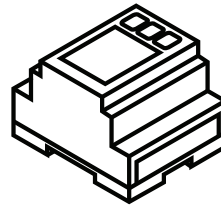# INDUSTRUINO

IND.I/O 1286
IND.I/O 32u4

USER MANUAL

Description

IND.I/O is the Arduino-compatible industrial controller. Reading industrial level sensors and driving actuators can be achieved with the ease of use of Arduino sketches.

I/O interfaces include:

- 8 CH 24V I/O
- 4 CH 0-10V/4-20mA 18bit input
- 2 CH 0-10V/4-20mA 12bit output
- Isolated RS485 transceiver
- Isolated power zones.

"IND.I/O" stands for "Industrial level I/O". The board offers an abundance of interface options, and has isolated power supplies for each of its three functional zones.

The processing and UI module of the Industruino IND.I/O comes in two variants:

- 32u4: 32K Flash / 2K RAM
- 1286: 128K Flash / 8K RAM

A vibrant community of users contribute to the Industruino Github page. Please find latest libraries, code examples and get involved on:

github.com/Industruino

Content

INDUSTRUINO
Industrial / Arduino Compatible

www.industruino.com
Emial: connect@industruino.com
Follow on Twitter: @industruino

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

EU Importer:
BTL cvba
Jan Mioenstraat 13
8610 Kortemark
Belgium

Operation instructions

Before using the Industruino kit, please read the manual carefully and pay full attention to safety to handle the product correctly.

For the latest instructions regarding installation, usage and operation of the Industruino kit please visit:

www.industruino.com/support

Safety instructions

⚠ WARNINGS

- Do not connect any part of the device to voltages higher than 32V.

- Always switch off power before you connect or disconnect an external device or accessory.

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

- Use only with cables and accessories that are approved or recommended by Industruino.

- 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.

- 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 Industruino.

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

- The device must be installed and wired by a trained technician following the applicable local safety standards and regulations.

Conditions of use

(1) Industruino IND.I/O programmable controller ("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.

Regulatory

CE COMPLIANCE $C\epsilon$

This product meets the essential requirements of applicable European Directives as follows:

2004/108/EC; Electromagnetic Compatibility Directive (EMC).
2011/65/EU; Restriction of Hazardous Substances Directive (RoHS).

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.
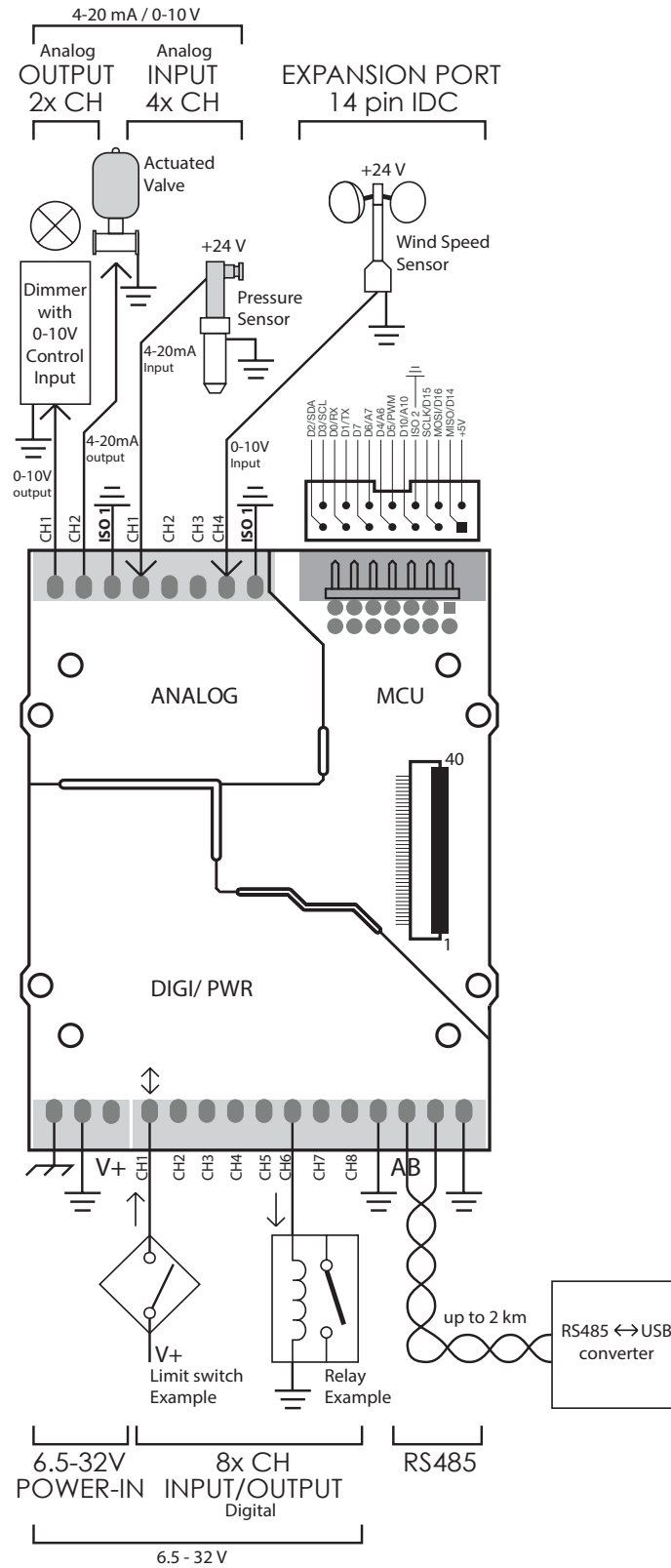
FCC COMPLIANCE

All Industruino products that are subject to the WEEE directive shipped from September 1, 2014 are compliant with the WEEE marking requirement.

