

## T15BR

### Installation Manual English

MAEN165, 2014-04

Everything for your HMI running



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## Installation manual for T15BR

# Foreword

All operator panels are developed to satisfy the demands of human-machine communication. Built-in functions such as displaying and controlling text, dynamic indication, time channels, alarm and recipe handling are included.

The operator panel works primarily in an object-oriented way, making it easy to understand and use. Configuration is carried out on a PC using the iX Developer. The project can then be transferred and stored in the operator panel itself.

Various types of automation equipment such as PLCs, servos or drives can be connected to the operator panels. In this manual, the term “the controller” refers to the connected equipment.

This manual explains how to install the operator panel. Please refer to the iX Developer reference manual for further information.

Order no: MAEN165

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# 1 Safety Precautions

Both the installer and the owner and/or operator of the operator panel must read and understand this installation manual.

## 1.1 General

- Read the safety precautions carefully.
- Check the delivery for transportation damage. If damage is found, notify the supplier as soon as possible.
- The supplier is not responsible for modified, altered or reconstructed equipment.
- Use only parts and accessories manufactured according to specifications of the supplier.
- Read the installation and operating instructions carefully before installing, using or repairing the operator panel.
- Never allow fluids, metal filings or wiring debris to enter any openings in the operator panel. This may cause fire or electrical shock.
- Only qualified personnel may operate the operator panel.
- Storing the operator panel where the temperature is lower/higher than recommended in this manual can cause the LCD display liquid to congeal/become isotopic.
- The LCD display liquid contains a powerful irritant. In case of skin contact, wash immediately with plenty of water. In case of eye contact, hold the eye open, flush with plenty of water and get medical attention.
- The figures in this manual serves an illustrative purpose. Because of the many variables associated with any particular installation, the supplier cannot assume responsibility for actual use based on the figures.
- The supplier neither guarantees that the operator panel is suitable for your particular application, nor assumes responsibility for your product design, installation or operation.
- It is recommended to turn on and shut down the operator panel at least once before installing any components/cards or before connecting the operator panel to external devices, like for example serial devices.
- This operator panel is certified to operate in a Class I, Division 2, Group A, B, C and D hazardous environment. The operator panel must be installed and operated as described in this document to meet this certification.
- Observe precautions for handling electrostatic discharge sensitive devices.



## 1.2 UL and cUL Installation

- All devices have to be supplied by a Class 2 power supply.

**Warning:**

Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous

AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT  
OUS'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

**Warning:**

Battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire.

This product contains a BR2330A battery that is not user replaceable.

LA BATTERIE PEUT EXPLOSER EN CAS DE MAUVAISE MANIPULATION.

NE LA RECHARGEZ PAS, NE LA DÉMONTÉZ PAS ET NE LA JETÉZ

PAS DANS LE FEU.

CE PRODUIT CONTIENT UNE PILE BR2330A QUI NE PEUT PAS ÊTRE

REPLACÉE PAR L'UTILISATEUR.

- Use minimum 75°C copper conductors only.
- To make wiring connections to the power supply connector, follow the table with cable and torque specifications below:

| Terminal Block Connector         | Wire Size                                 | TQ Lb. In. |
|----------------------------------|---|------------|
| Phoenix Contact Part No. 1757022 | 14-20 AWG<br>(2.08-0.52 mm <sup>2</sup> ) | 5-7        |

**Warning:**

Do not open when an explosive atmosphere is present.

N'OUVREZ PAS SI UNE ATMOSPHÈRE EXPLOSIVE EST PRÉSENTE.

**Warning:**

Explosion hazard! Do not disconnect while circuit is live unless the area is known to be non hazardous.

RISQUE D'EXPLOSION ! NE DÉBRANCHEZ PAS LORSQUE LE CIRCUIT EST  
SOUS TENSION SAUF SI LA ZONE EST CONNUE POUR ÊTRE NON DANGEREUSE.

**Caution:**

This equipment is tested as a component and is to be installed inside an enclosure rated minimum IP66.

CET ÉQUIPEMENT EST TESTÉ EN TANT QUE COMPOSANT ET DOIT ÊTRE INSTALLÉ  
DANS UN BOÎTIER AVEC INDICE DE PROTECTION IP66 MINIMUM.

**Caution:**

Temperature code T4 IEC / EN 60079-0 (2012) and IEC / EN 60079-15 (2010).

CODES DE TEMPÉRATURE T4 IEC / EN 60079-0 (2012) ET IEC / EN 60079-15 (2010).

## 1.3 High Potential Testing

Each terminal is high-pot (high potential) tested prior to shipment. After high-pot testing surge arresting devices are installed into the terminal that will enhance surge robustness. After placement, these devices will cause the terminal to fail high-pot testing.

---

**Note:**

If in-field high-pot testing is required contact Beijer Electronics.

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## 1.4 During Installation

- The operator panel is designed for stationary installation on a plane surface, where the following conditions are fulfilled:
  - no high explosive risks
  - no strong magnetic fields
  - no direct sunlight
  - no large, sudden temperature changes
- Install the operator panel according to the accompanying installation instructions.
- Ground the operator panel according to the accompanying installation instructions.
- Only qualified personnel may install the operator panel.
- Separate the high voltage, signal and supply cables.
- Make sure that the voltage and polarity of the power source is correct before connecting the operator panel to the power outlet.
- Peripheral equipment must be appropriate for the application and location.

## 1.5 During Use

- Keep the operator panel clean.
- Emergency stop and other safety functions may not be controlled from the operator panel.
- Do not use excessive force or sharp objects when operating the touchscreen.

## 1.6 Service and Maintenance

- Only qualified personnel should carry out repairs.
- The agreed warranty applies.
- Before carrying out any cleaning or maintenance operations, disconnect the equipment from the electrical supply.
- Clean the display and surrounding front cover with a soft cloth and mild detergent.
- The battery must be replaced by an authorized Beijer Electronics service center.

