YAMATAKE

CM2-ATT100-2001

ThermoPLUS
Smart Temperature Transmitter
(Remote Type)
Model ATT60/70
Operation Manual

Yamatake Corporation

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Preface

Thank you for purchasing the Yamatake's ThermoPLUS, the Smart Temperature Transmitter. ThermoPLUS is a highly reliable, next generaion of advanced transmitter for general use. It has been developed based on our extensive experience and field record. ThermoPLUS suites a wide range of applications and is easy-to-use in on-site operation.

Unpacking and Inspection

Unpacking

This product is a precision instrument and should be handled with care to prevent damage or breakage.
After unpacking the product, verify that the following items are included:

- ThermoPLUS Smart Temperature Transmitter
- 2 pressure-tight packings, 2 washers and 2 elbows
- 1 hexagonal wrench key
- 2-inch piple mounting bracket (optional)
- Operation manual

Verifying specifications

The specifications of your ThermoPLUS are written on its attached identification plate. Compare these specifications with those listed in the Appendix, and verify that all specifications on the plate are correct, paying special attention to the following:

- Basic model number
- Product number
- Power supply
- Output/communications
- Contact input/output

Inquiries

If you have any questions regarding the specifications of your ThermoPLUS, contact your nearest Yamatake representative. When making an inquiry, be sure to provide the model number and product number of the product.

Storage precautions

When storing ThermoPLUS before use, observe these precautions:

- Store it indoors at room temperature (77°F or 25°C) and humidity (65%), in a place safe from vibration or shock.
- Store it in the same condition as it was shipped.

When storing the product after use, follow these steps:

1. Rinse the inside of the transmitter with water to eliminate residual fluids, then allow it to dry.
2. Firmly attach the terminal box cover and the electrode cover in order to keep out the moisture.
3. Replace the transmitter in its original packaging.
4. Store the transmitter indoors at room temperature and humidity (65%), in a place safe from vibration or shock.

Safety Precautions

Introduction

Correct installation, correct operation and regular maintenance are essential to ensure safety during the use of this device. Do not try to install or operate the device before reading and understanding the safety precautions described in this manual. Be sure to follow the instructions, operation and maintenance

Safety Standard

The safety instructions presented in this operation manual conforms to ANSI (American National Standards Institute) Z535-4. Two kinds of safety precautions are used in this manual - Waring and Cautions. The meanings of these terms are as follows:

⚠ Warning Potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ Caution Failure to observe these precautions may produce dangerous conditions that could result in injury to the user or in physical damage.

General Precautions

- Turn OFF the power switch before any wiring work.
- Be sure that the product conforms to the specifications. If the range is inappropriate, excessive temperature may be generated, causing damage to the device.
- Do not use a transceiver (including cellular phones) within the area of 7 feet (2 meters) around this product or its connecting cables. Doing so may result in malfunctioning of the product.
- Check wiring carefully for mistakes. Wrong connections may result in product failure.
- Be sure that, while clamping a terminal, the other wire(s) do not touch the adjacent terminals.
- If something goes wrong with this procuct, its electrical output may become abnormal, causing an abnormal response. If product safety could be impaired in such a situation, this product should be used with appropriate consideration given to fail-safe design, including separation of the controller from the limiter, use of a duplex system and redundancy design.
- After the wires have been connected, be sure to close the terminal box cover and tighten the set-screws that hold the housing in place. The cover must be locked for an explosion-proof specification.

About Explosion-proof Models

Pressure-resistant Explosion-proof Housing

- Explosion-proof ATT (Advanced Temperature Transmitter) has a pressure-resistant explosion-proof housing. Handling an explosion-proof model requires special care. Be sure to read and understand all the applicable Explosion-proof codes and regulations of respective Approval Body before use.

- The completely sealed housing is designed to withstand the pressure that may result from an explosion of an explosive gas INSIDE the housing. This housing may prevent combusiton of any explosive gas OUTSIDE.

Applicable Installations

- Always use the explosion-proof unit in applicable condition and in applicable location. Failure to satisfy any of these requirements will destroy the designed explosion-proof characteristics of the transmitter. When wiring, follow all the applicable codes for explosion-proof and intrinsically safe system applicaitons.

- Attach only the supplied pressure-tight accesories to the signal-wire exit. If necessaty, change the wiring direction and use the albow (supplied). No other elbow may be used to ensure the designed explosion-proof characteristic.

- When handling explosion-proof unit, prevent corrosion, deformation or damage to its housing or cover. When installing the cover, completely tighten the hexagon socket set screw to lock. NEVER open the cover while the unit is in operation.

NOTES

Table of Contents

1. Overview of Product

1.1 Overview of ThermoPLUS Transmitter

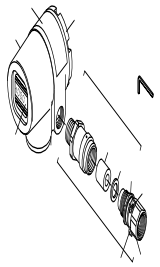
The ThermoPLUS Smart Temperature Transmitter is a temperature transmitter with a built-in microprocessor. It accepts various types of thermocouple (T/C), resistance temperature detector (RTD), or voltage signals, and coverts them to and outputs a signal of 4-20 mA DC or digital DE.

1.2 Types of ThermoPLUS Transmitter

ThermoPLUS Transmitters come in two types: the temperature-sensor-remote type and the temperature-sensor-integral type. Each type is further classified into water-proof and explosion-proof, with a total of four different types. This operation manual is intended for both the water-proof and explosion-proof types of the temperature-sensor-remote transmitter. For the temperature-sensor-integral type, see the operation manual “ThermoPLUS Smart Temperature Transmitter 2-Wire Temperature Transmitter (Integral Type)” (CM2-ATT110-2001).

1.3 ThermoPLUS Data Settings

A Smart Field Communicator (referred to as “SFC”), available separately, is used to adjust or set data for ThermoPLUS. The SFC can operate from anywhere on a DC 4-20 mA signal line as long as the wiring distance between ThermoPLUS and the SFC is 1,500 meters (1,640 yard) or less. For details, see the operation manual for the SFC (CM2-SFC100-2001).



Smart Field Communicator (sold separately)

1.4 Names of ThermoPLUS Parts

Description of parts

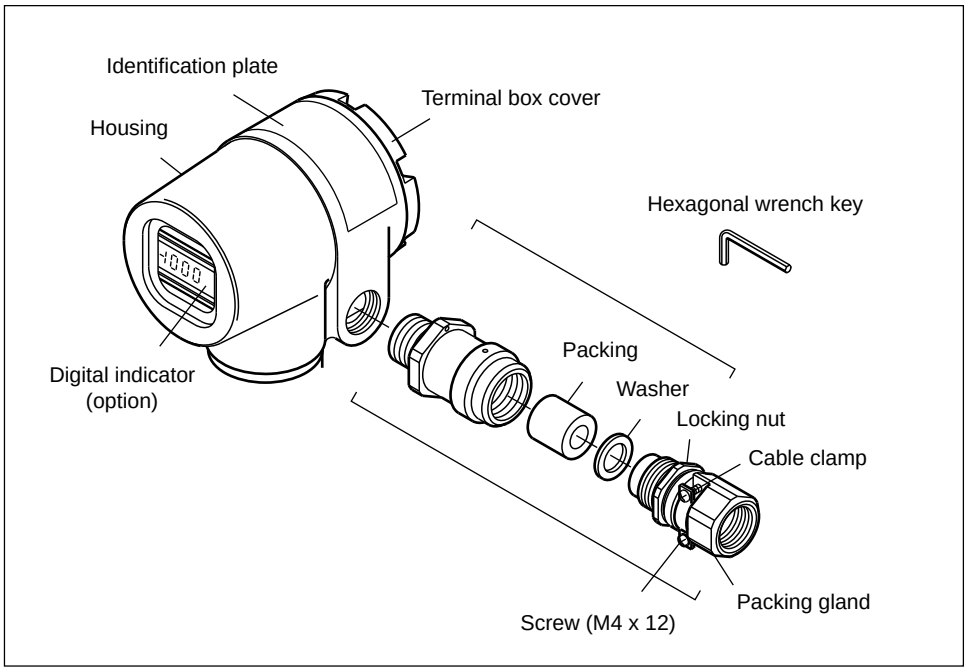


Figure 1-1 General view (front view)

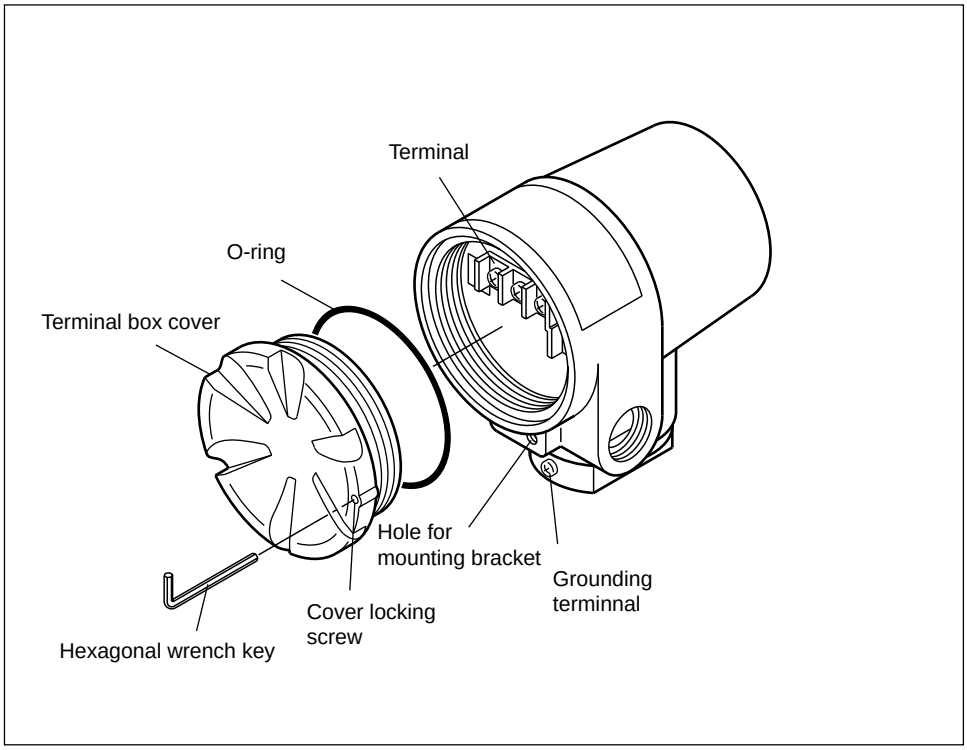


Figure 1-2 General view (rear view)

Description of parts (continued)

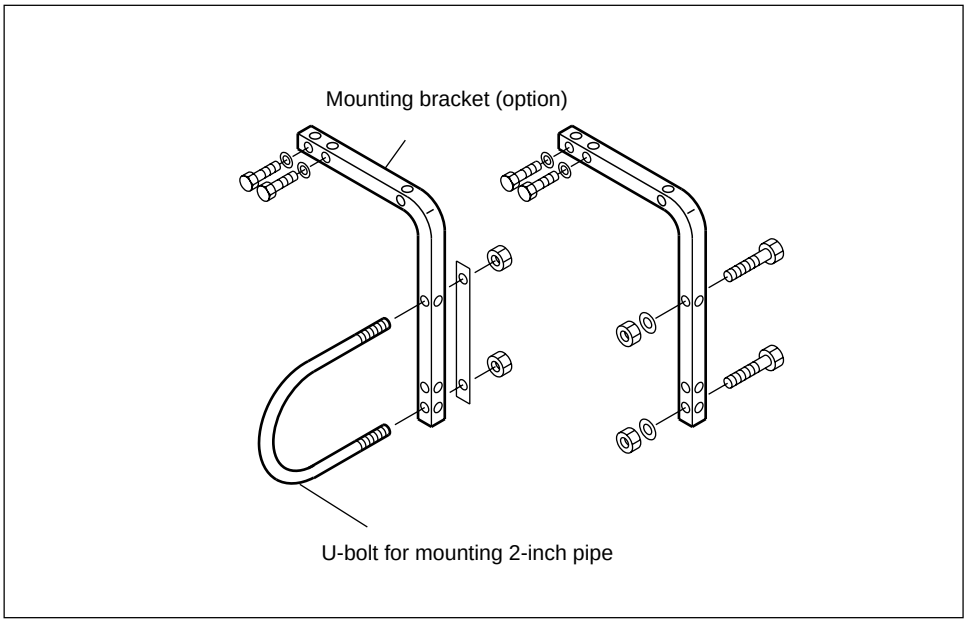


Figure 1-3 Mounting Bracket (optional)

2. Installation and Wiring

Safety Precautions

⚠ CAUTION

- After the transmitter is installed, do not use it as a foothold or for other improper uses. Doing so may cause damage to the product and personal injury.
- Hitting the glass portion of the indicator with a tool may break the glass and cause personal injury. Caution must be exercised with products equipped with digital indicators.
- The heat of the process fluid and/or the heat radiated from the piping may raise the surface temperature of the transmitter very high. Exercise caution.

