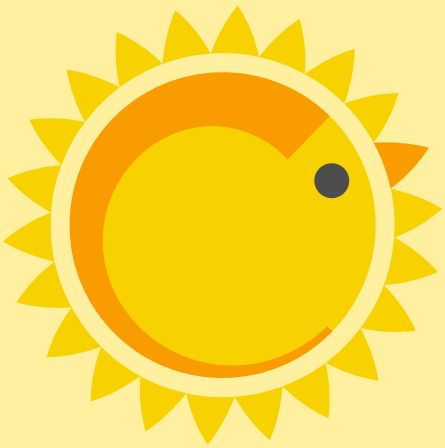

pio
programmable
input_output
interface

PIO INTERFACE

DATASHEET

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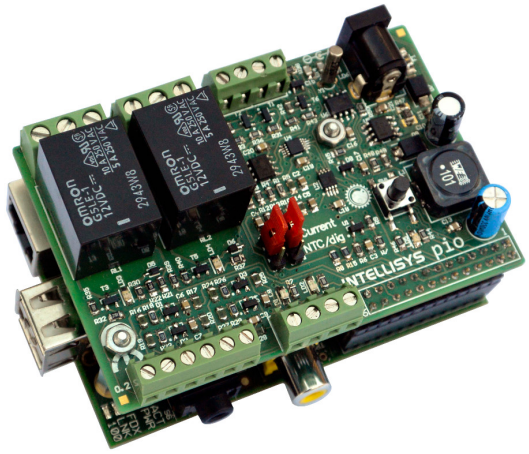
PIO

Programmable
Input and **O**utput interface
for use with Raspberry Pi.



pio
programmable
input_output
interface

For **C**, **Java** and **Python** programming languages.

Features

- Configurable, flexible, inputs and outputs.
- Small footprint.
- 2 universal inputs (**UI1** and **UI2**) and four digital inputs (**DI1**, **DI2**, **DI3** and **DI4**).
- 1 push-button for user purposes (**DI5**).
- 2 analogue outputs (**AO1** and **AO2**) and 2 relay outputs (**DO1** and **DO2**).
- 3 programmable LED (2 green, 1 red).
- RTC (real time clock) battery-powered (CR2032).

Description

Peripheral of inputs and outputs (I/O), small sizes, to be installed on RASPBERRY PI module, with extremely versatile I/O capability suitable for a broad range of applications, especially in Domotic and Building Automation applications. Various I/O's configurations available, for a total of 10 points.

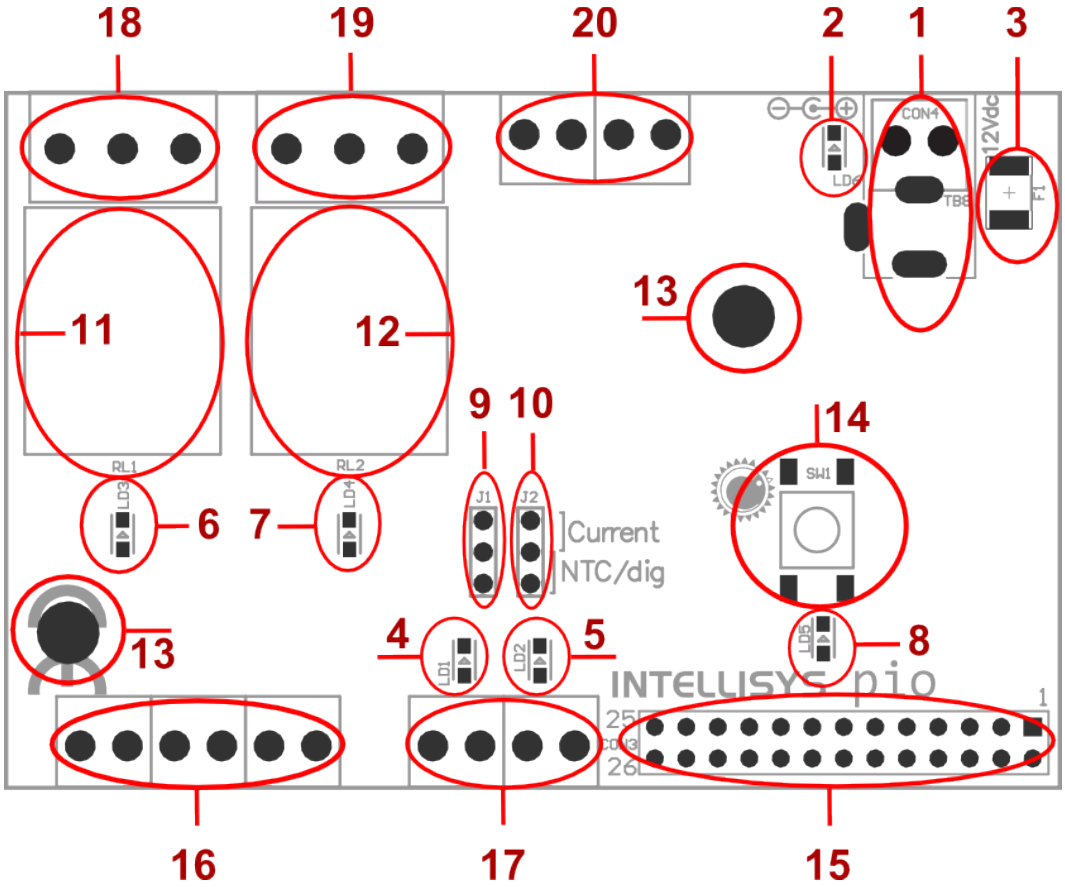
You may use the software library (see PIO LIBRARY FUNCTION REFERENCE MANUAL) writing simple code to have access to the physical I/O resources. It is very easy to turn on a LED, as you can see in the follow example:

```
int main (void)
{
    Pio_SYSTEM_Init();

    int RedLed = 3;
    int LedOff = 0;
    int LedOn = 1;

    Pio_LED_Command_Write(RedLed, LedOn);
}
```

