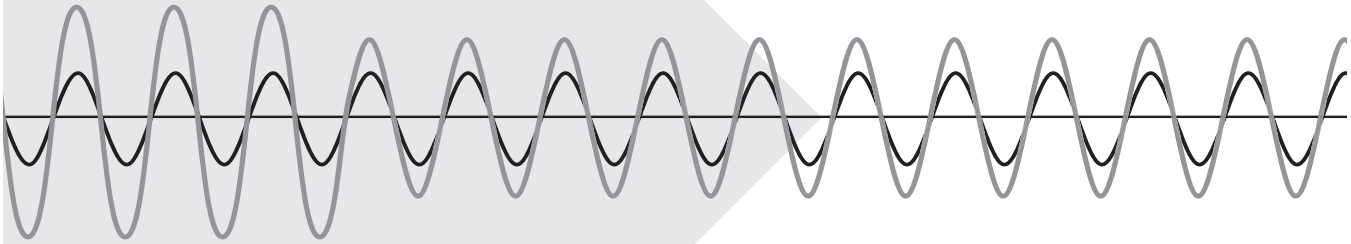
SL3™ TG3™ PX3™ SURGE PROTECTION

MasterMind™

MasterMind™ Quick Start Guide

PN 750-0119-002 A00



Operational Instructions for Advanced Monitoring Options: M3, M4E, M5, M6E

Current Technology

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Quick Start Guide to the Operation of the MasterMind™ Advanced Monitoring System

Thank you for choosing the Current Technology® MasterMind. We look forward to fulfilling your facility-wide Power Quality Monitoring needs. For more detailed information please consult the MasterMind Operation Manual (PN-750-0119-001) located at tnbpowersolutions.com/current_technology or call 800.238.5000 or 804.236.3300 Monday through Friday 8:00 a.m. to 5:00 p.m. (EST).

Warning Conventions

HAZARDOUS VOLTAGES PRESENT: Improper installation or misapplication may result in serious personal injury and/or damage to electrical system.

- ➤ Use only the test instruments, and insulated tools rated for the voltage and current specified.
- ➤ Always keep one hand in your pocket when anywhere around a powered line-connected or high voltage system.
- ➤ Don't wear any jewelry or other articles that could accidentally contact circuitry and conduct current, or get caught in moving parts.
- ➤ Perform as many tests as possible with power off and the equipment unplugged.
- ➤ Don't attempt repair work when you are tired.
- ➤ Never assume anything without checking it out for yourself! Don't take shortcuts!.
- ➤ Wear appropriate personal protective equipment for the job being performed. Example: Safety glasses, safety shoes, gloves, welding helmets, etc.

Verify Proper Operation

Verify that only the green indicating lights are illuminated and that there are no red lights illuminated. Green lights indicate a normal condition for each phase. Orange lights indicate medium MOV % protection and Red lights indicate low MOV % protection. Three-phase units have three (3) green indicating lights labeled "A," "B," and "C." Split-Phase units should only have lights "A" and "C" illuminated. See Table 1 for LED status condition.

The MasterMind Advanced Monitoring is equipped with a dual set of Form "C" contacts (see Figure 1). The relay containing the contacts is in the "alarm condition" (or normally closed) when: the power is off to the unit, when the unit is encountering loss of power to one or more phases, or the SPD is encountering (40% default) loss of capacity due to internal fuse operation. Test the operation of the Form "C" contacts by de-energizing the SPD and checking the state of the contacts with a continuity tester or observing the effect of the contacts on the user provided remote alarm circuits.

The MasterMind Advanced Monitoring contains an audible alarm that should not operate under normal conditions. To silence audible alarm, press the ALARM SILENCE button on display.

Condition	Corresponding Phase LED	Alarm Cond	M3 Status Message **	Priority *
Phase Loss (<80%)	LED Off	Y	"Alarm: Phase x Loss"	1A
Phase Low (80 to <90%)	LED Short Blink Green (≈25% duty)	Y	"Alarm: Phase x Low"	1B
Phase High (>110%)	LED Long Blink Green (≈75% duty)	Y	"Alarm: Phase x High"	1C
N-G Overvoltage	N/A	Y	"Alarm: N-G Voltage High"	2
Frequency Out of Range	N/A	Y	"Alarm: Frequency Out of Range"	3
MOV % Protection Low	LED On Red	Y	"Alarm: Protection x Low"	4
Filter/Cap Loss	LED Blink Red once every 2 seconds	Y	"Alarm: Protection Filter x Loss"	5
Selenium Loss	LED Blink Red twice every 2 seconds	Y	"Alarm: Protection Selenium x Loss"	6
MOV % Protection Medium	LED On Orange	N	"Alarm: Protection x Reduced"	7

Table 1: LED and Display Alarm Status Conditions

Notes:

* 1 Highest priority takes precedence: I.e. if phase is lost, LED is Off, no blinking even if filter loss. Alarm Condition means the Audible Alarm is ON, Dry Relay Contacts is OFF (de-energized), and System Alarm LED is ON.

