TGM1EL Series Moulded Case Circuit Breaker with Earth Leakage Protection

1 Overview

TGM1EL series moulded case circuit breaker with earth leakage protection is used in the AC 50Hz circuit with the rated voltage 400V and rated current up to 630A for infrequent conversion of the line and infrequent startup of the motor.

The circuit breaker has many protection functions such as long delay, short circuit short delay, short circuit instantaneous, overvoltage, undervoltage, open phase, residual current protection, and thermal simulation. The controller adopts high-precision electronic release to display the voltage, current, residual current, and fault information in real time, and all parameters can be adjustable, viewable, and settable.

The product has one 1-way RS485 standard interface as standard configuration, and complies with the "Low Voltage Moulded Case Circuit Breaker Communication Protocol – with Electric Leakage Protection" (DL/T645).

The product has one 1-way external control opening passive interface as standard configuration, and the circuit breaker will be powered off immediately when this port is short circuited.

Circuit breakers comply with standards:

IEC 60947-1 "Low-voltage switchgear and controlgear - Part 1: General rules"

IEC 60947-2 "Low voltage switchgear and controlgear - Part 2: Circuit breaker"

2 Type Designation

TG M 1 E L – □ □ □ / □ □ □ □ □

- Installation method: Fixed type front-panel by default; C: Plug-in type back-panel; F: Plug-in type front-panel
- Usage: Power distribution protection by default; 2: Motor protection
- Accessory (See Table 1)
- Trip mode (3: Electronic type)
- Number of poles: 3N: three-pole four-wire, N pole has no overcurrent release, and N pole is normally on; 4: 4P
- Operation method code: Direct operation via handle by default; P: For electric operation; Z: For operation via rotary handle;
- Breaking capacity: M:medium breaking; H:high breaking
- Frame rated current (A)
- With residual current protection
- Electronic type
- Design code
- Moulded case circuit breaker
- Enterprise code

Table 1

Accessory type	Code
None	00
Alarm contact	08
Aux. contact	20
Aux. contact + alarm contact set	28
Two sets of aux. contacts	60

Note: The product has the shunt function. If the additional function is required, please refer to Item 5.5.6.

Table 2

Code	Description
A	The N pole is not equipped with an overcurrent release element, and the N pole is always open.
B	The N pole is not equipped with an overcurrent release element, and the N pole is opened and closed together with other three poles (N pole is closed and then open)
C	The N pole is equipped with an overcurrent release element, and the N pole is opened and closed together with other three poles (N pole is closed and then open)
D	The N pole is equipped with an overcurrent release element, and the N pole is always open.

Note: 3-pole product by default: 3N corresponds to A type or D type: 4P corresponds to B type or C type: D type is not available for 250 frame.

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3 Operating Conditions

3.1 The ambient air temperature is ranged -5℃~+40℃.

3.2 The altitude at the installation site does not exceed 2000m.

3.3 The relative humidity of air does not exceed 50% at the temperature +40℃ at the installation site. A higher relative humidity is allowed at low temperatures, such as up to 90% at +20℃. Special measures are taken for condensation occurred occasionally due to temperature changes.

3.4 The pollution degree: 3;

3.5 The installation category of main circuit is Class III, and of the auxiliary circuit or control circuit not connected to the main circuit is Class II;

3.6 The circuit breaker shall be installed in a place where there is no explosive danger or conductive dust sufficient to cause metal corrosion or damage to the insulation;

3.7 The circuit breaker shall be installed in a place where there is no rain and snow immersion;

3.8 The external magnetic field of the installation site does not exceed 5 times the earth's magnetic field in any direction.

