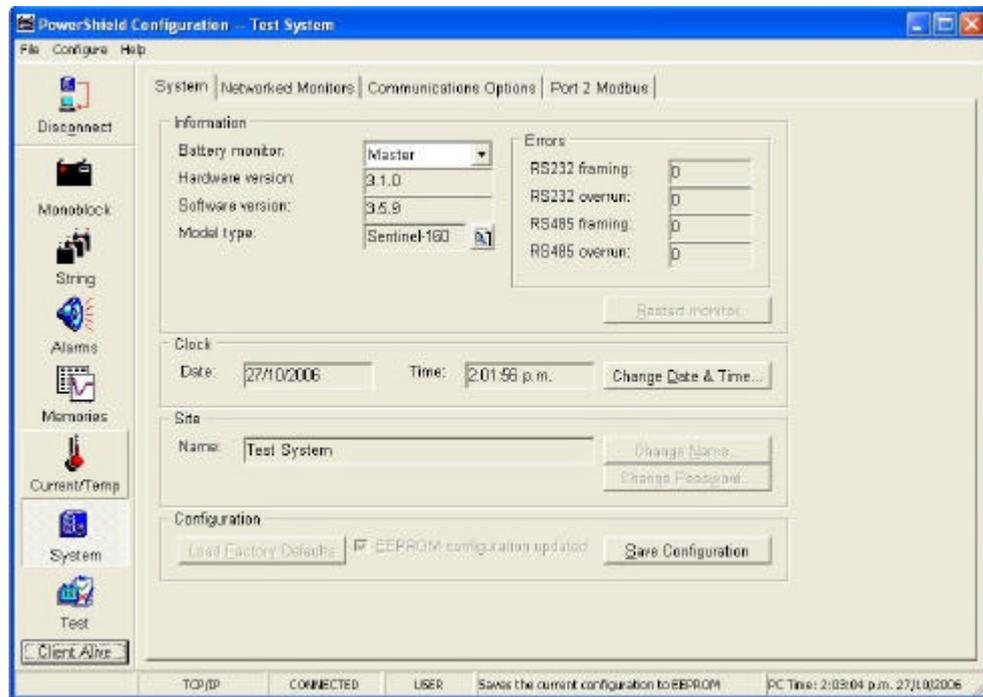
The configuration can be saved to non-volatile memory from the *System* screen. Perform the following steps:

- Activate the System screen by pressing the *System* button, or by selecting the *Configure/System* menu option.

- Press the button labelled *Save Configuration*. A message box will be displayed indicating that the save is taking place.

Note: You can also save the system's configuration to disk for backup. For information on how to do this, see the section "Storing Backup Configurations " on page 55.

Configuring System Information



The functions described in this section can all be accessed from the *System* screen. To access this screen, click the button labelled *System* on the left hand side of the main screen, or select *Configure/System* from the menu.

Configuring Site Information

System screen / System tab

The *System* tab displays information relevant to each monitor in the system. Use the *Monitor Number* pull down field to select each monitor unit.

Hardware and Software

Hardware and software versions are displayed, along with the model type, on the *System* tab.

Communication Errors

Communication errors, for both the RS232 communication connection, and the RS485 Local Area Network are recorded and displayed on the *System* tab.

Time and Date

Time and date, as held by the monitor, is displayed on the *System* tab. The date and time stored in the monitor may be modified by clicking the *Change Date and Time Button*.

To alter the time, click into the time field, and either type in the new time, or use the scroll arrows to set.

The time is displayed in hh:mm:ss AM/PM format.

To alter the date, either type the date into the field, or use the drop down calendar to select the appropriate date.

Alternatively, clicking the *Synchronise to PC* button will synchronise the monitor time with the computer being used.

Note: *If the Synchronise to PC button is used, ensure that the PC is in fact set to the correct time and date.*

For systems with more than one monitor, changing the Master monitor changes the entire PowerShield system.

Site Name

The name of the site to which you are currently connected is displayed.

To change the site name, click the *Change Name* button, type the desired name, and click *OK*.

Resetting a Monitor

To return the configuration of the selected monitor to the last saved configuration, click the *Restart Monitor* button. Ensure all monitors in the network are reset.

Note: *Proceed with caution, all configuration data will be reset including limits and alarms. Take care to ensure that an appropriate configuration is maintained. Ensure all networked monitor's are consistent*

Saving Configuration

Once the *PowerShield* system has been configured, the configuration can be saved to non-volatile memory by clicking the *Save Configuration* button on the *System* tab.

This procedure should be carried out both during, and once the system configuration is complete, and each time it is modified.

Note: *If you do not save the configuration to non-volatile memory, all configuration changes will be lost if power to the monitor is lost, or if the monitor is reset.*

Resetting the Configuration to Defaults

If you are configuring a new *PowerShield* system, it is a good idea to reset the configuration of the system to factory default values. This gives you a “clean slate” from which to start the configuration process.

To do this, click the *Load Factory Defaults* button. A dialog box will be displayed asking you to confirm that you want to reset the configuration.

Note: Proceed with caution, all configuration data for all networked monitors will be reset including limits and alarms. Take care to ensure that an appropriate configuration is maintained.

Network Statistics

System screen / LAN Statistics tab

When there are multiple monitors in a system, they are networked together to form a Local Area Network (LAN).

The *LAN Statistics* tab lists each monitor's network station, it's model type, and whether it is online or offline. Also displayed is data on recorded poll errors.

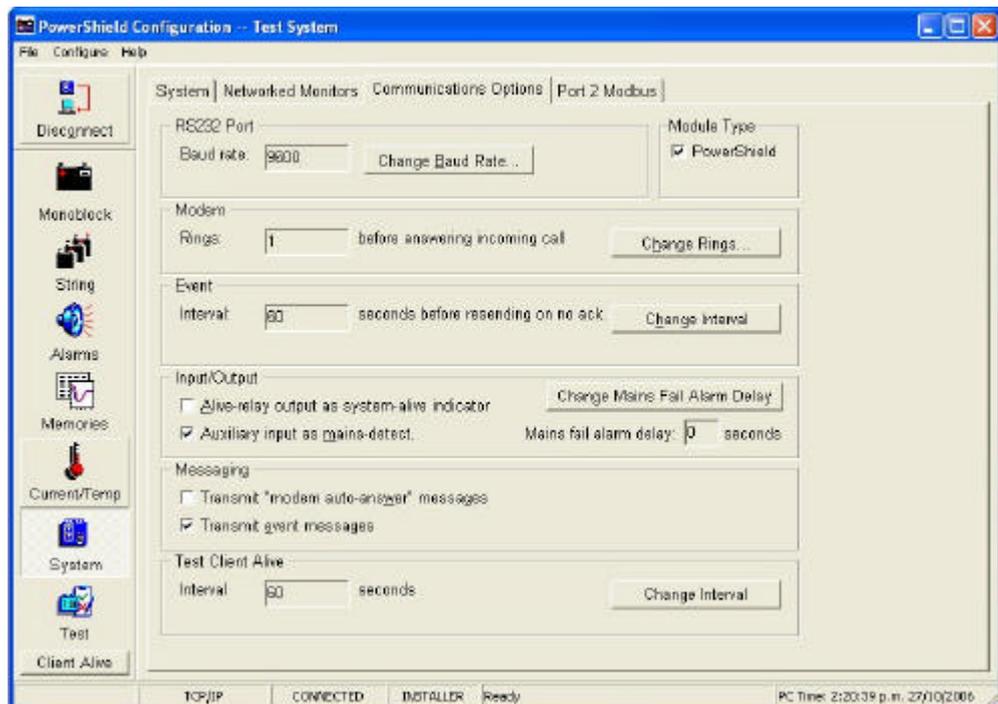
This screen can be used for network diagnostics.

Click the *Reset Poll Errors* button to reset this data to zero.

Communications Options

System Screen / Communications Options tab

This screen allows you to modify the communications options for the *PowerShield* system.



Baud Rate

This option sets the baud rate for the PowerShield system. The default value for the baud rate is 9600 baud.

You can change the baud rate of the PowerShield system by clicking the *Change Baud Rate* button.

Use the pull down field to select the desired new rate and click *OK*.

When you change the baud rate, you will lose communications with the monitor. You will then need to reconnect to the device using the “Connect to Battery Monitor” dialog. The *Configuration* software automatically changes baud rate to match in this situation.

Subsequent connections to the PowerShield system require changing the *Configuration* Software baud rate, to match that of the system.

See “Appendix C – Advanced Comms Options” on page 66 for information on how to change the baud rate of the *Configuration* software.

Module Type

This defaults to “PowerShield” and should not be changed without instruction by PowerShield Limited.

Modem Setup Options

This option is only relevant for systems that use a remote modem to communicate.

For these systems, you can set the number of rings that the monitor waits before answering an incoming call on the Modem.

To alter the number of rings, press the *Change Rings* button, enter the new value, and click *OK*.

Event Notification Options

This option is only relevant for systems that use live monitoring software such as *PowerShield Link* to communicate.

If configured, the monitor will automatically notify out when alarms and events occur.

The interval is the time before notification retry, if the first attempt was not acknowledged.

To alter the interval, press the *Change Interval* button, enter the new value, and click *OK*.

If notification is not acknowledged after four attempts, the Comms Notification failure alarm is triggered.

Note: When running a non-supervised test, any alarm or state change event will result in the test automatically stopping. To postpone the triggering of the Comms Notification alarm while running a test, tick the postpone tick-box.

Note: Individual alarms must also be configured to notify out. This can be done when Configuring Alarms. This involves specifying how alarms will be communicated to the user. See the section “Configuring Alarms” on page 49.

System Alive Indicator

Each monitor network also has a “Alive Relay Output”. This relay is always relay number 1 on the Master Monitor.

The purpose of this feature is to provide an external trigger that can be used to generate an Alarm if the *PowerShield* system loses power. When enabled, the Alive Relay is always activated. If the system loses power, the relay will drop out, triggering the external device.

Tick the tick-box to enable this feature.

When disabled, the relay can be used normally, and assigned to an alarm.

For more information on relays, see the section “Auxiliary Output Relays” on page 62.

Note: For the Alive Relay Output to work, it must be correctly wired to an appropriate system.

Mains Failure Detect

The *PowerShield* system can use the Auxiliary Input to monitor the local mains supply. If the auxiliary input is ACTIVE, then the mains supply is assumed to be on. If it is INACTIVE, then the mains supply is assumed to be off. If this feature is enabled and the mains supply fails, the Monitored Mains alarm will be triggered.

Tick the *Auxiliary Input as Mains Detect* tickbox to enable this feature.

For more information on inputs, see the section “Auxiliary Inputs” on page 62.

Note: For Mains Failure Detection to work, the auxiliary input must be correctly wired to an appropriate system.

Modem Auto-Answer

If a dial-up modem is being used with the *PowerShield* system, the monitor can be set to prompt the modem to stay in auto-answer mode. This helps prevent the modem not answering incoming calls.

Tick the *Transmit 'modem auto-answer' messages* tickbox to enable this feature.

Transmit Event Messages

This option is only relevant for systems that use live monitoring software such as *PowerShield Link* to communicate.

If configured, the monitor will automatically notify out when alarms and events occur.

Tick the *Transmit Event Messages* tickbox to enable this feature.

Note: Alarms must also be configured via the Alarms page, and the correct communication equipment installed.

Test Client Alive

When running a Supervised test, the *Client Alive* button must be clicked to indicate continued supervisor presence. The interval allowed between clicks can be set by the user.