Such products are marked with the "crossed-out wheelie bin" WEEE symbol (shown, above) in accordance with European Standard EN50419.
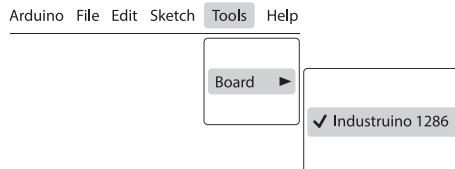
Wiring Map

Programming   Atmega 1286   ④

1. Download board definition files from our github page: *https://github.com/Industruino/boarddefinitions*
2. Install the downloaded board definition files.
3. On Windows only: Install the included CDC driver
4. Download libraries from our github page: *https://github.com/Industruino/libraries*
5. Install the downloaded libraries
6. Connect your Industruino via the USB port
7. Open the Arduino IDE
8. Click on menu "Tools->Boards" and select "Industruino 1286"

Arduino File Edit Sketch Tools Help

Board   ►
            ✓ Industruino 1286

8. Click on menu "Tools->Port" and select the serial port of the connected Industruino.

Arduino File Edit Sketch Tools Help

Serial Port ►
            ✓/dev/tty.usbmodem3d11
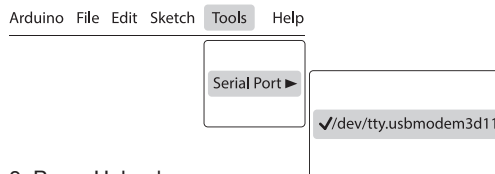
9. Press Upload

Atmega 32u4

1. On Windows only: Install Leonardo CDC driver included in the Arduino IDE folder
2. Download libraries from our github page: *https://github.com/Industruino/libraries*
3. Install the downloaded libraries
4. Connect your Industruino via the USB port
5. Open the Arduino IDE
6. Click on menu "Tools->Boards" and select "Arduino Leonardo"
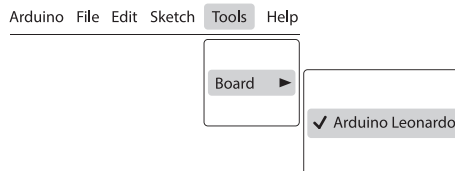
Arduino File Edit Sketch Tools Help

Board   ►
            ✓ Arduino Leonardo

7. Click on menu "Tools->Port" and select the serial port of the connected Industruino.

Arduino File Edit Sketch Tools Help

Serial Port ►
            ✓/dev/tty.usbmodem3d11
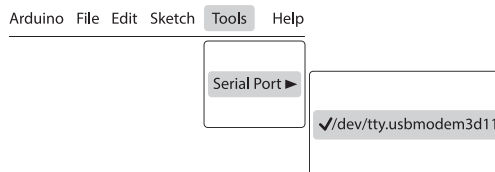
8. Press Upload

Download   Sample Code

The pre-loaded demo sketches can be downloaded from our github page and used as a starting point for your own applications:

Demo code
Pre-loaded code

Ethernet library
Communicate with the Ethernet module

Indio library
Drive the I/O functions of IND.I/O

LCD library
Display simple text on the LCD.

I/O ports

For all I/O functions of the IND.I/O product you will need the "Indio" library to access the I/O channels. The pins on the IDC expansion connector, the backlight pin, and the membrane panel buttons pin(s) should still be accessed using standard Arduino commands, not using the Indio library; the Indio library is only for the external I/O channels available on the green screw connectors.

Note:

High side drivers are over current/ short circuit protected and will automatically reset after the fault condition is removed.

Digital Input

⑤

Digital inputs are combined with digital outputs on the same physical connectors. Direction of the digital pins has to be set in the Setup() routine.

Configuration:

```
Indio.digitalMode(1,INPUT);      // Set CH1 as an input
```

Read:

```
Indio.digitalRead(1);          // Read CH1
```
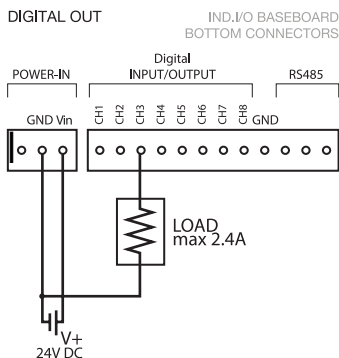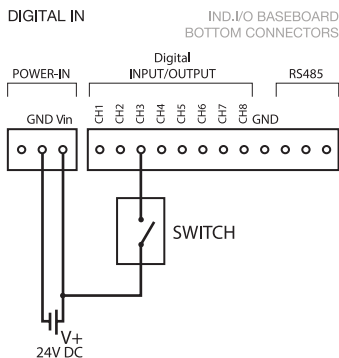
Interrupt:

The interrupt pin of the expander on the 12/24V digital side is connected to the INT7 pin of the 1286 topboard. This pin will trigger when a change on any of the 8 input or output channels occurs, and we can specify CHANGE, RISING, FALLING, LOW (note this pin is inverted: a change from LOW to HIGH on the digital channel triggers FALLING). If more than 1 channel needs to be detected by the interrupt, a flag can be set inside the interrupt service routine, and then any pin change can be checked inside the main loop, as discussed in this forum post *https://industruino.com/forum/help-1/question/multiple-channels-interrupts-on-32u4-topboard-205*

This code example (for 1286 topboard) shows a counter on the LCD for each rising edge on CH1 (without debounce).

```
#include <Indio.h>
#include <Wire.h>

#include <UC1701.h>
static UC1701 lcd;

volatile int counter = 0;

void setup() {

  Serial.begin(9600);
  lcd.begin();
  Indio.digitalMode(1, OUTPUT); //  Clear CH1 to LOW
  Indio.digitalWrite(1, LOW);  //
  Indio.digitalMode(1, INPUT); // Set CH1 as an input

  attachInterrupt(7, count, CHANGE);      // INT7 attached to the interrupt of the expander
                             // this is not D7
}

void count() {
  Serial.println("trigger");
  counter++;
}

void loop() {
  lcd.setCursor(1, 3);
  lcd.print(counter);
  delay(100);
}
```

