MSRx Charge Controller

Product Manual

Issue 15

1. Introduction

The MSRx series of Charge Controllers are designed to provide the charge regulation and supervisory functions necessary in a solar power system. The controller prevents damage to the battery due to excessive charge or discharge and also provides a convenient place to interconnect the solar arrays, battery bank and load equipment.

The MSRx series of Charge Controllers use fully solid-state switching of charge and load current and combine this with the flexibility and advantages of microprocessor control. The basic function of a charge controller is to control the transfer of energy from the array to the battery and load. The state of charge of the battery is sensed by monitoring the battery voltage.

The MSRx series of Charge Controllers are available in four basic configurations and in four types of enclosure as shown in the following table:

	MSRx2	**MSRx4**	**MSRx6**	**MSRx8**
Number of Array Inputs	2	4	6	8
Total Array Current	60A	120A	180A	240A
Load 1 Current	25A	25A	25A	25A
Load 2 Current	25A	25A	25A	25A
Painted Steel Enclosure (h x w)	600 x 400	600 x 400	600 x 600	600 x 600
Stainless Steel Enclosure (h x w)	600 x 400	600 x 400	600 x 600	600 x 600
Glass Reinforced Polyester (GRP) (h x w)	645 x 480	645 x 480	845 x 680	845 x 680
19” Rack Control Unit	4U High	4U High	8U High	8U High

1.1. Features of the MSRx Charge Controller

1.1.1. Voltages: 12V, 24V, 36V and 48V versions / Common Positive and Common Negative versions

1.1.2. Microcontroller (MCU) based control circuit

1.1.3. Solid state switching of up to 8 Array Inputs (8 x 30A max) / 2 Load Outputs (2 x 25A max)

1.1.4. Temperature compensation of the preset levels

1.1.5. LED indication of Regulation Status, Array Connection and Load Connection

1.1.6. LCD 16 x 2 Character Display with Menu, Up, Down and Select switches for user control

1.1.7. High Volts, Low Volts, Load Cut 1, Load Cut 2 Alarm indication and volt-free relay contacts

1.1.8. 40A single-pole Array MCBs / 32A single-pole Load MCBs fitted as standard

1.1.9. Protection against induced voltage transients

1.1.10. Controller Enclosure available in IP66 Painted, Stainless Steel or GPR or as 19” Rack Units

1.1.11. Optional Features – see Section 5

1.2. Quiescent Current of MSRx (Self Consumption)

1.2.1. 12V System (no alarms operating): Iq = 58mA i.e. Pq = 0.7W

1.2.2. 24V System (no alarms operating): Iq = 29mA i.e. Pq = 0.7W

1.2.3. 48V System (no alarms operating): Iq = 23mA i.e. Pq = 1.1W

2. Health & Safety

2.1. General

Read this manual thoroughly BEFORE undertaking any work.

Potentially lethal voltages can be present at the terminals within the Unit. Extreme care MUST be taken when performing any of the actions described in this manual. Remove all metallic personal adornments from the hands, wrists and neck before commencing work on a live unit. Ensure all tools are insulated.

2.2. Earthing

The MSRx Charge Controller can be used with either a Positive Earth (Positive Common) or Negative Earth (Negative Common) connected solar system. The MSRx Charge Controller does not have to be connected to earth.

3. MSRx Control Unit Operation

3.1. Test Mode

Some features of the Charge Controller make the demonstration of its functions and/or the testing of it difficult. To facilitate the factory testing of the unit, a Test Mode can be enabled (Menu D Screen 3). For protection, this Test Mode will be disabled when power is lost or 30 minutes after it was enabled. The user can also disable the test mode.

The Test Mode has the following effect:

All arrays are deemed to have sufficient voltage to be ready to charge the battery.

The Array Voltage Sampling Time = 16 seconds (see section 3.2)

The Regulation Connect Delay = 2 seconds (see section 3.5)

The Regulation Disconnect Delay = 2 seconds (see section 3.5)

The Regulation Minimum Off Time = 5 seconds (see section 3.5)

The Equalisation Time = 1 minute (see section 3.5)

3.2. Array Voltages

The only way to measure the open-circuit Array Voltage for each array is to disconnect it from the battery. If a particular array is already disconnected from the battery then the open-circuit voltage can be measured immediately. However, if a particular array is connected to the battery, then in order to maximise the charging current from each array, it will only be disconnected after a period of time known as the Array Voltage Sampling Time. This is a parameter that can be adjusted by the user from 15 seconds to 16 minutes (default is 8 minutes) – see Menu D Screen 5. This feature is useful for non-solid-state array switching devices (i.e. mercury displacement relays or contactors) to minimise the switching of these devices and to maximise the energy transfer. The arrays are sampled in the sequence: Array 1-2-3-4-5-6-7-8-1-2 etc. The time between sampling one array and the next successive array will be $1/8^{th}$ of the Array Voltage Sampling Time, i.e. if the Array Voltage Sampling Time is set to 8 minutes then each array will be sampled once every 8 minutes with the time delay between one array being sampled and the next array being sampled equal to 1 minute.

3.3. Battery Voltage Measurement

The MSRx has connections for Battery Power and Battery Sense. The Battery Power connections are for power cables to carry the current to and from the battery. Because of the current carried by the power cables, there will be a voltage difference between the voltage measured at the battery and the voltage measured at the MSRx Battery Power connections. **The Battery Sense connections MUST be made using 2-core screened cable and be connected to the Battery terminals to enable the accurate measurement of the Battery Voltage.**

3.4. Temperature Sensor

Battery manufacturers state Boost and Float Regulation Voltages for their batteries at one specific temperature. For use at other temperatures, the battery manufacturers state a compensation rate which should be applied to determine the correct regulation voltages at that temperature. To determine the correct regulation voltage at any other temperature is a simple calculation.

In the MSRx Charge Controller, the temperature is sensed by the Temperature Sensor.

In the MSRx Charge Controller, the parameter "Temperature Compensation Null Temperature" should be set to the specific temperature stated by the battery manufacturer at which there is no temperature compensation required (i.e. the "null" temperature). At this temperature the MSRx applies no compensation.

In the MSRx Charge Controller, the parameter "Temperature Compensation Rate" should be set to the value stated by the battery manufacturer. The MSRx will then make the correct calculations to ensure that the battery regulation is correctly compensated.

In the MSRx Charge Controller, the parameters may be set and changed by the user, although they are set up by default by selecting the particular type of battery settings.

If the temperature sensor is faulty or disconnected, the regulator will operate as if the battery temperature is equal to the Temperature Compensation Null Temperature (zero compensation applied) and the message “Fault: Temp Sense” will appear in sequence when the display is showing Menu 0.

3.5. Compensated Battery Voltage

The MSRx uses the Battery Sense connections to accurately measure the Battery Voltage and the Temperature Sensor to accurately measure the Battery Temperature and from these measurements it calculates a compensated battery voltage.

3.6. Battery Voltage Regulation Modes

If the compensated battery voltage is less than the Reset-to-Boost voltage, the unit will enter the Boost Mode. During this time the unit will connect the arrays to the battery if the voltage present on each array is greater than the battery voltage by 2V. If the total array current is greater than the load current, the battery will charge and the battery voltage will increase.

When the compensated battery voltage reaches the Boost voltage, the unit will enter the Equalisation Mode. In this mode, the unit will disconnect and reconnect the arrays to the battery to regulate the battery voltage at the Boost voltage for the Equalisation period. This ensures the battery reaches its optimum state of charge. If the Test Mode has been enabled then the Equalisation period will be 60 seconds.

After the Equalisation period, the unit will enter the Float Mode. In this mode, the unit will disconnect and reconnect the arrays to the battery to regulate the compensated battery voltage at the Float voltage.

If the compensated battery voltage decreases below the Reset-to Boost voltage, the unit will reset to Boost Mode. This would typically happen overnight.

When there is insufficient sunlight to generate current (at night or on a day with poor light conditions), the regulator disconnects the arrays from the battery to avoid the battery discharging back through the array. This is referred to as the Night mode and is shown on the display in Menu 0.

3.7. Battery Voltage Regulation Details

When the unit is regulating at either the Boost voltage or Float voltage, it will disconnect the arrays from the battery when the battery reaches the required voltage. It will re-connect the array to the battery when the compensated battery voltage falls below the required voltage by 0.15V(12V system), 0.3V (24V system) or 0.6V (48V system). This is known as the Regulation Hysteresis and is a variable that the user can change (see Menu D Screen 8).

When the controller wants to connect or disconnect the Array inputs to the Battery, it will do so in such a way that the heat generated by the Array Switches will be distributed on all the available Array Switches and external heatsinks. This is done my connecting or disconnecting the Array Switches in the following order:

Unit	Order of Array Switch Connection and Disconnection
MSRx2	1 – 2 – 1 – 2 etc
MSRx4	1 – 3 – 2 – 4 – 1 – 3 – 2 – 4 etc
MSRx6	1 – 5 – 3 – 2 – 6 – 4 – 1 – 5 – 3 – 2 – 6 – 4 etc
MSRx8	1 – 5 – 3 – 7 – 2 – 6 – 4 – 8 – 1 – 5 – 3 – 7 – 2 – 6 – 4 – 8 etc

When a solar system uses mechanical Array Switches, it may be useful to be able to vary certain parameters involved in the charging process. The MSRx Charge Controller allows the user to vary the following parameters:

Regulation Connection Delay: 1-10 seconds (default = 5 seconds) – this is the delay between one Array input being connected to the Battery and the next Array input being connected to the Battery during regulation.

Regulation Disconnection Delay: 1-10 seconds (default = 1 seconds) – this is the delay between one Array input being disconnected from the Battery and the next Array input being disconnected from the Battery during regulation.

Regulation Minimum Off Time: 5 seconds to 20 minutes (default 1 minute) – this is the minimum amount of time that any particular Array input will be disconnected from the battery during regulation. This parameter can be used to avoid the mechanical Array Switches from connecting and disconnecting at an unnecessarily high rate (i.e. every few seconds) and causing wear on the contacts.

3.8. High Volts Alarm

If the compensated battery voltage is higher than the High Volts activation voltage, the array will be immediately disconnected from the battery and the High Volts Alarm Relay and indicator will be activated. If the compensated battery voltage is lower than the High Volts reset voltage, the High Volts Alarm Relay and indicator will be immediately reset.

The Standard MSRx Controller has Alarm Relay contacts marked “High V Alarm”, and the 19” Rack MSRx Controller has Alarm Relay contacts marked “High Volts”, both of which are by default programmed to activate on the High Volts Alarm function. The relays can be re-programmed by the user for any alarm function (see Menu C Screens 9 to 14).

If the Load Cut on High Volts Alarm function is enabled (Menu D Screen 4) then the Loads will be disconnected when the High Volts Alarm is active and Load Cut 1 and Load Cut 2 Alarms will become active.

3.9. Low Volts Alarm

If the battery voltage is lower than the Low Volts activation voltage and remains lower for 5 seconds, the Low Volts Alarm Relay and indicator will be activated. If the battery voltage is higher than the Low Volts reset voltage, the Low Volts Alarm Relay and indicator will be immediately reset.

The Standard MSRx Controller has Alarm Relay contacts marked “Low V Alarm”, and the 19” Rack MSRx Controller has Alarm Relay contacts marked “Low Volts”, both of which are by default programmed to activate on the Low Volts Alarm function. The relays can be re-programmed by the user for any alarm function (see Menu C Screens 9 to 14).

3.10. Load Cut Alarms 1 & 2

If the battery voltage is lower than a Load Cut activation voltage and remains lower for 5 seconds, the Load Cut Alarm Relay and indicator will be activated. After the Load Cut Switch Delay Period, the Load Cut Switch and indicator will be activated. If the battery voltage is higher than the Load Cut reset voltage, the Load Cut Alarm Relay and indicator and the Load Cut switch and indicator will be immediately reset.

The Standard MSRx Controller has Alarm Relay contacts marked “Load 1/2 Alarm”, and the 19” Rack MSRx Controller has Alarm Relay contacts marked “Load Cut 1/2”, all of which are by default programmed to activate on the Load Cut 1/2 Alarm functions. The relays can be re-programmed by the user for any alarm function (see Menu C Screens 9 to 14).

3.11. Common Alarm / System Normal

The Common Alarm function will be activated if any of the following alarms or faults are active in the system: High Volts Alarm, Low Volts Alarm, Load Cut 1 Alarm, Load Cut 2 Alarm, Array Failure Alarm, Low Charge Alarm, High Volts 2 Alarm, Low Volts 2, Battery Sense Fault, Temperature Sensor Fault.

The 19” Rack MSRx Controller has Alarm Relay contacts marked “System Normal”, which are by default programmed to activate on the System Normal Alarm function. The relay can be re-programmed by the user for any alarm function (see Menu C Screens 9 to 14).

The Common Alarm function may be set as a System Normal function (see Setting Menu B). The System Normal function is the opposite of the Common Alarm function, i.e. it is activated when no alarms or faults are present.

3.12. Array Failure Alarm

The Array Failure function is designed to provide a monitoring of each connected array. This can be used to ensure the arrays are connected (i.e. not stolen or disconnected) and working (i.e. not broken). The function must be enabled for each connected array using Setting Menu B. Also, the period of time over which the arrays are monitored can be changed from the default of 48 hours.

The function works by detecting the array voltage as being greater than the battery voltage during the Array Failure time period. During times of darkness there will be no array voltage, but even on a cloudy day each array input will generate enough voltage to detect its presence. The Array Failure time should not be set to less than 24 hours.

The 19" Rack MSRx Controller has Alarm Relay contacts marked "Array Fail", which are by default programmed to activate on the Array Fail Alarm function. The relay can be re-programmed by the user for any alarm function (see Menu C Screens 9 to 14).

3.13. Low Charge Alarm Function

The Low Charge Alarm function is designed to indicate when the system is in a state of low charge. A low charge day is defined as being a 24 hour period in which the Array ampere hours is less than 90% of the Load ampere hours (i.e. the energy being put into the system is less than that taken out). The controller makes a decision one hour after dusk as to whether the preceding 24 hour period was a low charge day or not. The Low Charge Alarm function can be disabled by setting the Low Charge Days parameter (Setting Menu B) to 0 days (factory default). The Low Charge Alarm function is enabled by setting the Low Charge Days parameter (Setting Menu B) to a number of days between 1 and 15. The Low Charge Alarm will then be activated if the consecutive number of low charge days is equal to or greater than the Low Charge Days parameter as set by the user. The Low Charge Alarm will de-activate when a 24 hour period has elapsed which is not a low charge day.

3.14. High Volts 2 Alarm

The High Volts 2 Alarm function may be enabled or disabled using Setting Menu C (HV 2 Alm Fn: On / Off). The activation and de-activation set-points may be adjusted by the user using Setting Menu C.

If the High Volts 2 Alarm function is enabled, then if the compensated battery voltage is higher than the High Volts 2 activation voltage, the High Volts 2 Alarm function will be activated. If the compensated battery voltage is lower than the High Volts 2 reset voltage, the High Volts Alarm 2 function will be de-activated.

3.15. Low Volts 2 Alarm

The Low Volts 2 Alarm function may be enabled or disabled using Setting Menu C (LV 2 Alm Fn: On / Off). The activation and de-activation set-points may be adjusted by the user using Setting Menu C.

If the Low Volts 2 Alarm function is enabled, then if the battery voltage is lower than the Low Volts 2 activation voltage and remains lower for 5 seconds, the Low Volts 2 Alarm function will be activated. If the battery voltage is higher than the Low Volts 2 reset voltage, the Low Volts Alarm function will be de-activated.