PHISICAL

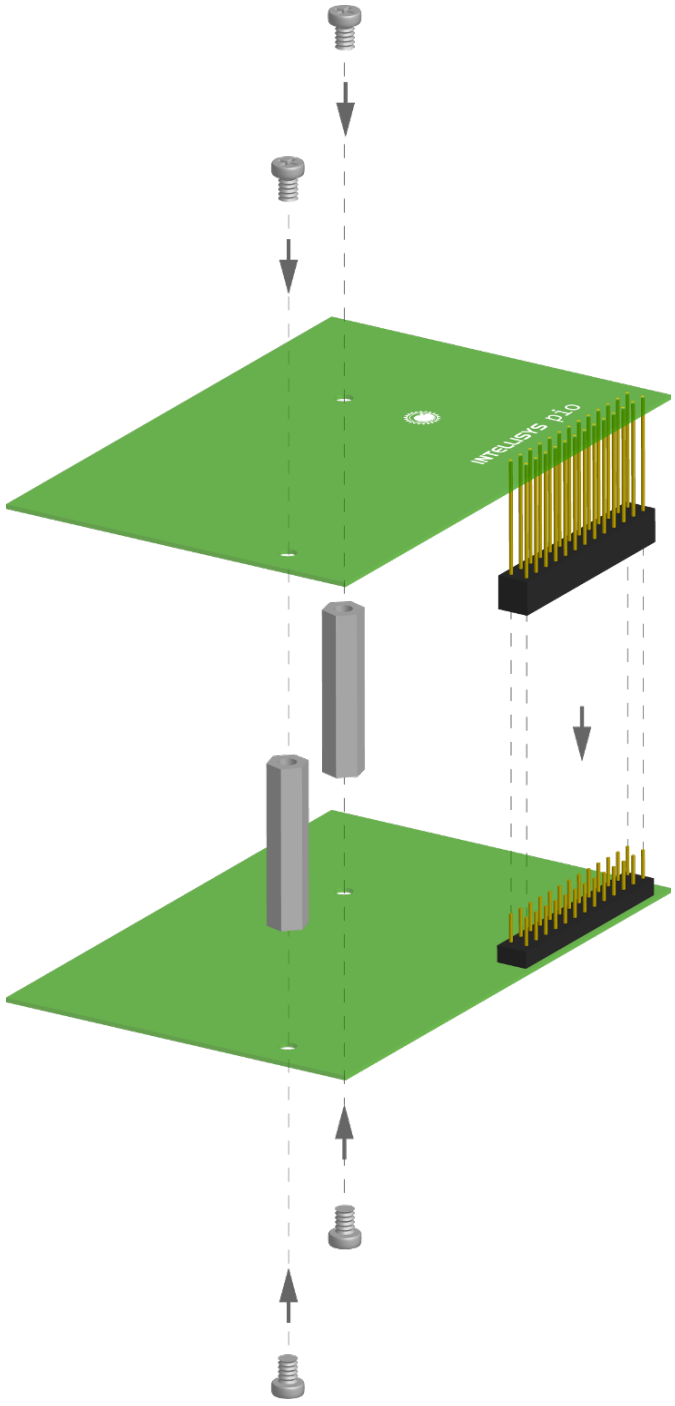


	Name	Description
1	***Supply terminal***	Power jack or terminal.
2	***LED Supply***	Blue LED power supply indicator.
3	***F1***	Self-resetting supply fuse.
4	***LD1***	User LED 1 - green.
5	***LD2***	User LED 2 - green.
6	***LD3***	Status LED for relay RL1 - orange.
7	***LD4***	Status LED for relay RL2 - orange.
8	***LD5***	User LED 3 - red.
9	***Jumper J1***	Universal input setting named UI1.
10	***Jumper J2***	Universal input setting named UI2.
11	***Relay RL1***	Relay 1.
12	***Relay RL2***	Relay 2.
13	***Mounting spacers***	Holes for mechanical spacers.
14	***Button SW1***	User button.

	Name	Description
15	***CON3***	Connector for electrically linking PIO interface to the “RASPBERRY pi”.
16	***Electrical terminal DI***	+12 Vcc reference connection for digital inputs (DI1, DI2, DI3, DI4).
17	***Electrical terminal UI***	Terminal connection for universal inputs (UI1, UI2).
18	***Electrical terminal DO1***	Terminal connection for digital output DO1 (relay RL1).
19	***Electrical terminal DO2***	Terminal connection for digital output DO2 (relay RL2).
20	***Electrical terminal AO***	Terminal connection for analogue outputs (AO1, AO2).

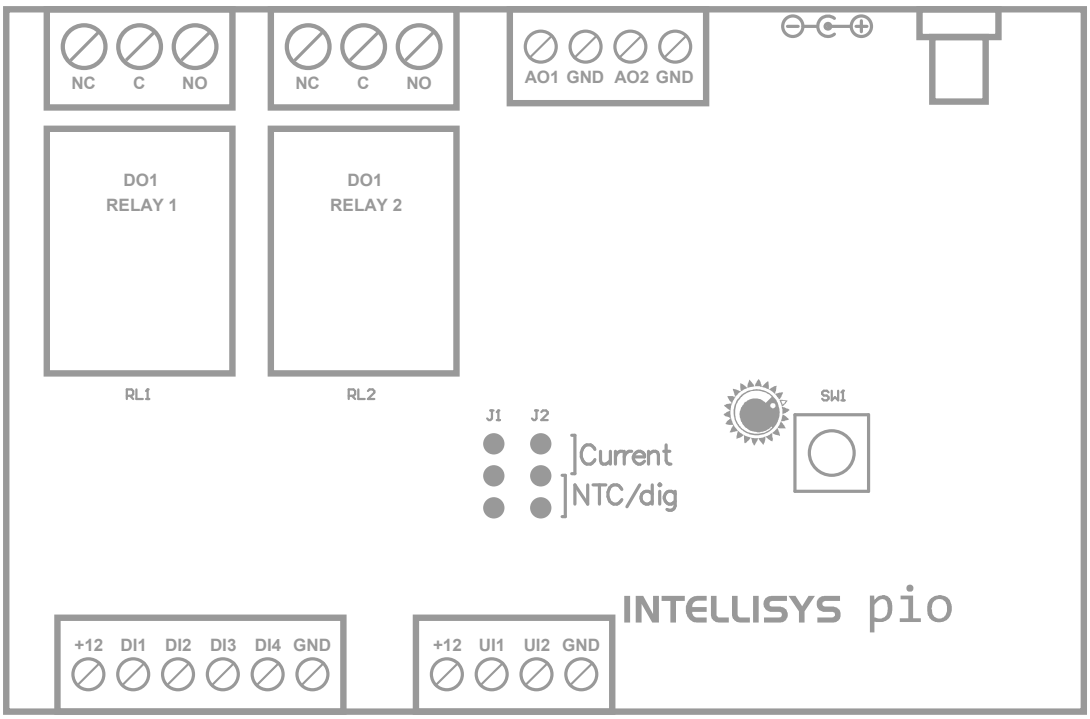
UNIT

The Pio interface is supplied without enclosure. It has 2 points mounting to facilitate installation on the RASPBERRY Pi. See mounting spacers (point 13) in the figure above. To assemble Pio with RASPBERRY Pi follow the next figure.



TERMINALS

Five connectors are used throughout to facilitate wiring of inputs and outputs. The 'DI' terminal is used for digital inputs DI1, DI2, DI3 and DI4. The 'UI' terminal is used for the universal inputs UI1 and UI2. The 'DO' terminals are used for digital outputs DO1 and DO2 respectively. The 'AO' terminal is used for analogue outputs AO1 and AO2.



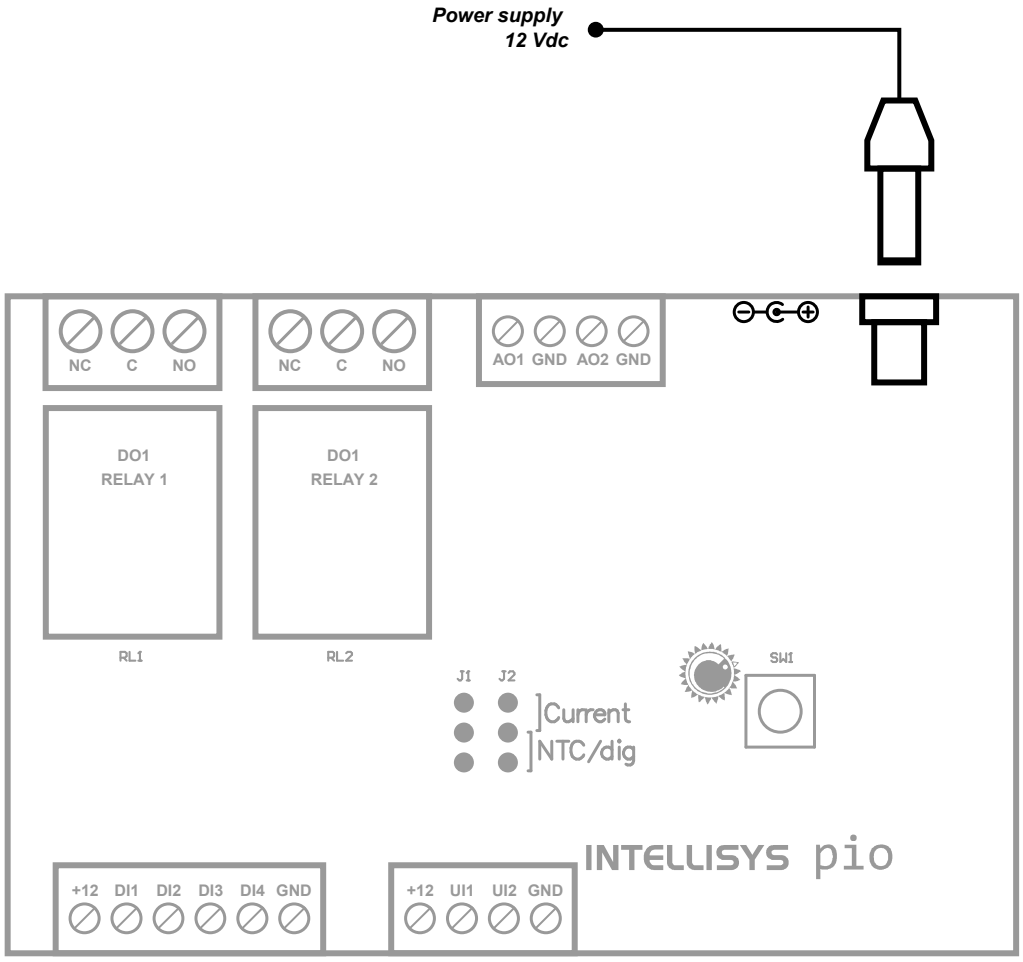
POWER

When the PIO interface is mechanically (with mounting spacers) and electrically (with CON3 connector) assembled to the RASPBERRY Pi, **to power both PIO and RASPBERRY Pi**, you must connect **only** the supply terminal of the PIO interface (see figure below).

