Smart terminal installation guide

Version: 20200110

Revision: 1

Table of Contents

1   Introduction

This document describes how to prepare monitoring setup and install Distence's smart terminals so that they are functional to be used from cloud service.

This document applies only to the following base products:

- T100

- T210

If these products are used against the instructions or specified environmental circumstances, Distence does not guarantee that the products will function properly.

Distence will deliver customizations for these base products which are called derivatives. Derivatives of these products usually require additional or separate documentation. In that case, consider that the documentation given especially for that derivative will override the information in this general document.

All products are rated for the following harsh environmental circumstances:

- Operating temperature: -40 … +70 °C

- Protection class against dust and water: IP67

Keep environmental requirements in mind in all phases. Especially when selecting equipment to be connected with Distence's smart terminal that they are also rated for the required environment so the complete setup is safe and provides the functionality required as a whole.

All smart terminals require Class II power supply unit. Recommendation: Select a power supply unit which output power is close to required maximum power to the equipment attached to smart terminal.
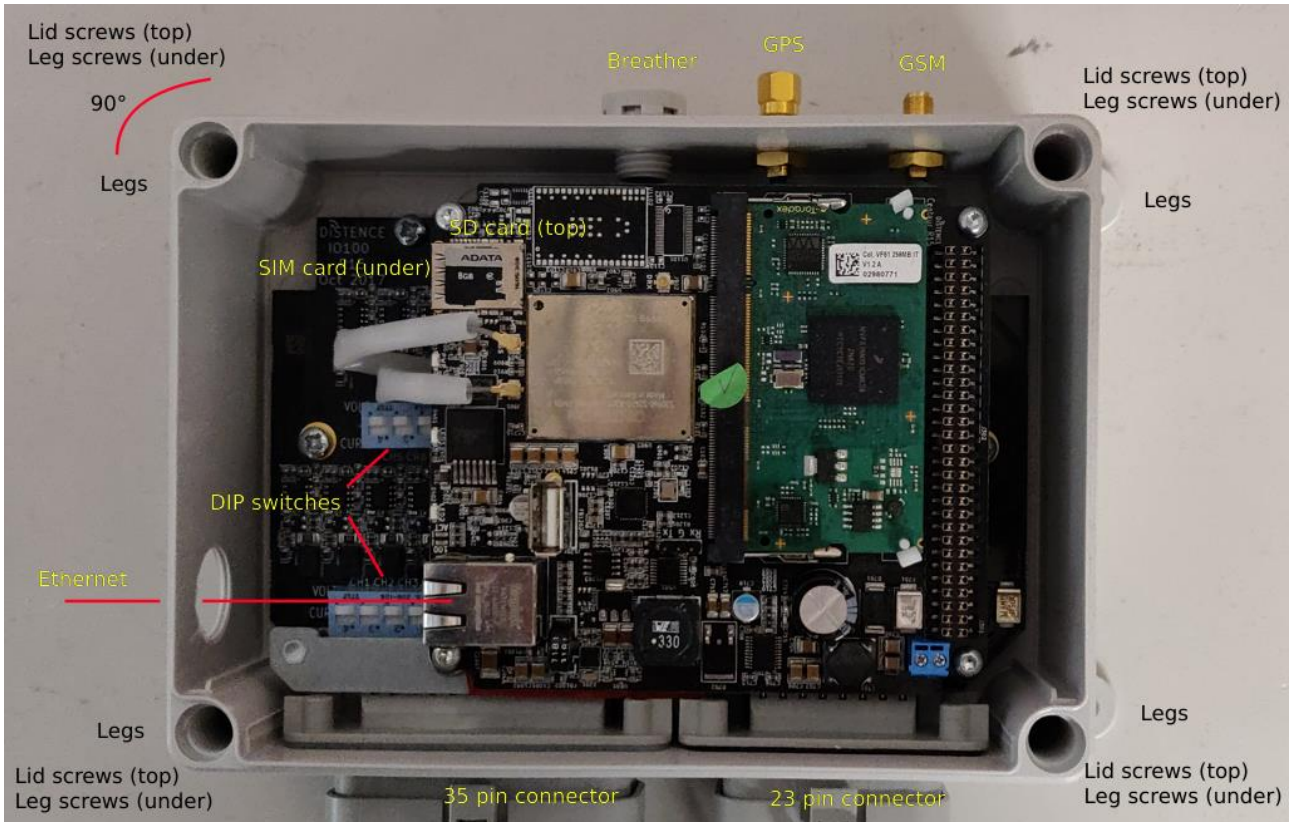
2 Overview of smart terminal

Figure 1: Overview of smart terminal

3   Before you start

Connections and functionalities must be tested in a controlled environment, e.g., at the factory or office, before installing the terminal to the production location.