3.16. Generator Set Control Function

The Low Volts 2 Alarm Function can be used as a Generator Set Control Function and Menu D Screen 9 gives the user added flexibility: Low Volts 2 Time (adjustable from 0, 5min, 15min, 30min, 1, 2, 4, 6, 8, 10, 12 hours).

If the Low Volts 2 Time is zero then the Low Volts alarm will work as normal.

If the Low Volts 2 Time is not zero, then when the function trips it will run until the reset level is achieved or the time has expired. By setting the reset level high, when the function is tripped, the Alarm contacts can be used to start the generator and it will run for the time selected (or until it reached the reset level).

3.17. Battery High Temperature Alarm

The Battery High and Low Temperature Alarm functions may be enabled or disabled using Setting Menu C (BTmp Alm Fn: On / Off). The activation set-points may be adjusted by the user using Setting Menu C.

If the Battery High Temperature Alarm function is enabled, then if the battery temperature is higher than Battery High Temperature Alarm set-point, then the Battery High Temperature Alarm function will be activated. If the battery temperature drops below the Battery High Temperature Alarm set-point by 2 degrees then the Battery High Temperature Alarm function will be de-activated.

3.18. Battery Low Temperature Alarm

The Battery High and Low Temperature Alarm functions may be enabled or disabled using Setting Menu C (BTmp Alm Fn: On / Off). The activation set-points may be adjusted by the user using Setting Menu C.

If the Battery Low Temperature Alarm function is enabled, then if the battery temperature is lower than Battery Low Temperature Alarm set-point, then the Battery Low Temperature Alarm function will be activated. If the battery temperature rises above the Battery Low Temperature Alarm set-point by 2 degrees then the Battery Low Temperature Alarm function will be de-activated.

3.19. Battery Sense Fault

If the Battery Sense connections become disconnected from the battery then the Battery Sense Fault function will be activated. (The Battery Voltage will then be measured as 0V, the Low Volt Alarms will activate and the Loads will be disconnected.)

3.20. Temperature Sense Fault

If the Temperature Sense connections become short circuited or disconnected then the Temperature Sense Fault function will be activated.

3.21. Status LED

A status LED is mounted on the MSRx Control PCB Assembly and is used to provide basic unit status to the user as described in the following table:

Mode	Status LED Operation
Boost Mode	Flash : 0.35 sec on - 0.35 sec off
Equalisation Mode	Flash : 1.05 sec on – 0.35 sec off
Float Mode	Steady
Night Mode	Flash: 0.35 sec on – 2.45 sec off

3.22. Power Up Sequence

Ensure that the jumper link is installed on LK1 in the Disable position on the MSRx PSU/Load PCB Assembly. Apply the battery power. The following screens should appear on the LCD Display:

`MSRx Charge` `Controller`	Power-up Screen	This screen appears for 2s when the unit has power first applied to it, or when the RESET switch on the MSRx Control PCB Assembly is pressed.
`Batt:24.5V +123A` `Mode: Boost`	Menu 0	Present Regulation Mode = Boost (for example)

3.23. Alarm Relays – MSRx Standard / 19" Rack

The Standard MSRx Controller has 4 Alarm Relay contacts provided, and the 19" Rack MSRx Controller has 6 Alarm Relay contacts provided. Each Alarm Relay is programmed at the factory to activate when the function that is printed beside the Alarm Relay contacts is active. However, the user can program any of the Alarm Relays to activate on any alarm function using Menu C Screens 9 to 14.

If more Alarm Relay contacts are required, see the optional Din-Rail modules that are available in Section 5.

3.24. Initial Charge Mode

The Initial Charge Mode is designed to be used once at commissioning to ensure the batteries are in their optimum condition. The Initial Charge Mode can be Enabled or Disabled using Menu D Screen 11.

If the Initial Charge Mode is Enabled, the unit will remain in the Initial Charge Mode until:

(a) the user Disables the Initial Charge Mode, or

(b) the Charging Array Ah is greater than the Initial Charge Array Ah Setting (Menu D Screen 12), or

(c) the Charging Days is greater than the Initial Charge Days Setting (Menu D Screen 13)

When the Initial Charge Mode is Enabled, the following conditions will exist:

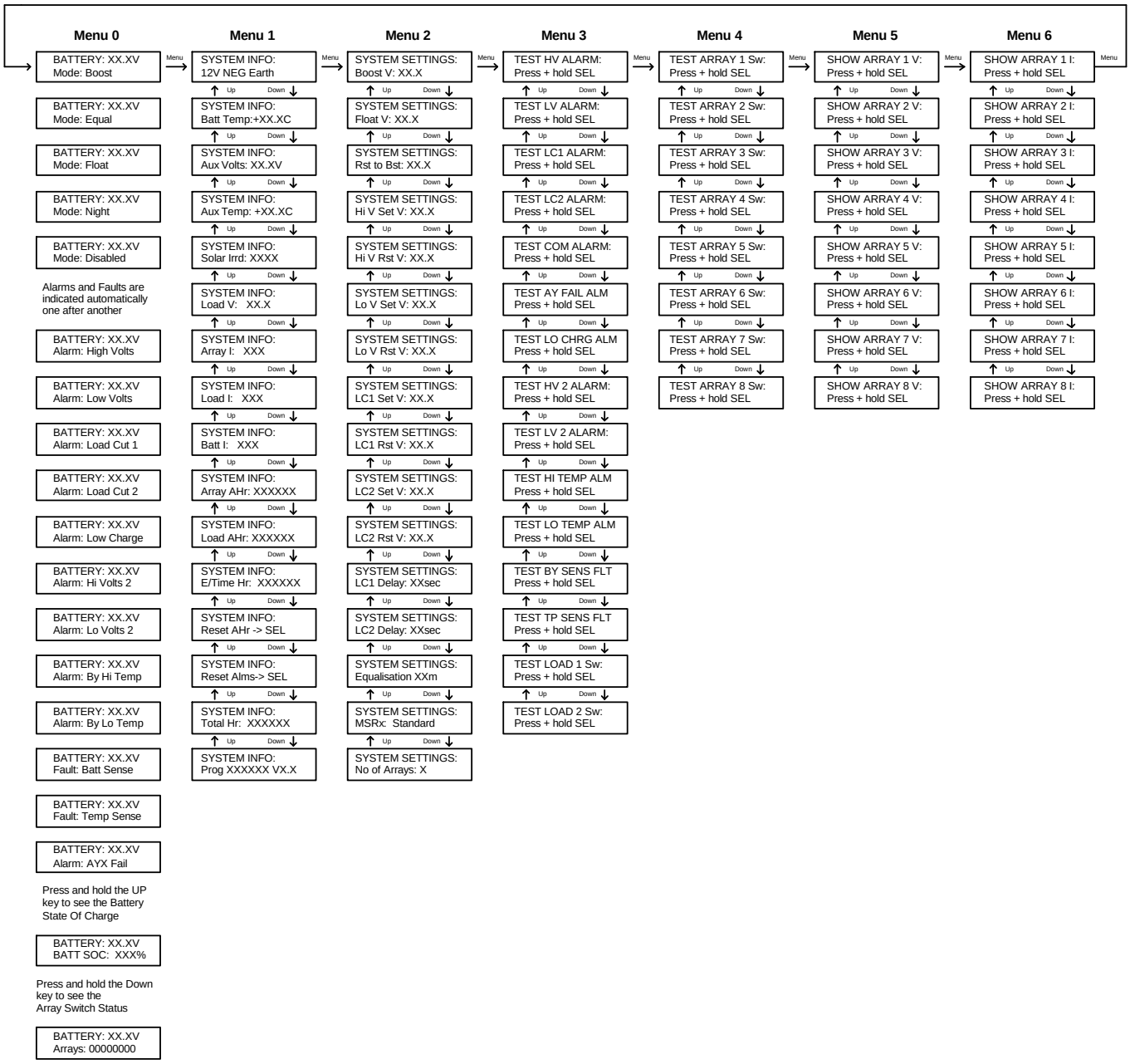
If the Arrays are ready to charge they will be connected to the battery (i.e. no regulation).

No High Volts Alarm and the Loads will be disconnected.

At the end of the Initial Charge Mode, normal operation will automatically resume (loads will be connected etc.).

4. MSRx LCD Display and Control

The MSRx Charge Controller has a 2-line by 16-character alphanumeric LCD Display which is used to display system information and settings to the user. The following diagram describes the various information screens available to the user:



4.1. Menu Navigation

Navigating the menus is done by using the Menu, Up and Down switches while the Select switch will activate various functions. Pressing Menu and Down together will take the user back to Menu 0 Screen 0 (Home).

Pressing the Menu switch at any screen in Menu 0 will change the display to show the top screen of Menu 1. In a similar manner, the user can move to Menus 2, 3, 4 etc and back to Menu 0, by pressing the Menu switch repeatedly.

The Up and Down Switches will move the user up and down within a menu.

The MSRx display has a power down feature, which operates 4 minutes after the last press of any switch. The display is re-activated by pressing any switch. This feature is normally disabled (see Setting Menu D Screen 15).

4.2. Menu 0 – Status

Menu 0 Screen 0 is called the Home Screen. It displays the Battery Voltage and Current on line 1 and the Unit Mode, Alarms or other information on line 2. Pressing the Menu and Down switches at any time will return the user to Menu 0.

Menu 0 will normally show the Mode of the unit. If any Alarms or Faults are active, the display will show each of the active alarms or faults in turn. The Mode will be displayed for 2 seconds followed by the list of alarms and faults for 1 second each.

Pressing the Up switch while in Menu 0 will show the Battery State of Charge in percentage (Screen xx).

Pressing the Down switch while in Menu 0 will show the Array Switch Status (Screen xx). This screen indicates whether the Array Switch is connected (=0) or disconnected (=1) from the battery. Reading left to right the display indicates Arrays: 12345678 (depending on unit).

Menu 0	Screen	Description
`Batt:24.5V +123A` `Mode: Boost`	Home Screen	Battery Voltage and Current (+ charge / - discharge) Press Menu and Down Switches together to return to this screen
`Batt:24.5V +123A` `Batt SOC:  100%`		Press Up switch to see the Battery State of Charge (0-100%)
`Batt:24.5V +123A` `Arrays: 00000000`		Press Down switch to see the Array Switch Status (0 = disconnected 1 = connected)

Menu 0 Line 2	Screen	Description
`Mode: Equal`		Equalisation Mode
`Mode: Float`		Float Mode
`Mode: Night`		Night Mode
`Mode: Disabled`		Disabled Mode
`Mode: Test`		Test Mode
`Initial Charge:`		Initial Charge Mode
`Alarm:High Volts`		High Volts Alarm active
`Alarm:Low Volts`		Low Volts Alarm active
`Alarm:Load Cut 1`		Load Cut 1 Alarm active (Load 1 Disconnected after delay)
`Alarm:Load Cut 2`		Load Cut 2 Alarm active (Load 2 Disconnected after delay)
`Alarm:Low Charge`		Low Charge Alarm
`Alarm:Hi Volts 2`		High Volts 2 Alarm active
`Alarm:Lo Volts 2`		Low Volts 2 Alarm active
`Alarm:By Hi Temp`		Battery High Temperature Alarm active
`Alarm:By Lo Temp`		Battery Low Temperature Alarm active
`Alarm: Ayx Fail`		Array X Failure
`Fault:Batt Sense`		Battery Sense Fault
`Fault:Temp Sense`		Temperature Sensor Fault

4.3. Menu 1 – System Information

Menu 1 allows the user to view various System Information. Screen 12 allows the user to Reset the Array Amphour, Load Amphour and Elapsed Time. Screen 13 allows the user to Reset any Alarms that are no longer above or below their trip set-point.

Menu 1	Screen	Description
SYSTEM INFO: 12V NEG Earth	Screen 0	System Voltage: 12V / 24V / 36V / 48V System Polarity: POS = Positive Earth / NEG = Negative Earth
SYSTEM INFO: Batt Temp: +xx.xC	Screen 1	Temperature Sensed by Temperature Sensor (A faulty or disconnected sensor will display "---.-C")
SYSTEM INFO: Aux Volts: xx.xV	Screen 2	Auxiliary Voltage via Analogue Input DRM if fitted and enabled See Analogue Input DRM Data Sheet
SYSTEM INFO: Aux Temp: +xx.xC	Screen 3	Auxiliary Temperature via Analogue Input DRM if fitted and enabled See Analogue Input DRM Data Sheet
SYSTEM INFO: Solar Irrd: xxxx	Screen 4	Solar Irradiation (W/m^2) via Analogue Input DRM if fitted and enabled See Analogue Input DRM Data Sheet
SYSTEM INFO: Load V: xx.x	Screen 5	Load Voltage (measured at the terminals on the MSRx unit for the Battery – this function only applies to MSRx 19" Rack)
SYSTEM INFO: Array I: xxx.x	Screen 6	Total Array Current (Measured across Array Shunt)
SYSTEM INFO: Load I: xx.x	Screen 7	Total Load Current (Measured across Load Shunt)
SYSTEM INFO: Batt I: xxx.x	Screen 8	Total Battery Current (Calculated from Array-Load Current)
SYSTEM INFO: Array AHr: xxxxxx	Screen 9	Array Current Amphours since last Amphour reset (Rollover from 999999 to 000000 will reset Load Ah and E/Time hours)
SYSTEM INFO: Load AHr: xxxxxx	Screen 10	Load Current Ampere-Hours since last Ampere-Hour reset (Rollover from 999999 to 000000 will reset Array Ah and E/Time hours)
SYSTEM INFO: E/Time Hr: xxxxxx	Screen 11	Elapsed Time since last Amphour reset
SYSTEM INFO: Reset AHr -> SEL	Screen 12	Reset Amphours Counters (Press Select to reset Array Amphours, Load Amphours and E/Time Amphours)
SYSTEM INFO: Reset Alms -> SEL	Screen 13	Reset Alarms (Press Select to reset alarms: any active alarm will be reset)
SYSTEM INFO: Total Hr: xxxxxx	Screen 14	Total Controller Run Time (Hours – this counter is non-resetable)
SYSTEM INFO: Prog xxxxxx Vx.x	Screen 15	Program Filename and Version Number

4.4. Menu 2 – System Settings

Menu 2 allows the user to view the System Settings associated with the Battery

Menu 2	Screen	Description
SYSTEM SETTINGS: Boost V: xx.x	Screen 0	Boost Regulation Voltage Set-point
SYSTEM SETTINGS: Float V: xx.x	Screen 1	Float Regulation Voltage Set-point
SYSTEM SETTINGS: Rst to BstV:xx.x	Screen 2	Reset to Boost Voltage
SYSTEM SETTINGS: Hi V Set V: xx.x	Screen 3	High Volts Alarm Trip Voltage Set-point
SYSTEM SETTINGS: Hi V Rst V: xx.x	Screen 4	High Volts Alarm Reset Voltage Set-point
SYSTEM SETTINGS: Lo V Set V: xx.x	Screen 5	Low Volts Alarm Trip Voltage Set-point
SYSTEM SETTINGS: Lo V Rst V: xx.x	Screen 6	Low Volts Alarm Reset Voltage Set-point
SYSTEM SETTINGS: LC1 Set V: xx.x	Screen 7	Load Cut 1 Alarm Trip Voltage Set-point
SYSTEM SETTINGS: LC1 Rst V: xx.x	Screen 8	Load Cut 1 Alarm Reset Voltage Set-point
SYSTEM SETTINGS: LC1 Set V: xx.x	Screen 9	Load Cut 2 Alarm Trip Voltage Set-point
SYSTEM SETTINGS: LC1 Rst V: xx.x	Screen 10	Load Cut 2 Alarm Reset Voltage Set-point
SYSTEM SETTINGS: LC1 Delay:xx sec	Screen 11	Load Cut 1 Delay Period (seconds) (Time between the alarm being activated and the load being cut)
SYSTEM SETTINGS: LC2 Delay:xx sec	Screen 12	Load Cut 2 Delay Period (seconds) (Time between the alarm being activated and the load being cut)
SYSTEM SETTINGS: Equalisation:xxm	Screen 13	Equalisation Period (minutes)
SYSTEM SETTINGS: MSRx: Standard	Screen 14	Type of MSRx Unit: Standard = Painted, Stainless, GRP Enclosure Alternative = 19” Rack Unit
SYSTEM SETTINGS: No of Arrays: x	Screen 15	Number of Arrays in the MSRx unit (MSRx2 = 2, MSRx4 = 4, MSRx6 = 6, MSRx8 = 8)

4.5. Menu 3 – Test

Menu 3 allows the user to test the Alarm functions to enable the user to test the Alarm Relays.