4 Technical Parameters

Table 3

Frame current (A)	250		400		630	
Rated current Ir (A)	100 ~ 250 adjustable		160 ~ 400 adjustable		250 ~ 630 adjustable	
	Range 1A					
Rated operating voltage Ue (V)	AC400					
Frequency (Hz)	50					
Rated insulation voltage Ui (V)	1000					
Rated impulse withstand voltage Uimp (kV)	8					
Breaking capacity level	M	H	M	H	M	H
Icu (kA)	50	85	50	85	50	85
Ics (kA)	50	50	50	50	50	50
Number of poles	3P+N、4P					
Isolation function	No					
Usage category	B		B		B	
Rated short-time withstand current Icw (kA)/1s	10		5		8	
Flashover distance (m)	≤50		≤100		≤100	
Short circuit short delay protection characteristics (Isd)	Short delay protection set value: 2Ir ~ 12Ir adjustable, with range 1; for characteristics, see Table 7					
Short circuit instantaneous protection characteristics (Ii)	Instantaneous protection set value: 4Ir ~ 14Ir adjustable, with range 1; for characteristics s, see Table 8					
Overvoltage protection characteristics	Voltage operation value: phase voltage 253V~286V (line voltage 437V~494V) adjustable, range 1V, closable Operation delay time: 1s-30s adjustable, range 1s					
Undervoltage protection characteristics	Voltageoperation value: phase voltage is 154V~187V (line voltage 266V~323V) adjustable, range 1V, closable Operation delay time: 1s-30s adjustable, range 1s					
Open phase protection characteristics	When the wire of any phase is disconnected at the inlet terminal of circuit breaker except for N pole, the circuit breaker will trip immediately, and theoperation time is ≤ 0.5s					
Residual current protection characteristics I △ n(mA)	30/50/100/200/300/500/ 800/1000mA Adjustable		50/100/200/300/500/ 800/1000mA Adjustable		50/100/200/300/500/ 800/1000mA Adjustable	
Limit non-drive time △ t(s)	0.06/0.1/0.2/0.3/0.4/0.5s Optional Conventional gear: 0.06/0.1/0.2s adjustable					
Rated residual non-operating current I △ no	50%I △ n					
Rated residual short circuit breaking capacity I △ m	25%Icu					
Communication function (optional)	1-way RS485 interface Communication protocol: "Low Voltage Moulded Case Circuit Breaker Communication Protocol – with Electric Leakage Protection" (DL/T 645). Communication baud rate: 2400, 4800, 9600, 19200, 38400, five gears adjustable					
Remote opening port	Standard remote opening control port (passive port, short circuited to open)					

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5 Protection Characteristics

5.1 Long delay operation characteristics

5.1.1 Power distribution long delay operation characteristics

Table 4

Operation characteristics	Operaiton time							
1.05 Ir	Not operated within 2 hours							
1.3 Ir	Not operated within 1 hour							
2 Ir	Frame size	250				400/630		
	Setting tiem tr (s)	12	60	80	100	12	60	100	150

Note: Ir is the rated current setting value of circuit breaker.

5.1.2 Motor protection type long delay operation characteristics

Table 5

Operation characteristics	Operaiton time							
1.05 Ir	Not operated within 2 hours							
1.2 Ir	Not operated within 1 hour							
1.5 Ir	Frame size	250				400/630		
	Operation time (s)	21.3	107	142	178	21.3	107	178	267
2 Ir	Operation time (s)	12	60	80	100	12	60	100	150
7.2 Ir	Operation time (s)	0.93	4.63	6.17	7.72	0.93	4.63	7.72	11.6
Trip level		/	10A	10	20	/	10	20	30

5.2 Short circuit short delay operation characteristics

Table 6

Current setting value	Operation characteristics	Trip time (tsd)					
Isd:2~12Ir Adjustable (closable)	Isd≤I < Ii	Definite time limit	Time (s)	0.06	0.1	0.2	0.3
			Tolerance (s)	±0.02	±0.03	±0.04	±0.06
			Returnable time	/	/	0.14	0.21
Note: The tolerance of the operating current is ±15%.							

5.3 Short circuit instantaneous operation characteristics

Table 7

Current setting value	Operation characteristics	Trip time (tsd)
Ii:4~14Ir Adjustable (closable)	I≤0.85Ii	Not operated
	I≥1.15Ii	< 0.2s

