Susol & Metasol

Super Solution

Meta Solution

Air Circuit Breakers

Instruction Manual

LS IS

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Instruction manual of Susol & Metasol ACB

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

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℃to min. -5℃ is recommended. However, the average temperature of 24 hours does not exceed +35℃.
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℃and 90% at 20℃. Do not use and store in presence of corrosive or ammonia gas.
   (H2S ≤ 0.01ppm, SO2 ≤ 0.01ppm, NH3 ≤ 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℃ to min. -20℃ 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℃, 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	Rated current	ACB terminal	Applicable busbar size	 Horizontal type					 Vertical type				
				40°C	45°C	50°C	55°C	60°C	40°C	45°C	50°C	55°C	60°C
1600AF AN-D AS-D AH-D	200A	15t× 50× 1EA	5t× 50× 1EA	200A	200A	200A	200A	200A	200A	200A	200A	200A	200A
	400A			400A	400A	400A	400A	400A	400A	400A	400A	400A	400A
	630A		5t× 50× 2EA 10t× 60× 1EA	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A
	800A		6t× 50× 2EA 10t× 60× 1EA	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A
	1,000A		8t× 50× 2EA	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A
	1,250A		6t× 75× 2EA 8t× 60× 2EA 10t× 50× 2EA	- 1250A	- 1250A	- 1250A	- 1250A	- 1250A	1250A	1250A	1250A	1250A	1250A
	1,600A		6t× 75× 3EA 10t× 60× 2EA 8t× 60× 3EA	- 1600A	- 1600A	- 1520A	- 1480A	- 1420A	1600A	1600A	1580A	1550A	1500A
2000AF AS/AH-D	2,000A	15t× 75× 1EA	8t× 75× 3EA 10t× 100× 2EA	-	-	-	-	-	2000A	2000A	1940A	1860A	1780A
3200AF AN-E AS-E AH-E	630A	20t× 75× 1EA	5t× 50× 2EA 10t× 60× 1EA	630A	630A	630A	630A	630A	630A	630A	630A	630A	630A
	800A		6t× 50× 2EA 10t× 60× 1EA	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A
	1,000A		8t× 50× 2EA	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A	1000A
	1,250A		6t× 75× 2EA 8t× 60× 2EA 10t× 50× 2EA	- 1250A	- 1250A	- 1250A	- 1250A	- 1250A	1250A	1250A	1250A	1250A	1250A
	1,600A		6t× 75× 3EA 10t× 60× 2EA 8t× 60× 3EA	- 1600A	- 1600A	- 1600A	- 1600A	- 1600A	1600A	1600A	1600A	1600A	1600A
	2,000A		8t× 75× 3EA 10t× 100× 2EA	2000A -	2000A -	2000A -	2000A -	2000A -	2000A	2000A	2000A	2000A	2000A
	2,500A		10t× 75× 3EA 8t× 75× 4EA	2500A	2500A	2500A	2400A	2300A	2500A	2500A	2500A	2500A	2400A
	3,200A		10t× 100× 3EA 10t× 75× 4EA	- 3200A	- 3200A	- 3100A	- 3000A	- 2900A	3200A	3200A	3120A	3050A	2960A
4000AF AS/AH-E	4,000A	10t× 100× 3EA	10t× 100× 4EA 10t× 75× 5EA	- 4000A	- 4000A	- 3900A	- 3800A	- 3640A	4000A	4000A	3950A	3800A	3680A
5000AF AS-F	4,000A	20t× 125× 2EA	10t× 100× 4EA	4000A	4000A	3920A	3860A	3800A	4000A	4000A	3960A	3900A	3880A
	5,000A		10t× 125× 4EA	5000A	5000A	4900A	4800A	4700A	5000A	5000A	4950A	4900A	4850A
6300AF AS-G AH-G	4,000A	20t× 125× 2EA	10t× 100× 4EA	4000A	4000A	4000A	4000A	4000A	4000A	4000A	4000A	4000A	4000A
	5,000A		10t× 125× 4EA	5000A	5000A	4900A	4820A	4750A	5000A	5000A	4950A	4870A	4850A
	6,300A	20t× 150× 2EA	10t× 150× 4EA	6300A	6300A	6170A	6040A	5900A	6300A	6300A	6220A	6160A	6100A

B. Service condition

2. Altitude and Insulation clearance

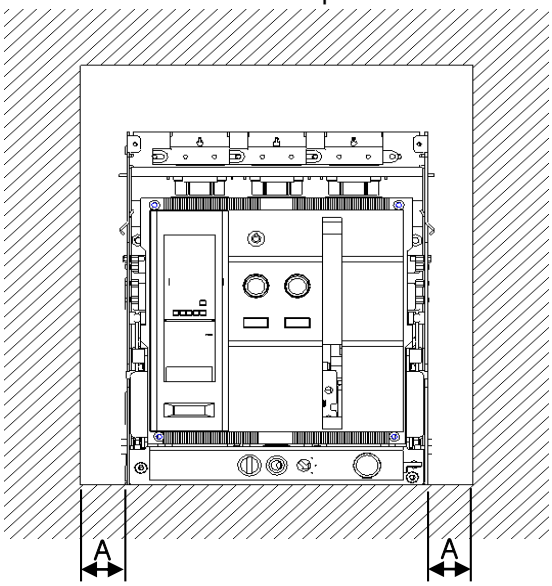
■ Altitude

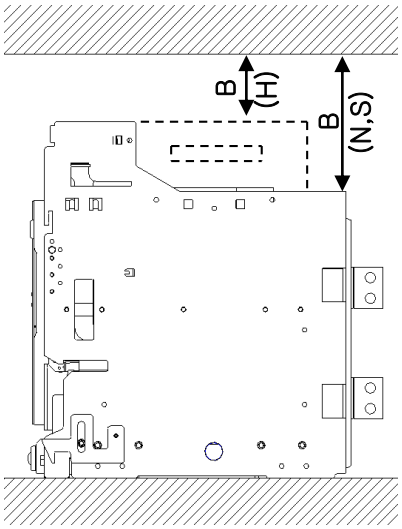
Susol ACB is designed for operation at altitudes under 2000m. At altitudes higher than 2000m, change the ratings upon a service condition.

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.



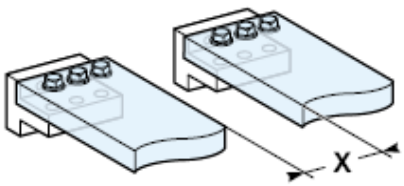


Type		A	B
Fixed	N/S	50	150
	H	50	150
Draw out	N/S	50	150 **
	H	50	0

** Option installation : "0"

■ Minimum insulation clearance

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

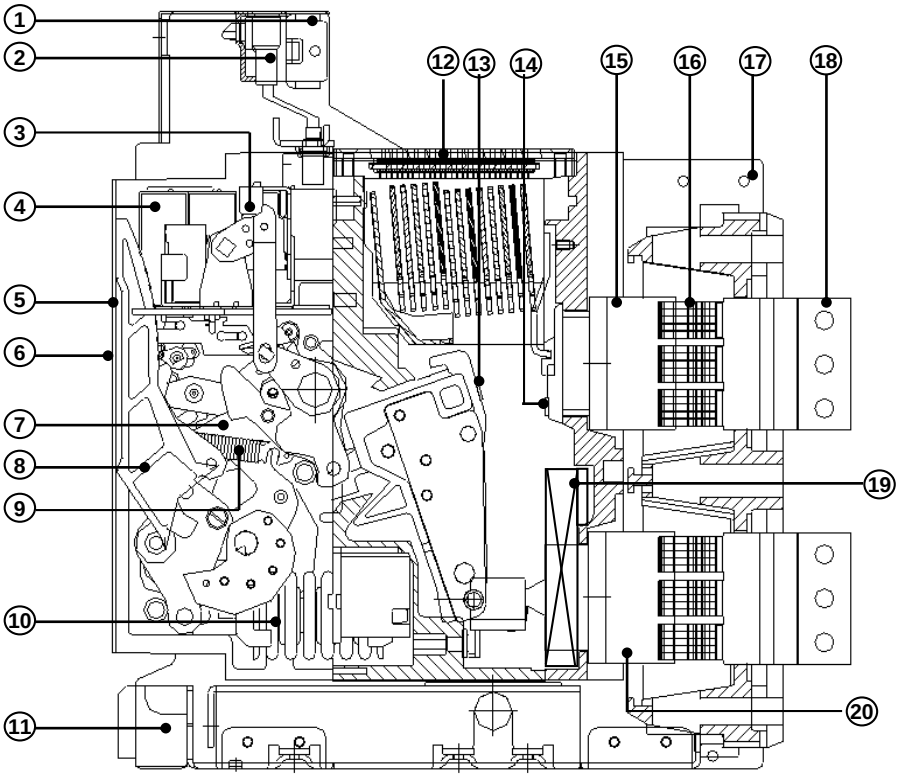


Insulating voltage (Ui)	Min. insulation clearance (X min)
600V	8 mm
1000V	14 mm

C. Structure and Operation

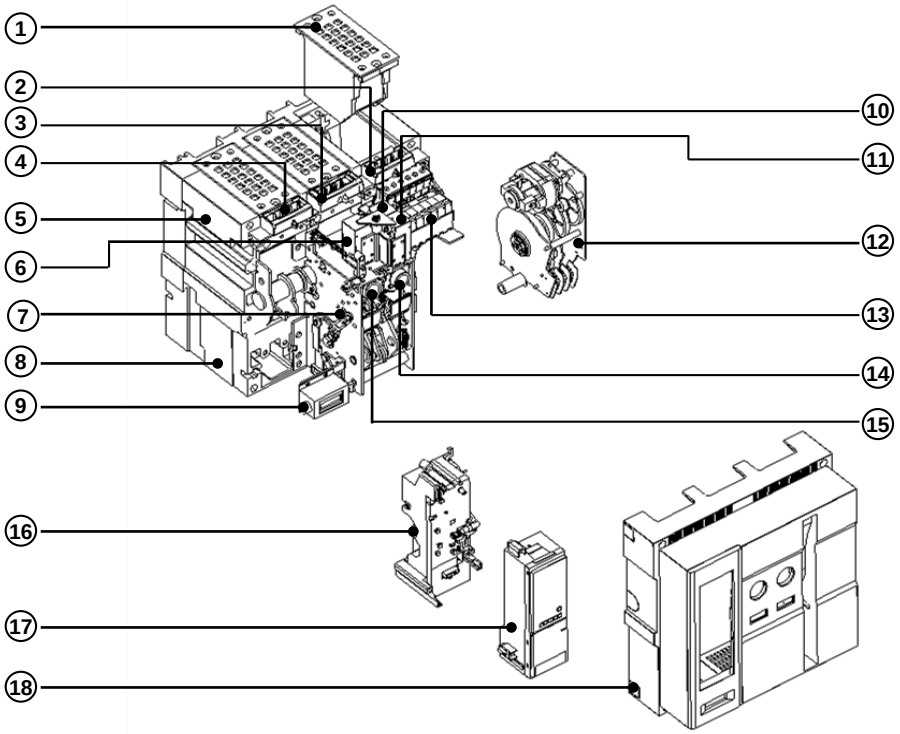
1. Internal structure and components

■ 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

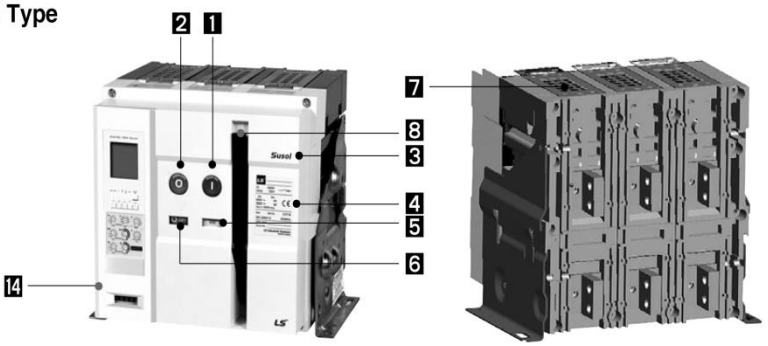


1. Arc chute
2. Aux. switch control terminal
3. Control power supply terminal
4. OCR control terminal
5. Carrying grip
6. Trip coil
7. Mechanism
8. Main body
9. Counter
10. UVT coil
11. Closing Coil
12. Motor Ass'y
13. Aux. switch
14. ON button
15. OFF button
16. MTD Base
17. OCR
18. Cover

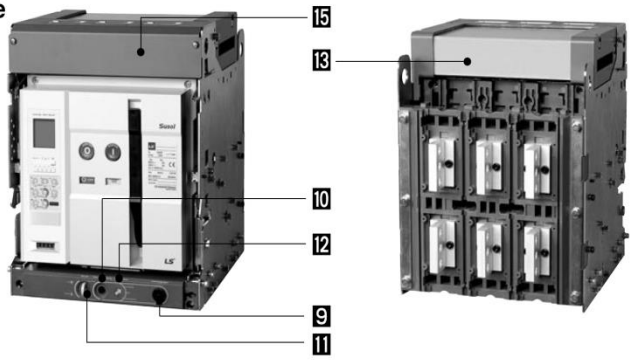
C. Structure and Operation

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

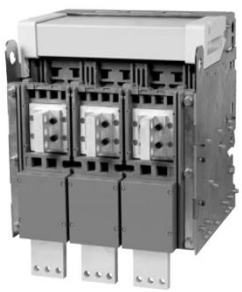


Fig.4 Vertical/plane type

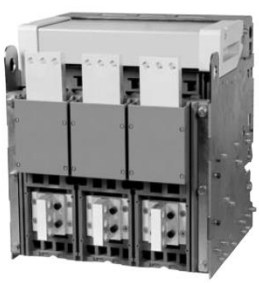


Fig.5 Plane/Vertical type

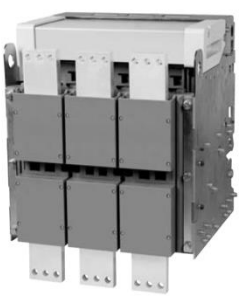


Fig.6 Plane type

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 (In) (e.g. Motor takes in 7~8times of In 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. Ue)

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.

Metasol series

AN-10D3-10J -

M1	
Charging motor	
MA	N/A
M1	AC/DC 100V ~ 130V
M2	AC/DC 200V ~ 250V
M3	DC 125V
M4	DC 24V ~ 30V
M5	DC 48V ~ 60V
M6	AC 380V ~ 415V
M7	AC 440V ~ 480V
M8	AC 48V

D1	
Closing Coil	
D0	N/A
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

D1	
Trip Coil	
D0	N/A
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

AX	
Aux, s/w & charging type	
AX	Standard 3a3b_OFF Charging
AC	Standard 3a3b_ON Charging
BX	Standard 5a5b_OFF Charging
BC	Standard 5a5b_ON Charging
HX	Hing Capa, 5a5b_OFF Charging
HC	Hing Capa, 5a5b_ON Charging
CC	Standard 6a6b_ON Charging
JC	Hing Capa, 6a6b_ON Charging
TX	Hing Capa, 4a4b_OFF Charging
TC	Hing Capa, 5a5b_ON Charging

NG0
OCR(refer to 13page)

(TCS type)
(TCS type)

U1	
UVT	
U0	N/A
U1	AC/DC 100V ~ 130V
U2	AC/DC 200V ~ 250V
U3	DC 125V
U4	DC 24V ~ 30V
U5	DC 48V ~ 60V
U6	AC 380V ~ 480V
U7	AC 48V

*UVT Delay is made up over AC/DC 48V,

AL	C
OPTION	

* TCS : Trip Circuit Supervision

AN
circuit breaker
DN
Switch Disconnector

-

10	
AMPARE FRAME	
-	-
06	630AF
08	800AF
10	1000AF
13	1250AF
16	1600AF
-	-
20	2000AF
25	2500AF
32	3200AF

D
Size & Neutral position
D : 630~1600AF 3/4P RST(N)
W : 630~1600AF 4P NRST
E : 2000~3200AF 3/4P RST(N)
X : 2000~3200AF 4P NRST

3
Number of Poles
3 : 3Poles(D)
4 : 4Poles(D,W)
3 : 3Poles(E)
4 : 4Poles(E,X)

-

10	
Rated current (CT SPEC,)	
00	N/A
02	200A
04	400A
06	630A
04	400A
06	630A
08	800A
10	1000A
13	1250A
16	1600A
00	N/A
06	630
08	800
10	1000
13	1250
16	1600
20	2000
25	2500A
32	3200A

J	
Installation & Connection	
Drawout type	
J	Manual Connection
A	Automatical Connection
Fixed type	
H	Rear Connected Horizontal
V	Rear Connected Vertical
M	Upper-Horizontal / Lower-Vertical
N	Upper-Vertical / Lower-Horizontal
P	Front Connected Flat

* 1) 2000AF of D frame is applied only rear connected vertical type,
* 2) Rated current(CT Spec,) of DN type is applied only "00",
* 3) DN type is selectable up to 3200AF only,
* 4) Refer to installation type of cradle to install drawout type busbar,

