



EXTER T60/T60m

Installation Manual
English

MAEN809F, 2014-11

Everything for your HMI running



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Installation manual for EXTER T60/T60m

Foreword

All EXTER 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 configuration tool. 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 EXTER 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 reference manual for further information.

Order no: MAEN809F

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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.

1.2 UL and cUL Installation

Caution:

This section is only valid for UL labeled EXTER T60/T60m panels.

- This equipment is suitable for use in non-hazardous locations only. [Combinations of equipment in your system are subject to investigation by the local authority having jurisdiction at the time of 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 DESIGNÉ NON DANGEREUX.



Warning:

Only UL and cUL approved expansion units are allowed to be connected to the port designated "EXPANSION". At the moment there are no such units evaluated or allowed.

SEULES LES UNITÉS D'EXTENSION CERTIFIÉES UL ET
cUL PEUVENT ÊTRE RACCORDÉES AU PORT DÉSIGNÉ « EXPANSION ».
À L'HEURE ACTUELLE, AUCUNE UNITÉ DE CE TYPE N'A ÉTÉ TESTÉE
OU AUTORISÉE.



Warning:

Do not replace expansion unit unless power has been switched off or the area is known to be non-hazardous.

NE REMPLACEZ L'UNITÉ D'EXTENSION QUE SI LE
COURANT A ÉTÉ COUPÉ OU SI LA ZONE EST JUGÉE NON DANGEREUSE.

- This product contains a battery; this must only be changed in an area known to be non-hazardous.
- Replace the battery with a CR2450 battery. Use of another type of battery may present a risk of fire or explosion.



Warning:

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

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.

- For use on a flat surface of a type 4X enclosure indoor use only.
- 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	TQLb.In.
X1/X100 Phoenix connectors	AWG 30-12	5-7
X1/X100 Anytek connectors	AWG 24-12	3.5

- These devices are Class 2 supplied programmable controllers (industrial PCs) for the use in industrial control equipment and are intended to be (front) panel mounted (Type 1 and 4x for indoor use only).

Caution:

The enclosure provides a degree of protection of at least IP20, but when installed in an apparatus, it should meet IP54.

LE BOÎTIER OFFRE UN DEGRÉ DE PROTECTION D'AU MOINS IP20, MAIS LORSQU'IL EST INSTALLÉ DANS UN APPAREIL, IL DOIT ÊTRE DE CLASSE IP54.

1.3 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 product according to the accompanying installation instructions.
- Ground the product 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 product to the power outlet.
- Peripheral equipment must be appropriate for the application and location.

1.4 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.

1.5 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.
- Replacing the battery incorrectly may result in explosion. Only use batteries recommended by the supplier. During the warranty period, the battery needs to be replaced by an authorized Beijer Electronics service center.

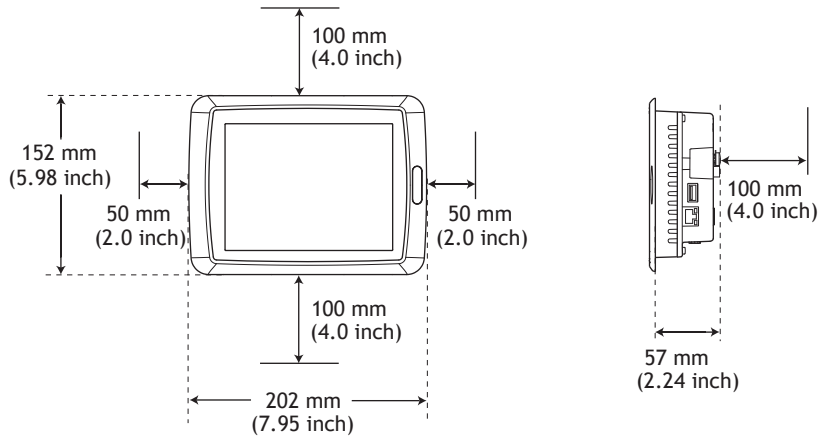
1.6 Dismantling and Scrapping

- 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.

