

Stride® Field I/O

SIO-MB04THMS USER GUIDE

Temperature Input Module: thermocouple, 4-channel in



Manual Number: SIO-MB04THMS-UG

GENERAL DESCRIPTION

Modbus data is mapped in tables and assigned an address. Data can be of two types:

- REGISTER, 2 bytes (word of 16 bits) that can be associated to an analog input or output, a variable, a setpoint, etc.
- COIL, 1 bit that can be associated to a digital input or output, or to a logic state.

A register could contain the image (mirror) of a group of coils; for example, the system flags of the device could be read or written as individual bits addressing the coil related to each or can be read or written as a word addressing the register. Modbus registers and coils are divided into the following groups of addresses:

- 0xxxx and 1xxxx = Coils (bit)
- 3xxxx and 4xxxx = Registers (word)

When reading functions are performed, use the tables indicated below to address the registers. These registers may be addressed by a Modbus TCP/IP server or by the integrated web server.

REGISTER ADDRESSES		
Register	Description	Access
40002	Firmware [0]	RO
40003	Firmware [1]	RO
40004	-Reserved-	RO
40005	-Reserved-	RO
40007	Node ID	R/W
40011	System Flags	R/W
40013	Watchdog timer	R/W
40031	Input Type, Channel 0	R/W
40032	Input Type, Channel 1	R/W
40033	Input Type, Channel 2	R/W
40034	Input Type, Channel 3	R/W
40041	Analog Input (0) - Ch0	RO
40042	Analog Input (1) - Ch1	RO
40043	Analog Input (2) - Ch2	RO
40044	Analog Input (3) - Ch3	RO
40050	Break Status	RO
41218	Degree Units Channel 0	R/W
41219	Degree Units Channel 1	R/W
41220	Degree Units Channel 2	R/W
41221	Degree Units Channel 3	R/W
41241	Offset Channel 0	R/W
41242	Offset Channel 1	R/W
41243	Offset Channel 2	R/W
41244	Offset Channel 3	R/W

COIL ADDRESSES			
Coil (Hex)	Coil (Dec)	Description	Access
0x00A1	00161	Watchdog Enable	R/W
0x00A2	00162	Watchdog Event	R/W
0x00A3	00163	Power Up Event	R/W

