Modbus Isolated IO Controller Datasheet

1 Introduction

The Modbus Isolated IO Controller provides two isolated channels each for digital and analog inputs. It supports a variety of power source options, enabling signal levels of 3.3V, 5V, 10V, and 12V. Additionally, It can source power from either internal or external voltage supplies for I/O functionality, offering greater flexibility in system integration. Each channel (input and output) is isolated from the others.

Each digital output can switch between 0V and 3.3V, 5V, 12V or referenced to an external voltage source. Each digital input can be between 0V and 1.8V to 12V. A 5V voltage source is provided for common applications that switch between 0-5V.

Each analog output can produce a voltage between 0-10V, and each analog input supports voltage or current controlled input sources ranging between 0-10V.

The controller may be used in numerous and diverse applications such as simple IO control, or 0-10V dimmers, weather station, water level detector or sensor, etc.

1.1 Features

- 2 isolated digital output channels
- 2 isolated digital input channels
- 2 isolated analog output channels
- 2 isolated analog input channels
- Built-in power supply (3.3V/ 5V/ 10V/ 12V) and external power supply option
- Flexible combination of internal or external power supply
- Implements Modbus RTU protocol
- Low power consumption
- Operating temperature range: 0°C to +55°C
- Flush mount and DIN Rail mounting options

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2 Part Numbers / Ordering Information

Part Number	Description
MC-0601-01A	Modbus Isolated IO Controller
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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Table of Contents

1 Introduction 1
1.1 Features 1
2 Part Numbers / Ordering Information 2
3 Specifications 5
4 FCC Compliance Statement 6
5 Hardware Features 7
6 Isolated IO Controller Configuration and Installation 9
6.1 Connection Diagram for Standard Modbus Power Supply 9
6.2 RS485-RJ11 Cable(30cm) 10
7 Mounting Instructions 11
7.1 Flush Mount 11
7.2 DIN Rail Mount 11
8 Terminal Wiring Instructions Isolated IO Controller 12
8.1 Isolated IO Digital INPUT Setup 13
8.2 Isolated IO Digital OUTPUT Setup 14
8.3 Isolated Analog INPUT Setup 15
8.4 Isolated Analog OUTPUT Setup 16
9 Modbus Registers 17
10 Mechanical Dimensions 19
11 System Status LED Indicators 20
12 Contact Information 21
Appendix A – References 22
Document References 22
Acronyms and Abbreviations 22
Appendix B – List of Figures and Tables 23
List of Figures 23

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List of Tables.....23
Appendix C – Revision History 24

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3 Specifications

Features	Interface	RS485 Modbus RTU
	System Status Indicator	1x RGB LED
	Mounting	Flush Mount
		DIN-Rail Mount
Power	Modbus Voltage	9-24V DC Bus Power
	Device Input Voltage	5V DC
	Power (Typ)	1.15W
	Power (Max)	1.20W
	Output Power*	3.3V/30mW
		5V/50mW
		10V/400mW
		12V/240mW
Analog Input	Number of Channels	2
	Analog Input range	0V - 10V
	Analog Input resolution	10mV
	Analog Input Accuracy	Typical: +/- 3%;
		For 0V - 1V, Accuracy: +/- 10mV (typical)
Analog Output	Number of Channels	2
	Analog Output range	0V - 10V
	Analog Output resolution	10mV
	Analog Output Accuracy	Typical: +/- 3%;
		For 0V - 1V, Accuracy: +/- 10mV (typical)
Digital IO Input	Number of Channels	2
	Digital Input Voltage	1.8VDC - 12VDC (refer to external power voltage)
Digital IO Output	Number of Channels	2
	Digital Output Voltage	1.8VDC - 12VDC (refer to external power voltage)
Physical Characteristics	Color	White
	Housing	Polycarbonate
	Dimension	L138.2mm x W76.0mm x H31.9mm
Environmental Limits	Operating Temperature	0 to 55°C
	Storage Temperature	-20 to 85°C
	Ambient Relative Humidity	5 to 95% (non-condensing)
Package Contents	Device	1x Modbus Isolated IO Controller
	Wire Assembly	1x Modbus RS485-RJ11 Cable(30cm)
Optional	Mounting Accessories	1x LDSBus DIN Rail Mount set

Table 2 - Modbus Isolated IO Controller Specifications

*Total current output up to 60mA.

