⚠ WARNINGS

System Design

- Do not create ST touch panel switches that could possibly endanger the safety of equipment and personnel. Damage to the ST, its I/O unit(s), cable(s), and other related equipment can cause an output signal to remain continuously ON or OFF and possibly cause a major accident. Therefore, design all monitoring circuits using limit switches, etc. to detect incorrect device movement. To prevent accidents related to incorrect signal output or operation, design all switches used to control vital machine operations so they are operated via a separate control system.
- Do not create switches used to control machine safety operations, such as an emergency stop switch, using a ST touch screen icon. Be sure to install these switches as separate hardware switches, otherwise severe bodily injury or equipment damage can occur.
- Please design your system so that equipment will not malfunction due to a communication fault between the ST and its host controller. This is to prevent any possibility of bodily injury or material damage.
- Do not use the ST unit as a warning device for critical alarms that can cause serious operator injury, machine damage or production stoppage. Critical alarm indicators and their control/activator units must be designed using standalone hardware and/or mechanical interlocks.
- The ST is not appropriate for use with aircraft control devices, aerospace equipment, central trunk data transmission (communication) devices, nuclear power control devices, or medical life support equipment, due to these devices' inherent requirements of extremely high levels of safety and reliability.
- When using the ST with transportation vehicles (trains, cars and ships), disaster and crime prevention devices, various types of safety equipment, non-life support related medical devices, etc. redundant and/or failsafe system designs should be used to ensure the proper degree of reliability and safety.
- After the ST backlight burns out, unlike the ST's standby Mode, the touch panel is still active. If the operator fails to notice that the backlight is burned out and touches the panel, a potentially dangerous machine operation error can occur. Therefore, do not use ST touch switches for the control of equipment safety mechanisms, such as Emergency Stop switches, etc. that protect humans and equipment from injury and damage. If your ST's backlight suddenly turns OFF, use the following steps to determine if the backlight is actually burned out.
  1) If your ST is not set to Standby Mode and the screen has gone blank, your backlight is burned out.
  2) Or, if your ST is set to Standby Mode, but touching the screen does not cause the display to reappear, your backlight is burned out.

Installation

- Do not modify the ST unit. Doing so may cause a fire or an electric shock.
- Do not use the ST in an environment where flammable gasses are present, since operating the ST may cause an explosion.

Wiring

- To prevent an electric shock, be sure to confirm that the ST's power cord is not connected to the main power when connecting any cords, cables or lines to the ST.
- Do not use power beyond the ST's specified voltage range. Doing so may cause a fire or an electric shock.

Maintenance

- The ST uses a lithium battery for backing up its internal clock data. If the battery is incorrectly replaced, the battery may explode. To prevent this, please do not replace the battery yourself. When the battery needs to be replaced, please contact your local ST distributor.

⚠ CAUTIONS

Installation

- Be sure to securely connect all cable connectors to the ST. A loose connection may cause incorrect input or output.

Wiring

- Ground the ST's FG line separately from other unit FG lines. Locating FG lines too close may cause an electric shock or a unit malfunction. Be sure to use a grounding resistance of 100Ω or less and a $2mm^2$ or thicker wire, or your country applicable standard.
- When wiring the ST, be sure that the rated voltage and terminal layout are within the designated range. If the voltage supplied differs from the rated voltage, or incorrect wiring or grounding is performed, it may cause a fire or unit malfunction.
- Use only the designated torque to tighten the ST's terminal block screws. If these screws are not tightened firmly, it may cause a short-circuit, fire, or ST malfunction.
- Be careful that metal filings and wiring debris do not fall inside the ST, since they can cause a fire, ST malfunction, or operation error.

Maintenance

- The liquid crystal panel contains a powerful irritant and if for any reason the panel is damaged and this liquid contacts any part of your body, be sure to wash that area with running water for 15 minutes. If any of this liquid enters your eye, flush your eye for 15 minutes with running water and contact a physician.

Unit Disposal

- When this unit is disposed of, it should be done so according to your country's regulations for similar types of industrial waste.

Other

- Among backlight units there may be slight variations in illumination color, however, this does not effect the performance or quality of the ST unit.