Before you start, ensure that you have all the elements available required for successful smart terminal installation. These elements are:

Smart terminal

- 3G stub antenna included

- Ethernet cable gland included (and plug for filling cable gland hole)

- T2xx series smart terminals have connector accessories included:

    o   35 pin connector

    o   23 pin connector

    o   Crimps for all wires (at least 58 pcs)

    o   Wire relief shells for 35 pin connector

    o   Wire relief shells for 23 pin connector

    o   4 x Screws for closing wire relief shells

Sensors

- Needed sensors can be purchased from Distence or directly from the suitable sensor distributor

- NOTE! When selecting sensor type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements

Cables to connect sensors or digital buses

- T2xx series smart terminals are not delivered with cables by default. Suitable cables can be purchased from Distence or you can manufacture them by yourself, but you need accessories mentioned in the chapter "Wire assembly accessories", e.g., suitable crimp tool not included in the smart terminal delivery

- NOTE! When selecting cable type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements

SIM card to communicate with cloud services via Internet (if Internet connection via mobile network preferred)

- Order SIM card from suitable Internet provider having 3G data subscriptions.

- PIN code request must be disabled. It might be possible to order SIM card with PIN code request disabled or disabling of PIN code request can be done manually using mobile phone. In latter case, please consult the mobile phone manual how to disable PIN code request.

- Unlimited data plan is recommended but if such a data plan is not available, monthly data traffic is usually between 100 MB and 1 GB depending on the application and amount of metrics collected

- No special M2M or public IP plans required. Normal NAT type of plan is OK.

- NOTE! Check temperature rating with operator that it fulfills your environment requirements

3G antenna (if Internet connection via mobile network preferred)

- Standard delivery includes stub antenna

- If smart terminal is going to be installed to the location where signal quality is bad, e.g., inside metal cabinet, you need to purchase antenna with longer cord so that antenna can be installed to the location where signal quality is good, e.g., outside metal cabinet. Different antennas can be purchased from Distence or directly from the suitable antenna distributor

- NOTE! When selecting antenna type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements

Ethernet cable (if Internet connection via LAN preferred)

- Standard delivery does not include Ethernet cable, so you need to purchase it from Distence or directly from suitable distributor

- NOTE! When selecting cable type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements

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SD card (if needed)

- Currently there is no functionality in the software which requires SD card

- If needed in the future, SD card can be purchased from Distence or directly from suitable distributor

- NOTE! When selecting SD card type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements

Mounting accessories

- Standard delivery does not include any accessories for mounting the smart terminal

- Smart terminal includes mounting legs with holes, so you need suitable screws, screwdriver and possibly drill to drill holes for mounting smart terminal

Power supply

- Standard delivery does not include power supply, but it can be purchased from Distence or directly from suitable distributor

- NOTE! When selecting power supply unit type, make sure that the rating (electrical, temperature, IP class) and physical size fulfills your environment requirements. Align power supply unit selection with sensor selections because power supply unit voltage is given out from connectors for sensor usage also. Check pinout chapters for more information.

- NOTE! Distence's smart terminals require Class II type of power supply unit having minimum of 2A of output current capacity with voltage range 12 … 48 VDC. Recommendation: Select a power supply unit which output power is close to required maximum power to the equipment attached to smart terminal.

4   Overview of the installation procedure

1. Instructions for mounting the smart terminal, see chapter "Mounting the smart terminal"

2. If mobile network (3G) communication to Internet is required, see chapter "Attaching the SIM card" and "Attaching the GSM antenna"

3. If global positioning system is required, see chapter "Attaching the GPS antenna"

4. If Ethernet (LAN) communication to Internet is required, see chapter "Attaching the Ethernet cable"

5. If SD card is required, see chapter "Attaching the SD card"

6. Attach required sensors according to pinout, see chapter "Pinouts of smart terminals"

    a. For T2xx smart terminals, you must select measurement mode for generic analog inputs. See chapter "T2xx measurement modes".

