



**Susol & Metasol**  
Super Solution Meta Solution

Air Circuit Breakers  
Instruction Manual

**LS** Industrial Systems  
[www.lsis.biz](http://www.lsis.biz)

# Instruction manual of Susol & Metasol ACB

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# A. Safety Precaution

## 1. Safety precaution

### ■ Outline for safety operation

This manual does not cover all possible contingencies, variations and details that may arise during installation, operation or maintenance of this equipment. If the user has questions regarding a particular installation, contact the local LSIS sales office. For application information, consult your nearest LSIS sales office.

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. LSIS's reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. If a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence

### ■ Qualified person

For the purpose of this manual and product labels, a qualified person with suitable knowledge of installation, construction, operation, or maintenance of the equipment and the hazards involved. In addition, this person has the following qualifications:

- (a) is trained and authorized to energize, de-energize, clear, ground, and connect circuits and equipment in accordance with established safety practices.
- (b) is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with safety practices.
- (c) is trained in rendering first aid.

These instructions do not cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. In case particular problems arise which are not covered sufficiently for the purchaser's purposes further information should be desired or the matter should be referred to the local LSIS's sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship.

### ■ Danger, Warning, Caution

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it.. The following special messages may appear throughout this manual to warn of potential hazard and to call attention to additional information which clarifies or simplifies a procedure.

Safety precaution is classified by danger, warning, caution and the meaning is as follows.



#### Danger

Not following the instruction may result in serious injury and even death



#### Warning

Not following the instruction may result in serious injury and even death



#### Caution

Not following the instruction may result in minor or moderate injury, or property damage

### ■ Dangerous Procedures

In addition to other procedures described in this manual as dangerous, user personnel must adhere to the following:

1. Always work only on de-energized equipment. Always de-energize a contactor, and remove it from the equipment before performing any tests, maintenance or repair.
2. Always let an interlock device or safety mechanism perform its function without forcing or defeating the device.

# A. Safety Precaution

## 2. Caution



### Caution

1. Be sure to tighten the terminal screws to the torque specified in the instruction manual.
2. Do not install in areas subject to high temperature, high humidity, dust, corrosive gas, vibrations, and shocks. To do so may result in malfunction or fire.
3. To get ACB tripped automatically, always clear the source of the malfunction before closing the ACB again. Failure to do so may result in fire.
4. Terminal screws should be checked and tightened periodically. Failure to do so may result in fire.
5. Use the ACB in 50/60Hz. Failure to do so may result in malfunction or fire.

## 3. Danger



### Danger

#### ■ HAZARD OF BODILY INJURY OR EQUIPMENT DAMAGE

1. Only qualified electrical workers with training and experience on high voltage circuits should perform work described in this set of instructions. These workers must understand the hazards involved in working with or near high voltage equipment. Such work should be performed only after reading this complete set of instructions.
2. The successful operation of Susol ACBs depends upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury as well as damage to electrical equipment or other property.
3. Susol ACBs have features designed to prevent unsafe operation, but it is not possible to eliminate every hazard with these features. Therefore, the person using this device is responsible for recognizing the potential hazards, for wearing protective safety equipment, and for taking adequate safety precautions.
4. Do not make any adjustment to the equipment or operate the system with safety features removed. Contact your local LSIS representative for additional instructions if the Susol ACB does not function as described in this manual.
5. Before performing visual inspections, tests, or maintenance on this device, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and connected. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of back feeding.
6. Before replacing covers or closing doors, carefully inspect the bus work area for tools and objects left inside the equipment. Use care while removing or installing panels so that they do not extend into energized bus.
7. Before making any electrical connection, take every precaution to see that all connections are de-energized and grounded.
8. Introducing foreign objects into this equipment can cause a short circuit which can result in severe damage, personal injury, or death. Short circuits can release large amounts of energy due to a rapid expansion of super-heated, ionized gases. Products of this instantaneous expansion can quickly engulf and burn personnel before preventive action can be taken. The short circuit source can cause additional injuries by propelling personnel or objects several feet from the equipment. Some foreign objects that can cause short circuits are tools, test leads and instruments not designed for high voltage circuits, wire, and other conducting or semi conducting materials. Workers must also be careful to keep clothing and body parts out of the equipment. Failure to observe these precautions could result in severe personal injury, death, or equipment

# A. Safety Precaution

## 4. Warning



### Warning

#### ■ Receiving

A visual inspection – inside and out – should be performed immediately upon receipt of the ACB and before removing it from the truck. Shipping papers should be checked to ensure all boxes or other accompanying pieces have been received. If any damage or shortages are evident, a claim should be filed at once with the carrier, and the nearest LSIS sales office. Claims for shortages or other errors must be made in writing to LSIS within 30days after receipt of ACB. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

#### ■ Handling

Removable lifting plates are provided on the top of the Susol ACB structure for insertion of hooks to lift the complete structure. This is the only recommended method of moving the Susol ACB structure. Extreme care should be used not to damage or deform the unit if other moving methods are employed.

#### ■ Storage

If it is necessary to store the equipment before installation, keep it in a clean, dry location with ample air circulation and heat to prevent condensation. Like all electrical apparatus, these units contain insulation that must be protected against dirt and moisture. Outdoor units may be stored outside only if roof caps are installed, space heaters energized and any openings are enclosed.

#### ■ Lifting Instructions

1. Do not pass cables or ropes through support holes.
2. Always use load rated shackles or safety hooks in support holes.
3. Rig so that legs of sling are no less than 45 degrees from horizontal.

#### ■ Moving

A crane or hoist can also be used to handle the breaker, if the lifting device is not available. If a forklift is utilized, the following precautions should be taken when moving circuit breakers:

1. Keep the breaker in an upright position only.
2. Make sure the load is properly balanced on the forks.
3. Place protective material between the breaker and the forklift to prevent bending or scratching.
4. Securely strap the breaker to the forklift to prevent shifting or tipping.
5. Excessive speeds and sudden starts, stops, and turns must be avoided when handling the breaker.
6. Lift the breaker only high enough to clear obstructions on the floor.
7. Take care to avoid collisions with structures, other equipment, or personnel when moving the breaker.
8. Never lift a breaker above an area where personnel is.

# B. Service condition

## 1. Normal/Special service condition

### ■ Normal service conditions

If under ordinary conditions the following normal working conditions are all satisfied, Susol ACB should be used under this condition unless otherwise specified.

#### 1) Ambient temperature

A range of max. +40°C to min. -5°C is recommended. However, the average temperature of 24 hours does not exceed +35°C.

#### 2) Altitude

2,000m or less.

#### 3) Environmental conditions

The air must be clean, and the relative humidity does not exceed 85% at a max. of +40°C and 90% at 20°C. Do not use and store in presence of corrosive or ammonia gas.

(H<sub>2</sub>S ≤ 0.01ppm, SO<sub>2</sub> ≤ 0.01ppm, NH<sub>3</sub> ≤ a few ppm)

#### 4) Installation conditions

When installing Susol ACB, refer to catalogue or the installation instructions in the instruction manual.

#### 5) Storage temperature

A range of max. +60°C to min. -20°C is recommended.

#### 6) Replacement

Approx. 15 years (depends on number of breaking of over current or service condition). Please see maintenance and inspection for further detail.

## 2. Special service conditions

In the case of special service condition, modified air circuit breakers are available. Please specify when ordering. Service life may be shorter, it depends on service conditions.

#### 1) Special environmental conditions

If it is used at high temperature and/or high humidity, the insulation durability and other electrical or mechanical features may deteriorate. Therefore, the breaker should be specially treated. Moisture fungus treatment with increased corrosion-resistance is recommended. When using products under this condition, please contact LS service team or nearest sales representatives.

#### 2) Special ambient temperature

If the ambient temperature exceeds +40°C, reduce the continuous conducting current for a use referring to Table. A.

#### 3) Special altitude

If it is used at the 2,000m or higher the heat radiation rate is reduced and the operating voltage, continuous current capacity and breaking capacity are decreased. Moreover the durability of the insulation is also decreased owing to the atmospheric pressure. Contact us for further detail.

**Table A. The compensation of rated current according to ambient temperature**

FRAME	정격전류	ACB 터미널	모션 적용 규격	수평형						수직형					
				40°C	45°C	50°C	55°C	60°C	40°C	45°C	50°C	55°C	60°C	40°C	45°C
				200A	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A
2000AF AN - D AS - D	200A	15t × 50 × 1ea	5t × 30 × 2ea	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A
	400A		5t × 40 × 2ea	400A	400A	400A	400A	400A	400A	400A	400A	400A	400A	400A	400A
	630A		5t × 50 × 2ea	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A
	800A		5t × 60 × 2ea	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A
	1000A		5t × 60 × 2ea	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A
	1250A		5t × 80 × 2ea	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A
	1600A		5t × 100 × 2ea	—	—	—	—	—	2000A						
	2000A		5t × 100 × 3ea	2000A	2000A	1950A	1900A	1850A	2000A	2000A	2000A	2000A	2000A	1950A	1900A
4000AF AN - E AS - E	630A	20t × 75 × 1ea	5t × 40 × 2ea	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A
	800A		5t × 50 × 2ea	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A
	1000A		5t × 60 × 2ea	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A
	1250A		5t × 80 × 2ea	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A	1250A
	1600A		5t × 100 × 2ea	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A
	2000A		5t × 100 × 3ea	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A
	2500A		5t × 100 × 4ea	2500A	2500A	2500A	2400A	2300A	2500A	2500A	2500A	2500A	2450A	2350A	—
	3200A		10t × 100 × 3ea	3200A	3200A	3100A	3000A	2900A	3200A	3200A	3200A	3150A	3050A	2950A	—
	4000A		10t × 125 × 3ea	—	—	—	—	—	4000A	4000A	3950A	3800A	3650A	—	—
5000AF AS - F	4000A	20t × 125 × 2ea	10t × 100 × 4ea	3800A	3800A	3400A	3200A	3000A	—	—	—	—	—	—	—
	5000A		10t × 125 × 4ea	5000A	5000A	4900A	4800A	4700A	5000A	5000A	4950A	4850A	4750A	—	—
	6300AF AS - G		10t × 100 × 4ea	4000A	4000A	4000A	3900A	3800A	4000A	4000A	4000A	3950A	3850A	—	—
	5000A		10t × 125 × 4ea	5000A	5000A	5000A	4900A	4800A	5000A	5000A	5000A	4950A	4850A	—	—
	6300A		20t × 150 × 2ea	10t × 150 × 4ea	6300A	6300A	6200A	6100A	6000A	6300A	6300A	6250A	6152A	6050A	—

# B. Service condition

## 2. Altitude and Insulation clearance

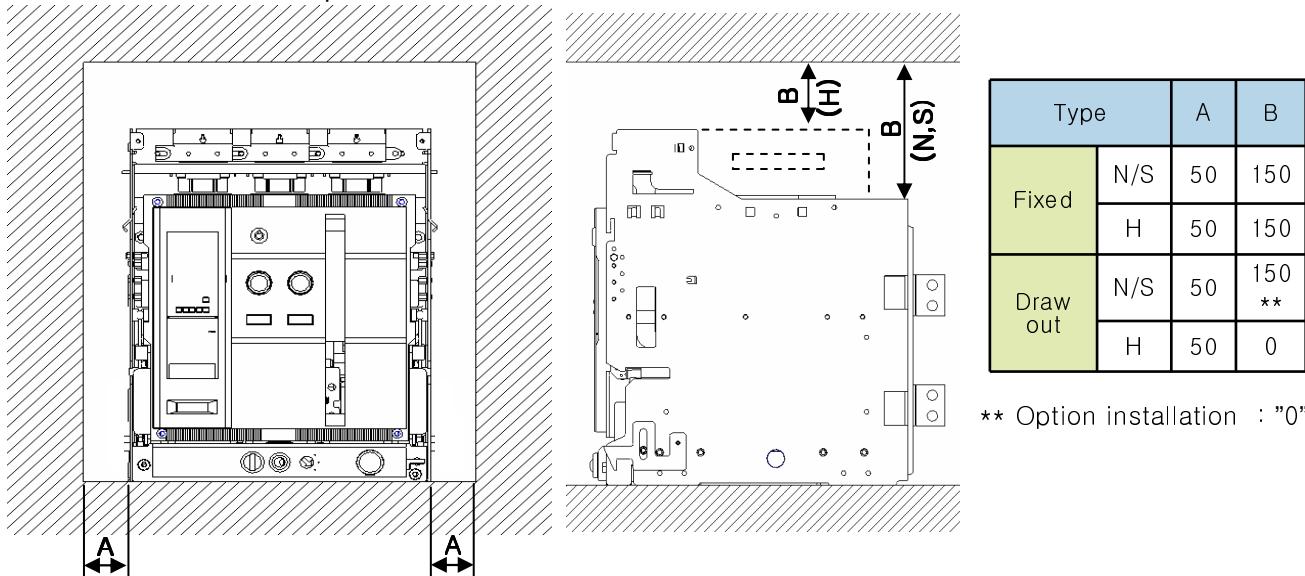
### ■ Altitude

Susol ACB is designed for operation at altitudes under 2000m. At altitudes higher than 2000m, change the ratings upon a service condition.

Item	Altitude [m]	2000	3000	4000	5000
Withstand voltage [V]		3500	3150	2500	2100
Average insulating voltage [V]		1000	900	700	600
Max. using voltage [V]		690	590	520	460
Current compensation constant		1 x In	0.99 x In	0.96 x In	0.94 x In

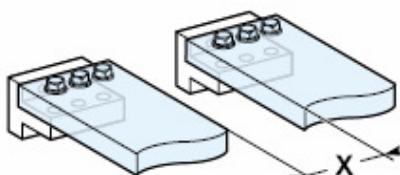
### ■ Insulation clearance

When drawing the electric power supply panel, please keep the distance of Insulation clearance between Susol ACB and panel as listed in table.



### ■ Minimum insulation clearance

The dimension of all charging parts should be over the minimum insulation clearance.

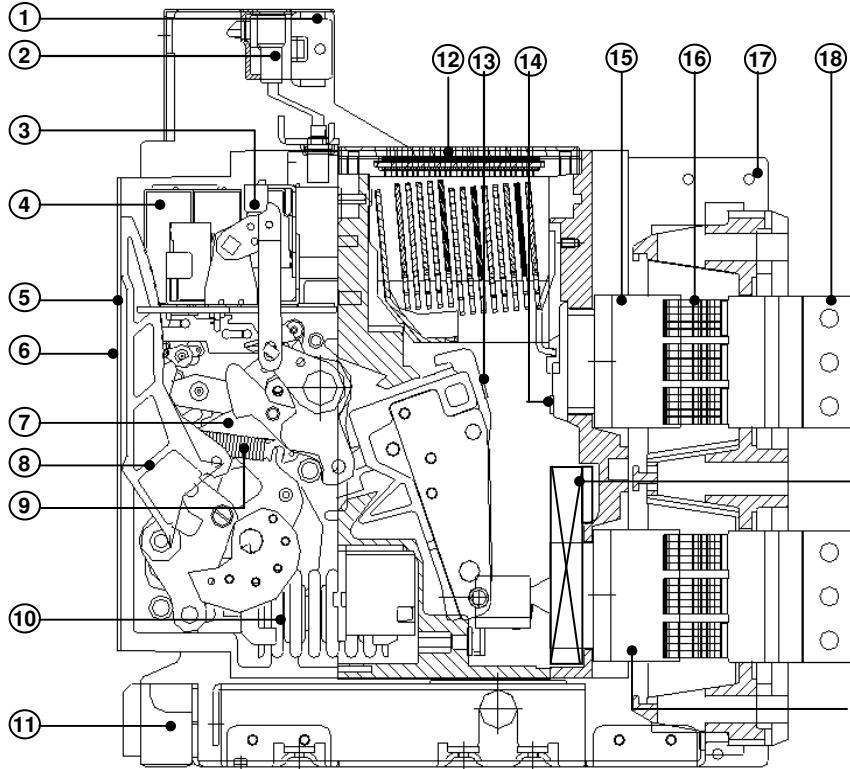


Insulating voltage (Ui)	Min. insulation clearance (X min)
600V	8 mm
1000V	14 mm

# C. Structure and Operation

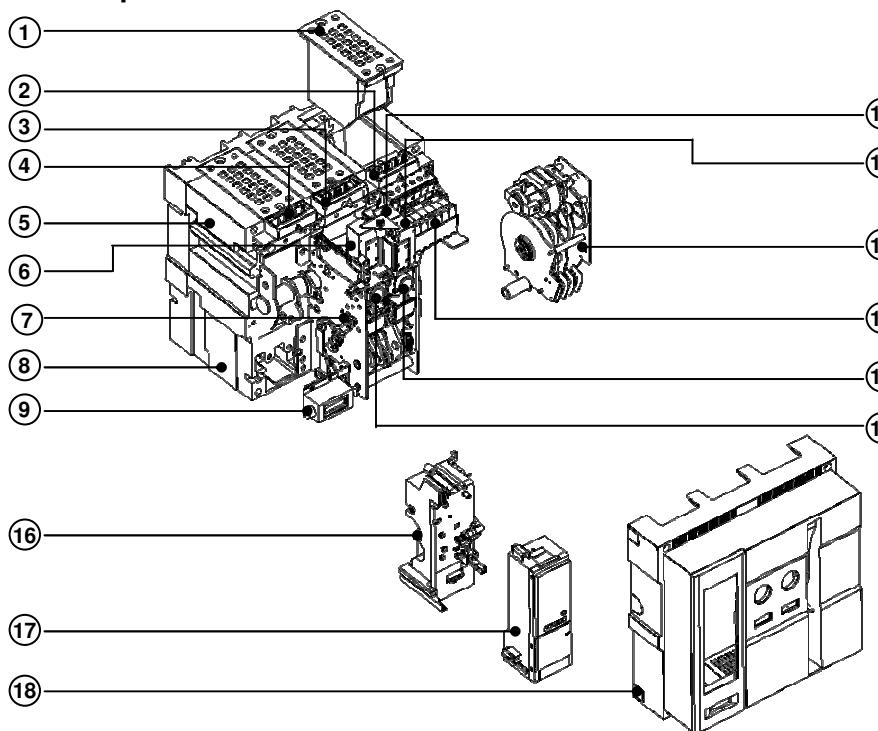
## 1. Internal structure and Components

### ■ Internal configuration



- (1) Control terminal block
- (2) Control terminal
- (3) Auxiliary switches
- (4) Closing, Trip, UVT Coil
- (5) Trip Relay
- (6) Front cover
- (7) Mechanism
- (8) Charge Handle
- (9) Trip spring
- (10) Closing spring
- (11) Draw-in/out device
- (12) Arc extinguishing part
- (13) Moving contact
- (14) Fixed contact
- (15) Conductor on source side
- (16) Cradle Finger
- (17) Cradle
- (18) Connecting conductor to circuit breakers
- (19) Power supply CT
- (20) Conductor on load side

