



INDUSTRIAL SHIELDS

TOUCHBERRY PI PANEL FAMILY

User guide



Touchberry Pi Panel Family

User Guide

Revised March 2024

Preface

This User Guide has been implemented by Boot & Work, S.L. working under the name Industrial Shields.

Purpose of the manual

The information contained in this manual can be used as a reference to operating, to functions, and to the technical data of the signal modules, power supply modules and interface modules.

Intended Audience

This User Guide is intended for the following audience:

- Persons in charge of introducing automation devices.
- Persons who design automation systems.
- Persons who install or connect automation devices.
- Persons who manage working automation installation.



Warnings:

- Unused pins should not be connected. Ignoring the directive may damage the controller.
- Improper use of this product may severely damage the Panel PC.
- Refer to the Panels User Guide regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product's User Guide and all accompanying documentation.
- Maintenance must be performed by qualified personnel familiarised with the construction, operation, and hazards involved with the control.
- Maintenance should be performed with the control out of operation and disconnected from all sources of power.
- Care should be taken when servicing electrostatic sensitive components. The manufacturer's recommendations for these components should be followed.
- The Panel PC family are Open Type panels. It is required that you install a Panel PC in a housing, cabinet, or electric control room. Entry to the housing, cabinet, or electric control room should be limited to authorised personnel. Failure to follow these installation requirements could result in severe personal injury and/or property damage. Always follow these requirements when installing Panel PC.
- In case of installation or maintenance of the Touchberry please follow the instructions marked in the Installation and Maintenance section.
- Do not disconnect equipment when a flammable or combustible atmosphere is present. Disconnection of equipment when a flammable or combustible atmosphere is

present may cause a fire or explosion which could result in death, serious injury and/or property damage.



Avertissements:

- Les broches non utilisées ne doivent pas être connectées. Ignorer la directive peut endommager le contrôleur.
- Une utilisation incorrecte de ce produit peut endommager gravement le contrôleur.
- Reportez-vous au Guide de l'utilisateur du Panel PC pour les considérations de câblage.
- Avant d'utiliser ce produit, il incombe à l'utilisateur de lire le Guide de l'utilisateur du produit et la documentation qui l'accompagne.
- La maintenance doit être effectuée par personnel qualifié familiarisé avec la fabrication, le fonctionnement et les dangers liés au contrôleur.
- La maintenance doit être effectuée avec l'équipement hors service et déconnectée de toutes les sources d'alimentation.
- Faites attention lors de l'entretien des composants sensibles à l'électricité statique. Les recommandations du fabricant pour ces composants doivent être suivies.
- Les automates de la famille Panel PC sont des contrôleurs de type ouvert. Il est nécessaire d'installer l'automate Panel PC dans un boîtier, une armoire ou une salle de contrôle électrique. L'accès au boîtier, à l'armoire ou à la salle de commande électrique doit être limité au personnel autorisé. Le non-respect de ces exigences d'installation peut entraîner des blessures graves et/ou des dommages matériels importants. Respectez toujours ces exigences lors de l'installation des automates de la Touchberry.
- En cas d'installation ou de maintenance du Touchberry, veuillez suivre les instructions indiquées dans la section Installation et Maintenance.
- Ne débranchez pas l'équipement en présence d'une atmosphère inflammable ou combustible. La déconnexion de l'équipement en présence d'une atmosphère inflammable ou combustible peut provoquer un incendie ou une explosion pouvant entraîner la mort, des blessures graves et/ou des dommages matériels.

Application Considerations and Warranty

Read and understand this manual

Please read and understand this manual before using the product. Please consult your comments or questions to Industrial Shields before using the product.

Application Consideration

THE PRODUCTS CONTAINED IN THIS DOCUMENT ARE NOT SAFETY RATED. THEY SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR ENSURING SAFETY OF PERSONS, AS THEY ARE NOT RATED OR DESIGNED FOR SUCH PURPOSES.

Please know and observe all prohibitions of use applicable to the products.

FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, NEVER USE THE INDUSTRIAL SHIELDS PRODUCTS.

NEVER USE THE INDUSTRIAL SHIELDS PRODUCTS BEFORE THEY ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Industrial Shields shall not be responsible for conformity with any codes, regulations or standards that apply to the combination of products in the customer's application or use of the product.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses may be suitable for the products:

- Systems, machines, and equipment that could present a risk to life or property.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installation subject to separate industry or government regulations.
- **WARNING:** On outdoor operations, locations involving potential chemical contamination or electrical interference, conditions or uses not described in this document please contact Industrial Shields for further information.

At the customer's request, INDUSTRIAL SHIELDS will provide applicable third-party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the system, machine, end product, or other application or use.

Intended use of Industrial Shields products

Consider the following:

Industrial Shields products should only be used for the cases of application foreseen in the catalogue and the associated technical documentation. If third-party products and components are used, they must have been recommended or approved by Industrial Shields.

The correct and safe operation of the products requires that your transport, storage, installation, assembly, operation and maintenance have been carried out correctly. It must respect the permissible ambient conditions. You should also follow the indications and warnings that appear in the associated documentation.

The product / system dealt with in this documentation should only be handled or manipulated by qualified personnel for the task entrusted and observing what is indicated in the documentation corresponding to it, particularly the safety instructions and warnings included in it. Due to their training and experience, qualified personnel are in a position to recognize risks resulting from the handling or manipulation of such products / systems and to avoid possible hazards.

Disclaimers

Weights and Dimensions

Dimensions and weights are nominal and they are not used for manufacturing purposes, even when tolerances are shown.

Performance Data

The performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of INDUSTRIAL SHIELDS's test conditions, and the users most correlate it to actual application requirements. Actual performance is subject to the INDUSTRIAL SHIELDS Warranty and limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when features are changed, or published ratings or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special numbers may be assigned to fix or establish key specifications for your

application on your request. Please consult with your INDUSTRIAL SHIELDS representative at any time to confirm actual specifications of purchased products.

Errors and Omissions

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used. These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety information and instructions on the components and in the associated technical user documentation. When carrying out a risk assessment of a machine in accordance with the EU Machinery Directive, the machine manufacturer must consider the following residual risks associated with the control and drive components of a PDS.

