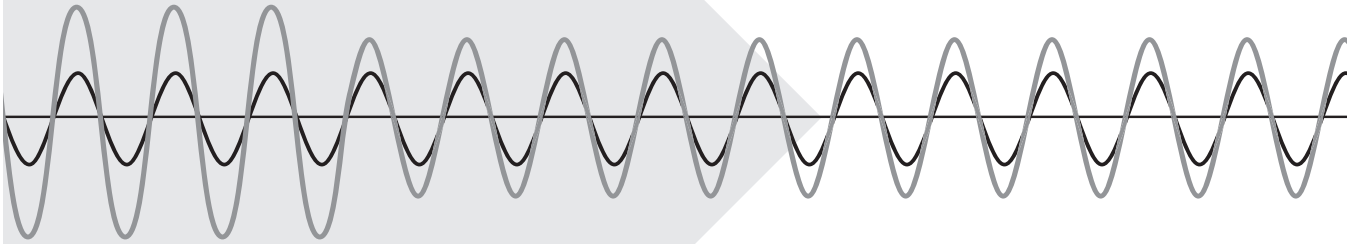
MasterMind™

Operation Manual
(M3, M4E, M5 & M6E)

PN 750-0119-001 Rev A 02



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Current Technology

Table of Contents

Your 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.

Assistance

Monday through Friday, 8:00 a.m. to 5:00 p.m. (EST): 800.238.5000 or 804.236.3300
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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 indication.

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 Over Voltage	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 (with T&B acceptance).

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.

Warning Conventions

HAZARDOUS VOLTAGES PRESENT: Improper installation or misapplication may result in serious personnel 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.

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.

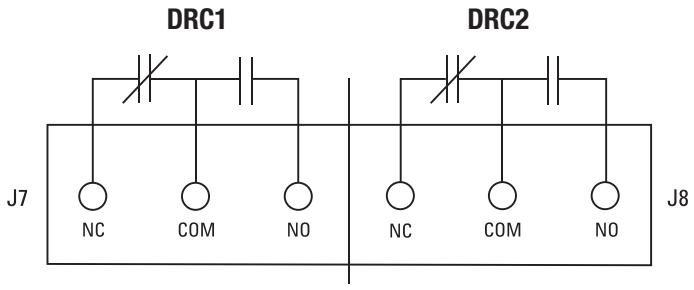


Figure 1

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 protection 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 LCD 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. 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).

New Advanced Monitoring Features:

- Instantaneous voltages 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:

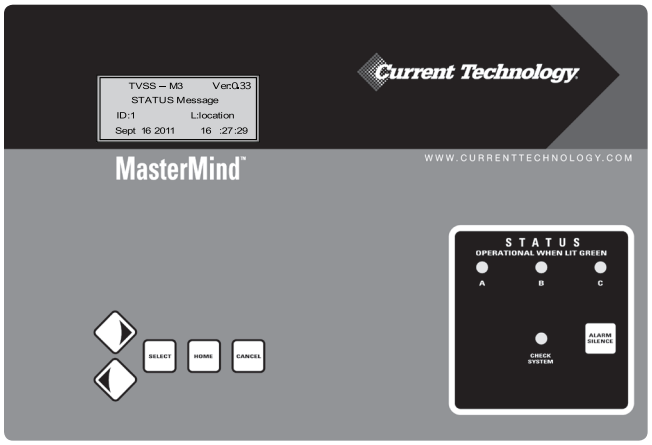
- RMS voltages on all modes: L-N, L-G, L-L, N-G (WYE, Hi-Leg, Split-Phase), L-L (Delta)
- Frequency of each phase
- Voltage Fundamental (RMS Value/Nominal Value)
- Voltage THD in % (THD = Even + Odd Harmonics)

Measured and Logged Power Quality Events:

- Voltage Sag and Swell
- Temporary Over Voltage
- Over Voltage
- 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 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 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:

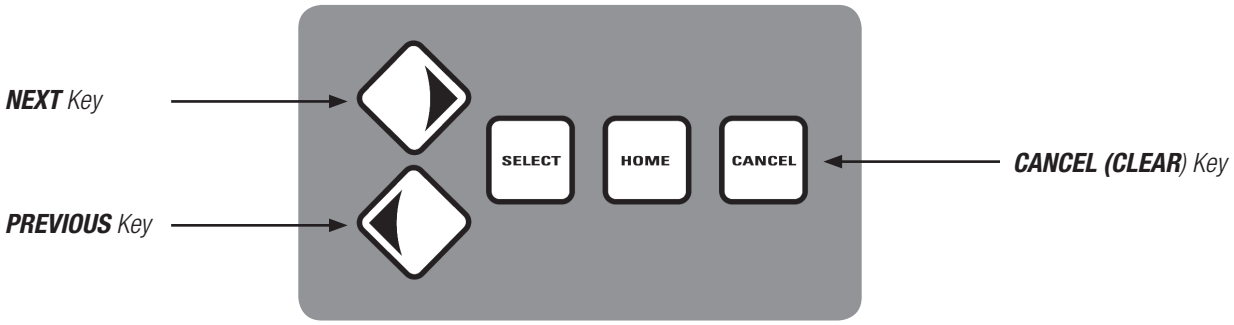
- Ethernet, ModBus TCP remote communications capability
- Web Interface

2.0 Display Navigation Screens

2.1 Introduction

This section explains the navigational steps for the alphanumeric LCD (character display). Please refer to section 4.10 (LCD Graphics Display) for additional information. 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*

3.0 Character Display

List of Figures for Character Display

3.1 Character Display Information

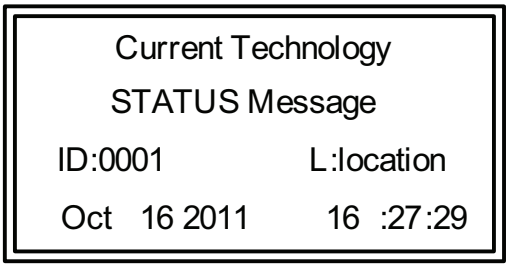


Figure 2: Home Screen/Startup Screen for M3 and M4E

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.

A rotating status message is also displayed in this screen. Three message display here:

- **Alarm Status messages**
  A rotating status message is also like Voltages drop/low/high, MOV alarm/Warn condition and many other alarm related messages
- **PQ Status Messages**
  Displays the latest Power Quality event that has occurred on the system
- **System Status messages**
  Displays information like EEPROM error and other system related information

These messages are displayed in cyclic fashion with an interval for 3 seconds between each status message. These messages will persist even after the faults have gone away. The message can be cleared by pressing the cancel button when the home screen is visible. This also has the effect of extinguishing the Alarm LED.

3.2 Login Level

To preform 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”

3.3 How to change Login Level with the Character Display:

Press **HOME** to get to MAIN screen.

Press **SELECT** > **PREVIOUS** > **PREVIOUS** to get to CONFIG screen.

Press **SELECT** > **PREVIOUS** > **PREVIOUS** to get to LOGIN/TIME screen.

Press **SELECT** to get to LOGIN screen.

Press **SELECT** and a blinking cursor should appear under the “t” in the word Default

Press **SELECT** and the letter “t” should flash in reverse video. (It is ready to be changed.)

Press **PREVIOUS** > **PREVIOUS** and Default should change to Service.

Press **SELECT** and reverse video should change to blinking cursor.

Press **NEXT** to move the cursor to the first letter of the password.

Press **SELECT** to activate that letter field.

Press **NEXT** several times until a “c” appears.

Press **SELECT** > **NEXT** to deactivate the first letter and highlight the next.

Continue on with this process until “core” is shown in those fields.

(Holding the **NEXT** or **PREVIOUS** buttons will scroll through the alphabet.)

With a blinking cursor under the last letter, press **HOME**.

Your Login should be acknowledged.

3.4 Main Screens

The following menus can be accessed from the Main Screen:

➤ METERING ➤ EVENTS ➤ RECORDS ➤ CONFIGURATION ➤ RESET

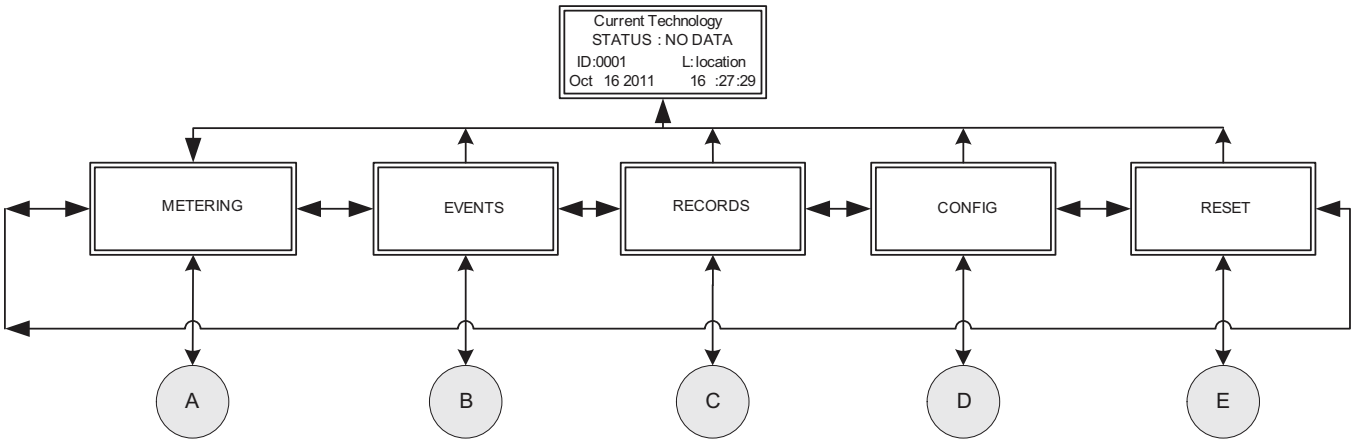


Figure 3: Main Screen to Main Menu

➤ HOME SCREEN/MAIN MENU

➤ METERING
- For viewing the metering values and surge counts.

➤ EVENTS
- For viewing and clearing events.

➤ RECORDS
- For viewing and clearing records.

➤ CONFIG
- For changing the configuration of the existing system.

➤ RESET
- For setting the system/threshold to default.
- Clearing records or events.
- Resetting the surge counter.

3.5 Metering Screen

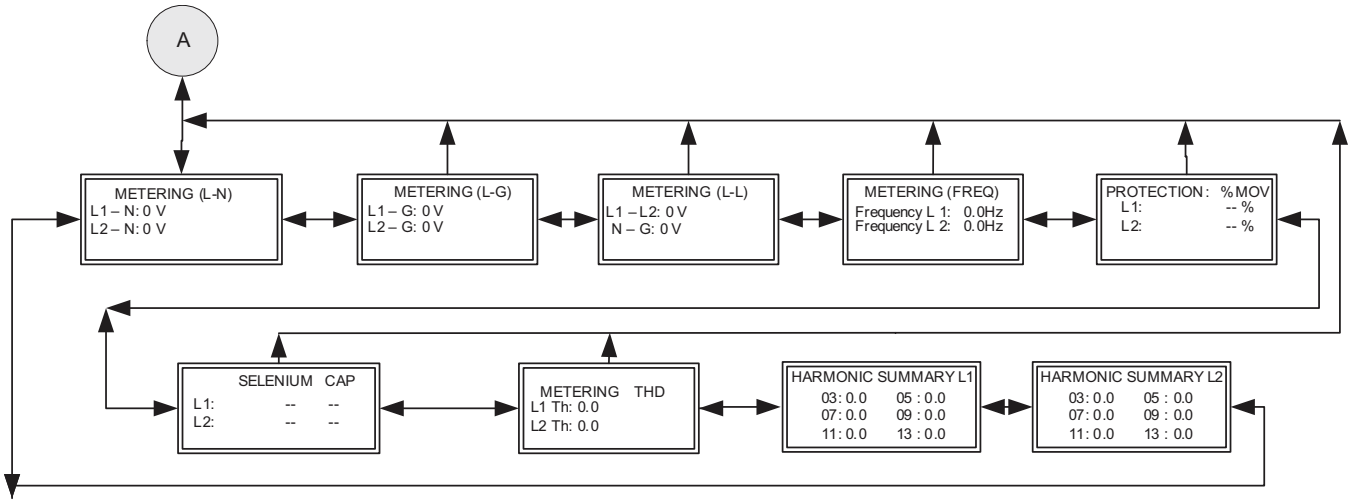


Figure 4: Metering Screen Sub Menus (2-Phase, 3-Wire mode)

The Metering (L-N), (L-G) & (L-L) Screen will change depending on the voltage mode selected. Figure 4 is valid only for 2-Phase, 3-Wire voltage configurations, like 120/240 2-Phase, 3-Wire + Ground. For 3-Phase, 4-Wire & 3-Phase, High-Leg DELTA voltages mode the Metering screen will change to the one displayed in Figure 5.

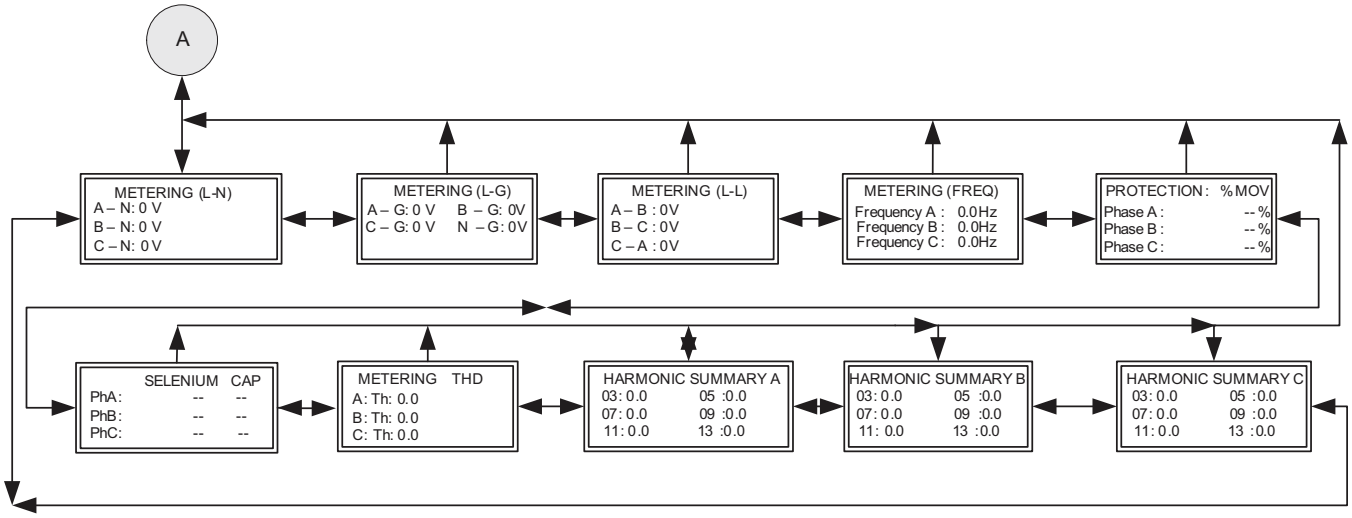


Figure 5: Metering Screen Sub Menus (3-Phase, High-Leg DELTA mode & 3-Phase, 4-Wire)

For 3-Phase, 3-Wire mode, no neutral or ground is present; hence the only metering screen needed is for L-L. Figure 6 shows the available sub menus in the metering screen.

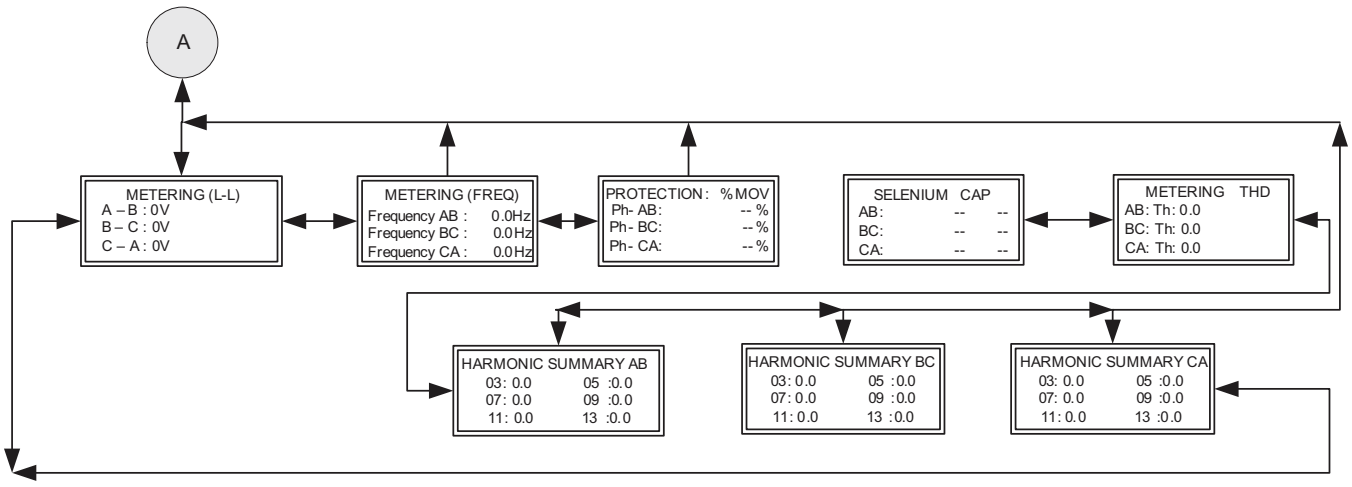


Figure 6: Metering Screen Sub Menus (3-Phase, 3-Wire)

3.6 Events Screen

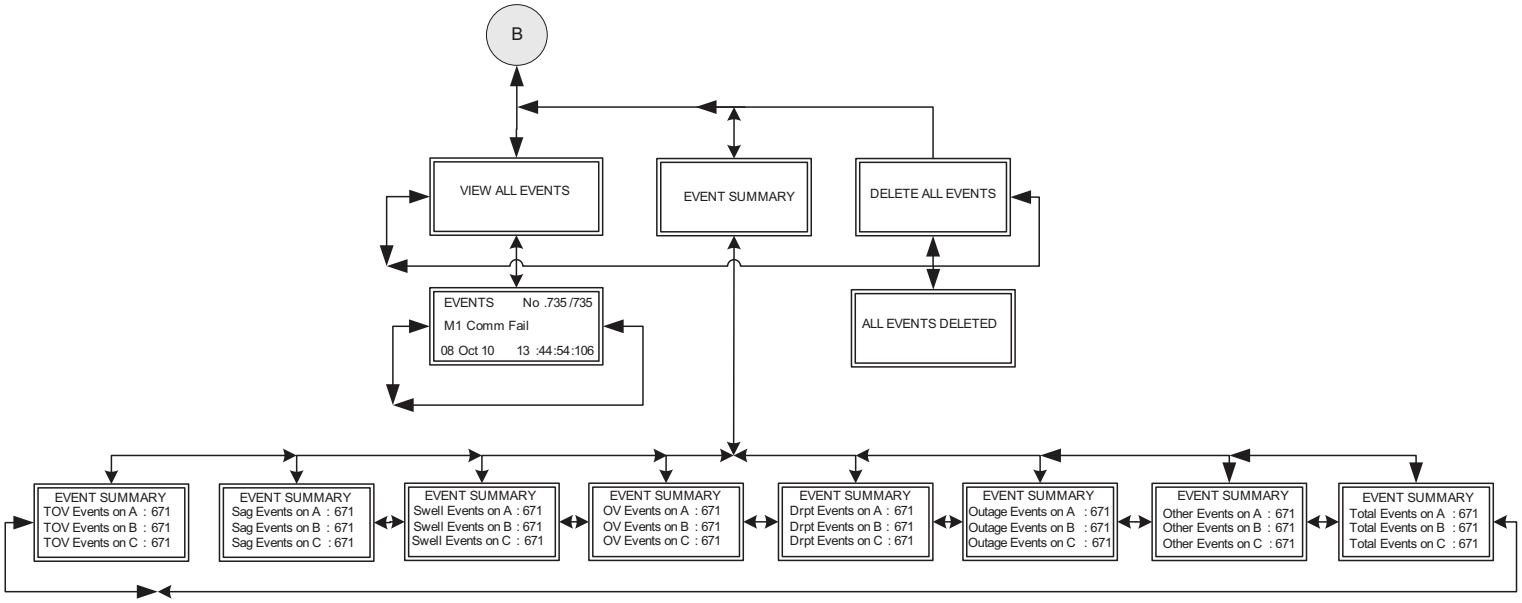


Figure 7: Event Screen Sub Menus

When entering the Event Screen, three options are available, **VIEW ALL EVENTS**, **EVENT SUMMARY** and **DELETE ALL EVENTS**. Upon entering VIEW ALL EVENTS, all the events that have been logged in M3 will be visible, if CLEAR KEY is pressed while in the Events Logged screen we will go back to the view all events screen. On selecting the **Event Summary** Screen (by pressing ENTER Key). The user will be able to see the following information:

- Total TOV Events on each Phase.
- Total Swell Events on each Phase.
- Total OV Events on each Phase.
- Total Sag Events on each Phase.
- Total Dropout Events on each Phase.
- Total Outage Events on each Phase.
- Other Events on each phase
- Total Event on each Phase.

On pressing cancel key from this screen, the event summary screen will reappear. Pressing next key will go to the **DELETE ALL EVENTS** screen. If we press ENTER on the Delete All Events screen it will delete all the events logged (If the user is logged in to the required level) and a new screen will appear showing **ALL EVENTS DELETED**. Press CLEAR button to exit from the screen and enter the event sub menu screen.
Note: All the events will be deleted on the entry to the ALL EVENTS DELETED SCREEN.

3.7 Records Screen

Upon entering the Records Screen, four options are available:

➤ **VIEW ALL RECORDS**

- In this menu all the records that are stored in the data base can be viewed. All types of Power Quality (PQ) records can be viewed here. The user can view the particular PQ i.e. Surge,TOV, Over Voltage etc. on the separate screen.

➤ **MIN/MAX RECORDS**

- This screen displays the Min/Max value of the particular PQ count for that particular day. They are also viewable depending on the various types of records. Figure 9 shows screen navigation in the Min/Max records.

➤ **RECORD SUMMARY**

- In this menu, the user will be able to see each PQ records total counts and the maximum duration for that particular PQ event.