WARNING: When testing the Load Switches, power to the Load will be removed or applied by the test.

Menu 3	Screen	Description
TEST HV ALARM: Press + hold SEL	Screen 0	Test High Volts Alarm indicator and relay (Press Select to change the state of the alarm)
TEST LV ALARM: Press + hold SEL	Screen 1	Test Low Volts Alarm indicator and relay (Press Select to change the state of the alarm)
TEST LC1 ALARM: Press + hold SEL	Screen 2	Test Load Cut 1 Alarm indicator and relay (Press Select to change the state of the alarm)
TEST LC2 ALARM: Press + hold SEL	Screen 3	Test Load Cut 1 Alarm indicator and relay (Press Select to change the state of the alarm)
TEST COM ALARM: Press + hold SEL	Screen 4	Test Common Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST AY FAIL ALM Press + hold SEL	Screen 5	Test Array Failure Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST LO CHRG ALM Press + hold SEL	Screen 6	Test Low Charge Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST HV 2 ALARM: Press + hold SEL	Screen 7	Test High Volts 2 Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST LV 2 ALARM: Press + hold SEL	Screen 8	Test Low Volts 2 Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST HI TEMP ALM Press + hold SEL	Screen 9	Test Batt High Temp Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST LO TEMP ALM Press + hold SEL	Screen 10	Test Batt Low Temp Alarm indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST BY SENS FLT Press + hold SEL	Screen 11	Test Batt Sense Fault indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST TP SENS FLT Press + hold SEL	Screen 12	Test Temp Sense Fault indicator and relay (if fitted and selected) (Press Select to change the state of the alarm)
TEST LOAD 1 Sw: Press + hold SEL	Screen 13	Test Load 1 solid-state switch (Press Select to change the state of the switch)
TEST LOAD 2 Sw: Press + hold SEL	Screen 14	Test Load 2 solid-state switch (Press Select to change the state of the switch)

4.6. Menu 4 – Test Array Switches

Menu 4 is entered from any screen of Menu 3 by pressing the Menu switch.

Menu 5 allows the user to change the state of the Array solid-state switches. The Up and Down switches allow the user to select the required array. Pressing the Select switch changes the sate for as long as the Select switch is pressed.

Screens 0-7 will only be accessible depending on the Number of Arrays in the system. For example, an MSRx4 will only access Screens 0-3.

Menu 4	Screen	Description
`TEST ARRAY 1 Sw:` `Press + hold SEL`	Screen 0	Test Array 1 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 2 Sw:` `Press + hold SEL`	Screen 1	Test Array 2 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 3 Sw:` `Press + hold SEL`	Screen 2	Test Array 3 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 4 Sw:` `Press + hold SEL`	Screen 3	Test Array 4 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 5 Sw:` `Press + hold SEL`	Screen 4	Test Array 5 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 6 Sw:` `Press + hold SEL`	Screen 5	Test Array 6 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 7 Sw:` `Press + hold SEL`	Screen 6	Test Array 7 solid-state switch (Press Select to change the state of the switch)
`TEST ARRAY 8 Sw:` `Press + hold SEL`	Screen 7	Test Array 8 solid-state switch (Press Select to change the state of the switch)

4.7. Menu 5 – Array Voltages

Menu 5 is entered from any screen of Menu 4 by pressing the Menu switch.

Menu 5 allows the user to view the open circuit array voltages. The Up and Down switches allow the user to select the required array.

NOTE: In order to measure the open-circuit voltage on any Array, the MSRx unit needs to turn off the Array solid-state switch to disconnect it from the battery. When the Select switch is pressed, the Array Switch is turned off and the voltage measured.

Screens 0-7 will only be accessible depending on the Number of Arrays in the system. For example, an MSRx4 will only access Screens 0-3.

NOTE: An array voltage will be measured correctly only when there is an array module connected to the array input, and the array input MCB is turned on.

Menu 5	Screen	Description
SHOW ARRAY 1 V: Press + hold SEL	Screen 0	Show Array 1 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 2 V: Press + hold SEL	Screen 1	Show Array 2 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 3 V: Press + hold SEL	Screen 2	Show Array 3 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 4 V: Press + hold SEL	Screen 3	Show Array 4 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 5 V: Press + hold SEL	Screen 4	Show Array 5 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 6 V: Press + hold SEL	Screen 5	Show Array 6 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 7 V: Press + hold SEL	Screen 6	Show Array 7 open-circuit array voltage (Press Select to show the voltage)
SHOW ARRAY 8 V: Press + hold SEL	Screen 7	Show Array 8 open-circuit array voltage (Press Select to show the voltage)

4.8. Menu 6 – Array Currents

Menu 6 is entered from any screen of Menu 4 by pressing the Menu switch.

Menu 6 allows the user to view the Array current flowing from each array. The Up and Down switches allow the user to select the required array.

NOTE: In order to measure an individual Array current, the MSRx unit will turn on that individual Array Switch to connect it to the Battery and it will turn off all the other Array Switches, which will disconnect them from the Battery. This will happen for 5 seconds following the pressing of the Select switch. The user will be unable to move up and down the Menu during the 5 second period.

Screens 0-7 will only be accessible depending on the Number of Arrays in the system. For example, an MSRx4 will only access Screens 0-3.

Menu 6	Screen	Description
SHOW ARRAY 1 I: Press + hold SEL	Screen 0	Show Array 1 current (Press Select to show the current)
SHOW ARRAY 2 I: Press + hold SEL	Screen 1	Show Array 2 current (Press Select to show the current)
SHOW ARRAY 3 I: Press + hold SEL	Screen 2	Show Array 3 current (Press Select to show the current)
SHOW ARRAY 4 I: Press + hold SEL	Screen 3	Show Array 4 current (Press Select to show the current)
SHOW ARRAY 5 I: Press + hold SEL	Screen 4	Show Array 5 current (Press Select to show the current)
SHOW ARRAY 6 I: Press + hold SEL	Screen 5	Show Array 6 current (Press Select to show the current)
SHOW ARRAY 7 I: Press + hold SEL	Screen 6	Show Array 7 current (Press Select to show the current)
SHOW ARRAY 8 I: Press + hold SEL	Screen 7	Show Array 8 current (Press Select to show the current)

4.9. Change Settings Menus

The Change Settings Menus A-D (see next few pages) exist to allow an authorised user to change the settings of the unit in the field. The Change Settings Menus can only be entered by doing the following:

MSRx Steel Enclosure Unit: Insert the jumper link on LK1 (on the MSRx PSU/Load PCB Assembly) in the Disable position, press and hold the Menu, Up and Down switches together and then press the Select switch.

MSRx 19" Rack Unit: Ensure the front panel keyswitch is turned to "Keypad Enable". Hold the Menu, Up and Down switches pressed and then press the Select switch.

4.9.1. Range of Settings

The Change Settings Menu allows the user to change the settings as shown in the overview diagram on the next page and listed on the following pages.

4.9.2. Changing Settings

The Menu, Up and Down switches are used to select the setting to be changed. The Select switch is pressed and the value will flash. The Up and Down switches are used to vary the value. The Select switch is pressed and the value will stop flashing. The Menu, Up and Down switches can be used again to select a setting to be changed or to navigate to the "Accept?" screen.

Auto-Repeat: When a setting value is flashing, if the Up or Down switch is pressed and held for more than 0.5 seconds, then the setting will continue to increment or decrement repeatedly.

4.9.3. Accepting Changes to Settings

In order to remember the new settings, the user must navigate to the "Accept ?" screen and press the Select switch. The unit will not remember any changes to settings unless they are accepted by using this screen.

4.9.4. Default Settings

The Change Settings Menu allows the user to reset most of the settings back to default preset battery settings. Refer to Section 4.19 for the range available.

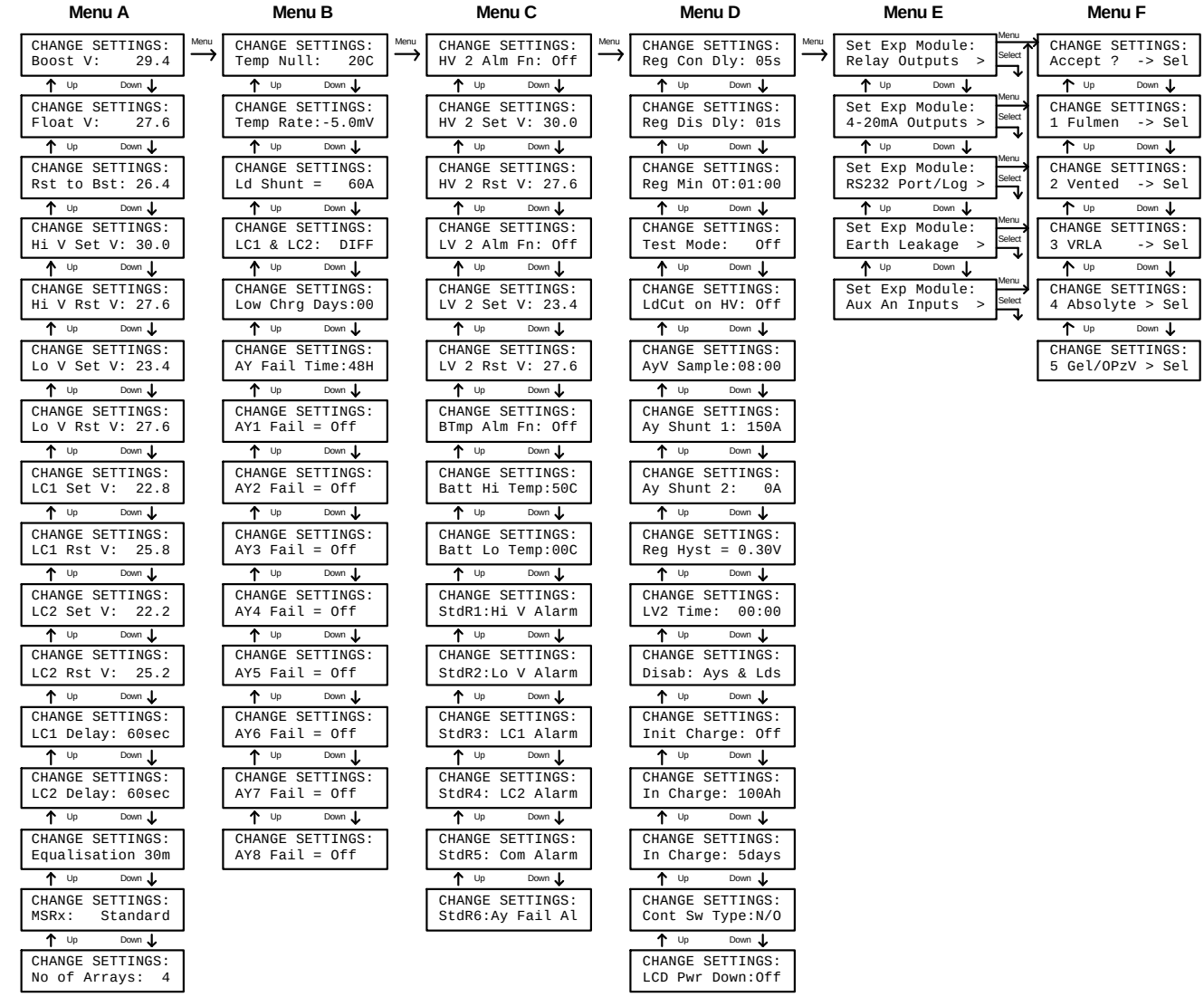
4.9.5. Exiting the Change Settings Menus

Pressing the Menu switch at one of the Menu D screens, will exit the Change Settings Menus without remembering any changes. The user is taken back to Menu 0.

Pressing the Select switch at the Accept screen (Screen 0) will exit the Change Settings Menus and remember any changes. The user is taken back to Menu 0.

Pressing the Select switch at any of the Default screens will exit the Change Settings Menus and the new default values will be programmed into the unit. The user is taken back to Menu 0.

4.9.6. Changing Settings Menus - Diagram



Enter Change Settings Menu by inserting the Disable link and pressing the Select switch with Menu, Up and Down switches all depressed.

