TERASAKI
Innovators in Protection Technology

TemTrip PRO

PRS-1H MULTI-FUNCTIONAL PROTECTIVE RELAY

INSTRUCTION MANUAL

Notice

- Be sure to read this manual before servicing or inspecting the product.
- Keep this manual in a safe location for future reference.
- Setting change and test of this model must be done by persons having knowledge.

TERASAKI ELECTRIC CO., LTD.

KRB-5433d

Table of Contents

1. Preface

Thank you for purchasing a TERASAKI PRS-1H multi-functional protective relay (TemTrip PRO).

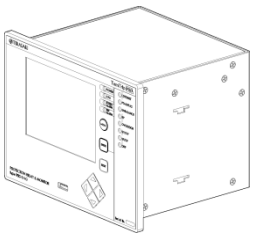
Before using the PRS-1H multi-functional protective relay (hereafter referred to as the "protective relay"), be sure to carefully read "2. Safety Notices", the entire contents of this manual, and all other appendixes to familiarize yourself with all device information, safety information, and precautions to ensure correct use of the relay.

1-1. Included Items

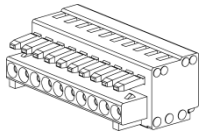
Before using this product, check that all the following items are included.

Included items

① Protective relay × 1



② Relay connector × 1



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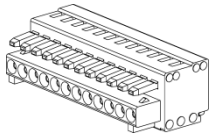
③ Relay connector × 1



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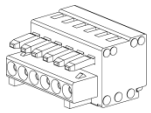
④ External input connector × 1



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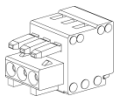
⑤ Communication connector × 1 (*1)



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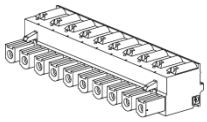
⑥ Current input connector × 2 (*2)



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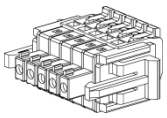
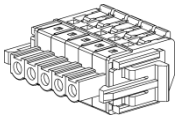
⑦ 4-20 mA output connector × 1 (*2)



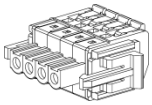
(5-pin)

⑧ Trip signal connector × 1



(5-pin)

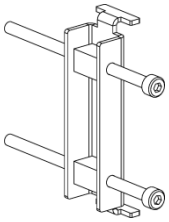
⑨ Control power or voltage input connector × 2



(4-pin)

⑩Ferrite core × 2

⑪ Mounting bracket × 2



*1: Not included in products without communication function

*2: For Type-F without monitoring function, only one current input connector is included and no 4-20 mA output connector is included.

Wire specifications

	Description	Solid wire	Stranded wire	Sheath peeling length
②③④⑤	Relay contact terminal, external input terminal, communication terminal (*1)	0.08 to 1.31 mm^2 (AWG28 to 16)	0.25 to 1.31 mm^2 (AWG23 to 16)	6.5 mm
⑧⑨	Trip relay contact terminal, voltage input terminal, control power input terminal	0.13 to 2.08 mm^2 (AWG26 to 14)	0.20 to 2.08 mm^2 (AWG24 to 14)	10.0 mm
⑦	4-20 mA terminal	0.13 to 2.08 mm^2 (AWG26 to 14)	0.20 to 2.08 mm^2 (AWG24 to 14)	9.0 mm
⑥	Current input terminal	0.20 to 3.31 mm^2 (AWG24 to 12)		10.0 mm

*1: Use the attached ferrite core (⑩) wound twice near the terminal.

2. Safety Notices

In these Instructions, safety notices are divided into "⚠CAUTION" according to the hazard level:

⚠CAUTION: A caution notice with this symbol indicates that neglecting the suggested procedure or practice could result in moderate or slight personal injury and/or property damage.

Note that failing to observe ⚠CAUTION notices could result in serious results in some cases. Because safety notices contain important information, be sure to read and observe them.

⚠ CAUTION

■ Common to transportation, operations and storage

- Do not place the product in an area that is subject to high temperature, high humidity, excessive dusty air, corrosive gas, strong vibration and shock, or other unusual conditions. Maintain the ambient temperature and humidity within the respective ranges shown in Table 1 Specifications of protective relay (without condensation). Failure to do so may result in malfunction.
  For cleaning, turn the power off and then wipe the device with a soft cloth that is soaked in lukewarm water and then firmly wrung out.
  Using thinner or other organic solvents may cause the device surfaces to discolor or melt.

■ Transportation

- Do not drop or impact the product. Carefully handle the product as this is an electronic device. Failure to do so may result in malfunction.

■ Operations

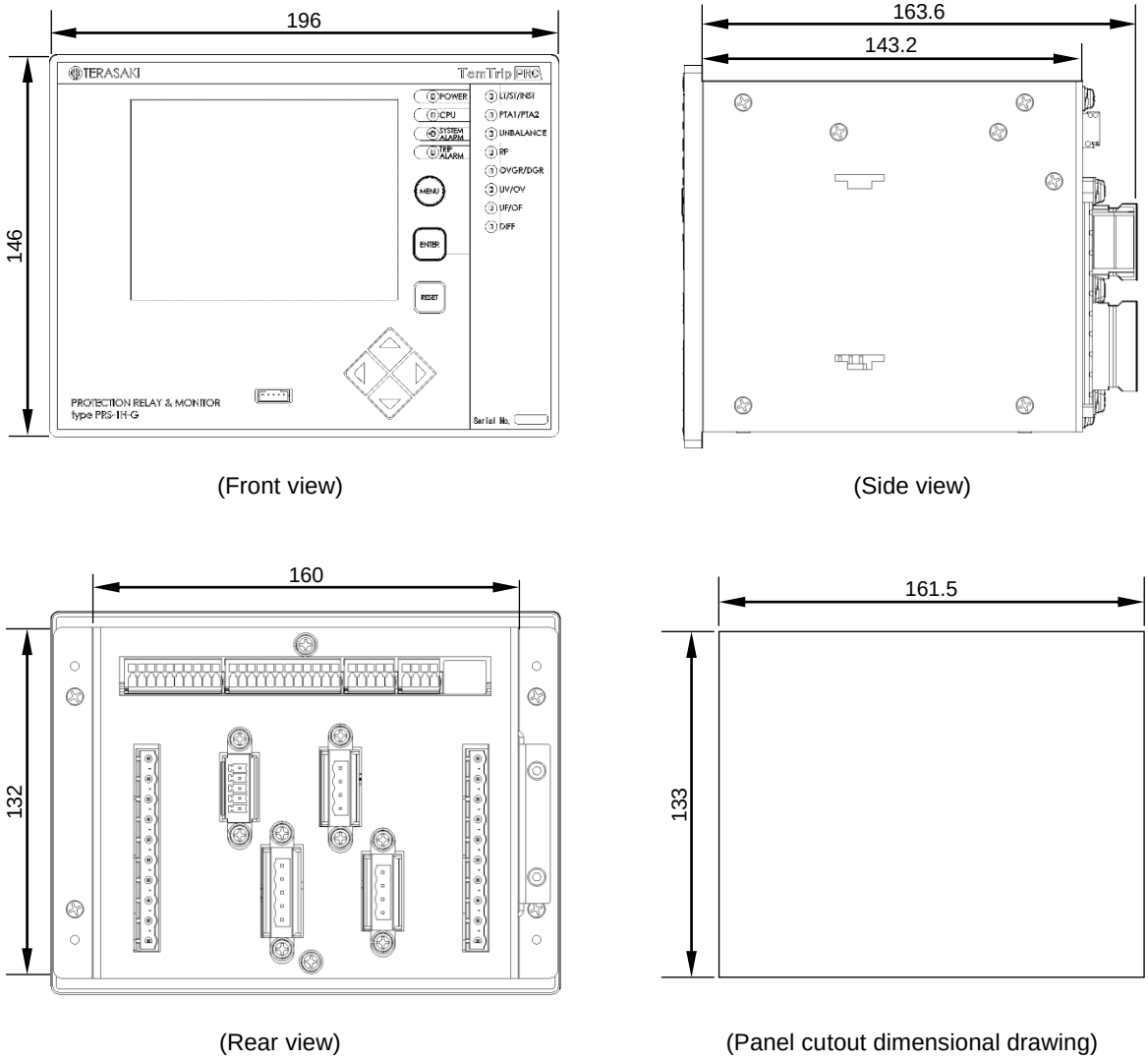
- The control power input terminal and rated voltage input terminal have the same connector shape, so be careful when wiring. Incorrect wiring may damage the equipment.
- The two current input terminals have the same connector shape, so be careful when wiring. Incorrect wiring may damage the equipment.
- Make sure that the product is set, adjusted or tested by a competent person. Before using the product, familiarize yourself with all safety information and precautions for the molded-case circuit breaker and OCR. Careless handling could result in unexpected accidents.
- After completion of a function check involving setting changes, be sure to return the settings to the original values. Failure to do so may cause a burnout or fire.
- If the product has not been used for a certain period of time, the date and time may be reset. In that case, set the date and time. (P.32, P.33)

3. Specifications

The specifications of the protective relay are shown in Table 1 below.

Table 1 Specifications of protective relay

Item	Details
Control voltage	24 VDC, 110 VDC
Power consumption	5 VA
External dimensions	W196 × H146 × D163.6 mm (including the terminals on the back)
Operating temperature	-10°C to +55°C
Storage temperature	-25°C to +75°C
Humidity	95% or lower (no condensation)
Applicable standards	IEC60255-8



(Front view) (Side view)

(Rear view) (Panel cutout dimensional drawing)

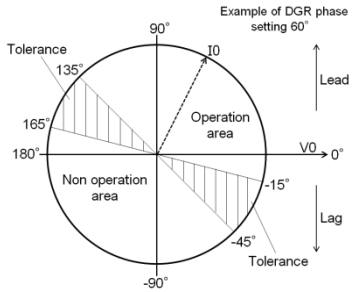
Figure 1 Outline drawings

Table 2 Functional specifications of protective relay (●: Standard feature, ○: Option)

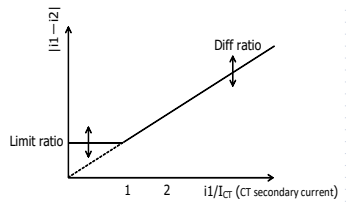
Function		Presence/absence		
		Type-G	Type-F	Type-T
Protective function	Long time-delay tripping (LT)	●	●	●
	Short time-delay tripping (ST)	●	●	●
	Instantaneous tripping (INST)	●	●	●
	Undervoltage protection (UV) *1	●	●	●
	Overvoltage protection (OV)	●	●	●
	Reverse power protection (RP)	●	-	-
	Ground fault overvoltage protection (OVGR)	●	●	●
	Directional ground fault protection (DGR) *2	●	●	●
	Differential current protection (DIFF) *3	●	-	●
	Negative phase sequence current protection (UB) *4	●	●	●
	Underfrequency detection (UF) *1	●	-	-
	Overfrequency detection (OF)	●	-	-
	Voltage establishment detection	●	-	-
	External trip	●	●	●
	Arc detection	○	○	○
Alarm function	Pre-trip alarm (PTA)	●	●	●
	System alarm (SYS)	●	●	●
Operation indication function	LED indicators, liquid crystal display (LCD), display and contact output	●	●	●
Measurement/event indication function	Current, voltage, electric power, frequency, power factor	●	●	●
	I/O state (contact)	●	●	●
	Harmonic measurement	○	○	○
	Trip event log (100 events)	●	●	●
	Alarm event log (100 events)	●	●	●
	Event log (200 events)	●	●	●
Monitoring function (4 to 20 mA)		●	○	●
Communication function *5		○	○	○
Control power supply		Required	Required	Required

*1: Activated with auxiliary switch input terminals a and c short-circuited

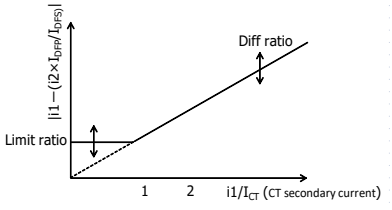
*5: Phase



*3: Detects the maximum phase energizing current value of the generator and outputs an operation signal when the maximum phase energizing current value exceeds the specified ratio differential set current value.The relationship between the ratio differential set current value and the maximum phase energization current value is shown below.



(Type-G)



(Type-T)

*4: Protects circuit breakers from negative phase sequence currents generated by phase failure and reverse phase, preventing motor burnout and machine damage.

Negative phase sequence current : Ins = $\sqrt{}$ (IR^2 * IS^2 + 2 * IR * IS * cos θ) / $\sqrt{}$3

(IR: R-phase current, IS: S-phase current, θ:Phase difference between R-phase current and 60 degrees moved S-phase current)

*5: The data format is Modbus RTU.

4. Characteristic list

4-1. Representation Format of Type

Type: PRS-1H - G H A1 1 - ####
① ② ③ ④ ⑤

Name	Symbol	Remarks
①Specification	G	For generator protection
	F	For feeder circuit
	T	For transformer protection
②Control power supply	H	Control power supply: 110 VDC
	L	Control power supply: 24 VDC
③Rated voltage	A1	Rated voltage Vn: 110 VAC
	A2	Rated voltage Vn: 220 VAC
④CT rated current	1	CT rated current: 1 A
	5	CT rated current: 5 A
⑤Options	N	No option
	M	Monitoring function (4 to 20 mA) (*)
	C	Communication function
	H	Harmonic measurement function
	A	Arc protection function

*: Optional for Type-F only. (For Type-G and Type-T, this function is provided as a standard feature.)

4-2. **Setting**

Table 3 to Table 5 show the setting items of the protective relay.

Table 3 Common setting items (1/3)

Item	Setting range			STEP	Remarks
	Type-G	Type-F	Type-T		
CT primary current	10 to 1500 A			1	-
CT secondary current	1 A / 5 A			-	(*1)
Rated current	5.0 to 1500.0 A			0.1	The actual setting range is limited to (0.5 to 1.0) × ICT according to the setting of ICT.
Rated primary voltage	110 to 16000 V			1	-
Rated secondary voltage	110 V / 220 V			-	-
Rated zero-phase voltage	190 V (Not adjustable)			-	-
Rated power	1 to 9000 kW	Automatic calculation ($\sqrt{3}$ * In * Vn * 0.8)		1	-
Frequency	60Hz / 50 Hz			-	-
Topology	1P3W / 3P3W			-	-
Demand power measurement interval	5 min / 30 min / 60 min			-	-
Power monitoring: Monitored power	100 to 9999 kW	-		1	-
Power monitoring: Relay setting	OFF / RY6	-		-	-
Relay output mode	HOLD/PULSE			-	This item can be set individually for each relay output.
Lockout relay:Output mode	HOLD/PULSE			-	-
Lockout relay:Output setting	OFF / ON			-	-
Lockout relay:UVT setting	OFF / ON			-	To use this setting, "LOCKOUT RY ENABLE" must be set to ON.
Phase1 (R-phase) current adjustment range	90.0 to 110.0%			0.1	This item is used for fine adjustment between the value actually measured at the installation location and the measured value displayed.
Phase 2 (S-phase) current adjustment range	90.0 to 110.0%			0.1	
Phase3 (T-phase) current adjustment range	90.0 to 110.0%			0.1	
Line voltage adjustment range	90.0 to 110.0%			0.1	
Active power adjustment range	90.0 to 110.0%			0.1	
Reactive power adjustment range	90.0 to 110.0%			0.1	
Ch mode	NONE / CURRENT / VOLTAGE / ACTIVE POWER / REACTIVE POWER / FREQUENCY / PF			-	This item specifies the function to be allocated to the channel.
4-mA output setting	"ZERO RANGE / FULL RANGE setting range" (→P.31)			-	(*2)
20-mA output setting				-	(*2)
4-mA output adjustment	90.0 to 110.0%			0.1	(*2)
20-mA output adjustment	90.0 to 110.0%			0.1	(*2)
Transmission address	1 to 31			1	(*3)
Transmission rate	9600/19200			-	(*3)
Parity	NONE/ODD/EVEN			-	(*3)
Display switching	ON / OFF			-	(*4)
Connection type	1 to 4			-	(*4)
Display brightness	10 to 100%			10	-
Display contrast	10 to 100%			10	-
Date setting	2000/1/1 to 2099/12/31			-	-
Time setting	00:00 to 23:59			-	-

*1: Specified at the time of ordering.

*2: Not displayed without the Type-F monitoring function.

*3: Displayed when there is a communication function.

*4: Refer to "8-4. MONITOR Screens" for the display by each selection.

*5: It is a setting that switches by inputting to the double setting terminal.

Table 3 Common setting items (2/3)

Item	Setting range			STEP	Remarks
	Type-G	Type-F	Type-T		
Long time-delay tripping 1					
Mode	OFF / TRIP			-	-
Characteristic	-	SIT (power of 0.02) / VIT (power of 1) / EIT (power of 2)		-	
Pickup current	(0.80 to 1.15) × In	(0.80 to 1.10) × In		0.01	-
Activation time limit	15.00 to 60.00 s	1.00 to 10.00 s		0.01	-
Output relay	Refer to 8-8-3. Relay Setting Operation.			-	-
Long time-delay tripping 2 (*5)					
Mode	OFF / TRIP			-	-
CHARACTER	-	SIT (power of 0.02) / VIT (power of 1) / EIT (power of 2)		-	-
Pickup current	(0.80 to 1.15) × In	(0.80 to 1.10) × In		0.01	-
Activation time limit	15.00 to 60.00 s	1.00 to 10.00 s		0.01	-
Short time-delay tripping 1					
Mode	OFF / TRIP			-	-
Pickup current	(2.00 to 5.00) × In	(1.00 to 10.00) × In		0.01	-
Activation time limit	0.10 to 1.00s	0.05 to 0.80s		0.01	-
I2T characteristics	OFF / ON			-	-
Output relay	Refer to 8-8-3. Relay Setting Operation.			-	-
Short time-delay tripping 2 (*5)					
Mode	OFF / TRIP			-	-
Pickup current	(2.00 to 5.00) × In	(2.00 to 10.00) × In		0.01	-
Activation time limit	0.10 to 1.00s	0.05 to 0.80s		0.01	-
I2T characteristics	OFF / ON			-	-
Instantaneous tripping 1					
Mode	OFF / TRIP			-	-
Pickup current	(2.00 to 24.00) × In			0.01	The maximum value is Ict × 16.
Output relay	Refer to 8-8-3. Relay Setting Operation.			-	-
Instantaneous tripping 2 (*5)					
Mode	OFF / TRIP			-	-
Pickup current	(2.00 to 24.00) × In			0.01	The maximum value is Ict × 16.
Pre-trip alarm 1					
Mode	OFF / ALARM			-	-
Characteristic	-	(Linked with "CHARACTER" in the Long time-delay tripping 1)		-	-
Pickup current	(0.75 to 1.05) × In	(0.75 to 1.10) × In		0.01	-
Activation time limit	10.0 to 30.0s	0.5 to 10.0s		0.1	-
Pre-trip alarm 2 (*5)					
Mode	OFF / ALARM			-	-
Characteristic	-	(Linked with "CHARACTER" in the Long time-delay tripping 2)		-	-
Pickup current	(0.75 to 1.05) × In	(0.75 to 1.10) × In		0.01	-
Activation time limit	10.0 to 30.0s	0.5 to 10.0s		0.1	-
Negative phase sequence					
Mode	OFF / ALARM / TRIP			-	-
Pickup current	(0.10 to 1.00) × In			0.01	-
Activation time limit	1.0 to 30.0s			0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation.			-	-
Directional ground fault					
Mode	OFF / ALARM / TRIP			-	-
Pickup current	1.0 to 10.0mA			0.1	-
Pickup voltage	(0.050 to 0.150) × V0n			0.001	-
Activation time limit	0.2 to 10.0s			0.1	-
Phase	0 to 90° / OFF			10	The OFF setting is a non-directional setting.
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-

Table 3 Common setting items (3/3)

Item	Setting range			STEP	Remarks
	Type-G	Type-F	Type-T		
Ground fault overvoltage					
Mode	OFF / ALARM / TRIP			-	-
Pickup voltage	(0.050 to 0.150) × V0n			0.001	-
Activation time limit	0.1 to 1.0s			0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-
Undervoltage					
Mode	OFF / TRIP			-	-
Reset voltage	(0.80 to 0.95) × Vn			0.01	-
Set voltage	(0.40 to 0.80) × Vn			0.01	-
Activation time limit	0.1 to 36.0s			0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-
Overvoltage					
Mode	OFF / TRIP			-	-
Set voltage	(1.05 to 1.50) × Vn			0.01	-
Activation time limit	0.1 to 5.0s			0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-
External trip					
Mode	OFF / TRIP			-	-
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-
System alarm					
Mode	OFF / ALARM			-	-
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-
Arc detection					
Mode	OFF / ALARM / TRIP			-	-
Pickup current	(0.5 – 6.0) × I_{CT}			0.1	The operation time limit is within 10ms.
Output relay	Refer to 8-8-3. Relay Setting Operation			-	-

Table 4 Setting items (for Type-G)

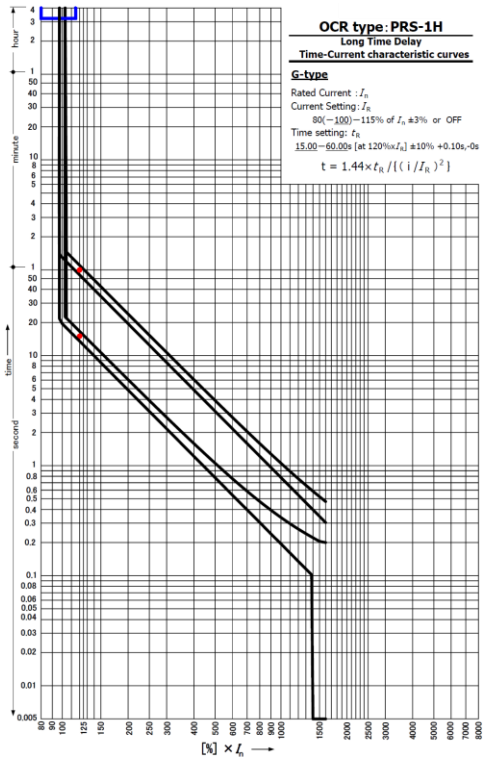
Item	Setting range	STEP	Remarks
Differential current			
Mode	OFF / ALARM / TRIP	-	-
CB AUX state	NORMAL / CB ON	-	If "CB ON" is set, it will not operate when the CB status is OFF.
Set differential current	(0.10 to 0.50) × i1	0.01	i1 = I1 ×ICT2 / ICT I1: Applied current on the primary side of generator
Limit differential current	(0.10 to 0.50) × I_{ct}	0.01	-
Activation time limit	0.2 to 10.0s	0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation		
Reverse power 1			
Mode	OFF / ALARM / TRIP	-	-
Pickup power	(0.04 to 0.10) × Pn	0.01	-
Activation time limit	2.5 to 20.0s	0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation	-	-
Reverse power 2 (*5)			
Mode	OFF / ALARM / TRIP	-	-
Pickup power	(0.04 to 0.10) × Pn	0.01	-
Activation time limit	2.5 to 20.0s	0.1	-
Frequency relay protection			
Mode	OFF / ALARM / TRIP	-	-
Underfrequency			
Pickup frequency	(0.80 to 1.05) × Fn	0.01	-
Activation time limit	1.0 to 10.0s	0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation	-	-
Overfrequency			
Pickup frequency	(0.95 to 1.40) × Fn	0.01	-
Activation time limit	1.0 to 10.0s	0.1	-
Output relay	Refer to 8-8-3. Relay Setting Operation	-	-
Voltage establishment			
Established voltage	(0.80 to 1.05) × Vn	0.01	-
Establishment activation time limit	0.1 to 30.0s	0.1	-
Dropout voltage	(0.40 to 0.80) × Vn	0.01	-
Dropout time	1.0 to 5.0s	0.1	-
Output relay	OFF / RY7	-	If RY7 is set, RY7 cannot be selected for other protection.