Installation Precautions

- Do not use the transmitter under any operating conditions other than those described in the product specifications (i.e., rated pressure, connection standard, rated temperature, rated vibration, and rated humidity). Using this product under incorrect operating conditions may cause damage to the product and leakage that could lead to a major accident.
- Wiring work in hazardous areas should be performed carefully by following the work methods specified in the explosion-protection guidelines.
- Provide good grounding to the transmitter. If it is not grounded or grounding is inadequate, output error will occur. Not grounding the transmitter is a violation of regulations. Be careful of your footing during installation. Always wear safety shoes.
- This product must be installed on a 2-inch pipe using the mounting bracket (optional part).

Wiring Precautions

⚠ CAUTION

- Performing wire work with wet hands or with the power connected may result in electric shock to personnel. Perform wiring work with dry hands, always wear gloves and be sure to disconnect the power to the product before performing work.
- Perform the wiring work correctly while carefully checking the specifications. Incorrect wiring will cause a damage or malfunction to the product.
- Use the power supply properly, based on the specifications. Connecting a different power supply will cause a damage to the product.
- This product is designed based on a two-wire wiring system. The power supply line also functions as a signal line. The wires are routed through the conduit hole on the side face of the transmitter and connected to the terminals. The conduit connection is potted with a sealing agent or by fitting a sealing plug, so that water cannot leak into the transmitter unit. The wires to be connected to the terminals must be drawn in from below the position where the connection port is located.
- Grounding wire
  The transmitter has two grounding terminals: one at the terminal and the other on the outside face. Either terminal can be used for grounding. The grounding terminal must be connected to a class D ground (grounding resistance 100 Ω or less) or better ground.

- If installing your ThermoPLUS according to the explosion-proof specifications, observe the restrictions specific to the explosion-proof equipment. The wiring method for the explosion-proof device is described in Section 2.6, “Wiring for Explosion-Proof Specifications.” In this case, also refer to respective applicable Approval Body for details.

⚠ WARNING

- Turn OFF the power supply before wiring work to prevent the electric shock from occurring.
- Be sure to follow all the regulations of respective Explosion-Proof Approval Body applicable.
- Use only the supplied pressure-tight accessories for installing an explosion-proof unit. Close the terminal box cober completely and tighten the packing unit securely. Never open the housing cover while the unit is in operation.

2.1 Overview

There are two product lines of ThermoPLUS; the temperature-sensor-remote type and the temperature-sensor-integral type. The transmitter you have purchased is the temperature-sensor-remote type and the converter is typically installed separately from the temperature-sensor. The seperate type can be connected to a temperature-sensor, in which case it no longer conforms to the JIS explosion-proof structure for the integral type, thus respective codes and regulations of your applicable Approval Body should be thoroughly followed. If your ThermoPLUS is to be attached to a temperature-sensor element, be sure to install it properly by reading and following the operation manual for the temperature-sensor-integral converter type (CM2-ATT110-2001).

2.2 Installation Environment

(1) Ambient temperature

Exercise extra caution if you are installing your ThermoPLUS at a location that is subject to large temperature fluctuation. To minimize the effects of heat radiated through the process, take mesruers as needed; such as using a radiator or air purging.

Note that when you use the temperature-sensor-integral type, even more heat will be felt.

The explosion-proof specifications stipulate the operating temperature (ambient temperature of the temperature-sensor section, for explosion-proof purposes separately from the temperature-sensor's heat-resistant temperature.

(2) Ambient atmosphere

If the transmitter is installed at a location where there may be a corrosive gas, protect the ThermoPLUS from the possible gas corrosion for the temperature-sensor elements. Select a corrosion-proof material that is appropriate to the actual fluid subject to measurement. If an inappropriate material is used, fluid may flow inside the converter, resulting in damage not only to the temperature sensor but also to the converter itself.

Continued

Continued

(3) Vibration and shock

Using ThermoPLUS in an environment subject to constant, excessive vibration is not recommended. However, if it is unavoidable, take necessary measures to minimize the vibration. Carefully examine the vibration factors, especially when using the transmitter with the temperature-sensor attached. Vibration may cause damage to the temperature-sesing element as well as the converter unit itself. For details of the effect of vibration on the temperature-sensing element, see the specifications of the sensor.

(4) Noise

Your ThermoPLUS has been tested and verified to be immune to high-frequency noise that is typical to field transceivers. However, due to the recent rapid proliferation of cellular phones, some of the models have not been tested for their effects. If such device is to be used near the ThermoPLUS, make sure that the device has no effect on the ThermoPLUS.

(5) Insulation resistance and voltage-withstand tests

Your ThermoPLUS has a built-in lightning arrester. When testing its insulation resistance and withstand voltage, exercise caution, because excessive electricity may deteriorate the arrester performance and internal damage may result. If these tests are necessary, be sure to follow the procedure provided in Section 2.7 “Insulation-Reisitance and Voltage-Withstand Tests.”

(6) Others

Install your ThermoPLUS in an area where adequate space is available for disassembly and maintenance.

2.3 Installing the Transmitter Using the Mounting Brackets

Mounting brackets are supplied with the ThermoPLUS as optional accessories. For additional mounting hardware, refer to Section 5.1, “Spare Parts.” With the mounting bracket, the ThermoPLUS can be installed on a 2-inch pipe as well.

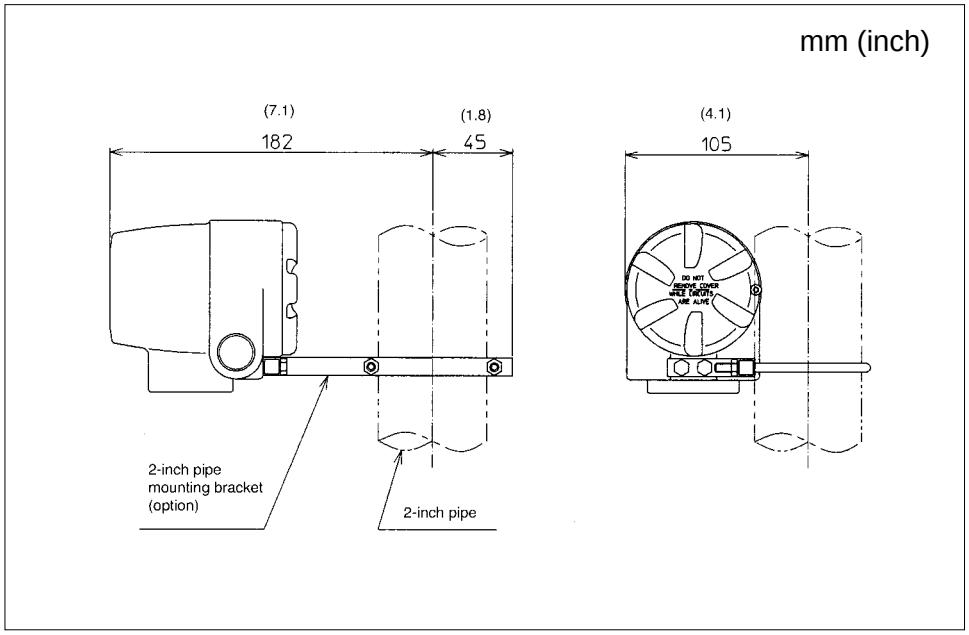


Figure 2-1 Mounting Brackets

2.4 Wiring

Use DC power and see ThermoPLUS's Specification sheet for the relationship between power supply and load resistance. Terminal connections are shown in Figures 2-2 and 2-3.
For the wiring cable, use vinyl-insulated vinyl sheath cable for control CVV (JIS C3401) or higher quality. The cable may be affected by electromagnetic induction if there is a high-voltage motor or transformer near the transmitter. If this is the case, use a shielded cable and place the transmitter as far away from the noise source as possible. If the transmitter is used in an environment where the ambient temperature becomes high or corrosion may occur, use a vinyl-sheath cable with high heat or corrosion resistance. If an inappropriate cable is used, the transmitter's reliability and explosion-proof performance will be adversely affected.
For grounding, use a 600-V vinyl-insulated cable and perform class D grounding work (grounding resistance 100 Ω or less).
For the wiring from the temperature sensor, use the cable dedicated to the temperature-sensor. Use a compensation lead wire for a thermocouple temperature sensor, and a 3-core cable for a thermoresistance temperature sensor.
(Note: Check the temperature specifications of the cable that is used to connect the temperature sensor. If its heat resistance is less than the maximum value of the ambient temperature, the explosion resistance may be compromised.)