4.10. Menu A – Change System Settings

Menu A	Screen	Description
CHANGE SETTINGS: Boost V: xx.x	Screen 0	Boost Regulation Voltage Set-point
CHANGE SETTINGS: Float V: xx.x	Screen 1	Float Regulation Voltage Set-point
CHANGE SETTINGS: Rst to Bst V:xx.x	Screen 2	Reset to Boost Voltage
CHANGE SETTINGS: Hi V Set V: xx.x	Screen 3	High Volts Alarm Trip Voltage Set-point
CHANGE SETTINGS: Hi V Rst V: xx.x	Screen 4	High Volts Alarm Reset Voltage Set-point
CHANGE SETTINGS: Lo V Set V: xx.x	Screen 5	Low Volts Alarm Trip Voltage Set-point
CHANGE SETTINGS: Lo V Rst V: xx.x	Screen 6	Low Volts Alarm Reset Voltage Set-point
CHANGE SETTINGS: LC1 Set V: xx.x	Screen 7	Load Cut 1 Alarm Trip Voltage Set-point
CHANGE SETTINGS: LC1 Rst V: xx.x	Screen 8	Load Cut 1 Alarm Reset Voltage Set-point
CHANGE SETTINGS: LC1 Set V: xx.x	Screen 9	Load Cut 2 Alarm Trip Voltage Set-point
CHANGE SETTINGS: LC1 Rst V: xx.x	Screen 10	Load Cut 2 Alarm Reset Voltage Set-point
CHANGE SETTINGS: LC1 Delay: xx sec	Screen 11	Load Cut 1 Delay Period (5 to 240 seconds) (Time between the alarm being activated and the load being cut)
CHANGE SETTINGS: LC2 Delay: xx sec	Screen 12	Load Cut 2 Delay Period (5 to 240 seconds) (Time between the alarm being activated and the load being cut)
CHANGE SETTINGS: Equalisation:xx m	Screen 13	Equalisation Period (1 to 90 minutes)
CHANGE SETTINGS: MSRx: Standard	Screen 14	Type of Unit: Standard Unit or 19” Rack Unit Standard = Painted, Stainless, GRP Enclosure
CHANGE SETTINGS: No of Arrays: x	Screen 15	Number of Arrays in the MSRx unit (MSRx2 = 2, MSRx4 = 4, MSRx6 = 6, MSRx8 = 8)

4.11. Menu B – Change System Settings

Menu B	Screen	Description
CHANGE SETTINGS: Temp Null: xxC	Screen 0	Temperature Compensation Null Temperature
CHANGE SETTINGS: Temp Rate:-x.xmV	Screen 1	Temperature Compensation Rate
CHANGE SETTINGS: Ld Shunt = xxxA	Screen 2	Load Shunt value: 60A / 100A / 150A (This must be set for the shunt value fitted to the unit)
CHANGE SETTINGS: LC1 & LC2: DIFF	Screen 3	Load Cut 1 & Load Cut 2: DIFF (Different) or SAME (Same) (The two load cuts can be selected to work together – same)
CHANGE SETTINGS: Low Chrg Days:00	Screen 4	Low Charge Days function: This sets the number of consecutive days the unit must see low charge before activating the low charge alarm.
CHANGE SETTINGS: AY Fail Time xxH	Screen 5	Array Fail Time: This sets the number of hours the unit will monitor each selected array input for its ready-to-charge condition
CHANGE SETTINGS: AY1 Fail = OFF	Screen 6	Array 1 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY2 Fail = OFF	Screen 7	Array 2 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY3 Fail = OFF	Screen 8	Array 3 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY4 Fail = OFF	Screen 9	Array 4 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY5 Fail = OFF	Screen 10	Array 5 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY6 Fail = OFF	Screen 11	Array 6 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY7 Fail = OFF	Screen 12	Array 7 Failure select: OFF or ON To select the array failure on this array – set to ON
CHANGE SETTINGS: AY8 Fail = OFF	Screen 13	Array 8 Failure select: OFF or ON To select the array failure on this array – set to ON

4.12. Menu C – Change System Settings

Menu C	Screen	Description
CHANGE SETTINGS: HV 2 Alm Fn: Off	Screen 0	High Volts 2 Alarm Function Select function On or Off
CHANGE SETTINGS: HV 2 Set V: xx.x	Screen 1	High Volts 2 Alarm Trip Voltage Set-point
CHANGE SETTINGS: HV 2 Rst V: xx.x	Screen 2	High Volts 2 Alarm Reset Voltage Set-point
CHANGE SETTINGS: LV 2 Alm Fn: Off	Screen 3	Low Volts 2 Alarm Function Select function On or Off
CHANGE SETTINGS: LV 2 Set V: xx.x	Screen 4	Low Volts 2 Alarm Trip Voltage Set-point
CHANGE SETTINGS: LV 2 Rst V: xx.x	Screen 5	Low Volts 2 Alarm Reset Voltage Set-point
CHANGE SETTINGS: BTmp Alm Fn: Off	Screen 6	Battery Temperature Alarm Function Select function On or Off
CHANGE SETTINGS: Batt Hi Temp: xx	Screen 7	Battery High Temperature Alarm Set-point
CHANGE SETTINGS: Batt Lo Temp: xx	Screen 8	Battery Low Temperature Alarm Set-point
CHANGE SETTINGS: StdR1: Hi V Alarm	Screen 9	Standard Relay 1 Alarm select: Assign any Alarm function to MSRx Standard or 19" Rack MSRx Alarm Relay marked "High Volts Alarm"
CHANGE SETTINGS: StdR2: Lo V Alarm	Screen 10	Standard Relay 2 Alarm select: Assign any Alarm function to MSRx Standard or 19" Rack MSRx Alarm Relay marked "Low Volts Alarm"
CHANGE SETTINGS: StdR3: LC1 Alarm	Screen 11	Standard Relay 3 Alarm select: Assign any Alarm function to MSRx Standard or 19" Rack MSRx Alarm Relay marked "Load 1 Alarm"
CHANGE SETTINGS: StdR4: LC2 Alarm	Screen 12	Standard Relay 4 Alarm select: Assign any Alarm function to MSRx Standard or 19" Rack MSRx Alarm Relay marked "Load 2 Alarm"
CHANGE SETTINGS: StdR5: Com Alarm	Screen 13	Standard Relay 5 Alarm select: Assign any Alarm function to MSRx 19" Rack Alarm Relay marked "System Normal" or "Common Alarm"
CHANGE SETTINGS: StdR6: Ay Fail Al	Screen 14	Standard Relay 6 Alarm select: Assign any Alarm function to MSRx 19" Rack Alarm Relay marked "Array Fail Alarm"

4.13. Menu D – Change System Settings

Menu D	Screen	Description
CHANGE SETTINGS: Reg Con Dly: 05s	Screen 0	Regulation Connection Delay: 1-10 seconds (default = 5 seconds) The delay between arrays connecting during regulation
CHANGE SETTINGS: Reg Dis Dly: 05s	Screen 1	Regulation Disconnection Delay: 1-10 seconds (default = 1 seconds) The delay between arrays disconnecting during regulation
CHANGE SETTINGS: Reg Min OT:01:00	Screen 2	Regulation Minimum Off Time: 5 seconds to 20 minutes (default 1 min) The minimum time each array must stay off during regulation
CHANGE SETTINGS: Test Mode: Off	Screen 3	Test Mode On/Off To enable or disable the Test Mode (see section 3.1)
CHANGE SETTINGS: LdCut on HV: Off	Screen 4	Load Cut on High Volts On/Off To enable or disable Load Cut when High Volts Alarm is active
CHANGE SETTINGS: AyV Sample:08:00	Screen 5	Array Voltage Sample Time: 15 seconds to 16 minutes (default 8 mins) The time between successive array voltage measurement on the same array when connected to the battery
CHANGE SETTINGS: Ay Shunt 1: 150A	Screen 6	Array Shunt 1 value select: 0A, 150A, 300A, 400A, 500A, 200A, 250A Standard (default) value for MSRx2/4/6/8 = 150A Must be set to 0A if not being used (0A = shunt not used)
CHANGE SETTINGS: Ay Shunt 2: 150A	Screen 7	Array Shunt 2 value select: 0A, 150A, 300A, 400A, 500A, 200A, 250A Standard (default) value for MSRx2/4 = 0A / MSRx6/8 = 150A Must be set to 0A if not being used (0A = shunt not used)
CHANGE SETTINGS: Reg Hyst = 0.30V	Screen 8	Regulation Hysteresis: Part of the Battery Regulation Control – see section 3.5
CHANGE SETTINGS: LV2 Time: 00:00	Screen 9	Low Voltage 2 Function Time – see Section 3.15 Adjustable from 0 to 5min, 15min, 30min, 1, 2, 4, 6, 8, 10, 12 hours
CHANGE SETTINGS: Disab: Ays & Lds	Screen 10	Disable Link Function: (determines what is disabled when link inserted) Default = Arrays & Loads disabled when link inserted User can change this to Arrays only, Loads only or None

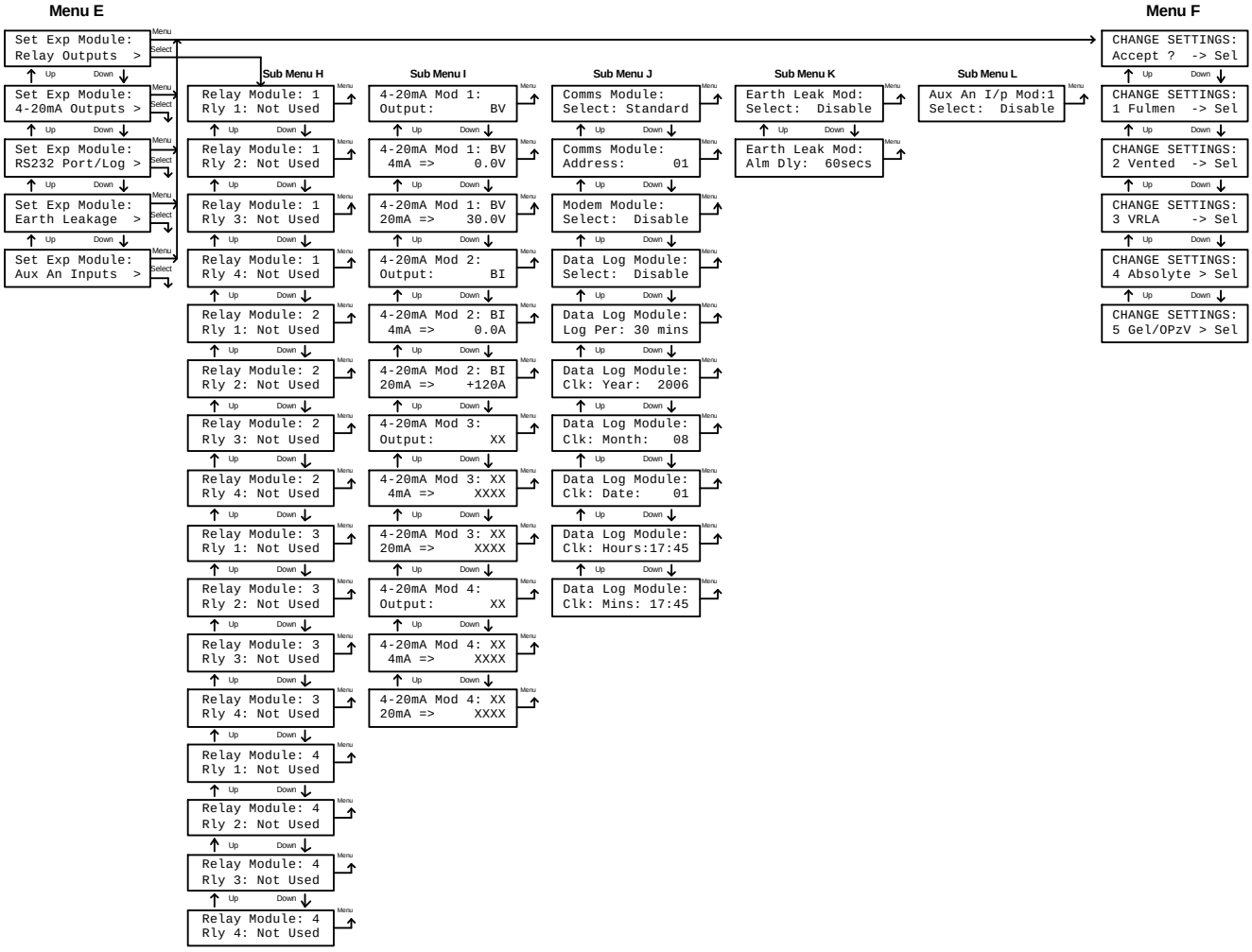
Menu D (continued)	Screen	Description
CHANGE SETTINGS: Init Charge: Off	Screen 11	Initial Charge Function: (see Section 3.24) Off = Function Disabled / On = Function Enabled
CHANGE SETTINGS: In Charge: 100Ah	Screen 12	Initial Charge Function: Initial Charge Array Ah Setting (see Section 3.24)
CHANGE SETTINGS: In Charge: 5days	Screen 13	Initial Charge Function: Initial Charge Days Setting (see Section 3.24)
CHANGE SETTINGS: Cont Sw Type:N/O	Screen 14	Contactor Switch Type: N/O = Normally Open / N/C = Normally Closed
CHANGE SETTINGS: LCD Pwr Down:Off	Screen 15	LCD Power Down Function: Off = No Power Down On = Power Down after 240 seconds (4 minutes) of no keypad activity

4.14. Menu E – Change System Settings

Menu E	Screen	Description
Set Exp Module: Relay Outputs >	Screen 0	Press Select to enter Relay Output Module set up screens Press Menu to move to Menu F
Set Exp Module: 4-20mA Outputs >	Screen 1	Press Select to enter 4-20mA Output Module set up screens Press Menu to move to Menu F
Set Exp Module: RS232 Port/Log >	Screen 2	Press Select to enter RS232 Port & Data Log Module set up screens Press Menu to move to Menu F
Set Exp Module: Earth Leakage >	Screen 3	Press Select to enter Earth Leakage Module set up screens Press Menu to move to Menu F
Set Exp Module: Aux An Inputs >	Screen 4	Press Select to enter Analogue Input Module set up screens Press Menu to move to Menu F

4.14.1. Expansion Port Settings Menus – Diagram

For more details see the datasheet for each Expansion Module (Section 5)



4.15. Menu F – Change System Settings

Menu F	Screen	Description
CHANGE SETTINGS: Accept ? -> SEL	Screen 0	Press Select to Accept any changes made. Press Menu to ignore any changes made.
CHANGE SETTINGS: 1 Fulmen -> SEL	Screen 1	Press Select to re-program Fulmen Battery Setting into memory. Press Menu to ignore any changes made.
CHANGE SETTINGS: 2 Vented -> SEL	Screen 2	Press Select to re-program Vented Battery Setting into memory. Press Menu to ignore any changes made.
CHANGE SETTINGS: 3 VRLA -> SEL	Screen 3	Press Select to re-program VRLA Battery Setting into memory. Press Menu to ignore any changes made.
CHANGE SETTINGS: 4 Absolyte -> SEL	Screen 4	Press Select to re-program Absolyte Battery Setting into memory. Press Menu to ignore any changes made.
CHANGE SETTINGS: 5 Gel/OPzV > SEL	Screen 5	Press Select to re-program Gel/OPzV Battery Setting into memory. Press Menu to ignore any changes made.

Note: The default regulation settings suggested in this manual are based on customer data and feedback. The end user should themselves ensure that the set points used are suitable for the type of battery used in each specific application.

