



Manufacturer

**TLV** CO., LTD.

Kakogawa, Japan

is approved by LRQA Ltd. to ISO 9001/14001



# Instruction Manual

Multi-purpose Controller  
**SC-F71**

**Hardware**

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## Introduction

Thank you for purchasing the TLV multi-purpose controller.

This product has been thoroughly inspected before being shipped from the factory. When the product is delivered, before doing anything else, check the specifications and external appearance to make sure nothing is out of the ordinary. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the product properly.

If detailed instructions for special order specifications or options not contained in this manual are required, please contact TLV for full details.

This instruction manual is intended for use with the model(s) listed on the front cover. It is necessary not only for installation but for subsequent maintenance, disassembly/reassembly and troubleshooting. Please keep it in a safe place for future reference.

- Microsoft Windows is a trademark of Microsoft Corporation (in the United States and other countries).
- MODBUS is a registered trademark of Schneider Electric SA.
- All companies and product names mentioned are trademarks or registered trademarks of the respective companies [owners].

## Safety Considerations

- Read this section carefully before use and be sure to follow the instructions.
- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- The precautions listed in this manual are designed to ensure safety and prevent equipment damage and personal injury. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential damage and danger: DANGER, WARNING and CAUTION.
- The three types of cautionary items above are very important for safety: be sure to observe all of them as they relate to installation, use, maintenance, and repair. Furthermore, TLV accepts no responsibility for any accidents or damage occurring as a result of failure to observe these precautions.

## Symbols

	<b>Indicates a DANGER, WARNING or CAUTION item.</b>
	Indicates an urgent situation which poses a threat of death or serious injury
	Indicates that there is a potential threat of death, serious injury or the risk of electrocution, burns or other situations which pose a danger to the life or health of the user
	Indicates that there is a possibility of injury or equipment/product damage
	<ul style="list-style-type: none"> <li>• To prevent injury to persons, damage to the instrument and the equipment, a suitable external protection device shall be required.</li> <li>• All wiring must be completed before power is turned on to prevent electric shock, fire or damage to the instrument and the equipment.</li> <li>• This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the equipment.</li> <li>• This instrument is not intended for use in locations subject to flammable or explosive gases.</li> <li>• Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.</li> <li>• TLV is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction may occur and warranty is void under these conditions.</li> </ul>

Continued on the next page

**CAUTION**

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy plant.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock to operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dissipation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to the instrument display, do not rub with an abrasive material or push the front panel with a hard object.

## Notice

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for explanation purpose.
- TLV is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- TLV is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. TLV makes no warranty, expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from TLV.
- Various symbols are used on the equipment, and they have the following meaning.
  -  : Alternating current
  -  : Direct current
  -  : Reinforced insulation
  -  : Safety precaution

This symbol is used where the instruction manual needs to be consulted for the safety of both the operator and the equipment. Carefully read the cautions in this manual before using the instrument.

## Notice Regarding the Export Trade Control Order (Japan)

The intended application and end user should be checked to make sure this product will not be used in weapons of mass destruction, military applications or military equipment etc.

Take precautions not to allow this product to be illegally exported, even in the case of reselling or distribution.

## Disposal

When disposing of each part used for this instrument, always follows the procedure for disposing of industrial wastes stipulated by the respective local community.

## Symbols

### Pictorial Symbols (safety symbols)

 <b>NOTE</b>	This icon indicates important information on installation, handling and operating procedures.
	This icon indicates supplemental information on installation, handling and operating procedures.
	This icon indicates where additional information may be located.

### Character Symbols

#### 11-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
0	1	2	3	4	5	6	7	8	9	-	.
A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
A	b	C	c	d	E	F	G	H	I	J	K
L	M	N	n	O (o)	P	Q	R	S	T	t	U
L	M	N	n	o	P	Q	R	S	T	t	U
u	V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)	→	
u	v	w	x	y	z	°	/	'	*	→	

#### 7-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
0	1	2	3	4	5	6	7	8	9	-	.
A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
A	b	C	c	d	E	F	G	H	I	J	K
L	M	N (n)	O (o)	P	Q	R	S	T	t	U	u
L	m	n	o	P	q	r	S	T	t	U	u
V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)			
v	w	x	y	z	°	/	'	*			

## Abbreviation symbols

These abbreviations are used in this manual:

Abbreviation symbols	Name	Abbreviation symbols	Name
PV	Measured value	TC (input)	Thermocouple (input)
SV	Set value	RTD (input)	Resistance temperature detector (input)
MV	Manipulated output value		
AT	Autotuning	V (input)	Voltage (input)
ST	Startup tuning	I (input)	Current (input)
OUT (1 to 3)	Output (1 to 3)	HBA (1, 2)	Heater break alarm (1, 2)
DI (1 to 6)	Digital input (1 to 6)	CT (1, 2)	Current transformer (1, 2)
DO (1 to 4)	Digital output (1 to 4)	LBA	Control loop break alarm
FBR	Feedback resistance	LBD	LBA deadband

## Screens used in this manual

The SC-F71 has two inputs. The following input type is available by setting parameters: Dual PV (PV + PV) type or PV + Remote setting type. The input type is set to PV + Remote setting type when shipped from the factory.

For a dual input model, the same parameter may exist in both Input 1 and Input 2. "1." or "2." is added to the top of the parameters for identification. "1." is not added to the top of the parameters list for the single input type.

Display example of the dual input type:

Input 1\_Set value (SV)      Input 2\_Set value (SV)



Display example of a single input type:

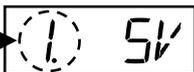
Set value (SV)



This manual uses the dual inputs for explanation. For other types such as a single input type, ignore the first character "1." at the top of the parameter.

The parameters used only for the dual input type are displayed with the colored background (  ).

Notation in this manual:

This part is not displayed on the single input type.  Input 1\_Set value (SV)

Parameter shown only on the dual input type  Input 2\_Set value (SV)

## Document Configuration

There are seven manuals pertaining to this product. Please be sure to read all manuals specific to your application requirements.

The following manuals can be requested from TLV or your local TLV representative.

Manual	Document Number	Remarks
Multi-purpose Controller SC-F71 Quick Start Guide	172-65706M	This manual is enclosed with instrument. This manual explains the basic key operation, mode menu, and data setting.
Multi-purpose Controller SC-F71 Installation Manual	172-65707M	This manual is enclosed with instrument. This manual explains the mounting and wiring.
Multi-purpose Controller SC-F71 Parameter List	172-65708M	This manual is enclosed with instrument. This list is a compilation of the parameter data of each mode.
<b>Multi-purpose Controller SC-F71 Instruction Manual [Hardware]</b>	<b>172-65709M</b>	<b>This manual you are reading now. This manual describes installation, wiring, troubleshooting and product specification.</b>
Multi-purpose Controller SC-F71 Instruction Manual [Parameters/Functions]	172-65710M	Parameters: This manual describes how to switch the operation modes and parameters, the range of parameters, and initialization/automatic conversion associated with the change of settings. Functions: This manual describes how to set up and each function.
Multi-purpose Controller SC-F71 Instruction Manual [Host Communication]	172-65711M	This manual explains original communication protocol and Modbus relating to communication parameters setting.
Multi-purpose Controller SC-F71 Instruction Manual [PLC Communication]	172-65712M	This manual describes how to set up the instrument for communication with a programmable controller (PLC).



Read this manual carefully before operating the instrument. Please keep the manual in a convenient location for easy reference.

## About this Manual

This manual consists of the following 7 chapters and index; Parts description, Model code, Mounting, Wiring and other basic handling of the instrument. If you are looking for basic handling information, you may be able to find one in the following table of contents.

### This manual [Hardware]:

	What do you want to do?	See the following section for more details
<input type="checkbox"/>	I want to check the features, the instrument, and the model code.	1. OUTLINE
<input type="checkbox"/>	I want to check the mounting caution and how to mount and remove.	2. MOUNTING*
<input type="checkbox"/>	I want to check the external dimensions and the panel cutout details	2. MOUNTING*
<input type="checkbox"/>	I want to check wiring caution, terminal layout, wiring to each terminal, etc.	3. WIRING*
<input type="checkbox"/>	I want to check the connection information of the loader communication.	3. WIRING*
<input type="checkbox"/>	I want to check how to use terminal covers	3. WIRING
<input type="checkbox"/>	I want to check the front appearance.	4. PARTS DESCRIPTION AND BASIC OPERATION*
<input type="checkbox"/>	I want to check the modes available.	
<input type="checkbox"/>	I want to know the basic operation such as setting a set value.	
<input type="checkbox"/>	I want to know what to do when I use the instrument for the first time.	5. OPERATION*
<input type="checkbox"/>	I want to know the error indications and the error codes.	6. TROUBLESHOOTING*
<input type="checkbox"/>	I want to know what actions I should take in case of errors.	6. TROUBLESHOOTING
<input type="checkbox"/>	I want to check the instrument information (ROM version, product identification code, instrument number).	6. TROUBLESHOOTING
<input type="checkbox"/>	I want to know the specification of the instrument.	7. SPECIFICATIONS*
<input type="checkbox"/>	I want to know how to replace a waterproof/dustproof packing	8. APPENDIX

\* Can be checked with the detailed manual supplied with the product.

### Major topics contained in other manuals:

	What do you want to do?	See the following instruction manual for more details
<input type="checkbox"/>	I want to know the functions and how to use them.	[Parameters/Functions]
<input type="checkbox"/>	I want to check the parameter names and their setting range.	[Parameters/Functions] Parameter List (This manual is enclosed with instrument.)
<input type="checkbox"/>	I want to know how to connect this instrument to a host computer.	[Host Communication]
<input type="checkbox"/>	I want to know how to connect this instrument to a programmable logic controller (PLC).	[PLC Communication]

# 1. Overview

## 1.1 Features

This high performance digital controller has the following features:

### Handle various control applications

- PID control (Reverse action)\*
- PID control (Direct action)\*
- Heating/Cooling PID control (Cooling linear type)\*
- Pressure control operation [MC-COS(R)/MC-VCOS(R)]\*
- Temperature control operation [MC-COS(R)/MC-VCOS(R)]\*
- Manual control\*\*

\* Specify when ordering

\*\* Switch the mode to Manual mode using Auto/Manual transfer

### Dual loop control is available

The following control types are available.

- Remote setting input\*
- 2-loop control \*
- Differential temperature control\*
- Control with PV select\*
- Cascade control\*

\* For details, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### Can handle various external disturbances

- Suppresses overshoot at startup (at power on, STOP to RUN), set value (SV) change, and occurrence of external disturbances\*
- Suppresses overshoot during the transition from ramp to soak when Setting change rate limiter is used\*
- Suppresses the bottom at the occurrence of external disturbances caused by Feedforward\*

\* For details, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### Freely assignable outputs

Output signal (control output, retransmission output, logic calculation output, and instrument status output) is freely assignable to each output (OUT: max. 3, DO: max. 4). \*

\* For details, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### Versatile memory area function

Main settings such as PID, event, and control related settings can be stored in up to 16 areas (Memory area function).

The use of this function offers:

- Simple ramp/soak control\*
- Simple sequence operation\*
- Control using Level PID\*

\* For details, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### Improved operatability

Function assignable key (FUNC key)\* SC-F71 is supplied with a FUNC key to which a specific function can be assigned. Assigning a function to the FUNC key realizes a direct access.

Desired screens can be grouped for easy access.\*

Up to 16 desired screens can be registered as one mode (Parameter select function).

\* For details, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### Communication

- Loader communication connector is supplied as standard on the front panel (SC-F71). Using our USB communication converter (COM-KG or COM-K2) and our communication tool (PROTEM-T)\*, the loader communication is possible to easily store and copy the set values.
  - \* Contact TLV.
- When Communication interface<sup>1)</sup> and communication protocol<sup>2)</sup> are specified at the time of order, any one of the following communication functions is possible.
  - Host communication to an upper system<sup>2)</sup>
  - PLC communication to MITSUBISHI MELSEC series<sup>3)</sup>

<sup>1)</sup> RS-422A

<sup>2)</sup> For details, refer to the separate manual [Host Communication].

<sup>3)</sup> For details, refer to the separate manual [PLC Communication].

## 1.2 Checking the Product

Before using this product, check each of the following:

- Model code
- Check that there are no scratches or breakage in external appearance (case, front panel, or terminal, etc.)
- Check that all of the items delivered are complete. (Refer to below)

Accessories	Q'TY	Remarks	
<input type="checkbox"/> Instrument	1	_____	
<input type="checkbox"/> Mounting bracket (with screw)	4	_____	
<input type="checkbox"/> Multi-purpose Controller SC-F71 Installation Manual (172-65706M)	1	Enclosed with instrument	
<input type="checkbox"/> Multi-purpose Controller SC-F71 Quick Start Guide (172-65707M)	1	Enclosed with instrument	
<input type="checkbox"/> Multi-purpose Controller SC-F71 Parameter List (172-65708M)	1	Enclosed with instrument	
<input type="checkbox"/> <b>Multi-purpose Controller SC-F71 Instruction Manual [Hardware] (172-65709M)</b>	<b>1</b>	<b>This manual</b>	This manual can be requested to TLV or your local TLV representative.
<input type="checkbox"/> Multi-purpose Controller SC-F71 Instruction Manual [Parameters/Functions] (172-65710M)	1	Contact TLV	
<input type="checkbox"/> Multi-purpose Controller SC-F71 Instruction Manual [Host Communication] (172-65711M)	1	Contact TLV	
<input type="checkbox"/> Multi-purpose Controller SC-F71 Instruction Manual [PLC Communication] (172-65712M)	1	Contact TLV	
<input type="checkbox"/> Waterproof/dustproof rubber packing KFZ900-317	1	Fitted to instrument	
<input type="checkbox"/> Terminal cover KFB400-58	2	_____	
<input type="checkbox"/> Front cover KRB900-36	Depending on the order quantity	Optional (sold separately)	

 If any of the above are missing, damaged, or if your manual is incomplete, contact TLV or your local TLV representative.

### 1.3 Model Code

Check that the product received is correctly specified by referring to the following model code list. If the product is not identical to the specifications, contact TLV or your local TLV representative.

#### 1.3.1 Suffix code

**SC-F71-**  ★  1

(1) (2) (3) (4) (5) (6)

Specification		Suffix code						
		(1)	(2)	(3)	(4)	(5)	(6)	
SC-F71-		<input type="checkbox"/>	★	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>
Control operation type	PID control with AT (Reverse action)	F						
	PID control with AT (Direct action)	D						
	Heating/Cooling PID control with AT	G						
	Pressure control operation [MC-COS(R)-3]	2						
	Pressure control operation [MC-COS(R)-16, Size 15 to 50 mm]	3						
	Pressure control operation [MC-COS(R)-16, Size 65 to 150 mm]	4						
	Pressure control operation [MC-COS(R)-21]	5						
	Pressure control operation [MC-VCOS(R)]	6						
	Temperature control operation [MC-COS(R)-16]	7						
	Temperature control operation [MC-VCOS(R)]	8						
Communication	None		N					
	RS-422A (4-wired system)		4					
Waterproof/Dustproof	IP65 (front)			1				
Input Range code	Refer to 1.3.2. Range Code Table				<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			
Unit/range code	Refer to Unit/Range Code Table (Added when control operation type is 2 to 8)					<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Special order model	X is added for the special order model							X

- 1) Output 1 (OUT1) is set to Input 1 control output, and Output 2 (OUT2) is set to Retransmission output when shipped from the factory.
- 2) Output 3 (OUT3) and the digital input will be factory preset as follows.  
 Output 3 (OUT3): OUT3 function selection ( $F_{n23}$   $o5L3$ ): **4** (Retransmission output),  
 Universal output type selection (OUT3) ( $F_{n23}$   $UNI$   $o$ ): **1** (Current output (4 to 20mA DC)),  
 Retransmission output 3 type ( $F_{n23}$   $Ra3$ ): **3** (Input 1\_Set value (SV) monitor)  
 Digital input: Function is not assigned to DI1 to DI6. Assign functions as necessary ( $F_{n23}$   $di$   $5L1$  to  $di$   $5L6$ ). However, when optional communication function is selected, the number of digital input is 4 points (DI1 to DI4).
- 3) When Heating/Cooling PID control is specified, “2: Measured input 2” in the specification code is not selectable.

### 1.3.2 Range Code Table

#### Thermocouple (TC) input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits**
K	K01	0 to 200 °C	4	T	T01	-199.9 to +400.0 °C	4
	K02	0 to 400 °C	4		T02	-199.9 to +100.0 °C	4
	K03	0 to 600 °C	4		T03	-100.0 to +200.0 °C	4
	K04	0 to 800 °C	4		T19	-200.0 to +400.0 °C	5
	K06	0 to 1200 °C	4		R	R01	0 to 1600 °C
	K07	0 to 1372 °C	4	R07		-50 to +1768 °C	4
	K08	-199.9 to +300.0 °C	4	R08		-50.0 to +1768.0 °C	5
	K09	0.0 to 400.0 °C	4	R09		0.0 to 1600.0 °C	5
	K10	0.0 to 800.0 °C	4	S	S06	-50 to +1768 °C	4
	K14	0 to 300 °C	4		S07	-50.0 to +1768.0 °C	5
	K41	-200 to +1372 °C	4	B	B03	0 to 1800 °C	4
	K42	-200.0 to +1372.0 °C	5		B04	0.0 to 1800.0 °C	5
	KA1	0 to 800 °F	4	E	E01	0 to 800 °C	4
	KA2	0 to 1600 °F	4		E23	0.0 to 800.0 °C	4
KA3	0 to 2502 °F	4	N		N02	0 to 1300 °C	4
J	J01	0 to 200 °C		4	N05	0.0 to 1300.0 °C	5
	J02	0 to 400 °C		4	W5Re/ W26Re	W03	0 to 2300 °C
	J03	0 to 600 °C	4	PL II		A01	0 to 1300 °C
	J04	0 to 800 °C	4		A05	0.0 to 1300.0 °C	5
	J08	0.0 to 400.0 °C	4	U	U01	-199.9 to +600.0 °C	4
	J29	-200.0 to +1200.0 °C	5		L	L04	0.0 to 900.0 °C
	JA1	0 to 800 °F	4	PR40-20	F02	0 to 1800 °C	5
	JA3	0 to 2192 °F	4		FA2	0 to 3200 °F	5
	JA6	0 to 400 °F	4				

#### RTD input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits**	
PT100	D01	-199.9 to +649.0 °C	4	Pt100	D21	-200.0 to +200.0 °C	5	
	D04	-100.0 to +100.0 °C	4		D27	0.00 to +50.00 °C	4	
	D05	-100.0 to +200.0 °C	4		D34	-100.00 to +100.00 °C	5	
	D06	0.0 to 50.0 °C	4		D35	-200.0 to +850.0 °C	5	
	D07	0.0 to 100.0 °C	4		DA1	-199.9 to +999.9 °F	4	
	D08	0.0 to 200.0 °C	4		DA9	0.0 to 500.0 °F	4	
	D09	0.0 to 300.0 °C	4		JPt100	P08	0.0 to 200.0 °C	4
	D10	0.0 to 500.0 °C	4			P29	-100.00 to +100.00 °C	5
	D12	-199.9 to +600.0 °C	4			P30	-200.0 to +640.0 °C	5

#### Voltage/Current input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits**
0 to 10 mV DC	101	Programmable range -199999 to +99999	5	1 to +5 V DC	601	Programmable range -19999 to +99999	5
0 to 100 mV DC	201		5	0 to 20 mA DC	701		5
0 to 1 V DC	301		5	4 to 20 mA DC	801		5
0 to 5 V DC	401		5	-10 to +10V DC	904		5
0 to 10 V DC	501		5	-5 to +5 V DC	905		5

\*\* In case of original communication, it is handled as 7-digit data.

In case of MODBUS communication, it is handled as a "double word".

Order of data transfer: upper word to lower word

### 1.3.3 Unit/Range Code Table

Thermocouple (TC) input

Valve	Unit	Pressure Sensor	Pressure Range	Code	Valve	Unit	Code
MC-COS(R)	°C kg/cm <sup>2</sup> g	MBS33M	0 to 5.10	001	°C kg/cm <sup>2</sup>	001	
			0 to 10.20	002			
			0 to 20.40	003			
			0 to 25.50	004			
		KH15	0 to 5.00	005			
			0 to 10.00	006			
			0 to 20.00	007			
	°C barg	MBS33M	0 to 5.00	101	°C bar	101	
			0 to 10.00	102			
			0 to 20.00	103			
			0 to 25.00	104			
		KH15	0 to 5.00	105			
			0 to 10.00	106			
			0 to 20.00	107			
	°F psig	MBS33M	0 to 72.5	201	°F psi	201	
			0 to 145.0	202			
			0 to 290.1	203			
			0 to 362.6	204			
		KH15	0 to 75.0	205			
			0 to 150.0	206			
0 to 300.0			207				
°C kPaG	MBS33M	0 to 500	301	°C kPa	301		
		0 to 1000	302				
		0 to 2000	303				
		0 to 2500	304				
°C MPaG	MBS33M	0 to 0.500	401	°C MPa	401		
		0 to 1.000	402				
		0 to 2.000	403				
		0 to 2.500	404				
MC-VCOS(R)	°C mmHgG	MBS33M	-760 to 2240	A01	°C mmHg	A01	
		KH15	-736 to 736	A02			
	°C mmHg abs	MBS33M	0 to 3000	A13	°C mbar	B01	
		KH15	2.4 to 1496	A14			
	°C mbarg	MBS33M	1013 to 298	B01	°C inHg	C01	
		KH15	-981 to 981	B02			
	°C mbar abs	MBS33M	0 to 4000	B13	°F psi	D01	
		KH15	33 to 1994	B14			
	°C inHgG	MBS33M	-29.9 to 88.2	C01	°C kPa	E01	
		MBS33M	0 to 118.1	C12			
	°F psig	MBS33M	14.70 to 43.3	D01	°C kPa abs	E12	
		KH15	14.22 to 14.2	D02			
	°F psi abs	MBS33M	0 to 58.02	D13			
		KH15	0.48 to 28.92	D14			
°C kPaG	MBS33M	-101.3 to 298.7	E01				
°C kPa abs	MBS33M	0 to 400.0	E12				

## 2. Installation

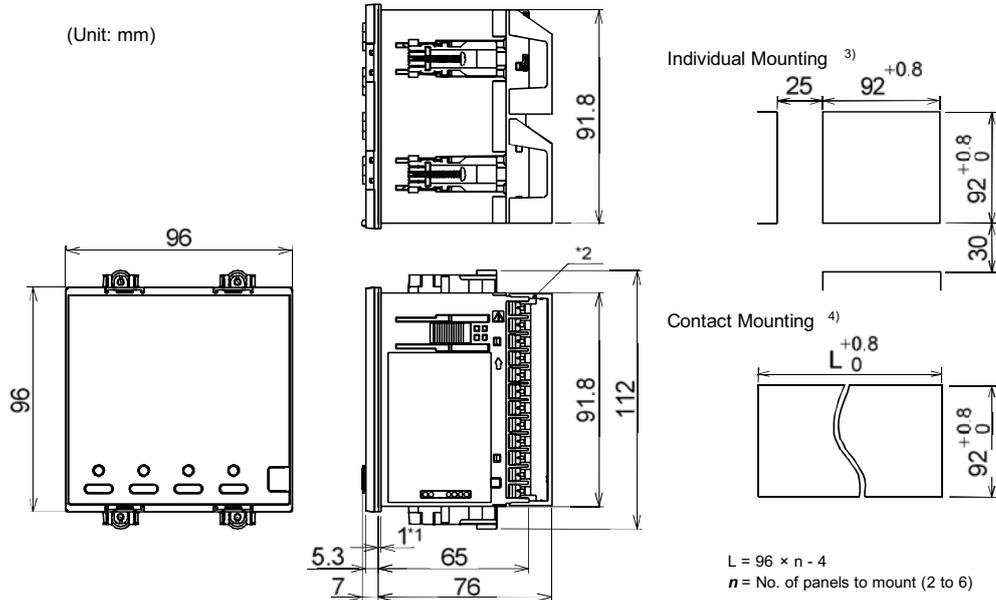
### 2.1 Installation



**WARNING** To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

- (1) This instrument is intended to be used under the following environmental conditions. **(IEC 61010-1)** [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
- (2) Use this instrument within the following environment conditions:
  - Allowable ambient temperature: -10 to +55 °C
  - Allowable ambient humidity: 5 to 95% RH (Absolute humidity: MAX.W.C 29 g/m<sup>3</sup> dry air at 101.3 kPa)
  - Installation environment conditions: Indoor use
    - Altitude up to 2000 m
    - Short-term temporary overvoltage: 1440 V
    - Long-term temporary overvoltage: 490 V
- (3) Avoid the following conditions when selecting the mounting location:
  - Rapid changes in ambient temperature which may cause condensation.
  - Corrosive or inflammable gases.
  - Direct vibration or shock to the mainframe.
  - Water, oil, chemicals, vapor or steam splashes.
  - Excessive dust, salt or iron particles.
  - Excessive induction noise, static electricity, magnetic fields or noise.
  - Direct air flow from an air conditioner.
  - Exposure to direct sunlight.
  - Excessive heat accumulation.
- (4) Mount this instrument in the panel considering the following conditions:
  - Provide adequate ventilation space so that heat does not build up.
  - Ensure at least 50 mm space on top and bottom of the instrument for maintenance and environmental reasons.
  - Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, thyristor units, large-wattage resistors.)
  - If the ambient temperature rises above 55 °C, cool this instrument with a forced air cooling fan, cooling unit, etc. Cooled air should not blow directly on this instrument.
  - In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
    - High voltage equipment: Do not mount within the same panel.
    - Power lines: Separate at least 200 mm.
    - Rotating machinery: Separate as far as possible.
  - For correct functioning mount this instrument in a horizontal position.
- (5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

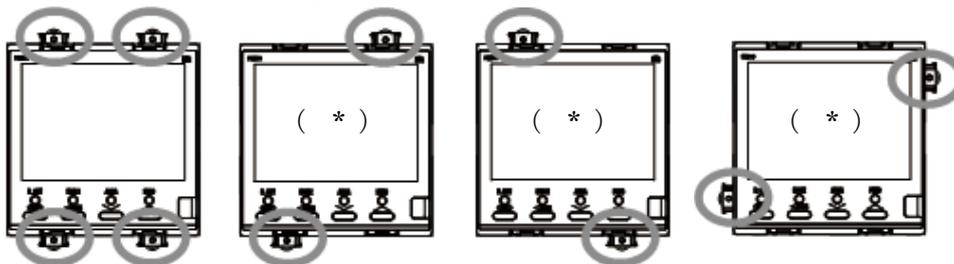
## 2.2 Dimensions



- 1) Packing
- 2) Terminal cover
- 3) To keep the instrument as waterproof as possible, make sure that the panel surface has no burr or distortion where the hole is to be cut out.
- 4) Remove the packing. When the SC-F71 is mounted closely protection will be compromised and they will not meet IP65 standards.