Table 5 Setting items (for Type-T)

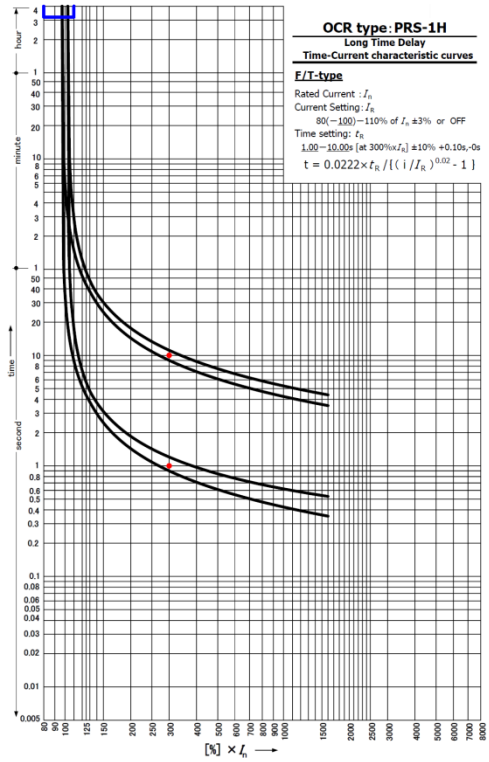
Item	Setting range	STEP	Remarks
Differential current			
Mode	OFF / ALARM / TRIP	-	-
Transformer wiring method	Y-Y / △-△ / △-Y / Y-△	-	-
Transformer primary current ratio	(0.30 to 1.20) × I_{ct}	0.01	-
Transformer secondary current ratio	(0.30 to 1.20) × I_{ct}	0.01	-
High speed over current setting	(5.00 to 15.00) × i1	0.01	-
Output relay	Refer to 8-8-3. Relay Setting Operation	-	-
Set differential current	(0.20 to 0.50) × i2	0.01	i2 = i1 × I_{DFS} / I_{DFP}
Limit differential current	(0.30 to 0.50) × I_{DFS}	0.01	-
Second harmonic component ratio	0.10 to 0.30	0.01	-
Activation time limit	0.20 to 5.00s	0.01	-

4-3. **Characteristic Curve**

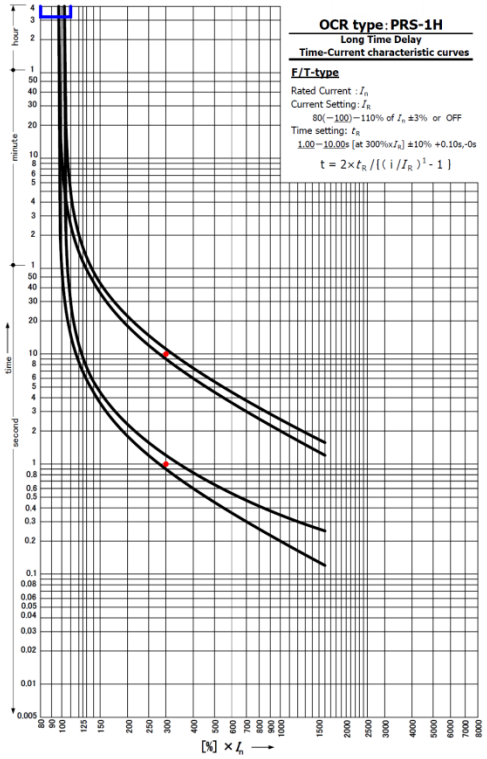
Figure 2 to Figure 5 show the operating characteristic curves of the protective relay.



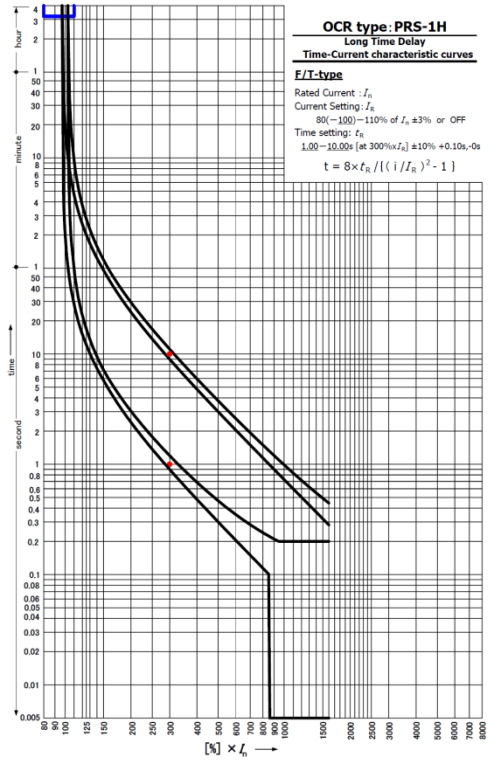
Long time-delay tripping (Type-G)



Long time-delay tripping (Type-F/T SIT[0.02])

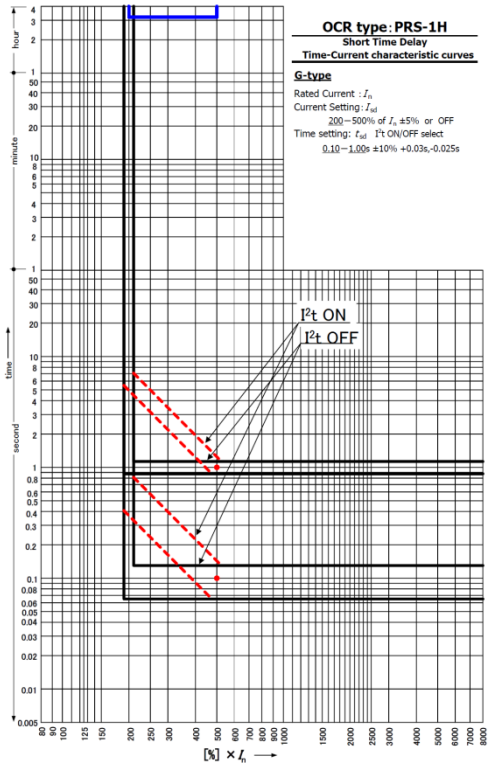


Long time-delay tripping (Type-F/T VIT[1.00])

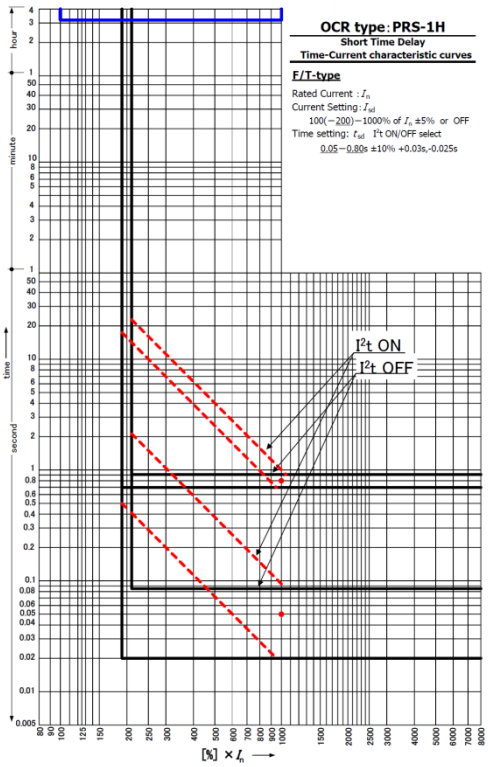


Long time-delay tripping (Type-F/T EIT[2.00])

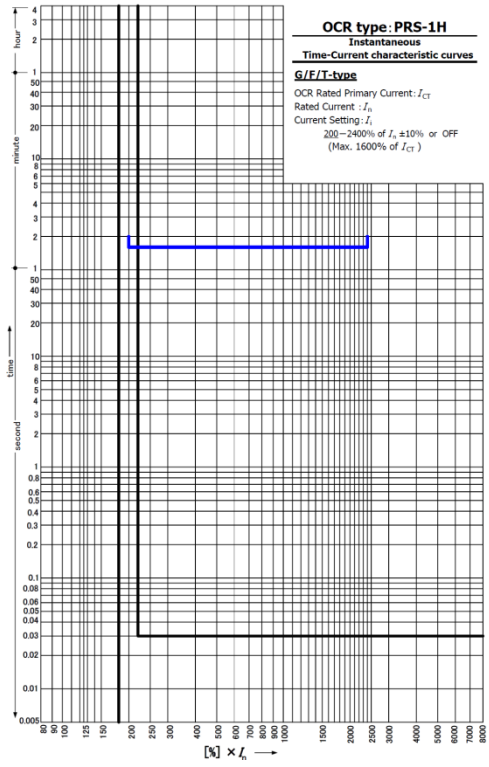
Figure 2 Operating characteristic curves of the protective relay 1



Short time-delay tripping (Type-G)



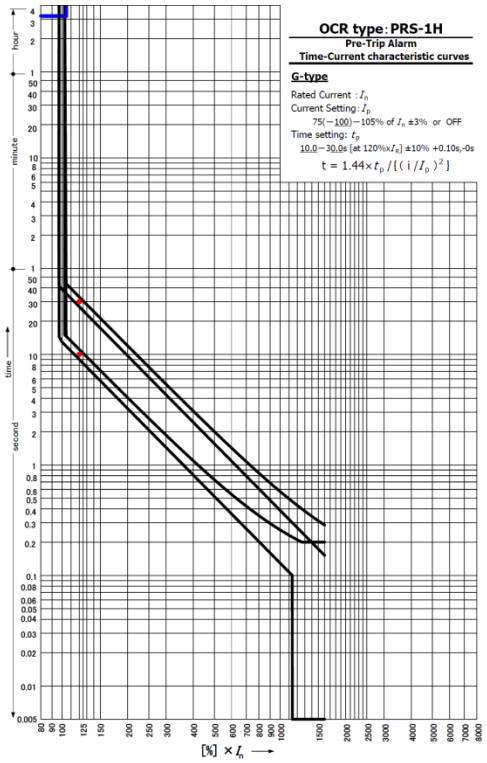
Short time-delay tripping (Type-F/T)



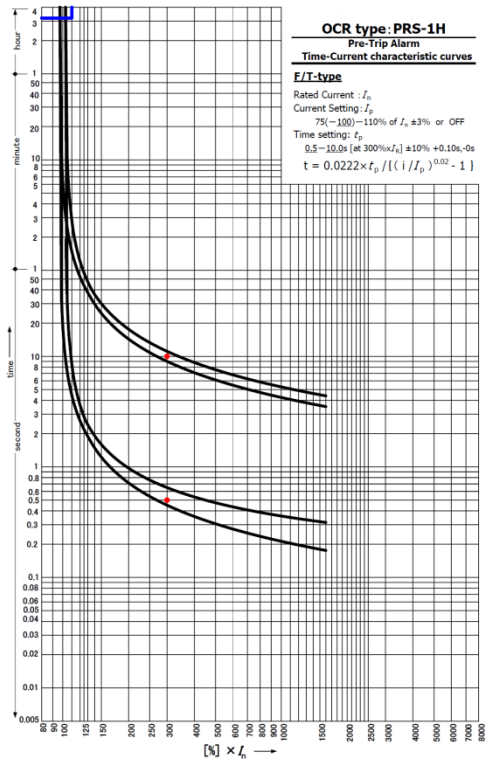
Instantaneous tripping

Double setting uses the same curve.

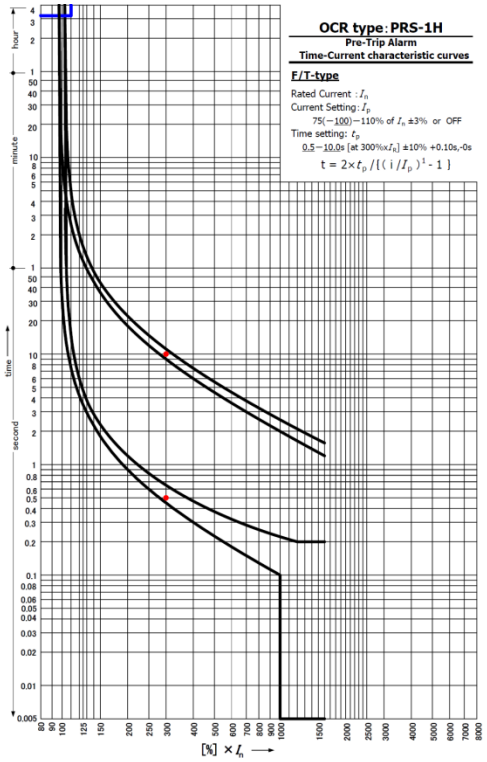
Figure 3 Operating characteristic curves of the protective relay 2



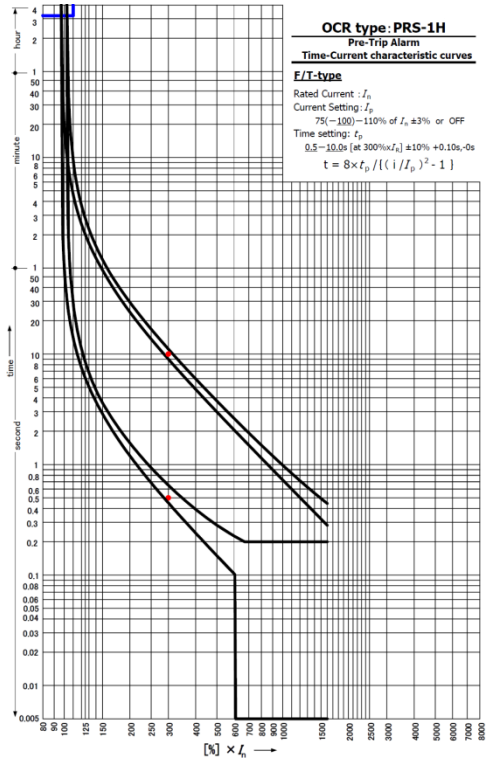
Pre-trip alarm (Type-G)



Pre-trip alarm (Type-F/T SIT[0.02])

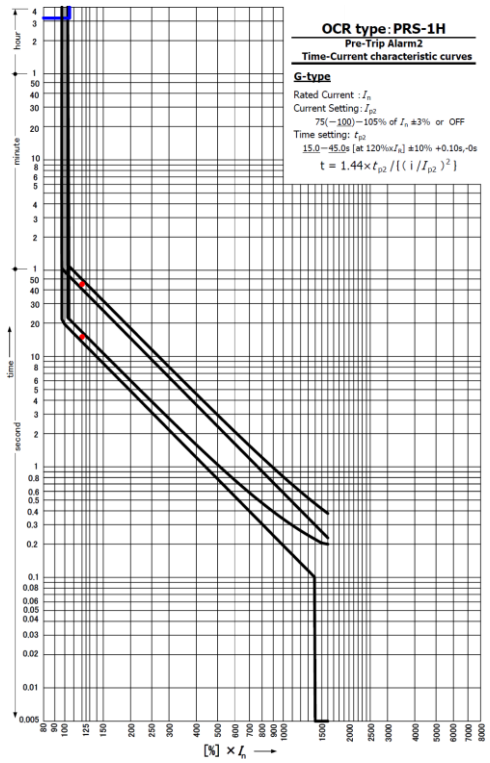


Pre-trip alarm (Type-F/T VIT[1.00])

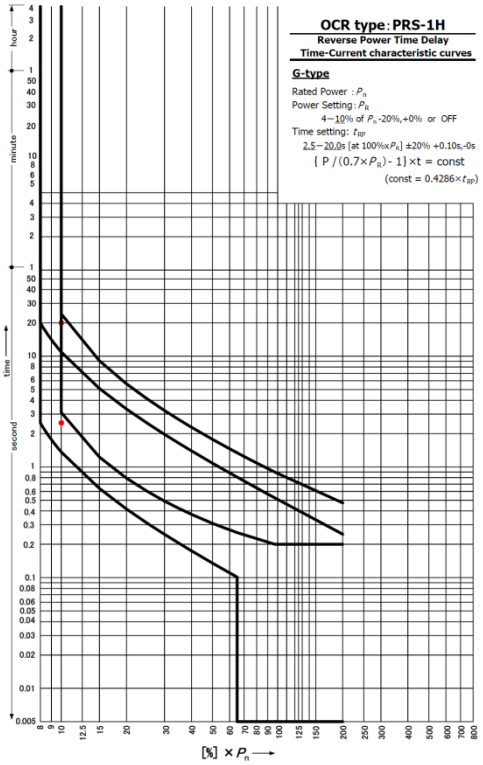


Pre-trip alarm (Type-F/T EIT[2.00])

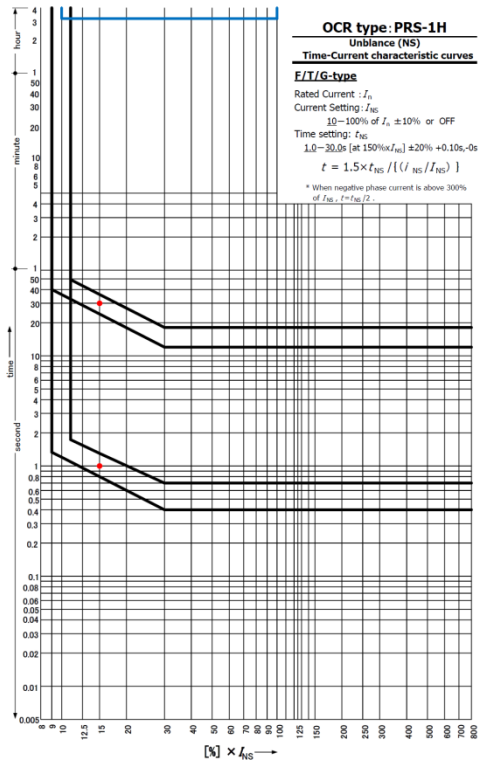
Figure 4 Operating characteristic curves of the protective relay 3



Pre-trip alarm 2 (Type-G)



Reverse power protection (Type-G)



Negative phase protection

Double setting uses the same curve.

Figure 5 Operating characteristic curves of the protective relay 4

5. Component Identifications

Figure 6 and Figure 7 show the appearance of the protection relay, and Table 6 and Table 7 explain each component of the protection relay.

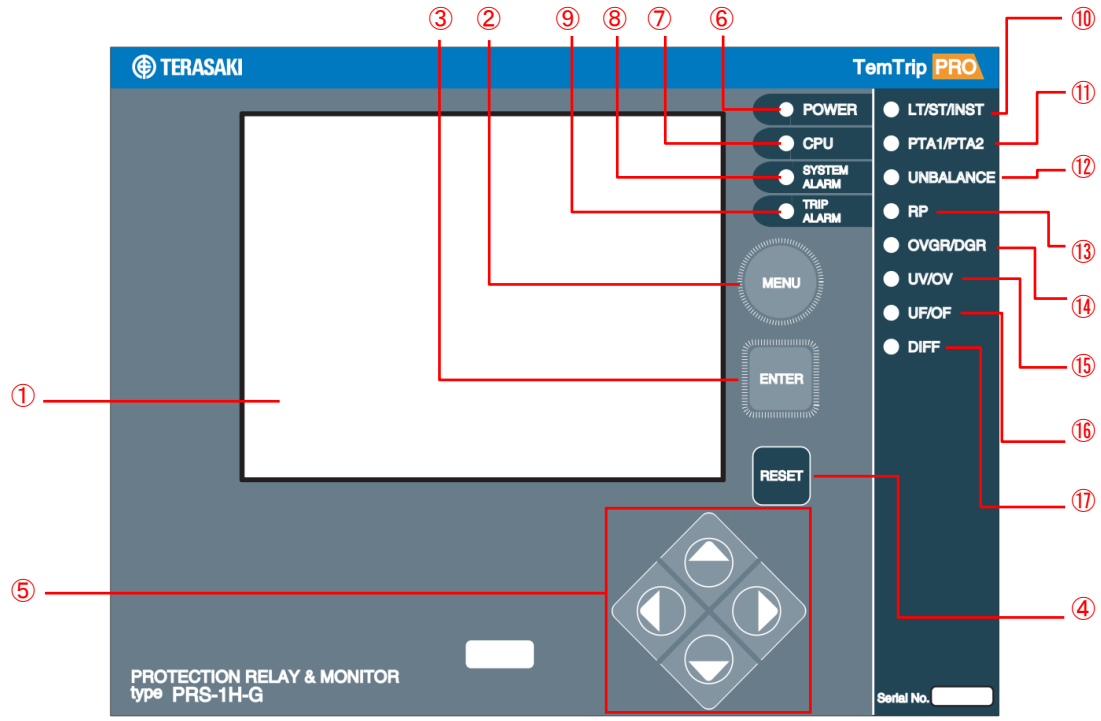


Figure 6 External view of the protective relay (front side)

Table 6 Name and function of each component of the protective relay (front side)

No.	Name	Description
①	Display area	This area displays various screens.
②	MENU button	This button is used to switch the displayed menu.
③	ENTER button	This button is used to apply the settings that have been changed.
④	RESET button	This button is used to reset the protection relay or extinguish the LEDs.
⑤	Arrow buttons	These buttons are used to move the cursor from one menu item to another.
⑥	POWER lamp	This lamp is lit in white while control power is being applied.
⑦	CPU lamp	This lamp is lit in green while the internal CPU is operating or blinks in green when the CPU detects an error.
⑧	SYSTEM ALARM lamp	This lamp lights up in red when an error occurs in the main unit.
⑨	TRIP ALARM lamp	This lamp lights up in red when tripping occurs or blinks in red when an alarm occurs.
⑩	LT/ST/INST lamp	This lamp blinks or lights up in red when long time-delay tripping, short time-delay tripping, or instantaneous tripping occurs.
⑪	Pre-trip alarm lamp	This lamp blinks or lights up in red when a pre-trip is detected.
⑫	Negative phase sequence current lamp	This lamp blinks or lights up in red when negative phase sequence current is detected.
⑬	Reverse power lamp	This lamp blinks or lights up in red when reverse power is detected.
⑭	Ground fault lamp	This lamp blinks or lights up in red when ground fault overvoltage or directional ground fault is detected.
⑮	Voltage lamp	This lamp blinks or lights up in red when undervoltage or overvoltage is detected.
⑯	Frequency lamp	This lamp blinks or lights up in red when underfrequency or overfrequency is detected.
⑰	Differential current lamp	This lamp blinks or lights up in red when differential current is detected.

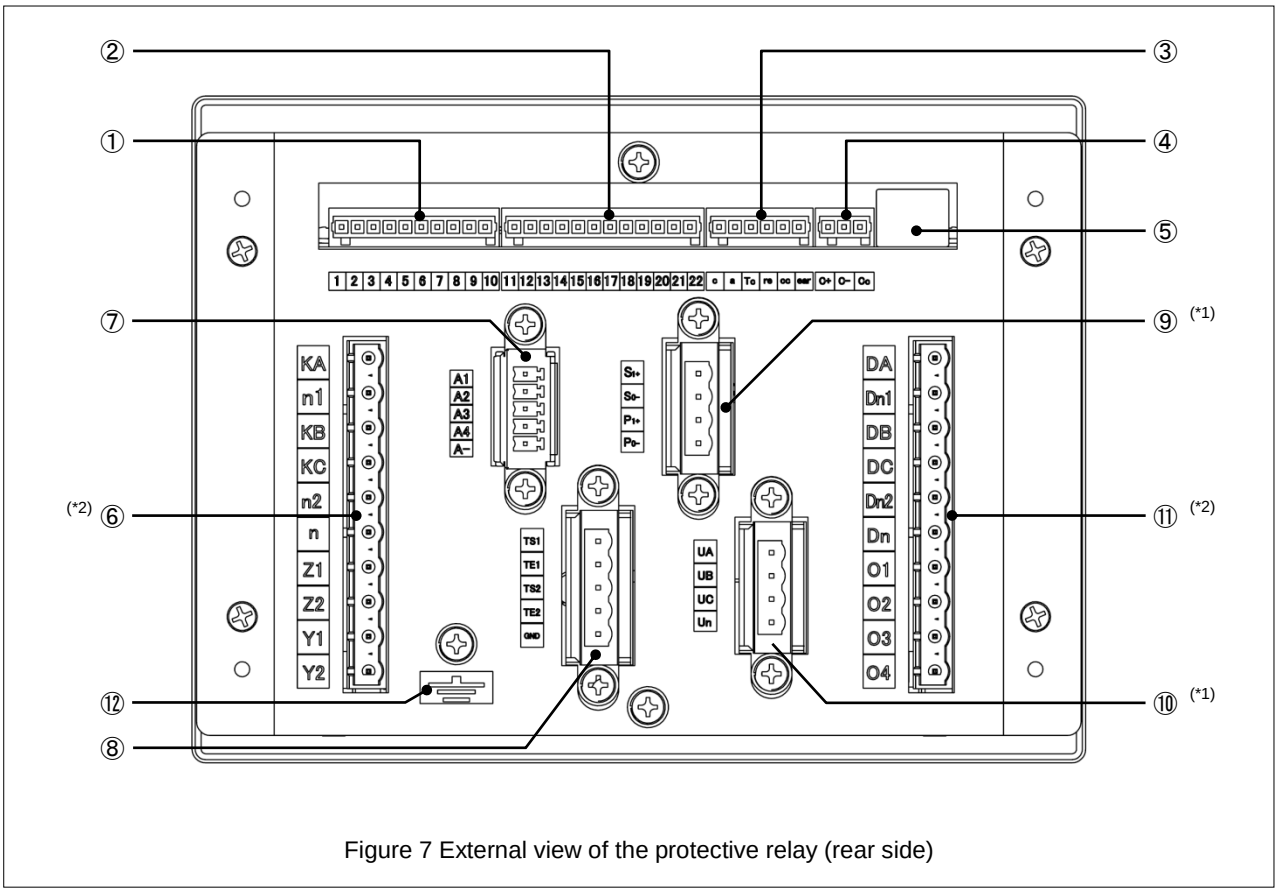


Figure 7 External view of the protective relay (rear side)

*1: Be careful when wiring because the terminals have the same shape.

*2: Be careful when wiring because the terminals have the same shape.(One connector has one terminal name mark)

Table 7 Name and function of each component of the protective relay (rear side)

No.	Name	Description
①	1 to 10	Relay output terminals 1 to 10
②	11 to 22	Relay output terminals 11 to 22
③	a, Tc, re, ear, cc, c	a-c: Auxiliary switch input terminal, Tc-c: External trip signal input terminal, re-c: Reset command input terminal, ear-c: Earthing switch input terminal, cc-c: Double setting input terminal
④	C+, C-, Cc	Communication terminals
⑤	-	Arc detection input terminal
⑥	KA, n1, KB, KC, n, n2	Input terminals from overcurrent detection CT (Rated current: 1 A or 5 A)
	Z1, Z2	Input terminals from electric leakage detection CT (Rated current: 1 A or 5 A)
	Y1, Y2	Input terminals from ground fault detection CT (Rated current: 1 A or 5 A)
⑦	A1, A2, A3, A4, A-	4-20 mA output terminals
⑧	TE1, TS1, TE2, TS2, TG	TE1-TS1: Trip signal output terminal, TE2-TS2: Trip signal output terminal 2
⑨	S1(+), S0(-)	Control power input terminals (protection function): 24 VDC, 110 VDC
	P1(+), P0(-)	Control power input terminals (monitoring function): 24 VDC, 110 VDC
⑩	UA, UB, UC, Un	Rated voltage input terminals
⑪	DA, Dn1, DB, DC, Dn2, Dn	Input terminals from ratio differential current CT (Rated current: 1 A or 5 A)
	O1, O2, O3, O4	Input terminals for current measurement
⑫	Ground terminal	-

6. Installation

This chapter describes how to install the protective relay.

