TECHNICAL INFORMATION MANUAL

Revision 02 – 05 June 2019

RA0002

Digital I/O Interface Unit

CAENRFID

Visit RA0002 web page, you will find the latest revision of data sheets, manuals, certifications and technical drawings. All you need to start using your product in a few clicks!

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.	-
05 Jun 2019	02	Modified RA0002 image	1, 6
		Added *REGULATORY COMPLIANCE* chapter	31, 32

Reference Document

[RD1] EPCglobal: EPC Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz – 960 MHz, Version 2.0.1 (April, 2015).

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Disposal of the product

Do not dispose the product in municipal or household waste. Please check your local regulations for disposal/recycle of electronic products.


RoHS
COMPLIANT

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1 INTRODUCTION

Product Description

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 R4301P 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

Accessories

Check for the supplied accessories below:

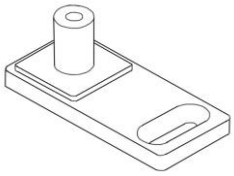
	
No.4 wall hooks	No.4 small screws (ø 3 mm)

Fig. 1.2: RA0002 Accessories

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. 1.3: Wall Mounting* page 7).

Fig. 1.3: Wall Mounting

To hang the RA0002 on the wall, fix the hooks to the wall using 4 rawlplugs (ø 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.

Ordering Options

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

2 FUNCTIONAL DESCRIPTION

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/OUPUT 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 OUPUT 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
GPIO0	GPI0	IN
GPIO1	GPI1	IN
GPIO2	GPI2	IN
GPIO3	GPI3	IN
GPIO4	GPO0	OUT
GPIO5	GPO1	OUT
GPIO6	GPO2	OUT
GPIO7	GPO3	OUT
GPIO8	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 R4301P reader, while for the others CAEN RFID readers it is necessary to wire the connector (for more info see § *DB15 female connector* page 26).

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 R4301P 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.

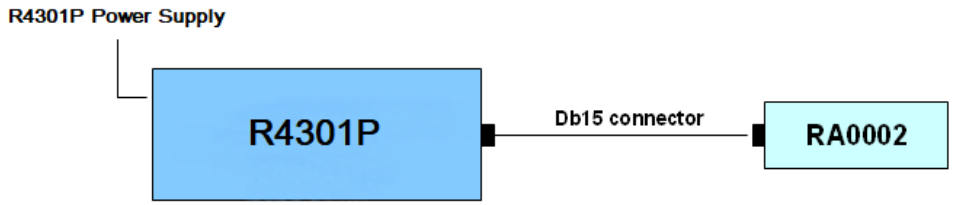


Fig. 2.1: RA0002: power supply through DB15 connector

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

RA0002 Power Supply ≥ R4301P Power Supply

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

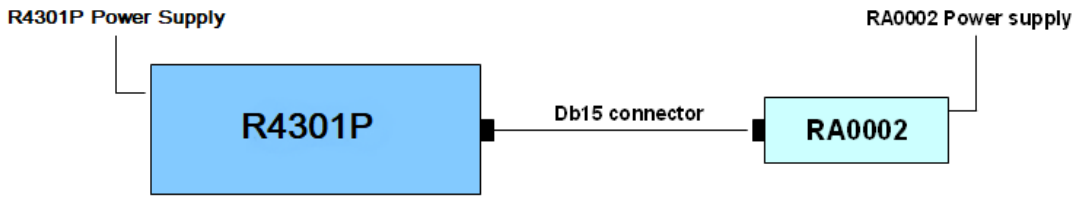


Fig. 2.2: RA0002: dedicated power supply

Startup

Consider the RA0002 connected with Ion R4301P reader. When the Ion R4301P 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* page 20) 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* page *21*.

Input Electrical Description

The following diagram shows the equivalent schematics of the input stage of the RA0002 module, i.e GPI0.

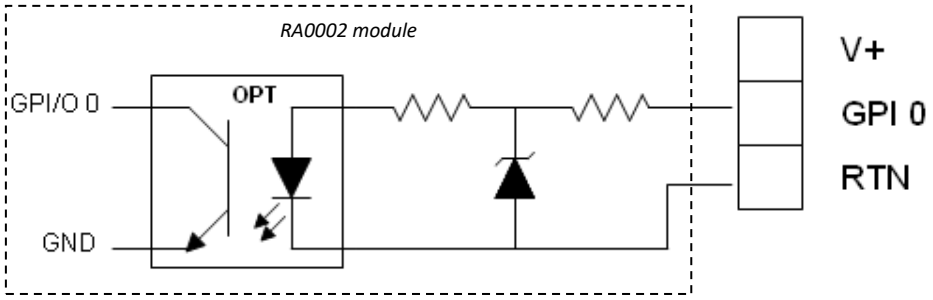


Fig. 2.3: Input electrical diagram

The terminals V +, GPI0, RTN are the card's interface toward the external devices.

Providing a voltage level between 5÷36 V on GPI 0, the result is a signal that activates the low-level GPI/O 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 GPI/O via the command given by the switch.

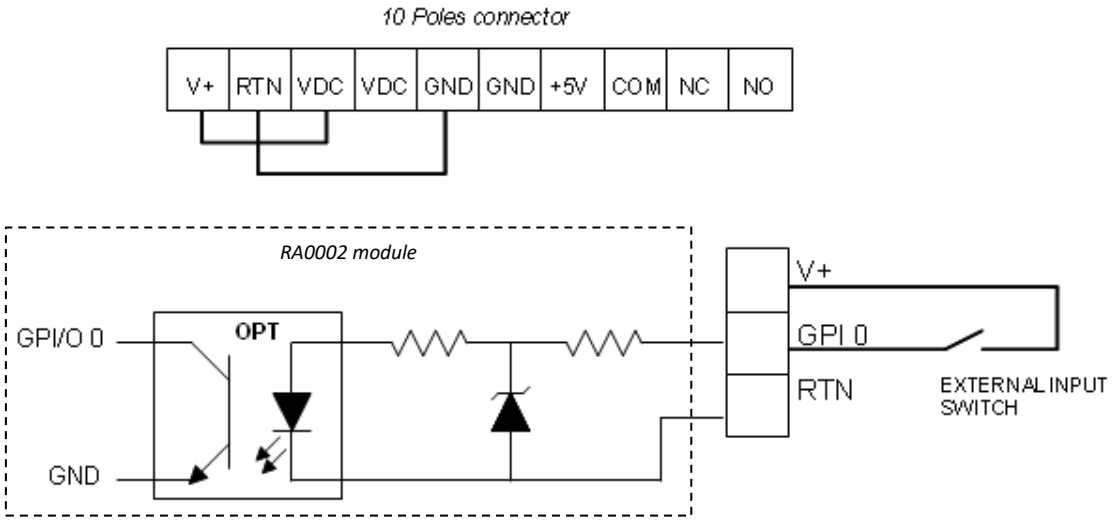


Fig. 2.4: Reader input interface

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.