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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

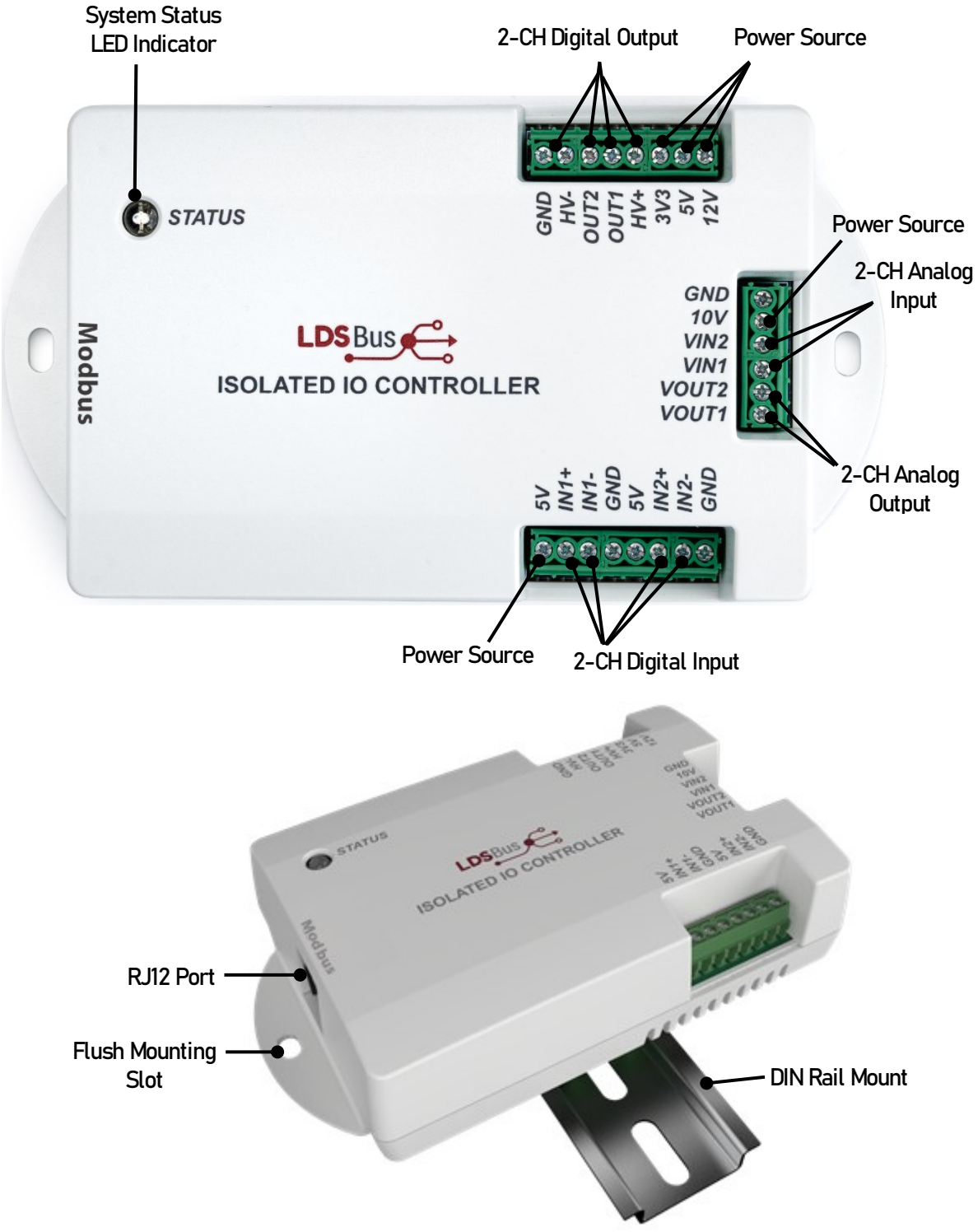

Figure 1 - Modbus Isolated IO Controller Hardware Features

Function	Labels	Description
2-CH Digital Input	IN1+ IN1- IN2+ IN2-	Two individual digital input channels to measure (monitor) the digital input TTL status. These 2 inputs are isolated from each other.
2-CH Digital Output	OUT2 OUT1	Two individual digital output channels to control external controller by TTL signal
	HV+ HV-	Used to define the power supply of Digital IO Output. OUT1 and OUT2 share a common power source (on-board external) though HV+ and HV- connections.
2-CH Analog Input	VIN2 VIN1	Two individual analog input channels to measure (monitor) the analog voltage. These 2 inputs are isolated from each other.
2-CH Analog Output	VOUT2 VOUT1	Two individual analog output channels to supply the analog voltage VOUT1 and VOUT2 share a common power source (on-board).
Power Source	3V3 5V 10V 12V	Output supply voltage for internal or external use
System Status LED Indicator	LED	Status LED
RJ12 Port	Modbus	Modbus data and power interface port

