# Modbus 4CH Solid State Relay Datasheet

## 1 Introduction

Modbus 4CH **S**olid **S**tate **R**elay (SSR) incorporates 4 relay controllers with an AC load current handling capacity of 1.80A. The relays can switch AC loads between 50Hz and 60Hz. Additional zero-cross features are included in the Modbus 4CH solid state relay.

Modbus 4CH Solid State Relay controllers are ideal for forward and reverse motor control applications, switching loads on and off, and handling inrush current efficiently.

Enhance your illumination control with our cutting-edge product tailored for precise LED strip management. Engineered with meticulous technical precision, our solid-state relay incorporates zero-cross detection technology, providing a distinct advantage in efficiency and performance. This innovative feature ensures optimal synchronization with the AC power waveform, mitigating electrical stress during switching and minimizing potential flickering issues.

## 1.1 Features

- 4 Channels Solid State Relay
- Status LEDs indicate relay activation states.
- Supports AC loads up to 1.8A per relay channel.
- Supports AC (20VAC to 240VAC)
- Supports zero-cross turn-on circuitry.
- Fast-blow fuse protection
- Implements the Modbus RTU protocol.
- Low power consumption of 271mW (typical)
- Operating temperature from 0°C to 70°C
- Flush mount and DIN Rail mounting options.

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# 2 Part Numbers / Ordering Information

| Part Number | Description |
|---|---|
| MC-0102-01A | Modbus 4CH Solid State Relay |
| MA-0102-01A | Modbus RS485-RJ11 Cable (30cm) |
| LA-1201-01A | LDSBus DIN Rail Mount Set |

**Table 1 - Part Numbers / Ordering Information**

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# 3 Specifications

| | | |
|---|---|---|
| **Features** | Interface | RS485 Modbus RTU |
| | System Status Indicator | 1x RGB LED |
| | Relay Status Indicator | 2x RG LEDs |
| | Power Indicator | 1x Green LED |
| | Mounting | Flush Mount |
| | | DIN-Rail Mount |
| **Power** | Modbus Voltage | 9-24V DC Bus Power |
| | Device Input Voltage | 5V DC |
| | Operating Power | Typ:271mW<br>Max:421mW |
| **Relay** | Number of SSR Channel | 4 |
| | Relay Type | AC Solid State Switch, dual power SCR thyristor outputs, Zero-Cross Detection |
| | Contact arrangement | Solid State Switch |
| | Rated voltage | 20VAC~ 240VAC |
| | Max. switching voltage | 240VAC |
| | Rated power | 1.80A @240VAC / 440W @240VAC |
| | Load continuous current | 1.80A |
| | Maximum Surge Current | 30A, t<16ms |
| **Physical Characteristics** | Colour | White |
| | Housing | Polycarbonate |
| | Dimension | L138.2mm x W76.0mm x H31.9mm |
| **Environmental Limits** | Operating Temperature | 0 to 70°C |
| | Storage Temperature | -20 to 85°C |
| | Ambient Relative Humidity | 5 to 95% (non-condensing) |
| **Package Contents** | Device | 1x Modbus 4CH Solid State Relay |
| | Wire Assembly | 1x Modbus RS485-RJ11 Cable(30cm) |
| **Optional** | Mounting Accessories | 1x LDSBus DIN Rail Mount Set |

**Table 2 - Modbus 4CH Solid State Relay Specifications**

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# 4 FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) These devices may not cause harmful interference, and

(2) These devices must accept any interference received, including interference that may cause undesired operation.

**NOTE:** The equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF exposure guidelines, at least 20cm of separation distance between the device and the user's body must be always maintained.

**FCC Radiation Exposure Statement**

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and it also complies with Part 15 of the FCC RF Rules. This equipment must be installed and operated in accordance with the instructions provided, and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and consider removing the no-collocation statement.