2 % Protection levels of 40% and 75% are default settings which can be changed by the user (M3 System only). If the Surge Module or Current Rating settings are changed, the Protection levels will change automatically, the thresholds that are available for MOV% protection depends on the ISM (ISB) that has been selected.

** 3 Subsequent Status message will be displayed on M3 Character and Graphics Displays, where "x" is corresponding Phase (A, B, C or L1, L2). The Highest Priority condition will over-write earlier conditions. Messages may be truncated to fit screen area.

4 Red System Status LED will remain on after status has returned to normal. User must clear the status by pressing the M3 Cancel button.

5 Alarm Conditions will also be logged in the Events Log.

Connecting Form “C” Dry Contacts

Dry Contacts: All SPD models have a dual set of Form “C” dry contacts available for connection to user-provided remote alarm and monitoring circuits.

The installer must provide the appropriate raceway and wiring for this circuit observing the restrictions on conduit openings illustrated in an earlier section of this manual. The installer must route the monitoring conductors to the blue terminal blocks on the door-mounted circuit board (Basic/M1 monitor board). Choose the appropriate materials and routing to allow the door to open and close without pinching or stressing wires.

The following diagram shows the Form “C” contact configuration. The annotations on the diagram match the markings on the blue terminal block.

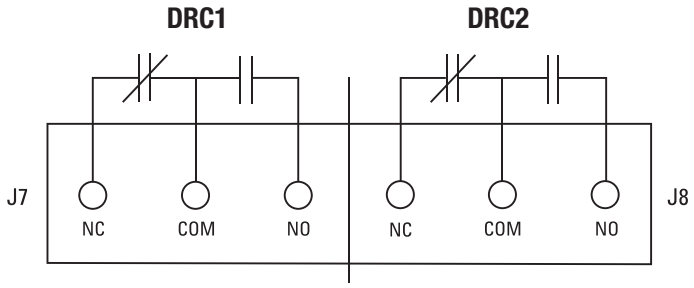


Figure 1

FCC TERMINAL BLOCK

- **Rated 250V 2A DC, 250V 5A AC, 22-14 AWG, 4.4 in.-lbs (0.5Nm)**
- **Contacts shown in non-energized state**

1.0 Introduction

1.1 Scope and Overview

The MasterMind monitoring systems are options available on the SL3™, TG3™, and PX3™ surge protective devices. The advanced monitoring packages in Table 2 are covered in this manual. The primary user interface is through a Graphical User Interface (GUI) presented on a character LED or optional graphic LCD display. Keypad and LED indications act as a secondary user interface. The M4E and M6E options also provide Ethernet/Modbus communication that can connect the system to a network of many other devices, which allows the system to respond to queries from other systems. Ethernet connectivity supports Web Server and Modbus TCP applications for remote monitoring of the system.

New Advanced Monitoring Features:

- Instantaneous voltage measurements: L-N, L-G, L-L, N-G
- Monitoring the percent protection remaining from the MOVs
- Monitoring Selenium Presence
- Monitoring Filter Presence
- Monitoring Surge Detection
- 3-Phase Availability Indication (LED) and Monitoring

Model	Description
M3	Advanced Monitoring, Character Display, Modbus RTU
M4E	M3 + Ethernet, Modbus TCP
M5	Advanced Monitoring, Graphics Display, Modbus RTU
M6E	M5 + Ethernet, Modbus TCP

Table 2: Model/Description

The following parameters are computed from the measurements, which are displayed and logged:

Measured:

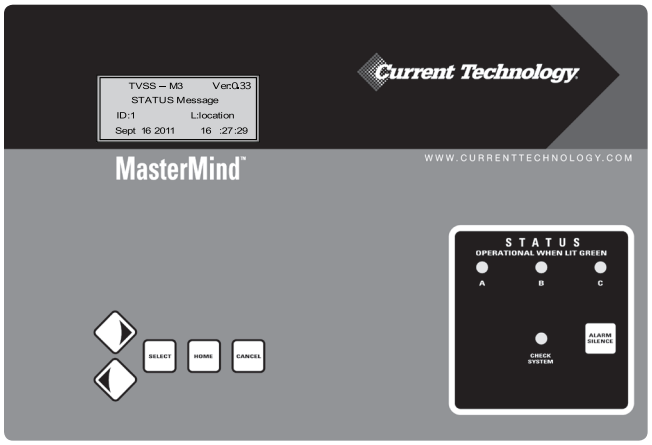
- RMS voltages on all modes: L-N, L-G, L-L, N-G (WYE, Hi-Leg, Split-Phase), L-L (Delta)
- Frequency of each phase
- Voltage Fundamental (RMS Value/Nominal Value)
- Voltage THD in % (THD = Even + Odd Harmonics)