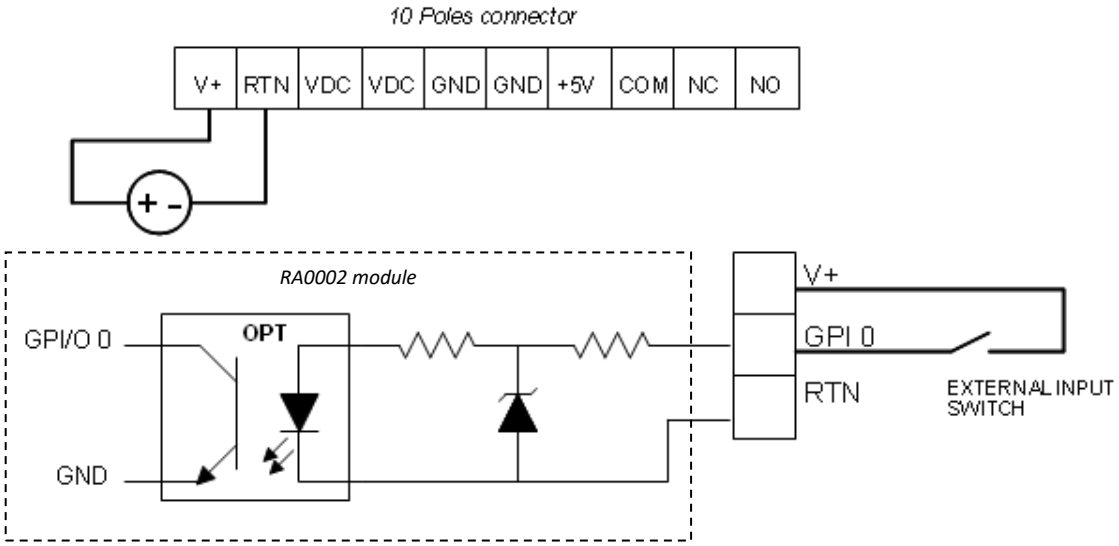


Fig. 2.5: Isolated input interface

Output Electrical Description

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

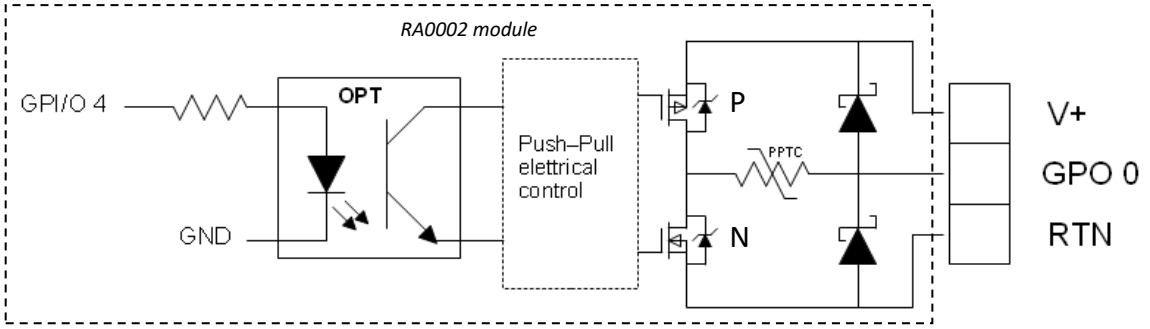


Fig. 2.6: Output electrical diagram

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

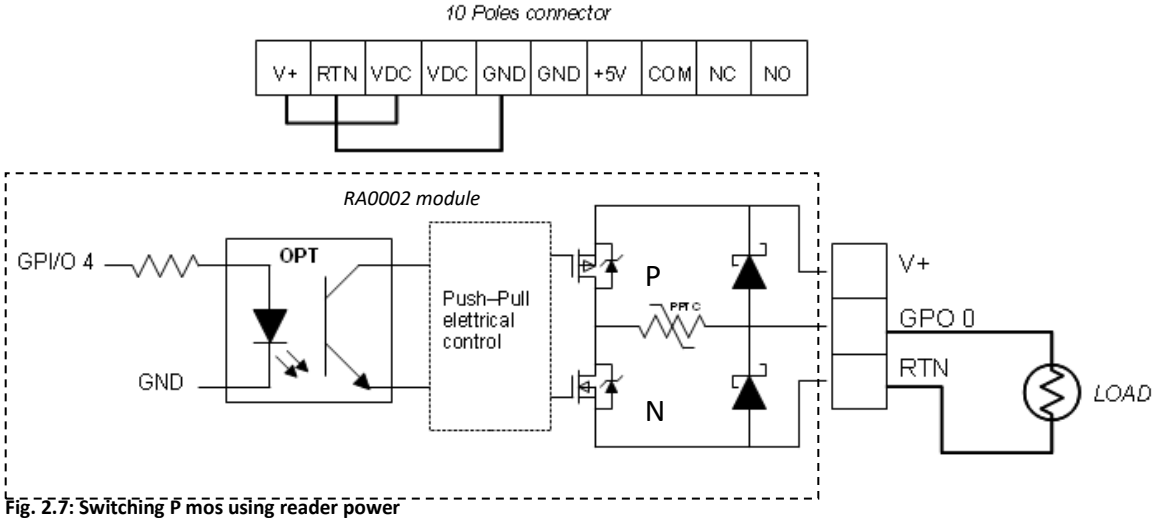


Fig. 2.7: Switching P mos using reader power

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

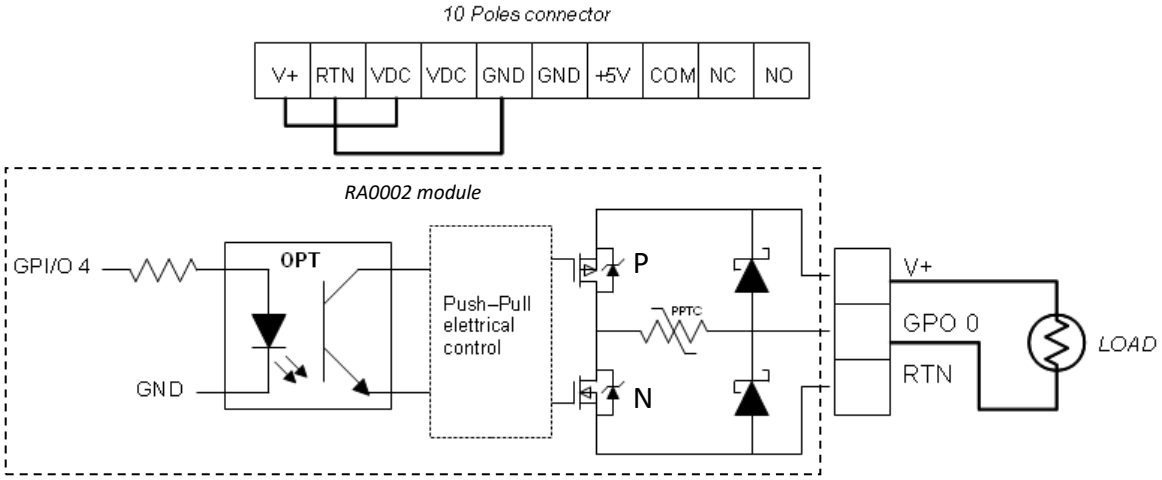


Fig. 2.8: Switching N mos using reader power

