MITSUBISHI ELECTRIC

Changes for the Better

MOULDED CASE CIRCUIT BREAKERS,
EARTH LEAKAGE CIRCUIT BREAKERS,
EARTH LEAKAGE RELAYS &
CIRCUIT PROTECTORS

HANDLING AND MAINTENANCE

01A

CONTENTS

1. Items to be practiced without fail for safety

For correct operation, please go over this paper "Items to be practiced without fail for safety" beforehand.

- Essential items to ensure safety are stated here. Be sure to follow the cautionary instructions given below.
- The manufacturers assembling their products using this breaker are requested to convey the requirements stated in this section "Items to be practiced without fail for safety" to the end users.
- The marks used respectively mean the following.

DANGER	Wrong handling can cause dangerous situation in which possibility of fatal accidents or serious injuries is assumed.
CAUTION	Wrong handling can cause dangerous situation in which possibility of significant or minor injuries or only impersonal damages is assumed.

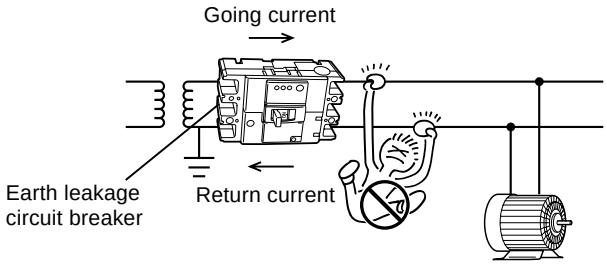
	Warning for possible electrification under certain conditions.
	Warning for possible outbreak of a fire under certain conditions.

	This means prohibition. Never ignore this indication.
	Be sure to follow these instructions without fail.

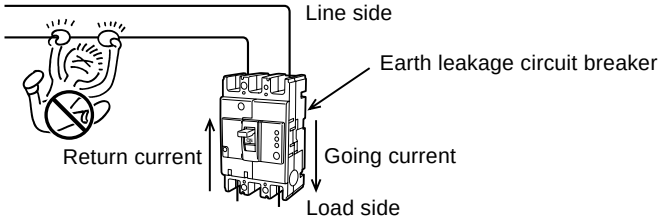
1.1 Cautionary instructions for operation

DANGER

- Don't touch the terminal. Electrification can result.
- The earth leakage circuit breaker is so composed to operate when differential current between going and returning reaches certain level, and no leakage is detected in the case as illustrated below. Never touch, therefore, the uncovered charged parts, two places at a time, and the power source side of the earth leakage circuit breaker.
  The circuit breaker doesn't operate at the electrification.



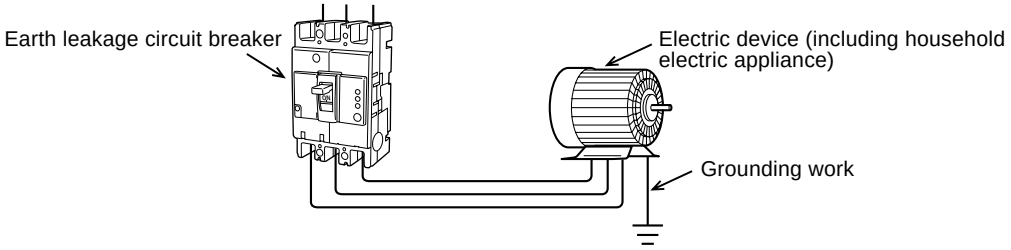
[When uncovered charged parts are touched at two places]



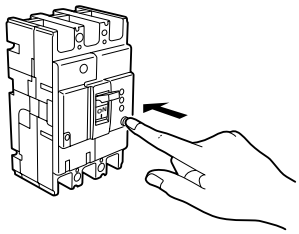
[When the power source side of the breaker is touched]

⚠CAUTION

- Layman's work is dangerous. Any electric work must be carried out by a qualified person (electrician).
- When the breaker cuts off automatically, turn it on after eliminating the cause. Otherwise, electrification and fire can result.
  If the cause is unknown, please contact us at our service station, branch offices, local offices, or ask an electrician in your country.
- Be sure to earth all the electrical devices of the circuits in which the earth leakage circuit breaker is used.



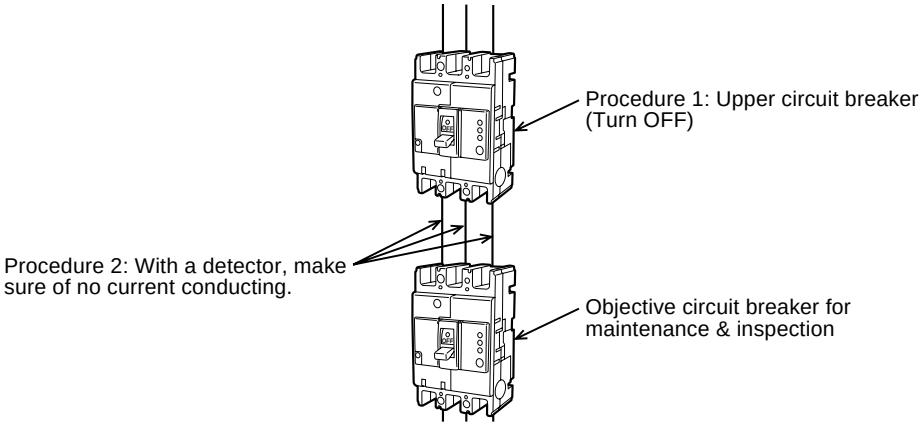
- Check operation of the earth leakage circuit breaker once a month or so by pressing the test button.
  The breaker is out of order if it isn't turned to "OFF" or "TRIP."
  Please get in touch with us at our service stations, branch offices, local offices, or ask an electrician in your country.



1.2 Cautionary instructions for maintenance & inspection

⚠CAUTION

- Maintenance and inspection must be practiced by a specialist having electrical knowledge.
- Before maintenance & inspection, turn off the upper circuit breaker and make sure of no current conducting to avoid possible electrification.



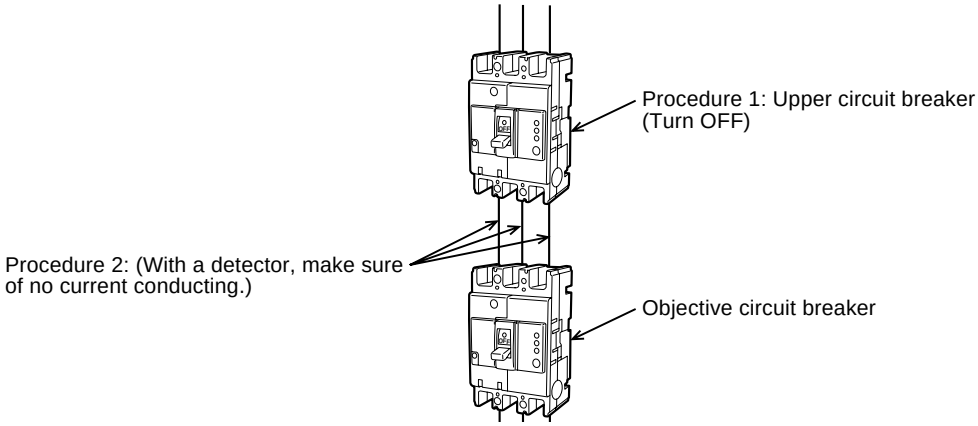
- Retighten the terminals regularly according to the inspection manual. Otherwise, fire can take place.

(5.2 Periodical inspection
As for fastening torque, refer to Appendix 2.)

1.3 Cautionary instructions for work

⚠CAUTION

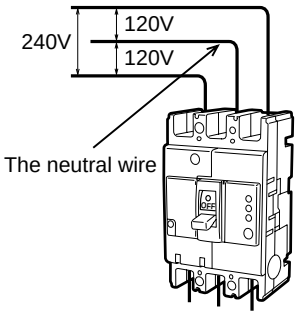
- Any electric work must be carried out by a qualified person (electrician).
- Before wiring, turn off the upper circuit breaker and make sure of no current conducting. Electrification can result.



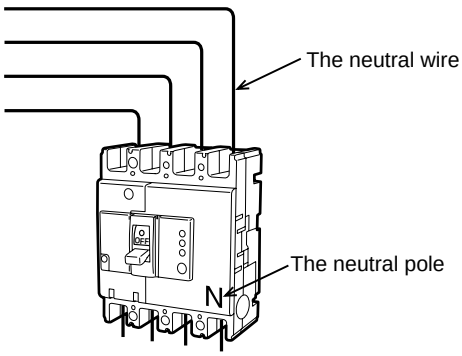
- Earth leakage circuit breaker dedicated to single phase 3-wire and three phase 4-wire types, be sure to connect the neutral wire to the neutral phase. Open phase or overcurrent fails operation and causes fire.

For 1ϕ, 3-W, connect the neutral wire to neutral pole

When used for single phase, 3-wire type, connect the neutral wire to the neutral pole of the earth leakage circuit breaker.



For 3ϕ, 4-W, connect the neutral wire to neutral pole

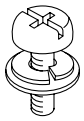
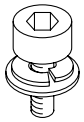
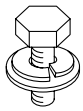
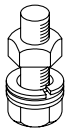


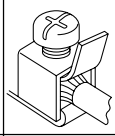
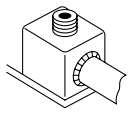
- Connect the earth leakage circuit breaker to the power source suitable for the ratings of the breakers. Connecting to a wrong power can cause malfunction and failure.

⚠CAUTION

- At wire connection, fasten the terminal screws with the torque stated in the instruction manual. Fastening with incorrect torque can cause fire.

Example of front connection type fastening torque (Others are in Appendix 2.)

Terminal screw	Screw diameter	M5	M6	M8			M12
	Shape						
	Fastening torque N·m	2~3	2.5~4.0	5.0~7.0	8.0~13.0	8.0~13.0	40.0~50.0

Solderless terminal screw	Screw diameter	M6	M10	M16	M18	M20	M24
	Shape						
	Fastening torque N·m	4.0~6.0	3.5~4.5	20.0~30.0	30.0~40.0	30.0~40.0	50.0~60.0

Tightening torque for Solderless terminal

Size of conductor, IEC(mm^2)	Size of conductor, AWG or kcmll(mm^2)	Tightening torque [N·m]	
		NF125-CW NV125-CW NF125-SW NV125-SW NF125-HW NV125-HW NV125-RW	NF125-SGW NF160-SGW NF125-HGW NF160-HGW NF125-RGW NF250-SGW NF125-UGW NF250-HGW NF250-RGW NF250-UGW
2.5	14(2.1)	4	5
4.0	12(3.3)	4	5
6.0	10(5.3)	4	5
10	8(8.4)	4.5	13
16	6(13.3)	5.1	13
25	4(21.2)	5.1	13
35	3(26.7)	6.5	13
–	2(33.6)	6.5	13
50	1(42.4)	6.5	13
–	1/0(53.5)	6.5	13
70	2/0(67.4)	6.5	13
95	3/0(85.0)	–	25.5
–	4/0(107)	–	25.5
120	250(127)	–	25.5
150	300(152)	–	25.5
185	350(177)	–	25.5

- Refrain from installing in abnormal environment such as high temperature, high humidity, high dust content, corrosive gas ambient, or of excessive vibration or impact. Electrification, fire, or operation failure can result.

- Carry out the work avoiding foreign matters such as dust, concrete powder, steel chips, and rain water to enter into the equipment. Otherwise, operation failure can result.

2. Before using

Besides operation, the items in this section are also applicable to work, maintenance and inspection.

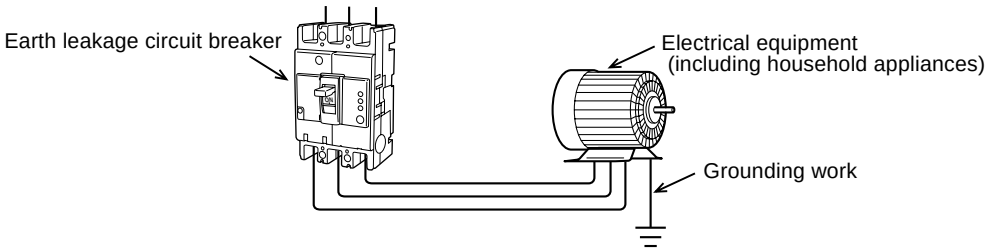
2.1 Cautionary instructions in general

⚠ DANGER

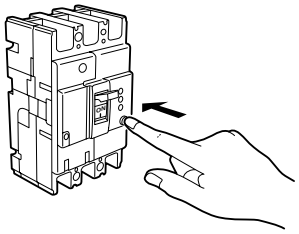
(1) Refrain from touching the terminal unit as electrification can result.
Note: Besides the terminal of the circuit breaker, the terminal unit includes the wires, bus bars, ring-type terminals, and other wiring materials.

⚠ CAUTION

(1) Layman's work is dangerous. Any electrical work must be carried out by a qualified person (electrician).
(2) Be sure to earth all the electrical devices of the circuits in which the earth leakage circuit breaker is used.



(3) Check operation of the earth leakage circuit breaker once a month or so by pressing the test button.
The breaker is out of order if it isn't turned "OFF" or "TRIP".
Please contact us at our service stations, branch offices, local offices, or ask an electrician in your country.



2.2 Operation

2.2.1 Switching operation

Electric power can be turned ON/OFF by moving the handle up/down.

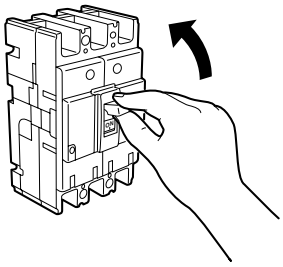
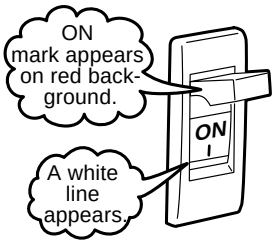
Note 1. Never apply any excessive impact to the handle.

Note 2. When the extension handle is used, fix it firmly with screws. After use, remove the extension handle quickly.

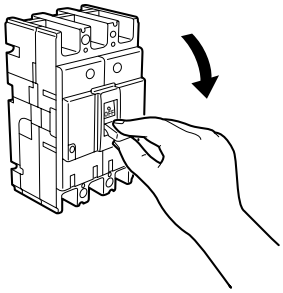
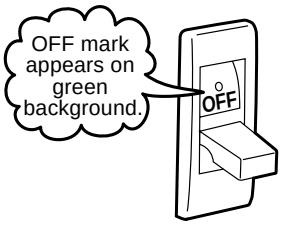
Note 3. ON, OFF operation must operate quickly and correctly. Otherwise it may cause open phase with a few time when operated slowly in case of some types of breakers.

Operating method and condition of the circuit breaker are illustrated below.

① Closing (ON)

	ON operation		ON state indication
Switch on the power (closing)		Moving the handle upward closes the circuit.	

② Opening (OFF)

	OFF operation		OFF state indication
Switch off the power (opening)		Moving the handle downward opens the circuit.	

2.2.2 Trip and reset operation

(1) For moulded-case circuit breaker

① Tripping

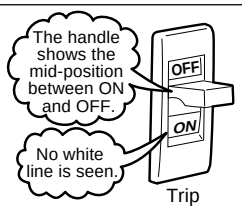
The moulded-case circuit breaker has an overcurrent tripping device which opens the circuit on detecting magnitude of overload current or short-circuit current, and is used for protecting electric wires and other power circuit.

Automatic opening (breaking) of circuits in this way is called “tripping.”

For some products, the circuit breakers can be tripped mechanically from the outside by pressing the trip button provided on the cover.

Press the trip button while the circuit breakers is kept “ON.” When in “OFF” state, tripping is not made in some cases.

There are two kinds of trip indications as shown below.

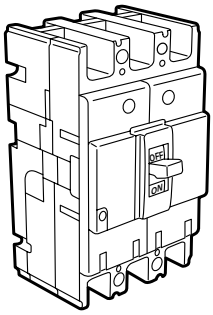
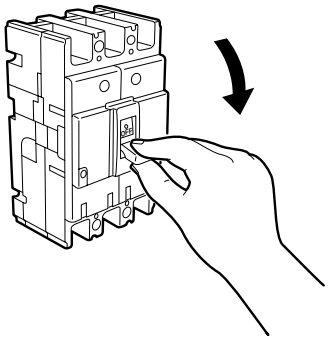
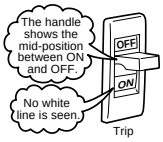
Type	Trip indication	Re-closing method
Moulded-case circuit breaker in general NF, NFE, MB, BH.	 Trip	Eliminate the cause of tripping ⇩ Reset operation ⇩ Re-closing

⚠CAUTION

At an automatic breaking, eliminate the cause then switch on the breaker. Otherwise fire can be resulted.
If the cause isn’t known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

② Reset operation

In the case of (1)-(b) of above (1), re-closing is possible by resetting.

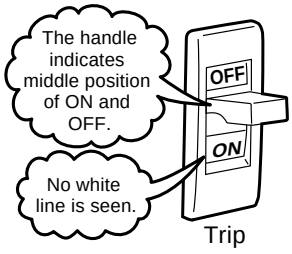
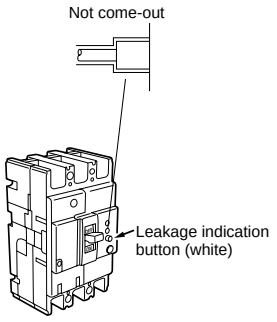
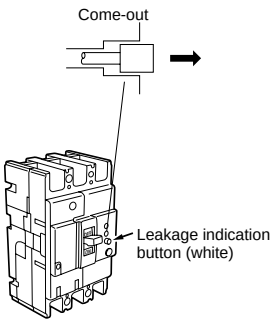
Resetting		Reset check
 Tripped state	Pull down the handle forcefully in OFF direction. 	When hands are released after reset, the handle turns to either mode shown below. Turns OFF. (reset completion)  Returns to trip (not completion) ⇩ Repeat resetting once more. 

(2) For earth leakage circuit breaker

① Trip

Tripping of earth leakage circuit breaker includes two kinds; leak trip in which magnitude of leakage is detected for automatic tripping (open circuit), and overcurrent trip in which magnitude of overload current or short-circuit current is detected for automatic tripping.

For distinction of two kinds of tripping, the leak indication button comes out at leak trip only. The indication button also comes out when the leak test button is pushed for checking leak current operation.

Type	Handle indication	Leakage indication button	
		Overcurrent trip or tripping by trip button	Leakage trip; tripping by leakage test button
NV, MN			

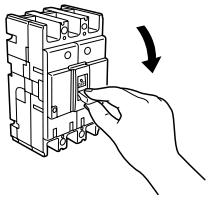
⚠CAUTION

When the breaker cuts off automatically, turn ON the handle after eliminating the cause. Otherwise, electrification and fire can take place.
If the cause isn't known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

② Reset operation

When the leakage indication button comes out, remove the cause of failure, reset in the following procedure, then close the circuit again.

Type	Handle reset	Leakage indicator reset
NV30-CS·50-CSA	Push down forcefully the handle in OFF direction.	Automatically reset when the handle is turned to ON position.
NV63-CW~600-CP NV32-SW~1200-SB		Automatically reest when the handle is reset.



Reset the handle.

(3) For earth leakage relay

① Operation

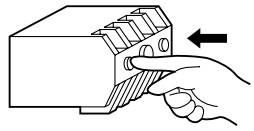
When leakage is detected by the earth leakage relay, contact point output is given, the leakage indicator button comes out, or the leakage indication lamp glows.

② Reset operation

⚠CAUTION

When the leakage indication button comes out or the leakage indication lamp glows, remove the cause then reset before starting operation again. Otherwise, electrification can result.
If the cause isn't known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

Type	Handle reset	Leakage indicator reset
NV-ZSA, NV-ZLA	—	Push to the projected reset button for leakage indicator.
NV- ZU, NV-ZBA NV-ZHA	—	Pushing the reset button turns off the leak indication lamp and resets. Turning off the control power also resets automatically.



Push in the reset button by a finger.

(4) Circuit protector

① Trip

The handle turns off at tripping.

Note: Where an alarm switch is attached, the handle stops between ON and OFF positions.

② Reset

Eliminate the cause of tripping, then close. (Resetting isn't necessary as the circuit protector is reset automatically.)

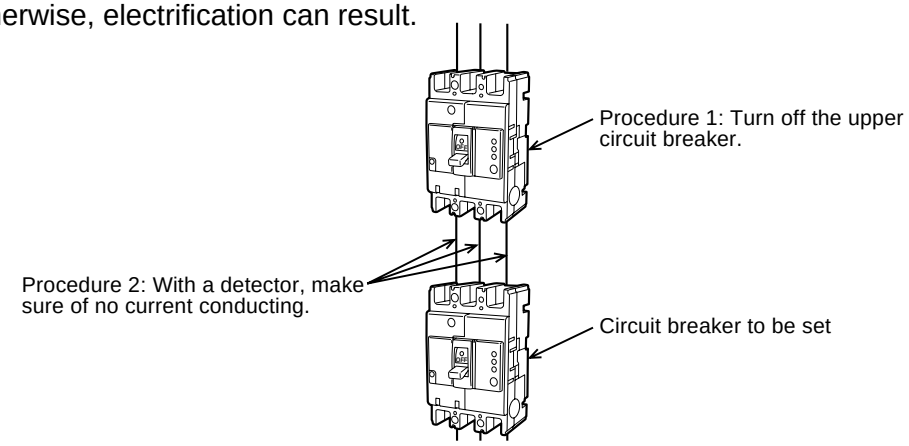
Note: When an alarm switch is attached, move the handle to OFF side once, then to ON side for reclosing. (The alarm switch of CP30-BA is reset at ON operation.)

2.3 How to set current rating, trip characteristic, sensitive current and operating time

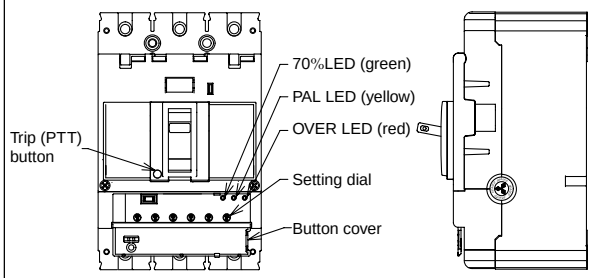
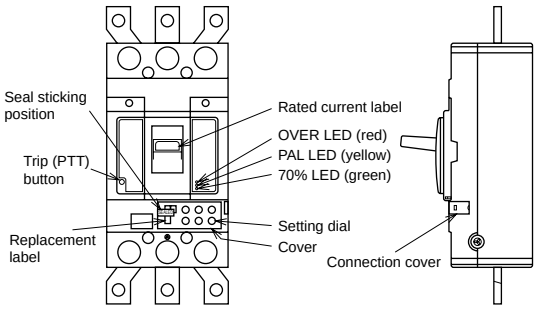
2.3.1 Cautionary instructions for setting

⚠CAUTION

- Let a person having technical knowledge of electricity set the breaker.
- Before setting, turn off the upper circuit breaker, or turn off the circuit breaker to be set or trip the breaker, then make sure of no current conducting.
  Otherwise, electrification can result.

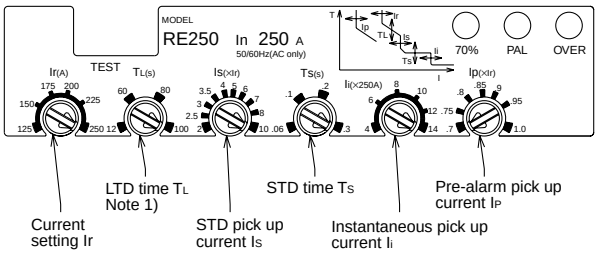


2.3.2 How to set characteristics of molded-case circuit breakers [800A frame and below electronic overcurrent tripping type]

	Group A	Group B
Applicable model	NF125-SGW(RE), NF125-HGW(RE), NF160-SGW(RE) NF160-HGW(RE), NF250-SGW(RE), NF250-HGW(RE)	NF400-SEP, NF400-HEP, NF400-REP, NF400-UEP NF630-SEP, NF630-HEP, NF630-REP, NF630-UEP NF800-CEP, NF800-SEP, NF800-HEP, NF800-REP NF800-UEP
Layout of setting dials		

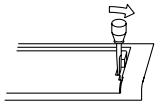
Setting method

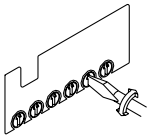
[for Group A]



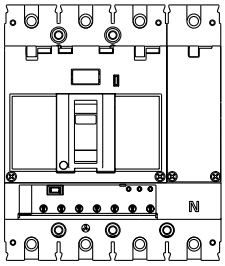
Step setting type:
- LTD time TL,
- STD pick up current Is,
- STD time Ts,
- Pre-alarm pick up current IP

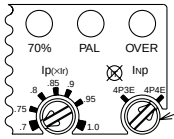
Continuously adjustable type:
- Current setting Ir
- Instantaneous pick up current Ii





For setting, turn the arrow of each dial to the position desired





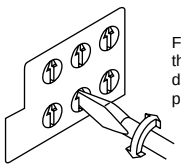
Neutral protection I_{Np}

(1) Open the button cover using a screwdriver as illustrated at left.
(2) Set operating characteristics by turning the dials.
For turning the dials for chracteristic setting,use a screwdriver as illustrated at left.

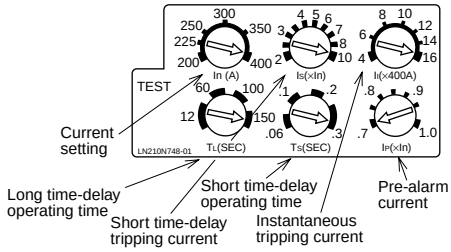
① A slotted head screwdriver of 3mm width and 0.5mm thickness at the top is suitable for the setting.
② At setting,refrain from applying force more than necessary as such can cause broken.
(Adequate operation torque is 0.02N·m maximum.)
* As for Is and Ip setting,a set value may advance to the next one in some cases
③ Except for the dials of current setting Ir and instantaneous pick up current Ir keep the arrow of the setting dials within the range of the thick line of setting value.
④ On 4P circuit breakers, neutral protection is selected using a 2-position setting:
4P 3E (neutral unprotected),
4P 4E (neutral protection at Ir),
where Ir is the circuit breaker current setting.

(3) Close the button cover.

[for Group B]

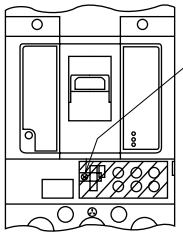


For setting, turn the arrow of each dial to the scale position desired



Step setting type:
- Long time-delay operating time TL
- Short time-delay tripping current Is
- Short time-delay operating time Ts
- Pre-alarm current IP

Continuously adjustable type:
- Current setting Ir
- Instantaneous trip current Ii



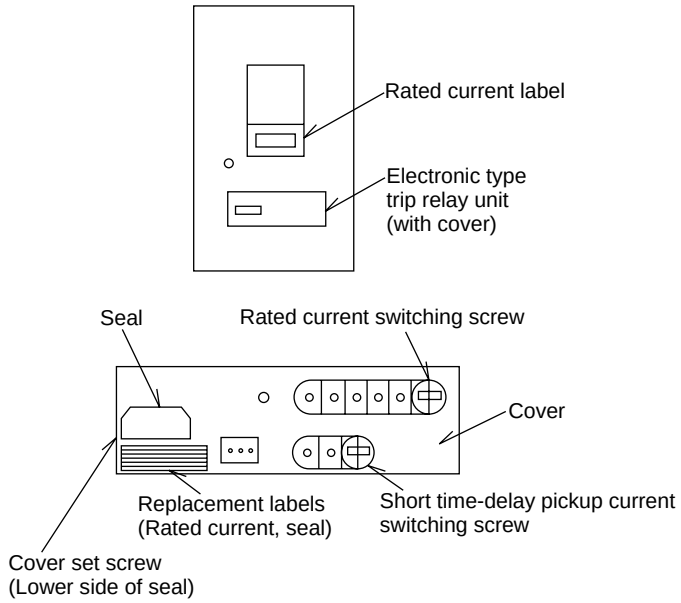
Fastening torque
0.3~0.6N·m

(1) Take off the seal, if sticked.
(2) Loosen the cover screw and open the cover.
(3) Set tripping characteristics by turning the dials.
For turning the dials for characteristic setting, use a screwdriver as illustrated at left.

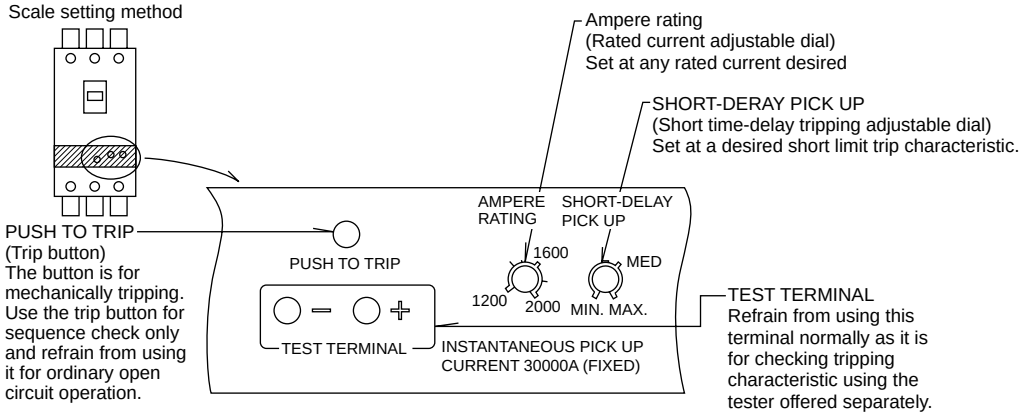
① A slotted head screwdriver of 3 mm width and 0.5 mm thickness at the top is suitable for the setting
② At setting, refrain from applying force more than necessary as such can cause failures.
(Adequate operation torque is 0.05N·m maximum.)
③ Except for the dials of current setting Ir and instantaneous tripping current Ii, keep the arrow of the setting dials within the range of the thick line of setting value.
Stopping the arrow in the middle may advance the set value to the next one in some cases.
* As for Is setting, a set value may advance to the next one in some cases.

(4) Take the seal of the same value for setting value out of the replacement labels, and stick the label to the top end of the handle.
(5) Attach the cover, and fasten the screws.
(6) Stick the seal, if it is necessary.

2.3.3 How to set characteristics of molded-case circuit breakers [1000~1600A frame electronic overcurrent tripping type]

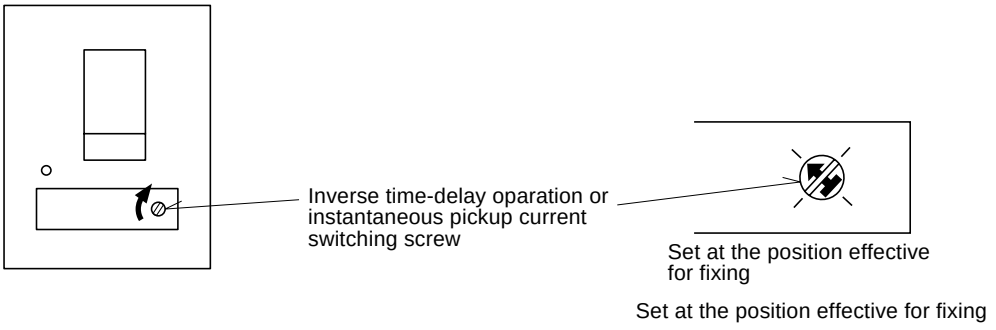
Applicable model	ETR (Electronic trip relay) mounting circuit breaker (NF1000-SS, NF1250-SS, NF1600-SS, NF1250-UR)	
Item	Rated current	Short time-delay tripping characteristic
Layout of setting terminals		
Setting method	(1) Take off the seal, loosen the cover set screw and take off the cover. (2) Loosen the rated current switching screw, move it to the position desired for setting by fingers, and tighten it with 0.3 to 0.45 N·m torque. A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for the setting. (3) Take the label and the seal of the same value for setting value out of the replacement labels. (4) Change the rated current label at the top end of the handle. (5) Attach the cover, and stick the seal.	(1) Remove the seal, loosen the cover set screw, and take off the cover. (2) Loosen the short limit pickup current switching screw, move it to the desired setting positon by fingers, and tighten it with 0.3 to 0.45 N·m torque. A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for the setting. (3) Take the seal out of the replacement labels. (4) Attach the cover and stick the seal.

2.3.4 How to set characteristics of molded-case circuit breakers [Applicable models: NFE2000-S, NFE3000-S, NFE4000-S]

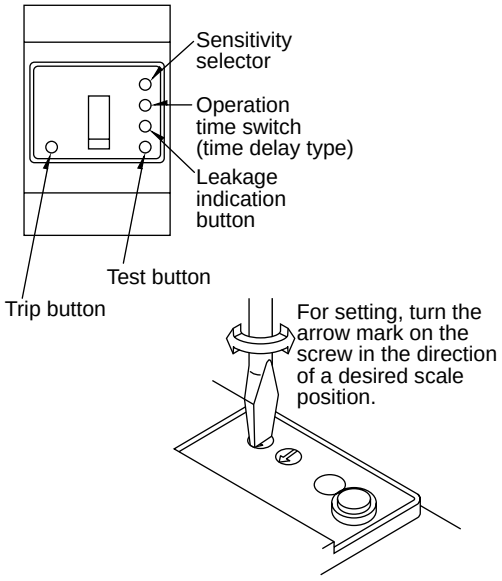
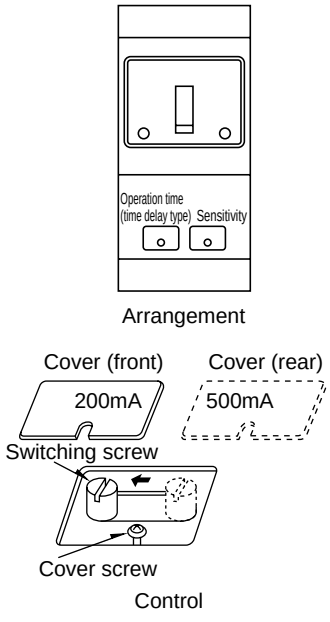


Remarks: For the electronic circuits of circuit breaker, control power is supplied from the built-in current transformer. Accordingly, the breakers can be used with no regard to circuit voltage.

2.3.5 How to set inverse time-delay or instantaneous tripping characteristics of circuit breakers [Adjustable thermal or magnetic type]

Applicable model	Adjustable magnetic type NF125-SGW(RT), NF125-HGW(RT), NF160-SGW(RT), NF160-HGW(RT), NF250-SGW(RT), NF250-HGW(RT), NF630-SP, NF800-SDP, NF1000-SSD, NF1250-SSD, NF1600-SSD, NF2000-S, NF2500-S NF3200-S, NF4000-S, NV630-SP, NV1000-SB, NV1200-SB, NF-SJW, NF-HJW
Item	Inverse time-delay or instantaneous tripping characteristic
Layout of setting terminals	
Setting method	Inverse time-delay oparation or instantaneous pickup current can be adjusted simply by turning the switching screw. For setting current of each notch, please refer to the operation characteristic curve. Note 1. Trip current differs at middle position of the scale. Note 2. Turn the adjust button in arrow direction only. Note 3. A slotted head screwdriver of 1mm thickness at the top is suitable for the setting.

2.3.6 How to switch voltage, sensitivity current and operating time (time delay type) of earth leakage circuit breakers

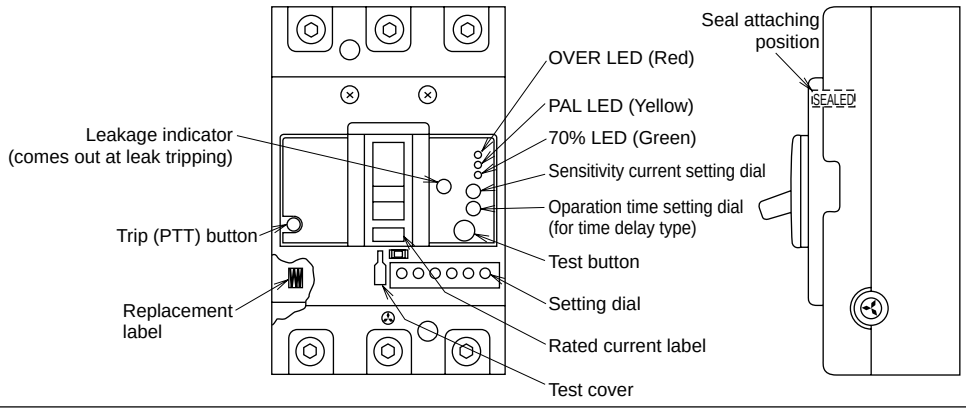
Applicable model	NV63-CW, NV125-CW, NV250-CW, NV32-SW, NV63-SW, NV125-SW, NV250-SW NV63-HW, NV125-HW, NV250-HW NV125-RW, NV250-RW NV400-CP, NV400-SP, NV630-CP, NV630-SP	NV1000-SB, NV1200-SB
	Multi voltage, sensitivity switching in 3 steps	Dual voltage, sensitivity switching in 2 steps
Setting terminal arrangement		
Voltage selection	Multi voltage types can be used for three circuit voltages as it is.	Dual voltage type can be used for two circuit voltages as it is.
Sensitivity, operating time	• A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for setting. • Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. • Refrain from applying unnecessary force at the time of setting. It can cause failure. (Addequate operation torque is 0.05N·m max.)	The sensitivity selector is attached to the right side of the cover viewed from the front side. To change from 500mA to 200mA, take the procedure state below while referring to the illustration given above. (1) Loosen the cover screw and take off the cover. (2) Loosen the switching screw and move it to the left. *Turn 5 to 6 times with a screwdriver suitable for the groove width. (3) Fasten the switching screw. Tighten the screw firmly as the bottom is to be connected electrically. Cover tightening torque: 0.4 to 0.6N·m A slotted head screwdriver of 6mm width and 0.8mm thickness at the top is suitable for setting. (4) Set the cover back in place and fix with the screw. *For the time delay type of the above model, switching procedure of operating time is the same as that of current switching.

2.3.7 How to change rated current, tripping characteristic and leak tripping characteristic of earth leakage circuit breakers (electronic overcurrent tripping type)

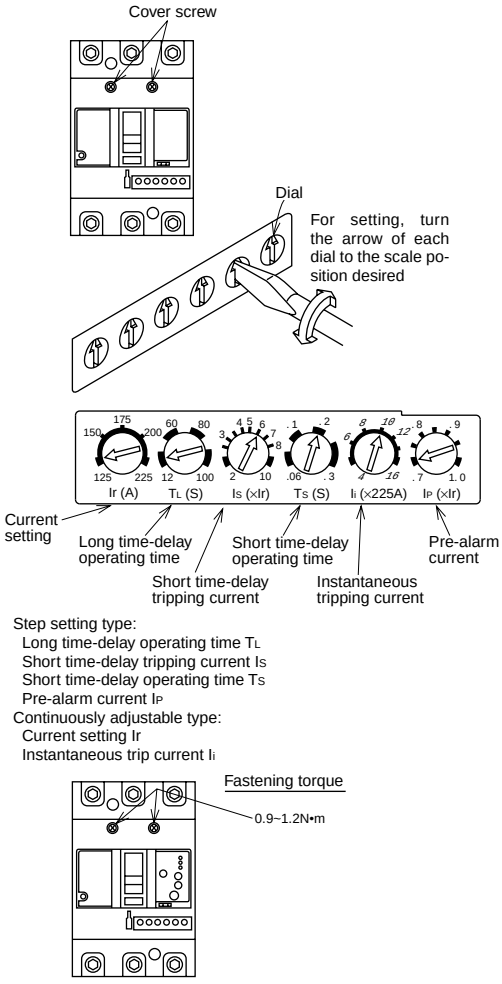
Applicable model

NV100-SEP, NV100-HEP
NV250-SEW, NV250-HEW

Setting dial arrangement



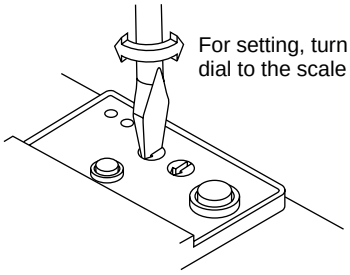
Tripping characteristics setting method



(1) Take off the seal, if sticked.
(2) Loosen the cover screw and open the cover.
(3) Set tripping characteristics by turning the dials.
For turning the dials for characteristic setting, use a screwdriver as illustrated at left.
① A slotted head screwdriver of 3 mm width and 0.5 mm thickness at the top is suitable for the setting
② At setting, refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.02N·m maximum.)
③ Except for the dials of current setting Ir and instantaneous tripping current I_i, keep the arrow of the setting dials within the range of the thick line of setting value.
Stopping the arrow in the middle may advance the set value to the next one in some cases.
* As for Is setting, a set value may advance to the next one in some cases.
(4) The blank labels may be used for indication of the current setting Ir. Please fill in the blank label with oily ink, and stick the label to the position under the handle.
(5) Close the cover and fasten the screws.
(6) Stick the seal, if it is necessary.

Setting method of leak tripping characteristics (sensitivity current, operation time)

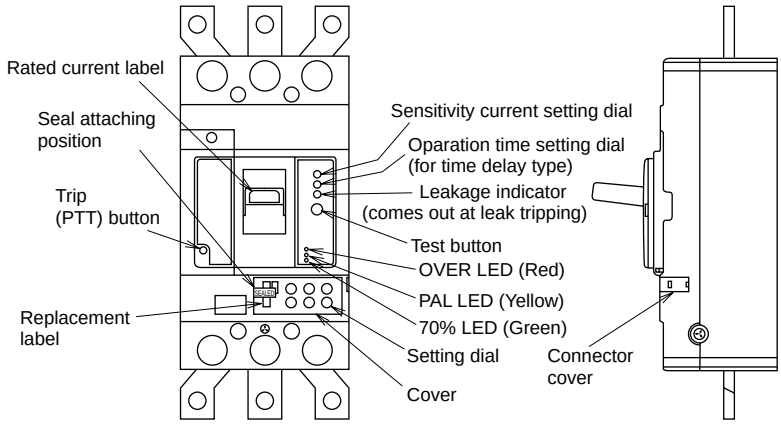
- For setting sensitivity current and operation time, open the cover in the same procedure as for tripping characteristic setting.
- A slotted head screwdriver of 4.5mm width and 0.6mm thickness is suitable for the setting.
- Stopping in the middle of each set values makes sensitivity current or operating time unstable in some cases.
  Be sure to set exactly at the position of each set value.
- At setting refrain from applying force more than necessary as such can cause failures.
  (Adequate operation torque is 0.05N·m maximum.)



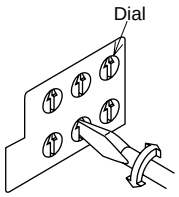
Applicable model

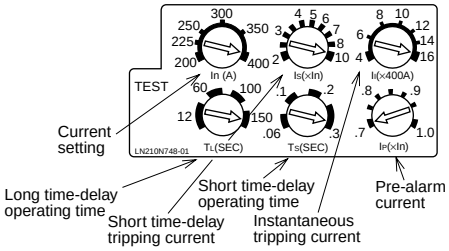
NV400-SEP, NV400-HEP, NV400-REP
NV630-SEP, NV630-HEP
NV800-SEP, NV800-HEP

Setting dial arrangement



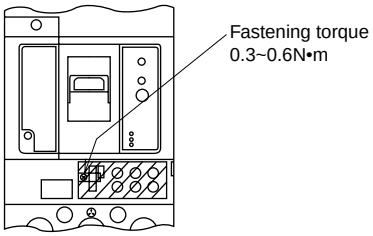
Tripping characteristics setting method





Step setting type:
- Long time-delay operating time T_L
- Short time-delay tripping current I_S
- Short time-delay operating time T_S
- Pre-alarm current I_P

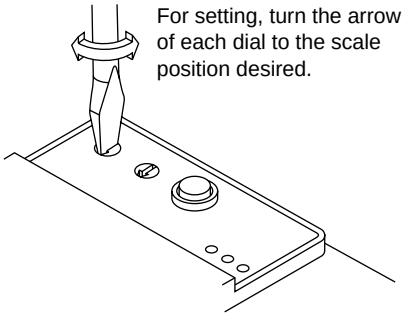
Continuously adjustable type:
- Current setting Ir
- Instantaneous trip current I_I



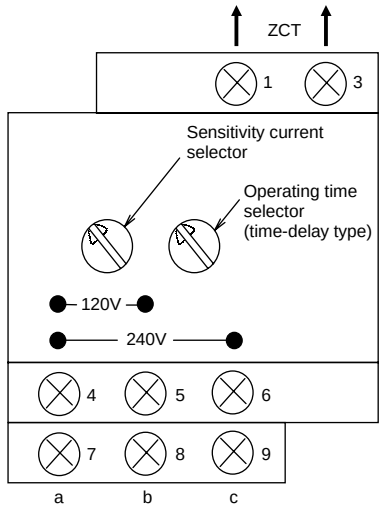
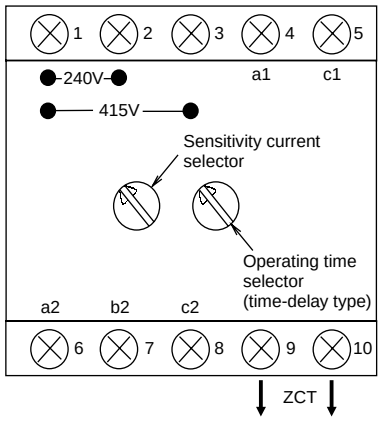
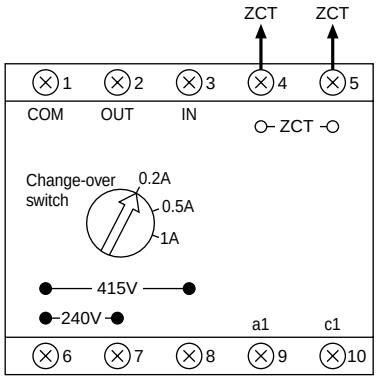
(1) Take off the seal, if sticked.
(2) Loosen the cover screw and open the cover.
(3) Set tripping characteristics by turning the dials.
For turning the dials for characteristic setting, use a screwdriver as illustrated at left.
① A slotted head screwdriver of 4.5mm width and 0.6 mm thickness at the top is suitable for the setting.
② At setting, refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.05N·m maximum.)
③ Except for the dials of current setting Ir and instantaneous tripping current I_I, keep the arrow of the setting dials within the range of the thick line of setting value.
Stopping the arrow in the middle may advance the set value to the next one in some cases.
* As for Is setting, a set value may advance to the next one in some cases.
(4) Take the seal of the same value for setting value out of the replacement labels, and stick the label to the top of the handle.
(5) Attach the cover, and fasten the screws.
(6) Stick the seal, if it is necessary.

Setting method of leak tripping characteristics (sensitivity current, operation time)

- For setting sensitivity current and operation time, open the cover in the same procedure as for tripping characteristic setting.
- A slotted head screwdriver of 4.5mm width and 0.6mm thickness is suitable for the setting.
- Stopping in the middle of each set values makes sensitivity current or operating time unstable in some cases.
  Be sure to set exactly at the position of each set value.
- At setting refrain from applying force more than necessary as such can cause failures.
  (Adequate operation torque is 0.05N·m maximum.)



2.3.8 How to switch voltage, sensitivity current and operating time of earth-leakage relay

Applicable model	Earth leakage relay		
	ZBA	ZSA, ZHA, ZLA	ZU
Switching terminal arrangment			
Voltage selection	• When source voltage is 120V in the above drawing,connect to 4 and 5 terminals. • When source voltage is 240V in the above drawing,connect to 4 and 6 terminals.	• When source voltage is 240V in the above drawing,connect to 1 and 2 terminals. • When source voltage is 415V in the above drawing,connect to 1 and 3 terminals.	• When source voltage is 240V in the above drawing,connect to 6 and 7 terminals. • When source voltage is 415V in the above drawing,connect to 6 and 8 terminals.
Sensitivity,operation time	• As lotted head screwdriver of 4.5mm width at the top and 0.6mm thickness is suitable for setting. • Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. • Refrain from applying unnecessary force at the time of setting. It can cause failure. (Adequate operation torque is 0.05N·m max.)	• As lotted head screwdriver of 4.5mm width at the top and 0.6mm thickness is suitable for setting. • Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. • Refrain from applying unnecessary force at the time of setting. It can cause failure. (Adequate operation torque is 0.05N·m max.)	• Turn the change-over switch with a screwdriver to set the arrow at a desired scale position.

3. Installation

3.1 Notice for selection

For selection, refer to the catalog, technical data, specifications and other technical materials.

For any question concerning the selection method, please enquire us.

We are not responsible for any failure and damage caused by wrong selection.

3.2 Normal service conditions

Our circuit breakers of the standard specifications are to be used in the following standard conditions.

- Operating ambient temperature: –10 to 40°C (Average temperature for 24 hours, however, shall not be higher than 35°C.)
- Relative humidity: 85% max. with no dewing
- Altitude: 2,000 m maximum
- Ambient of no excessive water or oil vapour, smoke, dust, salt content, corrosive substance, vibration, and impact

  Expected service life (MTTF) under the above conditions is 15 years.
- Lowering ratio of operational current in special ambient temperature over 40°C.

  50°C……0.9 times

  60°C……0.7 times

  Expected service life (MTTF) will be reduced compare with normal service conditions.

⚠CAUTION

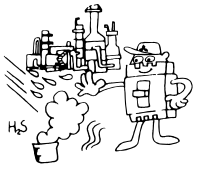
- Refrain from installing in any unusual environment of high temperature, high humidity, dust, corrosive gas, vibration and impact. Electrification, fire, and malfunction can result.

Note. The environment shall be free from any dewing or freezing.

3.3 Non-standard conditions

When operated under different conditions from the normal service conditions, it is necessary to take the following measures against the operating conditions.

Even with such measures taken, however, service life may become shorter in some cases.

Special environment		Circuit breaker for special environment	Specifications	Applicable model	
				MCCB	ELCB
Low temperature	 Freezing warehouse, low temperature room	Circuit breaker for low temperature 低 温 用 LOW TEMP. USE	This breaker is so designed to enable power supply, switching, and short circuit breaking at -40°C. The operating characteristics change at low temperature as they are adjusted for the reference ambient temperatur. (For storing, consider the use is possible up to -50°C at the lowest.)	• 1600 A frame of S-series and lower • All models of C-series	–
High temperature, high humidity	 Chemical plant	Circuit breaker for moisture-fungus treatment 一種熱帯処理 MOISTURE-FUNGUS TREATMENT 二種熱帯処理 MOISTURE-FUNGUS TREATMENT	• Moisture-fungus treatment of the 1st kind In addition to special surface treatment and special materials, corrosionproof treatment is applied. • Moisture-fungus treatment of the 2nd kind Special surface treatment is applied and special materials are used. In humid environment, insulation strength and other electrical performances tend to be lowered. The special surface treatment and the special materials are used to avoid such deterioration.	• Moisture-fungus treatment of the 1st kind (Note 2) Front connection, rear connection, and flush plate type of S-series and C-series of 2000A frame and lower. • Moisture-fungus treatment of the 2nd kind All models of S- and C- series	(Note 2) All models of S- and C- series All models of leakage relay (Moisture-fungus treatment of the 2nd kind only)
Corrosive gas, salt content	 Chemical plant, Oil refining plant	Added corrosion resistive circuit breaker 耐食増し CORROSION RESIST	• In the environment containing much corrosive gas (gas concentration level up to the note *given below), it is advisable to use MCCB of added corrosion resistive specifications. For the breakers of added corrosionproof type, corrosionproof plating is applied to the metal parts. • Where concentration of corrosive gas exceeds the level stated below, it is necessary to use MCCB of added corrosion resistive type being enclosed in a waterproof type enclosure or in any enclosure of protective structure. * Concentration of corrosive gas allowed by the Safety and Health Standard: (Ex.) H_2S (10 ppm), HCl (5 ppm), Cl_2 (1 ppm), SO_2 (5 ppm), NH_3 (25 ppm) - (Japan Industrial Health Association, since 1973) Where concentration of corrosive gas is about 1/100 of the noted level and H_2S (0.01 ppm), the standard MCCB can be used. Expected service life (MTTF) will be less than 15 years.	(Note 2) • Front connection, rear connction, and flush plate type of series S and C of 2000A frame and smaller	(Note 2) All models of S- and C- series
Dust, vapour	 Cement plant, spinning mill, gravel pit	Enclosed circuit breaker	Enclosed circuit breaker of dustproof (type I) or waterproof (type W) is advisable for places where much dust or vapour is contained. For installing circuit breakers in explosionproof enclosure, use non-ammonia mould product.		

Note 1. SHT and UVT of internal accessories are excluded.

2. Electronic types are excluded.

3.4 Inspection at arrival

(1) Make sure that the packing case is free from any abnormality such as breaking and wetting.

(2) Referring to the name plate, make sure that the delivered breaker is in conformity with your order.

(3) Check for the parts contained in the same package.

① Mounting screws

② Terminal screws

③ Insulation barriers (The barrier is contained in the same package for some models, but not for other models.)