To alter the number of rings, press the *Change Interval* button, enter the new value, and click *OK*.

See section "Test Controls" on page 57.

Configuring for Modbus [via Port 2]

System screen / Port 2 Modbus tab

This tab is only relevant for Sentinel and B2000 monitors that have the option RS485 or RS232 card installed at Port 2. 'Installed' or 'Not Installed' will be listed against the status.

RTU or ASCII protocols can be selected, along with Baud rate, flow control and Modbus address. Note that these settings comply with accepted norms, and must be applied appropriately.

Refer to the separate manual *6300-049 Sentinel Modbus Port 2 Interface* and it's companion document '*6300-050 Sentinel Modbus Port 2 Interface Resiter List*' for information regarding integrating PowerShield monitors with third party equipment.

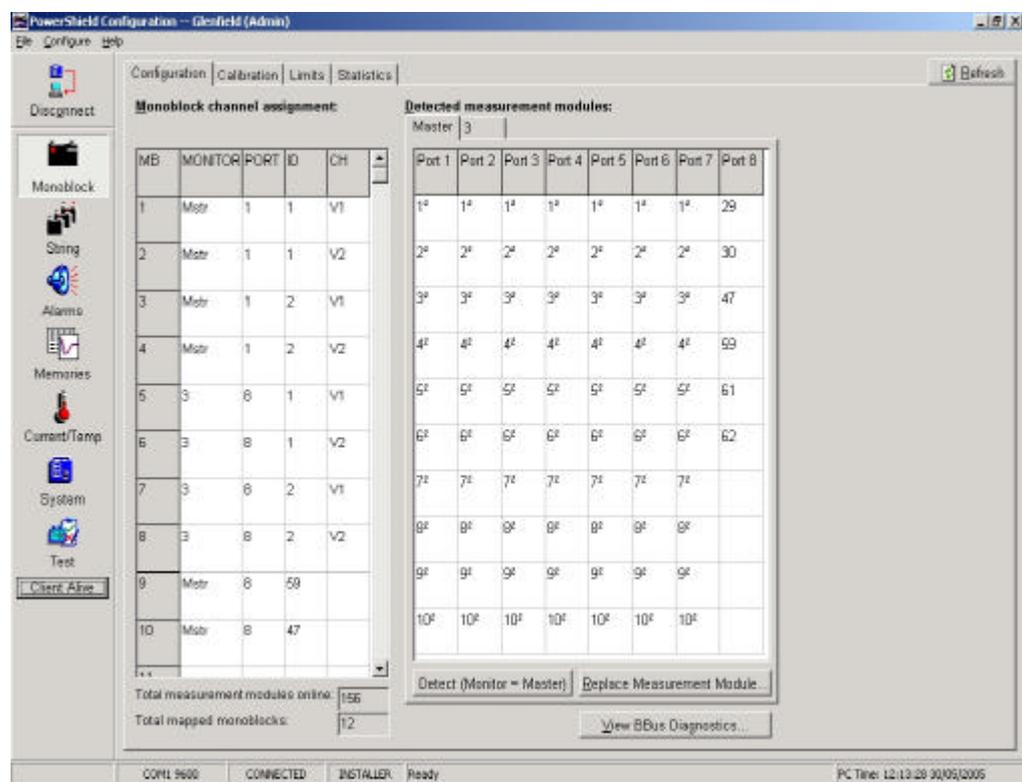
Configuring Monoblocks

The functions described in this section can all be accessed from the *Monoblock* screen. To access this screen, click the button labelled *MONOBLOCK* on the left-hand side of the main screen, or select *Configure/Monoblock* from the menu.

Detecting Modules

Monoblock screen / Configuration tab

The first step in the configuration of a *PowerShield* system involves detecting the measurement modules attached to each Monitor.



The *Configuration* tab displays two grids; *Monoblock Channel Assignment* on the left, and *Detected Modules* on the right.

This second grid has tabs labelled to match each Monitor in the system. In a system consisting of just one Monitor, there will be only one tab, labelled "Master". In larger systems, consisting of multiple networked Monitors, there should be multiple tabs. Each tab will be labelled with the address of the slave Monitors (the address is a number from 1 to 15).

Note: *If you are configuring a system with multiple networked Monitors, and only some of the Monitors are shown on the "Detected Modules" page, you may have a problem with the network configuration.*

To detect the modules associated with one of the Monitors in the system, select the appropriate tab, and click the *DETECT* button. A message box will be displayed warning you that this will overwrite calibration parameters for the modules detected. If you are detecting modules for the first time, you do not need to worry about this message box. Just click *YES*, and the detect operation will begin.

Note: If the access level is set to USER, the DETECT button will be disabled. In order to detect monoblocks, you must set the access level to INSTALLER.

The *Detected Modules* grid now fills with the ID numbers of the modules connected to each port of the selected Monitor. A small “2” adjacent to the detected ID indicates a dual module, no marking indicates a single version.

Repeat this for all the Monitor’s in the system.

When all modules have been detected, compare the number of monoblocks on the SIF, with the displayed *Total Modules Online*. If these two numbers are not the same, check that all modules are connected and powered correctly, and redetect.

Each detect performed by a Monitor overwrites the previous detect.

Assigning Monoblocks

Monoblock screen / Configuration tab

Having detected the measurement modules, each one now needs to be assigned or ‘mapped’ to its correct monoblock channel.

Note: It is advised that you detect all modules for all Monitors in the system before proceeding with assignment. This allows you to check that all modules are responding correctly before proceeding.

Working from the information on the SIF, click and drag each module ID from the *Detected Modules* grid, to the monoblock number to which the module is physically attached, in the *Monoblock Channel Assignment* grid. Alternatively, double clicking, or pressing the *ENTER* key inside the *Monoblock Channel Assignment* grid will bring up a dialogue box for each monoblock. Use the available pull down fields to enter the correct data and Click *OK*.

Note that a dual module will automatically assign itself to two adjacent monoblocks, ensure the correct pair is selected. One monoblock will be tagged as V1, the other V2. V1 reflects the most positive of the pair, and V2 reflects the most negative of the pair. To invert the V1/V2 assignment, right click on the

assigned grid cell and click the SWAP button. Note that correct assignment of the voltage to their respective monoblocks is essential for system accuracy.

Note: *If the access level is set to USER, monoblock mapping will be disabled. You must change the access level to INSTALLER to alter the monoblock mapping.*

Ensure the SIF information is followed precisely. Particularly in a large system, there will be repeated ID numbers, so it is essential that the Monitor and Bbus port numbers be observed.

If you make a mistake, and allocate a measurement module to an incorrect monoblock, you may delete a module assignment by selecting the appropriate monoblock in the *Channel Assignment* grid, and pressing the *DEL* key. Both halves of the module pair will be deleted for a dual module. Alternatively, you may overwrite a channel assignment at any time.

When all modules have been assigned, compare the *Total Modules Online* with the *Total Mapped Monoblocks*. If these two are not the same, check that all modules are correctly assigned.

Calibrating Measurement Modules

Monoblock screen / Calibration tab

Calibrating Measurement Modules is a retrospective function for Rev 6 hardware.

For all new hardware (Rev 7 Blue and Rev 8 Orange) calibration is automated. Do not edit calibration values without PSL support.

Setting Monoblock Limits

Monoblock screen / Limits tab

A voltage alarm can be activated if a monoblock voltage exceeds pre-set limits. These limits are set as a range, with both minimum and maximum voltages.

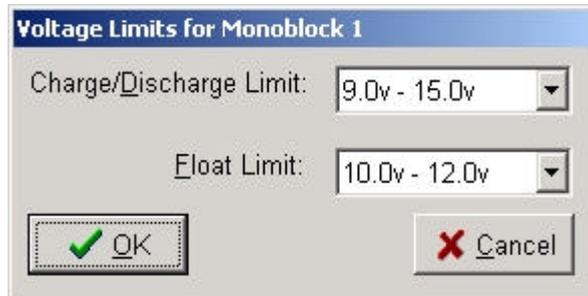
Monoblock limits are generally only used in exceptional circumstances. The Monoblock Variation and String Voltage alarm settings will identify most fault conditions.

Monoblock limits can be configured in two ways, individually, or by string.

Configuring Limits by String

In most cases, it is easier to set monoblock alarm limits by string. If you are configuring a new system, you will need to configure the strings before doing this – see the section “Configuring Strings”, on page 31.

To configure the voltage limits by string, click the *Set Limits by String* button, then enter the string number you wish to configure. The *Voltage Limits* dialog box will appear.



Two pull-down fields of pre-set voltage limits are presented. One set of limits is active during charge and discharge mode, and the other set of limits is active during float mode. Two sets of limits are supplied since the voltage limits during float charging will generally be much tighter than during discharge and bulk charging. Limits must be assigned for both states.

Select limits for each state, ensuring that they are appropriate for the string or monoblock being monitored. If none of the limits presented in the pull down fields are appropriate, you can change the limits. See the section “Customising Voltage Limits”, below.

Configuring Limits by Monoblock

In some cases it may be desirable to set the monoblock voltage limits by individual monoblock. To do this double-click on the appropriate monoblock, or select the monoblock and press the *ENTER* key. The *Voltage Limits* dialog will be displayed. You can then specify the charge/discharge and float limits for the individual monoblock, as described in “Configuring Limits by String”, above.

If none of the limits presented in the pull down fields are appropriate, you can change the limits. See the section “Customising Voltage Limits”, below.

Customising Voltage Limits

To customise the voltage limits, click the *Edit Voltage Limits Table* button. The *Voltage Limits Table* (shown below) has sixteen, indexed voltage ranges listed, each can be customised to suit requirements. Ensure that when edited, the range is maintained as min-max. Ensure that the selected voltage limits are appropriate to the monoblocks being monitored.

To enable or disable alarms, see the section “Configuring Alarms” on page 49.

LIMIT INDEX	MIN	MAX
1	11.8	13.9
2	12.8	13.9
3	13.7	13.9
4	13.8	14.0
5	13.5	14.0
6	0.0	65.5
7	0.0	65.5
8	0.0	65.5
9	0.0	65.5
10	0.0	65.5
11	0.0	65.5
12	0.0	65.5
13	0.0	65.5
14	0.0	65.5
15	0.0	65.5
16	0.0	65.5

OK Cancel

Viewing Monoblock Statistics

Monoblock screen / Statistics tab

The *Statistics* tab is a read-only display of live monoblock voltages, listed alongside the preset high and low voltage limits. You can use this page to check that the Monoblock voltages are correct, and that the monoblocks are responding as expected.

The screenshot shows the 'PowerShield Configuration' software window with the 'Statistics' tab selected. The 'Monoblock statistics' table displays the following data:

MB	LOW(V)	HIGH(V)	VOLTAGE
1	9.0	15.0	13.0
2	9.0	15.0	13.0
3	9.0	15.0	13.0
4	9.0	15.0	13.0
5	9.0	15.0	13.0
6	9.0	15.0	13.0
7	9.0	15.0	13.0
8	9.0	15.0	13.0
9	9.0	15.0	13.7
10	9.0	15.0	13.7
11	9.0	15.0	13.7
12	9.0	15.0	13.7
13	N.A.		
14	N.A.		
15	N.A.		
16	N.A.		
17	N.A.		
18	N.A.		
19	N.A.		
20	N.A.		
21	N.A.		

The interface also includes a sidebar with navigation options: Disconnect, Monoblock, Store, Alarms, Memories, Current/Temp, System, Test, and Clear Alarms. The status bar at the bottom shows 'CORP: ACTIVE', 'COP1: 9600', 'CONNECTED', 'INSTALLER: Ready', and 'PC Time: 12:17:26 30/05/2005'.

