

RA0002

Digital I/O Interface Unit



Technical Information Manual

Revision n. 01

22/10/2013



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Scope of Manual

The goal of this manual is to provide the basic information to work with the RA0002 Digital I/O Interface Unit.

Change Document Record

Date	Revision	Changes	Pages
22 Oct 2013	01	First release.	-

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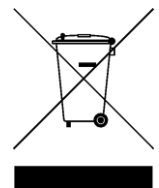
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Index

Scope of Manual	2
Change Document Record	2
Index.....	3
List of Figures.....	3
List of Tables.....	4
1 Introduction.....	5
General Information	6
Ordering Options	6
Accessories	6
Installation Notice.....	7
2 RA0002 Functional Description	8
General Description	9
Power Supply	10
Power Supply with Ion R4300P reader	10
Startup	11
Input Electrical Description.....	12
Reader input interface	12
Isolated input interface	13
Output Electrical Description.....	14
Switching P mos using reader power	14
Switching N mos using reader power.....	15
Switching P mos using external power.....	15
Safety Output System	16
Using Ion R4300P GPIO Interface	17
3 Connecting the RA0002.....	18
Connect a Photo-Electric Sensor to RA0002	19
Example n.1	19
Example n.2.....	21
Connect an Alarm Sounder to RA0002	22
Connect a Led Signal Tower to RA0002	24
How to Use Relay Output	26
4 RA0002 Technical Specifications	27
Technical Specifications Table	28
External Connections.....	29
DB15 female connector.....	29
RA0002 power connector.....	30
10-pin terminal block with quick coupling for power and address signals	30
24-pin terminal block with quick coupling for power and address signals	31
Front Panel LEDs	32
Mechanical Drawings.....	33

List of Figures

Fig. 1.1: RA0002 Digital I/O Interface Unit.....	6
Fig. 1.2: RA0002 Wall Mounting	7
Fig. 2.1: RA0002: power supply through DB15 connector	10
Fig. 2.2: RA0002: dedicated power supply	10
Fig. 2.3: Input electrical diagram	12
Fig. 2.4: Reader input interface	12
Fig. 2.5: Isolated input interface.....	13
Fig. 2.6: Output electrical diagram	14
Fig. 2.7: Switching P mos using reader power	14
Fig. 2.8: Switching N mos using reader power.....	15
Fig. 2.9: Switching P mos using external power.....	15
Fig. 2.10: Response time of resettable fuse.....	16
Fig. 4.1: GPIO DB15 socket connector pinout.....	29

Fig. 4.2: R0002 Front Panel LEDs32
Fig. 4.3: RA0002 Mechanical Drawings.....33

List of Tables

Tab. 2.1: Correspondence between the DB15 GPI/O and RA0002 GPI/O9
Tab. 2.2: Startup GPI/O configuration11
Tab. 4.1: RA0002 Technical Specifications.....28
Tab. 4.2: GPIO DB15 socket connector pinout29
Tab. 4.3: 10-pin terminal block table.....30
Tab. 4.4: 24-pin terminal block table.....31
Tab. 4.5: R0002 Front Panel LEDs32

1 Introduction

This Chapter gives general information about the **RA0002 Digital I/O Interface Unit**. It contains these topics:

- [General Information](#)
- [Ordering Options](#)
- [Accessories](#)
- [Installation Notice](#)



General Information

The CAEN RFID RA0002 Digital I/O Interface Unit provides an easily accessible interface to the CAEN RFID readers' digital inputs and outputs, in order to connect external devices such as motion sensors, lightstacks and audible alarms.

The RA0002 GPIO connector is dedicated for the [R4300P ION reader](#), while for the others CAEN RFID readers it is necessary to wire the connector.



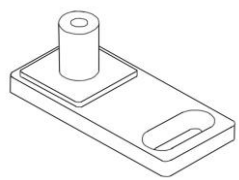

Fig. 1.1: RA0002 Digital I/O Interface Unit

Ordering Options

	Code	Description
Module	WRA0002XAAAA	RA0002 - Digital I/O Interface Unit
	WRA0002XKITA	RA0002 - Digital I/O Interface Unit (RA0002 module + DB15 cable)
Accessories	WALIM0000003	ION Power Supply

Accessories

Check for the supplied accessories below:

 <p>No.4 wall hooks</p>	 <p>No.4 small screws (ø 3 mm)</p>
--	---

Installation Notice

The RA0002 can be easily hanged on the wall.

First of all, press the 4 hooks on the RA0002 (vertically or horizontally, see § Fig. 1.2: RA0002 Wall Mounting pag.7).



Fig. 1.2: RA0002 Wall Mounting

To hang the RA0002 on the wall, fix the hooks to the wall using 4 rawlplugs (\varnothing 3 mm) (not included) + screws or, if you want to hang the RA0002 on a wood panelling, fix the hooks to the wall just using 4 screws.

2 RA0002 Functional Description

This Chapter gives information about the **RA0002 Digital I/O Interface Unit** functional aspects. It contains these topics:

- [General Description](#)
- [Power Supply](#)
- [Startup](#)
- [Input Electrical Description](#)
- [Output Electrical Description](#)
- [Safety Output System](#)
- [Using Ion R4300P GPIO Interface](#)



General Description

The RA0002 module is an I/O interface between the CAEN RFID readers and any external devices controllable by the readers.

The supply voltage of the interface is in the range 9Vdc ÷ 36Vdc (24Vdc nominal).

The device is equipped with 4 lines of INPUT, 4 lines of OUTPUT and 1 line connected to a SPDT relay.

The lines of INPUT/OUTPUT are opto-isolated, so the reader is electrically separated from the digital interface.

In INPUT, valid signals are considered from 5 to 36 V, while the OUTPUT can deliver a maximum current of 500mA in push-pull configuration.

The INPUT/OUTPUT lines are accessible via PUSH IN spring connection that facilitates the connections with the user's devices and the I/O selected by the reader are visible through the LEDs on the front of the box.

The following table shows the correspondence between the DB15 female connector GPI/O and the RA0002 GPI/O:

DB15 GPI/O	RA0002 GPI/O	IN / OUT
GPI00	GPI0	IN
GPI01	GPI1	IN
GPI02	GPI2	IN
GPI03	GPI3	IN
GPI04	GPO0	OUT
GPI05	GPO1	OUT
GPI06	GPO2	OUT
GPI07	GPO3	OUT
GPI08	RELAY OUT	OUT

Tab. 2.1: Correspondence between the DB15 GPI/O and RA0002 GPI/O

In CAEN RFID readers each GPI/O channel can work both as an input and as an output, while in the RA0002 there are 4 input dedicated channels, 4 output dedicated channels and an output channel that drives a SPDT relay.

By default the inputs and the outputs of CAEN RFID readers are HIGH and for this reason the RA0002 module is designed to work according a negative logic.

The DB15 female connector is dedicated for [Ion R4300P reader](#), while for the others CAEN RFID readers it is necessary to wire the connector (for more info see § *DB15 female connector* pag. 29).

Power Supply

The device can be powered directly from the RA0002 power connector by its dedicated power supply ([WALIM0000003](#)).

The input power and ground are also available on the RA0002 device on terminals VDC and GND.

Power Supply with Ion R4300P reader

The connection interface/reader is made via a connecting cable with DB15 connectors.

RA0002 can be powered through the DB15 connector or with its own dedicated power supply when is required more than 500mA total output current.

The input power and ground are also shown on the RA0002 device on terminals VDC and GND.