Measured and Logged Power Quality Events:

- Voltage Sag and Swell
- Temporary Overvoltage
- Overvoltage
- Voltage Dropout
- Voltage Outage
- Transients

1.2 MasterMind™ Monitoring Options

A FULL-FEATURED MONITORING OPTION FOR SL3™, TG3™ AND PX3™ PRODUCTS



M3 or M4E local display

M5 or M6E local display

M3 Monitoring

- Local character display with membrane switch user interface
- Power Quality Monitor that provides time, date, magnitude and duration of the following
    - Sags
    - Swells
    - Dropouts
    - Outages
    - THD
    - Frequency
    - Volts RMS per phase
    - Surges
        - Low 100A–500A
        - Med 500A–3000A
        - High 3000A+
    - Remaining surge protection percentage
- User settable alarm thresholds (magnitude and duration)
- Dry relay contacts
- Audible alarm, alarm silence
- Per phase LED indication
- ModBus RTU remote communications capability

M5 Monitoring

- Large graphics local display with membrane switch user interface
- Power Quality Monitor that provides time, date, magnitude and duration of the following
    - Sags
    - Swells
    - Dropouts
    - Outages
    - THD
    - Frequency
    - Volts RMS per phase
    - Surges
        - Low 100A–500A
        - Med 500A–3000A
        - High 3000A+
    - Remaining surge protection percentage
- User settable alarm thresholds (magnitude and duration)
- Dry relay contacts
- Audible alarm, alarm silence
- Per phase LED indication
- ModBus RTU remote communications capability

M4E Monitoring

Includes all above M3 features, plus the following:

- Ethernet, ModBus TCP remote communications capability
- Web Interface

M6E Monitoring

Includes all above M5 features, plus the following:

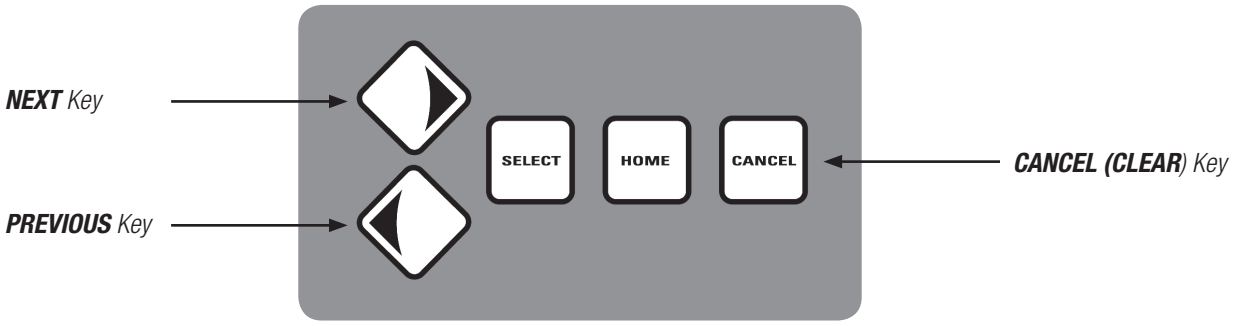
- Ethernet, ModBus TCP remote communications capability
- Web Interface

2.0 Display Navigation Screens

2.1 Introduction

For easier screen navigation it is important to become familiar with this section.

2.2 Keypad



Pressing the **HOME KEY** at any time during navigation will always bring up the home screen. The **NEXT** and **PREVIOUS** keys are used for switching between the various menus on a specific level. The **SELECT (or ENTER)** key is used to select a sub menu from the present screen, whereas the **CANCEL (CLEAR)** key will exit a sub menu and return to the main menu. The following table helps explain the keys and their functions.

