

# **Float Current Monitor**

## **FS3**

---

## **User Manual**

Version 4.0.10

Copyright Polytronics Engineering Ltd.

©2009 All Rights Reserved

# Table of Contents

1	General.....	5
2	Installing the Float Current Monitor.....	6
2.1	Installing the Core.....	7
2.1.1	Installing as Ground Fault Detector.....	7
2.2	Segment voltages.....	8
2.3	Temperature Sensor.....	9
2.4	Pilot Temperature Sensor (Optional).....	10
2.5	Analog Voltage Output (Optional).....	10
2.6	Turning the Unit ON.....	10
2.7	Device Communication.....	11
2.7.1	RS232 Communication.....	11
2.7.2	RS485 Communication.....	11
2.7.3	USB Communication.....	12
2.7.4	Fiber-Optics to Serial Converter (Optional).....	12
2.7.5	Ethernet (Optional).....	12
3	Float Current Monitor Utility Software.....	14
3.1	Installation.....	14
3.1.1	Connecting.....	14
3.1.2	Communicating Over a Modem/Ethernet.....	15
3.1.3	Communicating With Multiple Devices.....	16
3.1.4	Changing Device ID.....	17
3.1.5	Reading Device.....	17
3.1.6	Downloading Data.....	17
3.1.7	Clearing Data on Device.....	17
3.1.8	Setting Time and Date.....	17
3.1.9	Configuring the Device.....	18
4	Float Current Monitor LCD and Keypad.....	22
4.1	Keypad.....	22
4.2	First Level Menu.....	23
4.2.1	Status Display.....	23
4.2.2	Alarm Display.....	23
4.2.3	Segment Voltages.....	25
4.2.4	Temperature / Ripple Current Display.....	25
4.2.5	System Time / Device ID Display.....	25
4.3	Second Level Menu (Cycle Table).....	26
4.4	Third Level Menu (Used Capacity).....	26
4.4.1	Used capacity and event duration display.....	26
4.5	Fourth Level Menu (Stored Data).....	26
4.5.1	Number of Stored Data and Alarms.....	26
4.5.2	Number of Stored Cycles.....	26
4.5.3	Clear Memory.....	26
4.6	Fifth Level Menu (Capability).....	27
4.6.1	BTM Mode.....	27
4.7	Sixth Level Menu (Calibration Offset).....	27

4.7.1	Calibration Offset.....	27
4.7.2	Increase/Decrease Offset .....	27
5	Log File Format .....	28
5.1	Alarm File Format.....	28
5.2	Data File Format .....	28
5.3	Cycle File Format .....	30
6	Changing Ethernet Settings.....	31

## List of Figures

Figure 1: Float Current Monitor Pin Assignments .....	6
Figure 2: Extending the core and temperature sensor for more than 6 feet (optional) .....	7
Figure 3: Connecting the Core to the Battery Monitor .....	7
Figure 4: Connected for Ground Fault Detection. ....	8
Figure 5: Connecting the Battery Terminal to the Factstar.....	8
Figure 6: Four Cell Configuration Setups - Total Voltage Measurement or Segment Measurements	9
Figure 7: Eight Cell Configuration Setup - Segment Measurements .....	9
Figure 8: Device Power Configuration .....	10
Figure 9: RS232 Communication Connection.....	11
Figure 10: RS485 Communication Connection.....	12
Figure 17: Advanced COM Port Settings Window .....	15
Figure 18: Float Current Monitor Configuration Window .....	18
Figure 19: LCD Menu Structure .....	22
Figure 20: Variations of the Status Display .....	23
Figure 21: Variations of the Alarm Display .....	24
Figure 22: Segment Voltages Display .....	25
Figure 23: Temperature/Ripple Current Display .....	25
Figure 24: Time/Device ID Display .....	25
Figure 25: Cycle Display .....	26
Figure 20: Computer Network Connection.....	31
Figure 21: Local Area Connection Properties .....	32
Figure 22: Internet Protocol (TCP/IP) Properties .....	33

# 1 General

The Factstar (Float Current Monitor, FS3) is a real-time, stand-alone battery monitoring system, which is capable of monitoring float current, temperature, charge/discharge current, string voltage and 4 segment voltages. The system is also capable of detecting a variety of alarms such as high or low voltages, pending thermal run-away, low capacity in the event of discharge. The Float Current Monitor System is composed of one, or numerous monitoring devices depending on the system.

The Float Current Monitoring package includes the following:

- Float Current Monitor device

- Power Supply

- Sensing Core (current transformer) with temperature sensor

- CD (Includes Factstar Utility & Manual)

Options:

- Resistive Clips

- Fuse Clips

- Power Converter

- Pilot temperature sensor

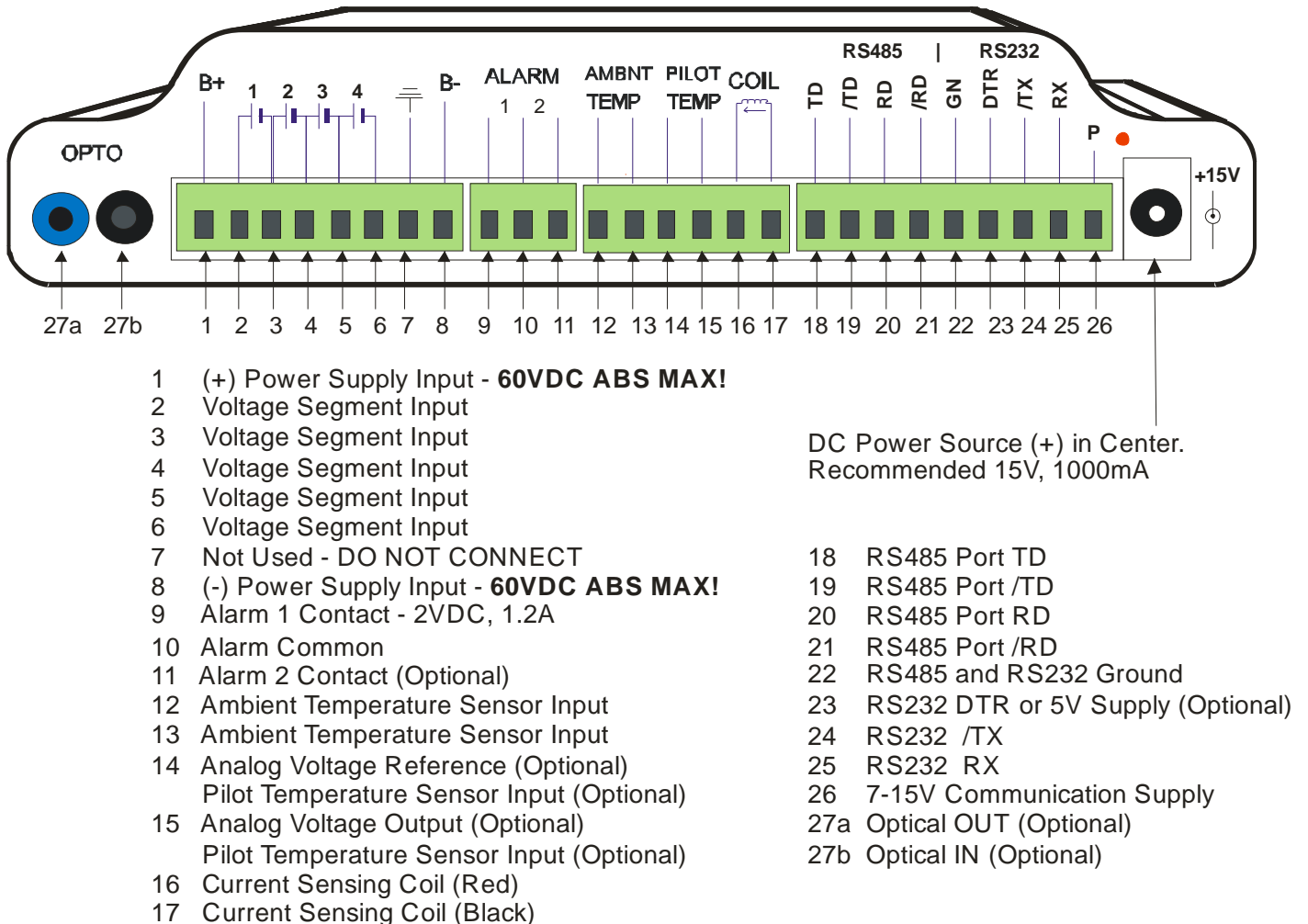
- Built in Ethernet web server

- Modem

## 2 Installing the Float Current Monitor

Find a suitable place to mount the Float Current Monitor in the battery room. Standard units will require a 120V AC outlet nearby. If an AC outlet is not close by, the Float Current Monitor can be powered off the batteries using a power converter (optional). The Float Current Monitor may be mounted using the mounting brackets on the back of the unit. See Figure 1 for connections.