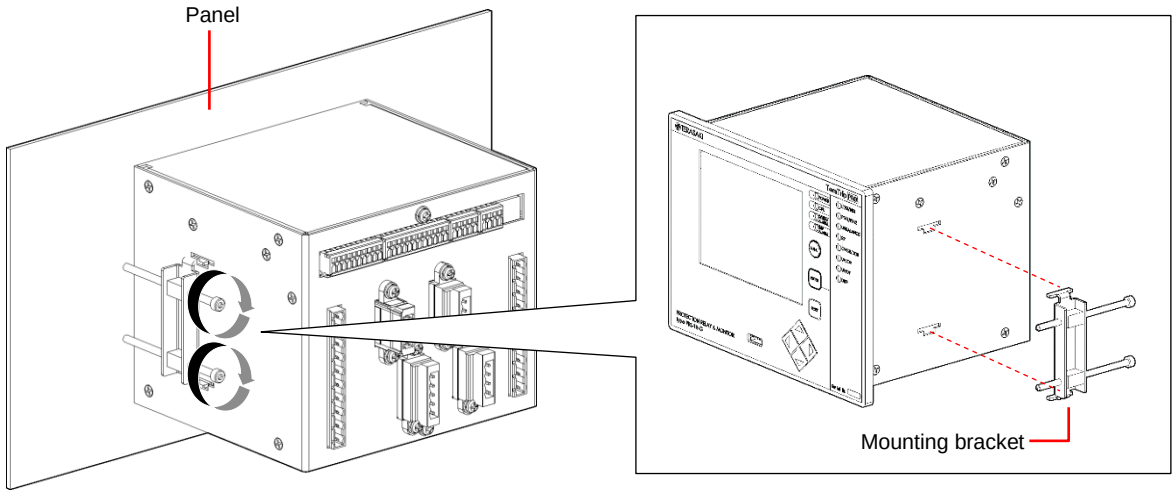


Figure 8 Installation method

1) Cut out the panel on which the protective relay is to be installed, according to the panel mounting dimensions shown in Figure 1 Outline drawings.

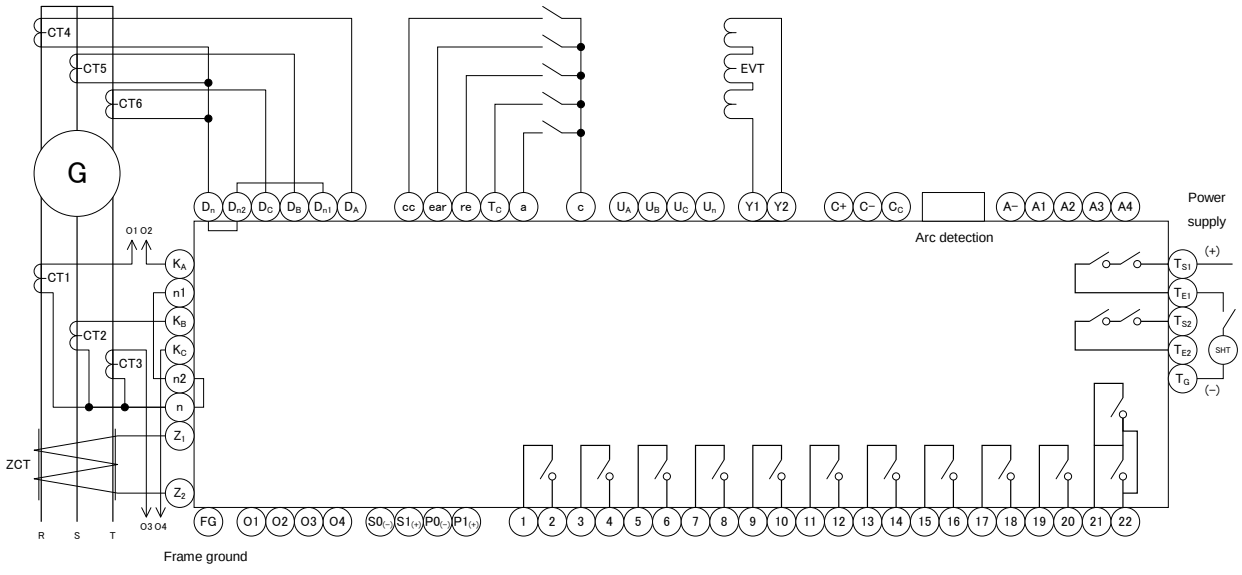
2) Install the protective relay and insert the mounting brackets provided into the right and left insertion grooves in the main unit of the protective relay.

3) Tighten each screw on the mounting bracket with an Allen key (M4) to a tightening torque of 20 to 30 cN·m until the main unit is secured properly.

7. Connection

7-1. Circuits and Ratings

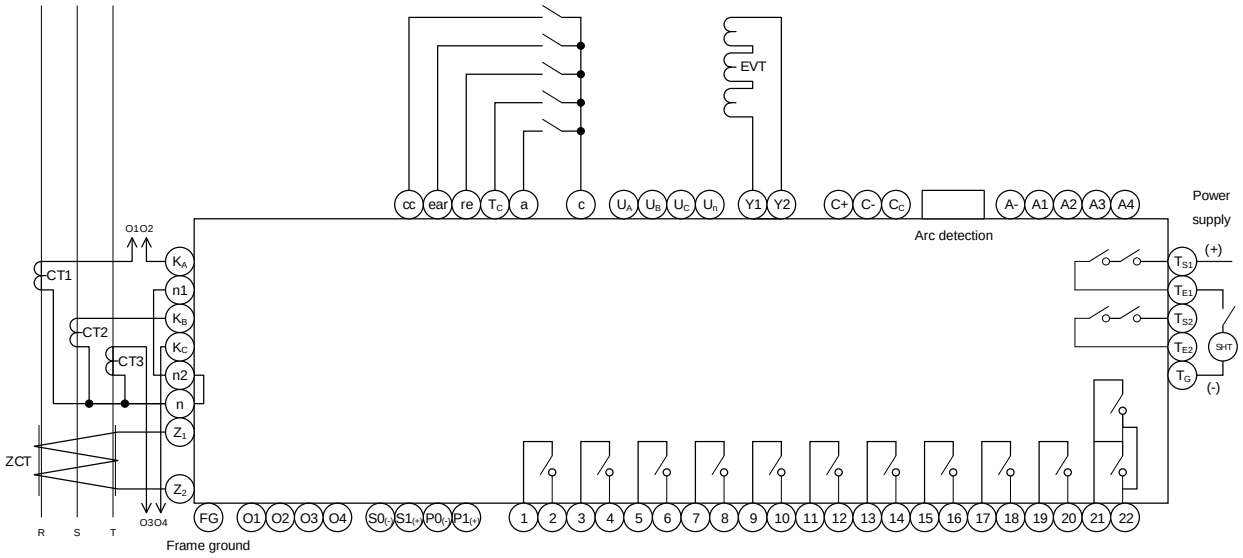
Figure 9 and Figure 10 show the wiring of the protective relay and Table 8 shows the terminal numbers, functions, and the meanings of each symbol.



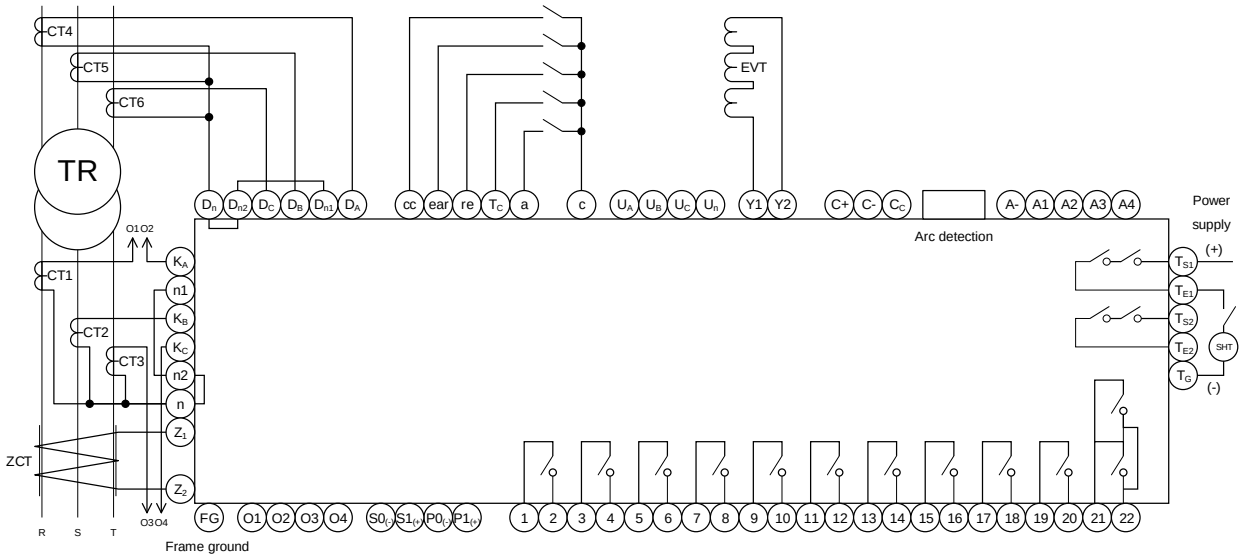
Type-G

Figure 9 Protective relay wiring diagram

Note: The wiring diagram illustrates the wiring of the protective relay with all the options mounted.



Type-F



Type-T

Figure 10 Protective relay wiring diagram

Note: The wiring diagram illustrates the wiring of the protective relay with all the options mounted.

Table 8 List of terminals in the protective relay wiring diagram

I/O terminal name	Terminal number	Remarks
Frame ground	FG	-
Control power supply	$S0_{(-)}$ - $S1_{(+)}$	Protective function (24 VDC, 110 VDC)
	$P0_{(-)}$ - $P1_{(+)}$	Monitoring function (24 VDC, 110 VDC)
CT for measurement (LT, ST, INST, PTA, UB, LT2, ST2, etc.)	KA - n1 KB - n1 KC - n2	CT secondary-side rated current: 1 A or 5 A (*1) R-phase: KA - n1, S-phase: KB - n1, T-phase: KC - n2
Ratio differential current signal	DA - Dn1 DB - Dn1 DC - Dn2	Signal from CT for detection (Rated current: 1 A or 5 A)
Auxiliary switch input	a - c	Circuit breaker close/open detection (normally open contact)
External trip signal input	Tc - c	Causing a short circuit between terminals for 50 milliseconds outputs a trip signal from between the TS1 and TE1 terminals.
Reset command input	re - c	Operating contact output reset switch
Double setting switch input	cc - c	Switch to change each characteristic setting (1, 2) on “8-6. SETTING Screens”
Earthing switch signal input	ear - c	-
Rated voltage input terminals (UV, OV)	UA, UB, UC, Un	Three-phase, 110 VAC or 220 VAC
ZCT	Z1, Z2	Secondary-side rated current: 1.5 mA For directional ground-fault tripping (DGR)
EVT	Y1, Y2	For ground-fault overvoltage tripping (OVGR) or directional ground-fault tripping (DGR)
Operation signal output	1 - 2 (RY 1)	Operation signal output selection Long time-delay tripping (LT/LT2), short time-delay tripping (ST/ST2), instantaneous tripping (INST/INST2), negative phase sequence current protection (UB), directional ground fault (DGR), ground fault overvoltage (OVGR), undervoltage (UV), overvoltage (OV), differential current (DIFF), reverse power (RP), underfrequency (UF), overfrequency (OF), system alarm (SYS), remote trip (RT), arc detection (ARC)
	3 - 4 (RY 2)	
	5 - 6 (RY 3)	
	7 - 8 (RY 4)	
	9 - 10 (RY 5)	
	11 - 12 (RY 6)	
	13 - 14 (RY 7)	
PTA output 1	15 - 16 (RY PTA)	PTA operation signal output 1 (automatic reset)
PTA output 2	17 - 18 (RY PTA2)	PTA operation signal output 2 (automatic reset)
Lockout output	19 - 20 (RY LOCKOUT)	Lockout operation signal output
Self-diagnostic output	21 - 22	Self-diagnosis for monitoring function and protective function
Trip output signal 1	TE1 - TS1 (RY TRIP1)	Signal output: Pulse (100 ms)
Trip output signal 2	TE2 - TS2 (RY TRIP2)	
Output signal for monitoring function	A1 - A-	A-: COMMON
	A2 - A-	
	A3 - A-	
	A4 - A-	
CT for monitoring function 4 - 20 mA (*2)	O1 - O2 (R-phase)	CT rated current: 1 A or 5 A R-phase: 01 to 02, T-phase: O3 to O4
	O3 - O4 (T-phase)	
Communication signal	C+	(+)
	C-	(-)
	Cc	Common

*1: The customer must specify this item when placing an order.

*2: Optional for Type-F only. (For Type-G and Type-T, this function is provided as a standard feature.)

8. How to Display Measurements and Make Settings

Make sure that control power is supplied. Control power supply is required to display measurements.

8-1. Outline

The following seven buttons are used to display measurements and set characteristics: MENU, arrows (up, down, left, and right), ENTER, and RESET. The buttons that can be used on the screen are displayed on the bottom of the screen. (Button operations in this chapter and subsequent chapters are explained using the symbols shown in Table 9.)

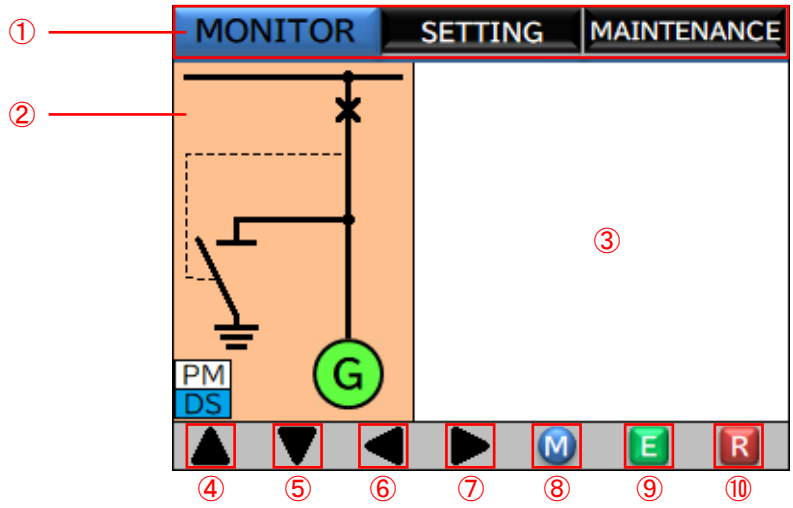


Figure 11 Menu screen

Table 9 Name and function of each component of menu screen

	Name	Symbol	Description
①	Menu tabs		Menus that can be selected are displayed. The selected menu is displayed in reverse video.
②	Monitor display area		Refer to 8-2. Monitor Display Screen.
③	Menu display area		The contents of the menu are displayed.
④	Up arrow button	[U]	These buttons are displayed when they can be used to switch the screen and select items.
⑤	Down arrow button	[D]	
⑥	Left arrow button	[L]	
⑦	Right arrow button	[R]	
⑧	MENU button	[M]	
⑨	ENTER button	[E]	
⑩	RESET button	[RST]	This button is displayed when the user needs to cancel relay operation or extinguish LEDs.

8-2. **Monitor Display Screen**

The monitor display screen (Figure 12) on the left side of the display area enables the user to visually identify the items shown in Table 10.

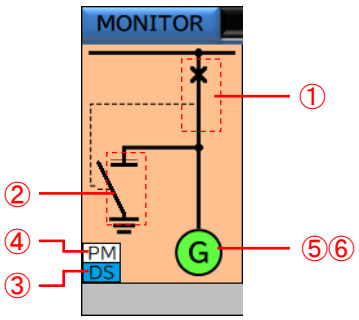


Figure 12 Monitor display screen

Table 10 Items in monitor display screen

No.	Name	Description				
①	CB state	OFF state (Open)	ON state (Closed)			
②	Earthing switch state	OFF state (Open)	ON state (Closed)	Show / hide the switch on the "SU-L" screen of the 8-5. SETUP Screens.		
③	Double setting state	DS OFF state (Lit in white)	DS ON state (Lit in blue)	OFF means that the protection function setting 1 is applied. When ON, the protection function setting 2 is applied.		
④	Power monitoring state (*2)	PM OFF state (Lit in white)	PM ON state (Lit in yellow)			
⑤	Voltage establishment state (*3)	Undetected (Lit in white)	Being detected (Blinking in green)	Established (Lit in green)		
⑥	Connection type (*1) Type-G	1 G Generator	2 AMP AMP	3 SC SC		
	Type-F, T	1 M Motor	2 Transformer	3 Power: down to up	4 Power: up to down	

*1 :Switch the connection type on the SU-L item of the 8-5. SETUP Screens.

*2: Implemented for Type-G only.

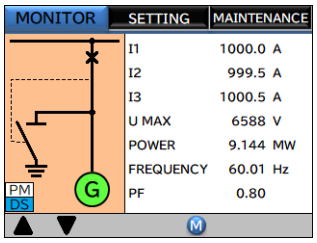
*3: The color changes only when the connection type of ⑥ is “Generator” in Type-G.

8-3. **Navigation to Each Setting Item Screen After Power ON**

The protective relay is provided with measured value display items, characteristic value setting items, and maintenance items that are used to display histories and conduct functional testing. The user can navigate to each screen by pressing the MENU button.

● Initial screen (INI-A-1)

This screen is displayed when the power is turned on and is then navigated to the screen automatically.



● Measured value display item (MO-MAIN)

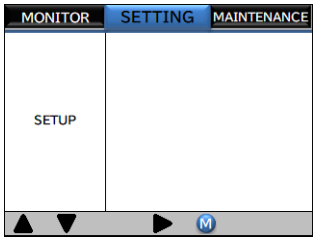
This screen displays various current values, line voltage, electrical power, demand power, and electrical energy.

If the product has not been used for a certain period of time, the date and time may be reset. In such a case, the following dialog box is displayed when the user navigates from the initial screen.

Clock has stopped.
Please set the clock.

Use the [E] button to navigate to the time setting screen and then set the time.

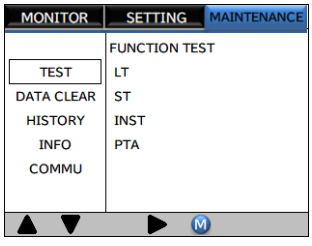
[M]



● Setting item (S-A)

This screen allows the user to change settings for rated current and each protective function.

[M]



● Maintenance item (MA-A)

This screen allows the user to display and delete recorded logs and conduct protective function verification testing.

[M]

Figure 13 Navigation to each setting item screen after power ON

8-3-1. **About the standby mode.**

The protection relay automatically switches to standby mode, which minimizes power consumption, if there is no operation for 30 minutes after the power is turned on. If you press a button other than [RST] in standby mode, the screen that was displayed until just before is displayed, and if an alarm occurs, the alarm screen is displayed. Note that the alarm screen does not switch to standby mode unless the alarm screen is canceled by pressing the [M] button.

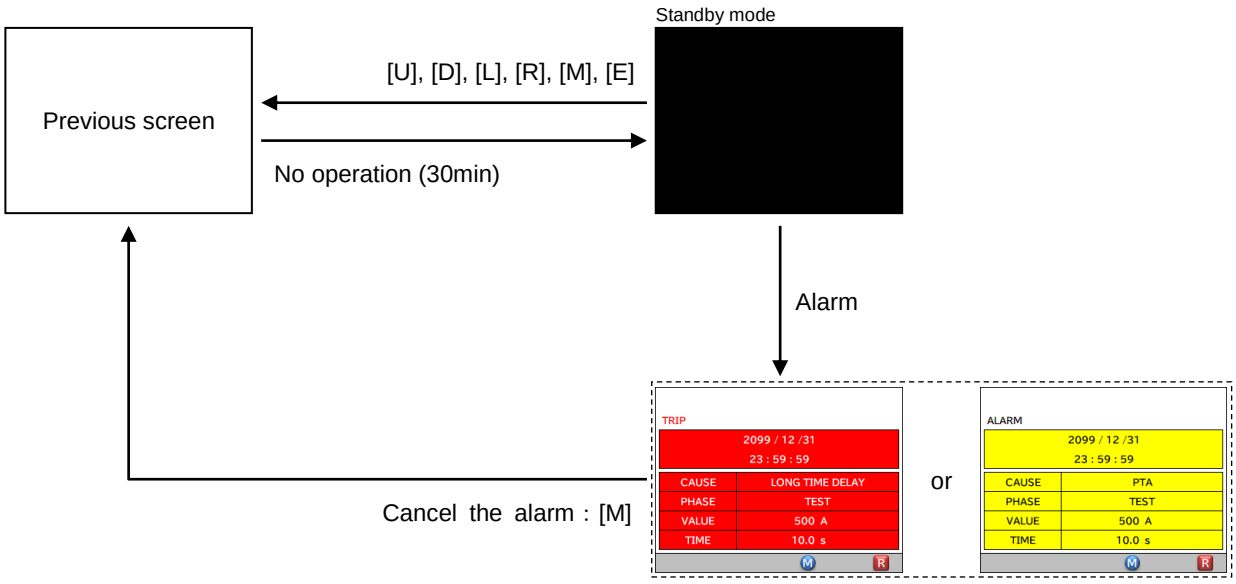


Figure 14 Navigation to standby mode

8-4. **MONITOR Screens**

Figure 15 show the MONITOR screen transitions. Refer to Table 11 for items that are actually displayed on the screen.