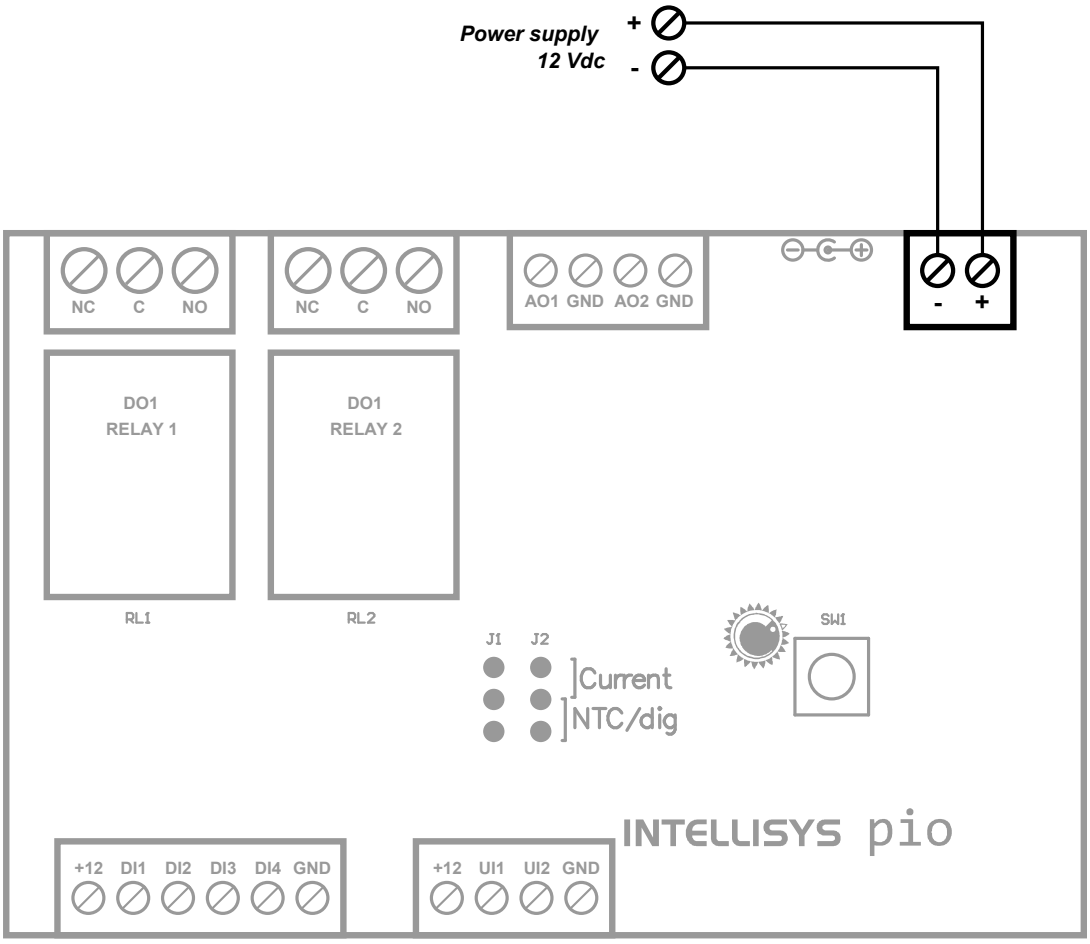
> DO NOT GIVE ELECTRICAL POWER SUPPLY TO THE RASPBERRY PI MODULE.
> RASPBERRY PI IS DIRECTLY POWERED FROM THE PIO INTERFACE.

Power the Pio interface with 12 voltage Vdc – at least 800 mA, recommended 1000 mA. **12 Voltage dc is highly recommended**. The PIO interface has no replaceable fuses; the protection is provided by a self-resetting fuse F1. When you turn on together the PIO interface and the RASPBERRY Pi, a blue led, named LED Supply, indicates that both units are powered on. The PIO interface is available with two power connections. The first one from jack connector and the other from terminal.

Connection with jack from power pack:



Connection with terminal:

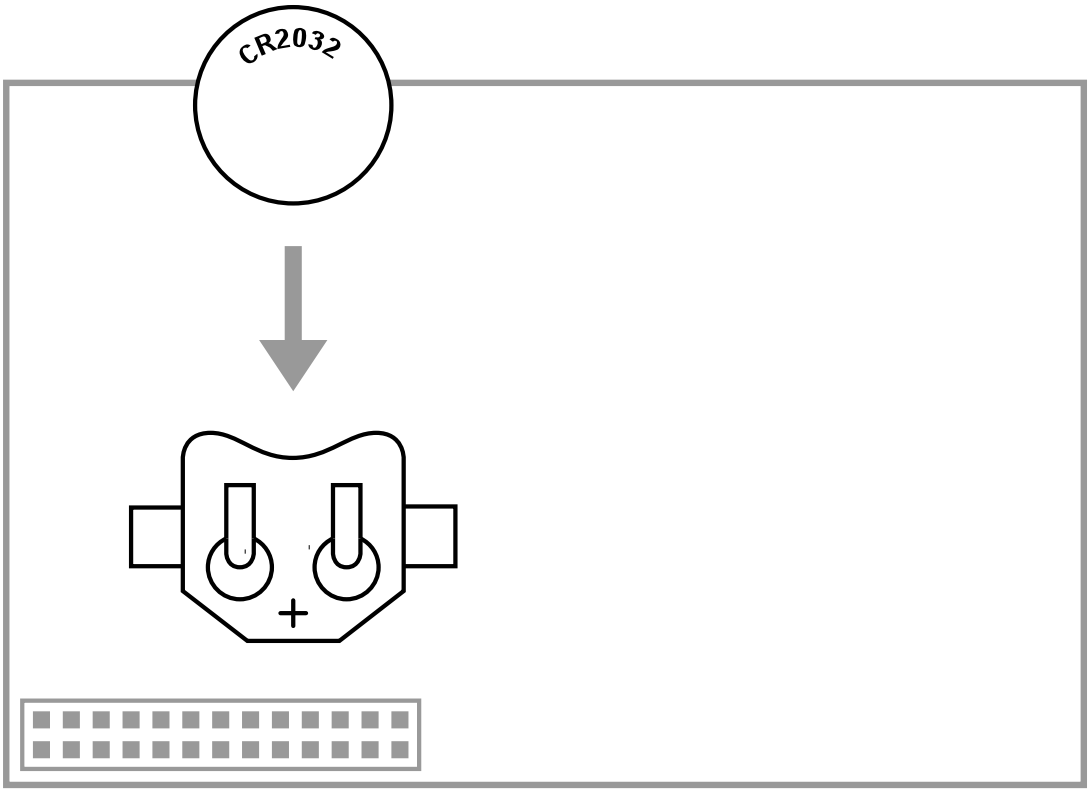


SERVICE INDICATORS

LED indicators for user applications, 2 green and 1 red.

BATTERY BACKUP

A plug-in lithium cell provides power to maintain the date and time for RTC when the interface is switched off. The battery clamp is located in the back of the PIO interface.