**Warning: Do not plug the device in until you have completed all the connections to the battery that is being monitored.**



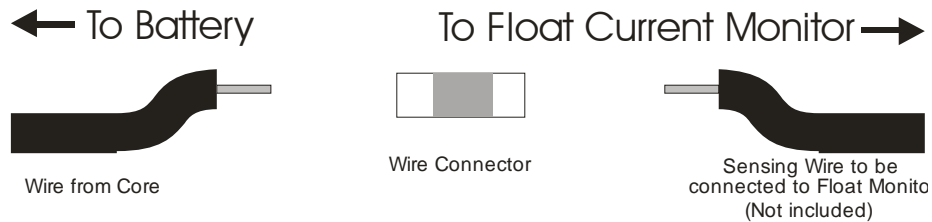
**Figure 1: Float Current Monitor Pin Assignments**

## 2.1 Installing the Core

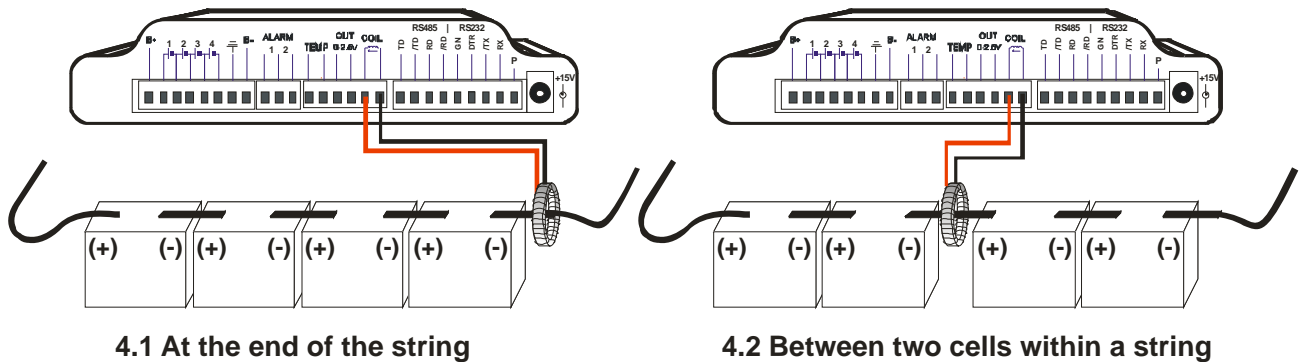
The Float Current Monitor ships with a current-sensing core. Install the core anywhere in the battery string by opening the battery string, and putting the wire that connects to the battery through the core (see Figure 2). The core is polarity sensitive, so check the label on it to be sure to that it is facing the right direction.

Once the core is installed, its sensing wires should be connected to the terminal as shown in Figure 3. The cable can be extended if necessary up to 30 feet with standard 18 gauge insulated cable as shown in Figure 2.

**Warning:** Do not drop, break, or damage the core. Damage can result in incorrect readings. When installing the core on the multi-post battery, do not install the core between posts of the same polarity!



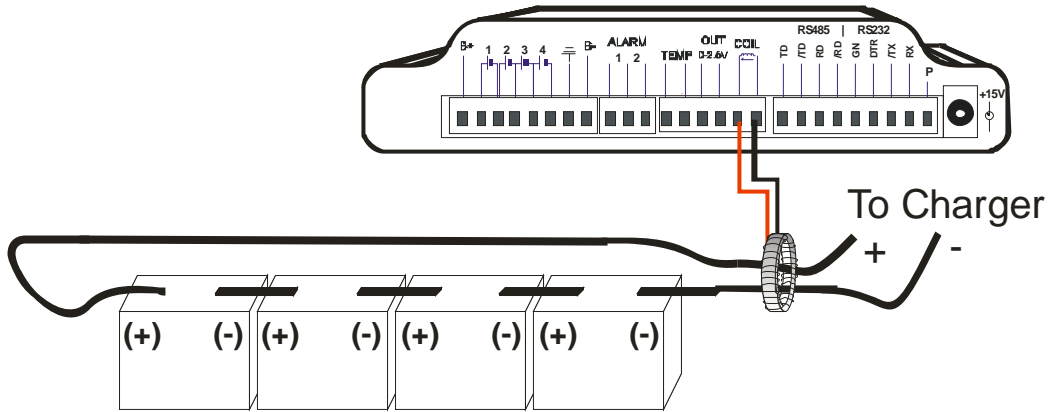
**Figure 2: Extending the core and temperature sensor for more than 6 feet (optional)**



**Figure 3: Connecting the Core to the Battery Monitor**

### 2.1.1 Installing as Ground Fault Detector

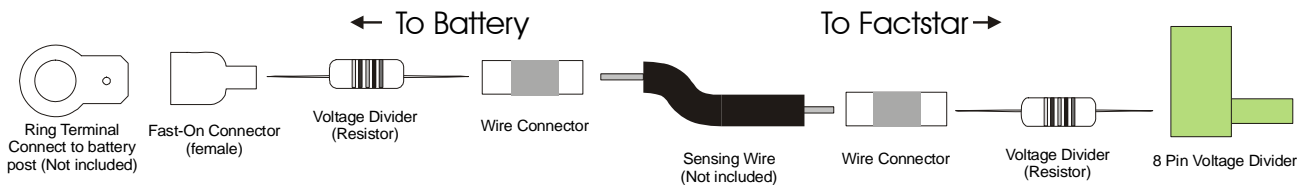
If the Float Current Monitor is being used as a ground fault detector, it is installed such that the core goes through both the positive and negative leads of the charger as shown in Figure 5.



**Figure 4: Connected for Ground Fault Detection.**

## 2.2 Segment voltages

Float Current Monitor monitors can measure up to four battery segments. Install ring terminals with male fast-on connectors to five battery posts (can be either positive or negative). Before connecting the segment sensing wire you need to install the appropriate voltage divider resistors (see Figure 5). The resistors do not come with the Factstar but can be purchased from Polytronics.



**Figure 5: Connecting the Battery Terminal to the Factstar**

Depending on the voltage levels of the batteries that are being monitored, different resistor values are required. Below is a table of resistor values for a specific voltage range.

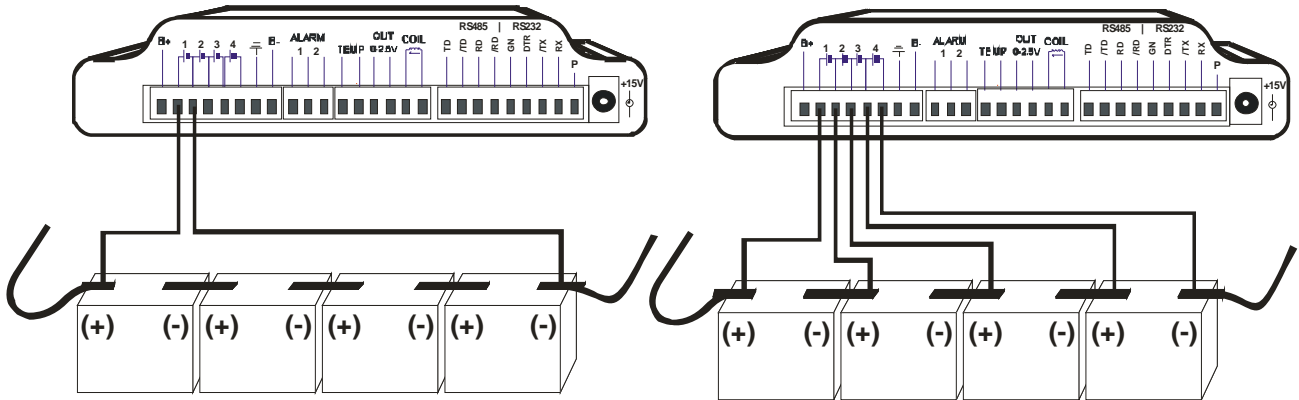
Range	Total String Voltage	Resistor Value	Segment Voltage Slope
A *	< 60 V	1K0 1% (Red)	4.380
B *	< 150 V	475k 1% (White)	10.07
C	< 450 V	2 x 1M5 1% (Black)	40.02
D	< 600 V	2 x 1M5 1% (Black)	40.02
E	> 600 V	Contact Polytronics	

\* Range A needs one resistor, either at the Float Current Monitor or at the battery post.