Configuring Strings

The functions described in this section can all be accessed from the *String* screen. To access this screen, click the button labelled *STRING* on the left hand side of the main screen, or select *Configure/String* from the menu.

Assigning String Data

String screen / Configuration tab

After the monoblocks have been configured, they must be grouped into strings.

The *Configuration* tab is shown below.

STRING	MB TYPE	FIRST MB	LAST MB	CURR CH	TEMP CH	AUX IN
1	12v, 0Ah	1	4	0-1	3-1	0
2	12v, 0Ah	5	8	3-1	0-1	0
3	12v, 0Ah	9	12	0-2	0-2	0
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

To configure a string, double click on the grid row corresponding to the string to be configured. Alternatively, select the grid row and press enter. This will cause the *String Configuration* Dialog Box to appear. This dialog box allows you to set the configuration for a single string.

Note: If the access level is set to *USER*, string configuration will be disabled. You must change the access level to *INSTALLER* to alter the string configuration.

String Parameters

Select the correct nominal monoblock voltage (i.e. 2V, 6V or 12V), and the capacity of the string in Amp-hours. The capacity rating should be the 10-hour rating, which should be available from the battery manufacturers data sheets.

Monoblocks

Enter the first and last monoblocks numbers for the string (this information should be contained in the MMF).

If you want the *PowerShield* system to automatically set the string voltage limits for the string (this is recommended), then ensure that the check-box labelled “*Set Default String Voltage Limits*” is ticked. You will be able to change these voltage limits later. However, the default limits set by the *PowerShield* system are a good starting point.

Current and Temperature Channels

In most cases, a current channel and a temperature channel will be assigned to the string. The monitor and port numbers for the current and temperature inputs should be specified in the SCF. It is possible to configure a string without a temperature channel (in which case no temperature information is recorded about the string) or even without a current channel (in which case no current information is recorded about the string).

For information on the correct channel numbers to use, see the section “Configuring Current and Temperature Sensors”, on page 37.

Note: Activation of discharge and recharge memories rely on current information. Not assigning a current channel to a string will prevent event logging of all string data.

If the string has a current channel allocated, select the Monitor to which the current sensor is physically connected, and the local channel that it uses.

If the string has a temperature sensor allocated, select the Monitor to which the temperature sensor is physically connected, and the local channel that it uses.

If you want the *PowerShield* system to automatically set the current and temperature limits for the string (this is recommended), then ensure the appropriate check boxes are ticked. You will be able to change these limits later. However, the default limits set by the *PowerShield* system are a good starting point.

Note: You cannot assign more than one string to a single current or temperature channel..

Auxiliary Input

If a current sensor is not assigned to the string, an Auxiliary input may be assigned to the string. For more information on auxiliary inputs, see the section “Auxiliary Inputs” on page 62.

If a current sensor is assigned to the string, the auxiliary input is ignored.

Activating the String Configuration

Once you have entered all of the string parameters, monoblock, current, temperature and auxiliary input information, and you are satisfied that the information is correct, click *OK*.

The *PowerShield* system will now configure the string as specified. This may take a number of seconds if the string is large – especially if it contains monoblocks monitored by networked Monitors. A message box will be displayed while the configuration is taking place.

If you want to exit the string configuration dialog without making any changes to string configuration, click *Cancel*.

Configuring String Limits

The *Configuration* software allows string limits to be set in three different ways.

- By ticking the “*Set Default Limits*” boxes when configuring strings (as described above).

- By following the methods described in the following sections.
- By using the *PowerShield* Limits Wizard.

Limits Wizard

The Limits Wizard will guide you through the process of configuring voltage, current and temperature limits for your *PowerShield* site.

To access the Limits Wizard select *Limits Wizard* from the Configure menu, and then follow the onscreen instructions.

The Wizard will prompt you for various parameters relating to the site that you are configuring. The Wizard will use these parameters to configure the limits for the site.

The information required to complete the Limits Wizard is:

- Nominal Float Voltage – can be expressed as Volts per Cell, Volts per Monoblock or Volts per String
- Minimum and Maximum temperature limits
- Minimum operating voltage per string
- Maximum charger current
- Maximum load current

With the above information, limits will be calculated and displayed. It is recommended that the Limits Wizard is used initially and limits are then edited as required.

The wizard does not set monoblock voltage limits, for information on this, see the section “Setting Monoblock Limits” on page 28.

Configuring String Current and Temperature Limits

String screen / Configuration tab

A current alarm can be activated if a string current exceeds pre-set limits.

A temperature alarm can be activated if the recorded temperature exceeds pre-set limits.

If you selected *Set Default Current Limits* and *Set Default Temperature Limits* when assigning the string data, the *PowerShield* system will automatically set the current and temperature limits for the string.

The current limits may be viewed or modified by pressing the *Configure Current Channel* button on the *Configuration* tab.

The temperature limits may be viewed or modified by pressing the *Configure Temp Channel* button on the *Configuration* tab.

For more information on current and temperature limits, and on how to configure the current and temperature channels, see the section “Configuring Current and Temperature Sensors” on page 37.

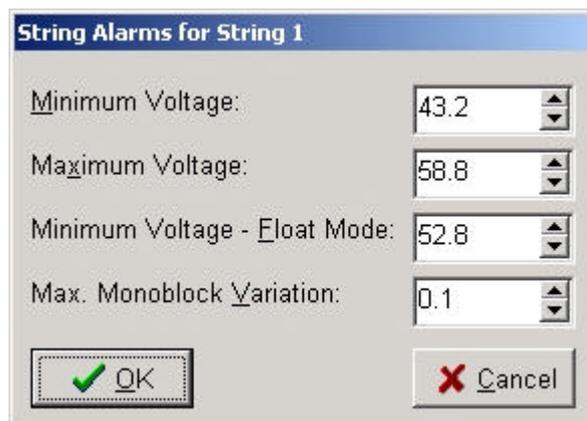
Setting String Voltage Limits

String screen / Limits tab

A voltage alarm can be activated if a string voltage exceeds preset limits. If you selected the *Set Default String Voltage Limits* option when assigning string data, then the voltage limits will have been set to default values by the *PowerShield* system.

The *Limits* tab allows you to view these limits and modify their values.

To configure string alarms, double click the desired string number, or select the desired string and press the *ENTER* key. The *String Alarms for String X* dialog box will appear.



In the *String Alarms for String X* dialogue box, enter the following values:

Minimum Voltage : This is the minimum allowed voltage of the string, under worst case discharge conditions.

Maximum Voltage : This is the maximum allowed voltage of the string, under maximum charge.

Minimum Float Voltage: This should be set just below the nominal float voltage of the string. Below this voltage, if the current is below the discharge threshold, the string is assumed to be in discharge; if the current is above the discharge threshold, the string is assumed to be in charge.

Maximum Monoblock Variation: This should be set to be just larger than the maximum expected monoblock variation throughout the string.

To enable or disable alarms, see the section “Configuring Alarms” on page 49.

Viewing String Statistics

String screen / Statistics tab

The *Statistics* tab is a read-only display of live string data.

Use the *String Number* field to select the string to be viewed.

Information shown includes:

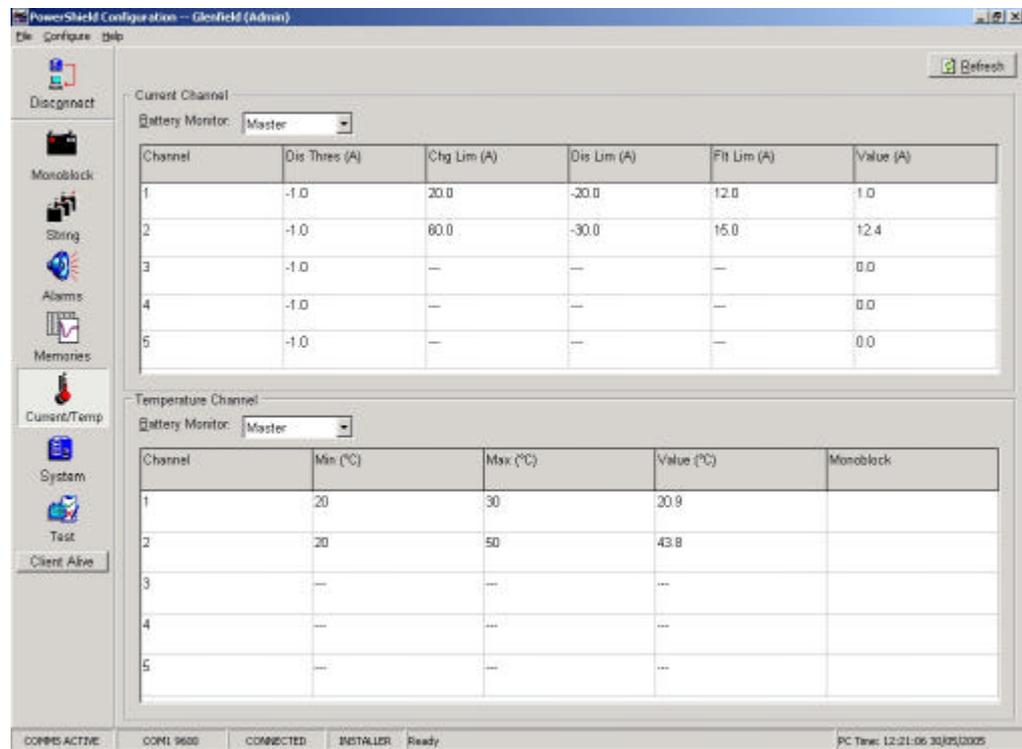
- Total number of monoblocks in the string
- Total string voltage
- Total number of mapped monoblocks in the string
- Lowest MB voltage, and the relevant MB number
- Highest MB voltage, and the relevant MB number
- Current and temperature readings - as recorded by the probes assigned to this string.

Listed beside the data for the selected string, is the status of all the strings in the system - Discharge, Charge, or Float.

Note: *If the current sensors have not been calibrated, the current readings for the string may be incorrect or may be zero. See the section “Setting up Current Sensors” on page 37 if this is the case.*

Configuring Current and Temperature Sensors

Each Sentinel has inputs for five current sensors and five temperature sensors.



The functions described in this section alter the configuration of the current and temperature sensors. The functions can all be accessed from the *Current/Temp* screen. To access this screen, press the button labelled *CURRENT/TEMP* on the left hand side of the main screen, or select *Configure/Current/Temp* from the menu.

In all systems, current and temperature alarm limits must be set. The current sensors must also be calibrated. In some systems, the mappings between current sensors and current *channels* may also need to be changed from the default values. This will usually only occur if the system has a single current sensor or a single temperature sensor associated with more than one string.

Setting up Current Sensors

Current/Temp screen

The *Current/Temp* screen contains a grid showing the current channel configuration for a single Monitor.

In systems with more than one Monitor, view the information for each by selecting the Monitor number in the drop down selection box labelled *Battery Monitor*.

To alter the configuration of a current channel, double click on the appropriate channel in the grid, or select the channel and press the *ENTER* key. The *Current Channel Configuration* dialog box will appear.

Note: If the access level is set to *INSTALLER*, you will be able to alter all of the parameters relating to the current channel. If the access level is set to *USER*, then you will only be able to alter the limits for the channel, and set the zero current point for the sensor.

Changing the Current Channel Limits

You may enter the charge, discharge and float current limits for a current channel directly into the *Current Channel Configuration* dialog box. If these limits are exceeded, an Alarm will be triggered.