2 Installation

2.1 Space Requirements

- Installation plate thickness: 1.5 - 7.5 mm (0.06 - 0.3 inch)
- Space requirements when installing the operator panel:

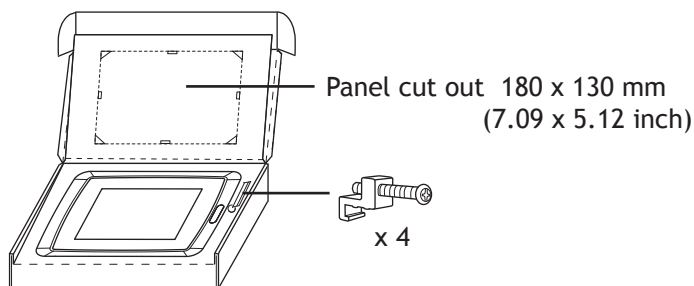


Caution:

The openings on the enclosure are for air convection. Do not cover these openings.

2.2 Installation Process

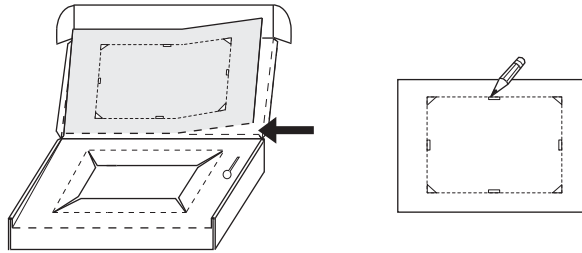
1. Unpack and check the delivery. If damage is found, notify the supplier.



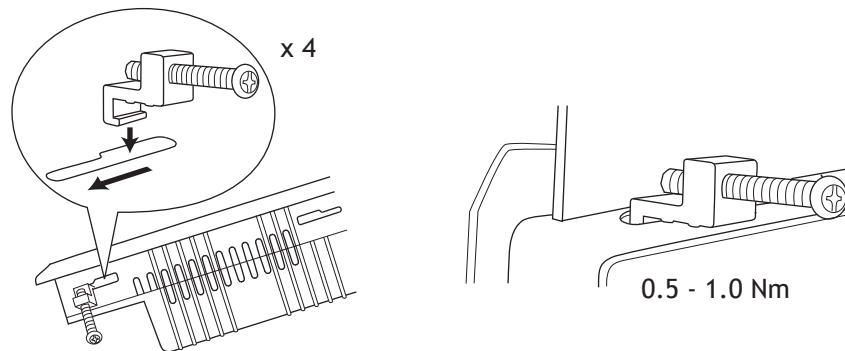
Note:

Place the operator panel on a stable surface during installation. Dropping it or letting it fall may cause damage.

- Place the panel cut out where the operator panel is to be situated, draw along the outer sides of the holes and cut according to the markings.



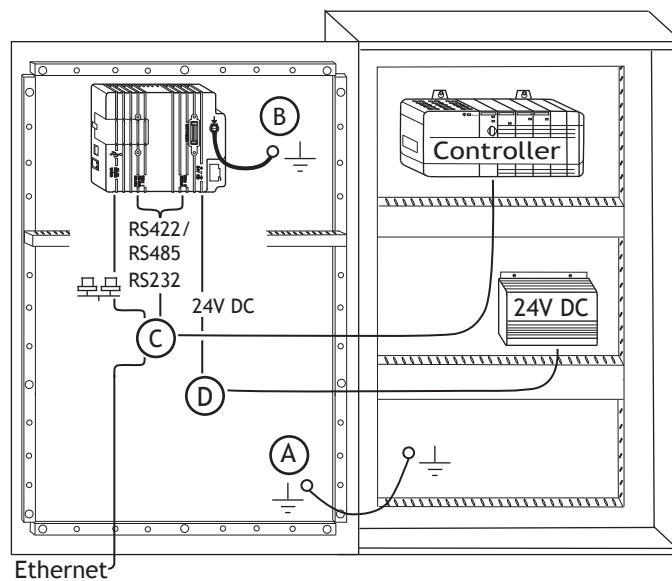
- Secure the operator panel in position, using all the fastening holes and the provided brackets and screws:



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

Caution:

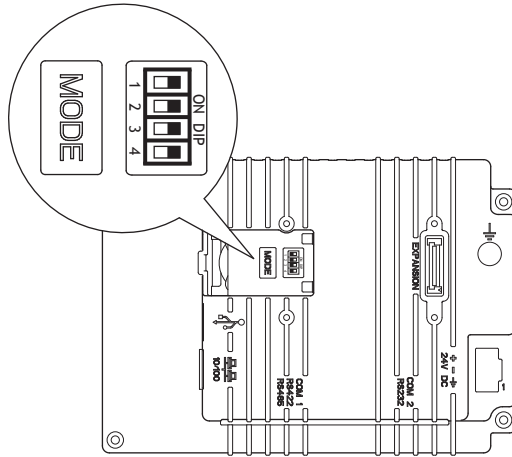
- The operator panel must be brought to ambient temperature before it is started up. If condensation forms, ensure that the operator panel is dry before connecting it to the power outlet.
- Ensure that the operator panel and the controller system have the same electrical grounding (reference voltage 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.