KEY	DATA MODE	EDIT MODE
SELECT (ENTER)	Enter the Sub menu	Enter the edit mode
CANCEL (CLEAR)	Exit sub Menu and enter Parent menu	Exit the edit mode
HOME	View home screen	View home screen
RIGHT ARROW (NEXT)	Next screen in the same Menu/Sub menu	Select the data to be edited / Incrementing data values
LEFT ARROW (PREVIOUS)	Previous screen in the same Menu/Sub menu	Select the data to be edited / Decrementing data values

**Edit mode is available only on Configuration screens*

2.3 Character Display

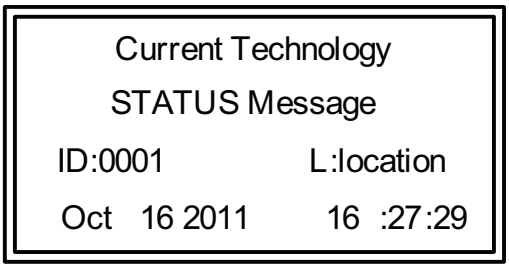


Figure 2: Home Screen/Startup Screen for M3 & M4E

Figure 2 depicts the Startup or the "Home" Screen on the character display. The Home Screen provides the firmware version, present status of the monitoring board, and the date/time.

2.4 LCD Graphics Display

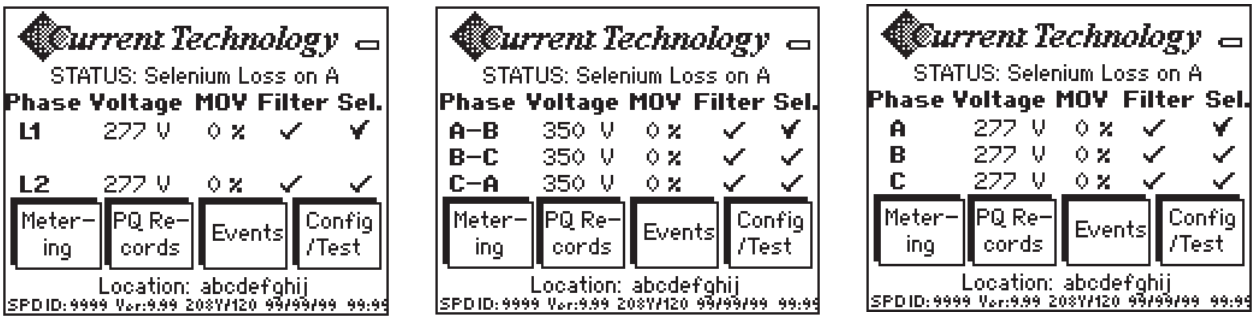


Figure 3: Home Screen/Startup Screen for M5 & M6E

Figure 3 includes images of the Main Screen/Startup Screen on the Graphic Display. The phases displayed on these screens depends on the system type. For example, a 2-Phase, 2-Wire system will display L1 & L2, whereas a 3-Phase, 3-Wire system will display A-B, B-C & C-A and a 3-Phase, 4-Wire system will display A, B, C. In short, this screen changes depending on the System Type selected.

2.5 Login Level and Password

To perform certain tasks such as change IP configuration, the login level will need to be changed to "service".

Login/Level	Password
1 – user	"text"
2 – admin	"task"
3 – service	"core"

Note: *After entering the last letter of the password, press Home Key. "Login Successful" should appear in the display.*

3.0 Webserver

3.1 Introduction

This section explains the various webpages available in the SPD unit and the information they contain. Simply connect the Ethernet cable to the Ethernet port. Set the I.P. addresses of the SPD unit. Navigate to the unit as described in Figure 4. For more detailed information please refer to MasterMind Ethernet Instructions (PN-750-0119-003) located at tnbpowersolutions.com/current_technology or call 800-238-5000 or 804-236-3300 Monday through Friday 8:00 a.m. to 5:00 p.m. (EST).

A detailed description of the Menu bar (which is used in navigation), its features and various sections is explained in Figure 4. Brief explanations of various webpages available under each section are provided in subsequent sections. To navigate to the SPD Main Webpage, simply enter http://(I.P. address, i.e., 169.192.0.2)/m3_status.html in the address bar. All other webpages can be reached from the Main page. Other page names are listed below.

