Comprehensive
Catalogue

2009

Susol

Super Solution

Low voltage circuit breakers

LS Industrial Systems

www.lsis.biz

New Name for LG Industrial Systems,
New Take-off for LS Industrial Systems

LS Industrial Systems

To advance to the next level,
LG Industrial Systems is reborn as LS Industrial Systems.
LS Industrial Systems will continue to lead the future
of industrial electrics and automation by providing
Total Solution, a core essential
for competition in the 21st century industrial era.

A brief company chronology

2000'S

Mar. 2005 Official Declaration of NEW Corporate Identification (LS)

Feb. 2004 Signed investment agreement to build electricity/automation equipment factory in Usi City, Jangssu Province, China

Jan. 2004 Opening U.A.E branch office

Dec. 2001 Established trading company in Shanghai, China

Jun. 2001 Unveiled a New Vision including Mid- and Long-Term Strategies

Sept. 2000 Completion of Power Testing & Technology Institute

1990'S

Dec. 1999 Transfer of building equipment business to LG-OTIS

Nov. 1999 Completion of electricity power plant in Vietnam

Jun. 1997 Established joint venture in Vietnam

Sept. 1995 LG Industrial Systems Co., Ltd. Goldstar Instrument & Electric Co., Ltd. and Goldstar Electric Machinery Co., Ltd. merged into one company.

July. 1994 Completion of Dae-Ryun factory in China

1980'S~ 1970'S

July. 1984 LG Industrial Systems Co., Ltd. opened to public

July. 1974 Established LG Industrial Systems Co., Ltd.

1960'S~ 1950'S

1958 ~1973 **LGIS laid foundations for the Electric Power Industry**
After Goldstar Co. was established in 1958, we started to produce WHM (Watt Hour Meter) units for the first time in Korea in 1964. We then proceeded to lay the foundation for the electric power and electronics industries, which were very important bases for industrial development of Korea.

R&D chronology

Susol circuit breakers

META-MEC MCCB and ELCB
(1996~)

MCB, BK type (1989~)

HiMEC MCCB and ELCB
(1989~1998)

2006 | • Developed Susol series MCCB & Contactor, TOR

2002 | • Developed Meta-MEC 4 pole ELCB and Magnetic Contactor
• Developed UL MCCB up to 600A
• Developed the newest Power Equipment Diagnosis System

2001 | • Developed Meta-MEC series low AF MCCB and obtained KEMA certificate according to IEC60947 and marked CE
• Developed high voltage GIS 362kV, 63kA and 8000A

2000 | • Developed Pro-MEC VCB and obtained international quality standard certificates (IEC 60056 & CESI)

1999 | • Developed Meta-MEC series low AF Contactors & TOR and obtained KEMA certificate according to IEC60947 and marked CE
• Developed Korea's first DPR(Digital Protection Relay)
• Developed Meta-MEC series adjustable type MCCB and obtained CE certificate (IEC60947 & KEMA Mark)

1998 | • Developed Meta-MEC series high AF MCCB & MS and obtained KEMA certificate according to IEC60947 and marked CE
• Developed Digital EMPR and obtained EMPR CE certificate

1997 | • Obtained the CE certificate (IEC 60947, TUV certificate) on MCCB, MS

1996 | • LGIS Cheongju Plant obtained the ISO14001

1995 | • Developed Demand Controller
• Developed high-performance Hi-MEC series MCCB & ELCB

1993 | • Obtained ISO9001
• Obtained ISO9002 for low voltage equipment
• Developed EMPR (Electronic Motor Protection Relay)
• Developed Korea's first GIMAC (Digital Integrated Meter)

1992 | • Developed IMC (Intelligent Motor Controller)

1990 | • Obtained U.S. ANSI Standard for vacuum circuit breakers

1989 | • Developed Korea's first high-performance Hi-MEC series MCCB & ELCB

1986 | • Broke the 10million units barrier in electric equipment
• Commenced the SCADA System Project
• Developed 154kV high-voltage GCB (Gas Circuit Breaker)
• Initiated the high-voltage GIS (Gas Insulated Switchgear) project

1984 | • Obtained LR and KR certification for MCCB

1977 | • Developed Earth Leakage Circuit Breakers

1974 | • Developed Molded Case Circuit Breakers

Global technology and R&D are behind the best industrial Electric power and automation products from LSIS

Quality Test at PT&T

High Voltage Test / Impulse Test

Characteristics Test / VCB Characteristics Test

Short-Circuit Test / ACB Breaker Test

Environmental Test /
Non-stop High Temperature Test

Electro Technology R&D Center

The Electro Technology R&D Center focuses on overall research and development activities related to power supply systems such as low and high voltage equipment as well as integrated digital networks, automatic switchboards and integrated power protection.
The R&D Center maximizes energy efficiencies by integrating rapidly developing information & technology, communication, electronics and mechanical engineering, while concentrating its efforts in creating a safe and pleasant industrial environment.

- **Power Equipments**
  The R&D Center researches products and technologies related to low and high voltage circuit breakers and contactors as well as power transmission & distribution.
- **Electric Technology**
  The R&D Center analyzes and researches core technologies related to power equipment.
- **SCADA**
  The R&D Center carries out projects and technology research in the fields of SCADA and DAS.
- **Simulator**
  The R&D Center predicts probable electrocution hazards by conducting simulated analyses of power generation phenomena, and develops simulation technologies and products that can optimize the constituent facilities.

Power Testing & Technology Institute

PT&T is a KOLAS-qualified (Korea Laboratory Accreditation Scheme) accredited testing laboratory and provides worldwide testing service with its 1500MVA-capacity High Power Laboratory, High Voltage Laboratory and Reliability Testing Laboratory.
PT&T is also fully recognized by foreign testing and certification bodies of high reputation as CESI of Italy, KEMA of Netherlands, UL of America, etc. for its low voltage testings.

- **Available Tests**
  - Electro-Mechanical Tests
  - Insulation Performance Tests
  - Short-Circuit Tests
  - Reliability Evaluation Tests
  - Arc Tests
  - Environmental Tests
- **Research & Development**
  Testing Technology, Measuring & Analyzing Technology, Power Equipment Monitoring & Diagnostic Techniques, Reliability Testing & Evaluation Technology.

Customer Satisfaction through Quality & Service
The best products come from LSIS

In order to provide the best quality products and services, LSIS not only has obtained the ISO9001 certificate but also implemented the TCS(Total Certification Service) program to help other affiliated companies to acquire the ISO9001 mark. We place the highest priority on delivering the best quality for complete customer satisfaction.

Quality is the basis for customer satisfaction

LSIS is implementing the 6-Sigma program with the goal of 'zero-defect' to make only the highest quality products. And to secure product reliability, we embody a high quality guarantee system by carrying out product test evaluations that are internationally recognized for their use of the most current technology.

A place for learning the most advanced technologies

The LSIS Training Center is conducting customer technology training for industrial system industry in Korea for the first time. The technical training center is currently giving lessons in the fields of factory automation, industrial electric power and electronics with real practice equipment while providing high-tech services through technical consulting and guidance.


Training Center Auditorium


Technical Training Classes


Product Exhibition Hall

Customer service is available anywhere in the world

LSIS offers web-based customer services anywhere in the world. We provide technical information, prompt Q&A's and accurate history of maintenance through our web service. We have established the Supply Chain Manage- ment System that embodies the integrated management of acquisition, production and sales, and we are now leading e-business in the areas of industrial electric power and automation.


http://www.lsis.biz


Service Information Center

Customer satisfaction with world-class products and services: LS Industrial Systems is committed to excellence!

Cheongju Plant (Korea)

Dalian Plant (China)

Hanoi Plant (Vietnam)

Wuxi Plant (China)

Electric Power Industry |

Electric Equipment & Systems

The electric equipment and systems of LS Industrial Systems, ranging from low to high voltage products, have not only acquired ISO 9001 and 14001 certification for their efficient design and excellent quality, but many other certificates, including KEMA, TÜV, CESI, ASTA, and KERI. The outstanding quality of the products that we are manufacturing conforms to international standards such as IEC, UL, ANSI, CCC, JIS, and KS.

We also provide Total Solutions that encompass customized designs and more advanced technology, as well as efficient production and installation, and highly accurate testing and analysis of power equipment.

Chonan Plant (Korea)

Wuxi Plant (China)

Automation Industry |

Automation Equipment, Industrial IT & RFID

LS Industrial Systems, a leading pioneer of the domestic automation business, developed the first ever PLC, Inverter (AC Drive), and DCS in Korean automation history. We now provide Total Solutions through the diverse application of our own products, ranging from controllers to control systems that are based on sophisticated technology and proven experience, to bring innovative change to distribution systems and logistics.

Janghang Plant (Korea)

Industrial Equipment Industry |

Metal Processing

In addition to supplying basic industrial material, such as copper tubes and STS pipes to the electronics and chemical industries, LS Industrial Systems also manufactures and supplies electric power tools that have been recognized for their excellent performance capabilities in over 38 countries.

Susol Low voltage circuit breakers

Susol LV circuit breakers

Super Solution

Contents :

Susol
MCCB

GOOD DESIGN
산업자원부선정

product
design
award
2007

■ Design for technical strong point: The Susol MCCB

SuSol Series MCCB is available forworld best breaking capacity up to 150kA, and MS is seal structure for hidden electricity Arc.
SuSol product represents simultaneously simple and complicated design for using cut diamond motive to emphasis on the hardness of industrial product.
And we applied the identity of product image by designing same concept MCCB and MS which is installed to cubicle.

SuSol Series acquire the competitive power through getting the picking up GD product and wining IF Design Award.

Super Solution

For power distribution

- The highest breaking capacity
- Optimum coordination technique (Cascading & discrimination)
- Powerful engineering tools

For protection of motor & its control device

- Optimal overload protection
- Guaranteed type-2 coordination between circuit breaker and contactor, relay

For controlling and disconnecting circuits

For extensive applications

- Wide range of optimized auxiliaries and accessories

Susol TD and TS series

Circuit breakers and Disconnecting switches

Susol TD and TS circuit breakers provide superior performance in a compact package. They are used in cascade rated systems, allowing the use of lower interruption circuit breakers downstream, which lead to lower system cost.

While meeting IEC60947-2 service and interrupting ratings, these breakers provide unmatched flexibility by employing a wide variety of trip units including fixed thermal & magnetic, adjustable thermal-fixed magnetic, adjustable thermal adjustable magnetic, and electronic options.

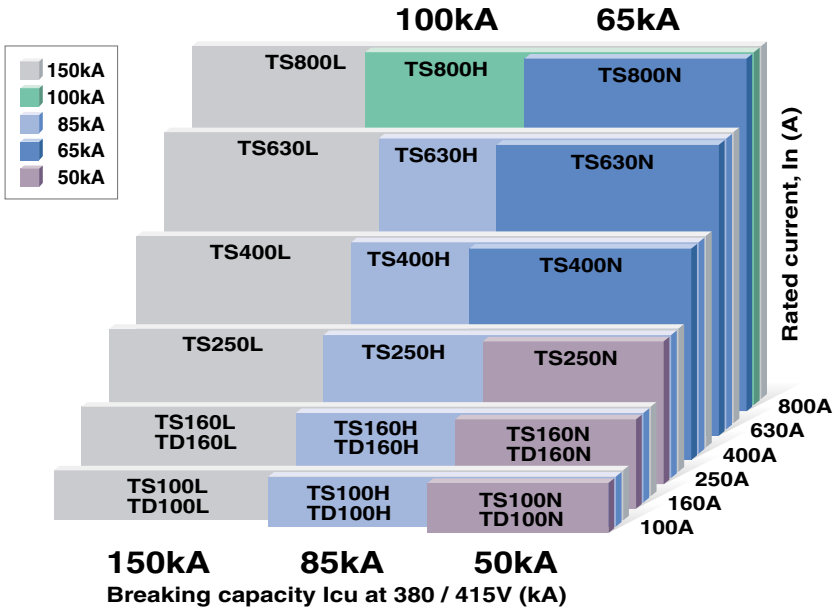
Susol TD circuit breaker is available in one frame size in ratings from 16 to 160 amperes and TS circuit breakers are available in three frame sizes in ratings from 40 to 800 amperes and in interrupting capacities up to 150 kA at 415V AC.

Standard calibration is at 40°C with optional 55°C factory calibration available for applications where higher ambient temperatures are encountered.

Susol MCCB

Susol TD and TS circuit breakers are rated from 16 to 800 amperes and are available in four frame sizes.

Ics=100% Icu : 50, 65, 85, 100, 150kA at 415VAC



Note) 1 pole MCCB N Type: 30kA, H Type: 50kA.

TD100/160

In 16~160A
Icu : 50kA(30kA*)(N), 85kA(50kA*)(H), 150kA(L)
Ics=Icu
90(35*)(W) x 140(H) x 86mm(D)

* 1pole MCCB

24 models in 4 frames

TS100/160/250

In 40~250A
Icu: 50kA(N), 85kA(H), 150kA(L)
Ics=Icu
105(W) x 160(H) x 86mm(D)

TS400/630

In 300~630A
Icu: 65kA(N), 85kA(H), 150kA(L)
Ics=Icu
140(W) x 260(H) x 110mm(D)

TS800

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

Susol MCCB Communication

■ **Communication interface:RS485 (ModBUS)**

■ **Transmittable data :**

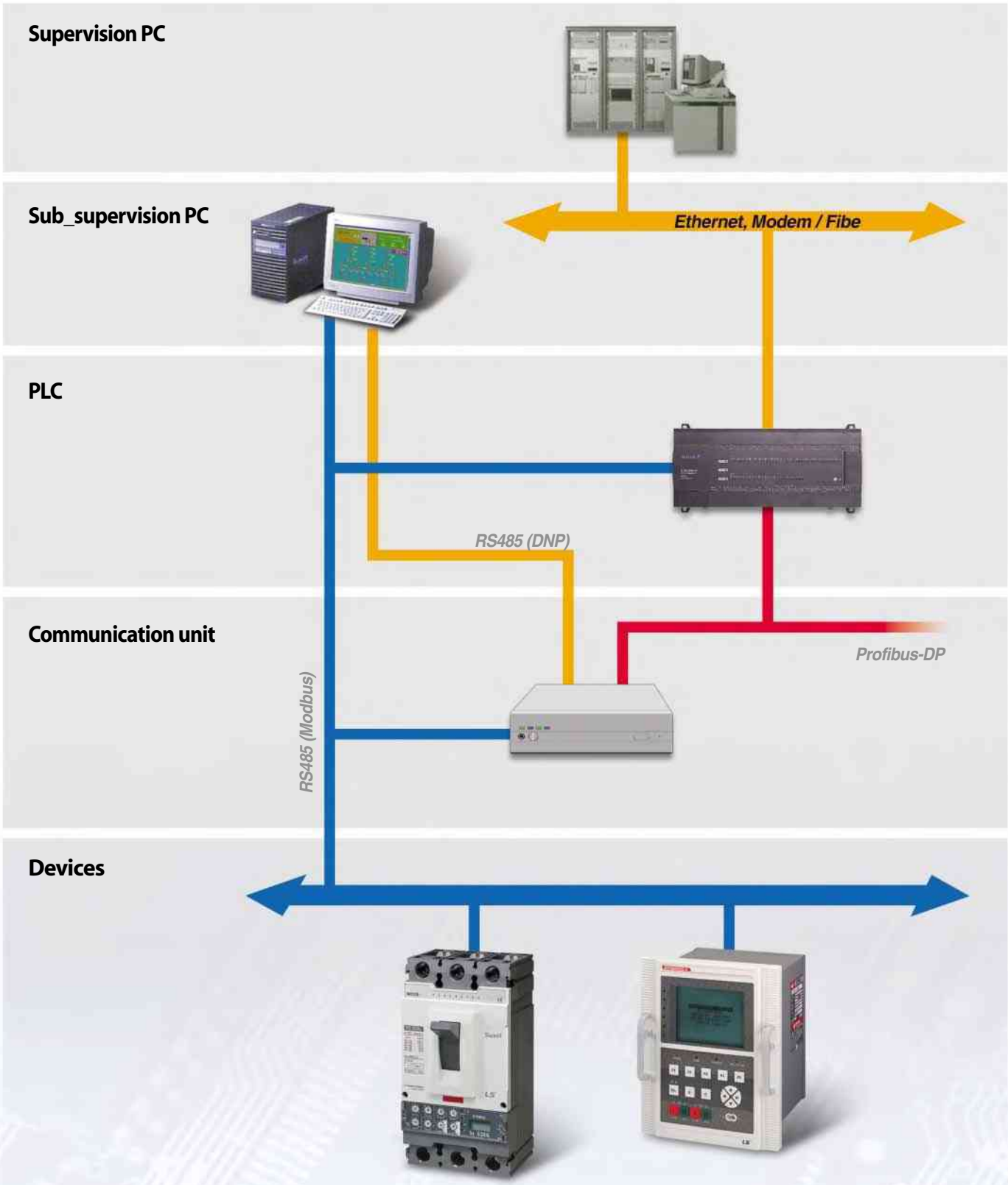
- Reading of protection settings
- The highest current of the three phases
- Measurement: R, S, T and N phase current (RMS)
- Fault reading: Type of fault, Fault phase

■ **The setting of communication address**
By using TR button and LCD display (Ammeter)

■ **ZSI Enable/Occurrence**

■ **Power source: DC24V Power is required**

Providing optimal solution



- MCCB(MODBUS) ➞ CU ➞ Profibus_DP ➞ PLC ➞ EtherNET ➞ Supervision PC
- MCCB(MODBUS) ➞ PLC ➞ EtherNET ➞ Supervision PC
- MCCB(MODBUS) ➞ CU ➞ RS485(DNP) ➞ SUB_Supervision PC
- MCCB(MODBUS) ➞ SUB_Supervision PC

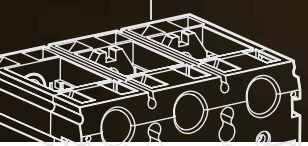
Susol MCCB System overview

Flexibility through modularity

Susol series offer various and compatible accessories which are providing simple installation and easy upgrading of the circuit breaker. Harmonization of the accessories allows stock reduction and greater service flexibility.

System overview

Susol MCCB Trip units



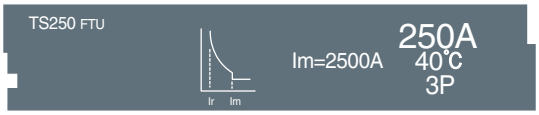
Interchangeable trip unit

Susol TS series circuit breakers provide several kinds of protection function according to selected trip unit and thanks to interchangeable trip unit concept, user can change the trip unit easily and rapidly. Especially, electronic trip units offer many kinds of protection functions.

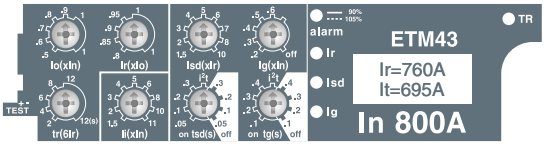
Interchangeable trip units

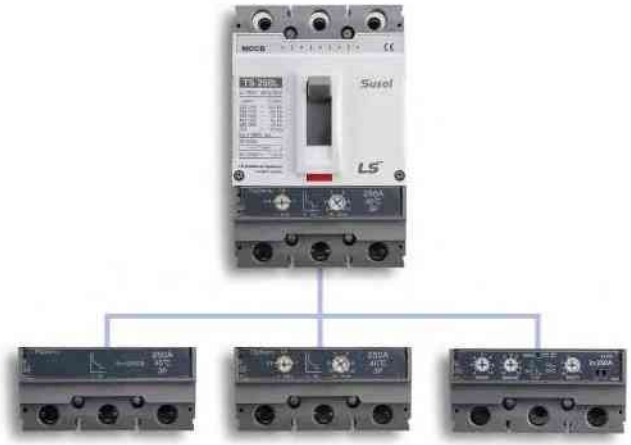
Protection of power distribution systems

1. Thermal Magnetic trip units
   - FTU: Fixed thermal and Fixed magnetic trip unit
   - FMU: Adjustable thermal and Adjustable magnetic trip unit
   - ATU: Adjustable thermal and Adjustable magnetic trip unit



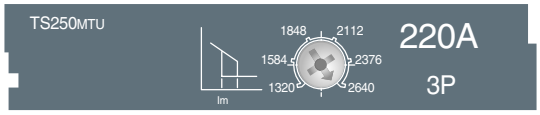
2. Electronic trip units
   - ETS: Standard electronic trip unit
   - ETM: Multi-functional electronic trip unit





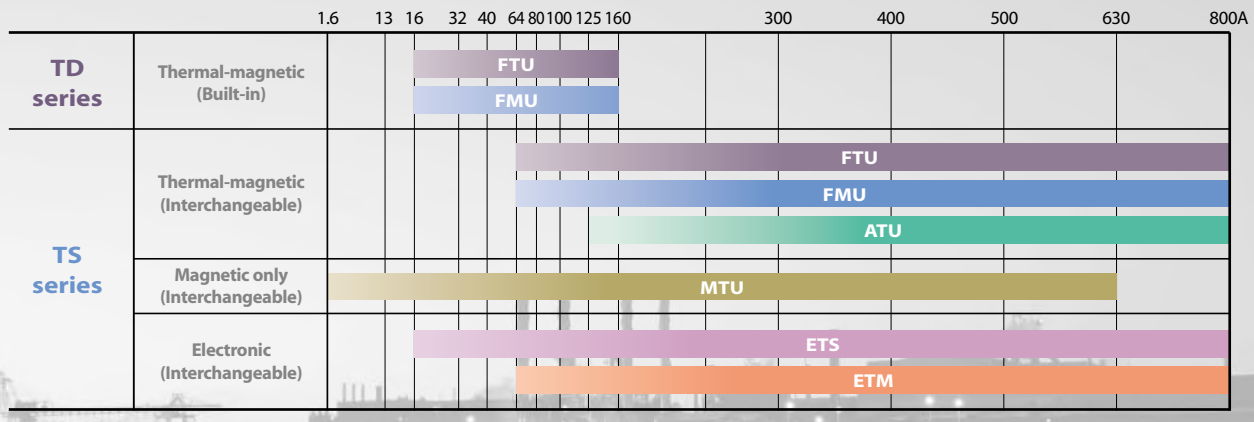
Motor Protection

- MTU: Magnetic only trip unit

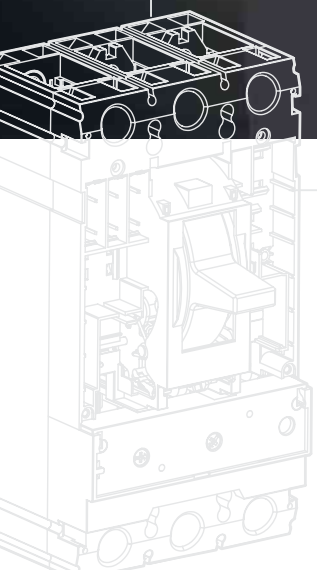


Control and disconnection

- DSU: Disconnecting Switch Unit

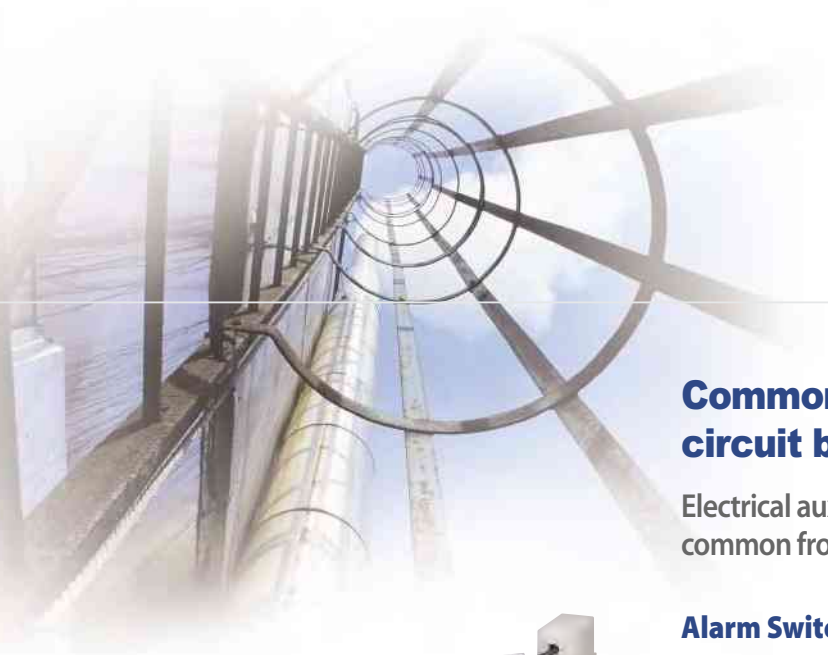


Susol MCCB Internal accessories



Simplicity

The range of internal accessories of TD & TS series circuit breakers is characterized by common use regardless of frame size and is allowing reduction of stocks.



Common use to all Susol TD and TS circuit breakers

Electrical auxiliaries that are installed internally are common from 16A to 800A.

Alarm Switch (AL)

Alarm switches offer provisions for immediate audio or visual indication of a tripped breaker due to overload, short-circuit, operation of shunt trip, or undervoltage trip conditions, operation of push button.

They are particularly useful in automated plants where operators must be signaled about changes in the electrical distribution system. This switch features a closed contact when the circuit breaker is tripped automatically. In other words, this switch does not function when the breaker is operated manually. Its contact is open when the circuit breaker is reset.

Fault Alarm Switch (FAL)

FAL indicates that the circuit breaker has tripped because of overload or short-circuit.

Auxiliary Switch (AX)

Auxiliary switch is for applications requiring remote “ON” and “OFF” indication. Each switch contains two contacts having a common connection. One is open and the other closed when the circuit breaker is open, and vice-versa.

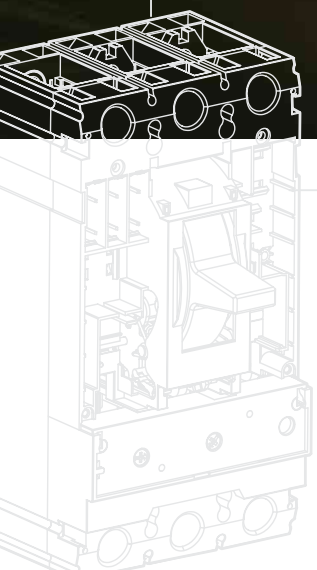
Undervoltage trip (UVT)

The undervoltage trip automatically opens a circuit breaker when voltage drops to a value ranging between 35% to 70% of the line voltage. The operation is instantaneous, and the circuit breaker cannot be reclosed until the voltage returns to 85% of line voltage. Continuously energized, the undervoltage trip must be operating be fore the circuit breaker can be closed.

Shunt Trip (SHT)

The shunt trip opens the mechanism in response to an externally applied voltage signal. LS shunt trips include coil clearing contacts that automatically clear the signal circuit when the mechanism has tripped.

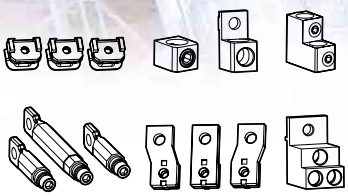
Susol MCCB External accessories



Convenience

Wide range of external accessories provides convenient solution for mounting, cable connection, insulation, safety lock and remote control.

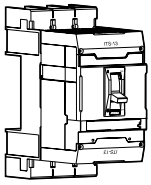
External accessories



Front and rear connection

Several kinds of terminals can be equipped with Susol TD and TS circuit breakers.

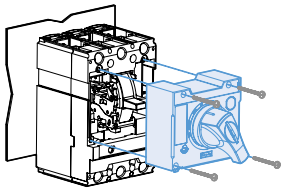
- Terminal mounter
- Terminal box for bare cable
- Extended lug terminal box
- Spreader
- Rear terminal



Plug-in base

It makes to extract and/or rapidly replace the circuit breaker without having to touch connections.(Easy replacement and maintenance)

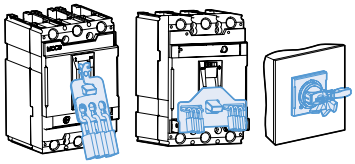
- Standard Plug-in base
- Plug-in base for 2 line arrangement



Direct & Extended Rotary Handle

There are two types of rotary handles.

- Direct rotary handle(with or W/O key lock device)
- Extended rotary handle

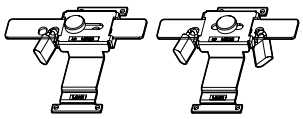


Locking device

- Fixed padlock
- Removable padlock
- Key lock device on direct handle

Motor operator

Motor operators enable the circuit-breaker to be switched ON and OFF locally or by remote control.



Mechanical interlocking device

Interlocks prevent connection to both sources at the same time, even momentarily.

Susol MCCB Residual Current Devices

■ Protection against earth leakage currents

The Susol circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). RCD unit interfaces directly below the circuit breaker trip unit area without the use of any secondary wiring or connections

Residual Current Devices
RTU23, RTU33 and RTU43 for TS type MCCBs

Apart from the protection against overloads typical of automatic circuit breakers, the residual current circuit breaker derived from them also guarantee protection of people against earth leakage currents, thereby ensuring protection against direct contacts, indirect contacts and fire hazards.-(ELCB)

The RCD unit has numerous current and time settings and an override blocking the time settings when set to 30mA. The earth leakage test button tests the electrical and mechanical operation of the device. In order to allow for a dielectric test of the breaker and RCD combination without damaging the electronics, the dielectric plug is placed within the setting area.

The RCD unit may be equipped with an alarm switch (FAL) to remotely indicate tripping due to an earth leakage current.

		RTU23	RTU33	RTU43
Number of poles		3*	3*	3*
Applicable circuit breaker	TS100	■		
	TS160	■		
	TS250	■		
	TS400		■	
	TS630		■	
	TS800			■
Protection charicteristics				
Sensitivity	I△n(A)	(adjustable) 0.03-0.3-1-3-10	(adjustable) 0.03-0.3-1-3-10	(adjustable) 0.03-0.3-1-3-10
Time delay **	Intentional time delay(ms)	(adjustable) 0-60-150-300-600	(adjustable) 0-60-150-300-600	(adjustable) 0-60-150-300-600
	Max. breaking time(ms)	(adjustable) 40-140-240-450-880	(adjustable) 40-140-240-450-880	(adjustable) 40-140-240-450-880
Rated voltage	AC 50/60 Hz	220~460V / 460~690V	220~460V / 460~690V	220~460V / 460~690V

* 3P modules may also be used on 2P circuit breakers.
** If the sensitivity is set to 30mA, the time delay setting is reduced to zero.

Susol MCCB Main characteristics

Susol series circuit breakers are suitable for

- Protection of power distribution
- Protection of motor & its control device
- Controlling and disconnecting circuits

Optimum technical support for

(Cascading, Discrimination, Type 2 coordination)

- Selecting economical protection system
- Quarantee safety of the installation
- Reducing the stress on components and damage
- Guarantee service continuity


MCCB
TS 800L
Susol
LS
TS800ATU
800A
40°C
3P


MCCB
TS 630L
Susol
LS
TS630ATU
630A
40°C
3P


MCCB
TS 250L
Susol
LS
250A
40°C
3P


MC-32
Susol
LS


MCCB
TS 250L
Susol
LS
250A
40°C
3P


MC-63
Susol
LS
MT-63
Susol
LS


MCCB
Susol
TS 800L
Susol
MCCB

A-1. Overview

Range of LS's low voltage circuit breakers

Susol

	Main switchboard	Main / Sub switchboard
Type of circuit breakers	ACB	MCCB
Rated current, In	630~5000A	16~800A
Breaking capacity, Icu	65~100kA	30*, 50, 65, 85, 100, 150kA
Service breaking capacity (% Icu), Ics	100%	100%
Rated short time withstand current, Icw	65~85kA	-
Applied standard	IEC 60947-2	IEC 60947-2
Utilization category	B	A
Image of circuit breaker		
Brand name	Ace-MEC	Susol
Image of brand	ACE MEC	Susol
Model name	LBA series	TD, TS series

* 1pole MCCB

Range of LS's low voltage circuit breakers

Susol

Main / Sub switchboard			Final distribution
MCCB	MCCB	MCCB	MCB
16~1600A	3~1200A	15~600A	1~125A
35, 50, 85kA	5~85kA	25, 35, 50kA	6, 10kA
75%	50%		
-	-	-	-
IEC 60947-2	IEC 60947-2	UL489	IEC 60947-2 / IEC 60898
A	A		
			
Meta-MEC	Meta-MEC	Meta-MEC	-
GB series	AB series	AB-U series	BK series

Range of Susol products

Susol

	160AF			250AF		
	Susol TD circuit breakers					
For power distribution						
	TD100	TD160	TD160 1P			
	Thermal magnetic trip unit					
	FTU	FTU	-			
	FMU	FMU	-			
	Susol TS circuit breakers					
For power distribution						
				TS100	TS160	TS250
				Thermal magnetic trip unit		
				FTU (Fixed thermal, Fixed magnetic trip unit)		
				FMU (Adjustable thermal, Fixed magnetic trip unit)		
				ATU (Adjustable thermal, Adjustable magnetic trip unit)		
				Electronic trip unit		
				ETS (Electronic trip unit, Standard)		
	Susol TS circuit breakers					
For motor protection				MTU (Magnetic only trip unit)		
	Susol switch-disconnectors					
Switch disconnector						
			TD160NA	TS100NA	TS160NA	TS250NA
			Disconnecting switch unit			
			DSU (Disconnecting switch unit)			

	630AF		800AF
For power distribution			
	Susol TS circuit breakers		
For power distribution			
	TS400	TS630	TS800
	Thermal magnetic trip unit		
	FTU (Fixed thermal, Fixed magnetic trip unit)		
	FMU (Adjustable thermal, Fixed magnetic trip unit)		
	ATU (Adjustable thermal, Adjustable magnetic trip unit)		
	Electronic trip unit		
	ETS (Electronic trip unit, Standard)		
	ETM (Electronic trip unit, Multifunction)		
	Susol TS circuit breakers		
For motor protection	MTU (Magnetic only trip unit)		
	Susol switch-disconnectors		
Switch disconnector			
	TS400NA	TS630NA	TS 800NA
	Disconnecting switch unit		
	DSU (Disconnecting switch unit)		

Overview of TD/TS family

Susol

			TD series								
											
MCCBs for power distribution			TD100			TD160			TS100		
Frame size		[AF]	100			160			100		
Rated current, In♣		[A]	16, 20 25, 32, 40, 50, 63, 80, 100			1P: 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160 2, 3P: 100, 125, 160			40, 50, 63, 80, 100		
No. of poles			2*, 3, 4			1, 2*, 3, 4			2*, 3, 4		
Rated operational voltage, Ue	AC	[V]	690			240(1P), 690			690		
	DC	[V]	500			250(1P), 500			500		
Rated impulse withstand voltage, Uimp		[kV]	8			8			8		
Rated insulation voltage, Ui		[V]	750			750			750		
Rated ultimate short-circuit breaking capacity, Icu			N	H	L	N	H	L	N	H	L
AC 50/60Hz	220/240V	[kA]	85	100	200	30(1P) 85	50(1P) 100	200	100	120	200
	380/415V	[kA]	50	85	150	50	85	150	50	85	150
	440/460V	[kA]	50	70	130	50	70	130	50	70	130
	480/500V	[kA]	30	50	65	30	50	65	42	65	85
	660/690V	[kA]	5	8	10	5	8	10	10	15	20
DC	250V	[kA]	42	65	100	16(1P) 42	25(1P) 65	100	50	85	100
DC(2poles in series)	500V	[kA]	42	65	100	42	65	100	50	85	100
Rated service breaking capacity, Ics		[%Icu]	100%	100%	100%	100%	100%	100%	100%	100%	100%
MCCBs for motor protection											
Frame size		[AF]	-			-			100		
Poles			-			-			3		
Operational voltage, Ue		[V]	-			-			690		
Breaking capacities									N	H	L
	Icu at 380/415V	[kA]	-			-			50	85	150
Trip unit	Magnetic only		-			-			●	●	●
Switch-disconnectors											
Rated thermal current, Ith		[A]	-			160			100		
Rated operational current, Ie		[A]	-			160			100		
Poles			-			2, 3, 4			2, 3, 4		
Operational voltage, Ue	AC 50-60Hz	[V]	-			690			690		
	DC	[V]	-			500			500		
Rated short-circuit making capacity, Icm		[kA peak]	-			3.1			2.8		
Rated short-time withstand current, Icw	1s	[A rms]	-			2200			2000		
	3s	[A rms]	-			2200			2000		
	20s	[A rms]	-			960			690		
Basic dimensions											
			W	H	D	W	H	D	W	H	D
front connection	1-pole	[mm]	-	-	-	35	140	86	-	-	-
	3-pole	[mm]	90	140	86	90	140	86	105	160	86
	4-pole	[mm]	120	140	86	120	140	86	140	160	86

♣ Applicable to MCCBs equipped with FTU, FMU, ATU

* 2 pole MCCB in 3pole frame size ** 700A only available for TS800FTU

Overview of TD/TS family

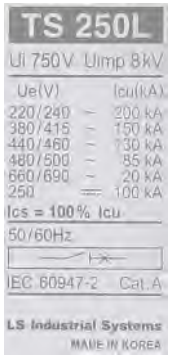
Susol

TS series





	TS160			TS250			TS400			TS630			TS800		
	160			250			400			630			800		
	100, 125, 160			125, 160, 200, 250			300, 400			500, 630			700**, 800		
	2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4		
	690			690			690			690			690		
	500			500			500			500			500		
	8			8			8			8			8		
	750			750			750			750			750		
	N	H	L	N	H	L	N	H	L	N	H	L	N	H	L
	100	120	200	100	120	200	100	120	200	100	120	200	100	120	200
	50	85	150	50	85	150	65	85	150	65	85	150	65	100	150
	50	70	130	50	70	130	65	85	130	65	85	130	65	100	130
	42	65	85	42	65	85	42	65	85	42	65	85	42	85	100
	10	15	20	10	15	20	10	20	35	10	20	35	10	20	35
	50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
	50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	160			250			400			630			800		
	3			3			3			3			3		
	690			690			690			690			690		
	N	H	L	N	H	L	N	H	L	N	H	L	N	H	L
	50	85	150	50	85	150	65	85	150	65	85	150	65	100	150
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	160			250			400			630			800		
	160			250			400			630			800		
	2, 3, 4			2, 3, 4			2, 3, 4			2, 3, 4			2, 3, 4		
	690			690			690			690			690		
	500			500			500			500			500		
	3.6			4.9			7.1			8.5			12		
	2500			3500			5000			6300			8000		
	2500			3500			5000			6300			8000		
	960			1350			1930			2320			2560		
	W	H	D	W	H	D	W	H	D	W	H	D	W	H	D
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	105	160	86	105	160	86	140	260	110	140	260	110	210	320	135
	140	160	86	140	160	86	185	260	110	185	260	110	280	320	135



Molded Case Circuit Breakers

The new series of TD and TS circuit-breakers is available in four frame sizes : 160, 250, 630, 800AF
The breakers are able to cover a range of service currents up to 800A and are available in the fixed version and plug-in version.
The breaking capacities, at 380/415V, are classified by following letters:

N: 50kA for 160 and 250AF
65kA for 630 and 800AF
H: 85kA for 160, 250 and 630AF
100kA for 800AF
L: 150kA for 160, 250, 630, 800AF

TD & TS circuit-breakers are climate-proof. The breakers are intended for use in rooms where there are no excessive operating conditions (e.g. dust, corrosive vapors, gases).
If the circuit-breakers are used in dusty or humid locations, suitable enclosures should be provided. Sufficient fresh air supply must be provided if there are harmful gases (e.g. hydrogen-sulfide vapor) in the ambient air.

All Susol TD and TS circuit breakers offer positive contact indication and are suitable for isolation in compliance with standards IEC 60947-1 and 2.

TD & TS circuit-breakers are suitable for protection of
- Power distribution systems supplied by transformers or generators
- Motor and generator

A switch-disconnector of Susol TD and TS circuit breakers is available for for circuit control and isolation.

Susol-TD and TS series circuit breakers and auxiliaries 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

IEC 60947-3

Low-voltage switchgear and controlgear
- Part 3: Switches, disconnectors, switchdisconnectors and fuse-combination units

IEC 60947-4

Low-voltage switchgear and controlgear
- Part 4-1: Contactors and motor-starters
  Electromechanical contactors and motor starters Switches, disconnectors, switchdisconnectors
- Part 4-2: Contactors and motor-starters
  AC semiconductor motor controllers and starters
- Part 4-3: Contactors and motor-starters
  AC semiconductor controllers and contactors for non-motor loads

The following certificates are available on a request.
- CE Declaration of conformity
- Certificate of conformance test (CB) - IEC 60947
- Full type test report issued by KEMA
- Certificate of conformance test - CCC (China)
- Letter of origin

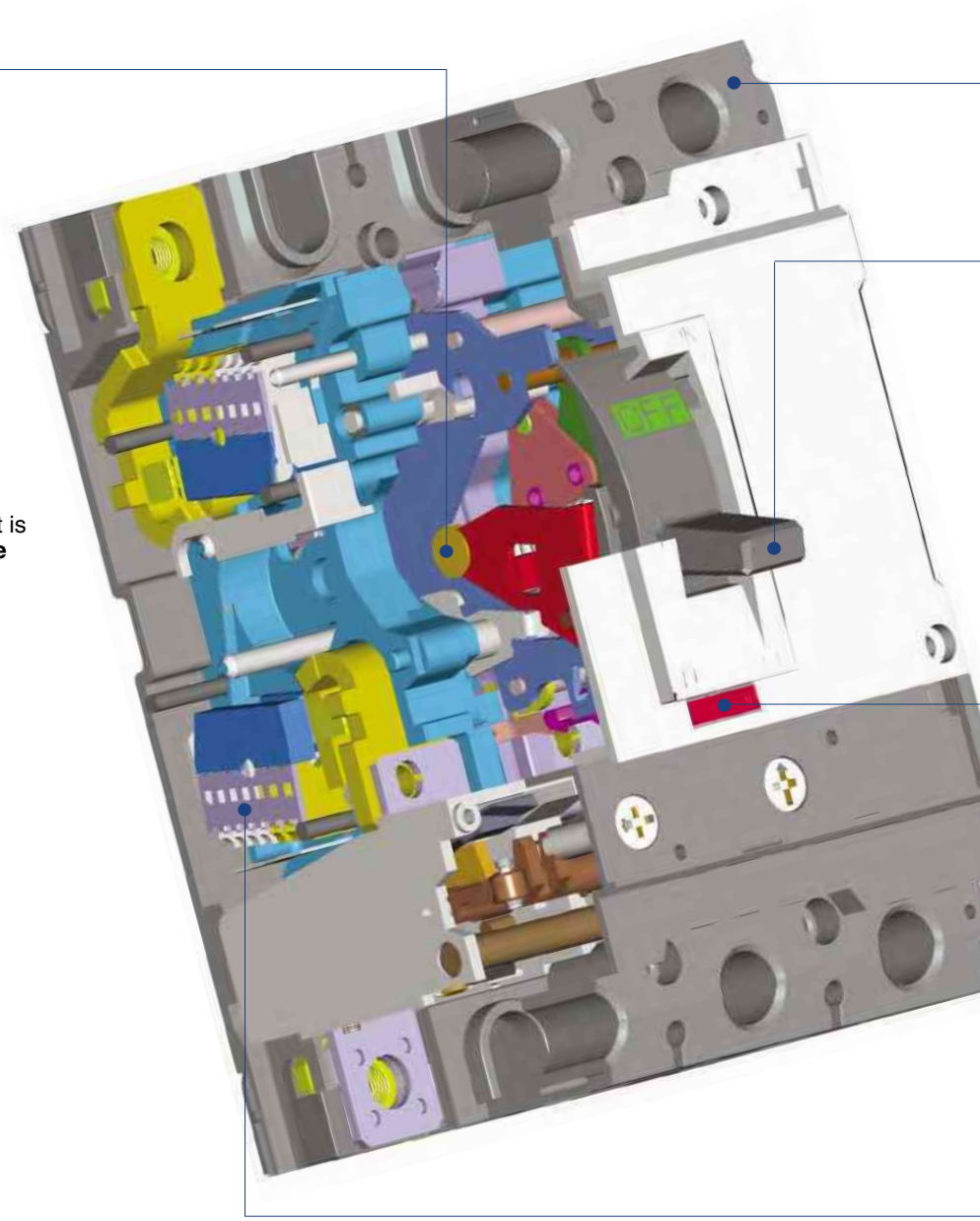
CE conformity marking

The CE conformity marking shall indicate conformity to all the obligations imposed on the manufacturer, as regards his products, by virtue of the European Community directives providing for the affixing of the CE marking.
When the CE marking is affixed on a product, it represents a declaration of the manufacturer or of his authorized representative that the product in question conforms to all the applicable provisions including the conformity assessment procedures. This prevents the Member States from limiting the marketing and putting into service of products bearing the CE marking, unless this measure is justified by the proved non-conformity of the product.

IECEE CB SCHEME

The IECEE CB Scheme is the world's first truly international system for acceptance of test reports dealing with the safety of electrical and electronic products. It is a multilateral agreement among participating countries and certification organizations. A manufacturer utilizing a CB test report issued by one of these organizations can obtain national certification in all other member countries of the CB Scheme.
The Scheme is based on the use of international (IEC) Standards. If some members' national standards are not yet completely harmonized with IEC Standards, national differences are permitted if clearly declared to all other members. The CB Scheme utilizes CB Test Certificates to attest that product samples have successfully passed the appropriate tests and are in compliance with the requirements of the relevant IEC Standard and with the declared national differences of various member countries.
The main objective of the Scheme, is to facilitate trade by promoting harmonization of the national standards with international Standards and cooperation among product certifiers worldwide in order to bring product manufacturers a step closer to the ideal concept of "one product, one test, one mark, where applicable'.

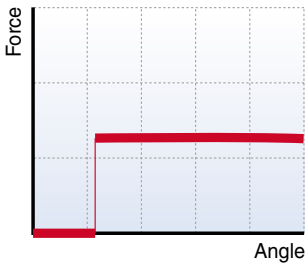
The primary components are: a switching mechanism, an automatic tripping device (and manual trip button), contacts, an arc-extinguishing device, terminals and a molded case.



Mechanism unit

- Unvarying contact force regardless of over travel
- RTA (Rapid Toggle Area)
  Open speed of moving contact is rapid by **optimized cam curve** regardless of trip signal

Optimized cam curve



Unvarying contact force

Molded case

- UL94 V-0 flame retarded
- High strength

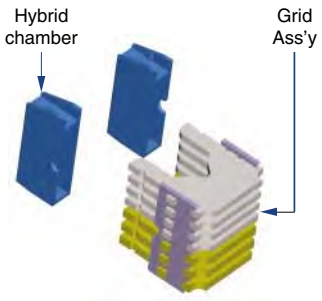
Trip button (push to trip)

- Enables tripping mechanically from outside, for confirming the operation of the accessory switches and the manual resetting function.

Note) Fault Alarm Switch, FAL is not operated by trip button.
FAL is applicable only to the breakers with electronic trip units.

Arc-Extinguishing unit

- PASQ Type Quenching Chamber
- Very superior to increasing arc voltage during short time
- PASQ ;
  - Puffer Assisted Self-Quenching
  - Patented by LSIS



Handle

- Function of indications
  - "ON" "OFF" "TRIP"
- Resetting
  When the handle indicates "tripped" position it must first be reset by moving the handle to the "OFF" position and then closing is possible
- Trip-Free even if the handle is held at "ON", the breaker will trip if an over current flows
- Suitable for Verification of the main contact position under abnormal conditions because the handle doesn't indicate open position

Marking and configuration

Rated frequency

Symbol indicating suitability for isolation as defined by IEC 947-2

Standard

Manufacturer

Utilization category

Marking and configuration

Susol

Model (Rating and breaking capacity)
- TS: Series
- 250: Max. Ampere rating
- N: Normal (Standard)
- H: High
- L: Current limiting

Standardized characteristics:
- Ui: Rated insulation voltage
- Uimp: Impulse withstand voltage
- Ue: Rated operational voltage
- Icu: Ultimate breaking capacity
- Ics: Service breaking capacity

	160AF	250AF	630AF	800AF
N - -	TD100N TD160N -	TS100N TS160N TS250N	TS400N TS630N -	TS800N - -
H - -	TD100H TD160H -	TS100H TS160H TS250H	TS400H TS630H -	TS800H - -
L - -	TD100L TD160L -	TS100L TS160L TS250L	TS400L TS630L -	TS800L - -

N	30kA(1P) 50kA	50kA	65kA	65kA
H	50kA(1P) 85kA	85kA	85kA	100kA
L	150kA	150kA	150kA	150kA

Product: Molded Case Circuit Breaker

Upstream connections

Fixing hole

Certificate plate

Indication of closed (I/ON) position

Brand name

Operating handle

Indication of open (O/OFF) position

Company logo

"push to trip" button

Rating of trip unit

Trip unit

Fixing hole

Downstream connections

Overview of trip units

Susol

On TS100 to TS800 circuit breakers, the thermal-magnetic and electronic trip units are interchangeable and may be rapidly fitted to the circuit breakers.
It is therefore easy to change the protection of a given circuit following a modification in an installation. On TS400 and 630 circuit breakers, the electronic trip units are interchangeable plug-in modules. Trip unit ETM offers a large number of protection settings.

Each Trip devices has different types of protection depending on the associated trip unit:

- Standard protection
- Protection of networks supplied by line distribution
- Protection of long cables
- Protection of DC networks
- Protection of motor-starters
- Service connection circuit breaker (for special subscriber contracts)

Susol TD100, TD160 circuit breakers may be equipped with either FTU or FMU.
The trip units are not interchangeable types and can be supplied only after fixed with circuit breakers.

Ampere ratings

MCCB frame type		Rated current, In[A]						
	Type of trip unit	Thermal magnetic release				Electronic release		DSU
		FTU	FMU	ATU	MTU	ETS	ETM	
TD100	Built in unit	16, 20, 25, 32, 40, 50, 63, 80, 100	16, 20, 25, 32, 40, 50, 63, 80, 100	-	-	-	-	-
TD160		100, 125, 160	100, 125, 160	-	-	-	-	160
TS100	Inter changeable trip unit	40, 50, 63, 80, 100	40, 50, 63, 80, 100	-	1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100	40, 80	-	100
TS160		100, 125, 160	100, 125, 160	100, 125, 160	32, 50, 63, 100, 160	40, 80, 160	-	160
TS250		125, 160, 200, 250	125, 160, 200, 250	125, 160, 200, 250	100, 160, 220	40, 80, 160, 250	-	250
TS400		300, 400	300, 400	300, 400	320	160, 250, 400	160, 250, 400	400
TS630		500, 630	500, 630	500, 630	500	160, 250, 400, 630	160, 250, 400, 630	630
TS800		700, 800	800	800	630	630, 800	630, 800	800

Types of trip units

FTU	• Fixed thermal, Fixed magnetic
FMU	• Adjustable thermal, Fixed magnetic
ATU	• Adjustable thermal, Adjustable magnetic
MTU	• Magnetic only
ETS	• Electronic (LSI)
ETM	• Electronic (LSIG, Ammeter, Communication, Zone selective interlocking)
DSU	• Disconnecting switch

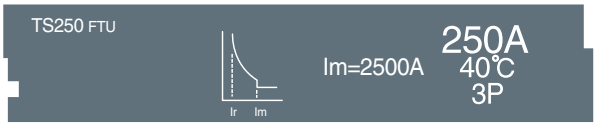
Overview of trip units

Trip unit identification

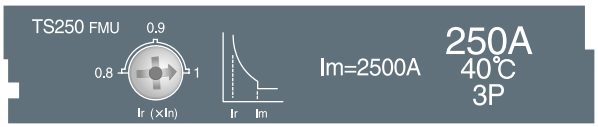
TS250 FMU

- TS250 — MCCB frame type
- FMU — Trip unit function

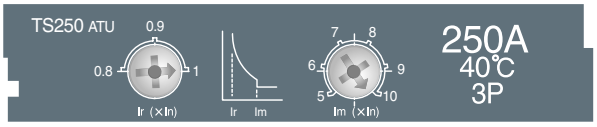
FTU Fixed-thermal, fixed-magnetic



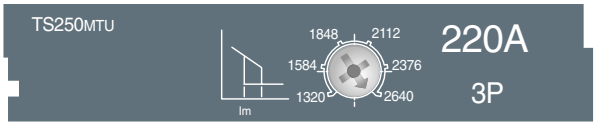
FMU Adjustable-thermal, fixed-magnetic



ATU Adjustable-thermal, adjustable-magnetic

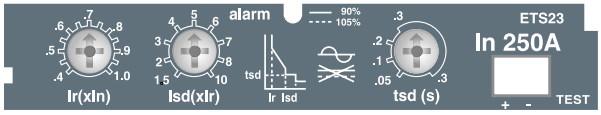


MTU Magnetic only

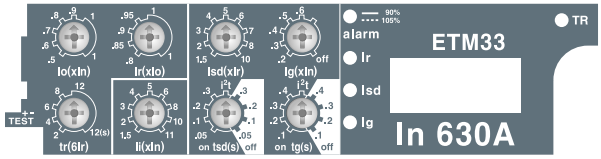


DSU Disconnecting switch

ETS Electronic (LSI)



ETM Electronic (LSIG, multi-function unit)



Double contactor structure

Optimize

Repulsion force

Shape of contactor

- Induce easily the arc mobility to grid direction
- Rapidly redeploy the arc from moving contactor
- Prevent contact tip from erosion

Open speed & contact force

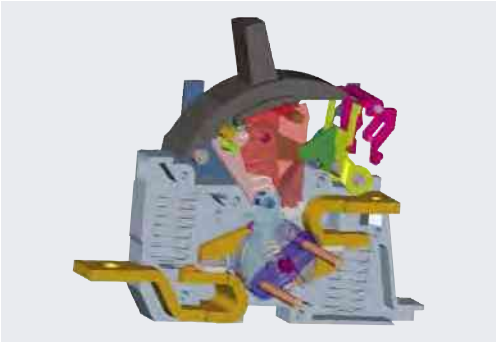


Fig. 3 “ON“ position

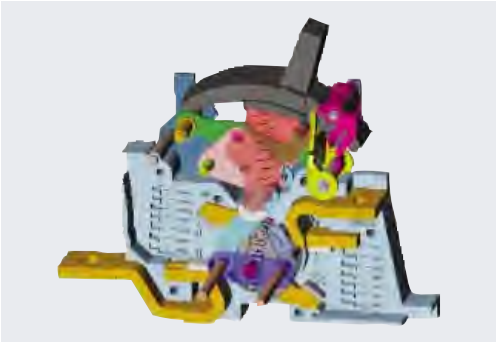


Fig. 4 “OFF“ position

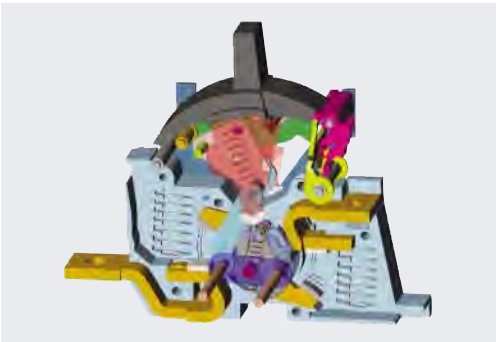
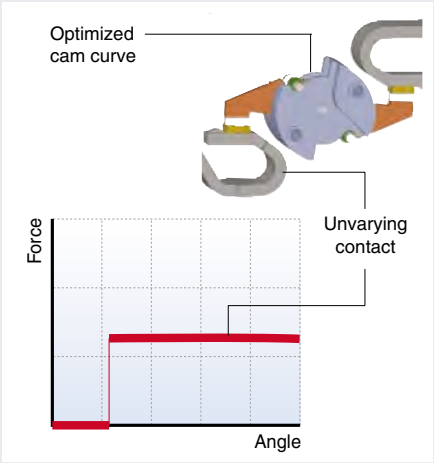


Fig. 5 “TRIP“ position

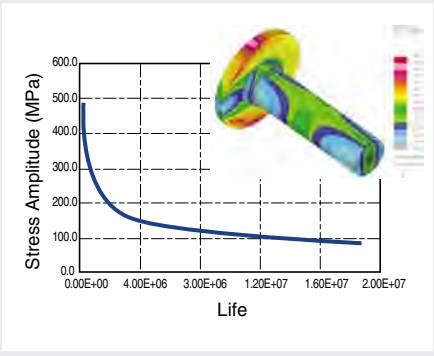
ON position

- Unvarying contact force regardless of over travel
- Open speed of moving contact is rapid by optimized cam curve regardless of trip signal
- Function of trip free



OFF position

- Push to trip in OFF position
  * Reset pin moment < Main spring moment
- Stability of endurance

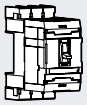
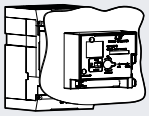
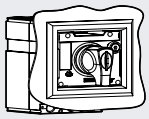
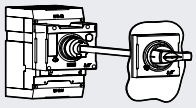


TRIP position

- Enables tripping mechanically from outside, for confirming the operation of the accessory switches and the manual resetting function

Degree of protection

The table indicates the degrees of protection guaranteed by Susol TD and TS circuit-breakers according to several type of installation. Basically, the fixed parts are always preset with IP20 degree of protection.
IP65 degree of protection can be obtained with the circuit-breaker installed in a switchboard fitted with an extended rotary handle operating mechanism transmitted on the compartment door.

Type	Degree of protection	IP	Protection of persons against access to hazardo us parts with:
 Circuit breaker	Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts	IP20	Wire
 Circuit breaker with terminal cover	The access probe of 2.5mm diameter shall not penetrate.	IP30	Wire
 Plug-in circuit breaker	Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts. * When the circuit breaker is installed and the supplied covers are mounted.	IP20 or IP30	Wire
 Circuit breaker with cover frame for door cutout	The access probe of 1.0mm shall not penetrate.	IP40	Wire
 Circuit breaker with cover frame and motor operator	The access probe of 1.0mm diameter shall not penetrate.	IP40	Wire
 Circuit breaker with cover frame and rotary direct handle	The access probe of 1.0mm diameter shall not penetrate.	IP40	Wire
 Circuit breaker with cover frame and rotary extended handle	Totally protected against ingress of dust and water jets fromany direction	IP65	Wire


MCCB
Susol
LS

A-2. Main characteristics

Electrical characteristics

			TD100			TD160			TS100		
Frame size		[AF]	100			160			100		
Rated current, In ♣		[A]	16, 20, 25, 32, 40, 50, 63, 80, 100			1P: 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160 2, 3P: 100, 125, 160			40, 50, 63, 80, 100		
No. of poles			2*, 3, 4			1, 2*, 3, 4			2*, 3, 4		
Rated operational voltage, Ue	AC	[V]	690			240(1P), 690			690		
	DC	[V]	500			250(1P), 500			500		
Rated impulse withstand voltage, Uimp		[kV]	8			8			8		
Rated insulation voltage, Ui		[V]	750			750			750		
Rated ultimate short-circuit breaking capacity, Icu			N	H	L	N	H	L	N	H	L
AC 50/60Hz	220/240V	[kA]	85	100	200	30(1P) 85	50(1P) 100	200	100	120	200
	380/415V	[kA]	50	85	150	50	85	150	50	85	150
	440/460V	[kA]	50	70	130	50	70	130	50	70	130
	480/500V	[kA]	30	50	65	30	50	65	42	65	85
	660/690V	[kA]	5	8	10	5	8	10	10	15	20
DC	250V	[kA]	42	65	100	16(1P) 42	25(1P) 65	100	50	85	100
	500V(2poles in series)	[kA]	42	65	100	42	65	100	50	85	100
Rated service breaking capacity, Ics		[%Icu]	100%	100%	100%	100%	100%	100%	100%	100%	100%
Rated short-circuit making capacity Icm											
AC 50/60Hz	220/240V	[kA]	187	220	440	105(1P) 187	105(1P) 220	440	220	264	440
	380/415V	[kA]	105	187	330	105	187	330	105	187	330
	440/460V	[kA]	105	154	286	105	154	286	105	154	286
	480/500V	[kA]	63	105	143	63	105	143	88	143	187
	660/690V	[kA]	8	14	17	8	14	17	17	30	40
Category of utilization				A			A			A	
Isolation behavior				●			●			●	
Trip unit (release)											
Thermal-Magnetic											
● fixed-thermal, fixed-magnetic		FTU		●			●			●	
● adjustable-thermal, fixed-magnetic		FMU		●			● *****			●	
● adjustable-thermal, adjustable-magnetic		ATU		-			-			-	
● magnetic only		MTU ***		-			-			●	
Electronic											
● LSI		ETS ***		-			-			●	
● LSI		ETM ***		-			-			-	
Option	Earth-fault protection, Ig			-			-			-	
	Zone selective interlocking, ZSI			-			-			-	
	Ammeter			-			-			-	
	Communication			-			-			-	
	Earth-leakage protection module ****			-			-			-	
Connection	fixed	front-connection		●			●			●	
		rear-connection		●			● *****			●	
	plug-in	front-connection		●			● *****			●	
		rear-connection		●			● *****			●	
Mechanical life		[operations]	25000			25000			25000		
Electrical life @ 415 V AC		[operations]	10000			10000			10000		
Basic dimensions, W×H×D (front connection)	1-pole	[mm]	-			35×140×86			-		
	3-pole	[mm]	90×140×86			90×140×86			105×160×86		
	4-pole	[mm]	120×140×86			120×140×86			140×160×86		
Weight (front connection)	1-pole	[kg]	-			0.57			-		
	3-pole	[kg]	1.5			1.5			2		
	4-pole	[kg]	1.8			1.8			2.6		
Reference standard			IEC60947-2			IEC60947-2			IEC60947-2		

♣ Applicable to MCCBs equipped with FTU, FMU, ATU
* 2 pole MCCB in 3pole frame size
** 700A only available for TS800FTU
*** Available for 3pole circuit breakers
**** Under development
***** Not applicable to 1pole

TS160			TS250			TS400			TS630			TS800		
160			250			400			630			800		
(100)※, 125, 160			125, 160, 200, 250			300, 400			500, 630			700**, 800		
2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4		
690			690			690			690			690		
500			500			500			500			500		
8			8			8			8			8		
750			750			750			750			750		
N	H	L	N	H	L	N	H	L	N	H	L	N	H	L
100	120	200	100	120	200	100	120	200	100	120	200	100	120	200
50	85	150	50	85	150	65	85	150	65	85	150	65	100	150
50	70	130	50	70	130	65	85	130	65	85	130	65	100	130
42	65	85	42	65	85	42	65	85	42	65	85	42	85	100
10	15	20	10	15	20	10	20	35	10	20	35	10	20	35
50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
220	264	440	220	264	440	220	264	440	220	264	440	220	264	440
105	187	330	105	187	330	143	187	330	143	187	330	143	220	330
105	154	286	105	154	286	143	187	286	143	187	286	143	220	286
88	143	187	88	143	187	88	143	187	88	143	187	88	187	220
17	30	40	17	30	40	17	40	74	17	40	74	17	40	74
A			A			A			A			A		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
-			-			●			●			●		
-			-			●			●			●		
-			-			●			●			●		
-			-			●			●			●		
-			-			●			●			●		
-			-			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
●			●			●			●			●		
25000			25000			20000			20000			10000		
10000			10000			6000			6000			3000		
-			-			-			-			-		
105 × 160 × 86			105 × 160 × 86			140 × 260 × 110			140 × 260 × 110			210 × 320 × 135		
140 × 160 × 86			140 × 160 × 86			186.5 × 260 × 110			186.5 × 260 × 110			280 × 320 × 135		
-			-			-			-			-		
2			2			5.4			5.4			15.1		
2.6			2.6			7.2			7.2			19.6		
IEC60947-2			IEC60947-2			IEC60947-2			IEC60947-2			IEC60947-2		

1. The breakers with electronic trip units are available only at 3-pole version. (Only for AC supply)

※ The trip unit ATU is available from 125A

Thermal magnetic trip units Overview

Susol TD & TS series circuit breakers can be installed with thermal magnetic trip units. And, there are two kinds of trip units according to way of installation as follows.

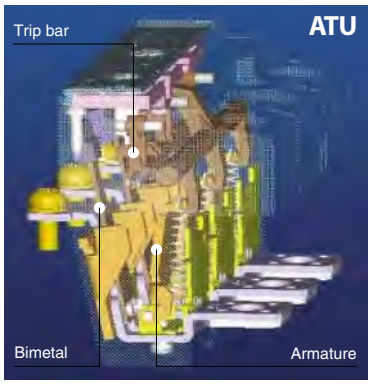
- Built-in trip units for TD series upto 160A
- Interchangeable trip units for TS series upto 800A

Function

Protection of power distribution

- Overload protection: Thermal protection with a fixed or adjustable threshold
- Short-circuit protection: Magnetic protection with a fixed or adjustable pick-up
- Protection of the fourth pole
  4P3T type (neutral unprotected)
  4P4T type 50% (neutral protection at 0.5 × In)
  4P4T type 100% (neutral protection at 1 × In)

Operation



Thermal magnetic types

- Time-Delay operation
  An overcurrent heats and warps the bimetal to actuate the trip bar by the bimetal characteristic.
- Instantaneous operation
  If the overcurrent is excessive, the armature is attracted and the trip bar actuated by electromagnetic force.

Ratings

Ratings(A)	
at 40℃	In
	TD100
	TD160
	TS100
	TS160
	TS250
	TS400
	TS630
	TS800

Thermal magnetic trip units(FTU/FMU/ATU) TD100 to TS800																	
16	20	25	32	40	50	63	80	100	125	160	200	250	300	400	500	630	800
●	●	●	●	●	●	●	●	●	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	●	●	●	-	-	-	-	-	-	-
-	-	-	-	●	●	●	●	●	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	●	●	●	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	●	●	●	●	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	●	●	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	●	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●

Note) Rated current 700A is available for TS800FTU.