Metasol series

AS-10D3-10J	–	M1		D1		D1		AX		NG0	U1		AL	C
		Charging motor		Closing Coil		Trip Coil		Aux, s/w & charging type		OCR(refer to 13page)	UVT		OPTION	
		MA	N/A	D0	N/A	D0	N/A	AX	Standard 3a3b_OFF Charging		U0	N/A		
		M1	AC/DC 100V ~ 130V	D1	AC/DC 100V ~ 130V	D1	AC/DC 100V ~ 130V	AC	Standard 3a3b_ON Charging		U1	AC/DC 100V ~ 130V		
		M2	AC/DC 200V ~ 250V	D2	AC/DC 200V ~ 250V	D2	AC/DC 200V ~ 250V	BX	Standard 5a5b_OFF Charging		U2	AC/DC 200V ~ 250V		
		M3	DC 125V	D3	DC 125V	D3	DC 125V	BC	Standard 5a5b_ON Charging		U3	DC 125V		
		M4	DC 24V ~ 30V	D4	DC 24V ~ 30V	D4	DC 24V ~ 30V	HX	Hing Capa, 5a5b_OFF Charging		U4	DC 24V ~ 30V		
		M5	DC 48V ~ 60V	D5	DC 48V ~ 60V	D5	DC 48V ~ 60V	HC	Hing Capa, 5a5b_ON Charging		U5	DC 48V ~ 60V		
		M6	AC 380V ~ 415V	D6	AC 380V ~ 480V	D6	AC 380V ~ 480V	CC	Standard 6a6b_ON Charging		U6	AC 380V ~ 480V		
		M7	AC 440V ~ 480V	D7	AC 48V	D7	AC 48V	JC	Hing Capa, 6a6b_ON Charging		U7	AC 48V		
		M8	AC 48V					TX	Hing Capa, 4a4b_OFF Charging	(TCS type)	*UVT Delay is made up over AC/DC 48V,			
								TC	Hing Capa, 5a5b_ON Charging	(TCS type)				

※ TCS : Trip Circuit Supervision

AS	–	10		D	3	–	10		J	
circuit breaker		AMPARE FRAME		Size & Neutral position	Number of Poles		Rated current (CT SPEC,)		Installation & Connection	
DS		–	–				00	N/A	Drawout type	
Switch Disconnector		06	630AF	D : 630~2000AF 3/4P RST(N) W : 630~2000AF 4P NRST	3 : 3Poles(D) 4 : 4Poles(D,W)		02	200A	J	Manual Connection
							04	400A	A	Automatical Connection
							06	630A	Fixed type	
		08	800AF				04	400A	H	Rear Connected Horizontal
							06	630A	V	Rear Connected Vertical
		10	1000AF				08	800A	M	Upper-Horizontal / Lower-Vertical
		13	1250AF				10	1000A	N	Upper-Vertical / Lower-Horizontal
		16	1600AF				13	1250A	P	Front Connected Flat
		20	2000AF				16	1600A		
							20	2000A		
		–	–	E : 2000~4000AF 3/4P RST(N) X : 2000~4000AF 4P NRST	3 : 3Poles(E) 4 : 4Poles(E,X)		00	N/A		
		20	2000AF				06	630		
							08	800		
							10	1000		
							13	1250		
							16	1600		
							20	2000		
		25	2500AF				25	2500A		
		32	3200AF				32	3200A		
		40	4000AF				40	4000A		
		–	–	F : 5000AF 3/4P 표준형 RST(N) Y : 5000AF 4P 역상형 NRST	3 : 3Poles(F) 4 : 4Poles(F,Y)		00	N/A		
		40	4000AF				40	4000A		
		50	5000AF				50	5000A		
		–	–	G : 4000/5000/6300AF 3/4P 표준형 RST(N) Z : 4000/5000/6300AF 4P 역상형 NRST	3 : 3Poles(G) 4 : 4Poles(G,Z)		00	N/A		
		40	4000AF				40	4000A		
		50	5000AF				50	5000A		
		63	6300AF				63	6300A		

* 1) 2000AF of D frame is applied only rear connected vertical type,
  4000AF of E frame is not applied front connected flat type,
  F and G frame is not applied P type and mixed P type,
* 2) Rated current(CT Spec,) of DS type is applied only "00",
* 3) DS type is selectable up to E,X-frame(4000AF) only,
* 4) Refer to installation type of cradle to install drawout type busbar,

Susol Series

AH-10D3-10J	M1	D1	D1	AX	NG0	U1	AL	C
	Charging motor	Closing Coil	Trip Coil	Aux. s/w & charging type	OCR(refer to 13page)	UVT	OPTION	

M1	
MA	N/A
M1	AC/DC 100V ~ 130V
M2	AC/DC 200V ~ 250V
M3	DC 125V
M4	DC 24V ~ 30V
M5	DC 48V ~ 60V
M6	AC 380V ~ 415V
M7	AC 440V ~ 480V
M8	AC 48V

D1	
D0	N/A
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

D1	
D0	N/A
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

AX	
AX	Standard 3a3b_OFF Charging
AO	Standard 3a3b_ON Charging
BX	Standard 6a6b_OFF Charging
BO	Standard 6a6b_ON Charging
HX	Hing Capa. 6a6b_OFF Charging
HO	Hing Capa. 6a6b_ON Charging
OO	Standard 8a8b_ON Charging
JO	Hing Capa. 8a8b_ON Charging
TX	Hing Capa. 4a4b_OFF Charging
TO	Hing Capa. 6a6b_ON Charging

※ TO8 : Trip Circuit Supervision

NG0
OCR(refer to 13page)
(TO8 type)
(TO8 type)

U1	
U0	N/A
U1	AC/DC 100V ~ 130V
U2	AC/DC 200V ~ 250V
U3	DC 125V
U4	DC 24V ~ 30V
U5	DC 48V ~ 60V
U6	AC 380V ~ 480V
U7	AC 48V

*UVT Delay is made up over AC/DC 48V.

AL	C
OPTION	

AH
circuit breaker
DH
Switch Disconnector

10	
AMPARE FRAME	
-	-
06	630AF
08	800AF
10	1000AF
13	1250AF
16	1600AF
20	2000AF

D
Size & Neutral position
D : 630~2000AF 3/4P RBT(N) W : 630~2000AF 4P NRBT

S
Number of Poles
S : 3Poles(D) 4 : 4Poles(D,W)

10	
Rated current (OT SPEC.)	
00	N/A
02	200A
04	400A
06	630A
04	400A
06	630A
08	800A
10	1000A
13	1250A
16	1600A
20	2000A

J	
Installation & Connection	
Drawout type	
J	Manual Connection
A	Automatical Connection
Fixed type	
H	Rear Connected Horizontal
V	Rear Connected Vertical
M	Upper-Horizontal / Lower-Vertical
N	Upper-Vertical / Lower-Horizontal
P	Front Connected Flat

-	-
06	630AF
08	800AF
10	1000AF
13	1250AF
16	1600AF
20	2000AF
25	2500AF
32	3200AF
40	4000AF

E
E : 630~4000AF 3/4P RBT(N) X : 630~4000AF 4P NRBT

S
S : 3Poles(E) 4 : 4Poles(E,X)

00	N/A
06	630
08	800
10	1000
13	1250
16	1600
20	2000
25	2500A
32	3200A
40	4000A

-	-
40	4000AF
50	5000AF
63	6300AF

G
G : 4000/5000/6300AF 3/4P RBT(N) Z : 4000/5000/6300AF 4P NRBT

S
S : 3Poles(G) 4 : 4Poles(G,Z)

00	N/A
40	4000A
50	5000A
63	6300A

* 1) 2000AF of D frame is applied only rear connected vertical type.
  4000AF of E frame is not applied front connected flat type.
  F and G frame is not applied P type and mixed P type.
* 2) Rated current(OT Spec.) of DH type is applied only "00".
* 3) DH type is selectable up to E,X-frame(4000AF) only.
* 4) Refer to installation type of cradle to install drawout type busbar.

D. Types and Ratings

1. Type of Metasol series

■ Options

Code	Description	Option description
AL	AL1 + MRB	
A1	AL1 + MRB + RES(AC110~130V) * AC only	
A2	AL1 + AL2 + MRB	
A3	AL1 + MRB + RES(DC110~125V) * DC only	
A4	AL1 + MRB + RES(AC200~250V) * AC only	
A5	AL1 + MRB + Auto Reset	
A6	AL1 + AL2 + MRB + Auto Reset	
A7	AL1 + MRB + RES(DC110~125V) + Auto Reset * DC only	
A8	AL1 + MRB + RES(AC200~250V) + Auto Reset * AC only	
A9	AL1 + MRB + RES(AC110~130V) + Auto Reset * AC only	
C	C	COUNTER
S	CS2	Charge switch communication
B	B	On/Off Button lock
M	MI	Mechanical interlock
D	DI or MOC	Door Interlock or MOC(Mechanism operated cell switch)
K	K1	Key Lock
K2	K2	Key Interlock Set
K3	K3	Key Interlock Double
R	RCS	Ready to Close switch
T	TM	Temperature Monitoring sensor
H1	SHT2 (Note2)	AC/DC 100V ~ 130V, Double Shunt coil
H2		AC/DC 200V ~ 250V, Double Shunt coil
H3		DC 125V, Double Shunt coil
H4		DC 24V ~ 30V, Double Shunt coil
H5		DC 48V ~ 60V, Double Shunt coil
H6		AC 380V ~ 480V, Double Shunt coil
H7		AC 48V, Double Shunt coil

*Note1) If mixed option is more than 5, it is separated by mixed option code.
**Note2) UVT and SHT2 can be not applicable together.

■ Special Specifications

F1 ~ F8	low-level contacts of Motors charge switch (Rating : Reference of M1~M8, ex) F1 : AC/DC 100V~125V)
VL~V9	low-level contacts of Trip Alarm Contacts (Component : Like AL ~ A9)
Z2	AL1+AL2 (1a1b) + MRB
Z6	AL1+AL2 (1a1b) + MRB + Auto Reset
Y2	AL1+AL2 (2b) + MRB
Y6	AL1+AL2 (2b) + MRB + Auto Reset
W2	AL1+AL2+MRB (low-level contacts of Alarm_1a1b)
W6	AL1+AL2+MRB+Auto Reset (low-level contacts of Alarm_1a1b)
X2	AL1+AL2+MRB (low-level contacts of Alarm contacts_2b)
X6	AL1+AL2+MRB+Auto Reset (low-level contacts of Alarm contacts_2b)
low-level contact : Min_24Vdc 3mA Max_24Vdc 300mA	

N01	**A4** (AL1 + MRB + RES(AC200~250V))+**C**(Counter)+**B**(ON/OFF Button Lock) +**K**(Key Lock)+**R**(Ready to Close switch)+M(Mechanicl Interlock)+**E**(Spring Auto Release)
N02	**AL** (AL1 + MRB)+**K**(Key Lock(OFF Lock))+**R**(Ready to Close switch)+**D**(Door Interlock or MOC)+**H1**(AC/DC 100V ~ 130V, Double Shunt coil)+**E**(Spring Auto Release)
N03	**C**(Counter)+**B**(ON/OFF Button Lock)+**K2**(Key Interlock Set)+**R**(Ready to Close switch)+**T**(Temperature monitoring sensor)
N04	**A4**(AL1 + MRB + RES(AC200~250V))+**B**(ON/OFF Button Lock)+**K**(Key Lock(OFF Lock))+M(Mechanical Interlock)+**T**(Temperature monitoring sensor)
N05	**A1**(AL1+MRB+RES110~130V)+**B**(ON/OFF Button Lock)+**K(Key Lock(OFF Lock))**+**R**(Ready to Close switch)+M(Mechanical Interlock)+**T**(Temperature monitoring sensor)
N06	**A2**(AL1+AL2+MRB)+**C(Counter)+K(Key Lock(OFF Lock))**+**R**(Ready to Close switych)+**T**(Temperature monitoring sensor)

D. Types and Ratings

2. Type of OCR/Cradle series

■ OCR

N	-	G	-	0
OCR TYPE		Communication & Ground fault protection		Control voltage & frequency
0 N/A N NORMAL		0 N/A G No communication + Residual earth fault protection		0 N/A 0 Self-power, 60Hz 5 Self-power, 50Hz

* Communication and output contacts for L,S,J,G do not work exept OCR LED without control power supply.

A	-	G	-	0
OCR TYPE		Communication & Ground fault protection		Control voltage & frequency
A Ammeter		G No communication + Residual earth fault protection Z No communication + Earth leakage protection E No communication + Ground fault(with external CT) C Communication + Residual earth fault protection K Communication + Earth leakage protection X Communication + Ground fault(with external CT)		0 Self-power, 60Hz 1 AC/DC 110V~220V, 60Hz 2 DC 24V~48V, 60Hz 5 Self-power, 50Hz 6 AC/DC 110V~220V, 50Hz 7 DC 24V~48V, 50Hz

* Control voltage is mandatory to communication (Self-power only : AC0, AK0,AX0, AC5, AK5,AX5)
* Communication and output contacts for L,S,J,G do not work exept OCR LED without control power supply.
(No output contacts : AG0,AG5,AZ0,AZ5,AE0,AE5)

P	-	G	-	0
OCR TYPE		Communication & Ground fault protection		Control voltage & frequency
P Power meter		C Communication + Residual earth fault protection K Communication + Earth leakage protection X Communication + Ground fault(with external CT) A Communication + Pre-Trip Alarm		1 AC/DC 110V~220V, 60Hz 2 DC 24V~48V, 60Hz 6 AC/DC 110V~220V, 50Hz 7 DC 24V~48V, 50Hz

* Communication is default, (Control voltage is mandatory)
* Allowed to protect generator,
* Voltage module is default on P and S type,

S	-	G	-	0
OCR TYPE		Communication & Ground fault protection		Control voltage & frequency
S Supreme meter		C Communication + Residual earth fault protection K Communication + Earth leakage protection X Communication + Ground fault(with external CT) A Communication + Pre-Trip Alarm		1 AC/DC 110V~220V, 60Hz 2 DC 24V~48V, 60Hz 6 AC/DC 110V~220V, 50Hz 7 DC 24V~48V, 50Hz

* Communication is default, (Control voltage is mandatory)
* Susol (AH) only,
* Allowed to protect generator,
* Voltage module is default on P and S type,

N	-	V	-	1
OCR TYPE		Communication & Ground fault protection		Control voltage & frequency
N NORMAL		V No communication + Pre-Trip Alarm (Marine type only)		1 AC/DC 110V~220V, 60Hz 6 AC/DC 110V~220V, 50Hz

* Earth leakage protection is default, (default CT current vector sum)
* Communication and output contacts for L,S,J,G do not work exept OCR LED without control power supply.

■ Cradle

AL	-	N16D	3	-	J	H	E	N
LS ACB CRADLE		FRAME SIZE	Number of Poles		Secondary connector type	Terminal configuration	Shutter	Other options
		N06~16D AN-06~16D	3 3Poles		J Manual Connection	H Rear Connected Horizontal	E No safety shutter	N No arc cover
		S06~16D AS-06~16D	4 4Poles		A Automatical Connection	V Rear Connected Vertical	F Safety shutter	S Arc cover
		H06~16D AH-06~16D				M Upper-Horizontal / Lower-Vertical		
		S20D AS-20D H20D AH-20D				N Upper-Vertical / Lower-Horizontal		
		N20~25E AN-20~25E				P Front Connected Flat		
		S20~25E AS-20~25E				CL Cell Switch (Marine type only)		
		N32E AN-32E S32E AS-32E				SB Shorting "B" contact (Marine type only)		
		H20~32E AH-20~32E						
		S40E AS-40E H40E AH-40E						
		S40~50F AS-40~50F						
		S40~50G AS-40~50G						
		H40~50G AH-40~50G						
		S63G AS-63G H63G AH-63G						