④ Terminal covers (The cover is contained in the same package for some models, but not for others.)

Note: At unpacking, be careful so that the sealing pags may not be scattered around.

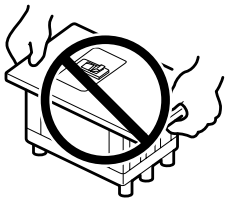
3.5 Conditions during transport and storage

3.5.1 Transport

Packing and transportation shall be carried out with care

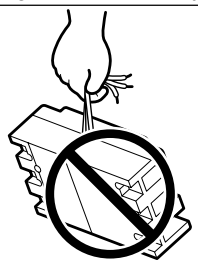
Never drop the packing.

Don't bring the breaker by holding the flash plate for carrying.



Carrying in this manner is dangerous as the breaker may drop.

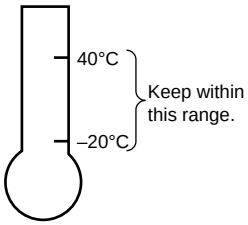
Don't bring the breaker up with holding the wires for carrying.



Holding on the attached lead wires of internal accessories for carrying as unreasonable force is applied to the attached wires.

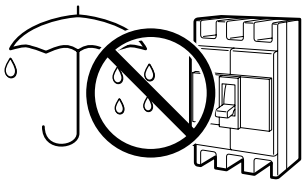
3.5.2 Storage

Storage temperature



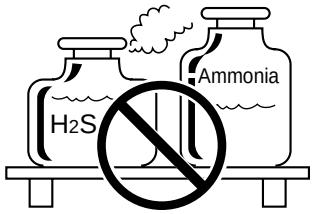
Average temperature for 24 hours, however, shall not be higher than 35°C.

Avoid humid air.
Relative humidity: 85% max.



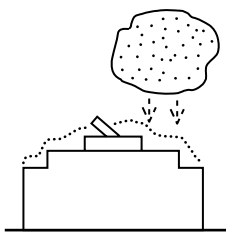
- Don't leave the breaker in a humid place for a long time.
- Keep the breaker so as not be dewed.

Avoid corrosive gas.

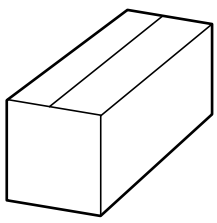


Storage the breaker in the environment of no corrosive gas.
H_2S 0.01 ppm max. SO_2 0.05 ppm max.
NH_3 0.25 ppm max.

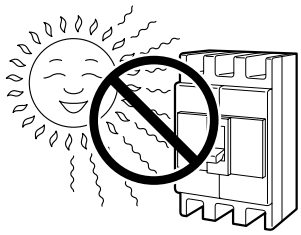
Place of low dust content



Housed in a packing case for storage



Avoid direct sunlight.



Avoid direct insolation during storage.

3.6 Installation and connection

3.6.1 General

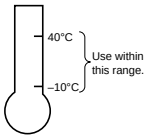
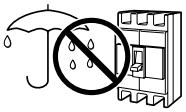
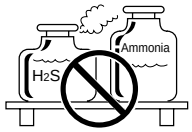
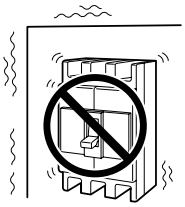
⚠CAUTION

- Let a qualified person (electrician) carry out the electrical work.
- Before wiring, turn the upper circuit breaker to OFF. Make sure that no power is supplied to prevent that the electrification can occur.

3.6.2 Installation

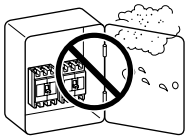
⚠CAUTION

Install the breaker in normal environment. In case of any unusual environments such as high temperature, high humidity, dust, corrosive gas, vibration and impact, the fire, the malfunction, and any operation failures can result.

Operating ambient temperature: –10°C to 40°C	Avoid humid air. Relative humidity 85% max.	Avoid corrosive gas.	Avoid vibration and impact.
 Average temperature for 24 hours, however, shall not be higher than 35°C.	 • Install the breakers in a place of low humidity • Keep the breakers so as not be dewed.	 Install the breakers in the environment of no corrosive gas. H_2S 0.01ppm max. SO_2 0.05ppm max. NH_3 0.25ppm max.	

⚠CAUTION

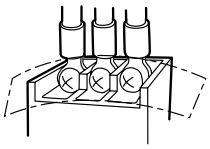
Use care to avoid rain, drill chips and other chips. Malfunction and operation failure can result.



Avoid direct exposure to rain, oil, dust and powder etc. Pay close attention, in particular, to drill chips made from steel plates and other conductive wastes.

Don't put dust and chips inside through the exhaust port.

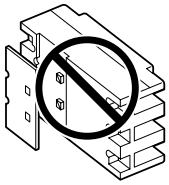
Cover the exhaust port with the sheet when under construction.



It is danger of poor electrification and abnormal temperature rise.

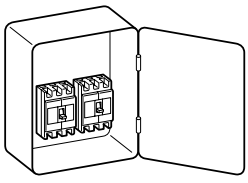
Don't disassemble!

Malfunction and operation failures can result.



Do not remove the compound filled in the threads at the rear surface and the rear cover.

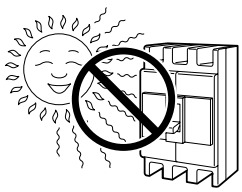
Use in a enclosure.



Be sure to use the breakers in a casing and never use them being exposed because arc is generated.

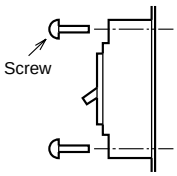
Avoid direct sunlight.

Temperature rise can lead to malfunction.



Use specified screws only.

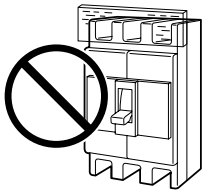
Install the breakers to the correct position using the specified screws (length and number of pieces) or the specified fittings.



Don't block up the exhaust port.

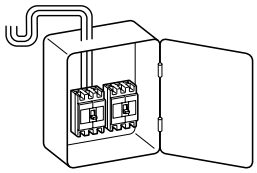
Breaking performance may possibly be lowered.

Don't put a flammable parts near the breaker.



It is in danger of fire when breaking the circuit.

Prevent the ingress of water into the enclosure.



See to it so that rain water isn't allowed to enter into the board along the wires, for example.

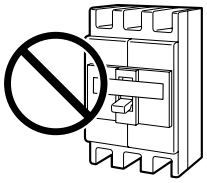
Never use thinner, detergent, and other chemicals for cleaning.

It is likely to make letters on the plate illegible or to lower insulation performance.

Clean the breaker using air cleaner or by brushing.

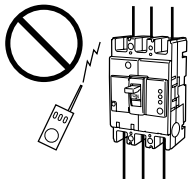
Do not adhere gum tape on the name plate.

The name plate may come off.



Avoid strong electro magnetic field.

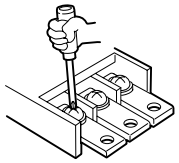
When a transceiver is used, keep it off at least 1 meter from installed places of the earth leakage circuit breakers and circuit breakers with electronic over-current release.



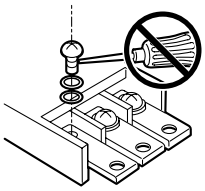
3.6.3 Connection

⚠CAUTION

- At the time of wire connection, tighten the terminals screws with the tightening torque shown in Appendix 4.
  Otherwise, fire can result.
- Loose fastening leads to overheat and can cause malfunction.
- Excessive fastening injures the screws and breaks the moulded case.
- Use a screwdriver suitable for screw shape.

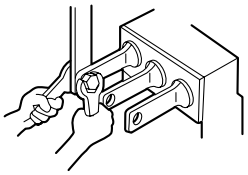


Oil is prohibitive to threads



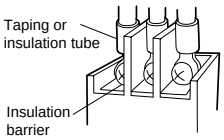
Oiling lowers frictions leading to loose screw. Over tightening causes breakage of the screw.

Don't deform the studs



Fasten the conductors of rear connection type without deforming the stud

Insulate the live and exposed part



When insulation distance isn't enough, or for the live and exposed part of the terminal to prevent short-circuit or ground fault due to metal piece dropping, applying insulation by taping, insulation tube, and insulation barrier. Of 400V and higher systems, in particular, uncovered conducting part is dangerous.

Note. The model that a standard packs insulation barrier together is to install insulation barrier.

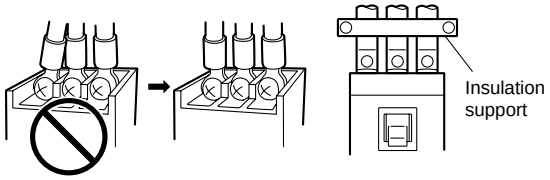
Use the terminal screws packed together.

Long terminal screw makes insulation distance insufficient, while short terminal screw causes insufficient tightening force, which leads to overheat.

Use ring-type terminals of suitable size.

Where a large number of solderless terminals are used for connection, connect them referring to Appendix 4.

Fix the conductors firmly keeping the poles parallel with each other



Attach the connecting conductors so that the poles are kept parallel with each other.

Fix (bundle) the connecting conductors firmly as significant magnetic force is generated according to magnitude of fault current.

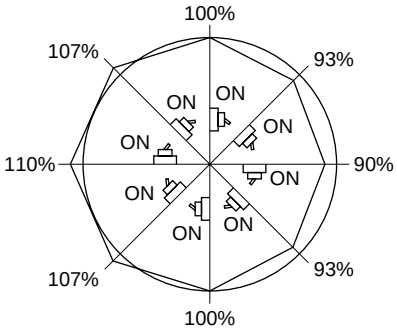
Magnetic force per 1 meter of conductor (In the case of 3-phase short circuit) N

Conductor distance cm / Let-through current r.m.s.kA (pf)	10	20
10 (0.4)	500	250
18 (0.3)	1900	950
25 (0.2)	4500	2250
35 (0.2)	8900	4450
42 (0.2)	12800	6400
50 (0.2)	18200	9100
65 (0.2)	30800	15400
85 (0.2)	52600	26300
100 (0.2)	73000	36500
125 (0.2)	114000	57000

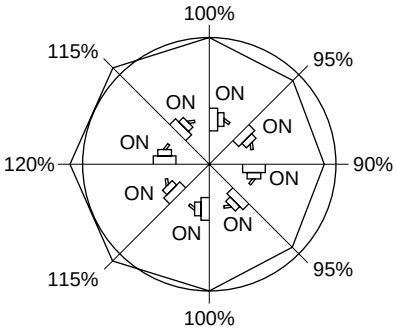
3.6.4 Mounting direction

(1) For the following models, pay attention to attaching position as overcurrent tripping is of fHydraulic-magnetic type and the tripping characteristic varies depending on mounting position. It is recommendable to use them attached vertically.

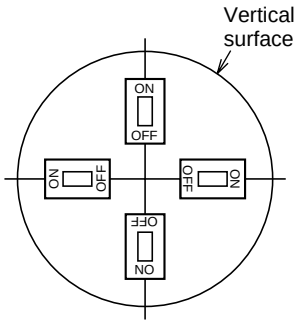
	Type
Moulded-case circuit breaker	NF30-CS, NF50-SS (1P), NF63-CW NF32-SW, NF63-SW, NF63-HW
Earth leakage circuit breaker	NV30-CS, NV50-CSA NV63-CW NV32-SW, NV63-SW, NV63-HW
Moulded-case circuit breaker for motor protection	MB30-CS, MB32-SW, MB50-CW, MB50-SW
Circuit protector	CP30-BA, CP-B, CP-S



Rate of change of rated current by mounting angle (For NF, NV, MB)



Rate of change of rated current by mounting angle (For CP)

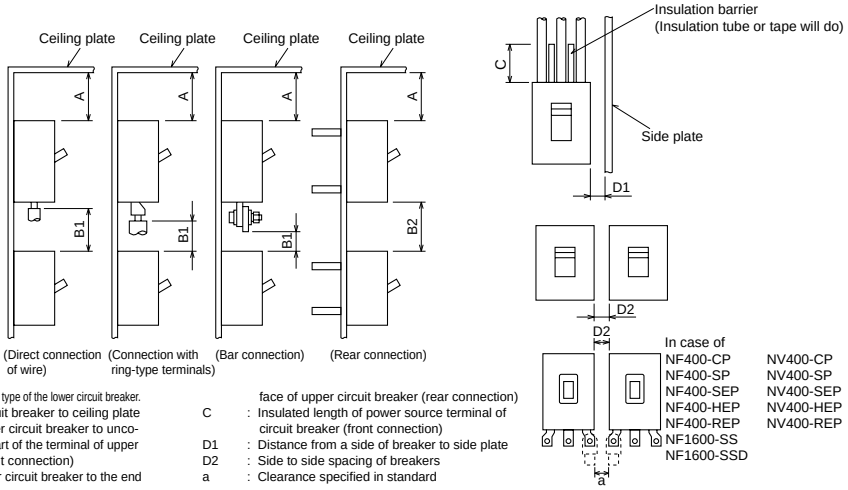


Mounting position which can assure operation characteristic for hydraulic-magnetic type

(2) Thermal-magnetic type and electronic type are not affected by mounting direction.

3.6.5 Distances between circuit breaker and earthed metal parts

When short circuit current is cut off, ionized gas goes out of the exhaust port at the power source side of the circuit breaker. At the power source side of the circuit breaker, provide the insulation distance shown in the table so that the outgoing gas may not be bothered. Short circuit and ground fault can also be resulted by dropped metal pieces, abnormal surge voltage generated in the lines, or by dust, iron chip, and salt content. Insulate uncovered conductors at the power source side of the circuit breaker exactly using insulation barriers, insulation tubes, and tapes.



Note:Vertical distance differs by each type of the lower circuit breaker.

A : Distance from circuit breaker to ceiling plate
B1 : Distance from lower circuit breaker to uncovered conducting part of the terminal of upper circuit breaker (front connection)
B2 : Distance from lower circuit breaker to the end face of upper circuit breaker (rear connection)
C : Insulated length of power source terminal of circuit breaker (front connection)
D1 : Distance from a side of breaker to side plate
D2 : Side to side spacing of breakers
a : Clearance specified in standard

Insulation distance mm (AC 440V and less)

Distances are obtained tests defined in the IEC 60947-2 standard.

Series	NFB Type name	NV Type name	Ceiling plate A: Uncovered metal plate, Without terminal cover	Ceiling plate A: Uncovered metal plate, With terminal cover	Ceiling plate A: Insulated plate, coated plate	Vertical spacing B1, B2: Without terminal cover	Vertical spacing B1, B2: With terminal cover	C	D1	D2
C·S·MB	NF30-CS, MB30-CS	NV30-CS, NV50-CSA	10	10	10	20	20	Larger than the dimension of exposed conducting part (Note 5)	20	May be put in tight contact (Note 2) (Note 3)
	NF32-SW, NF63-CW, MB30-SW, MB50-CW	NV63-CW	5	5	5	20	20		20	
	NF63-SW, NF63-HW, MB50-SW	NV32-SW, NV63-SW, NV63-HW	10	10	10	30	30		25	
	NF125-CW	NV125-CW	50 (30)	40 (30)	10	50	50		25	
	NF125-SW, MB100-SW	NV125-SW	50 (10)	30 (10)	10	50	50		25	
	NF125-HW	NV100-HEP, NV125-HW	50	40	40	80	80		40	
	NF250-CW	NV250-CW	40	40	40	50	50		50	
	NF160-SW, NF250-SW, MB225-SW	NV250-SW, NV250-SEW	70 (40)	40	40	70 (50)	50		50	
	NF160-HW, NF250-HW	NF250-HW, NV250-HEW	80	60	60	80	80		60	
	NF125-SGW, NF125-HGW, NF160-SGW NF160-HGW, NF250-SGW, NF250-HGW	—	30	30	30	50	50		5	
	NF400-CP	NV400-CP	60	60	60	60	60		40	(Note 2)
	NF400-SP, NF400-SEP	NV400-SP, NV400-SEP	70	70	70	70	70		70	(Note 3)
	NF400-HEP, REP	NV400-HEP, REP	200	200	200	200	200		150	May be put in tight contact (Note 2) (Note 3)
	NF630-SP, NF630-SEP, NF630-CP	NV630-CP, NV630-SP, NV630-SEP	70	70	70	70	70		70	
	NF630-HEP, REP	NV630-HEP	200	200	200	200	200		150	
	NF800-SEP, NF800-SDP, NF800-CEP	NV800-SEP	80	80	80	80	80		80	
	NF800-HEP, REP	NV800-HEP	200	200	200	200	200		150	
	NF1000-SS, NF1000-SSD, NF1250-SS NF1250-SSD, NF1600-SS, NF1600-SSD NF2000-S, NF2500-S, NF3200-S NF4000-S	NV1000-SB, NV1200-SB	100	100	100	100	100		100	
U	NF125-RGW, NF125-UGW	—	0 (Note 4)		0 (Note 4)	0 (Note 4)			5	
	NF250-RGW, NF250-UGW	—								
	—	NV125-RW							25	
	—	NV250-RW								
	NF400-UEP	—	70	70	70	70	70		70	(Note2)(Note3)
	NF630-UEP	—	70	70	70	70	70		70	May be put in tight contact (Note 2) (Note 3)
	NF800-UEP	—	80	80	80	80	80		80	
	NF1250-UR	—	200	200	200	200	200		200	
BH	BH, BH-P, BH-S, BH-PS	—	10	10	10	20	20		20	
UL	NF50-SWU (AC240V and less)	NV50-SWU (AC240V and less)	10	–	10	30	30		25	
	NF100-CWU (AC240V and less)	—	50 (30)	–	10	50	50		25	
	NF100-SWU (AC480Y/277V and less)	NV100-SWU (AC240V and less)	50 (10)	–	10	50	50		25	
	NF225-CWU (AC240V and less)	NV225-CWU (AC240V and less)	40	–	40	50	50		50	
	NF-SFW, NF-SJW (AC600Y/480V and less)	—	30	–	30	50	50		5 (Note 6)	
	NF-HJW (AC600Y/480V and less)	—	30	–	30	50	50		5 (Note 6)	

Note 1. The figures in parentheses in the table are the dimensions applied to AC 230 V and lower.

Note 2. Settle D2 dimension so that insulation distance (a according to each standard) can be secured.

Note 3. When NVs at both sides are put in contact and 2500A or higher current flows through NV at one side, the other NV may operate needless motion being affected by the magnetic field. In such a case, set D2 at 50mm or more.

Note 4. The terminal unit at the power side has no exhaust port and is so composed to discharge no arc requiring no insulation distance (space) to the power side. When an earth metal is put in contact with the terminal unit, however, uncovered part of the terminal or the wire must be insulated exactly using terminal covers, insulation barriers, tubes, and tapes to secure insulation distance (space) to the earth metal (the distance specified in board specifications etc.).

Note 5. Where surface type uncovered bars are used for connection, insulate by taping to the point where the bars overlap with the insulation barrier or to the root of the circuit breaker.

Note 6. In case of over AC440V, the distance is 10mm.

3.6.6 Current-carrying capacity and operating temperature

(1) Operating current vs. ambient temperature

Rated current of circuit breakers is adjusted for the rated ambient temperature. This is because circuit breakers are often installed in a casing as a switchboard or a control board, and temperature of the installed place of the breaker becomes higher than ambient temperature of the wires. If temperature of the installation site of circuit breakers greatly differ from the rated ambient temperature, it is necessary to correct rated current according to the temperature correction curve (shown in the Paragraph of characteristics and outside shape in the catalog). Load current can be increased up to the rated current corrected according to ambient temperature.

However, set current rating with enough allowance while taking fluctuation of power voltage and load current into consideration so that maximum operating current may not exceed the rated current.

① Cautionary instructions for using heat resistive wire

For using insulated wires of higher heat resistance than that of 600 V PVC insulated wire (allowable temperature 60°C), it is necessary to take the following points into consideration.

For circuit breakers, size of test wire is stipulated by each test current in IEC60947-1

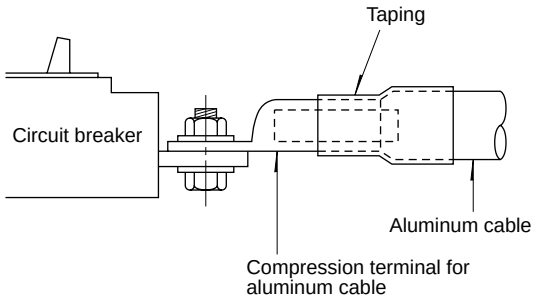
If size of connection wire is thinner than the test wire size, temperature of the breaker terminals increases and overcurrent tripping operation characteristic may change in some cases. (Operating time becomes shorter usually.) At motor load, for example, influence of change in operation characteristic by difference in size of connection wire is insignificant and can be disregarded because the load current is far lower than the rated current of the circuit breaker.

Size of test wire

Range of test current (A)			Conductor size (mm^2)
0	<	≤ 8	1.0
8		12	1.5
12		15	2.5
15		20	2.5
20		25	4.0
25		32	6.0
32		50	10
50		65	16
65		85	25
85		100	35
100		115	35
115		130	50
130		115	50
150		175	70
175		200	95
200		225	95
225		250	120
250		275	150
275		300	185
300		350	185
350		400	240

② Connection of aluminum conductors

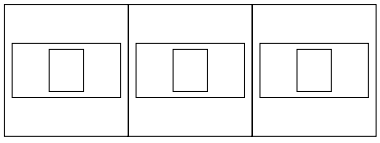
- When aluminum conductors are connected, be careful to prevent the contact resistance (due to the oxidized film of aluminum) from being increased.
- The surface of the connection point of the aluminum conductors shall be properly treated by plating (zinc displacement-Copper-Silver) or by joint compound. If the treatment is done only by joint compound, reliability is low, this should be limited to when plating is impossible (eg. at site).
- For aluminum cables, use compression terminals that are exclusively for aluminum cables.
- The compression portion of the terminal shall be provided with taping, and the aluminum wire shall not be exposed to the atmosphere.



(2) Maximum operating current of installation without clearance between breakers

In case of installation without clearance between breakers, because maifunction failures can result by heat of breaker, use the operating current not to exceed the below value.

Type name of breaker	Maximum operating current
BH BH-P BH-S BH-PS CP30-BA CP-B CP-S NF30-CS MB30-CS NV30-CS NV50-CSA MB30-CS NF32-SW NF63-CW MB30-SW NV63-SW NV63-CW MB50-SW NF63-SW NF63-HW NV63-SW NV63-HW MB50-SW NF125-CW NV125-CW NF125-SW NF125-SGW MB100-SW NV125-SW NV100-SEP NF125-HW NF125-HGW NV125-HW NV100-HEP NF160-SGW NF160-HGW NF250-CW NV250-CW NF250-SW NF250-SGW MB225-SW NV250-SW NV250-SEW NF250-HW NF250-HGW NV250-HW NV250-HEW	80% of rated current
NF400-CP NF400-SP NF400-SEP NF400-HEP NV400-CP NV400-SP NV400-SEP NV400-HEP NF400-REP NF400-UEP NV400-REP NF630-CP NF630-SP NF630-SEP NF630-HEP NV630-CP NV630-SP NV630-SEP NV630-HEP NF630-REP NF630-UEP NF800-CEP NF800-SDP NF800-SEP NF800-HEP NV800-SEP NV800-HEP NF800-REP NF800-UEP	90% of rated current



3.6.7 Breaker arrangements

(1) Connection of no-fuse breaker

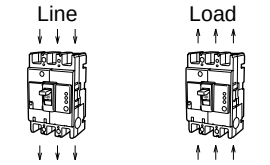
① Inverse connection

The illustration (a) is the standard connecting arrangement of line and load of the breaker terminals.

Except for the models which accept inverse connection, connection of (b) may lower breaking performance and inverse connection isn't advisable.

⚠CAUTION

When connected inversely, indication shall be made for line side and load side.



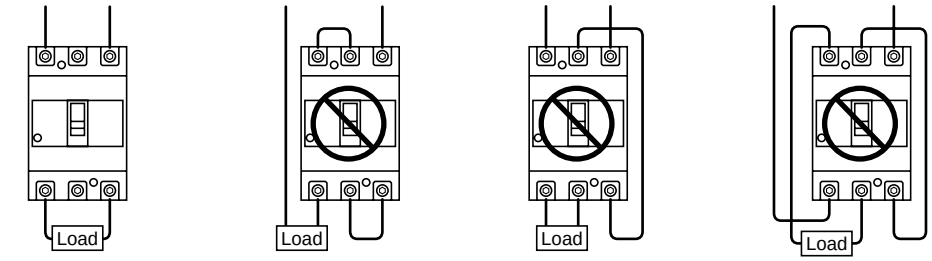
(a) Normal connection (b) Inverse connection

Models which accept inverse connection	Except for breaker with MDU	BH	BH-P	BH-S	BH-PS	CP30-BA	
		NF32-SW	NF63-CW	NF63-SW	NF63-HW	NF125-CW	NF125-SW
		NF125-SGW	NF125-HW	NF125-HGW	NF125-RGW	NF125-UGW	NF160-SW
		NF160-SGW	NF160-HW	NF160-HGW	NF250-CW	NF250-SW	NF250-SGW
		NF250-HW	NF250-HGW	NF250-RGW	NF250-UGW		
		MB30-SW	MB50-CW	MB50-SW	MB100-SW	MB225-SW	
		NF400-CP	NF400-SP	NF400-SEP	NF400-HEP	NF400-REP	NF400-UEP
		NF630-CP	NF630-SP	NF630-SEP	NF630-HEP	NF630-REP	NF630-UEP
		NF800-CEP	NF800-SDP	NF800-SEP	NF800-HEP	NF800-REP	NF800-UEP
		NF1000-SS	NF1000-SSD	NF1250-SS	NF1250-SSD	NF1600-SS	
		NF1600-SSD	NF2000-S	NFE2000-S	NF2500-S	NF3200-S	
		NFE3000-S	NF4000-S	NFE4000-S	NF1250-PAL	NF1600-PAL	NF2000-PAL
		NV400-CP	NV400-SP	NV400-SEP	NV400-HEP	NV400-REP	
		NV630-CP	NV630-SP	NV630-SEP	NV630-HEP	NV800-SEP	NV800-HEP
		DSN63-CW	DSN125-CW	DSN250-CW	DSN30-SW	DSN50-SW	
		DSN63-SW	DSN125-SW	DSN250-SW	DSN400-CP	DSN630-CP	DSN800-CP
		DSN400-SP	DSN630-SP	DSN800-SP	DSN1000-SS	DSN1250-SS	DSN1600-SS
		DSN2000-S	DSN2500-S	DSN3200-S	DSN4000-S		

② Electronic circuit breaker

⚠CAUTION

When 3-pole circuit breakers are used for single phase 2-wire lines, connect correctly in the manner illustrated below. Otherwise, overcurrent fails operation and causes fire.



Correct method of connection | Connection method of A | Connection method of B | Connection method of C

(a) Connection method of A
This connection may be acceptable only when carrying out the temperature-rise test in the acceptance test. Please never use this connection in any actual applications.

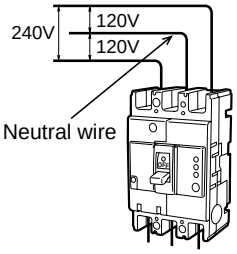
(b) Connection method of B or C
Please never use this connection in any actual use. Since the temperature-rise of the internal electronic circuit and the breaking performance are not guaranteed.

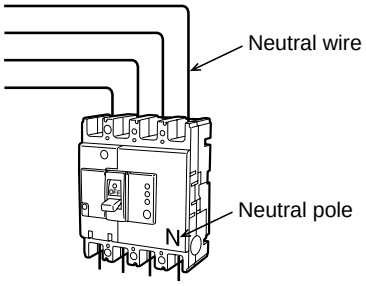
(2) Connection of earth leakage circuit breaker

⚠CAUTION

① Connect to a power source suitable for the rating of the circuit breaker. Otherwise, malfunction and failure can result.
Application of overvoltage outside the applicable voltage range can cause burning as the earth leakage circuit breaker incorporates electronic circuits.
Application of lower voltage than the applicable voltage range also fails operation.

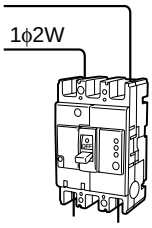
② Where a circuit breaker is used for 1 phase 3 wire system and 3 phase 4 wire system, be sure to connect the neutral wire to the neutral pole of the circuit breaker. Otherwise, operation fails at overcorrent.





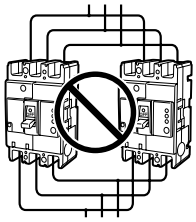
(a) For single phase two wire system, refrain from using neutral pole.

Where a 3-pole earth leakage circuit breaker is used for single phase 2 wire system, connect to the right and left poles of the circuit breaker. Using the neutral pole fails operation as the control power for the operation is supplied through the left and right poles.



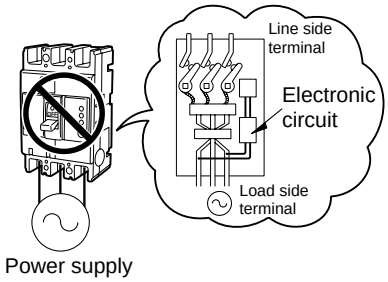
(b) Don't connect in parallel.

Refrain from parallel connection as unnecessary operation takes place because of loop circuit formed or the leak tripping unit is burnt in some cases. Also refrain from parallel connection of the earth leakage circuit breaker with a moulded use circuit breaker.



(c) Don't connect in reverse.

The electronic circuit of ELCB as standard are short time rating. If used by reverse connection, the electronic circuit have damaged by continuous voltage of after tripping. Therefore must not use reverse connection.
The following types are possible to using by reverse connection.



Types	Applicable voltage
NV32-SW, NV63-CW, NV63-SW NV125-CW, NV125-SW, NV250-CW, NV250-SW	AC230V
NV400-CP, NV400-SP, NV400-SEP, NV400-HEP NV400-REP, NV630-CP, NV630-SP, NV630-SEP NV630-HEP, NV800-SEP, NV800-HEP	AC230-400-440V

Note 1. Measuring display unit (MDU) breakers are not available.

3.6.8 Instruction for connections

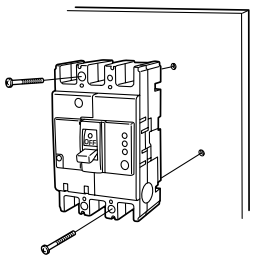
⚠CAUTION
Use the applicable connection parts for breaker.
Otherwise it may result in fire.

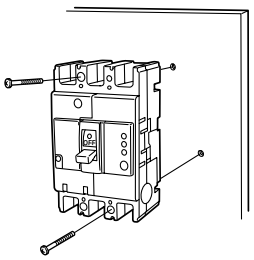
(1) Front connection

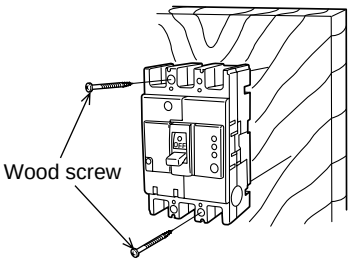
① Mounting

Mount directly using the mount hole.

Mount plate

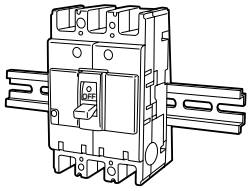






• Mount screws for steel plate and for wood plate (a part of NV models) are attached. For dimension, refer to Appendix 1.
Note) In some cities, mounting onto wood board is limited by fire defense code and others.

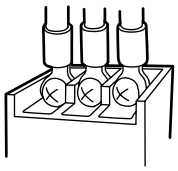
Mounting on IEC rail



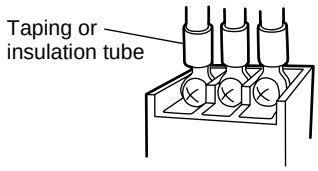
• Fix by attaching a slip stopper.

② Connection

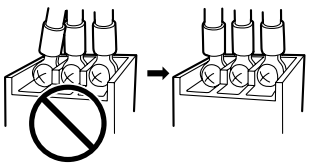
Wire connection with ring-type terminal



• For connection using ring-type terminals, refer to Appendix 4 for selection.



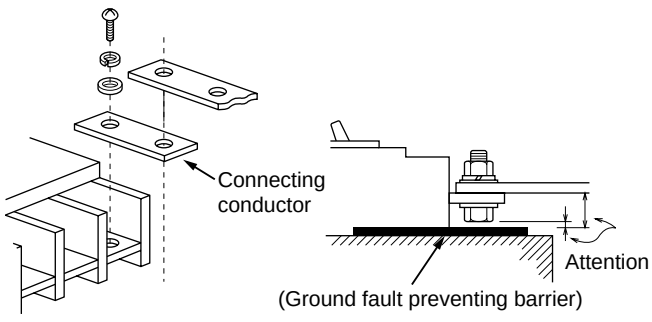
• Cover up exposed and conducting part of ring-type terminals with tube or insulation tape.



• Fasten the ring-type terminals so that the wires of different poles are kept parallel with each other.

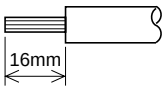
Bar connection

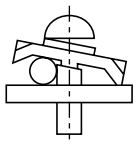
- When conductors are connected directly, process the conductors to the outline dimensions stated in the conductor machining drawing.
- To connect a conductor to a bar terminal, pay attention to insulation to the ground. Ground fault preventing barrier can be made to your designation.
- After making sure that the connecting conductors are free from any contamination and deposition of foreign matter, tighten them firmly.
- Where a connecting conductor is used, insulate the uncovered conductors of the power supply side using insulation barriers.

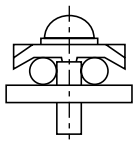


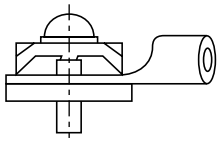
Clamp connection

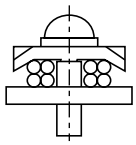
- When connected directly to a terminal, insert the solid or stranded wire straight, then fasten the terminal screws.
  Ring-type terminals and bars can also be connected.
- For stranded wires, divided the strands for insertion, then fasten. Retightening is necessary for stranded wires at initial connection in particular, as stress slackening takes place after fastening.
- Remove wire insulation to the dimension illustrated below.




(One solid wire)

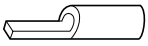

(Two solid wires)


(Connection with ring-type terminal)

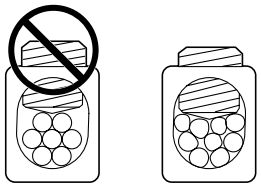

(Thick stranded wire)

Connection with solderless terminal

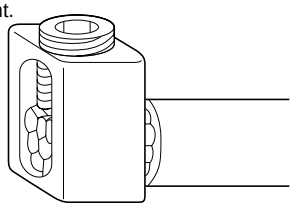
- Crimp after loosening strand of the connection wire and putting the core wires together. Regular inspection and retightening are necessary as the wires come loose as time goes.
- Where stranded wires of fine core such as the wires for appliances are used, use bar type or plate type solderless terminals.



- Refrain from soldering or binding stranded wires on the top end.



- Fasten carefully so that insulating materials of the wire is not caught.



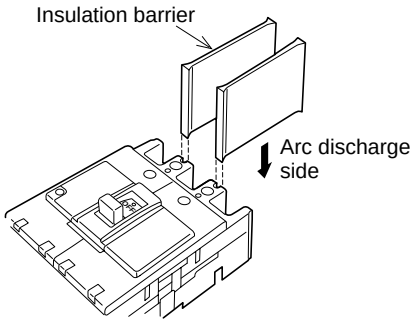
③Insulation

(a) Insulation barrier

The insulation barriers are used to reinforce insulation between phases of circuit breaker terminals, and to prevent failure caused by conductive foreign matter and dust. Be sure to use insulation barriers for the models of standard type.
To prevent problems, we are ready to mount the insulation barriers on the unit designated by you.

⚠CAUTION

1. For the standard models, be sure to use insulation barriers unless some other effective means are taken such as terminal cover.
2. To the models for which insulation barriers are packed together in both power source side and load side, attach them to both sides.
3. To the models for which insulation barriers are packed together in one side only, attach the barriers to arch discharge side (ON side) in either case of regular connection and inverse connection.



(Those with circle are optional.)

Applicable model		Connecting method			
MCCB	ELCB	Front	Rear	Flush	Plug-in
NF32-SW, NF63-CW MB30-SW, MB50-CW NF125-RGW, NF125-UGW, NF125-CW BH(2P, 3P, 40A, 50A) BH-P, BH-S, BH-PS	NV63-CW, NV125-CW, NV125-RW	○	—	—	—
NF63-SW, NF63-HW, NF125-SW, NF125-HW MB50-SW, MB100-SW	NV32-SW, NV63-SW, NV63-HW NV125-SW, NV125-HW NV100-SEP, NF100-HEP	Packed together as the standard practice	—	—	—
NF160-SW, NF160-HW, NF250-CW, NF250-SW NF250-HW NF125-SGW, NF125-HGW, NF125-RGW, NF125-UGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW, NF250-RGW, NF250-UGW MB225-SW	NV250-CW, NV250-SW, NV250-HW NV250-SEW, NV250-HEW, NV250-RW	Packed together as the standard practice	—	—	Packed together as the standard practice
NF400-CP, NF400-SP, NF400-SEP, NF400-HEP, NF400-REP NF400-UEP(3P)	NV400-CP, NV400-SP, NV400-SEP NV400-HEP, NV400-REP	Packed together as the standard practice	○	○	Packed together as the standard practice
NF400-UEP(4P), NF630-CP, NF630-SP NF630-SEP, NF630-HEP, NF630-REP, NF800-CEP NF800-SEP, NF800-HEP, NF800-REP, NF800-SDP NF630-UEP, NF800-UEP	NV630-CP, NV630-SP, NV630-SEP, NV630-HEP NV800-SEP, NV800-HEP	Packed together as the standard practice	○	○	○
NF1000-SS, NF1000-SSD, NF1250-SS, NF1250-SSD, NF1250-UR	—	Packed together as the standard practice	—	—	Packed together as the standard practice
NF1600-SS, NF1600-SSD, NF2000-S, NFE2000-S	NV1000-SB NV1200-SB	Packed together as the standard practice	—	—	—

④Terminal cover

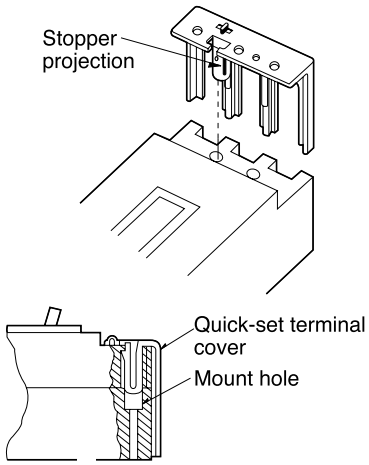
This is used to avoid exposure of charged parts. Different kinds are prepared for each application such as large size terminal cover (TC-L), small size terminal cover (TC-S), transparent terminal cover (TTC), Rear terminal cover (BTC), and plug-in terminal cover (PTC).

- Quick set terminal cover

  This cover can be attached simply by inserting into the mount hole on the circuit breaker proper.

  To disengage, slip off the cover stop projection by a finger or a screwdriver, then pull out. (PTC is of screw fix type.)

✵ The models of NF125-SGW/HGW/RGW/UGW, NF160-SGW/HGW, NF250-SGW/HGW/RGW/UGW are excluded.



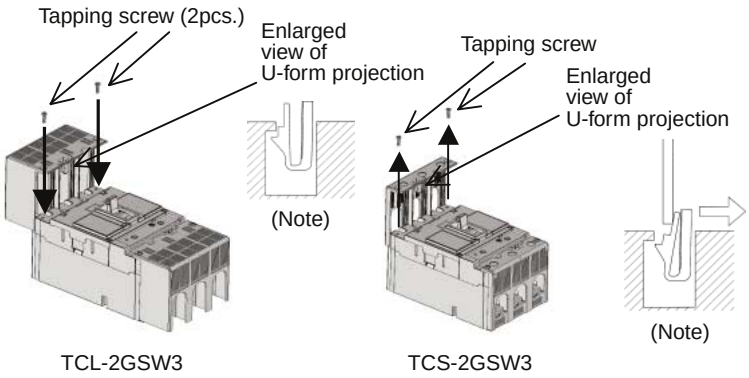
NF125-SGW/HGW/RGW/UGW, NF160-SGW/HGW,
NF250-SGW/HGW/RGW/UGW
DSN125-SGW, DSN160-SGW, DSN250-SGW

Mounting

1) Put the U-form projection in the hole of the breaker and push the terminal cover strongly to fasten it.
   (Push the indicated place by the "⇩" mark.)(Note)
2) Fix the terminal cover with tapping screws (in 4 positions with tightening torque 0.6 – 0.8 N·m).

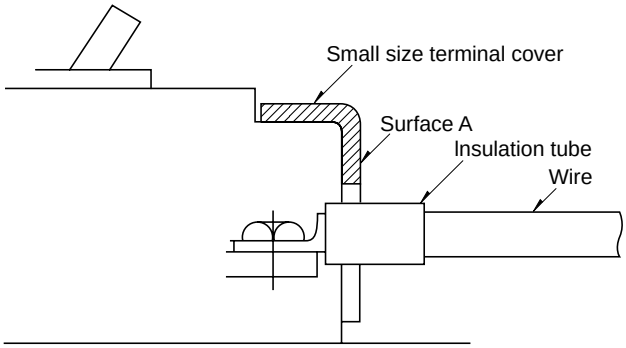
Removing

1) Remove the tapping screws.
2) Push the tip of the U-form projection fully toward the "⇨" mark by the screw driver or a finger tip and pull out the terminal cover toward the "⬆" mark.(Note)

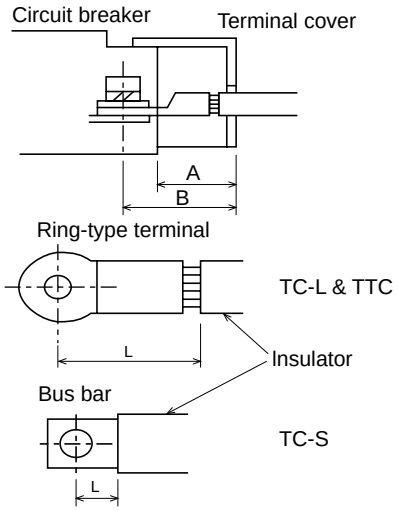


Note. except BTC or PTC

When a small size terminal cover (TC-S) is used, cover up the conducting part of the ring-type terminal with insulation tube or by taping but not exceeding surface A.



Note. No insulation barriers are needed with terminal covers are attached.



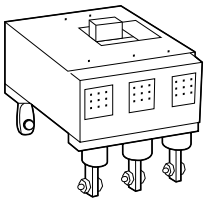
Exposed live parts

Limited condition (mm)	TC-L & TTC			TC-S		
	A	B	L	A	B	L
NF30-CS, MB30-CS, NV30-CS	25	34.5	29.5	5	14.5	12.0
NF32-SW, 50AF, 63AF	25	34.5	29.5	4.1	13.5	11.0
NF125-SGW/HGW NF160-SGW/HGW NF250-SGW/HGW NF125-UGW/RGW NF250-UGW/RGW	40	50.5	45.5	3.5	14.0	11.0
other 125AF	40	50.5	45.5	4.5	15.0	12.5
other 160AF, 250AF	40	50.5	45.5	3.2	13.5	11.0

(2) Rear connection

Rear connection type is for wiring from back side of the panel and terminal connection and bar connection are applicable. Rear studs (with insulation pipe or insulation base) are offered separately. Assembling is possible, therefore, by each user. For tightening torque, refer to Appendix 2.

①Bar stud

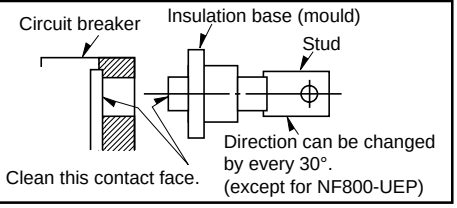


Assembling procedure (A)

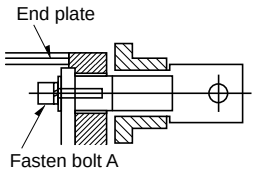
Model of breaker to be assembled	NF400-CP, NF400-SP NF400-SEP, NF400-HEP NF400-REP, NF400-UEP(3P)	NF400-UEP(4P), NF630-CP NF630-SP, NF630-SEP NF630-HEP, NF630-REP NF630-UEP NF800-CEP, NF800-SDP NF800-SEP, NF800-HEP NF800-REP, NF800-UEP
	NV400-CP, NV400-SP NV400-SEP, NV400-HEP NV400-REP	NV630-CP, NV630-SP NV630-SEP, NV630-HEP NV800-SEP, NV800-HEP
Size of bolt A	M8	M10
Tightening torque N·m	20	30

Take ±20% of the figures in the above table (tightening torque) as the rough guide of adequate range of tightening torque.

1. Clean the stud

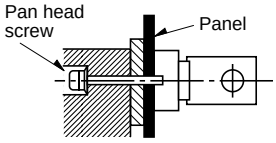


2. Attach the stud to the circuit breaker.



3. Attach onto the panel.

With the attached set screws, mount onto the panel using the mount hole on the circuit breaker. If the mount hole on the panel isn't threaded, use nuts.

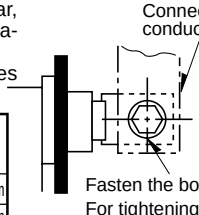


Assemble the circuit breaker and the insulation base and attach them together onto the panel.

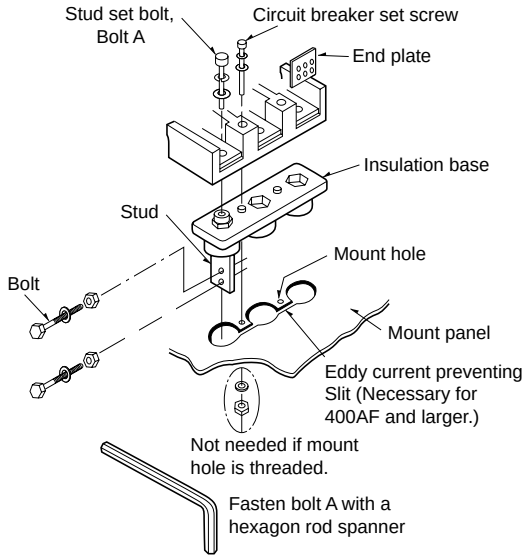
4. Connect the connecting conductor.

1. At connecting the conductors (bus bar, wire etc.), be careful so that no unreasonable force is applied to the stud.
2. When connected, fix (bundle) the wires at the positon (mentioned) below.

Stud direction / Type	Horizontal (□□□)	Horizontal (□□□)
100.250A frame	200mm maximum	120mm maximum
Others	350mm maximum	200mm maximum



The figures in the above table indicate distance from the top face of the panel. In the case of bus bar connection, the distance can be somewhat longer.

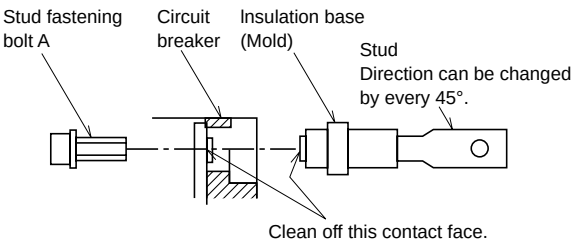


Assembling procedure (B)

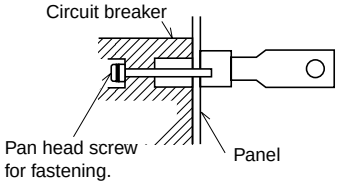
Model to be assembled	NF125-CW, NF125-SW NF125-HW, MB100-SW NV125-CW, NV125-SW NV125-HW, NV125-RW NV100-SEP, NV100-HEP	NF160-SW, NF160-HW NF250-CW, NF250-SW NF250-HW, MB225-SW NV250-CW, NV250-SW NV250-HW, NV250-SEW NV250-HEW, NV250-RW
Size of bolt A	M6	M6
Tightening torque N·m	4	10

Take ±20% of the figures in the above table (tightening torque) as the rough guide of adequate range of tightening torque.

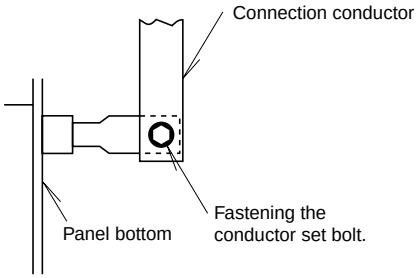
1. Attach the stud to the circuit breaker.



2. Attach onto the panel.



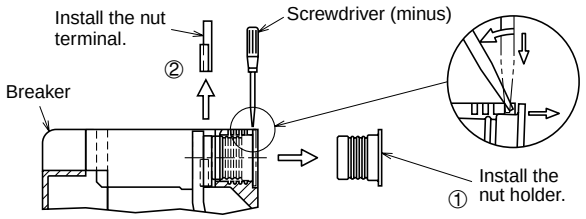
3. Connect the connecting conductor.



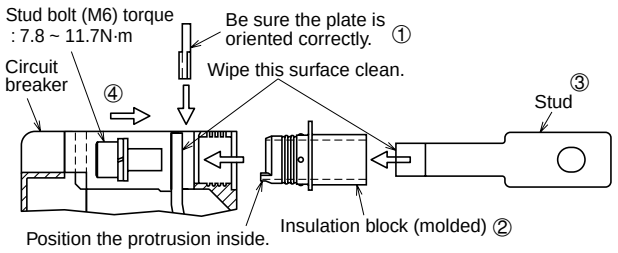
Assembling procedure (C)

Model to be assembled	NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW NF125-RGW, NF125-UGW NF250-RGW, NF250-UGW
Size of bolt A	M6
Tightening torque N·m	7.8~11.7

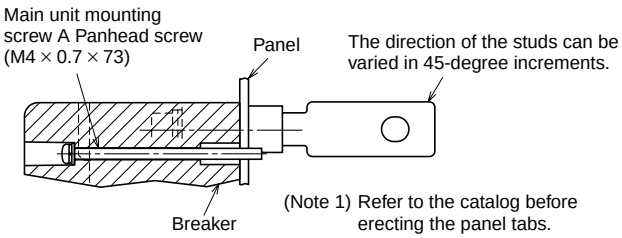
1. Changing from the front-mount type



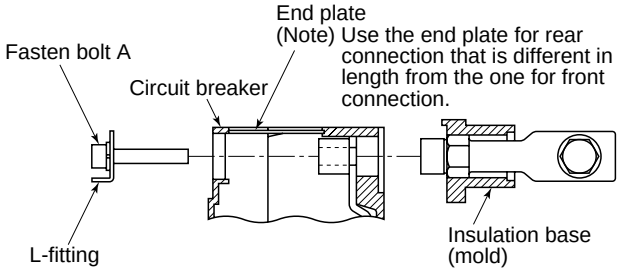
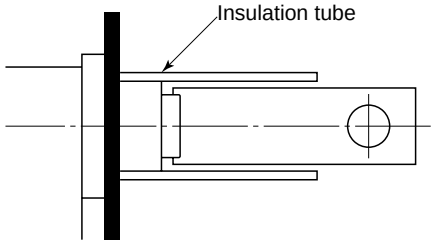
2. Installing the stud in the breaker



3. Installing on the panel



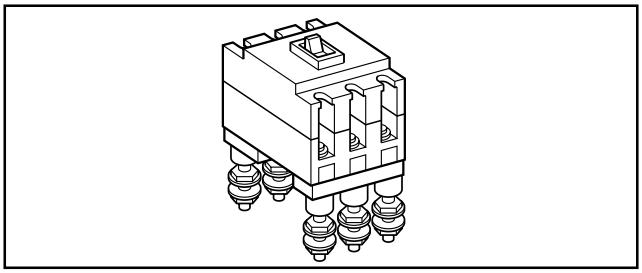
Cautionary instructions by each model

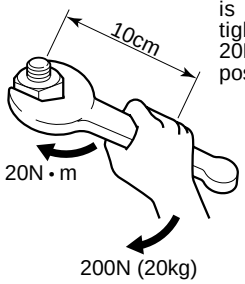
Model	Assembling procedure	Detail
NF400-CP, NF400-SP NF400-SEP, NF400-HEP NF400-REP NV400-CP, NV400-SP NV400-SEP, NV400-HEP NV400-REP	A-2	 Fasten L-fitting together as illustrated.
NF400-CP, NF400-SP NF400-SEP, NF400-HEP NF400-REP, NF400-UEP(3P) NV400-CP, NV400-SP NV400-SEP, NV400-HEP NV400-REP	A-4	 Insert the insulation tube into the center pole. For 4-pole breakers, insert the tube into the neutral pole, too.