7. Attach power supply according to pinout

8. Power up the smart terminal by activating power supply (from switch or plugging it to mains power)

9. Smart terminal connects to cloud service where from it can be operated from now on

NOTE! Obey always correct connector markings and installation instructions about wiring, cabling and installation order described in this document to guarantee safe installation for the smart terminal and person making the installation.

NOTE! Ensure that there is no voltage applied to any wires or cables when making connections to avoid any electrical shocks during the installation phase.

NOTE! Check all the connections carefully before activating power supply.

5 Mounting the smart terminal

1. Select suitable mounting location for smart terminal.

    a. Reserve some space around the smart terminal so that it is easy to

        i. screw and unscrew the mounting legs

        ii. attach and detach antenna

        iii. attach and detach cabling

        iv. open and close lid (by screwing and unscrewing lid screws)

        v. read type plate information, especially smart terminal serial number because it is needed for attaching smart terminal to the cloud services later

    b. Make sure that mounting location is within specified operating temperature range mentioned in the datasheet

    c. Make sure that mounting location is within specified IP class mentioned in the datasheet

2. Mounting legs can be adjusted within 90 degrees (from horizontal to vertical position) by loosening screws under lid screws

3. Drill holes to material behind the smart terminal mounting location if needed

4. Use suitable screws and screw driver to screw smart terminal in place and make sure that smart terminal is firmly tightened and does not rattle when shaken

6   Attaching the SIM card

1. Unscrew the lid screws

2. Take the lid off

3. Locate the SIM card holder. It's on the top board and it's double holder shared with SD card. The SIM card slot is under SD card slot. See Figure 1 for locating SIM card holder.

4. Slide the SIM card into the bottom slot of the double card holder and make sure it is firmly pushed completely in

5. Put lid back in place

6. Screw the lid screws back

7   Attaching the GSM antenna

1. Locate the antenna connector marked with text "GSM" outside the smart terminal enclosure. See Figure 1 for locating the antenna connector.

2. Screw antenna to the antenna connector until it is bottomed. NOTE! Do not use unnecessary force because you might twist and damage antenna cable inside the enclosure and after that mobile connection does not work properly with damaged antenna cable.

3. Heat shrink can be used to ensure that antenna connector does not become unscrewed in vibration conditions. In addition to that, heat shrink will protect antenna connector from dust and water.

8 Attaching the GPS antenna

4. Locate the antenna connector marked with text "GPS" outside the smart terminal enclosure. See Figure 1 for locating the antenna connector.

5. Screw antenna to the antenna connector until it is bottomed. NOTE! Do not use unnecessary force because you might twist and damage antenna cable inside the enclosure and after that mobile connection does not work properly with damaged antenna cable.

6. Heat shrink can be used to ensure that antenna connector does not become unscrewed in vibration conditions. In addition to that, heat shrink will protect antenna connector from dust and water.

9 Attaching the Ethernet cable

1. Remove plug from cable gland hole located on the side of smart terminal enclosure (don't mix this with the breather on top of the product). See Figure 1 for locating Ethernet.

2. Put the Ethernet cable through the cable gland (cable gland delivered within the package)

3. Screw cable gland tightly to the hole which was opened in item 1.

4. Connect the Ethernet cable to the RJ45 connector found from top board

5. Adjust Ethernet cable so that there is no unnecessary tension in the RJ45 connector

6. Tighten cable gland around the Ethernet cable to ensure that dust and water can't get through the cable gland

10   Attaching the SD card

1. Unscrew the lid screws

2. Take the lid off

3. Locate the SD card holder. It's on the top board and it's double holder shared with SIM card. The SD card slot is under the SIM card slot. See Figure 1 for locating SD card holder.