## 1.7 Dismantling and Scrapping

- The operator panel or parts thereof shall be recycled according to local regulations.
- The following components contain substances that might be hazardous to health and the environment: lithium battery, electrolytic capacitor and display.

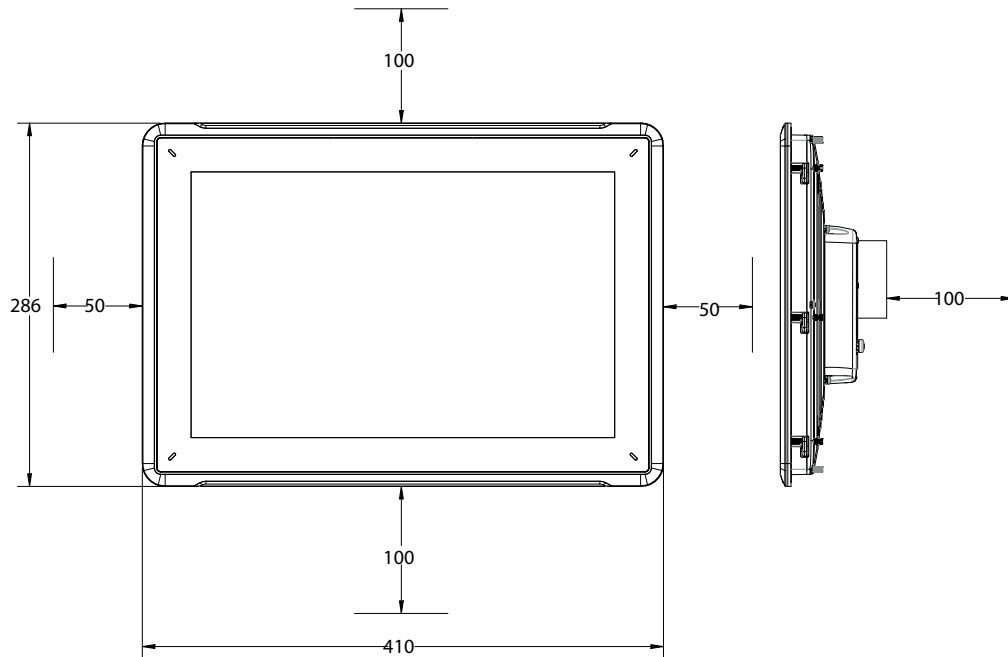
## 1.8 Appearance of Air in Touch Screen

The layer structure of the touch screen contains air and in rare cases appearance of bubbles can arise. This is purely cosmetic and does not affect any functionality of the operator panel. The appearance can occur under certain environmental conditions such as temperature, humidity, and atmospheric pressure.

## 2 Installation

### 2.1 Space Requirements

- Maximum installation plate thickness: 8 mm
- Space requirements in millimeters when installing the operator panel:



**Note:**  
The dimensions on the drawing are not proportional.



## 2.2 Installation Process

A Thumb Screw Installation Tool (provided) or a slotted screwdriver is required for installation.

1. Unpack and check the delivery. If damage is found, notify the supplier.

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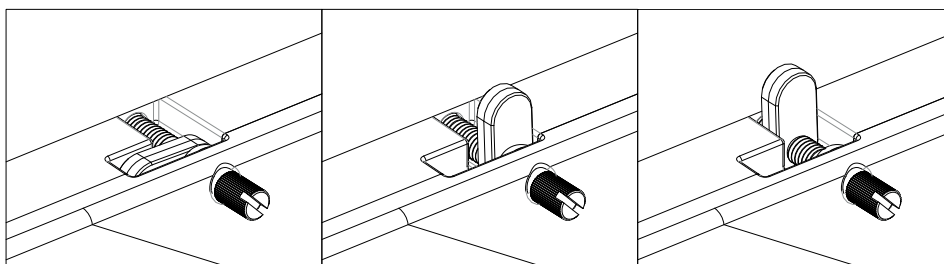
**Note:**

Place the operator panel on a stable surface during installation.

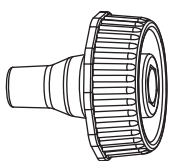
Dropping the operator panel or letting it fall may cause damage.

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2. To cut a correct opening for the operator panel, use the cut out dimensions in the outline drawing. A separate cut out drawing is available for download from the Beijer Electronics web site. For more information, see sections [Operator Panel Drawings](#) and [Technical Data](#).
3. Secure the operator panel in position by screwing the slotted thumb screw clockwise, allowing the built-in bracket to flip out and tighten against the cabinet. Tighten the screws (12) to  $0.7 \text{ Nm} \pm 0.2 \text{ Nm}$ .



4. For most applications, the provided Thumb Screw Installation Tool will provide adequate torque. In cases where the front panel seal (IP66, NEMA-4) is critical, a torque wrench should be used to ensure all twelve screws are torqued within the specification above.