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example: – Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology – Response times of the controller and drive – Operating and/or ambient conditions not within the scope of the specification – Condensation / conductive contamination – Parameterization, programming, cabling, and installation errors – Use of radio devices / cellular phones in the immediate vicinity of the controller – External influences / damage.
2. Exceptional temperatures as well as emissions of noise, particles, or gas caused by, for example: – Component malfunctions – Software errors – Operating and/or ambient conditions not within the scope of the specification – External influences / damage.
3. Hazardous shock voltages caused by, for example: – Component malfunctions – Influence of electrostatic charging – Induction of voltages in moving motors – Operating and/or ambient conditions not within the scope of the specification – Condensation / conductive contamination – External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Warranty and Limitations of Liability

Warranty

Industrial Shields's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by Industrial Shields.

INDUSTRIAL SHIELDS MAKES NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, REGARDING MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. INDUSTRIAL SHIELDS DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED

Limitations of Liability

INDUSTRIAL SHIELDS SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

IN NO EVENT SHALL INDUSTRIAL SHIELDS BE RESPONSIBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS INDUSTRIAL SHIELDS'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Device Opening Policy and Warranty Voidance Notice

The device should only be opened under the following circumstances:

1. SD Card Replacement: Opening is permitted for the purpose of replacing the SD card.
2. Jumper Configuration: The device may be opened to adjust jumper configurations, provided that such modifications are conducted in accordance with the guidelines outlined in the device's manual or as directed by authorised personnel.

Any unauthorised opening of the device for reasons other than those specified above will result in the immediate voidance of the warranty provided by Industrial Shields. This includes but is not limited to:

- Attempted repairs by unauthorised personnel, such as Raspberry Pi replacement (even though steps to perform this procedure are explained, it results in the warranty being void).
- Unauthorised modifications to the internal components.
- Opening the device out of curiosity or experimentation.

In order to see how to open the device, check [Section 11](#).

Table of Contents

1 Touchberry PI (Raspberry Pi 4B)	10
1.1 Controller Specifications.....	10
1.2 Raspberry Pi 4 B I/Os Pinout.....	12
2 General Specifications	14
3 Touch Screen Specifications	14
4 Power Supply	15
5 Pinout Scheme Connections	16
6 Screen configuration	17
7 Touch Panels PC Size	18
8 Input and output controls	20
8.1 Inputs.....	20
8.1.1 Analog.....	20
8.1.2 Digital.....	21
8.2 Outputs.....	21
8.2.1 Digital.....	21
9 Usage tests: Communication protocols	22
9.1 Ethernet.....	22
9.2 Wifi/Bluetooth.....	22
9.3 I2C.....	23
9.4 SPI.....	24
9.5 RS485.....	24
9.6 RS232-TTL.....	25
10 Other interesting available software	26
11 Device opening and Raspberry replacement	27
12 Revision Table	30



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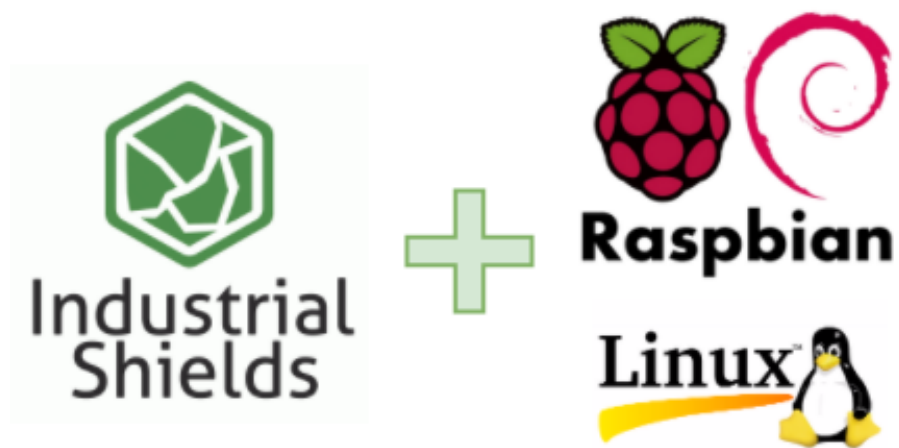
1 Touchberry PI (Raspberry Pi 4B)

1.1 Controller Specifications

Panel PC based on Raspberry PI board, encasing a 7" or 10.1" capacitive Touch Screen for industrial environment using Linux (Raspbian).

Board	Raspberry Pi 4B	PANEL PC 7"/10.1"
SoC	Broadcom BCM2837B0	
CPU	Quad core 64-bit ARM-Cortex A72 running at 1.5GHz	LINUX LINUX OPERATION SYSTEM
GPU	Broadcom VideoCore VI	
USB	(2) x USB2 Ports + (2) x USB3 Ports	ARDUINO Compatible with Arduino IDE
Storage	(1) x Micro SD / MMC / SDIO slot	
Network Communication	1x Gigabit Ethernet port (supports PoE with add-on PoE HAT) – (2) x RS485 HD - RS232 - SPI - I ² C - TTL	COM Industrial Communications
Wireless Communication	802.11 b/g/n/ac Wireless LAN (2.4GHz and 5GHz) and Bluetooth 5.0 with BLE	
Low level devices	40-pin GPIO header, populated	
IP Value	IP20	
GPIO Voltage	3.3V	
OS	Linux and Unix	

- This Panel PC is based on GNU/Linux OS installed on a SD card. It has many interfaces built in: Ethernet, USB, WiFi... Using the Ethernet port or WiFi network you can remotely control all parameters, data and inputs/outputs of your control system.
- Furthermore, Touchberry PI has enough I/O to replace PLCs on simple automation applications.
- Open protocols not only allow communication with other Industrial Shields PLCs, but also third-party devices and machinery.
- In complex systems, you can create a network between several Touchberry Pi. Providing integral supervision and control solutions for entire production plants and real-time data at hand.