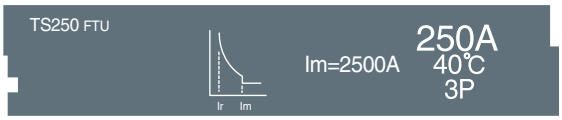
Thermal magnetic trip units Overview

Characteristics

Fixed thermal, fixed magnetic trip units

FTU

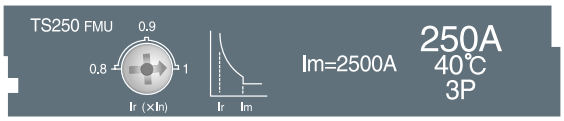
- Fixed thermal
  16A ... 800A rated currents
- Fixed magnetic
  400A ... 8000A tripping currents
- Applicable to TD100 ... TS800 frames



Adjustable thermal, fixed magnetic trip units

FMU

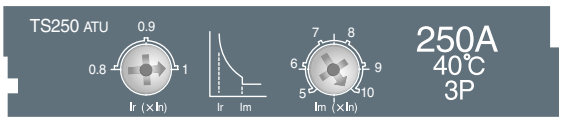
- Adjustable thermal
  16A ... 800A rated currents
  Adjustable : 0.8~1 × In
- Fixed magnetic
  400A ... 8000A tripping currents
- Applicable to TD100 ... TS800 frames



Adjustable thermal, adjustable magnetic trip units

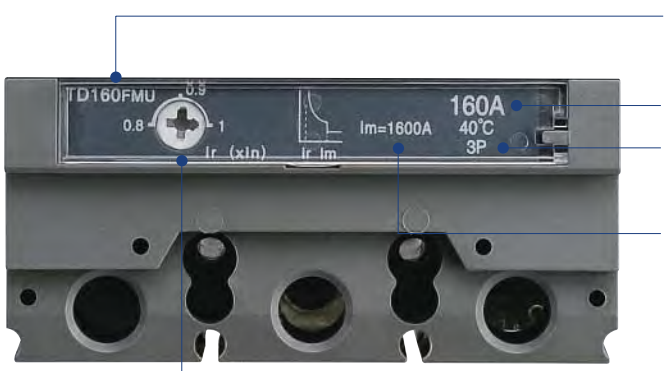
ATU

- Adjustable thermal
  100A ... 800A rated currents
  Adjustable : 0.8~1 × In
- Adjustable magnetic
  500A ... 8000A tripping currents
  Adjustable : 5~10 × In
- Applicable to TS160 ... TS800 frames



Thermal magnetic trip units FTU, FMU for TD100, TD160

Configuration



Trip unit identification

Ratings (A), In at 40°C

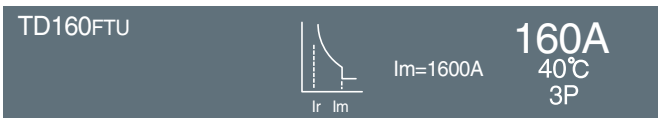
Number of pole

Short circuit protection (magnetic)
Setting current, Im

Overload protection (thermal)
Setting current, Ir

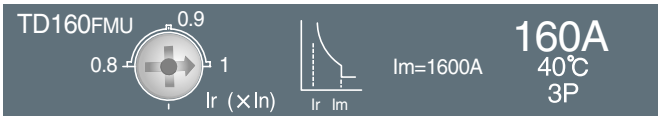
TD100 FTU, TD160 FTU

- Fixed thermal & magnetic trip unit

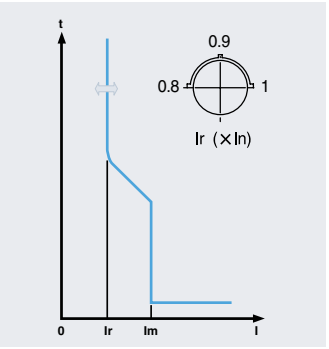


TD100 FMU, TD160 FMU

- Adjustable thermal & fixed magnetic trip unit



TD100 FMU, TD160 FMU



Catalogue numbering system

TD160 FMU

Trip unit function
- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal, fixed magnetic unit

MCCB frame type
- TD100 : TD100N, TD100H, TD100L
- TD160 : TD160N, TD160H, TD160L

Thermal magnetic trip units FTU, FMU for TD100, TD160

Characteristics

Thermal magnetic trip units(FTU/FMU) ... TD100 to TD160												
Rating(A)	at 40℃ In	16	20	25	32	40	50	63	80	100	125	160
	TD100	●	●	●	●	●	●	●	●	●	-	-
	TD160	-	-	-	-	-	-	-	-	●	●	●

Overload protection(thermal)		
Current setting(A) Ir		
	FTU	Fixed
	FMU	Adjustable 0.8, 0.9, 1 × In (3 settings)

Short - circuit protection(magnetic)			
Current setting(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% Ir)

Setting details

Thermal overload protection

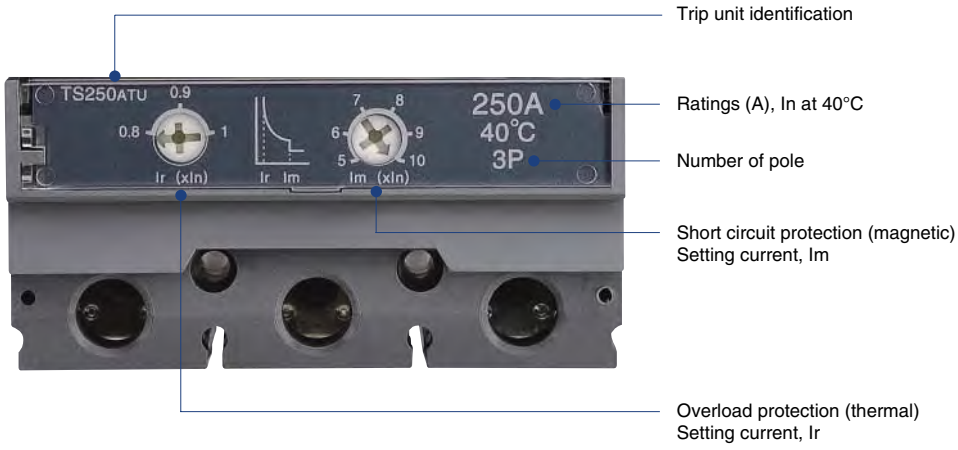
Trip unit type	Setting Ir	Trip unit rating, In (A)										
		16	20	25	32	40	50	63	80	100	125	160
TD100FTU	Fixed	16	20	25	32	40	50	63	80	100	-	-
TD100FMU	0.8	12.8	16	20	25.6	32	40	50.4	64	80	-	-
	0.9	14.4	18	22.5	28.8	36	45	56.7	72	90	-	-
	1	16	20	25	32	40	50	63	80	100	-	-
TD160FTU	Fixed	-	-	-	-	-	-	-	-	100	125	160
TD160FMU	0.8	-	-	-	-	-	-	-	-	80	100	128
	0.9	-	-	-	-	-	-	-	-	90	112.5	144
	1	-	-	-	-	-	-	-	-	100	125	160

Magnetic short-circuit protection

Trip unit type	Setting current, Ir	Setting current, Im		Trip unit rating, In (A)										
				16	20	25	32	40	50	63	80	100	125	160
TD100FTU		Fixed	In × 10	400	400	400	400	400	500	630	800	1000	-	-
TD100FMU	0.8 × In	Fixed	In × 10	400	400	400	400	400	500	630	800	1000	-	-
	0.9 × In	Fixed	In × 10	400	400	400	400	400	500	630	800	1000	-	-
	1.0 × In	Fixed	In × 10	400	400	400	400	400	500	630	800	1000	-	-
TD160FTU		Fixed	In × 10	-	-	-	-	-	-	-	-	1000	1250	1600
TD160FMU	0.8 × In	Fixed	In × 10	-	-	-	-	-	-	-	-	1000	1250	1600
	0.9 × In	Fixed	In × 10	-	-	-	-	-	-	-	-	1000	1250	1600
	1.0 × In	Fixed	In × 10	-	-	-	-	-	-	-	-	1000	1250	1600

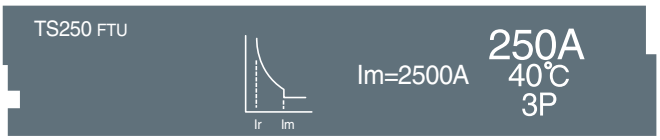
Thermal magnetic trip units
FTU, FMU for TS100, TS160, TS250
ATU for TS160, TS250

Configuration



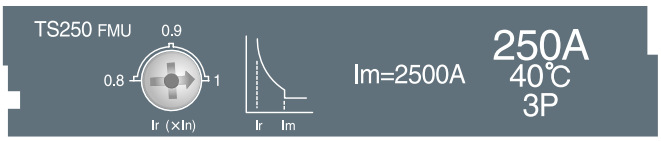
TS100 FTU, TS160 FTU, TS250 FTU

- Fixed thermal fixed magnetic trip unit



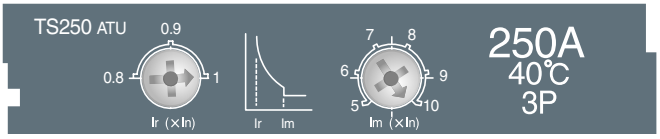
TS100 FMU, TS160 FMU, TS250 FMU

- Adjustable thermal fixed magnetic trip unit

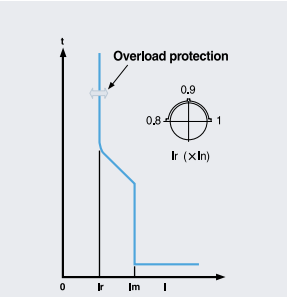


TS160 ATU, TS250 ATU

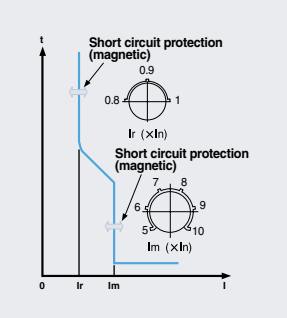
- Adjustable thermal adjustable magnetic trip unit



TS100 FMU, TS160 FMU, TS250 FMU



TS160 ATU, TS250 ATU



Thermal magnetic trip units FTU, FMU for TS100, TS160, TS250 ATU for TS160, TS250

Characteristics

Thermal Magnetic trip units(FTU/FMU/ATU) ... TS100 to TS250										
Rating(A)	at 40℃ In	40	50	63	80	100	125	160	200	250
	TS100	●	●	●	●	●	-	-	-	-
	TS160	-	-	-	-	●	●	●	-	-
	TS250	-	-	-	-	-	●	●	●	●

Overload protection(thermal)		
Current setting(A) Ir		
	FTU	Fixed
	FMU	Adjustable 0.8 to × In
	ATU	Adjustable 0.8 to × In

Short - circuit protection(magnetic)		
Current setting(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% Ir)

Catalogue numbering system

TS250 FTU

Trip unit function
- FTU: Fixed thermal, fixed magnetic unit

MCCB frame type
- TS100: TS100N, TS100H, TS100L
- TS160: TS160N, TS160H, TS160L
- TS250: TS250N, TS250H, TS250L

TS250 FMU

Trip unit function
- FMU: Adjustable thermal, fixed magnetic unit

MCCB frame type
- TS100: TS100N, TS100H, TS100L
- TS160: TS160N, TS160H, TS160L
- TS250: TS250N, TS250H, TS250L

TS250 ATU

Trip unit function
- ATU: Adjustable thermal, adjustable magnetic unit

MCCB frame type
- TS160: TS160N, TS160H, TS160L
- TS250: TS250N, TS250H, TS250L

The trip unit ATU is available from 125A

Thermal magnetic trip units
FTU, FMU for TS100, TS160, TS250
ATU for TS160, TS250

Setting details

Thermal overload protection

Trip unit type	Setting Ir	Trip unit rating, In (A)								
		40	50	63	80	100	125	160	200	250
TS100FTU	Fixed	40	50	63	80	100	-	-	-	-
TS100FMU	0.8 × In	32	40	50	64	80	-	-	-	-
	0.9 × In	36	45	57	72	90	-	-	-	-
	1.0 × In	40	50	63	80	100	-	-	-	-
TS160FTU	Fixed	-	-	-	-	100	125	160	-	-
TS160FMU	0.8 × In	-	-	-	-	80	100	128	-	-
	0.9 × In	-	-	-	-	90	113	144	-	-
	1.0 × In	-	-	-	-	100	125	160	-	-
TS160ATU	0.8 × In	-	-	-	-	-	100	128	-	-
	0.9 × In	-	-	-	-	-	113	144	-	-
	1.0 × In	-	-	-	-	-	125	160	-	-
TS250FTU	Fixed	-	-	-	-	-	125	160	200	250
TS250FMU	0.8 × In	-	-	-	-	-	100	128	160	200
	0.9 × In	-	-	-	-	-	113	144	180	225
	1.0 × In	-	-	-	-	-	125	160	200	250
TS250ATU	0.8 × In	-	-	-	-	-	100	128	160	200
	0.9 × In	-	-	-	-	-	113	144	180	225
	1.0 × In	-	-	-	-	-	125	160	200	250

Thermal magnetic trip units
FTU, FMU for TS100, TS160, TS250
ATU for TS160, TS250

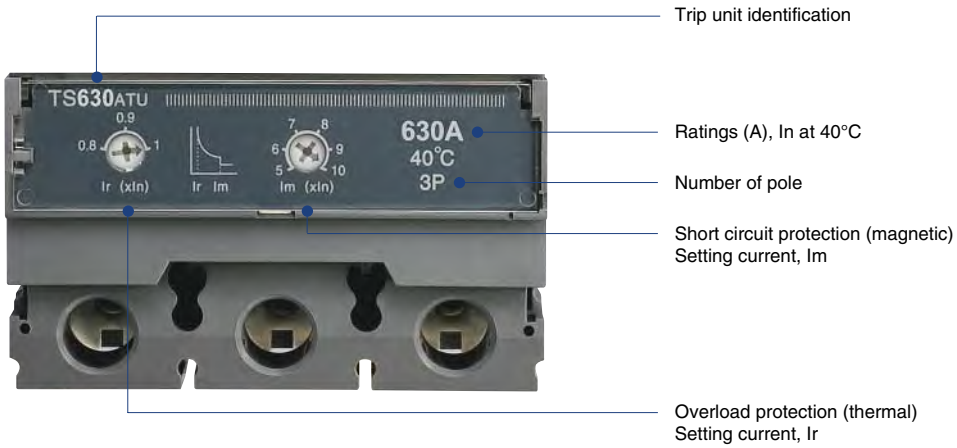
Setting details

Magnetic short-circuit protection

Trip unit type	Setting current, Ir	Setting current, Im		Trip unit rating, In (A)								
				40	50	63	80	100	125	160	200	250
TS100FTU		Fixed	In × 10	400	500	630	800	1000	-	-	-	-
TS100FMU	0.8 × In	Fixed	In × 10	400	500	630	800	1000	-	-	-	-
	0.9 × In	Fixed	In × 10	400	500	630	800	1000	-	-	-	-
	1.0 × In	Fixed	In × 10	400	500	630	800	1000	-	-	-	-
TS160FTU		Fixed	In × 10	-	-	-	-	1000	1250	1600		
TS160FMU	0.8 × In	Fixed	In × 10	-	-	-	-	1000	1250	1600	-	-
	0.9 × In	Fixed	In × 10	-	-	-	-	1000	1250	1600	-	-
	1.0 × In	Fixed	In × 10	-	-	-	-	1000	1250	1600	-	-
TS160ATU	0.8 × In	Adjustable	In × 5	-	-	-	-	-	625	800	-	-
			In × 6	-	-	-	-	-	750	960	-	-
			In × 7	-	-	-	-	-	875	1120	-	-
			In × 8	-	-	-	-	-	1000	1280	-	-
			In × 9	-	-	-	-	-	1125	1440	-	-
			In × 10	-	-	-	-	-	1250	1600	-	-
	0.9 × In	Adjustable	In × 5	-	-	-	-	-	625	800	-	-
			In × 6	-	-	-	-	-	750	960	-	-
			In × 7	-	-	-	-	-	875	1120	-	-
			In × 8	-	-	-	-	-	1000	1280	-	-
			In × 9	-	-	-	-	-	1125	1440	-	-
			In × 10	-	-	-	-	-	1250	1600	-	-
	1.0 × In	Adjustable	In × 5	-	-	-	-	-	625	800	-	-
			In × 6	-	-	-	-	-	750	960	-	-
			In × 7	-	-	-	-	-	875	1120	-	-
			In × 8	-	-	-	-	-	1000	1280	-	-
			In × 9	-	-	-	-	-	1125	1440	-	-
			In × 10	-	-	-	-	-	1250	1600	-	-
TS250FTU		Fixed	In × 10	-	-	-	-	-	1250	1600	2000	2500
TS250FMU	0.8 × In	Fixed	In × 10	-	-	-	-	-	1250	1600	2000	2500
	0.9 × In	Fixed	In × 10	-	-	-	-	-	1250	1600	2000	2500
	1.0 × In	Fixed	In × 10	-	-	-	-	-	1250	1600	2000	2500
TS250ATU	0.8 × In	Adjustable	In × 5	-	-	-	-	-	625	800	1000	1250
			In × 6	-	-	-	-	-	750	960	1200	1500
			In × 7	-	-	-	-	-	875	1120	1400	1750
			In × 8	-	-	-	-	-	1000	1280	1600	2000
			In × 9	-	-	-	-	-	1125	1440	1800	2250
			In × 10	-	-	-	-	-	1250	1600	2000	2500
	0.9 × In	Adjustable	In × 5	-	-	-	-	-	625	800	1000	1250
			In × 6	-	-	-	-	-	750	960	1200	1500
			In × 7	-	-	-	-	-	875	1120	1400	1750
			In × 8	-	-	-	-	-	1000	1280	1600	2000
			In × 9	-	-	-	-	-	1125	1440	1800	2250
			In × 10	-	-	-	-	-	1250	1600	2000	2500
	1.0 × In	Adjustable	In × 5	-	-	-	-	-	625	800	1000	1250
			In × 6	-	-	-	-	-	750	960	1200	1500
			In × 7	-	-	-	-	-	875	1120	1400	1750
			In × 8	-	-	-	-	-	1000	1280	1600	2000
			In × 9	-	-	-	-	-	1125	1440	1800	2250
			In × 10	-	-	-	-	-	1250	1600	2000	2500

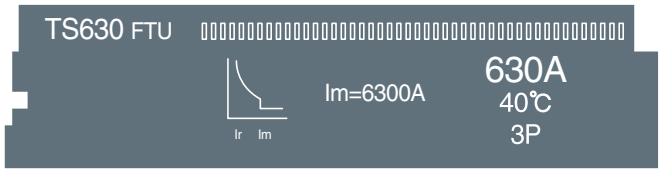
Thermal magnetic trip units
FTU, FMU, ATU for TS400, TS630

Configuration



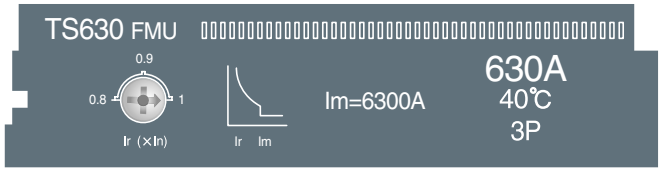
TS400 FTU, TS630 FTU

- Fixed thermal fixed magnetic trip unit



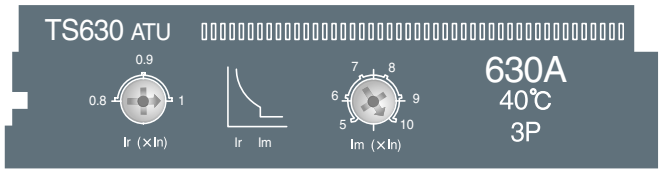
TS400 FMU, TS630 FMU

- Adjustable thermal fixed magnetic trip unit

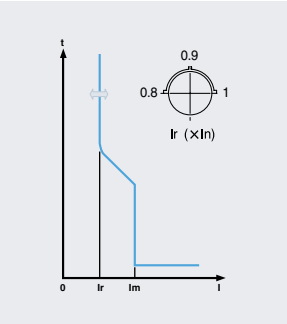


TS400 ATU, TS630 ATU

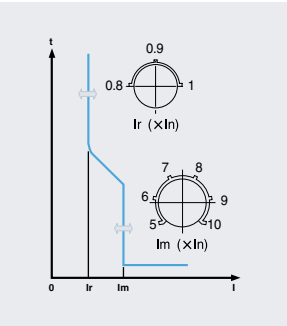
- Adjustable thermal adjustable magnetic trip unit



TS400 FMU, TS630 FMU



TS400 ATU, TS630 ATU



Thermal magnetic trip units FTU, FMU, ATU for TS400, TS630

Characteristics

Thermal Magnetic trip units(FTU/FMU/ATU) ... TS400 to TS630					
Rating(A) at 40℃ In		300	400	500	630
	TS400	●	●	-	-
	TS630	-	-	●	●
Overload protection(thermal)					
Current setting(A) Ir					
	FTU	In=Ir (Fixed)			
	FMU	Adjustable 0.8, 0.9, 1 × In (3 settings)			
	ATU	Adjustable 0.8, 0.9, 1 × In (3 settings)			
Short - circuit protection(magnetic)					
Current setting(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% Ir)			

Catalogue numbering system

TS630 ATU

Trip unit function
- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal & fixed magnetic unit
- ATU : Adjustable thermal & adjustable magnetic unit

MCCB frame type
- TS400 : TS400N, TS400H, TS400L
- TS630 : TS630N, TS630H, TS630L

Thermal magnetic trip units
FTU, FMU, ATU for TS400, TS630

Setting details

Thermal overload protection

Trip unit type	Setting	Trip unit rating, In (A)			
	Ir	300	400	500	630
TS400FTU	Fixed	300	400	-	-
TS400FMU	0.8	240	320	-	-
	0.9	270	360	-	-
	1	300	400	-	-
TS400ATU	0.8	240	320	-	-
	0.9	270	360	-	-
	1	300	400	-	-
TS630FTU	Fixed	-	-	500	630
TS630FMU	0.8	-	-	400	504
	0.9	-	-	450	567
	1	-	-	500	630
TS630ATU	0.8	-	-	400	504
	0.9	-	-	450	567
	1	-	-	500	630

Thermal magnetic trip units
FTU, FMU, ATU for TS400, TS630

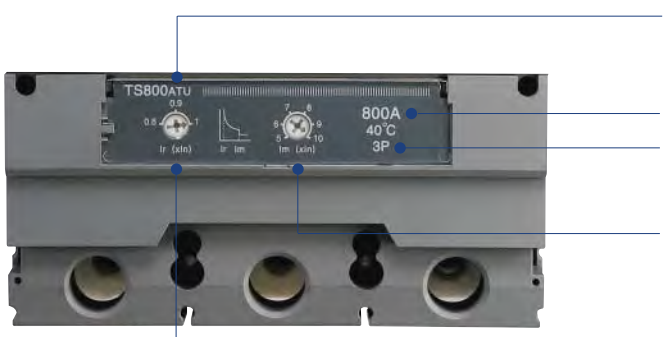
Setting details

Magnetic short-circuit protection

Trip unit type	Setting current, Ir	Setting current, Im		Trip unit rating, In (A) 300	400	500	630
TS400FTU		Fixed	In × 10	3000	4000	-	-
TS400FMU	0.8 × In	Fixed	In × 10	3000	4000	-	-
	0.9 × In	Fixed	In × 10	3000	4000	-	-
	1.0 × In	Fixed	In × 10	3000	4000	-	-
TS400ATU	0.8 × In	Adjustable	In × 5	1500	2000	-	-
			In × 6	1800	2400	-	-
			In × 7	2100	2800	-	-
			In × 8	2400	3200	-	-
			In × 9	2700	3600	-	-
			In × 10	3000	4000	-	-
	0.9 × In	Adjustable	In × 5	1500	2000	-	-
			In × 6	1800	2400	-	-
			In × 7	2100	2800	-	-
			In × 8	2400	3200	-	-
			In × 9	2700	3600	-	-
			In × 10	3000	4000	-	-
	1.0 × In	Adjustable	In × 5	1500	2000	-	-
			In × 6	1800	2400	-	-
			In × 7	2100	2800	-	-
			In × 8	2400	3200	-	-
			In × 9	2700	3600	-	-
			In × 10	3000	4000	-	-
TS630FTU		Fixed	In × 10	-	-	5000	6300
TS630FMU	0.8 × In	Fixed	In × 10	-	-	5000	6300
	0.9 × In	Fixed	In × 10	-	-	5000	6300
	1.0 × In	Fixed	In × 10	-	-	5000	6300
TS630ATU	0.8 × In	Adjustable	In × 5	-	-	2500	3150
			In × 6	-	-	3000	3780
			In × 7	-	-	3500	4410
			In × 8	-	-	4000	5040
			In × 9	-	-	4500	5670
			In × 10	-	-	5000	6300
	0.9 × In	Adjustable	In × 5	-	-	2500	3150
			In × 6	-	-	3000	3780
			In × 7	-	-	3500	4410
			In × 8	-	-	4000	5040
			In × 9	-	-	4500	5670
			In × 10	-	-	5000	6300
	1.0 × In	Adjustable	In × 5	-	-	2500	3150
			In × 6	-	-	3000	3780
			In × 7	-	-	3500	4410
			In × 8	-	-	4000	5040
			In × 9	-	-	4500	5670
			In × 10	-	-	5000	6300

Thermal magnetic trip units FTU, FMU, ATU for TS800

Configuration



Trip unit identification

Ratings (A), In at 40°C

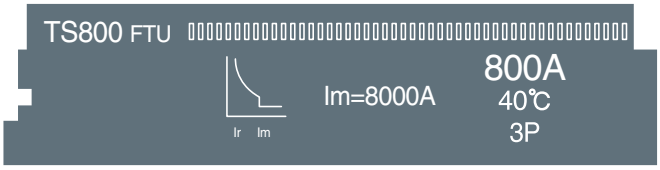
Number of pole

Short circuit protection (magnetic)
Setting current, Im

Overload protection (thermal)
Setting current, Ir

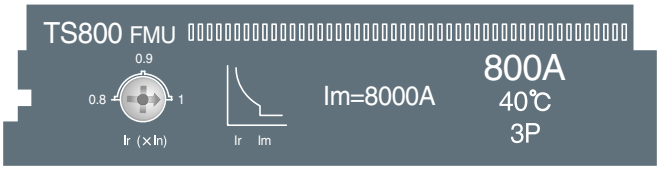
TS800 FTU

- Fixed thermal fixed magnetic trip unit



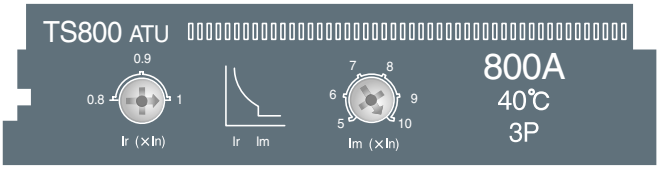
TS800 FMU

- Adjustable thermal fixed magnetic trip unit

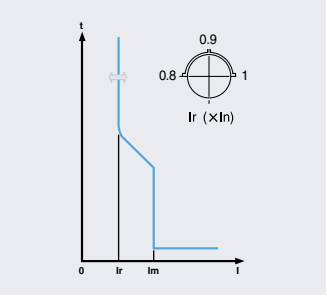


TS800 ATU

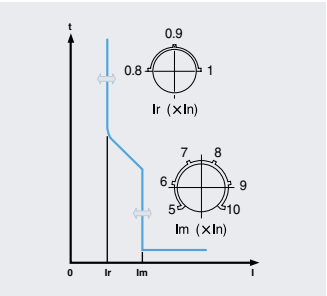
- Adjustable thermal adjustable magnetic trip unit



TS800 FMU



TS800 ATU



Catalogue numbering system

TS800 ATU

Trip unit function
- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal & fixed magnetic unit
- ATU : Adjustable thermal & adjustable magnetic unit

MCCB frame type
- TS800 : TS800N, TS800H, TS800L

Thermal magnetic trip units FTU, FMU, ATU for TS800

Characteristics

Thermal Magnetic trip units(FTU/FMU/ATU) ... TS800			
Rating(A) at 40℃ In		700 (1)	800
	TS800	●	●

Overload protection(thermal)		
Current setting(A) Ir		
	FTU	Fixed
	FMU	Adjustable 0.8, 0.9,1 × In (3 settings)
	ATU	Adjustable 0.8, 0.9,1 × In (3 settings)

Note1) Only available for TS800FTU

Short - circuit protection(magnetic)		
Current setting(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% Ir)

Setting details

Thermal overload protection

Trip unit type	Setting Ir	Trip unit rating, In (A) 700	800
TS800FTU	Fixed	700	800
TS800FMU	0.8	-	640
	0.9	-	720
	1	-	800
TS800ATU	0.8	-	640
	0.9	-	720
	1	-	800

Magnetic short-circuit protection

Trip unit type	Setting current, Ir	Setting current, Im		Trip unit rating, In (A) 700	800
TS800FTU		Fixed	In × 10	7000	8000
TS800FMU	0.8 × In	Fixed	In × 10	-	8000
	0.9 × In	Fixed	In × 10	-	8000
	1.0 × In	Fixed	In × 10	-	8000
TS800ATU	0.8 × In	Adjustable	In × 5	-	4000
			In × 6	-	4800
			In × 7	-	5600
			In × 8	-	6400
			In × 9	-	7200
			In × 10	-	8000
	0.9 × In	Adjustable	In × 5	-	4000
			In × 6	-	4800
			In × 7	-	5600
			In × 8	-	6400
			In × 9	-	7200
			In × 10	-	8000
	1.0 × In	Adjustable	In × 5	-	4000
			In × 6	-	4800
			In × 7	-	5600
			In × 8	-	6400
			In × 9	-	7200
			In × 10	-	8000

Overview of electronic trip units (Standard type)

Types: ETS23, ETS33, ETS43

3 frame size of circuit breaker: 250AF, 630AF, 800AF

Only three(3) pole circuit breakers are available.

The Trip units can be mounted on circuit breakers of N, H and L type from TS100 to TS800.

Test connector for trip unit (AC/DC 30mA ~ AC/DC 100mA)

Protection

- Overload protection
- Short-circuit protection

Ratings

		Trip units					
		ETS23			ETS33		ETS43
Rated current, In (A)	40	●	●	●	-	-	-
	80	●	●	●	-	-	-
	160	-	●	●	●	●	-
	250	-	-	●	●	●	-
	400	-	-	-	●	●	-
	630	-	-	-	-	●	●
	800	-	-	-	-	-	●
Applicable to		TS100 N/H/L	TS160 N/H/L	TS250 N/H/L	TS400 N/H/L	TS630 N/H/L	TS800 N/H/L

Current setting, Ir(A)

ETS	16	32	40	64	80	100	160	250	320	400	630	800
ETS23 for TS100N/H/L												
ETS23 for TS160N/H/L												
ETS23 for TS250N/H/L												
ETS33 for TS400N/H/L												
ETS33 for TS630N/H/L												
ETS43 for TS800N/H/L												

Setting values

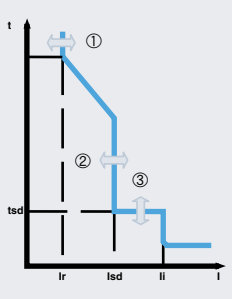
Overload protection (long time)	
Setting current (A), Ir	0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0 × In, 13 setting
Tripping time (s)	Fixed at 6 × Ir , tolerance ±20%

Short-circuit protection (short time)	
Tripping threshold (A), Isd	adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10 × Ir, 9 setting, tolerance ±15%
Time delay (ms)	adjustable 50, 100, 200, 300, 4 setting, tolerance ±20%

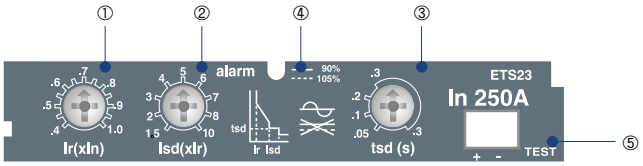
Short circuit protection (Instantaneous)	
Tripping threshold (A), Ii	Fixed at 11 × In

Overview of electronic trip units (Standard type)

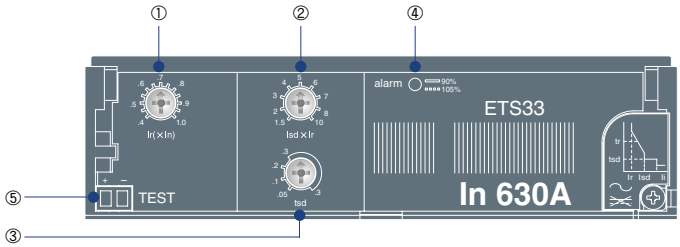
① Adjustable rated current setting (Ir)
② Adjustable short time delay current setting (Isd)
③ Adjustable time delay setting (tsd)
④ Alarm LED
90% Ir: ON,
105% Ir or more: ON-OFF
⑤ Test connector



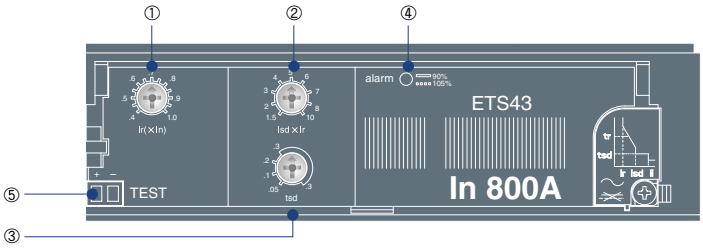
ETS23 for TS100/TS160/TS250



ETS33 for TS400/TS630



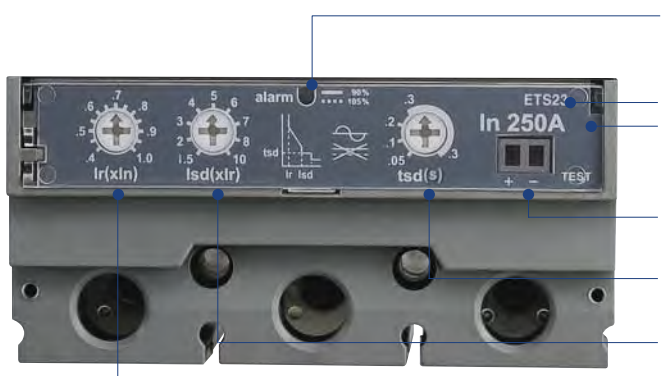
ETS43 for TS800



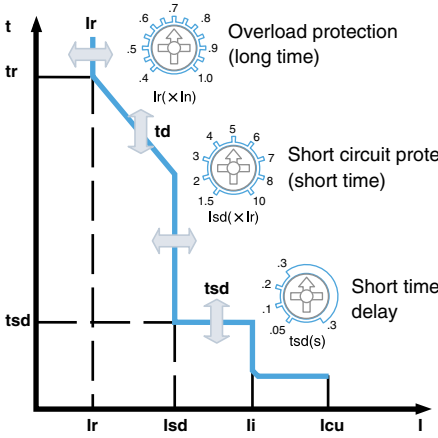
Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

Configuration

Electronic type, ETS23 for MCCBs TS100, TS160, TS250



Indication of alarm
Load: not less than 90% Ir → LED ON
Load: not less than 105% Ir → LED flickering
Trip unit identification
Trip unit rating, In
Test connector
Short time tripping delay
Short circuit protection (short time)
Overload protection (long time)



Overload protection (long time)

Short circuit protection (short time)

Short time tripping delay

Overload protection (long time)	
Setting current (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
Tripping time (s)	Fixed at 6×Ir , tolerance±20%

Short-circuit protection (short time)						
Tripping threshold (A), (Isd)	1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir 9 settings, tolerance ±15%					
Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous)	
Tripping threshold (A), Ii	Fixed at 11×In

Catalogue numbering system

ETS 23 In250A

Trip unit frame
- 23 for TS100, TS160, TS250
- 33 for TS400, TS630
- 43 for TS800

Rated current, In
- 40, 80A for TS100
- 40, 80, 160A for TS160
- 40, 80, 160, 250A for TS250

Trip unit function
- ETS: Standard electronic trip unit

Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

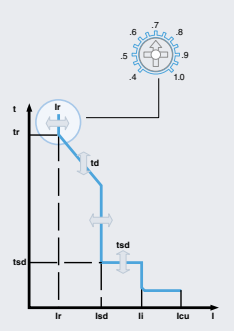
Current setting, Ir (A)

Standard electronic trip unit, ETS23

Trip unit	16	32	40	64	80	100	160	250	320	400	630	800
for TS100												
for TS160												
for TS250												

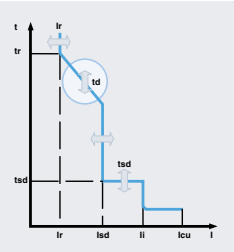
Setting details

Overload protection (long time)



Circuit breakers	TS100		TS160			TS250			
Trip unit rating, In(A)	40	80	40	80	160	40	80	160	250
Setting value	**Overload protection setting current Ir = Setting value (0.4~1) × In**								
0.4	16	32	16	32	64	16	32	64	100
0.45	18	36	18	36	72	18	36	72	113
0.5	20	40	20	40	80	20	40	80	125
0.55	22	44	22	44	88	22	44	88	138
0.6	24	48	24	48	96	24	48	96	150
0.65	26	52	26	52	104	26	52	104	163
0.7	28	56	28	56	112	28	56	112	175
0.75	30	60	30	60	120	30	60	120	188
0.8	32	64	32	64	128	32	64	128	200
0.85	34	68	34	68	136	34	68	136	213
0.9	36	72	36	72	144	36	72	144	225
0.95	38	76	38	76	152	38	76	152	238
1	40	80	40	80	160	40	80	160	250

Long time tripping delay, td (sec)

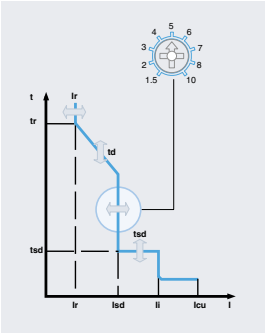


Tripping time (s)	Fixed at 6 × Ir tolerance ± 20%

Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

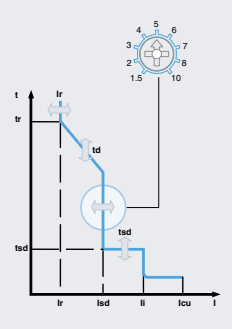
Setting details

Short-circuit protection (short time)



Circuit breakers		TS100		TS160			TS250			
Trip unit rating, In(A)		40	80	40	80	160	40	80	160	250
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir								
0.4		24	48	24	48	96	24	48	96	150
0.45		27	54	27	54	108	27	54	108	169
0.5		30	60	30	60	120	30	60	120	188
0.55		33	66	33	66	132	33	66	132	206
0.6		36	72	36	72	144	36	72	144	225
0.65		39	78	39	78	156	39	78	156	244
0.7	1.5	42	84	42	84	168	42	84	168	263
0.75		45	90	45	90	180	45	90	180	281
0.8		48	96	48	96	192	48	96	192	300
0.85		51	102	51	102	204	51	102	204	319
0.9		54	108	54	108	216	54	108	216	338
0.95		57	114	57	114	228	57	114	228	356
1		60	120	60	120	240	60	120	240	375
0.4		32	64	32	64	128	32	64	128	200
0.45		36	72	36	72	144	36	72	144	225
0.5		40	80	40	80	160	40	80	160	250
0.55		44	88	44	88	176	44	88	176	275
0.6		48	96	48	96	192	48	96	192	300
0.65		52	104	52	104	208	52	104	208	325
0.7	2	56	112	56	112	224	56	112	224	350
0.75		60	120	60	120	240	60	120	240	375
0.8		64	128	64	128	256	64	128	256	400
0.85		68	136	68	136	272	68	136	272	425
0.9		72	144	72	144	288	72	144	288	450
0.95		76	152	76	152	304	76	152	304	475
1		80	160	80	160	320	80	160	320	500
0.4		48	96	48	96	192	48	96	192	300
0.45		54	108	54	108	216	54	108	216	338
0.5		60	120	60	120	240	60	120	240	375
0.55		66	132	66	132	264	66	132	264	413
0.6		72	144	72	144	288	72	144	288	450
0.65		78	156	78	156	312	78	156	312	488
0.7	3	84	168	84	168	336	84	168	336	525
0.75		90	180	90	180	360	90	180	360	563
0.8		96	192	96	192	384	96	192	384	600
0.85		102	204	102	204	408	102	204	408	638
0.9		108	216	108	216	432	108	216	432	675
0.95		114	228	114	228	456	114	228	456	713
1		120	240	120	240	480	120	240	480	750

Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

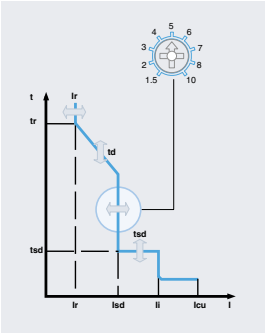


Circuit breakers		TS100		TS160			TS250			
Trip unit rating, In(A)		40	80	40	80	160	40	80	160	250
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir								
0.4		64	128	64	128	256	64	128	256	400
0.45		72	144	72	144	288	72	144	288	450
0.5		80	160	80	160	320	80	160	320	500
0.55		88	176	88	176	352	88	176	352	550
0.6		96	192	96	192	384	96	192	384	600
0.65		104	208	104	208	416	104	208	416	650
0.7	4	112	224	112	224	448	112	224	448	700
0.75		120	240	120	240	480	120	240	480	750
0.8		128	256	128	256	512	128	256	512	800
0.85		136	272	136	272	544	136	272	544	850
0.9		144	288	144	288	576	144	288	576	900
0.95		152	304	152	304	608	152	304	608	950
1		160	320	160	320	640	160	320	640	1000
0.4		80	160	80	160	320	80	160	320	500
0.45		90	180	90	180	360	90	180	360	563
0.5		100	200	100	200	400	100	200	400	625
0.55		110	220	110	220	440	110	220	440	688
0.6		120	240	120	240	480	120	240	480	750
0.65		130	260	130	260	520	130	260	520	813
0.7	5	140	280	140	280	560	140	280	560	875
0.75		150	300	150	300	600	150	300	600	938
0.8		160	320	160	320	640	160	320	640	1000
0.85		170	340	170	340	680	170	340	680	1063
0.9		180	360	180	360	720	180	360	720	1125
0.95		190	380	190	380	760	190	380	760	1188
1		200	400	200	400	800	200	400	800	1250
0.4		96	192	96	192	384	96	192	384	600
0.45		108	216	108	216	432	108	216	432	675
0.5		120	240	120	240	480	120	240	480	750
0.55		132	264	132	264	528	132	264	528	825
0.6		144	288	144	288	576	144	288	576	900
0.65		156	312	156	312	624	156	312	624	975
0.7	6	168	336	168	336	672	168	336	672	1050
0.75		180	360	180	360	720	180	360	720	1125
0.8		192	384	192	384	768	192	384	768	1200
0.85		204	408	204	408	816	204	408	816	1275
0.9		216	432	216	432	864	216	432	864	1350
0.95		228	456	228	456	912	228	456	912	1425
1		240	480	240	480	960	240	480	960	1500

Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

Setting details

Short-circuit protection (short time)

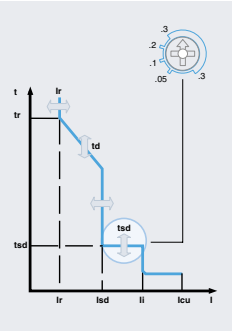


Circuit breakers		TS100		TS160			TS250			
Trip unit rating, In(A)		40	80	40	80	160	40	80	160	250
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir								
0.4		112	224	112	224	448	112	224	448	700
0.45		126	252	126	252	504	126	252	504	788
0.5		140	280	140	280	560	140	280	560	875
0.55		154	308	154	308	616	154	308	616	963
0.6		168	336	168	336	672	168	336	672	1050
0.65		182	364	182	364	728	182	364	728	1138
0.7	7	196	392	196	392	784	196	392	784	1225
0.75		210	420	210	420	840	210	420	840	1313
0.8		224	448	224	448	896	224	448	896	1400
0.85		238	476	238	476	952	238	476	952	1488
0.9		252	504	252	504	1008	252	504	1008	1575
0.95		266	532	266	532	1064	266	532	1064	1663
1		280	560	280	560	1120	280	560	1120	1750
0.4		128	256	128	256	512	128	256	512	800
0.45		144	288	144	288	576	144	288	576	900
0.5		160	320	160	320	640	160	320	640	1000
0.55		176	352	176	352	704	176	352	704	1100
0.6		192	384	192	384	768	192	384	768	1200
0.65		208	416	208	416	832	208	416	832	1300
0.7	8	224	448	224	448	896	224	448	896	1400
0.75		240	480	240	480	960	240	480	960	1500
0.8		256	512	256	512	1024	256	512	1024	1600
0.85		272	544	272	544	1088	272	544	1088	1700
0.9		288	576	288	576	1152	288	576	1152	1800
0.95		304	608	304	608	1216	304	608	1216	1900
1		320	640	320	640	1280	320	640	1280	2000
0.4		160	320	160	320	640	160	320	640	1000
0.45		180	360	180	360	720	180	360	720	1125
0.5		200	400	200	400	800	200	400	800	1250
0.55		220	440	220	440	880	220	440	880	1375
0.6		240	480	240	480	960	240	480	960	1500
0.65		260	520	260	520	1040	260	520	1040	1625
0.7	10	280	560	280	560	1120	280	560	1120	1750
0.75		300	600	300	600	1200	300	600	1200	1875
0.8		320	640	320	640	1280	320	640	1280	2000
0.85		340	680	340	680	1360	340	680	1360	2125
0.9		360	720	360	720	1440	360	720	1440	2250
0.95		380	760	380	760	1520	380	760	1520	2375
1		400	800	400	800	1600	400	800	1600	2500

Electronic trip units (Standard)
ETS23 for TS100, TS160, TS250

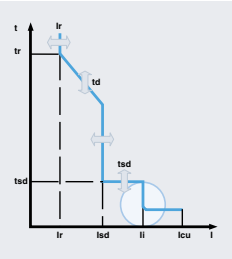
Setting details

Short time tripping delay setting, tsd (ms)



Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous), Ii (A)



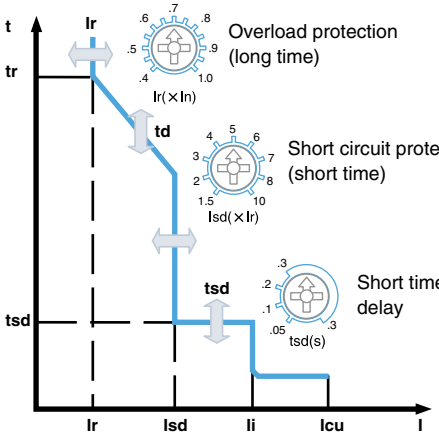
Tripping threshold (A), Ii	Fixed at 11 × In

Electronic trip units (Standard)
ETS33 for TS400, TS630

Configuration

Electronic type, ETS33 for MCCBs TS400 & TS630

Indication of alarm
Load: not less than 90% Ir → LED ON
Load: not less than 105% Ir → LED flickering
Trip unit identification
Trip unit rating, In
Short-circuit protection (short time)
Short time tripping delay
Overload protection (long time)
Test connector



Overload protection (long time)

Short circuit protection (short time)

Short time tripping delay

Overload protection (long time)	
Setting current (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
Tripping time (s)	Fixed at 6×Ir , tolerance±20%

Short-circuit protection (short time)						
Tripping threshold (A), (Isd)	1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir 9 settings, tolerance ±15%					
Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous)	
Tripping threshold (A), Ii	Fixed at 11×In

Catalogue numbering system

ETS 33 In630A

Trip unit frame
- 23 for TS100, TS160, TS250
- 33 for TS400, TS630
- 43 for TS800

Rated current, In
- 160, 250, 400A for TS400
- 160, 250, 400, 630A for TS630

Trip unit function
- ETS: Standard electronic trip unit

Electronic trip units (Standard)
ETS33 for TS400, TS630

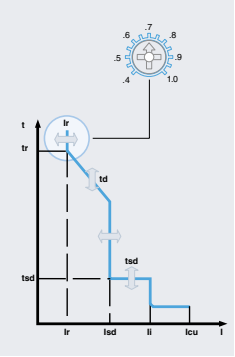
Current setting, Ir (A)

Standard electronic trip unit, ETS33

Trip unit	16	32	40	64	80	100	160	250	320	400	630	800
for TS400												
for TS630												

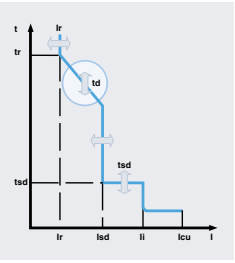
Setting details

Overload protection (long time)



Circuit breakers	TS400			TS630			
Trip unit rating, In(A)	160	250	400	160	250	400	630
Setting value	**Overload protection setting current Ir = Setting value (0.4~1) × In**						
0.4	64	100	160	64	100	160	252
0.45	72	113	180	72	113	180	284
0.5	80	125	200	80	125	200	315
0.55	88	138	220	88	138	220	347
0.6	96	150	240	96	150	240	378
0.65	104	163	260	104	163	260	410
0.7	112	175	280	112	175	280	441
0.75	120	188	300	120	188	300	473
0.8	128	200	320	128	200	320	504
0.85	136	213	340	136	213	340	536
0.9	144	225	360	144	225	360	567
0.95	152	238	380	152	238	380	599
1	160	250	400	160	250	400	630

Long time tripping delay, td (sec)

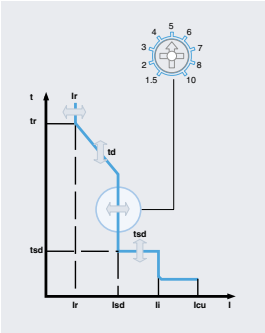


Tripping time (s)	Fixed at 6 × Ir tolerance ± 20%

Electronic trip units (Standard)
ETS33 for TS400, TS630

Setting details

Short-circuit protection (short time)

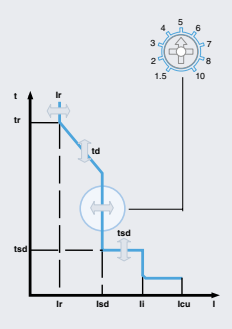


Circuit breakers		TS400			TS630			
Trip unit rating, In(A)		160	250	400	160	250	400	630
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir						
0.4	1.5	96	150	240	96	150	240	378
0.45		108	169	270	108	169	270	425
0.5		120	188	300	120	188	300	473
0.55		132	206	330	132	206	330	520
0.6		144	225	360	144	225	360	567
0.65		156	244	390	156	244	390	614
0.7		168	263	420	168	263	420	662
0.75		180	281	450	180	281	450	709
0.8		192	300	480	192	300	480	756
0.85		204	319	510	204	319	510	803
0.9		216	338	540	216	338	540	851
0.95		228	356	570	228	356	570	898
1		240	375	600	240	375	600	945
0.4	2	128	200	320	128	200	320	504
0.45		144	225	360	144	225	360	567
0.5		160	250	400	160	250	400	630
0.55		176	275	440	176	275	440	693
0.6		192	300	480	192	300	480	756
0.65		208	325	520	208	325	520	819
0.7		224	350	560	224	350	560	882
0.75		240	375	600	240	375	600	945
0.8		256	400	640	256	400	640	1008
0.85		272	425	680	272	425	680	1071
0.9		288	450	720	288	450	720	1134
0.95		304	475	760	304	475	760	1197
1		320	500	800	320	500	800	1260
0.4	3	192	300	480	192	300	480	756
0.45		216	338	540	216	338	540	851
0.5		240	375	600	240	375	600	945
0.55		264	413	660	264	413	660	1040
0.6		288	450	720	288	450	720	1134
0.65		312	488	780	312	488	780	1229
0.7		336	525	840	336	525	840	1323
0.75		360	563	900	360	563	900	1418
0.8		384	600	960	384	600	960	1512
0.85		408	638	1020	408	638	1020	1607
0.9		432	675	1080	432	675	1080	1701
0.95		456	713	1140	456	713	1140	1795
1		480	750	1200	480	750	1200	1890

Electronic trip units (Standard)
ETS33 for TS400, TS630

Setting details

Short-circuit protection (short time)

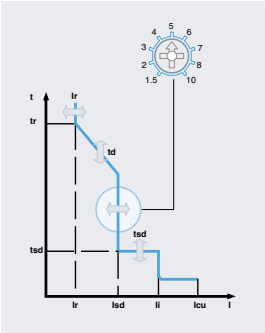


Circuit breakers		TS400			TS630			
Trip unit rating, In(A)		160	250	400	160	250	400	630
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir						
0.4		256	400	640	256	400	640	1008
0.45		288	450	720	288	450	720	1134
0.5		320	500	800	320	500	800	1260
0.55		352	550	880	352	550	880	1386
0.6		384	600	960	384	600	960	1512
0.65		416	650	1040	416	650	1040	1638
0.7	4	448	700	1120	448	700	1120	1764
0.75		480	750	1200	480	750	1200	1890
0.8		512	800	1280	512	800	1280	2016
0.85		544	850	1360	544	850	1360	2142
0.9		576	900	1440	576	900	1440	2268
0.95		608	950	1520	608	950	1520	2394
1		640	1000	1600	640	1000	1600	2520
0.4		320	500	800	320	500	800	1260
0.45		360	563	900	360	563	900	1418
0.5		400	625	1000	400	625	1000	1575
0.55		440	687.5	1100	440	688	1100	1733
0.6		480	750	1200	480	750	1200	1890
0.65		520	813	1300	520	813	1300	2048
0.7	5	560	875	1400	560	875	1400	2205
0.75		600	938	1500	600	938	1500	2363
0.8		640	1000	1600	640	1000	1600	2520
0.85		680	1063	1700	680	1063	1700	2678
0.9		720	1125	1800	720	1125	1800	2835
0.95		760	1188	1900	760	1188	1900	2993
1		800	1250	2000	800	1250	2000	3150
0.4		384	600	960	384	600	960	1512
0.45		432	675	1080	432	675	1080	1701
0.5		480	750	1200	480	750	1200	1890
0.55		528	825	1320	528	825	1320	2079
0.6		576	900	1440	576	900	1440	2268
0.65		624	975	1560	624	975	1560	2457
0.7	6	672	1050	1680	672	1050	1680	2646
0.75		720	1125	1800	720	1125	1800	2835
0.8		768	1200	1920	768	1200	1920	3024
0.85		816	1275	2040	816	1275	2040	3213
0.9		864	1350	2160	864	1350	2160	3402
0.95		912	1425	2280	912	1425	2280	3591
1		960	1500	2400	960	1500	2400	3780

Electronic trip units (Standard)
ETS33 for TS400, TS630

Setting details

Short-circuit protection (short time)

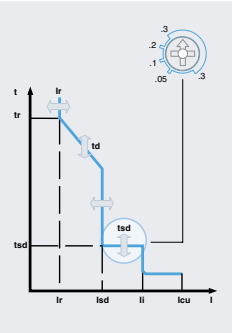


Circuit breakers		TS400			TS630			
Trip unit rating, In(A)		160	250	400	160	250	400	630
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir						
0.4		448	700	1120	448	700	1120	1764
0.45		504	788	1260	504	788	1260	1984
0.5		560	875	1400	560	875	1400	2205
0.55		616	963	1540	616	963	1540	2425
0.6		672	1050	1680	672	1050	1680	2646
0.65		728	1138	1820	728	1138	1820	2867
0.7	7	784	1225	1960	784	1225	1960	3087
0.75		840	1313	2100	840	1313	2100	3308
0.8		896	1400	2240	896	1400	2240	3528
0.85		952	1488	2380	952	1488	2380	3749
0.9		1008	1575	2520	1008	1575	2520	3969
0.95		1064	1663	2660	1064	1663	2660	4190
1		1120	1750	2800	1120	1750	2800	4410
0.4		512	800	1280	512	800	1280	2016
0.45		576	900	1440	576	900	1440	2268
0.5		640	1000	1600	640	1000	1600	2520
0.55		704	1100	1760	704	1100	1760	2772
0.6		768	1200	1920	768	1200	1920	3024
0.65		832	1300	2080	832	1300	2080	3276
0.7	8	896	1400	2240	896	1400	2240	3528
0.75		960	1500	2400	960	1500	2400	3780
0.8		1024	1600	2560	1024	1600	2560	4032
0.85		1088	1700	2720	1088	1700	2720	4284
0.9		1152	1800	2880	1152	1800	2880	4536
0.95		1216	1900	3040	1216	1900	3040	4788
1		1280	2000	3200	1280	2000	3200	5040
0.4		640	1000	1600	640	1000	1600	2520
0.45		720	1125	1800	720	1125	1800	2835
0.5		800	1250	2000	800	1250	2000	3150
0.55		880	1375	2200	880	1375	2200	3465
0.6		960	1500	2400	960	1500	2400	3780
0.65		1040	1625	2600	1040	1625	2600	4095
0.7	10	1120	1750	2800	1120	1750	2800	4410
0.75		1200	1875	3000	1200	1875	3000	4725
0.8		1280	2000	3200	1280	2000	3200	5040
0.85		1360	2125	3400	1360	2125	3400	5355
0.9		1440	2250	3600	1440	2250	3600	5670
0.95		1520	2375	3800	1520	2375	3800	5985
1		1600	2500	4000	1600	2500	4000	6300

Electronic trip units (Standard)
ETS33 for TS400, TS630

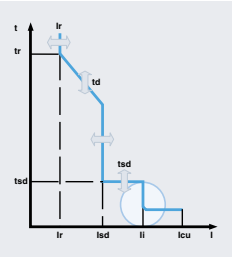
Setting details

Short time tripping delay setting, tsd (ms)



Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous), Ii (A)

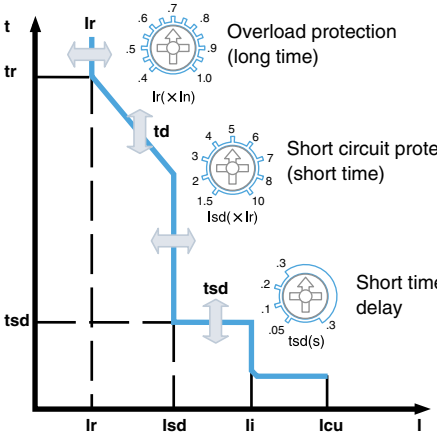


Tripping threshold (A), Ii	Fixed at 11 × In

Electronic trip units (Standard)
ETS43 for MCCBs TS800

Configuration

Electronic type, ETS43 for MCCBs TS800



Overload protection (long time)	
Setting current (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
Tripping time (s)	Fixed at 6×Ir , tolerance±20%

Short-circuit protection (short time)						
Tripping threshold (A), (Isd)	1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir 9 settings, tolerance ±15%					
Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous)	
Tripping threshold (A), Ii	Fixed at 11×In

Catalogue numbering system

ETS 43 In800A

Trip unit frame
- 23 for TS100, TS160, TS250
- 33 for TS400, TS630
- 43 for TS800

Rated current, In
- 630, 800A for TS800

Trip unit function
- ETS: Standard electronic trip unit

Electronic trip units (Standard)
ETS43 for MCCBs TS800

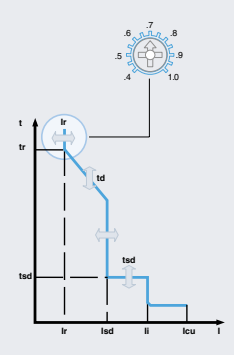
Current setting, Ir (A)

Standard electronic trip unit, ETS43

Trip unit	16	32	40	64	80	100	160	250	320	400	630	800
for TS800												

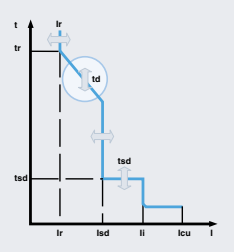
Setting details

Overload protection (long time)



Circuit breakers	TS800	
Trip unit rating, In(A)	630	800
Setting value	**Overload protection setting current Ir = Setting value (0.4~1) × In**	
0.4	252	320
0.45	284	360
0.5	315	400
0.55	347	440
0.6	378	480
0.65	410	520
0.7	441	560
0.75	473	600
0.8	504	640
0.85	536	680
0.9	567	720
0.95	599	760
1	630	800

Long time tripping delay, td (sec)

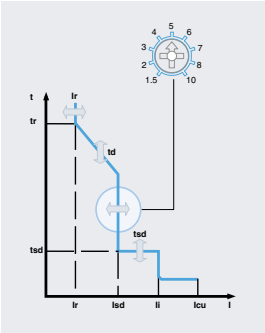


Tripping time (s)	Fixed at 6 × Ir tolerance ±20%

Electronic trip units (Standard)
ETS43 for MCCBs TS800

Setting details

Overload protection (long time)

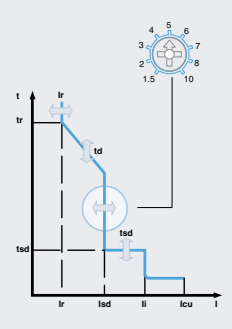


Circuit breakers		TS800	
Trip unit rating, In(A)		630	800
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir	
0.4	1.5	378	480
0.45		425	540
0.5		473	600
0.55		520	660
0.6		567	720
0.65		614	780
0.7		662	840
0.75		709	900
0.8		756	960
0.85		804	1020
0.9		850.5	1080
0.95		898	1140
1		945	1200
0.4	2	504	640
0.45		567	720
0.5		630	800
0.55		693	880
0.6		756	960
0.65		819	1040
0.7		882	1120
0.75		945	1200
0.8		1008	1280
0.85		1071	1360
0.9		1134	1440
0.95		1197	1520
1		1260	1600
0.4	3	756	960
0.45		851	1080
0.5		945	1200
0.55		1040	1320
0.6		1134	1440
0.65		1229	1560
0.7		1323	1680
0.75		1418	1800
0.8		1512	1920
0.85		1607	2040
0.9		1701	2160
0.95		1796	2280
1		1890	2400

Electronic trip units (Standard)
ETS43 for MCCBs TS800

Setting details

Overload protection (long time)

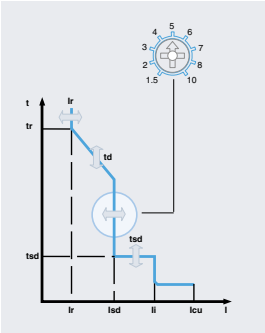


Circuit breakers		TS800	
Trip unit rating, In(A)		630	800
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir	
0.4		1008	1280
0.45		1134	1440
0.5		1260	1600
0.55		1386	1760
0.6		1512	1920
0.65		1638	2080
0.7	4	1764	2240
0.75		1890	2400
0.8		2016	2560
0.85		2142	2720
0.9		2268	2880
0.95		2394	3040
1		2520	3200
0.4		1260	1600
0.45		1418	1800
0.5		1575	2000
0.55		1733	2200
0.6		1890	2400
0.65		2048	2600
0.7	5	2205	2800
0.75		2363	3000
0.8		2520	3200
0.85		2678	3400
0.9		2835	3600
0.95		2993	3800
1		3150	4000
0.4		1512	1920
0.45		1701	2160
0.5		1890	2400
0.55		2079	2640
0.6		2268	2880
0.65		2457	3120
0.7	6	2646	3360
0.75		2835	3600
0.8		3024	3840
0.85		3213	4080
0.9		3402	4320
0.95		3591	4560
1		3780	4800

Electronic trip units (Standard)
ETS43 for MCCBs TS800

Setting details

Short-circuit protection (short time)

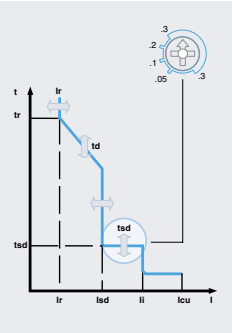


Circuit breakers		TS800	
Trip unit rating, In(A)		630	800
Setting value		Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir	
0.4		1764	2240
0.45		1985	2520
0.5		2205	2800
0.55		2426	3080
0.6		2646	3360
0.65		2867	3640
0.7	7	3087	3920
0.75		3308	4200
0.8		3528	4480
0.85		3749	4760
0.9		3969	5040
0.95		4190	5320
1		4410	5600
0.4		2016	2560
0.45		2268	2880
0.5		2520	3200
0.55		2772	3520
0.6		3024	3840
0.65		3276	4160
0.7	8	3528	4480
0.75		3780	4800
0.8		4032	5120
0.85		4284	5440
0.9		4536	5760
0.95		4788	6080
1		5040	6400
0.4		2520	3200
0.45		2835	3600
0.5		3150	4000
0.55		3465	4400
0.6		3780	4800
0.65		4095	5200
0.7	10	4410	5600
0.75		4725	6000
0.8		5040	6400
0.85		5355	6800
0.9		5670	7200
0.95		5985	7600
1		6300	8000

Electronic trip units (Standard)
ETS43 for MCCBs TS800

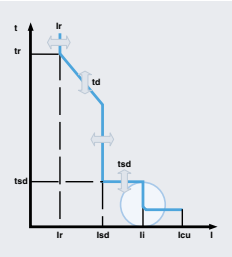
Setting details

Short time tripping delay setting, tsd (ms)



Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	

Short circuit protection (Instantaneous), Ii (A)



Tripping threshold (A), Ii	Fixed at 11 × In

Electronic trip units (Multifunction)
Overview

Types : ETM33, ETM43
Range of overload protection setting current (Ir): 64~630A (ETM33), 250~800A (ETM43)
Two frame size of circuit breakers: 630AF, 800AF
Trip units ETM33 and ETM43 can be mounted on circuit breakers of N, H and L type TS400 / TS630 / TS800
Only three(3) pole circuit breakers are available.

Ratings

Rated current, In(A)

Rated current In (A)	Trip unit		
	ETM33		ETM43
160	●	●	-
250	●	●	●
400	●	●	●
630	-	●	●
800	-	-	●
Circuit breakers	TS400 N/H/L	TS630 N/H/L	TS800 N/H/L

Current setting, Ir(A)

Trip unit		ETM33	ETM33	ETM43
Overload protection setting current, Ir(A)	64	●	●	-
	80	●	●	-
	100	●	●	-
	160	●	●	-
	250	●	●	●
	400	●	●	●
	630	-	●	●
	800	-	-	●
Applicable circuit breakers		TS400 N/H/L	TS630 N/H/L	TS800 N/H/L

Electronic trip units (Multifunction)
Overview

Setting values

Overload protection (long time)						
Setting current (A), Ir	Adjustable 0.4 ~ 1.0 × In, 30 settings					
Tripping time (s) at 6 × Ir	Adjustable 2, 4, 6, 8,12 5 settings, tolerance ±20%					

Short-circuit protection (short time)						
Tripping threshold (A), Isd	Adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10 × Ir, 9 settings, tolerance ±15%					
Time delay (tsd)	setting time (ms)	50	100	200	300	4 settings
	operation time (ms)	30<t≤70	70<t≤140	140<t≤240	240<t≤350	I^2t is off

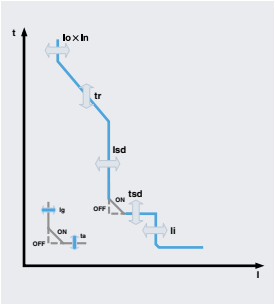
Short-circuit protection (instantaneous)	
Tripping threshold (A), Ii	Adjustable 1.5, 2, 4, 5, 6, 8, 10, 11 × In, 9 settings

Indication of tripping reason	
LED indication	Ir, Isd, Ii, (Ig)

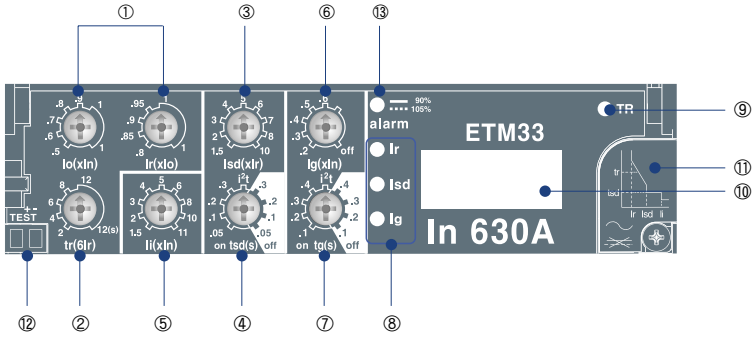
Option for TS400ETM to TS800ETM						
Ammeter (A)	Maximum load phase current and R,S,T,N phase current					
Earth fault protection (E)	Adjustable tripping threshold (A), 0.2~1 × In, 9 setting					
	setting time (ms)	100	200	300	400	4 settings
	operation time (ms)	60<t≤140	140<t≤230	230<t≤350	350<t≤500	I^2t is off
Communication (C)	Setting, R, S, T, N phase current, tripping reason					
ZSI (Z)	ZSI input and output signal					

Electronic trip units (Multifunction)
Overview

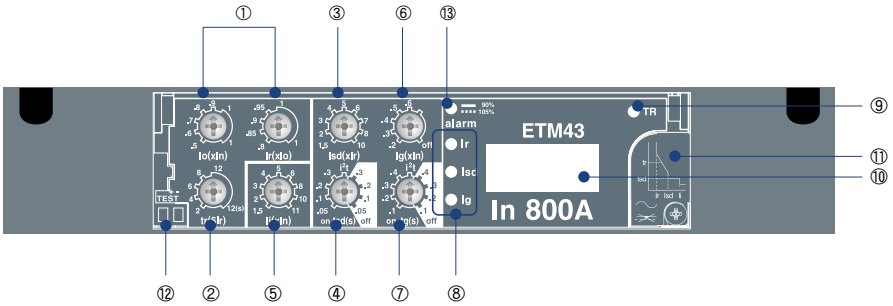
① Adjustable rated current setting (Ir)
② Adjustable long time setting (tr)
③ Adjustable short time current setting (Isd)
④ Adjustable time delay setting (tsd)
⑤ Adjustable instantaneous current setting (Ii)
⑥ Adjustable earth fault current setting (Ig)
⑦ Adjustable earth fault delay setting (tg)
⑧ Indication LED
⑨ TR (trip reason) button
⑩ Display LCD (Ammeter)
⑪ Auxiliary power
⑫ Test connector
⑬ Alarm LED



ETM33 for TS400/TS630

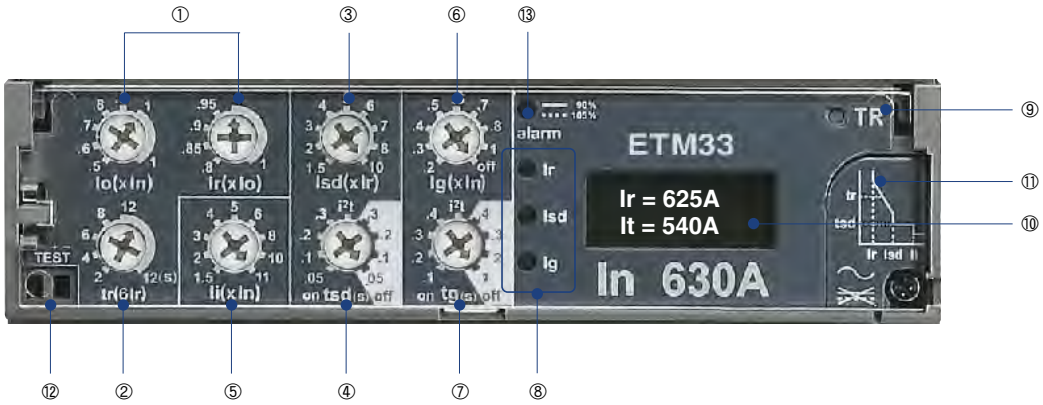


ETM43 for TS800

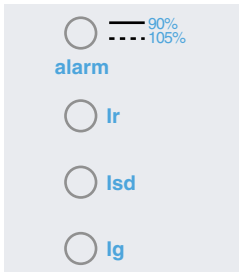


Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Configuration



① Adjustable rated current setting (Ir)
② Adjustable long time setting (tr)
③ Adjustable short time current setting (Isd)
④ Adjustable time delay setting (tsd)
⑤ Adjustable instantaneous current setting (Ii)
⑥ Adjustable earth fault current setting (Ig)
⑦ Adjustable earth fault delay setting (tg)
⑧ Indication LED
⑨ TR (trip reason) button
⑩ Display LCD (Ammeter)
⑪ Battery
⑫ Test connector
⑬ Alarm LED 90% Ir : ON,
105% Ir or more: ON-OFF



Alarm indication

The LED lights and remains lit when the load exceeds 90 % of Ir.
The LED blinks for an overload(≥105% Ir), warning that the circuit breaker may trip.

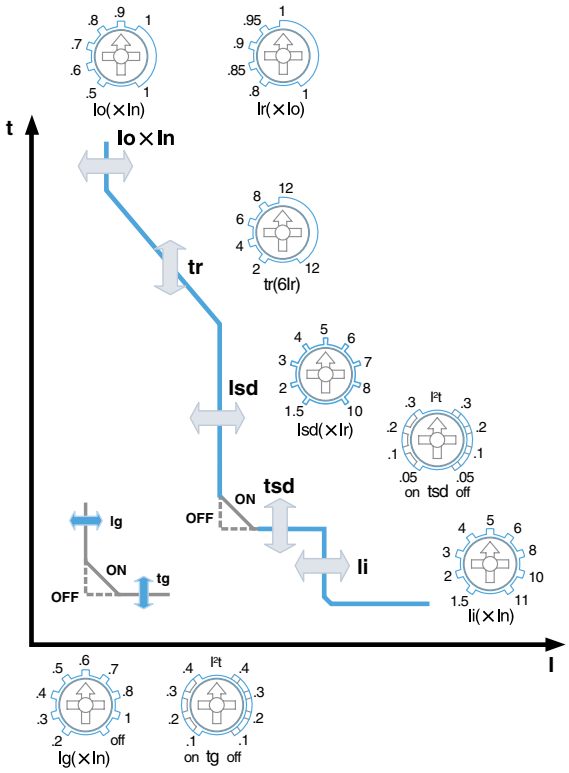
Fault indications

LEDs indicate the type of fault that caused tripping:
Ir : overload
Isd : short-circuit (short time, instantaneous)
Ig : earth fault
If push the TR button to indicate the tripping reasion, the indication LED of tripping is ON.
The information is however stored in memory and the LED can be reilluminated by pressing the TR button.
The LED automatically goes off and the memory is cleared when the circuit breaker is reset.
In normal condition, if push TR button, all indication LED is ON for testing auxiliary power and LED.

Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Tripping characteristics

Trip unit, ETM33



Long time protection against overloads

Io = Coarse adjustment (function of In)
Ir = Fine adjustment
tr = Long time delay

Short circuit protection

Isd = Short circuit threshold,
tsd = Short circuit time delay
I²t curve in position ON or OFF

Instantaneous protection

Ii = Instantaneous threshold

Earth fault protection

Ig = Insulation fault threshold
tg = Earth fault time delay
I²t curve in position ON or OFF

Catalogue numbering system

ETM 33 In600A

Trip unit frame
- 33 for TS400, TS630
- 43 for TS800

Rated current, In
- 160, 250, 400A for TS400
- 160, 250, 400, 630A for TS630

Trip unit function
- ETM : Multifunction electronic trip unit

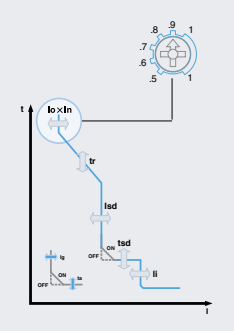
Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Setting details

Overload protection setting current, Ir(A)

Trip unit type		16	32	40	64	80	100	160	250	320	400	630	800
ETM33	for TS400												
	for TS630												

Overload protection (long time)

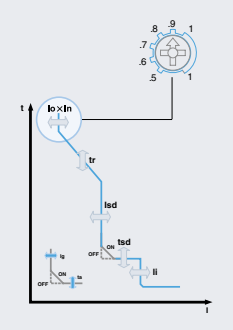


Type of trip unit		TS400ETM		
Rated current, In(A)		160	250	400
Setting value Coarse, Io	Setting value Fine, Ir	Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir		
0.5	0.8	64	100	160
	0.85	68	106.25	170
	0.9	72	112.5	180
	0.95	76	118.75	190
	1	80	125	200
0.6	0.8	76.8	120	192
	0.85	81.6	127.5	204
	0.9	86.4	135	216
	0.95	91.2	142.5	228
	1	96	150	240
0.7	0.8	89.6	140	224
	0.85	95.2	148.75	238
	0.9	100.8	157.5	252
	0.95	106.4	166.25	266
	1	112	175	280
0.8	0.8	102.4	160	256
	0.85	108.8	170	272
	0.9	115.2	180	288
	0.95	121.6	190	304
	1	128	200	320
0.9	0.8	115.2	180	288
	0.85	122.4	191.25	306
	0.9	129.6	202.5	324
	0.95	136.8	213.75	342
	1	144	225	360
1	0.8	128	200	320
	0.85	136	212.5	340
	0.9	144	225	360
	0.95	152	237.5	380
	1	160	250	400

Electronic trip units (Multifunction)
ETM33 for TS400, TS630

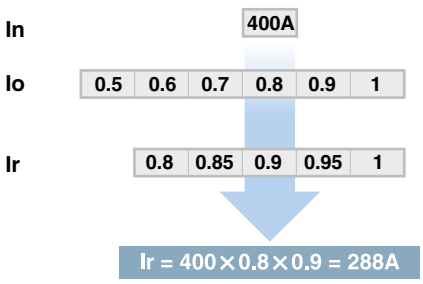
Setting details

Overload protection (long time)



Type of trip unit		TS630ETM			
Rated current, In(A)		160	250	400	630
Setting value Coarse, Io	Setting value Fine, Ir	Overload protection setting current, Ir (A)			
0.5	0.8	64	100	160	252
	0.85	68	106.25	170	267.75
	0.9	72	112.5	180	283.5
	0.95	76	118.75	190	299.25
	1	80	125	200	315
0.6	0.8	76.8	120	192	302.4
	0.85	81.6	127.5	204	321.3
	0.9	86.4	135	216	340.2
	0.95	91.2	142.5	228	359.1
	1	96	150	240	378
0.7	0.8	89.6	140	224	352.8
	0.85	95.2	148.75	238	374.85
	0.9	100.8	157.5	252	396.9
	0.95	106.4	166.25	266	418.95
	1	112	175	280	441
0.8	0.8	102.4	160	256	403.2
	0.85	108.8	170	272	428.4
	0.9	115.2	180	288	453.6
	0.95	121.6	190	304	478.8
	1	128	200	320	504
0.9	0.8	115.2	180	288	453.6
	0.85	122.4	191.25	306	481.95
	0.9	129.6	202.5	324	510.3
	0.95	136.8	213.75	342	538.65
	1	144	225	360	567
1	0.8	128	200	320	504
	0.85	136	212.5	340	535.5
	0.9	144	225	360	567
	0.95	152	237.5	380	598.5
	1	160	250	400	630

Setting example :

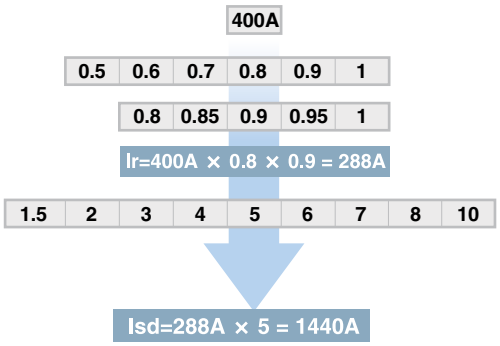


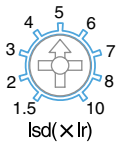
Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Short circuit protection

The short circuit threshold, Isd is a multiple of the overload setting, Ir.

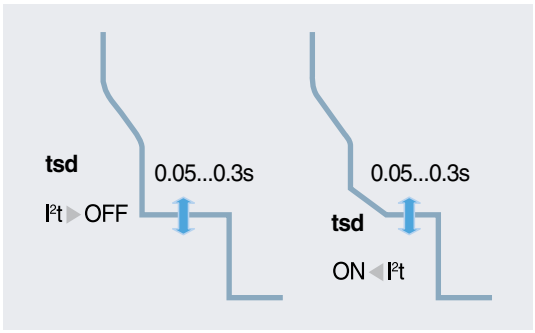
Setting example :

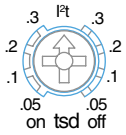




The breaker trips when the current exceeds 2880 A.

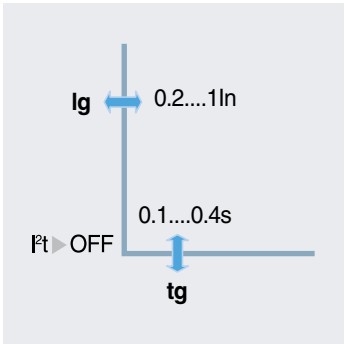
Short circuit time delay

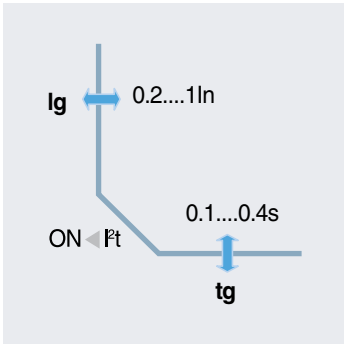


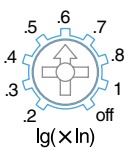


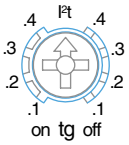
Earth fault protection(E), optional

The ETM trip units measure the vectorial sum of the three phase current and, if present, that of the neutral conductor.
If the sum of these values exceeds the set current thresholds for a period of time greater than the time delay, the breaker is tripped.









Ig = insulation fault threshold
tg = earth fault time delay

Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Ammeter (A), optional

The Ammeter device has an accuracy of ±10%.
The highest phase current is displayed in upper line.
In under line, R, S and T phase current is scrolled autom.

Ammeter display limits:

- minimum current ≥ 0.3 × In (one phase)
- maximum current ≤ 10 × In

Zone selective interlocking (ZSI), optional

Zone Selective Interlocking is mainly used in systems with high rated current and short circuit current values, with safety and service continuity requirements.
This type of discrimination can be achieved with circuit breakers equipped with specially designed electronic trip units (ETM for TS circuit breakers).

Zone selective interlocking (ZSI) is a system designed

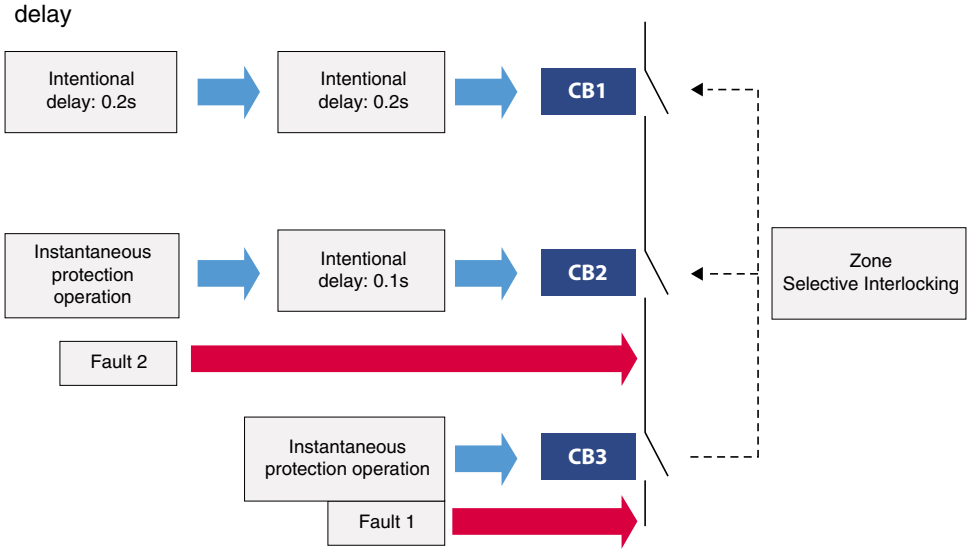
- to reduce the stress on electrical distribution components during short-circuit or earth fault conditions.
- to reduce the tripping times (Lower than hundred milliseconds).
- to reduce the damage caused by the fault and of interferences to the power supply system;

A number of circuit breakers are interconnected one after another by a pilot-wire.

Power source: DC24V Power is required.

Operation

- With ZSI, ETM trip unit detects the fault and then send the signal to upstream circuit breaker which applies the set time delay and ignore its present short-time and or/ earth fault delay and clear the fault with no intentional delay.
- Without ZSI, ETM trip unit detects the fault and then trips the circuit breaker with intentional delay



Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Communication(C), optional

Communication interface: RS485 (Modbus-RTU)

The Modbus RS485 system is an open bus on which communicating Modbus devices are installed. All kinds of PLCs and computers can be connected to the bus.

Transmitted data :

- Protection setting values
- Highest current of the three phases
- Measurement: R, S, T and N phase current
- Fault reading: Type of fault (Overload, short-circuit, etc)

The setting of communication address using TR button and LCD display (Ammeter).

Power source: DC24V Power is required.

Combination of options

- ☐ A(Ammeter)
- ☐ E(Earth fault protection)
- ☐ A+E
- ☐ A +C(Communication)
- ☐ A+E+C
- ☐ Z(Zone selective interlocking)
- ☐ Z+A
- ☐ Z+E
- ☐ Z+A+E
- ☐ Z+A +C
- ☐ Z+A+E+C

Electronic trip units (Multifunction)
ETM33 for TS400, TS630

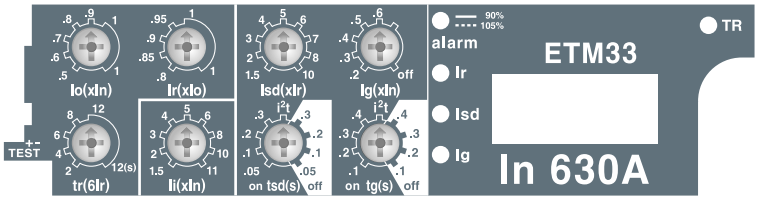
Menu structure of the electronic trip unit (ETM)

I	r	-	1	2	6	0	A	→ Display current value (RMS) of phase which is carrying maximum in each phase
I	s	-			6	5	A	→ Display current value (RMS) of each phase at an interval of every 2 seconds.

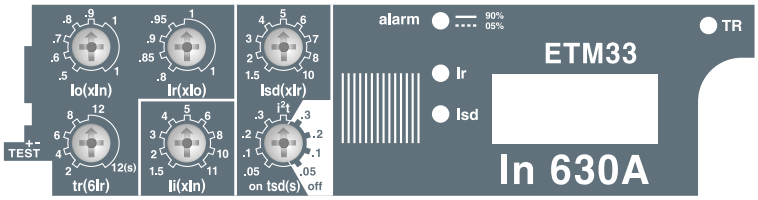
Electronic trip units (Multifunction)
ETM33 for TS400, TS630

Feature of trip unit according to option

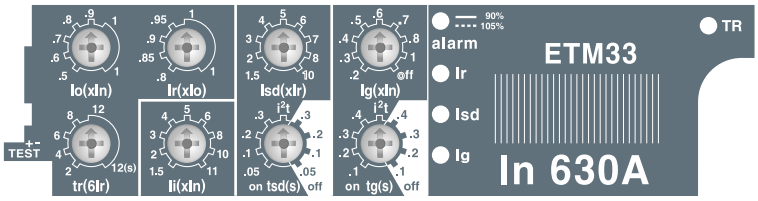
ETM33 A+E
ETM33 A+E+C
ETM33 Z+A+E
ETM33 Z+A+E+C



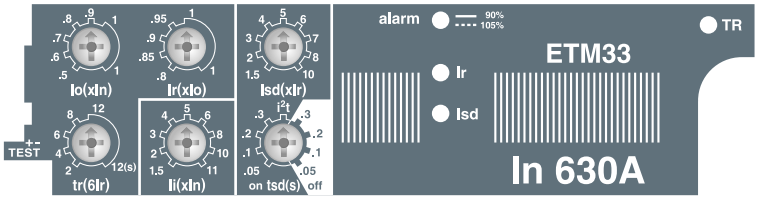
ETM33 A
ETM33 A+C
ETM33 Z+A
ETM33 Z+A+C



ETM33 E
ETM33 Z+E

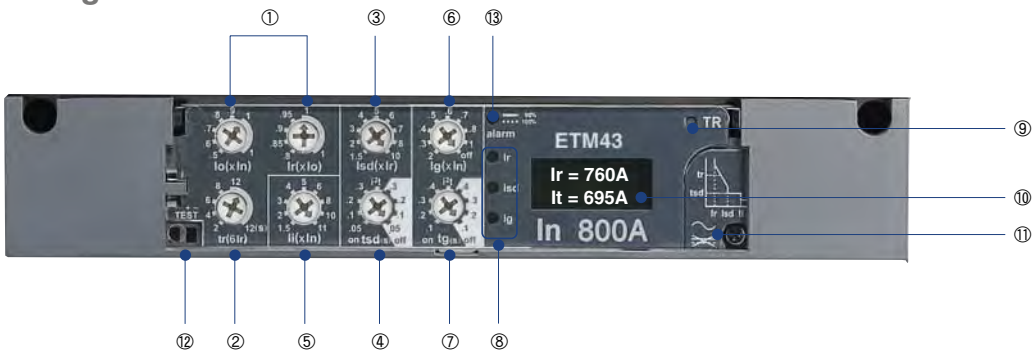


ETM33
ETM33 Z

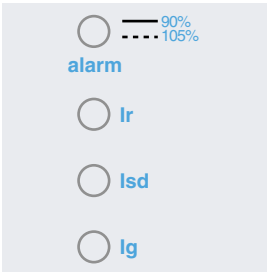


Electronic trip units (Multifunction)
ETM43 for TS800

Configuration



① Adjustable rated current setting (Ir)
② Adjustable long time setting (tr)
③ Adjustable short time current setting (Isd)
④ Adjustable time delay setting (tsd)
⑤ Adjustable instantaneous current setting (Ii)
⑥ Adjustable earth fault current setting (Ig)
⑦ Adjustable earth fault delay setting (tg)
⑧ Indication LED
⑨ TR (trip reason) button
⑩ Display LCD (Ammeter)
⑪ Battery
⑫ Test connector
⑬ Alarm LED 90% Ir : ON,
105% Ir or more: ON-OFF



Alarm indication

The LED lights and remains lit when the load exceeds 90 % of Ir.
The LED blinks for an overload(≥105% Ir), warning that the circuit breaker may trip.

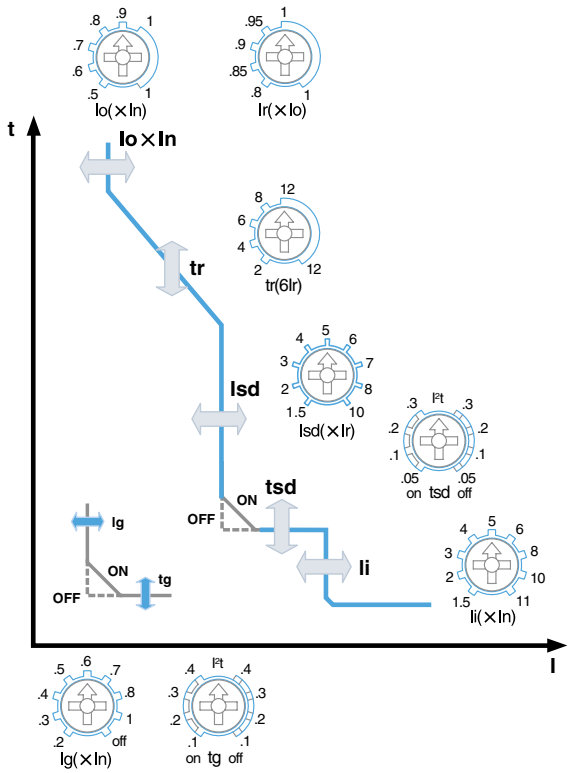
Fault indications

LEDs indicate the type of fault that caused tripping:
Ir : overload
Isd : short-circuit (short time, instantaneous)
Ig : earth fault
The information is however stored in memory and the LED can be reilluminated by pressing the TR button.
The LED automatically goes off and the memory is cleared when the circuit breaker is reset.
In normal condition, if push TR button, all indication LED is ON for testing auxiliary power and LED.

Electronic trip units (Multifunction)
ETM43 for TS800

Tripping characteristics

Trip unit for TS800 circuit breaker



Long time protection against overloads

Io = Coarse adjustment (function of In)
Ir = Fine adjustment
tr = Long time delay

Short circuit protection

Isd = Short circuit threshold,
tsd = Short circuit time delay
I²t curve in position ON or OFF

Instantaneous protection

Ii = Instantaneous threshold

Earth fault protection

Ig = Insulation fault threshold
tg = Earth fault time delay
I²t curve in position ON or OFF

Catalogue numbering system

ETM 43 In800A

Trip unit frame
- 33 for TS400, TS630
- 43 for TS800

Rated current, In
- 630, 800A for TS630

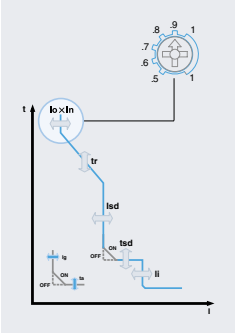
Trip unit function
- ETM: Multi function electronic trip unit

Electronic trip units (Multifunction)
ETM43 for TS800

Setting details

Trip unit rating, In

Trip unit type		16	32	40	64	80	100	160	250	320	400	630	800
ETM43	for TS800												



Overload protection (long time)

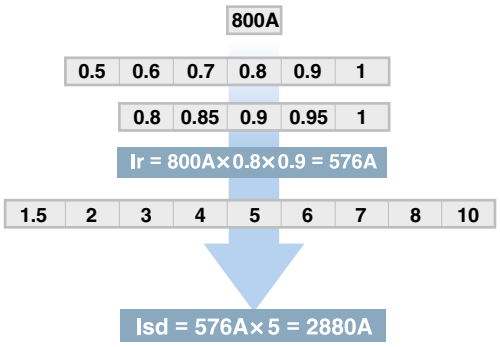
Type of trip unit		TS800ETM	
Rated current, In(A)		630	800
Setting value Coarse, Io	Setting value Fine, Ir	Overload protection setting current, Ir (A)	
0.5	0.8	252	320
	0.85	267.75	340
	0.9	283.5	360
	0.95	299.25	380
	1	315	400
0.6	0.8	302.4	384
	0.85	321.3	408
	0.9	340.2	432
	0.95	359.1	456
	1	378	480
0.7	0.8	352.8	448
	0.85	374.85	476
	0.9	396.9	504
	0.95	418.95	532
	1	441	560
0.8	0.8	403.2	512
	0.85	428.4	544
	0.9	453.6	576
	0.95	478.8	608
	1	504	640
0.9	0.8	453.6	576
	0.85	481.95	612
	0.9	510.3	648
	0.95	538.65	684
	1	567	720
1	0.8	504	640
	0.85	535.5	680
	0.9	567	720
	0.95	598.5	760
	1	630	800

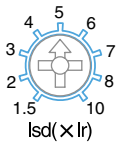
Electronic trip units (Multifunction)
ETM43 for TS800

Short circuit protection

The short circuit threshold, Isd is a multiple of the overload setting, Ir.

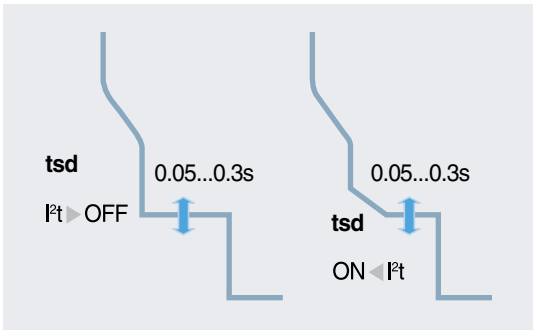
Setting example :

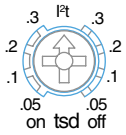




The breaker trips when the current exceeds 2880 A.

Short circuit time delay





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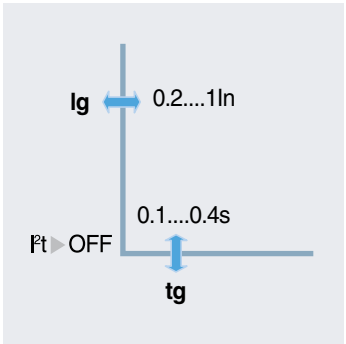

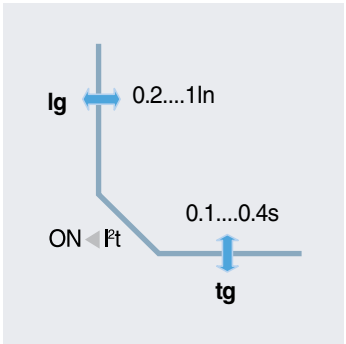

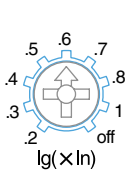

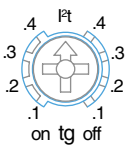

Ig = insulation fault threshold
tg = earth fault time delay

Electronic trip units (Multifunction)
ETM43 for TS800

Ammeter (A), optional

The Ammeter device has an accuracy of ±10%.
The highest phase current is displayed in upper line.
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Ammeter display limits:

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A number of circuit breakers are interconnected one after another by a pilot-wire.

Power source: DC24V Power is required.

Operation

- With ZSI, ETM trip unit detects the fault and then send the signal to upstream circuit breaker which applies the set time delay and ignore its present short-time and or/ earth fault delay and clear the fault with no intentional delay.
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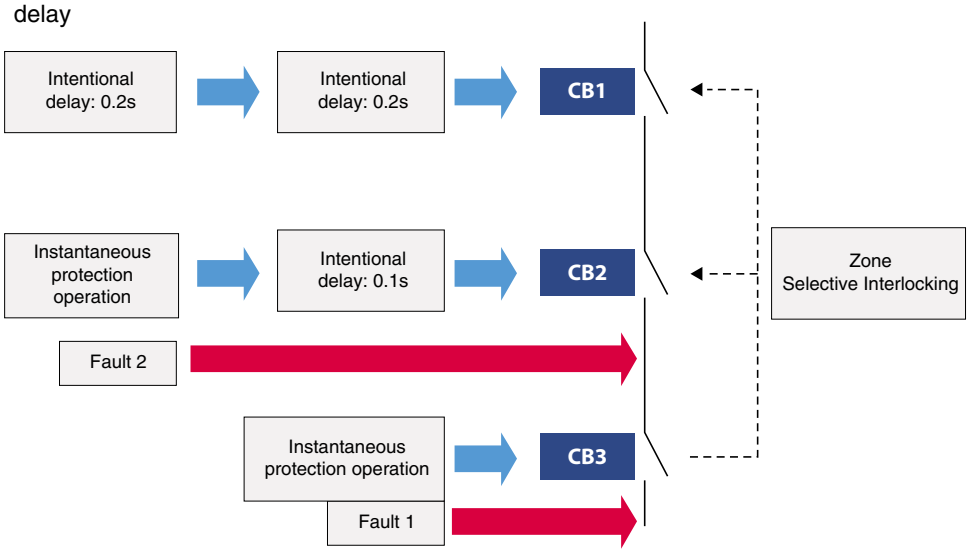


Electronic trip units (Multifunction)
ETM43 for TS800

Communication(C), optional

Communication interface: RS485 (Modbus-RTU)

The Modbus RS485 system is an open bus on which communicating Modbus devices are installed. All kinds of PLCs and computers can be connected to the bus.

Transmitted data:

- Protection setting values
- Highest current of the three phases
- Measurement: R, S, T and N phase current
- Fault reading: Type of fault (Overload, short-circuit, etc)

The setting of communication address using TR button and LCD display (Ammeter).

Power source: DC24V Power is required.

Combination of options

- ☐ A(Ammeter)
- ☐ E(Earth fault protection)
- ☐ A+E
- ☐ A +C(Communication)
- ☐ A+E+C
- ☐ Z(Zone selective interlocking)
- ☐ Z+A
- ☐ Z+E
- ☐ Z+A+E
- ☐ Z+A +C
- ☐ Z+A+E+C

Electronic trip units (Multifunction)
ETM43 for TS800

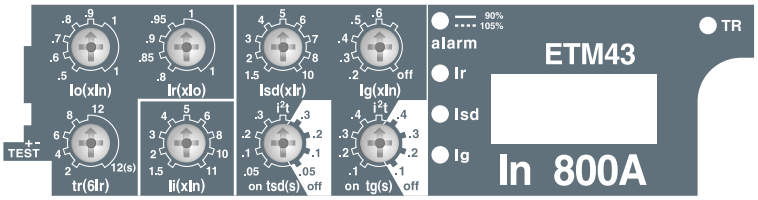
Menu structure of the electronic trip unit (ETM)

I	r	-	1	2	6	0	A	→ Display current value (RMS) of phase which is carrying maximum in each phase
I	s	-			6	5	A	→ Display current value (RMS) of each phase at an interval of every 2 seconds.

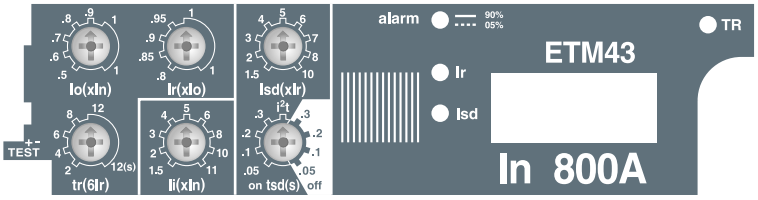
Electronic trip units (Multifunction)
ETM43 for TS800

Feature of trip unit according to option

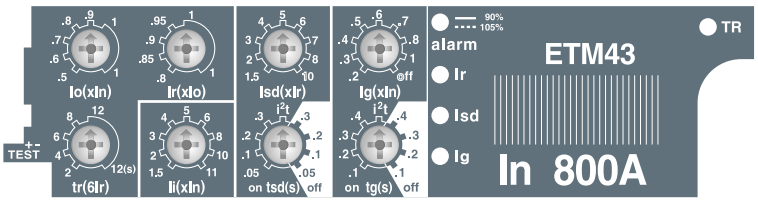
ETM43 A+E
ETM43 A+E+C
ETM43 Z+A+E
ETM43 Z+A+E+C



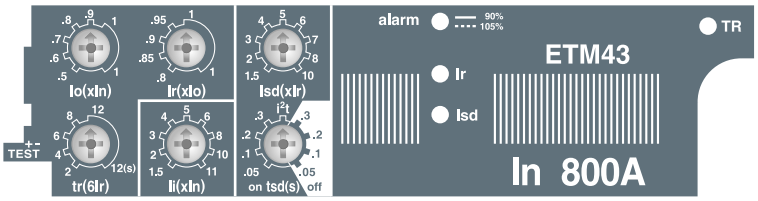
ETM43 A
ETM43 A+C
ETM43 Z+A
ETM43 Z+A+C



ETM43 E
ETM43 Z+E



ETM43
ETM43 Z



Electrical characteristics



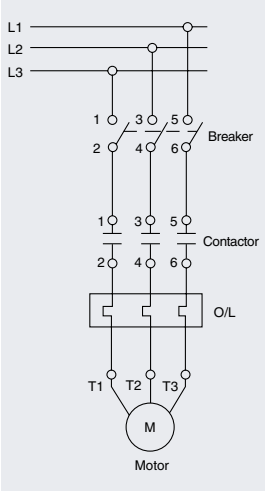
				TS100			TS160			TS250		
Frame size			[AF]	100			160			250		
Rated current, In			[A]	1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100			32, 50, 63, 100, 160			100, 160, 220		
No. of poles				3			3			3		
Rated operational voltage, Ue	AC		[V]	690			690			690		
	DC		[V]	500			500			500		
Rated impulse withstand voltage, Uimp			[kV]	8			8			8		
Rated insulation voltage, Ui			[V]	750			750			750		
Rated ultimate short-circuit breaking capacity, Icu				N	H	L	N	H	L	N	H	L
AC 50/60Hz	220/240V		[kA]	100	120	200	100	120	200	100	120	200
	380/415V		[kA]	50	85	150	50	85	150	50	85	150
	440/460V		[kA]	50	70	130	50	70	130	50	70	130
	480/500V		[kA]	42	65	85	42	65	85	42	65	85
	660/690V		[kA]	10	15	20	10	15	20	10	15	20
Rated service breaking capacity, Ics [%Icu]				100%	100%	100%	100%	100%	100%	100%	100%	100%
Rated short-circuit making capacity, Icm												
AC 50/60Hz	220/240V		[kA]	220	264	440	220	264	440	220	264	440
	380/415V		[kA]	105	187	330	105	187	330	105	187	330
	440/460V		[kA]	105	154	286	105	154	286	105	154	286
	480/500V		[kA]	88	143	187	88	143	187	88	143	187
	660/690V		[kA]	17	30	40	17	30	40	17	30	40
Category of utilization				A			A			A		
Isolation behavior				●			●			●		
Trip unit (release)												
● magnetic only			MTU	●			●			●		
Connection	fixed	front-connection		●			●			●		
		rear-connection		●			●			●		
	plug-in	front-connection		●			●			●		
		rear-connection		●			●			●		
Mechanical life			[operations]	25000			25000			25000		
Electrical life @415 V AC			[operations]	10000			10000			10000		
Basic dimensions, W×H×D (front connection)	3-pole		[mm]	105×160×86			105×160×86			105×160×86		
Weight (front connection)	3-pole		[kg]	2			2			2		
Reference standard				IEC60947-2			IEC60947-2			IEC60947-2		

MCCBs for motor protection

Susol

TS400			TS630			TS800		
400			630			800		
320			500			630		
3			3			3		
690			690			690		
500			500			500		
8			8			8		
750			750			750		
N	H	L	N	H	L	N	H	L
100	120	200	100	120	200	100	120	200
65	85	150	65	85	150	65	100	150
65	85	130	65	85	130	65	100	130
42	65	85	42	65	85	42	85	100
10	20	35	10	20	35	10	20	35
100%	100%	100%	100%	100%	100%	100%	100%	100%
220	264	440	220	264	440	220	264	440
143	187	330	143	187	330	143	220	330
143	187	286	143	187	286	143	220	286
88	143	187	88	143	187	88	187	220
17	40	74	17	40	74	17	40	74
A			A			A		
●			●			●		
●			●			●		
●			●			●		
●			●			●		
●			●			●		
●			●			●		
20000			20000			10000		
6000			6000			3000		
140×260×110			140×260×110			210×320×135		
5.4			5.4			15.1		
IEC60947-2			IEC60947-2			IEC60947-2		

Magnetic only trip unit
MTU for TS100, TS160, TS250, TS400, TS630, TS800



Magnetic only release

For the protection of motors from 1.6 to 250kW(400V), TS100 to TS800 circuit Breakers must be equipped with a special trip unit MTU adjustable thresholds.

This assembly ensures: Short-circuit protection (magnetic trip unit with adjustable thresholds); Suitability for isolation. For the TS100 to TS800 circuit breakers, trip unit MTU is interchangeable.

The circuit breakers presented here: Provide protection against short-circuits; Are suitable for isolation as defined by IEC60947-2 standard.

Configuration

Trip unit identification

Trip unit rating, In
and reference temperature

Magnetic setting for short-circuit protection

Catalogue numbering system

TS250 **MTU**

Magnetic only release

MCCB frame type
- TS100: TS100N, TS100H, TS100L
- TS160: TS160N, TS160H, TS160L
- TS250: TS250N, TS250H, TS250L
- TS400: TS400N, TS400H, TS400L
- TS630: TS630N, TS630H, TS630L
- TS800: TS800N, TS800H, TS800L

Magnetic only trip unit
MTU for TS100, TS160, TS250, TS400, TS630, TS800

Characteristics

Magnetic trip units(MTU)

Rating(A)		In
	N / H / L	TS100
		TS160
		TS250
		TS400
		TS630
		TS800

TS100 to TS800													
1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
●	●	●	●	●	●	●	●	●	-	-	-	-	-
-	-	-	-	-	●	●	●	●	●	-	-	-	-
-	-	-	-	-	-	-	-	●	●	●	-	-	-
-	-	-	-	-	-	-	-	-	-	-	●	-	-
-	-	-	-	-	-	-	-	-	-	-	-	●	-
-	-	-	-	-	-	-	-	-	-	-	-	-	●

Short - circuit protection(magnetic)

Pick - up	Im

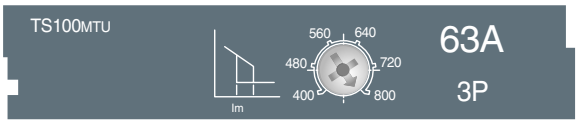
setting
6..12 × In (6 Point)

Setting details

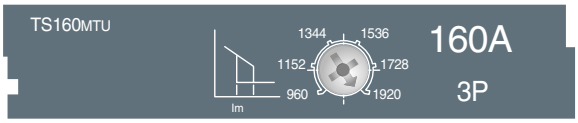
MTU In	6 × In	..	..	..	..	12 × In
1.6	10	12	14	16	18	20
3.2	20	24	28	32	36	40
6.3	40	48	56	64	72	80
12	70	84	98	112	126	140
20	120	144	168	192	216	240
32	190	228	266	304	342	380
50	300	360	420	480	540	600
63	400	480	560	640	720	800

MTU In	6 × In	..	..	..	..	12 × In
100	600	720	840	960	1080	1200
160	960	1152	1344	1536	1728	1920
220	1320	1584	1848	2112	2376	2640
320	1920	2304	2688	3072	3456	3840
500	3000	3600	4200	4800	5400	6000
630	3780	4536	5292	6048	6804	7560

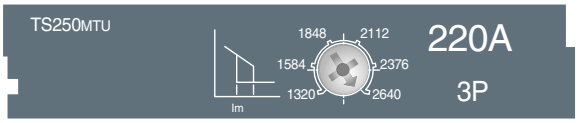
TS100 MTU
- Adjustable magnetic only unit



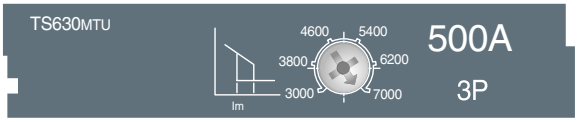
TS160 MTU
- Adjustable magnetic only unit

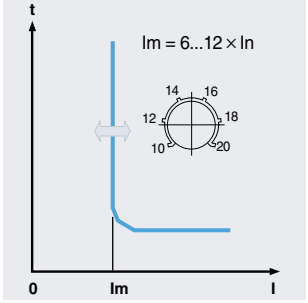


TS250 MTU
- Adjustable magnetic only unit



TS400 MTU, TS630 MTU, TS800 MTU
- Adjustable magnetic only unit





Switch-Disconnectors

Susol

			TD series		
					
			TD160NA	TS100NA	TS160NA
Frame size		[AF]	160	100	160
Conventional thermal current, Ith		[A]	160	100	160
No. of poles			2, 3, 4	2, 3, 4	2, 3, 4
Rated operational voltage, Ue	AC	[V]	690	690	690
	DC	[V]	500	500	500
Rated operational current, Ie			160	100	160
Rated impulse withstand voltage,Uimp		[kV]	8	8	8
Rated insulation voltage, Ui		[V]	750	750	750
Rated short-circuit making capacity, Icm		[kA peak]	3.1	2.8	3.6
Rated short-time withstand current, Icw	1s	[A rms]	2200	2000	2500
	3s	[A rms]	2200	2000	2500
	20s	[A rms]	960	690	960
Isolation behavior			●	●	●
Trip unit (release)					
● disconnector unit		DSU	●	●	●
Connection fixed	front-connection		●	●	●
	rear-connection		●	●	●
plug-in	front-connection		●	●	●
	rear-connection		●	●	●
Mechanical life		[operations]	25000	25000	25000
Electrical life @415 V AC		[operations]	10000	10000	10000
Basic dimensions, W×H×D (front connection)	3-pole	[mm]	90×140×86	105×160×86	105×160×86
	4-pole	[mm]	120×140×86	140×160×86	140×160×86
Weight (front connection)	3-pole	[kg]	1.5	2	2
	4-pole	[kg]	1.8	2.6	2.6
Reference standard			IEC60947-3	IEC60947-3	IEC60947-3

The switch-disconnectors are different from the circuit-breakers in the absence of the conventional protection unit. They keep the overall dimensions, connection systems and accessories unchanged from the corresponding circuit-breakers. Installation standards require upstream protection. However, thanks to their high-set magnetic release, TD160 ... TS800 DSU are self protected.

TS series

TS250NA	TS400NA	TS630NA	TS800NA
250	400	630	800
250	400	630	800
2, 3, 4	2, 3, 4	2, 3, 4	2, 3, 4
690	690	690	690
500	500	500	500
250	400	630	800
8	8	8	8
750	750	750	750
4.9	7.1	8.5	12
3500	5000	6300	8000
3500	5000	6300	8000
1350	1930	2320	2560
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
25000	20000	20000	10000
10000	6000	6000	3000
105 × 160 × 86	140 × 260 × 110	140 × 260 × 110	210 × 320 × 135
140 × 160 × 86	186.5 × 260 × 110	186.5 × 260 × 110	280 × 320 × 135
2	5.4	5.4	15.1
2.6	7.2	7.2	19.6
IEC60947-3	IEC60947-3	IEC60947-3	IEC60947-3

Trip unit identification

A-3. Accessories

Electrical auxiliaries

The following devices are installed into all TD & TS circuit breakers regardless of frame size.
And, the electrical auxiliaries can be easily installed in the accessory compartment of the circuit breakers which is cassette type.

UVT

Undervoltage release, UVT

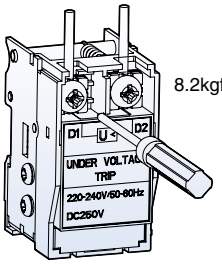
The undervoltage release automatically opens a circuit breaker when voltage drops to a value ranging between 35% to 70% of the line voltage. The operation is instantaneous, and after tripping, the circuit breaker cannot be re-closed again until the voltage returns to 85% of line voltage.

Continuously energized, the undervoltage release must be operating before the circuit breaker can be closed. The undervoltage release can be easily installed in the left accessory compartment of the Susol TD and TS circuit-breakers.

- Range of tripping voltage: 0.35 ~ 0.7Vn
- MCCB making is possible voltage: 0.85Vn (exceed)
- Frequency (only AC): 45Hz ~ 65Hz

Technical data

	Control voltage (V)	Consumption			Applicable MCCBs
		AC (VA)	DC (W)	mA	
Power consumption	AC/DC 24V	0.64	0.65	27	TD100, TD160, TS100, TS160, TS250, TS400, TS630, TS800
	AC/DC 48V	1.09	1.10	23	
	AC/DC 110~130V	0.73	0.75	5.8	
	AC 200~240V/DC 250V	1.21	1.35	5.4	
	AC 380~440V	1.67	-	3.8	
	AC 440~480V	1.68	-	3.5	
Max.opening time (ms)		50			
Tightening torque of terminal screw		8.2kgf · cm			
Transformer operating voltage (V) - Drop (Circuit breaker trips) - Rise (Circuit breaker can be switched on)		0.7~1.35Vn ~0.85Vn			



8.2kgf · cm

Electrical auxiliaries

SHT

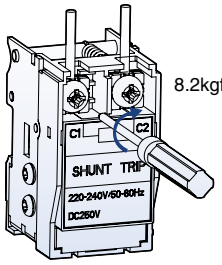
Shunt release, SHT

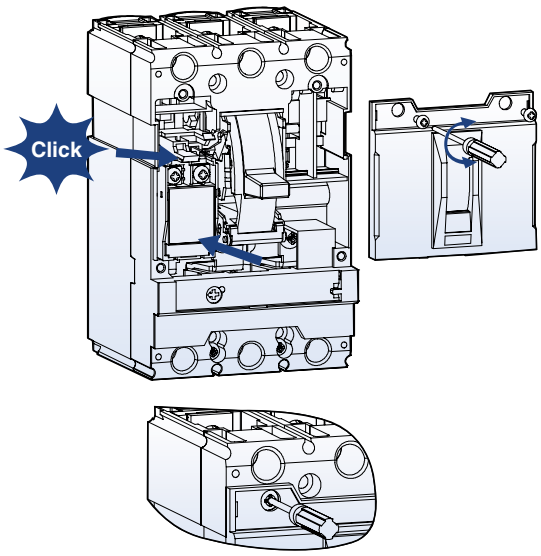
The shunt release opens the mechanism in response to an externally applied voltage signal. The releases include coil clearing contacts that automatically clear the signal circuit when the mechanism has tripped.
The shunt release can be installed in the left accessory compartment of the Susol TD & TS circuit-breakers.

- Range of operational voltage: 0.7 ~ 1.1Vn
- Frequency (only AC): 45Hz ~ 65Hz

Technical data

	Control voltage (V)	Consumption			Applicable MCCBs
		AC (VA)	DC (W)	mA	
Power consumption	DC 12V	-	0.36	30	TD100, TD160, TS100, TS160, TS250, TS400, TS630, TS800
	AC/DC 24V	0.58	0.58	24	
	AC/DC 48V	1.22	1.23	25	
	AC/DC 110~130V	1.36	1.37	10.5	
	AC 220~240V/DC250V	1.80	1.88	7.5	
	AC 380~500V	1.15	-	2.3	
Max.opening time (ms)		50			
Tightening torque of terminal screw		8.2kgf · cm			



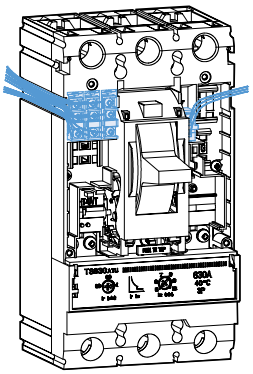


Electrical auxiliaries

Auxiliary switch (AX), Alarm switch (AL) and Fault alarm switch (FAL)

AX

AL



Auxiliary switch (AX)

Auxiliary switch is for applications requiring remote “ON” and “OFF” indication.
Each switch contains two contacts having a common connection.
One is open and the other closed when the circuit breaker is open, and vice-versa.

Alarm switch (AL)

Alarm switches offer provisions for immediate audio or visual indication of a tripped breaker due to overload, short circuit, shunt trip, or undervoltage release conditions.
They are particularly useful in automated plants where operators must be signaled about changes in the electrical distribution system. This switch features a closed contact when the circuit breaker is tripped automatically. In other words, this switch does not function when the breaker is operated manually.
Its contact is open when the circuit breaker is reset.

Fault alarm switch (FAL)

FAL Indicates that the breaker has tripped due to overload or short circuit.
And, it can be applied to only circuit breakers with electronic trip units.

Contact operation

MCCB	ON	OFF	TRIP
Position of AX	AXc1 — AXa1, AXb1	AXc1 — AXa1, AXb1	
Position of AL, FAL	AXc1 — AXa1, AXb1		AXc1 — AXa1, AXb1

Technical data

Conventional thermal current Ith	5A			TD100 TD160 TS100 TS160 TS250 TS400 TS630 TS800
Rated operational current Ie with rated operational voltage Ue	Voltage	Ie		
		Resistance	Inductance	
- Altemating current 50/60Hz AC	125V	5	3	
	250V	3	2	
	500V	-	-	
- Direct current DC	30V	4	3	
	125V	0.4	0.4	
	250V	0.2	0.2	

Electrical auxiliaries

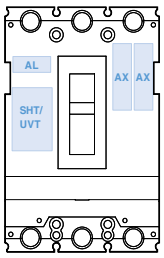
Possible configuration of electrical auxiliaries

Maximum possibilities

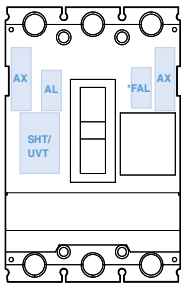
Phase	Accessory	TD160	TS250	TS630	TS800
R (Left)	AX	-	1	3	3
	AL	1	1	-	-
	SHT or UVT	1	1	1	1
T (Right)	AX	2	1	-	-
	AL	-	-	1	2
	FAL	-	1	1	1

Note) FAL can be applied to only MCCB with electronic trip release.

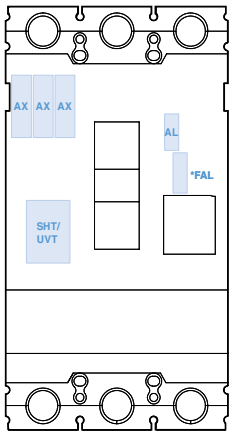
TD160



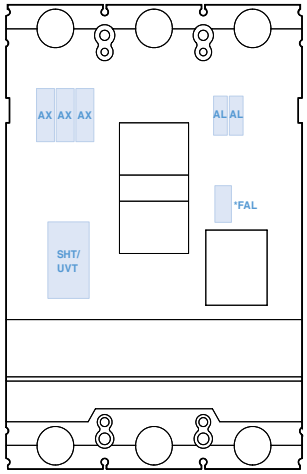
TS250



TS630



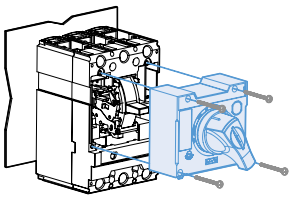
TS800



Rotary handles

Rotary handles

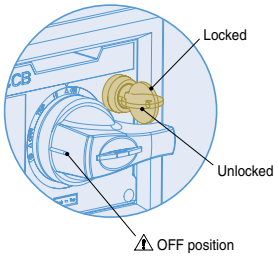
The rotary handle operating mechanism is available in either the direct version or in the extended version on the compartment door.
It is always fitted with a compartment door lock and on a request it can be supplied with a key lock in the open position.



Direct rotary handles

Direct rotary handles

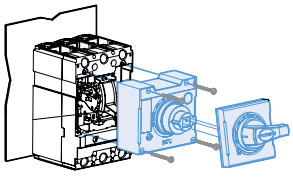
MCCB	Rotary handle
TD100,TD160	DH1
TS100,TS160,TS250	DH2
TS400,TS630	DH3
TS800	DH4



Direct rotary handle with a key lock

Direct rotary handles with a key lock

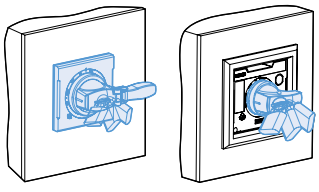
MCCB	Padlockable device	Lock function
TD100, TD160	DHK1	Lock in On or Off position
TS100, TS160, TS250	DHK2	
TS400, TS630	DHK3	
TS800	DHK4	



Extended rotary handles

Extended rotary handles

MCCB	Padlockable device
TD100,TD160	EH1
TS100,TS160,TS250	EH2
TS400,TS630	EH3
TS800	EH4



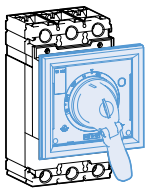
Padlocks for direct or extended handle

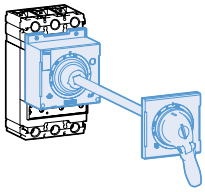
Padlocks can be used to lock the breaker in the ON or OFF position.

Rotary handles

Rotary handles

Degree of protections





Type	Degree of protection	IP
Circuit breaker with cover frame and rotary direct handle	The access probe of 1.0mm diameter shall not penetrate.	IP40
Circuit breaker with cover frame and rotary extended handle	Totally protected against ingress of dust and water jets from any direction	IP65

Locking devices

Removable locking device

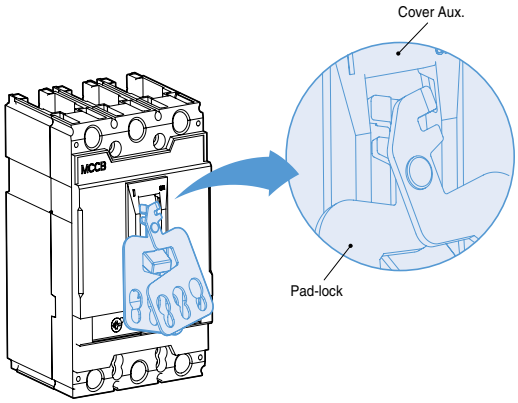
Removable locking device is available for all TD & TS circuit breakers.
The locking device is designed to be easily attached to the circuit-breaker.

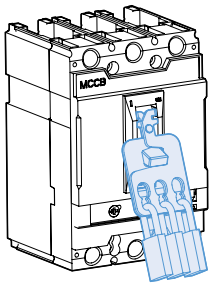
This device allows the handle to be locked in the “OFF” position.
Locking in the OFF position guarantee isolation according to IEC 60947-2.

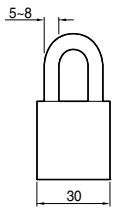
The locking device for the toggle handle can be installed in 3-pole and 4-pole circuit-breakers.
Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used.
(Padlocks are not supplied)

Removable locking device

MCCB	Padlockable device	Function
TD100,TD160	PL1	“OFF” position
TS100,TS160,TS250	PL2	
TS400,TS630	PL3	
TS800	PL4	







Padlock dimensions

Locking devices

Fixed locking device

Fixed locking device is available for all TD & TS circuit breakers.
This device allows the handle to be locked in the “ON” and “OFF” position.
Locking in the OFF position guarantee isolation according to IEC 60947-2.

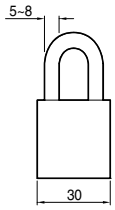
The locking device for the toggle handle can be installed in 3-pole and 4-pole circuit-breakers.
Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used.
(Padlocks are not supplied)

Fixed locking device

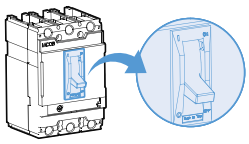
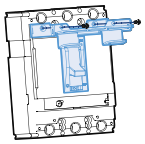
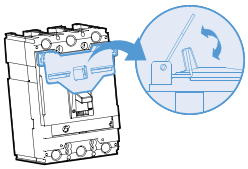
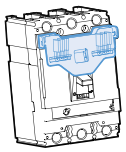
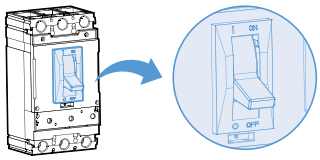
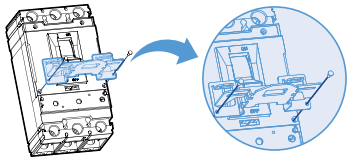
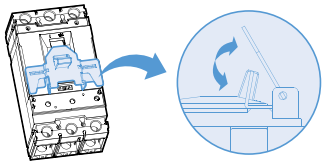
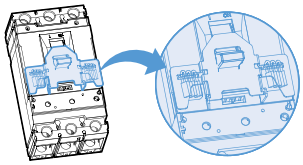
MCCB	Padlockable device	Function
TD100,TD160	PHL1	Lock in Off or On position
TS100,TS160,TS250	PHL2	
TS400,TS630	PHL3	
TS800	PHL4	

How to use

The locking device for the toggle handle is designed to be easily attached to the front of circuit-breaker.
① Please set the toggle handle in the position of ”On” or ”Off”.
② Install the lock device onto the front of auxiliary cover of circuit breaker.
③ Folding the wings of lock device as shown in picture 3.
④ The padlock to be used shall be that which is commercially available with the nominal dimension. (30mm nominal dimension, 5~8mm diameter)



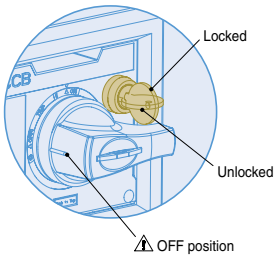
Padlock dimensions

TD100, 160	① 	② 
	③ 	④ 
TS100 ~ TS800	① 	② 
	③ 	④ 

Locking devices

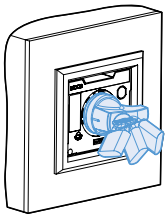
Locking by rotary handle with a key lock

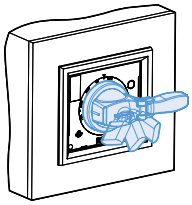
A locking can be done by using the rotary handle which has key lock device.
The lock is used to lock the circuit-breaker in the OFF position.



Locking by rotary handle with a key lock

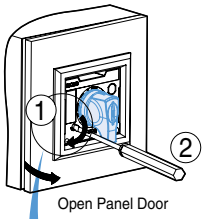
MCCB	Padlockable device	Function
TD100,TD160	DHK1	Lock in Off position
TS100,TS160,TS250	DHK2	
TS400,TS630	DHK3	
TS800	DHK4	

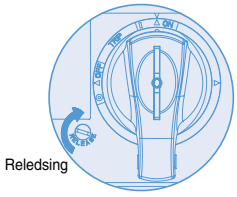




Padlocking by rotary handle

A padlocking can be also done by using the rotary handle.
The lock is used to lock the circuit-breaker in the ON and OFF position.
Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used.
(Padlocks are not supplied)



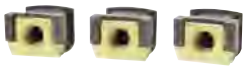


Releasing panel door lock at ON position

The panel door can be locked at ON and TRIP position of rotary handle.
To open the panel door at ON position, just rotate release screw clockwise.

Terminals

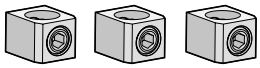
Front connection



Terminal mounter

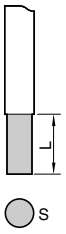
- It is supplied with Susol MCCBs as an standard part of circuit breaker.
- Connecting part with terminal for bus bar, cable with lug

MCCB	Type
TD100,TD160	TM1
TS100,TS160,TS250	TM2
TS400,TS630	-
TS800	-



Inner box terminal

- Bare cable connectors for Susol TD and TS series circuit breakers
- Can be used for both aluminum and copper cables



Applicable to	Type	Pole	Set quantity	Cable connection possibilities	Conductor size	
TD100, 160	SBT13 SBT14	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm) S(mm²)Cu/Al Tightening torque (kgf · cm)	21 2.5~95 120~147
TS100, 160, 250	SBT23 SBT24	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm) S(mm²)Cu/Al Tightening torque (kgf · cm)	21 10~150 120~147
TS400, 630	Note1) IBT33 IBT34	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm) S(mm²)Cu/Al Tightening torque (kgf · cm)	30 70~300 367~428
PB12, 13	Note2) IBT13 IBT14	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm) S(mm²)Cu/Al Tightening torque (kgf · cm)	18 2.5~95 306
PB22, 23	Note2) IBT23 IBT24	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm) S(mm²)Cu/Al Tightening torque (kgf · cm)	21 10~150 306

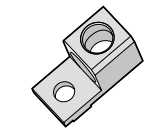
Note) 1. IBT3 for TS630 can be applied in case that rate current is upto 400A.
2. IBT13, 14 and IBT23, 24 are for Plug-in base.

Terminals

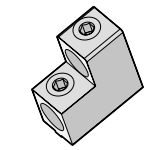
Front connection

Extended box terminals (Copper cables/bars and aluminum cables)

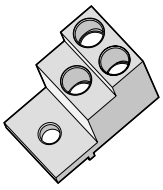
- The extended box terminals for TD and TS circuit breakers can be used for cooper cables/bars and aluminum cables. There are four (4) kinds of terminals.
- For TD100, TD160: 1-cable connector (EBT13, EBT14)
- For TS100, TS160, TS250: 1-cable connector (EBT23, EBT24)
- For TS400, TS630: 2-cable connector (EBT33, EBT34)
- For TS800: 3-cable connector (EBT43, EBT44)



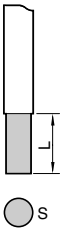
1-cable connector



2-cable connector



3-cable connector



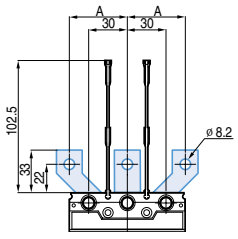
Applicable to	Type	Pole	Set quantity	Cable connection possibilities	Conductor size	
TD100, 160	EBT13 EBT14	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm)	20
					S(mm²)Cu/Al	2.5~95
					Tightening torque (kgf · cm)	306
TS100, 160, 250	EBT23 EBT24	3 4	1 Set (3EA) 1 Set (4EA)	1	L(mm)	24
					S(mm²)Cu/Al	10~150
					Tightening torque (kgf · cm)	306
TS400, 630	EBT33 EBT34	3 4	1 Set (3EA) 1 Set (4EA)	2	L(mm)	33 or 62
					S(mm²)Cu/Al	2×85 to 2×240
					Tightening torque (kgf · cm)	367~428
TS800	EBT43 EBT44	3 4	1 Set (3EA) 1 Set (4EA)	3	L(mm)	25~48
					S(mm²)Cu/Al	3×85 to 3×240
					Tightening torque (kgf · cm)	367~428

Terminals

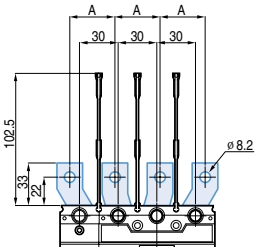
Front connection

Spreaders

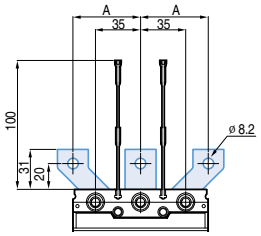
- As an optional part of circuit breaker
- Can increase the pitch of the terminals



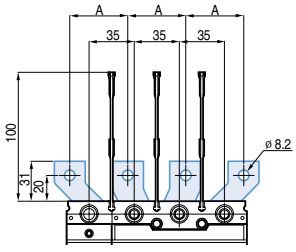
TD100, 160 3P



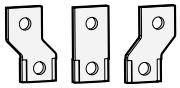
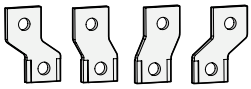
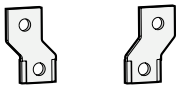
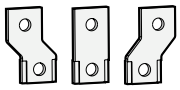
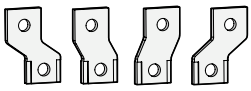
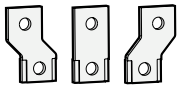
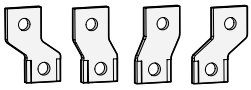
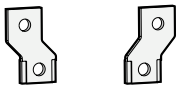
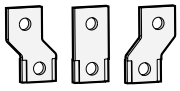
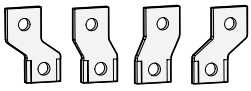
TD100, 160 4P



TS100, 160, 250 3P



TS100, 160, 250 4P

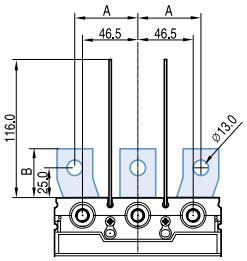
MCCB	Pole	Type	Size A (mm)	Feature
TD100, TD160	2P	SP12a	35	
	3P	SP13a		
	4P	SP14a		
	2P	SP12b	45	
	3P	SP13b		
	4P	SP14b		
TS100, TS160, TS250	2P	SP22a	45	
	3P	SP23a		
	4P	SP24a		
	2P	SP22b	52.5	
	3P	SP23b		
	4P	SP24b		

Terminals

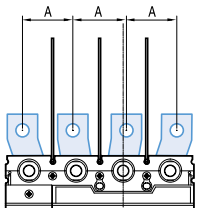
Front connection

Spreaders

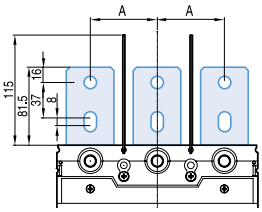
- As an optional part of circuit breaker
- Can increase the pitch of the terminals



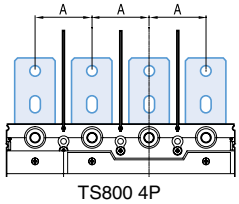
TS400, 630 3P



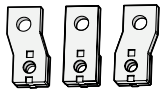
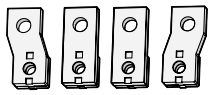
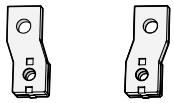
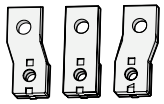
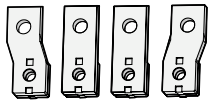
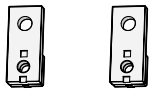
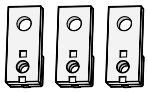
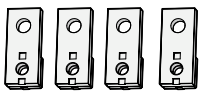
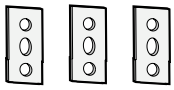
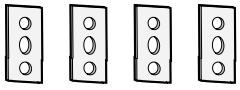
TS400, 630 4P



TS800 3P



TS800 4P

MCCB	Pole	Type	Size(mm)		Feature
			A	B	
TS400, TS630	2P	SP32a	52.5	41	
	3P	SP33a			
	4P	SP34a			
	2P	SP32b	70	54	
	3P	SP33b			
	4P	SP34b			
	2P	SPS32	46.5	41	
	3P	SPS33			
	4P	SPS34			
TS800	2P	SPS42	70	81.5	
	3P	SPS43			
	4P	SPS44			

Terminals

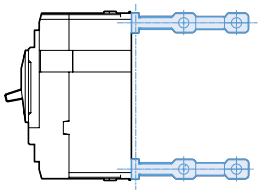
Rear connection

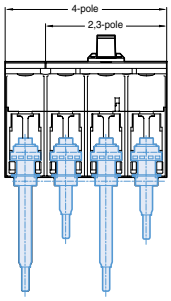
Rear connection terminals are used to adapt Susol TD and TS circuit breakers to switchboards or other applications that require rear connection.
These can be connected directly to circuit breakers without any modification

There are two kinds of rear connection terminals.
- Flat type
- Round type

Flat type

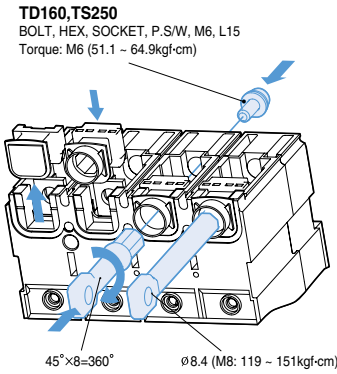
Flat vertical terminals

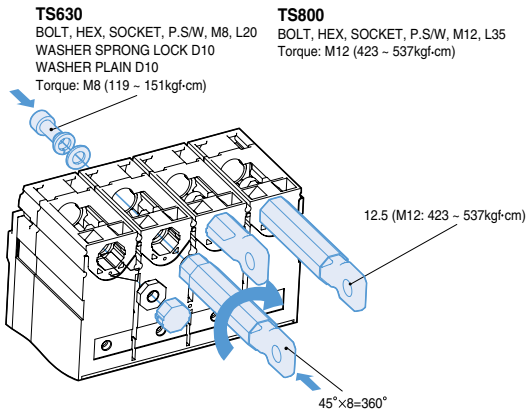




Flat type

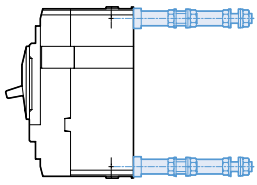
MCCB	2-pole	3-pole	4-pole
TD100,TD160	RTB12	RTB13	RTB14
TS100,TS160,TS250	RTB22	RTB23	RTB24
TS400,TS630	RTB32	RTB33	RTB34
TS800	RTB42	RTB43	RTB44

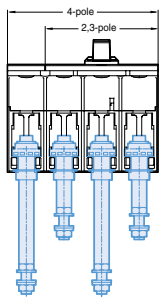




Round type

Round threaded terminals





Round type

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

Insulation

Short type covers

Insulation by terminal cover

Insulation terminal cover

The terminal covers are applied to the circuit-breaker to prevent accidental contact with live parts and thereby guarantee protection against direct contacts.

Two types by length are available:

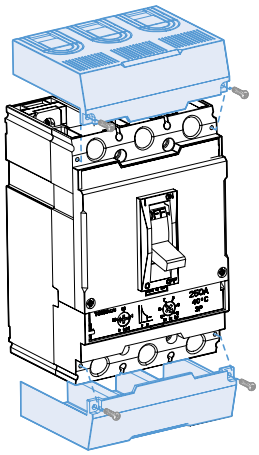
Short type covers, ITS
- IP40 degree of protection
- For fixed circuit-breakers with rear terminals and for moving parts of plug-in

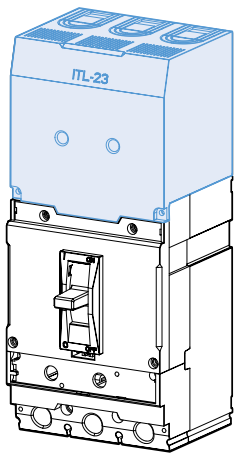
Long type covers

Long type covers, ITL
- IP40 degree of protection
- For fixed circuit-breakers with front, front extended, front for cables terminals.

MCCB		Terminal cover	
Frame type	Pole	Long type	Short type
TD100,TD160	2P (1) , 3-pole	ITL13	ITS13
	4-pole	ITL14	ITS14
TS100,TS160,TS250	2P (1), 3-pole	ITL23	ITS23
	4-pole	ITL24	ITS24
TS400,TS630	2P (1), 3-pole	ITL33	ITS33
	4-pole	ITL34	ITS34
TS800	2P (1), 3-pole	ITL43	ITS43
	4-pole	ITL44	ITS44

Note) (1) 2P in 3pole mold case





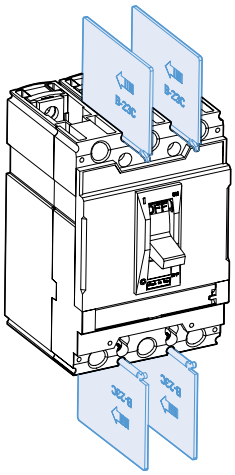
Insulation

Insulation by barrier

These allow the insulation characteristics between the phases at the connections to be increased.
They are mounted from the front, even with the circuit-breaker already installed, inserting them into the corresponding slots.
They are incompatible with both the insulating terminal covers.
It is possible to mount the phase separating partitions between two circuit-breakers side by side.

Insulation barriers

Type	Applied MCCB	Set quantity
B-23C	TD100, TD160	4pcs
	TS100, TS160, TS250	4pcs
B-33C	TS400, TS630	4pcs
B-43C	TS800	4pcs



Interlock

Mechanical Interlock
(Padlocks are not supplied)

Mechanical interlocking device

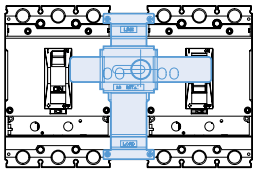
The mechanical interlock (MIT) can be applied on the front of two breakers mounted side by side, in either the 3-pole or 4-pole version and prevents simultaneous closing of the two breakers.

Fixing is carried out directly on the cover of the breakers.

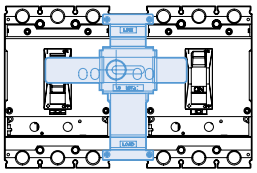
The front interlocking plate allows installation of a padlock in order to fix the position. (possibility of locking in the O-O position as well)

This mechanical interlocking device is very useful and simple for consisting of manual source-changeover system.

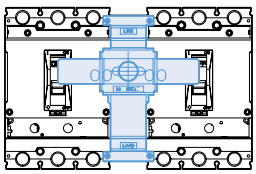
Operation



Left MCCB: ON/OFF is possible
Right MCCB: Off lock

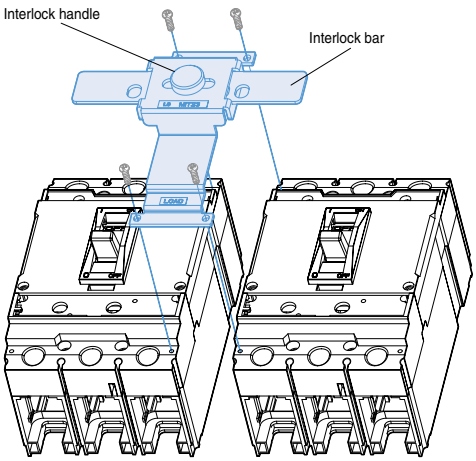


Left MCCB: Off lock
Right MCCB: ON/OFF is possible



Both MCCBs are of locked

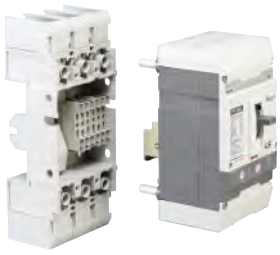
MCCB		Interlock
Frame type	Pole	
TD100,TD160	3-pole	MIT13
	4-pole	MIT14
TS100,TS160,TS250	3-pole	MIT23
	4-pole	MIT24
TS400,TS630	3-pole	MIT33
	4-pole	MIT34
TS800	3-pole	MIT43
	4-pole	MIT44



Plug-in device

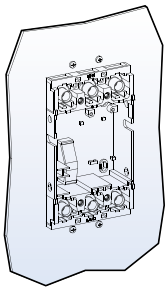
Plug-in device

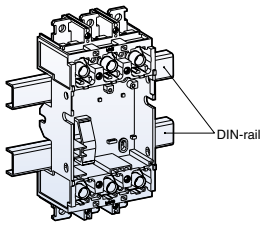
The plug-in base is the fixed part of the plug-in version of the circuit-breaker.
It will be installed directly on the back plate of panel.
The circuit-breaker is racked out by unscrewing the top and bottom fixing screws.
Plug-in base makes it possible to extract and/or rapidly replace the circuit breaker without having to touch connections for ship and important installations.