Table 3 - Modbus Isolated IO Controller Hardware Features

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6 Isolated IO Controller 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

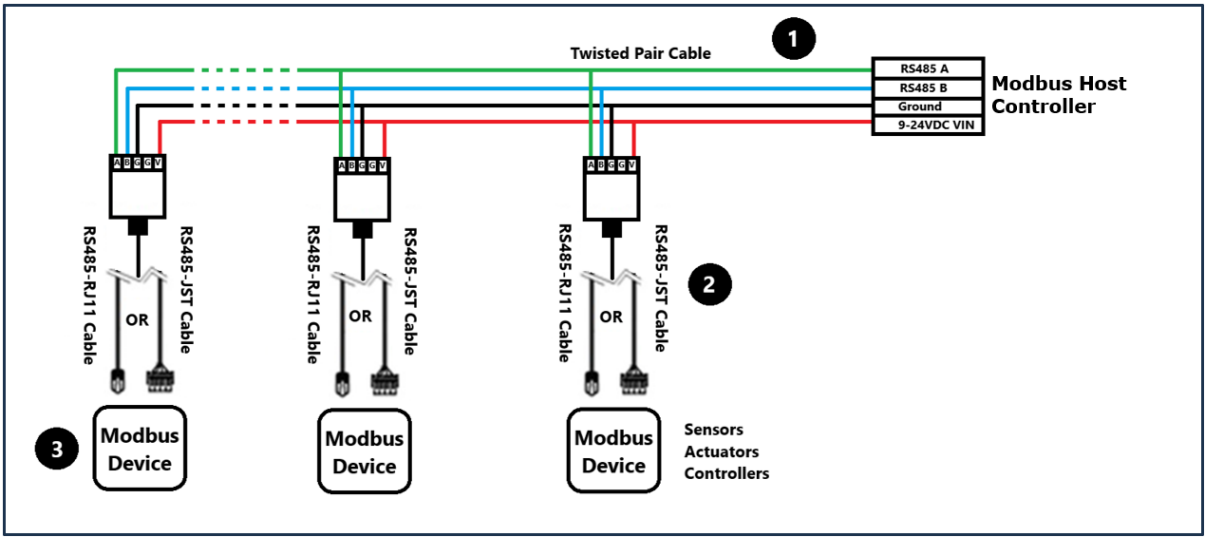

Figure 2 - Connection Diagram for Standard Modbus Power Supply

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)

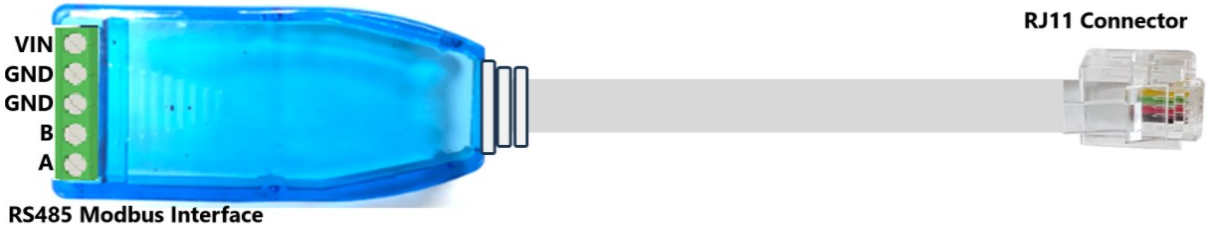

Figure 3 - RS485-RJ11 Cable(30cm)

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

Table 4 - RS485-RJ11 Cable (30cm) Pin Configuration

7 Mounting Instructions

7.1 Flush Mount

The device can be flush mounted directly on a wall or any flat surface using 2 M3.5*16mm (thread) screws.

