

MSR1-10 Type 2 Charge Controller

PN:102449 - 24V Common Negative

Product Manual

Issue 3



1. Introduction

The MSR1-10 Charge Controller is 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 MSR1-10 Charge Controller uses fully solid-state switching of Array (charge) and Load (discharge) current and combines 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.

1.1. Technical Specification

Operating Voltage Range	24VDC nominal (18-36VDC)
System Polarity	Common Negative
Operating Temperature Range	0-65°C
Array Input	1 Array Input rated at 10A continuously (Solid-State MOSFET technology)
Load Output	1 Load Output rated at 5A continuously (Solid-State MOSFET technology)
Battery Regulation	3-Stage Regulation: Boost, Equalisation, Float
Battery Voltage Sense	Best accuracy using remote battery sense cables
Battery Settings	User Programmable
Temperature Compensation	Optional using MSR Temperature Sensor
Alarm Relays	4 Programmable Alarm Relays with LEDs and volt-free changeover contacts
User Display	2 x 16 character LCD Display (High Temperature)
User Control	4 button keypad – Menu, Up, Down, Select
Quiescent Current	15mA at 24VDC (0.36W)
Induced Lightning Protection	Metal Oxide Varistors on Battery, Array, Load connections
Battery, Array, Load Connections	PCB Terminals - 10mm ² cable entry
Alarm Connections	PCB 2-part Terminals – 2.5mm ² cable entry
Dimensions	235mm x 120mm x 55mm
Weight	530g (including DIN rail carrier and fascia cover)
Mounting	Carrier to fix to 35mm DIN rail

1.1. Installation

The unit is designed to be mounted within an appropriate enclosure for the environment.

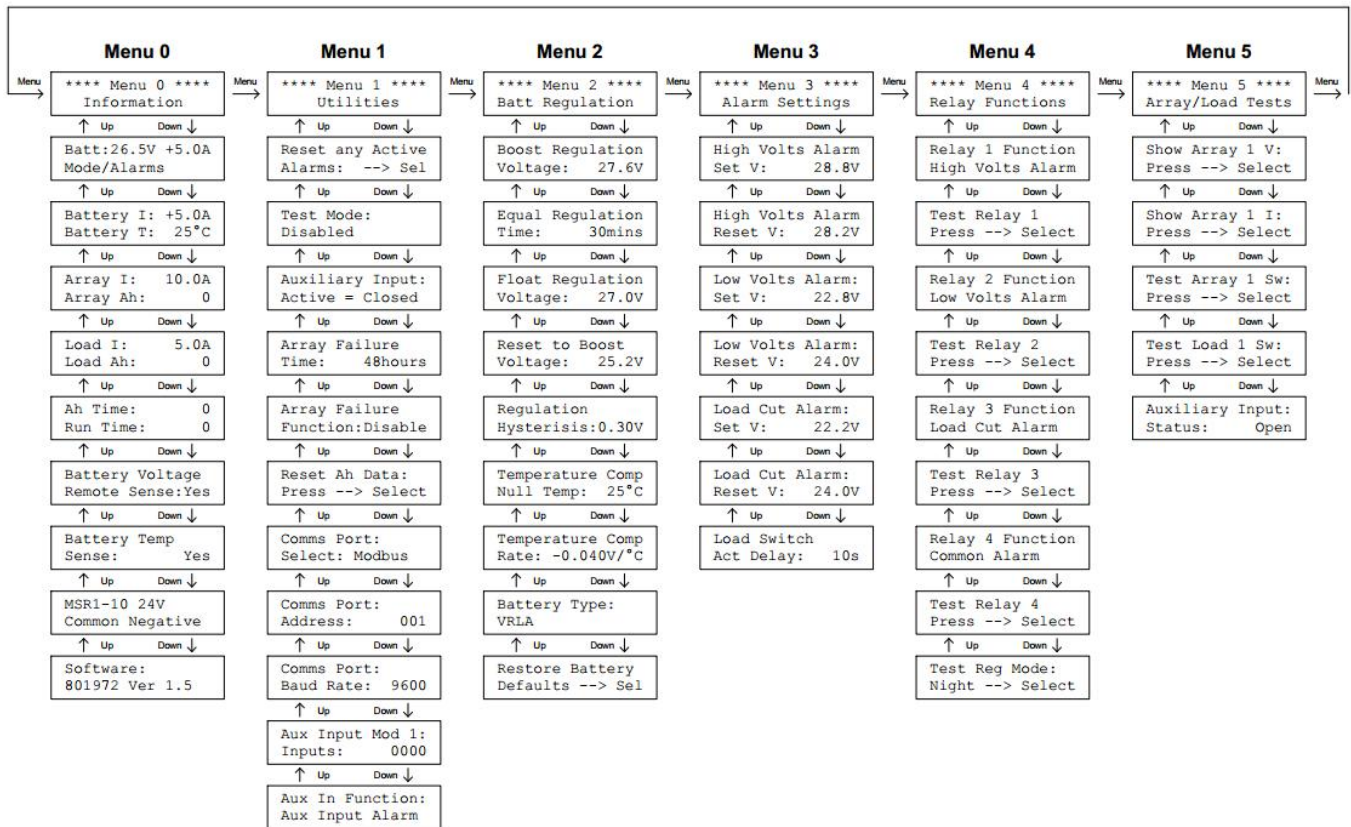
1.2. Connections to be made in this order:

- 1.2.1. Battery Power Connection (power cables to the battery)
- 1.2.2. Battery Sense Connection (2-core screened twisted pair connected to the battery)
- 1.2.3. Temperature Sensor (locate the sensor in the battery enclosure or attached to one pole of the battery)
- 1.2.4. Array Connection
- 1.2.5. Load Connection
- 1.2.6. Alarm Signals

2. Operation

The MSR1-10 Charge Controller uses a microprocessor to provide control and diagnostic features in the unit. A 2x16 alphanumeric LCD Display is used to indicate parameters and set-points as described below. The following diagram describes the various screens available to the user:

Controller Menu Guide:



2.1. 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 Screen).

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.

2.2. Parameter and Set-point Adjustment

At the appropriate screen, press Select and the parameter will flash. Use the Up and Down switches to select the desired value. Press Select again to accept and store the value in non-volatile memory.

2.3. Power Up Screen

LCD Display	Screen	Description
MSR1-10 Charge Controller	Screen 0	The Power Up Screen is shown for 2 seconds after power up

2.4. Menu 0 – Information

LCD Display	Screen	Description
**** Menu 0 **** Information	Screen 0	Menu Identifier (automatically goes to Screen 1 after 2 seconds)
Batt:26.5V +5.0A Mode / Alarms	Screen 1	Battery Voltage and Current (+ for charge, - for discharge) Present Regulation Mode & Alarms shown one after another
Battery I: +5.0A Battery T: 25°C	Screen 2	Battery Current Battery Temperature (T1: Temp Sense Input / T2: MSR RTD Interface)
Array I: 10.0A Array Ah: 0	Screen 3	Array Current Array Amp-hours
Load I: 5.0A Load Ah: 0	Screen 4	Load Current Load Amp-hours
Ah Time: 0 Run Time: 0	Screen 5	Amp-hour Time Total Run Time
Battery Voltage Remote Sense:Yes	Screen 6	Battery Voltage Remote Sense: Yes or No Select user option
Battery Temp Sense: Yes	Screen 7	Battery Temperature Sense: Yes or No Select user option
MSR1-10 24V Common Negative	Screen 8	Unit Model Number, Voltage System Polarity
Software: 801972 Ver 1.5	Screen 9	Unit Software Number and Version

2.4.1. Battery Voltage Remote Sense

Battery Voltage Remote Sense = Yes: The MSR1-10 Type 1 will measure the battery voltage on the Battery Sense terminals BS+, BS-, SCR. This is designed for the connection of a 2-core screened cable from the Battery terminals. This option provides the greatest accuracy of operation.