General Safety Precautions

- Do not strike the touch panel with a hard or pointed object, or press on the touch panel with too much force, since it may damage the touch panel or the display.
- Do not install the ST where the ambient temperature can exceed the allowed range. Doing so may cause the ST to malfunction or shorten its operation life.
- Do not restrict or limit the ST unit naturally occurring rear-face ventilation, or storing or using the ST in an environment that is too hot.
- Do not use this unit in areas where large, sudden temperature changes can occur. These changes can cause condensation to form inside the unit, possibly causing the unit to malfunction.
- Do not allow water, liquids, metal or charged particles to enter inside the ST case, since they can cause either a ST malfunction or an electrical shock. The allowable pollution degree is 2.
- Do not use or store the ST in direct sunlight, or in excessively dusty or dirty environments.
- Do not store or use the unit where strong jolting or excessive vibration can occur.

- Do not store or use the ST where chemicals (such as organic solvents, etc.) and acids can evaporate, or where chemicals and acids are present in the air.
  Corrosive chemicals: Acids, alkalines, liquids containing salt
  Flammable chemicals: Organic Solvents
- Do not use paint thinner or organic solvents to clean the ST.
- Do not store or operate the LCD display in areas receiving direct sunlight, since the sun's UV rays may cause the LCD display quality to deteriorate.
- Storing this unit in areas at a temperature lower than is recommended in this manual's specifications may cause the LCD display liquid to congeal, which may damage the panel. Conversely, if the storage area temperature becomes higher than the allowed level, the LCD liquid will become isotropic, causing irreversible damage to the LCD. Therefore, be sure to store the panel only in areas where temperatures are within those specified in this manual.
- After turning the ST OFF, be sure to wait a few seconds before turning it ON again. If the ST is restarted too soon, it may not start up correctly.
- Due to the possibility of unexpected accidents, be sure to back up the ST screen data regularly.

About the ST's Display Panel

- The ST's currently displayed data, its voltage*1 and brightness setting each affect the intensity of Contouring. (i.e, when some parts of the screen are brighter than others, creating a wavelike pattern)
- There are minute grid-points (dark and light) on the Display Panel's surface. This is part of the ST's design and not a defect.
- Extended shadows, or "Crosstalk" may appear on the sides of screen images. This is normal for an LCD display.
- Sometimes the display area may look as if the display colors have changed. This is a common attribute of LCD's and is not a defect.
- Displaying a single image for long periods can cause an afterimage to remain when the display is changed to another screen.

* Use the ST's "Stand-by Mode", which automatically turns the screen OFF when there is no input for a specified period of time.

* Do not display any single screen for a long period of time. Try to periodically change the screen display.

UL/c-UL(CSA) Application Notes

The ST400-AG41-24V/ST401-AG41-24V/ST402-AG41-24V units are UL/c-UL(CSA) listed product.

When applying for UL approval for a product that includes one of these ST units, please be sure to pay special attention to the fact that all products with built-in ST units require UL inspection of the combination of the ST and the product. This Unit conforms as a component to the following standards:

■UL508 UL File No.220851

Safety of Industrial Electrical Equipment.

- The ST's front face is evaluated as an Enclosure, and all other areas are evaluated as an Open Enclosure.
- Be sure to supply 24V power from a Class II circuit. The ST's front face satisfies NEMA#250 TYPE 4X/12 requirements.

■UL1604*1 UL File No.182139

Safety of Information Technology Equipment for use in Class I and II, Division 2, and Class III Hazardous (classified) locations.

■ CAN/CSA-C22.2, No.14 and No.213-M1987

Safety of Information Technology Equipment for use in Class I and II, Division 2, and Class III Hazardous (classified) locations.

ST400-AG41-24V (UL Registration Model : 3180053-02)

ST401-AG41-24V (UL Registration Model : 3180053-03)

ST402-AG41-24V (UL Registration Model : 3180053-04)

<Cautions>

If the ST is mounted so as to cool itself naturally, please mount it on a vertical panel. Also, insure that the ST is mounted at least 100 mm away from any other adjacent structures or machine parts. If these conditions are not met, the heat generated by the ST's internal components may cause it to fail to meet UL standards.

UL1604 Conditions of Acceptability and Handling Cautions:

1. Power and input/output wiring must be in accordance with Class I, Division 2 wiring methods - Article 501-4(b) of the National Electrical Code, NFPA 70 within the United States, and in accordance with Section 18-152 of the Canadian Electrical Code for installallations within Canada and in accordance with the authority have jurisdiction.
2. Suitable for use in Class I, Division 2, Groups A, B, C, and D Hazardous Locations or non-Hazardous Location only.
3. Confirm that the power supply has been turned OFF before disconnecting equipment, or confirm that the location is not subject to the risk of explosion.
4. **WARNING:** Explosion hazard - substitution of components may impair suitability for Class I, Division 2.
5. **WARNING:** Explosion hazard - when in hazardous locations, turn power OFF before replacing or wiring modules.
6. **WARNING:** Explosion hazard - DO NOT connect/disconnect equipment unless area is known to be nonhazardous or the power has been switched off. TOOL port is for system set-up and diagnostics in a nonhazardous location area only.