➤ **DELETE ALL RECORDS**

- This option is used to delete all the records in the database. The Min/Max records will also be cleared.

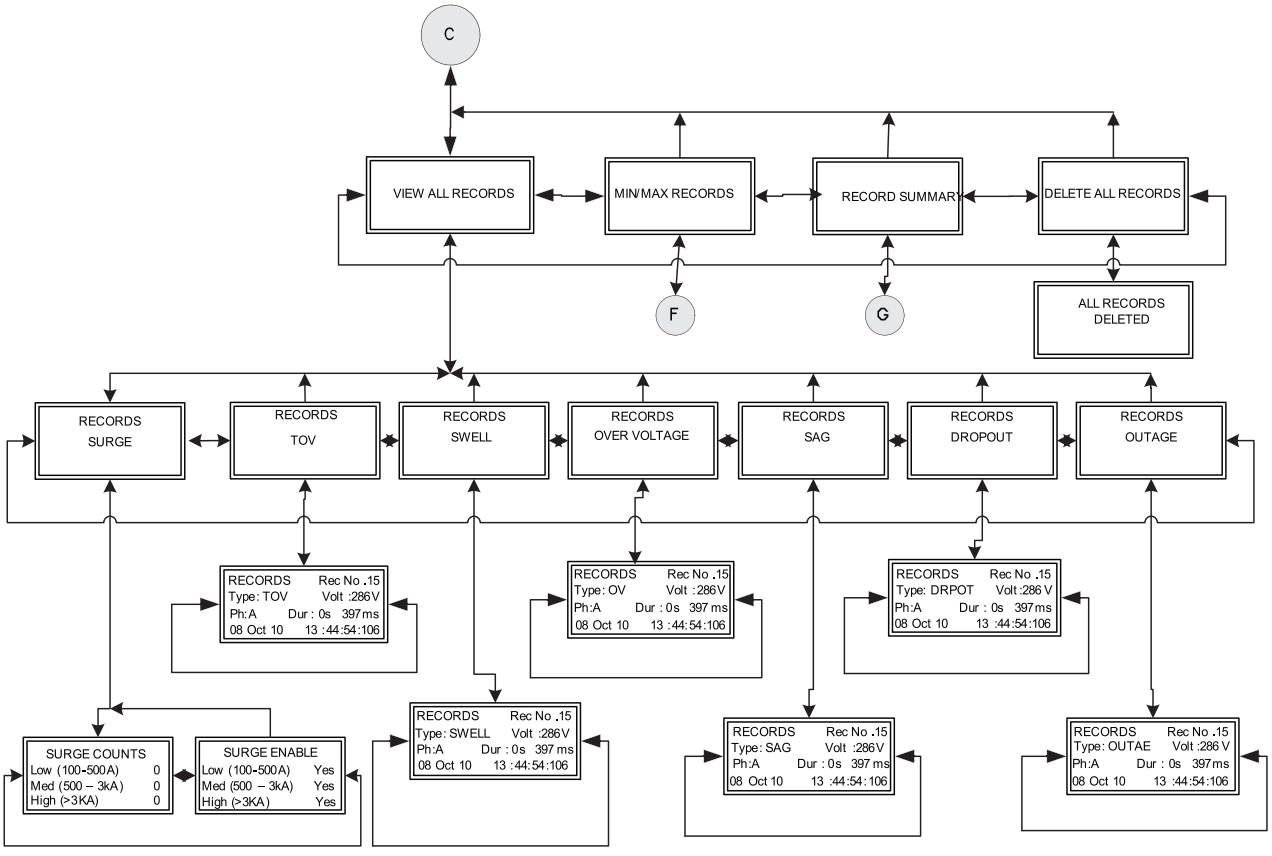


Figure 8 : View all Records Sub Menus

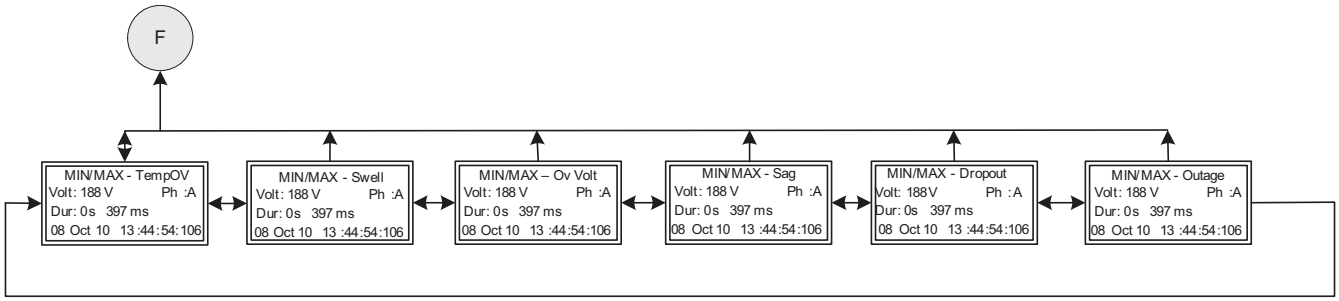


Figure 9: Min/Max Records Screen Navigation

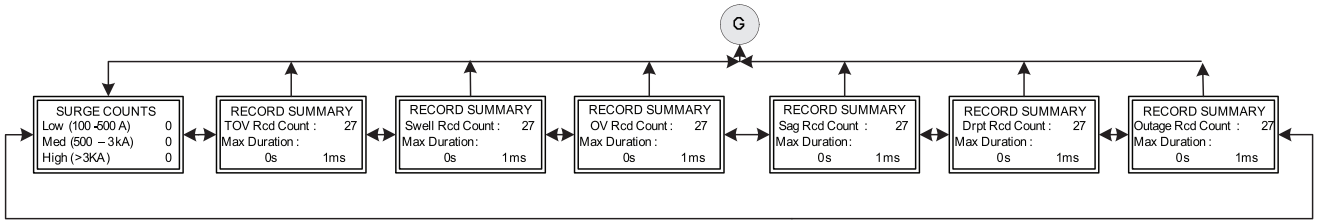


Figure 9A: Records Sub Menus

3.8 Configuration Screen

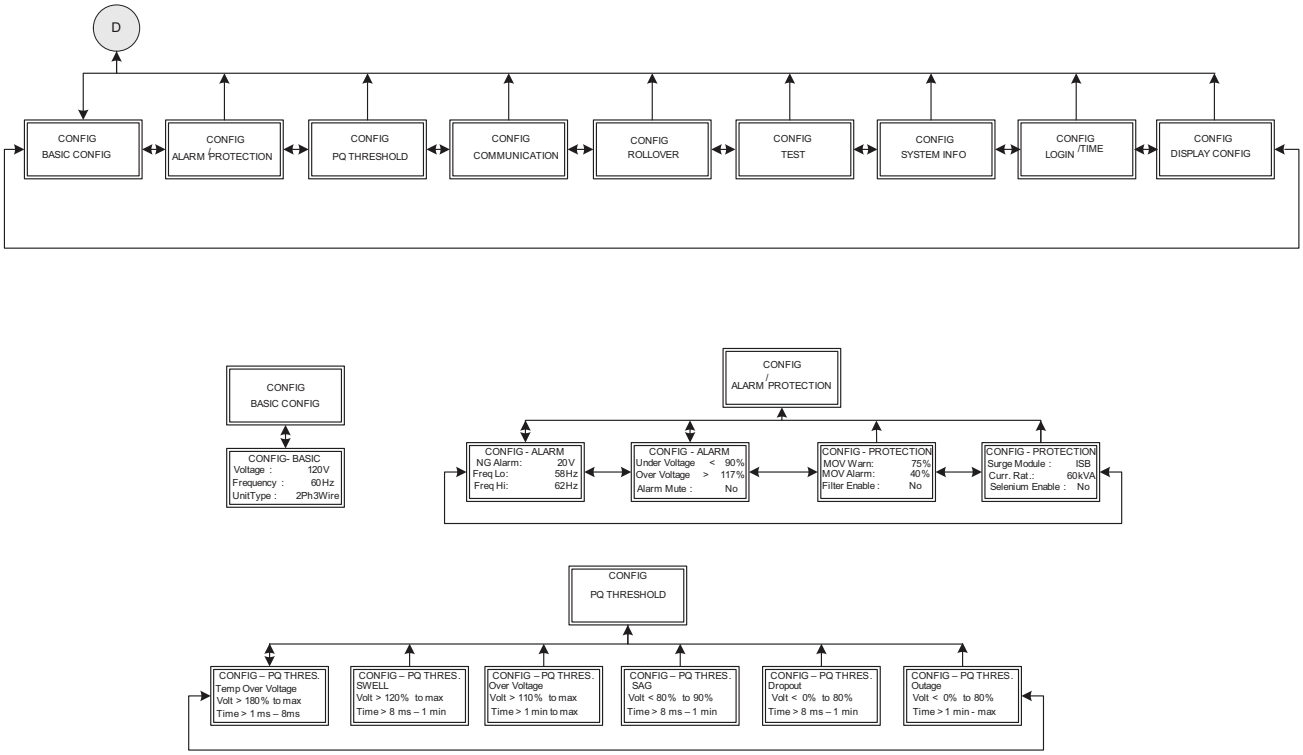


Figure 10: Configuration Screen Sub Menu-1

Figure 10 shows the various sub menus available. The sub menus available in the Configuration screen are:

➤ BASIC CONFIGURATION

- Screen for setting the Voltage, Frequency and Unit Type.

➤ ALARM/PROTECTIONS

- Screen for setting NG Alarm, Frequency Low & Frequency High.
- Screen for Under-Voltage, Over Voltage & Alarm Mute.
- Screen for MOV Warning and MOV alarm.
- Screen for setting the Surge Module, Current Rating and Selenium disable.

➤ POWER QUALITY THRESHOLDS

- Screen for setting the TOV voltage and time.
- Screen for setting the SWELL voltage and time.
- Screen for setting the Over Voltage's voltage and time.
- Screen for setting the SAG voltage and time.
- Screen for setting the DROPOUT voltage and time
- Screen for setting the OUTAGE voltage and time.

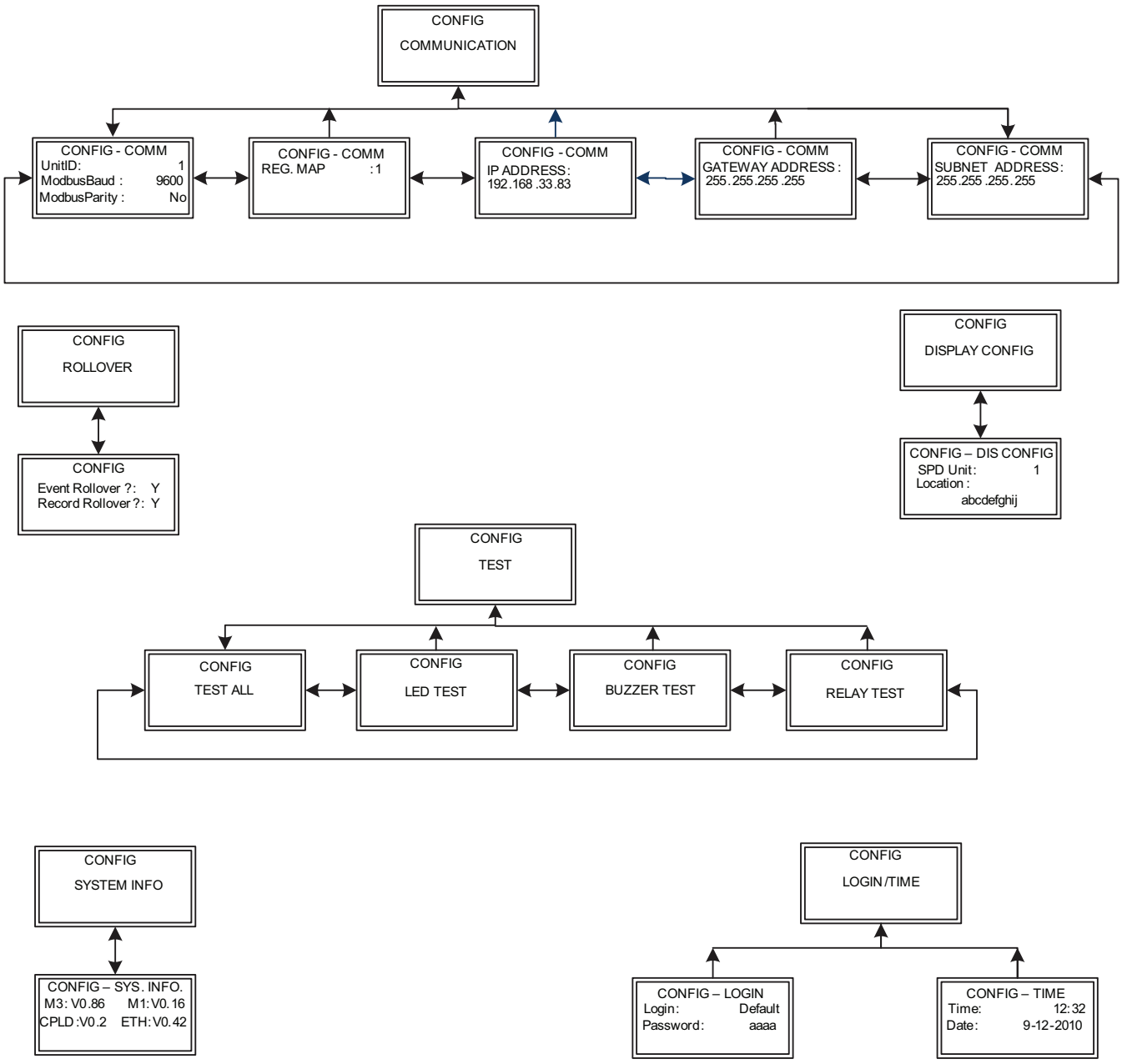


Figure 11: Configuration Screen Sub Menu-2

Figure 11 displays the various sub menus available. The menus available in the Configuration screen are:

➤ COMMUNICATION

- Screen for setting the Unit ID, Modbus Baud & Modbus Parity.
- Screen for setting the Reg. Map & IP Address.
- Screen for setting the Gateway address.
- Screen for setting the subnet mask.

➤ ROLLOVER

- Enable Event and Record Rollover.

➤ TEST

- Test all (M1 LEDs, Buzzer Test & Relays Test)
- LED Test (M1)
- Buzzer Test (M1)
- Relay Test (M1)

➤ SYSTEM INFO

- Screen for viewing M3 DSP version & M1 version.
- Screen for viewing CPLD and Ethernet Module Version

➤ LOGIN LEVELS AND TIME/DATE

- Screen for entering the username and password
  Note: *After entering the last letter of the password, press Home Key. "Login Successful" should appear in the display.*
- Screen for entering the time and date.

➤ DISPLAY CONFIGURATION

- Set the SPD ID
- Set the SPD Location

3.9 Reset Screen

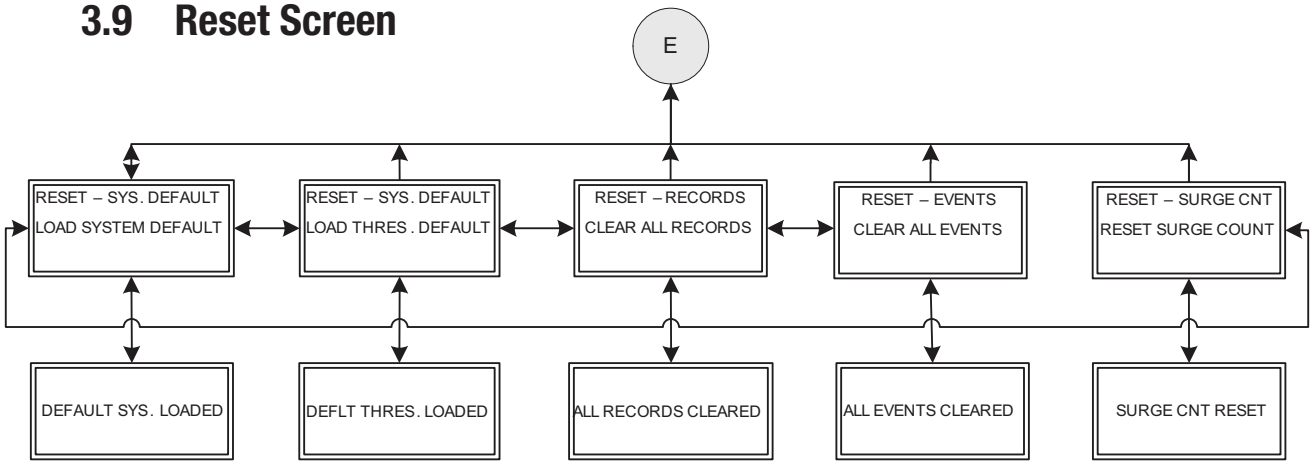


Figure 12: Reset Screen Sub Menus

Figure 12 shows the various screens available under the Reset menu.

➤ LOAD SYSTEM DEFAULT

- Screen for loading the default system values.
- See section 8.3 for system default values.

➤ LOAD THRESHOLD DEFAULT

- Screen for loading the default threshold values.
- See section 8.4 for default values.

➤ CLEAR ALL RECORDS

- Screen for clearing all the Power Quality records.

➤ CLEAR ALL EVENTS

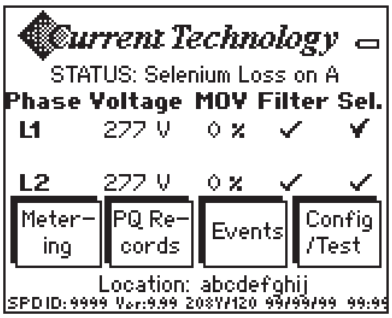
- Screen for clearing all the events.

➤ RESET SURGE COUNTS

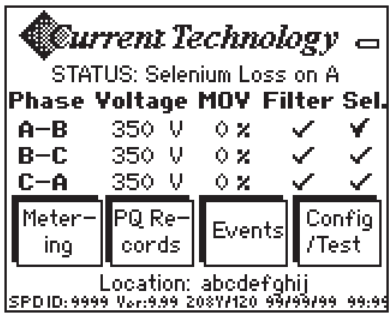
- Screen for resetting the surge counts.

4.0 LCD Graphics Display

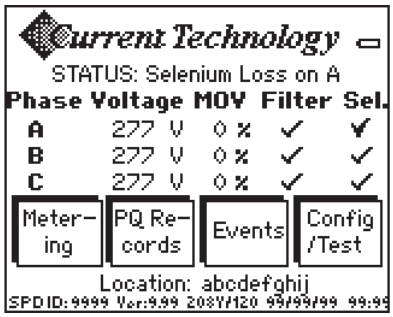
4.1 Main Screen



Split



Delta



Wye

Above are the images of the Main Screen/Startup Screens on the graphics display, the phases displayed on these screens depends on the system type. For example, a 2-Phase, 2-Wire system (Split) will display L1 & L2, whereas a 3-Phase, 3-Wire system (Delta) will display A-B, B-C & C-A and a 3-Phase, 4-Wire system (Wye) will display A, B, C. In short, this screen changes depending on the System Type selected.

A rotating status message is also displayed in this screen. Three message display here:

- **Alarm Status messages**
  A rotating status message is also like Voltages drop/low/high, MOV alarm/Warn condition and many other alarm related messages
- **PQ Status Messages**
  Displays the latest Power Quality event that has occurred on the system
- **System Status messages**
  Displays information like EEPROM error and other system related information

These messages are displayed in cyclic fashion with an interval for 3 seconds between each status message. These messages will persist even after the faults have gone away. The message can be cleared by pressing the cancel button when the home screen is visible. This also has the effect of extinguishing the Alarm LED.

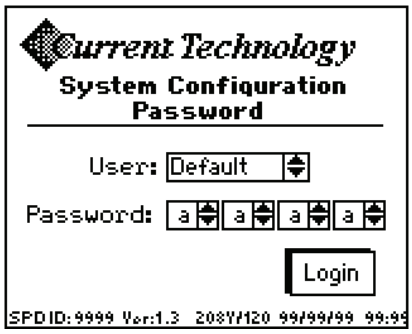
The screen also contains the following information:

- Low Battery indicator
- MOV status of all lines
- Selenium Status (optional)
- Filter Status (optional)
- Current Voltage (Depending on System Type)
- SPD Unit Number
- SPD Location
- Software Version of the system
- System Type
- Date
- Time

4.2 Login

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 the last letter of the password is entered, highlight the* Login *box and press the Select key. If this is successful, the screen will show the user name that was just entered, and the password will revert back to "aaaa."*

4.2.1 How to change Login Level with the Graphic Display

Press **HOME** to get to MAIN screen.

Press **PREVIOUS** > **SELECT** to get into the CONFIG/TEST screen.

Press **PREVIOUS** > **PREVIOUS** > **SELECT** to get into the LOGIN screen.

Press **SELECT** > and the USER field should blink.

Press **PREVIOUS** > **PREVIOUS** and the word SERVICE should appear there.

Press **SELECT** > **NEXT** to deactivate the USER field and get to the password.

Press **SELECT** and the first letter of the password should start blinking.

Press **NEXT** several times until a "c" appears.

Press **SELECT** > **NEXT** to deactivate the first letter and highlight the next.

Continue on with this process until "core" is shown in those fields.

(Holding the **NEXT** or **PREVIOUS** buttons will scroll through the alphabet.)

