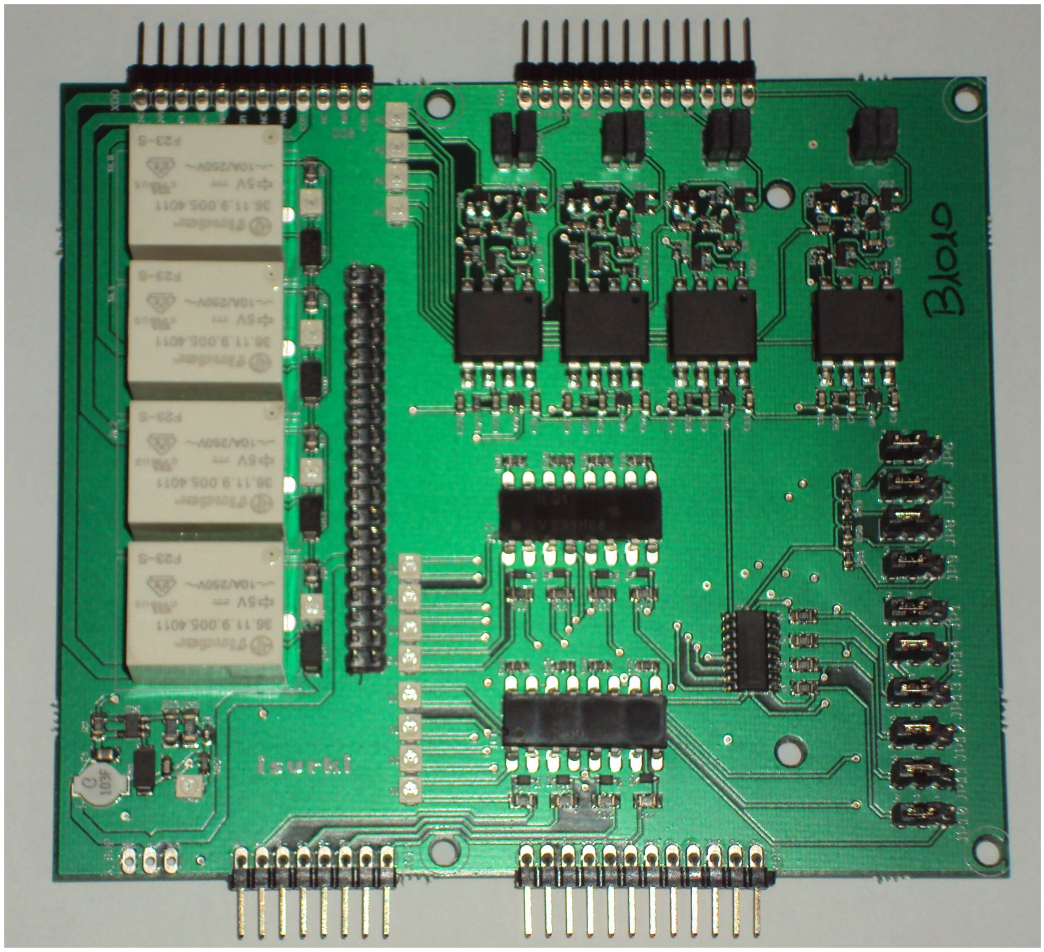
“TESDA v1.0”



DIGITAL & ANALOG

INPUT / OUTPUTS

FOR TORADEX IRIS CARRIER BOARD

USER GUIDE

SUMMARY

1 INTRODUCTION

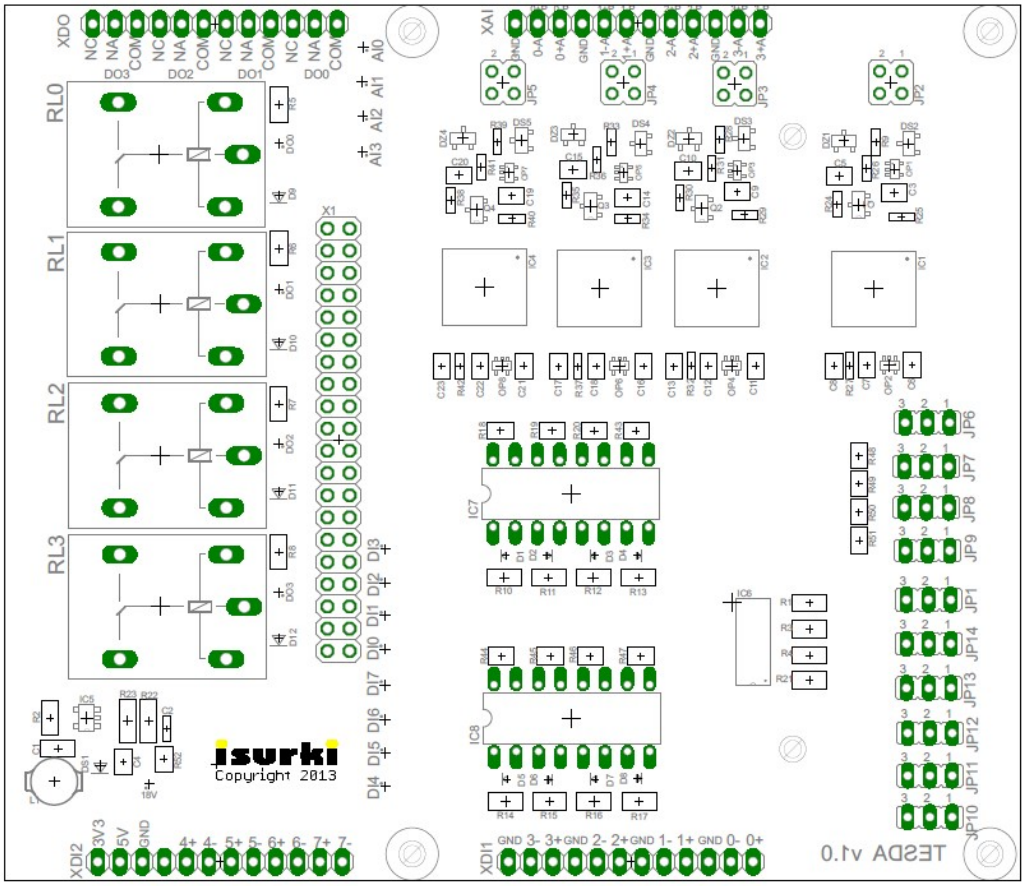
This User Manual concerns the ISURKI's developed and manufactured TESDA digital & analogue input/output board designed for interfacing the TORADEX IRIS CARRIER BOARD 1.3 (hereinafter referred as IRIS), from with a harsh industrial environment of devices, such as sensors, detectors, actuators,...

1.1 CHARACTERISTICS

The TESDA card directly interfaces with the X16 EXTENSION CONNECTOR of the IRIS carrier board, providing:

- Auxiliary power of 3.3 and 5.0 volts dc.
- 8 digital inputs, for voltaje free contacts or passive detector (i.e., proximity inductive detectors) with included 18 Vdc auxiliary supply.
- 4 pin to pin configured digital input/outputs. Digital outputs are relays with 1 switched contact.
- 4 x 4-20 mA analogue inputs, 12 bits, one by one configur entradas analógicas 4-20 mA, 12 bits, one by one configured as active or passive signals, with included 18 Vdc auxiliary supply.

