# Stride®
# Field I/O

## SIO-MB12CDR
## USER GUIDE

**Discrete Combo Module: 8-point in, 4-point out**


Manual Number: SIO-MB12CDR-UG

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## 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 digital inputs or outputs of a 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 where each bit corresponds to a coil. 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 |
| 40012 | Power Up / Safe | R/W |
| 40013 | Watchdog timer | R/W |
| 40031 | Digital Outputs | R/W |
| 40032 | Digital Inputs | RO |
| 40033 | Digital Inputs Rise Latch | R/W |
| 40034 | Digital Inputs Fall Latch | R/W |
| 40035 | Frequency, Digital Input 0 | RO |
| 40036 | Frequency, Digital Input 1 | RO |
| 40037 | Frequency, Digital Input 2 | RO |
| 40038 | Frequency, Digital Input 3 | RO |
| 40039 | 32-bit Counter, Digital Input 0 | R/W |
| 40041 | 32-bit Counter, Digital Input 1 | R/W |
| 40043 | 32-bit Counter, Digital Input 2 | R/W |
| 40045 | 32-bit Counter, Digital Input 3 | 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 |

**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 |
| 0x01E9 | 00489 | Output #0 | R/W |
| 0x01EA | 00490 | Output #1 | R/W |
| 0x01EB | 00491 | Output #2 | R/W |
| 0x01EC | 00492 | Output #3 | R/W |
| 0x01F9 | 00505 | Input #0 | RO |
| 0x01FA | 00506 | Input #1 | RO |
| 0x01FB | 00507 | Input #2 | RO |
| 0x01FC | 00508 | Input #3 | RO |
| 0x01FD | 00509 | Input #4 | RO |
| 0x01FE | 00510 | Input #5 | RO |
| 0x01FF | 00511 | Input #6 | RO |
| 0x0200 | 00512 | Input #7 | RO |
| 0x0209 | 00521 | Rising Edge Latch #0 | R/W |
| 0x020A | 00522 | Rising Edge Latch #1 | R/W |
| 0x020B | 00523 | Rising Edge Latch #2 | R/W |
| 0x020C | 00524 | Rising Edge Latch #3 | R/W |
| 0x020D | 00525 | Rising Edge Latch #4 | R/W |
| 0x020E | 00526 | Rising Edge Latch #5 | R/W |
| 0x020F | 00527 | Rising Edge Latch #6 | R/W |
| 0x0210 | 00528 | Rising Edge Latch #7 | R/W |
| 0x0219 | 00537 | Falling Edge Latch #0 | R/W |
| 0x021A | 00538 | Falling Edge Latch #1 | R/W |
| 0x021B | 00539 | Falling Edge Latch #2 | R/W |
| 0x021C | 00540 | Falling Edge Latch #3 | R/W |
| 0x021D | 00541 | Falling Edge Latch #4 | R/W |
| 0x021E | 00542 | Falling Edge Latch #5 | R/W |
| 0x021F | 00543 | Falling Edge Latch #6 | R/W |
| 0x0220 | 00544 | Falling Edge Latch #7 | R/W |

**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 | | | | | | | | | | | | | | | | |

Watchdog Event enable
Watchdog Event
Power Up Event

### 40012: **POWER UP / SAFE**

At power up (Power Up) and in the case of a Watchdog alarm (Safe), the outputs are automatically forced to the values set in this register. Each bit of the register corresponds to a digital output, as shown below. Default: 0

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

### 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: **DIGITAL OUTPUTS**

This register allows control of all output relays at once. For each bit in the register, 0 = OFF and 1 = ON. In addition to using this register, it is also possible to read and write each output using Modbus coil functions and the appropriate addresses from the "Coil Addresses" table.

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

## 40032: **DIGITAL INPUTS**

This register contains the status of all digital inputs (0 = OFF; 1 = ON). In addition to using this register, it is also possible to read each input using Modbus coil functions and the appropriate addresses from the "Coil Addresses" table.

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input | - | - | - | - | - | - | - | - | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |

## 40033: **DIGITAL INPUTS RISE LATCH**

Each bit of this register latches high (1) on a rising edge of its corresponding input. Once the latch is set, it must be cleared by writing a 0 to the latch bit before it will register another rising edge transition. In addition to using this register, it is also possible to read and write each bit using Modbus coil functions and the appropriate addresses from the "Coil Addresses" table.