**Caution**

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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# 5 Hardware Features

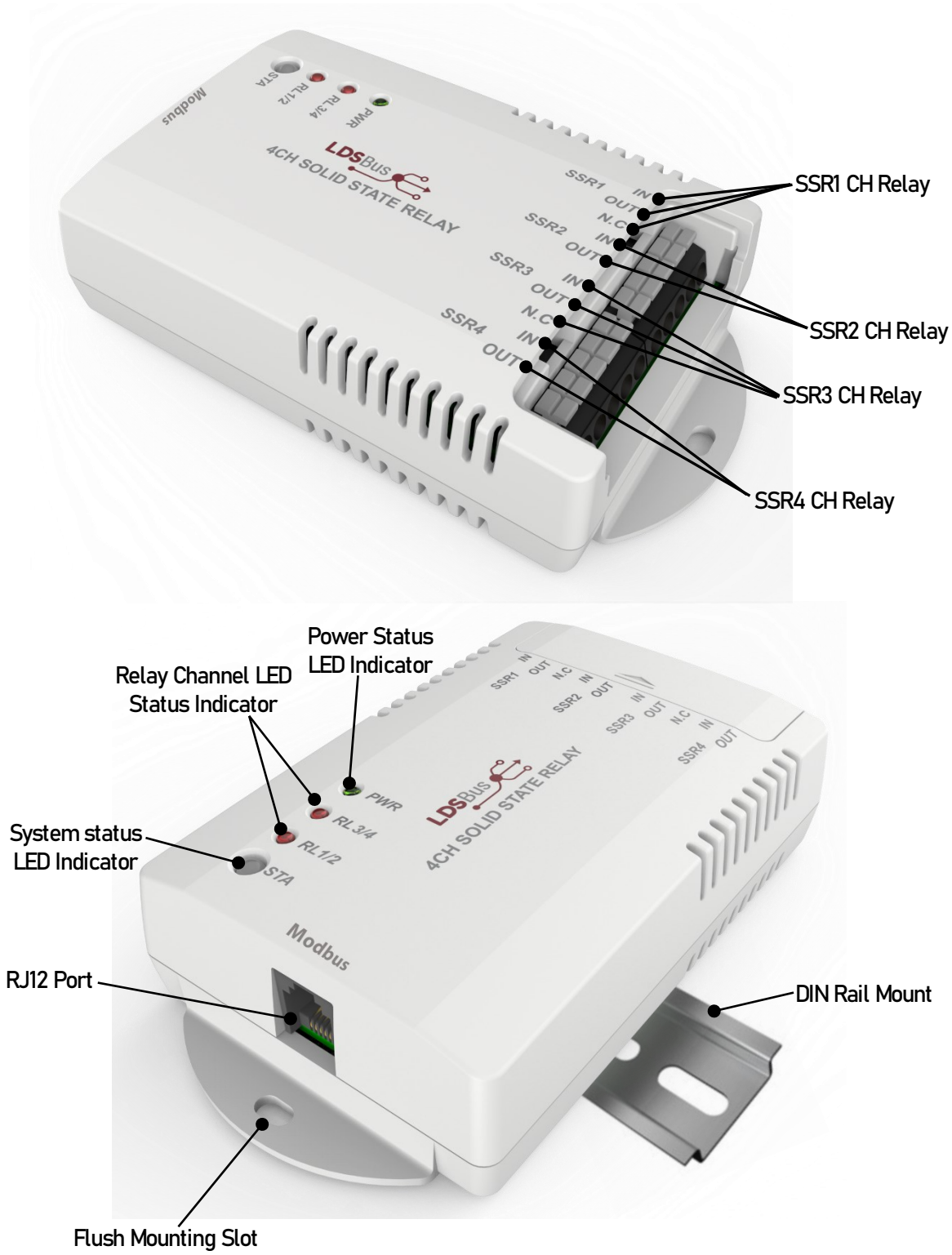


**Figure 1 - Modbus 4CH Solid State Relay Hardware Features**

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| Function | Labels | Description |
|---|---|---|
| SSR1 CH Relay | IN | Solid State Relay Channel 1 Input |
| | OUT | Solid State Relay Channel 1 Output |
| | NC | No Connection |
| SSR2 CH Relay | IN | Solid State Relay Channel 2 Input |
| | OUT | Solid State Relay Channel 2 Output |
| SSR3 CH Relay | IN | Solid State Relay Channel 3 Input |
| | OUT | Solid State Relay Channel 3 Output |
| | NC | No Connection |
| SSR4 CH Relay | IN | Solid State Relay Channel 4 Input |
| | OUT | Solid State Relay Channel 4 Output |
| Power Status LED Indicator | PWR | Power status LED |
| Relay Channel LED Status Indicator | RL 1/2 | Solid State Relay 1 & 2 status LED |
| | RL 3/4 | Solid State Relay 3 & 4 status LED. Refer to section 12 for more details |
| System Status LED Indicator | STA | Modbus status LED. Refer to section 11 for more details |
| RJ12 Port | Modbus | Modbus data and power interface port |

**Table 3 - Hardware Labels & Description**

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# 6 Sensor Configuration and Installation

Please visit https://brtsys.com/resources/software/utility-tools to access the Modbus Configuration Utility guide on how to configure the device name, device address and termination settings before using it for your specific application.