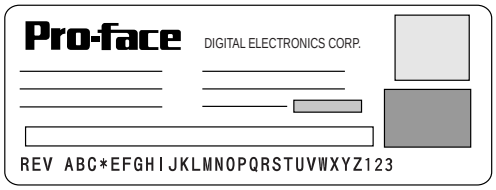
**1 ST400-AG41-24V/ST401-AG41-24V/ST402-AG41-24V units with revision code "A" or later are all UL1604 compliant.* Reference *"Revision Information"*

CE Marking Notes

The ST400-AG41-24V/ST401-AG41-24V/ST402-AG41-24V are CE marked, EMC compliant products. These units also conform to EN550011 Class A, EN61000-6-2 directives. For detailed CE marking information, please contact your local ST distributor.

Revision Information

Use the metallic label attached to the rear of the GP to identify your unit's revision code. This code is at the bottom of the label, to the right of "REV". In this example, the asterisk mark (*) is in the "D" position, which means this unit's revison code is "D".

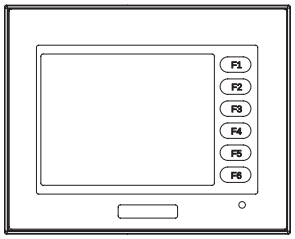


Package Contents

The following items are included in the ST's package. Before using the ST, please confirm that all items listed here are present.

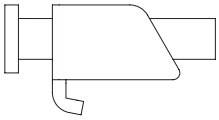
■ **ST Unit (1)**

<ST400-AG41-24V/ST401-AG41-24V/ ST402-AG41-24V>

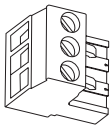


■ **Installation Gasket (1) <Attached to the ST Unit>**

■ **Installation Fasteners (4)**



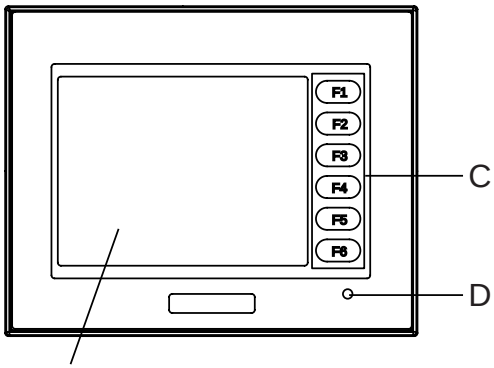
■ **Power Plug (1) <Attached to the ST Unit>**



■ **Installation Guide (1) <This Guide>**

This unit has been carefully packed, with special attention to quality. However, should you find anything damaged or missing, please contact your local ST distributor immediately.

1 Part Names



Front

A : Display

B : Touch Panel

C : Function Switches (F1 to F6)

D : Power Lamp

E : Power Plug

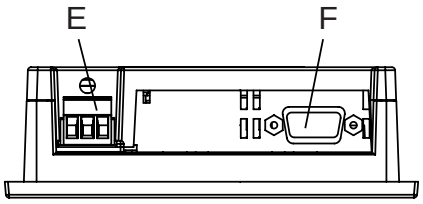
F : RS-422 Interface (X)

G : RS-232C Interface (Y)

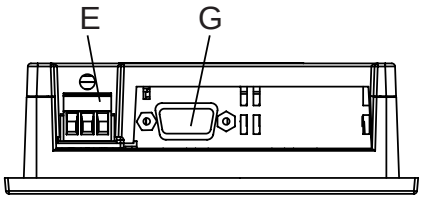
H : RS-485(MPI) Interface (X)

I : RS-422 Interface (Y)

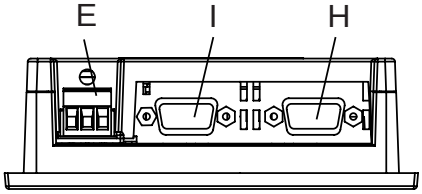
J : Tool Connector (TOOL)



