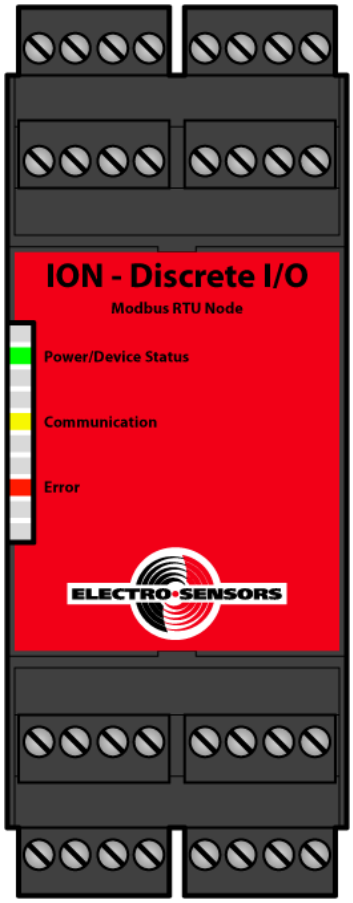
ION – Discrete I/O

Modbus RTU Node

USERS MANUAL



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Description

The ION Discrete I/O Modbus RTU Node is a 24Vdc powered, DIN rail mountable industrial I/O device with six discrete contact-closure/NPN/sinking type signal inputs (In1 → In6), three dc sensor power outputs, six FORM A relays (R1 → R6) and a Modbus RTU/RS485 slave interface. Inputs may be read and relay states read/written at any time over Modbus.

Installation/Mounting

Attaching to DIN rail

Orient the unit vertically with the LED LENS on the LEFT and the ROTARY SWITCHES (located behind the removable front cover) on the RIGHT (see Figure 1).

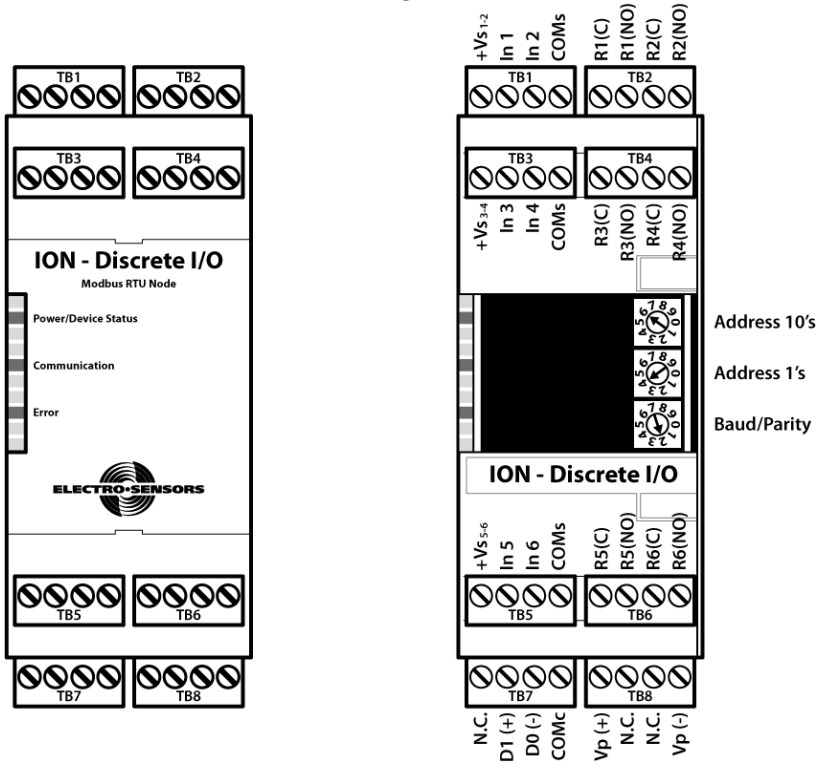
Slide the rear clip bottom groove onto the DIN rail bottom edge (rear clip springs should be pointing up and behind the rail bottom edge).

While pushing UP on the unit (compressing the rear clip springs), push the unit BACK until the rear clip top clears the rail top edge and snaps into place.