UNIVERSAL INPUTS – electrical connections

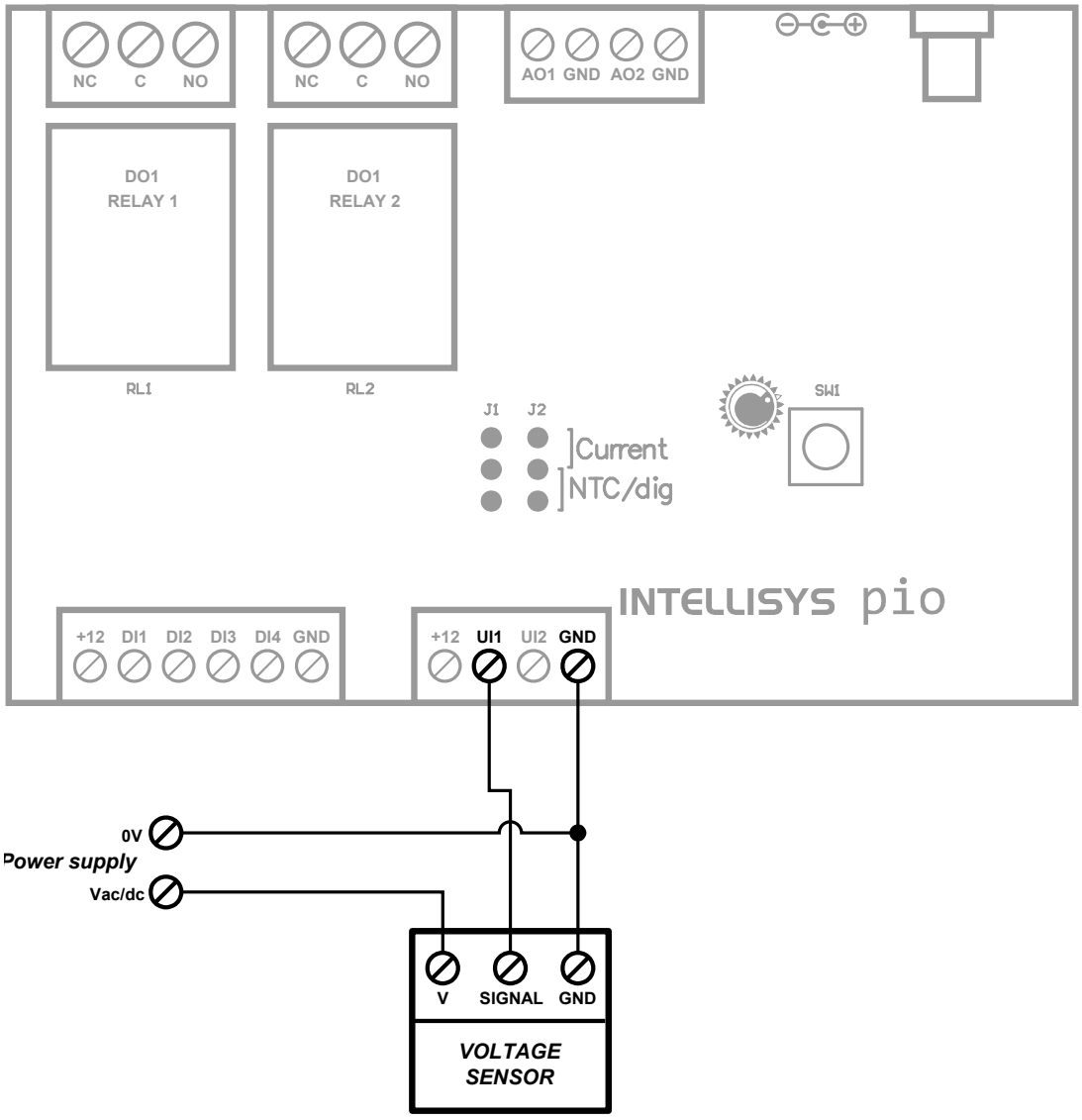
The term “Universal Input” is used to define an input channel that may be configured to be either analogue (Voltage, Current, NTC 10K) or digital. PIO has 2 universal inputs, UI1 and UI2, configurables both in VOLTAGE, CURRENT 0..20 mA and 4..20 mA, DIGITAL and NTC 10K passive sensor for temperature in the large range -20 °C .. +110 °C.
Inputs are used to make measurements of temperature, pressure, position, level, gas presence, humidity etc. The measurements are made by fitting the appropriate sensor which produces a continuous electrical signal that is proportional to the measurement being made.

Please refer to “PIO Function reference manual” to configure the universal inputs using programming languages.

VOLTAGE SENSOR

Connect Voltage Sensor, powered with external supply, to the PIO universal input.

- ***How to do to connect the sensor*** - :
  - remove jumper from J1 or J2 strip (depending you are connecting UI1 or UI2);
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write*, *Pio_UI_BottomVolt_Write*, *Pio_UI_TopVolt_Write*, *Pio_UI_BottomRange_Write*, *Pio_UI_TopRange_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



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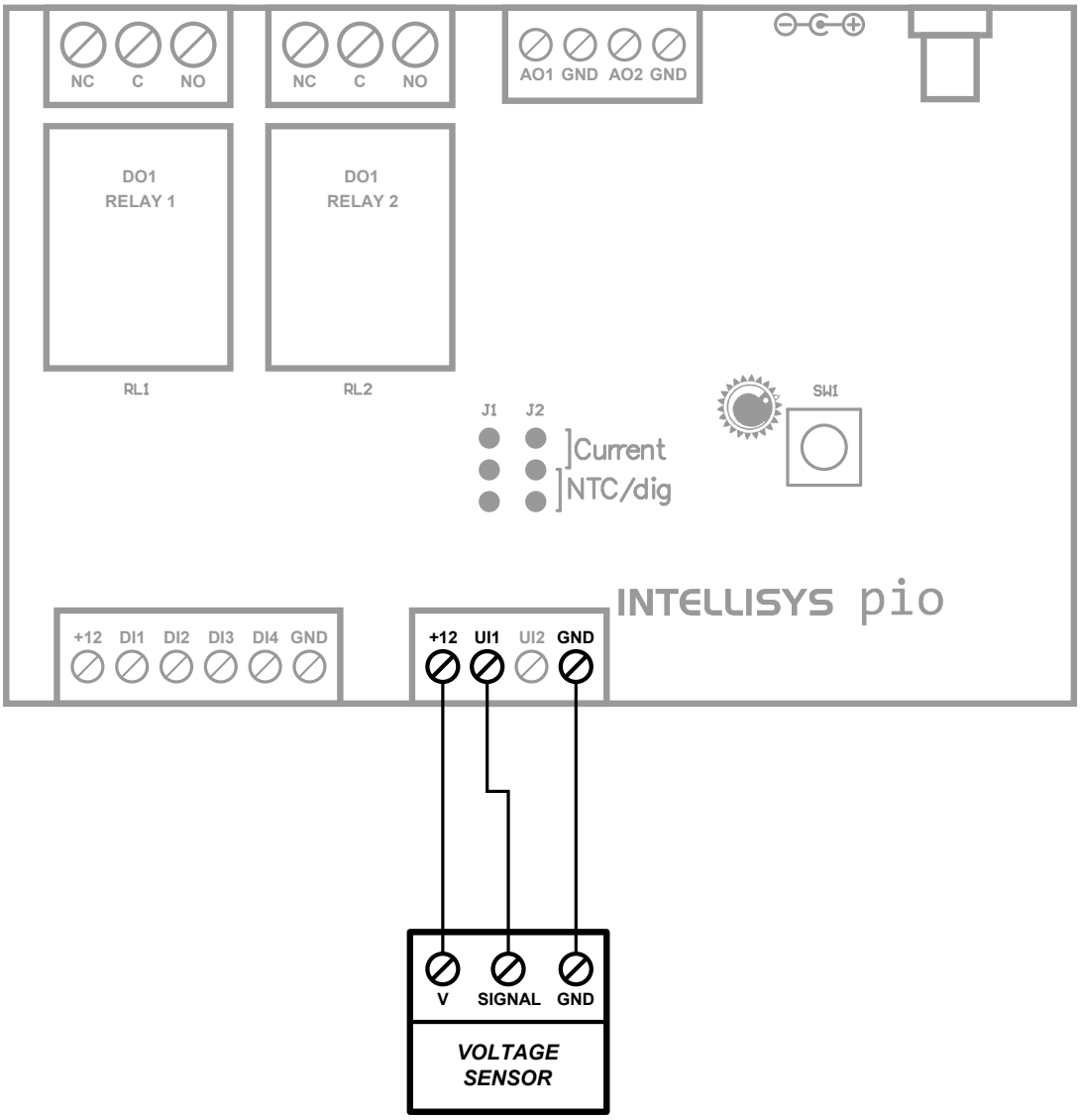
VOLTAGE SENSOR

Connect Voltage Sensor, powered with PIO 12 Vdc internal reference, to the PIO universal input.

