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UTS800/UTS1200
UL MCCB Manual

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Installation Instructions

UTS800/UTS1200

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FRAMES UTS800 TO UTS1200 FRONT MOUNTING TYPE CIRCUIT BREAKERS AND MOLDED CASE SWITCHES

DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- 1) This equipment must be installed and serviced only by qualified electrical personnel.
- 2) Turn off and lock out all power supplying this equipment before working on or inside equipment.
- 3) Replace all devices, doors, and covers before turning on power to this equipment.
- 4) Always verify that no voltage is present before working on or inside equipment, and always follow generally accepted safety procedures.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

LS Industrial Systems is not liable for the misapplication or mis-installation of its products.

The user is cautioned to observe all recommendations, warnings and cautions relating to the safety of personnel and equipment as well as general and local health and safety laws, codes and procedures.

1. Circuit Breaker Installation

Make sure that the equipment is suitable for the installation by comparing nameplate ratings with system requirements. Inspect the equipment for completeness and check for any damage.

DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- 1) Before mounting the circuit breaker in an electrical system, make sure there is no voltage present where work is to be performed.
- 2) Mount no closer to enclosure metal or live parts than is indicated in drawing.
- 3) All enclosure closing hardware must be installed.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

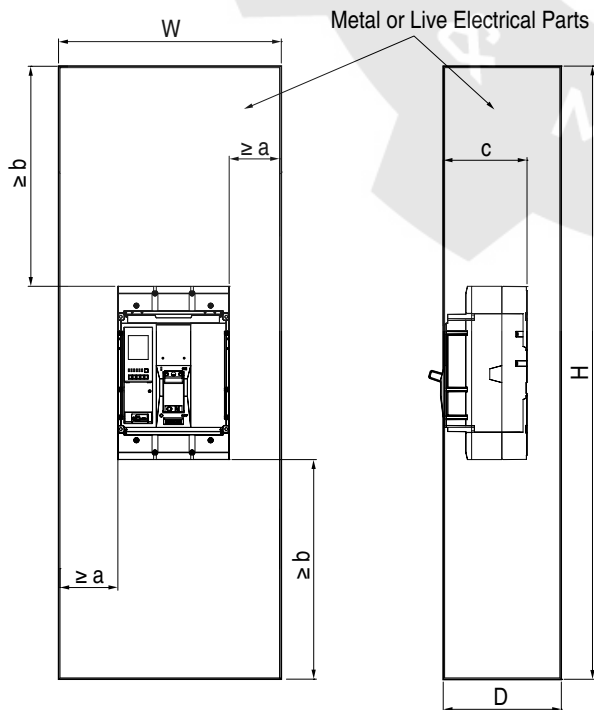
Dimensions for electrical and mechanical clearance to metal or live electrical parts.(See Fig. 1)

To mount the circuit breaker perform the following steps:

- 1) For individual surface mounting, drill and tap mounting bolts holes according to the drilling plan shown in Fig. 2. For dead- front cover applications, cut out cover to correct escutcheon dimensions refer to Fig. 3.
- 2) If circuit breaker includes factory-or field-installed internal accessories, make sure that accessory wiring can be reached when the circuit breaker is mounted.
- 3) Position circuit breaker on mounting surface. \geq
- 4) Install circuit breaker mounting screws and washers. Tighten hardware securely, but do not exceed 36 lb-in(4N.m.).

Enclosure Information

- Dimensions



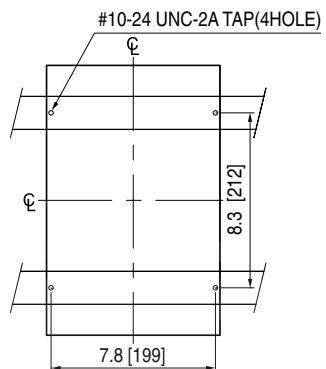
<Fig. 1> Clearances for Circuit Breaker

Circuit Breaker Type	80% RATED Inch(mm)					
	W	H	D	a	b	c
UTS800	20.3 (514.4)	51.9 (1318.3)	7.8 (196.9)	6.0 (152.2)	19.5 (495.6)	6.1 (155.5)
UTS1200	20.3 (514.4)	51.9 (1318.3)	7.8 (196.9)	6.0 (152.2)	17.8 (452.6)	6.1 (155.5)

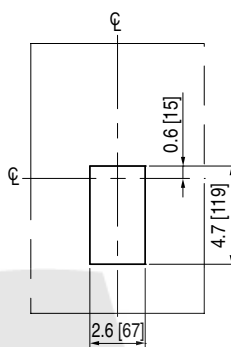
<Table.1> Size of Enclosure (80% Rated)

Circuit Breaker Type	100% RATED Inch(mm)					
	W	H	D	a	b	c
UTS800	20.3 (514.4)	51.9 (1318.3)	7.8 (196.9)	6.0 (152.2)	19.5 (495.6)	6.1 (155.5)
UTS1200	23.0 (584.2)	62.3 (1581.2)	14.8 (374.7)	7.4 (187.1)	23.0 (584.0)	6.1 (155.5)

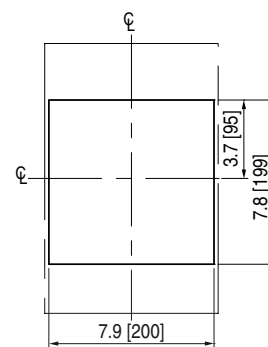
<Table.2> Size of Enclosure(100% Rated)



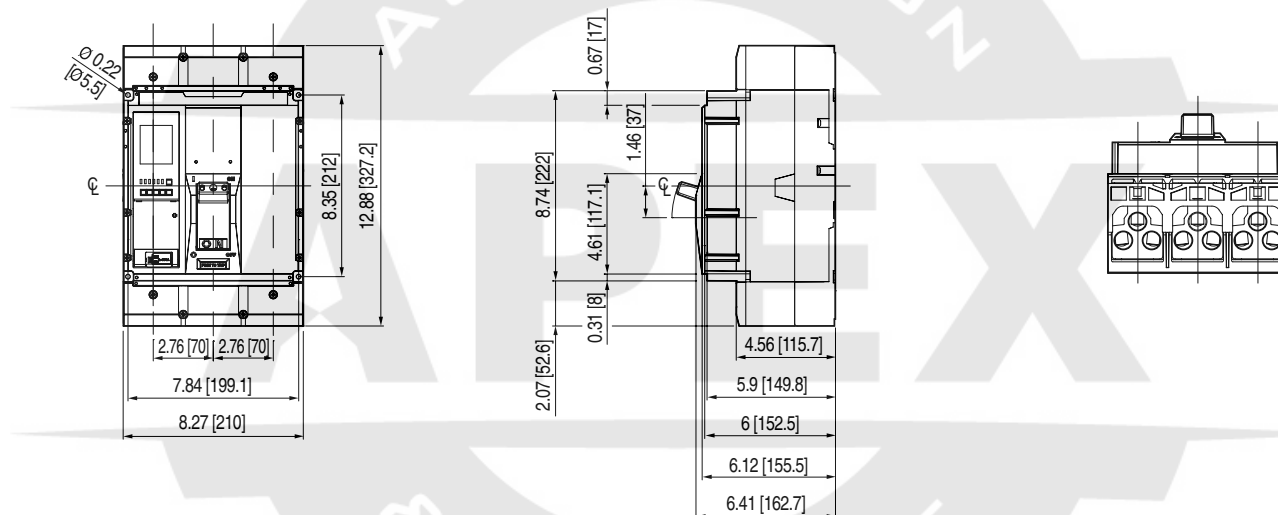
<Fig. 2> Circuit Breaker Mounting Holes Dimensions



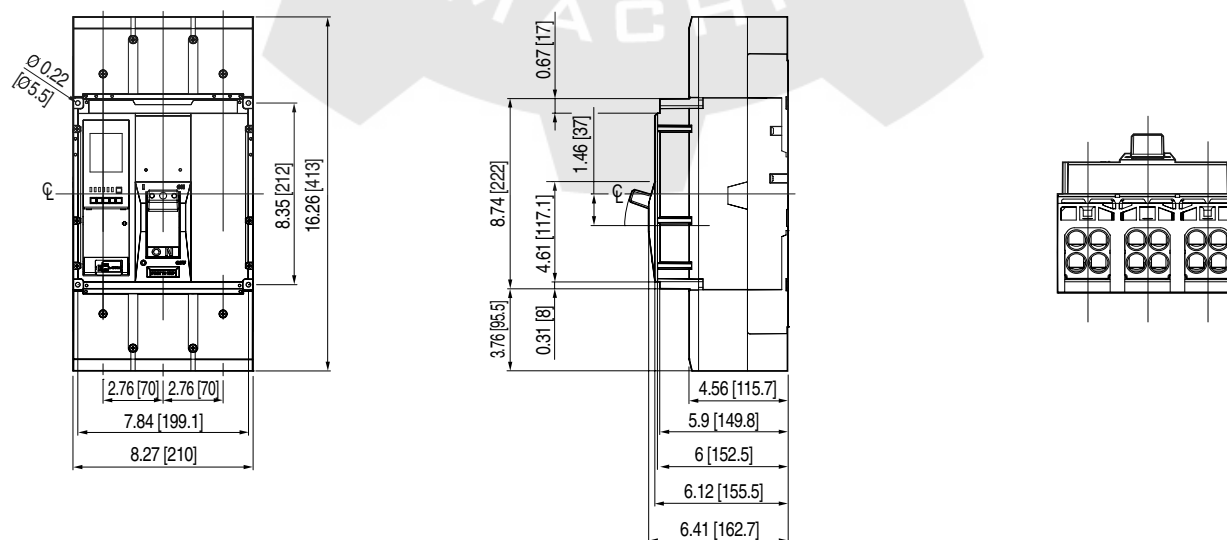
<Fig. 3> Circuit Breaker Escutcheon Dimensions

**Circuit Breaker Dimension**

- Dimensions



<Fig. 4> Individually-mounted 800 A 3-pole Circuit Breaker with Lugs at Both Ends

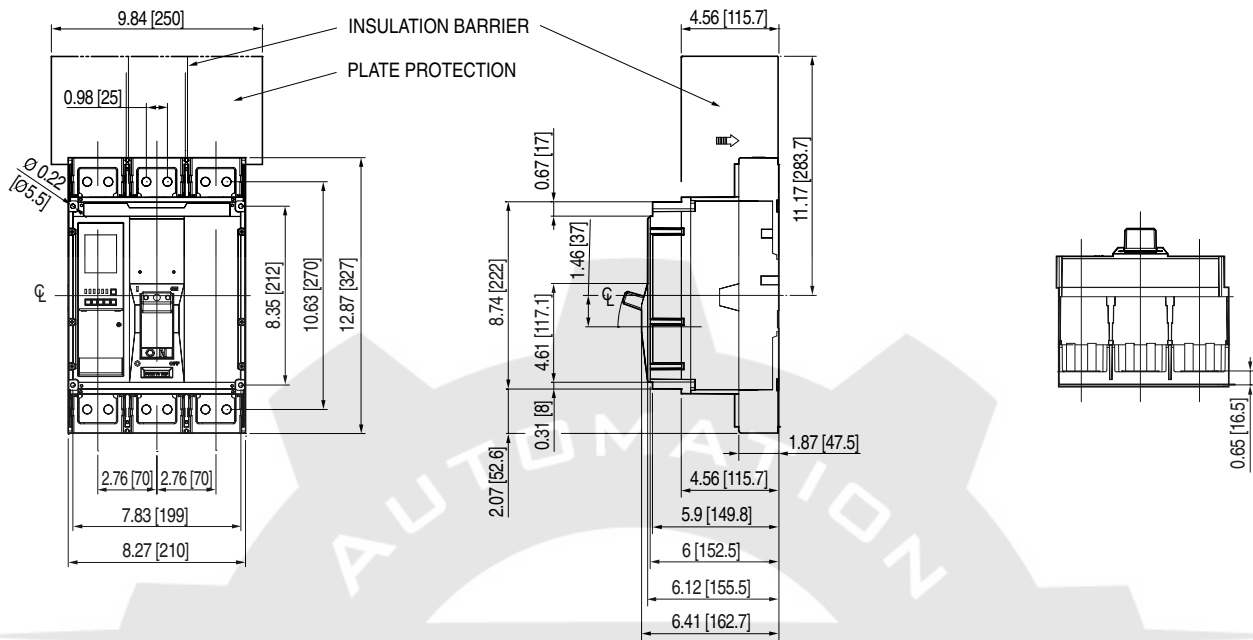


<Fig. 5> Individually-mounted 1200 A 3-pole Circuit Breaker with Lugs at Both Ends

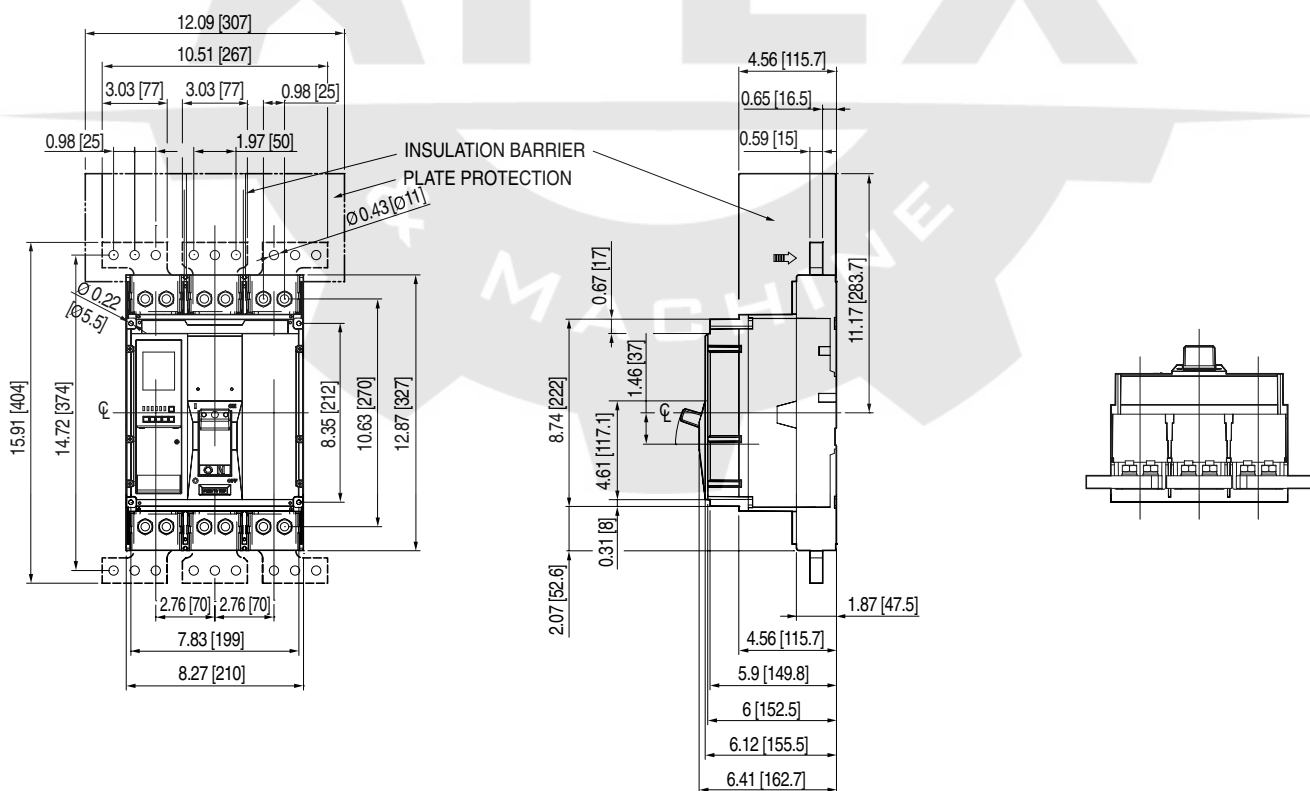
Installation Instructions

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<Fig. 6> Individually-mounted 800/1200 A 3-pole Circuit Breaker with Lugs at Both Ends



<Fig. 7> Individually-mounted 1200 A 3-pole Circuit Breaker with Connection Bus at Both Ends

2. Manual Operation

Manual Operation of the circuit breaker is controlled by the circuit breaker handle and the PUSH TO TRIP button. The circuit breaker has three positions, two of which are shown on the cover with raised lettering to indicate ON and OFF. The third position indicates a TRIP position and is between the ON and OFF positions. (See Fig. 8)

Circuit Breaker Reset

After an automatic or accessory initiated trip, or a manual PUSH TO TRIP operation, the circuit breaker is reset by moving the circuit breaker handle to the reset position.

