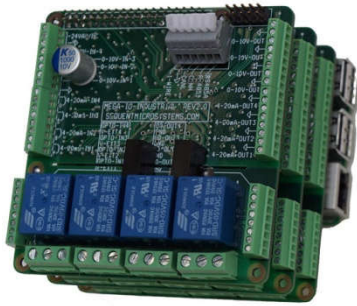


RASPBERRY PI MegaIO EXPANSION CARD
for INDUSTRIAL and BUILDING AUTOMATION
USER'S GUIDE VERSION 4.2

GENERAL DESCRIPTION.....	2
INDUSTRIAL vs BUILDING AUTOMATION FEATURES	3
BOARD LAYOUT.....	4
BLOCK DIAGRAM.....	5
CONNECTORS PINOUT	6
COMMUNICATIONS CONNECTOR.....	7
CONFIGURATION JUMPERS	8
RASPBERRY PI HEADER.....	9
RELAY TERMINAL BLOCKS	10
POWER REQUIREMENTS	10
SCHEMATICS	11
HARDWARE SPECIFICATIONS	14
LINEARITY OVER FULL SCALE.....	15
MECHANICAL SPECIFICATIONS	16
SOFTWARE SETUP	17

GENERAL DESCRIPTION



This board is a stackable expansion card for Raspberry Pi B+, 2, 3 and Zero. Two of the Raspberry Pi's GPIO pins are used for I2C communication. Another pin is allocated for the interrupt handler, leaving 23 GPIO pins available for the user. Any input can be configured as an interrupt. Up to four cards can be stacked on top of a Raspberry Pi.

The card comes in two different versions:

1. MegaIO-IND: IO expansion card for Industrial Automation:

- Four Optically Isolated 4-20mA Inputs
- Four 4-20mA Outputs
- Four 0-10V Inputs
- Four 0-10V Outputs
- Four Optically Isolated Digital Inputs
- Four Optically Isolated Open Drain Outputs
- Four Optically Isolated 10A/250V Relays
- Four Relay LED's
- Four General Purpose LED's
- RS485, CAN, 1 Wire communication
- Real time clock with battery backup
- Configurable Interrupts

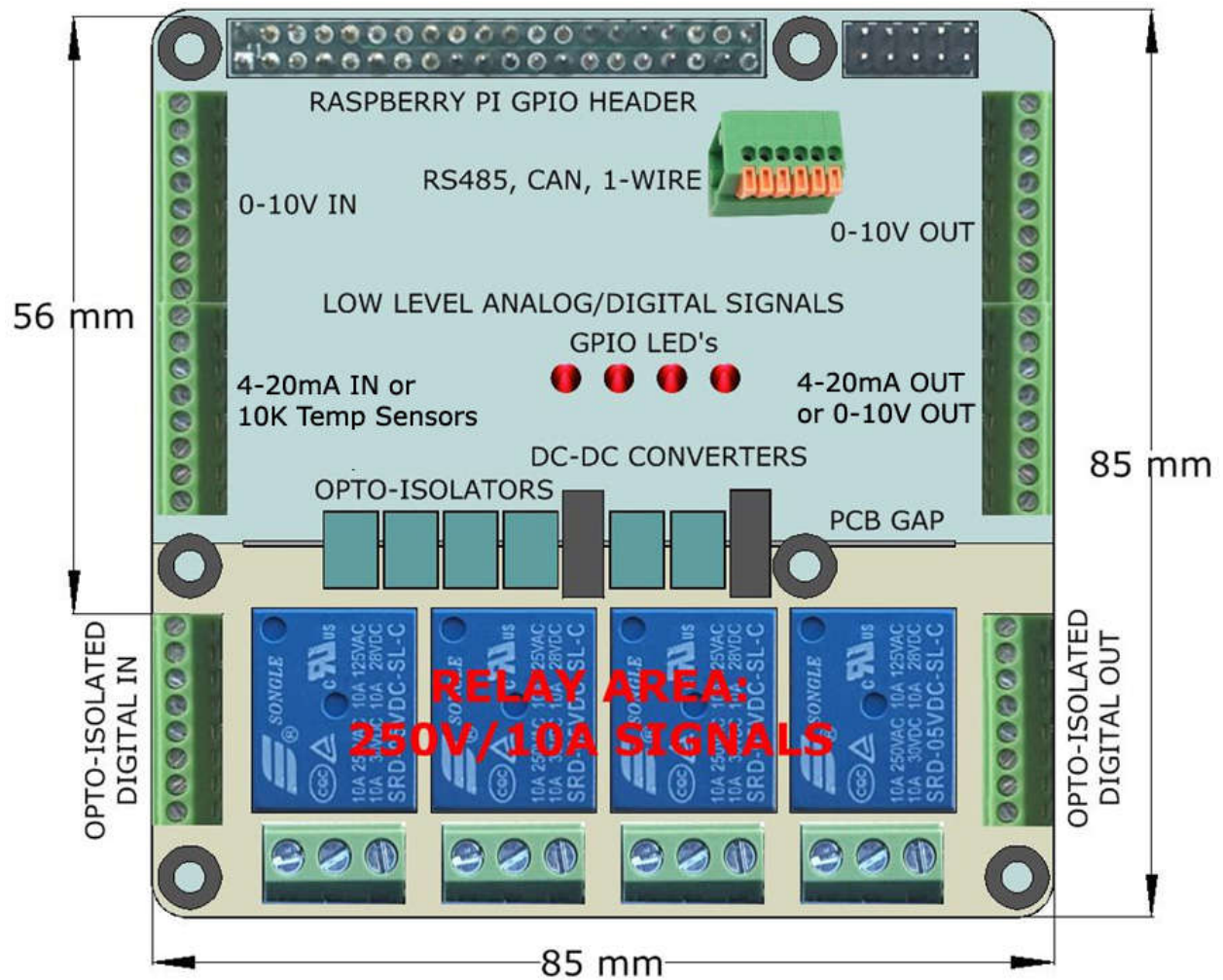
2. MegaIO-BAS: IO expansion card for Building Automation:

- Four 0-10V Inputs
- Four 10K Temperature Sensor Inputs
- Eight 0-10V Outputs
- Four Optically Isolated Digital Inputs
- Four Optically Isolated Open Drain Outputs
- Four Optically Isolated 10A/250V Relays
- Four Relay LED's
- Four General Purpose LED's
- RS485, CAN, 1 Wire communication
- Real time clock with battery backup
- Configurable Interrupts

INDUSTRIAL vs BUILDING AUTOMATION FEATURES

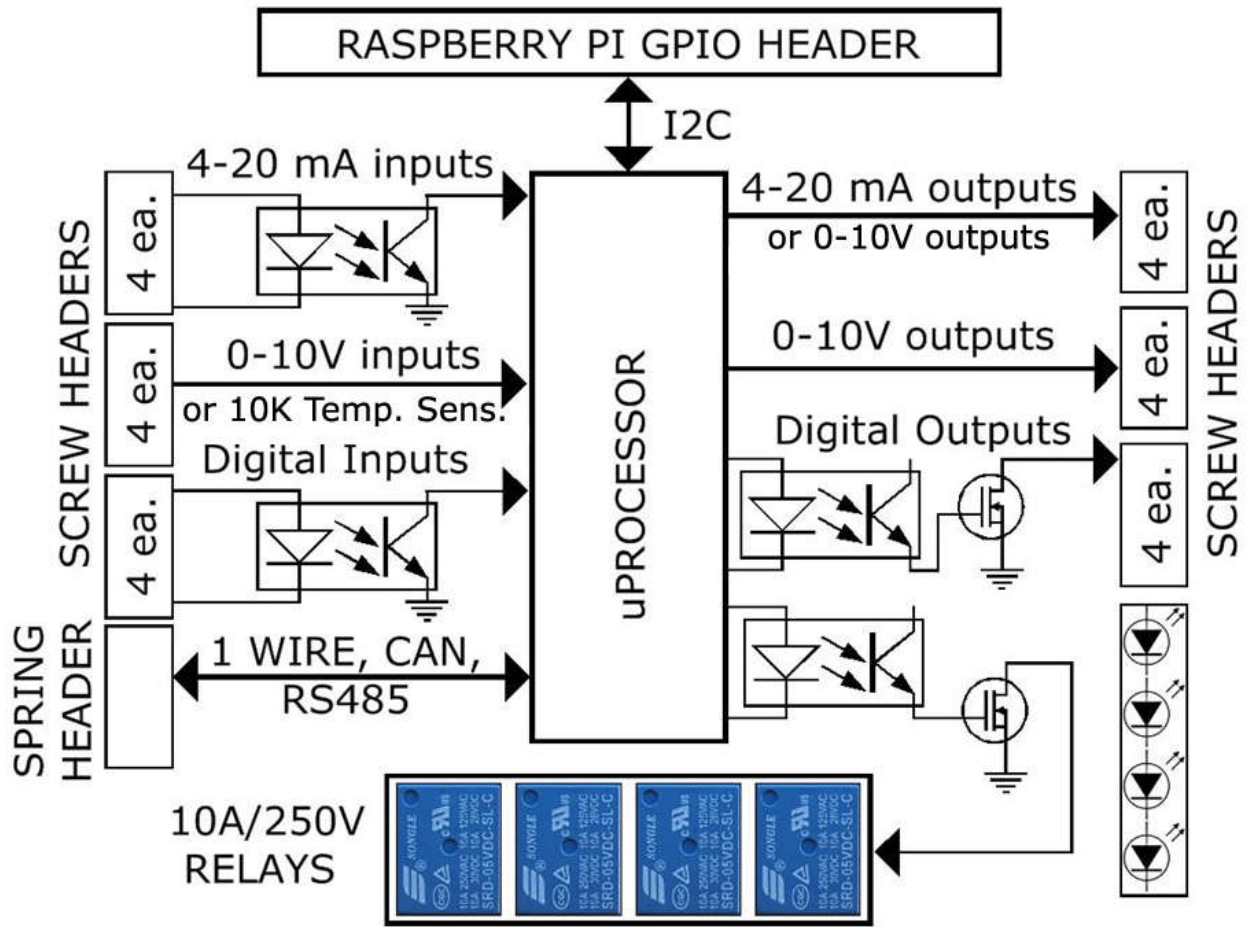
Features	MegaIO-IND	MegaIO-BAS
0-10V Inputs	4	4
0-10V Outputs	4	8
4-20mA Inputs	4	--
4-20mA Outputs	4	--
10K Temp. Sensor Inputs	--	4
Digital Inputs w/ LED	4	4
Digital Outputs w/ PWM & LED	4	4
10A/250V Relays	4	4
GPIO LEDs	4	4
RS485	1	1
CAN	1	1
1-Wire	1	1
On-board Pushbutton	1	1