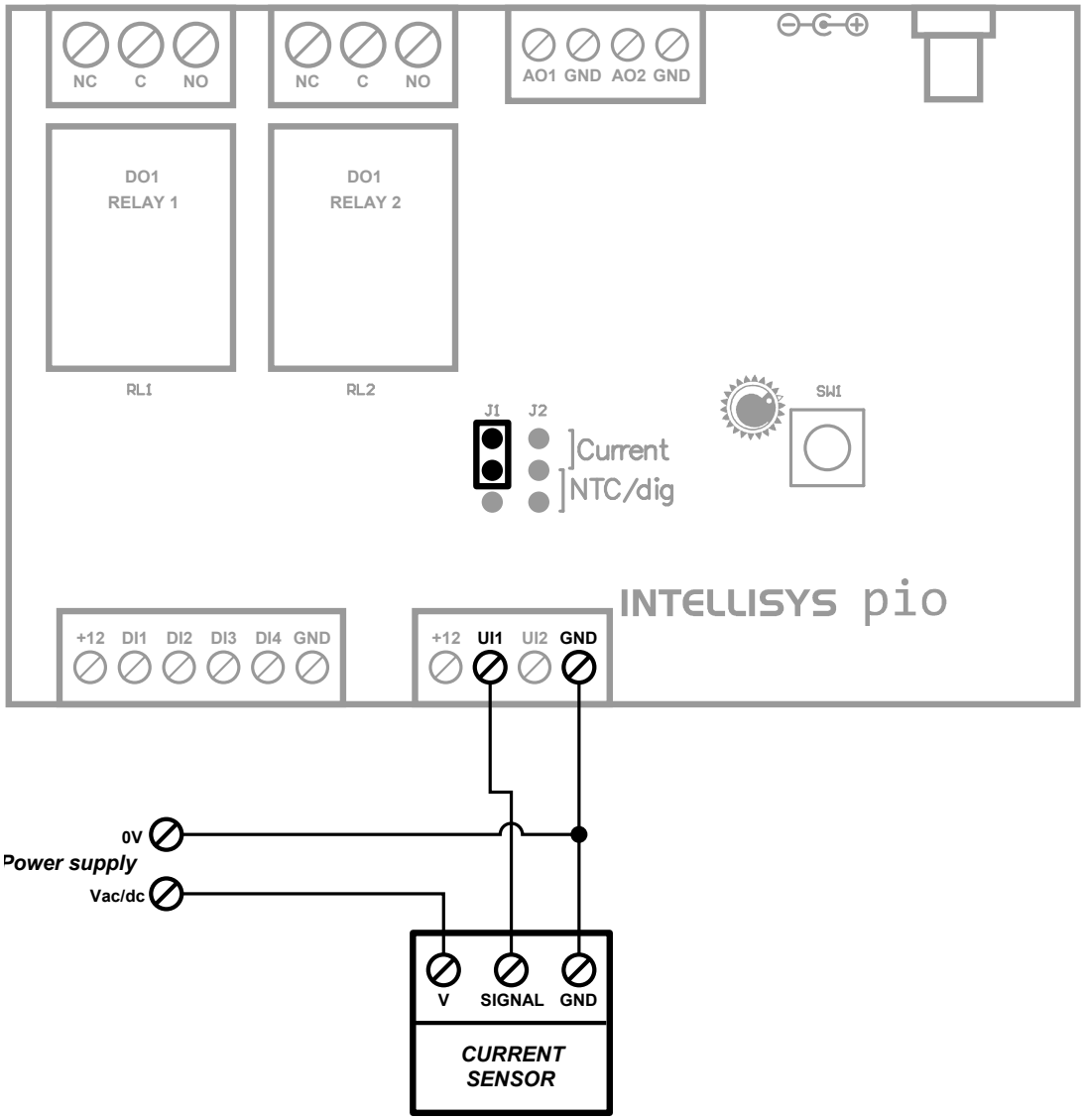
- ***How to do to connect the sensor*** - :
  - remove jumper from J1 or J2 strip (depending you are connecting UI1 or UI2);
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write*, *Pio_UI_BottomVolt_Write*, *Pio_UI_TopVolt_Write*, *Pio_UI_BottomRange_Write*, *Pio_UI_TopRange_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



CURRENT SENSOR

Connect Current Sensor, powered with external supply, to the PIO universal input.

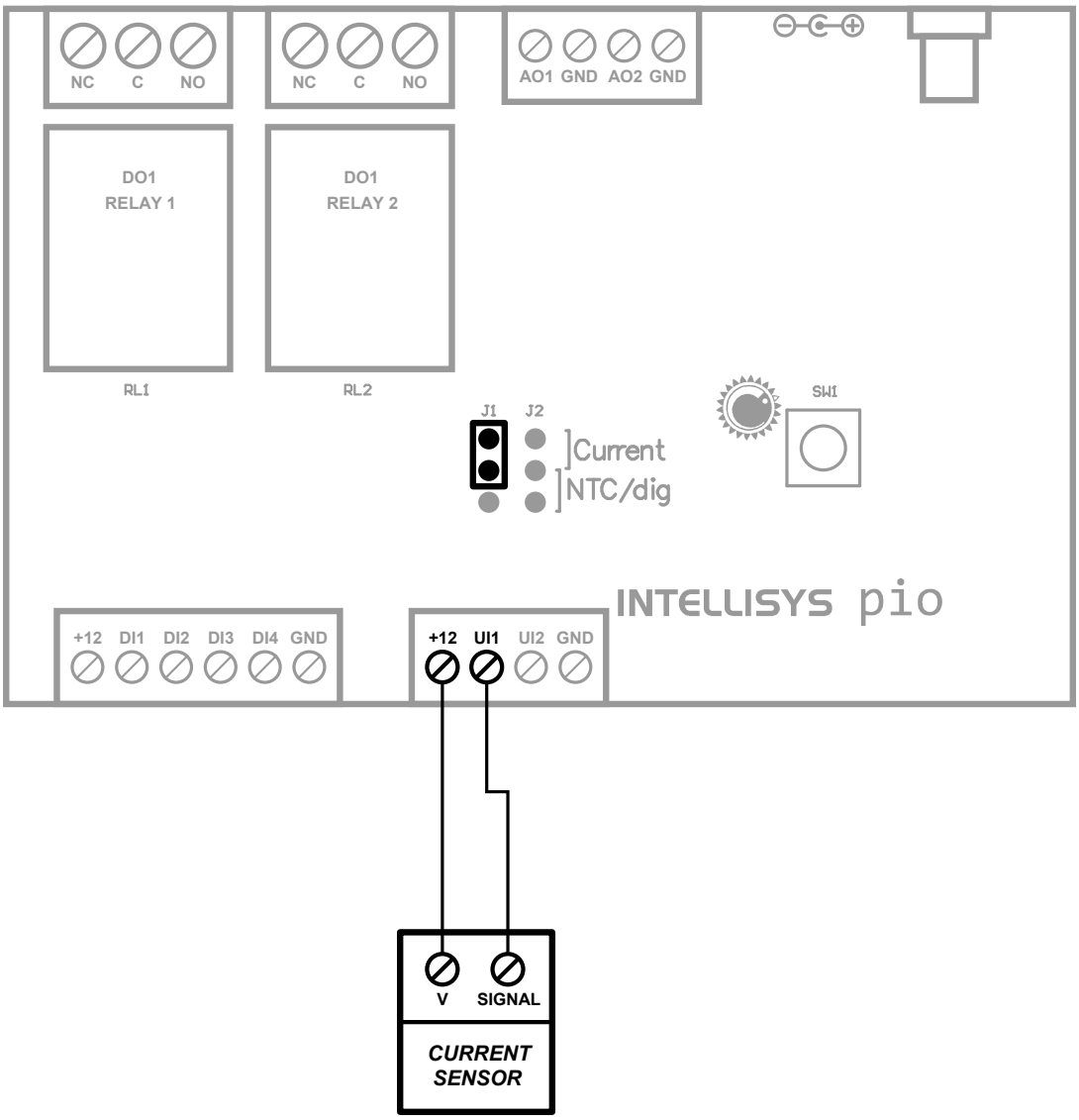
- ***How to do to connect the sensor*** - :
  - put jumper on J1 or J2 strip (depending you are connecting UI1 or UI2) in "Current" position, as showed in the next figure;
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write*, *Pio_UI_BottomRange_Write*, *Pio_UI_TopRange_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



CURRENT SENSOR

Connect Current Sensor that has two terminals, powered with PIO 12 Vdc internal reference, to the PIO universal input.