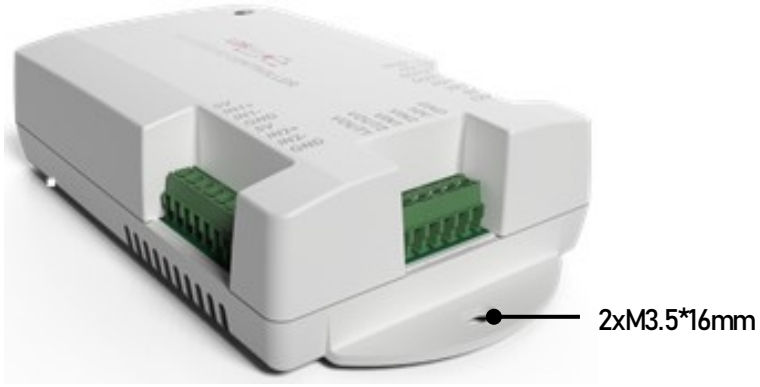

Figure 4 - Modbus Isolated IO Controller Flush Mount

7.2 DIN Rail Mount

The device 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.

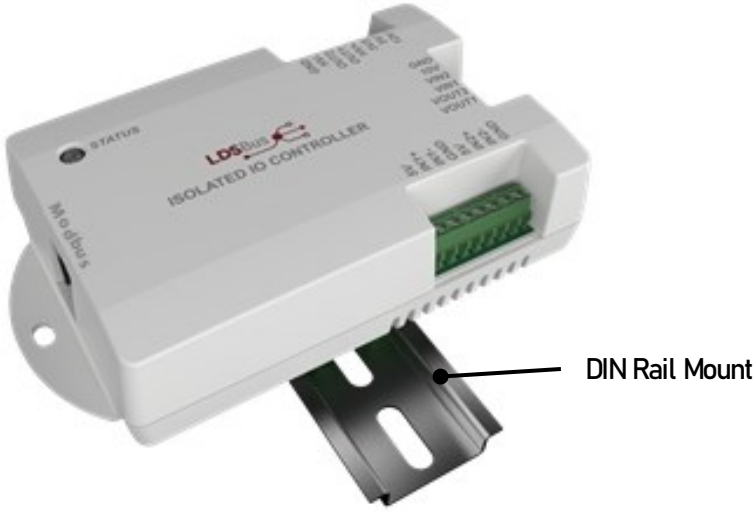

Figure 5 - Modbus Isolated IO Controller DIN Rail Mount

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8 Terminal Wiring Instructions Isolated IO Controller

Terminal blocks are connected with screws. To clamp the wire to the terminal block, insert a 0.4mm x 2.5mm slotted screwdriver and rotate in a clockwise direction. To release the wire, turn the handle in an anticlockwise direction.

Figure 6 - Clamping wire with screwdriver in Clock-wise Direction

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

Conductor Type	Wire dimeter/AWG
Solid conductor	0.2~1.5mm^2/26~16 AWG
Stranded conductor	0.2~1.5mm^2/26~16 AWG
Stranded conductor; with insulated ferrule	0.25~0.75mm^2

Table 5 - AWG to use in terminal block

As shown in Figure 7, the wire strip is 3mm to 5mm long.

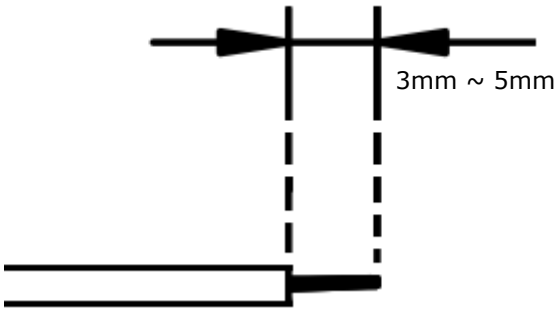

Figure 7 - Wire Strip Length

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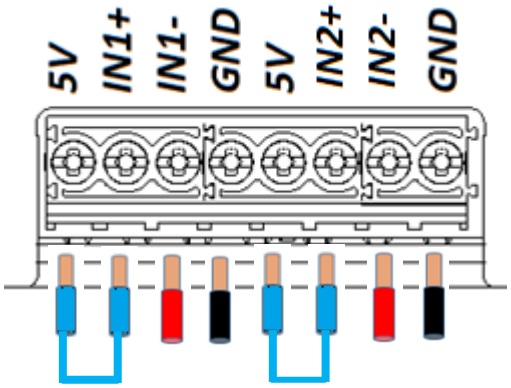
8.1 Isolated IO Digital INPUT Setup

The 2CH isolated digital input supports external digital signals ranging from 1.8 to 12V. The two options for connecting are as follows:

Note: As each channel is independent, Channel 1 and Channel 2 can use different configurations.