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Latch | - | - | - | - | - | - | - | - | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |

## 40034: **DIGITAL INPUTS FALL LATCH**

Each bit of this register latches high (1) on a falling edge of its corresponding input. Once the latch is set, it must be cleared by writing a 0 to the latch bit before it will register another falling edge transition. In addition to using this register, it is also possible to read and write each bit using Modbus coil functions and the appropriate addresses from the "Coil Addresses" table.

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Latch | - | - | - | - | - | - | - | - | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |

## 40035: **FREQUENCY DIGITAL INPUT 0**
## 40036: **FREQUENCY DIGITAL INPUT 1**
## 40037: **FREQUENCY DIGITAL INPUT 2**
## 40038: **FREQUENCY DIGITAL INPUT 3**

These registers contain the frequency of pulses occurring on digital input channels 0–3, respectively. The value is in 16-bit unsigned integer format, with units of hundredths of Hertz (i.e., Hertz with an implied two decimal places). The maximum measurable value of frequency is 300.00 Hz.

## 40039–40040: **32-BIT COUNTER DIGITAL INPUT 0**
## 40041–40042: **32-BIT COUNTER DIGITAL INPUT 1**
## 40043–40044: **32-BIT COUNTER DIGITAL INPUT 2**
## 40045–40046: **32-BIT COUNTER DIGITAL INPUT 3**

Each of these pairs of registers shows the value of a 32-bit counter that increments at each rising edge of its respective input channel. The counter values are stored as unsigned 32-bit integers, using two registers each.

At power-on of the device, the value of each counter is set to 0. The value can be reset to 0 by writing to the registers.

## WEB SERVER STRUCTURE

### Login Screen

The embedded web server uses the HTTP (unsecure) protocol on port 80. 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.

