



# Molded Case Circuit Breakers

# **Technical Materials**

(Handling & Maintenance)



# Contents

A Overview	1
B Structure and Operation	
C Trip Units	17
D Installation	
E Optional accessories	61
<b>F</b> Handling and Maintenance	

# Upgrade of Meta-MEC series ... **SUSO** series low voltage circuit breakers



- Compatible and differentiated design
  - Compatible with the Meta-MEC
  - Outlook differentiated design
- Same External dimension with MCCB and ELCB
- Upgrade the coordination
- Upgrade the coordination with Susol / Meta-MEC mass capacity
- Upgrade breaking capacity
  - E100AF: 10 ➡ 18kA
  - S125AF: 25 🔿 37kA
  - S250AF: 25 ➡ 37kA - H250AF: 35 ➡ 50kA
  - 11230AI . 33 30KA
- Ics = 100% Icu
- External differentiated Design



1. Standards & Approvals	2
2. The scope of Susol MCCB	3
3. The structure of Susol MCCB	4
4. Markings	5
5. Type names & Ordering information	6

# **Overview**

# 1. Standards & Approvals

# Susol TD and TS series circuit breakers comply with the following international standard.

# • IEC 60947-1

Low-voltage switchgear and controlgear - Part 1: General rules

# • IEC 60947-2

Low-voltage switchgear and controlgear - Part 2: Circuit-breakers

The following certificates are available upon a request.

- Certificate of conformance test CB (KEMA IEC 60947)
- Test report (KEMA)
- Certificate of conformance test CCC (China)
- Marine certificates (LR, DMV, ABS, KR)

### LS Susol TD and TS MCCB (TD, TS series) are certified from following shipping registers.

- LR Lloyd's Register of Shipping British shipping register
- DMV Det Norske Veritas- Norway shipping register
- ABS American Bureau of Shipping American shipping register
- KR Korean Register of shipping

# CE conformance marking

The CE Marking indicates that a product complies with the requirements of the applicable European Directives. These Directives for products set out essential requirements which must be met before products may be marketed or traded within the European Economic Area. Thus, a displayed CE Marking indicates that a product complies with the applicable Directives.



CE

Susol

LS

Α

Susol MCCB Technical Manual

# 2. The scope of Susol MCCB

	Main switchboard	Sub swit	Final distribution	
Type of circuit breakers	ACB	MCCB	MCCB	MCB
Rated current, In	630~5000A	16~800A	3~1600A	1~125A
Breaking capacity, Icu	65~100kA	50~150kA	5~85kA	1. 5~10kA
	(Rated using voltage 415/480V)	(Rated using voltage 415V)	(Rated using voltage 415V)	(Rated using voltage 220V)
Applied standard				
Utilization category	IEC 60947-2	IEC 60947-2	IEC 60947-2	IEC 60947-2
Image of circuit breaker	В	A	A	A
Brand name	Ace-MEC	Susol	Meta-MEC	Meta-MEC
Model name	LBA series	TD, TS series	AB, GB series	BK series

# The range of Susol MCCB

Susol TD series is in the range of 16 160A and Susol TS is in the range of 40 800A 16~40~800A.



3

TS400/630

# **TS800**

In 700, 800A Icu: 65kA(N), 100kA(H), 150kA(L) lcs=lcu 210(W) x 320(H) x 135mm(D)

# 3. The structure of Susol MCCB

# Breaking capacity of types and frame sizes

Br ca Ics=Icu	eaking pacity at 415VAC	100AF	160AF	250AF	Breaking capacity Ics=Icu at 415VAC		400AF	630AF	800AF
N type	150kA	TD100L TS100L	TD160L TS160L	TS250L	N type	150kA	TS400L	TS630L	TS800L
H type	85kA	TD100H TS100H	TD160H TS160H	TS250H	H type	85kA	TS400H	TS630H	TS800H
L type	50kA	TD100N TS100N	TD160N TS160N	TS250N	L type	50kA	TS400N	TS630N	TS800N

The accessories of Susol MCCB



Α

# 4. Markings

# Markings

	Product name: MCCB
	Terminals for power source     Mounting hole     Standard
	Closed (ON) position
	Brand name
220/240 - 200 kA 380/415 - 150 kA 440/460 - 130 kA 480/500 - 85 kA 660/690 - 20 kA 250 - 100 kA tcs = 100% tcu	Handle (ON/OFF)
	Open (OFF) position
LS Industrial Systems	Company logo
MADE IN KOREA	Trip test button
10 ATU 0.9    7 4 250A	N I I I I I I I I I I I I I I I I I I I
	The rated current of trip unit
Ir (xin) ir im im (xin)	inp unit
•	Mounting hole
	Terminals for load side
TS 2501 .	Frame type of circuit breakers
IS ZOUL	- N: Normal, H: High, L: Current Limiting
Ui 750V Uimp 8kV	Frame type of circuit breakers
Ue(V) Icu(kA)	- N. Normal, H. High, L. Current Limiting
220/240 ~ 200 kA	
$380/415 \sim 150 \text{ kA}$ $440/460 \sim 130 \text{ kA}$	
480/500 ~ 85 kA	
660/690 ~ 20 kA	
Ics = 100% Icu	los: rated service breaking capacity. Icu: ultimate breaking capacity
50/60Hz	50/60Hz: Rated frequency, 3P: 3poles, 40°C: Manufacturing company
IEC 60947-2 Cat.A •	Utilization category
LS Industrial Systems	Manufacturing company
	Origin place

# **Overview**

# 5. Type names & Ordering information

# For protection of power distribution & control device (Trip unit: FTU, ATU, FMU, ETS, ETM)



# For motor protection (Trip unit: MTU)

There is no function for overload protection and it is adjustable - magnetic type which can be set by the characteristic of inrush current of motor. The main frame of circuit breakers is same as the standard model. (Line and load protection type)



# For disconnecting switches (Trip unit: DSU)

It only has a function of switching without protection function even though it has a same appearance with circuit breakers.



# B Structure and Operation

1. Basic function of MCCB	10
2. The structure of MCCB	11
3. The operation & condition of MCCB	16

# Structure and operation

# 1. Basic function of circuit breakers

# The basic functions of MCCB

MCCB is for preventing the accident in advance by protecting the lode and cable from the faulty current.

#### 1. Instantaneous trip

When short-circuit current flows in, MCCB trips instantly. It is called instantaneous trip.

# 2. Overload trip (Time-delay trip)

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

# 3. Non-trip at starting current

When starting up the motor, the high current flows in, but MCCB should not trip at it.



▶ The function of MCCB is up to three conditions specified above.

# 2. The structure of MCCB

# Preview

Susol MCCB is consisted of switching mechanism, trip device, contacts, arc distinguishing part, terminals and molded case for supporting the parts listed before.





# Structure and operation

# 2. The structure of MCCB

#### 2. Operating mechanism

# 2.2.1. Operating mechanism according to ON, OFF

Operating mechanism is for breaking and switching circuit breakers by delivering the operating force on moving contact There are two kinds of operating mechanism One is called "Quick Make Quick contact. mechanism. Break" and another is called "Slow Make Quick Break".

- (1) Quick Make Quick Break operation is normally called "Quick Make" which makes operating spring move by the ON/OFF operation of handle and it makes Toggle Link comes back to operate the moving contact which is connected to multiple poles. It is usually adapted to the large size of circuit breakers as it has a high performance in welding-proof of contacts and breaking of loads.
- (2) Slow Make Fast Break operation is normally called "Slow Make" as operating speed depends on the operator. However, it trips at over current regardless of handle operation and automatically reset after trip. Therefore, it is usually adapted to circuit breakers which have small frame sizes for the convenient operation such as home distribution panel.