Table 2-1 Terminal numbers

Terminal numbers	RTD	TC	Remarks
1	A	N/A	
2	B	-	Voltage (-)
3	B	+	Voltage (+)
4	Power supply (+)		DC 24 V or
5	Power supply (-)		connected to the distributor
6	GND		
7	Burn-out		without short bar:Downscale
8			with short bar: Upscale

Figure 2-2 Terminal connection diagram (input wiring)

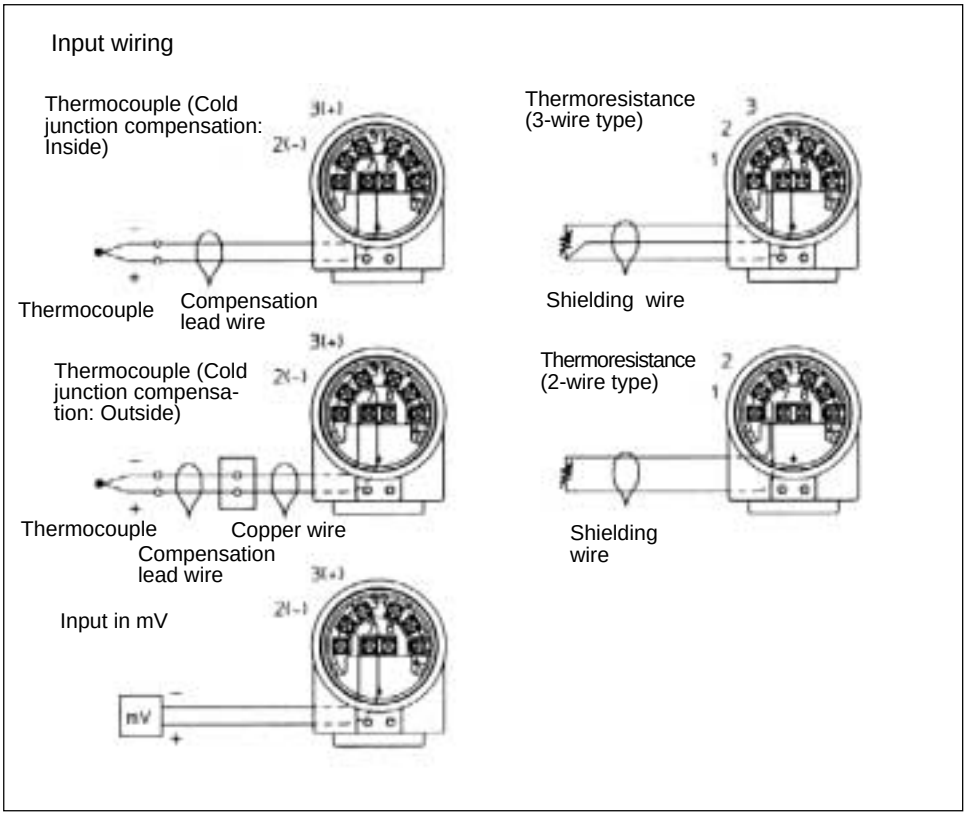
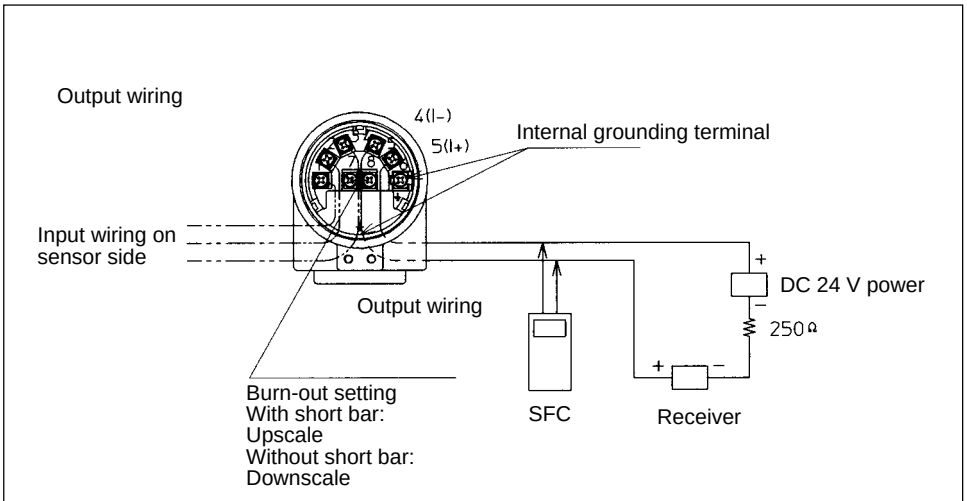


Figure 2-3 Terminal connection diagram (Output Wiring and Burn-out Setting)



Note: The size of the terminal screw is M4.

2.5 Burn-out Setting

As shown in Figure 2-3, “Terminal Connection Diagram (Output Wiring) and Burn-out Setting,” the burn-out setting depends on whether or not a short bar is installed on the terminal. If the transmitter is used with the short-circuit board installed, burn-out upscale (upscale output in the event of an error) takes effect; otherwise, burn-out downscale (downscale output in the event of an error) takes effect.
The product is shipped as either U (upscale) or D (downscale) according to the burn-out direction you specified as an option at the time of ordering. Verify the burn-out setting before using the transmitter.

Table 2-2 Burn-out setting

Short bar	Burn-out	Output in the event of error
Used	Upscale	≥DC20.8mA DC
Not used	Downscale	≤DC3.8mA DC

2.6 Wiring for Explosion-Proof Specifications

- JIS explosion-proof specifications employed in your ThermoPLUS are based on the explosion-proof standard that was stipulated as part of the technical standards revised in February 1997 (international conformity with IEC79). The explosion-proof performance stipulated in this standard can be achieved by combining ThermoPLUS with a pressure-tight packing-type cable ground (optional). Be sure to use the specified pressure-tight packing-type cable ground when wiring for explosion-proof specifications.
- For other types of explosion-proof specifications, follow the regulations, and guidelines stipulated by respective Explosion Approval Body.

2.7 Insulation-Resistance and Voltage-Withstand Tests

Precautions

Generally, insulation-resistance and voltage-withstand tests should not be necessary. If these tests are conducted, the built-in varistor for surge voltage absorption may be damaged. If these tests are absolutely necessary due to unavoidable circumstances, they must be conducted carefully by following the specified test procedures.

Test Procedure

1. Remove the external wires from the ThermoPLUS.

2. Short-circuit the + and – SUPPLY terminals.

3. Conduct the tests between these short-circuited terminals and the ground terminals.

4. Voltage to be applied and judgment criteria are shown as follows. To prevent damage to the product, voltages higher than the voltage values shown must not be applied.

Judgment Criteria

Voltage to be applied and judgment criteria are as follows.

Test	Judgment criteria
Insulation-resistance test	More than 2 x 10^7 Ω at an applied voltage of 25 VDC (25°C±5°C, less than 60% RH
Voltage-withstand test	50 VAC, 1 minute, current set at 2 mA

3. Operations and Settings

3.1 SFC

SFC is a very convenient tool that enables the user to communicate with the ThermoPLUS Transmitter and remotely operate and set internal data. SFC can adjust the ThermoPLUS or set its data from anywhere on a DC 4-20 mA signal line, as long as the wiring distance between ThermoPLUS and the SFC is 1,640 yard (1,500 meters) or less. For details about SFC, see the SFC operation manual (CM2-SFC100-2001).

SFC can display or change any of the transmitter values or status listed as follows. Such display or modification can be performed even during measuring operation.

3.2 Features of the SFC

Table 3-1 ThermoPLUS-specific features

√: Available, -: Unavailable

Item	Display	Modification	Details
Input selection	√	√	3.5.1
Cold junction (internal, external)	√	√	3.5.2
External cold junction temperature	√	√	3.5.3
Burn-out	√	√	3.5.4
Thermocouple disconnection diagnosis	√	√	3.5.5
Internal linearization processing	√	√	3.5.6
Displaying the maximum and minimum input values	√	–	3.5.7
Displaying the internal cold junction temperature	√	–	3.5.8
LRL	√	–	----

Table 3-2 Common features

√: Available, -: Unavailable

Item	Display	Modification	Details
Entering the tag number	√	√	3.6.1
Displaying the input temperature (units of measurement)	√	–	3.6.2
Displaying the transmitted output (%)	√	–	3.6.3
Lower-Range value for range setting	√	√	3.6.4
Upper-Range value for range setting	√	√	3.6.4
Span of range setting	√	*	3.6.4
Units of measuremen	√	√	3.6.5
Dumping time constant	√	√	3.6.6
Software version	√	–	3.6.7
Printing function	–	–	3.6.8
Maintenance printing	–	–	3.6.9
Action printing	–	–	3.6.10
URL	√	–	–
Output format (analog/digital)	√	√	3.6.11

*: This information cannot be changed directly, but a change is made as a result of setting LRV or URV.

3.3 Names of the SFC Components

Names of Components

The following figure shows the structure of the SFC and the names of its parts. The model shown here (SFC260) has the printer unit.

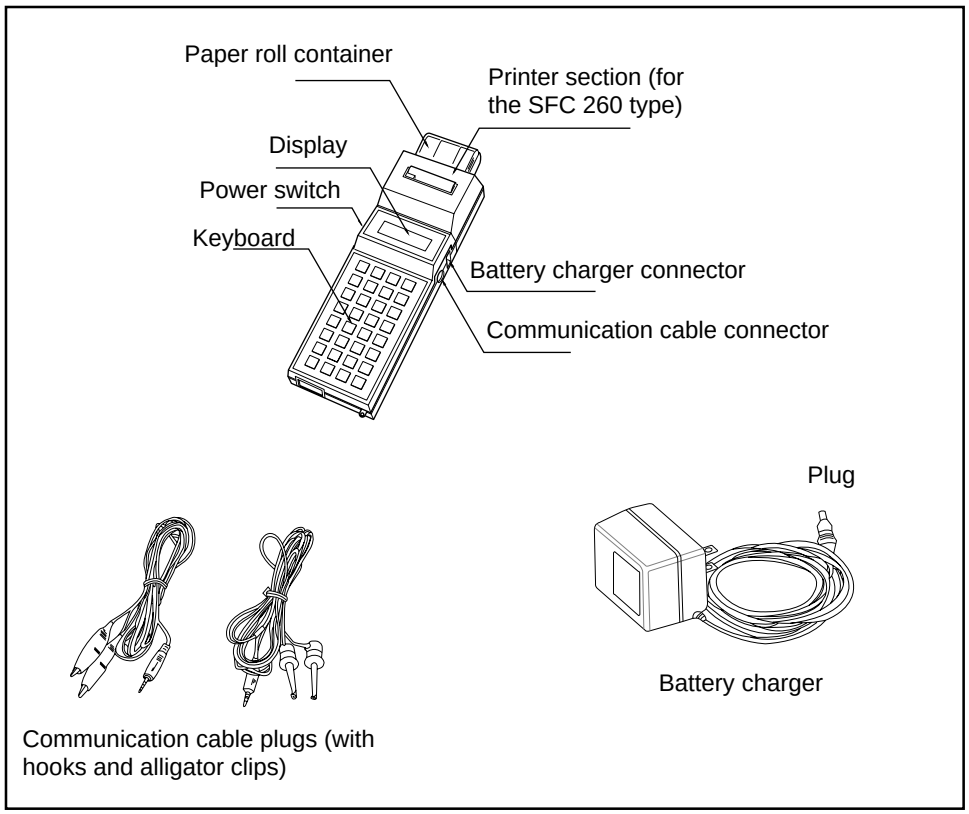


Figure 3-1 Names of the SFC components

SFC Keyboard

The following figure shows the keyboard of the SFC.

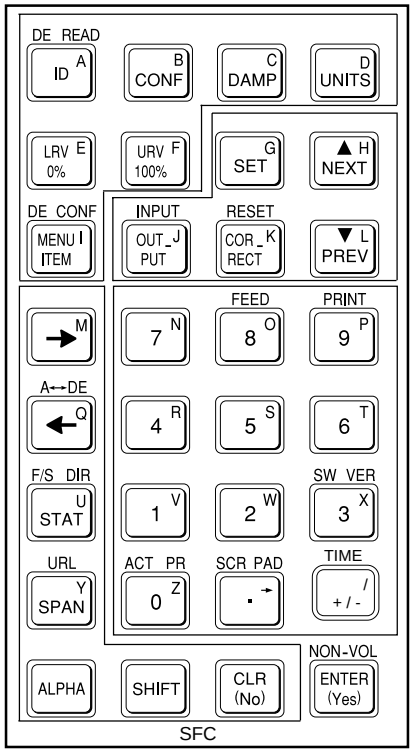
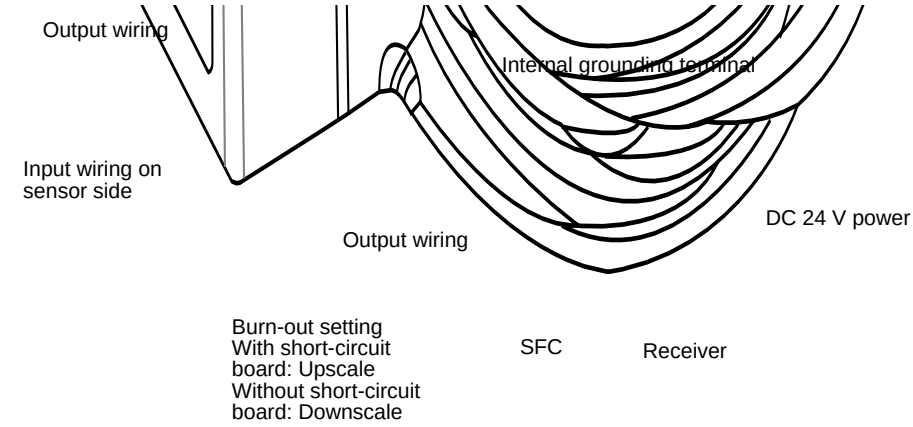


Figure 3-2 SFC Keyboard

3.4 Connecting the SFC

3.4.1 How to Connect the SFC

Connect SFC as shown in figure 3-3 before use.