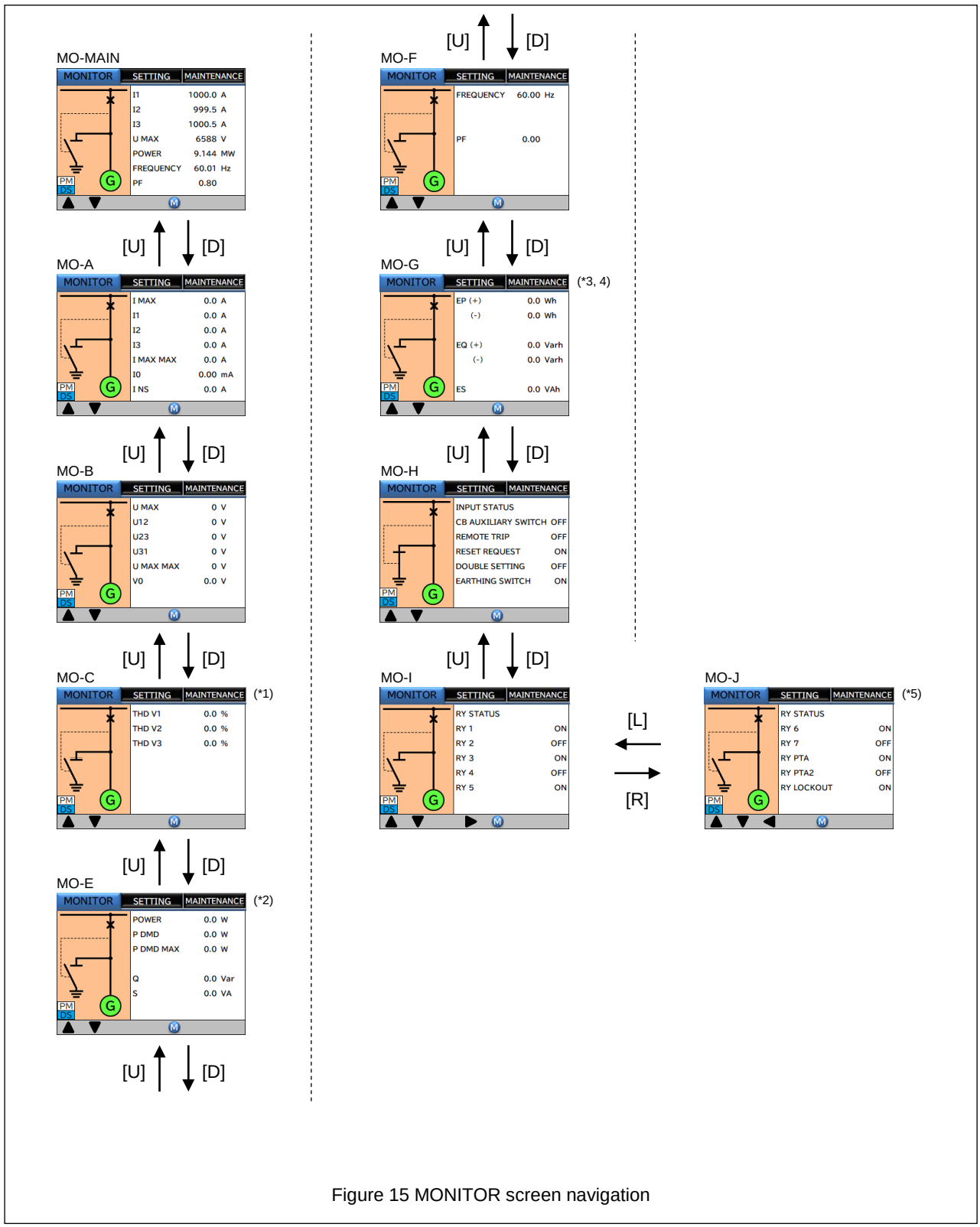


Figure 15 MONITOR screen navigation

Table 11 MONITOR subscreens

Screen	Display	Item	Display range	Remarks
MO-MAIN		Representative value		
	I1	Phase current of Phase 1 (R-phase)	0.0 to 6653.5 A	It will be the same value as the item on each screen.
	I2	Phase current of Phase 2 (S-phase)	0.0 to 6653.5 A	
	I3	Phase current of Phase 3 (T-phase)	0.0 to 6653.5 A	
	U MAX	Maximum Phase to Phase voltage	0 to 66535 V	
	POWER	Active power	-2147.4 to 2147.4 MW	
	FREQUENCY	Frequency	34.99 to 90.01 Hz	
	PF	Power factor	-1.00 to +1.00	
MO-A		Phase current screen		
	I MAX	Maximum Phase current	0.0 to 6653.5 A	-
	I1	Phase current of Phase 1 (R-phase)	0.0 to 6653.5 A	-
	I2	Phase current of Phase 2 (S-phase)	0.0 to 6653.5 A	-
	I3	Phase current of Phase 3 (T-phase)	0.0 to 6653.5 A	-
	I MAX MAX	Maximum Phase current to the present time	0.0 to 6653.5 A	-
	I0	Leakage current	0.00 to 665.35 mA	-
	I NS	Negative phase sequence current	0.0 to 6653.5 A	-
MO-B		Phase to Phase voltage screen		
	U MAX	Maximum Phase to Phase voltage	0 to 66535 V	-
	U12	Phase to Phase voltage between Phase1 and Phase2 (R/S-phase)	0 to 66535 V	-
	U23	Phase to Phase voltage between Phase2 and Phase3 (S/T-phase)	0 to 66535 V	-
	U31	Phase to Phase voltage between Phase3 and Phase1 (T/R-phase)	0 to 66535 V	-
	U MAX MAX	Maximum Phase to Phase voltage to the present time	0 to 66535 V	-
	V0	Ground fault voltage	0.0 to 6653.5 V	-
MO-C (*1)		Harmonic screen		
	THD V1	Phase 1 (R-phase) harmonic component	0.0 to 100.0 %	-
	THD V2	Phase 2 (S-phase) harmonic component	0.0 to 100.0 %	-
	THD V3	Phase 3 (T-phase) harmonic component	0.0 to 100.0 %	-
MO-E		Electric power screen		
	POWER	Active power	-2147.4 to 2147.4 MW	(*2)
	P DMD	Demand power	0.0 to 4294.9 MW	(*2)
	P DMD MAX	Maximum demand power	0.0 to 4294.9 MW	(*2)
	Q	Reactive power	-2147.4 to 2147.4 MVar	(*2)
	S	Apparent power	0.0 to 4294.9 MVA	(*2)
MO-F		Frequency and power factor screen		
	F INST	Frequency	34.99 to 90.01 Hz	-
	PF INST	Power factor	-1.00 to +1.00	-
MO-G		Electrical energy screen		
	EP(+)	Active power (+)	0.0 to 4000.0 GWh	(*3)
	EP(-)	Active power (-)	0.0 to 4000.0 MWh	(*4)
	EQ(+)	Reactive power (+)	0.0 to 4000.0 MVarh	(*4)
	EQ(-)	Reactive power (-)	0.0 to 4000.0 MVarh	(*4)
	ES	Apparent power	0.0 to 4000.0 GVAh	(*3)
MO-H		Phase current screen		
	CB AUXILIARY SWITCH	Auxiliary switch input state	ON/OFF	-
	REMOTE TRIP	External trip input state	ON/OFF	-
	RESET REQUEST	Reset command input state	ON/OFF	-
	DOUBLE SETTING	Characteristic switch input state	ON/OFF	-
	EARTHING SWITCH	Earthing switch input state	ON/OFF	-
MO-I		DO state display 1		
	RY 1	Relay 1 signal output state	ON/OFF	-
	RY 2	Relay 2 signal output state	ON/OFF	-
	RY 3	Relay 3 signal output state	ON/OFF	-
	RY 4	Relay 4 signal output state	ON/OFF	-
	RY 5	Relay 5 signal output state	ON/OFF	-

Screen	Display	Item	Display range	Remarks
MO-J		DO state display 2		
	RY 6	Relay 6 signal output state	ON/OFF	-
	RY 7	Relay 7 signal output state	ON/OFF	-
	RY PTA	Pre-trip alarm signal output state	ON/OFF	-
	RY PTA 2	Pre-trip alarm 2 signal output state	ON/OFF	(*5)
	RY LOCKOUT	Lockout operation signal output state	ON/OFF	-

*1: Displayed only when the harmonic measurement function is available.

*2: The display and unit change according to the number of digits of the measured value. (For negative numbers, the display and unit also change in the same way as above.)

Display range			Unit	STEP
0	to	9999	○	1
1.000		9.999	k○	0.001
10.00		99.99	k○	0.01
100.0		999.9	k○	0.1
1.000		9.999	M○	0.001
10.00		99.99	M○	0.01
100.0		Maximum value	M○	0.1

*2: The display and unit change according to the number of digits of the measured value. (When the measured value is greater than the maximum value, it is reset to 0.)

Display range			Unit	STEP
0	to	9999	k○h	1
1.000		9.999	M○h	0.001
10.00		99.99	M○h	0.01
100.0		999.9	M○h	0.1
1.000		9.999	G○h	0.001
10.00		99.99	G○h	0.01
100.0		Maximum value	G○h	0.1

*3: The display and unit change according to the number of digits of the measured value. (When the measured value is greater than the maximum value, it is reset to 0.)

Display range			Unit	STEP
0	to	9999	○	1
1.000		9.999	k○	0.001
10.00		99.99	k○	0.01
100.0		999.9	k○	0.1
1.000		9.999	M○	0.001
10.00		99.99	M○	0.01
100.0		Maximum value	M○	0.1

*5: Type-G displayed only.

8-5. **SETUP Screens**

Figure 16 to Figure 18 show the SETUP screen transitions. Refer to Table 12 for items that are actually displayed on the screen. When each setting item is changed, password authentication is required. For details on password authentication operation, refer to 8-5-3. Password Authentication Screens.

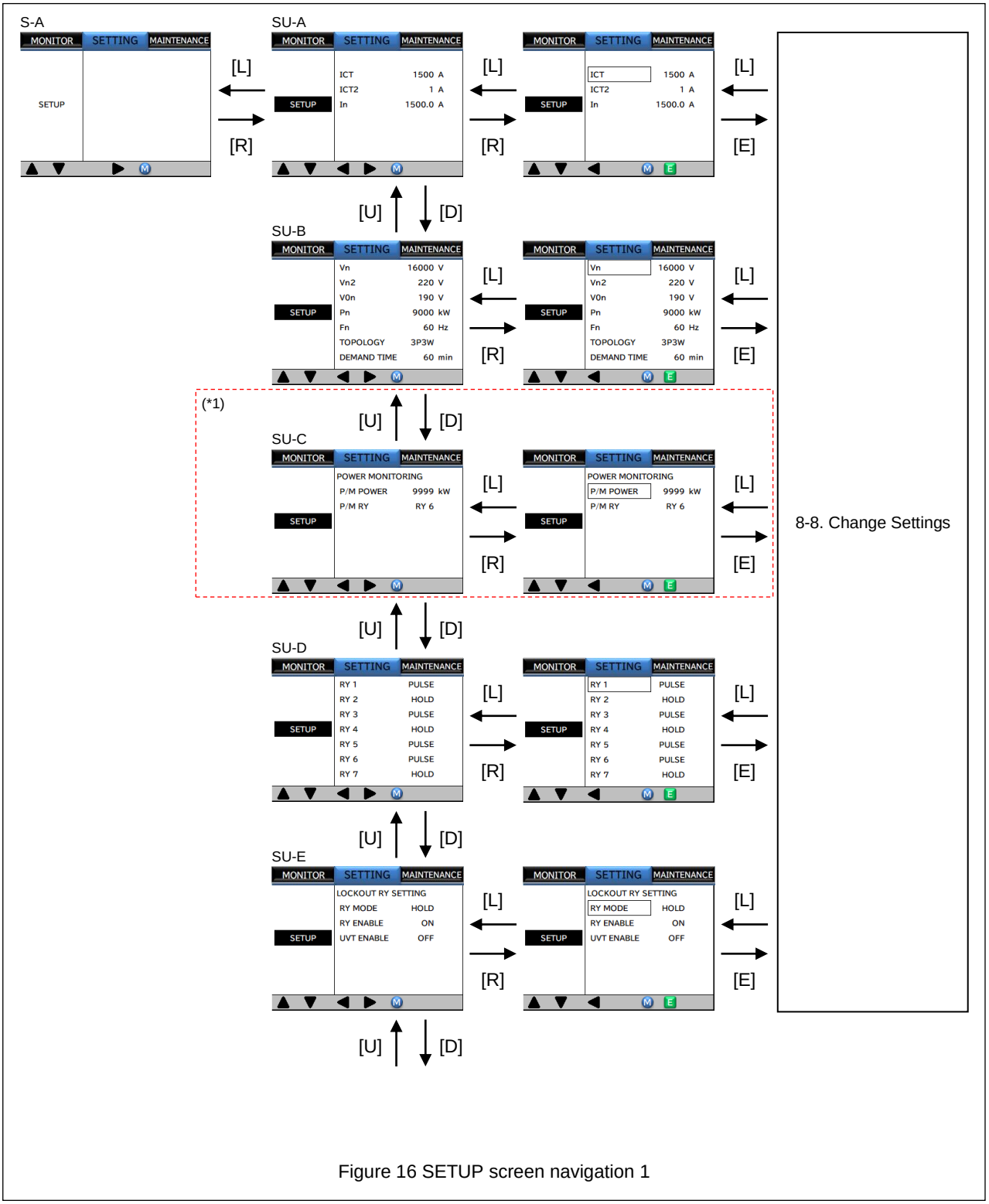


Figure 16 SETUP screen navigation 1

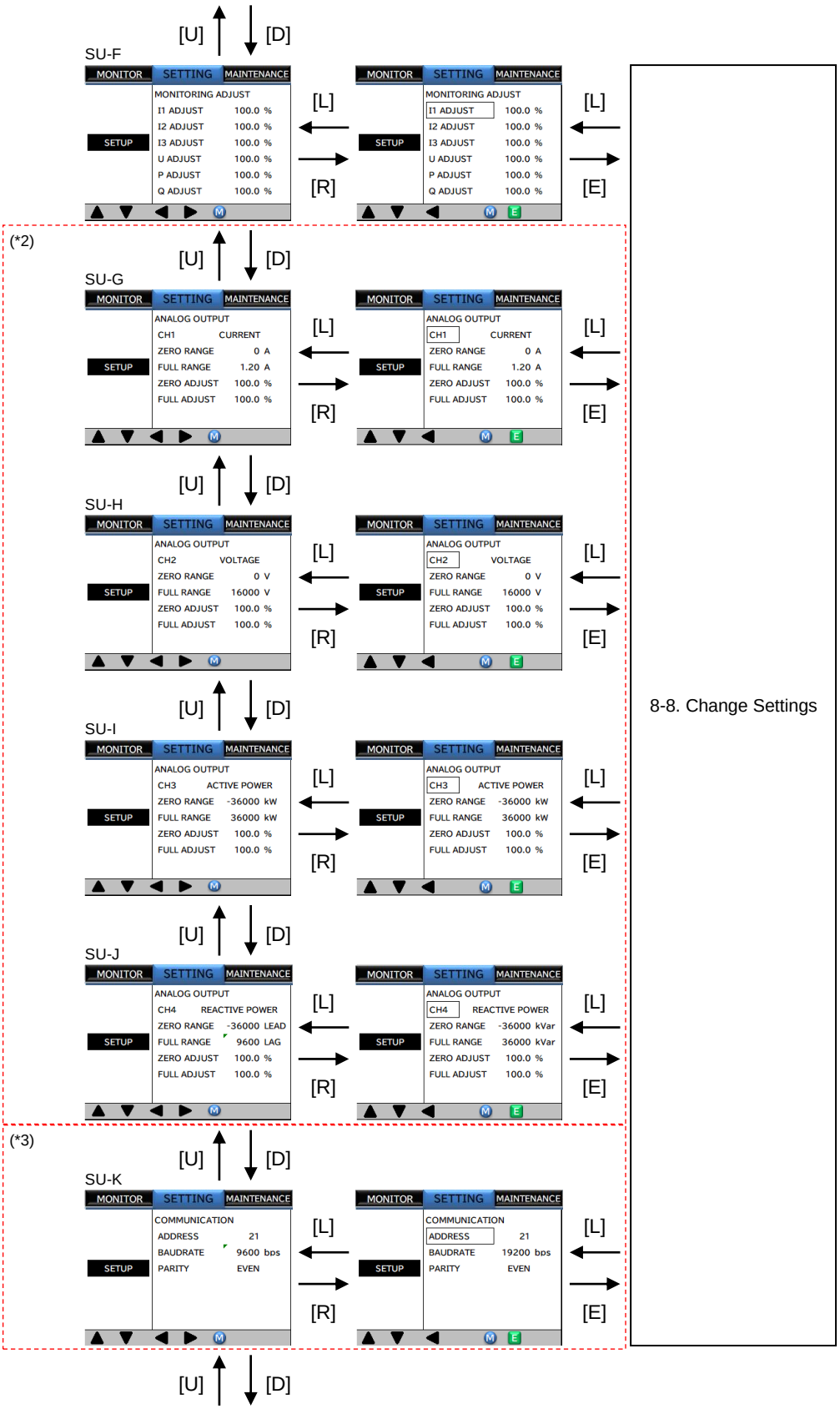


Figure 17 SETUP screen navigation 2

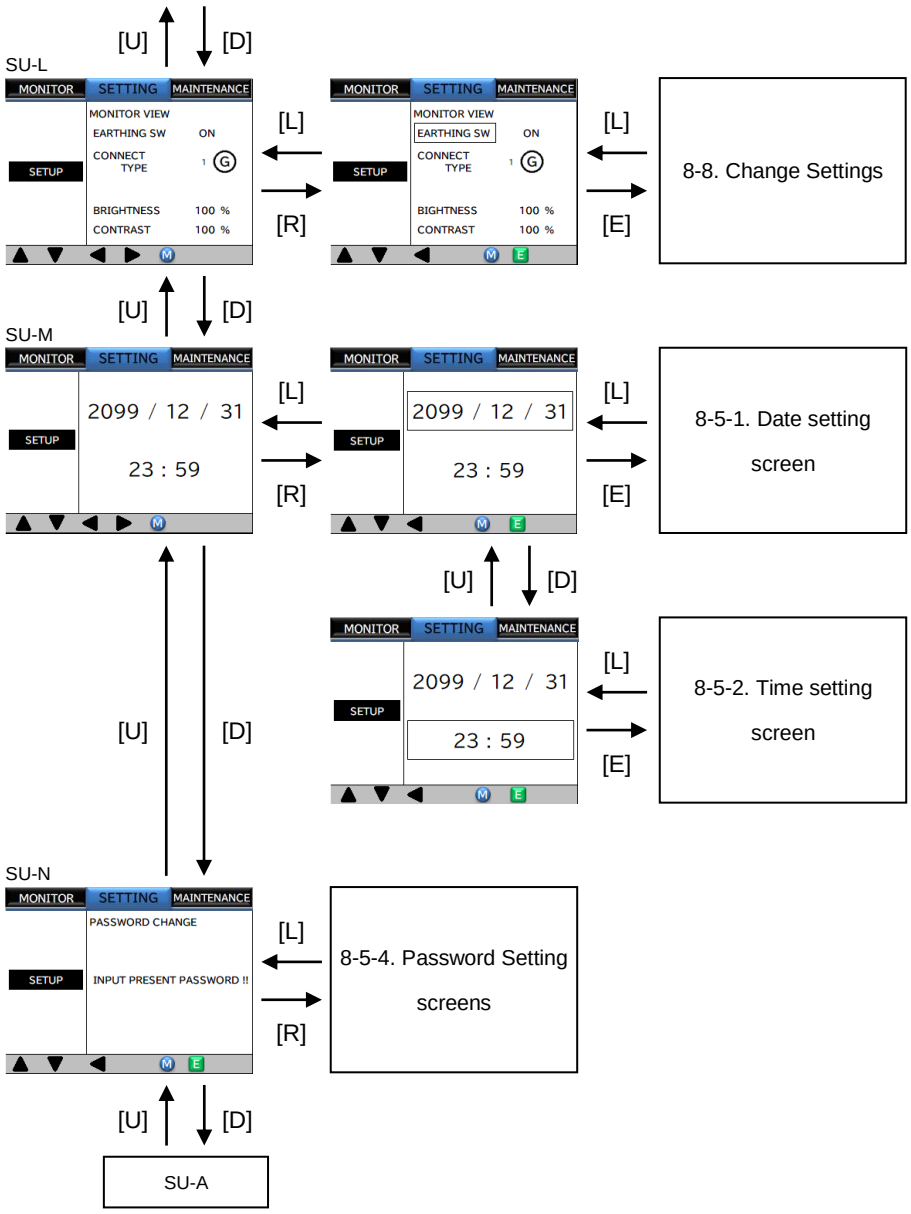


Figure 18 SETUP screen navigation 3

Table 12 SETUP subscreens

Screen	Display	Item	Setting range		STEP	Remarks
			Type-G	Type-F, -T		
SU-A	ICT	CT primary current	10 to 1500 A		1	-
	ICT2	CT secondary current	1 A / 5 A		-	(*1)
	In	Rated current	5.0 to 1500.0 A		0.1	The actual setting range is limited to (0.5 to 1.0) × ICT according to the setting of ICT.
SU-B	Vn	Rated primary voltage	110 to 16000 V		1	-
	Vn2	Rated secondary voltage	110 V / 220 V		-	-
	V0n	Rated zero-phase voltage	190 V (Not adjustable)		-	-
	Pn	Rated power	1 to 9000 kW	Automatic calculation (√3 * In * Vn * 0.8)	1	-
	Fn	Frequency	60Hz / 50 Hz		-	-
	TOPOLOGY	Topology	1P3W / 3P3W		-	-
	DEMAND TIME	Demand power measurement interval	5 min / 30 min / 60 min		-	-
SU-C (*2)	P/M POWER	Power monitoring: Monitored power	100 to 9999 kW	-	1	-
	P/M RY	Power monitoring: Relay setting	OFF / RY6	-	-	-
SU-D	RY 1	Relay output mode	HOLD/PULSE		-	This item can be set individually for each relay output.
	RY 2					
	RY 3					
	RY 4					
	RY 5					
	RY 6					
	RY 7					
SU-E	RY MODE	Lockout relay: Output mode	HOLD/PULSE		-	-
	RY ENABLE	Lockout relay: Output setting	OFF / ON		-	-
	UVT ENABLE	Lockout relay: UVT setting	OFF / ON		-	To use this setting, "LOCKOUT RY ENABLE" must be set to ON.
SU-F	I1 ADJUST	Phase1 (R-phase) current adjustment range	90.0 to 110.0%		0.1	This item is used for fine adjustment between the value actually measured at the installation location and the measured value displayed.
	I2 ADJUST	Phase 2 (S-phase) current adjustment range	90.0 to 110.0%		0.1	
	I3 ADJUST	Phase3 (T-phase) current adjustment range	90.0 to 110.0%		0.1	
	U ADJUST	Line voltage adjustment range	90.0 to 110.0%		0.1	
	P ADJUST	Active power adjustment range	90.0 to 110.0%		0.1	
	Q ADJUST	Reactive power adjustment range	90.0 to 110.0%		0.1	
SU-G SU-H SU-I SU-J (*3)	CH* MODE	mode	NONE / CURRENT / VOLTAGE / ACTIVE POWER / REACTIVE POWER / FREQUENCY / PF		-	This item specifies the function to be allocated to the channel.
	ZERO RANGE	4-mA output setting	"ZERO RANGE / FULL RANGE setting range" (→P.31)		-	-
	FULL RANGE	20-mA output setting				
	ZERO ADJUST	4-mA output adjustment	90.0 to 110.0%		0.1	-
	FULL ADJUST	20-mA output adjustment	90.0 to 110.0%		0.1	-
SU-K (*4)	ADDRESS	Transmission address	1 to 31		1	-
	BAUDRATE	Transmission rate	9600/19200		-	-
	PARITY	Parity	NONE/ODD/EVEN		-	-
SU-L	EARTHING SW	Display of earthing switch	ON/OFF		-	(*5)
	CONNECT TYPE	Connect type	1 to 4		-	(*5)
	BRIGHTNESS	Display brightness	10 to 100%		10	-
	CONTRAST	Display contrast	10 to 100%		10	-

*1: Specified at the time of ordering.

*2: Implemented for Type-G only.

*3: Not displayed without the Type-F monitoring function.

*4: Displayed when there is a communication function.

*5: Refer to "8-4. MONITOR Screens " for the display by each selection.

Screen	Display	Item	Setting range		STEP	Remarks
			Type-G	Type-F, -T		
SU-M	yyyy/mm/dd	Date	2000/1/1 to 2099/12/31		-	-
	hh: mm	Time	00: 00 to 23: 59		-	-
SU-N	PASSWORD CHANGE	Password change	0000 to 9999		-	Any number (four digits) (*6)

*6: Default passoword is “0000”

Table 13 ZERO RANGE / FULL RANGE setting range

MODE	ZERO RANGE		FULL RANGE	
	Setting range	STEP	Setting range	STEP
None	-	-	-	-
Current	0 A	-	(1.00 to 1.20)×Ict	0.01
Voltage	0 V	-	3000 to 16000 V	1
Active power	-36000 to 0 kW	1	1 to 36000 kW	1
Reactive power	-36000 to 0 kVar	1	1 to 36000 kVar	1
Frequency	45.00 to 65.00 Hz	0.01	46.00 to 66.00 Hz	0.01
Power factor	LEAD: 0.50 to 0.99	0.01	LAG: 0.50 to 1.00	0.01

8-5-1. **Date setting screen**

Figure 19 show the date setting screen navigation. Refer to Table 14 for items that are actually displayed on the screen.

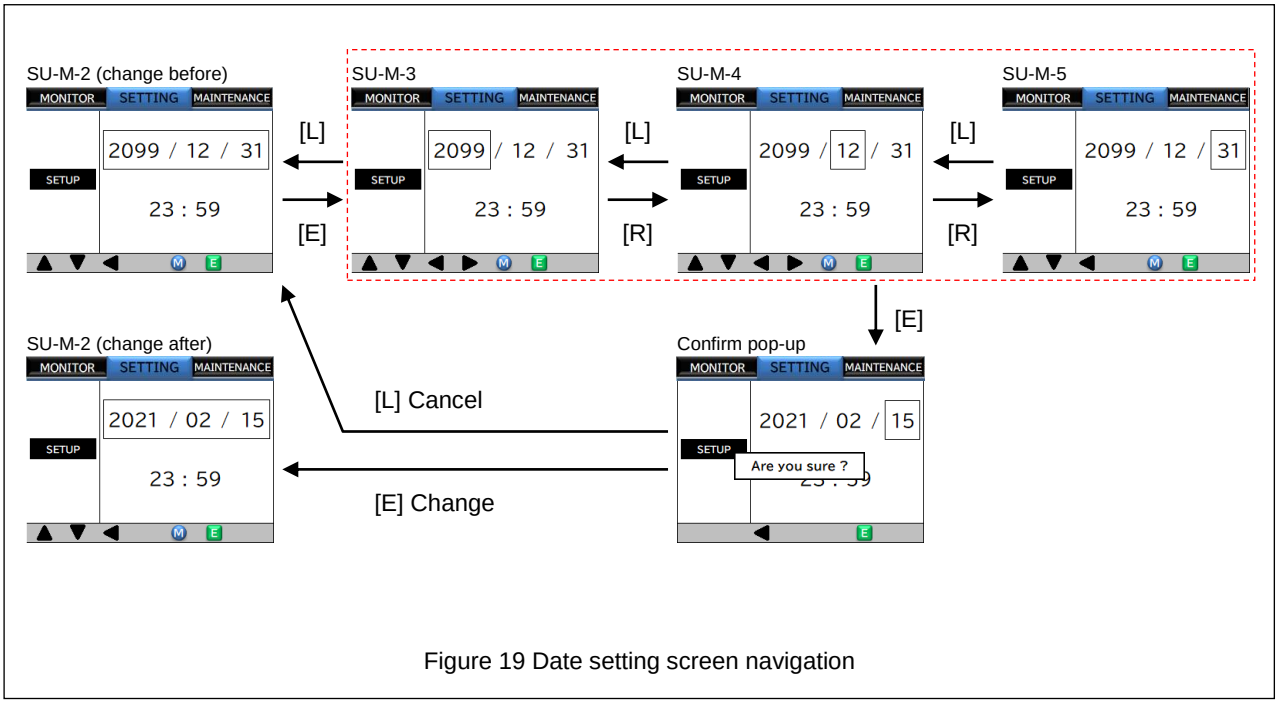


Figure 19 Date setting screen navigation

Table 14 Date setting subscreens

Screen	Display/setting item	Setting range	STEP	Remarks
SU-M-2	Setting item selection	-	-	-
SU-M-3	Year setting	2000 to 2099	1	Press the [U] button to increase the value, and press the [D] button to decrease the value.
SU-M-4	Month setting	1 to 12	1	
SU-M-5	Day setting	1 to 31	1	

8-5-2. **Time setting screen**

Figure 20 show the time setting screen navigation. Refer to Table 15 for items that are actually displayed on the screen.