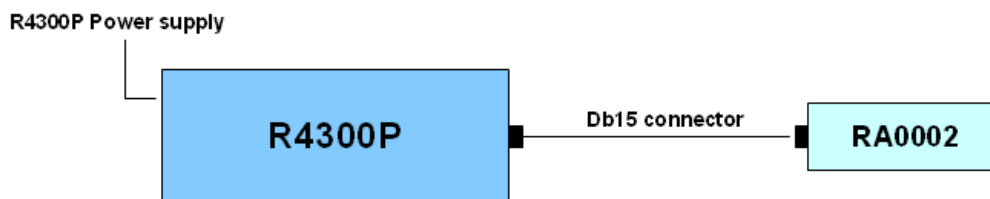


Fig. 2.1: RA0002: power supply through DB15 connector

When the RA0002 module is attached both to the Ion reader and to an external power supply, the following condition must be fulfilled:

$$\text{RA0002 Power Supply} \geq \text{R4300P Power Supply}$$



Warnings: The condition must be respected in order to avoid the damage of the module.

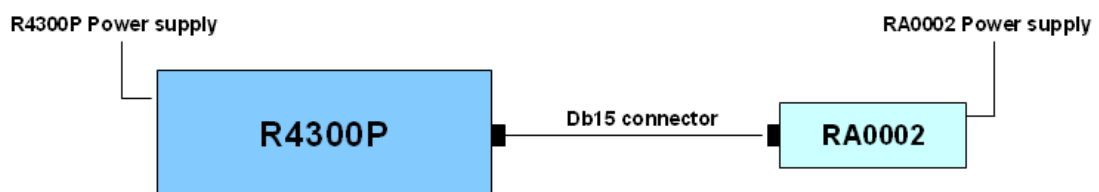


Fig. 2.2: RA0002: dedicated power supply

Startup

Consider the RA0002 connected with Ion R4300P reader. When the Ion R4300P reader is turned on, it executes the boot process. During the boot the reader performs the initialization process and it is not controllable.

During this phase the reader GPI/O follow the standard sequence in the table below:

RA0002 GPI/O	START UP	LED
GPI0	INPUT HIGH	OFF
GPI1	INPUT HIGH	OFF
GPI2	INPUT LOW	ON
GPI3	INPUT LOW	ON
GPO0	ACTIVE LOW	ON
GPO1	ACTIVE LOW	ON
GPO2	ACTIVE HIGH	OFF
GPO3	ACTIVE HIGH	OFF
RELAY OUT	NC	OFF

Tab. 2.2: Startup GPI/O configuration

Warning: During the boot process, a device connected to the RA0002 outputs may have particular behaviour: for example, an alarm sounder connected to RA0002 (like in the example n.1 of *Connect an Alarm Sounder to RA0002* pag. 22) will be active and sound during the boot process. If you want it to be turned off during the boot process simply connect the alarm sounder to GPO2 or GPO3 or connect the alarm sounder like in the example n.2 of *Connect an Alarm Sounder to RA0002* pag. 23.

Input Electrical Description

The following diagram shows the equivalent schematics of the input stage of the RA0002 module, i.e. GPIO.

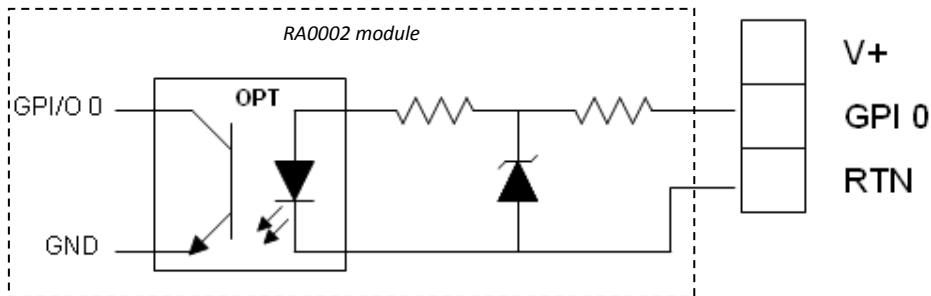


Fig. 2.3: Input electrical diagram

The terminals V +, GPIO, RTN are the card's interface toward the external devices.

Providing a voltage level between 5÷36 V on GPIO 0, the result is a signal that activates the low-level GPIO 0 of the reader connected to the RA0002 module.

Reader input interface

In the following example, the power of the reader is used to enable the GPIO via the command given by the switch.

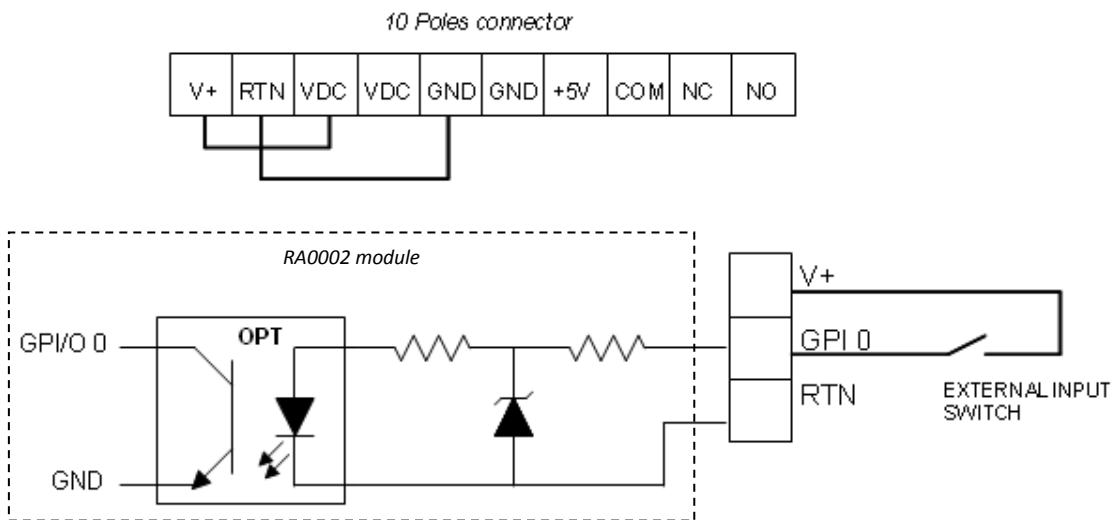


Fig. 2.4: Reader input interface

Isolated input interface

In the following example, an external isolated power supply is used to enable the GPI/O via the command given by the switch.

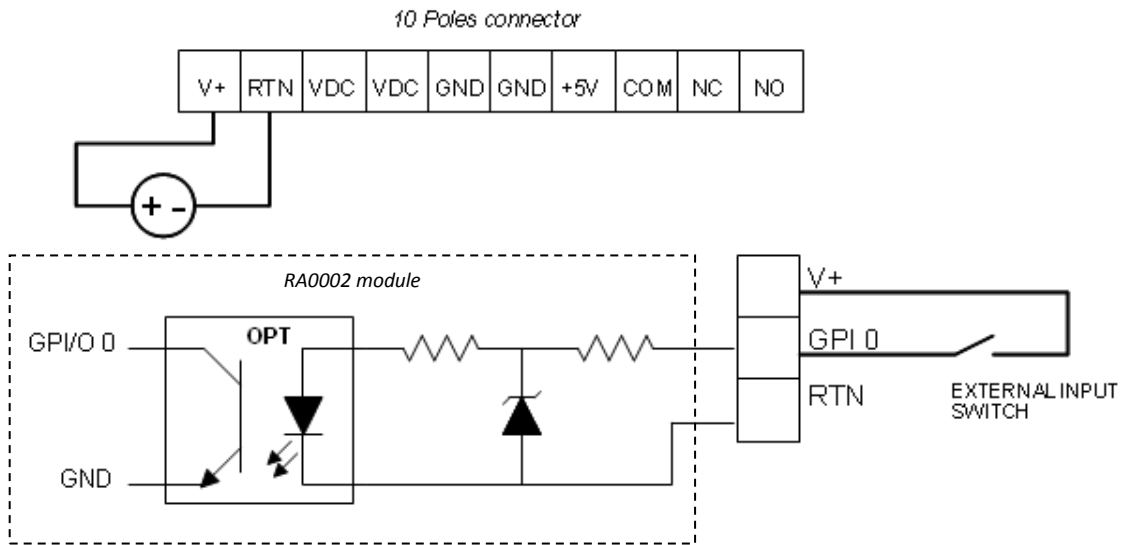


Fig. 2.5: Isolated input interface

Output Electrical Description

The following diagram shows the equivalent schematics of the output stage of the RA0002 module, i.e GPO0.