Digital Output

Digital outputs are combined with digital inputs on the same physical connectors pins. Direction of the digital pins has to be set in the Setup() routine.
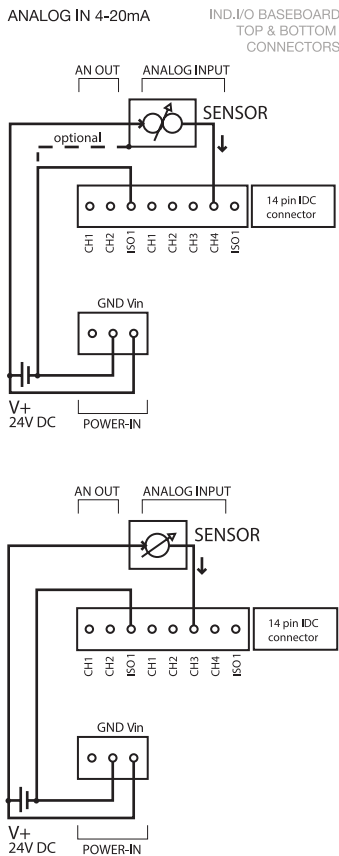
Configuration:

```
Indio.digitalMode(7,OUTPUT);      // Set CH7 as an output
```

Read/write one of the lines below:

```
Indio.digitalWrite(7,LOW);       // Set CH7 to low (0V)
```

```
Indio.digitalWrite(7,HIGH);      // Set CH7 to high (Vin voltage; ex 24V)
```

I/O ports

ANALOG IN 4-20mA

IND.I/O BASEBOARD
TOP & BOTTOM
CONNECTORS

Analog Input

⑥

Note:

The analog I/O section is galvanically isolated from the digital I/O section and the microcontroller section, to allow a separate power supply in the analog section for optimal accuracy. In case your analog sensors/actuators are on the same power supply as the digital section (Vin 12/24V), analog GND and digital GND connections should be tied together.

Configuration of resolution:

```
Indio.setADCResolution(16);      // Set the ADC resolution
                                 // Choices are 12bit@240SPS, 14bit@60SPS, 16bit@15SPS and 18bit@3.75SPS.
```

Configuration of input mode:

```
Indio.analogReadMode(1, V10);      // Set Analog-In CH1 to 10V mode (0-10V).
Indio.analogReadMode(1, V10_p);    // Set Analog-In CH1 to % 10V mode (0-10V -> 0-100%).
Indio.analogReadMode(1, V5);       // Set Analog-In CH1 to 5V mode (2x gain enabled on ADC).
Indio.analogReadMode(1, V5_p);     // Set Analog-In CH1 to 5V mode (0-5V -> 0-100%).
Indio.analogReadMode(1, V10_raw);  // Set Analog-In CH1 to 10V mode and read raw ADC value
                                   // (0-10V -> 0-4096).

Indio.analogReadMode(1, mA);       // Set Analog-In CH1 to mA mode (0-20mA).
Indio.analogReadMode(1, mA_p);     // Set Analog-In CH1 to % mA mode (4-20mA -> 0-100%)
Indio.analogReadMode(1, mA_raw);   // Set Analog-In CH1 to mA mode and read raw ADC value
                                   //(0-20mA -> 0-4096).
```

Read:

```
Indio.analogRead(1);            //Read Analog-In CH1 (output depending on selected mode as above)
```

Please note that the output of the Indio.analogRead() in RAW mode is not of the type INTEGER, but FLOAT. The output range is fixed from 0 to 4096 for all resolutions, but only in 12-bit mode this returns integers; for higher resolution the measurements are floating point numbers.

I/O ports

Analog Output

The analog I/O section is galvanically isolated from the digital I/O section and the microcontroller section, to allow a separate power supply in the analog section for optimal accuracy. In case your analog sensors/actuators are on the same power supply as the digital section (Vin 12/24V), analog GND and digital GND connections should be tied together.

Configuration of output mode:

```
Indio.analogWriteMode(1, V10);      // Set Analog-Out CH1 to 10V mode (0-10V).
Indio.analogWriteMode(1, V10_p);    // Set Analog-Out CH1 to % 10V mode ( 0-100% -> 0-10V).
Indio.analogWriteMode(1, V10_raw);  // Set Analog-Out CH1 to 10V mode and take raw DAC value
                                    // (0-4096 -> 0-10V).

Indio.analogWriteMode(1, mA);       // Set Analog-Out CH1 to mA mode (0-20mA).
Indio.analogWriteMode(1, mA_p);     // Set Analog-Out CH1 to % mA mode (0-100% -> 4-20mA).
Indio.analogWriteMode(1, mA_raw);   // Set Analog-Out CH1 to mA mode and take raw DAC value
                                    // (0-4096 -> 0-20mA).
```

Write (examples corresponding to above configuration):

```
Indio.analogWrite(1, 2.67, true);      // Set CH1 to 2.67V ("true" will write value to EEPROM of DAC,
                                       // restoring it after power cycling).
Indio.analogWrite(1, 33.5, true);       // Set CH1 to 33.5% (approx 3.685V)
Indio.analogWrite(1, 1000, true);       // Set CH1 DAC to integer value 1000 (approx 2.685V).

Indio.analogWrite(1, 10.50, false); //Set CH1 to 10.5mA ("false" will not write value to EEPROM of DAC)
Indio.analogWrite(1, 75, true);         // Set CH1 to 75% (approx 16mA).
Indio.analogWrite(1, 2048, true);       // Set CH1 DAC to integer value 2048 (approx 10.5mA).
```

Calibration

Indio's example sketch folder includes the "Indio_AnalogCalibration" sketch to interactively calibrate the analog inputs and outputs.
Please visit *https://github.com/Industruino/libraries#calibration* for full information on manual calibration.