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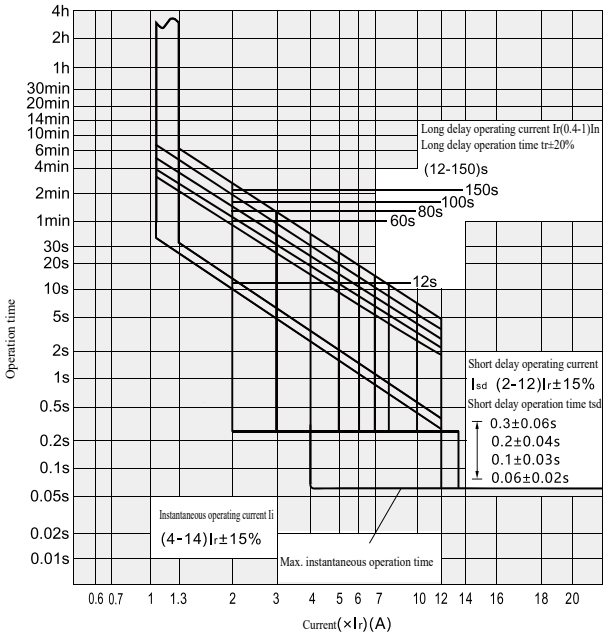
5.4 Distribution protection type current operation characteristic curve



5.5 Residual current protection characteristics

5.5.1 Gear setting range

Table 8

Parameter	Set value	Factory set value
Residual operating current IΔn (mA)	(30), 50, 100, 200, 300, 400, 500, 800, 1000	500

5.5.2 Operation characteristics

Table 9

Parameter	Characteristics			
$I_{\Delta n}$ (mA)	30、50、100、200、300、500、800、1000。			
Rated residual non-operating current	0.5Ia			
Residual operating current	Start value >0.8I, return value <0.75I			
△t (s)	Max. breaking time (s)			
	$I_{\Delta n}$	$2I_{\Delta n}$	$5I_{\Delta n}$	$10I_{\Delta n}$
0	0.3	0.15	0.04	0.04
0.06	0.5	0.2	0.15	0.15
0.1	0.8	0.3	0.3	0.3
0.2	1	0.4	0.4	0.4
0.3	1.2	0.5	0.5	0.5
0.4	1.4	0.8	0.8	0.8
0.5	1.6	1	1	1
0.6	1.7	1.2	1.1	1.1
0.7	1.8	1.4	1.2	1.2
0.8	1.9	1.6	1.3	1.3
0.9	2	1.8	1.4	1.4
1	2	1.8	1.5	1.5

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5.5.3 Overvoltage protection function
When the line phase voltage is higher than the overvoltage protection set value, the circuit breaker protection will trip. When the line voltage recovers to normal voltage, the circuit breaker can be closed and put into operation. The setting value range of overvoltage protection is 253V~286V, and the factory set value is 280V; the protection function can be set or disabled by user.

5.5.4 Undervoltage protection function
When the line phase voltage is below the undervoltage protection set value, the circuit breaker protection will trip. When the line voltage recovers to normal voltage, the circuit breaker can be closed and put into operation. The setting value range of undervoltage protection is 154V~187V, and the factory set value is 160V; the protection function can be set or disabled by user.

5.5.5 Open phase protection function
When there is an open phase at the power end of the line, the circuit breaker protection will trip. When the line voltage recovers to normal voltage, the circuit breaker will be closed and put into operation.

5.5.6 Linkage protection function
The linkage protection with other fire fighting equipment can be realized through the linkage interface as follows:
By remotely opening the control port on the upper cover, the remote control COM will be short connected to the remote control OFF to open (specified after the model: with shunt line).

6 Default Set Value of Factory Parameters of Conventional Product

Table 10

No.	Parameter set value	
1	Overload long delay setting	Current (Ir): 1In; Protection function state: Trip
		Delaty time (tr): 60s
2	Short circuit short delay setting	Current (Isd): 6Ir; Protection function state: Trip
		Delaty time (tsd): 0.3s
3	Short circuit instantaneous setting	Current (Ii): 10 Ir; Protection function state: Trip
4	Overvoltage protection setting	Operation value: 280V
		Protection function state: Trip; delay time: 3s
5	Undervoltage protection setting	Operation value: 160V
		Protection function state: Alarm; delay time: 3s
6	Open phase protection setting	Protection function state: Alarm
7	Residual current setting	IΔn: 500mA Protection function state: Trip
8		Δt: 0.06s
9	Communication baud rate (optional)	9600
10	Communication address (optional)	1