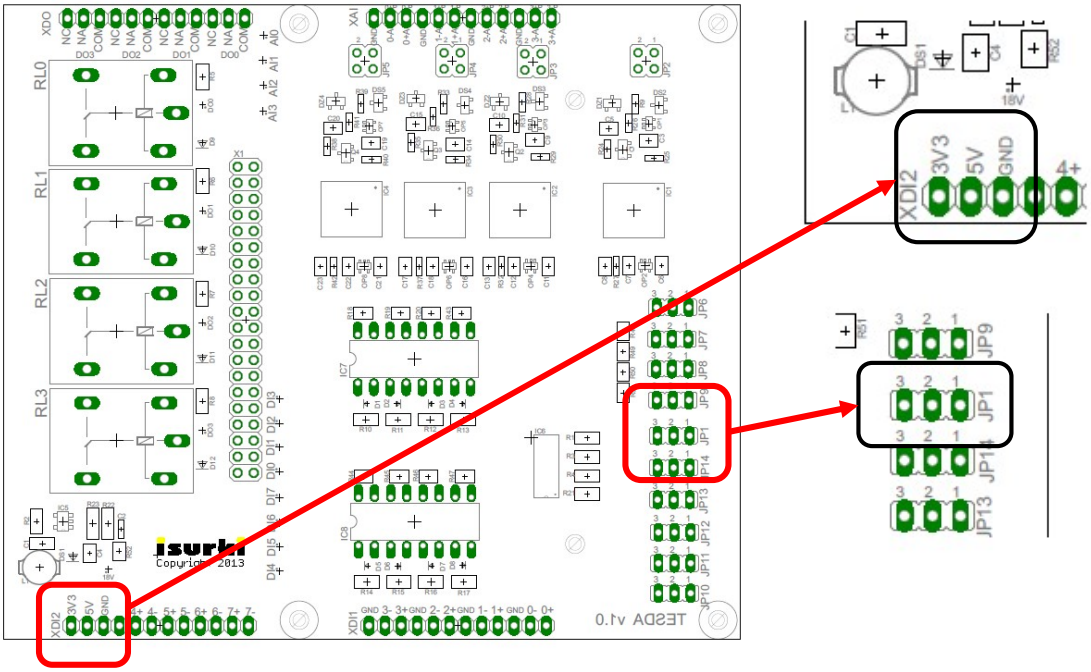
1.2 UPPER VIEW



2 INTERNALLY GENERATED AUXILIARY POWER SUPPLIES

TESDA provides the user with two auxiliary power supplies for his/her use with the next output ratings: 3.3V/2A and 5V/2.5A. Exceeding this limits may cause card misfunction or permanent damages.

Detachable connection terminals are located at the bottom left corner of the card:

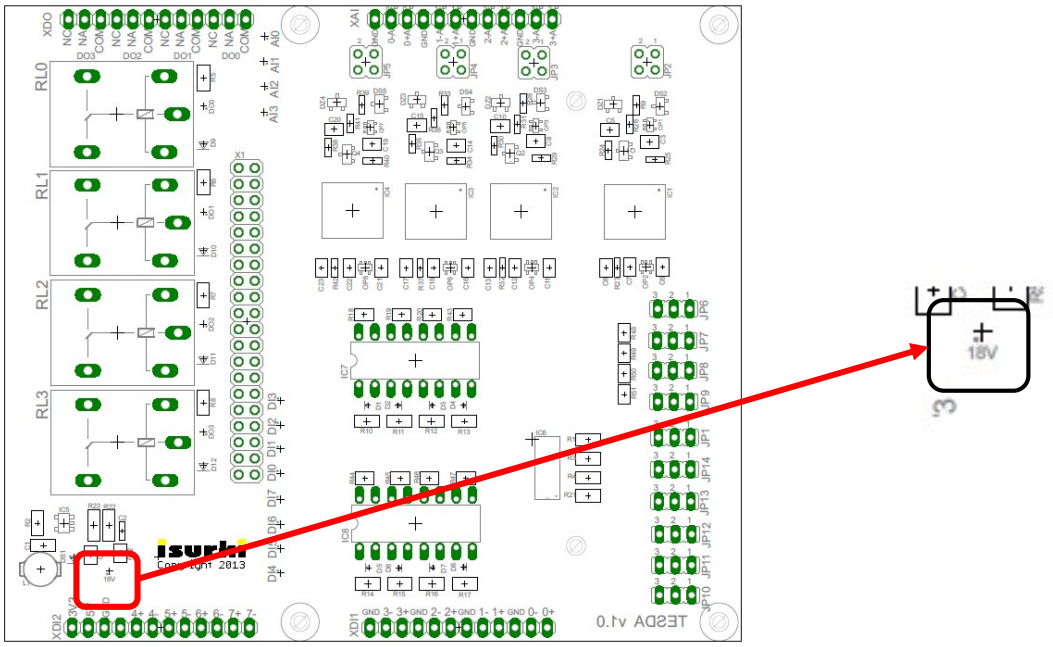


In case of using both auxiliary sources at the same time, the ground (GND) terminal should be shared.

TESDA also includes an 18 Vdc power supply for energizing passive detectors and sensors. Different ways of operation can be selected using the **JP1** jumper:

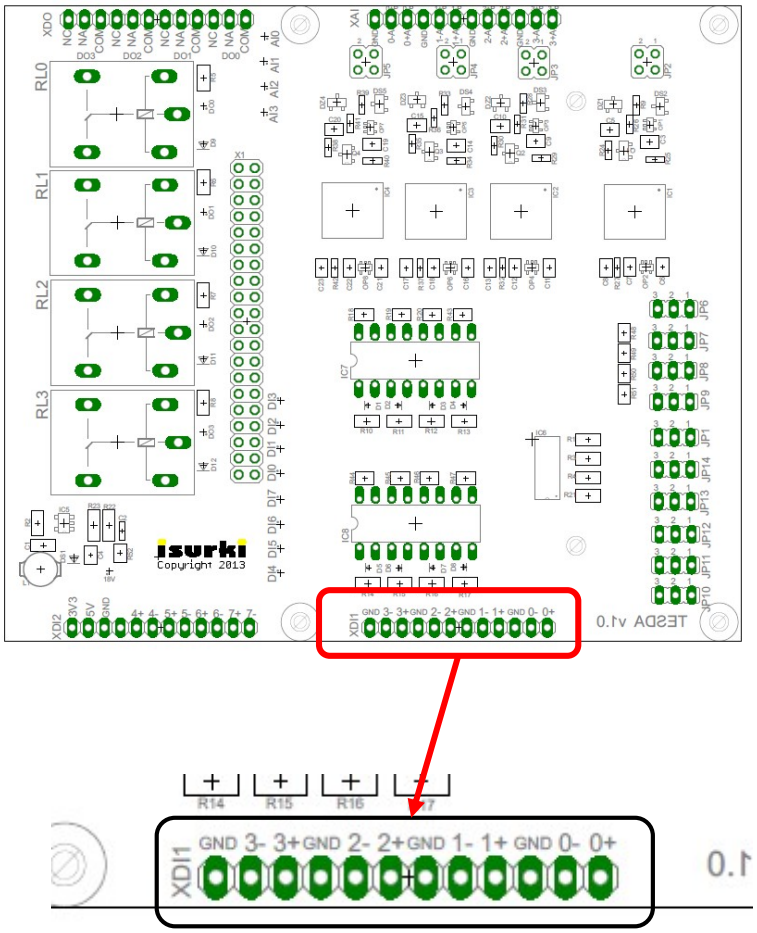
- With no jumpers: the 18 Vdc auxiliary suppy is always on.
- Connecting pins 2 and 3 of **JP1**: the 18 Vdc auxiliary supply is always of, out of service.
- Connecting pins 1 and 2 of **JP1**: the 18 Vdc auxiliary supply can be controlled by software.