## 6.1 Connection Diagram for Standard Modbus Power Supply

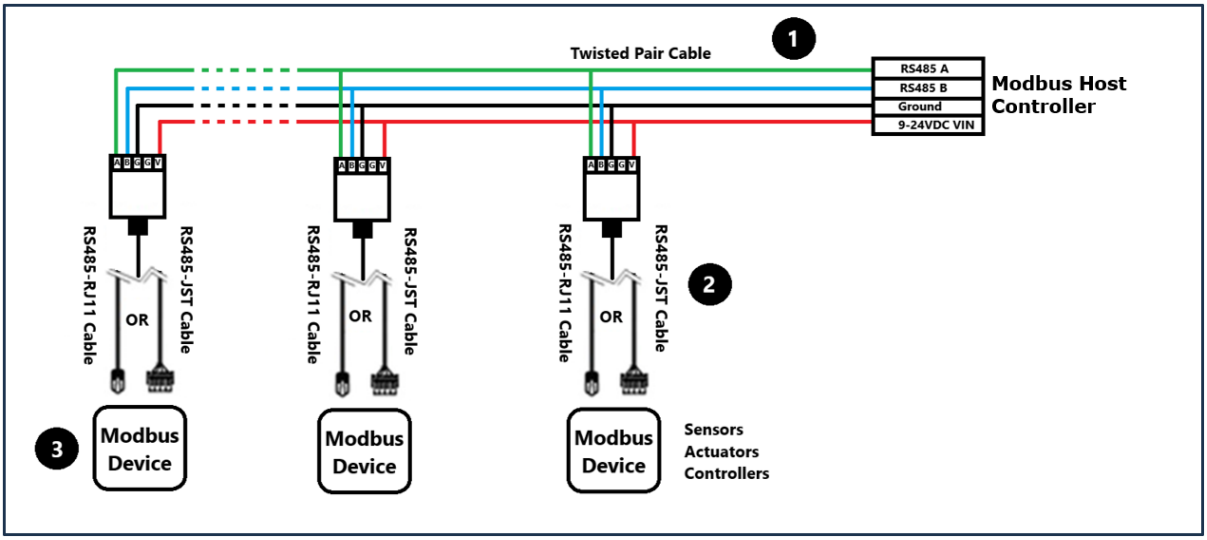


**Figure 2 - Connection Diagram for Standard Modbus Power Supply**

**Setup Instructions:**

1. Use a Cat5e/Cat6e RJ45 Twisted Pair Cable to connect the Modbus controller (Host) to the network for RS485 communication and power.

2. Connect each Modbus device to the network using either an RS485-JST cable or an RS485-RJ11 cable, as provided with the device.

3. Modbus devices have built-in bus termination resistors. These resistors can be enabled or disabled by using the Modbus Configuration Utility. When installing the device as the last device on the bus, these terminations may be used to terminate the bus.

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## 6.2 RS485-RJ11 Cable(30cm)

**Figure 3 - RS485-JST Cable(30cm)**

| PIN Legend | Function |
|---|---|
| VIN | Modbus Input Voltage 9-24VDC |
| GND | Ground |
| GND | Ground |
| B | RS485-B |
| A | RS485-A |

**Table 4 - RS485-JST Cable(30cm) Pin Configuration**

# 7 Mounting Instructions

## 7.1 Flush Mount

The Modbus 4CH Solid State Relay can be flush mounted directly on a wall or any flat surface using 2 M3.5*16mm (thread) screws.

**Figure 4 - Modbus 4CH Solid State Relay Flush Mount**

## 7.2 DIN Rail Mount

The Modbus 4CH Solid State Relay can be mounted on a DIN Rail using the LDSBus DIN Rail Mount set. This set is optional and includes the bracket and mounting screws.