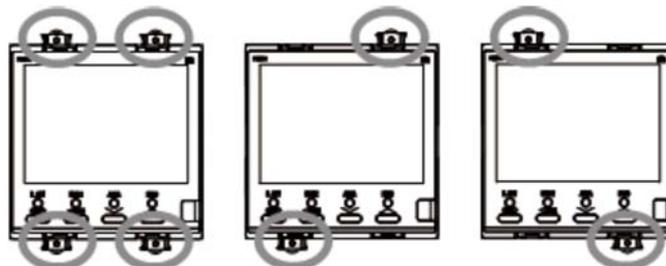
## 2.3 Mounting and Removal Procedures

The mounting position of the mounting brackets  
Mounting positions for a single controller



SC-F71 mounted with two mounting brackets does not provide water and dustproof protection.

### Mounting positions for close mounting



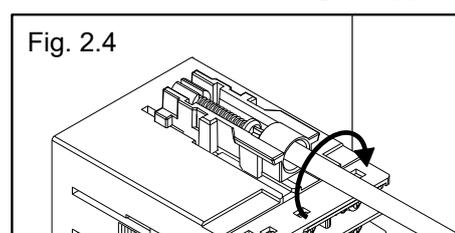
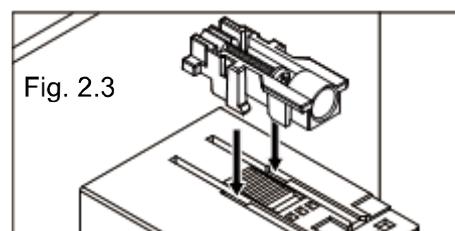
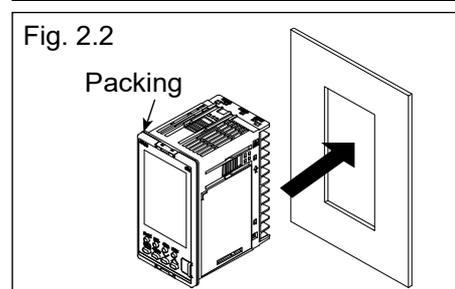
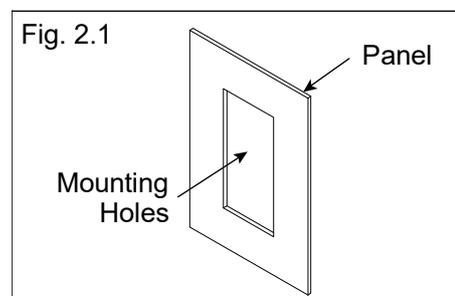
When mounted closely, the controllers are not waterproof or dustproof.

## Mounting procedures

The front of the instrument conforms to **IP65** (specify when ordering) when mounted on the panel. For effective waterproof/dustproof, the packing must be securely placed between the instrument and the panel without any gap. If the packing is damaged, please contact TLV or your local TLV representative.

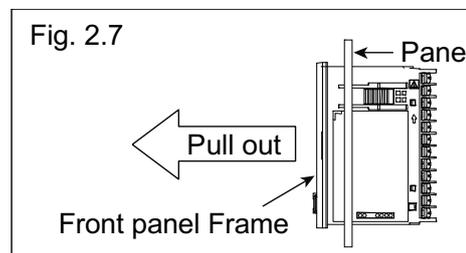
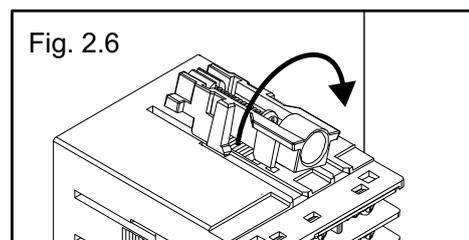
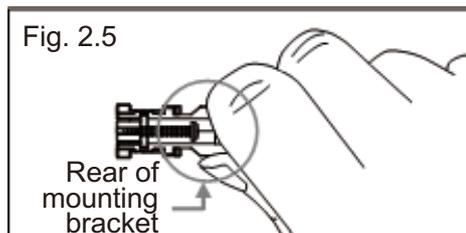
1. Prepare the panel cutout as specified in Fig. 2.1. (Panel thickness: 1 to 10 mm)  
 Refer to 2.2 Dimensions.
2. Set the waterproof/dustproof packing on the case from the back side of the instrument as shown in Fig. 2.2.  
 Insert the instrument through the panel cutout.
3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 2.3)  
 Do not push the mounting bracket forward.  
 **NOTE** For waterproof and dustproof protection, two mounting brackets must be placed on the top and the bottom of the instrument. If the mounting brackets are placed on the sides of the controller, waterproof and dustproof protection will not be guaranteed.
4. After inserting the mounting bracket, tighten the screw for the mounting bracket with a Phillips screwdriver. (Fig. 2.4)  
 After inserting the tip of the screwdriver, turn once only.

 For replacement of the packing, refer to 8.1 Replacing the Waterproof/Dustproof Packing in 8. Appendix.

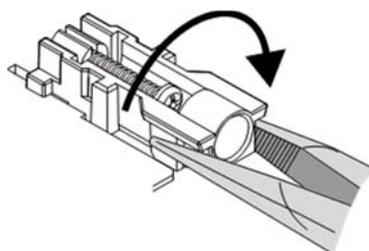


### Removal procedures

1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket.
4. Remove the mounting bracket by holding it (Fig. 2.5) and twisting it out from the instrument (Fig. 2.6)
5. The other mounting bracket(s) should be removed in the same way as described in 3 and 4.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 2.7)



Use long-nose pliers to remove the mounting brackets from the instrument that is installed in a narrow space or installed closely to each other in a vertical position.

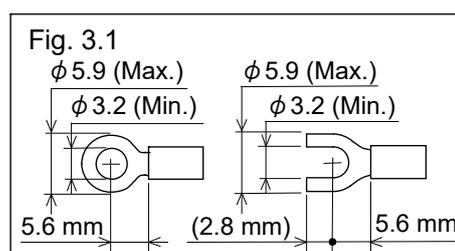


## 3. Wiring

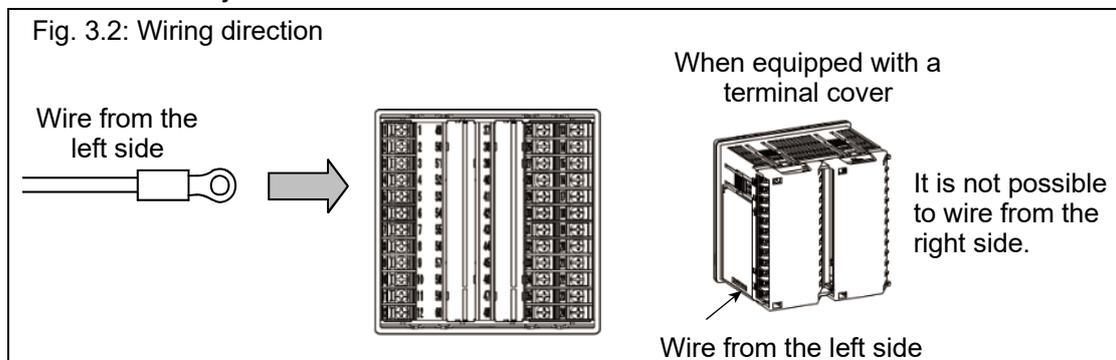
### 3.1 Wiring Cautions

<b>⚠ WARNING</b>	To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
<b>⚠ CAUTION</b>	When checking instrument operation after wiring, avoid using CA150 (Yokogawa Electric Corporation) to prevent malfunction due to incorrect operation. If CA150 must be used, turn on the CA150 before connecting to the instrument.

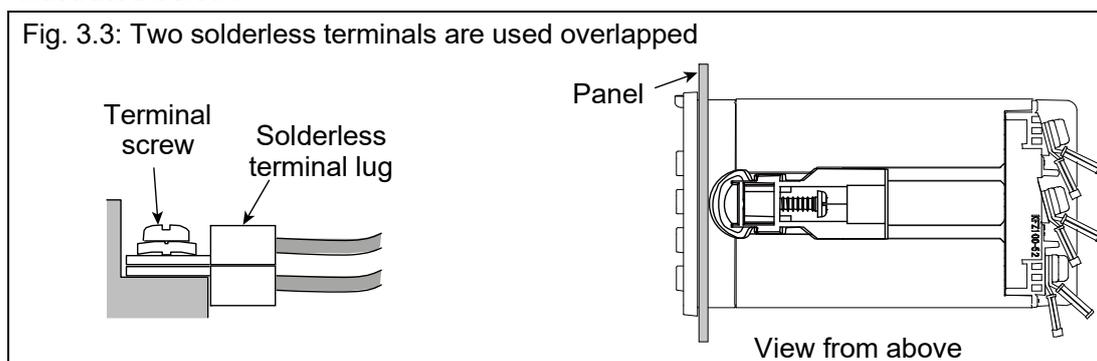
- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC 60950-1.
- When measured input 1 or measured input 2 is used as a current input (including when input 2 is used as a remote setting input), make sure that the current input value including transient conditions is within the allowable input range described in 7. Product Specifications. (Maximum allowable current: 30 mA or less (maximum allowable voltage between terminals 2 V DC or less)). When the current input value exceeds its allowable input range, the current detection components inside the main unit may be damaged, leading to failure. When connecting a current generator, make sure that the value (including the transient state immediately after the start-up) does not exceed its allowable input range. (Current generator specifications vary depending on the manufacturer.)
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- Allow approximately 5 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate breaking capacity close to the instrument.  
 Fuse type: Time-lag fuse (Approved fuse according IEC 60127-2 and/or UL 248-14)  
 Fuse rating: Rated voltage 250 V AC, Rated current 1 A (100 to 240 V AC type)



- Use the solderless terminal appropriate to the screw size.  
Screw size: M3 × 7 (with 5.8 × 5.8 square washer)  
Recommended tightening torque: 0.4 N·m  
Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm<sup>2</sup>  
Specified dimension: Refer to Fig. 3.1  
Specified solderless terminal: Circular terminal with isolation V1.25 to MS3  
Manufactured by J.S.T MFG CO., LTD.
- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.
- When wiring SC-F71, wire from the left direction toward the backside terminals as shown in Fig. 3.2. The wiring surfaces of the 2 right side lines of terminals are inclined to make it easier to wire from the left side.  
When using the terminal cover (Figs. 3.2, 3.4), it is not possible to wire from the right side. When wiring from the left and right with a close mounting, there are cases where adjacent instruments cannot be wired.

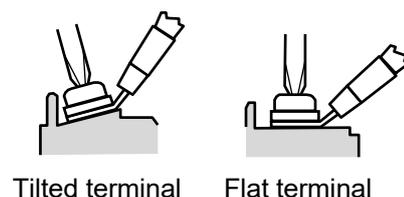


- Up to two solderless terminal lugs can be connected to one terminal screw. The requirements of reinforced insulation can be still complied with in this condition. When actually doing this, place one solderless terminal lug over the other as illustrated below.

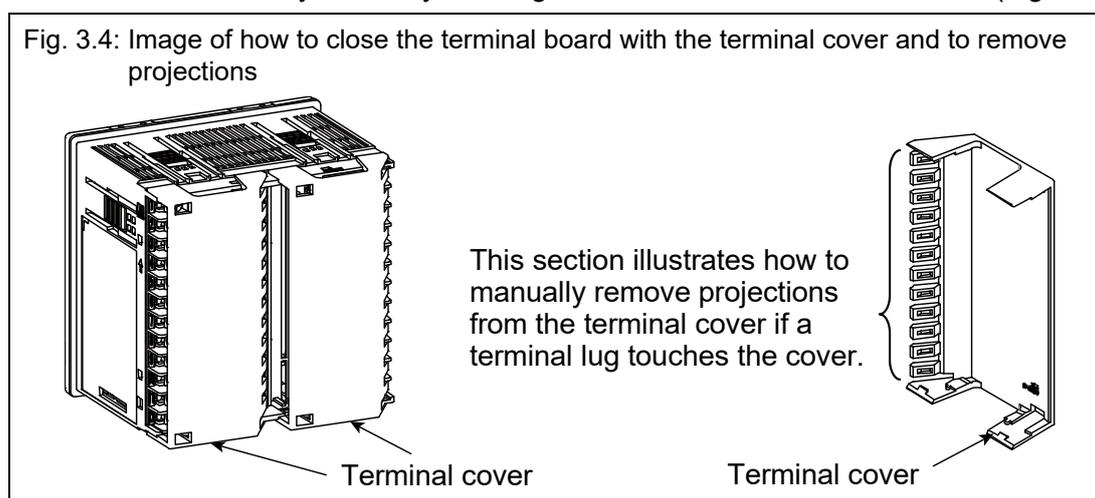


 If solderless terminal lugs other than the recommended dimensions are used, terminal screws may not be tightened. In that case, bend each solderless terminal lug before wiring. If the terminal screw is forcibly tightened, it may be damaged.

 When tightening a screw of the instrument, make sure to fit the screwdriver properly into the screw head mounted tilted or flat as shown in the right figure. Tightening the screw with excessive torque may damage the screw thread.



- Caution for using the terminal cover:
  - To prevent electric shock or instrument failure, always turn off the power before mounting or removing the terminal cover.
  - When mounting and removing the terminal cover, apply pressure very carefully to avoid damage to the terminal cover.
  - If a solderless terminal lug touches the terminal cover, remove the projection from the terminal cover by manually bending it back and forth until it breaks off. (Fig. 3.4)

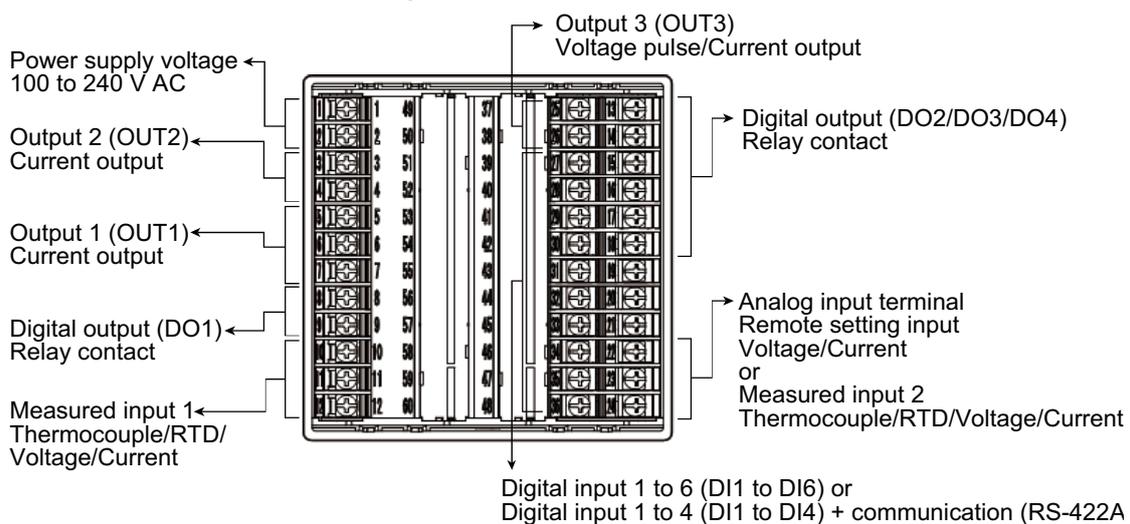


For the mounting and removing of the terminal cover, refer to 3.4 Handling of the Terminal Cover.

### 3.2 Terminal Layout

The terminal layout is as follows.

To prevent malfunctioning, do not connect wires to unused terminals.

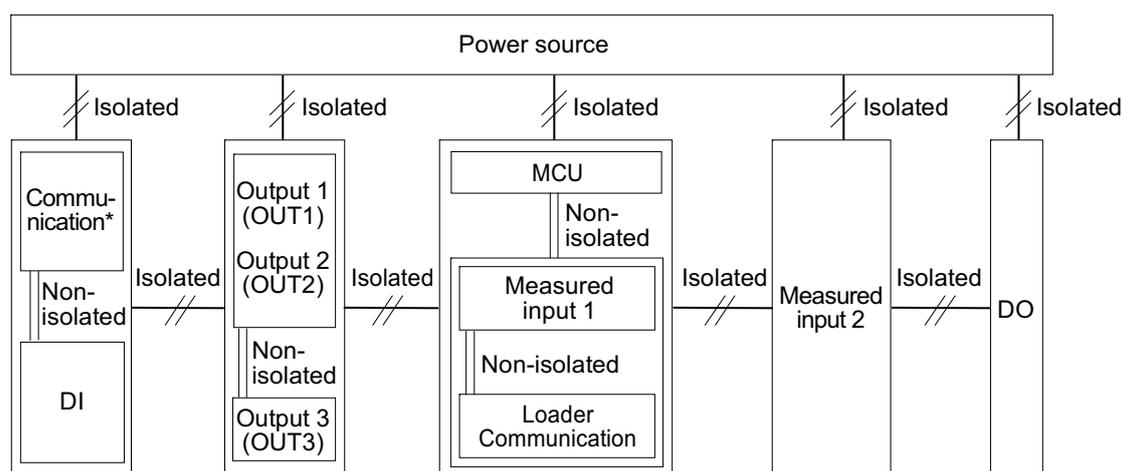


**NOTE** When measured input 1 or measured input 2 is used as a current input (including the case when input 2 is used as a remote setting input), make sure that the current input value including transient conditions is within the allowable input range described in 7. Product Specifications. (Maximum allowable current: 30 mA or less (maximum allowable voltage between terminals 2 V DC or less)). When the current input value exceeds its allowable input range, the current detection

components inside the main unit may be damaged, leading to failure. When connecting a current generator, make sure that the value (including the transient state immediately after the start-up) does not exceed its allowable input range. (Current generator specifications vary depending on the manufacturer.)

### Input/output isolation

See below for the input/output isolation block diagram for the instrument:



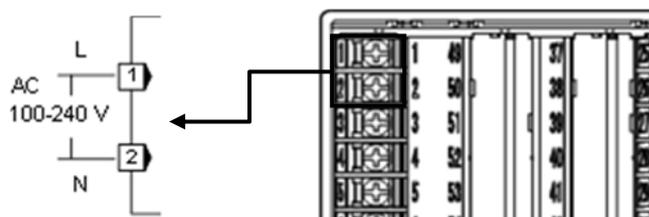
\* Option

### 3.3 Wiring of Each Terminal

Always check the polarity of each terminal prior to wiring.

#### 3.3.1 Power supply

- Connect the power to terminal numbers 1 and 2.



- Power supply voltage for the controller must be within the range shown below.

Power supply type	85 to 264 V AC [Including power supply voltage variation] (Rated: 100 to 240 V AC) Power supply frequency: 50/60 Hz Frequency variation: 50 Hz (-10 to +5%), 60 Hz (-10 to +5%)
Power consumption	7.4 VA max. (at 100 V AC), 10.9 VA max. (at 240 V AC)
Rush current	5.6 A or less (at 100 V AC), 13.3 A or less (at 240 V AC)

- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.

- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate breaking close to the instrument.

Fuse type: Time-lag fuse (IEC 60127-2, UL 248-14)

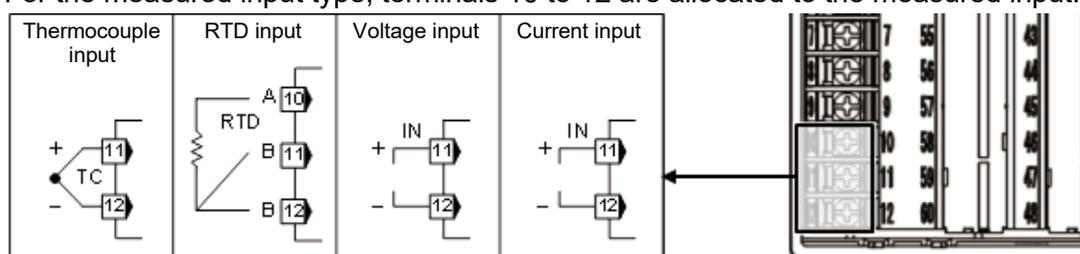
Fuse rating: Rated voltage: 250 V AC

Rated current: 0.5 A (24 V AC/DC type)

1 A (100 to 240 V AC type)

### 3.3.2 Measured input 1 (Thermocouple/RTD/Voltage/Current)

- For the measured input type, terminals 10 to 12 are allocated to the measured input.



- The input types (input group) are as follows

Input group	Input type
Thermocouple (TC) input	K, J, T, S, R, E, B, N (JIS C1602-1995), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751-00)
RTD input	Pt100 (JIS C1604-1997), JPt100 (JIS C1604-1997, Pt100 of JIS C1604-1981)
Low voltage input	0 to 10 mV DC, 0 to 100 mV DC
High voltage input	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
Current input	0 to 20 mA DC, 4 to 20 mA DC

**NOTE** When measured input 1 is used as a current input, make sure that the current input value including transient conditions is within the following allowable input range. When the current input value exceeds its allowable input range, the current detection components inside the main unit may be damaged, leading to failure. When connecting a current generator, make sure that the value (including the transient state immediately after the start-up) does not exceed its allowable input range. (Current generator specifications vary depending on the manufacturer.)

Current detection components: Shunt resistor (approx. 50  $\Omega$  0.1 W)

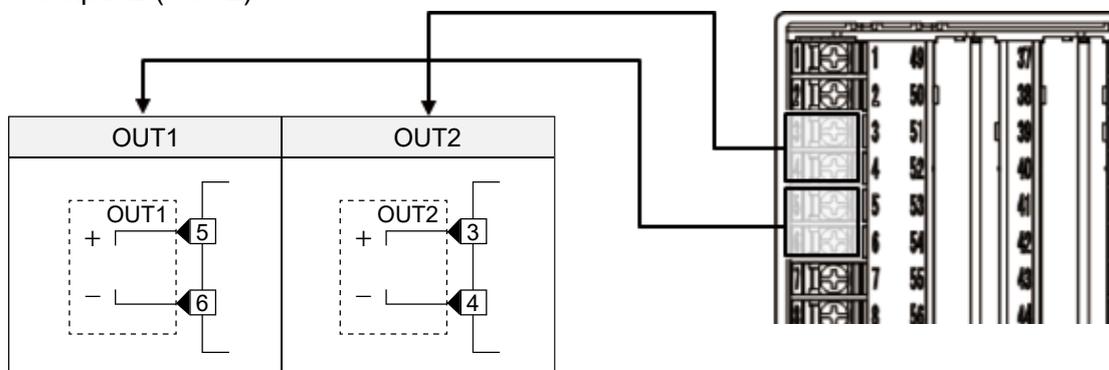
Allowable input range: Maximum allowable applied voltage 2 V DC or allowable current input range -20.0 to +30.0 mA (measured input 1: between terminals 11 and 12)

**NOTE** When the input type is changed from current input or high voltage input to TC, RTD or low voltage input, remove the wirings of the measured input before attempting the input change. Changing the input type with the signal applied to the instrument may lead to a failure of the instrument.