Communications

RS485

(7)

RS485

IND.I/O BASEBOARD
BOTTOM CONNECTORS

PULL-UP [O O] 560 Ω
TERM [O O] 120 Ω
PULL-DOWN [O O] 560 Ω

POWER-IN | Digital INPUT/OUTPUT | RS485

GND Vin | CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 GND | A B GND
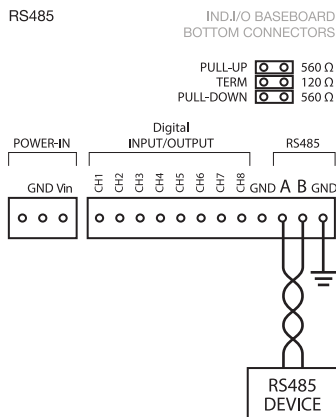
RS485
DEVICE

The RS485 compliant half-duplex port can be used to connect to up to 32 devices in a multidrop network configuration.

Caution: when available please connect the shield ground of the RS485 cable to the GND connection of the RS485 port to avoid common-mode voltages that could potentially damage equipments.

Hardware specifics for RS485 on the INDIO:
• Serial connection = Serial1 (does not interfere with 'Serial', which can be used for uploading and Serial Monitor at the same time)
• TxEnablePin = D9 (needs to be toggled to set direction of communications).

Modbus

To use the RS485 port in a Modbus Master or Slave configuration please download the SimpleModbusMaster or SimpleModbusSlave libraries through our github library page. Link: *https://github.com/Industruino/libraries*

Basic configuration of the above Modbus RTU libraries:

```
#define baud       115200   // tested 9600 to 115200
#define timeout    1000
#define polling    20    // the scan rate
#define retry_count 10
// used to toggle the receive/transmit pin on the driver
#define TxEnablePin 9                                 // INDUSTRUINO RS485

modbus_configure(&Serial1, baud, SERIAL_8N2, timeout, polling, retry_count, TxEnablePin, packets, TOTAL_NO_OF_PACKETS, regs);
```

Ethernet

10BaseT/100BaseTX Ethernet capability can be added to Industruino using the Ethernet Expansion module. The module connects to Industruino IND.I/O via the 14pin IDC expansion port and communicates via SPI protocol, with pin D10 as the chip select line.

Please visit our github library page to download the "EthernetIndustruino" library and code examples. Link: *https://github.com/Industruino/libraries*

Our Ethernet library is based on the standard Arduino Ethernet library and it supports the same commands. Any code that relies on the standard Arduino ethernet library should be compatible with Industruino ethernet as long as the included library is changed to the following line:

```
#include <EthernetIndustruino.h>
```

Memory

Micro-SD

A Micro-SD card holder is present on the optional Ethernet Expansion module. Communication happens via SPI with pin D4 as the chip select line. The standard Arduino SD library can be used for storing data on the Micro-SD card.
Cards should be formatted as FAT32 and have a maximum partition size of 2GB.

FRAM

An 8KB non-volatile FRAM chip is present on the optional Ethernet Expansion module. Communication happen via SPI with pin D6 as the chip select line. Please visit our github library page for code examples. Link: https://github.com/Industruino/libraries

UI

LCD

8

The 128x64 pixel graphic LCD can be used to display text and graphics. You have a choice between two different libraries to drive this LCD.

- UC1701 : A simple light-weight library
- U8g2 : A very elaborate library with many functions and fonts.

Input buttons

The three front panel buttons are read using input pins D23, D24, D25 on 1286 Topboard, or analog pin A5 on 32u4 Topboard.

The 1286 topboard also allows us to attach an interrupt to the membrane panel buttons: its button inputs are connected to pin change interrupts PCINT 4, 5, and 6 for buttons Down, Enter, and Up respectively.