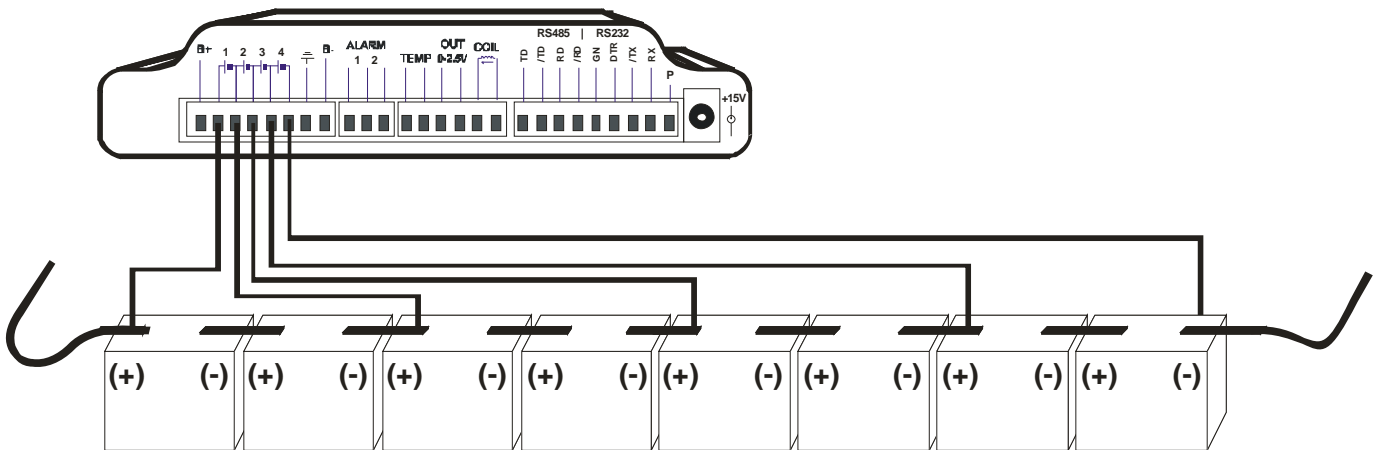
**Table 1: Voltage Ranges and Resistor Values**

If the battery string does not evenly divide into 4 segments, try to keep the segments as equal as possible. For example a 10-cell string can be divided into 4 segments of 4, 2, 2, 2 cells or 4 segments of 3, 3, 2, 2 cells. Either configuration is acceptable.

Once you have determined the correct resistor to use, follow the diagrams in Figure 6 and Figure 7 to complete the connections. Each connection on the battery posts should be done according to Figure 5.



**Figure 6: Four Cell Configuration Setups - Total Voltage Measurement or Segment Measurements**



**Figure 7: Eight Cell Configuration Setup - Segment Measurements**

## 2.3 Temperature Sensor

The temperature sensor is built into the core. It can also be purchased separately if position of the sensor is critical.

## 2.4 Pilot Temperature Sensor (Optional)

This temperature sensor connects where the analog voltage output is connected. This option gives the Float Current Monitor the ability to monitor and alarm ambient and pilot temperatures.

## 2.5 Analog Voltage Output (Optional)

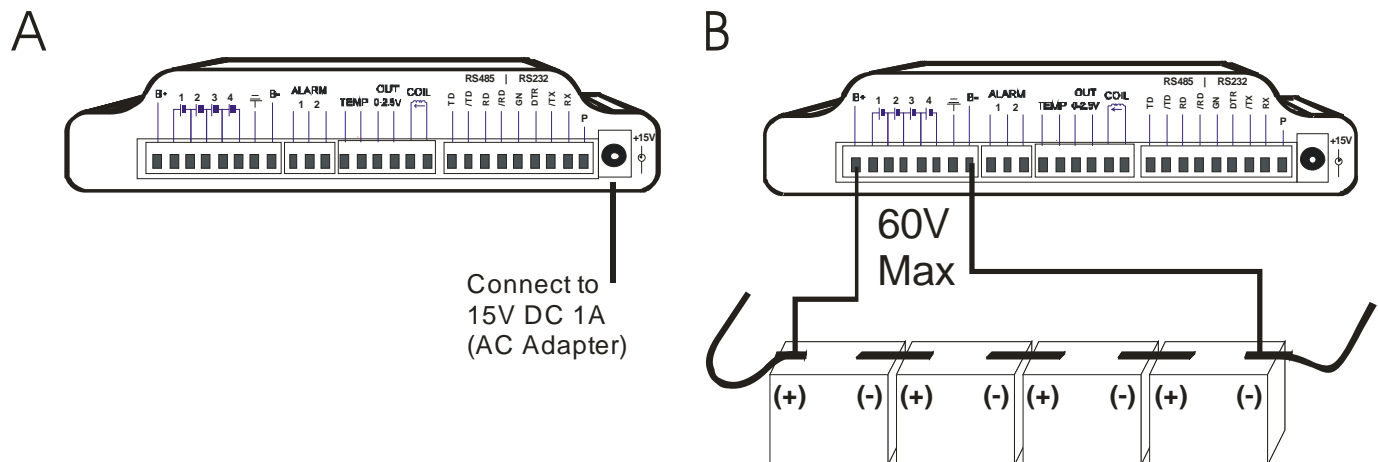
The voltage output is proportional to the measured current within these limits:

Low current: 0 – 1.50 V equivalent to 0 – 10 A

High current: 1.55 – 3 V equivalents to 10.001 – 600 A

## 2.6 Turning the Unit ON

Once you have completed all the relevant connections, plug the Float Current Monitor unit into an AC power source using the power supply provided, from the batteries being monitored (optional) or power converter (optional).



A – Powered from AC adapter

B – Powered from measured battery (optional)

**Figure 8: Device Power Configuration**

## 2.7 Device Communication

The Float Current Monitor can work alone with information displayed on the LCD. For most applications this is sufficient. However, the full utilization of the Float Current Monitor is only possible where communication between the Monitor and a computer is utilized.

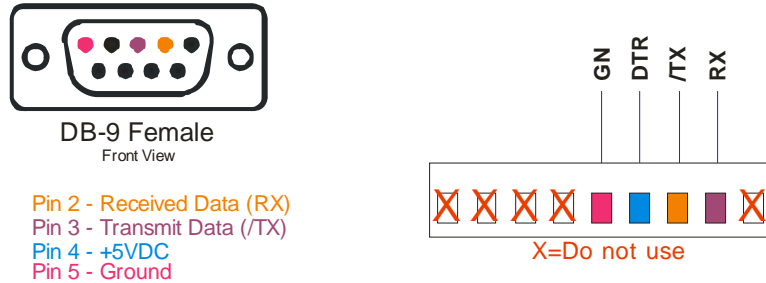
There are several ways to connect to the Float Current Monitor to the computer:

- RS485 to serial\USB converter
- RS232
- Fiber-optics to serial converter (optional)
- RS485 to Ethernet converter (optional)
- Ethernet (optional) with or without wireless connectivity

### 2.7.1 RS232 Communication

Serial communication is isolated from the rest of the Float Current Monitor and therefore requires an external power supply. For RS232, the power comes from the DTR and GND pins of a standard serial connector or a 5 VDC supply (optional) and are plugged into pins 22 (-) and 23 (+) of

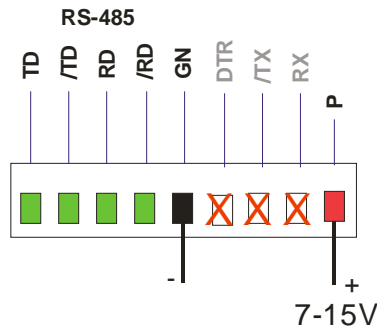
Figure 1 respectively. Refer to Figure 9 for wiring from the Float Current Monitor to a RS232 DB-9 Female connector.