Kind of end plate

Type	NF400-CP, NF400-SP NF400-SEP, NF400-HEP NF400-REP, NF400-UEP(3P)	NF400-UEP(4P) NF630-CP, NF630-SP NF630-SEP, NF630-HEP NF630-REP, NF630-UEP NF800-CEP, NF800-SDP NF800-SEP, NF800-HEP NF800-REP, NF800-UEP
	NV400-CP NV400-SP NV400-SEP NV400-HEP NV400-REP	NV630-CP NV630-SP NV630-SEP NV630-HEP NV800-SEP NV800-HEP
Power side	Insulation plate	Insulation plate
Load side	Insulation plate	Insulation plate

①Screw stud connection



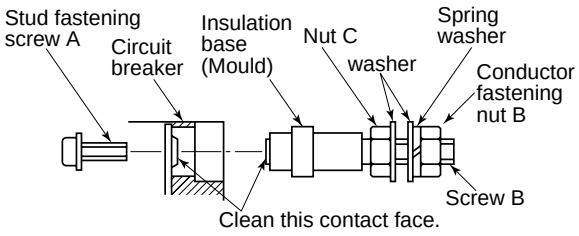


Generally, about 20kg power is generated by arm. So, tightening torque comes to 20N • m by grip-ping illustrated position.

Assembling procedure (A)

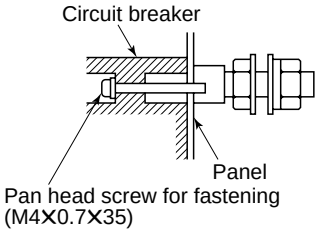
Model to be assembled	NF30-CS, MB30-CS, NV30-CS NF32-SW, NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW NV32-SW, NV63-CW, NV63-SW, NV63-HW

1. Attach the stud onto the circuit breaker.

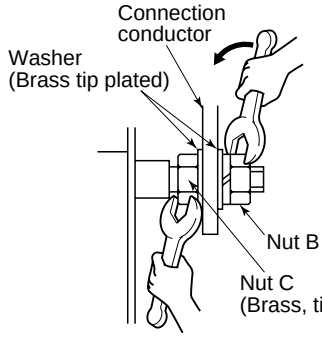


2. Mount onto the panel.

(Note)
Tap the panel referring to the catalog.



3. Connect the connection conductor.

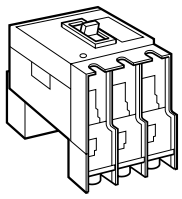


Fasten nut B
(Note)
Hold nut C with a wrench. Be careful so as not to apply unreasonable force to the stud.

Tightening torque for screw stud

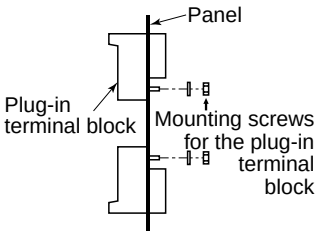
Type (Ampere frame)	Tightening torque N·m	
	Stud fastening screw A <Nominal diameter of screw>	Conductor fastening nut B <Nominal diameter of screw>
30A frame 50A frame 60A frame	1 <M4>	2 <M6>

(3) Plug-in type

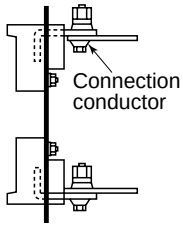


• Assembling procedure

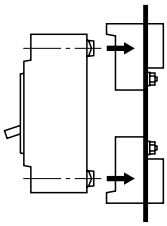
1. Attach the plug-in terminal block having the stud onto the panel or the angle.
   (If the plug-in terminal block is separate type, place the circuit breaker temporarily for positioning the push-in terminal block.)



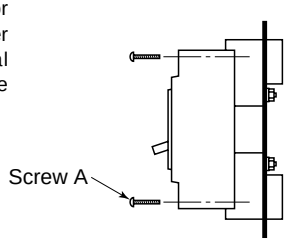
2. Attach the connection conductor to the plug-in stud.



3. Turn OFF the circuit breaker and insert into the plug-in terminal block.
   (Take off the cushion (foamed polystyrene of white) inserted into the tulip paart)



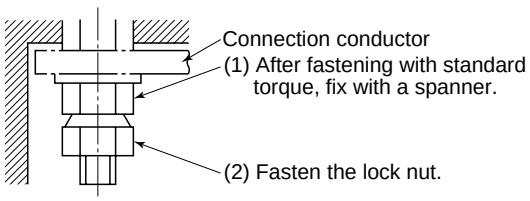
4. With the attached screw or to nut, fix the circuit breaker onto the plug-in terminal block using the mount hole on the breaker.



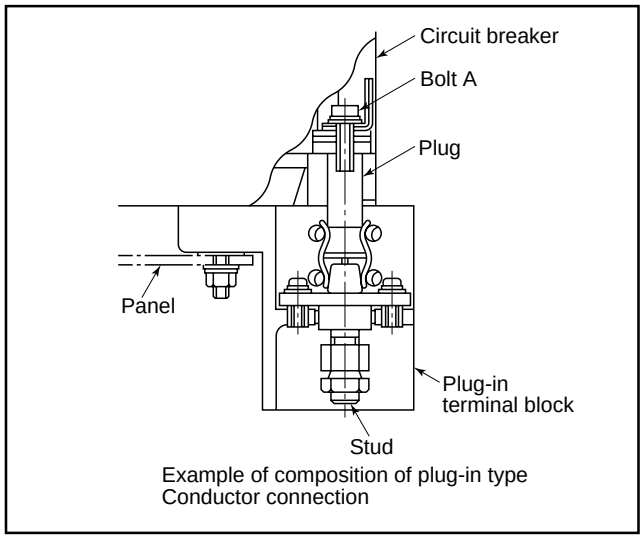
(Note)

❋ At wiring, refrain from applying excessive tensile load onto the stud.

❋ Fasten the double-nut type in the following manner.



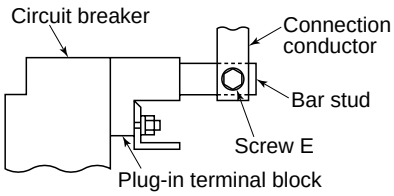
❋ At fasten ing the connection conductor, refrain from applying excessive load onto the side wall of the plug-in terminal block.



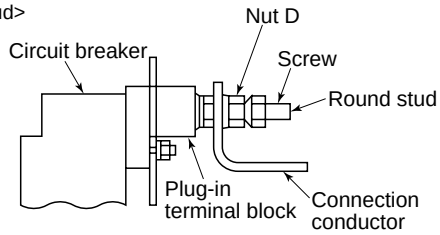
Example of composition of plug-in type
Conductor connection

• Conductor connection

<Bar stud>

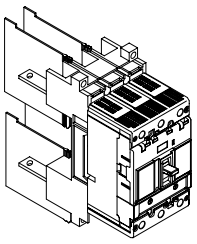


<Screw stud>

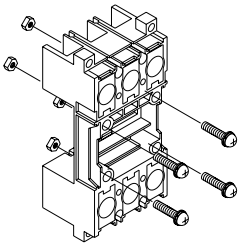


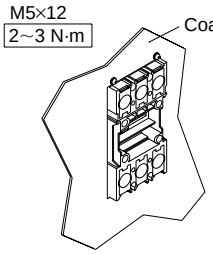
• For fastening torque, refer to Appendix 2.

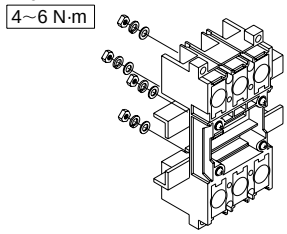
types for
NF125-SGW, NF125-HGW,
NF160-SGW, NF160-HGW,
NF250-SGW, NF250-HGW

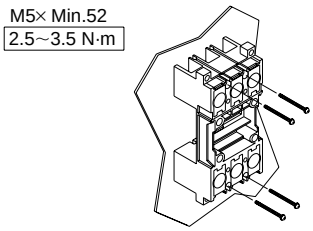


• Assembling

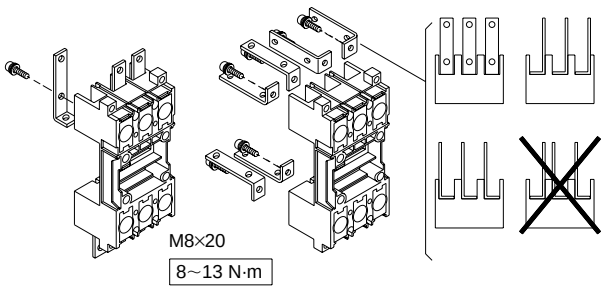


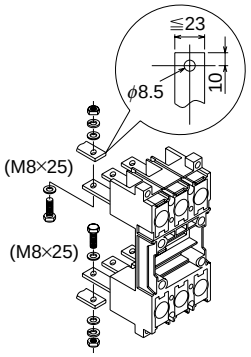




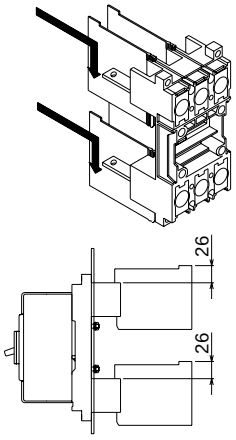


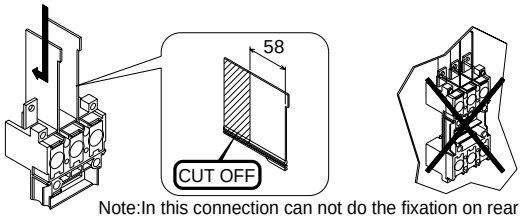
Note:The M5× min.52 screws were not packed.



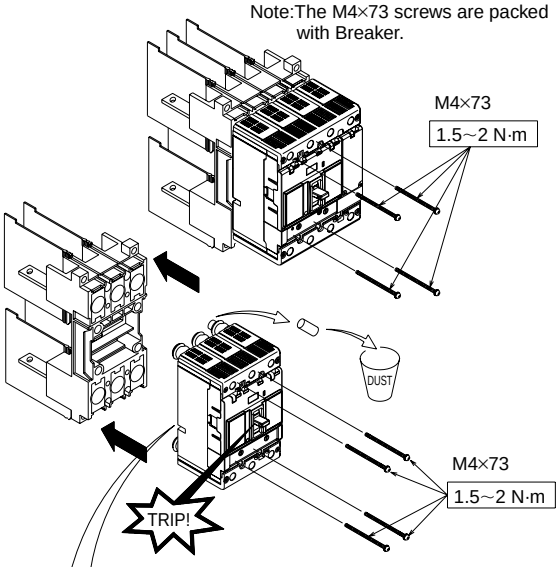


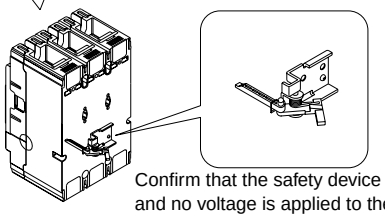
M8×25
9.5~14 N·m





Note:In this connection can not do the fixation on rear plate.





Confirm that the safety device unit is released and no voltage is applied to the circuit. (option)

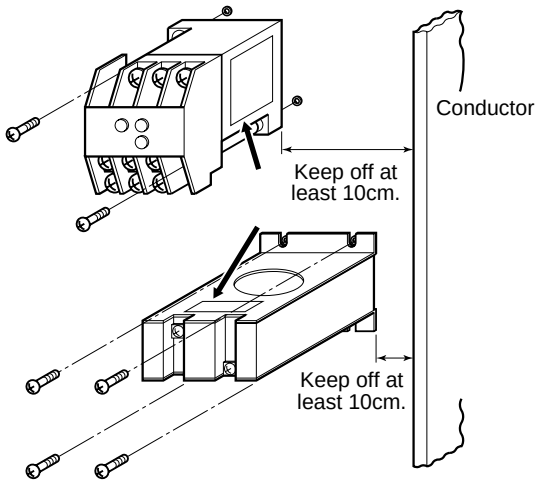
(5) Earth leakage relay

①Mounting

1. Mount the earth leakage relay and the ZCT unit separately. Refer to the catalog for mounting dimension.
2. With the relay of interchangeable type, the relay unit and the ZCT unit can be combined freely.
   For the relay of combination type, be sure to combine the relay unit and the ACT unit of the same manufacturing number.

Series	Hole diameter of ZCT (mm)						With primary conductor (A)	
	15	30	40	60	80	100	600~2000A	3200A
NV-ZBA NV-ZSA	Interchangeable type							
								—
NV-ZU	Combination type							

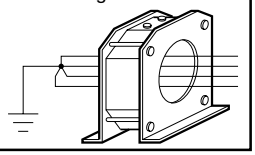
3. To avoid influence of outside magnetic field, mount the relay and the ZCT at least 10cm off the conductors which a large current of over several thousands ampere flows.



②Connection

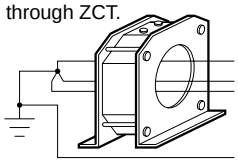
1. For single phase three-wise system and 3 phase 4-wire system, be sure to pass the three or four wires including the neutral wire through ZCT. (Pass the wire intended to conduct load current throught ZCT.)

Pass the neutral wire also through ZCT

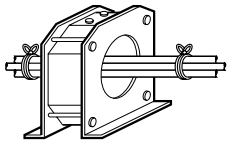


2. Where the line include a wire dedicated to grounding, refrain from passing the earth wire through ZCT. (Don't pass the wire not intended for conducting load current through ZCT.)

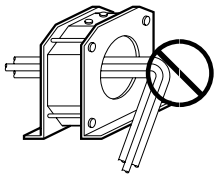
Don't pass the earth wire through ZCT.



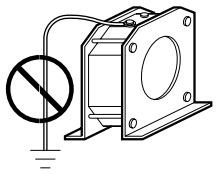
3. Bundle the wires passed through ZCT with clamp bands, for example, as they may apply mechanical stress to the ZCT when large current over the rated overcurrent strength flows at a short-circuit failure and others.



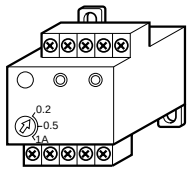
4. Don't bend sharply the wires passed through ZCT near the ZCT. When a primary conductor of over 300A is passed through, keep 30cm or more straight at one side.



5. Refrain from grounding the lead wire of the ZCT.



6. Make sure that the setting is free from any error as sensitivity current is switchable with some models.



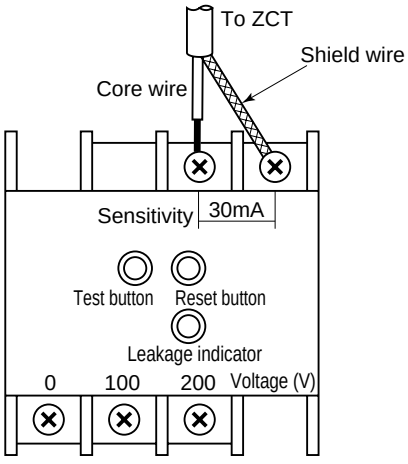
7. Where the relay unit is connected to the ZCT unit, take the following procedure.

Kind of lead wire used vs. sensitivity

Sensitivity	Length of lead wire		
	1m	1m~3m	3m~7m
30mA	Stranded vinyl coated wire of 0.5 to 2mm²	Single core shield wire	
100 · 200mA			of 0.5 to 2mm²
500mA and more			

Notes 1. Number of turns of wire stranding is about 40turns/m.
2. Where single core shield wire is used, connect the core wire and the shield wire in the right way acdording to the instruction manual. Example of NV-ZBA type is shown at the right.

Example of single core shield connection (NV-ZBA type)



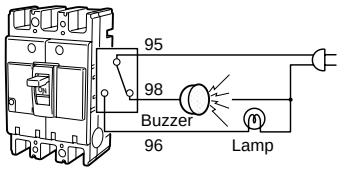
3.6.9 Instruction for accessories

(1) Internal accessories

The following devices are installed into the circuit breakers.
For the accessories with lead wires, allow at least 8 mm spacing when circuit breakers are installed side by side.

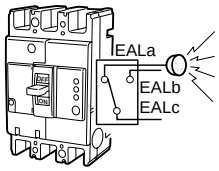
AL Alarm switch

This switch is for electrically indicate tripping of the circuit breakers.



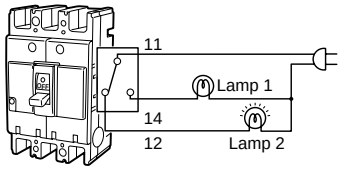
EAL Earth leakage alarm switch

The switch for electrically indicating trip state of the earth leakage circuit breaker by ground fault. Smaller frame than 225A are provided with SLT as the standard arrangement.
(It is attached to the back of the circuit breaker of built-in type.)



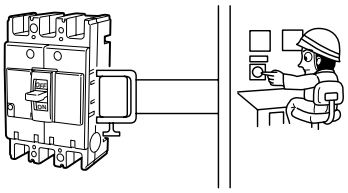
AX Auxiliary switch

This is for indicating ON/OFF state of the circuit breakers electrically.



SHT Shunt trip

The device to electrically trip the circuit breakers from a remote position.
The allowable operation voltage range is 70 to 110% of rated voltage.

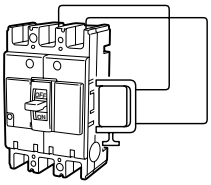


TBM Test button module

This device is for remotely testing by applying voltage. The same control sequence as SHT of NF can be assembled, and parallel connection of TBMs is possible. (SLT is attached as the standard.)

UVT Under voltage trip

The device for tripping the circuit breakers automatically when supply voltage comes down. The operating voltage is 70 to 35% of the UVT rated voltage.
At 85% and above of the rated voltage the circuit breaker can be cosed.



MG Insulation switch

Attaching insulation switch enables measurement of interpole meg at the load side simply by turning off the earth leakage circuit breaker.

LT, SLT Lead wire terminal block

This is connection with internal auxiliary devices, and can be prepared according to your designation.
(Dimensions of LT or SLT differs somewhat according to number of pieces attached and model of auxiliary devices.)

(2) AL (Alarm switch), AX (Auxiliary switch)

- AL (Alarm switch) is for indicating trip state of the circuit breakers electrically.
- AX (Auxiliary switch) is for indicating ON/OFF state of the circuit breakers electrically.

Operation of AL switch

State of circuit breaker	Contact condition of AL switch
Off or ON	· 98 (Open) · 96 (Close)(Note.1) · 95 (DC +)
Trip	· 98 (Close) · 96 (Open)(Note.1) · 95 (DC +)

Operation of AX switch

State of circuit breaker	Contact condition of AX switch
Off or Trip	· 14 (Open) · 12 (Close)(Note.1) · 11 (DC +)
ON	· 14 (Close) · 12 (Open)(Note.1) · 11 (DC +)

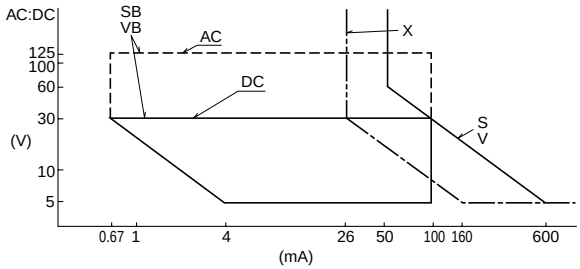
Note 1. When used for DC circuit, pay attention to polarity.
2. The dots of terminal marking shown in above examples means the sequence number of accessories.

AL • AX Rating of switch

Micro switch used	AC Voltage (V)	AC Amps (A) Resistance load	AC Amps (A) Induction load	DC Voltage (V)	DC Amps (A) Resistance load	DC Amps (A) Induction load
S	460	-	-	250	0.2	0.2
	250	3	2	125	0.4	0.4
	125	5	3	30	4	3
V	460	5	2	250	0.3	0.3
	250	10	10	125	0.6	0.6
	125	10	10	30	10	6
X (Note,1)	460	5	2.5	250	5	3
	250	10	10	125	10	6
	125	10	10	30	10	10

Note 1. When used for DC circuit of Type X, pay attention to polarity.

2.



For lower area than above bottom limit of applicable load, use the switch for minute load.

AL and AX for minute load

Micro switch used	AC Voltage (V)	AC Amps (A) Resistance load	AC Amps (A) Induction load	DC Voltage (V)	DC Amps (A) Resistance load	DC Amps (A) Induction load
SB	125	0.1	-	30	0.1	-
VB	125	0.1	-	30	0.1	-

For use in small current area, enquire us separately.

Note 1. For model of breakers to be assembled each type of micro switch, refer to the catalogue.
2. Practice insulated termination to the lead wires not used.
3. Unusual resistance is indicated in some cases when measured at minute current of a digital switch, for example.

(3) SHT (Shunt trip)

■ The device to trip circuit breakers electrically from a remote position.

■ Allowable operating voltage range is 70 to 110% of the rated voltage.

■ Coil rating (Standard)

<table>
<tr><th colspan="2" rowspan="2">Type designation of circuit breakers</th><th rowspan="2">Cut off switch</th><th rowspan="2">Voltage (Note 3)
(V)</th><th colspan="4">Input VA (Note 1)</th><th rowspan="2">Operating time
(Note 2)</th></tr>
<tr><th colspan="2">AC</th><th colspan="2">DC</th></tr>
<tr><td rowspan="2">NF-C·S·H·U
MB</td><td>32(30)·63A Frame
125A Frame
(NF125-SGW/HGW/RGW/UGW are excluded)</td><td rowspan="2">Equipped</td><td rowspan="2">AC100-240
380-550
(Compatible to 50 and 60Hz.)
DC100-125</td><td colspan="2" rowspan="2">120</td><td colspan="2">50</td><td rowspan="2">15 or less</td></tr>
<tr><td>160·250A Frame
NF125-SGW/HGW/RGW/UGW</td><td colspan="2">60</td></tr>
<tr><td colspan="2" rowspan="2">NF400-CP, NF400-SP, NF400-SEP, NF400-HEP, NF400-REP
NF400-UEP, NF630-CP, NF630-SP, NF630-SEP, NF630-HEP
NF630-REP, NF630-UEP, NF800-CEP, NF800-SDP
NF800-SEP, NF800-HEP, NF800-REP, NF800-UEP</td><td rowspan="2">Equipped</td><td rowspan="2">AC100-450/DC100-200</td><td>100V</td><td>20</td><td rowspan="2">100V</td><td rowspan="2">10</td><td rowspan="2">5~15</td></tr>
<tr><td>200V</td><td>50</td></tr>
<tr><td colspan="2">NV400-CP, NV400-SP, NV400-SEP, NV400-HEP, NV400-REP
NV630-CP, NV630-SP, NV630-SEP, NV630-HEP
NV800-SEP, NV800-HEP</td><td>380V</td><td>120</td><td rowspan="2">200V</td><td rowspan="2">35</td></tr>
<tr><td colspan="2">NF1000-SS, NF1000-SSD, NF1250-SS, NF1250-SSD
NF1600-SS, NF1600-SSD</td><td rowspan="2">Equipped</td><td rowspan="3">AC100-120
200-240
380-450
DC100</td><td colspan="2">450V</td><td>170</td><td colspan="2">200</td><td colspan="2">70</td><td>7~15</td></tr>
<tr><td colspan="2">NF1250-UR</td><td colspan="2">200</td><td colspan="2">70</td><td>7~15</td></tr>
<tr><td colspan="2">NF2000-S, NF2500-S, NF3200-S, NF4000-S</td><td rowspan="2">Equipped (Note 4)</td><td colspan="2">100</td><td colspan="2">100</td><td>15~25</td></tr>
<tr><td colspan="2">NFE2000-S, NFE3000-S, NFE4000-S</td><td colspan="2">50</td><td colspan="2">10</td><td>7~15</td></tr>
</table>

Cautionary instructions for use

Note 1. Use the appricable power supply capacity so that voltage drop by SHT operating current may not go down below the allowable operating voltage range.

2. Operating time means the time from application of rated voltage to the SHT to the point when the main contact of the circuit breaker opens.
3. 50 Hz and 60 Hz can be used commonly.
4. When used for DC, pay attention to polarity.
5. Design the control circuit so that the power supply of SHT is turned off after operation of SHT and before making the circuit breaker again.
6. All the SHTs at present are with coil seizure preventing switch, but some old SHTs are of short time rating (30 sec) without any switch for coil seizure prevention. To those of short time rating, refrain fro zapplying voltage in continuity.
7. Keep number of times of tripping lower than those shown below as SHT operation trips the circuit breaker.
8. Keep at the control voltage of SHT within the range of the rated voltage. Applying higher control circuit voltage can cause breakage of the seizure preventing switch or of the circuit breaker itself. Applying lower control circuit voltage can result failure of tripping, and breakage of the coil can cause when continuous low voltage is applied to the SHT coil.
9. Provide the operation circuit of SHT with short-circuit protecting devices such as fuses.
10. Refrain from closing the circuit breaker while applying voltage to the SHT as it can make switching life of the breaker shorter.

Rated current (A)	Number of operating cycle (IEC60947-2)			Number of operation by SHT, UVT, or trip button
	With current	Without current	Total	
In≤100	1500	8500	10000	10% of the total number of operations
100<In≤315	1000	7000	8000	
315<In≤630	1000	4000	5000	
630<In≤2500	500	2500	3000	
2500<In	500	1500	2000	

Remarks: Number of operation by the test button of earth leakage circuit breakers is 1,000 times.

(4) UVT (Under voltage trip)

(a) This device make it possilble to turn ON the circuit breaker after resetting manually when supply voltage is recovered at least to 85% after dropping to 70 to 35% or lower and tripping the breaker.

(b) Be sure to practice reset closing operation by applying the specified voltage to the coil of UVT.

(c) Refrain from reset closing operation of the circuit breaker without energizing the UVT as it accelerates wear of the tripping latch and an cause failure.

(d) Be sure to set a small size NFB or fuses in the UVT circuit.

① Coil rating of UVT

Model group	Type name of breaker	Voltage		Input (VA)	Operation time (Note 2)
		Standard voltage	Special voltage (Note1)		
1	NF32-SW, NF63-CW, NF63-SW, NF63-HW, NF160-SW, NF160-HW, NF250-CW, NF250-SW, NF250-HW MB30-SW, MB50-CW, MB50-SW, MB225-SW	AC100-110/120-130 selectable AC200-220/230-250 selectable AC380-415/440-480 selectable (Compatible to 50 and 60Hz.) DC100/110 selectable	–	5	30 or less
2	NF125-CW, NF125-SW, NF125-HW, MB100-SW				
3	NF125-SGW, NF125-HGW, NF125-RGW, NF125-UGW, NF160-SGW, NF160-HGW, NF250-SGW, NF250-HGW, NF250-RGW, NF250-UGW				
4	NF400-CP, NF400-SP, NF400-SEP, NF400-HEP, NF400-REP, NF400-UEP, NV400-CP, NV400-SP, NV400-SEP, NV400-HEP, NV400-REP, NF630-CP, NF630-SP, NF630-SEP, NF630-HEP, NF630-REP, NF630-UEP, NV630-CP, NV630-SP, NV630-SEP, NV630-HEP, NF800-CEP, NF800-SDP, NF800-SEP, NF800-HEP, NF800-REP, NF800-UEP, NV800-SEP, NV800-HEP	AC100-110 AC200-220 AC400-440 DC100	AC110-120 DC24 AC220-240 DC48 AC380-415 DC110 AC440-480 AC500-550	5	5~30
5	NF1000-SS, NF1000-SSD, NF1250-SS, NF1250-SSD NF1600-SS, NF1600-SSD	AC100-110 AC200-240 AC380-450 DC100-110	AC24 DC24 AC48 DC48 AC440-480 DC120-125 AC500-550	5	5~35
6	NF1250-UR				
7	NF2000-S, NF2500-S, NF3200-S, NF4000-S	60Hz AC110 AC220 AC440 50Hz AC100 AC200 AC400	AC120 DC100 AC240 AC380	20	5~30
8	NFE2000-S, NFE3000-S, NFE4000-S	AC100-120 AC200-240 AC380-450	–	5	5~30

Note 1. Manufacturing range of special voltage type differ by each model. Please enquire.

Note 2. The operating time is from non-voltage of the UVT to the start of main contact opening.

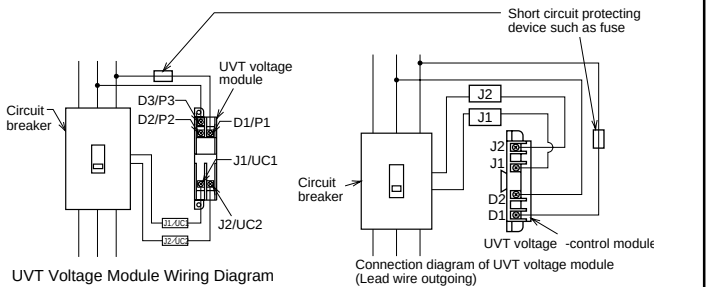
Note 3. Commonly used for both 50 Hz, and 60 Hz.

② Composition of UVT

(a) NF32-SW to NF1600-SS

A UVT mechanical unit is incorporated in the circuit breaker, and a UVT voltage-control module is attached outside. Lowered voltage is detected by the UVT voltage-control module, and the UVT mechanical unit functions to trip. Some are so composed to trip even when the handle of the circuit breaker is at OFF state but the coil of the UVT mechanical unit isn't energized, while others are composed for no tripping under this state. Refer to the following table.

Separate type is the standard for UVT voltage -control module, but a lead wire terminal block can be attached to the circuit breaker proper.



UVT Voltage Module Wiring Diagram (Lead-Wire Connection)

Connection diagram of UVT voltage module (Lead wire outgoing)

Connection diagram of UVT voltage -control module (Lead wire outgoing)

Model group	Tripped when the coil isn't energized and can't be reset.	Resetting is possible even if the coil isn't energized. ON operation without energizing closes the circuit breaker instantly and trips
1	○	—
2	○	○
3	—	○
4	—	○
5	○	—
6	○	—
7	○	—
8	—	○ (Excluding electrical operation)

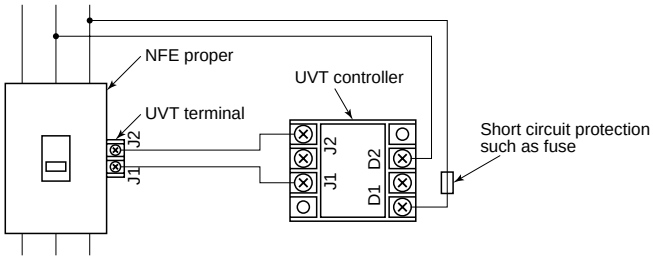
⚠CAUTION

Keep the control voltage within the range of the rated voltage of UVT. Applying higher control circuit voltage can cause burning of the UVT coil and fire. Applying lower control circuit voltage can result in malfunction and noise generation in the case of AC.

(b) NFE type

UVT of NFB type is so composed to detect lowered voltage by the UVT controller attached outside and to trip by the UVT mechanical unit incorporated in the circuit breaker. Time lag of about 50 msec is given to the operating time.

The UVT mechanical unit doesn't trip even if the coil of the unit isn't energized so long as the handle of the circuit breaker if OFF or reset. (Except for motor type electrical operation, however.)



Connection diagram of UVT controller (with LT)

Rating of UVT controller

Rated voltage (V)	Input VA	Suction voltage	Drop voltage
AC100-120	5	85% of rated voltage max.	35 to 70% of rated voltage
AC200-240			
AC380-450			

③ UVT for synchronous closing

When the coil isn't energized, UVT pf standard type trips and can't be reset. UVT of this type, however, is so composed not to trip even if the coil isn't energized so long as the handle of the circuit breaker is at OFF or RESET position.

Accordingly, reset state is kept even without energizing when reset by electrical operation.

Applicable model
NF1000-SS, NF1000-SSD, NF1250-SS, NF1250-SSD, NF1600-SS, NF1600-SSD
NF1250-UR

Note 1. Instructions at ordering

Besides indication of standard UVT, indicate "for synchronized closing."

2. Time delay type can also be manufactured.

3. The standard type of model group 1·2·3·4·8 in table① on page 44 are for synchronized closing.

④ Time delay type UVT

(Except for NF2000-S to NF4000-S and NFE)

• Operating time of this type has a time lag.

• Operation at instantaneous break down can be avoided.

Type name of UVT module	Time delay	Voltage (V)	
		Standard	Special
UVT-MC	100ms	AC100-120 200-240 380-450 (Commonly used for 50/60Hz) DC100-110	AC24 48 440-480 500-550 (Commonly used for 50/60Hz) DC24 48
U-05S	500ms	AC100-120 200-240 400-450 (Commonly used for 50/60Hz)	———
U-10S	1s		
U-05W	0.1·0.3·0.5s (selectable)	AC24/48 AC100-120/200-240/380-450 AC200-250/380-450/460-550 (Commonly used for 50/60Hz) DC100-110	AC380-450/460-550/600-690 (Commonly used for 50/60Hz) DC24/48
U-30W	0.5·1·3s (selectable)	AC100-120/200-240/380-450 AC200-250/380-450/460-550 (Commonly used for 50/60Hz)	———

(5) Cassette accessories

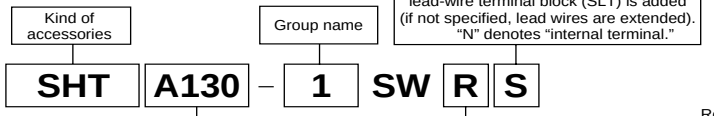
①30~250 A frames

The cassette accessories, AL, AX, AL+AX, and SHT can be installed to the following models by each user.

☐Type name of accessories (indicated by the attached name plate)

Applicable models	Group name	Kind of accessories				
		AL	AX	AL+AX	SHT (Note 1)	UVT (UVTN or UVTS) (Note 2)
NF32-SW, NF63-CW/SW/HW NV32-SW, NV63-CW/SW/HW MB30-SW, MB50-SW	05	AL-05SWL(S) AL-05SWR(S)	AX-05SWL(S) AX-05SWR(S)	ALAX-05SWL(S) ALAX-05SWR(S)	SHTA240-05SWR(S) SHTA550-05SWR(S) SHTD125-05SWR(S)	UVTNA130-05SWR(S) UVTNA480-05SWR(S) UVTNA130-05SWL(S) UVTNA480-05SWL(S) UVTNA250-05SWR(S) UVTND110-05SWR(S) UVTNA250-05SWL(S) UVTND110-05SWL(S)
NF125-CW/SW/HW NV125-CW/SW/HW-RW MB100-SW	1	AL-1SW AL-1SWLS AL-1SWRS	AX-1SW AX-1SWLS AX-1SWRS	ALAX-1SW ALAX-1SWLS ALAX-1SWRS	SHTA240-1SWR(S) SHTA550-1SWR(S) SHTD125-1SWR(S)	UVTNA130-1SW UVTND110-1SWRS UVTNA130-1SWRS UVTND110-1SWLS UVTNA130-1SWLS UVTSA130-1SW UVTNA250-1SW UVTSA130-1SWRS UVTNA250-1SWRS UVTSA250-1SW UVTNA250-1SWLS UVTSA250-1SWRS UVTNA480-1SW UVTSA480-1SW UVTNA480-1SWRS UVTSA480-1SWRS UVTNA480-1SWLS UVTSD110-1SW UVTND110-1SW UVTSD110-1SWRS
NF250-CW/SW/HW NF160-SW/HW NV250-CW/SW/HW/RW/SEW/HEW	2	AL-2SWL(S) AL-2SWR(S)	AX-2SWL(S) AX-2SWR(S)	ALAX-2SWL(S) ALAX-2SWR(S)	SHTA240-2SWR(S) SHTA550-2SWR(S) SHTD125-2SWR(S)	UVTNA130-2SWR(S) UVTNA480-2SWR(S) UVTNA130-2SWL(S) UVTNA480-2SWL(S) UVTNA250-2SWR(S) UVTND110-2SWR(S) UVTNA250-2SWL(S) UVTND110-2SWL(S)
NF250-SGW/HGW/RGW/UGW NF160-SGW/HGW NF125-SGW/HGW/RGW/UGW	2G	AL-2GSWL(S) AL-2GSWR(S) AL-2GSWN	AX-2GSWL(S) AX-2GSWR(S) AX-2GSWN	ALAX-2GSWL(S) ALAX-2GSWR(S) ALAX-2GSWN	SHTA240-2GSWR(S) SHTA550-2GSWR(S) SHTD125-2GSWR(S) SHTA240-2GSWRN SHTA550-2GSWRN SHTD125-2GSWRN	UVTSA130-2GSWR(S) UVTSA130-2GSWRN UVTSA250-2GSWR(S) UVTSA250-2GSWRN UVTSA480-2GSWR(S) UVTSA480-2GSWRN UVTSD110-2GSWR(S) UVTSD110-2GSWRN

Model designation code



Voltage	
SHT	UVT
A048 : 24-48VAC A240 : 100-240VAC A550 : 380-550VAC D012 : 12VDC D036 : 24-36VDC D048 : 36-48VDC D125 : 100-125VDC D250 : 220-250VDC	A048 : 24-48VAC selectable A130 : 100-110/120-130VAC selectable A250 : 200-220/230-250VAC selectable A480 : 380-415/440-480VAC selectable A600 : 500-550/600VAC selectable D110 : 100/110VDC selectable

Installation position
R: right-pole installation (Note1) L: left-pole installation Blank: either pole installation

Notes: (1) NV models are excluded.

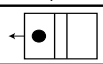
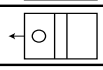
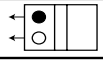
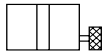
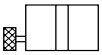
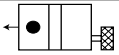
(2)

UVTN	Non-Synchronous closing
UVTS	Synchronous closing

With the UVTS model, the breaker can be reset even if the voltage is not applied.
NV250-SEW/HEW models cannot be produced.

Remarks: (1) Refer to Combinations of Accessories for details of combinations and poles.
(2) A cassette type of AL cannot be installed on circuit breakers with MG switch.

☐Mount position

Series	NF-C・S・H・U, MB		NV-C・S・H・U
Type name / Number of poles / Accessories	NF32-SW NF63-CW/SW/HW NF125-CW/SW	NF32-SW(3P) NF63-CW/SW/HW(3P) NF125-CW(3P), NF125-SW(3P, 4P) NF125-HW, NF125-SGW/HGW NF125-RGW/UGW NF160-SW/SGW/HW/HGW NF250-CW/SW/HW NF250-SGW/HGW NF250-RGW/UGW MB30-SW, MB50-CW/SW MB100-SW, MB225-SW	NV32-SW NV63-CW/SW/HW NV125-CW/SW/HW NV250-CW/SW/HW NV250-SEW/HEW NV125-RW, NV250-RW
	2-pole	2-pole, 3-pole, 4-pole	2-pole, 3-pole, 4-pole
AL			
AX			
AL+AX		 (Note 1)	 (Note 1)
SHT or UVT	 (Note 2)	 (Note 2) (Note 3)	 (Note 2) (Note 4) (Note 5)
AL+SHT or UVT		 (Note 2)	
AX+SHT or UVT		 (Note 2)	
AL+AX+SHT or UVT		 (Note 1) (Note 2)	

Notes: (1) Second AX can substitute the AL on the left-pole.
(2) Models with UVT require a UVT voltage module to be installed on the lead-wire terminal unit. (No such voltage module is required for SHT.) Part of UVT accessories is not of cassette type. (Details will be available upon request.)
(3) UVTs for left-pole installation can be produced, if specified, for frame current values of 32, 63 and 125A (excluding SGW/HGW/RGW/UGW).
(4) SHT cannot be installed.
(5) Models NV250-SEW/HEW are not allowed to install the UVT device.

Remarks: (1) Circled numbers indicate the order of installation.
(2) Accessories of EAL, and TBM can be installed independent of installations of AL, AX, and MG. (Two units among EAL, and TBM cannot be installed at the same time.)

②400~800A frames

● The cassette accessories, AL, AX, AL+AX, and SHT can be installed to the following models by each user.

□Type name of accessories (Indicated by the attached label)

Applicable model	Number of pole	Mounting pole	AL	AX	AL+AX	SHT
NF400-CP/SP/SEP/HEP/REP/UEP NF630-CP/SP/SEP/HEP/REP/UEP NF800-CEP/SDP/SEP/HEP/REP/UEP	2, 3	for right pole	—	AX-4SP AX-4SPRS AX2-4SPRS	—	SHT-4SP SHT-4SPRS
	2, 3, 4	for left pole	AL-4SPL AL-4SPLS AL2-4SPLS	AX-4SP AX-4SPLS AX2-4SPLS	ALAX-4SPL ALAX-4SPLS	SHT-4SP SHT-4SPLS
NV400-CP/SP/SEP/HEP/REP NV630-CP/SP/SEP/HEP NV800-SEP/HEP	3, 4	for left pole				

Note 1. AX or SHT with leads is common use for right and left poles, so can be mounted in either right and left poles.
2. For mounting plural AL, AX, or AL+AX with leads, install necessary number of the single type accessories.
3. For mounting three or more AL and AX with SLT, order separatelly.
4. For the type with SLT mounting to right pole of 4-pole circuit breaker, order separatelly.

Signification of Type name

AL **2** **–** **4SP** **L** **S**

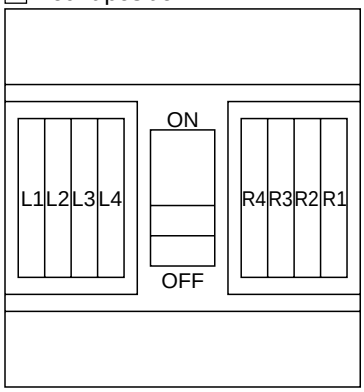
Type of accessory	
AL	Alarm switch
AX	Auxiliary switch
SHT	Shunt trip

Number of accessories
Specify for two or more AL (or AX) with SLT

Mount position	
R	Right pole
L	Left pole

with SLT
(with lead wire for no specification)

□Mount position



FrameA	400					600·800							
Mount position / Accessory	L1	L2	L3	R2	R1	L1	L2	L3	L4	R4	R3	R2	R1
AL	○	○	—	—	—	○	○	○	—	—	—	—	—
AX	○	○	—	○	○	○	○	○	○	—	—	○Note1.	○
AL+AX	○	○	—	—	—	○	○	—	—	—	—	—	—
SHT	—	○		○		—	—	○		Note 1.○		—	—

Note 1. AX in R2 and SHT in R3 · R4 can't be mounted together.
2. Accessories can't be mounted into R1, R2, R3, or R4 for earth leakage circuit breakers.

Cautionary instructions for using cassette accessories

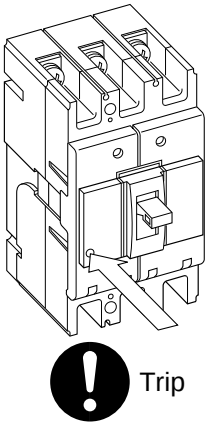
Note 1. For mounting and dismounting the cassette accessories, be sure to drop the control voltage of the circuit breaker and the accessories to zero, and trip the circuit breaker.
2. For the applicable accessories and mounting pole concerning each type of breaker, refer to the table in the catalogue.
3. Mount AL or AX in order of number attached to L or R.
4. The type with SLT for right pole can't be attached to 4-pole circuit breaker.
5. The cassette type of AL, AX, or SHT can't be attached to the earth leakage circuit breaker with MG.
6. The type with SLT can't be attached to the flush-mounting type circuit breaker.
7. For AL or AX with lead wire, the length of the lead wire outside of the breaker depend on the attached position.
8. The accessory with SLT and the one with lead wire or the one with SLT can't be mounted together into the same pole.
9. The cassette accessory can't be attached into the pole mounted UVT (under voltage trip).

How to attach cassette accessories

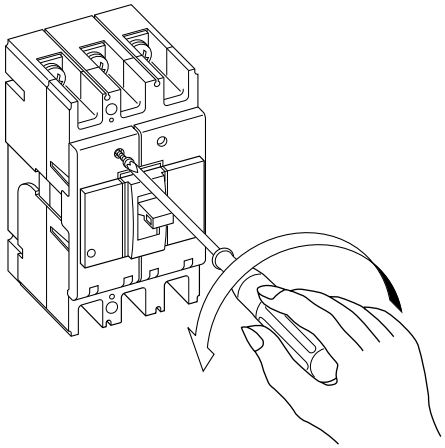
⚠CAUTION

- For mounting and dismounting the cassette accessories, be sure to drop voltage of the circuit breaker and the accessories to zero as electrification can result.
  Burning can take place should the circuit breaker operation for breaking.
- Never attach while the handle is at ON, OFF position. The parts are broken and can cause failure.

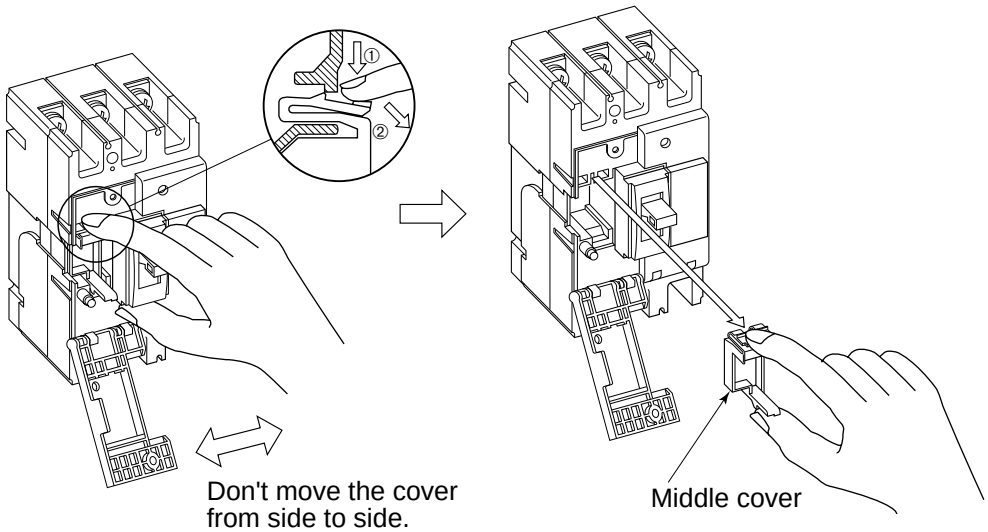
①Before opening the cover, press the trip button, and loosen the screw of the breaker cover.



②Then open the cover.



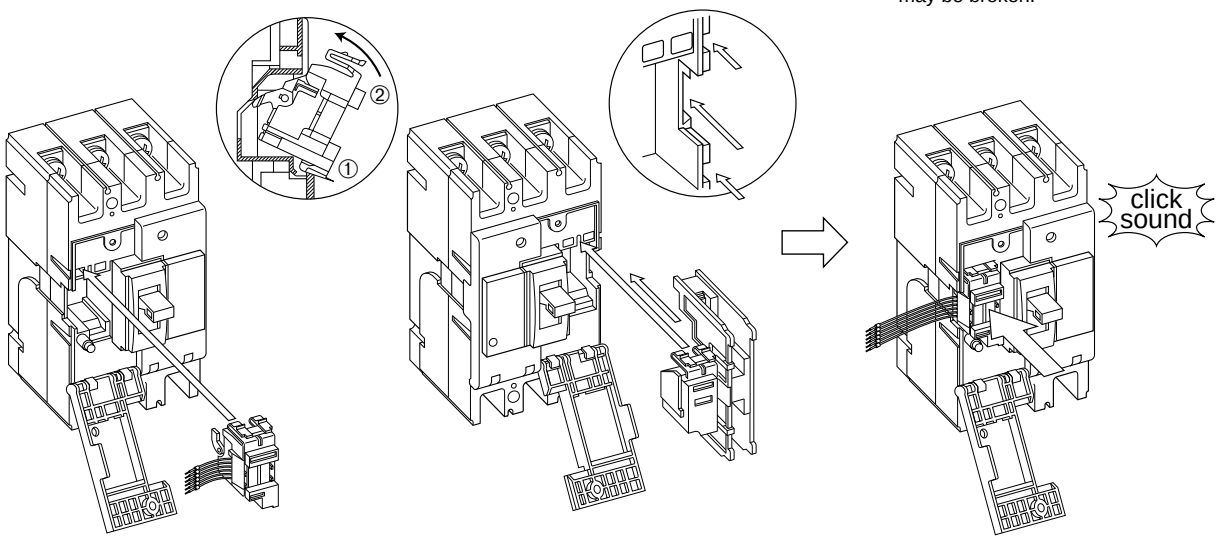
③If any middle cover or other accessories are attached, remove them before mounting the cassett accessory. (To the circuit breaker having a middle cover, be sure to attach the middle cover while no cassette accessories are mounted.)



[Models having the middle cover]
NF125-SW, NF125-HW, NF125-SGW, NF125-HGW
NV125-HW, NV100-HEP
NF160-SGW, NF160-HGW, NF250-SGW
NF250-HGW, NF125-RGW, NF125-UGW
NF250-RGW, NF250-UGW
NV125-SW, NV125-RW
NV250-HEW
NF630-HEP, NF630-REP, NF630-UEP
NF800-HEP, NF800-REP, NF800-UEP
NV630-HEP, NV800-HEP

④Push the accessory into the circuit breaker to the point where click sound is heard.

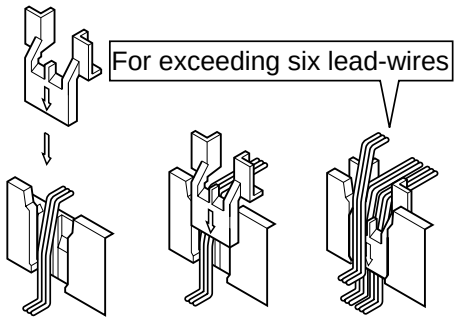
• Don't mount at ON, OFF position. The accessory may fail normal operation or may be broken.



• With lead wires

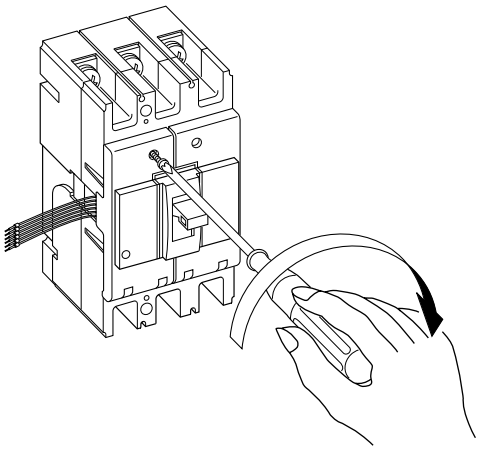
• With the lead wire terminal block SLT

For 600~800A frames with lead wires, fix the lead wires on the side of the breaker by the attachment.

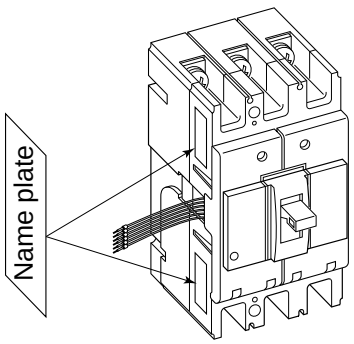


⑤Close the cover and tighten the screws.

Fastening torque



⑥Close the cover and tighten the screws.
Attach the name plate packed together onto a side of the circuit breaker. (except with SLT type)



⑦Attach assembling the accessory, be sure to check for smooth operation before use.

(6) EAL (Earth leakage alarm switch)

This switch is for electrically indicating tripped state of an earth leakage circuit breaker at a ground fault.

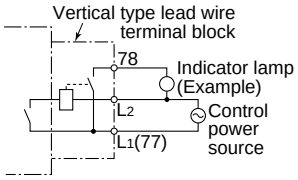
Operation of EAL switch

Condition of circuit breaker	Contact condition of EAL switch	
Tripped by overload or short-circuit fault ON·OFF	225A fram and below	78 (open), 77
	400A fram and above	98 (open), 96 (closed), 95
Tripped by ground fault	225A fram and below	78 (closed), 77
	400A fram and above	98 (closed), 96 (open), 95

Rating of EAL switch (250A frame and below)

AC		
Voltage V	Current A	
	Resistance load	Induction load
200	3	2
100	3	2

Specify voltage as the switch for 100V differs from that for 200V.
Control power is necessary at each voltage. For wire connection, see the drawing at right.



Rating of micro load EAL switch (400A frame and above)

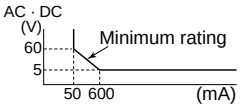
Microswitch used	AC			DC		
	Voltage V	Current A		Voltage V	Current A	
		Resistance load	Induction load		Resistance load	Induction load
SB	125	0.1	–	30	0.1	–
VB	125	0.1	–	30	0.1	–

For use in micro current area, please enquire us separately.
(Note) For model of breakers to be assembled each type of micro switch, refer to the catalogue.

Rating of EAL (400A frame and above)

Microswitch used	AC			DC		
	Voltage V	Current A		Voltage V	Current A	
		Resistance load	Induction load		Resistance load	Induction load
S	460	–	–	250	0.2	0.2
	250	3	2	125	0.4	0.4
	125	5	3	30	4	3
V	460	5	2	250	0.3	0.3
	250	10	10	125	0.6	0.6
	125	10	10	30	10	6

Note 1. Use the switch for micro load for lower area than Minimum rating shown bellow.