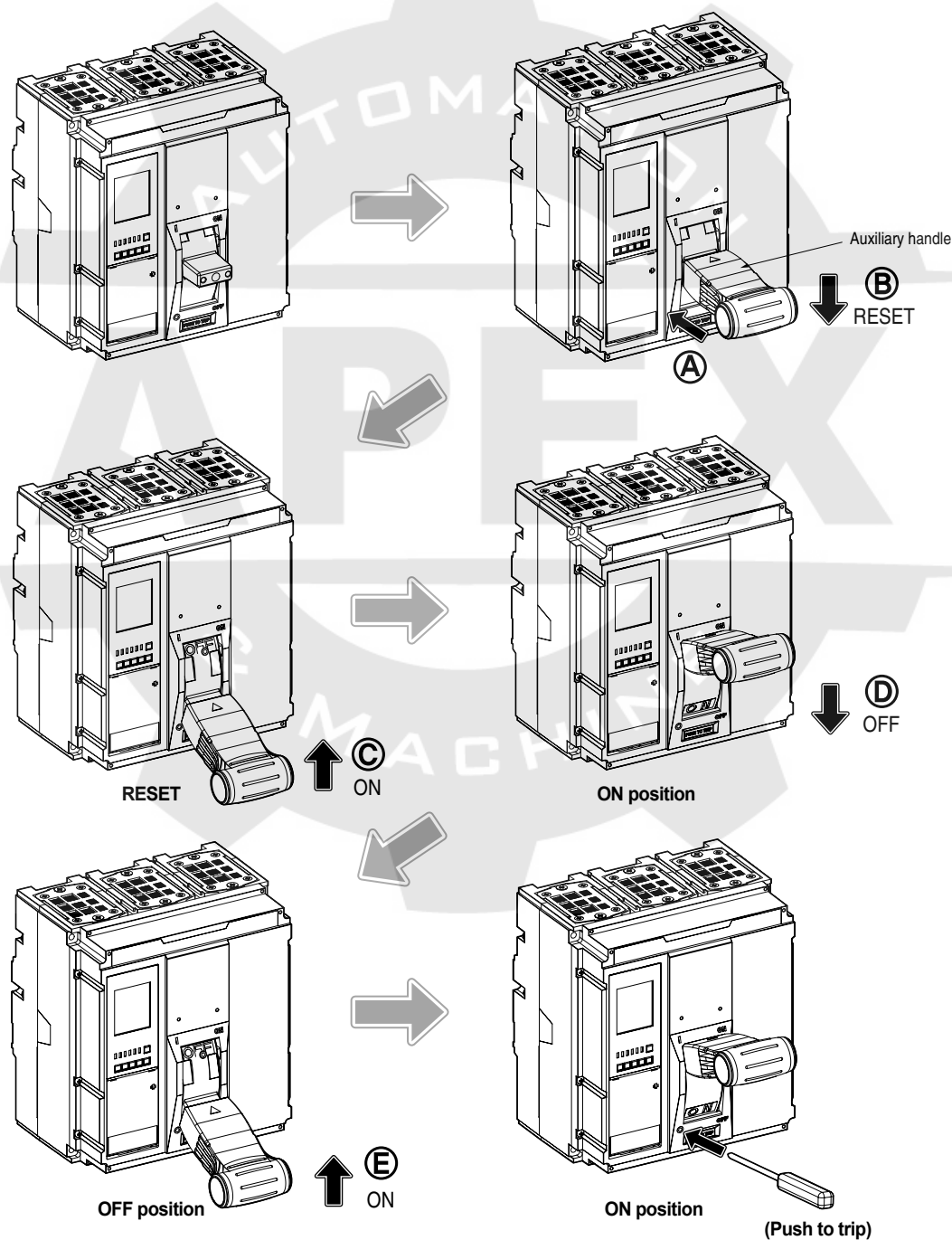
PUSH TO TRIP button

The PUSH TO TRIP button checks the tripping function and is used to manually exercise the operating mechanism.

NOTE) Press PUSH TO TRIP button once a year to exercise circuit breaker.

● Handle Position Indicator Color

- RED – ON
- GREEN – OFF (RESET)



<Fig. 8> Circuit Breaker Manual Controls

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3. Wire Installation



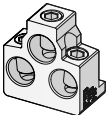

HAZARD OF FALSE TORQUE INDICATION

- 1) Do not allow conductor strands to interfere with threads of wire binding screw.
- 2) When installing cables into a lug body make sure cables do not back out during tightening of the wire binding screw.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN EQUIPMENT DAMAGE.

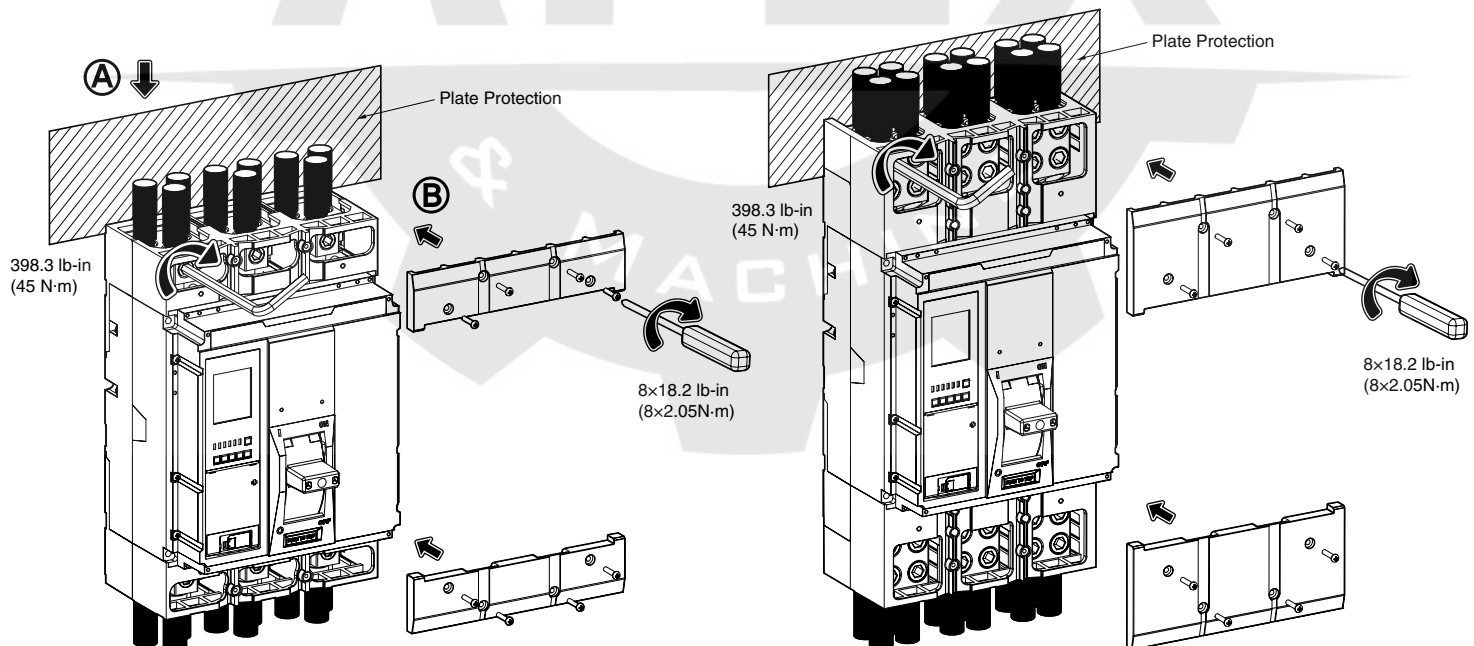
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<Table.3> Lug Information

Lug	Catalog Number	Ampere Range	Conductor				Wire Binding Screw Torque
			Type	Size	Number per Lug	Strip Length	
	AL800TS	400A	Cu	3/0AWG-	3	1.39 inch (35.2mm)	398.3 lb-in (45 N · m)
		600A		300kcmil			
		630A	Al	3/0AWG-			
		800A		400kcmil			
	AL1200TS	800A	Cu	3/0AWG-	4	Top: 1.46inch (37.1mm) Bottom: 2.54inch (64.6mm)	398.3 lb-in (45 N · m)
		1000A		350kcmil			
		1200A	Al	3/0AWG-			
				500kcmil			

Conductors must be cut square for secure termination.

- 1) Attach the PLATE PROTECTION as Fig.9. (Otherwise, short circuit may occur at phase to earth)
- 2) Square conductor ends and perform conductors to final configuration. Using a proper insulation stripping tool, strip conductor ends as recommended in Table 3.
Do not nick strands.
- 3) Install cable in lug (A), and torque wire binding screw as recommended on the faceplate and Table 3.
- 4) Install cover safety (B).

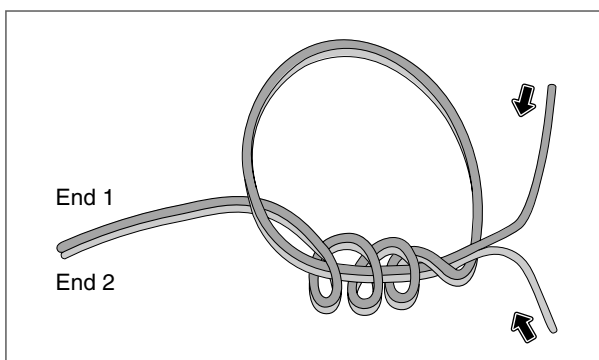
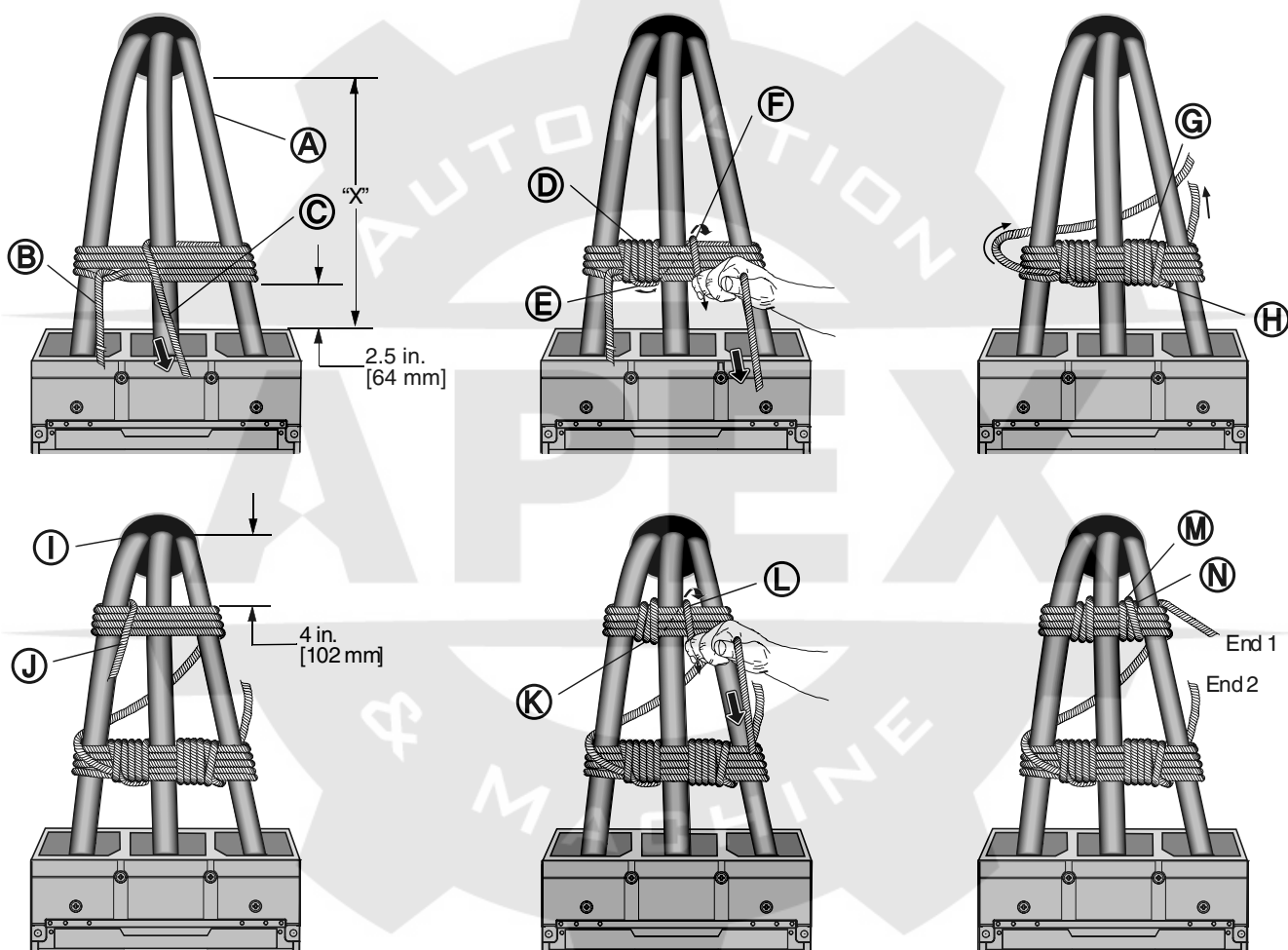


<Fig.9> Wire Installation

Restrain Cable

Wrap conductors using 30 ft. (9 m) of 3/8 in. (9.5 mm) sisal rope or equivalent.

- 1) Begin wrapping conductors (A) 2.5 in. (64 mm) above circuit breaker. Wrap conductors five times, leaving 12 plus "X" ft. (4 + "X"m) of excess rope at the first and (B). Pull rope (C) taut.
- 2) Wrap rope (D) several times until space between first two sets of conductors is completely filled. Weave final rope loop underneath previous loop (E). Bring rope (F) through right-hand space. Pull rope taut.
- 3) Wrap rope (G) several times until space between second and third set of conductors is completely filled. Weave final rope loop (H) underneath previous loop as shown. Pull rope taut.
- 4) Wrap rope four times around conductors 4 in. (102 mm) below where conductors exit enclosure (I). Pull rope (J) taut.
- 5) Wrap rope (K) several times until space between first two sets of conductors is completely filled. Bring rope (L) through right-hand space. Pull rope taut.
- 6) Wrap rope (M) several times until space between second and third set of conductors is completely filled. Weave final rope loop (N) underneath previous loop as shown. Pull rope taut.
- 7) Tie rope End 1 and End 2 together as shown. Rope must be taut. Cut off excess rope and tape ends to prevent fraying.
- 8) In the same way, Wrap the lower conductors.



<Fig. 10> Wrap Rope

Installation Instructions

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4. Accessory and Control Wiring Installation

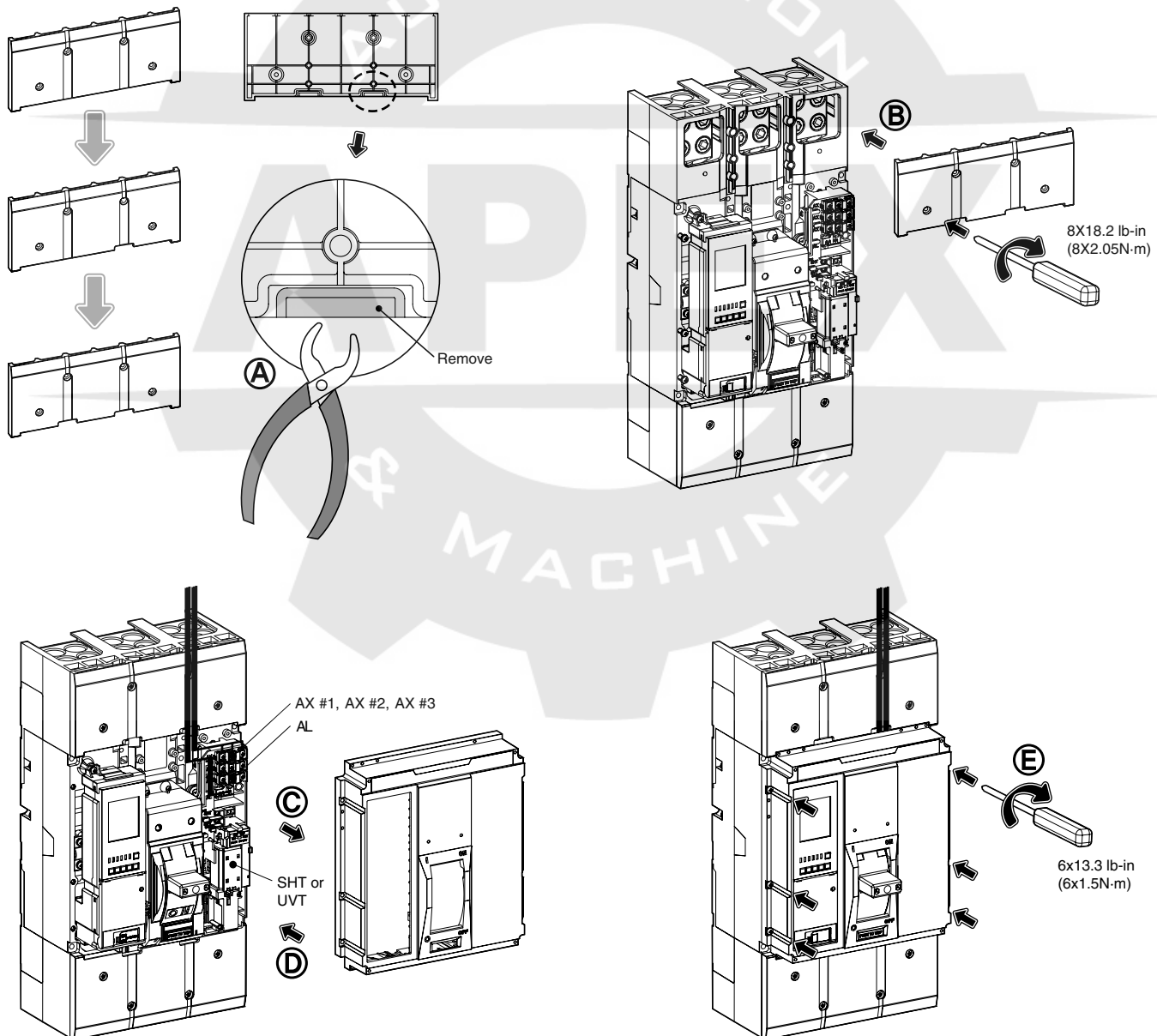
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- 1) Turn off all power supplying this equipment before working on or inside equipment.
- 2) Before removing the auxiliary cover in a circuit breaker, make sure there is no voltage present where work is to be performed and circuit breaker is tripped.