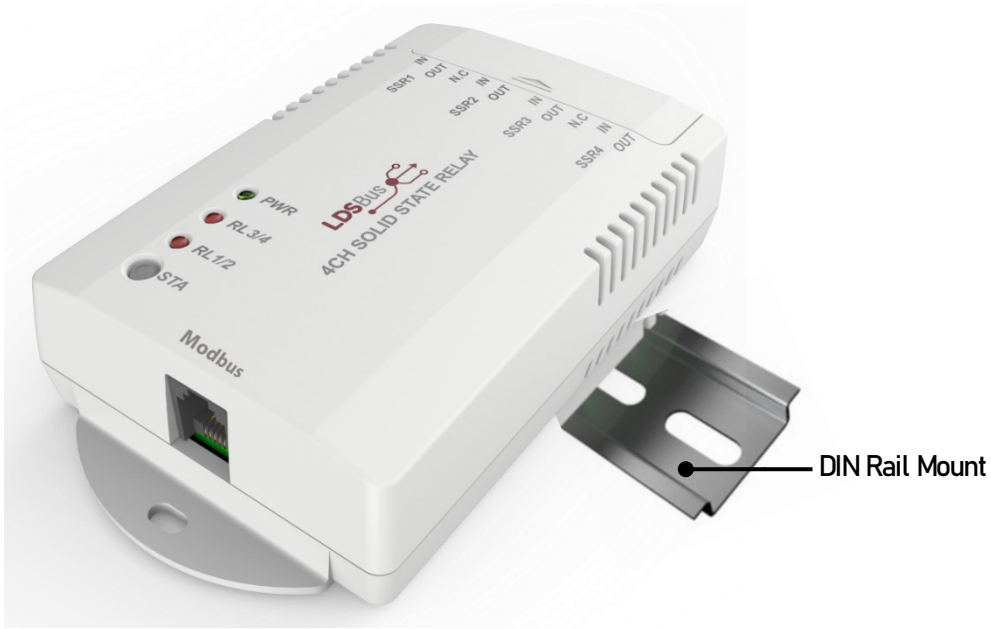


**Figure 5 - Modbus 4CH Solid State Relay DIN Rail Mount**

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# 8 Terminal Wiring Instruction SSR Channel

## 8.1 Connection and Wire

Connections are made with Push-in CAGE CLAMP technology. If using solid conductor wire / clamp with insulation ferrule, the stripped conductor is easily inserted into the clamp until it hits the backstop without the need for a screwdriver. If you use soft conductor wire, use a flat head screwdriver to press down the push button and push in the wire, as shown, until it hits the backstop. To remove the conductor wire from its connector, use a flat head screwdriver to press down the push button and pull out the wire as shown in Figure 6.

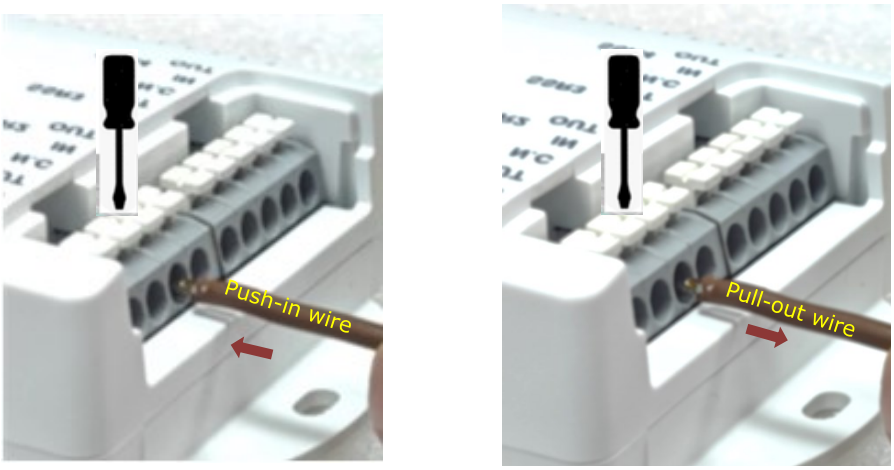


**Figure 6 - Terminal Wiring on SSR Channel (Push-in wire & Pull-out wire)**

Table 5 provides a list of American Wire Gauges (AWGs) that can be used in Terminal Blocks.

| Conductor Type | Wire dimeter/AWG |
|---|---|
| Solid conductor | 0.25~2.5mm$^2$/20~12 AWG |
| Stranded conductor | 0.25~2.5mm$^2$/20~12 AWG |
| Stranded conductor; with insulated ferrule | 0.25~1.5mm$^2$ |

**Table 5 - AWG to use in Terminal Block**

As shown in Figure 7, the wire strip may be 8mm to 12mm long. For safety, ensure that the striped conductor is always fully inserted, and no part of the conducting surface is exposed.