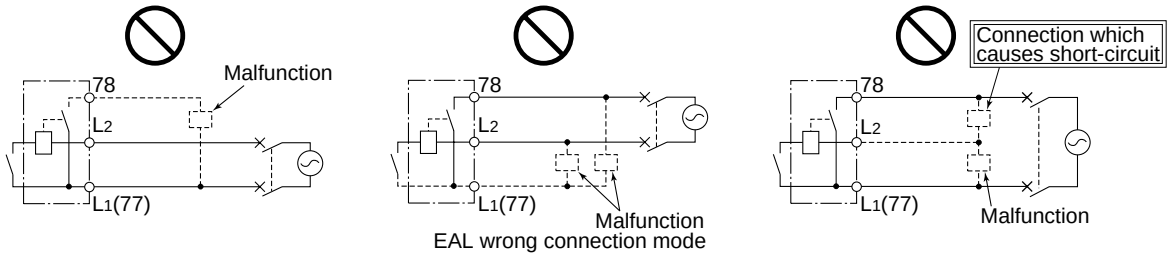
Rating of corrosion-proof EAL switch (400A frame and above)

	Micro switch of corrosion-proof type used	AC			DC		
		Voltage V	Current A		Voltage V	Current A	
			Resistance load	Induction load		Resistance load	Induction load
For corrosion-proof type	ST	460	–	–	250	0.2	0.2
		250	3	2	125	0.4	0.4
		125	5	3	30	4	3
	VT	460	1	0.5	250	0.3	0.3
		250	5	4	125	0.4	0.4
		125	5	4	30	5	3

If the breaker is treated by the 1st kind moisture-fungus treatment or by added corrosion-proof treatment, the micro switch of corrosion-proof type is to be used.

⚠CAUTION

① Connect the wires in the right way. Wrong connection can cause malfunction or short circuit.



② Avoid electrification, ground fault and contact with the main circuit as EAL output is internally connected with the control power.

Before starting operation, be sure to press the test button of the earth leakage circuit breaker to make sure of operation. The test button doesn't operate unless voltage is applied between the right and left pole of the breaker.

(7) TBM (Test button module)

① This module is used for testing earth leakage circuit breaker remotely while applying voltage. For time lag type, keep applying voltage for more than two seconds.

② The voltage application system is insulated from the main circuit and SHT of MCCB can be used commonly with the control sequence.

Type name	NV63-CW~NV600-CP, NV32-SW~NV600-SP, NV63-HW~NV250-HW, NV100-SEP~NV800-SEP, NV100-HEP~NV800-HEP, NV125-RW, NV250-RW, NV400-REP	
Control input rated voltage	AC100-240/DC100-240	(DC24V) (Note 1)
Applicable voltage range	AC/DC80-264V 50/60Hz	DC18-30V
Control input	1 VA max.	

Note 1. This module is manufactured for AC100-240/DC100-240V unless otherwise specified in particular. For DC24V, specify to that effect.

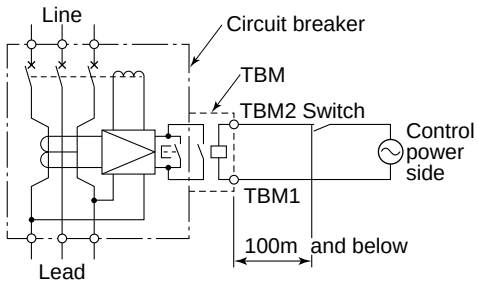
Cautionary instructions for use

Note 1. For operation, apply voltage also to the right and the left poles of the circuit breaker. Testing of the circuit breaker fails unless voltage is applied.

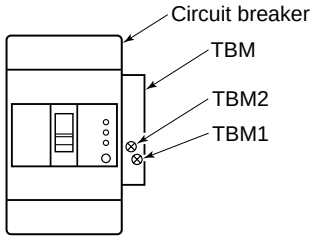
2. For sequence control of TBM, keep applying voltage until operation starts.

Earth leakage circuit breaker: (High-spped type ..... 0.1sec. or longer
Time lag type ..... 2 seconds min.

3. Resetting the circuit breaker while applying voltage to the TBM and closing again trips the breaker. Reduce voltage to zero, therefore, when the circuit breaker is closed again.
4. Number of times of testing is 1,000 times. Refrain from testing over 1,000 times.
5. The distance of wiring to the switch is 100m and below.



TBM connection diagram



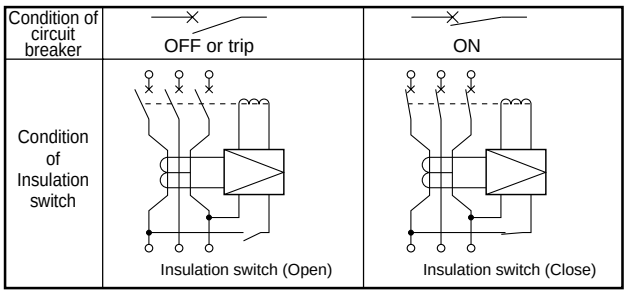
Port name

(8) MG (Insulation switch)

This switch is attached for insulation resistance measurement between rihght and left poles of the models to which control power is supplied through the right and the left poles, such as earth leakage circuit breaker.

Connecting a switch interlocked with the handle to one control circuit and turning off the circuit breaker opens the control circuit making it possible to carry out insulation resistance measurement. Even with the standard breakers, insulation resistance measurement is possible between a charged part and ground, the left pole and the middle pole, and between the middle pole and the right pole. Insulation resistance measurement between the left pole and the right pole only reduce the indication to zero but never breaks the ELCB.

Operation of insulation switch



(9) PAL (Pre-alarm module)

This module functions to give alarm output when load current exceeds a preset current level and serves for securing continuous power supply and also for preventive maintenance. The electronic breakers with mount digital ETR of 100 to 800A frames are provided with this module as an option. (Some models are with this module as the standard equipment.)
(1000 to 2000A frames are prepared for exclusive use.)

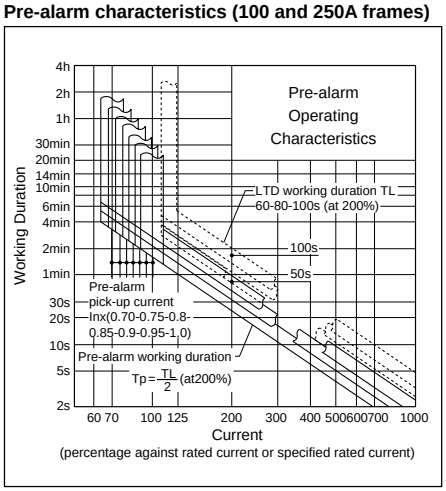
Type	Pre-alarm LED (Auto reset)	Solid state relay (SSR) output- Contactless output (Auto reset)	Switching capacity	Pre-alarm module-Contact output 8 (1a) (Self-holding)	Switching capacity	Reset system
NF125-SGW NF125-HGW NF160-SGW NF160-HGW NF250-SGW NF250-HGW	Standard equipment	option	DC24V-AC100-200V 20mA	Option	AC100V or AC200V 2A	Press the reset switch or turn off control power.
NV100-SEP NV100-HEP		—				
NV225-SEW NV225-HEW						
NF400-SEP NF400-HEP NF400-REP NF400-UEP NF600-SEP NF600-HEP NF600-REP NF600-UEP NF800-CEP NF800-SEP NF800-HEP NF800-REP NF800-UEP		option	DC24V-AC100-200V 20mA			
NV400-SEP NV400-HEP NV400-REP NV600-SEP NV600-HEP NV800-SEP NV800-HEP						

① Pre-alarm LED The LED starts blinking on the circuit breaker when load current exceeds the preset current, then changes to continuous glowing when pre-alarm output is given.

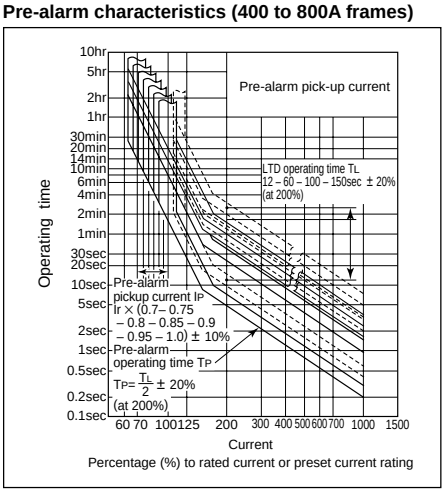
② Solid state relay output Open the upper cover of the circuit breaker, connect the connector of the lead wire packed together, and use it as the lead wire outlet. In this case, only the lead wire output of the internal accessories can be attached to the right pole. (For flush plate type, the outlet is manufactured in advance as PAL mount.)

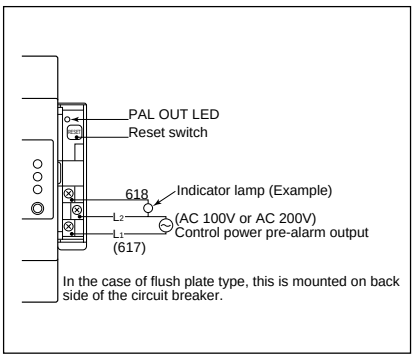
③ Pre-alarm module SLT is attached as a standard equipment and is used as the control power source of AC100V or AC200V. In this case, no other internal accessories can be attached to the right pole. (Auto resetting is also applicable.)

Pre-alarm characteristics (100 and 250A frames)



Pre-alarm characteristics (400 to 800A frames)





⚠CAUTION

Be careful to electrification, ground fault, and contact with the main circuit as PAL output is internally connected with the control power source.

3.6.10 External accessories

(1) Electric operation device

① Spring-charged type (1)

• Electric operation : When ON switch is turned off, a relay drives the motor to reset the latch mechanism, instantaneously turning the breaker ON with the accumulated force of the input spring. When OFF switch is turned off, the relay drives the motor to turn the breaker OFF (reset) and charge the input spring at the same time.

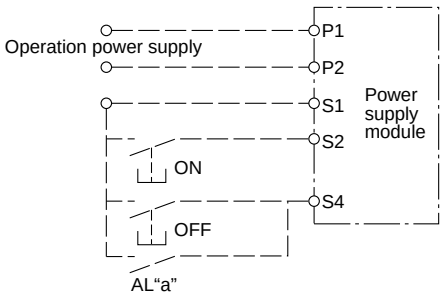
• Manual operation : Shift MANU/AUTO selector switch on the cover top to MANU then press ON button. The latch mechanism is reset and the accumulated force of the input spring instantaneously turns on the breaker ON.
Turning OFF (resetting)
Draw out the manual handle and reciprocate it a few dozen times to turn the breaker OFF (reset) and charge the input spring at the same time.

Caution on remote operation (electric operation)

(i) Press ON switch for 0.1 sec. or more, and OFF switch for 20 msec. or more. Otherwise the switches may not work.

(ii) The electric operation circuit is set up so OFF switch takes priority. Even if ON switch and OFF switch are pressed at the same time, therefore, the breaker is turned OFF without fail.

(iii) For the automatically reset type, use a breaker alarm switch (micro-loading) and connect terminals S1, S2 and S4 as shown in following Fig. Since the operation circuit has an ON signal one-shot output circuit in addition to the function to give priority to the OFF switch, an automatic resetting system with an UVT is set up and such a cycle as ON (invalid) → trip → OFF (reset) does not repeat even if the breaker has been tripped without UVT excitation when the ON signal is continually transmitted.



(iv) If a reset preventive UVT is installed and the UVT has been unexcited when the breaker is OFF, the breaker mechanism trips but the electric operation unit breaker OFF status is kept indicated. Even if the UVT is excited afterward, the breaker mechanism is kept tripped and turning the switch ON trips the mechanism. In such a case, the electric operation unit indicates tripped (ON is indicated for the 250AF except for NF250-HGW). After resetting, turn on the breaker OFF again.

(v) Any articles using same voltage incorporate switching power supply, so they may interfere with any communications equipment (AM radio, for instance) used in their vicinity. In such a case, provide a noise filter on the input side. An electrolytic capacitor is used as switching power supply. Draw your due attention to the use and custody at high temperature.

Caution on manual operation

[Turning ON]

(i) Shift MANU/AUTO selector switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.

(ii) Press ON button. The latch mechanism is disengaged and the accumulated force of the input spring turns the breaker ON. The ON button operating load is approx. 50 N.

[Turning OFF]

(i) Shift MANU/AUTO switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.

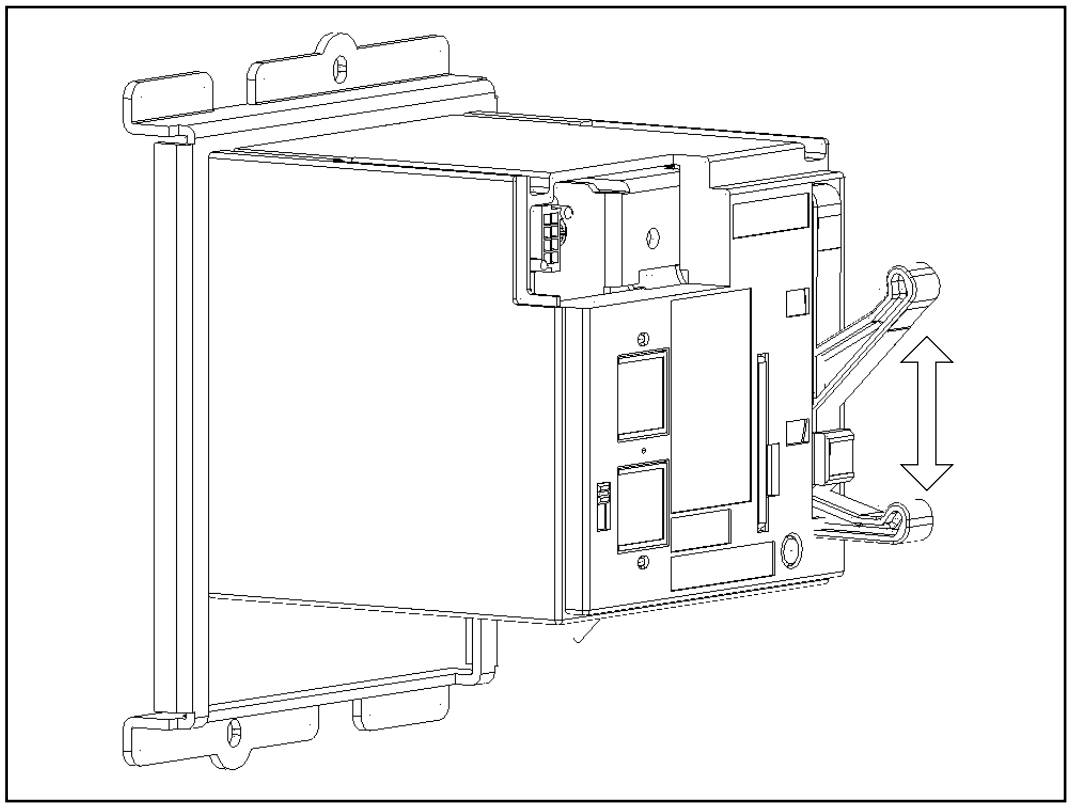
(ii) Draw out the manual handle and reciprocate it a few tens of times to turn the breaker OFF and charge the input spring.

<<For 63/125AF and NF250-HGW>>
Reciprocate the manual handle a few times. The breaker status will be indicated as "TRIP", and the spring status, "Discharge". In such a case, the input spring is not fully charged. So reciprocate the manual handle until "Charge" is indicated.

<<For 250AF>>
Reciprocate the manual handle until the breaker status is indicated as "OFF".
The breaker can be turned OFF without shifting the selector switch to MANU. However, the breaker is also controlled by remote operation, so operate the handle after shifting the selector switch to MANU.

(iii) After reciprocating the handle, be sure to return the MANU/AUTO selector switch to AUTO. When the switch has returned to AUTO, the electric operation circuit is automatically closed.

Note: When MANU is selected with the MANU/AUTO selector switch, the breaker cannot be electrically (remotely) operated. So be sure to return the selector switch to AUTO after ending manual operation.



Caution on OPEN (trip) button operation

(i) Shift MANU/AUTO selector switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.

(ii) Press OPEN (trip) button and the breaker trips. The OPEN (trip) button operating load is approx. 5 N.

(iii) After pressing OPEN button, be sure to return the MANU/AUTO selector switch to AUTO. When AUTO has been selected, the electric operation circuit is automatically closed.

Note 1: The breaker is structured so OPEN (trip) button cannot be pressed when the breaker is OFF.

Note 2: Be sure not to turn the breaker OFF with the OPEN (trip) button pressed. Otherwise the electric operation unit may be damaged.

Caution on test button operation

(i) To check the test button operation, check the breaker leakage indicator button through the inspection hole at the right side of the electric operation unit. Also check that the breaker operation status is indicated as "trip (yellow)" (for the 63/125AF).

Earth leakage breaker delay time and sensitivity selection

• Take the following procedure:

(i) Remove the operation circuit terminal wire and a power supply module setscrew to remove the power supply module from the electric operation base.

(ii) Remove 2 setscrews from the electric operation unit, and remove the electric operation base from the breaker.

(iii) Set the breaker sensitivity current selector switch and the earth leakage tripping time selector switch.

(iv) After setting them, install the electric operation base and the power supply module.

(v) Replace the sensitivity current nameplate and the earth leakage tripping time nameplate with those for the newly set ones.

(vi) Connect the operation circuit terminal again.

(vii) Check each operation again.

(a) How to install

The users who purchased a single electric operation unit for 63/125AF or NF250-HGW are requested to take the following procedure before installing the electric operation unit on the breaker:

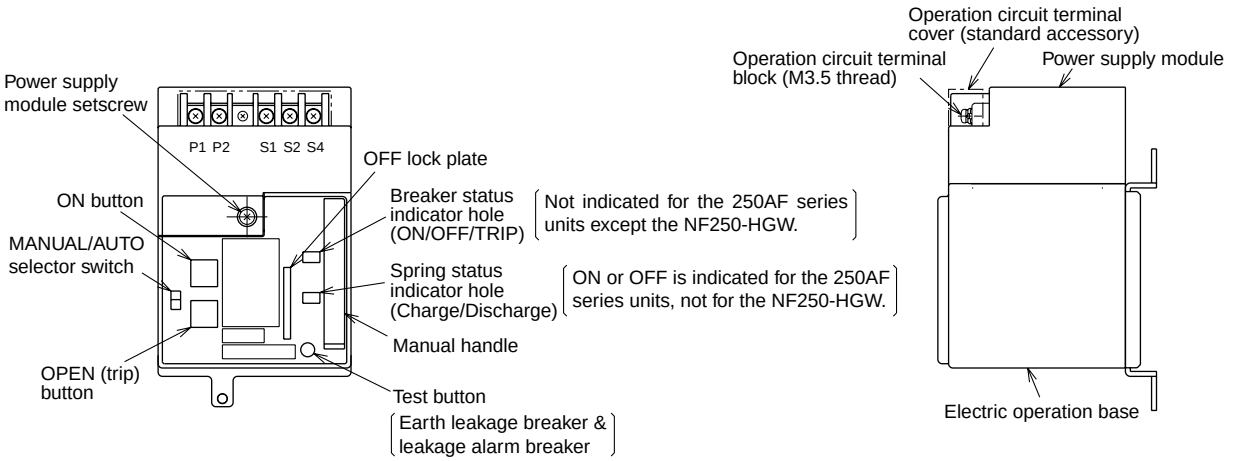
<<63/125AF (excl. NF125-HGW)>>

(1) For the no-fuse breaker, untighten the breaker cover screw and remove the part shown in Fig.1 with nippers then tighten the breaker cover screw again. For the other breakers, cut out the indicating plate in the position shown in Fig.1 with a cutter.
(2) Insert the attached indicating plate into the indicating plate hole on the breaker as shown in Fig.2.

<<NF125-HGW and NF250-HGW>>

(1) Untighten the breaker cover screw to remove the cover (Fig. 3).
(2) Remove the part shown in Fig. 4 with a cutter.
(3) Insert the attached indicating plate into the cover as shown in Fig. 5.
(4) Peel off the pressure sensitive adhesive double coated tape separator paper and bond the attached block to the cover reverse side as shown in Fig. 5.
(5) Install the breaker cover and tighten the breaker cover screw again.

Note: If the indicating plate is not inserted, the electric operation unit breaker status is kept indicated as ON.



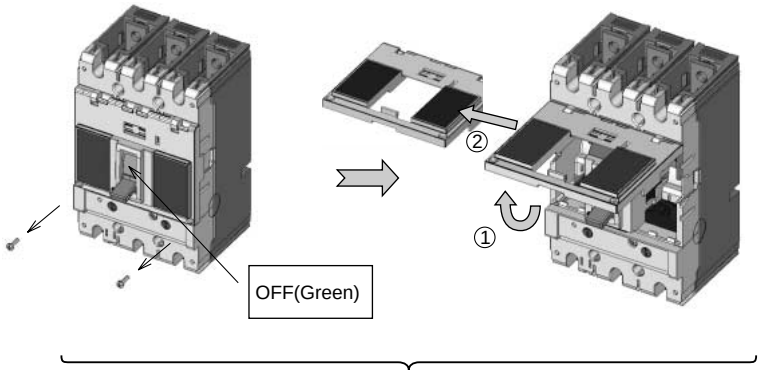


Fig. 3

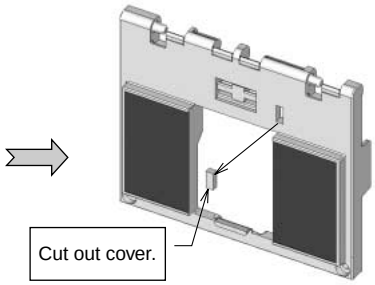


Fig. 4

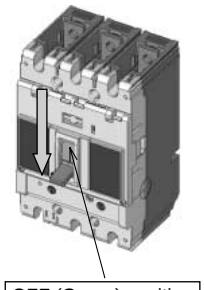


Fig. 6

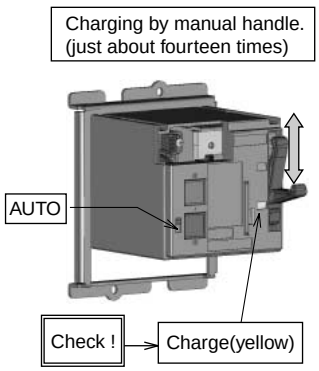


Fig. 7

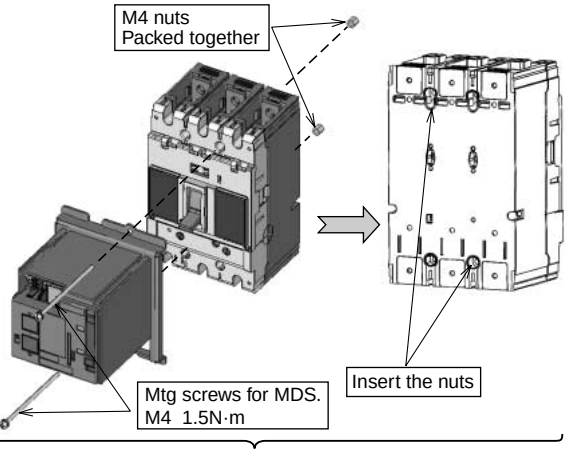


Fig. 8

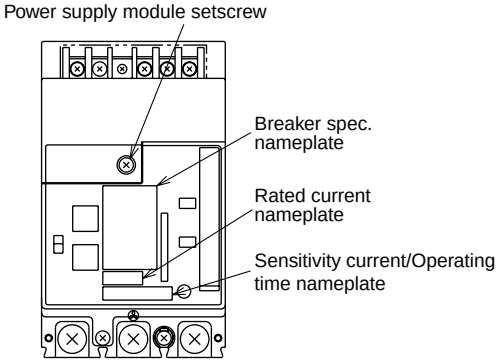


Fig. 11

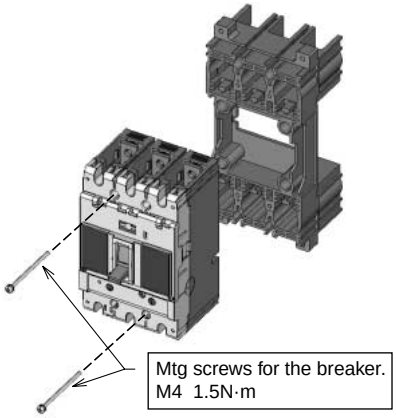


Fig. 12

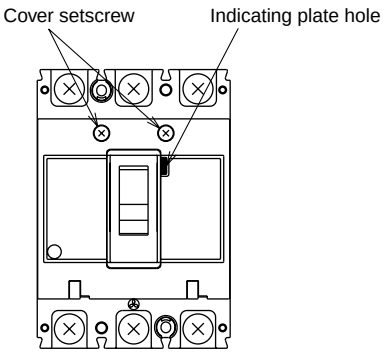


Fig. 1

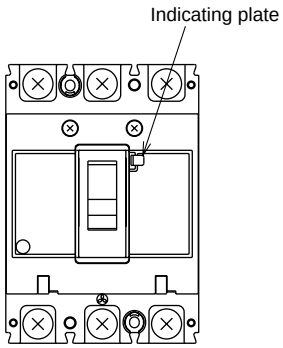


Fig. 2

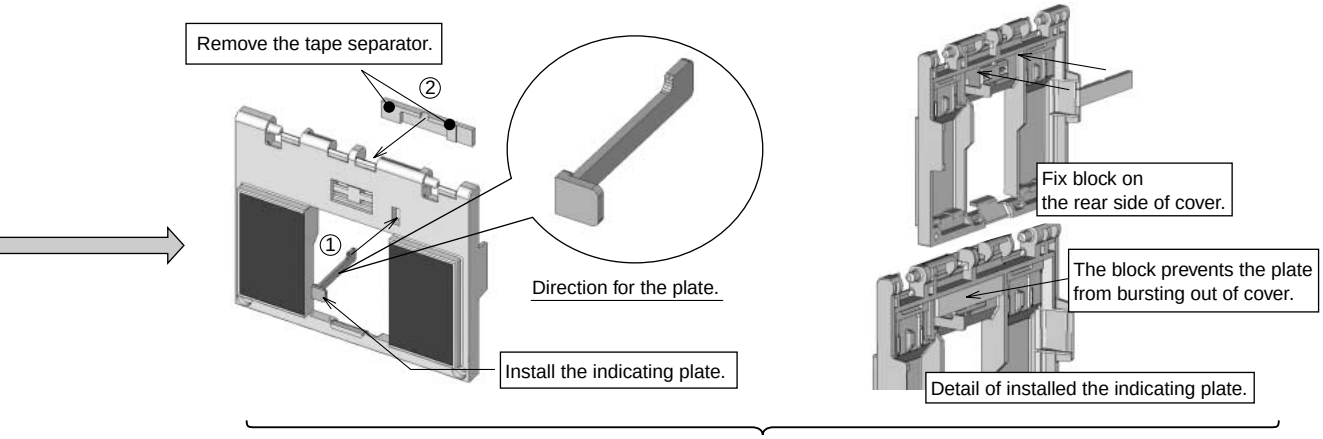


Fig. 5

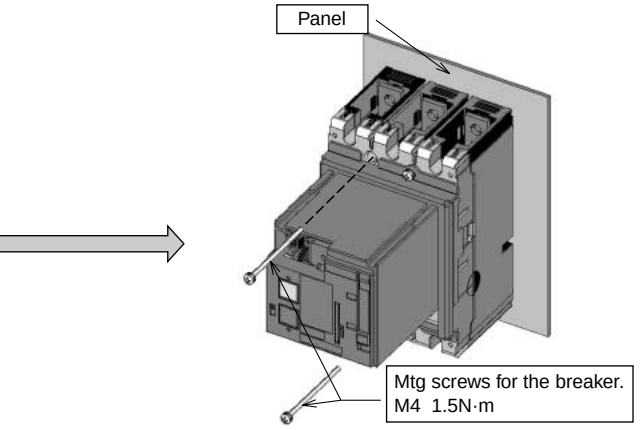


Fig. 9

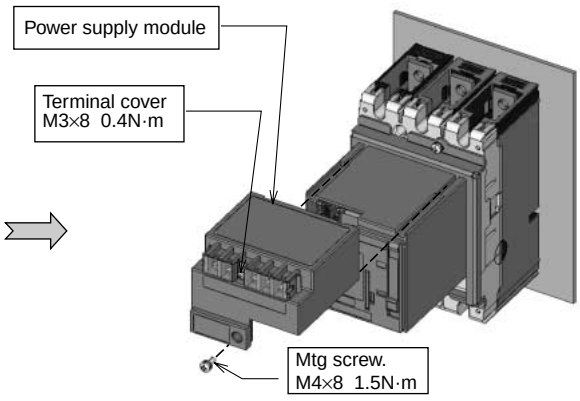


Fig. 10

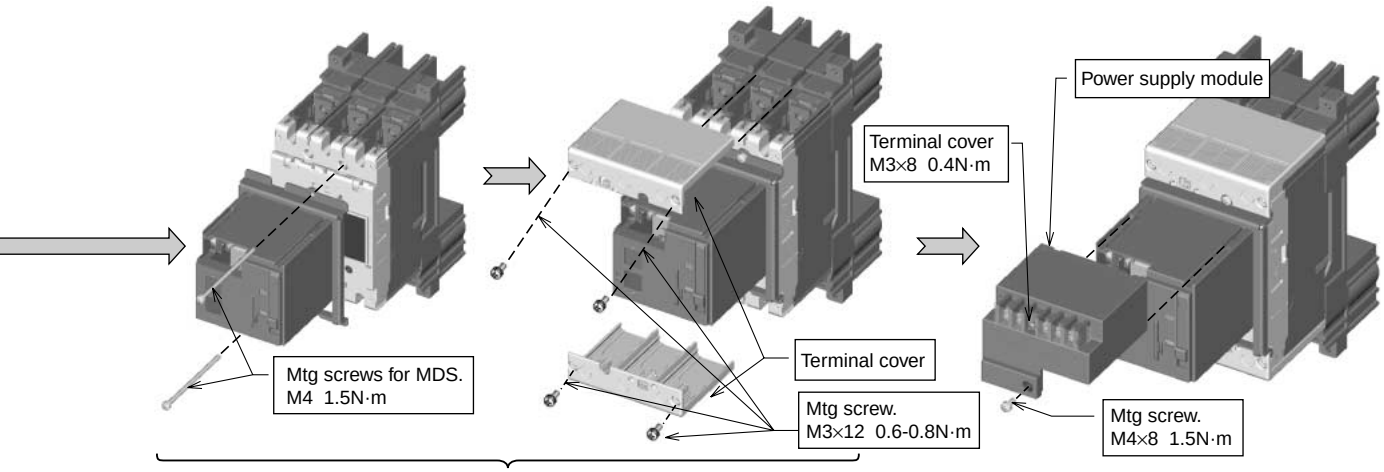


Fig. 13

Fig. 14

(i) For the Front and Rear connection type

(1) Untighten the power supply module setscrew to remove the power supply module from the electric operation unit.
(2) Turn the breaker OFF (Fig. 6).
(3) Set the electric operation unit to "Charge" (Fig. 7)
(or "OFF" for 250AF except NF250-HGW).
(4) Install the electric operation base on the breaker with attached 2 pcs. each of electric operation unit setscrews and nuts (Fig. 8)
(The users who purchased the breaker equipped with an electric operation unit need not take steps (2) - (4) above).
(5) Install the breaker equipped with an electric operation base on the panel with 2 breaker setscrews (Fig. 9).
(6) Inserting to fix the power supply module into the electric operation base groove with a power supply module setscrew (Fig. 10).

Note: Before installing the power supply module, complete wiring the breaker and installing the terminal cover. After installing the power supply module, the breaker cannot be wired and the terminal cover cannot be installed.

(7) Paste the attached nameplates on the electric operation unit cover as shown in Fig. 11.

(ii) Plug-in type

(1) Untighten the power supply module setscrew to remove the power supply module from the electric operation unit.
(2) Turn the breaker "OFF."
(3) Set the electric operation unit to "Charge" (or "OFF" for 250AF except NF250-HGW).
(4) Install the breaker on the plug-in terminal block with 2 breaker setscrews (Fig. 12).
(5) Tighten the electric operation base and the breaker to the plug-in terminal block with attached 2 electric operation unit setscrews (Fig. 13).
(6) Insert to fix the power supply module into the electric operation base groove with a power supply module setscrew (Fig. 14).

Note: Before installing the power supply module, complete wiring the breaker and installing the terminal cover. After installing the power supply module, the breaker cannot be wired and the terminal cover cannot be installed.

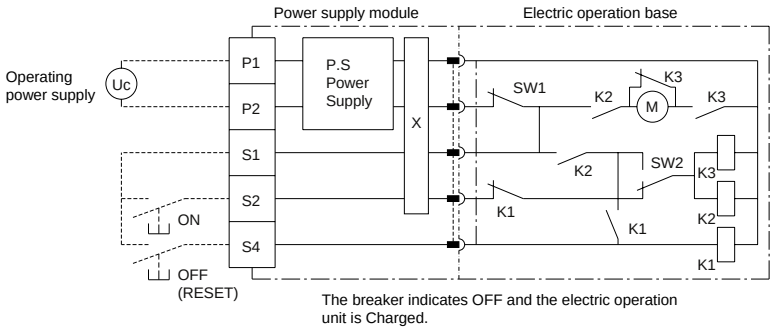
(7) Paste the attached nameplates on the electric operation unit cover as shown in Fig. 11.

(b) Operation circuit connection

(i) Connect the operation power supply to the operation power supply terminals (P1 and P2). There is no polarity.

(ii) Connect ON switch and OFF switch to the operation switch terminals (S1, S2 and S4). For the operation switches, use the micro-loading switches (with approx. DC 24 V, 30 mA of switching capacities) prepared at your side.

Note: For the voltage sharing items, the rush current (capacitor charging current 60A 1msec) mentioned later flows to the breaker and the fuse in the power supply circuit. So select the items with care to prevent fusion and operation errors.



P.S	Switching power supply (AC 100-240 V/DC 100-250 V types only)
SW1	MANU/AUTO selector switch
SW2	Charge/Discharge detecting switch
Ⓜ	Motor
K1	Relay (for OFF switch)
K2	Relay (for the motor)
K3	Relay (for the motor)
X	Pumping preventive circuit

(c) Caution on withstand voltage tests

The withstand voltage between the operation circuit terminals (P1, P2, S1, S2 and S4) and the ground is AC 1500 V.

② Motor-operated type (1)

• Electrical Operation : Rotary motion shall be converted into reciprocating rectilinear motion through DC motor → Speed reducer → Cam mechanism. Operation is by turning ON and OFF (reset) the circuit-breaker.

• Manual Operation : After selecting MANUAL for the changeover knob, insert the hexagonbar spanner provided as accessory. Turn ON/OFF (reset) according to the arrow mark. After operation, never fail to return the knob to AUTO side. (Note that the external signal prohibits ON/OFF while the knob is thrown to MANUAL side.)

(a) Precaution to be taken for handling

⚠CAUTION

Every time the electric operation unit is dismantled or remounted, turn off the master circuit-breaker, switch off the operational circuit to make sure that the main and operational circuits are not alive (charged). Beware of electric shock.

Precaution to be taken for remote (electric) operation

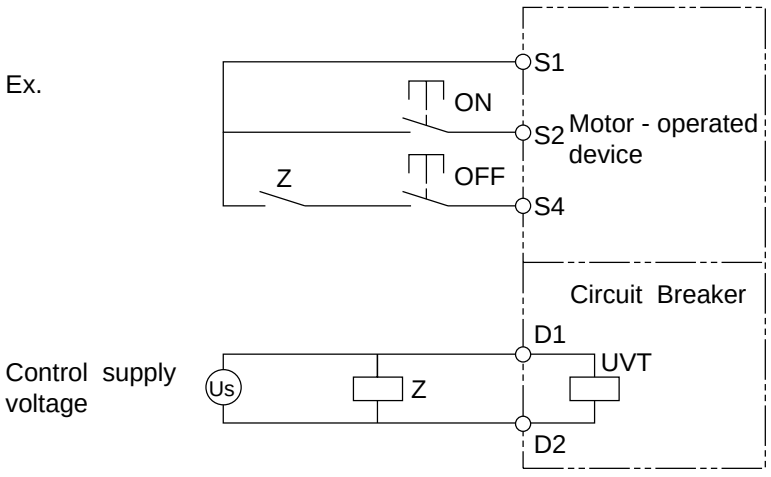
(i) Manipulate the operational switch for at least 20 msec. There may be some cases where operation does not run if this time interval is less than 20msec.

(ii) Because the electric operation circuit has been designed with priority given to OFF state, the circuit-breaker will stop under OFF condition without fail even if ON and OFF operational switches are erroneously depressed simultaneously.
Even when ON operational switch is inadvertently manipulated with OFF signal applied continuously, the ON signal will be canceled to maintain the OFF state.

(iii) If the circuit-breaker trips from OFF state due to non-excitation of UVT or to the manipulation of trip button, electric operation mechanism turns on idly for automatic shift to reset operation standby (OFF operation signal receivable). Therefore the operational sound of electric operational portion heard after OFF → Trip is not abnormal. In the case of the motor-operated type (1), the corrective action as above enables to reset by OFF operation signal irrespectively of the circuit-breaker trip from ON or from OFF.

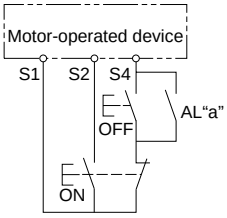
(iv) In case when UVT is provided, the user is requested to constitute an interlocking circuitry so that OFF operational signal should not be applied continuously while the UVT is under no voltage. (Applicable for NF50-HC and MB50-HC only).

Refer to the exemplary interlocking circuit below:



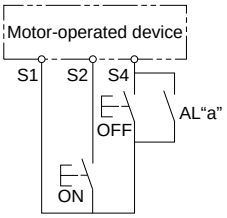
(v) For automatic resetting system, use the alarm switch (for microload) of the circuit-breaker and wire the operation switch circuitry (between terminals S1, S2, and S4) as shown in Fig. 1.

Fig. 1



Notice that in a circuitry without interlocking as shown in Fig.2, application is made immediately after resetting if the circuit-breaker trips when ON signal is applied continuously. Take care not to allow the continuous application of ON signal.

Fig. 2



(vi) When the automatic resetting is configured with UVT, the action OFF (reset) → Trip OFF (reset) → Trip will be repeated if UVT is under no voltage with the wiring as shown in Fig. 1.
In the event that the voltage of UVT and that of electrical operation fall gradually, the operation may continue to run even if the electrical circuit-breaker trips by UVT, repeating the action OFF → Trip to come finally to a standstill at an unstable position. In such a case, the operation may be disabled even when the power supply restores.
These are the reasons why the circuitry should be built up so that the power supply is cut off of the electric operation before the circuit-breaker trips by UVT.
Fig. 3 and 4 are exemplary cicrcuits, where the voltage relay cuts off the power supply of electric operation when the voltage of UVT drops. Any circuitry will go if the conditions as above are satisfied. (Applicable for NF50-HC and MB50-HC only)

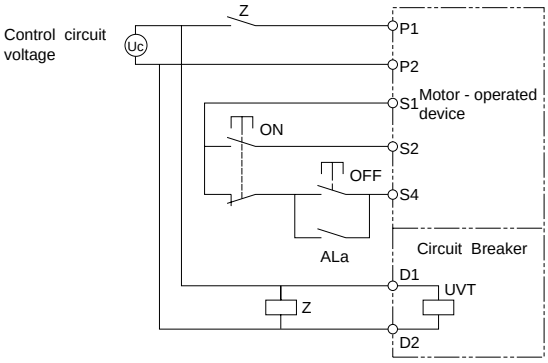


Fig. 3 (Case with same power supply)

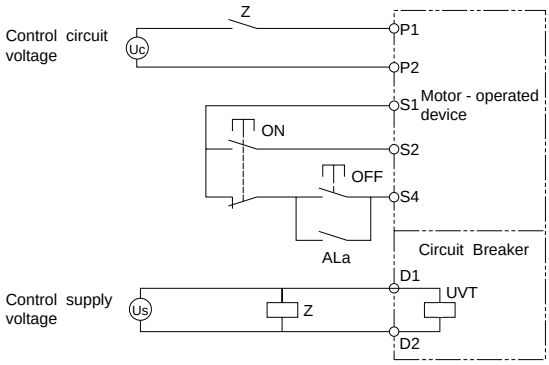


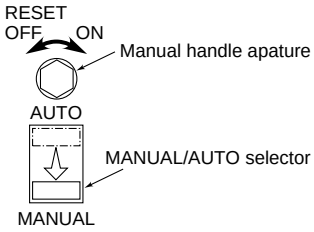
Fig. 4 (Case with different power supplies)

(vii) Any articles using same voltage incorporate switching power supply, so they may interfere with any communications equipment (AM radio, for instance) used in their vicinity. In such a case, provide a noise filter on the input side. An electrolytic capacitor is used as switching power supply. Draw your due attention to the use and custody at high temperature.

Precaution to be taken at manual operation

(i) Throw the MANUAL/AUTO knob to MANUAL side.
◦ Note that the electric operation circuit closes automatically as soon as this knob is thrown to MANUAL side.

(ii) Pull out the manual handle and insert it into the hexagonal hole for mounting the handle.



(iii) Turn ON (clockwise) or OFF (reset, counterclockwise) according to the arrow mark above the manual handle mount hole.

(iv) Never fail to house the manual handle in its original position after completion of the manual operation.

(v) Throw the MANUAL/AUTO changeover knob to AUTO side.
◦ Note that the electric operation circuit will close automatically as soon as the knob is thrown to AUTO side.

Note 1. The electric operation may make an idling action when the knob is abnormal because it is a corrective action to remedy the position of the electric operation cam in match with the position of the circuit-breaker the electric operation cam ON and the position of circuit-breaker handle OFF).

Note 2. No electric operation is possible if the manual/auto changeover knob is on MANUAL side. Never fail to change the knob over to AUTO after completion of the manual operation.

Precaution to be taken when manipulating the trip button

(i) Operation of the trip button trips the circuit-breaker. As has been described under (iii) of Remote Operation, reset operation standby state comes automatically for positional correction if the circuit-breaker positioned at OFF is made to trip. This will make an operational sound.

Precaution to be taken when manipulating test button

(i) The leak indicating button of the circuit-breaker cannot be seen when manipulating the test button. Therefore check the operating sound of the circuit-breaker and confirm that the action display trips (gray or yellow).

Delay time and sensitivity changeover in case of earth leakage breaker

◦ Operation shall be made in conformity to the following procedures:

(i) Disconnect the wire of operation terminal and remove the two screws attaching the electrical operation unit to dismount it from the circuit-breaker.
(ii) Manipulate the changeover switch to change over the sensitivity current and leak trip action time of the circuit-breaker.
(iii) Remount the electrical operation unit after completion of the changeover.
(iv) Rewrite the name plates for settings as changed of the sensitivity current and leak trip action time. Label the new settings on the circuit-breaker.
(v) Rewire the operational terminal.
(vi) Check the respective operations again.

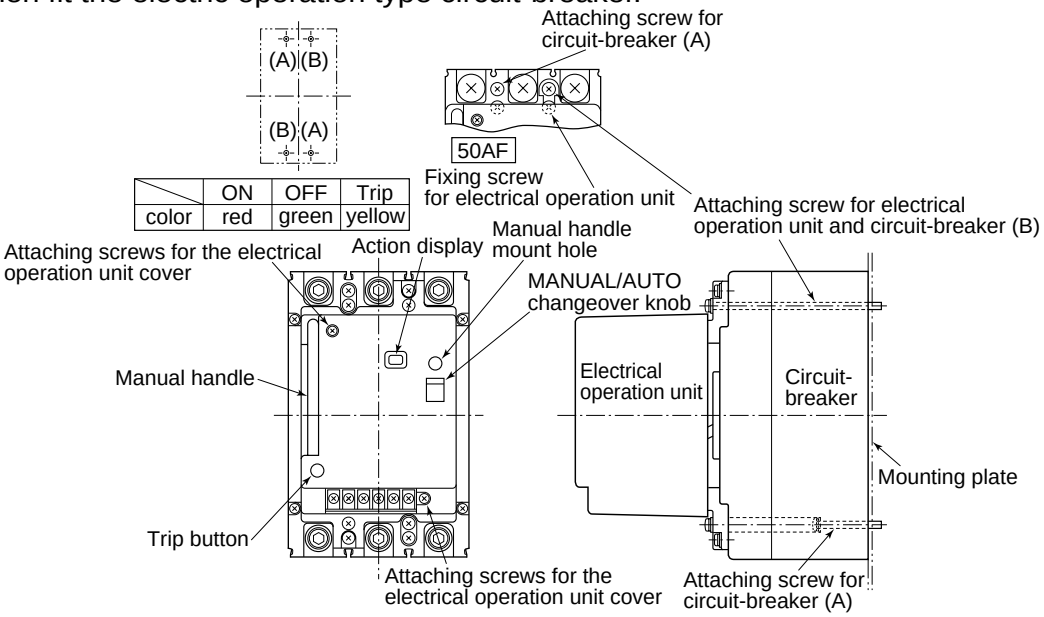
(b) How to mount

(i) Cases of front connection and rear connection types as well as plug-in type [NF50-HC and MB50-HC]

Mount the units as shown in the drawing below using the four attaching screws to be found in the package of the circuit-breaker.

a) When it is difficult to remove and refit the attaching screws for the circuit-breaker (A) due to the screwdriver contacting the electrical operation unit, use another screwdriver with longer handle (of the order of 150 mm in length).

b) In case of plug-in type, mount first the plug-in terminal block on the mounting plate and then fit the electric operation type circuit-breaker.



(ii) Cases of front connection and rear connection types as well as plug-in types (For the models other than the above)

a) Loosen the two attaching screws for electrical operation unit (B) to detach it from the circuit-breaker, when the nuts put into the back of the circuit-breaker, which are for temporary setting during transportation, shall be removed. They are unnecessary for mounting.

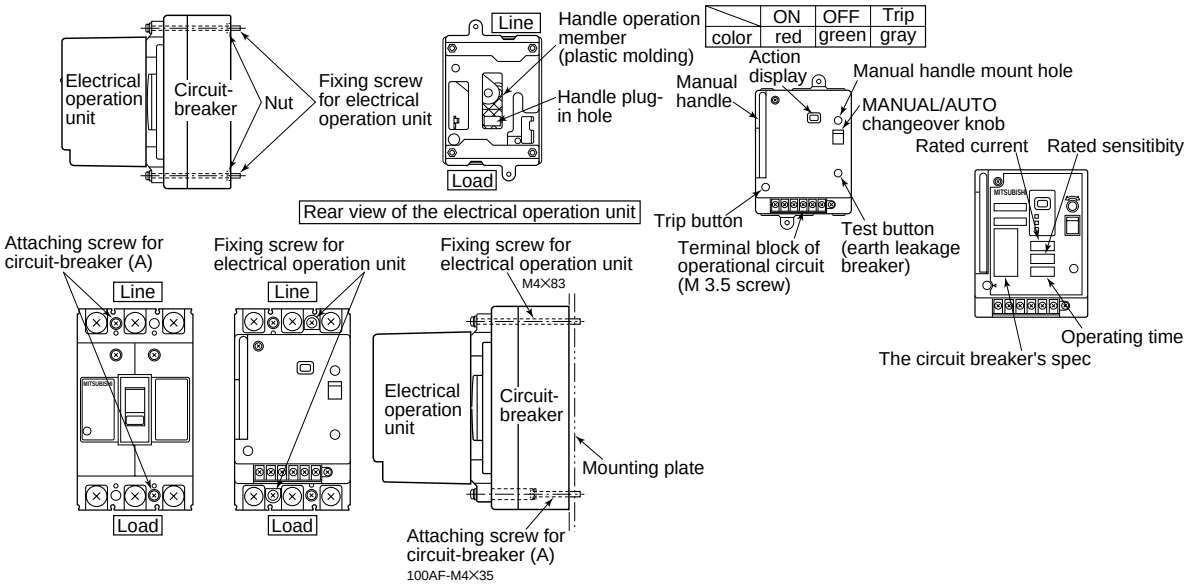
b) Fasten the circuit-breaker on the mounting plate with two attaching screws for the circuit-breaker. In case of plug-in type, mount the circuit-breaker on the plug-in terminal block.

c) Turn off the circuit-breaker.

d) Mount the electrical operation unit on the circuit-breaker in such a way that the handle of the circuit-breaker should fit into the handle insertion hole of the handle manipulation member (plastic molding) on the back of the electrical operation unit. Tighten the circuit-breaker and the electrical operation unit together into the mounting plate (plug-in terminal block in the case of plug-in type) using two attaching screws for the electrical operation unit (B).

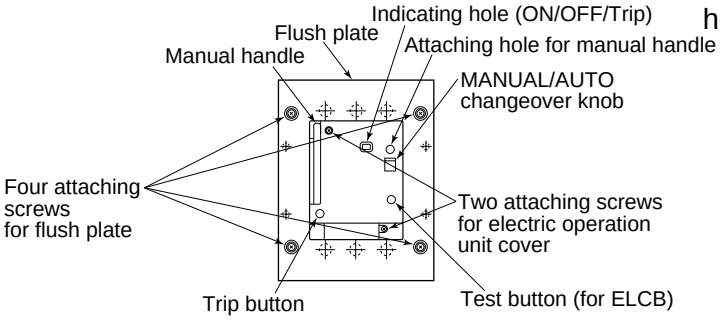
e) In case of the earth leakage breaker, adjust the indications of sensitivity current and leak trip action time on the name plate found in the same package to the settings, and label it at the prescribed position on the surface of the electrical operation unit.

At the time of delivery, the sensibility current and leak trip action time have been set 500mA and 2.0 sec respectively.

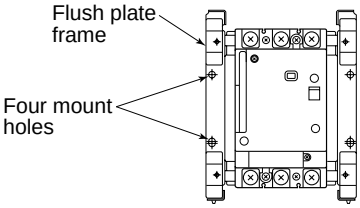


(iii) Case of flush plate type

a) Detach the four attaching screws for flash plate to remove this plate.

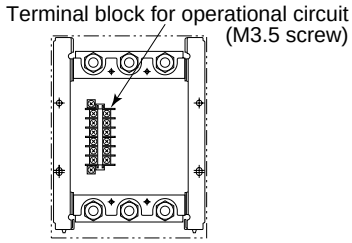


b) Mount the electric operation type circuit-breaker on the panel at the four mount holes of the flush plate frame.



c) Remount the flush plate as detached under a) above.

d) Wire it to the operation circuit terminal block on the reverse of the flush plate frame.

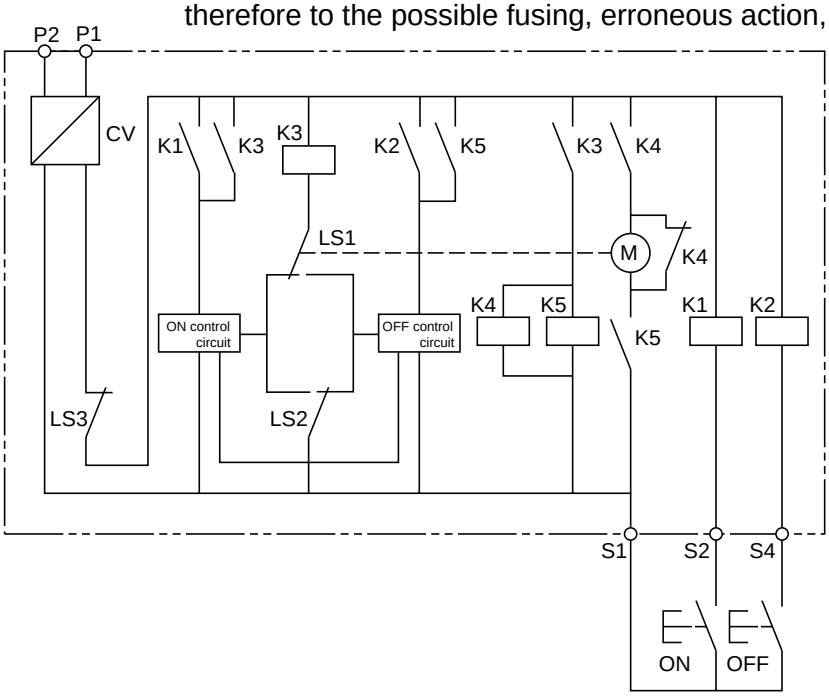


(c) Wiring to the operational circuit

(i) Connect the operational supply source to the operational supply terminals (Nos. P1 and P2). There is no polarity.

(ii) Connect the switch for ON/OFF operation to the operation switch terminals (Nos. S1, S2, and S4). The operation switch used shall be that for microload (opening/closing capacity of the order of 24VDC, 15mA). The operation switch shall be supplied by the user.

Note. In case of the articles using common voltage, the rush current (charging current of capacitor) of the order of 30 A will flow for about 30 msec into the breaker, fuse and the like provided in the power supply circuit when the power source is applied. Due attention should therefore to the possible fusing, erroneous action, etc. when you will select the articles.



