



V111 PROTECTIVE RELAY TESTER

RX 4717K

INSTRUCTION MANUAL

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RX 4717K
V111 PROTECTIVE
RELAY TESTER

Instruction Manual

V111 PROTECTIVE RELAY TESTER

———— **Forward** ————

Thank you so much for procuring RX4717K V1I1 PROTECTIVE RELAY TESTER. At the outset, please take a few minutes to read the Safety Precautions indicated in this manual in order to use this equipment safely and correctly.

■ **Warning and Caution notices**

The following Warning and Caution notices appear in this manual. These must be observed in order to protect both the user from physical harm and the equipment from damage.



Warning

Risk of serious and possible fatal physical injury from electric shock or other cause.



Caution

Risk of damage to the equipment.

■ **Manual composition**

Please read Section 1 before using the equipment for the first time.

Section 1. Overview

Describes an outline, features, applications, functions and an outline of the principle of operation of the RX4717K.

Section 2. Preparation

Required preparatory work before installing and operating the equipment.

Section 3. Description of panel and basic operation

Describes the functions, operations and basic operations of the dials on the panel.
Read while operating the equipment.

Section 4. Practical operation

Describes further operations.

Section 5. GPIB interface

Describes remote control by the GPIB.

Section 6. RS-232C interface

Describes remote control by the RS-232C.

Section 7. Troubleshooting

Corrective measures when error messages or abnormalities occur.

Section 8. Maintenance

Describes the methods of storage, repacking, transportation and performance tests.

Section 9. Specifications

Equipment specifications (functions and performance) are described.

———— Safety Precautions ————

Observe the following warnings and cautions in order to use this equipment safely. No responsibility or warranty is assumed for damages arising from use in a manner contrary to these warnings and cautions.

■ Observe text instructions

This manual has been compiled in order to enable safe operation and use of this equipment. Be sure to read this manual before using the equipment.

Items designated by warning advice of serious physical hazards. Be sure to observe them carefully.

■ Be sure to connect to ground

Since the unit includes a built-in filter, there is risk of shock if used without grounding.

To prevent getting an electric shock, securely connect the equipment to a ground providing a resistance to ground of 100 ohms or less according to the electrical installation technical standard.

Be sure to properly connect the ground. By connecting the 3-conductor power cable to a grounded 3-terminal wall socket, the equipment is automatically grounded.

When using a 3-pole-to-2-pole conversion adapter, be sure to connect the grounding wire (green) of the conversion adapter to the grounding terminal next to the receptacle or to connect the grounding terminal on the left side panel to the wire of 2mm² or greater.

■ Confirm power source voltage

This equipment operates at a supply voltage described in “Grounding and power supply connection” in the operation manual.

Before connecting this equipment, check that the proper voltage is being supplied to the wall power outlet.

■ Smoke, odor, noise

In event smoke, peculiar odor or noise is emitted, immediately disconnect the power source and **avoid further operation**.

Whenever such an abnormality occurs, prevent the equipment from being used until it is completely repaired and immediately contact us or our sales agency.

■ Pay special attention when removing covers

This equipment has internal dip switches which allow to prohibit/permit the functions such as “output on all together” and “waveform-switch +DC/-DC”. When these settings need to be changed, the top cover needs to be removed. Note that a dip-switch on the top of the PCB only is set up at this time.



Warning

Disconnect the power cable before removing the top cover.

This equipment contains dangerously high voltages. Do not touch other than the dip-switch.

■ Flammable gas

Do not use this equipment in the presence of flammable gas. There is danger of fire and explosion.

■ Do not modify

Do not use parts other than specified by the manufacturer and by no means attempts to modify the equipment.

There is risk of personnel hazard and damage to the equipment. The manufacturer reserves the option of refusing service in such cases.

■ Safety related symbols and indications

Following are general definitions of the symbols and indications used on the product.



Operation manual reference symbol

Advises of possible hazard to the user, as well as the need to consult this manual when using an operation or function.

Caution

Symbol indicating danger of electric shock

High Voltage

This symbol is posted in places posing danger of electric shock in the particular conditions.



Protective grounding terminal symbol

This symbol appears on a terminal that needs to be grounded to prevent electric shock.

Before operating the equipment, be sure to connect this terminal to a ground providing a resistance to ground for 100 ohms or less.

(Connecting the 3 conductor power cable to a 3-terminal wall socket with grounding eliminates the need to ground this grounding terminal.)

■ Other symbol



This symbol indicates that the external conductor of the connector is connected to the case.



Warning

This equipment is to measure and maintain a protective relay, and is intended to be operated by professional users who are engaged in maintenance work at power stations or substations, etc. and have a thorough understanding of safety. This equipment is therefore designed giving priority to functionality and operability over safety compared to general measuring instruments. When operating, pay special attention to safety to prevent accidents, etc.

Be extremely careful with the following:

- The power input terminal on the left side (AC85V-115V, AC180V-240V) is to be used when the supplied power cable is missing. When using the power input terminal, be extremely careful not to receive electric shock.
- A voltage of a maximum of 250Vrms is output to the voltage output terminal on the front panel. When operating the product, be extremely careful to avoid accidents such as electric shock.

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1. General Description

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1.1 Overview

The “RX4717K V1 • II Protective Relay Tester” is the test equipment to test protective relays used for power stations and substations, etc.

The RX4717K is a small, light and multi-function protective relay tester combining a digital direct synthesis type synthesizer, constant voltage output amplifier, single-phase constant current output amplifier and microcomputer.

Quickly changing or sweeping the output frequency, output amplitude or output phase of a single RX4717K unit makes it possible to measure its operation time (dynamic characteristics) and operation values (static characteristics) of a protective relay.

The RX4717K comes with an RS-232C and GPIB allowing a personal computer to externally control them for automatic measurement of the protective relay.

The power supply voltage is 85V to 115V or 180V to 240V. It also uses a power factor improving circuit as countermeasures against current harmonics, allowing use of the product with low current consumption.

Our protective relay testers include model name which contains two or three alphabets at the beginning of the name such as REX4707A and RX4717K and those 4707A without alphabets. The model, which contains the same 4-digit number and one alphabet following the number, has the same specifications.

The following protective relay testers belong to the same RELAY EXPRESS series which allow connection as master-slave links. They are hereinafter called “this series”.

4707, 4707A, REX4707A, 4708, 4708A, REX4708A, 4709, 4709A, REX4709A, 4710, 4710A, REX4710A, RX4717K, RX4718W, 4722, REX4722, REX4723, 4741, REX4741, As518

This series also include the following current output amplifiers even though they don't have control function by master-slave links. **4731, REX4731, As535**

1.2 Features

- Small (JIS rack size), light (19kg)
- Simultaneous output of voltage (range of 40V, 125V, 250V) and current (range of 0.4A, 4A, 20A) respectively with a single unit
- A built-in timer allows the single RX4717K unit to measure dynamic characteristics.
- High-accuracy panel display of the output amplitude/phase and set values allows the single RX4717K unit to measure static characteristics
- A built-in 10Hz to 200 Hz synthesizer allows a single RX4717K unit to measure frequency relays.
- Master/slave connection is possible with a single cable, facilitating multi-phase implementation.
- 32 panel setting memories facilitates calling up of set values.
- Standard equipment of the GPIB and RS-232C allows control by a computer.
- Use of a power factor improving circuit for the power supply reduces current harmonics with low current consumption.
- Allows quick change or operation in synchronization with the **4705A**

1.3 Function list

■ Amplifier

Completely isolated (withstand voltage: 500Vrms) single-phase voltage outputs (3 ranges of 40V, 125V and 250V) and single-phase current outputs (3 ranges of 0.4A, 4A and 20A).

■ Output changer

Front terminals

Side terminals (3-phase 4-wire connectors for voltage output and current output)

Grounding, short-circuiting

■ Output On/Off

Individual On/Off, or all of output On/Off all together (this function is enabled/disabled by the internal dip switch)

■ Amplifier signal output

Internal and external output (in case that the booster is used for the external output signals.)

■ Frequency mode selection

Internal (10.000-200.000Hz), 50Hz fixed, 60Hz fixed, line synchronization, external synchronization

■ Waveform selection

Sine wave, +DC/-DC (this function is enabled/disabled by the internal dip switch)

■ Amplitude and phase (normal value and fault value)

Amplitude setting: voltage : 0.000-250.00V, current : 0.00000-20.000A

Phase setting: voltage and current are set as 0 to 359.9 ° respectively (in case of the negative setting for phase is available, -359.9)

■ Master/slave

Separate, master, slave

Operation mode

Manual mode :

(quickly changed by the normal and fault instruction key on the front panel. The timer does not operate.)

Quick change mode : (quick change control function and timer function is valid.)

Hold quick change :

(simulation of permanent fault, the output value of fault value holds after quick change.)

Non-hold quick change :

(simulation of arc fault, normal \Leftrightarrow fault are occurred always synchronized with trip signal.)

Simultaneous measurement mode of operation and recovery :

(operation/recovery time is measured simultaneously)

Sweep operation :

Sweep : (one sweep and manual sweep by modify is available.)

Search sweep : (operation points of digital protective relays are measured by plural sweeps.

DSK search sweep : (operation points of disk protective relays are measured by plural sweeps of the specified number of times.

95 test mode : (test of frequency relay)

■ Quick change control function (valid when the operation mode is quick change mode.)

Quick change start phase (quick change is started by the phase set with respect to internal reference phase).

0-359.9°, On/Off of the function

Pre-trigger time (quick change starts after the setting time from quick change start command.)

10-6000ms, On/Off of the function

Fault duration (forced to normal value after the setting time elapsed from quick change start.)

0.001-65.000s, On/Off of the function

■ Time function (valid when the operation mode is quick change mode)

Timer mode

Interval (measures the time from the start of a quick change to the trip signal)

One-shot (measures the operation width of a trip signal)

Train (measures the total time of operation width of a trip signal)

Start measurement (measures the time from the start signal to the trip signal)

Timer setting

Timer clear

Auto (the timer value is automatically cleared when quick change operates.)

Manual (the timer value is cleared by pressing Clear key.)

Automatic

ON : (return to the normal value by the trip signal.)

OFF : (not return to the normal value by the trip signal. The fault value is retained)

■ Trip input

Logic setting of the trip signal

Chatter removal time for the trip signal

1-100ms, On/Off of the function

■ Operation start input

Logic setting of the operation start signal

Stop setting (the output is recovered to the normal value with recovery of the operation start signal.)

Use/disuse of the function

■ Control output to control this series 4731

■ Extended external response input

The trip input can be extended up to 255 channels using the optional expansion box.

■ Control-power output (DC110V)

Output On/Off

■ PSW mode (Set the function of the fault command key of on the front panel)

Alternate -----(the fault is retained once it is pressed),

Momentary---- (fault when pressed and normal when released)

■ Beep sound setting

On/Off

■ Panel setting memory

Read, write, comment input, read of 50Hz/60Hz initial value

■ Interface

GPIB, RS-232C

1.4 Principle of operation

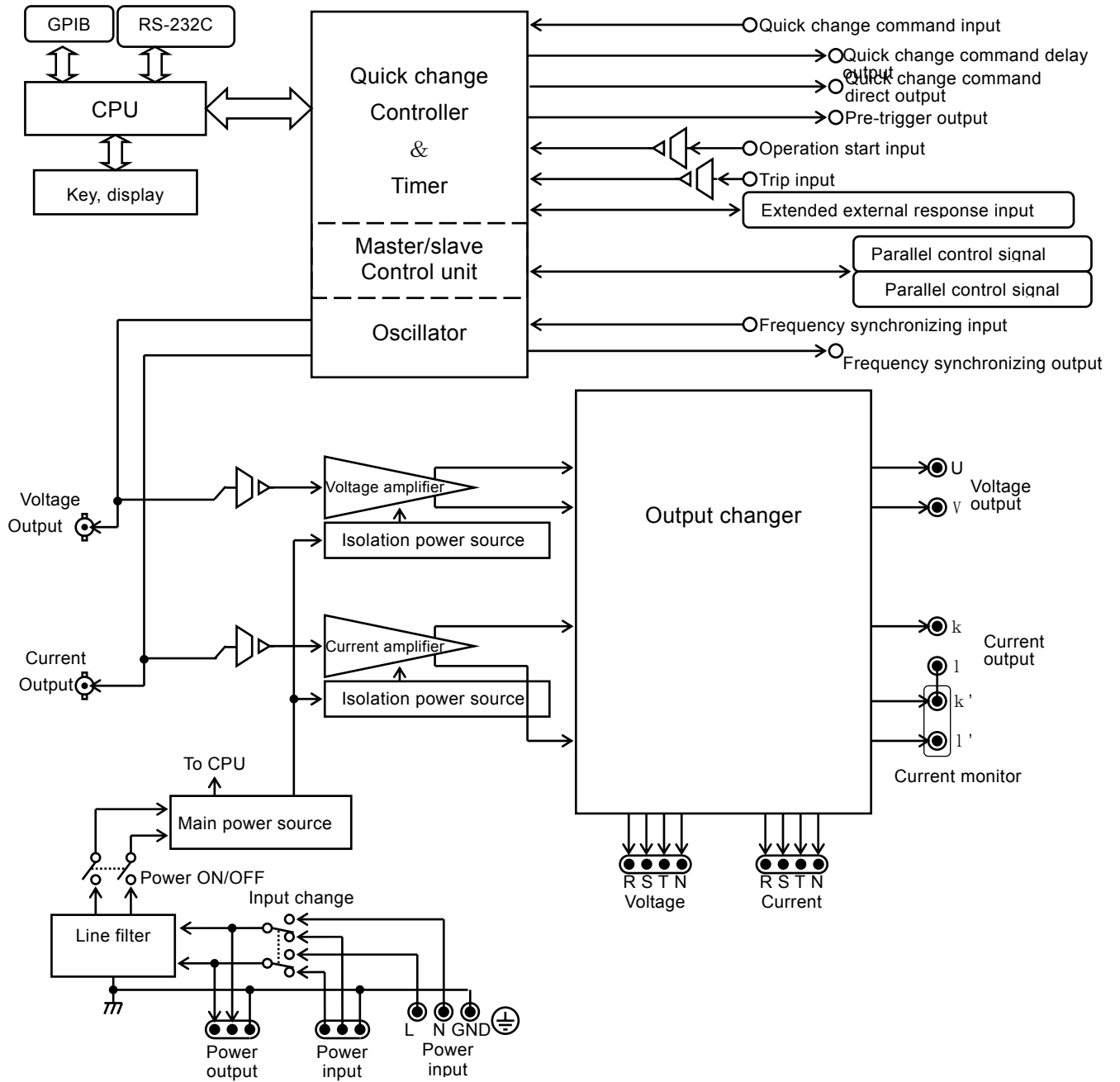


Figure 1-1 Block diagram

■ CPU

CPU controls the overall operation of the RX4717K. In the event of power interruption the RAM retains the content with a battery and the values set at the last shutdown are called up when the power is turned on.

■ Quick change controller and timer

A TRIP INPUT signal and START INPUT signal are isolated and applied into the quick change control where these signals are subjected to normal/fault quick change control.

The timer measures the operation time under the control of the quick change controller.

■ Master/slave control unit

Quick change operation and synchronization of output frequency between the master and slave are controlled.

■ Oscillator

The oscillator uses a digital direct combination type synthesizer (DDS). The DDS allows setting the waveform, amplitude and phase individually, and in the quick change operation the signal waveform with high degree of freedom can be created by the settings.

■ Voltage amplifier and current amplifier

The voltage amplifier output and the current amplifier output are isolated from line input, enclosure, input signal and each other.

■ Output changer

There are output terminals on the front panel and side panel of the unit.

The voltage amplifier and current amplifier output signals are led to output-terminals which is set by output setter.

■ Main power supply

The main power supply supplies the necessary power to the CPU and isolation power supply of each amplifier. It uses a power factor improving type converter to improve the power factor.

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2.1 Check before use

■ Safety check

Read the following items in the operation manual before use to secure the safety of users.

- Safety precaution (described in the beginning of this operation manual)
- 2.4 Grounding and power supply

■ Unpacking and repacking

Make sure that there is no damage caused by accidents during transportation.

Check the name and number of accessories listed below before installing the instrument.

Table 2-1 Configuration

Item	Quantity
●RX4717K unit	1
●Operation manual	1
●Accessories	
Power cable (one-end arrow type crimp-style terminal)	1
Power cable (with one-end 100V receptacle)	1
3-pin-to-2-pin conversion adapter	1
Daisy-chain power cable	1
Three-phase four-wire voltage output cable	1
Three-phase four-wire current output cable	1
Master/slave daisy-chain control signal cable	1
External signal cable (BNC-banana chip)	2
Accessory cable bag	1

When repacking the equipment for purpose of transportation, make sure to insert the cushioning materials sufficient to support the weight in the box with the appropriate strength and room in order to protect the equipment sufficiently.

2.2 Installation location

■ Installation location

Place the equipment so that four rubber legs of the bottom or the back are secured on the flat surface such as a table.

The weight of each unit is approximately 19kg. Install it on a strong and flat place bearing the total weight.

⚠ Caution

When using two or more of equipment in this series piling one atop another, the structural limit is 4 units or less.

■ Conditions of installation location

- Install where the temperature and humidity meet the following allowable ranges.
 - Performance guarantee : +15 to +35°C, 5 to 85%RH (no condensation)
 - Operation guarantee : 0 to +40°C, 5 to 85%RH (no condensation)
 - Storage condition : -10 to +50°C, 5 to 95%RH (no condensation)
- This equipment uses fans for the cooling.
 - The air inlets/outlets are located on the right and left sides.
Secure a space by at least 10cm from the wall, etc. for ventilation.
 - When you notice that the fans are stopped,
Cut power off immediately and inform us or our distributors. Using the equipment with the fans stopped may worsen the damage to make the repair harder.
- Avoid installing the equipment in the following locations.
 - Where excessive noise is included in the commercial power source.
If excessive noise is included in the commercial power source, noise is superposed on the output signals to make the specification less reliable. Use the commercial power source with less noise.
 - Where flammable gas exists.
The risk of explosion is involved in such places. Never install or use the equipment in such places.
 - Outside, where the equipment is exposed to direct sunlight, and near fire or heating sources.
Installing in such places may deteriorate the performance or cause malfunction of the equipment.
 - Where corrosive gas, water, dust, metal powder and salt content exist and the place with high humidity
Installing in such places may cause corrosion or malfunction of the equipment.
 - Near the source of electromagnetic field, high-voltage equipment, power lines and the source of pulse noise
Installing in such places may cause malfunction.
 - Where vibration frequently occurs
Installing in such a place may cause mal-operation or malfunction.

2.3 Setting of internal dip switch

This equipment contains the mode which outputs the DC voltage to test the DC relay. It also contains the function enabling to turn on and off the output at once to improve the operationability.

Such functions can broaden the range of application for this equipment but some may involve risks depending on the usage and be unnecessary in many cases. Therefore, enabled/disabled setting of these functions can be selected individually by setting the internal switch.

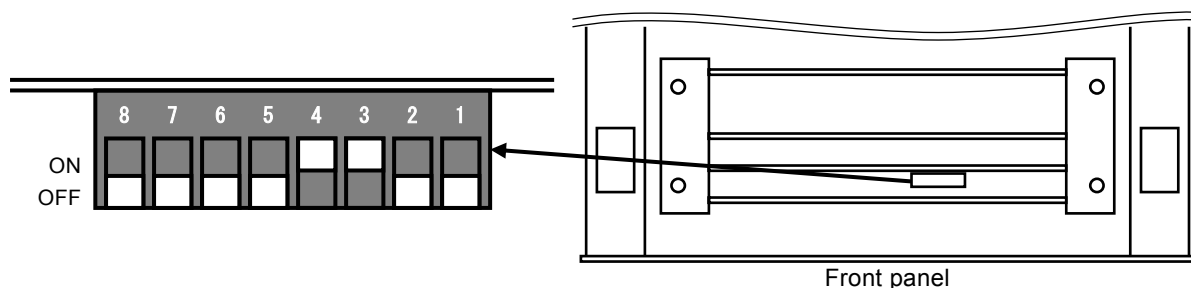
The factory setting is “disable” for DC output and “enable” for output ON/OFF function.

To change this setting, remove the top cover and change the dip switch setting on the top of the PCB indicated below.

Warning

Be sure to remove the power cable when removing the top cover.
This equipment contains some high-voltage parts. Never touch any other parts except for the dip switch.

The internal dip switch is set as shown below. Change the setting if necessary.



No	Description	Setting detail: *indicates the factory setting.
1	When the equipment is a master, all-output-ON-control-signal is sent to the slave.	ON(disable)/*OFF(enable)
2	All-output-ON-operation of this equipment	ON(disable)/*OFF(enable)
3	Wave select +DC/-DC function	*ON(disable)/OFF(enable)
4	When Amplifier output on/off key is OFF, signal amplitude of external signal output terminal set to "0 Vrms"	*ON(disable)/OFF(enable)
5-8	Unused	*OFF

Figure 2-1 Setting of internal dip switch

2.4 Grounding and power supply

■ Grounding

Warning

Since the unit includes a built-in filter, there is risk of shock if used without grounding. To prevent electric shock, securely connect the equipment to a ground providing a resistance to ground of 100 ohms or less according to the electrical installation technical standard.

- When the supplied power cable with 100V receptacle is used, connect the 3-conductor power cable to the grounded 3-terminal wall socket.
When the 3-pole-to-2-pole conversion adaptor is used for the 3-terminal wall socket, connect the grounding wire (green) of the conversion adaptor to the grounding terminal next to the receptacle.
- When the supplied power cable (one-end arrow type crimping terminal) is used, ground the grounding wire (green).
- Connect the grounding terminal on the left side panel by the wire of 2mm² or greater.

■ Power supply

Caution

Before connecting the power supply, check that the line voltage meets the rated power supply voltage of the equipment.

- The power supply specification of the RX4717K is as shown below.

Voltage	AC85V-115V, AC180V-240V
Frequency	48Hz-62Hz
Maximum electric power consumption	800VA

Use the supplied power cable to supply the power to the equipment. A terminal is provided on the left side for emergency at the site where the equipment is transported and the supplied power cable is not available.

The RX4717K can be operated by supplying the power to the terminal. When using this terminal, set a slide-switch position to the terminal position.

Warning

Note that this terminal is for emergency use only.
Since there is danger of causing electric shock, etc., avoid using this terminal all the time.

2.4 Grounding and power supply

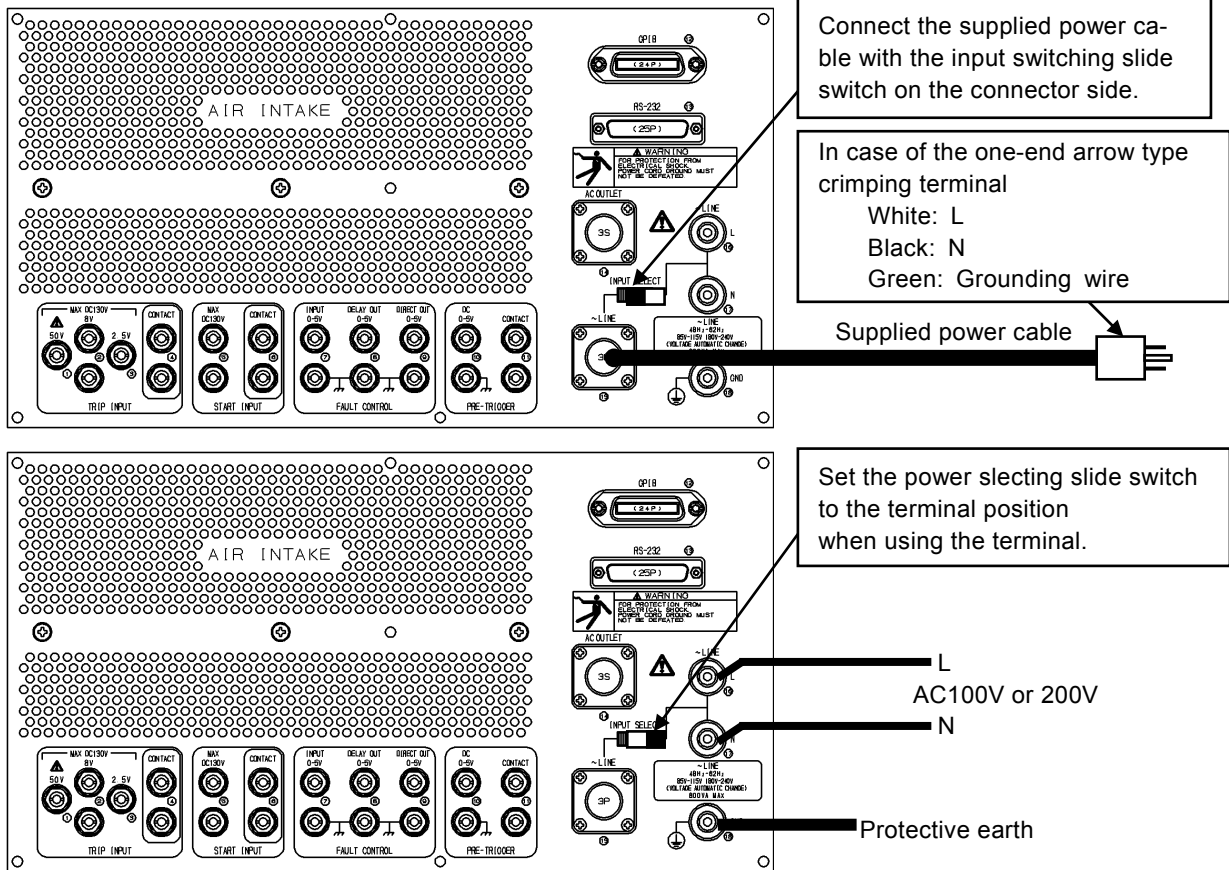


Figure 2-2 Connection of power cable

The RX4717K has a power output connector connecting in parallel with the power input. When two or more units of this series are used, use the supplied daisy-chain cable and connect the power output connector of the RX4717K to the power input connector of other equipment.

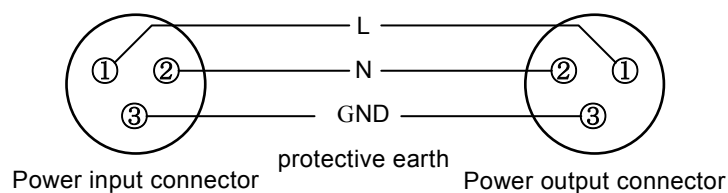


Figure 2-3 Pin connection of power input connector and power output connector

⚠ Caution

The maximum current capacities of the power input connector and the power output connector are 15A. Use under the range of capacity.

3. Description of Panel Controls and Basic Operation

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3.1 Name and function of each part of the panel

This manual uses the following indications.

Names on the keys and function names indicated on the key top :

GPIB LOCAL, MEMORY No

Names of the function indicated in orange under the key :

OTHER FUNC, READ

Names of LED (excluding the keys with LED) :

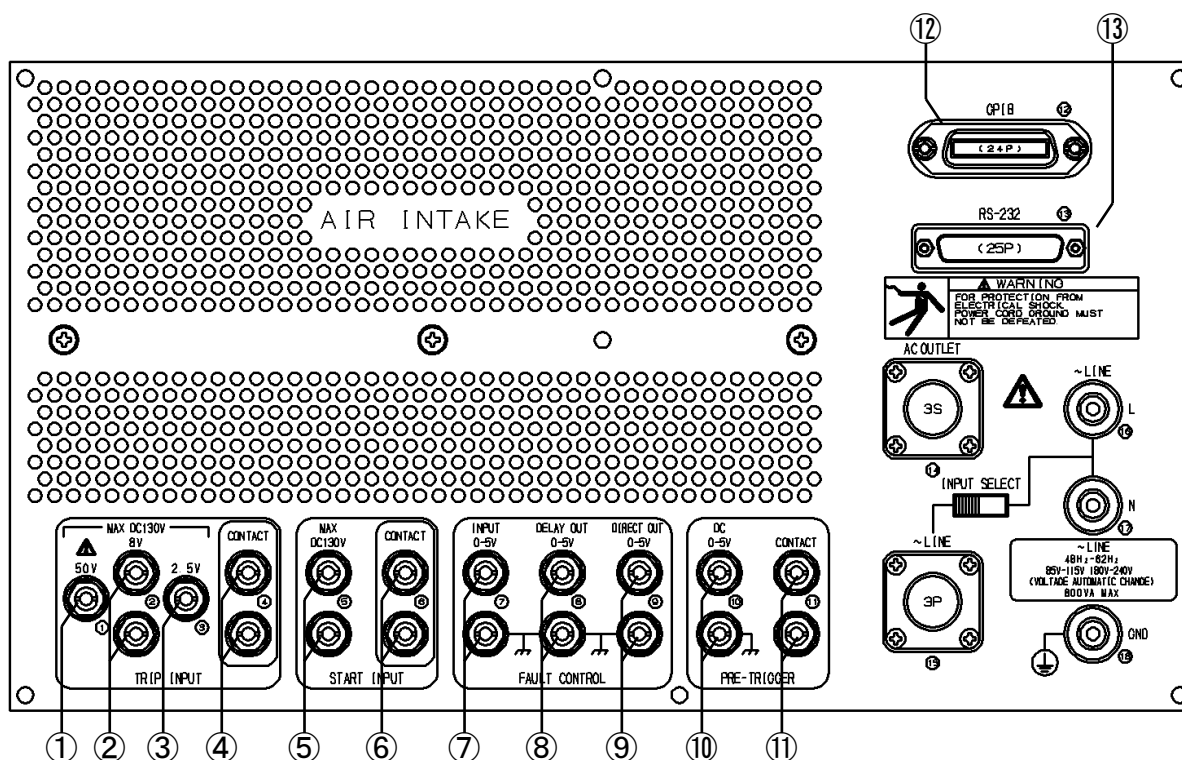
<Over>, <Trip signal>

Some names in the fluorescent display : **【Setting/Data】**, **【Operation mode】**

Display on the fluorescent display :

[ROM CHECK ERROR], [Sine wave]

3.1.1 Left side panel



①-④ TRIP INPUT(floating)

☞ “3.5.1 Trip input and operation start input”

This terminal receives operation signal input of a protective relay.

The maximum allowable voltage is +130V DC. (① to ③ : voltage input, the lowside terminal of ② is common)

The withstand voltage to the chassis is 354V peak (250Vrms).

- | | |
|---------------------------------------|---|
| ① Threshold voltage of +50V terminal | High level: +50.0V
Low level: +40.0V |
| ② Threshold voltage of +8V terminal | High level: +8.0V
Low level: +5.0V |
| ③ Threshold voltage of +2.5V terminal | High level: +2.5V
Low level: +1.0V |

④ is a contact-input with the open-circuit voltage of +5V and the short-circuit current of 10mA.

⑤⑥ START INPUT (floating)

☞ “3.5.1 Trip input and operation start input”

This terminal receives the signal input to start the quick change/sweep operation externally.







The withstand voltage to the chassis is 354V peak (250Vrms).

- ⑤ is a voltage-input with the allowable maximum input voltage of DC+130V.
- | | |
|-------------------|---------------------------------------|
| Threshold voltage | High level: +2.5V
Low level: +1.0V |
|-------------------|---------------------------------------|

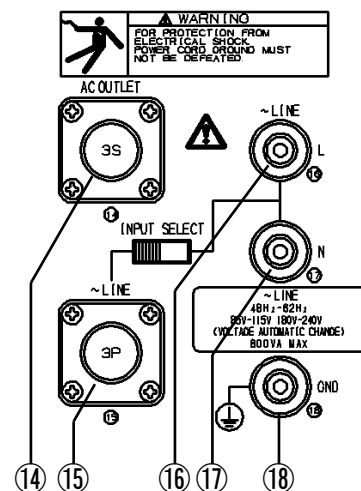
⑥ is a contact-input with the open-circuit voltage of +5V and the short-circuit current of 10mA.

**Caution**

Don't apply the voltage to the contact input(④ and ⑤), or the contact may be damaged.

- ⑦ **INPUT (Chassis potential)**  “4.4.2 Synchronization of quick change operation”
 These terminals, used for inputting signals to control the normal/fault output of RX4717K at 4705A, etc. Although these signals change the output to normal or fault, they do not trigger the timer.
 Threshold voltage High level: +2.5V
 Low level: +1.0V
 The allowable maximum input voltage DC+130V
- ⑧ **DELAY OUT (Chassis potential)**  “3.5.3 Operation of quick change mode”
 These terminals, used to output signals that change when the REX4708AW output quickly changes, becomes Low when in a FAULT condition.
 A "Low" of TTL level signal is in fault condition.
 It is used to controls the normal/fault condition of 4705A, etc. simultaneously.
- ⑨ **DIRECT OUT (Chassis potential)**  “3.5.3 Operation of quick change mode”
 This is a signal that changes just after operation command(start-input⑤, ⑥, or command key⑤④) is applied.
 It is a TTL level signal and becomes Low when in a FAULT condition.
 When the fault delay time (pre-trigger time) and the fault start phase has been set, at first ⑨ Direct-out becomes Low, and after the fault delay time elapses, amplifier output turns fault state from normal state at the timing of the fault-start-phase,
 and ⑧(Quick-change-command-)Delay-output becomes Low.
- ⑩⑪ **PRE-TRIGGER OUT**  “3.5.3 Operation of quick change mode”
 These terminals outputs signals (TTL level, contact) to activate the oscilloscope.
 The signal becomes Low on quick change starting.
 The signal returns to High 0.1 second after the output returns to NORMAL state.
 ⑩ is TTL level signal (chassis potential), and ⑪ is a contact signal (floating).
 ⑪ contact signal has the withstand voltage to the chassis is 354Vpeak (250Vrms).
- ⑫ **GPIB (Chassis potential)**  “5.1.1 GPIB specifications”
 This is a connector to control GPIB.
- ⑬ **RS-232C (Chassis potential)**  “6.2.2 Connector and signal line”
 This is a connector to control RS-232C.

3.1 Name and function of each part of the panel



⑭ POWER OUT (floating)

☞ “2.4 Grounding and power supply”

This is an output connector connected in parallel with the power input of the RX4717K. The withstand voltage to the chassis is 2121V_{peak} (1500V_{rms}).

When two or more units of this series are used, use the supplied daisy-chain cable to connect the power input connector of other equipment.

⑮ POWER INPUT (floating)

☞ “2.4 Grounding and power supply”

This is the connector for power input. The withstand voltage to the chassis is 2121V_{peak} (1500V_{rms}).

The supplied power cable is used. When this connector is used, set the input switching slide switch to this connector side.

⑯⑰ POWER LINE (floating)

☞ “2.4 Grounding and power supply”

This is the emergency power input terminal when the supplied power cable is missing. The withstand voltage to the chassis is 2121V_{peak} (1500V_{rms}).

When this terminal is used, set the input switching slide switch to this terminal side.

⑱ GND (grounding terminal)

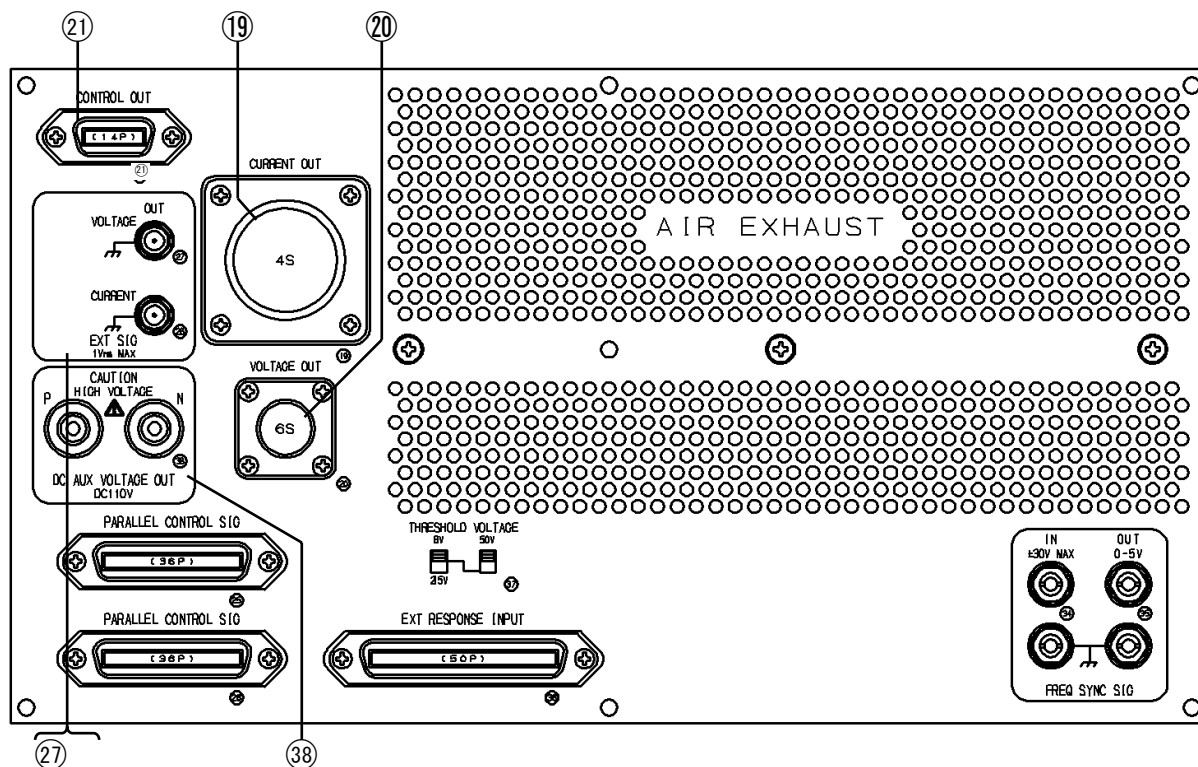
☞ “2.4 Grounding and power supply”

This is the protective grounding terminal which is connected to the chassis.

⚠ Warning

Power input terminals of ⑯ and ⑰ are for emergency. Avoid using them all the times because of the risk of electric shock.
Always ground to be safe.

3.1.2 Right side panel



②① **CONTROL OUT (Chassis potential)** ☞ “4.5 Connection with a current output amplifier 4731”

This is the connector to control the current power amplifier 4731.

①⑨ **CURRENT OUT (floating)** ☞ “3.3.4 Output changer”

This is the output connector of the current output.

The withstand voltage to the chassis is 707Vpeak (500Vrms).