IO Digital Input with 5V Application



Use AWG 26~16; The RED wire indicates that it comes from an external IO source

→ Connect to the IN1- or IN2-

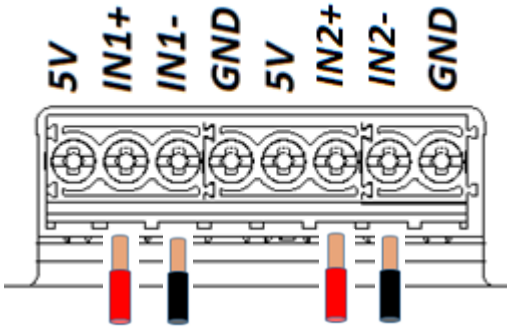
Use AWG 26~16; The BLACK wire indicates that it comes from external GND

→ Connect to the GND

Use AWG 26~16; The BLUE wire connects to the 5V source on board

→ Connect to the IN1+ or IN2+

IO Digital Input with External Pull-up



Use AWG 26~16; The RED wire indicates that it comes from External IO source

→ Connect to the IN1+ or IN2+

Use AWG 26~16; The BLACK wire indicates that it comes from external GND

→ Connect to the IN1- or IN2-

WARNING: When wiring, always TURN OFF the Power Supply.

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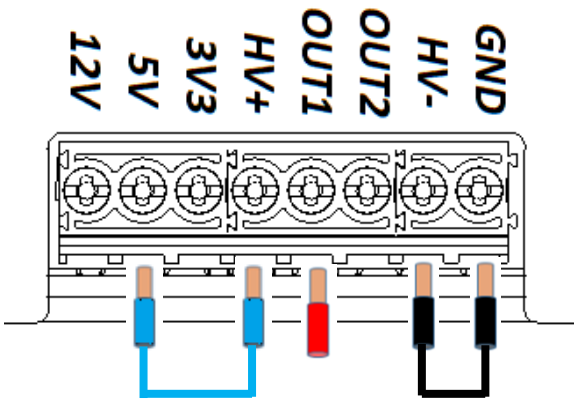
8.2 Isolated IO Digital OUTPUT Setup

The 2CH isolated digital output supports external digital signals ranging from 1.8 to 12V. The two options for connecting are as follows:

Digital Output with 5V Application



Use AWG 26~16; The RED wire indicates that it outputs an IO signal

→ Connect to the OUT1 or OUT2

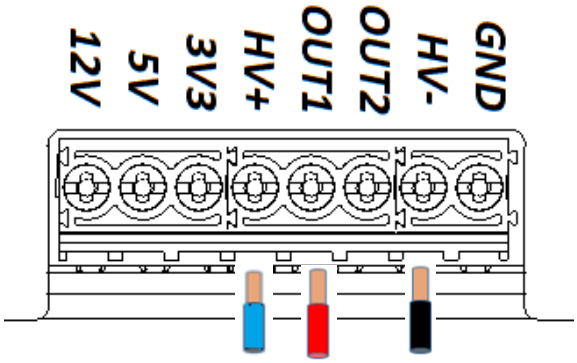
Use AWG 26~16; The BLACK wire connects to on board GND

→ Connect to HV-

Use AWG 26~16; The Blue wire connects to the 5V source on board

→ Connect to the HV+

Digital Output with External Source



Use AWG 26~16; The RED wire indicates that it outputs IO signal

→ Connect to the OUT1 or OUT2

Use AWG 26~16; The BLACK wire indicates that it comes from External GND

→ Connect to HV-

Use AWG 26~16; The BLUE wire indicates that it comes from External Source

→ Connect to HV+

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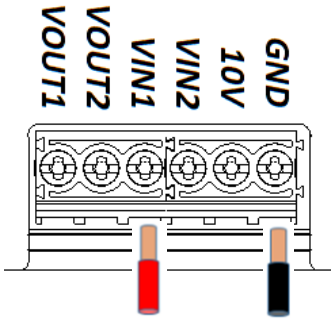
8.3 Isolated Analog INPUT Setup

The 2CH isolated analog input supports external analog signals ranging from 0 to 10V. The two options for connecting are as follows:

Analog Input with External Voltage Source



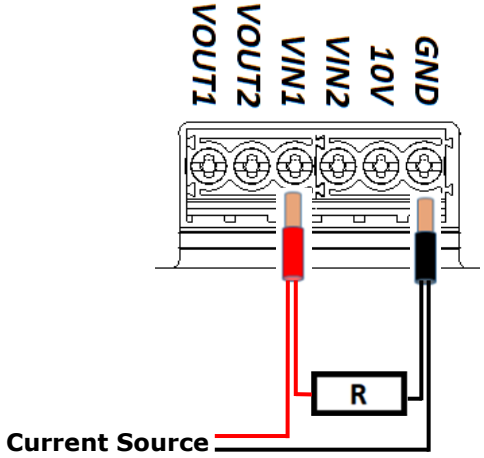
Use AWG 26~16; The RED wire indicates that it comes from external voltage source

→ Connect to VIN1 or VIN2

Use AWG 26~16; The BLACK wire indicates that it comes external GND

→ Connect to GND

Analog Input with External Current Source



Use AWG 26~16; The RED wire indicates that it comes from external current source

→ Connect to VIN1 or VIN2

Use AWG 26~16; The BLACK wire indicates that it comes from external GND

→ Connect to GND

R

Serial Resistor value depends on current source

→ Connect in between VIN1/VIN2 and GND

For example: Application current source 4mA to 20mA, recommend using 450ohm resistor

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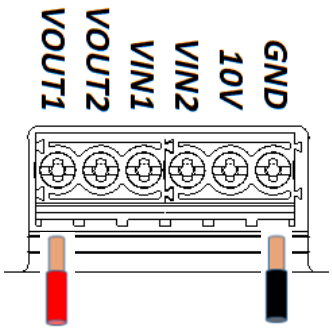
8.4 Isolated Analog OUTPUT Setup

The 2CH isolated analog output supports external analog signals ranging from 0 to 10V. The two options for connecting are as follows:

Analog Voltage Output



Use AWG 26~16; The RED wire indicates that it outputs 0V - 10V power

→ Connect to VOUT1 or VOUT2

Use AWG 26~16; The BLACK wire indicates that it comes external GND

→ Connect to GND

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 1 - Termination On	0 (Off)
Baud Rate(1)	0002H	1	0x03/0x10	0 - 1200 bps 1 - 2400 bps 2 - 4800 bps 3 - 9600 bps 4 -19200 bps 5 - 38400 bps 6 -115200 bps	9600 bps
Parity(1)	0003H	1	0x03/0x10	0 – None 1 – Odd 2 - Even	Even
Status LED Enable(1)	0004H	1	0x03/0x10	0 - LED Off 1 - LED On	1 (LED On)
Reserved	0005H	1	N/A	N/A	N/A
REG_DO_CHANNEL_NO	0006H	1	0x03/0x10	Digital Channel number X=0 refers to Channel 1; X=1 refers to Channel 2	0 (Channel 1)
REG_DO_CHANNEL_CONTROL	0007H	1	0x03/0x10	Channel x control 0 - Deactivate 1 - Activate	0x00FF (No Action)
REG_DO_CHANNEL_MODE	0008H	1	0x03/0x10	Channel x mode 0 - Level Mode 1 - Pulse Mode 3 - Sequence Mode	0x0000 (Level Mode)
REG_DO_CHANNEL_START_STOP_POLARITY	0009H	1	0x03/0x10	Start/stop polarity for Channel x polarity_negative = 0, polarity_positive =1	0x0001 (Positive Polarity)
REG_DO_CHANNEL_DEACTIVATION_MODE	000AH	1	0x03/0x10	Deactivation mode for Channel x 0 - Deactivation None 1 - Immediate 2 - Immediate After T1	0x0000 (Deactivation None)
REG_DO_CHANNEL_NO_OF_CYCLES	000BH	1	0x03/0x10	Number of cycles for Channel x (1 - 65535)	1
REG_DO_CHANNEL_NO_OF_PAIRS	000CH	1	0x03/0x10	Number of pairs for Channel x (1 - 255)	1
REG_DO_CHANNEL_T1	000DH	1	0x03/0x10	Digital out pulse/sequence 0 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_T2	000EH	1	0x03/0x10	Digital out pulse/sequence 0 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S1T1	000FH	1	0x03/0x10	Digital out sequence 1 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S1T2	0010H	1	0x03/0x10	Digital out sequence 1 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S2T1	0011H	1	0x03/0x10	Digital out sequence 2 T1 Time	0x0000 (0 Sec)