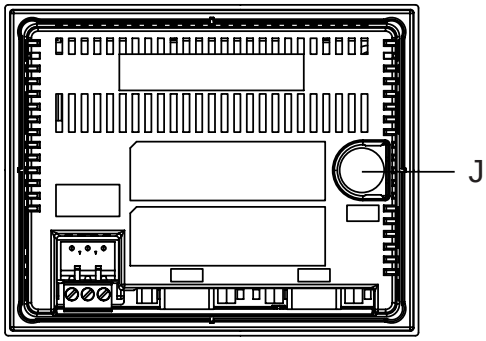
ST400-AG41-24V Bottom



ST401-AG41-24V Bottom



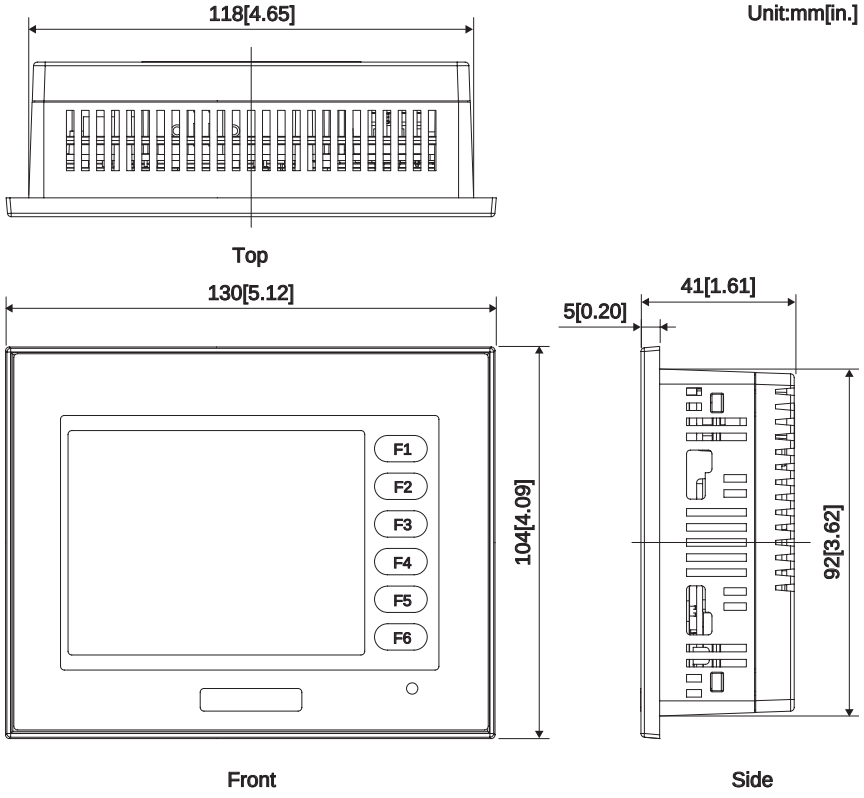
ST402-AG41-24V Bottom



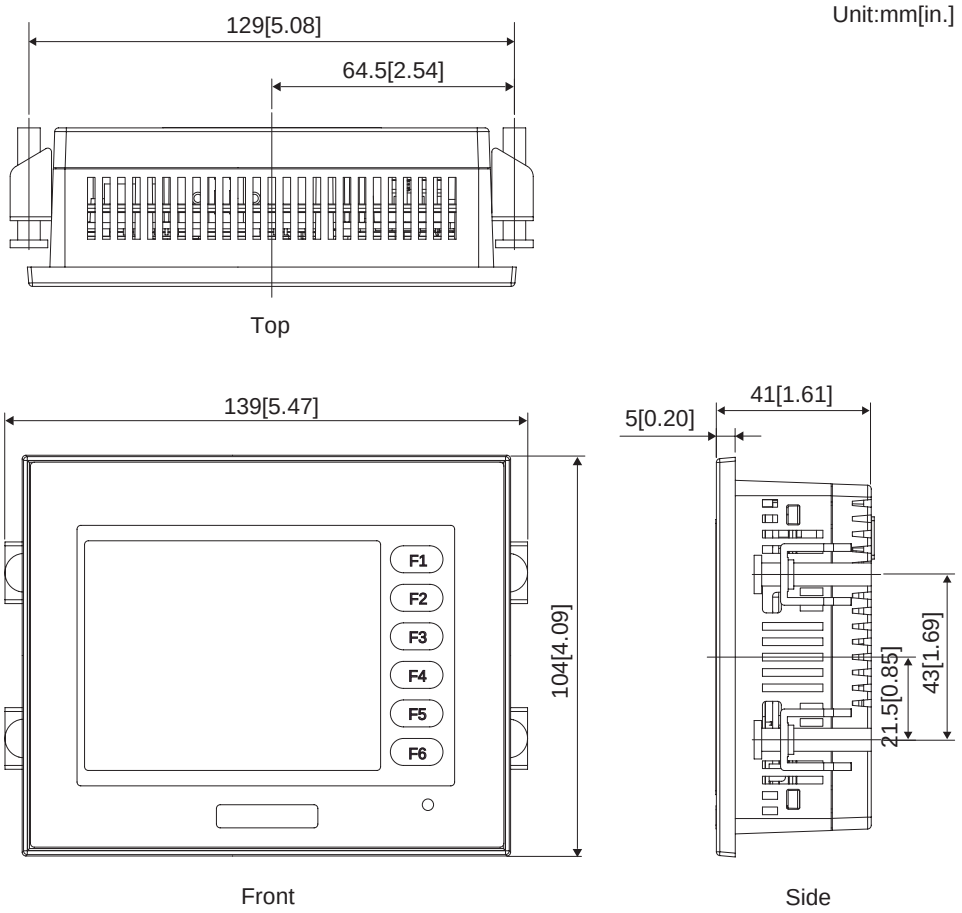
Rear

2 Dimensions

The ST unit dimensions are follows.



The following drawing shows the ST unit with installation fasteners.

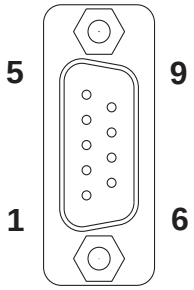


3 Interfaces

■ST400-AG41-24V

◆Serial Interface

RS-422 Interface (X)

Pin Connection	Pin No.	Signal	Signal Name	Direction
	1	RDA	Receive data A	Input
	2	RDB	Receive data B	Input
	3	SDA	Send data A	Output
	4	ERA	Enable receive A	Output
	5	GND	Ground	-
	6	CSB	Clear send B	Input
	7	SDB	Send data A	Output
	8	CSA	Clear send A	Input
	9	ERB	Enable receive B	Output

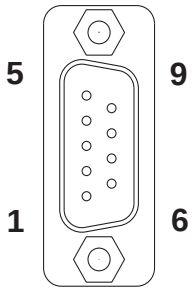
Recommended Connector : Dsub 9 pin socket-type XM2D-0901 <made by OMRON Corp.>
Recommended Cover : Dsub 9 pin cover XM2S-0913 <made by OMRON Corp.>

Note:
- Use inch-type screws (#4-40UNC) as set screws.
- This unit does is not equipped internally with termination resistance. Attach termination resistance to the cable.

■ST401-AG41-24V

◆Serial Interface

RS-232 Interface (Y)

Pin Connection	Pin No.	Signal	Signal Name	Direction
	1	CD	Carrier detect	Input
	2	RD	Receive data	Input
	3	SD	Send data	Output