**🗨️** For details on changing the Input type, refer to the separate SC-F71 Instruction Manual [Parameter/function] (172-65710M).

### 3.3.3 Output 1 (OUT1)/Output 2 (OUT2)

- Terminals 5 and 6 are used for Output 1 (OUT1); and Terminal 3 and 4 are used for Output 2 (OUT2).
- Connect an appropriate load according to the output type of Output 1 (OUT1) and Output 2 (OUT2).



- The specifications of each output are as follows.

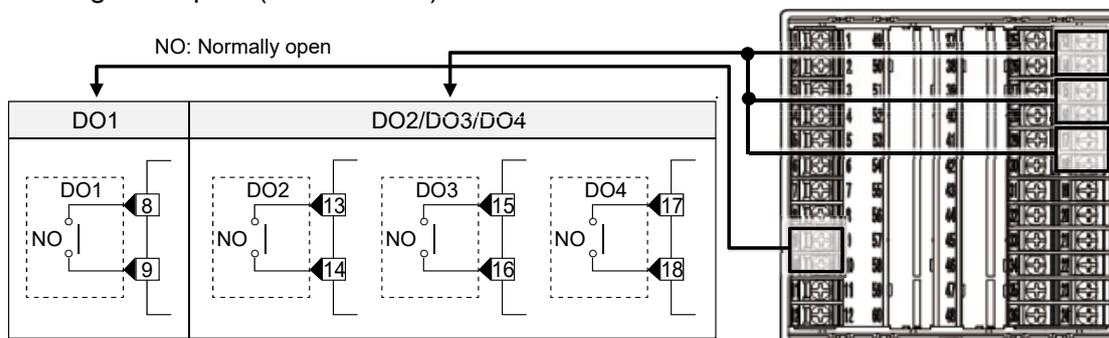
Output type	Specifications
Current output	0 to 20 mA DC (Allowable load resistance: 500 $\Omega$ or less)
	4 to 20 mA DC (Allowable load resistance: 500 $\Omega$ or less)

- Output signals (functions) can be assigned to each output (OUT1, OUT2) in the Engineering mode ( $F_n30$ )  
Input 1 Control output is assigned to Output 1 (OUT1) and Retransmission output is assigned to Output 2 (OUT2).  
Retransmission output assigned to Output 2 can be set in the Engineering mode, however "Input 1\_Measured value (PV)" is set when shipped from the factory.

 For details of output signal (function) assignment, refer to the separate SC-F71 Instruction Manual [Parameter/function] (172-65710M).

### 3.3.4 Digital output (DO1/DO2/DO3/DO4)

- Terminal 8 and 9 are used for DO1; and Terminals 13 through 18 are used for DO2 to DO4.
- Connect the load(s) according to the number of outputs (specify when ordering) of Digital outputs (DO1 to DO4).



- The only output type is relay contact output.

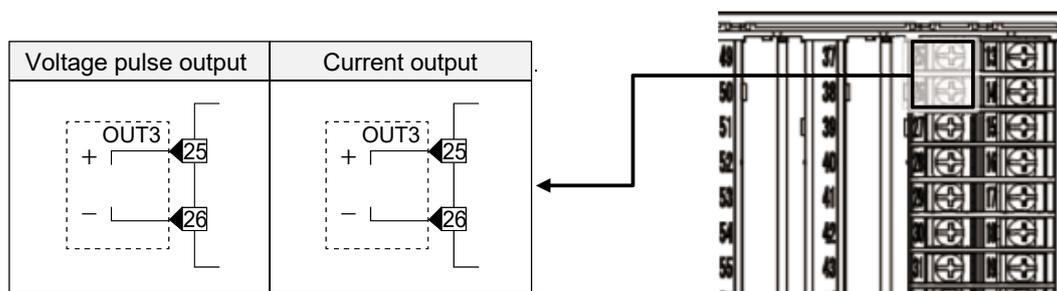
Digital output [4 points] (DO1 to DO4)	Contact type: a contact Contact rating (Resistive load): 250 V AC 1 A, 30 V DC 0.5 A Electrical life: 150,000 times or more (Rated load) Mechanical life: 20 million times or more (Switching: 300 times/min)
---	--

- Output signals (functions) can be assigned to each Digital output (DO1 to DO4). Output signal (function) assignment is available either Initial setting code at the time of order or reconfiguration in the Engineering mode.

☞ For details of Output signal (function) assignment, refer to the separate SC-F71 Instruction Manual [Parameter/Function] (172-65710M).

### 3.3.5 Output 3 (OUT3)

- Terminal 25 and 26 are used for Output 3 (OUT3).
- Connect a recorder, a load, etc according to the Output type of Output 3 (OUT3).



- Output 3 (OUT3) is a universal output. Even after the delivery of the instrument, the output type (see the table below) can be changed at Universal output type selection (OUT3) (UN o) in the Engineering mode (Fn30).

☞ For the details of changing the Output 3(OUT3), refer to the separate SC-F71 Instruction Manual [Parameter/Function] (172-65710M).

OUT3 type	Specifications
Voltage pulse output	0/14 V DC (Allowable load resistance: 600 $\Omega$ or more)
Current output	4 to 20 mA DC (Allowable load resistance: 500 $\Omega$ or less) [Factory set value]
Current output	0 to 20 mA DC (Allowable load resistance: 500 $\Omega$ or less)

- Output signal (function) can be assigned to Output 3 (OUT3) in Engineering mode (Fn30).

Retransmission output is assigned when shipped from the factory.

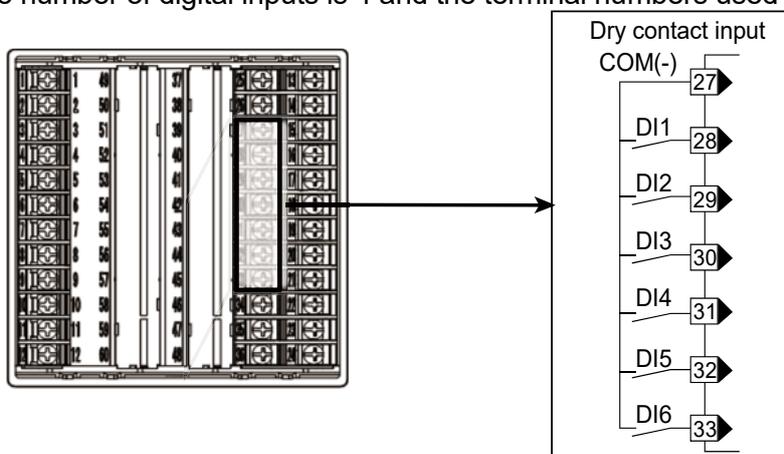
Retransmission output can be assigned in the Engineering mode (Fn33), however Input 1 Set value (SV) monitor is set when shipped from the factory.

☞ For the details of changing the Output 3(OUT3), refer to the separate SC-F71 Instruction Manual [Parameter/Function] (172-65710M).

### 3.3.6 Digital input (DI1 to DI6)

- Terminal 27 to 33 are used for Digital input 1 to 6 (DI1 to DI6).

When optional communication (RS-422A) is selected, the terminal numbers 32 to 36 are used, the number of digital inputs is 4 and the terminal numbers used are 27 to 31.



- Digital input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should meet the specification below.

Contact specifications: Time-lag fuse (IEC 60127-2, UL 248-14)

Fuse rating: OFF (contact open): 50 k  $\Omega$  or more

ON (contact closed): 1 k  $\Omega$  or less

Contact current: 3.3 mA DC or less

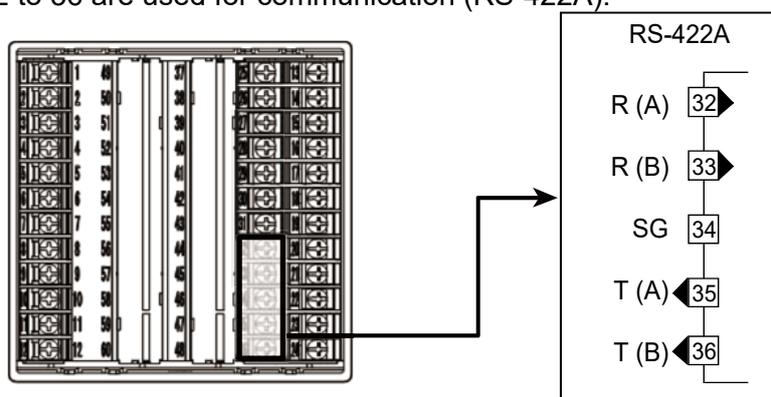
Capture judgment time: Within 200 ms

- Function assignment of Digital inputs 1 to 6 (DI1 to DI6) can be done in the Engineering mode ( $F_{n23}$ ).  
No function is assigned to DI1 to DI6 when shipped from the factory.

To assign functions to Digital input 1 to 6 (DI1 to DI6), refer to the separate SC-F71 Instruction Manual (172-65710M).

### 3.3.7 Communication (RS-422A) (optional)

- Terminal 32 to 36 are used for communication (RS-422A).



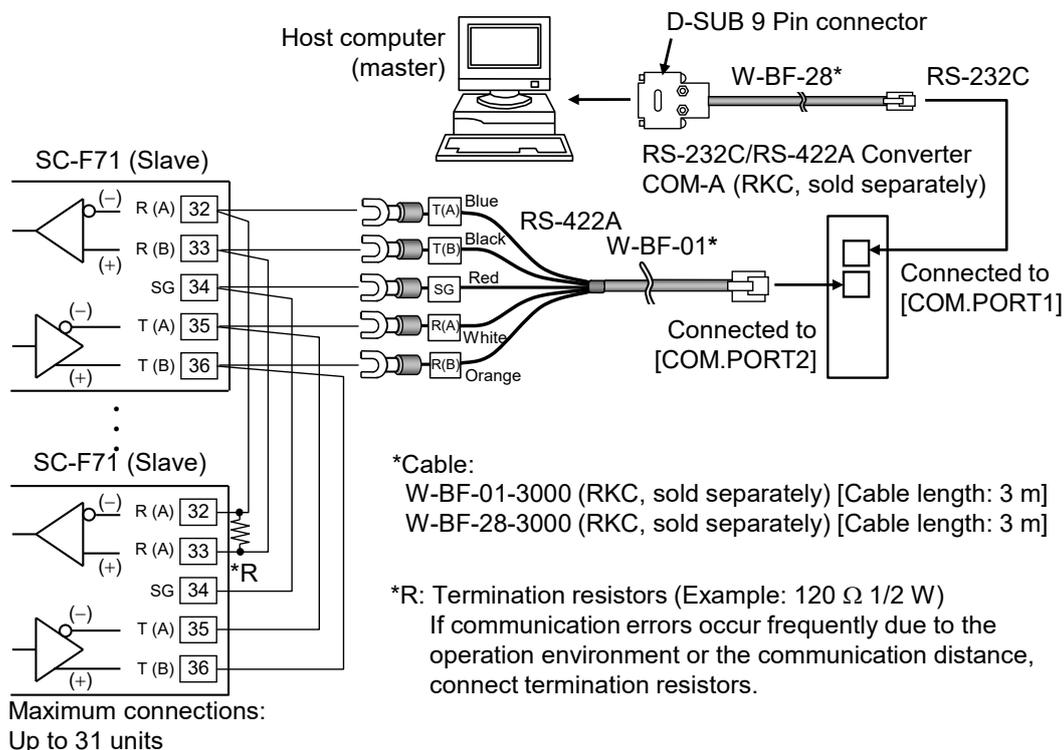
- Communication protocol can be configured with the engineering mode ( $F_{n50}$ ).

Communication protocol	Wiring example
Original communication (ANSI X3.28-1976)*	1 and 2
MODBUS	1 and 2
PLC communication (MITSUBISHI MELSEC series special protocol (QnA-compatible 3C frame format 4)	3



● Wiring example 2

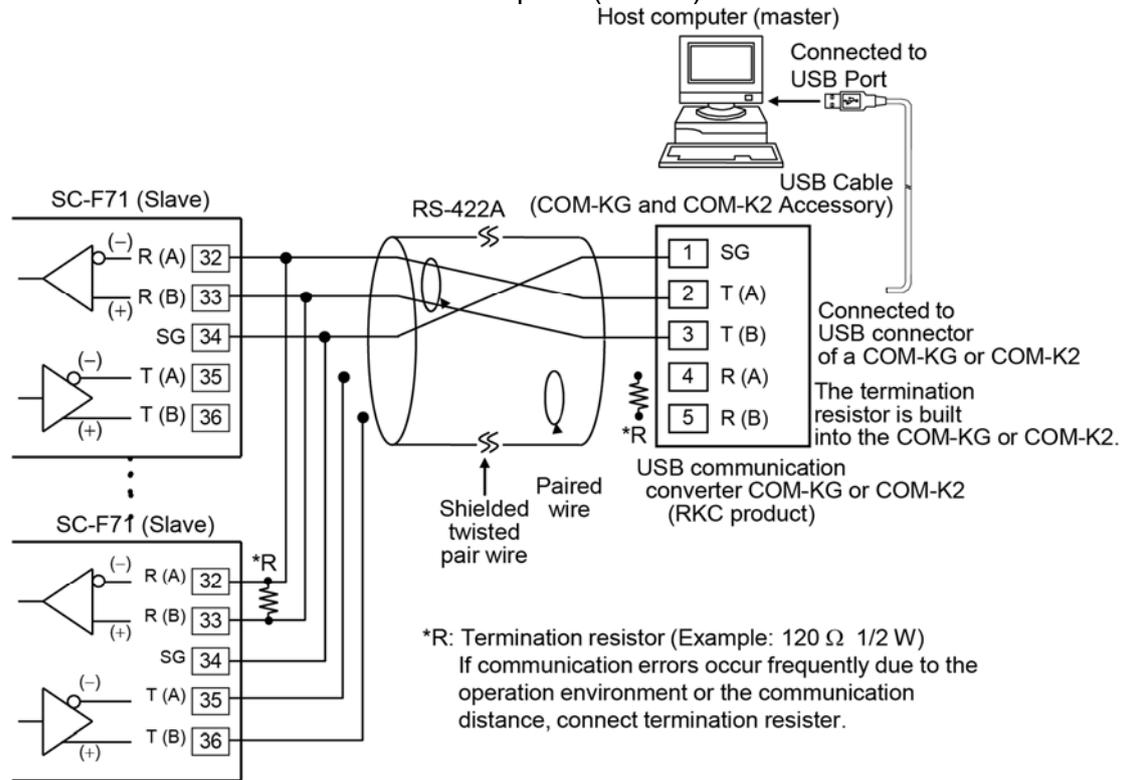
Connection to the RS-232C port of the host computer (master)



-  The communication cable and termination resistor(s) must be provided by the customer.
-  W-BF-01-3000 and W-BF-28-3000 (RKC, sold separately) can be used to connect the SC-F71 and the host computer. However, these cables are not shielded twisted pair wire. When the system is affected by the external noise, the twisted pair wire must be provided by the customer.
-  Recommended RS-232C/RS-422A converter: COM-A (RKC product)  
For the COM-A, refer to the COM-A/COM-B Instruction Manual.

● Wiring example 3

Connection to the USB of the host computer (master)



Maximum connections:  
Up to 31 units

The communication cable and termination resistor(s) must be provided by the customer.

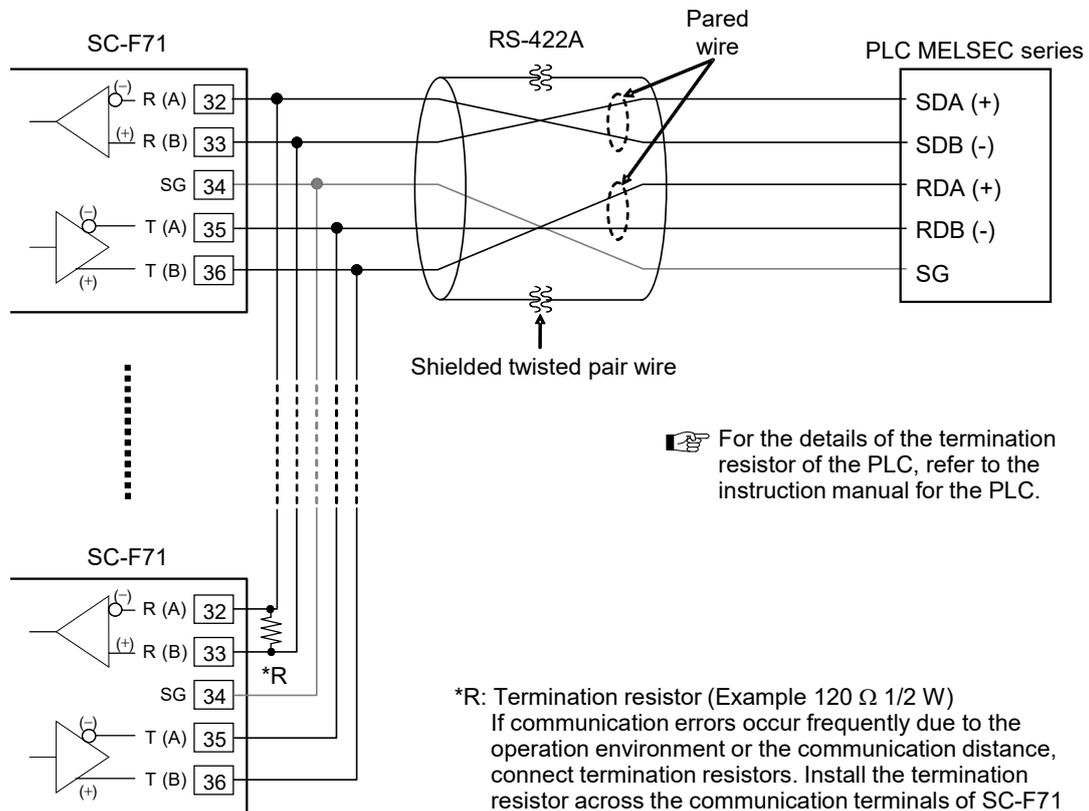
Recommended USB communication converter: COM-KG or COM-K2 (RKC product)  
For the COM-KG and COM-K2, refer to the relevant Instruction Manual.

● Wiring example 4

When the PLC to be connected is MITSUBISHI MELSEC series

**NOTE** Note that the signal polarity symbols (A and B) are opposite to each other between the PLC (MELSEC series) and the SC-F71. Normally A is connected to A and B to B. However, in this case, A must be connected to B, and B must be connected to A.

PLC MELSEC series		PLC MELSEC series	
Receive data (-)	R (A)	SDA	Send data (+)
Receive data (+)	R (B)	SDB	Send data (-)
Signal ground	SG	RDA	Receive data (+)
Send data (-)	T (A)	RDB	Receive data (-)
Send data (+)	T (B)	SG	Signal ground



Maximum connections:  
UP to 31 units

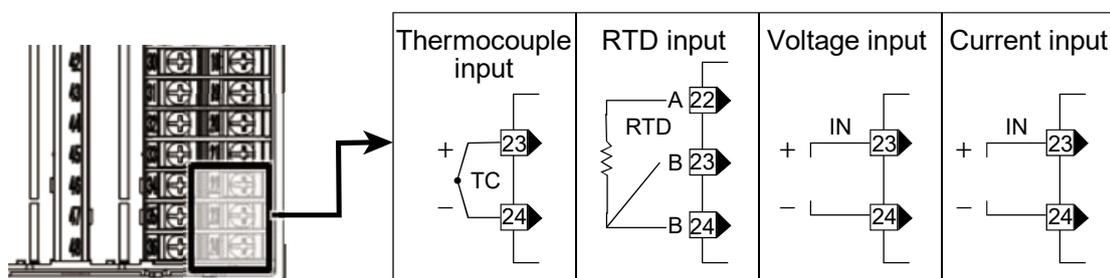
### 3.3.8 Analog input

- Terminals 22 to 24 are used for Analog input (Input 2). The set value can be sent or the second measured value can be received remotely with the analog signal.
- Input 2 can be set in the Engineering mode ( $F_{n5B}$ ).  
Remote setting input is set to Input 2 when shipped from the factory.

☞ For details on assigning Input 2, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

#### Remote setting input

- Terminals 23 and 24 are used for Remote setting input.
- Connect an appropriate input to terminals 23 and 24 according to the specification of the Remote setting input.



☞ Remote setting input type can be selected from the table below with the Input type of Input 2 ( $2\_INP$ ) in the Engineering mode ( $F_{n22}$ ). When shipped from the factory, remote setting input type is set to Input 1\_Input type (specified when ordering)

Input group	Input type
Thermocouple (TC) input	K, J, T, S, R, E, B, N (JIS C1602-1995), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751-00)
RTD input	Pt100 (JIS C1604-1997), JPt100 (JIS C1604-1997, JIS C1604-1981 of Pt100)
Low voltage input	0 to 10 mV DC, 0 to 100 mV DC
High voltage input	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
Current input	0 to 20 mA DC, 4 to 20 mA DC

☞ **NOTE** When remote setting input is used as a current input, make sure that the current input value including transient conditions is within the following allowable input range. When the current input value exceeds its allowable input range, the current detection components inside the main unit may be damaged, leading to failure. When connecting a current generator, make sure that the value (including the transient state immediately after the start-up) does not exceed its allowable input range. (Current generator specifications vary depending on the manufacturer.)  
Current detection components: Shunt resistor (approx. 50  $\Omega$  0.1 W)

Allowable input range: Maximum allowable applied voltage 2 V DC or allowable current input range -20.0 to +30.0 mA (remote setting input: between terminals 23 and 24)

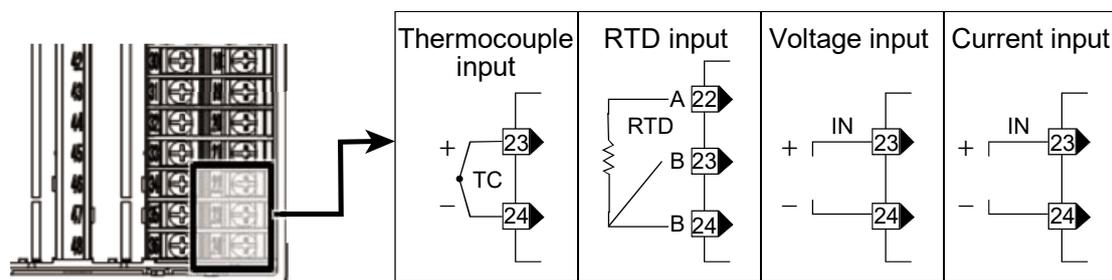
 **NOTE** When the input type is changed from current input or high voltage input to TC, RTD or low voltage input, remove the wirings of the measured input before attempting the input change. Changing the input type with the signal applied to the instrument may lead to a failure of the instrument.

 For details on changing the Input type of Input 2, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC60950-1.
- To avoid noise reduction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- Between Measured input 1 and Remote setting input are isolated.

### Measured input 2

- Terminal 22 through 24 are used for Measured input 2.
- Connect an appropriate input to terminals 22 to 24 according to the specification of the Remote setting input.



- Remote setting input is assigned to Input 2 when shipped from the factory. In order to assign Input 2 as Measured input 2, change the setting in the Engineering mode ( $F_{n5B}$ ) as required.

 For details on assigning Input 2, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

 Measured input 2 type can be selected from the table below with the Input type of Input 2 ( $2.INP$ ) in the Engineering mode ( $F_{n22}$ ).