The state of service of this 18 Vdc auxiliary power supply can be monitored throughout the led located at the botton left of the board.



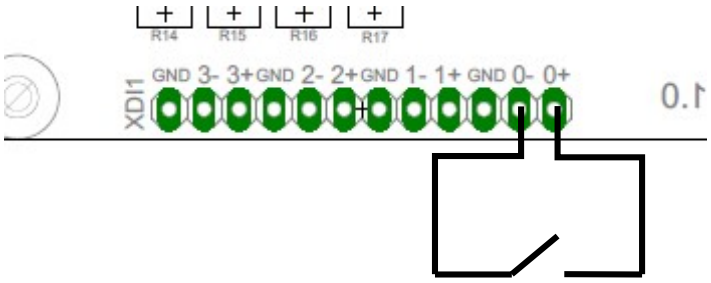
3 DIGITAL INPUTS

The TESDA board provides 4 digital inputs which connection detachable terminal **XDI1** is located at the bottom right of the card.



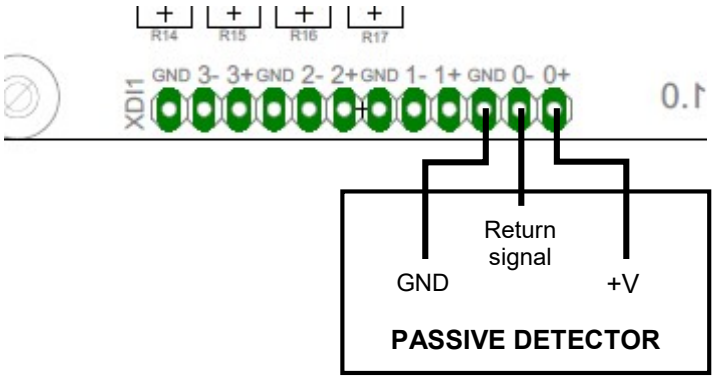
These digital inputs allow the connection of industrial field devices such as voltaje free contacts, passive and active detectors (photocells, inductive detectors, …), …

- The connection of voltage free (dry) contacts is as follows:



In the above mentioned case, the connection can be done without any polarity consideration.

- When connecting detectors that require supply from an external source, the next connection diagram applies:



In the above mentioned example, the 18 Vdc excitation to the detector is given through the 0+ and GND pins of the board. The output signal of the detector inputs the board through the 0- pin. For the rest of digital inputs, the diagram is equivalent.

The 4 digital inputs mode is user configurable in either pull-down (default) o pull-up mode, according to a respectively positive logic (default) or negative logic set up.

The default hardware set up of these four digital inputs in pull-down (positive logic) mode is carried out using a set of resistors as well as by means of the jumpers **JP6**, **JP7**, **JP8** y **JP9**. In case of different requirements, the user should state their needs when ordering the TESDA boards, since the mentioned resistors set replacement is required.

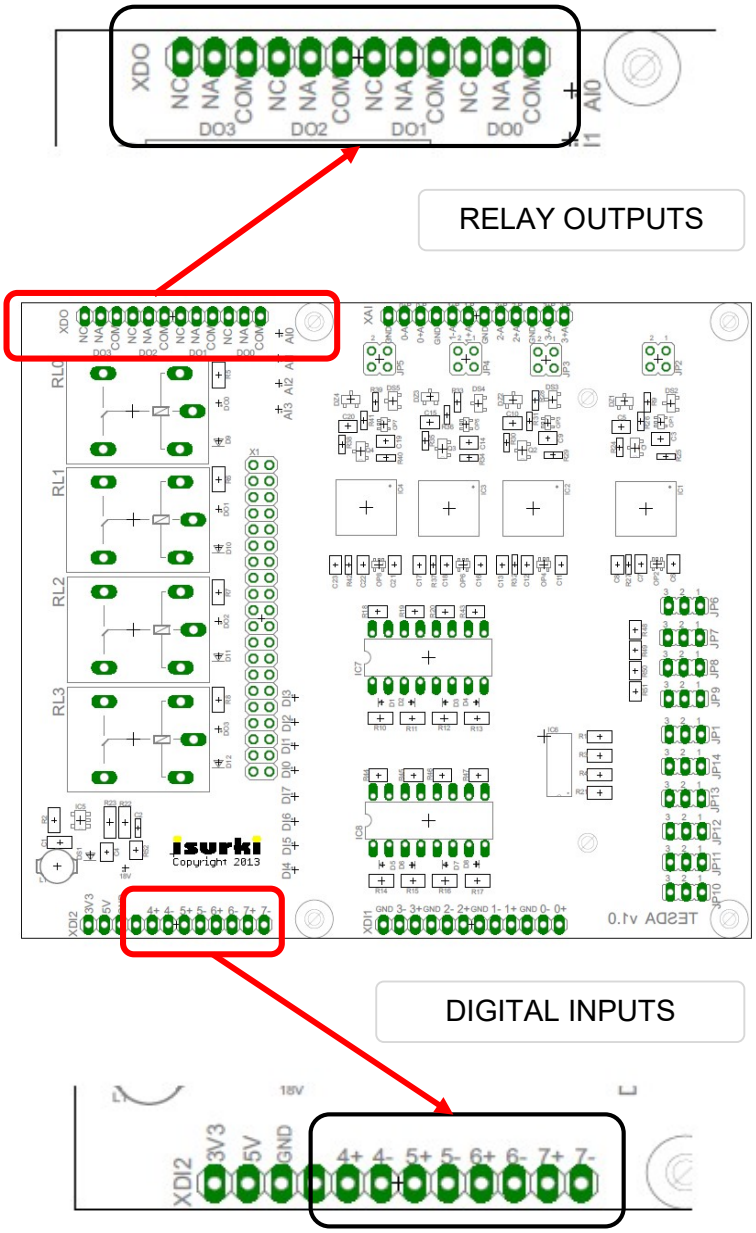
Therefor, the factory default set up of the digital inputs logic mode is pull-down (positive logic), considering the next configuration of the related jumpers:

- **JP6**: DI0 in pull-down mode (positive logic), pins 2 and 3 shortcircuited.
- **JP7**: DI1 in pull-down mode (positive logic), pins 2 and 3 shortcircuited.
- **JP8**: DI2 in pull-down mode (positive logic), pins 2 and 3 shortcircuited.
- **JP9**: DI3 in pull-down mode (positive logic), pins 2 and 3 shortcircuited.