CV	Switching power supply (multi voltage model)
	Diode stack (24V dc model)
LS1	Limit switch (for cam position detection)
LS2	Limit switch (for breaker handle positon detection)
LS3	Limit switch (MANUAL/AUTO selector
M	Motor
K1	Relay (for ON operation)
K2	Relay (for OFF operation)
K3	Relay (for motor)
K4	Relay (for motor)
K5	Relay (for motor)

(d) Precaution to be taken at the time of withstand voltage test

(i) Cases of articles using common voltage (100 to 240 VAC/100 to 220 VDC)

a) Withstand voltage is 1500 VAC between the operational supply terminals (Nos. P1 and P2) and the earth.

b) Withstand voltage is 1000 VAC between the operational switch terminals (Nos. S1, S2, and S4) and the earth.

(ii) Cases of 24 VDC

a) Withstand voltage is 1000 VAC between the operational terminals (Nos. P1, P2, S1, S2, and S4) and the earth.

③ Motor-operated type (2)

• Electrical Operation : The circuit-breaker is turned ON/OFF (reset) converting the forward and reverse rotation of motor into rectilinear motion by ball screw.

• Manual Operation : Manual operation handle is manipulated directly toward On or Off side of the circuit-breaker.

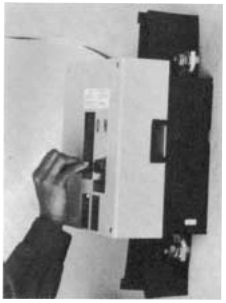
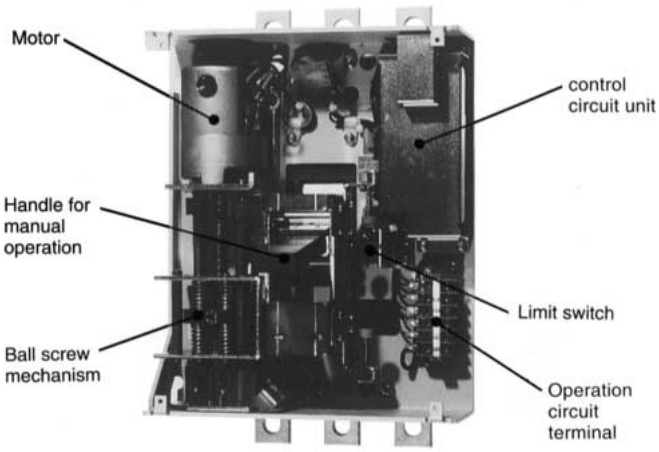


Fig. 2 Manual Operation

❋ Make sure to operate up to the position indicated by the name plate. (Should the operation be suspended midway, the limit switch for electrical operation may possibly not function, which will cause an error.



❋ In case when the unit is provided with the internal accessory for NFB, the terminal block of its lead-wire is mounted on the NFB.

Structure (with the cover for motor-operated type electrical operation unit removed)

(a) Precaution to be taken for handling

⚠CAUTION

Every time the electrical operation unit is dismantled or remounted, turn off the master circuit-breaker, switch off the operational circuit to make sure that the main and operational circuits are not alive (charged). Beware of electric shock. Notice that the manual operation handle operates at high speed during electric operation. Never try to perform the electric operation with cover opened. Turn off the power supply for operational circuit at the time of manual operation.

(i) When the circuit-breaker trips, the resetting (reclosing) procedure depends on the status of the electric operation unit before the trip:
Trip with unit ON: Resettting (OFF) operation → ON operation
Trip with unit OFF: ON operation → Resetting (OFF) operation → ON operation.

(ii) Never try to apply ON and OFF operation signals continuously. There must be a time interval of 0.5 sec or longer between the ON and OFF signals.

(iii) Since the electric operation unit is of intermittent rating, never try to operate 10 times or more continuously (ON and OFF consecutive operation is counted as one operation).

(iv) The operational voltage shall be within 85 to 110% of the rated operation voltage.

(v) In case of automatic reset mode, resetting operation shall be made with 0.5 sec of time interval after the NFB tripped.

(vi) Note that the electrical operation unit will not display the trip when the circuit-breaker trips due to some trouble (overload, short-circuit, leakage), internal accessories (UVT, SHT) or to the trip button, test button.

(vii) The electrical operation unit incorporating pumping prevention device, it can be turned off while the ON switch is maintained thrown, but it cannot be turned ON continuously after that. If it is to be turned on, once change the ON switch over to OFF, and then apply again the ON switch.

(viii) In the manual operation mode, make sure to manipulate the manual operation handle up to the position indicated by the name plate.

(ix) The withstand voltage of the electrical operation circuit is 1500V. If the withstand voltage test is performed under a voltage exceeding 1500V together with other equipment, cut off the terminals (P1, P2, S2 and S4) of the operational circuit.

(x) Note that the leak sensitivity current and action time changeover device for Earth leakage circuit breakers have been set 500 mA 2.0 sec (at delivery). If the user wants to change this setting, proceed to the change only after removing the frame.

(b) Mounting

(i) Front-connection/Rear-connection (Other than the U-series).

(i)-1 Sequential order for mounting the electrical operation type MCCB

a) Detach the four cover mount screws (A) to remove the cover.

b) Fix the electric operation type MCCB on the panel using four MCCB mount screws (B).

c) Connect the electric operation unit to the terminal of operational circuit.

d) Fasten the cover with four cover mount screws (A).

(i)-2 Maintenance and inspection of electrical operation unit (Removal of this unit only)

a) Detach the four cover mount screws (A) to remove the cover.

b) Remove the four frame mount screws (C).

c) Slide the electric operation unit slightly toward the power supply side to remove the frame from hook pin.

❋ When mounting the unit on the MCCB, thread the handle between the rollers of the bracket beforehand. The electric operation unit has been so designed that it may be supported temporarily by the hook pin in case of setting with screws.

❋ Mount the electric operation unit so that the end of the trip lever matches with the position of the trip button of MCCB.

❋ The end of the trip lever projects from the plane F of the frame. Take care not to allow the trip lever to be deformed.

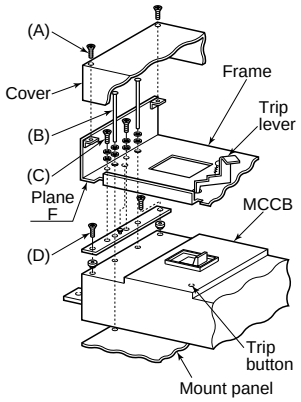


Fig. 3

(ii) Flush plate type (Other than the U-series)

a) Mounting the electric operation type MCCB
Fix the MCCB on the panel or the like using the attaching (mount) screws (E) for flash plate.

❋ NF1600-SS shall be mounted with the mount angle of MCCB.

b) Maintenance and inspection of electrical operation unit (Removal of this unit only) Same as for front connection/rear connection types.

Note. When mounting 800 AF and subsequents, the smaller slider out of the two sorts of sliders (insulating plates) between the bracket and cover shall be incorporated into the upper plane, and the notched portion of the larger one into the lower left corner.

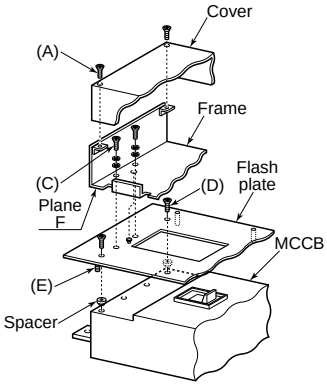


Fig. 4

(iii) Mounting the front-connection and rear-connection (U-series)

(iii)-1 NF400-SEP (3P)

a) Detach the electrical operation unit from the circuit-breaker.

Step 1 Detach the four cover mount screws (A) to remove the cover.

Step 2 Remove the four frame mount screws (C).

Step 3 Slide the electric operation unit slightly toward the power supply side to remove the frame from hook pin to remove the electric operation unit from the circuit-breaker.

Precaution to be taken:

The end of the trip lever projects from the plane F of the frame. Take care not to allow the trip lever to be deformed.

b) Mount the circuit-breaker on the board using four circuit-breaker mount screws (B). The mounting onto the board is the same as that of the circuit-breaker both for front connection and rear connection types.

c) Mount the electric operation unit in the sequential order reverse to a).

Note 1. When mounting on the circuit-breaker, thread the handle between the rollers of the bracket beforehand.

Note 2. The electric operation unit has been so designed that it may be supported temporarily by the hook pin in case of setting with screws.

Note 3. Before mounting the cover, connect electric operation unit to the terminal of the operational circuit.

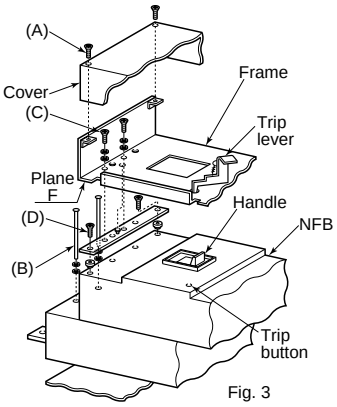


Fig. 3

(iii)-2 NF400-UEP(4P), NF630-UEP, NF800-UEP, NF1250-UR

a) Detach the four cover mount screws (A) to remove the cover.

b) Fasten the electric operation type circuit-breaker using the four breaker mount screws (B).

c) Connect electric operation unit to the terminal of the operational circuit.

d) Fix the cover with the four cover mount screws (A).

❋ If the electric operation unit is to be removed from the circuit-breaker for maintenance and inspection, the removal shall be made according to the procedure for NF400-UEP(3P).

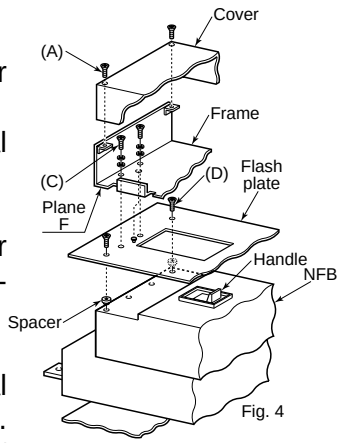


Fig. 4

(iv) Flush plate type (refer to Fig. 4) (U-series)

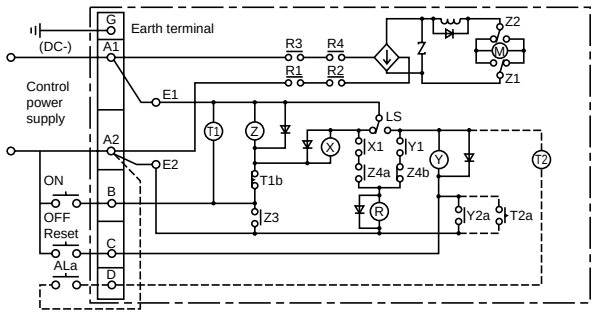
a) Maintenance and inspection of electrical operation unit (Removal of this unit only) Same as for front connection/rear connection types.

Note. When mounting it, the smaller slider out of the two sorts of sliders (insulating plates) between the bracket and cover shall be incorporated into the upper plane, and the notched portion of the larger one into the lower left corner.

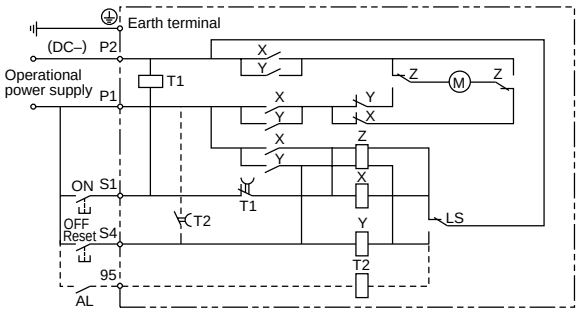
(c) Motor-operated type electric operation circuitry

Note. The portion indicated by broken lines in the circuitry, is added in the case of automatic resetting.

(1) Control circuit 1.
(400, 630 and 800AF)



(2) Control circuit 2.
(NF1000-SS to NF1600-SS)



M : Motor
X : Relay for ON operation
Y : Relay for OFF operation
Z : Relay for changing motor polarity
T1 : Timer for antipumping
T2 : Timer for automatic reset
LS : Limit switch
AL : Alarm switch for automatic reset (a contact)

Note 1. The above diagram indicates the MCCB when it is OFF.

Note 2. Since the electric operation is of self-sustaining type, instantaneous closing of operational switch only ensures the required operation.

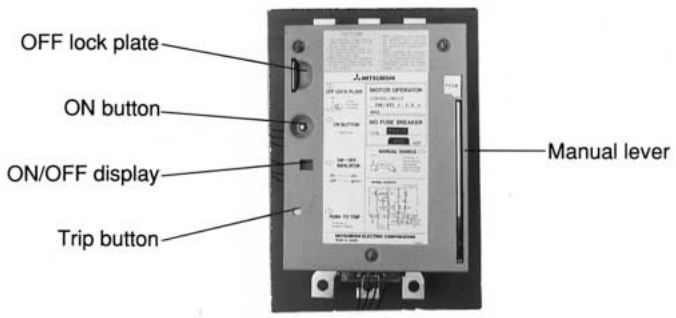
Note 3. The portion surrounded by the alternate long and short line represents the interior of the electrical operation unit which has already been wired. Note that the (T2) ondelay timer for the alarm switch for automatic resetting is not standardized. The user is requested to spacify it.

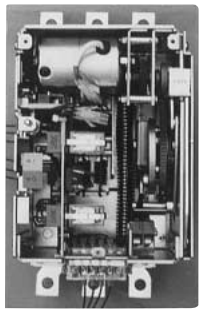
Note 4. The relay has polarity in case of DC operation. Decide tha polarity you desires as shown in the above diagram.

④ Spring-charged type (2)

• Electrical Operation : When the ON operation switch is closed, the closing coil is excited, latch mechanism is released and the closing spring will turn on the circuit-breaker instantaneously. If the OFF operation switch is closed, the relay will come into function to start the motor. If, under these conditions, the circuit-breaker is turned OFF (reset), the closing spring will be charged instantaneously.

• Manual Operation: Depressing the ON button will release the latch mechanism, and the closing spring will turn on the circuit-breaker instantaneously.
OFF (reset) Operation.
When the manual lever is taken out depressing the leaf spring, and the lever is thrown a dozen times reciprocatedly, the circuit-breaker turns OFF (resetting) and the closing spring is charged at the same time.





(a) Precaution to be taken when handling

⚠CAUTION

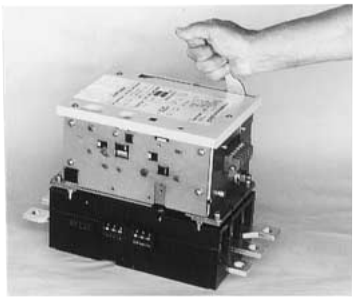
Every time the electrical operation unit is dismantled or remounted, turn off the master circuit-breaker, switch off the operational circuit to make sure that the main and operational circuits are not live (charged). Beware of electric shock.

Case of remote operation (electric operation)

(i) The operational voltage shall be within the range from 85 to 110% of the rated operational voltage.
(ii) Since the electric operation unit is of intermittent rating, avoid operating it 10 times or more continuously (ON and OFF consecutive operation is counted as one operation).
(iii) The turning off by the electric operation requires about 2 sec (from application of OFF signal on the electric operation unit to turning off of the circuit-breaker). If one wants to open urgently the main circuit by remote operation, it is recommended to use the circuit-breaker with SHT or UVT.
(iv) When the circuit-breaker trips, the resetting (reclosing) procedure depends on the status of the electric operation unit before the trips:
Trip with unit ON : Resetting (OFF) operation → ON operation
Trip with unit OFF : On operation → Resetting (OFF) operation → ON operation

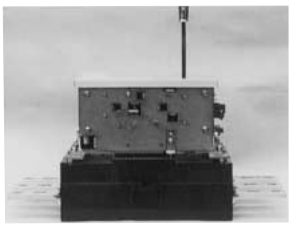
Case of local (manual) operation

(i) Turning ON
Pressing the ON button will release the latch mechanism and turn on the circuit-breaker instantaneously by the energy of the closing spring.



(ii) Turning OFF (reset)
The manual turning OFF (resetting) should be repeated more than 10 times after taking out the manual lever. Repeat the operation of manual lever without fail up until the manual lever idles. After completion of the manual operation, house the lever into its original position.
Note. Sometimes the operational load reduces more or less midway with the circuit-breaker turning off emitting a sound. Never fail to continue to operate the manual lever until it does idling.
(iii) Trip operation
The circuit-breaker with the electric operation unit has been so designed that it should not trip even if the trip button is depressed under OFF condition. When the circuit-breaker is to be tripped on occasion, for instance, of witnessed test, it shall either be made to trip after once it shall be turned ON or shall trip by turning it on with trip button depressed.

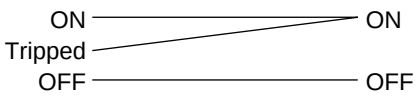
(iv) In case when the main circuit is to be opened in emergency:
If the main circuit is to be opened in emergency by manual operation, the circuit-breaker shall be made to trip depressing the trip button.

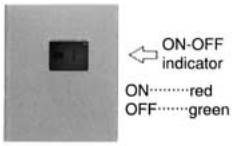


(v) OFF lock plate
If the electric operation unit is locked with a padlock with the OFF lock plate drawn out, it cannot be operated anymore electrically nor mechanically. This locking shall therefore be applied when ON operation is to be prohibited or erroneous closing is to be avoided.
Note. The OFF lock plate has been so designed that it cannot be drawn out before the completion of charging.
Up to three padlocks can be attached.

Indicator

(i) Pay your full attention to it that the electric operation unit does not indicate trip even when the circuit-breaker trips. It will indicate as below. Trip indicator may be manufactured upon your request.
(Condition of the circuit-breaker) (Indicate by the electric operation unit)





(ii) Electric operation unit with trip indicator (special order)
Notice that the electric operation unit indicate trip when the circuit-breaker trips, but that the trip indicator will evolve as below when the resetting operation is resumed. (Tripped → Indicate evolution of the electric operation unit when resetting) Tripped → ON → OFF

Case of circuit-breaker with UVT

(i) In case when the UVT comes into function with the circuit-breaker ON:
Making just after excitation of UVT becomes possible by automatic reset type circuitry.
(ii) In case when the UVT becomes non-excited with the circuit-breaker OFF:
Making is possible immediately after the excitation of UVT.

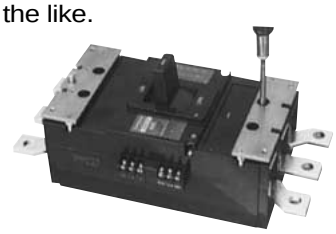
(b) Mounting method

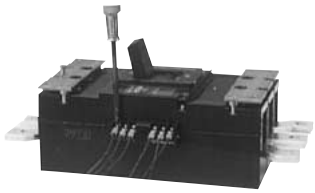
Precaution to be taken when handling

(i) Dismantling and remounting of the electric operation unit from and onto the circuit-breaker shall be done with the circuit-breaker tripped or ON and with the electric operation unit discharged (indicator of the electric operation unit: ON).
(ii) Note that the electric operation unit can be dismantled and remounted with cover provided (except the Flush plate type).
(iii) If the electric operation unit is to be handled individually, confirm beforehand that it is discharged (indicator : ON (red)).
If it is charged, depress the ON button to discharge it. Since the discharge is accompanied by a severe shock, discharging operation should be performed on a firm stand or the like.

Mounting the front connection, rear connection and plug-in type

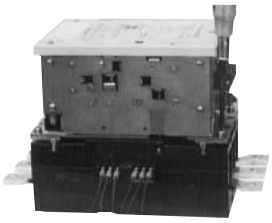
(i) Remove the electric operation unit.
(ii) Mount the circuit-breaker on the board. The mounting on the board is the same as that for the independent circuit-board both for front-connection, rear-connection and plug-in types.
(iii) Wire the circuit-breaker with the internal accessory unit. If the circuit-breaker has already been provided with the accessory, proceed to the wiring work under the condition.

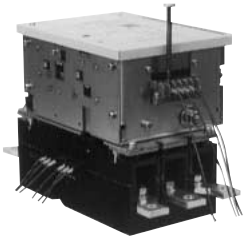


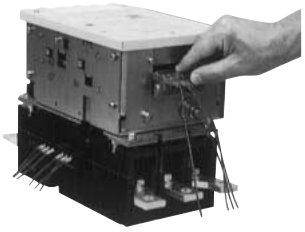


(iv) Mount the electric operation unit on the circuit-breaker. Attaching screws are four M6 screws, The electric operation unit has been so designed that it can be provisionally supported by hook pin when it is to be fastened with screws.

(v) Wire the electric operation unit to the control circuit. Mount the terminal cover after the wiring.







Mounting the flush plate type

(i) Detach the cover mounting screws of the electric operation unit.

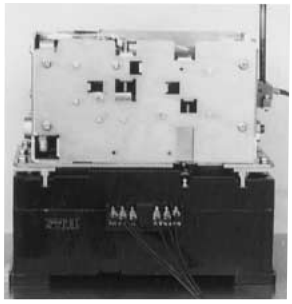
(ii) Detach the electric operation unit from the circuit-breaker.

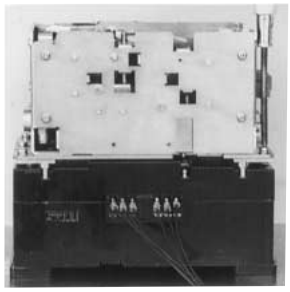
(iii) Mount the circuit-breaker on the board. The mounting method on the board is the same as that for the rear-connection type circuit-breaker.

(iv) Wire the circuit-breaker with its internal accessory. Refer to the above-mentioned mounting method for the rear-connection type.

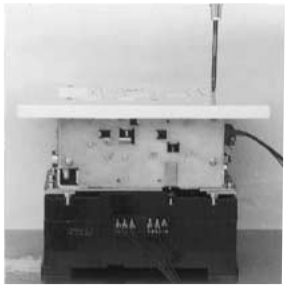
(v) Mount the electric operation unit on the circuit-breaker after removing the cover of the electric operation unit.

(vi) Connect the electric operation unit to the control circuit. Mount the terminal cover after wiring.



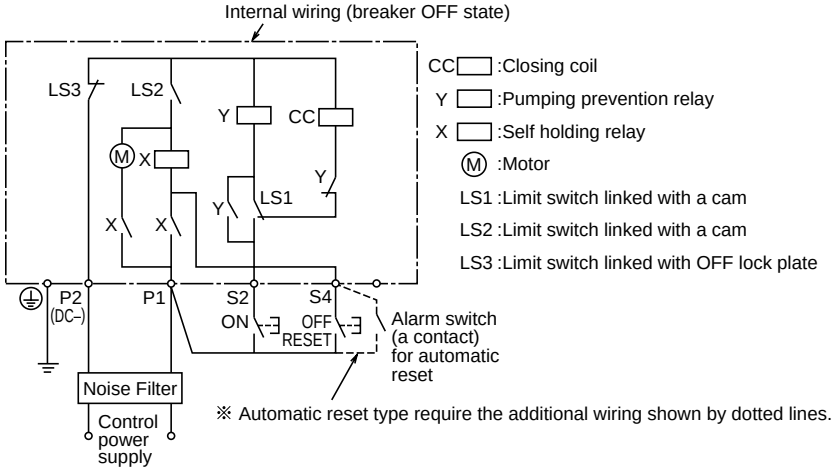


(vii) Mount the cover of the electric operation unit after fitting the panel to be supplied by user.



• Operational Circuit

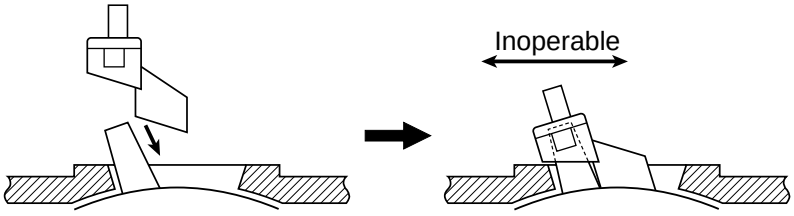
Such wiring as shown by the broken line will be added for the automatic resetting type.



(2) Lock cover (LC)

The lock cover is a plug-in type handle mechanism that can prohibit operation readily without applying any lock. A “Warning Tag” can be attached to it.

One can safely use this mechanism since it may trip with its handle locked at ON position if any overcurrent flows.



⚠CAUTION

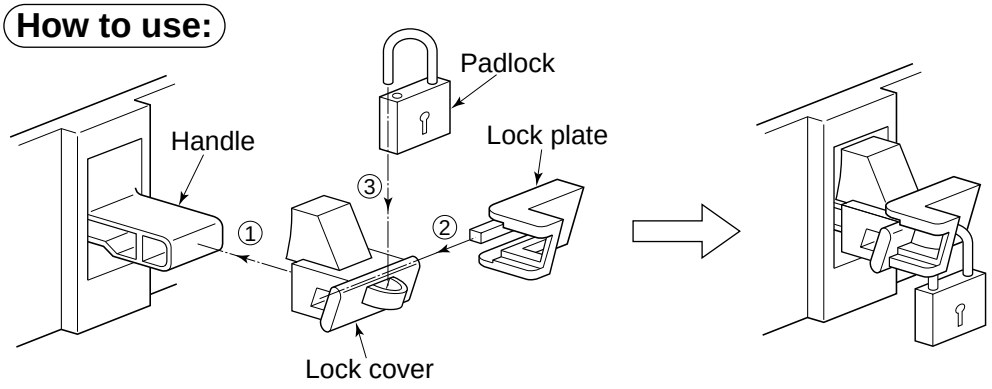
The wiring work shall be performed with the master circuit-breaker OFF even if the unit is locked into OFF position. Since an electric shock is to be apprehended, always confirm that there is no current flowing before proceeding to the wiring.

① Use the circuit-breaker always with the lock cover fully inserted. (Insert once again if the circuit-breaker trips.)

② Never try to trip by the trip button with the circuit-breaker locked into OFF position. Otherwise, the internal mechanism may be destructed.

(3) Handle lock (HLN, HLF or HL-S)

The handle locks is a device that lock ON or OFF the handle of the circuit-breaker. Users can safely use their lock because the circuit-breaker trips when an overcurrent flows therethrough even if the handle is locked into ON position. There are two types of locks: HLN and HLF which are used as mounted on the handle and HL-S which is used as fixed on the cover of the circuit-breaker.



(Case of HL)

⚠CAUTION

The wiring work shall be performed with the master circuit-breaker OFF even if the unit is locked into OFF position. Since an electric shock is to be apprehended, always confirm that there is no current flowing before proceeding to the wiring.

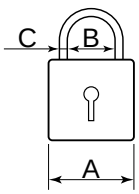
① Never try to trip the circuit-breaker by trip button with the circuit-breaker locked into OFF position. Otherwise, the internal mechanism may be broken.

② The padlock to be used shall be that which is commercially available with the nominal dimensions as shown in the table on the right hand.

Dimensions of padlock (mm)

Applicable type	A (Nominal dimensions)	B	C
NF250-A frame and below, NV250-A frame and below	25 ✻	14 ✻	4 ✻
NF400-A frame and above, NV400-A frame and above	40 ✻	22 ✻	5.5 ✻
NF2000-S and above	70	Standard ones in the same package	

✻ A:35, B:19, and C:5 for HL-S

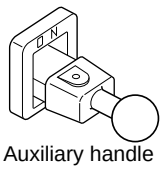


(4) Extension handle

This handle makes easy the opening/closing operation of the circuit-breaker.

Note 1. The extension handle, if used, shall be firmly fixed into the main handle.

Note 2. The extension handle should be detached from the main promptly afteruse, because if attached to the main the auxiliary may give the internal mechanism a severe shock to reduce its service life or will get into the air when the circuit-breaker trips.



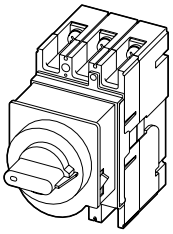
Auxiliary handle

(5) External handles

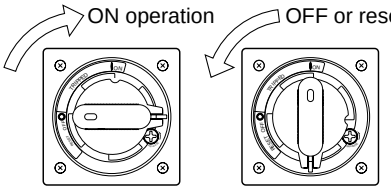
① F type handle

This handle is intended to manipulate the inboard circuit-breaker from without. It is used when the body of the circuit-breaker is provided with, for instance, the control center.

(a) Opening/Closing operation

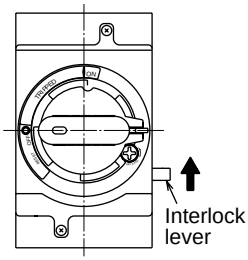


- The handle can turn ON when it is rotated clockwise.
- The handle can turn OFF when it is rotated counterclockwise.
- When the circuit-breaker trips, the handle can be reset if it is rotated counterclockwise further from OFF position.
- The handle is provided with the door lock mechanism that can open the door only when switching OFF.

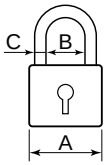


(b) How to release the safety device

A safety device that disables the circuit-breaker “ON” with door open has been provided as standard accessory. If the circuit-breaker is to be ON with the door open, turn the handle ON with the interlock lever pushed into the arrowed direction.



- Padlock: To be supplied by users.



Dimensions of padlock

The padlock to be used shall be commercially available one.

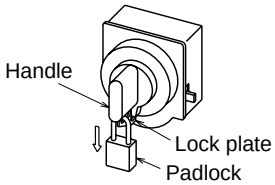
Applicable type	A (Nominal dimensions)	B	C
PSS(Note)	35	19	5
All models	40	22	5.5

Note. WSS types (handle models: F05SW2P to F6SWNV) perform trip display when the circuit-breaker trips even when the lock is ON. [Only when one padlock (35mm, 50g or less) is provided.]

(c) When locking up

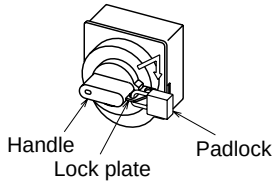
- ON lock

Pull out the lock plate in the arrowed direction with the handle turned to “ON” position then lock the handle with a commercial padlock.



- OFF lock

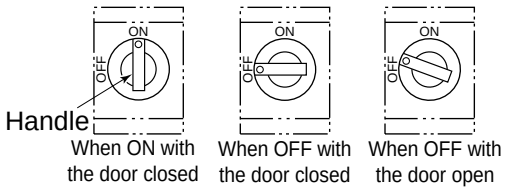
Turn the handle toward the reset position, while lightly drawing out the lock plate, return the handle in the arrowed direction when the lock plate has been drawn out, then fix the lock plate in the lock position. Use a commercial padlock through the hole on the lock plate to lock the handle.



Attention

(i) Never fail to remove the extension handle when the opening/closing operation is over or when UVT trip button and/or ELCB test button are operated or tripped. Otherwise it may give the internal mechanism a severe shock or reduce its service life or may get into the air when the circuit-breaker trips.

(ii) Refrain from using such organic solvent as thinner for cleaning the panel (decorative sheet) or handle.



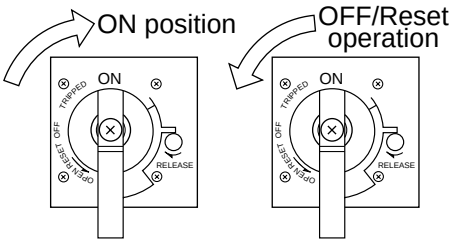
(iii) Handle position with the door open:
While the door is open, the handle position at OFF may shift. This results naturally from the structural feature of the external handle. It is not anomaly.

(iv) When the door is to be opened with the circuit-breaker ON, open it with the release pin left turned in the arrowed direction.

(v) It is difficult to manipulate the trip button of the circuit-breaker in case of 2 poles. Some metallic wire rod in L-shape shall be prepared.

② S type handle

This handle, intended to manipulate the inboard circuit-breaker from without, shall be used when it is to be provided on the door side.



(a) Opening/Closing operation

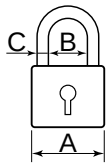
- Rotating the handle clockwise will turn the circuit-breaker ON.
- Rotating the handle counterclockwise will turn the circuit-breaker OFF.
- When the circuit-breaker trips, it can be reset if the handle is rotated counterclockwise further than OFF position.

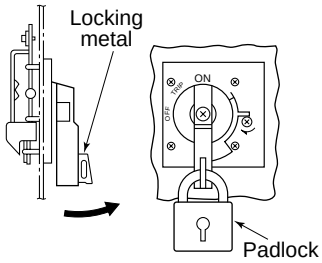
(b) When locking

The external handle can be locked at ON and OFF positions. Raise the locking metal of the external handle and shut a padlock. If the locking metal cannot be raised, move the external handle so that the metal should fit into the groove of the decorative sheet. The padlock shall be supplied by user. Up to 3 padlocks may be attached under normal conditions.

Dimensions of padlock
The padlock to be used shall be commercially available one.

Applicable type	A (Nominal dimensions)	B	C
PSS(Note)	35	19	5
All models	40	22	5.5





Note. S type external handles for WSS (S05SW to S4SW) display the trip when the circuit-breaker trips even if the locking is ON. [Only when one padlock (35mm, 50g or less) is provided.]

Attention

(i) Such organic solvent as thinner shall not be used for cleaning the panel (decorative sheet) and external handle.

(ii) Opening/closing the frontal sheet

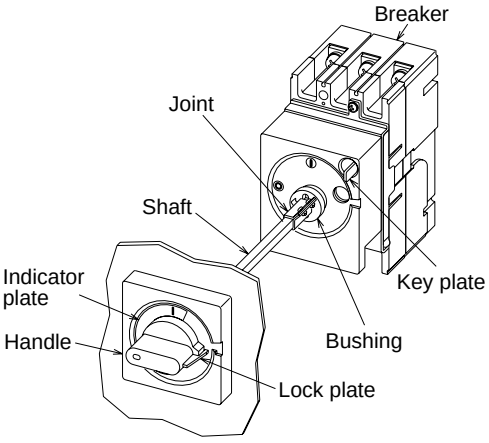
a) When the front sheet is to be opened, open it gently with the external handle left operated in the OPEN reset direction. When it is to be closed, close it after matching the position of the circuit-breaker handle with that of the external handle.
Never try to close the frontal sheet as left slided forcibly. Otherwise, the parts of the external handle may impinge against the handle of the circuit-breaker to damage it.

b) If the frontal sheet is to be opened with the circuit-breaker ON, open it with the release pin left turned in the arrowed direction.

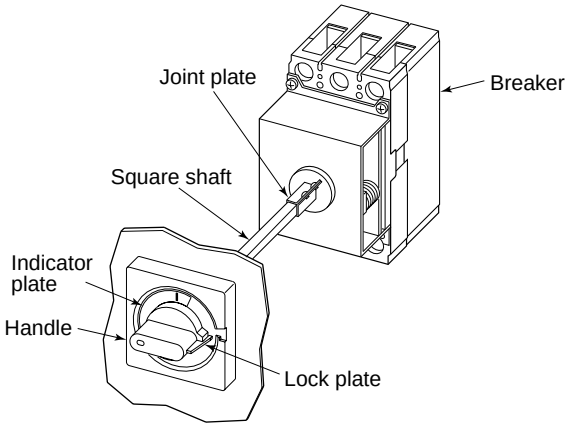
③ V type handle

(a) Assembly

● 125 and 250 A frames

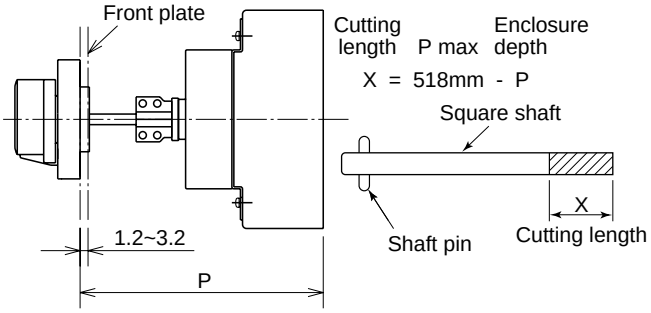


● 400, 630 and 800 A frames

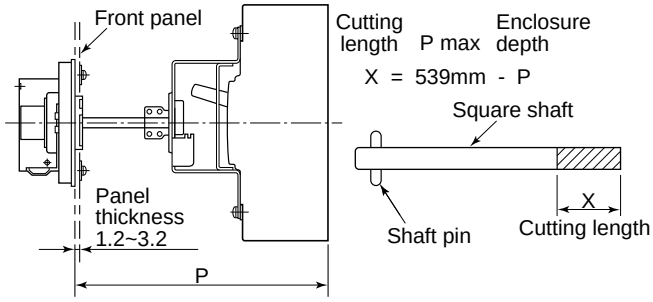


(b) Shaft cutting

● 125 and 250 A frames

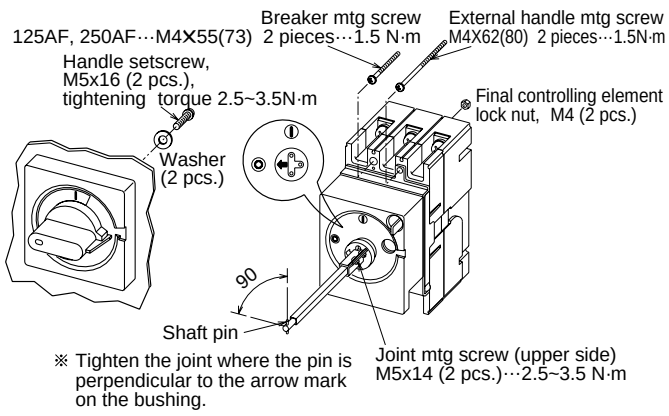


● 400, 630 and 800 A frames

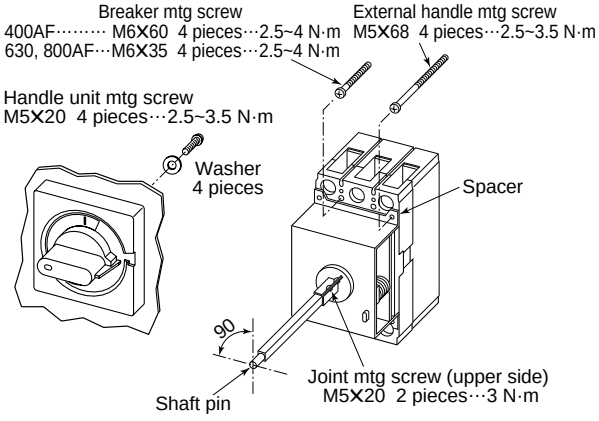


(c) Installation

●125 and 250 A frames



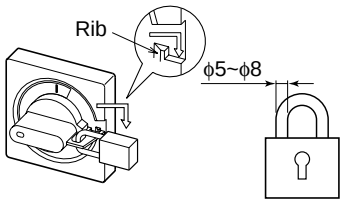
● 400, 630 and 800 A frames



Note. Set the shaft pin at vertical position under OFF state, then mount the joint plate.

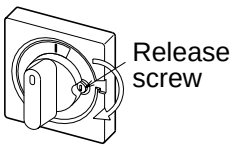
(d) Control handle

The handle can be locked in "OFF" position only. Pull out the lock plate in the arrowed direction, while moving the handle toward the resetting side, and hang it on the rib (take care since the handle is heavy). Lock the handle with a commercial padlock (ϕ5 - ϕ8). Up to 3 padlocks may be fitted. Padlocks are user-supplied.



(e) Door lock mechanism

The door can be locked in ON position and opened in OFF position. It is position to open the door in ON position to rotate the interlock release screw clockwise.



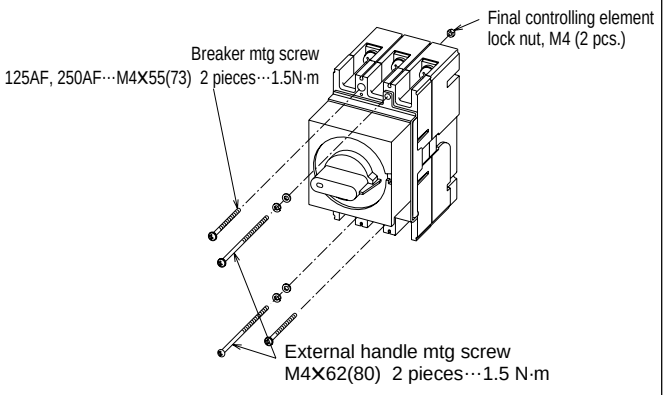
(f) Caution

Mount the external handle under OFF state.
Be careful that the shaft pin rotate when the breaker is tripped under opening the door.
The door cannot be closed in trip position.
Reset operation under opening the door, rotate the square shaft unticlockwise by spanner or monkey wrench.

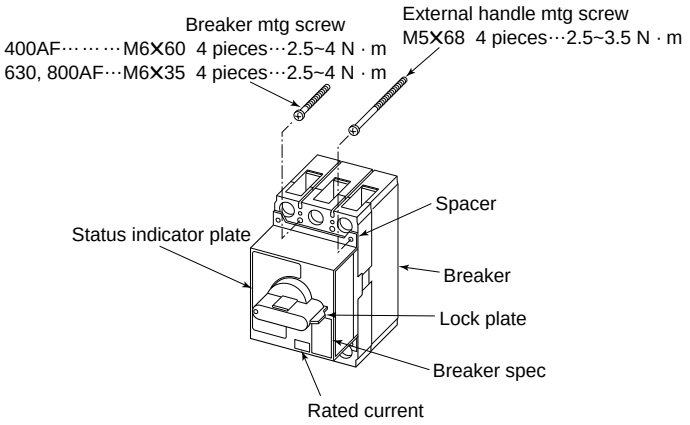
④ R Type handle

(a) Installation

●125 and 250 A frames



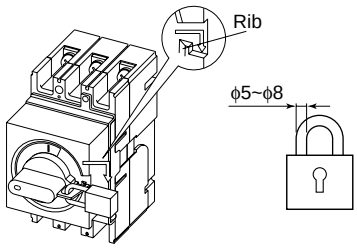
● 400, 630 and 800 A frames



Caution. Mount the external handle under OFF state.

(b) Lock Mechanism

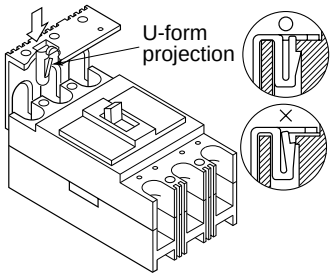
The handle can be locked in "OFF" position only. Pull out the lock plate in the arrowed direction, while moving the handle toward the resetting side, and hang it on the rib (take care since the handle is heavy). Lock the handle with a commercial padlock (ϕ5 - ϕ8).



(6) Terminal cover (400 A frame and below)

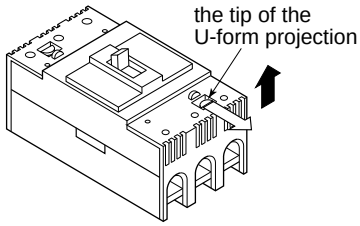
① MOUNTING

Put the U-form projection in the hole of the breaker and push the terminal cover strongly to fasten it.
(Push the indicated place by the "⇩" mark.)



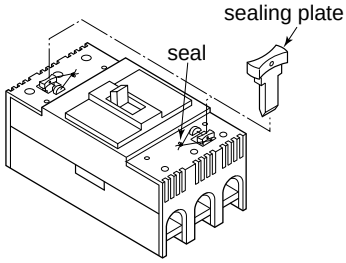
② REMOVING

Push the tip of the U-form projection fully toward the " ⇨ " mark by the screw driver or a finger tip and pull out the terminal cover toward the "⬆" mark.



③ SEALING

Terminal cover can be sealed with the sealing plate and wires.
Put the sealing plate into the hole of the U-form projection and seal the terminal cover.



Note. Pull the sealing wire so as not to loose.

4. MDU breaker

4.1 Measuring Display Unit (MDU)

- Energy management becomes possible by measurement and display of load current, line voltage, electric power, electric energy, harmonic current (3rd, 5th, 7th and total) and power factor of MDU.
- MDU with pulse output option can output pulse when electric energy accumulated setting unit.
  MDU with CC-Link option can transfer measured data to open network CC-Link.
- When a circuit breaker outputs a alarm , LED on MDU turns on.
  PAL : pre-alarm
  OVER : over current
- When the circuit breaker is tripped, fault cause and fault current stored in EEPROM.
  It makes cause investigation and restoration of power line possible.
  Fault cause : over current(L) and short-circuit(SI).
  Fault current : up to 16 times the max. rated current can be displayed.
- The max. demand value of load current, line voltage, total harmonic current, electric power and electric energy(hourly value),are stored in EEPROM.
  And MDU with CC-Link option can store the outbreak time of these.
  It makes easy finding of peak time of power consumption possible.

Items \ Types		NF400-SEPM/HEPM	NF630-SEPM/HEPM	NF800-SEPM/HEPM
Measured and displayed value	Load current : Present value, demand value, maximum demand value	○	○	○
	Line voltage : Present value, demand value, maximum demand value	○	○	○
	Harmonic current (3rd, 5th, 7th and total harmonics) : Present value, demand value, maximum demand value	○	○	○
	Electric power : Present value, demand value, maximum demand value	○	○	○
	Electric energy : Electric energy, electric energy (hourly value), maximum electric energy (hourly value)	○	○	○
	Power factor : Present value	○	○	○
	Rated (maximum) measuring current (note2.)	400A(800A)	630A(1260A)	800A(1600A)
	Accuracy of measuring current	±10A	±15.7A	±20A
	Rated (maximum) measuring voltage (note2.)	AC440V(690V)		
	Accuracy of measuring voltage	±11V		
	Measurment range of power factor	Lead 0~1~0 Lag		
Fault current/cause		○		
Alarm LED indication	PAL, OVER	○		
Alarm contact output (option) (note1.)	Pre-alarm (PAL) (Power supply AC/DC100-240V required)	○PAL		
	Trip indicator (TI) (Power supply AC/DC100-240V required)	○PAL, OAL		
Phasing line		3φ3W, 1φ3W(3 poles breaker), 3φ4W(4 poles breaker)		
Electric energy accumulated pulse output (option) (note3.)		○		
CC-Link transmission (option) (note3.)		○		
Control power (Allowable voltage range 85~110%)		AC/DC100-240V 12VA (note4.)		

⚠CAUTION

Note1. The module (terminal) is attached to the right side of the breaker.
Pre-alarm(PAL) output function can set [Self-holding] or [Auto reset].
For function of alarm contact output (PAL, OAL), MDU and the circuit breaker must be connected with the mutuality and the control power must be supplied to MDU and alarm contact output module.

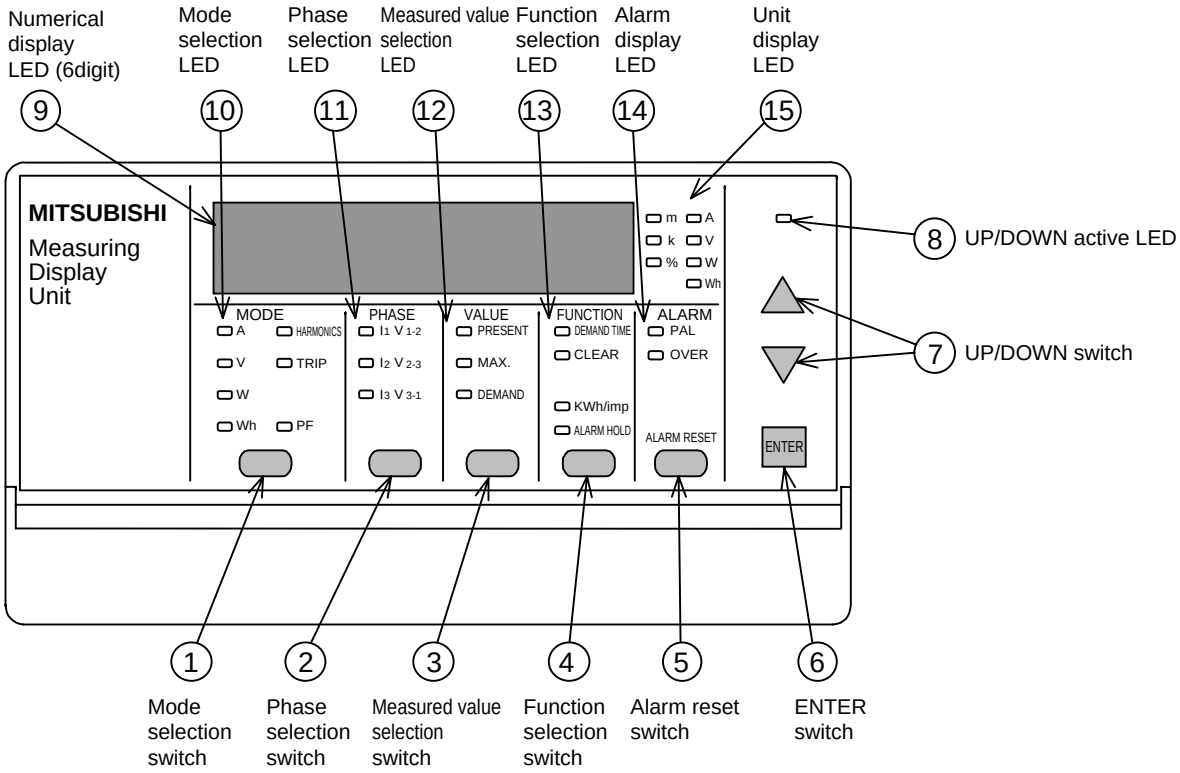
Note2. If input is over range, in this case, MDU display maximum measuring value.

Note3. Pulse output option and CC-Link option cannot be attached at the same time.

Note4. When control power supplied to MDU, then rushed current transitionally, max. 40Apeak, 1ms (at 240VAC).

4.2 Functions and names of each component

There may be functions and items that cannot be operated depending on the type and specification



4.3 Display and operation panel

① Mode selection switch

Displayed item is changed and selected by pushing this switch one by one.

② Phase selection switch

The phase is changed and selected by pushing this switch one by one.

Display of [I_N] is equipped on only 4 poles breaker.

③ Measured value selection switch

The types of value(PRESENT, MAX., DEMAND) is changed and selected by pushing this switch one by one.

④ Function selection switch

Function is changed and selected by pushing this switch one by one.

After the function selecting, sets the value or selects the item by pushing UP/DOWN switch.

Setting or selecting is active after pushing ENTER switch.

Pulse output unit is attached with electric energy accumulated pulse output option.

Function	Description
DEMAND TIME	Adjustable at 1-minute step. Range is between 0-15 minutes. Demand time cannot be set independently. It become common setup. The value is present value, if set to 0 minute.
CLEAR	Clears the stored data of electric energy, maximum demand value, fault current/cause, etc, or resets OAL contact output.
kWh/imp	Selects the unit of electric energy accumulated pulse output, 1, 10, 100, 1000, 10000kWh/imp.
ALARM HOLD	Selects the function of alarm LED (PAL) and contact output (PAL), self-holding or auto reset. (OVER LED is auto reset at any setup of alarm hold.)

⑤ Alarm reset switch

This switch resets alarm LED and alarm contact output, when the setup of "ALARM HOLD" is self-holding.

⑥ ENTER switch
This switch decides value or item that selected at function select mode.
⑦ UP/DOWN switch
This switch is used by set the value or select the item.
When this switch is active, UP/DOWN active LED is turned on.
⑧ UP/DOWN active LED
When UP/DOWN switch is active, this LED is turned on.
⑨ Numerical display LED(6digit)
Electric energy is displayed at 6digits. The other measurement values are displayed at right 3digits.
⑩ Mode selection LED
The LED of selected mode is turned on.
⑪ Phase selection LED
The LED of selected phase is turned on.
⑫ Measured value selection LED
The LED of selected value is turned on.
⑬ Function selection LED
The LED of selected function is turned on.
⑭ Alarm display LED
When an alarm is output from the circuit breaker, the corresponding LED is turned on.
⑮ Unit display LED
The LED of unit of measured value is turn on.

4.4 MDU terminal

(1) Control power terminal : L1, L2
Connect the control power of MDU. There is no polarity.
(2) Earth terminal : FG
Connect the FG terminal of MDU to,
MDU installation is breaker mounting : the PE terminal of holder plate on circuit breaker
MDU installation is panel mounting : the PE terminal of panel plate
PE terminal connect to the ground or PE conductor.
(3) Pulse output terminal : 113, 114(with electric power accumulated pulse output option)
Output terminal of electric energy accumulated pulse output. There is no polarity.
(4) CC-Link transmission terminal : DA, DB, DG, SLD(with CC-Link transmission option)
Connect the CC-Link transmission signals DA, DB, DG and SLD.