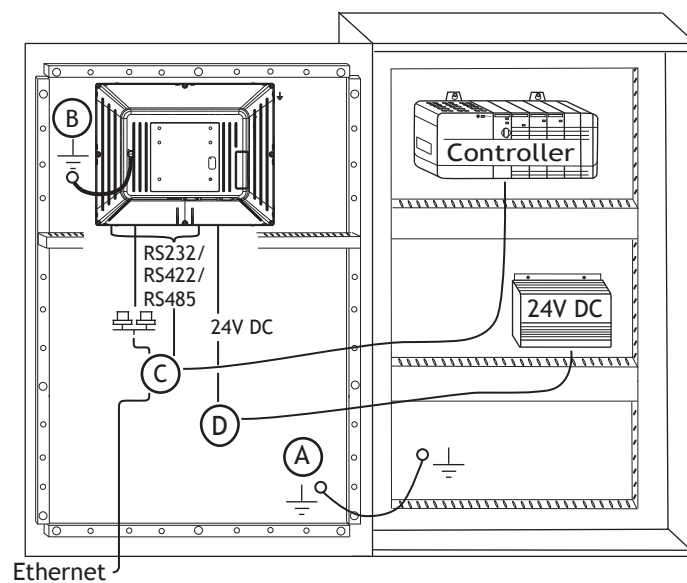


*Thumb Screw Installation Tool*

5. Connect the cables in the specified order, according to the drawing and steps below.

**Caution:**

- The operator panel must be brought to ambient temperature before it is started up. If condensation forms, ensure that the operator panel is dry before connecting it to the power outlet.
- Ensure that the operator panel and the controller system have the same electrical grounding (reference voltage level), otherwise errors in communication may occur.
- Ensure that the voltage and polarity of the power source is correct.
- Separate high voltage cables from signal and supply cables.
- Shielded communication cables are recommended.



- Use 14–20 AWG (2.08–0.52 mm<sup>2</sup>) wire for the power connections.
  - Connect cable A.
  - Connect cable B, using an M5 steel screw with zinc plating and a grounding conductor (as short as possible), that is sized correctly according to local electrical codes.
  - Connect cable C.
  - Connect cable D.
6. Carefully remove the laminated film over the operator panel display, to avoid static electricity that could damage the panel.

## 2.2.1 Connections to the Controller

For information about the cables to be used when connecting the operator panel to the controller, please refer to the help file for the driver in question.

## 2.2.2 Hazardous Location Installation

Connect the desired cables and attach them to strain relief plate with cable ties provided.



## 2.2.3 Other Connections and Peripherals

Cables, peripheral equipment and accessories must be suitable for the application and its environment. For further details or recommendations, please refer to the supplier.

### 3 Technical Data

| Parameter   | T15BR   |
|---|---|
| Front panel, W × H × D                                      | 410 × 286 × 83 mm   |
| Cut out dimensions, W × H                                   | 394 ± 1 mm × 270 ± 1 mm. Maximum corner radius: 4 mm. For IP66/NEMA-4, panel must maintain a flatness < 1 mm overall and < 0.05 mm/mm with a surface roughness, $R_a < 1.6 \mu\text{m}$ . |
| Mounting depth  | 76 mm (176 mm including clearance)  |
| Front panel seal  | IP 66, NEMA-4   |
| Rear panel seal   | IP 20   |
| Touch screen material                                       | Polyester on glass, resistive. Overlay: Autoflex EB <sup>(1)</sup> .  |
| Touch screen operations                                     | 5 million finger touch operations   |
| Reverse side material                                       | Powder-coated aluminum  |
| Frame material  | Powder-coated aluminum  |
| Weight  | 4.13 kg (+ 0.13 kg with CAN Module, + 0.15 kg with ATEX)  |
| Serial port for COM1 RS232 and COM2 RS422/RS485             | 9-pin D-sub contact with RS232 RTS/CTS, chassis-mounted female with standard locking screws 4-40 UNC  |
| Communication module  | CAN   |
| Ethernet  | 1 × 10/100/1000 Base-T (shielded RJ45)<br>1 × 10/100 Base-T (shielded RJ45)   |
| USB   | 3 × USB Host 2.0, max output current 500 mA   |
| Processor   | Intel® Atom   |
| External storage media                                      | 1 × SD card (optional)  |
| Flash memory (application memory)                           | 4 GB (iX version), 16 GB (PPC version)  |
| Memory RAM  | 1 GB (iX version), 2 GB (PPC version)   |
| LED   | 1 × multi-color   |
| Real time clock   | Yes (on chip)   |
| Battery   | BR 2330A  |
| Power consumption at rated voltage 12 V / 24 V respectively | Standby <sup>(2)</sup> : 11.2 W / 12.5 W<br>Typical <sup>(3)</sup> : 27.6 W / 28.8 W<br>Estimated maximum <sup>(4)</sup> : 31.2 W / 31.2 W  |
| Fuse  | 5.0 A Slow  |
| Power supply  | +12 V to +28 V DC (10 to 32 V DC)<br>CE: The power supply must conform with the requirements according to IEC 60950 and IEC 61558-2-4.  |
| Display   | TFT-LCD with LED backlight. 1280 × 800 pixels, 16.7 million colors  |

| Parameter                     | T15BR  |
|-------------------------------|--|
| Active area of display, W × H | 331.2 × 207.0 mm   |
| Operating temperature         | Minimum temperature:<br>-30 °C<br>Maximum temperature:<br>70 °C; UL 65 °C  |
| Storage temperature           | -40 °C to +85 °C   |
| Approvals and certifications  | Information is available on the web site<br><a href="http://www.beijerelectronics.com">www.beijerelectronics.com</a> |

(1) See section [Chemical Resistance](#) for more information.

(2) Standby mode: The backlight is turned off, there are no cabled interfaces and the CPU is below 5%. Optional CAN module is present.

(3) Typical mode: The backlight is fully powered, there are no cabled interfaces and an application is running. Optional CAN module is present.

(4) Estimated Maximum mode: All interfaces are cabled, all USB ports are plugged with mass-storage devices, the CPU is at 50% and audio is active. Optional CAN module is present and active.

## 4 Chemical Resistance

### 4.1 Metal Casing

The frame and casing material is powder-coated aluminum. This powder paint withstands exposure to the following chemicals without visible change:

|                      |                     |
|----------------------|---------------------|
| Acetic acid 10%      | Phosphoric acid 4%  |
| Citric acid 10%      | Phosphoric acid 10% |
| Diesel               | Sea water           |
| Distilled water      | Sodium chloride 2%  |
| Edible oil           | Sodium chloride 20% |
| Fuel oil             | Sulphuric acid 20%  |
| Hydrogen peroxide 3% | Tap water           |

The powder paint shows limited resistance to the following chemicals at room temperature:

|                      |                     |
|----------------------|---------------------|
| Butanol              | Nitric acid 3%      |
| Hydrochloric acid 5% | Nitric acid 10%     |
| Isopropyl alcohol    | Phosphoric acid 43% |
| Na-hypochlorite 10%  | Turpentine          |
| Sodium hypochlorite  |                     |

**Note:**

If exposure to any of the above chemicals is demanded, it is recommended to first test the chemical in a hidden spot of the metal casing.