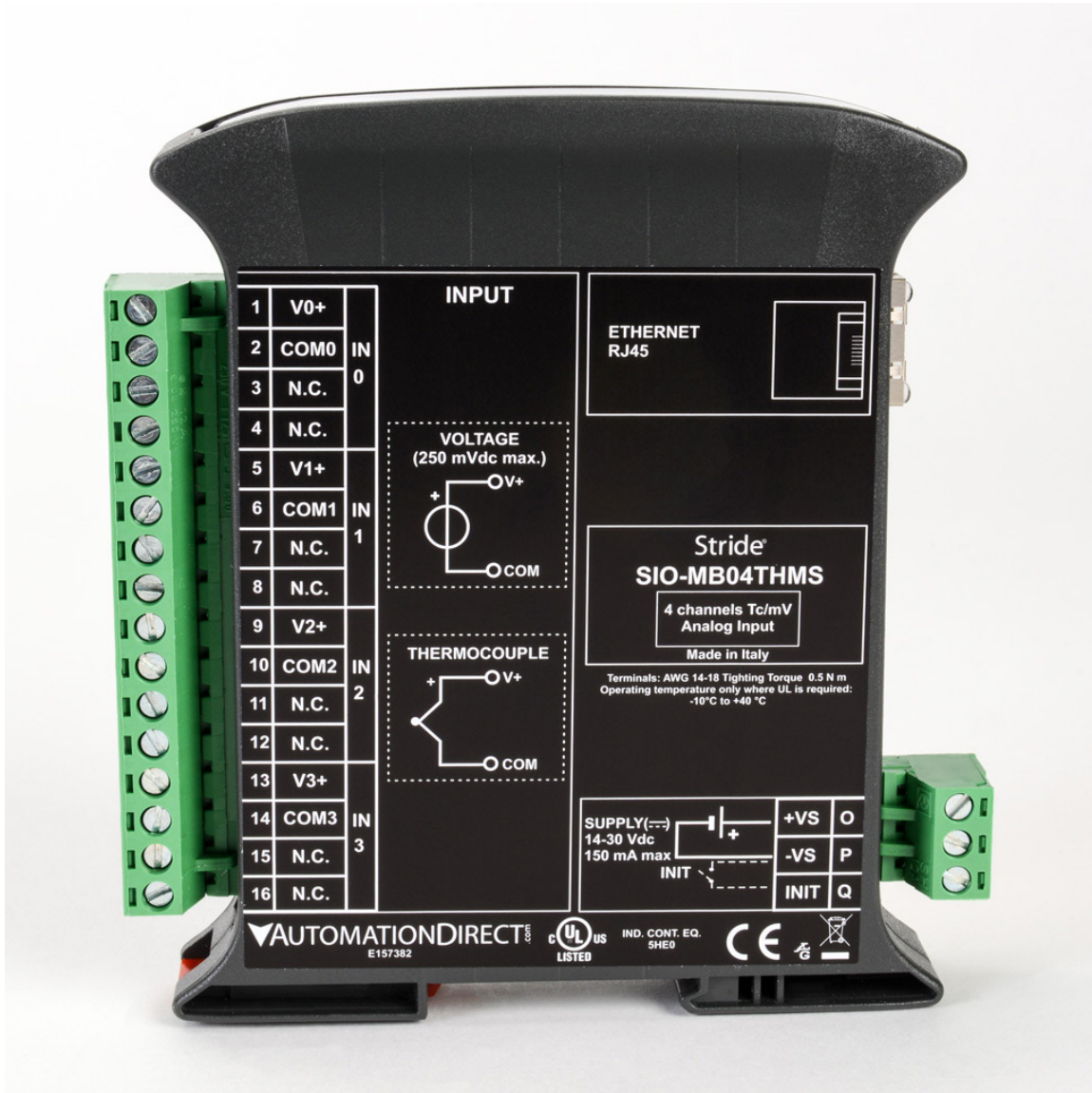
SUPPORTED MODBUS FUNCTION CODES	
Function	Description
01	Read Coil Status (0xxxx)
02	Read Inputs Status (1xxxx)
03	Read Holding Registers (4xxxx)
04	Read Inputs Registers (3xxxx)
05	Force Single Coil
06	Preset Single Register
15 (0x0F)	Force Multiple Coils
16 (0x10)	Preset Multiple Registers

NOTES:

- Registers and coils marked as RO in the column 'Access' are Read Only registers.
- Registers and coils marked as R/W in the column 'Access' are Read and Write registers.
- The group of 0xxxx addresses mirrors the group of 1xxxx addresses; the group of 3xxxx addresses mirrors the 4xxxx addresses. Therefore the first register could be addressed either as 30002 (with function 04) or 40002 (with function 03).
- A maximum of **128** coils can be read through Modbus function codes 01 and 02 (see "Supported modbus functions codes").
- A maximum of **64** registers can be read through Modbus function codes 03 and 04 (see "Supported modbus functions codes").
- A maximum of **64** registers can be written by Modbus function code 16 (see "Supported modbus functions codes").
- A maximum of **64** coils can be written by Modbus function code 15 (see "Supported modbus functions codes").

PRODUCT LABEL AND WIRING DIAGRAM

Terminal block pinouts and wiring diagrams are printed on the side of the module, as shown below.



DESCRIPTION OF MODBUS REGISTERS

40002 / 40003: FIRMWARE

Two read-only registers, containing the firmware version.

40007: NODE ID

Contains the Modbus address of the device; the values allowed are from 1 to 245 decimal.

This value must match the Modbus address of the connected Modbus device (data source).

