

USER MANUAL

SI-W709

Thermocouple I/O Module

SI-W709 M3

SI-W709

Thermocouple I/O Module

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DISCLAIMER

This user's manual is meant to assist users in installing and setting up the system. The information contained in this document is subject to change without any notice.

CE NOTICE

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

You are cautioned that any change or modifications to the equipment not expressly approve by the party responsible for compliance could void your authority to operate such equipment.



WARNING: Some internal parts of SI-W709 may have high electrical voltage. We strongly recommend that only qualified engineers are allowed to service and disassemble SI-W709. If any damages should occur on SI-W709 and are caused by unauthorized servicing, it will not be covered by the product warranty.

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Revision History

The revision history of SI-W709 User Manual is described below:

Version No.	Revision History	Date
M3	<ul style="list-style-type: none">• The Pin Assignment diagrams on Page 2-7, 3-2, 3-3, 3-4 has been revised.• The analog input range for Value 02 has been changed to $\pm 100\text{mV}$ on Page 4-12.• The SI-W709 System Exploded Diagram and part no. table have been revised on Page A-2 and Page A-3.	2020/11/24
M2	<ul style="list-style-type: none">• The Response-1 table has been revised on Page 4-9.• The firmware version in Section 4.3 Address Mapping has been revised on Page 4-11.	2020/2/12
M1	Initial Release	2019/10

1 Introduction

This chapter provides the introduction for SI-W709 module, applications list as well as the framework of the user manual.

The following topics are included:

- SI-W709 Overview
- Applications
- User Manual Structure

1.1 SI-W709 Introduction

Thank you for purchasing our SI-W709 Industrial IoT (IIoT) Remote I/O Module. SI-W709 Series is a set of data acquisition that can be remotely controlled by using Modbus RTU protocol. The communication interface between the module and the host is RS-485 serial bus. The baud rate is software programmable and transmission speeds is up to 115.2 Kbps. SI-Wx09 Series provide Analog-to-Digital, Digital-to-Analog, Digital Input / Output, Counters and other functions. SI-W709 modules can communicate with all computers and terminals. SI-W709 Remote I/O Module has 8 channels of Analog Input include Voltage, Current and Thermocouple.

The RS-485 network only requires two wires, DATA+ and DATA-. A maximum of 256 SI-W709 modules can be connected to an RS-485 network, and the transmission distance can reach up to 4000 feet. For the power requirements, the modules are designed for standard industrial unregulated 24 VDC Power input; however, they accept any power unit that supplies power within the range of +9 to +50 VDC.

1.2 Applications

- Building Automation
- Factory Automation
- Machine Automation
- Remote Maintenance
- Remote Diagnosis
- Testing Equipment

1.3 User Manual Structure

Chapter 1 Introduction

This chapter gives the brief introduction of SI-W709, applications list as well as the framework of this user manual.

Chapter 2 Getting Started

This chapter describes the system architecture and system and I/O specifications, illustrates the physical appearances, block diagrams, I/O module as well as quick installation guide. Read the safety reminders carefully on how to take care of SI-W709 properly.

Chapter 3 Hardware Configuration

This chapter describes the information of pin assignment, application wiring, mounting support as well as default settings. It also provides technical support information.

Chapter 4 MODBUS RTU Protocol

This chapter describes the command format, function list and address mappings information for MODBUS RTU protocol.

Appendix A Exploded Diagrams

This appendix provides the exploded diagrams and part numbers for SI-W709.

2 Getting Started

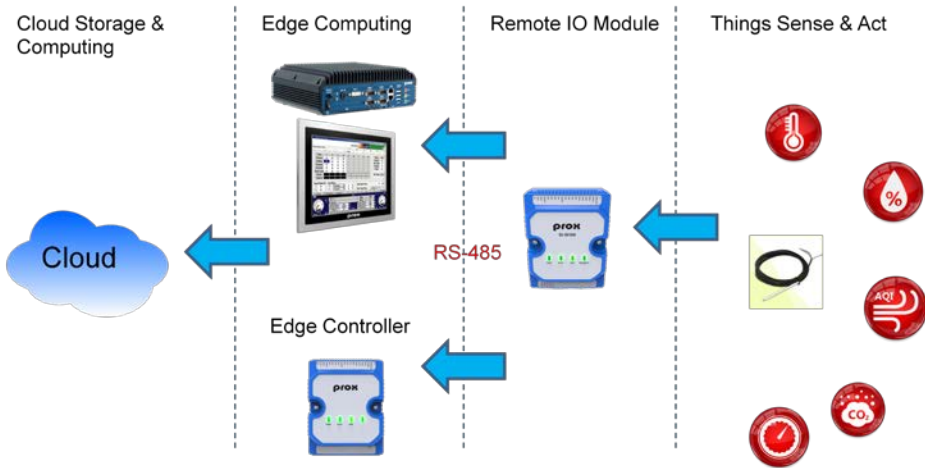
This chapter describes the system architecture and system and I/O specifications, illustrates the physical appearances, block diagrams, I/O modules as well as quick installation guide. Read the safety reminders carefully on how to take care of SI-W709 properly.

The following topics are included:

- System Architecture
- SI-W709 Overview
- System and I/O Specifications
- I/O Module
- Block Diagrams
- Quick Start
- Safety Precautions

2.1 System Architecture

The System Architecture diagram is illustrated as below:



Host Computer/ Edge Controller Gateway

Any computer, terminal or Edge controller Gateway can transfer data with Modbus RTU Protocol by using RS-232 or RS-485 serial interfaces. When only RS-232 is available, an RS-232 to RS-485 converter is required to convert the signals to the correct RS-485 data format. The Modbus protocol is easy to integrate Modbus compatible equipment into monitoring and control applications.