4. Slide the SD card into the bottom slot of the double card holder and make sure it is firmly pushed completely in

5. Put lid back in place

6. Screw the lid screws back

11 T2xx measurement modes

Channels:
CH5 = V4/C4
CH6 = V5/C5
CH7 = V6/C6
CH8 = V7/C7

Channels:
CH1 = V0/C0
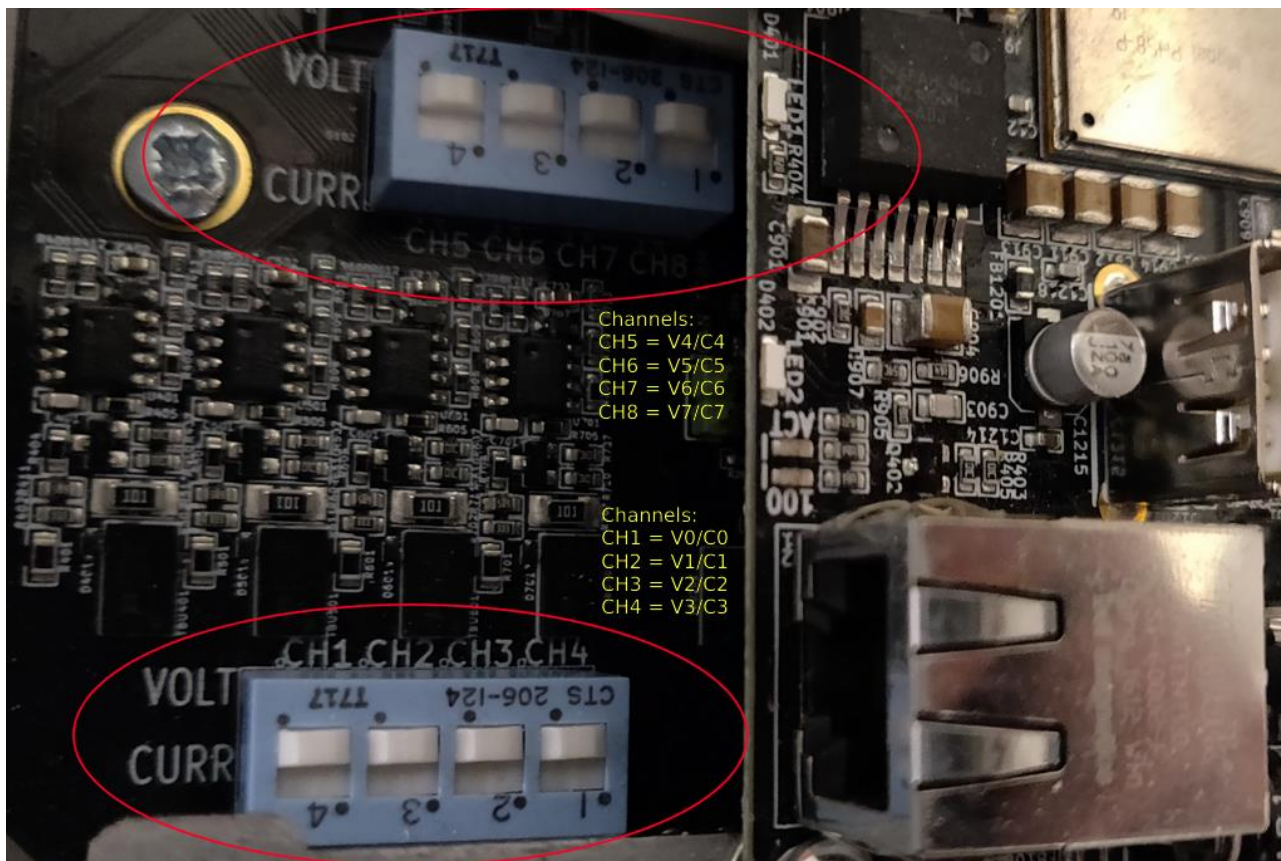CH2 = V1/C1
CH3 = V2/C2
CH4 = V3/C3

Figure 2: DIP switches to select measurement mode for individual generic sensor channels

In T2xx series smart terminals, each generic sensor channel has possibility to select between two measurement modes:

- VOLTAGE
- CURRENT

Mode is selected by sliding white switch either to VOLT (up in the picture) or CURR (down in the picture) side using small screw driver or by hand.

Channel identifiers are found from the silk print on the printed circuit board. NOTE! Channel identifiers on the smart terminal starts from 1 but equivalent channel identifiers on the pinout chart and on the software starts from 0. There is also number on the blue casing of DIP switch but ignore these numbers completely. In general, be careful that you select mode for correct channel. Here is a table to clarify the correct channel mapping between the hardware and pinout/software:

Smart terminal hardware	Pinout / Software V<x> = voltage mode for channel <x> C<x> = current mode for channel <x>
CH1	V0 / C0
CH2	V1 / C1
CH3	V2 / C2
CH4	V3 / C3
CH5	V4 / C4
CH6	V5 / C5
CH7	V6 / C6
CH8	V7 / C7

When channel is set to VOLTAGE mode, the measurement range is either:
- 0 … 10 V or
- 0 … 60 V

VOLTAGE measurement range is selectable by configuration parameters from the cloud service. Lower range is suitable for large number of sensors having standard output between voltage levels 0 … 10 V. Higher range is suitable for on/off type of activity monitoring.