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				(0 to 65535 Secs)	
REG_DO_CHANNEL_S2T2	0012H	1	0x03/0x10	Digital out sequence 2 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S3T1	0013H	1	0x03/0x10	Digital out sequence 3 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S3T2	0014H	1	0x03/0x10	Digital out sequence 3 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S4T1	0015H	1	0x03/0x10	Digital out sequence 4 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S4T2	0016H	1	0x03/0x10	Digital out sequence 4 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S5T1	0017H	1	0x03/0x10	Digital out sequence 5 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S5T2	0018H	1	0x03/0x10	Digital out sequence 5 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S6T1	0019H	1	0x03/0x10	Digital out sequence 6 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S6T2	001AH	1	0x03/0x10	Digital out sequence 6 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S7T1	001BH	1	0x03/0x10	Digital out sequence 7 T1 Time (0 to 65535 Secs)	0x0000 (0 Sec)
REG_DO_CHANNEL_S7T2	001CH	1	0x03/0x10	Digital out sequence 7 T2 Time (0 to 65535 Secs)	0x0000 (0 Sec)
RESERVED	001DH	1	N/A	N/A	N/A
REG_AO_CHANNEL1_SET_VOLTAGE	001EH	1	0x03/0x10	0 - 10000 millivolt	0 mV
RESERVED	001FH	1	N/A	N/A	N/A
REG_AO_CHANNEL2_SET_VOLTAGE	0020H	1	0x03/0x10	0 - 10000 millivolt	0 mV
Device UUID	0026H	8	0x03	MCxxxxxxxxxxxxyy where x is ASCII character and yy is 16bit running number	N/A
Device Firmware Version	002EH	1	0x03	Corresponding to version number	N/A
Device Part Number	002FH	1	0x03	Device ID	0xC001
Reserved	0030H	N/A	N/A	N/A	N/A
RELAY DI_CHANNE_1_STATUS	0031H	1	0x03	Digital channel 1	N/A
RELAY DI_CHANNE_2_STATUS	0032H	1	0x03	Digital channel 2	N/A
RELAY AI_CHANNEL_1_VAL	0033H	1	0x03	Voltage level in channel 1	N/A
RELAY AI_CHANNEL_2_VAL	0034H	1	0x03	Voltage level in channel 2	N/A
Reset	0150H	1	0x06	Write 1 to reset	N/A
Reserved	0152H	N/A	N/A	N/A	N/A
Identify	0154H	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.

