INSTALLATION & COMMISSIONING

1.Mount the device inside a DIN transmitter housing or onto a DIN-rail mounting bracket.

2. Connect the sensor to the 8-pin 2.54 mm sensor connector.
NOTE: The 6 GPIO pins exposed on the green screw connector are 3.3V signal level. Do not connect voltages higher than 3.6V to these pins as it will damage the device.

3. Connect a DC power supply (12-32V) to the V-/V+ M3 screw terminals.
NOTE: An external SELV power supply (12-32V) should always be connected to the V-/V+ loop terminals in order to operate the USB port . If no PSU is available a PP3 type 9V battery could be used for quick firmware upload purposes.

4. Download and install the Arduino IDE from Arduino.cc (minimum version 1.8.2)

5. In the boards manager (Tools->Boards Manager) search for "Industruino" and install the "Industruino SAML Boards" package.

For Windows users: before connecting the Industruino download and install the USB driver from:
https://static.industruino.com/downloads/drivers/drivers-industruino-windows-1.0.0.zip

6. Connect the 4-20mA.ker to your computer via the USB-micro port.
NOTE: The use of a USB isolator is recommended (see safety instructions on reverse side for further information).

7. Select "Industruino 4-20mA.ker" from Tools->Board

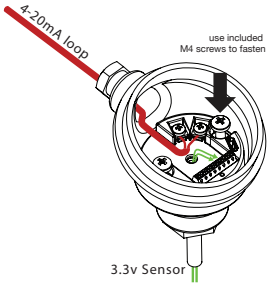
8. Select your serial port from Tools->Port

9. Select the SERCOM configuration from Tools->Serial configuration

10. Select the 3.3V sensor power rail startup status from Tools->External 3.3V initial status

11. Upload your first sketch.

1



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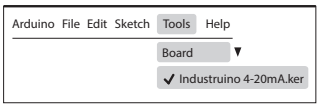

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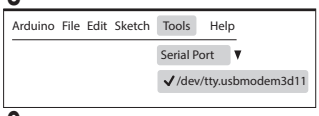

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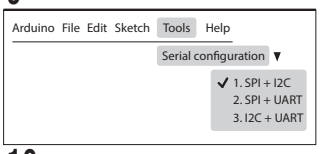

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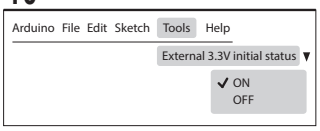
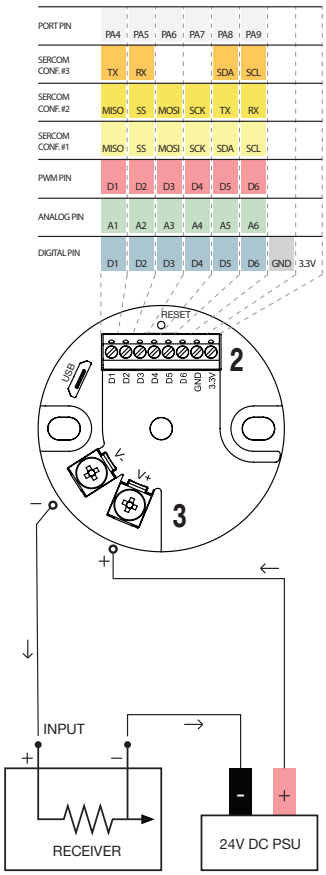


4-20mA.ker PINOUT



Internal functions

Arduino pin	Peripheral function	Instruction
PIN_DAC0	DAC 4-20mA loop control	analogWrite() value between 0-4095 to control loop current of 3.8-20.7mA
PIN_EXT_3V3_ENABLE	Control 3.3V supply rail for sensor	digitalWrite() 1 for on, 0 for off.
D0	On-board LED	digitalWrite() 1 for on, 0 for off.

CODE REFERENCE

Set DAC resolution

Syntax
analogWriteResolution(bit);

Parameters
bit: 8, 10, 12

Example
analogWriteResolution(12);
//Set DAC resolution to 12bit

Set DAC level

Syntax
analogWrite(pin, value);

Parameters
pin: The pin that you want to write to
value: The output value

Example
analogWrite(PIN_DAC0, 2048); //Set loop current mid scale (approx 12.25mA).