Detaching from DIN rail

Push the unit UP (compressing the rear clip springs) until the clip top can tilt free from the DIN rail top edge, tilt the unit top slightly forward enough to free it. Be careful not tilt too much (the rear clip springs can break).

Now lower the unit to free it from the rail bottom edge.



(front cover on) **(front cover off)**

Figure 1

Terminal blocks (see Figure 1)

Switch/sensor input terminals are organized into 3 pluggable 4-terminal blocks (**TB1, TB3, TB5**), each with:

1 Sensor DC power output terminal (+Vs)
2 Switch/sensor signal input terminals (In)
1 Signal common terminal (COMs)

Relay contact terminals are organized into 3 pluggable 4-terminal blocks (**TB2, TB4, TB6**):

2 isolated FORM A relays, each with a C (common) and NO (normally open) terminal per terminal block.

Modbus RTU/RS485 terminals are located on 1 pluggable 4-terminal block (**TB7**) with:

1 unused (N.C.) terminal
1 D1 (+) terminal (EIA/TIA-485 B)
1 D0 (-) terminal (EIA/TIA-485 A)
1 COMc common terminal (EIA/TIA-485 C)

24Vdc Power In terminals are located on 1 pluggable 4-terminal block (**TB8**) with:

1 Vp(+) terminal for connecting 24Vdc +
2 unused terminals (N.C.)
1 Vp(-) terminal for connecting 24Vdc –

Wiring switches and sensors to inputs (see Figure 1 and Figure 2)
Connect switches and/or compatible sensors to TB1/TB3/TB5 as shown in Figure 2.
Each input (In1 … In6) has an internal 10kΩ pull-up resistor and senses whether or not it is externally shorted to COMs.
Each +Vs terminal provides (40mA max) DC power for sensors.

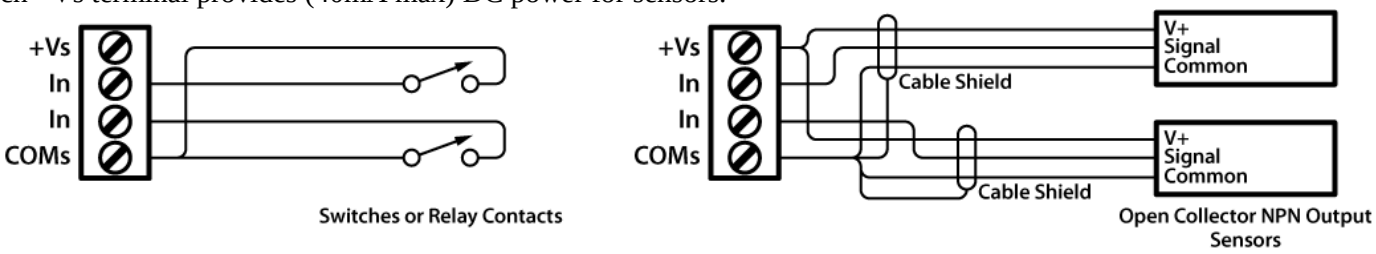


Figure 2

Setting the rotary switches (see Figure 1)
Three rotary switches (two slave Address, one Baud/Parity) are located under the removable front cover.
Remove the front cover by prying it free at the indented pry points (re-attach it after switches are set).
Set the slave Address switches to a UNIQUE value (in range 01 → 99; do not set to 00) within the Modbus network.
Set the Baud/Parity switch for the SAME baud rate, parity and stop bit setting as ALL other devices on the network.

Serial Baud/Parity switch

Setting	Baud rate	Data bits	Parity / Stop bits
0	9.6k	8	None / 2
1	19.2k	8	None / 2
2	38.4k	8	None / 2
3	57.6k	8	None / 2
4	115.2k	8	None / 2
5	9.6k	8	Even / 1
6	19.2k	8	Even / 1
7	38.4k	8	Even / 1
8	57.6k	8	Even / 1
9	115.2k	8	Even / 1

Table 1

Note: In Figure 1 the Address is 64 and the Baud / Parity / Stop settings are 38.4k / 8 / None / 2.

Data discrete input and relay output states are represented by single bits in Modbus registers, inputs and coils (below).