Input group	Input type
Thermocouple (TC) input	K, J, T, S, R, E, B, N (JIS C1602-1995), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751-00)
RTD input	Pt100 (JIS C1604-1997), JPt100 (JIS C1604-1997, JIS C1604-1981 $\phi$ Pt100)
Low voltage input	0 to 10 mV DC, 0 to 100 mV DC
High voltage input	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
Current input	DC 0~20 mA, DC 4~20 mA

 **NOTE** When measured input 2 is used as a current input, make sure that the current input value including transient conditions is within the following allowable input range. When the current input value exceeds its allowable input range, the current detection components inside the main unit may be damaged, leading to failure. When connecting a current generator, make sure that the value (including the transient state immediately after the start-up) does not exceed its allowable input range. (Current generator specifications vary depending on the manufacturer.)  
Current detection components: Shunt resistor (approx. 50 Ω 0.1 W)  
Allowable input range: Maximum allowable applied voltage 2 V DC or allowable current input range -20.0 to +30.0 mA (remote setting input: between terminals 23 and 24)

 **NOTE** When the input type is changed from current input or high voltage input to TC, RTD or low voltage input, remove the wirings of the measured input before attempting the input change. Changing the input type with the signal applied to the instrument may lead to a failure of the instrument.

 For the details of changing the Input 2, refer to the separate SC-F71 InstructionManual [Parameters/Functions] (172-65710M).

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC60950-1.
- To avoid noise reduction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- Measured input 1 and measured input 2 are isolated.

### 3.4 Handling of the Terminal Cover

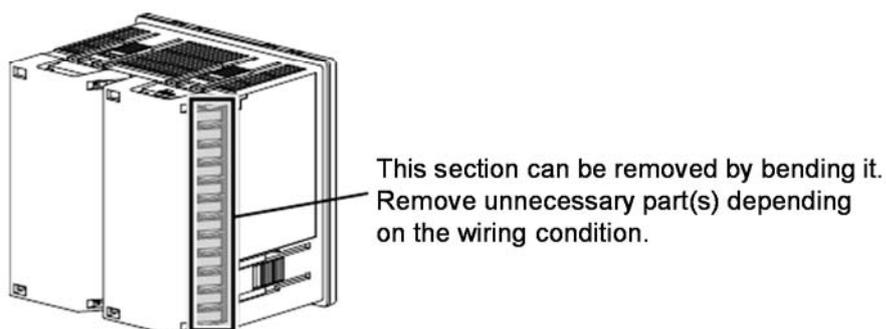
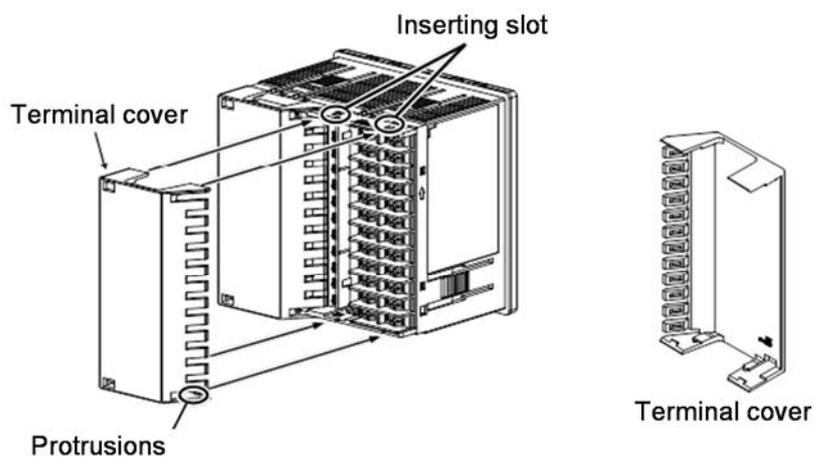
When mounting and removing the terminal cover, take the following steps:

 <b>WARNING</b>	To prevent electric shock or instrument failure, always turn off the power before mounting or removing the terminal cover.
--	--

 **NOTE** When mounting and removing the terminal cover, apply pressure very carefully to avoid damage to the terminal cover.

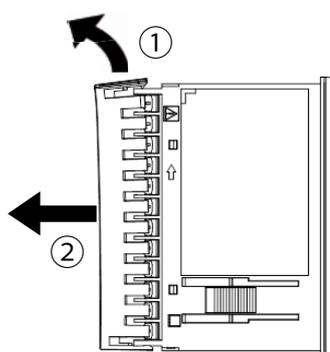
## Mounting procedures

1. Check the mounting direction of the terminal cover.
2. Push the protrusions of terminal cover into the insertion slots for mounting the terminal cover.



## Removal procedures

Release the protrusions of terminal cover from the insertion slots (①) shown in the following figure, and then pull the terminal cover (②) to remove it from the case.

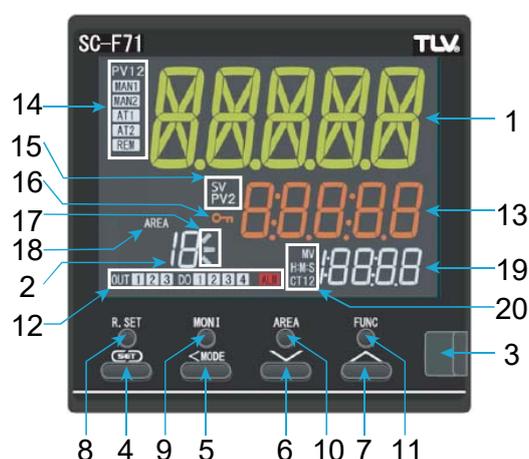


## 4. Basic Operation

### 4.1 Parts Description

This section describes various display units and the key functions.

#### Front panel view



1	Measured value (PV) display [Yellow-green]	Displays Measured value (PV) or various parameter symbols.
2	Memory area display [White]	Displays the memory area No. (1 to 16).
3	Loader communication connector	Setting and monitoring on a computer (PC) is possible if the controller is connected with our cable to a PC via our USB communication converter COM-KG or COM-K2 (sold separately) <sup>1)</sup> . Communication software PROTEM-T <sup>2)</sup> must be installed on the PC.
4	 SET key	Used for calling up parameters and set value registration.
5	 Shift key	Shifts digits when settings are changed. Used to switch the modes.
6	 Down key	Decreases numerals.
7	 Up key	Increases numerals.
8	 R.SET key	The parameters can be scrolled backwards.
9	 MONI key	Used to switch screens. When the MONI key is pressed while any screen other than Monitor & SV setting mode is displayed, the screen returns the PV/SV Monitor.
10	 AREA key	When the AREA key is pressed, the screen is switched to the Memory area transfer screen.
11	 FUNC key	The selected function can be assigned <sup>3)</sup> to this key for a direct access to it.

<sup>1)</sup> For the COM-K2\*, contact TLV.

\*A previous version of COM-K (version 1) can be also connected.

<sup>2)</sup> Download links can be found at: <https://www.tlv.com/>

<sup>3)</sup> Functions are configured in the Engineering mode.  
For detailed, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

Continued on the next page

12	OUT1 to 3 lamp [White]	Lights when Outputs 1 to 3 (OUT1 to 3) <sup>4)</sup> are turned on.
	DO1 to 4 lamp [White]	Lights when Digital outputs 1 to 4 (DO1 to 4) <sup>4)</sup> are turned on. (FZ110: DO1 and DO2)
	ALM lamp [Red]	Lights when any of the following occurs. <ul style="list-style-type: none"> <li>• Event 1 to 4</li> <li>• Input error<sup>5)</sup> of input 1 or 2</li> </ul>
13	Set value (SV) display [Orange]	Displays Set value (SV) or various parameter set values.
14	PV1/2 display lamp [White]	PV1 Lights when the Input 1_Measured value (PV) is displayed on the PV display unit. PV2 Lights when the Input 2_Measured value (PV) is displayed on the PV display unit.
	Manual (MAN1) mode lamp [White]	Lights when Input 1 is in Manual (MAN) mode. When lit, the SV display unit shows an Input 1_Manual manipulated output value.
	Manual (MAN2) mode lamp [White]	Lights when Input 2 is in Manual (MAN) mode. When lit, the SV display unit shows an Input 2_Manual manipulated output value.
	AT1 lamp [White]	<ul style="list-style-type: none"> <li>• Flashes when Autotuning (AT) is activated on Input 1. (After AT is completed: AT lamp will go out)</li> <li>• Lights when Startup tuning (ST) is activated on Input 1. (After ST is completed: AT lamp will go out)</li> </ul>
	AT2 lamp [White]	<ul style="list-style-type: none"> <li>• Flashes when Autotuning (AT) is activated on Input 2. (After AT is completed: AT lamp will go out)</li> <li>• Lights when Startup tuning (ST) is activated on Input 2. (After ST is completed: AT lamp will go out)</li> </ul>
	Remote (REM) mode lamp [White]	Lights in Remote (REM) mode. When lit, the SV display unit shows a remote setting input value.
	15	SV display lamp [White]
	PV2 display lamp [White]	PV2 Lights when the Input 2_Measured value (PV) is displayed on the SV display unit.
16	Set lock display [White]	Lights when the settings are locked.
17	Displays the ramp status [White]	SV ramp status is displayed; (rise, soak, fall) Rise:  Soak:  Fall: 
18	AREA display lamp [White]	Lights when Memory area is displayed.
19	Manipulated output value (MV) display [White]	Displays either Manipulated output value (MV) or Memory area soak time <sup>4)</sup>
20	MV display lamp [White]	Lights when Manipulated output value (MV) is displayed on the MV display.
	H:M:S display lamp [White]	Lights when time (hour:minute:second) is displayed on the MV display.
	CT 1/2 display lamp	Not used (Unlit)

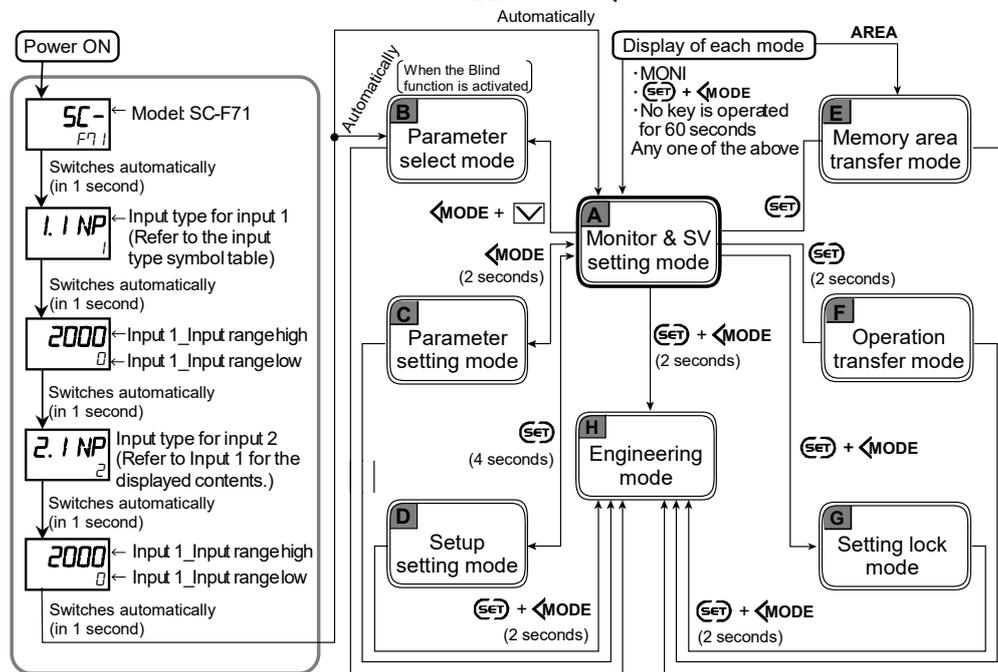
<sup>4)</sup> Outputs, such as control output, retransmission output, event output, are assigned to Outputs 1 to 3 (OUT1 to 3) and Digital outputs 1 to 4 (DO1 to 4). (Control output can be assigned to OUT1 to 3 only.)

Outputs are assigned in Engineering mode. For detailed, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

<sup>5)</sup> Invalid when shipped from the factory. ALM lamp conditions are set in Engineering mode. For detailed, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### 4.2 Mode Description

The instrument has eight different modes for operation and setting. Modes can be switched through the key operation of **SET** and **MODE** keys.



Legend X: Press X key once X+Y: Press X and Y keys simultaneously  
 X (n times): Press X key n times  
 X (n seconds): Press and hold X key for n seconds or more.  
 X+Y (n seconds): Press and hold X and Y keys simultaneously for n seconds

A	Monitor & SV setting mode	In this mode, setting of SV (control target value) and monitoring of PV, SV, and MV can be conducted. Conduct operation in this mode.
B	Parameter select mode	Only desired screens can be grouped for display. When the Blind function is valid, unnecessary modes can be hidden.
C	Operation transfer mode	In this mode, switching between RUN/STOP, Auto/Manual, and Remote/Local can be done as well as conducting AT and ST.
D	Setting lock mode	Set data lock can be set to prevent accidental key operations. Parameter select mode can be set up to group desired screens for display.
E	Memory area transfer mode	The memory area to be used for control (control area) can be switched in this mode.
F	Parameter setting mode	Parameters related to the control can be set. Parameters in this mode can be used in the memory area function, and up to 16 areas can be set.
G	Setup setting mode	Control related parameters not available in Memory area can be set up here.
H	Engineering mode	The instrument can be configured to the user's requirements (input, output, control mode, etc).

#### Input type symbol

Symbol	<i>U</i>	<i>J</i>	<i>T</i>	<i>S</i>	<i>R</i>	<i>E</i>	<i>b</i>	<i>n</i>	<i>P</i>
Input type	Thermocouple (TC) input								
	K	J	T	S	R	E	B	N	PLII
Symbol	<i>U</i>	<i>U</i>	<i>L</i>	<i>P<sub>r</sub></i>	<i>P<sub>r</sub></i>	<i>U<sub>P</sub></i>	<i>U</i>	<i>I</i>	
Input type	Thermocouple (TC) input			RTD input		Voltage	Current		
	W5Re/W26Re	U	L	PR40-20	Pt100	JPt100			

 For details on the each parameter from **A** to **H**, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

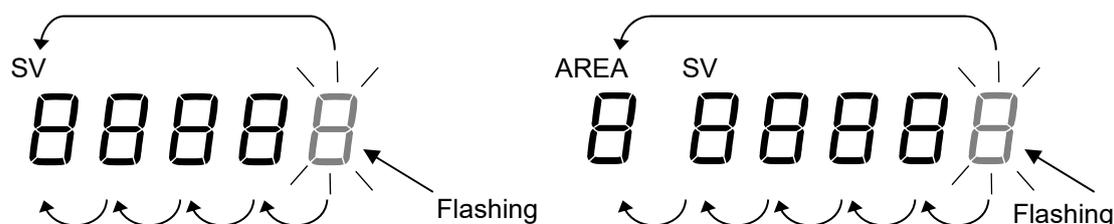
### 4.3 Changing Set Value

- The flashing digit indicates which digit can be set. Press  $\leftarrow$ MODE key to go to a different digit. Every time  $\leftarrow$ MODE key is pressed, the flashing digit moves as follows.

All modes except SV setting mode and Parameter setting mode

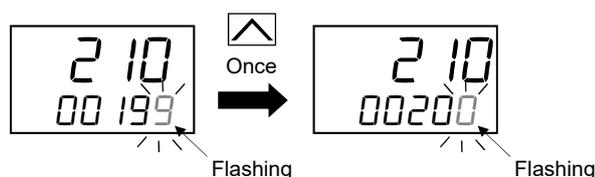
**A** : SV setting mode

**F** : Para meter setting mode

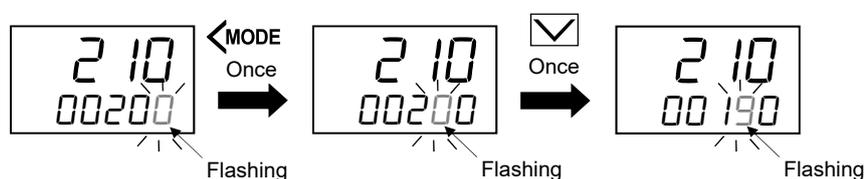


- The set value (selected items) can be changed by pressing the  $\blacktriangle$  and  $\blacktriangledown$  keys. The following is also available when changing the set value.

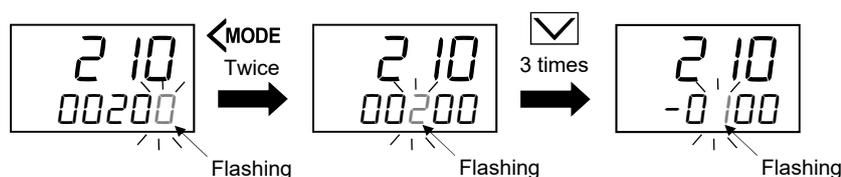
Increase SV from 199 °C to 200 °C:



Decrease SV from 200 °C to 190 °C:



Decrease SV from 200 °C to -100 °C:



- To store a new value for the parameter, always press the **SET** key. The display changes to the next parameter and the new value will be stored.

The modified data will not be stored only by operating the  $\blacktriangle$  and  $\blacktriangledown$  keys. In the Operation transfer mode, however, the selected mode will be valid only by the operations of these keys.

In case of the Set value (SV), the instrument can be configured in the **H**:

Engineering mode so that the modified set value will be adopted 2 seconds after the change without pressing the **SET** key.

- In case no operation is performed within 60 seconds after the change of the setting, the mode will return to **A**: Monitor & SV setting mode. The modified data will not be

registered in this case.

#### 4.4 Operation of the Direct Key (FUNC key)

SC-F71 has a FUNC key which allows a specified function to be assigned to it. The action of the FUNC key can be also set (press once or press and hold). Function assignment to the FUNC key and the key operation method can be configured at “FUNC key assignment (FN. KY)” and “FUNC key operation selection (FN. GYP)” in the Engineering mode (Fn I I).

- ☞ For the details of Function assignment to the FUNC key and the key operation method, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).



#### Functions assignable to the FUNC key

Function	*
RUN/STOP transfer [Factory set value]	A
Autotuning (AT) (Common to Input 1 and 2)	B
Input 1_Autotuning (AT)	B
Input 2_Autotuning (AT)	B
Auto/Manual transfer (Common to Input 1 and 2)	A
Input 1_Auto/Manual transfer	A
Input 2_Auto/Manual transfer	A
Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/ Differential temperature control)	A
Control area Local/External transfer	A
Interlock release	C
Hold reset (Common to Input 1 and 2)	C
Input 1_Hold reset	C
Input 2_Hold reset	C
Set data unlock/lock transfer	A
Area jump	D
Setting mode switch	E

#### \* Explanation of key action

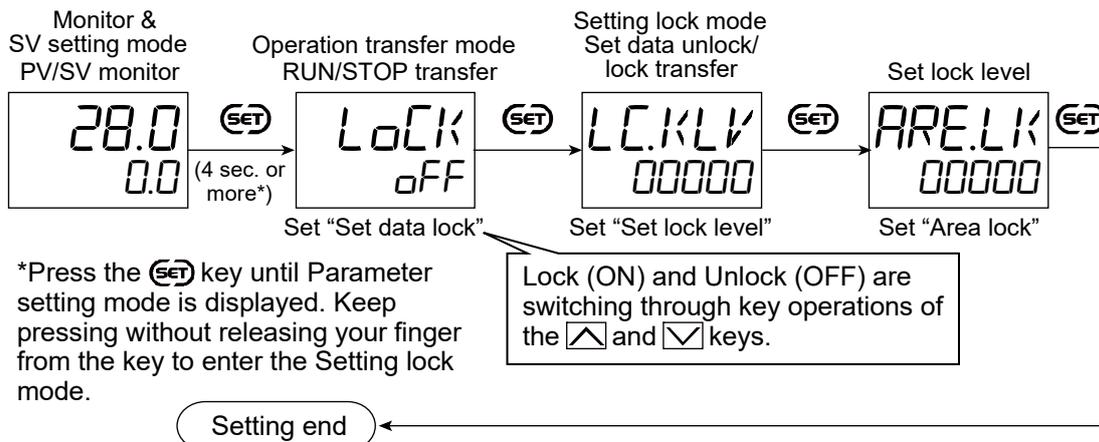
- A: Mode is changed for every press of the key.
- B: Function is turned on and off for every press of the key.
- C: Function is released or reset by pressing the key.
- D: Pressing the key switches the memory area to the preset area set in the Link area number in the Parameter setting mode.  
When the Link area number is not specified, a memory area with the number of the current control area number +1 will be used.
- E: Switches between setting modes when the key is pressed. (Parameter setting mode → Setup setting mode → Engineering mode → Parameter setting mode)

### 4.5 Protecting Setting Data

The Set data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake. The Set data lock function enables the restriction of setting changes for each mode (Setting lock level). The Area lock restricts switching the Memory areas. Both functions can be configured in the **D**: Setting lock mode.

For details on the Set data lock function, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

#### Setting procedure



- Next parameter is displayed.
- Press [SET] and <MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

<p>Setting lock mode Set data unlock/ lock transfer</p>  <p>Factory set value: OFF</p>	<p>The items locked in "Set lock level" and "Area lock" can be switched between lock and unlock.</p> <p>Set value: oFF: Unlock state on: Lock state *</p> <p>* A key symbol (Set lock display) appears on the front display.</p>
<p>Setting lock mode Set lock level</p>  <p>Factory set value: 00000</p>	<p>Select the operation mode to lock. The Set lock level can be changed even after the set data lock has been set.</p> <p>     Set value: 0: Unlock 1: Lock</p> <p>SV setting mode * + Parameter select mode * Set value (SV) and Interlock release</p> <p>Operation select mode Parameter setting mode Setup setting mode Engineering mode</p>

<p>Setting lock mode Area lock</p>  <p>Factory set value: 00000</p>	<p>Select to enable/disable the Memory area switching.</p> <p>00000    Set value: ↑    0: Memory area is adjustable when the setting data is locked. 1: Memory area is not adjustable when the setting data is locked. (Memory area transfer mode is not displayed)</p>
--	---

-  Switching the Set data lock is available anytime irrespective of RUN or STOP state.
-  Parameter switching is available during the Set data lock state for checking the data. When the SV setting mode is locked, the Set value (SV) setting screen in the SV setting mode will not be displayed.
-  Even during the Set data lock state, setting through the communication (optional function) and selection of functions by the FUNC key is possible.  
It should be noted that when the parameters in the Engineering mode are changed, the instrument must be stopped (or stay in the STOP mode).

## 5. Operation

### 5.1 Operating Precautions

Before starting the operation, check the following items.

#### Power ON

As soon as the instrument is powered up, operation is started after the display of the input type and the input range. [Factory set value: RUN]

#### Action at input error

The measures for input errors can be selected from Input burnout direction, Input error determination point, Manipulated output value at input error, PV flashing display at input error, and Input error status output.

When this instrument has an input error, actions and outputs are provided according to the setting.

 For details on the action at input error, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

#### Checking each parameter

The settings for the Set value (SV) and all parameters should be appropriate for the controlled system.

There are parameters in Engineering mode which cannot be changed when the controller is in RUN mode. Change the RUN/STOP mode from RUN to STOP when a change for the parameters in Engineering mode is necessary.

 For details on the RUN/STOP transfer and the each parameter, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

#### Operation at power failure

A power failure of 20 ms (24 V DC type: 5 ms) or less will not affect the control action. When a power failure of more than 20 ms (24 V DC type: 5 ms) occurs the instrument assumes that the power has been turned off. When the power returns, the operation of instrument will be re-starts in accordance with the content selected by Hot/Cold start.

 For details on the Hot/Cold start, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

#### Event hold action

- The event hold action is activated when the power is turned on or when transferred from STOP mode to RUN mode.
- The event re-hold action is activated when not only the SV is changed, but also the power is turned on or when transferred from STOP mode to RUN mode.

 For details on the event hold action, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

## 5.2 Setup Procedures

Set up the instrument prior to operating it referring to the following operating procedure. Refer to the following setup example.