When channel is set to CURRENT mode, the measurement range is:
- 0 … 25 mA

CURRENT mode is suitable for large number of sensors having standard output between current levels 4 … 20 mA and possibility to detect sensor failures when current level drops below 4 mA.

12   Pinout for T100 smart terminal

T100 smart terminals are delivered always with customer specific cabling so this document does not give specific instructions for connecting sensors or bus equipment. However, different possibilities are presented without giving wire colours.

12.1   Connecting voltage and current signal sensors

Connecting generic voltage signal sensor, e.g., having output signal 0 … 10 V:

1. Select any free channel from "ch0" … "ch2"

2. Connect sensor signal wire to selected channel input pin labeled "ch0" … "ch2"

3. Connect sensor ground wire to any of the pins labeled "GND"

4. Connect sensor power wire to suitable power supply for that sensor

Connecting generic current signal sensor, e.g., having output signal 4 … 20 mA:

1. Connect sensor signal wire to selected channel input pin labeled "ch3"

2. Connect sensor ground wire to any of the pins labeled "GND"

3. Connect sensor power wire to suitable power supply for that sensor

Characteristics of voltage and current channels:

- Voltage input resistance: more than 120 kΩ (depending on the selected measurement range)

- Current input resistance: 100 Ω

- Over voltage and reverse polarity protection

- Non-isolated inputs - negative pin of all inputs are connected to system ground

- Sensor output voltage ("Vsensor") is the same as non filtered input voltage in 23 pin connector pin labeled "PWR". It's connected through 0.75A 60V resettable PTC fuse. All "Vsensor" pins share one fuse. False polarity connection is shielded with diode.

12.2 Connecting RS485 bus devices

Connecting RS485 bus device:

1. Connect device according to RS485 bus specification to pins labeled

    a. "RS485 B/D+"

    b. "RS485 A/D-"

    c. "GND" if needed

12.3 Connecting RS232 bus devices

Connecting RS232 bus device:

1. Connect device according to RS232 bus specification to pins labeled

    a. "RS232 RX"

    b. "RS232 TX"

    c. "GND" if needed

12.4   Connecting relay

Connecting relay:

1. Choose which way circuit is wanted to control:

    a. NC: normally closed

        i. Connect circuit to pins labeled

            1. "NC"

            2. "COM"

    b. NO: normally open

        i. Connect circuit to pins labeled

            1. "NO"

            2. "COM"

Relay characteristics:

- Single SPDT type relay output

- Latching type relay - relay state will stay when device is unpowered

- Relay contacts are isolated from system ground

- Maximum switching voltage: 42 VAC / 60 VDC (SELV limits)

- Maximum switching current: 2 A

- Maximum switching power: 62.5 VA or 30W

- Minimum switching load: 0.01 mA / 10 mVDC

12.5   Connecting power supply unit

Connecting power supply unit:

1. Ensure you have Class II rated power supply unit because it is required to be used with the product. Recommendation: Select a power supply unit which output power is close to required maximum power to the equipment attached to smart terminal.

2. Connect power supply unit positive wire to pin labeled as:

    a. power

3. Connect power supply unit negative wire to:

    a. ground

Characteristics of supply voltage:

- 10-50 VDC possible 24V recommended

- Overvoltage withstand: 60 VDC (continuous)