Note: PowerShield uses a convention where negative current represents current in the discharge direction, and positive current represents current in the charge direction. If you set the charge limit to a negative value, the charge current alarm will never trigger. If you set the discharge limit to a positive value, the discharge current alarm will never trigger.

Changing the Current Discharge Threshold

The current sensor discharge threshold is the value of discharge current below which the string associated with the current sensor is assumed to be in discharge mode [the string voltage must also be less than the Minimum Float Voltage]. The discharge threshold value may be changed by entering a new value directly into the *Current Channel Configuration* dialog box.

The default value for the discharge threshold for each sensor is one amp. You should set this value so that it is just less than the smallest discharge current you would like to be able to detect.

Calibrating Current Sensors

To give accurate readings, each current sensor must be calibrated after installation. This can be done in two ways.

1. If the transducer model is known, it can be selected directly from the drop down list available. This automatically enters the appropriate gain, allowing a zero current point to be set (Zero Point Calibration).

Note: If the transducer model is known but is not listed, see “Appendix B – Current Transducer Gain Values” on page 63 for more information.

2. If the transducer type or nominal gain of the transducer is not known, you need to perform full calibration of the transducer. This requires the ability to set the current flowing through the transducer to two distinct, known currents. (Full Calibration)

Note: Ensure any current switching is done at an appropriate time, so as not to compromise the systems supported by the battery.

Performing Zero Point Calibration

Select the current transducer, as used for the string, from the drop down box. This will enter the appropriate gain value.

If the transducer model is not listed, see “Appendix B – Current Transducer Gain Values” on page 63 for more information.

If an under or oversized transducer is being used, select the correct multiplier. For more information on using under or oversized transducers, see the section “Appendix B – Current Transducer Gain Values” on page 63.

Now set the current flowing through the transducer to zero amps, or a known value close to zero amps. Click the *Zero Point Calibration* button, and follow the onscreen instructions.

The current transducer should now be calibrated.

Check that the direction of current flow is correctly recognised by the Monitor. Put the string that the sensor is attached to into charge mode, and check that the current shown by the Monitor increases in the positive direction. Alternatively, put the string into discharge mode, and check that the current becomes negative.

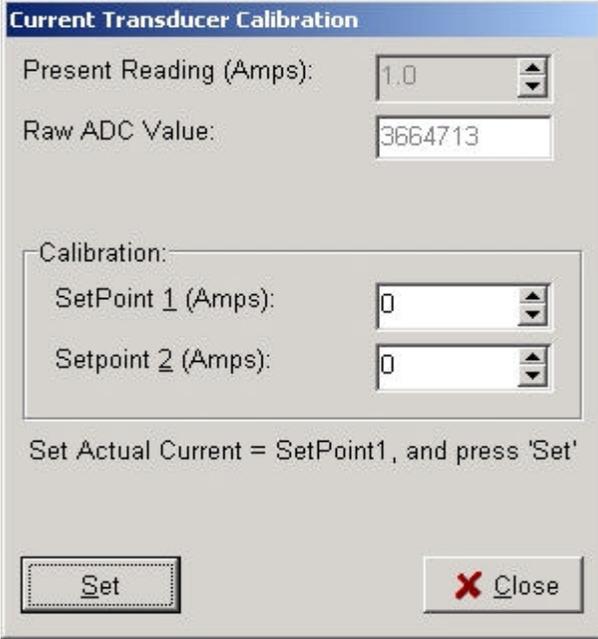
If the Monitor is not detecting the direction of current flow correctly, you need to invert the sign of the Gain value entered (ie. Tick or untick the Direction tick box).

Performing Full Calibration

To perform full calibration of a current sensor associated with the current channel, click the *Perform Full Calibration* button. The *Current Transducer Calibration* dialog will appear.

Note: If the access level is set to *USER*, this function will be disabled.

The dialog box allows you to enter the two set-point currents that are used in the calibration. Note that the convention used is that charge current is a positive number, and discharge current is a negative number.



The screenshot shows a dialog box titled "Current Transducer Calibration". It contains the following fields and controls:

- Present Reading (Amps):** A numeric input field with the value "1.0" and a spinner control.
- Raw ADC Value:** A numeric input field with the value "3664713".
- Calibration:** A group box containing:
 - SetPoint 1 (Amps):** A numeric input field with the value "0" and a spinner control.
 - Setpoint 2 (Amps):** A numeric input field with the value "0" and a spinner control.
- Set Actual Current = SetPoint1, and press 'Set'**: A text instruction.
- Buttons:** A "Set" button and a "Close" button with a red 'X' icon.

Enter the two currents that you will be using for the calibration, set the current flowing through the transducer to set point 1, and click the *Set* button.

Now set the current flowing through the transducer to set point 2, and click the *Set* button.

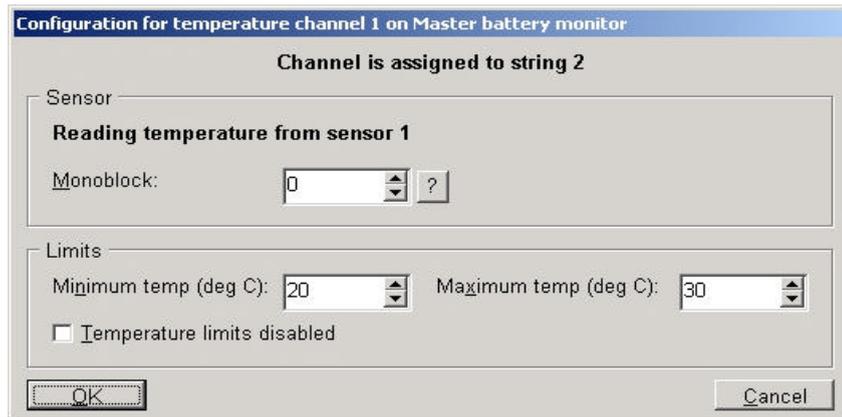
The calibration should now be complete. If the Monitor did not detect a change in current during the calibration process, or the values read were out of range, an error will be displayed. Check the wiring of the current transducer to the Monitor, and check that the transducer is connected to the correct input of the Monitor.

Setting up Temperature Transducers

Current/Temp screen

The *Current/Temp* screen contains a grid showing the temperature channel configuration for a single Monitor.

In systems with more than one Monitor, view the information for each by selecting the Monitor number in the drop down selection box labelled *Battery Monitor*.



To alter the configuration of a temperature channel, double click on the appropriate channel in the grid, or select the channel and press the *ENTER* key. The *Temperature Channel Configuration* dialog box will appear.

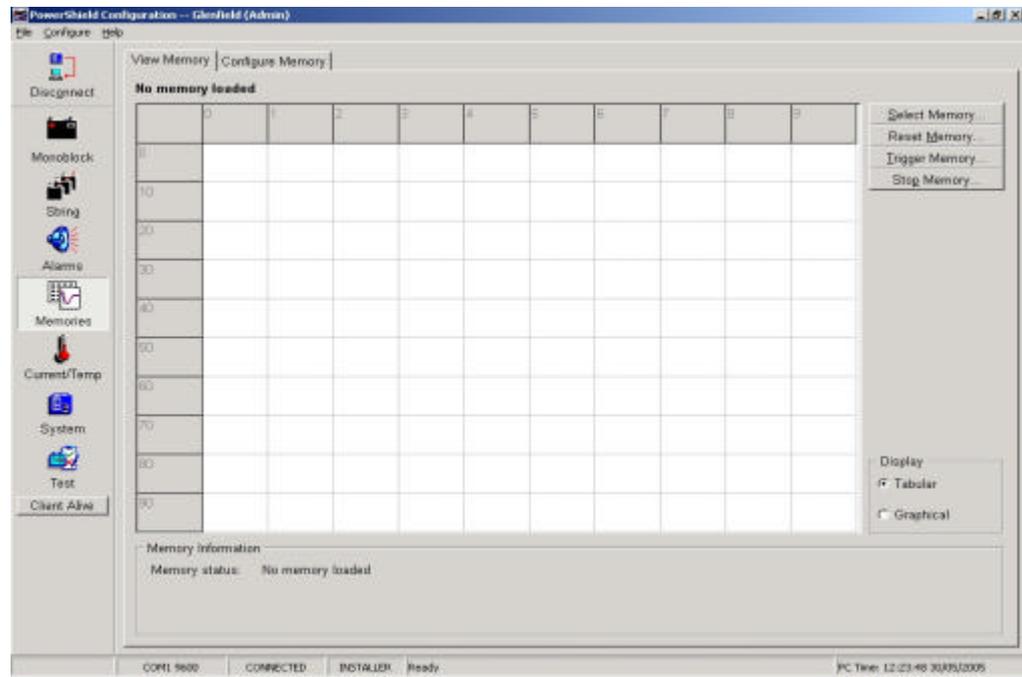
Note: If the access level is set to *INSTALLER*, you will be able to alter all of the parameters relating to the temperature channel. If the access level is set to *USER*, then you will only be able to alter the limits for the channel.

Changing the Temperature Channel Limits

You may enter the maximum and minimum limits for the temperature channel directly into the *Temperature Channel Configuration* dialog box. If these limits are exceeded, an Alarm will be triggered.

Configuring Memories

The functions described in this section can all be accessed from the *Memories* screen. To access this screen, press the button labelled *MEMORIES* on the left hand side of the main screen, or select *Configure/Memories* from the menu.



Types of Memory

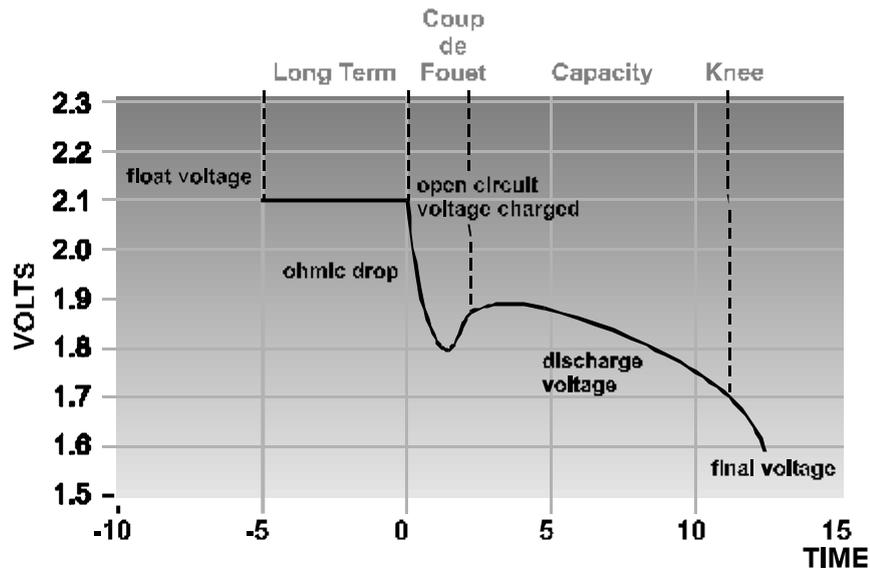
The *PowerShield* system has a number of different types of memory, designed to capture different characteristics of the batteries being monitored. Each memory has a set number of samples, but the logging interval and triggering characteristics of the memories may be configured by the user.

Capacity Memory

Initial logging – 20 samples, minimum sample interval 2 second, then 60 samples, minimum sample interval 2 seconds.

The Capacity Memory captures data during a battery discharge. It is made up of two parts, giving a total of 80 samples. The capacity memory should be set to cover the rated backup or expected discharge duration.