Common Characteristics																								
Number of poles	(P)			3, 4																				
Frequency	(Hz)			50/60																				
Rated operating voltage	(Ue)		(V)	690																				
Rated insulation voltage	(Ui)		(V)	1000																				
Rated impulse withstand voltage (Uimp)	(kV)			12																				
Circuit Breaker as per IEC60947-2																								
TYPE				AH-D						AH-E										AH-G				
Description				AH-06D	AH-08D	AH-10D	AH-13D	AH-16D	AH-20D	AH-06E	AH-08E	AH-10E	AH-13E	AH-16E	AH-20E	AH-25E	AH-32E	AH-40E	AH-40G	AH-50G	AH-63G			
Ampere Frame	(AF)			630	800	1000	1250	1600	2000	630	800	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300			
Rated current (In max)	(A)		at 40℃	200 400 630	400 630 800	1000	1250	1600	2000	400 630	800	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300			
Rated current of neutral pole	(A)			630	800	1000	1250	1600	2000	630	800	1000	1250	1600	2000	2500	3200	4000	4000	5000	6300			
Rated breaking capacity (Icu) (Syn)	(kA)	IEC 60947-2 KS C 4620	AC 690V / 600V / 550V	65						85									100					
			AC 500V / 460V / 460V	85						100									150					
			AC 415V/380V / 230V / 220V	85						100									150					
Rated service breaking capacity (Ics)	(kA)			''' % • Icu																				
				100						100									100					
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-2 KS C 4620	AC 690V / 600V / 550V	143						187									220					
			AC 500V / 460V / 460V	187						220									330					
			AC 415V/380V / 230V / 220V	187						220									330					
Rated Short-time capacity (Icw)	(kA)		1 sec	65						85									100					
			2 sec	60						75									100					
			3 sec	50						65									100					
Operating time (t)	(ms)		Maximum total breaking time	40						40									40					
			Closing time	80						80									80					
Switch-Disconnector as per IEC60947-3																								
TYPE				DH-D						DH-E														
Description				DH-06D	DH-08D	DH-10D	DH-13D	DH-16D	DH-20D	DH-06E	DH-08E	DH-10E	DH-13E	DH-16E	DH-20E	DH-25E	DH-32E	DH-40E						
Ampere Frame	(AF)			630	800	1000	1250	1600	2000	630	800	1000	1250	1600	2000	2500	3200	4000						
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-3	AC ~ 690V	143						187														
Rated Short-time capacity (Icw)	(kA)	IEC 60947-3	1 sec	65						85														
			2 sec	60						75														
			3 sec	50						65														
Operating time (t)	(ms)		Opening time	40						40														
			Closing time	80						80														
Common Mechanical and Electrical Life Cycle																								
Life cycle	ACB	(time)	Mechanical	Without maintenance	20,000						15,000								10,000					
				With maintenance	30,000						20,000								15,000					
			Electrical	Without maintenance	5,000						5,000								2,000					
				With maintenance	10,000						10,000								5,000					
Common Demension and Weight																								
Weight(3P/4P)		(kg)	Draw-out type	Main Body (With cradle) Motor charging type	63/74				70/85		87/103						104/147		181/223		186/230			
				Manual charging type	61/72				68/83		85/101						102/145		179/221		184/228			
				Cradle only	29/32				33/40		44/55						58/70		97/117		102/124			
			Fixed type	Motor charging type	34/44				38/47		44/55						63/100		98/123		103/130			
				Manual charging type	32/42				36/45		42/53						61/98		96/121		101/128			
External dimension	Draw-out type	(mm)	H:430(460), D:375	W(3P/4P)	334/419						412/527								785/1015					
	Fixed type	(mm)	H:300, D:295	W(3P/4P)	300/385						378/493								751/981					

Common Characteristics																				
Number of poles	(P)			3, 4																
Frequency	(Hz)			50/60																
Rated operating voltage	(Ue)		(V)	690																
Rated insulation voltage	(Ui)		(V)	1000																
Rated impulse withstand voltage (Uimp)	(kV)			12																
Circuit Breaker as per IEC60947-2																				
TYPE				A8-D							A8-E				A8-F		A8-G			
Description				A8-06D	A8-08D	A8-10D	A8-13D	A8-16D	A8-20D		A8-20E	A8-25E	A8-32E	A8-40E	A8-40F	A8-50F	A8-40G	A8-50G	A8-63G	
Ampere Frame	(AF)			630AF	800AF	1000AF	1250AF	1600AF	2000AF		2000	2500	3200	4000	4000	5000	4000	5000	6300	
Rated current (In max)	(A)		at 40℃	200 400 630	400 630 800	1000	1250	1600	2000		630,800,1000, 1250,1600,2000	2500	3200	4000	4000	5000	4000	5000	6300	
Rated current of neutral pole	(A)			630	800	1000	1250	1600	2000		630,800,1000, 1250,1600,2000	2500	3200	4000	4000	5000	4000	5000	6300	
Rated breaking capacity (Icu) (Sym)	(kA)	IEC 60947-2 KS C 4620	AC	690V / 600V / 550V	65						85				85		100			
				500V / 480V / 460V	70						85				100		120			
				415V/380V / 230V / 220V	70						85				100		120			
Rated service breaking capacity (Ics)	(kA)			''' % * Icu	100						100				100		100			
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-2 KS C 4620	AC	690V / 600V / 550V	143						187				187		220			
				500V / 480V / 460V	154						187				220		264			
				415V/380V / 230V / 220V	154						187				220		264			
Rated Short-time capacity (Icw)	(kA)			1 sec	65						85				85		100			
				2 sec	55						75				75		90			
				3 sec	50						65				65		85			
Operating time (t)	(ms)			Maximum total breaking time	40						40				40		40			
				Closing time	80						80				80		80			
Switch-Disconnector as per IEC60947-3																				
TYPE				D8-D							D8-E									
Description				D8-06D	D8-08D	D8-10D	D8-13D	D8-16D	D8-20D		D8-20E	D8-25E	D8-32E	D8-40E						
Ampere Frame	(AF)			630AF	800AF	1000AF	1250AF	1600AF	2000AF		2000	2500	3200	4000						
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-3	AC	~ 690V	143						187									
Rated Short-time capacity (Icw)	(kA)	IEC 60947-3		1 sec	65						85									
				2 sec	55						75									
				3 sec	50						65									
Operating time (t)	(ms)			Openning time	40						40									
				Closing time	80						80									
Common Mechanical and Electrical Life Cycle																				
Life cycle	ACB	(time)	Mechanical	Without maintenance	20,000						15,000				10,000		10,000			
				With maintenance	30,000						20,000				15,000		15,000			
			Electrical	Without maintenance	5,000						5,000				2,000		2,000			
				With maintenance	10,000						10,000				5,000		5,000			
Common Demension and Weight																				
Weight(3P/4P)		(kg)	Draw-out type	Main Body (With cradle)	Motor charging type	63/74				70/85	87/103			104/147	145/173		161/223		186/230	
					Manual charging type	61/72				68/83	85/101			102/145	143/171		179/221		184/228	
				Cradle only		29/32				33/40	44/50			58/70	78/90		97/117		102/124	
			Fixed type		Motor charging type	34/44				38/47	44/55			63/100	76/94		96/123		103/130	
					Manual charging type	32/42				36/45	42/53			61/98	74/92		96/121		101/128	
External dimension	Draw-out type	(mm)	H:430, D:375	W(3P/4P)		334/419					412/527				629/799		765/1015			
	Fixed type	(mm)	H:300, D:295	W(3P/4P)		300/385					378/493				597/767		751/961			

Common Characteristics													
Number of poles	(P)			3, 4									
Frequency	(Hz)			50/60									
Rated operating voltage	(Ue)		(V)	690									
Rated insulation voltage	(Ui)		(V)	1000									
Rated impulse withstand voltage (Uimp)	(kV)			12									
Circuit Breaker as per IEC60947-2													
TYPE				AN-D,W						AN-E,X			
Description				AN-06D	AN-08D	AN-10D	AN-13D	AN-16D		AN-20E	AN-25E	AN-32E	
Ampere Frame	(AF)			630AF	800AF	1000AF	1250AF	1600AF		2000	2500	3200	
Rated current (In max)	(A)		at 40℃	200 400 630	400 630 800	1000	1250	1600		630,800,1000, 1250,1600,200 0	2500	3200	
Rated current of neutral pole	(A)			630	800	1000	1250	1600		630,800,1000, 1250,1600,200 0	2500	3200	
Rated breaking capacity (Icu) (Sym)	(kA)	IEC 60947-2 KS C 4620	AC 690V / 600V / 550V	50						65			
			AC 500V / 460V / 460V	65						70			
			AC 415V/380V / 230V / 220V	65						70			
Rated service breaking capacity (Ics)	(kA)		''' % • Icu	100						100			
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-2 KS C 4620	AC ~ 690V	105						143			
			AC 500V / 460V / 460V	143						154			
			AC 415V/380V / 230V / 220V	143						154			
Rated Short-time capacity (Icw)	(kA)		1 sec	50						65			
			2 sec	42						50			
			3 sec	36						42			
Operating time (t)	(ms)		Maximum total breaking time	40						40			
			Closing time	80						80			
Switch-Disconnector as per IEC60947-3 (AC23A)													
TYPE				DN-D,W						DN-E,X			
Description				DN-06D	DN-08D	DN-10D	DN-13D	DN-16D		DN-20E	DN-25E	DN-32E	
Ampere Frame	(AF)			630AF	800AF	1000AF	1250AF	1600AF		2000	2500	3200	
Rated making capacity (Icm) (peak)	(kA)	IEC 60947-3	AC 690V / 600V / 550V	105						143			
Rated Short-time withstand current (Icw)	(kA)	IEC 60947-3	1 sec	50						65			
			2 sec	42						50			
			3 sec	36						42			
Operating time (t)	(ms)		Openning time	40						40			
			Closing time	80						80			
Common Mechanical and Electrical Life Cycle													
Life cycle	ACB	(time)	Mechanical	Without maintenance	20,000					15,000			
				With maintenance	30,000					20,000			
			Electrical	Without maintenance	5,000					5,000			
				With maintenance	10,000					10,000			
Common Demension and Weight													
Weight(3P/4P)		(kg)	Draw-out type (Main Body (With cradle))	Motor charging type	63/74					87/103			
				Manual charging type	61/72					85/101			
			Draw-out type	Cradle only	29/32					44/50			
			Fixed type	Motor charging type	34/44					44/55			
				Manual charging type	32/42					42/53			
External dimension	Draw-out type	(mm)	H:430, D:375	W(3P/4P)	334/419					412/527			
	Fixed type	(mm)	H:300, D:295	W(3P/4P)	300/385					378/493			

• KSC4620 속의 정격전압을 690/600V

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)

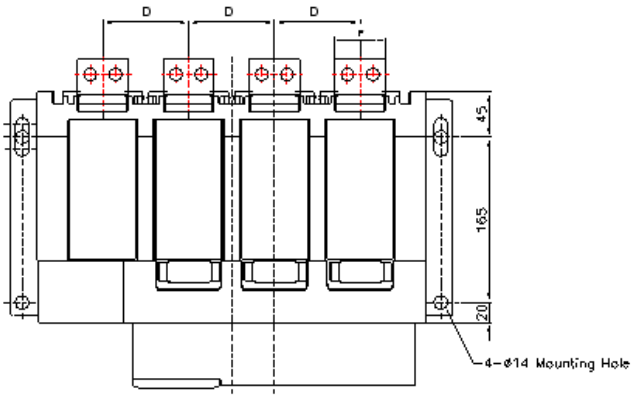
Unit : kg

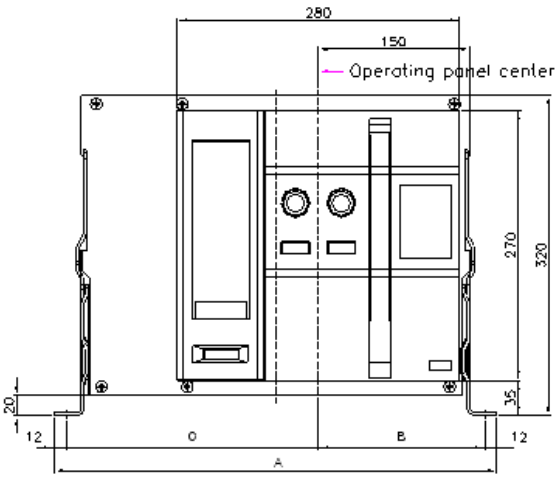
Type	2000AF				4000AF				5000AF		6300AF	
	1600A		2000A		3200A		4000A (Fork-type)					
	3P	4p	3P	4P	3P	4P	3P	4P	3P	4P	3P	4P
Fixed	34	44	38	47	44	55	63	100	76	94	103	130
Draw-out (With cradle)	63	74	70	85	87	103	104	147	145	173	186	230
Cradle	29	32	33	40	44	50	58	70	78	90	102	124

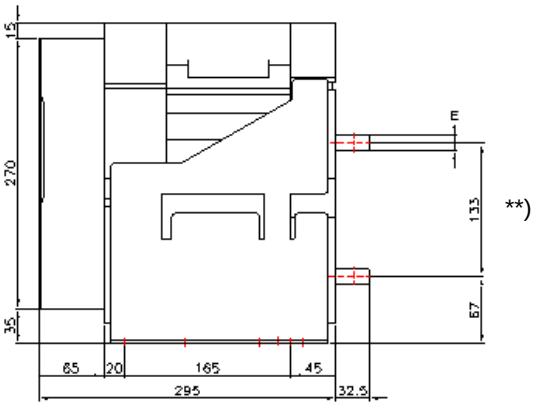
E. Weight & Dimension

2. Dimension

■ Fixed type







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

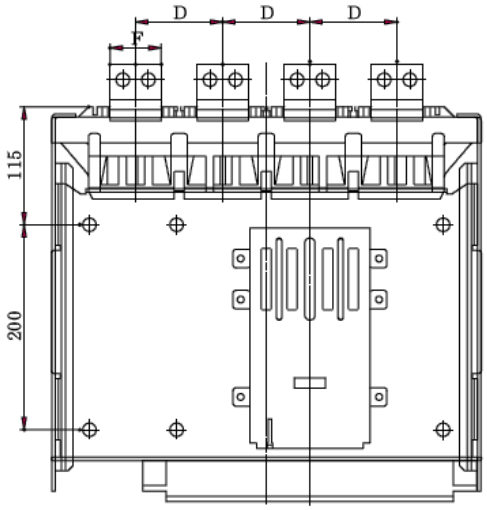
구분	2000AF 1600A 3P	2000AF 1600A 4P	4000AF 3200A 3P	4000AF 3200A 4P	4000AF 4000A 3P	4000AF 4000A 4P
A	354	439	432	547	432	547
B	165	165	204	204	204	204
C	165	250	204	319	204	319
D	85	85	115	115	140	140
E	15	15	20	20	12.5*2,10	12.5*2,10
F	50	50	75	75	100	100

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

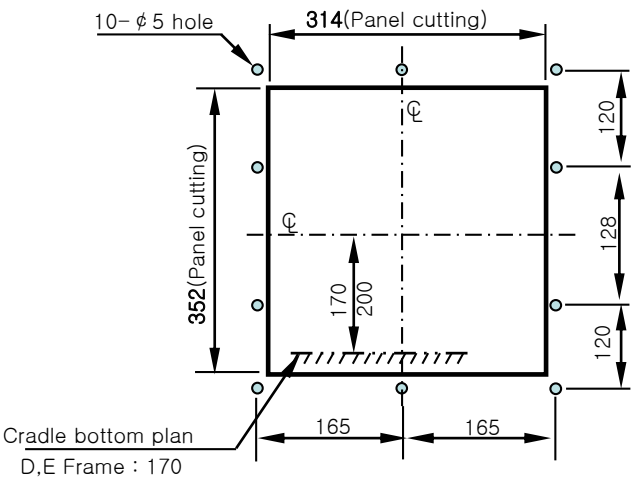
E. Weight & Dimension

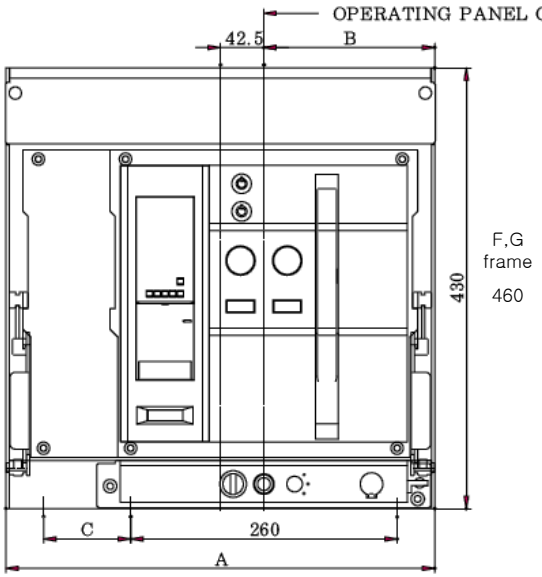
2. Dimension

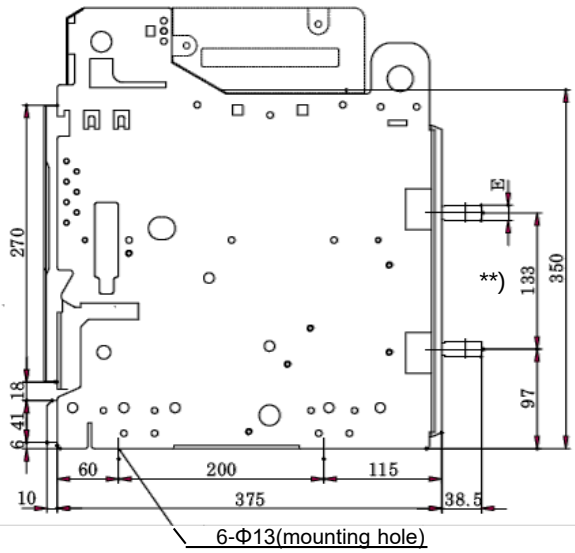
■ **Draw-out type**



■ **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

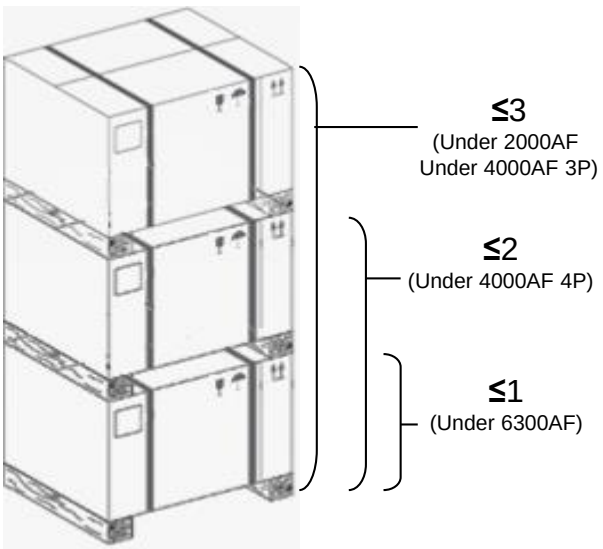
■ Receiving

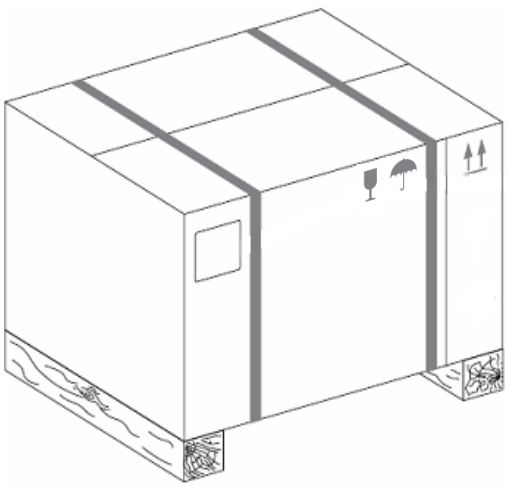
A visual inspection – inside and out – should be performed immediately upon receipt of the ACB and before removing it from the truck. Shipping papers should be checked to ensure all boxes or other accompanying pieces have been received. If any damage or shortages are evident, a claim should be filed 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℃ 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.