The powder paint shows little or no resistance to the following chemicals at room temperature:

|                    |                      |                           |
|--------------------|----------------------|---------------------------|
| Acetic acid, conc. | Methyl-ethyl ketone  | Toluene                   |
| Acetone            | Nitric acid 30%      | Trichlorethylene          |
| Ammonia 5%         | Phenol               | Xylene                    |
| Ammonia, conc.     | Sodium hydroxide 5%  | 97 octane unleaded petrol |
| Ethyl acetate      | Sodium hydroxide 30% | 98 octane leaded petrol   |

## 4.2 Touch Screen and Overlay

### 4.2.1 Autoflex EB

Autoflex EB covers the overlay surrounding the screen.

#### Solvent Resistance

Autoflex EB withstands exposure of more than 24 hours duration under DIN 42 115 Part 2 to the following chemicals without visible change:

|   |  |                             |
|---|--|-----------------------------|
| Ajax / Vim in solution                  | Downy / Lenor <sup>(1)</sup>             | Phosphoric acid (<30%)      |
| Alkalicarbonate solution <sup>(1)</sup> | Ethanol                                  | Potassium ferricyanide      |
| Ammonia (<40%) <sup>(1)</sup>           | Glycerine                                | Potassium hydroxide (<30%)  |
| Acetic acid (<50%)                      | Glycol                                   | Pure Turpentine             |
| Ariel powder in solution <sup>(1)</sup> | Gumption <sup>(1)</sup>                  | SBP 60/95 <sup>(1)</sup>    |
| Bleach <sup>(1)</sup>                   | Hydrochloric acid (<36%)                 | Sulfuric acid (<10%)        |
| Castor oil                              | Linseed oil                              | Tomato ketchup              |
| Caustic soda (<40%) <sup>(1)</sup>      | Methanol                                 | Trichloroacetic acid (<50%) |
| Cutting oil                             | Nitric acid (<10%)                       | White Spirit                |
| Cyclohexanol                            | Paraffin oil                             | Windex <sup>(1)</sup>       |
| Diacetone alcohol                       | Persil powder in solution <sup>(1)</sup> | Wisk                        |
| Diesel                                  | Petroleum spirit <sup>(1)</sup>          | -                           |

<sup>(1)</sup> Extremely faint glossing of the texture was noted.

Autoflex EB withstands DIN 42 115 Part 2 exposure of up to 1 hour duration to glacial acetic acid without visible change.

Autoflex EB is not resistant to high pressure steam at over 100 °C or the following chemicals:

|                               |                    |
|-------------------------------|--------------------|
| Concentrated mineral acids    | Benzyl alcohol     |
| Concentrated caustic solution | Methylene chloride |
| Dimethyl formamide            | Tetrahydrofuran    |

## 4.2.2 Touch Screen Surface

The touch screen surface on the operator panel withstands exposure to the following solvents without visible change:

| Solvents    | Time       |
|-------------|------------|
| Acetone     | 10 minutes |
| Isopropanol | 10 minutes |
| Toluene     | 5 hours    |

## 4.2.3 Touchscreen Protective Film

### Autoflex EB

It is recommended to use the Autoflex EB touch display protection film, that can be ordered from Beijer Electronics.

### Outdoor Use

In common with all polyester based films, Autoflex EB is not suitable for use in conditions of long-term exposure to direct sunlight.

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#### Note:

The layer structure of the touch screen contains air and in rare cases appearance of bubbles can arise. This is purely cosmetic and does not affect any functionality of the panel. The appearance can occur under certain environmental conditions such as temperature, humidity, and atmospheric pressure.

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## 4.3 Terminal to Panel Gasket

The gasket is made of flame retardant silicone rubber. The sealing capability is unaffected by the following chemicals:

|                      |                      |
|----------------------|----------------------|
| Acetic acid 10%      | Nitric acid 1.5%     |
| Ammonia 10%          | Phosphoric acid 4%   |
| Citric acid 10%      | Sea water            |
| Distilled water      | Sodium chloride 2%   |
| Edible oil           | Sodium chloride 20%  |
| Hydrogen peroxide 3% | Sodium hydroxide 30% |
| Isopropyl alcohol    | Tap water            |

The flame retardant silicone rubber shows limited resistance to the following chemicals at room temperature:

|                             |                     |
|-----------------------------|---------------------|
| Acetic acid, conc.          | Na-hypochlorite 10% |
| Ammonia 30%                 | Nitric acid 10%     |
| Butanol                     | Phosphoric acid 10% |
| Ethyl acetate               | Phosphoric acid 20% |
| Hydrochloric acid 37%, cold | -                   |

**Note:**

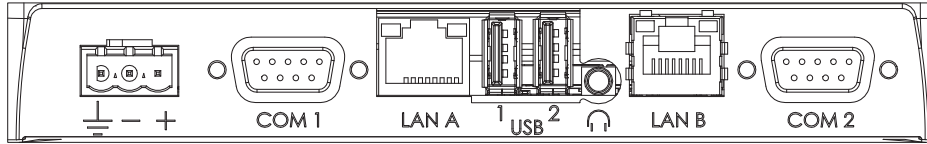
If exposure to any of the above chemicals is demanded, it is recommended to first test the chemical in a hidden spot of the gasket.