1.2 Raspberry Pi 4 B I/Os Pinout

The Raspberry Pi 4 model B pinout:

Raspberry Pi 4 B J8 GPIO Header

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1, I ² C)		DC Power 5v	04
05	GPIO03 (SCL1, I ² C)		Ground	06
07	GPIO04 (GPCLK0)		(TXD0, UART) GPIO14	08
09	Ground		(RXD0, UART) GPIO15	10
11	GPIO17		(PWM0) GPIO18	12
13	GPIO27		Ground	14
15	GPIO22		GPIO23	16
17	3.3v DC Power		GPIO24	18
19	GPIO10 (SPI0_MOSI)		Ground	20
21	GPIO09 (SPI0_MISO)		GPIO25	22
23	GPIO11 (SPI0_CLK)		(SPI0_CE0_N) GPIO08	24
25	Ground		(SPI0_CE1_N) GPIO07	26
27	GPIO00 (SDA0, I ² C)		(SCL0, I ² C) GPIO01	28
29	GPIO05		Ground	30
31	GPIO06		(PWM0) GPIO12	32
33	GPIO13 (PWM1)		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

Raspberry Pi 4 B J14 PoE Header

01	TR01		TR00	02
03	TR03		TR02	04

Pinout Grouping Legend

Inter-Integrated Circuit Serial Bus		Serial Peripheral Interface Bus	
Ungrouped/Un-Allocated GPIO		Universal Asynchronous Receiver-Transmitter	
Reserved for EEPROM			

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www.element14.com/RaspberryPi

Next, it is shown a table connection between external DC-37 female connector Pinout and Raspberry Pi 4B Pinout:

DC-37	Raspberry Pi GPIO	DC-37	Raspberry Pi GPIO	DC-37	Raspberry Pi GPIO	DC-37	Raspberry Pi GPIO	DC-37	Raspberry Pi GPIO
1	01	09	17	17	35	25	12	33	28
2	03	10	19	18	37	26	14	34	30
3	05	11	21	19	40	27	16	35	33
4	07	12	23	20	02	28	18	36	36
5	09	13	25	21	04	29	20	37	38
6	11	14	27	22	06	30	22	38	-
7	13	15	29	23	08	31	24	39	-
8	15	16	32	24	10	32	26	40	-

2 General Specifications

Item		Touch Panel
Power supply voltage	DC power supply	12Vdc to 24Vdc
Power consumption	DC power supply	28W min.
External power supply	Power supply voltage	12Vdc (30W) // 24Vdc (30W)
	Power supply output capacity	2.5A (12Vdc) // 1.25A (24Vdc)
Shock resistance		80m/s ² in the X, Y and Z direction 2 times each.
Ambient temperature (operating)		0° to 50°C
Ambient humidity (operating)		10% to 90% (no condensation)
Ambient environment (operating)		With no corrosive gas
Ambient temperature (storage)		-20° to 60°C
Power supply holding time		2ms min.
Weight		1137 gr. (7") / 1673 gr. (10.1").

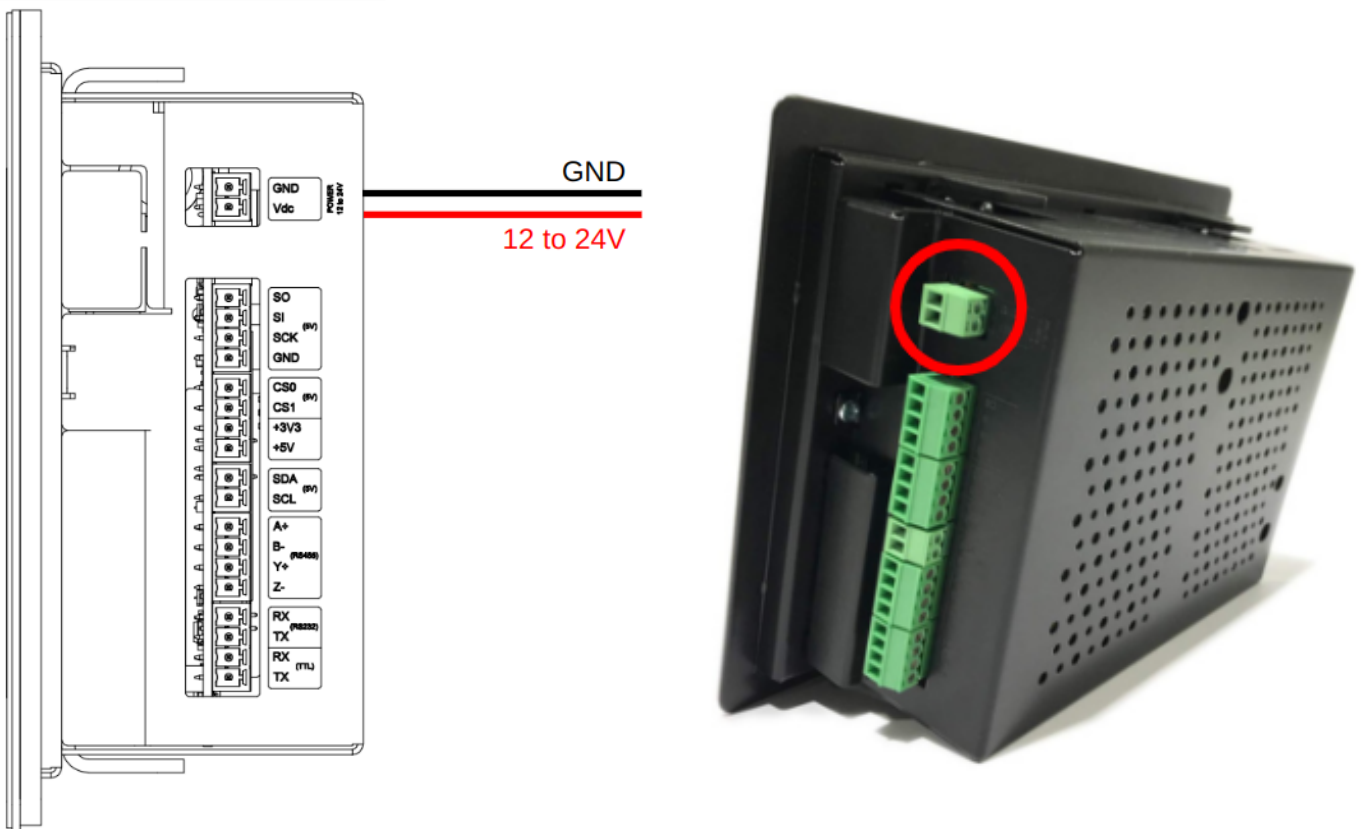
3 Touch Screen Specifications

Item	Touch Screen
Technology	Capacitive Touch Panel, 900 nits, RTD2662 controller chip
Image Resolution	1024 x 600 (7") / 1280 x 720 (10.1")
Format	16:9
Size	7" / 10.1"
Display Technology	TFT Type
Screen Type	IPS Display