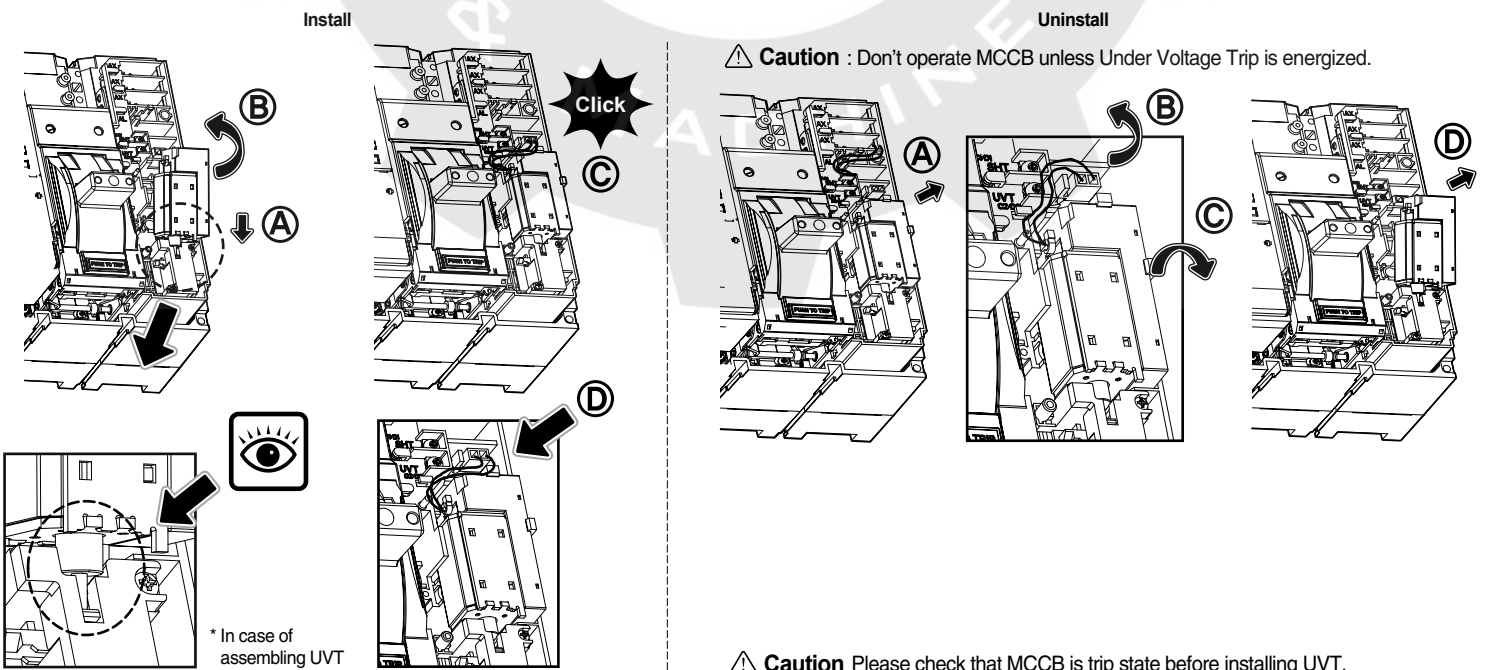
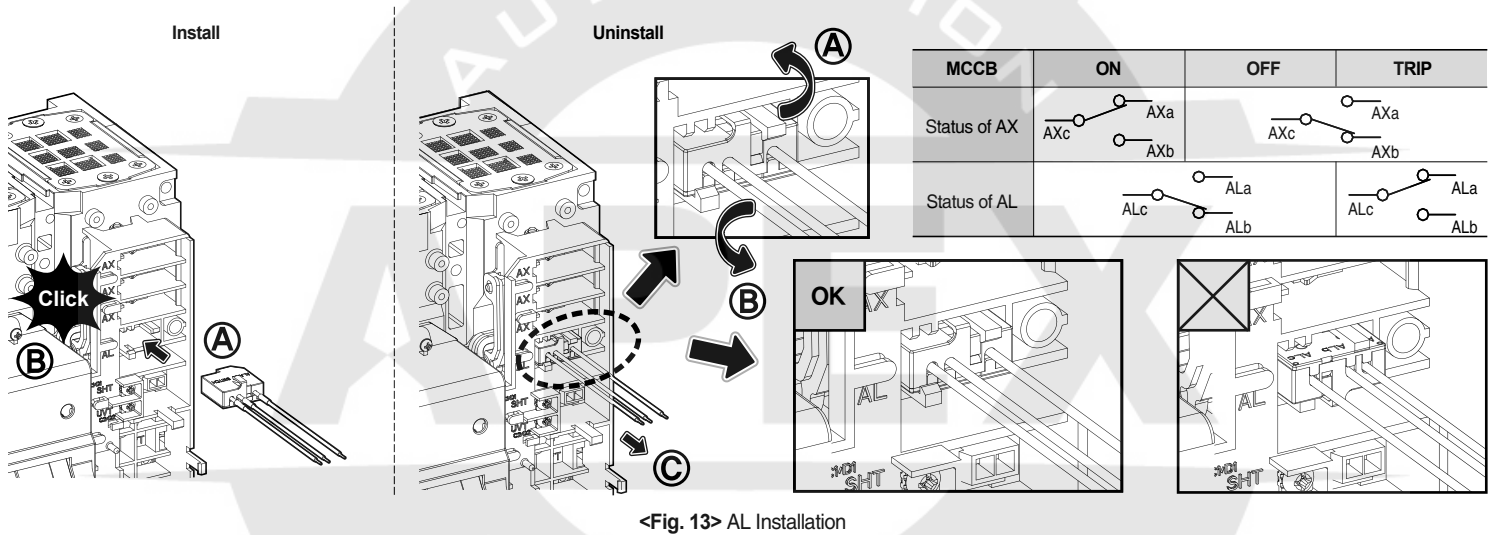
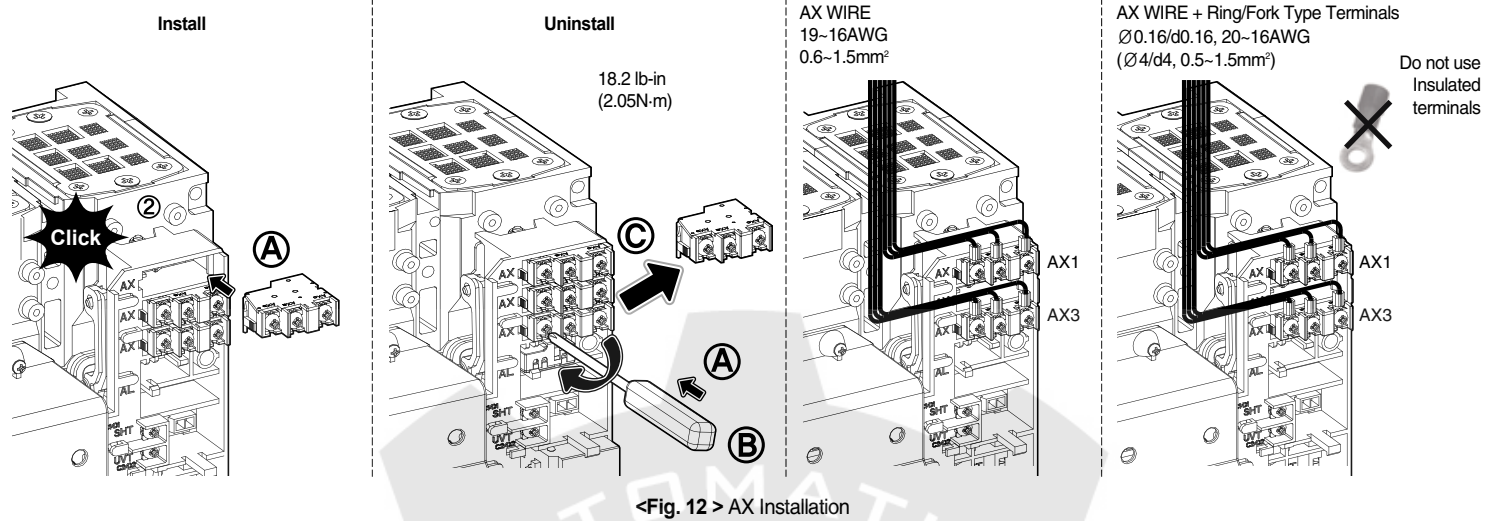
FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

- 1) Remove appropriate tab of safety cover with plier(A).
- 2) Install safety cover(B).
- 3) Loosen four screws from the auxiliary cover and open it (C).
- 4) Install field-installable accessories according to instructions supplied with them.
- 5) Arrange wire through wire opening in auxiliary cover to avoid pinching wires.
- 6) Replace auxiliary cover (D), and be careful not to pinch wires when installing cover.
Replace all auxiliary cover screws (E). Do not exceed torque specification of screws.
- 7) If circuit breaker has factory-installed accessories, refer to label on circuit breaker for electrical specifications.



<Fig. 11> Control Wiring Installation

Installation Instructions

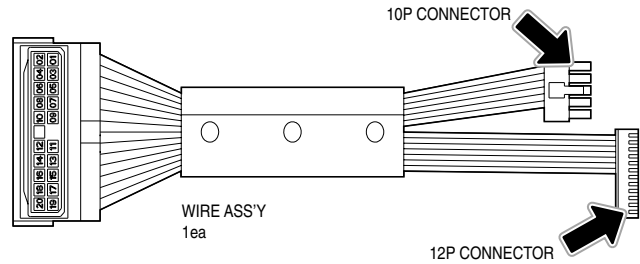
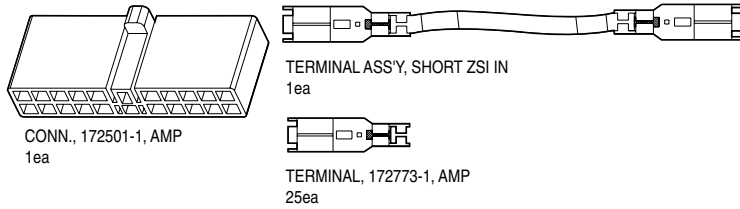


⚠ **Caution** Please check that MCCB is trip state before installing UVT.

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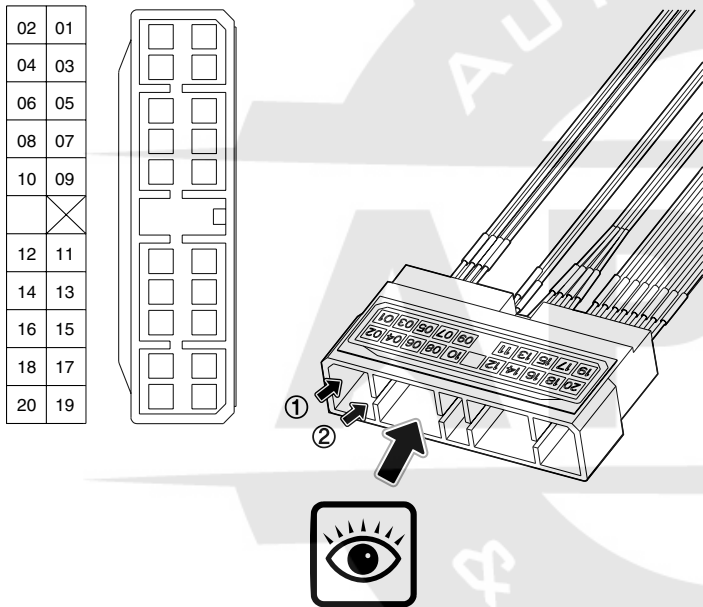
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WIRE ASS'Y OCR types

No.	Drawing No.	Part Name	Functions	OCR
1	76671176310	WIRE ASS'Y AG AC OCR	Communication, Digital Output, ZSI, Remote Reset	A Type
2	76671176311	WIRE ASS'Y A ZK PS CKA OCR	Communication, Digital Output, ZSI, Remote Reset, Earth Leakage(<30A), Voltage Module	P, S Type
3	76671176312	WIRE ASS'Y AE AX PX SX OCR	Communication, Digital Output, ZSI, Remote Reset, Earth Leakage(>30A), Voltage Module	P, S Type

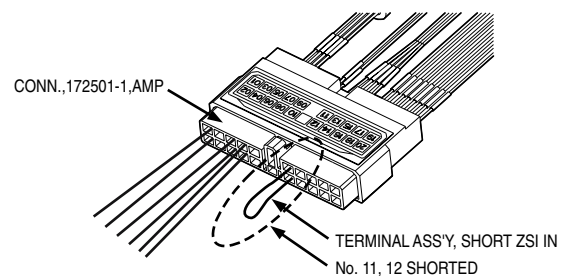
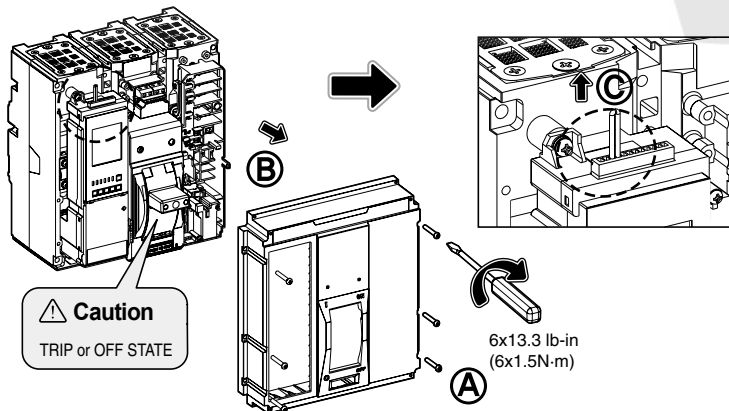
<Fig.15> Components of wire ass'y OCR and types



<Table.4> Terminal Number and Description

Number	Marking	Description
01	485+	Comm. +
02	485-	Comm. -
03	R1	Power +
04	R2	Power -
05	524	Relay Output (Long time)
06	534	Relay Output (Short time/Instantaneous)
07	544	Relay Output (Ground fault/PAL)
08	513	Relay Output Common
09	Z3	ZSI Out +
10	Z4	ZSI Out -
11	Z1	ZSI In +
12	Z2	ZSI In -
13	R11	Remote Reset +
14	R22	Remote Reset -
15	E1 or B1	Earth Leakage +
16	E2 or B2	Earth Leakage -
17	V1	VR Input
18	V2	VS Input
19	V3	VT Input
20	VN	V Input Common

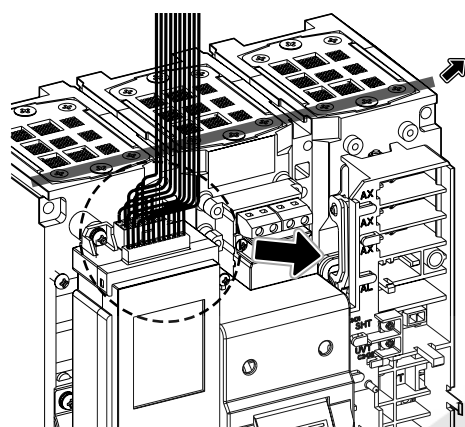
In case of not using ZSI function



Caution : If not using ZSI function of Trip Relay (OCR), please short ZSI INPUT of terminal No.11,12 (ZSI IN +, ZSI IN-) by using the "TERMINAL ASS'Y,SHORT ZSI IN"

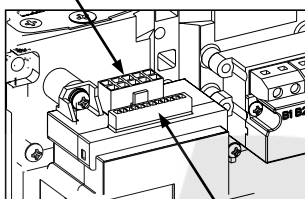
<Fig.16> Disassembling cover and short connector