- Connect cable A.
 - Connect cable B, using an M5 screw and a grounding conductor (as short as possible), that is sized correctly according to local electrical codes.
 - Connect cable C.
 - Connect cable D.
5. Carefully remove the laminated film over the operator panel display, to avoid static electricity that could damage the panel.

2.2.1 Mode Switches

All mode switches must be in OFF position during operator panel use.
The mode switches should not be touched unless by qualified personnel.



2.2.2 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.

2.2.3 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	EXTER T60/T60m
Front panel, W x H x D	202 x 152 x 6 mm
Mounting depth	57 mm (157 mm including clearance)
Front panel seal	IP 66
Rear panel seal	IP 20
Keyboard material/Front panel	Touch screen: Polyester on glass, 1 million finger touch operations. Overlay: Autotex F157 or F207*.
Reverse side material	Powder-coated aluminum
Weight	0.9 kg
Serial port RS422/RS485	25-pin D-sub contact, chassis-mounted female with standard locking screws 4-40 UNC
Serial port RS232C	9-pin D-sub contact, male with standard locking screws 4-40 UNC
Flash memory for application	12 MB (incl. fonts)
Ethernet	Shielded RJ 45
USB	Host type A (USB 1.1), max output current 500 mA
Real time clock	±20 PPM + error because of ambient temperature. Total maximum error: 1 minute/month at 25 °C. Temperature coefficient: -0.034±0.006 ppm/ °C ²
Real time clock battery	CR2450 (UL and cUL: Sanyo or Panasonic) Minimum lifetime: 3 years
Power consumption at rated voltage	Normal: 0.2 A Maximum: 0.4 A (For T60c and for T60m with hardware version lower than 07600: Normal: 0.25 A, Maximum: 0.45 A)
Display	320 x 240 pixels, T60: TFT-LCD, 64K colors. (For T60c: transmissive color STN-LCD, 64K colors; for T60m: TFT-LCD, 16 greyscales; for T60m with hardware version lower than 07600: transmissive monochrome STN-LCD.) T60: LED backlight lifetime at the ambient temperature of +25 °C: >50,000 h. (For T60c: CCFL backlight lifetime (at 25 °C): >75,000 h. For T60m with hardware version lower than 07600: CCFL backlight lifetime (at 25 °C): >58,000 h.)
Active area of display, W x H	115.2 x 86.4 mm
Fuse	Internal DC fuse, 2.0 AT, 5 x 20 mm
Power supply	+24 V DC (20 - 30 V DC). Power supply connector. CE: The power supply must conform with the requirements according to IEC 60950 and IEC 61558-2-4. UL and cUL: The power supply must conform with the requirements for class II power supplies.

Parameter	EXTERT60/T60m
Ambient temperature	Vertical installation: 0 ° to +50 °C Horizontal installation: 0 ° to +40 °C
Storage temperature	-20 ° to +70 °C
Relative humidity	5 - 85% non-condensed
Approvals and certifications	Information is available on the web site www.bejerelectronics.com

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

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

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 octan unleaded petrol
Ethyl acetate	Sodium hydroxide 30%	98 octan leaded petrol

4.2 Touch Screen and Overlay Material

4.2.1 Autotex F157/207

Autotex F157 or F207 covers the overlay surrounding the screen.

Solvent Resistance

Autotex F157/F207 withstands exposure of more than 24 hours duration under DIN 42 115 Part 2 to the following chemicals without visible change:

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

¹ Extremely faint glossing of the texture was noted.

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

Autotex 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

Outdoor Use

In common with all polyester based films Autotex F157/F207 is not suitable for use in conditions of long term exposure to direct sunlight.

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 Touch Screen Protector

For harsh environments and exposure to outdoor conditions, it is recommended to use a protective film to guard the touch screen from damage. These optional parts can be ordered from Beijer Electronics.