②① **VOLTAGE OUT(floating)** ☞ “3.3.4 Output changer”

This is the output connector of the voltage output.

The withstand voltage to the chassis is 707Vpeak (500Vrms).

③⑧ **DC AUX OUT DC110V (floating)** ☞ “3.6.3 Operation of control power output”

This is the output terminal with voltage of DC119V and the current capacity of 0.5A.

It is also used as a power source of the protective relay.

The withstand voltage to the chassis is 707Vpeak (500Vrms).

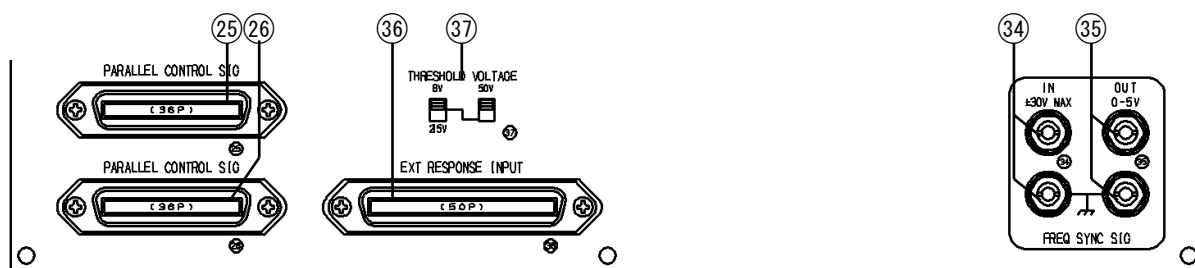
②⑦ **EXT SIG OUT (chassis potential)** ☞ “4.2 Amplifier signal selection”

"OUTPUT" is the signal output terminal that the internal synthesizer signal is output.

The range full scale output level is 1Vrms.

This signal is used for drive the external amplifier.

3.1 Name and function of each part of the panel



②⑤ ②⑥ PARALLEL CONTROL SIG (chassis potential) ☞ “4.1.2 Master / slave connection”

This is a connector connected for master/slave operation. ②⑤ and ②⑥ are connected in parallel.

③⑥ EXT RESONSE INPUT (floating) ☞ “4.3 Operation of extended response input”

This is the connector connecting the expanded response input box (optional) to expand the trip input up to 255 channels. The input of the expanded response input box is connected to the trip input of ① to ③ according to the ③⑦ threshold voltage. The withstand voltage of the response input terminal is 354V_{peak} (250V_{rms}) against the chassis. (The logic control terminal is a chassis potential.)

③⑦ THRESHOLD VOLTAGE ☞ “4.3 Operation of extended response input”

This is a switch to set the threshold voltage for the response input of ③⑥ expanded external response input.

③④ FREQ SYNC SIG IN (chassis potential) ☞ “3.4.1 Frequency setting”

This is a signal input to bring the frequency of RX4717K into synchronization with the external signal and used when the frequency mode is the external sync setting.

The falling edge of TTL level signal will have a phase of 0°.

The allowable maximum input voltage is DC ±30V.

It is used to bring the frequency of the RX4717K into synchronization with our 4705A.

Threshold voltage	High level: +2.5V
	Low level: +1.5V

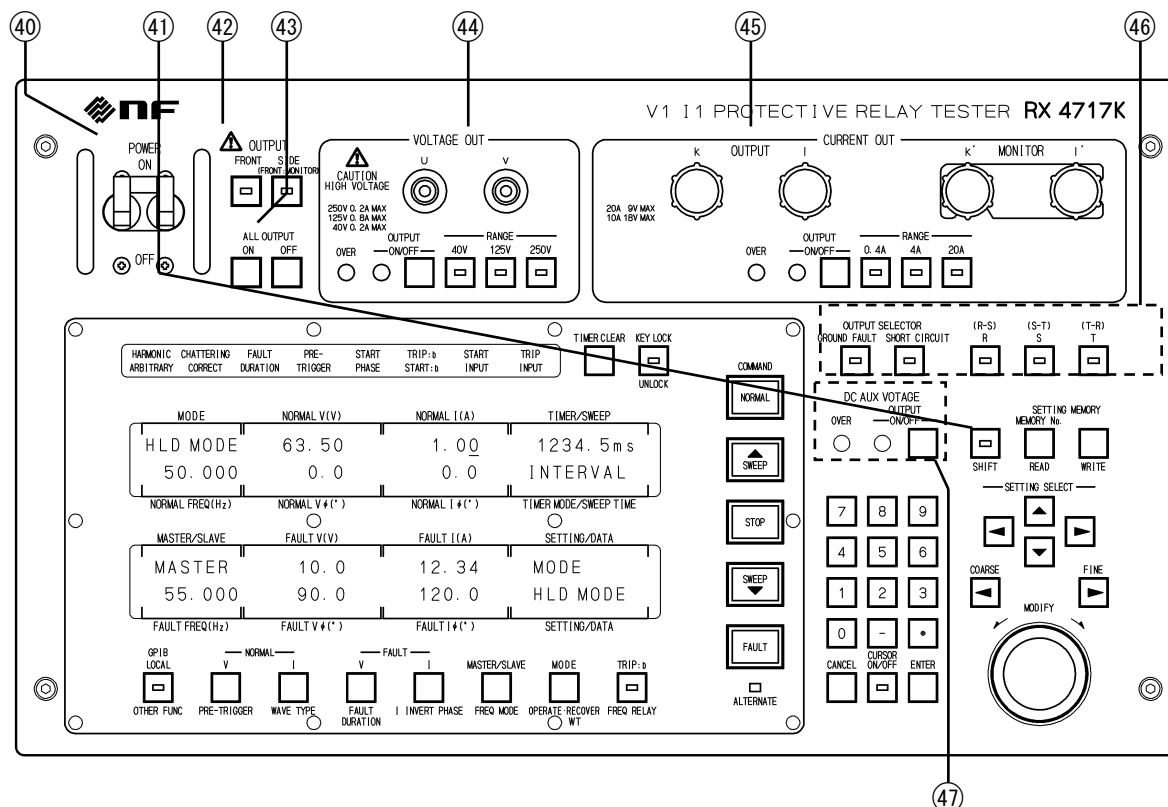
③⑤ FREQ SYNC SIG OUT (Chassis potential) ☞ “3.4.1 Frequency setting”

This outputs the internal frequency of RX4717K.

The falling edge of TTL level signal will have a phase of 0°.

It is used when the output frequency of RX4717K is brought into synchronization with our 4705A.

3.1.3 Front panel



④① **POWER ON/OFF**

This is a power supply switch. It also works as a non-fuse breaker (NFB) to shut off the power if too much current flows, or when the internal temperature extremely rises.

④② **SHIFT**

In order to use the function marked in orange below each button, press this **SHIFT** key to turn on the LED of **SHIFT** key before pressing the button for the desired function.

Example of key input display for SHIFT → **SHIFT**+**OTHER FUNC**

④③ **OUTPUT (selection)** “3.3.4 Output changer”

FRONT

The amplifier output is output to the output terminal on the front panel.

SIDE

The amplifier output is output to ④④VOLTAGE OUT and ④⑤CURRENT OUT on the right side panel, and ④⑦"DC AUX VOLTAGE" key becomes valid.



CAUTION

For **SIDE**, the output terminal of ④④VOLTAGE OUT can be used as a monitor terminal, but no load can be connected. The monitor terminal of ④⑤CURRENT OUT is used as a monitor terminal, but no load can be connected to the output terminal.

④③ **ALL OUTPUT**

☞ “3.3.2 Output ON/OFF”

This is a key to allow all the amplifier outputs to be turned on and off at once.

④④ **VOLTAGE OUT**

OUT U - V (floating)

☞ “3.3.4 Output changer”

These are the amplifier output terminals on the front panel.

The withstand voltage to the chassis is 707V_{peak} (500V_{rms}).

The maximum output voltage is 250V. Take great care of handling it.

<OVER>

☞ “3.3.3 Operation at overload”

This LED illuminates when overloading.

OUTPUT ON/OFF

☞ “3.3.2 Output ON/OFF”

ON/OFF key sets on and off independently. **<ON>** LED lights up when the output is on.

RANGE 40V, 125V, 250V

☞ “3.3.1 Setting of output range”

These are the setting keys for the output range.

The LED of the range key selected will be turned up.

④⑤ **CURRENT OUT**

OUT k - I (floating)

☞ “3.3.4 Output changer”

These are the current amplifier output terminals on the front panel.

The withstand voltage to the chassis is 707V_{peak} (500V_{rms}).

MONITOR k' I' (floating)

☞ “3.3.4 Output changer”

This is a monitor terminal for current output.

The withstand voltage to the chassis is 700V_{peak} (500V_{rms}).

<OVER>

☞ “3.3.3 Operation at overload”

This LED illuminates when overloading.

OUTPUT ON/OFF

☞ “3.3.2 Output ON/OFF”

ON/OFF sets on and off independently. **<ON>** LED lights up when the output is on.

Range 0.4A, 4A, 20A

☞ “3.3.1 Setting of output range”

These are the setting keys for the output range.

The LED of the range key selected will be turned up.

④⑥ **OUTPUT SELECTER**

☞ “3.3.4 Output changer”

GROUND FAULT, SHORT CIRCUIT

Fault mode can be set by these keys. Ground-fault / Short-circuit mode can be selected.

In the Ground-fault setting, the output is connected to one phase line of the three-phase and neutral line.

In the short circuit setting, the output is connected to one phase line and other phase line.

R, S, T

The connection line of amplifier output is selected.

④⑦ **DC AUX VOLTAGE**

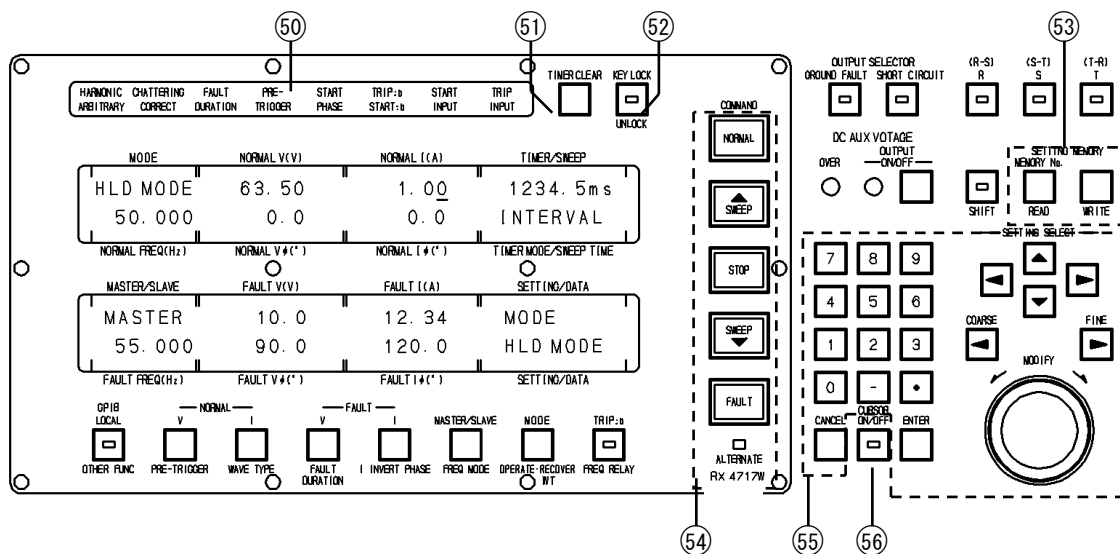
☞ “3.6.3 Operation of control power output”

This controls ON/OFF of ④⑧ “DC AUX VOLTAGE ” output on the right side panel.

<ON/OFF> LED lights up when the DC 110V is output.

<OVER> LED lights up when the DC 110V is overloaded.

3.1 Name and function of each part of the panel



50 (STATUS DISPLAY LED)

<CHATTERING CORRECT>, <FAULT DURATION>, <PRE-TRIGGER>, <START PHASE>

These light up when the functions are valid.

<TRIP: b>, <START: b>

Logic setting of [TRIP INPUT] and [START INPUT] signal.

This LED lights up when the negative-logic is set.

negative-logic : contact-state is open-circuit / voltage do not be applied

This LED do not light up when the positive-logic is set.

positive-logic : contact-state is short-circuit / voltage is applied

<START INPUT>, <TRIP INPUT>

These LEDs light up when the signal is applied to the input terminal (applying voltage for voltage input , short-circuit for contact input).

51 **TIMER CLEAR**

This clears the measurement value of the timer.

☞ “3.5.3.A Timer“

52 **KEY LOCK**

Pressing this key disables the panel control, and lights up the LED

(Except for **OUTPUT ALL ON/OFF**, each output **ON/OFF**, **GPIB LOCAL**, **SHIFT+LOCK OFF**)

SHIFT+LOCK OFF enables the panel control, and lights off the LED.

⑤③ **PANEL SET**  "3.6.2 Panel setting memory"

MEMORY No

This key specifies the memory number for panel setting.

The memory number displayed in **【Setting/Data】** , and the number can be selected by **MODIFY** dial.

SHIFT+WRITE, **SHIFT+READ**

These allow writing and reading the panel setting in/from the selected memory number.

⑤④ **COMMAND**  "3.5 Operation mode"

NORMAL

This command button is used to set the output to normal value.

SWEEP▲

This command button is used to start sweep from the fault value to the normal value when the system is in sweep mode.

STOP

This command button is used to stop the sweep temporarily when the system is in sweep mode.

SWEEP▼

This command button is used to start sweep from the normal value to the fault when the system is in sweep mode.

FAULT

This command button is used to set the output to the fault value.

The following operations are available with PSW mode.

MOMENTARY: returns to the normal value when released.





ALTERNATE: the fault value remains even when released.

To return to the normal value, press **FAULT** again or **NORMAL**.

<ALTERNATE>

This lights up when the PWS mode is ALTERNATE.

⑤⑤ **DATA INPUT**

Setting select , , , 

This key moves the cursor for selection of item on the fluorescent display.

COARSE◀, **FINE▶**

This key moves the cursor on the digits.

MODIFY

This key increases/decreases numerical value of the digit where the cursor is placed or change the setting.

Numeral buttons **0-9**, **-**, **.** and **CANCEL**

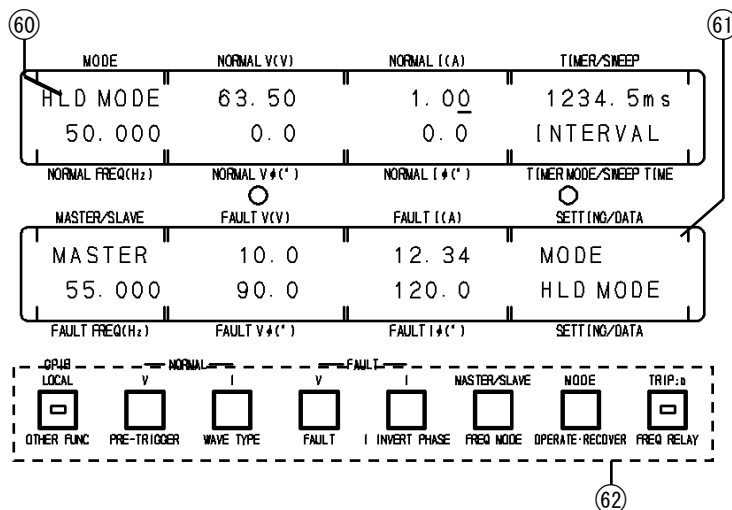
This key allows direct input of numerical value. Pressing **CANCEL** cancels the number in the order in which the number has been input.

ENTER

This key establishes the value input, or the setting has been changed.

⑤⑥ **CURSOR ON/OFF** ☞ “4.1.3 B) Simultaneous setting change”

This key toggles the indication of the cursor on and off. When the cursor indication is not displayed, the LED lights up.



⑥① **Upper VFD (vacuum fluorescent display)**

[MODE]

The operation mode is displayed. To select the operation mode, use **MODE** key of ⑥②

[NORMAL FREQ]

The value of the normal frequency is displayed.

[NORMAL V/I] , [NORMAL V/I ϕ]

The normal values of amplitude (upper part), and phase (lower part) are displayed.

[TIMER/SWEEP]

The measurement value of the timer and the sweep position is displayed.

[TIMER MODE/SWEEP TIME]

The timer mode, the timer measurement value and the sweep time are displayed.

⑥① **Lower VFD (vacuum fluorescent display)**

[MASTER/SLAVE]

The status of master/slave function is displayed. Use **MASTER/SLAVE** key of ⑥②.

Mode indication : **[MASTER] [SLAVE] [SEPARATE]**

[FAULT FREQ]

The fault frequency is displayed.

[FAULT V/I] , [FAULT V ϕ / I ϕ]

The fault values of amplitude (upper part) and phase (lower part) are displayed.

[SETTING/DATA]

This is used to set various functions and display data.

⑥2 Each setting key

GPIB LOCAL

☞ “5.2.4 Remote/local behavior“

This key cancels the remote condition of GPIB control to enable the panel control when it is a remote control condition, and the LED lights up.

SHIFT+OTHER FUNC.

☞ “3.6.1 Other function“,

In pushing **SHIFT+OTHER FUNC** key, the other function is displayed on the **【SETTING/DATA】** display.

NORMAL V

Whenever this key is pressed, the cursor position alternates **【NORMAL V(V)】** and **【NORMAL V ϕ 】**

SHIFT+PRE-TRIGGER

☞ “3.5.3.C) Operation of quick change mode

In pressing **SHIFT+PRE-TRIGGER** key, the pre-trigger-time is set on the **【SETTING/DATA】** .

NORMAL I

☞ “3.4.3 Waveform selection“

Whenever this key is pressed, the cursor position alternates **【NORMAL I】** and **NORMAL I ϕ 】**

SHIFT+WAVE TYPE,

In pressing **SHIFT+WAVE TYPE** key, the wave select mode is set on the **【SETTING/DATA】** .

FAULT V

☞ “3.5.3.B) Fault duration“

Whenever this key is pressed, the cursor position alternates **【FAULT V(V)】** and **【FAULT V ϕ 】** .

SHIFT+FAULT T DURATION

In pressing **SHIFT+ FAULT T--** key, the fault duration time is set on the **【SETTING/DATA】** .

FAULT I

☞ “3.4.2.A) Current phase reverse function“

Whenever this key is pressed, the cursor position alternates **【FAULT I】** and **【FAULT I ϕ 】**

SHIFT+I INVERT PHASE

In pressing **SHIFT+I INVERT PHASE** key, the phase value of the current output is reversed .

MASTER/SLAVE

The master/slave setting mode is displayed on the **【SETTING/DATA】** display.

SHIFT+FREQ MODE

In pressing **SHIFT+FREQ MODE** key, the frequency mode is displayed on the **【SETTING/DATA】** display. ☞ “4.1.1 Master / slave setting“, “3.4.1 Frequency setting“

MODE

The operation mode is displayed on the **【SETTING/DATA】** display.

SHIFT+OPERATE·RECOVER WT

In pressing **SHIFT+OPERATE·RECOVER WT** key, the fault duration time is displayed on the **【SETTING/DATA】** display.

☞ “3.5 Operation mode“, “3.5.4 Simultaneous operation/recovery measurement mode“

TRIP: b

This key switches the trip-input-logic.

SHIFT+FREQ RLY

In pressing **SHIFT+FREQ RLY** , the frequency-relay-test menu is displayed on the **【SETTING/DATA】** display.

☞ “3.5.1.A) Setting of [TRIP INPUT] logic“, “3.5.7 Operation of 95 relay test mode (frequency relay)“

3.2 Start

3.2.1 Power on

Install the RX4717K unit and turn the power on according to 2.2 Installation location and 2.4 Grounding and power supply.

After turning the power on, the following self-tests are conducted automatically.

- Turning on all LED except for <OVER> for testing lamps.
- Turning on all of fluorescent display for dot testing.
- Software version display
- Memory check

If there are no abnormalities, the RX4717K is set to the last settings stored in the memory, because its memory retains the settings at the last power-off-timing.

Its outputs, however, always stays with off-state for safety reasons.

If RX4717K checks its memory and finds any error, the lower fluorescent display shows either of the following messages:

- | | |
|-------------------|--|
| [ROM CHECK ERROR] | This indicates the program memory used has error. |
| [RAM CHECK ERROR] | This indicates the RAM used has error. |
| [CHECK SUM ERROR] | This indicates the data stored in battery-backed memory has error. |

[ROM CHECK ERROR] and [RAM CHECK ERROR] means malfunction in RX4717K.

Cut power off immediately, and contact our company or our sales agent.

In the case of check-sum-error, [CHECK SUM ERROR] is displayed for ten seconds or so, then, RX4717K is set to initial-setting (50Hz) and start to work.

If the battery, which should backup the memory, has been discharged, even then check-sum-error will also occur.

To fully recharge a completely discharged-battery, it takes about 100-hour energizing.

When the battery is fully charged, the data in memory are retained about 60 days with some variation depending on the condition of the individual unit and ambient temperature.

A deteriorated battery can retain data for a shorter period.

If the ability of the battery becomes impractical, ask the company for replacement at cost.

If the power is turned off during setting operation, [CHECK SUM ERROR] may occur when the power is turned on the next time. Therefore, turn off the power one or more seconds after the finish of setting or alternation procedure.

Measures for other errors  "7.1Error message"

3.2.2 Initial setting

There are two types of the panel initial setting, which are 50Hz and 60Hz.

The factory setting is 50Hz.

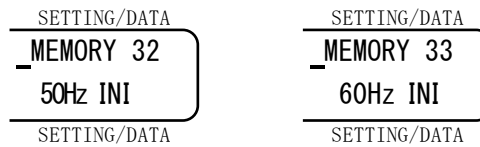
☞ “Table 3-1 List of Initial Values of Panel Setting“

This initial setting serves as reset when the current setting is unknown and does not operate well.

The initial setting is established as following.

Press **⑤** **MEMORY No** key to display the memory number on the **【SETTING/DATA】** display.

Rotate **MODIFY** key to set [Memory 32 50Hz initial value] or [Memory 33 60Hz initial value] on the **【SETTING/DATA】** display.



Press **SHIFT**+**READ** key to set the selected initial data.

[MEMORY **] is displayed on the **【SETTING/DATA】** display during setting the data.

All outputs of the amplifier are turned off for safety at the time of setting the data.

Memory data of number 32 and 33 cannot be rewritten, but memory data of number 1 to 31 can be rewritten.

Table 3-1 List of Initial Values of Panel Setting

Setting parameters	Initial values
Output range and output control	40V, 0.4A, OFF
Output changer mode	Front terminal
Normal / Fault frequency	50Hz (memory 32)/60Hz (memory 33)
Normal / Fault amplitude	0V, 0A
Normal / Fault phase	0°
Phase setting (+:lag, -:lead)	Without negative sign
Operation mode	Manual
Master / Slave / Separate	Separate
Frequency mode	50Hz fixed (memory No 32) 60Hz fixed (memory No 33)
Waveform selection	Sine wave
Amplifier input signal Ext-sig-out amplitude on/off setting	Internal, ON
Fault output line selection	Earth fault, R
Timer mode	Interval
Timer setting : timer clear	Auto
Timer setting : automatic recovery	ON
Trip input logic	↑ a : rise
Chattering removal time setting	2ms, OFF
Expanded response input	0
Operation Start signal logic	↑ a : rise
Stop setting of operation start input	Unused
Fault duration time	1s, OFF
Pre-trigger time	10ms, OFF
Fault start phase	0°, OFF
Sweep time	100s

Setting parameters	Initial values
Operation/recovery fault wait time	0.5s
Search / DSK search number of times	3
Search / DSK search judge-time	0.1s
Search / DSK search trip wait time	5.0s
Search / DSK search output cut control	Use
Frequency relay test cross frequency	48.5Hz (memory 32)/58.5Hz (memory 33)
Frequency relay test sweep rate	1Hz/s
Frequency relay test hold time	0.5s
Frequency relay test amplitude quick-change control	OFF
Output selection communication	OFF
PSW mode	Alternate
Beep sound setting	ON

3.3 Operation of amplifier output

RX4717K contains a voltage amplifier and a current amplifier, and the floating structure with the withstand voltage of 707V_{peak} (500V_{rms}) is used among each outputs and chassis respectively.

⚠ Caution

When the voltage output is connected with other equipment in series, pay attention to avoid the voltage exceeding the withstand voltage to the chassis. The RX4717K may fail to operate properly or be damaged if it is used with the voltage exceeding the withstand voltage.

Avoid parallel connection of voltage outputs, series connection of current outputs, and parallel connection between the voltage output and the current output.

The improper connection may fail to operate properly or damage the equipment.

⚠ Warning

The maximum output voltage of the voltage amplifier is 250V.

Pay extreme attention to handling the amplifier to avoid the hazard of electric shock.

Always turn the output off when connecting wires to the output terminal.

3.3.1 Setting of output range

The voltage output range includes 40V, 125V and 250V and the current output voltage includes 0.4A, 4A and 20A.

The rated load, setting resolution and output amplitude are different as below according to the AC mode (sine wave) and the DC mode.

Table 3-2 List of voltage output range

Range: AC	Rated load: AC	Range: ±DC	Rated load: DC
250V (0.00V-250.00V)	1250 Ω	250V (0.0V-250.0V)	2500 Ω
125V (0.00V-125.00V)	156 Ω	125V (0.0V-125.0V)	1250 Ω
40V (0.000V-40.000V)	200 Ω	40V (0.00V-40.00V)	400 Ω

Table 3-3 List of current output range

Range: AC	Rated load: AC	Range: DC	Rated load: DC
20A (0.000A-20.000A)	0.45 Ω	20A (0.00A-10.00A)	1.8 Ω
4A (0.0000A-4.0000A)	2.5 Ω	4A (0.000A-2.000A)	5 Ω
0.4A (0.00000A-0.40000A)	25 Ω	0.4A (0.0000A-0.2000A)	50 Ω

The output range is set when a setting key for the output range (44,45) is pressed and the LED of the key lights up. The output range can be set for each output.

When range setting is changed, the amplitude of the amplifier output turns to 0V, and the amplifier output is disconnected from the output terminals.

3.3.2 Output ON/OFF

Output ON/OFF control has two types:

[OUTPUT] **ON/OFF** key of ④④/④⑤ : each outputs turn ON/OFF individually according to the each key setting

[ALL OUTPUT] **ON/OFF** ④③key : all outputs turn ON/OFF all together.

Output signal go on outputting when <ON> LED (at the left side of **ON/OFF** key of ④④ ④⑤) is lighting.

When **ON/OFF** key of ④④ ④⑤ is pressed during the output-ON-state, the output is turned to OFF-state and the <ON> LED turns off.

④③ [ALL OUTPUT] **ON** - **OFF** key-operation may be dangerous if not operated properly, so ④③ [ALL OUTPUT] **ON** - **OFF** key-operation can be set to be enabled / disabled by the internal dip switch.

☞ “2.3 Setting of internal dip switch”

3.3.3 Operation at overload

When overload occurs, ④④ ④⑤ <OVER>LED of the output where the overload occurs lights up.

If the overload status lasts for three seconds or longer, buzzer sounds longly and the output is automatically turned OFF as well as the output amplitude is set to zero for safety.

⚠ Caution

When the beep sound setting is OFF, the buzzer does not sound even if the overload occurs. It is recommended to turn ON the beep sound setting.

☞ “3.6.1.0 A) Beep **setting**”

3.3.4 Output changer

The voltage/current amplifier output signals are distributed according to the setting of the [OUTPUT] ④ [FRONT] / [SIDE] key. (Refer to Fig 3-2)

When the output connector on the right side are used, use the supplied 3-phase 4-wire output cable.

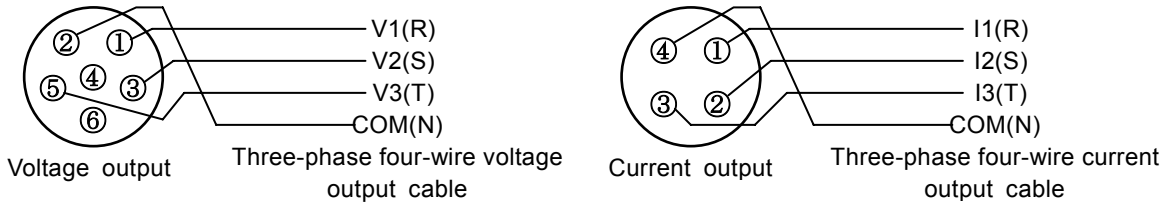


Figure 3-1 Pin Connection of Voltage/Current Output Connector and Three-phase Four-wire Voltage Output Cable

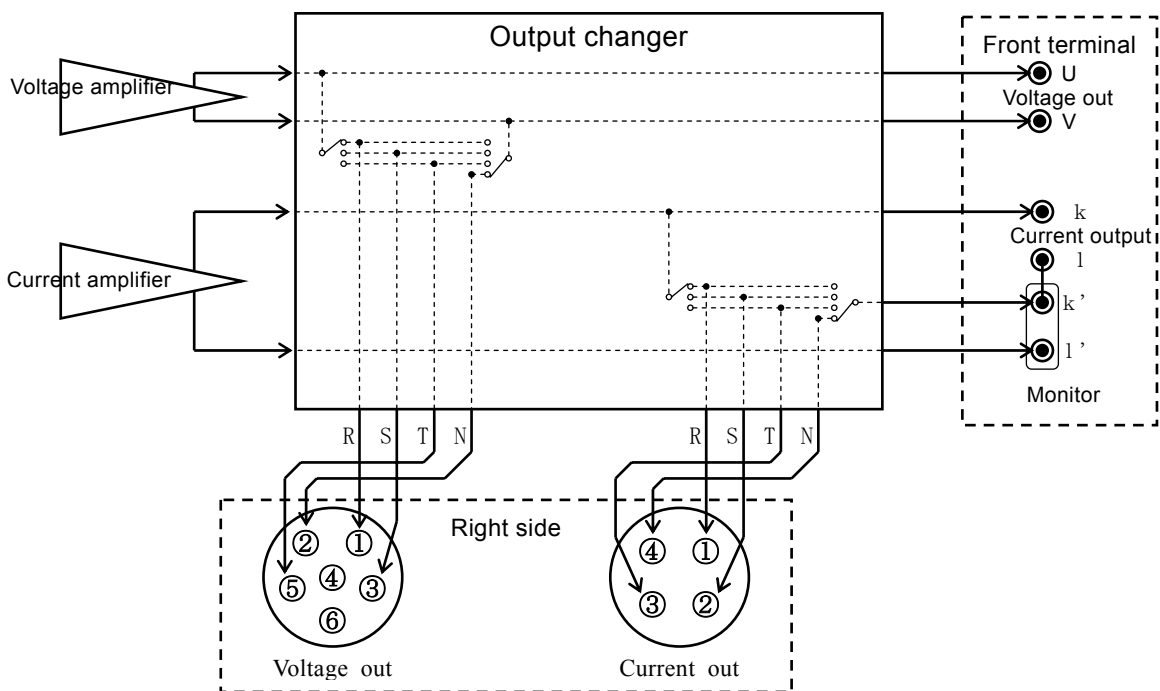


Figure 3-2 Configuration of Output Changer

When the output distribution is changed, the all outputs will be turned off for safety.

⚠ **Caution**

When the output changer mode is set for the side terminal,

- The voltage is output to U and V of the front output terminal for monitor, but the load can not be connected to this U-V terminal.
- The current output uses the front monitor terminal K' and I' for monitor, but the load can not be connected to them.

A) Front terminal

The front terminal mode is valid when [OUTPUT] ④② [FRONT] key is pressed and LED is turned on.

The voltage amplifier signal is output to " U " and " V " terminals at the front panel, and the current amplifier signal is output to " k " and " l " terminals at the front panel.

During the front terminal output mode, when ④② [SIDE] key is pressed, [SIDE] LED will be turned on and the previous earth-fault or short-circuit setting will become effective.

If the side terminal output mode is valid, various simulation mode setting (④⑥: earth-fault, short-circuit and R-S-T line selection) are available.

In the side terminal output mode, even if simulation mode setting key ④⑥ is changed, the output signal do not be turned off.

How to set the simulation mode is as follows.

B) Side terminal, earth fault

In the side terminal output mode (④② [SIDE] LED is lighting), if ④⑥ [GROUND FAULT] key is pressed,

[GROUND FAULT] LED is turned on, and the voltage output signal and current output signal are connected to between one phase-line and neutral-line of three-phase four-wire cable.

The output signal is distributed by setting of ④⑥ [R], [S] and [T] key as follows.

			[R]	[S]	[T]	
Voltage amplifier	U	→	R(①)	S(③)	T(⑤)	Voltage output Connector
	V	→	N(②)	N(②)	N(②)	
Current amplifier	k	→	R(①)	S(②)	T(③)	Current output connector
	l	→	N(④)	N(④)	N(④)	

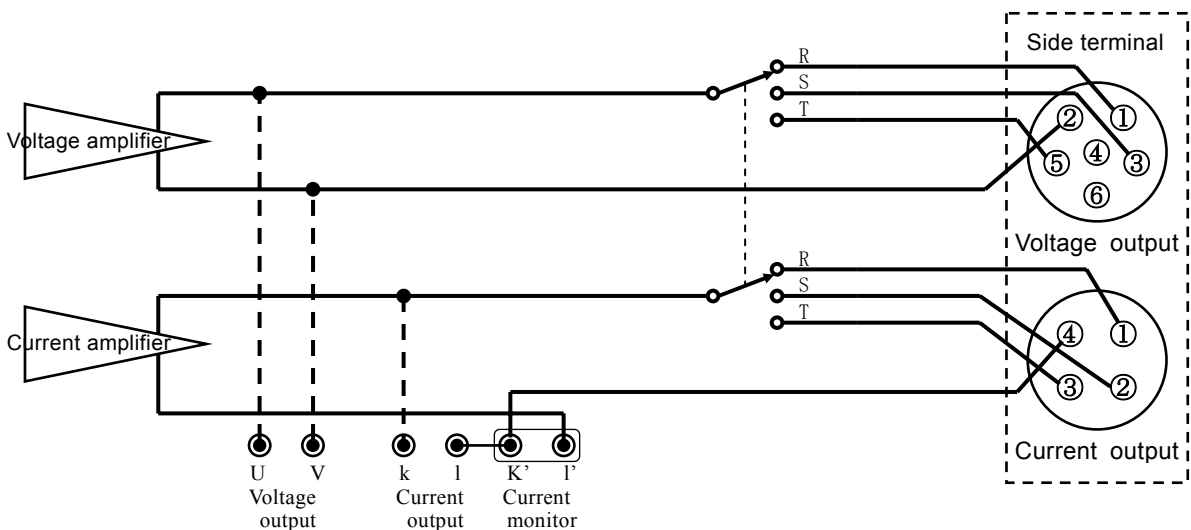


Figure 3-3 Operation of Output Changer at the Earth Fault

C) Side terminal, short-circuit

In the side terminal output mode (the **SIDE** LED is lighting), if **SHORT-CIRCUIT** key is pressed, **SHORT-CIRCUIT** LED is turned on, and the voltage output signal and current output signal are connected to between one phase-line and another phase-line of three-phase four-wire cable respectively.

The output signal is distributed by setting of **R**, **S** and **T** key as follows.

		R (R-S)	S (S-T)	T (T-R)	
Voltage amplifier	U →	R(①)	S(③)	T(⑤)	Voltage output Connector
	V →	S(③)	T(⑤)	R(①)	
Current amplifier	k →	R(①)	S(②)	T(③)	Current output connector
	l →	S(②)	T(③)	R(①)	

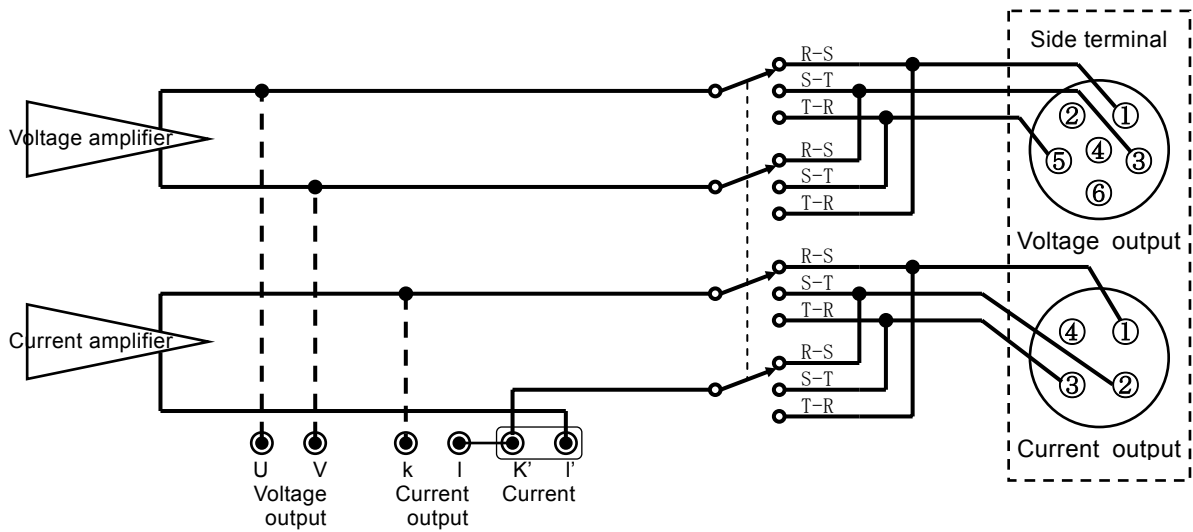


Figure 3-4 Operation of Output Changer at the short-circuit

3.4 Output signal setting

RX4717K selects either the signal generated by the internal synthesizer or the external signal, and the signals are amplified and output.

In case of using the internal synthesizer signal, refer to the description of “3.4.1 Setting of frequency” up to “3.4.3 Waveform selection”

In case of using the external signal input, refer to the description of “4.2 Amplifier signal “

3.4.1 Frequency setting

Frequency mode setting is common to all outputs.

When the frequency mode is changed, the outputs will be turned off for safety.

- Setting procedure

Press ④ [SHIFT]+[FREQ MODE] key of ⑥ to display the frequency mode on the 【SETTING/DATA】 display .

Select the frequency mode to be set with [MODIFY] dial, and press [ENTER] key of ⑤.

```
SETTING/DATA
FREQ MODE
LINE
SETTING/DATA
```

- 50Hz fixed [50Hz FIX]

The normal/fault frequency is fixed at 50Hz if [50Hz FIX] is displayed on the display of 【NORMAL·FAULT FREQ】 .

