



AM2 Multi-functional Protective Relay

Technical Manual User Manual V1.1

Acrel Electric CO., Ltd by shares

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Table of Contents

一、 Device Overview	1
1、 Overview	1
1.1 Typical application	1
1.2 Technical Features	1
2、 Technical performance and indicators	2
2.1 Rated electric parameters	2
2.1.1 Power supply	2
2.1.2 Rated current, voltage	2
2.2 Principal technical indices	2
2.2.1 Influence to deviation of measuring element	2
2.2.2 Contact capacity	2
2.3 Environmental conditions	2
2.4 Power consumption	2
2.5 Overload capability	3
2.6 Insulation performance	3
2.6.1 Insulation resistance	3
2.6.2 Media strength	3
2.6.3 Impulse voltage	3
2.7 Humid-heat tolerant performance	3
2.8 EMC	3
2.9 Mechanical performance	4
2.9.1 Vibration	4
2.9.2 Impulse	4
2.9.3 Collision	4
2.10 Device appearance	5
二、 Technical Manual	6
1、 Basic function	6
1.1 3-zone composite voltage overcurrent protection	6
1.2 Inverse time over-current protection	6
1.3 Two-stage grounding over-current protection(HV side)	7
1.4 LV side ground over-current	7
1.5 Post accelerating over-current protection	7
1.6 3-pole 1 cycle ARC	8
1.7 Over-voltage protection	8
1.8 Under-voltage protection	8
1.9 High temperature warning	9
1.10 Over-temperature trip	9
1.11 Over-loading warning	9
1.12 Zero sequence over-voltage warning	9
1.13 PT wire broken detection	9
1.14 Tele-functions	10
1.14.1 Tele-metering	10

1.14.2 Tele-control	10
1.14.3 Tele-signaling	10
1.15 Event log	10
2、Automation.....	10
2.1 Communication connection and parameter setting	10
2.2 Description of Modbus-RTU.....	10
2.3 Tele-metering (remotely read out the device register by function code 0x 04) ..	11
2.4 Tele-signaling (remotely read out the scattered data by function code 0x 02) ..	12
2.5 Tele-control(remotely write in the register, function code 0x 05).....	13
3、Setting	14
三、Man-machine interface description.....	17
1、Panel description	17
2、Menu structure	18
四、Reference drawing	20

一、 Device Overview

1、 Overview

1.1 Typical application

Multi-functional protective relay AM2 is designed for feeder protection and transformer protection up to 20kV distribution system which is featured by safe and reliable power supply. It is typically used in substation, industrial plant, hospital, school, commercial plaza and buildings.

1.2 Technical Features

The device is developed based on proved experience of protective relays. It's based on micro-processor and modern AC sampling technology. It is featured by efficiency, reliability and easy-to-use.

- The device is equipped with full protection functions. It is designed for fast installation, wiring and operation.
- Measuring three-phase current and zero-sequence current (I_a , I_b , I_c , I_0), three-phase or line voltage (U_{ab} , U_{bc} , U_{ca}), active power P , reactive power Q , power factor $\cos \phi$, frequency f .
- Up to 8 -channel DI, Users can customize the name.
- The relay supports the function of tele-control. It can be time synchronized.
- The relay is equipped with strong fault recorder. All kinds of waveform and binary signals are to be recorded.
- A RS485 communication interface to support the IEC60870-5-103, Modbus and other protocol.
- The full graphical programming technology, as well as stable and reliable protection relay library, improve reliability and correctness of the procedure.
- A dedicated chip is used in the relay to memorize the basic data after the loss of power supply. The device can work properly after the resume of power supply.
- Machine static low power consumption (about 4W), LCD module using the new technology, life expectancy increased substantially.

2、 Technical performance and indicators

2.1 Rated electric parameters

2.1.1 Power supply

- DC rated voltage: 220V 、 110V、 48V
Permissive variation: -20% ~ +15%
Ripple coefficient: not larger than 5%
- AC rated voltage: 220V
Permissive variation: -10% ~ +10%
Ripple coefficient: not larger than 5%

2.1.2 Rated current, voltage

- AC current: 5A or 1A Frequency: 50Hz;
- AC voltage: 100V or $100/\sqrt{3}$ V Frequency: 50Hz;

2.2 Principal technical indices

2.2.1 Influence to deviation of measuring element

- Temperature: within $\pm 1\%$ in case of normal operation temperature range;
- Overall deviation: within $\pm 2\%$.