5 Operator Panel Drawings

5.1 Communication Ports

RS-232

Pin no	Signal	Signal Name	Signal direction
1	DCD	Data Carrier Detect	Input
2	RD	Receive Data	Input
3	TD	Transmit Data	Output
4	DTR	Data Terminal Ready	Output
5	SG	Signal Ground	-
6	DSR	Data Set Ready	Input
7	RTS	Request To Send	Output
8	CTS	Clear To Send	Input
9	RI	Ring Indicator	Input

RS-422/485

Pin no	RS-422		RS-485	
	Signal	Signal direction	Signal	Signal direction
2	TxD+	Output	Tx/Rx+	In/Output
15	TxD-	Output	Tx/Rx-	In/Output
3	RxD+	Input		
16	RxD-	Input		
4	RTS+	Output		
17	RTS-	Output		
5	CTS+	Input		
18	CTS-	Input		
20	1)			
21	1)			
6	Do not use		2) Bus termination	4) Connect to pin no.19 for bus-termination.
19	Do not use		3) Bus termination	See above
7,8	0V		0V	
14	+5V <100mA	Output	+5V <100mA	Output

1) Pin no 20 connected to pin no 21 internal in the terminal

2) Directly connected internally to pin no. 2 (Tx/Rx+).

3) Connected to pin no. 15 (Tx/Rx-) internally via a 120ohm 1/4W resistor.

4) NOTE! Only the first and the last unit on the bus should be terminated.

USB

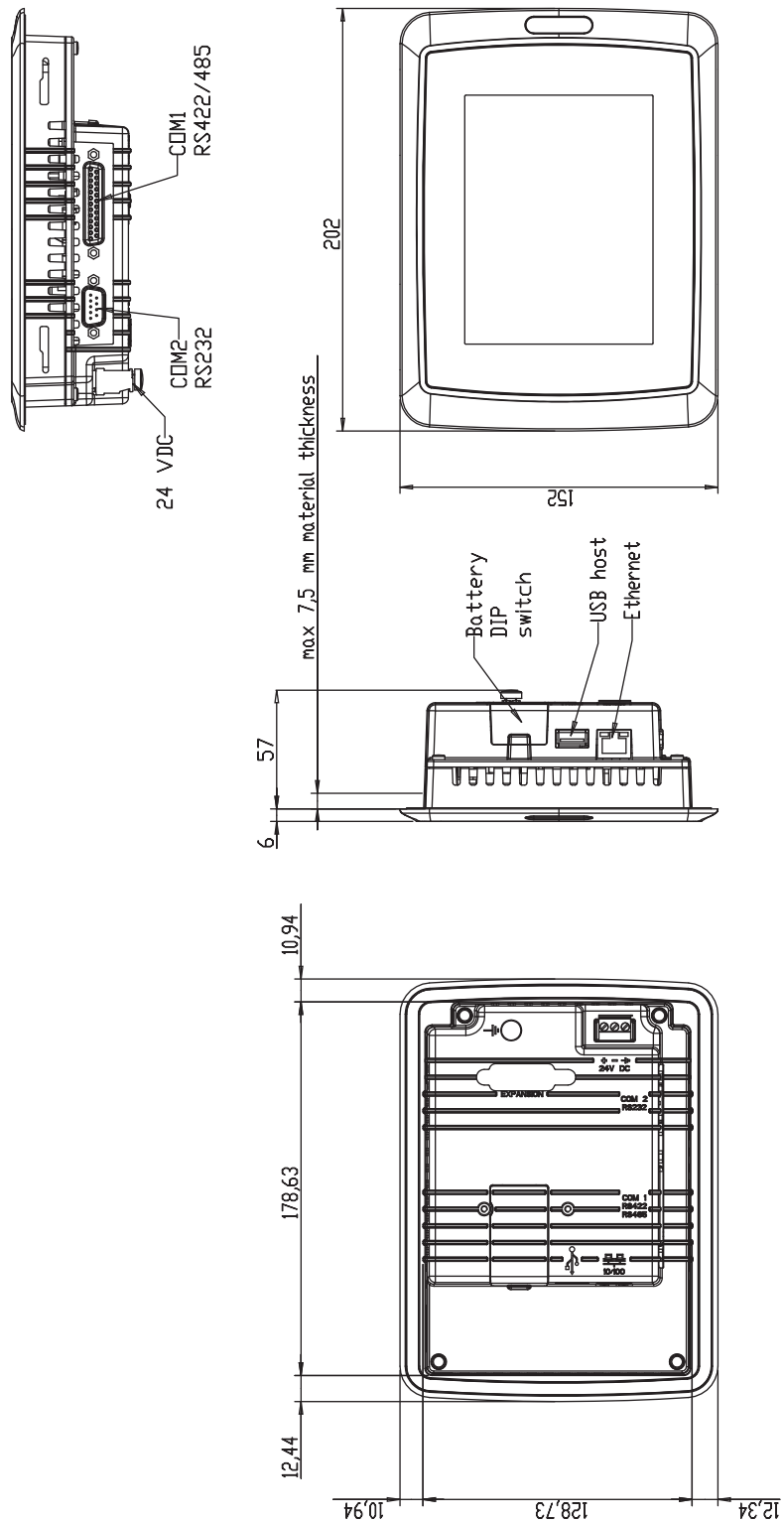
Pin no	Signal	Signal direction
1	VBUS	-
2	D-	In/Output
3	D+	In/Output
4	GND	-