4.16. MSRx Charge Controller Set-points for FULMEN Batteries (Default Values 1)

Controller Set-points	Volts / Cell	12V System	24V System	48V System
Boost & Equalise Regulation Voltage	2.45 V	14.70 ± 0.12V	29.40 ± 0.24V	58.80 ± 0.48V
Float Regulation Voltage	2.30 V	13.80 ± 0.12V	27.60 ± 0.24V	55.20 ± 0.48V
Reset to Boost Voltage	2.20 V	13.20 ± 0.12V	26.40 ± 0.24V	52.80 ± 0.48V
High Volts Alarm Trip Voltage	2.50 V	15.00 ± 0.12V	30.00 ± 0.24V	60.00 ± 0.48V
High Volts Alarm Reset Voltage	2.30 V	13.80 ± 0.12V	27.60 ± 0.24V	55.20 ± 0.48V
Low Volts Alarm Trip Voltage	1.95 V	11.70 ± 0.12V	23.40 ± 0.24V	46.80 ± 0.48V
Low Volts Alarm Reset Voltage	2.30 V	13.80 ± 0.12V	27.60 ± 0.24V	55.20 ± 0.48V
Load Cut 1 Alarm Trip Voltage	1.90 V	11.40 ± 0.12V	22.80 ± 0.24V	45.60 ± 0.48V
Load Cut 1 Alarm Reset Voltage	2.15 V	12.90 ± 0.12V	25.80 ± 0.24V	51.60 ± 0.48V
Load Cut 2 Alarm Trip Voltage	1.85 V	11.10 ± 0.12V	22.20 ± 0.24V	44.40 ± 0.48V
Load Cut 2 Alarm Reset Voltage	2.10 V	12.60 ± 0.12V	25.20 ± 0.24V	50.40 ± 0.48V
Load Cut 1 Switch Delay	N/A	60 seconds	60 seconds	60 seconds
Load Cut 2 Switch Delay	N/A	60 seconds	60 seconds	60 seconds
Equalisation Time	N/A	30 minutes	30 minutes	30 minutes
Temp Compensation Null Temp	N/A	20 ºC	20 ºC	20 ºC
Temp Compensation Rate	N/A	-5.0mV / cell / ºC	-5.0mV / cell / ºC	-5.0mV / cell / ºC

4.17. MSRx Charge Controller Set-points for Vented Cell Batteries (Default Values 2)

Controller Set-points	Volts / Cell	12V System	24V System	48V System
Boost & Equalise Regulation Voltage	2.40 V	14.40 ± 0.12V	28.80 ± 0.24V	57.60 ± 0.48V
Float Regulation Voltage	2.35 V	14.10 ± 0.12V	28.20 ± 0.24V	56.40 ± 0.48V
Reset to Boost Voltage	2.20 V	13.20 ± 0.12V	26.40 ± 0.24V	52.80 ± 0.48V
High Volts Alarm Trip Voltage	2.45 V	14.70 ± 0.12V	29.40 ± 0.24V	58.80 ± 0.48V
High Volts Alarm Reset Voltage	2.40 V	14.40 ± 0.12V	28.80 ± 0.24V	57.60 ± 0.48V
Low Volts Alarm Trip Voltage	1.90 V	11.40 ± 0.12V	22.80 ± 0.24V	45.60 ± 0.48V
Low Volts Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 1 Alarm Trip Voltage	1.85 V	11.10 ± 0.12V	22.20 ± 0.24V	44.40 ± 0.48V
Load Cut 1 Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 2 Alarm Trip Voltage	1.80 V	10.80 ± 0.12V	21.60 ± 0.24V	43.20 ± 0.48V
Load Cut 2 Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 1 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Load Cut 2 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Equalisation Time	N/A	30 minutes	30 minutes	30 minutes
Temp Compensation Null Temp	N/A	25 ºC	25 ºC	25 ºC
Temp Compensation Rate	N/A	-5.5mV / cell / ºC	-5.5mV / cell / ºC	-5.5mV / cell / ºC

4.18. MSRx Charge Controller Set-points for VRLA Cell Batteries (Default Values 3)

Controller Set-points	Volts / Cell	12V System	24V System	48V System
Boost & Equalise Regulation Voltage	2.30 V	13.80 ± 0.12V	27.60 ± 0.24V	55.20 ± 0.48V
Float Regulation Voltage	2.25 V	13.50 ± 0.12V	27.00 ± 0.24V	54.00 ± 0.48V
Reset to Boost Voltage	2.10 V	12.60 ± 0.12V	25.20 ± 0.24V	50.40 ± 0.48V
High Volts Alarm Trip Voltage	2.40 V	14.40 ± 0.12V	28.80 ± 0.24V	57.60 ± 0.48V
High Volts Alarm Reset Voltage	2.35 V	14.10 ± 0.12V	28.20 ± 0.24V	56.40 ± 0.48V
Low Volts Alarm Trip Voltage	1.90 V	11.40 ± 0.12V	22.80 ± 0.24V	45.60 ± 0.48V
Low Volts Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 1 Alarm Trip Voltage	1.85 V	11.10 ± 0.12V	22.20 ± 0.24V	44.40 ± 0.48V
Load Cut 1 Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 2 Alarm Trip Voltage	1.80 V	10.80 ± 0.12V	21.60 ± 0.24V	43.20 ± 0.48V
Load Cut 2 Alarm Reset Voltage	2.00 V	12.00 ± 0.12V	24.00 ± 0.24V	48.00 ± 0.48V
Load Cut 1 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Load Cut 2 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Equalisation Time	N/A	30 minutes	30 minutes	30 minutes
Temp Compensation Null Temp	N/A	25 ºC	25 ºC	25 ºC
Temp Compensation Rate	N/A	-3.3mV / cell / ºC	-3.3mV / cell / ºC	-3.3mV / cell / ºC

4.19. MSRx Charge Controller Set-points for Absolyte Cell Batteries (Default Values 4)

Controller Set-points	Volts / Cell	12V System	24V System	48V System
Boost & Equalise Regulation Voltage	2.35 V	14.10 ± 0.12V	28.20 ± 0.24V	56.40 ± 0.48V
Float Regulation Voltage	2.25 V	13.50 ± 0.12V	27.00 ± 0.24V	54.00 ± 0.48V
Reset to Boost Voltage	2.10 V	12.60 ± 0.12V	25.20 ± 0.24V	50.40 ± 0.48V
High Volts Alarm Trip Voltage	2.45 V	14.70 ± 0.12V	29.40 ± 0.24V	58.80 ± 0.48V
High Volts Alarm Reset Voltage	2.40 V	14.40 ± 0.12V	28.80 ± 0.24V	57.60 ± 0.48V
Low Volts Alarm Trip Voltage	1.95 V	11.70 ± 0.12V	23.40 ± 0.24V	46.80 ± 0.48V
Low Volts Alarm Reset Voltage	2.30 V	13.80 ± 0.12V	27.60 ± 0.24V	55.20 ± 0.48V
Load Cut 1 Alarm Trip Voltage	1.90 V	11.40 ± 0.12V	22.80 ± 0.24V	45.60 ± 0.48V
Load Cut 1 Alarm Reset Voltage	2.25 V	13.50 ± 0.12V	27.00 ± 0.24V	54.00 ± 0.48V
Load Cut 2 Alarm Trip Voltage	1.85 V	11.10 ± 0.12V	22.20 ± 0.24V	44.40 ± 0.48V
Load Cut 2 Alarm Reset Voltage	2.10 V	12.60 ± 0.12V	25.20 ± 0.24V	50.40 ± 0.48V
Load Cut 1 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Load Cut 2 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Equalisation Time	N/A	30 minutes	30 minutes	30 minutes
Temp Compensation Null Temp	N/A	25 ºC	25 ºC	25 ºC
Temp Compensation Rate	N/A	-3.0mV / cell / ºC	-3.0mV / cell / ºC	-3.0mV / cell / ºC

4.20. MSRx Charge Controller Set-points for Gel/OPzV Cell Batteries (Default Values 5)

Controller Set-points	Volts / Cell	12V System	24V System	48V System
Boost & Equalise Regulation Voltage	2.35 V	14.10 ± 0.12V	28.20 ± 0.24V	56.40 ± 0.48V
Float Regulation Voltage	2.28 V	13.68 ± 0.12V	27.36 ± 0.24V	54.72 ± 0.48V
Reset to Boost Voltage	2.11 V	12.66 ± 0.12V	25.32 ± 0.24V	50.64 ± 0.48V
High Volts Alarm Trip Voltage	2.40 V	14.40 ± 0.12V	28.80 ± 0.24V	57.60 ± 0.48V
High Volts Alarm Reset Voltage	2.15 V	12.90 ± 0.12V	25.80 ± 0.24V	51.60 ± 0.48V
Low Volts Alarm Trip Voltage	1.90 V	11.40 ± 0.12V	22.80 ± 0.24V	45.60 ± 0.48V
Low Volts Alarm Reset Voltage	2.25 V	13.50 ± 0.12V	27.00 ± 0.24V	54.00 ± 0.48V
Load Cut 1 Alarm Trip Voltage	1.85 V	11.10 ± 0.12V	22.20 ± 0.24V	44.40 ± 0.48V
Load Cut 1 Alarm Reset Voltage	2.25 V	13.50 ± 0.12V	27.00 ± 0.24V	54.00 ± 0.48V
Load Cut 2 Alarm Trip Voltage	1.80 V	10.80 ± 0.12V	21.60 ± 0.24V	43.20 ± 0.48V
Load Cut 2 Alarm Reset Voltage	2.05 V	12.30 ± 0.12V	24.60 ± 0.24V	49.20 ± 0.48V
Load Cut 1 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Load Cut 2 Switch Delay	N/A	10 seconds	10 seconds	10 seconds
Equalisation Time	N/A	30 minutes	30 minutes	30 minutes
Temp Compensation Null Temp	N/A	20 ºC	20 ºC	20 ºC
Temp Compensation Rate	N/A	-5.0mV / cell / ºC	-5.0mV / cell / ºC	-5.0mV / cell / ºC

5. MSRx Optional Features

5.1. 4-Channel Relay Din Rail Module – Micha Part Number: 101589

The 4-Channel Relay Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide four Auxiliary Relay Outputs. See separate datasheet.

5.2. 4-20mA Transducer Type A Din Rail Module – Micha Part Number: 101588

The 4-20mA Transducer Type A Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide one 4-20mA output signal (requires an external power source for the 4-20mA signal). See separate datasheet.

5.3. 4-20mA Transducer Type B Din Rail Module – Micha Part Number: 101597

The 4-20mA Transducer Type B Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide one 4-20mA output signal (an internal dc-dc converter provides power for the 4-20mA signal). See separate datasheet.

5.4. Auxiliary Analogue Input Din Rail Module – Micha Part Number: 101592

The Auxiliary Analogue Input Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide the facility to measure an Auxiliary Voltage (e.g. Load Volts), an Auxiliary Temperature (same sensor as the normal Battery Temperature Sensor) and a Reference Cell (which may be used to measure Solar Irradiation). See separate datasheet.

5.5. RS232 Port Din Rail Module – Micha Part Number: 101595

The RS232 Port Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide the user with an RS232 port which is isolated electrically from the MSRx Charge Controller. A local PC may be plugged into the RS232 port and data may be downloaded from the Controller. Communications protocol can be standard (Micha) or Modbus.

Alternatively, a line or GSM Modem may be connected to this port. See separate datasheet.

5.6. MSRx RS232 Port & Data Log Din Rail Module – Micha Part Number: 101596

The MSRx RS232 Port / Data Log Din Rail Module connects to the MSRx Control PCB Assembly Expansion Port to provide the user with an RS232 port which is isolated electrically from the MSRx Charge Controller. It also provides non-volatile memory which records the operation and status of the charge controller every 15, 30 or 60 minutes. A local PC may be plugged into the RS232 port and data may be downloaded from the Controller and the Data Logger. Communications protocol can be standard (Micha) or Modbus.

Alternatively, a line or GSM Modem may be connected to this port. See separate datasheet.

5.7. Industrial Line or GSM Modems

Industrial line or GSM Modems are available which have been proven to work with the MSRx Charge Controllers. With a modem built into the MSRx Charge Controller, the user may dial up from a remote location using a PC and modem and communicate with the MSRx Charge Controller.

The unit can be set to initialise the modem each time the MSRx Controller powers up.

5.8. MSRx Communications Software

The MSRx Communications Software runs within Microsoft Excel and provides a graphical user interface (GUI) with which to communicate with the MSRx Charge Controller. All the downloaded data from the MSRx Charge Controller is presented to the user and the downloaded data may be saved as a file to the hard disk of the PC.

5.9. MSRx Battery Fuse Assembly – Micha Part Number: 400792

An optional MSRx Battery Fuse Assembly (110 x 30mm) is available for use within the MSRx Charge Controllers. The rating of the fuse will be related to the charging current of the system:

MSRx2 – 80A fuse, MSRx4 – 160A fuse, MSRx6 – 250A fuse, MSRx8 – 325A fuse.

5.10. High Current Load Output (>25A)

The MSRx Charge Controller can supply two loads at up to 25A continuous or 50A surge for 2 seconds. It is possible to wire the two load outputs in parallel to increase the current of the resulting one load output to 50A continuous or 80A surge for 2 seconds.

If the two load outputs are wired in parallel, then the Load Cut 1 and Load Cut 2 Alarm levels must be set to the same value. This is done by navigating to the Change Settings Menu B (see section 0) and changing the function from "LC1 & LC2: DIFF" to "LC1 & LC2: SAME" which will force the Load Cut 2 setting to be the same as whatever the Load Cut 1 setting is. By doing this the two load outputs will switch together as one load output.

If a particular application requires a continuous load of greater than 50A or a surge current of greater than 80A then an optional High Current Load Output can be fitted. This consists of a high current MOSFET which is mechanically fixed to the unit mounting plate to provide thermal relief. For each high current MOSFET fitted, the load current can be increased to 30A continuous or 100A surge for 2 seconds. A maximum of two devices can be fitted and wired individually to provide two loads (each 30A continuous, 100A surge) or wired in parallel to provide one load (60A continuous, 200A surge for 2 seconds).

6. Installation – Steel Enclosure Units

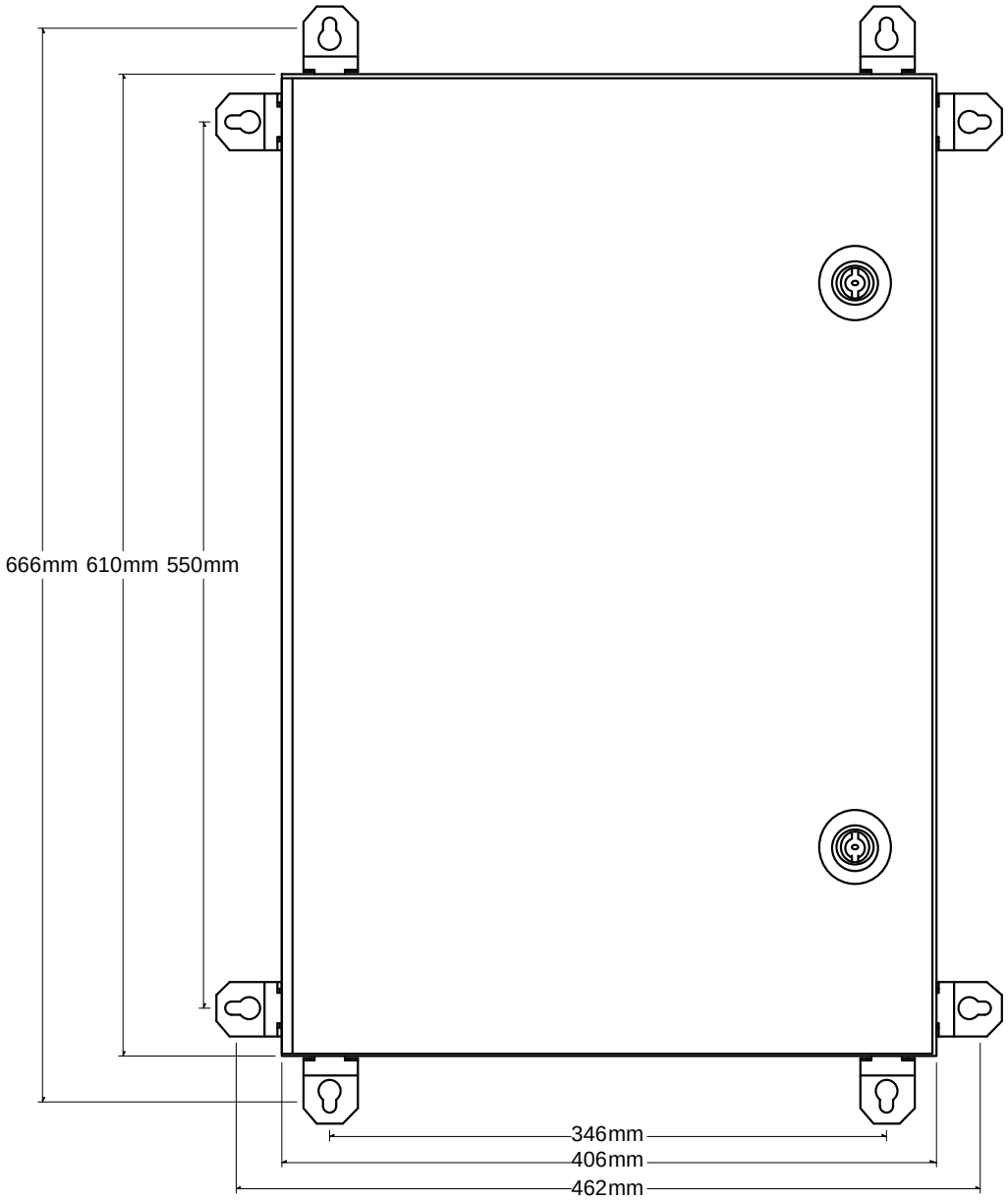
6.1. MSRx2 / MSRx4 Painted or Stainless Steel Controller Unit Mounting

6.1.1. The MSRx2 and MSRx4 Charge Controllers supplied in painted or stainless steel enclosures should be installed using the four mounting feet horizontally or vertically as shown in the diagram below.