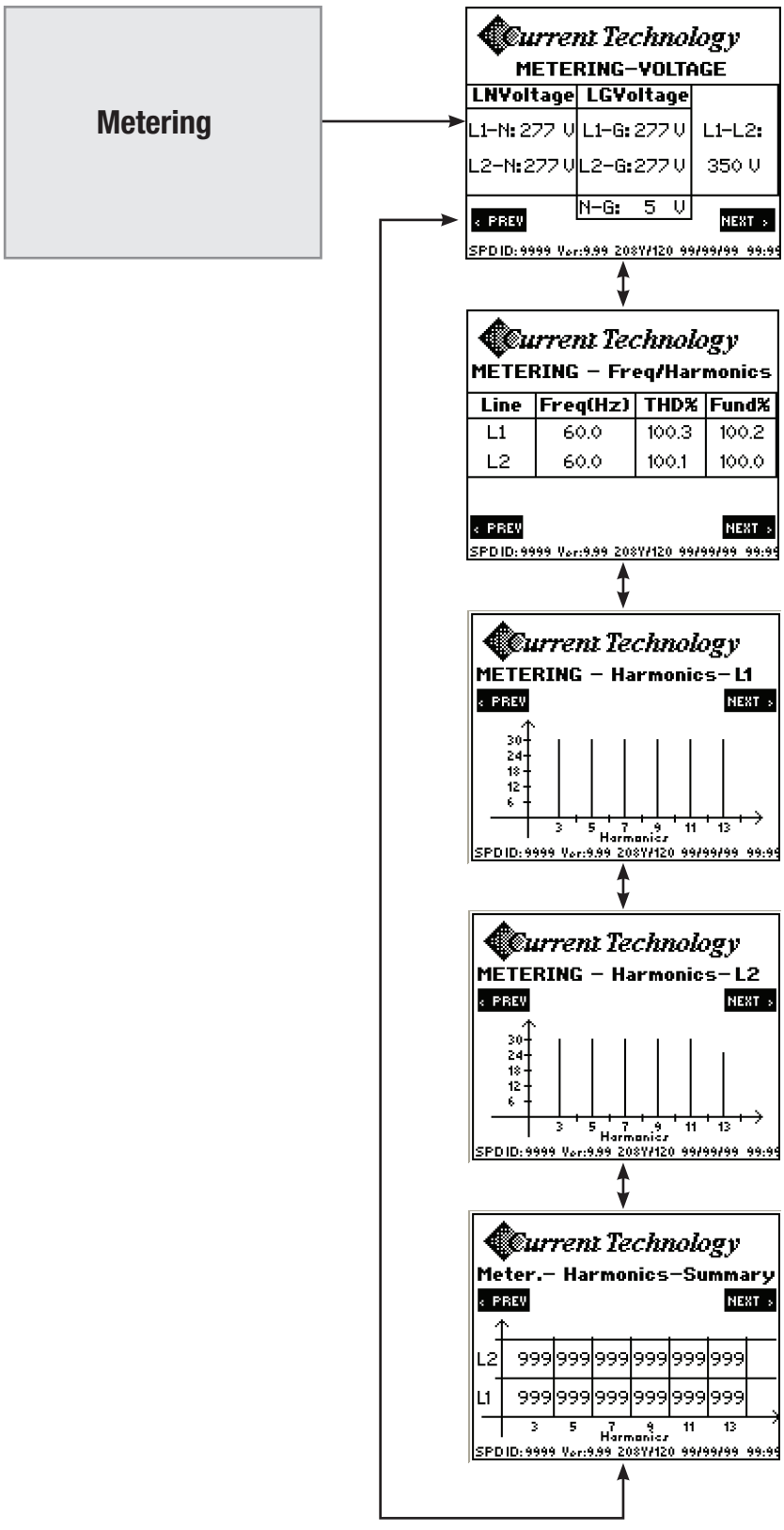
After the last letter is entered, navigate to the LOGIN "button" on that screen and press

SELECT. The words "Logging in . . ." should appear. The LOGIN screen will be visible again – this time with "Service" and "aaaa" displayed.

The user has four selectable menus from the Main Screen, including:

- Metering
- PQ Records
- Events
- Config /Test

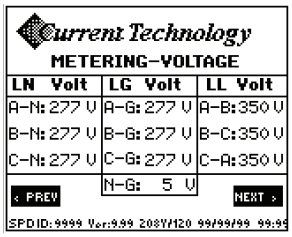
4.3 Metering Tree

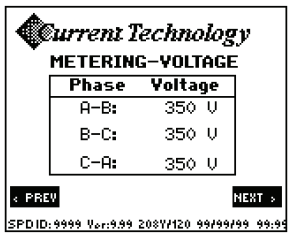


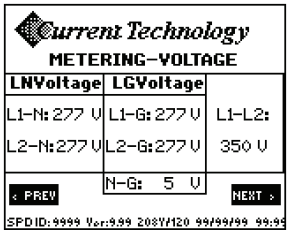
4.3.1 Metering Screens

Upon selecting the metering option:

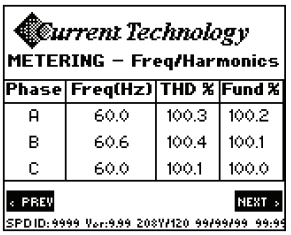
- All voltages depending on the mode (L)
  - For DELTA models (AB, BC, CA)
  - For WYE and High-Leg models (AN, BN, CN, AB, BC, CA, NG, AG, BG, CG)
  - For Split models (L1-N, L2-N, L1-G, L2-G, L1-L2, NG)
- The Surge Counts in the system
- The Frequency, Total Harmonics Distortion (THD) and Fundamental percentages.

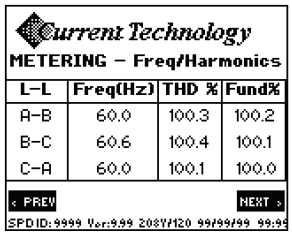


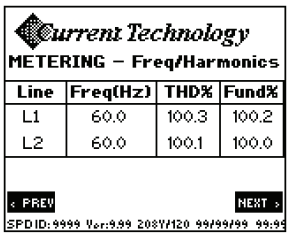




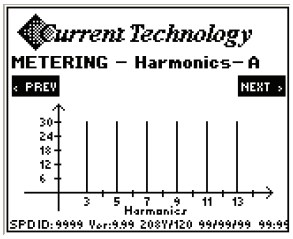
Metering – Voltage Examples

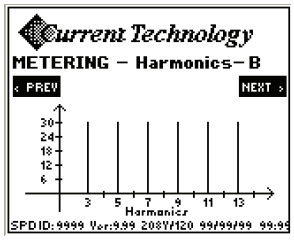


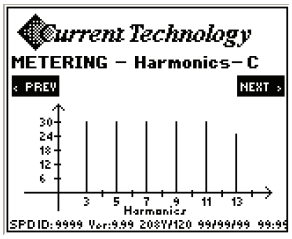


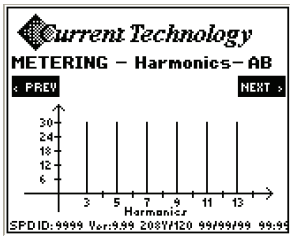


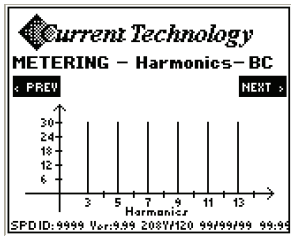
Metering – Frequency and THD and Fundamental (odd + even) Harmonics Examples

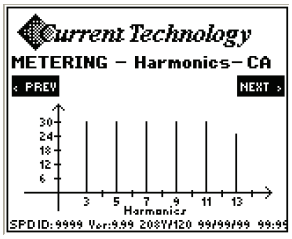


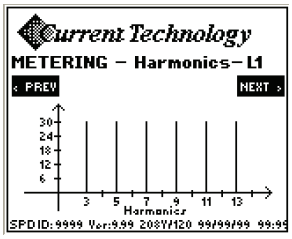


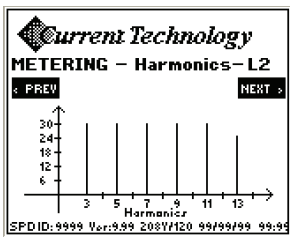




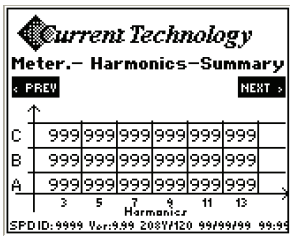


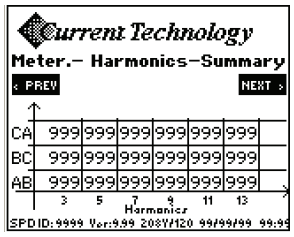


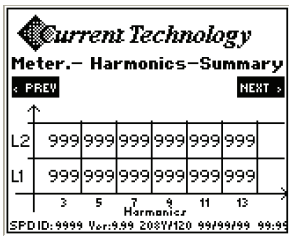




Metering – Harmonics per Phase/Mode Examples





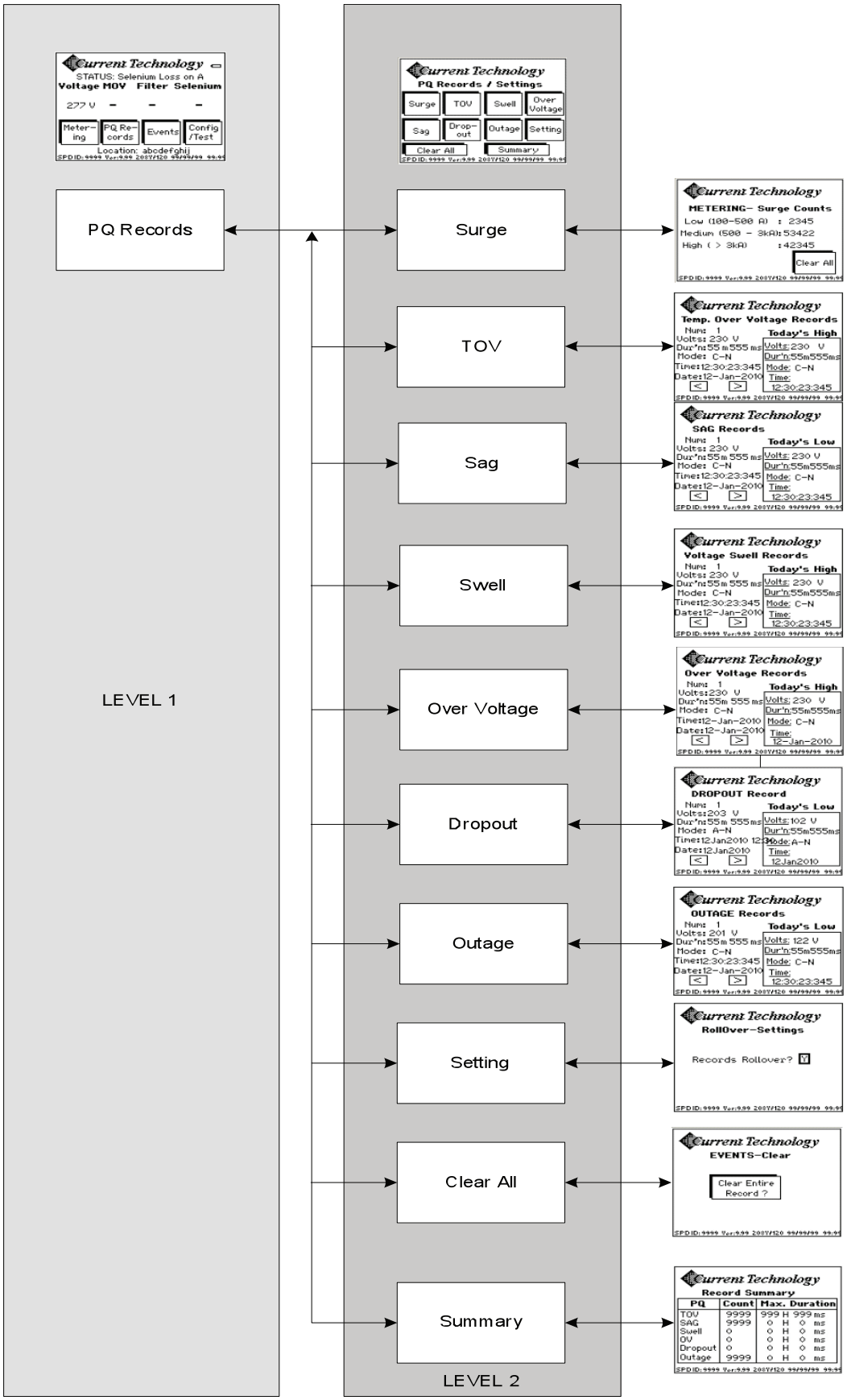


Metering – Harmonics Summary Examples

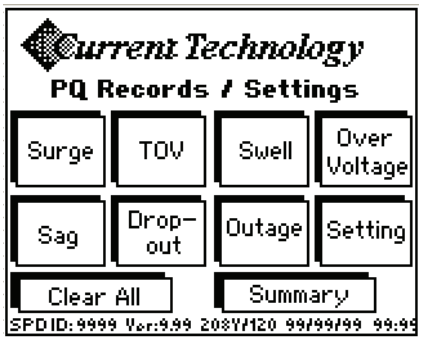
Upon entering the Metering Screens, the present Voltages, Frequency, Total Harmonic Distortion %, Fundamental %, 3rd, 5th, 7th, 9th, 11th and 13th harmonic values of each phase and Harmonic summary of each phase are viewable. The metering screens also will change depending on the different system types.

Note: THD reading reflects both odd and even harmonics.

4.4 Power Quality Records Tree

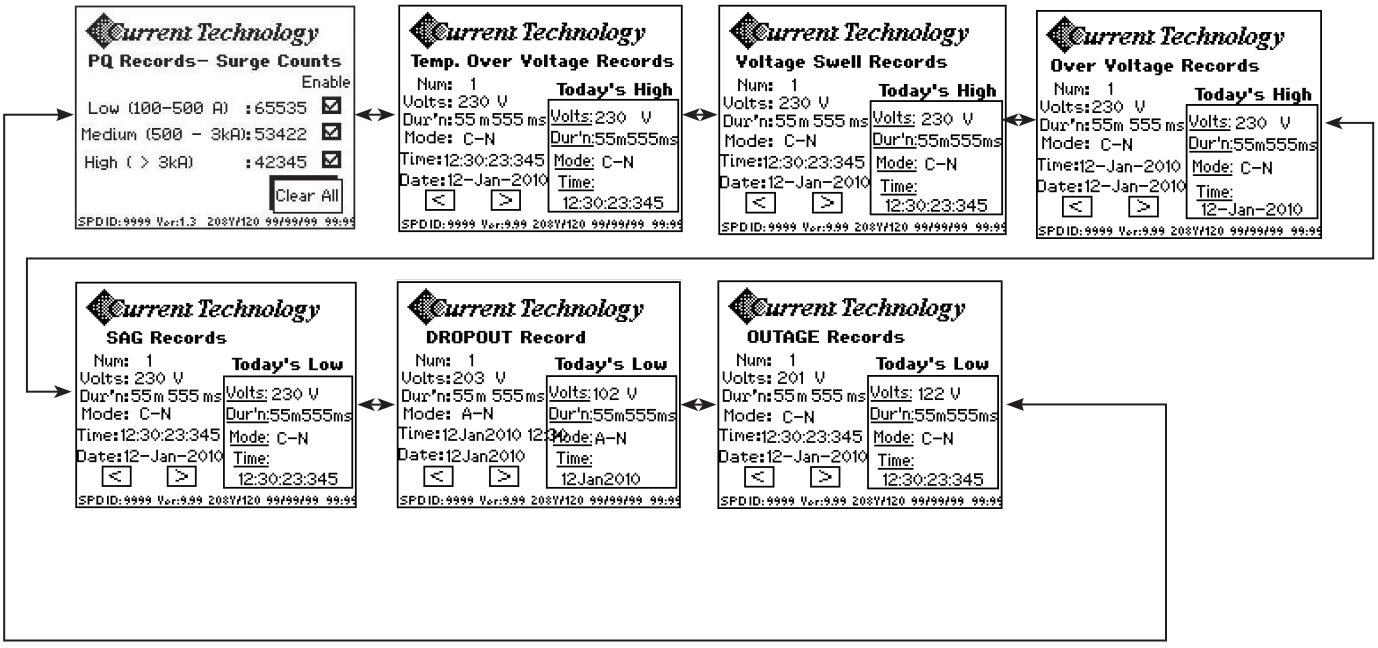


4.4.1 Power Quality Records



4.4.1.1 Power Quality Records Viewing

- These screens contain all the records stored in the system; Records are viewed according to its type. On selecting the Surge, TOV, Swell, Over Voltage, Sag, Dropout & Outage the following screens will be viewed respectively.
  Each Record Screen shows the highest/lowest voltage of that particular day.



4.4.1.2 Records Rollover – Settings

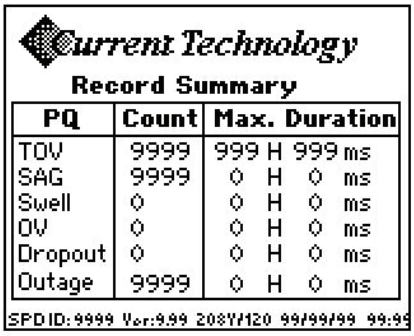
This page is used to allow the record to rollover or not. When the number of records reaches the maximum quantity, this option gives the user the ability to overwrite the oldest records. Setting Rollover to “N” will inhibit storage of new records after the maximum is reached.

4.4.1.3 Power Quality Records Clear All

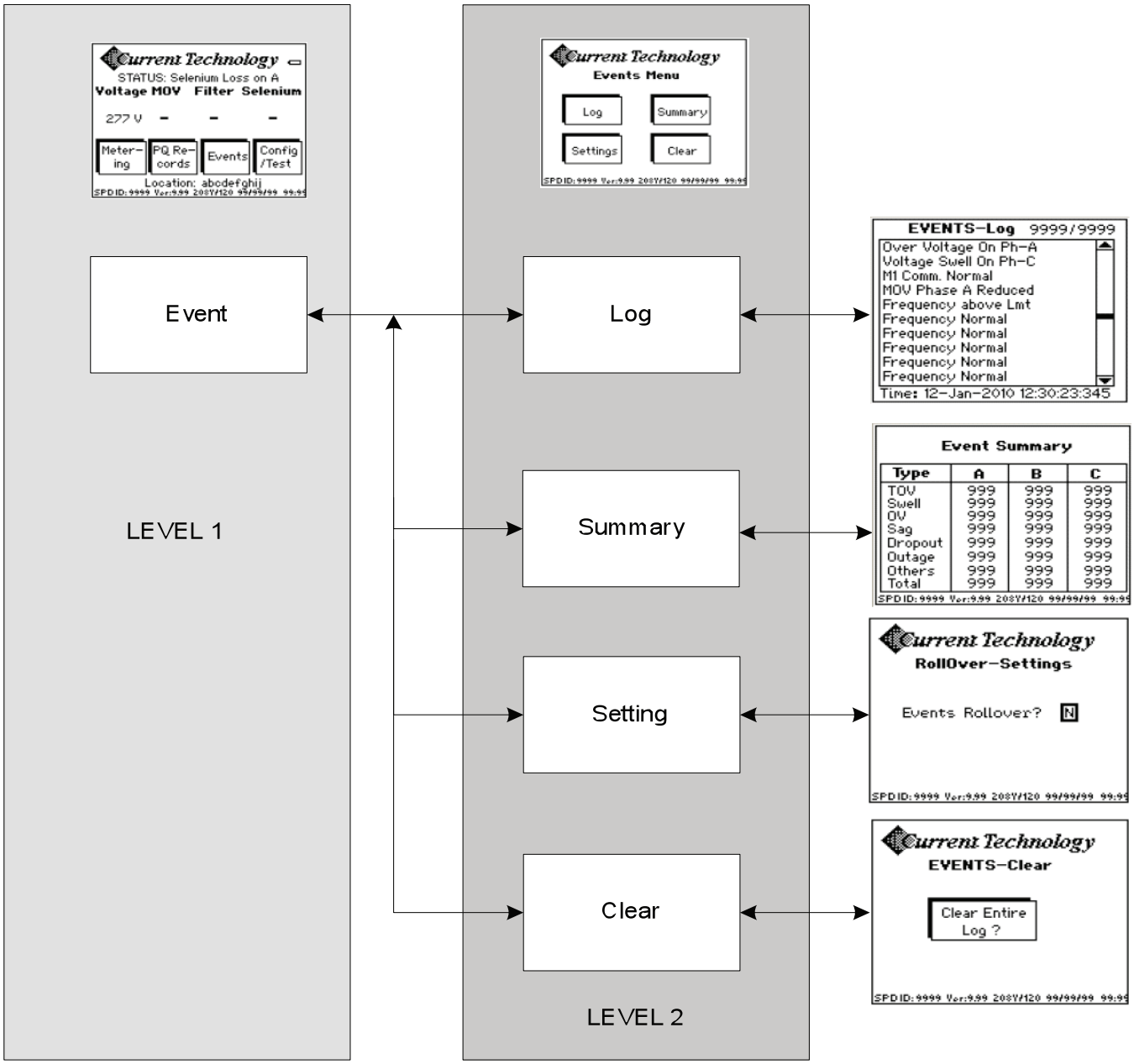
On selecting this button all the records present in the system will be cleared. It does not erase the corresponding events from the Event Log.

4.4.1.4 Power Quality Record Summary

This screen displays total number of records of each PQ events and their respective maximum durations.



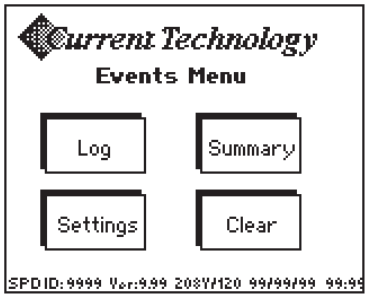
4.5 Events Tree



4.5.1 Events Menu

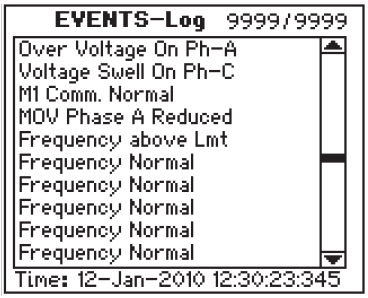
There are four options on this screen:

- **Log**
- **Settings**
- **Summary**
- **Clear**



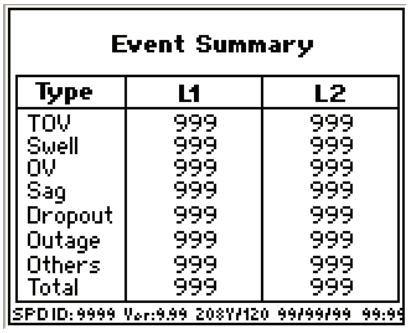
4.5.1.1 View Events Log

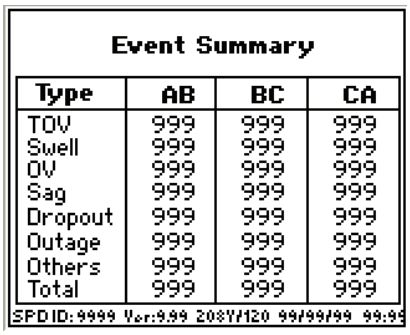
To view all Events logged in the system:
Use Prev/Next buttons to scroll through the list. Press and hold Prev + Select button for several seconds to jump to the first Event. Press and hold Next + Select buttons to jump to the last Event. If the highlighted Event is a PQ event, pressing Select will give you more information about that event. Press Cancel to return to a normal screen.