Frame connected to chassis.

Ethernet

Pin no	Signal	Signal direction
1	Tx+	Output
2	Tx-	Output
3	Rx+	Input
6	Rx-	Input
4,5,7,8	GND	

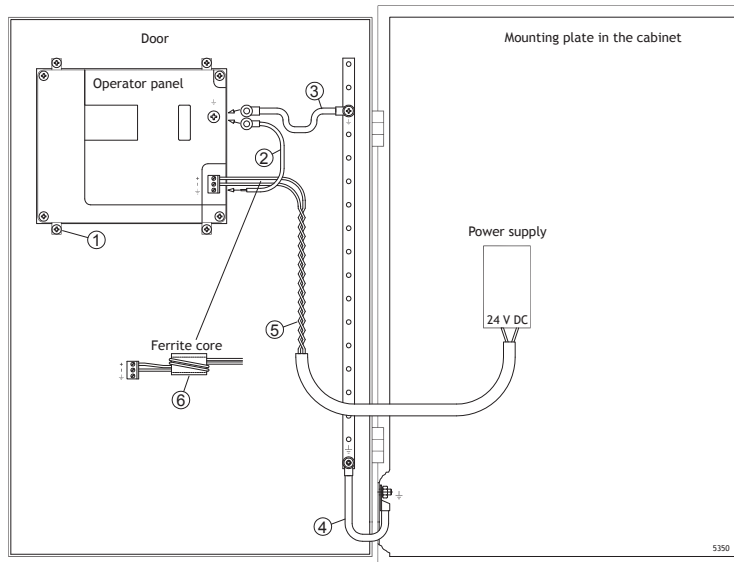
5.2 EXTER T60/T60m Outline



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



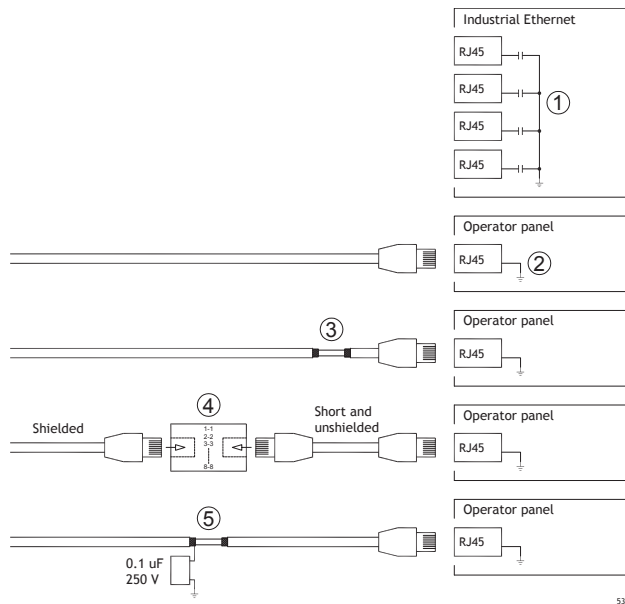
The operator panel's mounting clamps do not provide a secure grounding connection between the panel and the device cabinet, see 1 in drawing above.

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 6 or 4 mm² wire or grounding braid between the 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 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.