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

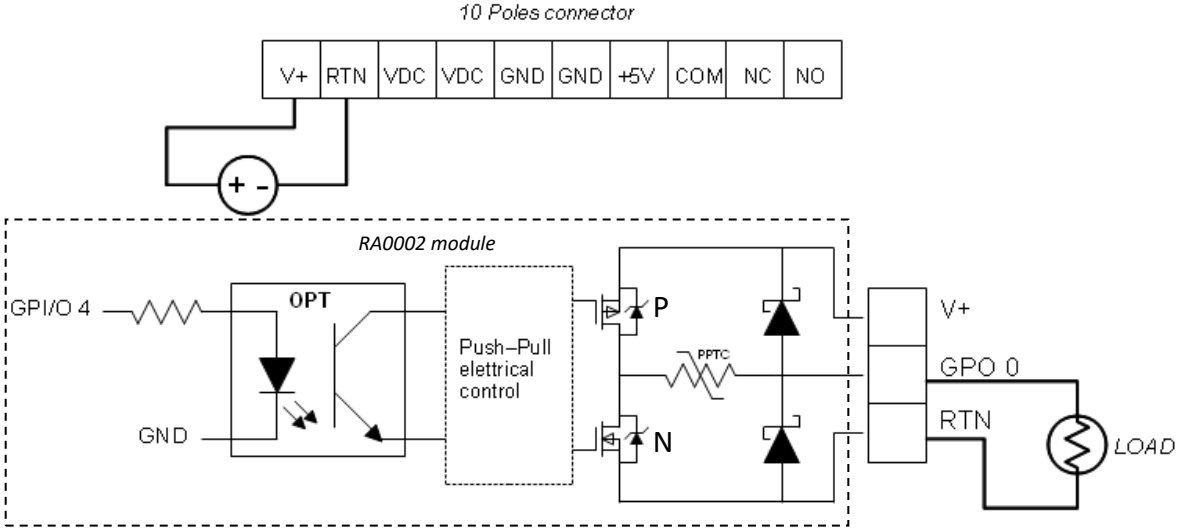


Fig. 2.9: Switching P mos using external power

It is the same configuration of the example *Switching P mos using reader power* page 13, 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:

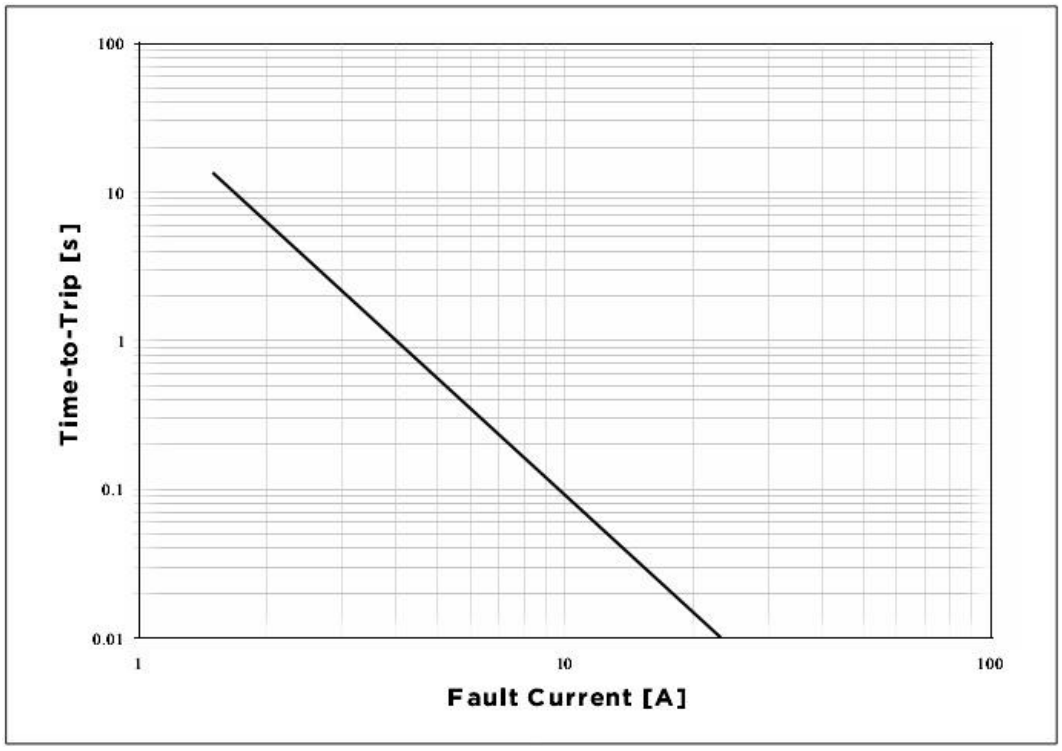


Fig. 2.10: Response time of resettable fuse

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

Using Ion R4301P GPIO Interface

This paragraph describes how to manage the GPI/O of the Ion R4301P reader.