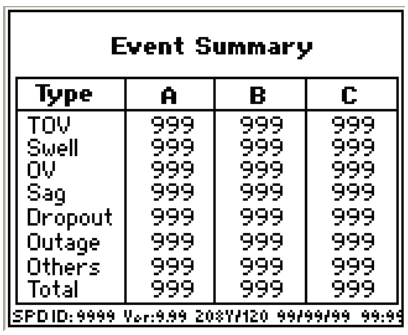


4.5.1.2 Summary

This screen shows the total number of Events that has occurred in each Phase, it also displays the number of PQ event related to each phase.







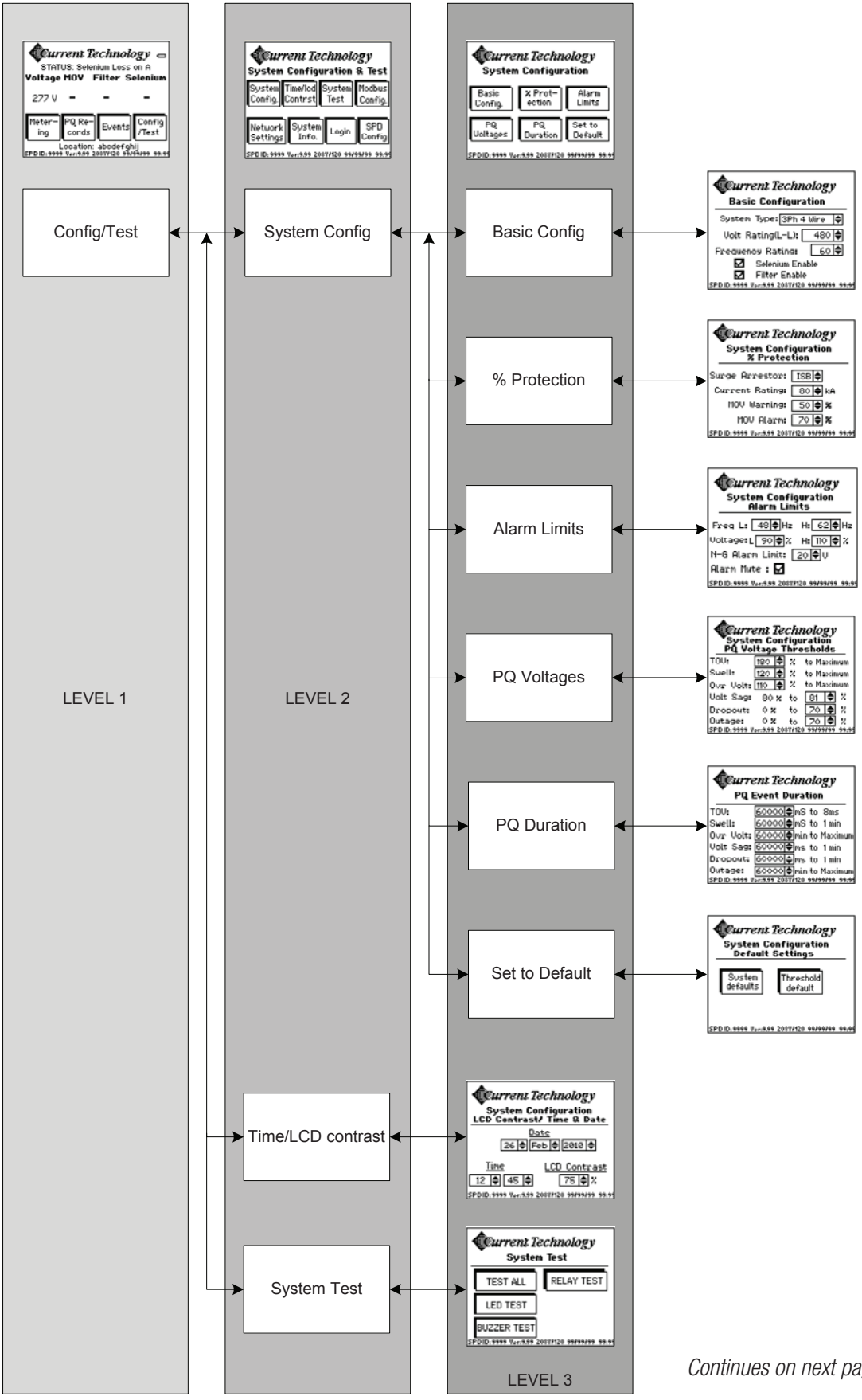
4.5.1.3 Events Rollover Settings

To enable or disable Events Rollover:
When the number of records reaches the maximum quantity, this option gives the user the ability to overwrite the oldest records. Setting Rollover to “N” will inhibit storage of new records after the maximum is reached.

4.5.1.4 Clear Events

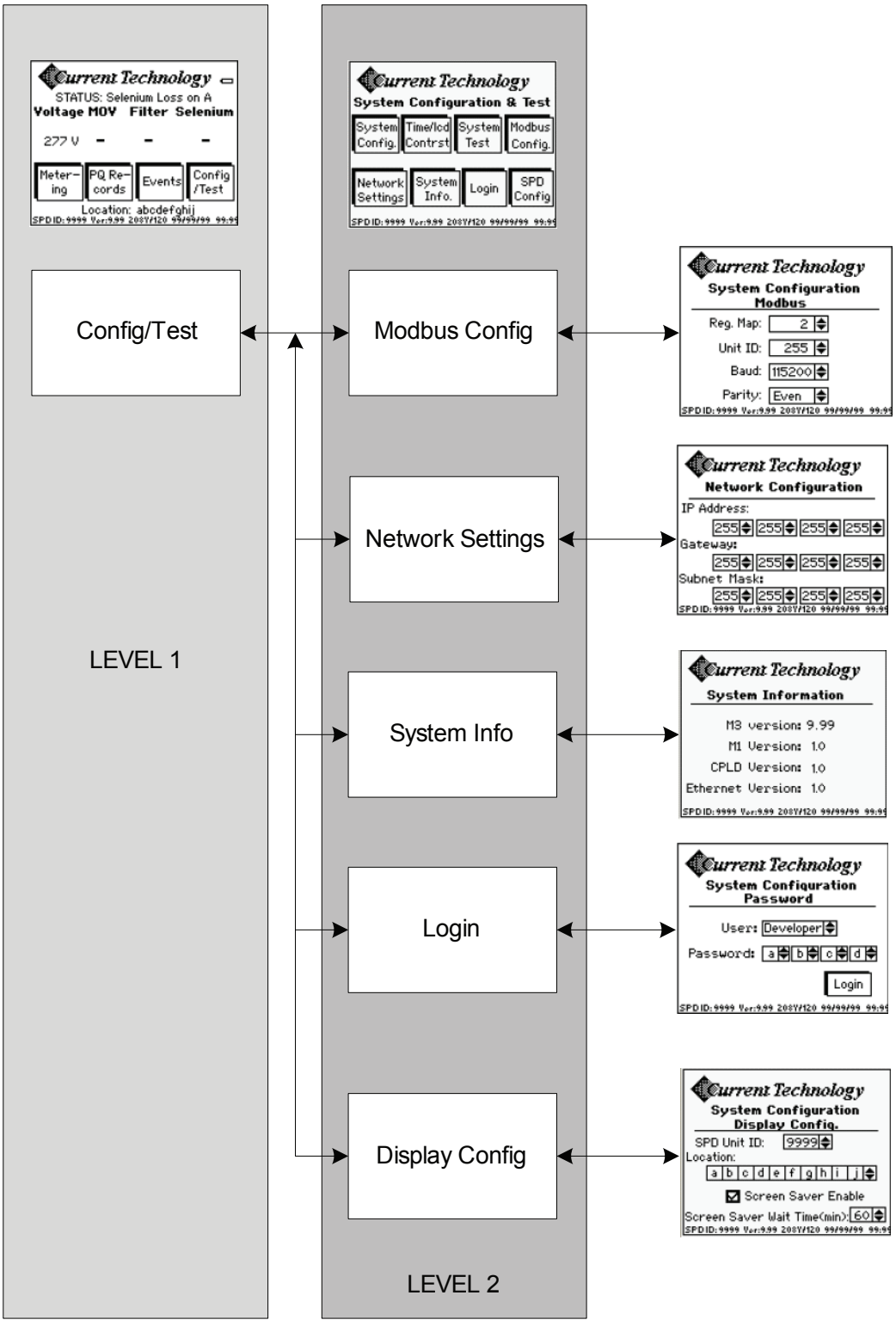
To clear all the Events

4.6 Config/Test Tree

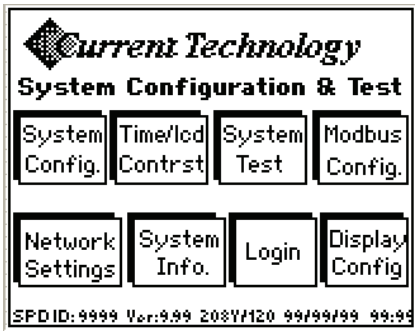


Continues on next page.

4.6 Config/Test Tree *Continued from previous page.*



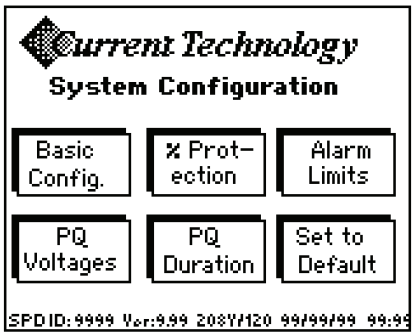
4.6.1 System Configuration & Test



Under this menu there are eight options available

- **System Config**
- **Time/LCD Contrast**
- **System Test**
- **Modbus Config**
- **Network Settings**
- **System Info**
- **Login**
- **Display Config**

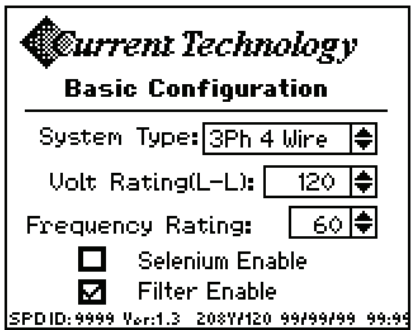
4.6.1.1 System Configuration



Under this menu there are six options available

- **Basic Config**
- **% Protection**
- **Alarm Limits**
- **Power Quality Voltages**
- **Power Quality Duration**
- **Set to Default**

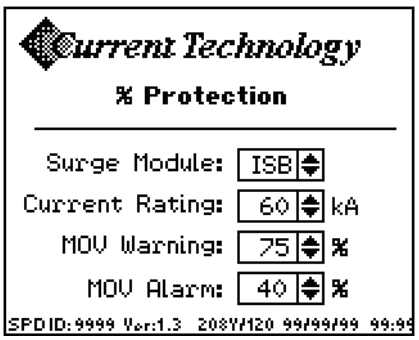
4.6.1.1.1 Basic Configuration



Allows the user to set the System Type, Voltage Rating, Frequency Rating, Selenium Enable & Filter Enable

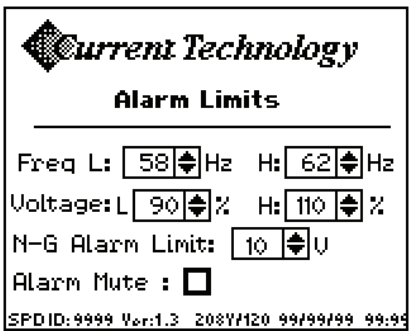
Note: If the system Type is even charged, the PQ record and Events Log should be cleared.

4.6.1.1.2 % Protection



Allows the user to set the Surge Module, Current Rating, MOV Warning & MOV Alarm.

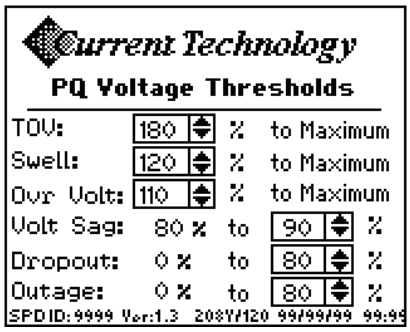
4.6.1.1.3 Alarm Limits



Allows the user to enter the Frequency Low, Frequency High, Voltage Low, Voltage High, Neutral to Ground Alarm and Alarm Mute settings

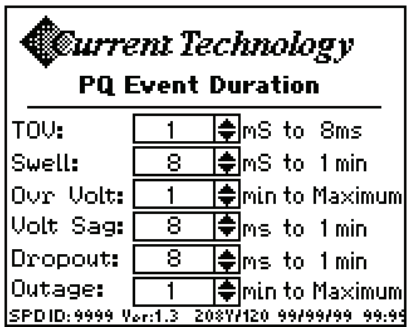
4.6.1.1.4 Power Quality Voltages

Sets the TOV, Swell, Over Voltage, Sag, Dropout & Outage Voltage limits



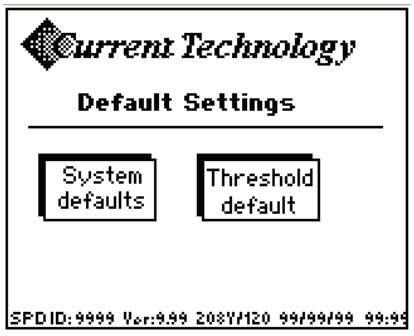
4.6.1.1.5 Power Quality Durations

Sets the TOV, Swell, Over Voltage, Sag, Dropout & Outage Voltage durations



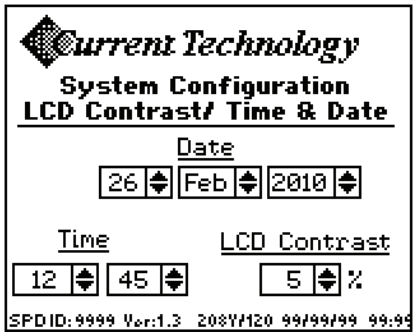
4.6.1.1.6 Set to Default

Allows the user to set the System/Threshold to default.
See section 7.4 for Threshold default.
Threshold defaults pertain to Power Quality settings only.
Caution: Restore system Default is a powerful function that restores almost all settings.



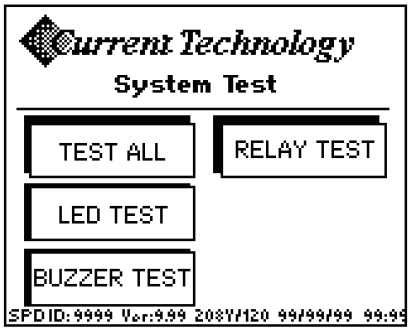
4.6.1.2 LCD Contrast / Time & Date

Sets the system time and the contrast of the LCD
Note: *Time is set in military 24-hour format.*



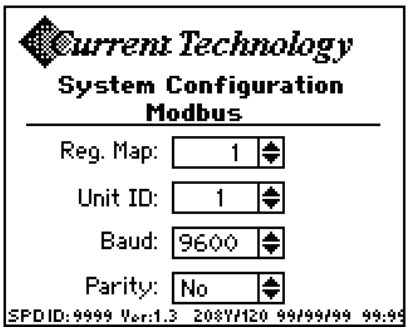
4.6.1.3 System Test

Perform test on M1: LED, Buzzer, Relay or All of the above



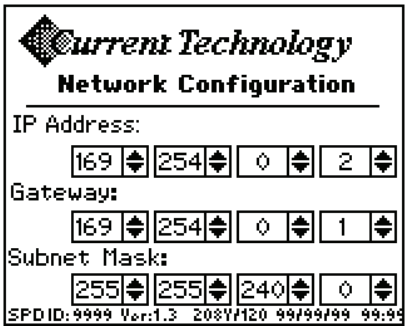
4.6.1.4 Modbus Configuration

Sets the Modbus map, Unit ID, Baud rate and Parity
(Default settings shown)



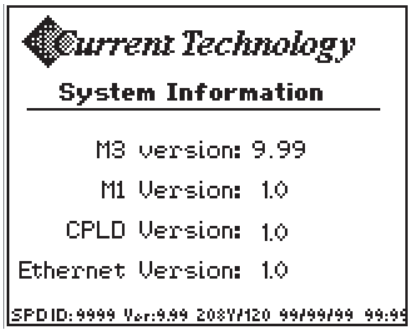
4.6.1.5 Network Configuration

Sets the IP address, default Gateway addresses and Subnet Mask



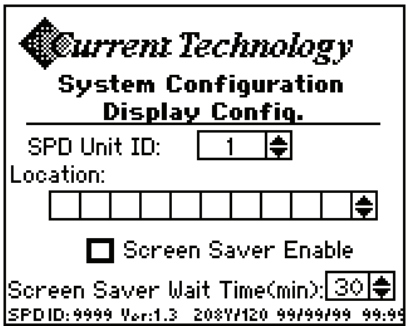
4.6.1.6 System Information

View the software version in M3 DSP, M1, M3 CPLD
and Ethernet module



4.6.1.7 SPD Configuration

To set the SPD unit number and the location.
Note: *This is not the same as the Modbus Unit ID.*



4.7 Software Reset

The system can be reset by pressing and holding Select+Cancel for 5 seconds. In the unlikely event that the system “hangs” the Reset button on the back of the MasterMind would need to be pressed. Alternately, the system power could be cycled.

5.0 Webserver Setup & Navigation

List of Figures

5.1 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 below. 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. 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.*

5.2 Block Diagram

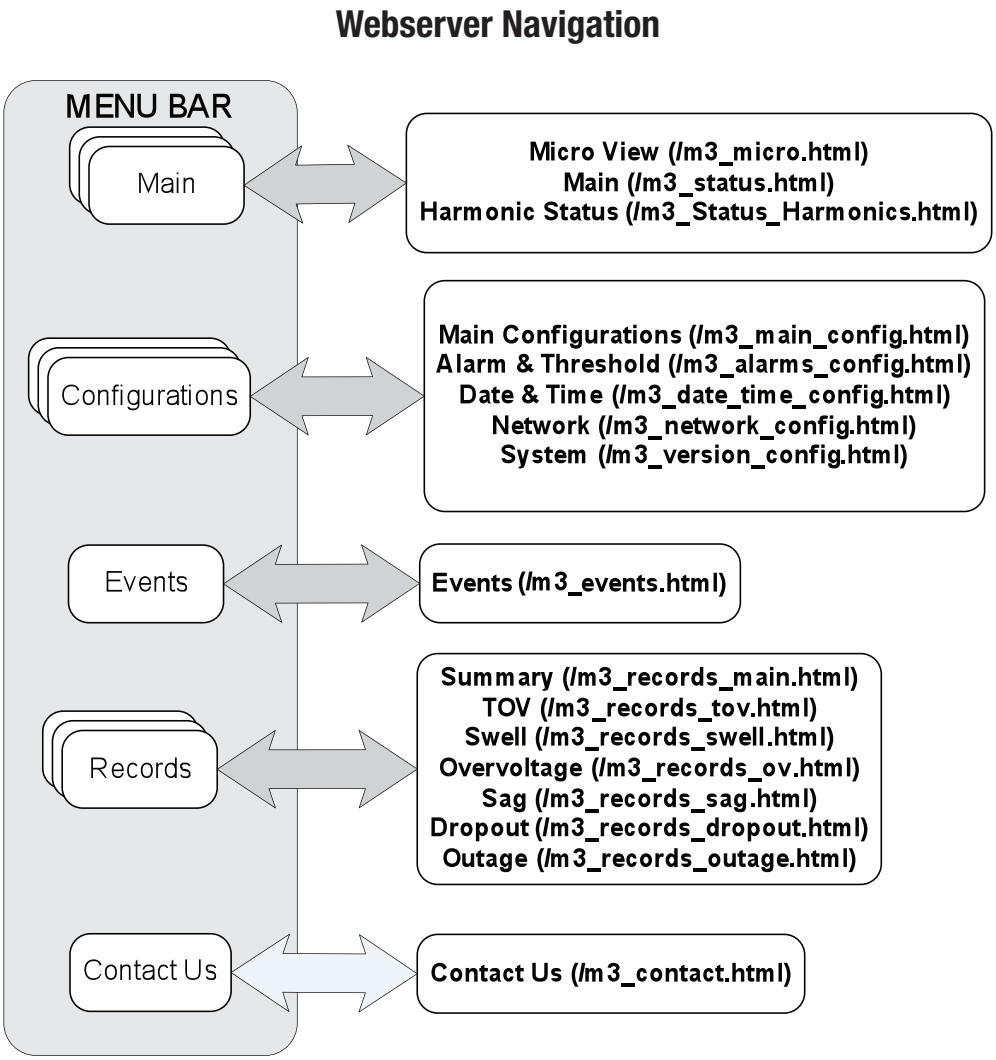


Figure 13: Block Diagram of the webserver navigation

5.3 Menu Bar

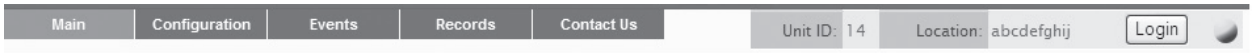


Figure 14: Menu bar of the SPD unit

Figure 14 shows the Menu-bar of the SPD unit's webserver which is displayed on every webpage. With the help of the Menu bar the User can navigate to different sections. The Menu bar is divided into five different tabs as indicated below:

- **Main Tab**
- **Configuration Tab**
- **Events Tab**
- **Records Tab**
- **Contact Us Tab**

A detailed explanation of the five different sections is provided later in this document. Details such as SPD unit's ID & SPD location are displayed on the Menu bar. A flashing green indicator indicates 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 15 below. Use lower case letters when typing in Login level and Password.