	4	ER	Enable receive	Output
	5	GND	Ground	-
	6	RD	Data set ready	Input
	7	RS	Request send	Output
	8	CS	Clear send	Input
	9	RI	Ring indicate	Input

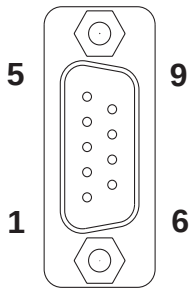
Recommended Connector : Dsub 9 pin socket-type XM2D-0901 <made by OMRON Corp.>
Recommended Cover : Dsub 9 pin cover XM2S-0913 <made by OMRON Corp.>

Note:
- Use inch-type screws (#4-40UNC) as set screws.

■ST402-AG41-24V

◆Serial Interface

RS-485(MPI) Interface (X)

Pin Connection	Pin No.	Signal	Signal Name	Direction
	1	NC	No connection	-
	2	NC	No connection	-
	3	LINE(+)	Line (+)	In/Output
	4	RTS	Request Send	Output
	5	GND	Ground	-
	6	5V	5V External Output*1	Output
	7	NC	No connection	-
	8	LINE(-)	Line (-)	In/Output
	9	NC	No connection	-

**1 When providing power via the Seimens Co.'s Profibus connector, power cannot be connected to the Device/PLC.*

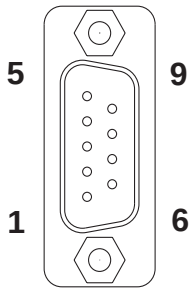
Recommended Connector : Dsub 9 pin pin-type XM2A-0901 <made by OMRON Corp.>
Recommended Cover : Dsub 9 pin cover XM2S-0913 <made by OMRON Corp.>

Note:

- When using an MPI interface, the Seimens Co.'s Profibus connector can be used.
- Use inch-type screws (#4-40UNC) as set screws.
- This unit does is not equipped internally with termination resistance. Attach termination resistance to the cable.