Installation Instructions



Caution: Please don't place the wires below the guide line

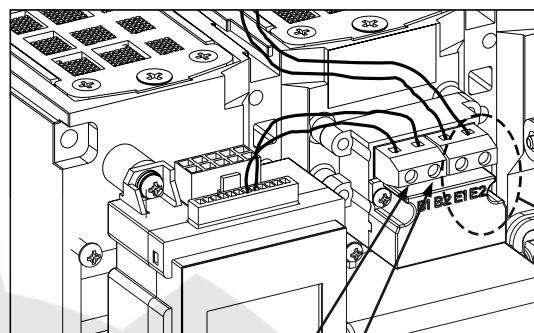
10P CONNECTOR



12P CONNECTOR

- In case of the wiring of Earth Leakage $\geq 30A$

Drawing No.	Part Name
76671176312	WIRE ASS'Y AE AX PX SX OCR



User wiring
E1, E2

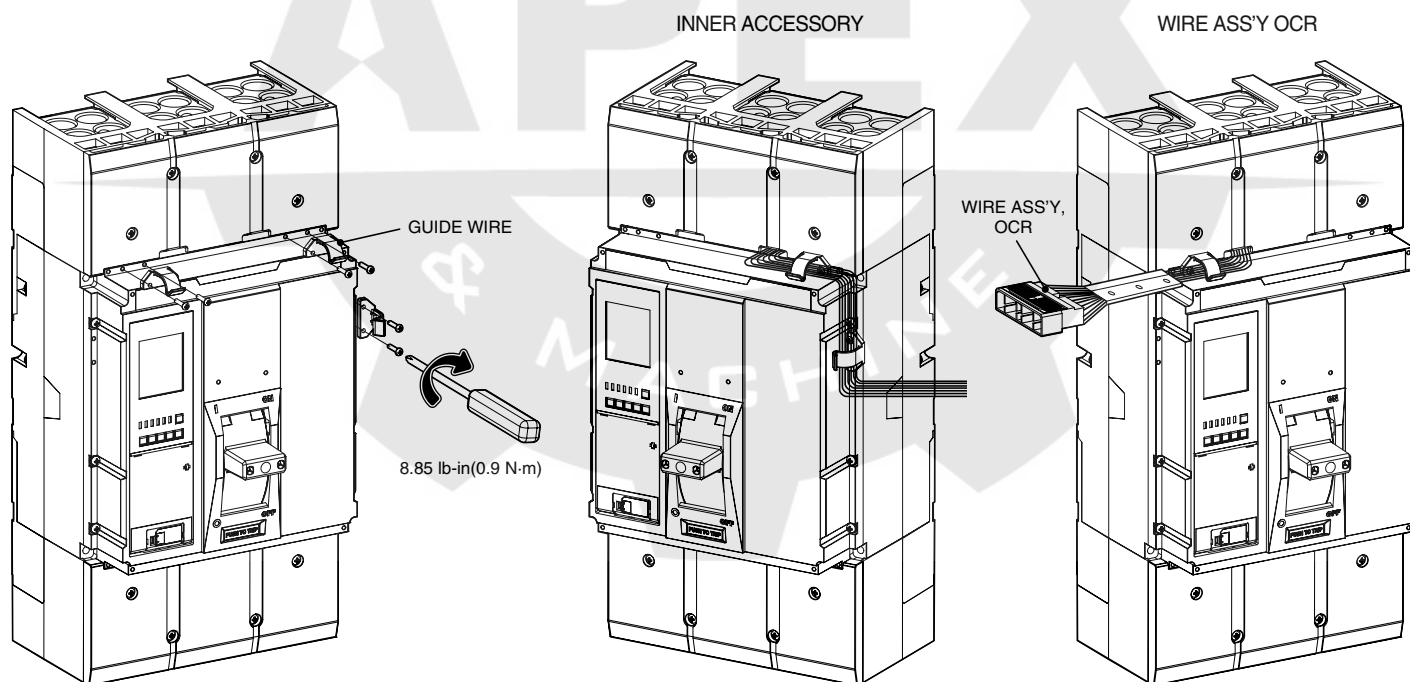
No. 15, B1 No. 16, B2

<Fig.17> Assembly of wire ass'y and withdrawal of wire

CAUTION

- 1) In case of disassembling and assembling the main cover, screw should be tightened in specific torque of 1.5N.m (15.3kgf.cm)
- 2) In case of disassembling and assembling the main cover by over tightening torque, the parts of MCCB can be damaged.

- 1) Install guide wire, using supplied hardware.
- 2) Please put the wires inside the guide wire parts to arrange those.



<Fig.18> Arrangement of wires

Installation Instructions

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5. Bus Installation

⚠ DANGER

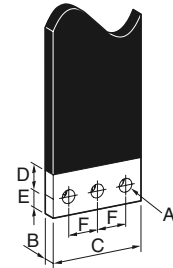
HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- 1) Apply appropriate personal protective equipment and follow safe electrical work practices.
- 2) This equipment must be installed and serviced only by qualified electrical personnel.
- 3) Turn off all power supplying this equipment before working on or inside equipment.
- 4) Always use a properly rated voltage sensing device to confirm power is off.
- 5) Replace all devices, doors and covers before turning on power to this equipment.

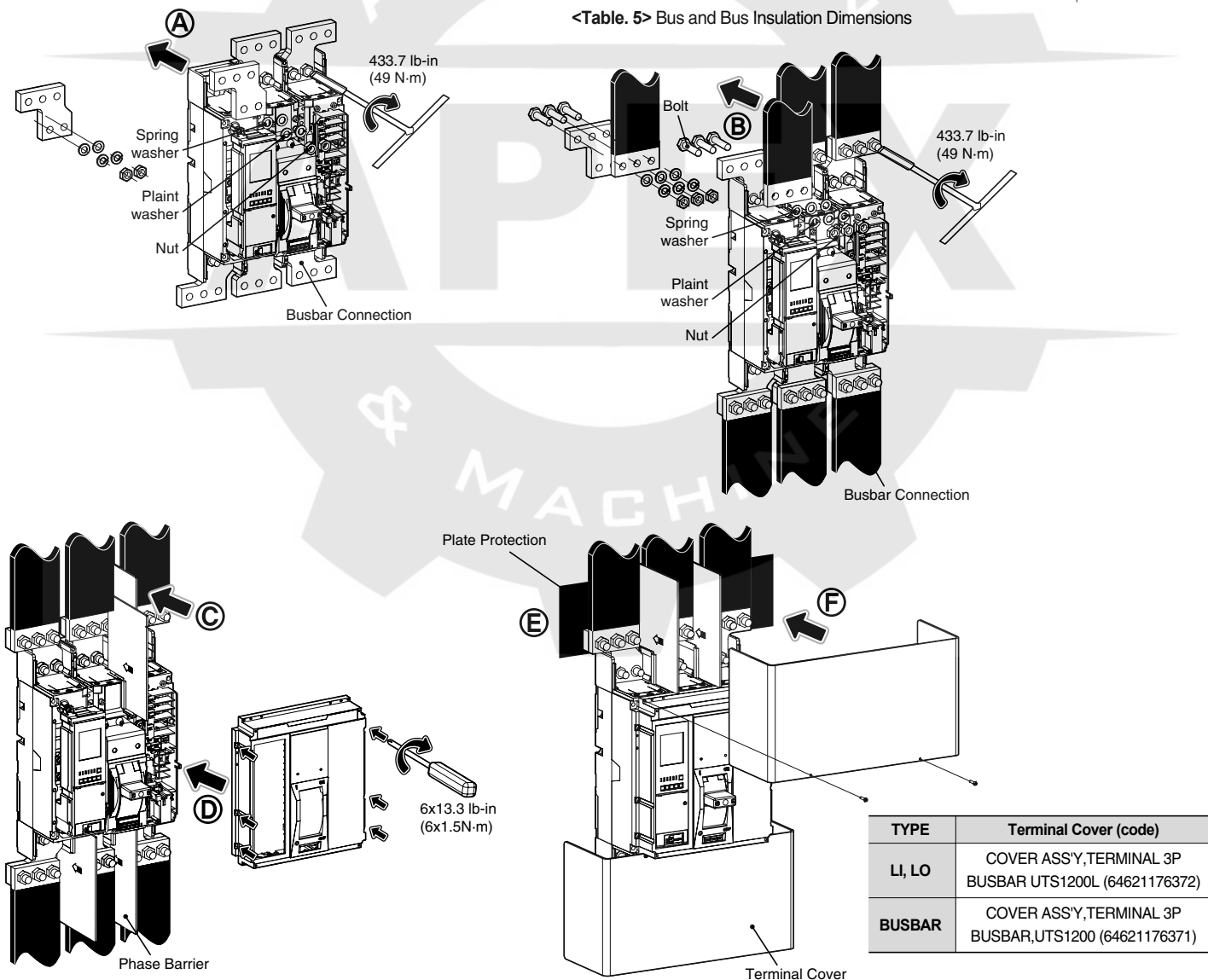
FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

- 1) Prepare bus connection, busbar & phase barrier
- 2) Install bus connection, using supplied hardware (A).
- 3) Install busbar, using supplied hardware (B).
- 4) Install phase barrier (C).
- 5) Replace cover (D).
- 6) Do not exceed torque specification of screws or bolts.
- 7) Attach the plate protection between busbar connection and enclosure(E). (Otherwise, short circuit may occur at phase to earth)
- 8) Install terminal cover (sold separately) (F).

Dimension	Length	
	UTS800	UTS1200
A	0.354in (9mm)	0.433in (11mm)
B	0.26~0.31in (6.5~8mm)	0.32~0.39in (8~10mm)
C	2.52in (64mm)	3.031in (77mm)
D	1.181in (30mm)	1.181in (30mm)
E	0.591in (15mm)	0.591in (15mm)
F	0.984in (25mm)	0.984in (25mm)



<Table. 5> Bus and Bus Insulation Dimensions



<Fig. 19> Bus installation



Installation Instructions

6. Circuit Breaker Removal

**DANGER****HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION**

- 1) Apply appropriate personal protective equipment and follow safe electrical work practices.
- 2) This equipment must be installed and serviced only by qualified electrical personnel.
- 3) Turn off all power supplying this equipment before working on or inside equipment.
- 4) Always use a properly rated voltage sensing device to confirm power is off.
- 5) Replace all devices doors and covers before turning on power to this equipment devices, equipment.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

- 1) Turn off all power supplying this equipment before working on or inside equipment.
- 2) Remove circuit breaker in reverse order of installation.

7. Troubleshooting

If problems occur during installation, Refer to the following guide. If trouble Persists, contact the local field office.

**DANGER****HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- 1) This equipment must be installed and serviced only by qualified electrical personnel.
- 2) Turn off all power supplying this equipment before working on or inside equipment.
- 3) Always use a properly rated voltage sensing device to confirm power is off.
- 4) Replace all devices, doors and covers before turning on power to this equipment.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

8. Other Safety Instructions

Check area where circuit breaker is installed for any safety hazards including personnel safety and fire hazards. Exposure to certain types of chemicals can cause deterioration of electrical connections.

**DANGER****HAZARD OF EQUIPMENT DAMAGE**

- 1) No circuit breaker should be reclosed until the cause of trip is known and the situation rectified.
- 2) Be careful not to be damaged by accidents during transportation or installation.
- 3) Check periodically terminals and connector for looseness or signs of overheating.

FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DEATH OR SEVERE INJURY.

Installation Instructions

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1) Solution for Circuit Breaker's abnormal condition

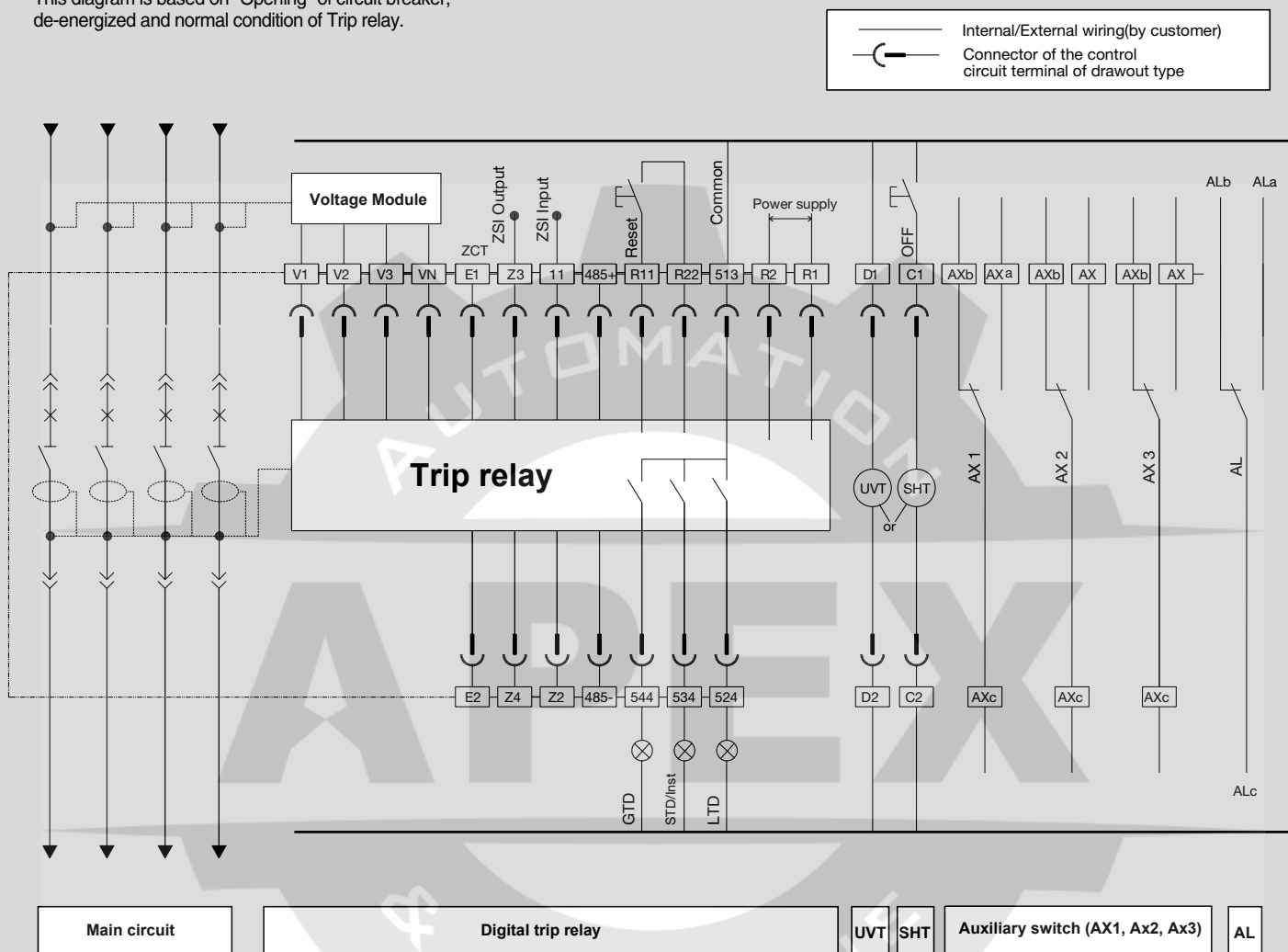
Type	Condition	Possible Causes	Solution
Temperature Increase	Terminal unit Overheating	<ul style="list-style-type: none"> Loose terminal unit tightening screw Faulty booth bar assemble 	<ul style="list-style-type: none"> Tightening with designated torque Booth bar reassemble
	Product (except terminal unit) overheating	<ul style="list-style-type: none"> Faulty contact to internal contactor Current density increase by wire terminal 	<ul style="list-style-type: none"> New product replacement
Abnormal operation	Impossibility of closing (ON)	<ul style="list-style-type: none"> Foreign substance in switch 	<ul style="list-style-type: none"> Remove foreign substance
		<ul style="list-style-type: none"> Reclosing without reset on trip position 	<ul style="list-style-type: none"> Closing after reset
	Impossibility of reoperating Impossibility of Breaking / OFF Impossibility	<ul style="list-style-type: none"> Worn out by breaking endurance 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> Reset device operation fault 	<ul style="list-style-type: none"> Request after service
		<ul style="list-style-type: none"> The coil of under voltage trip device is not excited. 	<ul style="list-style-type: none"> Applying power
		<ul style="list-style-type: none"> Switch spring burn out and exhaustion. 	<ul style="list-style-type: none"> Replacement and mending
		<ul style="list-style-type: none"> Bimetal corrosion and transformation 	<ul style="list-style-type: none"> Request after service
		<ul style="list-style-type: none"> Reaching the life of switch limit 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> Overheating of over current detecting element 	<ul style="list-style-type: none"> Operating after cooling
		<ul style="list-style-type: none"> Contact meeting and fusion by excessive breaking current 	<ul style="list-style-type: none"> New product exchange
Fault Current Flow	Fault Current Flow	<ul style="list-style-type: none"> Inflow of insulation material between contact. 	<ul style="list-style-type: none"> Remove foreign substance
		<ul style="list-style-type: none"> Conductive unit melting 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> Contact burn out (wear) 	
Frequent MCCB's	Break On normal load breaking	<ul style="list-style-type: none"> Wrong selection of product rating (causing overheating) 	<ul style="list-style-type: none"> New product exchange (rating reselect)
		<ul style="list-style-type: none"> No window inside panel (Causing overheating) 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> MCCB internal heating 	<ul style="list-style-type: none"> Tightening terminal screw (check)
		<ul style="list-style-type: none"> Loose terminal connection unit. 	
	Fault operating During motor starting	<ul style="list-style-type: none"> Heating by starting current 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> Overload current more than rated current flows. (when using motor with overload or over voltage) 	<ul style="list-style-type: none"> Rating adjustment
	Instantaneous Operation While Starting	<ul style="list-style-type: none"> Excessive starting current 	<ul style="list-style-type: none"> Instantaneous breaking current setting or rating adjustment
		<ul style="list-style-type: none"> Excessive current YΔ starting switching 	
		<ul style="list-style-type: none"> Excessive current by reversible operation 	
		<ul style="list-style-type: none"> Instantaneous restarting rush current 	
		<ul style="list-style-type: none"> Operation by starting current like charging current of condenser, incandescent electric lamp flow, charging, etc. 	
		<ul style="list-style-type: none"> Motor's Layer Short 	<ul style="list-style-type: none"> Motor mending
		<ul style="list-style-type: none"> Abnormal current flow at the same time with closing 	<ul style="list-style-type: none"> Circuit inspection
Inactivity	Operating current of rated current	<ul style="list-style-type: none"> Large rated current 	<ul style="list-style-type: none"> Select low rated current
		<ul style="list-style-type: none"> Current limit break of top fuse or incompatibility with top circuit breaker 	<ul style="list-style-type: none"> Protection cooperation review or rating adjustment
Short circuit of Power side	Inactive operation over rated operating current	<ul style="list-style-type: none"> Dust piling up 	<ul style="list-style-type: none"> New product exchange
		<ul style="list-style-type: none"> Switch side drop away of conductive material 	<ul style="list-style-type: none"> New product exchange