Remote I/O Module

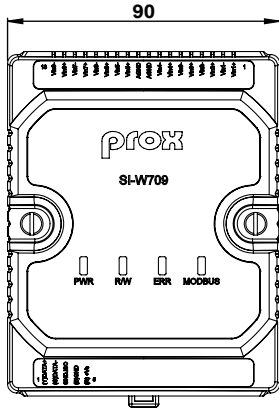
SI-W709 is the series of the Remote I/O Modules which are designed by Protech Systems. The bottom side I/O of module include RS-485 interface and power supply. The interface of communication is the RS-485 with 3-wire unregulated connector. The modules accept any power unit that supplies power within the range of +9 to +50 VDC. For the standard power unit, they are designed for standard industrial unregulated 24 VDC Power input.

The top side I/O of module is the I/O channels for monitoring and control. It provides Analog-to-Digital, Digital-to-Analog, Digital Input / Output, Relay output, Counters and other functions.

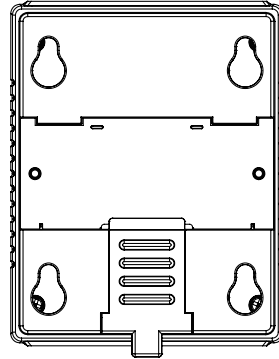
2.2 SI-W709 Overview

Unit: mm

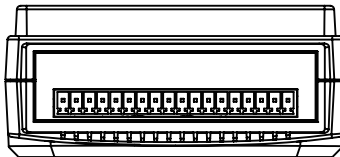
Front View



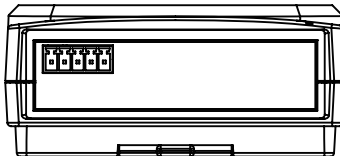
Rear View



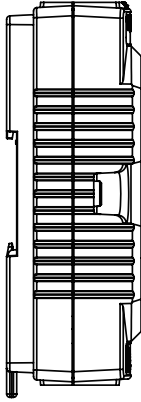
Top View



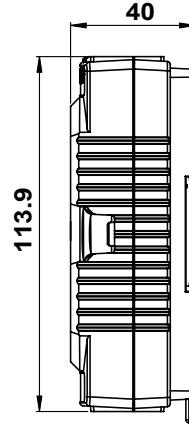
Bottom View



Left Side View



Right Side View



2.3 Specifications

System Specification	
Communication Interface	RS-485
Baud Rate	9,600 bps ~ 115,200 bps (Max)
Communication Protocol	Modbus /RTU
Intra-module Isolation	3000V
Installation	DIN-Rail, Wall Mount
LED Indicator	<ul style="list-style-type: none"> ➤ Power LED, Green ➤ R/W LED, Orange ➤ Error LED, Red ➤ Modbus LED, Green
I2C Interface	Temperature/ Humidity Sensor Module
Power Supply	9 ~ 50V DC In from terminal block
System Weight	220 g
Dimensions (W x H x D)	115 x 90 x 40 mm
Certificate	FCC/CE
I/O - Analog Input	
Channels	8
Wiring	Differential
Thermocouple	J, K, T, E, R, S, B
Sensor Type Voltage	±15 mV, ±50 mV, ±100 mV, ±500 mV, ±1V, ±2.5 V
Current	±20 mA, 0 ~ 20 mA, +4 ~ 20 mA
Resolution	16-bit
Sample Rate	10Hz (Total)
Accuracy	0.1% of FSR
Input Impedance	>400 KΩ
Common Voltage Protection	25V DC
Overvoltage Protection	±120V DC
Environment	
Operating Temperature (with airflow)	➤ -25°C ~ 75°C (13°F ~ 167°F)
Storage Temperature	➤ -40°C ~ 85°C (-4°F ~ 185°F)
Humidity	➤ 20% ~ 90%

2.4 About SI-W709 I/O Module

1. Common Specification of SI-W709 Series

Communication Interface:

- RS-485 (3-wire) to Host
- Speed: 9600, 19200, 38400, 57600, 115200 bps
- Maximum Communication Distance: 4000 feet (1.2km)
- Power and communication LED Indicator
 - **PWR**: Power indicator with Green LED
 - **R/W**: Data Read/Write indicator with Orange LED
 - **ERR**: Error indicator with Red LED
 - **Modbus**: Modbus communication indicator with Green LED
- Up to 256 I/O modules per serial port

Power Requirement

- Unregulated +9 ~ +50V DC

Mechanical

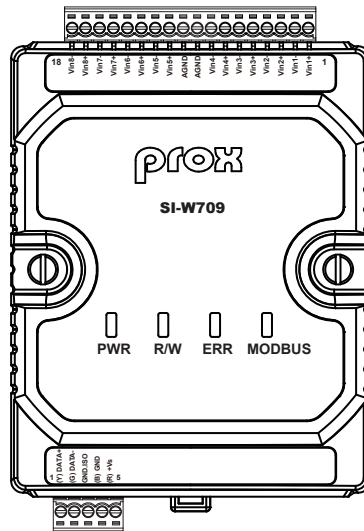
- Case: ABS+PC
- Plug-In Screw: Strip Length : 6~7mm
- Suitable Electric Wire: AWG 14~28

Environment:

- EMI: FCC Class A and CE
- Operation Temperature: -25°C ~ 75°C (-13°F ~ 167°F)
- Storage Temperature: -40°C ~ 85°C (-40°F ~ 185°F)
- Humidity: 20% ~ 90%

2. SI-W709 Thermocouple I/O Module

SI-W709 Module provides 8 channels Analog Input include voltage, current input and thermocouple input. SI-W709 series provide a programmable input range on all analog input channels. The range of analog input is 16-bit at +/- 15mV, +/- 50mV, +/-100mV, +/-500mV, +/-1V, +/-2.5V, 4~20mA, 0~20mA, -20~+20mA. This module is a cost-effective solution for industrial measurement, monitoring and control applications.