◆Expansion Serial Interface

RS-422 Interface (Y)

Pin Connection	Pin No.	Signal	Signal Name	Direction
	1	RDA	Receive data A	Input
	2	RDB	Receive data B	Input
	3	SDA	Send data A	Output
	4	ERA	Enable receive A	Output
	5	GND	Ground	-
	6	CSB	Clear send B	Input
	7	SDB	Send data A	Output
	8	CSA	Clear send A	Input
	9	ERB	Enable receive B	Output

Recommended Connector : Dsub 9 pin socket-type XM2D-0901 <made by OMRON Corp.>
Recommended Cover : Dsub 9 pin cover XM2S-0913 <made by OMRON Corp.>

Note:

- Use inch-type screws (#4-40UNC) as set screws.
- This unit does is not equipped internally with termination resistance. Attach termination resistance to the cable.

4 Installation

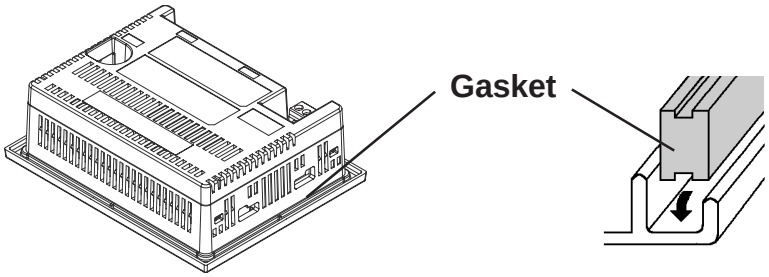
■ Confirm the Installation Gasket's Positioning

It is strongly recommended that you use the gasket. It absorbs vibration in addition to repelling water.

Place the ST on a level surface with the display panel facing downward. Check that the ST's installation gasket is seated securely into the gasket's groove, which runs around the perimeter of the panel's frame.

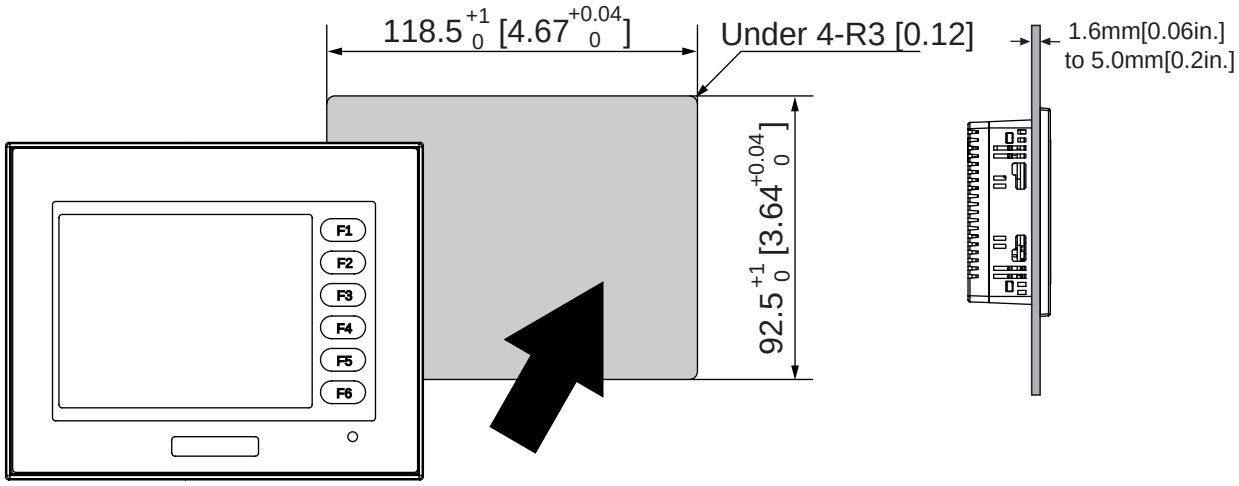
Important

- Before installing the ST into a cabinet or panel, check that the installation gasket is securely attached to the unit.
- A gasket which has been used for a long period of time may have scratches or dirt on it, and could have lost much of its dust and drip resistance. Be sure to change the gasket periodically (or when scratches or dirt become visible).
- Be sure the gasket's seam is not inserted into any of the unit's corners, only in the straight sections of the groove. Inserting it into a corner may lead to its eventually tearing.
- To ensure the installation gasket's maximum level of moisture resistance, be sure the gasket's seam is inserted as shown into the panel's bottom face.