2) Solution for accessories abnormal operation

Type	Condition	Possible Causes	Solution
SHT	Trip inactive	<ul style="list-style-type: none"> Operating voltage drop 	<ul style="list-style-type: none"> Power improvement
		<ul style="list-style-type: none"> Incorrect commercial voltage selection 	
		<ul style="list-style-type: none"> Coil burn out 	<ul style="list-style-type: none"> Request after service
UVT	Closing impossible	<ul style="list-style-type: none"> Applied frequency or voltage fault 	<ul style="list-style-type: none"> Power improvement
AL / AX	Fault operation	<ul style="list-style-type: none"> Loose attachment screw 	<ul style="list-style-type: none"> Readjustment

9. Wiring diagram of Control Circuit

This diagram is based on "Opening" of circuit breaker, de-energized and normal condition of Trip relay.



Terminal code description

C1	C2	Voltage trip Device (SHT)	
D1	D1	Under Voltage Trip (UVT)	
R1	R2	Control power of Trip relay	
513	~	544	Relay output for trip reason
R11	R22	Remote reset of relay output	
485+	485-	RS - 485 communication	

Z1	Z2	ZSI input	
Z3	Z4	ZSI output	
E1	E2	ZCT INPUT	
VN	~	V3	Voltage Module

Symbol and DESCRIPTIONS

AX , AL	Auxiliary switch , Alarm switch
LTD	Long time delay trip indicator
STD/Inst	Short time delay/instantaneous STD/Inst
GTD	Ground fault trip indicator GTD
(SHT)	Voltage trip Device (SHT)
(UVT)	Under Voltage Trip (UVT)

- Note) 1) The diagram is shown with "Opening" position of circuit breaker, de-energized and normal condition of Trip relay.
 2) Please consult us for the use of ZSI (Zone selective Interlocking).
 3) Refer to the catalogue for the connection of Trip relay and ZCT input terminals (E1,E2).
 4) UVT and SHT can not work together at the same time.

Trip Relay Setting

UTS800/UTS1200

ENGLISH

Trip units

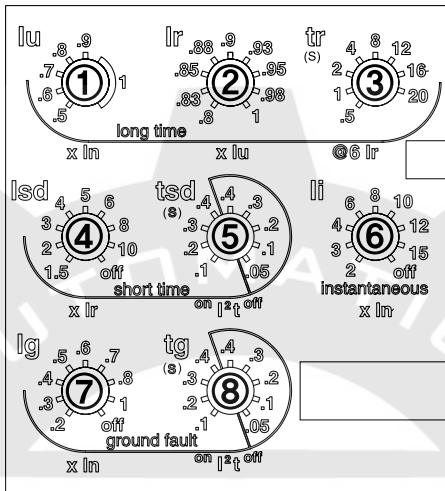
Circuit breaker includes factory-installed internal trip units. Be careful not to interchange trip units in the field. There are various kinds of trip units according to rated current and function as follows.

1. Trip Relay Externals and Configuration

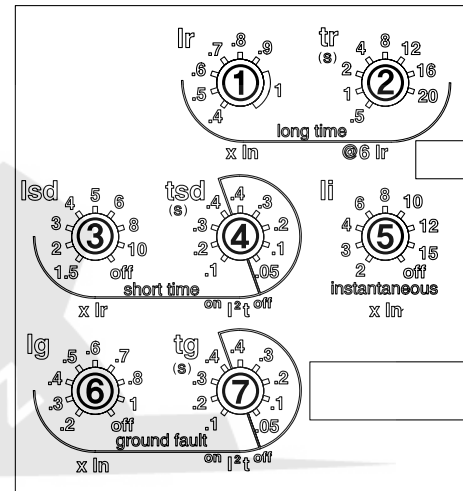
1) Knob Setting



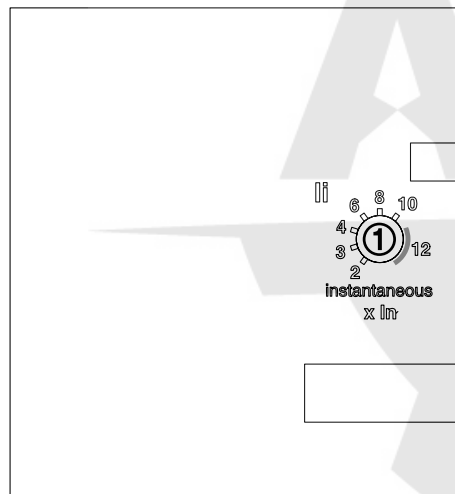
N, A type Knob information



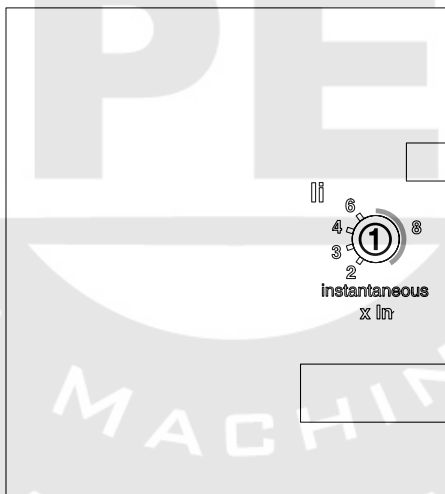
S type Knob Configuration



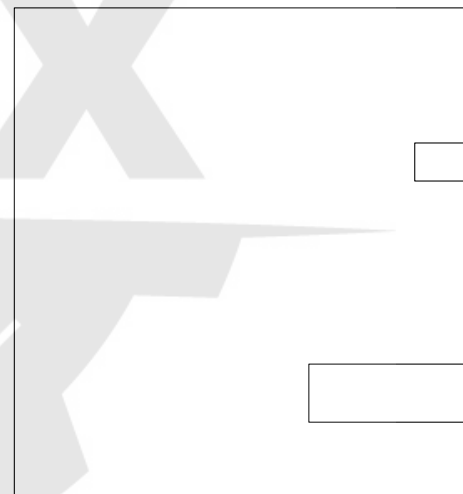
MCP800 type Knob information



MCP1200 type Knob information



MCS800/1200 type Knob information



N, A type Knob information

No	Type of knob	Mode	Setting step
①	Continues current setting	I_u	$(0.5-0.6-0.7-0.8-0.9-1.0) \times n$
②	Long-time current setting	I_r	$(0.8-0.83-0.85-0.88-0.89-0.9-0.93-0.95-0.98-1.0) \times I_u$
③	Long-time tripping delay	t_r	$(0.5-1-2-4-8-12-16-20)$, sec @ $6 I_r$
④	Short-time current Setting	I_s	$(1.5-2-3-4-5-6-8-10-off) \times I_r$
⑤	Short-time tripping delay	t_{sd}	$I_{t off} : (0.05-0.1-0.2-0.3-0.4)$, sec $I_{t on} : (0.1-0.2-0.3-0.4)$, sec
⑥	Instantaneous pick-up	I_i	$(2-3-4-6-8-10-12-15-off) \times I_n$
⑦	Ground-fault pick-up	I_g	$(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off) \times I_n$
⑧	Ground-fault tripping delay	t_g	$I_{t off} : (0.05-0.1-0.2-0.3-0.4)$ $I_{t on} : (0.1-0.2-0.3-0.4)$

P, S type Knob information

No	Type of knob	Mode	Setting step
①	Long-time current setting	lr	$(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
②	Long-time tripping delay	tr	$(0.5-1-2-4-8-12-16-20)$, sec @ 6 lr
③	Short-time current setting	ls	$(1.5-2-3-4-5-6-8-10-\text{off}) \times I_r$
④	Short-time tripping delay	tsd	I^2t off : $(0.05-0.1-0.2-0.3-0.4)$, sec I^2t on : $(0.1-0.2-0.3-0.4)$, sec
⑤	Instantaneous pick-up	li	$(2-3-4-6-8-10-12-15-\text{off}) \times I_n$
⑥	Ground-fault pick-up	lg	$(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-\text{off}) \times I_n$
⑦	Ground-fault tripping delay	tg	I^2t off : $(0.05-0.1-0.2-0.3-0.4)$ I^2t on : $(0.1-0.2-0.3-0.4)$

MCP800

No	Type of knob	Mode	Setting step
①	Instantaneous pick-up	li	$(2-3-4-6-8-10-12) \times I_n$

MCP1200

No	Type of knob	Mode	Setting step
①	Instantaneous pick-up	li	$(2-3-4-6-8) \times I_n$

MCS800/1200

No	Type of knob	Mode	Setting step
①	Instantaneous pick-up	li	$(15) \times I_n$

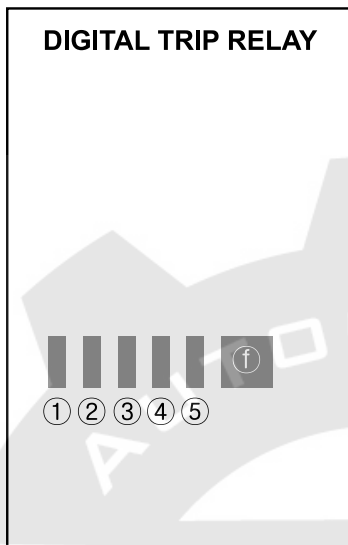
Trip Relay Setting

UTS800/UTS1200

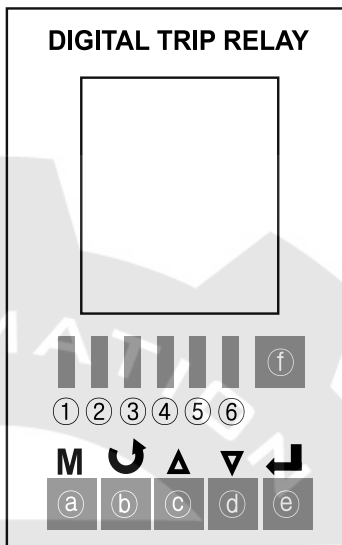
2) Key and LED Configuration



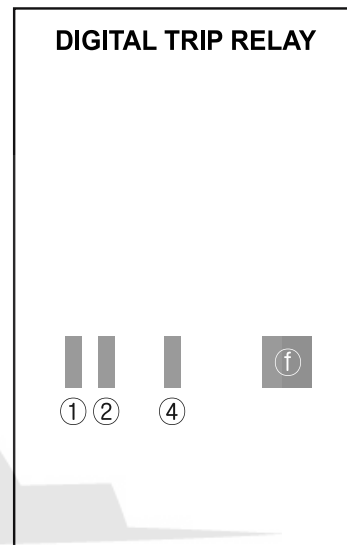
N type Key / LED



A, P, S type Key / LED



MCP, MCS type Key / LED



ENGLISH

LED Information

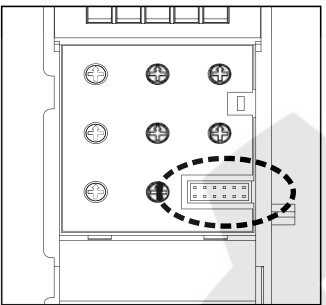
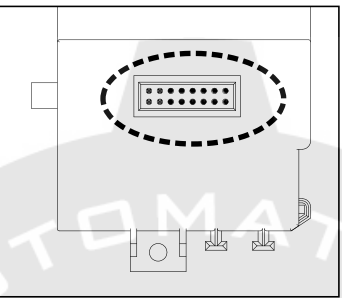
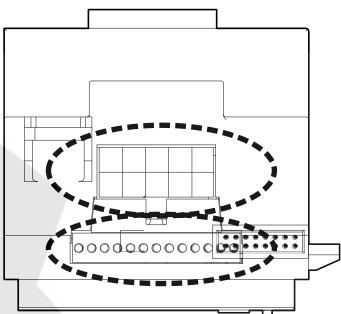
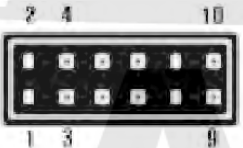
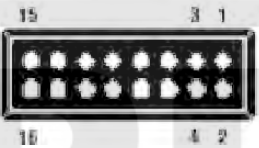

No	LED type	Operational mode
①	Alarm	LED Indicating an overload (Turn on above 90%, Blink above 105%)
②	Batt/SP	Self-Protection LED and Battery test LED
③	Ir	LED Indicating long-time delay
④	Isd/Ii	LED indicating short-time or instantaneous tripping
⑤	Ig/I _{Δn}	LED indicating ground-fault
⑥	COMM	LED indicating Communication

Key Configuration

No	Type of button	Function
a	M	Menu
b	↺	TAP
c	Δ	Up cursor
d	▽	Down cursor
e	↵	Enter
f		Reset/ESC

3) Terminal Configuration

LED Information

Division	CN1	CN2	CN3	CN4										
Figure	FRONT 	REAR 	TOP 											
				<table border="1"> <tr> <td>9</td><td>7</td><td>5</td><td>3</td><td>1</td></tr> <tr> <td>10</td><td>8</td><td>6</td><td>4</td><td>2</td></tr> </table>	9	7	5	3	1	10	8	6	4	2
9	7	5	3	1										
10	8	6	4	2										
1	TTL TX (OCR side)		ZSI OUT (+)	RS485 (-)										
2	Current signal - R phase	Power CT (-), GND ZSI OUT (-)	LTD contact											
3	TTL RX (OCR side)	ZSI IN (+)	RS485 (+)											
4	Current signal - S phase	Power CT (+), 24V	ZSI IN (-)	STD/INST contact										
5	DC 24V (+)		Remote reset (+)											
6	Current signal - T phase	MTD (+), 24V	Remote reset (-) GTD contact											
7	GND 24V		RCD (+)											
8	Current signal - N phase	MTD (-)	RCD (-)	Common contact										
9	GND 24V		Vr	External source										
10	Current signal - Common		Vs	External source (-)										
11		Signal CT - R phase	Vt											
12														
13		Signal CT - S phase												
14		Signal CT - Common												
15		Signal CT - T phase												
16		Signal CT - N phase												

Trip Relay Setting

UTS800/UTS1200

ENGLISH

2. Trip Relay Setting

1) Protection

N type

Long time										
Current setting (A)	I _u = I _n × ...		0.5	0.6	0.7	0.8	0.9	1.0		
	I _r = I _u × ...		0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98 1.0
Time delay (s)	t _r @(1.5 × I _r)		12.5	25	50	100	200	300	400	500
Accuracy: ±15% or below	t _r @(6.0 × I _r)		0.5	1	2	4	8	12	16	20
100ms	t _r @(7.2 × I _r)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8
Short time										
Current setting (A)	I _{sd} = I _r × ...		1.5	2	3	4	5	6	8	10 Off
Accuracy: ±10%										
Time delay (s) @ 10 × I _r	t _{sd}	I _t Off	0.05	0.1	0.2	0.3	0.4			
		I _t On		0.1	0.2	0.3	0.4			
	(I _t Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. TripTime(ms)	80	140	240	340	440			
Instantaneous										
Current setting (A)	I _i = I _n × ...		2	3	4	6	8	10	12	15 Off
Tripping time			50(±10ms)							
Ground fault										
Pick-up (A)										
Accuracy: ±10%(I _g > 0.4I _n) ±20%(I _g ≤ 0.4I _n)	I _g = I _n × ...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0 Off
Time delay (s) @ 1 × I _n	t _g	I _t Off	0.05	0.1	0.2	0.3	0.4			
		I _t On		0.1	0.2	0.3	0.4			
	(I _t Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			