**Set example 1**

**Model code: SC-F7103\*N1801303**

Input: Current input, 4 to 20 mA

Control: Pressure control operation MC-COS(R)-16, Size 15 to 50 mm

Output: Control output: Uses OUT1, Event output: Uses DO1

Event: Number of event points: 1 point (Uses Event 1), Deviation high \*  
 → Change the event action to Deviation high/low with hold function.  
 Event timer: 0.0 second \*, Without interlock function \*

Control set value: 200 °C

Event 1 set value: 10 °C

PID constants: Automatic setting by Autotuning (AT)

Valve coefficient: A: 0 (factory set value) → set to 123  
 b: 0 (factory set value) → set to 456  
 C: 0 (factory set value) → set to 432  
 d: 0 (factory set value) → set to 765  
 E: 0 (factory set value) → set to 567

**Set example 2**

**Model code: SC-F71-G\*N1D35**

Input: RTD (Pt100), -200.0 to +850.0 °C (Factory set value)  
 → Change the input range to -200.0 to +400.0 °C

Control: Heating/Cooling PID control with AT (air cooling)

Output: Control output: Heat-side: Uses OUT1, Cool-side: Uses OUT2  
 Event output: Uses DO1 and DO2

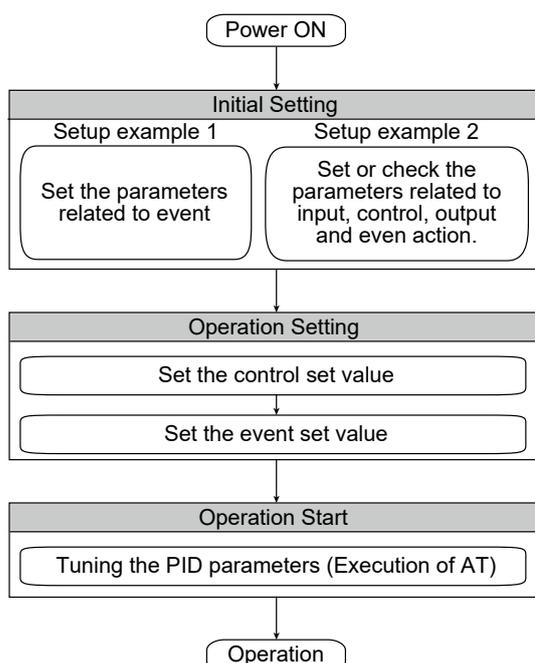
Event: Number of event points: 2 points (Uses Event 1 and 2)  
 Event 1, 2: Deviation high (Factory set value)  
 → Change the Event 2 to Deviation low.  
 Event timer: 0.0 second (Factory set value)  
 Without interlock function (Factory set value)  
 → Change to "with Interlock function."

Control set value: 100.0 °C

Event set value: Event 1: 10.0 °C, Event 2: -10.0 °C

PID constants: Automatic setting by Autotuning (AT)

■: Values to be set or confirmed in the Initial setting



☞ For operation in initial setting (Engineering mode), refer to 5.3 Initial Setup Before Operation.

☞ For operation setting, refer to the following:  
 5.4 Setting the Control Set Value [Set value (SV)]  
 5.5 Setting the Event Set Value

☞ For starting the operation, refer to 5.6 Tuning the PID Parameters (Execution of AT).

### 5.3 Initial Setup before Operation

Before starting the operation, confirm that the set value of the parameter matches the model code as specified when ordered. Parameters which were not specified when ordered must be set before use.

Some functions may need to be set in the Engineering mode. Read the following part before attempting the setting.

 <b>WARNING</b>	<p>Parameters in the Engineering mode should be set according to the application before setting any parameter related to operation. Once the parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. TLV will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.</p>
--	--

 **NOTE** Parameters in Engineering mode are settable only when the controller is in STOP mode. However, only checking can be made even in the RUN state.

#### Set value change and registration

- The flashing digit indicates which digit can be set. Every time the  MODE key is pressed, the flashing digit moves.
- To store a new value for the parameter, always press the  key. The display changes to the next parameter and the new value will be stored.
- The modified data will not be stored only by operating the  and  keys. In the Operation transfer mode, however, the selected mode will be valid only by the operations of these keys.
- In case of the Set value (SV), the instrument can be configured in the **H**: Engineering mode so that the modified set value will be adopted 2 seconds after the change without pressing the  key.
- In case no operation is performed within 60 seconds after the change of the setting, the mode will return to **A**: Monitor & SV setting mode. The modified data will not be registered in this case.

#### 5.3.1 Initial setting of setup example 1

When the SC-F71 is used with TLV MC-COS series, the valve coefficient corresponding to the individual control valve must be registered to the instrument. 6 valve coefficients (A to F) are indicated on the valve coefficient plate (if new, they are also indicated on the valve coefficient tag) of the MC-COS, MC-COSR, MC-VCOS or MC-VCOSR. Follow the procedures shown in the “Changing and Registering the Set Value” section on the following page to register the valve coefficients to the instrument.

- The pressure unit to be entered for the pressure value is defined by the valve coefficient F. Parameters to be entered in pressure units, such as measurement input range, target set value, and alarm set value, must be entered in the same pressure units selected for the valve coefficient F. If the pressure unit and the parameter do not match, the product will not operate properly.

- To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate), refer to the "Converting valve coefficient" section to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.

Parameters to be set (Engineering mode):

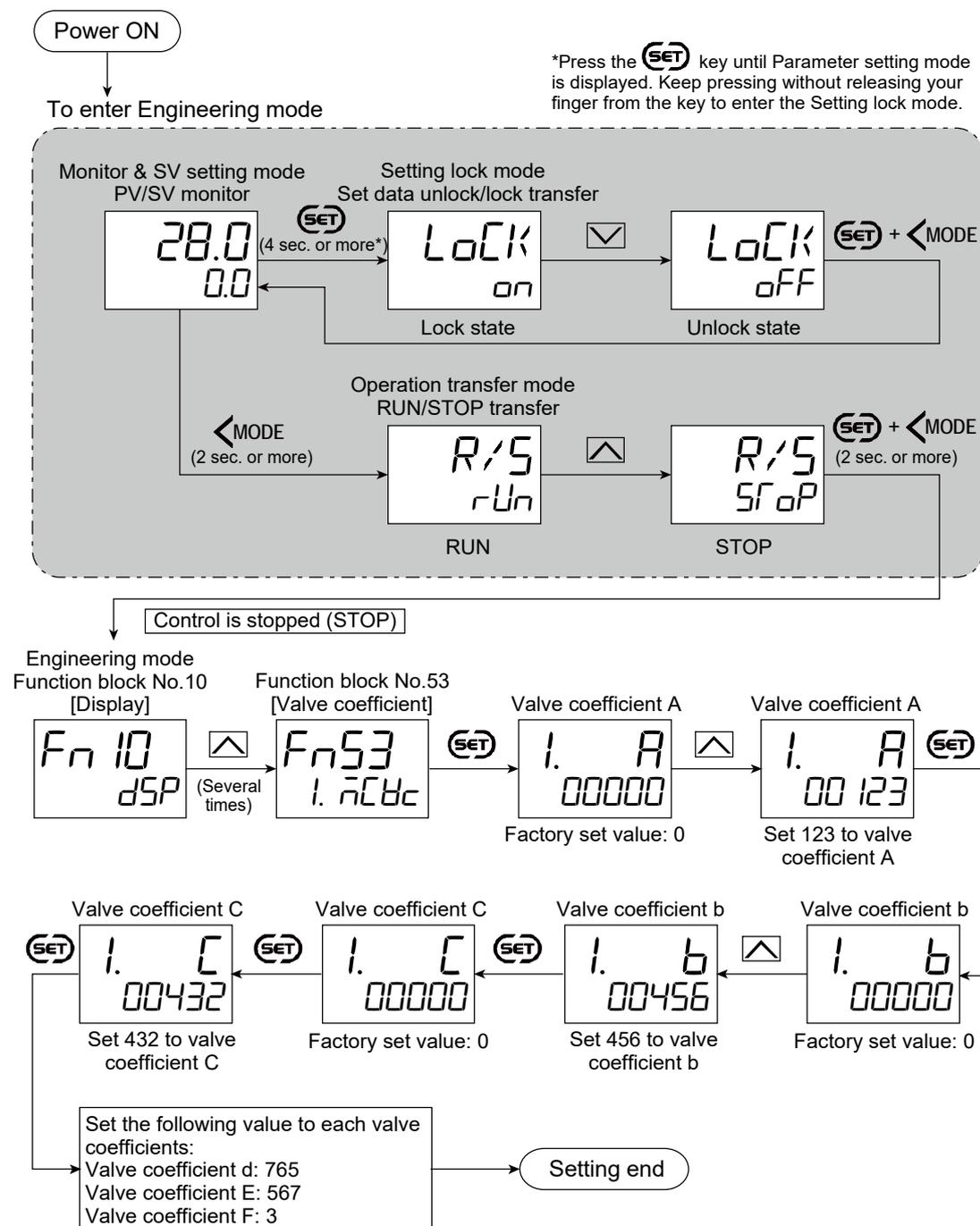
Mandatory setting items:

Function block No. 53 (*Fn53*): Valve coefficient A ( *l. A*), Valve coefficient b ( *l. b*),  
Valve coefficient C ( *l. C*), Valve coefficient d ( *l. d*),  
Valve coefficient E ( *l. E*), Valve coefficient F ( *l. F*)



Parameters other than valve coefficients A to F may be displayed in **Fn53**, however those parameters do not need to be changed from factory set values.

## Changing and Registering the Set Value



- Next parameter is displayed.
- Press **(SET)** and **<MODE>** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.  
(The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

### 5.3.2 Initial setting of setup example 1 (Setting parameters related to the event)

In the Setup example 1 (refer to Setup example 1 in 5.2 Setup procedure), all default factory set values except event related parameters can be used in actual applications without any changes.

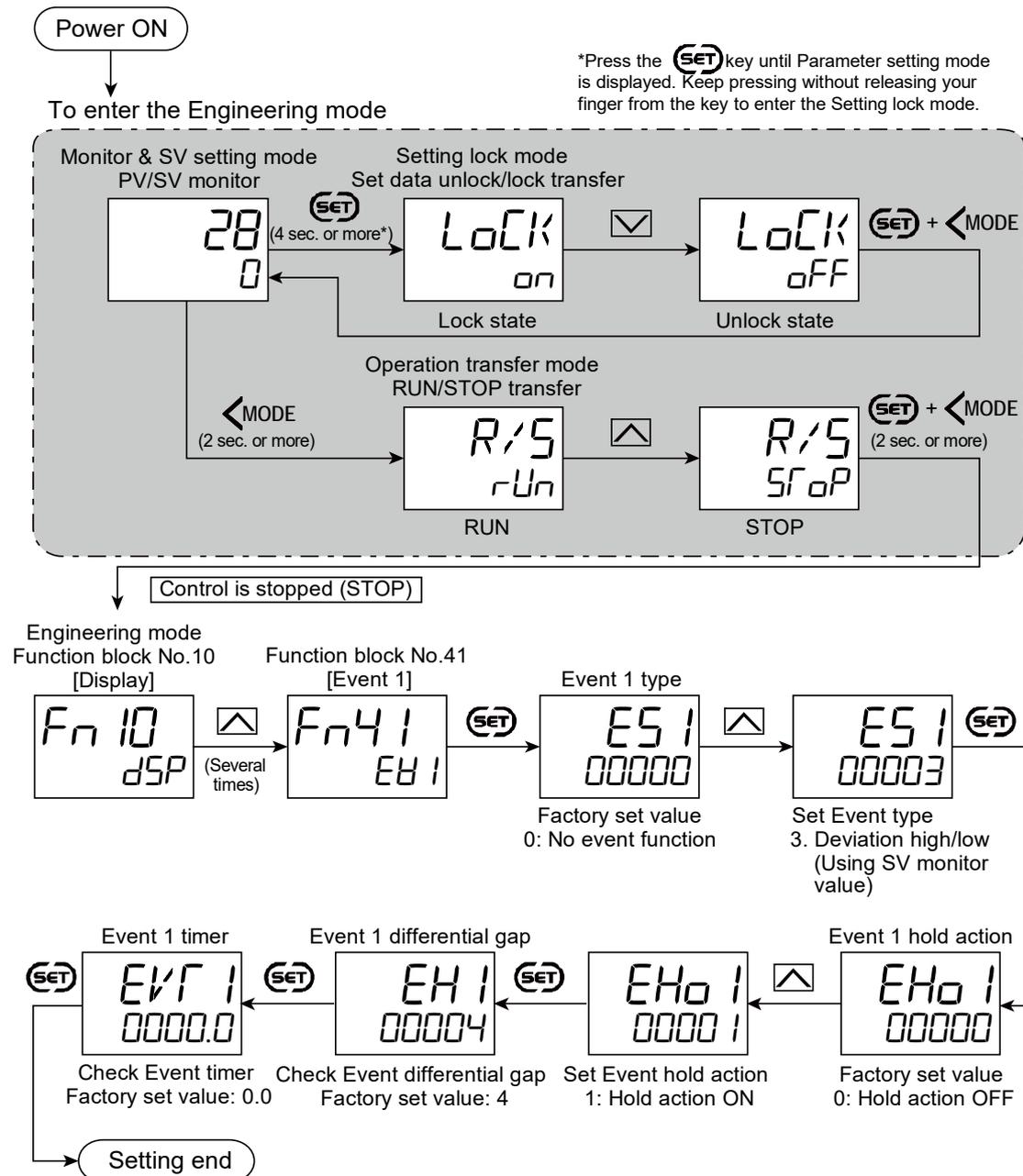
This section describes the Initial setting of the alarm related operation used in the Setup example 1.

Setup example: 1 Model code: SC-F71-3*N1801303 Event: Number of event points: 1 point (Uses Event 1) Deviation high (Factory set value) →Change the event action to Deviation high/low with hold function. Without interlock function (Factory set value)	<p>Deviation high/low</p> <p>ON</p> <p>Low High → PV</p> <p>▲: Set value (SV)          △: Event set value          ☆: Event differential gap</p>
--	--

Parameters to be set (Engineering mode):

- Mandatory setting items:  
 Function block No. 41 (Fn41): Event 1 type (E51), Event 1 hold action (EHo1)
- Related setting items (Set only when necessary):  
 Function block No. 41 (Fn41): Event 1 differential gap (EH1), Event 1 timer (EVT1)
- Items unnecessary to set (Used with factory setting):  
 Function block No. 34 (Fn34): DO1 function selection (do5L1),  
 DO1 logic calculation selection (doLG1)
- Function block No. 30 (Fn30): Energized/De-energized selection (ExL),  
 Interlock selection (IL5),  
 Output action at control stop (55)

## Changing and Registering Set Value



- Next parameter is displayed.
- Press **(SET)** and **<MODE>** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.  
(The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

### 5.3.3 Initial setting of setup example 2 (Setting parameters related to the input, control, output and event)

The setup example 2 (refer to Setup example 2 in 5.2 Setup Procedure) describes the initial setting of input, control, output and event action.

<p>Setup example: 2</p> <p>Model code: SC-F71-G*N1D35</p> <p>Input: RTD (Pt100), -200.0 to +850.0 °C (Factory set value) →Change the input range -200.0 to +400.0 °C</p> <p>Control: Heating/Cooling PID control with AT (cooling linear type)</p> <p>Output: Control output: Heat-side: Uses OUT1 Cool-side: Uses OUT2 Event output: Uses DO1 and DO2</p> <p>Event: Number of event points: 2 points (Uses Event 1 and 2) Event 1, 2: Deviation high (Factory set value) →Change the Event 2 to Deviation low. Event timer: 0.0 second (Factory set value) Without interlock function (Factory set value) →Change to “with Interlock function.”</p>	<p>Deviation high</p> <p>OFF ON → PV</p> <p>Low High</p> <p>Deviation low</p> <p>ON OFF → PV</p> <p>Low High</p> <p>▲: Set value (SV) △: Event set value ☆: Event differential gap</p>
--	--

Parameters to be set (Engineering mode):

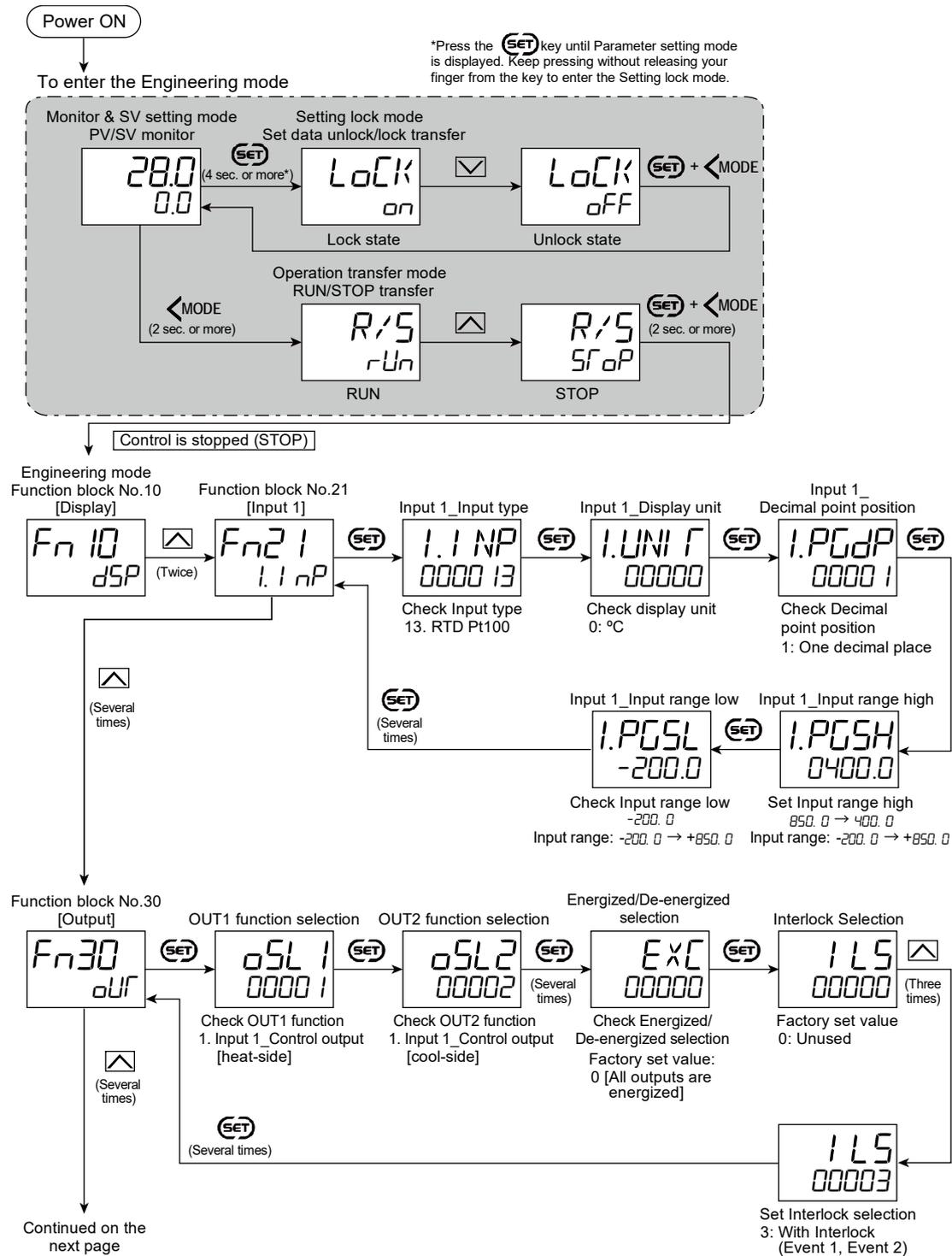
- Mandatory setting items:

- Function block No.21 (Fn21): Input 1\_Input type (I1NP),  
Input 1\_Display unit (I1UNIT),  
Input 1\_Decimal point position (I1PGDP),  
Input 1\_Input range high (I1PGSH),  
Input 1\_Input range low (I1PGSL)
- Function block No.30 (Fn30): OUT1 function selection (oSL1),  
OUT2 function selection (oSL2),  
Interlock selection (IL5)
- Function block No.34 (Fn34): DO1 function selection (doSL1),  
DO2 function selection (doSL1),  
DO1 logic calculation selection (doLG1),  
DO2 logic calculation selection (doLG2)
- Function block No.41 (Fn41): Event 1 type (ES1)
- Function block No.42 (Fn42): Event 2 type (ES2)
- Function block No.51 (Fn51): Input 1\_Control action (I1o5)

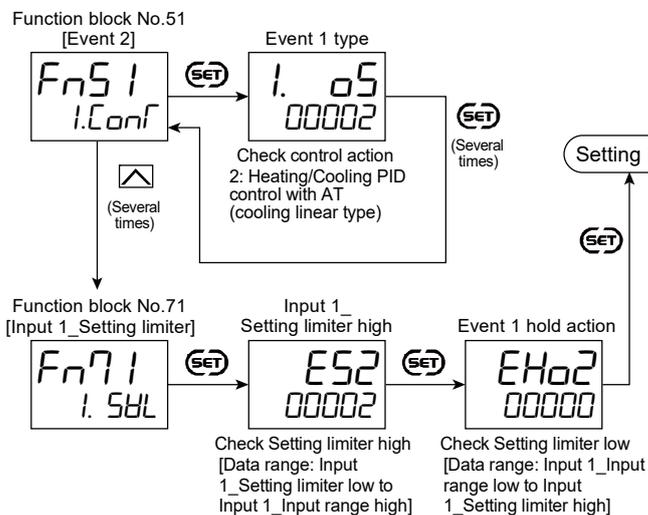
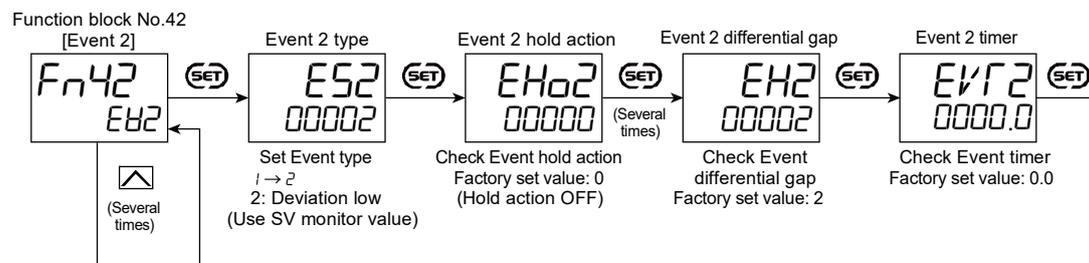
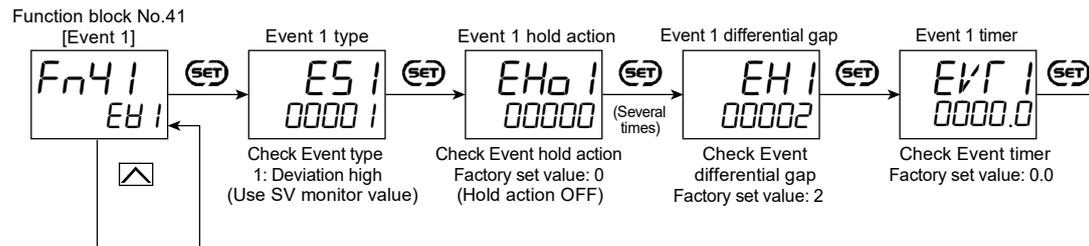
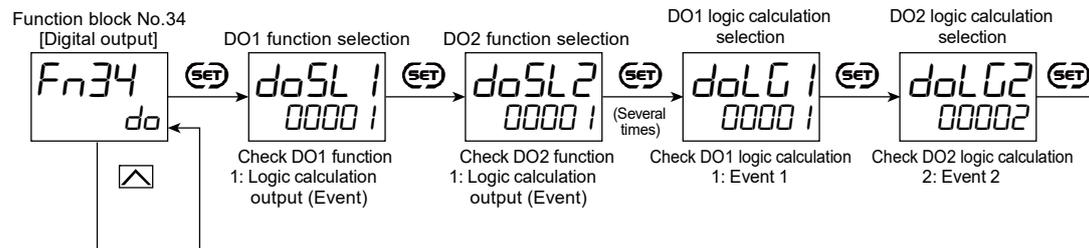
- Related setting items (Set only when necessary):

- Function block No.30 (Fn30): Energized/De-energized selection (ExE)
- Function block No.41 (Fn41): Event 1 differential gap (EH1),  
Event 1 timer (EVF1)
- Function block No.42 (Fn42): Event 2 differential gap (EH2),  
Event 2 timer (EVF2)
- Function block No.71 (Fn71): Input 1\_Setting limiter high (I1SLH),  
Input 1\_Setting limiter low (I1SLL)

### Setting procedure



Continued from the previous page



Setting End

- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

## 5.4 Setting the Control Set Value [Set value (SV)]

After finishing the initial settings, set the control target value, SV.

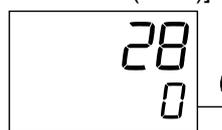
[Setting example: Set Input 1\_Set value (SV) to 200 °C]

1. Switch the display to the Set value (SV) setting mode

Press the **(SET)** key (or **▼** or **▲** key)\* to switch the display to the SV setting screen from the PV/SV monitor of Input 1.

\*Valid only when "Direct registration" is set in "Data registration" in Fn11 in the Engineering mode. When the instrument is set to "Direct registration" method and no key is operated for 2 seconds on the Set value (SV) setting screen, the screen will return to the PV/SV monitor.