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℃ 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.

■ Unpacking for draw-out type

1. Keep pushing the off button, insert a draw-out handle to the body of the circuit breaker. At this time, the draw-out position indicator shows CONNECTED position.
2. Check the draw-out handle properly inserted and then push the pad lock button and turn the draw-out handle counterclockwise. The breaker reaches the TEST position.
3. Push the pad lock button and turn the draw-out handle again counterclockwise until the pad lock button projects. At this time, the draw-out operation is finished with indicator which shows DISCONNECTED position.
4. Keep pushing the lever draw button, pull the extension rails of cradle forward and lift up the breaker from cradle securely by using lifting device and put it on flat place.
5. Separate the cradle from pallet by releasing all bolts tightened on pallet to fix the cradle.

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.

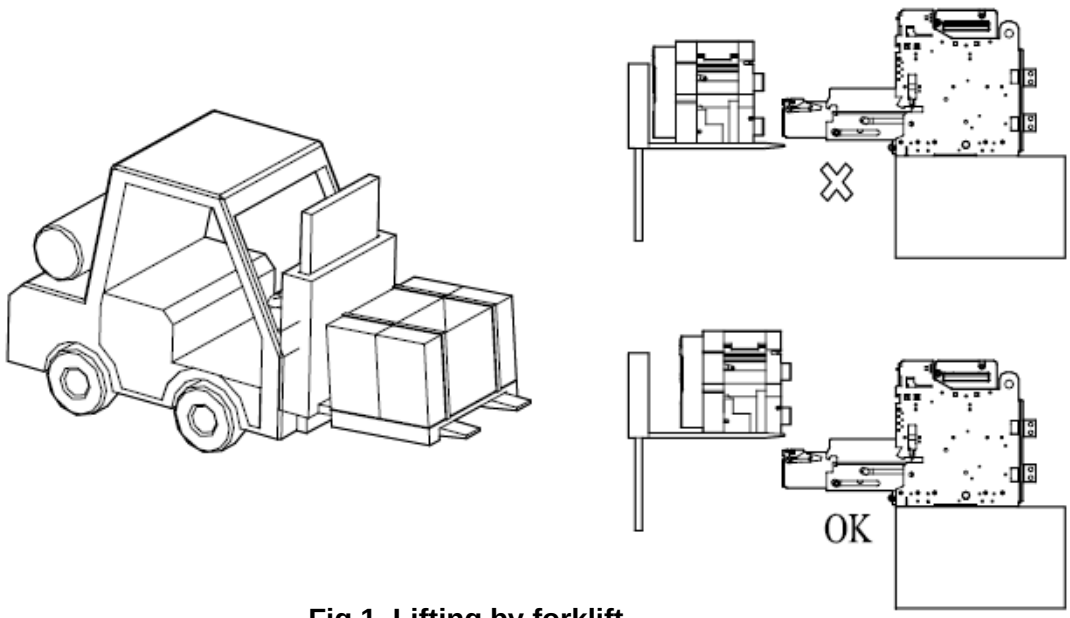


Fig 1. Lifting by forklift

-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.

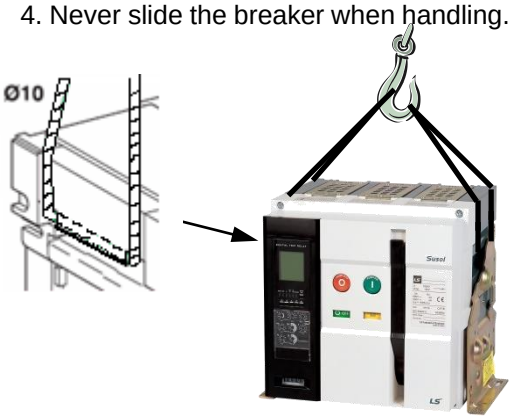


Fig. 2. Handling method of Fixed type

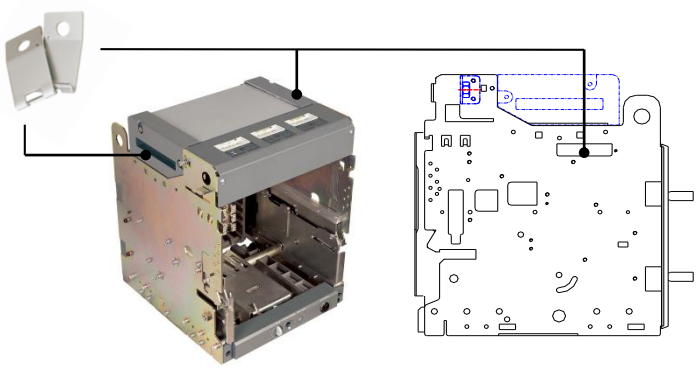


Fig. 3. Handling method of Draw-out type

2. Storage

■ Precaution of storage

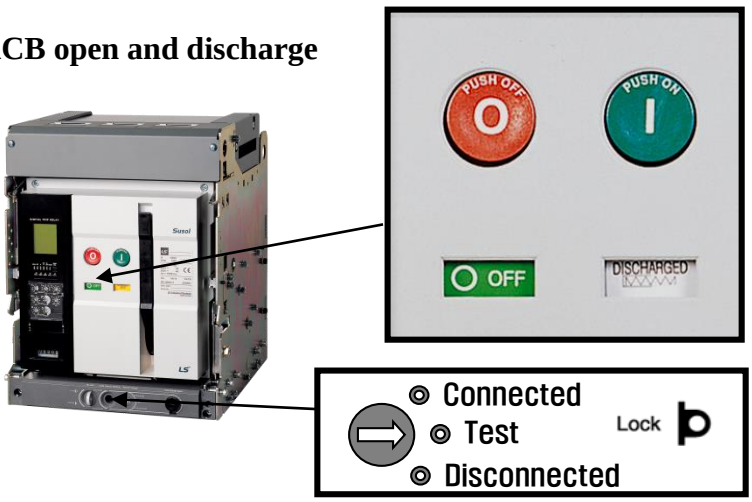
When storing a circuit breaker for a long term,

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℃ 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

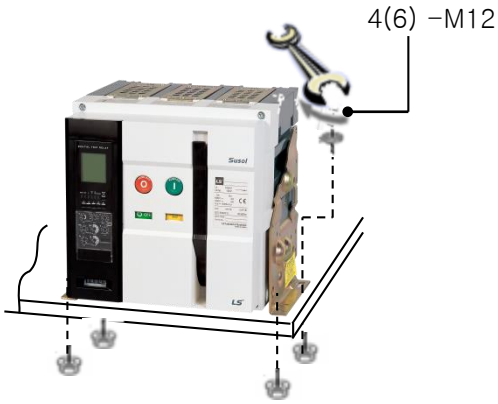


H. Installation

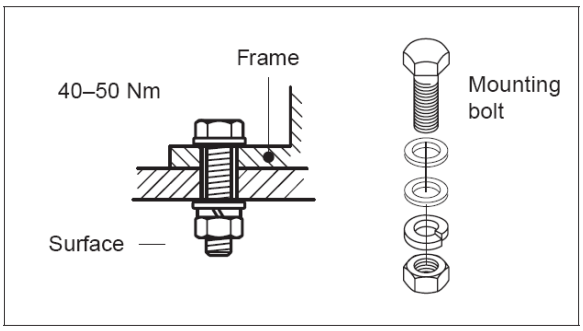
1. Fixed type

■ Installation of fixed type

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



<Torque>

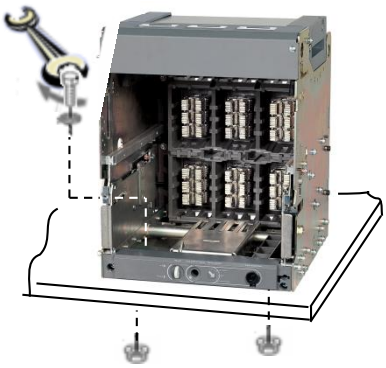


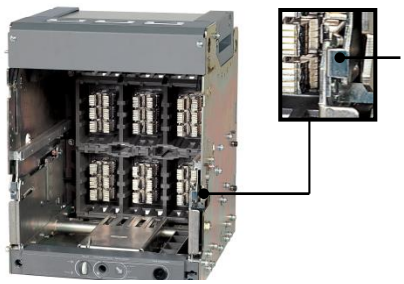
2. Draw-out type

■ Installation of draw-out type

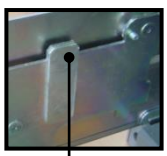
Install draw-out type according to the instruction given below.

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.





B
(ACB Mold Frame)



C
(Cradle Rail)

H. Installation

3. Precaution and installation of insulation barrier

■ Precaution

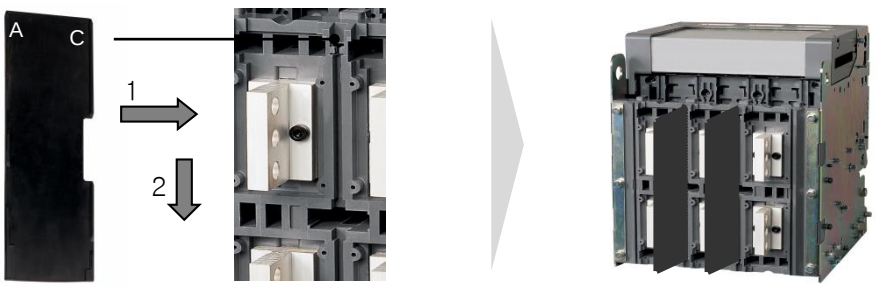
1. Do not lay down a breaker on the side or stand with the side of it.
2. Install a circuit breaker on perfect even ground. (Within 2mm of the level difference)
3. Do not install a circuit breaker with same direction of a rail when you use an angle.
4. Install a circuit breaker at a right angle to the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

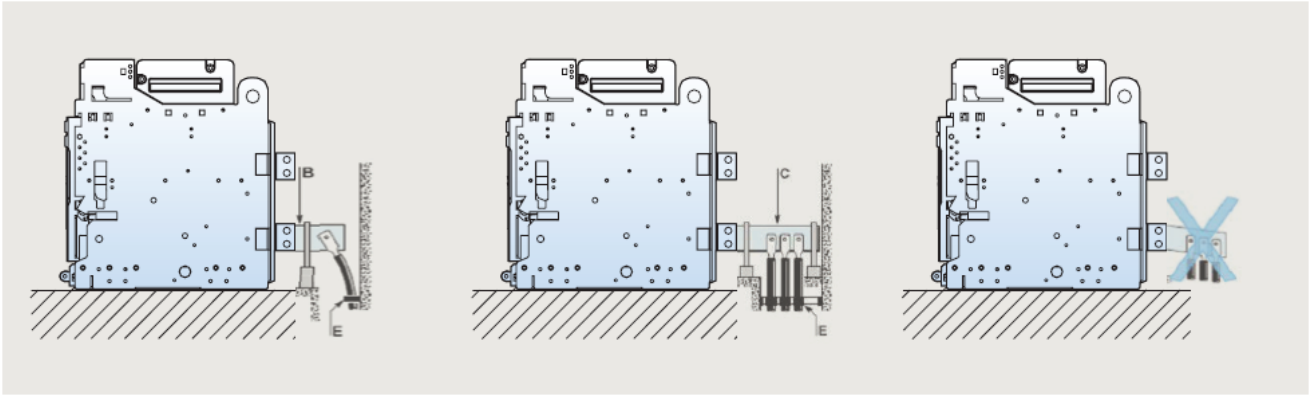


4. Bus-BAR Connection

■ Cable connections

Make sure that no excessive mechanical force put on the rear terminals for cable connection.

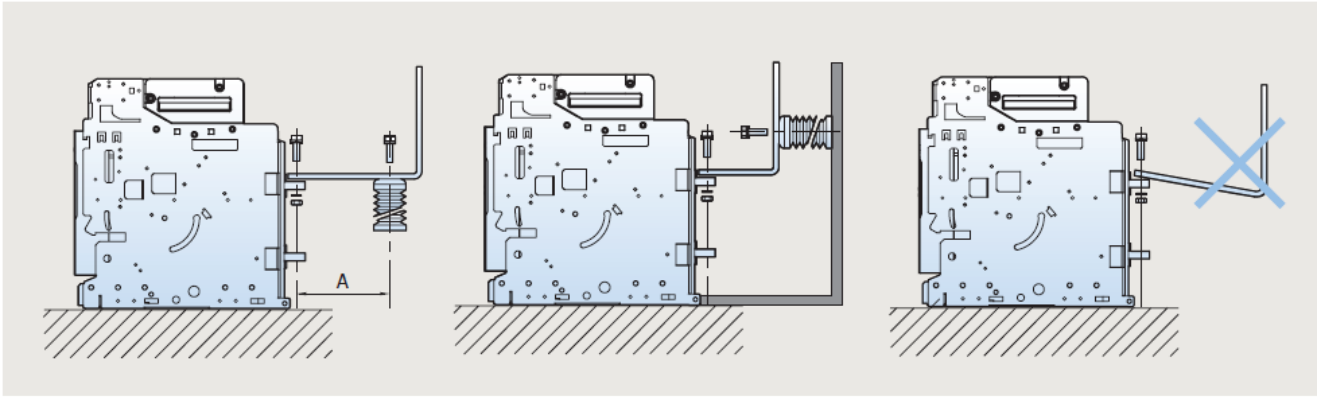
Extension terminal is fixed such as B, C and cable is to fixed to the frame such as E .



■ Bus-bar connection

For busbar connection, connect access parts with a provided torque and fix with parallel installing the support not to apply terminal weight to circuit breaker.

In order to prevent the spread safety or secondary accidents, secure maximum safe distance A (Table 1) from the access area to withstand the electrical force during the short circuit faults.



(Table 1) Maximum safe distance A

Short capacity (kA)	30	50	65	80	100	150
Length A (mm)	350	300	250	150	150	150

***** Warranty can not be applied to product damage by arbitrary alterations.

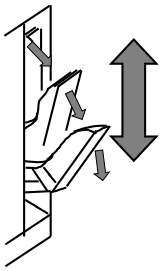
I. Operation

1. Manual operation

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

■ Manual charging

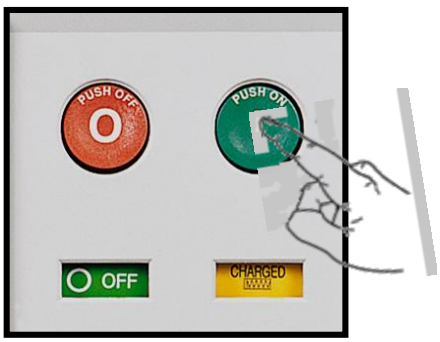
1. Charge the handle 7~ 8 times with full strokes.
2. When the closing spring is completely charged, the charging indicator shows “CHARGED”.



ACB off and 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”.



■ 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

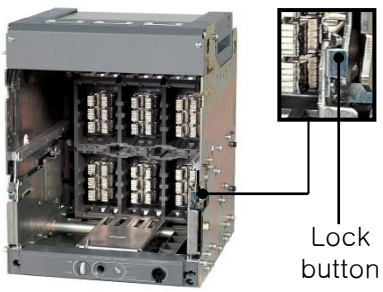
1. Remote closing can be made by energizing the closing coil (CC). Apply the rated voltage to the control terminals A1 and A2 and close the breaker.