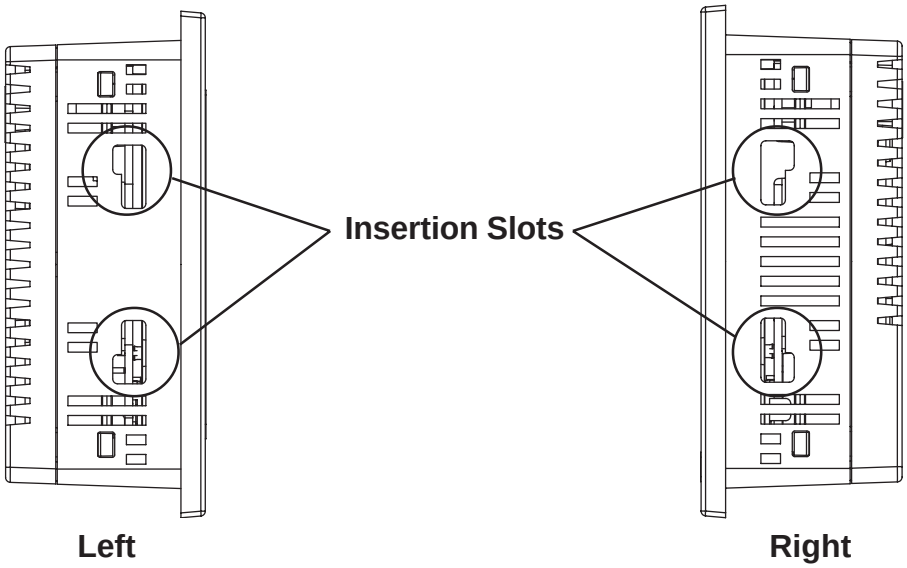
■ Create a Panel Cut and insert the ST into the panel from the front

Unit:mm[in.]

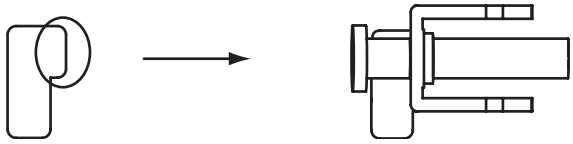


■ Attach the Installation Fasteners from Inside the Panel

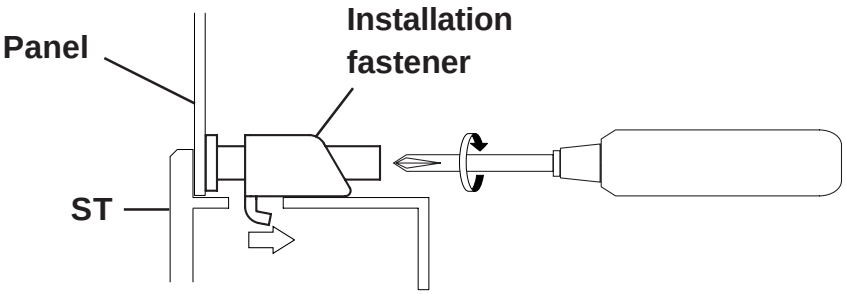
1. Refer to the following drawing when inserting installation fastener hooks in the ST unit's right side (2) and left side (2) installation fastener holes.



Important: As shown in the following figure, attach the Installation Fastener in the right position. If not, the ST unit may be drop out.



2. Insert each fastener's hook into the installation fastener hole and tighten it with a screwdriver.



Important:
- Tightening the screws with too much force can damage the ST's plastic case.
- The necessary torque is 0.5 N•m.

Note: Installation fasteners are sold by your local ST distributor.

5 Wiring

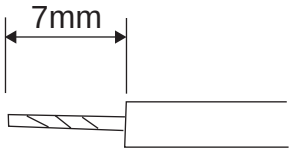
⚠ WARNINGS

- *To avoid an electric shock, prior to connecting the ST's power cord confirm that the ST's power supply is completely turned OFF, via a breaker, or similar unit.*
- *The ST400-AG41-24V/ST401-AG41-24V/ST402-AG41-24V units are designed to use only DC24V input. Any other power level can damage both the ST and the power supply.*
- *Since there is no power switch on the ST unit, be sure to attach a breaker-type switch to its power cord.*
- *When the FG terminal is connected, be sure the cord is grounded.*
- *If the power cord is pulled strongly, the power plug may fall out.*

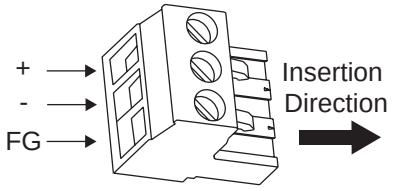
Important

- When the FG terminal is connected, be sure the wire is grounded. Not grounding the ST unit will result in excess noise and vibration.

