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Core IO - CR-IO-8DI

User Manual

8 Point Modbus I/O Module, 8 DI

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INTRODUCTION

Overview

In many installations, having cost effective, robust, and simple hardware becomes a key factor in winning a project. The Core line up provides the perfect solution to meet these criteria. Innon have partnered with Atimus, a company with a wealth of experience in the field, and are proud to present Core IO!

The 8DI provides 8 digital inputs. As well as monitoring volt free contacts, the device also allows the use of pulse counters.

BEMS communication is based on the robust and well proven Modbus RTU over RS485 or Modbus TCP (IP model only).

The configuration of the device can be achieved through the network using either the web interface (IP version only) or Modbus configuration registers, or by using an Android device and connecting over Bluetooth using the dedicated app.

This Core IO model

Both the CR-IO-8DI-RS and the CR-IO-8DI-IP modules come with 8 digital inputs.

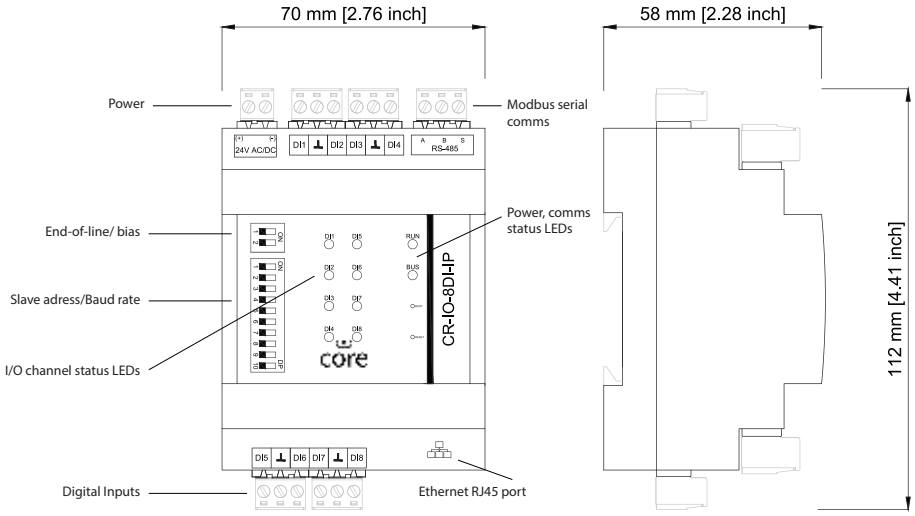
The CR-IO-8DI-RS only comes with the RS485 port, while the CR-IO-8DI-IP comes with both RS485 and IP ports.

Both models also come with Bluetooth on-board, so configuration can be achieved using an Android device and the dedicated app.

The IP CR-IO-8DI-IP model also integrates a web server configuration interface, accessible via a PC web browser.

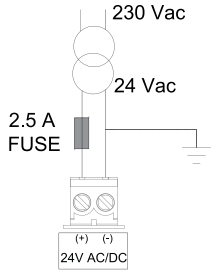
HARDWARE

Overview

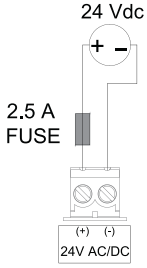


Wiring Power Supply

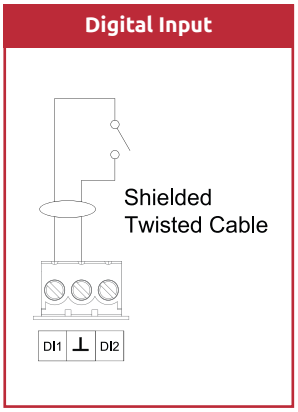
AC (24Vac)



DC (24Vdc)



Wiring Digital Inputs (DI)