7 Product Technical Data

7.1 Derating Coefficient at Different Temperature

Table 11

Current (A)	Ambient temp.					
	40℃	50℃	55℃	60℃	65℃	70℃
250	1In	0.9 In	0.89 In	0.85 In	0.81 In	0.78 In
400	1In	0.9 In	0.89 In	0.85 In	0.81 In	0.78 In
630	1In	0.9 In	0.89 In	0.85 In	0.81 In	0.78 In

7.2 When the altitude of the product exceeds 2000m, the electrical performance shall be corrected according to the table below

Table 12

Altitude (m)	2000	2500	3000	4000	5000
Power frequency withstand voltage (V)	3000	3000	2500	2000	1800
Insulation voltage (V)	1000	800	700	600	500
Operating current correction coefficient	1In	1In	0.94In	0.88In	0.85In

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7.3 Recommended value of wire specification

Table 13

Rated current In (A)	125	160	250	320	400	500	630
Sectional area of wire (mm^2)	50	70	120	185	240	2*150	2*185

7.4 Recommended value of tightening torque of inlet and outlet cable / copper busbar

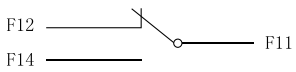
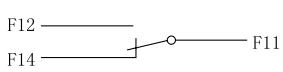
Table 14

Rated current（A）	Front-panel/back-panel wiring torque (N.m)
250	8.8 ～ 12
400	18 ～ 22
630	28 ～ 32

8 Introduction on Product Accessory

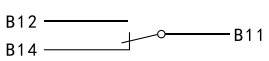
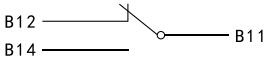
8.1 Aux. contact (installed on left side)

Table 15

Alarm contact	Resistive current Ith	250:3A		400/630: 6A	
	Usage category	AC-15	DC-13	AC-15	DC-13
	Operating voltage	AC380V/415V	DC110V/250V	AC380V/415V	DC110V/250V
	Rated operating current	0.3A	0.15A	1A	0.15A
	Wiring diagram  State of circuit breaker in the "OFF" or "Free Trip" position  State of circuit breaker in the "ON" position				

8. 2 Alarm Contact

Table 16

Aux. switch	Resistive current Ith	250:3A	400/630:6A
	Rated operating current Ie	Same as aux. contact	Same as aux. contact
	Wiring diagram  State of circuit breaker in the Free Trip (Alarm) position  State of circuit breaker in the "OFF" or "ON" position		

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8.3 Rotary Manual Operating Mechanism

The outline and installation dimensions of the rotary handle are shown below:

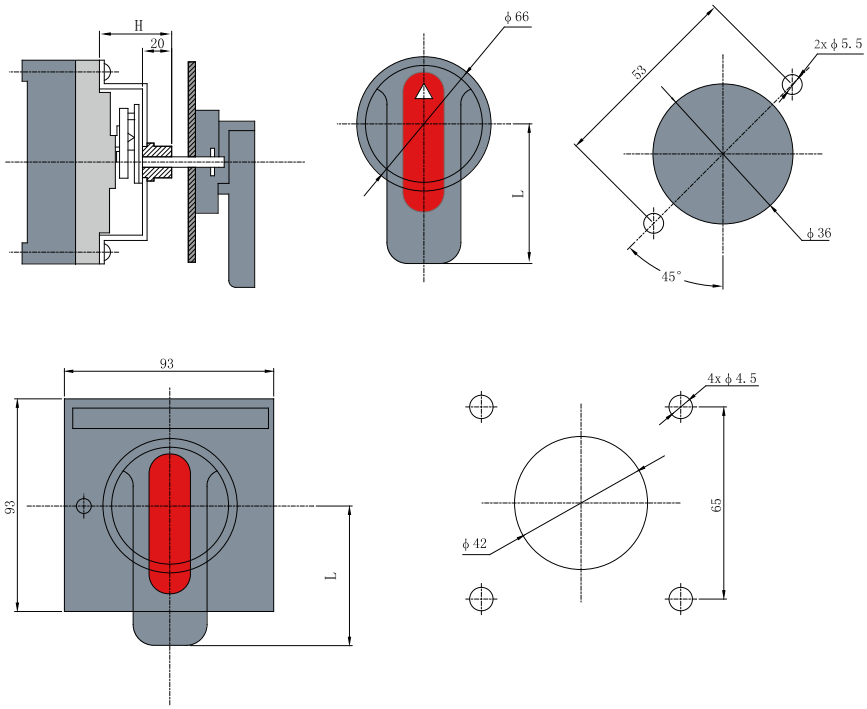


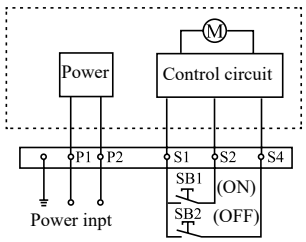
Table 17

Model & Spec.	TGM1EL-250	TGM1EL-400	TGM1EL-630
Installation dimensions (H)	57	87	89
Handle length (L)	95	125	125

8.4 Motor Mechanism

8.4.1 Motor mechanism wiring diagram

Table 18

Input voltage	AC220V/230V，AC380V/400V
Wiring diagram	 Instruction: P1 and P2 are external power inputs, and SB1 and SB2 are operating buttons (provided by user) Note: Those in the dotted box are the wiring diagram of internal accessories of motor mechanism.

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8.4.2 Outline and installation dimensions of motor mechanism

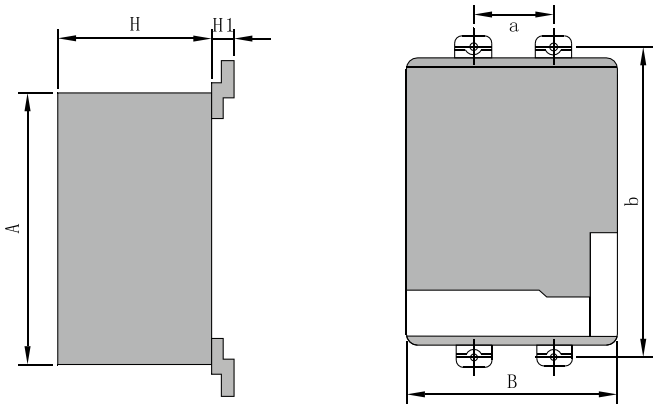
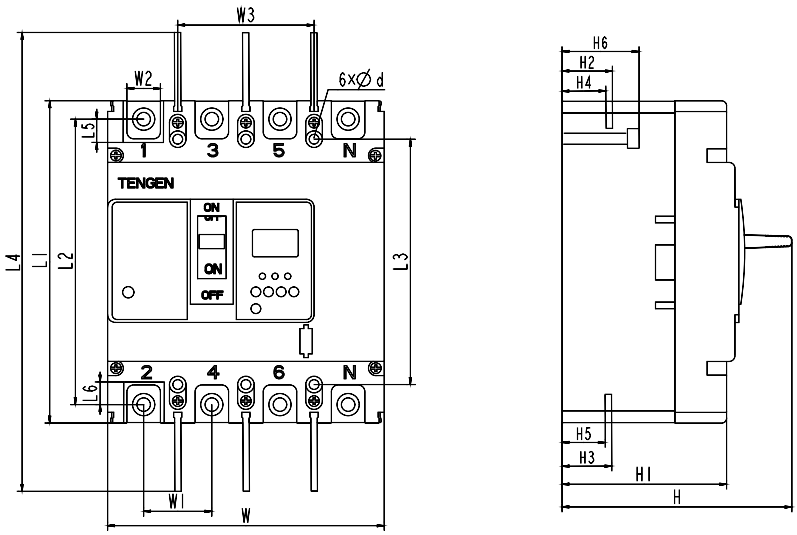


Table 19

Model	A	B	H	H1	a	b
TGM1EL-250	116	90	77	16.5	35	126
TGM1EL-400	174	130	117	35.5	44	193
TGM1EL-630	174	130	115	31.5	114	233

9 Outline and Installation Dimensions

9.1 Outline and installation dimensions of circuit breaker



Note: Arc isolating sheet is marked with dot lines.