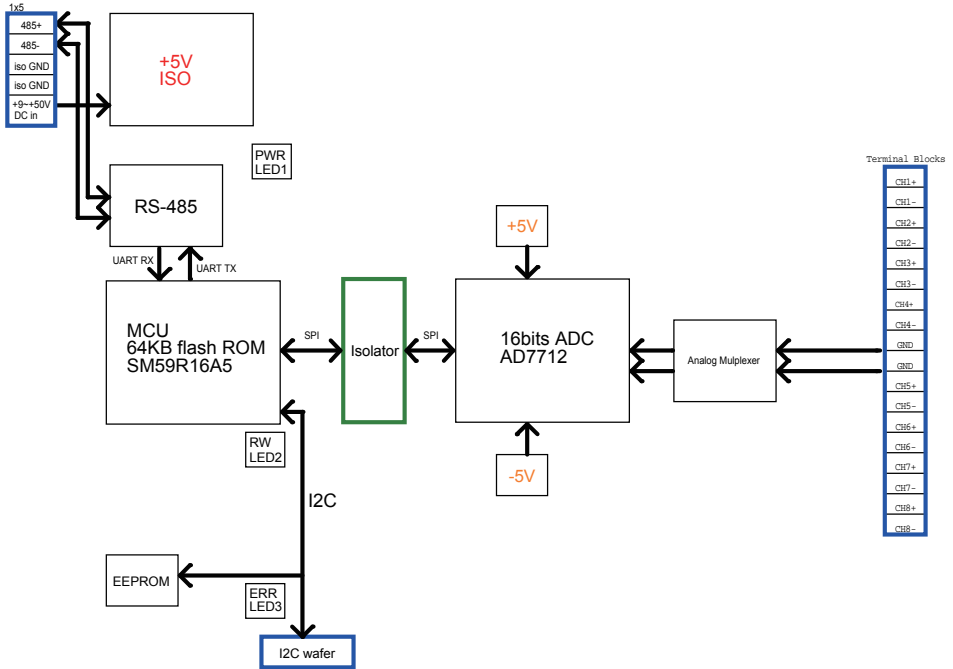
Channels:

- 8 Analog Input Channels

Analog Input:

- **Type :** +/- 15 mV, +/- 50 mV, +/-100 mV, +/- 500 mV, +/-1V, +/-2.5V, ± 20 mA, 0 ~ 20 mA, 4 ~ 20 mA
- **Resolution:** 16-bit

2.5 Block Diagram



2.6 Quick Start

To install SI-W709 I/O module, follow the steps below:

1. Refer to **Section 3.1** for the pin assignment of terminal block and **Section 3.2** for application wiring.
2. Open the Modbus utility for the host control.
3. Connect the module to the RS-485 network using the DATA+ and DATA-(GND) terminals. If the host is only equipped with an RS-232 interface, an RS-232 to RS-485 converter will be required. See **Section 3.1** for terminal assignment.
4. Connect the pin 4 and pin 5 of the module (SI-W709) to the power supply using the GND and +Vs terminals. See **Section 3.1** for terminal assignment. Note that the voltage supplied to the module should be in the range of +9 to +50 VDC.
5. Use the Modbus RTU Protocol and configure the module by using the following commands:
 - Read the Baud Rate Setting from the Holding Register (0x0020) by sending "01 41 00 20" command to the module. Check the settings of the module and utility are the same.
 - To read data from Input channels by sending function code 02h to read data from input channels.

2.7 Safety Precautions

Before operating SI-W709, read the following information carefully to protect it from damages, and extend the life cycle of SI-W709.

1. Check the Line Voltage
 - The operating voltage for the power supply should be within the range of 9~50V DC; otherwise, SI-W709 may be damaged.
2. Environmental Conditions
 - Place your SI-W709 on a sturdy, level surface. Be sure to allow enough space around SI-W709 to have easy access needs.
 - Avoid installing your SI-W709 in extremely hot or cold places.
 - Avoid direct sunlight exposure for a long period of time (for example, in a closed car in summer time. Also keep SI-W709 from any heating device.). Or do not use SI-W709 when it has been left outdoors in a cold winter day.
 - Avoid moving SI-W709 rapidly from a hot place to a cold place, and vice versa, because condensation may occur inside SI-W709.
 - Do not place SI-W709 too close to any radio-active device. Radio-active device may cause signal interference.
3. Handling
 - Avoid placing heavy objects on the top of SI-W709.
 - Do not allow any objects to fall into this device.
 - If water or other liquid spills into the device, unplug the power cord immediately.
4. Good Care
 - When the outside case gets stained, remove the stains using neutral washing agent with a dry cloth.
 - Never use strong agents such as benzene and thinner to clean the surface of the case.
 - If heavy stains are present, moisten a cloth with diluted neutral washing agent or alcohol and then wipe thoroughly with a dry cloth.
 - If dust is accumulated on the case surface, remove it by using a special vacuum cleaner for computers.

3

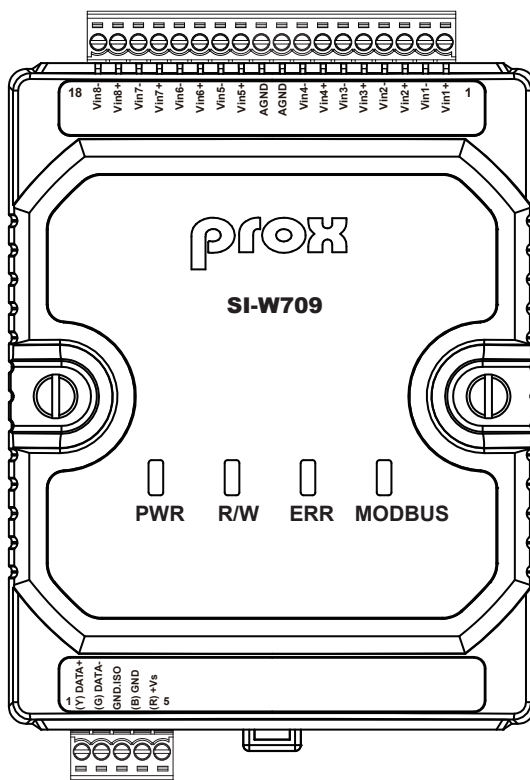
Hardware Configuration

This chapter describes the information of pin assignment, application wiring, mounting as well as default settings. It also provides technical support information.