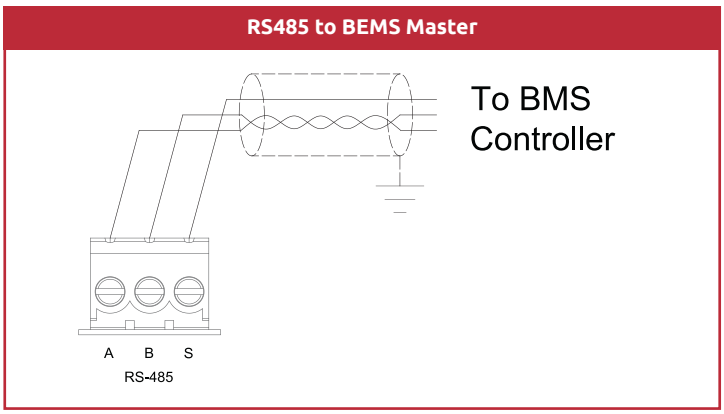
Wiring the RS485 network

Some useful links to our knowledge base website:

How to wire an RS485 network
https://know.innon.com/howtowire-non-optoisolated

How to terminate and bias an RS485 network
https://know.innon.com/bias-termination-rs485-network

Please note - both IP and RS versions can use the RS485 port to respond to serial Modbus master comms from the BEMS, but neither version can use the RS485 port to act as a Modbus master or gateway.



Front LED Panel

The LEDs in the front panel can be used to get direct feedback on the status of the I/Os of Core IO and more general information.

Below are some tables that will help decode each LED behaviour –

DI 1 to 8		
Digital Input Mode	**Conditions**	**LED Status**
Direct	Open circuit	LED OFF
	Short circuit	LED ON
Reverse	Open circuit	LED ON
	Short circuit	LED OFF
Pulse input	Receiving a pulse	LED blinks ON for every pulse

BUS and RUN		
LED	**Conditions**	**LED Status**
RUN	**Core IO not powered**	**LED OFF**
	Core IO correctly powered	**LED ON**
BUS	**Data being received**	**LED blinks Red**
	Data being transmitted	**LED blinks Blue**
	Bus polarity problem	**LED ON Red**

CONFIGURE I/O

Digital Inputs

Digital Inputs can have a clean/volt free contact connected to Core IO to read its open/closed status.

Each digital input can be configured to be either:

- Digital Input direct
- Digital Input reverse
- Pulse input

While the “direct” and “reverse” mode would basically return status “False (0)” or “True (1)” when the contact is either open or closed, the third mode “pulse input” is used to return a counter value increasing by 1 unit every time the digital input closes; please read section below for more details regarding pulse counting.

Pulse Counting

Digital Inputs and Universal Outputs can be configured specifically to work as pulse counting inputs.

The counting maximum readable frequency is 100Hz, with a duty cycle of 50% and the maximum “contact closed” readable resistance is 50ohm.

When an input is configured to count pulses, a number of Modbus Registers are available with information and commands specifically for the pulse counting function.

The pulse input will, in fact count 2 totalizers as follows –

- The first one is continuous; it will increase by one unit for every pulse received and will keep counting until a reset command is sent over Modbus

- The other totalizer is timed. Basically, it will also increase by one unit for every pulse received but will count only for a specified (adjustable) time (in minutes). When the time expires, this second counter will start counting again from “0” immediately, repeating the cycle, but will hold the last resulting value for a minute in the register (counting the next cycle in the background)

Each pulse counting input has the following Modbus registers associated with it –

• **counter (totalizer):** this is the main totalizer. It will go back to “0” only if a reset command is sent, or if Core IO is power cycled – you can also write to this value to restore a previous count if replacing a module or to reset to 0

• **counter (timer):** this is the second totalizer, the timed one. It will go back to “0” every time the timer reaches the maximum set value (with delay of 1 minute), or if Core IO is power cycled. If the counter reset is activated, the counts within the timed cycle will be ignored and the counter timer reset to 0. The reset will not reset this count to 0 after it has finished a timed cycle and is displaying the result for 1 minute

• **counter timer:** this data point returns the current time of the counter, in minutes. It will of course go back to “0” when it reaches the maximum set value

• **counter timer set:** using this data point you can configure the duration of the timer for the second totalizer (max set value), in minutes. This value is stored within the Core IO memory