Below demo sketch will show "waiting" on the LCD; when you press the "Enter" button an interrupt will be triggered and "Enter pressed" will show on the LCD for one second. To attach the interrupt to the "Up" or "Down" button change "PCINT5" in line PCMSK0 = (1 << PCINT6); to PCINT4 or PCINT6.

```
#include <UC1701.h>
static UC1701 lcd;

volatile int modeFlag = 0;

void setup() {

  lcd.begin(); //enable LCD
  // Enable Pin Change Interrupt 5 = Enter button
  PCMSK0 = (1 << PCINT5);
  PCICR = (1 << PCIE0);

  // Global Interrupt Enable
  sei();
}

ISR (PCINT0_vect)
{
  modeFlag = 1;
}

void loop() {

 lcd.setCursor(0, 0);
 lcd.print("waiting     ");

 if (modeFlag == 1) {
   lcd.setCursor(0, 0);
   lcd.print("Enter pressed");
   delay(1000);
   modeFlag = 0;
 }
}
```
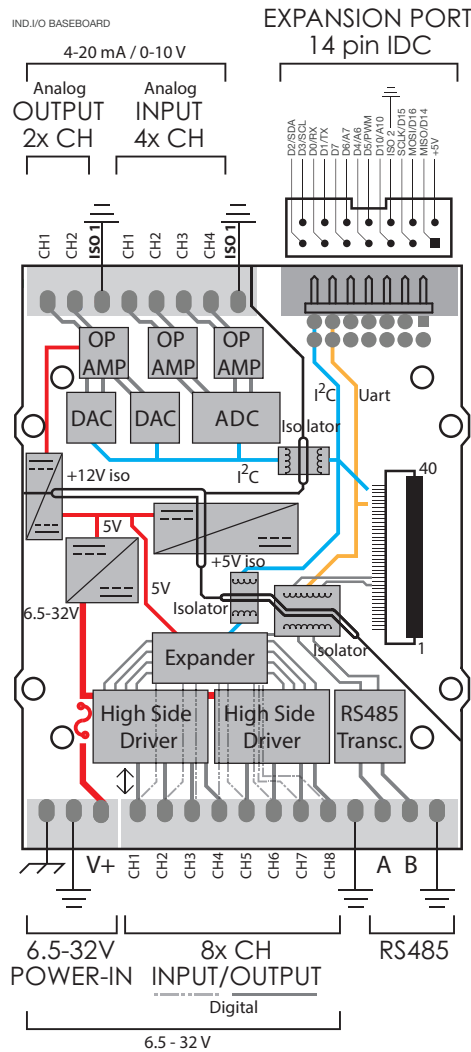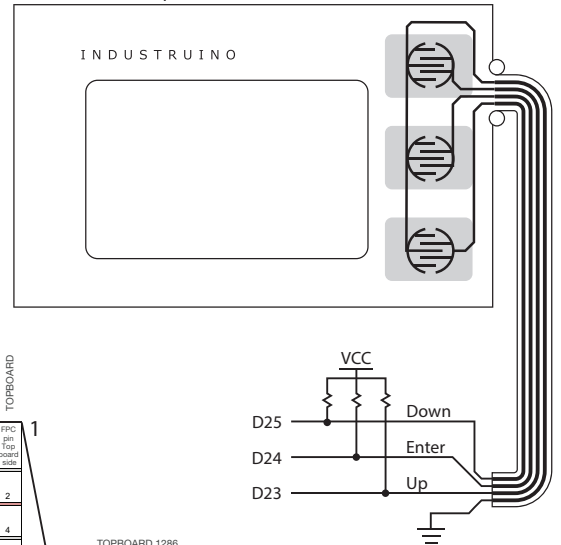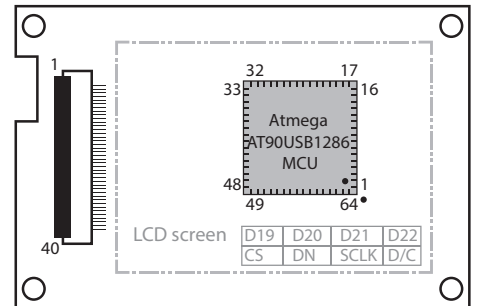
Ind.I/O 1286   Pinout Diagram

BUTTON PANEL
4 pin FPC cable

INDUSTRUINO

IND.I/O BASEBOARD

4-20 mA / 0-10 V

EXPANSION PORT
14 pin IDC

Analog OUTPUT 2x CH   Analog INPUT 4x CH

CH1 CH2 ISO 1   CH1 CH2 CH3 CH4 ISO 1

D2/SDA D3/SCL D0/RX D1/TX D7 D6/A7 D4/A6 D5/PWM D10/A10 ISO 2 SCLK/D15 MOSI/D16 MISO/D14 +5V

40 pin FPC cable

OP AMP   OP AMP   OP AMP

DAC   DAC   ADC

Isolator

I^2C Uart

+12V iso

I^2C

5V

+5V iso

5V

6.5-32V

Isolator

Expander

Isolator

High Side Driver   High Side Driver   RS485 Transc.

V+ CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8   A B

6.5-32V POWER-IN   8x CH INPUT/OUTPUT   RS485
Digital

6.5 - 32 V

VCC

D25 — Down
D24 — Enter
D23 — Up

TOPBOARD 1286

TOPBOARD 1286

32   17
33   16
Atmega AT90USB1286 MCU
48   1
49   64

LCD screen   D19 D20 D21 D22
             CS   DN   SCLK D/C

BASEBOARD		ATMEGA PIN	PORT PIN			TOPBOARD	
FPC pin Base board side	use on IND.I/O	Atmega Pin	Port Pin	Pin Function	Digital Pin	Analog Pin	PWM Pin	Serial Pin	FPC pin Top board side

FPC pin Base side	use on IND.I/O	Atmega Pin	Port Pin	Pin Function	Digital	Analog	PWM	Serial	FPC pin Top side
39	i2c SCL - main control bus / 14p IDC	18	PD0	INT0/OC0B	3		3	SCL	2
37	i2c SDA - main control bus / 14p IDC	19	PD1	INT1	2			SDA	4
35	RS485 TX / 14p IDC	21	PD3	INT3	1			TXD1	6
33	RS485 RX / 14p IDC	20	PD2	INT2	0			RXD1	8
32		8	PB0	SS/PCINT0	17				9
30	14p IDC expansion connector	9	PB1	SCLK/PCINT1	15			SCLK	11
28	14p IDC expansion connector	11	PB3	MISO/PCINT3	14			MISO	13
27	14p IDC expansion connector	10	PB2	MOSI/PCINT2	16			MOSI	14
26				3.3V					15
25				RESET					16
24				VIN					17
23	14p IDC expansion connector	37	PC2		4				18
21	14p IDC expansion connector	38	PC3	T.3	5				20
19	14p IDC expansion connector	39	PC4	OC3C	6		6		22
17	14p IDC expansion connector	40	PC5	OC3B	7		7		24
15	24V digital input PCINT	41	PC6	OC3A	8		8		26
13	RS485-E	42	PC7	CLK0	9				28
11	14p IDC expansion connector	54	PF7	TDI	10	A10			30
9		55	PF6	TDO	11	A11			32
7		56	PF5	TMS	12	A12			34
5		57	PF4	TCK	13	A13			36
3		58	PF3			A0			38
2		62				AREF			39