4 CONFIGURABLE DIGITAL INPUT/OUTPUTS

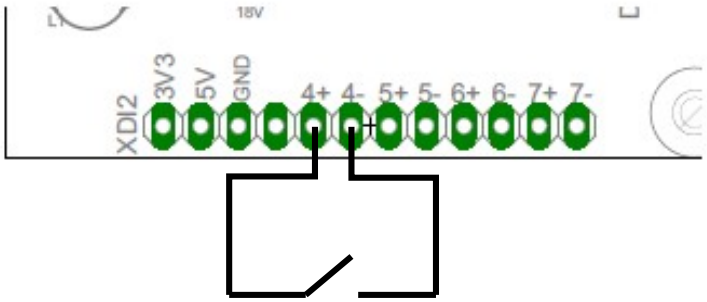
Additionally, the TESDA board provides 4 jumper configurable digital input/output points.

For the input configuration, the detachable **XDI2** connector is located at the bottom left of the board and, when used as relay digital outputs, at the top left corner with **XDO**.



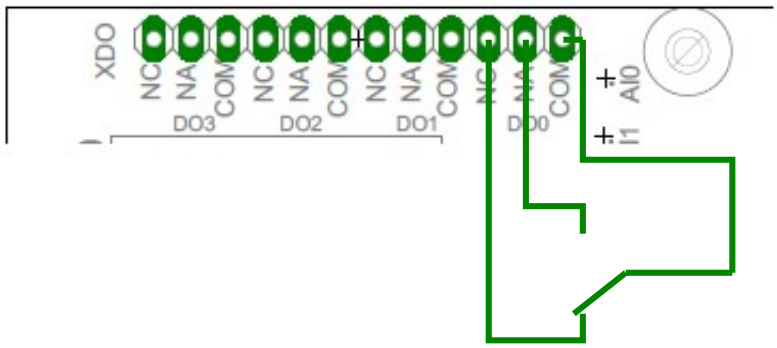
4.1 DIGITAL INPUTS

The four configurable digital inputs only can be connected to voltage free (dry) contacts, therefor, with no polarity considerations to be taken in account and with the same connection criteria as the stated in the case of the fixed digital inputs:



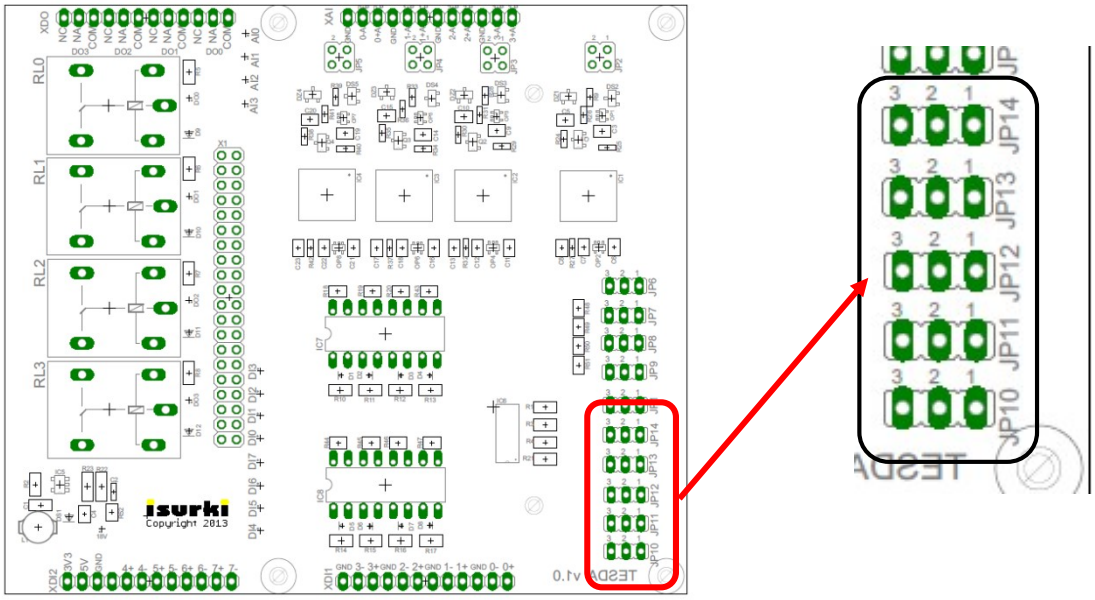
4.2 RELAY OUTPUTS

The relay outputs provide one dry switched contact (Normally open + normally closed) with one pin for the NO contact (marked as NA in the board), another pin for the NC contact (marked as NC in the board) and a third pin for the common terminal of the contact (COM in the board), according to the next schematics:



4.3 CONFIGURATION

The set up of the configurable digital inputs/outputs is done with the jumpers 10, 11, 12, 13 and 14 located at the right side of the board.



Jumpers 10, 11 and 12 allow to select if the first three of the four configurable digital points will work as input or output. Shortcircuiting the pins 1 and 2 of the jumper configure the point as input. On the other hand, connecting the pins 2 and 3 will configure the point as an output. To summarize:

- **JP10** select the first configurable point as DI4 or DO0.
- **JP11** select the second configurable point as DI5 or DO1.
- **JP12** select the third configurable point as DI6 or DO2.

Jumpers 13 and 14 allow configuring the last of the four configurable digital points as either DI7, DO3 or as 18 Vdc auxiliary supply control signal. **JP13** selects between 18 Vdc control signal (connecting pins 1 and 2) and DO3 (connecting pins 2 and 3). **JP14** selects between the incoming signal to **JP13** (connecting pins 2 and 3) and DI7 (connecting pins 1 and 2), according to the next diagram:

4.4 CONSIDERATIONS REGARDING DIGITAL OUTPUT #3 (DO3)

The relay output #3 is linked to the Colibri SODIMM pin **CLK12M_OUT** signal, which holds by default a high logic value with the processsor start up, leading to the relay activation when powering up the system and possibly causing, if not properly controlled, undesired or even risky situations on field actuators.