Battery Voltage Remote Sense = No: The MSR1-10 Type 1 will measure the battery voltage at the Battery Power terminals. This option is less accurate as the charge and discharge current on the power cables creates a voltage drop which means the MSR1-10 cannot measure the true battery voltage.

2.4.2. Battery Temperature Sense

Battery Temperature Sense = Yes: The MSR1-10 Type 1 will look for an MSR Temperature Sensor connected to terminals TS+, TS-, SCR. If no temperature sensor is found it will look for an RTD Temperature Sensor if an MSR RTD Interface is fitted. If no valid temperature sensor is found it will indicate an alarm and there will be no temperature compensation of battery settings.

Battery Temperature Sense = No: The MSR1-10 Type 1 will not look for a temperature sensor and there will be no alarm or temperature compensation of battery settings.

2.5. Menu 1 – Utilities

LCD Display	Screen	Description
**** Menu 1 **** Utilities	Screen 0	Menu Identifier
Reset any Active Alarms: --> Sel	Screen 1	Reset any Active Alarms
Test Mode: Disabled	Screen 2	Test Mode: Enable or Disable (Auto disable after 30 minutes) Test Mode: Array ready to charge / Equalisation Time = 30 seconds
Auxiliary Input: Active = Closed	Screen 3	Auxiliary Input Active Select: The Auxiliary Input is “Active” when the contact is Closed / Open
Array Failure Time: 48hours	Screen 4	Array Failure Time: Set the number of hours
Array 1 Failure Function:Disable	Screen 5	Array Failure Function: Enable or Disable
Reset Ah Data: Press --> Select	Screen 6	Reset Amp-hours data (and resets Amp-hour Time)
Comms Port: Select: Modbus	Screen 7	Communications Port Selection: Standard (Micha Protocol), Modbus , or SNMP1
Comms Port: Address: 001	Screen 8	Communications Port Address: Address can be set from 001 to 247 (Modbus range)
Comms Port: Baud Rate: 9600	Screen 9	Communications Port Baud Rate: Baud Rate can be set to 9600 or 19,200
Aux Input Mod 1: Inputs: 0000	Screen 10	4-Channel Auxiliary Input Module Inputs 1-4 are shown as inactive (0) or active (1,2,3,4)
Aux In Function: Aux Input Alarm	Screen 10	Auxiliary Input Function Select: Aux Input Alarm / Disable Array / Disable Load / Disable Array & Load

2.5.1. Auxiliary Input Function = Auxiliary Input Alarm

This determines what the controller does when the Auxiliary Input is active:

Aux Input Alarm: This is the default setting – it provides a simple alarm when Auxiliary Input is active

Disable: Array: If Auxiliary Input is active, then the Array power switch will be disabled

Disable: Load: If Auxiliary Input is active, then the Load power switch will be disabled

Disable: Ay & Ld: If Auxiliary Input is active, then the Array and Load power switches will be disabled

2.6. Menu 2 – Battery Regulation

LCD Display	Screen	Description
**** Menu 2 **** Batt Regulation	Screen 0	Menu Identifier
Boost Regulation Voltage: 27.6V	Screen 1	Boost Regulation Voltage Set-point
Equal Regulation Time: 30mins	Screen 2	Equalisation Regulation Time
Float Regulation Voltage: 27.0V	Screen 3	Float Regulation Voltage Set-point
Reset to Boost Voltage: 25.2V	Screen 4	Reset to Boost Voltage Set-point
Regulation Hysterisis:0.30V	Screen 5	Regulation Hysterisis
Temperature Comp Null Temp: 25°C	Screen 6	Temperature Compensation Null Temperature
Temperature Comp Rate: -0.040V/°C	Screen 7	Temperature Compensation Rate (Volts per °C)
Battery Type: VRLA	Screen 8	Battery Type Selection: NiCd KL65 19cell, Vented, VRLA, Absolyte, Gel/OPzV
Restore Battery Defaults --> Sel	Screen 9	Restore the Battery Default Settings to the factory settings: Press Select to restore Battery Defaults (see sections 2.7 & 2.9)