#### 2.2.2. Operating mechanism

ON, OFF, and TRIP condition of circuit breakers are shown in fig 2.2. When handle is moving from ON to OFF position, Main Spring pass over the dead point of Toggle Link and finally circuit breakers are tripped rapidly. Same closing operation is applied when handle is moving from OFF position to ON position. The trip operation due to over current is occurred by trip units such as Bi-Metal, electromagnetic and ODP. Bracket rotating makes Cradle of trip mechanism released and then Toggle Link passes over dead point due to Spring operation and then it makes contacts open automatically. The trip condition keeps handle staying in the middle of ON and OFF position to indicate the successful breaking of over current. In addition, even if handle is curbed in ON position, trip operation is freely occurred by over current as automatic trip operation has a structure of "Trip-Free".

In case of circuit breakers with multi poles, each pole should be insulated electrically from the Case and contact should be fixed at Cross Bar with insulating materials. This Cross Bar can be closed or broken at the same time as it is connected to operating mechanism. Susol circuit breakers has RTA technology which keeps the contact pressure stable through the optimized Cam Curve and embodies the rapid breaking function by releasing the moving contacts rapidly when faulty current flows in.



# **Susol MCCB Technical Manual**

# The structure of two contacts



Fig 2.2 Operating mechanism and characteristic of Susol circuit breakers

# Structure and operation

# 2. The structure of MCCB

# 2.3 Over current trip units

There are three different operating mechanisms according to trip units such as Thermal-Magnetic Type, Hydraulic Magnetic Type, and Electronic Type.

#### 2.3.1 Thermal-magnetic

#### (1) Time-Delay Operation

When over current flows in, Bi-Metal will be bended by heat in the direction of arrow and then it pushes Trip Cross bar to break the over current automatically.

#### (2) Instantaneous Trip

When short-circuit flows in, fixing armature which is attached to the current path attracts moving armature and it makes Trip Cross Bar operates to break the current earlier than Bi-Metal starts to get bended bended.

#### 2.3.2 Hydraulic-Magnetic Type

This trip unit is ODP (Oil Dash Pot). It consists of non-magnetic cylinder which includes the plunger along with back spring and it is sealed after being filled with silicon oil.

#### (1) Time-Delay Operation

If over current flows through coil the magnetic force will be over the spring force and plunger moves coil, to contacts and then attracts the armature to make circuit breakers trip automatically.

#### (2) Instantaneous Operation

If short-circuit flows in, armature is attracted without the movement of plunger and makes circuit breakers trip instantaneously as the magnetic flux of magnetic circuits gets greater.

### 2.3.3 Electronic Type

The trip unit is made of CT and Solid State Relay. If over current flows in, the current transformed by CT is applied to the detecting circuitry of maximum current and then changed into voltage. Micro processor will send Trigger signal after comparing the transformed values and then break the faulty current by releasing the magnet. Electronic type has long time-delay type, short time-delay and instantaneous type. It has the simple trip structure compared with mechanical type and the value is adjustable in a wide range.



Fig 2.3 Thermal-magnetic type





Fig 2.4 Hydraulic-magnetic type

Fig 2.5 Electronic type

# 2.4 Contacts part

The fixed and moving contacts are the important parts of MCCB and severe conditions are applied during switching operation.

The recommendable characteristic of contact materials are as follows.

- · Great dielectric strength.
- · Low contact resistance
- Less dissipation

Contacts in MCCB has a long life span, high breaking capacity, and minimized dimension by using the contact materials such as Ag-Tungsten or Ag-Oxidize Cadmium.

# 2.5 Arc-Extinguishing unit

When breaking the faulty current, arc occurs between contacts which has 8, 000~12, 000 °C central temperature with explosive expansion pressure. This characteristic of arc consequently makes contacts melt down and dissipate as well as makes the insulating materials deteriorate and break down. Therefore, circuit breakers should be designed to minimize arc by breaking the faulty current rapidly.

MCCB normally adopts De-ion arc extinguisher made of metal plate and every grid which has the V shape of groove is vertically aligned with the direction of arc arise. [Fig 2.6]

Arc which arise when opening contacts part moves through the internal Grid and it is cooled and split into smaller arcs through each Grid. Therefore, Arc voltage gets higher and the internal pressure of Mold Case has risen by the gas emitted from the insulating plate. In conclusion, high voltage and internal pressure compress the arc, sustain the emission of free electron, extinguish the arc and finally circuit is protected as the voltages between poles are recovered recovered.

Susol circuit breakers restrain arc which is risen from short-circuit through PASQ technology and break the short-circuit within the shortest time by minimizing the holding time.





Fig 2.7 The influence of magnetic field

15

# Structure and operation

# 3. The operation & condition of MCCB

# On position

- · Closed position (Switch on)
- Put handle in ON position to supply the power.
- ON mark is appeared over red.



# Off position

В

- Open position (Switch off)
- Put handle in OFF position to break the power supply.
- OFF mark is appeared over green.



# Reset

- When handle is in trip position, move it to OFF position first and then move it to ON position.
- If pressing trip button when circuit breaker is in position, the circuit is open and handle moves to trip position.

# Push the trip

# The confirmation of main contacts position

- Susol circuit breaker is in accordance with the insulation specified at ICE 60947.
- When handle is in OFF position, main terminal is normally open.
- OFF position is safety condition which can put circuit breakers in OFF position. This is totally obligation.



C. Trip Units	5
1. Thermal magnetic trip unit for TD100/ TD160	18
2. Thermal magnetic trip unit for TS100/ TS160/ TS250	21
3. Thermal magnetic trip unit for TS400/ TS630	24
4. Thermal magnetic trip unit for TS800	27
5. Electronic Trip Unit (ETS)	30
6. Electronic Trip Unit with Multifunction (ETM)	33

# 1. Thermal magnetic trip unit for TD100/TD160

# FTU, FMU trip unit is available for Susol TD100/TD160

lr (XIn

- FTU: Fixed rated current / Fixed instantaneous trip current



# Rating of trip unit

Bating(A)	at 40°C In	16	20	25	32	40	50	63	80	100	125	160
- iaan ig(, i)												
	1D100	•	•	•	•	•	•	•	•	•	-	-
	TD160	-	-	-	-	-	-	-	-	•	•	•
Overload protection(thermal)												
Current setting(A) Ir												
	FTU	Fixed	Fixed									
	FMU	Adjus	Adjustable 0.8, 0.9, 1 × In (3 settings)									
Short - circu	it protection(ma	gnetic)										
Current set	ting(A) Im											
	FTU	Fixed	Fixed 400A					ixed 10>	< In			
	FMU	Fixed 400A Fixed 10 × In										

3P

# TD100 Characteristic curves



	FMU	Adjustable 0.8, 0.9, 1 × In (3 settings)						
Short - circuit protection(magnetic)								
Current setti	ng(A) Im							
	FTU	Fixed 400A	Fixed 10×In					
FMU		Fixed 400A	Fixed 10×In					
Protection of	N pole							
	4P3T	Neutral No protection						
	4P4T	Neutral protection (100% lr)						