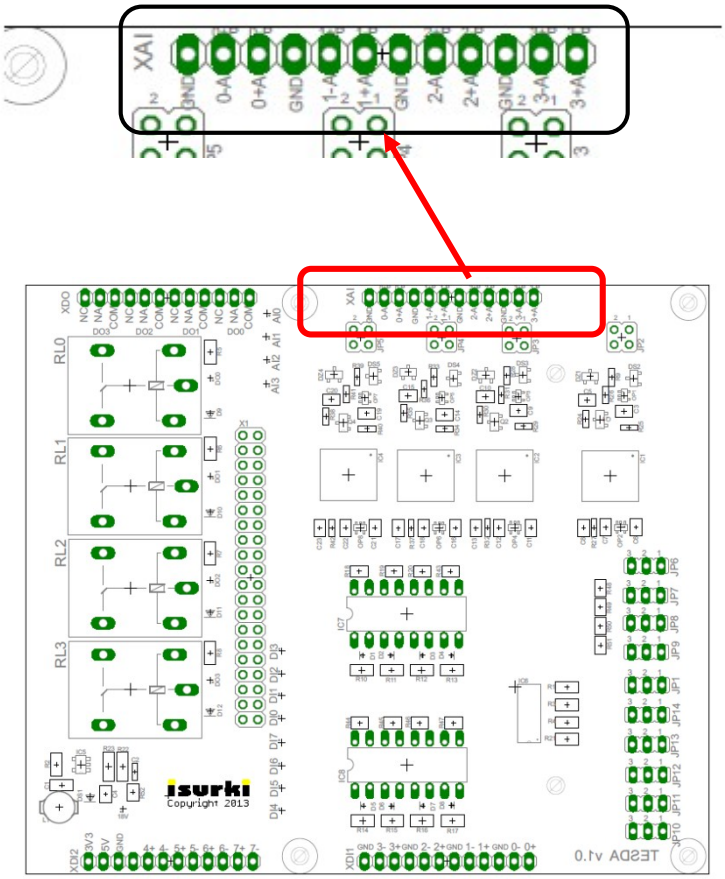
The default start up value of the GPIOs when booting the module can be consulted in the nex Toradex web page link: http://developer.toradex.com/knowledge-base/bootloader-customizer-kit

5 ANALOGUE INPUTS

5.1 CONNECTION

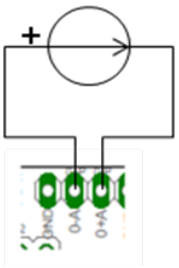
The TESDA analogue inputs allow the user the connection of both active and passive 4-20 mA transducer with a simple on board set up.

The detachable analogue input **XAI** connector is located at the right top of the TESDA board:

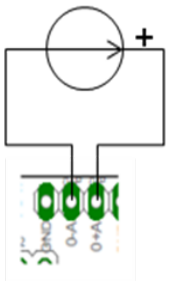


The connection procedure of a 4-20 mA current loop sensor is different depending on if it requires external excitation (passive sensor) or not (active). For the first case, the TESDA board provides a high quality industrial 18 Vdc auxiliary supply. The next drawings illustrate this concern, based on the first analogue channel marked as AI0.

- Passive sensor connection example: The positive terminal of the sensor is connected to the **0+P/0-A** board terminal and the negative to the **0-P/0+A**.



- Active sensor connection example: The positive terminal of the sensor is connected to the **0+A/0-P** board terminal and the negative to the **0-A/0+P**.



In both cases, the cable shield should be connected to the GND board terminal.

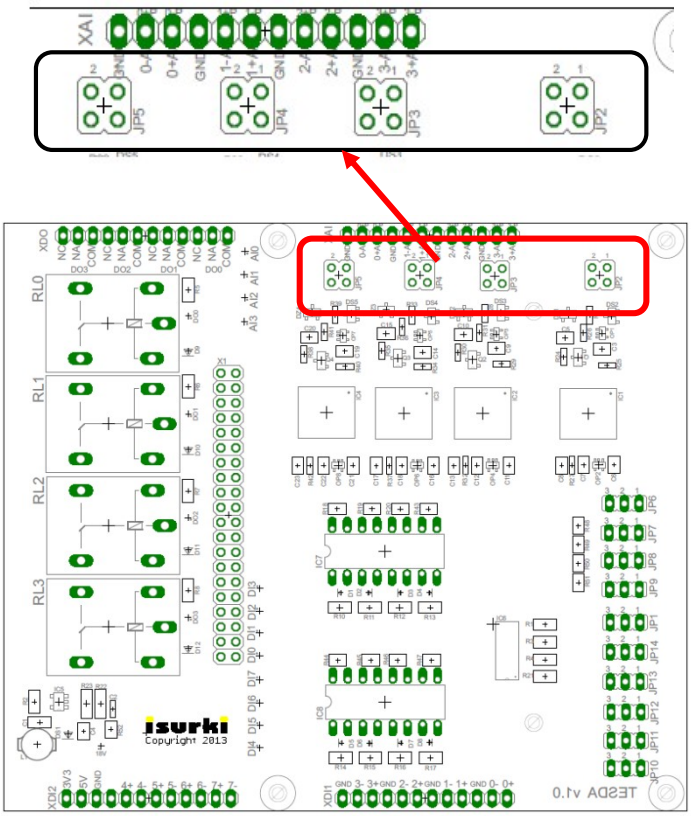
The set up between active or passive mode is done with the **JP2**, **JP3**, **JP4** y **JP5** jumpers, located just below the connection **XAI** terminal, as shown in the next picture and according to the next criteria:

- Set up as passive sensor: connect pin 1 to pin 2; connect pin 3 to pin 4.
- Set up as active sensor: connet pin 1 to pin 3.

The correspondence between analogue channels and jumpers is as follows:

- **JP2** for analogue input 3 set up.
- **JP3** for analogue input 2 set up.
- **JP4** for analogue input 1 set up.
- **JP5** for analogue input 0 set up.

:



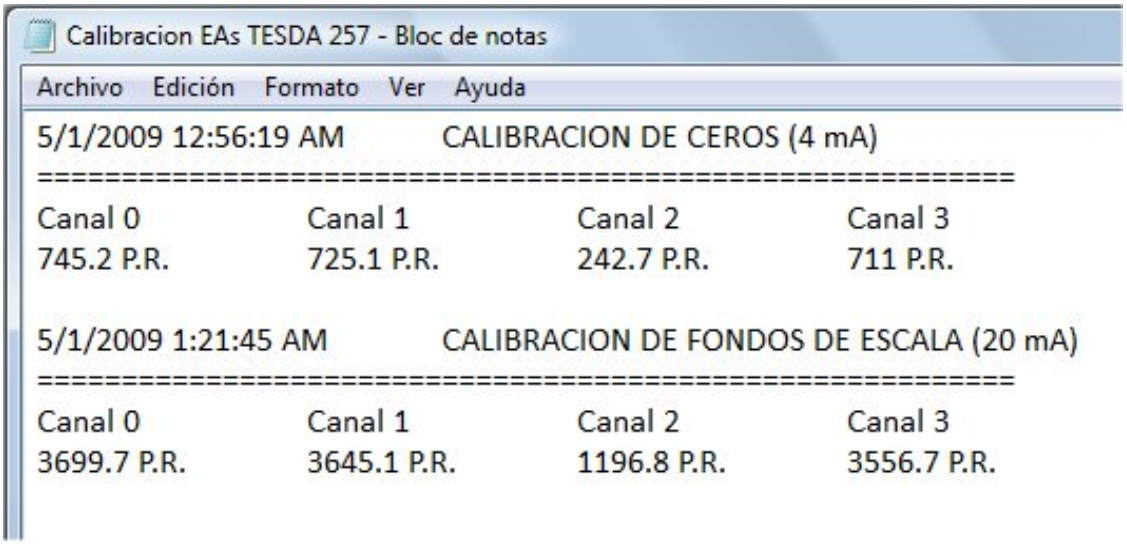
5.2 ANALOGUE INPUTS READ OUT AND CALIBRATION

ISURKI provides the TESDA user with free software tools and libraries for the real time automatic read out and calibration of the four analogue channels 12 bits ADC converters, featuring:

- Continuous acquisition and read out in resolution points (0 to 4096) and eletric units (4 to 20 mA).
- Convertion to user defined engineering units.
- Configurable filtering for smooth acquisition.
- Board calibration generating a text file report, as shown in the picture below.