- 60Hz fixed [60Hz FIX]

The normal/fault frequency is fixed at 60Hz if [60Hz FIX] is displayed on the display of 【NORMAL·FAULT FREQ】 .

- Internal [INTERNAL]

The normal/fault frequency is set in the range of 10.000 to 200.000Hz.

Since the normal frequency and the fault frequency can be set individually, the frequency quick change and the frequency sweep are possible.

The following are one setting examples.

Move the cursor to 【NORMAL FREQ】display with ▲, ▼, ◀ and ▶ and input 50.1 with the numeral buttons, and then press [ENTER] key.

The normal frequency is set to [50.100].

Next, move the cursor to the first decimal point of [50.100] with [COARSE◀] and [FINE▶]. If the [MODIFY] is turned to the right, the number will increase to [50.200], and if it is turned to the left, the number will decrease to [50.000].

Setting of 【FAULT FREQ】 is available following the same procedure above.

```
MODE
MANUAL
50.100
NORMAL FREQ (Hz)
```

```
MODE
MANUAL
50.000
NORMAL FREQ (Hz)
```

- Line synchronization [LINE]

The normal/fault frequency is synchronized with the commercial power supply frequency.

The synchronization frequency range is from 45 to 65Hz.

[LINE] is displayed on the 【NORMAL·FAULT FREQ】 display.

- External synchronization [EXTERNAL]

The normal/fault frequency is synchronized with the signal applied to ③④ [FREQ SYNC SIG IN] terminal.

The synchronization frequency range is from 45 to 65Hz.

[EXTERNAL] is displayed on the 【NORMAL FREQ】 and 【FAULT FREQ】 display.

A) Reference phase and frequency synchronization signal input/output

All phase difference settings of signals of the RX4717K (output phase and fault start phase) are the values in relation to a reference phase.

The following frequency synchronization signal output is the signal equal to the internal reference phase.

③⑤[FREQ SYNC SIG OUT] (for 4705A,etc) : TTL signal output

The falling edge is the reference phase of 0°.

When the frequency mode is set for external synchronization, the reference phase is the following frequency synchronization signal inputs.

③④[FREQ SYNC SIG IN] (for 4705A,etc) : TTL signal output

The falling edge is the reference phase of 0°.

When the negative-value-phase-setting is enabled, lead/lag-phase-setting is available, and setting range is from -359.9° to +359.9°.

All phase settings will take positive (+) value in lag-phase-setting.

Therefore, a setting of " 90° " will produce lag-phase of in relation to the reference phase, and a setting of "-90° " will produce lead-phase of " 90° " in relation to the reference phase.

RX4717K is designed so that phase setting value are available freely.

In practical use, however, it would be simple and easy to assign phase of " 0° " to the phase of the output which the user wants to take for the reference.

☞ "Figure 3-5 Output waveform with voltage of 0° and current of 90° "

3.4.2 Setting of amplitude and phase

The output amplitude setting is limited within the range currently being set.

Therefore, set the output amplitude after setting the required range.

When the negative-value-phase-setting is disabled, lag-phase-setting is available, and setting value is from 0° to +359.9°.

When the negative-value-phase-setting is enabled, lead/lag-phase-setting is available, and setting value is from -359.9° to +359.9°. (" - " means lead-phase)

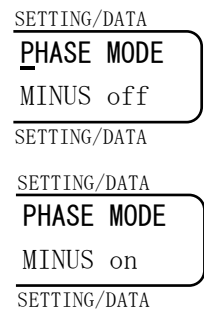
- How to enable the negative value in the phase setting

Press **SHIFT**+**OTHER FUNC** key and display the other function setting on the **【SETTING/DATA】** display.

Turn **MODIFY** dial to select **[PHASE MODE]**.

Move the cursor down with **▼**.

Turn **MODIFY** dial to select either **[MINUS on]** or **[MINUS off]**.



The amplitude are set respectively on the **【NORMAL V(V)】** , **【FAULT V(V)】** , **【NORMAL I(A)】** and **【FAULT I(A)】** display.

The phase are set respectively on the **【NORMAL V φ】** , **【FAULT V φ】** , **【NORMAL I φ】** and **【FAULT I φ】** display .

The cursor can be moved on the items with **▲**, **▼**, **◀** and **▶**, but using **[NORMAL]V/I** key, and **[FAULT]V/I** key of ⑥ is convenient as shown below.

3.4 Output signal setting

- ① First press **NORMAL V** key to move the cursor to the **【NORMAL V(V)】** display.
 - ② Press **NORMAL V** key again, and the cursor will be moved to the **【NORMAL V φ】** display.
 - ③ Press **NORMAL V** key again, and the cursor will go back to the **【NORMAL V(V)】** display.
- The same operation is applied to **NORMAL I**, **FAULT V** and **FAULT I** key.

①	→	②	→	③
NORMAL V(V)		NORMAL V(V)		NORMAL V(V)
0.00		0.00		0.00
0.0		0.0		0.0
NORMAL V φ (°)		NORMAL V φ (°)		NORMAL V φ (°)

When the cursor is on the setting position for the amplitude and phase, the cursor movement by **COARSE** and **FINE** is limited to the last three digits.

Move the cursor to the place you wish to set, and set the amplitude value and phase value with the numerical buttons or **MODIFY** dial.

■ Setting example of amplitude and phase

Output voltage : 40V Output current : 0.4A:

At first, range setting have to be done.

Press the **40V** [Range] key of **④④** [Voltage Out] and the **0.4A** [Range] key of **④⑤** [Current Out].

Press **NORMAL V** key to move the cursor to the **【NORMAL V(V)】** display. Input 40 with the numeral buttons and press **ENTER** key, and the normal voltage will be set as 40V.

Press **NORMAL I** key to move the cursor to the **【NORMAL I】** display. Input 0.4 with the numeral buttons and press **ENTER** key, and the normal current will be set as 0.4V.

NORMAL V(V)	NORMAL I(A)
40.000	0.40000
0.0	0.0
NORMAL V φ (°)	NORMAL I φ (°)

Press **NORMAL I** key again to move the cursor to the **【NORMAL I φ】** display.

Input 300 with numeral buttons and press **ENTER** key, and the normal current phase will be set as 300°.

NORMAL V(V)	NORMAL I(A)
40.000	0.40000
0.0	300.0
NORMAL V φ (°)	NORMAL I φ (°)

Press **COARSE** twice to move the cursor to the second digit of the phase.

Then turn **MODIFY** dial to the left for three times, and the normal current phase will be 270°.

NORMAL V(V)	NORMAL I(A)
40.000	0.40000
0.0	270.0
NORMAL V φ (°)	NORMAL I φ (°)

A) Current phase reverse function

SHIFT+**I INVERT PHASE** key of ② invert the normal or fault current phase where the cursor is set.

NORMAL V (V)	NORMAL I (A)	Press SHIFT +	NORMAL V (V)	NORMAL I (A)
40.000	0.40000		40.000	0.40000
0.0	270.0	I INVERT PHASE →	0.0	90.0
NORMAL V φ (°)	NORMAL I φ (°)		NORMAL V φ (°)	NORMAL I φ (°)
0.0	270.0	0.0	90.0	
0.0	0.00000	FAULT V (V)	FAULT I (A)	
0.0	0.0	0.000	0.00000	
FAULT V φ (°)	FAULT I φ (°)	0.0	0.0	
0.0	0.0	FAULT V φ (°)	FAULT I φ (°)	
0.0	0.0	0.0	0.0	

The following figure shows the waveforms of ③ Frequency synchronization signal output and normal voltage/current output when the normal voltage phase is set for 0° and the normal current phase is set for 90°.

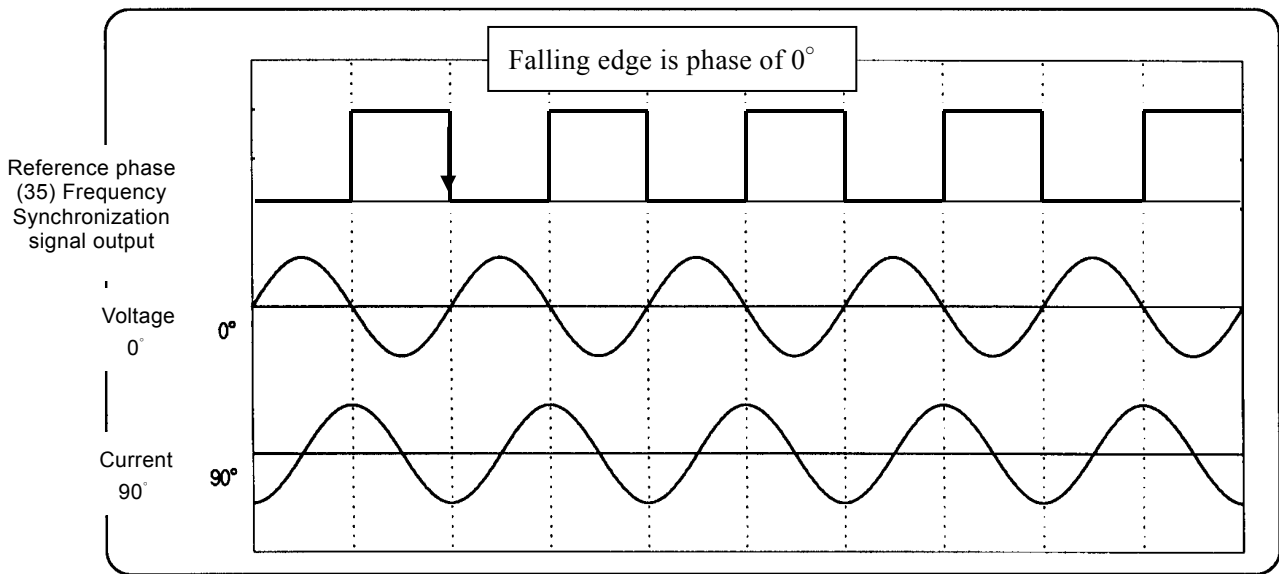


Figure 3-5 Output waveform with voltage of 0° and current of 90°

3.4.3 Waveform selection

Same waveform is set to all outputs by waveform selection.

A sine wave is set in normal operation, but other waveform may be set in special tests.

When the wave selection is modified, the all outputs will be turned off for safety.

- Setting procedure

Press **SHIFT**+**WAVE TYPE** key of ⑥ to display the wave selection setting on the **【SETTING/DATA】** display.

SETTING/DATA
WAVE SELECT
SINE
SETTING/DATA

Turn **MODIFY** dial to select the waveform you wish to operate, and press **ENTER** key.

- Sine wave [SINE]

When [SINE] is displayed on the **【SETTING/DATA】** display , sine waves are output.

- +DC[+DC], -DC[-DC]

This outputs +DC/-DC. <HARMONIC ARBITRARY>LED is turned on and [+DC MODE] / [-DC MODE] is displayed on the **【NORMAL FREQ】** and **【FAULT FREQ】** display.

With +DC/-DC setting, the current amplitude will be limited as following.

0.4A range	→ maximum 0.2A
4A range	→ maximum 2A
20A range	→ maximum 10A

+DC/-DC may be dangerous if handled improperly, and is enabled/disabled by the internal dip switch.

The menu is not displayed if it is disabled by the internal dip switch.

"2.3 Setting of internal dip switch"

3.5 Operation mode

RX4717K operates in the several mode depending on the setting.

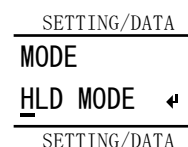
The Operation-MODE includes the following nine modes and the selected operation mode is displayed on the **【MODE】** display of ⑥.

Manual mode	[MANUAL]
Quick-change mode	[HLD MODE], [NHD MODE]
Operation·recovery simultaneous measurement mode	[OP:RECOV]
Normal sweep	[SWEEP]
Search sweep	[SRCH SWP]
DSK search sweep	[DISK SWP]
Frequency relay (95) test mode	[FREQ RLY]

When the operation mode is changed, the all outputs are turned off for safety.

- Setting procedure

Press **MODE** key of ②, and the operation mode is displayed on the **【SETTING/DATA】** display.



Select the operation mode you wish to set with **MODIFY** dial, and press **ENTER** key of ③.

NORMAL key sets the amplitude output to normal value and **FAULT** key sets it to fault value.

SWEEP▲, **STOP**, **SWEEP▼** starts and stops sweeping the output value.

The status of the output is confirmed by the LEDs of these operation command keys of ④.

FAULT key function can be set to either Alternate or Momentary mode by PSW mode setting.

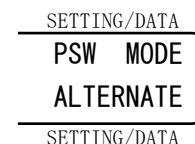
- Setting procedure of PSW mode

Press **SHIFT+OTHER FUNC** key of ②, the other function is displayed on the **【SETTING/DATA】** display.

Turn **MODIFY** dial, and display [PSW MODE] on the **【SETTING/DATA】** display.

Move the cursor down with **▼**.

Turn **MODIFY** dial, and display [MOMENTARY] or [ALTERNATE] on the **【SETTING/DATA】** display.



<ALTERNATE>LED of ④ lights up when the PSW mode is [ALTERNATE].

<ALTERNATE>LED of ④ does not light up when the PSW mode is [MOMENTARY].

- When the PSW mode is the Alternate mode, the outputs turn to fault value if **FAULT** key is pressed.

And the fault value is kept on even if **FAULT** key is released.

In order to return the output to normal value, press **FAULT** key again or press **NORMAL** key.

- When the PSW mode is Momentary mode, the outputs turn to fault value if **FAULT** key is pressed, but the output value returns to normal value as soon as **FAULT** key is released.

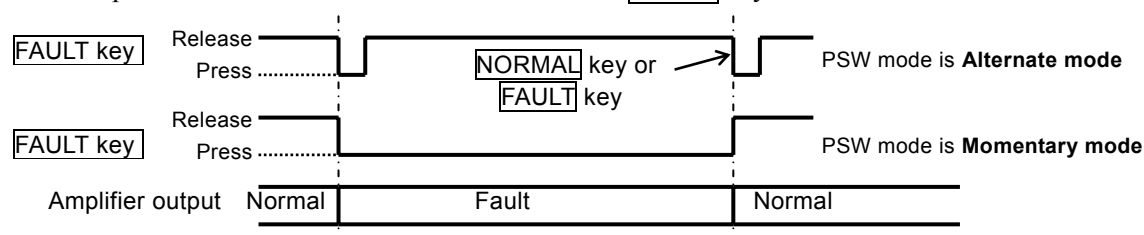


Figure 3-6 Operation of PSW mode

3.5.1 Trip input and operation start input

■ Operation of [TRIP INPUT]

The operation-signal from a protective relay is applied to the [Trip-Input] terminal (① to④).

The input signal of the [Trip-Input] controls operation as below according to the Operation Mode.

Manual mode	no use
Quick change mode	timer measurement and control of normal/fault state
Operation・Recovery simultaneous measurement mode	timer measurement
Normal sweep	stop of sweep (measurement of Operation・Recovery value)
Search sweep	stop of sweep (measurement of Operation・Recovery value)
DSK search sweep	stop of sweep (measurement of Operation・Recovery value)
Frequency relay(95) test mode	Operation・Recovery frequency and timer measurement

■ Operation of [START INPUT]

In order to externally start the Quick Change/Sweep, the signal is applied to the [START INPUT] terminals⑤ or ⑥.

The input signal of the [START INPUT] controls operation as below according to the Operation Mode.

Manual mode	no use
Quick change mode	control of Start/Stop of operation
Operation・Recovery simultaneous measurement mode	control of Start/Stop of operation
Normal sweep	start of operation only
Search sweep	no use
DSK search sweep	no use
Frequency relay(95) test mode	start of operation only



Caution

- When the Operation Mode is set for quick change mode and Operation/Recovery simultaneous measurement mode:

Quick change starts with the [START INPUT] signal (level-low), and the Fault output value returns to Normal value with [START INPUT] signal recovery(level-high).

Therefore, when the [START INPUT] signal contains chattering, as the signal is considered to be removed instantly, the output value(Fault value) returns to Normal value immediately. No chattering shall be contained in the operation [START INPUT] signal.

If chattering cannot be removed, recovery function of the operation [START INPUT] signal can be set to disable.

☞ “3.5.1.D) Setting of operation start input stop“

This setting prohibits returning output value (Fault value) to Normal value with chattering, so, the following procedure is necessary for returning to Normal value.

When PSW mode is the Alternate mode, press **NORMAL** or **FAULT** key.

When PSW mode is Momentary mode, release **FAULT** key.

A) Setting of [TRIP INPUT] logic

In standard operation, RX4717K takes a trip-signal of Voltage-Application (or short-contact = A contact) as a trip-operation, and a trip-signal of Voltage-Release (or open-contact = B contact) as a trip-recovery. However, RX4717K also can invert the signal input logic relation of trip-operation. Indication is as followings.

[↑a :RISE] ----- trip-operation is [short-contact or Voltage-Application]
 [↓b :FALL]----- trip-operation is [open-contact or Voltage-Release]

● Setting procedure

[TRIP:b] key ⑥ alternates [↑ a RISE] and [↓ FALL] setting.

With [↑ a RISE] setting, the <TRIP:b> of ⑤ and [TRIP:b] of ⑥ on the front panel will be turned off.

With [↓ b FALL] setting, the <TRIP:b> of ⑤ and [TRIP:b] of ⑥ on the front panel will be turned on.

Confirm your setting according to the following principles:

- When the protective relay operates and a signal is produced (the voltage changes from Low to High or the contact changes from short-circuited to opened), [↑ a RISE] setting is selected and the [TRIP: b] LED turns off.
- When the protective relay operates and the signal is removed (the voltage changes from High to Low or the contact changes from short-circuited to opened), [↓ b FALL] is selected and the [TRIP: b] LED turns on.

<TRIP INPUT>LED of ⑤ on the front panel of character indication LED lights up whenever voltage is applied (contact is short-circuited) regardless of setting.

B) Setting of trip input chattering correct function

When the system have a mechanical protective relay, chattering may be contained on a contact changing occasion, which makes it difficult to determine the operation point.

Therefore, RX4717K is provided with chattering correction function to ease determination of the operation point. If a value is set in the chattering correction function, the system concludes that the signal is changed when no chattering has been found for the set time period after the signal change.

When the chattering correction function is turned [on], the timer measurement value is corrected by the chattering correct time.

④ “3.5.3.A) Timer“

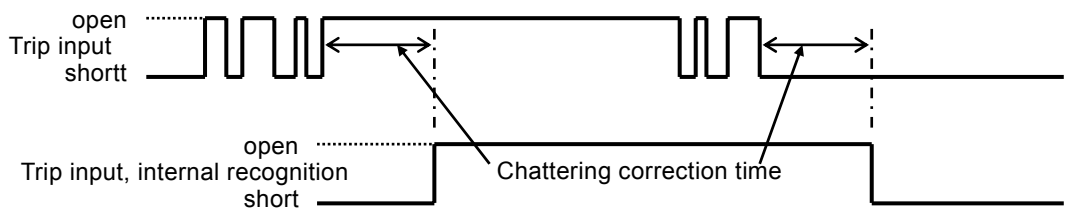


Figure 3-7 Operation of Chattering Correction Function

● Setting procedure

Press [SHIFT]+[OTHER FUNC] key of ⑥ and display the other function on the [SETTING/DATA] display.

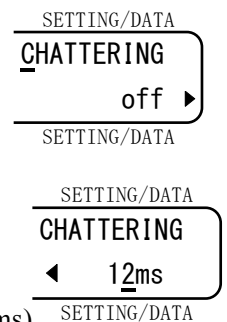
Rotate [MODIFY] dial and select [CHATTERING].

Move the cursor down with [▼], and rotate [MODIFY] dial to select [on]

[off] : (<CHATTERING> of ⑤ on the front panel will light off),

[on] : (<CHATTERING> of ⑤ on the front panel will light on) and press [▶].

Set the chattering correction time with the numeral buttons or [MODIFY] dial. (1-100ms)



C) Setting of operation start input logic

In standard operation, RX4717K takes an operation start input of voltage application (or contact short-contact) as a trip-operation, and an operation start input of voltage release (or open-contact) as a trip-recovery.

[↑a RISE] indicates above relationship.

However, RX4717K can invert the signal input logic for those relation having an opposite function. Standard setting displays [↑a RISE] and inverted setting displays [↓b FALL].

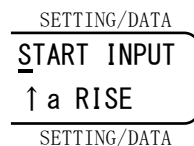
- Setting procedure

Press **SHIFT**+**OTHER FUNC** of ⑥₂ to display the other function on the **【SETTING/DATA】** display.
Rotate **MODIFY** and select [START INPUT].

Move the cursor down with **▼** and turn **MODIFY** to select

[↑ a RISE] (<START:b> LED of ⑤₀ on the front panel will light off),

[↓ b FALL] (<START:b> LED of ⑤₀ on the front panel will light on).



SETTING/DATA
START INPUT
↑ a RISE
SETTING/DATA

<OPERATION START> LED of ⑤₀ on the front panel lights up whenever voltage is applied (contact is short-circuited) regardless of setting.

D) Setting of operation start input stop

In standard operation, RX4717K takes an operation start input of voltage application (or contact short-contact) as a trip-operation, and an operation start input of voltage release (or open-contact) as a trip-recovery.

The recovery function of the operation-start-input can be set to enable/disable.

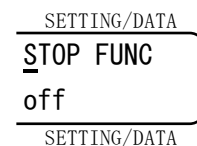
Select use [ON] when the user wishes to use the recovery function, and select disuse [OFF] when not to use the recovery function.

- Setting procedure

Press **SHIFT**+**OTHER FUNC** key of ⑥₂, and the other function is displayed on the **【SETTING/DATA】** display.

Rotate **MODIFY** dial to select [STOP FUNC].

Move the cursor down with **▼**, and turn **MODIFY** dial,
and select [on] or [off].



SETTING/DATA
STOP FUNC
off
SETTING/DATA

- [on]

When the stop-setting is [on], if an operation start input turns to voltage release (or open-contact), the recovery function is carried out. And the output signal will return to normal state from fault state.

This is available when the operation mode is as follows.

Quick change mode

Simultaneous operation/recovery measurement mode

However, when the operation mode is ~~not~~ neither of the above mode, the stop setting is not available even if [ON] is set

- [off]

When the stop setting is [off], even if an operation start input turns to voltage release (or open-contact), the recovery function is not carried out. And the output will not return to normal state.

When the stop setting is [off], in order to return to normal state, perform the following procedure.

When PSW mode is alternate, press **NORMAL** or **FAULT** key.

When PSW mode is momentary, release **FAULT** key.

3.5.2 Operation of manual mode

Use manual mode to check general operation of a protective relay. This is not affected by the trip input or operation start. In addition, the timer does not work. However **NORMAL** and **FAULT** key control allow setting the amplifier output for normal and fault state.

In manual mode, operation of trip or operation start input is not affected. However, the LED of <TRIP INPUT> and <START INPUT> on the panel can be used to monitor the status of operation.

Therefore, the operation/recovery point of a protective relay can be measured by changing the settings while observing the LED on the panel.

3.5.3 Operation of quick change mode

Quick change mode is used to measure the operation time (dynamic characteristics) of a protective relay. The response time of trip signal is measured by quickly changing the RX4717K output from the normal to fault values.

The quick change mode includes the hold quick change [HLD MODE] and non-hold quick change [NHD MODE].

The functions of fault duration, pre-trigger time and fault start phase are effective in this mode only.

Start-command will be triggered by pressing **FAULT** key of ⑤④ or Operation start input signal ⑤, ⑥.

Recovery-command will be triggered by pressing **NORMAL**, **FAULT** key of ⑤④ (depending on the PSW mode setting), Operation start input ⑤, ⑥ (when the Stop-setting is "ON") and Fault duration (when the function is ON).

■ Hold quick change

[HLD MODE]: This simulates a permanent fault ("HLD" stands for "hold")

Start-command (**FAULT** ⑤④ key, or Operation-start-input ⑤, ⑥) causes the Amplifier output to quickly change to the Fault state.

↓

When **Auto-Reset** of the timer-setting is "ON", and the Timer-mode is [INTERVAL] or [SEP.TIMER], Fault-state returns to normal state if Trip signal (one of ① to ④) turns to "ON".

When **Auto-Reset** of the timer-setting is "ON", and the timer mode is [ONE-SHOT], fault state returns to normal state if trip signal (one of ① to ④) turns to "OFF".

↓

Thereafter, any change of trip signal (one of ① to ④) does not change amplifier output.

↓

Recovery-command only can turn fault state of amplifier output to normal state, and thereafter amplifier-output can not be changed by change of trip signal.

3.5 Operation mode

When Start-command is **FAULT** and Stop-command is **FAULT** (PSW mode is momentary)

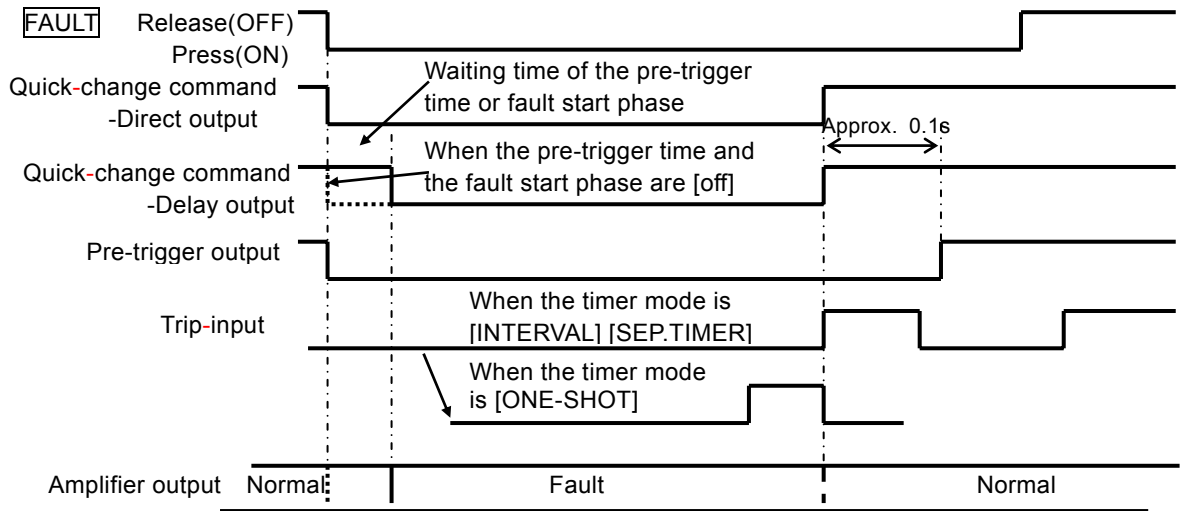


Figure 3-8 Operation of Hold-Quick-change when the Auto-return of the timer menu is [ON]

When Start-command is Operation-start-input (Stop-setting is ON) and Fault-state returns to Normal-state by Return-command

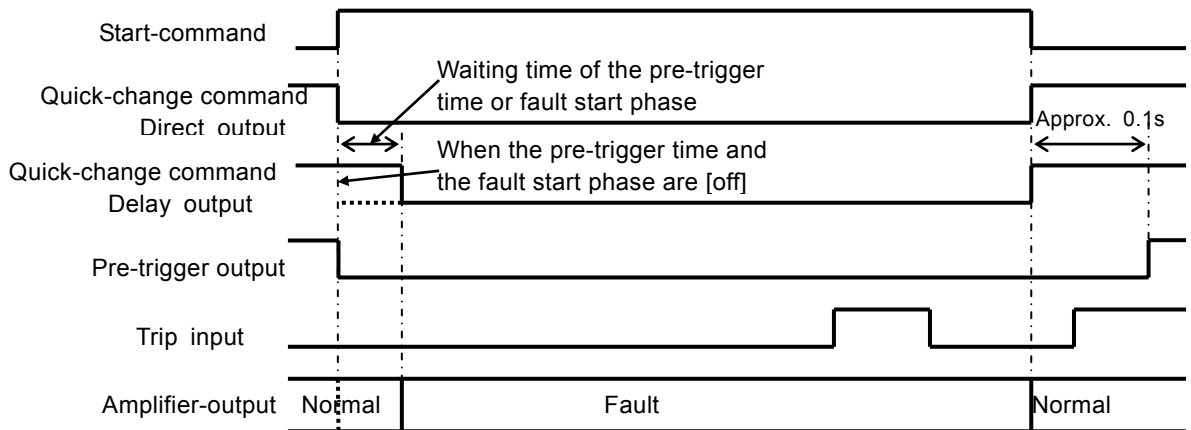


Figure 3-9 Operation of Hold-Quick-change when the Auto-return of the timer menu is [OFF]

■ Non-hold quick change

[NHD MODE]: This simulates Arc-fault (NHD stands for Non-Hold).

Start-command (**FAULT** ⑤ key, or operation start input ⑤, ⑥) causes the amplifier output to quickly change to the fault state.



When trip signal (one of ① to ④) turns to "ON", fault state returns to normal state.



When trip signal (one of ① to ④) returns to "OFF", normal state turns to fault state again.



Just like the above mentioned, amplifier output alternates normal state and fault state according to trip signal state of "ON/OFF".



With an operation stop command, the output becomes normal, and thereafter, any change in the trip signal does not change the output.

Return-command only can turn fault state of amplifier output to normal state, and thereafter amplifier output can not be changed by change of trip-signal.

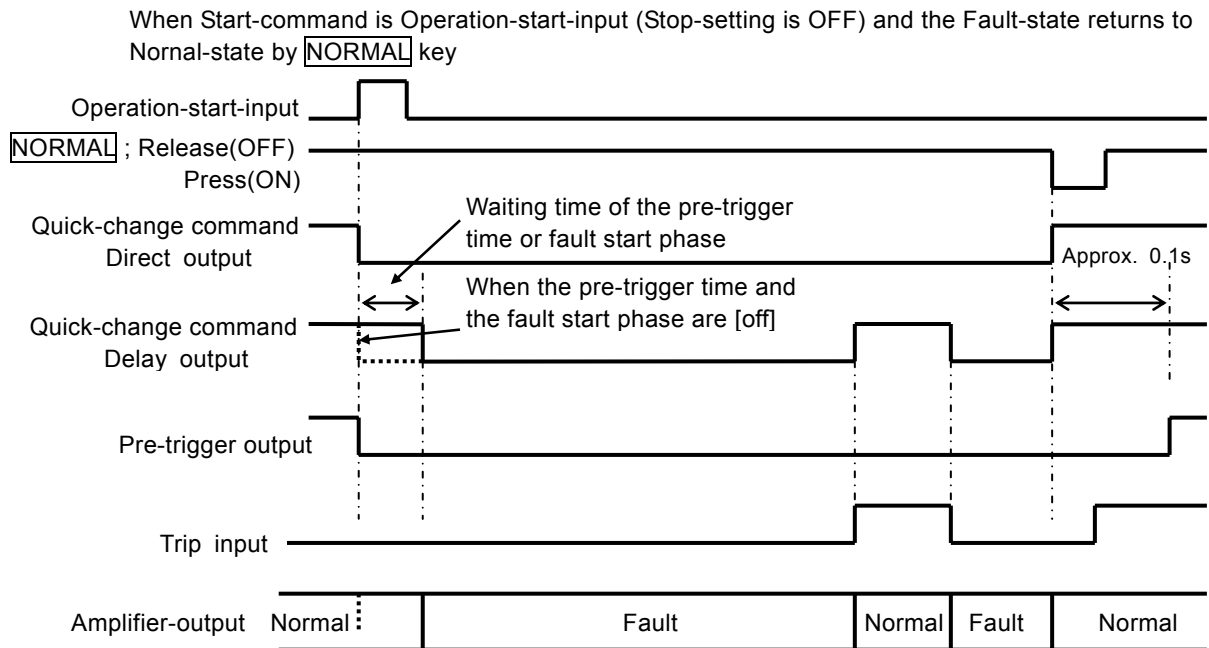


Figure 3-10 Operation of Non-Hold Quick-change

A) Timer

In quick change mode, the timer is used to measure operation-time of protective relay.

There are several timer-measurement modes in [HLD MODE] and [NHD MODE].

In [HLD MODE] : [INTERVAL], [ONE-SHOT] and [SEP.TIMER]

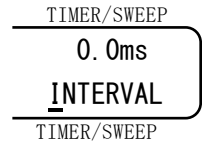
In [NHD MODE] : [INTERVAL] and [TRAIN]

● Setting procedure

By **MODE** ⑥ key, **SETTING/DATA** ⑥ display is set to [Operation-Mode].

By **MODIFY** key, set **SETTING/DATA** ⑥ display to [HLD MODE] , and Timer-mode is displayed on **TIMER/SWEEP** ⑥ display.

Move the cursor to **TIMER/SWEEP** ⑥ display with **▲**, **▼**, **◀**, **▶** and turn **MODIFY** to set Timer-measurement mode.



Measurements of INTERVAL, ONE-SHOT and TRAIN are as follows.

A: [INTERVAL], duration-time from fault Quick-change to Trip-input-operation

B: [ONE-SHOT], duration-time from Trip-input-operation(ON) to Trip-input-recovery(OFF)

B+C+D+E...: [TRAIN], a total of Trip-input-operation-time

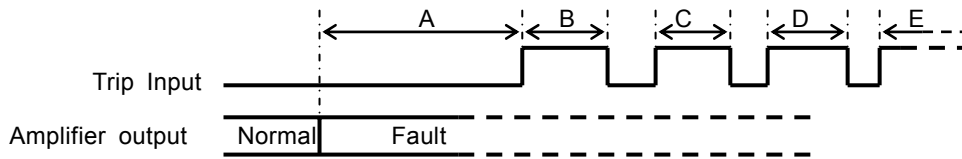


Figure 3-11 Measurement detail of INTERVAL, ONE-SHOT and TRAIN

Start-measure [SEP. TIMER] measures the time from the operation start input to the trip input.

The timer of RX4717K can be used in millisecond.

Start-measure [SEP. TIMER] is defined by the duration from the point of pressing **FAULT** ⑤ key to Trip-input ON.

A: Start measurement [SEParate TIMER]

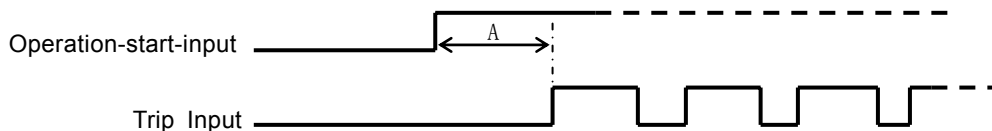


Figure 3-12 Measurement detail of SEP.TIMER

■ Setting of automatic reset of timer

Auto-reset to normal state of amplifier output is available only in timer mode of [HLD MODE].

Press **SHIFT**+**OTHER FUNC** key, and display the other function on the

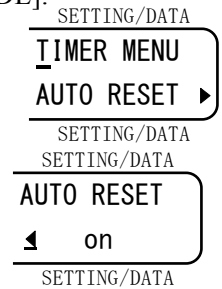
【SETTING/DATA】 display.

Rotate **MODIFY** dial and select [TIMER MENU].

Move the cursor down with **▼**,

and turn **MODIFY** dial to select [AUTO RESET], then, press **▶**.

Select [on] or [off] with **MODIFY**.



- When [AUTO RESET] is selected, if Trip-input is turned to "ON"-state, amplifier output turns to normal state from fault state. Auto-reset of [on] is selected usually.
- When Auto-reset of [off] is selected, ON-state of the trip-input does not turn amplifier output to normal state, and amplifier output keeps on fault state

Return-command (operation stop command : refer to 3-5-3) only can turn the amplifier output to normal state. Use this setting if the user wants to prevent the output from changing to normal state in measurement of a Fluctuation-range relay

■ Timer measurement value

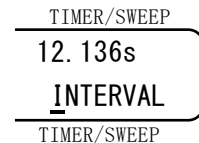
A timer measurement value is displayed on **【TIMER/SWEEP】** ⁶⁰ display. The timer automatically selects one of the following three ranges depending on the measurement time.

(If 999.99s is exceeded, measurement becomes disabled, showing an error message.)

0.0-9999.9ms

10.000-99.999s

100.00-999.99s



To clear the timer measurement value, [AUTO] and [MANUAL] CLEAR are available.

[MANUAL]: The timer is reset by pressing **TIMER CLR** ⁵¹ key.

[AUTO] : The timer is reset automatically by every Start-command input in setting [TIMER CLR] - [AUTO] on the **【SETTING/DATA】** display.

[AUTO] can work in the following timer modes.

In [HLD MODE] : [INTERVAL] and [SEP.TIMER]

In [NHD MODE] : [INTERVAL]

In the following timer modes, Timer is reset by only **TIMER CLR** key even if [AUTO] is set.

In [HLD MODE] : [ONE-SHOT]

In [NHD MODE] : [TRAIN]

- Setting procedure for TIMER CLEAR in TIMER MENU

Press **SHIFT**+**OTHER FUNC** key to display the other function on

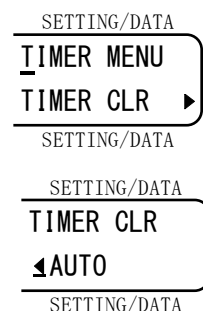
【SETTING/DATA】 display.

Rotate **MODIFY** to select [TIMER MENU].

Move the cursor down with **▼** and turn **MODIFY**

to select [TIMER CLR], then, press **▶**.

[AUTO] or [MANUAL] is selected by **MODIFY**.



■ Correction of timer measurement value using the trip input chattering correction function [ON]

When the chattering correction function is "OFF", timer measurement starts to count at the first change of trip input signal chattering.

If the user wishes to start timer measurement after the trip input signal change becomes stable, set the chattering correction function "ON".

☞ “3.5.1.B) Setting of trip input chattering correct function“

When the chattering correction function is turned "ON", the measurement value is corrected as below, and the corrected value is displayed as a timer measurement value.