Default value: 1 Decimal (01 Hex). INIT value: 245 Decimal (F5 Hex).

40011: SYSTEM FLAGS

Contains the enable bits and system event identifiers. The following parameters are configurable:

Watchdog Event Enable: this bit enables the Watchdog Event (0=Watchdog Disabled, 1 =Watchdog Enabled). If the Watchdog is enabled and the Watchdog Timer (configured in register 40013) expires before this device receives a Modbus command, the green PWR LED blinks and the Watchdog Event bit is set to 1. This bit must be set in logic on power up.

Watchdog Event: this bit is set to 1 when the Watchdog Timer expires before this device receives a Modbus command. This bit must be reset manually after a Watchdog event.

Power Up Event: this bit is forced to 1 at each time power is applied to the device to indicate that the device has been switched off or reset. With the setting of this bit as 0 (by the user) and checking its state, it is possible to know if a reset of the device has occurred (0 = reset not occurred; 1 = reset occurred). This bit must be reset manually.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Coil	-	-	-	-	-	163	162	161	-	-	-	-	-	-	-	-
Description																

40013: WATCHDOG TIMER

Contains the value of the Watchdog timer, in seconds. If the Watchdog is enabled and the device doesn't receive a command before this timer expires, the Watchdog bit will be set to 1 (see the description of "System Flags"). Default value: 10 (10 sec.).

40031: INPUT TYPE CHANNEL 0

40032: INPUT TYPE CHANNEL 1

40033: INPUT TYPE CHANNEL 2

40034: INPUT TYPE CHANNEL 3

These registers show the type of sensor configured for this input (see "Input Type Table").

Default: Tc K (05 Hex)

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Description	Input Type															

INPUT TYPE TABLE		
Type	Value (Hex)	Value (Dec)
Disabled	00h	0
250mV	01h	1
TC J	04h	4
TC K	05h	5
TC R	06h	6
TC S	07h	7
TC T	08h	8
TC B	09h	9
TC E	0Ah	10
TC N	0Bh	11

40041: ANALOG INPUT #0 VALUE

40042: ANALOG INPUT #1 VALUE

40043: ANALOG INPUT #2 VALUE

40044: ANALOG INPUT #3 VALUE

These registers return the measurement of each channel, converted to engineering units. The values are stored in the registers as 16-bit signed integers. Values for thermocouple sensor types are stored with one implied decimal place. Values are stored with two implied decimal places for mV inputs.

For example:

- Input type set as **Tc**: 246 stored in the register indicates 24.6°C
- Input type set as **mV**: 24656 stored in the register indicates 246.56 mV

NOTE: When INIT mode is active, the analog input measurements are not updated.

40050: BREAK STATUS

When a break condition is detected (e.g., broken sensor, disconnected cable, or over temperature) the bit corresponding to the channel is set to 1.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input	-	-	-	-	-	-	-	-	-	#3	-	#2	-	#1	-	#0
Description																

41218: DEGREE UNITS CHANNEL #0 VALUE

41219: DEGREE UNITS CHANNEL #1 VALUE

41220: DEGREE UNITS CHANNEL #2 VALUE

41221: DEGREE UNITS CHANNEL #3 VALUE

These registers contain the setting for the units in which to display temperature for each input. The values are 0 = Celsius (Default), 1 = Fahrenheit, and 2 = Kelvin.

The register format is a 16-bit unsigned integer.

DEGREE UNITS TABLE	
Type	Value (Hex)
Celcius	00h
Fahrenheit	01h
Kelvin	02h

41241: OFFSET CHANNEL #0 VALUE

41242: OFFSET CHANNEL #1 VALUE

41243: OFFSET CHANNEL #2 VALUE

41244: OFFSET CHANNEL #3 VALUE

These registers contain the offset values for each input.

The values are expressed in cents of mV for mV input and tenths of °C for Tc input.

The register format is a 16-bit unsigned integer.

WEB SERVER STRUCTURE

Login Screen

To access the server, open the web browser and enter the IP address of the device. Our examples use Chrome screen captures. Browsers may differ slightly.