■ 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

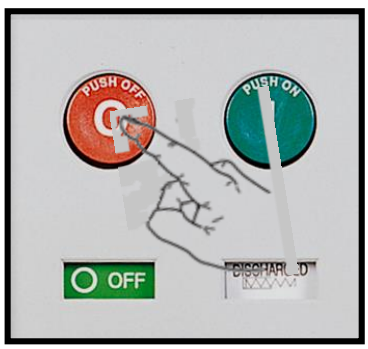
■ Draw-in operation procedure

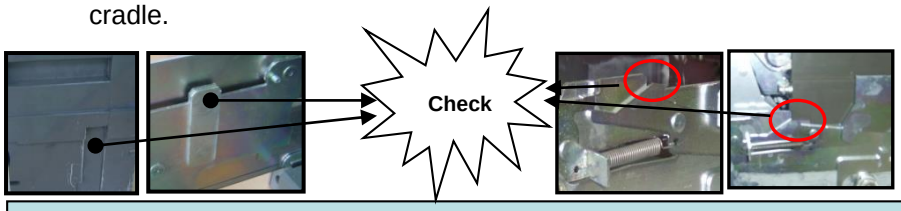


1. Pull the extension rails of cradle forward

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.

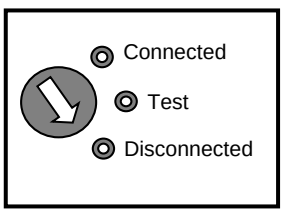
4. Keep pushing the OFF button when the circuit breaker in a trip condition, and insert a handle to the body of the circuit breaker.

I. Operation

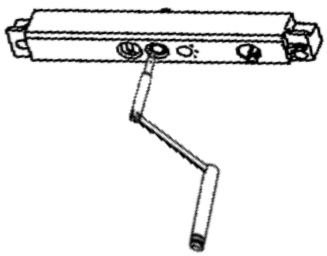
3. Draw-in operation

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.

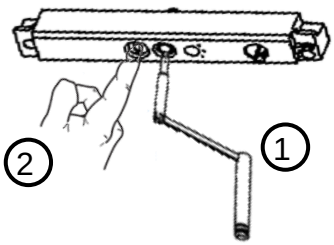
Disconnected position



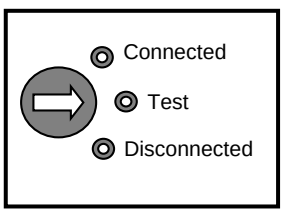
Lock



Release

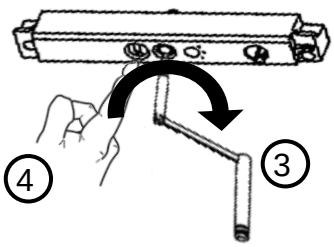


Tested position

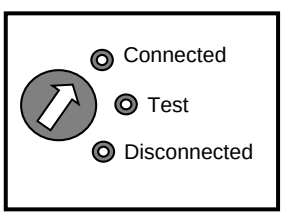


Release

Lock

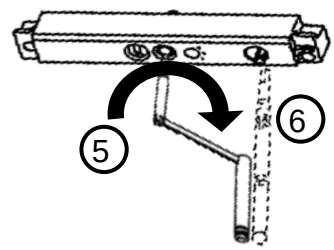


Connected position



Release

Lock

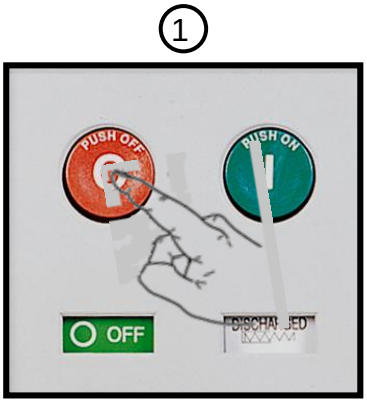


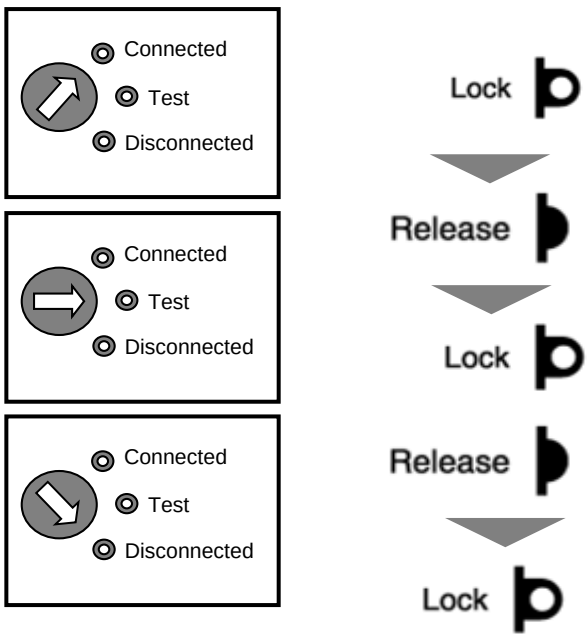
4. Draw-out operation

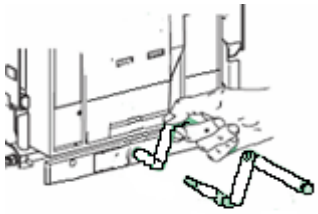
Caution
1. Please stop handle operation when draw in/out locking device protrudes.
2. Draw in or out by moving handle right or left side when draw in/out locking device can not be inserted.

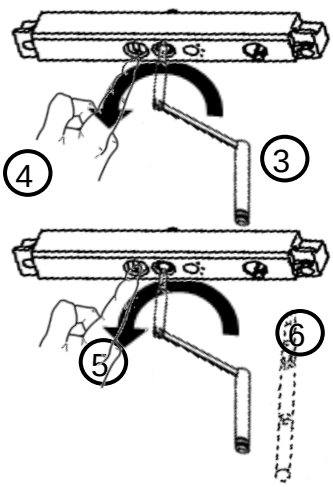
■ Draw-out operation procedure

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.







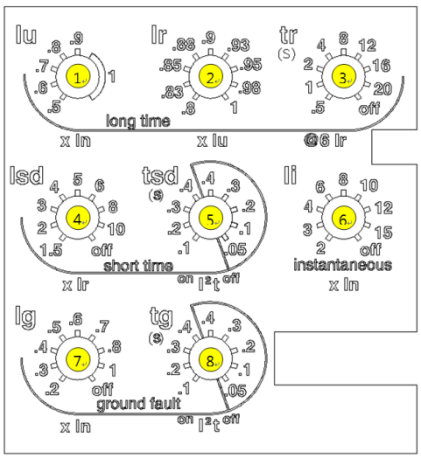


5. The circuit breaker indicated with ‘DISCONNECTED’ can be separated safely from the cradle by removing a draw in/out handle and releasing right and left locks.
6. Use a lifting hook to separate a circuit breaker from a cradle.

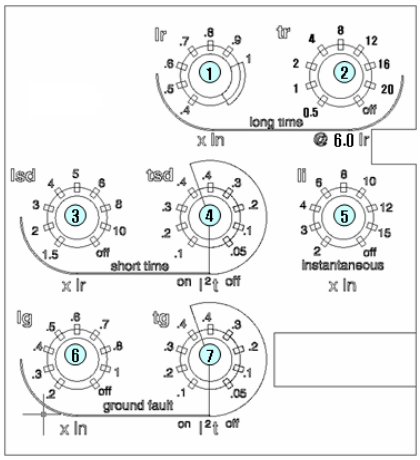
J. Trip relay externals and configuration

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	Iu	(0.5-0.6-0.7-0.8-0.9-1.0) × In
②	Long-time current setting	Ir	(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) × Iu
③	Long-time tripping delay	tr	(0.5-1-2-4-8-12-16-20-off), sec @ 6 Ir
④	Short-time current setting	Isd	(1.5-2-3-4-5-6-8-10-off)× Ir
⑤	Short-time tripping delay	tsd	I²t off : (0.05-0.1-0.2-0.3-0.4), sec I²t on : (0.1-0.2-0.3-0.4), sec
⑥	Instantaneous current setting	Ii	(2-3-4-6-8-10-12-15-off)× In
⑦	Ground-fault current setting	Ig	(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off)× In
⑧	Ground-fault tripping delay	tg	I²t off : (0.05-0.1-0.2-0.3-0.4) I²t on : (0.1-0.2-0.3-0.4)

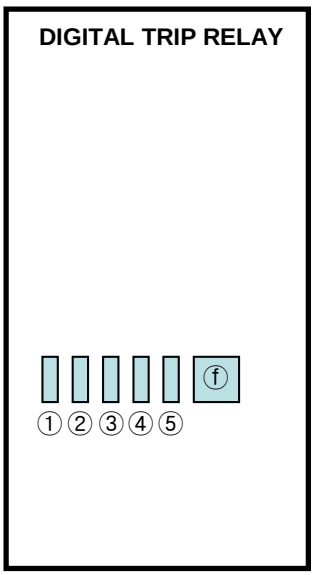
■ P,S type knob Information

No	Type of knob	Mode	setting step
①	Long-time current setting	Ir	(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 Ir
③	Short-time current setting	Isd	(1.5-2-3-4-5-6-8-10-off)× Ir
④	Short-time tripping delay	tsd	I²t off : (0.05-0.1-0.2-0.3-0.4), sec I²t on : (0.1-0.2-0.3-0.4) , sec
⑤	Instantaneous current setting	Ii	(2-3-4-6-8-10-12-15-off)× In
⑥	Ground-fault current setting	Ig	(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off)× In
⑦	Ground-fault tripping delay	tg	I²t off : (0.05-0.1-0.2-0.3-0.4) I²t on : (0.1-0.2-0.3-0.4)

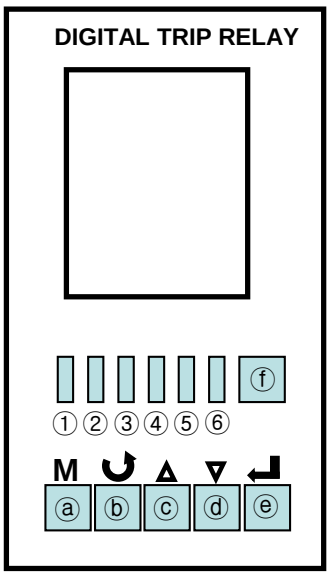
J. Trip relay externals and configuration

2. Key and LED configuration

■ N type key / LED



■ A, P, S type key / LED



■ LED Information

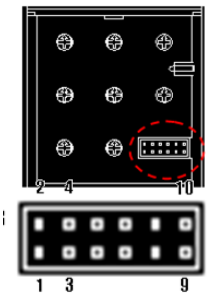
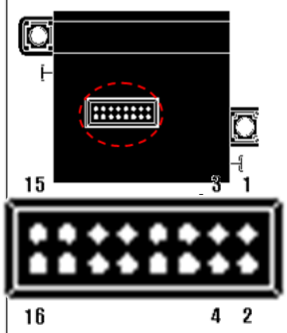
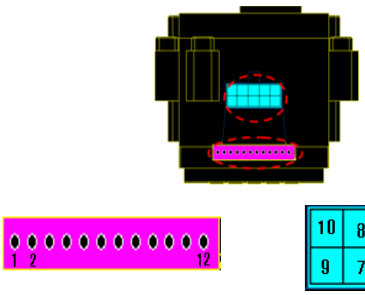
No	LED type	Operational mode
①	Alarm	LED Indicating an overload (Turn on above 90%, Blink above 105%)
②	Batt/SP	Self-Protection LED and Battery test LED
③	Ir	LED Indicating long-time tripping
④	Isd/Ii	LED indicating short-time or instantaneous tripping
⑤	Ig/I△n	LED indicating ground-fault or leakage tripping
⑥	COMM	LED indicating Communication(N type LED doesn't turn on)

■ Key Configuration

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

J. Trip relay externals and configuration

3. Connector

Division	CN1	CN2	CN3	CN4
Shape	Front 	Rear 	Top 	
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		Earth leakage (+)	
8	Current signal - N phase	MTD (-)	Earth leakage (-)	Common contact
9	GND 24V		Voltage - R phase	External source (+)
10	Current signal - Common		Voltage - S phase	External source (-)
11		Signal CT - R phase	Voltage - T phase	
12			Voltage - N phase	
13		Signal CT - S phase		
14		Signal CT - Common		
15		Signal CT - T phase		
16		Signal CT - N phase		

K. Trip relay setting

1. Protection

■ **N type**

Long time										
Current setting (A)	Iu = In×...		0.5	0.6	0.7	0.8	0.9	1.0		
	Ir = Iu×...		0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98	1.0
Time delay (s)	tr@(1.5×Ir)		12.5	25	50	100	200	300	400	500	Off
Accuracy: ±15% or below	tr@(6.0×Ir)		0.5	1	2	4	8	12	16	20	Off
100ms	tr@(7.2×Ir)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time										
Current setting (A) Accuracy: ±10%	Isd = Ir×...		1.5	2	3	4	5	6	8	10	Off
Time delay (s) @ 10×Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				
Instantaneous										
Current setting (A)	Ii = In×...		2	3	4	6	8	10	12	15	Off
Tripping time			below 50ms								
Ground fault										
Pick-up (A) Accuracy: ±10%(Ig>0.4In) ±20%(Ig≤0.4In)	Ig = In×...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1×In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

K. Trip relay setting

1. Protection

■ A type

Long time										
Current setting (A)	Iu = In×...		0.5	0.6	0.7	0.8	0.9	1.0		
	Ir = Iu×...		0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98	1.0
Time delay (s)	tr@(1.5×Ir)		12.5	25	50	100	200	300	400	500	Off
Accuracy: ±15% or below	tr@(6.0×Ir)		0.5	1	2	4	8	12	16	20	Off
100ms	tr@(7.2×Ir)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time										
Current setting (A)	Isd = Ir×...		1.5	2	3	4	5	6	8	10	Off
Accuracy: ±10%										
Time delay (s)	tsd	I^2t Off	0.05	0.1	0.2	0.3	0.4				
@ 10×Ir		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)	Ii = In×...		2	3	4	6	8	10	12	15	Off
Tripping time			below 50ms								
Ground fault										
Pick−up (A)	Ig = In×...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Accuracy: ±10%(Ig>0.4In)										
±20%(Ig≤0.4In)										
Time delay (s)	tg	I^2t Off	0.05	0.1	0.2	0.3	0.4				
@ 1×In		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				

Earth leakage (Option)										
Current setting (A)	Ig		0.5	1	2	3	5	10	20	30	Off
Time delay (ms)	tg	Alarm Time(ms)	140	230	350	800	950				
Accuracy: ±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)	Ir = In × ...		0.4	0.5	0.6	0.7	0.8	0.9	1.0	
Time delay (s)	tr@(1.5 × Ir)		12.5	25	50	100	200	300	400	500	Off
Accuracy: ±15% or below	tr@(6.0 × Ir)		0.5	1	2	4	8	12	16	20	Off
100ms	tr@(7.2 × Ir)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time										
Current setting (A) Accuracy: ±10%	Isd = Ir × ...		1.5	2	3	4	5	6	8	10	Off
Time delay (s) @ 10 × Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				
Instantaneous										
Current setting (A)	Ii = In × ...		2	3	4	6	8	10	12	15	Off
Tripping time			below 50ms								
Ground fault										
Pick-up (A) Accuracy: ±10%(Ig > 0.4In) ±20%(Ig ≤ 0.4In)	Ig = In × ...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1 × In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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)	Ig		0.5	1	2	3	5	10	20	30	Off
Time delay (ms) Accuracy: ±15%	tg	Alarm Time(ms)	140	230	350	800	950				
		Trip Time(ms)	140	230	350	800					

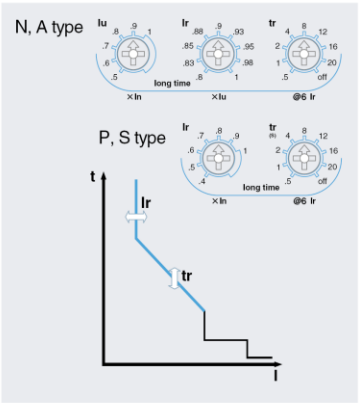
Note) Earth leakage function is available with ZCT or external CT

PTA(Pre Trip Alarm)										
Current setting (A)	Ip = Ir x ⋯		0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
Time delay (s) Accuracy: ±15%	tp@(1.2 × Ip)		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	±5%	1.2~40sec	0.1sec	±0.1sec
Over voltage		UV_Pick-up ~ 980V	1V	±5%			
Voltage unbalance		6% ~ 99%	1%	±2.5% or (*±10%)			
Reverse power		10~500 kW	1kW	±10%	0.2~40sec		
Over power		500~5000 kW	1kW	±10%			
Current unbalance		6% ~ 99%	1%	±2.5% or (*±10%)	1.2~40sec		
Over frequency	60Hz	UF_Pick-up ~ 65	1Hz	±0.1Hz			
	50Hz	UF_Pick-up ~ 55	1Hz	±0.1Hz			
Under frequency	60Hz	55Hz ~ OF_Pick-up	1Hz	±0.1Hz			
	50Hz	45Hz ~ OF_Pick-up	1Hz	±0.1Hz			

2. Operation characteristic

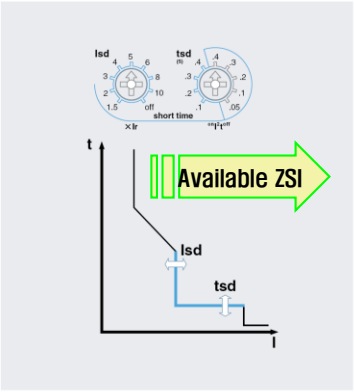
■ Long-time characteristic(L)



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) × In
   2) Setting range in N type and A type: (0.4 ~1.0) × In
      - Iu: (0.5-0.6-0.7-0.8-0.9-1.0) × In
      - Ir: (0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) × Iu
2. Time delay setting knob: tr
   - Standard operating time is based on the time of 6 × 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) × Ir flows in, relay is picked up.
4. Relay operates basing on the largest load current among R/S/T/N phase.