BOARD LAYOUT



All input and output signals are routed to 2.5mm screw terminal blocks. Heavy duty 5mm blocks are used for the relays. Communication signals (RS485, CAN, 1 Wire) are routed to a spring terminal block. The high voltage area is galvanically, electrically and mechanically separated from the low level signals.

BLOCK DIAGRAM



CONNECTORS PINOUT


0-10V INPUTS

	1	GND
	2	0-10V INPUT1
	3	GND
	4	0-10V INPUT2
	5	0-10V INPUT3
	6	0-10V INPUT4
	7	GND
	8	+24VDC

0-10V OUTPUTS

	1	0-10V OUTPUT1
	2	GND
	3	0-10V OUTPUT2
	4	GND
	5	0-10V OUTPUT3
	6	GND
	7	0-10V OUTPUT4
	8	GND


4-20mA INPUTS

	1	4-20mA INPUT1+
	2	4-20mA INPUT1-
	3	4-20mA INPUT2+
	4	4-20mA INPUT2-
	5	4-20mA INPUT3+
	6	4-20mA INPUT3-
	7	4-20mA INPUT4+
	8	4-20mA INPUT4-

4-20mA OUTPUTS

	1	4-20mA OUTPUT1+
	2	4-20mA OUTPUT1-
	3	4-20mA OUTPUT2+
	4	4-20mA OUTPUT2-
	5	4-20mA OUTPUT3+
	6	4-20mA OUTPUT3-
	7	4-20mA OUTPUT4+
	8	4-20mA OUTPUT4-

DIGITAL INPUTS

	1	V-EXT1
	2	OPTO-IN1
	3	V-EXT2
	4	OPTO-IN2
	5	V-EXT3
	6	OPTO-IN3
	7	V-EXT4
	8	OPTO-IN4

DIGITAL OUTPUTS

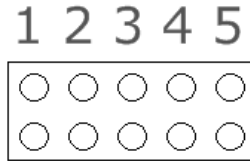
	1	GND
	2	OPEN DRAIN OUT1
	3	GND
	4	OPEN DRAIN OUT2
	5	GND
	6	OPEN DRAIN OUT3
	7	GND
	8	OPEN DRAIN OUT4

COMMUNICATIONS CONNECTOR

PIN	SIGNAL
1	RS485A
2	RS485B
3	CANH
4	CANL
5	GND
6	1-WIRE

CONFIGURATION JUMPERS

The 2x5 pin jumper installed in the upper right corner of the MEGA-IO card has the following functions:



Position 1-2: Factory use only.