Enter the Username and Password.

- Default username: admin
- Default password: password

Click **Login** to access the device as follows. Note that all pages include a **Logout** button to quit and return to the login page.

The device interface includes five configuration categories, as shown by the navigation menu on the left of the screen on the next page. Hovering over a navigation button will display a tooltip to describe the selection.

Network Settings

The screenshot shows the Stride I/O web interface. At the top left is the Stride I/O logo, and at the top right is a 'Logout' button. Below the logo is the device identifier 'SIO-MB04THMS'. A sidebar on the left contains several menu items: 'Network Settings' (highlighted with a green box and a mouse cursor), 'System Configuration', 'Software Update', 'Username and Password', and 'Analog Input'. A green callout box points to the 'Network Settings' menu item with the text: 'Set the Network parameters such as IP Address, Gateway Mask, Socket Timeout...'. The main content area is titled 'Enter the new network parameters and press SAVE' and contains the following fields:

- IP Address:** 192 | 168 | 1 | 100 | 192.168.1.100
- Subnet Mask:** 255 | 255 | 255 | 0 | 255.255.255.0
- Gateway Mask:** 192 | 168 | 1 | 1 | 192.168.1.1
- Socket Timeout:** 10 | min

A 'Save' button is located at the bottom right of the form area. At the bottom of the page, the URL 'www.automationdirect.com' is displayed.

On the Network Settings page, set the Ethernet communication parameters.

- **IP Address:** set the IP address of the device.
- **Subnet Mask:** set the subnet mask to match the local network.
- **Gateway Mask:** set the default gateway. A default gateway allows this device to communicate with devices on another subnet.
- **Socket Timeout:** set the timeout time in minutes; the device will close its TCP connection if it does not receive a command within this time period.

Click **Save** to apply and store the modified parameters. Wait for the device to reset. After modifying the network settings you will need to use the updated IP address to connect to the device, and may need to change the subnet mask on your PC.

System Configuration

On the System Configuration page, set the basic system parameters.

- **Name:** set a helpful name to identify this device; max 15 alphanumeric characters.
- **Modbus Address:** set the Modbus address of this device; the default value is 1. In INIT mode this value is temporarily set to 245.
- **Watchdog Enable** (ref. “System Flags” register): enables the Watchdog event (0 = Watchdog disabled, 1 = Watchdog enabled).
- **Timeout** (ref. “Watchdog timer” register): set the value in seconds of the Watchdog timer.
- **Watchdog Event** (ref. “System Flags” register): this flag signals that the Watchdog condition has occurred (0 = Normal condition; 1 = Alarm condition).
- **Power-up Event** (ref. “System Flags” register): this flag is forced to 1 at each power-on and indicates that the device has been switched off or a power cycle has occurred. (0 = power cycle has not occurred ; 1 = power cycle has occurred).

Click **Save** to apply and store the modified parameters. To read the parameters from the device click **Refresh**.

Software Update



When a software upgrade is required, click **Upgrade**.

- **Upgrade:** opens a dialog to enter credentials, select a file from the local PC and proceed with the update.
- **Firmware Version:** shows the firmware version loaded on the device.
- **WebPage Version:** shows the version of the web-based user interface loaded on the device.

Do not disconnect power from the device during the upgrade process.

Username and Password

Stride I/O

Logout

SIO-MB04THMS

Network Settings

System Configuration

Software Update

Username and Password

Analog Input

Enter new username and password!

Username: admin Max 15 characters

Password: password Max 15 characters

Save

www.automationdirect.com

Set the user name and password.

- **Username:** set the user name to access the device. Default “admin”.
- **Password:** set the password to access the device. Default “password”.

Click **Save** to apply and store the modified parameters.