The following topics are included:

- PIN Assignment
- Application Wiring
- Mounting Support
- Default Settings
- Technical Support

3.1 PIN Assignment

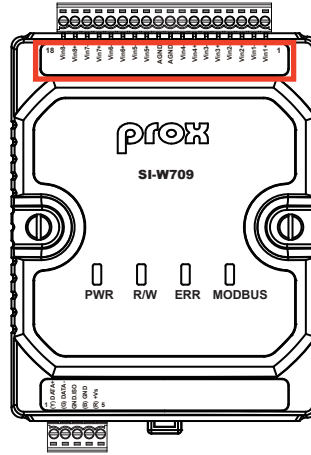


3.1.1 I/O Channel Connector

Connector Location: CN1

Description: I/O Channel Connector

PIN	ASSIGNMENT
1	Analog Input 1+
2	Analog Input 1-
3	Analog Input 2+
4	Analog Input 2-
5	Analog Input 3+
6	Analog Input 3-
7	Analog Input 4+
8	Analog Input 4-
9	Analog _GND
10	Analog _GND
11	Analog Input 5+
12	Analog Input 5-
13	Analog Input 6+
14	Analog Input 6-
15	Analog Input 7+
16	Analog Input 7-
17	Analog Input 8+
18	Analog Input 8-



CN1

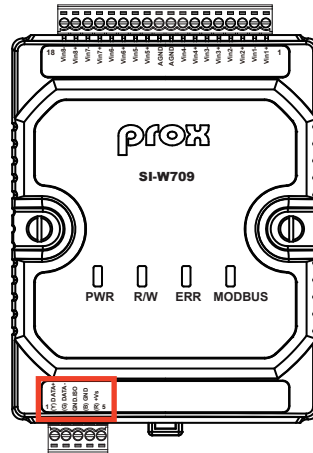
3.1.2 RS-485 and Power Connector

Connector Location: CN2

Description: RS-485 and Power Connector

PIN	ASSIGNMENT
1	(Y)DATA+
2	(G)DATA-
3	GND.ISO
4	(B)GND
5	(R)+Vs

Note: (R)+Vs: Define power supply voltage input range: +9 ~ +50V.



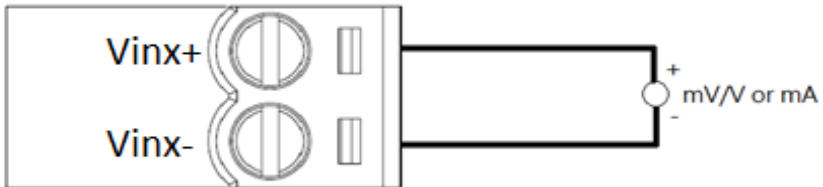
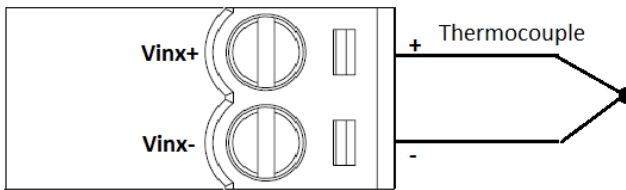
CN2

3.2 Application Wiring

3.2.1 I/O Wire Connection

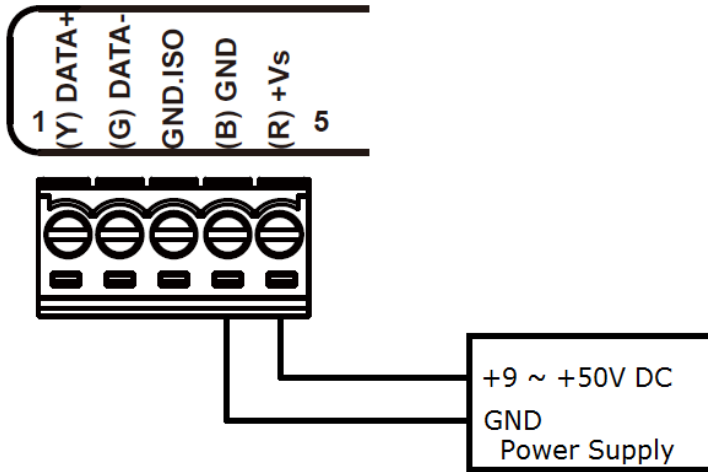
Analog Input Wire Connection

- **Voltage:** +-15 mV, +- 50 mV, +-100 mV, +- 500 mV, +-1V, +-2.5V
- **Current:** +-20mA, 0 ~ +20 mA, +4 ~ +20 mA



Note: Current Input needs an optional external 125Ω Resistor.