### ■ Components

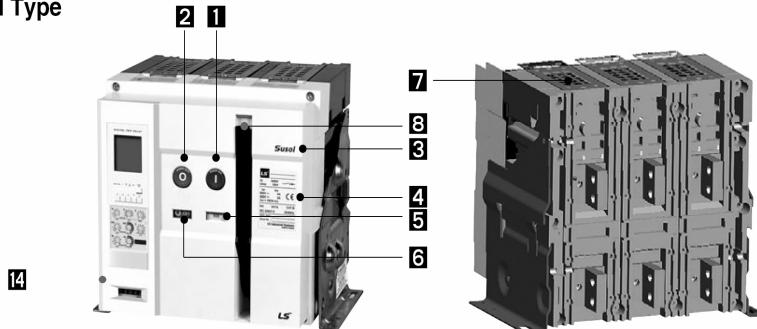


- (1) Arc chute
- (2) Aux. switch control terminal
- (3) Control power supply terminal
- (4) OCR control terminal
- (5) Carrying grip
- (6) Trip coil
- (7) Mechanism
- (8) Main body
- (9) Counter
- (10) UVT coil
- (11) Closing Coil
- (12) Motor Ass'y
- (13) Aux. switch
- (14) ON button
- (15) OFF button
- (16) MTD Base
- (17) OCR
- (18) Cover

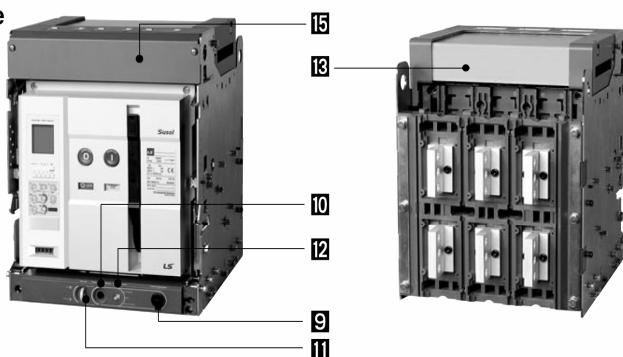
# C. Structure and Operation

## 1. Internal structure and Components

### ■ Fixed Type



### ■ Draw-out Type



- 1 ON button
- 2 OFF button
- 3 Series name
- 4 Rated name plate
- 5 Charge Discharge indicator
- 6 ON/OFF indicator
- 7 Arc box
- 8 Charge handle
- 9 Drawout handle
- 10 Handle storage space
- 11 Pad lock button
- 12 Position indicator
- 13 Arc Cover
- 14 Digital trip relay
- 15 Terminal cover

## ■ Terminal Configuration

There are many possible terminal configurations when connecting bus bar of distribution panel, vertical, horizontal plane type, etc.



Fig.1 Horizontal type



Fig. 2 Vertical type



Fig.3 Horizontal/Vertical type

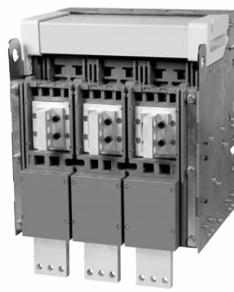


Fig.4 Vertical/plane type

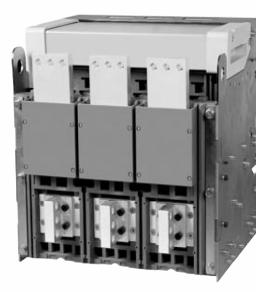


Fig.5 Plane/Vertical type

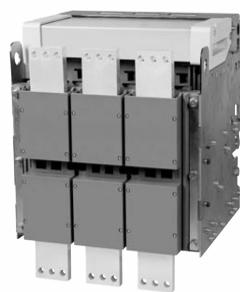


Fig.6 Plane type

# C. Structure and Operation

## 2. Basic function and Breaking operation

- ACB prevents a fire, a property damage, the breakage of an electrical equipment on load side by protecting a circuit from the fault currents.

### 1. Circuit Closing

The closing operation of mechanism applies the current to the load. When energized, some loads makes inrush current much greater than rated current ( $I_n$ ) (e.g. Motor takes in 7~8times of  $I_n$  for a few seconds). To prevent these over current which causes the dangerous phenomena for contacts (Erosion by arcs), closing operation should be prompt. If a circuit breaker is in accordance with all standard cases, it should be able to endure 15~20 times of the rated current and be opened promptly for the faults occurred during closing operation or after it has closed.

### 2. Current Conducting

A circuit breaker must not be exceeding an acceptable temperature rise under normal current conducting and there must be safe current conducting within specified breaking time under over current.

Furthermore, if a circuit breaker is of the discriminated type, it must has the structure which can withstand the high electrodynamics to accept the short-circuit current while a circuit breaker in downstream is operating to break it.

### 3. Circuit Opening, Current Breaking

- 1) Current can be broken manually or remotely by voluntary operation on mechanism.
- 2) A circuit breaker opens a circuit automatically under condition of current which may has any values at this time by an auxiliary trip unit (Under voltage, Ground fault, etc.)
- 3) A circuit breaker opens a circuit automatically against the over current because it is operated by OCR (the trip unit) even if it is in the closed position.

### 4. Isolation

When a circuit breaker is open, a certain isolation level is required between charging and non-charging parts. The Isolation Level is decided by following tests.

- 1) A maximum leakage current test under rated using voltage (Max.  $U_e$ )
- 2) An impulse voltage

- There are following breaking principles regarding over current.

#### 1. Instantaneous trip

When short-circuit current flows in, ACB trips instantly to minimize side effect due to the accident on load side. It is called instantaneous trip.

#### 2. Time delay breaking

When abnormal current flows in such as inrush current of transformer or condenser, and starting current of motor, ACB keeps the conducting condition for a regular time and break the current if it is continuously remained. In case of short-circuit, ACB minimizes the damage from accident by keeping the circuit for the time previously set concerning the operating time of branch breakers under selective discrimination. However, it breaks the circuit after the delayed time in case abnormal current continuously flows in due to the breaking failure of branch breakers. It is called as Time delayed breaking.

#### 3. Overload trip

If the current which exceeds the rated current flows in continuously, the cable is getting hotter and it causes the big fire. Therefore, ACB breaks the current before the temperature of cable reaches the dangerous level. It is called overload trip.

#### 4. Ground-fault trip

Ground fault defines as current flows into the ground from circuit or charging part of load due to breakdown. If ground fault current flows, it is inducted to other cables nearby owing to electronic induction, voltage level is risen and it finally cause severe effects or damage on other device.

Furthermore, in case personnel hands are touched, it may result in electrical shock. Ground fault breaking is to prevent any possible accident occurred from ground fault.

# D. Types and Ratings

## 1. Type of Susol Series

### Susol Series

AH-10D3-10U	M1	Closing power supply
MA	Motor Not Provided	DO C.C Not Provided
M1	AC/DC 100V ~ 130V	D1 AC/DC 100V ~ 130V
M2	AC/DC 200V ~ 250V	D2 AC/DC 200V ~ 250V
M3	DC 125V	D3 DC 125V
M4	DC 24V ~ 30V	D4 DC 24V ~ 30V
M5	DC 48V ~ 60V	D5 DC 48V ~ 60V
M6	AC 380V ~ 415V	D6 AC 380V ~ 480V
M7	AC 440V ~ 480V	D7 AC 48V
M8	AC 48V	

D1	Aux contact & Charging types
	Trip power supply
DO	SHT Not Provided
D1	AC/DC 100V ~ 130V
D2	AC/DC 200V ~ 250V
D3	DC 125V
D4	DC 24V ~ 30V
D5	DC 48V ~ 60V
D6	AC 380V ~ 480V
D7	AC 48V

\*UVT Delay is usable from AC/DC 48V

A H	10	3	10	J
Susol	AMIFARE FRAME	No. of pole	Rated current (CT SPEC.)	Installation
-	-		00 OCR & CT Not Provided	Draw-out type
06	630AF	D : 630~2000AF 3/4P Standard type RST(N) W : 630~2000AF 4P Reverse phase type NRST	02 200A 04 400A 06 630A 08 800A 10 1000A 13 1250A 16 1600A 20 2000A	J Manual connection A Automatic connection Fixed type H Top/Bottom horizontal type V Top/Bottom vertical type M Top horizontal/Bottom vertical type N Top vertical/Bottom horizontal type P Top/Bottom horizontal type
08	800AF	3 : 3poles (D) 4 : 4poles (D,W)	1000A 1300A 1600A 2000A	
10	1000AF		1250A 1600A	
13	1250AF		1600A 2000A	
16	1600AF		2000A 2500A	
20	2000AF		2500A 3200A	
25	2500AF		3200A 4000A	
32	3200AF		4000A	
40	4000AF		4000A	

00	OCR & CT Not Provided
06	630
08	800
10	1000
13	1250
16	1600
20	2000
25	2500
32	3200
40	4000

G : 4000/5000/6300AF 3/4P Standard type RST(N) Z : 4000/5000/6300AF 4P Reverse phase type NRST	3 : 3poles (G) 4 : 4poles (G,Z)
40	4000AF
50	5000AF
63	6300AF

# D. Types and Ratings

## 1. Type of Metasol Series

### Metasol Series

AS-10D3-10J		M1	D1
		Closing power supply	Trip power supply
MA	Motor Not Provided	D0 C.C Not Provided	D0 SHT Not Provided
M1	AC/DC 100V ~ 130V	D1 AC/DC 100V ~ 130V	D1 AC/DC 100V ~ 130V
M2	AC/DC 200V ~ 260V	D2 AC/DC 200V ~ 260V	D2 AC/DC 200V ~ 260V
M3	DC 125V	D3 DC 125V	
M4	DC 24V ~ 30V	D4 DC 24V ~ 30V	
M5	DC 48V ~ 60V	D5 DC 48V ~ 60V	
M6	AC 380V ~ 415V	D6 AC 380V ~ 460V	
M7	AC 440V ~ 460V	D7 AC 48V	
M8	AC 48V		

AS		10	3	10	3	J	10	3	U1	NG0	OCR	B	C
Metasol		-	No. of pole	Rated current (CT SPEC.)		Installation		Drawout type		Option		Type name	
AM/FARÉ FRAME		-	No. of pole	00 OCR & CT Not Provided		00 J Manual connection		00 A Automatic connection		00 H Top/Bottom horizontal type		H1 SHT2 AC/DC 100V ~ 130V	
Frame sizes & Phase array		-	No. of pole	02 000A		02 004A		02 630A		02 800A		H2 SHT2 AC/DC 200V ~ 260V	
D : 630~2000AF 3/4P Standard type RST(N)		06	630AF	04 400A		06 630A		08 1000A		08 1250A		H3 SHT2 DC 24V ~ 30V	
W : 630~2000AF 4P Reverse phase type NRST		08	800AF	08 1600A		10 1600A		10 1600A		10 2000A		H4 SHT2 DC 48V ~ 60V	
3 : 3poles (D, W) 4 : 4poles (D, W)		10	1000AF	12 1600A		13 1600A		13 1600A		13 2000A		H5 SHT2 AC 380V ~ 460V	
E : 2000~4000AF 3/4P Standard type RST(N)		13	2000AF	16 1600A		16 1600A		16 1600A		16 2000A		H6 SHT2 AC 440V ~ 460V	
X : 2000~4000AF 4P Reverse phase type NRST		16	2000AF	20 2000A		20 2000A		20 2000A		20 2500A		H7 SHT2 AC 48V	
F : 4000/5000/6300AF 3/4P Standard type RST(N)		25	2500AF	25 2500A		25 3200A		25 3200A		25 4000A		H8 S2 Charge switch communication +AN Type not applied/TDU MODULE not applied	
Y : 4000/5000/6300AF 4P Reverse phase type NRST		32	3200AF	32 3200A		32 4000A		32 4000A		32 4000A		H9 B On/Off Button lock	
Z : 4000/5000/6300AF 4P Reverse phase type NRST		40	4000AF	40 4000A		40 5000A		40 5000A		40 5000A		H10 M Mechanical interlock +AN Type not applied	
G : 4000/5000/6300AF 3/4P Standard type RST(N)		50	5000AF	50 5000A		50 6300A		50 6300A		50 6300A		H11 R QS Ready to Close switch	
H : 4000/5000/6300AF 4P Reverse phase type NRST		63	6300AF	63 6300A		63 6300A		63 6300A		63 6300A		H12 T TM Temperature Monitoring +AN Type not applied/TDU MODULE not applied	
I : -		-	-	63 6300A		63 6300A		63 6300A		63 6300A		H13 H SH2 Double Shunt coil #4# using LMT, not applied	

# D. Types and Ratings

## 1. Type of Metasol Series

### Metasol Series

AN-10D3-10U	M1	D1	Ax	NG0	U1	B	C
	Motor power supply	Trip power supply	Aux contact & Charging type	OCR	UVT	OPTION	
MA	Motor Not Provided	D0 SHT Not Provided	AX Low capacity OFF charge 3a3b		U0 UVT Not Provided		
M1	AC/DC 100V ~ 130V	D1 AC/DC 100V ~ 130V	AC Low capacity ON charge 3a3b		U1 AC/DC 100V ~ 130V		
M2	AC/DC 200V ~ 250V	D2 AC/DC 200V ~ 250V	BX Low capacity OFF charge 5a5b		U2 AC/DC 200V ~ 250V		
M3	DC 125V	D3 DC 125V	BC Low capacity ON charge 5a5b		U3 DC 125V		
M4	DC 24V ~ 30V	D4 DC 24V ~ 30V	HX High capacity OFF charge 5a5b		U4 DC 24V ~ 30V		
M5	DC 48V ~ 60V	D5 DC 48V ~ 60V	HC High capacity ON charge 5a5b		U5 DC 48V ~ 60V		
M6	AC 380V ~ 415V	D6 AC 380V ~ 480V	CC Low capacity ON charge 6a6b		U6 AC 380V ~ 480V		
M7	AC 440V ~ 480V	D7 AC 48V	JC High capacity ON charge 6a6b		U7 AC 48V		
M8	AC 48V						

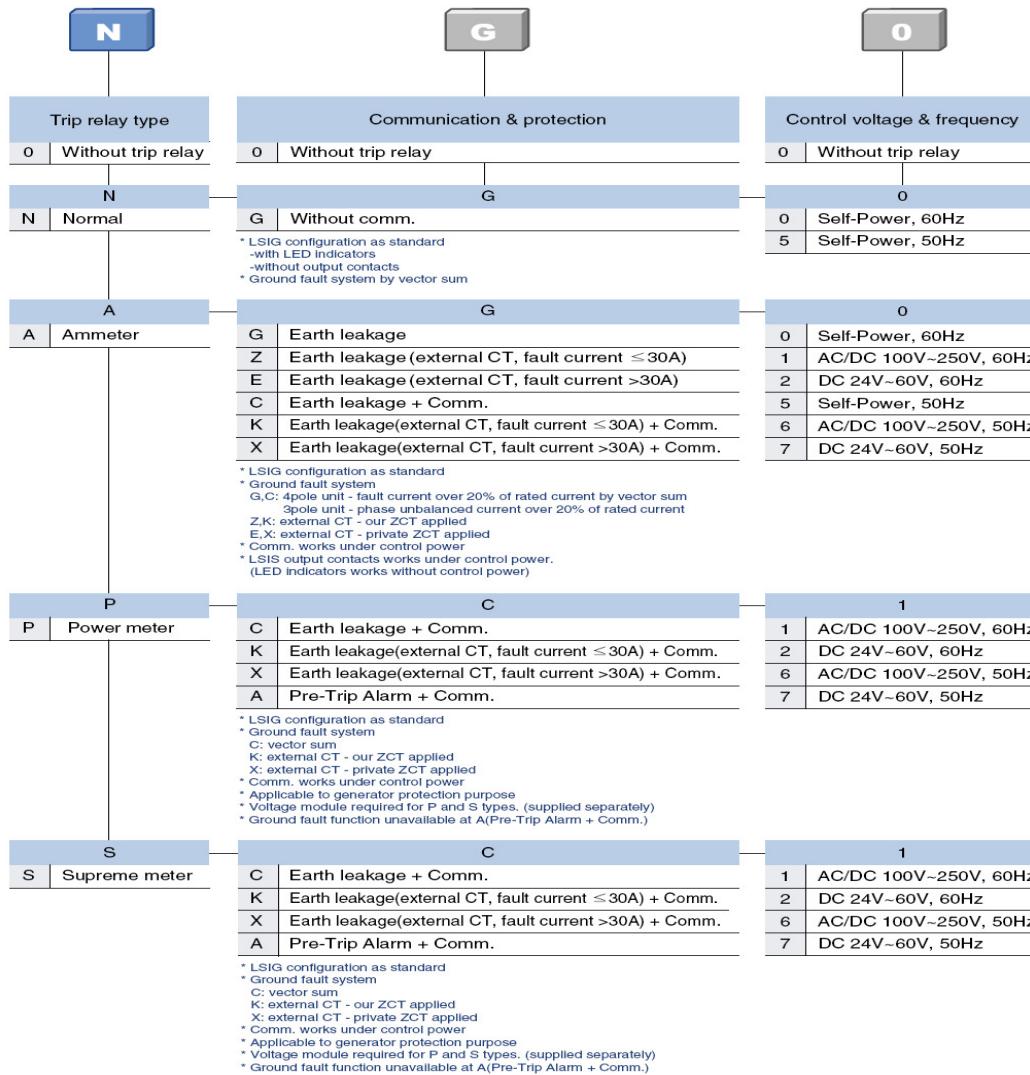
\*UVT Delay is usable from AC/DC 48V

AN	Metasol	D	3	10	J	10	UVT
		Frame sizes & Phase array	No. of pole	-	Rated current(C) / SPEC,	-	
		-	-	-	OGR & CT Not Provided		
06	630AF	D : 630~1600AF 3/4P Standard type RST(N) W : 630~1600AF 4P Reverse phase type NRST	3 : 3poles(D), 4 : 4poles(W)	00	00	200A	
08	800AF			02		400A	
10	1000AF			04		630A	
12	1250AF			06		800A	
14	1600AF			08		1000A	
16				10		1250A	
				13		1600A	
				16		1600A	
20	2000AF	E : 2000~3200AF 3/4P Standard type RST(N) X : 2000~3200AF 4P Reverse phase type NRST	3 : 3poles(E), 4 : 4poles(X)	00	00	OCR & CT Not Provided	
25	2500AF			06		630	
32	3200AF			08		800	
				10		1000	
				13		1250	
				16		1600	
				20		2000	
				25		2500A	
				32		3200A	