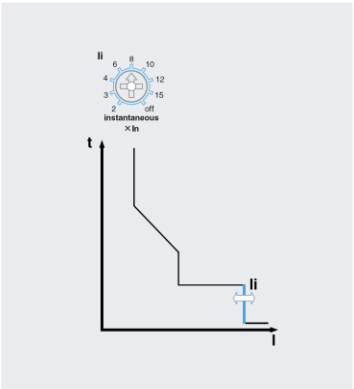
■ Short-time characteristic(S)



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) × Ir
2. Time delay setting knob: tsd
   - Standard operating time is based on the time of 10 × Ir.
   - Inverse time (I^2t On): 0.1-0.2-0.3-0.4 sec
   - Definite time (I^2t 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 characteristic(I)

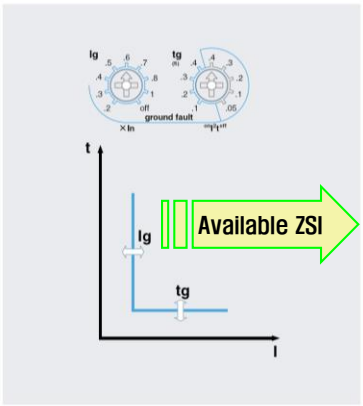


The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.

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

2. Operation characteristic

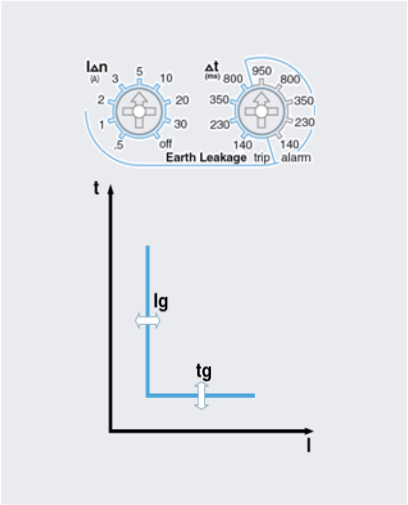
■ Ground fault characteristic (G)



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^2t On): 0.1-0.2-0.3-0.4 sec
   - Definite time (I^2t 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)

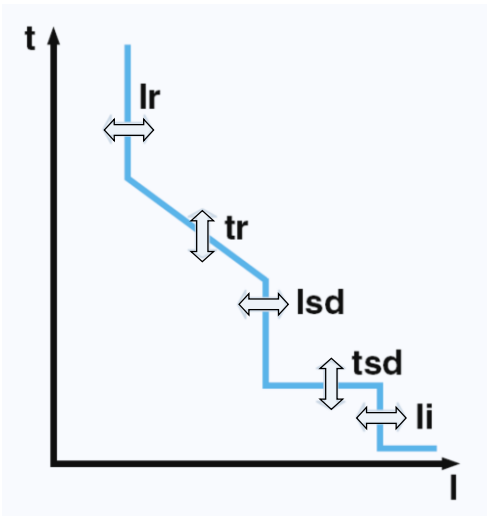
■ Earth leakage characteristic (G) - Option

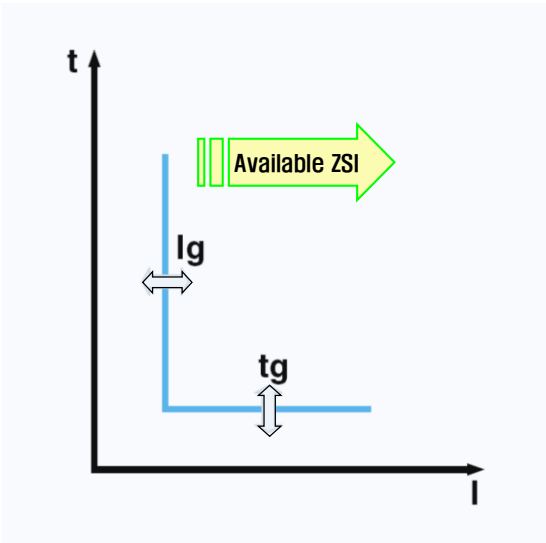


The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)

1.Standard setting current Knob : IΔn
 (1) ZCT provided Susol 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 : Δt
  - Trip time : 140-230-350-800ms
  - Alram time : 140-230-350-800-950ms
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.



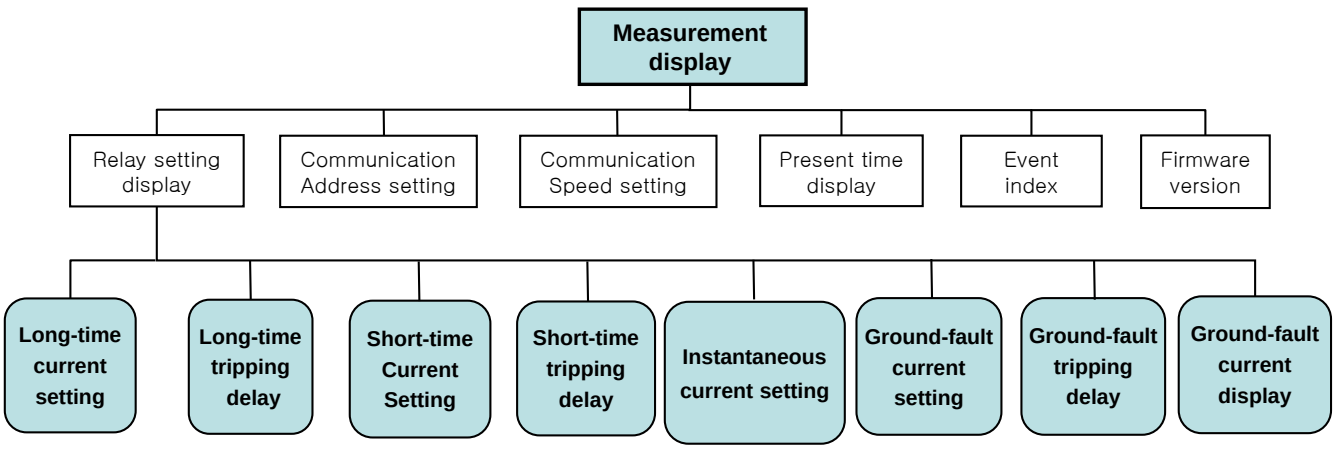


L. The operation of A type trip relay

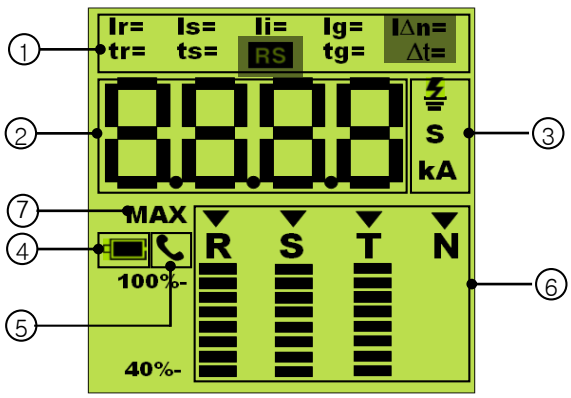
1. Menu tree

Caution

- Each movement within Menu Tree can be done by using 'Menu' and 'ESC' button.
- Use UP(△)/Down(▽) button to move around each setting information under Relay setting display.
- If not pressing any button for 90seconds after moving to other screens, the screen moves back to Measurement Display and any relevant data will not be saved.



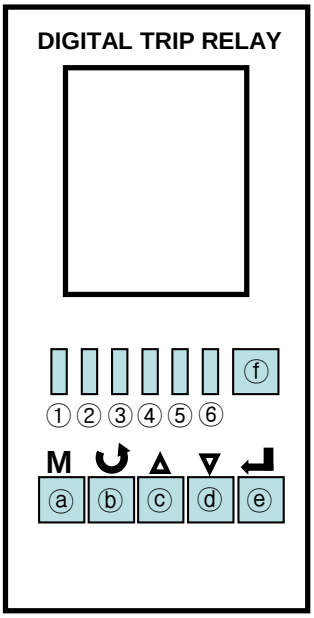
2. LCD segment



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
⑦	Segment which displays the phase having the biggest current value - Each phase current appears at one-second intervals. - When the phase having the biggest current value appears, MAX segment displays.
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

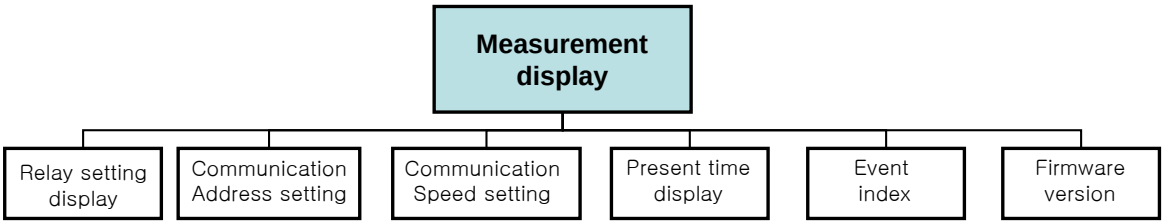
3. Button configuration

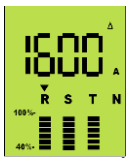


Caution

- After 90 seconds under Idle condition, it moves back to Measurement Display page. And data doesn't save.
- 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.

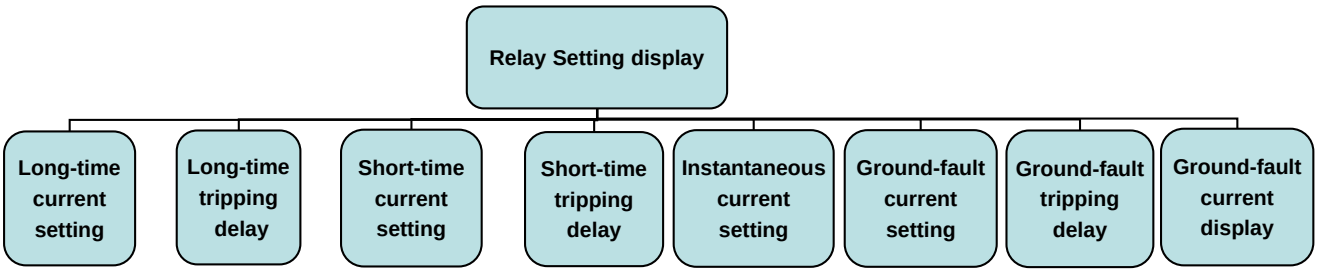
4. Measurement display

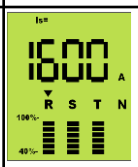
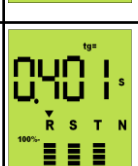
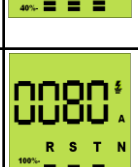


Display	Button	Contents
		1. The current of R, S, T, N phase are displayed in rotation at 3 second interval. 2. At this very moment, the inverted triangle is moving sideways from left to right to show which phase is being displayed on LCD currently. 3. Bar graphs represent each phase's load rate in scale (40%~110%).
	↻	1. 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.
	↻ △ ▽	1. The phase which will be displayed exclusively can be selected by pressing ' Up / Down' button.

L. The Operation of A type trip relay

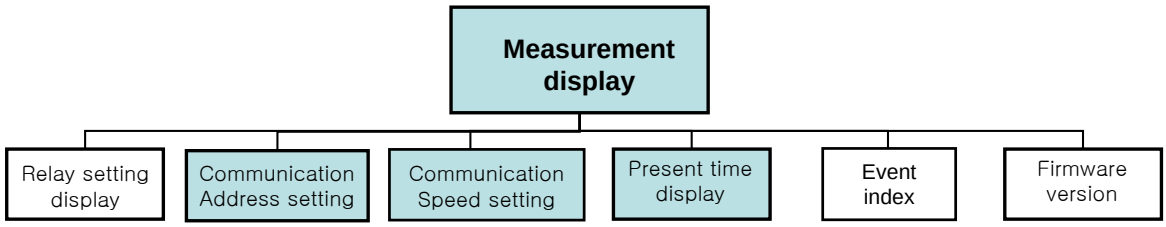
5. Relay setting display– Long-time delay, Short-time delay

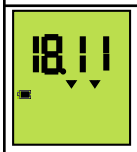
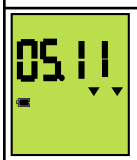


		Display	Button	Contents
Long-time	current		M ▲ ▼	1. If pressing 'MENU' button once from its normal Measurement display will switch to the screen that displays relay setting values. 2. An initial screen of Measurement Setting Display is arranged for long-time delay current setting, and other setting values can be seen by pressing 'Up/Down' button. 3. On the upper left of the screen "Ir =" is displayed
	delay time		M ▲ x 1	1. If pressing 'Up' button once from the Relay setting Display, the setting value of long-time tripping delay will be displayed. 2. On the upper left of the screen "tr=" is displayed.
short-time	current		M ▲ x 2	1. If pressing 'Up' button two times on the Relay setting display, the setting value of short-time current setting value will be displayed. 2. On the top of the screen "Is=" is displayed.
	delay time		M ▲ x 3	1. If pressing 'Up' button three times on the Relay setting Display, the setting time of short- time tripping delay will be displayed. 2. 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. 3. On the top of the screen "ts=" is displayed.
Instantaneous	current		M ▲ X 4	1. If pressing 'Up' button four times on the Relay setting Display, Instantaneous current setting value will be displayed. 2.On the top of the screen "Ii=" is displayed.
ground fault	pick up		M ▲ X 5	1. If pressing 'Up' button five times on the Relay setting Display, Ground-fault current setting value will be displayed. 2On the top of the screen "Ig=" is displayed.
	tripping delay		M ▲ X 6	1. If pressing 'Up' button six times on the Relay setting Display, the setting value of Ground- fault tripping delay will be displayed. 2. At this time, one larger value than the initial one will be displayed because LSB of time setting value is set in case of I^2t is On. For example, if it is of I2t 0.400sec on setting, 0.401 will be displayed. 3.On the top of the screen "tr=" is displayed.
	current delay		M ▲ X 7	1. If pressing 'Up' button seven times on the Relay setting Display, the setting current of ground fault will be displayed. 2. 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

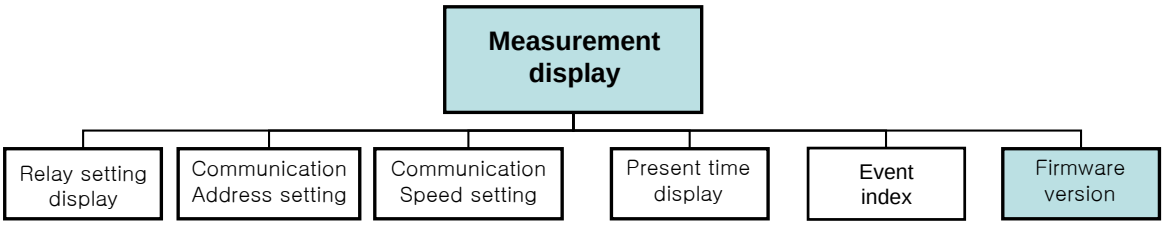
6. Relay setting display



Display			Button	Contents
Communication	Address		M x 2 ▲▼	1. If pressing 'MENU' button 2 times from the measurement display, move to Communication Address setting screen. 2. Communication Address can be set from 1 to 247. 3. If pressing 'Up' button short, Address increases by 1. 4. If pressing and holding 'Up' button, Address increases by 10.
			↵	1. Press 'Enter' button to save the setting, otherwise press 'ESC/RESET' button to move back to Measurement display. 2. 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 ▲▼	1. If pressing 'MENU' button 3 times from measurement display screen, move to Communication speed setting screen. 2. Communication speed can be set through Baud rate 38400 / 19200 / 9600. 3. If pressing 'Up / Down' button, the value of Baud rate rolling over will be displayed
			↵	1. Press 'Enter' button to save the setting, otherwise press 'ESC/RESET' button to move back to Measurement display. 2. 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.
Time	View		M x 4	1. If pressing 'MENU' button 4 times from Measurement display, move to present time display. 2. The present time is displayed with 'hour' and 'minute' by 24H type and dot between hour and minute turns on and off every second. 3. 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'.
	Set-up		↵	1.If pressing 'Enter' button once from time display, move to set-up time display. ①▼▼ : It's on the left and year/month will be displayed.(February/2013) ②Change using Up/Down button on the year setting mode, and then put 'Enter' button to switch to month setting mode.(User can change between 2000 to 2099. 20 is clipped) ③Change using Up/Down button on the month setting mode, and then put 'Enter' button to switch to day setting mode.(User can change between 1 to 12.)
			↵ x 3	④▼▼ : It's on the center and day/time will be displayed.(18th/11 hour) ⑤Change using Up/Down button on the day setting mode, and then put 'Enter' button to switch to hour setting mode.(User can change between 1 to 31. Leap year/month is not existed.) ⑥Change using Up/Down button on the hour setting mode, and then put 'Enter' button to switch to minute setting mode.(User can change between 0 to 23.)
			↵ x 5	⑦▼▼ : It's on the right and minute/second will be displayed.(5 minutes 11 seconds) ⑧Change using Up/Down button on the minute setting mode, and then put 'Enter' button to switch to second setting mode.(User can change between 0 to 59 both minute and second) ⑨If user press 'Enter' button on the second mode, time is saved in the RTC and then, user can see 'SAVE' one second and the initial screen will be returned. ⑩If user press reset button, time isn't saved and the initial screen will be returned.