# Configuration



Setting current, Ir

# TD100 Characteristic curves







# **Trip Units**

# 1. Thermal magnetic trip unit for TD100/ TD160



# TD160 operating characteristic curve

# Temperature compensation curve for TD160



# 2. Thermal magnetic trip unit for TS100/ TS160/ TS250

FTU

ATU

Rating(A)

#### FTU, FMU, ATU trip units are available for Susol TS100/TS160/TS250.

Im=2500A

З

### - FTU: Fixed Rated Current / Fixed Instantaneous Trip Current

- FMU: Adjustable Rated Current / Fixed Instantaneous Trip Current



- ATU: Adjustable Rated Current / Adjustable Instantaneous Trip Current

# Rating of trip unit

TS100 FMU, TS160 FMU, TS250 FMU



	15100	•	•	•	•	•	-	-	-	-	
	TS160	-	-	-	-	٠	٠	•	-	-	
	TS250	-	-	-	-	-	٠	•	٠	٠	
Overload protection(thermal)											
Current settir	ng(A) Ir										
	FTU	Fixed	Fixed								
	FMU	Adjustab	Adjustable 0.8 to $\times$ In								
	ATU	Adjustable 0.8 to × In									

TS160 ATU, TS250 ATU



# Configuration





Trip unit identification

Ratings (A), In at 40°C

Number of pole

Short circuit protection (magnetic) Setting current, Im

Overload protection (thermal) Setting current, Ir



200	

250

С

# **Trip Units**

# 2. Thermal magnetic trip unit for TS100/ TS160/ TS250



# TS100/ TS160/ TS250 Characteristic curves (FTU/FMU)

# Temperature compensation curve for TS100/ TS160/ TS250 (FTU/FMU)



# TS160/ TS250 Characteristic curves (ATU)



# Temperature compensation curve for TS160/ TS250 (ATU)



# 3. Thermal magnetic trip unit for TS400/ TS630

#### FTU, FMU, ATU trip units are available for Susol TS400/TS630

# - FTU: Fixed Rated Current / Fixed Instantaneous Trip Current



ATU



Thermal Magnetic trip units(FTU/FMU/ATU) ... TS400 to TS630

# Rating of trip unit

TS400 FMU, TS630 FMU Ir (×In)

Rating(A) at 40°C In		300	300 400		630				
	TS400	•	• •		-				
	TS630	-	-	•	٠				
Overload protection(thermal)									
Current settin	ng(A) Ir								
	FTU	In=Ir (Fixed)	In=Ir (Fixed)						
	FMU	Adjustable 0.8, 0.9, 1	Adjustable 0.8, 0.9, 1 × In (3 settings)						
	ATU	Adjustable 0.8, 0.9, 1 × In (3 settings)							

TS400 ATU, TS630 ATU



# Configuration

	ATU	Adjustable 0.8, 0.9, $1 \times \ln (3 \text{ settings})$
Short - cire	cuit protectio	on(magnetic)
Current settir	ng(A) Im	
	FTU	Fixed 10×In
	FMU	Fixed 10×In
	ATU	Adjustable 5, 6, 7, 8, 9, $10 \times \ln(6 \text{ settings})$
Protection	of N pole	
	4P3T	Neutral No protection
	4P4T	Neutral protection (100% lr)



Trip unit identification

Ratings (A), In at 40°C

Number of pole

Short circuit protection (magnetic) Setting current, Im

Overload protection (thermal) Setting current, Ir



# TS400/ TS630 Characteristics curves (FTU/FMU)



# Temperature compensation curve for TS400/ TS630 (FTU/FMU)



# **Trip Units**

# 3. Thermal magnetic trip unit for TS400/ TS630



# TS400/ TS630 Characteristics curves (ATU)

# Temperature compensation curve for TS400/ TS630 (ATU)



# 4. Thermal magnetic trip unit for TS800



Thermal Magnetic trip units(FTU/FMU/ATU) ... TS800

In

TS800

Rating(A) at 40°C

# Rating of trip unit





Overload	protection(th	nermal)
Current settir	ng(A) Ir	
	FTU	Fixed
	FMU	Adjustable 0.8, 0.9, 1 × In (3 settings)
	ATU	Adjustable 0.8, 0.9, 1 × In (3 settings)

700(1)

•

40°C 3P

TS800 ATU



Short - circuit protection(magnetic)				
Current settir	ng(A) Im			
	FTU	Fixed 10 × In		
	FMU	Fixed 10 × In		
	ATU	Adjustable 5, 6, 7, 8, 9, 10 × In(6 settings)		
Protection	of N pole			
	4P3T	Neutral No protection		
	4P4T	Neutral protection (100% lr)		

# Configuration



Trip unit identification

800

•

Ratings (A), In at 40°C

Number of pole

Short circuit protection (magnetic) Setting current, Im

Overload protection (thermal) Setting current, Ir

# **Trip Units**

# 4. Thermal magnetic trip unit for TS800



# TS800 Characteristic curve (FTU/FMU)

# Temperature compensation curve for TS800 (FTU/FMU)



# TS800 Characteristic curve (ATU)







С

# **Trip Units**

# 5. Electronic Trip Unit (ETS)

Electronic trip unit for Susol TS is divided into three types according to the application and can be installed to N, H, L type of TS100~ TS800 circuit breakers.

# The range of rated current according to the types

- ETS23: 16~250A (TS100/ TS160/ TS250)
- ETS33: 64~630A (TS400/ 630)
- ETS43: 252~800A (TS800)

# Ratings of trip unit

Type Rated Current (A)	TS630	TS800	TS100	TS160	TS250	TS400
40						
80						
160						
250						
400						
630						
800						
Long-time delay tripping current setting (A), Ir	0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0×In 13 settings					
Long-time delay operating time (tr)	Fixed at 6secs $\pm 20\%$ for $6 \times Ir$					
Short-time delay tripping current setting (A), Isd	1.5, 2, 3, 4, 5, 6, 7, 8, $10 \times \ln$ , 9 settings, tolerance $\pm 15\%$					
Short-time delay tripping time (ms)	50, 100, 200, 300ms, 4 settings, tolerance $\pm$ 20%					
Instantaneous tripping current, li	Fixed at 11 × In					

Indication of alarm

Trip unit identification Trip unit rating, In

Short time tripping delay

Short circuit protection (short time)

С

Overload protection (long time)

Test connector

Load: not less than 90% Ir . LED ON Load: not less than 105% Ir . LED flickering

# Electronic Trip Unit for TS100, 160, 250 (ETS23)

Electronic Trip Unit for TS400/TS630 (ETS
---

CI TEST

![](_page_32_Figure_4.jpeg)

етs23 In 250A

alarm

Overload protection (long time)

Test connector

# Electronic Trip Unit for TS800 (ETS43)

![](_page_32_Figure_8.jpeg)

3 P

-lyl

# **Trip Units**

# 5. Electronic Trip Unit (ETS)

# Operating characteristic curve (ETS)

![](_page_33_Figure_3.jpeg)

# 6. Electronic Trip Unit with Multifunction (ETM)

Electronic trip unit for Susol TS is divided into three types according to the application and can be installed to N, H, L type of TS100~ TS800 circuit breakers.