# D. Types and Ratings

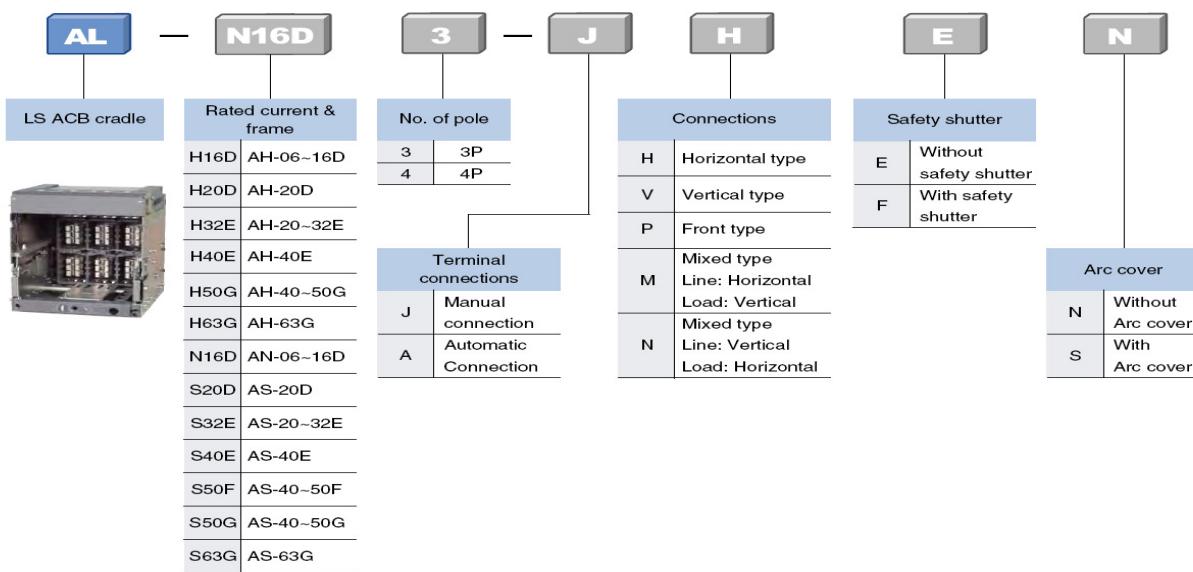
## 2. Type of OCR/Cradle Series

### ■ OCR



Note) The functions like Metering, Communication, ZSI, Remote Reset and DO control are not available only under Self-Power condition.

### ■ Cradle



# D. Types and Ratings

## 3. Ratings

### ■ Ratings of Susol Series

Susol														
	AH-06D	AH-08D	AH-10D	AH-13D	AH-16D	AH-20D	AH-25E	AH-32E	AH-40E	AH-40G	AH-50G	AH-63G		
Rated current(A)	(In max)	at 40°C	400	630	1000	1250	1600	2000	2500	3200	4000	5000	6300	
Setting current(A)*	Control trip relay (... × In max)		400	400	630	1000	1250	1600	2000	2500	3200	4000	5000	6300
Rated current of neutral pole (A)			400	400	630	1000	1250	1600	2000	2500	3200	4000	5000	6300
Faulted insulation voltage(V)	(Ui)					1000				1000				1000
Rated operating voltage(V)	(Ue)					690				690				690
Rated impulse withstand voltage (kV)(Imp)						12				12				12
Frequency(Hz)						50/60				50/60				50/60
Number of poles(P)						3, 4				3, 4				3, 4
Rated breaking capacity (kA sym)	(Icu)	IEC 60947-2 AC 50/60Hz	220V/230V/380V/415V 550V/600V/690V	85					100					150
Rated service breaking capacity (kA) (Ics)	(Icm)	IEC 60947-2 AC 50/60Hz	220V/230V/380V/415V 460V/480V/500V	85					100					150
Rated making capacity (kA peak)	(Icw)	IEC 60947-2 KS C 4620	220V/230V/380V/415V 550V/600V/690V	100%					100%					100%
Rated short-time withstand current (kA)	(Icw)					187				220				330
Operating time (ms)						187				220				330
Operating time (ms)						143				187				220
Rated short-time withstand current (kA)	(Icw)					65				85				100
Operating time (ms)						60				75				100
Operating time (ms)						50				65				100
Operating time (ms)						40				40				40
Maximum closing time						80				80				80
Life cycle (times)	Mechanical	Without maintenance				20,000				15,000				10,000
	Electrical	With maintenance				30,000				20,000				15,000
		Without maintenance				5,000				5,000				2,000
Connections **	Draw-out / Fixed	Horizontal connection				10,000				10,000				5,000
		Vertical connection				-				-	O			-
		Front connection				0				0	●			●
Weight (kg) (3P/4P)	Draw-out type	Main body (With cradle)	Motor charging type			63/774	70/85			87/103	104/147			181/223
		Cradle only	Manual charging type			61/772	68/83			85/101	102/145			179/221
Fixed type		Motor charging type				29/32	33/40			44/55	53/70			97/117
		Manual charging type				34/44	38/47			44/55	63/100			98/123
External dimensions (mm) (H×W×D)	Draw-out type	3P				430×334×375				430×412×375				96/121
	Fixed type	3P				430×419×375				430×527×375				460×1015×375
		4P				300×300×295				300×378×295				300×751×295
Trip relay	N. A. P. S type					300×385×295				300×493×295				300×981×295
Certificate & Approval						N. A. P. S type				N. A. P. S type				KEMA / KERI / CE
														KEMA / KERI / CE

Type	Susol								Susol					
Amper frame	(AF)	AH-06D	AH-08D	AH-10D	AH-13D	AH-16D	AH-20D	AH-25E	AH-32E	AH-40E	AH-40G	AH-50G	AH-63G	
Rated current(A)	(In max)	200	400	630	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300
Setting current (A)*	Control trip relay (... × In max)	400	400	630	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300
Rated current of neutral pole (A)		630	800	1000	1250	1600	2000	2500	3200	4000	4000	4000	5000	6300
Faulted insulation voltage(V)	(Ui)					1000				1000				1000
Rated operating voltage(V)	(Ue)					690				690				690
Rated impulse withstand voltage (kV)(Imp)						12				12				12
Frequency(Hz)						50/60				50/60				50/60
Number of poles(P)						3, 4				3, 4				3, 4
Rated breaking capacity (kA sym)	(Icu)	IEC 60947-2 AC 50/60Hz	220V/230V/380V/415V 550V/600V/690V	85					100					150
Rated service breaking capacity (kA) (Ics)	(Icm)	IEC 60947-2 KS C 4620	220V/230V/380V/415V 460V/480V/500V	85					100					150
Rated making capacity (kA peak)	(Icw)	IEC 60947-2 KS C 4620	220V/230V/380V/415V 550V/600V/690V	100%					100%					100%
Rated short-time withstand current (kA)	(Icw)					187				220				330
Operating time (ms)						187				220				330
Operating time (ms)						143				187				220
Operating time (ms)						65				85				100
Operating time (ms)						60				75				100
Operating time (ms)						50				65				100
Operating time (ms)						40				40				40
Maximum closing time						80				80				80
Life cycle (times)	Mechanical	Without maintenance				20,000				15,000				10,000
	Electrical	With maintenance				30,000				20,000				15,000
		Without maintenance				5,000				5,000				2,000
Connections **	Draw-out / Fixed	Horizontal connection				10,000				10,000				5,000
		Vertical connection				0				0				0
		Front connection				0				0				●
Weight (kg) (3P/4P)	Draw-out type	Main body (With cradle)	Motor charging type			63/774	70/85			87/103	104/147			181/223
		Cradle only	Manual charging type			61/772	68/83			85/101	102/145			179/221
Fixed type		Motor charging type				29/32	33/40			44/55	53/70			97/117
		Manual charging type				34/44	38/47			44/55	63/100			98/123
External dimensions (mm) (H×W×D)	Draw-out type	3P				430×334×375				430×412×375				460×785×375
	Fixed type	3P				430×419×375				430×527×375				460×1015×375
		4P				300×300×295				300×378×295				300×751×295
Trip relay	N. A. P. S type					300×385×295				300×493×295				300×981×295
Certificate & Approval						N. A. P. S type				N. A. P. S type				N. A. P. S type
														KEMA / KERI / CE

\*Refer to trip relay specification. \*\* ●: Standard, ○: Option

# D. Types and Ratings

## 3. Ratings

### ■ Ratings of Metasol AN,AS Series

Type	Ampere frame	(AF)	Metasol						Metasol								
			AN-06D	AN-08D	AN-10D	AN-13D	AN-16D	AS-20D	AS-20E	AS-25E	AS-32E	AS-40E	AS-50G	AS-50F	AS-63G		
Rated current(A)	(In max)	at 40°C	200	400	630	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300		
Setting current (A) *	Control trip relay ( ... × In max)		400	400	630	1000	1250	1600	2000	630, 800	1000, 1250	2500	3200	4000	4000	5000	6300
Rated current of neutral pole (A)			630	800					1600, 2000								
Rated insulation voltage(V)	(Ui)					1000				1,000					1,000		
Rated operating voltage(V)	(Ue)					680				690					690		
Rated impulse withstand voltage (kV)(Uimp)						12				12					12		
Frequency (Hz)						50/60				50/60					50/60		
Number of poles (P)						3, 4				3, 4					3, 4		
Rated breaking capacity (kA sym)						65				85					100%		
AC 50/60Hz						65				85					100%		
						550V/600V/690V				85					100%		
Rated service breaking capacity (kA) [ts]						100%				100%					100%		
						143				154					220		
Rated making capacity (kA peak)						143				154					220		
AC 50/60Hz						143				154					220		
						105				143					187		
Rated short-time withstand current (kA)						50				65					85		
						50				65					85		
Operating time (ms)						40				40					40		
						80				80					80		
Life cycle (time)	Mechanical					20,000				15,000					10,000		
	Without maintenance					30,000				20,000					15,000		
	With maintenance					5,000				5,000					2,000		
Connections **	Draw-out / Fixed					10,000				10,000					5,000		
	Horizontal connection					●				○					○		
	Vertical connection					○				○					●		
	Front connection					○				○					-		
Weight (kg) (3P4P)	Draw-out type	Main body (With cradle)	Motor charging type			63/74				70/85					145/173		
		Cradle only	Manual charging type			61/72				68/83					102/145		
	Fixed type		Motor charging type			29/32				33/40					58/70		
		Mixed connection				34/44				38/47					63/100		
External dimensions (mm) (H×W×D)	Draw-out type	3P				32/42				44/55					76/94		
		4P				36/45				42/53					61/98		
	Fixed type	3P				430×334×375				430×412×375					74/92		
		4P				430×419×375				430×527×375					460×629×375		
Trip relay						300×300×295				300×378×295					460×799×375		
Certificate & Approval						300×385×295				300×493×295					300×597×295		
						N, A, P type				N, A, P type					N, A, P type		
						KEMA / KERI / CE				KEMA / KERI / CE					KEMA / KERI / CE		

\* Refer to trip relay specification. \*\* ● Standard, ○ Option

# E. Weight & Dimension

## 1. Weight

### 1) AH Type (Susol ACB)

Unit : kg

Type	2000AF				4000AF				6300AF	
	1600A		2000A		3200A		4000A (Fork-type)			
	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P
Fixed	34	44	38	47	44	55	63	100	103	130
Draw-out (With cradle)	63	74	70	85	87	103	104	147	186	230
Cradle	29	32	33	40	44	50	58	70	102	124

### 2) AN,AS Type (Metasol ACB)

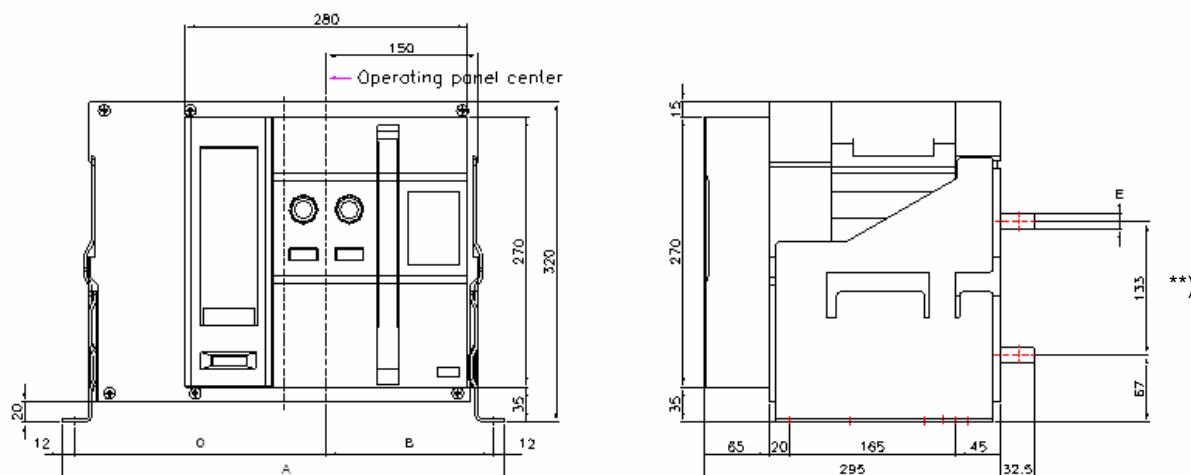
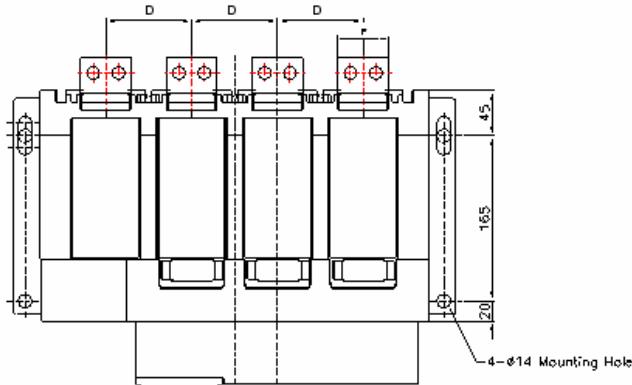
Unit : kg

Type	2000AF				4000AF				5000AF		6300AF	
	1600A		2000A		3200A		4000A (Fork-type)					
	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P
Fixed	34	44	38	47	44	55	63	100	76	94	103	130
Draw-out (With cradle)	63	74	70	85	87	103	104	147	145	173	186	230
Cradle	29	32	33	40	44	50	58	70	78	90	102	124

# E. Weight & Dimension

## 2. Dimension

### ■ Fixed type



\*\*) See the catalogue distance of pole to pole(over 4000A) and dimension of F/G frame.