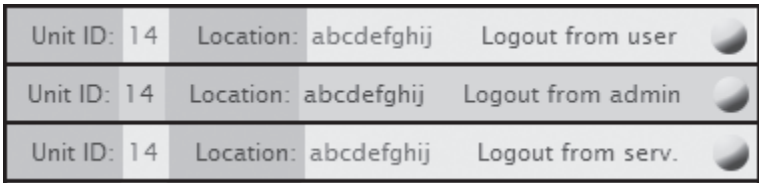


Figure 15: Menu bar when logged on to different levels

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

5.4 Main Tab

There are three options available under the Main tab:

- **Main Status**
- **Harmonic Status**
- **Micro View**

Figure 16: Dropdown menu of Main

5.4.1 Main Status *(/m3_status.html)*

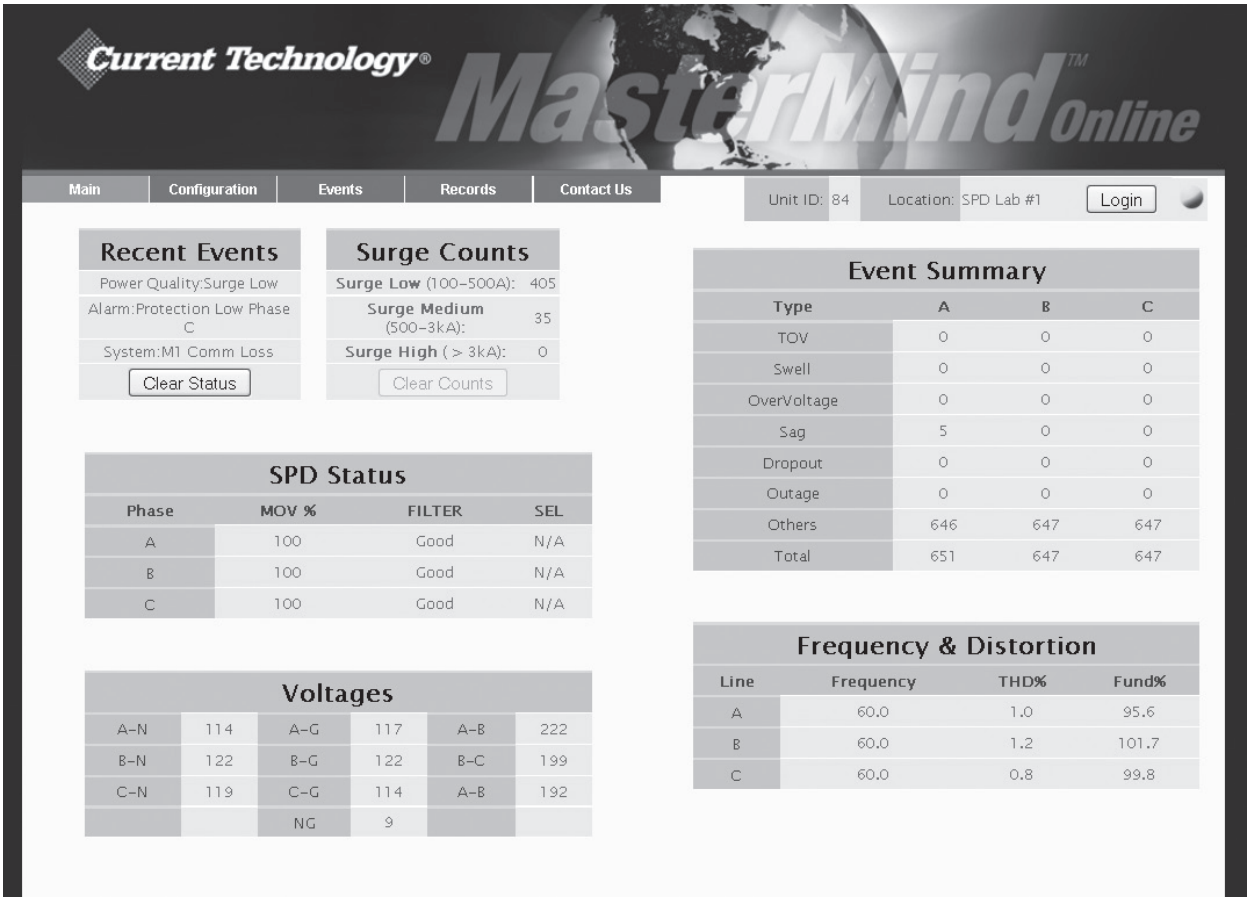


Figure 17: m3_status.html

Figure 17 shows the Main Status webpage. The information available on this webpage is:

➤ **Recent Events**
- Latest PQ (Power Quality) Event
- Latest Alarm Event
- Latest System Event
- Clear Status of all the Recent Events

➤ **Surge Counts**
- Counts for Low, Medium and High surges
- Clear all the surge counts *[allowed only from Login level 2 (Admin) or above]*

➤ **Surge Protection Device (SPD) Status**
- Metal Oxide Varistor % Protection (MOV%) of all available phases
- Selenium status of all available phases (optional)
- Filter status of all available phases (optional)

➤ **Voltages on all available phases**
- Line to Line (LL)
- Line to Neutral (LN)
- Line to Ground (LG)
- Neutral to Ground (NG)

➤ **Event Summary**
- Temporary Over Voltage (TOV) events on all available phases
- Swell events on all available phases
- Over Voltage (OV) events on all available phases
- Sag events on all available phases
- Dropout events on all available phases
- Outage events on all available phases
- Total events on all available phases

➤ **Frequency & Distortion**
- Frequency on all available phases
- Total harmonic distortion percentage (THD %) on all available phases
- Fundamental percentage (FUND%) on all available phases

5.4.2 Harmonic Status *(/m3_status_harmonics.html)*

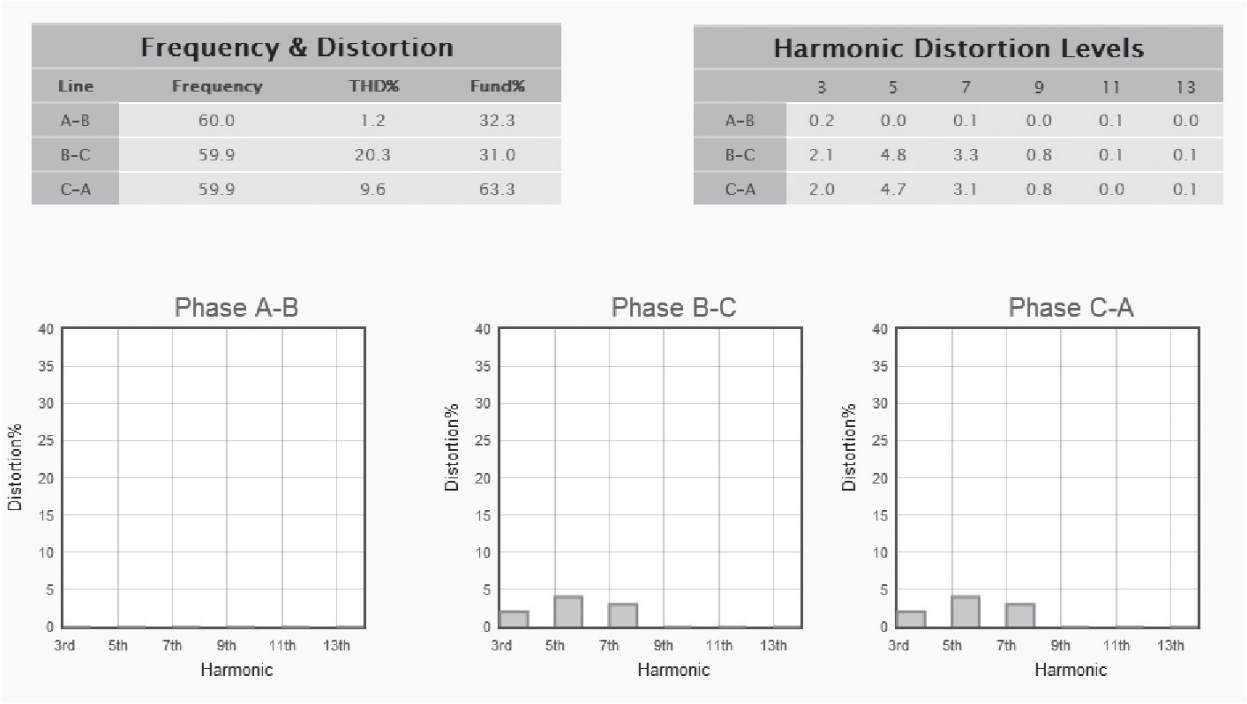


Figure 18: m3_Status_Harmonics.html page

The information available on the Harmonic Status webpage is:

➤ **Frequency & Distortion**

- Frequency on all available phases
- Total harmonic distortion percentage (THD % = Even + Odd) on all available phases
- Fundamental percentage (FUND%) on all the available phases

➤ **Harmonic Distortion Levels**

- 3rd, 5th, 7th, 9th, 11th & 13th distortion level of each phase

➤ **Graphical view of the harmonic distortion levels of all the phases**

5.4.3 Micro View *(/m3_micro.html)*

Micro View allows the user setup a tile style view for multiple SPD systems. Micro View provides a snapshot of the following:

The information available on the Micro View webpage is:

➤ **Unit ID & Location**

➤ **Recent Events**
- Power Quality Events
- Alarm Events
- System Alarm Events
- Clear status button to clear the recent events

➤ **System Type** (example: 3-Phase 4-Wire, 3-Phase 3-Wire... etc.)

➤ **SPD Status**
- Voltage of all available phases
- MOV% of all available phases
- Selenium status of all available phases
- Filter status of all available phases

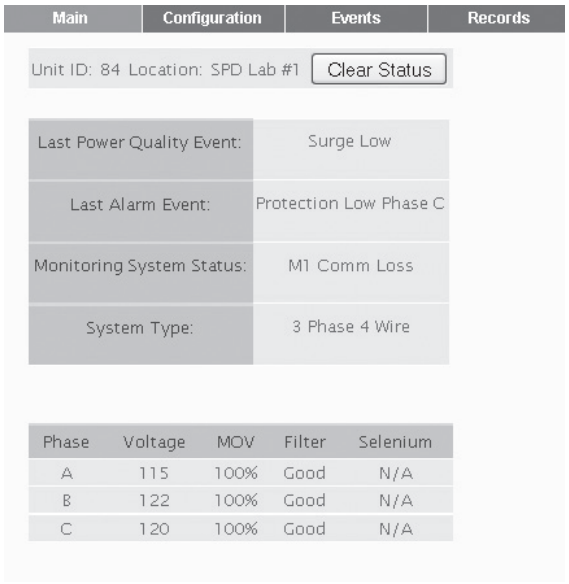


Figure 19: m3_micro.html page

5.5 Configuration Tab

There are five options available under the Configuration tab:

- **Main Configuration**
- **Alarm & Threshold**
- **Date & Time**
- **Network**
- **System**

Figure 20: Dropdown menu for Configuration

5.5.1 Main Configuration *(/m3_main_config.html)*

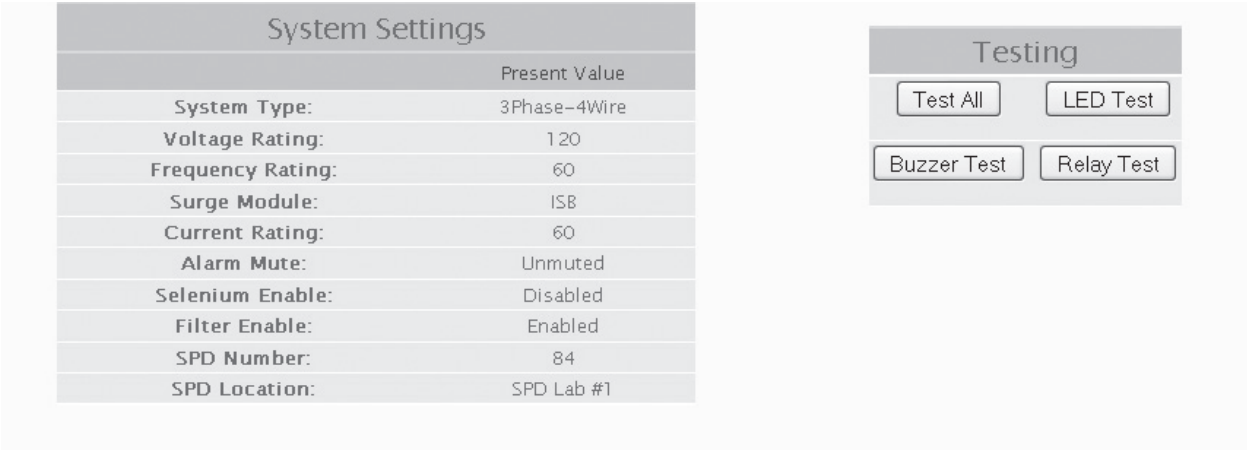


Figure 21: m3_main_config.html page

The following parameters can be viewed and configured on the Main Configuration webpage:

➤ **System Settings** *[editable only from Login level 3 (Service) or above]*

OPTIONS

- System Type ..... (See Section 8.1)
- Voltage Rating ..... (See Section 8.1)
- Frequency Rating ..... 50 or 60 Hz
- Surge Protection Device ..... ISB or ISM
- Current Rating ..... (See Section 8.2)*
- Alarm mute ..... Muted/Non-Muted
- Selenium Enable ..... Enable/Disable
- Filter Enable ..... Enable/Disable
- SPD unit number 1–9999
- SPD location number ..... 10 alpha-numeric characters

*ISB/ISM must be changed before changing current rating.
"System Config Submit" button helps in saving the new System Setting values. Once the System Setting is saved in SPD unit, the present value is updated.

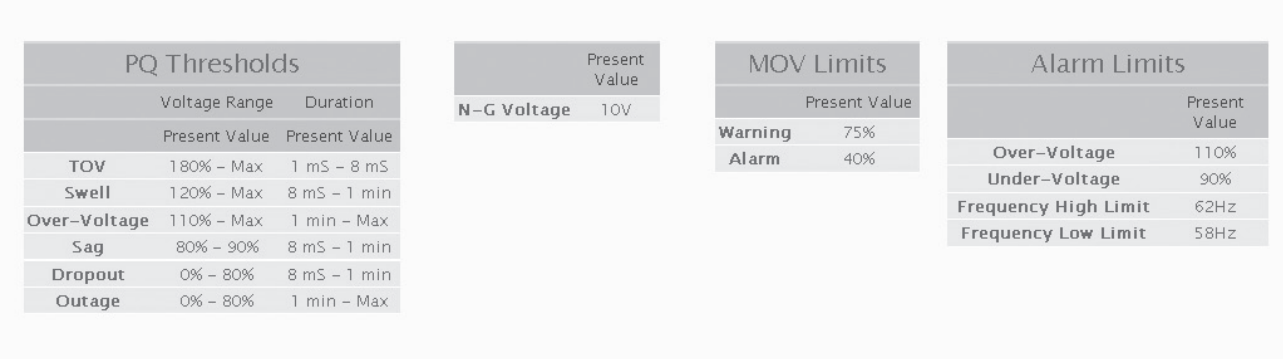
➤ **Default Settings** [viewable only from Login level 3 (Service) or above]

- Threshold default settings – Set all threshold values to default
- See section 8.3 for System default values
- See section 8.4 for Threshold default values

➤ **Testing**

- Test All – Test all the LEDs, buzzer & relay on M1 board
- LED Test – Test only the LEDs of the M1 board
- Buzzer Test – Test only the buzzer of the M1 board
- Relay Test – Test only the relay of the M1 board.

5.5.2 Alarm & Threshold *(/m3_alarms_config.html)*



PQ Thresholds

	Voltage Range	Duration
	Present Value	Present Value
TOV	180% – Max	1 mS – 8 mS
Swell	120% – Max	8 mS – 1 min
Over–Voltage	110% – Max	1 min – Max
Sag	80% – 90%	8 mS – 1 min
Dropout	0% – 80%	8 mS – 1 min
Outage	0% – 80%	1 min – Max

	Present Value
N–G Voltage	10V

MOV Limits

	Present Value
Warning	75%
Alarm	40%

Alarm Limits

	Present Value
Over–Voltage	110%
Under–Voltage	90%
Frequency High Limit	62Hz
Frequency Low Limit	58Hz

Figure 22: m3_main_config.html page
(Default values shown)

The following information is viewable and editable on the Alarm & Threshold webpage:

➤ **Power Quality Thresholds** [editable from Login level 2 (Admin) or above]
- Voltage range of TOV, Swell & Over Voltage (only lower voltage limit are editable).
- Voltage range of Sag, Dropout & Outage (only upper voltage limit are editable).
- Duration of all the power quality (only upper time limits are editable in duration).

"Power Quality Config Submit" button saves the new threshold values.

➤ **N-G Voltage Alarm Limit** [editable from Login level 2 (Admin) or above]

"N-G Voltage Limits Submit" button saves the new N-G voltage value.

➤ **MOV Limits** [editable from Login level 2 (Admin) or above]
- Warning percentage limit of MOV
- Alarm percentage limit of MOV

"MOV Limits Submit" button saves the new MOV limits values.

➤ **Alarm Limits** [editable from Login level 2 (Admin) or above]
- Alarm limit of Over Voltage
- Alarm limit of Under Voltage
- Alarm limit of Frequency high limit
- Alarm limit of Frequency low limit

"Alarm Limits Submit" button saves the new Alarm Limits values.

5.5.3 Date & Time *(/m3_date_time_config.html)*

The following information is viewable and editable on the Date & Time webpage:

➤ **Date** [editable from Login level 2 (Admin) or above]
- Month
- Date
- Year

➤ **Time** [editable from Login level 2 (Admin) or above]
- Hours (military 24-hour time)
- Minutes

By clicking the "Date & Time Config Submit" button the new configuration can be saved

Figure 23: m3_date_time_config.html page

5.5.4 Network *(/m3_network_config.html)*

The following information is viewable and editable on the Network webpage:

➤ **Modbus** [editable from Login level 3 (Service) or above]
- Register Map
- Unit ID
- Baud Rate
- Parity

The Modbus settings can be saved by pressing the "Modbus Config Submit" button

➤ **Ethernet** [non-editable; can be edited only from the M3 unit board]
- IP Address
- Subnet Mask
- Default Gateway

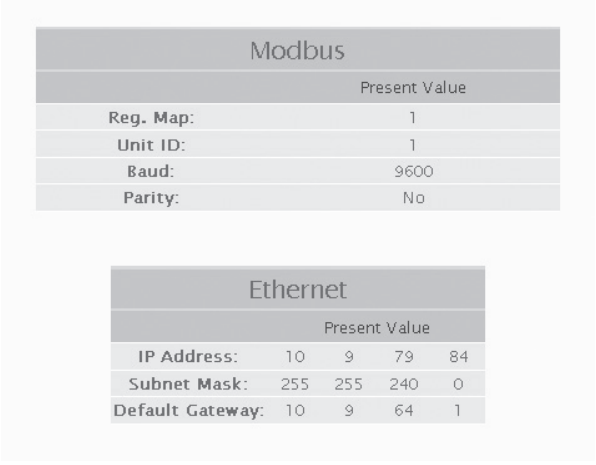


Figure 24: m3_network_config.html page

5.5.5 System *(/m3_version_config.html)*

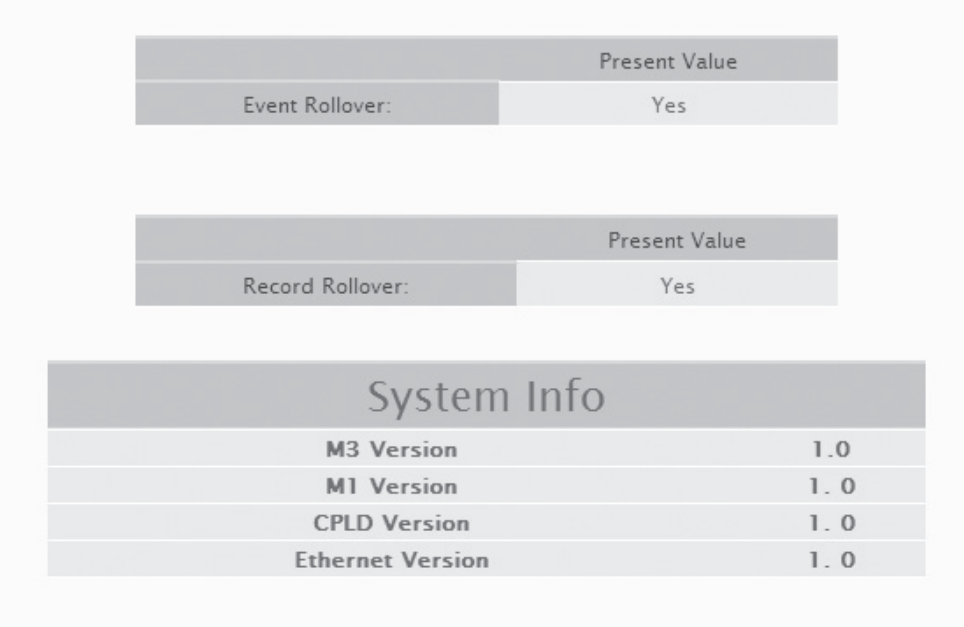


Figure 25: m3_version_config.html page

The following information is viewable and editable in the System webpage:

➤ **Event Rollover** Setting this value to Yes allows oldest ***Events*** to be written over.
The event rollover feature can be saved by pressing the "Event Rollover Submit" button.

➤ **Record Rollover** Setting this value to Yes allows oldest ***Records*** to be written over.
The record rollover feature can be saved by pressing the "Record Rollover Submit" button.
When the number of records reaches the maximum quantity, this option gives the user the ability to overwrite the oldest records. Setting Rollover to "N" will inhibit storage of new records after the maximum is reached.

➤ **System Info** (non-editable)
These are the firmware versions (M3, ASP, M1, M3 CPLD, and Ethernet module) of the system components.

➤ **Reset M3** [enabled from Login level 3 (Service) or above]
The MasterMind™ Monitor can be hardware reset by clicking the "Reset M3" button. This will temporarily cause the monitor to become non-communicative.

5.6 Events Tab *(/m3_events.html)*

This webpage is used to view the events that are logged in the SPD unit. The page displays the events in up to four subdivisions:

- **1–500**
- **501–1000**
- **1001–1500**
- **1501–2000.**

Upon clicking Events the latest event subdivision will be displayed. For viewing the previous 500 events and next 500 events, the user will have to click on the "Previous" and "Next" button on the page respectively.

This page has to be updated manually by the user by pressing F5 or clicking "Events Refresh" button.

