

# Stride<sup>®</sup> Field I/O

## SIO-MB04RTDS USER GUIDE

Temperature Input Module: RTD, 4-channel



Manual Number: SIO-MB04RTDS-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    |

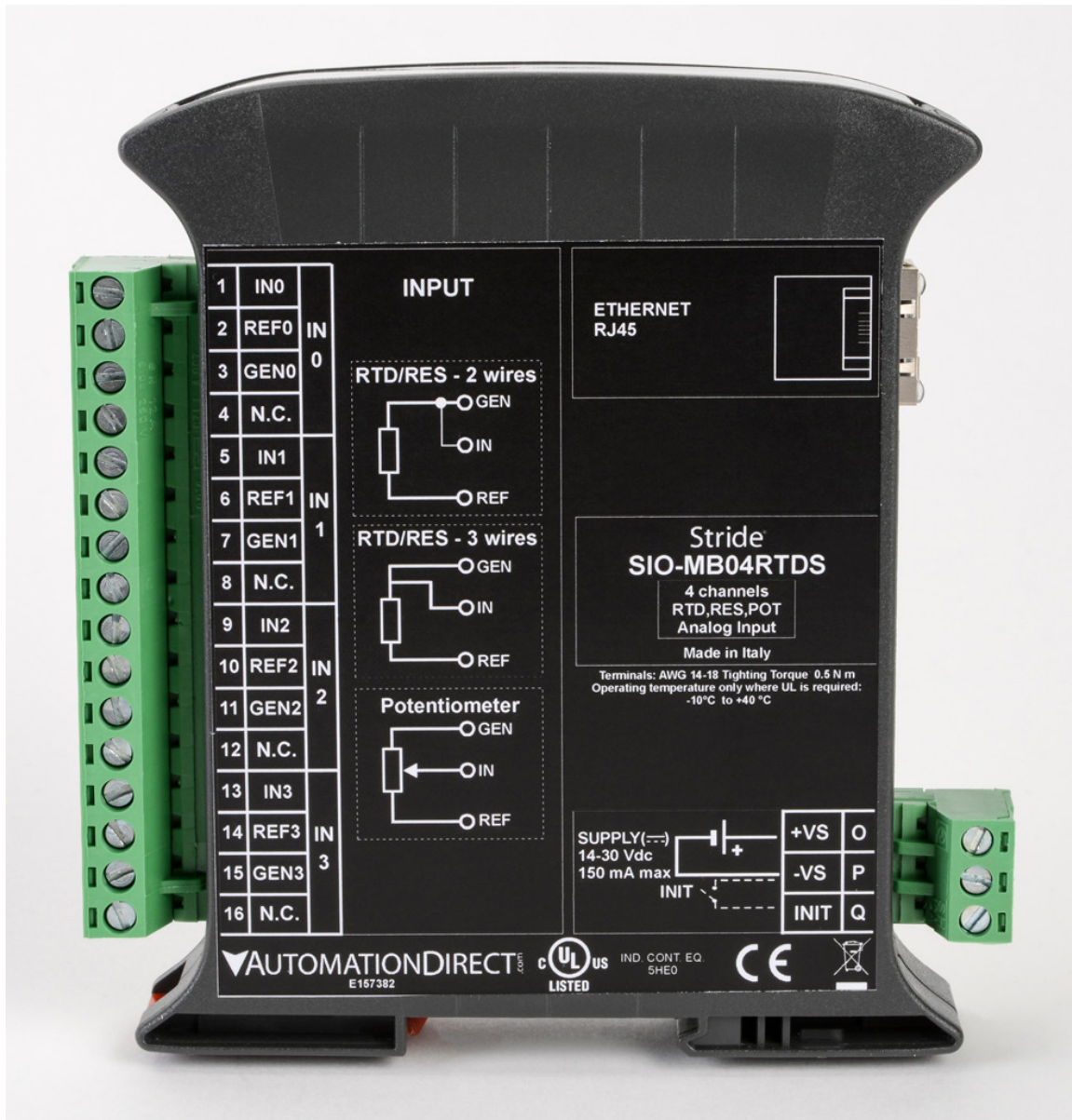
| SUPPORTED MODBUS FUNCTION CODES |                                |
|---------------------------------|--------------------------------|
| Function                        | Description                    |
| 01                              | Read Coil Status (0xxxx)       |
| 02                              | 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: Pt100 (0D 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) |
| Disabled            | 00h         |
| Resistor 0–2000 Ohm | 12h         |
| Resistor 0–500 Ohm  | 0Ch         |
| Pt100               | 0Dh         |
| Ni100               | 0Fh         |
| Pt1000              | 0Eh         |
| Ni1000              | 10h         |
| Pot. < 50 kOhm      | 11h         |

**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 the RTD and Res 500 Ohm sensor types are stored with one implied decimal place. Values are stored as integer ohms for Res 2000 ohm sensors, and one decimal place is implied for Potentiometer inputs.