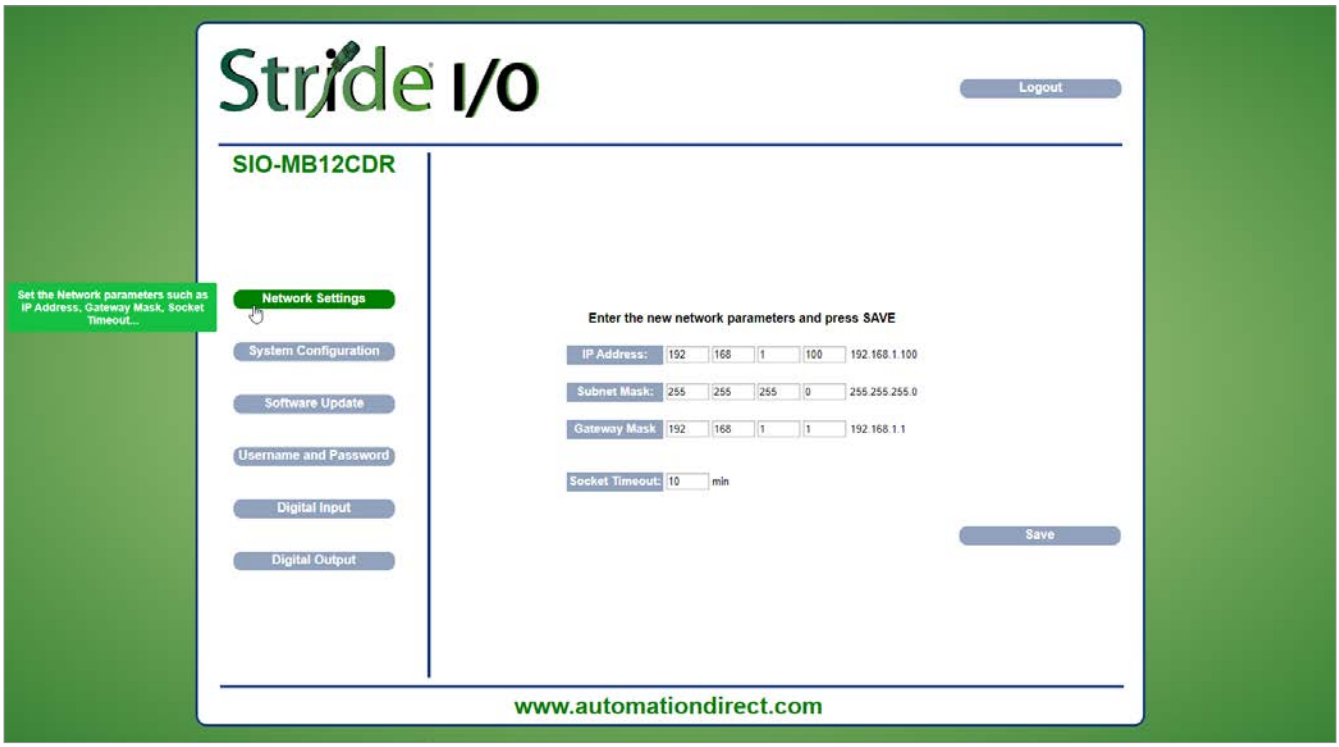

Enter the Username and Password.

- 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 six 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.