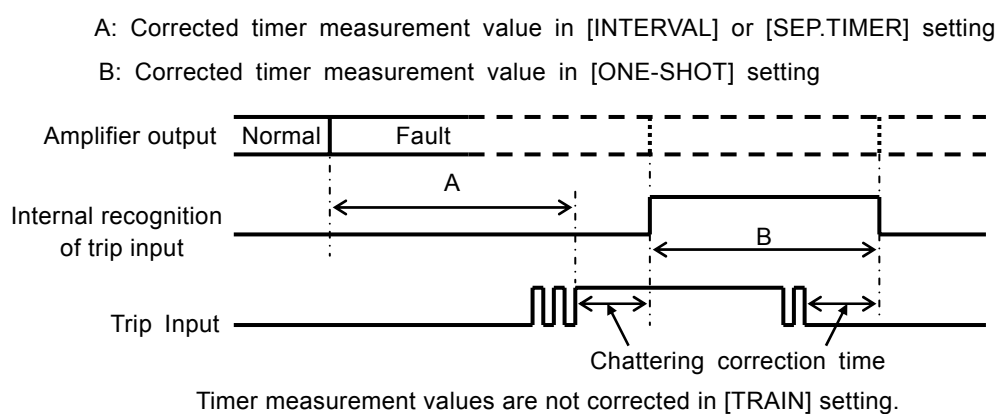


Figure 3-13 Timer measurement values when the trip input chattering correction function is [on]

B) Fault duration

When fault duration is set to "ON", amplifier output is forced to return to normal state from fault state after the set-time goes by

This function is used when the user does not want to leave amplifier output fault state for a long time.

● Setting procedure

Press **SHIFT**+**DURATION** key of ⑥ to display the fault duration on the **【SETTING/DATA】** display.

Rotate **MODIFY** dial and select [on] or [off] of the function.

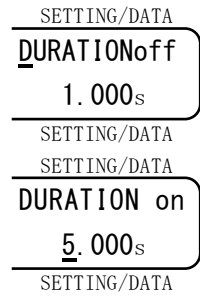
When the function is turned [on],

<DURATION>⑤ LED on the front panel will light on.

Move the cursor down with **▼**, and use the numeral buttons

or **MODIFY** dial to set the fault duration time.

(0.001-65.000s)



Only when operation mode is quick change mode, the fault duration function works well, and <DURATION> LED will light on.

Set the fault duration time a little longer than the expected measurement time. Even if the measurement does not come to an end, the amplifier output returns to normal state from fault state when the fault duration time goes by.

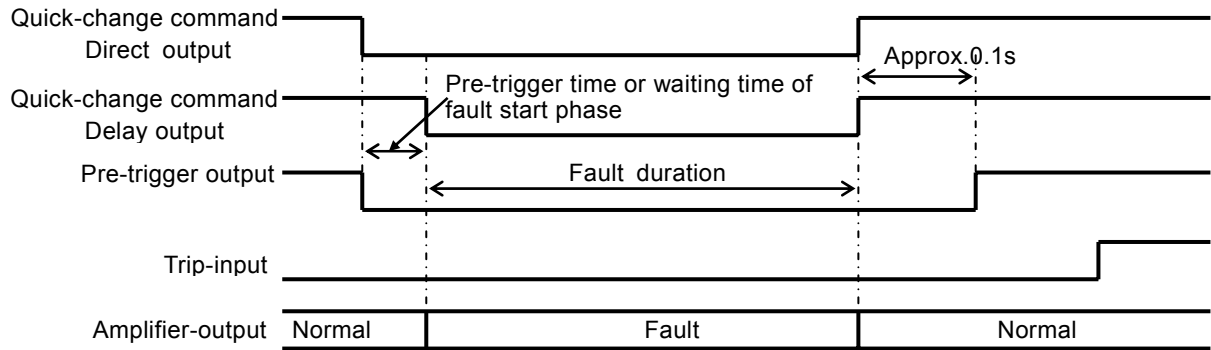


Figure 3-14 Operation of Fault-duration

C) Pre-trigger time and fault start phase

Pre-trigger time (fault delay time) sets the delay time from fault-start-command to an actual quick change of the amplifier output.

This function is useful in setting paper feeding time of the mechanical oscilloscope recorder, or in adjusting transfer-time of the Opposed-test.

- Setting procedure of pre-trigger time

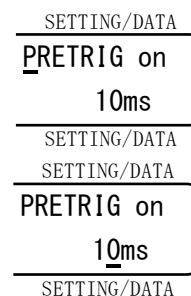
Press **SHIFT**+**PRETRIG** key of ② to display the pre-trigger time on the **【SETTING/DATA】** display.

Rotate **MODIFY** dial and select [on] or [off] of the function.

When the function is turned [on], <PREGRG> LED on the front panel will light on.

Move the cursor down with **▼**, and use the numeral buttons

or **MODIFY** dial to set the pre-trigger time. (10-6000ms)



A fault-start-phase is the phase when the amplifier-output quickly changes to fault state after the fault-start-command input. The setting value is set as the delay phase in relation to the reference phase.

④ “3. 4. 1. A) Reference phase and frequency synchronization signal input/output

- Setting procedure of Fault-start-phase

Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】**.

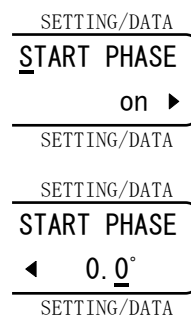
Rotate **MODIFY** to select [START PHASE].

Move the cursor down with **▼** and turn **MODIFY**

to select [on] or [off] of the function.

When the function is turned [on], <START PHASE>LED of ⑤ on the front panel will light on.

Press **▶** and select the fault-start-phase with the numeral buttons or **MODIFY**. (0.0-359.9 °)



Only in quick-change-mode, both function of pre-trigger time and fault-start-phase are variable.

When other mode but quick-change-mode is set, <PRETRIG> and <START PHASE>LED on the front panel will light off, both function of pre-trigger time and fault-start-phase does not work.

The delay of fault-quick-change (quick-change-command delay output) in relation to the fault-start-command (quick-change-command direct output) is different each other according to setting of [on] or [off] of the pre-trigger function and fault-start-phase function.

Both [off]	no delay
Pre-trigger only [on]	quick-change occurs after the pre-trigger-time elapses.
Fault-start-phase only [on]	quick-change occurs at the fault-start-phase timing.
Both [off]	quick-change both function of pre-trigger time and fault-start-phase occurs at the fault-start-phase timing after the pre-trigger-time elapses.

- Quick-change timing for Pre-trigger time of [on] 45ms and Fault-start-phase of [on] 180.0 °

MODE	NORMAL V (V)	NORMAL I (A)	TIMER/SWEEP
HLD MODE	100.00	1.0000	0.0ms
50.000	90.0	90.0	INTERVA
NORMAL FREQ(Hz)	NORMAL V φ (°)	NORMAL I φ (°)	TIMER MODE/SWEEP TIME
MASTER/SLAVE	FAULT V	FAULT I (A)	SETTING/DATA
SINGLE	50.00	2.0000	START PHASE
50.000	90.0	180.0	◀ 180.0°
FAULT FREQ(Hz)	FAULT V φ (°)	FAULT I φ (°)	SETTING/DATA

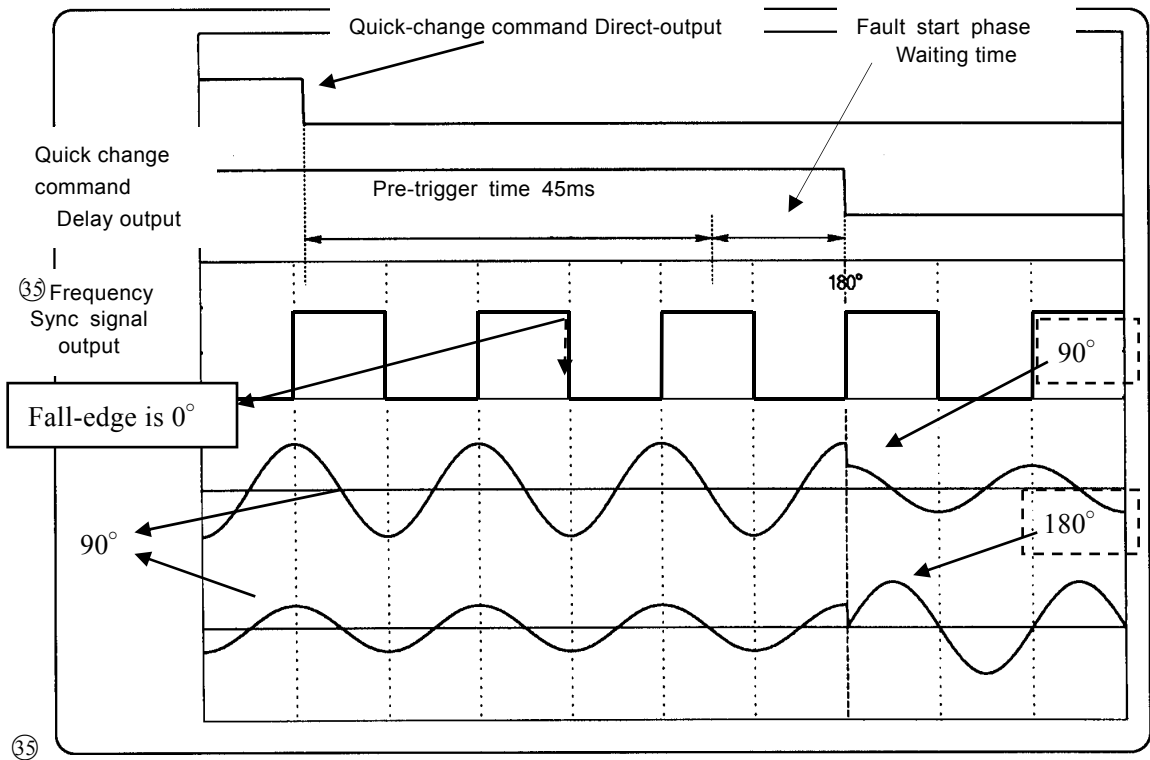


Figure 3-15 Typical quick change start timing when pre-trigger time and fault start phase are [on]

When the pre-trigger time and fault-start-phase are both set to [on], quick-change takes place when the internal reference phase comes to 180° after 45ms of pre-trigger time setting of the fault-command.

Therefore, the time period from the fault-start-command to quick-change occurrence varies within the maximum of one waveform (0 to 20ms for 50Hz) depending on the timing between the fault-command and internal reference-phase.

Since the normal voltage phase setting is 90°, quick-change takes place when the voltage phase is at 90°. Since the normal voltage phase and the fault voltage phase are the same, the voltage phase will not be discontinuous but the voltage amplitude becomes a half.

Since the normal current phase is 90° and the fault current phase is 180°, the current phase will turn to 180° from 90° with a fault quick change. The amplitude becomes doubled.

3.5.4 Simultaneous operation/recovery measurement mode

The simultaneous Operation/Recovery measurement mode allows the user to measure the operation-time and the recovery-time by a single try.

The operation-start-command is triggered by **FAULT** (59) key or [START INPUT] input of (5) (6) .

The operation-stop-command is given by **NORMAL** or **FAULT** (59) key (depending on the PSW mode setting) or Start-input (5) (6) (when Stop-setting is "ON").

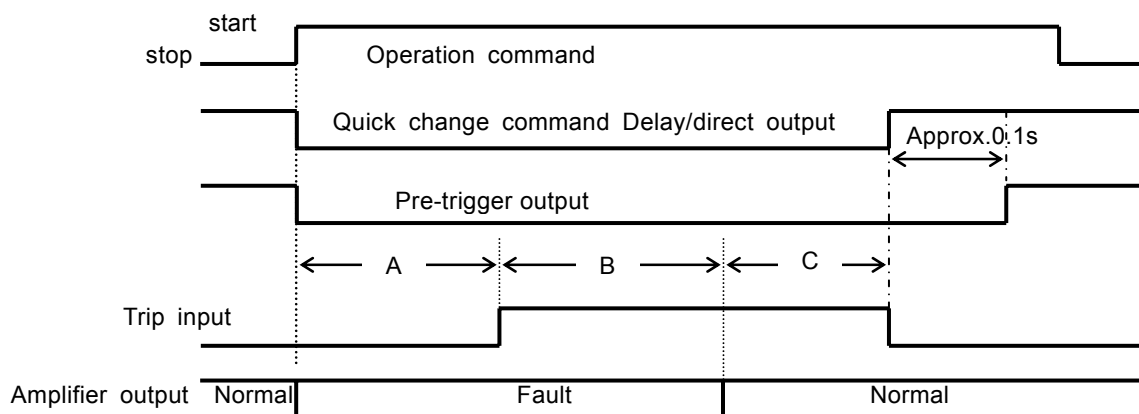


Figure 3-16 Operation of simultaneous operation/recovery measurement mode

Amplifier-output is turned to fault-state from normal-state with operation-start-command, and operation-time is defined as duration time from operation-start-command point to trip-input, and " A " described in Fig 3-16 is operation-time.

↓

Fault-state continues up to further fault-wait-time set in advance after trip-input is "ON", and " B " described in Fig 3-16 is fault-wait-time.

↓

Just after Fault-wait-time set in advance has passed, amplifier-output is turned to normal-state from fault-state, recovery-time of trip-input (=Protection-relay-recovery-time) is measured, and " C " described in Fig 3-16 is recovery-time.

Setting procedure of fault-wait-time

When the simultaneous Operation/Recovery-measurement mode is selected, or **SHIFT**+**WAIT TIME** (62) key is pressed, fault-wait-time can be set on the **【SETTING/DATA】** display.

Move the cursor down with **▼** and set fault-wait-time with the numeral buttons or **MODIFY**. (0.01-9.99s)

```

SETTING/DATA
WAITING TIME
0.01s

```

In simultaneous Operation/Recovery-measurement mode, only [INTERVAL] measure is available for the timer mode.

3.5 Operation mode

Since the measurement value is reset at every operation-command input, you can try to operate next measurement without pressing **TIMER CLR** key.

The measurement result is displayed on the **【SETTING/DATA】** display.

SETTING/DATA	
TS: 1252. 2m	←Operation time(ms or s)
TR: 10. 759s	←Recovery time(ms or s)
SETTING/DATA	

3.5.5 Operation of normal sweep

The normal sweep is an operation-mode to measure the operation-value (static characteristics) of a protective relay.

The amplifier-output changes continuously from the normal value to the fault value (operation value measurement) and from the fault value to the normal value (recovery value measurement).

- Items subject to sweep

Three parameters of Frequency, Amplitude and Phase can be swept.

But if the same value is set for normal-state and fault-state, amplifier-output value of the items does not change.

The fault value must be set to the more/less value that protective relay works well completely.

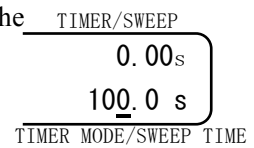
- Setting of sweep time

When the operation-mode is normal-sweep, the sweep-time is displayed on the

【TIMER MODE/SWEEP TIME】 display. Move the cursor to the

【TIMER/SWEEP】 display with ▲, ▼, ◀ and ▶,

and set the Sweep-time with numeral buttons or **MODIFY**. (1.0-1000.0s)



The elapsed time of sweep is displayed on the 【TIMER/SWEEP】 Ⓢ display.

For the manual sweep, set the elapsed time of sweep here.

When [100.0s] is set as Sweep-time on the 【TIMER MODE/SWEEP TIME】 display, the relationship between the displayed value and the output value is as follows.

[0.00s]: normal value

[50.00s]: middle of normal value and fault value

[100.00s]: fault value

The output value is displayed on 【NORMAL FREQ】 【NORMAL VOL·CURRENT】 【NORMAL VOL·CURRENT PHASE】. The following example is a display when the normal frequency is 50.000Hz, the normal voltage is 100.00V and the normal voltage/current phase difference is 0.0°.

MODE	NORMAL V (V)	NORMAL I (A)	TIMER/SWEEP
SWEEP	50.00	5.000	50.00s
50.000	-45.0	135.0	100.0s
NORMAL FREQ(Hz)	NORMAL V φ (°)	NORMAL I φ (°)	TIMER MODE/SWEEP TIME

MASTER/SLAVE	FAULT V (V)	FAULT I (A)	SETTING/DATA
SEPARATE	0.00	0.000	MODE
50.000	-90.0	270.0	SWEEP ↵
FAULT FREQ(Hz)	FAULT V φ (°)	FAULT I φ (°)	SETTING/DATA

The phase sweeps in the delay-direction when the fault value of phase is bigger than the normal value of phase, and in the lead-direction when smaller.

In Normal-sweep, Automatic-sweep and Manual-sweep are available.

In Manual-sweep, [M] is displayed on the 【TIMER/SWEEP】 display.

TIMER/SWEEP
M 0.00s
100.0 s
TIMERMODE/SWEEP TIME

- How to set either Automatic-sweep or Manual-sweep

Press **SHIFT**+**OTHER FUNC** key to display the other function on the 【SETTING/DATA】 display.

Rotate **MODIFY** and select [MAN SWEEP].

Move the cursor down with **▼** and turn **MODIFY** to select [off] / [on].

[off] : Automatic-sweep

[on] : Manual-sweep

SETTING/DATA
MAN SWEEP
off
SETTING/DATA

A) Manual sweep

In Manual-sweep, if the elapsed time of sweep is set at the 【TIMER/SWEEP】 display,

Amplifier-output values of parameters (Frequency, Amplitude, phase) is output in proportion to the elapsed time setting.

And Amplifier-output values is also displayed on the Upper-display^⑥.

In order to set elapsed time,

Move the cursor to 【TIMER/SWEEP】 with **▲**, **▼**, **◀** and **▶**, and set elapsed time with the numeral buttons or **MODIFY** dial.

TIMER/SWEEP
M 12.34s
100.0 s
TIMER MODE/SWEEP TIME

In the Manual-sweep, Operation-command and Operation-start-input is not valid, but the Trip-input state can be monitored with the <TRIP INPUT>LED on the front panel.

Therefore, the Operation/Recovery values of protective relay can be measured by monitoring the <TRIP INPUT>LED.

B) Automatic sweep

In Automatic-sweep, Sweep-time is the time that is necessary to sweep from normal-state value to fault-state value or from fault-state value to normal-state value.

An Sweep-start-command is given by **[SWEEP▲]**/**[SWEEP▼]**⁵⁴ or **[START INPUT]**⁵ ⁶ .

An Sweep-stop-command is given by **[NORMAL]**, **[FAULT]** and **[STOP]** key.

■ Sweep operation example from the normal value to the fault value

The sweep from normal-state value to fault-state value is used to find Operation-point of the protective relay, so the trip-input needs to be in the non-operation status when the sweep starts.

- Press **[NORMAL]** ⁵⁴ key to make Amplifier-output value to normal-state value.
Trip-input of ① to ④ needs to be in the non-operation-status at this time.
- Press **[SWEEP▼]** ⁵⁴ or perform the Operation-start⁵ ⁶ input, and Amplifier-output value sweeps from normal to fault. (LED of **[SWEEP▼]** ⁵⁴ will light on.)
- Press **[STOP]** ⁵⁴, and the sweep will stop, and LED of **[STOP]** will light on.

And Amplifier-output value is the then value.

- Press **[SWEEP▼]** again or perform Operation-start⁵ ⁶ input to sweep to fault-state value direction. (LED of **[SWEEP▼]** will light on.)
- When **[TRIP INPUT]** signal turns "ON", the sweep stops (LED of **[STOP]** key will light on).
The Amplifier-output value displayed on the Upper-fluorescent-display⁶⁰ at this time is an Operation-value of the protective relay.

■ Sweep operation example from the fault value to the normal value

The sweep from fault-state value to normal-state value is used to find Recovery-point of the protective relay, so the Trip-input needs to be in the operation-status("ON") when the sweep starts.

- Set PSW mode for **[ALTERNATE]** , and press **[FAULT]** key to set Amplifier-output value to Fault-state value. Trip-input is turned "ON" at this time
- Press **[SWEEP▲]** ⁵⁴ or perform the Operation-start⁵ ⁶ input, and Amplifier-output value sweeps from Fault to Normal. (LED of **[SWEEP▲]** ⁵⁴ will light on.)
- When Trip-input turns to non-Operate-status(" OFF "), the sweep stops (LED of **[STOP]** will light on) .
The Amplifier-output value displayed on the Upper-fluorescent-display⁶⁰ at this time is a Recovery-value of the protective relay.

3.5.6 Operation of Search / DSK-Search sweep

In normal sweep mode, if the sweep rate is too fast, the measurement result of Operation/Recovery time of protective relay may have a large margin of error.

In order to assure more correct measurement, Search/DSK-search sweep modes can be available to cover the above drawback.

The sweep parameters (Frequency, Amplitude, Phase), the sweep-time and the sweep-direction of the phase are same as those described in "3.5.5 Operation of normal sweep".

Search-sweep mode is useful for protective relay with fast operation time

DSK-search-sweep mode is useful for disk-type protective relay with slow response of Operation/Recovery-time.

Parameters of Search/DSK-search sweep menu in the other function have to be set.

- How to set Search/DSK-search sweep menu

When the operation mode is set for Search/ DSK-search-sweep by **MODE** (②) key and **MODIFY** key, the Search/DSK-search-sweep menu is displayed on the **【SETTING/DATA】** (⑥).

Alternatively, press **SHIFT+OTHER FUC** and **MODIFY** to select **[SEARCH MENU]**.

Move the cursor down with **▼** and turn **MODIFY** to select the sweep times **[SWP TIMES]**.

Press **▶** and use the numeral buttons and **MODIFY** to select the sweep times.(1-10)

Press **◀** to return to the **[SEARCH MENU]** of the other function.

Rotate **MODIFY** to select the judge time **[JUDGE TIME]**.

Press **▶** and use the numeral buttons and **MODIFY** to select the judge time. (0.1-10.0s)

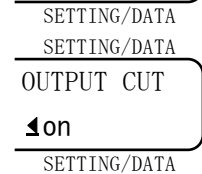
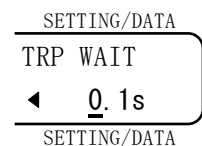
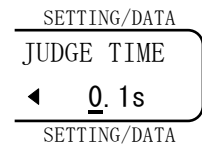
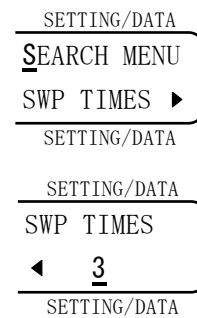
Set the trip-wait-time **[TRP WAIT]** following the same procedure.

(0.1-10.0s)

[OUTPUT CUT] "ON/OFF" setting is available.

on : Amplifier-output is turned off after measurement.

off : Amplifier-output is not turned off after measurement.



Note: The trip-wait-time is a parameter available in the DSK search sweep only.

■ Recommended settings

The following setting would assure correct measurement depending on the type of the protective relay.

Normal value:	about 70/130 % of expected Operation/Recovery value
Fault value:	about 130/70 % of expected Operation/Recovery value
Sweep time:	5 sec.
Sweep times:	3
Judgment time:	0.1 sec.

A) Search sweep

When a sweep starts from the normal value to the fault value and Trip-input signal turns to ON-state, the sweep is suspended.

When the judge time has passed, the Trip-input signal ON/OFF-state is checked again, and the sweep will be resumed in the opposite direction if the Trip-input signal remains ON-state, and in the same direction if the Trip-input signal is OFF-state.

As the first ON-state of Trip-signal can be seem to be attributed to chattering if the Trip-signal is recovered to OFF-state during the judge time span, then the sweep will be resumed in the same direction.

Since the sweep time increases twofold at every resuming, that is, the sweep runs at slower rate, a more accurate measurement can be obtained in a shorter time.

The user can select either Operation-value or Recovery-value according to selecting **[SWEEP▼]** / **[SWEEP▲]** key for sweep start trigger.

[SWEEP▼] : Operation-value detection
[SWEEP▲] : Recovery-value detection

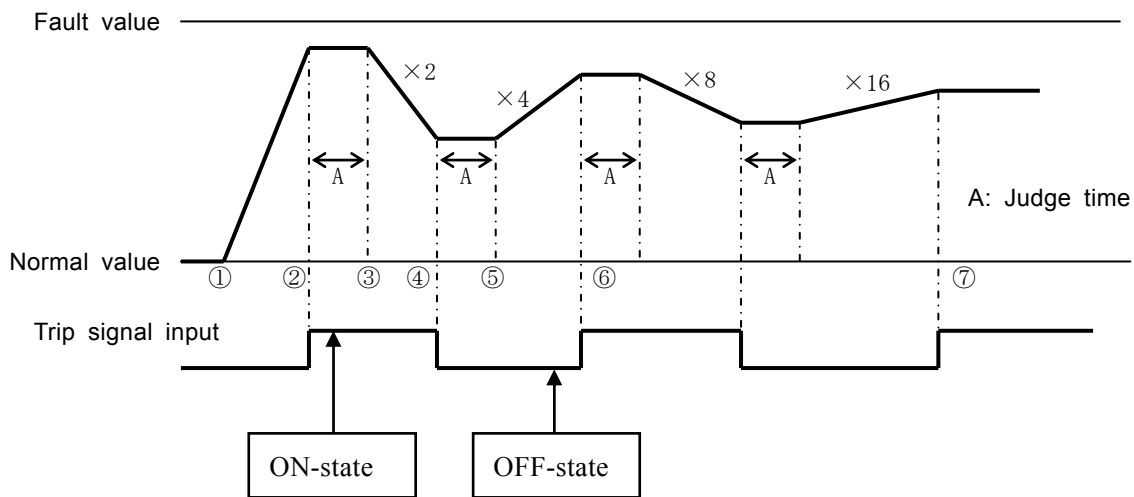


Figure 3-17 Operation of search sweep

- ① When **[SWEEP▼]** is pressed, the sweep will start from the normal value to fault value in the set sweep time. SETTING/DATA
OPRATE VAL
1 TIMES
SETTING/DATA
- ② When a trip-signal operates(ON), the sweep is suspended.
- ③ When the set judge time has passed, the sweep is resumed toward the normal value if the trip-signal remains ON-state, and toward the fault value again if the trip-signal returns to OFF-state. The sweep time is two times the first time.
- ④ At the next trip-signal change, the sweep will be suspended.
- ⑤ When the judge time has passed, the sweep is run in the opposite direction if the trip-signal remains as in (4) above, and in the same direction if it is changed. The sweep time is two times the previous time (i.e., four times the first or the set time). The indication of the sweep run changes to [2 TIMES], then to [3 TIMES] and so on at every sweep from normal value to fault value.
- ⑥ The above steps are repeated while the sweep time doubled at each run.
- ⑦ When the set times of fault-direction-sweep-run have been performed, the test is finished and the LED of the STOP lights up. Now the output is turned off if the output-cut is set for [on].

Since the test ends with the last sweep run in the fault direction in the above procedure, this is operation

value detection.

If the test is started with a press on the **SWEEP▲**, then the test ends after execution of set times of normal-direction sweep run, this is recovery value detection.

[RECOVE VAL] is displayed on the **【SETTING/DATA】**.

If the system fails to detect any operation or recovery value, [ERR] will be shown to finish the measurement.

SETTING/DATA
RECOVE VAL
1 TIMES
SETTING/DATA

B) DSK search sweep

Disk type protective relays have longer operation-time, which makes it takes much time to measure Operation /Recovery-value. Therefore, the test begins with a Quick-change to the fault-state value, then, after confirming Trip-input operation(On-state), a sweep starts from fault value to normal value.

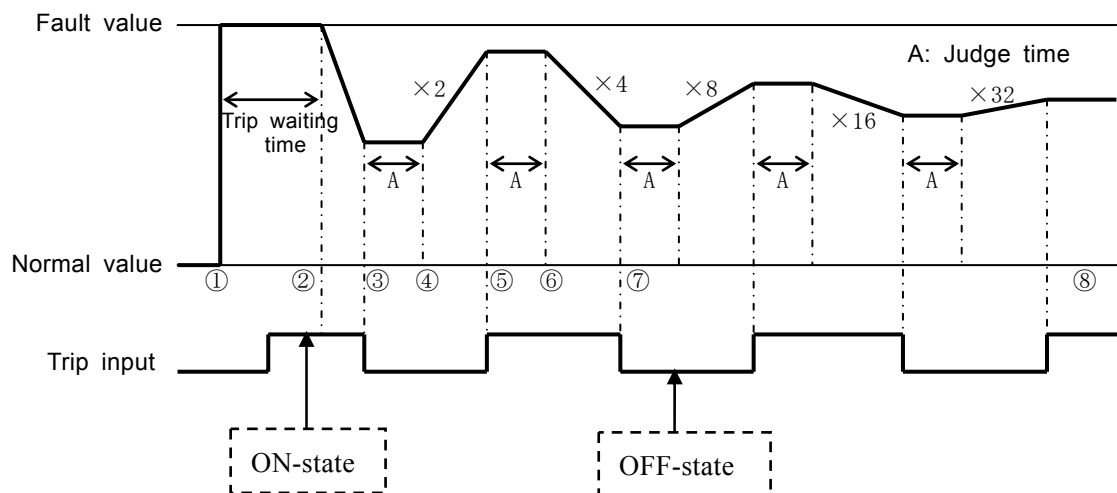


Figure 3-18 Operation of DSK search sweep

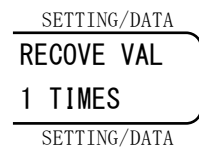
- ① Press the **[SWEEP▼]**, and a quick-change to the fault value occurs.
Indication of [OPRATE VAL] and [1 TIMES] are shown.
- SETTING/DATA
OPRATE VAL
1 TIMES
 SETTING/DATA
- ② When the set judge-time has passed, and if the trip-input signal is keeping ON-state, the sweep is started from the fault value to the normal value in the set sweep rate.
 - ③ When the trip-input signal returns to OFF-state, the sweep is suspended.
 - ④ When the set judge-time has passed, the sweep is resumed toward the fault value if the trip-input signal remains OFF-state, and toward the normal value if the trip-input signal is ON-state.
The sweep time becomes two times the first time.
 - ⑤ At the next trip signal change, the sweep is suspended.
 - ⑥ When the judge-time has passed, the sweep is run in the opposite direction if the trip-input remains as in the previous run, and in the same direction if it is changed. The sweep time is two times the previous time (i.e., four times the first or the set time). Every time the sweep is run in the fault direction, the Sweep-times displayed increases such as [2 TIMES] and [3 TIMES].
 - ⑦ The above steps are repeated while the sweep time is doubled at each run.
 - ⑧ When the set Sweep-times of fault-direction-sweep-run have been performed, the test is finished and the LED of the **[STOP]** lights up.

Now the Amplifier-output is turned off if the output-cut is set for [on].

Since the procedure ends with the last sweep run in the fault direction in the above procedure, this is Operation-value detection.

If the test is started with pressing **[SWEEP▲]** key, then the test comes to an end after execution of set Sweep-times of normal-direction-sweep-run.

This is recovery value detection.



SETTING/DATA
RECOVE VAL
1 TIMES
SETTING/DATA

[RECOVE VAL] is displayed on the **【SETTING/DATA】** .

If the system fails to detect any Operation/Recovery-value, [ERR] will be shown and the measurement will be finished.

3.5.7 Operation of 95 relay test mode (frequency relay)

In the Frequency-relay(95 relay) test mode, the following four data can be obtained by single operation.
 operation frequency, recovery frequency, operation time and recovery time.

An operation start command is given by **FAULT**, **SWEEP** (54) key or an Operation-start-input (5) (6).

An operation stop command is given by **NORMAL** and **STOP** (54) key.

When the frequency relay test mode is set, the frequency setting is automatically set for [INTERNAL].

In frequency relay test mode, several parameters must be set in the frequency relay test menu.

- Setting procedure of the frequency relay test menu

When the operation mode is set to a simultaneous operation/recovery measurement mode by **MODE** (62), **MODIFY** and **ENTER** key, the frequency relay test menu is displayed on the **【SETTING/DATA】**.

Alternatively press **SHIFT**+**FREQ RELAY** (62),

and the frequency relay test menu is displayed on the **【SETTING/DATA】**.

Rotate **MODIFY** to select the cross frequency [CROSS FREQ].

Press **▶** and select the cross frequency

with the numeral buttons or **MODIFY**. (10.000-200.000Hz)

Press **◀** to return to [FREQ RELAY].

Rotate **MODIFY** to select the sweep rate [SWEEP RATE].

Press **▶** and set the sweep rate

with the numeral buttons or **MODIFY**. (0.001-9.999Hz/s)

The hold time is set by the same procedure. (0.01-650.0s)

[on] / [off] of the AMPlitude-Quick-Change is also set by the same procedure.

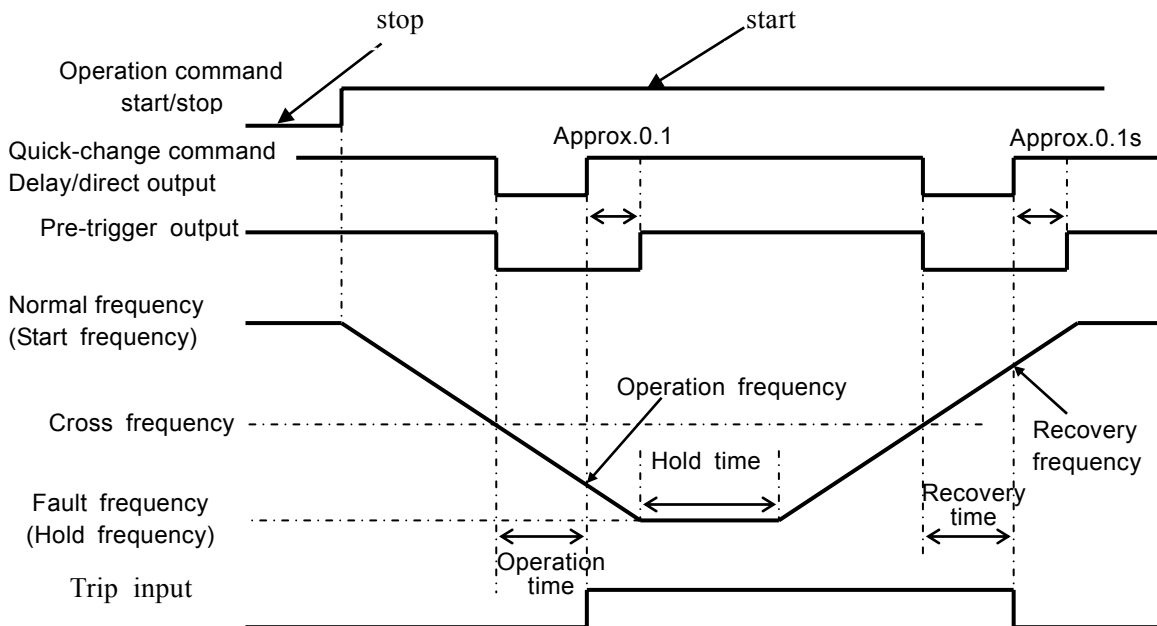
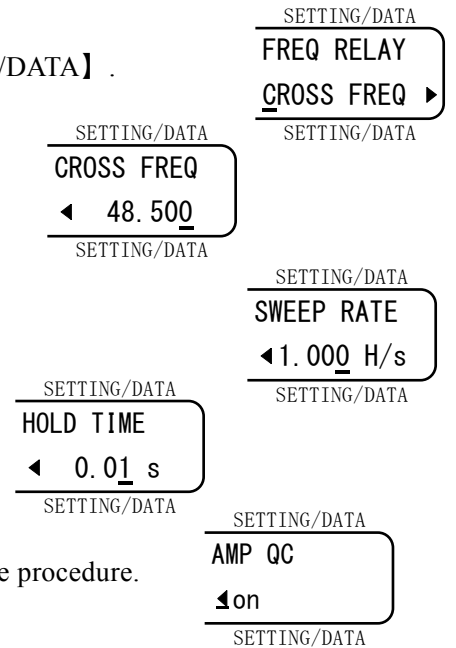


Figure 3-19 Operation of frequency relay test mode

■ Amplitude quick change

In the frequency relay test mode, the output amplitude can be quickly changed just before the frequency starts to sweep.

If the amplitude quick change setting in the frequency relay test menu is turned [on], the amplitude fault value setting is available. The frequency sweep starts just after the amplitude output is quickly changed to the fault value.

When the frequency sweep is over, the amplitude output returns to the normal value.

When the amplitude quick change setting is [off], the amplitude fault value setting is not available.

■ Display of measurement data

The measurement results are displayed on the 【TIMER/SWEEP】 , 【TIMER MODE/SWEEP TIME】 and 【SETTING/DATA】 .

TIMER/SWEEP		
FS: 53.965	←	Operation frequency(Hz)
TS: 966.3m	←	Operation time(ms or s)
TIMER/SWEEP		
SETTING/DATA		
FR: 52.615	←	Recovery frequency(Hz)
TR: 383.1m	←	Recovery time(ms or s)
SETTING/DATA		

When the measurement fails, the result is displayed as [-----] .

3.6 Other basic operation

Other function, panel setting memory function and control power output operation are described here.

3.6.1 Other function

Other functions include rarely used function and function which operation mistake needs to be avoided.

To set the other function, press **SHIFT**+**OTHER FUNC**

to display the other function which the user wish to use on the **【SETTING/DATA】**

using **MODIFY**.

SETTING/DATA
WAITING TIME
0.01s
SETTING/DATA

The following is a list of other functions.

Fault start phase	[START PHASE]	☞ “3.5.3.C) Pre-trigger time and fault start phase“
Amplifier input selection	[INPUT SEL]	☞ “4.2 Amplifier signal “
Chattering correct	[CHATTERING]	☞ “3.5.1.B) Setting of trip input chattering correct function“
Waveform selection	[WAVE SELECT]	☞ “3.4.3 Waveform selection“
Phase setting	[PHASE MODE]	☞ “3.4.2 Setting of amplitude and phase“
Search·DSK menu	[SEARCH MENU]	☞ “3.5.6 Operation of Search / DSK-Search sweep“
Timer setting	[TIMER MENU]	☞ “3.5.3.A) Timer“
Stop setting	[STOP FUNC]	☞ “3.5.1.D) Setting of operation start input stop“
Start input	[START INPUT]	☞ “3.5.1.C) Setting of operation start input logic“
Manual sweep	[MAN SWEEP]	☞ “3.5.5 Operation of normal sweep“
Extended response input	[EXT RESPNS]	☞ “4.3 Operation of extended response input“
Switch control	[SW CTRL]	☞ “4.1.3.D) Selector communication function“
PSW mode	[PSW MODE]	☞ “3.5 Operation mode“
Beep setting	[BEEP]	☞ “3.6.1. A) Beep Setting“
GPIB setting	[GPIB]	☞ “5.2.3 Setting of GPIB“
RS-232C setting	[RS-232C]	☞ “6.2.4 Setting of RS-232C“
Language	[LANGUAGE]	☞ “3.6.1.B) Language Setting“

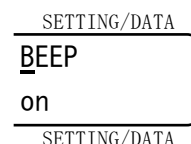
A) Beep setting

This function turns on and off the beep sound when buttons are pressed and when error occurs. Note that the beep does not sound at overload when it is turned off.

Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】** .

Rotate **MODIFY** and select [BEEP].

Move the cursor down with **▼** and turn **MODIFY** to select [on] or [off].



B) Language setting

Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】** .

Rotate **MODIFY** and select [LANGUAGE].

Move the cursor down with **▼** and turn **MODIFY** to select [ENGLISH] or [日本語] (Japanese) .

3.6.2 Panel setting memory

This function allows writing and reading of the memory number from 0 to 31 on the panel. The setting parameters for writing and reading is the same as “Table 3-1 List of Initial Values of Panel Setting “.

(Memory No. 32 is a default value for 50Hz and No. 33 is a default value for 60Hz and read only.)

Once test conditions have been set and written into the memory, they can be retrieved on the next test occasion; the user does not need setting them again.

In addition, the user can add comment when writing. Comment can be written within ten characters including numbers, [-] and [·]. (Also alphabets can be used in GPIB and RS-232C.)

The written memory data of No 1 to 31 can be cleared.

Memory write, read and comment input

Press **MEMORY NO** **③** to display the panel setting memory on the **【SETTING/DATA】** .

Rotate **MODIFY** to select the memory to be operated from [MEMORY 0] to [MEMORY 31].

- Write

Press **SHIFT**+**WRITE** **③** to write in the selected memory.
[NOW WRITING] is displayed during writing.

- Memory reading

Press **SHIFT**+**READ** **③** to read the selected memory. [NOW READING] is displayed during reading.
When memory reading is executed, the output turns off in all outputs for safety.

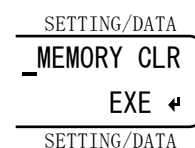
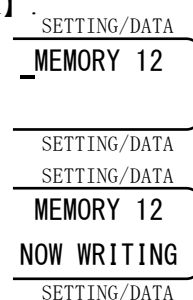
- Comment input

Move the cursor down with **▼** and input the comment with numeral buttons, then set with **ENTER**.

- All memory clear

Press **MEMORY No** **③** to display the panel setting memory on the **【SETTING/DATA】**

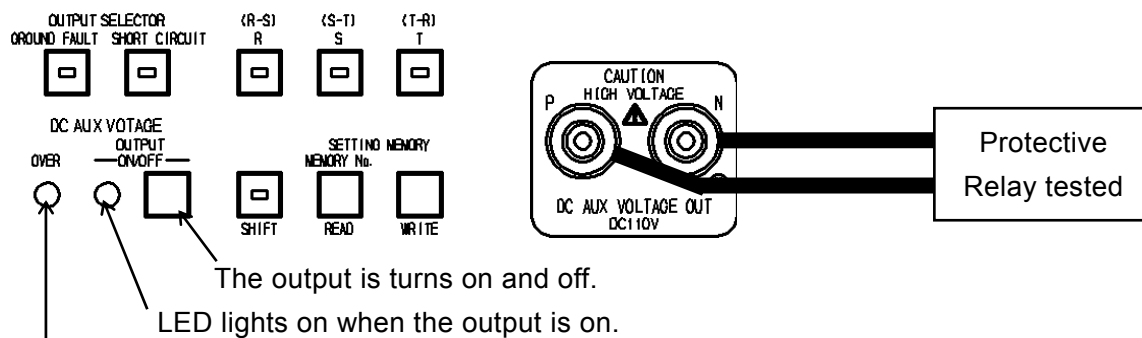
Rotate **MODIFY** to select [MEMORY CLR] and move the cursor down with **▼**, then, clear the memory with **ENTER** key.



3.6.3 Operation of control power output

The control power output on the right side panel is used as a power source of the protective relay to be tested in case of a single test of a protective relay. The output voltage is DC110V and the maximum output current is 0.5A.

The power is floated from the chassis and the withstand voltage to the chassis is 707Vpeak (500Vrms).



⚠ Caution

When the beep setting is off, the long beep does not sound if overload occurs. It is recommended to set the beep on. "3.6.1.0 A) Beep setting"

⚠ Warning

The output voltage of the control power output is DC110V. Take a great care for handling it because of a risk of electric shock.

Make sure to turn the output off when connecting a wire to the output.

4. Practical operation

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4.1 Master / slave function of this series

Units in this series allow to be combined into a polyphase system by connecting them one to others with a supplied daisy-chain control signal cable to make a master/slave configuration.

In a master/slave configuration, operation will be as follows:

- The frequency of all slave devices that are connected will be synchronized with that of the master device, and the phase of the master device will be the standard phase. Frequency can not be set from a slave device.
- Phase setting in any of master device or slave devices can be used in the same way as the use in a single unit.
- Operation in the master device causes a simultaneous quick change in all devices connected in the master/slave system. The timing of quick change is dominated by the master device.


4.1.1 Master / slave setting

Master/slave configuration includes [SEPARATE], [MASTER] and [SLAVE] .

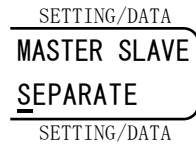
The setting item is displayed on the 【MASTER/SLAVE】 .

When the master/slave setting is changed, the output is turned off in all outputs for safety.

- Setting procedure

Press **MASTER/SLAVE**  to display master/slave on the 【SETTING/DATA】 .

Select the setting with **MODIFY** and press **ENTER**.



SETTING/DATA
MASTER SLAVE
SEPARATE
SETTING/DATA

■ [SEPARATE]

RX4717K operates separately. Use this setting when RX4717K is used as a single unit.

When RX4717K is used as a single unit, remove the daisy-chain master/slave control signal cable.

■ [MASTER]

This makes RX4717K a master device. The other devices connected to master device with a daisy-chain master/slave control signal cable (excluding 4741) will be destined for slaves (max. 3 devices).

■ [SLAVE]

This makes RX4717K a slave device. When the other device connected to slave devices with a daisy-chain master/slave control signal cable becomes a master device, this device will be destined for a slave.

【NORMAL·FAULT FREQ】 on the slave device displays [-----].



MASTER/SLAVE
SLAVE

FAULT FREQ

4.1.2 Master / slave connection

- Turn off the power of all devices, and pile up devices (max. 4).
- Connect the supplied power cable to the power input of the bottom device.
- Use supplied daisy-chain power cables and connect the device to the upper device in turn.

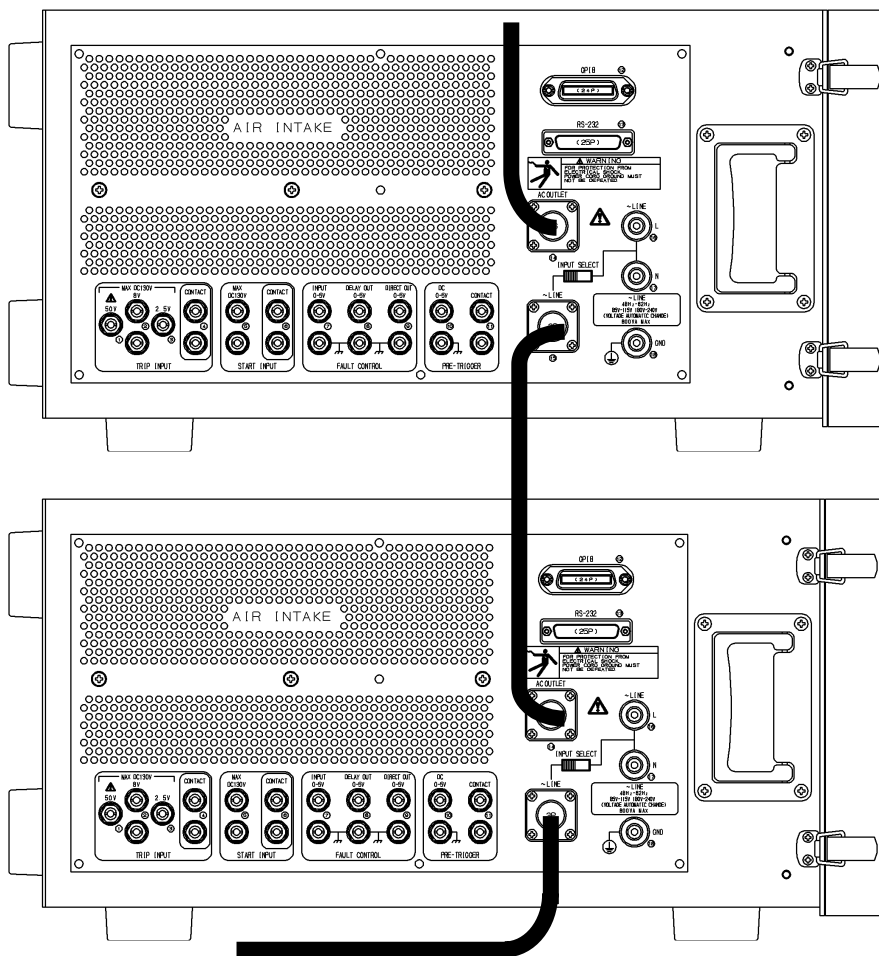
☞ “2.4 Grounding and power supply“

RX4717K has 15A of a maximum usable current capacity.

Avoid exceeding this value in use

- Connect a supplied daisy-chain control signal cable across the connectors of the parallel control signal in order. (These connectors and the cable do not distinguish between input and output.)
- Trip and operation start signals must be connected to the master device.

Do not connect them to any slave devices.



Power source: AC100V or 200V

Figure 4-1 Master/slave power connection

4.1 Master / slave function of this series

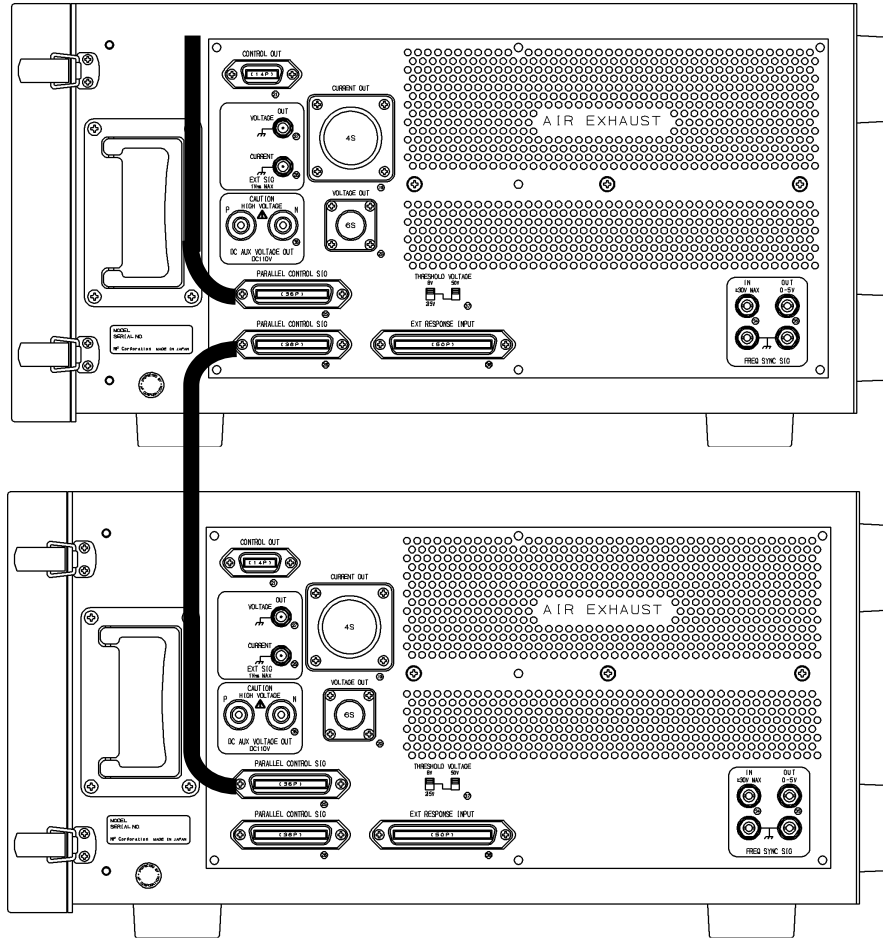


Figure 4-2 Connection of a daisy-chain master/slave control signal cable

4.1.3 Master / slave operation

A) Synchronization of operation mode

When the operation mode of a master device is changed, the operation mode of a slave device will automatically change to the same mode as the master device.

The slave device will operate according to the operation command of the master device.

When the operation mode is different between the master device and the slave device, they do not operate properly.

In the operation mode involving the following sweep, the parameters of the slave devices must be set to the same parameters of the master device.

When the settings are different, the operation does not work well.

Normal sweep	[SWEEP]
Search sweep	[SRCH SWEEP]
DSK search sweep	[DSK SWEEP]
Frequency relay test mode	[FREQ RLY]

B) Simultaneous setting change

If a master device changes amplitude and phase value with **MODIFY** dial when the cursor of a slave device is on the setting position for amplitude and phase, the value where the cursor is on of the slave device changes simultaneously.


To disable this function, press **CURSOR ON/OFF** of the slave device to turn off the cursor. (LED of **CURSOR ON/OFF** lights on.)

Press **CURSOR ON/OFF** again, and the cursor of the slave device will appear to enable the function. (LED of **CURSOR ON/OFF** lights off.)

C) All outputs on/off

If **ALL OUTPUT** key of a master device is pressed, all outputs of slave devices also turns ON.

However, since all-outputs-on function can be risky, the internal dip switch can disable all-outputs-on function of the slave device.

 "2.3 Setting of internal dip switch"

All-outputs on /off command can be received by 4717K, 4718W and 4723 only.

D) Selector communication function

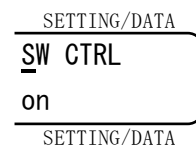
This function allows turning ON and OFF the synchronization of R, S, and T between the devices of this series equipped with an output selector for master/slave operation.

- Setting procedure

Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】**.

Rotate **MODIFY** and select [SW CTRL].

Move the cursor down with **▼** and turn MODIFY to select [ON] or [OFF].



4.2 Amplifier signal output

The internal synthesizer signal set in “3.4.1 Frequency setting” through “3.4.3 Waveform selection” is output to the external signal output ② with a range full-scale of 1 Vrms. This output is used to monitor the internal synthesizer signals and as a signal source of an external booster. The external signal output selects whether to set the amplitude for 0 when the amplifier output is turned off. This setting can be done by an internal dip switch.

☞ “2.3 Setting of internal dip switch”

4.2 Amplifier signal output

■ External output [EXT OUT]

The external signal output drives an external booster. All LEDs of the range keys of the output selected are turned off.

When the external signal output is 1 Vrms, the output amplitude of the external booster will be set as below.

Rotate **MODIFY** to select the external output [EXT OUT] and press **ENTER**,

then, the external booster amplitude is displayed on the **SETTING/DATA**.

Set the amplitude with the numeral buttons or **MODIFY**.

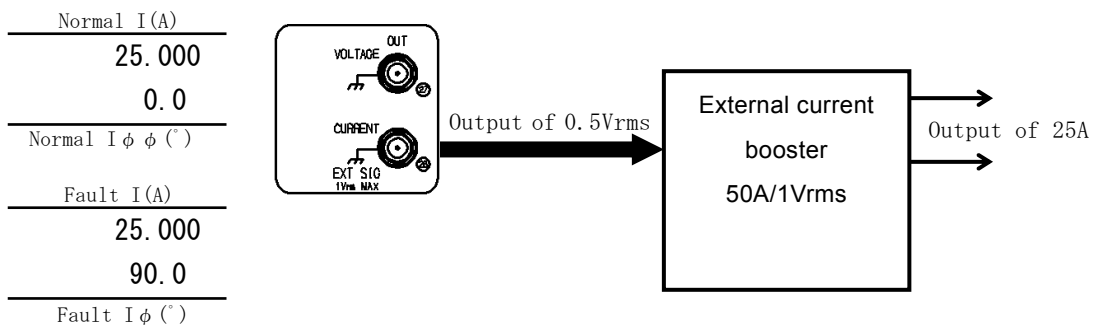
Setting range of voltage output: 0.00-999.99V

Setting range of current output: 0.000-99.999A

```

SETTING/DATA
I    50.0A
◀EXT OUT ▶
SETTING/DATA
    
```

When the external booster amplitude is [50.0A] and **NORMAL · FAULT CURRENT** indicates [25.000A], the external signal output amplitude is 0.5Vrms.



Depending on OUTPUT-ON/OFF-SW of this amplifier, the output amplitude of the external signal output ²⁷ ²⁸ is turns on/off according to the internal dip switch setting.

DIP-SW is not in 0-setting
error will occur.

<ON> LED stays off, and the amplifier output of the unit will not be output.

DIP-SW is in 0-setting

<ON> LED will be turned on and off, but the amplifier output of the unit will not be output.

The amplitude of external output ²⁷, ²⁸ becomes and the external booster output also becomes " 0 V ".

☞ "2.3 Setting of internal dip switch"

4.3 Operation of extended response input

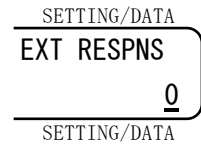
The extended response input function can extend the trip input up to 255 channels by connecting an optional expansion box for response signal to the extended external response input.

- Setting procedure

Press **SHIFT**+**OTHER FUNC** to display the other function **【SETTING/DATA】**.

Rotate **MODIFY** to select [EXT RESPNS].

Move the cursor down with **▼** and set the channel of trip input using the numeral buttons or **MODIFY**. (0 to 255)



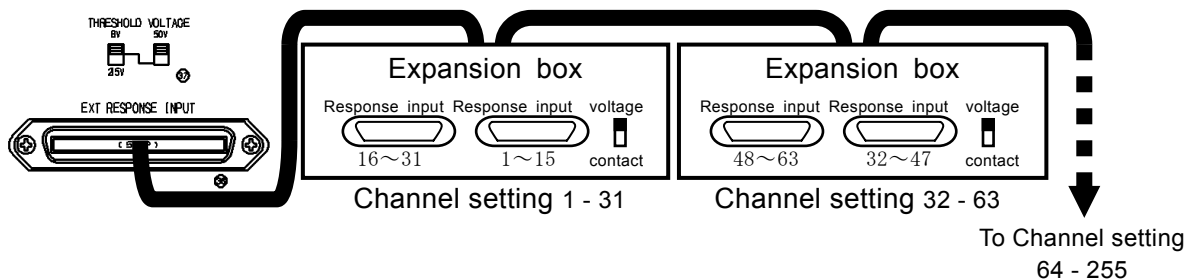
" 0 " setting is for a trip input of RX4717K and " 1 through 255 " setting are for the response input of an expansion box for response signal.

Caution

Trip input of RX4717K always operates when signal input occurs regardless of the channel setting of the trip input.

When the optional expansion box for response signal is connected to the expanded external response input and the channel is set to the response input of the expansion box (1 to 255), connect nothing to the trip input of RX4717K.

If connection is made by mistake, it is dangerous because the trip input is connected in parallel to the response input of the expansion box inside of RX4717K.



The response input of an expansion box for response signal selects the voltage input and the contact input with a toggle switch of the expansion box.

When the voltage input is selected, the threshold voltage will be set as +2.5V, +8V and +50V by a slide switch of the judge voltage.

4.4.2 Synchronization of quick change operation

For synchronizing the quick change operation, select the quick change mode for the operation mode of RX4717K and use each quick change signal terminal.

☞ “3.5 Operation mode“, “3.5.3 Operation of quick change mode“

Quick change signal terminals of RX4717K have two types: one for 4705A (a binding post terminal).

Signal output of RX4717K to synchronize the quick change operation of RX4717K with other system

- Quick change command direct output (for 4705A)

This is a logic signal and turns to Low when RX4717K is in operation.

In the quick change mode, when this signal changes to Low, the output of RX4717K quickly changes to fault after the pre-trigger time and the fault start phase. ☞ “3.5.3. C) **Pre-trigger time and fault start phase**“

- Quick change command delay output (for 4705A)

This is a logic signal which changes when the output of RX4717K quickly changes.
It turns to Low when fault is output.

- Signal input of RX4717K to synchronize the quick change operation of other system with RX4717K

- Operation start input (for 4705A)

This is a signal input to start the quick change of RX4717K externally. The signal input includes a contact input and a voltage input. When this signal operates, the output of RX4717K quickly changes after the pre-trigger time and the fault start phase.

Voltage input threshold voltage	High level: +2.5V
	Low level: +1.0V

- Quick change command input (for 4705A)

This is a logic signal and RX4717K outputs the fault when it is Low.

Threshold voltage	High level: +2.5V
	Low level: +1.0V

4.4.3 Connection with 4705A

A) Individual setting of pre-trigger time and fault start phase

The following connection allows setting the pre-trigger time and the fault start phase of RX4717K and 4705A individually and causing simultaneous quick change. RX4717K starts operation.

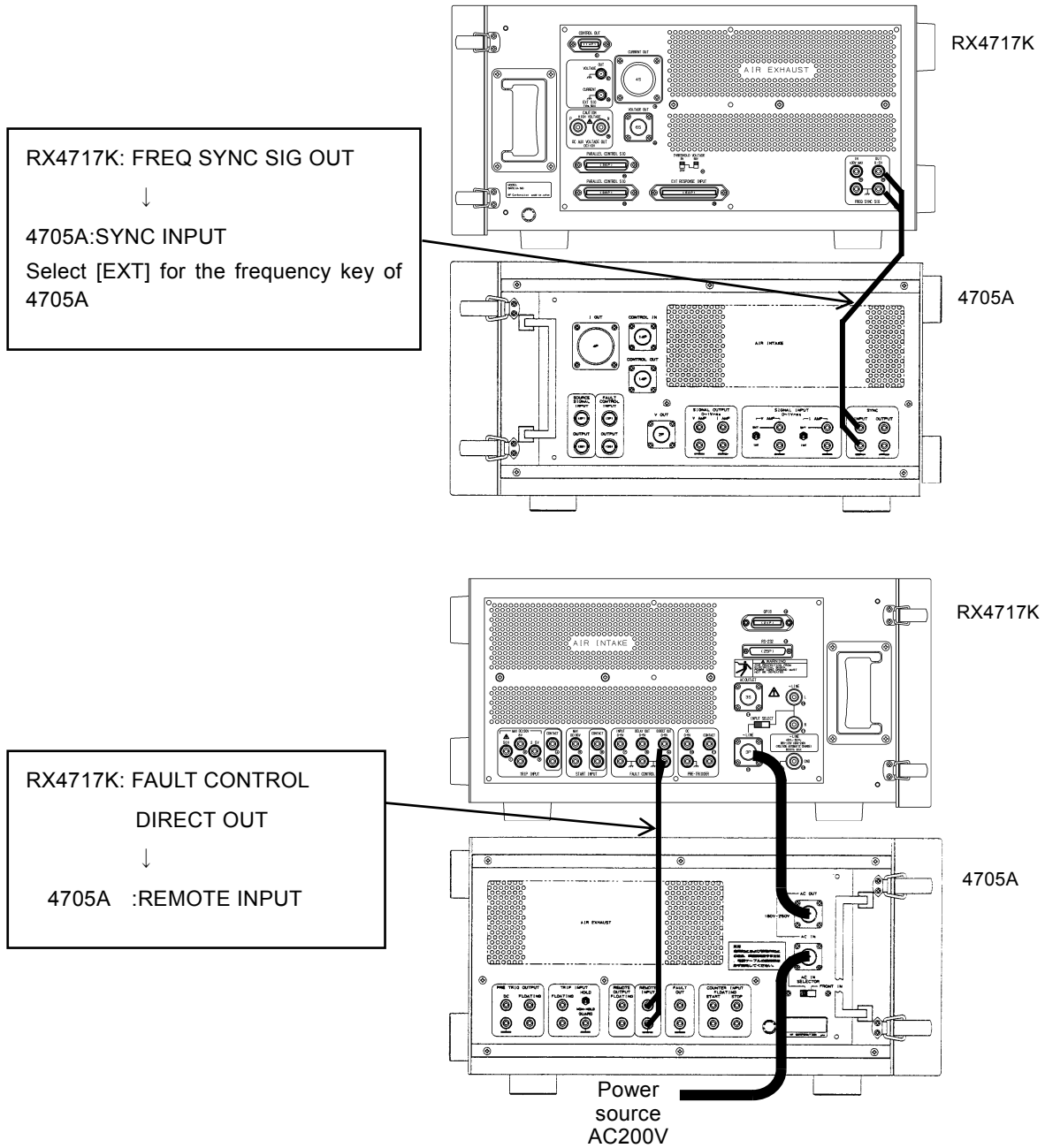


Figure 4-3 Connection diagram for individual pre-trigger time and fault start phase setting in 4705A

4.4 Operation in combined system with other type of units

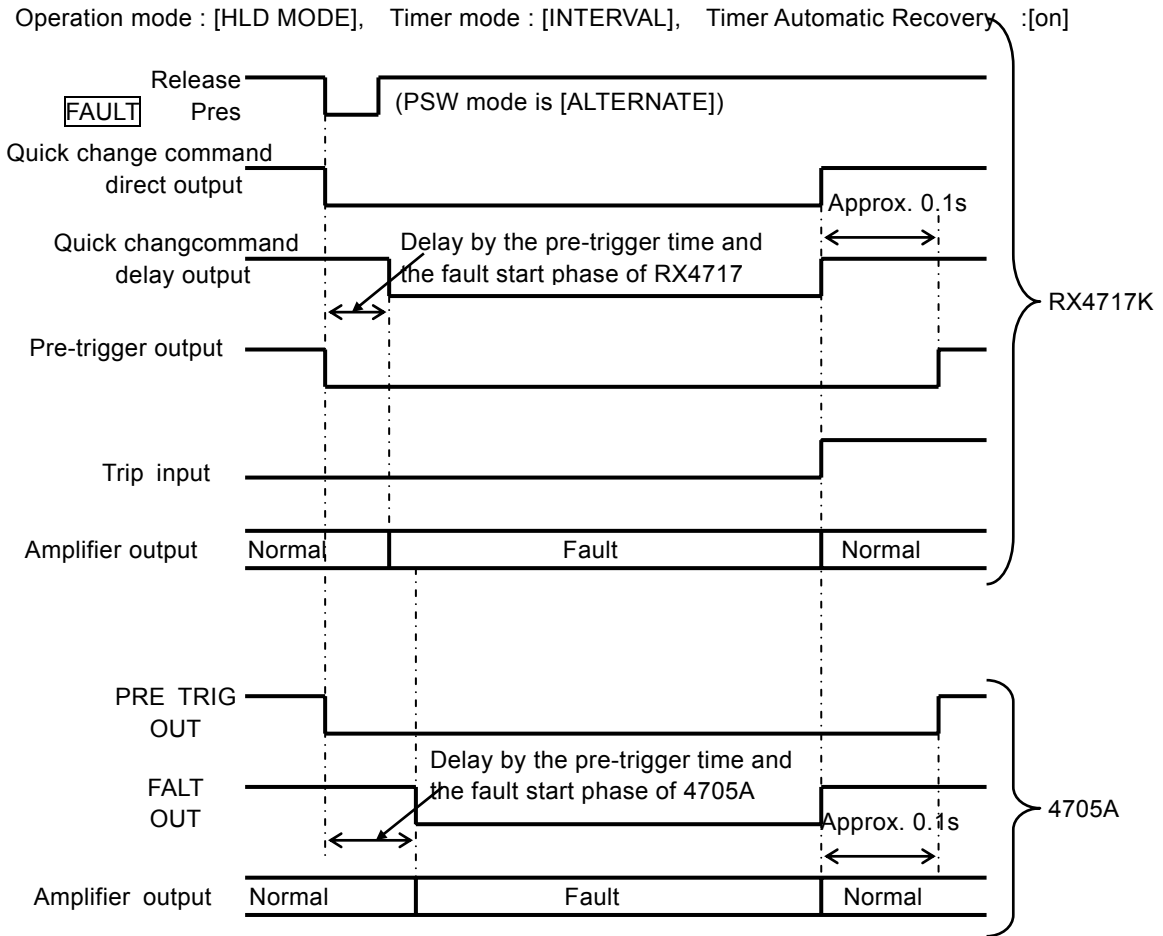


Figure 4-4 Operation when the pre-trigger time and the fault start phase are set individually in 4705A

B) Connection for simultaneous quick change to fault

To quickly change RX4717K and 4705A to fault simultaneously, make either of the following connections/settings.

- When the quick change command delay output of RX4717 is connected to REMOTE INPUT of 4705A, turn off the pre-trigger time and the fault start phase of 4705A.
- When the quick change control signal output or quick change command delay output of RX4717K is connected to FAULT CONTROL INPUT of 4705A, the pre-trigger time and the fault start phase of 4705A does not available.

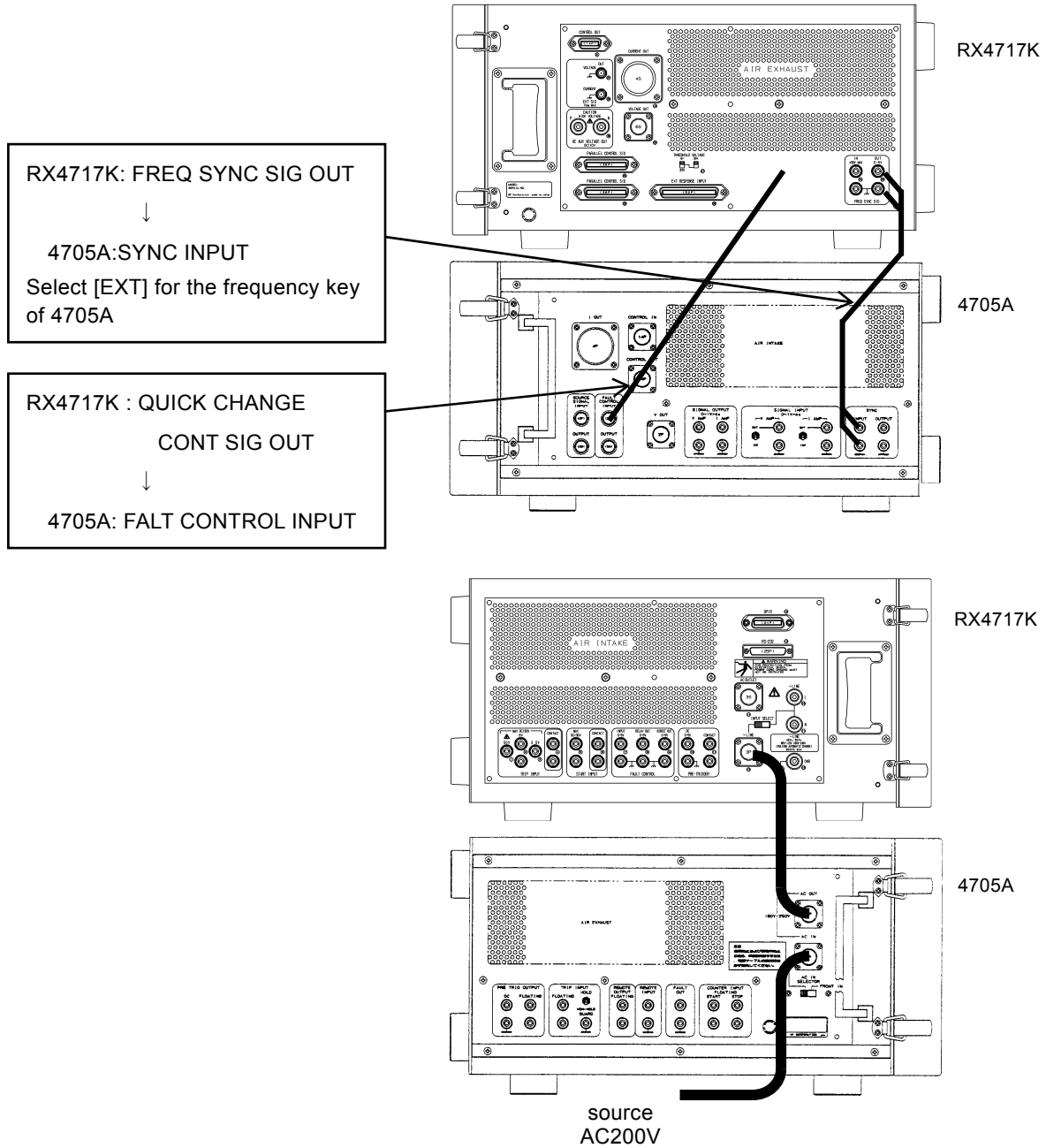


Figure 4-5 Connection diagram for simultaneous quick change with 4705A

4.4 Operation in combined system with other type of units

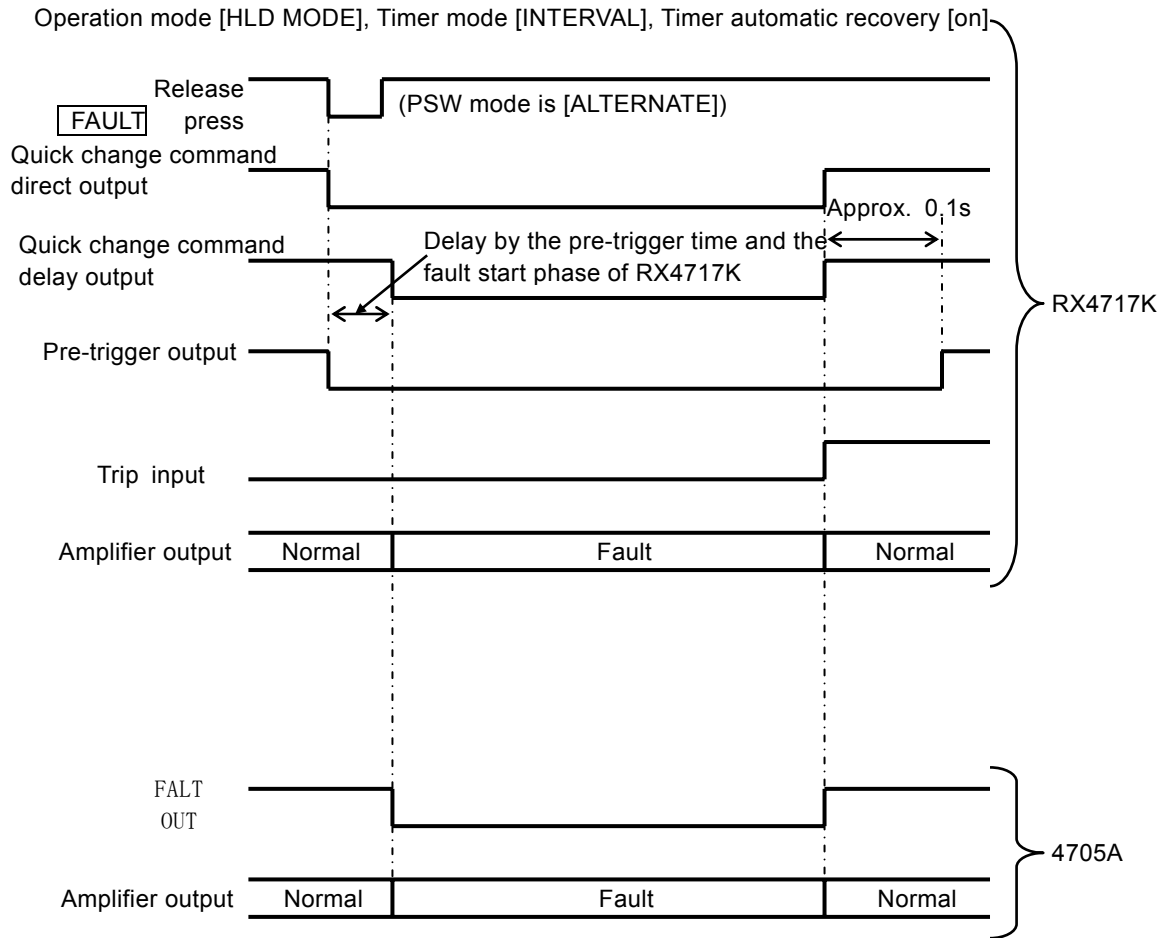


Figure 4-6 Operation for simultaneous quick change with 4705A

4.5 Connection with a current output amplifier 4731

This series 4731 is a current output amplifier with the maximum out of 450VA.

Connect the control output and the external signal output (current) on the right panel of RX4717K to 4731, and the range, output on/off and output signal of 4731 can be controlled remotely from the current output operation of RX4717K.

Range of RX4717K	Range of 4731
0.4A	no setting
4A	4A
20A	20A(25A)

⚠ Caution

When RX4717K controls 4731 remotely, 0.4A of the range can not be used. Select 4A or 20A.

The power is supplied through the power input/output connector on the left side connecting the supplied daisy-chain power cable.

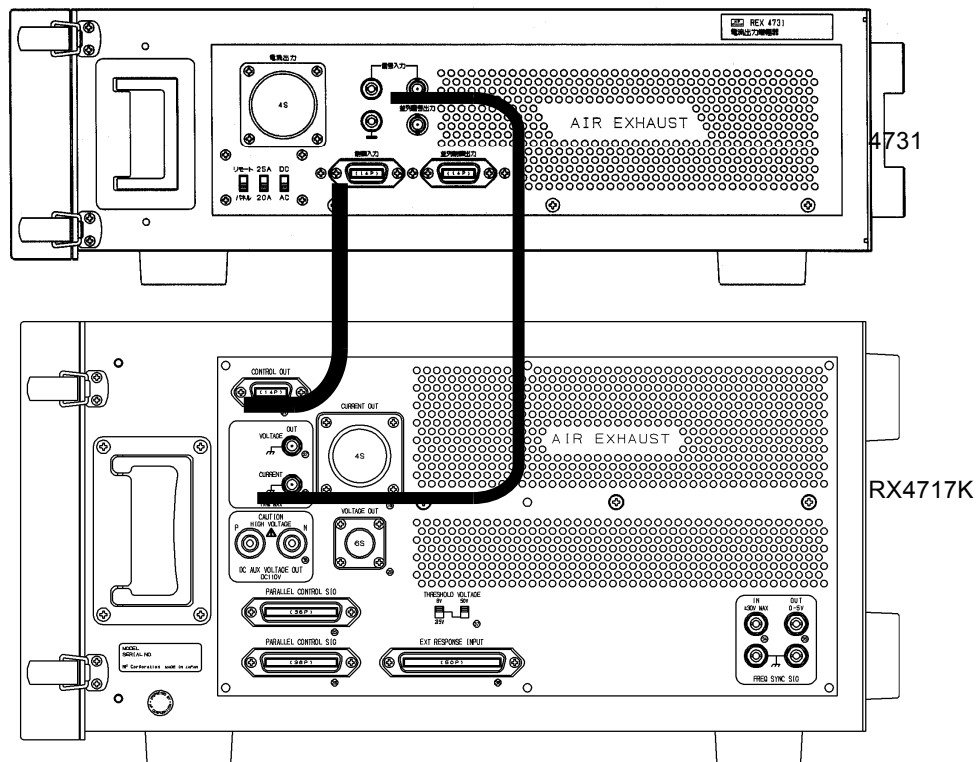


Figure 4-7 Connection with 4731

5. GPIB interface

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5.1 Overview of GPIB

GPIB is a general-purpose interface bus system for digital devices. It was approved by Institute of Electrical and Electronics Engineers (IEEE) in 1975 and is used to standardize the remote controllers of the instrumentation and peripheral devices and data I/O transfer.