A type

Long time										
Current setting (A)	I _u = I _n × ...		0.5	0.6	0.7	0.8	0.9	1.0		
	I _r = I _u × ...		0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98 1.0
Time delay (s)	t _r @(1.5 × I _r)		12.5	25	50	100	200	300	400	500
Accuracy: ±15% or below	t _r @(6.0 × I _r)		0.5	1	2	4	8	12	16	20
100ms	t _r @(7.2 × I _r)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8
Short time										
Current setting (A)	I _{sd} = I _r × ...		1.5	2	3	4	5	6	8	10 Off
Accuracy: ±10%										
Time delay (s) @ 10 × I _r	t _{sd}	I _t Off	0.05	0.1	0.2	0.3	0.4			
		I _t On		0.1	0.2	0.3	0.4			
	(I _t Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			
Instantaneous										
Current setting (A)	I _i = I _n × ...		2	3	4	6	8	10	12	15 Off
Tripping time			50(±10ms)							
Ground fault										
Pick-up (A)										
Accuracy: ±10%(I _g >0.4I _n) ±20%(I _g ≤0.4I _n)	I _g = I _n × ...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0 Off
Time delay (s) @ 1 × I _n	t _g	I _t Off	0.05	0.1	0.2	0.3	0.4			
		I _t On		0.1	0.2	0.3	0.4			
	(I _t Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			

Trip Relay Setting

A type

Long time									
Current setting (A)	$I_r = I_n \times \dots$	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
Time delay (s)	$t_r @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500
Accuracy: $\pm 15\%$ or below	$t_r @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20
100ms	$t_r @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8
Short time									
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10
Accuracy: $\pm 10\%$									Off
Time delay (s)	t_{sd}	0.05	0.1	0.2	0.3	0.4			
@ $10 \times I_r$			0.1	0.2	0.3	0.4			
	(I_t Off)								
	Min. Trip Time(ms)	20	80	160	260	360			
	Max. Trip Time(ms)	80	140	240	340	440			
Instantaneous									
Current setting (A)	$I_i = I_n \times \dots$	2	3	4	6	8	10	12	15
Tripping time		50(± 10 ms)							
Ground fault									
Pick-up (A)									
Accuracy: $\pm 10\%$ ($I_g > 0.4 I_n$)	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0
$\pm 20\%$ ($I_g \leq 0.4 I_n$)									Off
Time delay (s)	t_g	0.05	0.1	0.2	0.3	0.4			
@ $1 \times I_n$			0.1	0.2	0.3	0.4			
	(I_t Off)								
	Min. Trip Time(ms)	20	80	160	260	360			
	Max. Trip Time(ms)	80	140	240	340	440			

MCP800

- Instant Only
- I_i (Adjustable instant)

Instantaneous									
Current setting (A)	$I_i = I_n \times \dots$	2	3	4	6	8	10	12	
Tripping time		50(± 10 ms)							

MCP1200

- Instant Only
- I_i (Adjustable instant)

Instantaneous									
Current setting (A)	$I_i = I_n \times \dots$	2	3	4	6	8			
Tripping time		50(± 10 ms)							

MCS

- Instant Only
- I_i (Fixed instant current)
- UTS800: 12,000A / UTS1200: 18,000A

Other protection

Type	Pick-up			Time delay(s)		
	Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage	80V ~ 0V_Pick-up	1V	$\pm 5\%$	1.2~40sec		
Over voltage	UV_Pick-up ~ 980V	1V	$\pm 5\%$			
Voltage unbalance	6% ~ 99%	1%	$\pm 2.5\%$ or ($\pm 10\%$)			
Reverse power	10~500 kW	1kW	$\pm 10\%$	0.2~40sec		
Over power	500~5000 kW	1kW	$\pm 10\%$			
Current unbalance	6% ~ 99%	1%	$\pm 2.5\%$ or ($\pm 10\%$)	1.2~40sec	0.1sec	± 0.1 sec
Over frequency	60Hz	1Hz	± 0.1 Hz			
	50Hz	1Hz	± 0.1 Hz			
Under frequency	60Hz	1Hz	± 0.1 Hz			
	50Hz	1Hz	± 0.1 Hz			

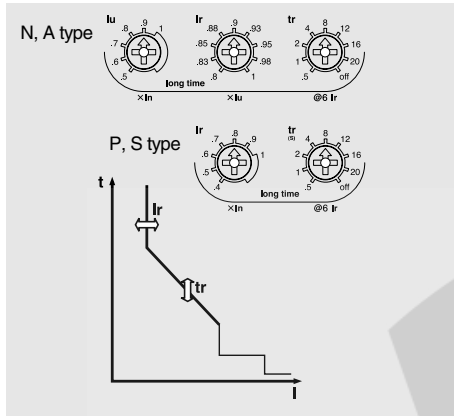
Trip Relay Setting

UTS800/UTS1200

ENGLISH

2) Operation characteristic

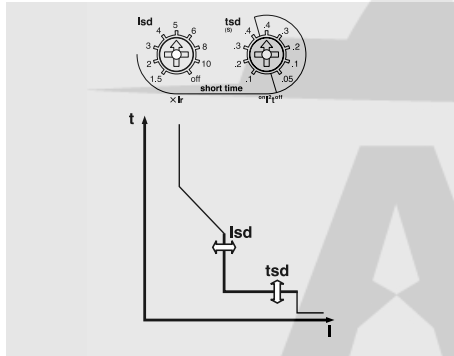
Long-time delay (L)



The function for overload protection which has time delayed characteristic in inverse ratio to fault current.

- Standard current setting knob: Ir
 - Setting range in P type and S type: $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
 - Setting range in N type and A type: $(0.4 \sim 1.0) \times I_n$
 - Iu: $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
 - Ir: $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times I_u$
- Time delay setting knob: tr
 - Standard operating time is based on the time of $6 \times I_r$
 - Setting range: 0.5-1-2-4-8-12-16-20 sec (8 modes)
- Relay pick-up current
 - When current over $(1.15) \times I_r$ flows in, relay is picked up.
- Relay operates basing on the largest load current among R/S/T phase.

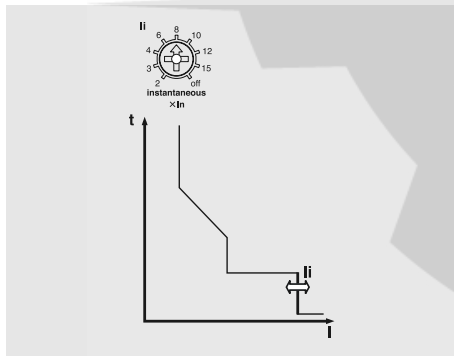
Short-time delay (S)



The function for fault current (over current) protection which has definite time characteristic and time delayed in inverse ratio to fault current.

- Standard current setting knob: Isd
 - Setting range: $(1.5-2-3-4-5-6-8-10-Off) \times I_r$
- Time delay setting knob: tsd
 - Standard operating time is based on the time of $10 \times I_r$.
 - Inverse time (I^t On): 0.1-0.2-0.3-0.4 sec
 - Definite time (I^t Off): 0.05-0.1-0.2-0.3-0.4 sec
- Relay operates basing on the largest load current among R/S/T phase.
- When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.

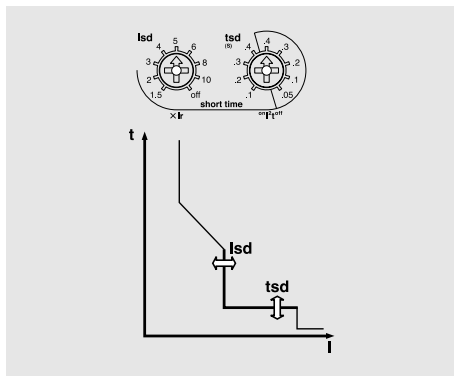
Instantaneous (I)



The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.

- Standard current setting knob: Ii
 - Setting range: $(2-3-4-6-8-10-12-15-Off) \times I_n$
- Relay operates basing on the largest load current among R/S/T phase.
- Total breaking time is below 50 (± 10)ms.

Ground Fault (G)



The function for breaking ground fault current above setting value after time-delay to protect the circuit from ground fault.

- Standard setting current knob: Ig
 - Setting range: $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) \times I_n$
- Time delay setting knob: tg
 - Inverse time (I^t On): 0.1-0.2-0.3-0.4 sec
 - Definite time (I^t Off): 0.05-0.1-0.2-0.3-0.4 sec
- Ground fault current is vector sum of each phase current. Therefore, 3Pole products may operate under its phase-unbalance including ground fault situations.(R/S/T Phase)
- When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.
- Ground-fault functions are basically provided with products equipped with a trip relay through its internal CT that is embedded in each phase.(But, it can't be used with earth-leakage protection function at the same time)

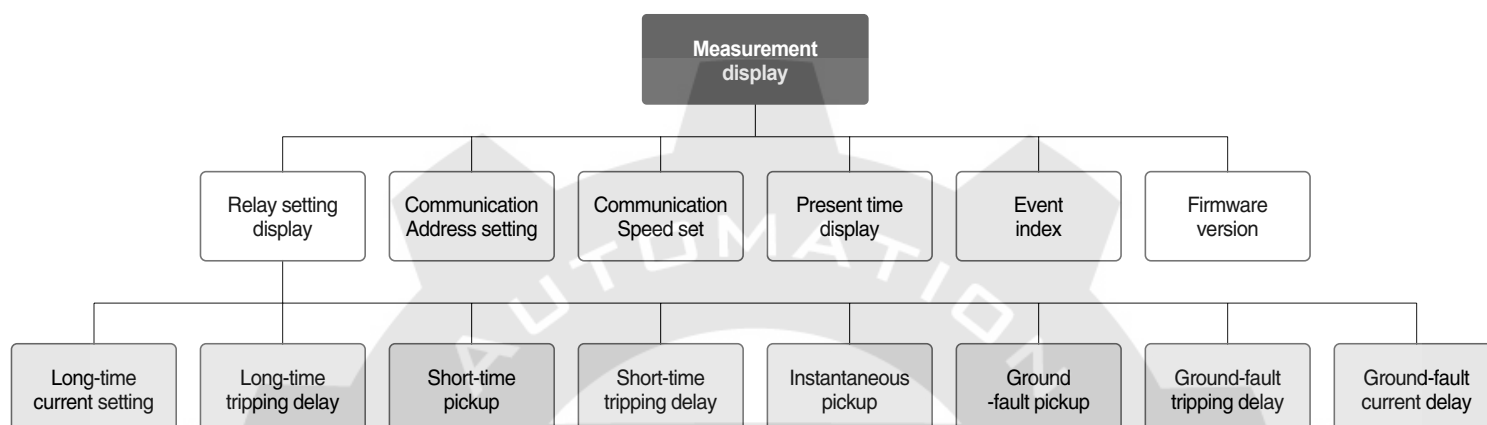
Trip Relay Setting

3. Operation of A type Trip Relay

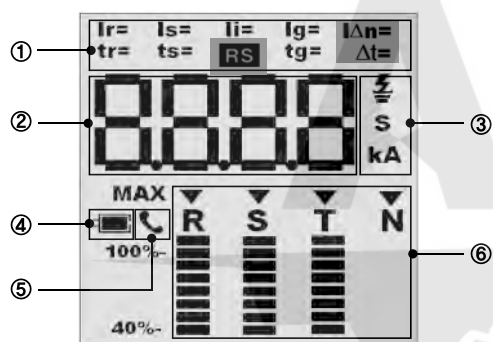
1) Menu Tree

CAUTION

- Each movement within Menu Tree can be done by using Menu and ESC button.
- Use UP(△)/Down(▽) button to move around each setting information under Relay Setting Display.
- If not pressing any button for 30seconds after moving to other screens, the screen moves back to Measurement Display and any relevant data will not be saved.



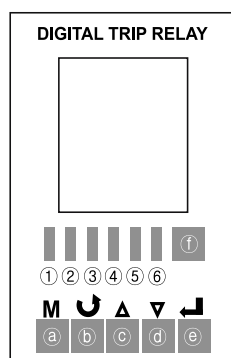
2) LCD Segment



NO	Contents
①	Segment that displays the types of relay current and time - Display of Setting values or Event
②	Segment that displays numbers or characters - Current, Time, and Simple character
③	Segment that displays the unit of current and time.
④	Low Battery Segment - LED flickers at 2~3 second interval if the voltage of 3.6V Lithium battery built in OCR is discharged below 2.5V.
⑤	Communication Segment - Upon answering to communication, it is displayed on the screen of Address and Speed Setting.
⑥	Segment which displays the measured current and the load rate of each phase - Inverted triangle indicates the current of phase which is being displayed on Measurement Display. - Load rate of R/S/T phase in proportion to Ir

When OCR is plugged in for the first time, all segments will be shown for approximately a second, and then return to Measurement Display.

3) Button Configuration



CAUTION

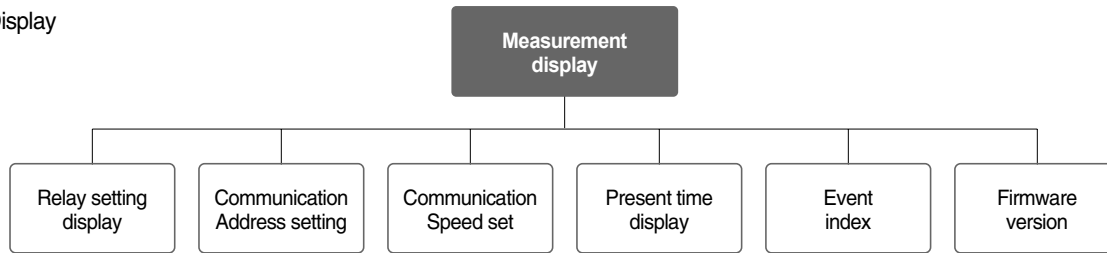
- OCR A type is composed of 6 buttons, and its LCD Back Light comes on for 30s if it sensing any button pressed during its operation.
- After 30 seconds under Idle condition, it moves back to Measurement Display page.
- If pressing ESC/RESET button in case of no power supply with OCR, BATT LED will come on to indicate the residual quantity of battery.
- If pressing ESC/RESET button in case of existing power supply with OCR, the status of LED only can be checked, not checking residual quantity of battery
- Only BATT LED turns on while pressing ESC/RESET button and other LEDs will turn on for 1~2 seconds after releasing ESC/RESET button.
- If ACB breaking the fault current normally, the information of cause for accident will be informed to users by turning on Indication LED.
- At this time Indication LED is operated by a separate battery built in OCR. Therefore, turn it off by pressing ESC/RESET button when discovering the cause of fault.

Trip Relay Setting

UTS800/UTS1200

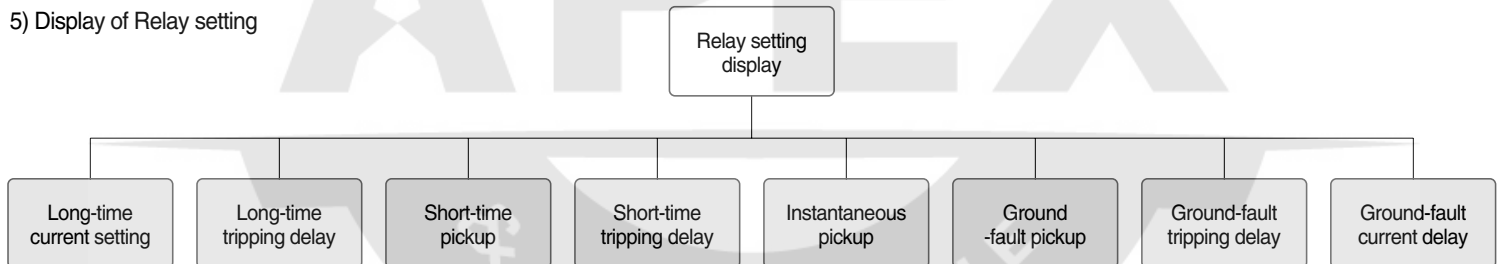
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4) Measurement Display







Display	Button	Contents
		1. The current of R, S, T, N phase are displayed in rotation at 3 second interval 2. At this very moment, the inverted triangle is moving sideways from left to right to show which phase is being displayed on LCD currently, and the below bar graphs represent each phase's load rate in scale (40%~110%).
		If pressing TAP button to display only one phase value exclusively on the screen without displaying each phase's current in rotation, the triangle sign(Δ) will appear at the top-right side of LCD screen. ※ This screen-freeze can be apply at other screens as well.
		The phase which will be displayed exclusively can be selected by pressing Up / Down cursor.