• **counter reset:** using this data point you can reset totaliser counter to value “0” and the timed counter will discard counts up to that point in the timed cycle and reset its timer to 0. Core IO will self-reset this data point to value “0” once the command has been executed

CONFIGURING THE DEVICE

FIXED SETTINGS

The RS485 Modbus Slave communication have some settings that are fixed as follows –

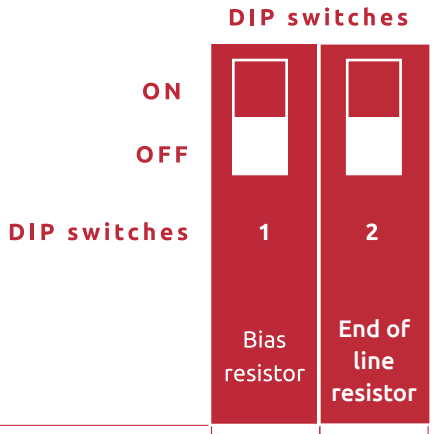
- 8-bit data length
- 1 stop bit
- Parity NONE

DIP SWITCH SETTING

The DIP switches are used to configure the other RS485 settings and the Modbus slave address thus –

- RS485 End-Of-Line (EOL) resistor
- RS485 Bias resistors
- Modbus Slave Address
- RS485 Baud-Rate

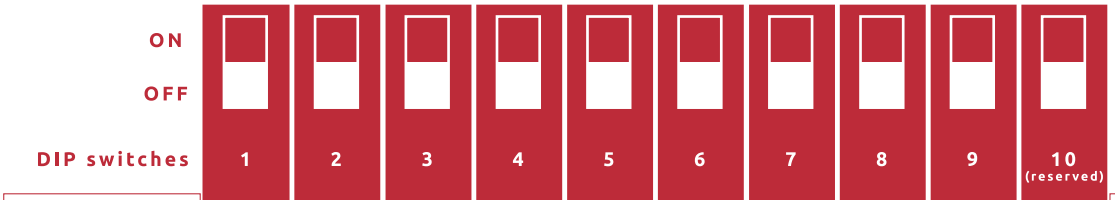
The bank of two EOL (End-Of-Line) blue DIP switches are configured as follows –



No bias, no termination	OFF	OFF
Bias active, no termination	ON	OFF
No bias, termination active	OFF	ON
Bias active, termination active	ON	ON

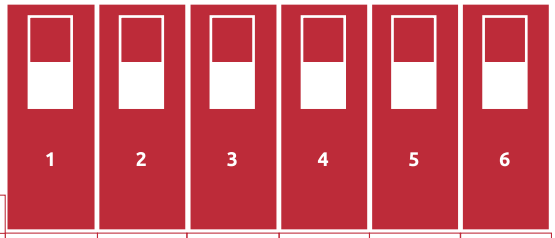
Please check our dedicated knowledge base article available at the website **http://know.innon.com** where we explain in detail the use of the termination and bias resistors on RS485 networks.

The Modbus ID and baud rate DIP switches are configured as follows –



Slave address										Baud rate
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	4800 Kbps
2	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	9600 Kbps
3	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	19200 Kbps
4	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	38400 Kbps
5	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	57600 Kbps
6	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	ON	76800 Kbps
7	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	115200 Kbps
8	OFF	OFF	OFF	ON	OFF	OFF	ON	ON	ON	230400 Kbps
9	ON	OFF	OFF	ON	OFF	OFF				
10	OFF	ON	OFF	ON	OFF	OFF				
11	ON	ON	OFF	ON	OFF	OFF				
12	OFF	OFF	ON	ON	OFF	OFF				
13	ON	OFF	ON	ON	OFF	OFF				
14	OFF	ON	ON	ON	OFF	OFF				
15	ON	ON	ON	ON	OFF	OFF				
16	OFF	OFF	OFF	OFF	ON	OFF				
17	ON	OFF	OFF	OFF	ON	OFF				
18	OFF	ON	OFF	OFF	ON	OFF				
19	ON	ON	OFF	OFF	ON	OFF				
20	OFF	OFF	ON	OFF	ON	OFF				
21	ON	OFF	ON	OFF	ON	OFF				
22	OFF	ON	ON	OFF	ON	OFF				
23	ON	ON	ON	OFF	ON	OFF				
24	OFF	OFF	OFF	ON	ON	OFF				
25	ON	OFF	OFF	ON	ON	OFF				
26	OFF	ON	OFF	ON	ON	OFF				
27	ON	ON	OFF	ON	ON	OFF				
28	OFF	OFF	ON	ON	ON	OFF				

Slave address DIP switch settings, continued.