By embedding the interface that matches the GPIB standard in each controller and peripheral devices, the devices can be compatible through the interface connectors.

This interface bus can connect the maximum of 15 devices on a bus. Data can be transferred in accordance with the three-line handshake method, enabling the secure data transmission even if the sending side and the receiving side use different transfer speed devices.

GPIB has many names, such as IEEE-IB, IEEE-488 bus, HP-IB, standard interface bus, or byte serial bus. The official name of GPIB is “IEEE Std. 488-1978: IEEE Standard Digital Interface for Programmable Instrumentation” .

GPIB bus and IEC bus are the same standard with the exception of the connector. Using the conversion connector can connect the two.

5.1.1 GPIB specifications

- | | | | |
|-----|---|---------------------------------------|---------------------------|
| (1) | Total cable length | ..... | 20m or less |
| (2) | Cable length between devices | ..... | 4m or less |
| (3) | Number of connectable devices (including controllers) | ..... | 15units or less |
| (4) | Transfer method | ..... | Three-line handshake |
| (5) | Transfer speed | ..... | 1M bytes/second (maximum) |
| (6) | Data transfer | ..... | 8-bit parallel |
| (7) | Signal lines | • Data bus | 8 |
| | | • Control bus | 8 |
| | | Handshake bus (DAV, NRFD, NDAC) | |
| | | Control bus (ATN, REN, IFC, SRQ, EOI) | |
| | • Signal/system ground | ..... | 8 |
| (8) | Signal logic | ..... | Negative logic |
| | | • True : Low | 0.8V or less |
| | | • False : High | 2.0V or more |

(9) Interface connector

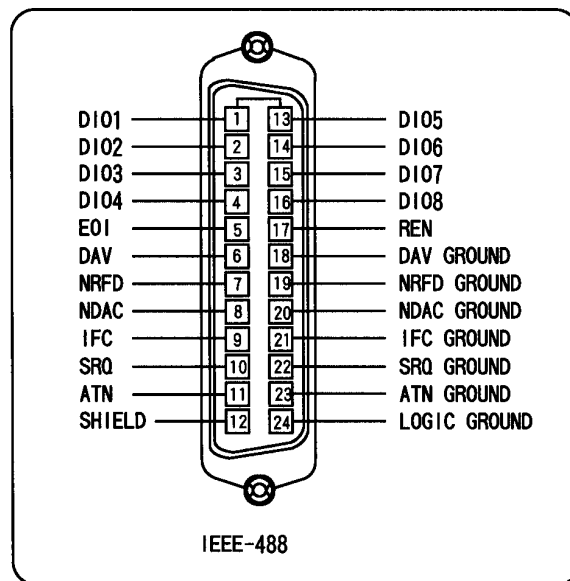


Figure 5-1 Interface connector

5.1.2 Signals on bus line and their behavior

GPIB bus line consists of 24 lines. They are eight data lines, eight control lines, and 8 signal/system ground lines

■ Data bus (DIO1 to DIO8)

Data bus is I/O line that are used to input and output address and command information. They are distinguished by ATN lines. DIO1 is used as LSB.

■ Handshake bus (DAV, NRFD, and NDAC)

The three line handshakes each other to perform secure data transmission.

● DAV(Data Valid)

It indicates that the signal sent from a talker or controller to a DIO line is effective.

● NRFD(Not ready for data)

It indicates that the listener is ready to receive a signal from a DIO line.

● NDAC(Not data accepted)

It indicates that the listener has finished data reception.

■ Management bus (ATN, REN, IFC, SRQ, and EOI)

● ATN(Attention)

It is a line sent from a controller that indicates which the signal sent from a DI0 carries data, address, or command.

● REN(Remote enable)

It is a line sent from a controller that switches between remote control and local control.

● IFC(Interface clear)

It is a line sent from a controller that initializes the interface of each device.

● SRQ(Service request)

It is a management line that invokes a controller from a talker or listener. When the controller detects this signal, it starts performing serial polling or parallel polling.

● EOI(End or identify)

It is used as an identification signal line for data end signal line or parallel polling sent from a talker.

5.1.3 GPIB handshake

This section explains GPIB handshake using data transfer as an example. The handshake is also performed when addresses or commands are transferred.

When GPIB handshake takes place, the state of every listener is checked. Until all listeners finish data transfer, talkers do not transfer new data, enabling secure data transfer even if the low speed device is used. The handshake behavior is decided by the state of the following signals:

- NRFD =High All listeners are ready for data reception.
- DAV =Low A talker transmits effective data on the data bus.
- NDAC =High All listeners finished data receptions.

The handshake timing chart is shown below.

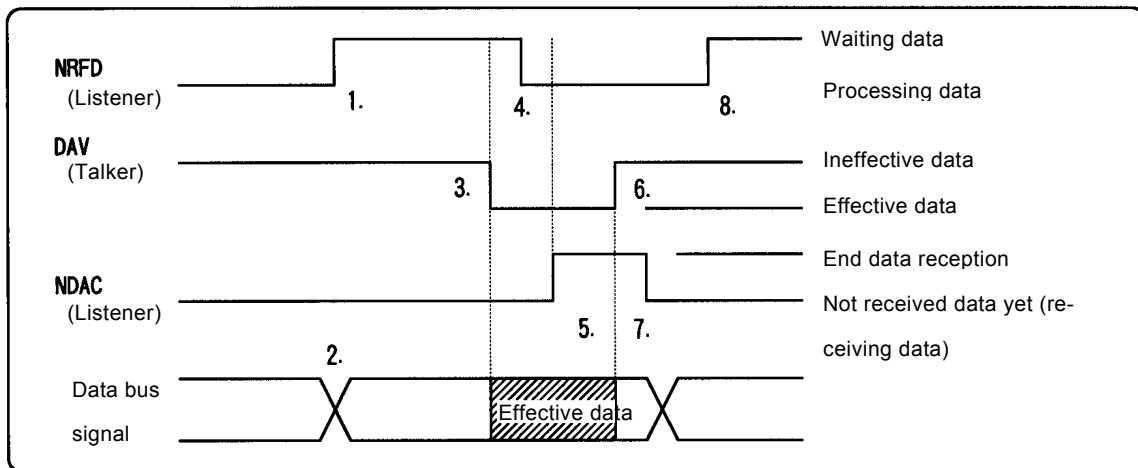


Figure 5-2 Handshake timing chart

1. All listeners are ready for data reception.
2. The talker outputs data to a data line. (This can be performed before step 1.)
3. The talker checks NRFD. If NRFD is set to High, the talker sets DAV to Low to notify the listener that the data is efficient.
4. When DAV is changed to Low, the listener starts reading data, sets NRFD to Low to notify the talker that data is being processed. When data input is finished, each listener set NDAC to High. NDAC on the bus is the OR of listeners' NDAC.
5. When all listeners finish data reception, NDAC is changed to High (the result of OR output) to indicate the talker of the end of the data reception.
6. The talker sets DAV to High to notify the listener that the data on the data bus is not effective.
7. The listener checks DAV is changed to High, set NDAC to Low, and finishes handshake with data reception uncompleted.
8. All the listeners finish data processing and indicate that they are ready for data reception.

5.1.4 Data transmission example

Shown below is an example of three-line handshake data transmission.

Data "ABC" is transmitted with delimiter "CR/LF".

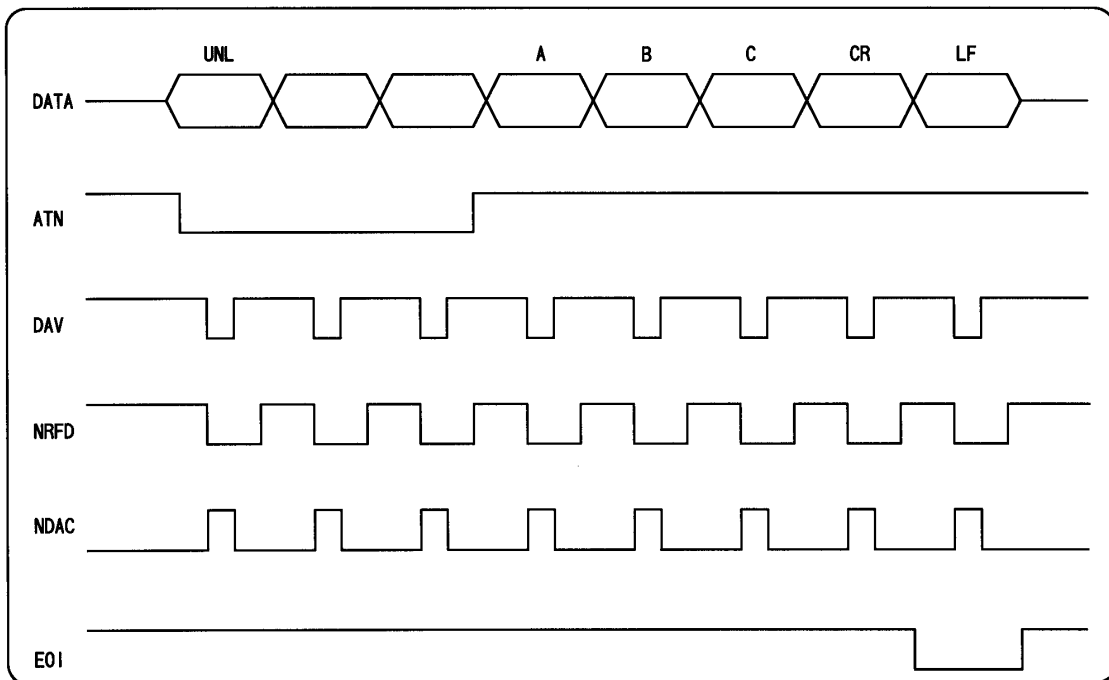


Figure 5-3 Data transmission example

5.1.5 Specifications of talker functions

- The number of talkers that can be used simultaneously on GPIB is one.
- When ATN signal of a controller is “H”, the talker transmits data to the listener.
- When data is being transmitted, handshake (source handshake) is performed automatically.
- The talker sends a service request (SRQ) to a controller.
- A talker can be used either in the local mode or the remote mode.
- Talker functions should be disabled under the following conditions:
 - When the talker address of another device is received.
 - When the talker is specified as a listener.
 - When an untalk (UNT) is received.
 - When IFC is received.

5.1.6 Specifications of listener functions

- Two or more listeners can be placed on GPIB.
- When ATN signal of a controller is High, the listener receives data from the talker.
- When data is being received, handshake (accept handshake) is performed.
- Listener functions should be disabled under the following conditions:
 - When the listener is specified as a talker.
 - When an unlisten (UNL) is received.
 - When IFC is received.

5.1.7 Multi-line interface messages

The multi-line interface messages are output from the controller when the ATN signal is set to Low. The list of the multi-line interface messages are shown in “Table 5-1 Multi-line interface messages.”

5.1 Overview of GPIB

b7 → b6 → b5 →					0	①	0	0	0	0	1	1	1	1	1					
					0	MSG	0	MSG	1	MSG	1	MSG	0	MSG	1	MSG	1	MSG		
②					Column 0		1	2	3	4	5	6	7							
b4 ↓	b3 ↓	b2 ↓	b1 ↓	Low ↓																
0	0	0	0	0	NUL		DLE	SP	0	↑	0	↑	0	↑	P	↑	0	↑	0	
0	0	0	1	1	SOH	GTL	DC1	LLO !	1	↑	1	↑	A	↑	Q	↑	a	↑	q	
0	0	1	0	2	STX		DC2	"	2	↑	2	↑	B	↑	R	↑	b	↑	r	
0	0	1	1	3	ETX		DC3	#	3	↑	3	↑	C	↑	S	↑	c	↑	s	
0	1	0	0	4	EOT	SDC	DC4	DCL \$	4	↑	4	↑	D	↑	T	↑	d	↑	t	
0	1	0	1	5	ENQ	PPC ③	NAK	PPU ¥	5	↑	5	↑	E	↑	U	↑	e	↑	u	
0	1	1	0	6	ACK		SYN	&	6	↑	6	↑	F	↑	V	↑	f	↑	v	
0	1	1	1	7	BEL		ETB	'	7	↑	7	↑	G	↑	W	↑	g	↑	w	
1	0	0	0	8	BS	GET	CAN	SPE (	8	↑	8	↑	H	↑	X	↑	h	↑	x
1	0	0	1	9	HT	TCT	EM	SPD)	9	↑	9	↑	I	↑	Y	↑	i	↑	y	
1	0	1	0	10	LF		SUB	*	:	↑	:	↑	J	↑	Z	↑	j	↑	z	
1	0	1	1	11	VT		ESC	+	:	↑	:	↑	K	↑	[	↑	k	↑	{
1	1	0	0	12	FF		FS	,	<	↑	<	↑	L	↑	④	↑	l	↑	|	
1	1	0	1	13	CR		GS	-	=	↑	=	↑	M	↑	]	↑	m	↑	}
1	1	1	0	14	SO		RS	.	>	↑	>	↑	N	↑	^	↑	n	↑	~	
1	1	1	1	15	SI		US	/	?	↑	UNL	↓	O	↓	-	↑	UNT	↓	o	
					Address command group (ACG)				Universal command group (UCG)				Listener command group (LAG)				Talker command group (TAG)			
Primary command group (PCG)												Secondary command group (SCG)								

Notes :

(1) MSG is an interface message.	TCT.... Take Control
(2) b1=DI01 b7=DI07, DI08 are not used.	LLO.... Local Lockout
(3) It carries the secondary command.	DCL ... Device Clear
(4) Backlash (\) is used in IEC standard and yen mark (¥) is used in JIS standard.	PPU ... Parallel Poll Unconfigure
GTL.... Go to Local	SPE ... Serial Poll Enable
SDC ... Selected Device Clear	SPD ... Serial Poll Disable
PPC ... Parallel Poll Configure	UNL ... Unlisten
GET ... Group Execute Trigger	UNT ... Untalk

Table 5-1 Multi-line interface messages

5.2 RX4717K GPIB interface

For RX4717K GPIB interface, the parameters that can be set on the panel can also be set remotely. Because setting data and setting status can be transferred to outer devices, you can construct sophisticated auto instrumental system easily.

The instructions that set RX4717K are called program codes. Each program code consists of three alphabets and numeral letters that follow ISO 8-bit code characters specifications.

ASCII character strings are used to output measurement data such as timer to the controller.

Note that RX4717K GPIB interface and RS-232C can not be used simultaneously. In addition, the following settings can not be used with the GPIB interface.

- Power on/off
- GPIB setting (addresses, delimiters)
- RS-232C setting (Baud rate, stop bit length, parity)
- Operation of MODIFY

5.2.1 Specifications

■ Interface functions

Function	Subset	Explanation
Source handshake	SH1	All send handshake functions are available.
Acceptor handshake	AH1	All reception handshake functions are available.
Talker	T5	Basic talker function, serial poll, talk-only mode, talker disabler with MLA.
Listener	L4	Basic listener function, listener disabler with MTA.
Service request	SR1	All service request functions are available.
Remote/local	RL1	All remote/local functions are available.
Parallel poll	PP0	No parallel polling functions are available.
Device clear	DC1	All device clear functions are available.
Device trigger	DT0	No device trigger functions are available.
Controller	C0	No controller functions are available.

■ Bus driver function

DIO1-8 NDAC NRFD SRQ	Open collector
DAV EOI	3-state

■ Codes used

The program codes used for RX4717K setting are written in ISO 7-bit codes (ASCII). For the comments on panel setting memory, ISO 8-bit codes can be used.

Alphabetic characters are case-independence. Both uppercase and lowercase characters are translated and executed without any differences.

■ Address and delimiter ☞ “5.2.3 Setting of GPIB”

The address and delimiter (for talker) of RX4717K is set on the other function and the set values are backed up with batteries while the power is turned off.

The range of address is a number between 1 and 30.

“CR” or “CR/LF” is selected and EOI signal is also sent with the delimiter at the same time.

The delimiter is one of “CR”, “LF” and “EOI”, or any combination of them for the listener.

■ Responses against interface messages

IFC	It initializes GPIB interface and releases the specified listener and talker.
DCL and SDC	It clears the I/O buffer for GPIB and error status, stops SRQ transmission, and resets SRQ factor. (The functions of the main unit do not change.)
LLO	It disables the GPIB LOCAL key on the panel.
GTL	It changes the status to Local.

■ Program codes

The program codes used for RX4717K setting are put in the input buffer at first. When a delimiter is received, the buffer is translated and executed at the sequence order.

The size of the input buffer is 1024 characters (1k bytes), and delimiters are not put into the input buffer.

If the input buffer receives more than 1k bytes of program codes, it overflows. The input buffer is cleared, and the program code is not executed.

If the program code contains a header or parameters that do not match the rule, the following data including the program code will be cleared and not be executed.

When the translation and execution finish, the input buffer is cleared and the next program code can be put into the buffer.

The program code is divided into a header and a parameter. If the size of the program code is less than the input buffer size, the next program code can be put into the buffer. Shown below is the syntax of the program code to be transmitted.

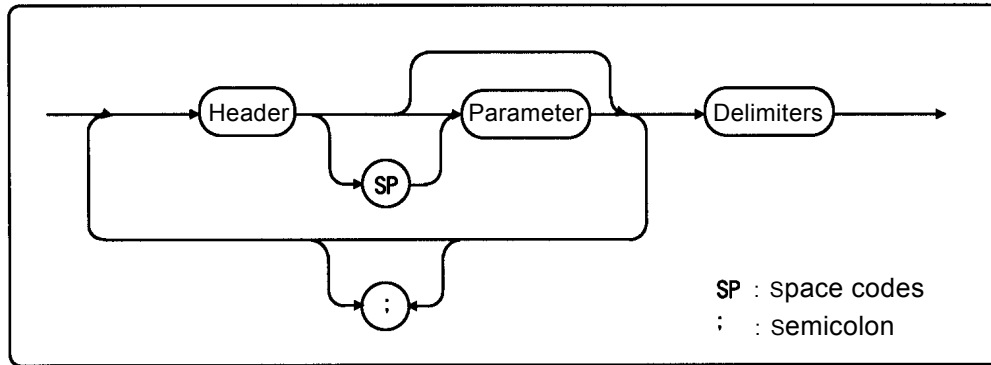


Figure 5-4 Syntax of program code

When you transmit multiple program codes continuously, you can place a space or a semicolon (;) between program codes for legible purpose. Because spaces and semicolons are also put into the buffer, using less spaces and semicolons enables efficient use of the buffer.

RX4717K program codes can be categorized into setting messages that set parameters or behavior and query messages that ask the status or setting.

The format of the basic setting message is shown below.

- Setting message (turning the fault start phase function on and setting it as 123.4°)

$$\frac{F P C}{a} \frac{0}{b} ; \frac{F P H}{a} \frac{123.4}{b \quad c}$$

- Query message (query on the fault start phase)

$$\frac{? F P H}{a}$$

a: Header. It is case-independence.

b: Space. Any number of spaces can be placed for legible purpose. If you do not need a space, you do not have to put it.

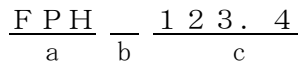
c: Parameter. A parameter consists of polarity (+ or -) and a number. If the parameter size is bigger than the specified size, it is not set. If the parameter has a polarity but does not have it, the parameter is treated as it has plus polarity.

d: Semicolon. Any number of semicolons can be placed for legible purpose. If you do not need a semicolon, you do not have to put it.

Query messages correspond to setting messages with some exceptions. A question mark (?) is placed before the header of the setting message. A query message does not have a parameter. Only one query message can be sent per transmission. Once RX4717K receives a query message, the next time it is designated as a talker, the response data will be sent. If multiple query messages are sent continuously, only the last one is effective.

The program codes are listed in "Table 5-2 Program code list."

■ Response message



- a: Header. It consists of all uppercase characters. If the header is turned off (“HDR0”), it is not sent.
- b: Space. If the header is turned off (“HDR0”), it is not sent.
- c: Parameter. It is a value of floating-point parameter. Only minus (-) is specified for polarity.

■ Service request

A service request (SRQ) is a function that issues a interrupt to the controller when RX4717K is under the following conditions, and it sets SRQ signal line of the bus line to Low.

SRQ factors are as follows.

- An error occurs.
- Amplifier output is over.
- Timer measurement is finished.
- Sweep is finished.

When the controller detects SRQ from RX4717K and serial poll is performed, RX4717K transmits the following status byte to the controller and sets SRQ signal line back to High.

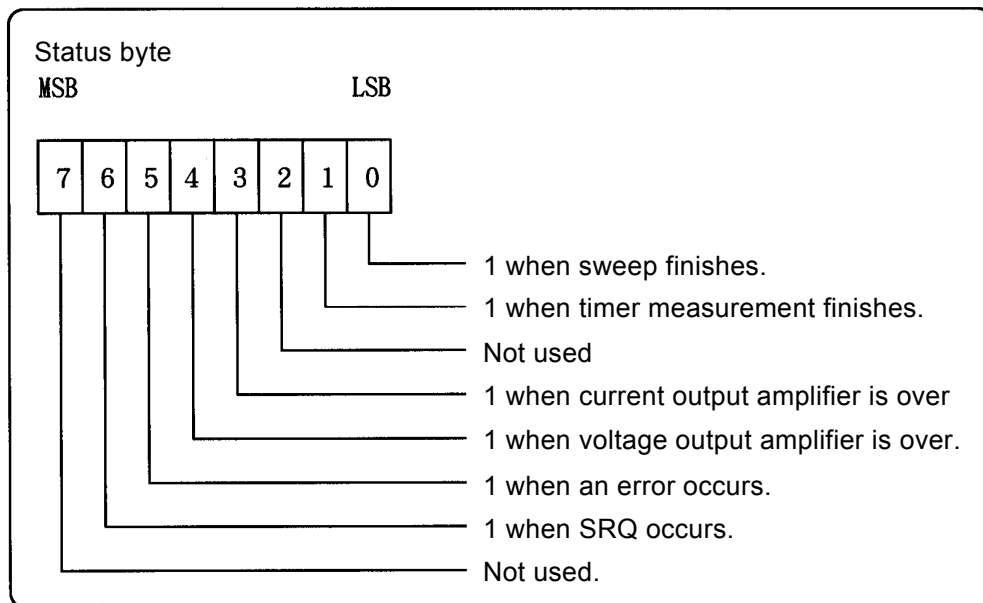


Figure 5-5 Status Byte

Service requests are selectable. To disable a service request, mask it by setting the bit for it to one. The header of the mask is [MSK] and decimal numbers should be used to set parameters.

If you want to use “Timer measurement finishes” and “Voltage output 1 amplifier is over”, set 2^1 and 2^4 to 0 and set the other bits to 1. So the value of the bytes is “MSK 45 ($2^0+2^2+2^3+2^5 = 45$)” .

Service requests are released under the following conditions:

- After the status byte is issued with serial poll
- Device clear (SDC or DCL) is received.
- Mask takes place with “MSK” of the appropriate factor.

■ Error codes

“7.1 Error message“

When an error occurs, issue query command “?ERR” and an error code is sent back.

5.2.2 Notes on handling GPIB

- The number of devices that can be connected to GPIB in the system is 15 including a controller.
The cable length has the following limitations:
 - The total length of cables must be 2m multiplied by the number of devices or 20m, whichever the shorter.
 - The length of a cable must be 4m or less.
- Before detaching GPIB connector, turn RX4717K off. If other devices are connected to the bus, turn them off, too.
- When you use GPIB, turn all devices connected to the GPIB bus on.
- Attention should be paid to set GPIB addresses. If one talk address is assigned to multiple devices, they may be damaged.
- Attention should be paid to specify a delimiter. Inconsistent delimiter will cause a trouble.
- If the header of the program code sent to RX4717K has an error, the whole program code string will not be executed. If the parameter has an error, the program code will not be executed.
- If you specify RX4717K as a talker without an output request (without issuing a query message), the GPIB bus may be locked.
- Because the GPIB interface is assumed to be used in good conditions, avoid using it where the power swing is wide or lots of noises are generated.

5.2.3 Setting of GPIB

RX4717K has GPIB and RS-232C interfaces, but they cannot be used simultaneously. So when you use RX4717K, you must set GPIB or RS-232C interface.

Whether you use GPIB or not, parameters including addresses can be set on the other function. The values you set will be backed up with batteries while the power is turned off.

If you want to use GPIB, set GPIB to on. When GPIB is set to on, RS-232C is automatically disabled. When GPIB is set to off, RS-232C is automatically enabled.

The address of GPIB is a number between 0 and 30. Usually address zero is assigned to the controller, so you may use a number between 1 and 30. The default value is 2.

Delimiters are used when RX4717K transmits data. Choose "CR" or "CR/LF". Any delimiters carry "EOI" with them.

- Setting procedure

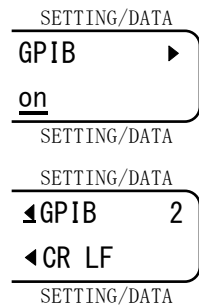
Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】**.

Rotate **MODIFY** and select **[GPIB]**.

Move the cursor down with **▼** and turn **MODIFY** to select **[on]**.

Move the cursor up with **▲** and press **▶**.

Move the cursor with **▲** (up to address) and **▼** (down to delimiter) and set the address (0 to 30) and delimiter **[CR]** or **[CR LF]** with **MODIFY**.



5.2.4 Remote/local behavior

The remote/local status of GPIB shows whether peripheral devices are controlled by the controller or not.

If RX4717K is set to the remote status by the controller, LED of the **[GPIB LOCAL]** is lit off and RX4717K cannot be controlled on the front panel.

To return RX4717K to the local status, press the **[GPIB LOCAL]**. When RX4717K returns to the local status, **[GPIB LOCAL]** on the front panel is lit and RX4717K can be controlled on the front panel.

When you use the controller to set RX4717K to LLO (local lockout), **[GPIB LOCAL]** key is disabled, meaning that the controller controls the remote/local status of RX4717K. To exit from the local lockout, set uni-line message REN to High (False).

The behavior of remote/local is shown below.

Note that the talker does not have remote or local status.

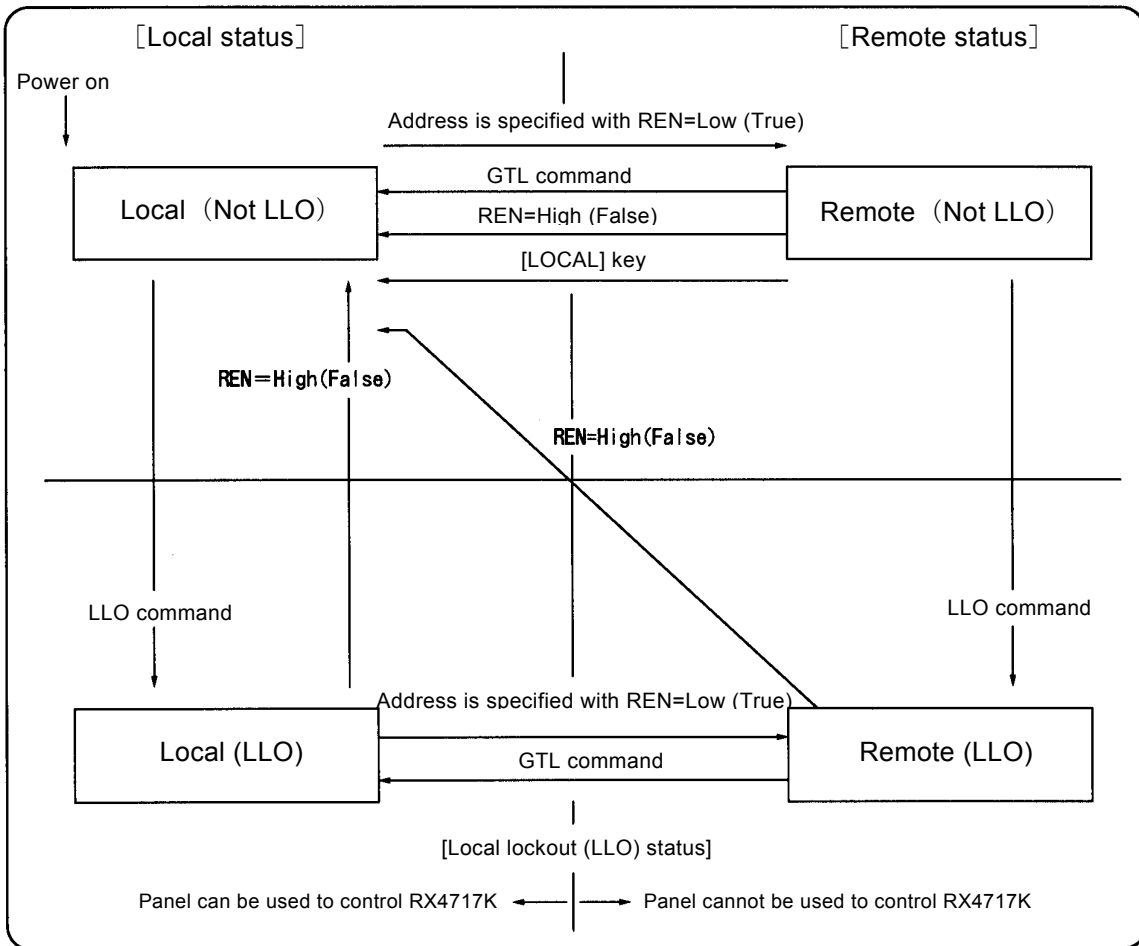


Figure 5-6 Remote/local behavior

5.2.5 Setting program codes

A) Setting the basic data on amplitude and phase

RX4717K has two types of amplitudes and phases. They are normal/fault and current voltage. You should specify the status and phase before setting amplitudes and phases.

For example, you should set below values to set the following status:

	Normal		Fault	
	Voltage out-put	Current out-put	Voltage out-put	Current out-put
Amplitude	63.5V	1A	32.8V	2A
Phase	0.0°	90.0°	30.0°	120.0°

- Transmission of program code

CES0 CEP0 RNG1 AMP63.5 PHS0 CEP1 RNG0 AMP1 PHS90 CES1 CEP0 AMP32.8 PHS30
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬
 OUC1 CEP1 AMP2 PHS120 OUC1 "CR/LF"
 ⑭ ⑮ ⑯ ⑰ ⑱ ⑲

Firstly, send CES0 (①) to transmit normal setting value, declaring the following data is normal setting values. Data from ② to ⑨ is treated as normal setting values.

Send CEP0 (②) to declare that the following data represents voltage output. Data items from ③ to ⑤ are interpreted as the setting value for voltage output.

RNG1 : The voltage output range is set to 125V. (Irrespective of normal or fault.)

AMP63.5 : The normal voltage amplitude is set to 63.5V.

PHS0 : The normal voltage phase is set to 0° .

Send CEP1 (⑥) to declare the following data represents current output. Data items from ⑦ to ⑨ are interpreted as the setting value for the current output.

RNG0 : The current range is set to 4A. (Irrespective of normal or fault)

AMP1 : The normal current amplitude is set to 1A.

PHS90 : The normal current phase is set to 90° .

Next send CES1 (⑩) to declare the following data represents the error values. Data items from ⑪ to ⑱ are interpreted as the error values. Error values are set respectively.

When ③ and ⑦ are used to set the range, the output is turned off automatically. Therefore, use ⑭ to turn the voltage output on and ⑱ to turn the current output on.

"CR/LF" (⑲) means the end of the data transmission. The actual setting of RX4717K starts at this point.

B) Response to query message

The following is the example of query message about the operational point when the operation mode is normal sweep [SWEEP].

- HDR1 CES2 CEP0 ?AMP “CR/LF” (program code transmission 1)
The header is on, the status specification is sweep output, the phase specification is voltage and the query is on the amplitude.
- AMP 50.63 ” CR/LF” (response message reception 1)
The voltage amplitude of sweep output is 50.63V.
- HDR0 ?PHS “CR/LF” (program code transmission 2)
The header is off and the query is on the phase.
- -150.2 “CR/LF” (response message reception 2)
The voltage phase of sweep output is -150.2° .