3.2.2 Power Supply Wire

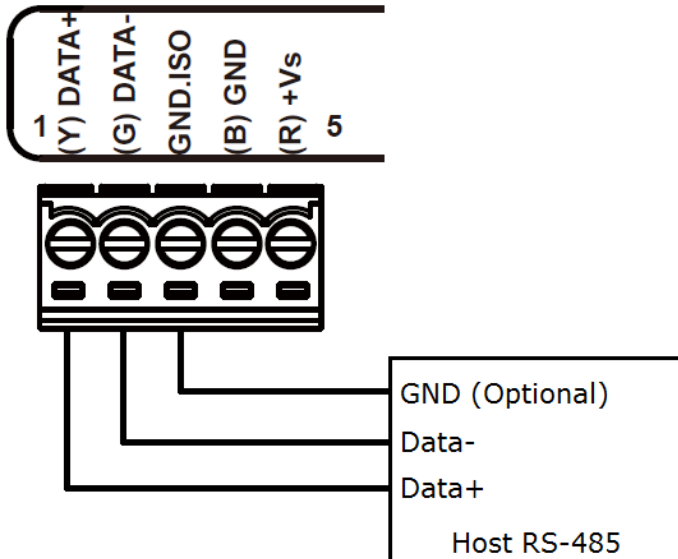


We suggest the following standard colors for each power line:

- (R)+Vs Red
- (B)GND Black

3.2.3 Communication Wiring

We recommend using shield-twisted-pair cable on SI-W709 I/O Module. And the cable has to comply with the EIA RS-485 standard. Only one set of twisted pair cable is required for transmitting data. For more stable power isolation, we recommend connecting **GND.ISO** pin to the **Ground** pin of the host.

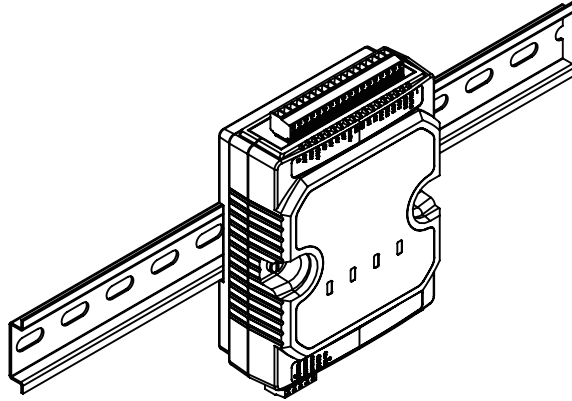


We suggest the following standard colors for each data line:

- | | |
|----------|------------------|
| (Y)DATA+ | Yellow |
| (G)DATA- | Green |
| GND.ISO | Black (Optional) |

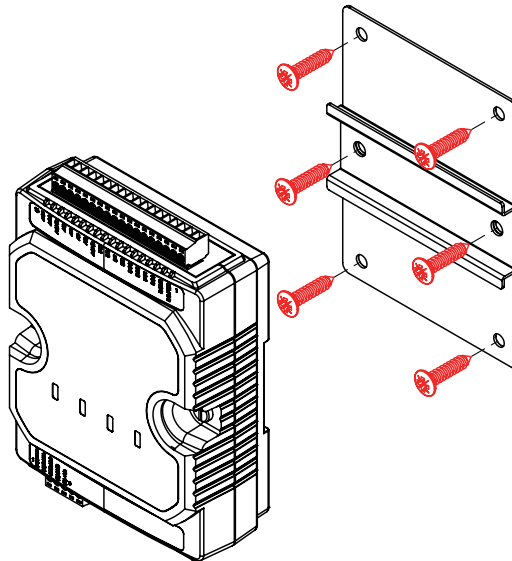
3.3 Mounting Support

3.3.1 Installing DIN-Rail Mount



3.3.2 Installing Wall Mount

- Step 1.** Prepare and fasten the 2 or 4 self-tapping T5 screws to tighten the wall mount kit onto the wall.
- Step 2.** Attach SI-W709 onto the wall mount kit installed on the wall to complete.



3.4 Default Settings

Before placing the I/O module in an RS-485 network, the module should be configured with factory default settings. It is recommended that you confirm the baud rate has been set correctly.

Default factory Settings of SI-W709 I/O Module are as below:

1. Device ID: 01h
2. Baud Rate: 115200 bps
3. Please refer to **Section 4.3 Address Mapping** for others.

3.5 Technical Support

If you have any technical question after you purchase our product, you can use the following form to contact our technical support staff.

https://www.protech.com.tw/Support/Technical_us.asp

When you request technical support, please provide the following information to our technical support staff.

1. Module Name and Serial Number: The serial number can be found printed on the barcode label attached on the rating label.
2. Firmware Version: Please refer to the Chapter 4 for the command to identify the firmware version of your I/O Module.
3. Host Configuration includes type and operating system
4. How to reproduce the technical question you meet? Please give full details to describe the procedures to reproduce the problem.
5. If the problem involves other hardware accessories or programs, please describe the details.
6. Any comments or suggestions related to the problem are welcome.

4 MODBUS RTU Protocol

This chapter contains helpful information about MODBUS RTU Protocol.

The following topics are included:

- Command Format
- Function List
- Address Mapping

The Modbus is a serial communication protocol which is published by Modicon Inc. Originally it is for use with Modicon programmable logic controllers. For more detailed information about Modbus, please visit <http://www.modbus.org/>.

SI-W709 Series I/O modules support the Modbus RTU protocol. The communication Baud Rates is up to 152000 bps. The communication interface is RS-485 with 2-wire (D+, D-) or 3-wire (D+, D-, ISO.GND). The maximum communication distance is 4000 feet (1.2 km). The command format is as below.

4.1 Command Format

4.1.1 READ Command

Command Format

ID	CMD	Address	CRC
1 Byte	1 Byte	2Byte	2Byte

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The Modbus commands are as 0x01, 0x02, 0x03...
- **Address:** The mapping address of register definition for SI-W709 Series.
- **CRC:** Cyclical Redundancy Check is produced by Modbus utility.

Response

ID	CMD	Length	Data	CRC
1 Byte	1 Byte	1 Byte	N-Byte	2 Bytes

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The command code is the same as Read command.
- **Length:** The data length
- **Data:** The readback data for the CMD
- **CRC:** Cyclical Redundancy Check is produced by firmware.