4 Power Supply

DC Power Supply: 12Vdc - 24Vdc

Current: 2.5A (12Vdc) // 1.25A (24Vdc)



Power supply: 12/24Vdc

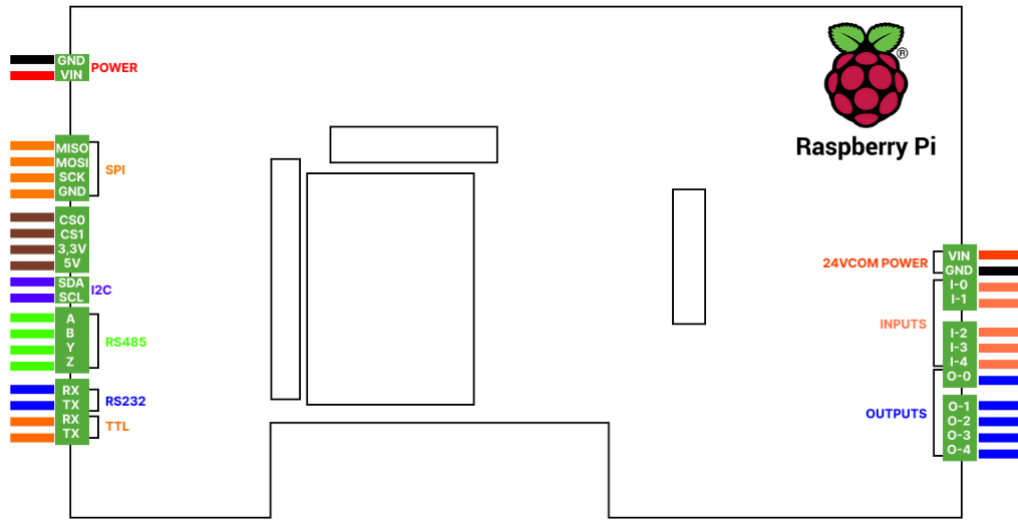


- Plug-in connector
- Pitch: 5,04 mm
- Two contact pins

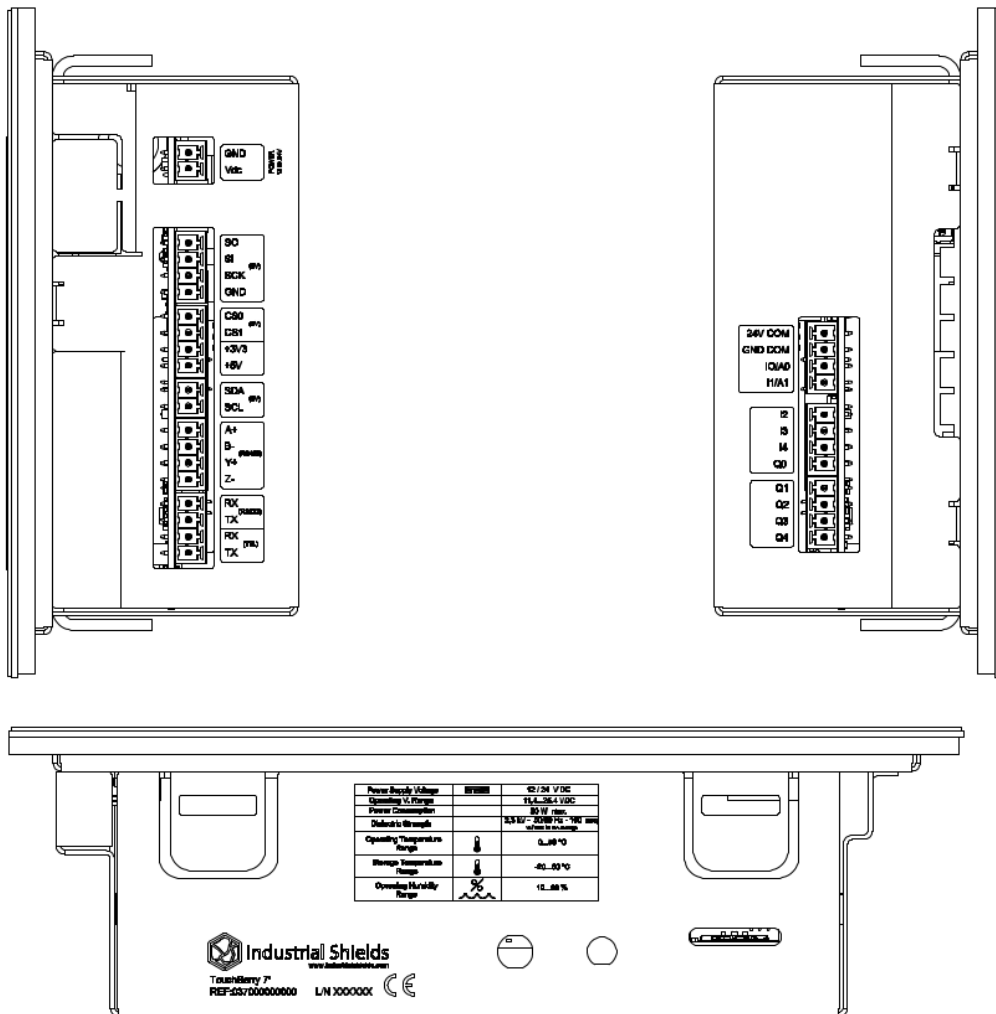
The input/output pins must be powered separately in addition to the general panel power supply.

5 Pinout Scheme Connections

The distribution of pins can be seen in the images below:



Serigraphy:



At the bottom of the panel we will find the USB and Ethernet connections:



6 Screen configuration

The Screen configuration feature is integral to our 7-inch and 10.1-inch touchscreen displays. The 7-inch variant is equipped with 5 side buttons for diverse settings, whereas the 10.1-inch version features 2 exclusive buttons for brightness control. Both options provide intuitive interfaces for users to customize the visual experience according to their preferences.