5.3 Program code list

Table 5-2 Program code list

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Master/slave	GRP	0: Separate 1: Master 2: Slave	Available	Not needed	Not needed	GRP1
Operation mode	MOD	0: Manual 1: HLD mode 2: NHD mode 3: Sweep 6: Operation recovery time 7: 95 test 8: Search sweep 9: DSK search sweep	Available	Not needed	Not needed	MOD1
Operation command	OST	0: Normal 1: Fault 2: Fault direction sweep 3: Normal direction sweep 4: Sweep stop	Available	Not needed	Not needed	OST2
PSW mode	PSW	0: Alternate 1: Momentary	Available	Not needed	Not needed	PSW1
Frequency mode	FMD	0: Internal 1: 50Hz fixed 2: 60Hz fixed 3: Line 4: External signal synchronization	Available	Not needed	Not needed	FMD1
Frequency (internal)	FRQ	10.000-200.000Hz	Available	Not needed	Not needed	FRQ50.5
Waveform selection	FNC	0: Sine 6: +DC 7: -DC When internal DIP SW does not allow selecting DC waveform, +DC and -DC setting will be disabled.	Available	Not needed	Not needed	FNC0

5.3 Program code list

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Code setting phase specification	CEP	0: voltage phase 1: current phase This command is used to assign setting values to each electric voltage phase when electric voltage and phases are set. This command is also used to ask setting data.	Available	**	Needed	CEP0
Code setting status specification	CES	0: Normal 1: Fault 2: Sweep output This command is used to assign setting values to each status when electric voltage and phases are set. This command is also used to ask setting data.	Available	Needed	**	CES1

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Amplitude	AMP	Voltage(except for +DC and -DC) 40V, 0.000 - 40.000V 125V, 0.00 - 125.00V 250V, 0.00 - 250.00V Voltage(except for +DC and -DC) 40V, 0.00 - 40.00V 125V, 0.0 - 125.0V 250V, 0.0 - 250.0V Current(except for +DC and -DC) 0.4A, 0.00000 - 0.40000A 4A, 0.0000 - 4.0000A 20A, 0.000 - 20.000A Current(except for +DC and -DC) 0.4A, 0.0000 - 0.2000A 4A, 0.000 - 2.000A 20A, 0.00 - 10.00A	Available	Needed	Needed	AMP 12.34
Phase	PHS	-359.9 - 359.9°	Available	Needed	Needed	PHS120
Phase setting range switch	PLS	0: Minus On 1: Minus Off	Available	Not needed	Not needed	PLS0
Current phase reverse	PAS	No parameters	Not available	Not needed	Not needed	PAS
Amplifier input selection	ISC	0: Internal 1: External input 2: External output	Available	Needed	Not needed	ISC0
External output amplitude range	EMA	Voltage: 0.00-999.99V Current: 0.000-99.999A When a device such as a booster is used externally, the setting value is used as a full-scale value.	Available	Needed	Not needed	EMA20

5.3 Program code list

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Output range	RNG	0: 40V, 4A 1: 125V, 20A 2: 250V, 20A 9: 0.4A	Available	Needed	Needed	RNG1
Each phase output on/off	OUC	0: OFF 1: ON	Available	Needed	Not needed	OUC1
All output on/off	OTC	0: OFF 1: ON	Not available	Not needed	Not needed	OTC1
Output selector mode	SCM	0: Side terminal 2: Front terminal	Available	Not needed	Not needed	SCM2
Output selector Earth fault/short-circuit	SCG	0: Earth fault 1: Short-circuit	Available	Not needed	Not needed	SCG1
Output selector Phase selection	SCP	0: R (earth fault), R-S (short-circuit) 1: S (earth fault), S-T (short-circuit) 2: T (earth fault), T-R (short-circuit)	Available	Not needed	Not needed	SCP0
Changer communication function	GSC	0: OFF 1: ON	Available	Not needed	Not needed	GSC0

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Operation start input logic	STL	0: ↑ a Apply 1: ↓ b Remove	Available	Not needed	Not needed	STL0
Operation start input status	STR	Query only 0: Recovery 1: Operation	Available	Not needed	Not needed	?STR
Operation start stop setting	SPS	0: unused 1: used	Available	Not needed	Not needed	SPS0
Trip input logic	TRL	0: ↑ a Apply 1: ↓ b Remove	Available	Not needed	Not needed	TRL0
Trip input status	TRP	Query only 0: Recovery 1: Operation	Available	Not needed	Not needed	?TRP
Chattering time	CHT	0.001 - 0.100s	Available	Not needed	Not needed	CHT0.05
Chattering time control	CHC	0: OFF 1: ON	Available	Not needed	Not needed	CHC1
Fault duration	FLT	0.001 - 65.000s	Available	Not needed	Not needed	FLT1.23
Fault duration control	FLC	0: OFF 1: ON	Available	Not needed	Not needed	FLC0
Pre-trigger time	PTT	0.010 - 6.000s	Available	Not needed	Not needed	PTT0.123
Pre-trigger time control	PTC	0: OFF 1: ON	Available	Not needed	Not needed	PTC1
Fault start phase	FPH	0.0 - 359.9°	Available	Not needed	Not needed	FPH90
Fault start phase control	FPC	0: OFF 1: ON	Available	Not needed	Not needed	FPC0

5.3 Program code list

Function	Header	Function and range	Query	Phase specification	Status specification	Example
Timer mode	CNT	0: Interval 1: One-shot 2: Train 3: Start measurement	Available	Not needed	Not needed	CNT0
Timer clear	CCL	No parameters	Not available	Not needed	Not needed	CCL
Timer setting timer clear	CRS	0: Automatic 1: Manual	Available	Not needed	Not needed	CRS1
Timer setting automatic recovery	ART	0:OFF 1:ON	Available	Not needed	Not needed	ART0
Operation time measurement value	CMV	Used for query of the operation time measurement value. Data range 0.0001 - 999.99s	Available	Not needed	Not needed	?CMV
Recovery time measurement value	RTD	Use for query of the recovery time measurement value Data range 0.0001 - 999.99s	Available	Not needed	Not needed	?RTD
Fault waiting time	FTW	0.01 - 9.99s	Available	Not needed	Not needed	FTW0.5

Function	Header	Operation and range	Query	Phase specification	Status specification	Example
Sweep time	STM	1.0-1000.0s	Available	Not needed	Not needed	STM123
Seep position	MSP	0.00 - sweep time s This command is issued to move to an arbitrary sweep position.	Available	Not needed	Not needed	MSP 12.34
Manual sweep	MSC	0:OFF 1:ON	Available	Not needed	Not needed	MSC1
Search·DSK sweep times	SWT	Set sweep times 1 - 10	Available	Not needed	Not needed	SWT3
Search ·DSK sweep judge time	JTM	0.1 - 10.0s	Available	Not needed	Not needed	JTM5.0
DSK sweep trip wait time	TTM	0.1 - 10.0s	Available	Not needed	Not needed	TTM3.0
Search·DSK sweep output cut	SOC	0: Unused 1: Used	Available	Not needed	Not needed	SOC1


Function	Header	Function and range	Query	Phase specification	Status specification	Example
95 test Crossover frequency	FCF	10.000 - 200.000Hz	Available	Not needed	Not needed	FCF48.5
95 test Sweep speed	FSS	0.001 - 9.999Hz/s	Available	Not needed	Not needed	FSS1.23
95 test Hold time	FRW	0.01 - 9.99s	Available	Not needed	Not needed	FRW3.45
95 test Amplitude quick change control	FAQ	0:OFF 1:ON	Available	Not needed	Not needed	FAQ0
95 test Operation frequency	FAF	Query only 10.000 - 200.000Hz	Available	Not needed	Not needed	?FAF
95 test Operation time	FAT	Query only 0.0001 - 999.99s	Available	Not needed	Not needed	?FAT
95 test Recovery frequency	FRF	Query only 10.000 - 200.000Hz	Available	Not needed	Not needed	?FRF
95 test Recovery time	FRT	Query only 0.0001 - 999.99s	Available	Not needed	Not needed	?FRT

5.3 Program code list

Function	Header	Operation and range	Query	Phase specification	Status specification	Example																
Measurement status read	MST	<p>Query only This is a status to show that the measurement ends correctly. When it ends correctly, 0 is shown. When no measurement value is obtained, the following values are used.</p> <table style="margin-left: 20px;"> <tr><td>Normal sweep</td><td>1</td></tr> <tr><td>95 test</td><td>8</td></tr> <tr><td>Search sweep</td><td>16</td></tr> <tr><td>DSK search sweep</td><td>32</td></tr> <tr><td>HLD mode</td><td>64</td></tr> <tr><td>NHD mode</td><td>128</td></tr> <tr><td>Simultaneous operation recovery measurement</td><td>256</td></tr> <tr><td>SOR mode</td><td>512</td></tr> </table>	Normal sweep	1	95 test	8	Search sweep	16	DSK search sweep	32	HLD mode	64	NHD mode	128	Simultaneous operation recovery measurement	256	SOR mode	512	Available	Not needed	Not needed	?MST
Normal sweep	1																					
95 test	8																					
Search sweep	16																					
DSK search sweep	32																					
HLD mode	64																					
NHD mode	128																					
Simultaneous operation recovery measurement	256																					
SOR mode	512																					

Function	Header	Operation and range	Query	Phase specification	Status specification	Example
Beep setting	BEP	0: OFF 1: ON	Available	Not needed	Not needed	BEP0
Expanded external response input	SRI	0 to 255	Available	Not needed	Not needed	SRI3
Control power output control	POC	0: OFF 1: ON	Available	Not needed	Not needed	POC1
Writing of panel setting memory	STO	<p>First parameter Memory number: 0 to 31 Second parameter Comment Comment is asked. In this example, current setting value and comment "reset" are put in memory 0.</p>	Available	Not needed	Not needed	STO0, Reset
Reading of panel setting memory	RCL	0 to 33 When an attempt is made to read an unrecorded memory number, an error occurs.	Not available	Not needed	Not needed	RCL10

5.3 Program code list

Function	Header	Operation and range	Query	Phase specification	Status specification	Example
Header ON/OFF	HDR	0: OFF 1: ON	Available	Not needed	Not needed	
SRQ mask	MSK	0 to 63 This mask is used to select SRQ signaling factors. Select appropriate factors out of the following list and add up the corresponding numbers. The resulting number will make a mask. After the number is set, SRQ will be prohibited. To release all the prohibitions, zero should be set. When MSK60 is set, SRQ will occur at the completion of timer measurement or stopping of sweep. 32 Error occurrence 16 V output overload occurrence 8 I output overload occurrence 4 Unused 2 Completion of timer measurement 1 Stop of sweep	Available	Not needed	Not needed	MSK60
Status byte	STS	Query only. This query command is issued to check the status shown below. The numbers corresponding to each occurrence factor are added up and returned. 64 SRQ occurrence 32 Error occurrence 16 V output overload occurrence 8 I output overload occurrence 4 Unused 2 Completion of timer measurement 1 Stop of sweep	Available	Not needed	Not needed	?STS
Error code	ERR	Query only This command is issued to ask error status. An error number is returned.  "7.1Error message"	Available	Not needed	Not needed	?ERR
Machine type	IDT	Query only This command is issued to ask machine type. [IDT 4717K] is returned.	Available	Not needed	Not needed	?IDT
Version	VER	Query only This command is issued to ask the software version of RX4717K. A character string like [VER 3.00] is returned.	Available	Not needed	Not needed	?VER

6. RS-232C interface

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6.2	RX-232C interface of RX4717K	6-5
6.2.1	Specifications.....	6-5
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6.1 Overview of RS-232C

RS-232C is an interface standard that is used between data communications equipment and computers or data terminal equipment. This interface is established JIS X 5101 "INTERFACE BETWEEN DATA CIRCUIT-TERMINATING EQUIPMENT (DCE) AND DATA TERMINAL EQUIPMENT (DTE)" and American EIA.

Serial data transmission is used and developed in communications area. If data should be transmitted from a distance, signals are modulated and sent, then they are demodulated and received by a modem. This is the most popular method for long distance communications. RS-232C is a interface standard of modems. Data terminal equipment and modems have the appropriate specifications. The connection between the two is shown in "Figure 6-1 RS-232C connection."

The RS-232C interface is used to connect personal computers. As the interface develops, RS-232C is gradually employed for instrumentation connection. When connecting a computer with a instrument through RS-232C interface, you can connect them without a modem because the distance between the two is short. In this case, the RS-232C interface is not used for original purpose, each side has two roles, a computer and data terminal equipment, causing an interface trouble. To avoid this trouble, the one side is used as a modem or a cross cable that connects input of one side to output of the other side and output of one side to input of the other side is used. An example of a cross cable connection is shown in "Figure 6-2 Connection without modem."

Compare to GPIB, RS-232C is used irregularly, so you should check the specifications of the devices to be connected carefully, use appropriate cables, and make appropriate programs that match the system.

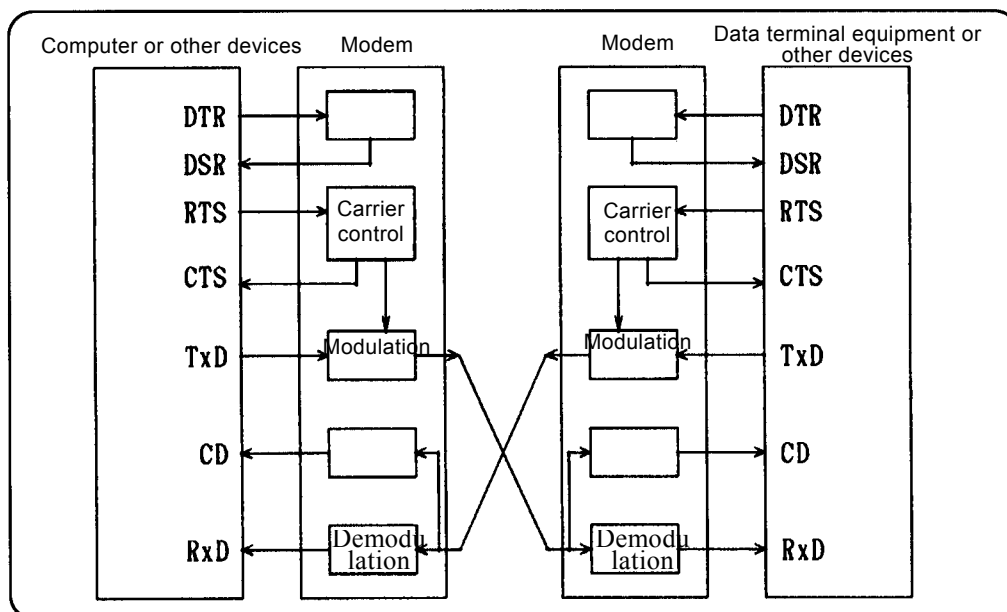
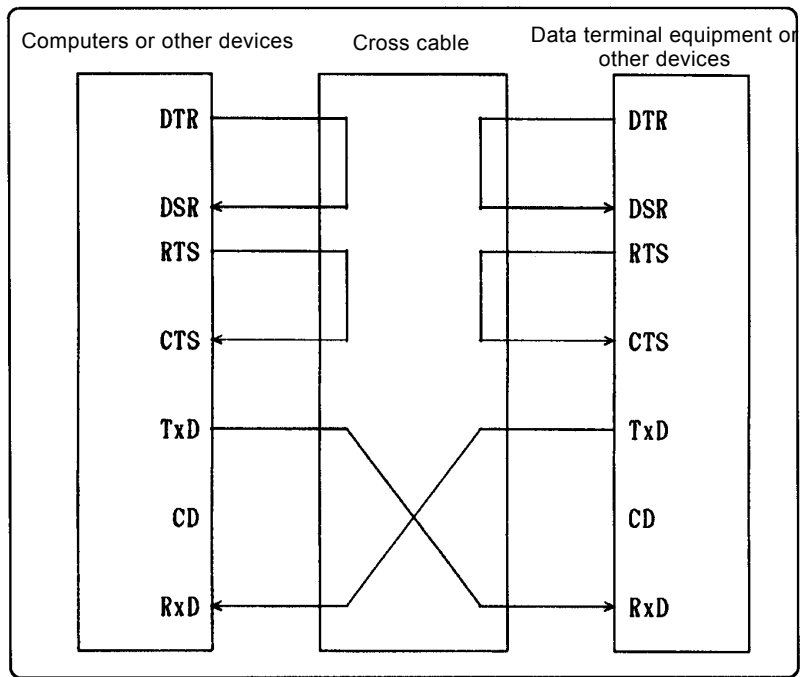


Figure 6-1 RS-232C connection



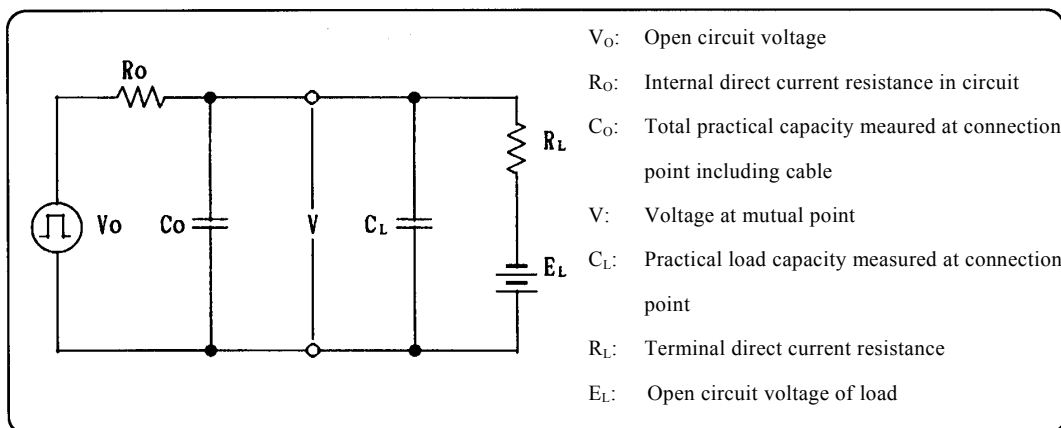
Abbreviations

- | | |
|---------------------------|------------------------|
| CD : Carrier Detect | RTS : Request To Send |
| CTS : Clear To Send | RxD : Received Data |
| DSR : Data Set Ready | TxD : Transmitted Data |
| DTR : Data Terminal Ready | |

Figure 6-2 Connection without modem

6.1.1 Specifications of RS-232C

■ Mutual connection equivalent circuit



- V_o : Open circuit voltage
- R_o : Internal direct current resistance in circuit
- C_o : Total practical capacity measured at connection point including cable
- V : Voltage at mutual point
- C_L : Practical load capacity measured at connection point
- R_L : Terminal direct current resistance
- E_L : Open circuit voltage of load

Figure 6-3 Mutual connection equivalent circuit

■ Receiver

Input impedance (R_L)	:	$3k\Omega$ - $7k\Omega$ (at the applied voltage of 3 to 25V)
Practical local capacity (C_L)	:	2500pF or less
Signal identification voltage "1"	:	-3V or less
	"0"	: +3V or more
Open circuit voltage (E_L)	:	2V or less

■ Driver

Maximum open circuit voltage (V_o):	$\pm 25V$ or less
Maximum current at short-circuit:	$\pm 0.5A$ or less
Logic output level "1"	: -15 to -5V
	"0" : +15 to +5V
Output impedance (R_o)	: 300Ω or less

■ Connector

The connector on the data terminal equipment is shown in "Figure 6-4 Connector on connection cable."

6.2 RX-232C interface of RX4717K

The RS-232C interface of RX4717K has almost the same functions as GPIB of RX4717K. Parameter setting, parameter transmission, and data transmission can be performed.

The RX-232C interface can not be used with GPIB simultaneously. The following settings are not available for RS-232C.

- Power ON/OFF
- Setting of GPIB (addresses and delimiters)
- Setting of RS-232C (baud rate, stop bit length, parity)
- Operation of MODIFY

Comparing to GPIB, RS-232C has the following disadvantages. GPIB will be enable faster and more sophisticated control.

- Because RX4717K and a computer are connected one to one, one computer cannot control multiple devices. When you want to use multiple RX4717K to construct multiple phase protection relay testers with master/slave connection and to control them by a computer, you should use GPIB.
- Because data is transmitted through serial line, the transmission speed is slower than GPIB that uses 8-bit parallel line.
- Because interrupts corresponding to SRQ of GPIB cannot be used, efficient program cannot be made.

6.2.1 Specifications

RX4717K RS-232C uses the specifications of the data terminal equipment that are based upon “JIS C 6361 LOW-SPEED ASYNCHRONOUS MODEM INTERFACE.”

Communication mode	: Asynchronous
Baud rate	: 300, 600, 1.2k, 2.4k, 4.8k, or 9.6k
Data bit length	: 8 bits
Stop bit length	: 1 bit or 2 bit
Parity	: EVEN, ODD or NONE
Output signal	: $\pm 12V$, equivalent for driver SN75188N
Input signal	: Maximum of $\pm 30V$, equivalent for receiver SN75189AN
Input and output operations cannot be conducted simultaneously.	

6.2.2 Connector and signal line

The pin numbers of the connector are shown in “Figure 6-5 Connector of data circuit-terminating equipment.”

Connector fixing screws are M2.6.

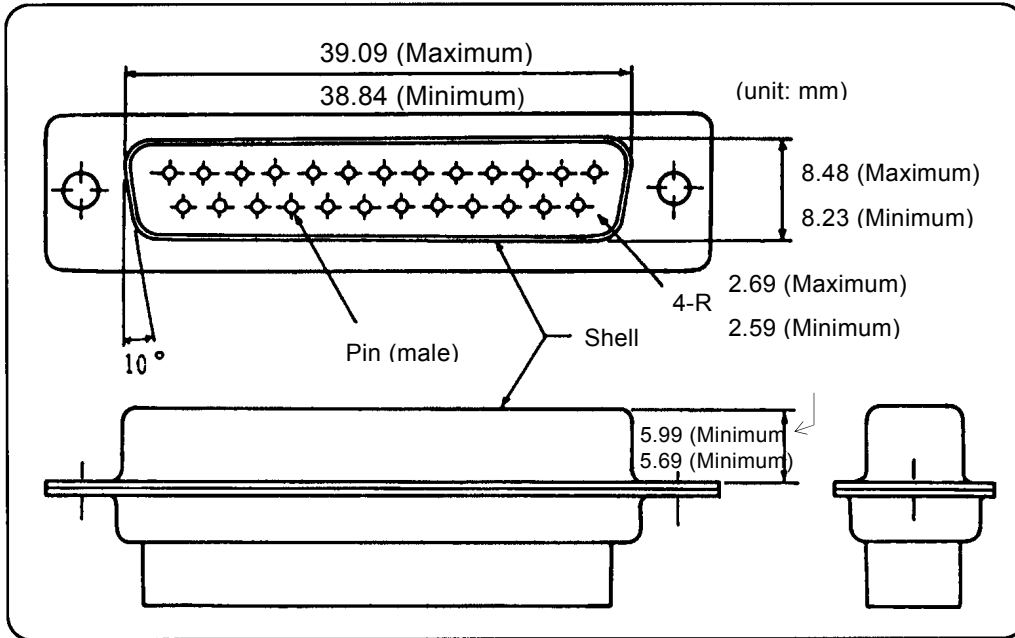


Figure 6-4 Connector on connection cable

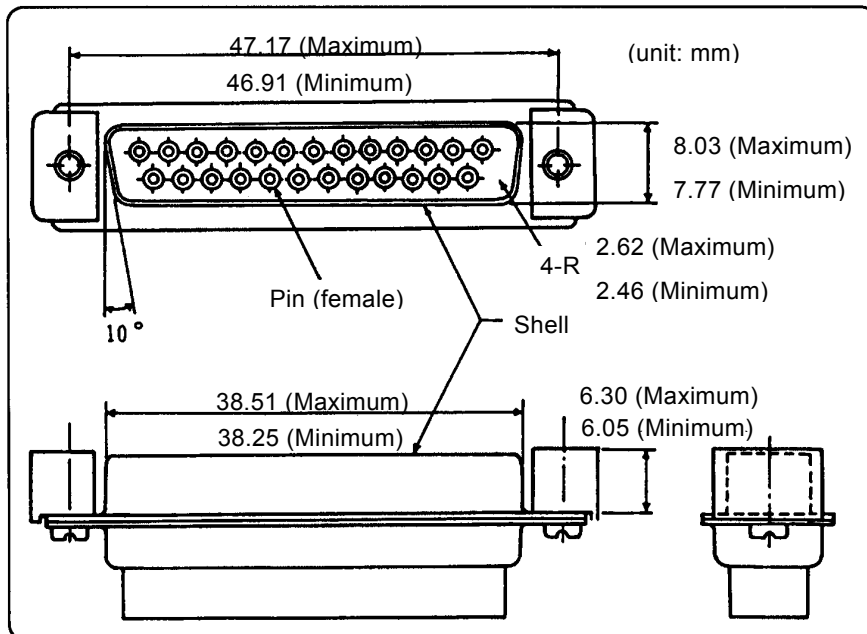


Figure 6-5 Connector of data circuit-terminating equipment

Table 6-1 Types and their explanation of RS-232C

Pin number	Name	Abbreviation	Explanation	Direction
1	Frame Ground	FG		
2	Transmitted Data	TxD	Data output signal line from RX4717K.	Output
3	Received Data	RxD	Data input signal line to RX4717K.	Input
4	Request to Send	RTS	“H” when data output from RX4717K starts. “L” when data output ends.	Output
5	Clear To Send	CTS	“H” to enable data output from RX4717K. Originally modem returns “H” to CTS in response to RTS. When response from the receiving side is not necessary, connect CTS to RTS directly. This pin can be used as BUSY for receiving side.	Input
6	Data Set Ready	DSR	“H” to enable data output from RX4717K. When DSR is set to “L” and RX4717K is put into output status, it becomes “Er6.” If this signal input is not necessary connect DSR to DTR directly.	Input
7	Signal Ground	SG		
20	Data Terminal Ready	DTR	“H” when RX4717K is in RS-232C mode. “L” when RX4717K is in GPIB mode.	Output

6.2.3 Connecting connector lines

Because no standard cables are produced unlike GPIB, lines should be connected to match the specifications of the equipment to be used through RS-232C interface without a modem.

An example of line connection between RX4717K (data terminal equipment) and the other data terminal equipment is shown below. Study the specifications of equipment to be connected before actual connection.

■ Minimum connection

Frame ground 1 is not separated from signal ground 7 in this equipment.

RX4717K	Pin No		Pin No	Host computer
Frame grand	1	—————	1	Frame ground
Transmitted data	2	—————	2	Transmitted data
Received data	3	—————	3	Received data
RTS	4	—————	4	RTS
CTS	5	—————	5	CTS
DSR	6	—————	6	DSR
Signal ground	7	—————	7	Signal ground
DTR	20	—————	20	DTR

Note

Note: Actual line connection should be done with careful study of the specifications of the equipment or programs.

■ When checking mutual connection

Frame ground 1 is not separated from signal ground 7 in this equipment.

RX4717K	Pin No		Pin No	Host computer
Frame ground	1	—————	1	Frame ground
Transmitted data	2	—————	2	Transmitted data
Received data	3	—————	3	Received data
RTS	4	—————	4	RTS
CTS	5	—————	5	CTS
DSR	6	—————	6	DSR
Signal ground	7	—————	7	Signal ground
Unused	8	—————	8	CD
DTR	20	—————	20	DTR

6.2.4 Setting of RS-232C

RX4717K contains two interfaces, GPIB and RS-232C. Since they can not be used simultaneously, one of them needs to be set.

Use of RS-232C, setting of baud rate and each parameter are done by the other function and the set values are backed up with batteries if the power is turned off.

To use RS-232C, turn the RS-232C on. When RS-232C is turned on, GPIB will be automatically turned off. On the contrary, when RS-232C is turned off, GPIB will be automatically turned on.

The setting parameters of RS-232C are as follows.

Use of RS-232C	:	ON/OFF
Baud rate	:	300, 600, 1.2k, 2.4k, 4.8k, or 9.6k
Stop bit length	:	1 bit or 2 bit
Parity	:	EVEN, ODD, or NONE

- Setting procedure

Press **SHIFT**+**OTHER FUNC** to display the other function on the **【SETTING/DATA】**.

Rotate **MODIFY** and select **[RS-232C]**.

Move the cursor with **▼** and turn **MODIFY** to select **[on]**.

```

SETTING/DATA
RS-232C ▶
on
SETTING/DATA

```

Move the cursor up with **▲** and press **▶**.

Rotate **MODIFY** and the following parameters are selected.

Baud rate	[BAUD RATE]
Stop bit length	[STOP BIT]
Parity	[PARITY]

```

SETTING/DATA
◀Baud rate
◀9600bps
SETTING/DATA

```

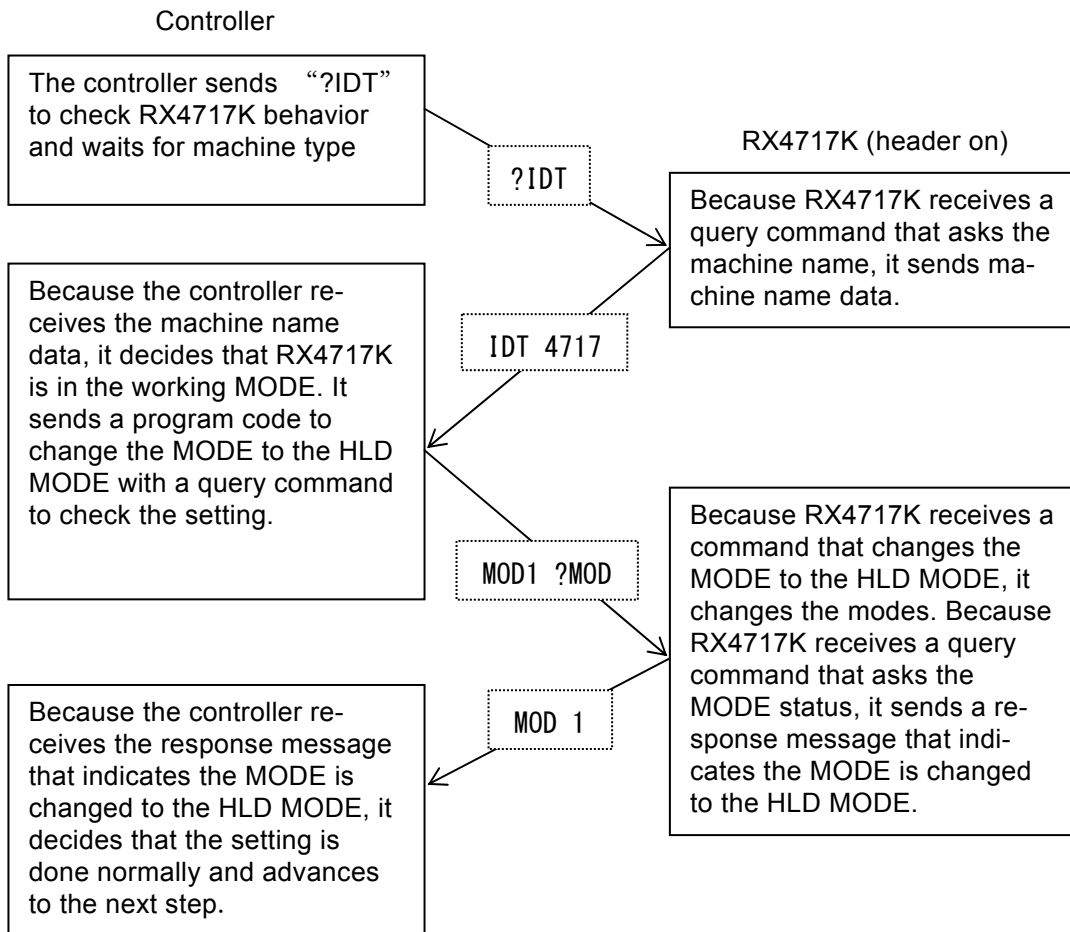
Move the cursor down with **▼** to select each parameter with **MODIFY**.

6.2.5 Setting of program codes

The program codes of RX4717 RS-232C interface are the same as those of GPIB.

Because RS-232C does not have handshake function unlike GPIB, you should append a query message to a program code to control RX4717K. You should advance to the next step after receiving a response from RX4717K. This secures the reliable operation. Changing of the range and turning on or off are time-consuming transactions, but they should be checked carefully in every step.

■ Setting example



7. Troubleshooting

7.1	Error message	7-2
7.2	Handling apparent faults	7-4

7.1 Error message

If abnormality is detected at the self test when the power is turned on, the error message is shown on the lower fluorescent display.

The following table shows the error messages. Please contact us or our sales agency if the error message occurs.

Table 7-1 List of error messages when the power is turned on

No	Message	Error content
1	ROM CHECK ERROR	An error occurred in the ROM used in the RX4717K. RX4717K fault.
2	RAM CHECK ERROR	An error occurred in the RAM used in the RX4717K. RX4717K fault.
3	CHECK SUM ERROR	The batteries used for memory backup was discharged and the data could not be retained.

When an error occurred in the normal operation, the error number and error message are displayed on the **【SETTING/DATA】** and a long beep sounds if the beep setting is on.

SETTING/DATA
ERR 10
OVER RANGE
SETTING/DATA

The display of the error number and error message will disappear with the press of keys other than **NORMAL** (operation by the press of key is not effective at this time) and the normal operation will be returned.

The following table shows the error contents.

Table 7-2 List of error messages in normal operation

No.	Message	Error content
10	OVER RANGE	The set value entered by the numeral buttons was outside the range.
14	NO DATA	The panel setting memory with no data stored in was tried to read. Or the panel setting memory content disappeared because the battery which backs up the memory was overdischarged.
15	INPUT ERR	Data was entered in unspecified format from the numeral buttons.
16	TIMER OVER	The timer value exceeded its maximum value (9999.9 sec.).
17	VAMP OVER	3 sec or more have elapsed after the voltage amplifier was overloaded.
18	IAMP OVER	3 sec or more have elapsed after the current amplifier was overloaded.
19	CONT OVER	3 sec or more have elapsed after the control power output was overloaded.
25	NOW EXT OUT	The range was set or ON/OFF setting was selected when the amplifier input selection is "external output".
27	NOW F SWEEPIN	In 95 test mode, frequency mode was set in other than "Internal".
29	NOW M SWEEPIN	When manual sweep is turned on, automatic sweep was operated.

7.1 Error message

No.	Message	Error content
30	HEADER ERR	A header not found in the specification was set when a program code was set by GPIB/RS-232C.
31	SYNTAX ERR	The parameters set by the GPIB/RS-232C do not conform to the specified format.
35	FRQMODE ERR	A frequency was set while no frequency mode was internally set by the GPIB/RS-232C.
36	NOW SWEEPINX	A command other than “?STS” and “OST” was sent by the GPIB/RS-232C during a sweep.
37	CHARACT OVER	10 or more characters were set in a comment in the panel setting memory by the GPIB/RS-232C.
38	INTERVALFIX	An item other than interval was set by a GPIB/RS-232C command in simultaneous operation/recovery measurement mode.
40	PARITY ERR	A parity error occurred in RS-232C transfer data.
41	OVER RUN	An overrun error occurred in RS-232C transfer data.
42	FRAMING ERR	The RS-232C transfer data stop bit mismatched.
43	BUFFER OVER	Data of 1025 or more characters was transferred at a time when a program code was set using the GPIB/RS-232C.
44	FORMAT ERR	A format error occurred when a program code was set using the GPIB/RS-232C.

7.2 Handling apparent faults

When using the RX4717K, if an apparent fault phenomenon occurs although there is no error indication, make sure that there is no error in the operation, usage and connections with reference to the following.

If none of them is applicable, it may be a fault. Leaving the problem unattended may lead to a secondary fault and is dangerous. Prevent the power from being turned ON and contact NF CORPORATION or our sales agent.

■ The voltage amplitude set value does not match the output value.

- A waveform other than a sine wave is set in the waveform selection.

Set the sine wave in the waveform selection.

☞ “3.4.3 Waveform selection”

- The load connection is not correct.

The voltage amplifier and current amplifier selects the output according to the setting of the output selector. Make sure to connect the load connection correctly.

For the current output, the front terminal and the side terminal are connected in parallel when the output selector mode is the side terminal. Therefore, when the load is connected to both, the output current will be split.

☞ “3.3.4 Output changer”

■ A trip signal operates incorrectly, preventing measurement of the operation time.

- The trip signal voltage is not appropriate.

When the trip signal is a voltage signal, the threshold voltage of RX4717K is selected from +50V, +8V and +2.5V. Select a value with a sufficient margin with respect to the trip signal voltage of the protective relay measured.

☞ “3.1.1 Left side panel”

Due to a high leakage current of a trip signal, the non-operation voltage of some protective relay when connected to the RX4717K, exceeds +50V.

In such a case, connect a resistor with a few kΩ in parallel to the trip signal input terminal so that the non-operation voltage may be low enough compared to 50V.

- The trip signal contains chattering.

When the timer mode is ONE-SHOT, the width of chattering will be measured if the trip signal contains chattering.

Use the trip input chattering correct function to remove the chattering.

☞ “3. 5. 1. B) Setting of trip input chattering correct function”

■ It does not quickly change to fault/ sweep does not operate.

- The trip input logic setting is not correct.

In standard setting, the trip input operates when the voltage is applied (or the contact is short-circuited) and returns when the voltage is removed (or the contact is opened). However, some protective relays have the opposite logic and the trip input logic setting can reverse the signal input logic.

If this setting is not correct, quick change to fault does not occur in the quick change mode and sweeping does not occur in the sweep mode.

Set the trip input logic setting correctly.

☞ “3. 5. 1. A) Setting of [TRIP INPUT] logic“

- The operation start input logic setting is not correct.

When the operation start command is given by the operation start input, the operation does not start if the input logic setting is not correct.

Set the operation start input logic setting correctly.

☞ “3.5.1.C) Setting of operation start input logic“

■ The timer does not operate even if a quick change is made by an external signal.

- The external signal is not connected to the operation start input.

The quick change command input and quick change control signal input of RX4717K are to make the RX4717K in the normal/fault status directly and the timer does not operate.

The operation start input of the RX4717K is an operation start command for each operation mode.

To operate the timer, make the quick change with the operation start input.

☞ “4.4.2 Synchronization of quick change operation“

- The operation start input signal contains chattering.

When the quick change is occurred by the operation start input, set the stop setting to [off] if the signal contains chattering.

When the stop setting is [on], it may returns to normal immediately or fault may occurs again if the input signal contains chattering and the timer does not operate properly.

☞ “3. 5. 1. D) Setting of operation start input stop“

■ A quick-change operation causes the hang-up or the RX4717K not to operate.

- The power supply capacity is not sufficient.

Using a table tap or cable reel causes high impedance of the power supply line. When the RX4717K is quickly changed and the electric power consumption is increased rapidly, this impedance reduces the power supply voltage, which may prevent normal operation of this equipment.

Supply the power to the RX4717K by directly plugging the power cable to the receptacle.

■ Key operation does not work.

- Key lock or cursor off setting is selected.

When this error occurs, LED of **KEY LOCK** or **CURSOR ON/OFF** is lit on.

Press **SHIFT** to light LED of **SHIFT** on and press the appropriate key to turn the LED of the key off.

- GPIB is a remote setting.

In remote setting, LED of **GPIB LOCAL** is turned off. Press **GPIB LOCAL** (LED will be lit on) to make it the local setting.

☞ “5.2.4 Remote/local behavior“

■ GPIB and RS-232C do not operate properly.

- GPIB setting and RS-232C setting are not correct.

RX4717K is equipped with two interfaces, GPIB and RS-232C but they can not be used at the same time.

To use GPIB, set it correctly. The redundancy of GPIB address between devices or the wrong address often causes the error.

☞ “5.2.3 Setting of GPIB“

To use RS-232C, set it correctly.

☞ “6.2.4 Setting of RS-232C“

- The operating environment is not good such as presence of external noise.

GPIB and RS-232C are the interfaces which should be used in the good operating environment.

Avoid using them in the operating environment where external noise is present.

■ The power is not turned on.

- The setting of the power supply input selector switch is not correct.

Set it correctly.

☞ “2.4 Grounding and power supply“

■ LED of **FAULT** remains on.

- Master/slave setting is not correct.

RX4717K remains the LED of **FAULT** on if it is set to slave when the supplied master/slave control daisy-chain cable is not connected to the parallel control signal.

Set it to “Separate” if the RX4717K is used as a single unit.

☞ “4.1.1 Master / slave setting“

8. Maintenance

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8.1 Daily cleaning

■ When the panel or case is dirty

Wipe it with a soft cloth. When the stain is hard to remove, use the cloth dipped in the neutral detergent. Never use volatile solvent like thinner or benzene or a wipe because it may degenerate the panel/case or damage the coating.

■ Removal of dust inside

RX4717K uses air cooling with blower to make it light and small. If it is used in the dusty environment, dust may enter inside resulting in the insulation failure and contact failure.

We clean the inside of the RX4717K when calibration is performed. Regular calibration is recommended.

8.1.1 Memory backup battery

While the RX4717K is connected to the power, the battery used for backup is charged with a low current.

A memory backup period when the battery is fully charged is about 60 days but it varies depending on the product and also varies depending on the ambient temperature.

It takes approximately 100 hours to charge the battery from a fully discharged condition to a fully charged condition. Then, if the battery is kept charged for over 200 hours a week, it keeps a fully charged condition. Continuous charging will not cause overcharging.

When the battery deteriorates, its backup period becomes shorter. If it comes to a point where the battery is no longer useful, our company will replace it with a new one at cost to customer.

Since the useful life of the battery greatly changes according to the operating conditions (charging state, ambient temperature, ambient humidity), it is meaningless to generalize, but if the battery maintains its fully charged condition, it is expected to take 3 to 5 years until the battery capacity reduces by half.

Storing the battery without charging for 6 months or more may drastically shorten the useful life of the battery, and therefore it is recommended to sometimes connect the power to the RX4717K.

8.2 Storage · Repacking · Transportation

■ Storage when RX4717K is not used for a long term

- Disconnect the power cable from the receptacle and the RX4717K.
- Store the RX4717K on the shelf or rack to avoid any falling objects and dust.
- Put the cloth or plastic cover on the RX4717K if dust may be accumulated.
- The temperature range for storage is from -10 to $+50^{\circ}\text{C}$ and the relative humidity range is from 5 to 95%RH. Avoid the place where radical temperature change may occur or the direct sunlight and store the RX4717K at room temperature.

■ Cautions for repacking and transportation

- Cover the RX4717K with a plastic bag or sheet.
- Prepare a cardboard box which tolerates the weight of the RX4717K with a sufficient room. When packing, protect the RX4717K by placing the cushioning materials into its six sides.
- For transportation, instruct the transportation company that the RX4717K is a precision instrument.

8.3 How to check the version number

When the power of RX4717K is turned on, the version number of the built-in software is displayed on the **【SETTING/DATA】**.

SETTING/DATA
4717
Ver X.XX
SETTING/DATA

In addition, the version number can be inquired using “?VER” command of GPIB and RS-232C.

8.4 Performance test

To guarantee the performance of RX4717K, calibration needs to be performed by us. Regular calibration is recommended to guarantee the performance.

This chapter describes the items tested without using special tools or measurement instruments among key items. If the test result shows that some items do not satisfy the specification, calibration or repair will be needed.

Ask us for the detail of tests, calibration or repair.

8.4.1 Preparation before performance test

Check the following items before performance test.

- That the power line voltage is within the rating (AC 85 to 115V or 180 to 240V).
- That the ambient temperature is within the range of +15 to +35°C.
- That the ambient humidity is within the range of 5 to 85%RH.

Prepare the measurement instrument and load noninductive resistance equivalent to the followings.