■	GND - ISO 1 PIN
■	VCC - ISO 1 PIN
■	DIGITAL PIN
■	ANALOG PIN
■	PWM PIN
■	SERIAL PIN

Topboard peripherals	Arduino pin	Atmega pin
LCD Backlight	D13	32
LCD Backlight (on 1286)	D26	17
LCD reset	A1 / D19	37
LCD Data/Command	A2 / D20	38
LCD MOSI	A3 / D21	39
LCD SCLK	A4 / D22	40
Membrane button panel	A5 / D23	41
Button down (on 1286)	D23	
Button enter (on 1286)	D24	
Button up (on 1286)	D25	
RS485	Arduino pin	Atmega pin
RX	D0 / RX	20
TX	D1 / TX	21
Enable (TX/RX mode)	D9	29
Digital I/O: I/O expander		
Name	IND-I/O Library designator	
INT	Interrupt connected to Topboard D8, PC INT	
CH1	1	
CH2	2	
CH3	3	
CH4	4	
CH5	5	
CH6	6	
CH7	7	
CH8	8	

Analog In - ADC		
Name	IND-I/O Library designator	
CH1	A1	
CH2	A2	
CH3	A3	
CH4	A4	
Analog Out - DAC		
Name	IND-I/O Library designator	
CH1	A1	
CH2	A2	

EEPROM: 24LC01 i2c add: 0x50

14P IDC Expansion Port

| D3/SCL | D1/TX | D6/A7 | D5/PWM | GND | MOSI/D16 | +5V |
| D2/SDA | D0/RX | D7 | D4/A6 | D10/A10 | SCLK/D15 | MISO/D14 |

Power In		
Name	Description	
⏚	Optional: Connect to Earth for improved EMC performance	
⏚ GND	Negative power terminal	6.5-32V
V+	Positive power terminal	

INDUSTRUINO IND.I/O - PRODUCT MANUAL. DECEMBER 2016
Industruino is an Arduino compatible industrial controller. *www.industuruino.com*

10

Ind.I/O 32u4   Pinout Diagram

BUTTON PANEL
4 pin FPC cable

INDUSTRUINO

IND.I/O BASEBOARD

4-20 mA / 0-10 V

EXPANSION PORT
14 pin IDC

Analog OUTPUT 2x CH

Analog INPUT 4x CH

CH1 CH2 ISO1   CH1 CH2 CH3 CH4 ISO1

D2/SDA D3/SCL D0/RX D1/TX D7 D6/A7 D4/A6 D5/PWM D10/A10 ISO2/D15 SCLK/D15 MOSI/D16 MISO/D14 +5V

40 pin FPC cable

OP AMP   OP AMP   OP AMP

DAC   DAC   ADC

I²C   Uart

Isolator

+12V iso

I²C   Isolator

5V

+5V iso

5V

6.5-32V

Isolator

Expander   Isolator

High Side Driver   High Side Driver   RS485 Transc.

V+   CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8   A B

6.5-32V POWER-IN   8x CH INPUT/OUTPUT
Digital

6.5 - 32 V

AREF

Down

Enter

Up

A5

TOPBOARD 32u4

Atmega 32u4

22 12
23   11
33   1
34 44

LCD screen

D19	D20	D21	D22	D13
CS	DN	SCLK	D/C	Back light

BASEBOARD		ATMEGA PIN PORT PIN			Digital Pin	Analog Pin	PWM Pin	Serial Pin	TOPBOARD
FPC pin BASE board side	Use on IND.I/O	Atmega Pin	Port Pin	Pin Function					FPC pin TOP board side
39	i2c - main control bus / 14p IDC	18	PD0	INT0/OC0B	3		3	SCL	2
37	i2c - main control bus / 14p IDC	19	PD1	INT1	2			SDA	4
35	RS485 TX / 14p IDC	21	PD3	INT3	1			TXD1	6
33	RS485 RX / 14p IDC	20	PD2	INT2	0			RXD1	8
32		8	PB0	SS/PCINT0	17				9
30	14p IDC expansion connector	9	PB1	SCLK/PCINT1	15			SCLK	11
28	14p IDC expansion connector	11	PB3	MISO/PCINT3	14			MISO	13
27	14p IDC expansion connector	10	PB2	MOSI/PCINT2	16			MOSI	14
26				3.3V					15
25				RESET					16
24				VIN					17
23	14p IDC expansion connector	25	PD4	ICP1	4	A6			18
21	14p IDC expansion connector	31	PC6	OC3A/OC4A	5		5		20
19	14p IDC expansion connector	27	PD7	OC4D/T0	6	A7	6		22
17	14p IDC expansion connector	1	PE6	INT6/AIN0	7				24
15	24V digital input PCINT	28	PB4	PCINT4	8	A8			26
13	RS485-E	29	PB5	OC1A/PCINT5/OC4B	9	A9	9		28
11	14p IDC expansion connector	30	PB6	OC1B/PCINT6/OC4B	10	A10	10		30
9		12	PB7	OC0B/OC1C/PCINT7/RTS	11		11		32
7		26	PD6	OC4D/T1	12	A11	12		34
5		32	PC7	OC4A/ICP3/CLK0	13		13		36
3		36	PF7	TDI		A0			38
2		42		AREF					39

40 ... 1

1 ... 40

	GND - ISO 1 PIN
	VCC - ISO 1 PIN
	DIGITAL PIN
	ANALOG PIN
	PWM PIN
	SERIAL PIN

Topboard peripherals	Arduino pin	Atmega pin
LCD Backlight	D13	32
LCD Backlight (on 1286)	D26	17
LCD reset	A1 / D19	37
LCD Data/Command	A2 / D20	38
LCD MOSI	A3 / D21	39
LCD SCLK	A4 / D22	40
Membrane button panel	A5 / D23	41
Button down (on 1286)	D23	
Button enter (on 1286)	D24	
Button up (on 1286)	D25	
RS485	Arduino pin	Atmega pin
RX	D0 / RX	20
TX	D1 / TX	21
Enable (TX/RX mode)	D9	29

