

M-SERIES



Technical catalogue

Air Circuit Breakers



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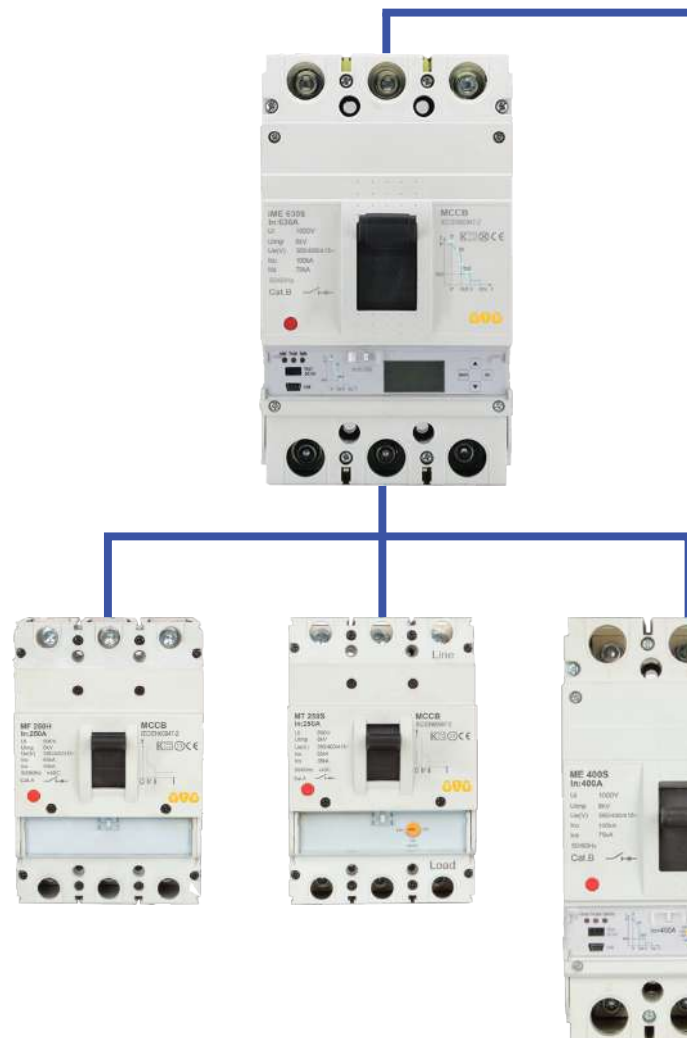


MA3 Series Air Circuit Breakers

Air circuit breakers of BTB Electric have always been appreciated for their high electrical performances, maximum modularity and standardisation which the all the ranges feature. Their very high safety, quality and rationality features, are the result of absolutely innovative design criteria.

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General

BEST-SOLUTION

*Various line-up and high flexibility,
Current range 630A ~ 6300A*

HIGH-RELIABILITY

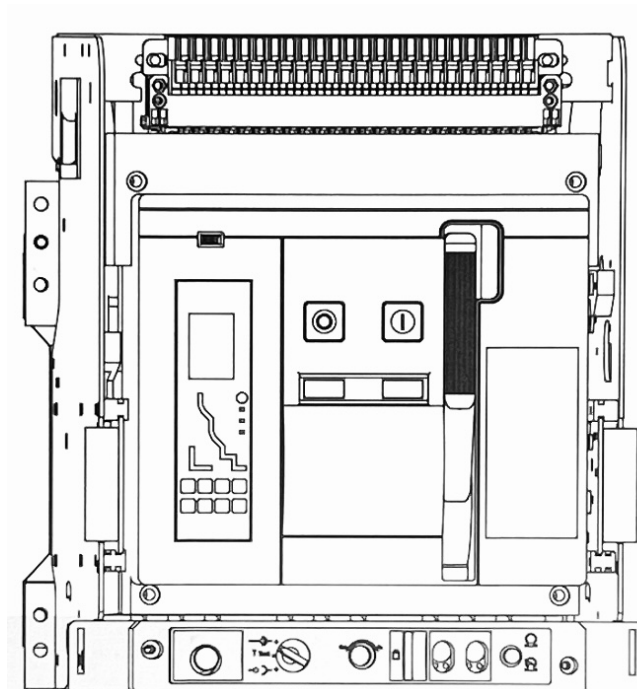
*Highest offered safety and reliability,
Impulse withstand voltage up to 12 kV*

HIGH-PERFORMANCE

*The highest breaking capacity:
135kA (6300A at 415V)*

CUSTOMER FRIENDLY

*3 ampere frame sizes 2000/4000/6300A,
Easy handling and retrofitted solution*



Application scope

MA3 series air circuit breaker is suitable for the circuit of AC 50Hz/60Hz with rated service voltage 400V, 690V and rated service current up to 6300A. It is mainly used to distribute electric energy and protect circuits and electric equipment against over-load, under-voltage, short-circuit and single-phase earthing fault.

With intelligentized and selective protection functions, the breaker can improve the reliability of power supply, and avoid unnecessary power failure. The breaker is applicable for power stations, factories, mines (for 690V) and modern high-buildings, especially for the distribution system of intelligentized building.

Applied Standards and Certifications

MA3 series air circuit breaker has acquired testing/certifications from IEC/EN 60947-1, 2 certified testing institute and can be installed and applied according to the usage environment and conditions permitted by the standards.

Compliance with Part No.: 1 General of IEC/EN 60947 Low Switch and Control Equipment.

Compliance with Part No.: 2 Low Voltage Switch Circuit Breaker of IEC/EN 60947 Low Switch and Control Equipment.

Our **MA3** series air circuit breakers are tested by IECEE laboratories – IEC system of conformity assessment schemes for electrotechnical equipment and components.



Operating conditions

Ambient temperature

-5°C~+40°C (the average value within 24h shall not exceed +35°C, special situation excluded)

Altitude

Below 2,000m above sea level.

Air conditions

Maximum temperature + 40°C (relative humidity should be under 85%)

Maximum temperature + 20°C (relative humidity should be under 90%)

Mounting conditions

Perpendicularity and angularity $\leq 5^\circ$

Air circuit breaker shall be installed under non-explosive, non-conducted dust, non-sufficient corrosion metal and without destructive insulation conditions.

Note

Without the intelligent controller, the breaker functions as a switch-disconnector.

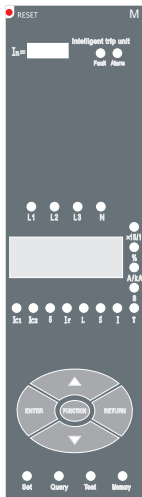
As for the total harmonic distortion (THD) rate, it must be managed below 5% in the distribution system phase. In case it is not complied with, it may cause heating in the product.

General

Intelligent trip unit

- Intelligent trip unit built in the **MA3**-Series Air circuit breaker has reinforced power monitoring functions such as temperature monitoring, fault recording other than the basic protection function, ultimately enabling stable power supply.
- Protection with power from Internal CT.
- Trip relays are classified according to function as follows:

M type

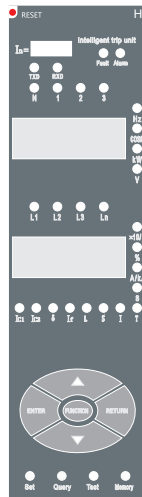


Protection:
Ir/Isd/li/Ig
Neutral protection
Thermal

Measurement:
LED
A
Fault status indicating
Maintenance functions

Connect:
Self Power
250VAC

H type



Protection:
Ir/Isd/li/Ig
Neutral protection
Thermal
Load monitor/alarm

Measurement:
LED
V/A/W/F/PF
Fault status indicating
Maintenance functions

Connect:
Modbus/RS-485
Self Power
250VAC

3M type

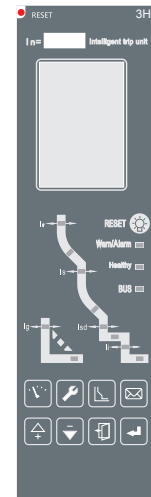


Protection:
Ir/Isd/li/Ig
Neutral protection
Thermal
OV/UV/OF/UF/rP

Measurement:
LCD
V/A/W/Wh/F/PF
Harmonics (31th)
Fault status indicating
Maintenance functions

Connect:
Self Power
250VAC

3H type



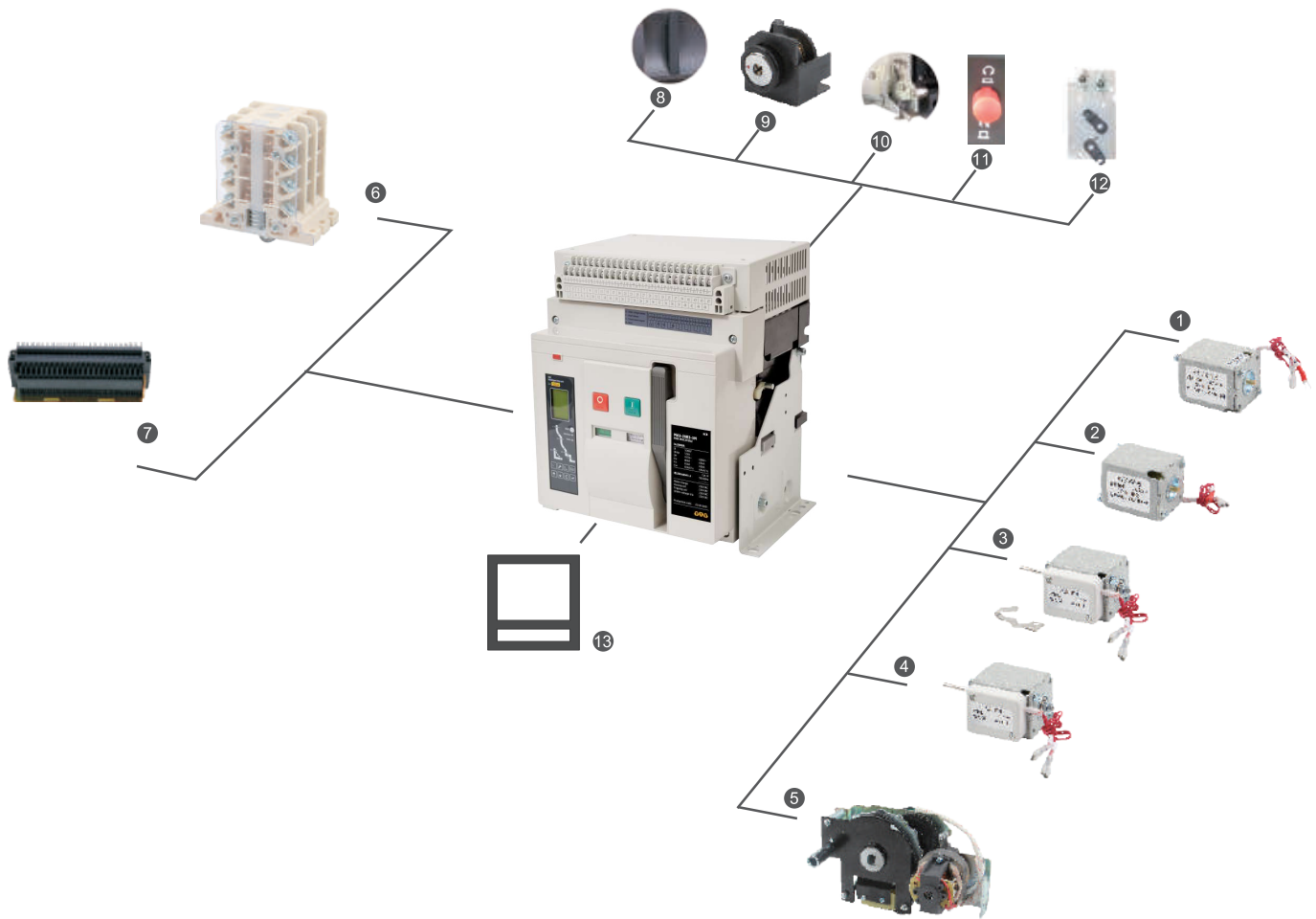
Protection:
Ir/Isd/li/Ig
Neutral protection
Thermal
Load monitor/alarm
OV/UV/OF/UF/rP

Measurement:
LCD
V/A/W/Wh/F/PF
Harmonics (31th)
Fault status indicating
Maintenance functions

Connect:
Modbus/RS-485
Self Power
250/400VAC

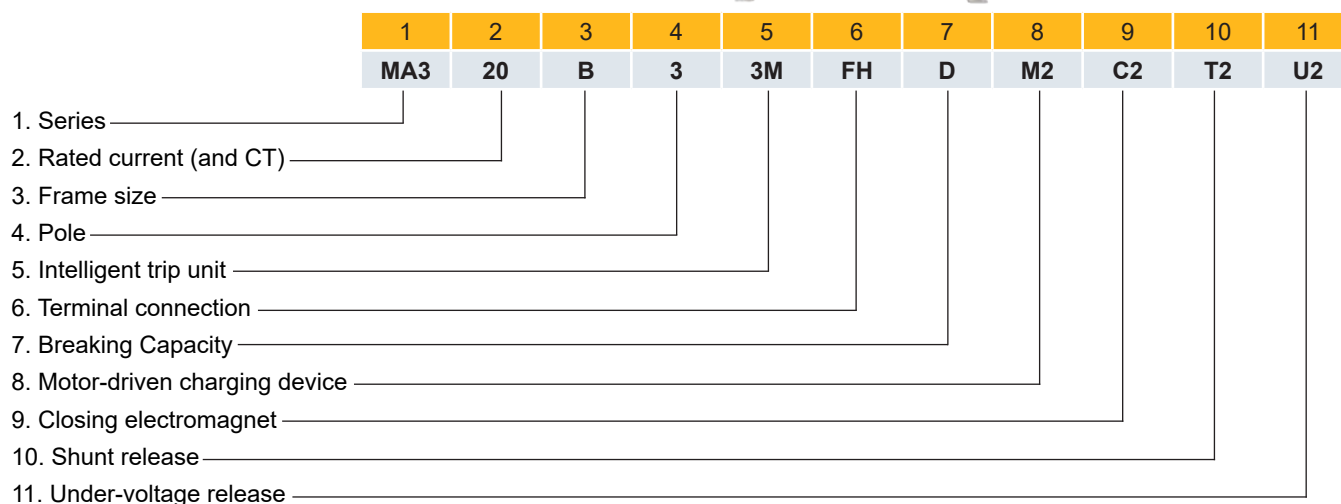
General

Accessories



- | | | | |
|----------|----------------------------------|-----------|--|
| 1 | Shunt release | 8 | Padlock |
| 2 | Closing electromagnet | 9 | Key lock |
| 3 | Under-voltage release | 10 | Door Interlock |
| 4 | Under-voltage release time-delay | 11 | Connected, disconnected, test position locking mechanism |
| 5 | Motor-driven charging device | 12 | Mechanical interlock |
| 6 | Auxiliary contact | 13 | Doorcase |
| 7 | Secondary wiring terminal | | |