**Figure 9: RS232 Communication Connection**

### 2.7.2 RS485 Communication

The power for the communication is supplied through pins 22 (GN, -) and 26 (P, +) of Figure 10. The voltage should be between 7 VDC and 15 VDC. Figure 10 shows the communication terminal block with green connections that represent the connections to RS485 communication link. A converter from RS485 to USB can be purchased from Polytronics.



**Figure 10: RS485 Communication Connection**

### 2.7.3 USB Communication

Connect a USB type B connector to the Float Current Monitor and the other end, type A, to the local PC. Install the driver and utility from the CD provided with the Float Current Monitor. Use the utility to connect to the Float Current Monitor using the USB communication port.

### 2.7.4 Fiber-Optics to Serial Converter (Optional)

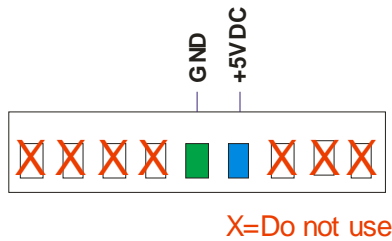
Fiber-Optics communication can provide a safer and isolated communication link between the Float Current Monitor and the computer. This connection requires you to have a fiber-optics model of the Float Current Monitor. You also have to optionally purchase a Fiber Optics to Serial Converter. You must also have two pieces (minimum 12" each) of fiber optic cabling.

First connect the serial cable to your computer and power on the converter through the supplied adapter. Once the converter is connected to the computer and powered on, connect a piece of fiber optic cable to the output (white or blue) of the converter into the input (black) of the Float Current Monitor. Then connect the other piece of fiber optic output of the Float Current Monitor (white or blue) into the input of the converter (black).

### 2.7.5 Ethernet (Optional)

Ethernet communication is isolated from the rest of the Float Current Monitor and therefore requires an external power supply. For Ethernet, the power comes from a 5 VDC supply and are plugged into pins 22 (-) and 23 (+) of

Figure 1 respectively. Refer to Figure 11 for wiring from the Float Current Monitor to a 5VDC power supply.



**Figure 11: Ethernet Connection**

The Ethernet cable connects to the top of the Float Current Monitor. The device can be configured on its own web page by opening a web browser and typing in the IP address of the Float Current Monitor. By default the device is set to the following:

**IP address: 192.168.0.1**  
**Subnet mask: 255.255.255.0**  
**Gateway: 192.168.0.254**

If the network the Float Current Monitor will be connected to does not have the same subnet mask and gateway as listed above, refer to Section 6 for further instructions on how to change the default network settings. The user name and password for the Float Current Monitor web page is “float” and “current” respectively. The web page allows you to set the network settings, upload new firmware, gather current data from the Float Current Monitor and configure its settings.

## 3 Float Current Monitor Utility Software

Float Current Monitor Utility software is provided for these functions:

- Downloading stored data and alarm list
- Clearing memory
- Changing Float Current Monitor ID number
- Setting Float Current Monitor clock
- Configuring Float Current Monitor and adjusting settings

The utility software runs on a Windows XP operating system and uses a serial port to communicate with the device.

A Float Current Monitor device is addressable and has a unique ID number in the range of 31 to 99. Hence, multiple Float Current Monitor devices (max 30) may be installed on the same RS485 communication network or optic cabling (full duplex, 9600 Baud, 8 data bits, 1 stop bit). The utility software could also be used remotely using a modem or TCP/IP to serial communication module.

***IMPORTANT: It is highly recommended to perform any Float Current Monitor reconfiguration (modification of its non-volatile memory) over a local communication link.***

### 3.1 Installation

To install insert the accompanied CD into your CD-ROM drive and follow the instructions on the screen.

If the CD doesn't launch by itself, do the following:

- Select "run" from the start menu.
- Type D:/setup and press Enter.

***Note: If your CD-ROM drive is labeled E, then you need to type E:/setup.***

After installing the Utility software, the software will have a shortcut on the desktop.

#### 3.1.1 Connecting

After connecting the Float Current Monitor to the computer, open the software utility. Select the COM port which you are using on the drop-down list. If you are connecting through TCP/IP, select it on the bottom of the drop-down list. If you are using a modem, select the associated radio button and enter the phone number. If you have multiple Float Current Monitors, check "Multiple Devices". If you are communicating through a Fiber Optics to serial converter, check "Fiber Optics". Check the "Delay" checkbox if connecting to the Float Current Monitor doesn't always work. Click the "Connect" button after checking that the Device ID is set correctly. If the serial

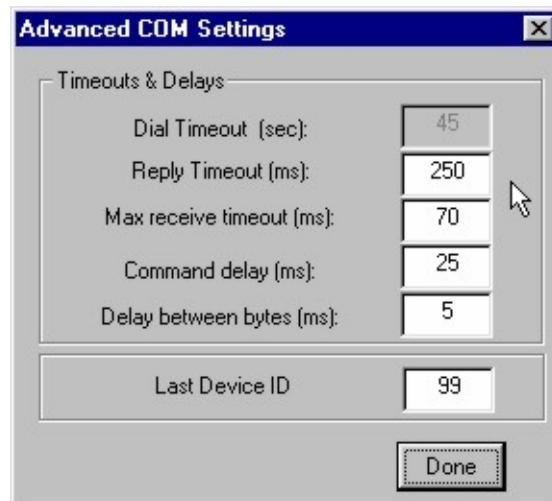
number (S/N) and firmware revision number (Rev) both show up, the communication with the Float Current Monitor has been established.

Note: If you need to find out the device ID for a particular device, you can press on the “Funcnt” key on the device itself several times until you get to the screen that displays the reference date, time and device ID (see section 4.2 First Level Menu)

### 3.1.2 Communicating Over a Modem/Ethernet

Selecting modem on the main screen automatically enables the text window next to it, where you enter the telephone number of the modem you are trying to communicate with. You can also change the settings for modem communication by clicking on the ‘Advanced’ button in the top left corner of the main screen. The Advanced COM Settings window will display (see Figure 12).

Once the communication is established, the procedure for reading data is the same as connecting directly to the device.



**Figure 12: Advanced COM Port Settings Window**

The functions of each of the fields in Figure 12 are explained below:

**Dial Timeout (sec):** The amount of the time the software waits to connect to the device.

**Reply Timeout (ms):** The maximum time period for reply the utility should wait before issuing an error message. This value depends on the communication link:

- Direct link: 100 – 300 ms
- Modem link: 250 – 500 ms
- TCP/IP link: 250 – 900 ms

**Max Receive Timeout (ms):** This field defines what the maximum time period the software should wait to receive the next data packet when transmission has started. This value should be in the range of ½ of the reply timeout. This field primarily applies to Float Current Monitor data downloading.

**Command Delay (ms):** This field defines the silence period between receiving a reply from the Float Current Monitor and issuing the next command. This value depends on the communication link type:

- Direct link: 50 – 100 ms
- Modem link: 100 – 200 ms
- TCP/IP link: 100 – 500 ms

**Delay Between Bytes (ms):** This field defines the silence period between command bytes. This value depends on the communication link type:

- Direct link: 0 – 5 ms
- Modem link: 2 – 7 ms
- TCP/IP link: 2 – 30 ms

**Last Device ID:** This field is the last device ID that a Float Current Monitor can have on the communication link.

### 3.1.3 Communicating With Multiple Devices

If you have a network of devices, you can communicate with any of them by simply connecting to any device on the network, either directly or through a modem.

The devices on the network must have different device IDs. You can only read data or download records from one device at a time.

If you do not know the device IDs on your network:

1. Enter 99 in the “Last Device ID” field in Figure 12
2. Check the “Multiple Devices” field in the top left corner of the main screen
3. Enter 31 in the “Device ID” field in the top right corner of the main screen
4. Click on Connect and then Detect in the main screen

If you already know the device IDs on your network:

1. Enter the highest ID number in the “Last Device ID” field in Figure 12
2. Check the “Multiple Devices” field in the top left corner of the main screen
3. Enter the lowest ID number in the “Device ID” field in the top right corner of the main screen
4. Click on Connect and then Detect in the main screen

Float Current Monitor will scan from the lowest ID to the highest ID and it will only show the devices it finds in the Device ID field.