The graph below shows the voltage during a typical discharge of a lead-acid cell.



Please note that the curve is a general presentation of the different phases of a discharge.

The *Capacity* memory logs current, temperature, monoblock voltage and string voltage. These memories start logging when a string changes from float or charge mode, into discharge mode (this is detected by monitoring the current in the string).

The shorter sampling rate at the start of the *Capacity* memory, captures detail during the initial part of the discharge. This allows a closer examination of the initial voltage dip (called the *Coup de Fouet*) that occurs at the start of a discharge when discharging a fully charged cell.

The remainder of the *Capacity* memory is designed to log the entire discharge in less detail.

If the string moves to charge mode, the *Capacity* memory will stop logging (and the *Recharge* memory will start logging)

Recharge Memory

50 Samples, minimum sample interval 2 second

The *Recharge* memory is designed to log the recharge of the battery after it has been discharged. It measures current and temperature, monoblock voltage and string voltage. It is triggered when a string moves from discharge mode into charge mode.

Long Term Memories

100 Samples each (minimum, maximum and average), minimum sample interval 1 day

The *Long Term* memories measure the maximum, minimum and average current, temperature and voltage for each logging interval. The minimum logging interval is one day, but the logging interval may be set to be as long as many weeks. The *Long Term* memories are always logging.

Medium Term Memory

50 Samples. minimum sample interval 1 second

The *Medium Term* memory provides a log of the recent history of the current, temperature and voltage of the battery system. The purpose of this memory is to provide recent history for the diagnosis of alarms. The *Medium Term* memory is always logging.

Formatting Memories

Memories Screen / Configure Memory Tab

The PowerShield System has a dynamic memory storage system, space is allocated for each memory with respect to the monoblock mapping and configuration. This gives maximum data storage for each PowerShield system.

For example, where a Monitor has a lot of modules connected to it, the fixed memories (Long and Medium Term) occupy a relatively high proportion of available data storage. However where there are fewer modules, the fixed memories occupy less space, allowing a higher quantity of discharge data to be stored.

Before configuring the memories, the Module memory system must be formatted. This allocates the appropriate memory storage space for each Monitor.

Clicking the *Format Memory* on the *Configure Memories* tab, will format the Monitor memory storage. The allocated spaces can be seen in graph form.

Note: *Proceed with caution, formatting the memory will delete any existing data, and may reset logging intervals. Only format the memory during the initial system configuration, or if the configuration has been altered. If the access level is set to USER, memory formatting will be disabled. You must change the access level to INSTALLER to format the memories.*

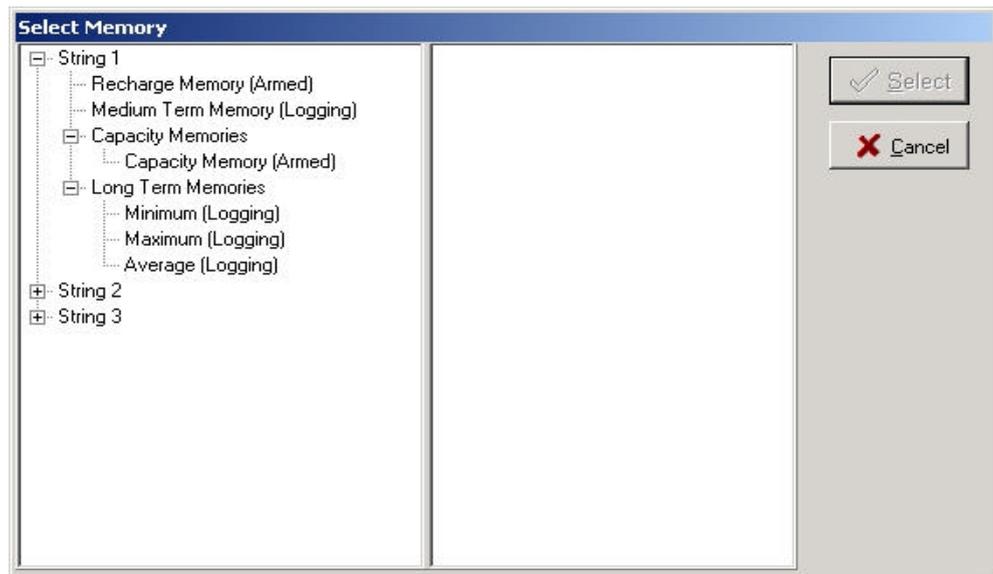
Format the memories after all monoblocks and strings have been mapped, but prior to setting logging intervals and trigger options.

Viewing a Memory

Memories Screen / View Memory Tab

The *Memories* screen allows you to view the contents of the *PowerShield* system's logging and archived memories, as stored by the monitors in the system.

To display the contents of a memory, click *Select Memory*. The *Select Memory* dialog will appear.



The logging and archived memories are filed within a tree structure. (Much like Microsoft Explorer) The left side of this dialog box displays the tree, and allows you can select any memory in the system. The right side of the dialog box displays the string and monoblock records available.

Each string in the system is listed, under each string are the four memory types – *Recharge*, *Medium Term*, *Capacity*, and *Long Term*. Under *LONG TERM* are *Minimum*, *Maximum* and *Average*. Under *CAPACITY* are any archived *Capacity* memories. (Existing *Capacity* memories are dated and archived when a new discharge is detected and logging begins)

Each memory is tagged with its current state, full, armed or logging. If the memory is tagged “Unknown State”, the Monitor has not had its memory system formatted. See “Formatting Memories” on page 44.

To move within the tree, double click a string or memory type. Once the desired memory is selected, click to select from the string and monoblock records on the right.

When you click *Select*, the contents of the memory will be uploaded from the Monitor, and displayed in the main grid on the *Memories* screen. The display

will be automatically updated every 5 seconds, so memories that are logging show live data.

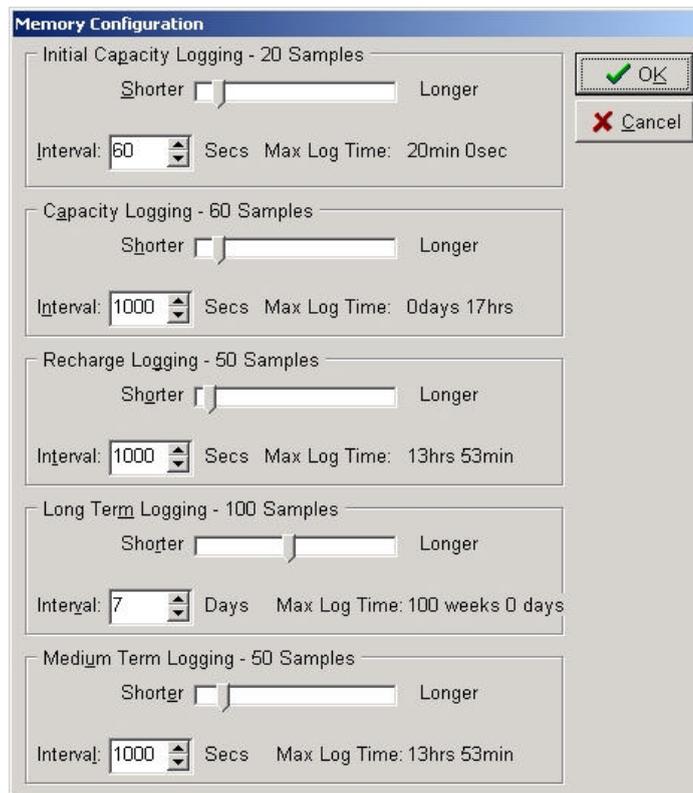
To display the contents of the memory in tabular format, click the radio button labelled *Tabular* on the *Memories* screen.

To display the contents of the memory in graphical format, click the radio button labelled *Graphical* on the *Memories* screen.

Configuring Memory Intervals

Memories Screen / Configure Memory Tab

Clicking the *Configure Intervals* button on the *Configure Memory* tab allows you to configure the logging intervals for the memories. The *Memory Configuration* dialog appears.



The intervals for any of the memories may be modified by entering values into the edit boxes, or dragging the slide bars in this dialog box.

Once you have finished configuring the memory intervals, click *OK* to download the new intervals to the Monitor. Click *Cancel* to exit without modifying any intervals.

Setting Memory Options

Memories Screen / Configure Memory Tab

Clicking the *Configure Options* button on the *Memories* screen allows you to configure the triggering options for the memories.

The *Capacity* memory will trigger with every discharge that exceeds the Current Discharge Threshold (for more information, see the section “Configuring Current and Temperature Sensors” on page 37). Data from every discharge event is logged, and with each new event, data from the previous is dated and archived. Logging stops five samples after the string returning to charge mode.

If a string changes state rapidly (within 5 samples) from discharge to charge and then back to discharge, the Monitor assumes it to all be a single event, and logs continuously.

This means that all discharges are documented and stored, regardless of duration, but the memory storage is utilised efficiently.

The *Capacity* memory may be set to either *Stop Recording Discharge Events* or *Continue Recording – Overwrite old Events*. This setting is only actioned when all available memory storage space is full, until this point it does not prevent discharge logging. (See the section “Formatting Memories” on page 44).

The *Recharge* memory may be configured for either *Single* or *Repetitive* triggering. The normal mode is *Repetitive*. With this option, the memory triggers each time a recharge event occurs. If the memory has old data in it at this stage, the data is over-written. In effect, this means that while every recharge event is logged, only the most recent event is held.

If a memory is set for *Single* triggering, triggering only occurs the first time a recharge event occurs. The data from the first event is not over-written, and subsequent events are not logged. Re-triggering only occurs once the memory has been manually reset (see “Resetting Memories”, below).

Resetting Memories

Memories Screen / View Memory Tab

Clicking the *Reset Memory* button on the *View Memory* tab screen allows you to reset all the memories of a specified type for a string. This causes the contents of the memories to be cleared, and the memory pointer to be reset to zero. In the case of a memory set to *Single* trigger, this also arms the memory’s trigger so that it can be re-triggered.

Note: *If the access level is set to USER, memory resetting will be disabled. You must change the access level to INSTALLER to reset a memory.*

Triggering Memories

Memories Screen / View Memory Tab

The *Capacity* and *Recharge* memories may be manually triggered under PC control. This is useful to test the operation of a memory. In most cases, the memories will be triggered automatically when a discharge or recharge event occurs.

To trigger all the memories of a specified type for a string, click the *Trigger Memory* button. A dialog box appears allowing you to select which memories you would like to trigger.

Once triggered, the memories will run until they are full.

Note: If the access level is set to USER, memory triggering will be disabled. You must change the access level to INSTALLER to trigger a memory.

Stopping Memories

Memories Screen / View Memory Tab

Once the *Capacity* and *Recharge* memories have been triggered, they may be stopped manually by clicking the *Stop Memory* button. This function is useful when testing the operation of a memory.

Note: If the access level is set to USER, memory stopping will be disabled. You must change the access level to INSTALLER to stop a memory.

Configuring Alarms

The functions described in this section can all be accessed from the *Alarms* screen. To access this screen, press the button labelled *ALARMS* on the left hand side of the main screen, or select *Configure/Alarms* from the menu.

Alarms are an important feature of the *PowerShield* system. Ensure that care is taken to set limits to suitable values; to have alarms enabled when appropriate; and that the Monitor is set to provide proper notification.

The configuration of alarm limits is not dealt with in this section.

For information on how to configure monoblock voltage limits, see the section, “Configuring Monoblocks” on page 26.