Model definition



1. Series

| | |
|-----|---|
| MA3 | Air Circuit Breakers / Design number |
|-----|---|

2. Rated current

| | |
|----|-------|
| 06 | 630A |
| 08 | 800A |
| 10 | 1000A |
| 12 | 1250A |
| 16 | 1600A |
| 20 | 2000A |
| 25 | 2500A |
| 32 | 3200A |
| 40 | 4000A |
| 50 | 5000A |
| 63 | 6300A |

3. Frame size

| | |
|---|----------------------|
| B | 2000A (630 ~ 2000A) |
| D | 4000A (2500 ~ 4000A) |
| E | 6300A (4000 ~ 6300) |

4. Pole

| | |
|---|--------|
| 3 | 3 Pole |
| 4 | 4 Pole |

5. Intelligent trip relay

| | |
|----|---------------|
| M | Relay M type |
| H | Relay H type |
| 3M | Relay 3M type |
| 3H | Relay 3H type |

6. Terminal connection

| | |
|---------------|-------------------------------------|
| Fixed type | |
| FH | Horizontal type |
| FV | Vertical type |
| FM | Mixed type (Horizontal Vertical) |
| Draw-out type | |
| DH | Horizontal type |
| DV | Vertical type |
| DM | Mixed type; Horizontal; Vertical |

7. Breaking Capacity

| | |
|---|-----------|
| D | Ics ≠ Icu |
| E | Ics = Icu |

8. Motor-driven charging device

| | |
|----|-------------|
| M0 | Manual type |
| M1 | 110 VAC |
| M2 | 220 VAC |
| M3 | 400 VAC |
| M6 | 110 VDC |
| M7 | 220 VDC |

9. Closing electromagnet

| | |
|----|-------------|
| C0 | Manual type |
| C1 | 110 VAC |
| C2 | 220 VAC |
| C3 | 400 VAC |
| C6 | 110 VDC |
| C7 | 220 VDC |

10. Shunt release

| | |
|----|-------------|
| T0 | Manual type |
| T1 | 110 VAC |
| T2 | 220 VAC |
| T3 | 400 VAC |
| T6 | 110 VDC |
| T7 | 220 VDC |

11. Under-voltage release

| | |
|----|---------|
| U0 | Without |
| U1 | 110 VAC |
| U2 | 220 VAC |
| U3 | 400 VAC |
| U6 | 110 VDC |
| U7 | 220 VDC |

Rating and Specification

| Frame size (A) (In max) | | | 2000 |
|---|-----------------------------|----------------------|--|
| Type | | | MA3-06B, MA3-08B, MA3-10B, MA3-12B, MA3-16B, MA3-20B |
| Current setting I _r (A) and CT rating at (40°C) | | | 630, 800, 1000, 1250, 1600, 2000 |
| Setting current (A) Control trip relay (... × I _n max) | | | 0.4 ~ 1.0 |
| Rated Operational Voltage, U _e | | | AC 415V/690V |
| Rated Insulation Voltage, U _i | | | 1000V |
| Rated Impulse Withstand Voltage, U _{imp} | | | 12kV |
| Rated Frequency | | | 50/60Hz |
| No. of Poles | | | 3, 4 |
| Rated Current of N-pole I _N (A) | | | 100%I _n |
| Breaking Capacity | | | D / E |
| Ultimate breaking capacity I _{cu} (kA rms) IEC/EN 60947-2 | 400/415V | | 80 / 65 |
| | 660V/690V | | 65 / 65 |
| Rated service breaking capacity I _{cs} (kA rms) IEC/EN 60947-2 | 400/415V | | 65 / 65 |
| | 660V/690V | | 65 / 65 |
| Rated short-time withstand current I _{cw} (kA rms (1s – 415V)) | | | 65 |
| Operating time (ms) | Maximum total breaking time | | ≤35 |
| | Maximum closing time | | ≤75 |
| Operating performance (cycles) | Electrical life | | 8000 |
| | Mechanical life | Maintenance free | 15000 |
| | | Maintenance required | 30000 |
| Terminal connection Horizontal / Vertical / Mixed | Fixed | | ● / ○ / ○ |
| | Draw-out | | ● / ○ / ● |
| Weight (kg) | Fixed | 3P | 43 |
| | | 4P | 54 |
| | Draw-out | 3P | 79 |
| | | 4P | 91 |
| Dimensions (mm) W x D x H | Fixed | 3P | 362×323×401 |
| | | 4P | 457×323×401 |
| | Draw-out | 3P | 375×419×432 |
| | | 4P | 470×419×432 |
| Intelligent trip unit M / H / 3M / 3H type | | | ● / ● / ● / ● |
| With front shield (closed cabinet) | | | IP54 |

Remarks: “●” with this function; “○” function for selection; “-” without this function

| 4000 | | 6300 | |
|------------------|-------------|------------------|-------------|
| MA3-25D, MA3-32D | MA3-40D | MA3-40E, MA3-50E | MA3-63E |
| 2500, 3200, 4000 | | 4000, 5000, 6300 | |
| 0.4 ~ 1.0 | | 0.4 ~ 1.0 | |
| AC 415V/690V | | AC 415V/690V | |
| 1000V | | 1000V | |
| 12kV | | 12kV | |
| 50/60Hz | | 50/60Hz | |
| 3, 4 | | 3, 4 | 3 |
| 100%In | | 50% / 100%In | |
| D / E | | D / E | |
| 120 / 100 | | 135 / 135 | |
| 85 / 85 | | 100 / 100 | |
| 100 / 100 | | 135 / 135 | |
| 85 / 85 | | 100 / 100 | |
| 100 | | 135 | |
| ≤35 | | ≤35 | |
| ≤75 | | ≤75 | |
| 6000 | | 1500 | |
| 10000 | | 2500 | |
| 20000 | | 5000 | |
| ● / ○ / ○ | | ● / ○ / ○ | |
| ● / ○ / ● | | ● / ○ / ○ | |
| 54 | 62 | 105 | 130 |
| 67 | 81 | 131 | - |
| 90 | 126 | 212 | 228 |
| 119 | 157 | 231 | - |
| 426×325×401 | 426×367×401 | 807×396×401 | 922×396×401 |
| 537×325×401 | 537×367×401 | 922×396×401 | - |
| 435×419×432 | 435×489×432 | 813×492×432 | 928×492×432 |
| 550×419×432 | 550×489×432 | 928×492×432 | - |
| ● / ○ / ○ / ● | | ○ / ○ / ○ / ● | |
| IP54 | | IP54 | |

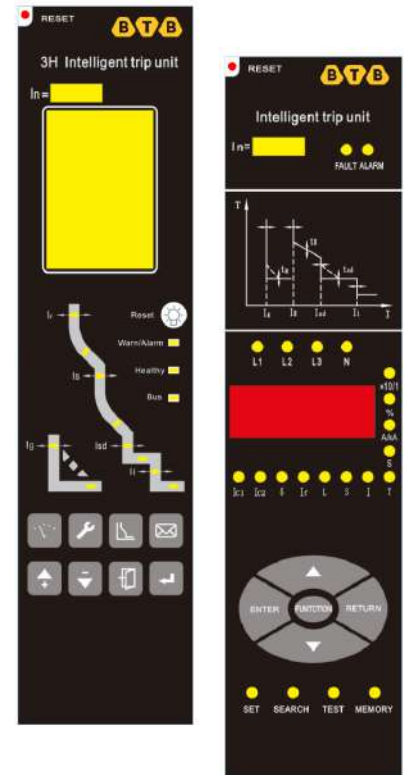
Intelligent trip unit

Protection with power from Internal CT

The Over current protection and Ground Module for display and communication fault protection can work with power from Internal CT, even if the control power source is off.

Intelligent trip unit are classified according to function

- Protection: overload, short current, ground fault, earth leakage, under voltage, over voltage, under frequency, over frequency, reverse power, unbalance, etc
- Measurement: voltage, ampere, power, energy, frequency, power factor, Harmonics, etc.
- Event & fault recording: Max. 8 events & faults
- Communication: Modbus/RS-485, Profibus-DP



Select function

| Function items | M type | H type | 3M type | 3H type |
|--|-----------|-----------|-----------|-----------|
| Display interface | | | | |
| Digital tube display | ● | ● | - | - |
| LCD display | - | - | ● | ● |
| Protection functions | | | | |
| Overload long delay protection | ● | ● | ● | ● |
| Overload thermal memory | ● | ● | ● | ● |
| Overload pre-alarm/alarm signaling operation | ● / ○ | ● / ○ | ● / ○ | ● / ○ |
| Short-circuit short delay protection | ● | ● | ● | ● |
| Short delay thermal memory | ● | ● | ● | ● |
| Short-circuit instantaneous protection | ● | ● | ● | ● |
| Grounding protection (Differential T) | ● | ● | ● | ● |
| Grounding alarm/ alarm signaling operation | ● / ○ | ● / ○ | ● / ○ | ● / ○ |
| Leakage protection /alarm/ alarm signaling operation (and grounding protection for selection) | ○ / ○ / ○ | ○ / ○ / ○ | ○ / ○ / ○ | ○ / ○ / ○ |
| Neutral solidly grounded protection | ● | ● | ● | ● |
| Current asymmetric protection/alarm/ alarm signaling operation | ● / ● / ○ | ● / ● / ○ | ● / ● / ○ | ● / ● / ○ |
| MCR / HSISC | ○ / ○ | ○ / ○ | ○ / ○ | ○ / ○ |
| Load monitor/ alarm/ alarm signaling operation | ○ / ○ / ○ | ● / ● / ○ | ○ / ○ / ○ | ● / ● / ○ |

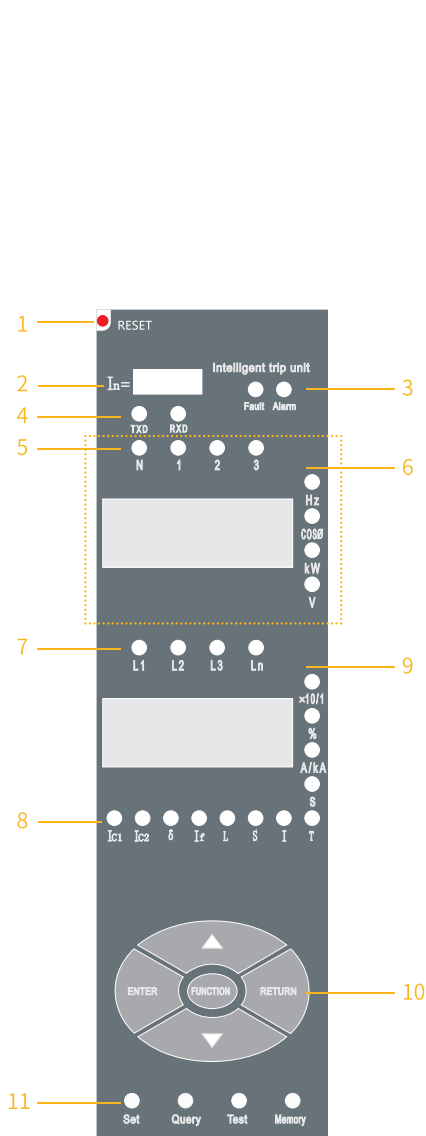
Select function

| Function items | M type | H type | 3M type | 3H type |
|---|--------|--------|-----------|-----------|
| Display interface | | | | |
| Over-voltage protection/ alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Voltage asymmetric protection / alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Phase sequence protection/ alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Under-frequency protection / alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Over-frequency protection / alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Current allowable-value protection/ alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Reverse-power protection / alarm/ alarm signaling operation | - | - | ● / ● / ○ | ● / ● / ○ |
| Testing functions | | | | |
| Current testing (Phase-poles, N-pole and Grounding) | ● | ● | ● | ● |
| Voltage testing (Phase-voltage, Cable-voltage and Voltage asymmetric rate) | ○ | ● | ● | ● |
| Phase sequence testing | - | - | ● | ● |
| Frequency testing | ○ | ● | ● | ● |
| Allowable-value testing (Current) | - | - | ● | ● |
| Allowable-value testing (Power) | - | - | ● | ● |
| Power testing (Active & Reactive power) | ○ | ● | ● | ● |
| Power factor testing | - | ● | ● | ● |
| Power energy testing (Active & Reactive power energy) | - | - | ● | ● |
| Harmonics testing | - | - | ● | ● |
| Maintenance functions | | | | |
| Fault status indicating | ● | ● | ● | ● |
| Fault record and query | ● | ● | ● | ● |
| Past record of peak current | - | - | ● | ● |
| Past record of alarm and query | - | - | ● | ● |
| Fault to trip signaling operation | ● | ● | ● | ● |
| Self-diagnostics function | ● | ● | ● | ● |
| Analog tripping test function | ● | ● | ● | ● |
| Contacts abrasion equivalent (alarm) query | ● | ● | ● | ● |
| Operation times query | ● | ● | ● | ● |
| Clock functions | ○ | ○ | ● | ● |
| Other | | | | |
| Signal unit | ○ | ● | ○ | ● |
| Communication | - | ● | - | ● |
| Regional selective interlock | ○ | ○ | ○ | ○ |

Remarks: “●” with this function; “○” function for selection; “-” without this function

Intelligent trip unit

M/H type



1. Fault to trip & reset
2. Rated current for name-plate
3. In sequence of fault & alarm indicating
4. In sequence of communication emission & receiver indicating (*for H type*)
5. In sequence of N phase, A phase, B phase, C phase voltage indicating (*for H type*)
6. In sequence of frequency, power factor, power, voltage indicating from upper to bottom (*for H type*)
7. In sequence of A phase, B phase, C phase, N phase current indicating
8. In sequence