6.1.2. Ensure that the surface to which the unit will be attached is flat.

6.1.3. Ensure that the fixing method employed is sturdy enough to support the weight of the Unit.

6.1.4. Position the unit so that it is shaded from direct sunlight, sheltered from extreme weather conditions and oriented so that the cable glands are pointing downwards.



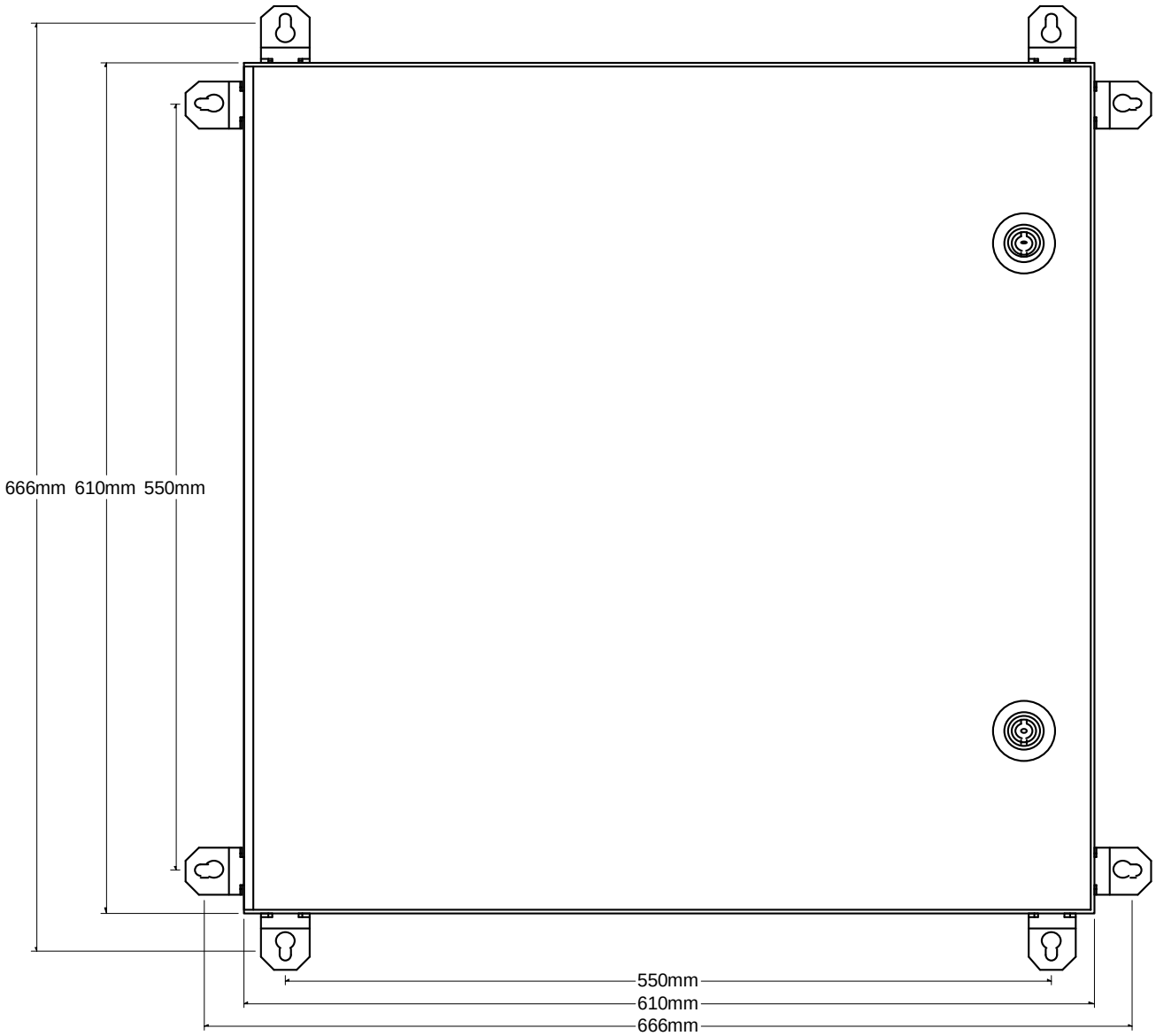
6.2. MSRx6 / MSRx8 Painted or Stainless Steel Controller Unit Mounting

6.2.1. The MSRx6 and MSRx8 Charge Controllers supplied in painted or stainless steel enclosures should be installed using the four mounting feet horizontally or vertically as shown in the diagram below.

6.2.2. Ensure that the surface to which the unit will be attached is flat.

6.2.3. Ensure that the fixing method employed is sturdy enough to support the weight of the Unit.

6.2.4. Position the unit so that it is shaded from direct sunlight, sheltered from extreme weather conditions and oriented so that the cable glands are pointing downwards.



6.3. MSRx Painted or Stainless Steel Controller Unit Electrical Connections

COMMON POSITIVE SYSTEM ONLY

CAUTION: SOLAR MODULES AND BATTERIES CAN HAVE POTENTIALLY LETHAL VOLTAGES PRESENT AT THEIR TERMINALS AND PRESENT AN ENERGY HAZARD.

Ensure the Jumper Link LK1 on the MSRx PSU/Load PCB Assembly is fitted in the DISABLE position.

WARNING - RISK OF EXPLOSION:

The battery cable MUST be connected to the MSRx Control Unit BEFORE connecting to the battery

Make the electrical connections in the order shown in the following table:

COMMON POSITIVE SYSTEM ONLY				
Connection	**1st Location**	**To**	**Connection**	**2nd Location**
BATT COM (+VE)	MSRx Control Unit		Battery Positive Terminal	Battery
BATT LIVE (–VE)	MSRx Control Unit		Battery Negative Terminal	Battery
Battery Sense BS+	MSRx PSU/Load PCB		Battery Positive Terminal	Battery
Battery Sense BS-	MSRx PSU/Load PCB		Battery Negative Terminal	Battery
ARRAY 1-8 COM	MSRx Control Unit		Array Positive Terminal	Array 1-8 Module
ARRAY 1-8 LIVE	MSRx Control Unit		Array Negative Terminal	Array 1-8 Module
Load Positive Terminal	Load 1		LOAD 1 COM	MSRx Control Unit
Load Negative Terminal	Load 1		LOAD 1 LIVE	MSRx Control Unit
Load Positive Terminal	Load 2		LOAD 2 COM	MSRx Control Unit
Load Negative Terminal	Load 2		LOAD 2 LIVE	MSRx Control Unit
Red or White wire	MSRx Temperature Sensor		TEMP SENSE TS+	MSRx PSU/Load PCB
Black or Blue wire	MSRx Temperature Sensor		TEMP SENSE TS-	MSRx PSU/Load PCB
High Volts Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Low Volts Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Load Cut 1 Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Load Cut 2 Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System

6.4. MSRx Painted or Stainless Steel Controller Unit Electrical Connections

COMMON NEGATIVE SYSTEM ONLY

CAUTION: SOLAR MODULES AND BATTERIES CAN HAVE POTENTIALLY LETHAL VOLTAGES PRESENT AT THEIR TERMINALS AND PRESENT AN ENERGY HAZARD.

Ensure the Jumper Link LK1 on the MSRx PSU/Load PCB Assembly is fitted in the DISABLE position.

WARNING - RISK OF EXPLOSION:

The battery cable MUST be connected to the MSRx Control Unit BEFORE connecting to the battery

Make the electrical connections in the order shown in the following table:

COMMON NEGATIVE SYSTEM ONLY				
Connection	**1st Location**	**To**	**Connection**	**2nd Location**
BATT COM (-VE)	MSRx Control Unit		Battery Negative Terminal	Battery
BATT LIVE (+VE)	MSRx Control Unit		Battery Positive Terminal	Battery
Battery Sense BS+	MSRx PSU/Load PCB		Battery Positive Terminal	Battery
Battery Sense BS-	MSRx PSU/Load PCB		Battery Negative Terminal	Battery
ARRAY 1-8 COM	MSRx Control Unit		Array Negative Terminal	Array 1-8 Module
ARRAY 1-8 LIVE	MSRx Control Unit		Array Positive Terminal	Array 1-8 Module
Load Negative Terminal	Load 1		LOAD 1 COM	MSRx Control Unit
Load Positive Terminal	Load 1		LOAD 1 LIVE	MSRx Control Unit
Load Negative Terminal	Load 2		LOAD 2 COM	MSRx Control Unit
Load Positive Terminal	Load 2		LOAD 2 LIVE	MSRx Control Unit
Red or White wire	MSRx Temperature Sensor		TEMP SENSE TS+	MSRx PSU/Load PCB
Black or Blue wire	MSRx Temperature Sensor		TEMP SENSE TS-	MSRx PSU/Load PCB
High Volts Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Low Volts Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Load Cut 1 Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System
Load Cut 2 Alarm Relay	MSRx PSU/Load PCB		Input Terminals	Telemetry System

6.5. MSRx Charge Controller Enable

To enable the MSRx Charge Controller, ensure Jumper Link LK1 on the MSRx PSU/Load PCB Assembly is fitted in the ENABLE position.

6.6. MSRx Charge Controller MCBs

Ensure the Array MCBs (if fitted) are set to their ON positions to allow the arrays to charge the battery.

Ensure the Load MCBs (if fitted) are set to their ON positions to allow the battery to supply current to the load.

6.7. Battery Temperature

To ensure the Battery Temperature Compensation is as accurate as possible, proceed with the following instructions after the temperature of the batteries has stabilised:

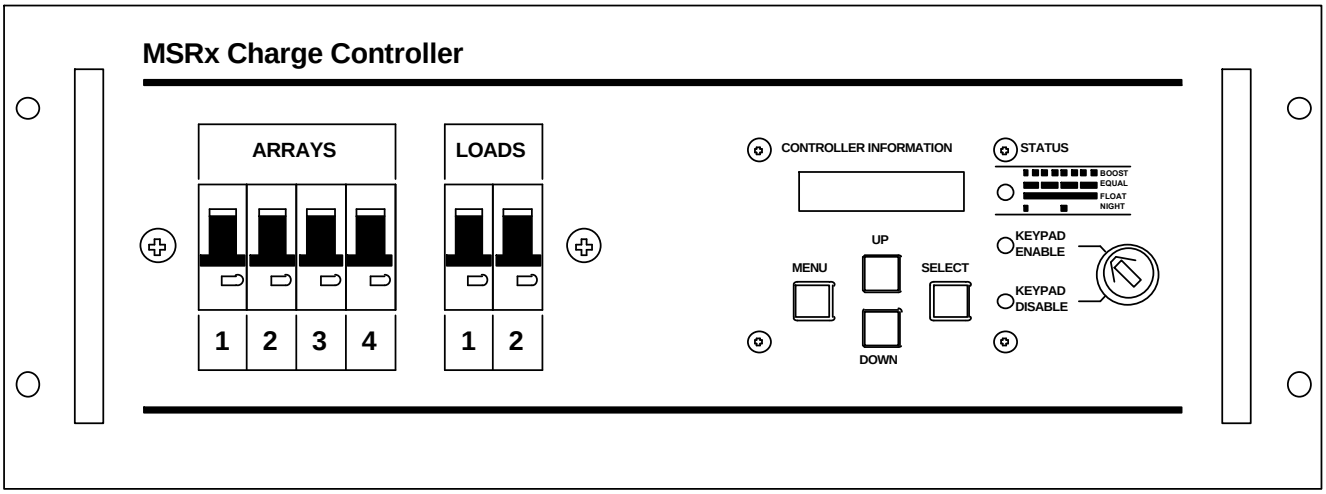
Using the user switches (Menu, Up, Down and Select), navigate to the Battery Temperature screen (Menu 1, Screen 1). Use a small flat screwdriver to adjust the potentiometer VR1 on the MSRx PSU/Load PCB Assembly so that the temperature shown on display is the same as the actual temperature as measured at the battery with a calibrated temperature meter.

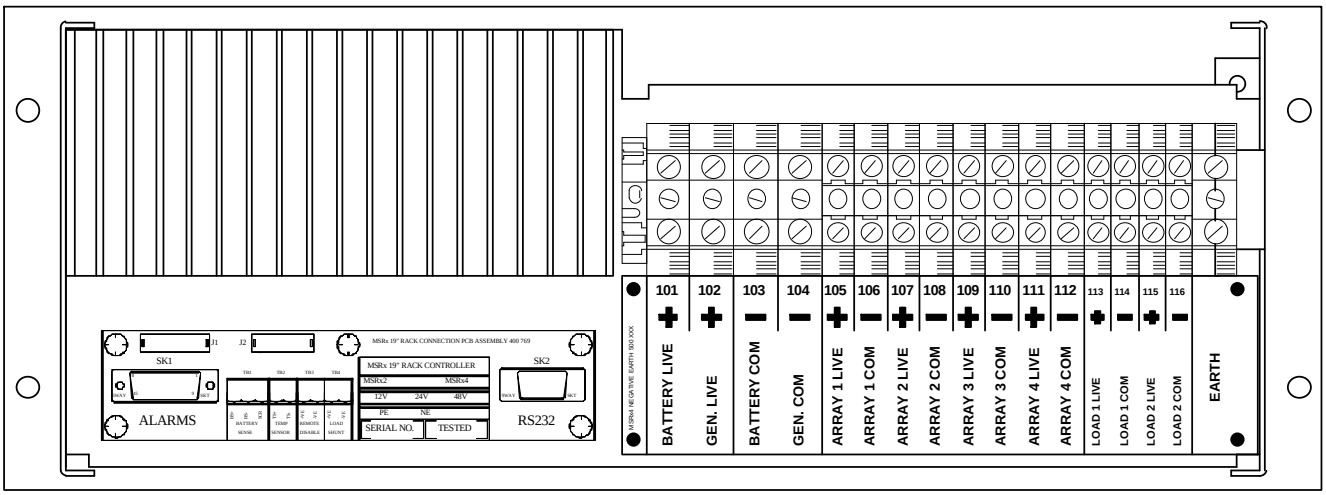
7. Installation – 19" Rack Units

7.1. MSRx2 / MSRx4 19" Rack Controller Unit Mounting

7.1.1. The MSRx2 and MSRx4 19" Rack Charge Controllers are designed to be fitted to a 19" Rack Frame and are 4U high (177mm). The units should be fitted such that they are supported by horizontal shelves and not by the front panel fixing holes.