Reading discrete input (In1 … In6) states

Modbus Function Code	Data	Address
02 (read multiple input status)	In1 … In6	10001 … 10006 (respectively)
03 (read multiple holding registers)	See 16-bit register view (below)	40001
04 (read multiple input registers)	See 16-bit register view (below)	30001

0	0	0	0	0	0	0	0	0	0	In6	In5	In4	In3	In2	In1

Reading/writing relay output (R1 … R6) states

Modbus Function Code	Data	Address
01 (read multiple coil status)	R1 … R6	00001 … 00006 (respectively)
03 (read multiple holding registers)	See 16-bit register view (below)	40002
04 (read multiple input registers)	See 16-bit register view (below)	30002
05 (force single coil)	R1 … R6	00001 … 00006 (respectively)
06 (preset single holding register)	See 16-bit register view (below)	40002
15 (force multiple coils)	R1 … R6	00001 … 00006 (respectively)
16 (preset multiple holding registers)	See 16-bit register view (below)	40002

0	0	0	0	0	0	0	0	0	0	R6	R5	R4	R3	R2	R1

Notes:
1 indicates a CLOSED state: input (In1 … In6) shorted to COMs; relay (R1 … R6) contacts closed.
0 indicates an OPEN state: input (In1 … In6) not shorted to COMs; relay (R1 … R6) contacts open.
Writing holding register 40001 is permitted but has no effect (In1 … In6 state data doesn't change).
The registers have a maximum value 0x003F – when writing holding registers, fill the (ten) unused bits with 0s.

LED operation

Power/Device status (green)	ON:	Device is powered
Communication (yellow)	ON:	Device is polled by a Modbus master at least once per second
Error (red)	ON:	Internal fault
	Flashing:	Communications fault (e.g. incorrect slave address, baud rate, message length; CRC or character error)

Specifications

DC Power input (Vp)	
V (Vp(+) – Vp(-))	24Vdc ±5%
I	230mA (max) – sensor power outputs (+Vs) fully loaded, relays energized
NOTE	Apply 24Vdc power across the TB8 Vp(+) and Vp(-) terminals. See Figure 1. DO NOT apply power to Modbus RTU/RS485 terminals.
Sensor DC power outputs (+Vs)	
V	Vp – 1V
I	40mA (max)
	Each +Vs output terminal is protected by an internal device which shuts off power when overloaded. To reset a +Vs terminal's power, remove ALL load from that terminal and wait 1 minute.
Discrete signal inputs (In1 … In6)	
Compatibility	Switches, relays and NPN open-collector (sinking) sensors / signal-sources
Rin	10kΩ (pull-up to Vp – 1V)
Closed (low) threshold	0.8V (max)
Open (high) threshold	2.2V (min)
Response time	400mS (changed input state must persist for 400mS before changing in Modbus)
Relay outputs (R1 … R6)	
Type	FORM A
V(max switching)	277 VAC, 30VDC
I (max switching)	1A
Response time	50mS (max - from end of Modbus write query, to relay coil state change)
RS485 serial port	
Isolation voltage	1kV (min)
Differential output voltage	1.5V (min) @ 54Ω line impedance
Configuration	2-wire RS485
Baud/Parity/Stop-bits	(see Table 1) set with 1 rotary Baud/Parity switch (see Figure 1)
NOTES	Connect the TB7 terminals to a half-duplex "2-wire" configured RS485 network: D1(+), D0(-) and COMc terminals - see p. 2 Terminal Blocks and Fig 1. DO NOT connect power sources to TB7 terminals or the RS485 network.
Modbus RTU slave	
Query → response latency	1mS (max) - query end to response start
Slave address	(01 → 99) set directly with 2 rotary slave Address switches (see Figure 1)
Supported function codes	See Reading discrete inputs states and Reading/writing relay outputs states.
Supported data addresses	See Reading discrete inputs states and Reading/writing relay outputs states.
Electrical isolation/grounding	3 isolated electronic circuits: sensors/power, internal digital and RS485 port. The sensors and 24Vdc power input (Vp) share the same circuit. All relay contact pairs are isolated from each other and everything else.
Operating temperature	-40 → +85°C (-40 → +185°F)
Dimensions	4.65 in (118 mm) H, 1.77 in (45 mm) W, 4.88 in (124 mm) D
Weight	0.55 Lb (0.25 kg)