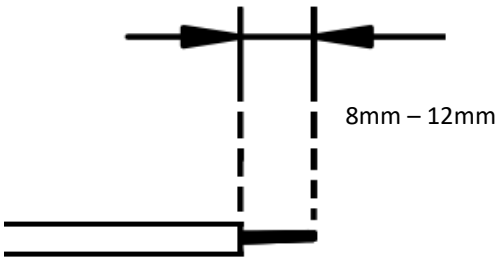


**Figure 7 - Wire Strip Length**

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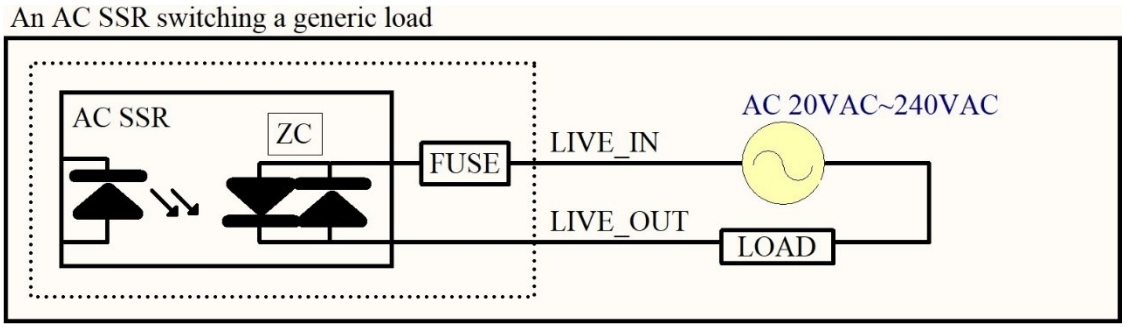
## 8.2 Setup

**WARNING:**

Please ensure that the power to the AC load device is turned off before initiating the setup process to prevent any potential hazards. Prioritize safety by disconnecting power sources before proceeding with installation or configuration.




Consider the Modbus 4CH Solid State Relay, Channel 1, as an illustration. The Modbus 4CH Solid State Relay is designed to facilitate the control of AC loads, capable of managing a maximum load of 240VAC/1.80A per channel. Provided below are recommended wiring configurations and wire specifications for optimal usage.

The following is the connection diagram:

| | |
|---|---|
| Use AWG 20~12; A Brown wire indicates that it comes from an AC Source line<br><br>→ Connect to SSR 'IN' | Use AWG 20~12; A Brown wire indicates that it comes to an AC load line<br><br>→ Connect to SSR 'OUT' |