Ic1: load monitor1,

Ic2: load monitor 2,

δ: asymmetric current,

If: grounding protection,

L: over-load long delay,

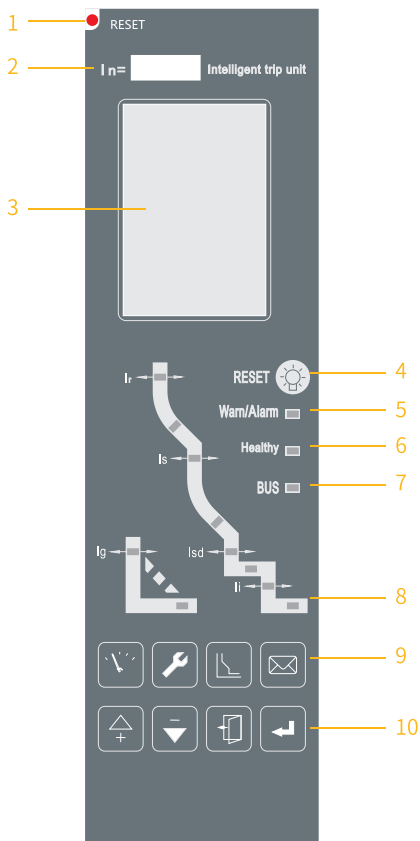
S: short-circuit short delay,

I: short-circuit instantaneous indicating

9. In sequence of opening & closing time, main contacts abrasion rate, current unit, time, self-diagnostics fault statues indicating from upper to bottom
10. 5 pieces operation buttons
11. In sequence of controller setting, query, testing, store service status indicating
12. Notes:

- *The dashed box is controller with voltage indicating function. Without indicating if no.*
- *Serial no.: 4 is with communication function controller. Without indicating if no.*
- *A/kA of serial no.: 9, light fixed is current A and continuous blinking in kA*
- *kW of serial no.: 6, light fixed is activepower and continuous blinking is reactive power*

3M/3H type



1. Fault to trip & reset
2. Rated current for name-plate
3. LCD indicating interface
4. Fault/alarm resetting button
5. Fault/alarm LED indicating (LED without light while normal working. LED with continuous blinking quickly while fault to trip. LED with light fixed while alarm)
6. LED always continuous blinking while controller on power and normal working status
7. Communication indicating (Modbus: extinguish without communication. Continuous blinking while communication. Proibus; extinguish without communication. Light fixed while communication – for 3H type)
8. Curve LED (Fault to trip at corresponding LED light flash indicating fault type. LED light fixed indicating present setting items while protective parameter setting)
9. In sequence of testing function, setting function, protection function and information function button. From left to right
10. In sequence of upward, downward, ESC and selection OK button. from left to right

Remarks: Serial no.: 7 is with communication function controller. No indicating if no-communication function

Intelligent trip unit

Setting and Protective Characteristics

| Over-load long delay protection M/H type & 3M/3H type | | | |
|---|--|---|--|
| Current setting I_r | (0.4 ~ 1.0 or 1.25) I_n or OFF (OFF-function close) Notes: Distribution protection is $1.0I_n$; Generator protection is $1.25I_n$ | | |
| 6 categories protective curre | SI: Normal inverse time $t=0.01396 Tr / (NO.02-1)$ VI; Fast inverse time $t=Tr / (N-1)$ EI (G): Express inverse time (use of general distribution protection) $t=3 Tr / (N^2-1)$ EI (M): Express inverse time (use of generator protection) $t=2.95 Trx I_n [N^2 / (N^2-1.15)]$ HV: High voltage fuse compatibility $t=15Tr/(N^4-1)$ I2t: Normal distribution protection $t=2.25Tr/N^2$ (factory default) $N=I/I_r$ I-fault current t-long delay acting time I_r -long delay setting current Tr -long delay setting time Remarks: only normal distribution protection I^2t for M/H type controller. Other protective curves shall be order. 3M/3H type controller with 6 categories protective curre for selection. | | |
| Normal distribution protection I2t time setting Tr (1.5 I_r) | M/H: 15, 20, 25, 30, 40, 50, 60, 80, 100, 120, 160, 200, 240, 320, 400, 480 (s) 3M/3H: 15, 30, 60, 120, 240, 360, 480, 600, 720, 840, 960 (s) | | |
| Protective curre type | 3M/3H: C1-C16 over-load long delay protective operating delay time in the drop-down list | | |
| Protective characteristics (Accuracy $\pm 10\%$) | Current (I/I_r) | Trip time | |
| | 1.05 | > 2h no-acting | |
| | 1.3 (Distribution protection) | < 2h acting | |
| | 1.2 (Motor protection) | < 2h acting | |
| $\geq 1.2I_r$ | Acting time as per 6 categories protection type formula calculator or curre query | | |
| Thermal memory time | M/H type: 30ms (ON) or power failure release 3M/3H type: instantaneous, 10ms, 20ms, 30ms, 45ms, 1hr, 2hrs, 3hrs or power failure release Remarks: connecting controller for auxiliary power supply with thermal memory function and auxiliary power supply failure, that is, release thermal memory | | |
| Short-circuit short delay protection M/H type & 3M/3H type | | | |
| Current setting I_{sd} | (1.5 ~ 15) I_r or OFF (OFF-functions close) | | |
| Time setting | Tsd1 inverse time | M/H type: 0.1 ~ 1.0 | |
| Tsd (s) | Tsd2 definite time | 3M/3H type: 0.1, 0.2, 0.3, 0.4 (selection: 0.1 ~ 1.0) | |
| | Current (I/I_{sd}) | Trip time | |
| | ≤ 0.9 | No-acting | |
| | ≥ 1.1 | Inverse time $I_{sd} < I < 8I_r$ | Curre 1 - 5 and over-load long delay simultaneously, but curve speed faster 10 times. curre 6 characteristics formula $t=64Tsd/N^2$ |
| | | Definite time $I > 8I_r$ (or $I > I_{sd}$) | Delay protection as per definite time delay setting time Tsd |
| Thermal memory time | M/H type: 15min (ON) or power failure release 3M/3H type: instantaneous, 10ms, 20ms, 30ms, 45ms, 1hr, 2hrs, 3hrs or power failure release Remarks: connecting controller for auxiliary power supply with thermal memory function and auxiliary power supply failure, that is, release thermal memory | | |
| Short-circuit instantaneous protection M/H type & 3M/3H type | | | |
| Current setting I_i | M/H type: $1.0I_n \sim 50kA$ or OFF (OFF-function close) 3M/3H type: $(1.0 \sim 20) I_n$ or OFF (OFF-function close) | | |
| Protective characteristics (Accuracy $\pm 10\%$) | Current (I/I_i) | Trip time | |
| | ≤ 0.85 | no-acting | |
| | > 1.15 | <40ms acting | |

Setting and Protective Characteristics

| Grounding protection/alarm M/H type & 3M/3H type | | | |
|---|--|---|---|
| Protection type | | Differential type (T), Earth current type (W), alternative factory default is differential type (T) | |
| Current setting I_g | | (0.2 ~ 1.0) I_n or OFF (OFF-function close) | |
| Time setting T_g | Definite time delay | 0.1 ~ 1.0 or OFF (OFF-only alarm and no trip) | |
| | Tg (s) | | |
| | Inverse time factor KG | 1.5 ~ 6 or OFF (OFF-grounding protection is definite time) | |
| Protective characteristics (Accuracy $\pm 10\%$) | Current (I/I_g) | Trip time | |
| | | ≤ 0.8 | No-acting (no alarm) |
| | ≥ 1.0 | $(I/I_g) < KG$ | Inverse time delay acting (or alarm) $t = T_g \times KG \times I_g/I$ |
| | | $(I/I_g) \geq KG$ | Definite time delay acting (or alarm) as per time setting |
| Grounding alarm 3M/3H type | | | |
| Performance mode | | Alarm / Close | |
| Alarm operating current setting | | (0.2 ~ 1.0) I_n | |
| Alarm operating delay time setting | | 0.1 ~ 1.0 (s) | |
| Alarm return current setting | | (0.2 ~ 1.0) I_n | |
| Alarm return delay time setting | | 0.1 ~ 1.0 (s) | |
| Alarm operating characteristics (Accuracy $\pm 10\%$) | Multiple of current (I/I setting) | | Acting time |
| | < 0.8 | | No-alarm |
| | ≥ 1.0 | | Alarm (time as per alarm operating time setting) |
| Alarm return characteristics (Accuracy $\pm 10\%$) | ≥ 1.0 | | Alarm without return |
| | ≤ 0.9 | | Alarm return (time as per alarm return time setting) |
| Neutral protection M/H type & 3M/3H type | | | |
| Neutral protective setting | | M/H type: 50% I_n , 100% I_n or OFF 3M/3H type: 50% I_n , 100% I_n , 160% I_n , 200% I_n or OFF OFF- close N phase protective function | |
| Protective characteristics | | Same as phases and poles over-load long delay protection, short-circuit short delay protection, short-circuit instantaneous protection and grounding protection | |
| Current asymmetric protection/Alarm M/H type & 3M/3H type | | | |
| M/H type | Current asymmetric rate setting δ | (40% ~ 100%) or OFF (OFF-function close) | |
| | Acting delay time setting $T\delta$ | 0.1 ~ 1.0 (s) or OFF (OFF-alarm no trip) | |
| 3M/3H type | Performance mode | | Alarm / Trip / Close |
| | Protective start setting | | 5%-60% |
| | Acting delay time setting $T\delta$ | | 0.1 ~ 40 (s) |
| | Alarm acting return setting | 5%~Start setting | Performance mode is alarm for setting this item |
| | Alarm return delay time | 10 ~ 200 (s) | |
| Protective characteristics (Accuracy $\pm 10\%$) | Actual current asymmetric rate / setting | | Trip time |
| | < 0.9 | | No-acting (No-alarm) |
| | ≥ 1.1 | | Acting (or alarm) as per setting delay time |
| Alarm return characteristics (Accuracy $\pm 10\%$) | Actual current asymmetric rate / setting | | Acting time |
| | ≥ 1.1 | | No return |
| | ≤ 0.9 | | Return as per alarm return delay time |

Intelligent trip unit

Setting and Protective Characteristics

| Under-voltage protection/Alarm 3M/3H type | | |
|--|---|---|
| Performance mode | Close / Trip / Alarm | |
| Protection/Alarm start setting | 100 (V) ~ Return value | |
| Protection acting delay time setting | 0.2 ~ 60 (s) | |
| Alarm acting return setting | Start value ~1200 (V) | Performance mode is alarm for setting this item. Return value \geq start value |
| Alarm return delay time | 0.2 ~ 60 (s) | |
| Protective characteristics (Accuracy $\pm 10\%$) | Multiple of voltage (Umin /Acting setting) | Trip time |
| | >1.1 | No-acting (No-alarm) |
| | ≤ 0.9 | Acting (or alarm) as per setting delay time |
| Alarm return characteristics (Accuracy $\pm 10\%$) | Multiple of voltage (Umin /Operating setting) | Acting time |
| | <0.9 | No return |
| | ≥ 1.1 | Return as per alarm return delay time |
| Over-voltage protection/Alarm 3M/3H type | | |
| Performance mode | Close / Trip / Alarm | |
| Protection/Alarm start setting | Return value ~1200 (V) | |
| Protection acting delay time setting | 0.2 ~ 60 (s) | |
| Alarm acting return setting | 100 (v) ~ Start value | Performance mode is alarm for setting this item. Return value \geq start value |
| Alarm return delay time | 0.2 ~ 60 (s) | |
| Protective characteristics (Accuracy $\pm 10\%$) | Multiple of voltage (U min / Acting setting) | Trip time |
| | <0.9 | No-acting (No-alarm) |
| | ≥ 1.1 | Acting (or alarm) as per setting delay time |
| Alarm return characteristics (Accuracy $\pm 10\%$) | Multiple of voltage (U min / Return setting) | Acting time |
| | ≥ 1.1 | No return |
| | ≤ 0.9 | Return as per alarm return delay time |
| Voltage asymmetric protection/Alarm 3M/3H type | | |
| Performance mode | Close / Trip / Alarm | |
| Protection/Alarm start setting | 2% ~ 30% | |
| Protection acting delay time setting | 0.2 ~ 60 (s) | |
| Alarm acting return setting | 2% ~ Start value | Performance mode is alarm for setting this item. Return value \geq start value |
| Alarm return delay time | 0.2 ~ 60 (s) | |
| Protective characteristics (Accuracy $\pm 10\%$) | Actual voltage asymmetric rate / setting | Trip time |
| | <0.9 | No-acting (No-alarm) |
| | ≥ 1.1 | Acting (or alarm) as per setting delay time |
| Alarm return characteristics (Accuracy $\pm 10\%$) | Actual voltage asymmetric rate / setting | Acting time |
| | >1.1 | No return |
| | ≤ 0.9 | Return as per alarm return delay time |
| Reverse power protection/Alarm 3M/3H type | | |
| Performance mode | Close / Trip / Alarm | |
| Protection/Alarm start setting | 5 ~ 500(kW) | |
| Protection acting delay time setting | 0.2 ~ 20 (s) | |
| Alarm acting return setting | 5(kW) ~ Start value | Setting this item while only performance mode is alarm. Return value \geq start value |
| Alarm return delay time | 1.0 ~ 360 (s) | |
| Protection/Alarm operating characteristics | Same as over-voltage protection / Alarm | |

Setting and Protective Characteristics

| Phase sequence /Alarm 3M/3H type | | | | | |
|--|---|--|---|---|---|
| Performance mode | | Close / Trip / Alarm | | | |
| Acting sequence setting range | | $\Delta \Phi$: A, B, C / $\Delta \Phi$: A, C, B | | | |
| Acting/Alarm characteristics | | Instantaneous | | | |
| Under-frequency, Over-frequency/Alarm_3M/3H type | | | | | |
| Performance mode | | Close / Trip / Alarm | | | |
| Under-frequency | Protection / Alarm start setting | | 45 (Hz) ~ Return value | | |
| | Acting delay time setting | | 0.2 ~ 5.0 (s) | | |
| | Alarm acting return setting | | Start value ~65 (Hz) | Performance mode is alarm for setting this item. Return value \geq start value | |
| | Alarm return delay time setting | | 0.2 ~ 36 (s) | | |
| Over-frequency | Protection / Alarm start setting | | Return value ~65 (Hz) | | |
| | Acting delay time setting | | 0.2 ~ 5.0 (s) | | |
| | Alarm acting return setting | | 45 (Hz) ~Start value | Performance mode is alarm for setting this item. Return value \geq start value | |
| | Alarm return delay time setting | | 0.2 ~ 36 (s) | | |
| Protection/Alarm acting characteristics | | Same as under-voltage, over-voltage protection/Alarm | | | |
| Load monitor M/H type & 3M/3H type | | | | | |
| M/H type | Current setting I _{c1} , I _{c2} | | (0.2 ~ 1) I _n or OFF (OFF-function close) | | |
| | Time setting | | 15, 20, 25, 30, 40, 50, 60, 80, 100, 120, 160, 200, 240, 320, 400, 480 (s) | | |
| | Output characteristics (Accuracy \pm 10%) | Load monitor mode | | Multiple of current | Acting time |
| | | | | ≤ 1.05 I _{c1} or I _{c2} | No operation |
| | | Mode 1 (Independent control two branches load) | | > 1.2 I _{c1} or I _{c2} | Delay replay operating (same as over-load long delay characteristics curve) |
| | | | | Mode 2 (Control the same branch load, require I _{c1} > I _{c2}) | |
| | | > 1.2 I _{c1} | Delay replay operating (same as over-load long delay characteristics curve) | | |
| $< I_{c2}$ | | Delay relay operating (delay fixed 60s) | | | |
| Thermal memory time | | 30min (OFF) or power failure release | | | |
| 3M/3H type | Operating mode | | Current setting | Time setting | |
| | Discharge I | Current mode 1 | (0.2 ~ 1.0) I _n | (20% ~ 80%) TR (TR: over-load long delay acting time) | |
| | | Current mode 2 | | | |
| | | Power mode 1 | 200 ~ 10000 (kW) | 10 ~ 3600(s) | |
| | | Power mode 2 | | | |
| | Discharge II | Current mode 1 | (0.2~1.0) I _n | (20% ~ 80%) TR (TR: over-load long delay acting time) | |
| | | Current mode 2 | 0.2I _n ~ Discharge I | 10 ~ 600(s) | |
| | | Power mode 1 | 200 ~ 10000 (kW) | 10 ~ 3600(s) | |
| Power mode 2 | | 100 (kW) ~ Discharge I | | | |