L. The operation of A type trip relay

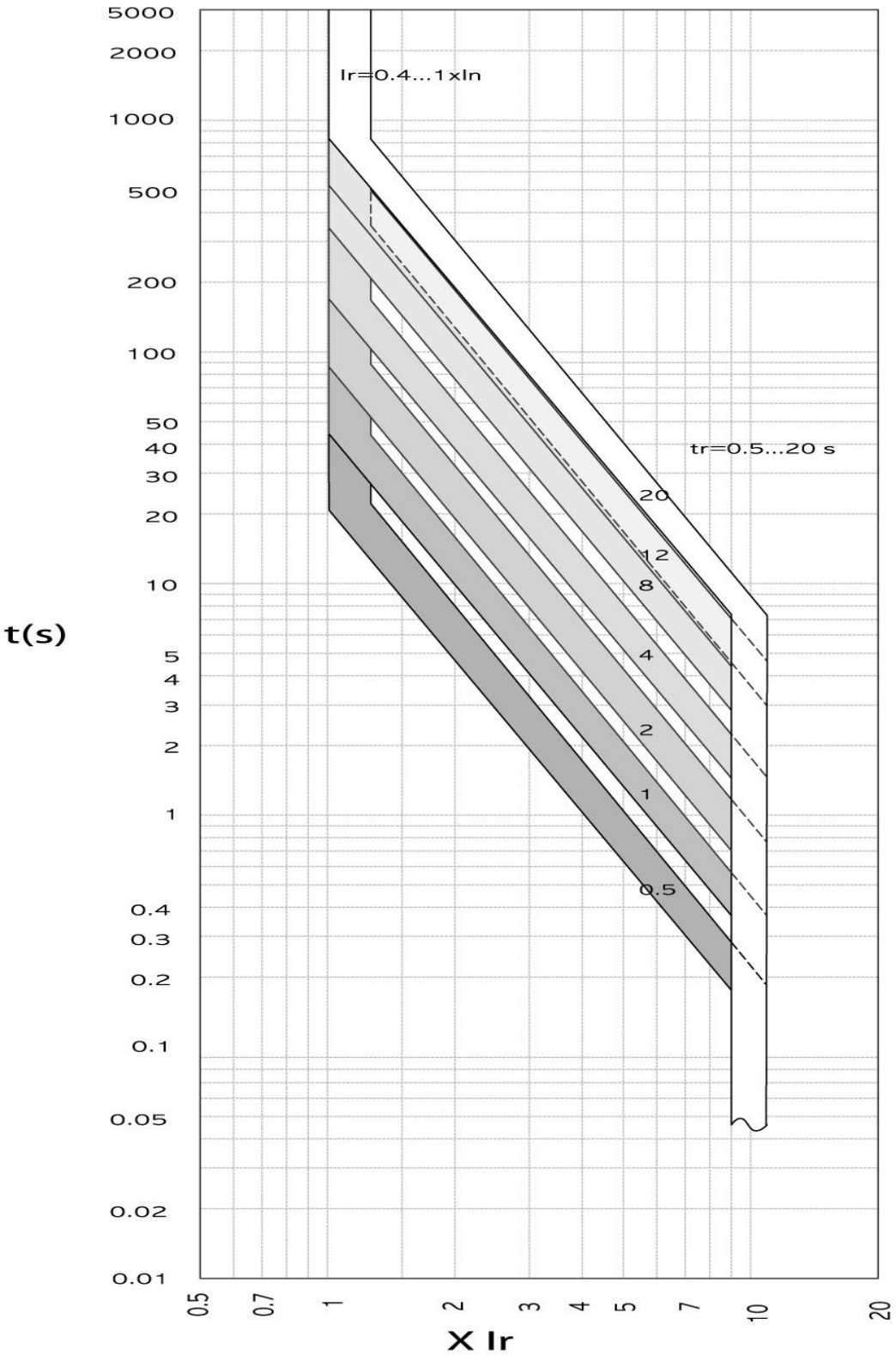
6. Relay setting display



Display		Button	Contents
Event		M X 5	1. If pressing 'MENU' button 5 times from Measuring display, move to Event Index. 2. 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.
			1. "Ii=" : Fault : long time/short time/instantaneous/ground fault 2. "1600A" : fault current 3. "▼" : Fault phase : R, S, T, N 4. ACB OCR N / A type can save 10 events and Event Index indicates events order. 5. When displaying the latest event, only one Segment will be showed on the Event Index and if pressing 'Up' button, Segment will be increased and the former saved event will be displayed.
			1. If there is no data in Event Index, "Empty" will be displayed.
		↵	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	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	1. If pressing 'Enter' 3 times, the information of minute/second will be displayed. ⑦ : The current screen is to indicate "12 minutes 51 seconds". 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