7.1.2. The drawing below is a General Arrangement of an MSRx4 19" Rack Charge Controller.

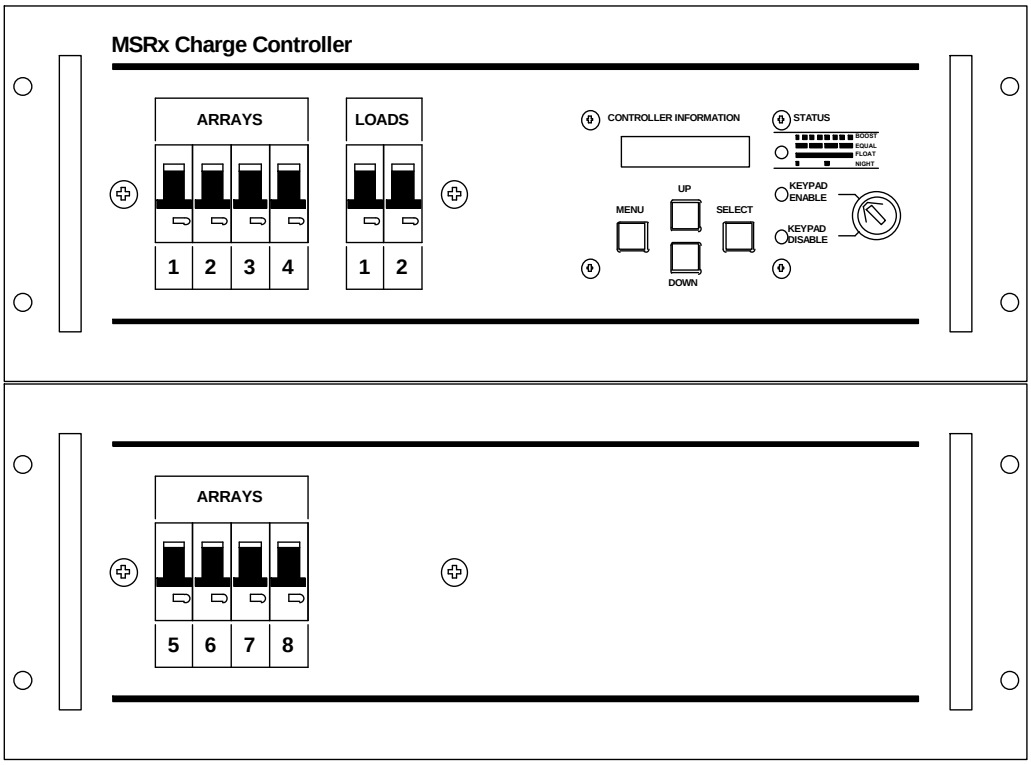


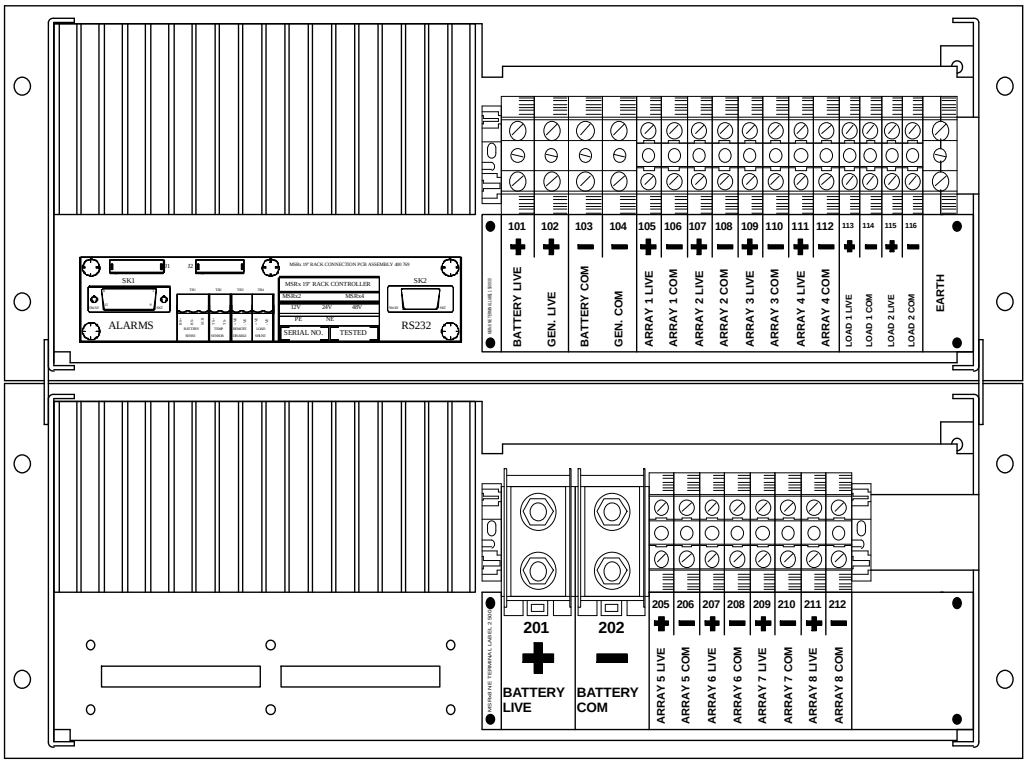


7.2. MSRx6 / MSRx8 19" Rack Controller Unit Mounting

7.2.1. The MSRx6 and MSRx8 19" Rack Charge Controllers are designed to be fitted to a 19" Rack Frame and are 8U high (355mm). The units should be fitted such that they are supported by horizontal shelves and not by the front panel fixing holes.

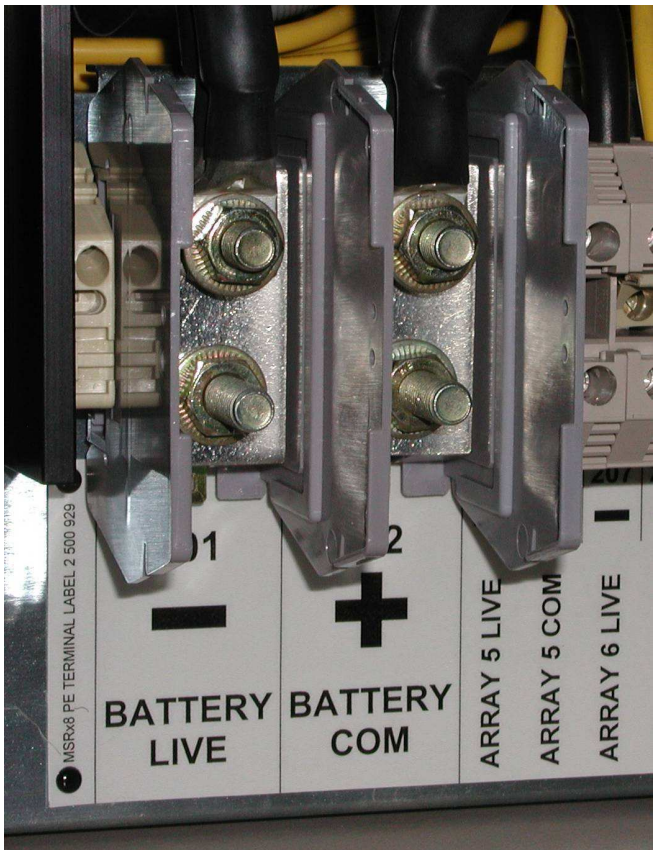
7.2.2. The drawing below is a General Arrangement of an MSRx8 19" Rack Charge Controller.





7.2.3. MSRx Charge Controller Battery Terminals

On MSRx6 and MSRx8 Rack Charge Controllers, the main battery terminals are stud type and the units are supplied with the terminal barriers not fitted. It is important that the stud terminal barriers are fitted before the battery connections are made. The barriers should be fitted as shown in the photograph below (they slide onto the side of the terminals).



7.3. MSRx 19" Rack Controller Unit Electrical Connections

COMMON POSITIVE SYSTEM ONLY

CAUTION: SOLAR MODULES AND BATTERIES CAN HAVE POTENTIALLY LETHAL VOLTAGES PRESENT AT THEIR TERMINALS AND PRESENT AN ENERGY HAZARD.

WARNING - RISK OF EXPLOSION:

The battery cable MUST be connected to the MSRx Control Unit BEFORE connecting to the battery

Make the electrical connections in the order shown in the following table:

COMMON POSITIVE SYSTEM ONLY				
Connection	**1st Location**	**To**	**Connection**	**2nd Location**
BATT COM (+VE)	MSRx Control Unit		Battery Positive Terminal	Battery
BATT LIVE (–VE)	MSRx Control Unit		Battery Negative Terminal	Battery
Battery Sense BS+	MSRx Control Unit		Battery Positive Terminal	Battery
Battery Sense BS-	MSRx Control Unit		Battery Negative Terminal	Battery
ARRAY 1-8 COM	MSRx Control Unit		Array Positive Terminal	Array 1-8 Module
ARRAY 1-8 LIVE	MSRx Control Unit		Array Negative Terminal	Array 1-8 Module
Load Positive Terminal	Load 1		LOAD 1 COM	MSRx Control Unit
Load Negative Terminal	Load 1		LOAD 1 LIVE	MSRx Control Unit
Load Positive Terminal	Load 2		LOAD 2 COM	MSRx Control Unit
Load Negative Terminal	Load 2		LOAD 2 LIVE	MSRx Control Unit
Red or White wire	MSRx Temperature Sensor		TEMP SENSE TS+	MSRx Control Unit
Black or Blue wire	MSRx Temperature Sensor		TEMP SENSE TS-	MSRx Control Unit

7.3.1. MSRx Charge Controller MCBs

Ensure the Array MCBs are set to their ON positions to allow the arrays to charge the battery.

Ensure the Load MCBs are set to their ON positions to allow the battery to supply current to the load.

7.3.2. Battery Temperature

To ensure the Battery Temperature Compensation is as accurate as possible, proceed with the following instructions after the temperature of the batteries has stabilised:

Using the user switches (Menu, Up, Down and Select), navigate to the Battery Temperature screen (Menu 1, Screen 1). Use a small flat screwdriver to adjust the potentiometer VR1 on the MSRx 19" Rack Control PCB Assembly (inside the rack unit) so that the temperature shown on display is the same as the actual temperature as measured at the battery with a calibrated temperature meter.

7.4. MSRx 19" Rack Controller Unit Electrical Connections

COMMON NEGATIVE SYSTEM ONLY

CAUTION: SOLAR MODULES AND BATTERIES CAN HAVE POTENTIALLY LETHAL VOLTAGES PRESENT AT THEIR TERMINALS AND PRESENT AN ENERGY HAZARD.

WARNING - RISK OF EXPLOSION:

The battery cable MUST be connected to the MSRx Control Unit BEFORE connecting to the battery

Make the electrical connections in the order shown in the following table:

COMMON NEGATIVE SYSTEM ONLY				
Connection	**1st Location**	**To**	**Connection**	**2nd Location**
BATT COM (-VE)	MSRx Control Unit		Battery Negative Terminal	Battery
BATT LIVE (+VE)	MSRx Control Unit		Battery Positive Terminal	Battery
Battery Sense BS+	MSRx Control Unit		Battery Positive Terminal	Battery
Battery Sense BS-	MSRx Control Unit		Battery Negative Terminal	Battery
ARRAY 1-8 COM	MSRx Control Unit		Array Negative Terminal	Array 1-8 Module
ARRAY 1-8 LIVE	MSRx Control Unit		Array Positive Terminal	Array 1-8 Module
Load Negative Terminal	Load 1		LOAD 1 COM	MSRx Control Unit
Load Positive Terminal	Load 1		LOAD 1 LIVE	MSRx Control Unit
Load Negative Terminal	Load 2		LOAD 2 COM	MSRx Control Unit
Load Positive Terminal	Load 2		LOAD 2 LIVE	MSRx Control Unit
Red or White wire	MSRx Temperature Sensor		TEMP SENSE TS+	MSRx Control Unit
Black or Blue wire	MSRx Temperature Sensor		TEMP SENSE TS-	MSRx Control Unit

7.4.1. MSRx Charge Controller MCBs

Ensure the Array MCBs are set to their ON positions to allow the arrays to charge the battery.

Ensure the Load MCBs are set to their ON positions to allow the battery to supply current to the load.

7.4.2. Battery Temperature

To ensure the Battery Temperature Compensation is as accurate as possible, proceed with the following instructions after the temperature of the batteries has stabilised:

Using the user switches (Menu, Up, Down and Select), navigate to the Battery Temperature screen (Menu 1, Screen 1). Use a small flat screwdriver to adjust the potentiometer VR1 on the MSRx 19" Rack Control PCB Assembly (inside the rack unit) so that the temperature shown on display is the same as the actual temperature as measured at the battery with a calibrated temperature meter.

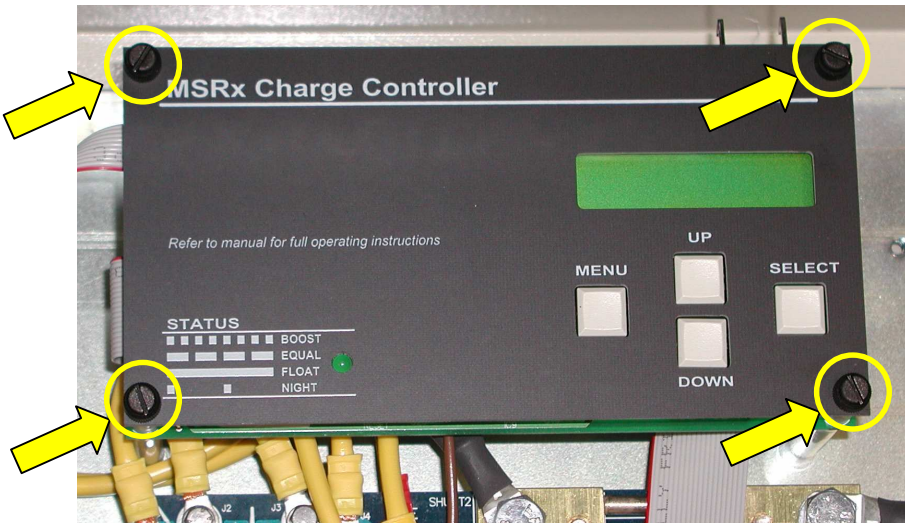
8. Re-Configuring the MSRx Charge Controller

8.1. Microcontroller (EPROM) Replacement

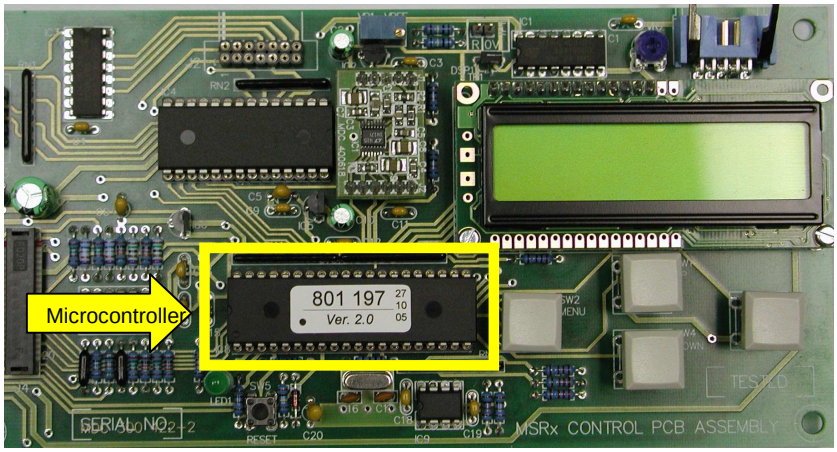
The operation of the MSRx Charge Controller is controller by a Microcontroller (sometimes known as the EPROM) which contains a software program. From time to time the software is upgraded to add features to the MSRx Charge Controller and a list of changes is included in Section 10 of this manual. Occasionally the Microcontroller may need to be replaced in the field. The following instructions detail how this should be done.

8.1.1. Ensure the Charge Controller is powered down, that all MCB's and MCCB's are in the OFF position and that the regulator chassis and enclosure are earthed.