Note: *Microsoft Internet Explorer, Google Chrome, and Mozilla Firefox are all supported.*

3.2 Block Diagram

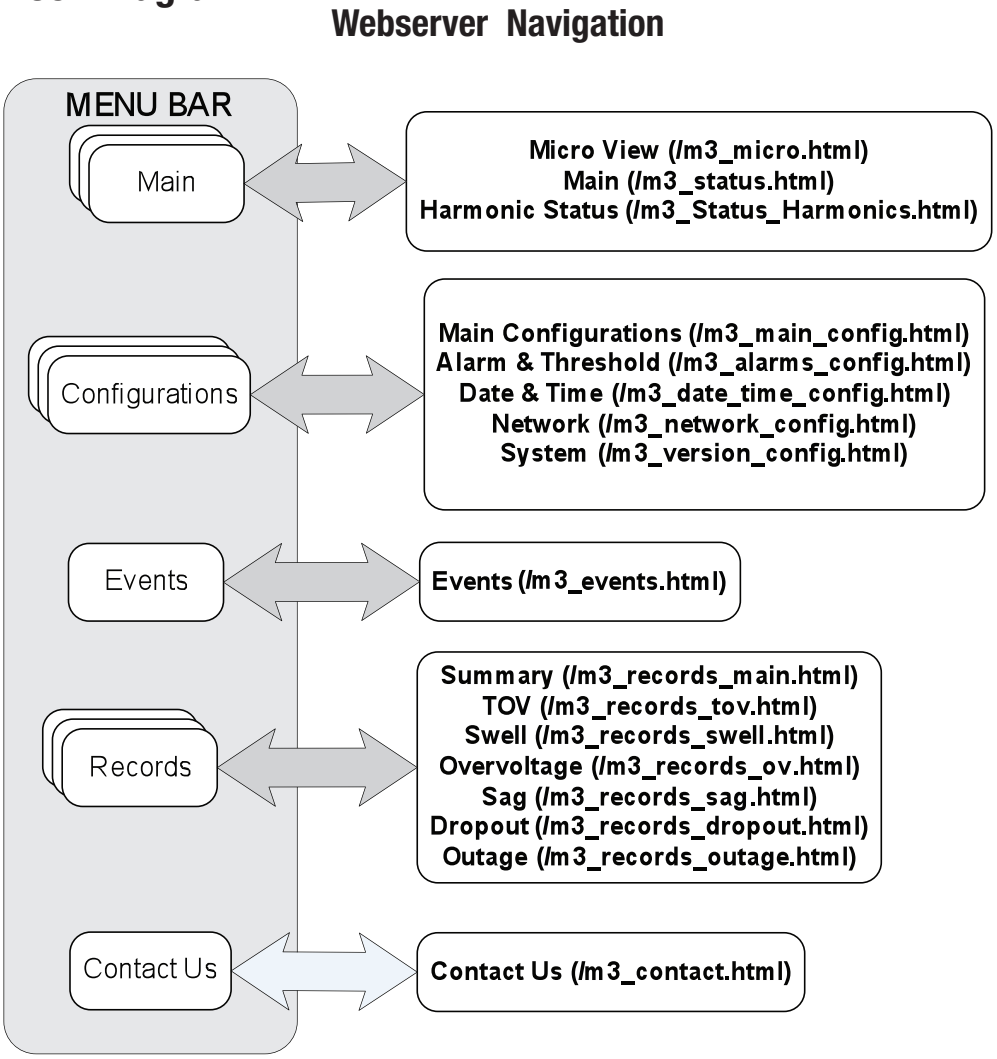


Figure 4: Block Diagram of the webserver navigation

3.3 Menu Bar

A flashing green indicator light displays the communication status between the webpage and SPD unit. The green indicator light will stop flashing when the communication between webpage and SPD unit fails/disconnects. A login button supports the ability to logon at different levels for configuration changes to the SPD unit. Once logged on, the user can logout from the Menu bar itself, as the login button changes to Logout from that particular level, **service** (Login level 3), **admin** (Login level 2) or **user** (Login level 1) as shown in Figure 5. Use lower case letters when typing in Login level and Password. See section 2.5 for login levels and passwords.