The flame retardant silicone rubber shows little or no resistance to the following chemicals at room temperature:

|                |                     |                  |
|----------------|---------------------|------------------|
| Acetone        | Methyl-ethyl ketone | Trichlorethylene |
| Ammonia, conc. | Nitric acid 30%     | Turpentine       |
| Diesel         | Phenol              | Unleaded petrol  |
| Fuel oil       | Sulphuric acid 20%  | Xylene           |
| Leaded petrol  | Toluene             | -                |

## 5 Operator Panel Drawings

### 5.1 Connectors

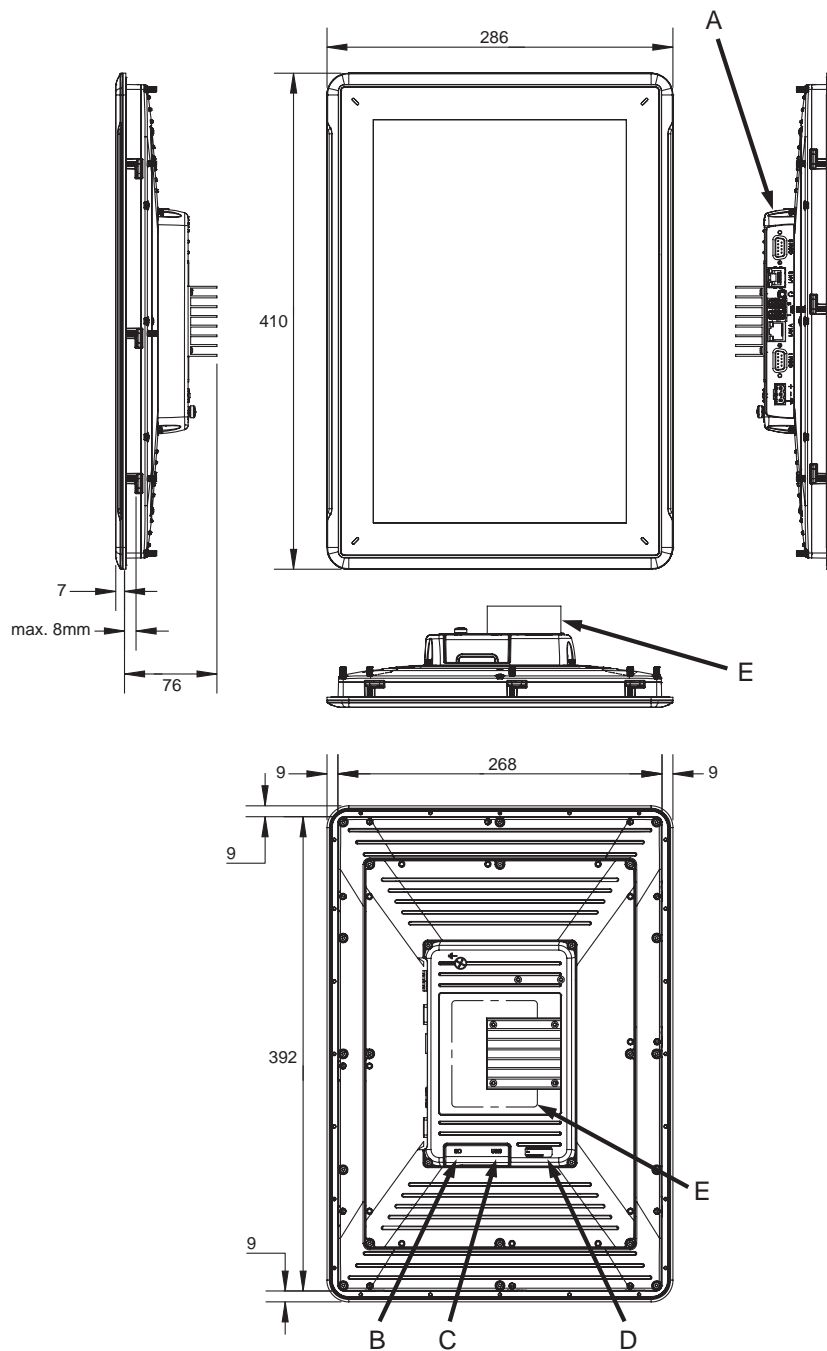


| Pos. | Connector    | Description                                 |
|------|--------------|---|
| 1    | Power supply | +12 - +24 V DC (10 - 32 V DC)               |
| 2    | COM 1        | RS232 Communication Port                    |
| 3    | LAN A        | 1 × 10/100 Base-T (shielded RJ45)           |
| 4    | USB          | 2 × USB Host 2.0, max output current 500 mA |
| 5    | Headphone    | Headphone Connector                         |
| 6    | LAN B        | 1 × 10/100/1000 Base-T (shielded RJ45)      |
| 7    | COM 2        | RS422 / RS485 Communication Port            |

### 5.2 Communication Ports

| Pin | Serial port, 9-pin female |            |                 |
|-----|---------------------------|------------|-----------------|
|     | COM1                      | COM2       |                 |
| 1   | -                         | RS422 Tx+  | RS485 Tx+ / Rx+ |
| 2   | RS232 RxD                 | -          |                 |
| 3   | RS232 TxD                 | -          |                 |
| 4   | -                         | RS422 Rx+  |                 |
| 5   | GND                       | GND        |                 |
| 6   | -                         | RS422 Tx-  | RS485 Tx- / Rx- |
| 7   | RS232 RTS                 | RS422 RTS+ |                 |
| 8   | RS232 CTS                 | RS422 RTS- |                 |
| 9   | -                         | RS422 Rx-  |                 |