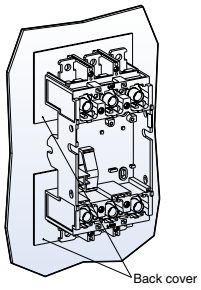


MCCB	Pole	Arrangement	Type	Means
TD100, TD160	2	Single line	PB12	
	3	Single line	PB13	
	2	Double line	PB12D2	For distribution board
	3	Double line	PB13D2	For distribution board
TS100, TS160, TS250	2	Single line	PB22	
	3	Single line	PB23	
TS400, TS600	2	Single line	PB32	
	3	Single line	PB33	
TS800	2	Single line	PB42	
	3	Single line	PB43	

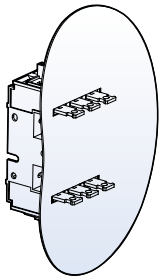
Front connection

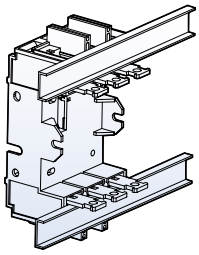






Rear connection

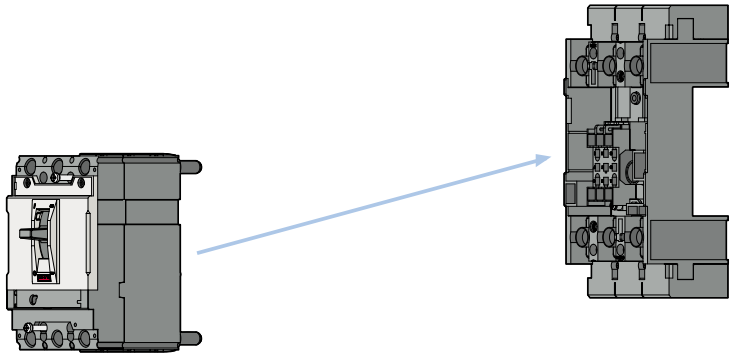




Plug-in system

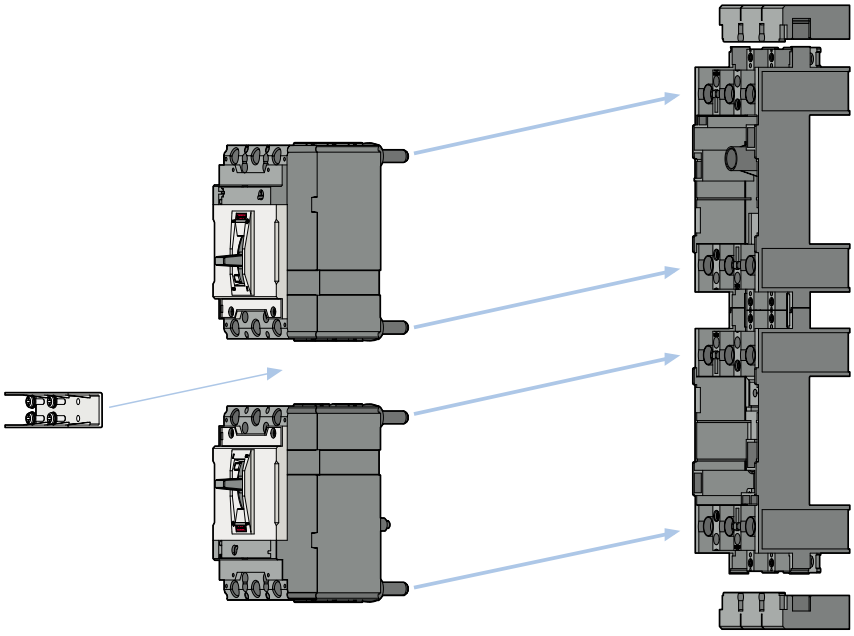
Normal type Plug-in MCCB : PB□ type

- MCCB rating : TD100~TS800
- generally used in switchgears



Double-row type Plug-in MCCB: PB□ D2 type

- MCCB rating : TD100, 160
- generally used in branch circuits

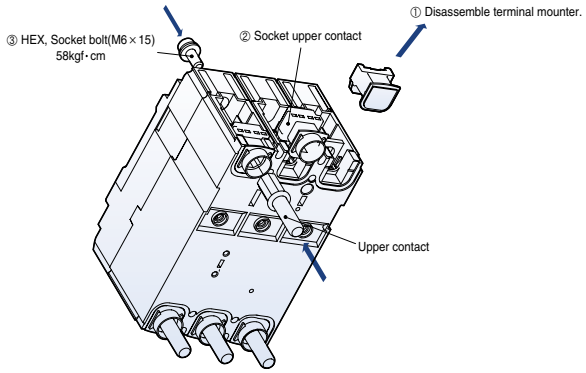


Plug-in device

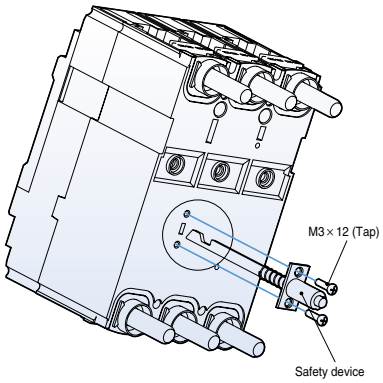
Assembling procedure

TD100, TD160

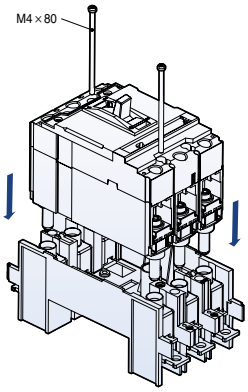
1. Conversion to Plug-in MCCB

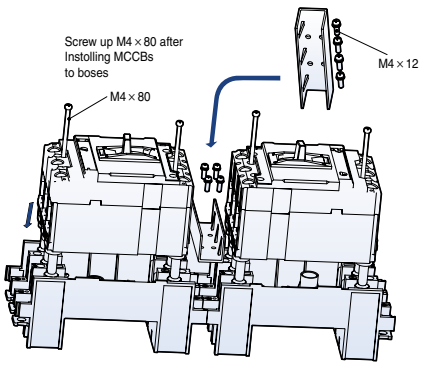


2. Assembling safety device



3. Assembling MCCB and plug-in device



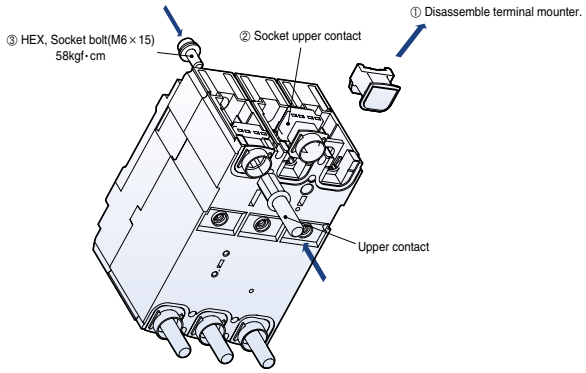


Plug-in device

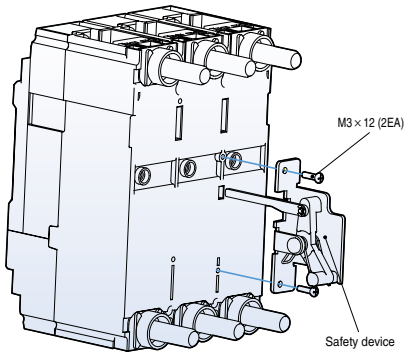
Assembling procedure

TS100, TS160, TS250

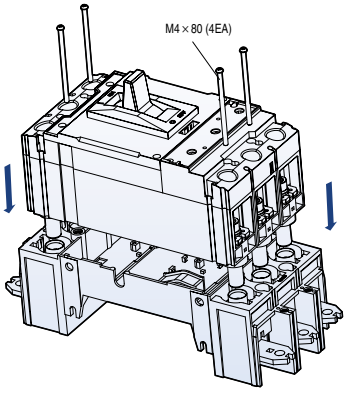
1. Conversion to Plug-in MCCB



2. Assembling safety device



3. Assembling MCCB and plug-in device

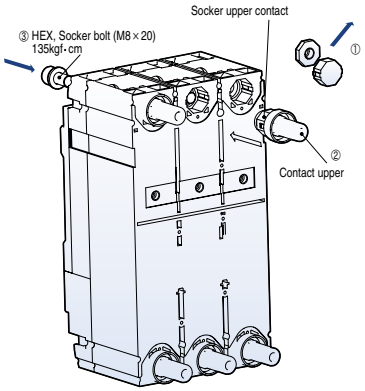


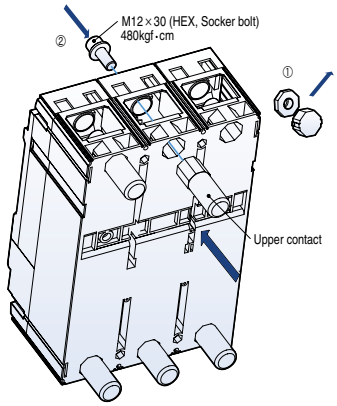
Plug-in device

Assembling procedure

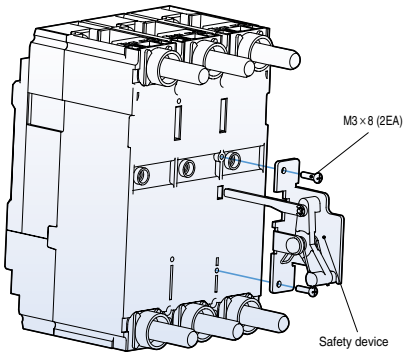
TS400, TS630	TS800

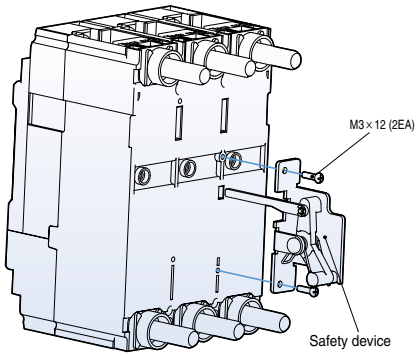
1. Conversion to Plug-in MCCB



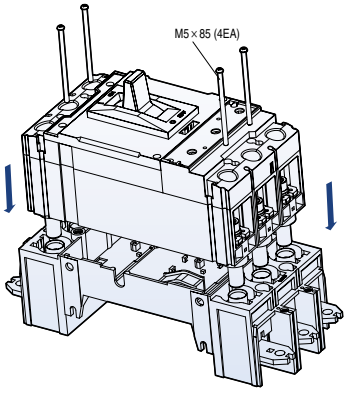


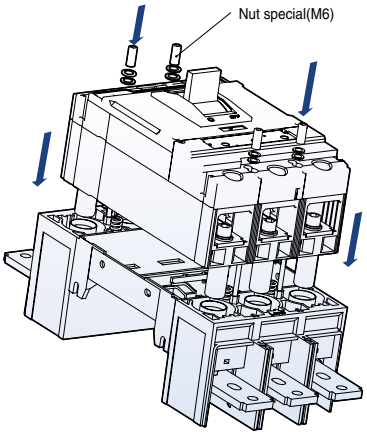
2. Assembling safety device





3. Assembling MCCB and plug-in device





Remote operation

TS250 + MOP2

Motor operator

Motor operators can also be operated by manual.The motor drives a mechanism which switches TD & TS toggle handle to the “ON” and “OFF/RESET” positions.

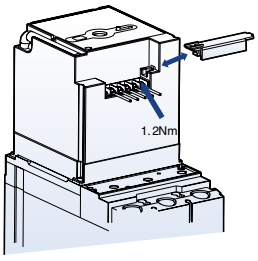
- The manual actuator handle is located on the front of the cover.
- Manual or Automatic operation can be selected.

The motor operator is an essential device for constructing a remote operated automatic source-changeover system to ensure a continuous supply of electrical power at following certain installations:

- Commercial sector: Hospital, Tall building, Bank, Insurance companies, Shopping centers
- Industry: Ships, Assembly lines at plant, Military sites, Port and Railway installation

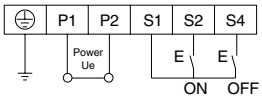
MCCB	Type	Control voltage	Actuation current (A)	Response time (ms)		Consumption (W)	Mechanical service life (operations)	No. of operations per hour
				Closing	Opening			
TD100, TD160	MOP1	① DC 24V ② AC 100~240V/ DC 100~220V	≤2.5A (DC 24V) ≤0.5A (AC)	310	200	14	25,000	120
TS100, TS160, TS250	MOP2	① DC 24V ② AC 100~110V/ DC 110V ③ AC 230/ DC 220V	≤5A (DC 24V) ≤2A (AC)	350	230	14	25,000	120
TS400,TS 630	MOP3			500	350	35	20,000	60
TS800	MOP4			700	420	35	10,000	20

Wiring connection



Standard connection

Circuit breaker On and Off controlled by remote operation and manual operation

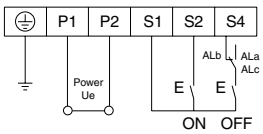


Connection with alarm switch (AL)

1) The below connection diagram is the method of using a alarm switch (AL) without shunt or undervoltage trip.
2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

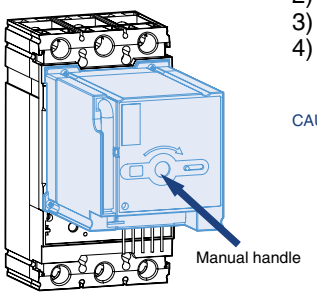
Connection with FAL (only for the breakers with electronic trip unit ETS or ETM)

1) The below connection diagram is the method of using a FAL for circuit breakers with electronic trip unit.
2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.



Remote operation

Manual operation

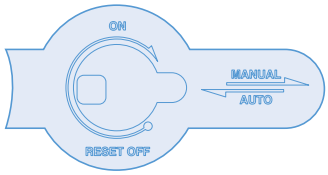


1) Insert the manual handle into the slot of Motor Operator surface and rotate it clockwise.
2) It must be rotated just 180° clockwise for safe operation of micro switch in the motor operator.
3) Return the manual handle after the manual operation
4) Turn the slide switch back to the position of AUTO.

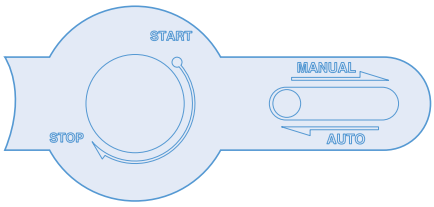
CAUTION: When the circuit breaker is tripped by trip button in the OFF status,
it is impossible to operate motor operator automatically It must be reset by manual operation.

Automatic operation

1) Set the slide switch to AUTO, then internal power is closed automatically.
2) Operating frequency should be less than these below regulated values.
   TD 160N/H/L, TS250N/H/L:180 operations per hour
3) Use the ON/OFF switch in the range of regulated values.
4) It may interfere near communication equipments because of internal switching power supply.
   It's recommended that a noise filter be installed to power supply.
5) Please do not input ON/OFF signals at the same time during the automatic operation.
6) If the circuit breaker has a UVT attached inside, charge a UVT on the rated voltage before performing MOTOR OPERATOR.



[TD100, 160, TS100, 160, 250]



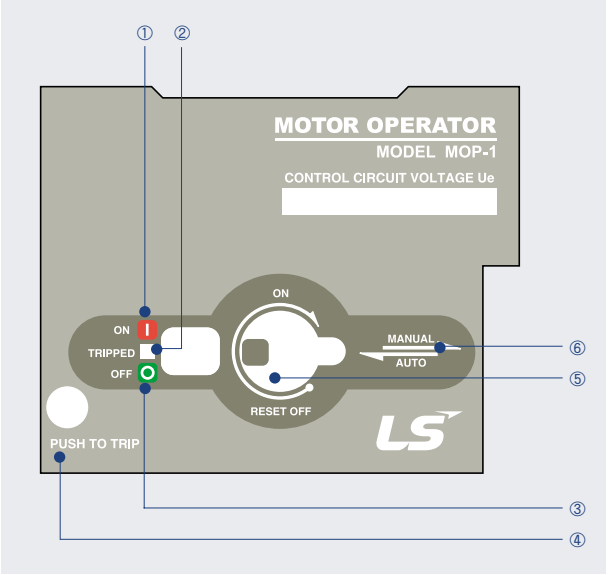
[TS400, 630, 800]

Remote operation

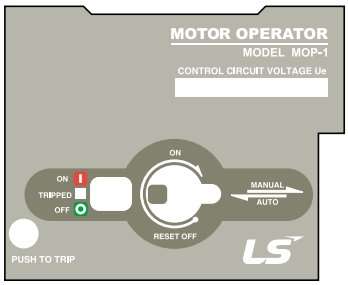
Motor operator

Feature

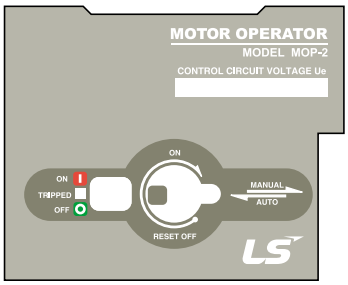
① On position indication (Red color)
② Trip position indication (White color)
③ Off position indication (Green color)
④ Button for push to trip
(available for only for TD160AF and TS630AF)
⑤ On/Off/Reset selection lever
⑥ Manual/Auto selection lever



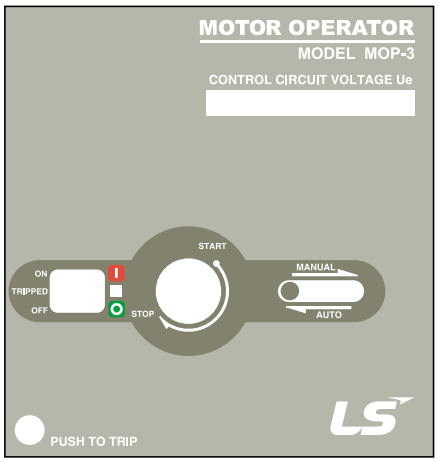
TD160 .... MOP-1



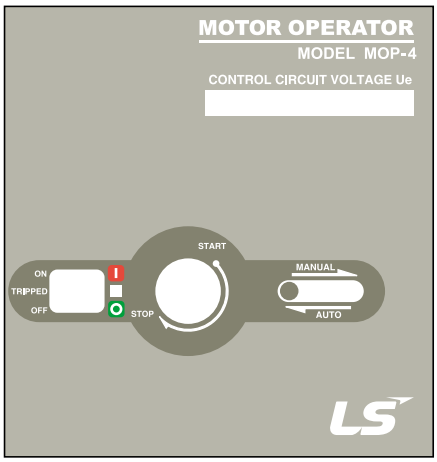
TS250 .... MOP-2



TS630.... MOP-3

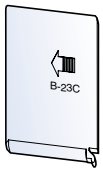
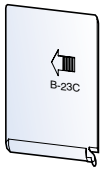
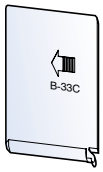
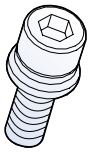
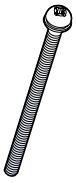
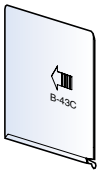
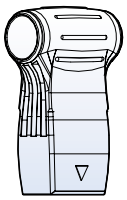


TS800 .... MOP-4



Standard accessories

The following accessories for mounting, connection, insulation, handle operation are standard items and are packed with Susol TD & TS series circuit breakers.

TD100N/H/L TD160N/H/L					
	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					
	M8×20	M4×75			
	3P: 6pcs 4P: 8pcs	3P: 2pcs 4P: 4pcs		3P: 4pcs 4P: 6pcs	
TS400N/H/L TS630N/H/L					
	M10×30	M5×85	M5		
	3P: 6pcs 4P: 8pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 6pcs	
TS800N/H/L					
	M12×35	M6×100	M6		
	3P: 6pcs 4P: 8pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 4pcs	3P: 4pcs 4P: 6pcs	1pc

Residual Current Devices (RCD)

The Susol circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). In particular, the TS100, TS160 and TS250 circuit breakers can be combined with the RTU23 of residual current device, the TS400 and TS600 circuit breakers can be combined with the RTU33 of residual current device and the TS800 circuit breaker can be combined with the RTU43 of residual current device. In all cases the RCD unit interfaces directly below the circuit breaker trip unit area without the use of any secondary wiring or connections.

The Susol circuit breaker and an RCD unit combination can be connected like any stand-alone breaker and are available as fixed or plug-in devices. The main connection interface of the RCD is an exact replacement of the breaker connection area, thus allowing the use of all standard breaker terminals.

Overview

Apart from the protection against overloads typical of automatic circuit breakers, the residual current circuit breaker derived from them also guarantee protection of people against earth leakage currents, thereby ensuring protection against direct contacts, indirect contacts and fire hazards.-(ELCB)

The RCD unit has numerous current and time settings and an override blocking the time settings when set to 30mA. The earth leakage test button tests the electrical and mechanical operation of the device. In order to allow for a dielectric test of the breaker and RCD combination without damaging the electronics, the dielectric plug is placed within the setting area. The RCD unit may be equipped with an alarm switch (FAL) to remotely indicate tripping due to an earth leakage current.

Compliance with standards :

- IEC 60947-2 (industrial), Appendix B
- IEC 61009 (residential)
- IEC 60755, class A, immunity to DC components up to 6mA
- VDE664, operation down to -25°C

Remote indications :

RCD unit may be equipped with an alarm contact (FAL-fault alarm switch) to remotely indicate tripping due to an earth leakage current.

Power supply :

RCD unit are self-supplied internally by the distribution-system voltage and therefore do not require any external source. They continue to function even when supplied by only two phases.

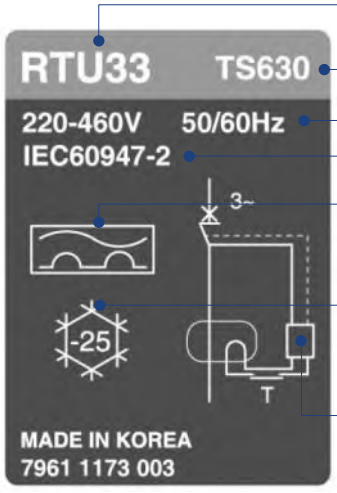
Residual Current Devices (RCD)

Configuration

- Intermediate terminal shield
- Sealable fixing screw for the intermediate terminal
- Dielectric plug(1)
- Test push-button
- Reset push-button
- Sealable fixing screw for
- Trip time delay settings(2)
- Sensitivity settings
- Slot for FAL auxiliary switch (optional)
- Sealing point for plate blocking access to the settings
- Rating plate

Lift this plug before the dielectric test
If the sensitivity is set to 30 mA, there is no time delay.
Whatever the time-delay setting.

Detail of Rating plate



- Type of RCD
- Applicable circuit breaker
- Operational voltage and frequency
- Compliance with standards
- Standardized symbols :
  - Class A immunity to DC components (6mA insensitivity)
  - Minimum operating temperature as per VDE664
- Schematic diagram

Residual Current Devices (RCD)

Ratings and Selection

RCD type		RTU23	RTU33	RTU43
Number of poles		3*	3*	3*
Applicable circuit breaker	TS100	■		
	TS160	■		
	TS250	■		
	TS400		■	
	TS630		■	
	TS800			■
Protection charicteristics				
Sensitivity	I△n(A)	(adjustable) 0.03-0.3-1-3-10	(adjustable) 0.03-0.3-1-3-10	(adjustable) 0.03-0.3-1-3-10
Time delay **	Intentional time delay(ms)	(adjustable) 0-60-150-300-600	(adjustable) 0-60-150-300-600	(adjustable) 0-60-150-300-600
	Max. breaking time(ms)	(adjustable) 40-140-240-450-880	(adjustable) 40-140-240-450-880	(adjustable) 40-140-240-450-880
Rated voltage	AC 50/60 Hz	220~460V / 460~690V	220~460V / 460~690V	220~460V / 460~690V

* 3P modules may also be used on 2P circuit breakers.
** If the sensitivity is set to 30mA, the time delay setting is reduced to zero.

Trip time delay settings
0-60-150-300-600ms

Sensitivity settings, I△n
0.03-0.3-1-3-10A

Residual Current Devices (RCD)

Combination

The addition of the RCD unit does not affect circuit breaker characteristics.

- Conformity with standards
- Protection degrees, class II insulation front face
- Suitability for isolation as defined by IEC 60947-2
- Electrical characteristics
- Trip unit characteristics
- Installation and connection methods
- Indication, measurement and control accessories
- Installation and connection accessories

		RTU23	RTU33	RTU43
MCCB	L×H×D(mm)	105×160×86	140×260×110	210×320×135
MCCB+RCD		105×240×86	140×370×110	210×450×135
RCD		105×80×86	140×110×110	210×130×135
MCCB+RCD	Weight(kg)	2.7	8.08	16.28
RCD		0.96	2.52	4.6
Type		Bottom		
Accessory		FAL(fault alram switch)		

A-4. Technical information

Temperature derating

A derating of the rated operational current of the Susol TD and TS molded case circuit breaker is necessary if the ambient temperature is greater than 40°C. Namely, when the ambient temperature is greater than 40°C, overload-protection characteristics are slightly modified.
Electronic trip units are not affected by variations in temperature.
But, the maximum permissible current in the circuit breaker depends on the ambient temperature.

Susol TD & TS series MCCB with thermal-magnetic trip units

MCCB	Rating (A)	Fixed MCCB (c/w Thermal-magnetic trip unit)							
		10°C	20°C	30°C	40°C	45°C	50°C	60°C	70°C
TD100 TD160	16	16	16	16	16	16	15	14	13
	20	20	20	20	20	19	19	18	16
	25	25	25	25	25	24	23	22	21
	32	32	32	32	32	31	30	28	26
	40	40	40	40	40	39	38	35	33
	50	50	50	50	50	48	47	44	41
	63	63	63	63	63	61	59	56	52
	80	80	80	80	80	78	75	71	66
	100	100	100	100	100	97	94	88	82
	125	125	125	125	125	121	117	110	103
	160	160	160	160	160	155	150	141	131
TS100 TS160	40	40	40	40	40	39	38	35	33
	50	50	50	50	50	48	47	44	41
	63	63	63	63	63	61	59	56	52
	80	80	80	80	80	78	75	71	66
	100	100	100	100	100	97	94	88	82
	125	125	125	125	125	121	117	110	103
	160	160	160	160	160	155	150	141	131
TS250	200	200	200	200	200	194	188	176	164
	250	250	250	250	250	242	234	220	205
TS400	300	300	300	300	300	291	281	264	246
	400	400	400	400	400	388	375	353	328
TS630	500	500	500	500	500	484	469	441	410
	630	630	630	630	630	610	591	555	517
TS800	800	800	800	800	800	775	750	705	656

Note) TD160 1pole MCCB is not applied to temperature derating.

Temperature derating

Susol TD & TS series MCCB with thermal-magnetic trip units

MCCB	Rating (A)	Fixed MCCB (c/w Thermal-magnetic trip unit)							
		10°C	20°C	30°C	40°C	45°C	50°C	60°C	70°C
TD100 TD160	16	16	16	16	16	16	15	14	13
	20	20	20	20	20	19	19	18	16
	25	25	25	25	25	24	23	22	21
	32	32	32	32	32	31	30	28	26
	40	40	40	40	40	39	38	35	33
	50	50	50	50	50	48	47	44	41
	63	63	63	63	63	61	59	56	52
	80	80	80	80	80	78	75	71	66
	100	100	100	100	100	97	94	88	82
	125	125	125	125	125	121	117	110	103
	160	144	144	144	144	140	135	127	118
TS100 TS160	40	40	40	40	40	39	38	35	33
	50	50	50	50	50	48	47	44	41
	63	63	63	63	63	61	59	56	52
	80	80	80	80	80	78	75	71	66
	100	100	100	100	100	97	94	88	82
	125	125	125	125	125	121	117	110	103
	160	160	160	160	160	155	150	141	131
TS250	200	200	200	200	200	194	188	176	164
	250	235	235	235	235	228	220	207	193
TS400	300	300	300	300	300	291	281	264	246
	400	400	400	400	400	388	375	353	328
TS630	500	500	500	500	500	484	469	441	410
	630	540	540	540	540	523	506	476	443
TS800	800	740	740	740	740	717	694	652	607

Power dissipation / Resistance

Susol TD & TS series MCCB with thermal-magnetic trip units

	AF	TD100 (3P & 4P)								
	Rating (A)	16	20	25	32	40	50	63	80	100
Fixed MCCB	R (mΩ)	5.60	5.60	3.80	3.80	1.84	1.34	1.10	0.91	0.70
	Watt single pole	1.43	2.24	2.38	3.89	2.94	3.35	4.37	5.82	7.00
	Watt three poles	4.30	6.72	7.13	11.67	8.83	10.05	13.10	17.47	21.00
Plug-in MCCB	R (mΩ)	5.68	5.68	3.88	3.88	1.92	1.42	1.18	0.99	0.78
	Watt single pole	1.45	2.27	2.43	3.97	3.07	3.55	4.68	6.34	7.80
	Watt three poles	4.36	6.82	7.28	11.92	9.22	10.65	14.05	19.01	23.40

	AF	TD160 (3P & 4P)		
	Rating (A)	100	125	160
Fixed MCCB	R (mΩ)	0.70	0.61	0.50
	Watt single pole	7.00	9.53	12.80
	Watt three poles	21.00	28.59	38.40
Plug-in MCCB	R (mΩ)	0.78	0.69	0.58
	Watt single pole	7.80	10.78	14.85
	Watt three poles	23.40	32.34	44.54

	AF	TS100,TS160,TS250 (3P & 4P)								
	Rating (A)	40	50	63	80	100	125	160	200	250
Fixed MCCB	R (mΩ)	3.37	2.86	2.86	1.36	0.96	0.76	0.62	0.52	0.25
	Watt single pole	5.39	7.15	11.35	8.70	9.60	11.88	15.87	20.80	15.79
	Watt three poles	16.18	21.45	34.05	26.11	28.80	35.63	47.62	62.40	47.38
Plug-in MCCB	R (mΩ)	3.43	2.92	2.92	1.42	1.02	0.82	0.68	0.58	0.31
	Watt single pole	5.49	7.30	11.59	9.09	10.20	12.81	17.41	23.20	19.54
	Watt three poles	16.46	21.90	34.77	27.26	30.60	38.44	52.22	69.60	58.63

	AF	TS400, TS630 (3P, 4P)				TS800 (3P, 4P)	
	Rating (A)	300	400	500	630	700	800
Fixed MCCB	R (mΩ)	0.30	0.30	0.26	0.21	0.12	0.12
	Watt single pole	26.82	47.68	65.25	83.35	73.81	73.81
	Watt three poles	80.46	143.04	195.75	250.05	221.44	221.44
Plug-in MCCB	R (mΩ)	0.34	0.34	0.30	0.25	0.14	0.14
	Watt single pole	30.42	54.08	75.25	99.23	86.61	86.61
	Watt three poles	91.26	162.24	225.75	297.68	259.84	259.84

- Power dissipated per pole (P/pole): Watts (W).
- Resistance per pole (R/pole): Milliohms (mΩ) (measured cold).
- Total power dissipation is the value measured at In, 50/60 Hz, for a 3 pole or 4 pole circuit breaker (Power= $3I^2R$)

Application
Primary use of transformer

Application for transformer protection

Transformer excitation surge current may possibly exceed 10 times rated current, with a danger of nuisance tripping of the MCCB. The excitation surge current will vary depending upon the supply phase angle at the time of switching, and also on the level of core residual magnetism.

So, it's recommended to select proper circuit breakers according to the continuous current carrying capacity of transformer. It requires to consider separately whether transformer is single phase or three phase. The below table indicates the proper molded case circuit breaker suitable for each transformer.

AC220V

Capacity of 3 phase transformer (kVA)		Below 1500	Below 1500	Below 2000	Below 3000
Capacity of single phase transformer (kVA)		Below 300	-		
Breaking capacity (kA) (sym)		42	85	100	120 / 200
Frame (A)	100	TD100N	TD100H TS100N	TS100H	TD100L TS100L
	160	TD160N	TD160H TS160N	TS160H	TD160L TS160L
	250	TS250N		TS250H	TS250L
	400	TS400N		TS400H	TS400L
	630	TS630N		TS630H	TS630L
	800	TS800N		TS800H	TS800L

AC460V

Capacity of 3 phase transformer (kVA)		Below 2000	Below 3000	Below 4000
Breaking capacity (kA) (sym)		50	65 / 70	85 / 100 / 130
Frame (A)	100	TD100N TS100N	TD100H TS100H	TD100L TS100L
	160	TD160N TS160N	TD160H TS160H	TD160L TS160L
	250	TS250N	TS250H	TS250L
	400	TS400N	TS400H	TS400L
	630	TS630N	TS630H	TS630L
	800	TS800N	TS800H	TS800L

Application
Primary use of transformer

Application for transformer protection (MCCBs for Transformer-Primary Use)

Transformers are used to change in the supply voltage, for both medium and low voltage supplies. The choice of the protection devices should be considered transient insertion phenomena, during which the current may reach values higher than the rated full load current; the phenomenon decays in a few seconds.

The peak value of the first half cycle may reach values of 15 to 25 times the effective rated current. For a protective device capable of protecting these units this must be taken into account. Manufacturers data and tests have indicated that a protective device feeding a transformer must be capable of carrying the following current values without tripping.

TD100/160, TS100~800 equipped with Thermal magnetic trip units

Transformer ratings (kVA)			MCCB rated current (A)	Trip unit
1 phase 230V	3 phase 230V 1 phase 240V	1 phase 230V		
3 to 4	5 to 6	9 to 11	16	
4 to 5	6 to 8	11 to 14	20	
5 to 6	8 to 10	14 to 17	25	
6 to 7	10 to 13	18 to 22	32	
7 to 9	13 to 16	22 to 28	40	
9 to 12	16 to 20	28 to 35	50	
12 to 14	20 to 25	35 to 44	63	
15 to 18	26 to 32	44 to 55	80	
18 to 23	32 to 40	55 to 69	100	FTU
23 to 29	40 to 50	69 to 87	125	FMU
29 to 37	51 to 64	89 to 111	160	ATU
37 to 47	64 to 80	111 to 138	200	
46 to 58	80 to 100	138 to 173	250	
55 to 69	96 to 120	166 to 208	300	
74 to 92	128 to 160	221 to 277	400	
92 to 115	160 to 200	277 to 346	500	
116 to 145	202 to 252	349 to 436	630	
129 to 161	224 to 280	388 to 484	700	
147 to 184	256 to 320	443 to 554	800	

TS100~800 equipped with electronic trip units

Transformer ratings (kVA)			MCCB rated current (A)	Trip unit	Ir max setting
1 phase 230V	3 phase 230V 1 phase 400V	3 phase 400V			
4 to 7	6 to 13	11 to 22	40		0.8
9 to 19	16 to 32	27 to 56	100		0.8
15 to 30	25 to 52	44 to 90	160		0.8
23 to 46	40 to 80	70 to 139	250	ETS ETM	0.8
37 to 74	64 to 128	111 to 222	400		0.8
58 to 115	100 to 200	175 to 346	630		0.8
74 to 184	127 to 319	222 to 554	800		1

Application
Protection of lighting & heating circuits

In the lighting & heating circuits, switching-surge magnitudes and times are normally not sufficient to cause serious tripping problems. But, in some cases, such as incandescent lamps, mercury arc lamps, metal halide and sodium vapour, or other large starting-current equipment, the proper selection should be considered.

Upon supply of a lighting installation, for a brief period an initial current exceeding the rated current (corresponding to the power of the lamps) circulates on the network. This possible peak has a value of approximately 15÷20 times the rated current, and is present for a few milliseconds; there may also be an inrush current with a value of approximately 1.5÷3 times the rated current, lasting up to some minutes. The correct dimensioning of the switching and protection devices must take these problems into account. Generally, it is recommended to make the maximum operating current not to exceed 80% of the related current.

AC220V

The maximum operating current (A)	The rated current of MCCB (A)	Breaking capacity (kA) sym 85	100	120	200
12	16	TD100N	TD100H	TD100L	
16	20				
20	25				
25	32				
32	40				
40	50		TD100H TS100N	TD100L TS100H	TD100L TS100L
50	63				
64	80				
80	100				
100	125	TD160N	TD160H TS160N	TS160H	TD160L TS160L
128	160				
160	200	TS250N		TS250H	TS250L
200	250				
240	300	TS400N		TS400H	TS400L
320	400				
400	500	TS630N		TS630H	TS630L
504	630				
560	700	TS800N		TS800H	TS800L
640	800				

AC460V

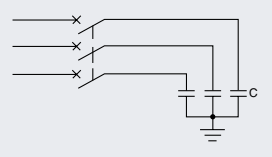
The maximum operating current (A)	The rated current of MCCB (A)	Breaking capacity (kA) sym 50	65	70	85	100	130
12	16	TD100N TS100N	TD100H TS100H		TD100L TS100L		
16	20						
20	25						
25	32						
32	40						
40	50						
50	63						
64	80						
80	100						
100	125	TD160N TS160N	TD160H TS160H		TD160L TS160L		
128	160						
160	200	TS250N	TS250H		TS250L		
200	250						
240	300	TS400N		TS400H		TS400L	
320	400						
400	500	TS630N		TS630H		TS630L	
504	630						
560	700	TS800N		TS800H		TS800L	
640	800						

Application
Protection of resistance welding circuits

Short circuit protection for resistance welding devices can be obtained by applying molded case circuit breaker properly. These breakers permit normally high welding currents, but trip instantaneously if a short circuit develops.
It's recommended to select proper circuit breaker according to the characteristics of welding devices as the follow table.

Characteristics of welding device		Applied circuit breaker (MCCB 2P)	
Capacity (kVA)	Maximum input (kVA)	220V (Single phase)	400V (Single phase)
15	35	TD100N/H/L 100A TS100N/H/L 100A TD160N/H/L 100A TS160N/H/L 100A	TD100N/H/L 50A TS100N/H/L 50A
30	65	TD160N/H/L 125A TS160N/H/L 125A TS250N/H/L 125A	TD100N/H/L 100A TS100N/H/L 100A TD160N/H/L 100A TS160N/H/L 100A
55	140	TS250N/H/L 250A	TD160N/H/L 125A TS160N/H/L 125A TS250N/H/L 125A

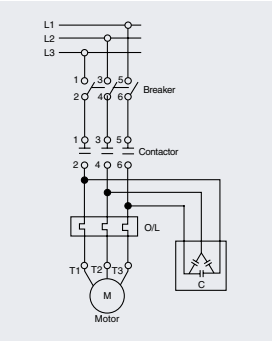
Application
Use of circuit-breakers for capacitor banks



Capacitor circuit

Application for protection of capacitor circuit

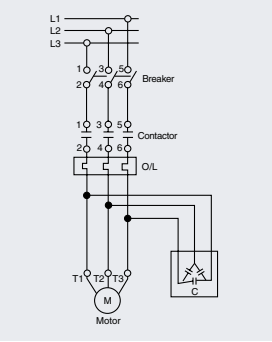
In order to reduce system losses (less than 0.5W/kvar in low voltage) and voltage drops in the power distribution system, reactive power compensation or power factor correction is generally undertaken. As a result, the power fed into the system is used as active power and costs will be saved through a reduction in the capacitive and inductive power factors. The compensation can be carried out by the fixed capacitors and automatic capacitor banks. However, the disadvantages of installing capacitors are sensitivity to over-voltages and to the presence of nonlinear loads.



Examples of equipment which consume reactive energy are all those receivers which require magnetic fields or arcs in order to operate, such as:

- Asynchronous motors: An asynchronous motor is a large consumer of inductive reactive energy. The amount of reactive power consumed is between 20% and 25% of the rated power of the motor (depending on its speed).

- Power Transformers: Power transformers are normally always connected. This means that reactive energy is always consumed. Also, as a consequence of its inductive nature, the reactive energy increases when the transformer is loaded.

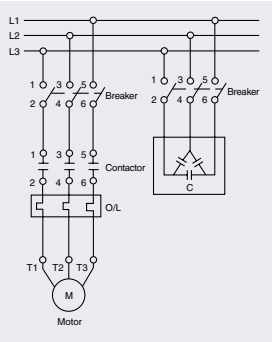


- Discharge lamps, Resistance-type soldering machines, Dielectric type heating ovens, Induction heating ovens, Welding equipments, Arc furnaces

At the instant of closing a switch to energize a capacitor, the current is limited only by the impedance of the network upstream of the capacitor, so that high peak values of current will occur for a brief period, rapidly falling to normal operating values.

According to the relevant standards IEC 60831-1/IEC 70, capacitors must function under normal operating conditions with the current having a RMS value up to 1.3 times the rated current of the capacitor. Additionally, a further tolerance of up to 15% of the real value of the power must be taken into consideration. The maximum current with which the selected circuit-breaker can be constantly loaded, and which it must also be able to switch, is calculated as follows:

Maximum expected rated current= Rated current of the capacitor bank × 1.5 (RMS value)



Usual connection diagram

Application
Use of circuit-breakers for capacitor banks

220V, 50/60Hz Circuit

Capacitor rating kVAR	Single-phase circuit		Three-phase circuit	
	Capacitor rated current (A)	MCCB rated current (A)	Capacitor rated current (A)	MCCB rated current (A)
5	22.7	40	13.1	20
10	45.5	80	26.2	40
15	68.2	125	39.4	63
20	90.9	160	52.5	80
25	113.6	200	65.6	100
30	136.4	225	78.7	125
40	181.8	300	105.0	160
50	227.3	400	131.2	200
75	340.9	630	196.8	300
100	454.5	700	262.4	400
150	681.8	-	393.7	630
200	909.1	-	524.9	800
300	1363.6	-	787.3	-
400	1818.2	-	1049.8	-

Notes) 1. The MCCB rated current should be approx. 150% of the capacitor rated current.
2. The MCCB short-circuit capacity should be adequate for the circuit short-circuit capacity.

Application
Use of circuit-breakers for capacitor banks

440V, 50/60Hz Circuit

Capacitor rating kVAR	Single-phase circuit		Three-phase circuit	
	Capacitor rated current (A)	MCCB rated current (A)	Capacitor rated current (A)	MCCB rated current (A)
5	11.4	20	6.6	16
10	22.7	40	13.1	20
15	34.1	63	19.7	32
20	45.5	80	26.2	40
25	56.8	100	32.8	50
30	68.2	125	39.4	63
40	90.9	160	52.5	80
50	113.6	200	65.6	100
75	170.5	300	98.4	160
100	227.3	400	131.2	200
150	340.9	500	196.8	300
200	454.5	700	262.4	400
300	681.8	-	393.7	630
400	909.1	-	524.9	800

Notes) 1. The MCCB rated current should be approx. 150% of the capacitor rated current.
2. The MCCB short-circuit capacity should be adequate for the circuit short-circuit capacity.

Application
Using circuit-breakers in DC networks

Susol circuit-breakers for protection of power distribution with thermal overload and magnetic short-circuit trip units are suitable for usage in DC networks.
The circuit-breakers with electronic overcurrent releases are not suitable for DC networks.

Circuit-breaker selection criteria

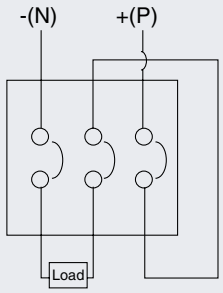
The followings are the most important criteria for selection of suitable circuit breaker for DC networks.

- The rated current determines the rating and size of the circuit-breaker (Equipment)
- The rated voltage determines the number of poles in series necessary for breaking
- The maximum short-circuit current at the connection point determines the breaking capacity

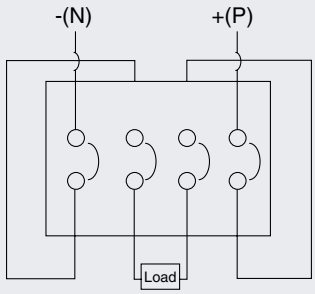
Setting range of the trip values

- Thermal overload protection: Same setpoints as in 50/60Hz circuits
- Instantaneous short-circuit protection: The response threshold increases by maximum 40%.

The following wiring diagrams are recommended since the current must flow through all current paths in order to conform to the thermal tripping characteristic curve.



Recommended wiring method
for DC500V circuit



Recommended wiring method
for DC600V circuit

	Model	Trip unit	Applicable to DC circuits	Breaking capacity (kA)
Thermal magnetic	TD100N,TD160N	FTU FMU ATU	○	42
	TS100N,TS160N, TS250N TS400N, TS630N TS800N		○	50
	TD100H, TD160H		○	65
	TS100H, TS160H, TS250H TS400H, TS630H TS800H		○	85
	TD100L, TD160L TS100L, TS160L, TS250L TS400L, TS630L TS800L		○	100
Electronic	TS250, TS630, TS800	ETS, ETM	Impossible to use to DC circuits	

Application
Circuit breakers for 400Hz networks

When circuit breakers are used at high frequencies, the breakers in many cases require to be derated as the increased resistance of the copper sections resulting from the skin effect produced by eddy currents at 400Hz.

- Standard production breakers can be used with alternating currents with frequencies other than 50/60 Hz (the frequencies to which the rated performance of the device refer, with alternating current) as appropriate derating coefficients are applied.

Thermal magnetic trip units

Thermal trip

As can be seen from the data shown in below, the tripping threshold of the thermal element (In) decreases as the frequency increases because of the reduced conductivity of the materials and the increase of the associated thermal phenomena.
Rated current (A) at 400Hz= K1 × rated current (A) at 50/60Hz

Instantaneous trip

The magnetic threshold increases with the increase in frequency.
Instantaneous current (A) at 400Hz= K2 × Instantaneous current (A) at 50/60Hz

Thermal magnetic trip units

TD and TS series performance table at 400Hz

Rated current (A) in 400 Hz	Applied circuit breaker (MCCB)	Trip unit	Multiplier factors (K1, K2)	
			K1 (Thermal trip units)	K2 (Magnetic trip units)
16	TD100N, TD100H, TD100L TS100N, TS100H, TS100L TD160N, TD160H, TD160L TS160N, TS160H, TS160L	FTU FMU ATU	0.8	2
20			0.8	2
25			0.8	2
32			0.8	2
40			0.8	2
50			0.8	2
63			0.8	2
80			0.8	2
100			0.8	2
125			0.8	2
160	TS250N, TS250H, TS250L		0.8	2
200			0.8	2
250	TS400N, TS400H, TS400L TS630N, TS630H, TS630L		0.8	2
300			0.8	2
400			0.8	2
500			0.8	2
630	TS800N, TS800H, TS800L		0.8	2
700			0.8	2

Note) K1 × Multiplier factor of rated current (In)
K2-Multiplier factor of instantaneous current due to the induced magnetic fields
FTU-Fixed Thermal and magnetic trip unit
FMU × Adjustable thermal and fixed magnetic trip unit
ATU × Adjustable thermal and magnetic trip unit

Application
Circuit breakers for 400Hz networks

Electronic trip units

The use of electronics offers the advantage of greater operating stability when the frequency is varied. However, the devices are still subjected to frequency related temperature effects which may sometimes pose restrictions on their use. Column K1 of the table below gives the maximum permissible current to be used for the current setting (knob position).

Rated current (A) in 400 Hz	Applied circuit breaker (MCCB)	Trip unit	Multiplier factors (K1, K2)	
			K1 (Thermal trip units)	K2 (Magnetic trip units)
40	TS100N, TS100H, TS100L TS160N, TS160H, TS160L TS250N, TS250H, TS250L TS400N, TS400H, TS400L TS630N, TS630H, TS630L TS800N, TS800H, TS800L	ETS ETM	0.4 to 1	1
80			0.4 to 1	1
160			0.4 to 0.9	1
250			0.4 to 0.9	1
400			0.4 to 0.8	1
630			0.4 to 0.8	1
800			0.4 to 0.75	0.97

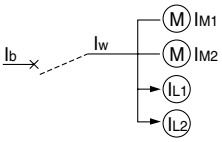
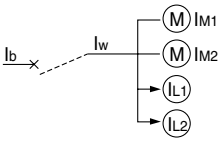
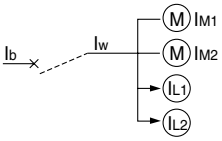
Note) ATU × Adjustable thermal and magnetic trip unit
K1 × Multiplier factor of rated current (In)
K2-Multiplier factor of instantaneous current due to the induced magnetic fields
ETS × Electronic trip unit (Standard)
ETM × Electronic trip unit (Multi-function)

Application
Protection of several kinds of loads

Application for protection of several kinds of loads

It requires to select proper circuit breakers according to the characteristics of loads when they are installed to protect several kinds of loads. It's needed to consider the maximum operating current and the capacity of loads in total so as to select the rated current of breakers.

Selection of circuit breaker protecting the several loads simultaneously

The kind of loads (I_M: motors, I_L: others)	Permissible current in cable or wire: I_W	The rated current of circuit breaker: I_b
In case of, $\Sigma I_M \leq \Sigma I_L$ 	$I_W \geq \Sigma I_M + \Sigma I_L$	Choose the low value among two formulas: $I_b \geq 3\Sigma I_M + \Sigma I_L$. and $I_b \leq 2.5 I_W$ It's permitted to select the above value only if I_W (above 100A) isn't subject to the rated current of circuit breaker.
In case of, $\Sigma I_M > \Sigma I_L$, $\Sigma I_M \leq 50A$ 	$I_W \geq 1.25\Sigma I_M + \Sigma I_L$	
In case of, $\Sigma I_M > \Sigma I_L$, $\Sigma I_M > 50A$ 	$I_W \geq 1.1\Sigma I_M + \Sigma I_L$	

The rated current of breakers as the main circuit of 3 phase inductive loads (AC 220V)

Capacity of loads In total (below kW)	The maximum operating current (below A)	Capacity of the highest motor (kW / A)															
		0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
		4.8	8	11.1	17.4	26	34	48	65	79	93	125	160	190	230	310	360
3	15	20	32	32													
4.5	20	32	32	32	50												
6.3	30	40	40	40	50	63											
8.2	40	50	50	50	50	80	100										
12	50	63	63	63	63	80	100										
15.7	75	100	100	100	100	100	100	125	160								
19.5	90	100	100	100	100	100	100	125	160	200							
23.2	100	125	125	125	125	125	125	125	160	200	200						
30	125	160	160	160	160	160	160	160	160	200	250						
37.5	150	200	200	200	200	200	200	200	200	200	250	300					
45	175	200	200	200	200	200	200	200	200	200	250	300	400				
52.5	200	250	250	250	250	250	250	250	250	250	250	300	400	500			
63.7	250	300	300	300	300	300	300	300	300	300	300	300	400	500	500		
75	300	400	400	400	400	400	400	400	400	400	400	400	400	500	500		
86.2	350	400	400	400	400	400	400	400	400	400	400	400	400	500	500	630	
97.5	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500	630	700
112.5	450	500	500	500	500	500	500	500	500	500	500	500	500	500	500	700	700
125	500	630	630	630	630	630	630	630	630	630	630	630	630	630	630	700	700
150	600	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	800
175	700	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800

Application
Protection of several kinds of loads

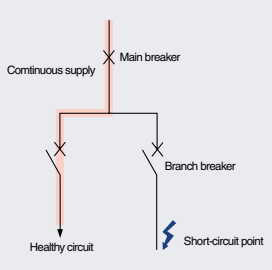
The rated current of breakers as the main circuit of 3 phase inductive loads (AC 440V)

Capacity of loads In total (below kW)	The maximum operating current (below A)	Capacity of the highest motor (kW / A)																
		0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
		4.8	8	11.1	17.4	26	34	48	65	79	93	125	160	190	230	310	360	220	250
3	7.5	16	16	16															
4.5	10	16	16	16	32														
6.3	15	20	20	20	32	40													
8.2	20	32	32	32	32	40	50												
12	25	32	32	32	32	40	50												
15.7	38	50	50	50	50	50	50	63	80										
19.5	45	50	50	50	50	50	50	63	80	100									
23.2	50	63	63	63	63	63	63	63	80	100	125								
30	63	80	80	80	80	80	80	80	100	100	125								
37.5	75	100	100	100	100	100	100	100	100	100	125	160							
45	88	100	100	100	100	100	100	100	100	100	125	160	200						
52.5	100	125	125	125	125	125	125	125	125	125	125	160	200	250					
63.7	125	160	160	160	160	160	160	160	160	160	160	160	200	250	250				
75	150	200	200	200	200	200	200	200	200	200	200	200	200	250	250				
86.2	175	200	200	200	200	200	200	200	200	200	200	200	200	250	300	400			
97.5	200	250	250	250	250	250	250	250	250	250	250	250	250	250	300	400	400	500	
112.5	225	250	250	250	250	250	250	250	250	250	250	250	250	250	300	400	400	500	500
125	250	300	300	300	300	300	300	300	300	300	300	300	300	300	300	400	400	500	500
150	300	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	500	500
175	350	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	500	630	630
200	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	700	700
250	500	630	630	630	630	630	630	630	630	630	630	630	630	630	630	630	630	800	800
300	600	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	800	800
350	700	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	-	-
400	700	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	-	-

Notes) The above mentioned technical data is defined under the usage conditions as follows ;
1. The circuit breaker is tripped within 10seconds in 600% of the current of the fully operating loads.
2. The start-up input current is set within 1700% of the current of the fully operating loads.
3. The capacity of highest motor is also applied when several loads starts up simultaneously.

Protective coordination
Discrimination & Cascading

The primary purpose of a circuit protection system is to prevent damage to series connected equipment and to minimize the area and duration of power loss.
The first consideration is whether an air circuit breaker or molded case circuit breaker is the most suitable. The next is the type of system to be used.
The two major types are: Discrimination and cascading.

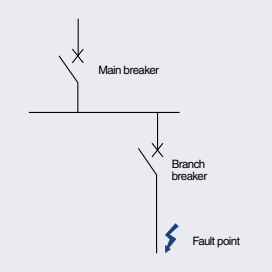


Discrimination

According to IEC60947-2, the discrimination can be defined as follows.

Total discrimination (total selectivity)
Over-current discrimination where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection without causing the other protective device to operate.

Partial discrimination (partial selectivity)
Over-current discrimination where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection up to a given level of over-current, without causing the other protective device to operate.



No discrimination
In case of a fault, main and branch circuit breakers open.

Cascading

This is an economical approach to the use of circuit breakers, whereby only the main (upstream) breaker has adequate interrupting capacity for the maximum available fault current.
The MCCBs downstream cannot handle this maximum fault current and rely on the opening of the upstream breaker for protection.
The advantage of the cascade back-up approach is that it facilitates the use of low cost, low fault level breakers downstream, thereby offering savings in both the cost and size of equipment.
As Susol TD & TS circuit breakers have a very considerable current limiting effect, they can be used to provide this ‘cascade back-up’ protection for downstream circuit breakers.

Protective coordination
Cascading, network 220/240V

Complementary technical information

Main: Susol TD **Branch: Meta-MEC AB, GB and Susol TD, TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	85	100	200	85	100	200
AB	ABE103b	25	50	65	85	50	65	85
	ABS103b	50	65	85	100	65	85	100
	ABH103b	65	85	100	120	85	100	120
	ABE203b	35						
	ABS203b	50						
	ABH203b	65						
	ABE403b	35						
	ABS403b	50						
	ABH403b	85						
	ABL403b	125						
	ABE803b	50						
	ABS803b	100						
	ABL803b	125						
GB	GBN103	50	85	85	100	85	85	100
	GBH103	85		100	120		100	120
	GBL103	125			150			150
	GBN203	50						
	GBH203	80						
	GBL203	125						
Susol TD & TS	TD100N	85		100	200		100	200
	TD100H	100			200			200
	TD160N	85					100	200
	TD160H	100						200
	TS100N	100						
	TS100H	120						
	TS160N	100						
	TS160H	120						
	TS250N	100						
	TS250H	120						
	TS400N	100						
	TS400H	120						
	TS630N	100						
	TS630H	120						
	TS800N	100						
	TS800H	120						

Protective coordination
Cascading, network 220/240V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB, GB and Susol TD, TS**

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	100	120	200	100	120	200	100	120	200
AB	ABE103b	25	65	65	85	65	65	85	65	65	85
	ABS103b	50	85	100	100	85	100	100	85	100	100
	ABH103b	65	100	120	120	100	120	120	100	120	120
	ABE203b	35							85	85	100
	ABS203b	50							100	100	120
	ABH203b	65							100	120	150
	ABE403b	35									
	ABS403b	50									
	ABH403b	85									
	ABL403b	125									
	ABE803b	50									
	ABS803b	100									
	ABL803b	125									
GB	GBN103	50	100	100	120	100	100	120	100	100	120
	GBH103	85	100	120	120	100	120	120	100	120	150
	GBL103	125			150			150			200
	GBN203	50							100	100	120
	GBH203	80								120	150
	GBL203	125									200
Susol TD & TS	TD100N	85	100	120	200	100	120	200	100	120	200
	TD100H	100		120	200		120	200		120	200
	TD160N	85				100	120	200	100	120	200
	TD160H	100					120	200		120	200
	TS100N	100		120	200		120	200		120	200
	TS100H	120			200			200			200
	TS160N	100					120	200		120	200
	TS160H	120						200			200
	TS250N	100								120	200
	TS250H	120									200
	TS400N	100									
	TS400H	120									
	TS630N	100									
	TS630H	120									
	TS800N	100									
	TS800H	120									

Protective coordination
Cascading, network 220/240V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB, GB and Susol TD, TS**

Branch breaker		Main breaker	TS400N	TS400H	TS400L	TS630N	TS630H	TS630L	TS800N	TS800H	TS800L
		Rated breaking capacity (kArms)	100	120	200	100	120	200	100	120	200
AB	ABE103b	25									
	ABS103b	50									
	ABH103b	65									
	ABE203b	35	85	85	100	85	85	100			
	ABS203b	50	100	120	150	100	120	150			
	ABH203b	65	100	120	150	100	120	150			
	ABE403b	35	85	100	100	85	100	100	85	100	100
	ABS403b	50	100	120	120	100	120	120	100	120	120
	ABH403b	85	100	120	150	100	120	150	100	120	150
	ABL403b	125			200			200			200
	ABE803b	50							100	120	120
	ABS803b	100								120	150
	ABL803b	125									200
GB	GBN103	50	100	120	150	100	120	150	100	120	150
	GBH103	85	100	120	150	100	120	150	100	120	150
	GBL103	125			200			200			200
	GBN203	50	100	120	150	100	120	150	100	120	150
	GBH203	80	100	120	150	100	120	150	100	120	150
	GBL203	125			200			200			200
Susol TD & TS	TD100N	85	100	120	200	100	120	200	100	120	200
	TD100H	100		120	200		120	200		120	200
	TD160N	85	100	120	200	100	120	200	100	120	200
	TD160H	100		120	200		120	200		120	200
	TS100N	100		120	200		120	200		120	200
	TS100H	120			200			200			200
	TS160N	100		120	200		120	200		120	200
	TS160H	120			200			200			200
	TS250N	100		120	200		120	200		120	200
	TS250H	120			200			200			200
	TS400N	100		120	200		120	200		120	200
	TS400H	120			200			200			200
	TS630N	100					120	200		120	200
	TS630H	120						200			200
	TS800N	100								120	200
	TS800H	120									200

Protective coordination
Cascading, network 380/415V

Complementary technical information

Main: Susol TD **Branch: Meta-MEC AB, GB and Susol TD, TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	50	85	150	50	85	150
AB	ABE103b	10	25	30	30	25	30	30
	ABS103b	25	35	50	50	35	50	50
	ABH103b	35	50	65	65	50	65	65
	ABE203b	18						
	ABS203b	25						
	ABH203b	35						
	ABE403b	25						
	ABS403b	35						
	ABH403b	50						
	ABL403b	85						
	ABE803b	35						
	ABS803b	50						
	ABL803b	85						
GB	GBN103	35	50	50	70	50	50	70
	GBH103	50		70	85		70	85
	GBL 103	85			120			120
	GBN203	35						
	GBH203	50						
	GBL203	85						
Susol TD & TS	TD100N	50		85	150		85	150
	TD100H	85			150			150
	TD160N	50					85	150
	TD160H	85						150
	TS100N	50						
	TS100H	85						
	TS160N	50						
	TS160H	85						
	TS250N	50						
	TS250H	85						
	TS400N	65						
	TS400H	85						
	TS630N	65						
	TS630H	85						
	TS800N	65						
	TS800H	85						

Protective coordination
Cascading, network 380/415V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB, GB and Susol TD, TS**

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	50	85	150	50	85	150	50	85	150
AB	ABE103b	10	30	40	40	30	40	40	30	40	40
	ABS103b	25	35	65	65	35	65	65	35	65	65
	ABH103b	35	50	70	70	50	70	70	50	70	70
	ABE203b	18							35	50	50
	ABS203b	25							40	65	70
	ABH203b	35							50	70	85
	ABE403b	25									
	ABS403b	35									
	ABH403b	50									
	ABL403b	85									
	ABE803b	35									
	ABS803b	50									
	ABL803b	85									
GB	GBN103	35	50	70	85	50	70	85	50	70	85
	GBH103	50		85	100		85	100		85	100
	GBL103	85			120			120			120
	GBN203	35							50	70	85
	GBH203	50								85	100
	GBL203	85									120
Susol TD & TS	TD100N	50		85	150		85	150		85	150
	TD100H	85			150			150			150
	TD160N	50					85	150		85	150
	TD160H	85						150			150
	TS100N	50		85	150		85	150		85	150
	TS100H	85			150			150			150
	TS160N	50					85	150		85	150
	TS160H	85						150			150
	TS250N	50								85	150
	TS250H	85									150
	TS400N	65									
	TS400H	85									
	TS630N	65									
	TS630H	85									
	TS800N	65									
	TS800H	85									

Protective coordination
Cascading, network 380/415V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB,GB and Susol TD,TS**

Branch breaker		Main breaker	TS400N	TS400H	TS400L	TS630N	TS630H	TS630L	TS800N	TS800H	TS800L
		Rated breaking capacity (kArms)	65	85	150	65	85	150	65	100	150
AB	ABE103b	10									
	ABS103b	25									
	ABH103b	35									
	ABE203b	18	40	50	70	40	50	70			
	ABS203b	25	50	70	85	50	70	85			
	ABH203b	35	50	85	100	50	85	100			
	ABE403b	25	50	70	85	50	70	85	50	70	85
	ABS403b	35	50	85	100	50	85	100	50	85	100
	ABH403b	50		85	120		85	120	65	100	120
	ABL403b	85			150			150		100	150
	ABE803b	35							65	85	100
	ABS803b	50							65	100	120
	ABL803b	85								100	150
GB	GBN103	35	65	85	85	65	85	85	65	100	85
	GBH103	50		85	100		85	100		100	100
	GBL103	85			120			120			120
	GBN203	35	65	85	100	65	85	100	65	100	100
	GBH203	50		85	120		85	120		100	100
	GBL203	85			120			120			120
Susol TD & TS	TD100N	50	65	85	150	65	85	150	65	100	150
	TD100H	85			150			150			150
	TD160N	50	65	85	150	65	85	150	65	100	150
	TD160H	85			150			150			150
	TS100N	50	65	85	150	65	85	150	65	100	150
	TS100H	85			150			150			150
	TS160N	50	65	85	150	65	85	150	65	100	150
	TS160H	85			150			150			150
	TS250N	50	65	85	150	65	85	150	65	100	150
	TS250H	85			150			150			150
	TS400N	65		85	150		85	150		100	150
	TS400H	85			150			150			150
	TS630N	65					85	150		100	150
	TS630H	85						150			150
	TS800N	65								100	150
	TS800H	85									150

Protective coordination
Cascading, network 480/500V

Complementary technical information

Main: Susol TD **Branch: Meta-MEC AB, GB and Susol TD,TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	30	50	65	30	50	65
AB	ABE103b	8	14	25	30	14	25	30
	ABS103b	14	25	30	42	25	30	42
	ABH103b	25	30	42	50	30	42	50
	ABE203b	10						
	ABS203b	14						
	ABH203b	25						
	ABE403b	18						
	ABS403b	25						
	ABH403b	35						
	ABL403b	65						
	ABE803b	25						
	ABS803b	45						
	ABL803b	65						
GB	GBN103	22	30	42	42	30	42	42
	GBH103	35		50	50		50	50
	GBL103	50			65			65
	GBN203	22						
	GBH203	35						
	GBL203	50						
Susol TD & TS	TD100N	30		50	65		50	65
	TD100H	50			65			65
	TD160N	30					50	65
	TD160H	50						65
	TS100N	42						
	TS100H	65						
	TS160N	42						
	TS160H	65						
	TS250N	42						
	TS250H	65						
	TS400N	42						
	TS400H	65						
	TS630N	42						
	TS630H	65						
	TS800N	42						
	TS800H	85						

Protective coordination
Cascading, network 480/500V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB, GB and Susol TD,TS**

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	42	65	85	42	65	85	42	65	85
AB	ABE103b	8	25	30	35	25	30	35	25	30	35
	ABS103b	14	30	42	50	30	42	50	30	42	50
	ABH103b	25	42	50	65	42	50	65	42	50	65
	ABE203b	10							25	35	42
	ABS203b	14							30	42	50
	ABH203b	25							42	50	65
	ABE403b	18									
	ABS403b	25									
	ABH403b	35									
	ABL403b	65									
	ABE803b	25									
	ABS803b	45									
	ABL803b	65									
GB	GBN103	22	42	50	65	42	50	65	42	50	65
	GBH103	35		50	65		50	65		50	65
	GBL103	50		65	85		65	85		65	85
	GBN203	22							42	50	65
	GBH203	35								50	65
	GBL203	50									85
Susol TD & TS	TD100N	30	42	65	85	42	65	85	42	65	85
	TD100H	50		65	85		65	85		65	85
	TD160N	30					65	85		65	85
	TD160H	50					65	85		65	85
	TS100N	42		65	85		65	85		65	85
	TS100H	65			85			85			85
	TS160N	42					65	85		65	85
	TS160H	65						85			85
	TS250N	42								65	85
	TS250H	65									85
	TS400N	42									
	TS400H	65									
	TS630N	42									
	TS630H	65									
	TS800N	42									
	TS800H	85									

Protective coordination
Cascading, network 480/500V

Complementary technical information

Main: Susol TS **Branch: Meta-MEC AB, GB and Susol TD,TS**

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	42	65	85	42	65	85	42	85	100
AB	ABE103b	8									
	ABS103b	14									
	ABH103b	25									
	ABE203b	10	25	35	42	40	50	70			
	ABS203b	14	30	42	50	50	70	85			
	ABH203b	25	42	50	65	50	85	100			
	ABE403b	18	30	42	42	30	42	42	30	42	50
	ABS403b	25	35	50	50	35	50	50	35	50	65
	ABH403b	35	42	65	65	42	65	65	42	65	85
	ABL403b	65			85			85		65	85
	ABE803b	25							35	50	65
	ABS803b	45							42	65	85
	ABL803b	65								65	85
GB	GBN103	22	42	50	65	42	50	65	42	65	65
	GBH103	35		65	65		65	65		85	85
	GBL103	50		65	85		65	85		85	100
	GBN203	22	42	50	65	42	50	65	42	65	65
	GBH203	35		65	65		65	65		85	85
	GBL203	50			85			85		85	100
Susol TD & TS	TD100N	30	42	65	85	42	65	85	42	85	100
	TD100H	50		65	85		65	85		85	100
	TD160N	30		65	85		65	85		85	100
	TD160H	50		65	85		65	85		85	100
	TS100N	42		65	85		65	85		85	100
	TS100H	65			85			85		85	100
	TS160N	42		65	85		65	85		85	100
	TS160H	65			85			85		85	100
	TS250N	42		65	85		65	85		85	100
	TS250H	65			85			85		85	100
	TS400N	42		65	85		65	85		85	100
	TS400H	65			85			85		85	100
	TS630N	42					65	85		85	100
	TS630H	65						85		85	100
	TS800N	42								85	100
	TS800H	85									100

Protective coordination
Motor protection cascading, network 220/240V

Complementary technical information

Main: Susol TD,TS **Branch: Susol TD,TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	85	100	200	85	100	200
Susol TD & TS	TD100N	85		100	200		100	200
	TD100H	100			200			200
	TD160N	85					100	200
	TD160H	100						200
	TS100N	100						
	TS100H	120						
	TS160N	100						
	TS160H	120						

Branch breaker		Upstream	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Main breaker capacity (kArms)	100	120	200	100	120	200	100	120	200
Susol TD & TS	TD100N	85	100	120	200	100	120	200	100	120	200
	TD100H	100		120	200		120	200		120	200
	TD160N	85				100	120	200	100	120	200
	TD160H	100					120	200		120	200
	TS100N	100		120	200		120	200		120	200
	TS100H	120			200			200			200
	TS160N	100					120	200		120	200
	TS160H	120						200			200
	TS250N	100								120	200
	TS250H	120									200

Branch breaker		Main breaker	TS400N	TS400H	TS400L	TS630N	TS630H	TS630L	TS800N	TS800H	TS800L
		Rated breaking capacity (kArms)	100	120	200	100	120	200	100	120	200
Susol TD & TS	TD100N	85	100	120	200	100	120	200	100	120	200
	TD100H	100		120	200		120	200		120	200
	TD160N	85	100	120	200	100	120	200	100	120	200
	TD160H	100		120	200		120	200		120	200
	TS100N	100		120	200		120	200		120	200
	TS100H	120			200			200			200
	TS160N	100		120	200		120	200		120	200
	TS160H	120			200			200			200
	TS250N	100		120	200		120	200		120	200
	TS250H	120			200			200			200
	TS400N	100		120	200		120	200		120	200
	TS400H	120			200			200			200
	TS630N	100					120	200		120	200
	TS630H	120						200			200
	TS800N	100								120	200
	TS800H	120									200

Protective coordination
Motor protection cascading, network 380/415V

Complementary technical information

Main: Susol TD, TS **Branch: Susol TD, TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	50	85	150	50	85	150
Susol TD & TS	TD100N	50		85	150		85	150
	TD100H	85			150			150
	TD160N	50					85	150
	TD160H	85						150
	TS100N	50						
	TS100H	85						
	TS160N	50						
	TS160H	85						

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	50	85	150	50	85	150	50	85	150
Susol TD & TS	TD100N	50		85	150		85	150		85	150
	TD100H	85			150			150			150
	TD160N	50					85	150		85	150
	TD160H	85						150			150
	TS100N	50		85	150		85	150		85	150
	TS100H	85			150			150			150
	TS160N	50					85	150		85	150
	TS160H	85						150			150
	TS250N	50								85	150
	TS250H	85									150