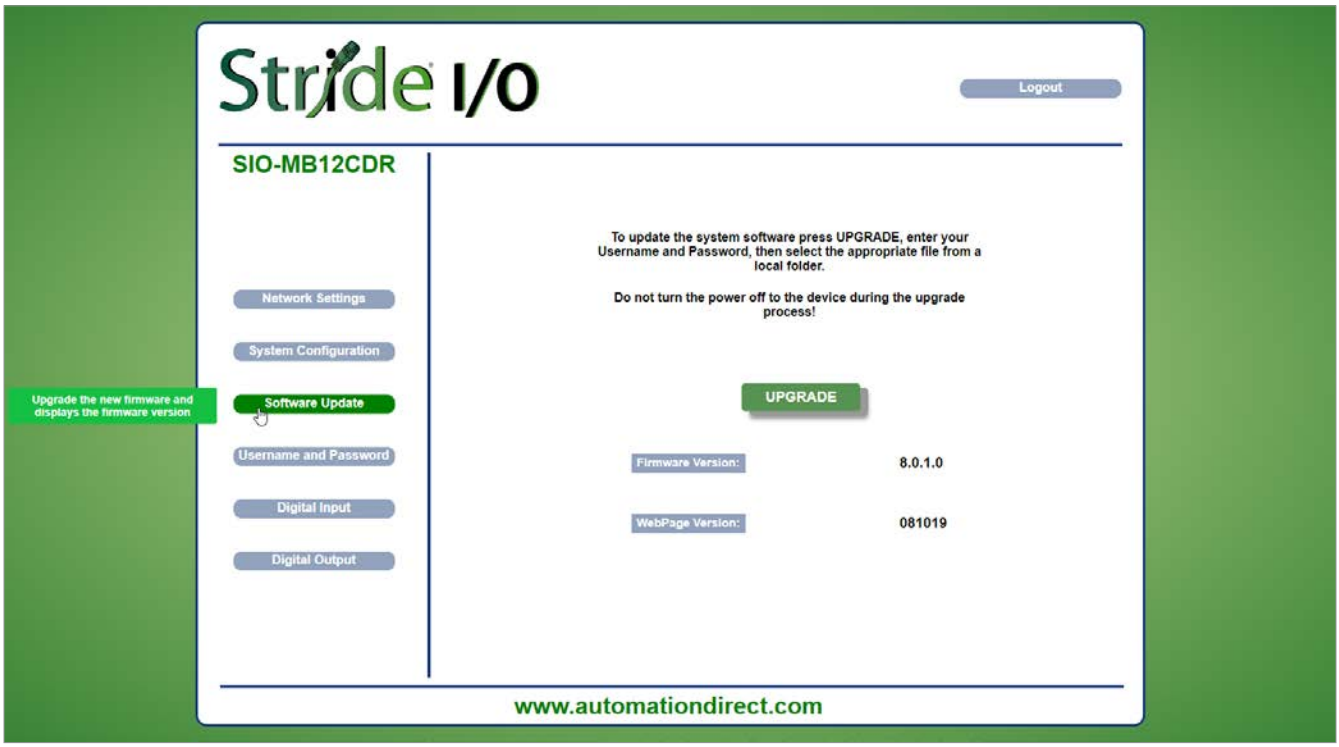
## System Configuration


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

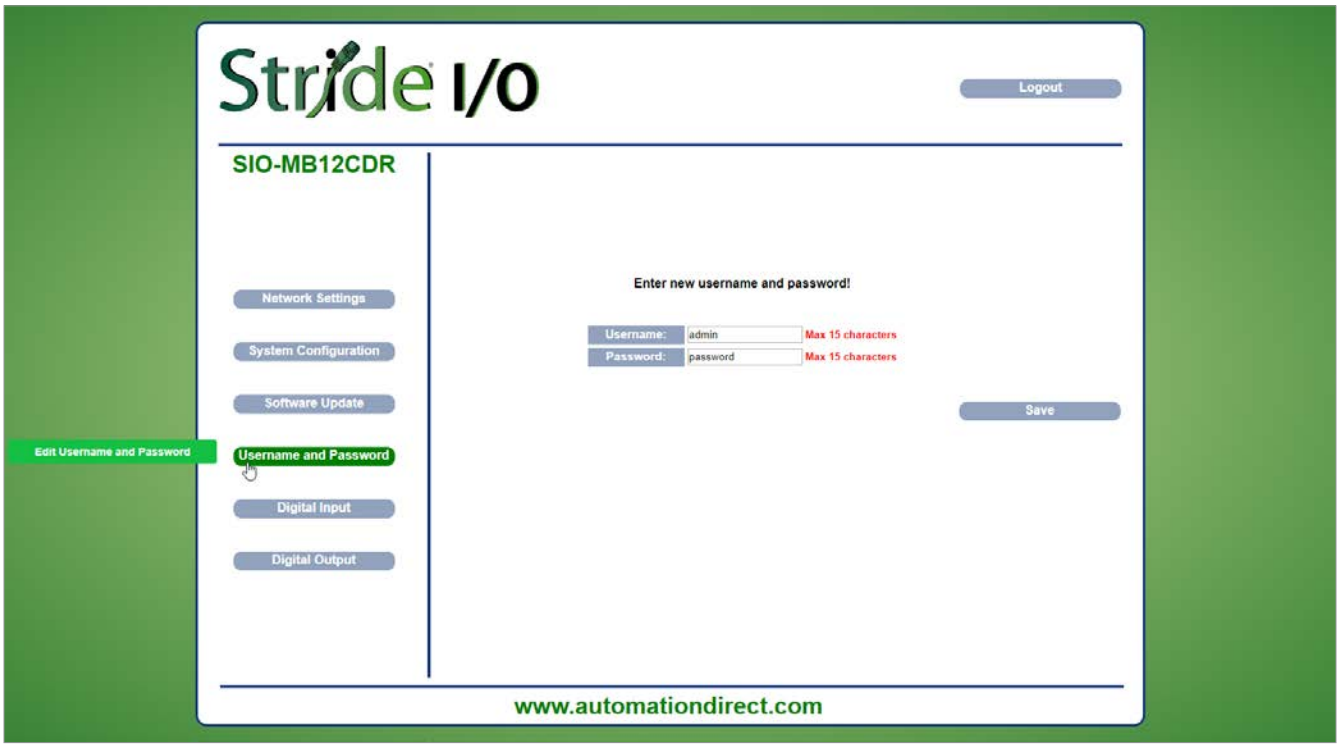



When a software upgrade is required, click **Upgrade**.