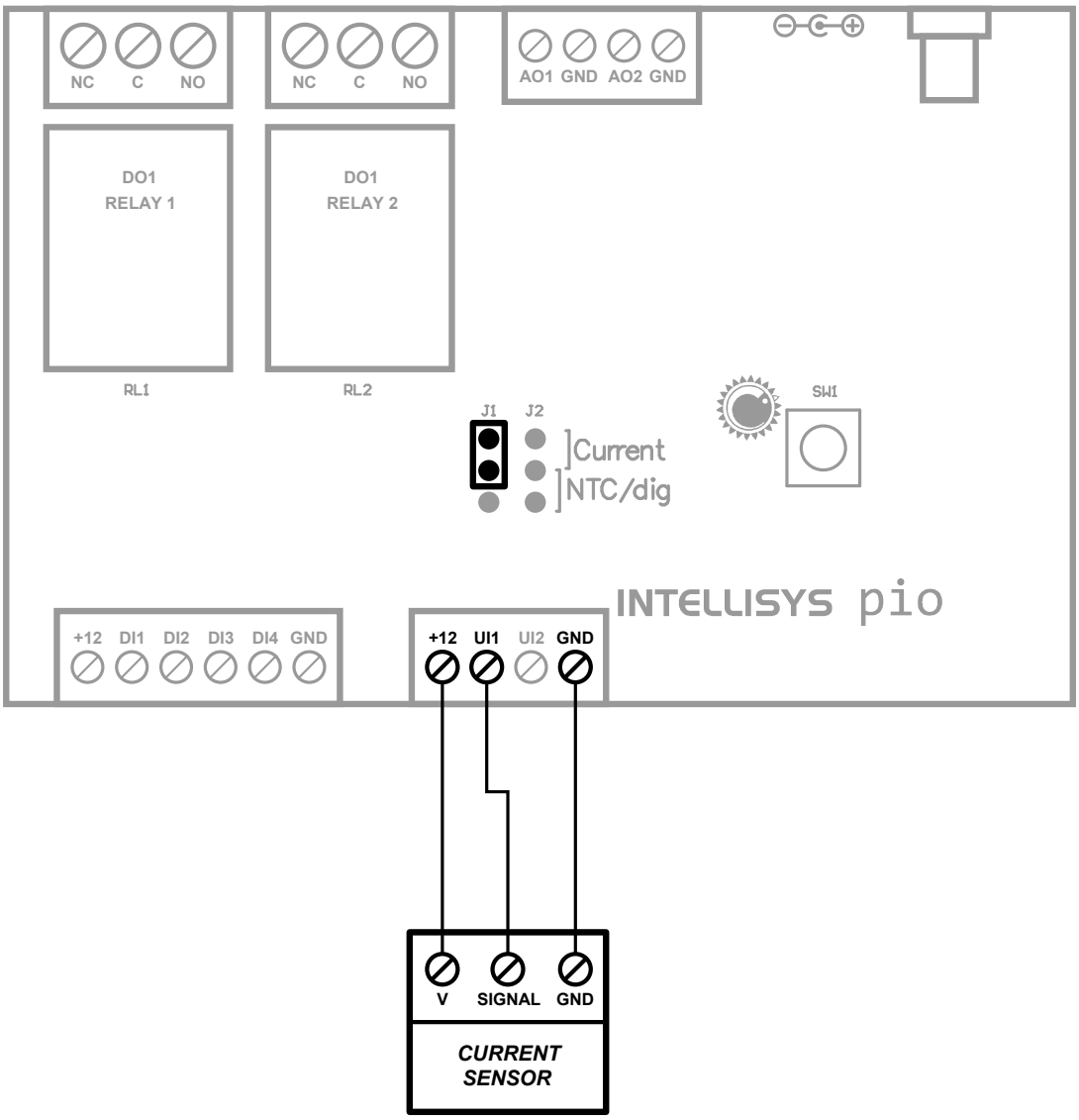
- ***How to do to connect the sensor*** - :
  - put jumper on J1 or J2 strip (depending you are connecting UI1 or UI2) in "Current" position, as showed in the next figure;
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write*, *Pio_UI_BottomRange_Write*, *Pio_UI_TopRange_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



CURRENT SENSOR

Connect Current Sensor that has three terminals, powered with PIO 12 Vdc internal reference, to the PIO universal input.

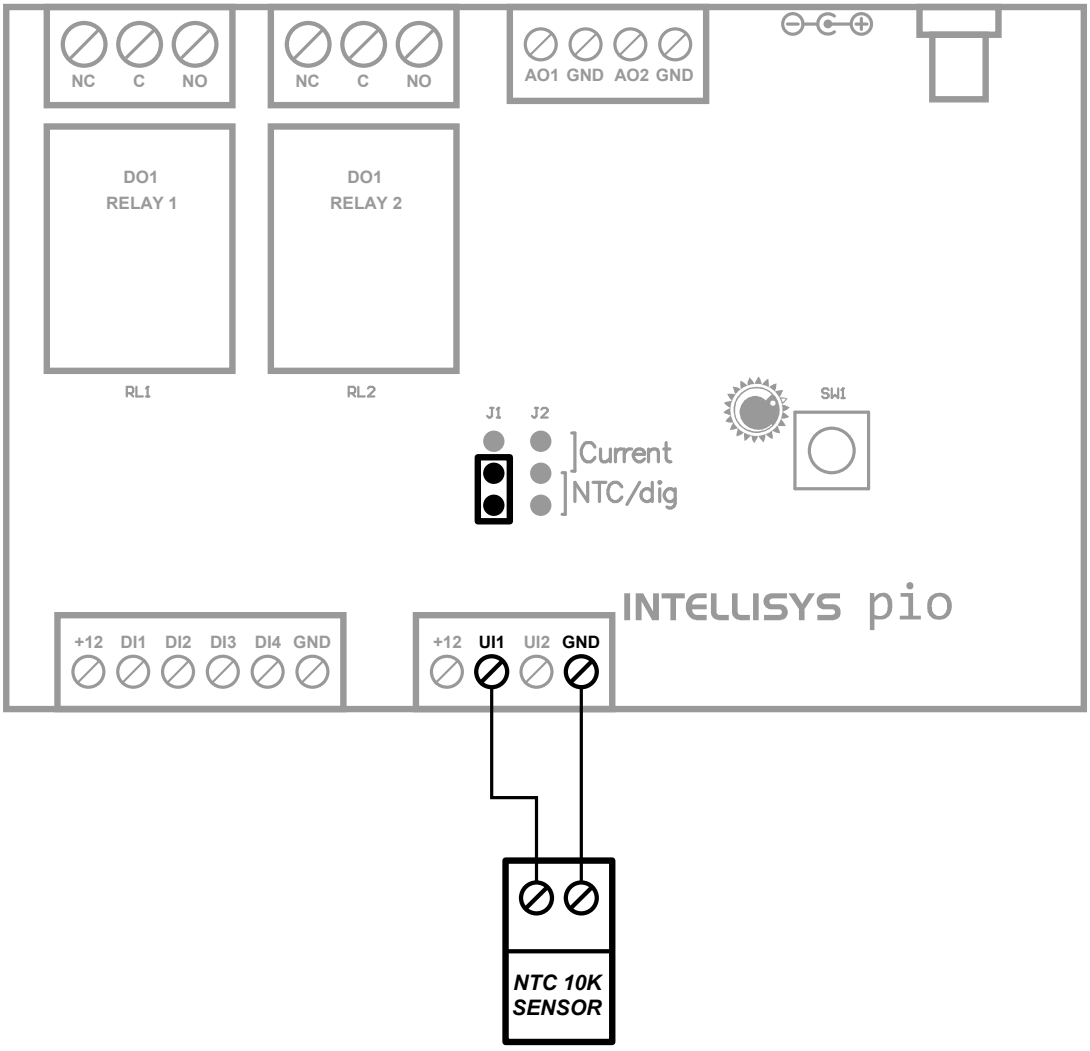
- ***How to do to connect the sensor*** - :
  - put jumper on J1 or J2 strip (depending you are connecting UI1 or UI2) in "Current" position, as showed in the next figure;
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write*, *Pio_UI_BottomRange_Write*, *Pio_UI_TopRange_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



THERMISTOR NTC 10K SENSOR

Connect Thermistor NTC 10K Sensor to the PIO universal input.