Position 3: Processor reset.

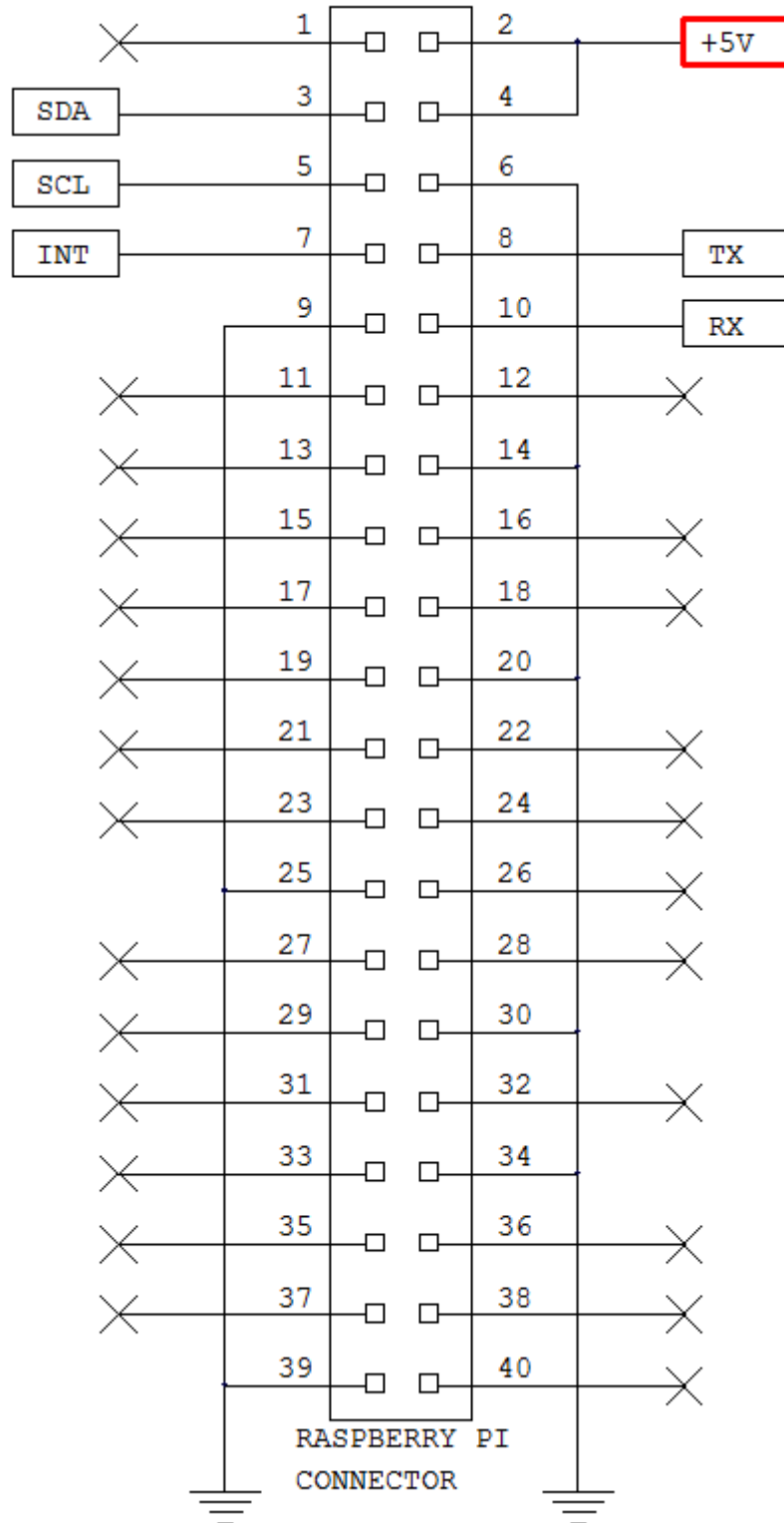
Position 4-5: Stack Level. These two jumpers permit addressing multiple MEGA-IO cards on the I2C bus. No jumpers need to be installed if only one card is present. If two or more cards are stacked up, the card I2C address 0 - 3 is as follows:



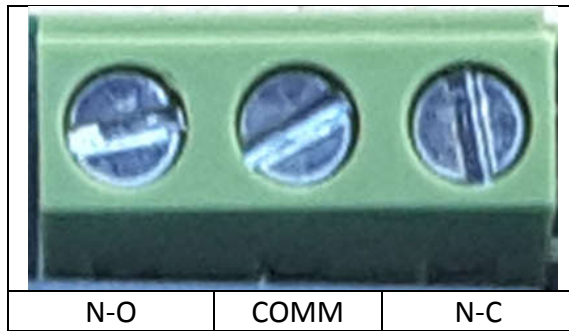
STACK LEVEL 1 2 3 4

ID Jumper	000	001	010	011
Stack level	1	2	3	4
I2C Address	0x38	0x39	0x3A	0x3B

RASPBERRY PI HEADER



RELAY TERMINAL BLOCKS



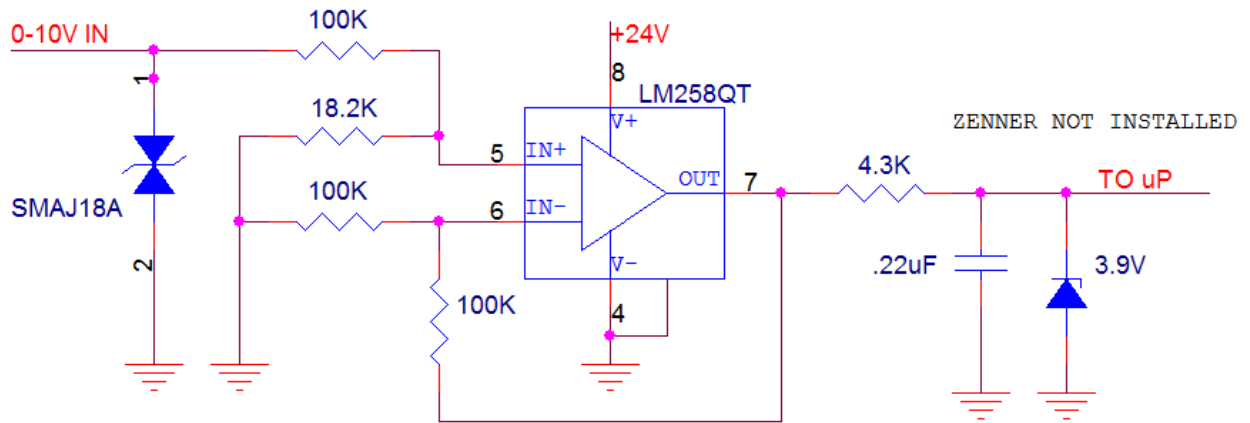
POWER REQUIREMENTS

The MegaIO-IND card requires an external 24VDC/500mA regulated power supply. A local 5V regulator supplies power to Raspberry Pi, and a 3.3V regulator powers the digital circuits. Isolated DC-DC converters are used to power the relays.

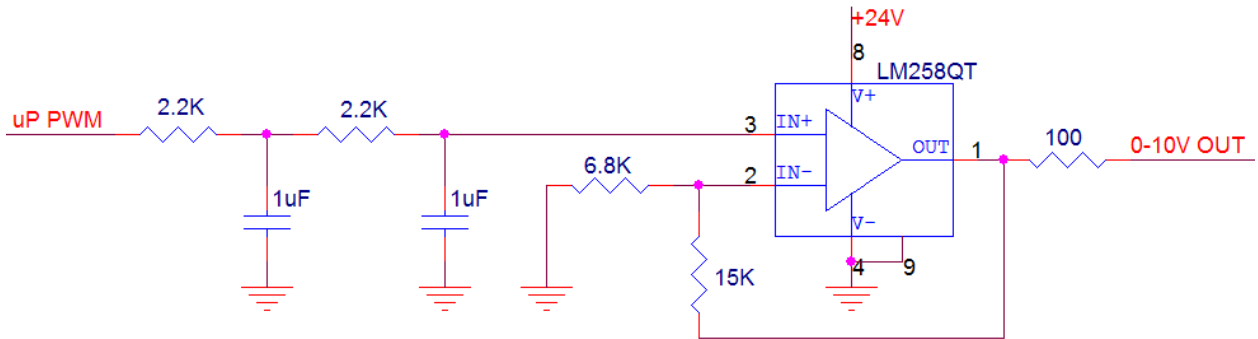
Only one 24VDC source can be used to power both the Raspberry Pi and the MegaIO-IND card.