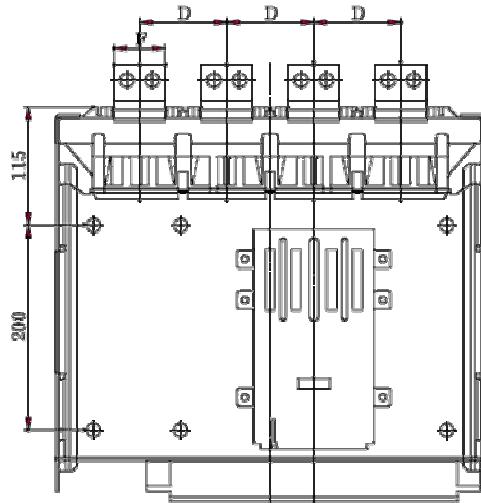
구분	2000AF 1600A 3P	2000AF 1600A 4P	4000AF 3200A 3P	4000AF 3200A 4P	4000AF 4000A 3P	4000AF 4000A 4P
A	354	439	432	547	432	547
B	165	165	204	204	204	204
C	165	250	204	319	204	319
D	85	85	115	115	140	140
E	15	15	20	20	12.5*2,10	12.5*2,10
F	50	50	75	75	100	100

구분	5000AF 5000A 3P	5000AF 5000A 4P	6300AF 4/5000A 3P	6300AF 4/5000A 4P	6300AF 6300A 3P	6300AF 6300A 4P
A	649	819	805	1035	805	1035
B	165	165	204	204	204	204
C	460	630	577	807	577	807
D	190	190	244	244	244	244
E	20	20	20	20	20	20
F	125	125	125	125	150	150

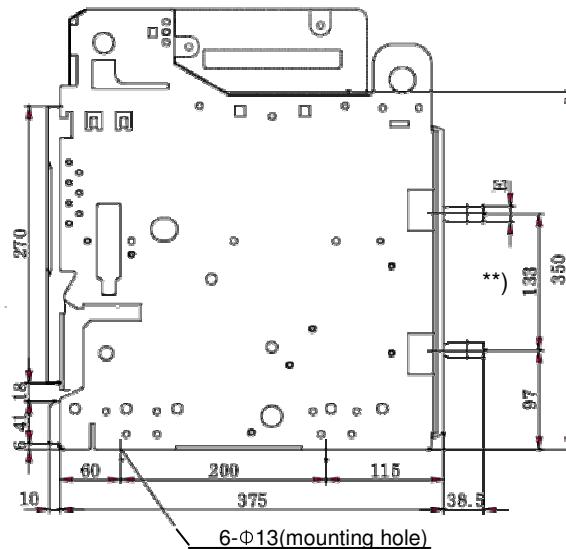
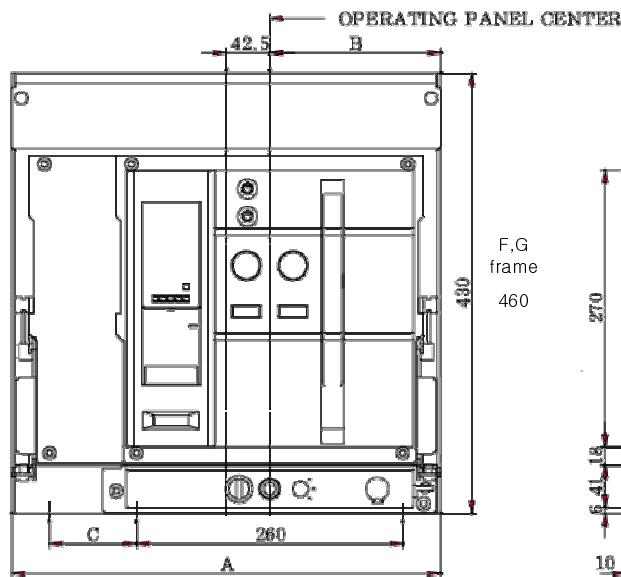
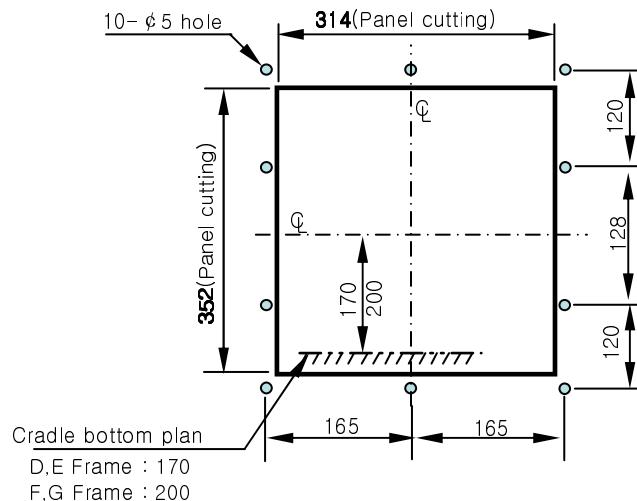
# E. Weight & Dimension

## 2. Dimension

### ■ Draw-out type



### ■ Panel cut



\*\*) See the catalogue distance of pole to pole(over 4000A).

구분	2000AF 1600A 3P	2000AF 1600A 4P	4000AF 3200A 3P	4000AF 3200A 4P	4000AF 4000A 3P	4000AF 4000A 4P
A	334	419	785	1015	785	1015
B	167	167	206	206	206	206
C	-	85	-	115	-	115
D	85	85	115	115	140	140
E	15	15	20	20	12.5*2,10	12.5*2,10
F	50	50	75	75	100	100

구분	5000AF 5000A 3P	5000AF 5000A 4P	6300AF 4/5000A 3P	6300AF 4/5000A 4P	6300AF 6300A 3P	6300AF 6300A 4P
A	629	799	785	1015	785	1015
B	167	167	206	206	206	206
C	35	205	113	343	113	343
D	190	190	244	244	244	244
E	20	20	20	20	20	20
F	125	125	125	125	150	150

# F. Unpacking

## 1. Receiving

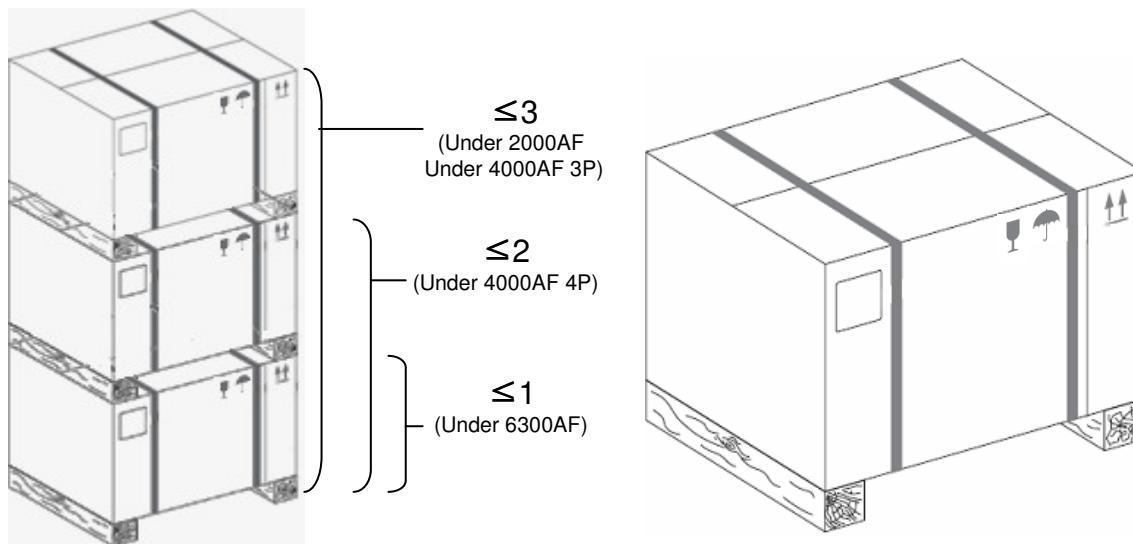
### ■ Receiving

A visual inspection – inside and out – should be performed immediately upon receipt of the ACB and before removing it from the truck. Shipping papers should be checked to ensure all boxes or other accompanying pieces have been received. If any damage or shortages are evident, a claim should be filed at once with the carrier, and the nearest LSIS sales office. Claims for shortages or other errors must be made in writing to LSIS within 30 days after receipt of ACB. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

## 2. Unpacking

### ■ Unpacking

- 1.Before unpacking the breaker, check that all boxes and packing are in good condition.
- 2.While unpacking, check the breaker is in good condition.
- 3.Check that the information given on the rating /accessory nameplates corresponds to the purchase order.
- 4.Care about the unpacking to avoid damaging the products. Unpacking them attentively to avoid dropping the products from carrying components and pallets.
- 5.Install the products to the final installation place after unpacking as soon as possible. If you cannot install the products immediately, you had better not unpacking them. Keep the products indoor around 15°C and under 50% of humidity. Standard packing condition for domestic portage is not suited to outdoor storage. If you cannot keep the maintenance above, you should inspect a degree of the damages before you install the products. Unsuitable keeping does not guarantee good qualities of the products and could occur additional danger of an accident.



# F. Unpacking

## 3. Check point and Caution

Please read the following check points and caution carefully as they imply the critical contents which should be confirmed before performing the unpacking, inspection, or installation, etc.

### ■ Check points upon receiving

1. A visual inspection – inside and out – should be performed immediately upon receipt of the ACB and before removing it from the truck. If any damage or shortages are evident, a claim should be filed at once with the carrier to the nearest LSIS sales office.
2. Unpacking them attentively to avoid dropping the products from carrying components and pallets.
3. Install the products to the final installation place after unpacking as soon as possible. If you cannot install the products immediately, you had better not unpacking them. Keep the products indoor around 15°C and under 50% of humidity. Standard packing condition for domestic portage is not suited to outdoor storage. If you cannot keep the maintenance above, you should inspect a degree of the damages before you install the products. Unsuitable keeping does not guarantee good qualities of the products and could occur additional danger of an accident.

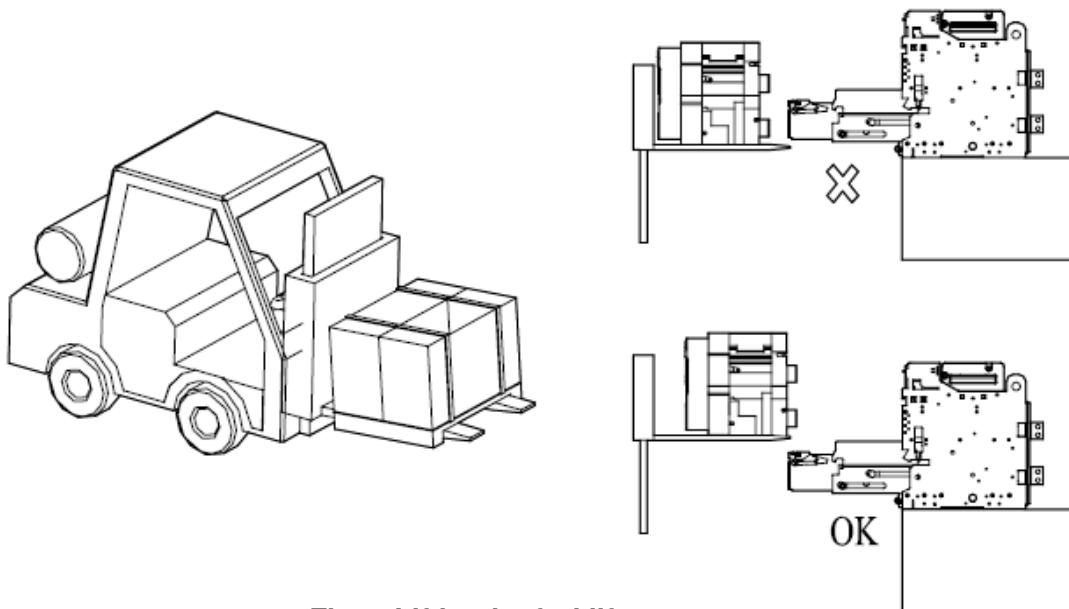
### ■ Caution for installation inspection

1. Confirm all power sources are completely de-energized first.
2. Disconnect all electrical switches which may operate during inspection.
3. Disconnect all plugs connected to operating part of product (Shunt coil, OCR, etc.)
4. In case of Draw-out type, pull out the product until guideline comes to TESTED position from cradle. (Basic inspection is available under TEST position.)
5. In case of detailed inspection, remove the product form cradle securely and put it to the even stand.
6. Inspect product.

# G. Handling and Storage

## 1. Handling

- This breaker and cradle are designed to move easily by overhead lifting devices such as hoisters. You can use lifting hooks which is optional to move them without difficulty. All the carrying devices should be suited to the product's permissible weight which is presented in Table.1. In case of using forklift, refer to figure.1.

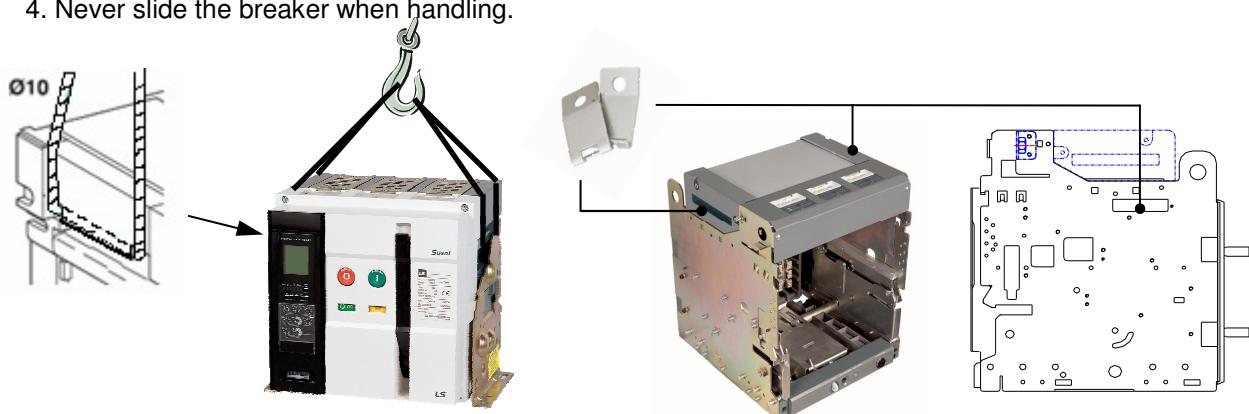


**Fig 1. Lifting by forklift**

-When lifting products with forklift, be careful with the bottom plane not to exceed the rear side of products. (Refer to fig.1)

### ■ Precaution of Handling

1. To lift the breaker (Fixed type), use the lifting hooks on the sides of the breaker, and lift with rope or something similar.
2. When placing the breaker on the ground, be careful not to drop or to impact the breaker.
3. When the draw-out breaker is lifted with the cradle, lift it in the connected position.
4. Never slide the breaker when handling.



**Fig. 2. Handling method of Fixed type**

**Fig. 3. Handling method of Draw-out type**

# G. Handling and Storage

## 2. Storage

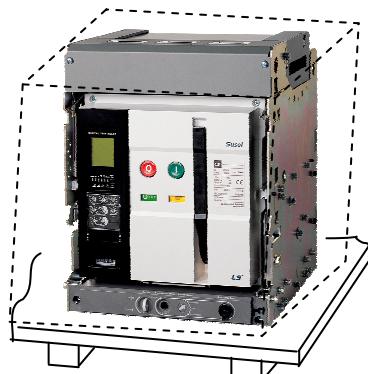
### ■ Precaution of Storage

**When storing a circuit breaker for a long term,**

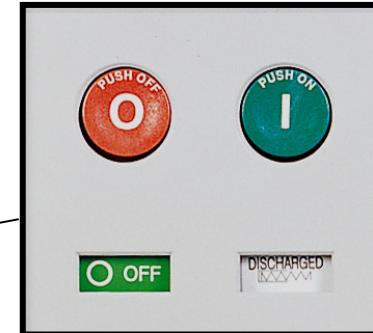
1. Keep the breaker at OFF position with the charging spring discharged.
2. Store the draw-out type breaker on the plat place after the TEST position inserted.

### ■ Storage method

1. Store the breaker in a dust free and dry environment.
2. Keep the breaker in OFF position with the charging spring discharged.
3. Cover the breaker with a vinyl sheet or a similar cover. When putting the breaker into service after long term storage, it is unnecessary to lubricate the parts of the breakers.
4. Keep the breaker indoor as it was packaged around 15°C and under 50% of humidity.
5. Standard packing condition for domestic portage is not suited to outdoor storage. If you cannot keep the maintenance above, you should inspect a degree of the damages before you install the products.
6. Unsuitable keeping does not guarantee good qualities of the products and could occur additional danger of an accident.



**ACB open and discharge**



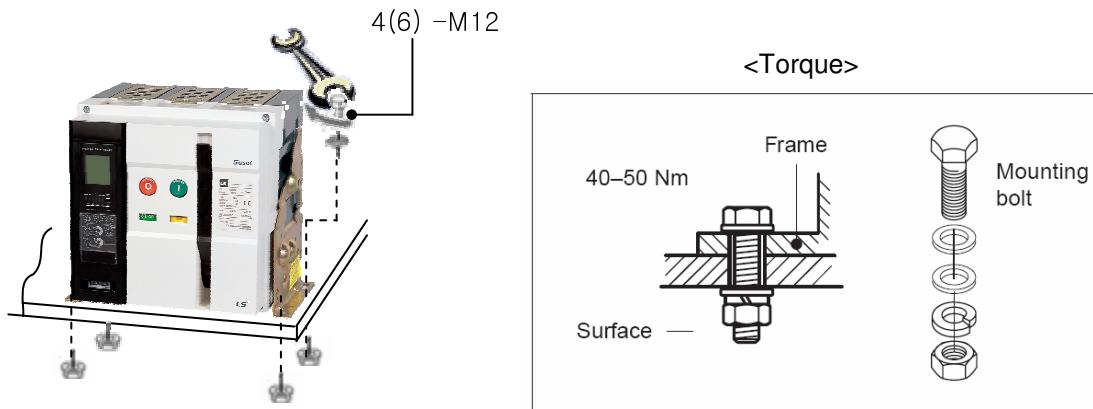
- |              |                                  |
|--------------|----------------------------------|
| Connected    | <input checked="" type="radio"/> |
| Test         | <input type="radio"/>            |
| Disconnected | <input type="radio"/>            |

# H. Installation

## 1. Fixed type

### ■ Installation of Fixed type

Securely install the left and right mounting frames with M12 bolts (4EA).

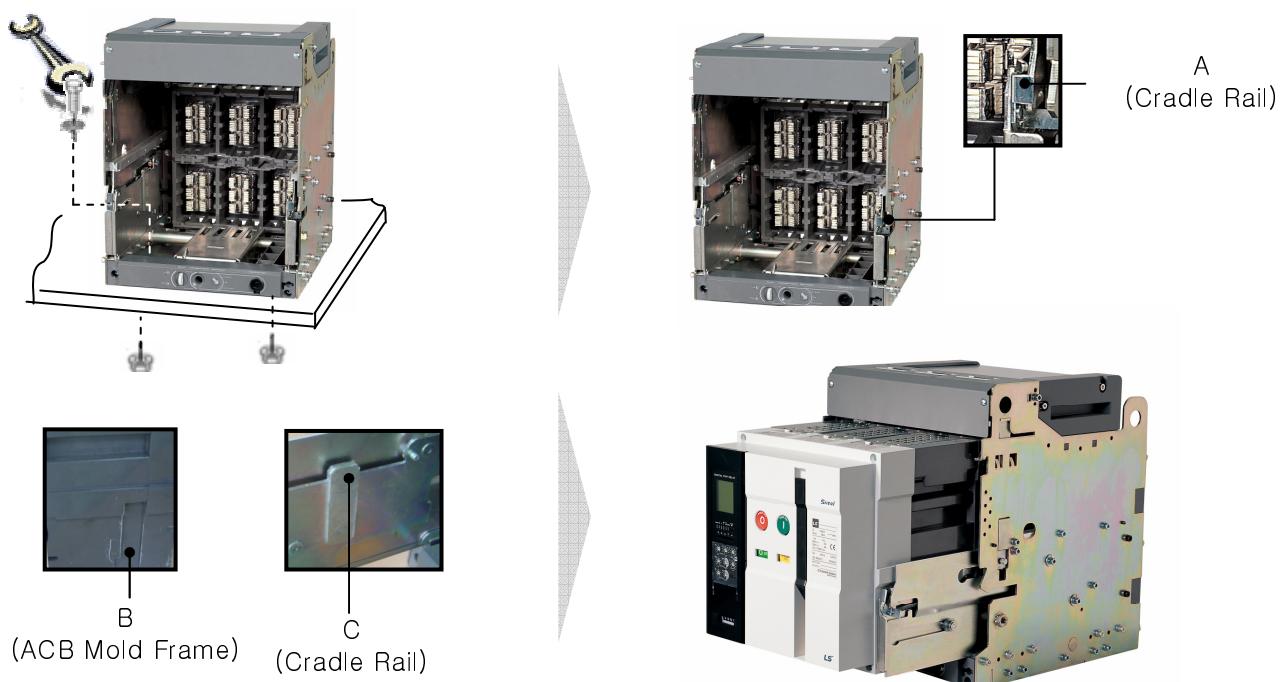


## 2. Draw-out type

### ■ Installation of Draw-out type

Install draw-out type according to the instruction given below.