Power multimeter (2721) volts alternating current • alternating current: within $\pm 0.1\%$,
phase: within $\pm 0.1^\circ$

Universal timer accuracy 1×10^{-6} or more

Distortion rate meter full scale 0.1% or less

Voltage load			Current load		
200 Ω	20W	40V range	25 Ω	10W	0.4A range
156 Ω	200W	125V range	2.5 Ω	100W	4A range
1250 Ω	100W	250V range	0.45 Ω	300W	20A range

8.4.2 Output amplitude·phase

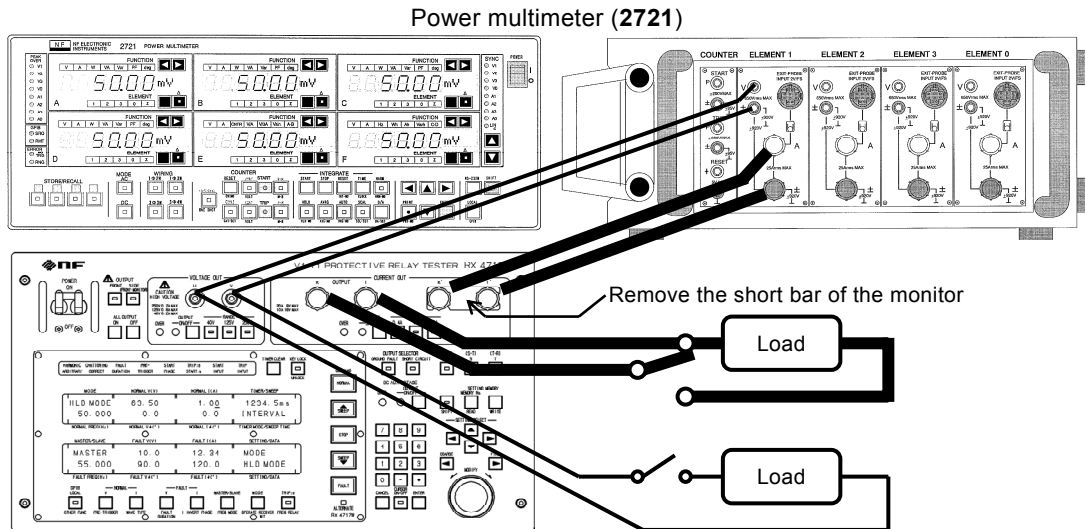


Figure 8-1 Connection of power multimeter (2721) and load

■ Amplitude accuracy

Leave open the load at the voltage output and short circuit the load at the current output.

Set the voltage and current for each range to a full-scale value and check the accuracy of the amplitude is as follows.

Amplitude accuracy: within $\pm 0.5\%$ of the full-scale value for each range ($\pm 0.2\%$ typ.)

■ Phase accuracy

Leave open the load at the voltage output and short circuit the load at the current output.

The accuracy of voltage phase is obtained with 4A in 4A range setting of the current as a reference, and the accuracy of current phase is obtained with 63.5 V in 125V setting of the voltage as a reference. Set the voltage and current at the full-scale value for each range and check the accuracy is as follows.

Phase accuracy: within $\pm 0.3^\circ$

■ Load regulation

The load regulation for the voltage output is calculated from the measurement value when the rated load is connected with the load open (no load) as a reference, and the load regulation for the current output is from the measurement value when the rated load is connected with the load open (no load) as a reference.

Set the voltage and current at the full-scale values for each range and check that each load regulation meets the following range.

Load regulation of amplitude: within $\pm 0.2\%$ (when the rated output amplitude·load variation is 100%.)

Load regulation of phase: within $\pm 0.2^\circ$ (when the rated output amplitude·load variation is 100%.)

8.4.3 Distortion rate

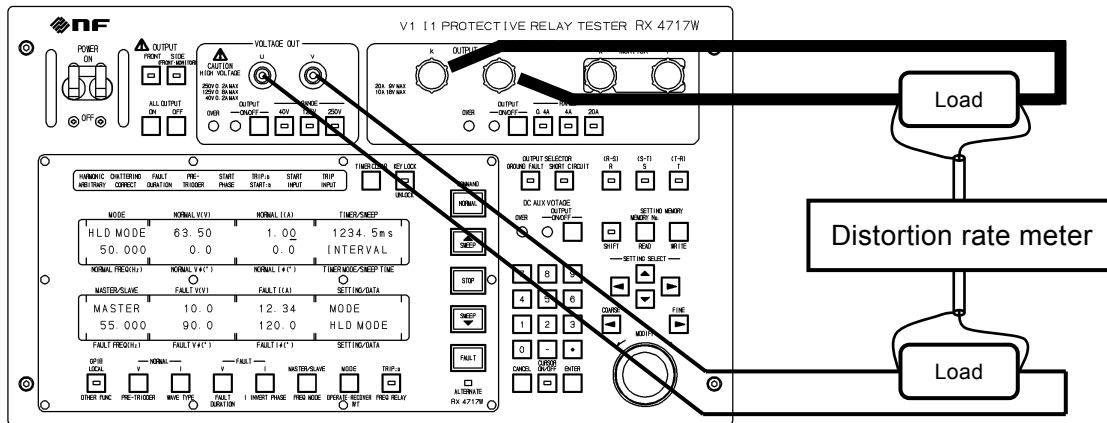


Figure 8-2 Connection of a distortion rate meter and load

Connect the rated load to the voltage output and current output. Set the full-scale value for each range and check that the distortion rate between both ends of the load meets the following range

Distortion rate: within 0.5% (at pure resistance rated load·rated voltage)

Note: When the inductive load is connected to the current output load, the voltage of harmonic wave noise content is emphasized and the distortion rate is dropped off.

8.4.4 Frequency accuracy

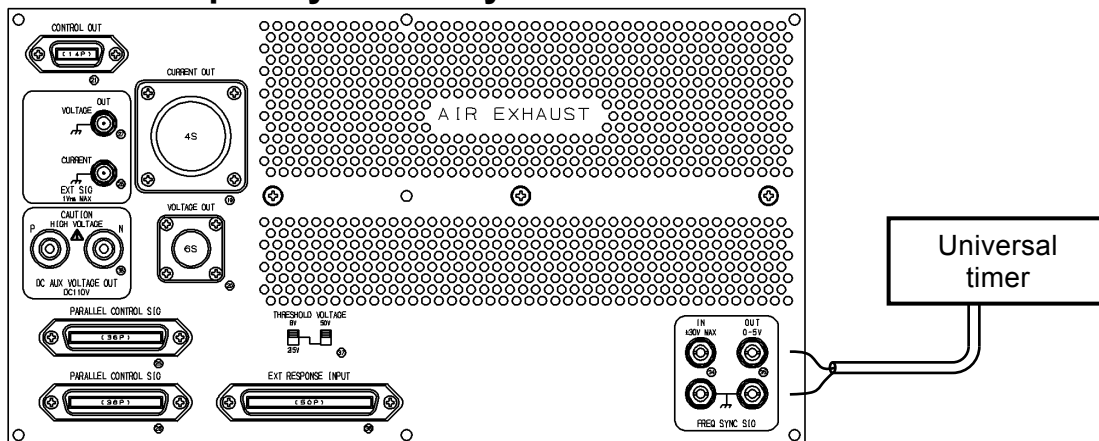


Figure 8-3 Connection of a universal timer (frequency accuracy)

Set the frequency mode to 50Hz FIX and 60Hz FIX. Check that the frequency accuracy meets the following range.

Frequency accuracy: within ± 30 ppm

8.4.5 Timer accuracy

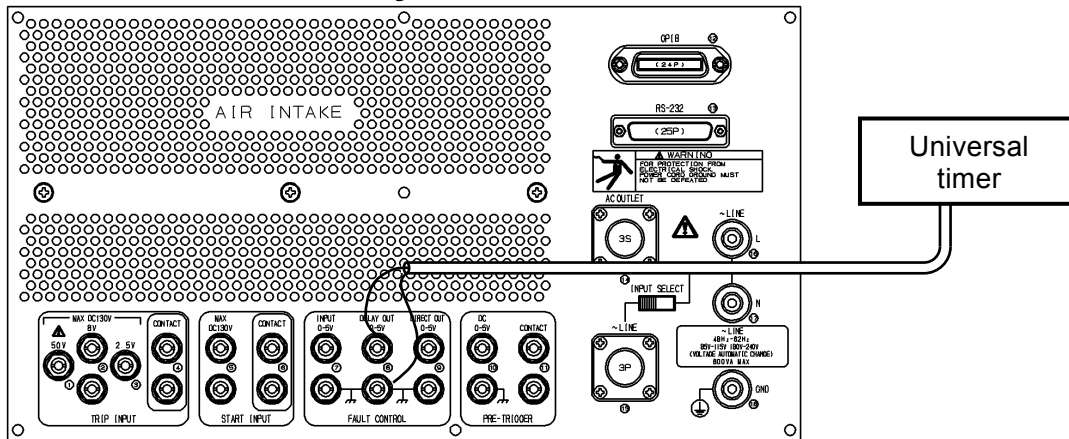


Figure 8-4 Connection of a universal timer (timer accuracy)

Set the operation mode to [HOLD MODE] and the timer mode to [INTERVAL].

Set the universal timer to the mode which measures the time from fall to rise.

Turn the fault duration function on and initiate the quick change to fault with the fault duration setting of 100ms, 1s, and 10s. After the fault duration has elapsed, the system returns to normal and the timer stops.

With a measurement value of the universal timer as a standard, check that the accuracy of the timer value of RX4717K meets the following range.

Timer accuracy: within $\pm(0.01\%+1\text{digit})$

Note: The fault duration fluctuates about $\pm 10\text{ms}$.

9. Specification

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9.1 Voltage · Current output rating

9.1.1 AC output

		Voltage output single phase			Current output single phase		
Rated output range		40V	125V	250V	0.4A	4A	20A
AC output voltage range		0 to 40V	0 to 125V	0 to 250V	0 to 10V	0 to 10V	Note 1 0 to 18V
AC output current range		0 to 0.2A	Note 2 0 to 0.8A	0 to 0.2A	0 to 0.4A	0 to 4A	0 to 20A
Allowable load power factor		0.7-1.0 (delay)					
Rated load Note 3		200 Ω	156 Ω	1250 Ω	25 Ω	2.5 Ω	0.45 Ω
Amplitude accuracy		Within ±0.5% of each range full scale (±0.2% typ.)					
Phase setting range		-359.9° to +359.9° (delay setting)					
Phase accuracy		Within ±0.3°					
Set resolution	Amplitude	1mV	0.01V	0.01V	0.01mA	0.1mA	1mA
	Phase	0.1°					
Load regulation	Amplitude	Within ±0.2% (with rated output amplitude, load variation 100%)					
	Phase	Within ±0.2° (with rated output amplitude · load variation 100%)					
Line regulation	Amplitude	Within ±0.1% (with rated output amplitude · power variation ±10%)					
	Phase	Within ±0.1° (with rated output amplitude · power variation ±10%)					
Distortion rate		Within 0.5% (with pure resistance rated load · rated output)					

- The unit is effective value (rms) unless specified otherwise.
- The rating above applies when the output frequency is 48Hz to 62Hz and is a sine wave.
- The rating above applies when the ambient temperature is +15 to +35°C and the ambient humidity is 5 to 85%RH.
- The output voltage is specified by the output terminal. The phase is specified by a relative value at each output.
- Quick changes and sweeps are only possible within the same range.

Note 1: The output voltage available becomes smaller when the current output is 10A or more.

☞ “Figure 9-1 Output voltage characteristics in the 20A range of current output”

Note 2: The output current available becomes smaller when the voltage output is 63.5V or less

☞ “Figure 9-2 Output current characteristics in the 125V range of voltage output”

Note 3: The rated voltage output load has the minimum available resistance at the maximum voltage output.

The rated current output load has the maximum available resistance at the maximum current output.

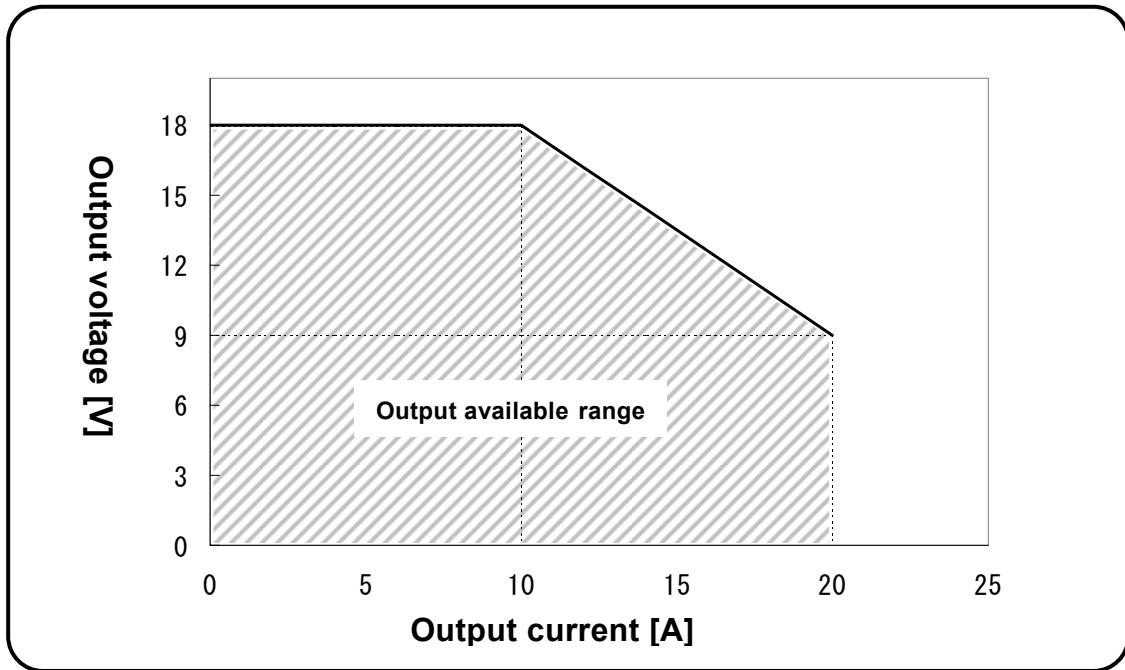


Figure 9-1 Output voltage characteristics in the 20A range of current output

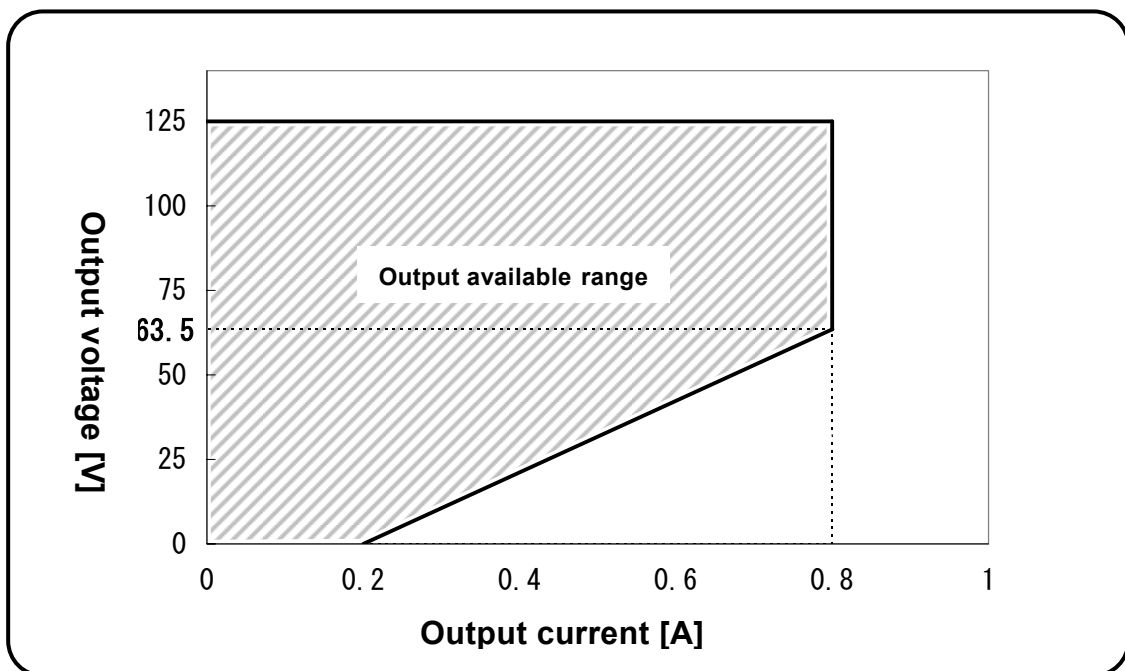


Figure 9-2 Output current characteristics in the 125V range of voltage output

9.1.2 DC output

		Voltage output single phase			Current output single phase		
Rated output range		40V	125V	250V	0.4A	4A	20A
DC output voltage range	DC+ setting	0 to +40V	0 to +125V	0 to +250V	0 to +10V	0 to +10V	0 to +18V
	DC-setting	0 to -40V	0 to -125V	0 to -250V	0 to -10V	0 to -10V	0 to -18V
DC output current range	DC+ setting	0 to +0.1A			0 to +0.2A	0 to +2A	0 to +10A
	DC-setting	0 to -0.1A			0 to -0.2A	0 to -2A	0 to -10A
Rated load		400 Ω	1250 Ω	2500 Ω	50 Ω	5 Ω	1.8 Ω
Amplitude accuracy		Within $\pm 1.0\%$ of each range full scale ($\pm 0.5\%$ typ.)					
DC offset		Within $\pm 0.5\%$ of each range full scale					
Set resolution		10mV	0.1V	0.1V	0.1mA	1mA	10mA
Load regulation		Within $\pm 0.5\%$ (with rated output amplitude · load variation 100%)					
Line regulation		Within $\pm 0.1\%$ (with rated output amplitude · power variation $\pm 10\%$)					

- The rating above applies when the ambient temperature is +15 to +35°C and the ambient humidity is 5 to 85%RH.
- The output voltage is specified by the output terminal. The phase is specified by a relative value at each output.
- Quick changes and sweeps are only possible within the same range.

Note 1: The rated voltage output load has the minimum available resistance at the maximum voltage output.
The rated current output load has the maximum available resistance at the maximum current output.

9.2 Signal generator

■ Number of phase

2 phases of voltage single phase and current single phase

■ Frequency mode

50Hz fixed, 60Hz fixed and internal (variable frequency)

Accuracy within $\pm 30\text{ppm}$

Internal variable range 10.000 to 200.000Hz, 1mHz of resolution

Line synchronization

External synchronization frequency range 48 to 62Hz

Synchronization settling time within 1s

External synchronization

External synchronization frequency range 45 to 65Hz

Synchronization settling time within 1s

■ Waveform selection

Sine wave

DC+, DC- (Enable/disable is set by the internal dip switch.)

9.3 Operation mode

The RX4717K has the following operation modes to facilitate performing various tests.

■ Manual mode

Allows a normal/fault state to be output freely according to the panel setting without affecting the operations of a start signal or trip signal. The built-in timer does not operate.

The level of a trip input can be monitored from the LED on the front panel, making it possible to operate frequencies, amplitudes, phases and waveforms while checking the relay operation.

■ Hold (HLD) quick change mode

This is a fault mode simulating the permanent fault. When the trip input operates, the amplifier output returns to normal and remains unchanged if the trip input changes afterwards.

It quickly changes normal/fault states for each of elements such as frequency, amplitude, phase and waveform and measures the relay operation/recovery time using the built-in timer through changes of a trip input.

Elements whose normal value matches the fault value are not quickly changed.

The following quick change control function is available in this mode.

Fault start phase 0 to 359.9°, resolution of 0.1° and function off

Quickly changes to fault when the setting phase is generated by quick change start command.

Pre-trigger time 10 to 6000ms, resolution of 1ms and function off

Quickly changes to fault when the setting time elapses after the quick change start command is given.

Fault duration 0.001 to 65.000s, resolution of 1ms and function off

If a trip input does not change within a set time, it is forcibly returned to a normal state.

■ Non-hold (NHD) quick change mode

This is a fault mode simulating the arc fault. The first trip input makes the amplifier output normal and when the trip input recovers, the amplifier output becomes fault, then quickly changes by the trip signal. It quickly changes normal/fault states for each of elements such as frequency, amplitude, phase and waveform and measures the relay operation/recovery time using the built-in timer through changes of a trip input.

When the normal command is received, the output becomes normal and the test ends. The amplifier output remains normal even if the trip signal changes.

Elements whose normal value matches the fault value are not quickly changed.

The quick change control function is available in this mode as in the hold quick change mode.

■ Simultaneous operation/recovery measurement mode

In this mode, operation time and recovery time are measured simultaneously by one quick change.

Fault waiting time 0.01 - 9.99s, resolution of 10ms

This sets the time until the output recovers to a normal state after the operation time is measured.

■ Normal sweep

This performs a sweep between normal and fault values for each of elements such as frequency, amplitude and phase. No sweep is applicable for elements whose normal value and fault value are the same.

There are two types of sweep: manual sweep and automatic sweep.

Automatic sweep automatically stops the sweep through a change of the trip input and allows measurement of the operation value and recovery value of the protective relay from the panel display at that time. During a fault direction sweep, the sweep is stopped through trip input operation and during a normal direction sweep, the sweep is stopped through recovery of the trip input.

Manual sweep needs input of the sweep position using keys such as MODIFY. The trip input state has no effects on the sweep.

Sweep operation	2-direction sweep from normal to fault and from fault to normal.
Manual sweep	ON/OFF (When this is turned off, automatic sweep is on.)
Sweep time	1.0 - 1000.0s, resolution of 0.1s

■ Search sweep

This mode repeats sweeps between a normal value and fault value while slowing down the speed to measure more accurate operation time.

No sweep is applicable for elements whose normal value and fault value are the same.

Sweep operation	sweeps for detecting the operating value and for detecting the recovery value.	
Judge time	0.1s to 10.0s	(Also used for DSK search sweep)
	Setting of the time required for judging that the trip input change is determined.	
Number of sweeps	1 to 10 times	(Also used for DSK search sweep)
	Setting of the number of sweeps repeated	
Output cut	on/off	(Also used for DSK search sweep)
	Setting of turning the output on (used) or off (unused) after measurement	

■ DSK search sweep

Operates a disk type protective relay with slow operation first, then carries out a search sweep and measures more accurate operating values and recovery values in a short time.

No sweep is applicable for elements whose normal value and fault value are the same.

Sweep operation	sweeps for detecting the operating value and for detecting the recovery value.	
Judge time	0.1s to 10.0s	(Also used for search sweep)
	Setting of the time required for judging that the trip input change is determined.	
Number of sweeps	1 to 10 times	(Also used for search sweep)
	Setting of the number of sweeps repeated	
Output cut	on/off	(Also used for search sweep)
	Setting of turning the output on (used) or off (unused) after measurement	
Trip waiting time	0.1 to 10.0s	
	Setting of the waiting time from the quick change caused by the operation start to change of the trip.	

■ Frequency sweep mode

This is a dedicated frequency relay measurement mode. It measures operation frequency, operation time, recovery frequency and recovery time with a single sweep.

Sweep speed 0.001 to 9.999Hz/s, resolution of 1mHz/s

Setting of the frequency sweep speed

Crossover frequency 10.000 to 200.000Hz, resolution of 1mHz

Setting of the crossover frequency to measure the operation/recovery time.

Frequency hold time 0.01 to 650.00s, resolution of 0.01s

Setting of the holding time until the frequency sweep starts in the direction from the normal to fault.

Amplitude quick change ON/OFF

Setting whether to have quick change of the output amplitude and phase (on/off) when the measurement starts.

9.4 Timer

This timer is used for a quick change operation. Connecting a trip signal from the protective relay allows measurement of operation time (dynamic characteristic) of the protective relay.

■ Timer mode

Interval	Measures the time from the start of a quick change to the first trip input operation point.
One-shot	Measures the time of operation width of the first trip input operation.
Train	Measures the total time of operation width of the trip input.
Start measurement	Measures the time from the operation start input to the trip input

■ Measurement range

3 ranges of 0 to 9999.9ms, 10.000 to 99.999s and 100.00s to 999.99s
Automatic range switching

■ Measurement accuracy

Within \pm (0.01%+1 digit)

■ Timer setting

Timer clear

Automatic	Automatic clear of the timer value when quick change operates.
Manual	Clear of the timer value by Clear key operation.

Automatic recovery

ON	recovers to normal with the trip input operation in the hold quick change mode.
OFF	does not recover to normal and remains fault with the trip input operation in the hold quick change mode.

9.5 Output selector

This switches the voltage output and current output to the front terminal or the side terminal. Two sets of output selector for voltage and current are built in.

The side terminal is a 3-phase 4-wire type and earth fault (interphase) or short circuit (line) can be selected. In addition, phase selection of R, S and T allows selecting one interphase or line.

■ Setting of output selector

Front terminal	outputs to the front terminal.
Earth fault	selects between R and N, S and N or T and N by phase selection.
Short circuit	selects between R and S, S and T or T and R by phase selection.

■ Voltage output (side terminal)

Output format	floating, withstand voltage between chassis AC500Vrms 1min, SNS type metal connector with 6 pins (manufactured by Sanwa Denki Kogyo Co., Ltd.)
Pin connection	①-R, ③-S, ⑤-T, ②-N

■ Current output (side terminal)

Output format	floating, withstand voltage between chassis AC500Vrms 1 min, SNS type metal connector with 4 pins (manufactured by Sanwa Denki Kogyo Co., Ltd.)
Pin connection	①-R, ②-S, ③-T, ④-N

9.6 Master/slave

It is possible to connect 2 to 4 RX4717K units and use them as a multi-phase protective relay tester by making daisy-chain connections of accessory parallel control cables one by one to the parallel control signal connectors.

Through operations of the master unit only, it is possible, to synchronize frequencies with the master unit, make phase setting between the units possible and perform simultaneous operations of quick changes and sweeps.

■ Master/slave setting

Master	RX4717K becomes a master unit.
Separate	RX4717K is used as a single unit.
Slave	RX4717K becomes a slave unit.

■ Selector communication function ON/OFF

This function turns the synchronization of R, S, and T states on/off between the devices equipped with the output selector of this series when the master/slave operation is on.

■ Parallel control signal

This is a connector to make daisy-chain connections of supplied parallel control cables in the master/slave function.

Format	chassis potential in the common side, 36-pin multi-connector
--------	--

9.7 Amplifier signal output

This function drives the external booster using the internal synthesizer signal of RX4717K.

■ Setting

Internal

The amplifier output signal is an internal synthesizer signal.

External output

The external signal output drives the external booster. The output amplitude of the external booster is set as follows.

Voltage output setting range: 0.00 to 999.99V

Current output setting range: 0.000 to 99.999A

■ External signal output

This is a synthesizer output inside the RX4717K and used to drive the external amplifier.

Number of output phases	2 phases of voltage single phase and current single phase
Output format	Unbalanced, common side: chassis potential, BND receptacle.
Output voltage	1Vrms (when rated value is set for each range)
Output phase	In phase to voltage · current output terminal
Output impedance	10 Ω or less

9.8 Other functions

- Amplifier output on/off control

On/off for each phase, on/off for all phases (ON is enabled/disabled by the internal dip switch.)

- PSW mode (setting of the fault command key operation on the front panel.)

Alternate (fault is retained once pressed), momentary (fault when pressed, normal when released)

- Phase setting minus on/off

- Current phase reverse function

- Beep setting on/off

- Panel setting memory

Read, write, comment input, 50Hz/60Hz initial value read, all memory clear.

- Internal dip switch setting

Description	Setting detail: *indicates the factory setting.
When RX4717K is a master, all output ON is sent to the slave.	ON(disable)/*OFF(enable)
All output ON of RX4717K	ON(disable)/*OFF(enable)
Wave select +DC/-DC function	*ON(disable)/OFF(enable)
When the external signal output is off, the signal amplitude is 0.	*ON(disable)/OFF(enable)

- Language setting

A displayed language in the VFD could be selectable English or Japanese.

9.9 Various input/output

■ Operation start input

This is the input signal to start a quick-change or sweep operation by an external signal. It has the input logic setting and stop setting function.

When the stop setting is turned on, the quick-change or sweep operation can be stopped by removing the signal.

Input format	voltage and contact, binding post	
Voltage input	floating, withstand voltage between chassis AC250Vrms 1 min	
Voltage input range	0 to +130V	
Input impedance	20k Ω	
Threshold voltage	High level: +2.5V Low level: +1.0V	
Contact input	floating, withstand voltage between chassis AC250Vrms 1 min	
Open voltage	+5V	
Short-circuit current	10mA	
Logic setting	apply a, remove b	
Stop setting	ON/OFF	

■ Trip input

This is the operation signal input terminal of the protective relay. This is used to control the timer and normal/fault and to automatically stop the sweep operation. It has the input logic setting and chattering correction function.

Input format	voltage and contact, binding post	
Voltage input	floating, withstand voltage between chassis AC250Vrms 1 min	
Voltage input range	0 to +130V	
Input impedance	20k Ω	
Threshold voltage of +2.5V terminal	High level: +2.5V Low level: +1.0V	
Threshold voltage of +8V terminal	High level: +8.0V Low level: +5.0V	
Threshold voltage of +50V terminal	High level: +50.0V Low level: +40.0V	
Contact input	floating, withstand voltage between chassis AC250Vrms 1 min	
Open voltage	+5V	
Short-circuit current	10mA	
Logic setting	apply a, remove b	
Chattering correction time	1 to 100ms, resolution of 1ms and function off	

■ Quick change command input

This is the external signal input to directly control the output of the RX4717K from a normal to fault state. When High, it is in a normal state and when Low, a fault state.

It is mainly used to perform simultaneous quick-change control in combination with out 4705A and to control the RX4717K by a command of the 4705A (REMOTE OUTPUT).

Input format	logic signal, chassis potential: common side, binding post
Voltage input range	0 to +130V
Input impedance	10k Ω
Threshold voltage	High level: +2.5V Low level: +1.0V

■ Quick change command delay output

This is the signal that changes when the output of the RX4717K quickly changes. When the RX4717K is in a fault state, it becomes Low.

It is mainly used to perform simultaneous quick-change control in combination with out 4705A and to control the RX4717K by a command of the 4705A (REMOTE INPUT).

Output format	logic signal, chassis potential: common side, binding post
Voltage output range	0 to +5V

■ Quick change command direct output

This is the signal that changes when the RX4717K start operating. It is Low when the RX4717K is in operation.

It is mainly used to perform simultaneous quick-change control in combination with out 4705A and to control the RX4717K by a command of the 4705A (REMOTE INPUT).

Output format	logic signal, chassis potential: common side, binding post
Voltage output range	0 to +5V

■ Pre-trigger output

This is the signal to start the oscillator.

When the RX4717K starts operation, the voltage output becomes Low and the contact output becomes short-circuit. It recovers in approx. 0.1 sec after the quick change command direct output recovers.

Output format	Voltage and contact, binding post
Voltage output	Chassis potential: common side
Voltage output range	0 to +5V
Contact output	floating, withstand voltage between chassis AC250Vrms 1 min
Contact capacity	AC30V/0.1A, DC30V/0.2A

■ Frequency synchronization signal input

This is the input signal synchronized with the output frequency of the RX4717K. The falling edge of the signal is phase 0 degrees.

Mainly used connected with our 4705A(SYNC OUTPUT).

Input format	logic signal, chassis potential: common side, binding post
Voltage output range	0 to +5V

■ Frequency synchronization signal output

This is the output signal synchronized with the output frequency of the RX4717K. The falling edge of the signal is phase 0 degrees.

Mainly used connected with our 4705A(SYNC INPUT).

Output format logic signal, chassis potential: common side, binding post

Voltage output range 0 to +5V

■ Expanded external response input

This is a connector connected to the expanded response input box (optional) to expand the trip input up to 255 channels.

Output format 50-pin multi-connector

Signal format response signal input: floating, withstand voltage between chassis AC250Vrms 1 min, control output for signal selection: chassis potential

Selected address 0 to 255

Simultaneous selection disabling signal 1 bit

Power supply output +24V, 100mA

■ Control power output

This is the DC power supply output for control power supply of the protective relay. It is used for test of the protective relay requiring the control power supply.

Output format floating, withstand voltage between chassis AC500Vrms 1 min, binding post

Output voltage within DC110V $\pm 5\%$

Output current 0.5Amax

■ Control output

This is the connector connecting this series 4731.

Output format Chassis potential: common side, 14-pin multi-connector

9.10 Interface

9.10.1 GPIB

The GPIB cannot be used simultaneously with the RS-232C.

■ Setting items

All front panel settings except power switch, language setting, GPIB address and RS-232C parameters

■ Code used

ISO 8-bit codes, alphabet upper/lower case-insensitive

■ SRQ factors

Output overload, timer measurement end, sweep end, error generation

■ SRQ mask

Individually maskable

■ Interface function

SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT0, C0

9.10.2 RS-232C

The RS-232C cannot be used simultaneously with the GPIB.

■ Setting items

All front panel settings except power switch, language setting, GPIB address and RS-232C parameters

■ Baud rate

Switching of 6 points; 300, 600, 1.2k, 2.4k, 4.8k and 9.6k

■ Data bit length

8 bits

■ Stop bit length

1 bit or 2 bits

■ Parity

NONE, EVEN or ODD

9.11 General

- Power supply

48Hz-62Hz AC85V-115V, AC180V-240V

- Maximum power consumption

800VA

- Withstand voltage

Between total power input and chassis AC 1500V, one minute

Between total voltage output and chassis AC 500V, one minute

Between total current output and chassis AC 500V, one minute

Between control power output and chassis AC 500V, one minute

Between trip input and chassis AC 250V, one minute

Between operation start input and chassis AC 250V, one minute

Between pre-trigger contact output and chassis AC 250V, one minute

- Performance guarantee temperature and humidity

+15 to +35°C, 5 to 85%RH No condensation

- Operation guarantee temperature and humidity

0 to +40°C, 5 to 85%RH No condensation

- Storage temperature and humidity

-10 to +50°C, 5 to 95%RH No condensation

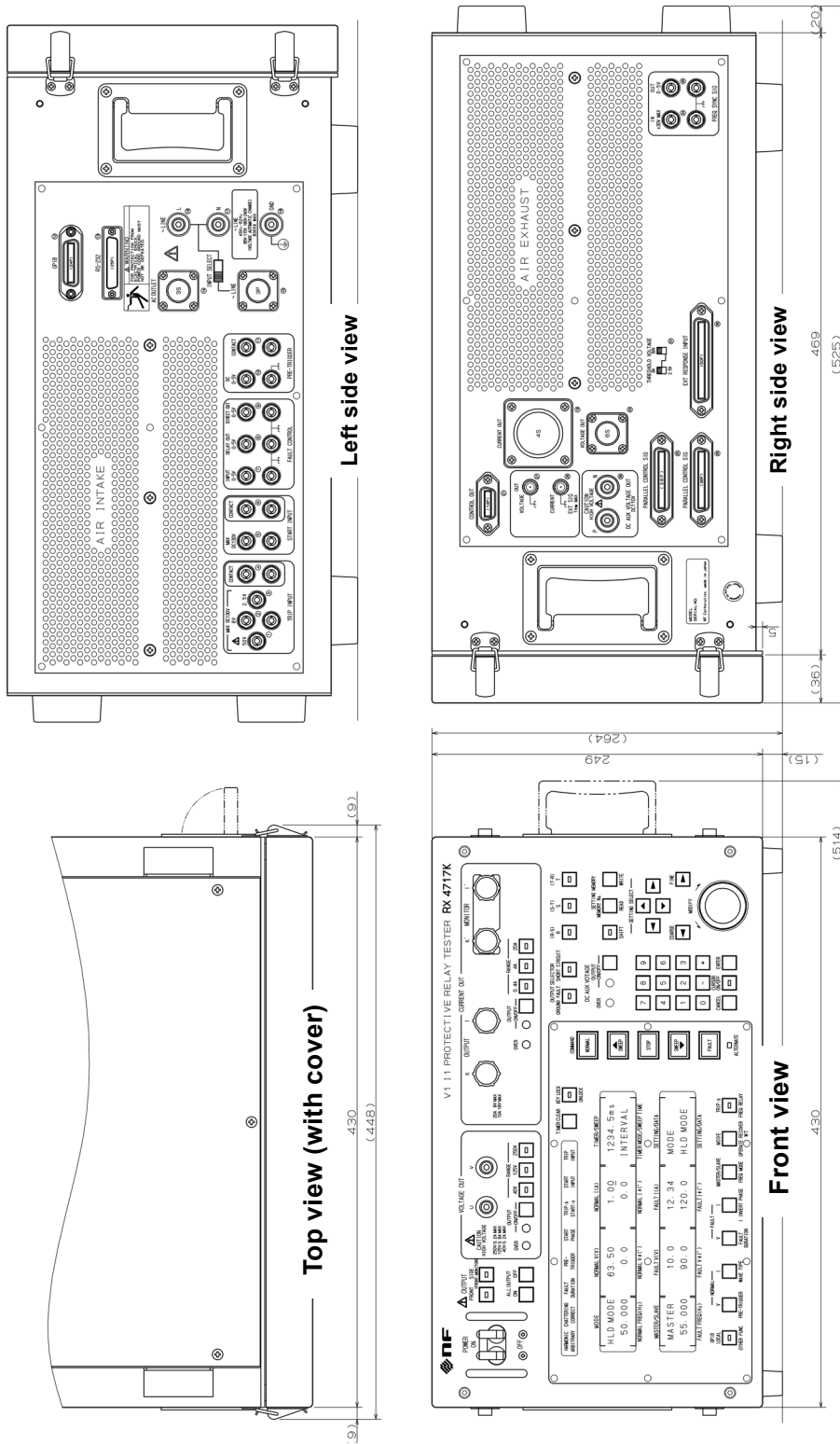
- External dimensions

430(W)×249(H)×469(D)mm not including protrusions

 「Figure 9-3 External dimensions」

- Weight

19kg



Surface treatment
 Front panel: painting munsell 5Y8.5/1 semi-gloss
 Side panel: painting munsell 5Y6.5/1 leather tone
 Cover: painting munsell 5Y6.5/1 leather tone

Figure 9-3 External dimensions

WARRANTY

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All **NF** products are warranted against defects in materials and workmanship for a period of one year from the date of shipment. During the warranty period of, **NF** will, at its option, either will repair the defective product without any charge for the parts and labor, or either repair or replace products which prove to be defective. For repair service under warranty, the product must be returned to a service center designated by **NF**. Purchaser shall prepay all shipping cost, duties, and taxes for the product to **NF** from another country, and **NF** shall pay shipping charge to return the product to purchaser.

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RX4717K Protective Relay Tester Instruction Manual

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