Intelligent trip unit

Setting and Protective Characteristics

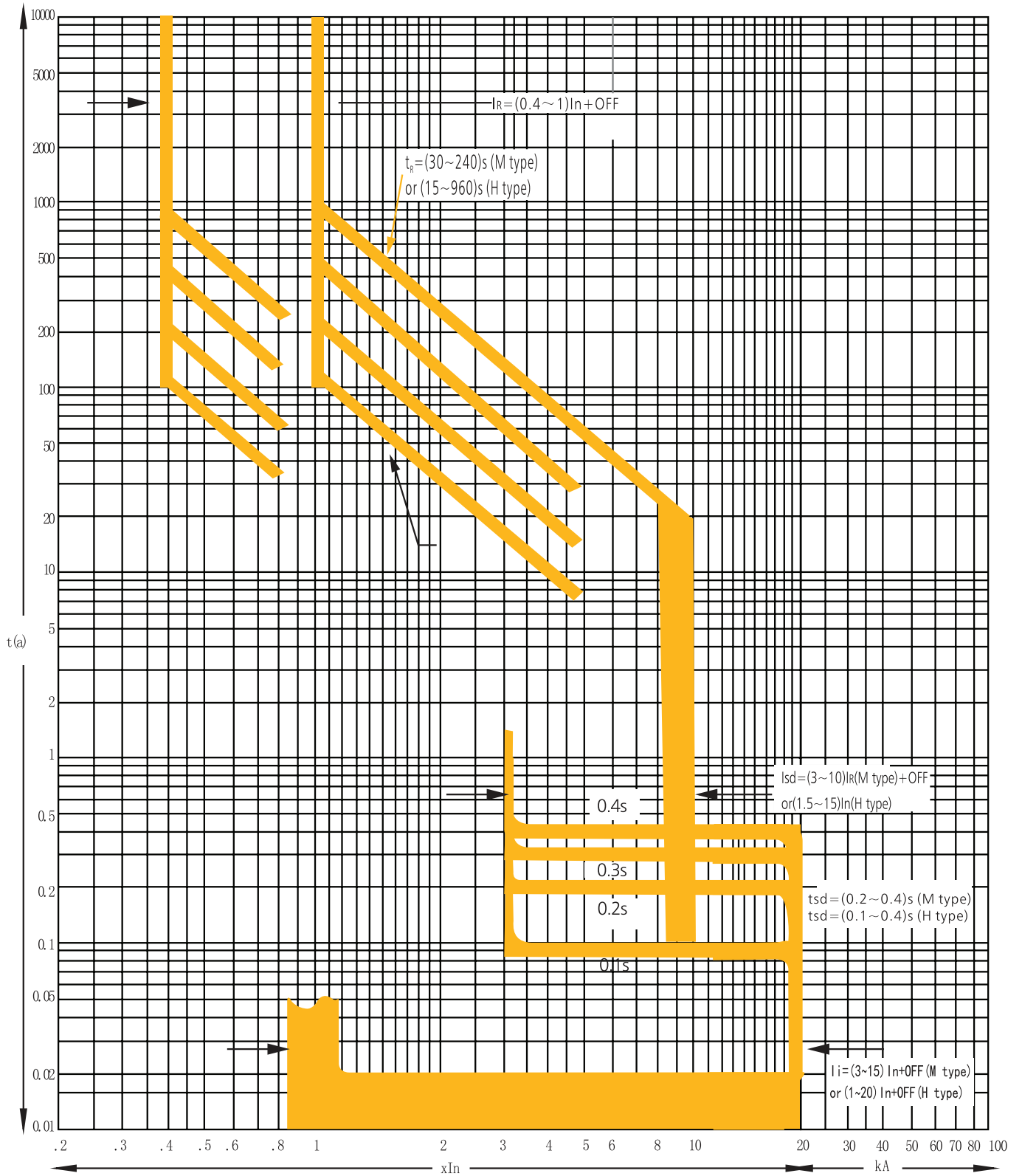
Over-load long delay protective operating delay table C1-C16

| Current type | Fault current | Delay time (s) | | | | | | | | | | | | | | | |
|------------------|---------------|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 |
| SI | 1.5lr | 0.61 | 0.98 | 1.47 | 2.46 | 3.68 | 4.91 | 6.14 | 8.29 | 11.1 | 17.2 | 24.6 | 36.8 | 49.1 | 61.4 | 73.7 | 86 |
| | 6lr | 0.14 | 0.22 | 0.33 | 0.55 | 0.82 | 1.1 | 1.39 | 2.06 | 2.47 | 3.84 | 5.48 | 8.22 | 10 | 13.7 | 16.4 | 19.2 |
| VI | 1.5lr | 2 | 3.2 | 4.8 | 8 | 12 | 16 | 20 | 27 | 36 | 56 | 80 | 120 | 160 | 200 | 240 | 280 |
| | 6lr | 0.2 | 0.32 | 0.48 | 0.8 | 1.2 | 1.6 | 2 | 2.7 | 3.6 | 5.6 | 8 | 12 | 16 | 20 | 24 | 28 |
| EI(G) | 1.5lr | 8 | 12.8 | 19.2 | 32 | 48 | 64 | 80 | 108 | 144 | 224 | 320 | 480 | 640 | 800 | 960 | 1120 |
| | 6lr | 0.29 | 0.46 | 0.69 | 1.14 | 1.71 | 2.29 | 2.86 | 3.86 | 5.14 | 8 | 11.4 | 17.1 | 22.9 | 28.6 | 34.3 | 37.1 |
| EI(M) | 1.5lr | 6.22 | 9.96 | 14.9 | 24.9 | 37.3 | 49.8 | 62.2 | 84 | 112 | 174 | 249 | 373 | 498 | 622 | 747 | 871 |
| | 6lr | 0.28 | 0.45 | 0.68 | 1.13 | 1.69 | 2.26 | 2.82 | 3.81 | 5.08 | 7.9 | 11.3 | 16.9 | 22.6 | 28.2 | 33.9 | 36.7 |
| HV | 1.5lr | 2.46 | 3.94 | 5.9 | 9.85 | 14.8 | 19.7 | 24.6 | 33.2 | 44.3 | 68.9 | 98.5 | 147 | 197 | 246 | 295 | 344 |
| | 6lr | 0.01 | 0.01 | 0.02 | 0.03 | 0.05 | 0.06 | 0.08 | 0.1 | 0.14 | 0.22 | 0.31 | 0.46 | 0.62 | 0.77 | 0.93 | 1 |
| I ² t | 1.5lr | 15 | 20 | 25 | 30 | 40 | 60 | 80 | 120 | 160 | 240 | 360 | 480 | 600 | 720 | 840 | 960 |
| | 6lr | 0.94 | 1.25 | 1.56 | 1.88 | 2.5 | 3.75 | 5 | 7.5 | 10 | 15 | 22.5 | 30 | 37.5 | 45 | 52.5 | 60 |

Factory Setting (Approval)

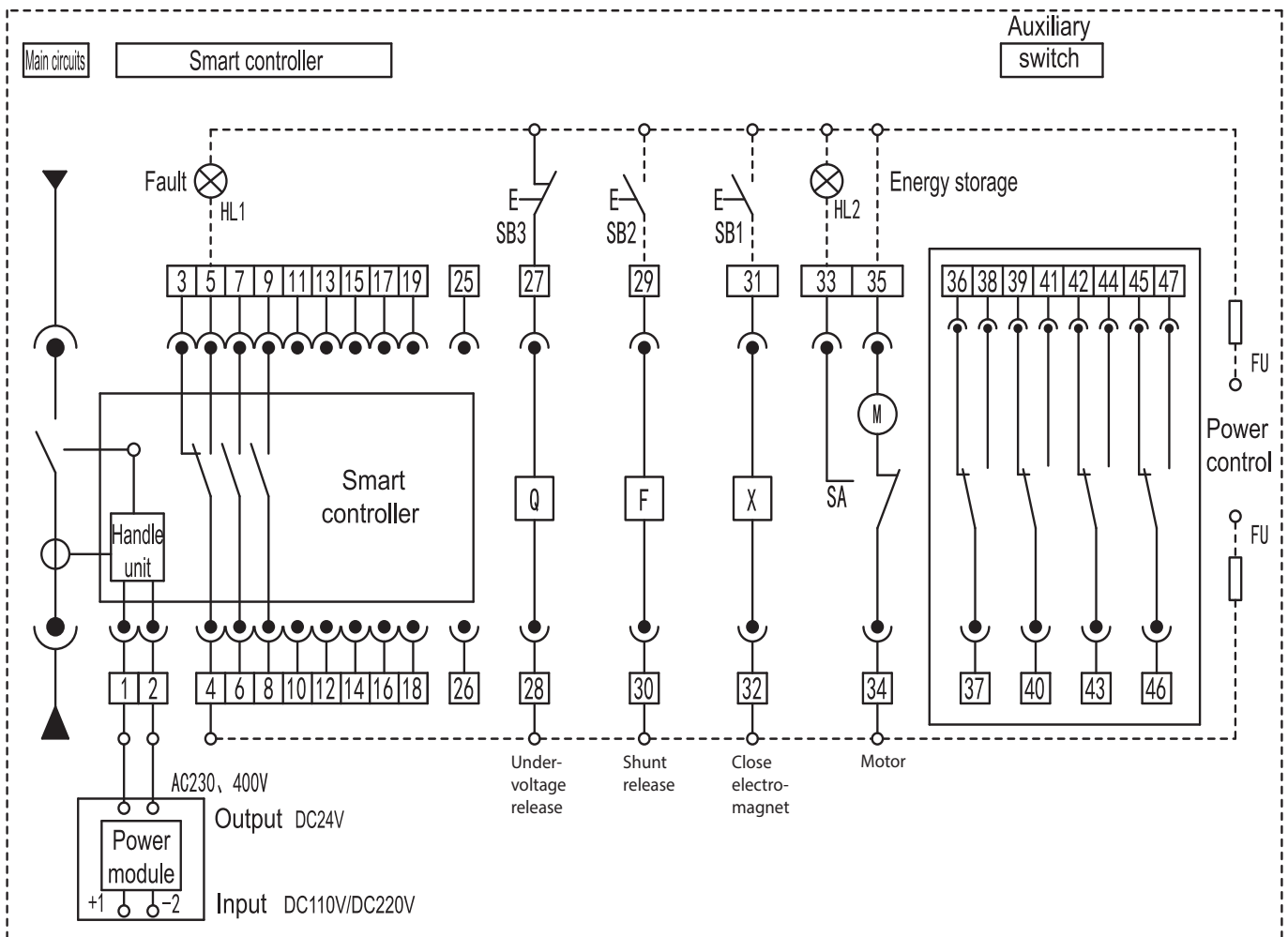
| Protection characteristics | | Setting current | Setting time | Remarks |
|-----------------------------|---------------|-----------------|---------------|--|
| Over-load long delay | | 1.0In | 30s | Thermal memory (ON-30ms) |
| Short-circuit short delay | Inverse time | 6lr | 0.2s | - |
| | Definite time | 8lr | 0.2s | |
| Short-circuit instantaneous | | 12In | - | - |
| Neutral protection | | 100%In | - | - |
| Grounding protection | In ≤ 1250A | 0.8In | Alarm no trip | - |
| | In 1600A | 1200A | | |
| Asymmetry current | | OFF | - | The user open by themselves according to their request |
| Load monitor | | OFF | - | - |

Over current protection characteristic



Electrical diagram

M type connections



1, 2: Auxiliary power supply incoming for smart controller. auxiliary power supply is DC, which add the power module

3, 4, 5: Signal contacts for release fault to trip indicating, 4 for common terminal

6, 7 & 8, 9: Two sets of auxiliary open contacts for circuit breakers (for selection)

10, 11: /

12, 13: Group 1 controller signal outgoing (for selection)

14, 15: Group 2 controller signal outgoing (for selection)

16, 17: Group 3 controller signal outgoing (for selection)

18, 19: Group 4 controller signal outgoing (for selection)

20: Controller grounding

21, 22, 23, 24: N, A, B, C phase voltage signal incoming (for selection)