The Ion R4301P 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 R4301P Technical Information Manual.

3 CONNECTING THE RA0002

Connect a Photo-Electric Sensor to RA0002

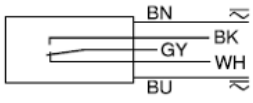
Example n.1

RA0002 is powered by R4301P Ion

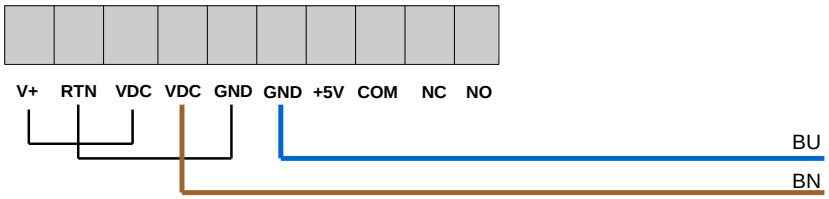
RA0002 is powered by R4301P

Photo-electric sensor model - **XUK1ARCNL2**

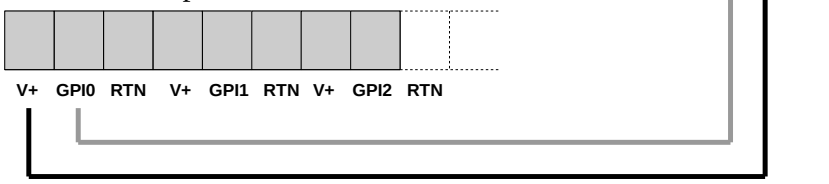
Connections

Pre-cabled, relay output	Relay output
(≂) BU (Blue) (≂) BN (Brown) Relay common/GY (Grey) N/O BK (Black) N/C WH (White)	

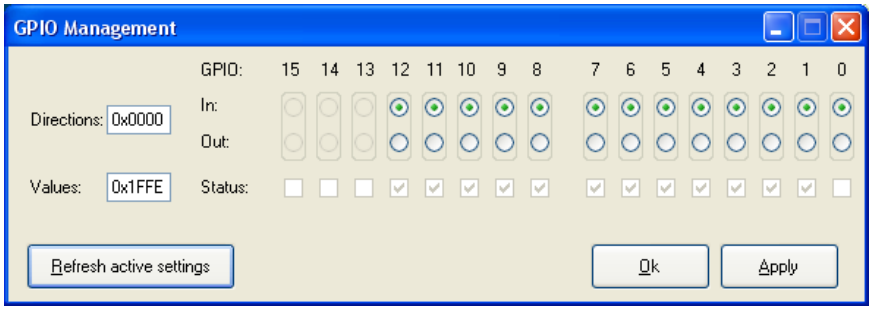
10 poles connector



24 poles connector

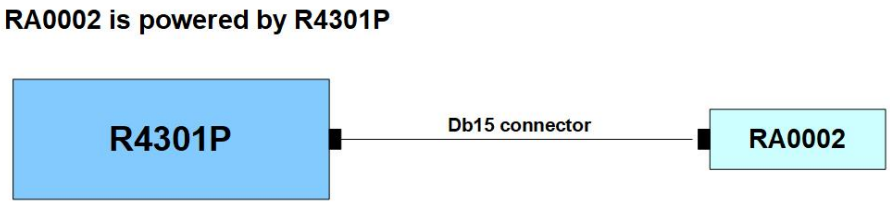


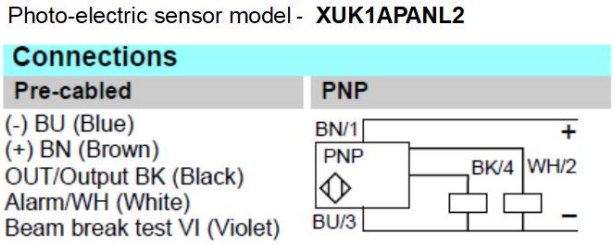
For example, using CAEN RFID Easy Controller software (downloadable at the Ion R4301P web page or in the Software&Firmware section), when the RA0002 module receives a valid input from the photo-electric sensor, the connected GPI enables its correspondent GPI/O to low level.