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10 Mechanical Dimensions

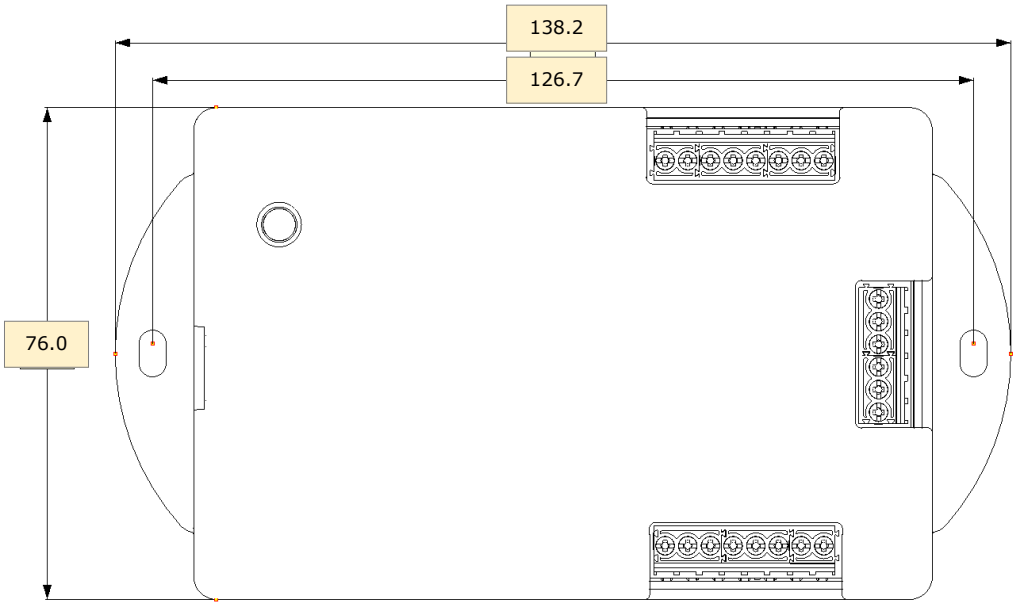

Figure 8 - Modbus Isolated IO Controller Dimension – Top View

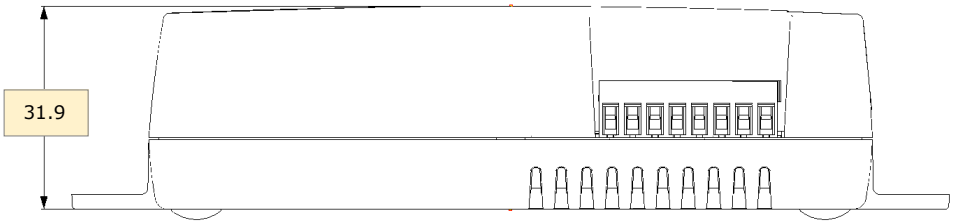

Figure 9 – Modbus Isolated IO Controller Dimension – Side View

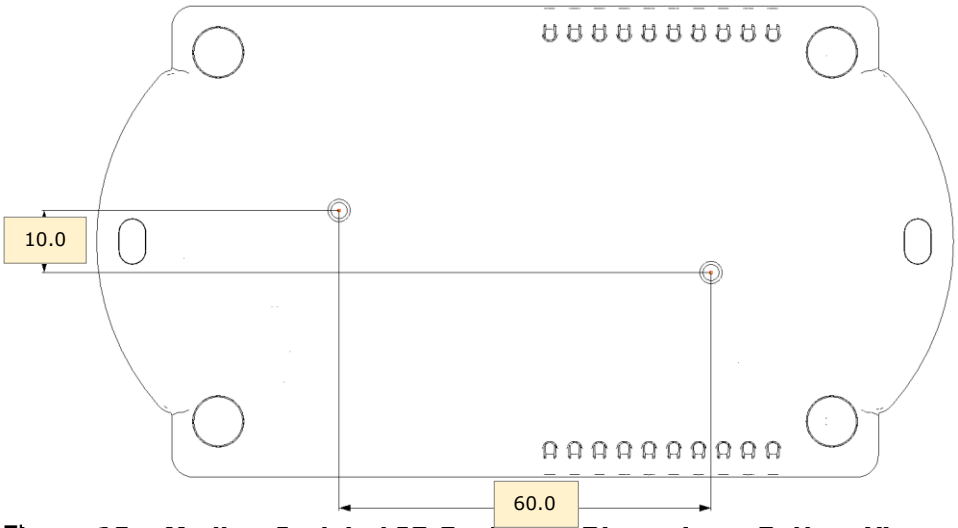

Figure 10 – Modbus Isolated IO Controller Dimension – Bottom View

Note: All dimensions are in millimetres.

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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	RED		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

Notes:

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 Contact Information

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Appendix A – References

Document References

Modbus Configuration Utility User Guide

Modbus Device Configuration Application Note

Acronyms and Abbreviations

Terms	Description
AC	Alternating Current
AWG	American Wire Gauges
DC	Direct Current
IoT	Internet of Things
LED	Light Emitting Diode

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Appendix B – List of Figures and Tables

List of Figures

Figure 1 - Modbus Isolated IO Controller Hardware Features 7
Figure 2 - Connection Diagram for Standard Modbus Power Supply 9
Figure 3 - RS485-RJ11 Cable(30cm) 10
Figure 4 - Modbus Isolated IO Controller Flush Mount 11
Figure 5 - Modbus Isolated IO Controller DIN Rail Mount 11
Figure 6 - Clamping wire with screwdriver in Clock-wise Direction 12
Figure 7 - Wire Strip Length 12
Figure 8 - Modbus Isolated IO Controller Dimension – Top View 19
Figure 9 – Modbus Isolated IO Controller Dimension – Side View 19
Figure 10 – Modbus Isolated IO Controller Dimension – Bottom View 19

List of Tables

Table 1 - Part Numbers / Ordering Information 2
Table 2 - Modbus Isolated IO Controller Specifications 5
Table 3 - Modbus Isolated IO Controller Hardware Features 8
Table 4 - RS485-RJ11 Cable (30cm) Pin Configuration 10
Table 5 - AWG to use in terminal block 12
Table 6 - Modbus Registers 18
Table 7 - System Status LED Indicators 20

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Appendix C – Revision History

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Document Feedback: Send Feedback

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