25, 26: External connection N pole or incoming of earth current transformer

27, 28: Under-voltage release

29, 30: Shunt release

31, 32: Closing electromagnet

33, 34, 35: Motor operation mechanism, 34 for common terminal

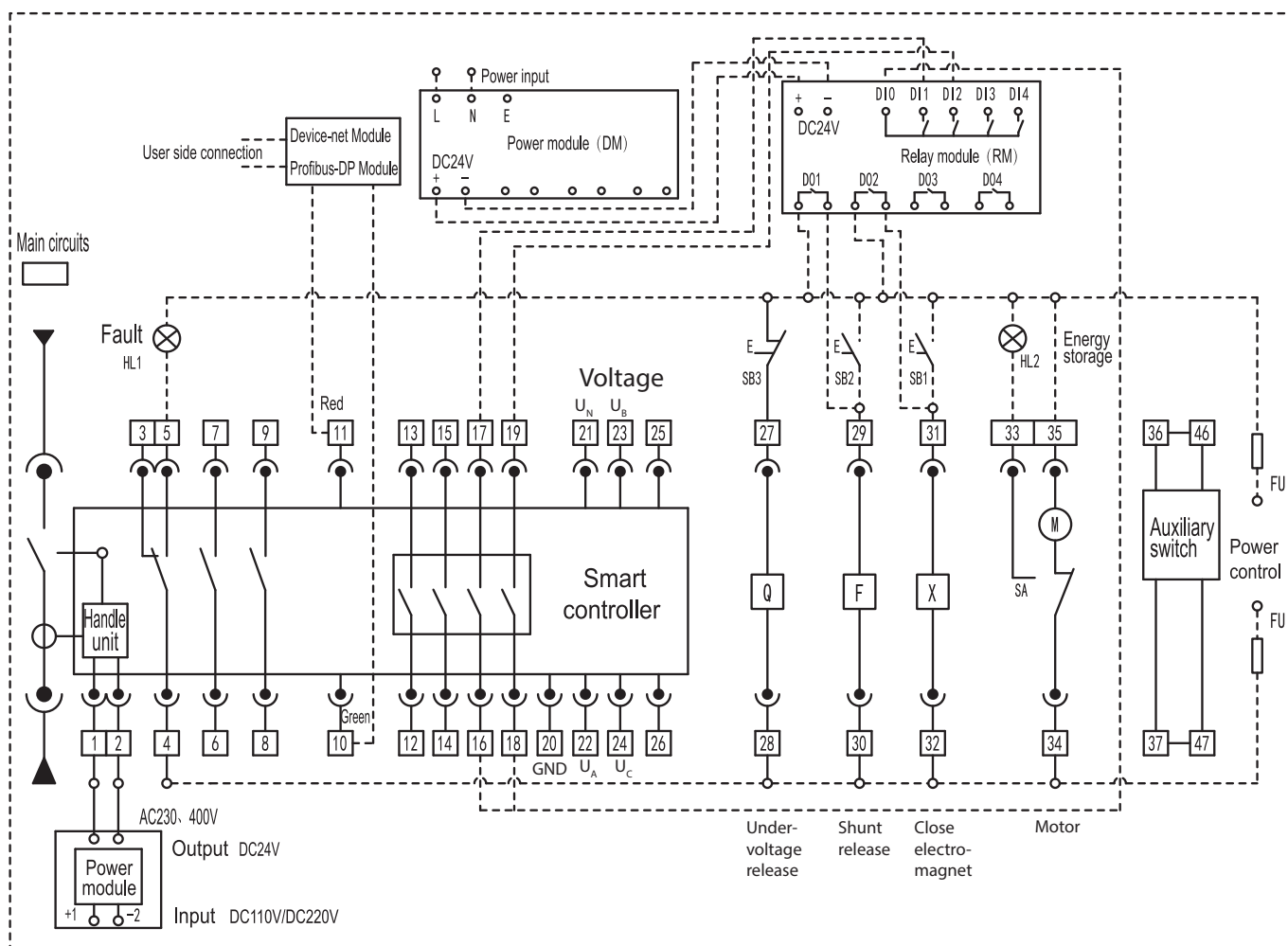
Q, F, X, M: Under-voltage release, shunt release, closing electromagnet, motor operation mechanism

HL1, HL2: Fault to trip indicating, motor energy storage fulfill indicating (provide by the user)

SB1, SB2, SB3: Close, open, under-voltage button (provide by the user/under-voltage shall be short connection)

SA, FU: Motor travel switch (with motor), fuse (provide by the user)

H type connections



1,2: Auxiliary power supply incoming for smart controller. auxiliary power supply is DC, which add the power module

3, 4, 5: Signal contacts for release fault to trip indicating, 4 for common terminal

6, 7 & 8, 9: Two sets of auxiliary open contacts for circuit breakers

10, 11: Communication interface

12, 13: Load monitor 1 (default)

14, 15: Load monitor 2 (default)

16, 17: Opening signal output

18, 19: Closing signal output

20: Controller grounding

21, 22, 23, 24: N, A, B, C phase voltage signal incoming

25, 26: External connection N pole or earth current transformer incoming

27, 28: Under-voltage release or no-voltage release

29, 30: Shunt release

31, 32: Close electromagnet

33, 34, 35: Motor operation mechanism (34 for common terminal)

36 – 47: Auxiliary switch

Q, F: Under-voltage release and shunt release

X, M: Close electromagnet and operation mechanism

HL1, HL2: Fault to trip indicating and motor energy storage finish indicating (provide by the user)

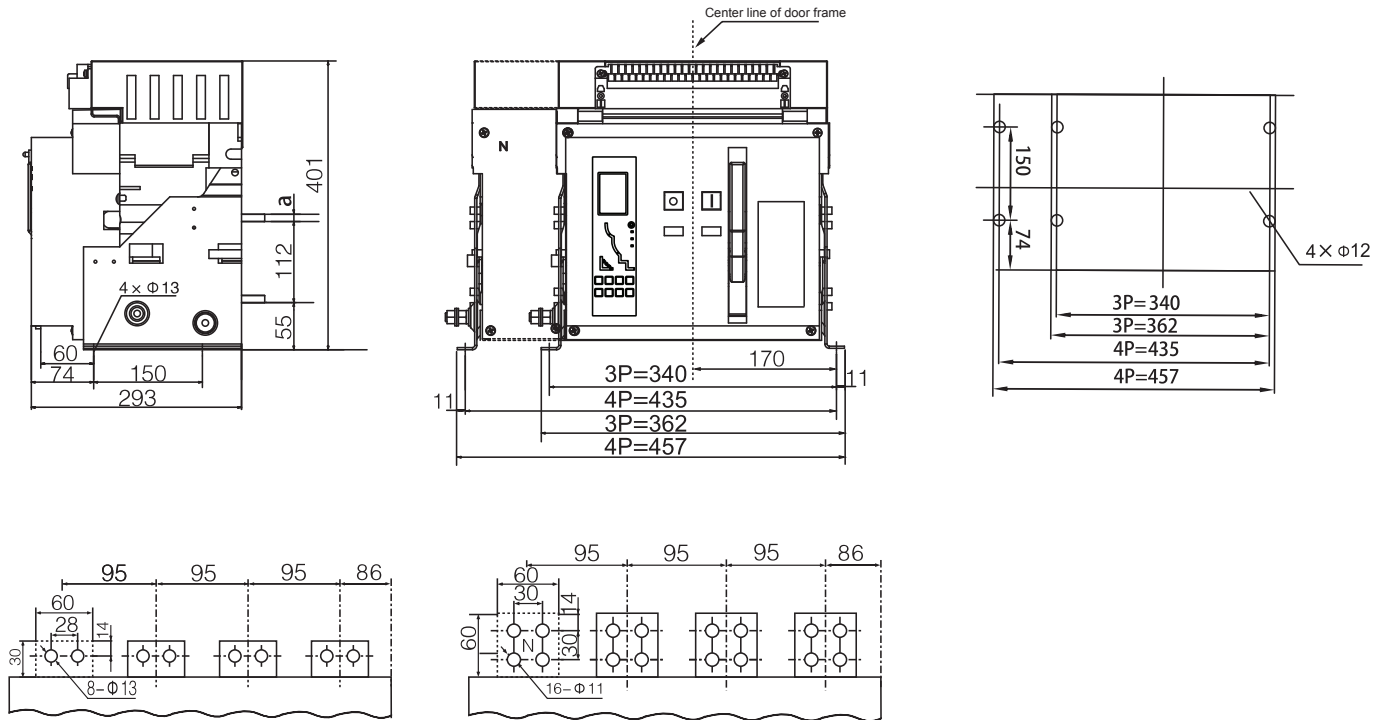
SB1, SB2, SB3: Opening, closing and under-voltage button (provide by the user)

SA: Motor travel switch with the motor

FU: Fuse (provide by the user)

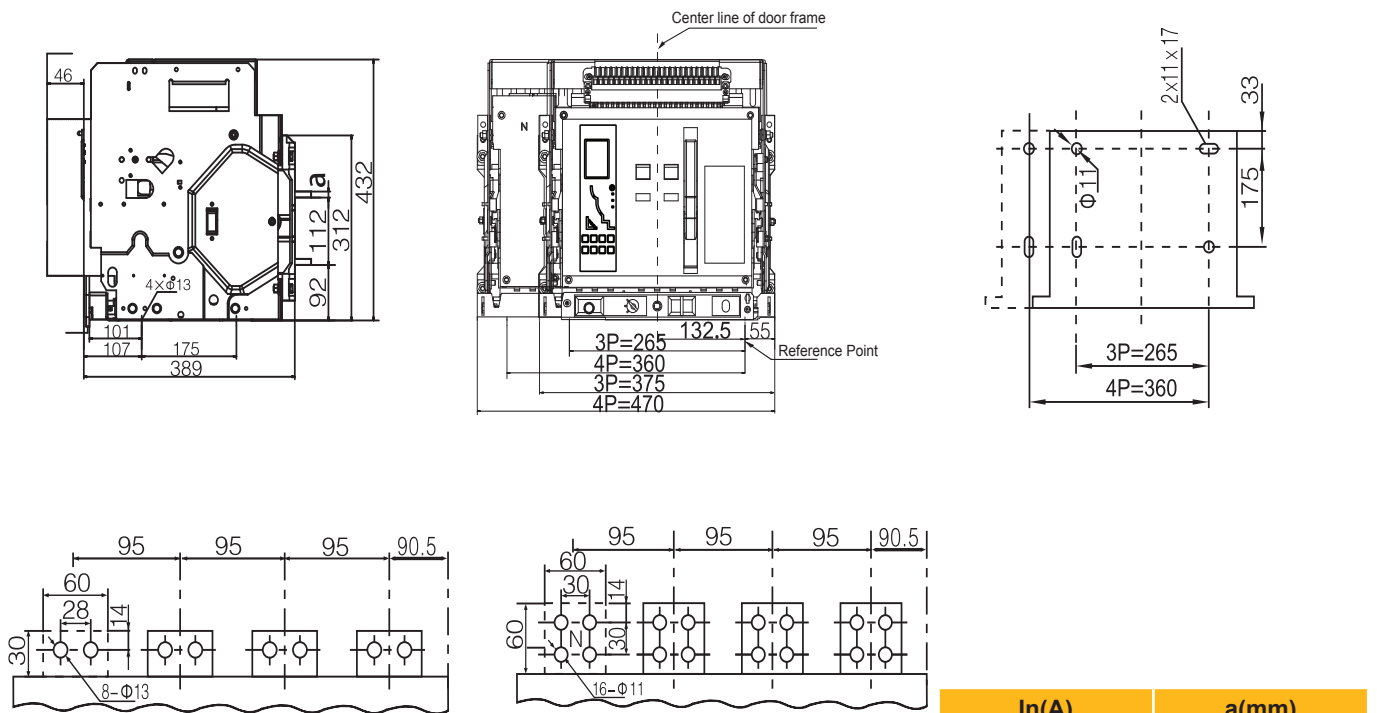
Dimensions

ACB Fixed type – Frame 2000A 3P/4P (630A ~ 2000A)



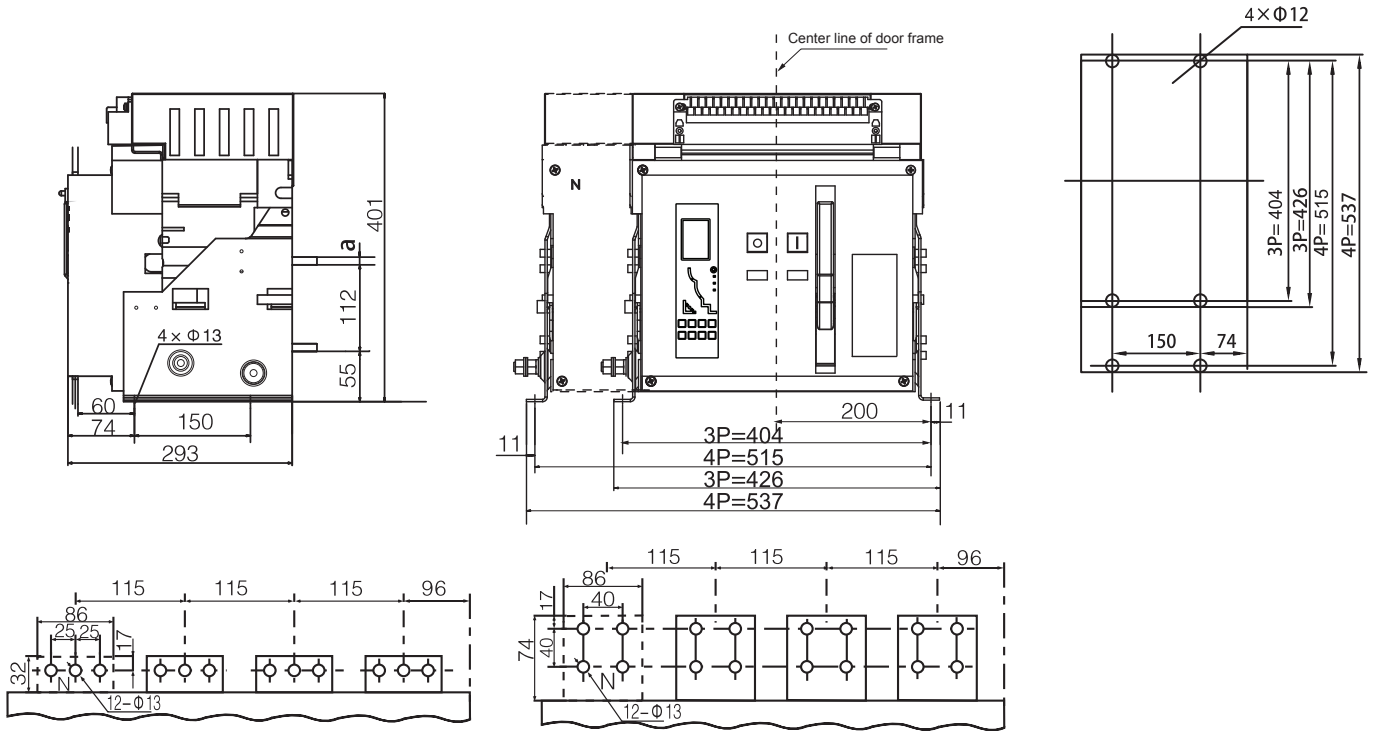
| In(A) | a(mm) |
|-------------|-------|
| 630 - 800 | 10 |
| 1000 - 1600 | 15 |
| 2000 | 20 |

ACB Drawout type – Frame 2000A 3P/4P (630A ~ 2000A)