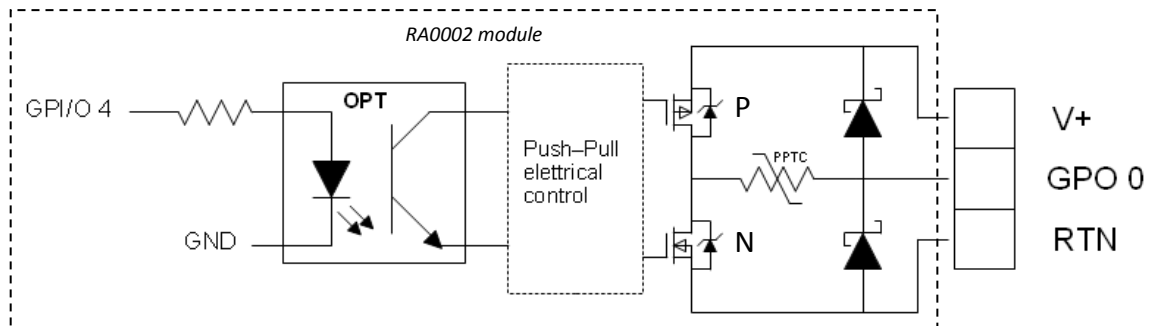


Fig. 2.6: Output electrical diagram

The terminals V +, 0 GPO, RTN are the card's interface toward the external devices.

When the GPI/O 4 is at the high level, the mosfet N is active while the mosfet P is interdicted.

When the GPI/O 4 is at the low level, the mosfet P is active, while the mosfet N is interdicted.

Switching P mos using reader power

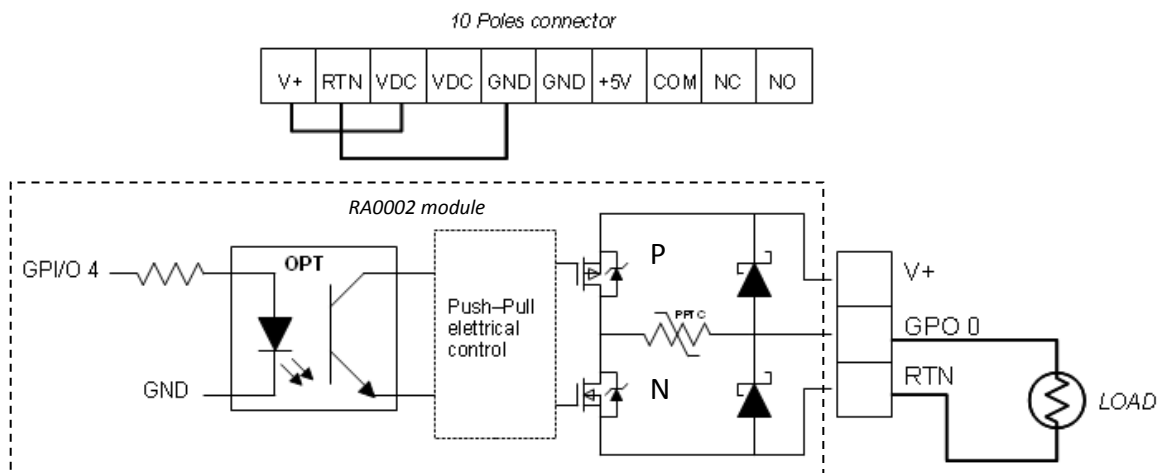


Fig. 2.7: Switching P mos using reader power

Enabling at low level the reader GPI/O 4, the mosfet P is active and the load is powered.

Switching N mos using reader power

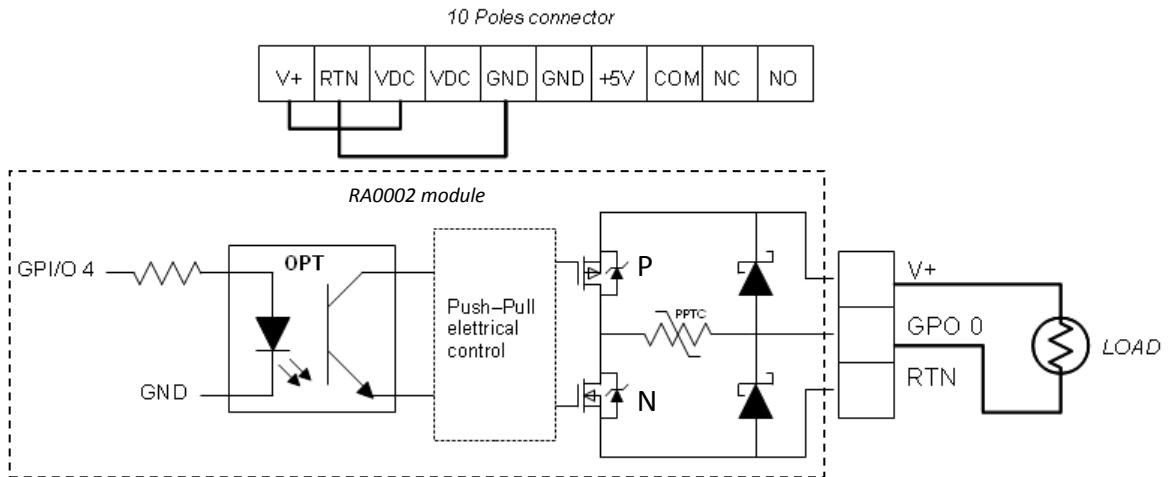


Fig. 2.8: Switching N mos using reader power

Enabling at high level the reader GPI/O 4, the mosfet N is active and the load is powered.

Note: In this case, the LED indicator is off when the output is active and turned on when the output is not active.