After the scan is complete, select the device that you want to communicate with from the Device ID field, and follow the same procedure outlined in the previous sections.

### **3.1.4 Changing Device ID**

After you detect the device and are able to read the correct serial number, you can simply change the device ID by entering the new device ID in the “New ID” field, and click on Update. Note that the new device ID should be between 31 and 99.

***Important: Make sure there are no duplicates in ID numbers in the network.***

### **3.1.5 Reading Device**

Upon successfully connection and detection you can now read your Factstar device through your computer screen. By pressing “Read Data” you will receive a real-time battery monitoring data regarding Current, Large Current difference, Large Current, AC Ripple, Temperature, Total Voltage and string voltages respectively. Select “Segment V” if you want to see the segment voltages. What you are reading on the screen is the same as going on the Factstar and looking off the LCD. Reading the device on the computer is a great way to monitor your batteries without stepping into the battery room.

### **3.1.6 Downloading Data**

Click the “Download” button; you will be given the option to select where you would like to download. It is a good idea to note where you download your data so you can easily remember and access these files. When downloading data, there are two files that are downloaded; alarm and data. Both types of files are “.CSV”, which can be opened with Excel. See Log File Format for more detailed information on contents of files.

### **3.1.7 Clearing Data on Device**

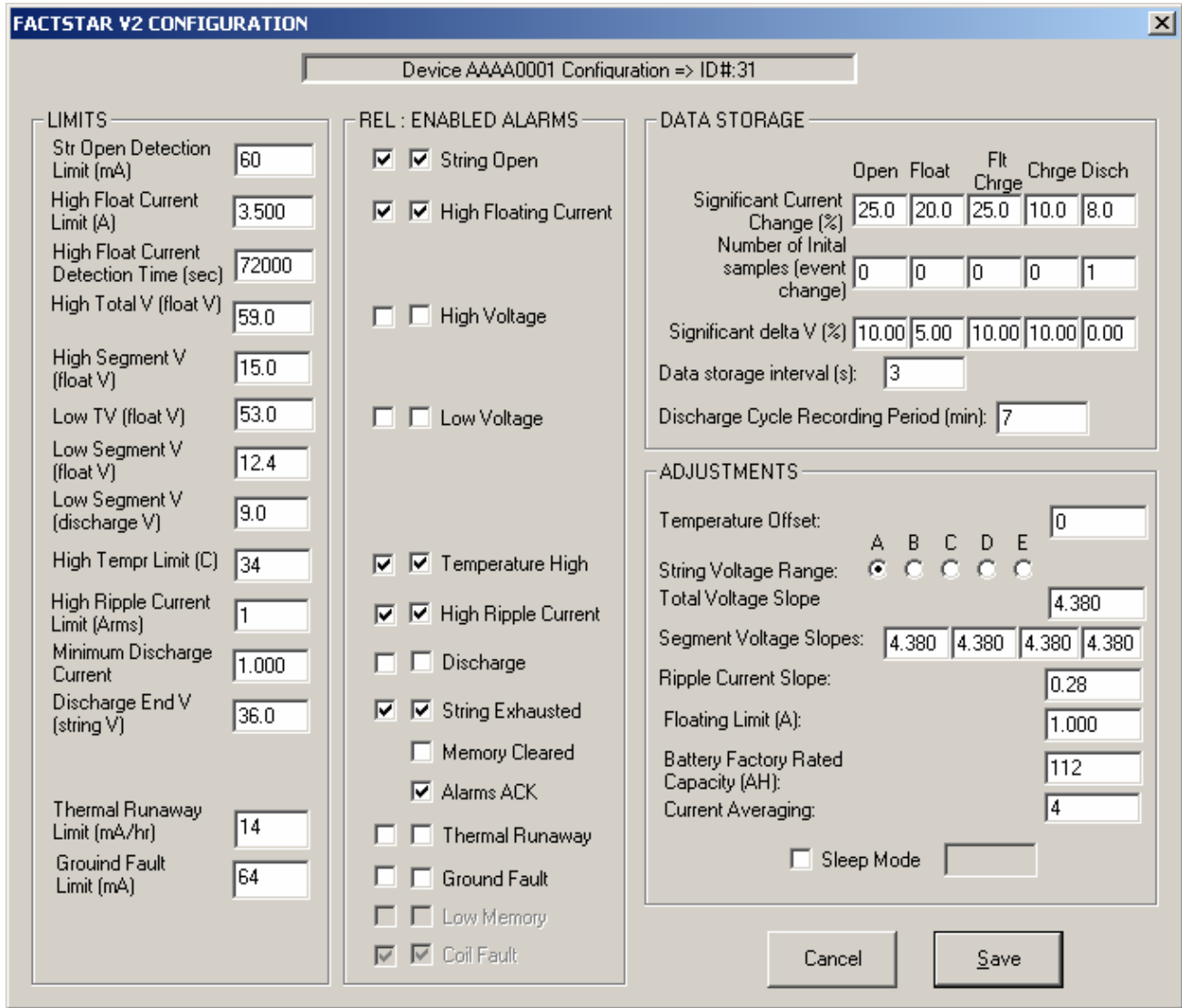
After downloading data, it is a good habit to clear the data to allow more memory space on the Float Current Monitor to store and collect more data. The Float Current Monitor is capable of holding up to 1 year of average data collection. To clear data on the Float Current Monitor, click on “Clear Memory” to delete the alarms, data and cycles.

### **3.1.8 Setting Time and Date**

To set the time and date on the Factstar, check “Synch” on the bottom right corner of the utility window. Click “Update Clock” to update the time of the Float Current Monitor with the time on the computer. The offset function allows you to offset the time in one-hour intervals. For instance, if the time on your computer is 5pm and you input an offset of 3, the Factstar time will be 8pm. Negative numbers are also permitted in the offset function.

***Note: The Factstar is not equipped with daylight saving. If you are collecting precise data, either note the time differential when reading data or set the time again.***

### 3.1.9 Configuring the Device



**Figure 13: Float Current Monitor Configuration Window**

There are four panels in the Configuration screen: Limits, Data Storage, Adjustments, and Rel:Enabled Alarms which will be explained in the following sections. The password to access this is “dixie”.

#### 3.1.9.1 Limits

These limits will trigger an appropriate alarm:

Field	Typical Value Range	Comments/Explanation
Open Detection Limit	0 - 60	Current less than entered value (in mA) is considered as open state.

Low TV (float)	Depends on the battery	Value which is considered as low Voltage Alarm at floating state. Typically, this value is specified by battery manufacturer or if not known then 2.17V/per cell.
Low Segment V (float)	Depends on the battery and how the battery is segmented.	Segment voltage below this value will trigger Low segment voltage alarm at floating state. Typically, if battery segments are equal size, the value is LOW TV value divided by number of segments (1 – 4).
Low Segment V (Discharge)	Depends on the battery and how the battery is segmented.	Segment voltage below this value will trigger segment outside limits alarm during discharge. Typically, if battery segments are equal size, the value is Discharge End V divided by number of segments (1 – 4).
Discharge End V	Depends on the battery	Absolute minimum voltage which is permitted by Manufacturer of the battery, to be discharged to. Discharge below this value may damage battery. Typical values are 1.67V/cell.
High Segment V (float)	Depends on the battery and how the battery is segmented.	Segment voltage above this value will trigger Segment Voltage Outside Limit alarm at floating state. Typically, if battery segments are equal size, the value is High Total V value divided by number of segments (1 – 4).
High Total V (float)	Depends on the battery	Total voltage above this value will trigger Total Voltage Outside Limit alarm at floating state.
High Tempr Limit (C)	If battery is installed in air-conditioned environment, typically limit is 28-32 C.	Temperature values above this limit will trigger Temperature Outside Limits Alarm.
High Pilot Tempr Limit (C)	If battery is installed in air-conditioned environment, typically limit is 28-32 C.	Temperature values above this limit will trigger Pilot Temperature Outside Limits Alarm.
High Ripple Current		Ripple current values above this limit will trigger High Ripple Current Alarm.
High Float Current Detection Time	Time period for how long battery has to be at floating state before alarm is activated	Typically right after recharge, battery float current remains slightly higher for 2 – 12 hours period. By setting this field accordingly, high float current alarm after recharge can be avoided.
Minimum Discharge Current	Value in milliamps	If negative current in absolute value exceeds this limit, the Float Current Monitor enters into discharge mode.
Thermal Runaway	86400 minimum	This value sets the time current must be over a

Detection Time (sec)		limit, calculated based on the battery capacity, to trigger the associated alarm.
Ground Fault Limit (mA)	25-100	The limit at which the associated alarm will trigger.