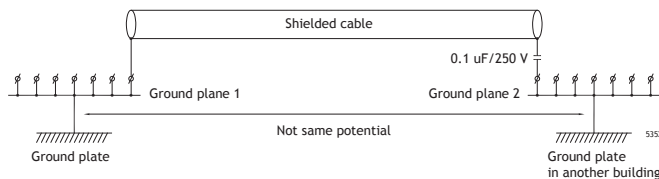
One option is to break the shield, see 3 in drawing above.

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

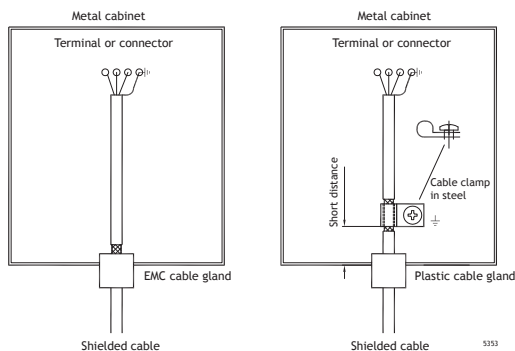
You can ground the shield via an external 0.1 μF /250 V plastic capacitor, see 5 in drawing above. This will connect the HF transients to the ground.

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 $\mu\text{F}/250\text{ V}$ 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 Hz grounding loops.

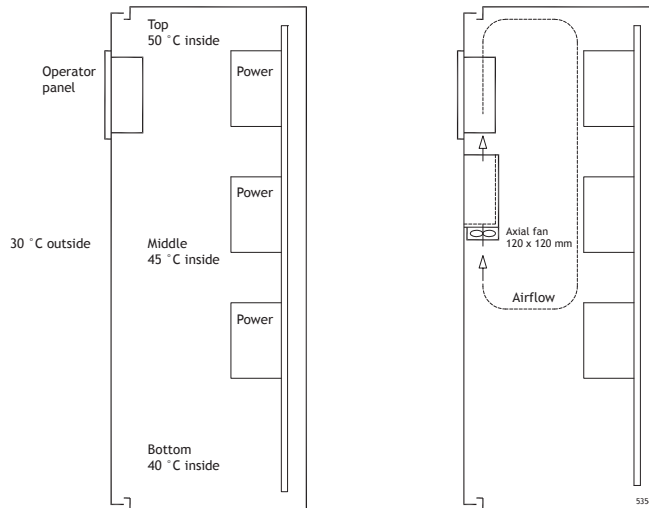


1. Use an EMC cable gland or regular plastic cable gland, remove the outer jacket and connect the shield to the installation plate with a 360° metal cable clamp.
2. Place the 24 V DC and communications cabling in one cable trunk/cable duct and 230/380 V AC in another. If the cables need to be crossed, 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 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/m² and degrees C.

Installing a fan inside the cabinet will even out the temperature, while moving air provides considerably better cooling than still air. A suitable fan is a 120 x 120 mm axial fan, available in 24 V DC, 115 and 230 V AC.

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.

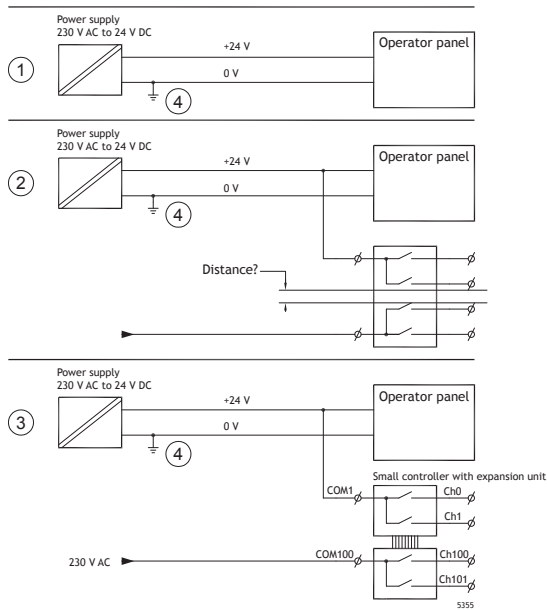
A good fan with a ball-bearing mounting has an expected lifespan of at least 40,000 hours (not a guaranteed lifespan) at 40 °C. This corresponds to at least 4 years of continuous use. If a thermostat is installed, the fan only operates when needed.

Large graphic terminals draw only one fifth of the current when the background lighting is off. The loss effect drops from e.g. 25 W to only 5 W.