Digital I/O: I/O expander	
Name	IND-I/O Library designator
INT	Interrupt connected to Topboard D8, PC INT
CH1	1
CH2	2
CH3	3
CH4	4
CH5	5
CH6	6
CH7	7
CH8	8

Analog In - ADC	
Name	IND-I/O Library designator
CH1	A1
CH2	A2
CH3	A3
CH4	A4

Analog Out - DAC	
Name	IND-I/O Library designator
CH1	A1
CH2	A2

EEPROM: 24LC01 i2c add: 0x50

14P IDC Expansion Port

| D3/SCL | D1/TX | D6/A7 | D5/PWM | GND | MOSI/D16 | +5V |
| D2/SDA | D0/RX | D7 | D4/A6 | D10/A10 | SCLK/D15 | MISO/D14 |

Power In			
Name	Description		
⏚	Optional: Connect to Earth for improved EMC performance		
⏚ GND	Negative power terminal	6.5-32V	
V+	Positive power terminal		

Dimensions

9

Front View
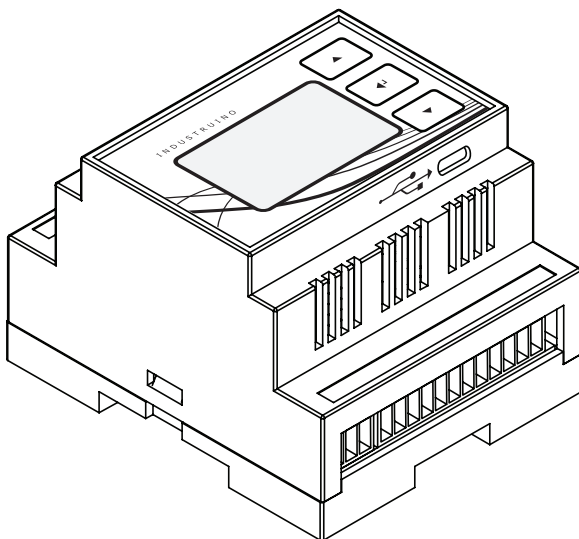
71.5

86.8

INDUSTRUINO
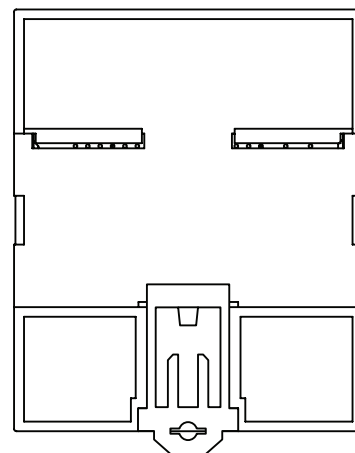
Side VIew

59.5

35
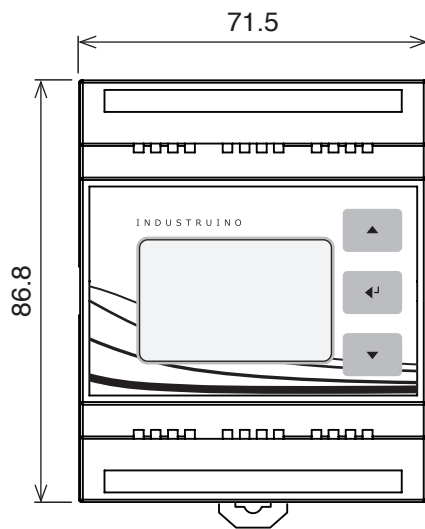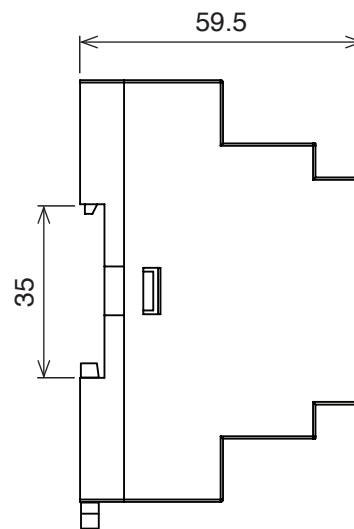
Isometric View