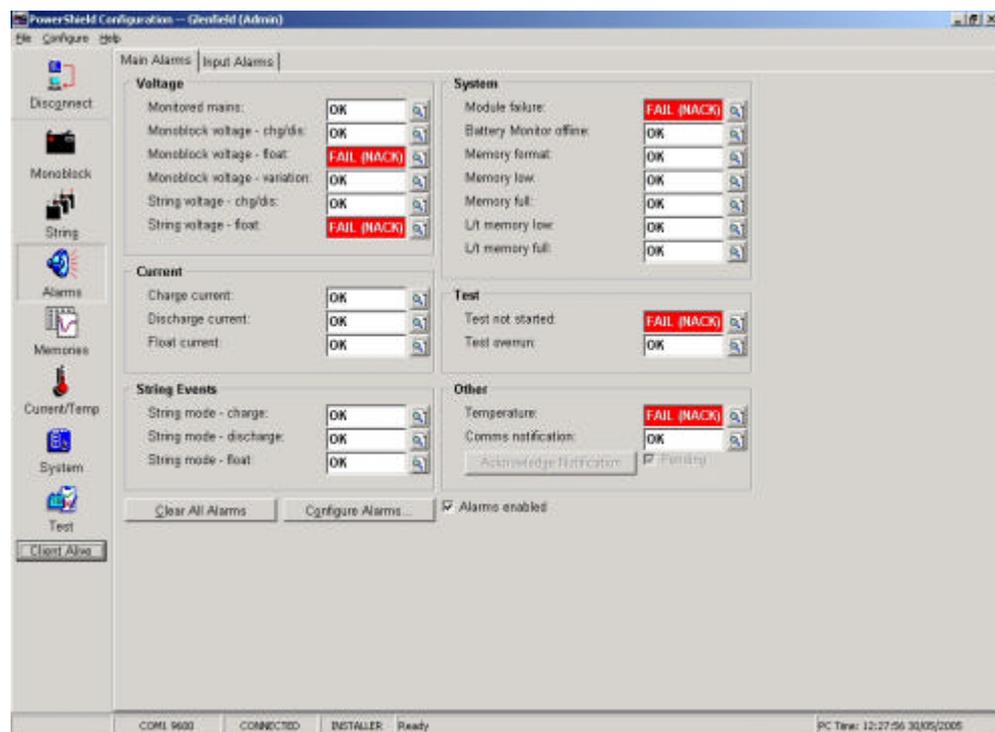
For information on how to configure string limits, see the section, “Configuring Strings” on page 31.

For information on how to configure current and temperature limits, see the section, “Configuring Current and Temperature Sensors” on page 37.

Viewing Alarm Status

Alarms screen / Main Alarms tab

The *Alarms* screen displays a summary of all alarms in the *PowerShield* system.



A brief description of each of the alarms is given in the section “Description of Alarms” below.

If an alarm has failed, detailed information about the alarm can be viewed by double clicking on the Alarm, or selecting the appropriate Alarm and pressing the *ENTER* key. The *Extended Alarm Information* dialog box will be displayed. This dialog box displays additional information about the alarm, including the time that alarm was triggered.

Description of Alarms

Monitored Mains

The Monitored Mains Alarm is triggered when the mains supply fails. This alarm must be configured, it is not on by default. See the section “Communications Options” on page 22.

Monoblock Voltage Alarms

The Monoblock Voltage Alarms are triggered when the voltage of any of the monoblocks in a system exceeds its pre-set limits. Limits for this alarm can be set when configuring the monoblocks in a system – see the section “Setting Monoblock Limits” on page 28 for more information.

The *Chg/Dis* alarm occurs when the voltage of a monoblock exceeds its limits in Charge mode or in Discharge mode. The *Float* alarm occurs when the voltage of a monoblock exceeds its limits in Float mode. Note that there are separate limits set for these two alarms. In general, the float mode limits will be much tighter than the Charge/Discharge mode limits.

Monoblock Variation Alarm

The Monoblock Variation Alarm is triggered when the variations of the monoblock voltages in a string exceed a pre-set limit. Limits for this alarm are set when configuring the strings in a system. For more information, see the section “Configuring String Limits” on page 33.

String Voltage Alarms

The String Voltage Alarms are triggered when the total voltage of a string exceeds its pre-set limits. Limits for this alarm are set when configuring the strings in a system. For more information, see the section “Configuring Strings” on page 31.

When a string is in Charge or Discharge mode, a String Voltage Alarm is triggered if the string voltage exceeds the string’s maximum limit, or is less than the strings minimum limit. When a string is in Float mode, the maximum voltage

limit is the same, but the minimum limit is determined by the *Minimum Float Voltage* specified during the configuration of the string.

Current Alarms

The Current Alarms are triggered when the current measured by a current transducer exceeds its pre-set limits. Limits for the alarm are set when configuring the current and temperature transducers. For more information, see the section “Configuring String Current and Temperature Limits” on page 34.

String Events

String Events are not fault conditions, rather a change of mode, from float to discharge for example. The change of string mode is considered important enough to give notification. The three modes are charge, discharge and float.

Module Failure Alarm

The Module Failure Alarm is triggered if a measurement module fails to communicate with the monitor it is attached to.

This will be caused by the module being disconnected from the Bbus, or by the module being de-powered.

Monitor Offline Alarm

The Monitor Offline Alarm is triggered when a Monitor that was previously responding, stops responding on the network.

This will obviously only occur in a networked system of two or more Monitors.

Memory Format Alarm

The Memory Format Alarm is triggered if the Monitor’s memory system is not formatted. This should only occur at the time of first configuration.

Memory Low Alarm

The Memory Low alarm is triggered when the dynamic part of the Monitor’s memory system (allocated to the Capacity and Recharge memories) is almost full. Check to ensure all memory data has been uploaded to the database, and clear the archive to allow further logging.

Memory Full Alarm

The memory full alarm is triggered when the dynamic part of the Monitor’s memory system (allocated to the Capacity and Recharge memories) is full. Check to ensure all memory data has been uploaded to the database, and clear the archive to allow further logging.

L/T Memory Low Alarm

The Long Term Memory Low alarm is triggered when the fixed part of the Monitor's memory system (allocated to the Long Term and Medium Term memories) is almost full.

Check to ensure all memory data has been uploaded to the database, and clear the archive to allow further logging.

L/T Memory Full Alarm

The Long Term Memory Full Alarm is triggered when the fixed part of the Monitor's memory system (allocated to the Long Term and Medium Term memories) is full.

Check to ensure all memory data has been uploaded to the database, and clear the archive to allow further logging.

Test Not Started Alarm

The Test Not Started Alarm is triggered when an unsuccessful attempt to start a test is made. This may be because of incorrect limits, alarms being present etc. See the section "Controlled Discharge Testing" on page 57.

Test Overrun Alarm

The Test Overrun Alarm is triggered if a test runs past its intended endpoint. A check is also made that the strings being tested also return to charge at the conclusion of the test.

Temperature Alarm

The Temperature Alarm is triggered if the measured temperature exceeds the set limits.

Comms Notification Alarm

The Communication Notification Alarm is triggered if four consecutive notification attempts are made, and are not acknowledged. Note that these notification attempts will only occur if the correct settings are made.

Clearing Alarms***Alarms screen / Main Alarms tab***

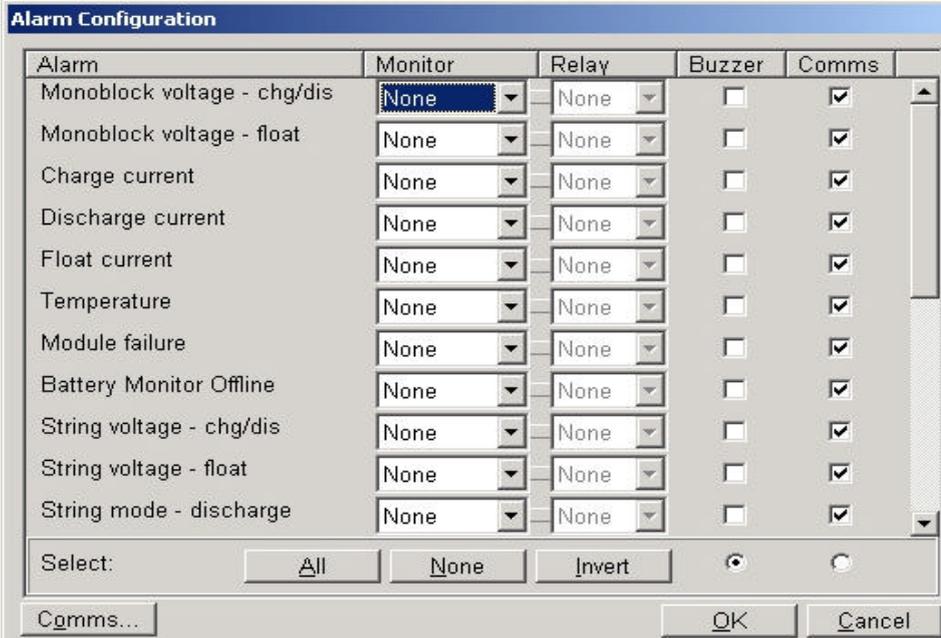
Once an alarm has triggered, you can clear all alarms by clicking the *Clear Alarms* button. All activated alarms will clear if the fault condition has ceased to occur. If a fault condition still exists, the alarm will re-activate.

Configuring Alarms

Alarm screen / Main Alarms tab

Each alarm can be configured to give an alert, either via a relay output; to live monitoring software; an audible alert for on site notification; or all of the above. Note that alarms will only occur if the correct limits have been set.

To set up these alarm notifications, click the *Configure Alarms* button.



Alarm	Monitor	Relay	Buzzer	Comms
Monoblock voltage - chg/dis	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Monoblock voltage - float	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Charge current	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Discharge current	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Float current	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Temperature	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Module failure	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Battery Monitor Offline	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
String voltage - chg/dis	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
String voltage - float	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
String mode - discharge	None	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Select:

Each alarm is listed on the *Alarm Configuration* dialogue box, with options for relay, buzzer, and comms.

Alarms may be selected individually, or by using the group selection buttons at the bottom of the alarm list.

Auxiliary Output Relay

Auxiliary output relays are provided so that the *PowerShield* system can trigger some piece of external equipment when an alarm goes off. For example, the system can turn on a light, sound a beeper, or trigger an input to a SCADA system if an alarm goes off.

When a relay is assigned to an alarm, that relay will be activated when the alarm is triggered. It is possible to assign a separate relay to each alarm (if there are enough relays in the system), or a number of alarms to a single relay.

To assign a relay to an alarm, select the Monitor and relay number, to which the external equipment is connected.

For more information on relays, see the section “Auxiliary Output Relays” on page 62.

Note: *For the auxiliary output relays to work, they must be correctly wired to an appropriate system.*

Audible Alert

To assign an audible notification for an alarm, click on the corresponding tick-box in the Buzzer column.

The Master Battery Monitor will sound a buzzer when the specified alarm is triggered.

Communication

If the Monitor is connected to live monitoring software such as *PowerShield Link*, alarm notification can be given across a TCP/IP network. This gives the advantage that multiple sites can be monitored live and simultaneously from a single host PC.

Contact PowerShield Limited for further information on *Link*.

To assign a comms notification for an alarm, click on the corresponding tick-box in the Comms column.

The Master Battery Monitor will sound notify the Host PC when the specified alarm is triggered.