Key Features:

7-Inch Touchscreen:

- 5 buttons for configuring brightness and other settings.
- Intuitive interface for versatile adjustments.
- The buttons include Menu, Power, Exit, Up, and Down, situated at the rear right of the screen.

10.1-Inch Touchscreen:

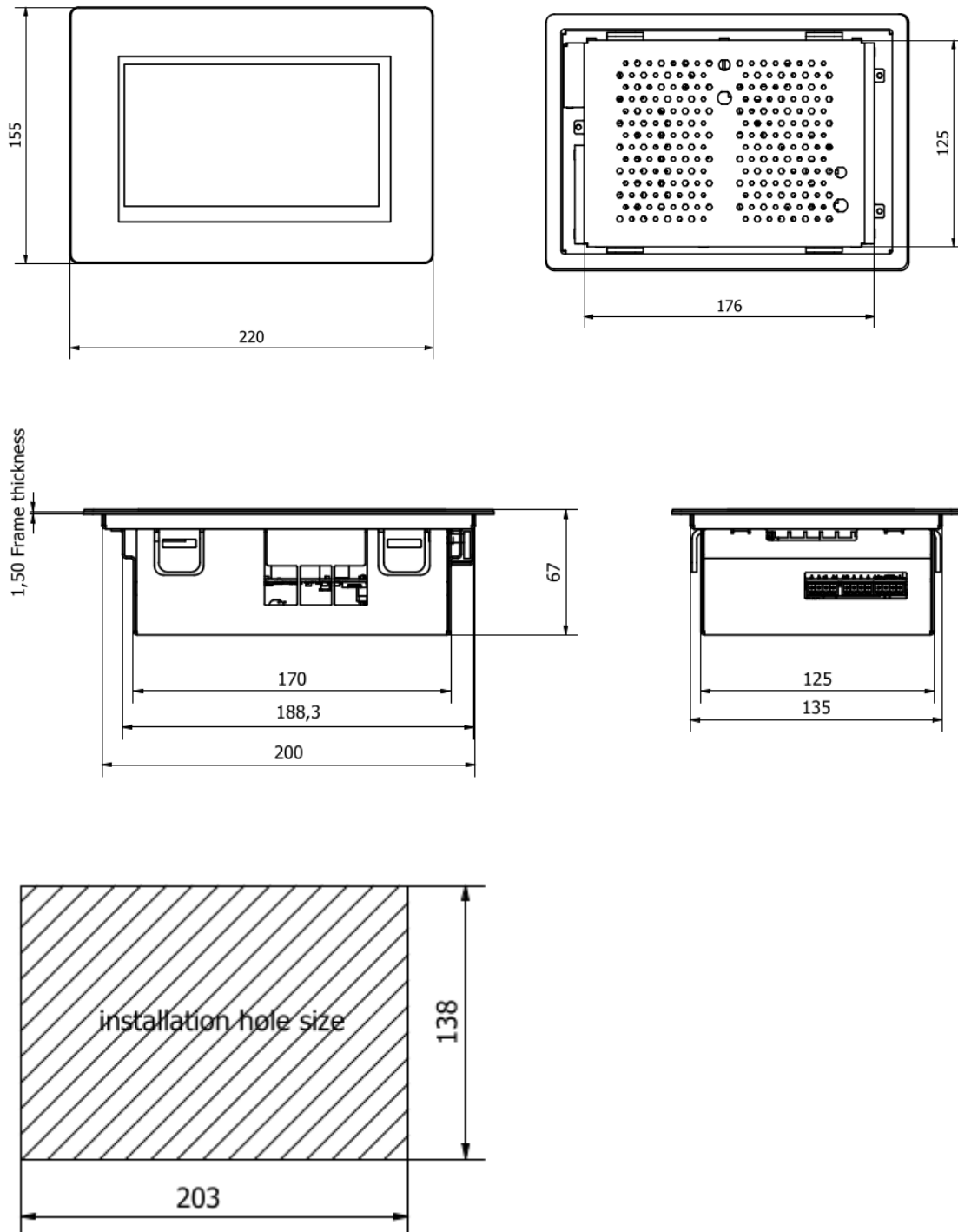
- 2 dedicated buttons for brightness control.
- Streamlined interface for efficient adjustments.
- The buttons are located at the rear, at the top of the screen housing.

This section guides users through the differences in Screen configuration, empowering them to tailor the visual experience to their preferences and specific environments.