Error Response

ID	CMD	Address	Data	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The command code is the same as Read command.
- **Address:** The address of register definition for SI-W709 Series.
- **Data:** Error Code
- **CRC:** Cyclical Redundancy Check is produced by firmware.

4.1.2 WRITE Command

Command Format

ID	CMD	Address	Data	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2Bytes

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The Modbus commands are as 0x05, 0x06, 0x42...
- **Address:** The mapping address of register definition for SI-W709 Series.
- **Data:** Data Packet
- **CRC:** Cyclical Redundancy Check is produced by Modbus utility.

Response

ID	CMD	Length	Data	CRC
1 Byte	1 Byte	1 Byte	N-Byte	2 Bytes

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The command code is the same as Read command.
- **Length:** The data length
- **Data:** The responded data for the CMD
- **CRC:** Cyclical Redundancy Check is produced by firmware.

Error Response

ID	CMD	Address	Data	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

- **ID:** The Slave Device address is from 0 to 255.
- **CMD:** The command code is the same as Read command.
- **Address:** The address of register definition for SI-W709 Series.
- **Data:** Error Code
- **CRC:** Cyclical Redundancy Check is produced by firmware.

*If a CRC is mismatched, the module will not respond.

4.2 Function List

Function Code	Description	Section
0x03	Request the Value from Analog Channel	4.2.1
0x04	Read the sensor data of Analog Input Register	4.2.2
0x06	Set the Value or Range to the Analog Channel	4.2.3
0x41	Read Function Settings	4.2.4
0x42	Write Function Settings	4.2.5

Example:

1. Read Firmware Version

Command Packet:

ID	CMD	Address	CRC
0x01	0x41	0x00, 0x00	0x51, 0xCC

Return Data Packet:

ID	CMD	Length	Data	CRC
0x01	0x41	0x0D	0x30 0x30 0x30 0x2D 0x30 0x31 0x2D 0x31 0x39 0x30 0x34 0x32 0x35	0xFD 0xF2

2. Write and Switch to High at the channel 1 of Digital Output mode

Command Packet:

ID	CMD	Address	Value	CRC
0x01	0x05	0x10, 0x00	0x00 0x01	0x08, 0xCA

Return Data Packet:

ID	CMD	Length	Data	CRC
0x01	0x05	0x01	0x01	0xD1 0x89

3. Slave ID Address

Command Packet:

ID	CMD	CRC
0x01	0x11	0xC0, 0x2C

Return Data Packet:

ID	CMD	Length	Data	CRC
0x01	0x11	0x01	0x01	0x91 0x8D

4.2.1 Function 0x03 – Read Analog Input Channel Value

This function code is used to read the value of Analog Input Channel for SI-W709 module.

Request

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x03
02 ~ 03	Channel address	2 Bytes	<ul style="list-style-type: none"> • 0x3000~0x3007: Analog Input Channel Range • 0x32C0: Analog Input sampling rate
04 ~ 05	CRC	2 Bytes	Produced by utility.

Response-1

The channel address is 0x3000~0x3007, 0x32C0.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x03
02	Byte Count	1 Byte	1
03	Readback value	1 Bytes	Analog Input Channel Range Sampling Rate
04 ~ 05	CRC	2 Bytes	Produced by firmware.

Error Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x83
02	Data	1 Byte	0xCD: No function
03 ~ 04	CRC	2 Bytes	Produced by firmware.

4.2.2 Function 0x04 – Read Analog Input Channel Value

This function code is used to read the Analog Input Channel value of SI-W709 I/O module.

Request

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x04
02 ~ 03	Channel address	2 Bytes	<ul style="list-style-type: none"> • 0x4000~0x401C: Analog Input Channel Value • 0x4640: Get Temperature Value • 0x4650: Get Humidity Value
04 ~ 05	CRC	2 Bytes	Produced by utility.

Response-1

The channel address is 0x4000~0x401C.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x04
02	Byte Count	1 Byte	4
03 ~ 06	Readback value	4 Bytes	The Value of Analog Input Channel
07 ~ 08	CRC	2 Bytes	Produced by firmware.

Response-3

The channel address is 0x4640.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x04
02	Byte Count	1 Byte	2
03 ~ 04	Readback value	2 Bytes	<ul style="list-style-type: none"> • Temperature Value: 0xF060 ~0x30D4 (-40°C ~125°C)
05 ~ 06	CRC	2 Bytes	Produced by firmware.

Response-4

The channel address is 0x4650.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x04
02	Byte Count	1 Byte	1
03	Readback value	1 Byte	<ul style="list-style-type: none"> • Humidity Value: 0x00~0x64 (0% ~ 100%)
04 ~ 05	CRC	2 Bytes	Produced by firmware.

Error Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x84
02	Data	1 Byte	0xCD: No Function
03 ~ 04	CRC	2 Bytes	Produced by firmware.

4.2.3 Function 0x06 – Write Analog Input Channel Value

This function code is used to set the value of Analog Output Channel for SI-W709 module.

Request

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x06
02 ~ 03	Channel address	2 Bytes	<ul style="list-style-type: none"> • 0x3000~0x3007: Analog Input Channel Value • 0x32C0: Analog Input sampling rate
04	Output Value	1 Byte	Refer to Section 4.3 Address Mapping .
05 ~ 06	CRC	2 Bytes	Produced by utility.

Response-1

The channel address is 0x3000~0x3007.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x06
02	Byte Count	1 Byte	1
03	Readback value	2 Bytes	Analog Input Channel Value
04 ~ 05	CRC	2 Bytes	Produced by firmware.

Response-2

For channel address is 0x32C0.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x06
02	Byte Count	1 Byte	1
03	Readback value	1 Bytes	Analog Channel Range and Sample Rate
04~ 05	CRC	2 Bytes	Produced by firmware.