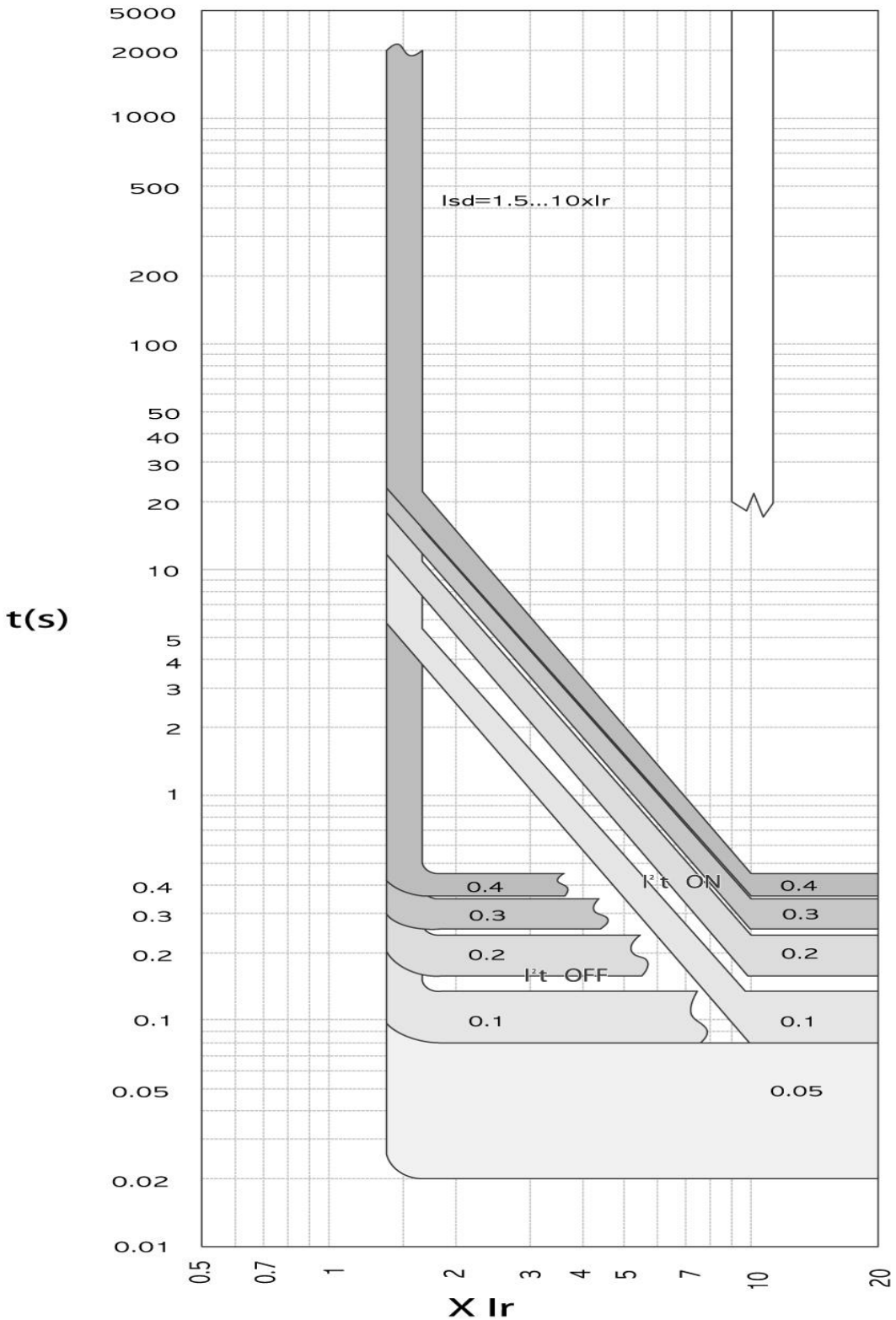
M. Tripping curves

1. Long-time protection

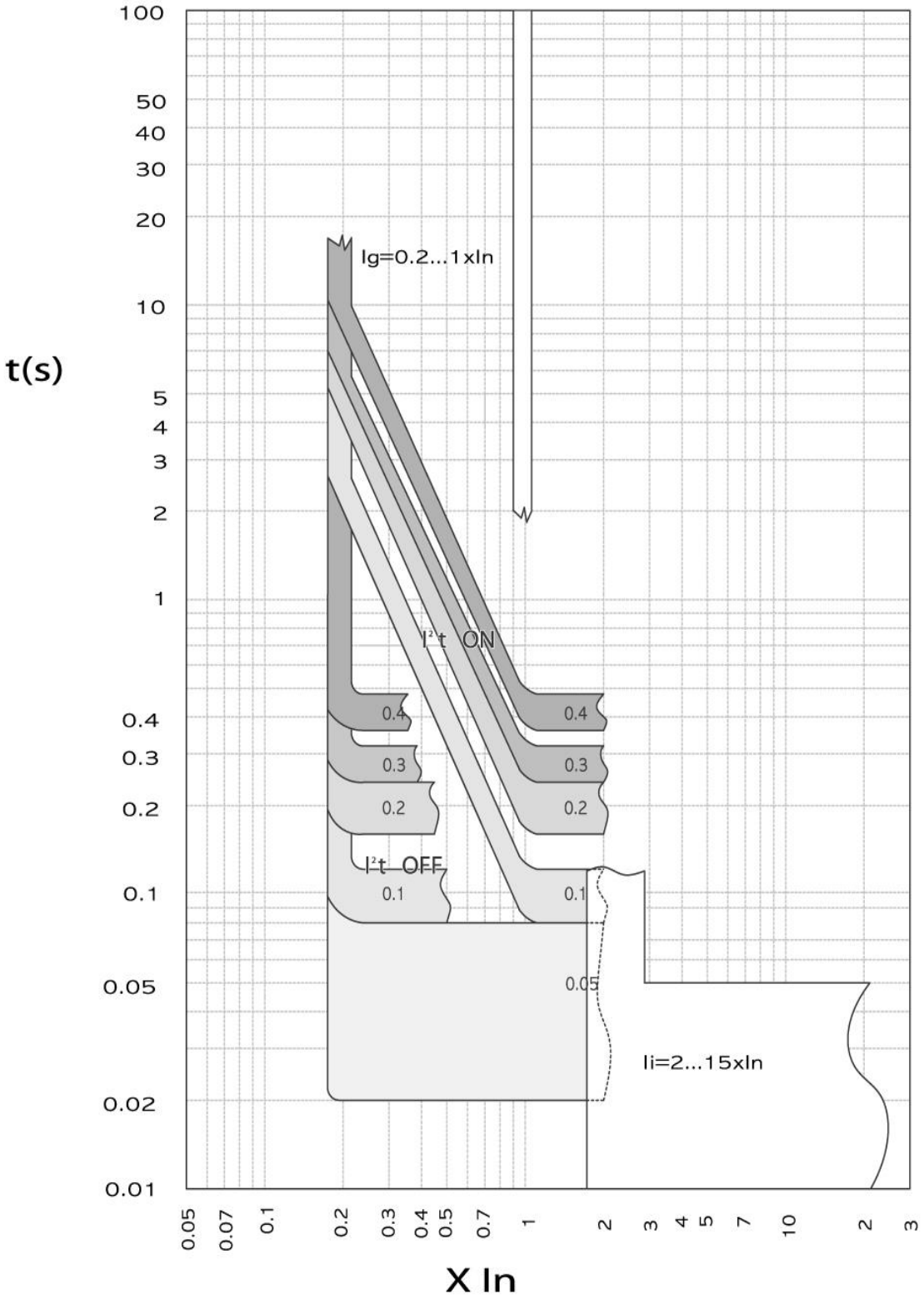


M. Tripping curves

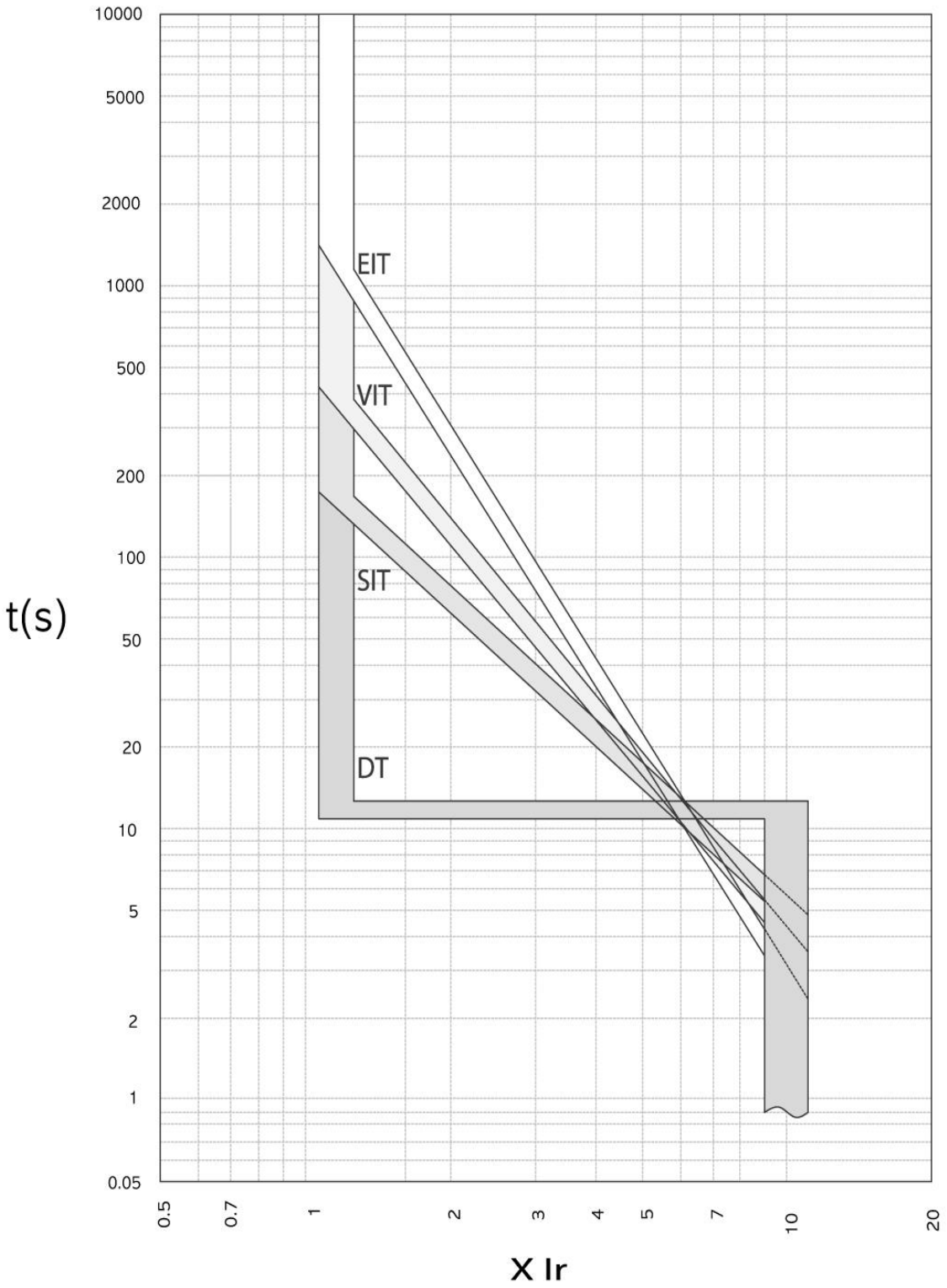
2. Short-time protection



3. Instantaneous / Ground-fault protection



4. IDMTL


10000
5000
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SIT
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0.5
0.7
1
2
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4
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7
10
20
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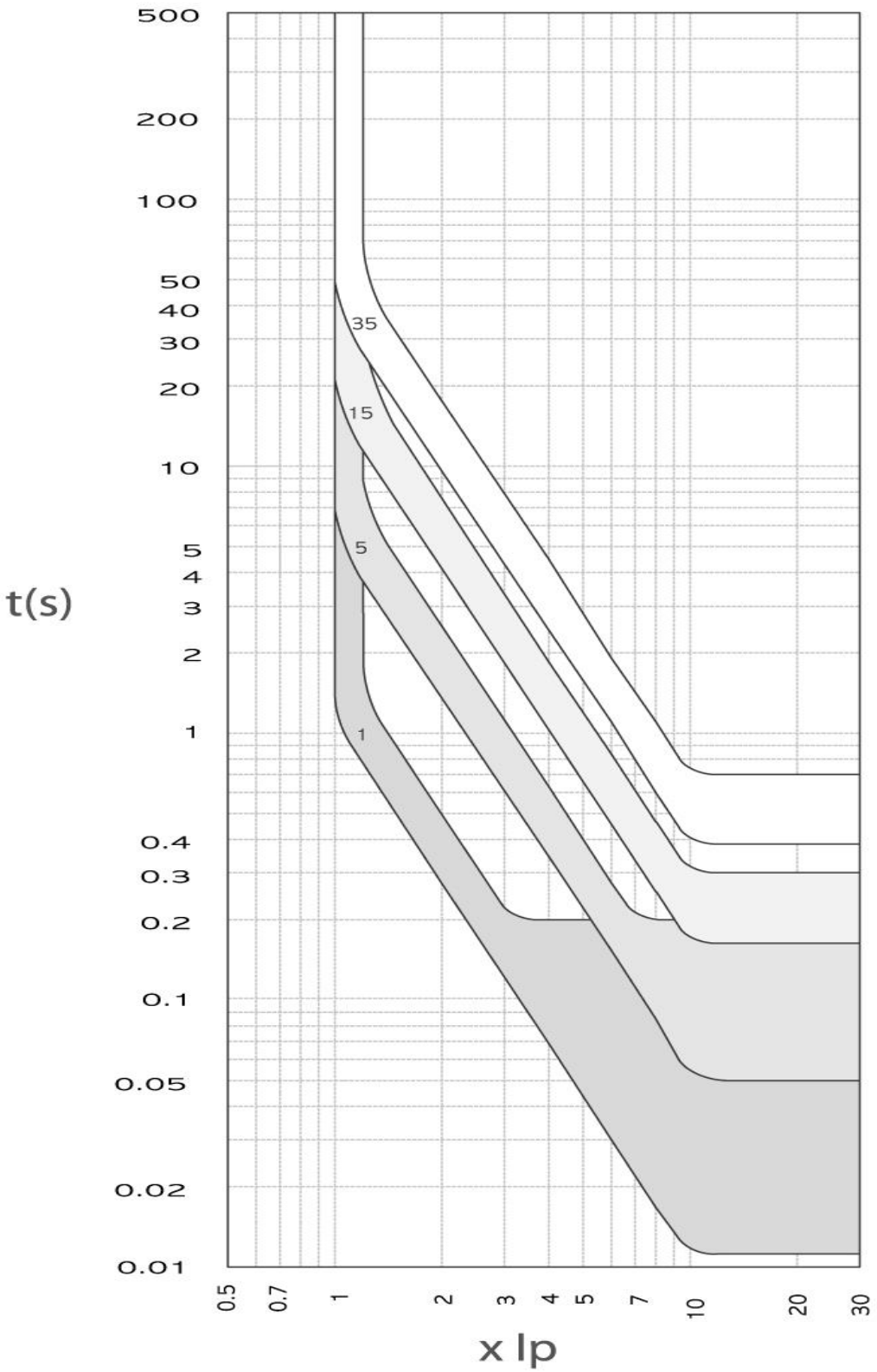
5. Pre trip alarm

■ 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	Replacement cycle
General environment for a use	Location with clean & dry air	Electrical rooms with dust proof & air-conditioner	Once every 2 years when operating after installation under the usage environment over 70 times	Within approx. 10 years
	Indoor location with little dust Location without corrosive gases	Distribution panel or individual electrical room without dust proof & air conditioner		
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 when operating after installation under the usage environment over 70 times	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

*** Add grease to every operational part at every maintenance cycle**

N. Inspection and troubleshooting

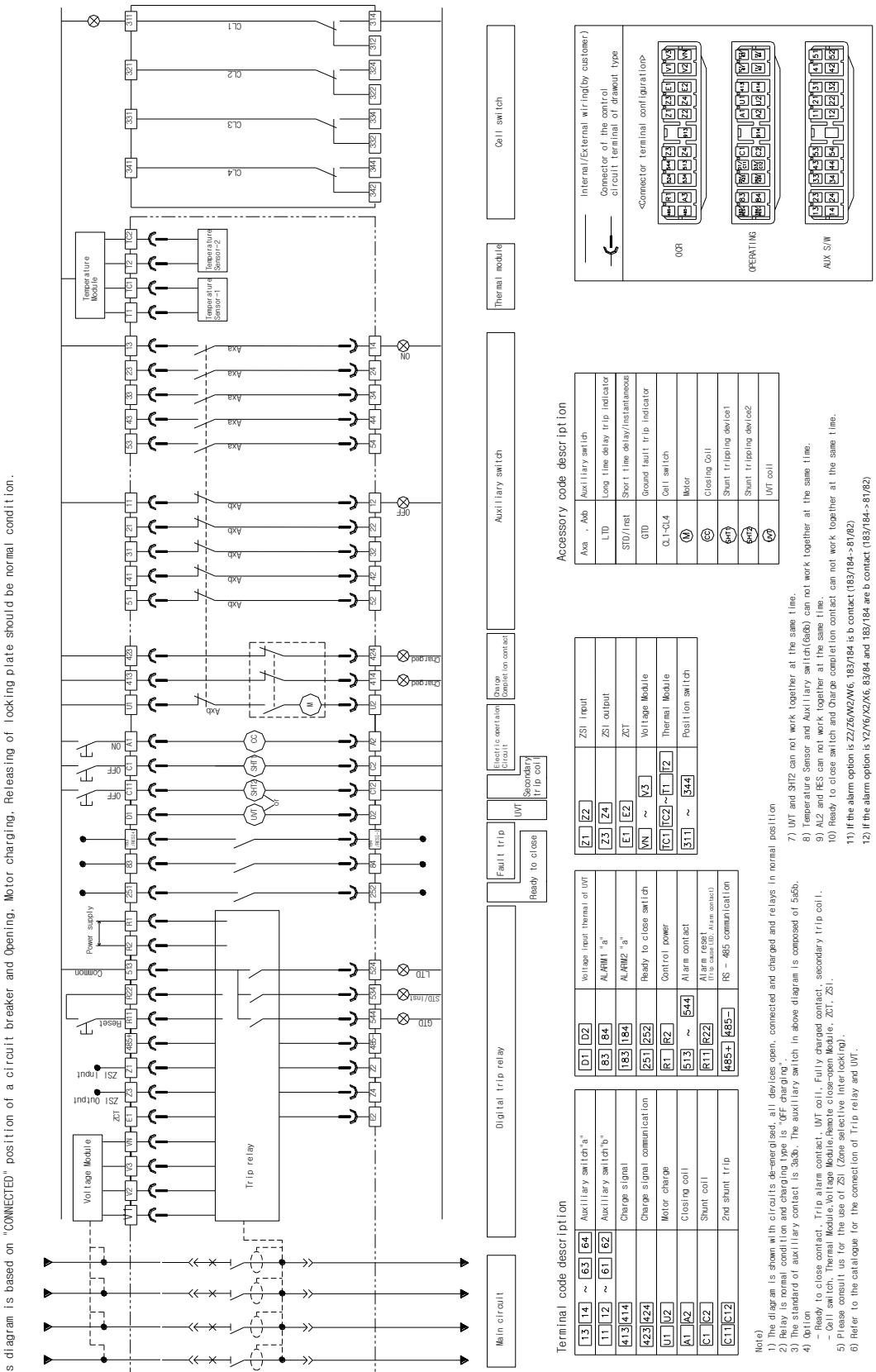
2. Defects and troubleshooting guideline

■ 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.	1. Check voltage. Replace damaged UVT.
	2. Voltage disturbance occurred to the trip device.	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	1. Remove cause; Check condition of breaker before re-closing.
	2. Excess current is too high at closing operation.	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	1. Check voltage supply. (0.7~1.1Vn)
	2. Defect on UVT circuit	2. Replace UVT.
OPEN operation does not work manually.	1. Damage on the mechanism	1. Contact AS center.
	2. Deposition of main circuit.	2. Contact AS center.
Breaker does not close neither manually nor remotely.	1. Closing operation at state of short-circuit.	1. Remove cause; Check condition of breaker.
	2. Fault Trip Reset button does not reset.	2. Reset Fault Trip Reset button.
	3. Unstable draw-in/out state of the product.	3. Check product's draw-in/out state.
	4. Anti-pumping function	4. Re-operate after removing power of the closing coil.
	5. Closing spring of breaker is not charged.	5. Check power supply of the charging motor. Check if manual charging works. Contact AS center or replace charging motor if necessary.
	6. Power supply problem of the closing coil.	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. Power supply problem of the trip coil.	7. Remove power supply of the trip coil.
	8. Insufficient power supply of the UVT or defect.	8. Apply voltage (V>0.85Vn) to the auxiliary switch and try closing operation using the closing coil.
	9. Locked state of the breaker under open position	9. Check if the closing error state is normal.
	10. In case breaker is interlocked.	10. Release interlock.
Closes manually but does not close from remote.	1. Inappropriate voltage supply of the closing coil.	1. Check voltage supply of the closing coil. (0.85~1.1Vn)
	2. Defect of the closing coil's open circuit.	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.	1. Insert while pressing Open button.
	2. Under Padlock or interlock	2. Remove padlock or interlock.
	3. Not putting the product into the cradle securely.	3. Push product into cradle securely.
Breaker does not get drawn out.	1. Crank handle is inserted.	1. Remove crank handle.
	2. Breaker is not in Disconnected position.	2. Draw out to the Disconnected position completely.
	3. Under Padlock or interlock	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.	1. Check if cradle fits with main frame.
	2. Inappropriate position of the cluster.	2. Move cluster to the right position.
	3. Safety shutter is under interlock.	3. Remove interlock.

O. Wiring diagram of control circuit

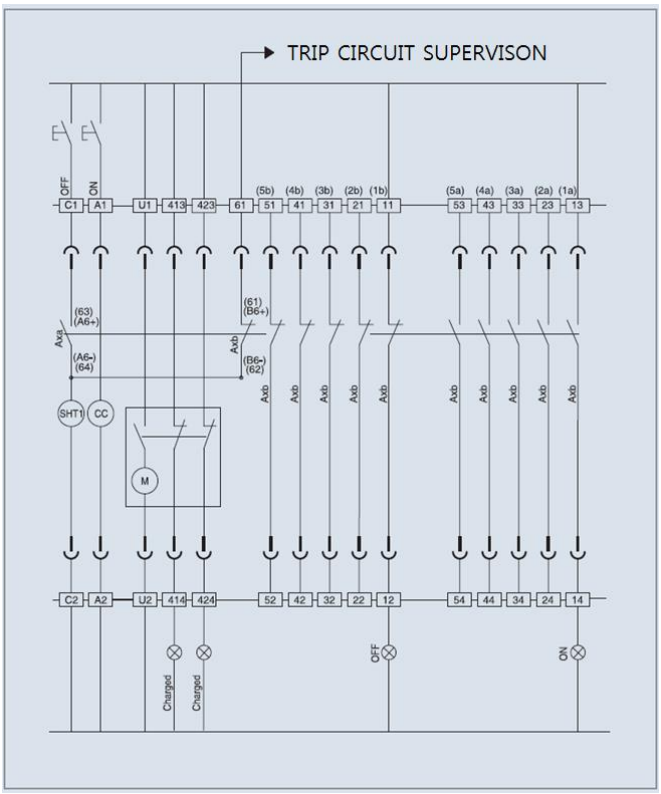
1. Wiring diagram



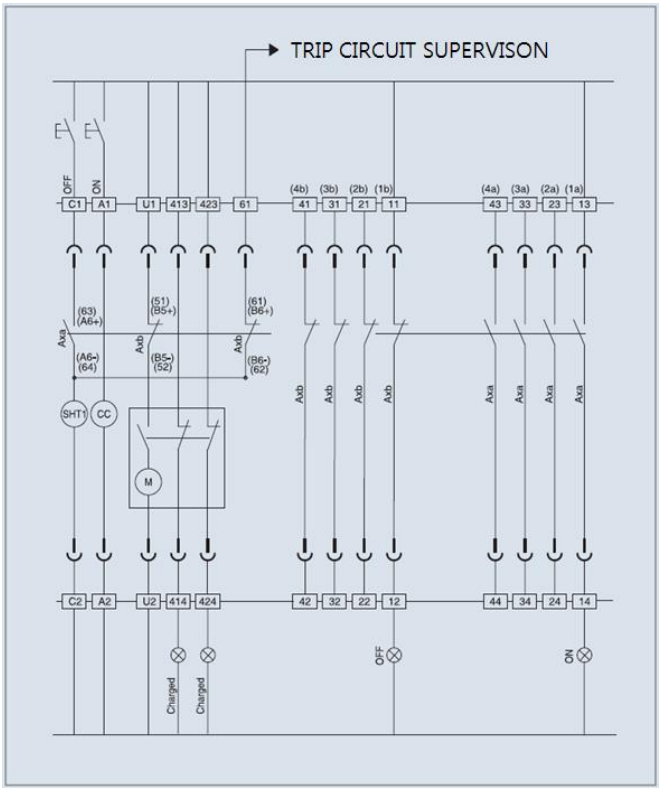
O. Wiring diagram of control circuit

1. Wiring diagram

■ TC(On Charge) ‘5a5b’



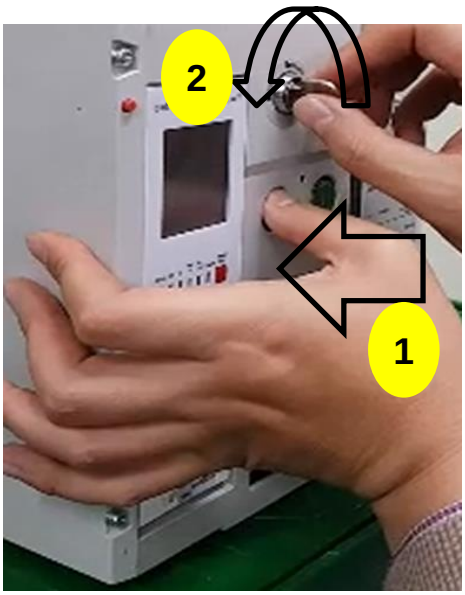
■ TX(Off Charge) ‘4a4b’



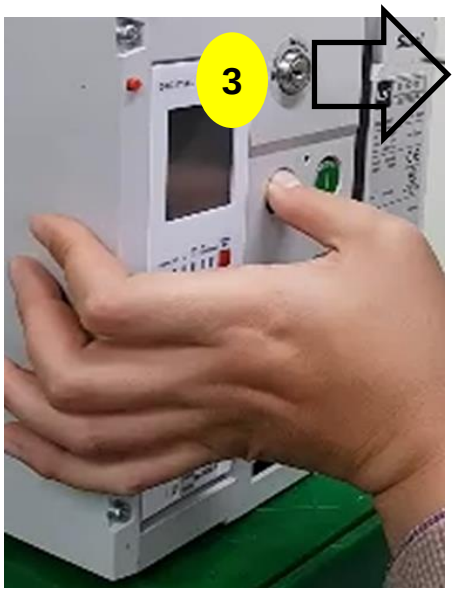
P. Other operation

1. KEYLOCK operation

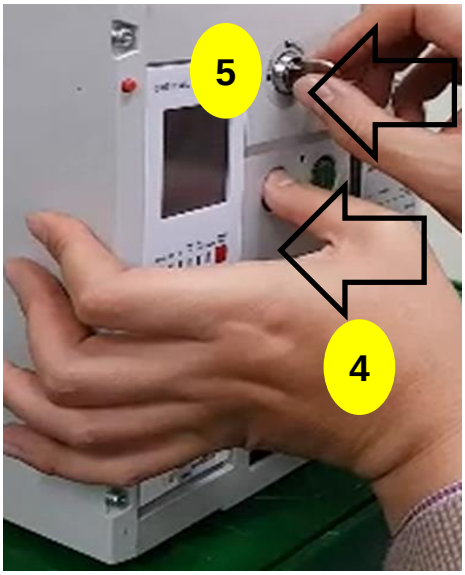
Keylock is used to prevent unintentional closing operation of the ACB by user. When the ACB is in the operation state, the ACB can operate the On/Off operation with plugged the key. If the ACB is locked, the key is unplugged and the closing operation is not possible.



➢ **Turn the key CCW with keeping after pushing the off button**



➢ **When the key is rotated to lock position, remove the key with pulling it**



➢ **Push the off button and Insert the key**

➢ **Turn the key slightly to the lock position and Turn to the opposite direction.**

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