**Note: Entering zero in any of these fields will disable the alarm:**

### 3.1.9.2 Data Storage

Field	Typical Value Range		Comments/Explanation
Significant Current Change (%)	Open	3 -5 %	Current change (last saved value and present reading) greater than this value in the corresponding state will force the data being recorded. This value is adjusted internally depending on the current value and current ripple.
	Float	5 -15 %	
	Flt Charge	10 – 20 %	
	Charge	10-20 %	
	Disch	5-20 %	
Number Of Initial samples	Open	0	Defines how many samples are recorded (with maximum speed, approx 0.2 s per sample) when battery state changes. Higher value is used for discharge, to capture battery initial voltage response to the load.
	Float	0	
	Flt Charge	0	
	Charge	1	
	Disch	1	
Significant Delta V	Open	1-10 %	This is the significant delta voltage (between value stored and now) which will trigger recording a new data set. Value is in percentage.
	Float	1 – 5 %	
	Flt Charge	3 – 10 %	
	Charge	3 – 10 %	
	Disch	1 – 5 %	
Data Storage interval	3600 - 86400		Interval, in seconds, of how often the monitor will record data set if no changes detected.
Discharge Cycle Recording Period (min)	7		Interval, in minutes, of how often the monitor will record data during a discharge.

### 3.1.9.3 Adjustments

Field	Typical Value Range	Comments/Explanation
Temperature Offset	0	Shifts ambient temperature reading by so many 1/10 degrees as specified
String Voltage Range	A - D	Select according to Table 1: Voltage Ranges and Resistor Values
Segment Voltage Slopes	As given by software	There should be no reason to change these values, use String Voltage Range to change it.

Ripple Current Slopes	0.28	Does not change.
Floating Limit (A)	1.0	The point at which the state of the Float Current Monitor changes from Floating.
Battery Factory Rated Capacity	Factory rating from battery spec sheet	Value in AH, recommended at 10A discharge rate, if given in the battery spec. This value is used by the FS firmware to calculate High Floating current alarm threshold and thermal runaway duration.
Current Averaging	37	Averages the current reading.
Sleep Mode	120-3600	The Float Current Monitor goes into power saving mode for the duration entered.

#### **3.1.9.4 Rel : Enabled Alarms**

The first column is for enabling the relay for a particular alarm. The second column is for displaying the alarm on the Float Current Monitor LCD.

For example, suppose that a buzzer is connected to the Float Current Monitor alarm contacts. Then, according to Figure 13, if the temperature is above the limit, an alarm notice will be displayed on the Float Current Monitor LCD and the buzzer will be activated. To silence/acknowledge an alarm press the CLR button when an alarm is displayed, for further information see the Alarm Display section.

# 4 Float Current Monitor LCD and Keypad

## 4.1 Keypad

The Float Current Monitor keypad has 4 buttons, under the LCD screen. The SEL/ALT key will take you from one menu level to another. The Reset/ $\uparrow$ , and the Funct/ $\downarrow$  keys are used to scroll through the sub-menus on the same menu level. The ON/CLR button is an exit button. While in a menu, you can press this button to return to the default status screen. The menu structure for the Float Current Monitor is presented in Figure 14.

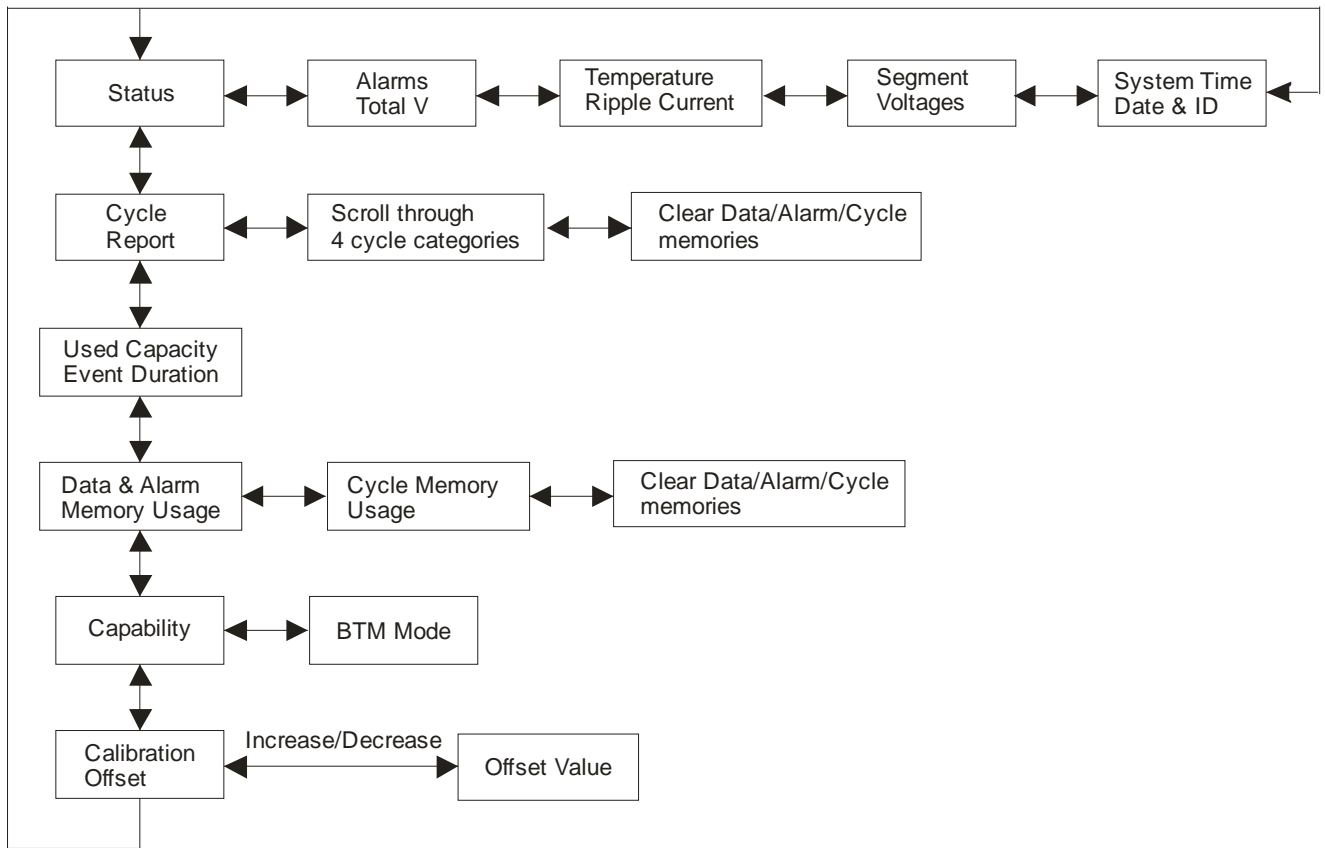
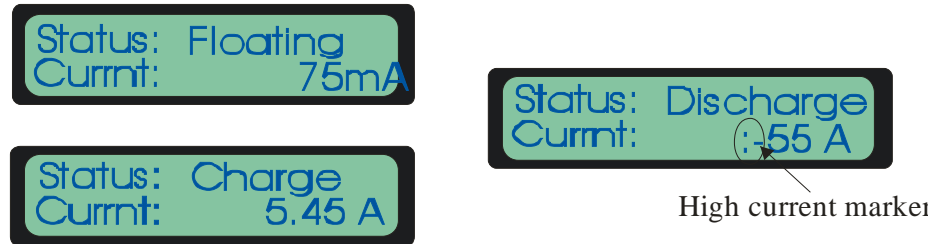


Figure 14: LCD Menu Structure

## 4.2 First Level Menu

### 4.2.1 Status Display



**Figure 15: Variations of the Status Display**

Current is displayed in the following format:

- 0.00 - 9.99 A (0.01 A granularities)
- 10.0 – 25.0 A (0.1 A granularities)
- 25 – 600 A (1 A granularity)

String status can be one of the following:

- 0-Unknown - device cannot determine the status (device fault, start-up)
- 1-Open - current is less than minimum floating current value
- 2-Floating - string is fully charged, and floating current is detected
- 3-FloatChrg - string is not fully charged, recharge current is small
- 4-Charge - positive current, bigger than threshold value, is flowing into the string. Energy is being put back in the battery
- 5-Discharge - negative current, bigger than threshold value, is flowing from the string. Energy is being taken from the battery
- 6-Equalization - positive current is flowing into the string. String is reaching equalization voltage (max floating voltage limit).
- 7-FloatRip - the string is floating but the value being read is negative due to ripple on the string.