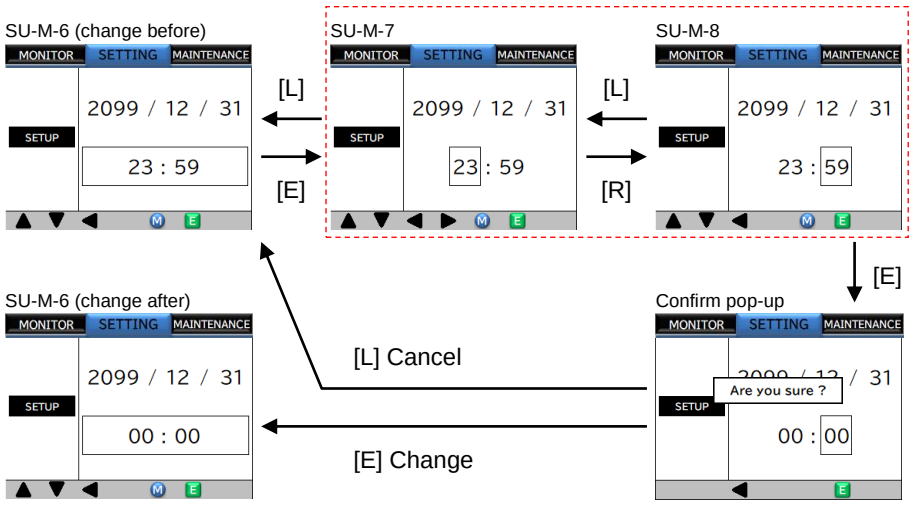


Figure 20 Time setting screen navigation

Table 15 Time setting subscreens

Screen	Display/setting item	Setting range	STEP	Remarks
SU-M-6	Setting item selection	-	-	-
SU-M-7	Hour setting	0 to 23	1	Press the [U] button to increase the value, and press the [D] button to decrease the value.
SU-M-8	Minute setting	0 to 59	1	

8-5-3. **Password Authentication Screens**

Password authentication is required in the following cases:

- When setting items are changed (authentication is required only for the first time unless the user navigates to other screens using the MENU button)
- When the password is changed
- When setting items are changed after the password has been changed
- When histories are deleted from the maintenance screen

Figure 21 shows the password authentication screen navigation. Refer to Table 16 for items that are actually displayed on the screen.

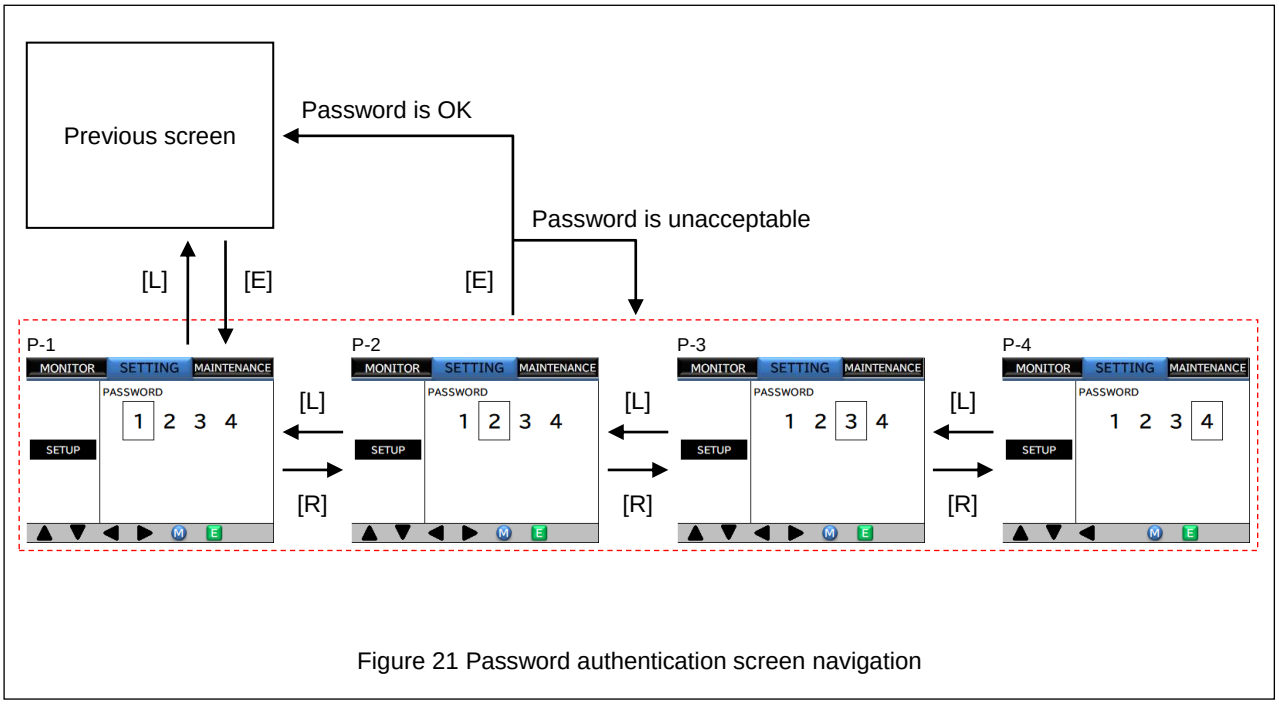


Figure 21 Password authentication screen navigation

Table 16 Password authentication subscreens

Screen	Display/setting item	Setting range	STEP	Remarks
P-1	Password input: 1st digit	0 to 9	1	Press the [U] button to increase the value, and press the [D] button to decrease the value.
P-2	Password input: 2nd digit	0 to 9	1	
P-3	Password input: 3rd digit	0 to 9	1	
P-4	Password input: 4th digit	0 to 9	1	

8-5-4. **Password Setting screens**

Figure 22 shows the password setting screen navigation. Refer to Table 17 for items that are actually displayed on the screen.

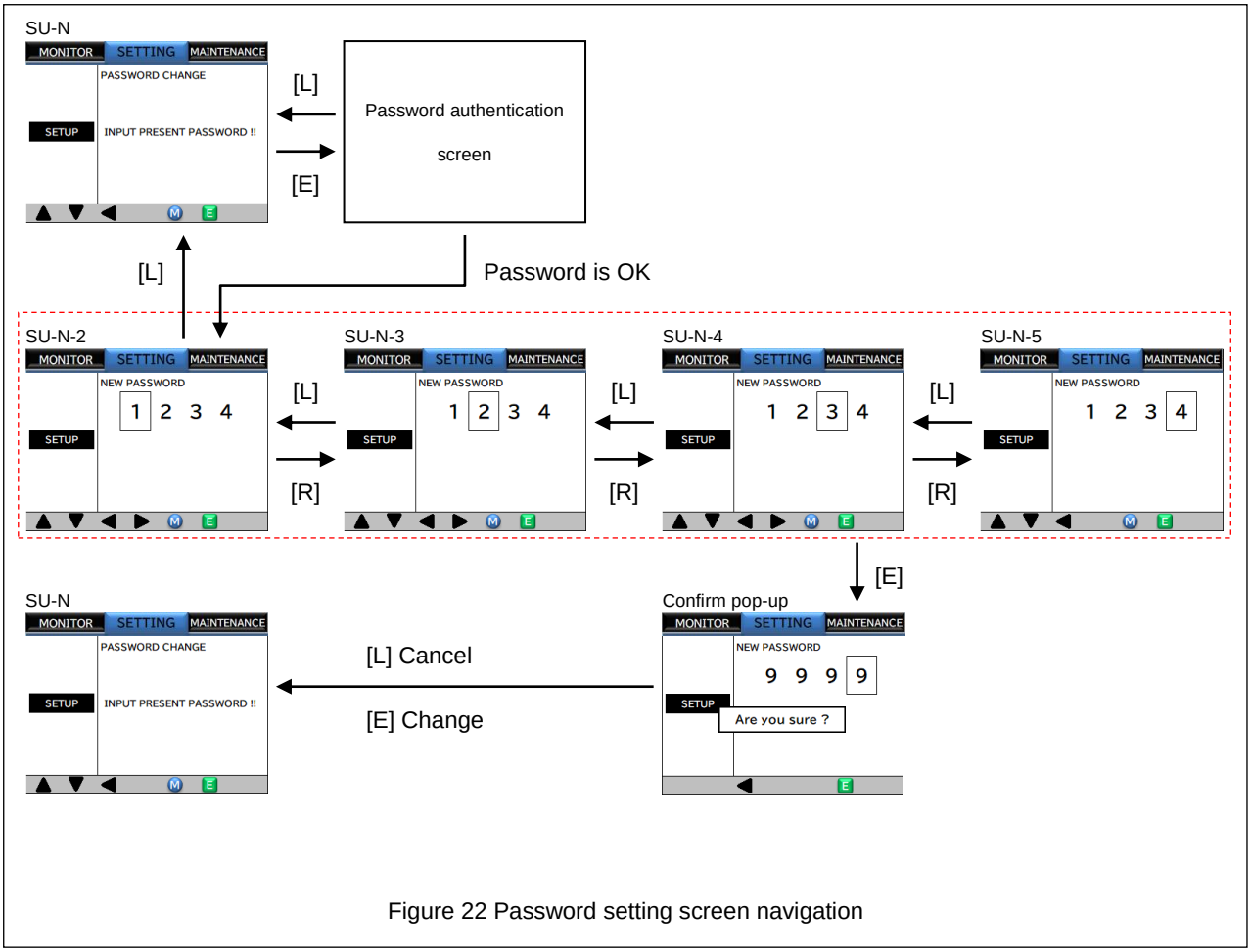


Figure 22 Password setting screen navigation

Default passoword is “0000”

Table 17 Password setting subscreens

Screen	Display/setting item	Setting range	STEP	Remarks
SU-N	Password change screen	-	-	Initial display
SU-N-2	Password setting: 1st digit	0 to 9	1	Press the [U] button to increase the value, and press the [D] button to decrease the value.
SU-N-3	Password setting: 2nd digit	0 to 9	1	
SU-N-4	Password setting: 3rd digit	0 to 9	1	
SU-N-5	Password setting: 4th digit	0 to 9	1	

8-6. **SETTING Screens**

Figure 23 shows the SETTING screen navigation. For each screen, refer to the relevant chapters.

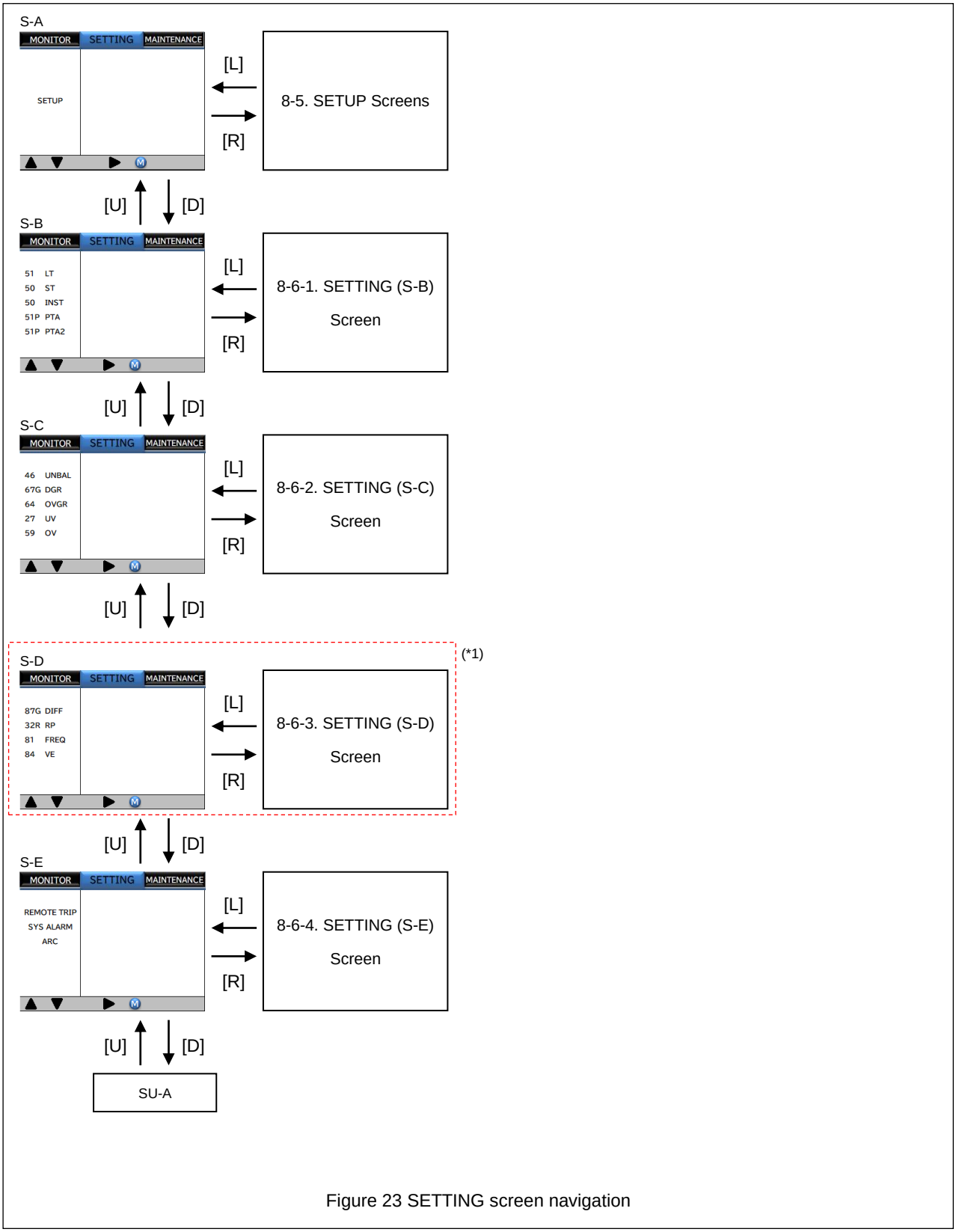


Figure 23 SETTING screen navigation

*1: Not displayed in Type-F.

8-6-1. **SETTING (S-B) Screen**

Since the screen configuration differs depending on the type, the screens is explained for each type.

Type-G

Figure 24 to Figure 25 show the SETTING (S-B) screen navigation for Type-G. Refer to Table 18 for items that are actually displayed on the screen.

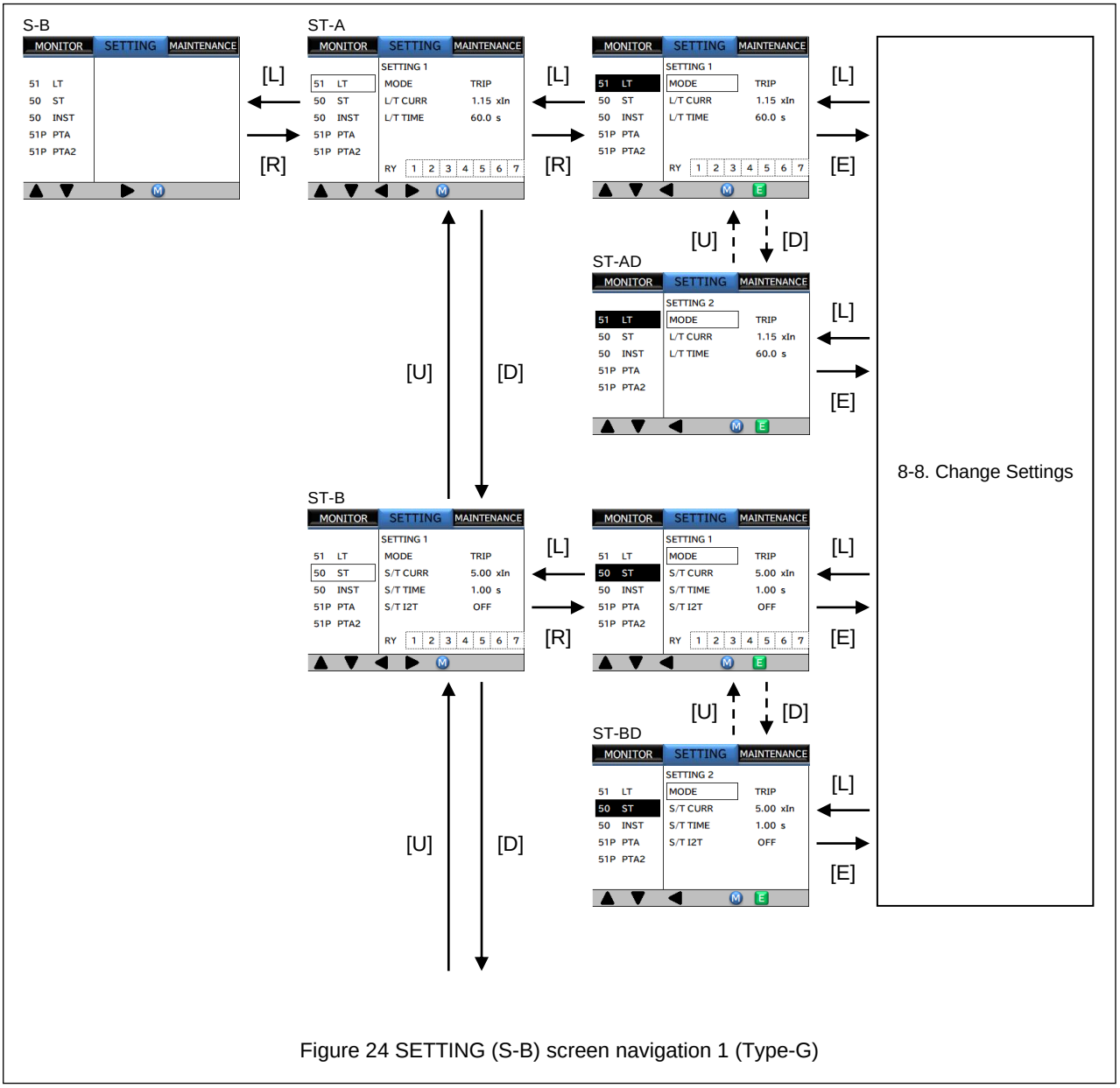


Figure 24 SETTING (S-B) screen navigation 1 (Type-G)

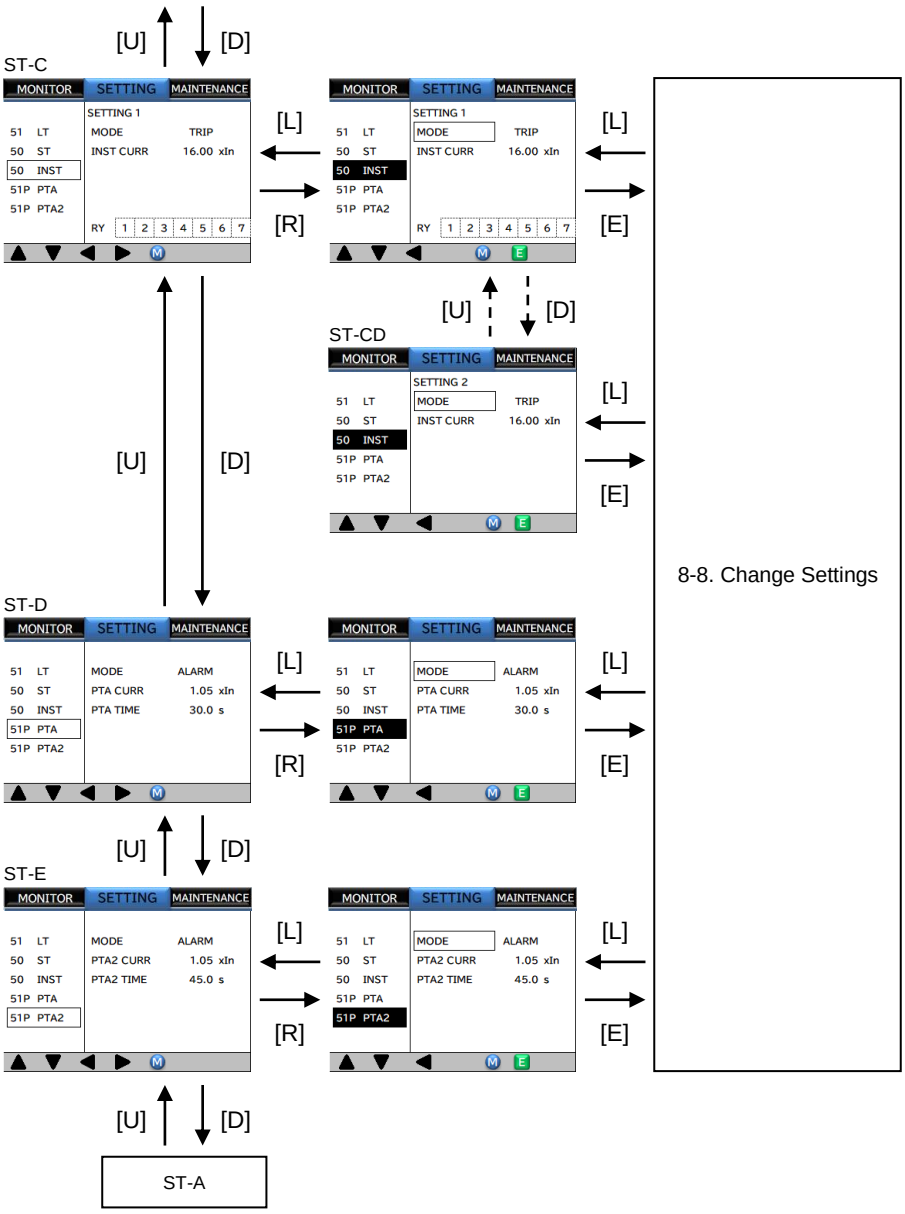


Figure 25 SETTING (S-B) screen navigation 2 (Type-G)

Table 18 SETTING (S-B) subscreens (Type-G)

Screen	Display	Item	Setting range	STEP	Remarks
ST-A	LT SETTING 1	Long time-delay setting 1			
	MODE	Mode	OFF / TRIP	-	-
	L/T CURR	Pickup current	(0.80 to 1.15) × In	0.01	-
	L/T TIME	Activation time limit	15.00 to 60.00 s	0.01	-
	RY	Output relay	(*1)	-	-
ST-AD	LT SETTING 2	Long time-delay setting 2			
	MODE	Mode	OFF / TRIP	-	-
	L/T CURR	Pickup current	(0.80 to 1.15) × In	0.01	-
	L/T TIME	Activation time limit	15.00 to 60.00 s	0.01	-
ST-B	ST SETTING 1	Short time-delay setting 1			
	MODE	Mode	OFF / TRIP	-	-
	S/T CURR	Pickup current	(2.00 to 5.00) × In	0.01	-
	S/T TIME	Activation time limit	0.10 to 1.00s	0.01	-
	S/T I2T	I2T characteristics	OFF / ON	-	-
	RY	Output relay	(*1)	-	-
ST-BD	ST SETTING 2	Short time-delay setting 2			
	MODE	Mode	OFF / TRIP	-	-
	S/T CURR	Pickup current	(2.00 to 5.00) × In	-	-
	S/T TIME	Activation time limit	0.10 to 1.00s	-	-
	S/T I2T	I2T characteristics	OFF / ON	-	-
ST-C	INST SETTING 1	Instantaneous setting 1			
	MODE	Mode	OFF / TRIP	-	-
	INST CURR	Pickup current	(2.00 to 24.00) × In	0.01	The maximum value is Ict × 16.
	RY	Output relay	(*1)	-	-
ST-CD	INST SETTING 2	Instantaneous setting 2			
	MODE	Mode	OFF / TRIP	-	-
	INST CURR	Pickup current	(2.00 to 24.00) × In	0.01	The maximum value is Ict × 16.
ST-D	PTA	Pre-trip alarm			
	MODE	Mode	OFF / ALARM	-	-
	PTA CURR	Pickup current	(0.75 to 1.05) × In	0.01	-
	PTA TIME	Activation time limit	10.0 to 30.0s	0.1	-
ST-E	PTA 2	Pre-trip alarm 2			
	MODE	Mode	OFF / ALARM	-	-
	PTA2 CURR	Pickup current	(0.75 to 1.05) × In	0.01	-
	PTA2 TIME	Activation time limit	15.0 to 45.0s	0.1	-

*1: Refer to 8-8-3. Relay Setting Operation.

Type-F, T

Figure 26 to Figure 27 show the SETTING (S-B) screen navigation for Tye-F, T. Refer to Table 19 for items that are actually displayed on the screen.