Note: The size of the terminal screw is M4.

Figure 3-3 Connecting the SFC

⚠ Warning

After the SFC is connected as shown above, turn on the power switch. When using the SFC for setting or checking during startup, place the control loop connected to the transmitter in the manual control mode; otherwise, a dangerous operational condition may occur.
If the ThermoPLUS Transmitter is operated with its housing cover open, it is no longer considered explosion-proof equipment. Operate your ThermoPLUS with the cover open only in a safe place in a non-explosion-proof area.

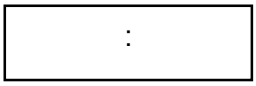
How to Interact with the SFC Screen

The SFC can be operated interactively. To operate the SFC in an interactive manner, observe the following instructions:

- To respond “Yes” to a question on the screen, press the NON-VOL ENTER (Yes) key. Pressing the NON-VOL ENTER (Yes) key on the special function screen will bring you to the next level in the communication hierarchy.
- To respond “No” to a question, press the CLR (No) key. Pressing the CLR (No) key on the special-function screen brings you back to the previous level in the communication hierarchy. Pressing and holding down the CLR (No) key returns you to the initial screen.
- When selecting a different function in the same hierarchy, press either the ▲ NEXT key or the ▼ PREV key.

Caution

If a “:” mark shown below appears in the eighth digit at the top of the SFC screen, immediately discontinue operation of the SFC and recharge its battery. If you ignore this mark and continue operation, the battery will continue to discharge, become damaged, and cannot be recharged.



3.4.2 Starting Communication

⚠ Warning

- Before starting communication with the transmitter form the SFC, switch over the process-control loop to manual control.
- If communication with the transmitter begins while the process-control loop is still in the auto control mode, abrupt changes in output may occur, creating an unstable operating environment.

Procedure

Start communicating with Thermones by operating the SFC as follows:

Step	Description	SFC screen
1	Check to make sure that the ThermoPLUS is turned on. If its power switch is off, turn it on.	
2	Check to make sure that the signal lines of the ThermoPLUS and SFC are correctly wired.	
3	Turn on the power switch of the SFC. The SFC performs a self-diagnosis and displays the message shown to the right. This message requests the user to take an appropriate action so that the host control system is not directly affected by the fluctuation of ThermoPLUS output that may be caused by communication between the SFC and ThermoPLUS. Take special care when using an analog output system. Press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL?
4	The message to the right is displayed.	PRESS ID

Procedure
(continued)

Step	Description	SFC screen
5-1	Analog specifications: Press the DE READ ID A key. When this step is completed, the ThermoPLUS and the SFC are connected and other communication-related information can be set.	TAG No. WORKING... ATT TAG No. ATT XXXXXXXX
5-2	Digital specifications: Press the SHIFT key and then press the DE READ ID A key. When this step is completed, the communication between ThermoPLUS and the SFC are established and is ready for further communication. Tag number, xxxxxxxx (8 digits) will appear unless default tag number setting was done prior to shipment. To enter the tag number, refer to 3.6.1 “Displaying and Changing the Tag Number.”	SHIFT- DE XMTR WORKING... XX % ATT DE TAG No. ATT DE XXXXXXXX
6	Press the CLR (No) key. When the message to the right is displayed, the SFC can be disconnected from the ThermoPLUS.	ATT XXXXXXXX READY...

Note: For use of SFC prior to version 7.8; please do not be alarmed if “STT” appears in stead of “ATT”, after step 5. “STT” is Yamakate’s former model of temperature transmitter, and should be regarded as same as “ATT.”

3.5 ThermoPLUS-Specific Features by Using SFC

3.5.1 Displaying and Changing the Input

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 6 of Section 3.4.2.	ATT XXXXXXXX READY...
2	Press the B CONF key, to display this message.	ATT CONFIG CHANGE CONFIG?
3	Press the NON-VOL ENTER (Yes) key. The ThermoPLUS-specific features are now ready to be set. These features enable the user to change the type of input and set the cold junction, output format, power filter, and detection of thermocouple burn-out. Note that the power filter is not applicable to the ThermoPLUS.	ATT CONFIG PROBE = TYPE J
4	Press the DE CONF MENU ITEM key to select the type of input. (For the thermoresistance input, either Pt100 or JPt100 can be selected.) (For the thermocouple input, Type J, K, T, S, R, E, B, or N can be selected.) (Voltage input is in mV only.)	Thermoresistance input: ATT CONFIG PROBE = Pt100 Thermocouple input: ATT CONFIG PROBE = TYPE J Voltage input: ATT CONFIG PROBE = mV
5	Press the NON-VOL ENTER (Yes) key. The subsequent steps are for exiting the procedure for setting the ThermoPLUS-specific features. These steps are also used when the settings of other ThermoPLUS-specific features are changed.	ATT CONFIG ENTERD IN SFC

Procedure
(continued)

Step	Description	SFC screen
6	Press the NEXT or PREV key until the message to the right is displayed.	ATT CONFIG DOWNLOAD DATA?
7	Press the NON-VOL ENTER (Yes) key. The messages to the right are displayed in this order.	ATT CONFIG WORKING... ATT CONFIG DATA LOADED! ATT CONFIG CHANGE CONFIG?
8	When the setting is completed, press the CLR (No) key. When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT XXXXXXXX READY...

3.5.2 Displaying and Changing the Cold Junction Options

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 3 of Section 3.5.1.	ATT CONFIG PROBE = TYPE J
2	Press the ▲H NEXT key to display this message.	ATT CONFIG CJT IS INTERNAL
3	Press the DE CONF MENU ITEM key and select either internal or external cold junction.	ATT CONFIG CJT IS INTERNAL ATT CONFIG CJT IS EXTERNAL
4	Press the NON-VOL ENTER (Yes) key.	ATT CONFIG ENTERD IN SFC
5	Press the ▲H NEXT or ▼T PREV key until the message to the right is displayed.	ATT CONFIG DOWNLOAD DATA?
6	Press the NON-VOL ENTER (Yes) key. The messages to the right are displayed in this order.	ATT CONFIG WORKING... ATT CONFIG DATA LOADED! ATT CONFIG CHANGE CONFIG?
7	When the setting is completed, press the CLR (No) key. When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT CONFIG READY...

3.5.3 Displaying and Changing the Temperature Input for External Cold Junction

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 3 of Section 3.5.1.	ATT CONFIG PROBE = TYPE J
2	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	ATT CONFIG 0.0000°C ECJT
3	Press numeric keys to set the external cold junction temperature.	ATT CONFIG 0.2000°C ECJT
4	Press the NON-VOL ENTER (Yes) key.	ATT CONFIG ENTERD IN SFC
5	Press the ▼L PREV or ▲H NEXT key until the message to the right is displayed.	ATT CONFIG DOWNLOAD DATA?
6	Press the NON-VOL ENTER (Yes) key. The messages to the right are displayed in this order.	ATT CONFIG WORKING... ATT CONFIG DATA LOADED ATT CONFIG CHANGE CONFIG?
7	When the setting is completed, press the CLR (No) key. When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT XXXXXXXX READY...

3.5.4 Displaying and Changing the Thermocouple Burn-out Setting

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 3 of Section 3.5.1.	ATT CONFIG PROBE = TYPE J
2	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	ATT CONFIG BURN OUT ON
3	Press the DE CONF MENU ITEM key and select whether thermocouple burn-out diagnosis is ON or OFF.	ATT CONFIG BURNOUT ON or ATT CONFIG BURNOUT OFF
4	Press the NON-VOL ENTER (Yes) key .	ATT CONFIG ENTERED IN SFC
5	Press the ▲H NEXT or INPUT OUTPUT key until the message to the right is displayed.	ATT CONFIG DOWNLOADED DATA?
6	Press the NON-VOL ENTER (Yes) key. Messages will be displayed as shown.	ATT CONFIG CHANGE CONFIG? ATT CONFIG WORKING ATT CONFIG CHANGE CONFIG?
7	Press the CLR (No) key when the setting is completed. When this message is displayed, the ThermoPLUS can be disconnected from SFC.	ATT XXXXXXXX READY...

3.5.5 Displaying and Changing the Settings for Internal Linearization Processing

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 3 of Section 3.5.1.	ATT CONFIG PROBE = Pt100
2	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	ATT CONFIG O/P LINEAR
3	Press the DE_CONF MENU ITEM key to select the option for having the ThermoPLUS internally calculate linearization and output the value, or the option for assigning output within the preset range according to the input from the temperature sensor, without internal calculation by the ThermoPLUS.	ATT CONFIG O/P LINEAR
4	Press the NON-VOL ENTER (Yes) key.	ATT CONFIG ENTERD IN SFC
5	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	ATT CONFIG DOWNLOAD DATA?
6	Press the NON-VOL ENTER (Yes) key. The messages to the right are displayed in this order.	ATT CONFIG WORKING... ATT CONFIG DATA LOADED! ATT CONFIG CHANGE CONFIG?
7	When the setting is completed, press the CLR (No) key. When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT XXXXXXXX READY...

3.5.6 Displaying the Maximum and Minimum Input Values

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described in step 3 of Section 3.5.1.	ATT CONFIG CHANGE CONFIG?
2	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	ATT CONFIG READ Hi/Low PV?
3	Press the NON-VOL ENTER (Yes) key to read the maximum and minimum values of temperature stored in the ThermoPLUS. Once this data is read, it is erased and the next maximum and minimum values are stored.	ATT CONFIG WORKING... ATT CONFIG -3.14°C Lo
4	Press the ▲H NEXT or ▼L PREV key.	ATT CONFIG 1 2 4 . 8 9 °C Hi
5	When data has been read, press the ▲H NEXT or ▼L PREV key.	ATT CONFIG EXIT?
6	Press the NON-VOL ENTER (Yes) key. When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT CONFIG READY...

3.5.7 Displaying the Internal Cold Junction Temperature

Procedure

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 3 of Section 3.5.1.	ATT CONFIG CHANGE CONFIG?
2	Press the ▲ NEXT or ▼ PREV key until the message to the right is displayed.	ATT CONFIG READ CJT?
3	Press the NON-VOL ENTER (Yes) key to read the Internal Cold Junction Temperature. The displayed value will update itself every 6 seconds.	ATT CONFIG WORKING... ATT CONFIG 25.31°C CJT
4	When data has been read, press the CLR (No) key.	ATT CONFIG READ CJT?
5	When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT CONFIG READY...

3.6 Using the Common Features of SFC

3.6.1 Displaying and Changing the Tag Number

Procedure

The tag number can be displayed or changed with the procedure described as follows. This example shows changing XXXXXXXX to TIC001.