1. Securely install the cradle at the bottom with M12 bolts (4EA).
2. Pull the extension rails of cradle forward.
3. Put the breaker on the rail as shown in picture by using lifting device.
4. Please check if the circuit breaker fits well to the cradle.
5. Slowly push the circuit breaker by moving the rail handle.



# H. Installation

## 3. Precaution and Installation of insulation barrier

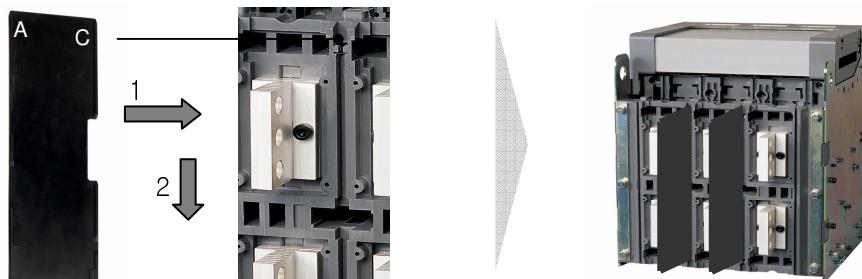
### ■ Precaution

1. Do not lay down a breaker on the side or stand with the side of it.
2. Install a circuit breaker on perfect even ground. (Within 2mm of the level difference)
3. Do not install a circuit breaker with same direction of a rail when you use an angle.
4. Install a circuit breaker at a right angle to the direction of a rail to decentralize weight of the circuit breaker.



### ■ Installation of insulation barrier

1. Insert insulating barriers between the phases after installing of a circuit breaker for the safety. (option)
2. In case of draw-out type, direction of insertion is "C".
3. In case of fixed type, direction of insertion is "A".



# I. Operation

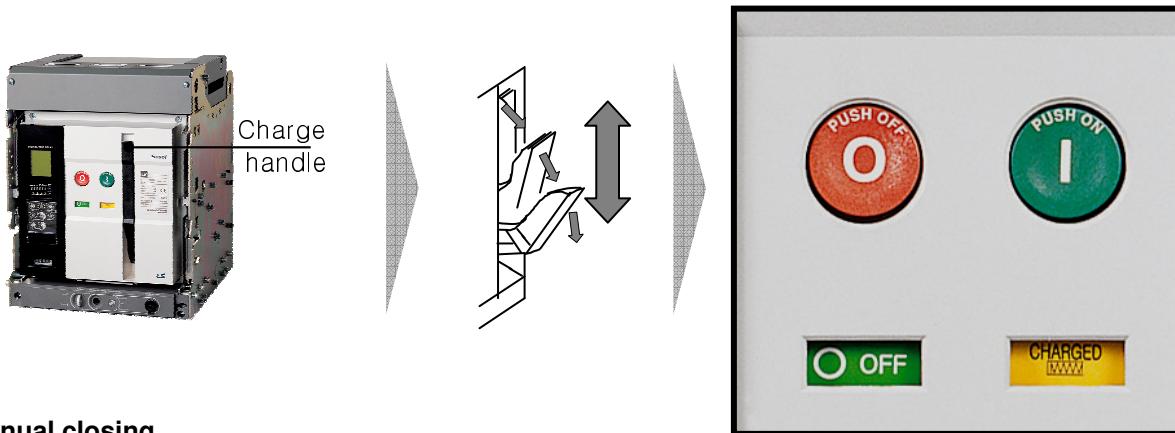
## 1. Manual Operation



**Caution :** Before opening or closing the breaker equipped with an under voltage tripping device, control voltage should be applied.

### ■ Manual charging

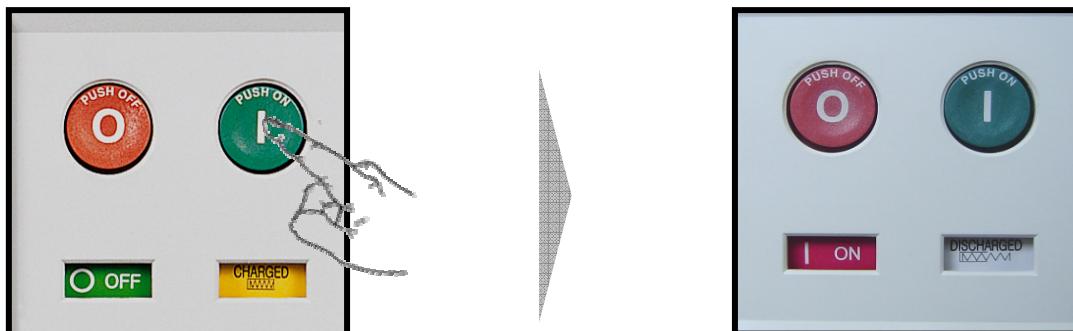
1. Charge the handle 7~8 times with full strokes.
2. When the closing spring is completely charged, the charging indicator shows "CHARGED".



### ■ Manual closing

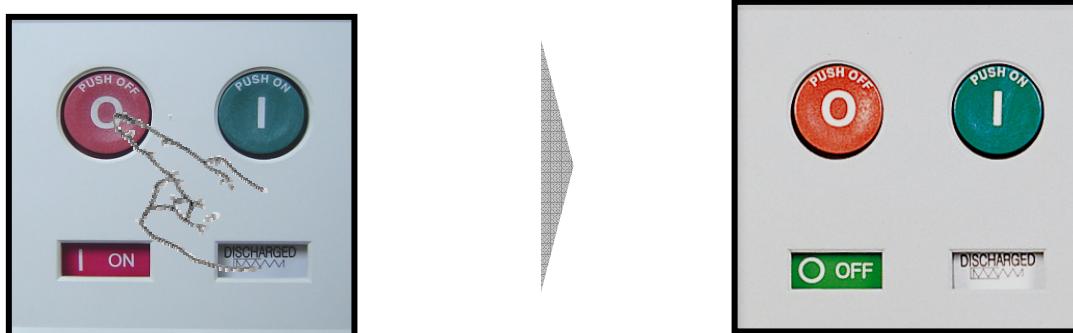
1. Push ON button.
2. The breaker will be closed.
3. The ON/OFF indicator shows "ON" and the charging indicator shows "DISCHARGED".

ACB off and charged



### ■ Manual tripping

1. Push the OFF button and breaker will be tripped.
2. The ON/OFF indicator shows "OFF".



# I. Operation

## 2. Electrical operation

### ■ Electrical operation

Closing operation is done by charging the closing spring from remote control. If pushing trip button, closing spring is automatically charged by a geared motor and a circuit breaker is closed by closing button.

### ■ Electrical closing

1. Remote closing can be made by energizing the closing coil (CC). Apply the rated voltage to the control terminals A1 and A2 and close the breaker.



### ■ Electrical trip

1. Remote opening can be made by energizing the shunt trip device or under voltage trip device.
2. In the case of SHT, apply the rated voltage to the terminal C1 and C2.
3. In the case of UVT, remote opening is also possible by applying a short - circuit across terminals D1 and D2 of the UVT controller.

## 3. Draw-in operation

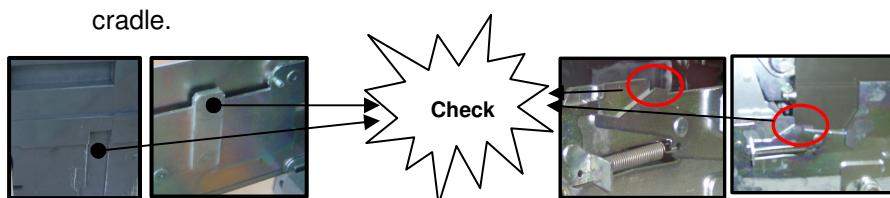
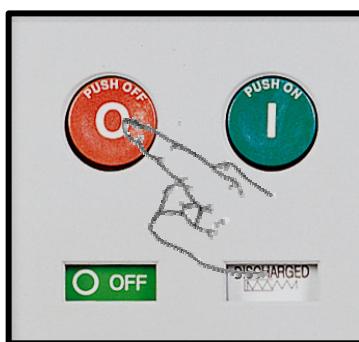
### ■ Draw-in operation procedure



1. Pull the extension rails of cradle forward

2. Put the breaker on the rail by using lifting device. Please check if the circuit breaker fits well to the cradle.

3. Slowly push the circuit breaker by moving the rail handle until it stops.



### Caution

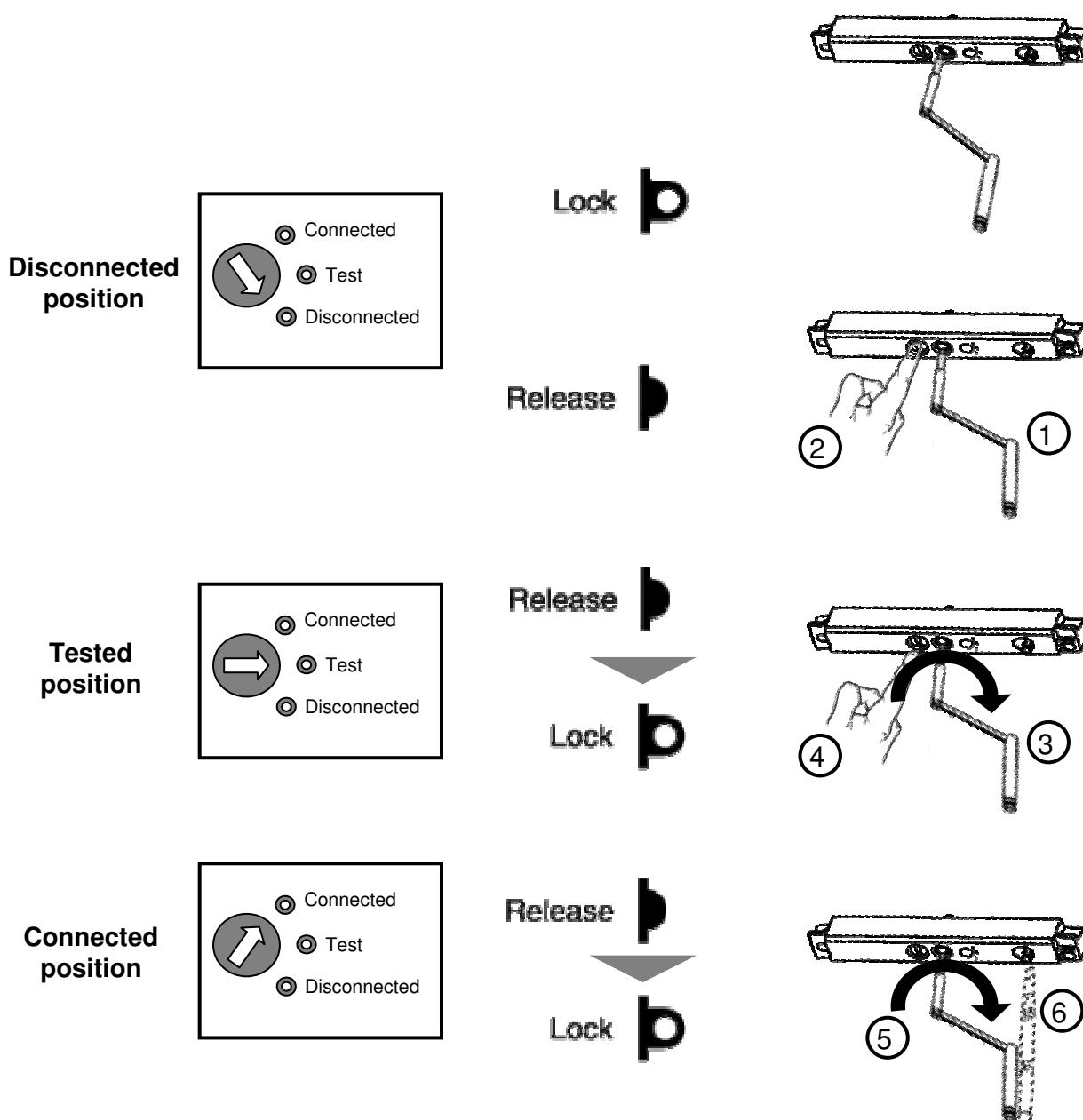
1. Operating handle of cradle only can be inserted when pushing OFF button.
2. If locking device for draw in/out protrudes, stop handle operation and move to next procedure as it indicates the complete operation of ongoing process.

4. Keep pushing the OFF button when the circuit breaker in a trip condition, and insert a handle to the body of the circuit breaker.

# I. Operation

## 3. Draw-in operation

5. Check the draw-out handle properly inserted and then push the lock plate and turn the draw-out handle clockwise in order to insert the breaker.
6. When the breaker reaches the TEST position, the lock plate automatically projects and the draw-out handle is locked.
7. Push in the lock plate and turn the draw-out handle again clockwise until the lock plate projects, the inserting operation is finished. At this time, the draw-out position indicator shows CONNECTED position.



# I. Operation

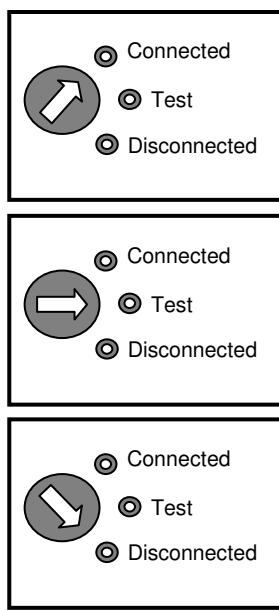
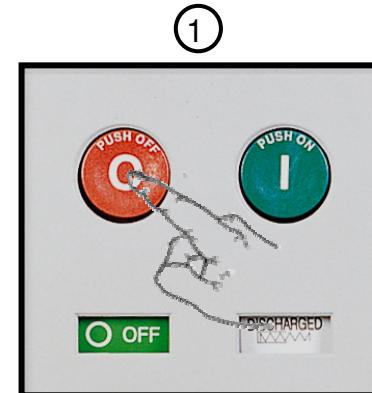
## 4. Draw-out operation


**Caution**

1. Please stop handle operation when draw in/out locking device protrudes.
2. Draw in or out by moving handle right or left side when draw in/out locking device can not be inserted.

**Draw-out operation procedure**

1. Keep pushing the OFF button when the circuit breaker in a trip condition, and insert a handle to the body of the circuit breaker.
2. Check the draw-out handle properly inserted and then push the lock plate and turn the draw-out handle counterclockwise in order to insert the breaker.
3. When the breaker reaches the TEST position, the lock plate automatically projects and the draw-out handle is locked.
4. Push in the lock plate and turn the draw-out handle again counterclockwise until the lock plate projects, At this time, the draw-out operation is finished with indicator which shows DISCONNECTED position.



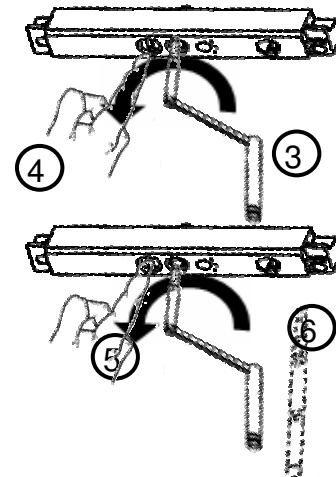
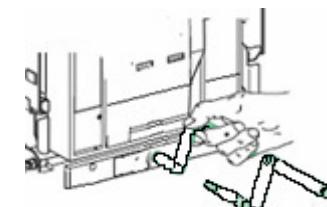
Lock

Release

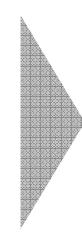
Lock

Release

Lock



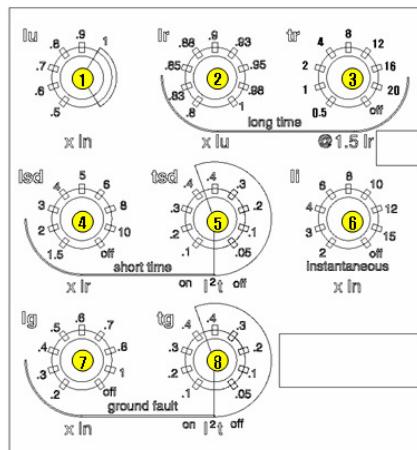
5. The circuit breaker indicated with 'DISCONNECTED' can be separated safely from the cradle by removing a draw in/out handle and releasing right and left locks.
6. Use a lifting hook to separate a circuit breaker from a cradle.