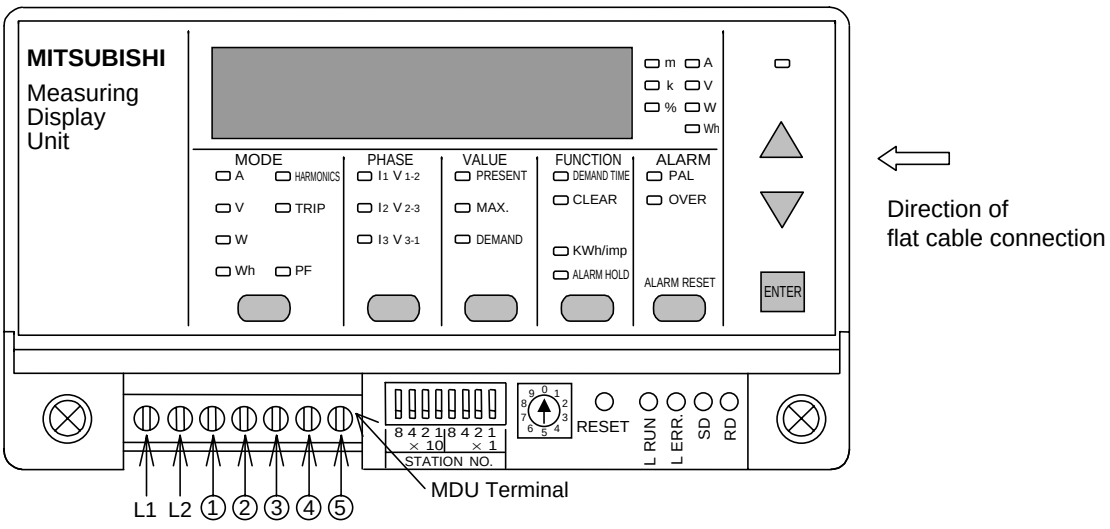


Fig. Outline of MDU breaker mounting

MDU terminal (MDU breaker mounting)

	①	②	③	④	⑤
No transmission	—	FG	—	—	—
Pulse output	—	FG	—	113	114
CC-Link	FG	SLD	DG	DB	DA

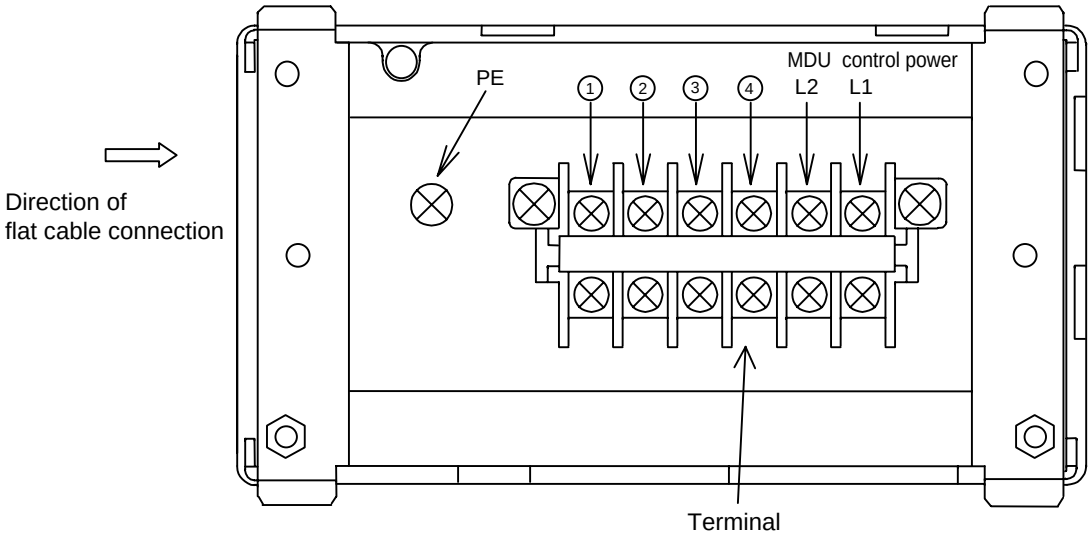


Fig. Outline of MDU panel mounting
(Except for CC-Link option)

MDU terminal (MDU panel mounting)

	①	②	③	④
No transmission	—	—	—	—
Pulse output	114	113	—	—

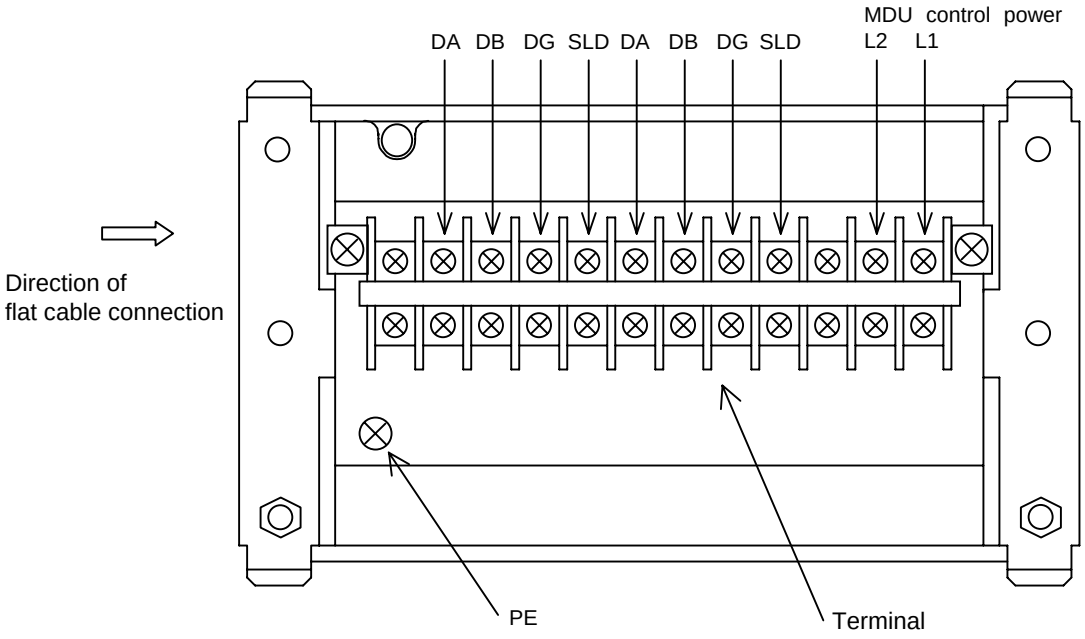


Fig. Outline of MDU panel mounting
(With CC-Link option)

4.5 CC-Link transmission

(1) Station number setting switch

Open the MDU terminal cover, set the station number by BCD code.

(Setting range : 1-64, default setting : 1)

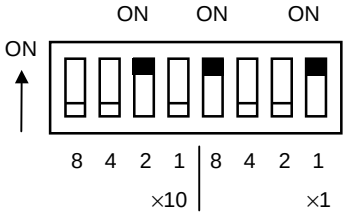
Sample setting :

X10 ··· 2X10=20

X1 ··· 8X1+1X1=9

a total is, 20+9=29

station number = 29



Station number setting switch

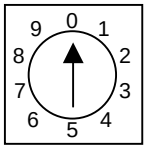
Station number sets no overlap on the same line.

As for the number of connection and matching of the other device, see 4.5.

(2) Transmission baud rate setting switch

Set the transmission speed.

Number	Descriptions
0	156kbps (default setting)
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps
5~9	Unusable (L ERR. LED turn on)



Transmission baud rate setting switch

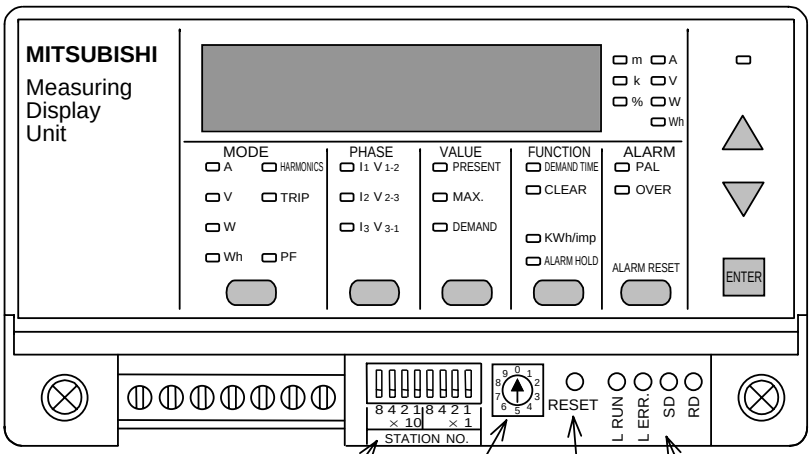
(3) Reset switch

After station number or transmission baud rate is set or changed, push this RESET switch and restart MDU.

(4) Operation status display LED

This LEDs displayed operation status of communication.

LED name	Description
L RUN LED	ON : Normal communication OFF : Communication cutoff
L ERR. LED	ON : Communication data error Blink : Communication data error OFF : Normal communication
SD LED	ON : Sending data
RD LED	ON : Receiving data



Station number setting switch

Transmission baud rate setting switch

RESET switch

Operation status display LED

⚠CAUTION

(5) Caution of CC-Link setup operation

①Set the station number before communication line on.

②Set the station number with less than the stress of 10N.

③If the station number changed after control power supplied to MDU. Push the RESET switch at that time. Otherwise the change is not accepted and the station number does not change.

④Push RESET switch with thin stick.

⑤Do not change the setting of switches with automatic pencil. It may cause malfunction by carbon dust.

⑥Cannot change MDU, when data link is in proceeding.

⑦If data link failed then data of master module is holding.

4.6 Configuration conditions of CC-Link system

Station type of MDU is remote device station, and the number of occupied station is 1 station.
However following 1,2 conditions shall be satisfied according to CC-Link specification.

Condition 1. {(1Xa)+(2Xb)+(3Xc)+(4Xd)}≦64

a : Number of modules occupying 1 station (MDU is applied.)
b : Number of modules occupying 2 stations
c : Number of modules occupying 3 stations
d : Number of modules occupying 4 stations

Condition 2. {(16XA)+(54XB)+(88XC)} ≦2304

A : Number of remote I/O stations ≦64
B : Number of remote device stations (MDU is applied.) ≦42
C : Number of local stations, standby master stations, intelligent device stations ≦26

Maximum connectable number is 42. (at only MDUs connection)

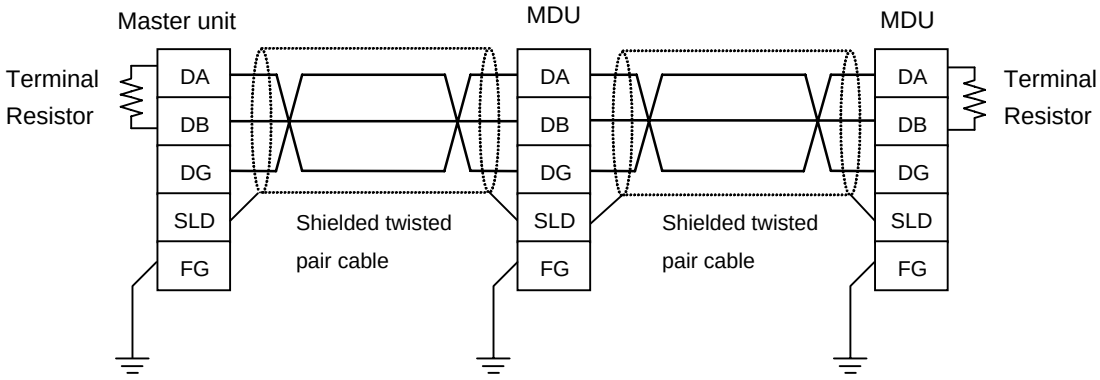
Condition 1. {(1X42)+(2X0)+(3X0)+(4X0)}=42 ≦64
Condition 2. {(16X0)+(54X42)+(88X0)}=2268 ≦2304

When MDU is panel mounting, the shielded twisted pair cable which connect terminal on MDU mounting panel and terminal on MDU.

(1) The distance of one side connection (=15cm) is included in the distance of adjacent station.
(2) The distance of each sides connection (=30cm) is included in the maximum transmission distance.
(3) Use the shielded twisted pair cable which is the same as these connections (the model is FANC-SB). If the different cable is used, change the cable of these connections.

4.7 Connection of terminal resistor (With CC-Link option)

Always connect terminal resistor supplied with the master module to the modules at both ends and between DA and DB.



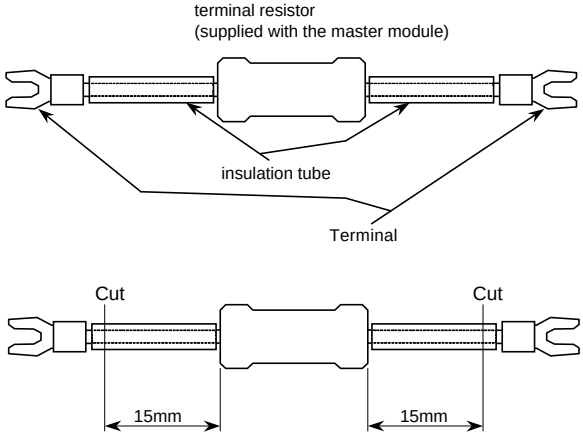
Terminal resistor shall be connected between DA and DB when MDU is end of line.
At this case,

MDU breaker mounting : Process terminal resistor which is supplied by the master module, in accordance with “modification”.

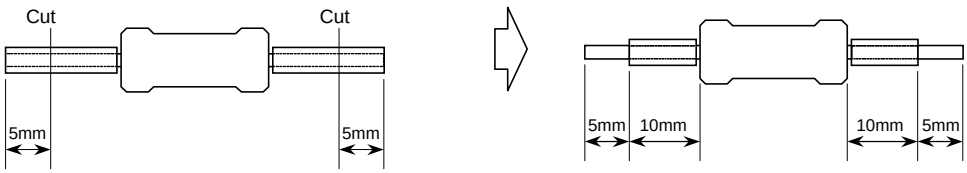
MDU panel mounting : Not need processing.

[Modification]

(1) Cut the both leads of terminal resistor with 15mm remained.



(2) 5mm both end of insulation tubes are cut.



⚠CAUTION

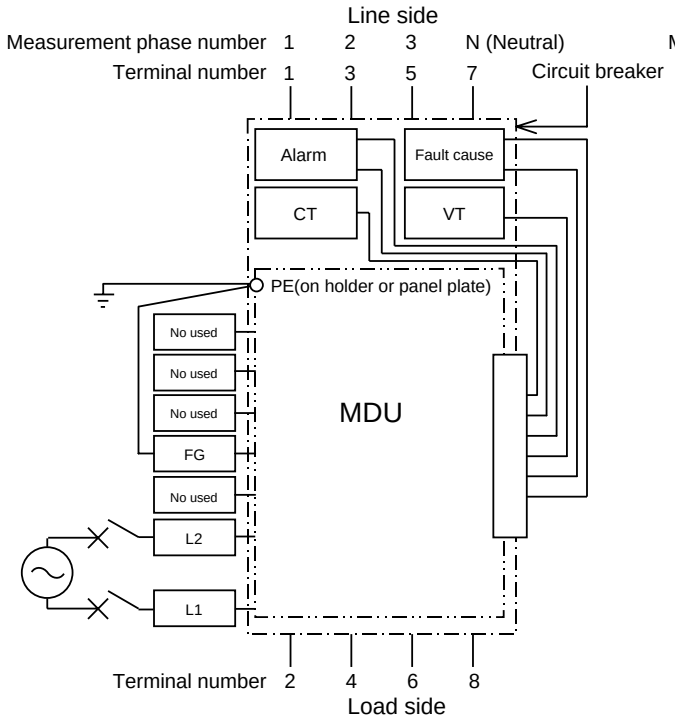
The terminal resistor value is different depends on the connected CC-Link shielded twisted pair cable.

Check the resistor value when it will be connected on the terminal DA-DB.

When wrong resistor is connected, CC-Link communication may not work correctly.

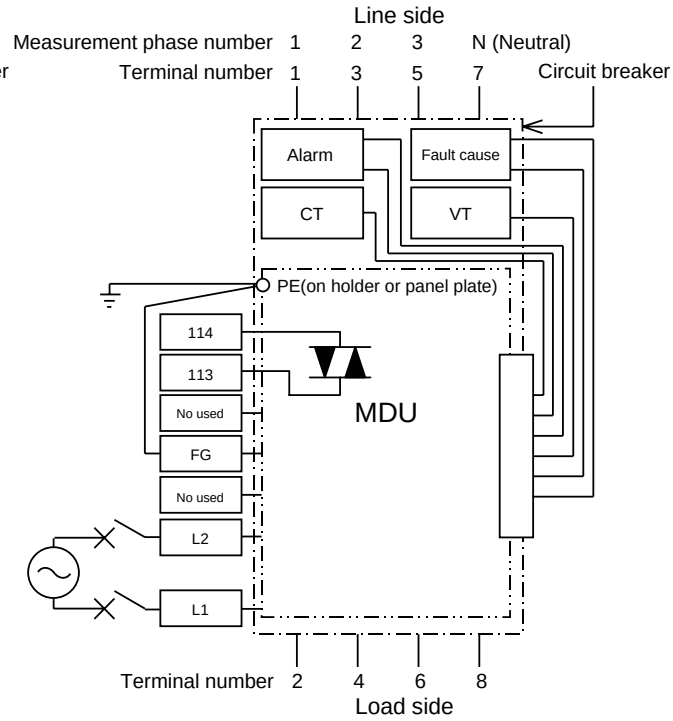
Please read the instruction manual included with the same package as master module, about resistor value.

4.8 External connection diagram



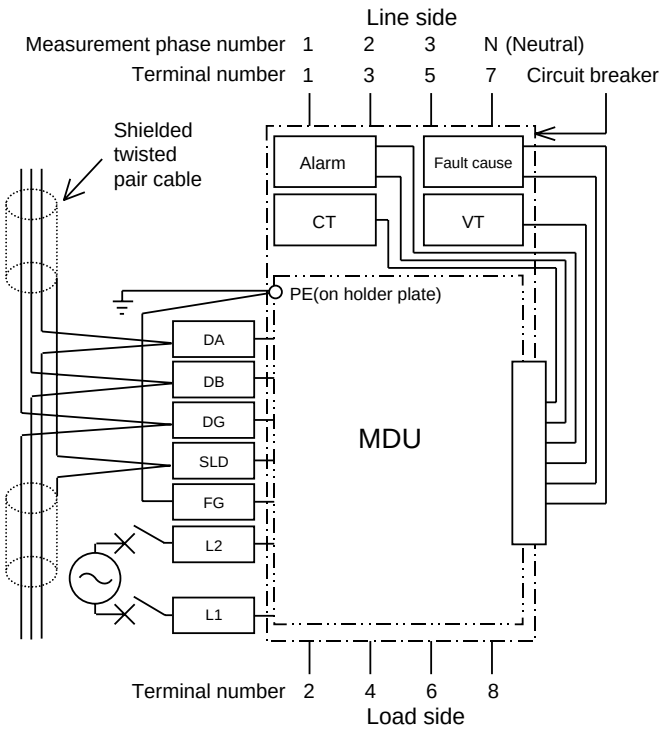
Note : L1 and L2 are no polarity.
Note : Neutral is only 4 poles breaker.

No transmission



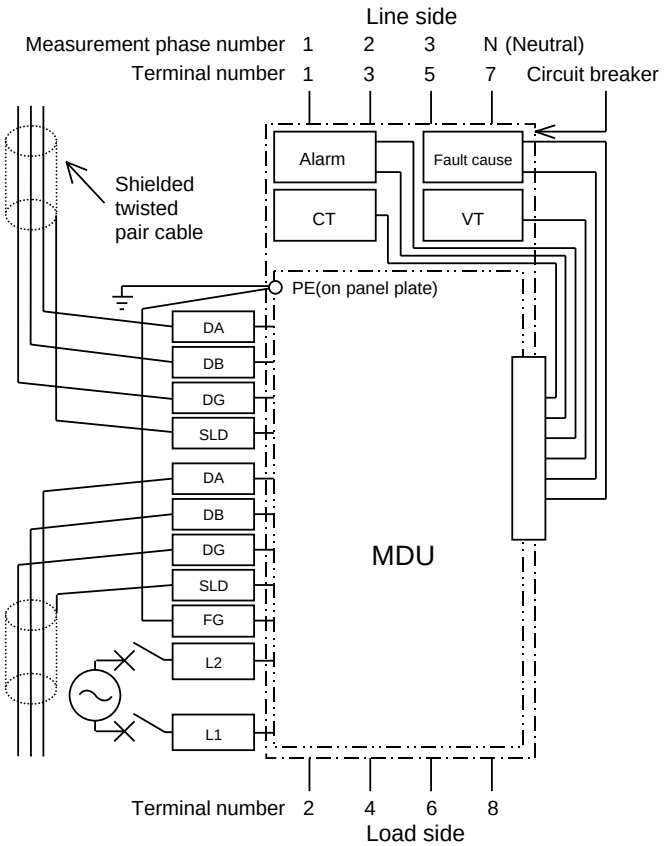
Note : L1 and L2 are no polarity.
Note : Neutral is only 4 poles breaker.

Electric energy accumulated pulse output



Note : L1 and L2 are no polarity.
Note : Neutral is only 4 poles breaker.
Note : When MDU is end of line,
connect terminal resistor between
DA and DB

CC-Link transmission
at MDU breaker mounting



Note : L1 and L2 are no polarity.
Note : Neutral is only 4 poles breaker.
Note : Shielded twisted pair cable connects to the both sets of the terminals.
(One set of the terminal is DA,DB,DG and SLD).
Do not connect by using one of pair terminal.
When MDU is end of line, then connect terminal resistor between
DA and DB

CC-Link transmission
at MDU breaker mounting

4.9 Detailed specifications of MDU

(1) Measurement, display and transmission items.

Measuring items (accuracy)(note3.) \ Function		MDU display	No transmission	Electric energy accumulated pulse output		CC-Link transmission			Remarks
			storage (note1.)	pulse output (note2.)	storage (note1.)	monitor	setting	storage (note1.)	
Load current (±2.5%)	Present value (I_1, I_2, I_3, I_N)	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
	Demand value (I_1, I_2, I_3, I_N)	○	—	—	—	○	—	—	Demand time : 0-15min. adjustable. (present value if set to 0 minute)
	Maximum demand value (max. phase) (note5.)	○	○	—	○	○	—	○	} Maximum demand value after latest reset.
	Occurrence time of demand max. value (y·m·d·h·m)	—	—	—	—	○	—	○	
Line voltage (±2.5%)	Present value (V_{1-2},V_{2-3},V_{3-1})	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
	Demand value (V_{1-2},V_{2-3},V_{3-1})	○	—	—	—	○	—	—	Demand time : 0-15min. adjustable. (the value is present value, if set to 0 minute)
	Maximum demand value (max. phase) (note5.)	○	○	—	○	○	—	○	} Maximum demand value after latest reset.
	Occurrence time of demand max. value (y·m·d·h·m)	—	—	—	—	○	—	○	
Harmonics current (±2.5%)	Present value of 3rd,5th and 7th harmonic (I_1, I_2, I_3, I_N)	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
	Maximum value of 3rd,5th and 7th harmonic (max. phase) (note5.)	○	○	—	○	○	—	○	} Maximum value after latest reset.(not demand value)
	Occurrence time of max value (y·m·d·h·m)	—	—	—	—	○	—	○	
	Present value of total harmonics (I_1, I_2, I_3, I_N)	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
	Demand value of total harmonics (I_1, I_2, I_3, I_N)	○	—	—	—	○	—	—	Demand time : 0-15min. adjustable. (present value if set to 0 minute)
	Maximum demand value (max. phase)(note5.)	○	○	—	○	○	—	○	} Maximum demand value after latest reset.
	Occurrence time of demand max. value (y·m·d·h·m)	—	—	—	—	○	—	○	
Electric power (±2.5%)	Present value (reverse electric power can be measured)	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
	Demand value (reverse electric power can be measured)	○	—	—	—	○	—	—	Demand time : 0-15min. adjustable. (present value if set to 0 minute)
	Maximum demand value (note6.)	○	○	—	○	○	—	○	} Maximum demand value after latest reset.
	Occurrence time of demand max. value (y·m·d·h·m)	—	—	—	—	○	—	○	
Electric energy (±2.5%)	Electric energy (note6.)(note7.)	○ 6digit	○ 6digit	○	○ 6digit	○ 6digit	—	○ 6digit	Accumulated value after the latest reset
	Electric energy (hourly value) (note6.)	○	—	—	—	○	—	—	Hourly accumulated value
	Maximum electric energy (hourly value) (note6.)	○	○	—	○	○	—	○	} Maximum value after latest reset.
	Occurrence time of max. value (y·m·d·h·m)	—	—	—	—	○	—	○	
Fault current Fault cause	Fault current (±15%)	○	○	—	○	○	—	○	Newest fault current and cause after the latest reset.
	Fault cause	○	○	—	○	○	—	○	(Occurrence is monitored at 1ms cycle.)
Power factor (±5%)	Present value	○	—	—	—	○	—	—	R.M.S. value of 4cycles samplings. (note4.)
Memory clear Reset	Fault cause reset	○	—	—	—	—	○	—	
	Memory clear of Maximum demand value and Occurrence time of max. value (y·m·d·h·m)	○	—	—	—	—	○	—	
	Memory clear of electric energy	○	—	—	—	—	○	—	
	Alarm reset	○	—	—	—	—	○	—	
Alarm	PAL, OVER (note8.)	○ (LED ON)	—	—	—	○	—	—	OVER is not transmission
Setup	Clock	○	○	—	○	○	○	○	Requires initial setup and re-setup after a power failure. (not guaranteed against a power failure.)
	Demand time (note9.)	○	○	—	○	○	○	○	Default setup is 2minutes. Adjustable at 1-minute step. Range is between 0-15 minutes.
	Pulse output unit	○	—	—	○	—	—	—	No indication, then default setup is [1kWh/imp]
	Alarm hold (self-holding, auto reset)	○	○	—	○	○	○	○	No indication, then default setup is With PAL or TI option : self-holding No option : auto-reset

⚠CAUTION

Note1.Data storage to EEPROM takes place as below :
Electric energy : at the power failure and every 2 hours
Fault current/cause : at the fault occurrence
Demand time, pulse output unit and alarm hold : at the setup
Maximum demand value and maximum harmonic current : at every 2 hours

Note2.Pulse is outputted, when electric energy accumulated setup unit. Adjustable at 1kWh, 10kWh, 100kWh, 1000kWh or 10000kWh.
Pulse output is able to count by PLC, etc.

Note3.The accuracy of load current and line voltage is percentage toward the measuring ratings.
Ex.NF400-SEPM,
rating measuring load current is 400A, the accuracy is ±10A,
rating measuring line voltage is 440V, the accuracy is ±11V.
When measurement value of load current or line voltage is less than and including accuracy, the value is cut off and MDU displays “0”.
The accuracy of power factor is rate to 90° (electrical angle).
The value of power factor is reference value if less than 50%.

Note4.Sampling for measurement takes place once every 2 seconds in 4 cycles of 50/60Hz, and the measured values are used to calculation of the present values, and the values are updated.
A demand value is obtained by averaging out the present values measured at 2 seconds cycle at the preset demand time.
For machines, which undergo interrupted continuous load, such as resistance welder, special care should be exercised for these values.

Note5.A max. phase means the phase measured maximum value among all phases.

Note6.Reverse electric power or energy is not measured.

Note7.Data of electric energy is 6 digits (up to 999999kWh), and others are 3 digits.

Note8.LEDs on MDU are displayed,
Alarm hold setting is [Auto reset] : automatic reset,
Alarm hold setting is [Self-holding] : self-holding, alarm is reset by pushing alarm reset switch.

Note9.Demand time cannot be set independently. It becomes common setup.

(2) Measured value display and the range displayed

Item	Type	Rated current	Range displayed	Display
Load current	NF400-SEPM/HEPM	200~400A	0~800A 800A over	0~800A is displayed (less than 10A, "0A" is displayed) 800A is displayed
	NF630-SEPM/HEPM	300~630A	0~999A 1000A~1260A 1260A over	0~999A is displayed (less than 15.7A, "0A" is displayed) 1.00~1.26kA is displayed 1.26kA is displayed
	NF800-SEPM/HEPM	400~800A	0~999A 1000A~1600A 1600A over	0~999A is displayed (less than 20A, "0A" is displayed) 1.00~1.60kA is displayed 1.60kA is displayed
Line voltage	NF400-SEPM/HEPM NF630-SEPM/HEPM NF800-SEPM/HEPM	Common	0~690V 690V over	0~690V is displayed (less than 10V, "0V" is displayed) 690V is displayed
Harmonic current	NF400-SEPM/HEPM	200~400A	0~400A 400A over	0~400A is displayed (less than 10A, "0A" is displayed) 400A is displayed
	NF630-SEPM/HEPM	300~630A	0~630A 630A over	0~630A is displayed (less than 15.7A, "0A" is displayed) 630A is displayed
	NF800-SEPM/HEPM	400~800A	0~800A 800A over	0~800A is displayed (less than 20A, "0A" is displayed) 800A is displayed
Electric power	NF400-SEPM/HEPM	200~400A	–478kW over –478~–100kW –99.9~0kW 0~99.9kW 100~478kW 478kW over	–478kW is displayed –478~–100kW is displayed –99.9~0kW is displayed (less than –0.5kW, "0kW" is displayed) 0~99.9kW is displayed (less than 0.5kW, "0kW" is displayed) 100~478kW is displayed 478kW is displayed
	NF630-SEPM/HEPM	300~630A	–753kW over –753~–100kW –99.9~0kW 0~99.9kW 100~753kW 753kW over	–753kW is displayed –753~–100kW is displayed –99.9~0kW is displayed (less than –0.8kW, "0kW" is displayed) 0~99.9kW is displayed (less than 0.8kW, "0kW" is displayed) 100~753kW is displayed 753kW is displayed
	NF800-SEPM/HEPM	400~800A	–956kW over –956~–100kW –99.9~0kW 0~99.9kW 100~956kW 956kW over	–956kW is displayed –956~–100kW is displayed –99.9~0kW is displayed (less than –1.0kW, "0kW" is displayed) 0~99.9kW is displayed (less than 1.0kW, "0kW" is displayed) 100~956kW is displayed 956kW is displayed
Electric energy	Common	Common	0~999999kWh	0~999999kWh (When 999999kWh over, then return to 0kWh and continuously accumulated)
Electric energy (hourly value)	NF400-SEPM/HEPM	200~400A	0~478kWh	0~478kWh is displayed
	NF630-SEPM/HEPM	300~630A	0~717kWh	0~717kWh is displayed
	NF800-SEPM/HEPM	400~800A	0~956kWh	0~956kWh is displayed
Fault current	NF400-SEPM/HEPM	200~400A	0~999A 1000A~6400A 6400A over	0~999A is displayed 1.00~6.4kA is displayed 6.4kA is displayed
	NF630-SEPM/HEPM	300~630A	0~999A 1000A~9600A 9600A over	0~999A is displayed 1.00~9.6kA is displayed 9.6kA is displayed
	NF800-SEPM/HEPM	400~800A	0~999A 1000A~9990A 10000A~12800A 12800A over	0~999A is displayed 1.00~9.99kA is displayed 10.0~12.8kA is displayed 12.8kA is displayed
Power factor	Common	Common	lag 0~100~lead 0%	0~100~0% (lead is displayed "–"(minus))

(3) Note of measurement

① Load current measuring

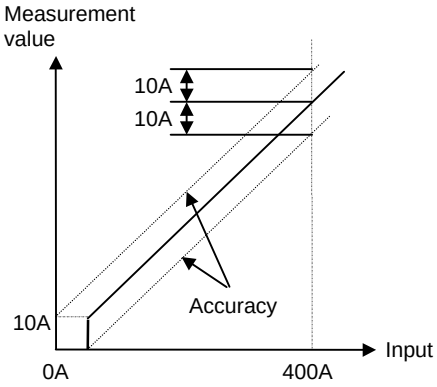
The accuracy of load current measuring is ±2.5% of measuring rated current.

In case of NF400-SEPM, the accuracy is equal to 400A × ±2.5%=±10A.

That means ±10A is allowed as tolerance through 0 to 400A.

And when the measured value is less than 2.5% of measuring rated current, displayed value is shown 0 by cut off.

When the measured value is higher than the measuring rated current or rated voltage, the accuracy is ±2.5% of the measured value.



② Demand value

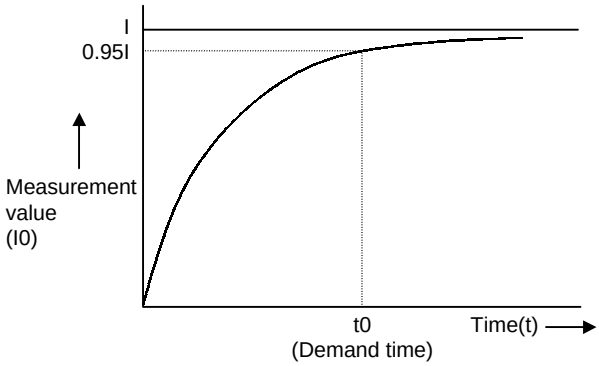
Demand value is approx. mean value of demand time.

Demand time (t0) is the time which show 95% of I, while the current I is carried continuously.

When the demand value shows (I), three times of (t0) constant current flow is required.

When the demand value is measured, the measured value is not influenced by short time load fluctuation or blinking.

It shows approx. mean value by demand time.

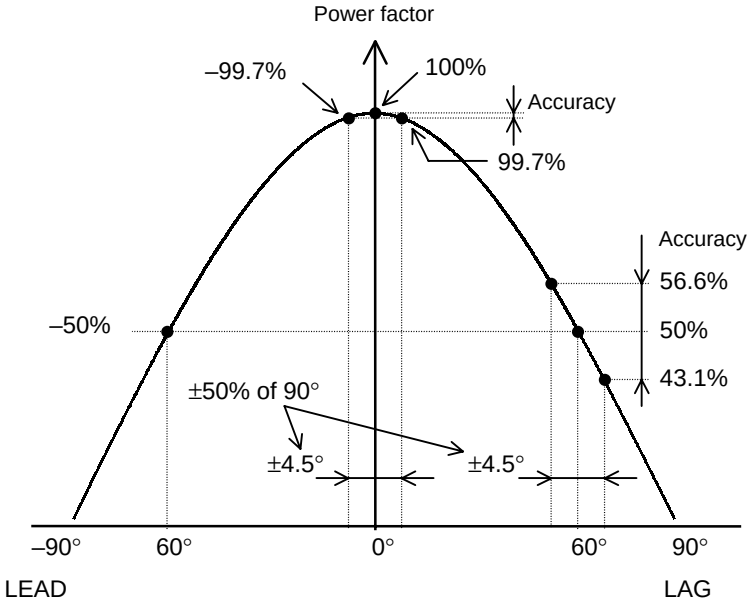


③ Power factor measuring

The accuracy of power factor measuring is ±5% of 90°(electrical angle).

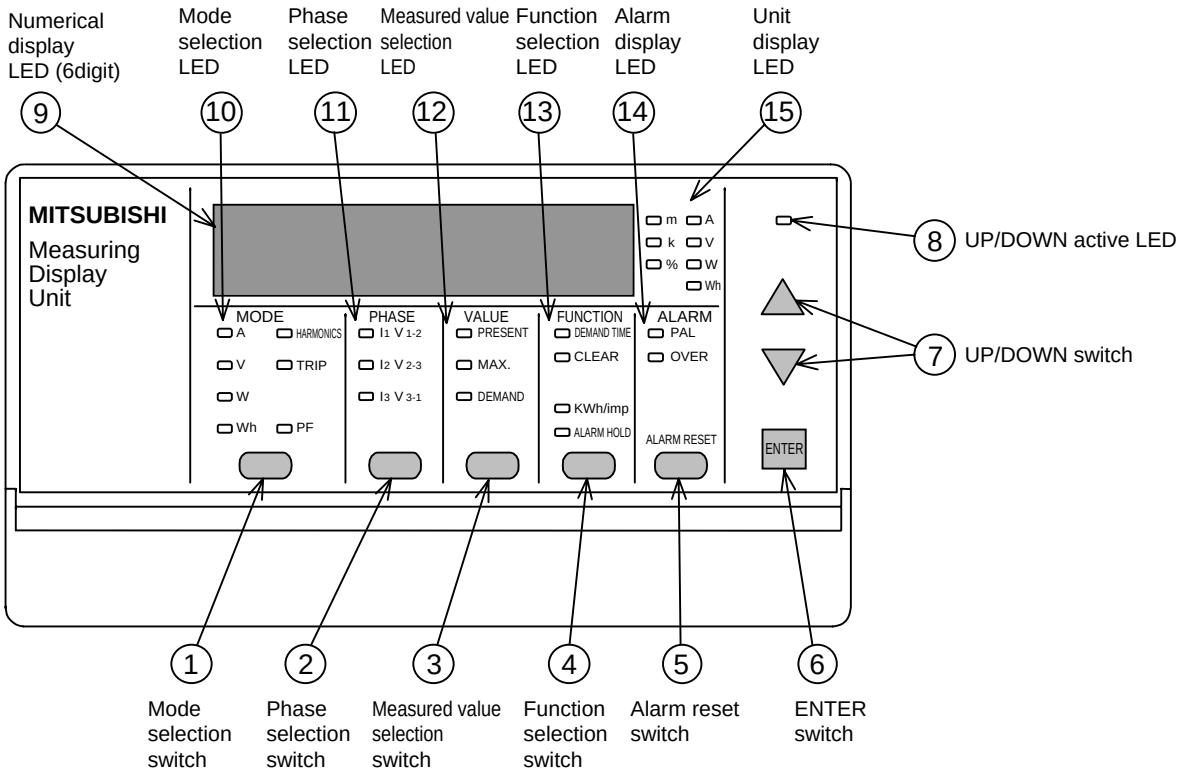
It means the accuracy of power factor is approximate ±0.3% (LEAD 99.7% - LAG99.7%) at 100%.

And the accuracy of power factor is approximate ±7% (43.1% - 56.6%) at LEAD50% or LAG50%.



4.10 Operation of MDU

Displayed items and functions are changed by pushing ①~④ switch.
Selected item is shown by LED (below ⑩ - ⑬).
(Ex. Phase selection $I_1 \rightarrow I_2 \rightarrow I_3 \rightarrow I_N \rightarrow I_1$...)
UP/DOWN switch⑦ is active when adjustment or reset operation is required.
(UP/DOWN active LED⑧ is turned on)
There may be functions which cannot be operated depending upon the specifications.
The invalid function is skipped.



4.11 Operation of measurement and display mode selection

(1) Load current
- Push ①(Mode selection switch). Select the [A] LED.
- Push ③(Measured value selection switch). Select the measurement value.
  Present value ⋯Select the [PRESENT] LED.
  Demand value ⋯Select the [PRESENT] and [DEMAND] LED.
  Maximum demand value ⋯Select the [MAX.] and [DEMAND] LED.
- Push ②(Phase selection switch). Select the phase. (Except for maximum demand value.)

(2) Line voltage
- Push ①(Mode selection switch). Select the [V] LED.
- Push ③(Measured value selection switch). Select the measurement value.
  (The same operation of load current.)
- Push ②(Phase selection switch). Select the phase. (Except for maximum demand value.)

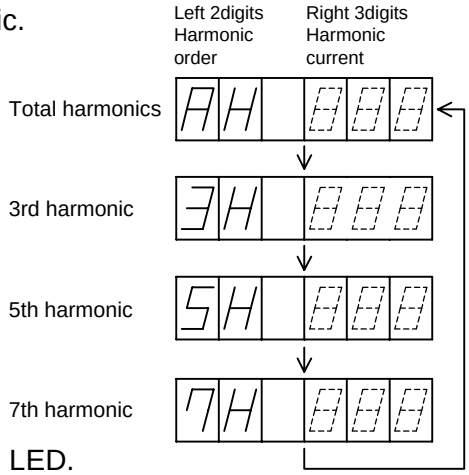
(3) Electric power
- Push ①(Mode selection switch). Select the [W] LED.
- Push ③(Measured value selection switch). Select the measurement value.
  (The same operation of load current.)

(4) Electric energy
- Push ①(Mode selection switch). Select the [Wh] LED.
- Push ③(Measured value selection switch). Select the measurement value.
  Electric energy ⋯Select the [PRESENT] LED.
  Electric energy (hourly value) ⋯Select the [PRESENT] and [DEMAND] LED.
  Maximum electric energy (hourly value) ⋯Select the [MAX.] and [DEMAND] LED.

(5) Harmonic current

• Push ①(Mode selection switch). Select the [HARMONICS] LED.

• Push ⑦(UP/DOWN switch). Select the order of the harmonic.
(Harmonic order is displayed numerical display at LED⑨ of left 2 digit. See the right figure.)



• Push ③(Measured value selection switch).

• Select the measurement value.

(a) 3rd, 5th, 7th harmonic

Present value ⋯ Select the [PRESENT] LED.

Maximum value ⋯ Select the [MAX.] LED.

(b) Total harmonics

Present value ⋯ Select the [PRESENT] LED.

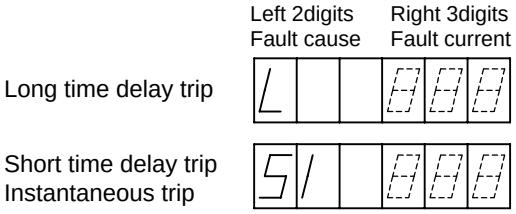
Demand value ⋯ Select the [PRESENT] and [DEMAND] LED.

Maximum demand value ⋯ Select the [MAX] and [DEMAND] LED.

• Push ②(Phase selection switch). Select the phase.
(Except for maximum demand value.)

(6) Fault current/cause

• Push ①(Mode selection switch). Select the [TRIP] LED.
(Newest fault current and cause after latest reset are displayed numerical display LED⑨. See the under figure)



When the circuit breaker was tripped, fault current and cause are displayed at numerical display LED⑨ with flashing.

Push one of the ① - ⑧ switches, the display mode is returned before tripping.

(7) Power factor

• Push ①(Mode selection switch). Select the [PF] LED.

4.12 Operation of alarm reset

When the circuit breaker outputted pre-alarm(PAL), [PAL] LED at ⑭(Alarm display LED) is turned on, and alarm contact is outputted if equipped with PAL or TI option.
When the setup of “ALARM HOLD” is [Self-holding], LED and contact output are holding, and those are reset by pushing ⑤(Alarm reset switch).
When the setup of “ALARM HOLD” is [Auto-reset], ⑤(Alarm reset switch) is invalid.

When the circuit breaker outputted over current alarm(OVER), [OVER] LED at ⑭(Alarm display LED) is turned on.
[OVER] LED is automatic reset in any setup of "ALARM HOLD".
Function of alarm is shown this table.

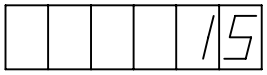
Alarm	Function
Pre alarm (PAL)	When the circuit breaker outputted pre-alarm, [PAL] LED on the MDU is turned on. And alarm contact is outputted if equipped with PAL or TI option.
Over current alarm (OVER)	When the circuit breaker outputted OVER, [OVER] LED on the MDU is turned on.

4.13 Operation of function mode selection

(1) Demand time

- Push ④(Function selection switch). Select [DEMAND TIME] LED.
- Push ⑦(UP/DOWN switch). Set the demand time. (Adjustable at 1-minute step. Range is between 0 - 15 minutes)
- Push ⑥(ENTER switch) to be set.

Right 2digit
Demand time

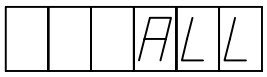


Ex. Display of numerical display LED at demand time is 15min

(2) Memory clear

- Push ④(Function selection switch). Select [CLEAR] LED.
- Push ⑦(UP/DOWN switch). Select the data to clear.
  The data is shifted in the shown turn.
  If the date is [ALL], it means all of data in storage (except for electric energy), then display [ALL] at ⑨(Numerical display LED) with flashing.
  In the case of others, the same LED of measurement and display mode with flashing.

ALL (except for electric energy)
↓
Load current of maximum demand value
↓
Line voltage of maximum demand value
↓
Total harmonics current of maximum demand value
↓
3rd harmonic current of maximum value
↓
5th harmonic current of maximum value
↓
7th harmonic current of maximum value
↓
Electric power of maximum demand value
↓
Time electric energy of maximum value
↓
Fault current/cause (with contact output reset)note
↓
Electric energy
↓
(back to ALL)



Ex. Display of numerical display LED at data is「ALL」

Note. OAL contact output if eqquipped with TI option is reseted this operation.

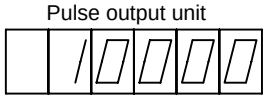
- Push ⑥(ENTER switch) to be cleared.
  In the case of the data which is electric energy, push ①(Mode selection switch) and ⑥(ENTER switch) at the same time.

(3) Pulse output unit

- Push ④(Function selection switch). Select [kWh/imp] LED.
- Push ⑦(UP/DOWN switch). Set the unit.
  The unit is shifted under turns.

1kWh/imp
↓
10kWh/imp
↓
100kWh/imp
↓
1000kWh/imp
↓
10000kWh/imp
↓
(back to 1kWh/imp)

Right 5digit
Pulse output unit



Ex. Display of numerical display LED at unit is「10000kWh/imp」

- Push ⑥(ENTER switch) to be set.

When electric energy accumulated setup unit, pulse is outputted.
Pulse output is able to count by PLC etc.
Pulse is outputted, 0, 1 or 2 times every 2seconds.
If output is 2 times, time of between pulse is minimum 0.35s.
Specifications of pulse output, see the right table.

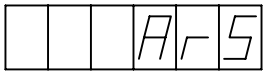
Output device	Solid state relay(SSR), non-voltage contact a (terminals of 113,114)
Contact capacity	AC100-200V/DC24V 20mA
Pulse output unit	1, 10, 100, 1000 or 10000kWh/imp (Adjustable)
Pulse width	0.35~0.45sec
Maximum distance	100m

(4) Alarm hold

- Push ④(Function selection switch). Select [ALARM HOLD] LED.
- Push ⑦(UP/DOWN switch). Select the self-holding or auto reset.
- Push ⑥(ENTER switch).

Self-holding

Auto reset

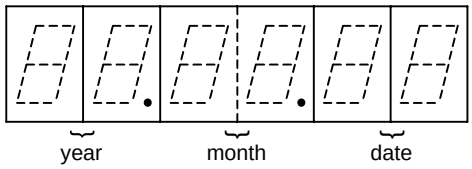


4.14 Operation of the other setups

(1) Clock setup

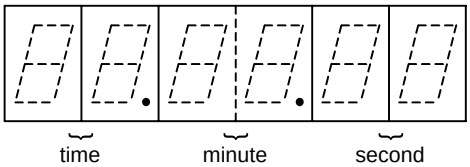
- Push ①(Mode selection switch) and ③(Measured value selection switch) at the same time. Go to the date setup mode.
- Use the switch and shift the flashing LED, to change the date.
  ①(Mode selection switch) : for left shift (←)
  ②(Phase selection switch) : for right shift (→)
- Push ⑦(UP/DOWN switch). Select the values.

Date setup mode



- After date setting, push ⑥(ENTER switch). Shift the time setup mode.

Time setting mode



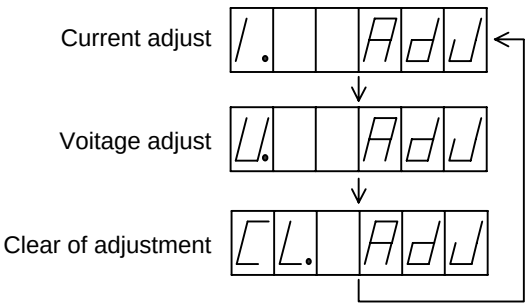
- Use the switch and shift the blinking LED to be changed.
  ①(Mode selection switch) : for left shift (←)
  ②(Phase selection switch) : for right shift (→)
- Push ⑦(UP/DOWN switch). Select the values.
- After date setup, push ⑥(ENTER switch).

  Note. If setting date or times are not effective, then those are corrected.
  Ex.00.13.20 → 00.12.20

  Note. At time setup mode, if push ③(Measured value selection switch), then stop the time setup mode with no change the time.

(2) Zero adjustment mode

- Push ②(Phase selection switch) and ③(Measured value selection switch) at the same time. Go to the zero adjustment mode.
- Push ⑦(UP/DOWN switch). Select the item.



- Push ⑥(ENTER switch).

[Note of function mode selection with switch operation]

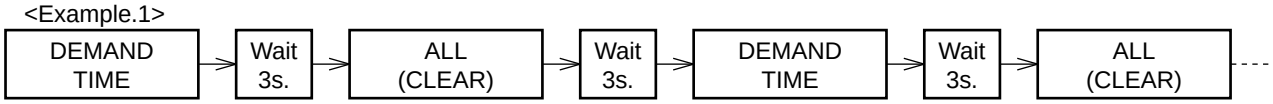
Function mode selection with switch operation makes setup or clear possible (function is shown below).
Select the function by pushing the function mode selection switch, select the value by pushing UP/DOWN switch and pushing ENTER switch.
The data of EEPROM is rewritten or cleared.

Function	Description
DEMAND TIME	Variable at 1-minute step between 0-15 minutes. Demand time cannot be set independently but set in common. Present value if set to 0 minute.
CLEAR	Clears the stored data of electric energy, maximum demand value, fault current/cause, etc, or resets OAL contact output.
kWh/imp(note.)	Selects the unit of electric energy accumulated pulse output, 1, 10, 100, 1000, 10000kWh/imp.
ALARM HOLD	Selects the function of alarm LED (PAL) and contact output (PAL), self-holding or auto reset. (OVER LED is auto reset at any preset of alarm hold.)

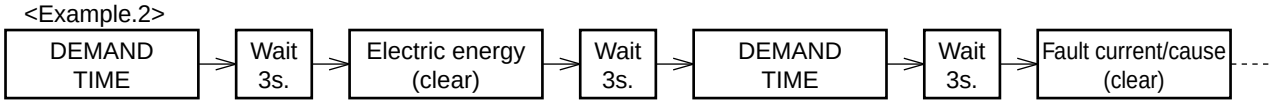
Note. Pulse output unit is attached with electric energy accumulated pulse output option.

To rewrite and clear EEPROM needs a little bit time.
When some operations were done without time interval, it may not be accepted.
Therefore open 3 seconds and more intervals to each operations.

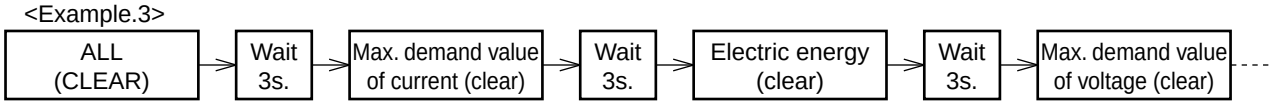
<Example.1>



<Example.2>



<Example.3>



[Note of setting by CC-Link transmission]

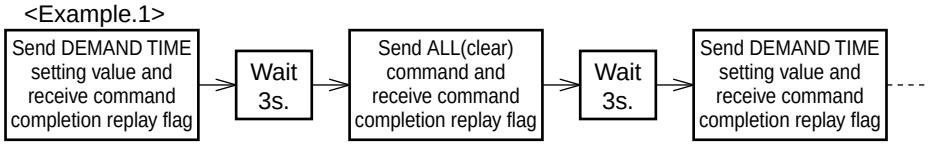
CC-Link transmission makes setup or clear possible by transmission command.
Send the command as shown below, thereupon the data of EEPROM is rewritten or cleared.

Function	Command name	Command code	Cannel number	Setting(note.)
CLEAR	Bit set/reset	9Eh	—	Set the command execution request flag to ON.
DEMAND TIME	Byte data set	C0h	20h	0-15[minutes](0000H-000FH). 1[minutes] unit
ALARM HOLD	Byte data set	C0h	24h	0000H : Auto reset, 0001H : Self-holding

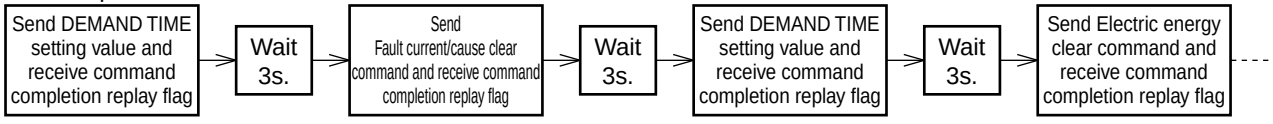
Note. Read carefully [MDU Beaker programming manual (CC-Link)] for further details.

To rewrite and clear EEPROM needs a little bit time.
When some commands or setting values send without time interval, it may not be accepted.
Therefore send at intervals of over 3 seconds each sending.