For example:

- Input type set as **RTD**: 246 stored in the register indicates 24.6°C
- Input type set as **Potentiometer**: 400 stored in the register indicates 40% of the nominal maximum value of the potentiometer
- Input type set as **Res 2000 Ohm**: 1256 stored in the register indicates 1256 Ohms
- Input type set as **Res 500 Ohm**: 1352 stored in the register indicates 135.2 Ohms

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 | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Break input #3</p> <p>Break input #2</p> <p>Break input #1</p> <p>Break input #0</p> </div> <div style="width: 50%; border-left: 1px solid black; padding-left: 10px;"> </div> </div> |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

**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) |
| Celsius            | 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 ohms for the Res 2000 ohm input, tenths of ohm for Res 500 ohm input, tenths of % for the potentiometer input and tenths of °C for the RTD 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.



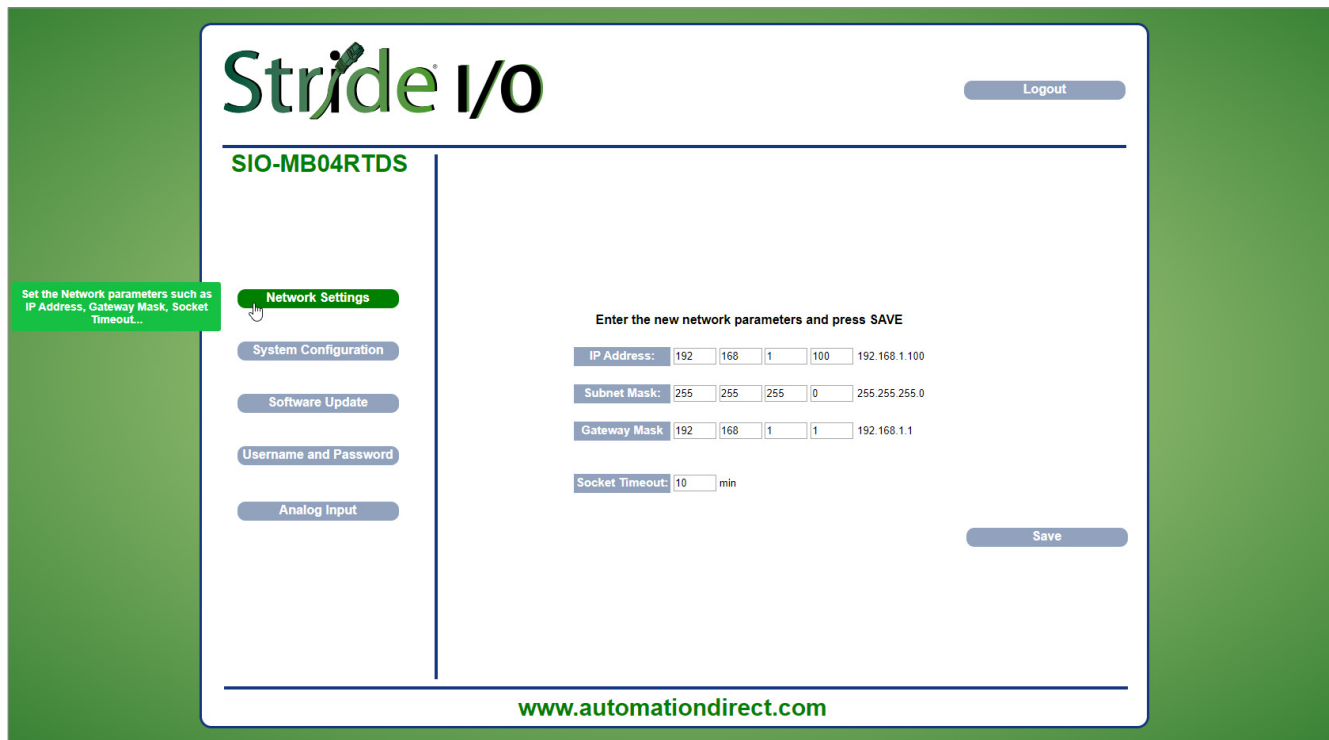
Enter the Username and Password.

- 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



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

**Stride I/O** Logout

**SIO-MB04RTDS**

Network Settings

**System Configuration**

Software Update

Username and Password

Analog Input

Name: SIO-MB04RTDS

Modbus Address: 1

MAC Address: 80:1F:12:03:F0:13

WatchDog Enable:  TimeOut: 10 (max 255 s)

WatchDog Event:

PowerUp Event:

Refresh

Save

www.automationdirect.com

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

The screenshot displays the Stride I/O web interface for the SIO-MB04RTDS device. The page features a navigation menu on the left with the following options: Network Settings, System Configuration, Software Update, Username and Password (highlighted), and Analog Input. The main content area is titled "Enter new username and password!" and contains two input fields: "Username: admin" and "Password: password", both with a "Max 15 characters" limit. A "Save" button is located to the right of the password field. The Stride I/O logo and a "Logout" button are at the top right. The website URL "www.automationdirect.com" is at the bottom.

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

**Stride I/O** Logout

**SIO-MB04RTDS**

Network Settings

System Configuration

Software Update

Username and Password

**Analog Input**

|              | Input Type  | Offset | Value | Break |
|--------------|-------------|--------|-------|-------|
| Analog In 0: | Pt100       | 0      | 852   | ●     |
| Analog In 1: | Res 500 ohm | 0      | 852   | ●     |
| Analog In 2: | Ni100       | 0      | 852   | ●     |
| Analog In 3: | Pot         | 0      | 852   | ●     |

Set Same Input    Read    Save

www.automationdirect.com

Sets the input type and displays the value

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.