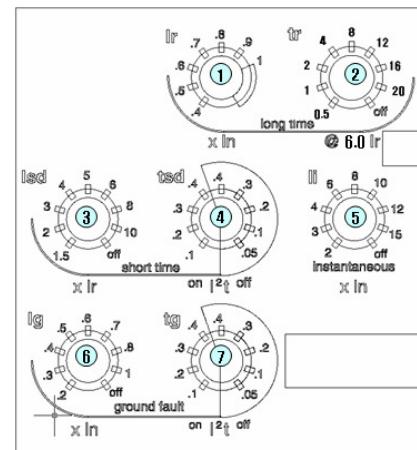
# J. Trip relay externals and configuration

## 1. Knob Setting

### ■ N, A type Knob Configuration



### ■ S type Knob Configuration



### ■ N, A type Knob Information

No	Type of knob	Mode	setting step
①	Continues current setting	lu	(0.5-0.6-0.7-0.8-0.9-1.0) × In
②	Long-time current setting	Ir	(0.8-0.83-0.85-0.88-0.89-0.9-0.93-0.95-0.98-1.0) × lu
③	Long-time tripping delay	tr	(0.5-1-2-4-8-12-16-20-off), sec @ 6 Ir
④	Short-time current Setting	ls	(1.5-2-3-4-5-6-8-10-off) × Ir
⑤	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
⑥	Instantaneous pick-up	li	(2-3-4-6-8-10-12-15-off) × In
⑦	Ground-fault pick-up	lg	(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off) × In
⑧	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)

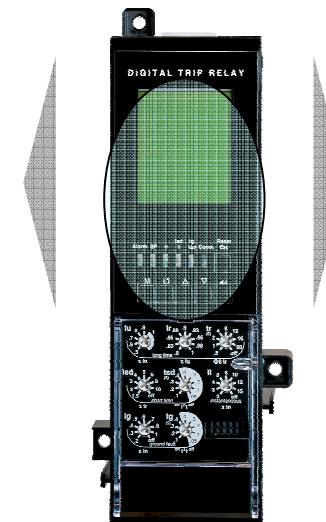
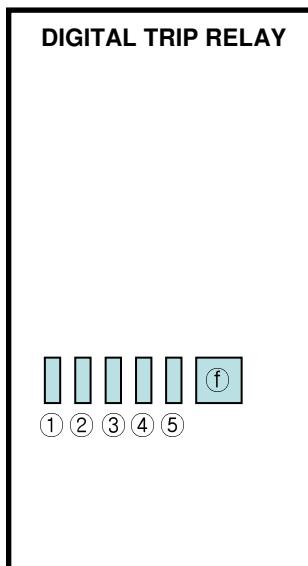
### ■ S type Knob Information

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) × In
②	Long-time tripping delay	tr	(0.5-1-2-4-8-12-16-20-off), sec @ 6 lr
③	Short-time current setting	ls	(1.5-2-3-4-5-6-8-10-off) × lr
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-off) × In
⑥	Ground-fault pick-up	lg	(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off) × In
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)

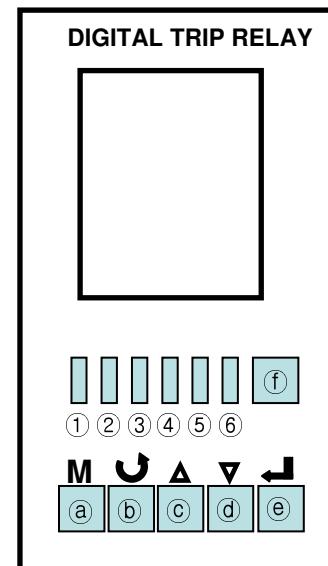
# J. Trip relay externals and configuration

## 2. Key and LED Configuration

### ■ N type Key / LED



### ■ A, P, S type Key / LED



### ■ LED Information

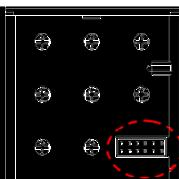
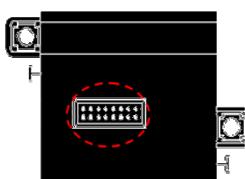
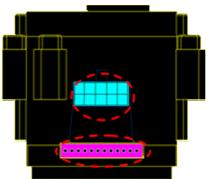
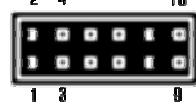
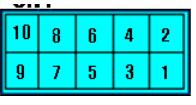
No	LED type	Operational mode
①	Alarm	LED Indicating an overload (Turn on above 90%, Blink above 105%)
②	Batt/SP	Self-Protection LED and Battery test LED
③	Ir	LED Indicating long-time delay
④	I <sub>sd</sub> /I <sub>i</sub>	LED indicating short-time or instantaneous tripping
⑤	I <sub>g</sub> /I <sub>△n</sub>	LED indicating ground-fault
⑥	COMM	LED indicating Communication

### ■ Key Configuration

No	Type of button	Function
(a)	M	Menu
		Measurement display → Menu Display, Menu display → Measurement Display
(b)	U	TAP
		Maintain the active display
(c)	△	Up cursor
		Move the cursor up on screen or increment a setting value
(d)	▽	Down cursor
		Move the cursor down on screen or decrement a setting value
(e)	←	Enter
		Enter into secondary menu or setting input
(f)		Reset/ESC
		Reset errors or ESC from menu

# J. Trip relay externals and configuration

## 3. Connector

Division	CN1	CN2	CN3	CN4
Figure	FRONT 	REAR 	TOP 	
NO				
1	TTL TX (OCR side)	CT-Ir	ZSI OUT (+)	RS485 (+)
2	Current signal-Ir	Power CT (-), GND	ZSI OUT (-)	DO Relay #1
3	TTL RX (OCR side)	CT-Is	ZSI IN (+)	RS485 (-)
4	Current signal-Is	Power CT (+), 24V	ZSI IN (-)	DO Relay #2
5	Power (+), 24V	CT-It	Remote reset (+)	Spare
6	Current signal-It	Delay Contact (-), GND	Remote reset (-)	DO Relay #3
7	Power (-),GND	CT-In	RCD (+)	Spare
8	Current signal-In	Delay Contact (+)	RCD (-)	DO Relay COM
9	Power (-),GND	CT-Ir, Override	Vr	Power (+)
10	Current signal COM	MTD (+),24V	Vs	Power (-)
11		CT-Is, Override	Vt	
12		MTD (-)	V COM	
13		CT-It, Override		
14		CT-COM		
15		In Override		
16		Spare		

# K. TRIP Relay Setting

## 1. Protection

### ■ N Type

#### Long time

Current setting (A)	$I_u = I_n \times ...$	0.5	0.6	0.7	0.8	0.9	1.0		
	$I_r = I_u \times ...$	0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98
Time delay (s)	$tr@ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500
Accuracy: $\pm 15\%$ or below	$tr@ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20
100ms	$tr@ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8
									Off

#### Short time

Current setting (A)	$I_{sd} = I_r \times ...$	1.5	2	3	4	5	6	8	10	Off
Accuracy: $\pm 10\%$										
Time delay (s)		$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
@ $10 \times I_r$	tsd	$I^2t$ On		0.1	0.2	0.3	0.4			
		Min. Trip Time(ms)	20	80	160	260	360			
	( $I^2t$ Off)	Max. Trip Time(ms)	80	140	240	340	440			

#### Instantaneous

Current setting (A)	$I_i = I_n \times ...$	2	3	4	6	8	10	12	15	Off
Tripping time										below 50ms

#### Ground fault

Pick-up (A)										
Accuracy: $\pm 10\% (I_g > 0.4I_n)$	$I_g = I_n \times ...$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
$\pm 20\% (I_g \leq 0.4I_n)$										
	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			
Time delay (s)		Min. Trip Time(ms)	20	80	160	260	360			
@ $1 \times I_n$	(tg)	Max. Trip Time(ms)	80	140	240	340	440			

# K. TRIP Relay Setting

## 1. Protection

### ■ A Type

Long time									
Current setting (A)	$I_u = I_n \times ...$	0.5	0.6	0.7	0.8	0.9	1.0	0.95	0.98
	$I_r = I_n \times ...$	0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98
Time delay (s)	$tr @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500
Accuracy: $\pm 15\%$ or below	$tr @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20
100ms	$tr @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8
Short time									
Current setting (A)	$I_{sd} = I_r \times ...$	1.5	2	3	4	5	6	8	10
Accuracy: $\pm 10\%$									Off
Time delay (s)	$t_{sd}$ @ $10 \times I_r$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4		
		$I^2t$ On		0.1	0.2	0.3	0.4		
	$(I^2t$ Off)	Min. Trip Time(ms)	20	80	160	260	360		
		Max. Trip Time(ms)	80	140	240	340	440		
Instantaneous									
Current setting (A)	$I_i = I_n \times ...$	2	3	4	6	8	10	12	15
Tripping time		below 50ms							
Ground fault									
Pick-up (A)									
Accuracy: $\pm 10\% (I_g > 0.4I_n)$	$I_g = I_n \times ...$		0.2	0.3	0.4	0.5	0.6	0.7	0.8
$\pm 20\% (I_g \leq 0.4I_n)$									1.0
	$t_g$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4		
		$I^2t$ On		0.1	0.2	0.3	0.4		
Time delay (s)	$t_g$ @ $1 \times I_n$	Min. Trip Time(ms)	20	80	160	260	360		
		Max. Trip Time(ms)	80	140	240	340	440		
Earth leakage (Option)									
Current setting (A)	$I_g$	0.5	1	2	3	5	10	20	30
Time delay (ms)	$t_g$	Alarm Time(ms)	140	230	350	800	950		
Accuracy: $\pm 15\%$		Trip Time(ms)	140	230	350	800			

Note) Earth leakage function is available with ZCT or external CT

# K. TRIP Relay Setting

## 1. Protection

### ■ P,S 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	500	Off
Time delay (s)	$tr @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below 100ms	$tr @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20	Off
	$tr @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time										
Current setting (A) Accuracy: $\pm 10\%$	$I_{sd} = I_n \times \dots$	1.5	2	3	4	5	6	8	10	Off
Time delay (s) $@ 10 \times I_r$	$tsd$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2t$ On		0.1	0.2	0.3	0.4			
		Min. Trip Time(ms)	20	80	160	260	360			
	$(I^2t \text{ Off})$	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	Off
Tripping time		below 50ms								
Ground fault										
Pick-up (A)										
Accuracy: $\pm 10\% (I_g > 0.4I_n)$ $\pm 20\% (I_g \leq 0.4I_n)$	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
	$tg$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2t$ On		0.1	0.2	0.3	0.4			
Time delay (s) $@ 1 \times I_n$	$(I^2t \text{ Off})$	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			
Earth leakage (Option)										
Current setting (A)	$I_g$	0.5	1	2	3	5	10	20	30	Off
Time delay (ms)	$tg$	Alarm Time(ms)	140	230	350	800	950			
Accuracy: $\pm 15\%$		Trip Time(ms)	140	230	350	800				

Note) Earth leakage function is available with ZCT or external CT

PTA(Pre Trip Alarm)										
Current setting (A)	$I_p = I_r \times \dots$	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
Time delay (s) Accuracy: $\pm 15\%$	$tp @ (1.2 \times I_p)$	1	5	10	15	20	25	30	35	Off

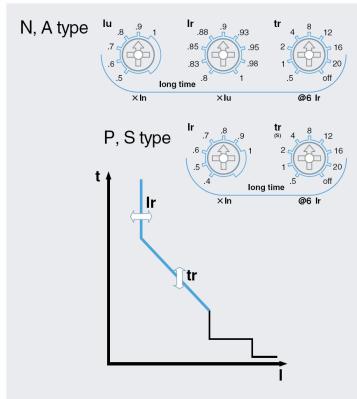
Other protection	Pick-up			Time delay(s)		
	Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage	80V ~ 0V_Pick-up	1V	$\pm 5\%$			
Over voltage	UV_Pick-up ~ 980V	1V	$\pm 5\%$	1.2~40sec	0.2~40sec	$\pm 0.1sec$
Voltage unbalance	6% ~ 99%	1%	$\pm 2.5\%$ or (* $\pm 10\%$ )			
Reverse power	10~500 kW	1kW	$\pm 10\%$			
Over power	500~5000 kW	1kW	$\pm 10\%$			
Current unbalance	6% ~ 99%	1%	$\pm 2.5\%$ or (* $\pm 10\%$ )			
Over frequency	60Hz UF_Pick-up ~ 65	1Hz	$\pm 0.1Hz$	1.2~40sec	0.1sec	$\pm 0.1sec$
	50Hz UF_Pick-up ~ 55	1Hz	$\pm 0.1Hz$			
Under frequency	60Hz 55Hz ~ OF_Pick-up	1Hz	$\pm 0.1Hz$			
	50Hz 45Hz ~ OF_Pick-up	1Hz	$\pm 0.1Hz$			

# K. TRIP Relay Setting

ems

## 2. Operation Characteristic

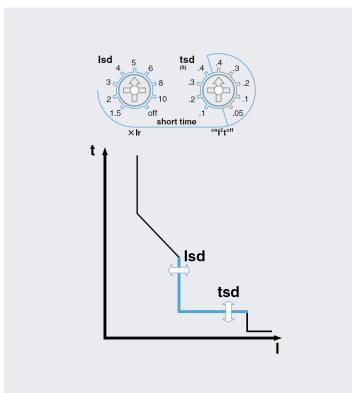
### ■ Long-time delay (L)



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

1. Standard current setting knob: Ir
  - 1) Setting range in P type and S type:  $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times In$
  - 2) Setting range in N type and A type:  $(0.4 \sim 1.0) \times In$ 
    - $Iu: (0.5-0.6-0.7-0.8-0.9-1.0) \times In$
    - $Ir: (0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times Iu$
2. Time delay setting knob: tr
  - Standard operating time is based on the time of  $6 \times Ir$
  - Setting range: 0.5-1-2-4-8-12-16-20-Off sec (9 modes)
3. Relay pick-up current
  - When current over  $(1.15) \times Ir$  flows in, relay is picked up.
4. Relay operates basing on the largest load current among R/S/T/N phase.

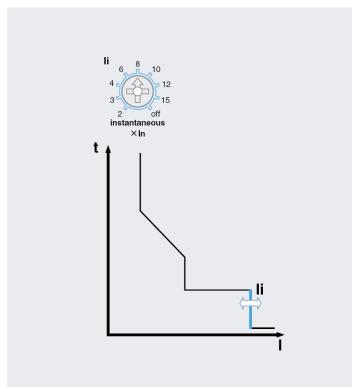
### ■ Short-time delay (S)



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

1. Standard current setting knob: Isd
  - Setting range:  $(1.5-2-3-4-5-6-8-10-Off) \times Ir$
2. Time delay setting knob: tsd
  - Standard operating time is based on the time of  $10 \times Ir$ .
  - Inverse time ( $I^2 t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2 t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Relay operates basing on the largest load current among R/S/T/N phase.
4. Relay can operate at instantaneous current through ZSI.

### ■ Instantaneous (I)



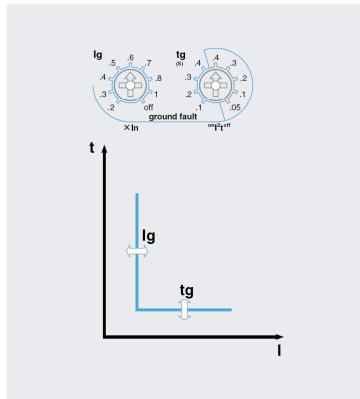
**The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.**

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

# K. TRIP Relay Setting

## 2. Operation Characteristic

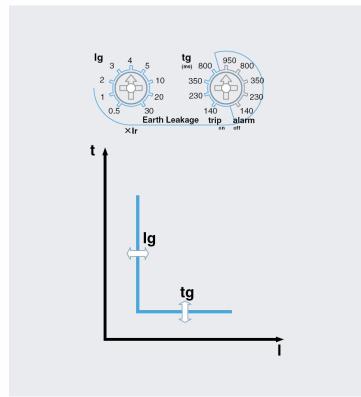
### ■ Ground Fault (G)



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

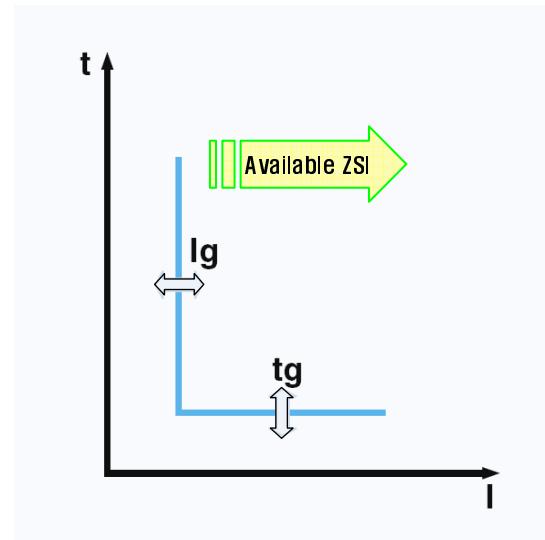
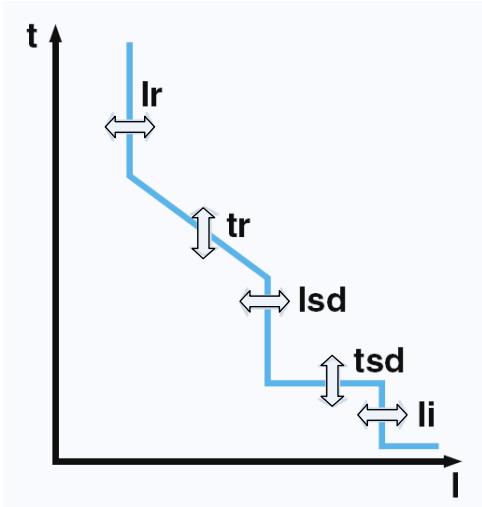
1. Standard setting current knob: Ig
  - Setting range: (0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) × In
2. Time delay setting knob: tg
  - Inverse time ( $I^2 t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2 t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Ground fault current = R+S+T+N(Vector Sum)
4. Relay can operate at instantaneous current through ZSI.
5. The protection for ground fault is a basic function of Trip relay (Internal CT type)

### ■ Earth Leakage (G) – Option



**The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)**

1. Standard setting current Knob : Ig
    - (1) ZCT provided Susul ACB (OCR Z,K Type)
      - Setting range : 0.5-1-2-3-4-5-10-20-30-Off(A)
    - (2) Private ZCT (OCR E,X Type)
      - Setting range : 0.5-1-2-3-4-5-Off(A)
  2. Time delay setting knob : tg
    - Alarm time : 140-230-350-800ms
    - Trip time : 60-140-230-350-800ms
  3. It is only available with private ZCT or general purpose external CT.
- \* Notice in setting range  
In case of using our ZCT all setting points from 0.5 to 30A, the secondary current of ZCT are available.  
However if private ZCT is selected the setting range is limited to 0.5~5A.