- Reverse polarity protected

- Non-isolated power input - negative pin is connected to system ground

13 Pinout for T210 smart terminal

13.1 35 pin connector
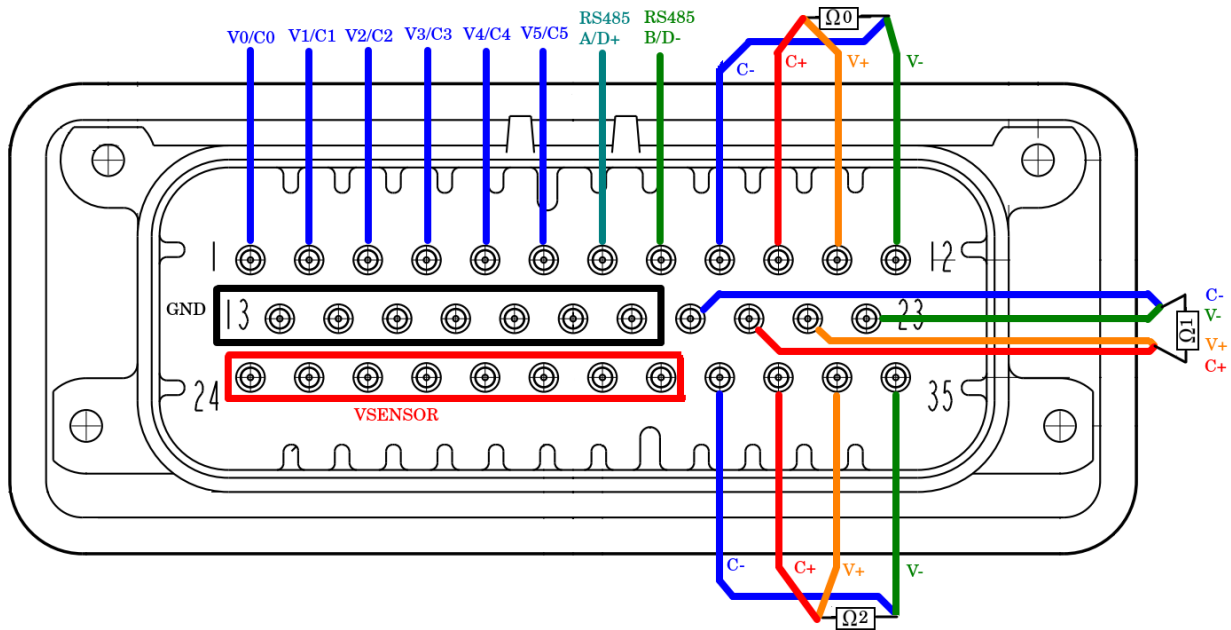
13.1.1   Connecting voltage and current signal sensors

Connecting generic voltage signal sensor, e.g., having output signal 0 … 10 V:

1. Select any free channel from "V0" … "V5"

2. Select VOLTAGE mode for selected channel according to chapter "T2xx measurement modes" instructions

3. Connect sensor signal wire to selected channel input pin labeled "V0" … "V5" (pins 1 … 6)

4. Connect sensor ground wire to any of the pins labeled "GND" (pins 13 … 19)

5. Connect sensor power wire to any of the pins labeled "VSENSOR" (pins 24 … 31)

Connecting generic current signal sensor, e.g., having output signal 4 … 20 mA:

1. Select any free channel from "C0" … "C5"

2. Select CURRENT mode for selected channel according to chapter "T2xx measurement modes" instructions

3. Connect sensor signal wire to selected channel input pin labeled "C0" … "C5" (pins 1 … 6)

4. Connect sensor ground wire to any of the pins labeled "GND" (pins 13 … 19)

5. Connect sensor power wire to any of the pins labeled "VSENSOR" (pins 24 … 31)

Characteristics of voltage and current channels:

- Voltage input resistance: more than 120 kΩ (depending on the selected measurement range)

- Current input resistance: 100 Ω

- Over voltage and reverse polarity protection

- Non-isolated inputs - negative pin of all inputs are connected to system ground

- Sensor output voltage ("Vsensor") is the same as non filtered input voltage in 23 pin connector pin labeled "PWR". It's connected through 0.75A 60V resettable PTC fuse. All "Vsensor" pins share one fuse. False polarity connection is shielded with diode.

### 13.1.2   **Connecting Pt-100 and Pt-1000 type of temperature sensors**

Connecting Pt-100 and Pt-1000 type of temperature sensor:

1. Select free temperature channel from "Ω0" … "Ω2"
2. Connect temperature sensor wires to pins labeled
    a. "Ω0 V+" … "Ω2 V+" (pins 11, 22, 34)
    b. "Ω0 C+" … "Ω2 C+" (pins 10, 21, 33)
    c. "Ω0 C-" … "Ω2 C-" (pins 9, 20, 32)
    d. "Ω0 V-" … "Ω0 V-" (pins 12, 23, 35)

Characteristics of temperature channels:

- For Pt-100 type of sensors

- Bank isolated, functional isolation for extra low voltage circuit, 1kV RF isolation (Si8662AB-B-IS1) on SPI bus connected to ADC (ADS1248IPWR)