**A**: Monitor & SV setting mode  
PV/SV monitor  
[Auto mode (RUN)]



PV/SV monitor  
[Auto mode (STOP)]



**A**: Monitor & SV setting mode  
Set value (SV) setting



Flashing →

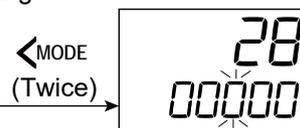
2. Shift the flashing digit to the hundreds digit

Press **◀MODE** key to shift the flashing digit to the hundreds digit. The flashing digit indicates which digit can be set.

Set value (SV) setting



Flashing →



Shift the flashing digit

3. Change the numerical value from "0" to "2"

Press the **▲** key twice to change the numerical value from "0" to "2".

Setting range:

Input 1\_Setting limiter low to

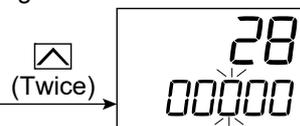
Input 1\_Setting limiter high

Varies with the setting of the

Decimal point position.

Factory set value: 0

Set value (SV) setting



4. Store the set value (SV)

Press the **(SET)** key to store the set value. The display changes to the next parameter.

Set value (SV) setting



**A**: Monitor & SV setting mode  
PV/SV monitor



The parameter displayed after the set value (SV) varies depends on the product specifications.

### Set value change and registration

- The flashing digit indicates which digit can be set. Every time **◀MODE** key is pressed, the flashing digit moves.
- To store a new value for the parameter, always press the **(SET)** key. The display changes to the next parameter and the new value will be stored. The modified data will not be stored only by operating the **▼** and **▲** keys.
- In case no operation is performed within 60 seconds after the change of the setting, the mode will return to **A**: Monitor & SV setting mode. The modified

data will not be registered in this case.

## 5.5 Setting the Event Set Value

After finishing the initial settings, set the event set values if they are used.

[Setting example: Set the Event 1 set value (EV1) to 20 °C]

1. Switch the mode to the Parameter setting mode

Press and hold the **SET** key for 2 seconds or more on the PV/SV monitor screen of Input 1 until the first screen (Parameter group No. 00 [Pn00]) in the Parameter setting mode is displayed.

**A**: Monitor & SV setting mode  
PV/SV monitor

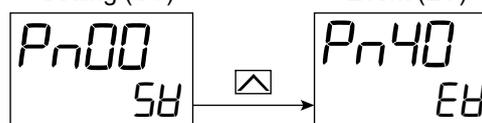
**F**: Parameter setting mode  
Setting (SV)



2. Switch the display to parameter group No. 40  
Press the **▲** key to switch the display to the Parameter group No. 40 [Pn40] screen from the Parameter group No. 00 [Pn00] screen.

**F**: Parameter setting mode  
Pn00  
Setting (SV)

Pn40  
Event (EV)

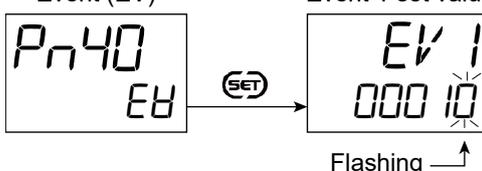


3. Switch the screen to Event 1 set value (EV1)

Press the **SET** key to switch the display to the Event 1 set value (EV1) screen from the Parameter group No. 40 [Pn40] screen.

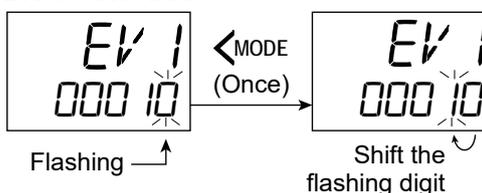
Pn40  
Event (EV)

Event 1 set value



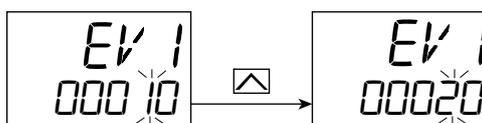
4. Shift the flashing digit to the tens digit  
Press the **◀MODE** key to shift the flashing digit to the tens digit. The flashing digit indicates which digit can be set.

Event 1 set value



5. Change the numerical value from "1" to "2"  
Press the **▲** key to change the numerical value from "1" to "2".

Event 1 set value



Setting range:

Deviation (When assigned to Input 1 or Differential temperature input):

-(Input 1\_ Input span) to +(Input 1\_ Input span)

Varies with the setting of the Decimal point position.

Factory set value:

Upper limit action, upper/lower limit action:

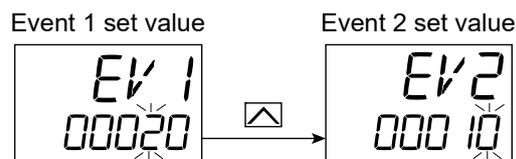
Maximum

Lower limit action, range action: Minimum

For more details of the setting range and the factory set values other than the above, refer to the separate SC-F71 Instruction Manual [Parameters/Functions].

#### 6. Store the Event 1 set value

Press the **(SET)** key to store the set value. The display changes to the next parameter.



 The parameter displayed after the Event 1 set value (EV1) varies depends on the product specifications.

#### Set value change and registration

- The flashing digit indicates which digit can be set. Every time **<MODE** key is pressed, the flashing digit moves.
- To store a new value for the parameter, always press the **(SET)** key. The display changes to the next parameter and the new value will be stored. The modified data will not be stored only by operating the **∇** and **∧** keys.
- In case no operation is performed within 60 seconds after the change of the setting, the mode will return to **A**: Monitor & SV setting mode. The modified data will not be registered in this case.

## 5.6 Tuning the PID Parameters (Execution of AT)

Suitable PID values are automatically calculated by Autotuning (AT) function. The Autotuning (AT) function automatically measures, computes and sets the optimum PID values.

 Before starting Autotuning, make sure that all required conditions to start AT are satisfied.

### Requirements for Autotuning (AT) start

To start Autotuning (AT), go to **C**: Operation transfer mode.

Operation state	RUN/STOP transfer	RUN
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
	Autotuning (AT) setting	PID control (State before starting AT)
Parameter setting	PID control of Input 1 or Position proportioning PID control	Input 1_Output limiter high [heat-side] > 0% Input 1_Output limiter low [heat-side] < 100%
	PID control of Input 2	Input 1_Output limiter high > 0% Input 1_Output limiter low < 100%
	Heating/Cooling PID control	Input 1_Output limiter high [heat-side] > 0% Input 1_Output limiter low [heat-side] < 100% Input 1_Output limiter high [cool-side] > 0% Input 1_Output limiter low [cool-side] < 100%
Input value state	The Measured value (PV) is not inside the Input error range. [Input error range: Input error determination point (high) ≥ Measured value (PV), Input error determination point (low) ≤ Measured value (PV)]	

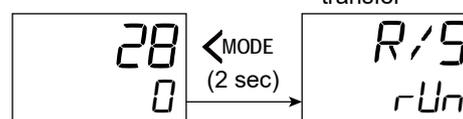
 For the details of the “Caution for using the Autotuning (AT)” and “Requirements for Autotuning (AT) cancellation”, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

1. Switch the mode to the Operation transfer mode

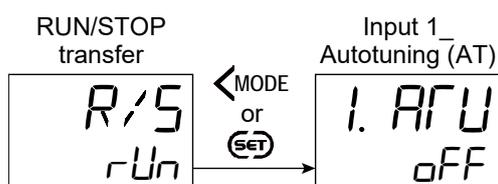
Press and hold the **MODE** key for 2 seconds or more on the PV/SV monitor screen of Input 1 until the first screen in the Operation transfer mode is RUN/STOP transfer screen.

**A**: Monitor & SV setting mode  
PV/SV monitor

**C**: Operation transfer mode  
RUN/STOP transfer



2. Switch the display to the Autotuning (AT)  
Press the **MODE** key or the **SET** key on the RUN/STOP transfer screen to select the Input 1\_Autotuning (AT) screen.



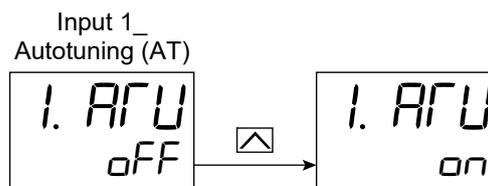
### 3. Start Autotuning (AT)

Press the  key to switch from “OFF” to “ON” to start Autotuning (AT). The AT1 (AT1) lamp starts flashing.

Setting range: OFF: PID control

ON: Start Autotuning (AT)

Factory set value: OFF



 To return to the PV/SV monitor screen during the AT, press and hold the  MODE key for 2 seconds or more, or press the  MODE key while pressing and holding the  key.

 For more details of the setting range and the factory set values other than the above, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

### 4. Finish the Autotuning (AT)

When the Autotuning (AT) is finished, the control will automatically return to “OFF: PID control” and AT1 (AT1) lamp turns off.

 The Autotuning (AT) can be started by Digital input (DI). Refer to the separate SC-F71 Instruction Manual [Parameters/Functions] for more information on assigning Digital input (DI).

 The Autotuning (AT) can be started by a key operation of the direct key (FUNC key). For “FUNC key assignment”, refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

## 6. Troubleshooting

### 6.1 Error Displays

This Section describes error display when the measured value (PV) exceeds the display range limit and the self-diagnostic error.

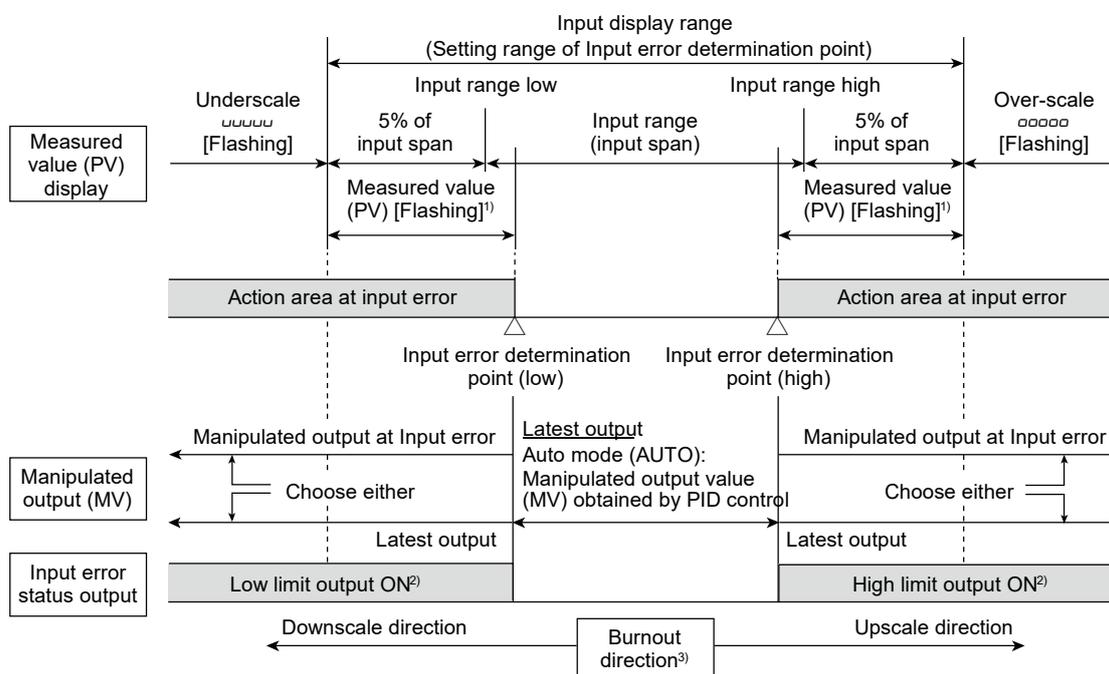
#### Input error displays

The table below shows displays, description, actions and solutions when the measured value (PV) exceeds the display range.

 **NOTE** Before replacing the sensor, always turn OFF the power of the SC-F71 or switch the mode to STOP with RUN/STOP transfer.

Display	Description	Action (Output)	Solution
Measured value (PV) [Flashing]	Measured value (PV) exceeded the input error determination point or the input range. Display does not flash when “Non-flashing display” is set.	<ul style="list-style-type: none"> <li>Action at input error: Output depending on the action at Input error (high/low limit)</li> </ul>	Check input type, input range, sensor connection and sensor break.
ooooo [Flashing]	Over-scale Measured value (PV) exceeded the high limit of display range.	<ul style="list-style-type: none"> <li>Event output: Output depending on the event action at input error</li> </ul>	
uuuuu [Flashing]	Underscale Measured value (PV) exceeded the low limit of display range.		

- Input error determination point is set within the input range



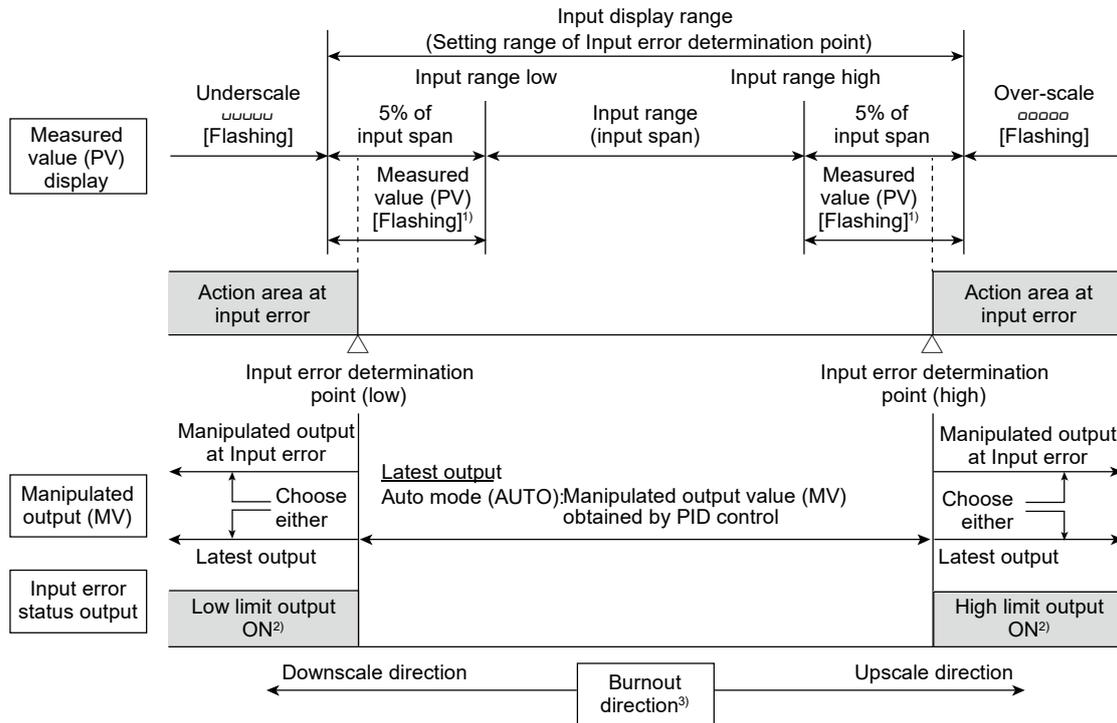
<sup>1</sup> Flashing can be suppressed by setting “PV flashing display at input error” (Function block No. 10 in the Engineering mode).

<sup>2</sup> For Input error status output, refer to ● Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (Separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M)).

<sup>3</sup> Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.  
RTD input: Upscale

High voltage/Current inputs: Downscale (Indicates value near 0)

● **Input error determination point is set outside the input range**



<sup>1</sup> Flashing can be suppressed by setting "PV flashing display at input error" (Function block No. 10 in the Engineering mode).

<sup>2</sup> For Input error status output, refer to ● Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (Separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M)).

<sup>3</sup> Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.

RTD input: Upscale

High voltage/Current inputs: Downscale (Indicates value near 0)

## Self-diagnostic error

In an error is detected by the Self-diagnostic function, the PV display shows “Err,” and the SV display shows the error code. If two or more errors occur simultaneously, the total summation of these error code is displayed.

Error code	Description	Action	Solution
1	Adjustment data error <ul style="list-style-type: none"> <li>Adjusted data range is abnormal.</li> </ul>	Display: Error code display Output: All the outputs are OFF Communication: Relevant error code to be sent <Example of error display> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px 0;">             Err              4           </div>	Turn off the power once. If the SC-F71 is restored to normal after the power is turned on again, then probable cause may be external noise source affecting the control system. Check for the external noise source. If an error is repeated after the power is turned on again, the SC-F71 may need to be repaired or replaced. Contact TLV or your local TLV representative.
2	Data back-up error <ul style="list-style-type: none"> <li>Back-up action is abnormal.</li> <li>Data write failure</li> </ul>		
4	A/D conversion error <ul style="list-style-type: none"> <li>Error in A/D conversion circuit is detected.</li> </ul> Temperature compensation error <ul style="list-style-type: none"> <li>Out of the temperature measurement range</li> </ul>		
If any of the following errors occur, all action of the SC-F71 is stopped. In this case the error code is not displayed.			
Error code	Description	Action	Solution
No error display	Watchdog timer error <ul style="list-style-type: none"> <li>Part of the internal program stops running.</li> </ul>	Display: All displays are OFF Output: All outputs are OFF Communication: Stopped	Turn off the power once. If an error is repeated after the power is turned on again, the SC-F71 may need to be repaired or replaced. Contact TLV or your local TLV representative.
	Power supply voltage is abnormal (power supply voltage monitoring) <ul style="list-style-type: none"> <li>Decrease of power supply voltage</li> </ul>	Display: All displays are OFF Output: All outputs are OFF Communication: Stopped	
	Display units error	Display: All displays are OFF Output: All outputs are OFF Communication: Sends error code 64	

## 6.2 Solutions for Problems

This section explains possible causes and solutions of the errors. For any inquiries or to confirm the specifications of the product, contact TLV or your local TLV representative.

If the instrument needs to be replaced, always strictly observe the warnings below.

 <b>WARNING</b>	<ul style="list-style-type: none"><li>• To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.</li><li>• To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.</li><li>• To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.</li><li>• To prevent electric shock or instrument failure, do not touch the inside of the instrument.</li><li>• All wiring must be performed by authorized personnel with electrical experience in this type of work.</li></ul>
 <b>CAUTION</b>	<p>All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.</p>

## Display related errors

Problem	Possible cause	Solution
No display appears	The internal assembly is not inserted into the case correctly.	Insert the internal assembly into the case correctly.
	Power supply terminal connection is not correct.	Connect power supply correctly by referring to 3.3 Wiring of Each Terminal.
	Power supply terminal contact failure.	Retighten the terminal screws.
	Supply voltage is not correct.	Apply proper power supply voltage by referring to 7. Product Specifications.
Display is unstable	Noise source is present near the instrument.	Separate the noise source from the instrument. Set the appropriate value at Digital filter according to the input response.
	The terminal block of the instrument (with thermocouple input) is directly exposed to the air flow from an air conditioner.	Do not directly expose the terminal block to the air from the air conditioner.
Measured value (PV) display differs from the actual value	Wrong sensor is used.	Check the instrument specification and use a proper sensor.
	Input type setting is wrong.	Make proper setting by referring to the separate manual [Parameters/Functions] (172-65710M).
	Connection between the sensor (thermocouple) and the instrument is made with a cable other than compensating wire.	Be sure to use a compensating wire.
	For RTD input, leadwire resistance in three wires between the sensor and the instrument is different from one another.	Use a leadwire with the same resistance among three leadwires.
	PV bias is set.	Set PV bias to "0" by referring to the separate manual [Parameters/Functions] (172-65710M). However, this is limited only to when the PV bias setting can be changed.
	PV ratio is set.	Change the PV ratio setting by referring to the separate manual [Parameters/Functions] (172-65710M). However, this is limited only to when the PV ratio setting can be changed.



### How to check the input

- When the input is configured as Thermocouple input:  
Short the input terminals\*, and if a temperature around the ambient temperature of the input terminals is displayed, the controller is working properly.  
\*Measured input terminals 11-12, Measured input 2 terminals 23-24
  - When the input is configured as RTD input:  
Insert a 100  $\Omega$  resistor across Input terminals A-B.<sup>1)</sup> Short terminals between B-B.<sup>2)</sup>  
If temperature around 0 °C is displayed, the instrument is working fine.
- <sup>1)</sup> Measured input 1 terminals 10-11, Measured input 2 terminals 22 and 23  
<sup>2)</sup> Measured input 1 terminals 11 and 12, Measured input 2 terminals 23 and 24

- When the input is configured as Voltage/Current input:  
Input\* a certain voltage or current from a voltage/current generator to the controller. If the controller shows the equivalent input value, the input setting and function of the controller is working correctly.

\*Measured input terminals 11 and 12, Measured input 1 terminals 11 and 12, Measured input 2 terminals 23 and 24

### Control related errors

Problem	Possible cause	Solution
Control is abnormal	Supply voltage is not correct.	Apply proper power supply voltage by referring to 7. Product Specifications.
	Disconnection of sensor or sensor wire.	Turn off the power or STOP the operation by "RUN/STOP transfer" and repair the sensor or replace it.
	The sensor is not wired correctly.	Conduct correct wiring of sensor by referring to 3.3 Wiring of Each Terminal.
	Wrong sensor is used.	Check the instrument specification and use a proper sensor.
	Input type setting is wrong.	Make proper setting by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
	Sensor insertion depth is insufficient.	Check the sensor insertion. If insertion is loose, firmly insert the sensor.
	Sensor insertion position is wrong.	Insert the sensor at the specified location.
	Input signal wires are not separated from instrument power and/or load wires.	Separate input signal wires from instrument power and load wires
	Noise source is present near the instrument.	Separate the noise source from the instrument.
	Inappropriate PID constants.	Set appropriate PID constants.
Startup tuning (ST) cannot be activated	Startup tuning (ST) mode is "oFF (ST unused)." (Factory set value: oFF)	Refer to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
	Requirements for performing the Startup tuning (ST) are not satisfied.	Satisfy the requirements for performing the Startup tuning (ST) by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
Autotuning (AT) cannot be activated	Requirements for performing the Autotuning (AT) are not satisfied.	Satisfy the requirements for performing the Autotuning (AT) by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
Autotuning (AT) aborted	Requirements for aborting the Autotuning (AT) are established.	Identify causes for Autotuning (AT) abort by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M) and then remove them. Then, execute Autotuning (AT) again.
Optimum PID values cannot be obtained by Autotuning (AT)	Autotuning (AT) does not match the characteristics of the controlled object.	Set PID constants manually by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

Continued on the next page

Problem	Possible cause	Solution
Autotuning (AT) cannot be finished normally	Temperature change of the process is too slow (1 °C or less per minute for temperature rise and fall).	Set PID constants manually by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
	Autotuning (AT) was executed around the ambient temperature or close to the maximum temperature achieved by the load.	
Measured value (PV) overshoots or undershoots	Proportional band is narrow. Proportional (P) constant is small.	Increase Proportional (P) value within the acceptable limit of response delay.
	Integral time is short. Integral (I) constant is small.	Increase Integral (I) value within the acceptable limit of response delay.
	Derivative time is short. Derivative (D) constant is small.	Increase Derivative (D) value within the acceptable limit of process stability.
	The instrument is configured for ON/OFF control.	Change the control mode to Proportional control or PID control.
No output change in step	Output change rate limiter is set.	Set the Output change rate limiter to "0.0: OFF" by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the Output change rate limiter setting can be changed.
Output does not rise over (or goes below) a certain value	Output limiter is set.	Change the Output limiter setting by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the Output limiter setting can be changed.

### Operation related errors

Problem	Possible cause	Solution
No setting change can be made by key operation	Set data is locked.	Release the Set data lock by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
A set value (SV) above (or below) a certain limit cannot be set	Setting limiter is set.	Change the Setting limiter setting by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the Setting limiter setting can be changed.
Set value (SV) does not change immediately when the Set value (SV) is changed	Setting change rate limiter is set.	Set the Setting change rate limiter to "0: No function" by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).

Continued on the next page

Problem	Possible cause	Solution
Remote setting input value display differs from the actual value	RS bias is set.	Set the RS bias to "0" by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the RS bias setting can be changed.
	RS ratio is set.	Change the RS ratio setting by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the RS ratio setting can be changed.
For Voltage/Current input types, the displayed value for the input voltage or the input current is inverted.	Invert setting is done.	Set the Inverting input to "0: Unused" by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
Unable to select the 2-loop control (except Remote setting input) such as 2-loop control, Differential temperature control, Control with PV select, Cascade control, or Input circuit error alarm).	"Remote setting input" is selected at the time of order.	Check the specification code of Option 3 type. When "Measured input 2" is not specified, switching to 2-loop control (2-loop control, Differential temperature control, Control with PV select, Cascade control, or Input circuit error alarm) is not possible.
Unable to switch to the RUN mode from the STOP mode.	The terminal to which the RUN/STOP transfer of the Digital input (DI) function is assigned may be open. *	Close the applicable terminal. Alternatively, deactivate the digital input (DI) function, referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
Unable to switch to the Auto mode from the Manual mode.	The terminal to which the Auto/Manual transfer of the Digital input (DI) function is assigned may be open. *	

\* When "Digital input (DI)" is specified at the time of ordering, functions like "RUN/STOP transfer" or "Auto/Manual transfer" will be automatically assigned to the Digital input (DI) terminal.