Float Current Monitor devices are capable of measuring currents by two modes: float-current and large current mode. The switching point of the modes is around 30A. The method change is indicated on the LCD display with “:” character which means it is in large current mode.

### 4.2.2 Alarm Display



**Figure 16: Variations of the Alarm Display**

String	Description
None	No alarm
Tempr Lim	Temperature outside limits
T RunAway	Thermal runaway has been detected
Str Open	String is at open condition (no float current detected)
Hi Ripple	Ripple (AC) current value exceeds pre-configured limit
High Volt	One or more segment voltage values are too high
Exhausted	String total voltage is equal or less than pre-configured end of discharge voltage (during discharge)
Low Volt	One or more segment voltage values is lower than pre-configured limit
Pilt Temp	Pilot temperature is high
DISCH	The batteries are discharging
GND Fault	A ground fault has been detected
ALMR ACK	Alarms have been silenced (alarm relay contact opens)
MEM CLR	Memory has been cleared

**Table 2: Float Current Monitor Alarms**

When an alarm is detected, it is logged into the alarm memory with a time stamp. Individual alarms can be enabled/disabled using the utility software.

Additionally, when an alarm is detected, the alarm relay is closed (for local alarm enunciation). Pressing the “CLR” button while alarms are displayed, will acknowledge the alarm and the relay contact will open. The acknowledgment message with a time stamp is logged into the alarm memory. Silenced alarm marker is also displayed on the LCD.

Alarms remain acknowledged (silenced) until a new alarm condition is detected or the CLR button is pressed again (toggles silence function ON/OFF).

### 4.2.3 Segment Voltages



**Figure 17: Segment Voltages Display**

Segment voltages are displayed in 0.1V granularities if voltage range A is used. Otherwise the display is limited to 1V granularities.

### 4.2.4 Temperature / Ripple Current Display



**Figure 18: Temperature/Ripple Current Display**

If the temperature sensor is not connected, temperature reads 200C. If the sensor is shorted, the device displays –100C.

Ripple current is measured with granularities of 0.1A rms.

### 4.2.5 System Time / Device ID Display



**Figure 19: Time/Device ID Display**

Float Current Monitor keeps its internal time in seconds elapsed since 12 AM at the reference date. All records are stamped with a count in seconds. The display converts the seconds into an appropriate date/time string. The reference date is stored in the device configuration memory and can be changed using the utility “Clock synchronization” function.

If multiple Float Current Monitor installations are required, a unique ID number must be assigned to each individual device. It is recommended that the range for the Float Current Monitor IDs is from 31 to 99. The ID number can be changed using the utility software.

***IMPORTANT! Do not perform any configuration functions on multi-device installation, if there are two or more devices with the same ID number. Results in such a case can be unpredictable. Always check the installation for ID numbers first!***

## 4.3 Second Level Menu (Cycle Table)



**Figure 20: Cycle Display**

Cycle table reports total number of discharge hits and cumulative capacity used (AHrs) detected for the string. The discharges are grouped into 4 categories:

- Cycles shorter than 30 seconds
- Cycles shorter than one minute
- Cycles shorter than five minutes
- Cycles longer than five minute

To clear the cycle display as well as the alarms and data records, push the Funct/↓ button until the erase memory message is displayed, followed by the ON/CLR button.

## 4.4 Third Level Menu (Used Capacity)

### 4.4.1 Used capacity and event duration display

Used capacity display shows the energy in AH taken from battery during discharge and energy restored during charge. Event duration display shows the time the current event has lasted (in minuets if the event is less than 60 minutes and in hours otherwise).

## 4.5 Fourth Level Menu (Stored Data)

### 4.5.1 Number of Stored Data and Alarms

Shows memory usage of alarms and data records that are be stored.

### 4.5.2 Number of Stored Cycles

Shows memory usage of cycle records that are be stored. This contains a count of the discharges and equalizations.

### 4.5.3 Clear Memory

It is recommended that the memory be cleared using the utility software after downloading data.

The memory for the alarms and data can be cleared by pushing the Funct/↓ button followed by the ON/CLR button.

## **4.6 Fifth Level Menu (Capability)**

### **4.6.1 BTM Mode**

To change the BTM mode capability of the Float Current Monitor, push the Funct/↑ button followed by the ON/CLR button.

## **4.7 Sixth Level Menu (Calibration Offset)**

### **4.7.1 Calibration Offset**

This function is only for specialized service personnel.

### **4.7.2 Increase/Decrease Offset**

To change the calibration offset of the Float Current Monitor, push the Funct/↓ or Funct/↑ to decrease or increase the current reading respectively. The adjustment is by 10 mA increments. Save the adjustment by pushing the ON/CLR button.

# 5 Log File Format

## 5.1 Alarm File Format

The name convention for the alarm file is as following: Alarm\_**mmddyy**\_a.csv where:

**mm**: month

**dd**: date

**yy**: year

**a**: can be from a to z (assigns a new letter for duplicate data)

The format of the file is shown below in Table 4. Alarm Type numbers correspond to the following alarm, ID and value:

Alarm Type	Alarm Name	ID	Value
1	High Temperature	0	Temperature (0.1 deg C resolution)
2	Thermal Runaway	0	Current (1 mA resolution)
3	String Open	0	Current (1 mA resolution)
4	Hi Ripple Current	0	Ripple Current (0.1 A resolution)
5	Voltage High	Segment	Segment Voltage
6	String Exhausted	0	Total Voltage
7	Voltage Low	Segment	Segment Voltage
8	Pilot Temperature High	0	Temperature (0.1 deg C resolution)
9	Discharge	0	Current (1 mA resolution)
10	Reserved		
11	Reserved		
12	Ground Fault	0	Current (1 mA resolution)
13	Alarms Silenced	0	0
14	Memory Cleared	0	1=data 2=alarms 4=cycles

**Table 3: Alarm Explanation.**

#	Time	Alarm Type	ID	Value
1	66006	3	0	1
2	66253	8	0	19257

**Table 4: Alarm Log Sample.**

## 5.2 Data File Format

The name convention for the data file is as following: Data\_**mmddyy**\_a.csv where:

**mm**: month

**dd**: date

yy: year

a: can be from a to z (assigns a new letter for duplicate data)

The format of the data log file is shown in Table 5. Explanations of Event Type and Record Type are described below. Table 3 describes the Pending Alarm by converting the pending alarm to a binary representation and using positions of the ones to correspond to an alarm in Table 3.

#	Time (1/10s)	Event Type	Record Type	Pending Alarm	Current (mA)	AC Current (1/10A)	Tempr	Total V	SEG1 V	SEG2 V	SEG3 V	SEG4 V
1	323560	4	2	0	53500	0	251	0	0	0	0	0
2	324200	5	2	0	-11348	0	251	0	0	0	0	0

**Table 5: Data Log Sample.**

Event type is defined as follows:

- 0-Unknown - device cannot determine the status (device fault, start-up)
- 1-Open - current is less than minimum floating current value
- 2-Floating - string is fully charged, and floating current is detected
- 3-FloatChrg - string is not fully charged, recharge current is small
- 4-Charge - positive current is flowing into the string
- 5-Discharge - negative current is flowing from the string
- 6-Equalize - the string is charging to an equalization voltage.