# 9 Modbus Registers

| Parameter | Starting Address | Quantity of Registers | Supported Function Code | Parameter Range and Description | Default |
|---|---|---|---|---|---|
| **Address(1)** | 0000H | 1 | 0x03/0x10 | 1 to 126 | 126 |
| **RS485 Termination(1)** | 0001H | 1 | 0x03/0x10 | 0 - Termination OFF<br>1 - Termination ON | Termination OFF |
| **Baud Rate(1)** | 0002H | 1 | 0x03/0x10 | 0 - 1200 bps<br>1 - 2400 bps<br>2 - 4800 bps<br>3 - 9600 bps<br>4 - 19200 bps<br>5 - 38400 bps<br>6 -115200 bps | 9600 bps |
| **Parity(1)** | 0003H | 1 | 0x03/0x10 | 0 - None<br>1 - Odd<br>2 - Even | Even |
| **Status LED Enable(1)** | 0004H | 1 | 0x03/0x10 | 0 - LED OFF<br>1 - LED ON | LED ON |
| **RESERVED** | 0005H | 1 | N/A | N/A | N/A |
| **REG_SSR1_ CONTROL** | 0006H | 1 | 0x03/0x10 | SSR 1 control<br>0 - Deactivate<br>1 - Activate | 0x00FF |
| **REG_SSR1_ MODE** | 0007H | 1 | 0x03/0x10 | SSR 1 mode<br>0 - Level Mode<br>1 – Pulse Mode | 0x0000 (Level Mode) |
| **RESERVED** | 0008H | 1 | N/A | N/A | N/A |
| **REG_SSR1_ DEACTIVATION_ MODE** | 0009H | 1 | 0x03/0x10 | Deactivation mode for SSR 1<br>0 - Deactivation None<br>1 - Immediate<br>2 – Immediate After T1(2) | 0x0000 (Deactivation None) |
| **REG_SSR1_T1** | 000AH | 1 | 0x03/0x10 | SSR 1 timing T1(2) | 0x0000 (0 Second) |
| **REG_SSR1_T2** | 000BH | 1 | 0x03/0x10 | SSR 1 timing T2(3) | 0x0000 (0 Second) |
| **REG_SSR1_NO_OF_CYCLES** | 000CH | 1 | 0x03/0x10 | Number of cycles for SSR 1 (write 1 always) | 1 |
| **REG_SSR2_ CONTROL** | 000DH | 1 | 0x03/0x10 | SSR 2 control<br>0 - Deactivate<br>1 – Activate | 0x00FF |
| **REG_SSR2_ MODE** | 000EH | 1 | 0x03/0x10 | SSR 2 mode<br>0 - Level Mode<br>1 – Pulse Mode | 0x0000 (Level Mode) |
| **RESERVED** | 000FH | 1 | N/A | Reserved | N/A |
| **REG_SSR2_ DEACTIVATION_ MODE** | 0010H | 1 | 0x03/0x10 | Deactivation mode for SSR 2<br>0 - Deactivation None<br>1 - Immediate<br>2 - Immediate After T1(2) | 0x0000 (Deactivation None) |
| **REG_SSR2_T1** | 0011H | 1 | 0x03/0x10 | SSR 2 timing T1(2) | 0x0000 (0 Second) |
| **REG_SSR2_T2** | 0012H | 1 | 0x03/0x10 | SSR 2 timing T2(3) | 0x0000 (0 Second) |
| **REG_SSR2_NO_OF_CYCLES** | 0013H | 1 | 0x03/0x10 | Number of cycles for SSR 2 (write 1 always) | 1 |
| **REG_SSR3_ CONTROL** | 0014H | 1 | 0x03/0x10 | SSR 3 control<br>0 - Deactivate<br>1 - Activate | 0x00FF |
| **REG_SSR3_ MODE** | 0015H | 1 | 0x03/0x10 | SSR 3 mode<br>0 - Level Mode | 0x0000 (Level Mode) |

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| | | | | | |
|---|---|---|---|---|---|
| | | | | 1 – Pulse Mode | |
| **RESERVED** | 0016H | 1 | N/A | N/A | N/A |
| **REG_SSR3_ DEACTIVATION_ MODE** | 0017H | 1 | 0x03/0x10 | Deactivation mode for SSR 3<br>0 - Deactivation None<br>1 - Immediate<br>2 – Immediate After T1[2] | 0x0000 (Deactivation None) |
| **REG_SSR3_T1** | 0018H | 1 | 0x03/0x10 | SSR 3 timing T1[2] | 0x0000 (0 Second) |
| **REG_SSR3_T2** | 0019H | 1 | 0x03/0x10 | SSR 3 timing T2[3] | 0x0000 (0 Second) |
| **REG_SSR3_NO_O F_CYCLES** | 001AH | 1 | 0x03/0x10 | Number of cycles for SSR 3 (write 1 always) | 1 |
| **REG_SSR4_ CONTROL** | 001BH | 1 | 0x03/0x10 | SSR 4 control<br>0 - Deactivate<br>1 - Activate | 0x00FF |
| **REG_SSR4_ MODE** | 001CH | 1 | 0x03/0x10 | SSR 4 mode<br>0 - Level Mode<br>1 - Pulse Mode | 0x0000 (Level Mode) |
| **RESERVED** | 001DH | 1 | N/A | N/A | N/A |
| **REG_SSR4_ DEACTIVATION_ MODE** | 001EH | 1 | 0x03/0x10 | Deactivation mode for SSR 4<br>0 - Deactivation None<br>1 - Immediate<br>2 – Immediate After T1[2] | 0x0000 (Deactivation None) |
| **REG_SSR4_T1** | 001FH | 1 | 0x03/0x10 | SSR 4 timing T1[2] | 0x0000 (0 Second) |
| **REG_SSR4_T2** | 0020H | 1 | 0x03/0x10 | SSR 4 timing T2[3] | 0x0000 (0 Second) |
| **REG_SSR4_NO_O F_CYCLES** | 0021H | 1 | 0x03/0x10 | Number of cycles for SSR 4 (write 1 always) | 1 |
| **Device UUID** | 0026H | 8 | 0x03 | MCxxxxxxxxxxxxyy where x is ASCII character and yy is 16-bit running number | N/A |
| **Device Firmware Version** | 002EH | 1 | 0x03 | 0xXXMN<br>XX – Not concerned<br>M – Major<br>N – Minor | N/A |
| **Device Part Number** | 002FH | 1 | 0x03 | Device ID | 0x4002 |
| **Reserved** | 0030H | N/A | N/A | Reserved | N/A |
| **SSR CH1_CH2_CH3_C H4_STATUS** | 0031H | 1 | 0x03 | SSR channel 1 2,3 and 4 statuses | N/A |
| **SSR BOARD_ TEMPERATURE** | 0032H | 1 | 0x03 | Board temperature -- 5500 to 12500 (-55 to 125 in degrees) | N/A |
| **Reset** | 0150H | 1 | 0x06 | Write 1 to reset | N/A |
| **Reserved** | 0151H | N/A | N/A | Reserved | N/A |
| **Identify** | 0152H | 1 | 0x06 | Write 1 to start blinking the device @1Hz for 10 seconds | N/A |