To check the assignment of the Digital input (DI) configured at the time of ordering, refer to 1.3.2 Range Code Table or 1.3.3 Unit/Range Code Table.

### Event related errors

Problem	Possible cause	Solution
Event function is abnormal	Event function is different from the specification.	Change the Event action type by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M) after the instrument specification is confirmed.
	Event output relay contact Energized/De-energized is reversed.	Check the setting details by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
	Setting of Event differential gap is not appropriate.	Set the appropriate Event differential gap by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
No output of the Event function is turned on	Event is not assigned to the output.	Check the contents of Output assignment by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M).
Event hold action is not activated	Setting change rate limiter is set.	Set the Setting change rate limiter to "0: No function" by referring to the separate SC-F71 Instruction Manual [Parameters/Functions] (172-65710M). However, this is limited only to when the Setting limiter setting can be changed.

### Communication related errors

- Original communication

Problem	Possible cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Check connection and connect cable properly.
	Disconnection, contact failure, or wrong connection of communication cable	Check wiring and connector. Repair or replace, if necessary.
	Communication setting (communication speed, data bit configuration) is different from a host computer	Check setting and make a proper setting.
	Address setting is wrong	
	Data format is wrong	Review communication program
	Transmission line is not set to receive state after data send (for RS-485)	
	Communication protocol setting is wrong	

Continued on the next page

Problem	Possible cause	Solution
EOT return	Invalid communication identifiers	Check if communication identifiers are correct and if there are any identifiers for unsupplied functions.
	Data format is wrong	Review communication program
NAK return	Communication error occurred (parity bit error, framing error, etc.)	Identify the error and take necessary actions (e.g. check of transmitted data, retransmission)
	BCC error occurred	
	Data is out of the setting range	Check the setting range and correct the data.
	Invalid communication identifiers	Check if communication identifiers are correct and if there are any identifiers for unsupplied functions.

- Modbus

Problem	Possible cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Check connection and connect cable properly.
	Disconnection, contact failure, or wrong connection of communication cable	Check wiring and connector. Repair or replace, if necessary.
	Communication setting (communication speed, data bit configuration) is different from a host computer	Check setting and make a proper setting.
	Address setting is wrong	
	Transmission error detected. (Overrun error, framing error, parity error, or CRC-16 error)	Retransmit after time-out or Review program on master side
	Time interval between the data that composes a message is more than 24-bit time.	
No response	Communication protocol setting is wrong	Set Communication protocol to "1" or "2" by referring to the separate manual [Host communication]. 1: Modbus (Order of data transfer: upper word to lower word) 2: Modbus (Order of data transfer: lower word to upper word)
Error code: 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code: 2	When the mismatched address is specified	Confirm the address of holding register
Error code: 3	When the specified number of data items in the query message exceeds the maximum number of data items available	Confirm the setting data
Error code: 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, contact TLV or your local TLV

	representative.
--	-----------------

- PLC communication (MAPMAN)

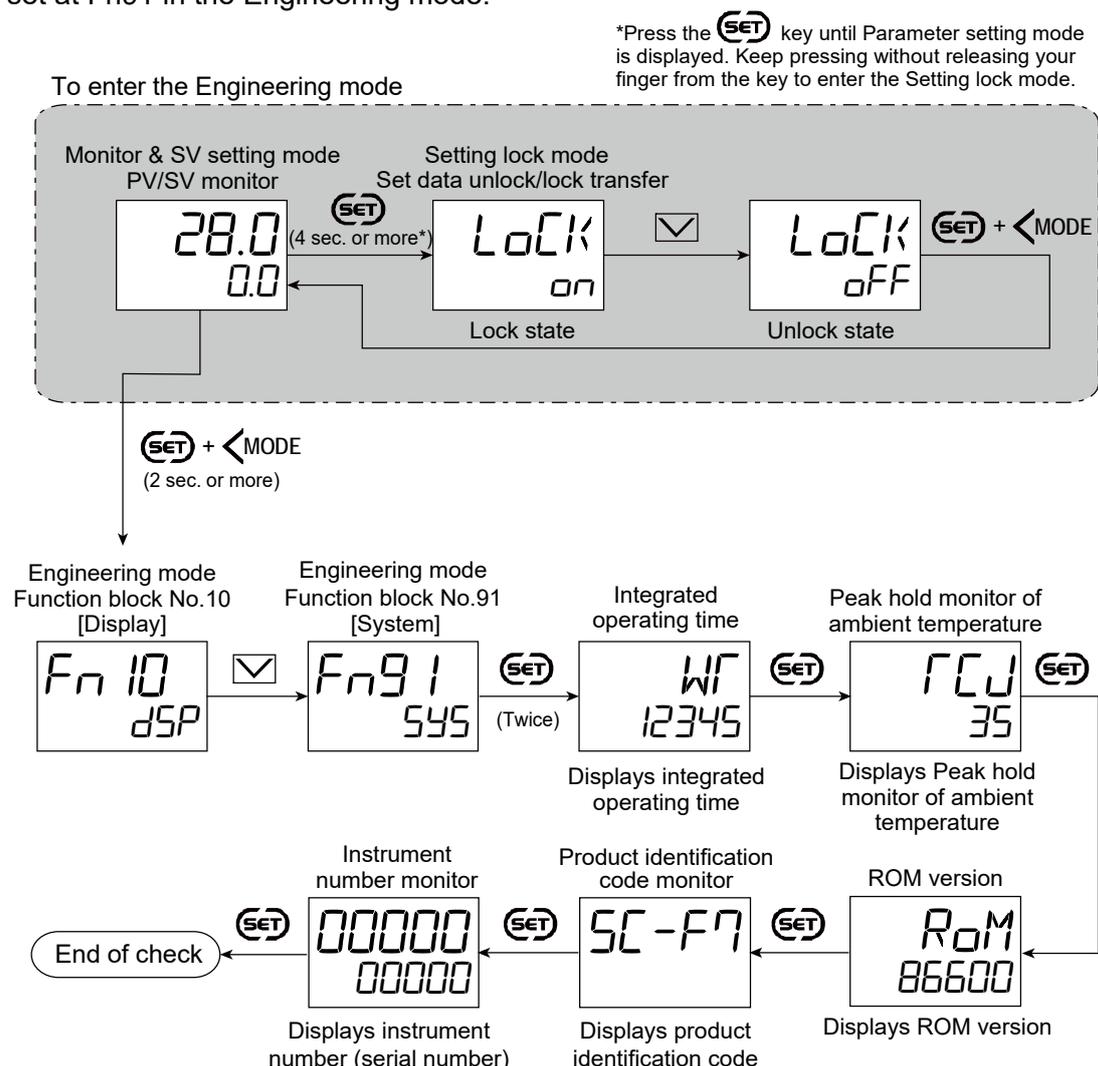
Problem	Possible cause	Solution
<ul style="list-style-type: none"> <li>Even if "1" is set to the sitting request bit or monitor request bit in request command, transfer is not finished. Request command does not return to "0"</li> <li>It looks like communication is done properly, but the monitor values are not sent to the PLC.</li> <li>No response</li> </ul>	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed, data bit configuration and protocol with those of the PLC	Confirm the communication settings of controller and set them correctly
	Wrong setting of PLC communication data	Confirm the PLC communication settings and set them correctly
	Setting of PLC becomes write inhibit	Setting of termination resistor in accordance with PLC or the insertion is done Setting of PLC is turned into write enable (Write enable in RUN, shift to monitor mode, etc.)
	Accesses outside the range of memory address of PLC (wrong setting of address)	Setting of PLC becomes write inhibit Confirm the PLC communication environment setting and set them correctly
If two or more controllers are connected, no units after the second unit are recognized	Instrument link recognition time is short	Set the Instrument link recognition time* longer. * Set the Instrument link recognition time only for a master controller (address 0).
When the setting request command of request command is set in "1," setting error is become	Data rang error	Confirm the setting range of set value and set them correctly

### 6.3 Verifying Instrument Information

When error occurs and when you contact us, you are requested to provide us with the information on the instrument model code and specification. You can check the ROM version, product identification code and serial number of the instrument on the instrument display. The Integrated operating time and the maximum ambient temperature (Peak hold monitor of the ambient temperature).

#### How to display the information

ROM version, product identification code monitor and Serial number monitor can be set at Fn91 in the Engineering mode.



- Next parameter is displayed.
- Press **SET** and **<MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.  
The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

## How to check

- ROM Version

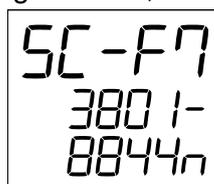
[Example]



- Product identification code monitor

Displays the product identification code of the instrument. As the code is too long to be displayed on a single screen, it can be scrolled left and right with  and  keys.

[Example]



- Instrument number monitor

Displays the serial number of the instrument.



To read the displayed characters, refer to "Character Symbols".



Alternatively, you can check the product identification code (MODEL), serial number (S/N) and suffix code (CODE) on the label on the side of the instrument if you are unable to check the information on the display.

- Integrated operating time

As soon as the instrument is powered, "1" is added. Thereafter, "1" is accumulated for each hour.

- Peak hold monitor of ambient temperature

Temperature around the rear terminal is measured and the maximum value is stored.



The Integrated operating time and the Peak hold monitor of the ambient temperature (maximum ambient temperature) cannot be reset.

## 7. Product Specifications

### Measurement input

Number of Inputs	1 point + 1 point (Isolated between each input) (1 point depends on function selected for Input 2)
Measurement input types	<p>Thermocouple (TC) input: K, J, T, S, R, E, B, N (JIS C1602-1995), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751-00)</p> <p>RTD input: Pt100 (JIS C1604-1997), JPt100 (JIS C1604-1997, Pt100 of JIS C1604-1981) 3-wire system</p> <p>Low voltage input: 0 to 10 mV DC, 0 to 100 mV DC</p> <p>High voltage input: 0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC</p> <p>Current input: 0 to 20 mA DC, 4 to 20 mA DC</p>

### Input range

#### Thermocouple (TC) input

Input type	Measured range
K	-200.0 to +400.0 °C (-328.0 to +752.0 °F) -200.0 to +1372.0 °C (-328.0 to +2502.0 °F)
J	-200.0 to +400.0 °C (-328.0 to +752.0 °F) -200.0 to +1200.0 °C (-328.0 to +2192.0 °F)
T	-200.0 to +400.0 °C (-328.0 to +752.0 °F)
S	-50.0 to +1768.0 °C (-58.0 to +3214.0 °F)*
R	-50.0 to +1768.0 °C (-58.0 to +3214.0 °F)*
E	-200.0 to +1000.0 °C (-328.0 to +1832.0 °F)*
B	0.0 to 1800.0 °C (0.0 to 3272.0 °F)*
N	0.0 to 1300.0 °C (0.0 to 2372.0 °F)*
PLII	0.0 to 1390.0 °C (0.0 to 2534.0 °F)*
W5Re/W26Re	0 to 2300 °C (0 to 4200 °F)
U	-200.0 to +600.0 °C (-328.0 to +1112.0 °F)
L	0 to 900 °C (0 to 3200 °F)
PR40-20	0 to 1800 °C (0 to 3200 °F)

\* The least significant digit (LSD) may flicker when the display resolution is set to 0.1 °C (0.1 °F)

#### RTD input

Input type	Measured range
Pt100	-200.0 to +850.0 °C (-328.0 to +1562.0 °F) -100.00 to +100.00 °C (-148.00 to +212.00 °F) 0.00 to 50.00 °C (32.00 to 122.00 °F)
JPt100	-200.0 to +640.0 °C (-328.0 to +1184.0 °F) -100.00 to +100.00 °C (-148.00 to +212.00 °F) 0.00 to 50.00 °C (32.00 to 122.00 °F)

#### Voltage/current input

Input type	Measured range
Low voltage	0 to 10 mV DC, 0 to 100 mV DC
High voltage	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
Current	DC 0 to 20 mA, DC 4 to 20 mA

Sampling period	0.05 seconds When Input 2 is configured for 2-loop control or cascade control: 0.1 seconds
Effects of signal resistance (TC input)	Approx. 0.18 $\mu\text{V}/\Omega$ (Converted depending on TC types)
Input line resistance (RTD input)	Approx. 0.006%/ $\Omega$ of span (100 $\Omega$ or less per wire) If the resistance is 100 $\Omega$ or more, the measuring range may be limited.

Input impedance (Voltage/Current input)	Low voltage input: 1 M $\Omega$ minimum High voltage input: 1 M $\Omega$ minimum Current input: Approx. 50 $\Omega$ Maximum Allowable Voltage 2 V DC
Measured current (RTD input)	Approx. 1 mA
Action at input break	TC input: Upscale or Downscale (selectable) RTD input: Upscale Low voltage input: Upscale or Downscale (selectable) High voltage input: Downscale (Indicates value near 0) Current input: Downscale (Indicates value near 0)
Action at input short circuit (RTD input)	Downscale (Measured range: except 0.00 to 50.00 °C [32.00 to 122.00 °F] range) Upscale (Measured range: 0.00 to 50.00 °C [32.00 to 122.00 °F])
Action at input error	<ul style="list-style-type: none"> <li>• Input error determination point (high), Input error determination point (low) Input range low <math>-(5\%</math> of input span) to Input range high <math>+(5\%</math> of input span) When the input type is Pt100 or JPt100, the low limit value cannot be <math>-5\%</math>. Low limit of Pt100: <math>-245.5</math> °C (<math>-409.8</math> °F), corresponding to approx. 2 <math>\Omega</math> Low limit of JPt100: <math>-237.6</math> °C (<math>-395.7</math> °F), corresponding to approx. 2 <math>\Omega</math> It is also used as Input error determination of the Event action.</li> <li>• Input error (high) action selection, Input error (low) action selection "Control continues" or "Manipulated output value at input error" (selectable)</li> <li>• Manipulated output value at input error PID control: <math>-5.0</math> to <math>+105.0\%</math> Heating/Cooling PID control: <math>-105.0</math> to <math>+105.0\%</math> Position proportioning PID control: <math>-5.0</math> to <math>+105.0\%</math> Actual output value is limited by the Output limiter.</li> <li>• PV flashing display at input error Flashing display or Non-flashing display (selectable)</li> </ul>
Measured input correction	PV bias: $-\text{Input span}$ to $+\text{Input span}$ PV ratio: 0.001 to 9.999 PV digital filter (First order lag digital filter): 0.0 to 100.0 seconds (0.0: Filter OFF)
Allowable input range	$-1.0$ to $+3.0$ V (TC input/RTD input/Low voltage input) $-12$ to $+12$ V (High voltage input) $-20.0$ to $+30.0$ mA (Current input)
Square root extraction function (Voltage/Current input)	Calculation method Measured value = PV low input cut-off 0.00 to 25.00% of input span

## Remote setting input

Number of Inputs	1 point (Isolated from PV)	
Input type	Thermocouple (TC) input:	K, J, T, S, R, E, B, N (JIS-C1602-1995), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751-00)
	RTD input:	Pt100 (JIS-C1604-1997), JPt100 (JIS-C1604-1997, Pt100 of JIS-C1604-1981) 3-wire system
	Low voltage input:	0 to 10 mV DC, 0 to 100 mV DC
	High voltage input:	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
	Current input:	0 to 20 mA DC, 4 to 20 mA DC
Input range	Programmable range	
Sampling cycle	0.05 seconds	
Input impedance	Low voltage input:	1 M $\Omega$ or more
	High voltage input:	1 M $\Omega$ or more
	Current input:	Approx. 50 $\Omega$
	Maximum Allowable Voltage 2 V DC	
Action at input break	TC input:	Upscale or Downscale (selectable)
	RTD input:	Upscale
	Low voltage input:	Upscale or Downscale (selectable)
	High voltage input:	Downscale (Indicates value near 0)
	Current input:	Downscale (Indicates value near 0)
Remote input correction	RS bias:	-Input span to +Input span
	RS ratio:	0.001 to 9.999
	RS digital filter (First order lag digital filter):	0.0 to 100.0 seconds (0.0: Filter OFF)
Allowable input range	-1.0 to +3.0 V (TC input/RTD input/Low voltage input)	
	-12 to +12 V (high voltage input)	
	-20.0 to +30.0 mA (Current input)	

## Digital input (DI)

Number of inputs	Up to 6 points (DI1 to DI6)	
Input method	Dry contact input	
	OFF (Open state):	50 k $\Omega$ or more
	ON (Close state):	1 k $\Omega$ or less
	Contact current:	3.3 mA DC or less
	Voltage at open:	Approx. 5 V DC
Capture judgment time	Within 200 ms	

## Output

Assign output

Number of outputs: Output (OUT): 3 points (OUT1 to OUT3)  
Event output (DO): 4 points (DO1 to DO4)

Output assignment: Refer to Output assignment list

Output assignment list

Output specification	OUT1, OUT2	OUT3		DO
	Current	Voltage pulse	Current	
Control output (Heat-side)	✓	✓	✓	✓
Control output (Cool-side)	✓	✓	✓	✓
Logic calculation output (Event output)	✓	✓	✓	✓
Logic calculation output	✓	✓	✓	✓
RUN state output	✓	✓	✓	✓
Output of the communication monitoring result	✓	✓	✓	✓
Manual mode state output	✓	✓	✓	✓
Remote mode state output	✓	✓	✓	✓
AT state output	✓	✓	✓	✓
Output with set value (SV) changing	✓	✓	✓	✓
File output	✓	✓	✓	✓
Retransmission output	✓	✓	✓	✓

Output type

- Current output [OUT1, OUT2, OUT3]  
Output current: 4 to 20 mA DC, 0 to 20 mA DC  
Output range: 3.2 to 20.8 mA DC, 0 to 21 mA DC  
Allowable load resistance: 500 Ω or less
- Voltage pulse output [OUT3]  
Output voltage: DC 0/14 V (rated)  
At ON: 12 to 17 V  
At OFF: 0.5 V or less  
Allowable load resistance: 600 Ω or more  
Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)
- Relay contact output [DO1 to DO4]  
Contact type: a contact  
Contact rating (Resistive load): 250 V AC 1 A, 30 V DC 0.5 A  
Electrical life: 150,000 times or more (rated load)  
Mechanical life: 20 million times or more (switching: 300 time/min.)

## Performance

Reference performance (under standard conditions)

Measured input  
(PV):

Accuracy:

Input types	Input range	Accuracy
K, J, T, E, U, L (Accuracy is not guaranteed for less than -100 °C)	< -100 °C	±1.0 °C (Approx. value)
	-100 °C to < +500 °C	±0.5 °C
	≥ 500 °C	±0.1% of Reading
N, S, R, PLII, 5Re/W26Re (Accuracy is not guaranteed for less than 400 °C for input type S, R and W5Re/W26Re)	< 0 °C	±2.0 °C
	0 °C to < 1000 °C	±1.0 °C
	≥1000 °C	±0.1% of Reading
B (Accuracy is not guaranteed for less than 400 °C)	< 400 °C	±70 °C (Approx. value)
	400 °C to < 1000 °C	±1.4 °C
	≥1000 °C	±0.1% of Reading
PR40-20 (Accuracy is not guaranteed for less than 400 °C)	< 400 °C	±20 °C (Approx. value)
	400 °C to < 1000 °C	±10 °C
	≥ 1000 °C	±0.1% of Reading
Pt100, JPt100	< 200 °C	±0.2 °C
	≥200 °C	±0.1% of Reading
	0.00 to 50.00 °C	±0.10 °C
Voltage/current input		±0.1% of span

Display accuracy is equal to the above accuracy with the value below the minimum resolution rounded up.

Noise elimination ratio Series mode: 60 dB or more (50/60 Hz)  
Common mode: 120 dB or more (50/60 Hz)

Resolution:

Input type	Input resolution	
K, J, T, E, U, L, N, S, R, PLII, W5Re/W26Re	1/200000	
PR40-20, B	1/100000	
Pt100, JPt100	-200 to +850 °C	1/200000
	-100.00 to +100.00 °C	1/60000
	0.00 to 50.00 °C	
Low voltage input	0 to 10 mV DC	1/120000
	0 to 100 mV DC	1/200000
High voltage input	0 to 1 V DC	1/200000
	0 to 5 V DC	
	1 to 5 V DC	
	0 to 10 V DC	
	-5 to +5 V DC	
	-10 to +10 V DC	
Current input	0 to 20 mA DC	1/200000
	4 to 20 mA DC	

Cold-junction temperature compensation error: ±0.5 °C (range of the standard conditions: 23 °C±2 °C)

Close horizontal mounting error: ±1.5 °C (Between -10 to +55 °C)

Close vertical mounting error: Close horizontal mounting: Within ±1.5 °C  
Close vertical mounting: ±3.0 °C

Remote setting  
input

Accuracy  
Noise elimination ratio  
Resolution  
Cold-junction temperature  
compensation error

} Same as Measured input (PV) in the Performance section

Current output

Accuracy: ±0.1% of span

	Resolution: Approx. 1/25000
Operating influence (Variation under the operating condition)	
Influence of ambient temperature	Input: TC input: $\pm 0.006\%/^{\circ}\text{C}$ of span RTD input: $\pm 0.006\%/^{\circ}\text{C}$ of span Voltage/current input: $\pm 0.006\%/^{\circ}\text{C}$ of span
	Output: Voltage/current output: $\pm 0.015\%/^{\circ}\text{C}$ of span
Influence of physical orientation	Input: TC input: $\pm 0.3\%$ of span or $\pm 3^{\circ}\text{C}$ or less RTD input: $\pm 0.5^{\circ}\text{C}$ or less Voltage/current input: Less than $\pm 0.1\%$ of span
	Output: Voltage/current output: Less than $\pm 0.3\%$ of span

## Displays

Measured input display (PV1, PV2)	5-digit 11-segment LCD (Yellow-green)
	Display range: Input range low - (5% of input span) to Input range high + (5% of input span)
	When the input type is Pt100 or JPt100, the low limit value cannot be -5%
	Low limit of Pt100: $-245.5^{\circ}\text{C}$ ( $-409.8^{\circ}\text{F}$ ), corresponding to approx. $2\ \Omega$
	Low limit of JPt100: $-237.6^{\circ}\text{C}$ ( $-395.7^{\circ}\text{F}$ ), corresponding to approx. $2\ \Omega$
	The display starts flashing when the Input range or the Input error determination point has been exceeded
	The display starts flashing "ooooo" when the input exceeds the display range.
	The display starts flashing "uuuuu" when the input goes below the display range.
Setting display, PV2 display (SV, PV2)	5-digit 7-segment LCD (Orange)
Output value, time (MV, TIME)	4 $\frac{1}{2}$ digit 7-segment LCD (White)
Memory area display	1 $\frac{1}{2}$ digit 7-segment LCD (White)
Output display (OUT1 to OUT3)	Action indicator LCD (White) $\times$ 3 points
Manual display (MAN)	Action indicator LCD (White)
Remote display (REM)	Action indicator LCD (White)
Autotuning display (AT)	Action indicator LCD (White)
Alarm display (ALM)	Action indicator LCD (Red)
Event output display (DO)	Action indicator LCD (White) $\times$ 4 points
Set lock display	Action indicator LCD (White)
Ramp state display	Action indicator LCD (White) $\times$ 3 points

## Operation keys

Select items/ Set parameters	4 keys ( <b>SET</b> , <b>MODE</b> , <b>↓</b> , <b>↑</b> )
Reverse set	Key ( <b>R.SET</b> )
Display/Setting mode selector	Key ( <b>MONI</b> )
Memory area transfer	Key ( <b>AREA</b> )
Direct access key	Key ( <b>FUNC</b> ) A desired function can be assigned to the FUNC key

## Control operation type

PID control with AT (reverse action)  
 PID control with AT (direct action)  
 Heating/Cooling PID control with AT  
 Pressure control operation [MC-COS(R)-3]  
 Pressure control operation [MC-COS(R)-16, sizes 15 to 50 mm]  
 Pressure control operation [MC-COS(R)-16, sizes 65 to 150 mm]  
 Pressure control operation [MC-COS(R)-21]  
 Pressure control operation [MC-VCOS(R)]  
 Temperature control operation [MC-COS(R)-16]  
 Temperature control operation [MC-VCOS(R)]

## Event function

Number of event	4 points (Output selection is possible)
Event type	Deviation high (Using SV monitor value) <sup>1)</sup> Deviation low (Using SV monitor value) <sup>1)</sup> Deviation high/low (Using SV monitor value) <sup>1)</sup> Band (Using SV monitor value) <sup>1)</sup> Deviation high/low (Using SV monitor value) [High/Low individual setting] <sup>1)</sup> Band (Using SV monitor value) [High/Low individual setting] <sup>1)</sup> SV high (Using SV monitor value) SV low (Using SV monitor value) Process high <sup>2)</sup> Process low <sup>2)</sup> Deviation high (Using local SV) <sup>1)</sup> Deviation low (Using local SV) <sup>1)</sup> Deviation high/low (Using local SV) <sup>1)</sup> Band (Using local SV) <sup>1)</sup> Deviation high/low (Using local SV) [High/Low individual setting] <sup>1)</sup> Band (Using local SV) [High/Low individual setting] <sup>1)</sup> SV high (Using local SV) SV low (Using local SV) MV high [heat-side] <sup>2)</sup> MV low [heat-side] <sup>2)</sup> MV high [cool-side] <sup>2)</sup> MV low [cool-side] <sup>2)</sup> Process high/low [High/Low individual setting] <sup>2)</sup> Process band [High/Low individual setting] <sup>2)</sup>

<sup>1)</sup> Event hold action and re-hold action is available.