Activating the Alarm Configuration

When all alarm configuration selections have been entered in the *Alarm Configuration* dialogue box, click *OK* to proceed.

Storing Backup Configurations

Backing up to Disk

To keep a record of the site configuration, it is possible to save to the host PC. This record becomes useful if the battery installation needs to be serviced or replaced, as it allows for a configuration to be altered for a time, then easily returned to its original format.

It also provides for a 'head office' copy of each site configuration to be kept.

To save to the host PC, select *Backup* from the File menu.

In the *Save Battery Monitor Configuration to File* dialogue box, select the required destination directory.

Enter a file name for the configuration, and click *Save*. The save operation will take several minutes for large installations.

The file is saved as a BATTERY MONITOR FILE type, with the suffix .DAT.

Note: Installation configuration takes time. Ensure a backup copy is always saved to disk.

Restoring from Disk

If an installation configuration has been backed up to disk, it can be re-loaded onto the same, or another monitor of the same model type.

To restore a saved configuration onto a monitor, select *Restore* from the File menu.

Select the appropriate file from the directory (it must be a *.DAT file type) and click *Open*.

At the completion of the configuration load, you will be prompted to reset the all monitor's in the system.

Note: Installation configuration takes time. Prior to changing a configuration, ensure it is necessary.

Configuration Checklist

At the completion of installation, if there appears to be a problem, return to the applicable section of the manual and ensure that all steps have been completed correctly. This checklist is not intended as a substitute for a full and complete understanding of this manual.

- PowerShield Configuration software successfully installed
- Monitor configuration reset to defaults
- Sitename, time and date set for the new site
- Communication parameters set
- All measurement modules detected
- All measurement modules mapped to correct monoblocks
- Strings configured and assigned string limits
- Current sensors configured and calibrated
- Temperature sensors configured
- Memories configured
- Alarms configured
- Configuration has been completed and saved
- Configuration saved to disk as a backup (optional but strongly recommended)

Controlled Discharge Testing

The *Configuration* software has built in test control functionality. It allows controlled discharge tests to be performed on the monitored strings. PSL recommends that discharge tests are undertaken only by experienced operators, who have read and are familiar with this entire manual.

The monitor can be used to trigger a discharge via one of the relay outputs, and then automatically end the test when test limits are reached or if alarms occur. The monitor memories will trigger upon detecting the discharge (this assumes that all appropriate current and voltage settings have been made) and record it.

For more information on discharge triggers, see the section "Changing the Current Discharge Threshold" on page 38.

For more information on memories, see the section "Configuring Memories" on page 42.

Important: The test control function is intended for systems where all strings are identical, and connected in parallel. It is not intended for use with systems that cover multiple applications, for example a UPS and generator batteries.

All limits are referenced to String 1, and only one set of test limits may be set for a discharge. See following sections for more information on test limits.

The functions described in this section can all be accessed from the *Test* screen. To access this screen, press the button labelled *TEST* on the left hand side of the main screen, or select *Configure/Test* from the menu.

Test Controls

Test Screen / Present Tab

There are two types of discharge test that can be performed by the *Configuration* software, Automated and Supervised. All of the following test parameters that may be set, are specific to each type.

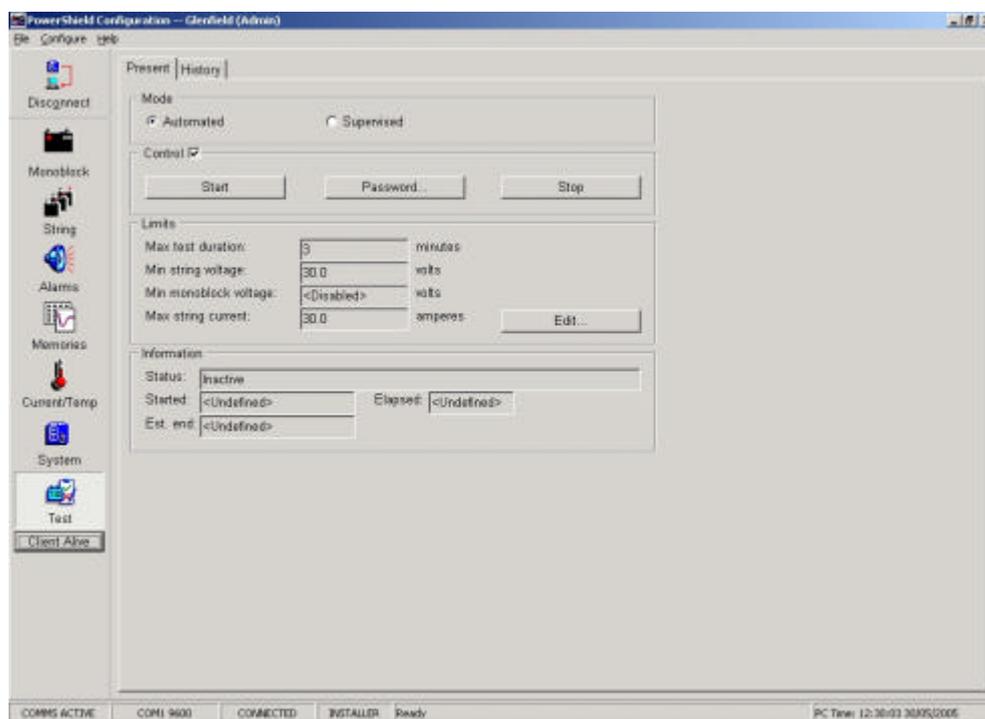
If you are using the User level access of *Configuration*, you will have access to both automated and supervised tests, however both are covered by password protection. You will be able to change the password, but only if you know the current password.

If you are using the Installer level access of *Configuration*, you will have access to both automated and supervised tests, and will not have to enter a password to start a test. You will be able to change the password.

When you first open the Test screen for a new monitor, the *Control* tickbox is unticked and disabled. A test will not start with this box unticked.

Ticking the box allows tests to be run at the site by other software packages like *PowerShield Vision*, where it appears in a read-only format. It is part of the monitor's configuration, and any changes to the state of the tickbox should be saved.

The box can only be ticked when using Installer level access of *Configuration*. See the section "Access Level" on page 15 for more information on access levels.



Automated Tests

Automated tests will not start with alarms present.

Automated tests will stop automatically as soon as any alarm is triggered.

Automated tests will stop automatically as soon as any of the enabled test limits are reached.

Supervised Tests

Supervised tests will stop if the *Client Alive* button is not clicked within the set interval. This is to ensure that the test is conducted with the appropriate supervision, as alarm conditions will not cause the test to stop automatically.

If the communication link is down, the client alive message will not be received by the monitor, and the test will terminate.

Supervised tests will stop automatically as soon as any of the enabled test limits are reached.

Test Limits

Configuration will not allow a test to start without at least one valid limit set enabled. Not all limits must be enabled.

To be valid, test limits must be within the normal run-time limits. For example; a minimum monoblock voltage test limit cannot be set at 10.2V, if the normal limit is set at 10.4V. All test limits are referenced to String 1.

To set test limits, click the *Edit...* button. The *Battery Test Limits* dialog box will open.

To edit a limit, it must be enabled. To enable a limit, tick the tickbox below it. The limit edit box becomes live.

Enter the desired value. When all desired limits have been set, enable those which you wish to run the test to. This may vary for example if you want to confirm available backup time, or stop test at a predetermined low voltage point. Click *OK* to confirm limits.

Test Passwords

If you are using the User level access of *Configuration*, you will have access to both automated and supervised tests, however both are covered by password protection. You will be able to change the password, but only if you know the current password.

To change the password, click the *Password* button. Enter the existing password in the *Old* line. Now enter the chosen new password in the *New* line, enter it again in the confirmation line, and click *OK*.

If you are using the Installer level access of *Configuration*, you will have access to both automated and supervised tests, and will not have to enter a password to start a test. You will be able to change the password.

To change the password, click the *Password* button. You do not have to know the existing password. Simply enter the chosen new password in the *New* line, enter it again in the confirmation line, and click *OK*.

Note that the password for Automated tests is different to the password for Supervised tests.

Battery Test Control

The monitor can be used to trigger a discharge via third party equipment.

Relay 2 on the monitor is the designated Battery Test Control relay. When a test is started, the relay switches, and the signal can be used to initiate a discharge. The monitor will start logging when it detects the discharge.

When test limits are reached, or alarms occur, the Battery Test Control relay will drop out, ending the discharge. Note that manually triggered discharges will not be covered by this auto-stop feature.

For more information on relays, see the section “Auxiliary Output Relays” on page 62.

***Note:** For the auxiliary output relays to work, they must be correctly wired to an appropriate system. See the separate document "PowerShield Installation & Wiring Manual" for correct wiring procedures.*

Running a Test

Test Screen / Present Tab

PSL recommends that discharge tests are undertaken only by experienced operators, who have read and are familiar with this entire manual.

Starting a Test

To start a test, complete the following steps:

- Confirm the PowerShield system is operating and communicating correctly.
- Confirm monitor memory space is available
- Confirm the *Control* tickbox is ticked
- Confirm the status of any alarms (remember that alarms will prevent an automated test starting).
- Set and enable valid and appropriate test limits
- Click the *Start* button
- The test should now start, and the discharge begin.

At the bottom of the *Present* tab is an information bar. It shows the status - Inactive, Initialising, Active, Finalising - of the test, along with the start, elapsed, and estimated end times.

Note that an estimated end time will not be displayed if a test duration limit has not been enabled.

If the test did not start, check the *History* tab for details. See the section "Viewing Test Data" on page 61.

Stopping a Test

An Automated test will stop automatically if an alarm occurs for any reason, or when test limits are reached.

A Supervised test will stop automatically when test limits are reached, or if the *Client Alive* button is not clicked within the required time.

A test may be stopped at any time by the operator. To stop a test, click the *Stop* button.

Viewing Test Data

Test Screen / History Tab

Once a test has been completed, the relevant details and the limits under which it was conducted, may be viewed on the *History* tab.

This is useful for determining why a test has been terminated prematurely, or why a test has failed to start.

Appendix A – Auxiliary Channels

Auxiliary Inputs

Each Sentinel provides four Auxiliary Inputs for taking digital signals from third party equipment. Each input may be allocated and named at the Alarms Screen.

Current Sensor

If the string does not have a current sensor, the *PowerShield* system can use the Auxiliary Input to decide if the string current is in the charge or discharge direction. If the auxiliary input is ACTIVE, then the string is assumed to be in discharge. If it is INACTIVE, then the string is assumed to be in charge mode.

Current information is, obviously, not logged or stored if a string does not have a current sensor.

Wiring of the Auxiliary input terminals is described in the manual “*PowerShield* Installation & Wiring Manual”.

Mains Failure Detect

The *PowerShield* system can use the Auxiliary Input to monitor the local mains supply. If the auxiliary input is ACTIVE, then the mains supply is assumed to be on. If it is INACTIVE, then the mains supply is assumed to be off.

Wiring of the Auxiliary input terminals is described in the manual “*PowerShield* Installation & Wiring Manual”.

Note: The auxiliary input can only be wired for one of the above functions, and the Sentinel must only be configured to utilise one.

Auxiliary Output Relays

Each Sentinel provides four auxiliary output relays. These may be configured to activate when an alarm is triggered, Relay 1 may be used as a 'system alive' indicator, and Relay 2 may be used as a battery test control.

The relay connections on the back of a Sentinel have three pins, NC [Normally Closed], NO [Normally Open], C [Common]

When the relay is not active, the “nc” connection is connected to “c” and the “no” connection is open. When the relay is active, “nc” goes open, and “no” is connected to “c”.