The events can also be cleared from this page if logged on to Level 2 (Admin) or above else this feature is disabled. All events can be exported into .csv format by right-clicking "Download Events To File" link, select "Save Target as..." In the "Save as type" field set it to "All Files", In the "filename" field, change the extension to ".cvs".
Note: *This is specific to M.S. Internet Explorer (i.e., other browsers may differ slightly).*

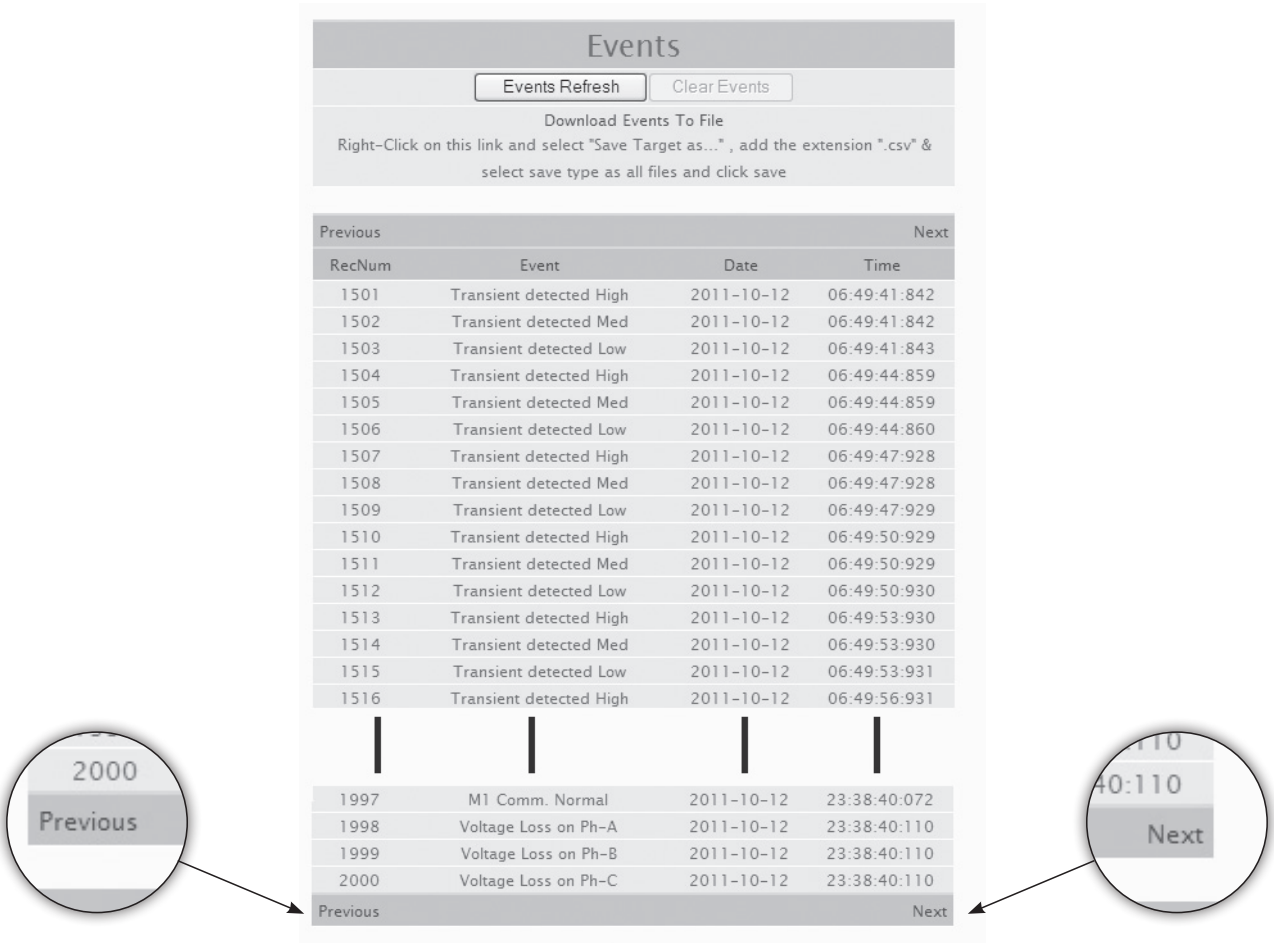


Figure 26: m3_events.html page

Note: *These Events can be sorted by clicking on the column headings.*

5.7 Records Tab

Figure 27: Dropdown menu for Records

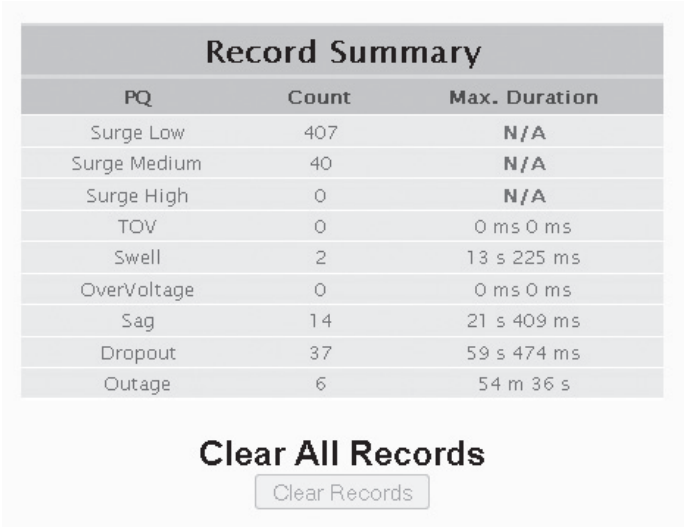
There are seven options available under the Records tab:

- **Summary**
- **TOV**
- **Swell**
- **Over Voltage**
- **Sag**
- **Dropout**
- **Outage**

5.7.1 Summary *(/m3_records_main.html)*

This webpage displays the summary of all the records in the SPD unit such as:

- Surge Low counts
- Surge Medium counts
- Surge High counts
- Count & Maximum duration of TOV records
- Count & Maximum duration of swell records
- Count & Maximum duration of over voltage records
- Count & Maximum duration of sag records
- Count & Maximum duration of dropout records
- Count & Maximum duration of outage records
- Clear All Records clears everything except the Surge Counters.
  Clearing any Record does not remove the corresponding Event from the Event log.



Record Summary

PQ	Count	Max. Duration
Surge Low	407	N/A
Surge Medium	40	N/A
Surge High	0	N/A
TOV	0	0 ms 0 ms
Swell	2	13 s 225 ms
OverVoltage	0	0 ms 0 ms
Sag	14	21 s 409 ms
Dropout	37	59 s 474 ms
Outage	6	54 m 36 s

Clear All Records

Clear Records

Figure 28: m3_records_main.html page

5.7.2 TOV *(/m3_records_tov.html)*

This webpage is used to view all TOV records seen by the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “TOV Records Refresh” button. All TOV records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

Figure 29: m3_records_tov.html page

5.7.3 Swell *(/m3_records_swell.html)*

This webpage is used to view the swell records in the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “Swell Records Refresh” button. All Swell records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

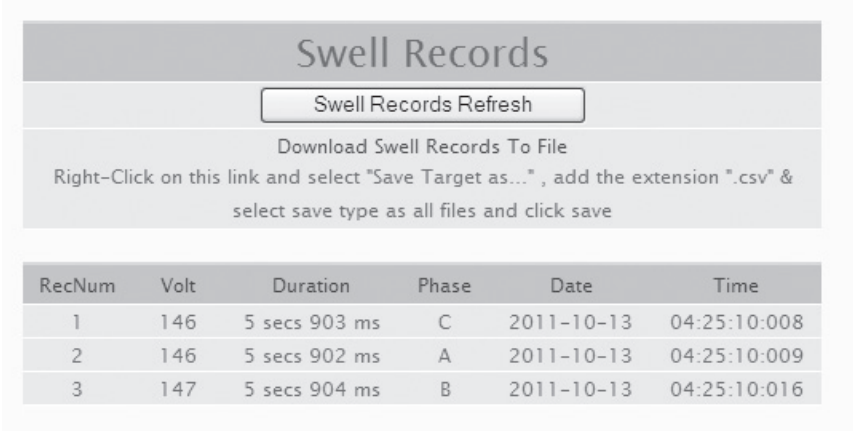


Figure 30: m3_records_swell.html page

5.7.4 Over Voltage *(/m3_records_ov.html)*

This webpage is used to view all over voltage records in the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “Over Voltage Records Refresh” button. All Over Voltage records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

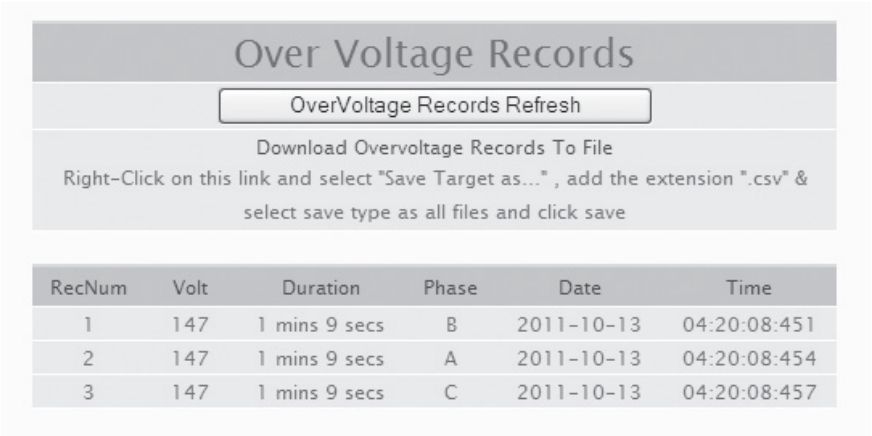


Figure 31: m3_records_ov.html page

5.7.5 Sag *(/m3_records_sag.html)*

This webpage is used to view all sag records in the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “Sag Records Refresh” button. All Sag records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

Figure 32: m3_records_sag.html page

5.7.6 Dropout *(/m3_records_dropout.html)*

This webpage is used to view the dropout records in the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “Dropout Records Refresh” button. All Dropout records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

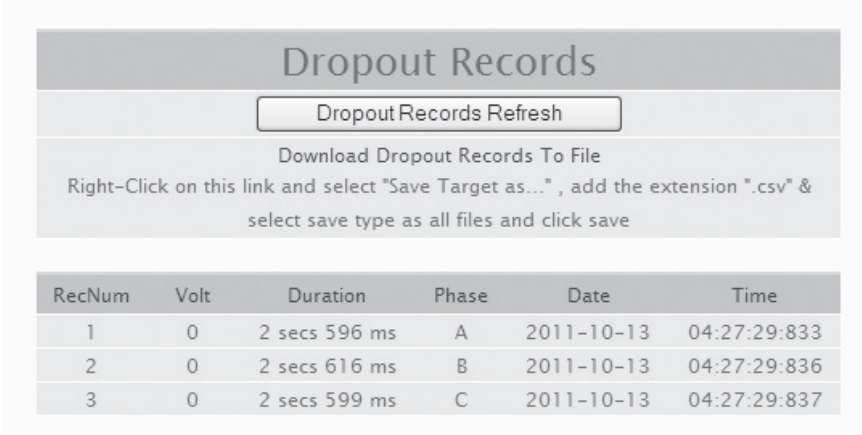


Figure 33: m3_records_dropout.html page

5.7.7 Outage *(/m3_records_outage.html)*

This webpage is used to view the outage records in the SPD unit. Manually update this page to get latest records by pressing F5 or clicking “Outage Records Refresh” button. All Outage records can be exported into .csv format by right-clicking “Download Events To File” link, select “Save Target as...” In the “Save as type” field set it to “All Files”, In the “filename” field, change the extension to “.cvs”.

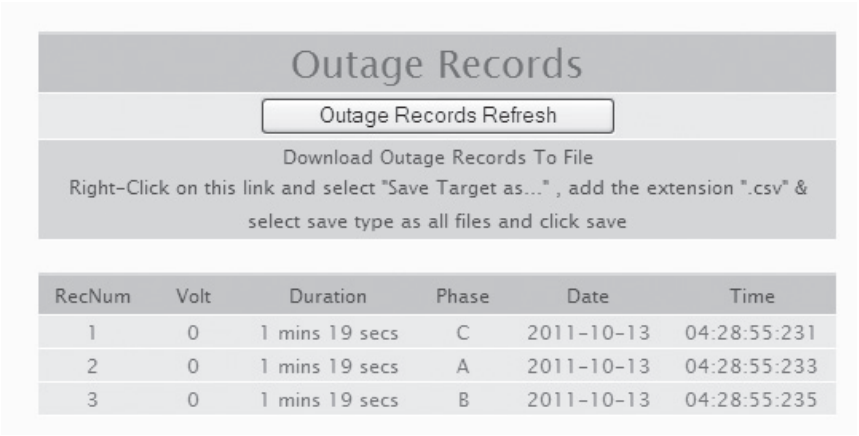


Figure 34: m3_records_outage.html page

5.8 Contact Us Tab *(/m3_contact.html)*

This page contains:

- Current Technology address
- Email ID of technical support
- Email ID of the customer support
- Web address of Current Technology

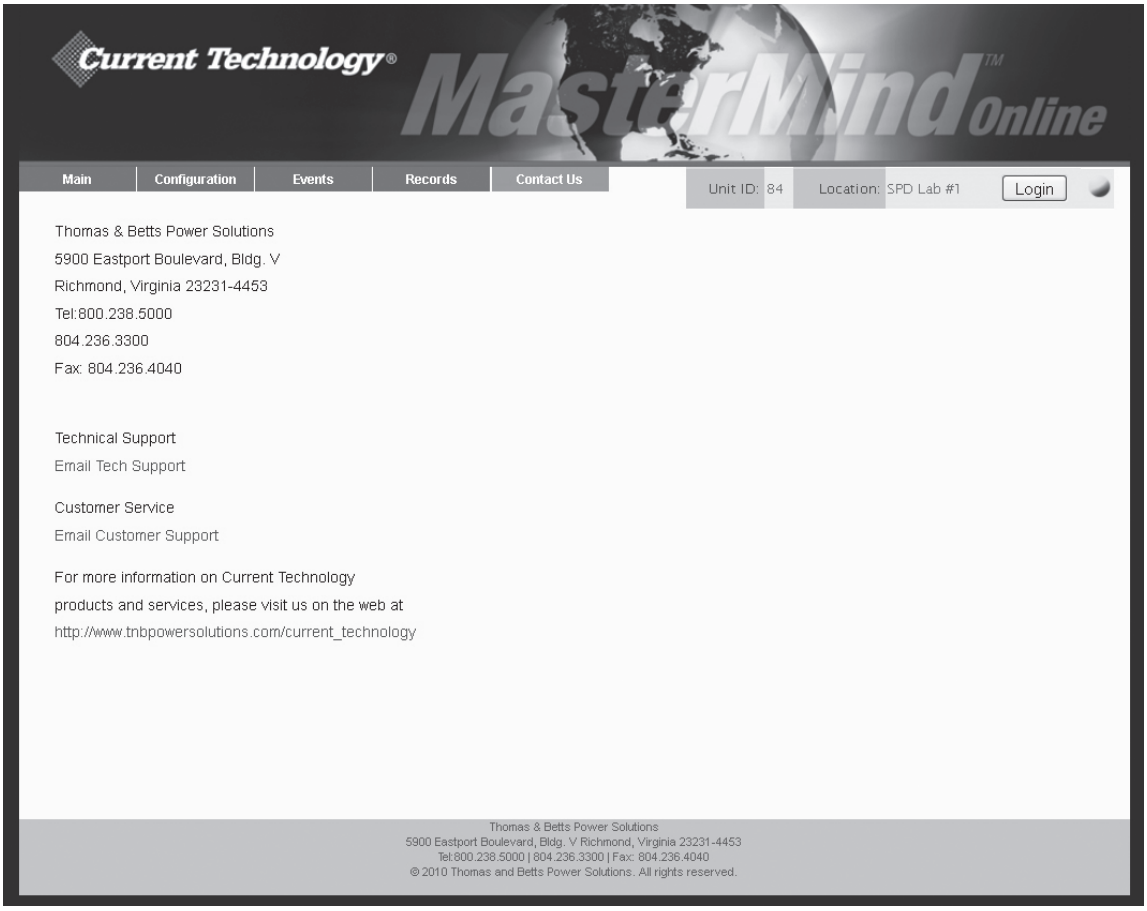


Figure 35: m3_contact.html page

6.0 ModBus

6.1 Modbus RS-485 Serial Interface Settings

The Advanced Monitoring PCB acts as a Modbus slave, and its communications is initiated through Modbus master using an RS-485 link. It 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:

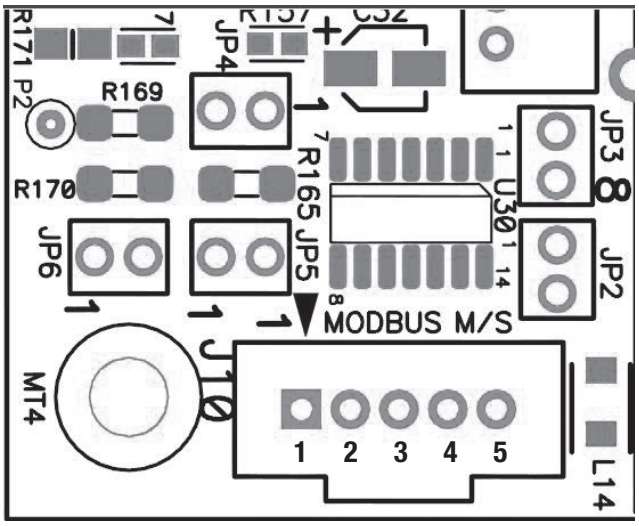
Baud Rate	9600 (default), 19200
Word length	8
Parity	None (default), Even, Odd
Stop bits	1
Flow Control	None

Additional required settings are:

Reg MAP = 1

Unit ID = 1 to 247 (each unit must have a unique ID))

6.2 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	JP4, JP6 On
End of Line	JP5 ON

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

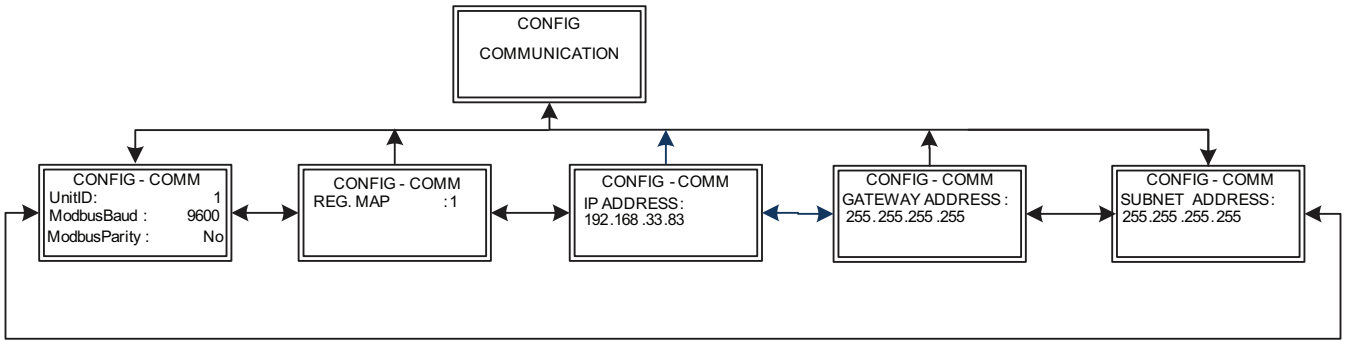
JP4 and JP6 are optional 2.7k ohm pull-down/up resistors which may be necessary in some RS/485 configurations. JP5 is used to terminate the RS/485 line. Use this when the Advanced Monitoring PCB is at the end of the serial line.

6.3 Modbus via Ethernet Interface

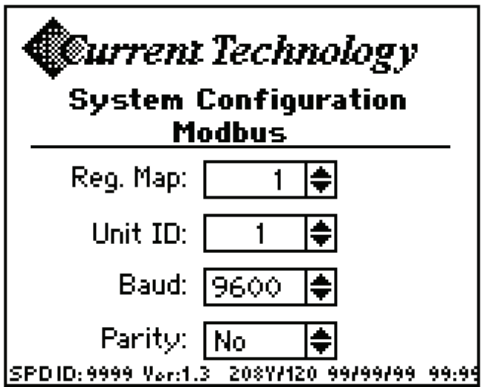
Simply connect the Ethernet cable to the Ethernet port. Only one interface RS-485 or Ethernet may be used at one time. Contact factory for additional setup information if required.

6.4 Modbus System Configuration (as shown):

6.4.1 Modbus setup via Character Display

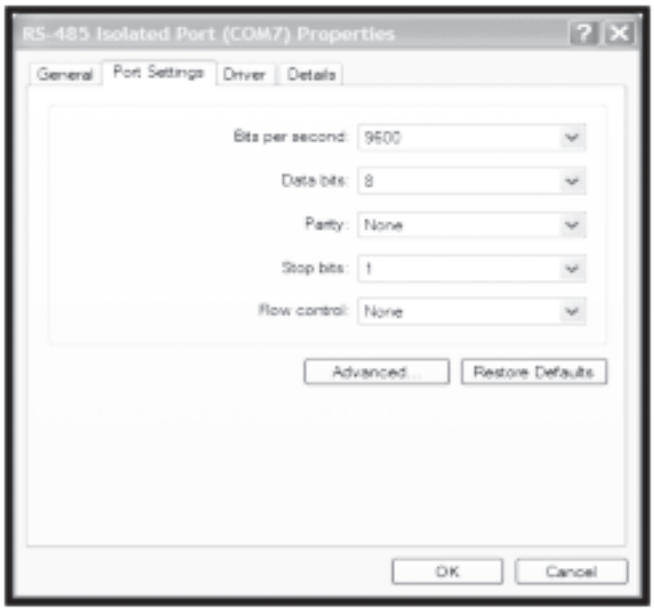


6.4.2 Modbus setup via LCD Graphics Display



Default values shown

6.4.3 Modbus setup via Web Server



Default values shown

6.5 Modbus Configuration

The Advanced Monitoring PCB acts as a Modbus slave, and its communication is initiated through Modbus master using RS-485 link. It is identified by a unique slave ID by the master.
Modbus registers are organized into reference types identified by the leading number of the reference address:

Table 1: Modbus Register Addresses

Reference	Description
0xxxx	Read/Write Discrete Outputs or Coils. A 0x reference address is used to drive output data to a digital output channel.
1xxxx	Read Discrete Inputs. The ON/OFF status of a 1x reference address is controlled by the corresponding digital input channel.
3xxxx	Read Input Registers. A 3x reference register contains a 16-bit number received from an external source – e.g. an analog signal.
4xxxx	Read/Write Output or Holding Registers. A 4x register is used to store 16-bits of numerical data (binary or decimal), or to send the data from the CPU to an output channel.