Step	Description	SFC screen
1	Press the [DE READ / ID / A] key. Options: • If you do not want to change the tag number, press the [CLR / (No)] key to end this procedure. • If you want to change the tag number, proceed to step 2.	ATT TAG NO. X X X X X X X X
2	Press the [ALPHA], [6 / T], [DE CONF / MENU / ITEM], and [C / DAMP] keys in this order. Note: • If a wrong key was pressed by mistake, move the cursor backward by pressing the [ALPHA] key and the [A←DE / ← / Q] key, and then press the [ALPHA] key again. Then restart the input.	ATT TAG NO. TIC
3	Press keys [ALPHA], [ACT PR / 0 / Z], [ACT PR / 0 / Z], and [1 / V] in this order.	ATT TAG NO. TIC001
4	Press the [NON-VOL / ENTER / (Yes)] key. Options: • Pressing the [CLR / (No)] key before pressing the [NON-VOL / ENTER / (Yes)] key will take you back to the previously set tag number.	ATT TAG NO. WORKING ATT TAG NO. TIC001
5	Press the [SHIFT] key and then the [NON-VOL / ENTER / (Yes)] key. Result: •Data has been stored in the transmitter.	XXXXXXXX READY...

3.6.2 Displaying the Input Temperature Value

Procedure

To display the temperature value applied to the transmitter, use the following procedure:

Step	Description	SFC screen
1	Press the SHIFT and INPUT OUTPUT keys. Result: • In this example, the temperature input to the transmitter is 4°C.	INPUT TIC001 4.00 °C
2	Press CLR (No) key.	ATT TIC001 READY...

3.6.3 Displaying the Transmitted Output (%)

Procedure

To display the temperature value applied to the transmitter, use the following procedure:

Step	Description	SFC screen
1	Press the INPUT OUTPUT key. Result: • In this example, the output is 50%.	OUTPUT TIC001 50.00%
2	Press the CLR (No) key.	ATT TIC001 READY...

3.6.4 Displaying and Changing the Upper- and Lower-Range Values for Range Setting

Overview

Display or change the upper- and lower-range values for range setting and the temperature corresponding to the desired span by using the following procedure.
The following case is described here as an example:
• Lower Range Value: 0°C changed to 20°C
• Upper Range Value: 50°C changed to 55°C
• Span: 50°C changed to 75°C
Notes:
- Span is automatically determined by the difference between Upper- and Lower-Range Values. The span is displayed but cannot be changed directly.
- When changing the upper- and lower-range values for range setting, be sure to change the Iower-Range Value first and then the Upper-Range Value.

Displaying the Set Range

Displaying the Set Range

Step	Description	SFC screen
1	• Press the LRV 0% key to display the Lower-Range Value. • Press the URV 100% key to display the Upper-Range Value. • Press the URL SPAN key to display the span.	LRV TIC001 0.0000 °C URV TIC001 50.00 °C SPAN TIC001 50.00 °C
2	Options: • If the displayed data does not need to be changed, press the CLR (No) key to end the procedure. • If the displayed data needs to be changed, proceed to the procedure for changing the set range, which is described on the next page.	ATT TIC001 READY...

Changing the Set Range

Changing the Set Range

Step	Description	SFC screen
1	To change the Lower Range Value, press the LRV 0% key.	LRV TIC001 0.0000 °C
2	Press the 2 and 0 keys.	LRV TIC001 20.00 °C
3	Press the ENTER key. Result: • The Lower Range Value has been set to 20°C.	LRV TIC001 WORKING... LRV TIC001 20.00 °C
4	To change the Upper Range Value, press the URV 100% key.	URV TIC001 50.00 °C
5	Press the 7 and 5 keys.	URV TIC001 75.00 °C
6	Press the ENTER key. Result: • The Upper Range Value has been set to 75°C.	URV TIC001 WORKING... URV TIC001 75.00 °C
7	Press the SHIFT and ENTER keys. Result: • The data has been stored in the transmitter.	SHIFT ATT TIC001 WORKING... ATT TIC001 READY...

3.6.5 Displaying or Changing the Engineering Unit of Measurement

Engineering units available

Available engineering units of measurement are as follows. By pressing the key, you can display them in the order (or reverse order) shown.

• °C –> °F –> K –> R –> °C
(When the SFC uses the SI units by default)

Procedure

Display or change the engineering unit of measurement by using the following procedure. Here we describe the procedure for displaying the unit of measurement when °C is set.

Step	Description	SFC screen
1	Press the UNITS key.	UNIT TIC001 °C
2	If you want to use a different unit of measurement, press either the NEXT key or UNITS key repeatedly until the desired unit is displayed on the screen. Pressing the PREV key once will bring you back to the previous unit of measurement.	

3.6.6 Displaying or Changing the Damping Time Constant

Overview

In some cases, fluctuation of temperature causes the output from the transmitter to be unstable, depending on the conditions of the process. This makes the measured values difficult to read. By using a larger damping time constant, minute fluctuations in the measured values can be eliminated and the output can be stabilized.

Damping Time Constants available

The damping time constants that can be selected are listed as follows. Pressing the keys shown in the following procedure allows you to display each damping time constant in either the forward or backward direction. The actual response time will be delayed by about 0.4 seconds from the displayed value (time loss). The unit is “seconds.”

• 0.0 –> 0.3 –> 0.7 –> 1.5–> 3.1 –> 6.3 –> 12.7 –> 25.5 –> 51.1 –> 102.3

Procedure

Display or change the damping time constant by performing the following procedure. Here we describe the case in which 0.0 second is already set.

Note:
If the damping time constant needs to be changed, first select a value larger than the current set value and see how the output fluctuates.

Step	Description	SFC screen
1	Press the C DAMP key.	DAMP TIC001 0.0 sec
2	To change the damping time constant, press either the ▲ H NEXT key or ▼ L PREV key repeatedly until the desired value appears on the screen. • When the ▲ H NEXT key is pressed, the message on the right is displayed.	DAMPING TIC001 WORKING... DAMP TIC001 0.3 sec
3	First press the SHIFT key and then press the NON-VOL ENTER (Yes) key. Result: The data has been stored in the transmitter.	SHIFT ATT TIC001 WORKING... ATT TIC001 READY...

3.6.7 Displaying the Software Version

Procedure

Check the software version by using the following procedure. Here we describe the case where the software version is 7.1.
SFC : 7.8
ATT :3.3

Step	Description	SFC screen
1	Press the SHIFT key.	SHIFT
2	Press the SW VER 3 X key. Results and options: • If the SFC is not in communication with the transmitters, the message on the right is displayed. • If the SFC is in communication with the transmitter, the message on the right is displayed.	VERSION SFC=7.8 VERSION TIC001 SFC=7.8 XMTR=3.3
3	After checking the software version, press the CLR (No) key.	ATT TIC001 READY...

3.6.8 Printing Function (optional)

Types of Printing Functions

There are two kinds of printing functions operated using different keys:

- Maintenance printing
  Using the maintenance printing function, you can print out the data stored in the transmitter (tag number, damping time constant, output range, temperature, output values, etc.).

- Action printing
  Using the action printing function, you can print the responses of the transmitter each time you operate the SFC keys.

Recording Form Feed

Feed the recording form by using the following procedure.

Step	Description	SFC screen
1	Press the SHIFT and FEED 8 keys in this order. Result: • Each time you press the FEED 8 key, the recording form is fed by one line.	PRINTER FEED
2	Press the CLR (No) key to clear the recording form feed function. Result: • “PRINTER FEED” disappears and the display reverts to the initial screen.	ATT TIC001 READY...

3.6.9 Printing Function: Printing Out Data Stored in the Transmitter (Maintenance Printing)

When to Print Out Data Stored in the Transmitter

This printing function is used to print the tag number, damping time constant, output range, temperature, output value, results of self-diagnosis, etc. It can be used to record the settings of the transmitter and the status of functional problems.

Procedure

Use the following procedure:

Step	Description	SFC screen
1	Press the CLR (No) key.	ATT TIC001 READY...
2	Press the SHIFT key.	SHIFT-
3	Press the PRINT 9 P key. Result: • Printing starts.	WORKING... PRINTING ATT TIC001 READY...

Example of Maintenance Printing

Example of data printing		Meaning
'99-06-03 04:51		Date, time
TAG No. TIC001		Tag number
FORM	: LINEAR	Internal linearization setting
ANA/DE	: DIGITAL XMTR	Output mode
PROM#	: 2000000037	PROM number
SW VER	: 3.3	Software version
DAMP	: 0.0s	Damping time constant
SPAN	: 100.00°C	Span
LRV	: 0.0000°C	Measured value that can produce 0% output
URV	: 100.00°C	Measured value that can produce 100% output
-LRV	: -200.0°C	Minimum value of range setting
URL	: 850.0°C	Maximum value of range setting
COLD JUNCTION	: INTERNAL	Cold junction setting
FILTER	: 60 Hz	Power source frequency filter (not used)
INPUT	: 25.2°C	Input value
OUTPUT	: 25.2%	Output value
SV	: 29.2°C CJT	Internal cold junction temperature
RESULT OF SELF-DIAGNOSIS: OK		Results of self-diagnosis

Figure 3-4 Example of Maintenance Printing

3.6.10 Printing Function: Printing Responses Continuously (action printing)

When to Print Responses

The printing function is used to continuously print data about the responses of the transmitter each time the SFC keys are used. If data needs to be kept as a record, the action printing function (continuous printing) may be used.

Procedure

Execute the printing function by using the following procedure.
Note: This procedure can be performed during measurement.

Step	Description	SFC screen
1	Press the CLR (No) key.	ATT TIC001 READY...
2	Press the SHIFT key and ACT PR 0 2 keys in this order.	ATT TIC001 ACTION PRINT?
3	Press the NON-VOL ENTER (Yes) key. Result: The following is printed. ACTION PRINT * START TAG NO. TIC001 (tag number) 99.06.03 11:52 (date and time)	
4	From this step onward, the responses of the transmitter will be printed each time the keys on the SFC are operated.	
5	To end this printing function, press the SHIFT and ACT PR 0 2 keys in this order.	ATT TIC001 ACTION PRINT?
6	Press the CLR (No) key. Result: The message * Action print * end is printed and printing ends.	

Example of Action Printing

Pressing the keys as shown at the left would produce the print output shown at the right.

Key	Example of data printout	
SHIFT Key		
ACT PR / 0 Z Key		
NON-VOL / ENTER (Yes) Key	ACTION PRINT * START TAG NO. TIC001 '99-07-01 16:09	
DAMP Key	ATT ATT	TAG NO. TIC001
URL / SPAN Key	DAMP 0.0	TIC001 S
LRV E / 0% Key	SPAN 100°C	TIC001 °F
SHIFT Key	URV 0.0000°C	TIC001 °F
ACT PR / 0 Z Key		
CLR (No) Key	*ACTION PRINT * END	

Figure 3-5 Example of Action Printing

3.6.11 Changing from Analog Mode to Digital Mode

This section shows the procedure for changing the ThermoPLUS from analog mode to digital mode or digital mode to analog mode.

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 6 of Section 3.4.2.	TAG TIC001 READY...
2	Press the SHIFT key and then press the A—DE / ← / 0 key. When the message to the right is displayed, press the NON-VOL / ENTER (Yes) key.	SHFT- ATT TIC001 CHANGE TO DIGITAL?
3	Press the NON-VOL / ENTER (Yes) key for verification purposes.	ATT TIC001 ARE YOU SURE?
4	The procedure is completed when these messages are displayed.	ATT TIC001 WORKING... ATT DE TIC001 DE XMTR. ATT DE TIC001 READY...