Map sensor value onto DAC

Syntax
map(value, fromLow, fromHigh, toLow, toHigh)

Parameters
value: the value to map
fromLow: the lower bound of the value's current range
fromHigh: the upper bound of the value's current range
toLow: the lower bound of the value's target range
toHigh: the upper bound of the value's target range

Example
SensorValue = map(SensorValue, -16000, 16000, 50, 3914) //map a sensor's original output range (-16000...16000) to match the 4-20mA range of the 12 bit DAC.

GUIDE BOOK: 4-20mA.ker

INDUSTRUINO

Intended Use

Industruino 4-20mA.ker is an Arduino® derived 4-20mA sensor transmitter.
In this manual, the product 'Industruino 4-20mA.ker', is hereinafter referenced to as the 'product'.

NOTICE This product is intended for commercial use only, and should only be used in industrial environments.

NOTICE (1) Industruino 4-20mA.ker sensor transmitter ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
ES GEAR LTD. OR ITS DISTRIBUTORS SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN ES GEAR LTD. OR ITS DISTRIBUTORS' USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.

("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;

Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.

Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.

Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions ES Gear Ltd. may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by ES Gear Ltd. and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact an ES Gear Ltd. representative.

USER INSTRUCTIONS

Safety instructions

⚠ WARNING:

• The product must be installed and wired by a trained technician following the applicable local safety standards and regulations that apply in specific cases.

• Always switch off power before you connect or disconnect any external device or accessory.

• Use a SELV DC power supply (12-32V, 21mA Max.).

• Use twisted pair wiring for the loop circuit. Failure to follow recommended wiring and grounding recommendations might result in degraded performance, damage to the device and compromise safety.

• The USB port is intended for firmware uploading and sensor calibration purposes only. Never use the USB port when the product is installed in a hazardous area or integrated into an system where high voltages or long wires could be present. To safely download or debug an application via the USB port, the following two approaches can be used:
1. Use of a third party USB isolation device with a galvanic isolation rating higher than the potential voltages present in the system.
2. Remove the product from the system and move it to a safe area for programming / calibration. Use a separate SELV power supply, keeping the supply wiring to a length of maximum 2m.

• Failure to follow these instructions could result in damage to external equipment, personal injury or death.
• Do not connect any part of the product to voltages higher than DC 32V.

• Avoid circuit or wire exposure. Do not touch exposed connections or components when the product is powered on or when devices connected to it are powered on.

• Use only with cables and accessories that are approved or recommended by the manufacturer.

• Use only for applications described in the catalog and the manual, and only with third party devices or components if they have been approved or recommended by the manufacturer.

• The product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

• Do not operate with suspected failures. If suspected damage occurs with the device, have it inspected by qualified service personnel before further operations.

• Do not operate in an explosive atmosphere.
• Do not use in wet/damp conditions.
• Keep device surfaces clean and dry.

REGULATORY

EU CE DoC

Product: Industruino 4-20mA transmitter
Model: 4-20mA.ker
Manufacturer: ES Gear Limited
Address: 9B Amtel Building, 148 Des Voeux Road Central, Hong Kong

This declaration is issued under the sole responsibility of the manufacturer.
The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

• 2014/30/EU The Electromagnetic Compatibility Directive
• 2011/65/EU The Restriction of Hazardous Substances Directive

The full EU Declaration of Conformity can be downloaded from the following internet address: *industruino.com/420maker (bottom of page, CE DoC).*

FCC COMPLIANCE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
This device may not cause harmful interference.

This device must accept any interference received, including interference that may cause undesired operation.

This product meets the requirements of the WEEE directive 2012/19/EU. Such products are marked with the "crossed-out wheelie bin" WEEE symbol (shown, above) in accordance with European Standard EN50419.

Manufacturer: ES Gear Limited
9B, Amtel Building
148 Des Voeux Road
Central, Hong Kong

The full manual can be accessed on following internet address:
industruino.com/420maker
(bottom of page, 'Manual').