# The range of rated current according to the types

- ETM33: 64~630A (TS400/ TS630)
- ETM43: 252~800A (TS800)

# Ratings of trip unit

Type Rated Current (A)	TS400	TS630	TS800
160	•		
250	•	•	
400	•	•	
630		•	•
800			

Long-time delay trip (Overload Protection)			
① Long-time delay current setting	Available to set in the range of 40~100% of the rated current		
- 1st setting (lo)	lo = (0.5, 0.6, 0.7, 0.8, 0.9, 1.0) × In: 6 setting		
- 2nd setting Ir)	Ir = 0.8, 0.85, 0.9, 0.95, 1.0) In: setting		
② Tripping time	tr = 2-4-6-8-12sec: 5 setting, 6 × Ir		

Short-time delay trip (Short-circuit Protection)			
③ Short-time delay current setting	lsd = (1.5-2-3-4-5-6-7-8-10) × lr, 9 settings (tolerance $\pm$ 15%)		
④Tripping time	tsd = 50-100-200-300ms 4 settings (tolerance $\pm$ 20%),		
	Indication of I <sup>2</sup> t (ON-OFF)		

Instantaneous trip (Short-circuit Protection)		
(5) Instantaneous current setting	li = (1.5-2-3-4-5-6-8-10-11) × Ir, 9 settings	

Earth Fault Protection			
6 Earth Fault current setting	Ig = (0.2-0.3-0.4-0.5-0.6-0.7-0.8-1-off) × In, 9 settings		
⑦ Earth Fault tripping time	tg = 100-200-300-400ms, 4 settings (tolerance $\pm$ 20), Indication of I <sup>2</sup> t (ON-OFF)		

# **Trip Units**

# 6. Electronic Trip Unit with Multifunction (ETM)

# Configuration

![](_page_35_Figure_3.jpeg)

# How to set ETM

#### Long-time delay current setting

![](_page_35_Figure_6.jpeg)

![](_page_35_Figure_7.jpeg)

#### Rated current = $\ln * lo(\times ln) * lr(\times lo)$

→ Setting example
 ① In = 630A
 ② Knob of lo(× ln) = 0.9
 ③ Knob of lr(× lr) = 1.0
 → Rated current = 630 × 0.9 × 1.0 =567A

#### Short-time delay current setting

![](_page_35_Figure_11.jpeg)

#### Short time critical current = $Ir \times Isd( \times Ir)$ $\rightarrow$ Setting example

- Knob of Isd( $\times$  Ir) = 5
- lr = 567A
- $\rightarrow$  Short time critical current = 567  $\times$  5 = 2835A

![](_page_35_Figure_16.jpeg)

![](_page_35_Figure_17.jpeg)

#### Instantaneous critical current = $\ln \times li(\times \ln)$ $\rightarrow$ Setting example

- Knob of li(  $\times$  ln) = 5 ln = 630A
- $\rightarrow$  Instantaneous critical current = 630  $\times$  5 = 3150A

# 6. Electronic Trip Unit with Multifunction (ETM)

# Alarm

1) LED turns on when load current is over 90% of Ir.

2) LED blinks to warn the trip operation of circuit breakers when load current is over 105% of Ir.

# Fault Alarm

1) LEDs indicate the cause of trip

Ir: Overload trip

Isd: Short-circuit trip (short time-delay or instantaneous trip)

Ig: Ground fault trip

2) LED corresponding to the cause of trip turns on when pressing TR button in the trip position.

LED automatically goes off and all information stored in memory is cleared if resetting circuit breakers. All LEDs excluding alarm are turned on to check the auxiliary supply and LEDs if pressing TR button in the normal condition.

# Ammeter (A)

![](_page_36_Figure_14.jpeg)

Ammeter has an accuracy of  $\pm 10\%$ .

The highest current of phase is displayed in upper line.

The current of R, S, T phase is automatically scrolled.

The tolerance of ammeter:

- minimum current  $\geq$  0.25 × In (No indication of low current)
- maximum current  $\geq$  10  $\times$  In

# Zone selective interlocking (ZSI)

ZSI means locking the protective zone selectively.

The faulty current should be above the short-time delay area to detect the failure or send ZSI signal.

ZIS function can be presented in case of circuit breakers with time-delay function. In other words, it is to have an additional safety device under condition that T-C curve of circuit breakers can guarantee the time discrimination.

# The communication function of low voltage equipment

- The advantages of communication and data measurement are as follows.

- Correct diagnosis of device condition: It increases the reliability of protection and restoration of electric systems by monitoring the contact conditions or the presence of faults. In addition, it helps the diagnosis of equipment and maintenance.
- 2) Correct check of load condition: Two main points are listed below.
  - ① Available to check the present condition of load

It cuts down the maintenance expense and maximizes the efficiency by measuring the value of voltage and harmonic current/voltage.

② Easy to set up the ratings for equipment (Including protection relays)
It provides the helpful information which will be used for acting the ratio

It provides the helpful information which will be used for setting the ratings.

3) Application of new protective algorism: Communication signal is faster than protection relays. Coordination can be easily applied to the range where it is difficult to coordinate with the existing characteristic curve by sending the communication signals which shows the condition of protection relays.

# 6. Electronic Trip Unit with Multifunction (ETM)

# Operating characteristic curve (ETM)

![](_page_37_Figure_3.jpeg)

![](_page_37_Figure_4.jpeg)

![](_page_37_Figure_5.jpeg)

![](_page_37_Figure_6.jpeg)

# Installation

1. Precaution for safety	38
2. Installation method of TD100/TD160	39
3. Installation method of TS100/TS160/TS250	41
4. Installation method of TS400/TS630	43
5. Installation method of TS800	45
6. Insulating distance	47
7. Terminal connection	50
8. Fixed installation	51
9. Installation of plug-in type plug	52
10. Rear connection	53
11. Plug-in installation	55
12. Standard parts by types	60

# Installation method

# 1. Precaution for safety

Please read the manufacturers' operating instructions and safety precaution before product being taken into service. This operating instruction should be given to the end-user or maintenance engineer

#### **△** Safety Precaution

Please read carefully safety precaution and follow it to ensure safety and proper operation before installation, wiring, operation, maintenance and inspection of the device

Danger: 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

#### A Danger

- 1. Make sure that the upstream circuit breaker is disconnected from the supply before product being installed; it may cause electrical shock.
- 2. Do not touch a exposed terminal which is live; it may cause electrical shock or short circuit.
- Do not allow two exposed live wires to touch the human body at the same time; it may cause electrical shock but circuit breakers can not be operated.

#### 

- 1. Please read carefully safety precaution and install products according to instruction manual.
- Qualified engineer should install circuit breakers and perform maintenance as wrong installation can cause malfunction or accident.
- Do not install products in hazardous areas such as wet areas or in the presence of oils or direct sunlight, otherwise it may result in electrical shock, short-circuit, a fire or malfunction.
  - 1) Ambient temperature: -5~40°C
  - 2) Relative humidity: 45~85%
  - 3) Altitude: less than 2000m
  - 4) Shall be no abnormal vibrations or impacts, excessive vapor, oil. dust, and flammable or corrosive gas.
- 4. Please put a proper power source onto the products, otherwise it may cause non-operation or malfunction.
- 5. Tighten the screws with the torque specified at instruction manual as insufficient tightening torque can cause a big fire.
   \* Please refer to installation method for details
- 6. Please connect terminal of each phase in parallel with conductor, otherwise it may cause short-circuit between phases.
- Do not perform the withstand voltage test and not measure the insulating resistance between phases. When you carrying out the above test in lines of circuit, please separate the product from the circuit, otherwise it may cause malfunction.
- 8. Please put the earth terminal of electric equipment to the ground.
- Please mount the insulating barrier between phases, otherwise it causes short-circuit between phases. Please insulate between products when installing them closely.
- 10. Close handle after clearing the cause of trip, otherwise it can cause electrical shock or a fire.
- 11. Do not attempt to disassemble, repair, or modify any units unauthorized
- 12. Dispose of product according to waste regulations.
- 13. Do not directly connect to AI terminal or conductor.