Table 20

Product model	Outline dimensions												Installation dimensions					
	L1	L4	W	W1	W2	H	H1	H2	H3	H4	H5	L2	L3	L5	L6	W3	H6	Φd
TGM1EL-250	165	300	142	35	26	118	85	21.5	21.5	17.5	17.5	146	126	14	14	70	60	4.5
TGM1EL-400	257	469	198	48	33	153	98	39	38.5	34	35.5	224	194	14.5	14.5	94	67	8
TGM1EL-630	280	484	239	58	44	159	103	38	37	32	32	250	233	16	16	116	72	7

Note 1: H6 is the depth of the hole of mounting screw of product

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9.2 Product Handle Position and Panel Size

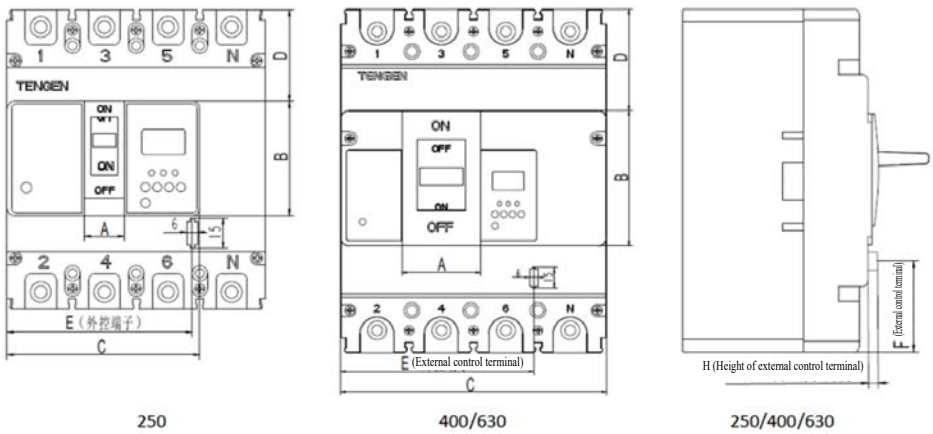
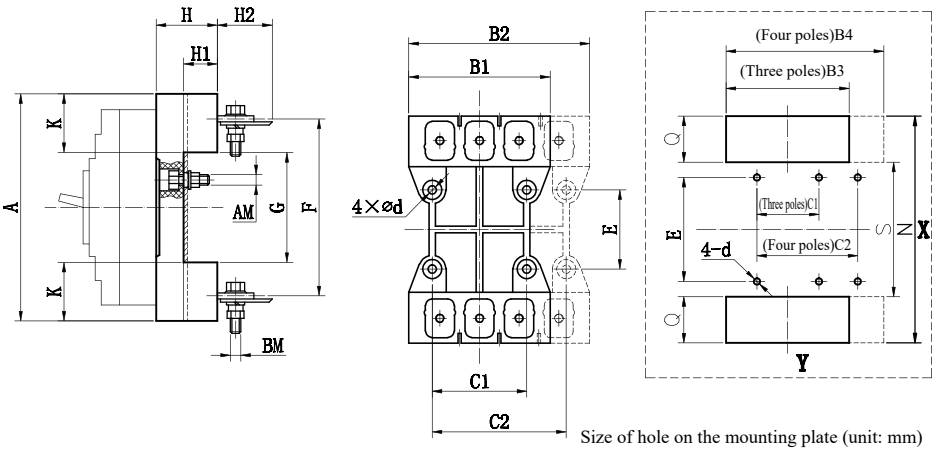


Table 21

Model	A	B	C	D	E	F	H
TGM1EL-250	22	63	107	50.6	102	42	8
TGM1EL-400	59	101.5	198	76	144	56	8
TGM1EL-630	65	102	239	76.5	162.5	82	8

9.3 Outline and Installation Dimensions of Plug-In Type Back-Panel



Size of hole on the mounting plate (unit: mm)

Table 22

Model	A	B1	B2	C1	C2	E	F	G	K	H	H1	H2	H3	N	S	Q	B3	B4	AM	BM	Ød
250	186	107	145	70	105	54	145	94	46	50	33	37	20	196	84	56	117	155	M6	M8	6.5
400	280	149	200	60	108	129	224	170	55	60	38	46	24	290	160	65	159	210	M8	M12	8.5