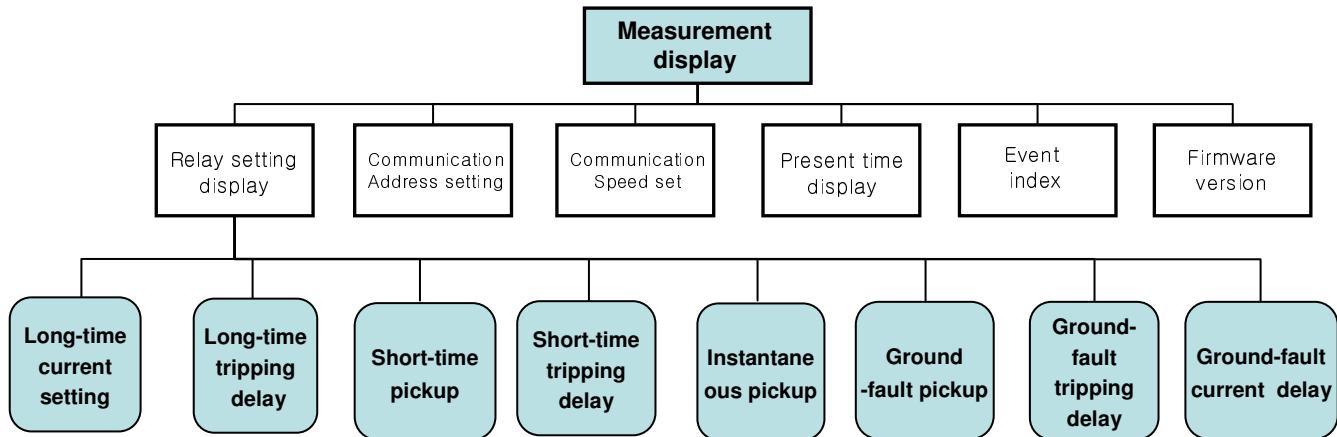


# L. The Operation of A type TRIP RELAY

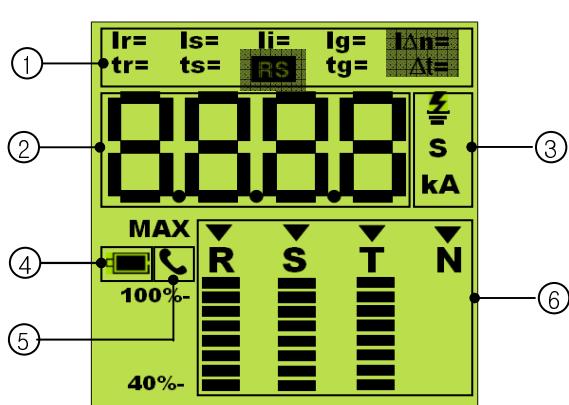
## 1. Menu Tree

### Caution

- Each movement within Menu Tree can be done by using Menu and ESC button.
- Use UP( $\Delta$ )/Down( $\nabla$ ) 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.



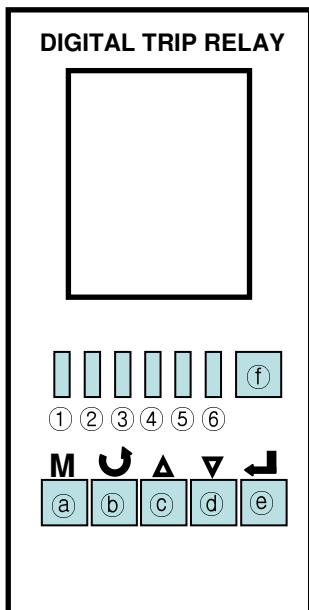
## 2. LCD Segment



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.	

# L. The Operation of A type TRIP RELAY

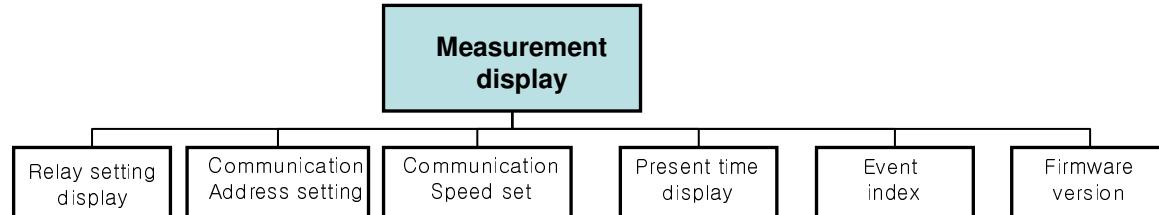
## 3. Button Configuration



### 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. .

## 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(△) 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.

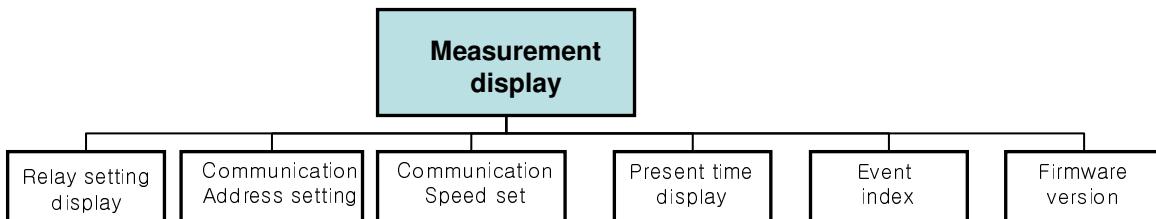
# L. The Operation of A type TRIP RELAY

## 3. Relay Setting Display- Long-time Delay, Short-time Delay

Relay setting Display							
Long-time current setting		Long-time tripping delay		Short-time pickup		Short-time tripping delay	
Display		Button		Contents			
Long-time current				M △ ▽		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.	
Long-time delay time				M △ x 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				M △ x 2		If pressing 'Up cursor' two times on the Relay setting display, the setting value of short-time tripping delay will be displayed	
short-time delay time				M △ x 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 I2t is On. For example, if it is of I2t 0.400sec on setting, 0.401 will be displayed	
Instantaneous current				M △ x 4		If pressing 'Up cursor' four times on the Relay setting Display, Instantaneous pick up setting value will be displayed.	
ground fault pick up				M △ x 5		If pressing 'Up cursor' five times on the Relay setting Display, the setting value of Ground-fault pickup will be displayed.	
ground fault tripping delay				M △ x 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 I2t is On. For example, if it is of I2t 0.400sec on setting, 0.401 will be displayed	
current delay				M △ x 7		If pressing 'Up cursor' seven times on the Relay setting Display, the setting current 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 "_____".	

# L. The Operation of A type TRIP RELAY

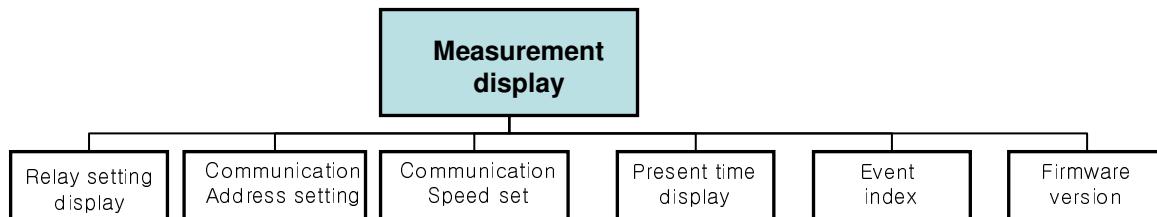
## 3. Relay Setting Display



Display		Button	Contents
Communication	address	 M x 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.
	Speed	 ↙	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.
	Speed	 M x 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
	time	 ↙	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.
Present	time	 M x 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 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 1minite 1 second January 1st, 2000'.
Event		 M x 5	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.
		 M x 5	1. "li=" : 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.
		 M x 5	If there is no data in Event Index, 'Empty' will be displayed.

# L. The Operation of A type TRIP RELAY

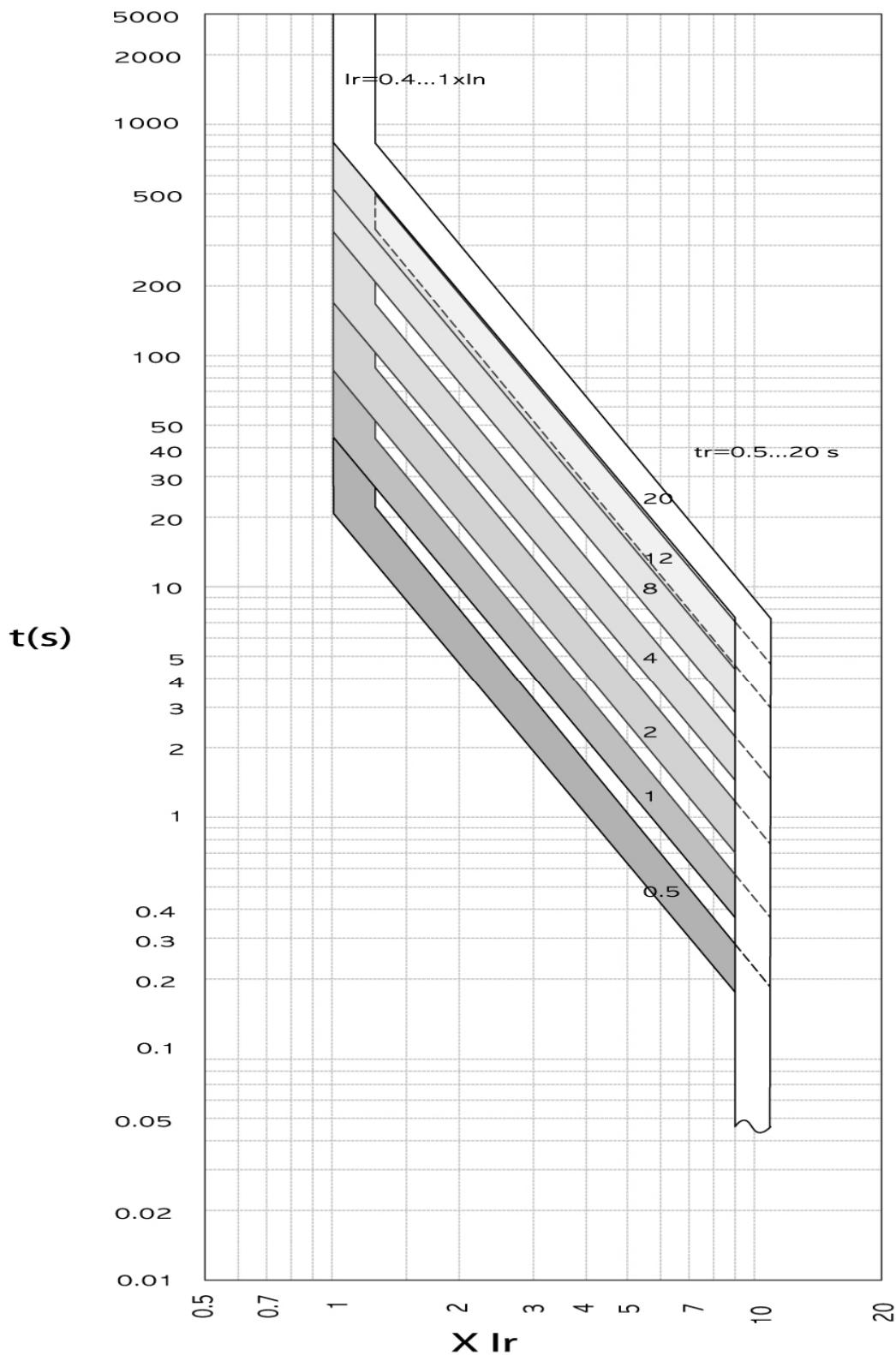
## 3. Relay Setting Display



Display	Button	Contents
Event	 ① ← ② ↓ ③ ↘	1. If pressing 'Enter' from Event Index, the time information of relevant events is displayed. 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. Left screen indicates "January, 2007"
	 ← x 2 ④ ↓ ⑤ ↘ ⑥ ↓	1. If pressing 'Enter' 2 times, the information of Date/Time will be displayed. ④ : The current screen indicates '1 o'clock, 8th'. ⑤ : Displaying Event Date/Time ⑥ : Event Index : Displaying the 7th Event
	 ← x 3 ⑦ ↓ ⑧ ↘ ⑨ ↓	1. If pressing 'Enter' 3 times, the information of minute/second will be displayed. ⑦ : The current screen is to indicate "12 minutes 51seconds". ⑧ : Displaying Event Minute/Second ⑨ : Event Index : Displaying the 7th Event
Firmware version	 M x 6	1. If pressing 'MENU' button 6 times from Measurement Display, move to firmware Version