Table 2: Function Codes Supported

Function Code	Function Type	Application
03h	Read Holding Register	Read metering data and Configuration data
06h	Preset Single Register	Change Configuration data/Reset Warnings & Alarms
10h	Preset Multiple Registers	Change Configuration data/Reset Warnings & Alarms
11h	Report Slave ID	To Report active Advanced Monitoring PCBs in Modbus Network

Table 3: Exception Responses from MasterMind

Error Code	Error	Meaning
1	Illegal Function	Function code requested by Master is not supported
2	Illegal Data Address	The Data Address requested by Master is not valid
3	Illegal Data Value	The Data value is not acceptable

Address (HEX): A valid address should be entered in the HEX format, this addresses corresponds to a particular metering parameter.

Device ID: A device ID of the Advanced Monitoring PCB should be entered. This value can be changed using the GUI, Web Server or Service Port.

6.6 Modbus Map 1 – Configuration Data

Note: Not all data in this section is writeable. Each register's read/write ability is noted individually. Contact factory for a electric copy of this map.

Parameter Name	Register Address	Scale	R/W	Allowable Values
Modbus ID	1001	1	R/W	1 – 247
Software Major Rev.	1002	1	R	
Software Minor Rev.	1003	1	R	
System Type	1004	1	R/W	1 = 2Ph-3Wire 2 = 3Ph-3Wire 3 = 3Ph-4Wire 4 = 3Ph-HLDelta
Voltage Rating	1005	1	R/W	See section 6.1
Frequency Rating	1006	1	R/W	50, 60
Unit Serial Number	1007	1	R	0 – 9999
Selenium Enabled	1008	1	R/W	1 = Enabled; 0 = Disabled
Alarm Mute	1009	1	R/W	0 = Unmuted; 1 = Muted
LCD Contrast	1010	1	R/W	1 – 10
IP Address Byte 1	1011	1	R/W	0 – 255
IP Address Byte 2	1012	1	R/W	0 – 255
IP Address Byte 3	1013	1	R/W	0 – 255
IP Address Byte 4	1014	1	R/W	0 – 255
Event Rollover	1015	1	R/W	0 = No; 1 = Yes
Record Rollover	1016	1	R/W	0 = No; 1 = Yes
Surge Module	1017	1	R/W	0 – ISB 1 – ISM
Current Ratings	1018	1	R/W	See section 6.2
Modbus Baud	1019	1	R/W	0 – 9600 1 – 19200 2 – 115200
Modbus Parity	1020	1	R/W	0 = No 1 = Odd 2 = Even
Temp Over Voltage Hi Limit	1021	1	R/W	180 – 200
Temp OV Time Hi Limit	1022	1	R/W	1 – 8
Swell Voltage Hi Limit	1023	1	R/W	120 – 180
Swell Time Hi Limit	1024	1	R/W	8 – 60000
Over Voltage Hi Limit	1025	1	R/W	110 – 120
Over Voltage Time Hi Limit	1026	1	R/W	1 – 600
Sag Voltage Low Limit	1027	1	R/W	81 – 90
Sag Time Hi Limit	1028	1	R/W	8 – 60000
Under Voltage Low Alarm Limit	1029	1	R/W	80 – 90
Dropout Voltage Low Limit	1030	1	R/W	0 -80
Dropout Time Hi Limit	1031	1	R/W	8 – 60000
Outage Voltage Low Limit	1032	1	R/W	0 – 80
Outage Time Hi Limit	1033	1	R/W	1 – 120
Neutral-Ground Alarm Limit	1034	1	R/W	1 – 30
Frequency Low Limit	1035	1	R/W	45 – 59
Frequency Hi Limit	1036	1	R/W	51 – 68
MOV Warning Limit	1037	1	R/W	0 – 99
MOV Alarm Limit	1038	1	R/W	0 – 99
Time Hour	1039	1	R/W	0 – 23
Time Minute	1040	1	R/W	0 – 59
Date Month	1041	1	R/W	1 – 12

Parameter Name	Register Address	Scale	R/W	Allowable Values
Date Day	1042	1	R/W	1 – 31
Date Year	1043	1	R/W	2000 – 2099
Remote Logged In Level	1044	1	R/W	0 – 4
Remote Password Char1	1045	1	R/W	97 – 112
Remote Password Char2	1046	1	R/W	97 – 112
Remote Password Char3	1047	1	R/W	97 – 112
Remote Password Char4	1048	1	R/W	97 – 112
M1 Version	1049	1	R	0 – 255
CPLD Version	1050	1	R	0 – 255
Xport Version	1051	1	R	0 – 255
Has Features	1052	1	R	0 – 65535
Gateway Address 1	1053	1	R/W	0–255
Gateway Address 2	1054	1	R/W	0–255
Gateway Address 3	1055	1	R/W	0–255
Gateway Address 4	1056	1	R/W	0–255
Subnet Mask 1	1057	1	R/W	0–255
Subnet Mask 2	1058	1	R/W	0–255
Subnet Mask 3	1059	1	R/W	0–255
Subnet Mask 4	1060	1	R/W	0–255
OV Volt Alarm Limit	1061	1	R/W	110 – 120
Set System Defaults	1062	1	R/W	Set to 1 to set defaults
Set Threshold Defaults	1063	1	R/W	Set to 1 to set defaults
Clear Records	1064	1	R/W	Set to 1 to clear Records
Clear Events	1065	1	R/W	Set to 1 to clear Events
System Test	1066	1	R/W	Set to 1 to run all system tests Set to 2 to run Led test Set to 3 to run buzzer test Set to 4 to run Relay
Clear Status	1067	1	R/W	On setting this register all the Alarm, PQ & system status will be cleared
Filter Enable	1068	1	R/W	0 – Disable Filter 1 – Enable Filter
Location Character 0	1069	1	R/W	1st Character of Location
Location Character 1	1070	1	R/W	2nd Character of Location
Location Character 2	1071	1	R/W	3rd Character of Location
Location Character 3	1072	1	R/W	4th Character of Location
Location Character 4	1073	1	R/W	5th Character of Location
Location Character 5	1074	1	R/W	6th Character of Location
Location Character 6	1075	1	R/W	7th Character of Location
Location Character 7	1076	1	R/W	8th Character of Location
Location Character 8	1077	1	R/W	9th Character of Location
Location Character 9	1078	1	R/W	10th Character of Location
Local Login Level	1079	1	R	Displays the local login level
Clear Surge	1080	1	R/W	On setting the register to 1, the surge counts will reset
Software Reset	1081	1	R/W	On setting the register to 1, the SPD unit will reset
Surge Low Enable	1082	1	R/W	On setting the register to 1, the Surge Low will be enabled, 0 – will disable it
Surge Medium Enable	1083	1	R/W	On setting the register to 1, the Surge Low will be enabled, 0 – will disable it
Surge High Enable	1084	1	R/W	On setting the register to 1, the Surge High will be enabled, 0 – will disable it

6.7 Modbus Map 1 – Status

Parameter Name	Register Address	Scale	R/W	Allowed Values
Communication Loss with M1	2001	1	R	Set when SPD losses communication with M1
Selenium At Phase A	2002	1	R	0 – Bad; 1 – Good
Selenium At Phase B	2003	1	R	0 – Bad; 1 – Good
Selenium At Phase C	2004	1	R	0 – Bad; 1 – Good
Filter At Phase A	2005	1	R	0 – Bad; 1 – Good
Filter At Phase B	2006	1	R	0 – Bad; 1 – Good
Filter At Phase C	2007	1	R	0 – Bad; 1 – Good
MOV STATUS M1	2008	1	R	Not used
Voltage AN	2009	1	R	Unsigned positive integer value
Voltage BN	2010	1	R	Unsigned positive integer value
Voltage CN	2011	1	R	Unsigned positive integer value
Voltage AB	2012	1	R	Unsigned positive integer value
Voltage BC	2013	1	R	Unsigned positive integer value
Voltage CA	2014	1	R	Unsigned positive integer value
Voltage AG	2015	1	R	Unsigned positive integer value
Voltage BG	2016	1	R	Unsigned positive integer value
Voltage CG	2017	1	R	Unsigned positive integer value
NG Voltage	2018	1	R	Unsigned positive integer value
THD Phase A	2019	10	R	Unsigned positive integer value
THD Phase B	2020	10	R	Unsigned positive integer value
THD Phase C	2021	10	R	Unsigned positive integer value
Fundamental Phase A	2022	10	R	Unsigned positive integer value
Fundamental Phase B	2023	10	R	Unsigned positive integer value
Fundamental Phase C	2024	10	R	Unsigned positive integer value
Frequency Phase A	2025	10	R	Unsigned positive integer value
Frequency Phase B	2026	10	R	Unsigned positive integer value
Frequency Phase C	2027	10	R	Unsigned positive integer value
Phase VTG M1	2028	1	R	Unused
MOV Percentage Phase A	2029	1	R	Unsigned positive integer value
MOV Percentage Phase B	2030	1	R	Unsigned positive integer value
MOV Percentage Phase C	2031	1	R	Unsigned positive integer value
Reg LED M1	2032	1	R	Unsigned positive integer value
Reg Relay Ctl M1	2033	1	R	Unsigned positive integer value
Surge Count Low	2034	1	R	Unsigned positive integer value
Surge Count Medium	2035	1	R	Unsigned positive integer value
Surge Count High	2036	1	R	Unsigned positive integer value
Surge Count Total	2037	1	R	Unsigned positive integer value

Parameter Name	Register Address	Scale	R/W	Allowed Values
Battery Status	2038	1	R	Flashes between 0 & 1 means battery is Low
Recent Events PQ Status	2039	1	R	Unsigned positive integer value
Recent Events Alarm Status	2040	1	R	Unsigned positive integer value
Recent Events Monitor Status	2041	1	R	Unsigned positive integer value
Average LL Voltage	2042	1	R	Unsigned positive integer value
Total Events A (Event Summary)	2043	1	R	Unsigned positive integer value
Total Events B (Event Summary)	2044	1	R	Unsigned positive integer value
Total Events C (Event Summary)	2045	1	R	Unsigned positive integer value
Other Events A (Event Summary)	2046	1	R	Unsigned positive integer value
Other Events B (Event Summary)	2047	1	R	Unsigned positive integer value
Other Events C (Event Summary)	2048	1	R	Unsigned positive integer value
TOV Events A (Event Summary)	2049	1	R	Unsigned positive integer value
TOV Events B (Event Summary)	2050	1	R	Unsigned positive integer value
TOV Events C (Event Summary)	2051	1	R	Unsigned positive integer value
Swell Events A (Event Summary)	2052	1	R	Unsigned positive integer value
Swell Events B (Event Summary)	2053	1	R	Unsigned positive integer value
Swell Events C (Event Summary)	2054	1	R	Unsigned positive integer value
OV Events A (Event Summary)	2055	1	R	Unsigned positive integer value
OV Events B (Event Summary)	2056	1	R	Unsigned positive integer value
OV Events C (Event Summary)	2057	1	R	Unsigned positive integer value
Sag Events A (Event Summary)	2058	1	R	Unsigned positive integer value
Sag Events B (Event Summary)	2059	1	R	Unsigned positive integer value
Sag Events C (Event Summary)	2060	1	R	Unsigned positive integer value
Dropout Events A (Event Summary)	2061	1	R	Unsigned positive integer value
Dropout Events B (Event Summary)	2062	1	R	Unsigned positive integer value
Dropout Events C (Event Summary)	2063	1	R	Unsigned positive integer value
Outage Events A (Event Summary)	2064	1	R	Unsigned positive integer value
Outage Events B (Event Summary)	2065	1	R	Unsigned positive integer value
Outage Events C (Event Summary)	2066	1	R	Unsigned positive integer value
Lowest Voltage on A	2067	1	R	Unsigned positive integer value
Lowest Voltage on B	2068	1	R	Unsigned positive integer value
Lowest Voltage on C	2069	1	R	Unsigned positive integer value
Highest Voltage on A	2070	1	R	Unsigned positive integer value
Highest Voltage on B	2071	1	R	Unsigned positive integer value
Highest Voltage on C	2072	1	R	Unsigned positive integer value
TOV Total (Record Summary)	2073	1	R	Unsigned positive integer value
TOV Duration High (Record Summary)	2074	1	R	Unsigned positive integer value
TOV Duration Low (Record Summary)	2075	1	R	Unsigned positive integer value
Swell Total (Record Summary)	2076	1	R	Unsigned positive integer value

Parameter Name	Register Address	Scale	R/W	Allowed Values
Swell Duration High (Record Summary)	2077	1	R	Unsigned positive integer value
Swell Duration Low (Record Summary)	2078	1	R	Unsigned positive integer value
OV Total (Record Summary)	2079	1	R	Unsigned positive integer value
OV Duration High (Record Summary)	2080	1	R	Unsigned positive integer value
OV Duration Low (Record Summary)	2081	1	R	Unsigned positive integer value
Sag Total (Record Summary)	2082	1	R	Unsigned positive integer value
Sag Duration High (Record Summary)	2083	1	R	Unsigned positive integer value
Sag Duration Low (Record Summary)	2084	1	R	Unsigned positive integer value
Dropout Total (Record Summary)	2085	1	R	Unsigned positive integer value
Dropout Duration High (Record Summary)	2086	1	R	Unsigned positive integer value
Dropout Duration Low (Record Summary)	2087	1	R	Unsigned positive integer value
Outage Total (Record Summary)	2088	1	R	Unsigned positive integer value
Outage Duration High (Record Summary)	2089	1	R	Unsigned positive integer value
Outage Duration Low (Record Summary)	2090	1	R	Unsigned positive integer value
Phase A Harmonic 3	2091	10	R	Unsigned positive integer value
Phase A Harmonic 5	2092	10	R	Unsigned positive integer value
Phase A Harmonic 7	2093	10	R	Unsigned positive integer value
Phase A Harmonic 9	2094	10	R	Unsigned positive integer value
Phase A Harmonic 11	2095	10	R	Unsigned positive integer value
Phase A Harmonic 13	2096	10	R	Unsigned positive integer value
Phase B Harmonic 3	2097	10	R	Unsigned positive integer value
Phase B Harmonic 5	2098	10	R	Unsigned positive integer value
Phase B Harmonic 7	2099	10	R	Unsigned positive integer value
Phase B Harmonic 9	2100	10	R	Unsigned positive integer value
Phase B Harmonic 11	2101	10	R	Unsigned positive integer value
Phase B Harmonic 13	2102	10	R	Unsigned positive integer value
Phase C Harmonic 3	2103	10	R	Unsigned positive integer value
Phase C Harmonic 5	2104	10	R	Unsigned positive integer value
Phase C Harmonic 7	2105	10	R	Unsigned positive integer value
Phase C Harmonic 9	2106	10	R	Unsigned positive integer value
Phase C Harmonic 11	2107	10	R	Unsigned positive integer value
Phase C Harmonic 13	2108	10	R	Unsigned positive integer value

6.8 Modbus Map 2

Memory map alternate:

Parameter Name	Register Address	Scale	R/W	Allowed Values
Sag Voltage Low Limit	2	1	R/W	81 – 90
Swell Voltage Hi Limit	3	1	R/W	120 – 180
Outage Time Hi Limit	4	1	R/W	1 – 120
Voltage Rating	5	1	R/W	See section 6.1
Month	6	1	R/W	1 – 12
Day	7	1	R/W	1 – 31
System Type	8	1	R/W	1 = 2Ph-3Wire 2 = 3Ph-3Wire 3 = 3Ph-4Wire 4 = 3Ph-HLDelta
Timeout	9	1		Unused
Unused	10	1		Unused
Email Flag	11	1		Unused
Threshold Mode	12	1		Unused
Gateway Register 1	13	1	R/W	0-65535
Gateway Register 2	14	1	R/W	0-65535
Global IP Reg1	15	1		Unused
Global IP Reg2	16	1		Unused
IP Address Register 1	17	1	R/W	0-65535
IP Address Register 2	18	1	R/W	0-65535
TCP Port No.	19	1		Unused
Voltage AN	20	1	R	Unsigned positive integer value
Voltage BN	21	1	R	Unsigned positive integer value
Voltage CN	22	1	R	Unsigned positive integer value
NG Voltage	23	1	R	Unsigned positive integer value
Unused	24	1		Unused
Configuration Change	25	1		Unused
MOV % For Phase A	26	1	R	Unsigned positive integer value
MOV % For Phase B	27	1	R	Unsigned positive integer value
MOV % For Phase C	28	1	R	Unsigned positive integer value
M1 Led Status	29	1	R	Unsigned positive integer value
Clear Events	30	1	R/W	Write 1 to clear all events
Event Counter	31	1		Unused
Event Number	32	1		Unused
Event Start Time1	33	1		Unused
Event Start Time2	34	1		Unused
Event End Time1	35	1		Unused
Event End Time2	36	1		Unused
Event Type	37	1		Unused
Event Phase	38	1		Unused
Event Minmax	39	1		Unused

Parameter Name	Register Address	Scale	R/W	Allowed Values
Fault	40	1		Unused
Read Password 1	41	1		Unused
Read Password 2	42	1		Unused
Write Password 1	43	1		Unused
Write Password 2	44	1		Unused
Read FAC Password 1	45	1		Unused
Read FAC Password 2	46	1		Unused
Write FAC Password 1	47	1		Unused
Write FAC Password 2	48	1		Unused
DNS IP Addr1	49	1		Unused
DNS IP Addr2	50	1		Unused
Modbus ID	51	1	R/W	1 – 247
Alarm Status	52	1	R	Unsigned positive integer value
Software Major Version	53	1	R	0-255
M1 Version	54	1	R	0-255
Thd Phase A	55	10	R	Unsigned positive integer value
Thd Phase B	56	10	R	Unsigned positive integer value
Thd Phase C	57	10	R	Unsigned positive integer value
Hardware Status	58	1		Unused
Surge Count Total	59	1	R	Unsigned positive integer value
Time Zone	60	1		Unused
THD Progress	61	1		Unused
String Data1	62	1		Unused
String Data2	63	1		Unused
String Data3	64	1		Unused
String Data4	65	1		Unused
String Data5	66	1		Unused
String Data6	67	1		Unused
String Data7	68	1		Unused
String Command	69	1		Unused
CAL A	70	1		Unused
CAL B	71	1		Unused
CAL C	72	1		Unused

7.0 System, Alarm and Power Quality Messages

7.1 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

7.2 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 Over Voltage	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*

7.3 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 Over Voltage (TOV)	“PQ: TOV on y Phase”	“PQ: TOV y Phase”
Swell	“PQ: Swell on y Phase”	“PQ: Swell y Phase”
Over Voltage	“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*

8.0 MasterMind System Tables

8.1 System Type / Voltage Rating Table

System Type	Allowable Voltage Ratings	Mode
2Ph – 3Wire	120	L-N
3Ph – 3Wire	208, 240, 380, 400, 480, 600	L-L
3Ph – 4Wire	120, 127, 220, 277, 347	L-N
3Ph – HiLegDelta	240	L-L

8.2 Surge Module Type / Current Rating Table

Module Type	Allowable Current Ratings
ISM	50, 080, 100, 125, 150, 200, 250, 300
ISB	60, 80, 100, 125, 150, 200, 250, 300

8.3 System Default Table

Configuration	Default Value
Unit ID	1
Unit Type	3 Phase 4 wire
Voltage Rating	120
Frequency Rating	60
SPD Unit ID	1
Modbus Register Map	1
Modbus Baud Rate	9600
Modbus Parity	No
Selenium Enable	No
Filter Enable	Yes
Alarm Mute	No
LCD Contrast	5
IP Address	169.254.0.2
Event Rollover	No
Record Rollover	No

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8.3 System Default Table *(continued)*

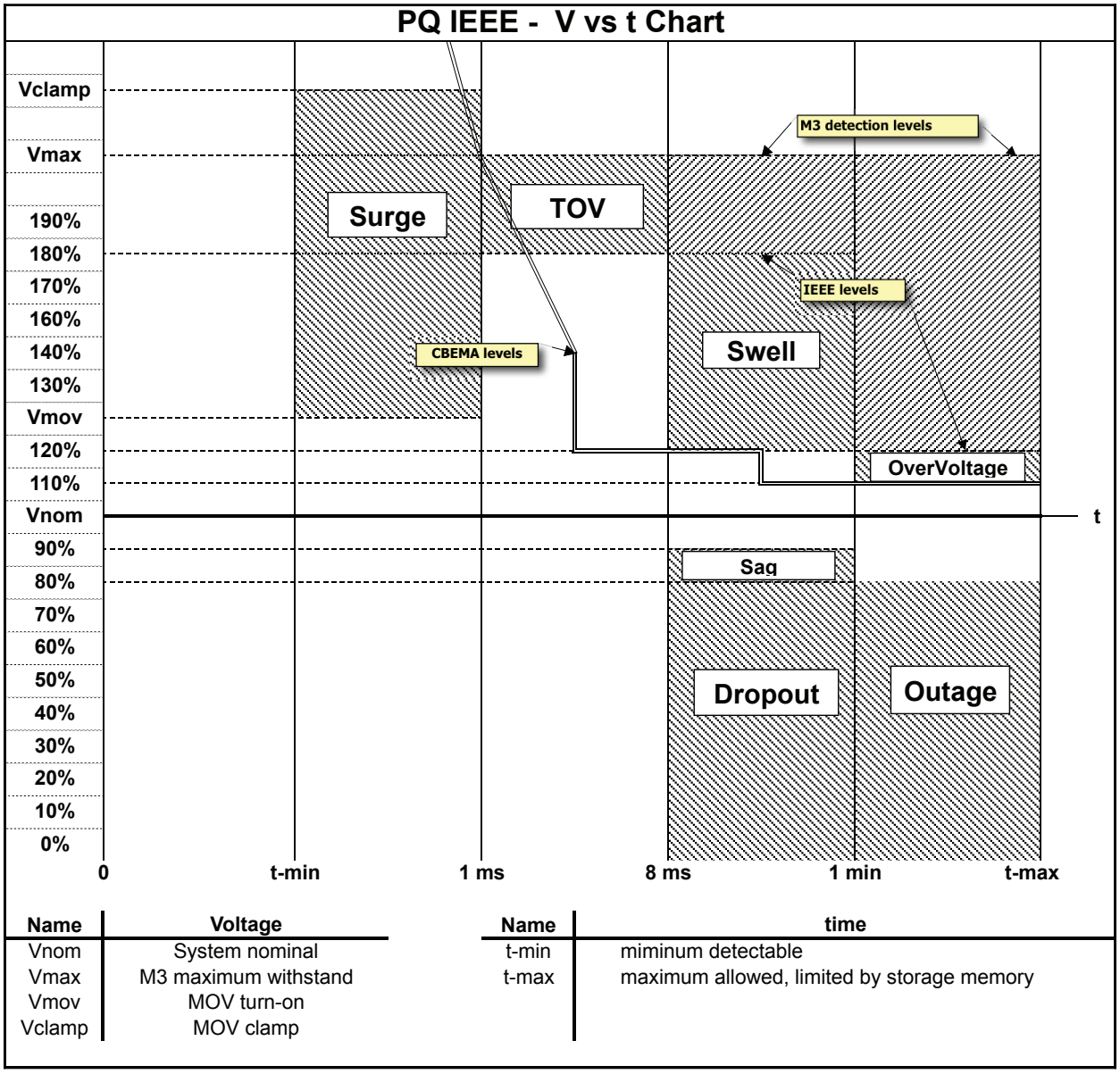
Current Rating	60
MOV Warning Limit	75*
MOV Alarm Limit	40*
Surge Module	ISB
Gateway Address	169.254.0.1
Subnet Mask Address	255.255.240.0
Frequency Low Limit	58
Frequency High Limit	62
Location	blank (10 spaces)
Remote Login	0
Screen Saver Time	30
Surge High Enable	Enabled
Surge Medium Enable	Enabled
Surge Low Enable	Enabled

*MOV Limits will reflect the Surge Module and Current Rating that have been chosen.