Slave address						
29	ON	OFF	ON	ON	ON	OFF
30	OFF	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	ON	OFF	OFF	OFF	OFF	ON
34	OFF	ON	OFF	OFF	OFF	ON
35	ON	ON	OFF	OFF	OFF	ON
36	OFF	OFF	ON	OFF	OFF	ON
37	ON	OFF	ON	OFF	OFF	ON
38	OFF	ON	ON	OFF	OFF	ON
39	ON	ON	ON	OFF	OFF	ON
40	OFF	OFF	OFF	ON	OFF	ON
41	ON	OFF	OFF	ON	OFF	ON
42	OFF	ON	OFF	ON	OFF	ON
43	ON	ON	OFF	ON	OFF	ON
44	OFF	OFF	ON	ON	OFF	ON
45	ON	OFF	ON	ON	OFF	ON
46	OFF	ON	ON	ON	OFF	ON
47	ON	ON	ON	ON	OFF	ON
48	OFF	OFF	OFF	OFF	ON	ON
49	ON	OFF	OFF	OFF	ON	ON
50	OFF	ON	OFF	OFF	ON	ON
51	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	OFF	ON	ON
53	ON	OFF	ON	OFF	ON	ON
54	OFF	ON	ON	OFF	ON	ON
55	ON	ON	ON	OFF	ON	ON
56	OFF	OFF	OFF	ON	ON	ON
57	ON	OFF	OFF	ON	ON	ON
58	OFF	ON	OFF	ON	ON	ON
59	ON	ON	OFF	ON	ON	ON
60	OFF	OFF	OFF	ON	ON	ON
61	ON	OFF	ON	ON	ON	ON
62	OFF	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON

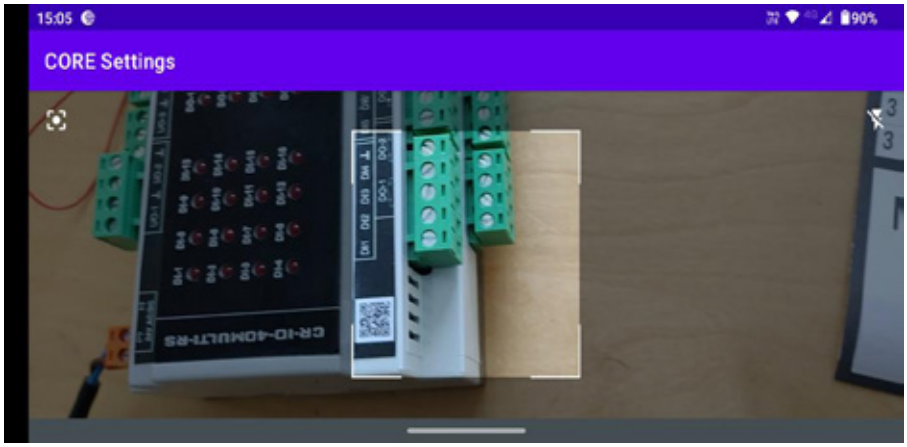
Bluetooth and Android App

Core IO has built-in Bluetooth which allows the Core Settings app running on an Android device to configure the IP settings and I/O.