3.7 Setting the Signal Mode for Digital Communication Specifications

Table 3.3 defines the information that can be transferred with the communication protocol used in the ThermoPLUS digital mode. This section describes how to check and change the amount of data to be transferred.

Table 3-3 Data Elements for Digital Transmission

<table>
<tr><th>Data element</th><th>Selection</th></tr>
<tr><td>Output signal mode for digital transmission</td><td>One of the following can be selected:
Single Range: This mode is used to display on the TDCS controller the PV value for the range that is set in the temperature transmitter.
Dual Range: This mode is used to display on the TDCS controller the PV value in two different units of measurement, one for full range and another for working range.
Single Range w/SV: This mode is used to display on the TDCS controller the single range and the temperature transmitter’s cold junction temperature.</td></tr>
<tr><td>Information size mode for digital transmission</td><td>One of two modes can be selected:
4 bytes:
Byte 1 [FLAG] 2 [P V] 3 [P V] 4 [P V]
Byte 1: Identification of output signal mode
Bytes 2-4: PV values
6 bytes:
Byte 1 [FLAG] 2 [P V] 3 [P V] 4 [P V] 5 [I D] 6 [D B]
Byte 1: Identification of output signal mode
Bytes 2-4: PV values
Byte 5: Identification of database being transmitted (LRV, URV, span, etc.)
Byte 6: Data being transmitted
<table><tr><th></th><th></th><th>4 bytes</th><th>6 bytes</th></tr><tr><td>Note:
Transfer rate:</td><td>PV value
Temperature</td><td>Approx. 3/sec.
Approx.
once every 2.5 sec.</td><td>Approx.2.5/sec.
Approx.
once every 3 sec.</td></tr></table></td></tr>
<tr><td>Fail-safe mode for digital transmission</td><td>This fail-safe mode applies to STDC card operations, not to the temperature transmitter.
The two types of fail-safe mode are the STDC card input setting and output setting. The three directions of burn-out are lower limit, upper limit, and hold.
<table><tr><th>Type of fail-safe</th><th>SFC display</th><th>Burn-out direction</th></tr><tr><td rowspan="3">STDC input setting</td><td>F/S = B/O Lo</td><td>Lower limit</td></tr><tr><td>F/S = B/O Hi</td><td>Upper limit</td></tr><tr><td>Hold

F/S = LKG displayed immediately error.)
F/S = FSO, B/O Lo</td><td>
(The STDC output signal holds the PV value before the transmitter

Lower limit</td></tr><tr><td rowspan="3">STDC output setting (The STDC output signal holds the PV value displayed immediately before the transmitter error.)</td><td>F/S = FSO, B/O Hi</td><td>Upper limit</td></tr><tr><td>F/S = FSO, LKG</td><td>Hold</td></tr><tr><td></td><td></td></tr></table>F/S: FAIL SAFE
B/O: BURN OUT
LKG: LAST KNOWN GOOD VALUE
FSO: FREEZE SLOT OUTPUT</td></tr>
</table>

3.7.1 Setting the Output Signal Mode

The following procedure can be used to check and set the output signal mode shown in Table 3-3, such as “Single Range,” “Dual Range,” and “Single Range w/SV”:

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 4 of Section 3.6.11 and that digital communication is enabled.	ATT DETIC001 READY...
2	Press the SHIFT key and then press the DE CONF MENU I ITEM key.	SHIFT- DE CONFIG Single Range
3	Press the DE CONF MENU I ITEM key to display a desired output signal mode.	DE CONFIG Single Range w/SV or DE CONFIG DUAL RANGE
4	Press the NON-VOL ENTER (Yes) key.	DE CONFIG ENTERED IN SFC
5	Press the ▲H NEXT or ▼L PREV key until the message to the right is displayed.	DE CONFIG DOWNLOAD DATA?
6	Press the NON-VOL ENTER (Yes) key.	DE CONFIG WORKING...
7	When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT DE TIC001 READY...

3.7.2 Setting the Information Size Mode

The following procedure can be used to check and set the information size mode “4-byte output” or “6-byte output” shown in Table 3-3:

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 4 of Section 3.6.11 and that digital communication is enabled.	ATT DE TIC001 READY...
2	Press the [SHIFT] key and then press the [DE CONF / MENU / ITEM] key.	SHIFT- DE CONFIG Single Range
3	Press the [▲ H / NEXT] or [▼ L / PREV] key to display a desired signal mode.	DE CONFIG DE -6 Byte
4	Press the [DE CONF / MENU / ITEM] key to display a desired output signal mode.	DE CONFIG DE -4 Byte
5	Press the [NON-VOL / ENTER / Yes] key.	DE CONFIG ENTERED IN SFC
6	Press the [▲ H / NEXT] or [▼ L / PREV] key until the message to the right is displayed.	DE CONFIG DOWNLOAD DATA?
7	Press the [NON-VOL / ENTER / Yes] key.	DE CONFIG WORKING...
8	When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT DE TIC001 READY...

3.7.3 Setting the Fail-Safe Mode

The following procedure can be used to check and set the fail safe mode shown in Table 3-3:

Step	Description	SFC screen
1	Make sure that the ThermoPLUS is in the ready state described previously in step 6 of Section 3.4.2 and that digital communication is enabled..	ATT DETIC001 READY...
2	Press the SHIFT key and then press the DE CONF MENU/ITEM key.	SHIFT- DE CONFIG Single Range
3	Press the ▲ NEXT or ▼ PREV key to display a desired signal mode.	DE CONFIG F/S = B/O Hi
4	Press the DE CONF MENU/ITEM key to display a desired output signal mode.	DE CONFIG F/S = B/0 Lo DE CONFIG F/S = B/0 LKG DE CONFIG F/S = FSO B/O Lo DE CONFIG F/S = FSO B/O Hi DE CONFIG F/S = FSO, LKG

Continued

Continued

Step	Description	SFC screen
5	Press the NON-VOL ENTER (Yes) key.	DE CONFIG ENTERED IN SFC
6	Press the ▲ NEXT or ▼ PREV key until the message to the right is displayed.	DE CONFIG DOWNLOAD DATA?
7	Press the NON-VOL ENTER (Yes) key.	DE CONFIG WORKING...
8	When this message is displayed, the ThermoPLUS can be disconnected from the SFC.	ATT DE TIC001 READY...

3.8 Adjusting the Output Current

3.8.1 Setting the Constant Current Mode

Overview

This product can be set so it will output a constant current in the range of 4 mA (0%) to 20 mA (100%). The setting of the constant current is performed in the output mode. This function is convenient for executing a loop check.

Caution

Make sure that the output mode will be canceled after the output is set. Check to ensure that the output is equivalent to the process temperature after cancellation of the output mode.

Procedure

Set the constant current source mode by performing the following procedure. In this example, the output is fixed at 50% (12 mA).

Step	Description	SFC screen
	Setting	
1	Press the INPUT OUTPUT key. Result • The current output is displayed.	OUTPUT TIC001 WORKING... OUTPUT TIC001 10.00 %
2	Press the numeric keys 5 and ACT PR 0 in this order.	OUTPUT TIC001 50.00 %
3	Press the NON-VOL ENTER (Yes) key Result • This product outputs 12 mA (50%).	OUTPUT TIC001 WORKING... OUTPUT TIC001 50.00 % #
	Cancelling	
4	Press the INPUT OUTPUT key. Result: • The current output is displayed.	OUTPUT TIC001 WORKING... OUTPUT TIC001 50.00 % #
5	Press the CLR (No) key. Result: • The output mode has been canceled.	OUTPUT TIC001 WORKING.. OUTPUT TIC001 READY...
	Checking	
6	Press the INPUT OUTPUT key. Result: • The current output is displayed.	OUTPUT TIC001 WORKING... OUTPUT TIC001 10.00 %

3.8.2 Canceling the Constant Current Mode

Procedure

Cancel the output mode by using the following procedure.

Note:

Check to ensure that the output is equivalent to the process temperature after cancellation of the output mode.

Step	Description	SFC screen
	Canceling	
1	Press the INPUT OUT-PUT key. Result: • The current output is displayed.	OUTPUT TIC001 WORKING... OUTPUT TIC001 50.00 % #
2	Press the CLR (No) key. Result: • The output mode has been canceled.	OUTPUT TIC001 WORKING.. OUTPUT TIC001 READY...
	Checking	
3	Press the INPUT OUT-PUT key. Result: • The current output is displayed.	OUTPUT TIC001 WORKING... OUTPUT TIC001 10.00 %

3.8.3 Calibrating the Output Signal

Procedure

Calibrate the output signal by using the following procedure. First, set the output to 0% (100%) and then calibrate it so that the current on an amperemeter reads 4 mA (20 mA).

Step	Description	SFC screen
1	Press the INPUT/OUTPUT key. Result: • The current output is displayed on the screen.	OUTPUT TIC001 WORKING... OUTPUT TIC001 0.00 %
2	Press the ACT PR 0 key. (If the output is set at 100%, press the 1, ACT PR 0 AND ACT PR 0 keys.)	OUTPUT TIC001 0 %
3	Press the NON-VOL ENTER (Yes) key. Result • The transmitter is now in the 4 mA (20 mA) constant current source mode.	OUTPUT TIC001 WORKING OUTPUT TIC001 0.00 % #
4	Check the amperemeter to make sure that the reading on the amperemeter is 4 mA (20 mA).	
5	Press the INPUT/OUTPUT key.	OUTPUT TIC001 WORKING... OUTPUT TIC001 0.00 % #
6	Press the RESET CORRECT key. Results and options: • If the reading on the amperemeter is 4 mA (20 mA), proceed to step 9. • If the reading on the amperemeter is less than 4 mA (20 mA), proceed to step 7. • If the reading on the amperemeter is greater 4 mA (20 mA), proceed to step 8.	OUTPUT TIC001 CORRECT 4mA #

Continued

Continued

Step	Description	SFC screen
7	Press the [▲ NEXT] key. • After pressing the key once, check the reading on the amperemeter. • Press the key repeatedly until the reading becomes 4 mA (20 mA). • When the reading becomes 4 mA (20 mA), proceed to step 9.	OUTPUT TIC001 WORKING... OUTPUT TIC001 INCREASED 4mA # OUTPUT TIC001 CORRECT DAC DER #
8	Press the [▼ PREV] key. • After pressing the key once, check the reading on the amperemeter. • Press the key repeatedly until the reading becomes 4 mA (20 mA).	OUTPUT TIC001 WORKING... OUTPUT TIC001 INCREASED 4mA # OUTPUT TIC001 CORRECT DAC ZER#
9	Go to “Storing Calibrated Values and Canceling the Constant Current Source Mode” on the next page.	

3.8.4 Storing the Calibrated Values and Canceling the Constant Current Source Mode

Procedure

Store calibrated values and cancel the constant current source mode by using the following procedure.

Step	Description	SFC screen
1	Press the CLR (No) key.	ATT TIC001 READY...
2	Press the SHIFT and NON-VOL ENTER (Yes) keys. Result: • Data storage has been completed.	ATT TIC001 WORKING... ATT TIC001 DATA NONVOLATIL#
3	Press the INPUT OUTPUT key. Result: • The message on the right is displayed, indicating that the current output is 0% (100%).	OUTPUT TIC001 WORKING... OUTPUT TIC001 0.00 % #
4	Press the CLR (No) key. Result: • The # mark disappears, indicating that the constant current source mode has been canceled.	OUTPUT TIC001 WORKING... OUTPUT TIC001 READY...