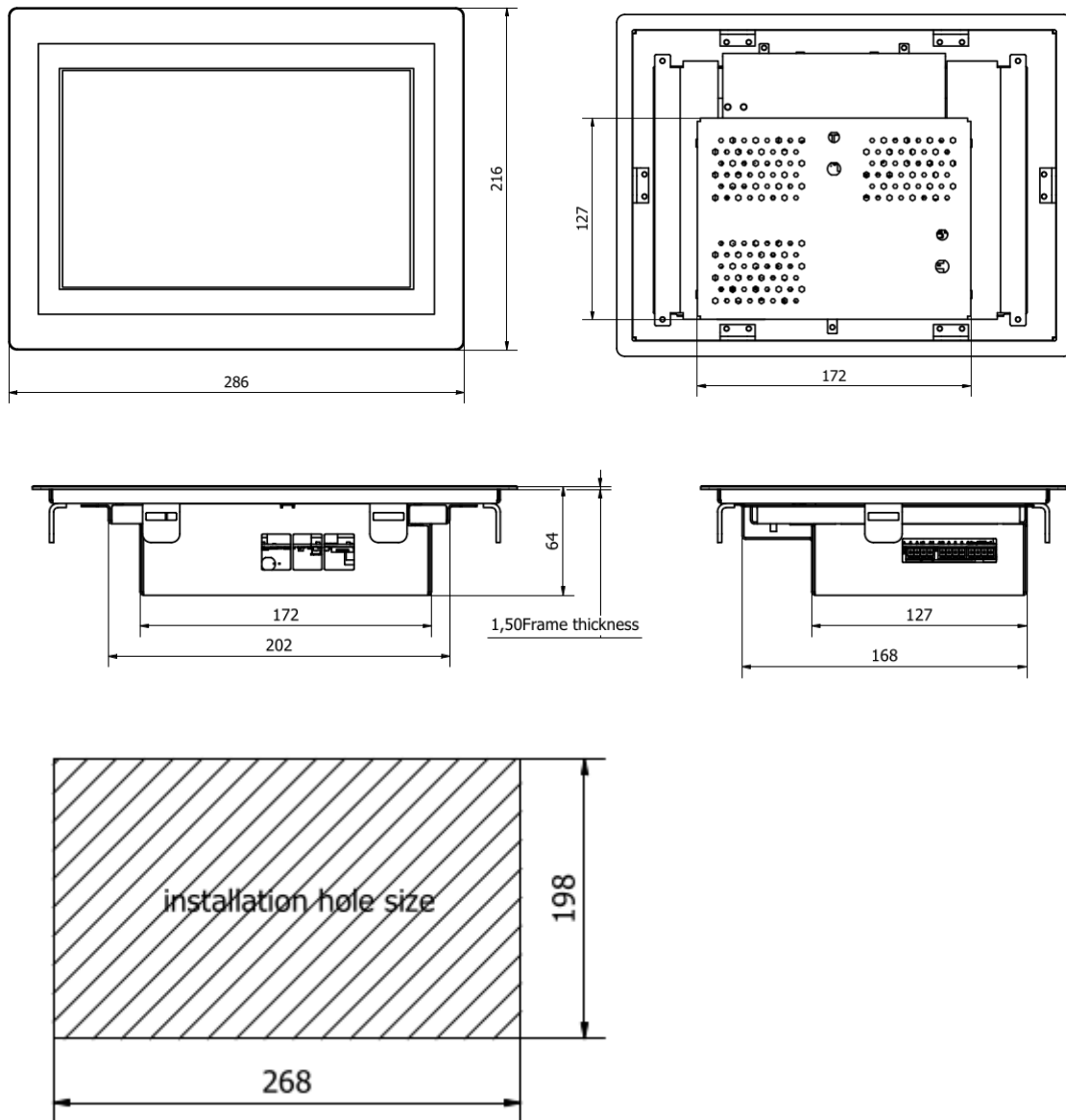
7 Touch Panels PC Size

The panel measurements are different depending on the version of the product.

In the case of the 7" panel:



In the case of the 10.1" panel:



8 Input and output controls

8.1 Inputs

8.1.1 Analog

In analog inputs, the voltage difference between -Vcc (ground) and +Vcc can vary across a wide range of values. An analog input provides a measurement in the form of a digital value that is represented by an N-bit number. Both digital and analog I/O have self-insulation, which means that they can be connected to power supplies with different voltages than 24 V.

The Touchberry Panel provides 2 analog inputs (I-0 to I-1) which can be used with both modes (0-10V and 4-20mA).

To read the value of the analog inputs, the Touchberry has a series of tests for this. If we use the 4-20mA configuration (default), we will do it as follows:

```
pi@raspberrypi:~ $ ./test/4-20mA/get-analog-input I0
pi@raspberrypi:~ $ ./test/4-20mA/get-analog-input I0
```

If you have the analog input configured from 0 to 10V, it will be done like this:

```
pi@raspberrypi:~ $ ./test/analog/get-analog-input I0
pi@raspberrypi:~ $ ./test/analog/get-analog-input I1
```

WARNING: Remember that the power must be connected to the set of input output pins, through the 24V COM and GND COM pins.

Also remember to connect a 1 K Ω resistor in series to the analog input (since the 4-20 mA mode is used by default and the resistor is needed).

8.1.2 Digital

In digital inputs, the voltage difference between -Vcc (ground) and +Vcc can only be between two states: 0 (which corresponds to -Vcc or GND) or 1 (which corresponds to +Vcc), with no intermediate values. Both digital and analog I/O have self-insulation, which means that they can be connected to power supplies with different voltages than 24 V.

The Touchberry Panel provides 3 digital inputs (I-2 to I-4) which can be used with both modes (5-24V and 250mA).

In order to measure the value of the digital input, we will use the tests that are precompiled in this way:

```
pi@raspberrypi:~ $ ./test/digital/get-digital-input I2
pi@raspberrypi:~ $ ./test/digital/get-digital-input I3
pi@raspberrypi:~ $ ./test/digital/get-digital-input I4
```

In this way it will return 0 or 1 in case of LOW 0 and in case of HIGH 1.

8.2 Outputs

8.2.1 Digital

Voltage variation from -Vcc (or GND) to +Vcc, with no intermediate values. Two states: 0 (-Vcc or GND) and 1 (+Vcc). In Digital and Analog I/O there is self insulation, so it is possible to connect them using a different power supply from the 24V one.

The Touchberry Panel provides 5 digital outputs (from Q-0 to Q-4).

To configure the digital outputs, in the same way as the inputs, we will use the tests provided as follows:

```
pi@raspberrypi:~ $ ./test/digital/set-digital-output 00 1
pi@raspberrypi:~ $ ./test/digital/set-digital-output 00 0
pi@raspberrypi:~ $ ./test/digital/set-digital-output 01 1
pi@raspberrypi:~ $ ./test/digital/set-digital-output 01 0
pi@raspberrypi:~ $ ./test/digital/set-digital-output 02 1
pi@raspberrypi:~ $ ./test/digital/set-digital-output 02 0
pi@raspberrypi:~ $ ./test/digital/set-digital-output 03 1
pi@raspberrypi:~ $ ./test/digital/set-digital-output 03 0
pi@raspberrypi:~ $ ./test/digital/set-digital-output 04 1
pi@raspberrypi:~ $ ./test/digital/set-digital-output 04 0
```

This time, the attributes of this test are: the output (O0..O4) and the state that we want to assign 0 for the LOW output and 1 for the HIGH output.

The Touchberry board contains test LEDs that allow us to see the configuration of the digital outputs.

9 Usage tests: Communication protocols

9.1 Ethernet

Ethernet is the technology that is most commonly used in wired local area networks (LAN). A LAN is a network of computers and other electronic devices that covers a small area such as a room, office, or building. It is used in contrast to a wide area network (WAN), which spans much larger geographical areas. Ethernet is a network protocol that controls how data is transmitted over a LAN. Technically, it is referred to as the IEEE 802.3 protocol. The protocol has evolved and improved over time to transfer data at the speed of a gigabit per second.