# 2. Installation method of TD100 / TD160

# TD100 /TD160 circuit breakers should be installed as shown below.

# The installation of TD100/TD160

- 1. Keep circuit breaker vertically from the front and side view as shown in fig.1 and then fix it with mounting screws provided with 3 pole/4 pole circuit breakers as shown in fig.3.
- 2. When installing, keep insulating distance from metal conductor as shown in fig.2.

![](_page_40_Figure_6.jpeg)

![](_page_40_Figure_7.jpeg)

# Installation method

# 2. Installation method of TD100 / TD160

- 3. Tighten the screws after wiring cables to the product as shown in fig.4. (The unit of figure: mm)
- 4. Put a driver to the groove at the bottom of trip unit cover to open it and adjust the setting dial of the rated current to the desired number as shown in fig. 5. \* In order not to break the cover put a proper force on it when opening.
- 5. Install the insulating barrier enclosed in product as shown in fig.6.
- 6 In case of Installing the terminal cover purchased separately tighten it with the screws as shown in fig 7

![](_page_41_Figure_6.jpeg)

# 3. Installation method of TS100 / TS160 / TS250

# TS100/ TS160/ TS250 circuit breakers should be installed as shown below.

# The installation of TS100/ TS160/ TS250

- 1. Keep circuit breaker vertically from the front and side view as shown in fig.1 and then fix it with mounting screws provided with 3 pole/4 pole circuit breakers as shown in fig.3.
- 2. When installing, keep insulating distance from metal conductor as shown in fig.2.

![](_page_42_Figure_6.jpeg)

![](_page_42_Figure_7.jpeg)

# Installation

# 3. Installation method of TS100 / TS160 / TS250

- 3. Tighten the screws after wiring cables to the product as shown in fig.4. (The unit of figure: mm)
- 4. Put a driver to the groove at the bottom of trip unit cover to open it and adjust the setting dial of the rated current to the desired number as shown in fig. 5. \* In order not to break the cover put a proper force on it when opening.
- 5. Install the insulating barrier enclosed in product as shown in fig.6.
- 6. In case of Installing the terminal cover purchased separately, tighten it with the screws as shown in fig.7.

![](_page_43_Figure_6.jpeg)

# 4. Installation method of TS400 / TS630

# TS400 /TD630 circuit breakers should be installed as shown below.

# The installation of TS400/ TS630

- 1. Keep circuit breaker vertically from the front and side view as shown in fig.1 and then fix it with mounting screws provided with 3 pole/4 pole circuit breakers as shown in fig.3.
- 2. When installing, keep insulating distance from metal conductor as shown in fig.2.

![](_page_44_Figure_6.jpeg)

![](_page_44_Figure_7.jpeg)

# Installation

# 4. Installation method of TS400 / TS630

- 3. Tighten the screws after wiring cables to the product as shown in fig.4. (The unit of figure: mm)
- 4. Put a driver to the groove at the bottom of trip unit cover to open it and adjust the setting dial of the rated current to the desired number as shown in fig. 5. \* In order not to break the cover put a proper force on it when opening.
- 5. Install the insulating barrier enclosed in product as shown in fig.6.
- 6 In case of Installing the terminal cover purchased separately tighten it with the screws as shown in fig 7

![](_page_45_Figure_6.jpeg)

# 5. Installation method of TS800

# TS800 circuit breakers should be installed as shown below.

# The installation of TS800

- 1. Keep circuit breaker vertically from the front and side view as shown in fig.1 and then fix it with mounting screws provided with 3 pole/4 pole circuit breakers as shown in fig.3.
- 2. When installing, keep insulating distance from metal conductor as shown in fig.2.

![](_page_46_Figure_6.jpeg)

![](_page_46_Figure_7.jpeg)

![](_page_46_Figure_8.jpeg)

# 5. Installation method of TS800

- 3. Tighten the screws after wiring cables to the product as shown in fig.4. (The unit of figure: mm)
- 4. Put a driver to the groove at the bottom of trip unit cover to open it and adjust the setting dial of the rated current to the desired number as shown in fig. 5. \* In order not to break the cover put a proper force on it when opening.
- 5. Install the insulating barrier enclosed in product as shown in fig.6.
- 6 In case of Installing the terminal cover purchased separately tighten it with the screws as shown in fig 7

![](_page_47_Figure_6.jpeg)

D

# 6. Insulation distance

# Please make sure the insulation distance for your safely when installing.

When installing circuit breakers, make sure of the insulation distance between circuit breakers, circuit breakers and panel or bus bar for safety. This insulation distance is different according to breaking capacity and it is specified in IEC60947-2 and can be verified by carrying out the test. If circuit breakers trips at short-circuit current, the ionized gas with high temperature occurs and it is emitted through the exhaust hole installed at power source side. Therefore, the sufficient insulation distance is necessary as short-circuit or ground fault can be caused by emitted gas.

# In case of metallic cubicle (Insulation distance up to ceiling)

	A(mm)	
	415V	240V
TD100N, TD160N	35	30
TD100H, TD160H	35	30
TD100L, TD160L	35	30
TS100N, TS160N, TS250N	35	30
TS100H, TS160H, TS250H	35	30
TS100L, TS160L, TS250L	35	30
TS400N, TS630N	60	50
TS400H, TS630H	60	50
TS400L, TS630L	60	50
TS800N	100	80
TS800H	100	80
TS800L	100	80

![](_page_48_Figure_6.jpeg)

# In case of circuit breakers in a row

- C1: Minimum distance up to live part of upper circuit breaker
- C: C1+ Distance of exposed live part

	C1(mm)		C(mm)
	415V	240V	O(IIIII)
TD100N, TD160N	35	30	
TD100H, TD160H	35	30	
TD100L, TD160L	35	30	duct
TS 100N, TS160N, TS250N	35	30	l con
TS100H, TS160H, TS250H	35	30	paso
TS100L, TS160L, TS250L	35	30	exb
TS400N, TS630N	60	50	n of
TS400H, TS630H	60	50	ensic
TS400L, TS630L	60	50	dime
TS800N	100	80	The
TS800H	100	80	
TS800L	100	80	

![](_page_48_Figure_11.jpeg)

![](_page_48_Picture_12.jpeg)

![](_page_48_Figure_13.jpeg)

D

# Installation

# 6. Insulation distance

# Insulated length of main terminal of circuit breakers

- D1: Connection by ring terminal after taping
- D2: Connection by bus bar after taping
- D3: Connection by ring terminal with insulation barrier
- D4: Connection by bus bar with insulation barrier

			-		
(m	n)	(mm)	(mm)	(mm)	
TD100N, TD160N		50		50	
TD100H, TD160H		50	20	50	
TD100L, TD160L		50	ct +	50	
TS100N, TS160N, TS250N		100	npuq	100	
TS100H, TS160H, TS250H		100	od oc	100	
TS100L, TS160L, TS250L		100	esod	100	
TS400N, TS630N		100	ofex	100	
TS400H, TS630H		200	sion e	200	
TS400L, TS630L		200	nens	200	
TS800N		100	e dir	100	
ТS800Н		200	Ę	200	
TS800L		200		200	<u>ංර්ෂී හේ රාෂී රාෂී රා</u> ෂී රාෂී රාෂී රාෂී රාෂී රාෂී රාෂී රාෂී රා