An approximate value of the net power consumption for the operator panel can be calculated by multiplying the supply voltage with the current drawn by the operator panel. This is assuming that all supplied power is transformed to heat.

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.

Note:

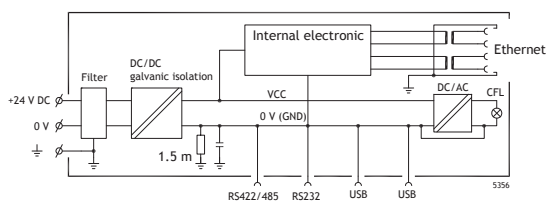
Here is an example that explains why a secure 24 V DC feed can be ruined by mixing 24 V relay contacts with 230 V AC relay contacts in a smaller controller. Check that the clearances and creepage distances between 24 V DC and 230 V AC fulfill EN 60950 or UL 950. If not, input a separate 24 V unit into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

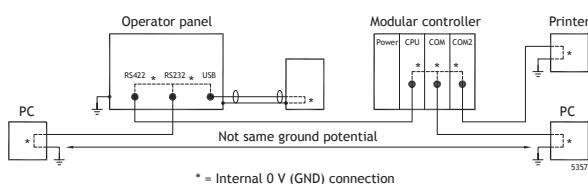
Connect 0 V on the 24 V feed to the ground, see 4 in drawing above. This offers three advantages:

- 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 operator panel has galvanic isolation against the 24 V DC feed but no galvanic isolation between the communication ports for RS232, RS422/485 and USB. Only the Ethernet connection has galvanic isolation.



When a PC is connected to the panel, the panel's internal 0 V (GND) will be connected to the protective ground via the PC.

A number of USB devices can have the shield connected together with the protective ground. Here, the panel's 0 V (GND) is connected to the protective ground when, for example, a USB memory stick, keyboard or similar device is plugged in.

If a number of units are connected that have a 0 V and a ground connection, and these are connected to various grounding points, there is a substantial risk of problems. Grounding currents go through communication cables, the rear plate of the controller, and internally in the operator panel, and can cause errors.

Use external units to improve communication and achieve galvanic isolation. Westermo has good industry-standard insulators that are also insulated from the 24 V DC feed.

Note:

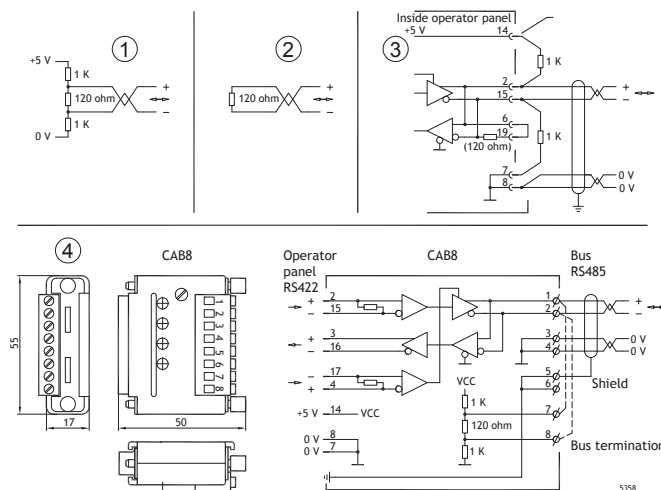
It is very important to make sure that the 24 V feed in the external insulation unit is not connected to one of the communication outlets. If it does not have 100% insulation against the 24 V feed, disturbances and grounding currents from the 0V on the 24 V side will disrupt communication.

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 mm² (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. The RS485 standard does not describe how the “Fail Safe” function would be carried out, just that the system should be be able to handle the error.

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).



Some (older) operator panels had pull-up and pull-down resistance except for the actual bus termination at 120 Ω, similar to Westermo and Profibus. See 1 in drawing above.

Newer panels have another type of recipient, so-called built-in “Fail Safe”, where simple bus termination resistance is sufficient. See 2 in drawing above.

If other nodes on the RS485 network require pull-up and pull-down and the operator panel is at one end of the loop, one of the following procedures can be carried out:

- Connect two 1 kΩ / 0.25 W resistors in the 25-pole D-sub contact. See 3 in drawing above. Set jumper pins 6-19.
- Use CAB8. It offers the option of bus termination with pull-up/-down. It is also easy to connect the bus cable via the screw terminal block. See 4 in drawing above.

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