Switching P mos using external power

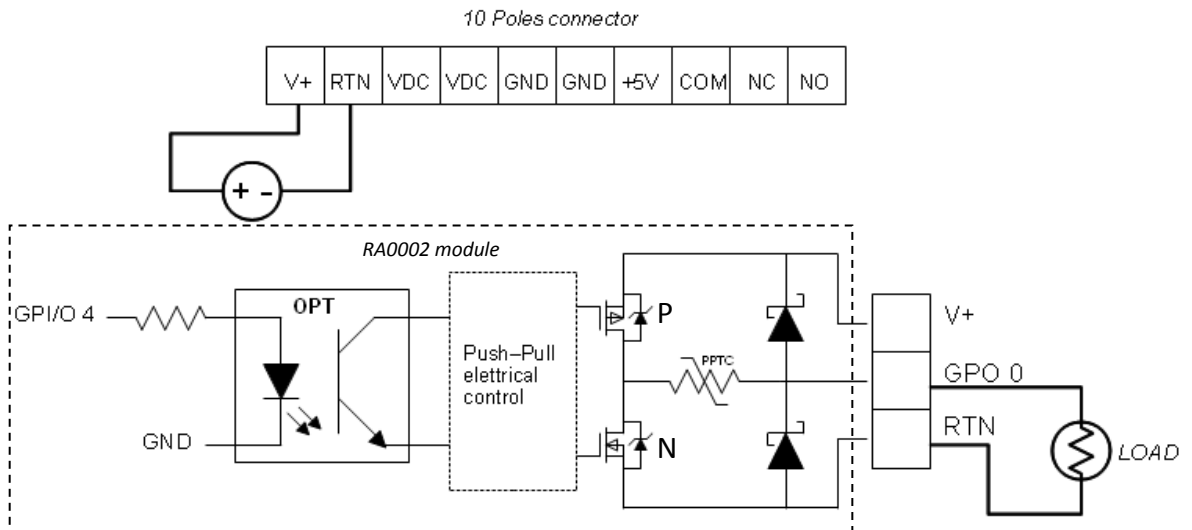


Fig. 2.9: Switching P mos using external power

It is the same configuration of the example *Switching P mos using reader power* pag. 14, but in this case the load is powered from an external source.

Safety Output System

The output current of 4 outputs GPO0, GPO1, GPO2, GPO3 is limited by 4 resettable fuses (0.75 A).

For the fuses response time, see the following figure:

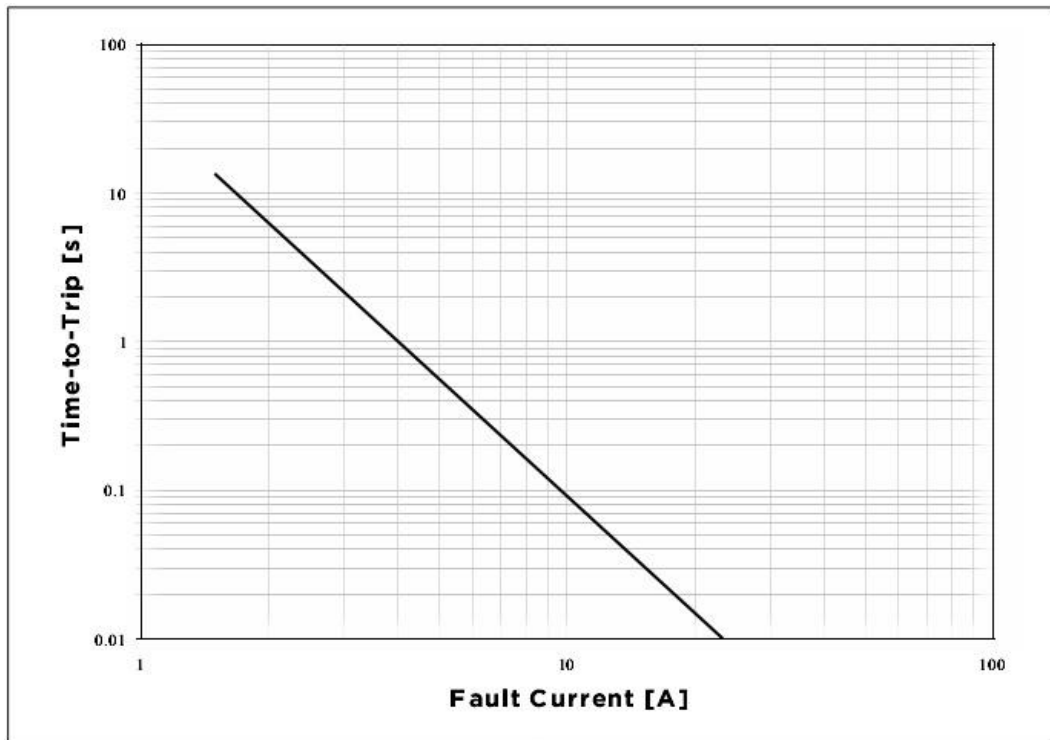


Fig. 2.10: Response time of resettable fuse

The fuse properly restores its functionality once the current returns below the threshold level.

Using Ion R4300P GPIO Interface

This paragraph describes how to manage the GPI/O of the Ion R4300P reader.

The Ion R4300P reader has 13 general purpose input and output (GPIO) interfaces, but to control RA0002 you need only 9 signal.

The GPIO lines can be managed directly from the console Linux shell of the reader. Looking into the `/dev` directory, you can find an inner dedicated directory for each GPIO line:

```
root@ion:~# ls -d /dev/gpio*
/dev/gpio0  /dev/gpio11 /dev/gpio3  /dev/gpio6  /dev/gpio9
/dev/gpio1  /dev/gpio12 /dev/gpio4  /dev/gpio7
/dev/gpio10 /dev/gpio2  /dev/gpio5  /dev/gpio8
```

For instance, the first GPIO line is mapped to the `gpio0` directory and, looking into it, you'll find the following pseudo-files:

```
root@ion:~# ls /dev/gpio0/
device      direction  power      subsystem  uevent     value
```

using the pseudo-file `direction` you can configure the GPIO line as an input or as an output while using the pseudo-file `value` you can get/set the GPIO line level.

For instance, to know the configuration of the first GPIO line you can perform the following commands:

```
root@ion:~# cat /dev/gpio0/direction
in
```

To get the level of the first GPIO line you can perform the following commands:

```
root@ion:~# cat /dev/gpio0/value
1
```

Since all the GPIO lines are configured as input lines by default at the startup, in order to set a GPIO line to a specified level you have to configure it as an output line before. Let consider the following example where we set the GPIO line 0 to the low level:

```
root@ion:~# echo out > /dev/gpio0/direction
root@ion:~# cat /dev/gpio0/direction
out
root@ion:~# echo 0 > /dev/gpio0/value
```

For technical information on Ion GPIO ports please refer to [Ion R4300P Technical Information Manual](#).

3 Connecting the RA0002

This Chapter gives some examples of usage of the **RA0002 Digital I/O Interface Unit**. It contains these topics:

- [Connect a Photo-Electric Sensor to RA0002](#)
- [Connect an Alarm Sounder to RA0002](#)
- [Connect a Led Signal Tower to RA0002](#)
- [How to Use Relay Output](#)



Connect a Photo-Electric Sensor to RA0002

Example n.1

RA0002 is powered by R4300P

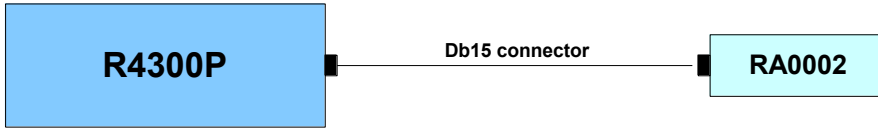


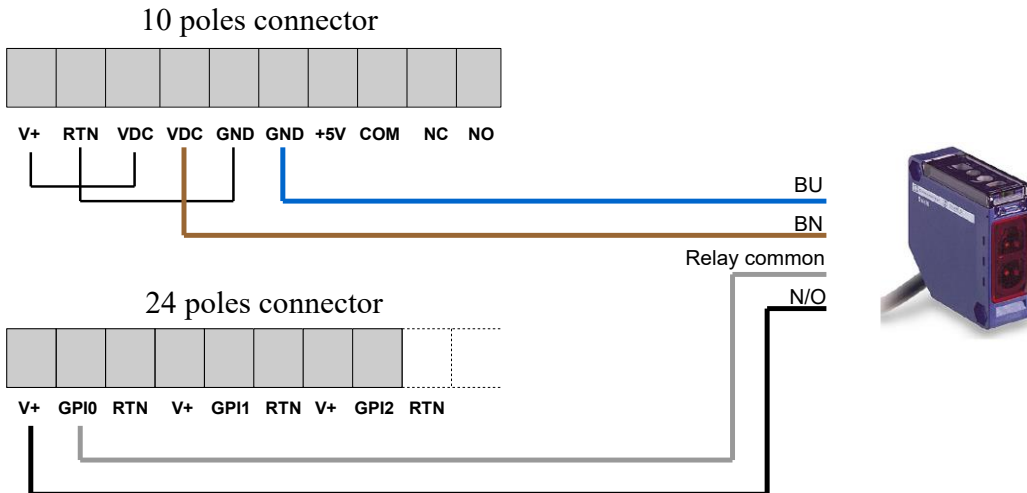
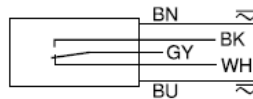
Photo-electric sensor model - XUK1ARCNL2