Branch breaker		Main breaker	TS400N	TS400H	TS400L	TS630N	TS630H	TS630L	TS800N	TS800H	TS800L
		Rated breaking capacity (kArms)	65	85	150	65	85	150	65	100	150
Susol TD & TS	TD100N	50	65	85	150	65	85	150	65	100	150
	TD100H	85			150			150			150
	TD160N	50	65	85	150	65	85	150	65	100	150
	TD160H	85			150			150			150
	TS100N	50	65	85	150	65	85	150	65	100	150
	TS100H	85			150			150			150
	TS160N	50	65	85	150	65	85	150	65	100	150
	TS160H	85			150			150			150
	TS250N	50	65	85	150	65	85	150	65	100	150
	TS250H	85			150			150			150
	TS400N	65		85	150		85	150		100	150
	TS400H	85			150			150			150
	TS630N	65					85	150		100	150
	TS630H	85						150			150
	TS800N	65								100	150
	TS800H	85									150

Protective coordination
Motor protection cascading, network 480/500V

Complementary technical information

Main: Susol TD, TS **Branch: Susol TD, TS**

Branch breaker		Main breaker	TD100N	TD100H	TD100L	TD160N	TD160H	TD160L
		Rated breaking capacity (kArms)	30	50	65	30	50	65
Susol TD & TS	TD100N	30		50	65		50	65
	TD100H	50			65			65
	TD160N	30					50	65
	TD160H	50						65
	TS100N	42						
	TS100H	65						
	TS160N	42						
	TS160H	65						

Branch breaker		Main breaker	TS100N	TS100H	TS100L	TS160N	TS160H	TS160L	TS250N	TS250H	TS250L
		Rated breaking capacity (kArms)	42	65	85	42	65	85	42	65	85
Susol TD & TS	TD100N	30	42	65	85	42	65	85	42	65	85
	TD100H	50		65	85		65	85		65	85
	TD160N	30				42	65	85	42	65	85
	TD160H	50					65	85		65	85
	TS100N	42		65	85		65	85		65	85
	TS100H	65			85			85			85
	TS160N	42					65	85		65	85
	TS160H	65						85			85
	TS250N	42								65	85
	TS250H	65									85

Branch breaker		Main breaker	TS400N	TS400H	TS400L	TS630N	TS630H	TS630L	TS800N	TS800H	TS800L
		Rated breaking capacity (kArms)	42	65	85	42	65	85	42	85	100
Susol TD & TS	TD100N	30	42	65	85	42	65	85	42	85	100
	TD100H	50		65	85		65	85		85	100
	TD160N	30	42	65	85	42	65	85	42	85	100
	TD160H	50		65	85		65	85		85	100
	TS100N	42		65	85		65	85		85	100
	TS100H	65			85			85		85	100
	TS160N	42		65	85		65	85		85	100
	TS160H	65			85			85		85	100
	TS250N	42		65	85		65	85		85	100
	TS250H	65			85			85		85	100
	TS400N	42		65	85		65	85		85	100
	TS400H	65			85			85		85	100
	TS630N	42					65	85		85	100
	TS630H	65						85		85	100
	TS800N	42								85	100
	TS800H	85									100

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TD100~TS800 **Branch: AB103~AB203**

Branch breaker		Main breaker Rating (A)		TD100N/H/L Trip units-Thermal magnetic									TD160N/H/L		
				16	20	25	32	40	50	63	80	100	100	125	160
AB103	E	Trip units-Thermal magnetic	~10				0.4	0.5	0.5	0.5	0.63	0.8	T	T	T
			15					0.5	0.5	0.5	0.63	0.8	T	T	T
			20						0.5	0.5	0.63	0.8	9	T	T
			30							0.5	0.63	0.8	9	9	9
			40								0.63	0.8	9	9	9
			50								0.63	0.8	8	8	8
			60									0.8	8	8	8
			75											8	8
			100												8
	S		15					0.5	0.5	0.5	0.63	0.8	10	10	10
			20						0.5	0.5	0.63	0.8	9	10	10
			30						0.5	0.5	0.63	0.8	9	9	9
			40							0.5	0.63	0.8	9	9	9
			50								0.63	0.8	8	8	8
			60								0.63	0.8	8	8	8
			75										8	8	8
			100											8	8
	H		15					0.5	0.5	0.5	0.63	0.8	10	10	10
			20						0.5	0.5	0.63	0.8	9	10	10
			30						0.5	0.5	0.63	0.8	9	9	9
			40							0.5	0.63	0.8	9	9	9
			50								0.63	0.8	8	8	8
			60								0.63	0.8	8	8	8
			75									0.8	8	8	8
			100											8	8
AB203b	E	Trip units-Thermal magnetic	100												
			125												
			150												
			175												
			200												
			225												
	S		100												
			125												
			150												
			175												
			200												
			225												
	H		100												
			125												
			150												
			175												
			200												
			225												

TS100N/H/L					TS160N/H/L			TS250N/H/L				TS400N/H/L		TS630N/H/L		TS800N/H/L
Trip units-Thermal magnetic/Electronic																
40	50	63	80	100	100	125	160	125	160	200	250	300	400	500	630	800
T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
			T	T	T	T	T	T	T	T	T	T	T	T	T	T
			T	T	T	T	T	T	T	T	T	T	T	T	T	T
				T	T	T	T	T	T	T	T	T	T	T	T	T
						T	T	T	T	T	T	T	T	T	T	T
							T	T	T	T	T	T	T	T	T	T
10	10	10	11	11	11	12.5	12.5	15	15	18	18	T	T	T	T	T
10	10	10	10	11	11	11	12.5	15	15	15	18	T	T	T	T	T
		8	10	11	11	11	11	15	15	15	18	20	T	T	T	T
			8	11	11	11	11	15	15	15	15	20	T	T	T	T
			8	11	11	11	11	15	15	15	15	20	20	T	T	T
				8	8	8	11	12.5	12.5	12.5	12.5	20	20	20	T	T
						8	11	12.5	12.5	12.5	12.5	20	20	20	T	T
							11	12.5	12.5	12.5	12.5	20	20	20	T	T
10	10	10	11	11	11	12.5	12.5	15	15	18	18	25	25	25	25	T
10	10	10	10	11	11	11	12.5	15	15	15	18	25	25	25	25	T
		8	10	11	11	11	11	15	15	15	18	20	25	25	25	T
			8	11	11	11	11	15	15	15	15	20	25	25	25	T
			8	11	11	11	11	15	15	15	15	20	20	25	25	T
				8	8	8	11	12.5	12.5	12.5	12.5	20	20	20	25	T
						8	11	12.5	12.5	12.5	12.5	20	20	20	25	T
							11	12.5	12.5	12.5	12.5	20	20	20	25	T
						8	8			8	8	T	T	T	T	T
							8				8	T	T	T	T	T
												15	15	15	15	T
												12.5	12.5	15	15	T
												11	12.5	12.5	12.5	T
												11	11	12.5	12.5	T
						8	8			8	8	18	18	18	18	T
							8				8	18	18	18	18	T
												15	15	15	15	T
												12.5	12.5	15	15	T
												11	12.5	12.5	12.5	T
												11	11	12.5	12.5	T
						8	8			8	8	18	18	18	18	28
							8				8	18	18	18	18	28
												15	15	15	15	28
												12.5	12.5	15	15	28
												11	12.5	12.5	12.5	28
												11	11	12.5	12.5	28

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TD160~TS800 **Branch: GB103~GB203**

Branch breaker		Main breaker Rating (A)		TD100N/H/L Trip units-Thermal magnetic									TD160N/H/L		
				16	20	25	32	40	50	63	80	100	100	125	160
GB103	N	Trip units-Thermal magnetic	16				0.4	0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	1.25
			100												1.25
	H		16					0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	1.25
			100												1.25
	L		16					0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	1.25
			100												1.25
GB203	N	Trip units-Thermal magnetic	125												
			160												
			200												
			250												
	H		125												
			160												
			200												
			250												
	L		125												
			160												
			200												
			250												

	TS100N/H/L					TS160N/H/L			TS250N/H/L				TS400N/H/L		TS630N/H/L		TS800N/H/L
	Trip units-Thermal magnetic/Electronic																
	40	50	63	80	100	100	125	160	125	160	200	250	300	400	500	630	800
	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
			0.5	0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
				0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
				0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
					0.8	2	2	2	2	25	25	25	T	T	T	T	T
							1.25	1.25	2	25	25	25	T	T	T	T	T
								1.25	2	25	25	25	T	T	T	T	T
	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
			0.5	0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
				0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
				0.63	0.8	2	2	2	2	25	25	25	T	T	T	T	T
					0.8	2	2	2	2	25	25	25	T	T	T	T	T
							1.25	1.25	2	25	25	25	T	T	T	T	T
								1.25	2	25	25	25	T	T	T	T	T
	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T	T	T	T	T	T
			0.5	0.63	0.8	2	2	2	2	12.5	12.5	12.5	T	T	T	T	T
				0.63	0.8	2	2	2	2	12.5	12.5	12.5	T	T	T	T	T
				0.63	0.8	2	2	2	2	12.5	12.5	12.5	T	T	T	T	T
					0.8	2	2	2	2	12.5	12.5	12.5	T	T	T	T	T
							1.25	1.25	2	12.5	12.5	12.5	T	T	T	T	T
								1.25	2	12.5	12.5	12.5	T	T	T	T	T
											2	2.5	5	5	10	12.5	T
												2.5		5	10	12.5	T
															10	12.5	T
																12.5	T
											2	2.5	5	5	10	12.5	T
												2.5		5	10	12.5	T
															10	12.5	T
																12.5	T
											2	2.5	5	5	10	12.5	50
												2.5		5	10	12.5	50
															10	12.5	50
																12.5	50

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TD100/160 (Thermal magnetic) **Branch: TD100/160 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TD100N/H/L Trip units-Thermal magnetic									TD160N/H/L		
				16	20	25	32	40	50	63	80	100	100	125	160
TD100	N	Trip units-Thermal magnetic	16				0.4	0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	2
			100												1.6
	H		16					0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	2
			100											1.0	1.6
	L		16					0.5	0.5	0.5	0.63	0.8	2	2	2
			20						0.5	0.5	0.63	0.8	2	2	2
			25						0.5	0.5	0.63	0.8	2	2	2
			32							0.5	0.63	0.8	2	2	2
			40								0.63	0.8	2	2	2
			50								0.63	0.8	2	2	2
			63									0.8	2	2	2
			80											1.25	2
			100											1.0	1.6
TD160	N		100											1.0	1.6
			125												1.25
			160												
	H		100												1.6
			125												1.25
			160												
	L		100												1.6
			125												1.25
			160												

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TS100/160/250 (Electronic) **Branch: TD100/160 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TS100N/H/L					TS160N/H/L			TS250N/H/L			
				Trip units-Thermal magnetic/Electronic											
				40	50	63	80	100	100	125	160	125	160	200	250
TD100	N	Trip units-Thermal magnetic	16	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			20	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			25	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			32			0.5	0.63	0.8	2	2	2	2	T	T	T
			40				0.63	0.8	2	2	2	2	T	T	T
			50				0.63	0.8	2	2	2	2	T	T	T
			63					0.8	2	2	2	2	T	T	T
			80					0.8	1.0	1.25	2	1.25	T	T	T
			100							1.0	1.6	1.0	T	T	T
	H		16	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			20		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			25		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			32			0.5	0.63	0.8	2	2	2	2	50	50	50
			40				0.63	0.8	2	2	2	2	50	50	50
			50				0.63	0.8	2	2	2	2	50	50	50
			63					0.8	2	2	2	2	50	50	50
			80					0.8	1.0	1.25	2	1.25	50	50	50
			100							1.0	1.6	1.0	50	50	50
	L		16	0.5	0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			20		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			25		0.5	0.5	0.63	0.8	2	2	2	2	T	T	T
			32			0.5	0.63	0.8	2	2	2	2	50	50	50
			40				0.63	0.8	2	2	2	2	50	50	50
			50				0.63	0.8	2	2	2	2	50	50	50
			63					0.8	2	2	2	2	50	50	50
			80					0.8	1.0	1.25	2	1.25	50	50	50
			100							1.0	1.6	1.0	50	50	50
TD160	N		100							1.0	1.6	1.0	2.6	4	5
			125								1.25		1.25	4	5
			160												5
	H		100							1.0	1.6	1.0	2.6	4	5
			125								1.25		1.25	4	5
			160												5
	L		100								1.25	2	2.6	4	5
			125											4	5
			160												5

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TS400/630/800 (Electronic) **Branch: TD100/160 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TS400N/H/L		TS630N/H/L		TS800N/H/L
				Trip units-Thermal magnetic/Electronic				
				300	400	500	630	800
TD100	N	Trip units-Thermal magnetic	16	T	T	T	T	T
			20	T	T	T	T	T
			25	T	T	T	T	T
			32	T	T	T	T	T
			40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
	H		16	T	T	T	T	T
			20	T	T	T	T	T
			25	T	T	T	T	T
			32	T	T	T	T	T
			40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
	L		16	T	T	T	T	T
			20	T	T	T	T	T
			25	T	T	T	T	T
			32	T	T	T	T	T
			40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
TD160	N		100	T	T	T	T	T
			125	T	T	T	T	T
			160	T	T	T	T	T
	H		100	T	T	T	T	T
			125	T	T	T	T	T
			160	T	T	T	T	T
	L		100	T	T	T	T	T
			125	T	T	T	T	T
			160	T	T	T	T	T

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TS100/160/250 (Electronic) **Branch: TS100/160/250 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TS100N/H/L					TS160N/H/L			TS250N/H/L			
				Trip units-Thermal magnetic/Electronic											
				40	50	63	80	100	100	125	160	125	160	200	250
TS100	N	Trip units-Thermal magnetic	40				0.63	0.8	2	2	2	2	T	T	T
			50				0.63	0.8	2	2	2	2	T	T	T
			63					0.8	2	2	2	2	T	T	T
			80							1.25	2	2	T	T	T
			100							1	1.6	1	T	T	T
	H		40				0.63	0.8	2	2	2	2	50	50	50
			50				0.63	0.8	2	2	2	2	50	50	50
			63					0.8	2	2	2	2	50	50	50
			80							1.25	2	2	50	50	50
			100							1	1.6	1	50	50	50
	L		40				0.63	0.8	2	2	2	2	50	50	50
			50				0.63	0.8	2	2	2	2	50	50	50
			63					0.8	2	2	2	2	50	50	50
			80							1.25	2	2	50	50	50
			100							1	1.6	1	50	50	50
TS160	N		100								1.6	1	2.6	4	5
			125								1.25		1.25	4	5
			160												5
	H		100								1.6	1	2.6	4	5
			125								1.25		1.25	4	5
			160												5
	L		100								1.6	1	2.6	4	5
			125								1.25		1.25	4	5
			160												5
TS250	N		125											1.25	2.5
			160												2.5
			200												
			250												
	H		125											1.25	2.5
			160												2.5
			200												
			250												
	L		125											1.25	2.5
			160												2.5
			200												
			250												

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TS400/630/800 (Electronic) **Branch: TS100/160/250 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TS400N/H/L		TS630N/H/L		TS800N/H/L
				Trip units-Thermal magnetic/Electronic				
				300	400	500	630	800
TS100	N	Trip units-Thermal magnetic	40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
	H		40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
	L		40	T	T	T	T	T
			50	T	T	T	T	T
			63	T	T	T	T	T
			80	T	T	T	T	T
			100	T	T	T	T	T
TS160	N		100	T	T	T	T	T
			125	T	T	T	T	T
			160	T	T	T	T	T
	H		100	T	T	T	T	T
			125	T	T	T	T	T
			160	T	T	T	T	T
	L		100	T	T	T	T	T
			125	T	T	T	T	T
			160		T	T	T	T
TS250	N		125	5	5	T	T	T
			160		5	T	T	T
			200			T	T	T
			250				T	T
	H		125	5	5	T	T	T
			160		5	T	T	T
			200			T	T	T
			250				T	T
	L		125	5	5	T	T	T
			160		5	T	T	T
			200			T	T	T
			250				T	T

Protective coordination
Protection discrimination table, Discrimination

Complementary technical information

Main: TS400/630/800 (Electronic) **Branch: TS400/630/800 (Thermal magnetic)**

Branch breaker		Main breaker Rating (A)		TS400N/H/L		TS630N/H/L		TS800N/H/L
				Trip units-Thermal magnetic/Electronic				
				300	400	500	630	800
TS400	N	Trip units-Thermal magnetic	300			8	8	T
			400				8	10
	H		300			8	8	T
			400				8	10
	L		300			8	8	T
			400				8	10
TS630	N		500				8	10
			630					10
	H		500				8	10
			630					10
	L		500				8	10
			630					10
TS800	N		800					
	H		800					
	L		800					

Protective coordination
Motor protection discrimination table

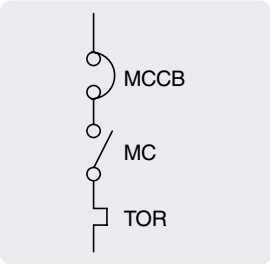
Complementary technical information

Main: Susol TD, TS **Branch: Susol TD, TS**

Branch breaker	Main breaker		TD100N/H/L									
	Trip unit		Trip units-Thermal magnetic									
		Rating (A)	16	20	25	32	40	50	63	80	100	
TD100N/H/L	FMU	16							5	6.4	8	
		20								6.4	8	
		25								6.4	8	
		32									8	
		40										
		50										
		63										
		80										
		100										
TD160N/H/L	FMU	100										
		125										
		160										
TS100N/H/L	MTU	100										
TS160N/H/L	MTU	150										
TS250N/H/L	MTU	220										
TS400N/H/L	MTU	320										
TS630N/H/L	MTU	500										
TS100N/H/L	ETS	40										
		80										
		100										
TS160N/H/L	ETS	150										
TS250N/H/L	ETS	220										
TS400N/H/L	ETS	320										

	TD160N/H/L			TS250N/H/L		TS100N/H/L		TS160N/H/L TS250N/H/L			TS400N/H/L TS630N/H/L		TS800N/H/L	
	FMU			ATU		ETS		ETS			ETS/ETM		ETS/ETM	
	100	125	160	200	250	40	80	80	160	250	400	630	630	800
	12.5	12.5	12.5	20	25		1	0.9	1.75	36	T	T	T	T
	12.5	12.5	12.5	20	25		1	0.9	1.75	36	T	T	T	T
	12.5	12.5	12.5	20	25		1	0.9	1.75	36	T	T	T	T
	12.5	12.5	12.5	20	25				1.75	36	T	T	T	T
		12.5	12.5	20	25				1.75	36	T	T	T	T
			12.5	20	25				1.75	36	T	T	T	T
				20	25					36	T	T	T	T
					25					36	T	T	T	T
											T	T	T	T
											T	T	T	T
												T	T	T
												T	T	T
											T	T	T	T
												T	T	T
												T	T	T
		12.5	12.5	36	36				1.75	3.6	T	T	T	T
					36					3.6	T	T	T	T
											T	T	T	T
												T	T	T
												T	T	T

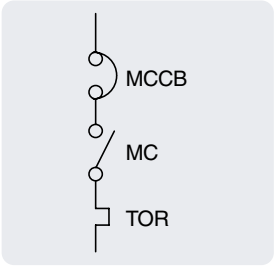
Protective coordination
Type 2 Coordination according to IEC60947-4-1



Performance: Ue=200/240V			
MCCB	N	H	L
TD100	85kA	100kA	200kA
TS100	100kA	120kA	200kA

Motor		MCCB		Contactor	Thermal overload relay	
kW	A	Type	Rating Ir (A)	Type	Type	Setting range (A)
0.37	1.8	TD100	16	MC-9	MT-32	1.6-2.5
0.55	2.75	TD100	16	MC-32	MT-32	2.5-4
0.75	3.5	TD100	16	MC-32	MT-32	2.5-4
1.1	4.4	TD100	16	MC-40	MT-63	4-6
1.5	6.1	TD100	16	MC-40	MT-63	5-8
2.2	8.7	TD100	16	MC-40	MT-63	9-13
3	11.5	TD100	16	MC-40	MT-63	9-13
3.7	13.5	TD100	16	MC-40	MT-63	12-18
4	14.5	TD100	16	MC-40	MT-63	12-18
5.5	20	TD100	20	MC-40	MT-63	16-22
7.5	27	TD100	32	MC-40	MT-63	24-36
9	32	TD100	32	MC-85	MT-95	28-40
10	35	TD100	40	MC-85	MT-95	28-40
11	39	TD100	40	MC-85	MT-95	34-50
15	52	TD100	63	MC-85	MT-95	45-65
18.5	64	TD100 TS100	80	MC-85	MT-95	54-75
22	75	TD100 TS100	80	MC-85	MT-95	63-85
25	85	TD100 TS100	100	MC-85	MT-95	70-95

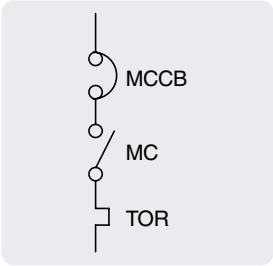
Protective coordination
Type 2 Coordination according to IEC60947-4-1



Performance: Ue=380/415V			
MCCB	N	H	L
TD100	50kA	85kA	150kA
TS100	50kA	85kA	150kA

Motor		MCCB		Contactor	Thermal overload relay	
kW	A	Type	Rating Ir (A)	Type	Type	Setting range (A)
0.37	1.03	TD100	16	MC-9	MT-32	1-1.6
0.55	1.6	TD100	16	MC-9	MT-32	1-1.6
0.75	2	TD100	16	MC-9	MT-32	1.6-2.5
1.1	2.6	TD100	16	MC-32	MT-32	2.5-4
1.5	3.5	TD100	16	MC-32	MT-32	2.5-4
2.2	5	TD100	16	MC-40	MT-63	4-6
3	6.6	TD100	16	MC-40	MT-63	5-8
3.7	7.7	TD100	16	MC-40	MT-63	6-9
4	8.5	TD100	16	MC-40	MT-63	7-10
5.5	11.5	TD100	16	MC-40	MT-63	9-13
7.5	15.5	TD100	16	MC-40	MT-63	12-18
9	18.5	TD100	20	MC-40	MT-63	16-22
10	20	TD100	20	MC-40	MT-63	16-22
11	22	TD100	25	MC-40	MT-63	16-22
15	30	TD100	32	MC-85	MT-95	24-36
18.5	37	TD100 TS100	40	MC-85	MT-95	28-40
22	44	TD100 TS100	50	MC-85	MT-95	34-50
25	52	TD100 TS100	63	MC-85	MT-95	45-65
30	60	TD100 TS100	63	MC-85	MT-95	45-65
33	68	TD100 TS100	80	MC-85	MT-95	54-75
37	72	TD100 TS100	80	MC-85	MT-95	63-85
40	79	TD100 TS100	80	MC-85	MT-95	63-85
45	85	TD100 TS100	100	MC-85	MT-95	70-95

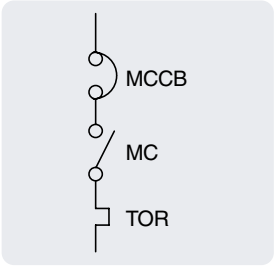
Protective coordination
Type 2 Coordination according to IEC60947-4-1



Performance: Ue=440V			
MCCB	N	H	L
TD100	42kA	72kA	130kA
TS100	42kA	72kA	130kA

Motor		MCCB		Contactor	Thermal overload relay	
kW	A	Type	Rating Ir (A)	Type	Type	Setting range (A)
0.37	0.99	TD100	16	MC-9	MT-32	0.63-1
0.55	1.36	TD100	16	MC-9	MT-32	1-1.6
0.75	1.68	TD100	16	MC-9	MT-32	1.6-2.5
1.1	2.37	TD100	16	MC-9	MT-32	1.6-2.5
1.5	3.06	TD100	16	MC-18	MT-32	2.5-4
2.2	4.42	TD100	16	MC-25	MT-32	4-6
3	5.57	TD100	16	MC-25	MT-32	4-6
3.7	7.1	TD100	16	MC-32	MT-32	5-8
4	7.9	TD100	16	MC-32	MT-32	6-9
5.5	10.4	TD100	20	MC-32	MT-32	9-13
7.5	13.7	TD100	20	MC-32	MT-32	12-18
9	16.9	TD100	20	MC-40	MT-63	12-18
11	20.1	TD100	25	MC-40	MT-63	16-22
15	26.5	TD100	32	MC-40	MT-63	24-36
18.5	32.8	TD100 TS100	40	MC-50	MT-63	28-40
22	39	TD100 TS100	40	MC-50	MT-63	34-50
25	45.3	TD100 TS100	50	MC-50	MT-63	34-50
30	51.5	TD100 TS100	63	MC-65	MT-95	45-65
33	58	TD100 TS100	63	MC-65	MT-95	45-65
37	64	TD100 TS100	80	MC-65	MT-95	54-75
40	67	TD100 TS100	80	MC-85	MT-95	54-75
45	76	TD100 TS100	100	MC-85	MT-95	63-85

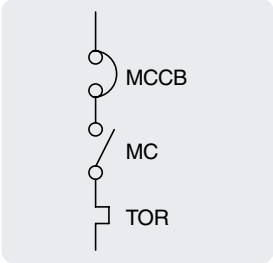
Protective coordination
Type 2 Coordination according to IEC60947-4-1



Performance: Ue=480/500V			
MCCB	N	H	L
TD100	30kA	50kA	65kA
TS100	42kA	65kA	85kA

Motor		MCCB		Contactor	Thermal overload relay	
kW	A	Type	Rating Ir (A)	Type	Type	Setting range (A)
0.37	1	TD100	16	MC-9	MT-32	0.63-1
0.55	1.21	TD100	16	MC-9	MT-32	1-1.6
0.75	1.5	TD100	16	MC-9	MT-32	1-1.6
1.1	2	TD100	16	MC-9	MT-32	1.6-2.5
1.5	2.6	TD100	16	MC-32	MT-32	2.5-4
2.2	3.8	TD100	16	MC-32	MT-32	2.5-4
3	5	TD100	16	MC-40	MT-63	4-6
3.7	5.9	TD100	16	MC-40	MT-63	5-8
4	6.5	TD100	16	MC-40	MT-63	5-8
5.5	9	TD100	16	MC-40	MT-63	7-10
7.5	12	TD100	16	MC-40	MT-63	9-13
9	13.9	TD100	16	MC-40	MT-63	12-18
11	15	TD100	16	MC-85	MT-95	12-18
15	18.4	TD100	20	MC-85	MT-95	16-22
18.5	23	TD100	25	MC-85	MT-95	18-25
22	28.5	TD100	32	MC-85	MT-95	24-36
25	33	TD100 TS100	40	MC-85	MT-95	28-40
30	39.4	TD100 TS100	40	MC-85	MT-95	34-50
33	45	TD100 TS100	50	MC-85	MT-95	34-50
37	50	TD100 TS100	50	MC-85	MT-95	45-65
40	55	TD100 TS100	63	MC-85	MT-95	45-65
45	60	TD100 TS100	63	MC-85	MT-95	54-75

Protective coordination
Type 2 Coordination according to IEC60947-4-1



Performance: Ue=660/690V			
MCCB	N	H	L
TD100	42kA	72kA	130kA
TS100	42kA	72kA	130kA

Motor		MCCB		Contactor	Thermal overload relay	
kW	A	Type	Rating Ir (A)	Type	Type	Setting range (A)
0.37	0.6	TD100	16	MC-9	MT-32	0.4~0.63
0.55	0.9	TD100	16	MC-9	MT-32	0.63-1
0.75	1.1	TD100	16	MC-9	MT-32	1-1.6
1.1	1.5	TD100	16	MC-9	MT-32	1-1.6
1.5	2	TD100	16	MC-32	MT-32	1.6-2.5
2.2	2.8	TD100	16	MC-32	MT-32	2.5-4
3	3.8	TD100	16	MC-32	MT-32	2.5-4
3.7	4.4	TD100	16	MC-40	MT-63	4-6
4	4.9	TD100	16	MC-40	MT-63	4-6
5.5	6.6	TD100	16	MC-40	MT-63	5-8
7.5	8.9	TD100	16	MC-40	MT-63	7-10
9	10.6	TD100	16	MC-85	MT-95	9-13
11	11.5	TD100	16	MC-85	MT-95	9-13
15	14	TD100	16	MC-85	MT-95	12-18
18.5	17.3	TD100	20	MC-85	MT-95	16-22
22	21.3	TD100	25	MC-85	MT-95	18-25
25	25.4	TD100	32	MC-85	MT-95	24-36
30	30.3	TD100	32	MC-85	MT-95	24-36
33	34.6	TD100 TS100	40	MC-85	MT-95	28-40
37	39	TD100 TS100	40	MC-85	MT-95	34-50
40	42	TD100 TS100	50	MC-85	MT-95	34-50
45	44	TD100 TS100	50	MC-85	MT-95	34-50

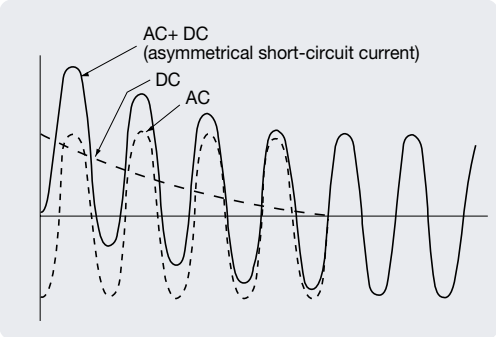
How to calculate short-circuit current value
Various short-circuit

The purpose of calculating short circuit values
- Selection of circuit breakers, fuse.
- Adjusting metering devices
- Consideration for mechanical resistance
- Consideration for thermal resistance

Various value of short-circuit current should be applied to the tests for upper factors.
Symmetrical current for AC and asymmetrical current for DC are used for classifying short circuit current.
Their differences should be essentially considered in the basic step of making network plan.

Symmetrical short-circuit current real value

Short-circuit current is composed of AC and DC as it shows on <Fig.1>. The short-circuit which indicates the real value of AC is called as symmetrical short-current real value, I (rms)sym. This current is the essential factor of selecting MCCB, ACB, fuse.



<Fig.1> Composition of short-circuit current

Maximum asymmetrical short-circuit current real value: I (rms)asym

The short-circuit which indicates the real value of DC is called as asymmetrical short-circuit current real value.
And this current value is changeable upon the short-circuit closing phase.
This current value is treated for checking the thermal resistant strength of wrings, CT and etc.
With symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value, α from <Fig.5>.
and maximum asymmetrical short-circuit current real value is calculated with this formula.

$$I\ (rms)asym = \alpha I\ (rms)sym$$

3-phases average asymmetrical short-circuit current real value: I (rms)ave

Each phase is different in its input current value in 3 phases circuit. So that AC rate for 3 phases is different. This value is the average of asymmetrical short-circuit current of 3 phases.
And with symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value, β, and 3-phases average asymmetrical short circuit current real value is calculated with this formula.

$$I\ (rms)ave = \beta I\ (rms)sym$$

Maximum asymmetrical short-circuit current instantaneous value: Imax

Each phase has different instantaneous current value. And when asymmetrical short-circuit current shows its maximum instantaneous value, the current value is called as maximum asymmetrical short-circuit current instantaneous value. This current is to test the mechanical strength of serial equipments.
And with symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value, γ and maximum asymmetrical short-circuit current instantaneous value is calculated with this formula.

$$Imax = \gamma I\ (rms)sym$$

Network impedance for calculating short-circuit current value

Bellows should be considered for the calculation as the impedance components affecting circuit to trouble spot from short-circuit power.

a. Primary part impedance of incoming transformer It's calculated from the short-circuit current data which is provided by power supplier. Calculated value can be regarded as reactance.

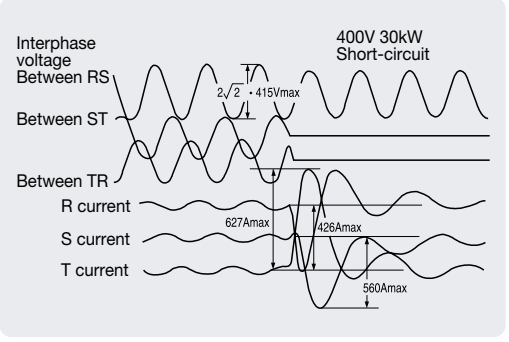
b. Impedance of incoming transformer Its amount is upon the capacity of transformer and primary voltage. Generally this impedance can be regarded as reactance and refer to <Table.4>, <Table.5>.

How to calculate short-circuit current value
Various short-circuit

c. Reactance of motor
Motor works as generator and supply short circuit current in the condition of an accident circuit such as <Fig.2>.
Generation factor of firm motor should be considered in a low voltage circuit where a circuit breaker operates quickly and in a high voltage circuit for the selection of fuse. Reactance of motor can be regarded in the range of 25% normally.

d. Distribution impedance
Impedance of cable and busduct do control short-circuit remarkably in low voltage network. Refer to <Table.5>, <Table.6>.

e. Others
MCCB, ACB CT are equipments for the network of low voltage.
The impedance of these equipment which is calculated from short-circuit current value should be considered.
Generally, the impedance of those equipment is that of rated current (normal condition), if operators apply that impedance value, bigger reactance value may be applied to calculated short-circuit current value.



<Fig.2> Short-circuit of motor

How to calculate short-circuit current value With percent impedance

Ohm formula (Ω), percent impedance formula (%), unit formula (per unit) can be applied to calculate short-circuit current value.

Ohm formula [Ω]

Short-circuit current value is calculated by converting into ohm value [Ω]

Percent impedance formula (%) Each impedance is converted into the impedance of base value and base voltage.

And the required amount for electric demand should be shown as percent unit.
And apply that value in ohm formula.

Unit formula

The base value equals 1.0. and all value of network shows in the way of decimal system. Applying any of upper calculation formulas to achieve short-circuit current value, it shows equal value. To select a certain formula for doing it, operator can select one of those formula which is proper to oneself. Below is percent impedance formula.

Finding base value

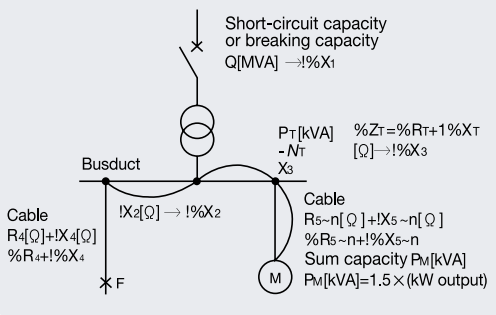
The rated current of transformer shall be the base value.

Base capacity $P_B = P_T$ [kVA]

Base voltage $V_B = V_T$ [V]

Base current $I_B = I_T = \frac{P_T}{\sqrt{3}V_T} \times 10^3$ [A]

Base impedance $Z_B = \frac{V_B^2}{P_B \times 10^3} = \frac{V_T^2}{P_T \times 10^3}$ [Ω]



<Fig.3> Base value

Converting impedance into base value

a. Primary part impedance of transformer: $\%X_1$

$$\%X_1 = \frac{P_B}{Q \times 10^3} \times 100 \text{ [\%]}$$

Q: Primary part short-circuit capacity

b. Impedance of transformer: %ZT
It generally indicates as percent impedance. If base capacity is equal to transformer capacity, %ZT can be used as it is. When base capacity is not equal to transformer capacity, convert values by this formula.

$$\frac{P_T}{\%Z_T} = \frac{P_B}{\%Z_B}$$

%: value converted by base value

1phase transformer should converted into the value of 3 phase transformer, And the percent impedance is equal to $\frac{\sqrt{3}}{2} \times$ calculated urgent value.

c. Reactance of motor: %Xm
Transformer capacity shows the value in kW, so it is converted into unit, kVA.
(kVA value) ≒ 1.5 × (Output of motor, kW)
%Xm= 25% Converting it from base capacity

$$\frac{P_M}{\%Xm} = \frac{P_B}{\%Xm}$$

(Converting formula for different capacity)

d. Impedance of busduct, cable
Cable: Area of cross-section & length
Busduct: Rated current

In <Fig.5>, <Fig.6>
Z_C = (Ω per each unit length) × (length) [Ω]
Convert this value into % value.

$$\%Z_C = \frac{Z_C}{Z_B}$$

(% converting formula)

2cables in same dimension, it's recommendable to divide the length by 2.

How to calculate short-circuit current value

Preparing a impedance map

Prepare impedance map according to the impedance value from (2). Various electricity suppliers like source, motor have same electric potential in impedance map.
As you find it on <Fig.4> (a), extend it from the unlimited bus to fault point, draw impedance map.

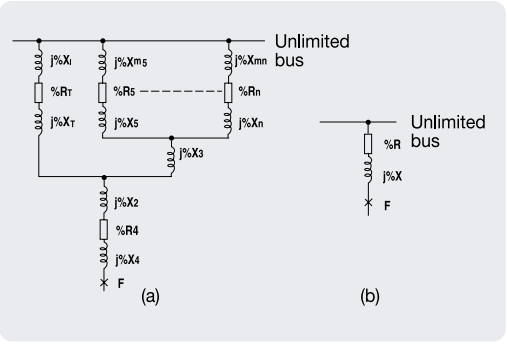
Calculating impedance

Calculate impedance as <Fig.4 (b)> in impedance map < Fig.4 (a)>

$\%Z = \%R + j\,\%X$

$\%Z = \sqrt{(\%R)^2 + (\%X)^2}$

Calculating symmetrical short-circuit current real value



<Fig.4> Base value

Calculating various short-circuit current value

IF (3 ø) = IF (rms)sym (3 ø)

$$= \frac{P_B \times 10^3}{\sqrt{3}V_B \cdot \%Z} \times 100$$

$$= \frac{I_B}{\%Z} \times 100\,[A]$$

Calculate various short-circuit current value with α, β, γ values from <Fig.5> like

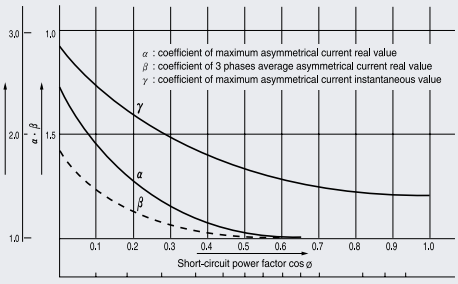
short-circuit power factor cos $\phi = \frac{\%R}{\%Z}$

3 phases average asymmetrical real value
I_F (rms)ave= βI_F (rms)sym
Maximum average asymmetrical real value
I_F (rms)asym= Ω I_F (rms)sym
Maximum asymmetrical instantaneous value
$I_F$max= γI_F (rms)sym

In case of 1 phase short-circuit

Current value from (5) multiplied by $\frac{\sqrt{3}}{2}$

Each short-circuit current value (1 ø)= $\frac{\sqrt{3}}{2}$
(3phases short-circuit current) × α (or γ)



<Fig.5>

How to calculate short-circuit current value With a simple formula

For its special cases, calculating exact value should be needed, in the other hand, for the practical use, we recommend simple formula.

Finding a base value

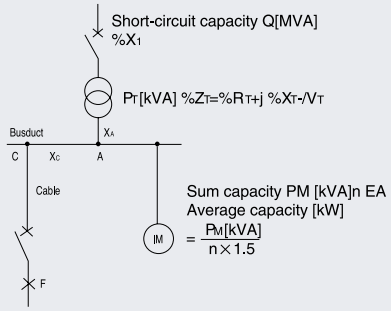
It shall be the rated current of transformer.

P_B= PT [kVA]

V_B= VT [V]

I_B= IT [A]

$$Z_B = \frac{VT_B\ [\Omega]}{PT \times 103}$$



<Fig.6> Base value

Short-circuit current from incoming circuit

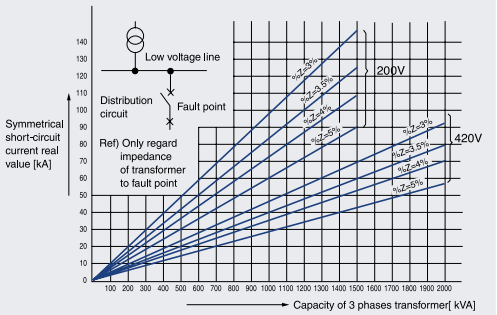
Disregard the impedance value of primary part of transformer. Calculate short-circuit current value according to <Fig.7>.
(If the impedance value of primary part of transformer is considered, calculate the current value as below formula)

$$I_A(R) = \frac{I_B}{\sqrt{(\%R_T)^2 + (\%X_1 + \%X_T)^2}} \times 100[A]$$

$$\%X_1 = \frac{P_B}{Q \times 10^3} \times 100\ [\%]$$

If the value of $\%R_T$ is not clear, $\%Z_T \fallingdotseq \%T_T$

$$I_A(R) = \frac{I_B}{\%X_1 + \%X_T} \times 100[A]$$



Ref 1) Calculation in the random voltage E Voltage line which is mostly close to E shall be selected to calculate it .
i.e. in case of 220V, (200V line value) ÷ 200/220

Ref 2) Calculation for a certain impedance Zt (%) Impedance line which is mostly close to Zt (%) shall be selected to calculate it.
i.e. 420V, Zt= 4.5%
%Z=4% Line value (or 5% line) × 4 (or 5)/4.5

Ref 3) When the value is out of lines or over 200VA or below 100kA, multiply 10 times to the calculated values.

<Fig.7> Transformer capacity and short-circuit current

Short-circuit current to motor

I_A (M)= 4 × Σ (Rated current of motor)

Symmetrical short-circuit current at point A

$I_A = I_A(R) + I_A(M)$

Decreasing coefficient caused by busduct

Obtaining the value of $\frac{l \cdot I_A}{10VT}$

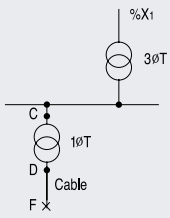
Calculate decreasing coefficient from <Fig.10>

Decreasing short-circuit current by reactance

When there's 1phase transformer in a certain circuit, calculate it in the base of reactance.
Regarding the reactance as pre-impedance at source part at point of <Fig.8>,

$$X_C = \frac{E_B}{\sqrt{3}\, I_C}$$

Reactance C~D: X_D[Ω] (impedance of 1 ø T)



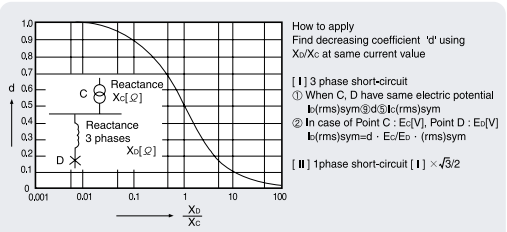
How to calculate short-circuit current value

Calculating the value of X_D/X_C and decreasing coefficient d from the reactance of <Fig.9>.
Current at point D $I_D = d \cdot I_C$

Impedance of 1 phase transformer $X_D = X\ (1\ \text{ø})\ \frac{1}{2}$

a. Short-circuit current at E_C voltage base
I_D (rms)sym · 3 ø = d · I_C (rms)sym · 3 ø

b. Short-circuit current at E_D voltage base
I_D (rms)sym · 3 ø = d · I_C (rms)sym · 3 ø × E_C/E_D



<Fig.9> Decreasing coefficient of short-circuit current by reactance: d

Coefficient d for cables

Calculating the value of $\frac{l\ I_D}{10V_T}$

Decreasing coefficient b value is calculated from <Fig.13>. For insulator drawn wrings, we can find the value directly from <Fig.13>.

Calculating symmetrical short-circuit current real value

I_F (rms)sym= b × I_D[D]

Various short-circuit current

In case of having short-circuit current power factor, find α, β, γ from <Fig.5>, If not find 3 values from <Table.1>

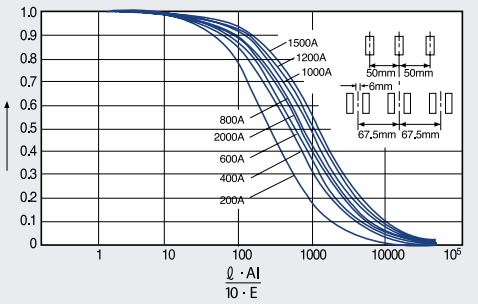
- 3 phases short-circuit asymmetrical current average value
  I_F (rms)ave= βI_F (rms)sym
- Maximum asymmetrical real value
  I_F (rms)ave= αI_F (rms)sym
- Maximum asymmetrical instantaneous value
  I_F (rms)ave= γI_F (rms)sym

<Table.2> α, β, γ values when short circuit power factor value is not definite.

Symmetrical short-circuit real value (A)	Variables		
	Maximum asymmetrical real value	3 phases short-circuit asymmetrical current average value	Maximum asymmetrical instantaneous value
2500	1.0	1.0	1.48
2501~5000	1.03	1.02	1.64
5001~1000	1.13	1.07	1.94
1001~15000	1.18	1.09	2.05
15001~25000	1.25	1.13	2.17
25000	1.33	1.17	2.29

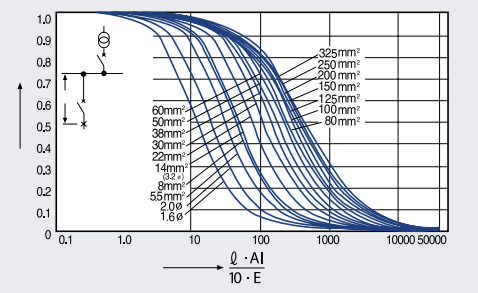
1 phase short-circuit

(Each current)= $\frac{\sqrt{3}}{2}$ × 3 phases short-circuit current × γ (or α)

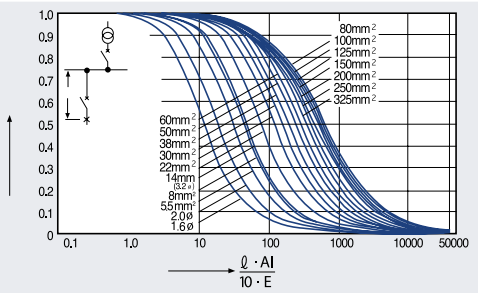


Busduct Ratings (A)	Material	General busduct			
		Size [mm] [Ω/m]	Resistance R [Ω/m]	Reactance X [Ω/m]	Impedance Z [Ω/m]
Cu	200	3×25	2.41×10^{-4}	1.312×10^{-4}	2.74×10^{-4}
	400	6×40	0.751×10^{-4}	1.02×10^{-4}	1.267×10^{-4}
	600	6×50	0.607×10^{-4}	0.91×10^{-4}	1.094×10^{-4}
	800	6×75	0.412×10^{-4}	0.72×10^{-4}	0.830×10^{-4}
	1000	6×100	0.315×10^{-4}	0.60×10^{-4}	0.678×10^{-4}
	1200	6×125	0.261×10^{-4}	0.516×10^{-4}	0.578×10^{-4}
	1500	6×150	0.221×10^{-4}	0.449×10^{-4}	0.500×10^{-4}
	2000	6×125×2	0.129×10^{-4}	0.79×10^{-4}	0.800×10^{-4}

<Fig.10> Decreasing coefficient of general busduct (Cu)



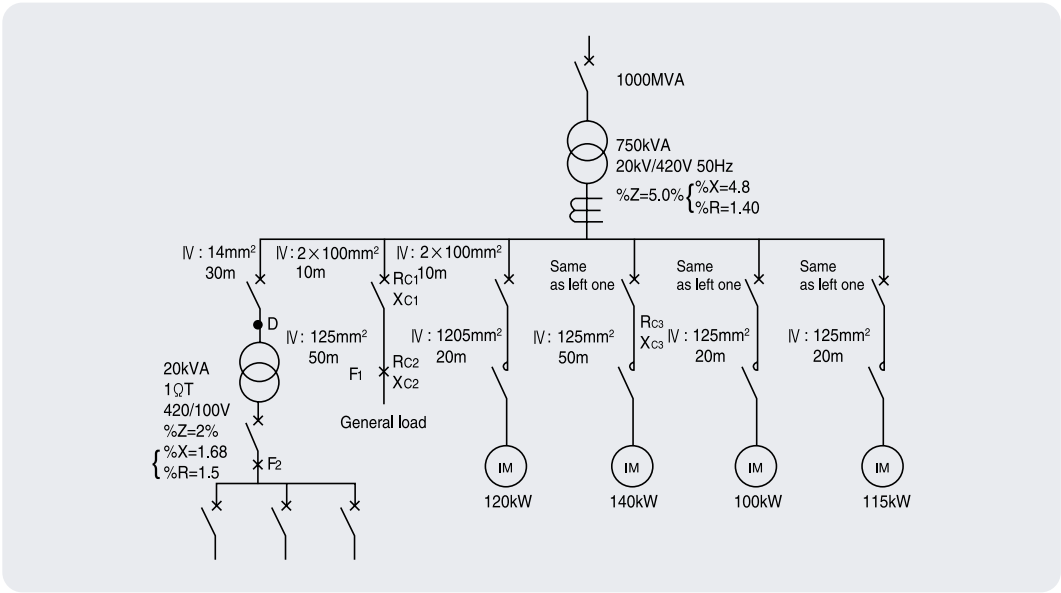
<Fig.11> Decreasing coefficient b in cable (600V IV)



<Fig.12> Decreasing coefficient b in cable (600V IV)

How to calculate short-circuit current value Calculation example

Calculation1) Short-circuit current value will be achieved by simple formula and percent impedance formula for <Fig.13>



<Fig.13>

Percent impedance formula

(1) Base value

$P_B = 750kVA$ $V_B = 420V$

$I_B = 1031A$ $Z_B = 0.237\ \Omega$

(2) Each impedance

a. Reactance at primary part of transformer

$$\%X_1 = \frac{750}{1000 \times 10^3} \times 100 = 0.075\ [\%]$$

b. Impedance of transformer

$\%R_T = 1.4\%$

$\%X_T = 4.8\%$

c. 1 ø Tr impedance

$$\%R_{T1} = \frac{1.15 \times 750}{20} \times \frac{1}{2} = 21.6\ [\%]$$

$$\%X_{T1} = \frac{1.68 \times 750}{20} \times \frac{1}{2} = 31.5\ [\%]$$

d. Reactance of transformer

$$\%X_{m1} = \frac{750}{120 \times 1.5} \times 25 = 104\ [\%]$$

$$\%X_{m2} = \frac{750}{140 \times 1.5} \times 25 = 89\ [\%]$$

$$\%X_{m3} = \frac{750}{100 \times 1.5} \times 25 = 125\ [\%]$$

$$\%X_{m4} = \frac{750}{115 \times 1.5} \times 25 = 108.7\ [\%]$$

e. Impedance of cable

Converting impedance of whole metal tube

[$2 \times 100mm^2$ 10m]

$$\%R_{C1} = \frac{0.00018 \times 10}{0.237} \times \frac{1}{2} \times 100 = 0.38\ [\%]$$

$$\%X_{C1} = \frac{0.00013 \times 10}{0.237} \times \frac{1}{2} \times 100 = 0.27\ [\%]$$

[$125mm^2$ 20m]

$$\%R_{C2} = \frac{0.00014 \times 20}{0.237} \times 100 = 1.18\ [\%]$$

$$\%X_{C2} = \frac{0.00013 \times 20}{0.237} \times 100 = 1.09\ [\%]$$

[$250mm^2$ 50m]

$$\%R_{C3} = \frac{0.00007 \times 50}{0.237} \times 100 = 1.47\ [\%]$$

$$\%X_{C3} = \frac{0.00013 \times 50}{0.237} \times 100 = 2.74\ [\%]$$

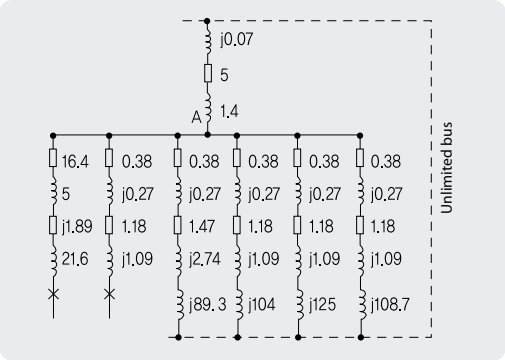
[$14mm^2$ 30m]

$$\%R_{C4} = \frac{0.00013 \times 30}{0.237} \times 100 = 16.45\ [\%]$$

$$\%X_{C4} = \frac{0.00015 \times 30}{0.237} \times 100 = 1.88\ [\%]$$

How to calculate short-circuit current value

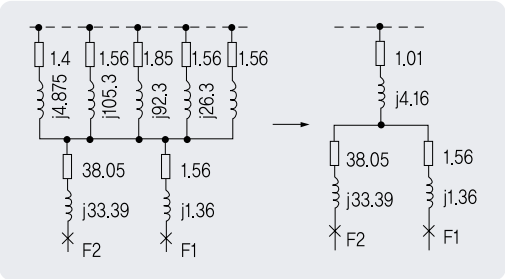
(3) Preparing a impedance map
Connect short-circuit supplier to the unlimited bus.



<Fig.14>

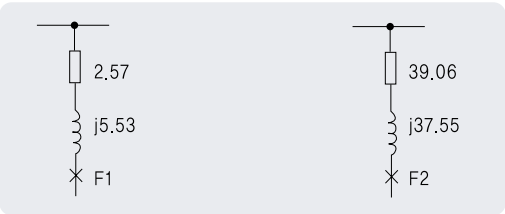
Calculating impedance

Calculate it in serial/parallel type formula



<Fig.15>

a. Fault point F_1 b. Fault point F_2



$\%Z_1 = \sqrt{(2.57)^2 + (5.53)^2} = 6.1[\%]$ $\%Z_2 = \sqrt{(39.06)^2 + (37.55)^2} = 54.2[\%]$

(5) Calculation of asymmetrical short-circuit current

a. Fault point F_1

I_{F1} (rms)sym $= \frac{1031}{6.1} \times 100 = 16900[A]$

$\cos \phi_1 = \frac{2.57}{6.1} = 0.422$

b. Fault point F_2 (1 phase circuit)

I_{F2} (rms)sym $= \frac{1031}{54.2} \times 100 = 1902[A] \cdots$ (at 100V)

$= \frac{1031}{54.2} \times 100 \times \frac{420}{100} = 7989[A] \cdots$ (at 420V)

I_{F2} (rms)sym is short-circuit current. Therefore, convert it into 1 phase short-circuit current.

I_{F2} (rms)1 Ω sym $= 7989 \times \frac{\sqrt{3}}{2} = 6919[A]$

$\cos \phi_2 = \frac{39.06}{54.2} = 0.72$

(6) Various short-circuit current
Calculate α, β, γ from <Fig.5>.

a. Fault point F_1
$\cos \phi_1 = 0.422$
$\alpha = 1.05$ $\beta = 1.3$ $\gamma = 1.74$
I_{F1} (rms)ave $= 1.03 \times 16900 = 17407$ [A]
I_{F1} (rms)asym $= 1.05 \times 16900 = 17745$ [A]
I_{F1}max $= 1.74 \times 16900 = 29406$ [A]

b. Fault point F_2
$\cos \phi_2 = 0.72$
$\alpha = 1.0$ $\beta = 1.48$
$I_{F2}1\phi$ (rms)asym $= 1.0 \times 6919$ [A]
$I_{F2}1\phi$ max $= 1.48 \times 6919 = 10240$ [A]

Simple calculation formula

(1) Base value
$P_B = 750$kVA $V_B = 420$V
$I_B = 1031$A $Z_B = 0.237\ \Omega$

(2) Short-circuit current of incoming circuit
Disregard the impedance of primary part of transformer
In <Fig.7> $I_{A(R)} = 20500$ A

(3) Short-circuit current of motor
Sum of motor capacity=
$(120+140+100+115) \times 1.5 = 713$ [kVA]

$I_{A(M)} = \frac{713}{\sqrt{3} \times 420} \times 4 = 3920$ [A]

(4) Symmetrical short-circuit current at point A
$I_A = 20500+3920 = 24420$ [A]

How to calculate short-circuit current value Calculation example

(5) Decreasing short-circuit current for cable

a. At point F_1

• $2 \times 100mm^2$ 10m

$2 \times 100mm^2$ 10m= $100mm^2$ 5m

$$\frac{l}{10E} I_A = \frac{20 \times 24420}{10 \times 420} = 29.1$$

Coefficient b= 0.935

Short-circuit current value at point C

Ic (rms)sym= 0.935×24420= 22850 [A]

• $125mm^2$ 20m

$$\frac{l}{10E} I_C = \frac{20 \times 22850}{10 \times 420} = 108.9$$

I_{F1} (rms) sym= 0.785×244850= 17940 [A]

b. At point F_1

• $14mm^2$ 30m

$$\frac{l}{10E} I_C = \frac{30 \times 24420}{10 \times 420} = 174.4$$

Coefficient b= 0.249

I_D (rms)3 ø sym= 0.24×24420= 6080 [A]

• Decreasing by the reactance (1 ø Tr)dp

Convert the value of '%X of 1 ø Tr' to base capacity

X_D= $750 \times 2/20$= 75%

Impedance of primary part at 1 ø Tr

$$XA = \frac{I_B}{I_D} \times 100 = \frac{1031}{6080} \times 100[\%]$$

Convert X_D to equivalent 3 phases, and

$$\frac{X_D/2}{X_A} = \frac{750 \times 2 \times 6080}{20 \times 2 \times 1031 \times 100} = 2.21$$

Coefficient d of <Fig.9> d= 0.32

I_{F2} (rms)3 ø sym= 0.32×6080=1945[A] (400V)

= $0.32 \times 6080 \times 420/100$

= 817 [A] (100V)

$\therefore$ I_{F2} (rms)1 ø sym= $8171 \times \frac{\sqrt{3}}{2}$ = 7076 [A]

(6) Various short-circuit current

Find α, β, γ from <Table.1>

a. At point F_1

α= 1.25 β = 1.13 γ = 2.17

IF1 (rms)ave= 1.13×17940= 20272 [A]

IF1 (rms)asym= 1.25×17940= 22425 [A]

IF1max= 2.17×17940= 38930 [A]

b. At point F_2

α= 1.13 γ= 1.94

IF21 ø (rms)asym= 1.13×7076= 7945 [A]

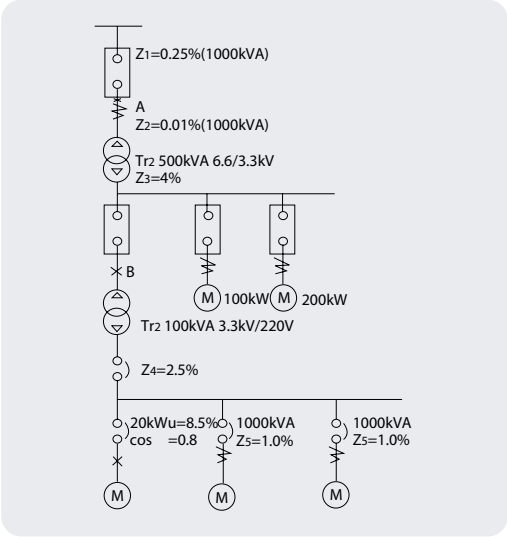
IF21 ø max= 1.94×7076= 13727 [A]

<Table.2> Comparison of short-circuit

Fault point		F_1	F_2
Symmetrical short-circuit current real value	Percent impedance calculation value	16900A	6919A
	Simple formula calculation value	17940A	7076A
		106%	102%
3 phases average asymmetrical current real value	Percent impedance calculation value	17407A	-
	Simple formula calculation value	20272A	-
		116%	-
Maximum asymmetrical current real value	Percent impedance calculation value	17745A	6919A
	Simple formula calculation value	22425A	7995A
		126%	115%

How to calculate short-circuit current value

Short-circuit current value will be achieved by simple formula for <Fig.16>



<Fig.16>

(1) Calculate rated current at each point

① Rated current I_{nA} at point A

$$I_{nA}=\frac{500[kVA]\times1000}{\sqrt{3}\times6.6[kV]\times1000}=43.7[A]$$

② Rated current I_{nB} at point B

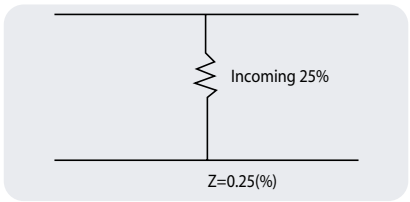
$$I_{nB}=\frac{100[kVA]\times1000}{\sqrt{3}\times3.3[kV]\times1000}=17.5[A]$$

$$I_{nC}=\frac{20[kW]\times1000}{\sqrt{3}\times220[V]\times0.85\times0.8}=77.2[A]$$

(2) Put 1000k VA for base capacity and calculate short-circuit current at each point.

① Short-circuit current I_{SA} at point A

a) Impedance Map



b) Short-circuit I_{SA}

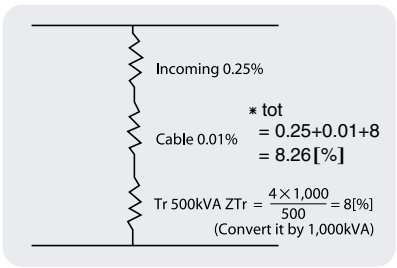
$$I_{SA}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times6.6[kV]\times1000\times0.25\%}=34990[A]$$

∗ Breaking capacity of breaker [MVA]
MVA= 3 short-circuit current[kA] line to line voltage[kV]

② Short-circuit current at point B: I_{SB}

a) Impedance Map

∗ Serial sum of impedance
Ztot= 0.25+0.01+8= 8.26[%]



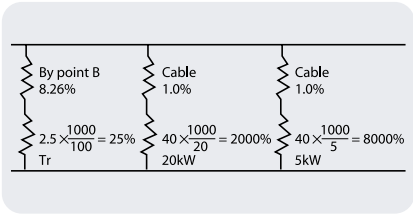
b) Short-circuit current I_{SC}

$$I_{SB}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times3.3[kV]\times1000\times8.26}=2118[A]$$

∗ Breaking capacity of breaker [MVA]
MVA= $\sqrt{3}$ short-circuit current [kA] line to line voltage[kV]

③ Short-circuit current at point C: I_{SC}

a) Impedance Map



∗ Parallel sum of impedance

$$Z=\frac{1}{\frac{1}{33.26}+\frac{1}{2001}+\frac{1}{8001}}=32.58\ [\%]$$

b) Short-circuit current I_{SC}

$$I_{SC}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times220[V]\times32.58[\%]}=8055\ [A]$$

Calculation formula

Rated current $In=\frac{\text{Transformer capacity}}{\sqrt{3}\times\text{Rated voltage}}$

Short-circuit current $Is=\frac{\text{Transformer capacity}\times100}{\sqrt{3}\times\text{Rated voltage}\times\%Z}$

How to calculate short-circuit current value
Combination of transformer and impedance

<Table. 3> Combination of transformer and impedance

Transformer / Impedance	3 phases transformer											
	6.3kV/210V Oil Tr.			6.3kV/210V Mold Tr.			20kV/420V Mold Tr.			20kV/420V Oil Tr.		
Transformer capacity (VA)	ZT[%]	RT[%]	XT[%]	ZT[%]	RT[%]	XT[%]	ZT[%]	RT[%]	XT[%]	ZT[%]	RT[%]	XT[%]
20	2.19	1.94	1.03									
30	2.45	1.92	1.53	4.7	2.27	4.12						
50	2.47	1.59	1.89	4.7	1.94	4.28						
75	2.35	1.67	1.66	4.4	1.56	4.11						
100	2.54	1.65	1.96	4.6	1.5	4.24						
150	2.64	1.64	2.07	4.2	1.29	4.0						
200	2.8	1.59	2.31	4.5	1.17	4.35						
300	3.26	1.46	2.92	4.5	1.2	4.33						
500	3.61	1.33	3.36	4.7	0.08	4.69	5.0	1.56	4.76	6.0	1.0	5.92
750	4.2	1.55	3.9	6.0	0.8	5.95	5.0	1.40	4.80	6.0	0.9	5.93
1000	5.0	1.35	4.82	7.0	0.7	6.96	5.0	1.26	4.84	6.0	0.8	5.95
1500	5.1	1.22	4.95	7.0	0.6	6.97	5.5	1.2	5.37	7.0	0.75	6.96
2000	5.0	1.2	4.85	7.5	0.65	7.47	5.5	1.1	5.39	7.0	0.7	6.96

<Table. 4> Example of transformer impedance

Transformer / Impedance	1 phase transformer					
	6.3kV/210V Oil Tr.			6.3kV/210V Mold Tr.		
Transformer capacity (VA)	ZT[%]	RT[%]	XT[%]	ZT[%]	RT[%]	XT[%]
10				14.9	14.9	0.268
20				14.0	14.0	0.503
30				14.8	14.8	0.523
50				13.6	13.6	0.494
75				11.0	11.0	0.558
100				8.87	8.85	0.562
200				7.70	7.68	0.571
300				5.75	5.69	0.619
500				5.08	4.97	1.05
750				5.05	4.92	1.16
1000				4.03	3.93	0.904
2000				4.55	4.50	0.637
3000				4.29	4.22	0.768
5000				3.26	3.18	0.725
7500				2.72	2.81	0.775
10000	2.5	2.07	1.40	2.33	2.18	0.823
15000	2.37	1.84	1.49	2.04	1.82	0.937
20000	2.57	1.76	1.87	1.90	1.60	1.02
30000	2.18	1.58	1.50			
50000	2.05	1.47	1.42			
75000	2.27	1.46	1.74			
100000	2.48	1.49	1.98			
150000	3.39	1.31	3.13			
200000	3.15	1.31	2.87			
300000	2.23	1.28	2.96			
500000	4.19	1.09	4.03			

<Table. 5> Example of cable impedance (600 vinyl cable)

Cable dimension	Impedance of cable 1m (Ω)			
	Internal insulation wiring or cable of steel tube and duct	Internal vinyl tube wiring of steel tube and duct	Insulator wiring in building	Resistance (Ω) / cable 1meter
ø 1.6mm	0.00020	0.00012	0.00031	0.0089
ø 2mm				0.0056
ø 3.2mm				0.0022
5.5mm²				0.0033
8mm²				0.0023
14mm²	0.00015	0.00010	0.00026	0.0013
22mm²				0.00082
30mm²				0.00062
38mm²				0.00048
50mm²	0.00013	0.00009	0.00022	0.00037
60mm²				0.00030
80mm²				0.00023
100mm²				0.00018
125mm²				0.00014
150mm²				0.00012
200mm²				0.00009
250mm²				0.00007
325mm²				0.00005

<Remark1> At 60Hz, the reactance multiply 2 times itself, so 1/2 reactance of primary part can achieve IB.

<Remark2> When the cable is parallelly 2 or 3ea, reactance and resistance can be calculated in the condition of 1/3 and 1/3 length cable.

How to calculate short-circuit current value
Various short-circuit

<Table.6> Impedance sample of bus and busduct (50Hz)

[$\times 10^{-4}$ Ω/m]

Ampere rating (A)	50Hz			60Hz		
	R	X	Z	R	X	Z
600	1.257	0.323	1.297	1.385	0.387	1.438
800	0.848	0.235	0.879	0.851	0.282	0.896
1000	0.641	0.185	0.667	0.645	0.222	0.682
1200	0.518	0.152	0.540	0.523	0.183	0.554
1350	0.436	0.129	0.454	0.443	0.155	0.469
1500	0.378	0.113	0.394	0.386	0.135	0.409
1600	0.360	0.107	0.375	0.367	0.128	0.389
2000	0.286	0.084	0.298	0.293	0.101	0.310
2500	0.218	0.065	0.228	0.221	0.078	0.235
3000	0.180	0.054	0.188	0.184	0.064	0.195
3500	0.143	0.042	0.149	0.146	0.051	0.155
4000	0.126	0.038	0.131	0.129	0.045	0.136
4500	0.120	0.036	0.125	0.122	0.043	0.130
5000	0.095	0.028	0.099	0.098	0.034	0.103

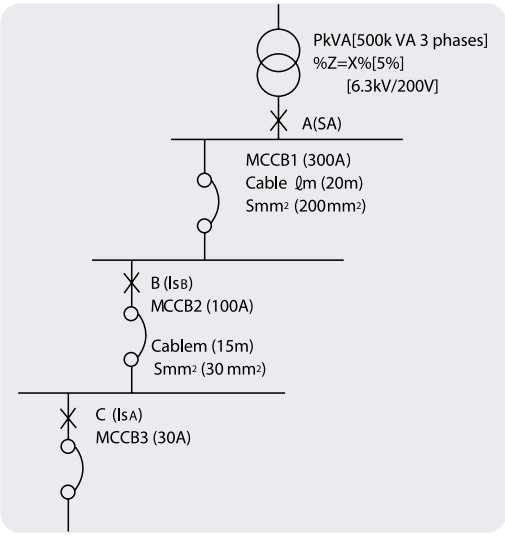
<Table.6> Impedance sample of Bus and busduct (50Hz)

[$\times 10^{-4}$ Ω/m]

Ampere rating (A)	50Hz			60Hz		
	R	X	Z	R	X	Z
600	0.974	0.380	1.045	0.977	0.456	1.078
800	0.784	0.323	0.848	0.789	0.387	0.879
1000	0.530	0.235	0.580	0.536	0.282	0.606
1200	0.405	0.185	0.445	0.412	0.222	0.468
1350	0.331	0.152	0.364	0.338	0.183	0.384
1500	0.331	0.152	0.364	0.338	0.183	0.384
1600	0.282	0.129	0.311	0.289	0.155	0.328
2000	0.235	0.107	0.259	0.241	0.128	0.273
2500	0.166	0.076	0.182	0.169	0.091	0.192
3000	0.141	0.065	0.155	0.144	0.078	0.164
3500	0.122	0.056	0.135	0.127	0.068	0.143
4000	0.110	0.051	0.121	0.113	0.061	0.126
4500	0.094	0.043	0.104	0.096	0.052	0.109
5000	0.082	0.038	0.091	0.084	0.045	0.096
5500	0.078	0.035	0.086	0.080	0.043	0.091
6500	0.068	0.028	0.074	0.071	0.031	0.077

How to calculate short-circuit current value
Calculation example

Using a certain graph, you can find and calculate the short-circuit current value which is at one position of network. No matter the condition of network is different, you can do the calculation through adjusting variables.