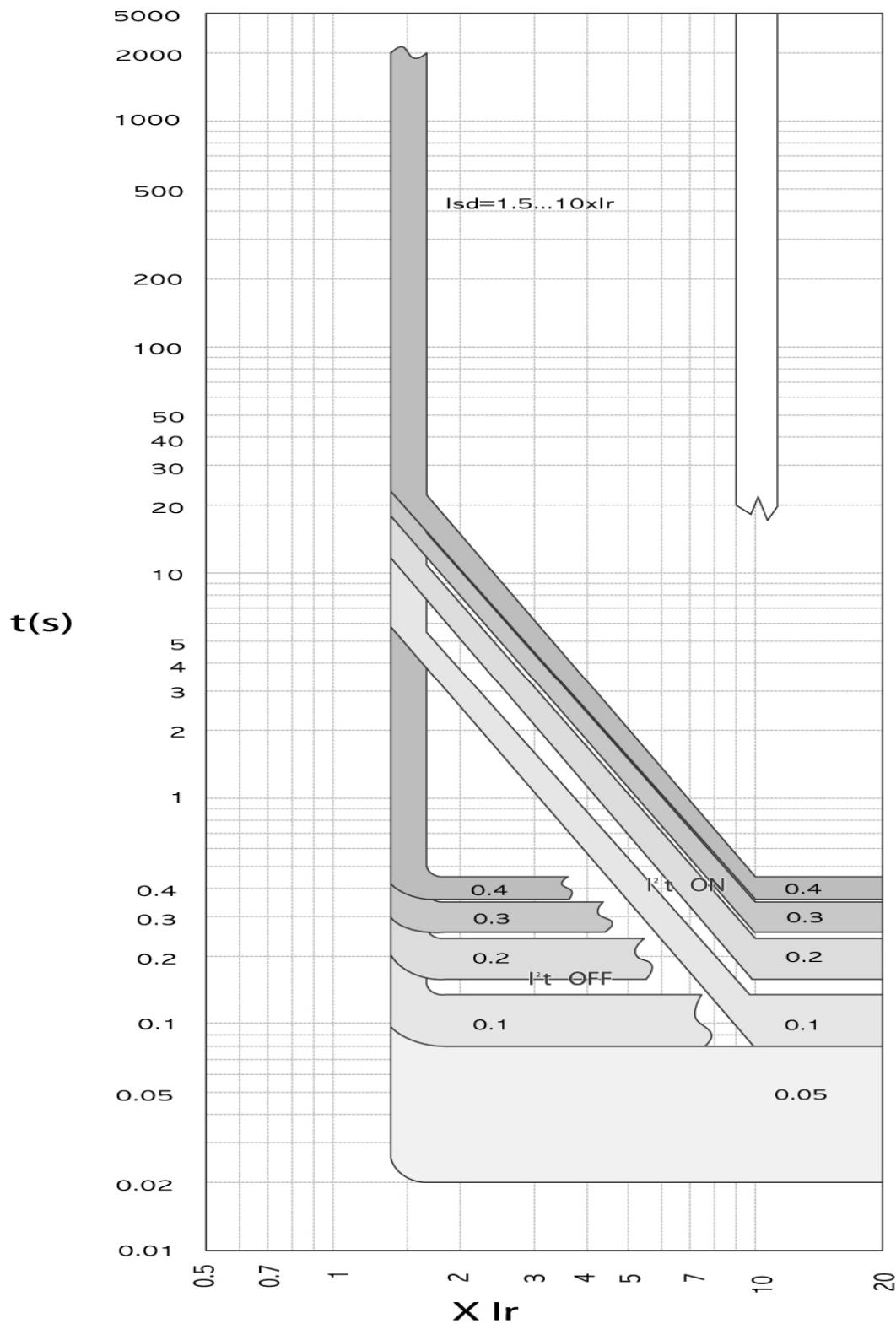
# M. Tripping curves

## 1. Long-time protection



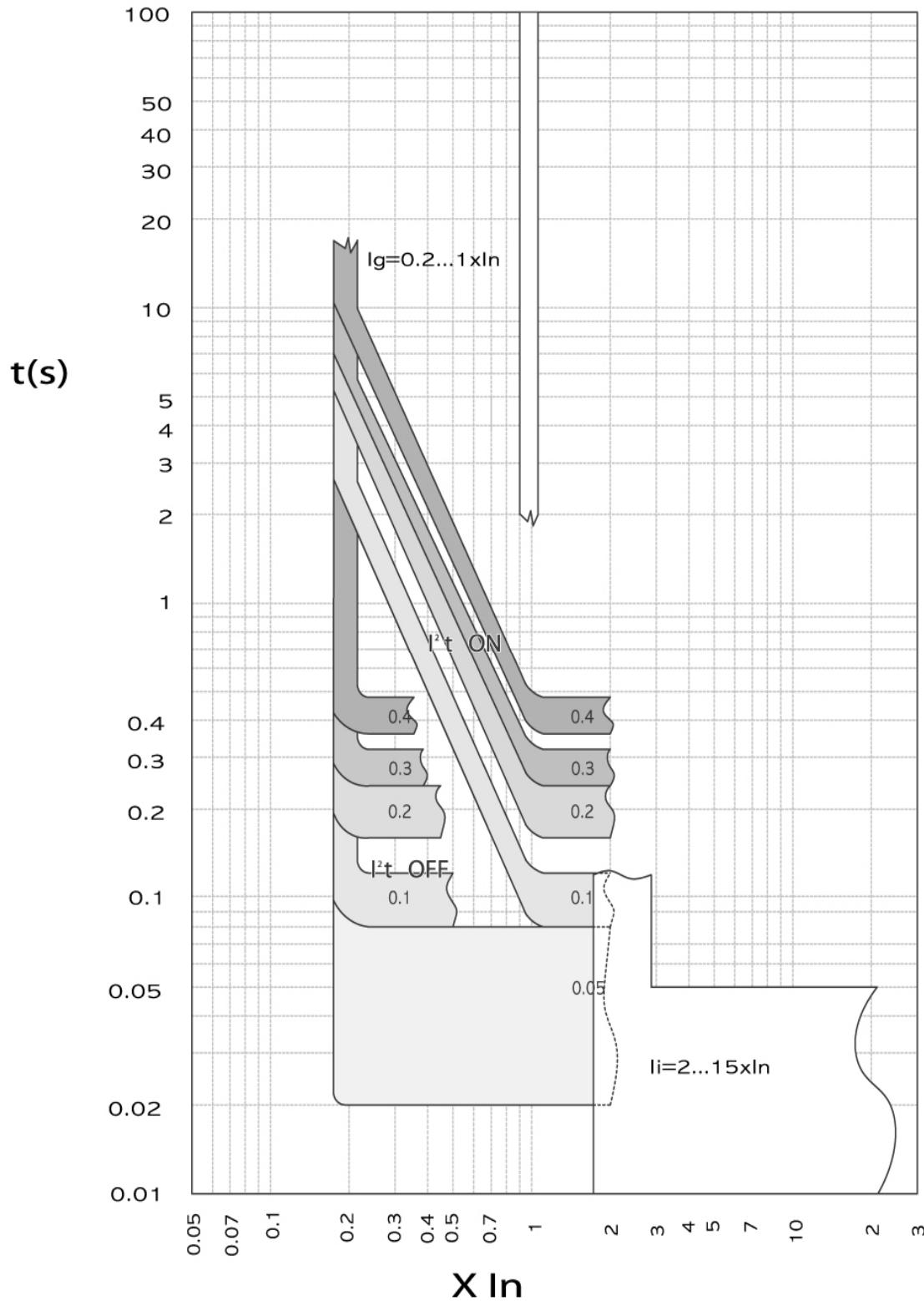
# M. Tripping curves

## 2. Short-time protection



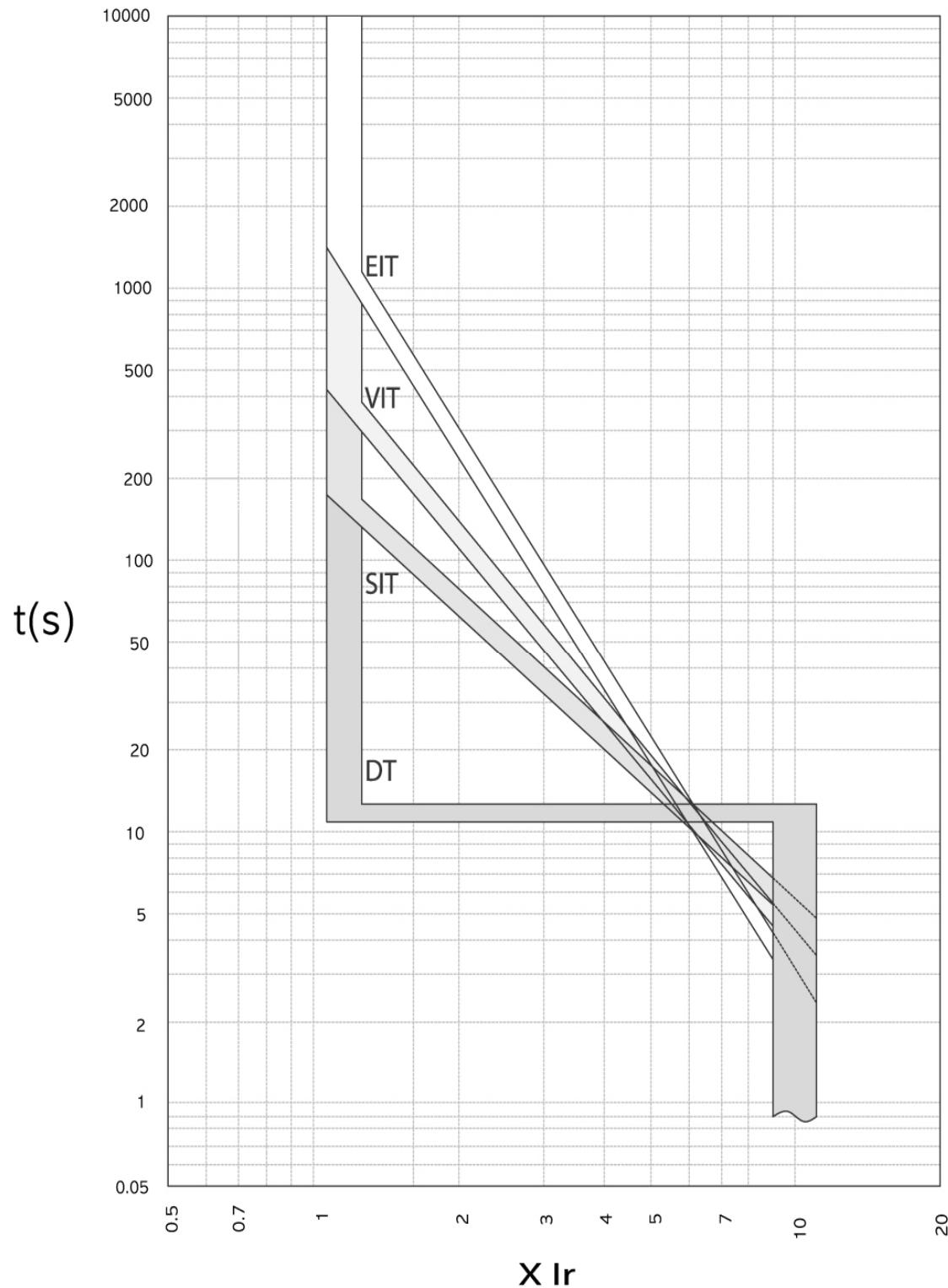
# M. Tripping curves

## 3. Instantaneous / Ground-fault protection



# M. Tripping curves

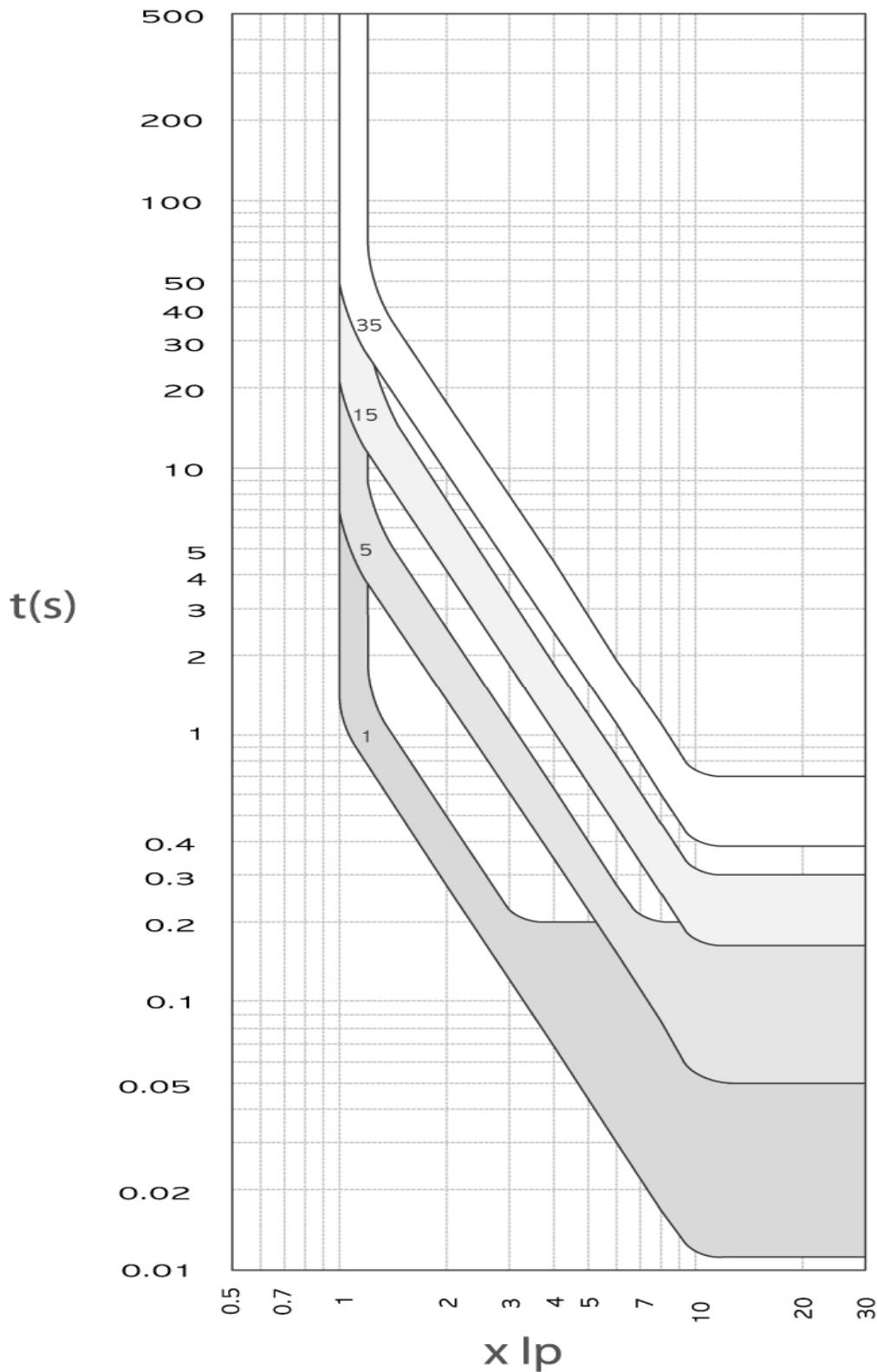
## 4. IDMTL



# M. TRIP RELAY 특성곡선

## 5. Pre Trip Alarm

■ Ground-fault ■ IDMTL



# N. Inspection and Troubleshooting

## 1. Inspection and maintenance cycle

The purpose of inspection for ACB is to prevent the accidents in advance and maintain the performance of it by changing timely the consumable and deteriorative parts. Please make sure the following guideline specified the method for inspection & cycles before using of the equipment.

### ■ Maintenance cycle upon using condition

Using condition	Environments	Specific examples	Inspection cycle	Replace ment cycle
General environment for a use	Location with clean & dry air	Electrical rooms with dust proof & air-conditioner	Once every 2 years	Within approx. 10 years
	Indoor location with little dust	Distribution panel or individual electrical room without dust proof & air conditioner		
	Location without corrosive gases			
Special environment for a use	Location with salinity, high temperature gases such as sulphur dioxide and hydrogen sulphide	Geothermal power plants, waste water treatment plants, steel mills, paper factories, pulp factories, etc.	Once every 1 year	Within approx. 7 years
	Locations with harmful or corrosive gases where humans cannot stay for a long time	Chemical factories, quarries, mining areas, etc.	Once every half a year	Within approx. 5 years

# N. Inspection and Troubleshooting

## 2. Defects and Troubleshooting guideline

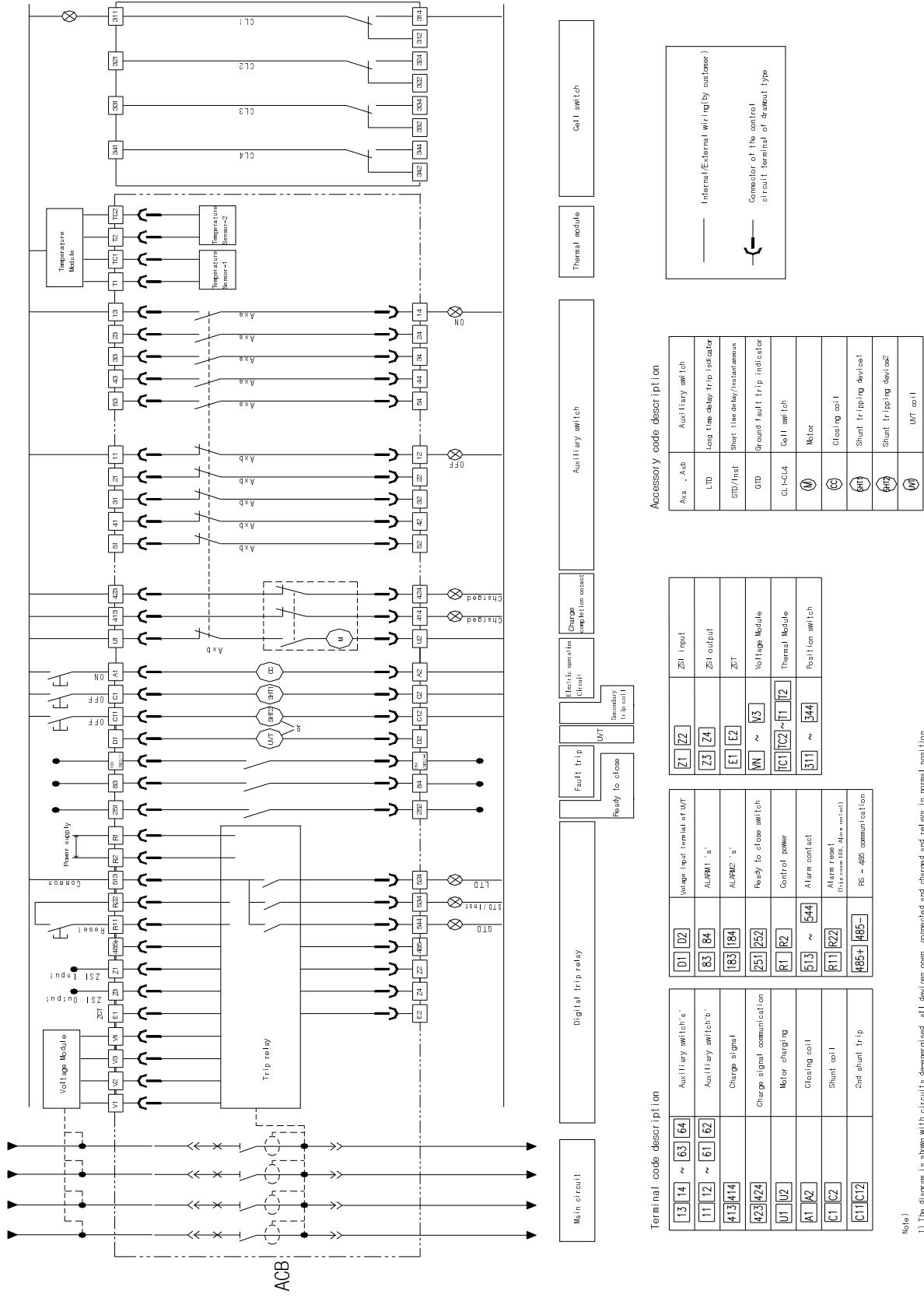
### ■ Troubleshooting guideline

Types of Defect	Cause	Countermeasure
The breaker is opened but Fault Trip Reset button does not come out.	1. Voltage does not exist or UVT is damaged. 2. Voltage disturbance occurred to the trip device	1. Check voltage. Replace damaged UVT. 2. Check voltage supply part.
The breaker is opened simultaneously with the closing operation and the Fault Trip Reset button comes out.	1. In state of short-circuit 2. Excess current is too high at closing operation.	1. Remove cause; Check condition of breaker before re-closing. 2. Revise network or change setting of trip device.
OPEN operation is done manually but not from remote.	1. Voltage supply from the trip device is too low. V<0.7Vn 2. Defect on UVT circuit	1. Check voltage supply. (0.7~1.1Vn) 2. Replace UVT.
OPEN operation does not work manually.	1. Damage on the mechanism 2. Deposition of main circuit.	1. Contact AS center 2. Contact AS center.
Breaker does not close neither manually nor remotely.	1. Closing operation at state of short-circuit. 2. Fault Trip Reset button does not reset. 3. Unstable draw-in/out state of the product. 4. Anti-pumping function 5. Closing spring of breaker is not charged. 6. Power supply problem of the closing coil. 7. Power supply problem of the trip coil. 8. Insufficient power supply of the UVT or defect. 9. Locked state of the breaker under open position 10. In case breaker is interlocked.	1. Remove cause; Check condition of breaker 2. Reset Fault Trip Reset button. 3. Check product's draw-in/out state. 4. Re-operate after removing power of the closing coil. 5. Check power supply of the charging motor. Check if manual charging works. Contact AS center or replace charging motor if necessary. 6. Remove power supply of the closing coil. Apply power again after checking the breaker's closing availability. Contact AS center if manual charging is unavailable 7. Remove power supply of the trip coil. 8. Apply voltage (V>0.85Vn) to the auxiliary switch and try closing operation using the closing coil. 9. Check if the closing error state is normal 10. Release Interlock.
Closes manually but does not close from remote	1. Inappropriate voltage supply of the closing coil. 2. Defect of the closing coil's open circuit.	1. Check voltage supply of the closing coil. (0.85~1.1Vn) 2. Replace closing coil.
Does not charge electrically	Wrong voltage supply to spring charging motor	1. Check voltage supply 2. Check the circuit of charging motor 3. Try reset operation and if there is a problem or defect, contact local AS center and replace charging motor.
Crank handle for draw-in/out does not get inserted	1. No opening of the crank insertion by pressing Open button. 2. Under Padlock or interlock 3. Not putting the product into the cradle securely.	1. Insert while pressing Open button. 2. Remove padlock or interlock. 3. Push product into cradle securely.
Breaker does not get drawn out.	1. Crank handle is inserted 2. Breaker is not in Disconnected position. 3. Under Padlock or interlock	1. Remove crank handle 2. Draw out to the Disconnected position completely. 3. Remove padlock or interlock.
Breaker is not drawn in completely (It is not in the Connected position)	1. The cradle and main frame of the breaker do not fit. 2. Inappropriate position of the cluster. 3. Safety shutter is under interlock	1. Check if cradle fits with main frame 2. Move cluster to the right position. 3. Remove interlock.

# O. Wiring diagram of Control circuit

## 1. Wiring diagram

This diagram is based on 'CONNECTED' position of a circuit breaker and opening. Motor charging. Releasing of locking plate should be normal condition.



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