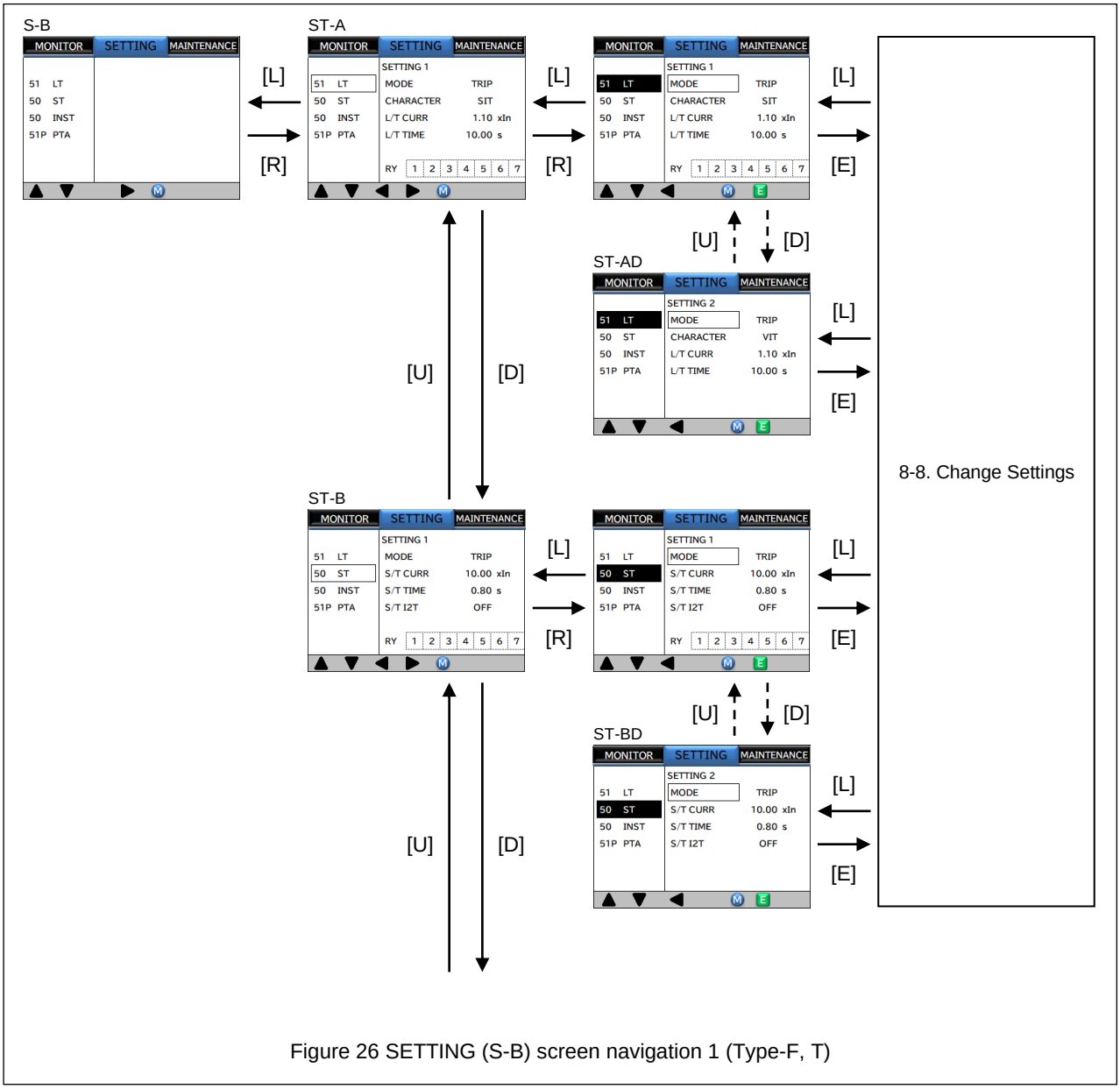


Figure 26 SETTING (S-B) screen navigation 1 (Type-F, T)

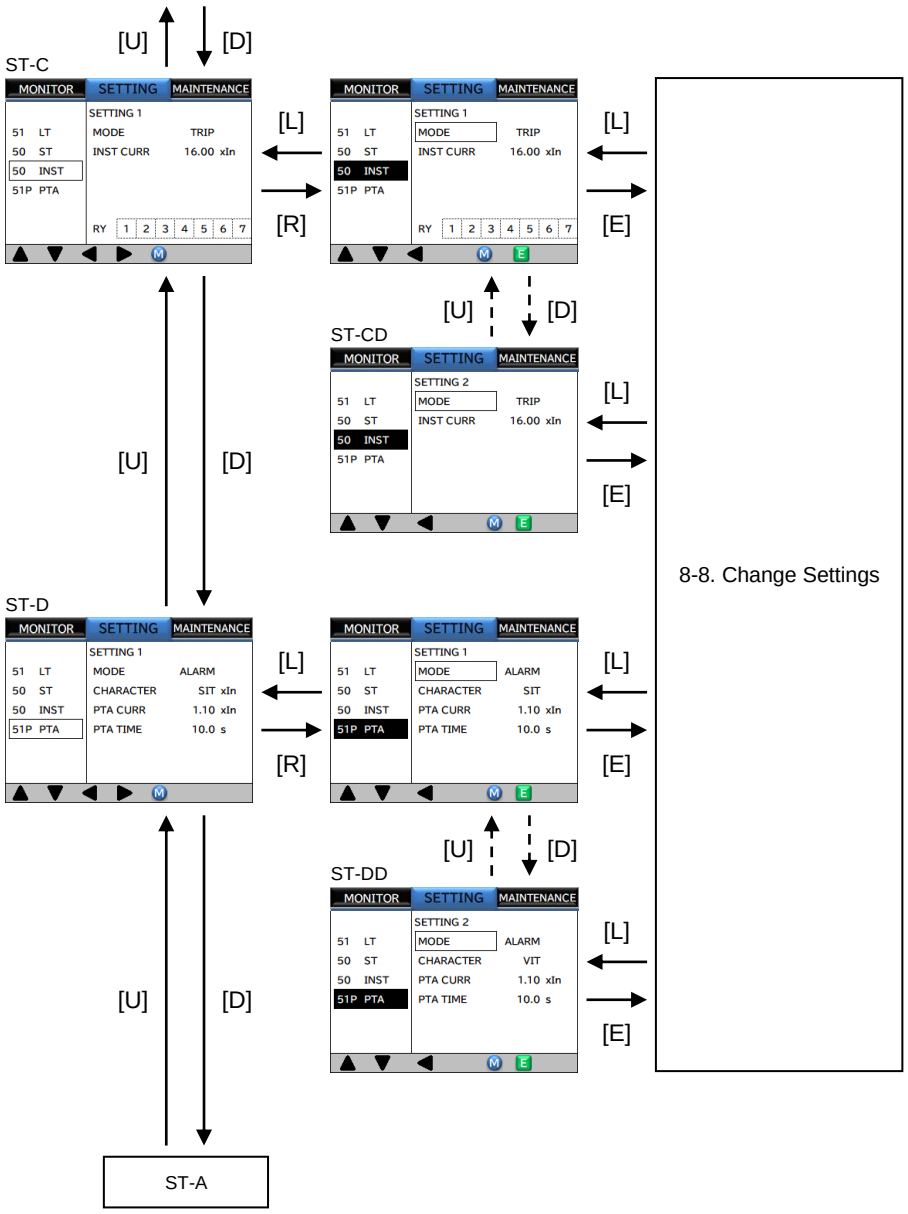


Figure 27 SETTING (S-B) screen navigation 2 (Type-F, T)

Table 19 SETTING (S-B) subscreens (Type-F, T)

Screen	Display	Item	Setting range	STEP	Remarks
ST-A	LT SETTING 1	Long time-delay setting 1			
	MODE	Mode	OFF / TRIP	-	-
	CHARACTER	Characteristic	SIT (power of 0.02) / VIT (power of 1) / EIT (power of 2)	-	-
	L/T CURR	Pickup current	(0.80 to 1.10) × In	0.01	-
	L/T TIME	Activation time limit	1.00 to 10.00 s	0.01	-
	RY	Output relay	(*1)	-	-
ST-AD	LT SETTING 2	Long time-delay setting 2			
	MODE	Mode	OFF / TRIP	-	-
	CHARACTER	CHARACTER	SIT (power of 0.02) / VIT (power of 1) / EIT (power of 2)	-	-
	L/T CURR	Pickup current	(0.80 to 1.10) × In	0.01	-
	L/T TIME	Activation time limit	1.00 to 10.00 s	0.01	-
ST-B	ST SETTING 1	Short time-delay setting 1			
	MODE	Mode	OFF / TRIP	-	-
	S/T CURR	Pickup current	(1.00 to 10.00) × In	0.01	-
	S/T TIME	Activation time limit	0.05 to 0.80s	0.01	-
	S/T I2T	I2T characteristics	OFF / ON	-	-
	RY	Output relay	(*1)	-	-
ST-BD	ST SETTING 2	Short time-delay setting 2			
	MODE	Mode	OFF / TRIP	-	-
	S/T CURR	Pickup current	(2.00 to 10.00) × In	-	-
	S/T TIME	Activation time limit	0.05 to 0.80s	-	-
	S/T I2T	I2T characteristics	OFF / ON	-	-
ST-C	INST SETTING 1	Instantaneous setting 1			
	MODE	Mode	OFF / TRIP	-	-
	INST CURR	Pickup current	(2.00 to 24.00) × In	0.01	The maximum value is Ict × 16.
	RY	Output relay	(*1)	-	-
ST-CD	INST SETTING 2	Instantaneous setting 2			
	MODE	Mode	OFF / TRIP	-	-
	INST CURR	Pickup current	(2.00 to 24.00) × In	0.01	The maximum value is Ict × 16.
ST-D	PTA SETTING 1	Pre-trip alarm setting 1			
	MODE	Mode	OFF / ALARM	-	-
	CHARACTER	Characteristic	(Linked with "CHARACTER" in the Long time-delay setting 1)	-	-
	PTA CURR	Pickup current	(0.75 to 1.10) × In	0.01	-
	PTA TIME	Activation time limit	0.5 to 10.0s	0.1	-
ST-DD	PTA SETTING 2	Pre-trip alarm setting 2			
	MODE	Mode	OFF / ALARM	-	-
	CHARACTER	Characteristic	(Linked with "CHARACTER" in the Long time-delay setting 2)	-	-
	PTA CURR	Pickup current	(0.75 to 1.10) × In	0.01	-
	PTA TIME	Activation time limit	0.5 to 10.0s	0.1	-

*1: Refer to 8-8-3. Relay Setting Operation.

8-6-2. **SETTING (S-C) Screen**

Figure 28 show the SETTING (S-C) screen navigation. Refer to Table 20 for items that are actually displayed on the screen.

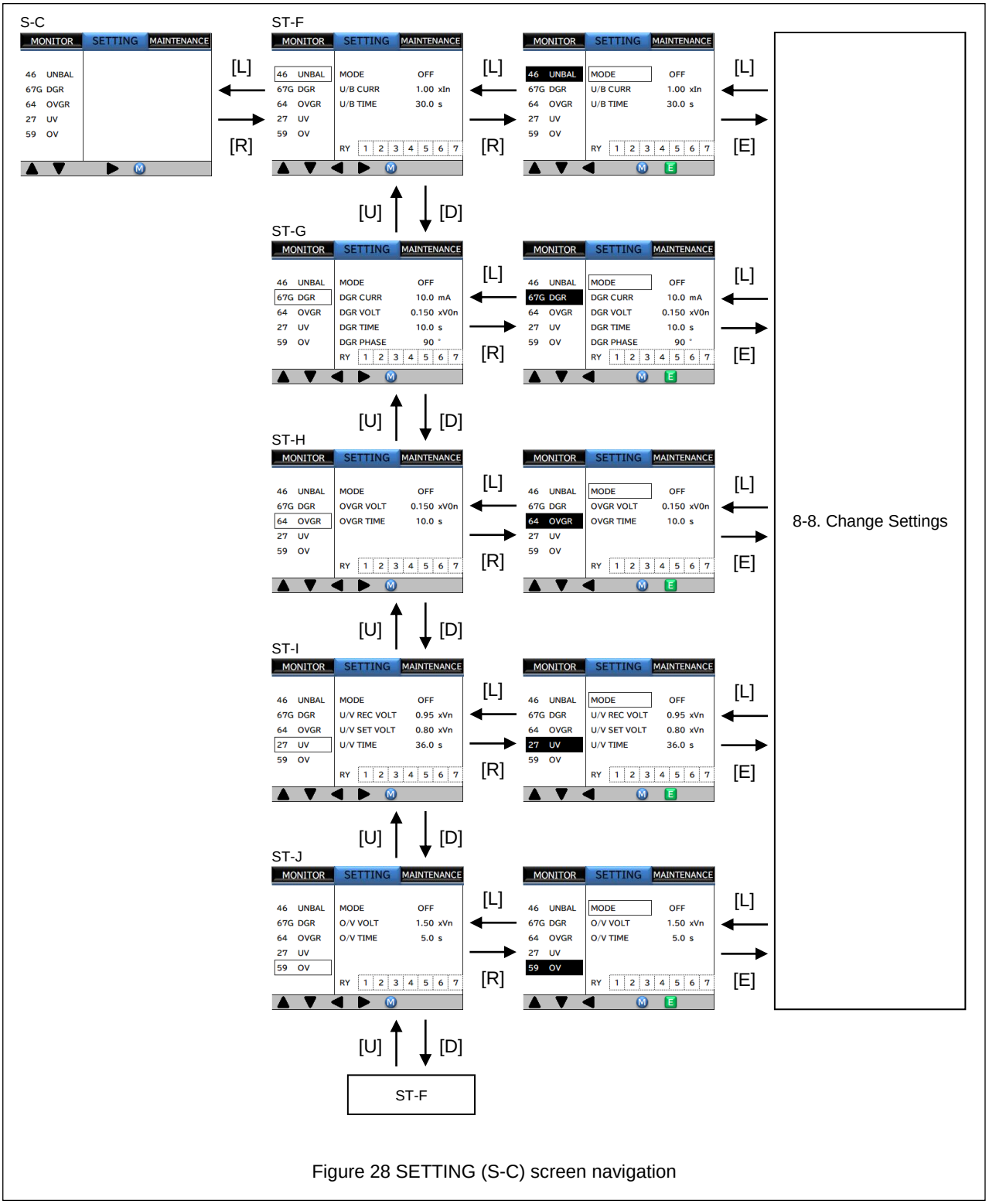


Figure 28 SETTING (S-C) screen navigation

Table 20 SETTING (S-C) subscreens

Screen	Display	Item	Setting range		STEP	Remarks
			Type-G	Type-F, T		
ST-F	UNBALANCE	Negative phase sequence				
	MODE	Mode	OFF / ALARM / TRIP		-	-
	U/B CURR	Pickup current	(0.10 to 1.00) × In		0.01	-
	U/B TIME	Activation time limit	1.0 to 30.0s		0.1	-
	RY	Output relay	(*1)		-	-
ST-G	DGR	Directional ground fault				
	MODE	Mode	OFF / ALARM / TRIP		-	-
	DGR CURR	Pickup current	1.0 to 10.0mA		0.1	-
	DGR VOLT	Pickup voltage	(0.050 to 0.150) × V0n		0.001	-
	DGR TIME	Activation time limit	0.2 to 10.0s		0.1	-
	DGR PHASE	Phase	0 to 90° / OFF		10	The OFF setting is a non-directional setting.
	RY	Output relay	(*1)		-	-
ST-H	OVGR	Ground fault overvoltage				
	MODE	Mode	OFF / ALARM / TRIP		-	-
	OVGR VOLT	Pickup voltage	(0.050 to 0.150) × V0n		0.001	-
	OVGR TIME	Activation time limit	0.1 to 1.0s		0.1	-
	RY	Output relay	(*1)		-	-
ST-I	UNDER VOLTAGE	Undervoltage				
	MODE	Mode	OFF / TRIP		-	-
	U/V REC VOLT	Reset voltage	(0.80 to 0.95) × Vn		0.01	-
	U/V SET VOLT	Set voltage	(0.40 to 0.80) × Vn		0.01	-
	U/V TIME	Activation time limit	0.1 to 36.0s		0.1	-
	RY	Output relay	(*1)		-	-
ST-J	OVER VOLTAGE	Overvoltage				
	MODE	Mode	OFF / TRIP		-	-
	O/V VOLT	Set voltage	(1.05 to 1.50) × Vn		0.01	-
	O/V TIME	Activation time limit	0.1 to 5.0s		0.1	-
	RY	Output relay	(*1)		-	-

*1: Refer to 8-8-3. Relay Setting Operation.

8-6-3. **SETTING (S-D) Screen**

Since the screen configuration differs depending on the type, the screens is explained for each type.

Type-G

Figure 29 and Figure 30 show the SETTING (S-D) screen navigation for Type-G. Refer to Table 21 for items that are actually displayed on the screen.

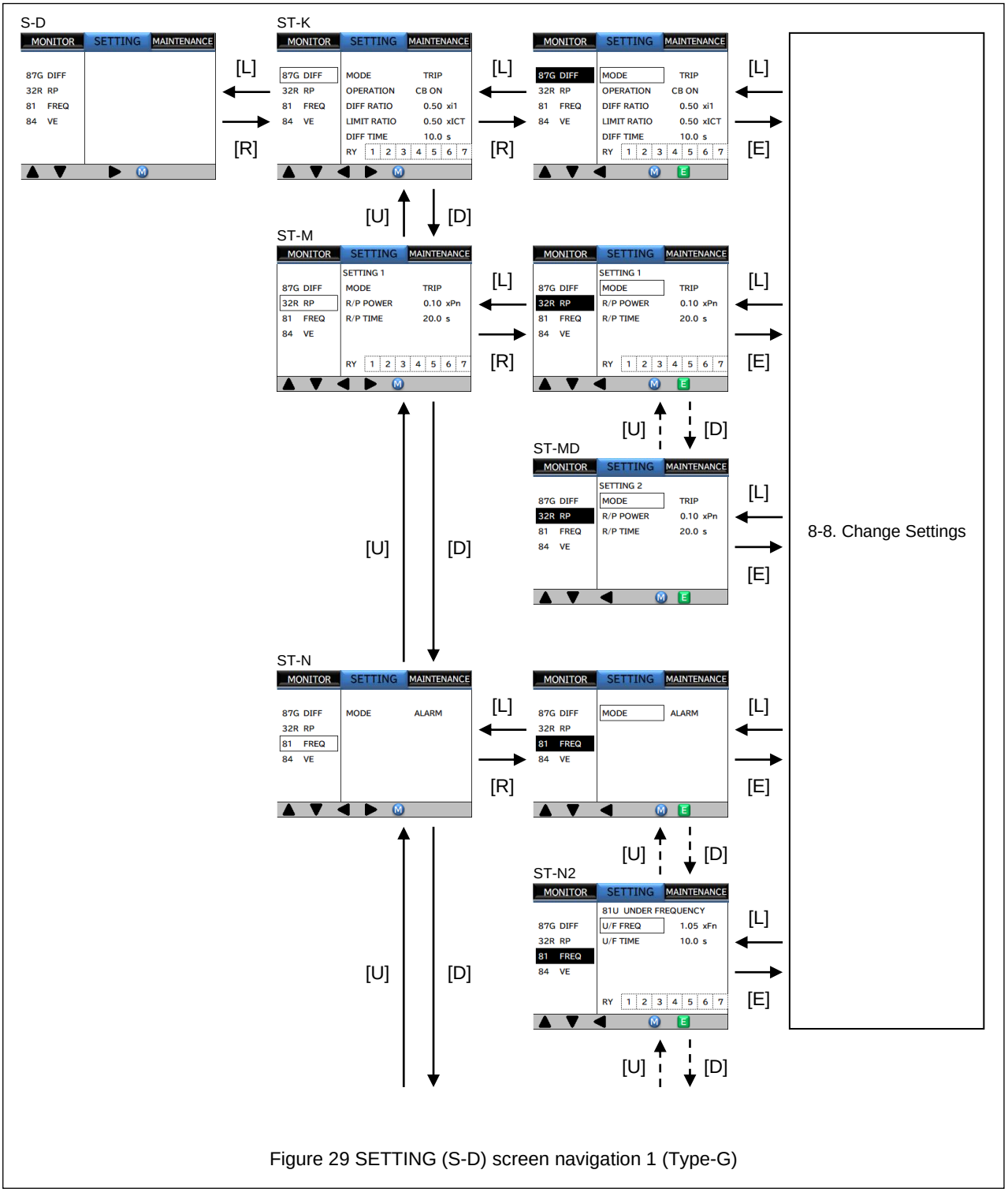


Figure 29 SETTING (S-D) screen navigation 1 (Type-G)

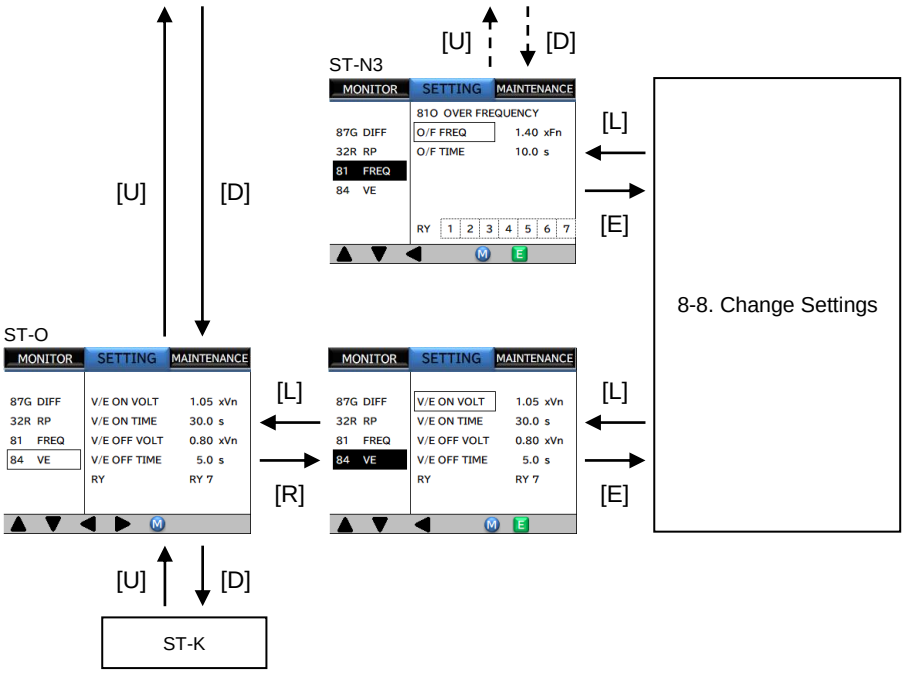


Figure 30 SETTING (S-D) screen navigation 2 (Type-G)

Table 21 SETTING (S-D) subscreens (Type-G)

Screen	Display	Item	Setting range	STEP	Remarks
ST-K	DIFF CURRENT	Differential current			
	MODE	Mode	OFF / ALARM / TRIP	-	-
	OPERATION	CB AUX state	NORMAL / CB ON	-	-
	DIFF RATIO	Set differential current	(0.10 to 0.50) × i1	0.01	i1 = I1 ×ICT2 / ICT I1: Applied current on the primary side of generator
	LIMIT RATIO	Limit differential current	(0.10 to 0.50) × I_{ct}	0.01	-
	DIFF TIME	Activation time limit	0.2 to 10.0s	0.1	-
	RY	Output relay	(*1)	-	-
ST-M	RP SETTING 1	Reverse power setting 1			
	MODE	Mode	OFF / ALARM / TRIP	-	-
	R/P POWER	Pickup power	(0.04 to 0.10) × Pn	0.01	-
	R/P TIME	Activation time limit	2.5 to 20.0s	0.1	-
	RY	Output relay	(*1)	-	-
ST-MD	RP SETTING 2	Reverse power setting 2			
	MODE	Mode	OFF / ALARM / TRIP	-	-
	R/P POWER	Pickup power	(0.04 to 0.10) × Pn	0.01	-
	R/P TIME	Activation time limit	2.5 to 20.0s	0.1	-
ST-N	FREQUENCY RELAY	Frequency relay protection			
	MODE	Mode	OFF / ALARM / TRIP	-	-
ST-N2	UNDER FREQUENCY	Underfrequency			
	U/F FREQ	Pickup frequency	(0.80 to 1.05) × Fn	0.01	-
	U/F TIME	Activation time limit	1.0 to 10.0s	0.1	-
	RY	Output relay	(*1)	-	-
ST-N3	OVER FREQUENCY	Overfrequency			
	O/F FREQ	Pickup frequency	(0.95 to 1.40) × Fn	0.01	-
	O/F TIME	Activation time limit	1.0 to 10.0s	0.1	-
	RY	Output relay	(*1)	-	-
ST-O	VOLTAGE ESTABLISH	Voltage establishment			
	V/E ON VOLT	Established voltage	(0.80 to 1.05) × Vn	0.01	-
	V/E ON TIME	Establishment activation time limit	0.1 to 30.0s	0.1	-
	V/E OFF VOLT	Dropout voltage	(0.40 to 0.80) × Vn	0.01	-
	V/E OFF TIME	Dropout time	1.0 to 5.0s	0.1	-
	RY	Output relay	OFF / RY7	-	If RY7 is set, RY7 cannot be selected for other protection.

*1: Refer to 8-8-3. Relay Setting Operation.

Type-T

Figure 31 show the SETTING (S-D) screen navigation for Type-T. Refer to Table 22 for items that are actually displayed on the screen.