- **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

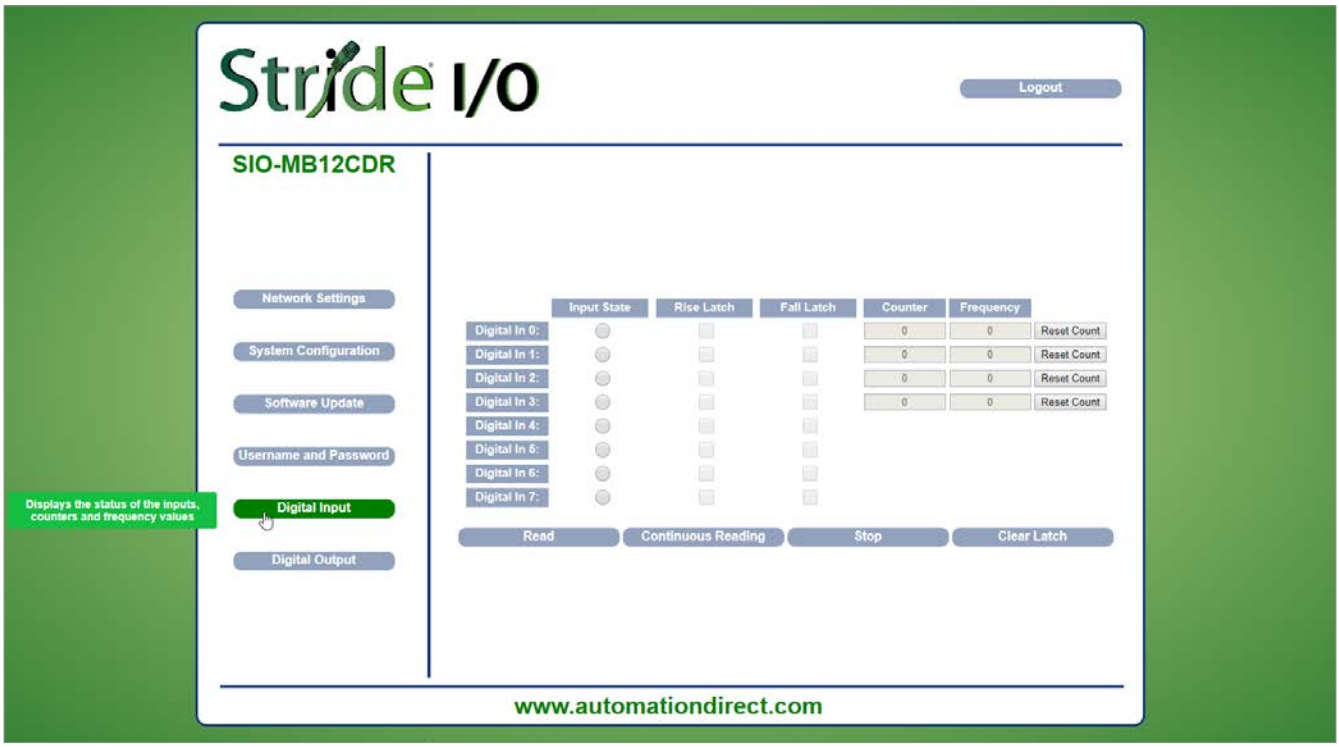



Set the user name and password.

- **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.

## Digital Input




This page displays the state of the digital inputs and their associated latches.

- **Read**: retrieves current values for all channels (one time)
- **Continuous Reading**: continuously retrieves current values for all channels
- **Stop**: stops continuous reading
- **Input State** (ref. "Digital Inputs" register): indicates the state of each digital input. The indicator will be filled (red) when the digital input's state is 1 (ON).
- **Rise Latch** (ref. "Digital Inputs Rise Latch" register): indicates the state of the rising edge latch for each digital input.
- **Fall Latch** (ref. "Digital Inputs Fall Latch" register): indicates the state of the falling edge latch for each digital input.
- **Counter** (ref. "32 bit Counter Digital Input" registers): indicates the current value of the counter register associated with each input.
- **Frequency** (ref. "Frequency Digital Input" registers): indicates the current value of the frequency register associated with each input.
- **Clear Latch**: resets all latches.
- **Reset Count**: resets the counter register associated with the digital input.

## Digital Output


This page displays the values of and allows writing to the digital outputs, and allows configuration of the PowerUp and Watchdog settings for each output.

- **Refresh**: retrieves current values and updates the page display.
- **Output State** (ref. "Digital Outputs" register): indicates the state of each digital output. The indicator will be green when the digital output's state is ON (logic state 1), and gray with the digital output's state is OFF (logic state 0).
- **Power Up** (ref. "PowerUp/Safe" register): indicates and sets the output logic state for the Power Up event (ref. "System Flags" register).
- **Watchdog** (ref. "PowerUp/Safe" register): indicates and sets the output logic state for the Watchdog event (ref. "System Flags" register).

## 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.

### 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.

In alarm condition, the output values are automatically set to the values specified in the relevant “Safe” registers. 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.