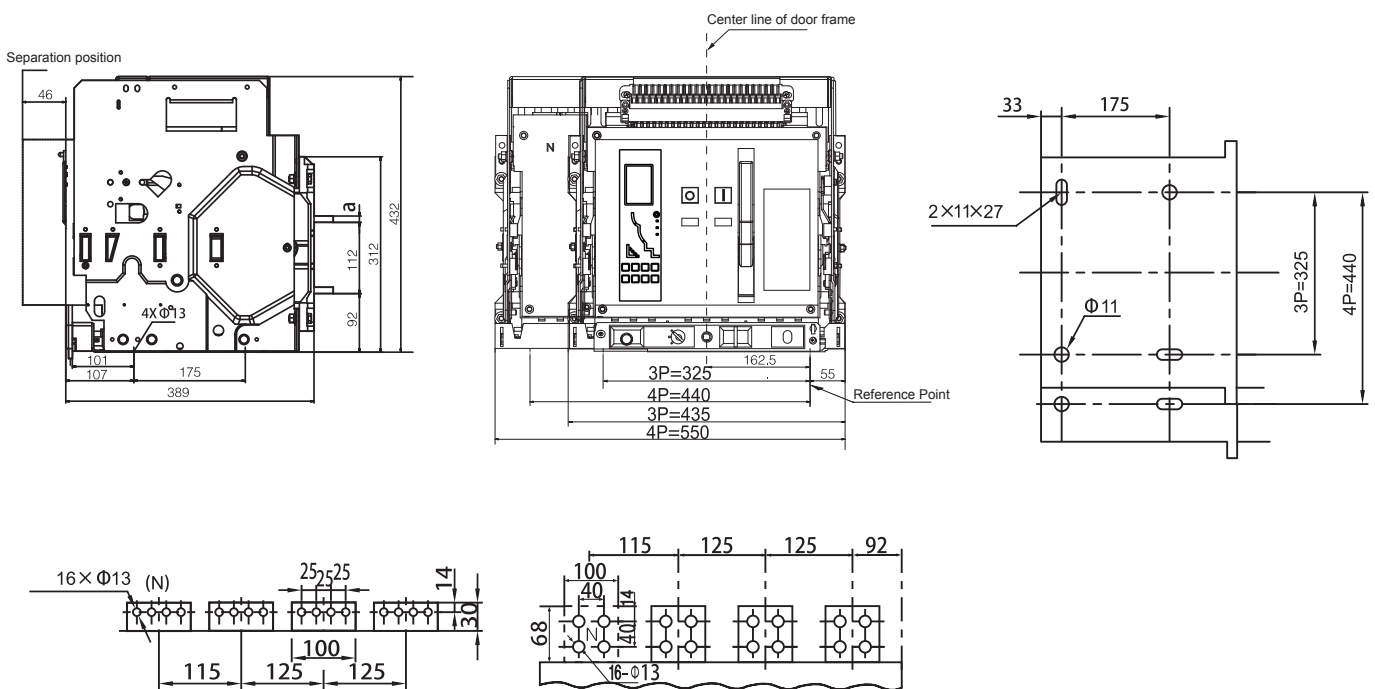
| In(A) | a(mm) |
|-------------|-------|
| 630 - 800 | 10 |
| 1000 - 1600 | 15 |
| 2000 | 20 |

ACB Fixed type – Frame 4000A 3P/4P (2500A, 3200A)



| In(A) | a(mm) |
|-------|-------|
| 2500 | 20 |
| 3200 | 30 |

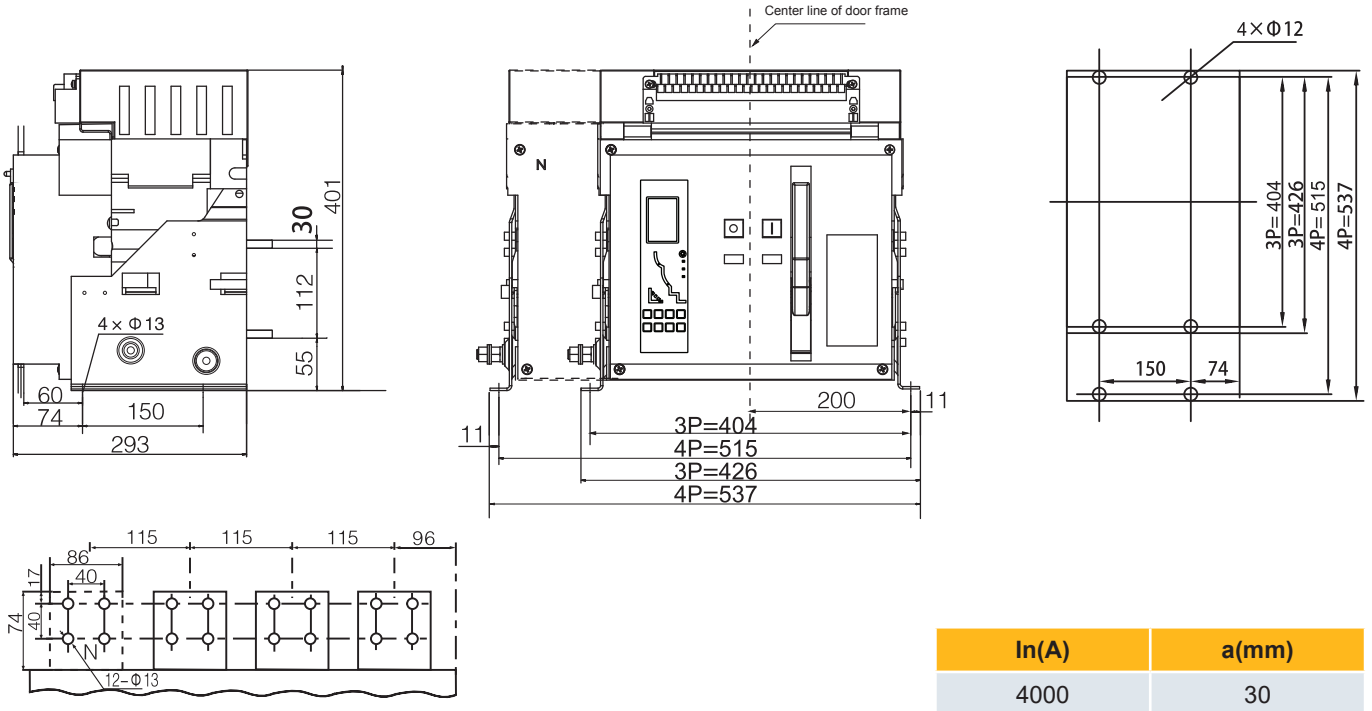
ACB Drawout type – Frame 4000A 3P/4P (2500A, 3200A)



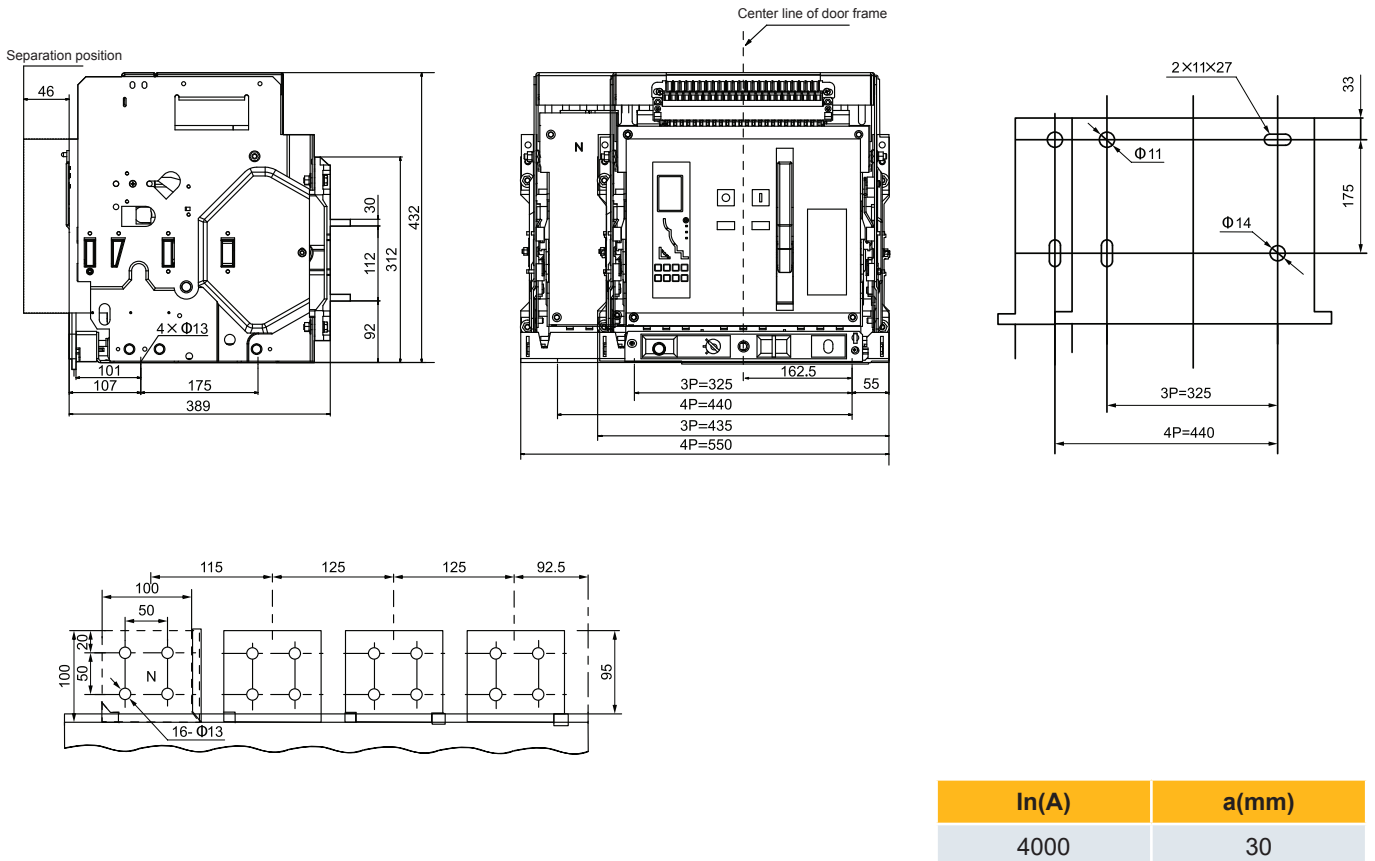
| In(A) | a(mm) |
|-------|-------|
| 2500 | 20 |
| 3200 | 30 |

Dimensions

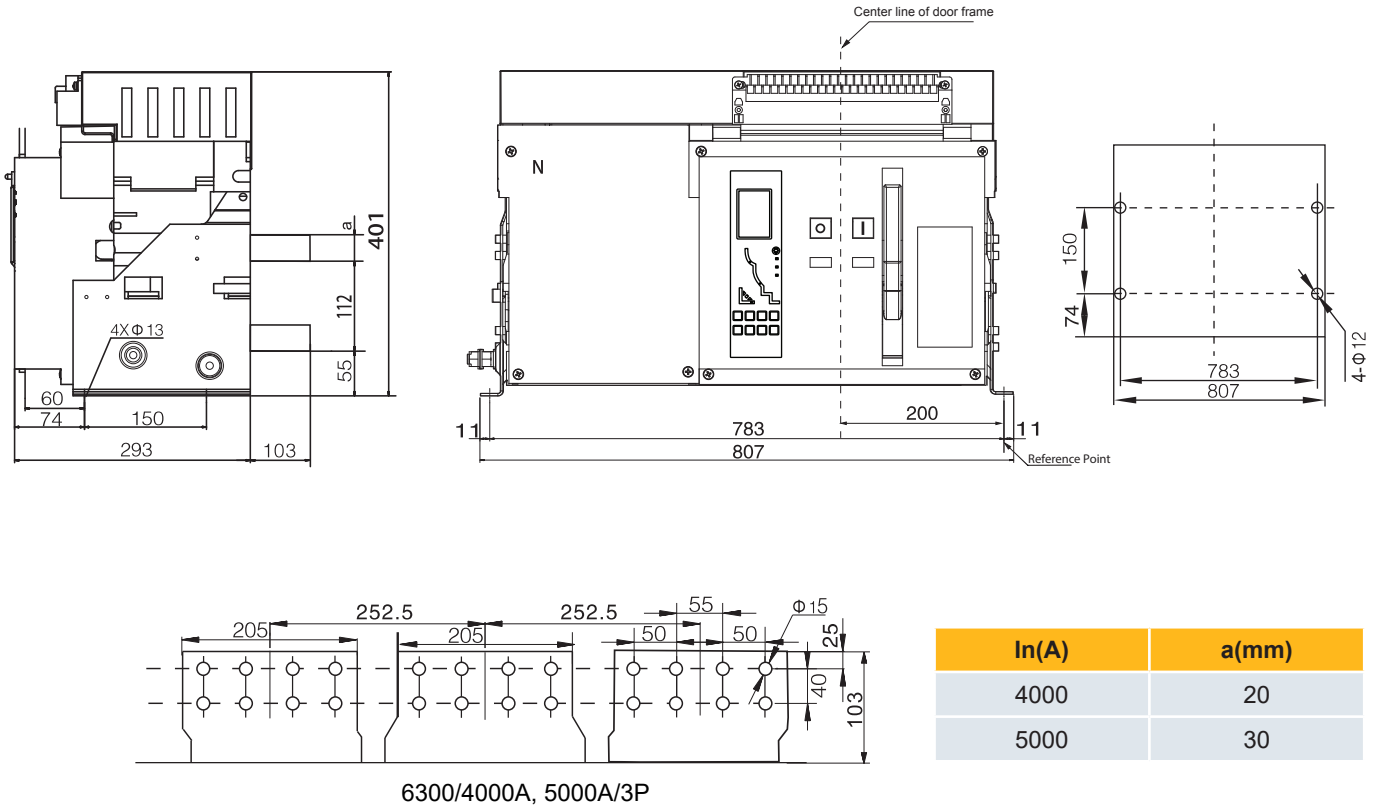
ACB Fixed type – Frame 4000A 3P/4P (4000A)