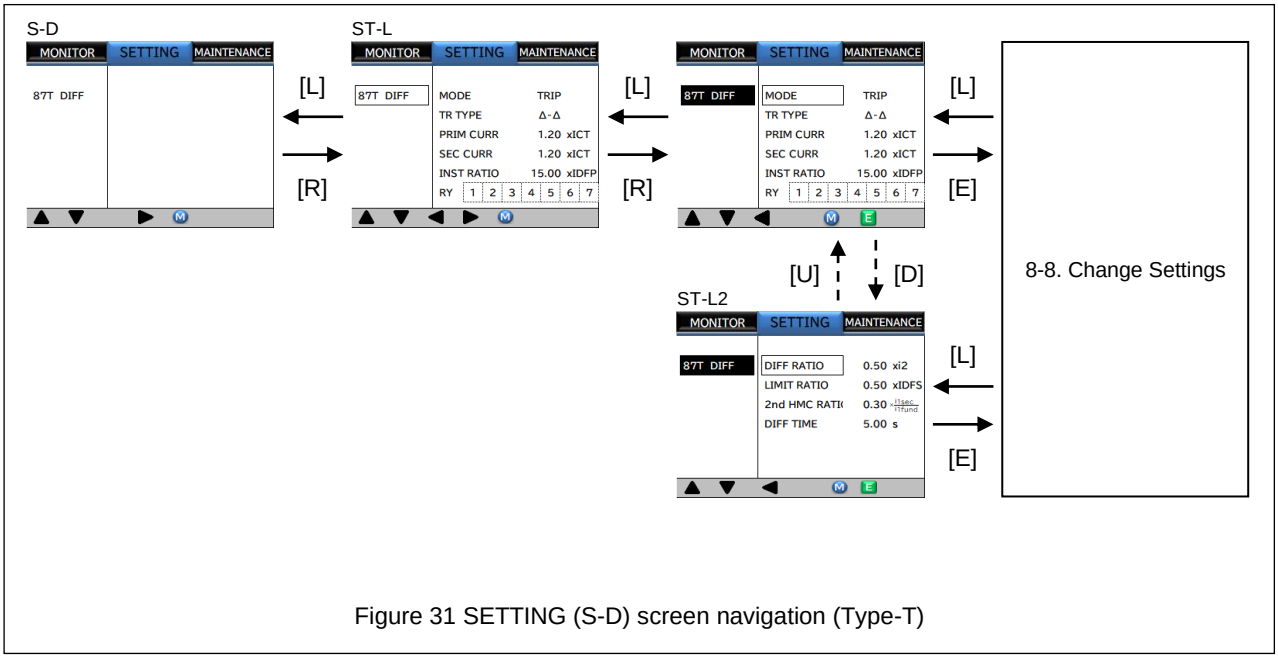


Figure 31 SETTING (S-D) screen navigation (Type-T)

Table 22 SETTING (S-D) subscreens (Type-T)

Screen	Display	Item	Setting range	STEP	Remarks
ST-L	DIFF CURRENT	Differential current			
	MODE	Mode	OFF / ALARM / TRIP	-	-
	TR TYPE	Transformer wiring method	Y-Y / △-△ / △-Y / Y-△	-	-
	PRIM CURR (I_{DFP})	Transformer primary current ratio	(0.30 to 1.20) × I_{ct}	0.01	-
	SEC CURR (I_{DFS})	Transformer secondary current ratio	(0.30 to 1.20) × I_{ct}	0.01	-
	INST RATIO	High speed over current setting	(5.00 to 15.00) × i1	0.01	-
	RY	Output relay	(*1)	-	-
ST-L2	DIFF CURRENT	Differential current			
	DIFF RATIO	Set differential current	(0.20 to 0.50) × i2	0.01	i2 = i1 × I_{DFS} / I_{DFP}
	LIMIT RATIO	Limit differential current	(0.30 to 0.50) × I_{DFS}	0.01	-
	2nd HMC RATIO	Second harmonic component ratio	0.10 to 0.30	0.01	-
	DIFF TIME	Activation time limit	0.20 to 5.00s	0.01	-

*1: Refer to 8-8-3. Relay Setting Operation.

8-6-4. **SETTING (S-E) Screen**

Figure 32 shows the SETTING (S-E) screen navigation. Refer to Table 23 for items that are actually displayed on the screen.

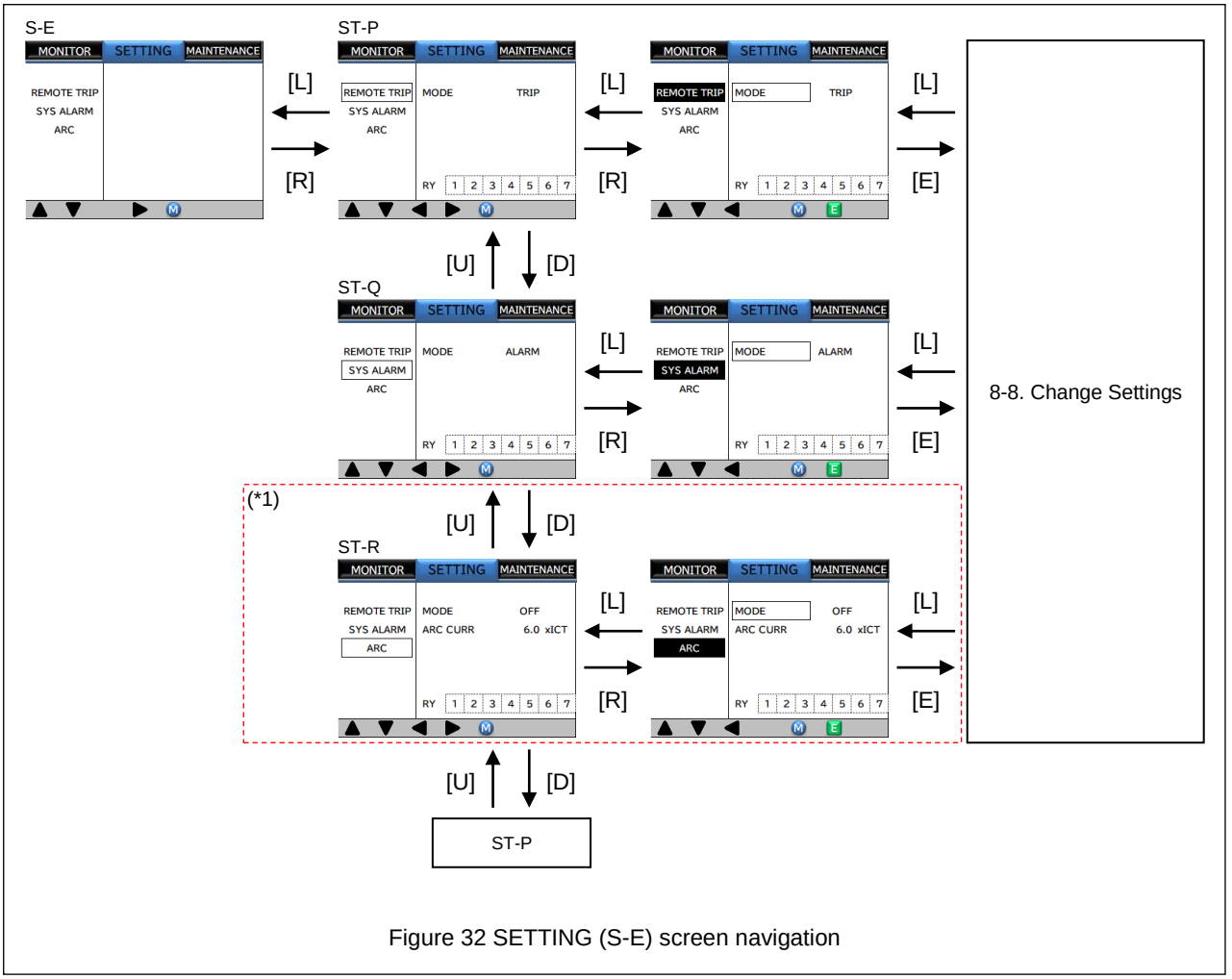


Figure 32 SETTING (S-E) screen navigation

Table 23 SETTING (S-E) subscreens

Screen	Display	Item	Setting range		STEP	Remarks
			Type-G	Type-F, T		
ST-P-1	REMOTE TRIP	External trip				
	MODE	Mode	OFF / TRIP		-	-
	RY	Output relay	(*2)		-	-
ST-Q-1	SYSTEM ALARM	System alarm				
	MODE	Mode	OFF / ALARM		-	-
	RY	Output relay	(*2)		-	-
ST-R-1	ARC DETECTION	Arc detection				
(*1)	MODE	Mode	OFF / ALARM / TRIP		-	-
	ARC CURR	Pickup current	(0.5 – 6.0) × I_{CT}		0.1	The operation time limit is within 10ms.
	RY	Output relay	(*2)		-	-

*1: Displayed only when the ARC function is available

*2: Refer to 8-8-3. Relay Setting Operation.

8-7. **MAINTENANCE Screens**

Figure 33 shows the MAINTENANCE screen navigation. For each screen, refer to the relevant chapters.

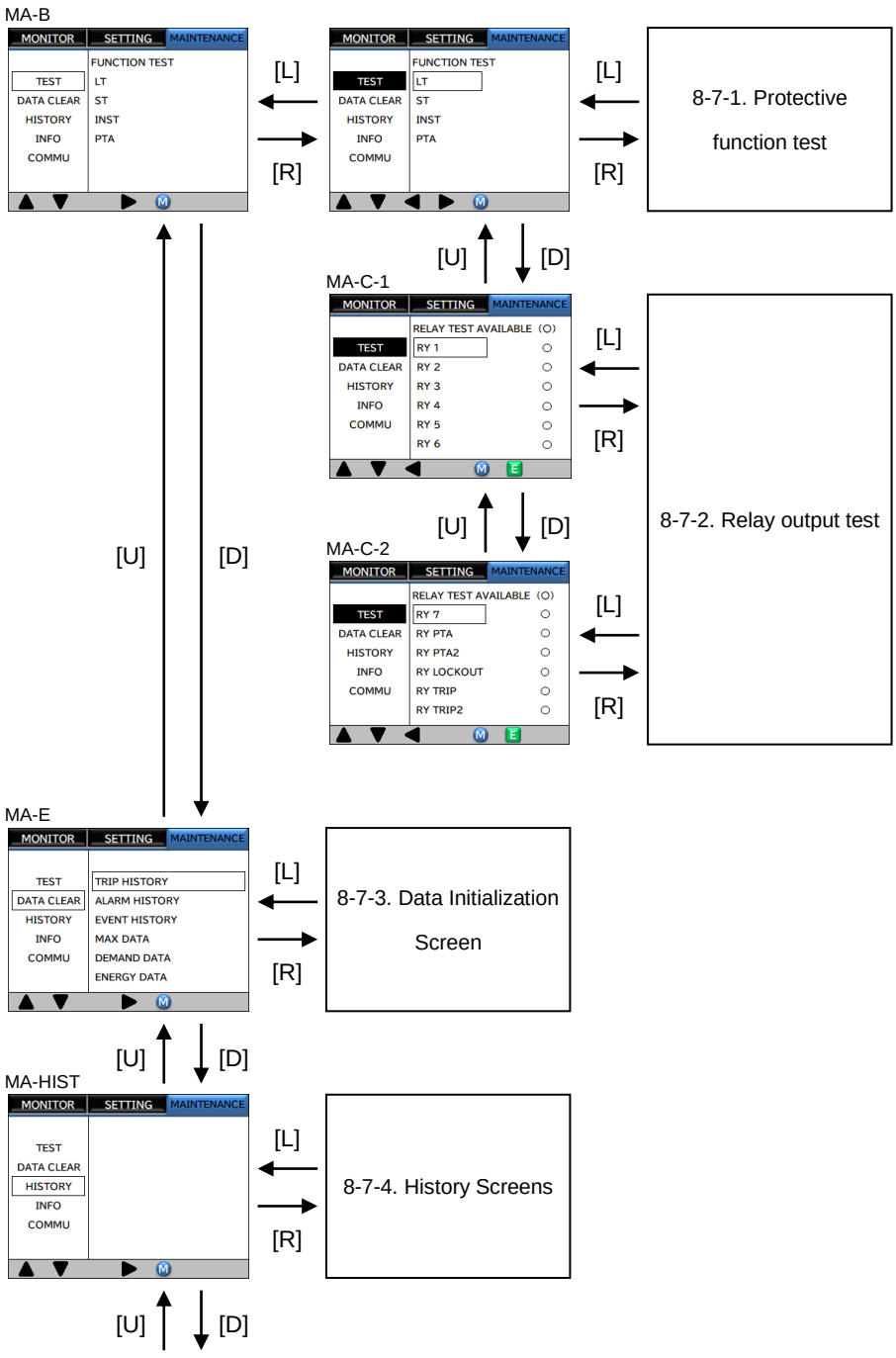


Figure 33 MAINTENANCE screen navigation 1

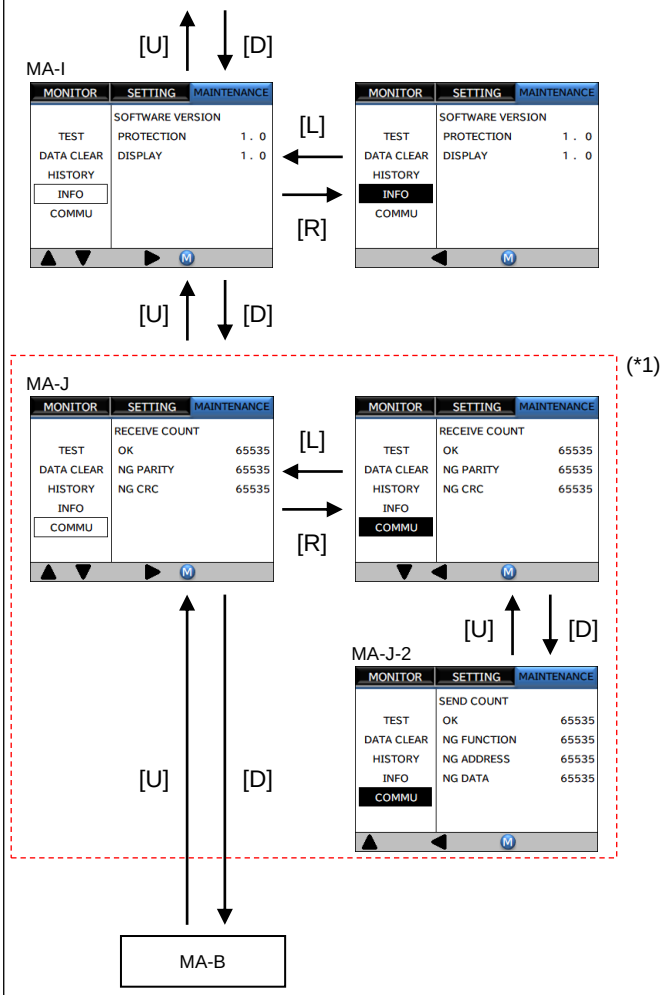


Figure 34 MAINTENANCE screen navigation 2

Table 24 MAINTENANCE subscreens

Screen	Display	Item	Setting range	Remarks
MA-B	FUNCTION TEST	Function test		
	O/C LONG	Long time-delay tripping	TRIP / NONE TRIP	-
	O/C SHORT	Short time-delay tripping	TRIP / NONE TRIP	-
	O/C INST	Instantaneous tripping	TRIP / NONE TRIP	-
	O/C PTA	Pre-trip alarm	ALARM / NONE ALARM	-
MA-C-1	RELAY TEST	Relay test (1)		
	RY 1	Relay 1	-	-
	RY 2	Relay 2	-	-
	RY 3	Relay 3	-	-
	RY 4	Relay 4	-	-
	RY 5	Relay 5	-	-
	RY 6	Relay 6	-	-
MA-C2	RELAY TEST	Relay test (2)		
	RY 7	Relay 7	-	-
	RY PTA	Pre-trip alarm relay	-	-
	RY PTA2	Pre-trip alarm relay 2	-	Displayed only for Type-G
	RY LOCKOUT	Lockout relay	-	-
	RY TRIP1	Trip relay	-	-
	RY TRIP2	Trip relay 2	-	-
MA-E	DATA CLEAR	Data initialization		
	TRIP HISTORY	Trip history	-	All data is reset at once.
	ALARM HISTORY	Alarm history	-	All data is reset at once.
	EVENT HISTORY	Event history	-	All data is reset at once.
	MAX DATA	Maximum value data	-	-
	DEMAND DATA	Demand data	-	-
	ENERGY DATA	Electric power data	-	-
MA-I	INFO	System Information		
	PROTECTION	Protection version	-	-
	DISPLAY	Display version	-	-
MA-J	COMM RECEIVE COUNT	Reception count		
(*1)	OK	Number of normal data packets received	0 to 65535	-
	NG PARITY	Number of parity errors	0 to 65535	Number of data packets containing parity errors
	NG CRC	Number of CRC errors	0 to 65535	Number of data packets containing CRC errors
MA-J-2	COMM SEND COUNT	Transmission count		
(*1)	OK	Number of normal data packets sent	0 to 65535	-
	NG FUNCTION	Number of invalid functions	0 to 65535	Unsupported function code
	NG ADDRESS	Number of invalid addresses	0 to 65535	No address
	NG DATA	Number of invalid data values	0 to 65535	Invalid data values

*1: Displayed when there is a communication function.

8-7-1. **Protective function test**

Tests can be conducted using the long time-delay tripping, short time-delay tripping, instantaneous tripping, and pre-trip alarm functions. Figure 35 shows the protective function test screen transitions. Refer to Table 25 for behaviors, LED states, and other information during testing.

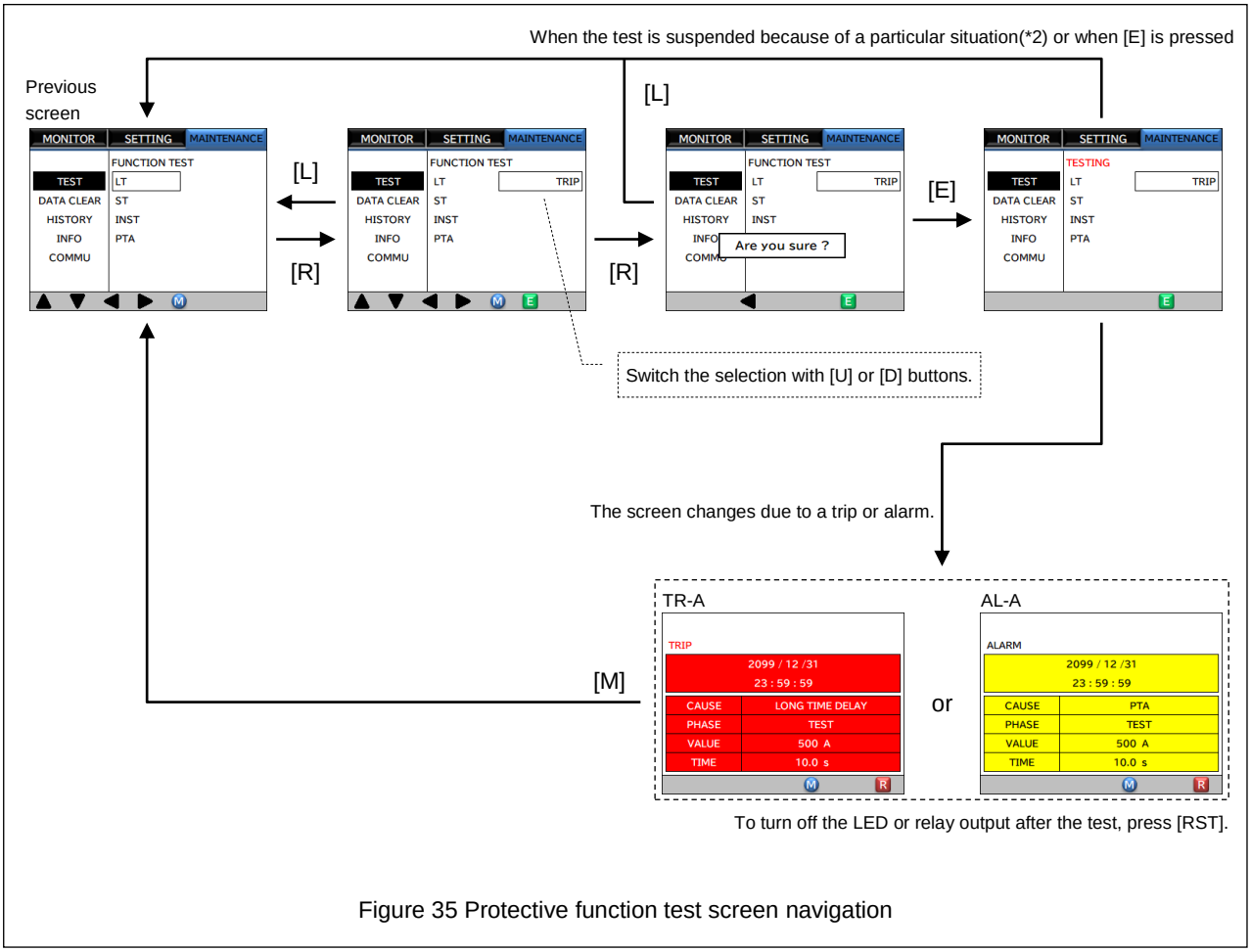


Figure 35 Protective function test screen navigation

*1: In the following cases, after [E] is pressed, no test is started and the display returns to the MA-B screen.

- When the device to be tested is set to OFF
- When an applied current value equal to or greater than Ict×10% is detected
- When the state of a trip or alarm has not been reset after they occurred

*2: In the following cases, the test is suspended and the display returns to the MA-B screen.

- When an applied current value equal to or greater than Ict×10% is detected
- When a trip or alarm occurs

Table 25 Each state after protective function test

Test conducted	Screen refresh	[TRIP/ALARM] LED state	Individual LED states		Relay activation	Log update
			During pickup	After activation		
TRIP	TRIP incident screen (AL-A)	Lit in red	Blinking in red	Lit in red	Activated	Updated
ALARM	ALARM incident screen (TR-A)	Blinking in red	Blinking in red	Unlit	Activated	Updated
NONE TRIP	No refresh	Unlit	Blinking in red	Unlit	Not activated	Not updated
NONE ALARM	No refresh	Unlit	Blinking in red	Unlit	Not activated	Not updated

8-7-2. **Relay output test**

Test the signal output by manipulating the contacts directly. To stop the output after the relay is operating, press the [RST] button displayed at the bottom right of the screen to stop the output. (In the case of pulse output, it will be reset automatically.) Figure 36 shows the screen transition of the relay output test.

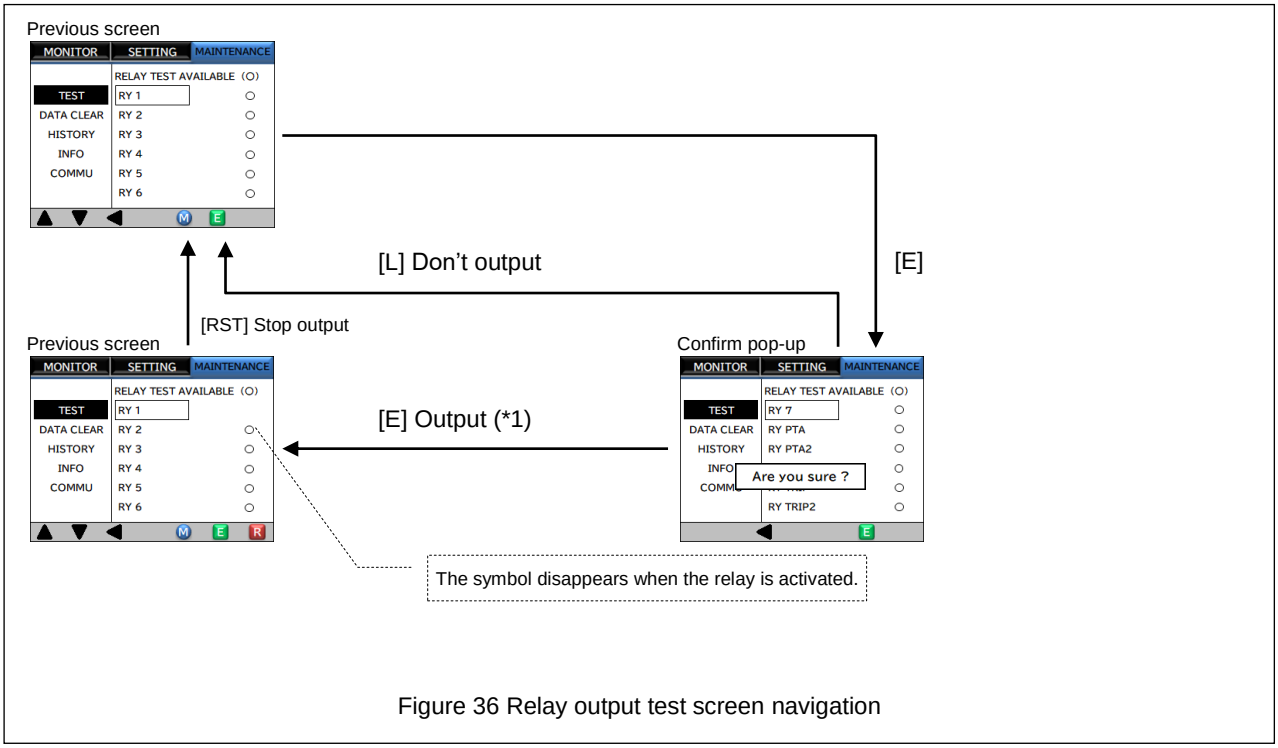


Figure 36 Relay output test screen navigation

*1: Even if [E] is pressed during relay output, the relay will not be activated.

8-7-3. **Data Initialization Screen**

Figure 37 shows the data initialization screen navigation.

If you press the [R] button from the previous screen for the first time after moving the menu with the [M] button, the password authentication screen (P.34) is displayed.