# In case of metallic cubicle (Insulation distance up to side plate)

	E(mm)	
	415V	240V
TD100N, TD160N	25	15
TD100H, TD160H	25	15
TD100L, TD160L	25	15
TS100N, TS160N, TS250N	25	15
TS100H, TS160H, TS250H	25	15
TS100L, TS160L, TS250L	25	15
TS400N, TS630N	20	15
TS400H, TS630H	20	15
TS400L, TS630L	20	15
TS800N	45	20
TS800H	45	20
TS800L	45	20

![](_page_49_Picture_10.jpeg)

![](_page_49_Picture_11.jpeg)

# The distance of exposed cable

	F
	(mm)
TD100N, TD160N	20
TD100H, TD160H	20
TD100L, TD160L	20
TS100N, TS160N, TS250N	10
TS100H, TS160H, TS250H	10
TS100L, TS160L, TS250L	10
TS400N, TS630N	10
TS400H, TS630H	10
TS400L, TS630L	10
TS800N	10
TS800H	10
TS800L	10

![](_page_50_Figure_3.jpeg)

# Insulation distance of two circuit breakers installed in parallel (with terminal cover)

	G
	(mm)
TD100N, TD160N	0
TD100H, TD160H	0
TD100L, TD160L	0
TS100N, TS160N, TS250N	0
TS100H, TS160H, TS250H	0
TS100L, TS160L, TS250L	0
TS400N, TS630N	0
TS400H, TS630H	0
TS400L, TS630L	0
TS800N	0
TS800H	0
TS800L	0

![](_page_50_Picture_6.jpeg)

Installation

# 7. Terminal connection

# Connecting terminal by types

![](_page_51_Figure_3.jpeg)

# 8. Fixed installation

# Fixed installation

Susol circuit breakers can be directly mounted to the panel by tightening the screws. If bus-bar or terminals are used to connect the circuit breakers on the back of the panel, make sure of the safety clearance.

![](_page_52_Picture_4.jpeg)

# Tightening parts & tightening torque

	TD100, TD160	TS100, TS160, TS250	TS400, TS630	TS800
Fixing Nut	1Pole: 2EA(M3 × 75)	Ø		G
	3Pole: 2EA(M4 × 75) 4Pole: 4EA(M4 × 75)	3Pole: 2EA(M4 × 75) 4Pole: 4EA(M4 × 75)	3Pole: 4EA(M5 × 85) 4Pole: 4EA(M5 × 85)	3Pole: 4EA(M6 × 100) 4Pole: 4EA(M6 × 100)
Fixing Bolt	-	-	G	G
			3Pole: 4EA 4Pole: 4EA	3Pole: 4EA 4Pole: 4EA
Terminal Bolt	<b>S</b>	JO P		
	1Pole: 2EA(M8 × 20) 3Pole: 6EA(M8 × 20) 4Pole: 8EA(M8 × 20)	3Pole: 6EA(M8×20) 4Pole: 8EA(M8×20)	3Pole: 6EA(M10 × 30) 4Pole: 8EA(M10 × 30)	3Pole: 6EA(M12 × 35) 4Pole: 8EA(M12 × 35)
	Torque: Max 78kgf · cm	Torque: Max 147kgf · cm	Torque: Max 490kgf · cm	Torque: Max 630kgf · cm

# 9. Installation of plug-in type plug

# Safety precaution

# △ Danger

Make sure that circuit breakers are disconnected from the power supply before mounting/dismounting, wiring, maintenance and inspection. Otherwise, it may result in electrical shock and short-circuit.

# △ Warning

- 1. Please do not use the deformed and damaged products
- 2. Qualified engineer should install circuit breakers and do a maintenance as wrong installation may result in malfunction or accident.
- 3. Do not install products in hazardous areas such as wet areas or in the presence of oils or direct sunlight. Otherwise, it may result in a fire or malfunction.
- 4. Please use the accessories which comply with the ratings and poles of product.
- 5. Please read carefully safety precaution and install products according to instruction manual. Otherwise it may result in any malfunction or accidents.
- 6. Tighten the screws with the torque specified at instruction manual as insufficient tightening torque may result in a big fire.
- 7. Make the connecting conductor paralleled with terminal when tightening the terminal. Otherwise, it may result in shortcircuit between phases.
- 8. When installing the products closely mount the insulating barrier between terminals In absence of insulating barrier put an insulating tape over the exposed conductor and ring terminal or mount the terminal cover (sold separately). Otherwise, it may result in short circuit between phases.
- 9. Please be careful with products during transit or installation.
- 10. Do not attempt to disassemble, repair, or modify any units unauthorized
- 11. Dispose of product according to waste regulations.

# Rear connection of terminals

- 1. Mount rear connection terminals to circuit breakers in reference to fig.1 and fig.2.
- 2. Tighten conductor with specified torque in reference to fig.1 and fig.2 to prevent the big fire.
- 3. Mount the terminal cover (sold separately) on the circuit breakers after connecting the rear terminals.
- 4. Minimum size of panel hole to connect the rear terminals should be more than 30(TS630)/40(TS800)

![](_page_53_Figure_22.jpeg)

Fig1. Flat type for rear connection

![](_page_53_Picture_24.jpeg)

Fig2. Round type for rear connection

# 10. Rear connection

It is applicable to the rear connection of terminals of Susol circuit breakers. There are two types of terminals according to the shapes: Flat type and Round type.

# Table 1. Rear connection of Flat type

Type	Tightening torque		
Type	А	В	
TD160 , TS250	M6	M8	
(BOLT, HEX, SOCKET)	49~60kgf ⋅ cm	120~147kgf ⋅ cm	
TS630	M8		
(BOLT, HEX, SOCKET)	120~147kgf · cm	M12	
TS800	M12	415~507kgf ⋅ cm	
(BOLT, HEX, SOCKET)	415~507kgf · cm		

# Table 2. Rear connection of Round type

Туре	Tightening torque		
	А	В	
TD160, TS250	M6	M8	
(BOLT, HEX, SOCKET)	49~60kgf · cm	120~147kgf · cm	

# Flat type terminals for rear connection

Application	2-pole	3-pole	4-pole
TD100, TD160	RTB12	RTB13	RTB14
TS100, TS160, TS250	RTB22	RTB23	RTB24
TS400, TS630	RTB32	RTB33	RTB34
TS800	RTB42	RTB43	RTB44

# Round type terminals for rear connection

Application	2-pole	3-pole	4-pole
TD100, TD160	RTR12	RTR13	RTR14
TS100, TS160, TS250	RTR22	RTR23	RTR24
TS400, TS630	-	-	-
TS800	-	-	-

# 10. Rear connection

# External dimension of flat type terminal by product types

![](_page_55_Figure_3.jpeg)

![](_page_55_Figure_4.jpeg)

Туре	L1	L2	L3	L4
TD160	122	43.7	87.7	30
TS250	140	42.5	88.5	35
TS630	230	50.1	114	46.5
TS800	287	98	184	70

# External dimension of round type terminal by product types

![](_page_55_Figure_7.jpeg)

# 11. Plug-in installation

# Plug-in device

Plug-in base is to remove or replace circuit breakers rapidly and easily without touching the terminal connection and it is mainly used where easy replacement and maintenance are required such as ships and broadcasting systems.