INDUSTRUINO

Back View

Industruino Enclosure

Models: Ind.I/O 1286, Ind.I/O 32u4

Size: 72 x 87 x 60mm

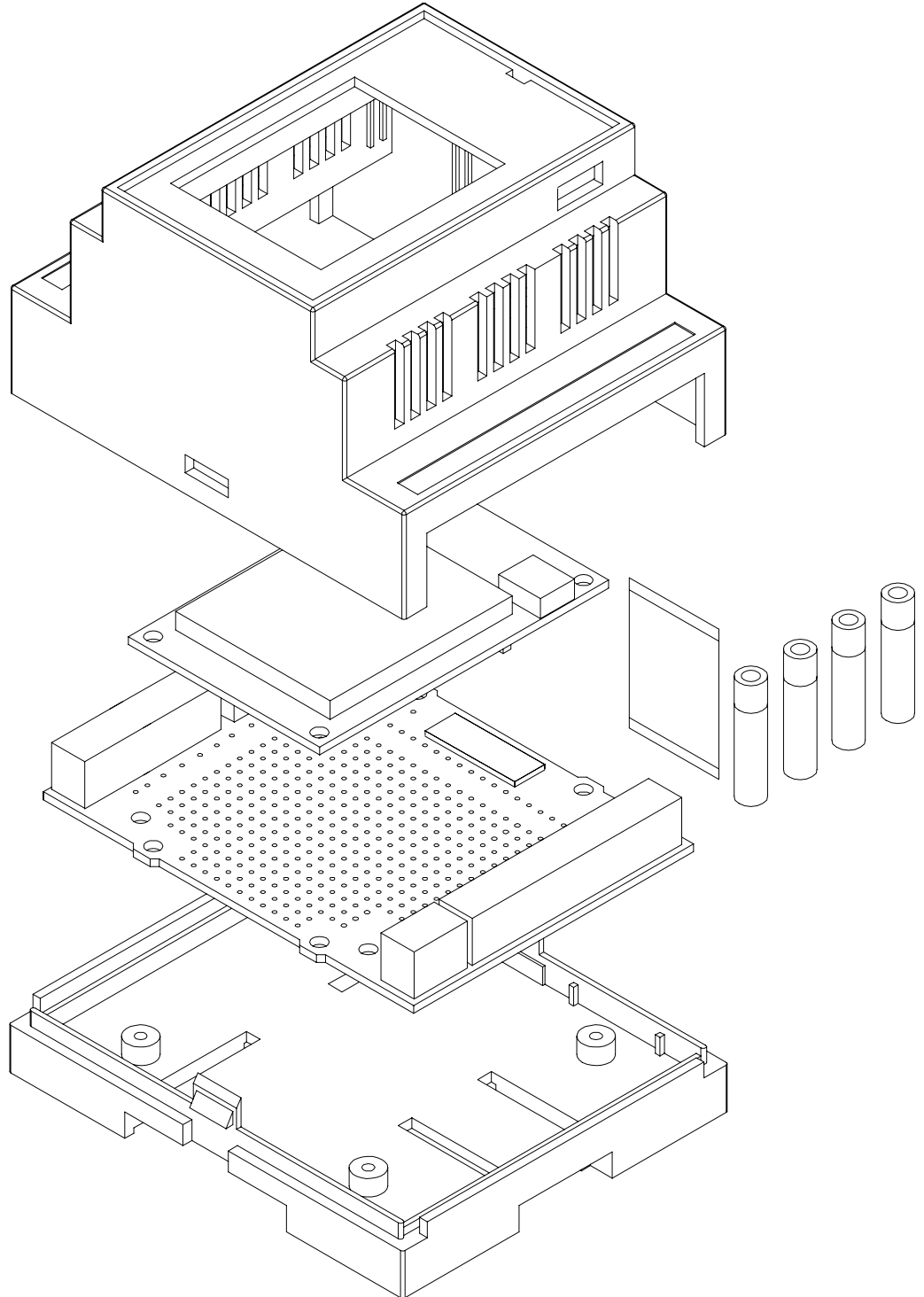Description: DIN-rail mount, click-on mechanism
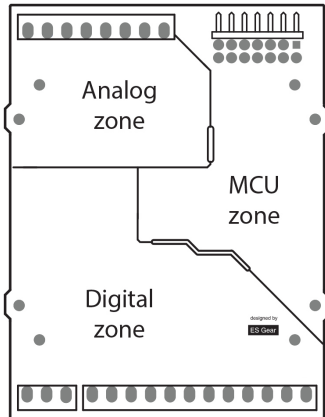
| Material: PPO polymer | Units: mm |

Packing list

The following items are included:

1. Thermoplastic enclosure   1x
2. Membrane button panel   1x
3. Topboard with LCD   1x
4. Screws for Topboard   4x
5. 40 pin FPC connector   1x
6. Ind.I/O Baseboard   1x
7. Screws for Baseboad   8x
8. Connectors for Baseboard   3x
9. Cardboard box   1x

Ind.I/O Specification

Installation	
Mounting	on 35 mm DIN rail, 4 spacing units wide

Supply voltage	
Standard input voltage	12V / 24V
permissible range, lower limit (DC)	6.5 V
permissible range, upper limit (DC)	32 V

Digital inputs	
Number of digital inputs	8 (shared with digital outputs)
Type of digital input	Galvanically isolated serializer with interrupt
Input voltage range	0-32V
Logic HIGH voltage	>11V
Logic LOW voltage	<3V
Maximum trigger frequency	10 KHz
Protection of digital outputs	Short-circuit, over-current, over-temperature, ESD, transients.

Digital outputs	
Number of digital outputs	8 (shared with digital outputs)
Type of digital output	Galvanically isolated high-side driver (Charge pump NFET)
Output voltage range	Tied to supply voltage (6.5-32V)
Maximum current per output	2.6 A
Maximum total current	6.5 A
Maximum switching frequency	400 Hz
Protection of digital outputs	Short-circuit, over-current, over-temperature, ESD, transients.

Analog inputs	
Number of analog inputs	4
Type of analog inputs	Buffered ADC
Range of voltage measurement	0-10V
Range of current measurement	0-20mA
Switching of voltage / current mode	Automatic - in software
Resolution	18Bit
Conversion rate	18bit: 3.75 Hz - 16bit: 15 Hz - 14bit: 60 Hz - 12bit: 240 Hz
Protection of analog inputs	ESD, transients.

Analog Outputs	
Number of analog outputs	2
Type of analog outputs	Buffered DAC
Range of output voltage	0-10V
Range of output current	0-20mA
Switching of voltage / current mode	Automatic - in software
Resolution	12Bit
Update rate	20 KHz
Protection of analog outputs	Short-circuit, over-current, over-temperature, ESD, transients.

Communication ports	
RS485	
Isolation topology	Isolated from MCU and analog field section
Duplex type	Half duplex
Number of receivers on bus	32
Data rate	1 Mbps
Expansion port (direct MCU control)	
Isolation topology	Isolated from digital and analog field section
Number of pins	14
Voltage level	5V
Protocols supported	SPI, I2C, UART, 9 GPIO's
Protection of expansion port	ESD, transients.

User Interface	
LCD	128x64 pixel FSTN with dimmable backlight
Push buttons	3 - push button membrane panel

Enviromental	
Protection class	IP20
Ambient operating temperature	0 - 55 °C

Dimensions	
Width	71.5 mm
Height	87 mm
Depth	58 mm
Weight	150 g