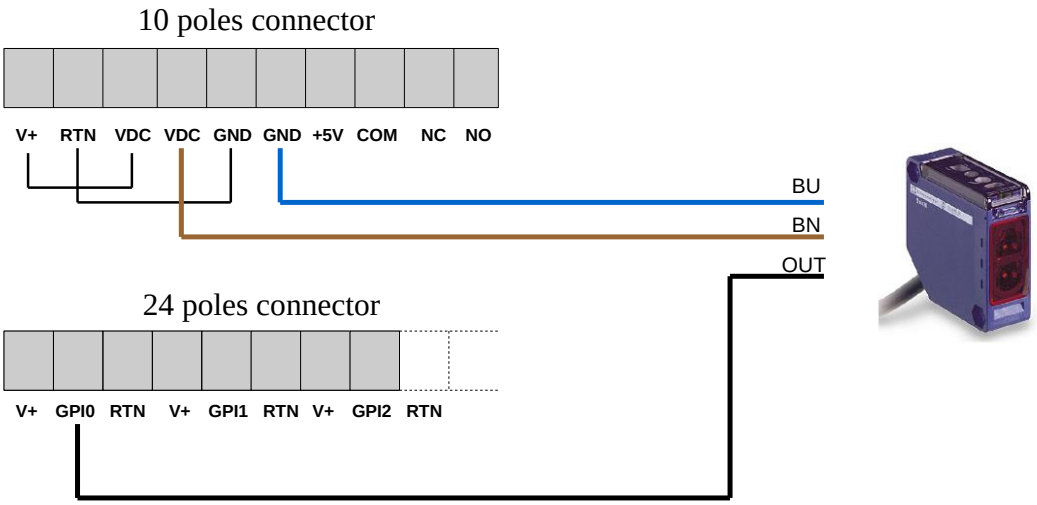


Example n.2

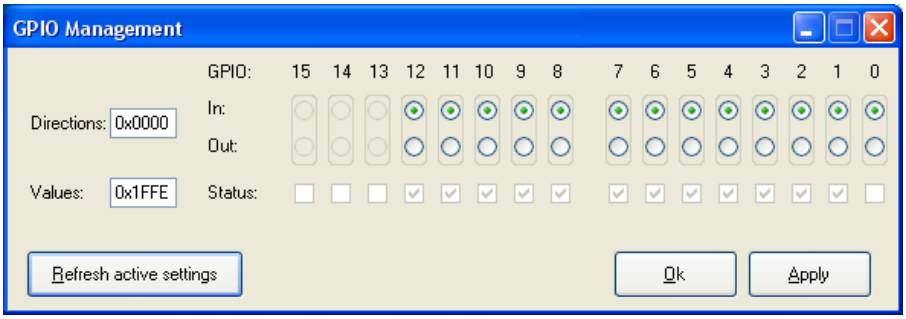
RA0002 is powered by R4301P





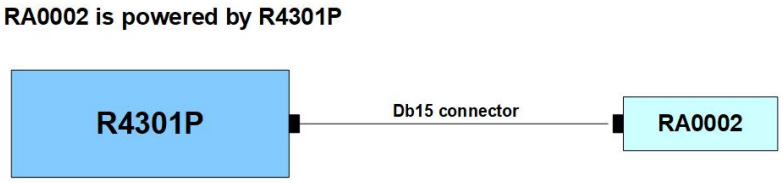


For example, using CAEN RFID Easy Controller software (downloadable at the Ion R4301P web page or in the Software&Firmware section), when the RA0002 module receives a valid input from the photo-electric sensor, the connected GPI enables its correspondent GPI/O to low level.

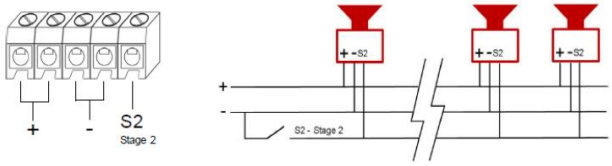


Connect an Alarm Sounder to RA0002

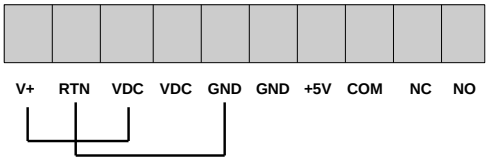
RA0002 is powered by R4301P



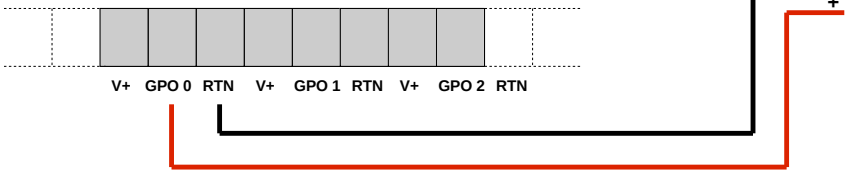
Alarm sounder model - **SONF1DC24R-H**



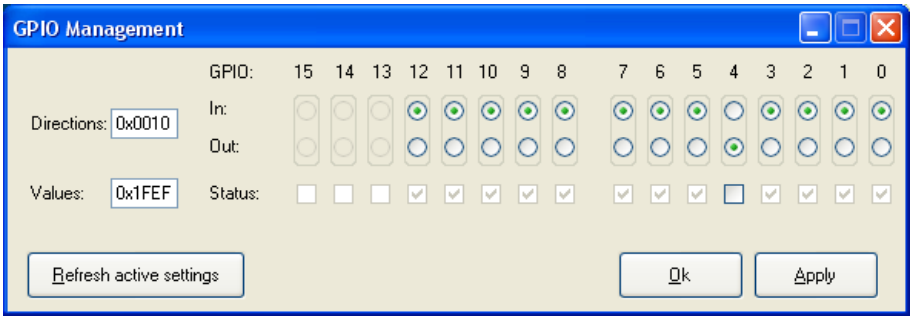
10 poles connector



24 poles connector

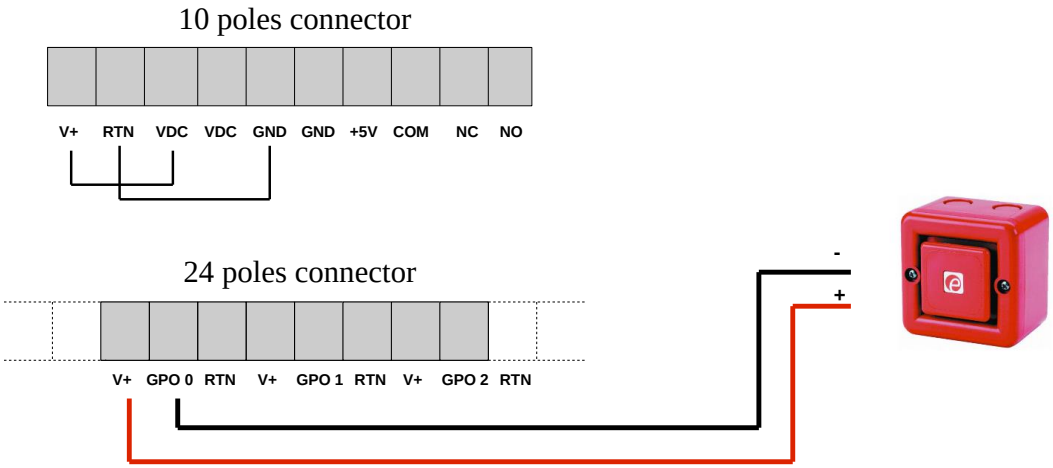


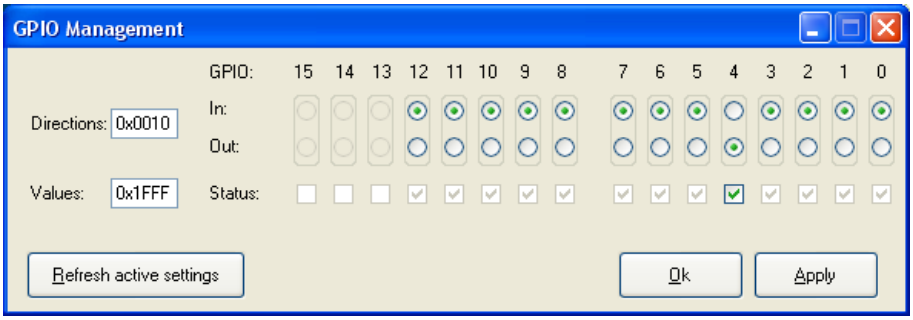
Example n.1: using CAEN RFID Easy Controller software (downloadable at the Ion R4301P web page or in the Software&Firmware section), when you enable low the right GPI/O from the R4301P, the RA0002 module receives a valid output and power up the alarm sounder.