Error Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x86
02	Data	1 Byte	0xCD: No function
03 ~ 04	CRC	2 Bytes	Produced by firmware.

4.2.4 Function 0x41 – Read Module Setting

This function code is used to read SI-W709 module setting.

Request

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x41
02 ~ 03	Address of Holding Register	2 Bytes	<ul style="list-style-type: none"> • 0x0000: Firmware Version • 0x0010: Module Name • 0x0020: Baud Rate Setting
04 ~ 05	CRC	2 Bytes	Produced by utility.

Response-1

The channel address is 0x0000.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x41
02	Byte Count	1 Byte	0x0B: Firmware Version
03 ~ 0D	Readback Data	13 Bytes	The responded data for the CMD
0E ~ 0F	CRC	2 Bytes	Produced by firmware.

Response-2

The channel address is 0x0010.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x41
02	Byte Count	1 Byte	0x04: Module Name
03 ~06	Readback Data	4 Bytes	The responded data for the CMD
07 ~ 08	CRC	2 Bytes	Produced by firmware.

Response-3

The channel address is 0x0020.

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x41
02	Byte Count	1 Byte	0x01: Baud Rate setting
03	Readback Data	1 Bytes	The responded data for the CMD
04 ~ 05	CRC	2 Bytes	Produced by firmware.

Error Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0xC1
02	Data	1 Byte	0xCD: No Function
03 ~ 04	CRC	2 Bytes	Produced by firmware.

4.2.5 Function 0x42 – Write Module Setting

This function code is used to write SI-W709 module setting.

Request

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x42
02 ~ 03	Address of Holding Register	2 Bytes	<ul style="list-style-type: none"> • 0x0020: Baud Rate Setting • 0x0030: Device ID
04 ~ 05	Data Packet	2 Bytes	Refer to Section 4.3 Address Mapping .
06 ~ 07	CRC	2 Bytes	Produced by utility.

Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0x42
02	Byte Count	1 Byte	0x01
03	Readback Data	1 Bytes	Refer to Section 4.3 Address Mapping .
04 ~ 05	CRC	2 Bytes	Produced by firmware

Error Response

Offset	Description	Counts	Data
00	Slave ID address	1 Byte	1 to 255
01	Function Code	1 Byte	0xC2
02	Data	1 Byte	0xCD: No Function
03 ~ 04	CRC	2 Bytes	Produced by firmware.

4.3 Address Mapping

For SI-W709 Series, the Modbus Address mappings and definitions are as follows:

Address	Description	Attr.				
0000	Firmware Version (as : 00-20191126)	R				
0010	Module Name (String="W709")	R				
0020	Baud Rate Setting					R/W
	Code	0	1	2	3	
	Baud	9600	19200	38400	57600	
	Code	4				
	Baud	115200				
0030	Set Device ID Default: 01	W				
3000	Analog Input Channel 1 range 0 ~ 16 (Default:4)	R/W				
3001	Analog Input Channel 2 range 0 ~ 16 (Default:4)	R/W				
3002	Analog Input Channel 3 range 0 ~ 16 (Default:4)	R/W				
3003	Analog Input Channel 4 range 0 ~ 16 (Default:4)	R/W				
3004	Analog Input Channel 5 range 0 ~ 16 (Default:4)	R/W				
3005	Analog Input Channel 6 range 0 ~ 16 (Default:4)	R/W				
3006	Analog Input Channel 7 range 0 ~ 16 (Default:4)	R/W				
3007	Analog Input Channel 8 range 0 ~ 16 (Default:4)	R/W				
32C0	Set Analog Input Sampling Rate 10 ~ 200 Hz	R/W				
4000	Analog Input Channel 1 value Note 1	R				
4004	Analog Input Channel 2 value Note 1	R				
4008	Analog Input Channel 3 value Note 1	R				
400C	Analog Input Channel 4 value Note 1	R				
4010	Analog Input Channel 5 value Note 1	R				
4014	Analog Input Channel 6 value Note 1	R				
4018	Analog Input Channel 7 value Note 1	R				
401C	Analog Input Channel 8 value Note 1	R				

Address	Description	Attr.
4640	Get Temperature Value F060 ~ 30D4 (-40°C ~125°C)	R
4650	Get Humid Value 0 ~ 64h (0%~100%)	R

Note 1:

Negative: (FFFF8000 ~ 00007FFF) -32768 ~ 32767

Note 2:

Analog Input Range:

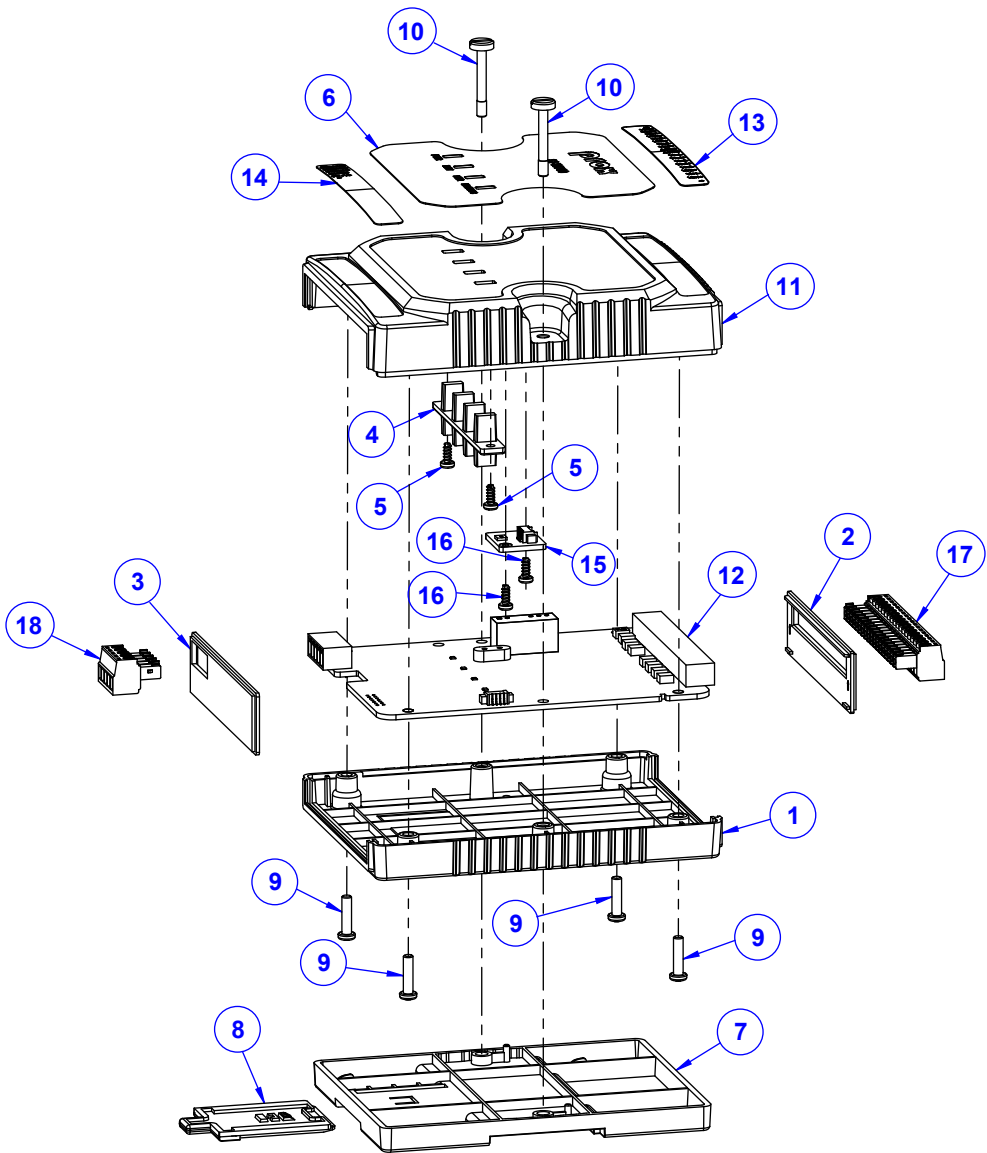
Value	Analog Input Range
00	±15mV
01	±50mV
02	±100mV
03	±500mV
04	±1V
05	±2.5V
06	±20mA
07	0~20mA
08	4~20mA
0A	Thermocouple K type
0B	Thermocouple B type
0C	Thermocouple E type
0D	Thermocouple J type
0E	Thermocouple R type
0F	Thermocouple S type
10	Thermocouple T type

Appendix A Exploded Diagrams

This appendix includes SI-W709 assembly exploded diagram and the parts list as well as SI-W709 part numbers.

- SI-W709 Assembly Exploded Diagram

SI-W709 Assembly Exploded Diagram



The list for the parts above is described on the next page.

No.	Component Name	P/N No.	Q'ty
1	SI-W109 Remote IO Rear Case (Blue)	30-001-12110468	1
2	SI-W109 Remote IO Top Plate (Blue)	30-009-12210468	1
3	SI-W109 Remote BTM IO Plate (Blue)	30-009-12110468	1
4	SI-W109 Light Pipe Short (Translucent)	30-021-02130468	1
5	Round Head Screw #1 / T2.6x6mm	22-135-26006011	2
6	SI-W709 Name Plate	94-017-01601476	1
7	SI-W109 Mount Bracket (Cool Gray 11C)	30-059-12110468	1
8	SI-W109 Mount Buckle (Cool Gray 11C)	30-059-12210468	1
9	Pan Head Screw M3x0.5Px12mm	22-222-30012811	4
10	M3xL22 Screw	22-272-30022021	2
11	SI-W109 Front Cover (Blue)	30-002-12110468	1
12	SR-W709 IO BD	SR-W709	1
13	SI-W709 Name Plate	94-017-01601476	1
14	SI-W709 Name Plate	94-017-01601476	1
15	Temperature and Humidity sensor	SR-W000RA-D0N	1
16	Round Head Screw #0 / T2.0x6mm	22-135-20006011	2
17	Terminal block, 18P	10-625-01810047	1
18	Terminal block, 5P	10-625-00510147	1

Engineering Analog Input value is 4 Byte float (IEEE_754) :

$$(-1)^S * (Fraction * 2^{(exp - 128)} + 1)$$

Analog Output Slew Rate

Value	Frequency	Value	Frequency	Value	Frequency	Value	Frequency
0	64K Hz	4	4K Hz	8	250 Hz	12	16 Hz
1	32K Hz	5	2K Hz	9	125 Hz	13	8 Hz
2	16K Hz	6	1K Hz	10	64 Hz	14	4 Hz
3	8K Hz	7	500 Hz	11	32 Hz	15	1 Hz

※ Exclude Enable/Disable the Analog Input channel function. It is performance reduction function. When we can't achieve 200Hz performance, consider again.

※ Increase Digit Output Clock Function

If you are using modbus tool, you do not need to calculate crc value. Else if you want verify the function by programming, you need to write crc to check function as :

```

unsigned int crc_chk(unsigned char* data, unsigned char length) {
    int j;
    unsigned int reg_crc=0xFFFF;
    while( length-- ) {
        reg_crc ^= *data++;
        for(j=0;j<8;j++){
            if(reg_crc & 0x01) /* LSB(b0)=1 */
                reg_crc=(reg_crc>>1) ^ 0xA001;
            else reg_crc=reg_crc>>1;
        }
    }
    return reg_crc;
}
    
```