***IMPORTANT:** Make sure that your PLC is powered (12-24Vdc). Just with USB is insufficient power to power up the Ethernet communication.

For Ethernet communication with eth0 interface, there aren't any Raspberry Pi used pins.

Ethernet hardware configuration must be plug and play.

You can maintain a simple connection with the NETCAT tool like this:

```
pi@raspberrypi:~ $ nc -l port (server)
pi@raspberrypi:~ $ nc server_ip port (client)
```

Example:

```
#Touchberry:
pi@raspberrypi:~ $ nc -l 1234
#Other PLC:
pi@raspberrypi:~ $ nc 10.42.0.114 1234
```

Or you can create some slightly more complex code and create more complex automations depending on the functions you want to add.

9.2 Wifi/Bluetooth

All products of the Raspberry Pi family incorporate WiFi/Bluetooth connection. To set up Wi-Fi in the Raspberry PLC, you can follow [this guide](#).

And if you want to know how to use Bluetooth to, for example, communicate with the Raspberry PLC with an Android Phone, you can follow [this guide](#).

9.3 I2C

To send an I2C message in a Linux environment, you can use the `i2c-tools` package, which provides the `i2cset` and `i2cget` commands.

These commands allow you to write data to an I2C device or read data from an I2C device, respectively.

Here's an example of how you can use `i2cset` to send an I2C message:

```
i2cset -y <bus_number> <device_address> <register_address> <value> [b]
```

- `<bus_number>`: The I2C bus number (e.g., 1 for `/dev/i2c-1`).
- `<device_address>`: The I2C address of the target device.
- `<register_address>`: The register address where you want to write data.
- `<value>`: The value you want to write to the specified register.
- `[b]`: Optional parameter indicating that the value is in byte format.

For example, to write the value `0x45` to register `0x02` of an I2C device with address `0x50` on bus 1, you would run:

```
pi@raspberrypi:~ $ i2cset -y 1 0x50 0x02 0x45
```

Keep in mind that the actual bus number, device address, register address, and data value will depend on your specific hardware and requirements.

Additionally, you may need to ensure that the I2C kernel modules are loaded (`i2c-dev` and the driver specific to your hardware). You can use the `lsmod` command to check if these modules are loaded.

```
pi@raspberrypi:~ $ lsmod | grep i2c
```

Here's an example of how you can use `i2cget` to read data from an I2C device:

```
pi@raspberrypi:~ $ i2cget -y 1 0x50 0x02
```

#This command reads a byte from the specified register address (`0x02`) of the I2C device with address `0x50` on bus 1. The output will be the value read from the register.

9.4 SPI

To use SPI communications, we recommend using the spidev library.

```
pi@raspberrypi:~ $ pip install spidev
```

Here I leave you a simple example in python with which we can communicate using this protocol.

```
import spidev

# Initialize SPI
spi = spidev.SpiDev()
spi.open(0, 0) # The arguments (bus, device) depend on your setup
# Configure SPI settings
spi.max_speed_hz = 1000000 # Set the SPI speed (Hz)
spi.mode = 0 # Set the SPI mode (consult your device's datasheet)
# Prepare your data to be sent
data_to_send = [0x01, 0x02, 0x03]
# Send the SPI message
received_data = spi.xfer2(data_to_send)
# Close the SPI connection
spi.close()
# Process the received data if needed
print("Received Data:", received_data)
```

This Python code uses the spidev library to establish an SPI connection, send data, and receive a response from an SPI device.

9.5 RS485

RS-485, on this device, can be configured as Half Duplex or Full Duplex. Below we will see an example of each one.

First, to use this communication, some prior configurations must be made. In order to configure the RE and DE:

```
echo 27 > /sys/class/gpio/export
echo 17 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio27/direction
echo out > /sys/class/gpio/gpio17/direction
```

The baudrate is very important in serial communications and is configured as follows:

```
stty 115200 -F /dev/ttyS0 raw -echo
```

In this case we have set it to 115200, but it can be varied according to your needs.

Half Duplex:

Configuration of DE and RE for the use of RS-485 in Half duplex.

For receptions:

```
echo 0 > /sys/class/gpio/gpio17/value  
echo 0 > /sys/class/gpio/gpio27/value
```

Then, to see the data we are receiving, with the command: `cat /dev/ttyS0`

For transmissions:

```
echo 0 > /sys/class/gpio/gpio17/value  
echo 1 > /sys/class/gpio/gpio27/value
```

So, we can send messages, for example with: `echo MESSAGE > /dev/ttyS0`

Full Duplex:

Configuration of DE and RE in Full duplex:

```
echo 0 > /sys/class/gpio/gpio17/value  
echo 1 > /sys/class/gpio/gpio27/value
```

Then you are ready to use RS-485 in your projects.

We recommend adding a delay of at least 1 ms between reception and transmission.

9.6 RS232-TTL

Below we provide an example applicable to RS232 and TTL, setting the baud rate to 115200, for example, with the following command:

```
pi@raspberrypi:~ $ stty 115200 -F /dev/ttyS0 raw -echo
```

Therefore, we send a message as follows:

```
pi@raspberrypi:~ $ echo -ne Hello > /dev/ttyS0
```

and we will receive through the port by executing:

```
pi@raspberrypi:~ $ cat /dev/ttyS0
```

*The /dev/ttyS0 port is a common port for these serial communications, only one of these can be used, to be chosen at the time of purchase.