5) Display of Relay setting

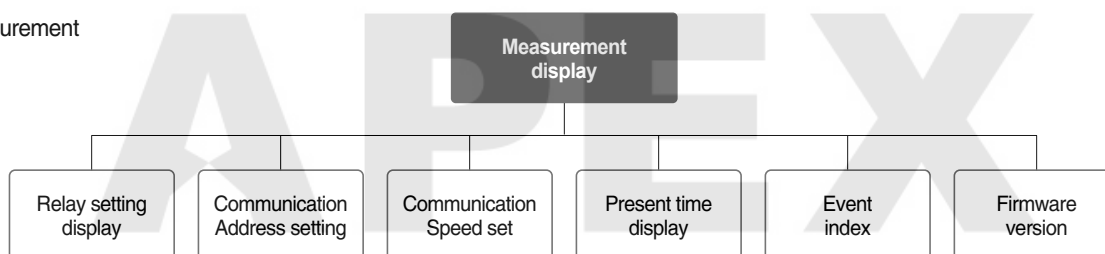













Display		Button	Contents
Long-time	current	 Δ ∇	If pressing a Menu button once from its normal Measurement Display will switch to the screen that displays relay setting values. An initial screen of Measurement Setting Display is arranged for long-time delay current setting, and other setting values can be seen by pressing Up/Down cursor.
	delay time	 $\Delta \times 1$	If pressing 'Up cursor' once from the Relay setting Display, the setting value of long-time tripping delay will be displayed.
Short-time	current	 $\Delta \times 2$	If pressing 'Up cursor' two times on the Relay setting display, the setting value of short-time tripping delay will be displayed.
	delay time	 $\Delta \times 3$	If pressing 'Up cursor' three times on the Relay setting Display, the setting time of short- time tripping delay will be displayed. At this time, one larger value than the initial one will be displayed because LSB of time setting value is set in case of Ft is On. For example, if it is of Ft 0.400sec on setting, 0.401 will be displayed.

Trip Relay Setting

Display		Button	Contents
Instantaneous	current	 M $\Delta \times 4$	If pressing 'Up cursor' four times on the Relay setting Display, Instantaneous pick up setting value will be displayed.
	pick up	 M $\Delta \times 5$	If pressing 'Up cursor' five times on the Relay setting Display, the setting value of Ground-fault pickup will be displayed.
	tripping delay	 M $\Delta \times 6$	If pressing 'Up cursor' six times on the Relay setting Display, the setting value of Ground- fault tripping delay will be displayed. At this time, one larger value than the initial one will be displayed because LSB of time setting value is set in case of Ft is On. For example, if it is of Ft 0.400sec on setting, 0.401 will be displayed.
	current delay	 M $\Delta \times 7$	If pressing 'Up cursor' seven times on the Relay setting Display the setting current cursor Display, of ground fault will be displayed. At this time, the 10~100% of In will be displayed and other values out of this range will be indicated as “ _ _ _ _ ”

6) Display of measurement



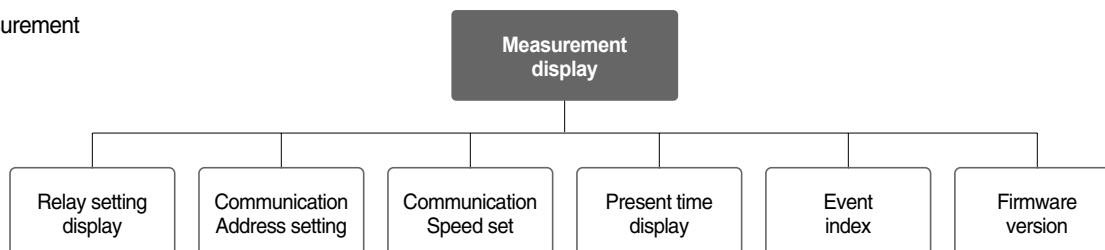
Display		Button	Contents	
Instantaneous	current		M × 2  	If pressing 'MENU' button 3 times from the measurement Display, move to Communication Address Setting screen. Communication Address can be set from 1 to 247.
				Press Enter button to save the setting, otherwise press ESC/RESET button to move back to Measurement Display. If successfully saved, 'SAVE' is displayed on screen and move to Measurement Display and if pressing ESC/RESET button, move to Measurement Display without saving.
	current delay		M × 3  	If pressing 'MENU' button 3 times from measurement Display screen, move to Communication Speed Setting screen. Communication speed can be set through Baud rate 38400 / 19200 / 9600. If pressing 'Up / Down' cursor, the value of Baud rate rolling over will be displayed.
				Press Enter button to save the setting, otherwise press ESC/RESET button to move back to Measurement Display. If successfully saved, 'SAVE' is presented on screen and move to Measurement Display and if pressing ESC/RESET button, move to Measurement Display without saving.
Ground fault	current		M × 4	If pressing 'MENU' button 4 times from Measurement Display, move to Present Time Display. The present time is displayed with 'hour' and 'minute' by 24H type and Dot between hour minute hour and minute turns on and off every second. Unless present time is set, present time will be set '1 hour 1minute' as initial time is set as '1hour 1minute 1 second January 1st, 2000'.












Trip Relay Setting

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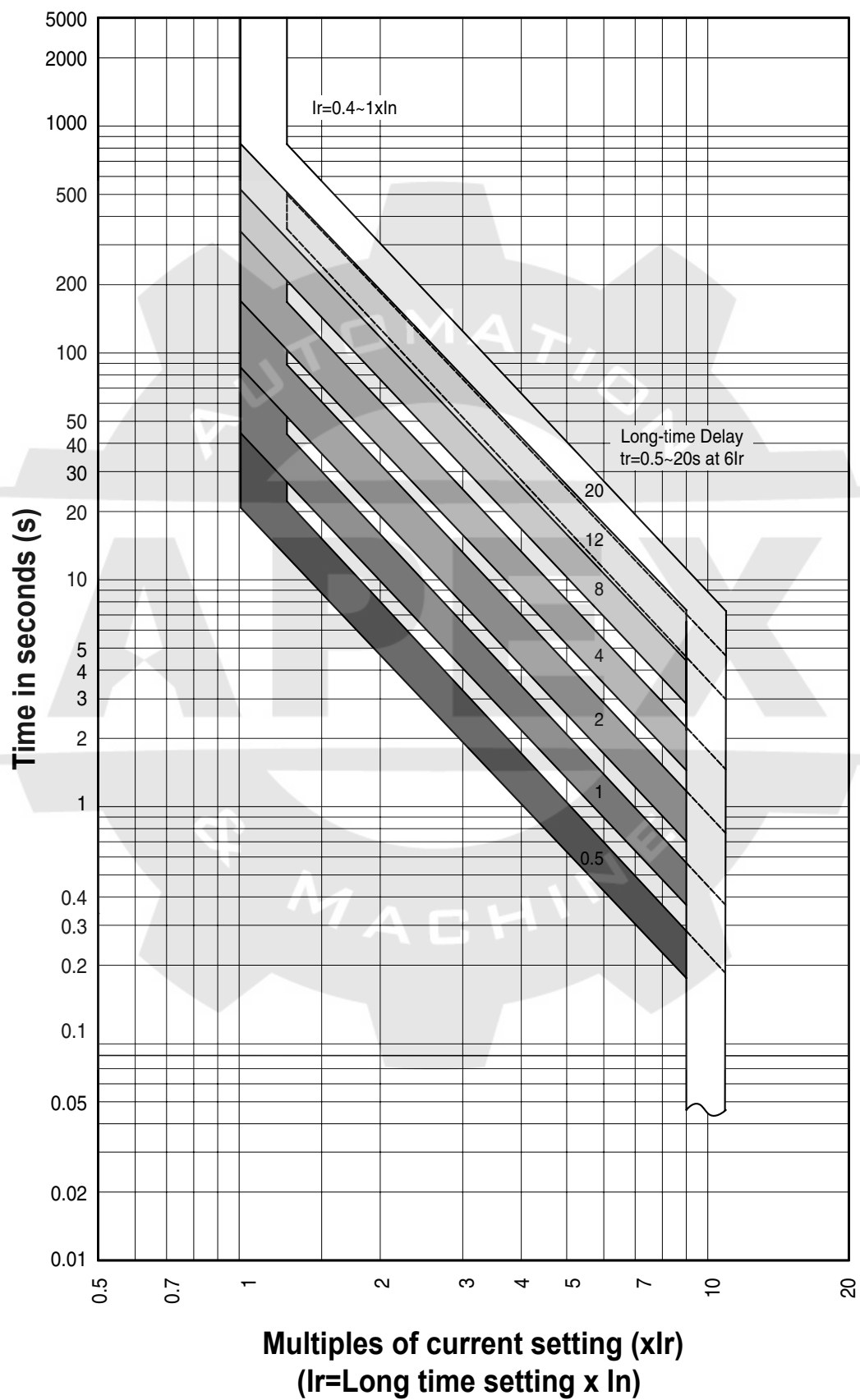
7) Display of measurement



Display	Button	Contents
     	M × 5	<p>If pressing 'MENU' button 5 times from Measuring Display, move to Event Index. On the Event Index, The information of fault events is shown on screen up to 10 faults and each information displays fault current, a type of fault, fault phases, occurring time which includes second, minute, hour, date, month, and year.</p>
		<p>1. "I": Fault : long time/short time/instantaneous/ground fault 2. "1600A" : fault current 3. "▼" : Fault phase : R, S, T, N ACB OCR N / A type can save 10 events and Event Index indicates events order. When displaying the latest event, only one Segment will be showed on the Event Index and if pressing "Up" cursor, Segment will be increased and the former saved event will be displayed.</p>
		<p>If there is no data in Event Index, 'Empty' will be displayed.</p>
	 ① ② ③	<p>1. If pressing 'Enter' from Event Index, the time information of relevant events is displayed.</p> <p>①  : Displaying the 7th Event (Event Index) ②  : Displaying Event Year/Month ③ If pressing 'Enter' once, the information of Year/month will be displayed. Enter Left screen indicates "January, 2007"</p>
	 × 2 ④ ⑤ ⑥	<p>1. If pressing 'Enter' 2 times, the information of Date/Time will be displayed.</p> <p>④ : The current screen indicates '1 o'clock, 8th. ⑤ : Displaying Event Date/Time ⑥ : Event Index : Displaying the 7th Event</p>
	 × 3 ⑦ ⑧ ⑨	<p>1. If pressing 'Enter' 3 times, the information of minute/second will be displayed.</p> <p>⑦ : The current screen is to indicate "12 minutes 51seconds". ⑧ : Displaying Event Minute/Second ⑨ : Event Index : Displaying the 7th Event</p>
Firmware version	M × 6	<p>1. If pressing 'MENU' button 6 times from Measurement Display, move to firmware</p>