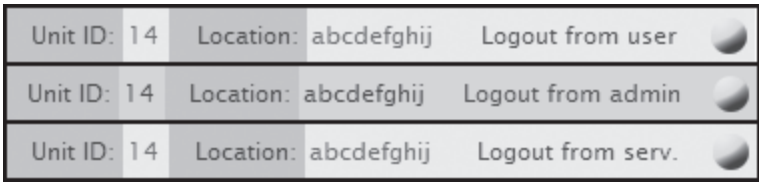


Figure 5: Menu bar when logged on to different levels

3.4 Main Status *(/m3_status.html)*

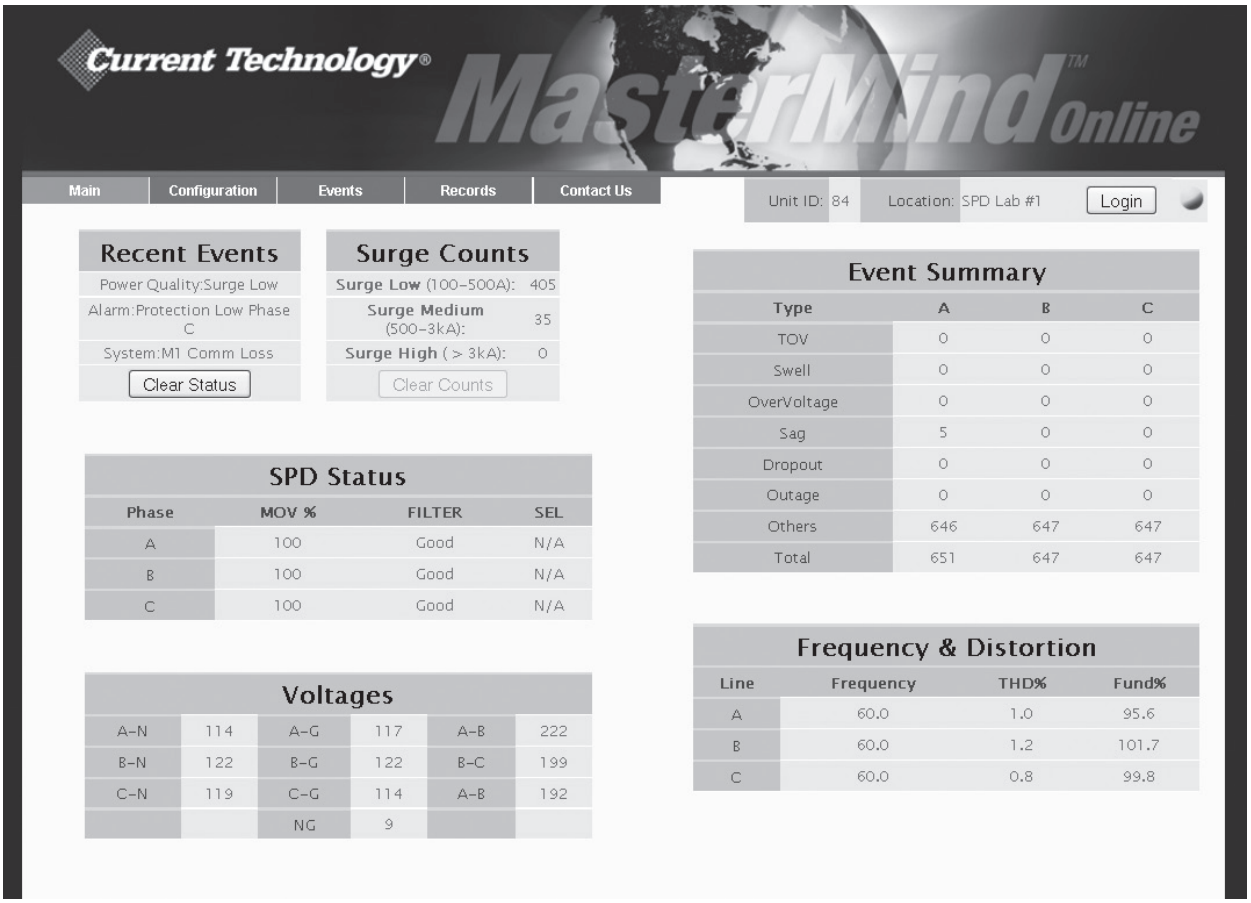


Figure 6: m3_status.html

4.0 ModBus

4.1 Modbus RS-485 Serial Interface Settings

The Advanced Monitoring PCB acts as a Modbus slave, and its communication is initiated through Modbus master using an RS-485 link. The Advanced Monitoring PCB is identified by a unique slave ID by the master. Try the default settings first. Contact factory for additional setup information if required.

Modbus Serial Options:

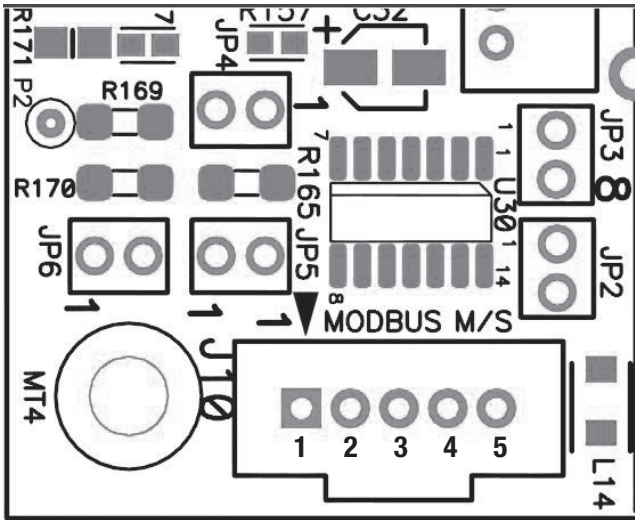
Baud Rate	9600 (default), 19200
Word length	8
Parity	None (default), Even, Odd
Stop bits	1
Flow Control	None

Additional required settings are:

Reg MAP = 1

Unit ID = 1 to 247 (Each unit must have unique ID).