Connections

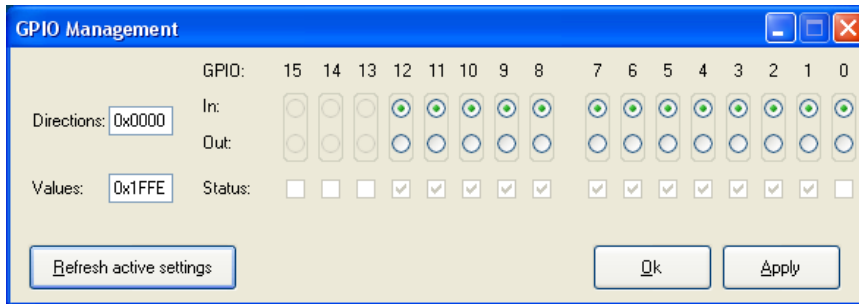
Pre-cabled, relay output

Relay output

- (~) BU (Blue)
- (~) BN (Brown)
- Relay common/GY (Grey)
- N/O BK (Black)
- N/C WH (White)



For example, using [CAEN RFID Easy Controller software](#), when the RA0002 module receives a valid input from the photo-electric sensor, the connected GPI enables its correspondent GPI/O to low level.



Example n.2

RA0002 is powered by R4300P

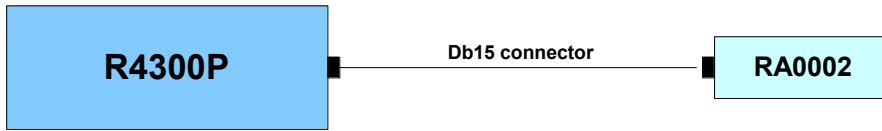


Photo-electric sensor model - **XUK1APANL2**

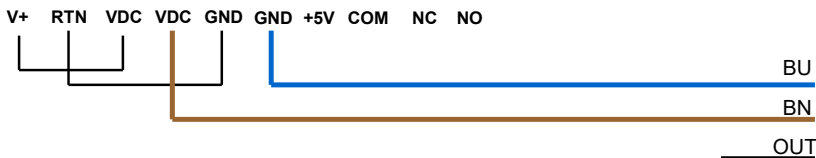
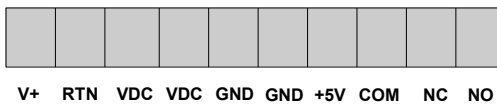
Connections

Pre-cabled	PNP
(-) BU (Blue)	BN/1
(+) BN (Brown)	+
OUT/Output BK (Black)	BK/4
Alarm/WH (White)	WH/2
Beam break test VI (Violet)	BU/3

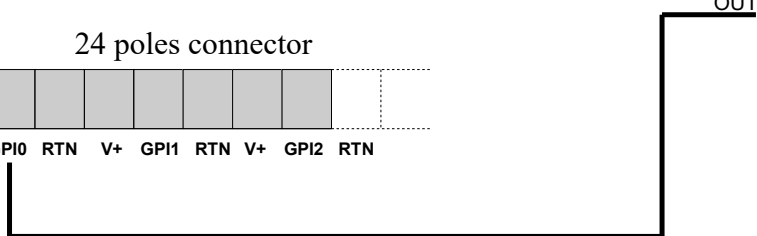
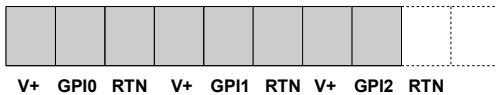
The circuit diagram shows a PNP transistor with its emitter connected to a positive supply (+) and its collector connected to the output terminal (BK/4). The base of the transistor is connected to the sensor terminal (WH/2). Another terminal (BU/3) is also shown connected to the supply.



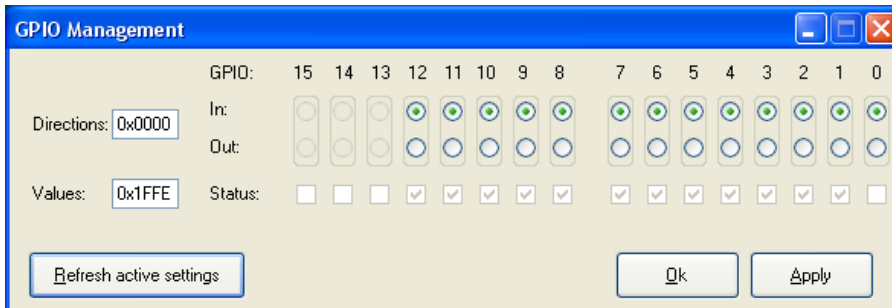
10 poles connector



24 poles connector

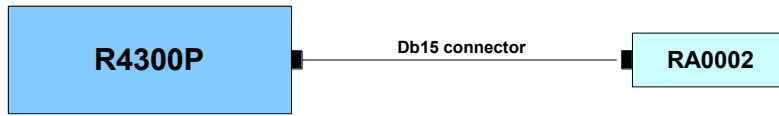


For example, using [CAEN RFID Easy Controller software](#), when the RA0002 module receives a valid input from the photo-electric sensor, the connected GPI enables its correspondent GPI/O to low level.