Graph note

P coordinates – Transformer capacity (kVA)
Is_1 coordinates – Short-circuit current value (kA)
Is_2 coordinates – Short-circuit current value affected cable condition (kA)
ⓐ Line - % impedance of transformer (%)
ⓑ Line - Length of cable (m)
ⓒ Line - Square mm of cable (mm^2)
ⓓ Line - Is_2 (kA)

Remark) ⓒ line shows the length of hard vinyl cable (600V IV)

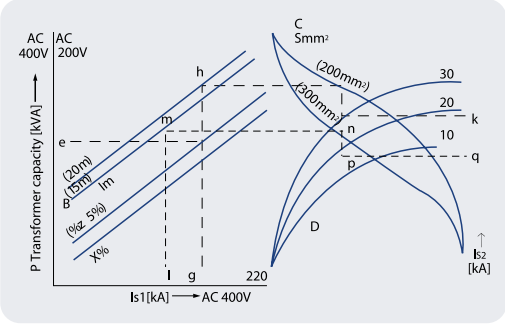
How to calculate short-circuit current value

(1) 3 phases transformer
① Short-circuit current value at (A) where it is just below transformer. At P coordinates, find the coordinates value (g) of the cross point (f) which is from transformer capacity (e) and A line. Disregard primary part impedance of transformer.
② Find the short-circuit current value at Point B, C which are considered cable impedance.
- At short-circuit current g (kA) of Is_1 coordinates, find the value (h) of B line
- Move (h) to parallel direction of Is, and find the cross point (i) to C line.
- Move (i) to parallel direction of Is_2, and find the cross point value (j) to D line (g), finally find (k) of Is_2

(2) 1 phase transformer
① Short-circuit current value where it is just below transformer. Find the value as same as that of 3 phase transformer and multiply it 3 times. (g'kA)
② Find the short-circuit current value where it is considered cable impedance.
- Multiply 2/3 times to g' of Is coordinates
- Find the Is_2 value as same as that of 3 phase transformer and multiply it 3/2 times.

Remark

1. It's not considered the transformer contribution. Multiply 4 times the rated current of transformer in cases.
2. The real short-circuit current value is littler lower that its calculated value by the way we suggest because we take the rated voltage as AC200V, 400V. So the current value should be calculated in the consideration of stability
3. The calculated value is symmetrical real value.



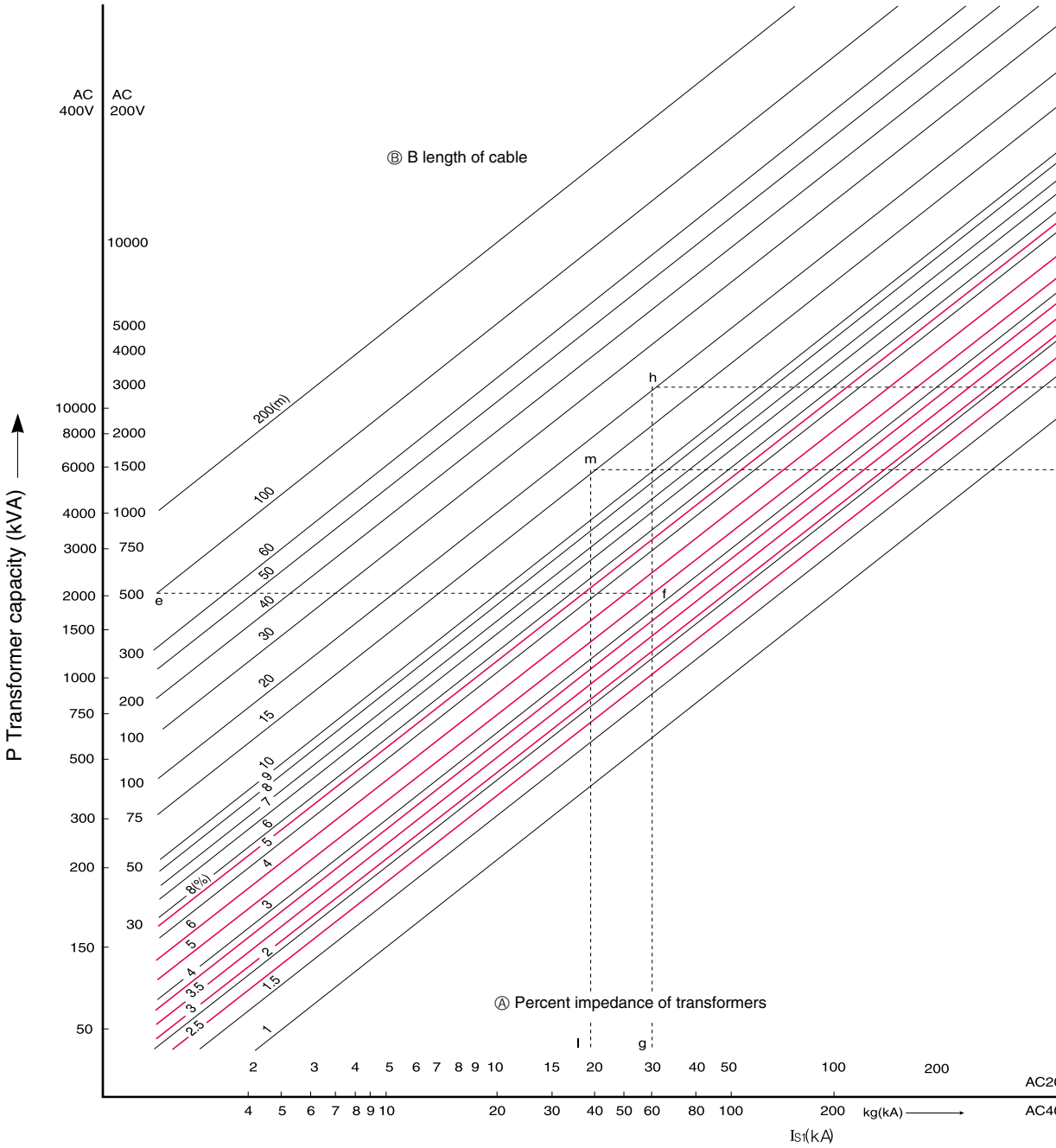
How to calculate short-circuit current value
Calculation graph

(1) Short-circuit current value at point A (I_{SA})

- At P coordinates, find (f) which is the point which is to match transformer capacity 500kVA and A line. Then move (f) to Is_1 direction and finally find (g).
- I_{SA}= 29kVA (g)

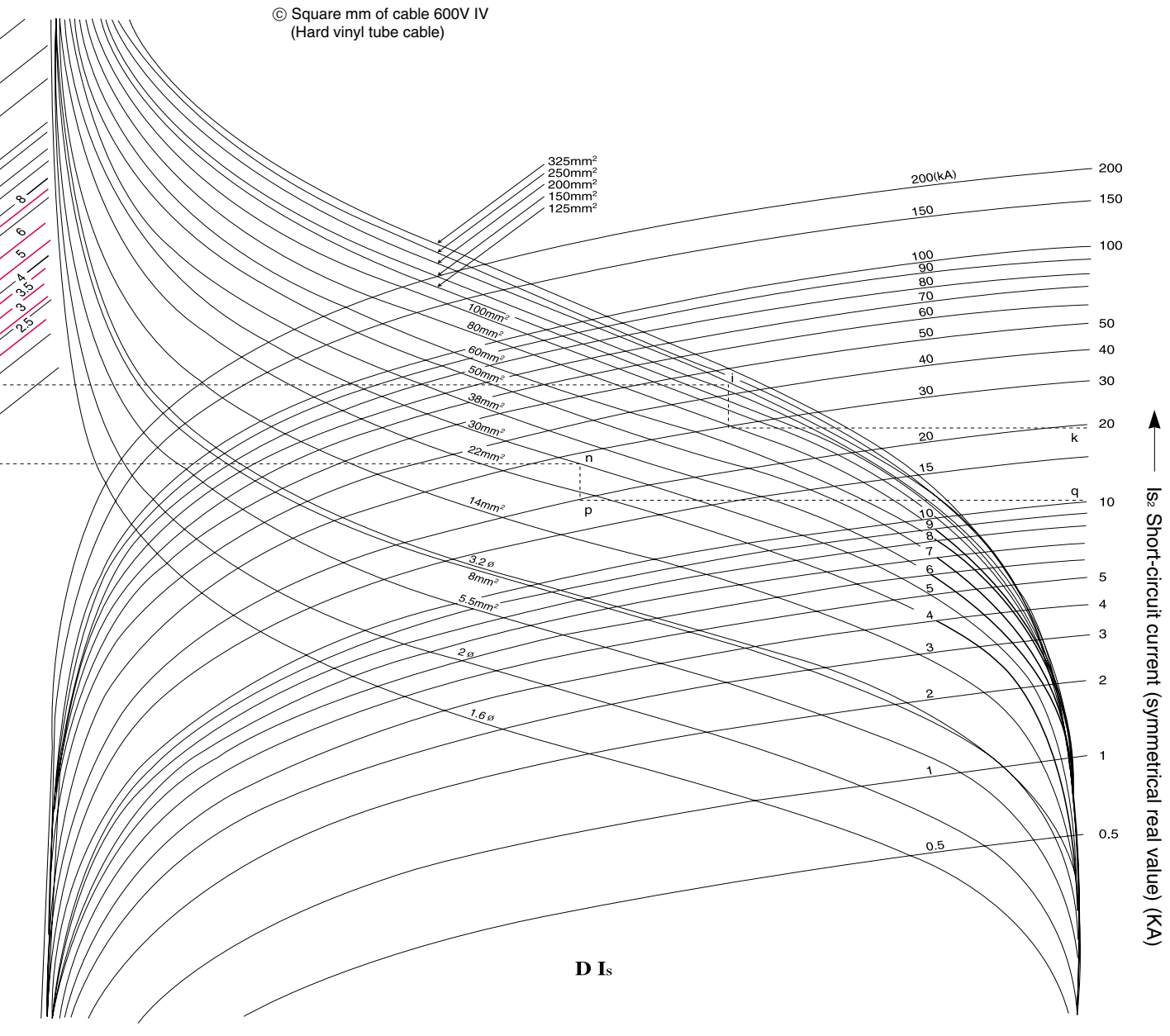
(2) Short-circuit current value at point B (I_{SB})

- Find value h of B line (20mm) at g (= 29kA) of Is_1 coordinates
- Move h parallely to the direction of Is_1, and find value I at the cross point with C line (200mm)
- Move I parallely to the direction of Is_2, and find value j at the cross point with D line (g= 29kA)
- I_{SB}= 19kA (k)



(3) Short-circuit current value at point C (I_{sc})

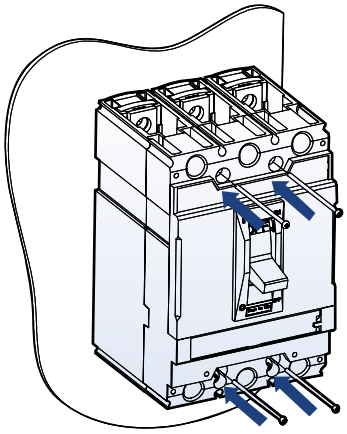
- Find Is_1 coordinates value (19kA) of short-circuit current value k (= 19kA) at Point B. and find cross point m between 19kA and B line.
- Move m parallely to the direction of Is_1 coordinates, and find the cross point n at C line (30mm).
- Move n parallely to the direction of Is_1 and find the cross point p of $Is_2$with D line.
- Isc= 10kA (g)

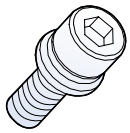


A-5. Mounting & Connection

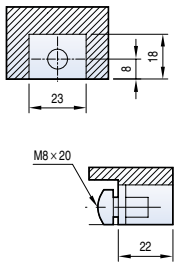
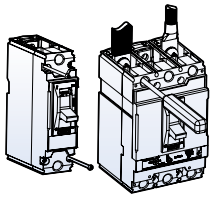
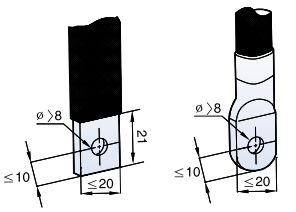
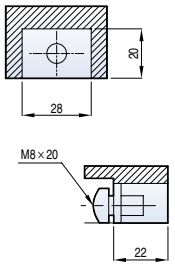
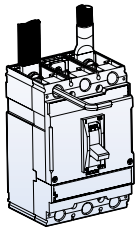
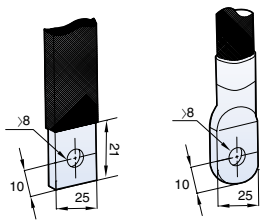
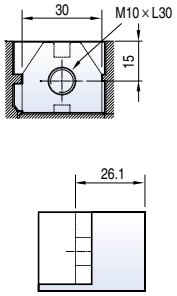
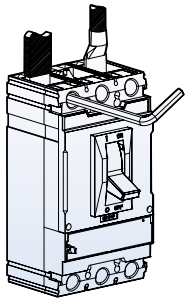
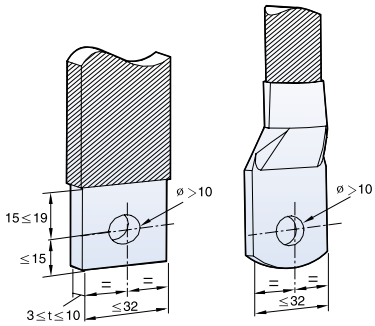
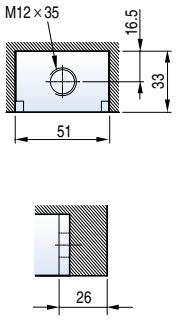
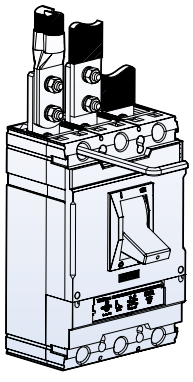
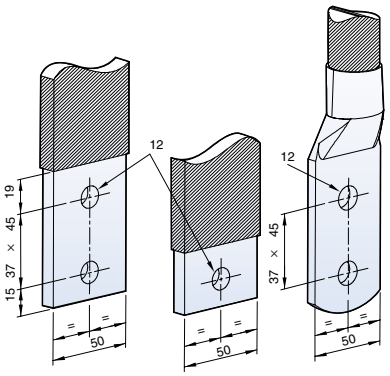
Fixed mounting

Susol TD and TS circuit-breakers can be directly connected to the mounting plate.
If busbars or terminals are used to connect the circuit breaker
on the back of the mounting plate,
the appropriate safety clearances must be observed.



	TD100, TD160	TS100,TS160, TS250	TS400, TS630	TS800
Screw for mounting	 1Pole:2EA(M3×75) 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)
Nut for mounting	-	-	 3Pole:4EA 4Pole:4EA	 3Pole:4EA 4Pole:4EA
Screw for connection of terminals, Spreader	 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

Connecting terminal & conductor

		Terminal (mm)	Conductor (mm)
TD100 TD160		 Max 78kgf · cm	
TS100 TS160 TS250		 Max 147kgf · cm	
TS400 TS630		 Max 490kgf · cm	
TS800		 Max 630kgf · cm	

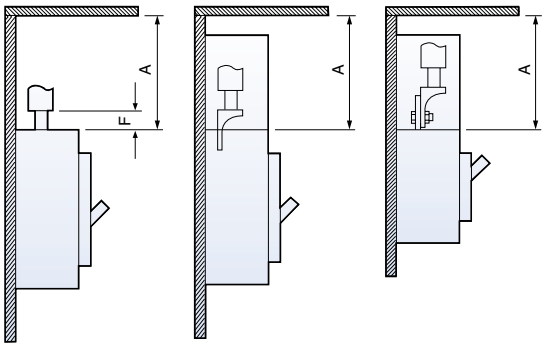
Safety clearance

When installing a circuit breaker, safety clearances must be kept between the breaker and panels, bars and other protection devices installed nearby. These safety clearances are depend on the ultimate breaking capacity and are defined by tests carried out in accordance with standard IEC 60947-2.

When a short circuit interruption occur, high temperatures pressures are present in and above the arc chambers of the circuit-breaker. In order to allow the pressure to be distributed and to prevent fire and arcing or short-circuit currents, safety clearances are required.

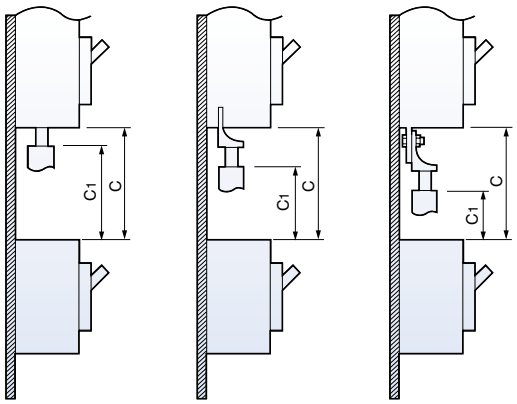
A: Insulation distance to ceiling for installation in metallic cubicle

	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



C1: Minimum distance for superimposed circuit breakers
(from lower circuit breaker to uninsulated part of terminal of upper circuit breaker)
C: C1+ the dimension of exposed conducting part (The dimension of exposed conduct)

	C1(mm)		C(mm)
	415V	240V	
TD100N, TD160N	35	30	The dimension of exposed conduct
TD100H, TD160H	35	30	
TD100L, TD160L	35	30	
TS 100N, 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	



Direct connection of cable

Connection by using a cable terminal or ring terminal

Connection by using a cable terminal with extended terminal

Safety clearance

D: Insulated length of main terminal of circuit breaker

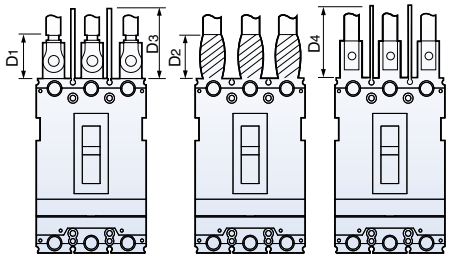
D1: Connection by ring terminal after taping
(Larger than the dimension of exposed conducting part)

D2: Connection by bar after taping

D3: Connection by ring terminal using insulation barrier
(Larger than the dimension of exposed conduct

D4: Connection by bar using insulation barrier

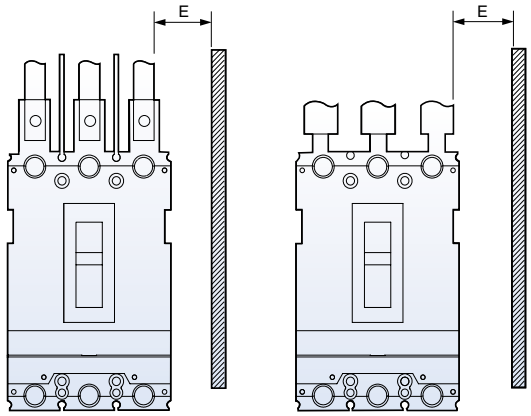
	D1 (mm)	D2 (mm)	D3 (mm)	D4 (mm)
TD100N, TD160N	The dimension of exposed conduct + 20	50	The dimension of exposed conduct + 20	50
TD100H, TD160H		50		50
TD100L, TD160L		50		50
TS100N, TS160N, TS250N		100		100
TS100H, TS160H, TS250H		100		100
TS100L, TS160L, TS250L		100		100
TS400N, TS630N		100		100
TS400H, TS630H		200		200
TS400L, TS630L		200		200
TS800N		100		100
TS800H		200		200
TS800L		200		200



Note) If uninsulated conductors are used for connection, please insulate by taping to the point where the conductors overlap with the insulation barrier or to the root of the circuit breaker.

E: Distance from a side of breaker to side plate

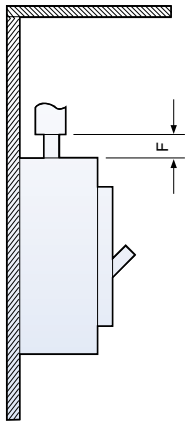
	E(mm)	
	415V	240V
TD100N, TD160N	25	15
TD100H, TD160H	25	15
TD100L, TD160L	25	15
TS100N, TS160N, TS250N	25	15
TS100H, TS160H, TS250H	25	15
TS100L, TS160L, TS250L	25	15
TS400N, TS630N	20	15
TS400H, TS630H	20	15
TS400L, TS630L	20	15
TS800N	45	20
TS800H	45	20
TS800L	45	20



Safety clearance

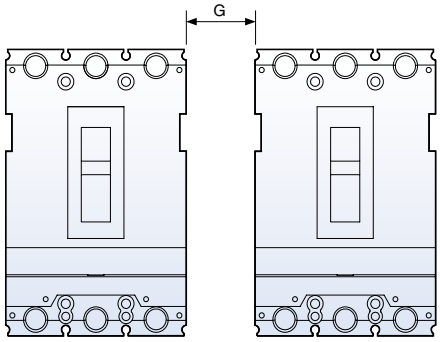
F: The dimension of exposed conducting part

	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



G: Minimum center distance for two horizontally installed circuit-breakers

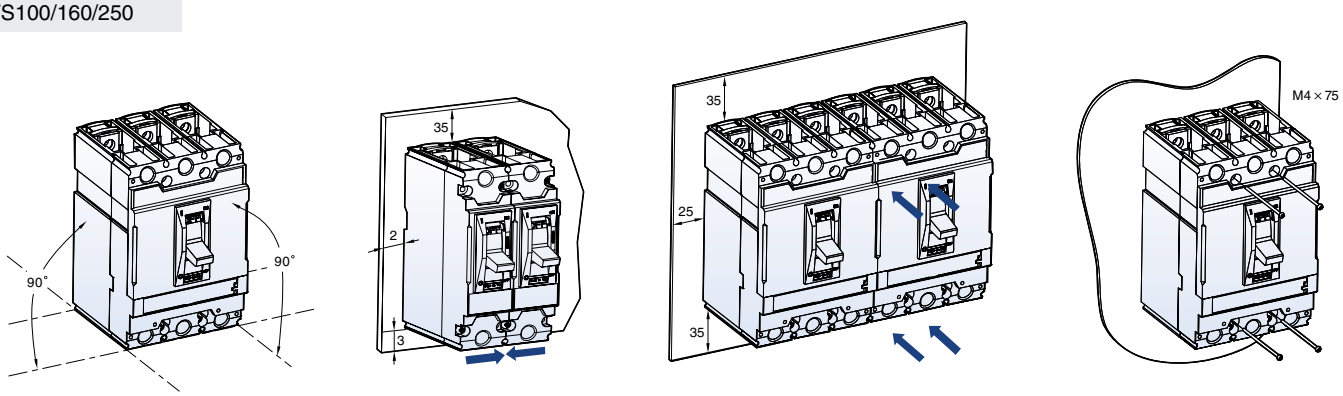
	G (mm)
TD100N, TD160N	0
TD100H, TD160H	0
TD100L, TD160L	0
TS100N, TS160N, TS250N	0
TS100H, TS160H, TS250H	0
TS100L, TS160L, TS250L	0
TS400N, TS630N	0
TS400H, TS630H	0
TS400L, TS630L	0
TS800N	0
TS800H	0
TS800L	0



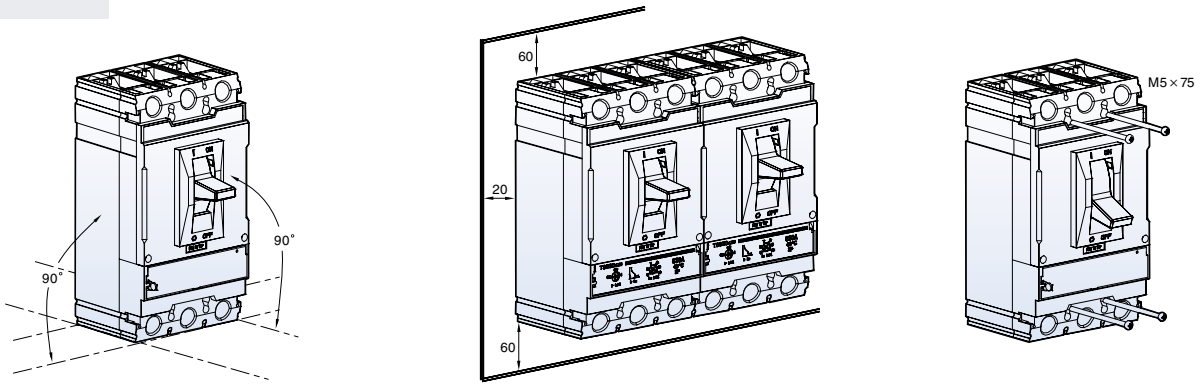
Note) In case of using long or short terminal covers.

Example of installation

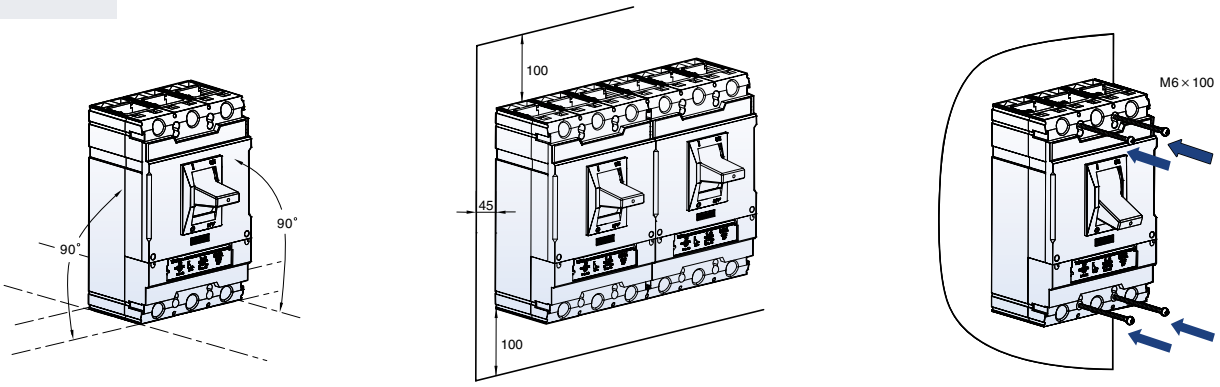
TD100/160
TS100/160/250



TS400/630



TS800



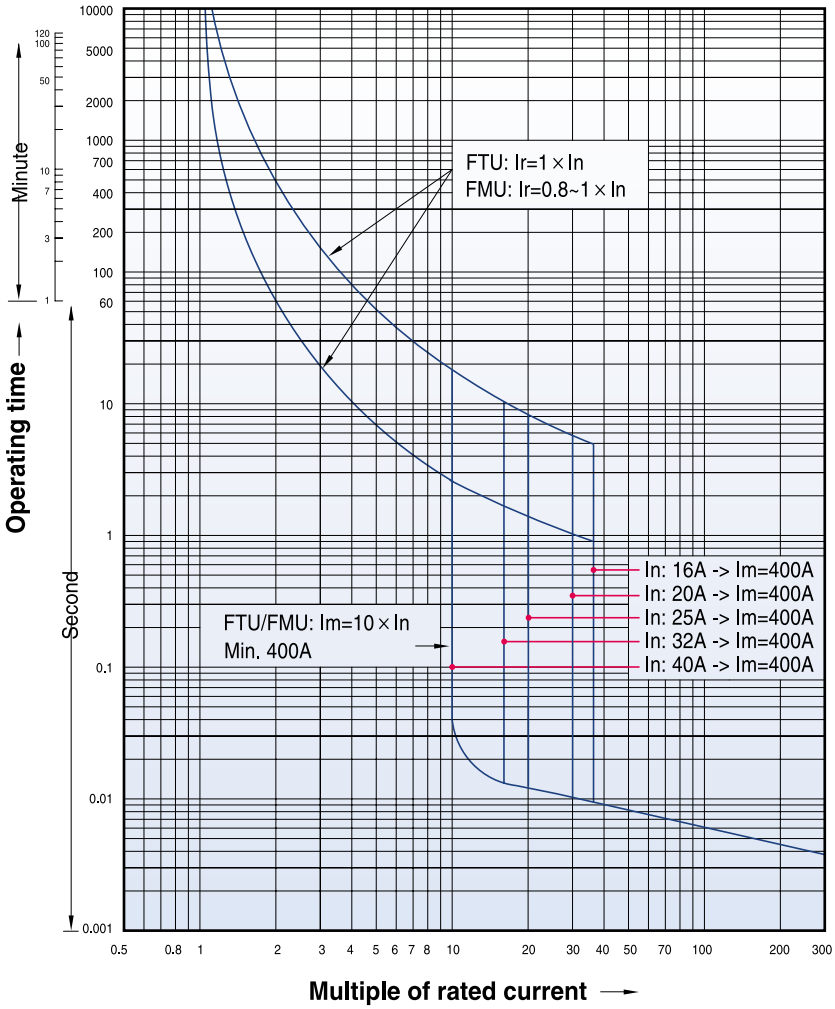
Note) In case of using long or short terminal covers,
no need to consider on minimum center distance for two horizontally installed circuit-breakers

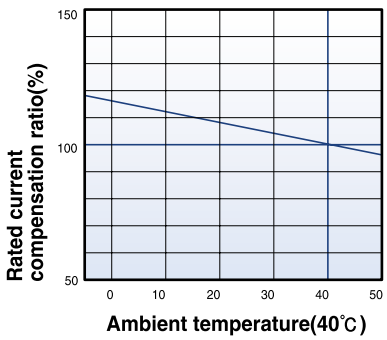
A-6. Characteristics curves

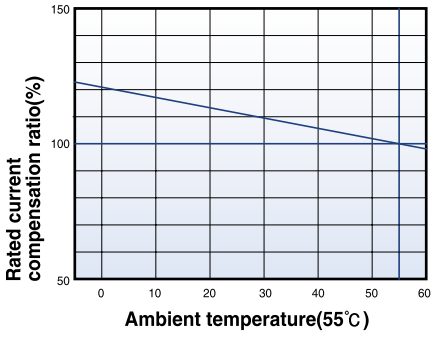
Circuit breakers with thermal-magnetic trip units

TD100

FTU
FMU
16~100A







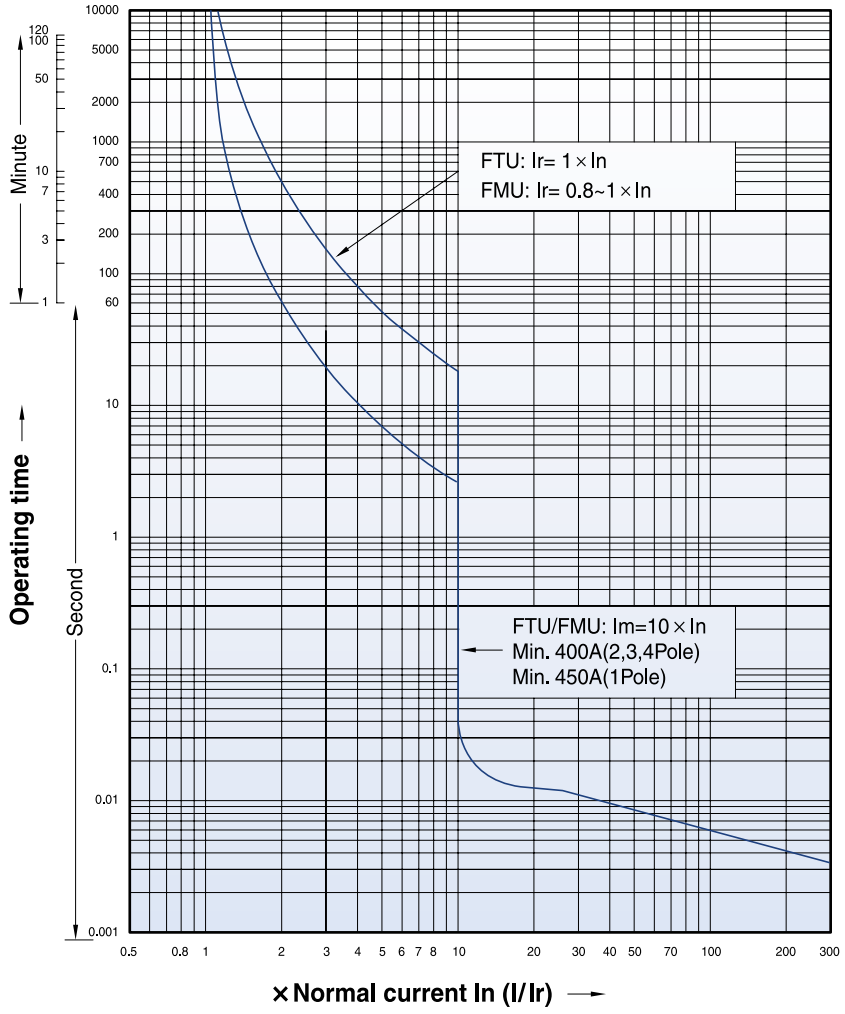
Circuit breakers with thermal-magnetic trip units

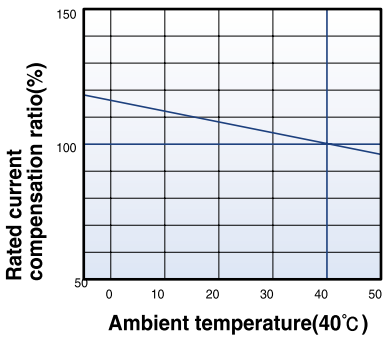
TD160

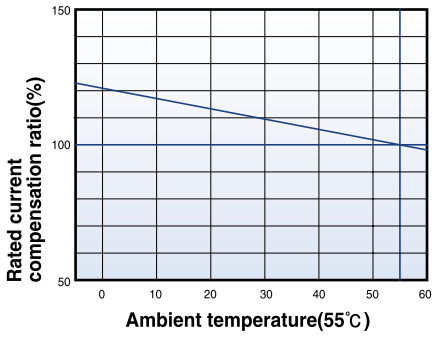
FTU

FMU

100~160A







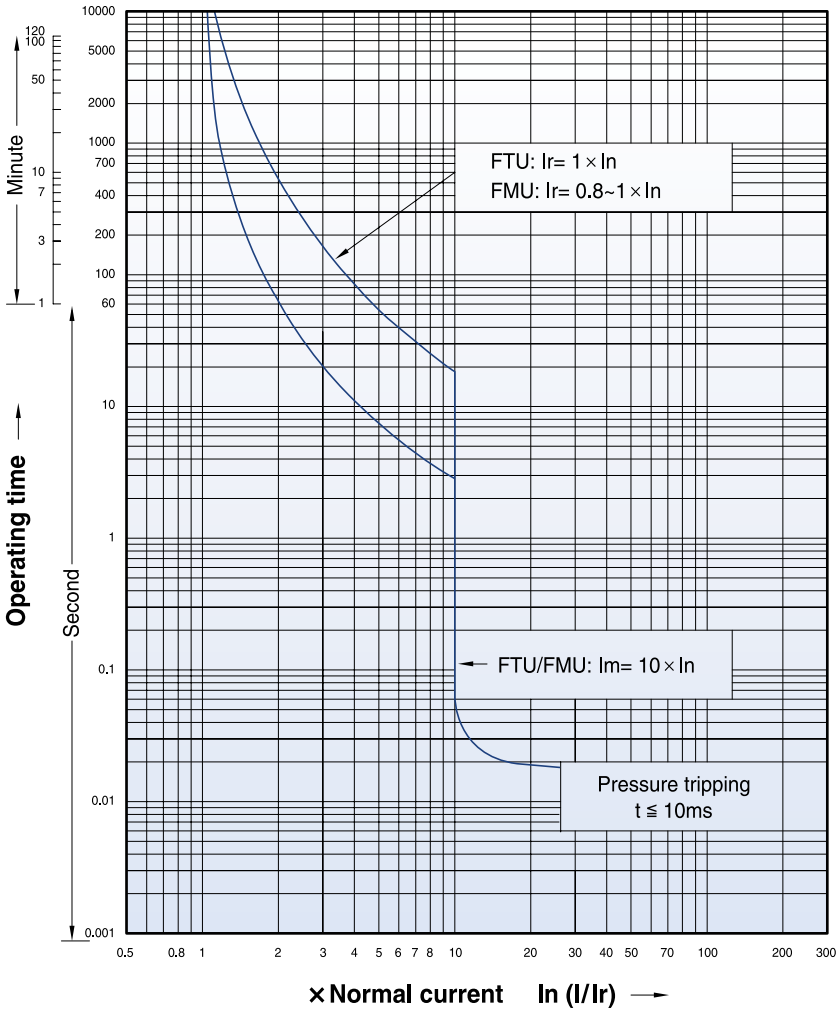
Circuit breakers with thermal-magnetic trip units

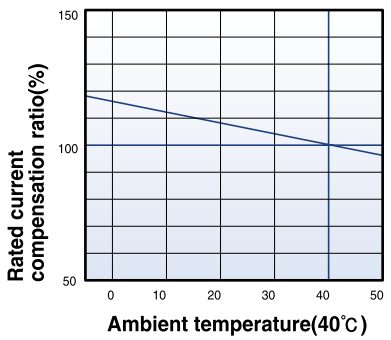
TS100

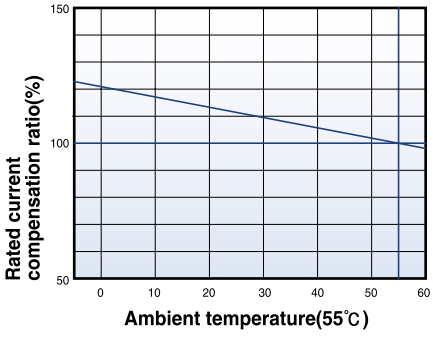
FTU

FMU

40~100A







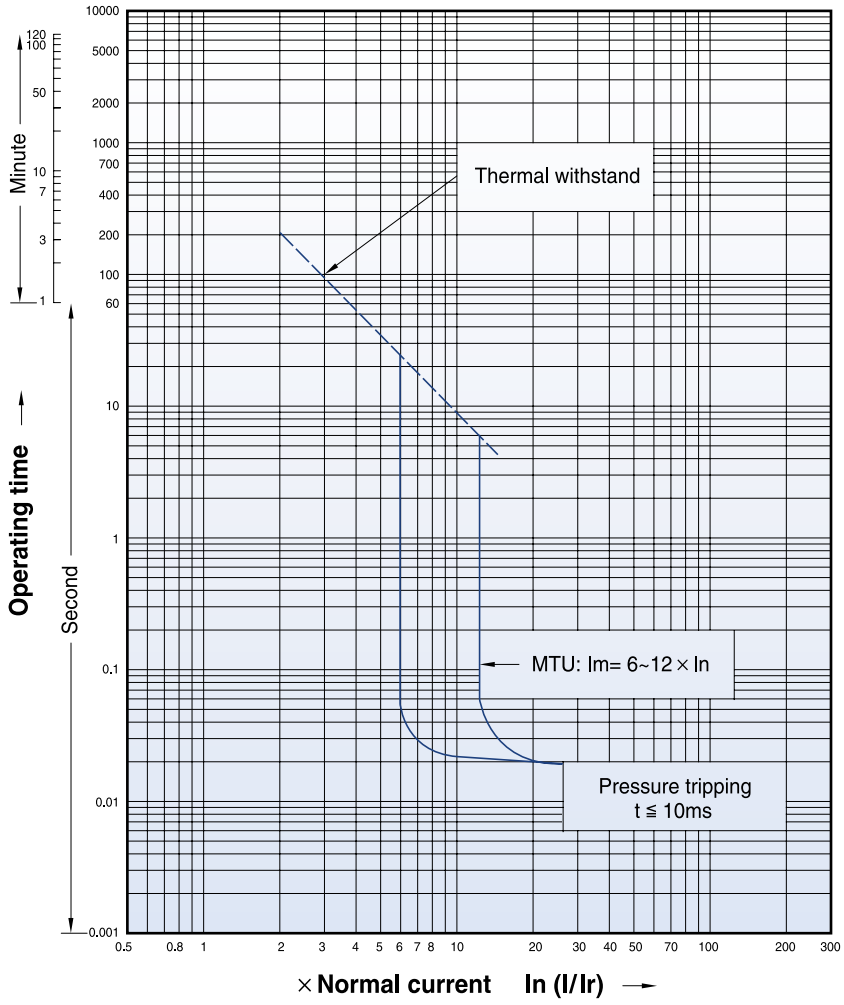
Circuit breakers with magnetic only trip units

TS100

Magnetic only
MTU
1.6~100A

TS160

Magnetic only
MTU
32~160A



Magnetic trip units(MTU)

Rating(A)		In	TS100 to TS800													
			1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
	N / H / L	TS100	●	●	●	●	●	●	●	●	●	-	-	-	-	-
		TS160	-	-	-	-	-	●	●	●	●	●	-	-	-	-
		TS250	-	-	-	-	-	-	-	-	●	●	●	-	-	-
		TS400	-	-	-	-	-	-	-	-	-	-	-	●	-	-
		TS630	-	-	-	-	-	-	-	-	-	-	-	-	●	-
		TS800	-	-	-	-	-	-	-	-	-	-	-	-	-	●

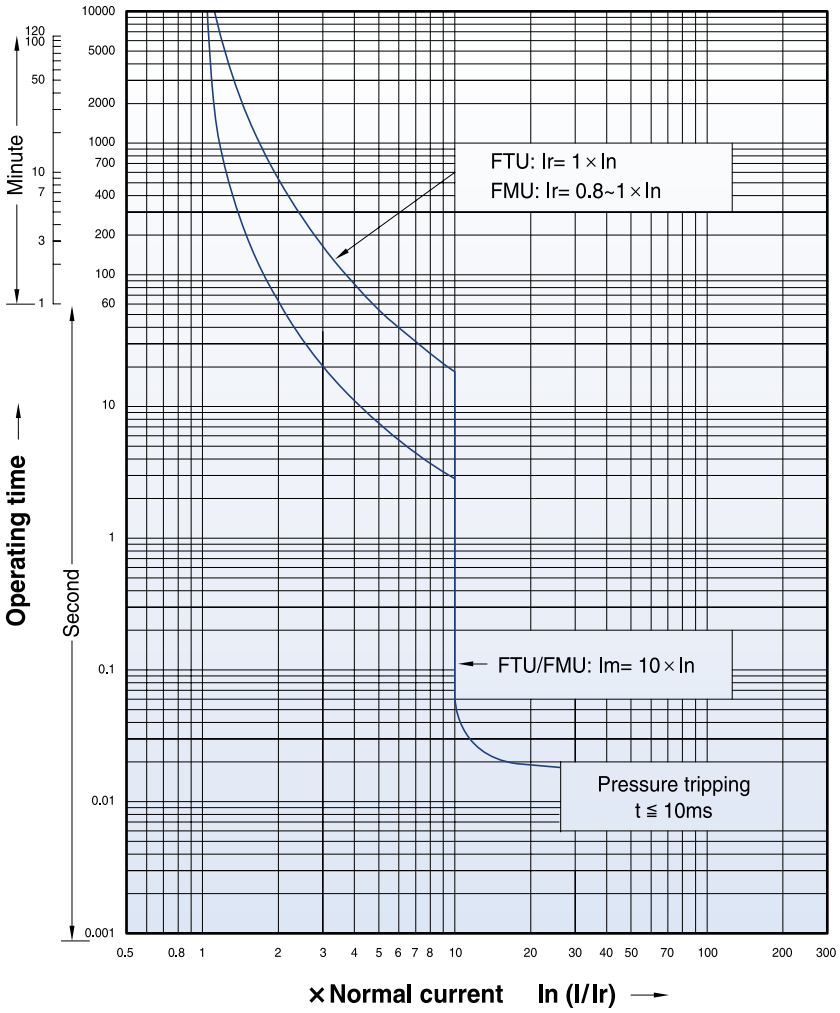
Short - circuit protection(magnetic)

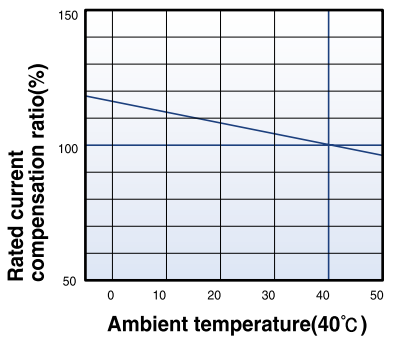
Pick - up	Im	Setting
		6..12 × In (6 Point)

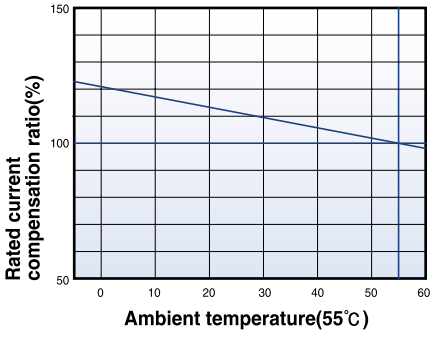
Circuit breakers with thermal-magnetic trip units

TS160

FTU
FMU
100, 125, 160A





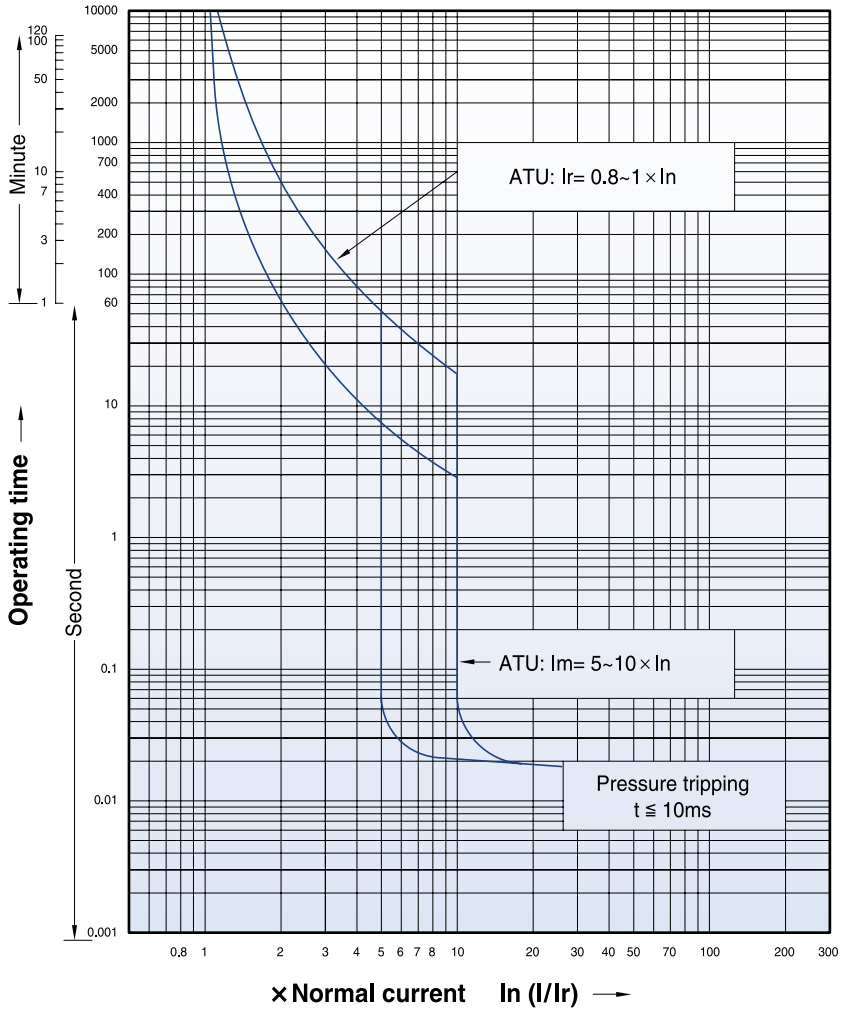


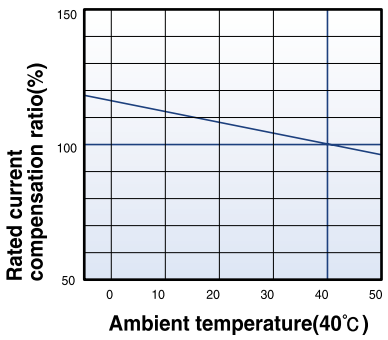
Circuit breakers with thermal-magnetic trip units

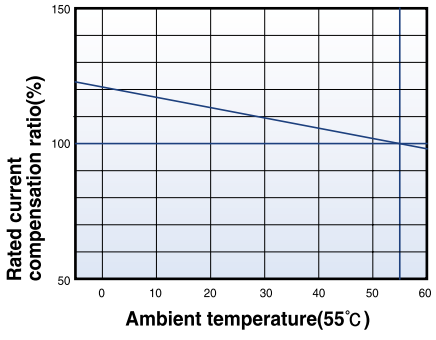
TS160

ATU

100, 125, 160A







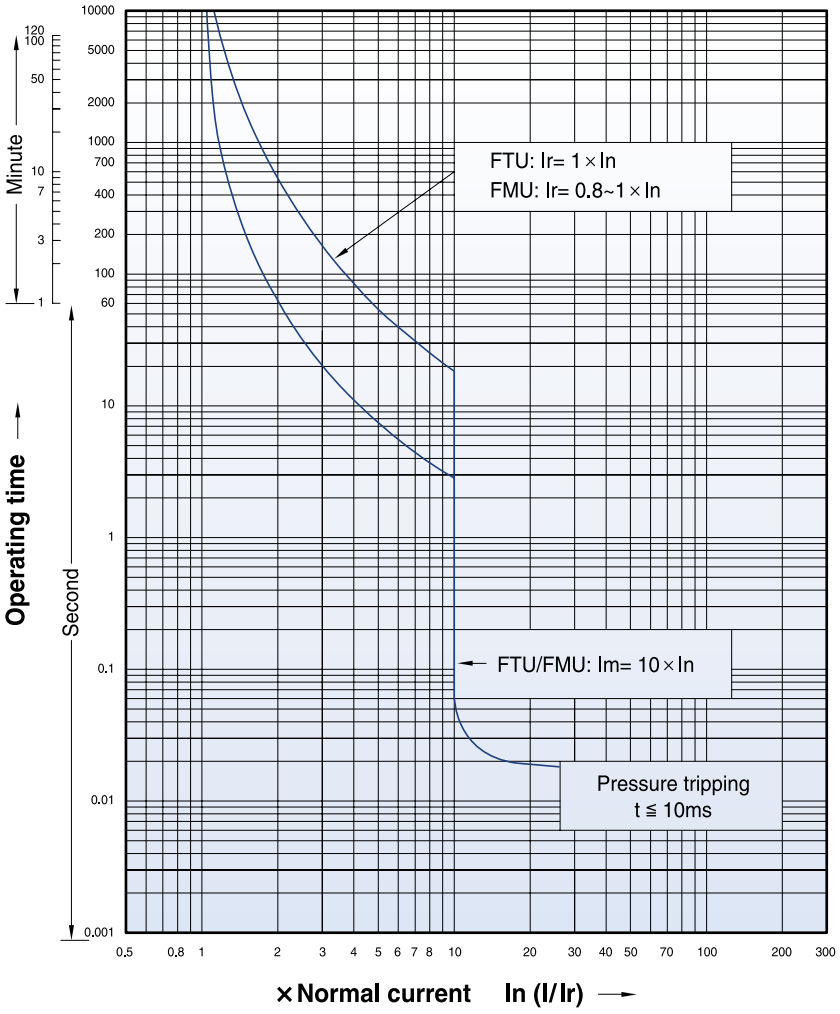
Circuit breakers with thermal-magnetic trip units

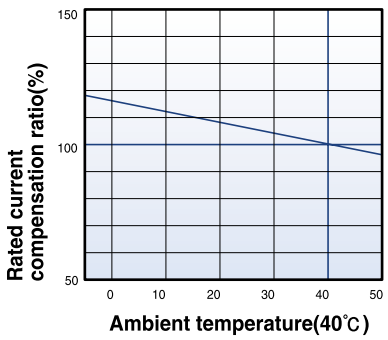
TS250

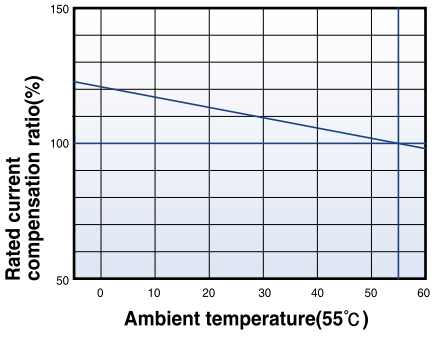
FTU

FMU

125~250A





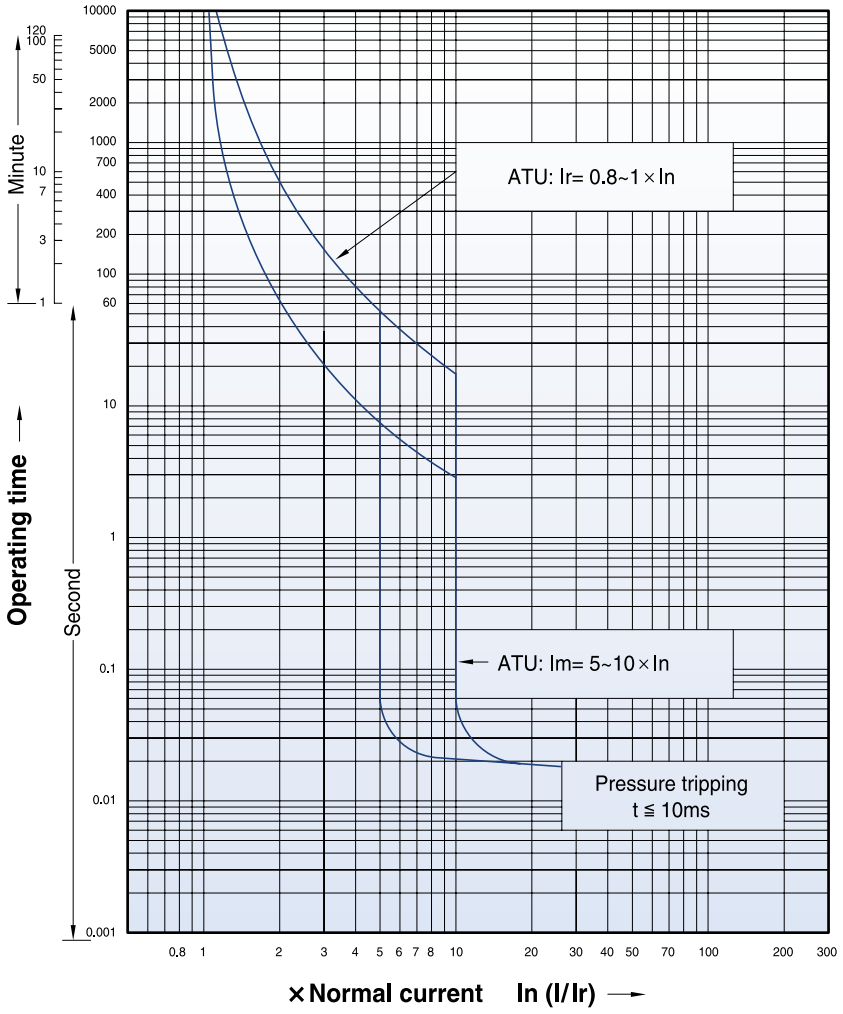


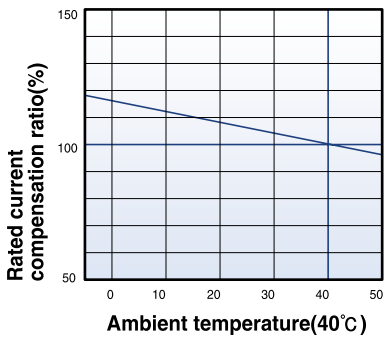
Circuit breakers with thermal-magnetic trip units

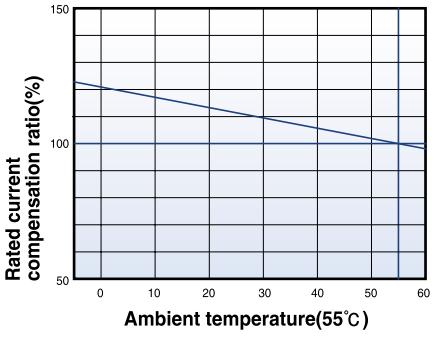
TS250

ATU

125~250A



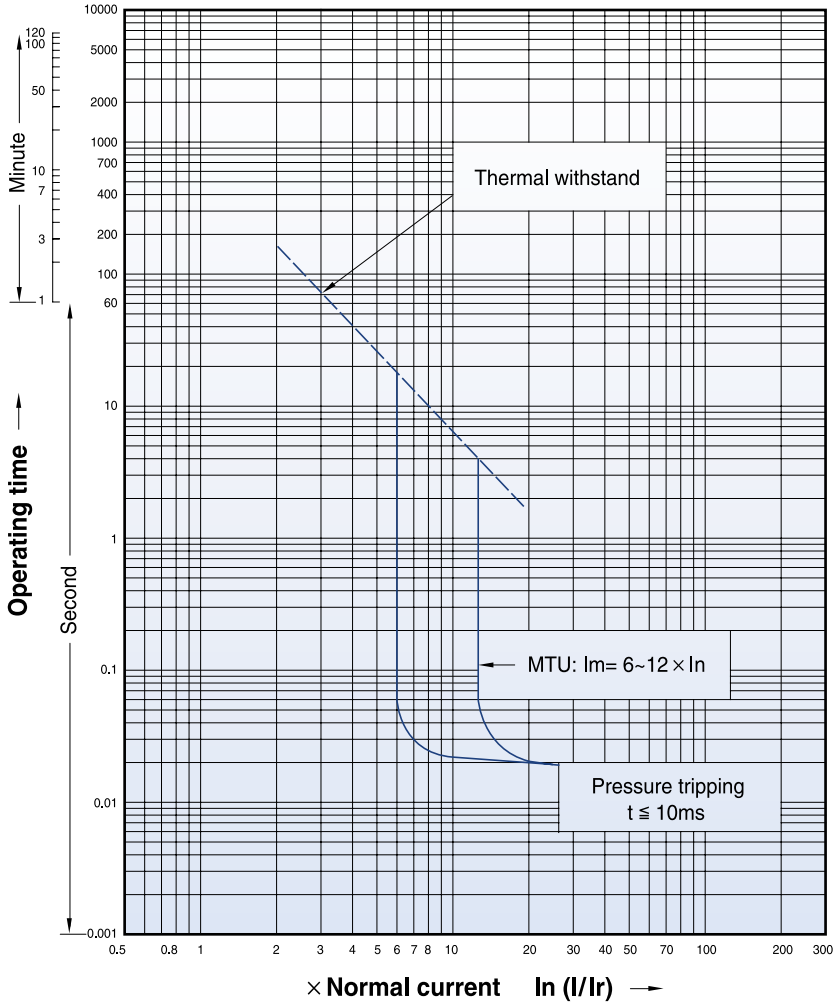




Circuit breakers with magnetic only trip units

TS250

Magnetic only
MTU
100, 160, 220A



Magnetic trip units(MTU)

Rating(A)		In	TS100 to TS800												
			1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
	N / H / L	TS100	●	●	●	●	●	●	●	●	●	-	-	-	-	-
		TS160	-	-	-	-	-	●	●	●	●	●	-	-	-	-
		TS250	-	-	-	-	-	-	-	-	●	●	●	-	-	-
		TS400	-	-	-	-	-	-	-	-	-	-	-	●	-	-
		TS630	-	-	-	-	-	-	-	-	-	-	-	-	●	-
		TS800	-	-	-	-	-	-	-	-	-	-	-	-	-	●

Short - circuit protection(magnetic)

Pick - up	Im	Setting
		6..12×In (6 Point)

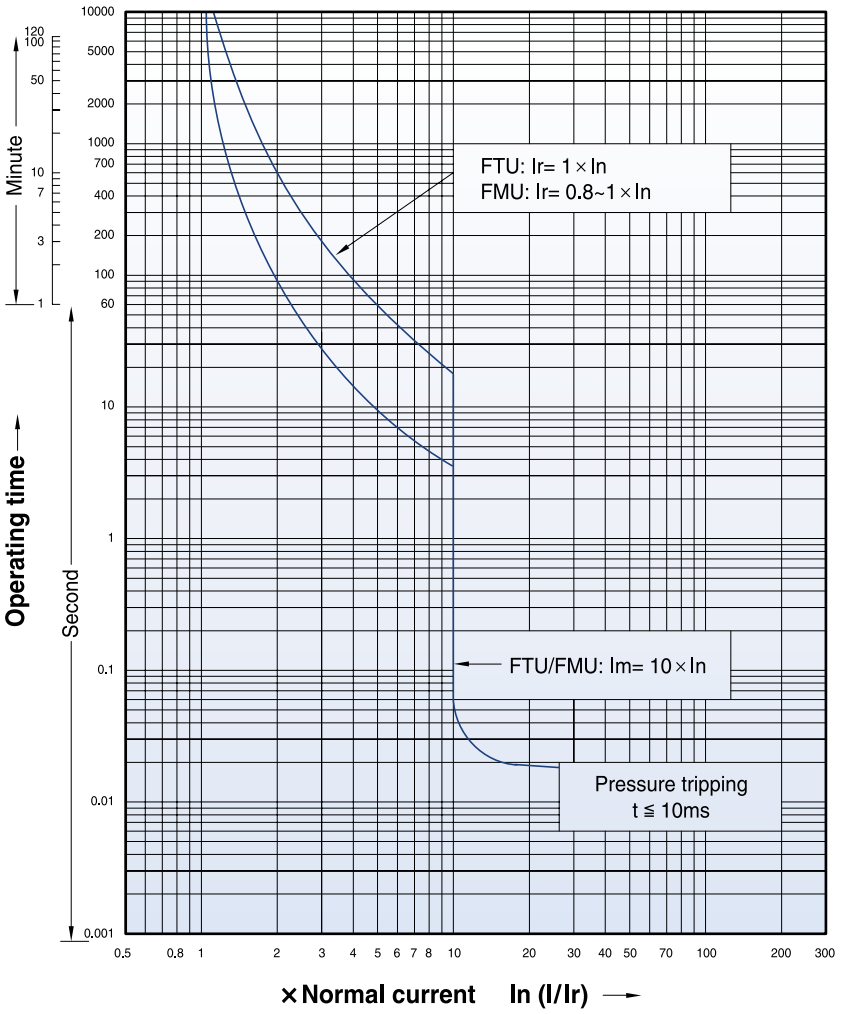
Circuit breakers with thermal-magnetic trip units

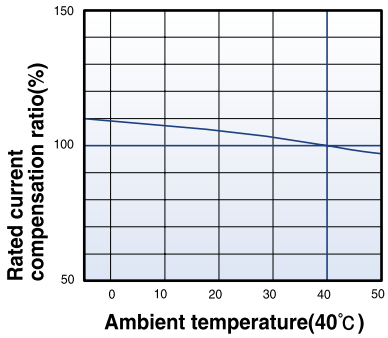
TS400

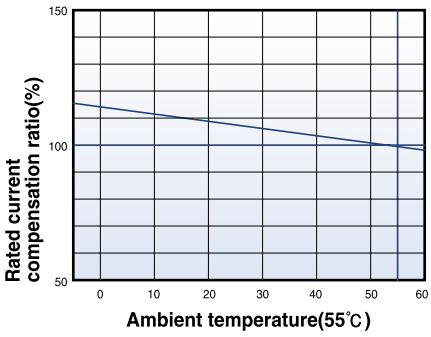
FTU

FMU

300, 400A





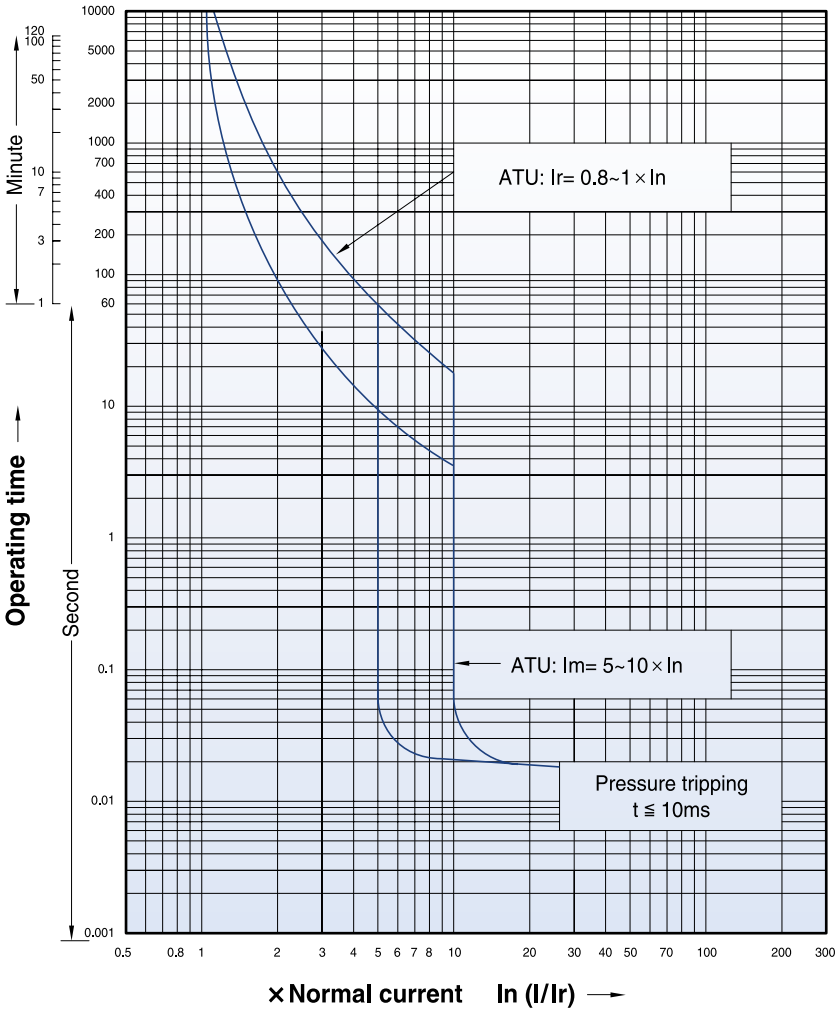


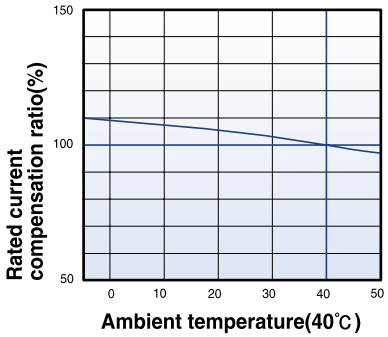
Circuit breakers with thermal-magnetic trip units

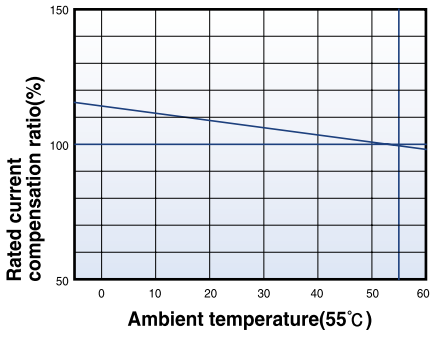
TS400

ATU

300, 400A





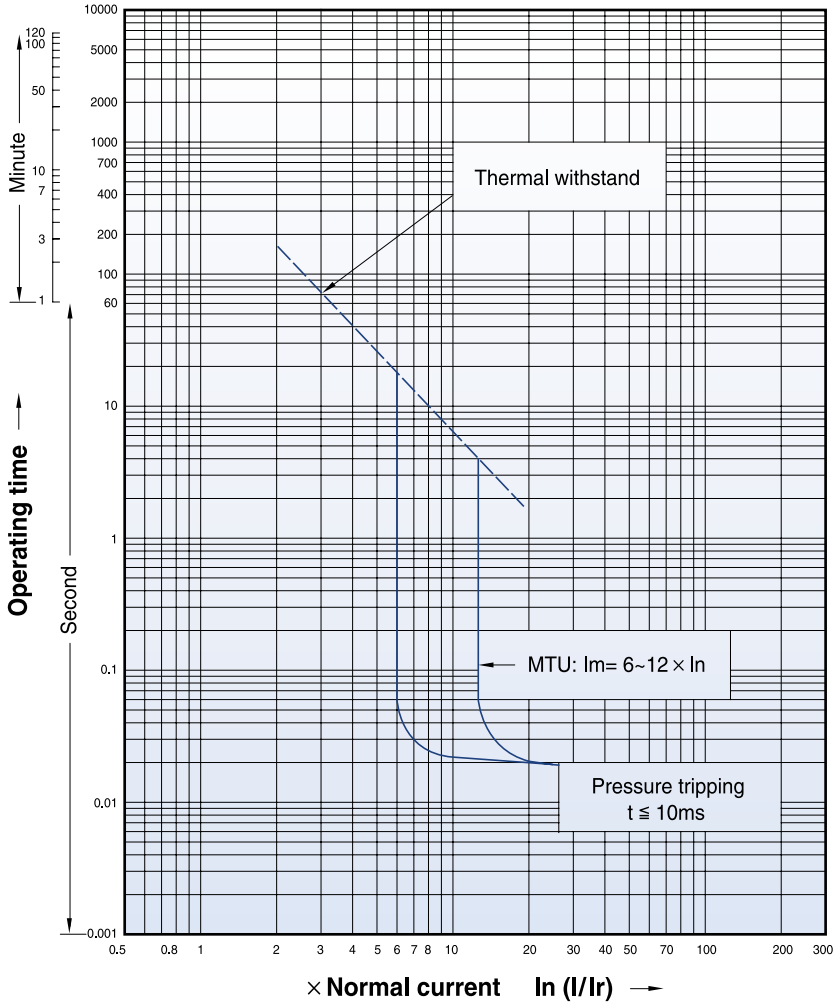


Circuit breakers with magnetic only trip units

TS400

MTU

320A



Magnetic trip units(MTU)

Rating(A)		In	TS100 to TS800												
			1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
	N / H / L	TS100	●	●	●	●	●	●	●	●	●	-	-	-	-	-
		TS160	-	-	-	-	-	●	●	●	●	●	-	-	-	-
		TS250	-	-	-	-	-	-	-	-	●	●	●	-	-	-
		TS400	-	-	-	-	-	-	-	-	-	-	-	●	-	-
		TS630	-	-	-	-	-	-	-	-	-	-	-	-	●	-
		TS800	-	-	-	-	-	-	-	-	-	-	-	-	-	●

Short - circuit protection(magnetic)

Pick - up	Im	Setting
		6..12 × In (6 Point)