■Power Cord Specifications

Power Cord Diameter	0.2 to 2.5 mm^2 (0.0001 to 0.0097 $inch^2$) (24 – 12 AWG)
Conductor Type	Simple or Stranded Wire
Conductor Length	

■Power Plug Specifications



+	24V
-	0V
FG	Grounding Terminal connected to the ST chassis

Note:

- The power cord should be equivalent to the specification shown above. Be sure to twist the power cords together, up to the power plug. (See illustration on next page)
- Recommended power plug is Phoenix Contact Co.'s MSTB2,5/3-ST-5,08.

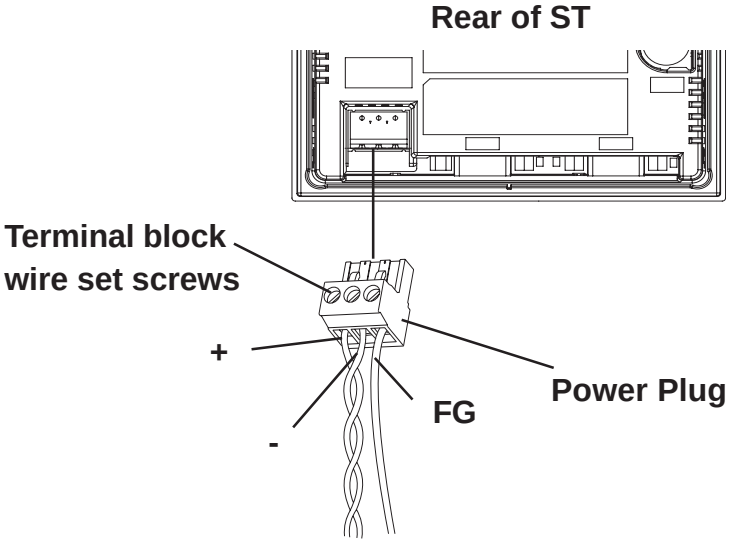
■ Connecting the ST Power Cord

When connecting the power cord, be sure to follow the procedures given below.

1. Confirm that the ST's power cord is unplugged from the power supply.
2. Remove the power plug from the ST unit.
3. Remove the vinyl cover of each of the power cord's wires and insert each wire into the power plug's wire hole.
4. Replace the power plug.

Note:

- Use a flat screwdriver (Size 0.6 x 3.5) to tighten the terminal block wire set screws. The torque required to tighten these screws is 0.5 to 0.6 N•m.
- Do not solder the wire itself.



6 Power Supply Cautions

Please pay special attention to the following instructions when connecting the power cord. Use the power plug and connects to the ST power connector.

- Between the line and the ground, be sure to use a low-noise power supply.
- Input and Output signal lines must be separated from all power control cables used for operational circuits.
- To increase noise resistance, be sure to twist the ends of the power cord wires before connecting them to the ST power connector.
- The ST's power supply cord should not be bundled with or kept close to main circuit lines (high voltage, high current), or input/output signal lines.
- Connect a surge absorber to handle power surges.
- To reduce noise, make the power cord as short as possible.

7 Grounding Cautions

- When attaching a wire to the ST's rear face FG terminal, (on the Power Input Terminal Block), be sure to create an exclusive ground.*1
- The FG terminal and the ST's internal 0V power are connected. Be sure to confirm that this type of connection is allowed in your current system.

8 Input/Output Signal Line Cautions

- All ST Input and Output signal lines must be separated from all operating circuit (power) cords.
- If this is not possible, use a shielded cord and ground the shield.

9 Maintenance and Periodic Inspection

When dirt collects on the surface or the frame of the display, soak a soft cloth in water with a neutral detergent, wiring the cloth tightly, and wipe the display.

Important

- Do not use paint thinner, organic solvents, or strong acid compounds to clean the unit.
- *Do not use hard or pointed objects to operate the touch-screen panel, since it can damage the panel surface.*

10 Backlight

- The ST unit's backlights cannot be replaced by the customer. When the backlights need to be replaced, please contact your local ST distributor.

***1** *Use a grounding resistance of 100Ω, a cord diameter should be 0.2 to 2.5 mm^2 (0.0001 to 0.0097 inch^2), or your country's applicable standard.*

Note

Be aware that the Digital Electronics Corporation shall not be held liable for any real or estimated damages or losses, or third party claims resulting from the use of this product.

©2003 Digital Electronics Corporation

Memo