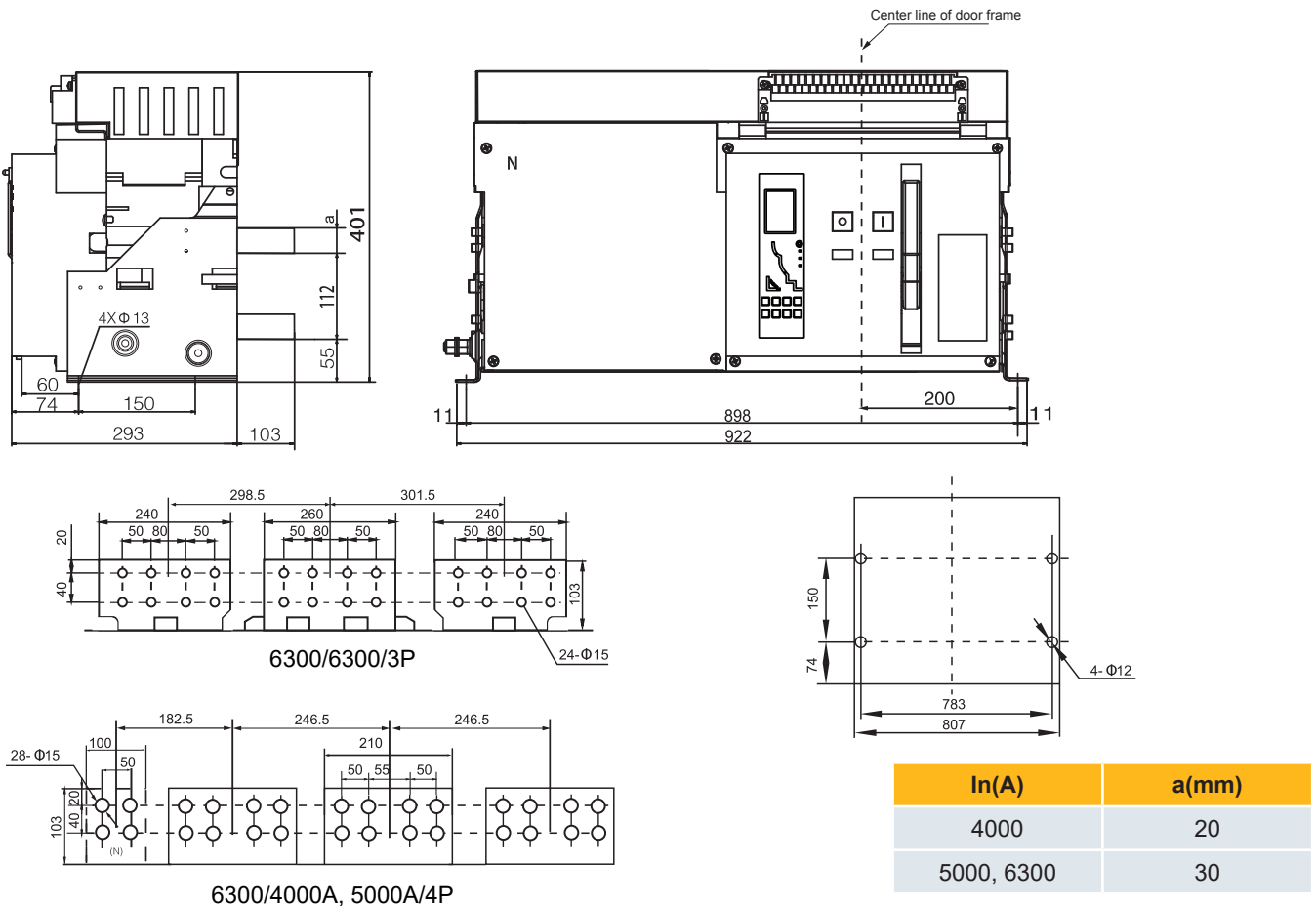
ACB Drawout type – Frame 4000A 3P/4P (4000A)



ACB Fixed type – Frame 6300A 3P (4000A, 5000A/3P)

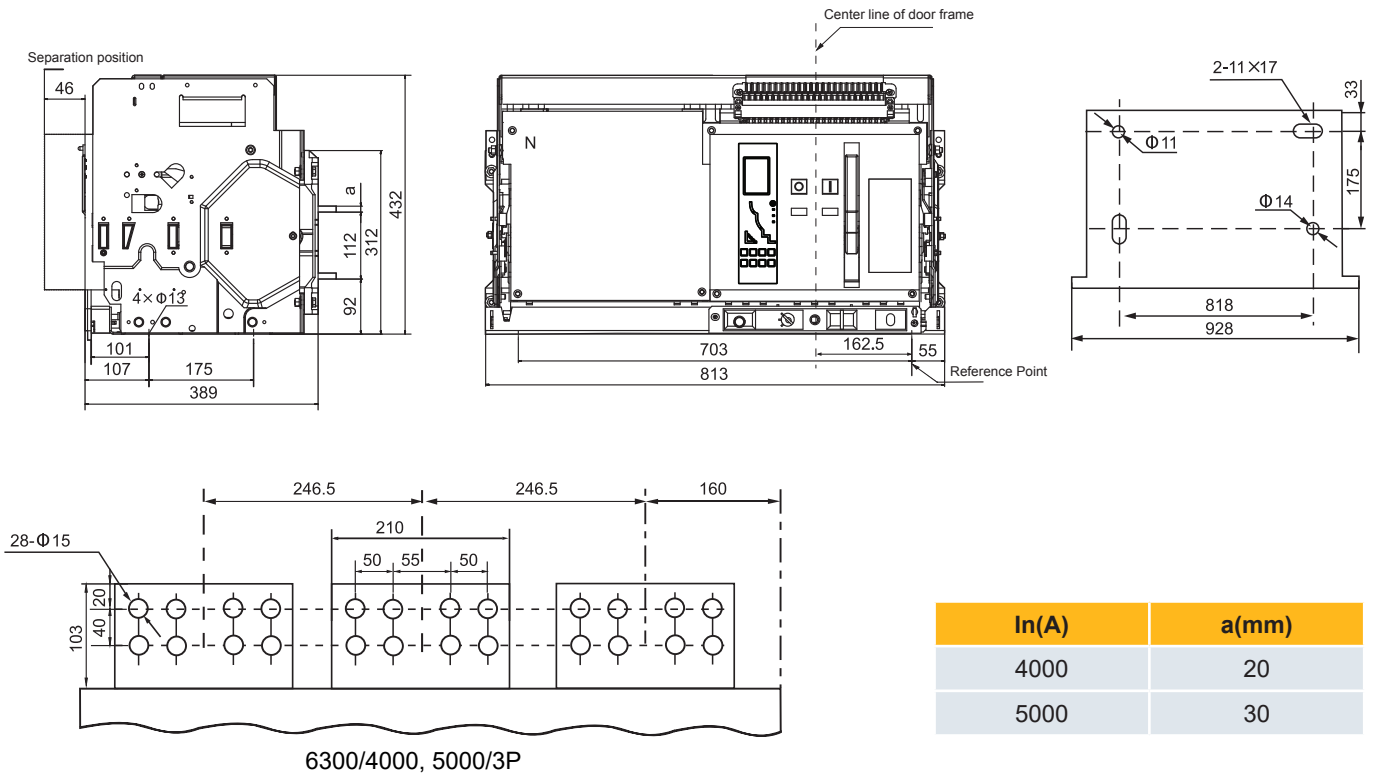


ACB Fixed type – Frame 6300A (4000A, 5000A/4P, 6300A/3P)

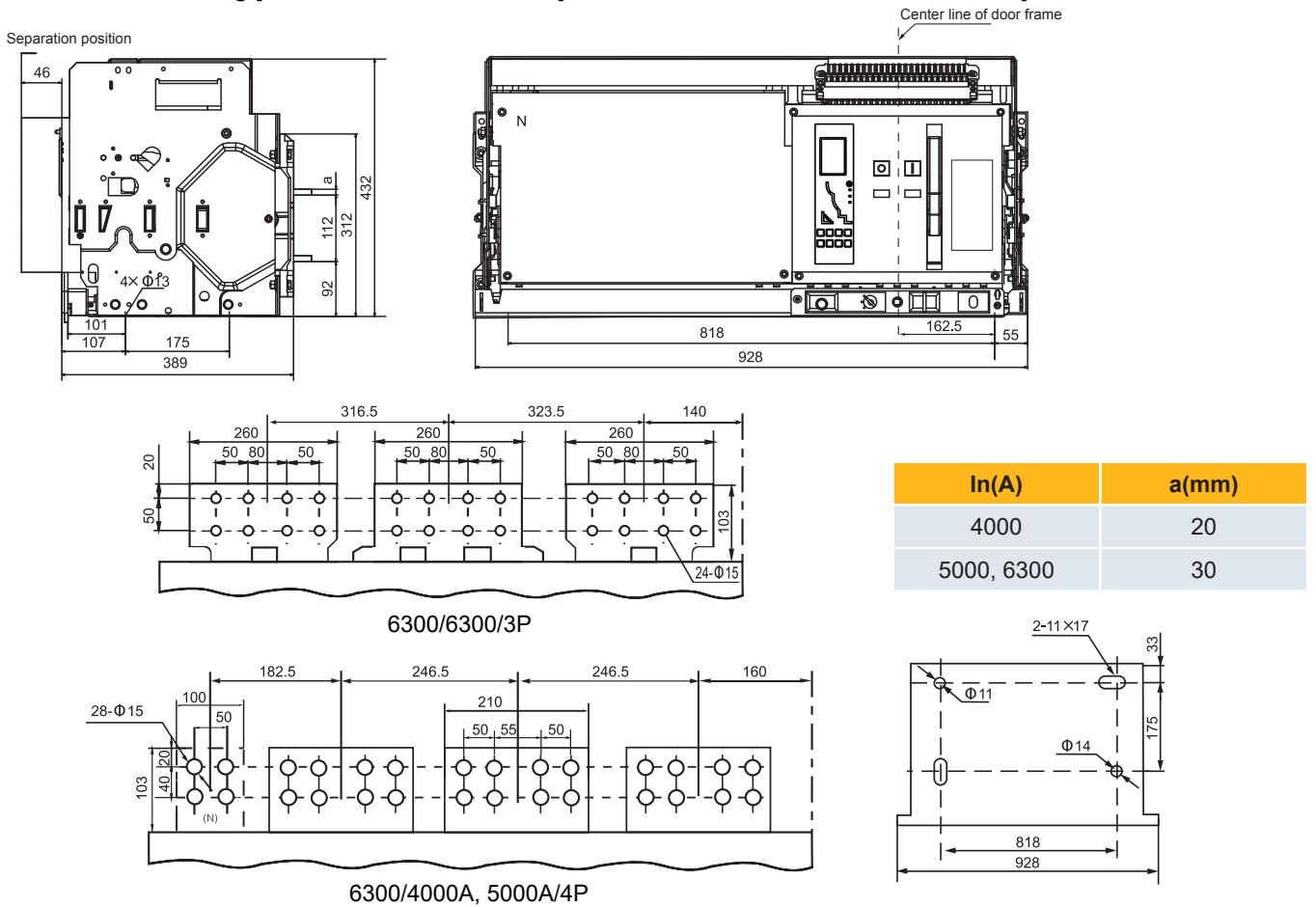


Dimensions

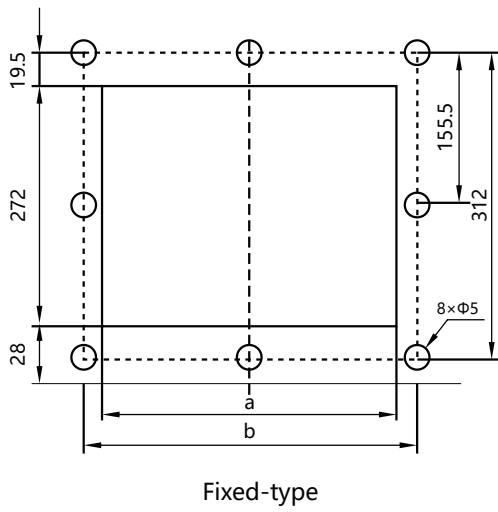
ACB Drawout type – Frame 6300A 3P (4000A, 5000A/3P)



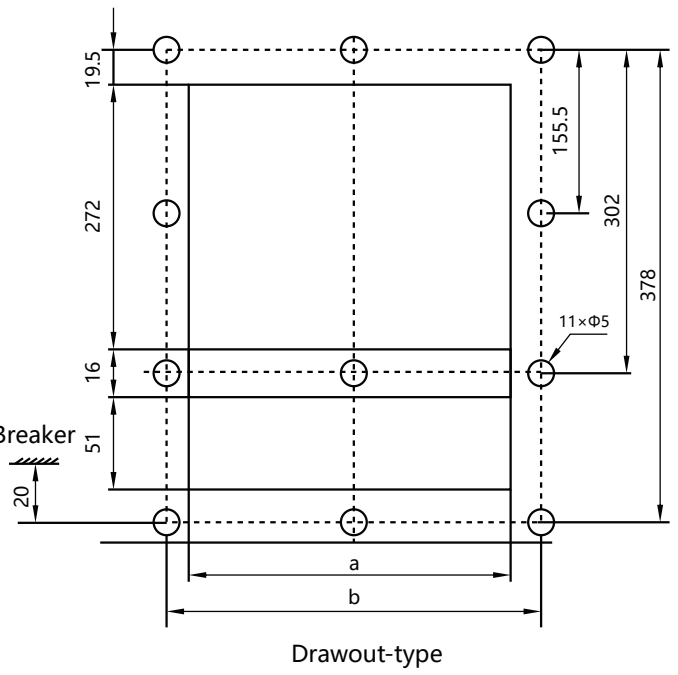
ACB Drawout type – Frame 6300A (4000A, 5000A/4P, 6300A/3P)



Installation size for panel drilling



Undersurface of Breaker



| Frame | a | b |
|---------------|-----|-----|
| 2000A | 306 | 346 |
| 2500A ~ 6300A | 366 | 406 |

Shunt release



Shunt release can realize the remote control to break the circuit breaker.

- Rated control power voltage $U_s(V)$ AC220V/230V, AC380V/400V, DC220V, DC110V
- Work voltage (0.7~1.1) U_s
- Breaking time (50±10) ms

Forbid making the power for long time to avoid the shunt release being damaged.

Closing electromagnet



After the motor finishing the energy storage, closing release can instantly close the circuit breaker

- Rated control power voltage $U_s(V)$ AC220V/230V, AC380V/400V, DC220V, DC110V
- Work voltage (0.85~1.1) U_s
- Closing time (55±10) ms

Forbid making the power for long time to avoid the closing release being damaged

Under-voltage release

Without power supply, under-voltage release can't close. It is classified into instantaneous and time-delay type.