## 5.3 T15BR Outline

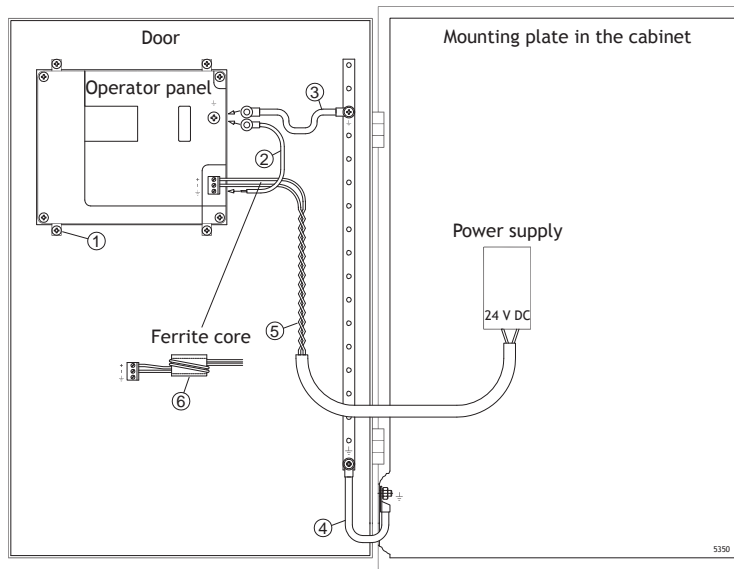


- A. Connectors*
- B. SD memory card slot*
- C. USB host*
- D. Expansion port*
- E. Optional CAN module (not shown)*
- CAN depth does not exceed heat sink.*

## 6 Additional Installation Tips

When experiencing communication problems in for example noisy environments or when operating close to temperature limits, the following recommendations are to be noticed.

### 6.1 Grounding the Operator Panel



The operator panel's mounting clamps do not provide a secure grounding connection between the panel and the device cabinet, see 1 in drawing above.

1. Connect a wire that is sized correctly according to local electrical codes between the operator panel's quick-connect plinth and the panel's chassis, see 2 in drawing above.
  2. Connect a wire or grounding braid that is sized correctly according to local electrical codes between the operator panel's chassis and the closest grounding point on the door, see 3 in drawing above.
  3. Connect a strong but short grounding braid between the door and the device cabinet, see 4 in drawing above.
  4. Twist the cables onto the 24 V DC feed, see 5 in drawing above.  
 2 turns around the ferrite core provide 4 times the suppression of 1 turn.  
 3 turns around the ferrite core provide 9 times the suppression of 1 turn.
- A ferrite core suppresses disturbances to the 24 V feed, see 6 in drawing above.

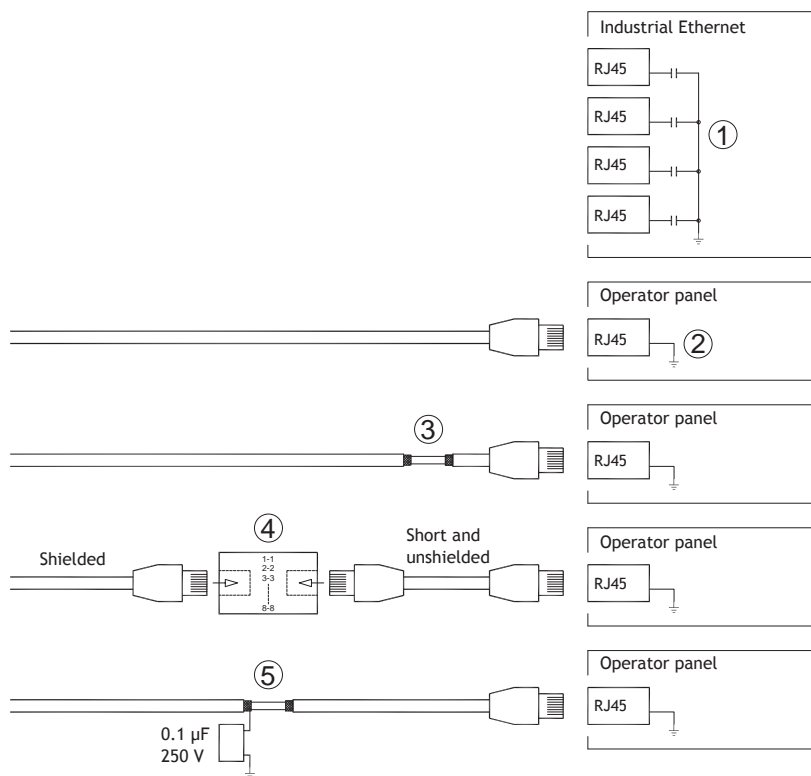
**Note:**

The grounding wires should be short and the conductor should have a large area. A long, thin grounding wire has a very high impedance (resistance) at high frequencies and will not guide disturbances to the ground.

Multi-wire conductors are better than single wire conductors with the same area.

A braided conductor wire with the same area is even better. The best is a short, thick grounding braid.

## 6.2 Ethernet Connection in the Operator Panel



In some industrial units for Ethernet, the RJ45 contact's shield is connected to the chassis via a capacitor, see 1 in drawing above.

The operator panel's Ethernet shield is directly connected to the chassis, see 2 in drawing above.

1. Check whether the other Ethernet unit has its shield directly grounded or grounded via a capacitor.

**Note:**

In many cases, connecting the shielded Ethernet cabling to the chassis at both ends is inappropriate. Hum or grounding loops can occur. Unshielded cabling may even result in fewer communication errors.

A good solution may be to use a shielded Ethernet cable, but to connect the shield at one end only.

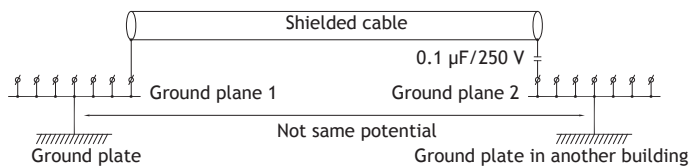
One option is to break the shield, see 3 in drawing above.

A more elegant method is to expand the shielded Ethernet cabling with a piece of unshielded Ethernet cable, see 4 in drawing above.