- ***How to do to connect the sensor*** - :
  - put jumper on J1 or J2 strip (depending you are connecting UI1 or UI2) in “NTC/dig” position, as showed in the next figure;
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *`Pio_UI_Type_Write`* and *`Pio_UI_Value_Read`* functions to read value from sensor.



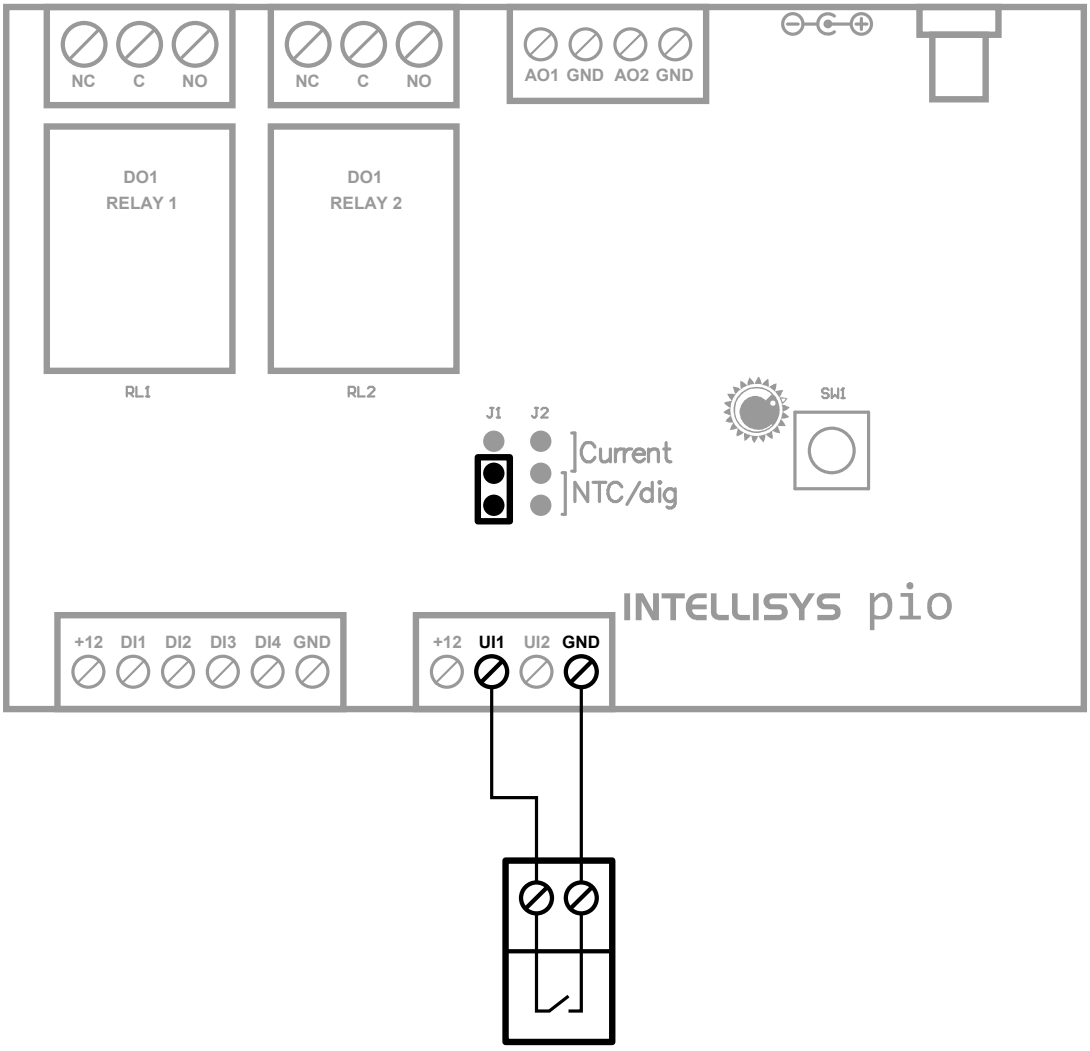
Sensor element	NTC 10K	Sensor element	NTC 10K
Tolerance ± 0,25 °C / 25 °C.		Tolerance ± 0,25 °C / 25 °C.	
Temp. °C	Ω	Temp. °C	Ω
-20	97120	29	8407
-15	72980	30	8055
-10	55340	35	6532
-5	42340	40	5326
0	32660	45	4368
5	25400	50	3602
10	19900	55	2986
15	15710	60	2488
20	12490	65	2082
21	11938	70	1751
22	11417	75	1480
23	10923	80	1256
24	10452	85	1071
25	**10000**	90	916
26	9572	95	787
27	9165	100	679
28	8777	110	511

THERMISTOR NTC 10K characteristic.

DIGITAL SENSOR

Connect Digital Sensor (On/Off – open/close, free voltage contact) to the PIO universal input.

- ***How to do to connect the sensor*** - :
  - put jumper on J1 or J2 strip (depending you are connecting UI1 or UI2) in "NTC/dig" position, as showed in the next figure;
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_UI_Type_Write* and *Pio_UI_Value_Read* functions to read value from sensor.