4.2 Modbus RS-485 Serial Jumper Settings



(Pins are numbered one to five going left to right)

Modbus Part (2 or 4 wire)
Mating plug number Molex 50-57-9405
Mating pin number Molex 16-02-111x

(Lower Right Corner of Advanced Monitoring PCB board)

Option	Jumper
2-Wire	JP2, JP3 On
4-Wire	JP2, JP3 Off
Pull-up/down Resistors	JP6, JP4 On
End of Line	JP5 ON

J10 Pin Out (header)
1 RX+
2 RX-
3 TX+
4 TX-
5 GND

JP6 and JP4 are optional 2.7k ohm pull-up/down resistors which may be necessary in some RS/485 configurations. JP5 is used to terminate the RS/485 line. Use this when the Advanced Monitoring PCB is at the end of the serial line.

5.0 System, Alarm and Power Quality Messages

5.1 System Messages

These are messages which indicate what particular part of the monitoring or communications system has incurred a failure. Each message details the exact portion of the system which has the fault.

Condition	Graphic Display Message	Character Display Message
Low Battery	System: Low Battery	Sys: Low Battery
Memory Full	System: Memory Full	Sys: Memory Full
Log Memory Error	System: Log Memory Error	Sys: Log Mem Error
EEPROM Error	System: EEPROM Error	Sys: EEPROM Error
M1 Comm Loss	System: M1 Comm Loss	Sys: M1 Comm Loss
Modbus Error	System: Modbus Error	Sys: Modbus Error
Ethernet Error	System: Ethernet Error	Sys: Ethernet Error
Other Error	System: Other Error	Sys: Other Error

5.2 Alarm Messages

These are messages generated by MasterMind system to indicate conditions of the nine most serious ones which may be experienced. These indicate that the system has encountered a problem either with the input power or the ability of the system to respond to transient events. Each alarm alerts the user to the specific problem encountered so that it can remedied.

Alarm Condition	Graphic Screen Message	Character Screen Message
Phase Loss (<80%)*	Alarm: Phase x Loss	Alarm: Phase x Loss
Phase Low (80 to <90%)*	Alarm: Phase x Low	Alarm: Phase x Low
Phase High (>110%)*	Alarm: Phase x High	Alarm: Phase x Hi
N-G Overvoltage	Alarm: N-G Voltage High	Alarm: N-G Volt High
Frequency Out of Range	Alarm: Freq High/Low	Alarm: Freq High/Low
% Protection < 40%*	Alarm:% Protection x Low	Alarm: % Prot x Low
Filter/Cap Loss	Alarm: Filter x Loss	Alarm: Filter x Loss
Selenium Loss	Alarm: Selenium x Loss	Alarm: Selen x Loss
% Protection 40 to 75%*	Alarm: % Prot x Reduced	Alarm:% Prot x Redcd

x = A, B, C, L1 or L2

** Default settings*

5.3 Power Quality Messages

Each message alerts user to a Power Quality deviation of actual voltage from nominal voltage.

Power Quality Event	Graphic Screen Message	Character Screen Message
Transient Surge	“PQ: x Surge”	“PQ: x Surge”
Temporary Overvoltage (TOV)	“PQ: TOV on y Phase”	“PQ: TOV y Phase”
Swell	“PQ: Swell on y Phase”	“PQ: Swell y Phase”
Overvoltage	“PQ: Over-V on y Phase”	“PQ: Over-V y Phase”
Sag	“PQ: Sag on y Phase”	“PQ: Sag y Phase”
Dropout	“PQ: Dropout on y Phase”	“PQ: Dropout y Phase”
Outage	“PQ: Outage on y Phase”	“PQ: Outage y Phase”

x = Low, Med or High *y = A, B, C, L1 or L2*

6.0 MasterMind System Specifications

- Voltage Accuracy (1%)
- Voltage Sampling Rate (3.8 kHz)
- Screen Update Rate (1/sec)
- Date/Time Accuracy (1 min/month)
- Date/Time Resolution (1 ms)
- Number of Power Quality records (1k), All events (2k), Modbus nodes (247), Surge counts (65,535 Low, Medium and High).
- M3 battery (Lithium, 3V, 235mAh, CR2032)
- Dimensions (M3 system 11" x 10" x 2.0")
- Weight (M3 system – M1, M3, M3PS – 1.67 lbs.)
- Temperature (storage -40°C to +60°C, operation -20°C to +60°C)
- Humidity (Relative, 5–95%, non-condensing)
- RoHS Compliant
- Warranty (See Warranty Statement at end of manual)
- Certifications (UL 1449 3rd Ed, UL 60950-1)
- RS/485 /RTU specs (2/4 wire options, 9600-19200 bps).
  See ModBus section for proper setup.