2.7. Battery Regulation Default Settings (selected in Menu 2 Screens 8 & 9)

Factory Default = VRLA Battery Settings (unless other battery settings are requested by the customer)

Regulation Setting	NiCd 19cell	Vented	VRLA	Absolyte	Gel/OPzV
Boost Regulation Voltage	29.45V	28.8V	27.6V	28.2V	28.2V
Equalisation Time	30 mins	30 mins	30 mins	30 mins	30 mins
Float Regulation Voltage	27.0V	28.2V	27.0V	27.0V	27.3V
Reset to Boost Voltage	25.65V	26.4V	25.2V	25.2V	25.3V
Temperature Compensation Null °C	20°C	25°C	25°C	25°C	20°C
Temperature Compensation Rate	-66mV/°C	-66mV/°C	-40mV/°C	-36mV/°C	-60mV/°C

2.8. Menu 3 – Alarm Settings

LCD Display	Screen	Description
**** Menu 3 **** Alarm Settings	Screen 0	Menu Identifier
High Volts Alarm Set V: 28.8V	Screen 1	High Voltage Alarm Set (Trip) Voltage Set-point
High Volts Alarm Reset V: 28.2V	Screen 2	High Voltage Alarm Reset Voltage Set-point
Low Volts Alarm: Set V: 22.8V	Screen 3	Low Voltage Alarm Set (Trip) Voltage Set-point
Low Volts Alarm: Reset V: 24.0V	Screen 4	Low Voltage Alarm Reset Voltage Set-point
Load Cut Alarm: Set V: 22.2V	Screen 5	Load Cut Alarm Set (Trip) Voltage Set-point
Load Cut Alarm: Reset V: 24.0V	Screen 6	Load Cut Alarm Reset Voltage Set-point
Load Switch Act Delay: 10s	Screen 7	Load Switch Activation Delay Time (seconds) (Time between the alarm being activated and the load being cut)

2.9. Alarm Default Settings (selected in Menu 2 Screens 8 & 9)

Factory Default = VRLA Battery Settings (unless other battery settings are requested by the customer)

Alarm Setting	NiCd 19cell	Vented	VRLA	Absolyte	Gel/OPzV
High Volts Alarm Set Voltage	31.0V	29.4V	28.8V	29.4V	28.8V
High Volts Alarm Reset Voltage	27.0V	28.8V	28.2V	28.8V	25.8V
Low Volts Alarm Set Voltage	23.5V	22.8V	22.8V	23.4V	22.8V
Low Volts Alarm Reset Voltage	26.5V	24.0V	24.0V	27.6V	27.0V
Load Cut Alarm Set Voltage	21.85V	22.2V	22.2V	22.8V	22.2V
Load Cut Alarm Reset Voltage	26.0V	24.0V	24.0V	27.0V	27.0V
Load Switch Activation Delay	10 seconds	10 seconds	10 seconds	10 seconds	10 seconds

2.10. Menu 4 – Alarm Relays Function and Test

LCD Display	Screen	Description
**** Menu 4 **** Relay Functions	Screen 0	Menu Identifier
Relay 1 Function High Volts Alarm	Screen 1	Set Alarm Relay 1 Function: Set to desired function (default High Voltage Alarm)
Test Relay 1 Press --> Select	Screen 2	To Test Alarm Relay 1 – press Select Pressing Select changes the state of the alarm relay
Relay 2 Function Low Volts Alarm	Screen 3	Set Alarm Relay 2 Function: Set to desired function (default Low Voltage Alarm)
Test Relay 2 Press --> Select	Screen 4	To Test Alarm Relay 2 – press Select Pressing Select changes the state of the alarm relay
Relay 3 Function Load Cut Alarm	Screen 5	Set Alarm Relay 3 Function: Set to desired function (default Load Cut Alarm)
Test Relay 3 Press --> Select	Screen 6	To Test Alarm Relay 3 – press Select Pressing Select changes the state of the alarm relay
Relay 4 Function Common Alarm	Screen 7	Set Alarm Relay 4 Function: Set to desired function (default Common Alarm)
Test Relay 4 Press --> Select	Screen 8	To Test Alarm Relay 4 – press Select Pressing Select changes the state of the alarm relay
Test Reg Mode: Night --> Select	Screen 1	Test Regulation Mode Relays / Contacts Press Select repeatedly to cycle through Night, Boost, Equal, Float