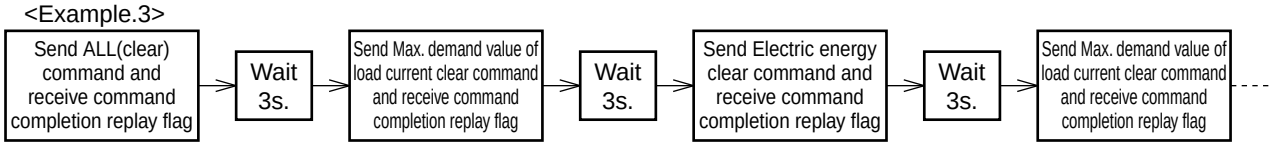
<Example.1>



<Example.2>

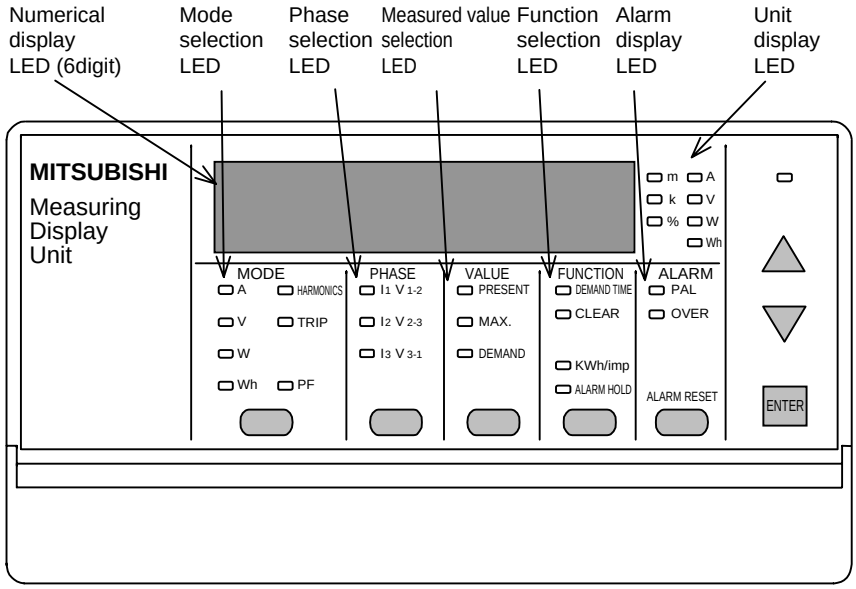


<Example.3>



4.15 MDU operation modes and displays

Following measured values is displayed according to the operation mode.



(❋, ❋ : either one of the LEDs, ❋&❋ : both LEDs, - : OFF)

Operation mode \ LEDs		Mode selection LED	Phase selection LED(note1.)	Measured value selection LED	Function selection LED	Numerical display LED(6digit) (note2.)						Unit display LED	Remarks
Load current	Present value of each phase	A	I_1, I_2, I_3, I_N	PRESENT	—				＊	＊	＊	A, kA	
	Demand value of each phase	A	I_1, I_2, I_3, I_N	PRESENT&DEMAND	—				＊	＊	＊	A, kA	
	Maximum demand value (Max. phase)	A	—	MAX&DEMAND	—				＊	＊	＊	A, kA	
Line voltage	Present value of each phase	V	V_{1-2}, V_{2-3}, V_{3-1}	PRESENT	—				＊	＊	＊	V	
	Demand value of each phase	V	V_{1-2}, V_{2-3}, V_{3-1}	PRESENT&DEMAND	—				＊	＊	＊	V	
	Maximum demand value (Max. phase)	V	V_{1-2}, V_{2-3}, V_{3-1}	MAX&DEMAND	—				＊	＊	＊	V	
Harmonic current	Present value of each order (Order selected UP/DOWN swich)	HARMONICS	I_1, I_2, I_3, I_N	PRESENT	—	3	H		＊	＊	＊	A, kA	
						5	H		＊	＊	＊	A, kA	
						7	H		＊	＊	＊	A, kA	
	Maximum value of each order (Order selected UP/DOWN swich)	HARMONICS	—	MAX	—	3	H		＊	＊	＊	A, kA	
						5	H		＊	＊	＊	A, kA	
						7	H		＊	＊	＊	A, kA	
	Present value of total harmonics of each phase	HARMONICS	I_1, I_2, I_3, I_N	PRESENT	—	A	H		＊	＊	＊	A, kA	
	Demand value of total harmonics of each phase	HARMONICS	I_1, I_2, I_3, I_N	PRESENT&DEMAND	—	A	H		＊	＊	＊	A, kA	
	Maximum demand value (total value)	HARMONICS	—	MAX&DEMAND	—	A	H		＊	＊	＊	A, kA	
Electric power	Present value	W	—	PRESENT					＊	＊	＊	KW	
	Demand value	W	—	PRESENT&DEMAND	—				＊	＊	＊	KW	
	Maximum demand value	W	—	MAX&DEMAND					＊	＊	＊	KW	
Electric energy	Electric energy	Wh	—	PRESENT	—	＊	＊	＊	＊	＊	＊	KWh	
	Electric energy (hourly value)	Wh	—	PRESENT&DEMAND	—	＊	＊	＊	＊	＊	＊	KWh	
	Maximum electric energy (hourly value)	Wh	—	MAX&DEMAND	—	＊	＊	＊	＊	＊	＊	KWh	
Fault current	Fault curren/cause (L : Over cureent SI : Short-circuit)	TRIP	—	—	—	L			＊	＊	＊	A, kA	Current and cause of a fault which occurred after the last reset or those of the latest event.
						S	I		＊	＊	＊	A, kA	
Power factor	Present value	PF	—	PRESENT	—				＊	＊	＊	%	
Setups	Demand time	—	—	—	DEMAND TIME					＊	＊	—	Variable at 1-minute step. Ranges between 0-15 minutes.
	Pulse output unit	—	—	—	kWh/imp		＊	＊	＊	＊	＊	KWh	Pulse unit is 1,10,100,1000 or10000 kWh/imp
	Alarm hold (self-holding auto reset)	—	—	—	ALARM HOLD				S	H	d	—	Self-holding
									A	r	S	—	Auto reset
Memory clear	Specifies all items below (except for electric energy)	—	—	—	CLEAR	A	L	L				—	
	Maximum demand value of load current	A	—	MAX&DEMAND	—				＊	＊	＊	A, kA	
	Maximum demand value of line voltage	V	—	MAX&DEMAND	—				＊	＊	＊	V	
	Maximum demand value of total harmonics current	HARMONICS	—	MAX&DEMAND	—	A	H		＊	＊	＊	A, kA	
	Maximum value of each order harmonics current (Order selected UP/DOWN swich)	HARMONICS	—	MAX	—	3	H		＊	＊	＊	A, kA	
						5	H		＊	＊	＊	A, kA	
						7	H		＊	＊	＊	A, kA	
	Maximum demand value of electric power	W	—	MAX&DEMAND	—				＊	＊	＊	KW	
	Maximum value of time electric energy	Wh	—	MAX&DEMAND	—	＊	＊	＊	＊	＊	＊	KWh	
	Fault current/cause (L : Over current SI : Short-circuit)	TRIP	—	—	—	L			＊	＊	＊	A, kA	The latest event.
						S	I		＊	＊	＊	A, kA	
	Electric energy	Wh	—	PRESENT	—	＊	＊	＊	＊	＊	＊	KWh	

Note 1."N" is equipped on only 4 poles breaker.

Note 2."＊" is displayed the numerical value, blank is no display.

4.16 Normal service condition

⚠CAUTION

- Our circuit breakers of the standard specifications are to be used in the following standard conditions.
  ①Operating ambient temperature : -10 to 40ºC
  (Average temperature for 24 hours, however, shall not be higher than 35ºC.)
  ②Relative humidity : 85% max. with no dewing
  ③Altitude: 2,000 m maximum
  ④Environment conditions : Do not use and store in atmospheres with sulfide gas, ammonia gas etc.
  (H_2S≦0.01ppm.SO_2≦0.1ppm.NH_3≦ a few ppm.)
- Lowering ratio of operational current in special ambient temperature over 40ºC.
  50ºC.....0.9 times
  60ºC.....0.7 times
- Never use thinner, detergent, and other chemicals for cleaning.
  It is likely to make letters on the plate illegible or to lower insulation performance.
  Clean the breaker using air cleaner or by brushing.

4.17 Measurement of insulation resistance and withstand voltage test

⚠CAUTION

- VT is connected between the poles on the load side of the circuit breaker.
  ①Measurement of insulation resistance
  A 1000 volt insulation resistance tester cannot be used with △ marks in the table as below.
  A 500 volt insulation resistance tester shall be used, but measured resistance shows low resistance.
  ②Withstand voltage test
  Voltage shall not be applied at the portions with X marks in the table as below.

Measuring point/test			Measurement of Insulation resistance		Withstand voltage test		
State of handle			ON	OFF	ON	OFF	Test condition
Between live part and earth (except MDU terminal)			○	○	○	○	AC2500V 1min (In the case of these tests, Do not connect MDU terminal to live part or erath)
Between different poles	Line side	Between left and middle poles	△	○	×	○	
		Between middle and right poles	△	○	×	○	
		Between left and right poles	△	○	×	○	
		Between middle and neutral poles	△	○	×	○	
	Load side	Between left and middle poles	△	△	×	×	
		Between middle and right poles	△	△	×	×	
		Between left and right poles	△	△	×	×	
		Between middle and neutral poles	△	△	×	×	
Between line and load terminal			—	○	—	○	
Between main circuit and MDU terminal (L1, L2)			○	○	○	○	AC2500V 1min (Note1.)
Between main circuit and MDU terminal (113, 114, FG) (With electric energy accumulated pulse output option)			○	○	○	○	
Between main circuit and MDU terminal (DA, DB, DG, SLD, FG) (With CC-Link option)			○	○	○	○	
Between MDU terminal (L1, L2) and MDU terminal (FG)			○	○	○	○	AC1500V 1min (Note2.)
Between MDU terminal (L1, L2) and MDU terminal (113, 114, FG) (With electric energy accumulated pulse output option)			○	○	○	○	
Between MDU terminal (L1, L2) and MDU terminal (DA, DB, DG, SLD, FG) (With CC-Link option)(Note3.)			○	○	○	○	

Note1. Connect MDU terminal (L1, L2, 113, 114, DA, DB, DG, SLD and FG) to the earth side.

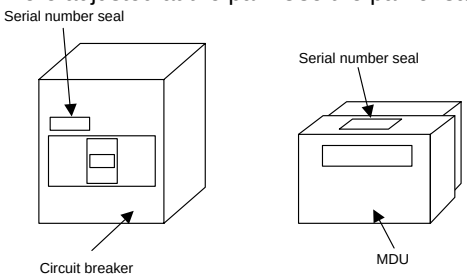
Note2. Connect MDU terminal (113, 114, DA, DB, DG, SLD and FG) to the earth side.

Note3. Do not test between MDU terminal (DA, DB, DG and SLD) and MDU terminal (FG).

4.18 Connections and installation

⚠CAUTION

- Do not connect in reverse.
- The circuit breaker and MDU were adjusted at the pair. Use the pair of same serial number.



If the pair of different serial number was used, the accuracy is not guaranteed.
Do not pull the cable which connects MDU and the circuit breaker over 15N. The cable may come off.

- When the trouble occurred, repair is performed pairing MDU and the circuit breaker.
- The cable which connects MDU and the circuit breaker, shall be kept the distance longer than 10cm from the heavy current circuit. Fix the cable tightly near the connector to avoid the stress to the connector.
- The connector from the circuit breaker is insulated from inside of the circuit breaker.
  The breaker usually works even if the cable is not connected with MDU.
  But connect the cable early and correctly, because it may become cause of missing measuring.
- Supply the control power to L1 and L2 of MDU terminal. Fuses or MCCB shall be installed in control power circuit.
  Do not supply the control power of MDU from the main circuit.
- For function of alarm LED (PAL, OVER) on MDU and contact output (PAL, OAL), MDU and the circuit breaker must be connected with the mutuality and the control power must be supplied to MDU and alarm contact output module.
- When MDU is used in 1 phase 2 wire, the connection is shown in figure 1.
  The load side of phase No.1 is live part. It needs insulation processing.
  Use the measurement data of I2, I3 and V2-3. Ignore the measurement data of I1, V1-3 and V3-1.
- When MDU is used in 1 phase 3 wire, the connection is shown in figure 2.
  The neutral wire connects to phase No.2 of MDU.
  If connect the neutral wire to phase No.1 or phase No.3 of MDU, then the measurement is not guaranteed.

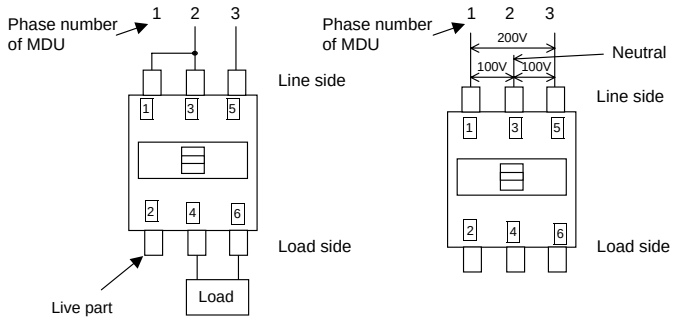


Fig1. Connection of using in 1 phase 2wire. Fig2. Connection of using in 1 phase 3wire.

⚠CAUTION

- The size of wiring MDU is sown as below.

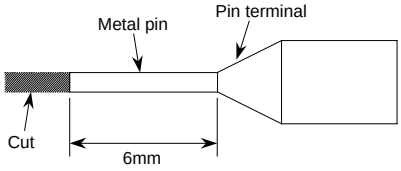
	Single core	Twisted core
In case of single connection	0.45-1.2mm^2	0.14-1.5mm^2
In case of double connection	0.45-0.8mm^2	0.14-75mm^2

- Tighten the terminal screws with following tightening torque.

Tightening torque	0.5 - 0.6 N·m
Tool minus head screw driver	Bit size Thickness 0.6mm Width 3.5mm
Wire strip length	6mm

- The finish of the wire
  In case of single core wire, it can be connected directly to the terminals.
  In case of twisted core wire, strip the insulation and twist copper wires. Then it can be connected directly to the terminals. Takes care the short circuit by wiring. The solder plating is not allowed.

Following compression pin terminal is recommended.
Manufacturer : Phenix contact
Cross section of wiring 0.25mm^2:AI 0.25-6 YE (Catalog NO. 3200179)
Cross section of wiring 0.5mm^2:AI 0.5-6 WH(Catalog NO.3200687)
Terminal for 2 wires 0.5mm^2 × 2:AI-TWIN 2 × 0.5-8 WH(Catalog NO.3200933)



Please contact to the manufacturer as for further details.
However the length of pin terminal (compression) is longer than 6mm, cut the metal pin as follows.

[Note of MDU with electric energy accumulated pulse output option]

⚠CAUTION

- Output line shall be kept the distance longer than 10cm from the heavy current circuit. And maximum wiring distance is less than and including 100m.
- In the case of pulse output connects to the AC, please pay attention to malfunction of receiver by leakage current by earth capacitance or mutual capacitance between wires.

[Note of MDU with CC-Link transmission option]

⚠CAUTION

- Make sure to connect DA, DB, DG and SLD terminals on MDU to CC-Link line with shielded twisted pair cable.
  When the lived wires are connected to CC-Link terminals, by mistake, it may occur electric shock or fire. Because CC-Link terminals use only low voltage signals.
- The shielded twisted pair cable of CC-Link line shall be kept the distance longer than 10cm from the heavy current circuit.
  However, it shall be kept the distance longer than 30cm from the heavy current circuit when parallel installation with the heavy current circuit is required.

4.19 Installation in the panel board (EMC directive)

Following EMC tests are required with IEC60947-2,

(1) Radiated radio frequency emission.
(2) Radiated radio frequency electromagnetic field immunity.

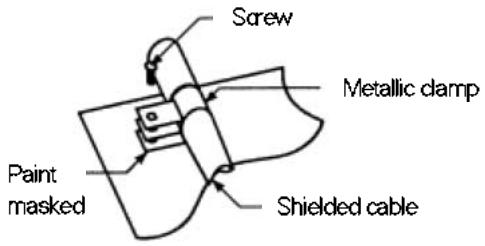
MDU shall be installed in the panel board. It effects not only for safe against electric shock but also to interrupt noise emission from MDU is confirmed in accordance with following conditions.

Condition 1: (Power distribution board, control panel board)

(1) Power distribution board or control panel board shall be made of conductive materials.
(2) Electrical contact impedance of screwed area between top/bottom plates and enclosure shall be as low as possible with paint removing.
(3) Internal plate of power distribution board or control panel board shall be also paint removed to reduce the electrical contact impedance around screwed area.
(4) Power distribution board or control panel board shall be grounded to the earth with a large cable.

Condition 2: (Power line and grounded line)

(1) Connect FG terminal of MDU to PE terminal of MDU (panel) holder plate.
Make the earthing point (to be grounded to the earth) near MDU.
PE terminal shall be grounded to this point with as short wire as possible.
PE terminal effects to reduce the noise of MDU and to shut down the external noise.
The grounded wire impedance shall be low.
(2) Shielded cable earthing
①When CC-Link cable or power supply cable of MDU are wired from the panel board, use the shielded cable and ground to the earth near the way out.
Secure earthing reduces electromagnetic induction and high frequency noise.
②Remove the paint around grounded area to reduce the electrical contact impedance.
Metallic clamp is recommended.



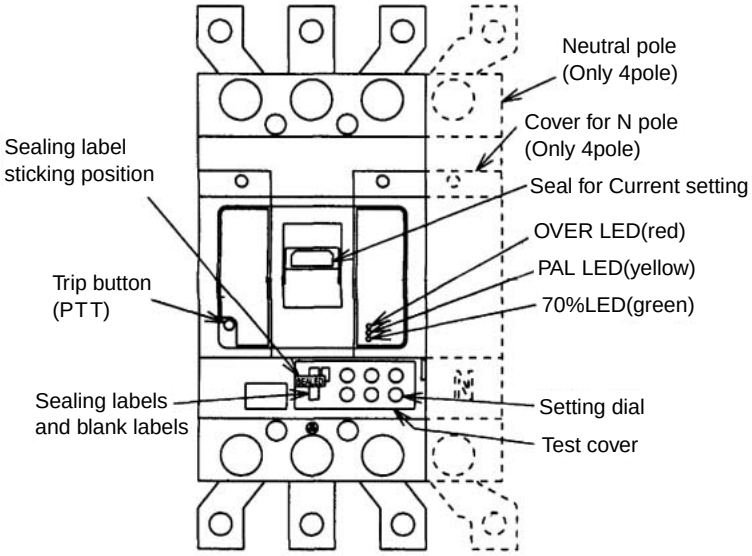
For further details, please read "MELSEC CPU user's manual" regarding to the wire and cable connection method to PLC.

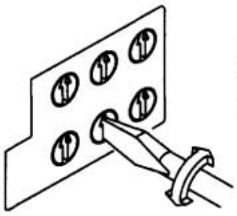
4.20 Installation of the circuit breaker

Setting method of the operating characteristics

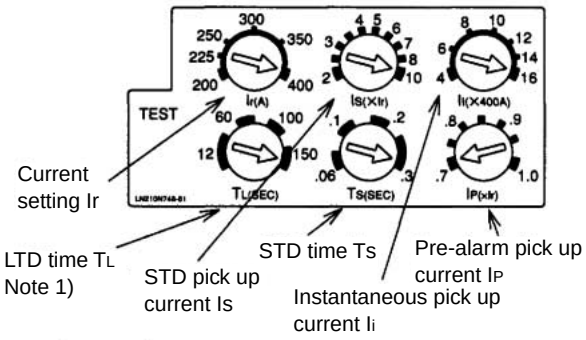
⚠CAUTION

Always make sure the circuit breaker is off or tripped when setting the operating characteristics.



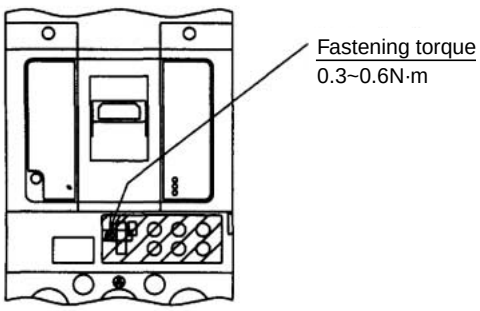


For setting, turn the arrow of each dial to the position desired



Step setting type:
LTD time T_L,
STD pick up current I_S,
STD time Ts,
Pre-alarm pick up current I_P
Continuously adjustable type:
Current setting Ir,
Instantaneous pick up current I_i

Note1) If the LTD time TL is set on "12sec", the LTD time may be shorter than the STD time.



(1) Take off the sealing label, if sticked.
(2) Loosen the test cover's screw and open the test cover.
(3) Set operating characteristics by turning the dials.
For turning the dials for chracteristic setting, use a screwdriver as illustrated at left.
① A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for the setting.
② At setting, refrain from applying force more than necessary as such can cause failues.
(Adequate operation torque is 0.05N·m maximum.)
③ Except for the dials of current setting Ir and instantaneous pick up current I_i keep the arrow of the setting dials within the range of the thick line of setting value.
* As for Is setting, a set value may advance to the next one in some cases
(4) The blank labels may be used for indication of the current setting Ir. Please fill in the blank label with oily ink, and stick the label to the top of the handle.
(5) Close the test cover and tighten the screw.
(6) Stick the sealing label, if it is necessary.

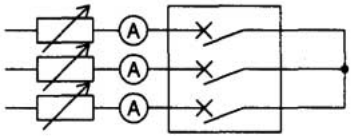
4.21 Testing of over current relay method

⚠CAUTION

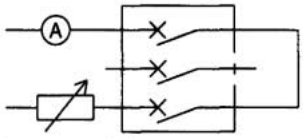
- For function of alarm LED (PAL, OVER) on MDU and contact output (PAL, OAL), MDU and the circuit breaker must be connected with the mutuality and the control power must be supplied to MDU and alarm contact output module.
- Can not test MDU by "Y-250". In this case, MDU displays "0A".
  But alarm LEDs of pre-alarm (PAL) and over current (OVER) on MDU are turned on.
  When the circuit breaker is tripped by "Y-250". In this case, MDU displays fault cause, but fault current is "0A".

Use the optional breaker tester “Y-250” or else carry out the test with load current.
If the breaker tester “Y-250” is used, execute the test according to its manual.
Here the testing method is explained assuming with load current.

(1) Apply AC current to the circuit-breaker from three-phase or single-phase power supply. In case of single-phase power supply, apply the current with any two poles in series.



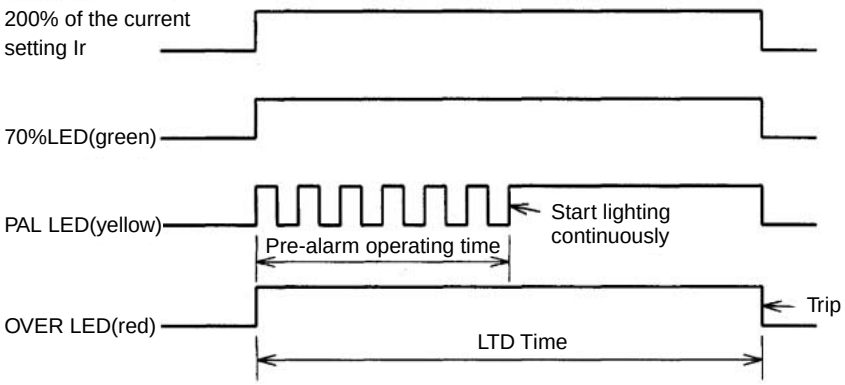
Current regulation resistance



Current regulation resistance

(2) The respective LEDs on the front face of the circuit-breaker, if on, allow to confirm the respective operational currents.
70% LED(green) : Good if continuous lighting commences within a range 60 to 80% of the current setting Ir.
PAL LED(yellow) : If Ip is set 0.7xIr, good if flashing every 0.5sec start within the range 60 to 80% of the current setting Ir.
OVER LED(red) : Good if continuous lighting commences within a range over 105% up to 125% of the current setting Ir.

(3) LTD and pre-alarm operating time can be checked by applying a current equivalent to 200% of the current setting Ir. If any current exceeding the current setting Ir is applied before this test, the operating time reduces.
Therefore the first measurement will be invalid in that case. When the circuit-breaker trips, the trip circuit is reset, and the next operating time can be measured under normal conditions.

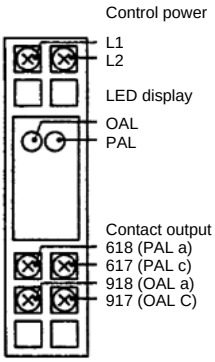


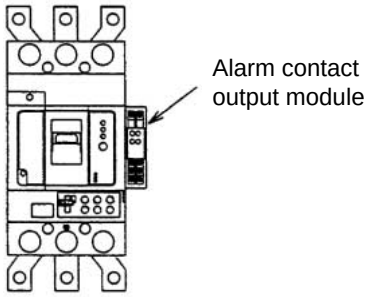
The result is good if the operating time measured falls within the following range.

Setting of LTD time TL	TL=12sec	TL=60sec	TL=100sec	TL=150sec
Pre-alarm operation time	4.8~7.2sec	24~36sec	40~60sec	60~90sec
LTD operating time	9.6~16.4sec	48~72sec	80~120sec	120~180sec

4.22 Installation of alarm contact output module (option)

(1) Combination of alarm output

Types	NF400-SEPM, NF400-HEPM NF630-SEPM, NF630-HEPM NF800-SEPM, NF800-HEPM	
Function name / Option name	PAL	OAL
PAL	○	○
TI		○
Name of each component		



(2) Caution to use

⚠CAUTION

- For function of alarm LED (PAL, OVER) on MDU and contact output (PAL, OAL), MDU and the circuit breaker must be connected with the mutuality and the control power must be supplied to MDU and alarm contact output module.
- Make sure to connect the flat cable and the connector of MDU.

- Control power must be supplied for alarm contact output module.
  Connect control power supply to terminal of alarm contact output module L1 and L2. L1 and L2 are no polarity.
  Control power : AC/DC 100-240V 50-60Hz 5VA
- Use the power supply which is not cut off by the circuit breaker tripping.
- When the alarm output setting is [Self-holding], PAL (pre-alarm) output is reset by pushing "ALARM RESET" switch on MDU or cut off of MDU control power.
- OAL (over load and short-circuit) alarm is reset by operation of "CLEAR" of MDU. (See section 8.3)
  The fault cause is held even if MDU control power is cut off or "ALARM RESET" switch on MDU is pushed.
- Alarm contact output module make a little noise by internal electric circuit, but it is normalcy.
- Tightening torque of alarm contact output module terminal is 0.9 - 1.2N·m. Tighten certainty.
- Contact capacity is shown in the table.

	cosϕ=1	cosϕ=0.4 L/R=0.007
AC125V	3A	2A
AC250V	3A	2A
DC30V	2A	2A
DC100V	0.4A	0.3A

- Functions of PAL and OAL are able to test using the optional breaker tester "Y-250".
  At the testing, control power must be supplied for alarm contact output module and MDU.
- Internal attachment of right side is not equipped on.
- Make sure to confirm the function of alarm contact output module before using.

(3) Function of alarm contact output module

- Alarm contact output module is displayed LED and outputs contact about fault cause and alarm of the circuit breaker.
- Function of LED display and contact output are under table.

Output		Alarm	Fault cause
		Pre-alarm(PAL)	Over load, short circuit (OAL)
LED display	PAL	Turn on	—
	OAL	—	Turn on
Contact output	PAL	ON	—
	OAL	—	ON

4.23 Installation of MDU

The circuit breaker and MDU are adjusted in the pair.
Use the pair of same serial number.
If the pair of different serial number was used, the accuracy is not guaranteed.

MDU breaker mounting type

MDU and installation parts are included with same package.

(1) Installation of the breaker.
Mount the breaker by using screw included with same package.
Be careful to bite of extension cable and connector.

(2) Installation of MDU
Holder plate is installed on the breaker.
①Fit MDU to holder plate. (See Fig 1.)
Be careful to bite of extension cable and connector between MDU and holder plate.
②Open the MDU terminal cover, under 5N.
Fix MDU to holder plate by using 2 screws. (See Fig 2.)

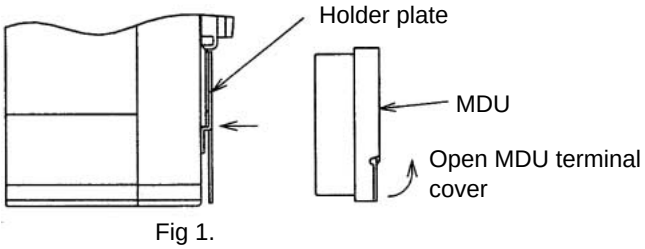


Fig 1.

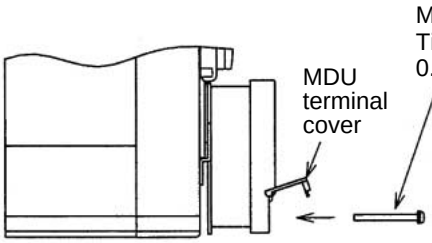
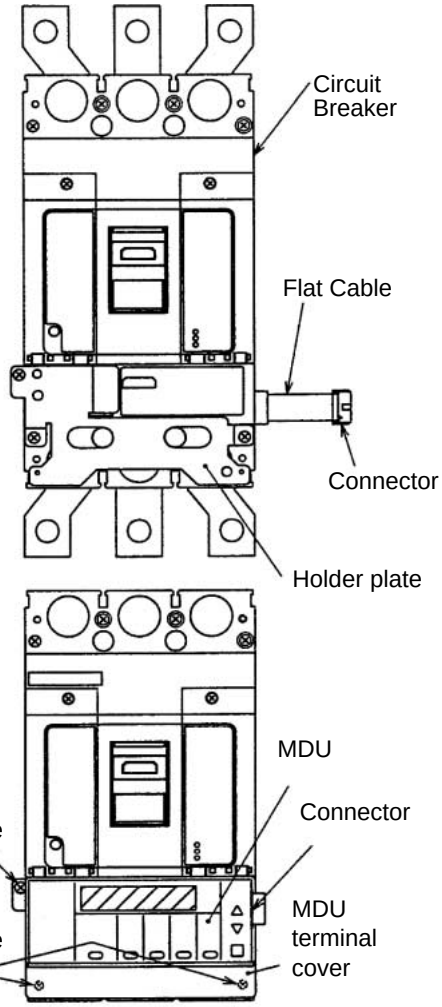


Fig 2.



(3) Connection of MDU
①Make sure to connect, the flat cable and the connector of MDU, the flat cable and the connector of extension cable, until [CLICK].
②PE terminal
Connect the PE terminal of holder plate to the ground.
③Control power
Open the MDU terminal cover.
Connect the control power of MDU to L1 and L2 terminal.
④FG terminal
Open the MDU terminal cover. Connect the FG terminal to PE terminal of holder plate. (See Fig 3 and Table 1.)
⑤Electric energy accumulated pulse output
Open the MDU terminal cover. Connect the pulse output cable to 113 and 114 terminal. (See Fig 3 and Table 1.)
⑥CC-Link transmission
Open the MDU terminal cover. Connect the CC-Link shielded twisted pair cable to DA, DB, DG, SLD terminal. (See Fig 3 and Table 1.)
If this MDU is end of line, connect the terminal resistor between DA and DB. (Refer to 6.5)

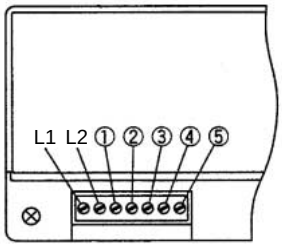


Fig 3. (MDU terminal cover come off)

Table 1. MDU terminal

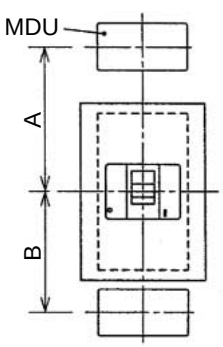
	①	②	③	④	⑤
No transmission	—	FG	—	—	—
Pulse output	—	FG	—	113	114
CC-Link	FG	SLD	DG	DB	DA

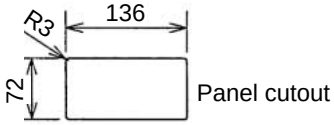
4.24 MDU panel mounting type

MDU, the extension cable and installation parts are included with same package.

(1) Installation of the breaker
Mount the breaker by using screw included.

(2) Installation of MDU
Keep space greater than value of Fig 1.
Install MDU to the panel by panel holder plate.
①Set MDU obliquely and insert to the panel cut-out from the lower part. (See Fig 2.)
②Push MDU into the direction of an arrow. (See Fig 3.)
In this case, open the hook of the connector, not to touch the panel cutout.
③Insert the stopper of panel holder plate to the ditch of holder plate.
(Two places of right and left. See Fig 4.)
④Fix MDU by using nut and panel holder plate from back side of panel. (See Fig 5 and Fig 6.)





Keep space greater than value of below figure. (Note.)

Frame	A		B
	SEPM	HEPM	
400	237	367	198
630	246	376	214
800			

Panel thickness 1-3.2mm

Note. In the case of Front-connected, keep space between MDU and conductor or insulation barrier too.

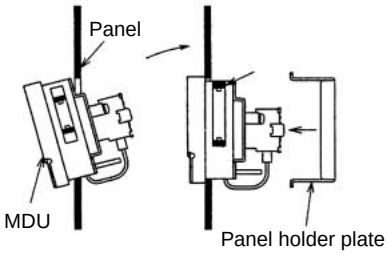


Fig2. Fig3.

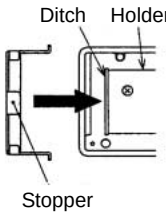


Fig4.

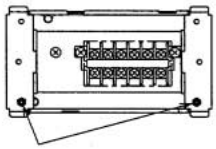


Fig5. No transmission Pulse output

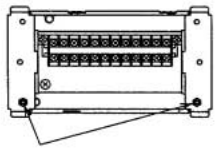


Fig6. CC-Link transmission

Installation of the extension cable and MDU
①Connect the flat cable and MDU by the extension cable.
The extension cable shall be kept the distance longer than 10cm from the heavy current circuit.
Fix the cable tightly near the connector to avoid the stress to the connector.
②Make sure to connect the cable and the connector, until [CLICK].
③PE terminal
Connect the PE terminal of panel plate to the ground.
④Control power
Slide the terminal cover.
Connect the control power of MDU to L1 and L2 terminal.
⑤Electric energy accumulated pulse output terminal
Slide the terminal cover.
Connect the pulse output cable to 113 and 114 terminal. (See Fig 7 and Table 2.)
⑥CC-Link transmission terminal
Slide the terminal cover.
Connect the CC-Link shielded twisted pair cable to DA, DB, DG and SLD terminal. (See Fig 8 and Table 2.)
Connect the cable to the both sets of the terminals (One set of the terminals is DA, DB DG and SLD). (See Fig 9.)
Do not connect by using one set of the terminals.
If this MDU is end of line, connect the terminal resistor between DA and DB. (See Fig 10 and Refer to 6.5)

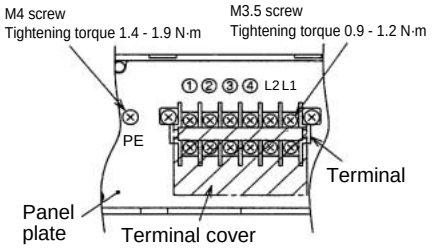


Fig7. (No transmission, Pulse output)

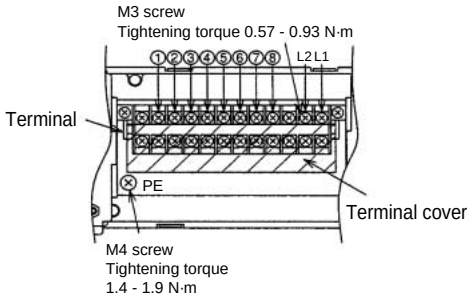


Fig8. (CC-Link transmission)

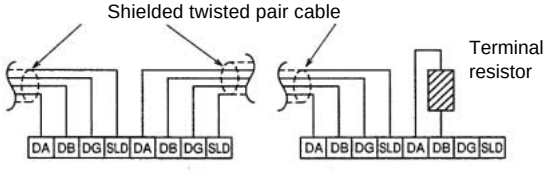


Fig9. Fig10.

Table 1. MDU terminal

	①	②	③	④	⑤	⑥	⑦	⑧
No transmission	—	—	—	—	/	/	/	/
Pulse output	114	113	—	—	/	/	/	/
CC-Link transmission	DA	DB	DG	SLD	DA	DB	DG	SLD

4.25 Note of MDU with CC-Link option

(1) If occurred watchdog timer error on MDU, but link special register of master module (SW0084-SW0087) is not "1" (ON).

(2) If MDU control power supply is failed over 5-10ms, then cutoff CC-Link I/F.
When return from power failure then statuses are,
Initial data processing request flag (RX(n+1)8) is "1" (ON).
Remote READY (RX(n+1)B) is "0" (OFF).
Indicate flag of alarm (RXn2 - RXn7) is holding before power failure.
Remote register (RWrn - RWrn+3) is "00H".

(3) For the details of programming, refer to [MDU Breaker Programming Manual (CC-Link)].

4.26 Remote I/O (with CC-Link option)

The remote input RX and remote output RY used by MDU are each 32 points.
The allocation and signal name of the remote input RX and remote output RY is shown the table below.

Remote input RX		Remote output RY	
Device No.	Signal name	Device No.	Signal name
RXn0, RXn1	Unusable	RYn0~RYnE	Unusable
RXn2	PAL		
RXn3, RXn4 ,RXn5	Unusable		
RXn6	LTD (fault cause)		
RXn7	STD/INST (fault cause)		
RXn8,RXn9	Unusable		
RXnA~RxnE	Unusable		
RXnF	Command completion reply flag	RYnF	Command execution reply flag
RX(n+1)0~RX(n+1)7	Unusable	RY(n+1)0~RY(n+1)7	Unusable
RX(n+1)8	Initial data processing request flag	RY(n+1)8	Initial data setting completion flag
RX(n+1)9	Unusable	RY(n+1)9	Unusable
RX(n+1)A	Error status flag	RY(n+1)A	Error reset request flag
RX(n+1)B	Remote READY	RY(n+1)B~RY(n+1)F	Unusable
RX(n+1)C~RX(n+1)F	Unusable		

n : Address allocated to the master module by the station number setting.

Note. In case of setup of alarm hold is [Self-holding], if status flag is "1" (ON), it is holding until alarm reset.
In case of setup of alarm hold is [Auto reset], status flag is automatically reset after alarm signal from the breaker stopping.

Note. Alarm and input bit (RXn2, RXn6 and RXn7) can not be change while error status flag (RX(n+1)A) is "1" (ON).
Immediate removing from the failure cause is recommended.

Note. Do not read/write to unusable remote registers. If read/write is performed, the functions of the MDU are not guaranteed.

4.27 Remote register (with CC-Link option)

The allocation of the remote register is shown the table below.

Communication Direction	Address	Description
Master ⇓ Remote	RWwm	Command, channel, data etc.
	RWwm+1	
	RWwm+2	
	RWwm+3	
Remote ⇓ Master	RWrn	Reply data
	RWrn+1	
	RWrn+2	
	RWrn+3	

m, n : Address allocated to the master module by the station number setting.

4.28 Error codes

When an error occurs on MDU,

(1) "Er" is displayed in left 2 digits of numerical LED and error code is displayed in right 3 digits of numerical LED.
("L ERR" LED is turn on with CC-Link option)

(2) When MDU with CC-Link option, then reply error code.

Error details and corrective action for each trouble occurrence are shown below.

[LED display status]

Description	Left 2 digits of numerical LED	Right 3 digits of numerical LED	Error details	Corrective action
Common	Er	006	Hardware error Real time clock IC error	Reset the power supply of the MDU. Electric energy data is not cleared by this operation. In the case of MDU with CC-Link option, the other method is to push RESET switch. But a part of electric energy data may be cleared by this method. Therefore record the electric energy data before pushing RESET switch.
	Er	007	Hardware error ADC error	
	Er	050	Hardware error EEPROM error	
	Er	051	Hardware error EEPROM error	
CC-Link option	L ERR. LED turn on		Communication data error	Wire the communication cable correctly.
			Station number setting or transmission baud rate setting is changed.	Returned to the previous state. Push RESET switch when the setting was changed.
			Station number or transmission baud rate set outside the range.	Modify it to the correct setting.

[Error codes]

Error code (hex)	Error details	Corrective action
01H	Undefined command	Modify it to the correct command.
C0H	Hardware error	Reset the power supply of the MDU. Electric energy data is not cleared by this operation. In the case of MDU with CC-Link option, the other method is to push RESET switch. But a part of electric energy data may be cleared by this method. Therefore record the electric energy data before pushing RESET switch.
C1H	Out of channel range	Modify it to the correct channel.
C2H	Out of setting range	Modify it to the correct setting.

Note. Please read each module instruction manual when other errors, except for above mentioned table, occur.

Note. Once error status flag (RX(n+1)A) is "1" (ON), the flag can not be reset by PLC reset.
Error reset request flag shall be "1" (ON) to reset error status flag (RY(n+1)A).
Refer to the error code, the error cause shall be removed before resetting.

Note. Alarm and input bit (RXn2,RXn6 and RXn7) can not be change while error status flag (RX(n+1)A) is "1" (ON).
Immediate removing from the failure cause is recommended.

4.29 Troubleshooting

When the trouble occurs on MDU, please check the following.

(1) Is the cable connected correctly?

(2) Are you using the pair of same serial number?

(3) When the measured current is less than 2.5% of rated current, MDU cuts off and displays "0A".

(4) When the current meter (clamp on type) was used and it does not correspond to harmonics. It may differ from the measurement value of MDU.

5. Maintenance and inspection

⚠CAUTION

- Any maintenance/inspection shall be performed by the personnel having expertise concerned. Note that there exists the risk of electrical shock.
- Any maintenance/inspection shall be performed after cutting off the master circuit-breaker and making sure that there is no current flowing. Note that there exists the risk of electrical shock.

(1) If maintenance and/or inspection should be carried out without cutting off the power supply in an unavoidable cases, wear rubber gloves and insulated boots laying rubber mat on the floor. Use insulated tools and instruments only. An access to the live parts is necessary in this maintenance and inspection work, when workers' full attention should be paid to the insulation of human body from the live parts.
Any normal opening/closing may be done safely because the live parts are covered with insulated moulded case or the like.

(2) In the event of measurement of sensitivity current and operate time of the ELCB mounted on hot line, de-energize first and then wire before proceeding to the measurement as far as possible. If, from sheer necessity, the measurement should be made under electrified condition, full care should be taken of the safety.

5.1 Initial inspection

The following items shall be checked when electrification is initiated with MCCB and ELCB installed:

Type	Inspection item	Criterion	Remarks
Common	1. Are there any excessive screws, machining chips, cut pieces of electric wire and other conductors around the terminals?	There must never be such foreign matters remaining.	
	2. Is there any crack nor breakage of cover and/or base?	No crack/breakage allowed	
	3. Any dew condensation on the cover, base and/or terminals?	No dewing allowed nor traces of condensation allowed.	
	4. The insulation resistance to be measured by 500V insulation resistance tester.	Measurement should be 5MΩ or higher.	For ELCB, refer to the "Attention."
	5. Are the conductive connections tightened firmly?	The tightening torque should be as prescribed.	
ELCB	6. Is the rated voltage of ELCB the same as that of circuit voltage?	Should be the same.	
	7. Apply voltage and depress the test button to check the operation.	Leak trip state should come out and reclosing possible.	

Attention

(1)Voltage of the withstand voltage test

The withstand voltage test shall be performed in compliance with the table given on the right.
Do not exceed the values given in this table.
Note that the withstand voltage is 1000 V between the contacts incorporated into the leakage relay.

Main circuit		Auxiliary or control circuit	
Rated insulation voltage	Test voltage (AC effective value)	Rated insulation voltage of operational circuit	Test voltage (AC effective value)
Ui ≤ 300V	2000V	Uis ≤ 60V	1000V
300V < Ui ≤ 600V	2500V	60V < Uis ≤ 600V	2 Uis + 1000V (Min. 1500V)

(2) Measurement of insulation resistance and withstand voltage test

Notice that the following applicable types are subject to the restrictions ① and ② below:
Applicable types: Earth leakage circuit breakers.

① Measurement of insulation resistance

A 1000 volt insulation resistance tester cannot be used.
For measuring the insulation resistance a 500 volt insulation resistance tester shall be used.
In portions with △ in the following table, the circuit breaker with a insulation switch (MG) can be measured its insulation resistance when the circuit breaker is opened (OFF).

② Withstand voltage test

Voltage shall not be applied at the portions with ✕ marks in the table. (Should the portions with ✕ undergo erroneously the withstand voltage test, some trip but some others do not. In any case these portions, if once subjected to the test, shall not be reused.)

Measuring point/test			Measurement of insulation resistance		Withstand voltage test	
State of handle			ON	OFF	ON	OFF
Between live part and earth			○	○	○	○
Between different poles	Line side	Between left and middle poles	○	○	○	○
		Between middle and right poles	○	○	○	○
		Between left and right poles	△	○	✕	○
	Load side	Between left and middle poles	○	○	○	○
		Between middle and right poles	○	○	○	○
		Between left and right poles	△	△	✕	✕
Between line and load terminal			—	○	—	○

* For the MDU breakers, please refer to chapter 4.16

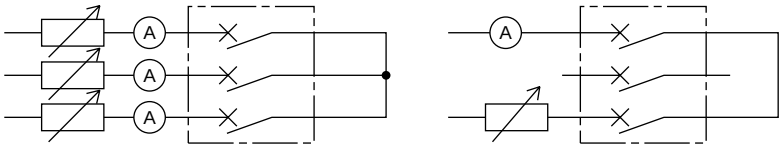
(3) Overcurrent trip test (1)

NF125-SGW (RE), NF125-HGW (RE)
NF160-SGW (RE), NF160-HGW (RE)
NF250-SGW (RE), NF250-HGW (RE)
NF400-SEP, NF400-HEP, NF400-REP,
NF400-UEP, NF400-ZEP
NF630-SEP, NF630-HEP, NF630-REP,
NF630-UEP
NF800-SEP, NF800-HEP, NF800-REP,
NF800-UEP
NV100-SEP, NV100-HEP
NV250-SEP, NV250-HEP
NV400-SEP, NV400-HEP, NV400-REP
NV630-SEP, NV630-HEP
NV800-SEP, NV800-HEP

The test shall be conducted only in the following test circuits:

Use the optional breaker tester “Y-250” or else carry out the test with load current.
If the breaker tester “Y-250” is used, execute the test according to its manual. Here the testing method is explained assuming with load current.

① Apply AC current to the circuit-breaker from three-phase or single-phase power supply. In case of single-phase power supply, apply the current with any two poles in series.



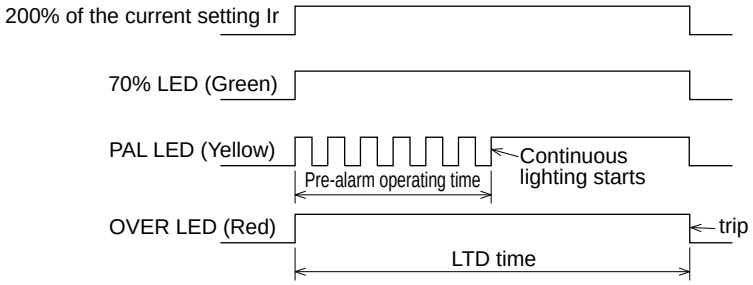
② The respective LEDs on the front face of the circuit-breaker, if on, allow to confirm the respective operational currents.

70% LED (Green): Good if continuous lighting commences within a range 60 to 80% of the current setting Ir.

PAL LED (Yellow): If Ip is set 0.7 x Ir, good if flashing every 0.5 sec starts within the range 60 to 80% of the current setting Ir.

OVER LED (Red): Good if continuous lighting commences within a range 105 to 125% of the current setting Ir.

③ LTD and pre-alarm operating time can be checked by applying a current equivalent to 200% of the current setting Ir. If however any current exceeding the current setting Ir is applied before this test, the operating time reduces. Therefore the first measurement will be invalid in that case. When the circuit-breaker trips, the trip circuit is reset, and the next operating time can be measured under normal conditions.



The result is good if the operating time measured falls within the following range: (Ampere frame 100~225)

Setting of LTD time TL	TL=12sec	TL=60sec	TL=80sec	TL=100sec
Pre-alarm operating time	4.8~7.2sec	24~36sec	32~48sec	40~60sec
LTD operating time	9.6~14.4sec	48~72sec	64~96sec	80~120sec

The result is good if the operating time measured falls within the following range: (Ampere frame 400~800)

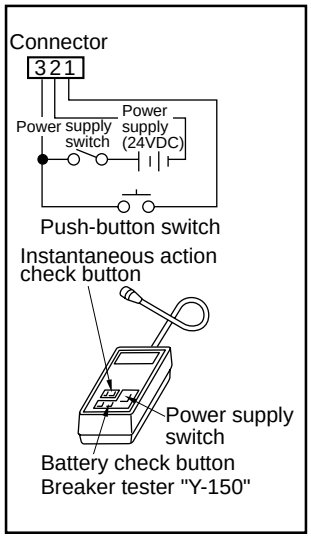
Setting of LTD time TL	TL=12sec	TL=60sec	TL=100sec	TL=150sec
Pre-alarm operating time	4.8~7.2sec	24~36sec	40~60sec	60~90sec
LTD operating time	9.6~14.4sec	48~72sec	80~120sec	120~180sec

(4) Overcurrent trip test (2)

Applicable type: NF1000-SS NF1250-SS NF1600-SS NF1250-UR
NF1000-PAL NF1250-PAL NF1600-PAL NF2000-PAL

⚠CAUTION Perform the test under the condition that the circuit-breaker is ON and the load current does not flow.

(Connector (JST make)
Housing: H3P-SHF-AA
Contacts: BHF-001T-0. 8BS)



① Prepare the external power supply (24 VDC) and switches or optional breaker tester “Y-150”.

② Strip off the stamped seal, loosen the transparent cover attaching screws under this seal, and wire the connector to the test terminal.

Table of LTD test operating time (sec)

Ampere frame	SETTING POSITION					
	1	2	3	4	5	6
1000	500A	600A	700A	800A	900A	1000A
	15-37	22-54	29-73	38-96	49-122	60-150
1250	600A	700A	800A	1000A	1200A	1250A
	14-34	19-46	24-60	38-96	54-136	60-150
1600	800A	1000A	1200A	1400A	1500A	1600A
	15-37	23-59	34-84	46-115	52-130	60-150
2000	1200A	1400A	1500A	1600A	1800A	2000A
	22-54	29-73	34-84	38-96	49-122	60-150

③ Long time delay test.
(a) When the power supply switch is turned on, the test signal comes on enabling the long time delay.
(b) The test signal has been so designed that about 200% of the maximum rated current produces. The operating time depends upon the setting of the rated current.

④ Instantaneous tripping test
The instantaneous trip happens when the power supply switch and push-button (instantaneous action check button in case of tester) are turned on.

⑤ When the test is over, a stamped seal shall be taken out of the seals for replacement.

⑥ Tighten the transparent cover with 0.3 to 0.6 N·m of tightening torque, and stick the stamped seal on the tightening screw.

⑦ Though the overcurrent display LED goes off and the trip coil remains tripped if the test is carried out with the circuit-breaker OFF, the circuit-breaker handle remains unchanged (OFF). If application is made under this state, the handle will idle. The test should therefore be performed with the circuit-breaker ON without fail.

5.2 Periodical inspection

The inspection shall be worked out once one month after the commencement of the use and then periodically in terms of the environmental conditions in order that any trouble may be avoided and that the circuit-breaker can be used for longest possible time.

Yardstick for inspection periodicity

1	Clean and dry environment	Once every 2 to 3 years
2	Environment not exposed to severe dust, corrosive gas vapor, salt, etc.	Once a year
3	Other places than 1 and 2	Once every six months

Type	Inspection item	Criterion	Remarks
Common	1. Is any conductor connection not loosened?	No loosening allowed.	If loosened, the connection should be retightened with such appropriate torque as indicated in the Attached Table.
	2. Are the cover and base not cracked or otherwise damaged? Is the handle not broken?	No crack nor damage on the cover and base. No broken handle.	
	3. Internal submersion by inundation or substantial mud or dust not adhered?	No internal submersion nor substantial mud and/or dust adhered to.	In case of internal submersion, replace the circuit-breaker with a new one, or have it overhauled at our service center.
	4. Is there any abnormal temperature rise?	(1) Visual inspection shall find out no discoloration, by burning, of the stud on the reverse side of the terminal, tightened and the molded portions of the body. (2) No terminal shall manifest any specifically high temperature while the currents of respective phases are well balanced. (Max. allowable value of terminal temperature rise: 60K). (3) No remarkable difference between the right and left sides on the lateral face of the base as long as the load current is well balanced.	(1) Note that there exists some differential temperature between the following terminals: • Between the terminal on line side and that on load side. • Between the terminal of middle pole and those on right and left sides
	5. Is there ON/OFF operation by handle smooth?	Operation should be done smoothly.	Normally open or normally closed circuit-breaker can maintain a smoother operation if it is opened and closed periodically.
	6. Is there TRIP operation by trip button?	The circuit breaker should be able to reset after tripping.	
ELCB	7. Test shall be conducted using the test button.	The circuit-breaker should be able to operate and be closed again for certain.	Test shall be done about once a month.

5.3 Inspection after tripping

When circuit-breaker trip accidental current, it may be either reused or should be replaced by new one depending on the intensity of the accidental current thus trip.