10 Other interesting available software

There are other programs available to run on Debian, below we leave some screenshots where you can see examples and how to use these software programs, also on our blog there is interesting information about our touch panels:

Node-Red:

<https://www.industrialshields.com/blog/arduino-industrial-1/software-for-iot-solutions-40>

11 Device opening

There are specific circumstances that may require opening the device:

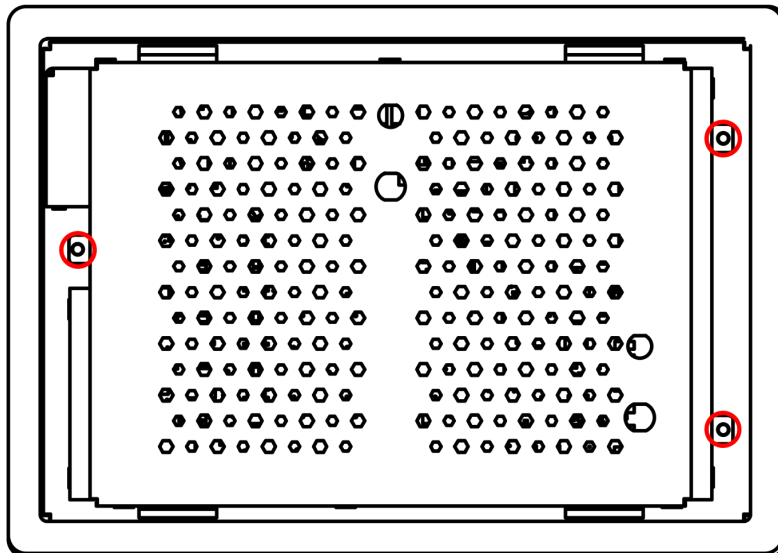
1. Changing SD Card: The SD card, which stores essential data and system configurations, may need to be replaced in case of corruption, upgrading to a higher capacity card, or transferring data between devices.
2. Adjusting Jumper Configurations: Some configurations of the device may require adjustments to jumpers for proper operation. Opening the device provides access to these jumpers, allowing for configuration changes as needed.

Warning! As explained in the warranty section at the start of this document, opening the device for a reason not included in this list will result in the warranty being void. If you have any doubts, contact our technical support team at [industrialshields.com](https://www.industrialshields.com).

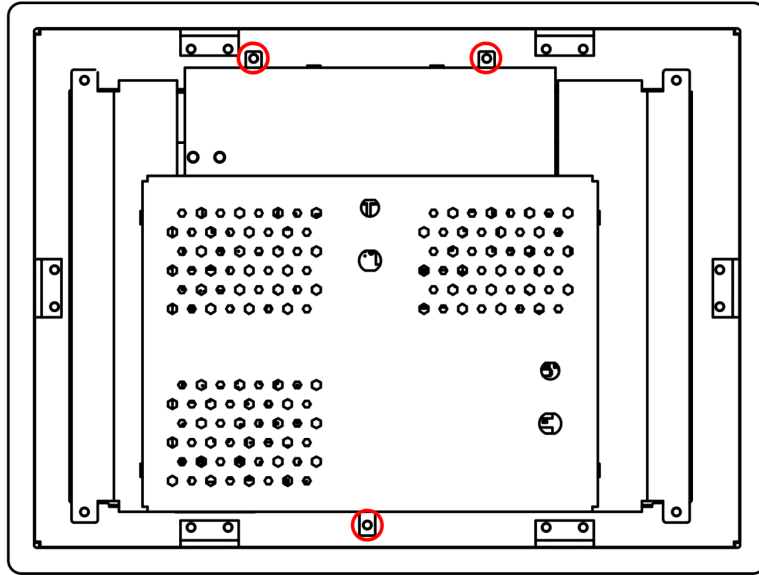
For example, opening the device to replace the Raspberry Pi will result in the warranty being void. Nonetheless, this section explains the steps about how to do so up to removing the Raspberry.

In order to open the device, follow these steps. Attention! Make sure the device is totally off and disconnected from power or other devices before proceeding.

1. Unscrew and remove the external screws, shown in the following diagrams:
 - o 7" Panel:



- 10.1" Panel:

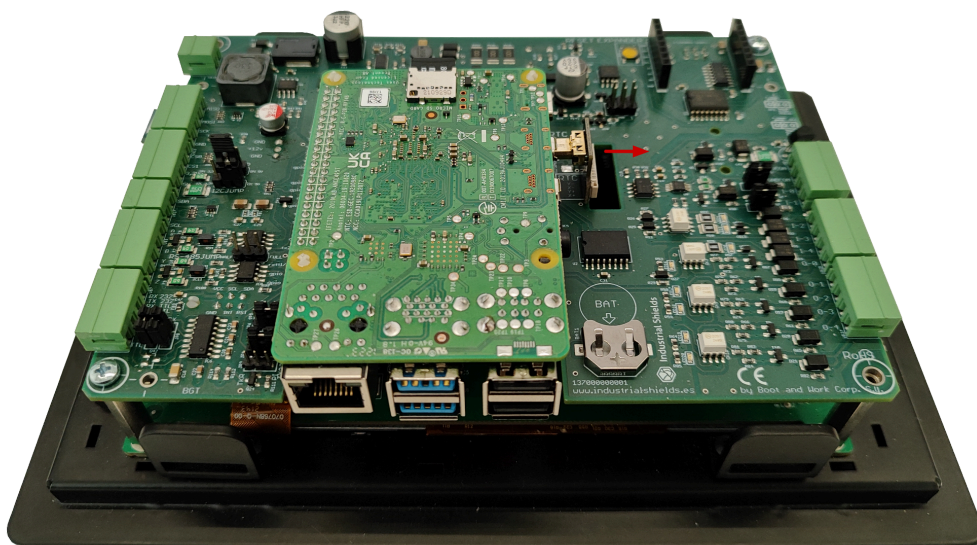


2. Carefully remove the metal cover by pulling it upwards.

At this point you will have access to the SD card or jumpers. Perform the necessary configurations/SD change and follow the steps up to this point in reverse order to close the device.

If you want to replace the Raspberry, proceed with the next steps. Warning! Proceeding with the further steps will result in the warranty being void!

3. Remove the HDMI connected to the Raspberry by gently pulling the microHDMI wire:



4. Finally, remove the Raspberry Pi by pulling it upwards. Keep in mind that it is fixed to the main PCB by 4 plastic supports and be careful not to bend any pin of the Raspberry Pi GPIO header.

In order to assemble the device once again, follow the steps in the inverse order.

12 Revision Table

Revision Number	Date	Changes
0	15/09/2019	First implementation
1	17/12/2019	Touchberry PI: The internal Raspberry PI 3B+ has been changed for the Raspberry PI 4B model
2	21/04/2022	TinkerBoard S model update
3	09/09/2022	Change on Section 9.2
4	07/09/2023	Family Implementation
5	31/01/2024	Touchberry model update
6	12/03/2024	Added Touchberry disassembly procedure and conditions

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