Please download the app from Google Play – search for “core settings”
Download and install the app, then check/make the following settings changes –

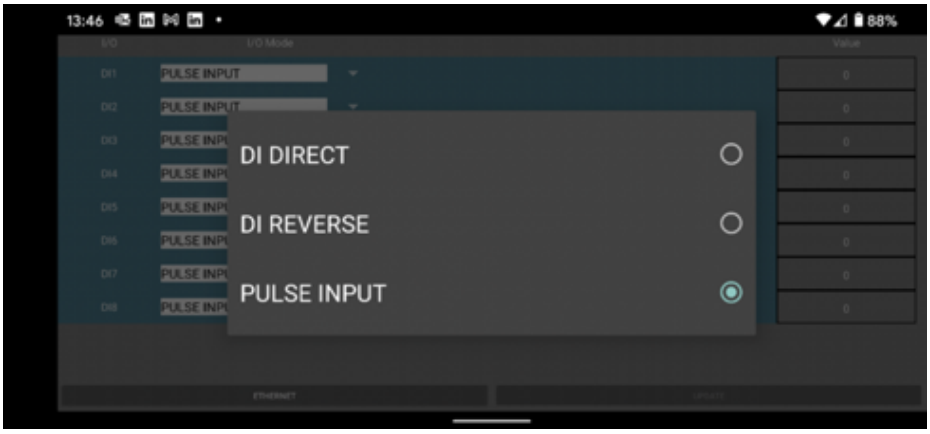
- Open your phone settings (drag down from top, press “cog” icon)
- Click on “Apps”
- Select “Core Settings” app
- Press “Permissions”
- Press “Camera” – set to “Allow only while using the app”
- Go back then press “Nearby devices” – set to “Allow”

When you run the app, the camera will switch on, and you will need to use it to read the QR code on the module you wish to set up, i.e. –



The Android device will ask you to allow the Bluetooth devices to pair on the first connection, watch out for the notifications on your device and accept them.

Once connected, you will land on the I/O setup screen, where you can set up the I/O and read input and output current values –



Use the drop-down arrows in the “I/O Mode” column to select the type of input type by clicking in the respective radio button –

Once you make a change or number of changes, the “UPDATE” button on the bottom right will go from greyed-out to white; press this to commit your changes.

Click on the “ETHERNET” button (bottom left) to set-up the required IP settings.
Set and commit data as per the I/O method above.

Click on “MODE” button (bottom left) to get back to the I/O settings.

Ethernet Port and Web Server Configuration (IP version only)

For the IP models of Core IO, a standard RJ45 socket is available to be used for:

- Modbus TCP (slave) communication
- Web server access to configure the device

The IP models still provide access on the RS485 port for Modbus RTU (slave) communication on these models, so the user can decide which one to use to connect the BEMS to Core IO.

The default settings of the IP port are:

IP address:	192.168.1.175
Subnet:	255.255.255.0
Gateway address:	192.168.1.1
Modbus TCP port:	502 (fixed)
Http port (web server):	80 (fixed)
Web server user:	atimus (fixed)
Web server password:	HD1881 (fixed)

IP address, subnet and gateway address can be changed from the Bluetooth Android app or from the web server interface.

The web server interface looks and works in much the same way as the Core Settings app described in the previous section.

BEMS POINT LISTS

Modbus Register Types

Unless otherwise stated in the tables, all I/O point values/statuses and settings are held as Holding Register Modbus data type and use a single register (16 bit) to represent an Integer (Int, range 0 - 65535) type of data.

Pulse count registers are 32-bit long, unsigned registers, i.e. two consecutive 16-bit registers combined, and their byte order is sent in little endian, i.e. –

• Niagara/Sedona Modbus driver – 1032

• Teltonika RTU xxx – 3412 – also use 2 x “Register count/values” to obtain all 32 bits

For some Modbus master devices, the decimal and hex register addresses in the table will need to be incremented by 1 to read the correct register (e.g. Teltonika RTU xxx)

Bit-field data type uses individual bits from the 16 bits available on the Modbus register to provide multiple Boolean information by reading or writing a single register.