3.9 Calibrating the Set Range by Inputting the Actual Temperature

3.9.1 Overview

Overview

This section describes how to calibrate upper- and lower-limit values for the set range by inputting a reference temperature into the transmitter using the SFC.
Calibrate the lower-limit value first and then the upper-limit value.

Calibration Devices

The calibration devices described as follows are usually required:

- Reference temperature generator: a generator capable of producing temperature over a range of measurement close to that of the transmitter to be tested
- Accuracy: ± 0.05%FS or ± 0.1% (whichever is larger)
- Power supply: 24 V DC
- Standard resistor: 250 Ω ± 0.005%
- Voltmeter: Digital voltmeter (10V DC range) with an accuracy of ± 0.02% rdg + 1dgt
- SFC

Requirements for Calibration

CAUTION:
When conducting actual-temperature calibration, the following requirements must be met:

- The calibration must be conducted in a testing laboratory where there is no wind.
- The standard temperature is 23°C (73°F) and the standard humidity is 65%. (Room temperatures from 15 to 35°C (50 to 95°F)and room humidity from 45% to 75% are acceptable if measurement at that temperature and humidity will not influence the results of measurement.)
- It is best if the accuracy of the measuring instruments be four times greater than that of the transmitter.

Assembling the Calibration Devices

The calibration devices are to be assembled as follows:

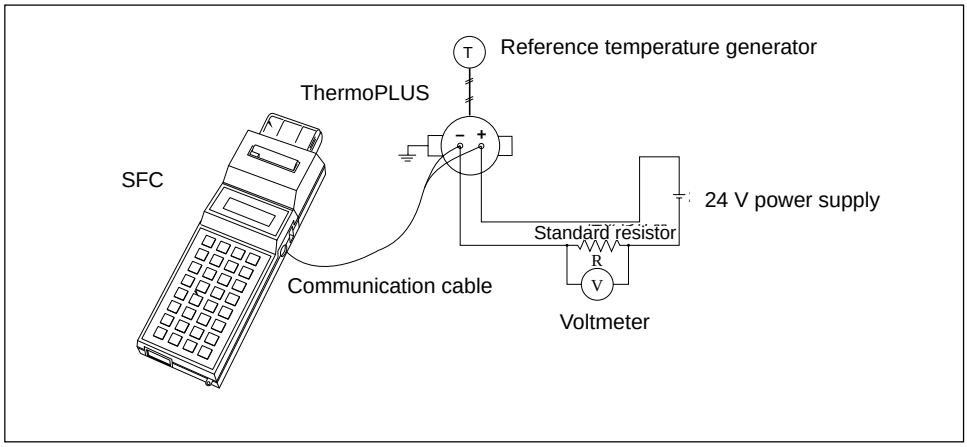


Figure 6-6 Wiring and Piping for the Calibration Devices

3.9.2 Calibrating the Lower-Range Value

Procedure

Calibrate the lower-limit value of actual temperature using the following procedure. This procedure starts at the point when normal communication between the SFC and the transmitter has been established.

Step	Description	SFC screen
1	Press the DE READ / ID A key	ATT TAG NO. TIC001
2	Apply temperature so that the temperature gauge on the reference temperature calibration equipment generator reads 0°C. Press the LRV E / 0% key	
3	• The Lower Range Value that the transmitter has stored in memory is displayed. In this example, the lower-limit value is 0.00°C.	LRV TIC001 0.0000 °C
4	Press the RESET / COR_K / RECT key.	LRV TIC001 CORRECT LRV?
5	Press the NON-VOL / ENTER / (Yes) key twice. Result: • The Lower Range Value is calibrated tot the current Lower Range temperature of this product.	LRV TIC001 ARE YOU SURE? LRV TIC001 WORKING... LRV TIC001 LRV CORRECTED
6	Press the LRV E / 0% key. • The message on the right is displayed, allowing confirmation of the Lower Range Value stored in the transmitter's memory.	LRV TIC001 0.0000 °C

3.9.3 Calibrating the Upper-limit Value

Procedure

Calibrate the upper-limit value of actual temperature using the following procedure:

Step	Description	SFC screen
1	Press the DE READ / ID key.	ATT TAG NO. TIC001
2	Apply temperature so that the temperature gauge on the reference temperature generator reads 100°C.	
3	Press the URV F / 100% key. • The Upper Range Value that the transmitter has stored in memory appears on the screen. (In this procedure, 100°C is defined as the Upper Range Value.)	URV TIC001 100.0 °C
4	Press the RESET / CORRECT key.	URV TIC001 CORRECT URV?
5	Press the NON-VOL / ENTER (Yes) key twice. Result: • The Upper Range Value is calibrated to the current Upper Range temperature of this product.	URV TIC001 ARE YOU SURE? URV TIC001 WORKING... URV TIC001 URV CORRECTED
6	Press the URV F / 100% key. • The message on the right is displayed, allowing confirmation of theUupper Range Value stored in the transmitter's memory.	URV TIC001 100.0 °C

3.9.4 Resetting Calibrated Data

Procedure

Use the following procedure to make calibrated or entered values revert to the original values in effect before calibration or data entry:

Step	Description	SFC screen
1	Press the keys SHIFT and RESET CORRECT in this order.	SHIFT ATT TIC001 RESET CORRECT?
2	Press the NON-VOL ENTER (Yes) key. Result: • About 2 seconds later, the message on the right is displayed, and the calibrated data reverts to the data stored at the time of the delivery of the transmitter to the customer.	ATT TIC001 WORKING ATT TIC001 CORRECTS RESET# ATT TIC001 READY... #

3.10 Setting Lower-Range Value as Actual Temperature

Overview

"#" mark appears when the input value is reverted to the default setting. By following the steps described below, "#" mark will disppear. Setting Lower Range Value can be done by using the actual temperature. (Refer to 3.9 "Calibrating the Set Ranbe by Inputting the Actual Temperature.")

Setting LRV as Actual Temperature

Follow the steps below:

Step	Description	SFC screen
1	Seet the actual temperature input as LRV.	ATT TIC001 READY...
2	Press LRV E 0% key.	LRV TIC001 0.000 °C
3	Press G SET key.	LRV TIC001 SET LRV?
4	Press NON-VOL ENTER (Yes) key. Result: • LRV is stored and displayed.	LRV TIC001 WORKING... LRV TIC001 15.00 °C

4. Troubleshooting

Maintenance Precautions

⚠ WARNING

- While this product is in operation in an explosion-proof area, opening the cover of the equipment may result in an explosion. Keep the cover closed during operation.
- This product is manufactured and shipped under Yamatake's rigorous quality control system. Do not modify this product. Doing so will cause critical damage to the product.

Maintenance

Check the following components on a periodic basis:

- Has the case, cover, or grounding cable been damaged?
- Are the grounding cable, cover, or cover-detent screws loose?
- Are the teminal screws loose?
- Is there any deterioration in the O-rings fitted to the set-screws holding the cover in position?

Troubleshooting

If this product does not function or if it malfunctions, releases gas or liquid from this product, leave it open to the atmosphere, and check the following items:

- Are there any loose or broken wires?
- Are the readings correct for power source voltage and load resistance?
- In case the ThermoPLUS is indicating "Burnout" condition, or it does not function, first conduct the status diagnosis using the SFC. (See the following pages 4.1 "Troubleshooting by SFC.")
- ThermoPLUS with LCD will display the abnormal conditions on the window. It, however, does not display the nature of erronous condition, so use SFC to conduct the status diagnosis.

4.1 Troubleshooting by SFC

4.1.1 Troubleshooting and Verification of Normal Functioning

Verification of Normal Functioning and Self-Diagnosis

Using the SFC, you can verify that the transmitter is operating normally. If the transmitter has functional trouble, follow the self-diagnostic messages provided by the SFC. If abnormal conditions are encountered in the transmitter, in the process, in the SFC or in the communication system during measurement, follow self-diagnostic messages.

Procedure for Verifying Normal Functioning

When verifying normal functioning, connect the SFC to the product and perform the following procedure.

Step	Description	SFC screen
1	Press the F/S DIR / STAT key. Results and options: • When “STATUS CHECK=OK” message appears, the process of verifying normal functioning ends. • When a message other than “STATUS CHECK=OK” appears, take appropriate action by referring to the instructions given on the following pages. Proceed to step 2.	ATT TIC001 WORKING...
2	Results and options: • Take appropriate action by referring to the messages given on the following pages. • If there is more than one message, each individual message is displayed for 2 seconds.	ATT TIC001 STATUS CHECK=OK ATT TIC001 READY...

4.1.2 If Abnormal Conditions are Encountered during Communication

Message and Action

If the “CRITICAL STATUS” message is displayed during communication, take the following action.

Message	Action
ATT TIC001 CRITICAL STATUS PRESENT STATUS	Press the F/S DIR U STAT key. Deal with the conditions encountered by following the displayed messages. Note: • Even if the “CRITICAL STATUS” message is displayed, three keys DE READ ID A, INPUT OUT J PUT and F/S DIR U STAT are still operable. • After taking action, press the F/S DIR U STAT key to check that the “SELF-DIAGNOSIS RESULT OK” message is displayed.
:	The battery power is becoming low. Follow the instructions given in the SFC operation manual (CM2-SFC100-2001).
	• Press the F/S DIR U STAT key. Deal with conditions encountered by following the displayed messages. If minor trouble is encountered: • When trouble has been eliminated, the # mark will disappear. • When the # mark disappears, press the F/S DIR U STAT key to display the “SELF-DIAGNOSIS RESULT OK” message.

4.1.3 Self-diagnostic Messages

Message

When abnormal conditions are encountered, press the F/S DIR STAT key to display a self-diagnostic message. The meaning of this message and the action to take are as follows.

If the abnormal condition seems to have occurred in the process, SFC or communication system:

Message	Description, cause	Action
NO XMTR RESPONSE	• Receiving instrument does not respond.	• Perform the procedure for starting communication again. • Press the F/S DIR STAT key and look at the message. • Check the connection of the loop and SFC.

If abnormal conditions seem to have occurred in the SFC or a communication system:

Message	Description, cause	Action
FAILED COMM CHK	Preface to a diagnostic message	
HI RES / LO VOLT	• Extra-high loop resistance • Extra-low power-supply voltage	Adjust loop resistance. • Increase the voltage of the power supply.
ILLEGAL RESPONSE	Improper communication	Check the connection, wiring and power supplies.
LOW LOOP RES	Extra-low loop resistance value	Adjust the resistance value.
PRINTER FAIL!	Printer failure	Contact the sales representative or manufacturer shown in the back of the operation manual.
SFC FAULT	SFC Fault	• Perform the procedure for starting communication again. • If the same message is displayed, contact the supplier or manufacturer shown at the back of the operation manual.

If an operational mistake seems to have been made:

Message	Description, cause	Action
CORRECT LRV?	What value was entered to set the range to 0%?	Verify the entered value. If an incorrect value was entered, correct it.
CORRECT URV?	What value was entered to set the range to 100%?	Verify the entered value. If an incorrect value was entered, correct it.
CORRECT RESET #	Calibration must be performed again.	Calibrate the upper- and Lower-Range Values of the range.
ENTRY>SENS RNG	The set value is 1.0 times the Upper-Range Value of the range shown on a pressure gauge	After checking the value by pressing the CLR (No) key, enter the correct value.
EXCESS SPAN COR#	Excessive span calibration	Calibrate the Upper-Range Value of the range.
EXCESS ZERO COR#	Excessive zero calibration	Calibrate theLlower-Range Value of the range.
EXCESSIVE OUTPUT	Output value required in the constant current source mode is greater than output range; (1.25% to 105%.)	After checking the value by pressing the CLR (No) key, enter the correct value.
INVALID REQUEST	Operational mistake during the operation of SFC	Check the SFC operation procedure.
INVALID KEY ENTRY	• Invalid key entry • Invalid sequence of key entry	After checking the value by pressing the CLR (No) key, enter the correct value.
NOT SUPPORT	Do not use the key(s) that were pressed.	Press the correct keys.