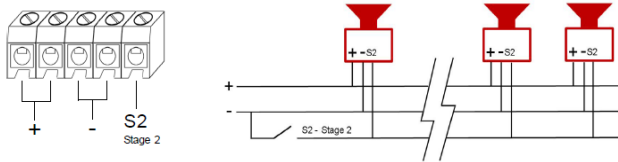


Connect an Alarm Sounder to RA0002

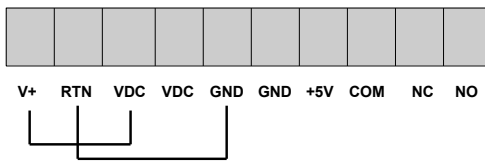
RA0002 is powered by R4300P



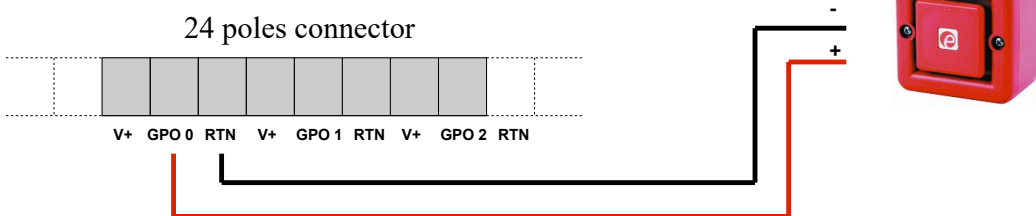
Alarm sounder model - **SONF1DC24R-H**



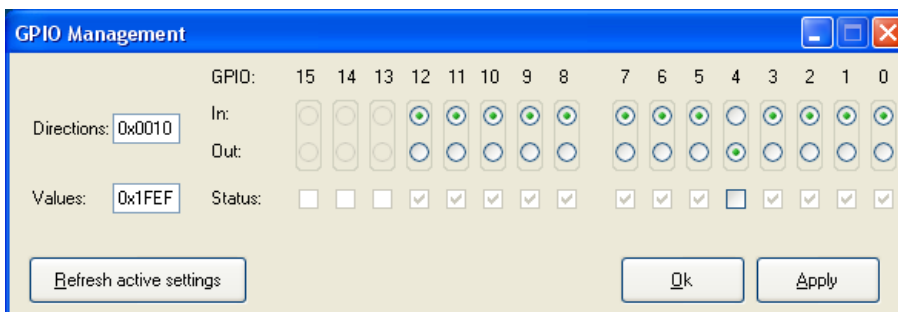
10 poles connector



24 poles connector

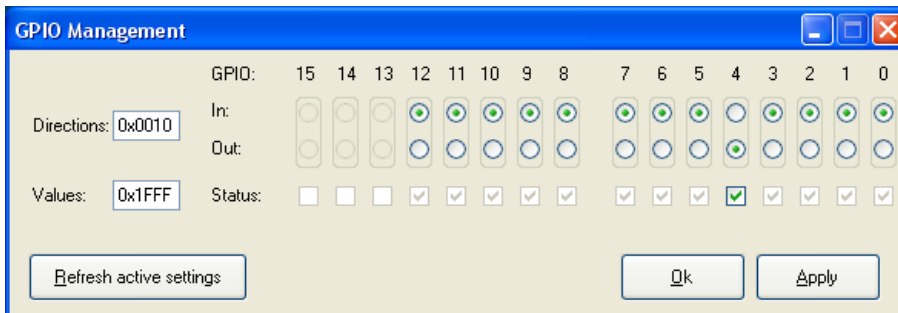
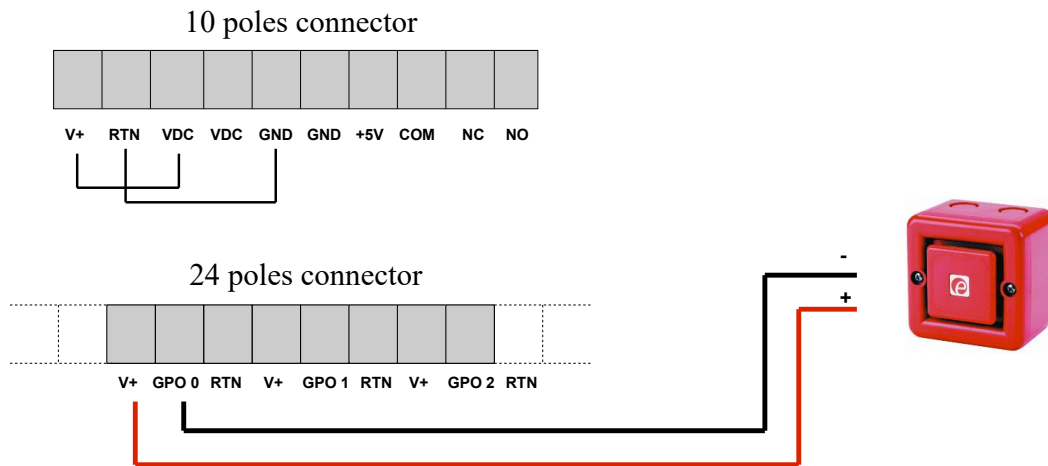


Example n.1: using [CAEN RFID Easy Controller software](#), when you enable low the right GPI/O from the R4300P, the RA0002 module receives a valid output and power up the alarm sounder.



Example n.2: if you want to work with a positive logic, you have to connect the sounder as illustrated in the pictures below.

When you enable high the right GPIO from the R4300P, the RA0002 module receives a valid output and powers up the alarm sounder.

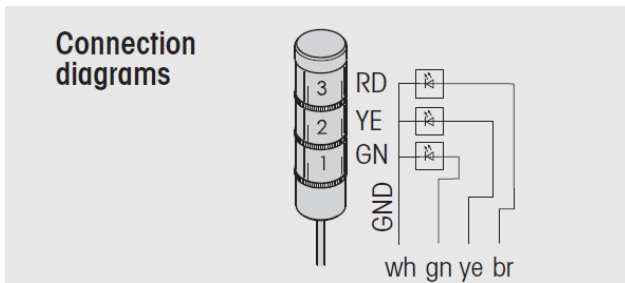


Connect a Led Signal Tower to RA0002

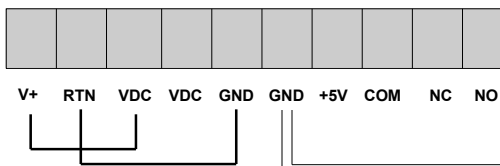
RA0002 is powered by R4300P



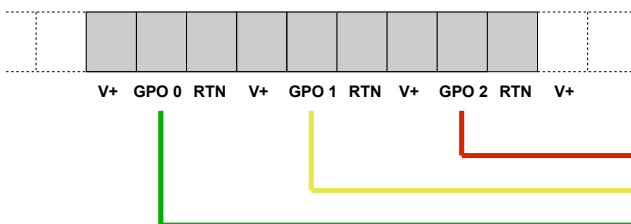
Led signal tower model – WERMA 69300055



10 poles connector



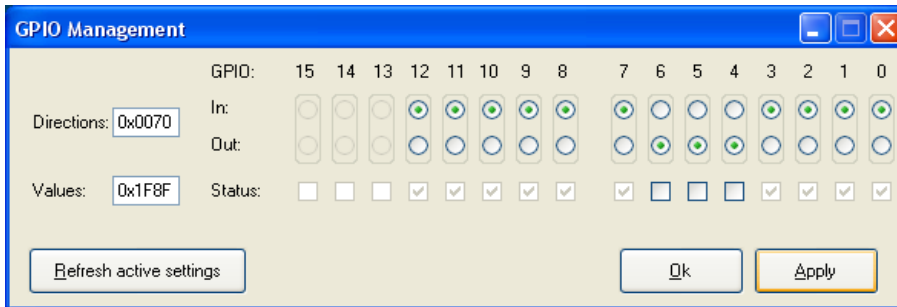
24 poles connector



gnd
red
yellow
green



For example, using [CAEN RFID Easy Controller software](#), when you enable low the right GPI/O from the R4300P, the RA0002 module receives a valid output and power up the led signal tower.

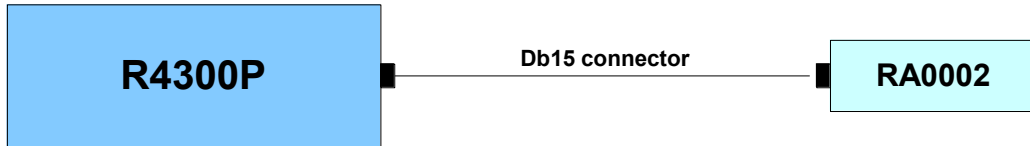


In this setup all the 3 lights are on.