8.4 Power Quality Events and Threshold Defaults

Power Quality Event	Time Range		% of Nominal Voltage Range	
	Lower Value	Upper Value	Lower Value	Upper Value
TOV	>**1 ms**–8 ms	8 ms	**180%** – Max	Max Input
	(Adjustable)	(fixed)	(Adjustable)	
Swell	>**8 ms**–1 min	1 min	**120%** – Max	Max Input
	(Adjustable)	(fixed)	(Adjustable)	
Over Voltage	>**1 min**–Max	Maximum	**110%** – Max	Max Input
	(Adjustable)	Log time	(Adjustable)	
Sag	>**8 ms**–1 min	1 min	80%	80 – **90%**
	(Adjustable)	(fixed)	(fixed)	(Adjustable)
Dropout	>**8 ms**–1 min	1 min	0%	0 – **<80%**
	(Adjustable)	(fixed)	(fixed)	(Adjustable)
Outage	>**1 min**–Max	Maximum	0%	0 – **<80%**
	(Adjustable)	Log time	(fixed)	(Adjustable)
Values in **Bold** are the default values.				

9.0 Power Quality Chart



Name	Voltage
Vnom	System nominal
Vmax	M3 maximum withstand
Vmov	MOV turn-on
Vclamp	MOV clamp

Name	time
t-min	miminum detectable
t-max	maximum allowed, limited by storage memory

This Power Quality (PQ) Chart shows the zones (Time v.s. % of Nominal System Voltage) that the MasterMind™ system is triggered to capture and record Power Quality events. This chart is based on the IEEE Std 1159-2009, overlaid on top of the ITIC/CBEMA curve. These are the default triggered setpoints which can be adjusted via the user interface.

10.0 M-Series Comparison Chart

M-Series Model	M1	M2	M3	M4E	M5	M6E
LEDs						
Phase LEDs	X	X	X	X	X	X
Tri-Color LEDs	X	X	X	X	X	X
Status/Fault LED	X	X	X	X	X	X
Displays						
LCD Character			4 x 20	4 x 20		
Graphics Display					4.7” 160 x 128	4.7” 160 x 128
Backlight			X	X	X	X
Alarms						
Summary Dual 2 Form “C”	X	X	X	X	X	X
Audible	X	X	X	X	X	X
Audibe-Mute button	X	X	X	X	X	X
Surge Counter						
Modular		7-digit				
Single Level		X				
Tri-Level (L,M,H)			X	X	X	X
% Protection	LED	LED	%xxx	%xxx	%xxx	%xxx
Voltage						
True RMS			X	X	X	X
Accuracy			1%	1%	1%	1%
L-N			X	X	X	X
L-G			X	X	X	X
L-L			X	X	X	X
N-G			X	X	X	X

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10.0 M-Series Comparison Chart *(Continued)*

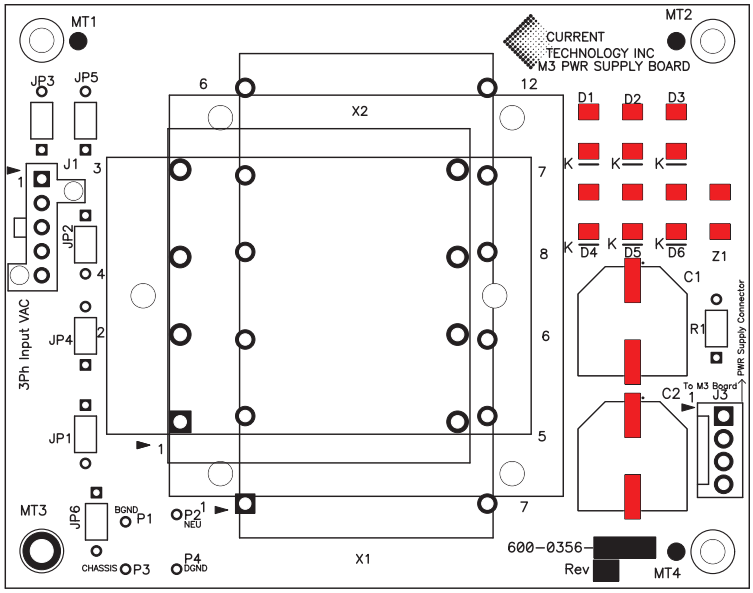
M-Series Model	M1	M2	M3	M4E	M5	M6E
Harmonics						
THD Voltage			X	X	X	X
Communications						
Modbus-RTU			X	X	X	X
Modbus-TCP/IP				X		X
Multi-Unit (on Modbus-RTU)			247	247	247	247
WebServer				X		X
Password Protect			X	X	X	X
Data Logging						
# Events			2000	2000	2000	2000
# Power Quality Records			1000	1000	1000	1000
Time-Date Stamp			X	X	X	X
Battery Backup			10 yrs	10 yrs	10 yrs	10 yrs
Power Quality Meter						
TOV			X	X	X	X
Swells			X	X	X	X
Over Voltage			X	X	X	X
Sags			X	X	X	X
Dropout			X	X	X	X
Outage			X	X	X	X
Surges			X	X	X	X
Adjustable Set Points (Voltage and Time)			X	X	X	X
Tied To			IEEE 1159	IEEE 1159	IEEE 1159	IEEE 1159
Remote Mounting	X	X	X	X	X	X

11.0 MasterMind™ System Specifications

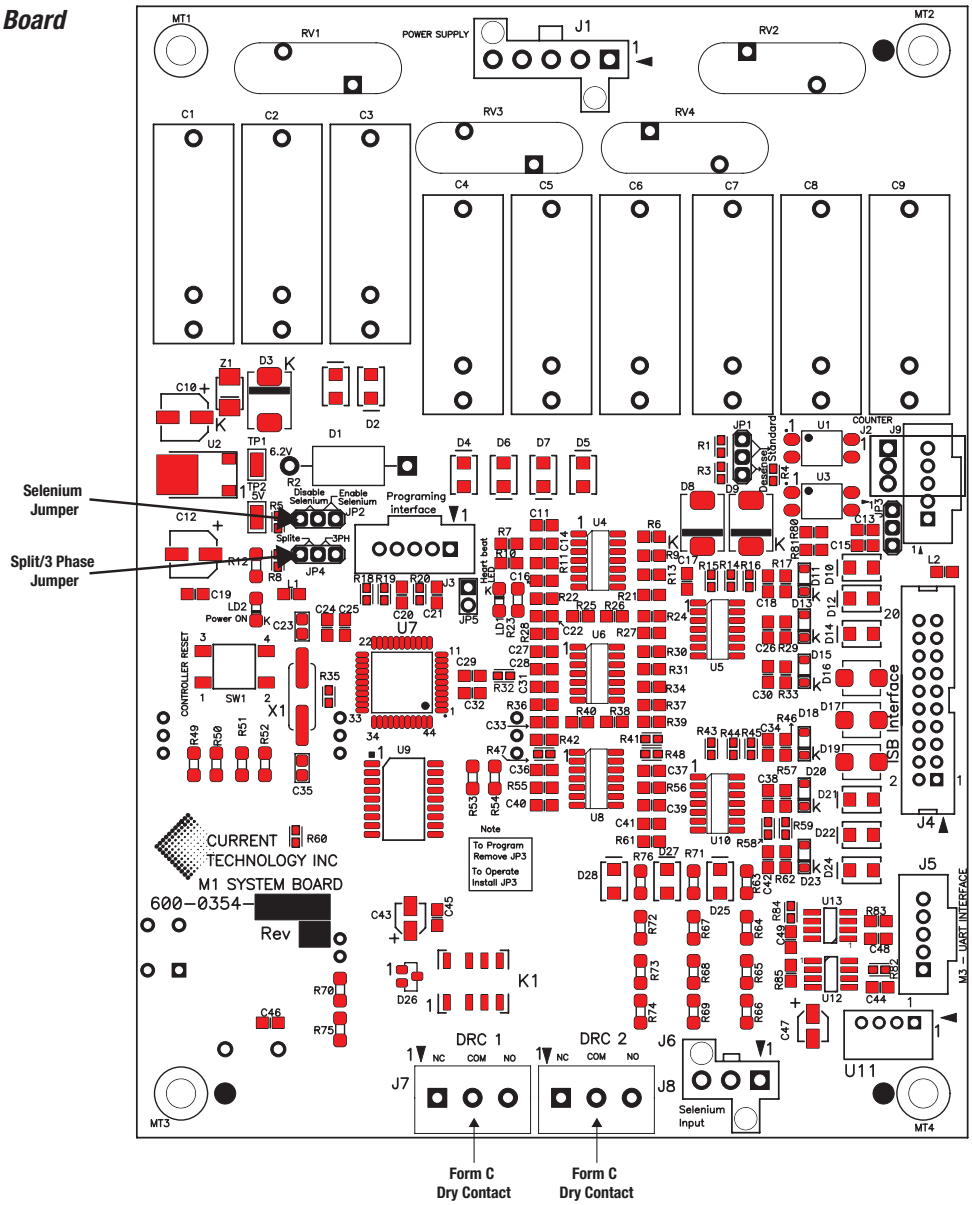
- Voltage Accuracy (1%)
- Voltage Sampling Rate (3.8 kHz)
- Screen Update Rate (1/sec)
- Date/Time Accuracy (1 min/month)
- Date/Time Resolution (1 ms)
- Number of Power Quality records (1k), All events (2k), Modbus nodes (247), Surge counts (65,535 Low, Medium and High).
- M3 battery (Lithium, 3V, 235mAh, 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 (Marked with the green Marketing RoHS tag)
- 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 6.0 for proper setup.
- *Ethernet (10/100Base-T)*

12.0 Advanced Monitoring System Boards

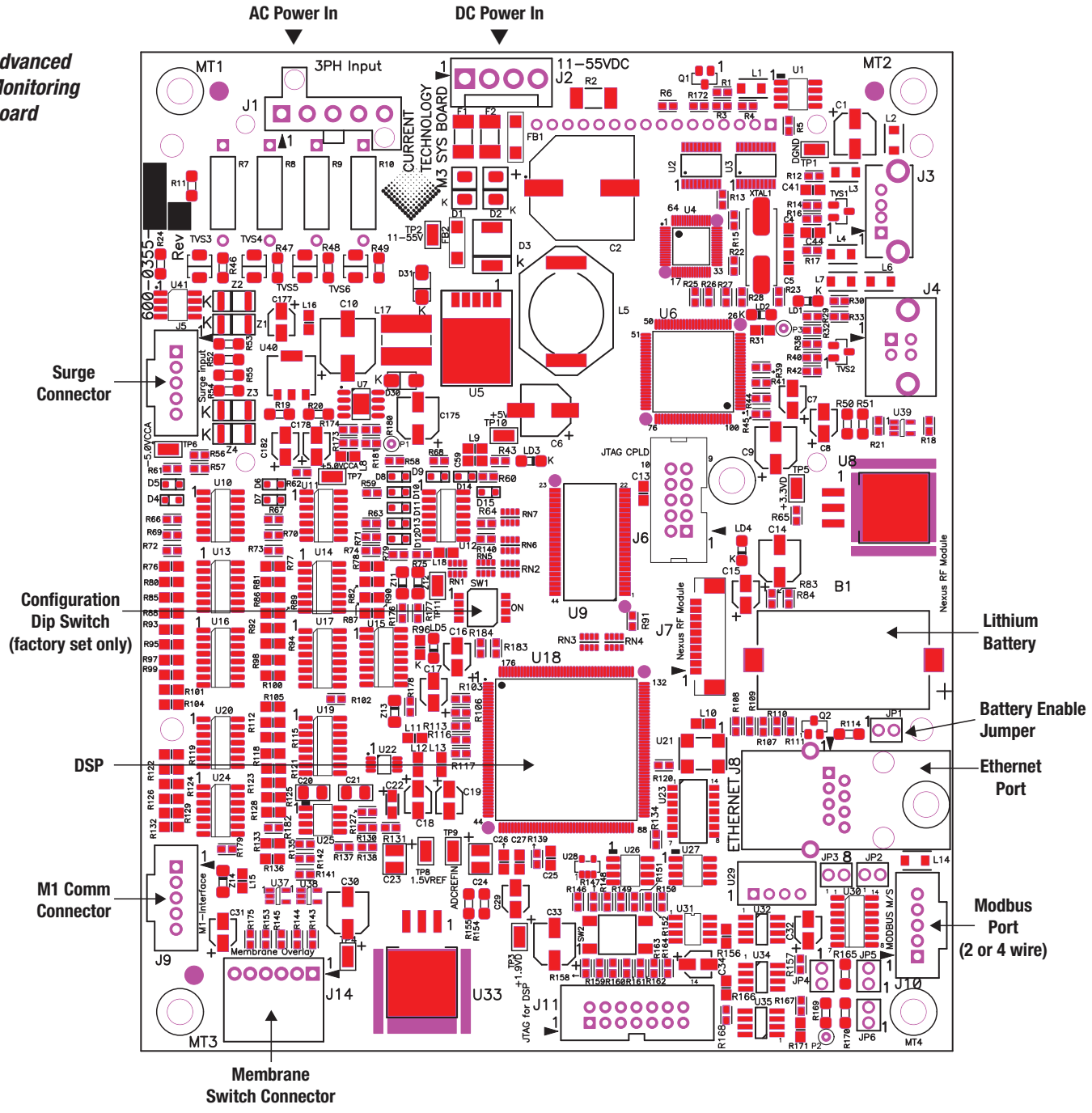
Power Supply Board



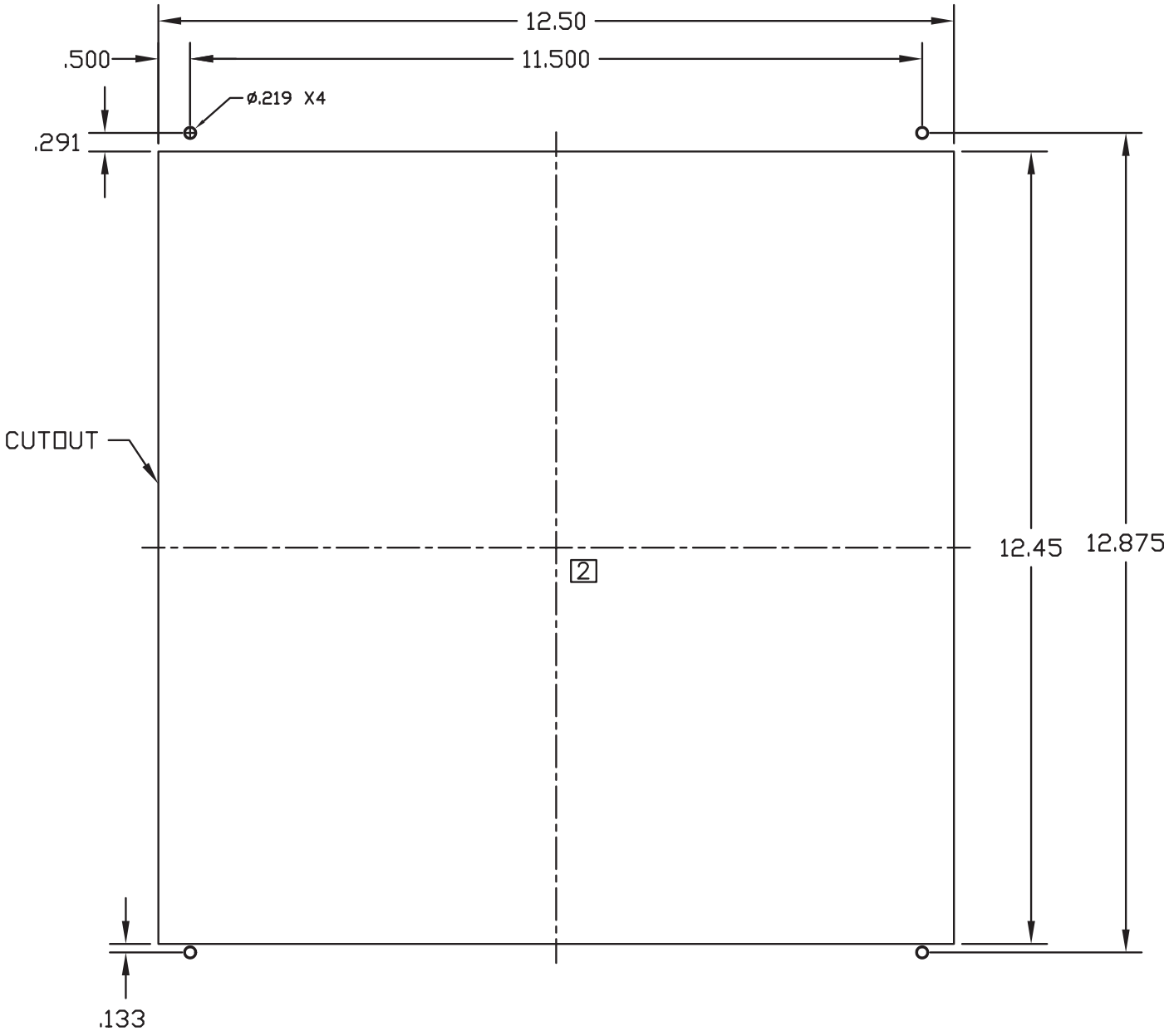
Basic Monitoring Board



Advanced Monitoring Board



12.1 Remote Mounting Cutout Specifications for M3–M6 Options



13.0 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*

14.0 Glossary

Alphanumeric Display
A display that gives the information in the form of characters (numbers or letters)

ASCII
American Standard Code for Information Interchange. A type of 8 digit code that represents the letters of the alphabet and other characters. On a keyboard, each key represents a different ASCII code. Sometimes pronounced ASK-TWO or ASKEE.

CAT-5 Cable
Category 5 cable is a twisted pair high signal integrity cable type often referred to as Cat5. Most Category-5 cables are unshielded, relying on the twisted pair design for noise rejection. Category 5 has been superseded by the Category 5e specification.

Delta
A standard three-phase circuit connection configured such that the ends of each phase winding connected in series form a closed loop with each phase 120 electrical degrees from the other. It appears as a triangle and looks like the Greek letter delta (r).

Event
Describes the seven power quality fault types that will be recorded and logged by MasterMind. These are: TOV, SAG, SWELL, Over Voltage, Outage.

Ethernet
A network where the computers are connected by cables. 10Base2 are connected by coaxial cable. 10BaseT and 100BaseT are connected by twisted pair cabling.

GUI
Graphical User Interface

IP
Internet Protocol

IP Address
An IP address has two parts: the identifier of a particular network on the Internet and an identifier of the particular device (which can be a server or a workstation) within that network. On the Internet itself – that is, between the router that move packets from one point to another along the route – only the network part of the address is looked at.

LAN
Local Area Network

LCD
Liquid Crystal Display

LED
Light Emitting Diode, a semiconductor that emits light when current passes through it.

Local IP
The IP address used to connect to a device from within a Local Access Network.

Modbus
Modbus protocol is defined as a master/slave protocol, meaning a device operating as a master will poll one or more devices operating as a slave.

Multidrop
Network based on a master/client architecture.

Protocol
A standard procedure for regulating data transmission between computers.

RS-485
EIA-485, also known as TIA/EIA-485 or RS-485, is a standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. EIA-485 only specifies electrical characteristics of the driver and the receiver. It does not specify or recommend any communications protocol. EIA-485 enables the configuration of inexpensive local networks and multidrop communications links.

RTC
Real Time Clock. It is a battery-powered clock that is included in a microchip in a computer.

RTU
Remote Terminal Unit. Serial Modbus connections can use this transmission mode. This format uses binary coding which makes the message unreadable when monitoring, but reduces the size of each message which allows for more data exchange in the same time span.

Sag
An RMS reduction in the ac voltage, at the power frequency, for durations from a ½ cycle to a few seconds. Ref. IEEE 1100.

SPD (Surge Protective Device)
Electrical devices typically installed in power distribution panels, process control systems, communications systems, and other heavy-duty industrial systems, for the purpose of protecting against electrical surges and spikes, including those caused by lightning.

Surge
A surge is a transient voltage or current with a duration of a few microseconds.

Swell
A temporary increase in the rms value of the voltage or current of more than 10 percent of the nominal voltage, at the power frequency, for any duration from 1/2 cycle to 1 minute.

TCP
Transmission Control Protocol (Used in TCP/IP data transmission in Internet)

TCP/IP
Transmission Control Protocol/Internet Protocol. This is the standard now widely in use for computers to communicate on networks, especially the internet.

TOV
Temporary Over Voltage, less duration than 1 minute. Less duration than a Swell, Sag or dropout for logging purposes.

URL
A Uniform Resource Locator: the address of a webpage, ftp site, audio stream or other Internet resource.

5 Year Limited Warranty

Thomas & Betts Power Solutions, LLC / Current Technology® 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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