<sup>2)</sup> Event hold action is available.

Setting range	a) Deviation	Event setting: -Input span to +Input span
		Differential gap: 0 to Input span
	b) Process and SV	Event setting: Same as measured range (When Control with PV select: -Input span to +Input span)
		Differential gap: 0 to Input span
	c) MV	Event setting: -5.0 to +105.0%
		Differential gap: 0.0 to 110.0%
	Additional function	Hold action
		a) Hold action OFF b) Hold action (ON, when transferring from STOP to RUN) c) Re-hold action (ON, when transferring from RUN to STOP, when the SV is changed)
	Event timer:	0.0 to 600.0 seconds
	Interlock selection:	0 to 4095 <sup>1)</sup>
	Interlock release:	<i>on</i> (Interlock state), <i>off</i> (Interlock release)
	ALM lamp lighting condition:	0 to 4095 <sup>1)</sup>
	Event assignment:	Input 1, Input 2, or Differential temperature input is assignable.
	Output action at control stop:	0 to 7 <sup>2)</sup>
		<sup>1)</sup> OR-selectable from Event 1 to 4, Input error high, or Input error low.
		<sup>2)</sup> OR-selectable from Logic calculation output (continue control), Retransmission output (continue control), Instrument status output (continue control).

### Retransmission output

Output type	Measured value (PV), Local SV, SV monitor value, Deviation, Manipulated output value [heat-side] <sup>1)</sup> , Manipulated output value [cool-side] <sup>2)</sup> , Remote setting input value, Measured value (PV) of differential temperature input	
	<sup>1)</sup> Heating/Cooling PID control: Output value [heat-side]	
	<sup>2)</sup> Output value [cool-side] in Heating/Cooling PID control	
Output scaling	High/Low individual setting (High limit > Low limit)	
	Measured value (PV)	Same as measured range
	Local SV	Same as measured range
	SV monitor value	Same as measured range
	Deviation	Input span to input span
	Manipulated output value [heat-side]	-5.0 to +105.0%
	Manipulated output value [cool-side]	-5.0 to +105.0%
	Remote setting input value	Same as measured range
	Measured value (PV) of differential temperature input	-(Input 1_Input span) to +(Input 1_Input span)

## Multi-memory area

### Memory area function

Number of areas	16 points
Stored parameters	Set value (SV), Set value (SV) of differential temperature input, Event set value (or Event set value [high]), Event set value [low], Proportional band [heat-side], Integral time [heat-side], Derivative time [heat-side], Control response parameter, Proactive intensity, Manual reset, FF amount, Output limiter high [heat-side], Output limiter low [heat-side], Proportional band [cool-side], Integral time [cool-side], Derivative time [cool-side], Overlap/Deadband, Output limiter high [cool-side], Output limiter low [cool-side], Select Trigger type for Memory area transfer, Area soak time, Link area number, Setting change rate limiter (up), Setting change rate limiter (down), Manipulated output value at area transfer, Auto/Manual transfer selection at area transfer, Remote/Local transfer selection at area transfer
Method of area transfer	a) through key operations b) through the communication function c) through external contact signal d) through the set area soak time e) through the event function

### Memory area link function

Area soak time	0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds 0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds
Soak time unit	0: 0 hours 00 minutes to 99 hours 59 minutes 1: 0 hours 00 minutes to 199 minutes 59 seconds 2: 0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds
Link area number	0 to 16 (0: No link)

## Communication

### Host communication

Interface	Based on RS-422A, EIA standard
Protocol	Original communication: ANSI X3.28-1976 subcategory 2.5 A4 compliant MODBUS communication: MODBUS-RTU PLC communication: MAPMAN communication

### Loader communication

Protocol	Original communication: ANSI X3.28-1976 subcategory 2.5 A4 compliant
Synchronous method	Start/Stop synchronous type
Communication speed	38400 bps
Data format	Start bit: 1 Data bit: 8 Parity bit: Without Stop bit: 1 Number of data digit: 7-digit (fixed)

Maximum connection	1 point
Connection method	Exclusive cable (not complying with the USB standard)
Interval time	10 ms
Other	<p>1) Power can be supplied to the instrument from COM-KG or COM-K2 (or COM-K version 1) (our USB communication converter). This power supply is designed for setting up the internal set values. Control is stopped (output off, relay open) and host communication is also stopped. The PV/SV monitor shows "LOAD" for the measured value (PV) display and "----" for the set value (SV) display. The LCD backlight is partially turned off.</p> <p>2) While the instrument is powered by COM-KG or COM-K2 (or COM-K version 1), if power is applied to the instrument, the instrument will be reset and starts for normal operation.</p> <p>3) When the instrument is normally powered, the host communication can be used simultaneously.</p>

### Self-diagnostic function

Control stop (Error number is displayed)	<p>Adjustment data error (Err 1)</p> <p>Data back-up error (Err 2)</p> <p>A/D conversion error (Err 4)</p> <p>Temperature compensation error (Err 4)</p> <p>Valve coefficient not set (Err 8)</p> <p>Display units error (Err 64)</p>
Action stop (Error number is not displayed)	<p>Power supply voltage is abnormal</p> <p>Watchdog timer error</p>

### General specifications

Power supply voltage	85 to 264 V AC [Including power supply voltage variation] (50/60 Hz) (Rated 100 to 240 V AC) Frequency variation: 50 Hz (-10 to +5%), 60 Hz (-10 to +5%)
Power consumption (at maximum load)	Max. 7.4 VA (at 100 V AC) Max. 10.9 VA (at 240 V AC)
Rush current	5.6 A or less (at 100 V AC) 13.3 A or less (at 240 V AC)

Insulation resistance

	1	2	3	4	5	6
1 Grounding						
2 Power supply terminal	500 V DC 20 MΩ or more					
3 Measured input terminal 1	500 V DC 20 MΩ or more	500 V DC 20 MΩ or more				
4 Measured input terminal 2	500 V DC 20 MΩ or more	500 V DC 20 MΩ or more	500 V DC 20 MΩ or more			
5 Output terminal	500 V DC 20 MΩ or more					
6 DO terminal (relay)	500 V DC 20 MΩ or more					
7 Communication, Digital input terminal	500 V DC 20 MΩ or more					

Grounding is done on the control panel.

#### Withstand voltage

Time: 1 min.	1	2	3	4	5	6
1 Grounding						
2 Power supply terminal	1500 V AC					
3 Measured input terminal 1	1500 V AC	3000 V AC				
4 Measured input terminal 2	1500 V AC	3000 V AC	1000 V AC			
5 Output terminal	1500 V AC	3000 V AC	1000 V AC	1500 V AC		
6 DO terminal (relay)	1500 V AC	3000 V AC	3000 V AC	3000 V AC	3000 V AC	
7 Communication, Digital input terminal	1500 V AC	3000 V AC	1000 V AC	1000 V AC	1500 V AC	3000 V AC

#### Power failure handling

Power failure	A power failure of 20 ms or less will not affect the control action
Memory backup	Backed up by non-volatile memory Number of writing: Approx. one trillion ( $10^{12}$ ) times (FRAM) Data storage period: Approx. 10 years (FRAM)
Power failure recovery	Hot/cold start a) Hot start 1 Operation is resumed from the state before the power failure and from the output before the failure. b) Hot start 2 Operation is resumed from the state before the power failure. In case of Manual mode, the operation starts from the Output limiter low limit. c) Cold start Operation starts in Manual mode, irrespective of the mode before the power failure. The operation starts from the Output limiter low limit. d) STOP start The operation starts from the STOP state irrespective of the mode before the power failure e) Follow the selected action when power is restored Start the operation by following the items below ① RUN/STOP selection when power is restored ② MAN/AUTO selection when power is restored ③ LOC/REM selection when power is restored ④ LOC/EXT selection when power is restored ⑤ Output value selection when power is restored Selectable from a) to e) Start determination point: 0 to input span (0: Action conforms to the Hot/Cold start) Unit: same as the reading

## Environment conditions

### ● Operating environmental conditions

Ambient temperature	-10 to +55 °C
Ambient humidity	5 to 95% RH (absolute humidity: MAX.W.C 29 g/m <sup>3</sup> dry air at 101.3 kPa)
Vibration	Frequency range: 10 to 150 Hz Maximum amplitude: 0.075 mm Maximum acceleration: 9.8 m/s <sup>2</sup> Each direction of XYZ axes
Shock	Free fall from 50 mm in height Each direction of XYZ axes (In non-energization)

### ● Reference operating conditions

Reference temperature	23 °C ±2 °C Temperature variation: ±5 °C/h
Reference humidity	50% RH ±10% RH
Magnetic field	Geomagnetism
Power supply voltage	Reference value ±1%

### ● Transportation and Storage environment condition

Vibration	Number of vibration [Hz]	Level		Attenuation slope [dB/oct]
		(m/s <sup>2</sup> ) <sup>2</sup> /Hz	[g <sup>2*</sup> /Hz]	
	3	0.048	(0.0005)	3
	3 to 6	—	—	3 to 6
	6 to 18	1.15	(0.012)	6 to 18
	18 to 40	—	—	18 to 40
	40	0.096	(0.001)	40
40 to 200	—	—	40 to 200	

The effective value of the acceleration is 5.8 m/s<sup>2</sup> [0.59 g\*] within the number of vibration. \*g = 9.806658 m/s<sup>2</sup>

Shock	Height 40 cm or less
Temperature	-40 to +70 °C
Humidity	5 to 95%RH (Non condensing) Absolute humidity: MAX.W.C 35 g/m <sup>3</sup> dry air at 101.3 kPa

## Mounting and structure

Mounting method	Panel-mounted (close horizontal mounting, close vertical mounting)
Mounting orientation	Datum plane ±90°
Case color	Black
Case material	PC (Flame retardancy: UL94 V-0)
Front panel material	PC (Flame retardancy: UL94 V-0)
Terminal block material	PPE (Flame retardancy: UL94 V-1)
Filter material	PC
Panel sealing	Based on IP65 (IEC 60529) [Front panel (when the front loader connector cover is installed)]* * When the front loader connector cover is not installed: IP00
Weight	Approx. 300 g
External dimensions	96 mm × 96 mm × 65 mm (W × H × Depth behind the panel)



## 8. Appendix

### 8.1 Replacing the Waterproof/Dustproof Packing



#### WARNING

- In order to prevent electric shock and instrument failure, always turn off the power supply before replacing the packing.
- In order to prevent electric shock and instrument failure, always turn off the power supply before pulling out the internal chassis.
- In order to prevent injury or instrument failure, do not touch the internal printed wiring board.

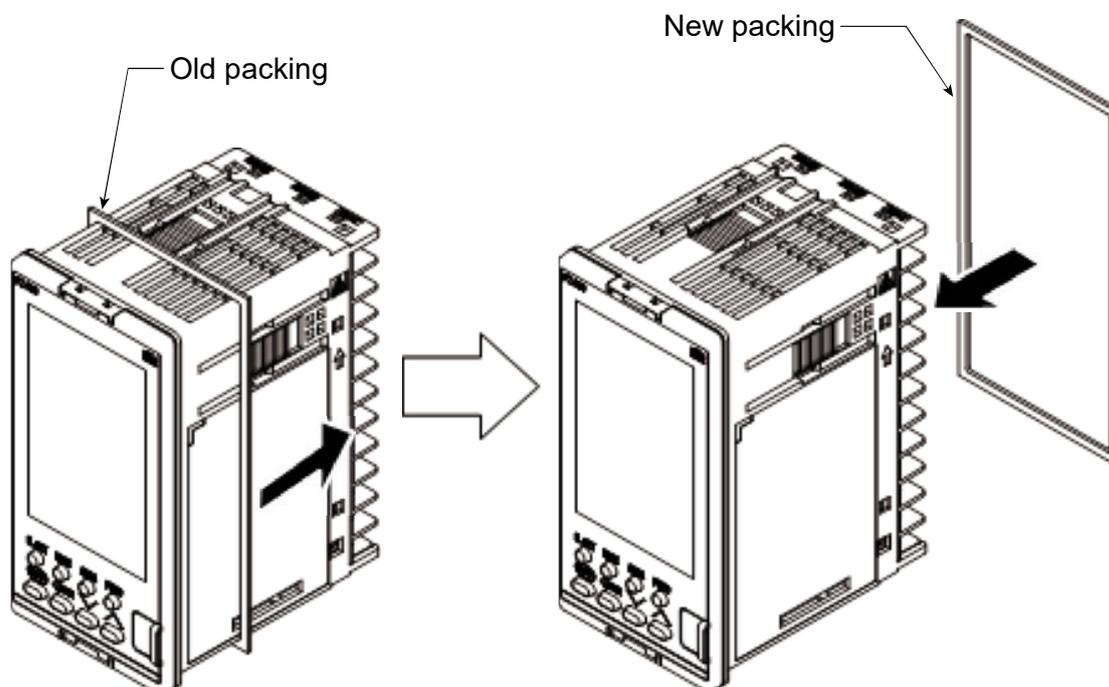
This controller is equipped with a water- and dust-proof structure. This waterproof and dustproof construction uses rubber packing. If the waterproof and dustproof packing deteriorates, contact TLV or your local TLV representative. To replace the packing, take the following steps:

#### Replacing the packing for the case

1. Turn the power OFF.
2. Remove the wiring.
3. Remove the mounting bracket, and then remove the instrument from the control panel.

 Refer to 2.3 Mounting and Removal Procedures.

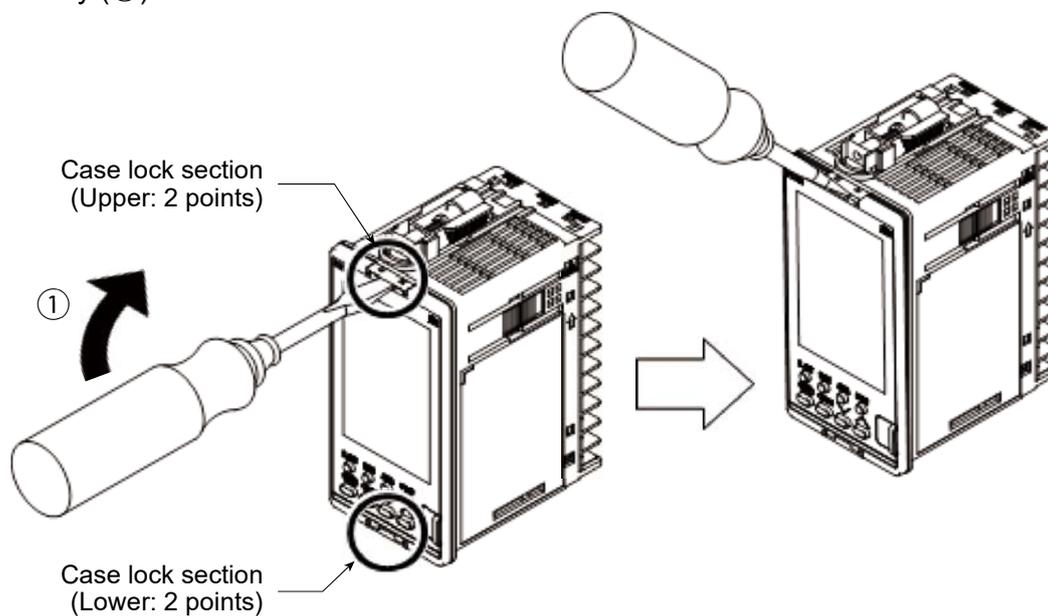
4. Remove the old packing, and then replace the old packing with a new one.



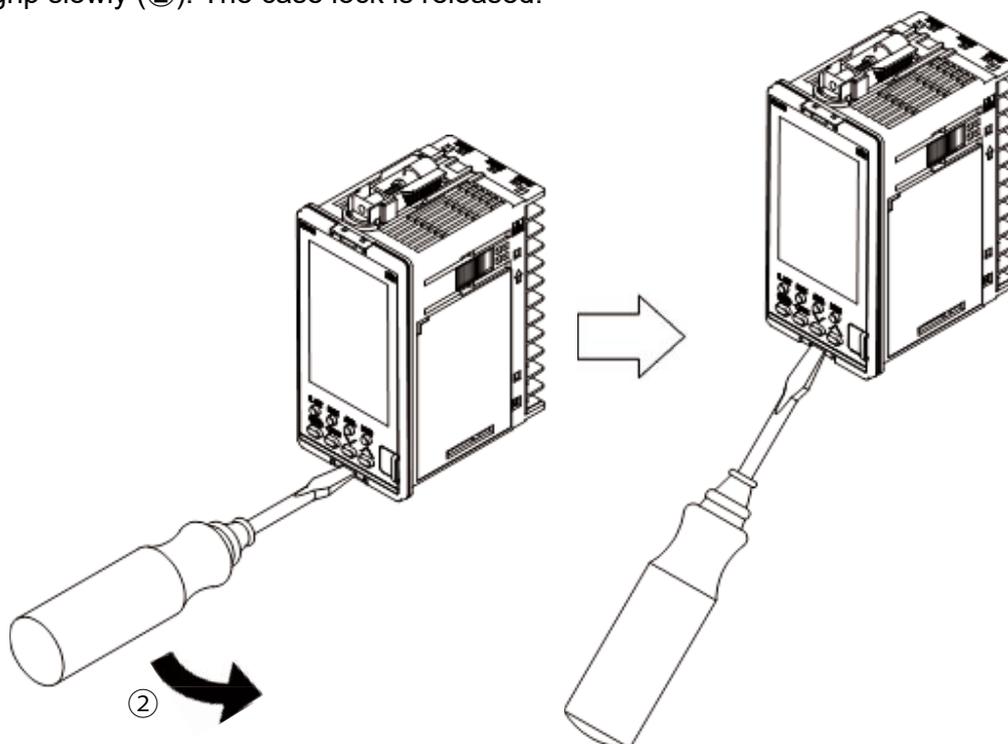
Packing for the case: KFZ900-317

### Replacing the packing for the front frame

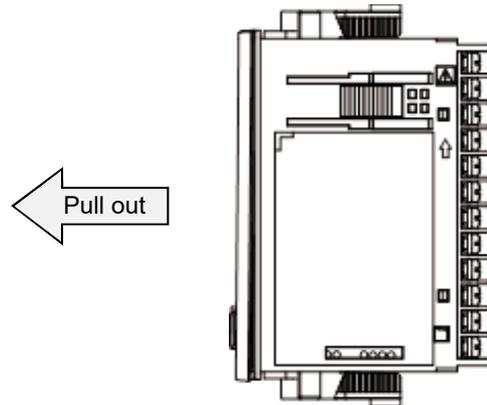
1. Turn the power OFF.
2. Wedge the slotted screwdriver into the upper case lock section, and lift the grip slowly (①). The case lock is released.



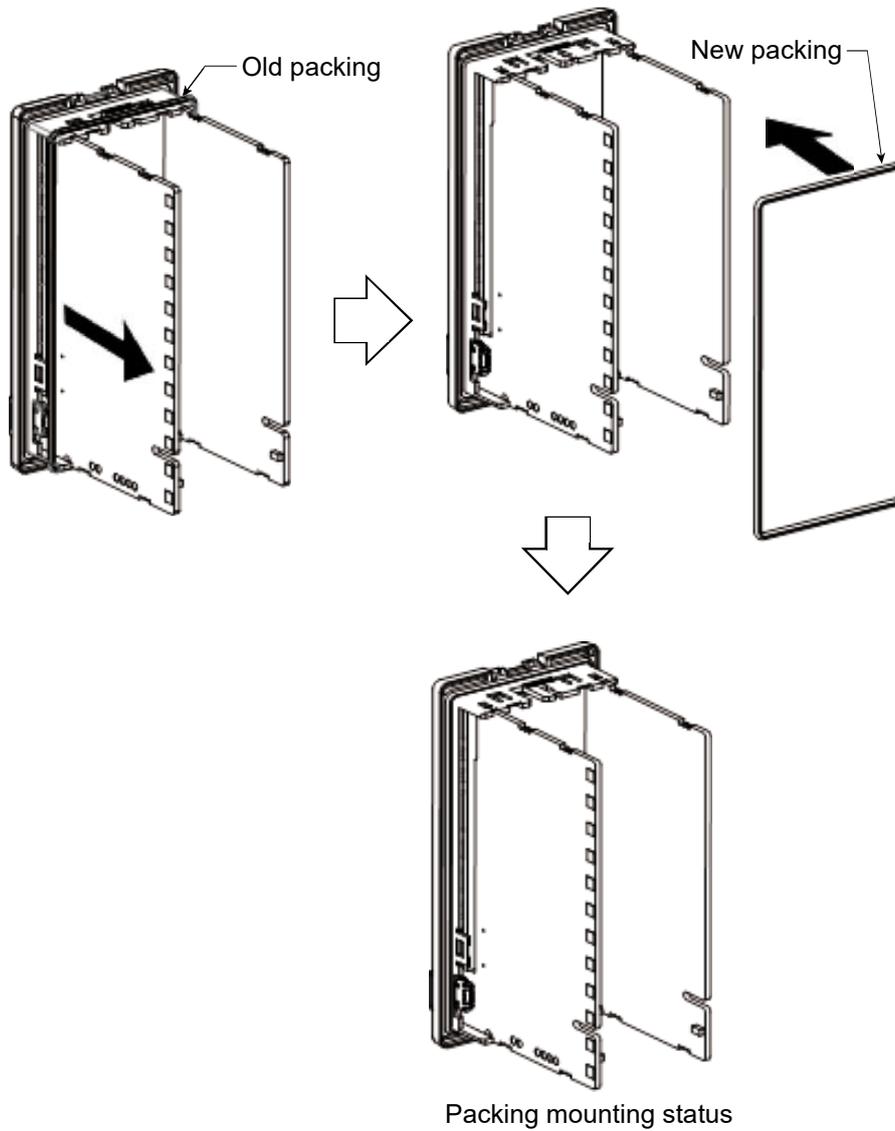
3. Wedge the slotted screwdriver into the lower case lock section, and hold down the grip slowly (②). The case lock is released.



4. As the internal unit slightly comes out of the case, pull it out toward you.



5. Remove the old packing, and then replace the old packing with a new one.



- Packing for the front frame: KFG900-38
6. Insert the internal assembly in the case.

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This warranty does not cover defects or failures caused by:

1. improper shipping, installation, use, handling, etc., by persons other than TLV, TII or TLV group company personnel, or service representatives authorized by TLV; or
2. dirt, scale or rust, etc.; or
3. improper disassembly and reassembly, or inadequate inspection and maintenance by persons other than TLV or TLV group company personnel, or service representatives authorized by TLV; or
4. disasters or forces of nature or Acts of God; or
5. abuse, abnormal use, accidents or any other cause beyond the control of TLV, TII or TLV group companies; or
6. improper storage, maintenance or repair; or
7. operation of the Products not in accordance with instructions issued with the Products or with accepted industry practices; or
8. use for a purpose or in a manner for which the Products were not intended; or
9. use of the Products in a manner inconsistent with the Specifications; or
10. use of the Products with Hazardous Fluids (fluids other than steam, air, water, nitrogen, carbon dioxide and inert gases (helium, neon, argon, krypton, xenon and radon)); or
11. failure to follow the instructions contained in the TLV Instruction Manual for the Product.

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