If multiple MegaIO-IND cards are stacked on top of each other, a single 24VDC power supply has to be used to power all the cards.

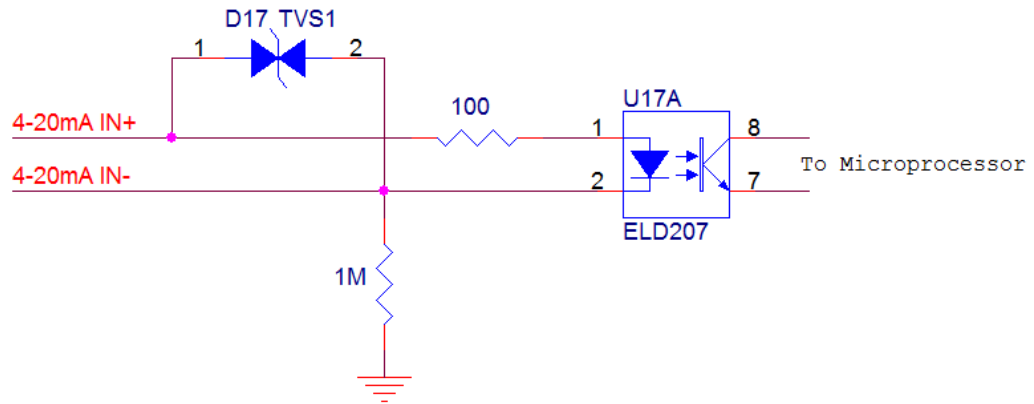
SCHEMATICS



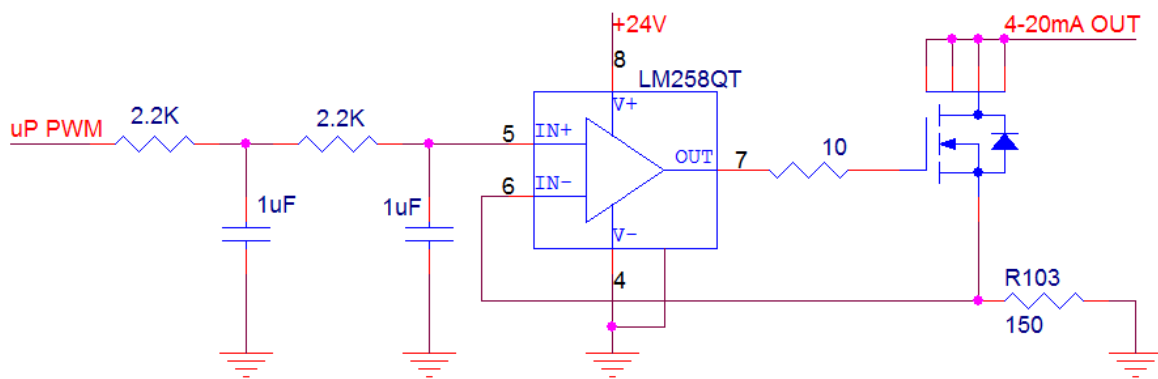
0-10V INPUTS



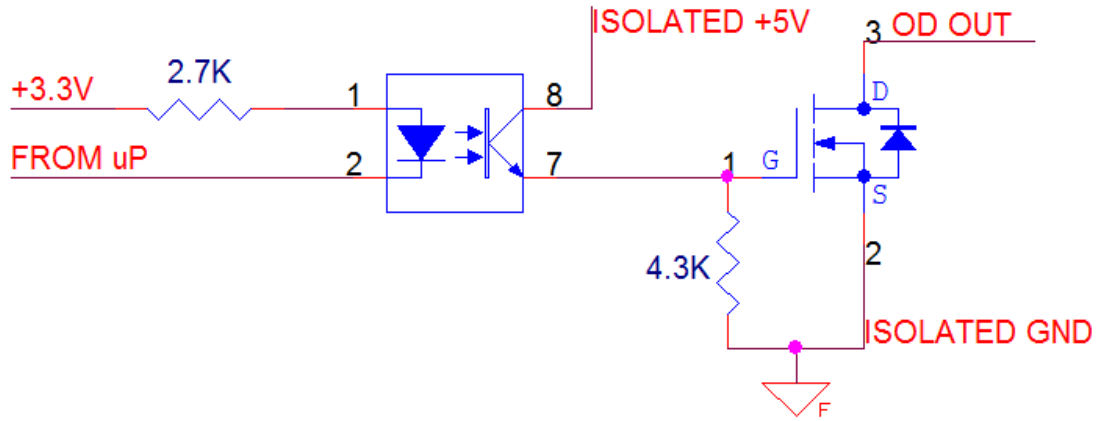
0-10V OUTPUTS



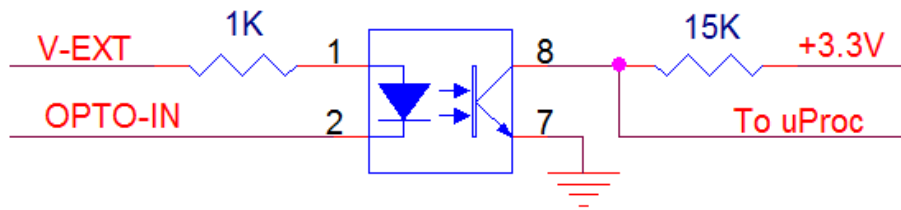
4-20mA INPUTS



4-20mA OUTPUTS



OPEN DRAIN OUTPUTS



OPTO-ISOLATED INPUTS

HARDWARE SPECIFICATIONS

ON BOARD FUSE: 1A

MICROCONTROLLER: STM32F072R8T6

- 32-bit Cortex CPU
- Operating voltage: 3.3V
- CPU frequency: 16 MHz
- Max. input voltage on any pin: 3.6V
- Output Low Level Voltage on I/O pins: Max. 0.45V
- Output High Level Voltage on I/O pins: Min. 2.6V

0-10V INPUTS:

- TVS Protection: SMAJ18A
- TVS Clamping Voltage: 29.2V
- Maximum Input Voltage: 12V
- Input Impedance: 100K Ω +/- 20%

0-10V OUTPUTS:

- Output buffer: LM258QT
- Maximum Output Current: 60mA
- Minimum Output Load: 70 Ω

4-20mA INPUTS:

- Sample rate: Up to 1 Msps

4-20mA OUTPUTS:

- Resistive load: Minimum 5 K Ω

OPTO-ISOLATED INPUTS & OUTPUTS

- Transceiver: ELD207

OPEN DRAIN OUTPUTS

- Driver: DMN6140L-13
- Drive capability: 60V/1.6A

RELAYS: SRD-05VDC-SL-C

- Maximum current/voltage: 10A/250V

POWER CONSUMPTION:

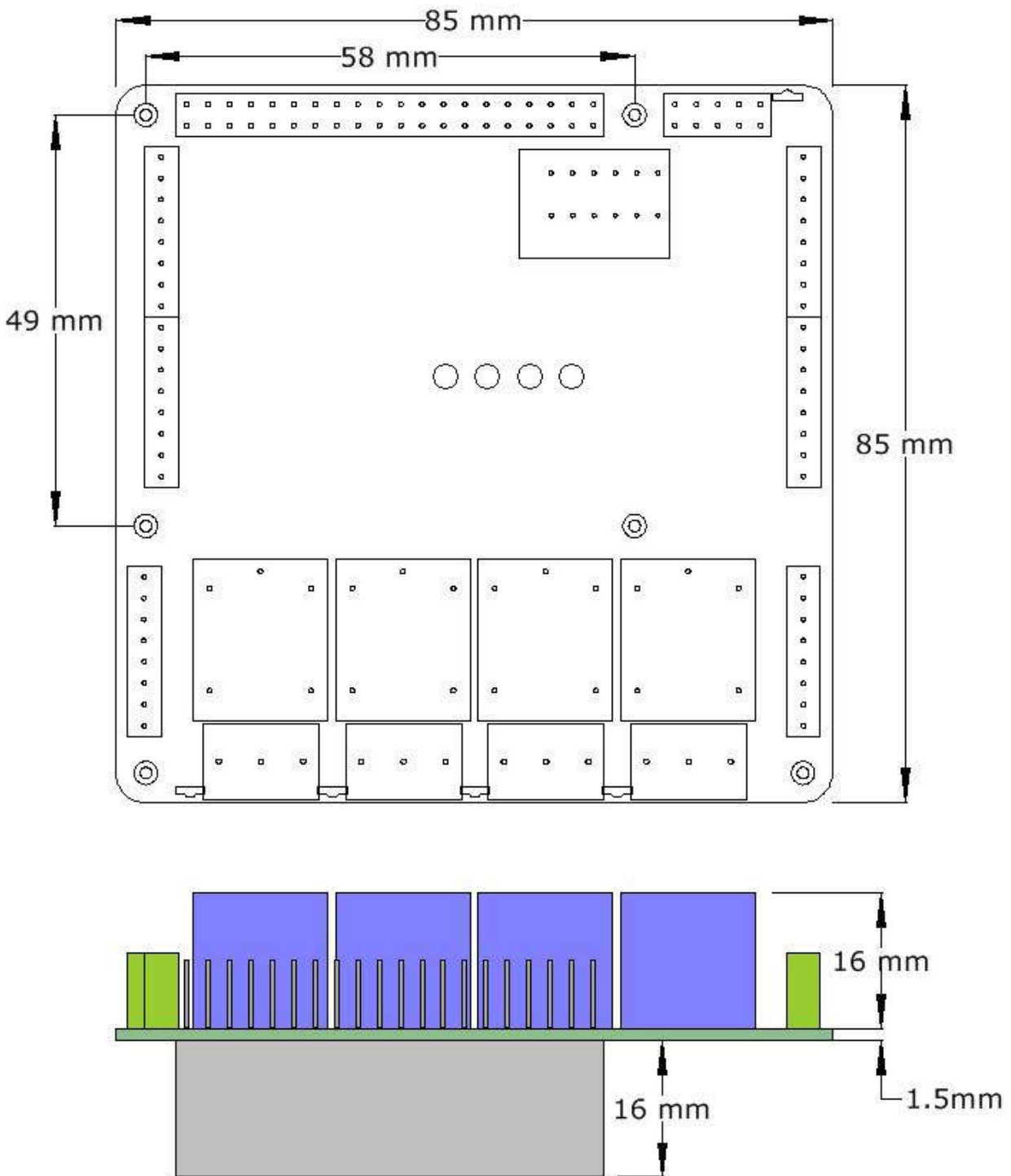
- 10 mA @ +24V (all relays OFF)
- 100 mA @ +24V (all relays ON)



LINEARITY OVER FULL SCALE

Channel	Max Error	
4-20mA IN	32 μ A	0.2%
4-20mA OUT	<10 μ A	<0.06%
0-10V IN	15 μ V	0.15%
0-10V OUT	<10 μ V	<0.1%

MECHANICAL SPECIFICATIONS



SOFTWARE SETUP

1. Have your Raspberry Pi ready with the [latest OS](#).
2. Install the [Wiring Pi](#) library (many thanks to Gordon Henderson)
3. Enable I2C communication:

```
~$ sudo raspi-config
```

```
1 Change User Password Change password for the default user
2 Hostname             Set the visible name for this Pi on a
3 Boot Options         Configure options for start-up
4 Localisation Options Set up language and regional settings
5 Interfacing Options  Configure connections to peripherals
6 Overclock            Configure overclocking for your Pi
7 Advanced Options     Configure advanced settings
8 Update               Update this tool to the latest versio
9 About raspi-config   Information about this configuration

P1 Camera             Enable/Disable connection to the Raspberry Pi Camera
P2 SSH                Enable/Disable remote command line access to your Pi
P3 VNC                Enable/Disable graphical remote access to your Pi usin
P4 SPI                Enable/Disable automatic loading of SPI kernel module
P5 I2C                Enable/Disable automatic loading of I2C kernel module
P6 Serial             Enable/Disable shell and kernel messages on the serial
P7 1-Wire             Enable/Disable one-wire interface
P8 Remote GPIO        Enable/Disable remote access to GPIO pins
```

4. Install the megaio software from github.com:

```
~$ git clone https://github.com/SequentMicrosystems/megaioind-rpi.git
```

5.

```
~$ cd /home/pi/megaioind-rpi
```
6.

```
~/megaioind-rpi$ sudo make install
```
7.

```
~/megaioind-rpi$ megaioind
```

The program will respond with a list of available commands.

Type "`megaioind -h`" for online help.

After installing the software, you can update it to the latest version with the commands:

1.

```
~$ cd /home/pi/megaioind-rpi
```
2.

```
~/megaioind-rpi$ git pull
```
3.

```
~/megaioind-rpi$ sudo make install
```