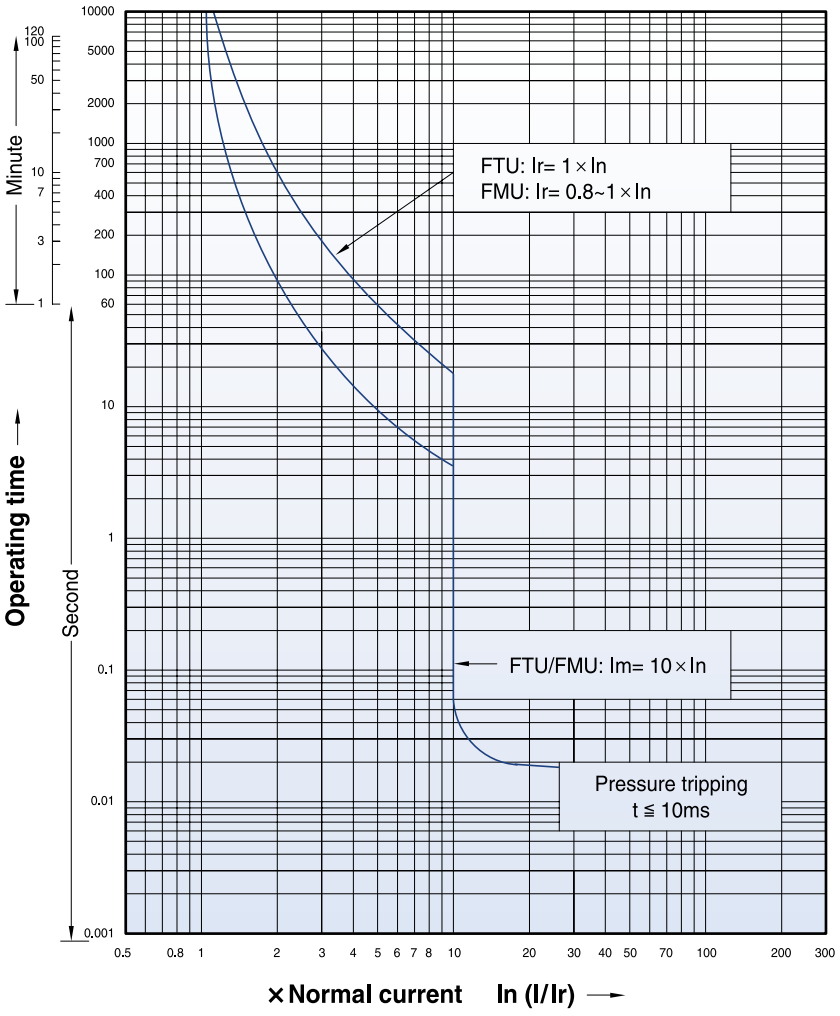
Circuit breakers with thermal-magnetic trip units

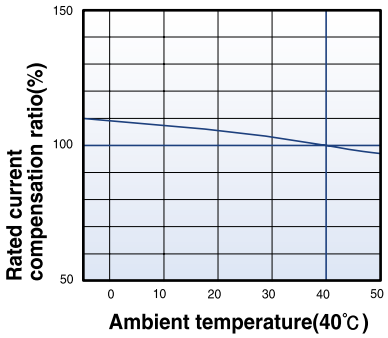
TS630

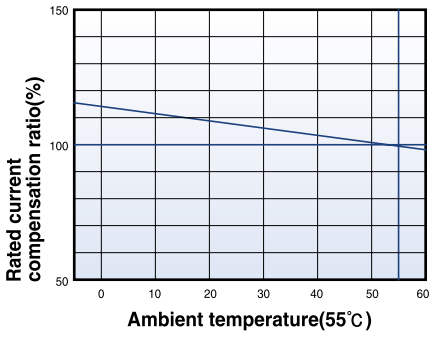
FTU

FMU

500, 630A





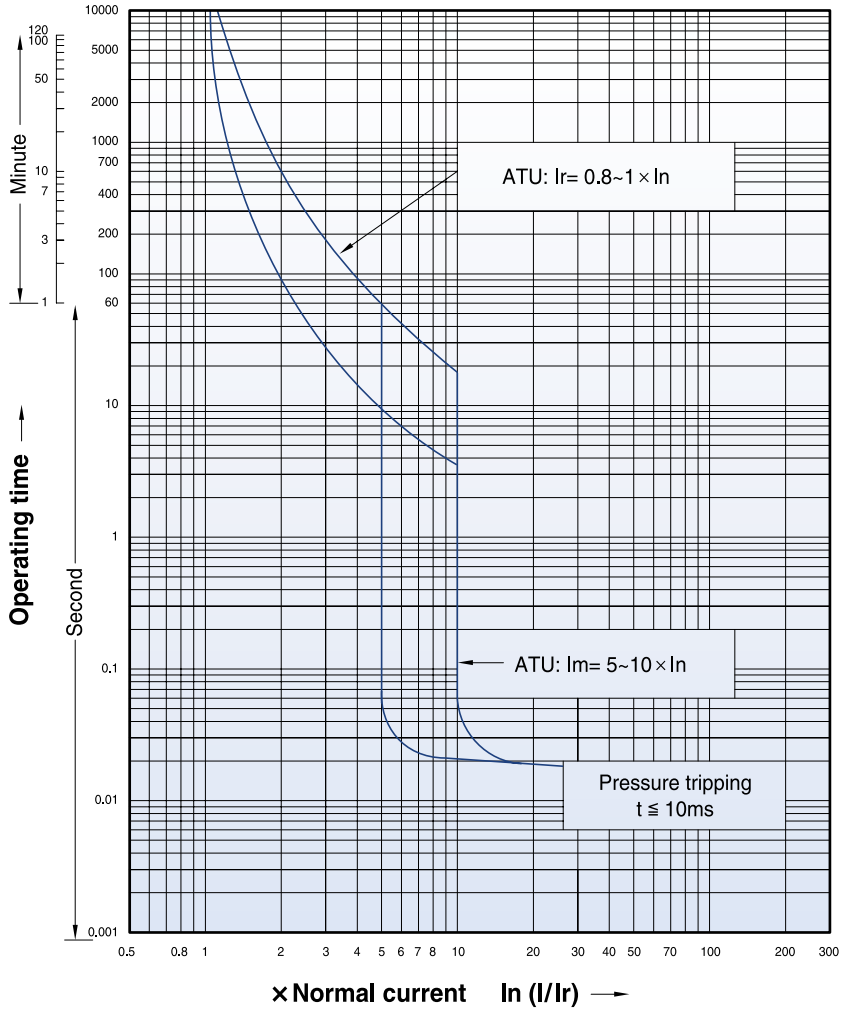


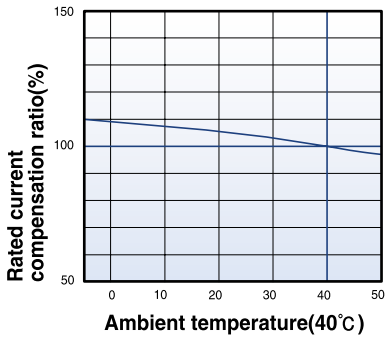
Circuit breakers with thermal-magnetic trip units

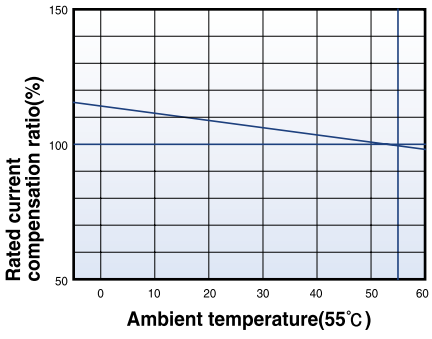
TS630

ATU

500, 630A

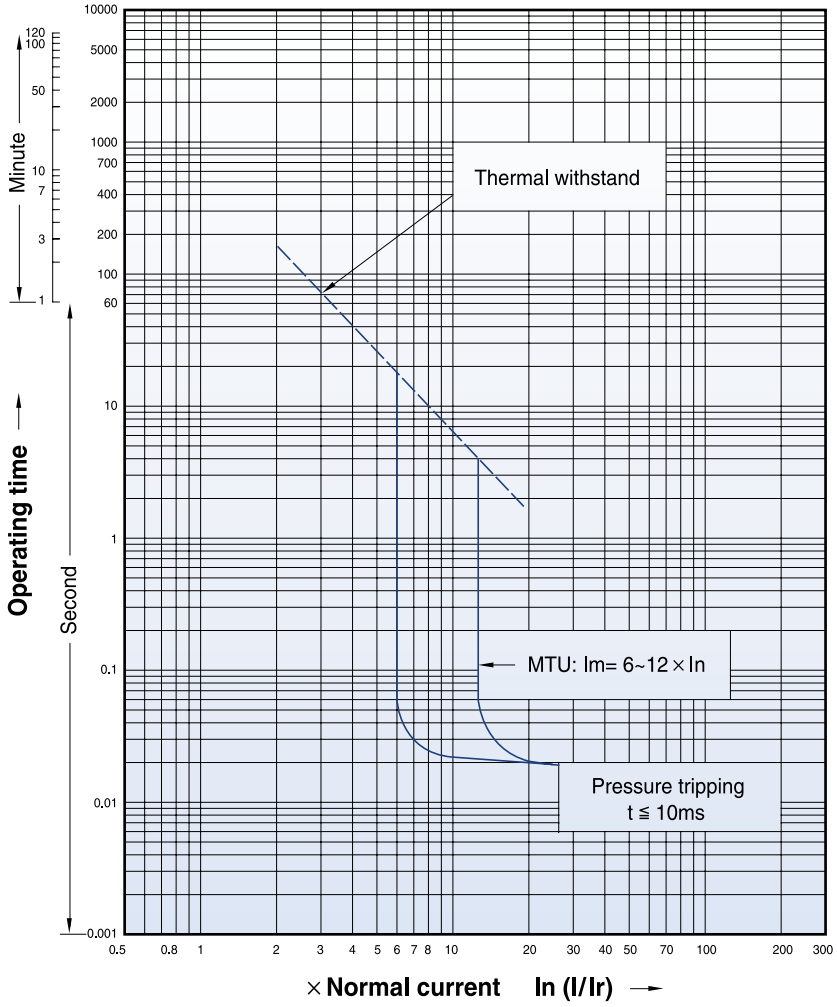






Circuit breakers with magnetic only trip units

TS630
MTU
500A



Magnetic trip units(MTU)

Rating(A)		In	TS100 to TS800												
			1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
	N / H / L	TS100	●	●	●	●	●	●	●	●	●					
		TS160						●	●	●	●	●				
		TS250									●	●	●			
		TS400												●		
		TS630													●	
		TS800														●

Short - circuit protection(magnetic)

Pick - up	Im	Setting
		6..12×In (6 Point)

Circuit breakers with thermal-magnetic trip units

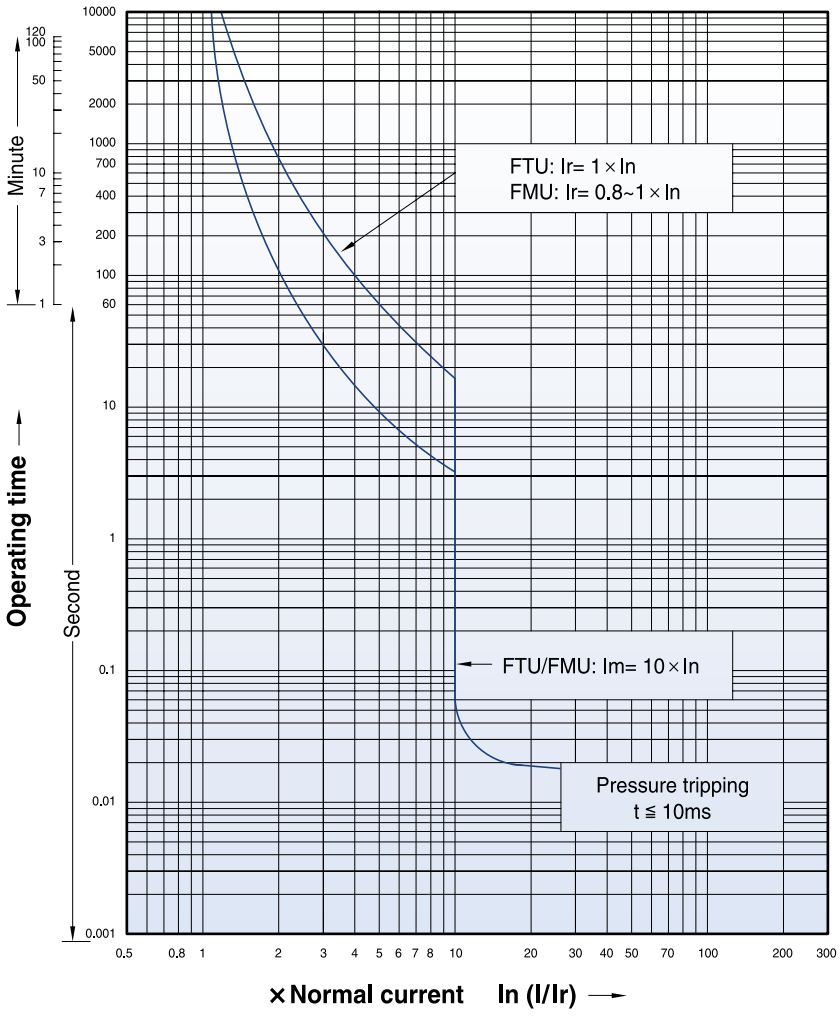
TS800

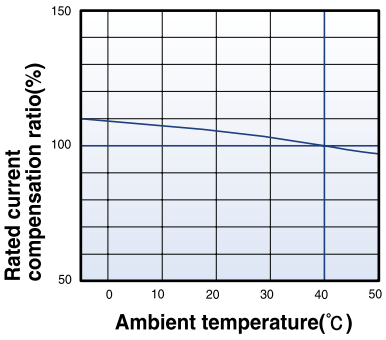
FTU

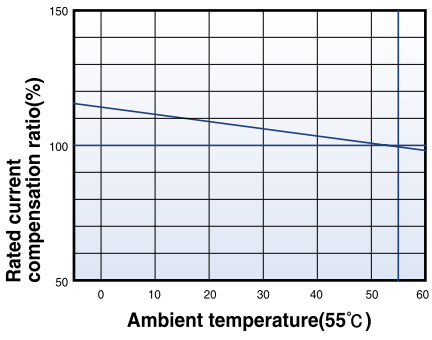
700, 800A

FMU

800A

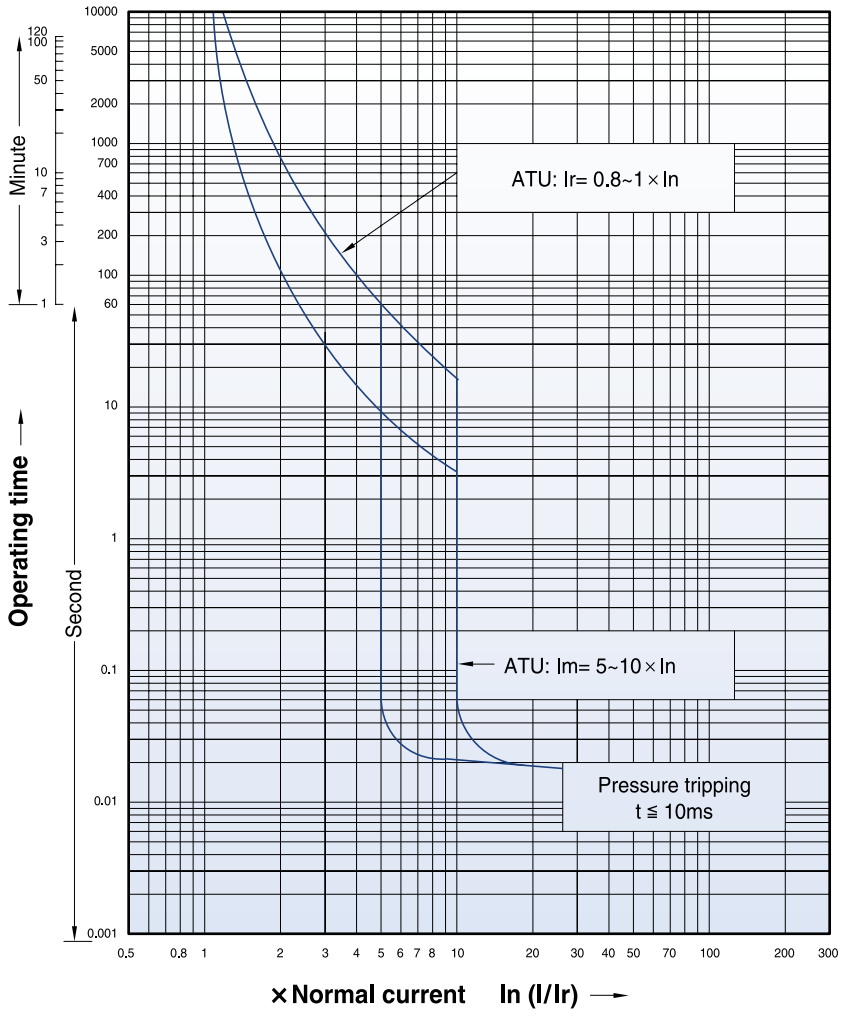


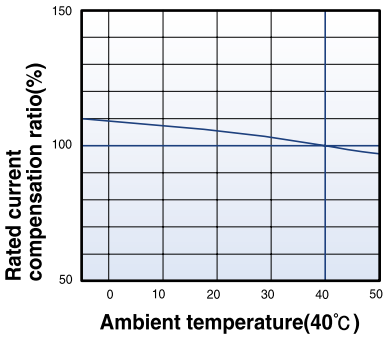


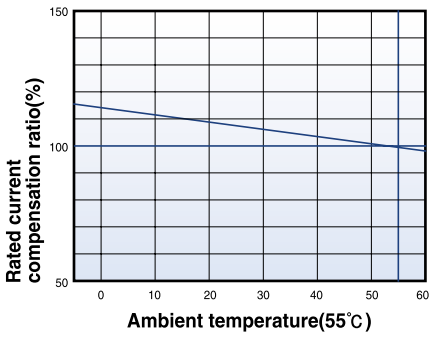


Circuit breakers with thermal-magnetic trip units

TS800
ATU
800A





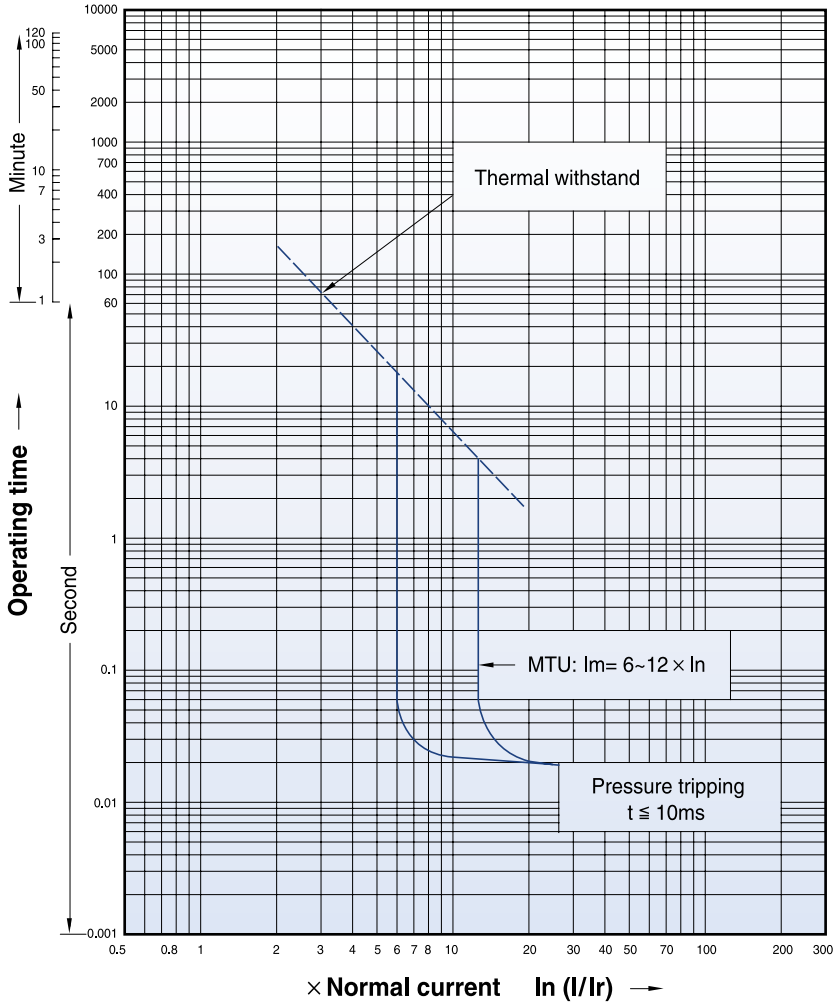


Circuit breakers with magnetic only trip units

TS800

MTU

630A



Magnetic trip units(MTU)

Rating(A)		In	TS100 to TS800													
			1.6	3.2	6.3	12	20	32	50	63	100	160	220	320	500	630
	N / H / L	TS100	●	●	●	●	●	●	●	●	●	-	-	-	-	-
		TS160	-	-	-	-	-	●	●	●	●	●	-	-	-	-
		TS250	-	-	-	-	-	-	-	-	●	●	●	-	-	-
		TS400	-	-	-	-	-	-	-	-	-	-	-	●	-	-
		TS630	-	-	-	-	-	-	-	-	-	-	-	-	●	-
		TS800	-	-	-	-	-	-	-	-	-	-	-	-	-	●

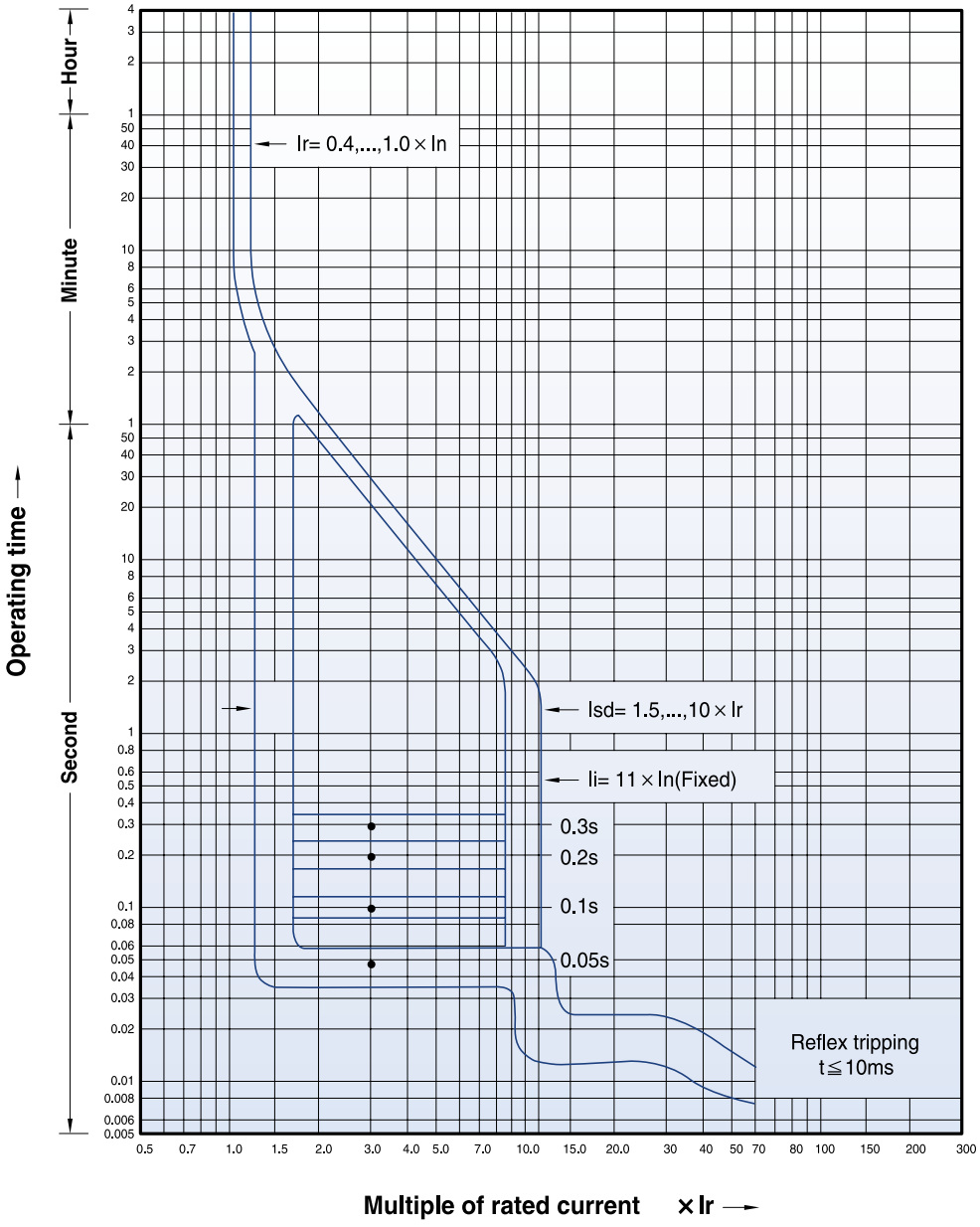
Short - circuit protection(magnetic)

Pick - up	Im	Setting
		6..12 × In (6 Point)

Circuit breakers with electronic trip unit (ETS)

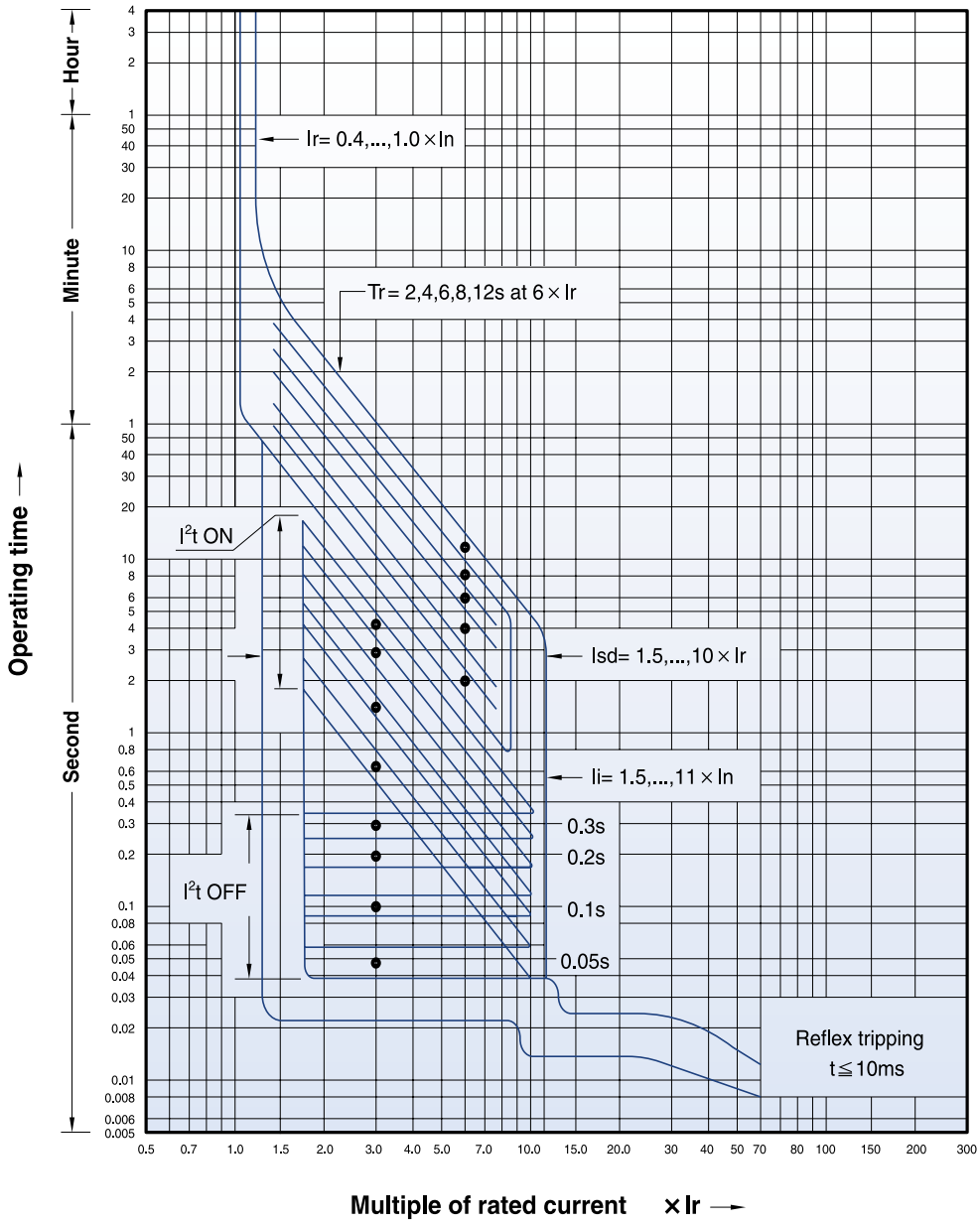
TS100 to TS800

ETS23
ETS33
ETS43



Circuit breakers with electronic trip unit (ETM)

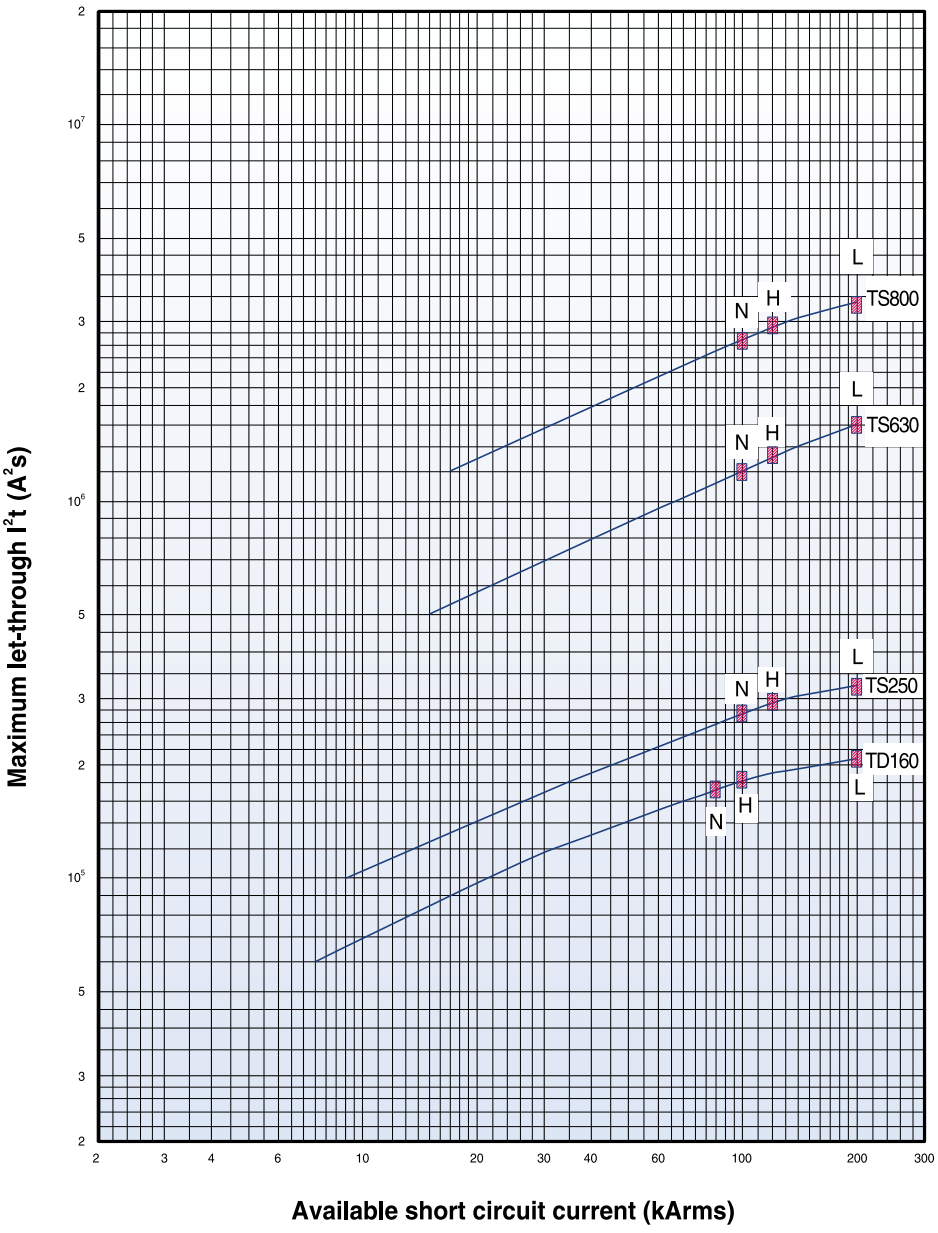
TS400
TS630
TS800
ETM33
ETM43



Specific let-through energy curves

220/240V

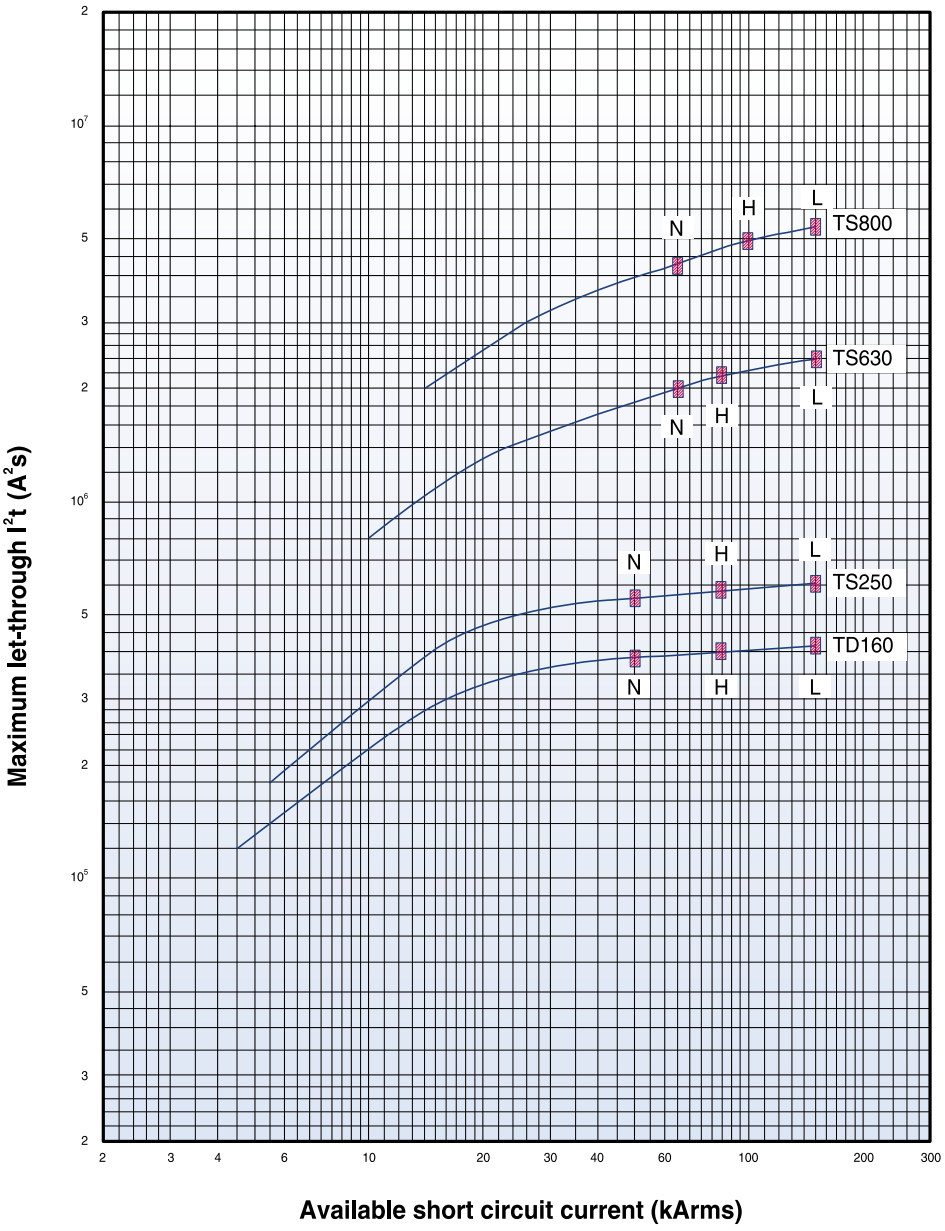
Thermal stress



Specific let-through energy curves

380/415V

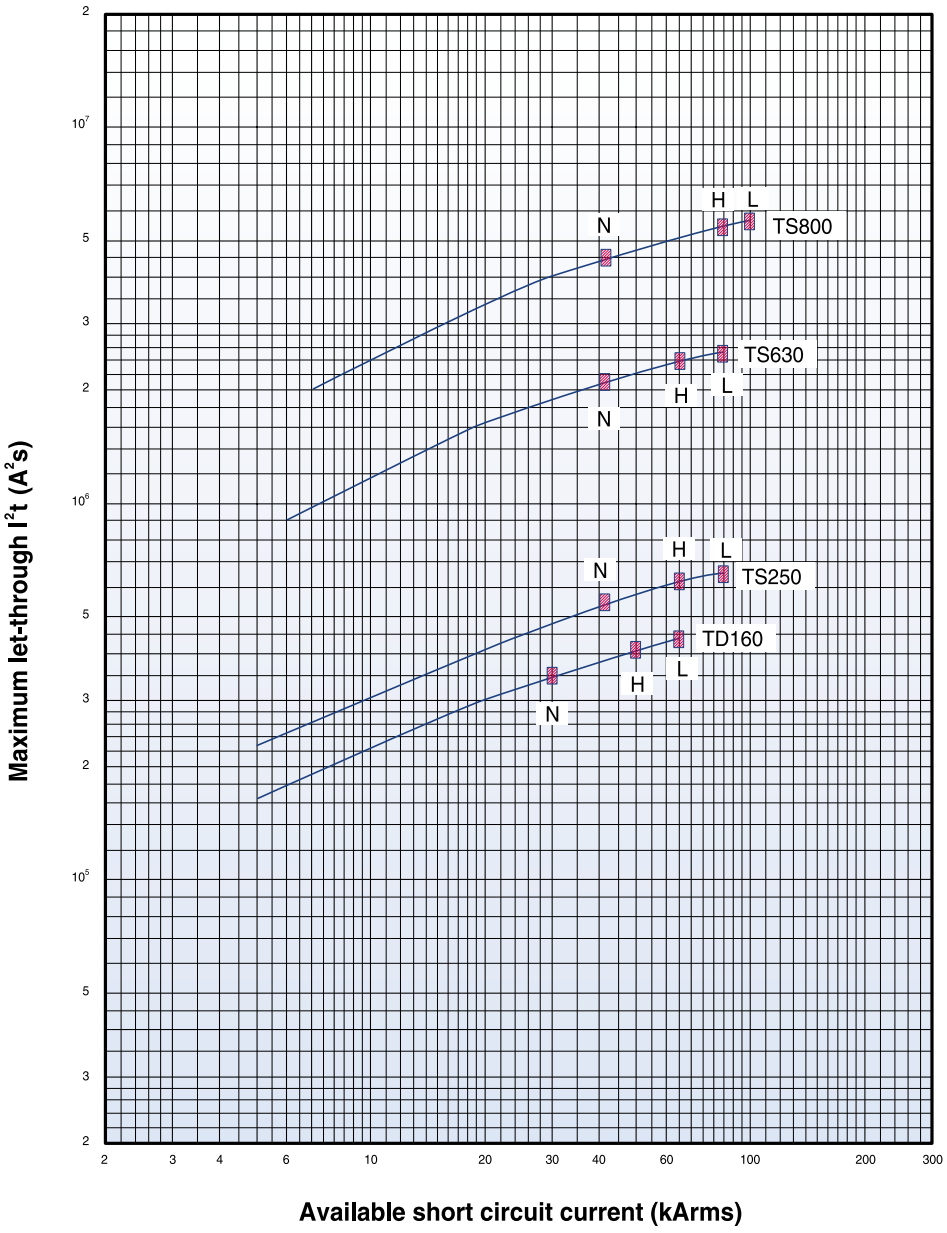
Thermal stress



Specific let-through energy curves

480/500V

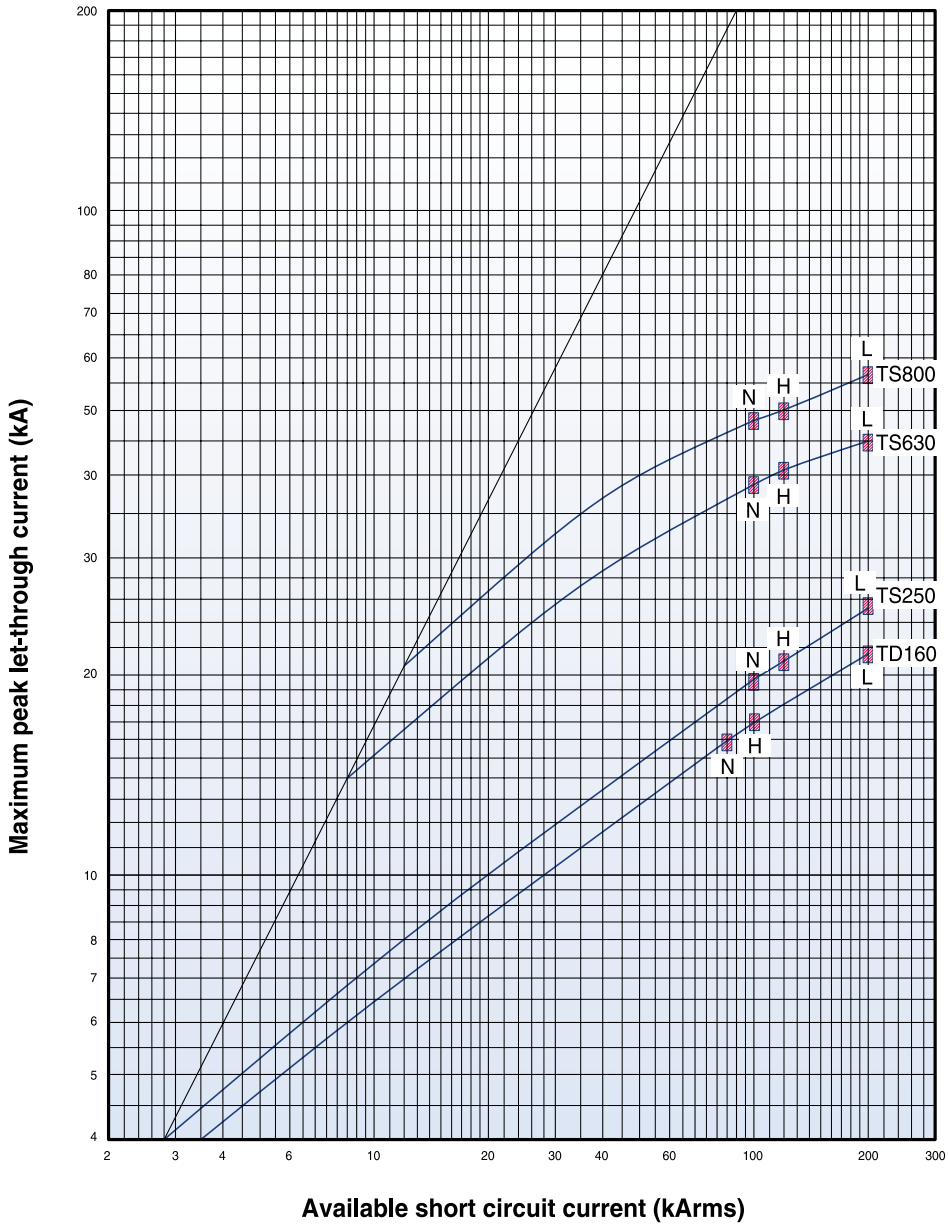
Thermal stress



Current-limiting curves

220/240V

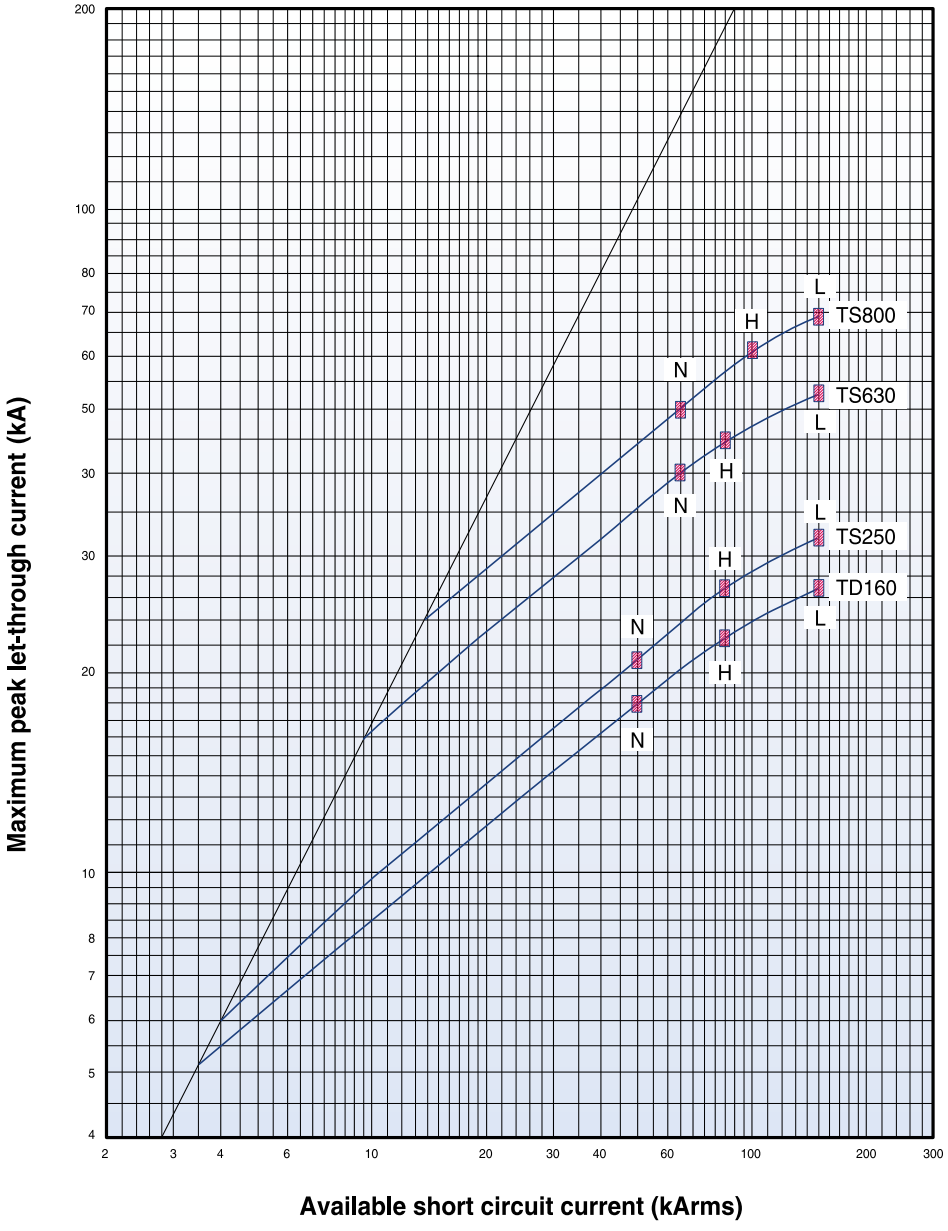
Peak current



Current-limiting curves

380/415V

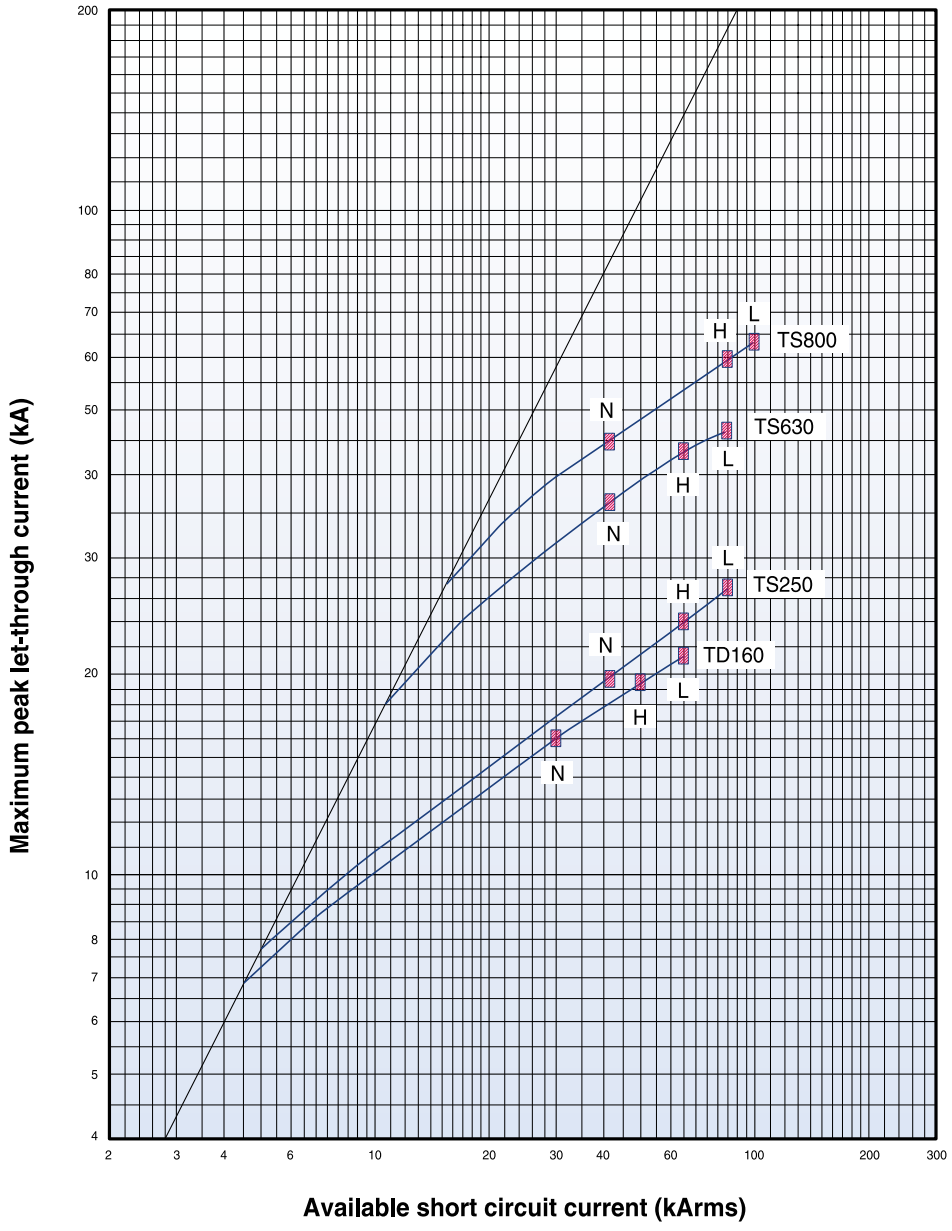
Peak current



Current-limiting curves

480/500V

Peak current



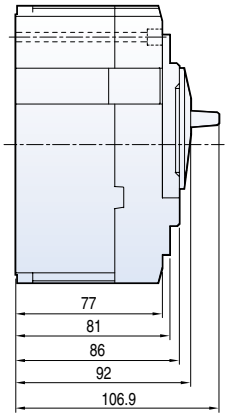
A-7. Dimensions

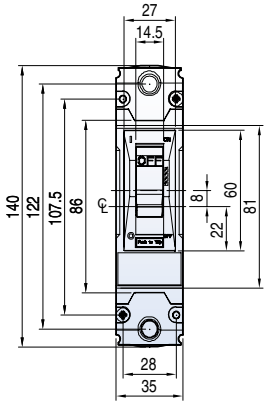
Overall dimensions

Susol

TD160

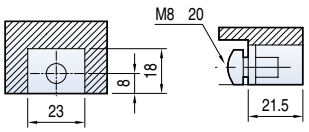
[mm]



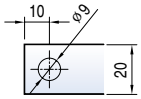


1P

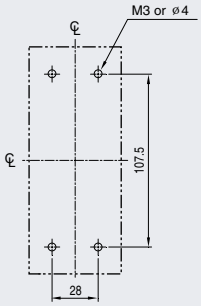
Terminal section



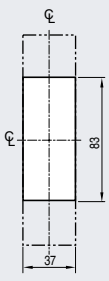
Conductor



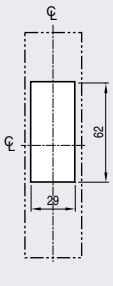
Panel drilling



Front panel cutting



1P



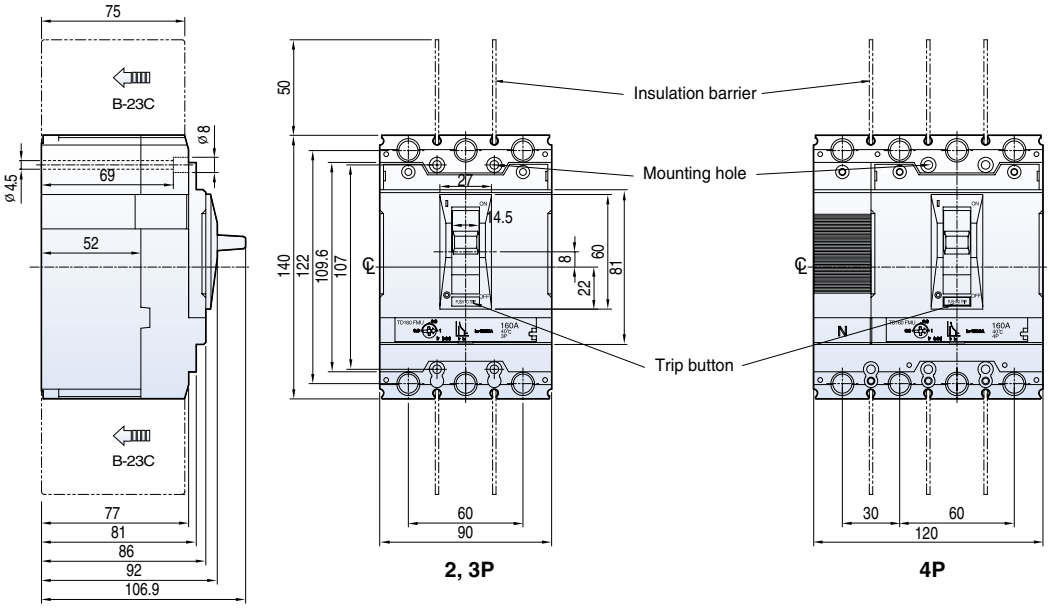
1P

Overall dimensions

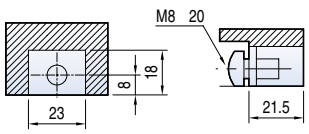
Susol

TD100/160

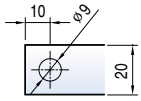
[mm]



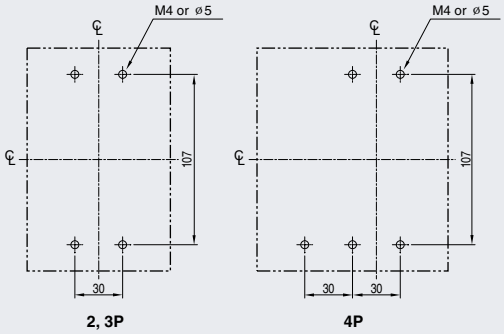
Terminal section



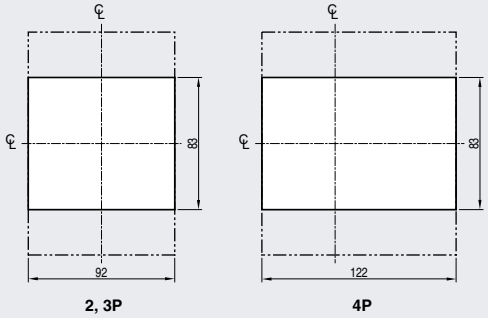
Conductor



Panel drilling



Front panel cutting

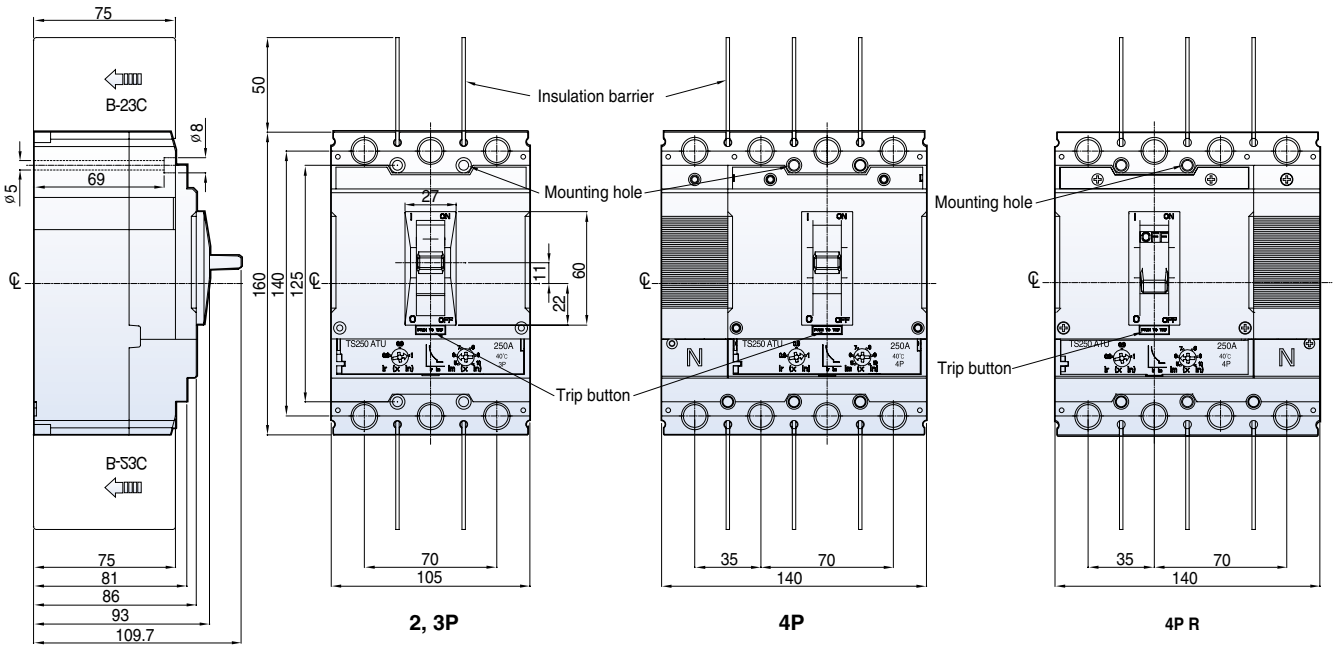


Overall dimensions

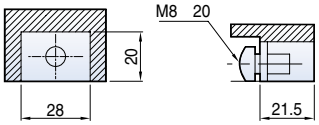
Susol

TS100/160/250

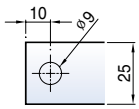
[mm]



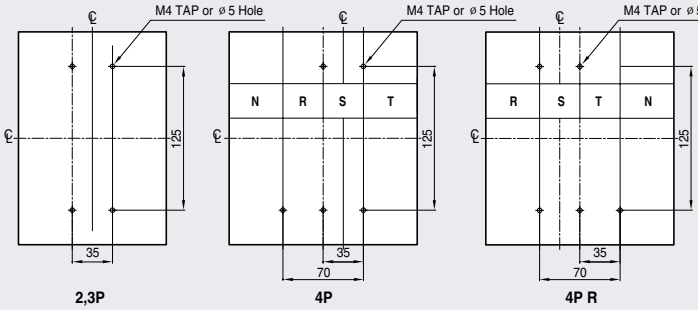
Terminal section



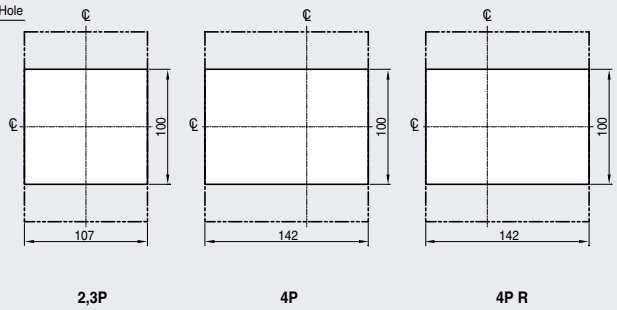
Conductor



Panel drilling



Front panel cutting

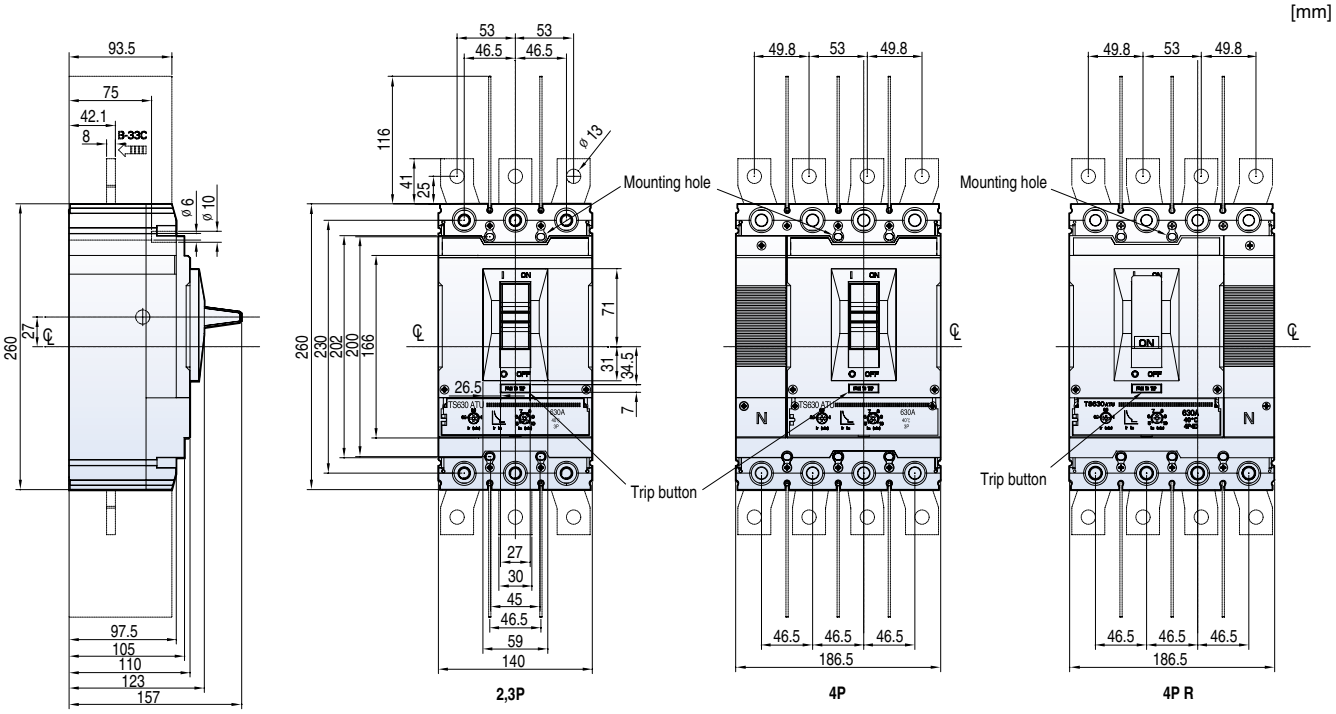


Overall dimensions

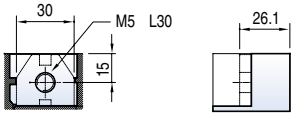
Susol

TS400/630

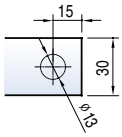
[mm]



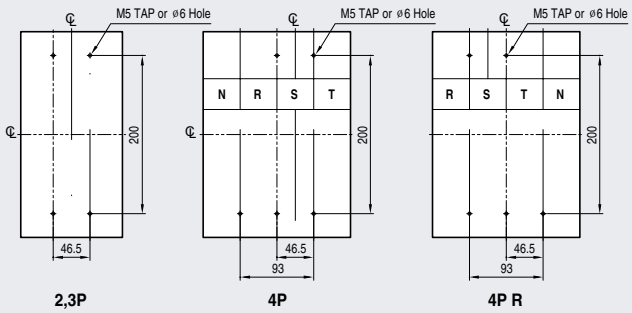
Terminal section



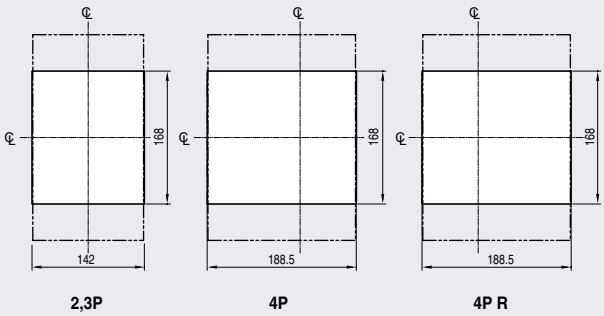
Conductor



Panel drilling



Front panel cutting

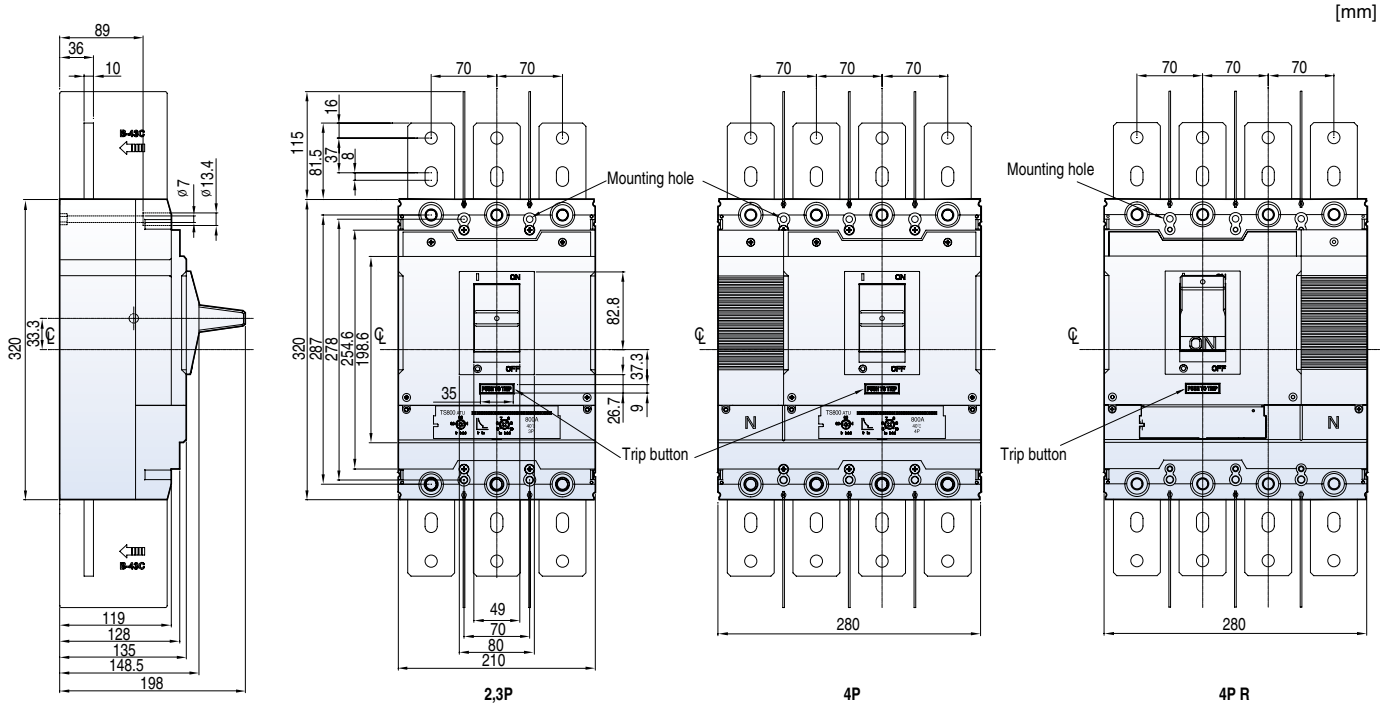


Overall dimensions

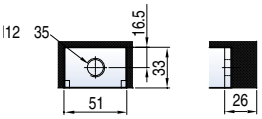
Susol

TS800

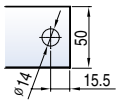
[mm]



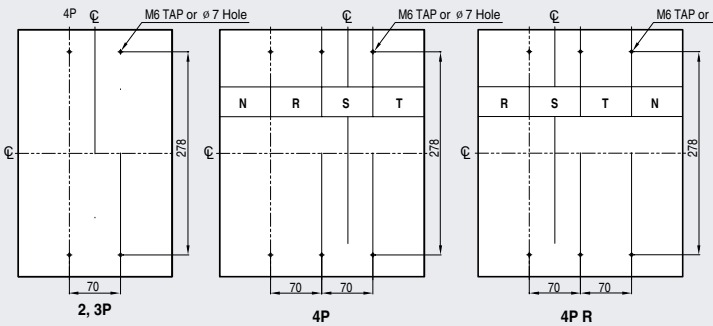
Terminal section



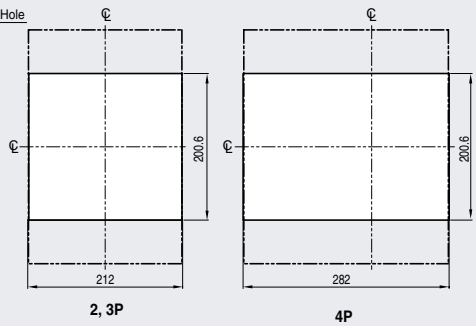
Conductor



Panel drilling



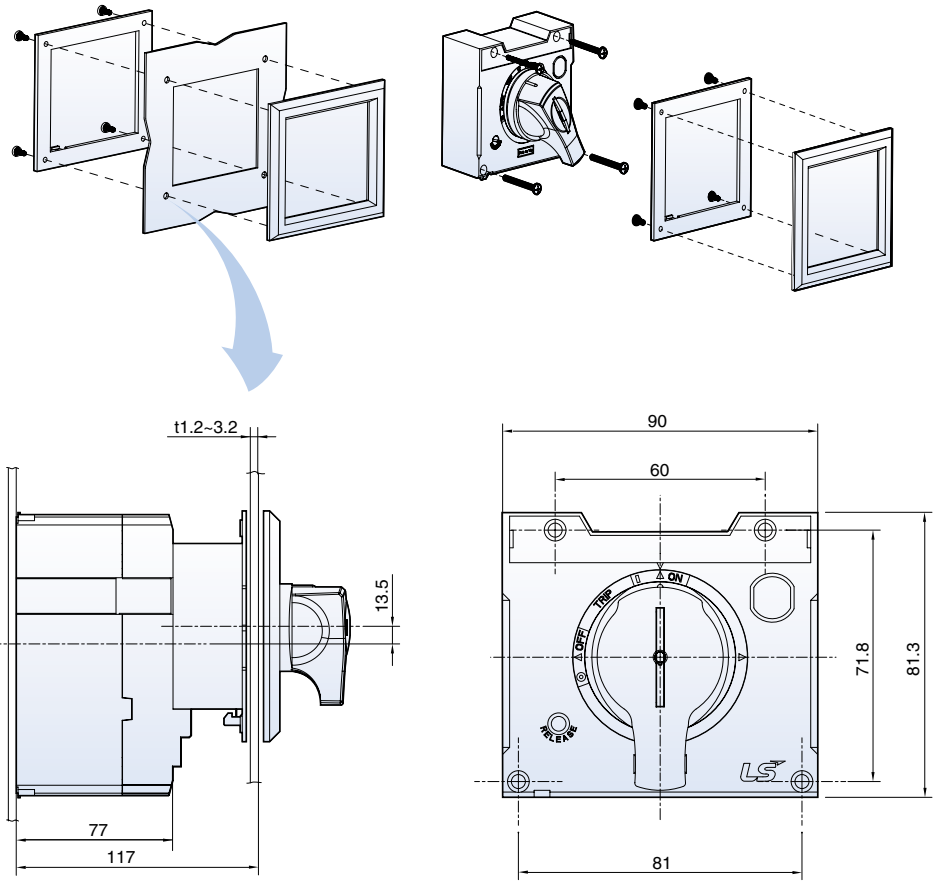
Front panel cutting



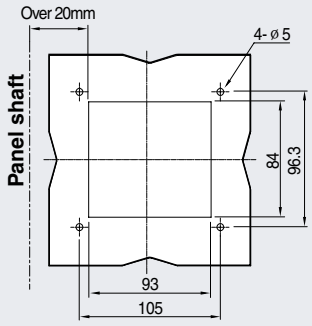
Direct rotary handles

DH1 & DHK1 for TD100/160

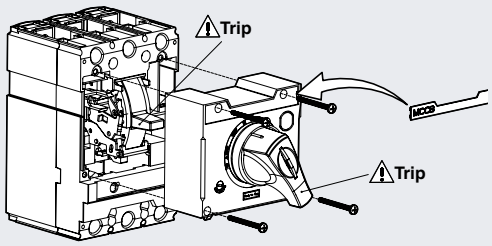
[mm]