All TESDA boards are supplied from factory with a high accuracy personalized calibration report of the four analogue channels.

For using the free software tools provided by ISURKI, the TESDA board should be connected to an IRIS board with a Tegra or Vybrid TORADEX processor with Windows CE installed.

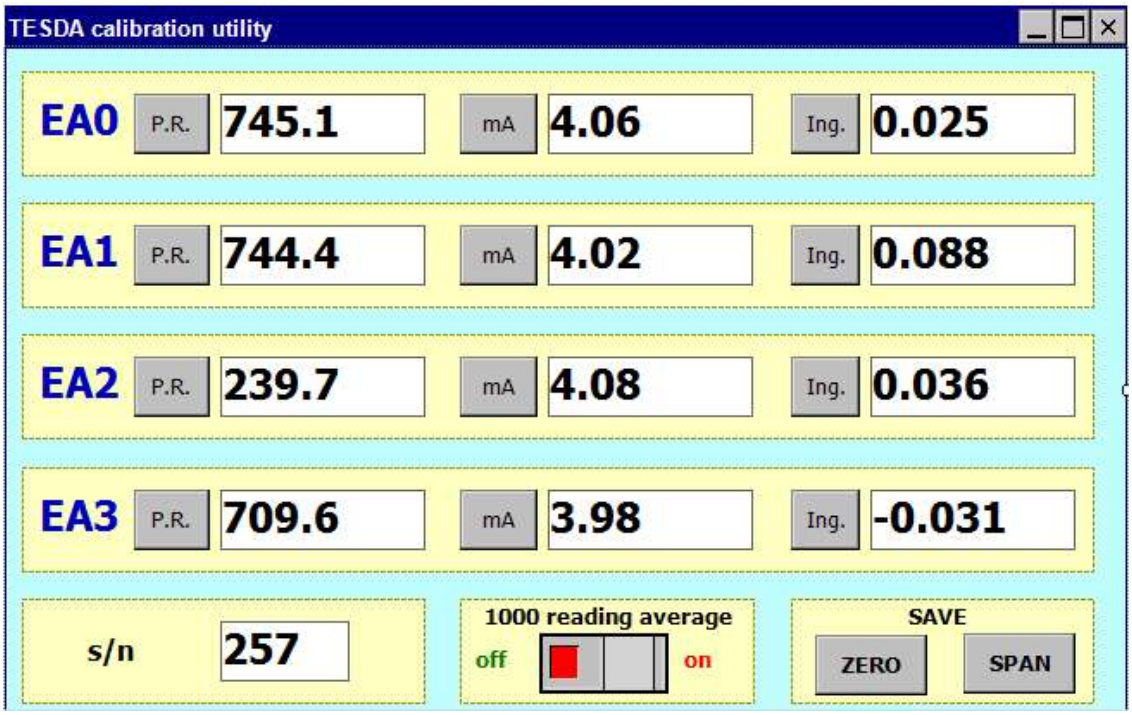


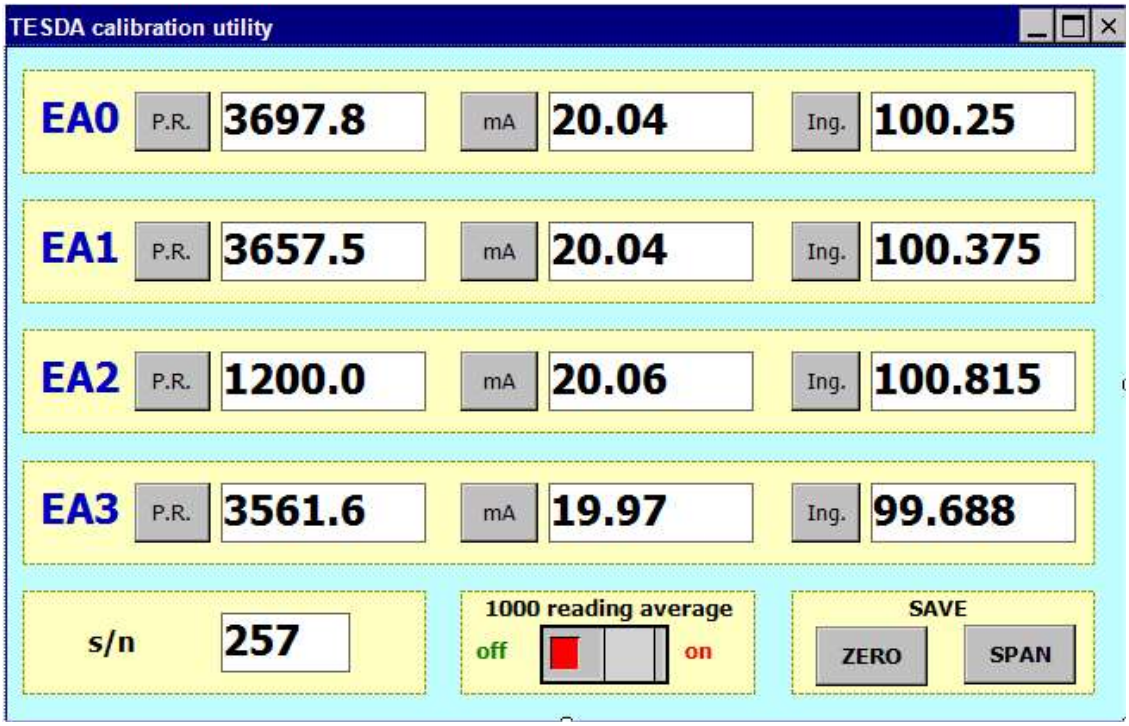
5.3 USER CALIBRATION

If required, the user can perform his/her own calibration, getting the ADC resolution points in the range 0 to 4096 (12 bits), corresponding to the zero (4 mA) and full scale sensor signal (20 mA) of each channel. The next tools would be required:

- A laboratory 4 to 20 mA current loop accurate generator.
- The free software tool *CalibracionEAs_TESDAeaLibrary.exe* provided by ISURKI.

Attached below you can see a couple of screenshots of this tool, showing respectively the resolutions points obtained for the offset and span calibration.