4.1.4 If an Error Has Occurred on the ThermoPLUS Transmitter

This section describes troubleshooting using the ThermoPLUS's built-in self-diagnostic feature. The two error modes employed by the ThermoPLUS are the minor error mode and the serious error mode. The remedy depends on the error mode; therefore, be sure to check the status and take an appropriate action.

1. Minor Errors

This error mode indicates that a minor error such as an out-of-range has occurred. With the specifications for the unit wth a built-in LCD, the temperature displays blink at each second. Table 4.1 lists the error messages that are displayed in the minor error mode along with the action that should be taken by the user. Use this table as a reference in the event of an error.

Table 4-1 Messages for minor errors

Cause of error	Action
I/P OUT OF SPEC	A minor error was detected because an entered value was beyond the upper-limit or lower-limit value for the sensor in use. The sensor must be replaced with an appropriate one.
AMB TEMP HI/LO	The cold junction temperature fell beyond the operating temperature range for the equipment (-40 to 85°C / -40 to 185°F). The equipment's ambient temperature must be reduced by using a screen or by cooling air with air purge or by changing to the separation type.
IN OUTPUT MODE	OUTPUT MODE for supplying constant current is in effect. This setting must be canceled using the OUTPUT and CLR keys.

2. Serious Errors

This error mode indicates that an internal error has occurred on the ThermoPLUS or that some error has occurred on the temperature sensor. With the specifications containing a built-in LCD, "Err" is displayed and the output depends on the burnout setting. The details of the error can be output as error messages using the SFC. Table 4.2 shows the error message that is displayed in this error mode along with the action that should be taken by the user. Use this table as a reference in the event of an error.

Table 4-2 Messages for serious errors

Error message	Nature of error	Action
T/C BREAK	Disconnection occurred on the sensor.	Check the wiring on the sensor. Replace thermocouples or compensation lead wire.

4.2 FAQs (Frequently Asked Questions)

This section presents frequently asked questions and the answers to troubleshooting problems.

Table 4.3 FAQs

Condition	Suggested Actions
There is no output.	Check the loop again. Is the supply voltage correct? Is the load resistance correct? Was AC 100 V applied by mistake? Are correct connection terminals used?
Communication cannot be established with the SFC.	Is the ThermoPLUS's power switch on? Is the supply voltage correct? Is the load resistance correct? Is the SFC's power switch on? Is a correct terminal used to connect the SFC? Is the loop correct?
When the SFC was used for communication, "STT" was displayed, not "ATT."	This ThermoPLUS belongs to Yamatake's conventional model STT; therefore, "STT" is the correct display on the SFC. Also for older version's SFC, "SFT" may be displayed; no need to be alarmed.
Output is not stable.	Is there any sensor error? Is the sensor type or range setting for the sensor correct? Was an attempt made to use analog specifications as digital specifications by mistake? Is the equipment used within the correct specifications, such as supply voltage and ambient temperature? Is there any external noise added electrically?
Output response is slow.	Is there any sensor error? Is an appropriate dumping time constant used? Is sensor protection pipe's delay taken into account?
Output is too high (low).	Is there any sensor error? Is the sensor type or range setting for the sensor correct?

4.3 Contact Information in the Event of an Error

If an error cannot be resolved by the troubleshooting procedures presented in this manual, contact your Yamatake's sales representative or Yamatake customer service. When you contact us, please provide the following information:

Investigation Item Entry Sheet

____/____/_____
Month Date Year

Your company name: Office:

Your name:Contact:

Name of the store: Person in charge:

Manufactured date: Process number:

Format:

Setting:

Type of sensor:

Sensor maker:

Range:

Problem:

5. Maintenance

5.1 Spare Parts:

Table 5-1 lists the spare parts that are available for your ThermoPLUS Transmitter. Contact your Yamatake representative, distributor orYamatake customer service for purchase. When ordering spare parts, please provide us with the part name and part number listed in Table 5-1 along with desired quantities.

Table 5-1 List of spare parts

#	Name	Part number	Quantity used per transmittere	Resale Units
1	Case cover (w/ O-ring)	80370406-001	1	1
2	O-ring for the case cover	80020935-842	1	10
1s	Cover (w / O-ring) standard finish	80345533-001	1	1
1a	Cover (w / O-ring) corrosion resistant finish	80345533-002	1	1
1b	Cover (w / O-ring) corrosion proof finish	80345533-003	1	1
3	Pressure-tight packing cable ground	80370411-001	2	1
4	Elbow		2	1
5	Bracket kit	80370404-002	1	1

5.2 Disassembly and Assembly

The inside of your ThermoPLUS cannot be disassembled. The maintenance the user should perform is the replacement of the O-ring that is used for the ThermoPLUS's case cover.
The parts list contains several parts that can be re-ordered in case they are lost during installation or during periodic maintenance when the pressure-tight packing cable ground may be removed.

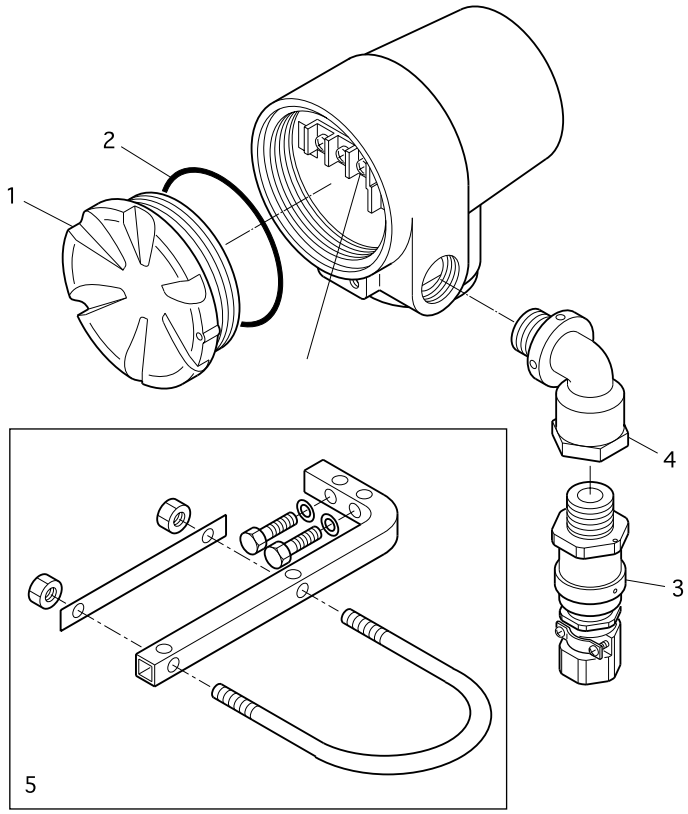


Fig 5-1 Exploded view

6. Types of Installation

6.1 Example of Sensor Installed Seperately
(Single input from a temperature sensor installed on piple)

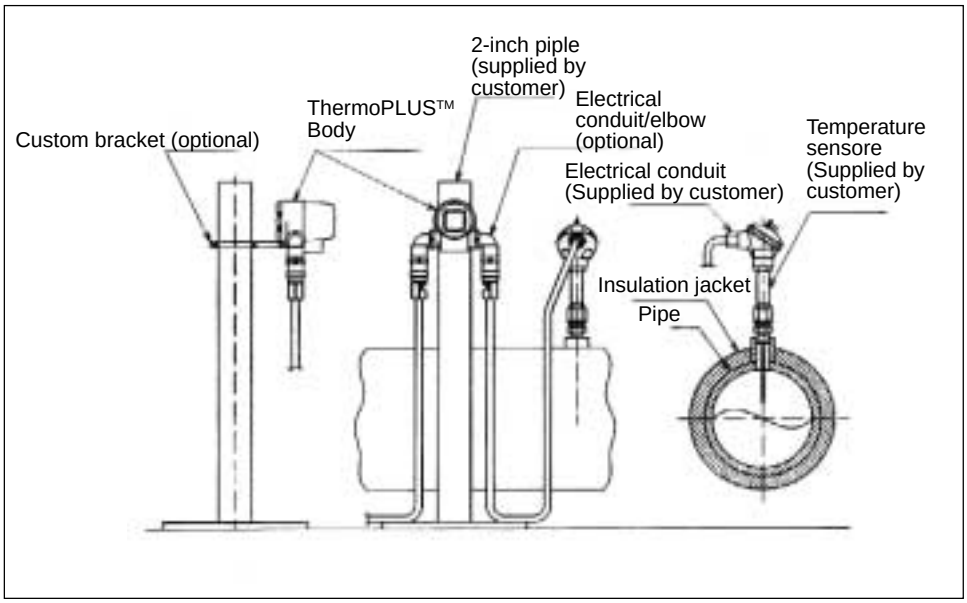


Figure 6-1

6.2 Example of Sensor Connected Directly
(Example of Installation on tank walls)

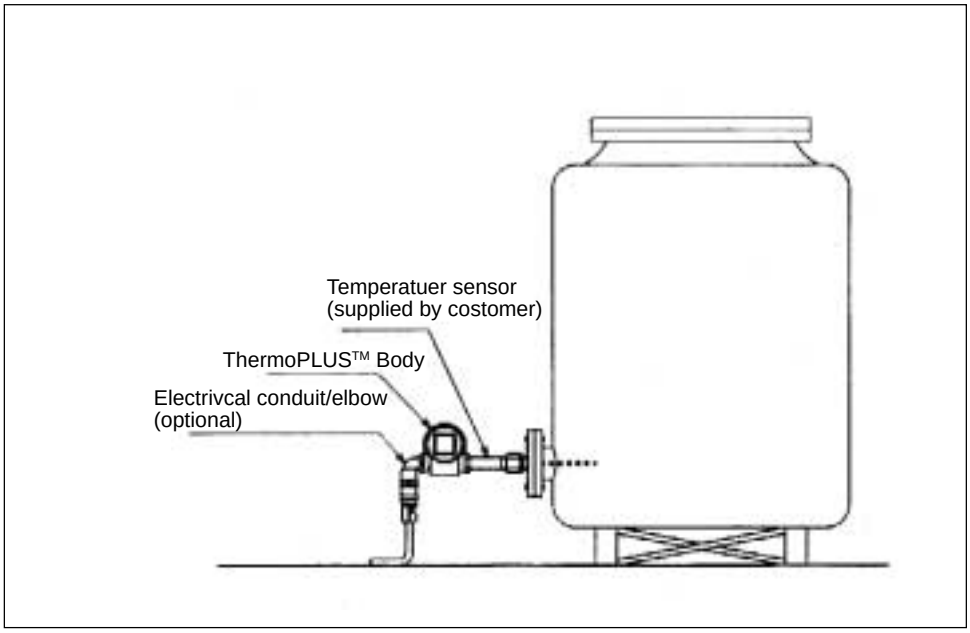


Figure 6-2

MEMO

Document Number: CM2-ATT100-2001

Document Name: ThermoPLUS Smart Temperature Transmitter (Remote Type) Model ATT60/70 Operation Manual

Date: Mar., 2000
Oct., 2000 (Rev. 2)

Issued/Edited by: Yamatake Corporation

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