Panel drilling



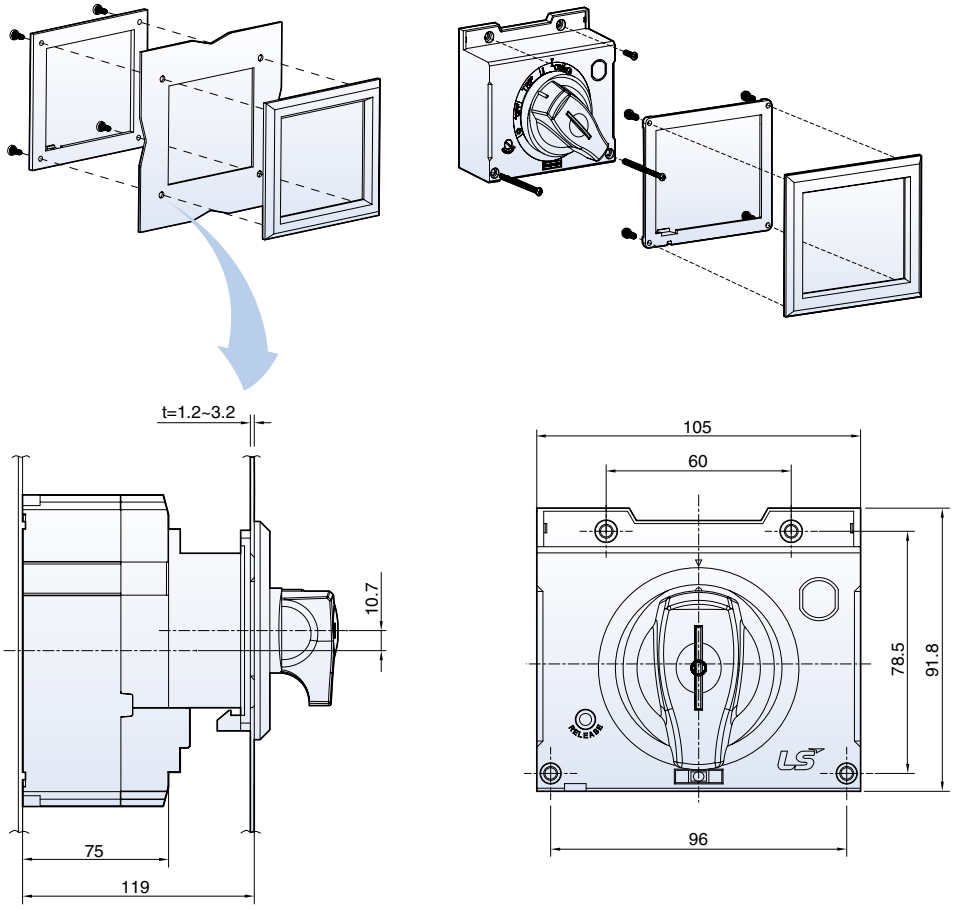
Way of installation



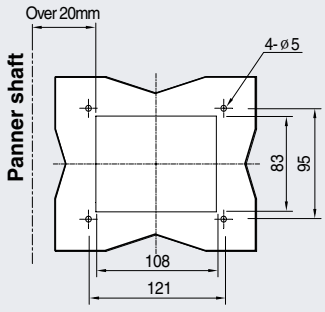
Direct rotary handles

DH2 & DHK2 for TS100/160/250

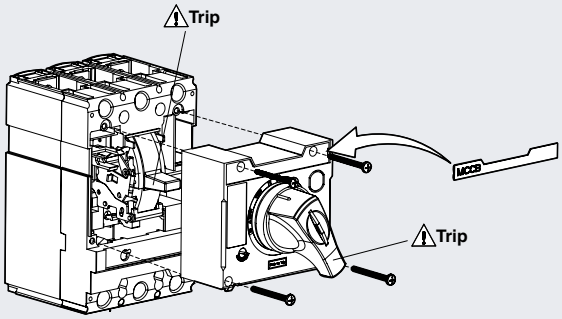
[mm]



Panel drilling



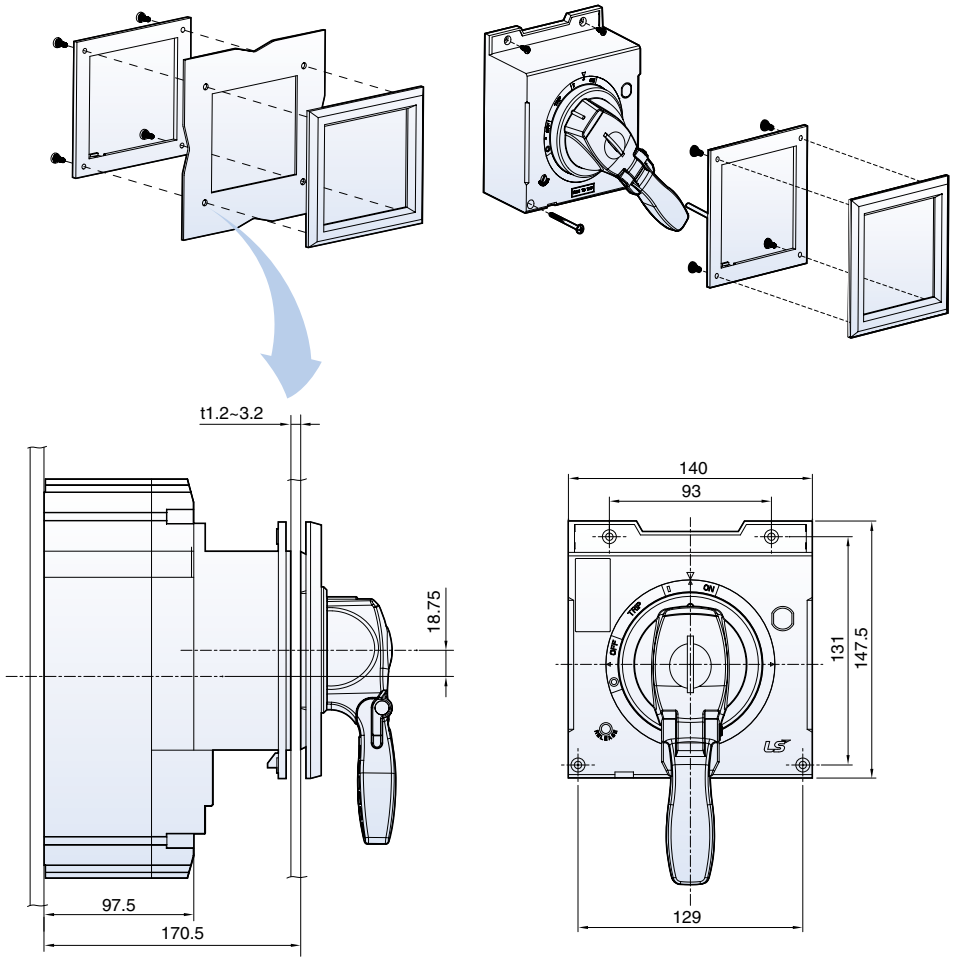
Way of installation



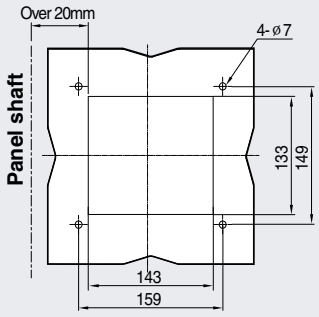
Direct rotary handles

DH3 & DHK3 for TS400/630

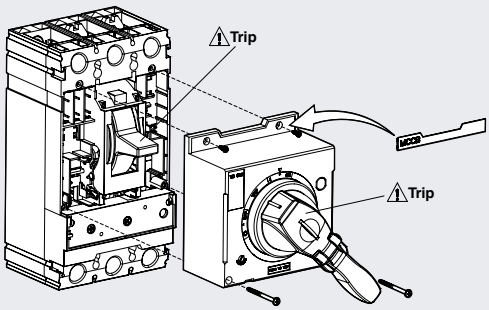
[mm]



Panel drilling



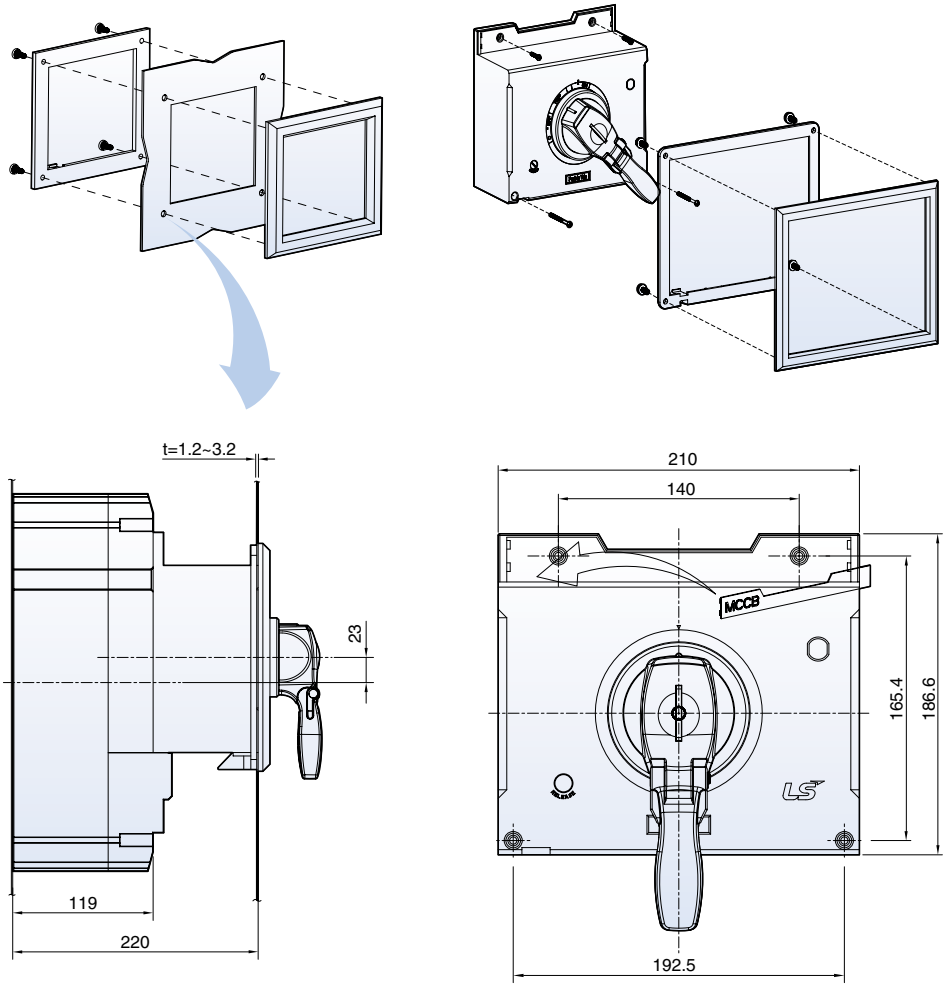
Way of installation



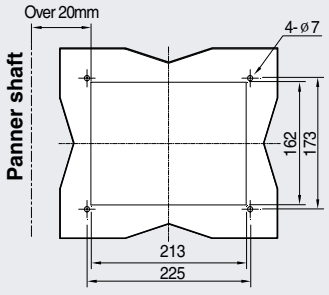
Direct rotary handles

DH4 & DHK4 for TS800

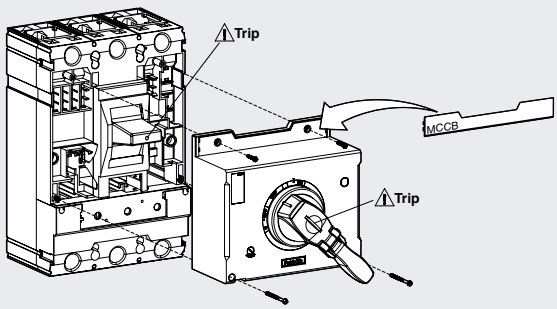
[mm]



Panel drilling



Way of installation



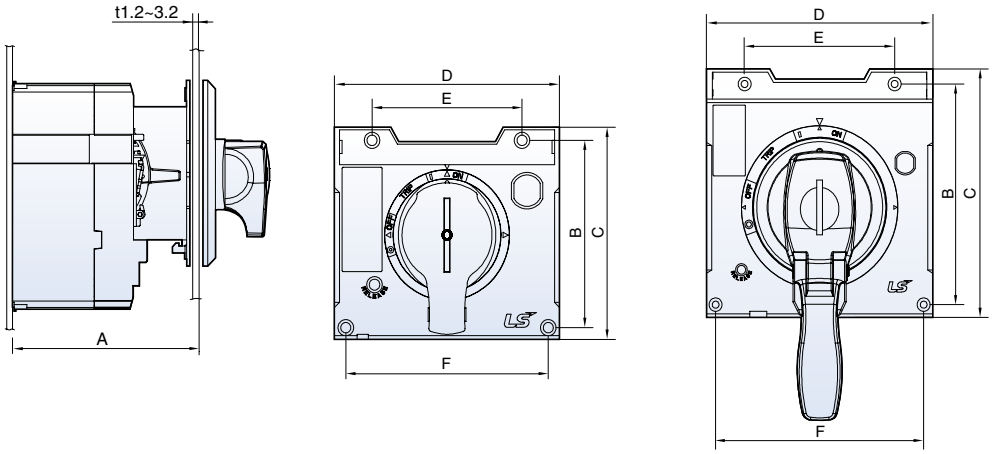
Direct rotary handles

Dimension table for D-handles

[mm]

TD100/TS250

TS630/TS800

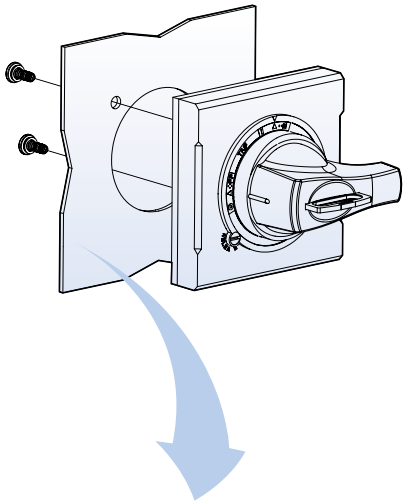


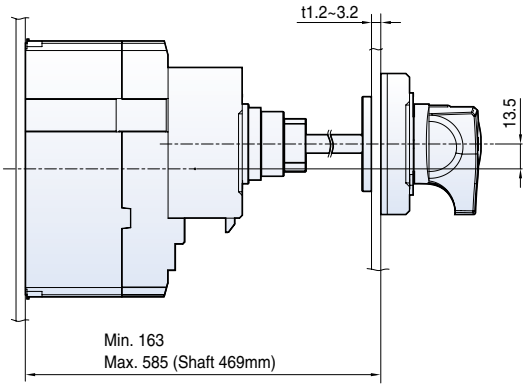
Applicable to	TD160	TS250	TS630	TS800
A (mm)	117	119	170.5	210
B (mm)	71.8	78.5	131	165.4
C (mm)	81.3	91.8	147.5	186.6
D (mm)	90	105	140	210
E (mm)	60	60	93	140
F (mm)	81	96	129	192.5

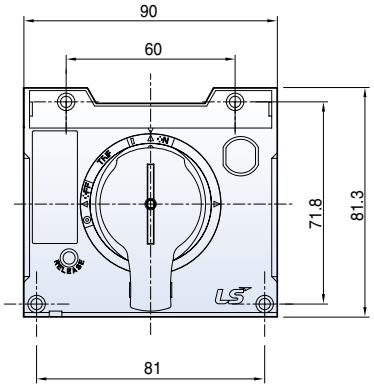
Extended rotary handles

EH1 for TD100/160

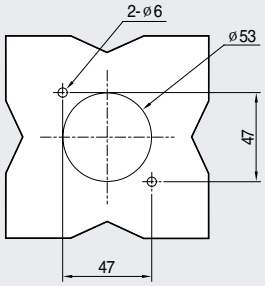
[mm]



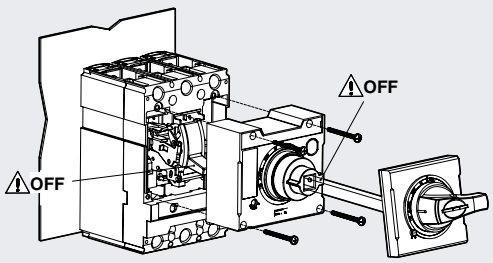




Panel drilling



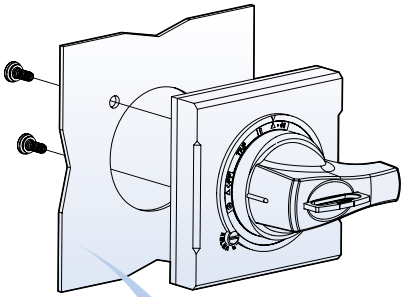
Way of installation

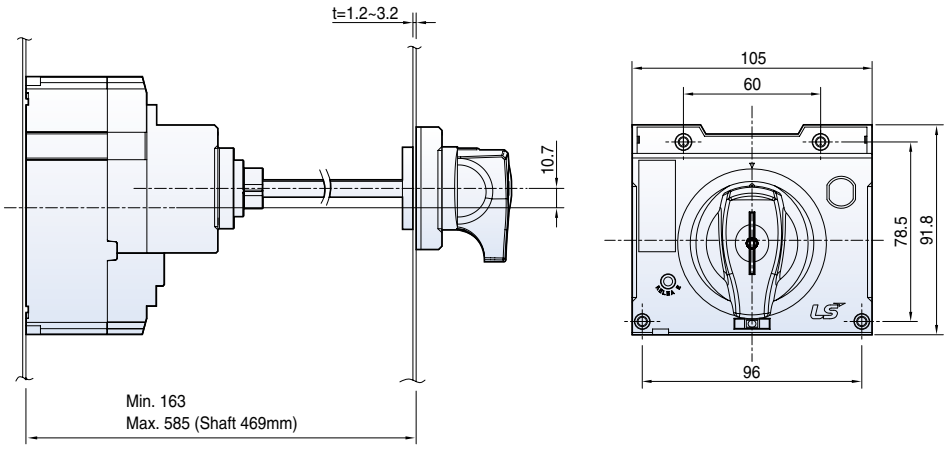


Extended rotary handles

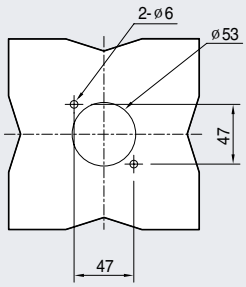
EH2 for TS100/160/250

[mm]

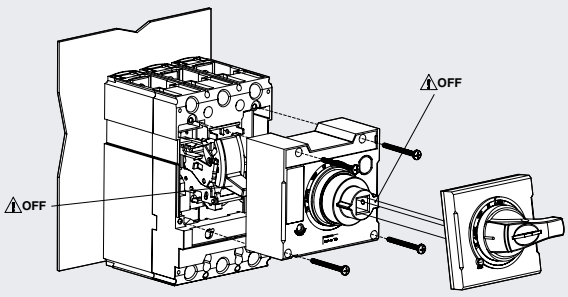




Panel drilling



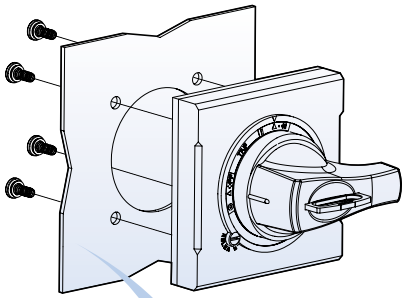
Way of installation

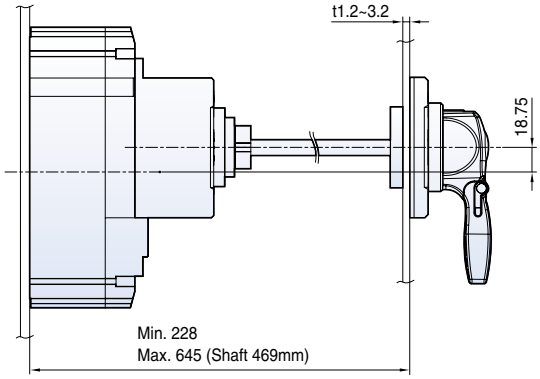


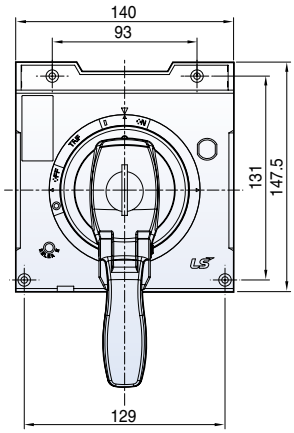
Extended rotary handles

EH3 for TS400/630

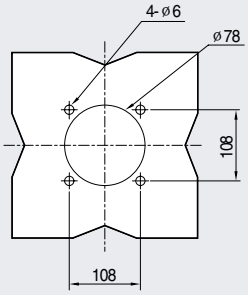
[mm]



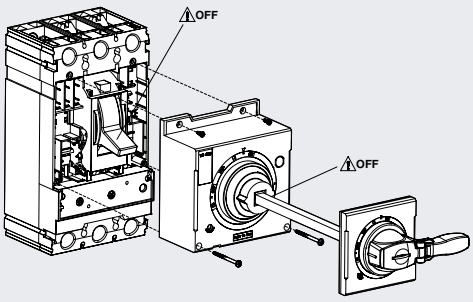




Panel drilling



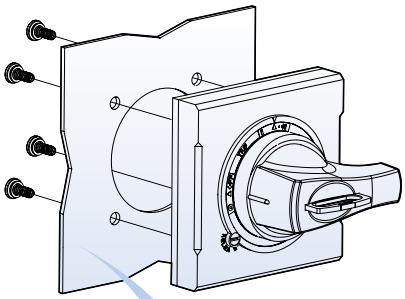
Way of installation

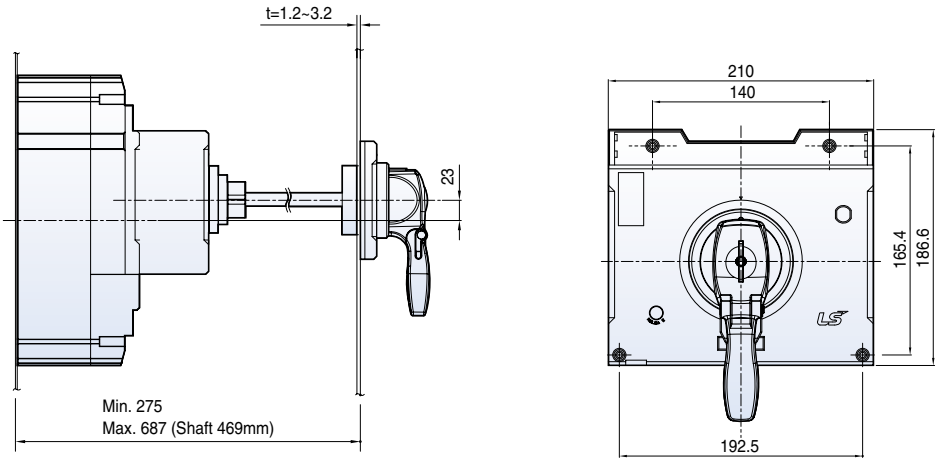


Extended rotary handles

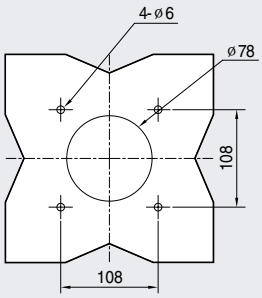
EH4 for TS800

[mm]

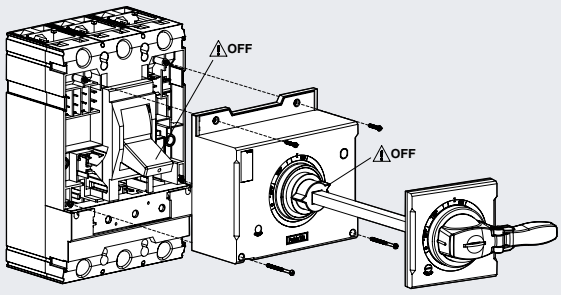




Panel drilling



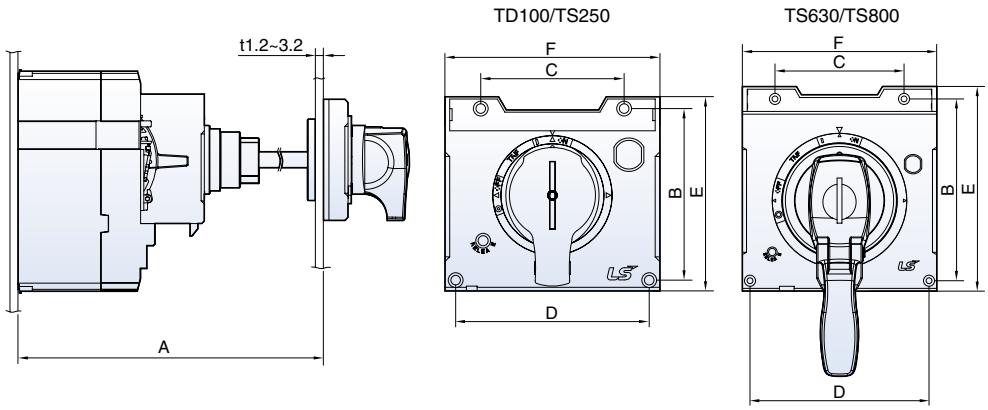
Way of installation



Extended rotary handles

Dimension table for E-handles

[mm]

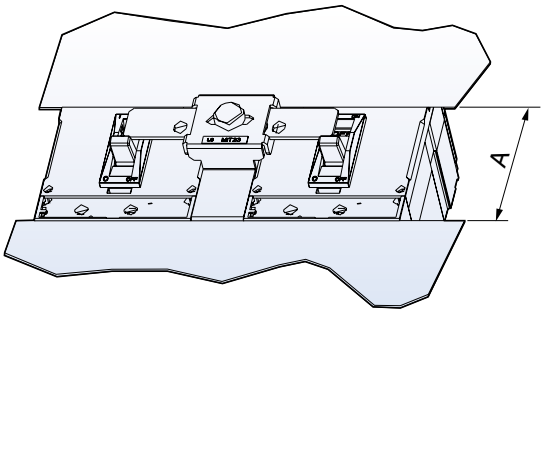


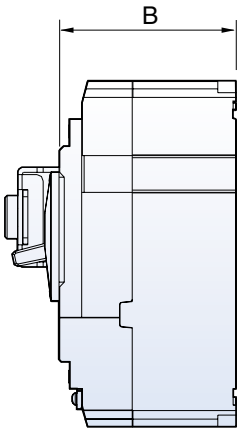
Model	EH1	EH2	EH3	EH4
Applicable to	TD160	TS250	TS630	TS800
A (mm)	Min. 163	Min. 163	Min. 228	Min. 275
	Max. 585	Max. 585	Max. 645	Max. 687
B (mm)	71.8	78.5	131	165.4
C (mm)	60	60	93	140
D (mm)	81	96	129	192.5
E (mm)	81.3	91.8	147.5	186.6
F (mm)	90	105	140	210
Shaft (mm)	469	469	469	469

Mechanical interlocking device

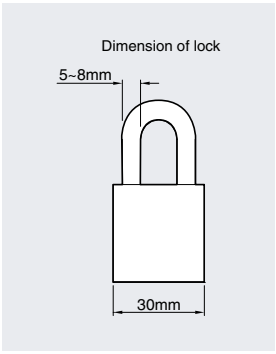
MIT13, MIT23, MIT33, MIT43

[mm]





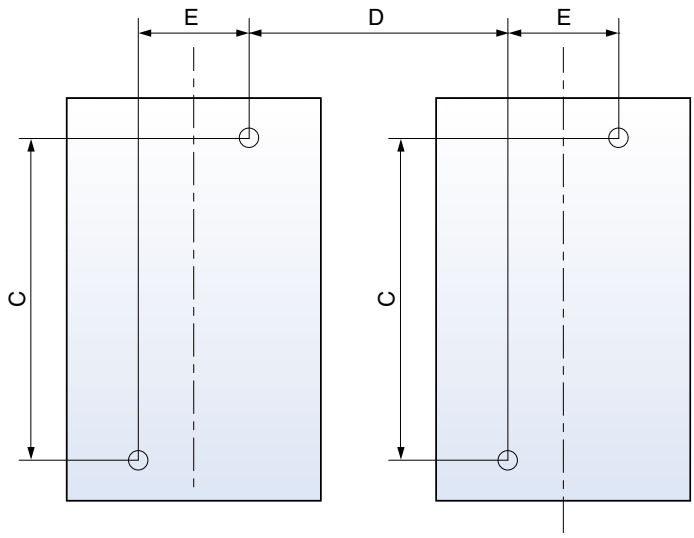
	A (mm)	B (mm)
TD160	83	86
TS250	102	86
TS630	168	110
TS800	201	135



Mechanical interlocking device

Mounting dimension for MIT

[mm]



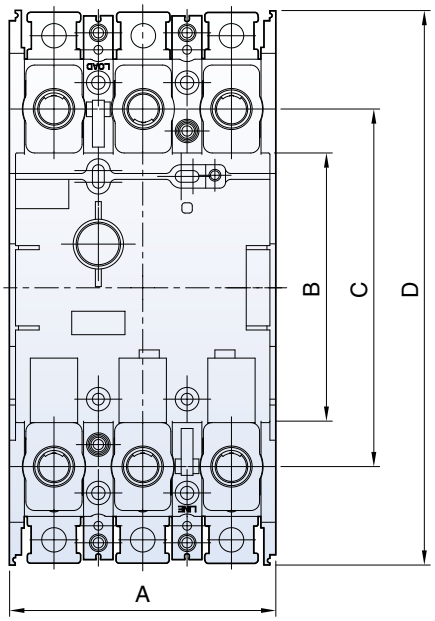
2, 3Pole MCCBs	C(mm)	D(mm)	E(mm)
TD100/160	107	90	30
TS100/160/250	125	105	35
TS400/630	200	139.5	46.5
TS800	278	210	70

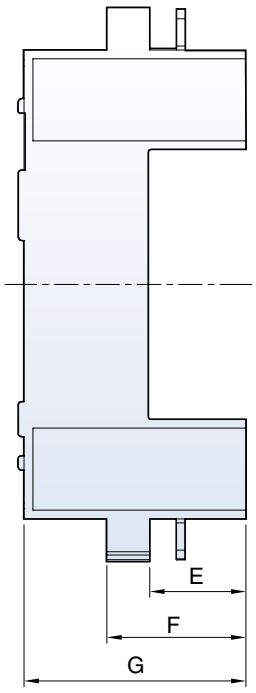
4Pole MCCBs	C(mm)	D(mm)	E(mm)
TD100/160	107	90	60
TS100/160/250	125	105	70
TS400/630	200	139.5	93
TS800	278	210	140

Plug-in device

Plug-in devices for TD100/160

[mm]





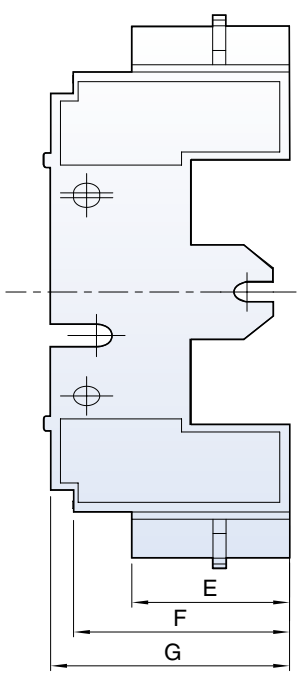
TD100/160

	TD100/160
A(mm)	90
B(mm)	92
C(mm)	122
D(mm)	189.2
E(mm)	32.5
F(mm)	47
G(mm)	75

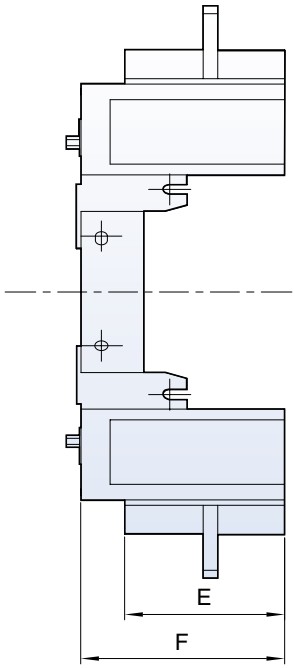
Plug-in device

Plug-in devices for TS100/160/250/400/630/800

[mm]



TS100/160/250/400/630



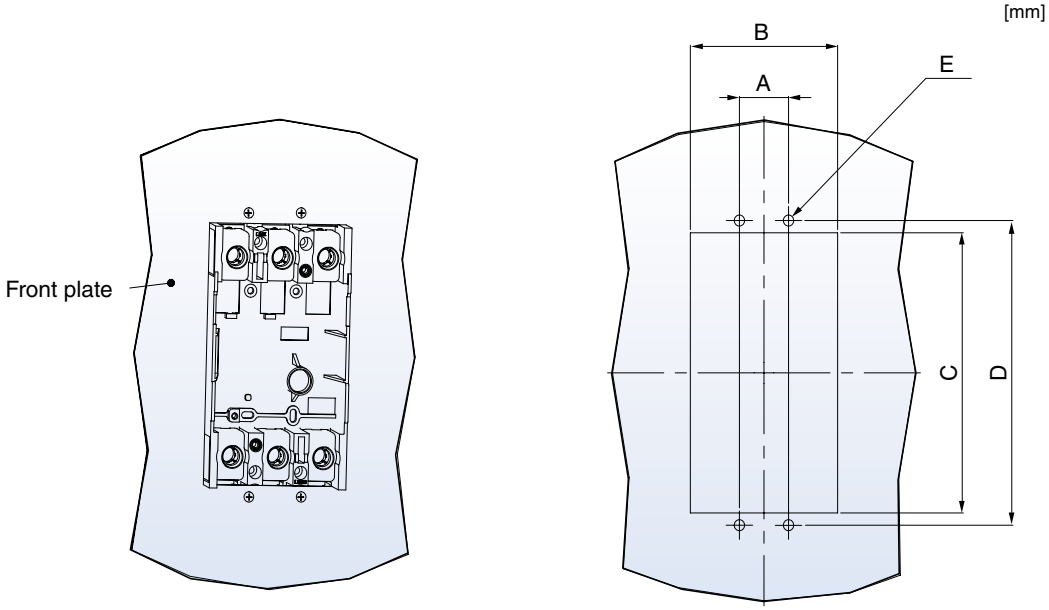
TS800

	TS100/160/250	TS400/630	TS800
A(mm)	105	140	210
B(mm)	103.5	186.4	220
C(mm)	140	230	287
D(mm)	220	335.2	451
E(mm)	48.2	73	110
F(mm)	66	94.2	140
G(mm)	73	102	-

Plug-in device

Mounting to front plate

[mm]

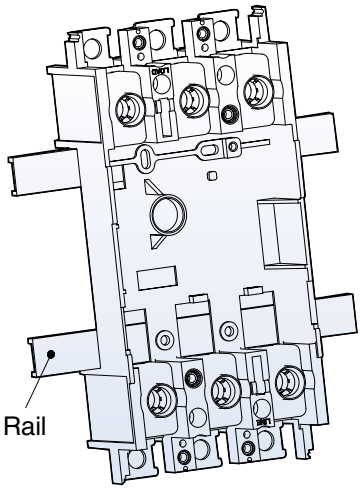


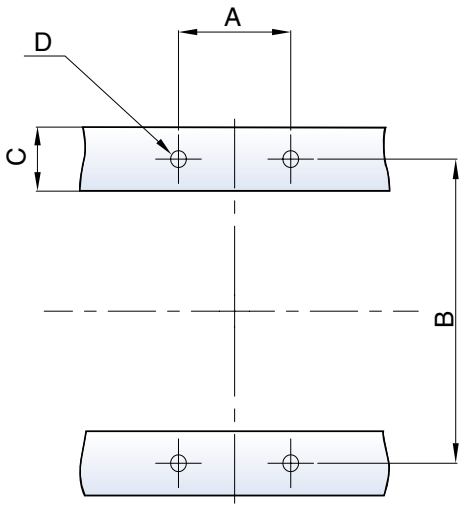
Applicable to	TD100/160	TS100/160/250	TS400/630	TS800
A (mm)	30	35	46.5	70
B (mm)	90	105	140	210
C (mm)	160	182	290	387
D (mm)	173	202	314	422
E (mm)	M4 or ø 5	M4 or ø 5	M5 or ø 6	M6 or ø 7

Plug-in device

Rail mounting

[mm]



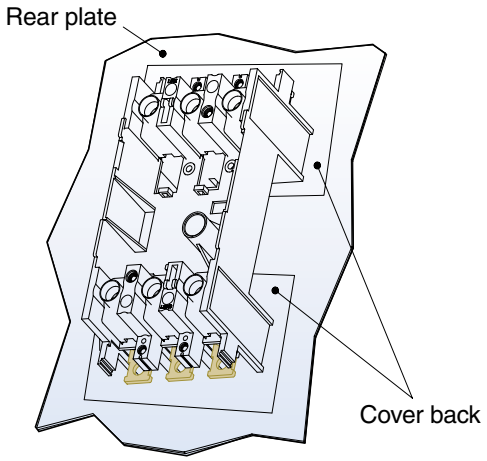


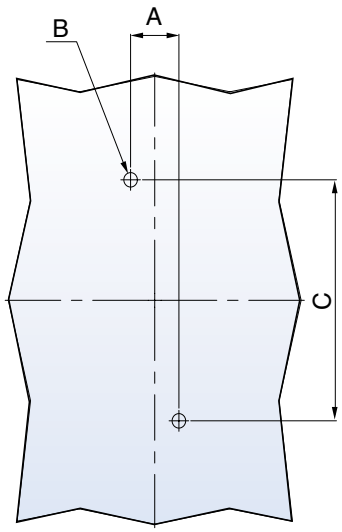
Applicable to	TD100/160	TS100/160/250	TS400/630	TS800
A (mm)	30	70	100	156
B (mm)	76	77.8	101.6	104.2
C (mm)	14	28	32	43
D (mm)	M4 or ø 5	M6 or ø 7	M6 or ø 7	M8 or ø 9

Plug-in device

Mounting to rear plate with cover back

[mm]



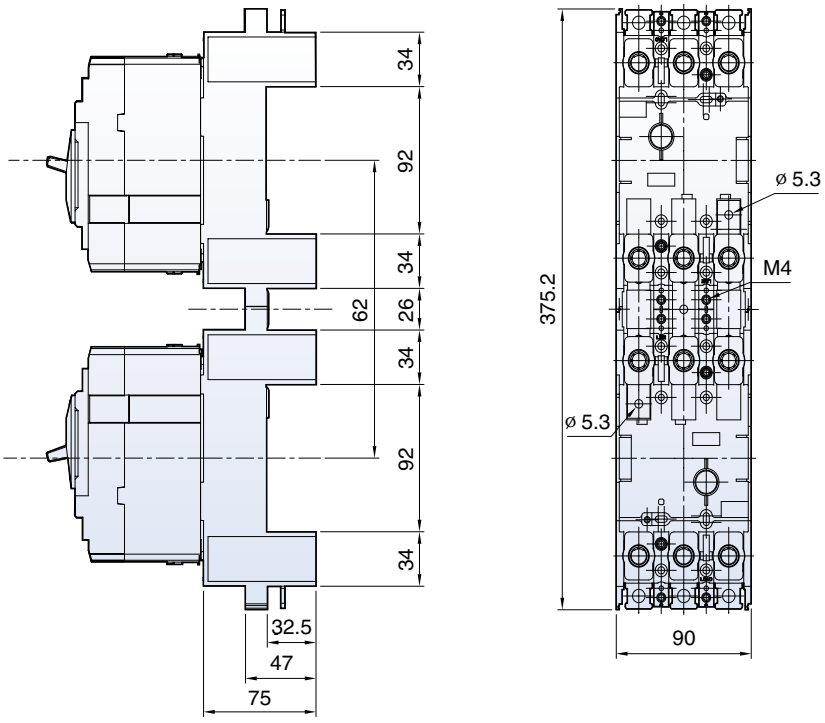


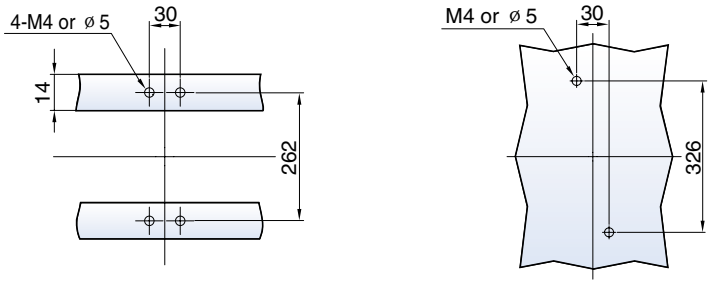
Applicable to	TD100/160	TS100/160/250	TS400/630	TS800
A (mm)	30	35	46.5	70
B (mm)	140	154	216	343
C (mm)	M4 or ø 5	M4 or ø 5	M5 or ø 6	M6 or ø 7

Plug-in device

Mounting

[mm]

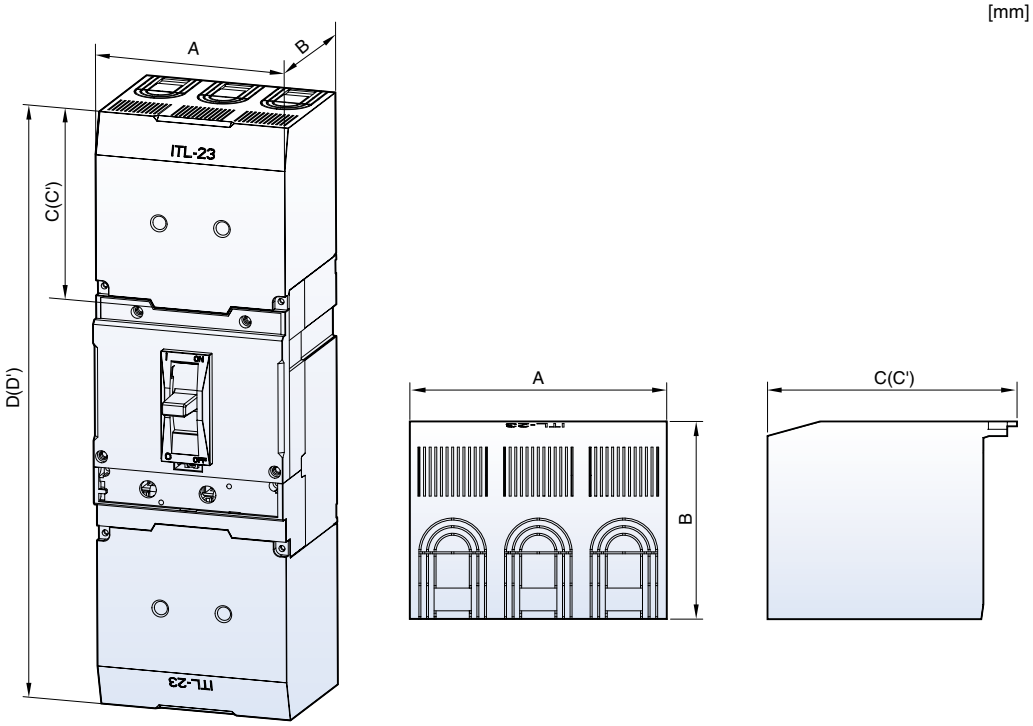




Terminal cover

ITS and ITL

[mm]

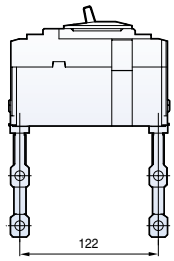


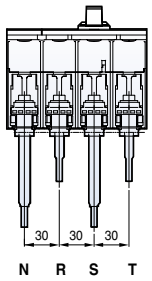
Applicable to	Type			Dimension(mm)					
Frame type	Pole	Long type	Short type	A	B	C (Long type)	C′ (Short type)	D (Long type)	D′ (Short type)
TD100, TD160	2P, 3P	ITL13	ITS13	90	80.8	48.5	30.5	196	160
	4P	ITL14	ITS14	120	80.8	32	25		
TS100, TS160, TS250	2P, 3P	ITL23	ITS23	105	80.8	102	36.3	321.4	190
	4P	ITL24	ITS24	140	80.8	98	32.3		
TS400, TS630	2P, 3P	ITL33	ITS33	140	105	144.5	54.8	479.4	300
	4P	ITL34	ITS34	186	105	138.5	48.8		
TS800	2P, 3P	ITL43	ITS43	210	127.8	181.5	61.5	600	360
	4P	ITL44	ITS44	280	127.8	172.5	52.5		

Rear terminals

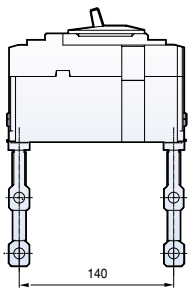
[mm]

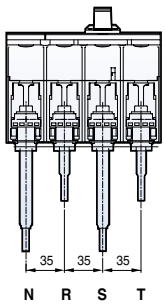
TD100
TD160



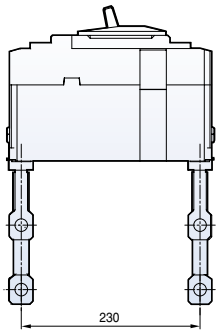


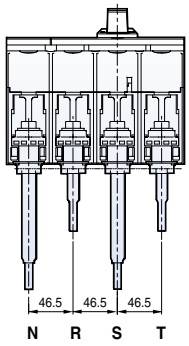
TS100
TS160
TS250



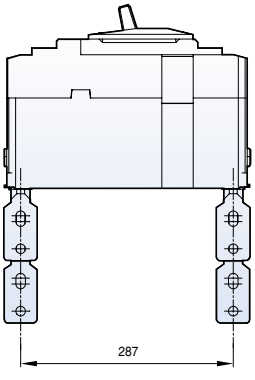


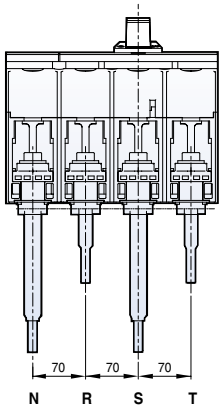
TS400
TS630





TS800

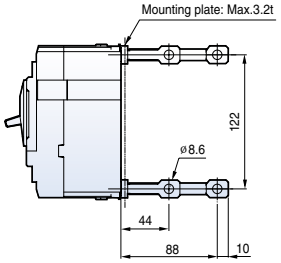


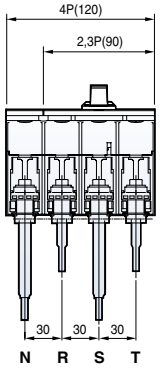


Rear terminals

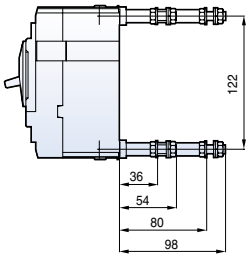
TD100 / TD160

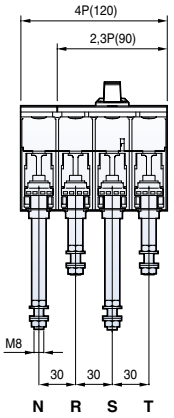
Bar type



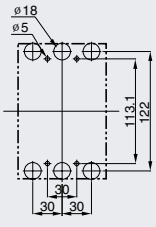


Round type

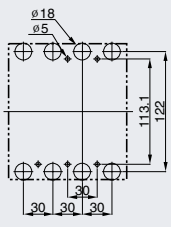




Panel drilling

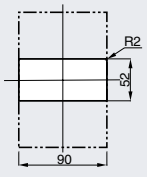


2, 3P

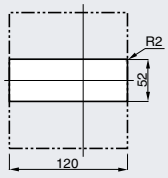


4P

Front panel cutting



2, 3P

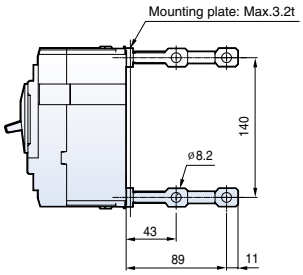


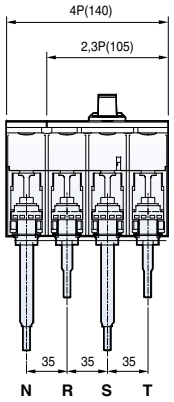
4P

Rear terminals

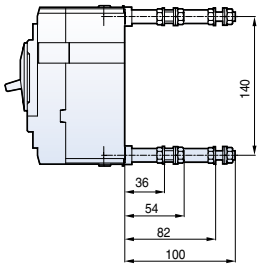
TS100 / TS160 / TS250

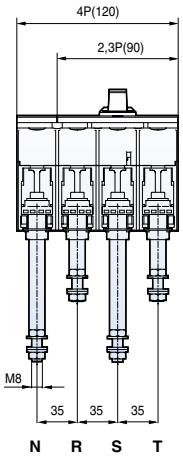
Bar type



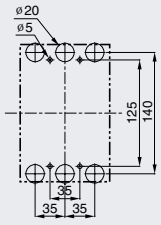


Round type

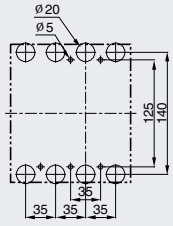




Panel drilling

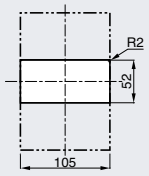


2, 3P

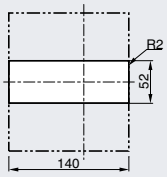


4P

Front panel cutting



2, 3P

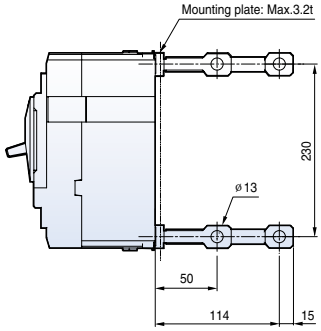


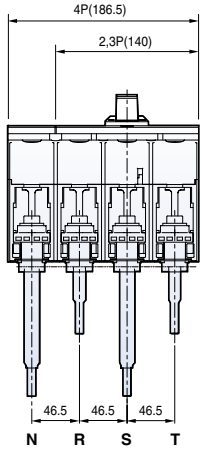
4P

Rear terminals

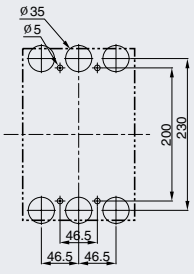
TS400 / TS630

Bar type

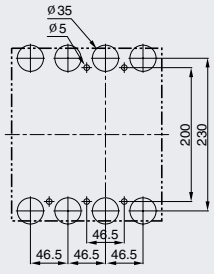




Panel drilling

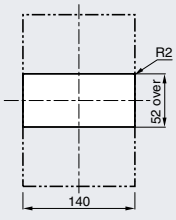


2, 3P

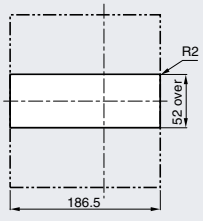


4P

Front panel cutting



2, 3P

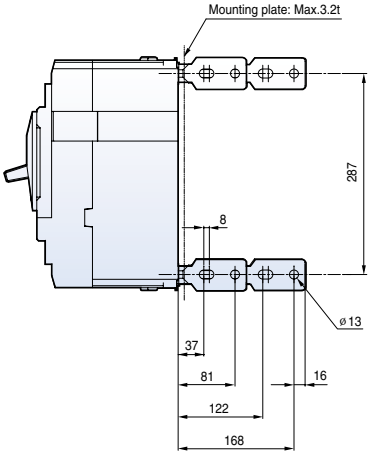


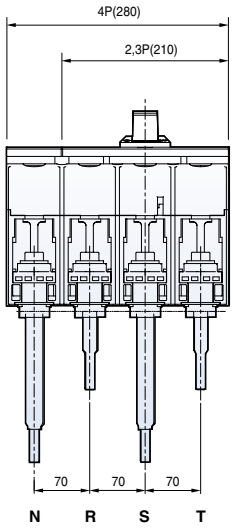
4P

Rear terminals

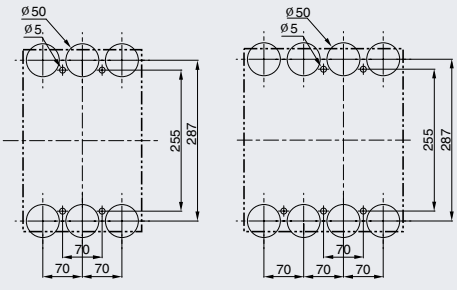
TS800

Bar type

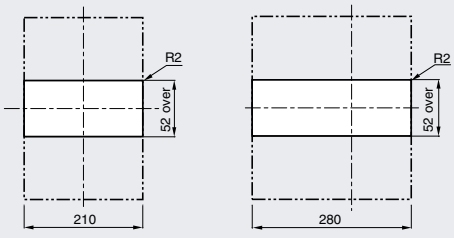




Panel drilling



Front panel cutting



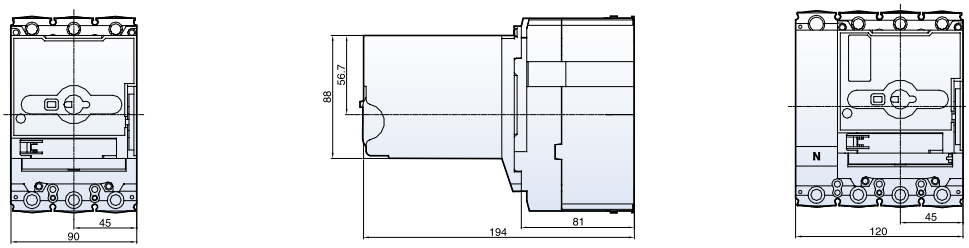
Circuit breaker with motor operator

MOP1, MOP2, MOP3, MOP4

[mm]

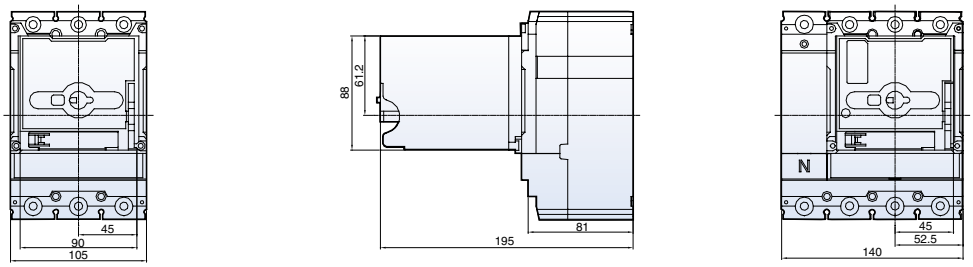
TD100N/H/L
TD160N/H/L

Circuit breaker with MOP1



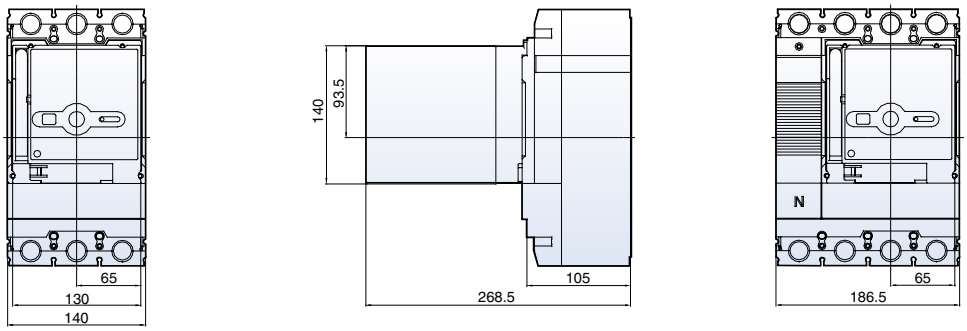
TS100N/H/L
TS160N/H/L
TS250N/H/L

Circuit breaker with MOP2



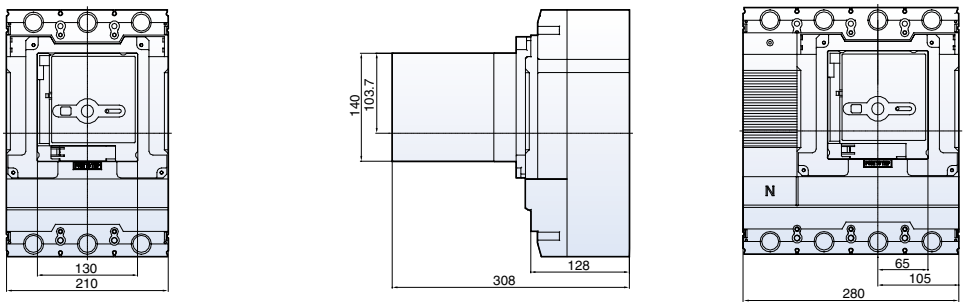
TS400N/H/L
TS630N/H/L

Circuit breaker with MOP3



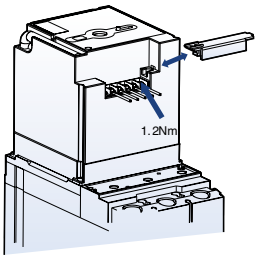
TS800N/H/L

Circuit breaker with MOP4



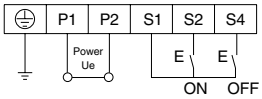
Wiring connection

Motor operator



Standard connection

Circuit breaker On and Off controlled by remote operation and manual operation

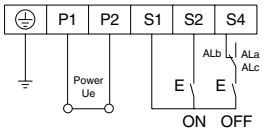


Connection with alarm switch (AL)

1) The below connection diagram is the method of using a alarm switch (AL) without shunt or undervoltage trip.
2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

Connection with FAL (only for the breakers with electronic trip unit ETS or ETM)

1) The below connection diagram is the method of using a FAL for circuit breakers with electronic trip unit.
2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

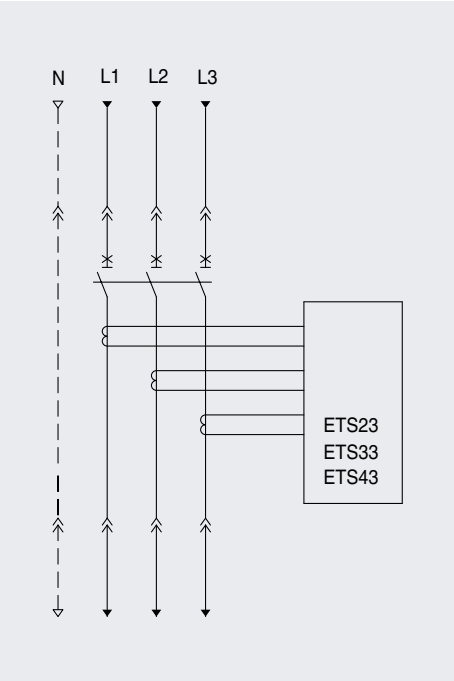


Wiring diagram(State of operation)

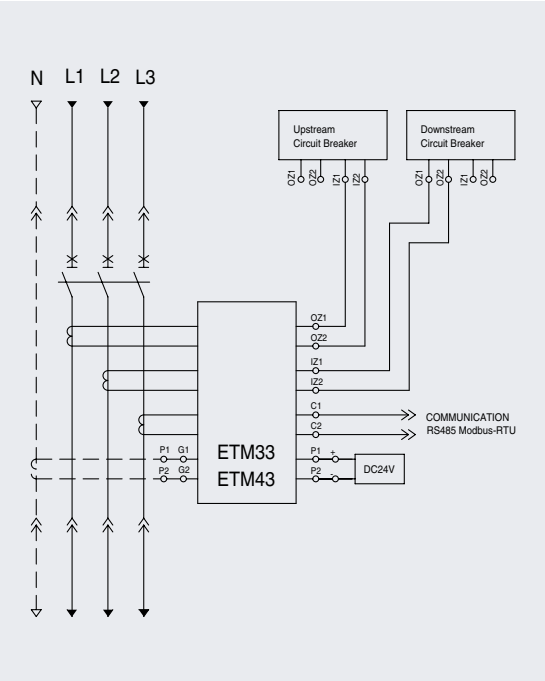
ETS23/ETS33/ETS43

The diagram is shown in the following conditions:

- Fixed version circuit-breaker (depending on type of circuit-breaker)
- Circuit breakers open.
- Releases not tripped



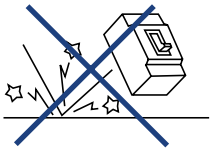
Three-pole circuit-breaker with
ETS23/ETS33/ETS43 electronic release



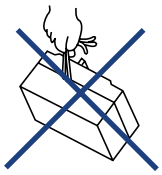
Three-pole circuit-breaker with
ETM33/ETM43 electronic release
(External natural current transformer)

Conditions for transport and storage

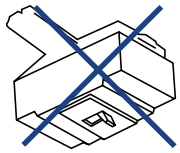
Transport



Do not drop the packing.

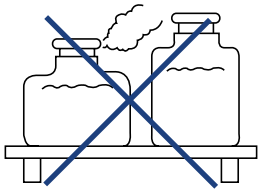


Don’t bring the MCCB up with holding the wires for carrying.

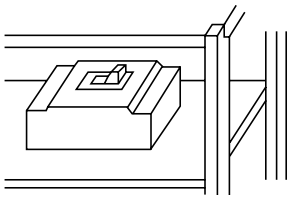


Don’t bring the MCCB in a reverse state for carrying after installing on din rail.

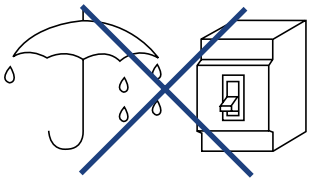
Storage



Avoid corrosive gas.

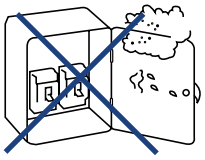


Keep the MCCB in state of Off or Trip position for storage.

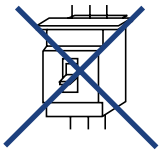


Avoid humid air.
Relative humidity: Max.85%

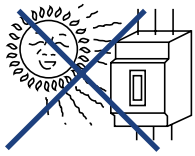
Installation



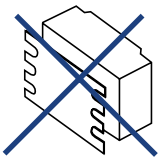
Avoid direct exposure to rain,oil, dust and powder etc.



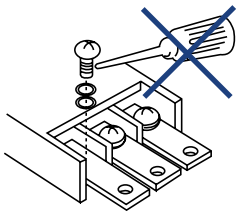
Don’t block up the exhaust port.



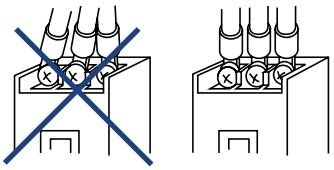
Avoid direct sunlight.



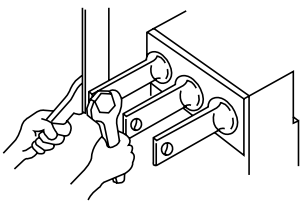
Do not remove the insulation plate at the back of MCCB.



Remove lubricating oil.



Hold the conductors firmly keeping the poles parallel with each other.



Don’t deform the studs.
Fasten the conductors of rear connection type without deforming the stud.

Installation recommendations

Susol TD and TS circuit breakers equipped with thermal magnetic trip units may be used between -25°C and +70°C. For temperature higher than 40°C, the circuit breakers should be derated. And, altitude does not significantly affect circuit breaker characteristics up to 2000m.

Please do not install the circuit breakers in place of environment with shock, high temperature, humidity, dust, corrosive gases, excessive vibration, etc. to prevent fire accidents and malfunction of the device.
1) Operating Ambient Temperature: -5 to 40°C
2) Permissible storage-temperature: - 40°C to 85°C
3) Relative Humidity: 45~85%
4) Altitude: less than 2,000m

Circuit breakers equipped with thermal magnetic trip units
For temperature higher than 40°C, the circuit breakers should be derated. But, on a request, we can supply Susol TD and TS circuit breakers which are particularly designed to hold 100% rated current (In) at 55°C without tripping in normal condition.

Circuit breakers equipped with electronic trip units
Susol TS circuit breakers equipped with electronic trip units may be used between -20°C and +70°C. For temperature higher than 40°C, the circuit breakers should be derated.

Susol TD and TS circuit breakers equipped with thermal magnetic trip units are designed to enable power supply, switching and short circuit breaking by -25°C. And, the permissible storage temperature range in the original packing is -40°C to +85°C.

For the use of where dust or vapour is much contained, it is strongly recommended to put it into enclosure of dustproof or waterproof. Excessive vibration may cause tripping, breaks in connections or damage to mechanical parts.

In the environment containing corrosive gas, it is recommended to use MCCB of added corrosion resistive enclosure or in any enclosure of protective structure.

Ordering information

MCCB c/w trip unit

Series	AF	Rated ultimate short-circuit breaking capacity at 415VAC		Type of trip unit	Rated current	No of pole		Ambient temperature
TD	160	N		FMU	160A	3P		40°C 55°C
TD	100	N	50kA	FTU FMU	16, 20, 25, 32, 40, 50, 63, 80, 100A 16, 20, 25, 32, 40, 50, 63, 80, 100A	2P	3P2T	
		H	85kA			3P	3P3T	
		L	150kA					
TD	160	N	50kA	FTU FMU DSU	100, 125, 160A 100, 125, 160A 160A	4P	4P3T 4P4T 4P3T+N/2	
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	250	N		ATU	250A	3P		40°C 55°C
TS	100	N	50kA	FTU FMU MTU ETS23 DSU	40, 50, 63, 80, 100A 40, 50, 63, 80, 100A 1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100A 40, 80A 100A			
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	160	N	50kA	FTU FMU ATU MTU ETS23 DSU	100, 125, 160A 100, 125, 160A 125, 160A 32, 50, 63, 100, 160A 40, 80, 160A 160A			
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	250	N	50kA	FTU FMU ATU MTU ETS23 DSU	125, 160, 200, 250A 125, 160, 200, 250A 125, 160, 200, 250A 100, 160, 220A 40, 80, 160, 250A 250A			
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	400	N	65kA	FTU FMU ATU MTU ETS33 ETM33 DSU	300, 400A 300, 400A 300, 400A 320A 160, 250, 400A 160, 250, 400A 400A	2P 3P 4P	3P2T 3P3T 4P3T 4P4T 4P3T+N/2	
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	630	N	65kA	FTU FMU ATU MTU ETS33 ETM33 DSU	500, 630A 500, 630A 500, 630A 500A 160, 250, 400, 630A 160, 250, 400, 630A 630A			
		H	85kA					
		L	150kA					
		NA	- (only for DSU)					
TS	800	N	65kA	FTU FMU ATU MTU ETS43 ETM43 DSU	700, 800A 800A 800A 630A 630, 800A 630, 800A 800A			
		H	100kA					
		L	150kA					
		NA	- (only for DSU)					

Example) 1. TD100N FTU100A 3P2T
2. TS160N FMU160A 3P3T
3. TS250N ATU250A 4P3T
4. TS800L ETS43 800A 3P3T

Note) 1. Type of trip units
(1) FTU Fixed thermal, fixed magnetic
(2) FMU Adjustable thermal, fixed magnetic
(3) ATU Adjustable thermal, adjustable magnetic
(4) MTU Magnetic only Trip Unit
(5) ETS Electronic Trip Unit, Standard
(6) ETM Electronic Trip Unit, Multifunction (11 options)
(7) DSU Disconnecting Switch Unit

2. Electronic type and MTU type MCCBs are only available in 3 pole.
3. Option for ETM33 (Please refer to page number A-2-45 ~ 46 for more details.)
(1) ETM33 A (4) ETM33 AC (7) ETM33 ZA (10) ETM33 ZAC
(2) ETM33 E (5) ETM33 AEC (8) ETM33 ZE (11) ETM33 ZAEC
(3) ETM33 AE (6) ETM33 Z (9) ETM33 ZAE
4. Option for ETM43 (Please refer to page number A-2-52 ~ 54 for more details.)
(1) ETM43 A (4) ETM43 AC (7) ETM43 ZA (10) ETM43 ZAC
(2) ETM43 E (5) ETM43 AEC (8) ETM43 ZE (11) ETM43 ZAEC
(3) ETM43 AE (6) ETM43 Z (9) ETM43 ZAE

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