- Temperature range with Pt-100 -200 to +850 °C (18ohm to 390ohm) excitation 500 uA gain x1 tested

- Temperature range with Pt-1000 -200 to +850 °C (18ohm to 3.9kohm) excitation 500 uA gain x1 tested

- Accuracy in the range of 1 Celsius (tested over operating temperature)

13.2   23 pin connector
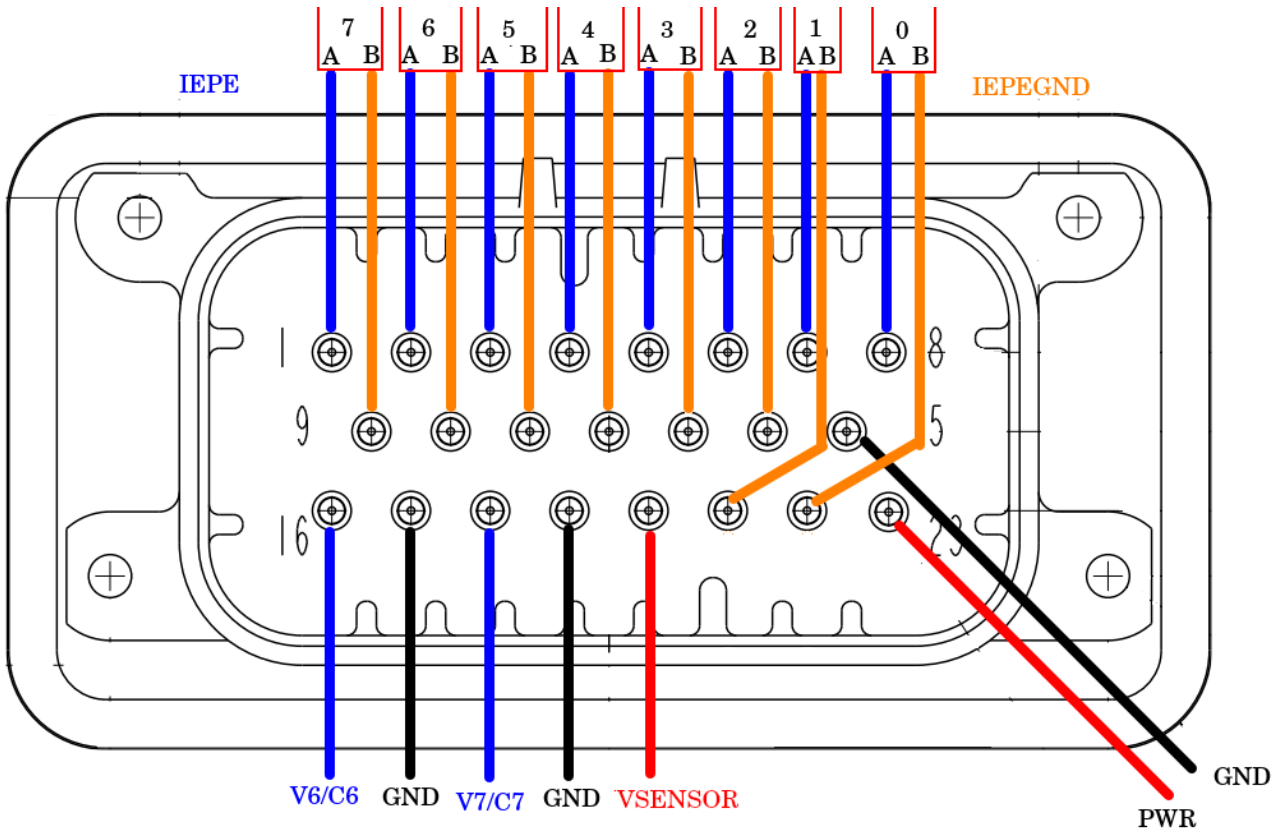
13.2.1 Connecting IEPE type of vibration sensors

Connecting IEPE type of vibration sensor:
1. Select free channel from "IEPE0" … "IEPE7"
2. Connect according to IEPE standard to pins labeled
    a. "IEPE0 B" … "IEPE7 B" (pins 22, 21, 14, 13, 12, 11, 10, 9)
    b. "IEPE0 A" … "IEPE7 A" (pins 8, 7, 6, 5, 4, 3, 2, 1)

Characteristics of IEPE vibration channels:

- Frequency range

    o Full signal amplitude available between 10Hz - 23kHz (hardware high pass and low pass filters active)

- Maximum input voltage range +- 10V

- Over voltage protection

- Constant current max 24V@4mA for transducers

13.2.2 Connecting voltage and current signal sensors

Connecting generic voltage signal sensor, e.g., having output signal 0 … 10 V:

1. Select any free channel from "V6" … "V7"
2. Select VOLTAGE mode for selected channel according to chapter "T2xx measurement modes" instructions
3. Connect sensor signal wire to selected channel input pin labeled "V6" … "V7" (pins 16, 18)
4. Connect sensor ground wire to any of the pins labeled "GND" (pins 17, 19) or you can use equivalent pins from 35 pin connector
5. Connect sensor power wire to any of the pins labeled "VSENSOR" (pin 20) or you can use equivalent pins from 35 pin connector

Connecting generic current signal sensor, e.g., having output signal 4 … 20 mA:

1. Select any free channel from "C6" … "C7"
2. Select CURRENT mode for selected channel according to chapter "T2xx measurement modes" instructions
3. Connect sensor signal wire to selected channel input pin labeled "C6" … "C7" (pins 16, 18)
4. Connect sensor ground wire to any of the pins labeled "GND" (pins 17, 19) or you can use equivalent pins from 35 pin connector
5. Connect sensor power wire to any of the pins labeled "VSENSOR" (pin 20) or you can use equivalent pins from 35 pin connector

Characteristics of voltage and current channels:

- Voltage input resistance: more than 120 kΩ (depending on the selected measurement range)

- Current input resistance: 100 Ω

- Over voltage and reverse polarity protection

- Non-isolated inputs - negative pin of all inputs are connected to system ground

- Sensor output voltage ("Vsensor") is the same as non filtered input voltage in 23 pin connector pin labeled "PWR". It's connected through 0.75A 60V resettable PTC fuse. All "Vsensor" pins share one fuse. False polarity connection is shielded with diode.

13.2.3   Connecting power supply unit

Connecting power supply unit:

1. Ensure you have Class II rated power supply unit because it is required to be used with the product. Recommendation: Select a power supply unit which output power is close to required maximum power to the equipment attached to smart terminal.

2. Connect power supply unit positive wire to pin labeled:

   a. "PWR" (pin 23)

3. Connect power supply unit negative wire to pin labeled:

   a. "GND" (pin 15)

Characteristics of supply voltage:

- 10-50 VDC possible 24V recommended

- Overvoltage withstand: 60 VDC (continuous)

- Reverse polarity protected

- Non-isolated power input - negative pin is connected to system ground

14   Notes

Required power supply unit:

- Distence's smart terminals require Class II type of power supply unit having minimum of 2A of output current capacity with voltage range 12 … 48 VDC.

- Recommendation: Select a power supply unit which output power is close to required maximum power to the equipment attached to smart terminal.

Cable material:

- Use only cables with rating fulfilling environment requirements, e.g., -40 … +70 °C temperatures

15   Explanations of symbols

⚠	If the smart terminal is installed in the environment where ambient temperature exceeds 60 °C, you must select cables with ratings fulfilling environment requirements.

16   Wire assembly accessories

16.1   T2xx accessories

General wire requirements:

- Usable wires with AMPSEAL connectors 20-16 AWG

- Use gold plated crimps from AMPSEAL series

Crimping hand tool:

- http://www.te.com/usa-en/product-58529-1.html#pdp-docs-features

35 pin connector accessories:

- 35 pin smart terminal side connector

    o http://www.te.com/usa-en/product-1-776163-4.html

- 35 pin mating connector which houses crimps

    o http://www.te.com/usa-en/product-776164-4.html

- Wire relief (order two for one connector, two screws needed to fasten)

    o http://www.te.com/usa-en/product-776463-1.html

- Crimps

    o http://www.te.com/usa-en/product-770854-3.html crimps

23 pin connector accessories:

- 23 pin smart terminal side connector

  - http://www.te.com/usa-en/product-1-776087-4.html

- 23 pin mating connector which houses crimps

  - http://www.te.com/usa-en/product-770680-4.html

- Wire relief (order two for one connector, two screws needed to fasten)

  - http://www.te.com/usa-en/product-776464-1.html

- Crimps

  - http://www.te.com/usa-en/product-770854-3.html