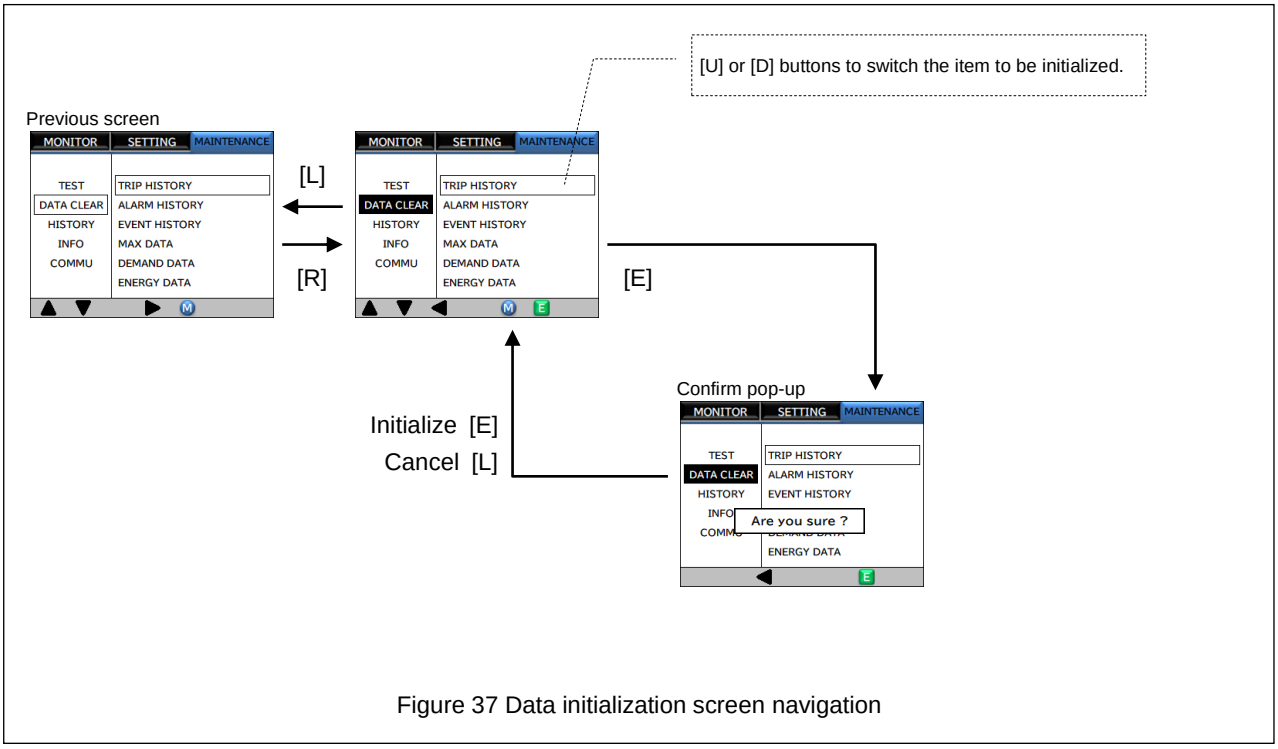


Figure 37 Data initialization screen navigation

8-7-4. **History Screens**

Figure 38 shows the history (trip, alarm, event) screen navigation. Refer to Table 26 for items that are actually displayed on the screen.

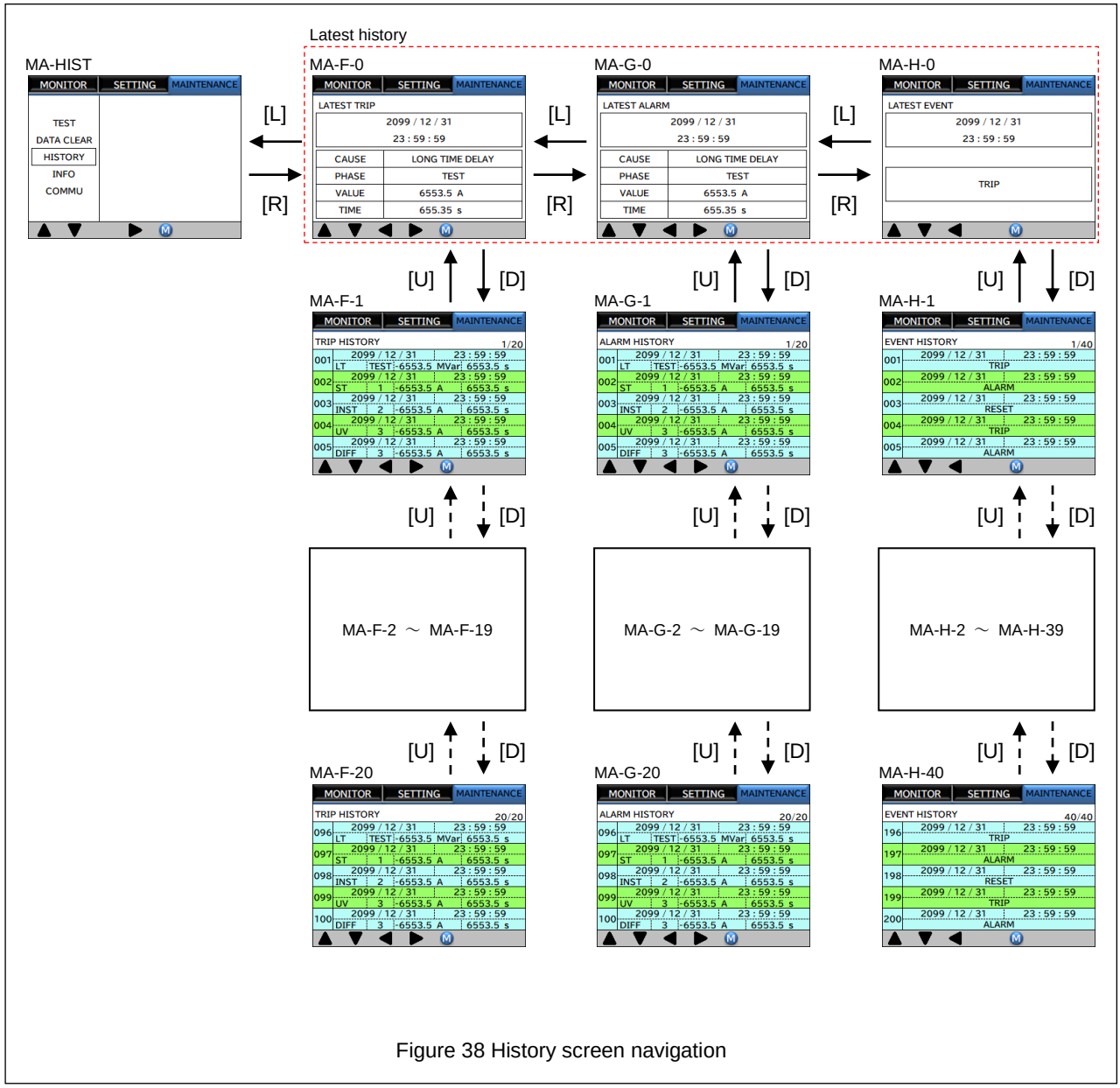


Figure 38 History screen navigation

Table 26 History subscreens

Screen	Display	Item	Remarks
MA-F-0	LATEST TRIP	Trip activation data	This screen displays the occurrence date and time, cause, phase, concerned value, and operating time for the latest trip activation.
MA-G-0	LATEST ALARM	Alarm activation data	This screen displays the occurrence date and time, cause, phase, concerned value, and operating time for the latest alarm activation.
MA-H-0	LATEST EVENT	Event occurrence data	This screen displays the occurrence date and time and description for the latest event that has occurred.
MA-F-1 to 20	TRIP HISTORY	Trip activation history	This screen displays the occurrence dates and times, causes, phases, concerned values, and operating times for the recorded trip activations in chronological order. The user can view only five histories per screen, but can view up to 100 histories by scrolling the screen with the [U] and [D] arrow buttons.
MA-G-1 to 20	ALARM HISTORY	Alarm activation history	This screen displays the occurrence dates and times, causes, phases, concerned values, and operating times for the recorded alarm activations in chronological order. The user can view only five histories per screen, but can view up to 100 histories by scrolling the screen with the [U] and [D] arrow buttons.
MA-H-1 to 40	EVENT HISTORY	Event occurrence history	This screen displays the occurrence dates and times and descriptions for the recorded events in chronological order. The user can view only five histories per screen, but can view up to 200 histories by scrolling the screen with the [U] and [D] arrow buttons.

* For details on how to view the screen contents, refer to "8-9. Display Contents of History and Incident Screens".

8-8. **Change Settings**

When the [E] button is pressed from the previous screen for the first time after moving the menu with the [M] button, the password authentication screen (P.34) is displayed.

8-8-1. **Numerical change**

If the value to be changed is a numerical value, you can change the numerical value of each digit with the [U] or [D] button. The [L] or [R] button is used to move the digit, but if you press the [L] button on the most significant digit, editing is canceled and the screen returns to the transition source screen. Figure 39 shows the screen transition of numerical setting.

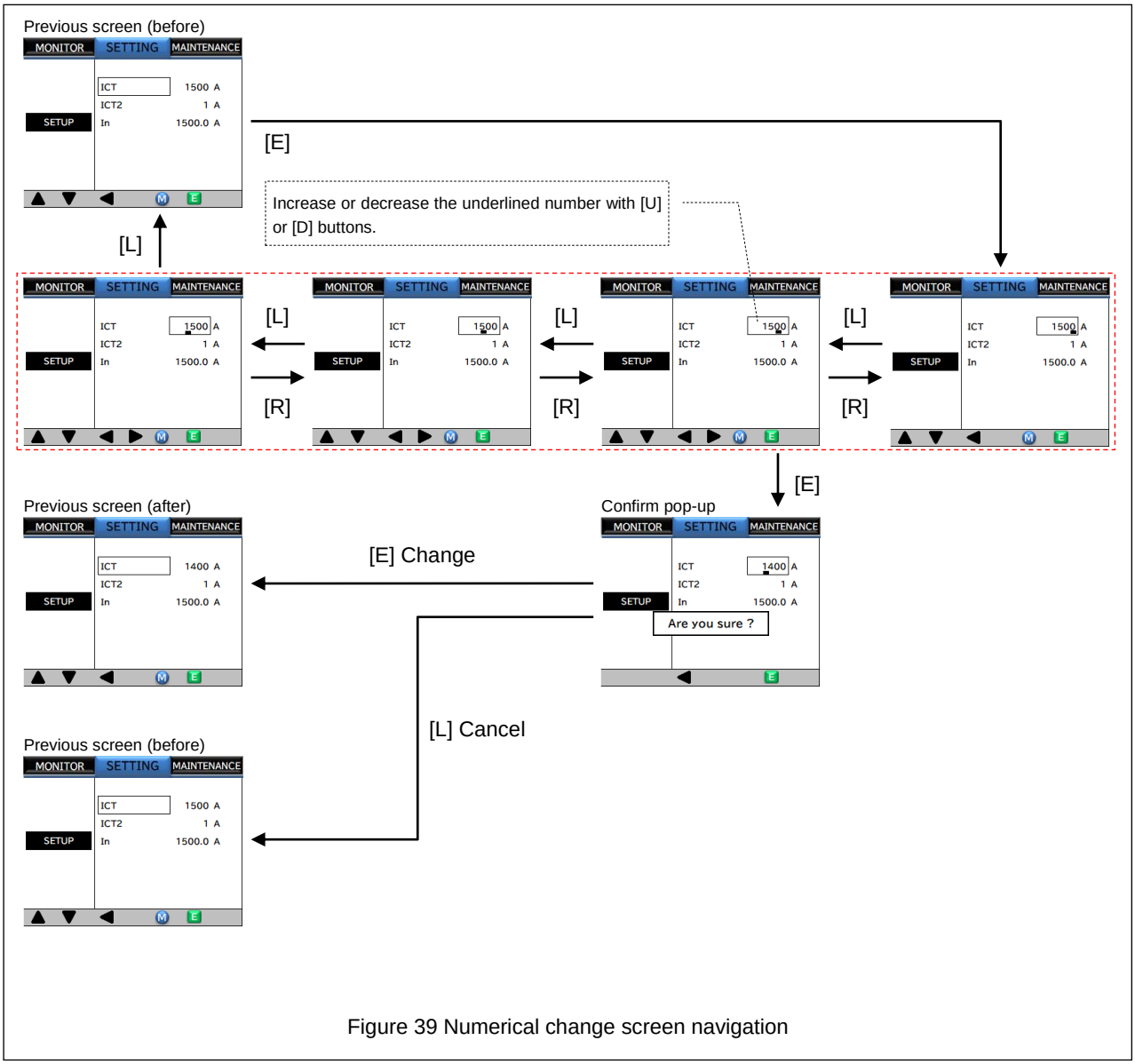


Figure 39 Numerical change screen navigation

8-8-2. **Selection change**

If the value to be changed is in the selection format, switch the selection with the [U] or [D] button. Figure 40 shows the screen navigation of the selection setting.

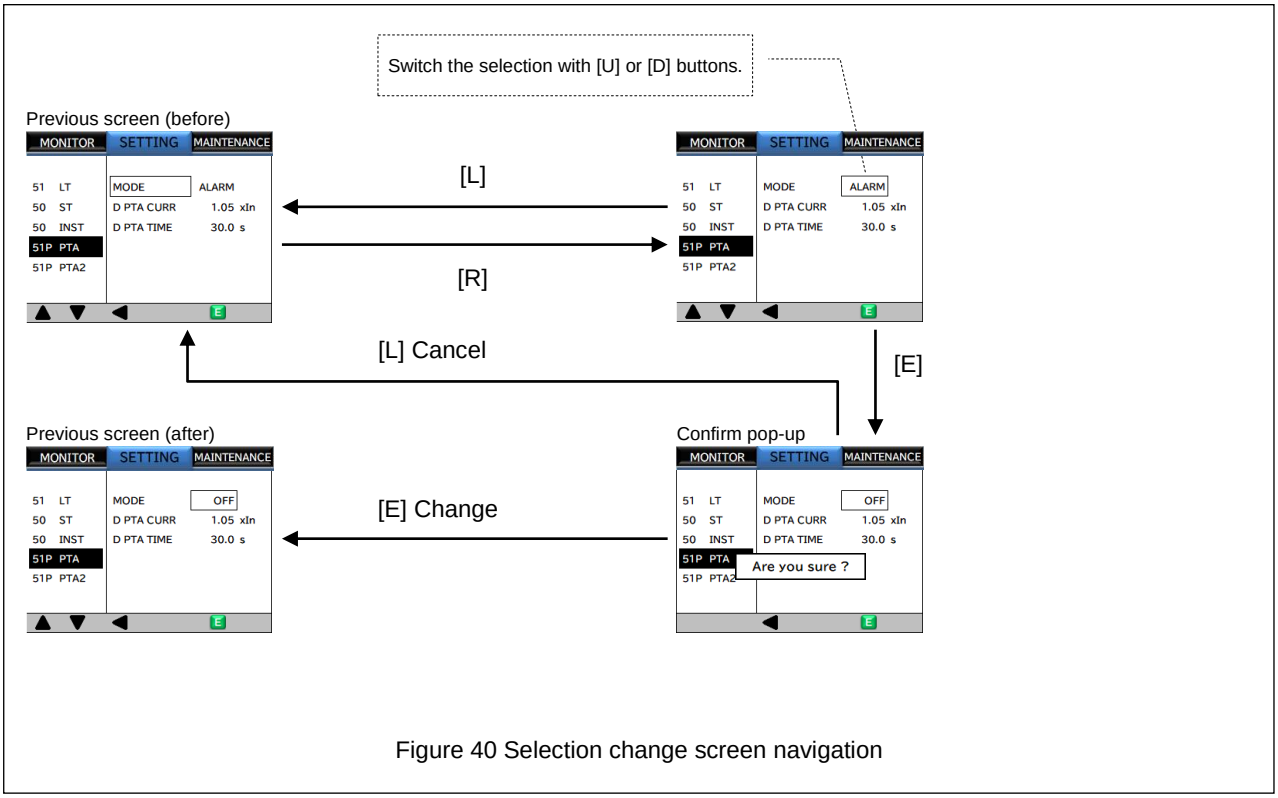


Figure 40 Selection change screen navigation

8-8-3. **Relay Setting Operation**

Figure 41 shows the relay setting screen transitions. Refer to Table 27 for items that are actually displayed on the screen.

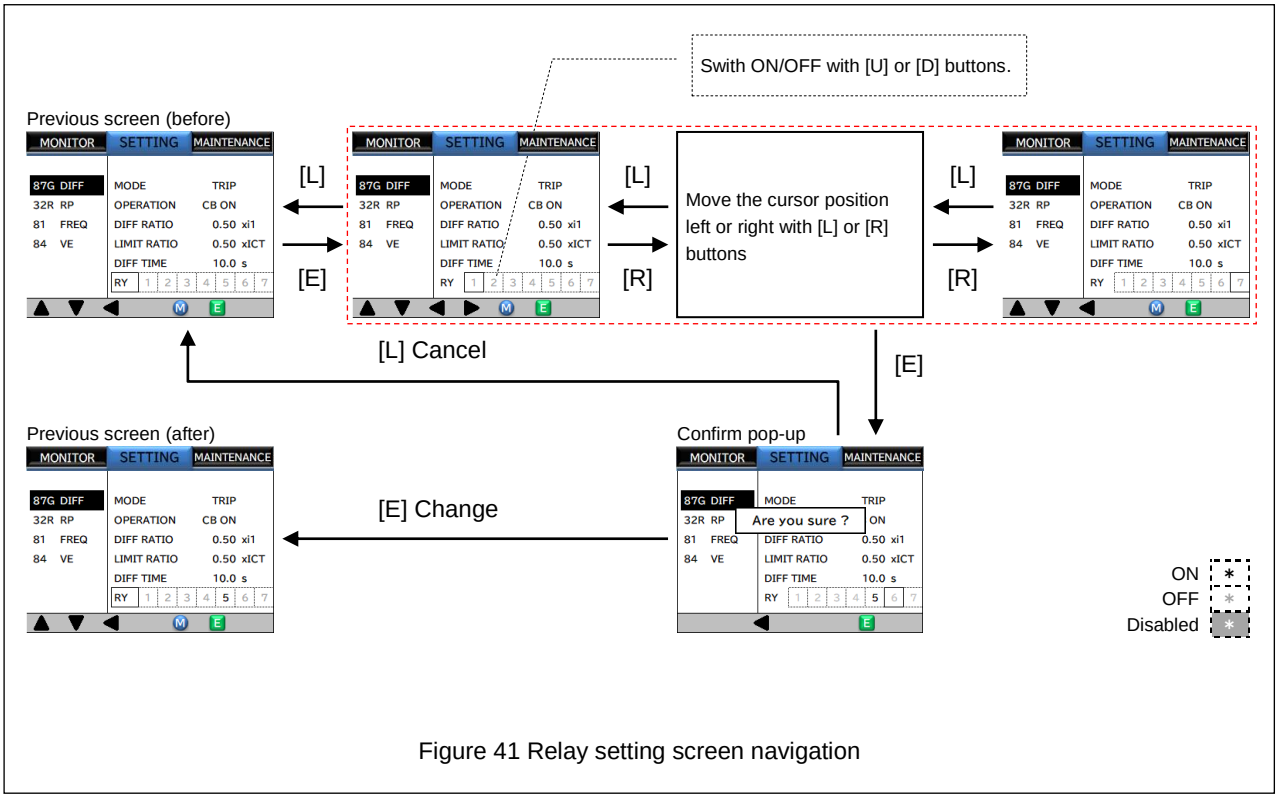


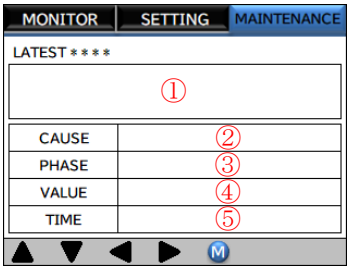
Figure 41 Relay setting screen navigation

Table 27 Relay setting subscreens (RY1 to RY7)

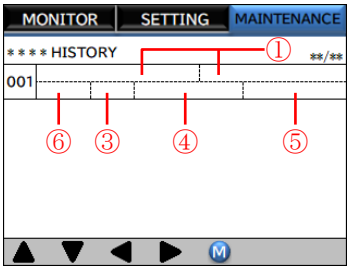
Display	Item	Setting range		STEP	Remarks
		PRS1H-G	PRS1H-F, T		
RY1	Relay 1 selection	OFF / ON		-	-
RY2	Relay 2 selection	OFF / ON		-	-
RY3	Relay 3 selection	OFF / ON		-	-
RY4	Relay 4 selection	OFF / ON		-	-
RY5	Relay 5 selection	OFF / ON		-	-
RY6	Relay 6 selection	OFF / ON*	OFF / ON	-	*: If "P/M RY" in the SU-C-1 screen is set to "RY6", this item cannot be set.
RY7	Relay 7 selection	OFF / ON*	OFF / ON	-	*: If "RY" in the ST-O-1 screen is set to "RY7", this item cannot be set.

8-9. **Display Contents of History and Incident Screens**

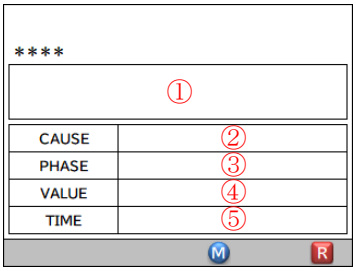
Figure 42 shows the trip/alarm activation history screen and trip/alarm activation incident screen, and Table 28 and Table 29 explain the contents of these screens.



History screen (trip/alarm)



History list screen (trip/alarm)



Accident screen (trip/alarm)

Figure 42 Trip/alarm activation history screen and incident screen

Table 28 Display items in trip/alarm activation history screen and incident screen

No.	Display contents
①	Displays the date and time when the trip or alarm occurred
②	Displays the message for the cause of the trip or alarm activation
③	Displays the phase (1 to 3) where the trip or alarm occurred * For output test, "TEST" is displayed on the incident screen and "Te" is displayed on the history list screen.
④	Displays the value at which the trip or alarm occurred
⑤	Displays the time when the trip or alarm activation was displayed
⑥	Displays the abbreviation of the message for the cause of the trip or alarm activation

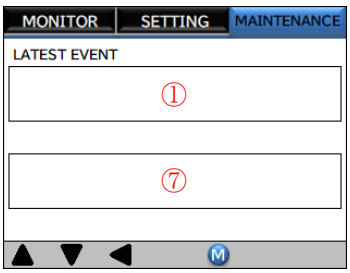
* For messages and the units of value, refer to the following table.

Table 29 Messages and the units of value for the cause of trip or alarm

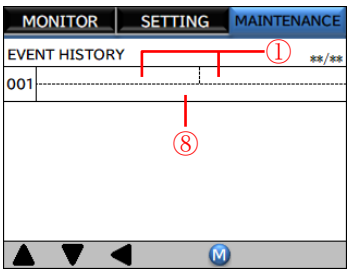
Cause of activation display		Description	Units of incident value	Units of incident time
②	⑥		④	⑤
LONG TIME	LT	Long time-delay tripping activation	A	s
SHORT TIME	ST	Short time-delay tripping activation	A	s
INSTANTANIOUS	INST	Instantaneous tripping activation	kA	-
PRE TRIP ALARM	PTA	Pre-trip alarm	A	s
PRE TRIP ALARM 2	PTA2	Pre-trip alarm 2	A	s
REVERSE POWER	RP	Reverse power	W or kW (*1)	s
NS CURRENT	NS	Negative phase sequence	A	s
UNDER FREQ	UF	Underfrequency	Hz	s
OVER FREQ	OF	Overfrequency	Hz	s
DIFF CURRENT	DIFF	Differential current	A	s
OVGR	OVGR	Ground fault overvoltage	V	s
DGR	DGR	Directional ground fault	mA	s
ARC	ARC	Arc detection	A	-
UNDER VOLTAGE	UV	Undervoltage	V	s
OVER VOLTAGE	OV	Overvoltage	V	s
REMOTE TRIP	RT	External trip	-	-
SYSTEM ALARM1	SYS1	System alarm 1	-	-
SYSTEM ALARM2	SYS2	System alarm 2	-	-
SYSTEM ALARM3	SYS3	System alarm 3	-	-

*1: If the reverse power exceeds 10,000 W, the unit will be changed to kW and any digits after the decimal point will be truncated.

Figure 43 shows the event history screens, and Table 30 and Table 31 explain the contents of these screens.



Event history screen



Event history list screen

Figure 43 Event history screens

Table 30 Event history sbuscreens

No.	Display contents
①	Displays the date and time when the event occurred
⑦	Displays the message corresponding to the event
⑧	Displays the simplified message corresponding to the event

* For messages and their descriptions, refer to the following table.

Table 31 Event messages

Event message ⑦⑧	Description
TRIP	Trip occurred
ALARM	Alarm occurred
REMOTE TRIP	External trip occurred
RESET	Reset command was issued
EARTHING SWITCH ON	Earthing switch input turned ON
EARTHING SWITCH OFF	Earthing switch input turned OFF
RELAY TEST	Relay test was executed
DOUBLE SETTING ON	Double setting switch turned ON
DOUBLE SETTING OFF	Double setting switch turned OFF
CB ON	CB ON
CB OFF	CB OFF
RESET TRIP HISTORY	Trip histories were reset
RESET ALARM HISTORY	Alarm histories were reset
RESET EVENT HISTORY	Event histories were reset
RESET MAX VALUE	Maximum values were reset
RESET DEMAND MAX	Maximum demand values were reset
RESET ACCUMULATED ENERGY	Accumulated electric energy was reset
PRESS RESET BUTTON	Reset button was pressed
DETECTION VOLT ESTABLISH	Voltage establishment was detected
DETECTION MONITORING POWER	Monitored power was detected
NON OPERATION CB	VCB was not activated when a trip occurred
DISCONNECTION SHT CIRCUIT	SHT circuit wiring was broken
DISCONNECTION ARC SENSOR	Arc sensor connector wiring was broken

8-10. **Responses to Abnormal Events**

- If internal CT circuit wiring is broken or another similar problem occurs, the system will blink the CPU lamp without outputting data. If the problem is resolved, the system will be reset automatically. Even if automatic reset does not occur, the system may be returned to normal operation by power cycling. If the system is still not restored, contact us.
- If an error occurs in the protective function or monitoring function, the self-diagnostic output terminal (21 - 22) will start contact output. If the function is restored normally, the contact output will stop.
- In the following cases, values (set values or recorded values) are displayed as "---".
  - Values outside the setting range for each setting item
  - Values within the setting range for each setting item that deviate from the specified step

  However, when such values are set, they may be displayed normally by pressing the [U] or [D] arrow button so that the value falls within the setting range. If values are not displayed normally, contact us.

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Published in Apr. 2021

Revised in Jan.2024

KRB-5433d