This plug-in type is applicable to Susol circuit breakers.

![](_page_56_Picture_5.jpeg)

# Standard

- It is rated up to 800A and widely applicable to distribution panel.

![](_page_56_Picture_8.jpeg)

![](_page_56_Picture_9.jpeg)

# Distribution panel in two row

- Circuit breakers can be mounted in distribution panel in two rows and it is rated up to 160A for wide application.

![](_page_56_Figure_12.jpeg)

![](_page_56_Figure_13.jpeg)

ขрง ๑৮.๑

# 11. Plug-in installation

# The types of Plug-in

Applied circuit breakers	No.poles	Arrangement	Types of Plug-in device Remarks	Remarks
	2	Normal	PB12	
TD100 TD100	3	Normal	PB13	
10100, 10160	2	Double row array	PB12D2	For switchboard
	3	Double row array	PB13D2	For switchboard
TS100, TS160, TS250	2	Normal	PB22	
	3	Normal	PB23	
TS400, TS600	2	Normal	PB32	
	3	Normal	PB33	
TS800	2	Normal	PB42	
	3	Normal	PB43	

# The installation types of Plug-in

![](_page_57_Picture_5.jpeg)

Installation in front of the mounting plate

![](_page_57_Picture_7.jpeg)

Installation on the back of the mounting plate

![](_page_57_Picture_9.jpeg)

Installation in front of DIN-rail

![](_page_57_Picture_11.jpeg)

Installation on the back of DIN-rail

![](_page_57_Picture_13.jpeg)

Installation in front of Back cover

# Safety precaution for Plug-in device

Please read the manufacturers' operating instructions and safety precaution before product being taken into service. This operating instruction should be given to the end-user or maintenance engineer

# **△** Safety Precaution

Please read carefully safety precaution and follow it to ensure safety and proper operation before installation, wiring, operation, maintenance and inspection of the device

△ Danger: 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

# ▲ Danger

- 1. Make sure that the upstream circuit breaker is disconnected from the supply before product being installed; it may cause electrical shock.
- 2. Do not touch a exposed terminal which is live; it may cause electrical shock or short circuit.
- 3. Do not allow two exposed live wires to touch the human body at the same time; it may cause electrical shock but circuit breakers can not be operated.

# 

- 1. Please read carefully safety precaution and install products according to the instruction manual.
- 2. Qualified engineer should install circuit breakers and perform maintenance as wrong installation can cause malfunction or accident.
- 3. Do not install products in hazardous areas such as wet areas or in the presence of oils or direct sunlight, otherwise it may result in electrical shock, short-circuit, a fire or malfunction.
  - 1) Ambient temperature: -5~40°C
  - 2) Relative humidity: 45~85%
  - 3) Altitude: less than 2000m
  - 4) Shall be no abnormal vibrations or impacts, excessive vapor, oil. dust, and flammable or corrosive gas.
- 4. Please put a proper power source onto the products, otherwise it may cause non-operation or malfunction.
- 5. Tighten the screws with the torque specified at instruction manual as insufficient tightening torque can cause a big fire. \* Please refer to installation method for details
- 6. Please connect terminal of each phase in parallel with conductor, otherwise it may cause short-circuit between phases.
- 7. Please be careful with products during transit or installation.
- 8. Dispose of product according to waste regulations.
- 9. Do not directly connect to AI terminal or conductor.
- 10. Do not attempt to disassemble, repair, or modify any units unauthorized.

# Installation

# 11. Plug-in installation

# Installation procedure for Plug-in device by types (TD100~160/ TS100~250)

- (1) Please install Plug-in device in order as shown in figures below.
- (2) The installation procedure for TD100 is identical to TD160.
- (3) The installation procedure is identical to TS250.

![](_page_59_Figure_6.jpeg)

![](_page_59_Figure_7.jpeg)

# Installation procedure for Plug-in device by types (TS400~800)

- (1) Please install Plug-in device in order as shown in figures below.
- (2) The installation procedure for TS400 is identical to TS630.

![](_page_60_Figure_4.jpeg)

# Installation of PLATE TERMINAL

![](_page_60_Figure_6.jpeg)

# 12. Standard parts by types

The parts listed below are necessary for installing Susol circuit breakers and provided as a package. \* Please refer to Susol MCCB catalogue for parts not listed below.

	Connection	Mountin	Mounting		Handle
TD100N/H/L					
TD160N/H/L		Ð		<b>¢m</b> <sup>B-23C</sup>	
	M8 × 20	M3 × 75(1P) M4 × 75			
	1P: 2pcs 3P: 6pcs 4P: 8pcs	1P: 2pcs 3P: 2pcs 4P: 4pcs		3P: 4pcs 4P: 6pcs	
TS100N/H/L				_	
TS160N/H/L TS250N/H/L		ſ		¢ <b>m</b> <sup>B-23C</sup>	
	M8×20	M4×75			
	3P: 6pcs 4P: 8pcs	3P: 2pcs 4P: 4pcs		3P: 4pcs 4P: 6pcs	
TS400N/H/L TS630N/H/L		<b>O</b>	6	<b>Çm</b> B-33C	
	M10×30	M5 × 85	M5		
	3P: 6pcs 4P: 8pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 6pcs	
TS800N/H/L			6	E43C	
	M12×35	M6×100	M6		
	3P: 6pcs 4P: 8pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 6pcs	1pc

# Accessories

1. Electrical auxiliaries	62
2. Rotary handle	67
3. Locking device	71
4. Terminals	74
5. Terminal cover	79
6. Insulating barrier	80
7. Interlock	81
8. Remote operator	83

# 1. Electrical auxiliaries

### Internal Accessories are 100% common use for all Susol MCCB types.

(But, Fault Alarm Switch (FAL) is only applicable to the circuit breakers with electronic trip unit.)

# Auxiliary Switch (AX)

AX (Auxiliary Switch) is the application which indicates "On" or "OFF" condition of circuit breakers by sending signals to outside. Each AX is consisted of change-over contact. Therefore, if one contact is closed, another becomes open, and vice-versa. \* Refer to the condition of contact operation.

# Alarm switch (AL)

Alarm switches is for indicating the trip condition of circuit breakers caused from overload, short-circuit, and operation of SHT/UVT by sending signals to outside. It operates when breaker is tripped automatically by fault current and trip test button is pressed but it will not operate when operating circuit breakers manually. Each AL is consisted of change-over contact. Therefore, if one contact is closed, another becomes open, and vice-versa. \* Refer to the condition of contact operation.

# Fault alarm switch (FAL)

Fault alarm switch FAL (Fault Alarm Switch) only operates when circuit breakers are tripped by overload or short-circuit but it will not operate when pressing the trip test button. This device is only applicable to the circuit breakers with electronic trip unit (ETM, ETS). Each FAL is consisted of change-over contact. Therefore, if one contact is closed, another becomes open, and vice-versa. \* Refer to the condition of contact operation.

# Undervoltage trip (UVT)

UVT (Undervoltage release) is designed to trip circuit breakers automatically when circuit voltage drops below 35~70% of Ue Trip operation is executed instantly without any delay and circuit breakers will not be closed until 35 Ue. delay, 85% of Ue is recovered. If users desire to close circuit breakers again, it should be maintained over 85% of Ue continuously first and then reset it to put it in the ON position.