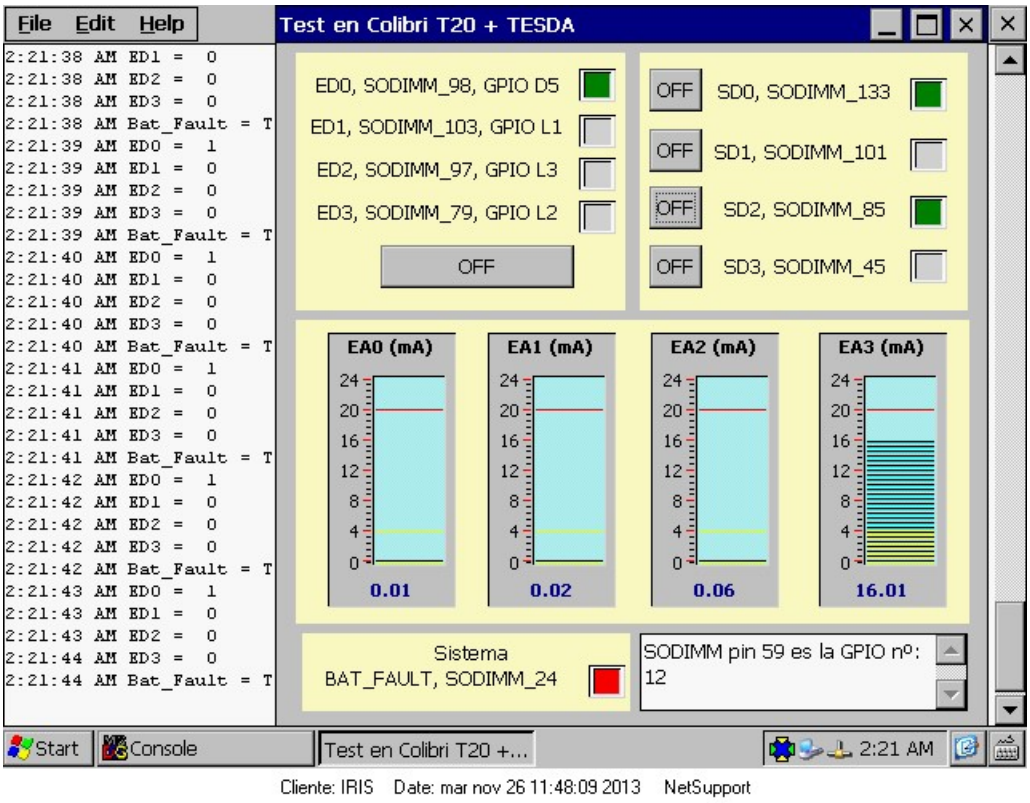


Using the ZERO and SPAN buttons located at the bottom right of the window the user can save the calibration results into a text format file.

5.4 FUNCTIONAL TEST

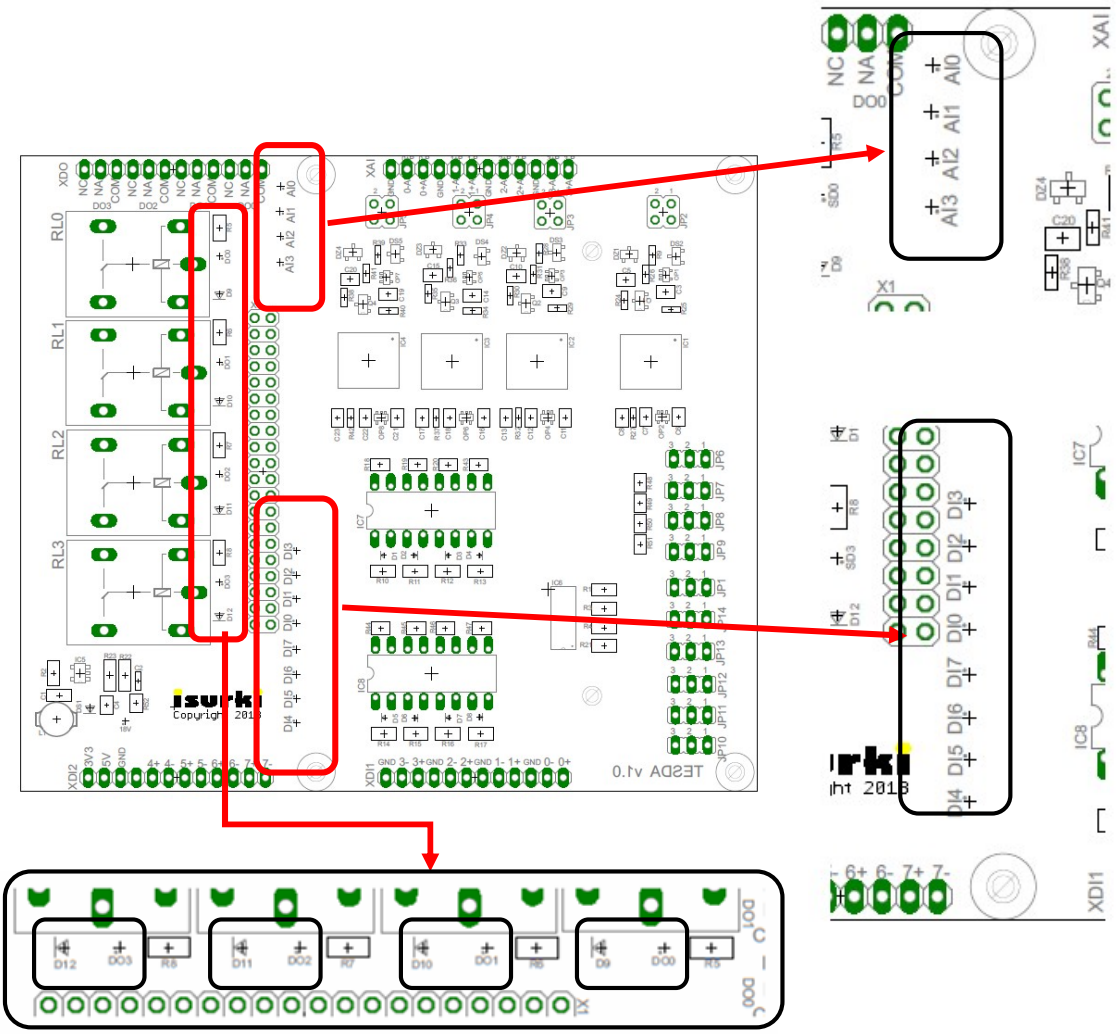
To check the functional operation of the TESDA board, ISURKI provides the user with a free software tool which includes:

- Continiuos automatic monitoring of the state of the 4 digital inputs.
- Continious automatic monitoring of the actual value of the 4 4-20 mA analogue inputs.
- Push buttons for the four relay digital outputs activation & deactivation.
- State of the BAT_FAULT_PIN of the SODIMM connector of the Colibri MCU board.
- Toradex and Isurki's used libraries information through out the Windows Console.



6 INDICATION LEDS

TESDA card provides on board visual led indication of the state of both digital inputs and outputs. Green leds locations are shown in the below attached picture.



The led marking on the board is as follows:

AI (Analog Input):

AI0 – Analog input 0

AI1 – Analog input 1

AI2 – Analog input 2

AI3 – Analog input 3

In the referred analogue inputs leds, the light intensity is proporcional to the mA input value, lighting the weakest with the 4 mA input signal and the maximum with the 20 mA.