Modbus Register Tables

General Points						
Decimal	**Hex**	**Name**	**Details**	**Stored**	**Type**	**Range**
3002	BBA	Firmware version - units	Most significant number for firmware version e.g. 2.xx	YES	R	0-9
3003	BBB	Firmware version - tenths	2nd Most significant number for firmware version e.g. x.0x	YES	R	0-9
3004	BBC	Firmware version - hundredths	3rd Most significant number for firmware version e.g. x.x4	YES	R	0-9

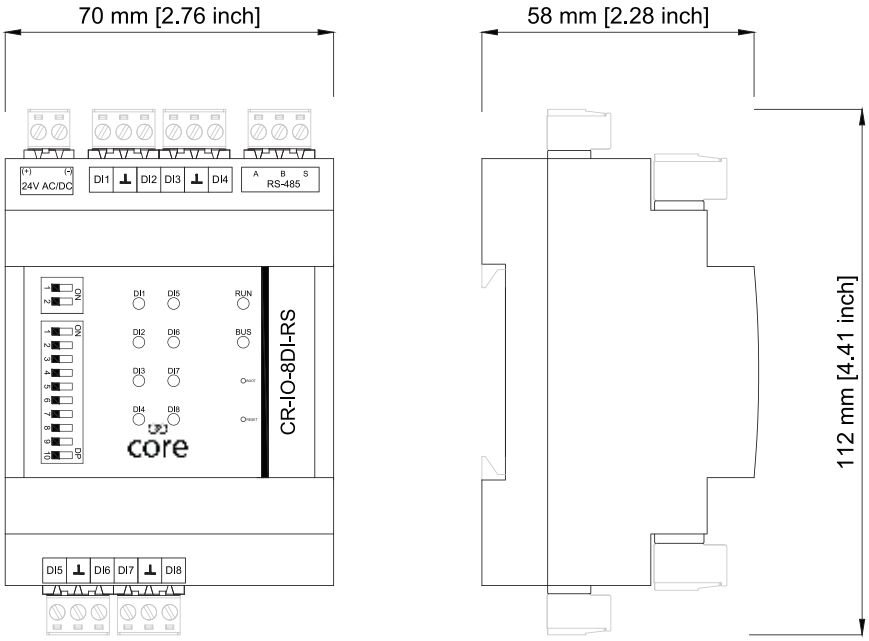
Digital Input Points						
Decimal	Hex	Name	Details	Stored	Type	Range
99	28	DI 1 mode	Digital Input mode select: 0 = Digital Intput direct 1 = Digital Intput reverse 2 = Pulse input	YES	R/W	0...2
100	29	DI 2 mode				
101	2A	DI 3 mode				
102	2B	DI 4 mode				
103	2C	DI 5 mode				
104	2D	DI 6 mode				
105	2E	DI 7 mode				
106	2F	DI 8 mode				
0	0	DI 1	Read Digital Input status (digital input mode): 0 = inactive 1 = active	YES	R	0...1
1	1	DI 2				
2	2	DI 3				
3	3	DI 4				
4	4	DI 5				
5	5	DI 6				
6	6	DI 7				
7	7	DI 8				
1111	457	DI 1-8	Read digital input status by bit (only digital input mode, bit 0 = DI 1)	NO	R	0…1
9	9	DI 1 counter (totalizer)	Read digital input status by bit (only digital input mode, bit 0 = DI 1)	NO	R/W	0...4294967295
11	B	DI 1 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
13	D	DI 1 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
14	E	DI 1 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
15	F	DI 1 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
16	10	DI 2 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
18	12	DI 2 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
20	14	DI 2 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
21	15	DI 2 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
22	16	DI 2 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
23	17	DI 3 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
25	19	DI 3 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
27	1B	DI 3 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
28	1C	DI 3 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
29	1D	DI 3 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1

30	1E	DI 4 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
32	20	DI 4 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
34	22	DI 4 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
35	23	DI 4 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
36	24	DI 4 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
37	25	DI 5 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
39	27	DI 5 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
41	29	DI 5 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
42	2A	DI 5 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
43	2B	DI 5 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
44	2C	DI 6 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
46	2E	DI 6 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
48	30	DI 6 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
49	31	DI 6 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
50	32	DI 6 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
51	33	DI 7 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
53	35	DI 7 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
55	37	DI 7 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
56	38	DI 7 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
57	39	DI 7 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1
58	3A	DI 8 counter (totalizer)	32 bit long, total counter value (totalizer) (pulse input mode)	NO	R/W	0...4294967295
60	3C	DI 8 counter (timer)	32 bit long, counter value for the running timer (pulse input mode)	NO	R	0...4294967295
62	3E	DI 8 counter timer	Running timer in minutes. Will reset once "counter timer set" reached and start again	NO	R	0…14400
64	40	DI 8 counter timer set	Timer duration configuration in minutes	YES	R/W	0…14400
65	41	DI 8 counter reset	Reset command to all counted values (goes back to "0" automatically)	NO	R/W	0…1