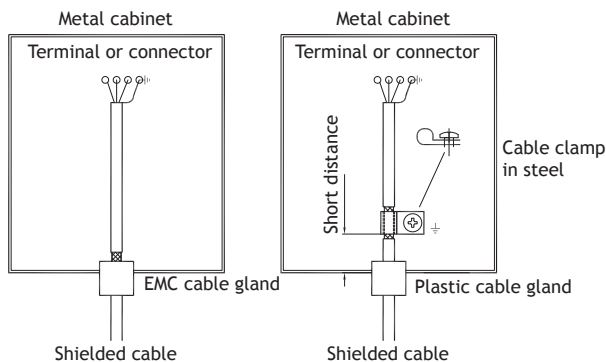
The shield can be grounded via an external 0.1  $\mu$ F/250 V plastic capacitor, see 5 in drawing above. This will connect the HF transients to ground.

## 6.3 To Achieve Better EMC Protection

- Use shielded cables for RS232 communication.
- Use twisted pair and shielded cabling for RS422 and RS485.
- Use the cabling intended for the bus type; Ethernet, Profibus, CC-Link, CAN, Device Net etc.
- Install and connect according to applicable specifications for the relevant bus standard.
- Use shielded cabling for Ethernet, preferably with foil and a braided shield.
- D-sub covers should be shielded, and the shield should be connected to the cover 360° where the cable enters.
- Connect the shield at both ends.



With longer distances, there is a risk that the ground potential may be different. In that case, the shield should only be connected at one end. A good alternative is to connect the other end of the shield to the ground via a 0.1 μF/250 V plastic capacitor. Both ends are then connected to the ground in terms of HF, but only connected to the ground at one end in terms of LF, thus avoiding the 50/60 Hz grounding loops.

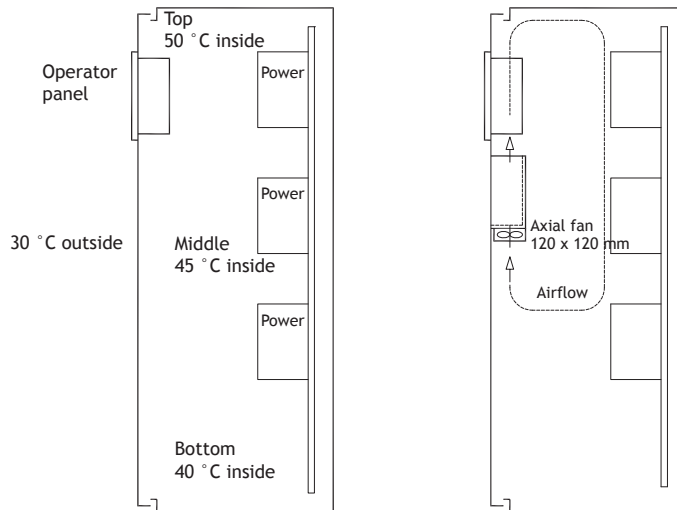


1. Use an EMC cable gland or regular plastic cable gland, remove the outer jacket and connect the shield to the installation plate with a 360° metal cable clamp.
2. Place the 24 V DC and communications cabling in one cable trunk/cable duct and 230/380 V AC in another. If the cables need to be crossed, cross them at 90° only. Avoid combining the cabling for stronger 24 V DC outputs with the communication cabling.

Ferrite cores that are snapped onto the shielded cabling may remove minor disturbances. Large ferrite pieces that are snapped onto unshielded cabling and where the wires go 2-4 times around the cores are approximately 5-25 times more efficient.

## 6.4 Ambient Temperature

The maximum ambient temperature for the operator panel is provided in the specifications. The ambient temperature refers to the temperature in the device cabinet which cools the operator panel's electronics.



In most cases, the ambient temperature for the operator panel is significantly higher than the device cabinet's ambient temperature.

If the cabinet is tall and there are a number of heat-generating devices, the temperature at the top of the cabinet will be considerably higher than the theoretical temperature increase that would be expected. All electronics are sensitive to heat. The lifespan of an electrolytic capacitor is cut in half with an 8-10 °C increase in temperature. A 15-20 °C temperature increase results in a quarter of the lifespan etc.

Rittal has a good program for estimating the anticipated average temperature in the cabinet as well as a large program for controlling the temperature in the device cabinet.

An enamel-coated steel cabinet has a radiant heat value of 5.5 W/m<sup>2</sup> and degrees C.

Installing a fan inside the cabinet will even out the temperature, while moving air provides considerably better cooling than still air.

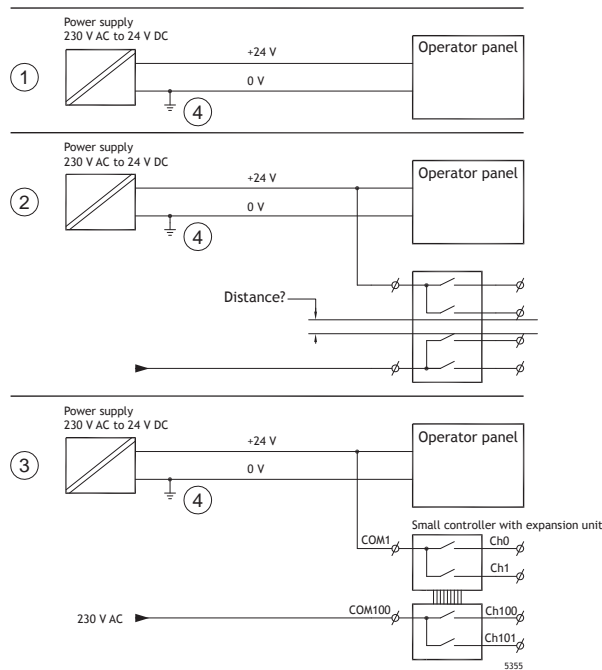
Install the fan so that it sits in the cooler area and blows cold air against the operator panel. If the fan is mounted at the top and sucks warm air upwards, the fan's ambient temperature will be higher, resulting in a shorter lifespan.