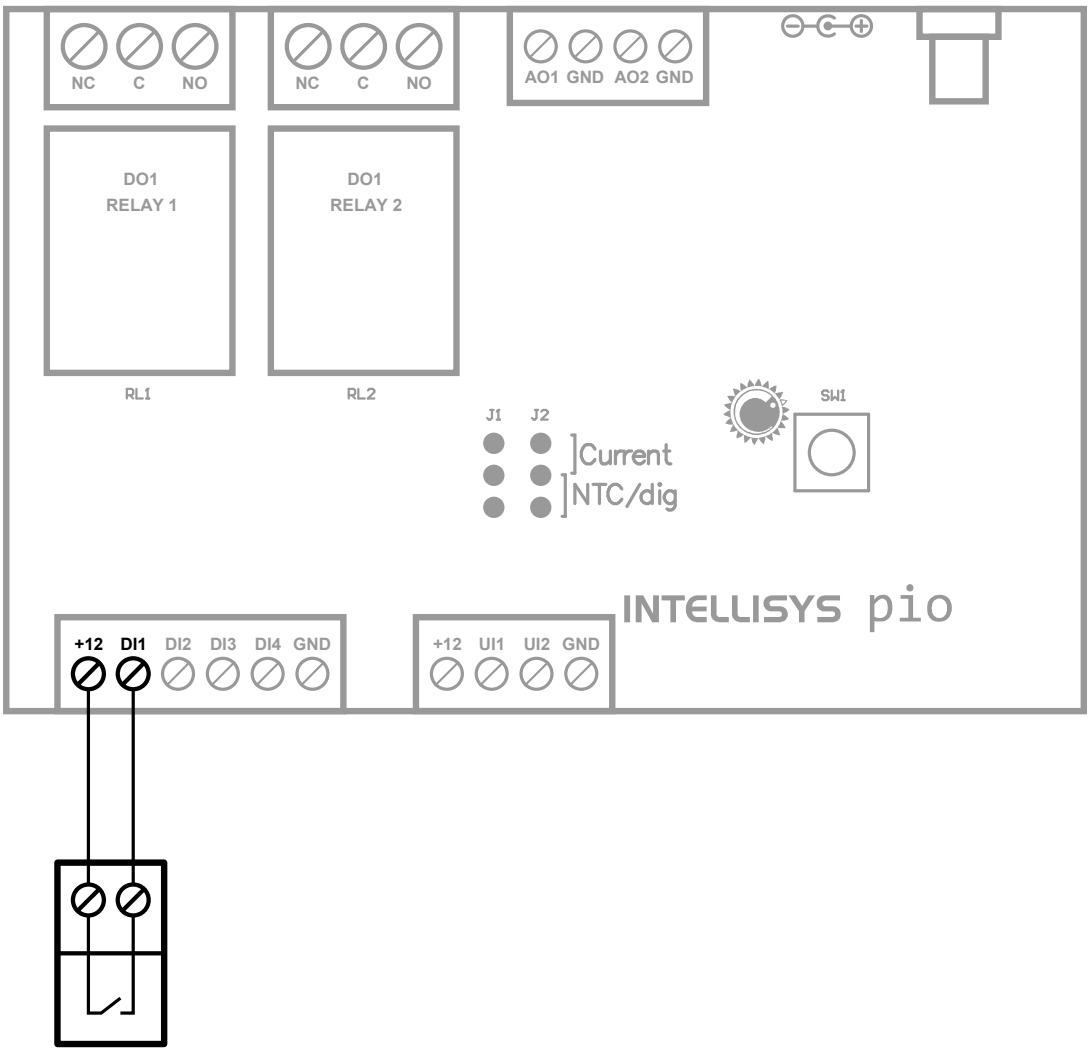
DIGITAL INPUTS – electrical connections

The digital inputs DI1, DI2, DI3 and DI4 are used to monitor the device status and/or switches. The status will be either open or close (OFF or ON). It is also possible to count the change of status making the digital input a counter.

Please refer to PIO Function reference manual to configure the digital inputs using programming languages.

Connect Digital Sensor (On/Off – open/close, free voltage contact) to the PIO digital input.

- ***How to do to connect the sensor*** - :
  - connect the sensor following the next schematic;
  - referring to the PIO function reference manual using *Pio_DI_Status_Read* to read status from sensor.

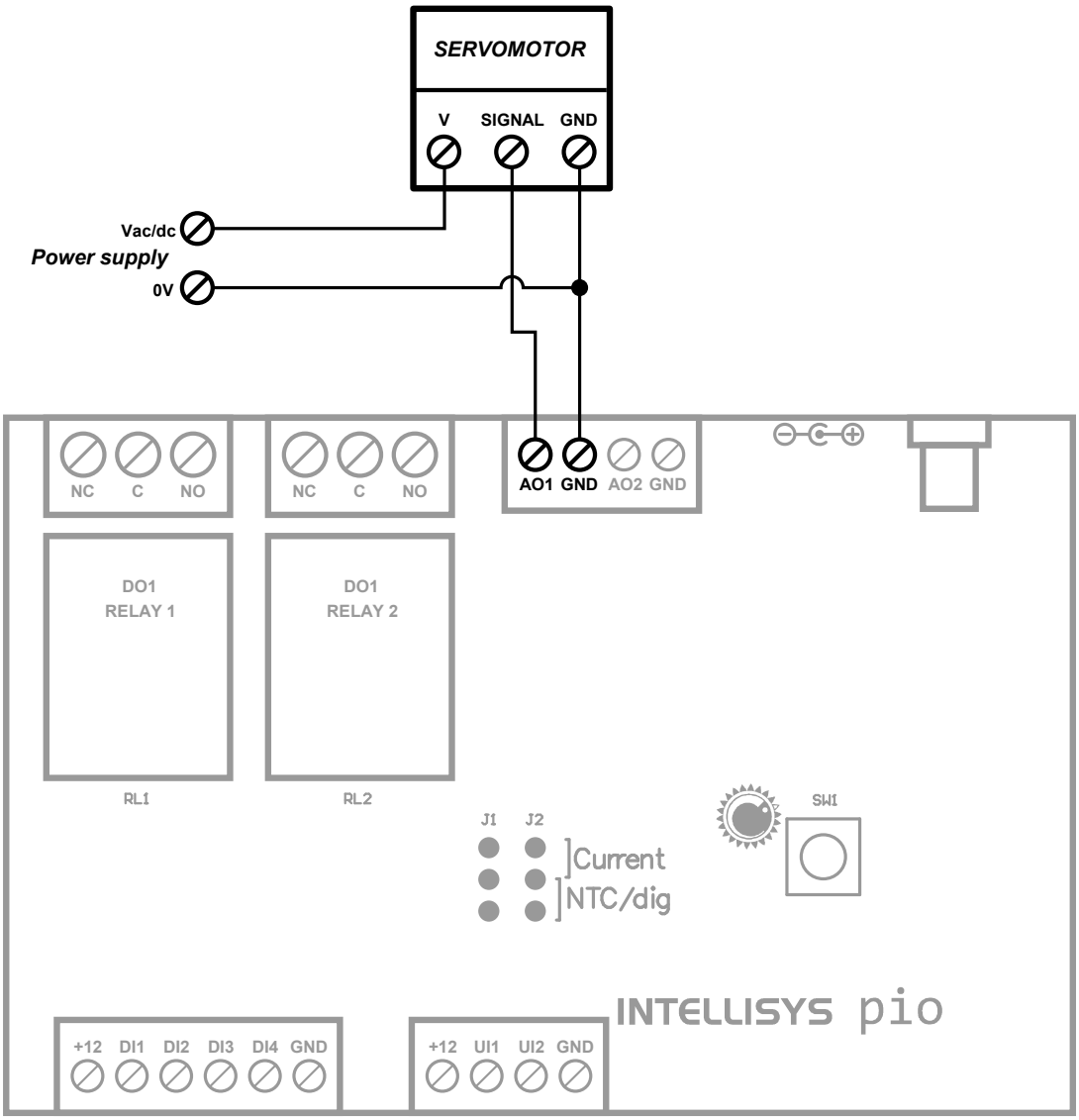


ANALOGUE OUTPUTS – electrical connections

The Analogue Outputs AO1 and AO2 are used to command valves, dampers, generic actuators etc, however where a continuous voltage is required. They are also used to drive multiple relay modules where the relay selected depends from voltage level given to the output. The voltage value for each output is from 0 (zero) to 10 (ten) volts dc. Please refer to the PIO Function reference manual to configure the analogue outputs using programming languages.

Connect Analogue Output channels to drive servomotors.

- ***How to do to connect the servomotor***- :
  - connect the servomotor following the next schematic;
  - referring to the PIO function reference manual using *Pio_AO_BottomVolt_Write, Pio_AO_TopVolt_Write and Pio_AO_Value_Write* to give command to servomotor.



DIGITAL OUTPUTS

The Digital Outputs DO1 (relay RL1) and DO2 (relay RL2) are used to switch commands ON or OFF. For each channel you can connect Normally Open (NO) or Normally Close (NC) contact.
Please refer to the PIO Function reference manual to configure the digital outputs using programming languages.

- ***How to do to connect the output - :***
  - referring to the PIO function reference manual using *Pio_DO_Command_Write* to give command to the output.

INSTALLATION:

The procedure requires:
Do not power RASPBERRY PI.
Insert the PIO interface female connector on RASPBERRY PI male connector.
Leave unconnected all the I/O terminals.
Perform input channel linking.
Power up **ONLY** the PIO interface.
Connecting inputs and checking.
Connect outputs and checking.

ORDER CODE

Interface

IS-PIO	Programmable Input and Output interface for RASPBERRY PI + Terminal jack for 12 Vdc power pack.
IS-PIO-TC	Programmable Input and Output interface for RASPBERRY PI + Terminal for external 12 Vdc power.

Accessories

IS-PIO-PP	12 Vdc power pack to power the PIO and Raspberry PI using Terminal jack.