Record type is defined as follows:

1. Start of event
2. Delta current
3. Delta total voltage
4. Delta segment voltage
5. Initial sampling after event change
6. Discharge cycle counter recording
7. Timer elapsed

Pending alarm is defined by the following bit values:

		14	13	12			9	8	7	6	5	4	3	2	1
--	--	----	----	----	--	--	---	---	---	---	---	---	---	---	---

1. High temperature
2. Thermal runaway
3. String open
4. High ripple current
5. Voltage high
6. String exhausted
7. Voltage low
8. Pilot temperature high
9. Discharge
12. Ground fault
13. Alarms silenced
14. Memory cleared

### 5.3 Cycle File Format

The name convention for the data file is as following: Cycle\_**mm****dd****yy**\_a.csv where:

**mm**: month

**dd**: date

**yy**: year

**a**: can be from a to z (assigns a new letter for duplicate data)

The format of the data log file is shown in Table 6. Explanations of Event Type and Record Type are described below.

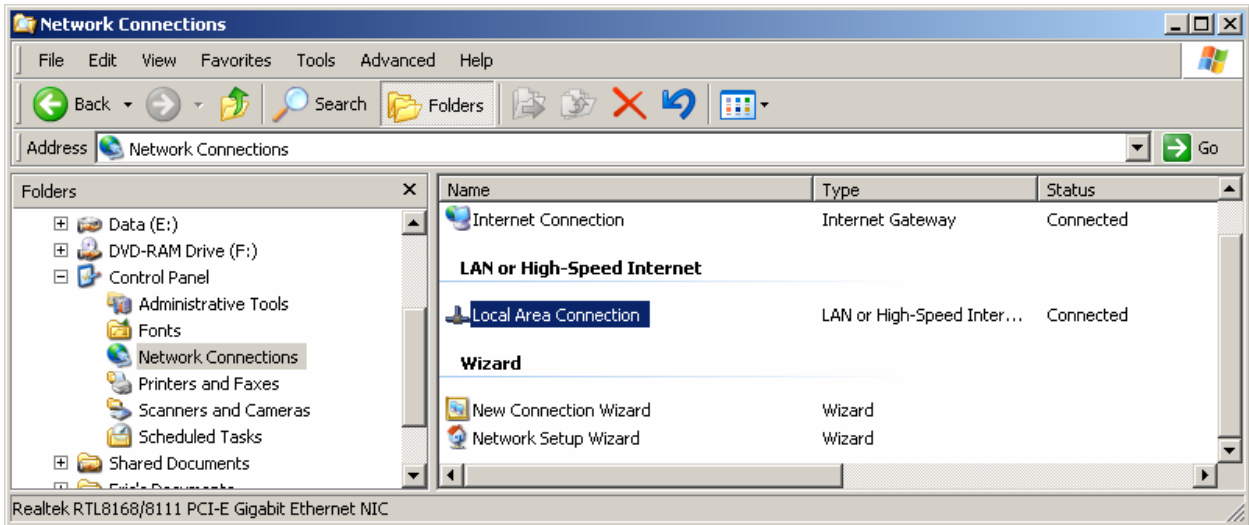
#	Type	Start Time	Duration	AHrs (1/10)	Start Voltage	End Voltage	Temperature (1/10)
1	Discharge	2068542	57	153	130	120	253
2	Equalization	2069985	2564	155	125	133	254

**Table 6: Cycle Log Sample.**

## 6 Changing Ethernet Settings

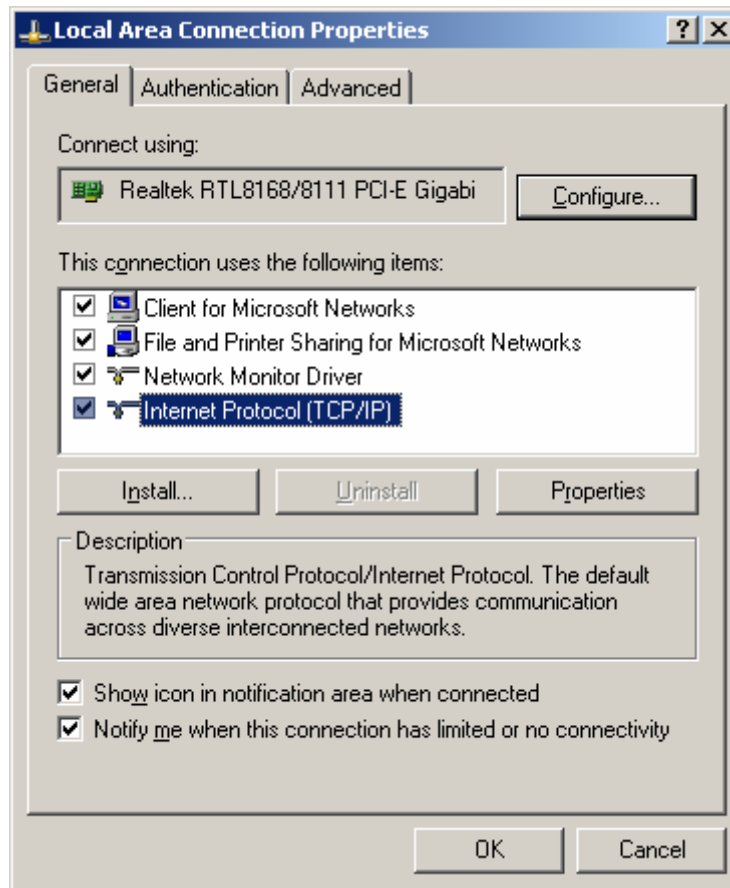
Below are the instructions on how to connect the Ethernet enabled Float Current Monitor to a network with different setup as the default.

1. Open up Windows Explorer and navigate to My Computer -> Control Panel -> Network Connections -> Local Area Connection, refer to Figure 21.



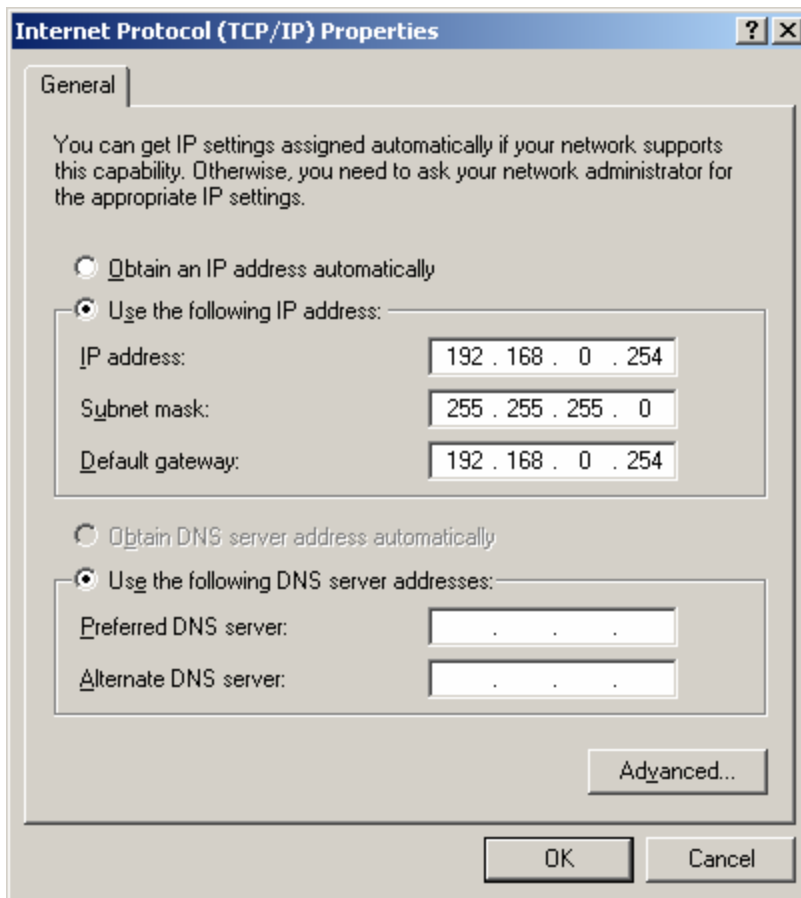
**Figure 21: Computer Network Connection**

2. Right mouse click on Local Area Connection and select properties. Under the General tab select Internet Protocol (TCP/IP) and click Properties button, refer to Figure 22.



**Figure 22: Local Area Connection Properties**

3. Change the dialog box such that it looks like the settings shown in Figure 23. Then press OK until the dialogs are all closed.



**Figure 23: Internet Protocol (TCP/IP) Properties**

The Float Current Monitor web page will be accessible once you connect it directly to the computer. The computer settings may be reverted back to the original settings after the Float Current Monitor network settings are changed for the network.