The operator panel's loss effect = supply voltage x current. Virtually no power goes to external users and no loss effects due to inputs.



## 6.5 Safety

Most of the operator panels are fed with 24 V DC.



If a power supply that meets safety standards is used and only feeds the operator panel, there is no problem. See 1 in drawing above.

However, if a 24 V unit that also feeds other units is used, there is reason to be cautious, see 2 in drawing above. The operator panel does not have insulation that meets safety requirements in the event of a potential short circuit between 230 V AC and 24 V DC. It is assumed that the 24 V feed is secure, for example, SELV according to EN 60950 (protection against electric shock) and UL 950.

### Example:

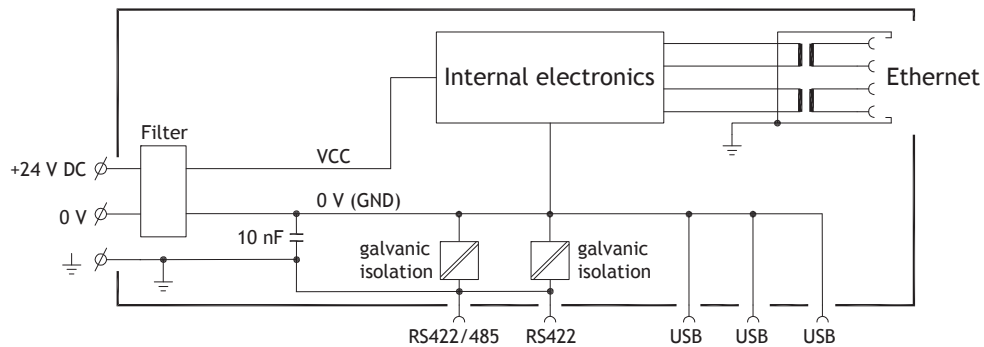
Here is an example that explains why a secure 24 V DC feed can be ruined by mixing 24 V relay contacts with 230 V AC relay contacts in a smaller controller. Check that the clearances and creepage distances between 24 V DC and 230 V AC fulfill EN 60950 or UL 950. If not, input a separate 24 V unit into the operator panel.

If there is a substantial distance between the relay contacts for 24 V DC and 230 V AC, it is OK to use the same 24 V devices for all feeds. See 3 in drawing above.

Connect 0 V on the 24 V feed to the ground, see 4 in drawing above. This offers three advantages:

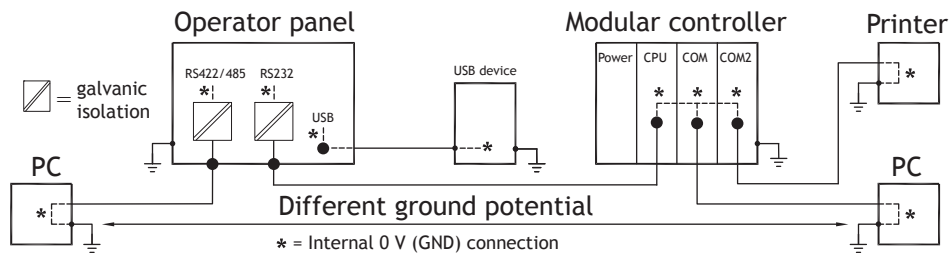
- Safety is increased. The 24 V feed will not be live in the event of a faulty connection or short circuit between 0 V (24 V) and 230 V phase.
- Transients on the 24 V feed are connected to the ground.
- No risk that the 24 V feed is at a high level in relationship to the ground. This is not unusual since there is high static electricity.

## 6.6 Galvanic Isolation



The communication ports COM1 and COM2 have built-in galvanic isolation from the terminal and the input power supply. The communication port grounds are bonded to protective earth ground and therefore to one another. Both Ethernet ports have galvanic isolation as well. There is no galvanic isolation between the terminal and the input power supply. If galvanic isolation is required between the terminal and the power supply an external isolation device is required.

Caution should be taken when connecting peripherals to the terminal. Many peripherals including USB devices will bond the terminal's signal ground (0 V) to the protective earth ground. Bonding signal ground and protective earth ground may increase electrical emissions and introduce communication errors.



### Note:

It is very important to make sure that the 24 V feed in the external insulation unit is not connected to one of the communication outlets. If it does not have 100% insulation against the 24 V feed, disturbances and grounding currents from the 0 V on the 24 V side will disrupt communication.

Using this type of unit solves one problem but creates a larger problem! A substandard installation may work now, but problems may arise when other devices are connected.

## 6.7 Cable and Bus Termination RS485

- Use shielded and twisted pair cable. The pair capacitance may not exceed 52.5 pF/m and area at least 0.25 mm<sup>2</sup> (AWG 24), if you want to use the maximum transfer distance and maximum transfer speed.
- 0 V, the reference voltage for communication should be included in the cabling. With two-way communication use two pairs; one pair for communication and one pair for 0 V.
- The shield must be grounded at one end. The other end is usually grounded, but with longer distances or when there is a difference in the ground potential, the shield should be connected to the ground via 0.1 µF/250 V plastic capacitor to prevent ground current in the braided shield. A number of manufacturers recommend that the shield be grounded at each node. Various manufacturers have different systems for bus termination.

Depending on the recipients' design, the bus wires may be on the same level or require pull-up or pull-down to ensure that no faulty signals are detected when the bus is in resting mode (all transmitters are disconnected).

## 6.8 COM Port Common-Mode Voltage

The COM port I/Os have special restrictions for common-mode voltage with respect to ground.

| COM Port           | Maximum Common-Mode Voltage Range |
|--------------------|-----------------------------------|
| COM1 - RS232       | -15 V to +15 V                    |
| COM2 - RS422/RS485 | -7 V to +7 V                      |



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