List of Alarms available on each Programmable Alarm Relay:

Not used	Alarm Relay not used
High Volts Alarm	High Voltage Alarm
Low Volts Alarm	Low Voltage Alarm
Load Cut Alarm	Load Cut Alarm (Battery Failure)
Aux Input Alarm	Auxiliary Input Alarm (If Auxiliary Input is active)
Batt Sense Alarm	Battery Sense Alarm (if Battery Sensor is faulty or disconnected)
Temp Sense Alarm	Temperature Sense Alarm (if Temp Sensor is faulty or disconnected)
Common Alarm	Common Alarm (if any Alarm is active)
System Normal	System Normal (if no Alarm is active)
Array Fail Alarm	Array Failure Alarm (no voltage from Array for number of hours)

2.11. Menu 5 – Array and Load Tests

LCD Display	Screen	Description
<pre>**** Menu 5 **** Array/Load Tests</pre>	Screen 0	Menu Identifier
<pre>Show Array 1 V: Press --> Select</pre>	Screen 1	To show the open circuit Array Voltage – press Select
<pre>Show Array 1 I: Press --> Select</pre>	Screen 2	To show the closed circuit Array Current – press Select
<pre>Test Array 1 Sw: Press --> Select</pre>	Screen 3	To Test Array 1 Switch – press Select Pressing Select changes the state of the array switch
<pre>Test Load 1 Sw: Press --> Select</pre>	Screen 4	To Test the Load 1 Switch – press Select Pressing Select changes the state of the Load Switch
<pre>Auxiliary Input: Status: Open</pre>	Screen 5	Auxiliary Input Status: Shows the status of the Auxiliary Input as “Open” or “Closed”

2.12. Power Up and Configuration Screens

Display	Screen	Description
MSR1-10 Charge Controller	Screen 0	Power Up Screen is shown for 2 seconds after power is turned on
Configure Unit: Voltage: 24V	Screen 1	The unit is designed to work at 24V only This cannot be changed
Configure Unit: Common Negative	Screen 2	The unit is designed to work as a Common Negative System This cannot be changed
Calibrate PCB Temp: 23.4°C	Screen 3	This screen is used to calibrate the individual controller during the factory testing procedure.
Calibrate Zero Current: Select	Screen 4	This screen is used to calibrate the individual controller during the factory testing procedure.
Calibrate Array Current: 0.00A	Screen 5	This screen is used to calibrate the individual controller during the factory testing procedure.
Calibrate Load Current: 0.00A	Screen 6	This screen is used to calibrate the individual controller during the factory testing procedure.

2.12.1. Power Up Screen

The Power Up Screen is shown for 2 seconds after power is applied to the Unit.

To enter the Configuration Screens, the Menu and Select switches should be pressed and held down when the Power Up Screen is shown. When the first Configuration Screen is shown, the switches may be released.

Under normal circumstances (when the Menu and Select switches are not pressed) after showing the Power Up Screen for 2 seconds, the unit will automatically go to Menu 0 Screen 0.

2.12.2. Configuration Screens

IMPORTANT: The Configuration Screens should ONLY be used by authorised persons.

The Configuration Screens are intended to be used at time of manufacture to configure the software depending on Unit Voltage and Unit Type.

CAUTION: Setting the Configuration Screens incorrectly may cause incorrect operation.

WARNING: Setting the Configuration Screens incorrectly may result in damaging the unit.