8.1.2. Remove the four thumbscrews holding the facia plate in place as shown:



8.1.3. Identify the microcontroller on the circuit board as shown:



8.1.4. Using an IC removal tool or small screwdriver, carefully remove the existing IC.

8.1.5. Remove the replacement IC from its protective tube and carefully insert into the IC socket, ensuring all pins are straight. Note the orientation of the IC - the black dot on the label must be in the bottom left position. Avoid touching any pins or other components. The label on the IC identifies the Software (e.g. 801 197 in the example above), the version (Ver.2.0), a date code (27-10-05) and the black dot indicating orientation.

8.1.6. Replace the facia cover. Power up the controller and check the display shows the normal start-up screen.

8.1.7. Place the original IC into protective packaging and return for reprogramming.

8.1.8. For the MSRx 19" Rack Control PCB Assembly the Microcontroller reference is IC13 (the only 40-pin device on the PCB).

8.2. System Voltage

8.2.1. The MSRx Charge Controller requires a power supply module suitable for the system voltage. The following table lists the appropriate MSRx PSU Module PCB Assemblies for the different system voltages.

System Voltage	Description	Micha Part Number
12V	MSRx 12V PSU Module PCB Assembly	400 501
24V	MSRx 24V PSU Module PCB Assembly	400 502
36V	MSRx 36V PSU Module PCB Assembly	400 791
48V	MSRx 48V PSU Module PCB Assembly	400 503

8.3. Changing the System Voltage

8.3.1. Disconnect Battery Sense connections from the battery

8.3.2. Disconnect Battery Power connections from the battery

8.3.3. Locate the MSRx PSU Module:

On the MSRx Steel Enclosure Units, the MSRx PSU Module is located on the MSRx PSU/Load PCB Assembly.

On the MSRx 19" Rack Units, the MSRx PSU Module is located on the MSRx 19" Rack Control PCB Assembly.

8.3.4. Remove the existing MSRx PSU Module PCB Assembly by removing the two nylon nuts securing the Module in place.

8.3.5. Install the replacement MSRx PSU Module PCB Assembly making sure that the connector mates properly with the header and secure the Module with the two nylon nuts.

8.3.6. The MSRx Charge Controller automatically senses the change of system voltage.

8.4. System Polarity

Note: Changing the PE/NE switch on the MSRx PSU PCB Assembly does not reconfigure the external system in any way. The switch is used to provide power to the MSRx Charge Controller and to indicate to the controller which system polarity has been chosen by the customer (or factory set). If the switch is set in the opposite polarity to the system, then the MSRx Charge Controller will not power up (the array inputs will remain disconnected from the battery and the load outputs will remain disconnected from the battery).

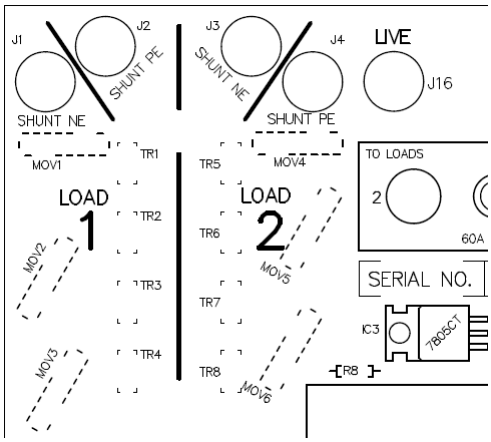
8.4.1. The MSRx Charge Controller requires minimal changes to configure the system for Common Positive or Common Negative use. Controllers are supplied with the polarity specified at the time or ordering.

8.4.2. If it becomes necessary to re-configure the unit, proceed with the following instructions:

8.5. Changing System Polarity from Common Positive to Common Negative – MSRx Steel Enclosure Units

8.5.1. The unit MUST be completely disconnected from any external electrical connections. Swap the connections to J1 and J2, and then the connections to J3 and J4, as follows:

8.5.2. Identify the cable that is connected from LOAD 1 LIVE to the MSRx PSU/Load PCB Assembly – it is connected via a ring crimp to J1 (also labelled "SHUNT NE"). Disconnect this cable from J1.



8.5.3. On the MSRx PSU/Load PCB Assembly, disconnect the cable from J2 (also labelled "SHUNT PE") and connect it to J1.

8.5.4. Reconnect the cable from LOAD 1 LIVE to J2 on the MSRx PSU/Load PCB Assembly.

8.5.5. Identify the cable that is connected from LOAD 2 LIVE to the MSRx PSU/Load PCB Assembly – it is connected via a ring crimp to J3 (also labelled "SHUNT NE"). Disconnect this cable from J3.

8.5.6. On the MSRx PSU/Load PCB Assembly, disconnect the cable from J4 (also labelled "SHUNT PE") and connect it to J3.

8.5.7. Reconnect the cable from LOAD 2 LIVE to J4 on the MSRx PSU/Load PCB Assembly.

8.5.8. Be sure to amend the terminal label to show the new polarity of the unit.

8.5.9. On the MSRx PSU/Load PCB Assembly, change the position of switch SW1 to the NE position.

8.5.10. The unit is now configured for Common Negative use (the MSRx Charge Controller automatically senses the change of system polarity).

8.6. Changing System Polarity from Common Negative to Common Positive – MSRx Steel Enclosure Units

8.6.1. The unit MUST be completely disconnected from any external electrical connections. Swap the connections to J1 and J2, and then the connections to J3 and J4, as follows:

8.6.2. Identify the cable that is connected from LOAD 1 LIVE to the MSRx PSU/Load PCB Assembly – it is connected via a ring crimp to J2 (also labelled "SHUNT PE"). Disconnect this cable from J2.

8.6.3. On the MSRx PSU/Load PCB Assembly, disconnect the cable from J1 (also labelled "SHUNT NE") and connect it to J2.

8.6.4. Reconnect the cable from LOAD 1 LIVE to J1 on the MSRx PSU/Load PCB Assembly.

8.6.5. Identify the cable that is connected from LOAD 2 LIVE to the MSRx PSU/Load PCB Assembly – it is connected via a ring crimp to J4 (also labelled "SHUNT PE"). Disconnect this cable from J4.

8.6.6. On the MSRx PSU/Load PCB Assembly, disconnect the cable from J3 (also labelled "SHUNT NE") and connect it to J4.

8.6.7. Reconnect the cable from LOAD 2 LIVE to J3 on the MSRx PSU/Load PCB Assembly.

8.6.8. Be sure to amend the terminal label to show the new polarity of the unit.

8.6.9. On the MSRx PSU/Load PCB Assembly, change the position of switch SW1 to the PE position.

8.6.10. The unit is now configured for Common Positive use (the MSRx Charge Controller automatically senses the change of system polarity).

8.7. Changing System Polarity from Common Positive to Common Negative – MSRx 19" Rack Units

8.7.1. The unit MUST be completely disconnected from any external electrical connections and access to the inside of the unit is required.

8.7.2. Identify the cable that is connected from LOAD 1 MCB to the MSRx 19" Rack Control PCB Assembly – it is connected via a ring crimp to J8 (also labelled "SHUNT NE"). Disconnect this cable from J8.

8.7.3. On the MSRx 19" Rack Control PCB Assembly, disconnect the cable from J9 (also labelled "SHUNT PE") and connect it to J8.

8.7.4. Reconnect the cable from LOAD 1 MCB to J9 on the MSRx 19" Rack Control PCB Assembly.

8.7.5. Identify the cable that is connected from LOAD 2 MCB to the MSRx 19" Rack Control PCB Assembly – it is connected via a ring crimp to J6 (also labelled "SHUNT NE"). Disconnect this cable from J6.

8.7.6. On the MSRx 19" Rack Control PCB Assembly, disconnect the cable from J1 (also labelled "SHUNT PE") and connect it to J6.

8.7.7. Reconnect the cable from LOAD 2 MCB to J1 on the MSRx 19" Rack Control PCB Assembly.

8.7.8. On the MSRx 19" Rack Charge Controller rear panel, remove the PE Terminal Label that is mounted below the main terminals (by removing the four 2-part black plastic rivets holding it in place) and replace it with a NE Terminal Label.

8.7.9. On the MSRx PSU Module, change the position of switch SW1 to the NE position.

8.7.10. The unit is now configured for Common Negative use (the MSRx Charge Controller automatically senses the change of system polarity).

8.8. Changing System Polarity from Common Positive to Common Negative – MSRx 19" Rack Units

8.8.1. The unit MUST be completely disconnected from any external electrical connections and access to the inside of the unit is required.

8.8.2. Identify the cable that is connected from LOAD 1 MCB to the MSRx 19" Rack Control PCB Assembly – it is connected via a ring crimp to J9 (also labelled "SHUNT PE"). Disconnect this cable from J9.

8.8.3. On the MSRx 19" Rack Control PCB Assembly, disconnect the cable from J8 (also labelled "SHUNT NE") and connect it to J9.

8.8.4. Reconnect the cable from LOAD 1 MCB to J8 on the MSRx 19" Rack Control PCB Assembly.

8.8.5. Identify the cable that is connected from LOAD 2 MCB to the MSRx 19" Rack Control PCB Assembly – it is connected via a ring crimp to J1 (also labelled "SHUNT PE"). Disconnect this cable from J1.

8.8.6. On the MSRx 19" Rack Control PCB Assembly, disconnect the cable from J6 (also labelled "SHUNT NE") and connect it to J1.

8.8.7. Reconnect the cable from LOAD 2 MCB to J6 on the MSRx 19" Rack Control PCB Assembly.

8.8.8. On the MSRx 19" Rack Charge Controller rear panel, remove the NE Terminal Label that is mounted below the main terminals (by removing the four 2-part black plastic rivets holding it in place) and replace it with a PE Terminal Label.

8.8.9. On the MSRx PSU Module, change the position of switch SW1 to the PE position.

8.8.10. The unit is now configured for Common Positive use (the MSRx Charge Controller automatically senses the change of system polarity).

9. Troubleshooting Guide

9.1. Common Problems

Situation	Possible causes	Action
The display is inactive	The MSRx display powers down after 4 minutes from the last user switch press	Press any front panel switch to activate the display
The display is inactive	The Polarity switch on the MSRx PSU Module may be incorrectly set	Set the Polarity switch correctly
The display is inactive	The MSRx PSU Module may not be functioning correctly	Check the PSU Module output voltages (see section 9.2)
The display indicates: "Fault - BY Sense"	The Battery Sense connections are not made correctly	Check the Battery Sense connections
The display indicates: "Fault – Temp Sen"	The Temperature Sensor connections are not made correctly	Check the Temperature Sensor connections
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	Prolonged poor weather has resulted in the battery being discharged	Minimise load until light conditions improve
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	Extra loads have been added which exceeds the design	Remove the extra loads
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	The Battery Sense connections are not made correctly	Check the Battery Sense connections
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	The Load MCB is switched off	Switch the Load MCB on
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	The Array MCBs are switched off	Switch the Array MCBs on
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	The Load Switch is faulty	Test the Load Switch using Menu 3
Low Volts Alarm / Load Cut Alarm or Load is Disconnected	The battery is discharged because the array switches are faulty	Test the Array Switches using Menu 4
High Volts Alarm	The arrays are not being disconnected from the battery	Test the Array Switches using Menu 4

9.2. Test Procedures

Tests	Procedure
Test the Array Switches using Menu 4	Navigate to Menu 4 and use the Select switch to change the present state of the Array Switch. Check that the solid-state switch works by using a DVM with a current clamp on the output cable to ensure that current flows when the switch should be closed and no current flows when the switch should be open. Alternatively, use a DVM to measure the voltage across the Array Input terminals. When the array switch is closed, the voltage should equal the battery voltage (within 0.5V). When the array switch is open, the voltage should be the open circuit array voltage (during the day) or close to zero (at night).
Test the Load Switches using Menu 3	Navigate to Menu 3 and use the Select switch to change the present state of the Load Switch. Check that the solid-state switch works by using a DVM with a current clamp on the output cable to ensure that current flows when the switch should be closed and no current flows when the switch should be open. Alternatively, use a DVM to measure the voltage across the Load Output terminals. When the load switch is closed, the voltage should equal the battery voltage (within 0.5V). When the load switch is open, the voltage should be zero.
Check the PSU Module output voltages	Disconnect the ribbon cable from the MSRx Control PCB Assembly to J11 of the MSRx PSU/Load PCB Assembly. Using a DVM make the following measurements on connector J1 of the MSRx PSU Module (Pin 5 is nearest to SW1): Connect the negative probe to pin 2 of J1 and the positive probe to pin 5 of J1 and ensure the DVM indicates +12.0 ± 0.5V. Connect the negative probe to pin 2 of J1 and the positive probe to pin 4 of J1 and ensure the DVM indicates –12.0 ± 0.5V. If these two measurements are correct then the MSRx PSU Module would appear to be OK.

10.Software History

Software Version	Date Released	Comments
801 313 Ver 1.0	6th July 2006	Change to PIC18F4620 Microcontroller – requires: Standard Unit: Control PCB Assembly 400327 Issue 4 or higher 19" Rack Unit: Control PCB Assembly 400766 Issue 2 or higher Added Programmable Standard Alarm Relays to Menu C Added Regulation Hysteresis to Menu D / Default Battery settings now in Menu F Added Absolyte Battery Settings Added DRM Control Menus to new Menu E and sub menus
801 313 Ver 1.1	31st July 2006	Added DRM RS232 Communications and Data Logging Test Mode now disabled 30 mins after being enabled
801 313 Ver 1.2	26th Sept 2006	Added Gel/OPzV Battery Settings Added Analogue Input Module Set up Screen to Menu E Added Auxiliary Volts Screen to Menu 1 (Screen 2) 4-20mA Transducer Module – Battery Current Settings more flexible
801 313 Ver 1.3	7th Nov 2006	Fixed bug in Load Current sign display If Aux Temp Enabled but result outside -30C to +60C then display ---.-C
801 313 Ver 1.4	28th Nov 2006	Added RS232 Upload of parameters from PC Added Array Shunt 1 & 2 Value = 500A
801 313 Ver 1.5	24th July 2007	Fixed bug on 4-20mA setting screens: Up to Version 1.4 all the transducers output 4mA when looking at Unit 1 4mA setting and Up to Version 1.4 all the transducers output 20mA when looking at Unit 1 20mA setting
801 313 Ver 1.6	28th Nov 2008	Defaults now only written at first time power up Added LC1Alm=Off to Relay Alarm Functions (i.e. active state = relay off)
801 313 Ver 1.7	5th May 2009	Added Low Volts 2 Function Run Time on Menu D Screen 9 (See Section 3.15)
801 313 Ver 1.8	29th May 2009	Added 200A Shunt to Array Shunt selections (Menu D) and calculation (Section 4.13) Added Disable Link Function selection in Menu D Screen 10 (Section 4.13)
801 313 Ver 1.9	13th Aug 2009	Added 250A Shunt to Array Shunt selections (Menu D) and calculation (Section 4.13)
801 313 Ver 2.0	2nd Feb 2010	Added Modbus Communications Protocol to serial communications (Section 5.5, 5.6) Added Modem Initialisation on power up (Section 5.7)
801 313 Ver 2.1	6th May 2011	Changed Home Screen (Section 4.2) Added Auto-repeat on settings (Section 4.9.2) Added Initial Charge Mode (Section 3.24) / Contactor Switch Type / LCD Power Down
801 313 Ver 2.2	23rd Sept 2011	Fixed software bug affecting Disable Link Function in Version 2.1 only. (Load Outputs were disabled no matter what option was chosen in Version 2.1)