Analog Input

The screenshot shows the Stride I/O web interface for the SIO-MB04THMS device. The page title is "SIO-MB04THMS" and the user is logged in. The sidebar contains navigation buttons: Network Settings, System Configuration, Software Update, Username and Password, and Analog Input. The main content area displays a table with the following data:

	Input Type	Offset	Value	Break
Analog In 0:	Tc K	0	1421.2	●
Analog In 1:	Tc K	0	1421.1	●
Analog In 2:	Tc K	0	1421.1	●
Analog In 3:	Tc K	0	1421.3	●

Below the table are buttons for "Set Same Input", "Read", and "Save". A green callout box points to the "Analog Input" button in the sidebar with the text "Sets the input type and displays the value". The website URL "www.automationdirect.com" is displayed at the bottom of the interface.

This page displays the values of the analog inputs in the unit of measurement defined by the “Input Type”. Each input is electrically isolated from all others and can be configured independently.

- **Read:** retrieves current value and break status from the device for all channels.
- **Input Type** (ref. “Input Type” registers): sets the desired type of sensor connected to the input. A channel can be disabled by selecting “Disabled” as its input type.
- **Value** (ref. “Analog Input” registers): shows the current value of each analog input.
- **Break** (ref. “Break” register): indicates the connectivity status of the sensor. If a sensor is disconnected, a wire is broken or the sensor is over temperature, a red indicator is shown under the break column at that channel.
- **Offset:** sets an offset value to be added to the raw sensor reading to calibrate the sensor.
- **Set Same Input:** sets all channels to the input type selected for the first channel (Analog In 0).

Click **Save** to apply and save all changes on the page.

INIT, RESET AND WATCHDOG FUNCTIONS

INIT Function

The INIT function facilitates access to a device when there is a problem accessing it at its configured IP address. The configured username and password are required for INIT access.

The INIT terminal is adjacent to the power terminals. Applying power to the device while the INIT terminal is shorted to the -VS terminal causes the device to request a temporary IP address from the DHCP server on the network. If there is no DHCP server on the network, the device will temporarily use 192.168.1.174.

The temporary INIT mode Modbus ID is 245.

Once connected in INIT mode, device network parameters (IP address, subnet mask, etc.) may be changed to conform to the requirements for your industrial network. Other parameters may also be modified while INIT mode is active. Once the short (or jumper) is removed from the INIT and -VS terminals, the device can be accessed using the user-configured IP address, username, and password.

NOTE: If not using DHCP, verify that 192.168.1.174 is not in use on your network and ensure that the 192.168.1.n network is accessible to your computer.

To use the INIT function:

- Before applying power to the device, short the INIT terminal to the -VS terminal.
- Apply power to the device and connect the RJ45 Ethernet port to your computer.
- Open a browser and type 192.168.1.174 or the DHCP-assigned address in the address field.
- Browse through the user interface to view configuration settings and data, or change configuration settings.
- When all changes are complete and saved, disconnect power from the device.
- Remove the connection shorting the INIT and -VS terminals.
- Apply power to the device and access it from a browser using the configured IP address, user name and password.

NOTE: When INIT mode is active, the analog input measurements are not updated.

Hardware Reset to Default

With the device powered and not in INIT mode, push and hold the RESET button located on the front of the device for 5 seconds. The green PWR LED will switch off, the yellow STS LED will turn orange and the device will reset.

When the reset procedure is finished, both LEDs will be in the default condition and the following parameters will be set:

- **IP Address:** 192.168.1.100
- **Subnet Mask:** 255.255.255.0
- **Default Gateway:** 192.168.1.1
- **Modbus Address:** 1
- **Username:** admin
- **Password:** password

Watchdog Function

The device is equipped with a Watchdog timer. If enabled, it activates an alarm each time that there is not communication between the device and the master for a time greater than that specified.

During this alarm condition the green PWR LED on the front of the device blinks and the “Watchdog Event” coil is forced to 1. To exit from the alarm condition, send any command to the device and reset the “Watchdog Event” coil.

NOTE: When the device is switched off the state of the “Watchdog Enable” bit remains stored in EEPROM.