2.12.3. Configure Unit Voltage and Polarity (Screens 1-2)

These screens do not cause any change to the controller.

The design is fixed for 24V Common Negative operation.

2.12.4. Calibration Screens (Screens 3-6)

These screens are used for calibration purposes during the factory test and should not be used unless the user understands the purpose of the screens.

2.12.5. Exiting the Configuration Screens

Pressing Menu at any time will take the user to Menu 0.

If no switches are pressed for 60 seconds then the unit will move to Menu 0.

3. Software

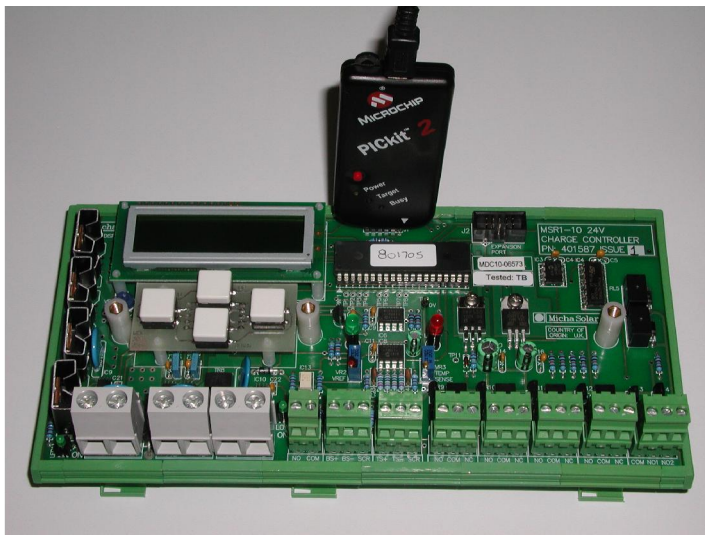
3.1. Software History

Software Version	Date Released	Manual	Comments
801 972 Ver 1.3	6 th Sept 2013	801973-1	Production Release
801 972 Ver 1.4	26 th Nov 2013	801973-2	Added Battery & Temperature Sense Selection Options Added RTD Interface on Expansion Port Added Com Port Baud Rate Selection: 9600, 19200
801 972 Ver 1.5	17 th Dec 2013	801973-3	Changed Auxiliary Input Active Select (Menu 1 Screen 3) Added Auxiliary Input Function Select (Menu 1 Screen 11) Changed Relay Function Select: Aux Input Alarm

3.2. Program Port

The Microcontroller can be programmed without removing it from the PCB by using the Program Port J1.

The Microcontroller can be programmed with or without power connected to it.



(1) Remove the fascia cover and connect a PICkit2 or PICkit 3 Programmer to J1 (Note the arrow indicating Pin1 on the programmer and J1) as shown:

(2) Follow the normal programming instructions.

(3) When programming is successful, disconnect the programmer from the unit and replace the fascia cover.

3.3. Installation / Replacement of the MCU

Ensure that anti-static precautions are taken to avoid damage to the Microcontroller when handling (i.e. touch a conductor that is connected to earth before carrying out the following):

Turn off all power to the Controller.

Remove any Fascia Cover using the plastic thumbscrews. Identify the Microcontroller (the 40 pin integrated circuit with a label on it showing the software number and version) on the PCB Assembly. Carefully lever out the Microcontroller presently located there by using a small flat screwdriver on both ends equally. Do this carefully.

Identify the device to be installed. Carefully handle the device without touching the legs of the device. Note the orientation of the semi-circular notch at one end of the device. Note which end on the PCB socket has a similar notch. Now insert the Microcontroller into the PCB socket so that the notch in the device is at the same end as the notch in the socket. Before pressing down on the device to mate it fully in its socket, check that all pins are properly lined up with the pins in the PCB socket. Press the device fully home into the socket and check that no leg has been bent or missed its socket.

Replace any Fascia Cover using the plastic thumbscrews.

Restore power to the Controller.