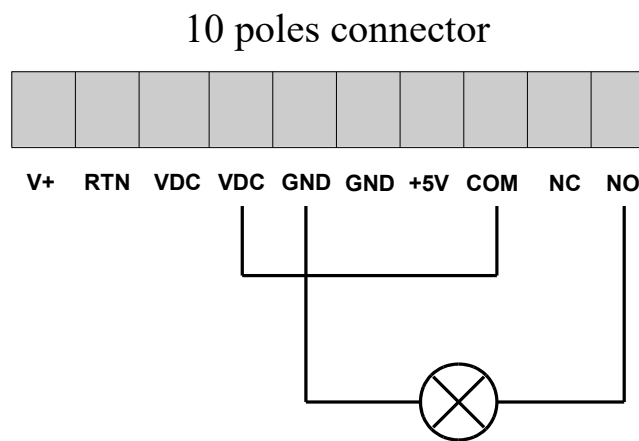
Note: In case of shared ground, like in the led signal tower case, we can work only in negative logic (active low signal).

How to Use Relay Output

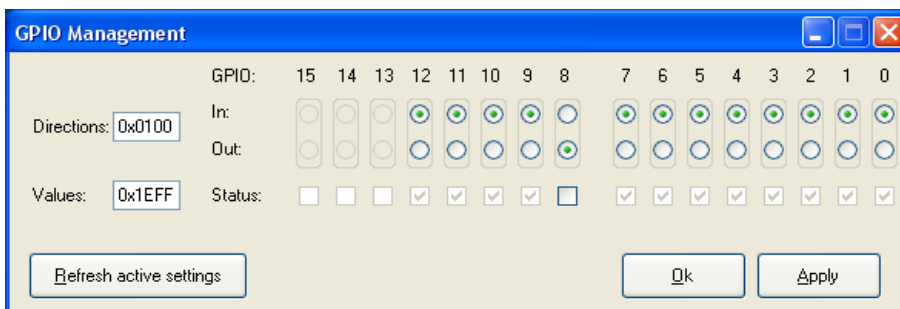
RA0002 is powered by R4300P



Example of a typical connection :



For example, using [CAEN RFID Easy Controller software](#), when you enable low the GPI/O 8 from the R4300P, the RA0002 module receives a valid output and switch the relay to the Normally Open (NO) contact.



4 RA0002

Technical Specifications

This Chapter describes the technical specifications of the **RA0002 Digital I/O Interface Unit**. It contains these topics:

- [Technical Specifications Table](#)
- [External Connections](#)
- [Front Panel LEDs](#)
- [Mechanical Drawings](#)



Technical Specifications Table

Function	Digital I/O nterface unit
Reader interface	DB 15 (Connection to Ion R4300P Reader)
Terminals	Push in pcb terminals
Supply Voltage Range	9 Vdc ÷ 36 Vdc , 24 Vdc (Typ)
Input terminal ratings	5 ÷ 48 Vdc voltage each signal can support
Input resistance for GPIs	3 kΩ (Typ)
Output terminal ratings	0 ÷ 500 mA overall for all external loads
Output breakdown voltage	60 Vdc
Input/Output isolation	750 Vrms
Relay nominal	5A, 240 VAC
Relay Max Switching Voltage	400 VAC
Relay Expected Life, Mechanical	15x10 ⁶ cycles
Relay Expected Life, Electrical	1x10 ⁴ cycles (at 5A, 250 VAC , 6 cycles/min)
Safety output current	Multifuse Polyswitch RKEF075
User interface	Green LED: power Yellow LED: selected GPI/O information
IP rating	IP30
Operating Temperature	-20 to 60 °C
Humidity	5 to 95% (on-condensing)
Dimensions	(W)100,5 x (L)131 x (H)34,4 mm ³
Weight	200 g

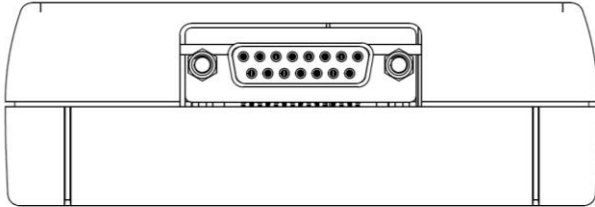
Tab. 4.1: RA0002 Technical Specifications

External Connections

The location of the connectors is shown in the following pictures.

Their specifications are listed below.

DB15 female connector



In the following table the pinout of the GPIO DB15 socket connector is shown. Connector external shell is connected to GND.

Pin #	Signal	Description
1	GPIO0	General-purpose IO #0
2	GPIO2	General-purpose IO #2
3	GPIO4	General-purpose IO #4
4	GPIO6	General-purpose IO #6
5	GPIO8	General-purpose IO #8
6	GPIO10	General-purpose IO #10
7	GPIO12	General-purpose IO #12
8	GND	Ground
9	GPIO1	General-purpose IO #1
10	GPIO3	General-purpose IO #3
11	GPIO5	General-purpose IO #5
12	GPIO7	General-purpose IO #7
13	GPIO9	General-purpose IO #9
14	GPIO11	General-purpose IO #11
15	DC_BYPASS	Input supply voltage bypass (500mA max)
-	Shell	External shell (connected to Ground)

Tab. 4.2: GPIO DB15 socket connector pinout

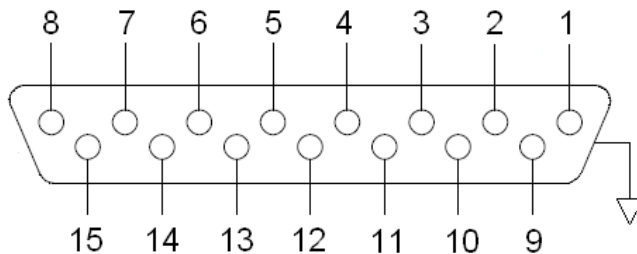
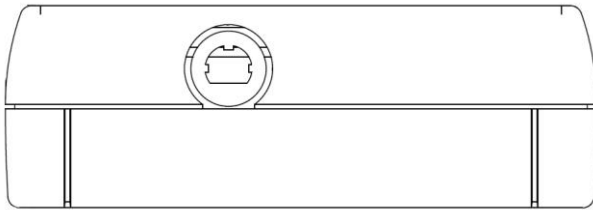


Fig. 4.1: GPIO DB15 socket connector pinout



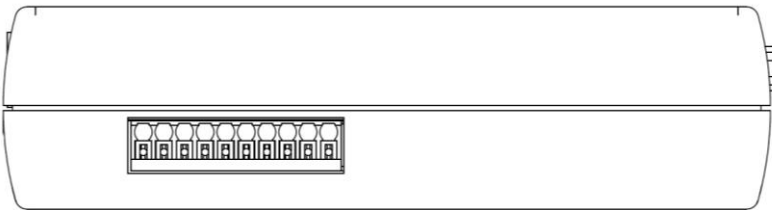
Warning: avoid connecting the DC_BYPASS signal to any of GPIO pins, otherwise the reader can be permanently damaged.

RA0002 power connector



Note: The RA0002 power connector is the same connector of the Ion R4300P reader.