Appendix B – Current Transducer Gain Values

The following table lists the current transducers supplied by PSL, and their nominal gain values when connected to a monitor. This list matches the list available for selection within the Configuration Software.

TRANSDUCER TYPE	B1000 Gain	Sentinel / B2000 Gain
LEM HA200SB	0.012207	0.000030
LEM HA400SB	0.024414	0.000060
LEM HAL50S	0.007629	0.000019
LEM HTA100S	0.015258	0.000037
LEM HTA200S	0.030516	0.000075
LEM HTA300S	0.045776	0.000112
LEM HTA400S	0.061035	0.000149
LEM HTA500S	0.076294	0.000186
LEM HTA600S	0.091553	0.000224
LEM HTA1000S	0.152584	0.000373
URD HCS-36-200-AP		0.0000745058
URD HCS-36-500-AP		0.0001862650
URD HCS-36-800-AP		0.0002980230

Transducer Orientation

The sign of the gain depends on the orientation of the transducer when it is installed.

For LEM & URD transducers, if the transducer is installed in with the arrow pointing in the direction of conventional current flow when charging, you should enter a negative gain. For example, for a HA200SB connected with the transducer arrow pointing in the direction of the conventional current flow, you would enter '-0.012207'.

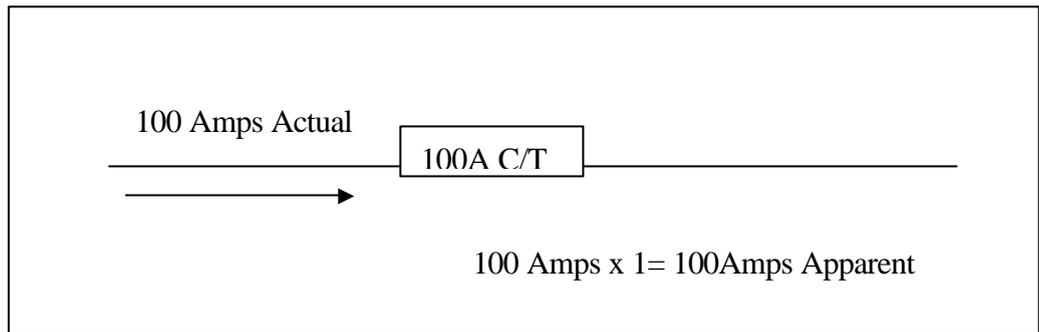
Oversized and Undersized Current Transducers

Current sensors are usually supplied as part of a complete PowerShield system. However where an existing system is being upgraded or expanded, the current transducers may be undersized for the new system.

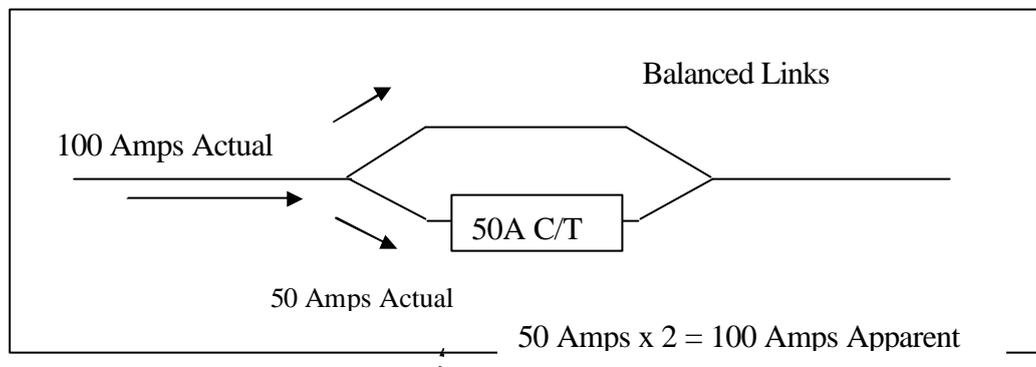
Similarly, a customer may want to re-use an existing current transducer which is under or over rated for the application.

The *Configuration Software* allows for these circumstances by providing a multiplier in the Configuration of Current Channel dialog.

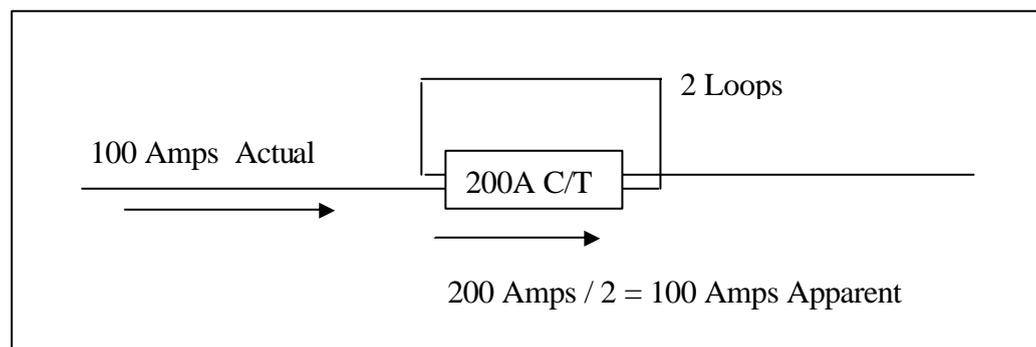
The common method is to use a transducer directly sized for the application. This usually requires the supply cable to pass through the transducer once.



To use an under sized transducer it is possible halve the actual current being measured by splitting the main supply cable using two balanced links and fitting the smaller current transducer to only 1 of these links.



To use an oversized transducer it is possible to double the actual current being measured by looping the main supply cable through the transducer.



Once the current Transducer is installed, select the correct multiplier from the drop down box in the Configuration of Current Channel dialog and continue calibration as usual. See below for multiplier examples.

- For directly specified transducers the multiplier is x1.
- For undersized transducers the multiplier is selectable from x2 to x5

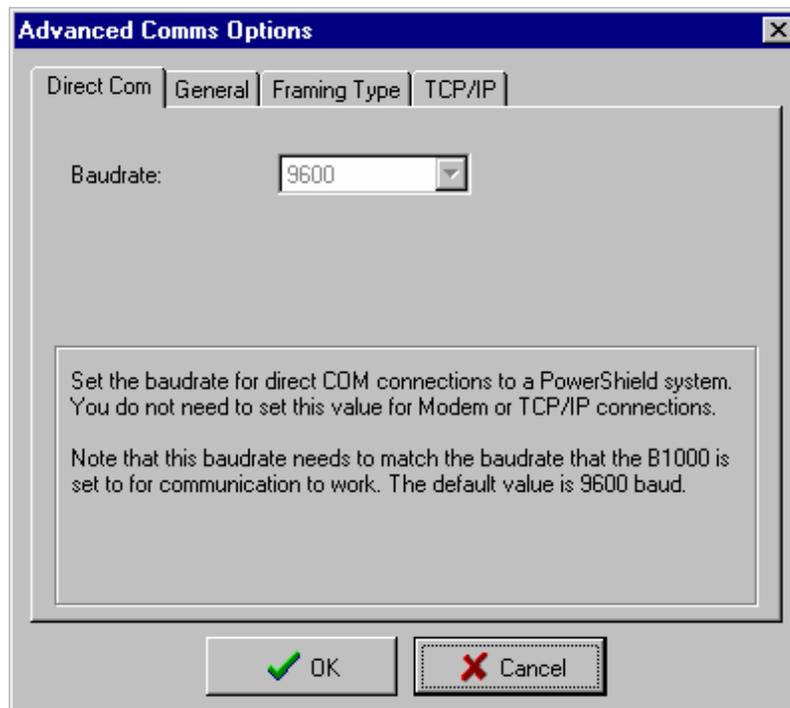
- For oversized transducers the multiplier is selectable from /2 to /5.

Appendix C – Advanced Comms Options

There are a number of communications options available for communicating with the *PowerShield* system. Usually the default communications options will suffice, and you will not need to change any of the advanced options. In some special cases, however, you may need to modify the options or view the communications options to check that they are correct for the *PowerShield* system you are attempting to communicate with. This section outlines what the communications options are, and how they affect communications with the *PowerShield* system.

The Advanced Comms Options Dialog Box

To access the “Advanced Comms Options” dialog box, click the ADVANCED button on the “Connect to Battery Monitor” dialog box.



Direct Com Options

Options on the “Direct Com” tab relate only to direct serial (RS232) links to a *PowerShield* system.

Baud rate:

This option sets the baud rate for connecting to the *PowerShield* system. This baud rate must match the baud rate of the *PowerShield* system for communication to work. The default value for the baud rate is 9600 baud.

For information on how to set the baud rate of the *PowerShield* system, see the section “Communications Options” on page 22.

General Options

Options on the “General” tab relate to all types of communication link (Modem, Direct COM and TCP/IP).

Response Timeout:

This is the number of seconds that the PC software will wait for a response from the *PowerShield* system before displaying a dialog box indicating that a response was not received. The default value for this parameter is three seconds.

If you are using a cellular modem link, it may be necessary to increase this timeout value, since the amount of time for a message to be transmitted across the cellular network may be quite long, especially if signal strength is low.

Note: If both the Response Timeout and the Response Retries are set to high values, the Configuration Software may appear to hang for some time until communications are regained or confirmed as lost.

Response Retries:

This is the number of communication retries the *Configuration Software* will automatically attempt before alerting the user to a loss in communication with the monitor. These retries, when occurring, are displayed at the left end of the status bar at the bottom of the main window.

Note: If both the Response Timeout and the Response Retries are set to high values, the Configuration Software may appear to hang for some time until communications are regained or confirmed as lost.

Modbus Address:

This parameter defines the Modbus address of the *PowerShield* system. In almost all cases, the *PowerShield* systems have their Modbus address set to 247. If you have an RTU version of the firmware loaded into the monitor units, you may need to use a different Modbus address in order to communicate.

Note that communication will not be possible if the Modbus address is set to the wrong value.

Note that this RTU firmware method is different to connecting to a Sentinel or B2000 monitor via Port 2. Refer to ‘Configuring for Modbus [via Port 2]’ on page 25 for more information.

Framing Type

PowerShield offers two types of monitor firmware, MODBUS ASCII and MODBUS RTU. Options on the “Framing Type” tab relate to the low level framing of the Modbus messages that are sent to the *PowerShield* system. In general, it is best to set the Framing Type to “Modbus ASCII”.

Some special versions of the firmware loaded into the monitor units will accept Modbus RTU commands only. The “Modbus RTU” selection is provided to support this firmware. Note that if you select “Modbus RTU” for a monitor that does not support Modbus RTU, communication will not work.

Note that this RTU firmware method is different to connecting to a Sentinel or B2000 monitor via Port 2.

TCP/IP

Options of the “TCP/IP” tab apply only to connections that are being made using the TCP/IP protocol. This is generally only used when connecting to a *PowerShield* system over an Ethernet LAN.

Note that the Ethernet devices in *PowerShield* monitors conform to standard Ethernet protocols, and can be managed as with any network device.

The *PowerShield* Sentinel and B2000 monitors use Lantronix XPort embedded Ethernet devices. Refer to the supplied *PowerShield* CD for utilities, or to www.lantronix.com for more information.

IP Address:

This specifies the IP address of the *PowerShield* device you are attempting to communicate with.

Must be in the standard form xxx.xxx.xxx.xxx

Port:

This specifies the port number of the *PowerShield* device you are attempting to communicate with.

For a Sentinel or B2000 monitor, the Port is always 10001