Note: The plug-in type installation method is not available for the 630 frame

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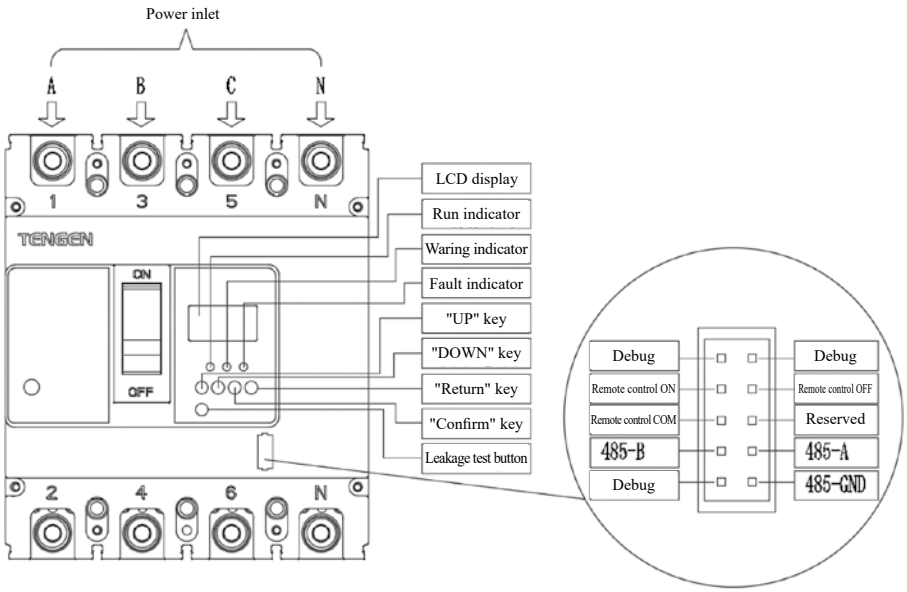
10 Description of Circuit Breaker Controller Panel and External Control Port



10.1 Description of Indicators on Panel

♦ “RUN” indicator (green): flicker during the normal operation of product;

♦ “Warning” indicator (yellow):

1. When the current is > the overload current setting value Ir * the overload prewarning setting coefficient (with 0.9 fixed), the warning indicator will flicker, and when ≤0.95 * overload current setting value Ir * overload prewarning alarm setting coefficient (with 0.9 fixed), the warning indicator is not on.

2. If the residual current warning is enabled, when the residual current value > the residual current gear value (mA) * residual current warning setting coefficient (default 60%) and the duration time exceeds the residual current warning delay time (default 60s), the warning light will flicker; when the residual current value < [residual current gear value (mA) * residual current warning setting coefficient (default 60%) -5mA], the warning light does not light up.

♦ "Fault" indicator (red): this light will flicker when the alarm function is enabled and there is a voltage or current fault; this light will always on when the product trips due to the voltage or current fault if the trip function is enabled; this light will be off during the normal operation.

Note: The settable residual current warning on the interface is in the "ON" or "OFF" state, and it is in the "OFF" state by default.

10.2 Description of External Control Port

♦ Remote control opening port: It is a passive port. When the "Remote control COM" and "Remote control OFF" are enabled, the circuit breaker will open; when the "Remote control COM" and "Remote control ON" are enabled, the circuit breaker will be closed automatically (the controller and external control lead shall be customized to match with the motor mechanism);

♦ Debugging: This port is used for factory calibration, and cannot be connected to other devices by users.

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11 Ordering Notice

Please specify the following information when ordering:

a) The model, name, and number of poles of the circuit breaker.

b) The rated current of the circuit breaker.

c) The accessory name, specification and combination code of the circuit breaker (the operating voltage value should be specified for shunt release and undervoltage release).

d) Purpose: For power distribution (power distribution application is available by default when delivery) and for motor protection (indicated by 2).

e) Quantity.

For example: TGM1EL-250, 3P+N, 50kA breaking capacity, rated current 250A, with auxiliary contacts, 20 units.

Please specify: TGM1EL-250M/3N320 250A 20 units.

The circuit breaker has three line types: shunt line, communication line, and shunt communication line; the circuit breaker is equipped with a function interface, and the corresponding line indicates the corresponding functional requirement. If there are special requirements for circuit breakers, please contact the manufacturer.

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12 Model Description