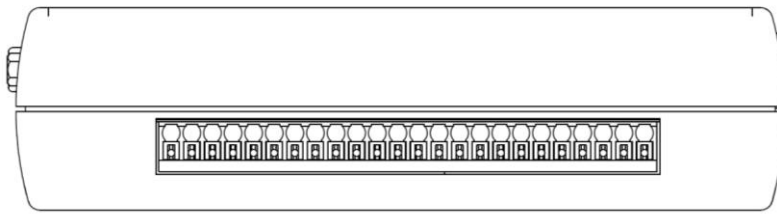
10-pin terminal block with quick coupling for power and address signals



Pin #	Pin name	Range
1	V+	36 Vdc max
2	RTN	
3	VDC	9 – 36 Vdc
4	VDC	9 – 36 Vdc
5	GND	
6	GND	
7	5VOUT	5 Vdc , I _{max} 1A
8	COM	
9	NC	240/400 VAC , I _{max} 5A
10	NO	240/400 VAC , I _{max} 5A

Tab. 4.3: 10-pin terminal block table

24-pin terminal block with quick coupling for power and address signals



Pin No.	Pin name	I/O	Range
1	V+	-	36 Vdc max
2	GPI0	Input	5 ÷ 36 Vdc
3	RTN	-	-
4	V+	-	36 Vdc max
5	GPI1	Input	5 ÷ 36 Vdc
6	RTN	-	-
7	V+	-	36 Vdc max
8	GPI2	Input	5 ÷ 36 Vdc
9	RTN	-	-
10	V+	-	36 Vdc max
11	GPI3	Input	5 ÷ 36 Vdc
12	RTN	-	-
13	V+	-	36 Vdc max
14	GPO0	Output	Push pull (0 ÷ 500 mA)
15	RTN	-	-
16	V+	-	36 Vdc max
17	GPO1	Output	Push pull (0 ÷ 500 mA)
18	RTN	-	-
19	V+	-	36 Vdc max
20	GPO2	Output	Push pull (0 ÷ 500 mA)
21	RTN	-	-
22	V+	-	36 Vdc max
23	GPO3	Output	Push pull (0 ÷ 500 mA)
24	RTN	-	-

Tab. 4.4: 24-pin terminal block table

Front Panel LEDs

The R0002 front panel houses the following LEDs (see figure below):

LED	FUNCTION	TYPE
POWER	Power ON	Green LED
INPUT	GPI0	GPI0 activated
	GPI1	GPI1 activated
	GPI2	GPI2 activated
	GPI3	GPI3 activated
OUTPUT	GPO0	GPO0 activated
	GPO1	GPO1 activated
	GPO2	GPO2 activated
	GPO3	GPO3 activated
RELAY	NC contact	Yellow LED

Tab. 4.5: R0002 Front Panel LEDs

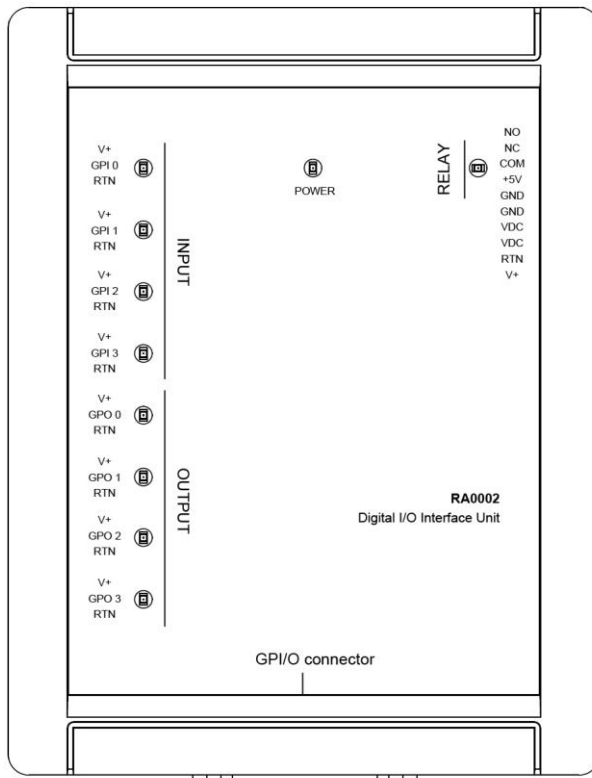


Fig. 4.2: R0002 Front Panel LEDs

Mechanical Drawings

The mechanical drawings of RA0002 are shown in the figure below.

All dimensions are in millimeters.

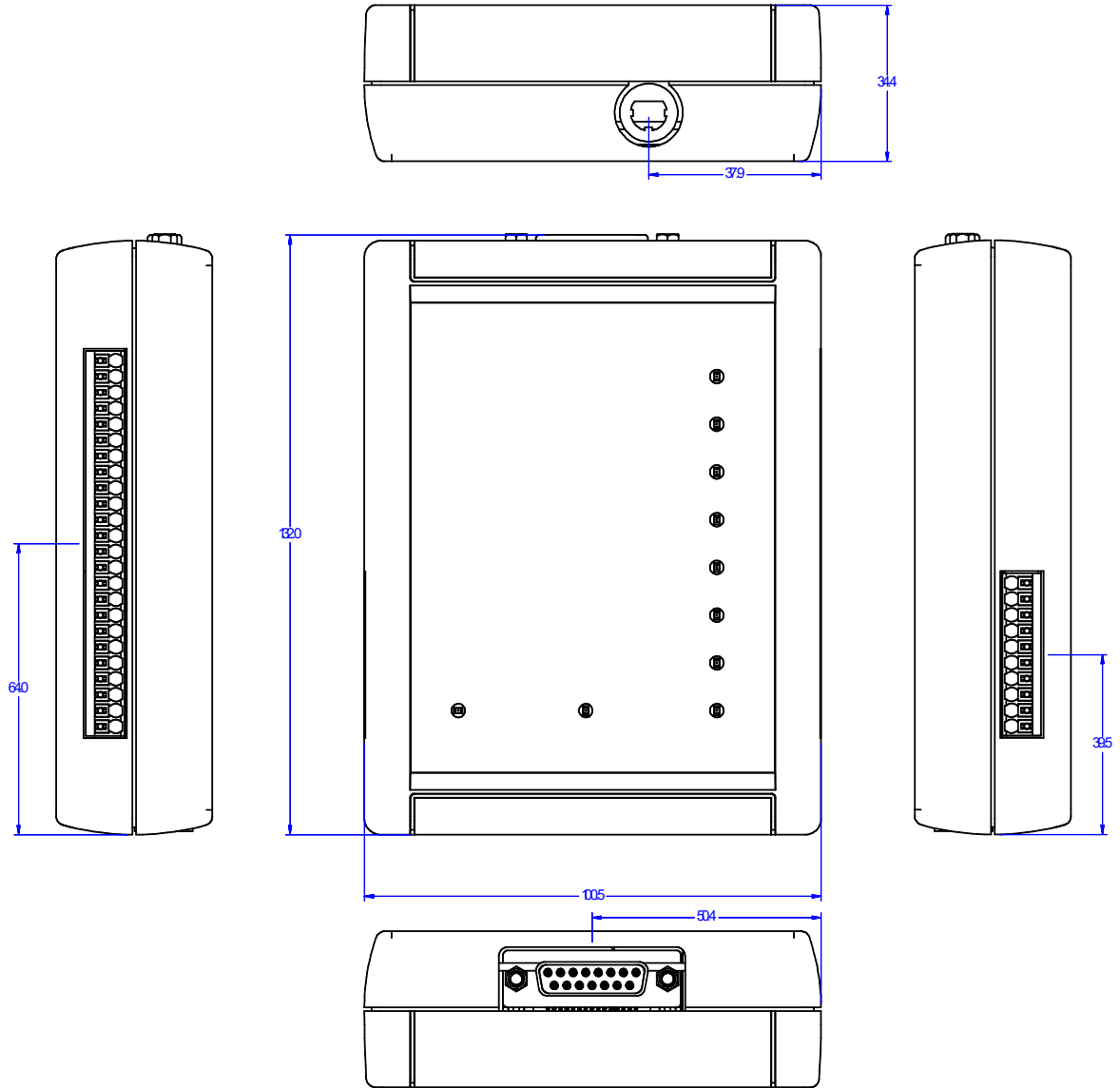


Fig. 4.3: RA0002 Mechanical Drawings