- Trip condition: 35~70% of rated voltage
- Reset/Re-close condition: Over 85% of rated voltage
- Applied frequency: 45~65Hz

# Shunt trip (SHT)

SHT (Shunt Release) is designed to trip circuit breakers when the specified voltage is applied from outside. Trip operation is executed instantly without any delay and trip signal have ceased automatically once the circuit breaker is tripped.

- Operation (Trip Signal) condition: 70~110% of Ue
- Applied frequency: 45~65Hz

# The possible combination of internal accessories

Position	Accessories	TD160	TS250	TS630	TS800
Left handle (R phase)	AX	-	1	3	3
	AL	1	1	-	-
	SHT or UVT	1	1	1	1
Right handle (T phase)	AX	2	1	-	-
	AL	-	-	1	2
	FAL	-	1	1	1

Note) Fault alarm switch (FAL) is applicable to circuit breakers with electronic trip unit. SHT, UVT can not be applicable at the same time.

Operation condition of contact (AX, AL, FAL)

МССВ	ON	OFF	TRIP
Operation of AX	AXc1 AXa1 O AXb1	AXc1 —0~	0- AXa1 0- AXb1
Operation of AL, FAL	AXc1 —O	о— АХа1 Ф— АХb1	AXc1 — AXa1 O— AXb1

# The rating of contact (AX, AL, FAL)

Conducting current, Ith	5A				
The rated current by voltages (le)		Rated voltage	Rated current (le)		Applied C/P
		(Ue)	Resistance load	Coil load	Applied C/B
	AC 50/60Hz	125V	5	3	Common use for
		250V	3	2	Susol MCCBs
		500V	-	-	TD100, TD160
	DC	30V	4	3	TS100, TS160
		125V	0.4	0.4	TS250, TS400
		250V	0.2	0.2	TS630, TS800

# The rating of Undervoltage (UVT)

	Pated voltage (V/n)	Power consumption			Applied C/B
	hated voltage (vii)	AC (VA)	DC (W)	mA	Applied 0/D
Rated voltage	AC/DC 24V	0.64	0.65	27	
&	AC/DC 48V	1.09	1.10	23	
Power	AC/DC 110~130V 0.73	0.75	5.8		Common use for
consumption	AC 200~240V/DC 250V	1.21	1.35	5.4	Susol MCCBs
	AC 380~440V	1.67	-	3.8	TD100, TD160
	AC 440~480V	1.68	-	3.5	TS100, TS160
Operating time (opening)		50ms (Maximum)			TS250, TS400
Terminal tightening torque		8.2kgf ⋅ cm		TS630, TS800	
Operating voltage	Trip of C/B	35~70% Vn			
	Re-closing of C/B	More than 85%			

# The rating of Shunt Trip (SHT)

	Patod voltago (V/n)	Power consumption			Applied C/B
	haled vollage (vii)	AC (VA)	DC (W)	mA	
Rated voltage	DC 12V	-	0.36	30	
&	AC/DC 24V	0.58	0.58	24	Common use for
Power	AC/DC 48V	1.22	1.23	25	Susol MCCBs
consumption	AC/DC 110~130V	1.36	1.37	10.5	TD100, TD160,
	AC 220~240V/DC250V	1.80	1.88	7.5	TS100, TS160,
	AC 380~500V	1.15	-	2.3	TS250, TS400,
Operating time (opening)		50ms (Maximum)		TS630, TS800	
Terminal tightening torque			8.2kgf · cm		

# 1. Electrical auxiliaries

# Safety Precaution for Auxiliary Switch (AX) / Alarm switch (AL) / Fault alarm switch (FAL)

- (1) Please read the manufacturers' operating instructions and safety precaution before Auxiliary Switch (AX), Alarm switch (AL), Fault alarm switch (FAL) being taken into service.
- (2) The installation and maintenance should be done by qualified engineer. Please mount the internal accessories only to the relevant products.
- (3) Please read carefully safety precaution and follow it to ensure safety and proper operation before installation, wiring, operation, maintenance and inspection of the device.
- (4) Please keep safety precaution listed above for safety reason.
  - Danger: 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

#### — <u>∧</u> Danger

- 1. Make sure that the upstream circuit breaker is disconnected from the supply before product being installed; it may cause electrical shock.
  - \_\_\_\_\_ <u>Aution</u>
- 1. Please read carefully safety precaution and install products according to instruction manual.
- 2. This operating instruction should be given to the end-user or maintenance engineer.
- 3. Please do not put exceeding power on each Hook when assembling them as it can be easily damaged.

# Safety Precaution for Undervoltage trip (UVT) / Shunt trip (SHT)

- Please read the manufacturers' operating instructions and safety precaution before Undervoltage trip (UVT) / Shunt trip (SHT) being taken into service.
- (2) The installation and maintenance should be done by qualified engineer. Please mount the internal accessories only to the relevant products.
- (3) Please read carefully safety precaution and follow it to ensure safety and proper operation before installation, wiring, operation, maintenance and inspection of the device
- (4) Please keep safety precaution listed above for safety reason.
  - Danger: 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

# ▲ Danger

1. Make sure that the upstream circuit breaker is disconnected from the supply before product being installed; it may cause electrical shock.

#### 

- 1. Please read carefully safety precaution and install products according to instruction manual.
- 2. This operating instruction should be given to the end-user or maintenance engineer.
- 3. Please do not put exceeding power on each Hook when assembling them as it can be easily damaged.

# Installation procedure of internal accessories

- (1) Pleas make sure the handle of Susol circuit breakers is in the trip position before installing AX/FAL contacts. Please push the trip button for the trip operation (Refer to the figure.2).
- (2) Please separate aux. cover by releasing 4 screws.
- (3) Please pushing down to the mounting hole on the left/right side of Susol circuit breakers as shown in fig. 3, 4 until the clicking sound hears.
- (4) Please tighten the wire with the specified torque, 0.8Nm(8.2kgf  $\cdot$  cm), as shown in fig.1, 5.
- \* Not necessary to tighten the wires to (AL)/(FAL) as they are already connected.
  (5) Tighten the screws after putting the aux. cover on by the specified torque, 0.8Nm(8.2kgf · cm) for TD100~160 and TS100~250 and 1.2Nm(12.2kgf · cm) for TS400~800.
  - \* In case of TS800, it may not be easy to install Aux. cover as many wires are on TS800. In such case, remove the rib of aux. cover by using proper tools to fix the Aux. cover.
  - \* When removing Undervoltag trip and Shunt trip of TD100~series, please put circuit breakers in the ON position from the Trip position.
- (6) Please check if it operates well or not before putting into service.
  - \* Fault Alarm Switch (FAL) is only applicable to electronic trip unit.
  - \* SHT, UVT can not be used at the same time.

**Susol MCCB Technical Manual** 

# Super Solution

Green Innovators of Innovation

#### HEAD OFFICE

LS Tower 1026-6, Hogye-dong, Dongan-gu Anyang-si, Gyeonggi-do 431-848, Korea Tel. (82-2)2034-4887, 4873, 4918, 4148 Fax. (82-2)2034-4648 http://eng.lsis.biz

#### Cheong-Ju Plant

Cheong-Ju Plant #1, Song Jung Dong, Hung Duk Ku, Cheong Ju, 361-720, Korea Tel. (82-43)261-6001 Fax. (82-43)261-6410

Specifications in this catalog are subject to change without notice due to continuous products development and improvement.

LS Industrial Systems Co., Ltd.