**Table 6 - Modbus Registers**

[1]This indicates that any updates to these communication/status register(s) will only take effect after the device has been rebooted.
[2]T1 – Enabled duration of the control signal in pulse mode
[3]T2 – Disabled duration of the control signal in pulse mode

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# 10 Mechanical Dimensions

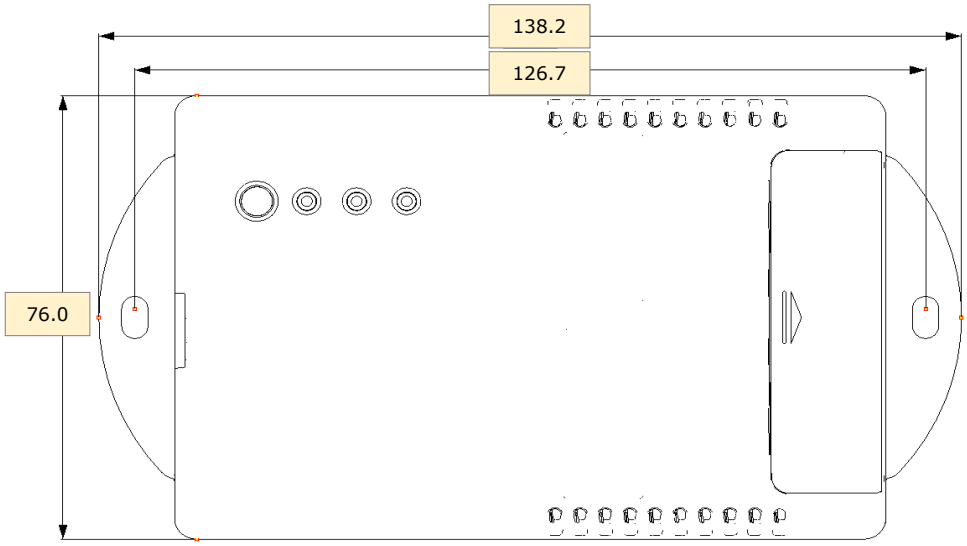


**Figure 8 - Modbus 4CH Solid State Relay Dimension – Top View**

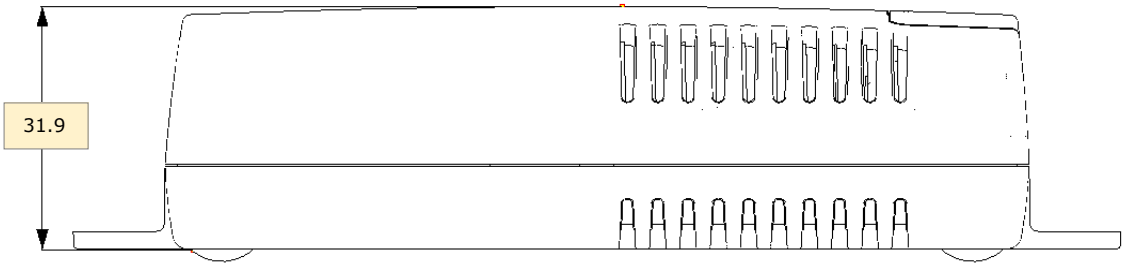


**Figure 9 - Modbus 4CH Solid State Relay Dimension – Side View**

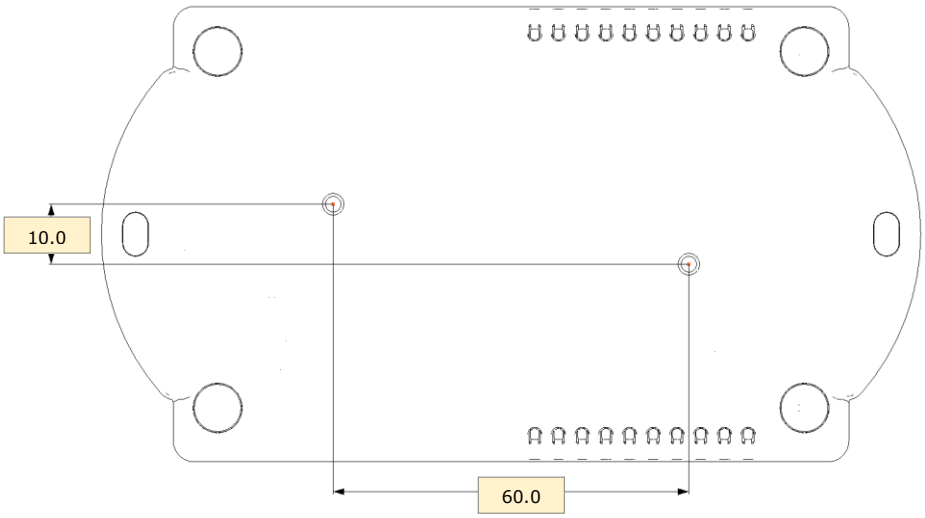


**Figure 10 - Modbus 4CH Solid State Relay Dimension – Bottom View**

**Note:** All dimensions are in millimeters.

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# 11 System Status LED Indicators

| Device Status | LED Color | | Flashing Frequency | Description |
|---|---|---|---|---|
| Termination ON | BLUE | | Steady – Non- flashing | |
| Termination OFF | GREEN | | Steady – Non- flashing | |
| Device Configuration Error | YELLOW |  | Steady – Non- flashing | Device configuration error |
| Communication | RED/GREEN/ BLUE/YELLOW | - | Blink twice (Short blink) | Device in communication |
| Firmware update | YELLOW |  | Steady – Non- flashing | Device firmware update. |

**Table 7 - System Status LED Indicators**

**Note:**

1. For reliable communication, ensure that the power supply and the RS485 termination settings are correct.
2. Ensure that the Modbus address and baud rate are configured correctly before deployment.

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# 12 Relay Channel Status LED Indicators