4. Characteristic Curves of Trip Relay

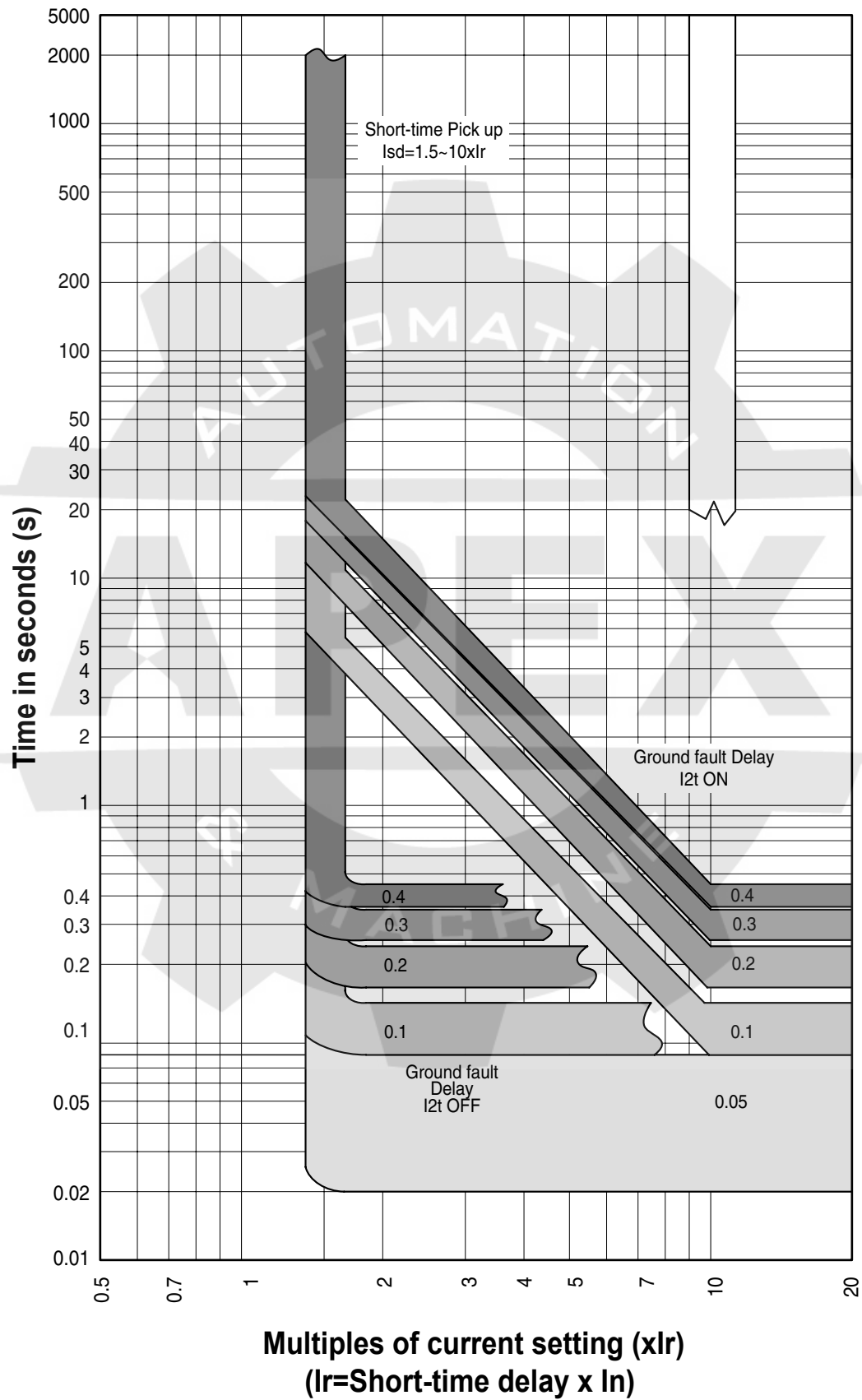
1) Long-time delay



Trip Relay Setting

UTS800/UTS1200

2) Short-time delay

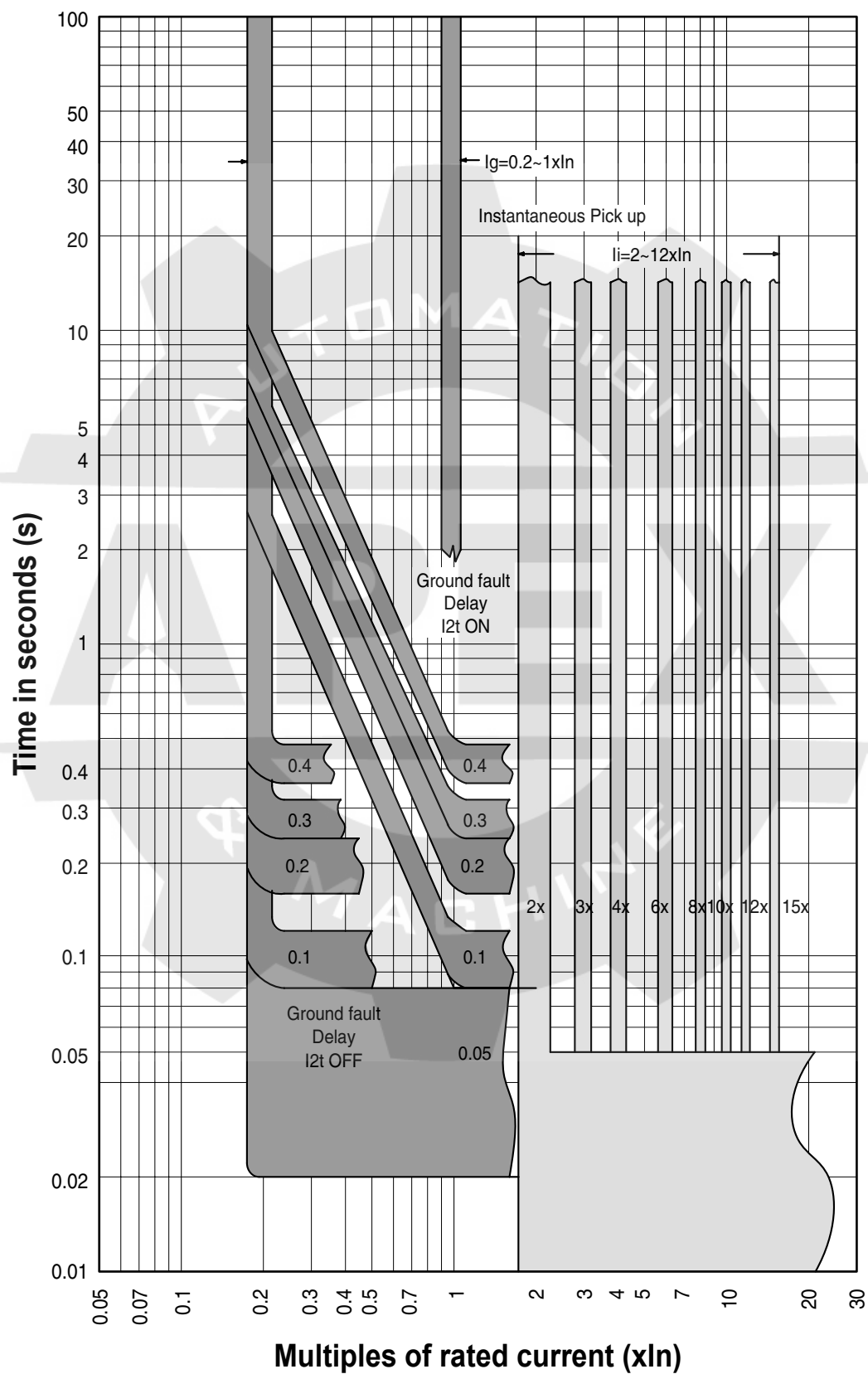


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Trip Relay Setting

3) Instantaneous / Ground fault

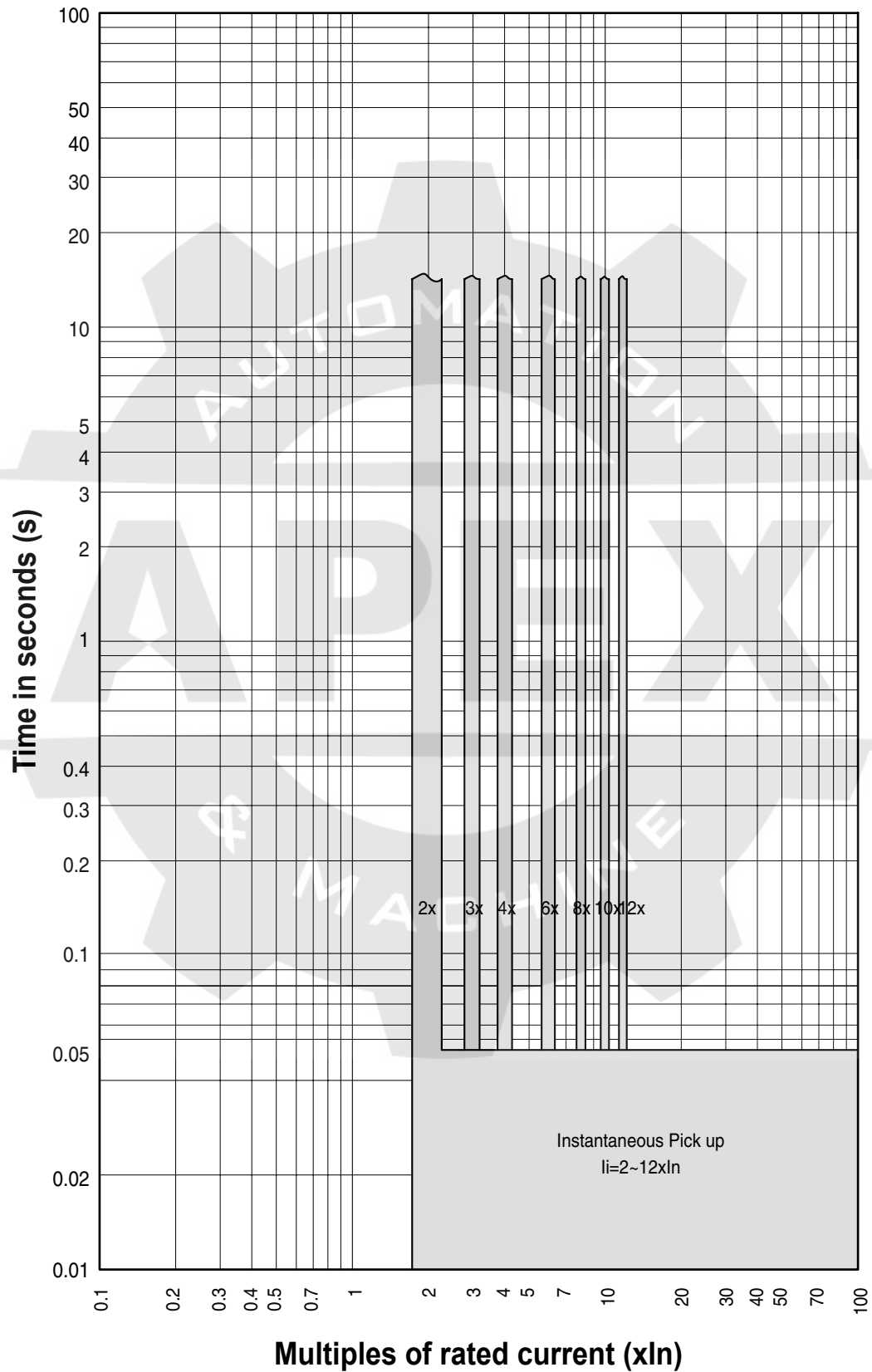


Trip Relay Setting

UTS800/UTS1200

4) MCP800

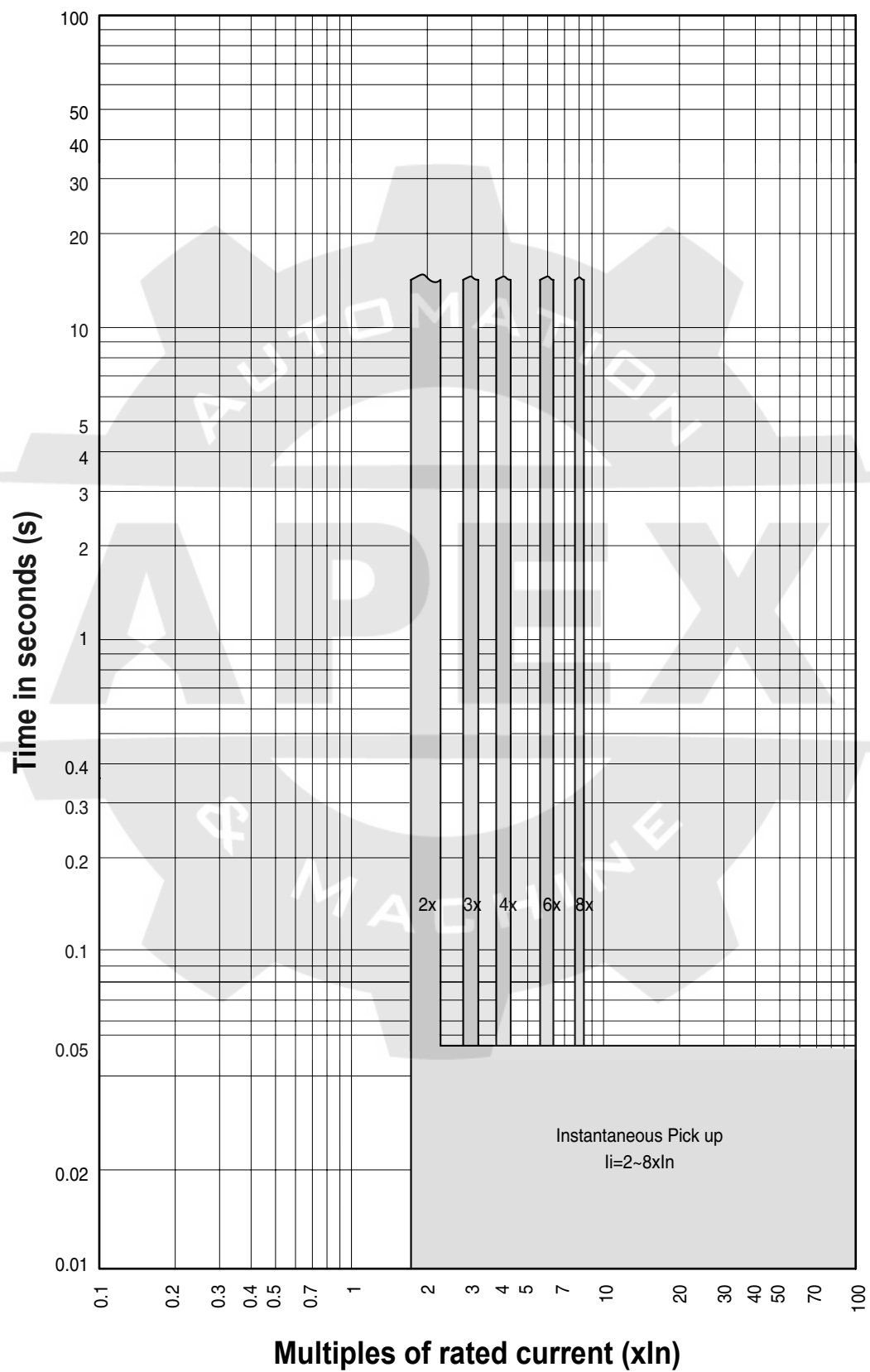
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Trip Relay Setting

5) MCP1200

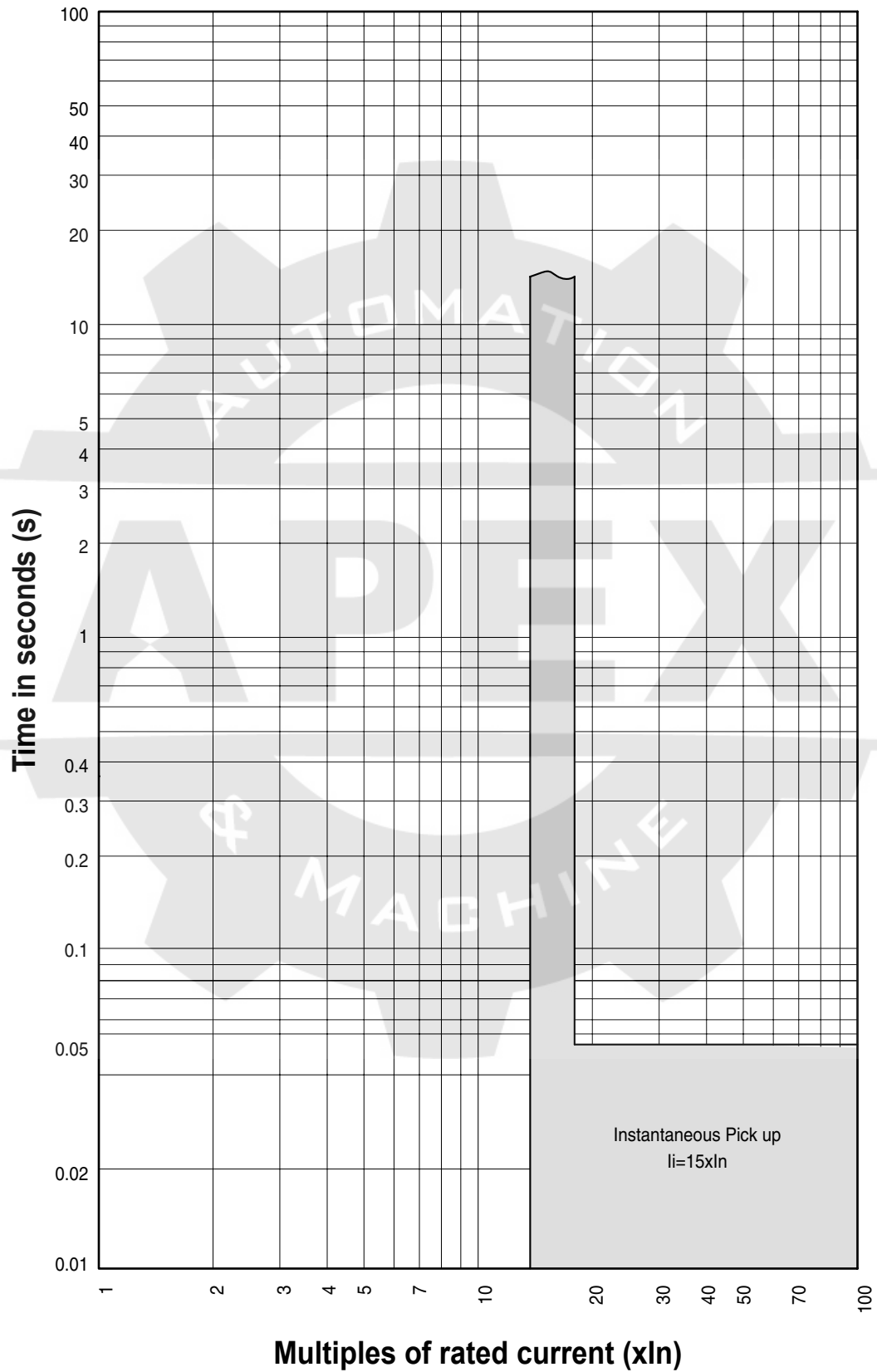


Trip Relay Setting

UTS800/UTS1200

6) MCS800/1200

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5. Risk Analysis

1) Risk Analysis occurrence conditions

⚠ CAUTION

The same phenomenon appears, contact your nearest LSIS sales office.

Related Function	Error No.	Condition for Error occurrence
Rating Plug	1	when Rating plug is not attached to OCR.
		not recognized even after Rating plug is inserted.
		when there is an error to resistor of Rating plug.
	2	when Rating plug not matching to CT Rating is inserted (In case of Below 45% and above 100%)
		when setting value of Dip switch does not correspond to rating of Rating plug.
ADC	3	Such a Mounting failure as disconnection of ADC related circuit, Bad soldering.
		Failure of OP-AMP, Analog switch, resistor, capacitor related ADC
		Malfunction of manual integrator
		Error of Function related to ADC
RAM	4	Malfunction of MCU RAM
ROM	5	Malfunction of MCU Flash
MTD	6	when connecting line of MTD and OCR is disconnected by vibration.
		connecting WIRE to MTD is disconnected.
		when there is an error to input pattern applied by PCB
KNOB	7	Difference between setting value and recognition value of Knob occurs.
		Recognition value of Knob is '0' (selecting 0 is forbidden.)
		Recognition value of Knob is above '9' (generally 1~9 selection is available.)

Trip Relay Setting











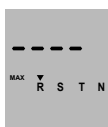
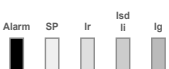
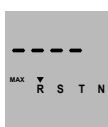
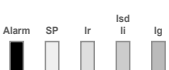
UTS800/UTS1200

2) Risk Analysis operation

CAUTION

The same phenomenon appears, contact your nearest LSIS sales office.

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Error	Display of LCD Error	LED Display	Playing	Remark
1	 Er-1 PhraseDisplayed	 Sign : LED Alarm blinks as below Operation : 1 time blinks → 1 sec off → Repeat		
2	 Er-2 PhraseDisplayed	 Sign : LED Alarm blinks as below Operation : 2 time blinks → 1 sec off → Repeat		
3	 Er-3 PhraseDisplayed	 Sign : LED Alarm blinks as below Operation : 3 time blinks → 1 sec off → Repeat	Relaying impossible	LCD and LED operates simultaneously
4	 Er-4 PhraseDisplayed	 Sign : LED Alarm blinks as below Operation : 4 time blinks → 1 sec off → Repeat		
5	 Er-5 PhraseDisplayed	 Sign : LED Alarm blinks as below Operation : 5 time blinks → 1 sec off → Repeat		
6	 - A type operate when outpower supply is applied Operation : 1 time blinks → 1 sec off → Repeat - P/S type operate when outpower supply is applied Sign : MTU ERROR Displayed.	 Sign : LED Alarm blinks as below Operation : 6 time blinks → 1 sec off → Repeat	Relaying possible	- In case of A type, when extender power supply is applied, LCD operates only and LED does not operate.
7	 - A type operate when outpower supply is applied Sign : RS Phrase Displayed. Operation : 2 time blinks → 1 sec off → Repeat - P/S type operate when outpower supply is applied Sign : KNOB ERROR Displayed.	 Sign : LED Alarm blinks as below Operation : 7 time blinks → 1 sec off → Repeat		- In case of P/S type, No ALARM operation. LCD operates only.

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AUTOMATION



Safety Instructions /
Instrucciones de
seguridad

- For your safety, please read user's manual thoroughly before operating. / Para su seguridad, lea el manual de usuario completamente antes de la operación.
- Contact the nearest authorized service facility for examination, repair, or adjustment. / Contacte al centro de servicio autorizado más cercano para exámenes, reparo y ajuste.
- Please contact a qualified service technician when you need maintenance. Do not disassemble or repair by yourself! / Contacte a un técnico de servicio capacitado para mantenimiento. No lo desmonte o repare Ud. mismo.
- Any maintenance and inspection shall be performed by the personnel having expertise concerned / Cualquier mantenimiento y inspección debe ser realizado por personal con conocimiento y experiencia asociado.

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