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

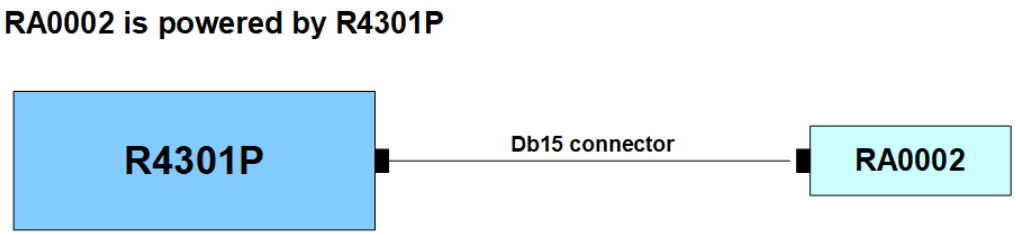
When you enable high the right GPI/O from the R4301P, the RA0002 module receives a valid output and powers up the alarm sounder.



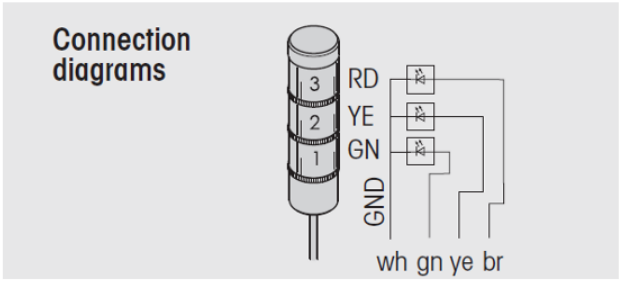


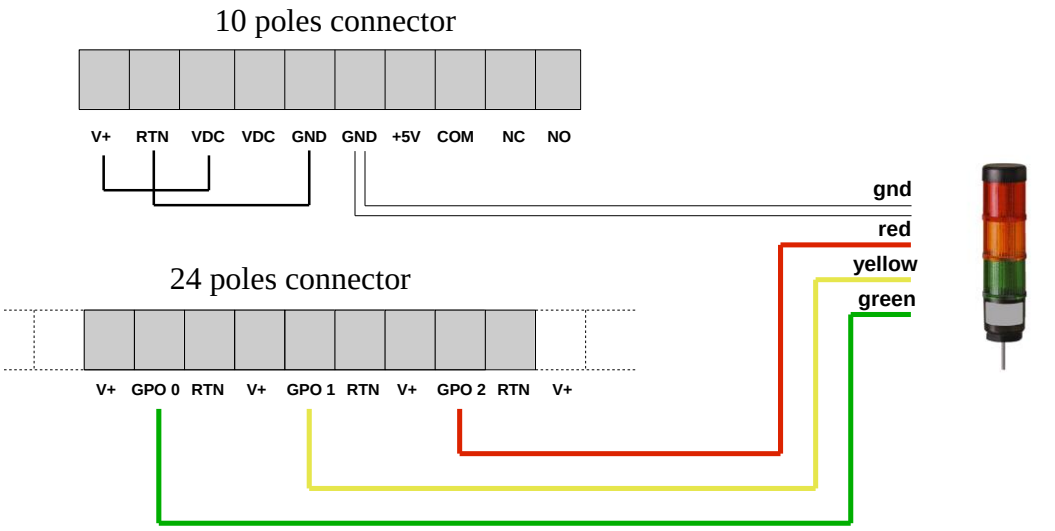
Connect a Led Signal Tower to RA0002

RA0002 is powered by R4301P

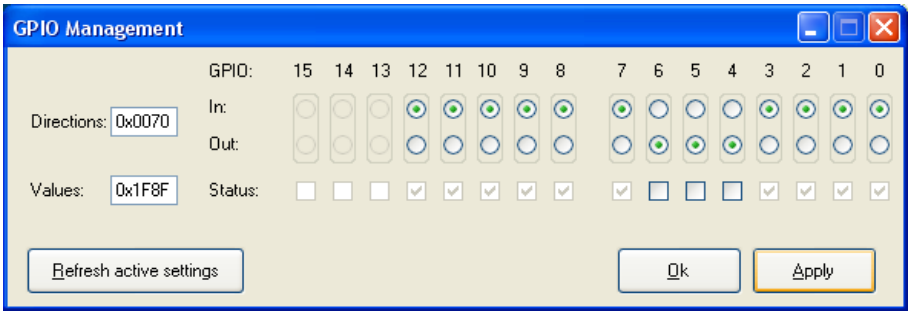


Led signal tower model – **WERMA 69300055**





For example, using CAEN RFID Easy Controller software (downloadable at the Ion R4301P web page or in the Software&Firmware section), when you enable low the right GPI/O from the R4301P, the RA0002 module receives a valid output and power up the led signal tower.

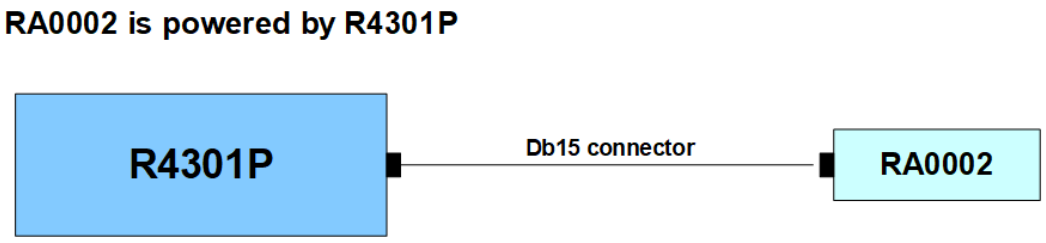


In this setup all the 3 lights are on.

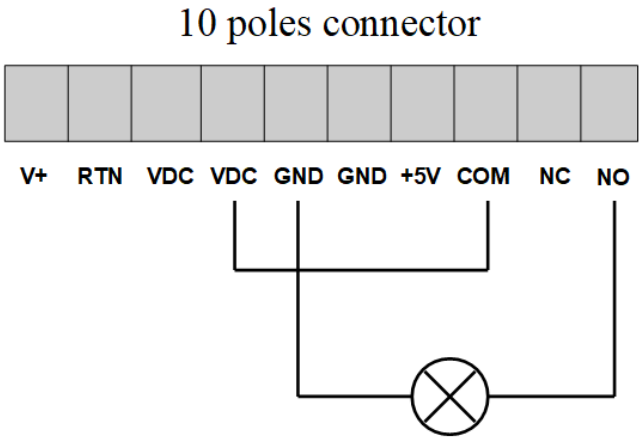
Note: In case of shared ground, like in the led signal tower case, we can work only in negative logic (active low signal).