Intensity of the trip current/Degree of damage on MCCB/ELCB and countermeasures to be taken

Intensity of trip current	Degree of damage on MCCB/ELCB	Countermeasures
Case where it is clear that the circuit-breaker operated within the range of time-delay trip	No such anomaly at all as soiled vent	Reusable (The circuit-breaker can function 50 times (100 A or less) at the overload current 6 times higher than the rated current.)
Such relatively low short-circuit current as allows the instantaneous tripping. ⇕ Large short-circuit current near to the rated breaking capacity	Black soot seen near the vent. ⇕ Soot and dust seen also on the handle, and remarkable dirt and grime near the vent. Molten metal adheres to the vent and its vicinity. Severely deformed box of box type circuit-breaker.	Reusable ⇕ To be replaced by new one.

Remark: The leak display button may pop out when the earth leakage breaker trip an accidental current that surpasses the instantaneous trip current.

In case when the intensity of the accidental current cannot be inferred, remove the MCCB/ELCB and measure the insulation resistance. If the result does not attain the prescribed value (5MΩ), proceed to the withstand voltage test.

Though the breaker may be used for the time being if there be prescribed withstand voltage, it shall be replaced with new one as soon as possible.

If both the insulation resistance and withstand voltage are high enough, the breaker may be recognized as reusable. For a certain period, however, it shall be checked for any abnormal temperature rise or any other anomalies.

(1) The measurement of insulation resistance and the withstand voltage test shall be performed according to (1) and (2) of 5.1.

(2) For ELCB, the operation shall be confirmed by test button too.

5.4 Yardstick service life

The maintenance and inspection shall be brought into practice depending on the environment where the circuit-breaker is installed. The longevity of the circuit-breaker cannot be decided only in terms of the year of use. Though the service life requires some diagnosis by some experts, the yardstick of longevity may be as follows:

Yardstick for service life

Degree		Environment	Example	Replacement yardstick (year)
Referential use conditions	1	Places with ever clear and dry air	Dust-proof and air-conditioned electrical room	About 10 to 20
	2	Indoor where there is no corrosive gas and little dust	Circuit-breakers in distribution boards and boxes in individual electrical rooms without dust-proof and air-conditioning	About 7 to 15
Poor emvironment	1	Places with little dust but with such gases as salty, sulfurous acid, hydrogen sulfide, high moisture	Geothermal power houses, sewage treatment plants, iron and steel works, paper and pulp plants, etc.	About 3 to 7
	2	Places with severe corrosive gases and dust where humans cannot be for a long time	Chemical plants, quarries, mines, etc.	About 1 to 3

Size of circuit-breaker frame (A)	Number of operating cycles			Number of operation by voltage tripping, undervoltage tripping devices or trip button
	Electrification	No electrification	Total	
In ≤ 100	1500	8500	10000	10% of the total opening/ closing frequency
100 < In ≤ 315	1000	7000	8000	
315 < In ≤ 630	1000	4000	5000	
630 < In ≤ 2500	500	2500	3000	
2500 < In	500	1500	2000	

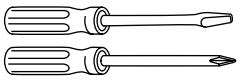
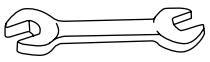
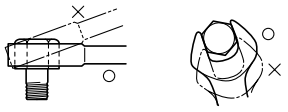
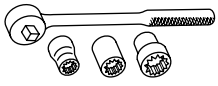
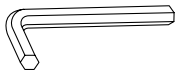
Remark: Number of operation by the test button of ELCB is 1000 times.

The opening/closing life has been prescribed by IEC60947-2 as shown in the table above.
Note that the larger the frame of the circuit-breaker is, the more opening/closing life reduces.
Though the user might think these frequencies to be fewer than expected, this is because the circuit-breaker is basically a protective device that differs from the switch intended for more frequent opening/ closing.
It is recommendable to install an electromagnetic contacter for opening/closing in a case where a capacitor bank is switched in terms of the change in power factor.
Precaution should be taken in use of the circuit-breaker because the tripping by voltage tripping device, in particular, reduces the service life.

5.5 Standard tools and measuring instruments

(1) Standard tools

Our circuit-breakers have been designed so that they may be installed and connected with commercially available tools. Users are requested to mount and connect them using most appropriate tools.
Table below gives examples of tools ordinarily used.

Use	Name	Remarks
Screw tightening	 Screwdriver	Screwdrivers should be used whose diameters are of size suited to the diameters of the cruciform grooves. Size of diameter: For M3, M4 and M5: No. 2 For M6 and M8: No. 3
Tightening of bolts and nuts	 Double-ended wrench	 Screwdriver shall be inserted into the bottom of the groove and then turned.
	 Socket wrench	The socket wrench allows to tighten rather firm. Pay your attention to it that it may break too small bolts and/or buts or else any other bolts if the tightening totque is too great.
	 Hexagonbar spanner	To be used for tightening hexagon socket cap screws. Spanner with suitable diameter should be inserted into the bottom of the groove and then turned.

Note. Also commercially available are such tightening tools (torque wrench as generally called) that allow to control the tightening torque.

(2) Measuring instruments

Name	Use
Multitester	This tester is used generally to measure the voltage in the maintenance and inspection work for circuit-breaker.
Thermistor thermometer	This enables an easy measurement of the temperature of terminals and molds.
Grip tester (clamp meter)	This makes it possible to measure the current of the electric part as electrified.
Insulation resistance tester	Measures the insulation resistance. A 500 VDC insulation resistance tester to be used in the maintenance and inspection of circuit-breaker. (1000 VDC one not to be used)
Earth leakage breaker tester	Measures the sensitivity current and operating time of the earth leakage breaker.

6. Troubleshooting

6.1 Troubleshooting for circuit-breaker proper (MCCB/ELCB)

Trouble			Cause		Countermeasure
Abnormal operation	Closing impossible		Foreign matter in switching mechanism		Foreign matters to be removed
			No resetting		To be reset once again
			Resetting impossible	See below (*)	See below
	(*) Resetting impossible Tripping impossible OFF impossible		Wear due to trip endurance	Incessant use of voltage trip operation	To be replaced with new one, Voltage trip to be replaced by electric operation
				End of service life	To be replaced with new one
			Poor reset mechanism	Poor adjustment	To be returned for repairing
			Non-excitation of undervoltage coil	Carelessness	To be excited
			Resetting time has not elapsed		Wait until the bimetal is cooled down
			Breakage and/or fatigue of the switching spring	Breakage by initial trouble	To be returned for repairing
				End of service life	To be replaced by new one
			Fusion of contact due to excessive interruptive current		To be replaced by circuit-breaker with large breaking capacity
Broken handle			Excessive operation power		Handle to be replaced
			Poor positional relationship between the external handle and the circuit-breaker		Handle to be replaced Revision of positional relationship
			Excessive shock from exterior		To be replaced with new one
Poor electrification			Insulating material mingled between contacts		Foreign matter to be removed (with removable cover) To be returned for repairing (with unremovable cover)
			Corrosion by infiltrating rain water, etc.		To be replaced with new one
			Fused conductive portion	Excessive interrupting current	To be replaced by new one with larger breaking capacity
			Large consumption of contact	Short-circuit current cut off. End of service life	To be replaced with new one
				Application of overcurrent	
Breakage of rated changeover screw			Excessive tightening torque (tighten with 3 to 4.5 kg-cm of torque)		To be returned for repairing
Troublesome operation	Troublesome operation under normal load		Too high an ambient temperature	Erroneous selection (temperature correction)	Rating selection to be changed
				Board hermetically closed	Ventilation
			Too high a temperature rise	Loosened connection to terminal	Retighten
			Deviation of applied frequency (thermal-adjustable electromagnetic type 800AF or higher)	Erroneous selection (frequency)	To be replaced with circuit-breaker of suitable frequency
			Load current strained with much high component		Distortion factor to be decreased by reactor Selection of rating to be changed
			Rather small measurements by error of measuring instrument due to distorted current		To be measured correctly by a meter with true effective value, and correct selection of rating
		Electronic type MCCB Overcurrent display LED is on	Too small a setting of rated current		Correct the setting of rated current
			Tightening forgotten of the changeover screw of rated current		Correct retightening of the rated current changeover screw with tightening torque: 3 to 4.5 kg-cm
			Failure of rated current changeover portion		To be returned for repairing
	Erroneous action while starting		Exothermic reaction due to repeated starting current	Erroneous selection	To be replaced by a unit with higher rating
			Too long a starting time	Erroneous selection	To be replaced by a unit with higher rating
	Instantaneous action during starting		Too high a starting current		Electromagnetic setting to be change or the unit to be replaced by one with higher rating
			Too high a starting rush current		Electromagnetic setting to be change or the unit to be replaced by one with higher rating
			Transient current when changing delta connection to star one. Transient current due to reversible operation		Electromagnetic setting to be change or the unit to be replaced by one with higher rating
			Rush current at the time of instantaneous restart		Electromagnetic setting to be change or the unit to be replaced by one with higher rating
			Rare short-circuit of motor		Motor to be repaired
			Bimetal reset incomplete after instantaneous tripping		To be fully restored
			Abnormal current running simultaneously with closing (short-circuit closing)		Circuit to be checked to remove the cause
	Operating while in use		Transmission was made with antenna of transceiver (5W or higher) closely mounted on the electronic MCCB and earth leakage breaker		Transceiver to be used at a distance at least 1 m from the electronic MCCB
Short-circuit on line side			Shift from the short-circuit of another conductor		Cause to be removed To be replaced with new one
			Accumulated dust		Cause to be removed To be replaced with new one
			Fall of conductor on line side		Cause to be removed To be replaced with new one
Temperature rise	Too high a temperature on the terminal side		Poor tightening	Poor maintenance	Retighten
			Contact heavily consumed	End of service life	To be replaced by new one
			Increased contact resistance	Intrusion of rust and dust	Foreign matters to be removed
	Too high a temperature on the lateral side of the mould		Complete electromagnetic type used in high frequency (400 Hz, for instance)		Suitable frequency to be selected To be changed into thermal type.
			Load current distorted containing much high frequency component		Distortion factor to be decreased by reactor Selection of rating to be changed
			Erroneous measurement dependent on feeling		To be measured with a measuring instrument
	Exothermic reaction of the tightened portion of stud		Loosened stud		Retighten
			Poor contact between the conductive portion of stud and the body terminal		Reassemble the stud
			Groove machining forgotten for reduction of eddy-current exothermic reaction of rear-connected type iron mount plate (400AF or higher)		Groove to be provided
No operation	No tripping with over current		Too high a rated current selected		To be replaced by a unit with lower rating
			Wrong frequency applied		Suitable frequency to be selected
			Tripping of backup circuit-breaker	Too low a current for instantaneous tripping of backup breaker	Instantaneous electromagnetic switch to be lowered Raise the electromagnetic setting of backup breaker or change the rating
No operation with tester (electronic MCCB)	Overcurrent display LED does not come on. Or, though it comes on, it goes off sonner than normal.		The battery of breaker tester has come at the end of its service life.		Battery to be replaced.
	Overcurrent display LED comes on and goes off after prescribed time. But, no tripping.		Poor tripping mechanism		To be returned for repairing.

6.2 Troubleshooting for leakage operation portion

Trouble		Cause	Countermeasure
Trouble-some action	Operates simultaneously with closing (such operation of leakage mechanism as popping-out of the leakage display button)	Too long a wire and too large a ground electrostatic capacity causes the leak current to flow	Rated sensitivity current to be changed, or ELCB to be installed near load
		Normal operation due to leak current	Leak point to be repaired
	Operates during use	Refer to 5.4	
Abnormal operation	Leakage operation and the like by test button, but no display	Poor lamp or its end of service life	To be replaced by new one
		Display button does not come out due to poor adjustment	To be returned for repairing
No operation	Depressing the test button does not lead to operation	Trouble in electronic circuit	To be replaced by new one
		No voltage applied	Apply specified voltage
		Poor continuity of contact	Remove foreign matter on the contact

6.3 Troubleshooting of accessories

Trouble		Cause		Countermeasure
NFM/NVM (electric operation device)	Operation disabled	Voltage drop of operational power supply	Too low a capacity of the wire of operational circuit	Increase the diameter of the wire
			Too low a capacity of the operational power supply	Improve the operational power supply
		Burnt resistor/motor	Excessive continuous operation	To be returned for repairing (replacement of resister/motor)
		Erroneous wiring		Regularize the wiring
		Erroneous voltage applied		Regular operational voltage to be applied
	Continuous idling	Operation of ON and OFF circuits at the same time or erroneous manipulation		Push button to be provided with interlock
		Self-sustaining auxiliary switch contact to be used for automatic resetting		The contact for automatic resetting to be used as that for alarm switch
	One turn of idling when closing	Voltage tripping in OFF state or tripping by undervoltage		OFF operation once to reset and ON operation again
		The circuit-breaker proper has automatically cut off and tripped		
UVT (undervoltage tripping device)	Closing disabled	Erroneous frequency or voltage applied		Power supply to be improved
		No pulling	Too large a voltage drop	Voltage to be improved
	No tripping even with no voltage	Trouble in circuit-breaker tripping mechanism		To be returned for repairing
SHT (voltage tripping device)	No tripping action	Insufficient voltage	Operational voltage drop	Power supply to be improved
			Erroneous voltage applied	Power supply to be improved
		Coil burnt out	Continous excitation of coil	To be returned for repairing (replacement of coil, auxiliary contact to be provided for protection from burning)
			Continuous excitation under a voltage inferior to the operating voltage	To be returned for repairing (replacement of coil), power supply to be improved
			Poor auxiliary contact for prevention of burning	To be returned for repairing (replacement of coil, contact to be repaired)
			Abnormal voltage applied	To be returned for repairing (replacement of coil)
AL (alarm switch), AX (auxiliary switch), EAL (earth-leakage alarm, switch), MG (Insulation switch) PAL (pre-alarm)	Malfunction	Poor contact due to overcurrent		To be returned for repairing
		Erroneous wiring	Erroneous wiring when installing	Regular wiring to be made referring to the name plate
		Microload	Erroneous selection	To be returned for repairing (to be replaced with that for microload)
		Loosened attaching screws	Insufficient tightening Vibration during transportation	To be returned for repairing (re-adjustment)

6.4 Analysis of unnecessary operation

Operation of ELCB by the causes on purpose, leak current, electrification, ground fault etc., is normal, while operation by other causes such as surge and induction is unnecessary (called stray operation or nuisance trip). It seems that quite a number of users have the preconception that earth leakage circuit breakers are troublesome as they operate unreasonably. Therefore, unnecessary operation is analyzed and selection of correct ELCB is stated in the following text.

6.4.1 Classification of ELCB operation

ELCB operation is classified as follows;

- Operation
  - Normal operation
    - (1) Operation by leak current, electrification, ground fault etc.
  - Unnecessary operation
    - Those attributable to ELCB
      - (2) Fault of earth leakage circuit breaker
      - (3) Inadequate sensitivity current (too sensitive)
    - Those attributable to circuit and others
      - (4) Operation by surge
      - (5) Operation by circulation current
      - (6) Operation by induction
      - (7) Operation by wrong wire connection
      - (8) Operation by inadequate earth
      - (9) Operation by influence of at ground fault of shunt circuit
      - (10) Operation by overload or short-circuit
      - (11) Operation by environment (vibration, impact etc.)
      - (12) Operation by carrier phone unit
      - (13) Operation by electromagnetic wave
      - (14) Operation by inverters
      - (15) Others (Operation of surge absorber etc.)

6.4.2 Detail of operation

(1) Normal operation

Operation of ELCB according to each purpose. Primary examples are shown below.

① Deterioration of equipment insulation ..... This is often the case with water handling devices such as washing machine and those subjected to high impact such as press machine.

② Deterioration of wire insulation ..... This is often the case with joints and terminals of temporarily installed electric lines.

③ Faulty work ..... Ground fault by damage or disconnection of cables during work.

④ Careless handling ..... Electrification by wetting and ground fault by surge or dropped foreign matter.

(2) Fault of ELCB

Failure caused by deterioration and corrosion of parts but fault of the leak detecting unit is rare. In some cases, closing becomes unstable because of wear of the magnet or the switching mechanism. Besides such fault, ELCB of low balancing characteristic tends to operation when the motor starts. It is, therefore, necessary, to use ELCB made by reliable manufacturers.

(3) Inadequate sensitivity current

ELCB operates if the sensitivity current is too sensitive compared with normal leak current of the circuit. This is a matter of selection.

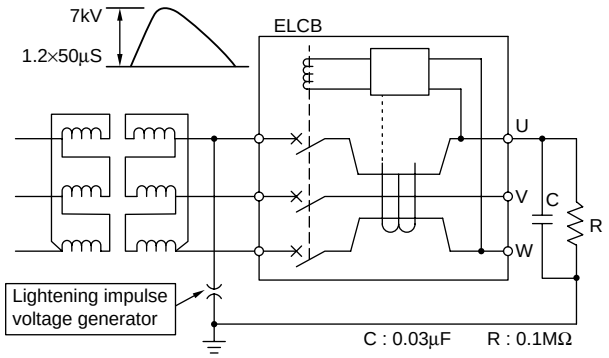
In most cases, leak current from circuits is attributable to static capacity to ground of the wire. Of some electric furnaces and sheath heaters, the insulation resistance comes down when cooled even if the insulation resistance is enough at high temperature, and it takes time to find out the cause of ELCB operation.

As to leak current from circuits, it must also be noted that ELCB is operated not only by leak current under normal condition but also by transient leak current to ground at switching or at start-up. Transient leakage at start-up is generated through static capacity to the frame of winding as potential distribution of winding at start-up differs from that during operation.

(4) Operation by surge

To surge by secondary transfer of inductive lightening of wires, non-operation test by lightening impulse is set forth in JIS C-8371, and surge resistivity is ensured. Circuit of the lightening impulse non-operation test is shown at right.

Almost all NVs of Mitsubishi are provided with a DPDC surge discrimination circuit for judging leak current to ground by ground fault current and surge so as to improve unnecessary operation preventing function.

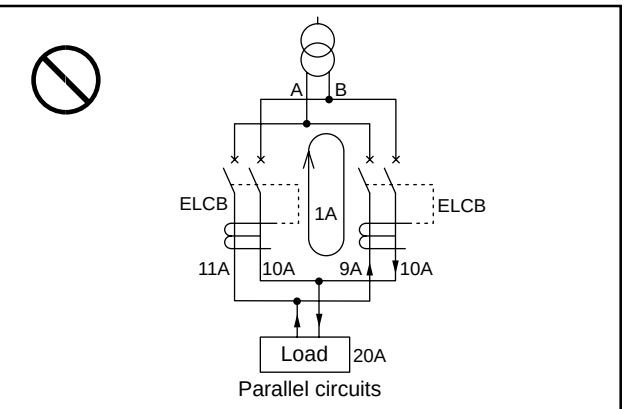


Test circuit of lightening impulse non-operation

(5) Operation by loop circuit (circulation current)

In the parallel circuits connected at load side, diverted current of each phase isn't necessarily equal between the right and the left branches. If A phase is diverted into 11A and 9A, for example, the difference of 1A is to be circulating in the loop.

Parallel use of two ELCBs is therefore prohibitive as the circulation current causes operation of the earth leakage circuit breaker.



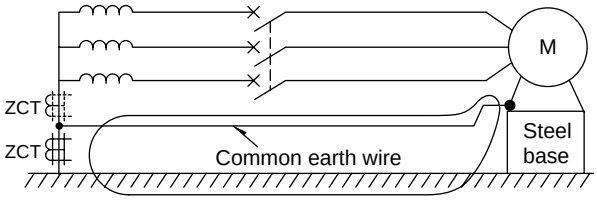
Parallel circuits

(5) Operation by induction

Those with loop circuits are susceptible to induction. Taking a loop as a loop antenna, the primary winding of ZCT is to be connected with the antenna, and induction is easily generated.

When a common earth wire is used, place the ZCT at the position of the continuous line in the drawing, then the primary conductor of the ZCT forms a loop. To avoid this, the ZCT must be placed at the position shown by the dotted line in the drawing.

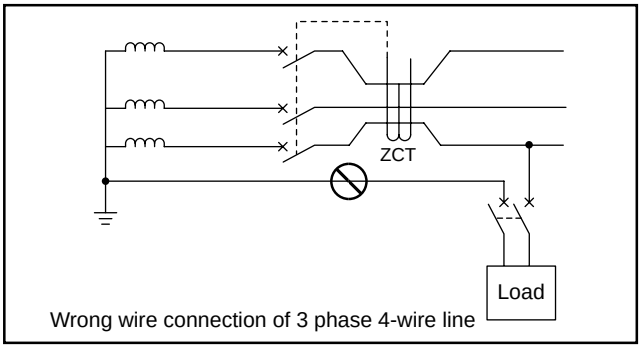
Induction can also be generated in the input circuit of the earth leakage relay, and it is necessary to braid the lead wires between the earth leakage relay, and the ZCT.



Ground fault detection by earth wire

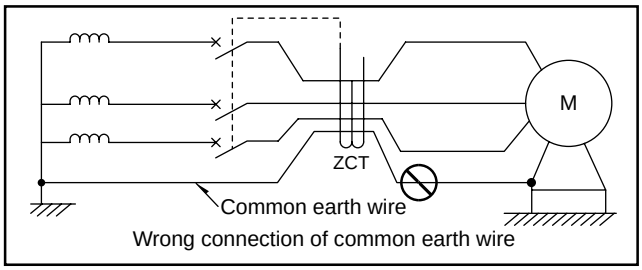
(7) Operation by wrong wire connection

Failure in passing the neutral wire through the ZCT for the lines of single phase 3-wire or 3 phase 4-wire is a simple mistake. In this case, the ELCB is operated by single phase load current.



Wrong wire connection of 3 phase 4-wire line

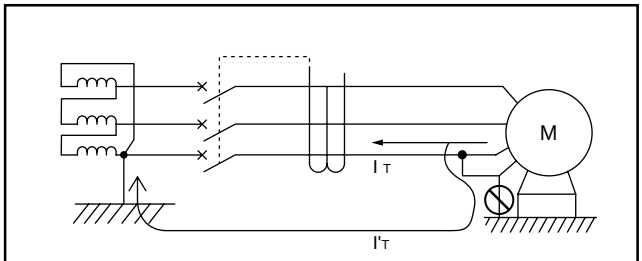
On the other hand, the common earth wire shall not go through the ZCT as it can be cause malfunction at leakage.



Wrong connection of common earth wire

(8) Operation by inadequate earth

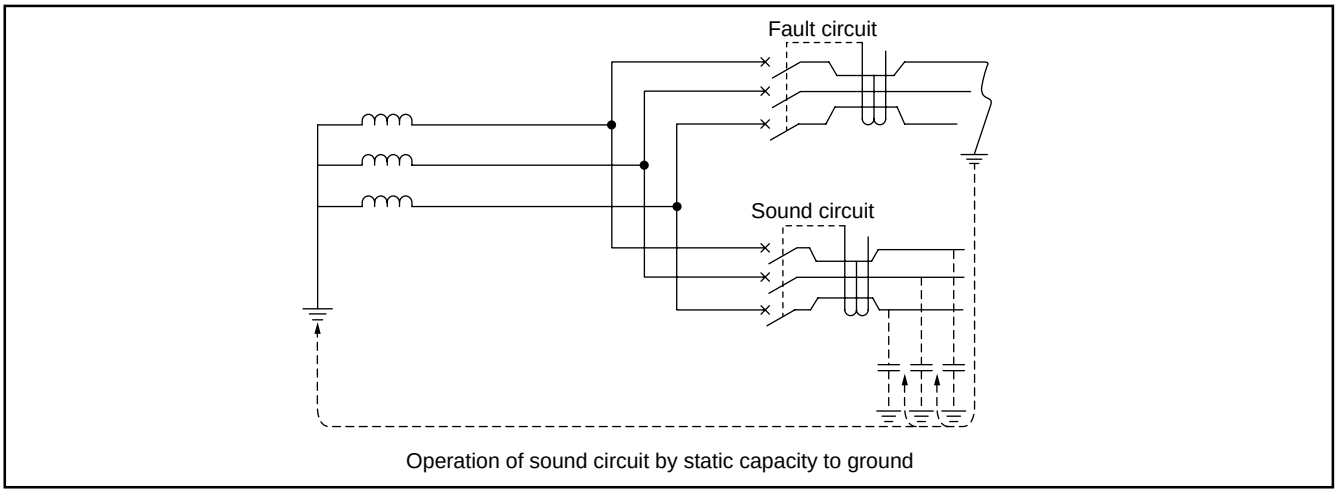
Though the wire is grounded at the earth side, the wire shall not be earthed at the load side. By the voltage of voltage drop in the line at the earth side, a part of the load current is diverted as shown by I'T, and the ELCB is operated.



Inadequate double ground

(9) Operation of sound circuit at ground fault of shunt circuit

Not only the ELCB in the ground fault circuit but also the one in the sound circuit is operated in some cases through the circuit as illustrated below. This can be avoided by keeping sensitive current suitably for the leak current by static capacity to ground.



Operation of sound circuit by static capacity to ground

(10) Operation by overload and short-circuit

It is natural that the devices having overload or short-circuit operation elements operate at short-circuit. However, ELCB is commonly used for many other purposes, and it tends to be overlooked that ELCB operate even at an overload and a short-circuit failure. Moreover, even the one dedicated to ground fault is sometimes operated by an excessive overload and short-circuit because balance performance of ELCB is limited. In these cases, however, overload and short-circuit can be noticed if they are significant.

(11) Environment of vibration, impact, high temperature etc.

These factors may be taken almost equal to those of Mitsubishi's MCCB. Heat resistivity of electronic circuits tends to be fell unreliable. To Mitsubishi's ELCB, enough allowance is given to ratings of the parts, the parts which can withstand high temperature operation are used, and the ICs incorporating tempereture compensation circuits are used to ensure stable operation even in varying temperature environment.

(12) Operation by carrier phone unit

Malfunctions of the ELCB can result in some cases when attached to a line provided with a carrier phone, which enables calls through the power line.

Since the carrier phone forcefully gives high frequency signals (normally 50kHz to 400kHz) between the line and the ground, the ELCB detects the high frequency signals as if they are leak current and leads to malfunction. Malfunction or not depends largely on magnitude of the high frequency signals, high frequency characteristic of the ELCB, and degree of rated sensitive current.

(13) Operation by electromagnetic wave

When a portable type transceiver is placed near the ELCB at transmission, particularly intense magnetic field is generated easily resulting in malfunction. Generally speaking, frequency bands of portable type transceivers are 27/28MHz, 50/50MHz, 150MHz, 400MHz, and 900MHz, and the output is about 0.5 to 5W. It is confirmed that the ELCB is free from any malfunction when different kinds of transceivers of 5W output are used for transmission being placed at 1m from the ELCB.

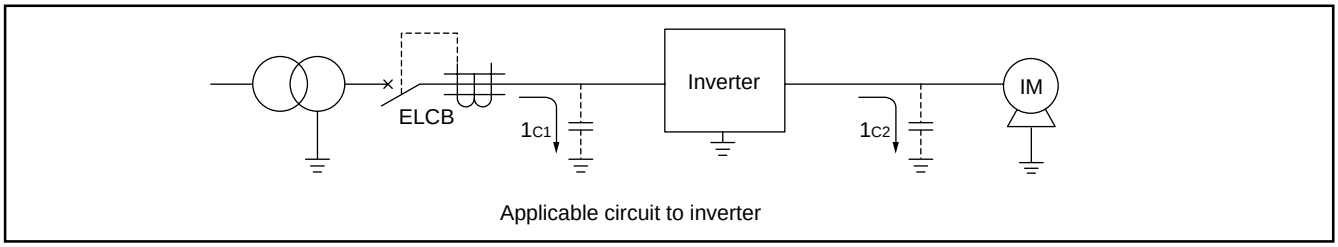
(14) Operation by inverters

Inverters operate many high-frequency components as they turn A.C. power supply to D.C. through rectification, then turn to A.C. again by switching through transistors.

Increased static capacity to ground sometimes causes malfunctions as the high frequency components are kept flowing by the static capacity to ground. To use ELCB in general in an inverter circuit, it is necessary to select those of lower sensitive current than usual in order avoid unnecessary operation.

For ground fault detection of high sensitivity in inverter circuit and yet for stable ground fault detection at both the primary and the secondary sides of the inverters, it is necessary to use an ELCB designed for higher harmonic earth-leakages and surges, which is hardly affected by high frequency components, as the measure against the inverter.

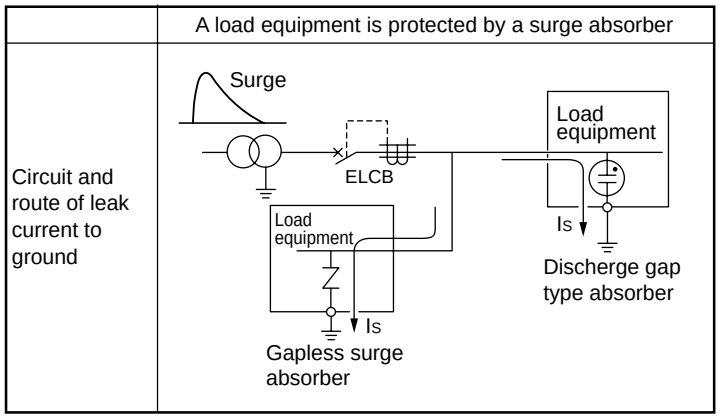
It is also essential to install the ELCB at the primary side of the inverter, and never at the secondary side.



Applicable circuit to inverter

(15) Others

As electronic arrangement of load equipment advances, surge absorbers are installed in the equipment more and more to protect them against surge. As the surge absorbers connected to the ground discharge the surge to the ground, a high leak current is generated to the ground, for a short time though, and unnecessary operation of the ELCB is resulted in some cases.



Leak current to ground through surge absorber

Most Mitsubishi's ELCB are provided with a DPDC surge discriminating circuit for judging ground fault current by failure such as faulty insulation from leak current to ground by surge, and improvement in the performance of preventing unnecessary operation is realized even when the surge absorber is installed between the line and the ground.

7. After-sales service

7.1 Countermeasures to be taken in case of anomaly

Should any anomaly arise while the circuit-breaker is operating, take the following countermeasures:

⚠CAUTION

- Use to be prohibited under abnormal conditions:
  Continuing to use the circuit-breaker under abnormal conditions may lead to some accidents.

① With electrical safety supervisor

If any anomaly occurs, the electrical safety supervisor shall be informed of this anomaly, and necessary inspection shall be worked out based on the instructions given by this supervisor. In case when the cause is unknown or repairing required, please contact our Service Center or our branches.

② Without electrical safety supervisor

Immediately contact our Service Center, our branches or the nearest electric work contractor.

7.2 After-sales service system

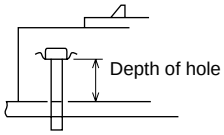
We have organized a system responding to any requests from users (inspection, repairing, diagnosis of degradation). For any detail, do not hesitate to contact us.

APPENDIX 1 Breaker mounting screws

■ NFB

Series	Type	Depth of hole	Wood screw (round wood screw)for Front-connection	Front-connection	Rear-connection	Plug-in (drawout)	Required quantity per unit			
							1P	2P	3P	4P
S·C·M·E	NF30-CS, MB30-CS	10	4.1 X 25	M4 X 0.7 X 20	M4 X 0.7 X 20	—	—	2	2	—
	NF50-SS(1P)	46	—	M4 X 0.7 X 55	M4 X 0.7 X 55	—	2	—	—	—
	NF32-SW, NF63-CW, NF63-SW, NF63-HW NF125-CW, NF125-SW, NF125-HW NF250-CW, NF250-SW, NF250-HW MB30-SW, MB50-CW, MB50-SW MB100-SW	45	4.1 X 58	M4 X 0.7 X 55	M4 X 0.7 X 55	M4 X 0.7 X 55	—	2	2	4
	NF160-SW, NF160-HW, MB225-SW	45	4.1 X 58	M4 X 0.7 X 55	M4 X 0.7 X 55	M4 X 0.7 X 55 M4 X 0.7 X 73	—	2 (plug-in:4)	2 (plug-in:4)	4
	NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW	63	—	M4 X 0.7 X 73	M4 X 0.7 X 73	M4 X 0.7 X 73	—	4	4	4
	NF400-CP, NF400-SP, NF400-SEP NF400-HEP, NF400-REP	47	—	M6 X 60	M6 X 72	M6 X 72	—	4	4	4
	NF630-CP, NF630-SP, NF630-SEP NF630-HEP, NF630-REP NF800-CEP, NF800-SDP, NF800-SEP NF800-HEP, NF800-REP,	15	—	M6 X 35	M6 X 40	M6 X 35	—	4	4	4 (plug-in:6)
	NF1000-SS, NF1000-SSD, NF1250-SS NF1250-SSD	18.5	—	M8 X 40	M8 X 40	M8 X 40	—	4	4	4
	NF1600-SS, NF1600-SSD	18.5	—	M8 X 40	M8 X 40	—	—	4	4	4
	NF2000-S, NF2500-S, NFE2000-S	85.5	—	M10 X 120 (hexagonal socket bolt)	M10 X 120 (hexagonal socket bolt)	M12 X 60 (hexagonal bolt)	—	—	4	4 (drawout:4)
	NF3200-S, NFE3000-S	—	—	—	M12X60(hexagonal bolt)	M12X60(hexagonal bolt)	—	—	4	—
	NF4000-S, NFE4000-S	—	—	—	M12X75(hexagonal bolt)	M12X60(hexagonal bolt)	—	—	4	—
U	NF125-RGW, NF250-RGW	63	—	M4 X 0.7 X 73	M4 X 0.7 X 73	M4 X 0.7 X 73	—	4	4	—
	NF125-UGW, NF250-UGW	63	—	M4 X 0.7 X 73	M4 X 0.7 X 73	M4 X 0.7 X 73	—	4	4	4
	NF400-UEP	47/144	—	M6 X 65/162	M6 X 72/169	M6 X 72/169	—	—	4	—
	NF400-UEP(4P), NF630-UEP, NF800-UEP	15/112	—	M6 X 35/132	M6 X 40/137	M6 X 35/132	—	—	4	6
	NF1250-UR	22.5	—	M8 X 45	M8 X 45	M8 X 45	—	—	4	4
BH	BH, BH-S	—	—	Mounting bracket	—	—	2	4	4	—
			—	Mounting plate	—	—	—	—	—	—
	BH-P, BH-PS	—	—	—	—	BPA mounting base	—	—	—	—
UL	NF50-SWU, NF100-CWU, NF100-SWU, NF225-CWU	45	—	M4 X 0.7 X 55	—	—	—	2	2	—
	NF-SFW, NF-SJW, NF-HJW	63	—	M4 X 0.7 X 73	—	—	—	—	4	—

Remark 1) The attaching screws as shaded in the table above shall be delivered in the same packages as MCCB, except the plug-in connection type screws, which shall be put into the package of plug-in type terminal block. Any other attaching screws shall be supplied by users themselves.
2) Attaching screws other than hexagonal socket bolts and hexagonal bolts are Pround head screws.
3) Any models having two types of attaching screws have different screws lengths on line and load sides.
4) NF800-UEP have no plug-in type.



■ NV

	Type		Depth of hole	Wood screw (round wood screw) for Front-connection	Screw for iron plate (P round head screw)			Required quantity per unit	
					Front-connection	Rear-connection	Plug-in	2.3P	4P
ELCB	NV-2F, NV-G2N, NV-G3NA		16	4.1 X 25	M4 X 0.7 X 35	—	—	2	—
	NV30-CS, MN30-CS		10	4.1 X 25	M4 X 0.7 X 20	M4 X 0.7 X 20	—	2	—
	NV50-CSA		10	4.1 X 25	M4 X 0.7 X 20	M4 X 0.7 X 20	—	2	—
	NVB50-P		—	—	BPA mounting base		—	1	—
	NV32-SW, NV63-CW, NV63-SW, NV63-HW		45	4.1 X 58	M4 X 0.7 X 55	M4 X 0.7 X 55	M4X0.7X55	2	—
	NV125-CW, NV125-SW, NV125-HW		45	4.1 X 58	M4 X 0.7 X 55	M4 X 0.7 X 55	M4X0.7X55	2	4
	NV125-RW		45/61	—	M4 X 0.7 X 55/73	M4 X 0.7 X 55/73	M4X0.7X55/73	4	—
	NV250-SEW, NV250-HEW, NV250-CW, NV250-SW, NV250-HW		45	4.1 X 58	M4 X 0.7 X 55	M4 X 0.7 X 55	M4X0.7X55	2 (plug in:4)	—
	NV250-RW		45/61	—	M4 X 0.7 X 55/73	M4 X 0.7 X 55/73	M4X0.7X55/73	4	—
	NV400-CP, NV400-SP, NV400-SEP, NV400-HEP, NV400-REP		47	—	M6 X 60	M6 X 72	M6 X 72	4	4
	NV630-CP, NV630-SP, NV630-SEP, NV630-HEP NV800-SEP, NV800-HEP		15	—	M6 X 35	M6 X 40	M6 X 35	4	4
	NV1000-SB · 1200-SB		18.5	—	M8 X 40	M8 X 40	M8 X48	4	—
ELR	Relay	ZBA	10	—	M4 X 0.7 X 20	—	—	2	
		ZSA · ZU · ZHA	10.5	—	M4 X 0.7 X 20	Flush (P counter sunk flat head screw) M4 X 0.7 X 12	—	2	
	ZCT	ZT15B · ZT30B · ZT40B	—	—	M5 X 0.8 X 20	—	—	4	
		ZT60B · ZT80B · ZT100B	—	—	M6 X 20	—	—	4	

Remark 1) The attaching screws as shaded in the table above shall be delivered in the same packages as ELCB.
2) NV1000-SB and NV1200-SB have no plug-in type.

APPENDIX 2 Standard tightening torque for connections

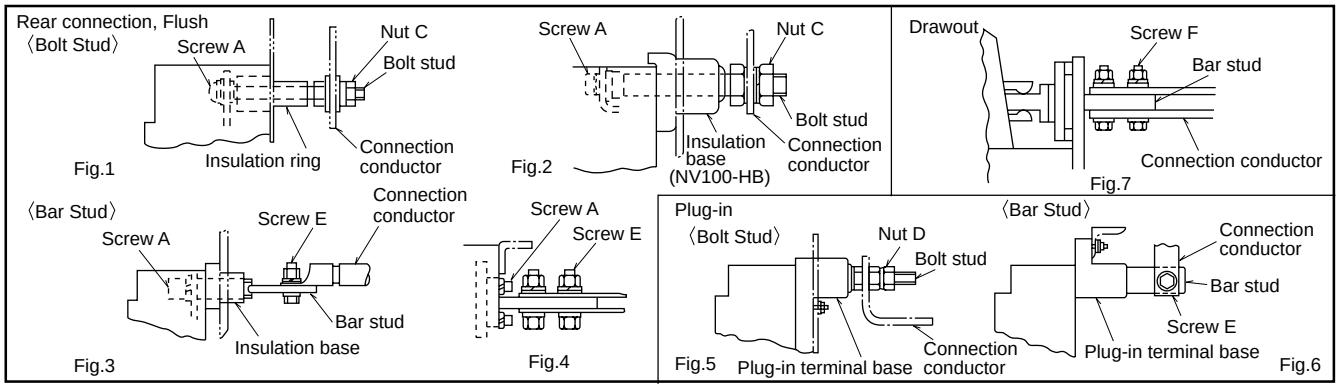


Table List of standard tightening torque for connections (Note 1)

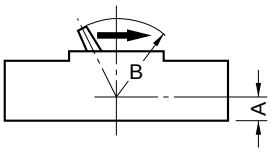
Torque in N·m

Type / Connection		Rear connection								Plug-in type				drawout type	
		Bolt stud				Bar stud				Bolt stud		Bar stud		Bar stud	
		Fig. 1		Fig. 2		Fig. 3		Fig. 4		Fig. 5		Fig. 6		Fig. 7	
		Screw A		Nut C		Screw A		Screw E		Nut D		Screw E		Screw F	
MCCB	ELCB	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque
NF30-CS, MB30-CS	NV30-CS, MN30-CS	M4X0.7	—	M6	2	—	—	—	—	—	—	—	—	—	—
NF32-SW NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW	NV32-SW, NV63-CW NV63-SW, NV63-HW	M4X0.7	1	M6	2	—	—	—	—	M6	2	—	—	—	—
NF125-CW, NF125-SW, NF125-HW NF125-RW, MB100-SW	NV125-CW, NV125-SW NV125-HW NV100-SEP, NV100-HEP NV125-RW	—	—	—	—	M6	4	M8	12	M8	5	—	—	—	—
NF160-SW, NF160-HW, NF250-CW NF250-SW, NF250-HW, MB225-SW	NV250-CW, NV250-SW NV250-HW, NV250-SEW, NV250-HEW, NV250-RW	—	—	—	—	M6	10	M8	12	—	—	M8	12	—	—
NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW NF125-RGW, NF125-UGW, NF250-RGW, NF250-UGW	—	—	—	—	—	M6	10	M8	12	—	—	M8	12	—	—
NF400-CP, NF400-SP, NF400-SEP NF400-HEP, NF400-REP	NV400-CP, NV400-SP NV400-SEP NV400-HEP, NV400-REP	—	—	—	—	M8	20	M12	45	—	—	M12	45	—	—
NF400-UEP(3P)															
NF400-UEP(4P)	—	—	—	—	—	M10	30	M12	45	—	—	M12	45	—	—
NF630-CP, NF630-SP, NF630-SEP NF630-HEP, NF630-REP	NV630-CP, NV630-SP NV630-SEP, NV630-HEP	—	—	—	—	M10	30	2-M12	45	—	—	2-M12	45	—	—
NF630-UEP															
NF800-CEP, NF800-SDP, NF800-SEP NF800-HEP, NF800-REP	NV800-SEP, NV800-HEP	—	—	—	—	M10	30	2-M12	45	—	—	2-M12	45	—	—
NF800-UEP (Note 2)															
NF1000-SS, NF1000-SSD NF1250-SS, NF1250-SSD	NV1000-SB (Note 2) NV1200-SB	—	—	—	—	4-M8	12	2-M12	45	—	—	2-M12	45	Same as the plug-in type	
NF1250-UR (Note 2)															
NF1600-SS, NF1600-SSD	—	—	—	—	—	4-M8	12	4-M10	25	—	—	—	—	—	—
NF2000-S, NFE2000-S	—	—	—	—	—	4-M8	12	4-M10	25	—	—	—	—	4-M10	25
NF2500-S	—	—	—	—	—	4-M8	12	4-M12	45	—	—	—	—	4-M12	45
NF3200-S, NF4000-S NFE3000-S, NFE4000-S	—	—	—	—	—	4-M12	45	4-M16	100	—	—	—	—	4-M16	100

Note 1) The suitable range of tightening torque shall be the corresponding numerical values in the table above ±20%. For detail, please refer to the handling procedures to be found in the package.

2) No plug-in type.

APPENDIX 3 Operating force of handle



The numerical values below represent the measurements resulting from the handle as pulled horizontally (arrowed direction). B size gives the dimensions without those of auxiliary handle.

	Type	Poles	Operational force of handle, N · m			Dimensions (mm)	
			ON	OFF	Reset	A	B
MCCB S.C.M	NF30-CS, MB30-CS	2, 3	0.45	0.15	0.03	47	20
	NF32-SW, NF63-SW, NF63-HW, NF63-CW MB30-SW, MB50-SW, MB50-CW	2	1.05	1.25	2.5	32	58
		3	1.35	1.55	3.1		
	NF50-HCW	3	1.5	1.4	2.85	46	58
	NF125-SW, NF125-HW, NF125-CW, MB100-SW	2	0.83	0.99	3.15	33	57
		3	1.31	1.53	4.93		
	NF250-SW, NF250-CW, MB225-SW, NF160-SW	2, 3	2.1	3	5.2	38	54
	NF250-HW, NF250-HEW, NF160-HW	2, 3	2.1	3	5.2	38	54
	NF125-SGW, NF125-HGW, NF-SFW (110A and less)	2, 3	2.9	2.7	2.9	42.5	67.5
		4	3.3	3.1	3.3		
		3	2.9	2.7	2.9		
	NF160-SGW, NF160-HGW	2, 3	3.3	3.1	3.3		
		4	3.6	3.3	3.5		
	NF250-SGW, NF250-HGW	2, 3	4.4	3.9	3.9		
		4	4.6	4.0	4.5		
	NF-SFW (125A and more), NF-SJW, NF-HJW	3	4.4	3.9	3.9		
	NF400-SP, NF400-SEP, NF400-HEP, NF400-REP	2, 3	10.2	8.4	20	49	106
	NF400-CP	2, 3	7.8	6.15	16.1	49	85
	NF630-CP, NF630-SP, NF630-SEP, NF630-HEP, NF630-REP NF800-CEP, NF800-SDP, NF800-SEP, NF800-HEP, NF800-REP	3	13.5	12	30	49	106
	NF1000-SS, NF1000-SSD, NF1250-SS, NF1250-SSD, NF1600-SS, NF1600-SSD	3	15.5	10.1	19.4	84	106
	NF2000-S, NF2500-S	3	51.3	31	54	142	159
	NFE2000-S	3	79.2	55	92.4	142	159
	NF3200-S, NFE3200-S	3	79.2	55	92.4	167	159
	NF4000-S, NFE4000-S	3	78.5	52.4	149.6	217	164
U	NF125-RGW, NF125-UGW	3	2.9	2.7	2.9	42.5	67.5
	NF250-RGW, NF250-UGW	3	4.4	3.9	3.9	42.5	67.5
	NF400-UEP	3	10.2	8.4	20	146	106
	NF630-UEP, NF800-UEP	3	13.5	12	30	146	106
	NF1250-UR	2, 3	15.5	10.1	19.4	88	106
ELCB	NV30-CS	3	0.45	0.15	0.03	47	20
	NV50-CSA	2, 3	1.35	1.55	3.1	32	58
	NV63-CW	2, 3					
	NV32-SW, NV63-SW	2, 3					
	NV63-HW	3					
	NV100-SEP, NV100-HEP	3	2.05	2.55	5.1	34	56
	NV125-SW, NV125-HW, NV125-CW	3	1.31	1.53	4.93	33	57
	NV125-RW	3					
	NV250-SW, NV250-SEW	3	2.1	3	5.2	38	54
	NV250-HW, NV250-HEW	3					
	NV250-CW	3					
	NV250-RW	3	2.1	3	5.2	38	54
	NV400-SP, NV400-SEP, NV400-HEP, NV400-REP	3	10.2	8.4	20	49	106
	NV400-CP	3	7.8	6.15	16.1	49	85
	NV630-CP, NV630-SP, NV630-SEP, NV630-HEP NV800-SEP, NV800-HEP	3	13.5	12	30	49	106
	NV1000-SB, NV1200-SB	3	35.2	6.2	23.8	92	98
	NV1000-SA, NV1200-SA	3	35.2	6.2	23.8	128	98

APPENDIX 4 Service network

Country / Region	Company	Address	Telephone
Australia	Mitsubishi Electric Australia Pty. Ltd	348 Victoria Road, Rydalmere, N.S.W. 2116, Australia	612-9684, 7586
Belgium	Emac S.A.	Industrialaan 1, B-1702 Groot-Bijgaarden, Belgium.	32-(0)2-4810211
Chile	RHONA S.A.	Vte. Agua Santa 4211 Casilla 30-D (P.O. Box) Viña Del Mar. Chile	(56-32)-610896
China	SHANGHAI SETSUYO TRADING CO.,LTD.	Building of Innovation Center, Room No. 406A, 680 Guiping Road Shanghai, P.R.China	021-6485-6611
	RYODEN INTERNATIONAL LTD.	(Shanghai) 3F, Block 5, 103 Cao Bao Road, Shanghai, China	021-6475-3228
Colombia	Proelectrico Representaciones S.A.	Cra 53 No 29C-73 U.I.C.- Medellin. COLOMBIA.	574-235-00-28
Denmark	Louis Poulsen CO. A/S	Geminivej 32, DK-2670 Greve, Denmark.	45-(0)43-95-95-95
Egypt	CAIRO ELECTRICAL GROUP	9 Rostoum Street Garden City, APT. 5, P.O. BOX: 165-11516, Cairo-Egypt.	20-2-7961337
Germany	Mitsubishi Electric Europe B.V. German Branch.	Gothaer Strasse 8, 40880 Ratingen, Germany.	49-(0)2102-4860
Greece	Drepanias Antonios S.A.	52, Arkadias STR.GR 121 32. Peristeri Athens Greece.	30(1)57 81 599 699
Hong Kong	Ryoden international Ltd.	10/F Manulife Tower 169 Electric Road North Point. Hong Kong.	28878870
Indonesia	P.T.SAHABAT INDONESIA.	JL Muara Karang Selatan Blok A/Utara No.1 kav. NO.11 P.O. Box 5045/Jakarta/11050. Jakarta Indonesia.	021-6621780
Ireland	Mitsubishi Electric Europe B.V. Irish Branch.	Westgate Business Park, Ballymount, Dublin 24, Ireland.	353-(0)1-4505007
Italy	Mitsubishi Electric Europe B.V. Italy	C.D.Colleoni-P.Perseo Ing.2, Via Paracelso 12 1-20041 Agrate Brianza (M1)	39-(0)39 60 531
Korea	HAN NEUNG TECHNO Co., Ltd.	2 Fl. Dong Seo Game Channel Bldg ., 1F 660-11 Deungchon-Dong, Kanguseo-Ku, Seoul, 157-030 Korea	82-2-3668-6567
Kuwait	SALEM M AL-NISF ELECTRICAL CO.W.L.L.	P.O. Box 4784. Safat. 13048 Kuwait.	965-484-5660
Lao PDR	SOCIETE LAO IMPORT-EXPORT	43-47 Lane Xang Road P.O. BOX 2789 VT Vientiane Lao PDR.	21-215043, 21-215110
Lebanon	COMPTOIR D'ELECTRICITE GENERALE INTERNATIONAL	Cebaco Center-Block A. Autostrade Dora, P.O. BOX: 90-1314 Beirut-Lebanon.	961-1-240430
Myanmer	PEACE MYANMAR ELECTRIC CO., LTD.	NO. 216, Bo Aung Gyaw Street, Botataung 11161, Yangon, Myanmar.	951-295426
Nepal	Watt & Volt House Co., Ltd.	KHA 2-65, Volt House Dilli Bazar Post Box: 2108, kathmandu, Nepal	977-1-411330
New Zealand	Melco Sales (N.Z.) Ltd.	1 Parliament Street Lower Hutt. New Zealand.	644-569-7350
Norway	SCANELEC	Leirvikasen 43B, N5020 Bergen, Norway.	47-55-506000
Pakistan	Prince Electric Co.	16 Brandreth Road Lahore 54000. Pakistan.	042-7654342
Philippines	EDISON ELECTRIC INTEGRATED, INC.	24th Fl. Galleria Corporate Center Edsa Cr, Ortigas Ave. Quezon City, Metro Manila. Philippines.	02-643-8691
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Singapore	MITSUBISHI ELECTRIC ASIA PTE LTD.	307 Alexandra Road #05-01/02 Mitsubishi Electric Building Singapore 159943	65-473-2308
Slovenia	INEA d.o.o.	Ljubljanska 80, SI-61230 Domzale, Slovenia.	386-(0)17 21 80 00
South Africa	Circuit Breaker Industries LTD.	Private Bag 2016. Isando 1600, Johannesburg, South Africa	27-11-928-2000
Spain	Mitsubishi Electric Europe B.V. Spanish Branch.	Caretera De Rubi 76-80, 08190 - Sant Cugat Del Valles (Barcelona) Spain	34-93-595-3131
Sweden	Euro Energy Components AB	Box 103 48 S-434 24 Kungsbcka, Sweden.	46-(0)300-69 00 40
Switzerland	Trielec A G	Mühlentalstrasse 136, 8201 Schaffhausen, Switzerland	41-(0)52-6258425
Taiwan	Setsuyo Enterprise Co., Ltd.	6F, NO. 105 Wu-Kung 3rd rd., Wu-Ku Hsiang, Taipei Hsien Taiwan	02-2298-8889
Thailand	UNITED TRADING & IMPORT CO. LTD.	77/12 Bumrungmuang Road, Klong Mahanak, Pomprab Bangkok 10100.	223-4220-3
The Netherlands	Imtech Marine & Industry	Postbox 5054, NL-3008 AB-Rotterdam, Netherlands.	31-(0)10 487 19 11
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U.K.	Mitsubishi Electric Europe B.V. UK-Branch.	Travellers Lane, Hatfield, Herts, AL10 8xB, U.K.	44-(0)1707-276-100
Uruguay	Fierro Vignoli S.A.	P.O. box 20022/Suc Upae, Montevideo. Uruguay.	598-2-92-08-08
Venezuela	ADESCO C.A.	Lle 8, Calpon Elinsu, La Urbina-EDO, Miranda P.O. BOX 78034 Caracas 1074A., Venezuela	58-2-241-7634
Vietnam	Sa Giang Techno Co., Ltd.	207/4 Nguyen Van Thu St., Dist 1, Ho Chi Minh City, Vietnam	848-821-6453

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EARTH LEAKAGE CIRCUIT BREAKERS,
EARTH LEAKAGE RELAYS &
CIRCUIT PROTECTORS

Safety Tips : Be sure to read the instruction manual fully befofe using this product.

MITSUBISHI ELECTRIC CORPORATION
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