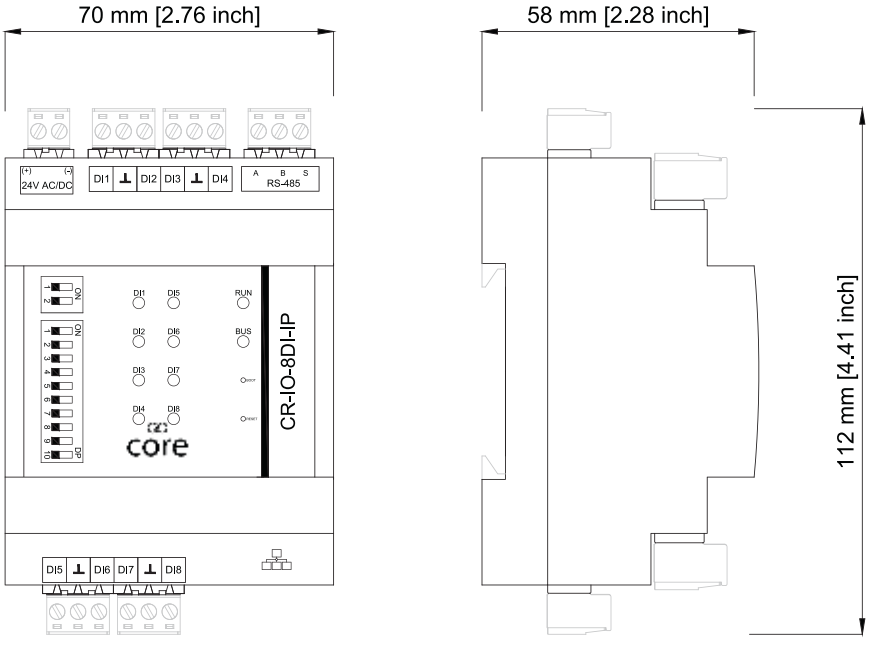
TECHNICAL DATA

Drawings

Part number: CR-IO-8DI-RS



Part number: CR-IO-8DI-IP



Specifications

Power supply	24 Vac +10%/-15% 50 Hz, 24 Vdc +10%/-15%
	Current draw – 70mA min, 80mA max
Digital Inputs	8 x Digital Inputs (volt free)
	DI direct, DI reverse, PULSE (up to 100 Hz, 50% duty cycle, max 50 ohm contact)
Interface to BEMS	RS485, opto-isolated, max 63 devices supported on the network
	Ethernet/IP (IP version)
Protocol to BEMS	Modbus RTU, baud rate 9600 – 230400, 8 bit, no parity, 1 stop bit
	Modbus TCP (IP version)
Ingress Protection Rating	IP20, EN 61326-1
Temperature and humidity	Operating: 0°C to +50°C (32°F to 122°F), max 95% RH (without condensation)
	Storage: -25°C to +75°C (-13°F to 167°F), max 95% RH (without condensation)
Connectors	Plug-in Terminals 1 x 2.5 mm^2
Mounting	Panel mounted (2x on-board sliding screw holders on the back) / DIN rail mounting

Guidelines for Disposal

• The appliance (or the product) must be disposed of separately in accordance with the local waste disposal legislation in force.

• Do not dispose of the product as municipal waste; it must be disposed of through specialist waste disposal centres.

• Improper use or incorrect disposal of the product may negatively affect human health and the environment.

• In the event of illegal electrical and electronic waste disposal, the penalties are specified by local waste disposal legislation.