How to Use Relay Output

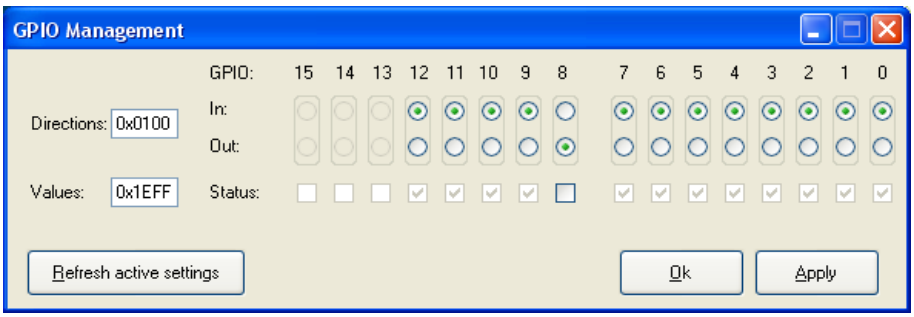
RA0002 is powered by R4301P



Example of a typical connection :



For example, using CAEN RFID Easy Controller software (downloadable at the Ion R4301P web page or in the Software&Firmware section), when you enable low the GPI/O 8 from the R4301P, the RA0002 module receives a valid output and switch the relay to the Normally Open (NO) contact.



4 TECHNICAL SPECIFICATIONS

Technical Specifications Table

Function	Digital I/O nterface unit
Reader interface	DB 15 (Connection to Ion R4301P 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

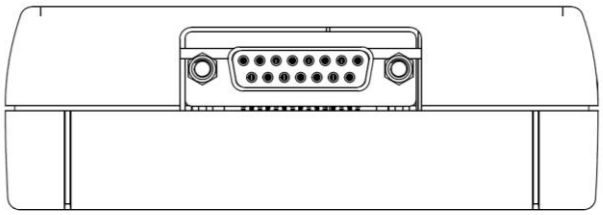
Tab. 4.1: Technical Specifications Table

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

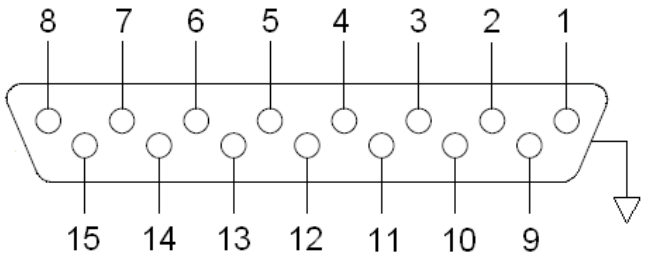
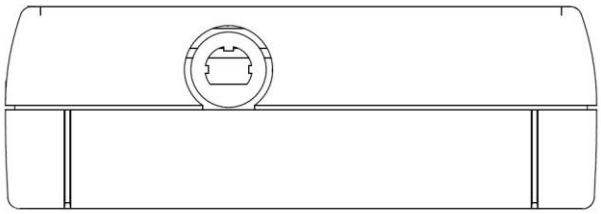


Fig. 4.1: GPIO DB15 socket connector pinout

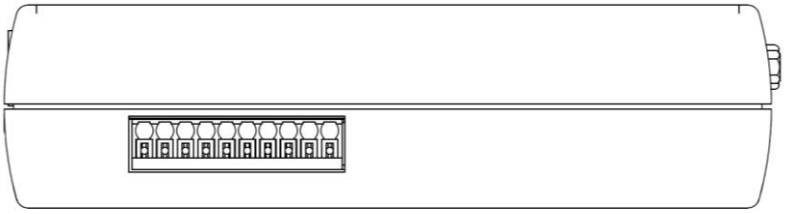
Warning: avoid connecting the DC_BYPASS signal to any of GPIO pins, otherwise the reader can be permanently damaged

RA0002 power connector



Note: The RA0002 power connector is the same connector of the Ion R4301P reader.

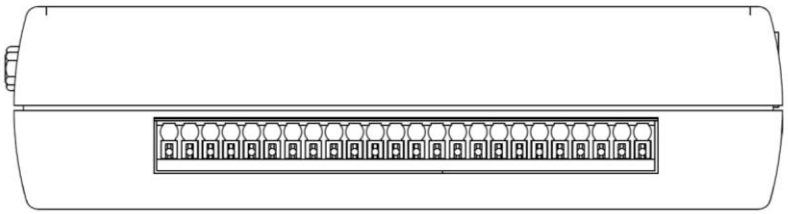
10-pin terminal block with quick coupling for power and address signals



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 , Imax 1A
8	COM	
9	NC	240/400 VAC , Imax 5A
10	NO	240/400 VAC , Imax 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	Yellow LED
	GPI1	GPI1 activated	Yellow LED
	GPI2	GPI2 activated	Yellow LED
	GPI3	GPI3 activated	Yellow LED
OUTPUT	GPO0	GPO0 activated	Yellow LED
	GPO1	GPO1 activated	Yellow LED
	GPO2	GPO2 activated	Yellow LED
	GPO3	GPO3 activated	Yellow LED
RELAY		NC contact	Yellow LED