After closing the circuit breaker, under-voltage release can break the circuit breaker when the voltage drops to (70%~35%) U_s . The circuit breaker can be closed again when power voltage recovers and exceeds 85% U_s



- Rated control power voltage $U_s(V)$ AC220V/230V, AC380V/400V
- Action voltage (0.35~0.7) U_s
- Reliable making voltage (0.85~1.1) U_s
- Reliable non-making voltage $\leq 0.35U_s$
- Delay time: 0.5s, 1s, 1.5s, 3s (Frame-1600 , non-adjustable); 0.5s, 1s, 3s, 5s (Frame-2000A, 3200A, 4000A, 6300A, adjustable)

Make sure there is power supply on the under-voltage release, before making the circuit breaker

Auxiliary contact



- Standard model: 4NO/4NC
- For Frame-1600: only have 4NO/4NC
- For Frame-2000, 3200, 4000, 6300: 4NO/4NC, 4NO+4NC, 2NO+6NC, 3NO+3NC
- Ith: AC380V/AC400V 0.75A, DC220V 0.15A, AC220V/AC230V 1.3A

Motor-driven charging device



With the function of motor-driven storing and auto restoring energy after closing the circuit breaker, the mechanism can ensure closing the circuit breaker instantly after breaking the circuit breaker

- Rated control power voltage $U_s(V)$ AC220V/230V, AC380V/400V, DC220V, DC110V
- Work voltage $(0.85\sim 1.1) U_s$
- Power loss 75W(1600A), 85W(2000A), 110W(3200A, 4000A), 150W(6300A)
- Energy-storage time $<5s$

Key lock



The OFF push-button of the breaker can be locked in the position of depress, and at this time, the breaker can not be closed for operation; when the user selects the option, the factory provides locks and keys; One breaker is provided with one lock and one key for the lock; two breakers are provided with two locks and one key for the locks; three breakers are provided with three same locks and two same keys for the locks

Note: the air circuit breaker with key lock, when the key has to be pulled out, it is necessary to first press the OFF key, turn the key anticlockwise, and then pull out the key

“Disconnected” position locking device for the draw-out type

For the “disconnected” position of the draw-out circuit breaker, a lock rod can be pulled out to lock the matter, and the breaker locked will be unable to be turned towards the TEST or CONNECTION position, Padlocks have to be provided by users themselves

Three position locking device for the draw-out

It is locking device for three position (disconnected, test, connection) of draw-out type. Three position of circuit breaker is indicated by indicator, the driving and reversing handle is locked in the exact position, the lock can be released by the reset button

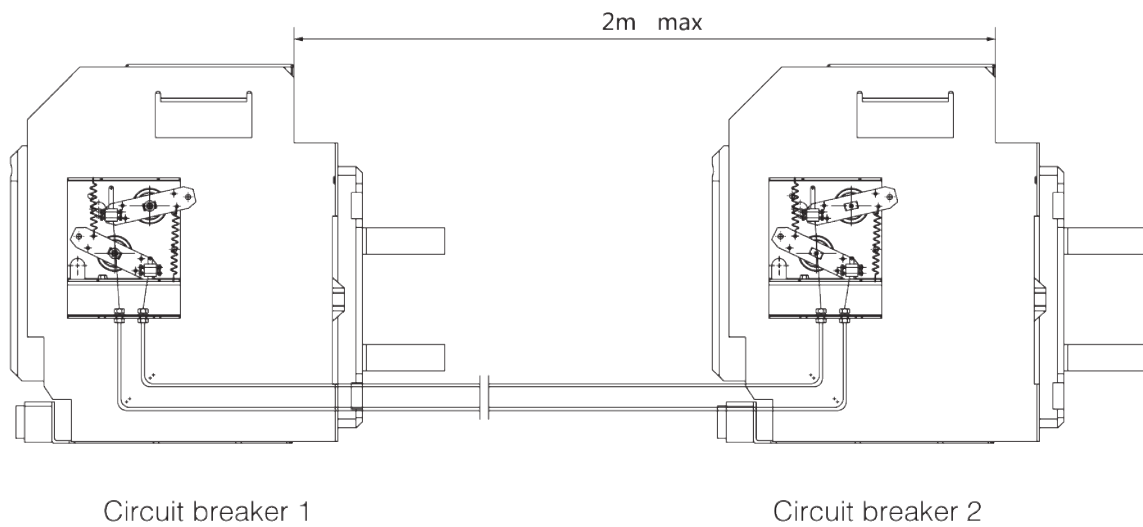


Door-case

Installed on the door of the distribution cubicle, for sealing the distribution cubicle and making the protection class to IP40 (fixed type and draw-out type)

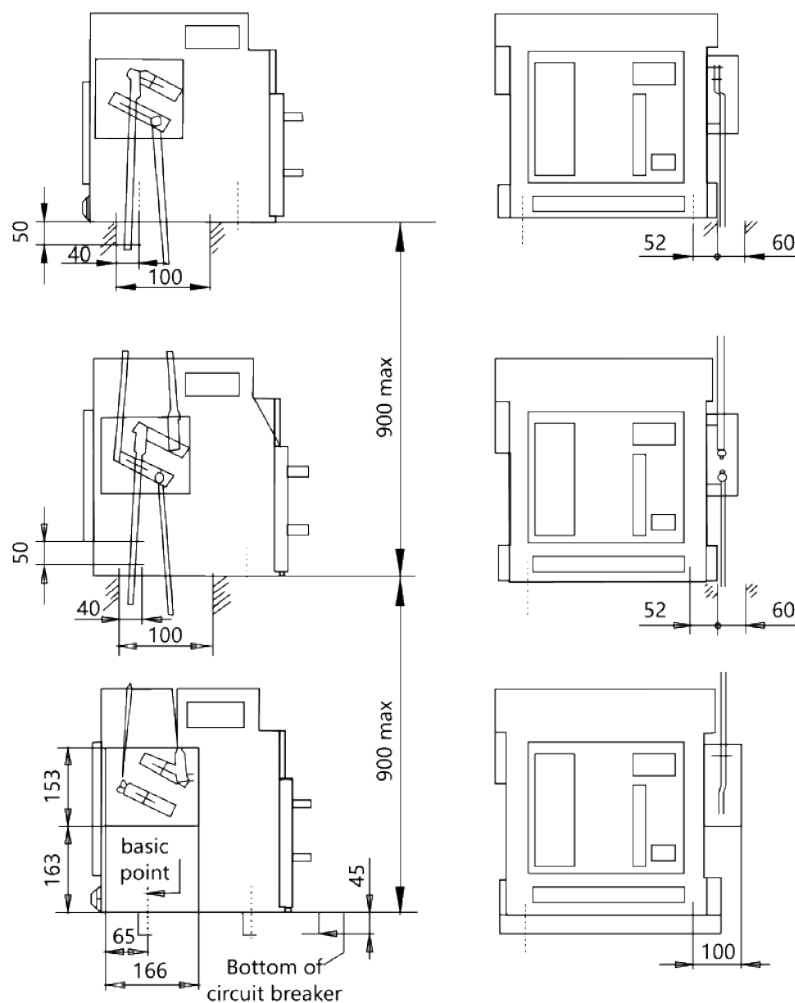
Accessories

Horizontal-installed mechanical interlock



Note: 2 pcs of circuit breaker horizontal-installed with steel cable mechanical interlock (fixed type or drawout type circuit breaker).

Vertical-installed mechanical interlock



Note: 3 pcs of circuit breaker vertical-installed with connecting-rod type mechanical interlock. If need 2 pcs of circuit breaker interlocked, just remove the top one

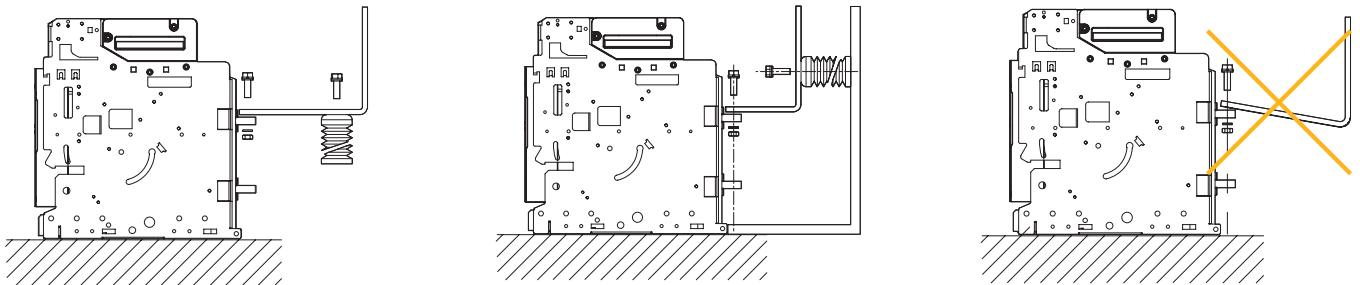
Temperature derating

Ambient temperature: -5°C - $+40^{\circ}\text{C}$; the average value no more than $+35^{\circ}\text{C}$ within 24 hours. Over $+40^{\circ}\text{C}$ the user shall be de-rating capacity as described in the following.

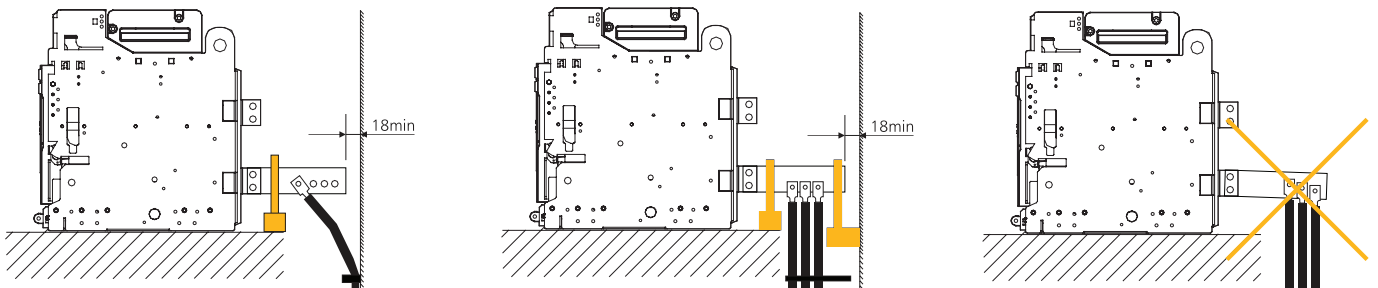
| Ambient temperature | | +40°C | +50°C | +60°C |
|---------------------|-------|-------|-------|-------|
| Frame 2000 | 630A | 630A | 630A | 630A |
| | 800A | 800A | 800A | 800A |
| | 1000A | 1000A | 1000A | 1000A |
| | 1250A | 1250A | 1250A | 1250A |
| | 1600A | 1600A | 1550A | 1500A |
| | 2000A | 2000A | 1900A | 1750A |
| Frame 4000A | 2000A | 2000A | 2000A | 2000A |
| | 2500A | 2500A | 2500A | 2500A |
| | 3200A | 3200A | 3100A | 2900A |
| | 4000A | 4000A | 3550A | 3200A |
| Frame 6300A | 4000A | 4000A | 4000A | 4000A |
| | 5000A | 5000A | 5000A | 5000A |
| | 6300A | 6300A | 5500A | 4800A |

Installation recommendation BUS-BAR Connection

Bus-bar connection



Cables connections



Technical information

Maintenance procedures

Regular inspection required

| Regular inspection required | |
|--|---|
| Interval time | Operation mode |
| Annually | Turn on and off local and remote devices, and use various auxiliaries |
| | Successively |
| | Test operator column |
| | Small test suite for control unit test |
| Every two years or when the maintenance index of the controller unit reaches 100 | Check the arc extinguishing chamber |
| | Check contact system |
| | Check the tightness of the connection |

Parts need to be replaced according to the number of business cycles

| Accessory | Intervening entity |
|---|--------------------|
| Arc extinguishing chamber | User |
| Electric operating mechanism | User |
| Mechanical interlock | User |
| Link spring | User |
| Shunt coil / closing coil / undervoltage coil | User |

Maintenance operations

1. Each rotating part shall be regularly filled with lubricating oil during use
2. Regular maintenance shall be carried out to remove dust so as to maintain the insulation level of the circuit breaker
3. The contact system shall be inspected regularly, especially after each short circuit breaking. The inspection contents are as follows:
 - The flame marks on the two walls of the arc extinguishing chamber are clear, whether the arc extinguishing wall is broken or not, and whether the arc extinguishing grid is seriously burned, which needs to be replaced in time according to the situation
 - Whether the contact is in good contact and the contact thickness is $\leq 1\text{mm}$, it needs to be sent to the manufacturer for replacement
 - Whether the connecting parts are loose
 - After the breaker fault is broken, the controller can light up to indicate the cause of the fault. After the power is cut off, it still has the memory function. After the power is turned on again, press the “fault check” key on the control panel to indicate the information of the last fault trip. If a new fault occurs, clear the past fault memory and keep the new fault memory

Note: the simulated power-off of the test state is not memorized. Press the “reset” key once after the inspection to make the controller enter the normal state.

Troubleshooting

| Fault phenomenon | Cause analysis | Exclusion scheme | Remarks |
|---------------------------------------|--|--|--|
| Motor cannot store energy or abnormal | The voltage specification is inconsistent with the circuit breaker | Check whether the data label on the circuit breaker conforms to the ordering requirements, or it will be replaced | The external power supply must meet the requirements and the wiring is correct |
| | Wrong wiring of circuit breaker or external line | Check the circuit with the universal meter against the wiring diagram | |
| | Motor burned out | Replace the motor | |
| | After energy storage, the motor continues to operate | The travel switch in the mechanism is broken. Replace the travel switch | |
| The circuit breaker cannot be closed | Undervoltage coil not engaged | Supply power to undervoltage coil, replace if burnt out | |
| | Load short circuit or controller reset button not reset | Reset the reset button of the controller after eliminating the short circuit fault | |
| | Shunt coil energized for a long time | The shunt coil cannot be energized or checked for a long time. If it is burnt out, replace it | |
| The circuit breaker cannot be opened | No action of shunt coil and undervoltage coil | Supply power to shunt coil, replace if burnt out | |
| | | Make the undervoltage coil lose power, and replace the undervoltage coil if it does not act | |
| | No action of flux converter | If there is no signal from the ETU, replace the ETU Adjust the position of the flux converter | |
| Frequent tripping of circuit breaker | Controller red reset button pops up | Check what protection indicator is on and eliminate the cause of the fault | |
| | | If there is no fault in the circuit, the controller shall be replaced | |
| | Undervoltage coil protection function start | Check if the grid voltage fluctuates | |
| | | Check whether the power supply of undervoltage coil is loose Can the fault be eliminated after the undervoltage coil is removed | |



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Designed by BTB Electric
Add: Orhangazi Mah. Mimsan San. Sit. 1780 sok.
No: 5 Esenyurt / İstanbul / Türkiye
E-mail: sales@btb-electric.com
Web: btb-electric.com