There are 2 channel status LEDs, and these LEDs are dual-color LEDs. RL1/2 indicates the status of relay channels 1 and 2 and RL3/4 indicates the status of channels 3 and 4.

| Device Status | LED Color | | SSR1 | SSR2 | Description |
|---|---|---|---|---|---|
| RL1/2 | OFF |  | OFF | OFF | SSR1 and SSR2 both are Inactive |
| | Red | | ON | OFF | SSR1 Active and SSR2 Inactive |
| | Green | | OFF | ON | SSR2 Active and SSR1 Inactive |
| | Yellow |  | ON | ON | SSR1 and SSR2 both are Active |
| | | | **SSR3** | **SSR4** | |
| RL3/4 | OFF |  | OFF | OFF | SSR3 and SSR4 both are Inactive |
| | Red | | ON | OFF | SSR3 Active and SSR4 Inactive |
| | Green | | OFF | ON | SSR4 Active and SSR3 Inactive |
| | Yellow |  | ON | ON | SSR3 and SSR4 both are Active |
| PWRGreen | Green | | - | - | SSR All Channel Power Enabled |

**Table 8 - Relay Channel Status LED Indicators**

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# 13 Contact Information

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# Appendix A – References

## Document References

Modbus Configuration Utility User Guide

## Acronyms and Abbreviations

| Terms | Description |
|---|---|
| AC | Alternating Current |
| AWG | American Wire Gauges |
| DC | Direct Current |
| IoT | Internet of Things |
| LED | Light Emitting Diode |
| SSR | Solid State Relay |
| 4CH | 4 Channels |
| RL1/RL2/RL3/RL4 | Solid State Relay Channel 1/2/3/4 |
| PWR | Power |
| N.C | No Connection |

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# Appendix C – Revision History

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