7.0 Monitoring System Troubleshooting Chart

Common Symptoms

Common Causes	No Heartbeat, and all other green LEDs OFF	Blank LCD Graphics Display, but has backlight	Blank Character Display, no backlight	Character Display shows Main screen ONLY	Graphic Display hard to read or not operating	M3 detects that all the phases are lost	Erratic readings from MOV prot %, or selenium, or Cap filters	Frequent alarms for Volts High/Low, Freq, or N-G volts	Red Alarm LED (M1) stays lit after pressing cancel	M3 acts peculiar after a Configuration change	No Modbus communication – serial mode	No Modbus or Web Server communication via TCP/IP*	No service port communications
No DC Power to Advanced Monitoring System (on J2) or incorrect (between 11–55VDC)	■		■										
Advanced Monitoring System not configured for correct type system						■	■	■	■				
Need to adjust the contrast on the display					■								
Dip Switch SW1 is not set correctly (service only)		■		■							■	■	■
Advanced Monitoring System Reg Map & Unit ID don't match PC setting											■		
Com Port# on PC doesn't match actual hardware port#											■		■
Baud rate, parity, stop bits & flow control don't match PC config											■		■
AC input on J1 is not present						■			■				
FPC flat Graphic Display cable not seated correctly or loose		■			■								
Filter and/or Selenium weren't disabled in M3 configuration									■				
Cancel MUST be pressed while user is seeing main screen									■				
Wrong type cable used (crossover vs. 1 to 1 patch cable)												■	
M1 20 position ribbon cable not plugged in or needs replug							■		■				
Nominal frequency set wrong on M3								■	■				
Need to Delete Events Log and PQ Records after change										■			
Alarm limits are narrow or set incorrectly								■	■				
IP settings on computer not compatible with M3 Settings												■	
M1 does not have a good Neutral Connection to SPD (via 20-pin)							■						
Bad Cable or Connection	■	■	■		■	■	■	■	■		■	■	■
Rs485 Connection has no Ground Reference											■		■

* *Consult your local IT professional for assistance*

8.0 5 Year Limited Warranty

Thomas & Betts Power Solutions warrants the MasterMind Advanced Monitoring Product (the "Product"), shall meet applicable industry standards and specifications and be free from defects in materials and/or workmanship. Should any failure of the Product to conform to this warranty appear within five (5) years from the date of the purchase of the Product, Thomas & Betts Power Solutions shall either repair or replace the defective Product, or part thereof, upon return to Thomas & Betts Power Solutions' manufacturing facility in Richmond, Virginia with transportation charges prepaid.

Thomas & Betts Power Solutions shall have no liability under this warranty for any problems or defects directly or indirectly caused by misuse of the Product, alteration of the Product (including removal of any warning labels), accident, neglect or improper installation, application, operation, or repair of the Product.

THE WARRANTY STATED HEREIN IS THE SOLE AND EXCLUSIVE WARRANTY FOR CURRENT TECHNOLOGY® PRODUCTS, AND IS IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES. THOMAS & BETTS POWER SOLUTIONS SPECIFICALLY DISCLAIMS ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Installation, operation, or use of the Product for which this warranty is issued shall constitute acceptance of the terms hereof.

The liability of Thomas & Betts Power Solutions under this warranty is expressly limited to the replacement or repair of the defective Product or the defective part thereof, at Thomas & Betts Power Solutions' sole option.

IN NO EVENT SHALL THOMAS & BETTS POWER SOLUTIONS BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER. IN NO EVENT WILL THOMAS & BETTS POWER SOLUTIONS' LIABILITY EVER EXCEED THE PURCHASE PRICE PAID FOR SUCH DEFECTIVE PRODUCT.

This warranty is not transferable and may only be enforced by the purchaser. Claims under this warranty must be submitted to Current Technology® within thirty (30) days of discovery of any MasterMind product defect.

Warranty Period	
MasterMind™	5 Years from original date of purchase

☐ M3 ☐ M4E ☐ M5 ☐ M6E

Model

Date of Purchase

Date Installed

Installer

Administrator

Administrator Contact Information

Phone

email

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