Digital Inputs (Digital Inputs):

DI0 – Digital input 0

DI1 – Digital input 1

DI2 – Digital input 2

DI3 – Digital input 3

DI4 – Digital input 4

DI5 – Digital input 5

DI6 – Digital input 6

DI7 – Digital input 7

Digital outputs DO:

DO0 – Digital output 0

DO1 – Digital output 1

DO2 – Digital output 2

DO3 – Digital output 3

7 FACTORY DEFAUL SETUP

0 means no jumper

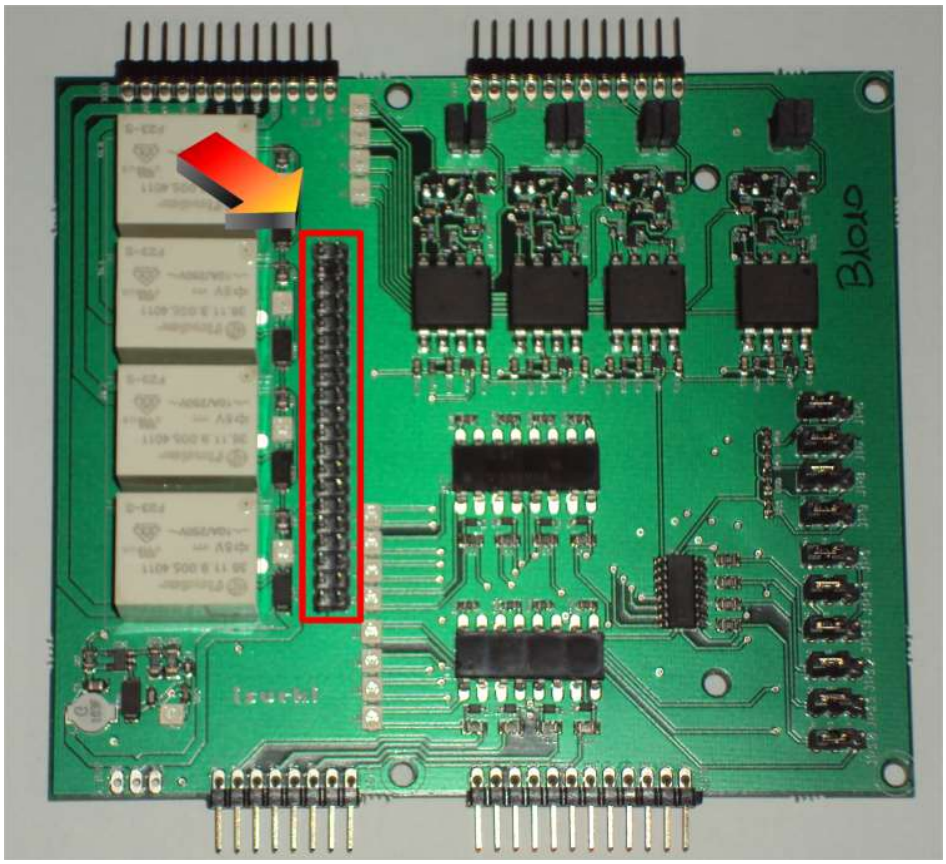
I means jumper installed

JUMPER	IDEN	SET UP DESCRIPTION	1-2	2-3	3-4	1-3
JP1	18V	18 Vdc auxiliary supply active	**0**	**0**		
JP2	AI3	Analog input 3 in active mode				**I**
JP3	AI2	Analog input 2 in active mode				**I**
JP4	AI1	Analog input 1 in passive mode	**I**		**I**	
JP5	AI0	Analog input 0 in passive mode	**I**		**I**	
JP6	DI0	DI0 in pull-down mode(positive logic)		**I**		
JP7	DI1	DI1 in pull-down mode(positive logic)		**I**		
JP8	DI2	DI2 in pull-down mode(positive logic)		**I**		
JP9	DI3	DI3 in pull-down mode(positive logic)		**I**		
JP10	DO0	DI/O0 configured as relay output		**I**		
JP11	DO1	DI/O1 configured as relay output		**I**		
JP12	DO2	DI/O2 configured as relay output		**I**		
JP13	DO3	DI/O3 configured as relay output		**I**		
JP14	DO3	DI/O3 configured as relay output		**I**		

8 CONNECTION

Connecting with Toradex IRIS Carrier Board

The 2 x 20 pin IDE **X1** male connector of the TESDA board (see picture below) directly interfaces with the **X16** EXTENSION CONNECTOR of the IRIS carrier board, through a 40 pole flat ribbon cable with two IDE female connectors at both sides. This flat cable, with a length of 20 cm., is included together with the board.



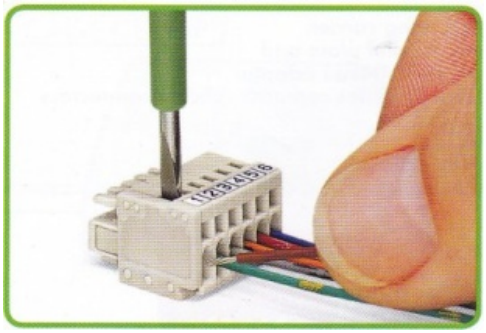
I/O connectors

Detachable cage clamps provide an easy and quick connection of the different field signals comino from devices, sensors and actuators, allowing the connection of the different wires even in the absence of the TESDA board, considerably reducing the on field unit replacement time in case of maintenance operations.

The TESDA unit supply include all the power and I/O detachable aerial connectors including 50 cm (20”) of cable. The I/O connectors characterististics are:

- Commercial reference: WAGO, item number 733-372.
- Type: cage clamp
- pitch: 2’5 mm
- 250V/2’5kV/2
- Nominal current: 4 A.
- Wire section: 0’08 a 0’5 mm^2.
- Required tool: 2’5 x 0’4 mm. screwdriver

The wire insertion procedure is shown in the below picture.



9 TECHNICAL SPECIFICATIONS

CONCEPT	NUM / REMARKS	CHARACTERISTICS
Power supply input	1 x	• 6 – 27 Vdc, • shortcircuit and polarity inversion protected
Auxiliary power supply outputs	1 x 1 x 1 x	• 18 Vdc (for AIs & DIs), software managed. • 5 Vdc-3'5 A • 3'3 Vdc-2'5 A
Digital inputs	4 x (fixed) 4 x (configurable)	• voltage free / voltage active • optoisolated (V_{AIS}=5300 V_{RMS}) • maximum input current: 60 mA • maximun reverse voltage: 6V. • pull-down (default) o pull-up (factory configurable on request). • Led indication for both AIs and DIs.
Digital relay outputs	4 x (configurable)	• 1 SPDT contact 0'12A@250Vac, 4A@12Vdc • Led for status indication.
Analogue inputs	4 x	• Electric range: 4 to 20 mA • Optoisolated (V_{AIS}=1414 V_{RMS}) • Jumper configurable passive or active mode. • Led indication, with progressing luminosity according to input signal value.
Housing	Policarbonate	• 137'5 (depth) x 118 (high) x 45 (wide) mm. • Policarbonate • Working temperatura range: -40 to +125 ºC
Mounting		DIN rail

10 TECHNICAL ASSISTANCE

(34) 943-635437

tecnica@isurki.com

www.isurki.com/pc-embebido