Tab. 4.5: Front Panel LEDs

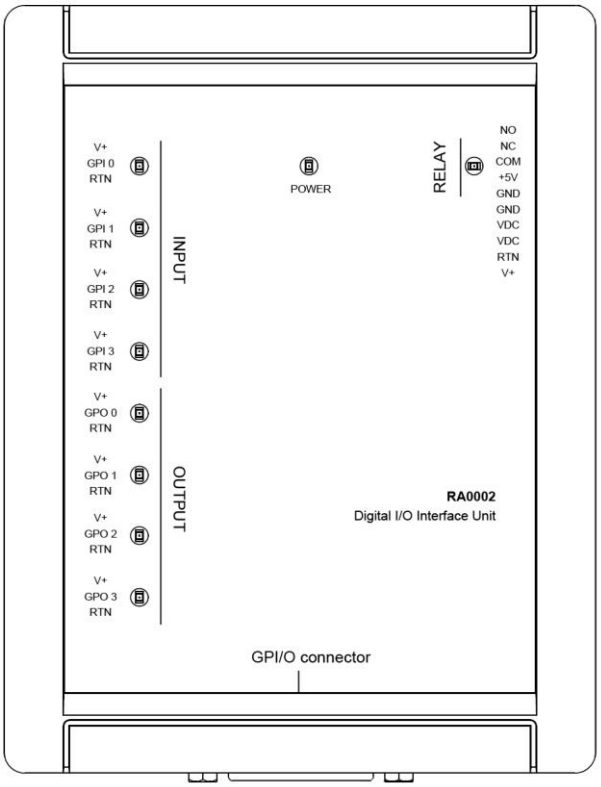


Fig. 4.2: Front Panel LEDs

Mechanical Drawings

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

All dimensions are in millimeters.

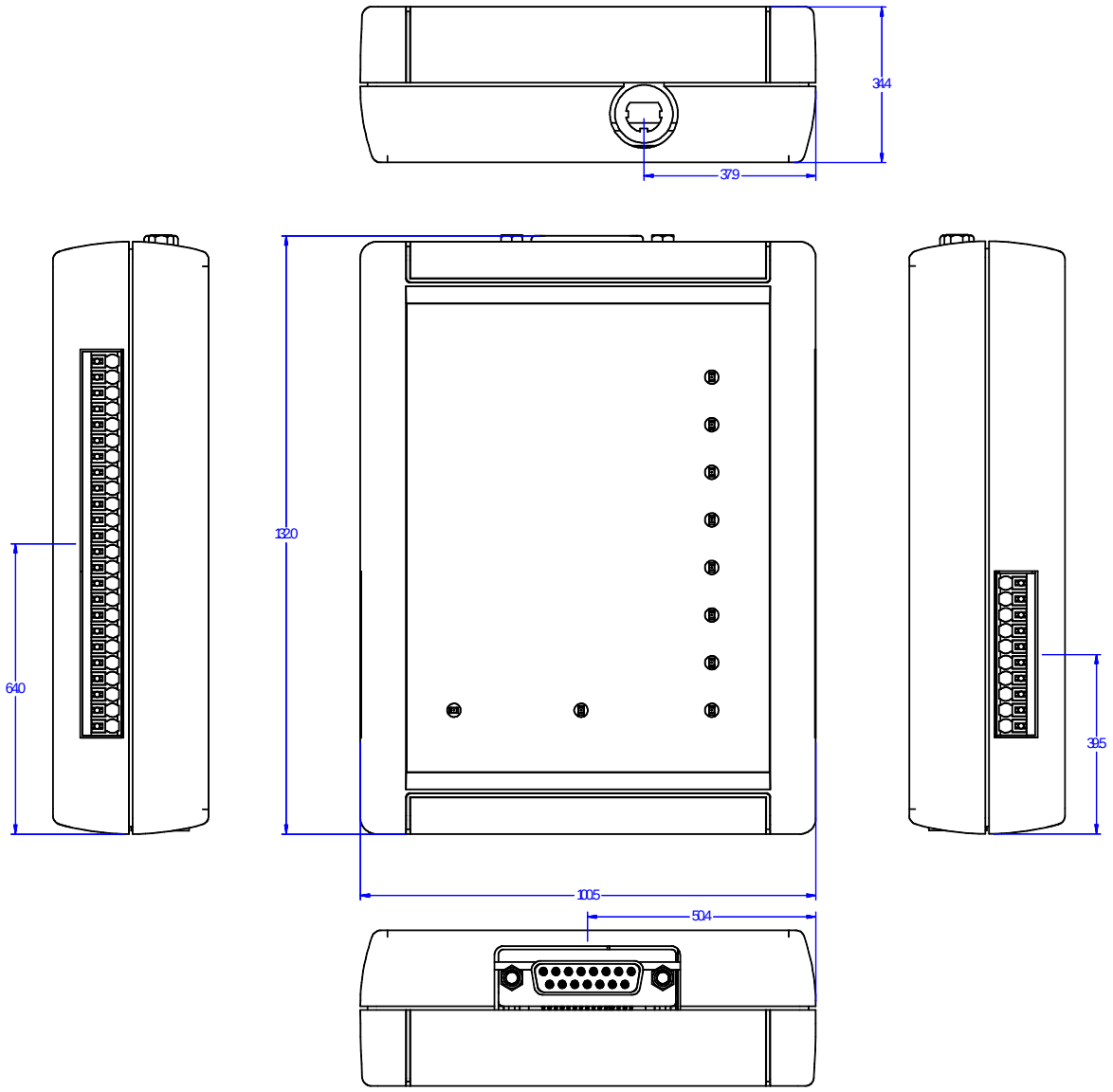


Fig. 4.3: Mechanical Drawings

5 REGULATORY COMPLIANCE

CE Compliance

Reference standard:

ETSI EN 301 489-1 V2.2.0:2017

ETSI EN 301 489-3 V2.2.1:2017

EN 55032:2015

CEI EN 55024:2013 +/A1:2015

CEI EN 60950-1:2007 +/A11:2010 +/A2:2014 +/A12:2014 + A1:2014

See § *RA0002 CE Declaration of Conformity* page 32 for the RA0002 CE Compliance Certificate.

RoHS EU Directive

RA0002 Digital I/O Interface Unit is compliant with the EU Directive 2011/65/CE on the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS2).

RA0002
CE DECLARATION OF CONFORMITY

We

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herewith declare under our own responsibility that the product:

Code: **WRA0002XAAAA**
Description: **RA0002 - Digital I/O Interface Unit**

corresponds in the submitted version to the following standards:

ETSI EN 301 489-1 V2.2.0:2017

ETSI EN 301 489-3 V2.2.1:2017

EN 55032:2015

CEI EN 55024:2013 +/A1:2015

CEI EN 60950-1:2007 +/A11:2010 +/A2:2014 +/A12:2014 + A1:2014

and declare under our sole responsibility that the specified product meets the principle requirements and other applicable regulations of directives 2014/30/EU (EMC) and 2011/65/EU (RoHS2).

Date: 05/06/2019

Adriano Bigongiari (Chief Executive Officer)

On the basis of this declaration, this product will bear the following mark: CE