2.2.2 Contact capacity

- Trip space contact: 5A (DC220V closure of capacity), 8A (DC48V closure of capacity) ;
- signal space contact: 5A (DC220V closing capacity)。

2.3 Environmental conditions

- Ambient temperature: $-25^{\circ}\text{C} \sim +55^{\circ}\text{C}$
- Relative humidity: 5% ~95% (no condensated dew or ice inside produce)
- Atmospheric pressure: 66Kpa ~ 106Kpa

2.4 Power consumption

- AC current circuit: As $I_N = 5\text{A}$, not larger than 0.5VA each phase;
As $I_N = 1\text{A}$, not larger than 0.5VA each phase;
- AC voltage circuit: At rated voltage, not larger 0.5VA each phase;
- DC power supply circuit: For normal operation, not larger than 5W;
As the system operates, not larger than 10W.

2.5 Overload capability

AC current circuit: at two multiples of rated current, continuous operation; at 10 multiples of rated current, 10s is permitted; at 20 multiples of rated current, 1s is permitted.

AC voltage circuit: at 2 multiples of voltage, continuous operation.

2.6 Insulation performance

2.6.1 Insulation resistance

Under normal test atmospheric conditions, the insulation resistance of the system between the externally leading active circuits and the open non-active metal parts as well as the housings and between the electrically unconnected circuits is measured by a 500V megger to be not lower than $100M\Omega$.

2.6.2 Media strength

Under normal test atmospheric conditions, the system can tolerate the 50Hz, 1min. power frequency withstand voltage test and no breakthrough flashover and element damages will occur. During the test, as the voltage is applied at any tested circuit, the other circuits will be interconnected and grounded equipotentially.

2.6.3 Impulse voltage

Under normal test atmospheric conditions, such circuits as DC input circuit, AC input circuit, output contacts, etc. to ground and between the electrically unconnected circuits can tolerate the short-duration impulse voltage test of 1.2/50 μs standard lightning waves and its open-circuit test voltage is 5kV.

2.7 Humid-heat tolerant performance

The system can tolerate the constant humid-heat test stipulated in GB/T7261.20. The test temperature is $+40^{\circ}C \pm 2^{\circ}C$, relative humidity, $(93 \pm 3)\%$ and test duration, 48hrs. Within 2hrs before the test completion, a 500V DC megger is used to measure the insulation resistance between the externally leading active circuits and the open inactive metal part as well as the housings and the various electrically unconnected circuits to be not lower than $1.5M\Omega$; the media strength not lower than 75% of the voltage for the media strength test stipulated in 2.6.2.

2.8 EMC

	Item	Request
	RF radiated electromagnetic field immunity	The protection conforms to radiated, RF electromagnetic field immunity test class III stipulated in the standard GB/T 14598.9-2002.
	Electric fast transient pulse group immunity	The protection conforms to electrical fast transient/burst immunity test class IV stipulated in the standard GB/T 14598.10 - 2007 (idt IEC 60255-22-4:2002) .

	Item	Request
	1MHz pulse group immunity	The protection conforms to 1MHz pulse group immunity test class III stipulated in the standard GB/T 14598.13 - 2008 (eqv IEC 60255-22-1:2007) .
	Electrostatic discharge anti-interference	The protection conforms to the electrostatic discharge immunity test class 4 stipulated in the standard GB/T 14598.14 - 1998 (idt IEC 60255-22-2:1996) .
	Radiated emission value limiting test	The protection conforms to radiated emission value limiting test class A stipulated in the standard GB/T 14598.16 - 2002 (IEC 60255-25:2000 , IDT) .
	RF induction conduction degree harassment	The protection conforms to immunity to conducted disturbances, induced by radio-frequency fields class 3 stipulated in the standard GB/T 14598.17-2005.
	Surge (impulse) immunity	The protection conforms to surge (impulse) immunity test class 3 stipulated in the standard GB/T 14598.18-2007.
	Power Frequency Magnetic Field Immunity	The protection conforms to power frequency magnetic field immunity test class 4 stipulated in the standard GB/T 14598.19-2007.

2.9 Mechanical performance

2.9.1 Vibration

The system can tolerate the vibration response test of severity Class I stipulated in 3.2.1 of GB/T 11287-2000.v

The system can tolerate the vibration endurance test of severity Class I stipulated in 3.2.2 of GB/T 11287-2000.

2.9.2 Impulse

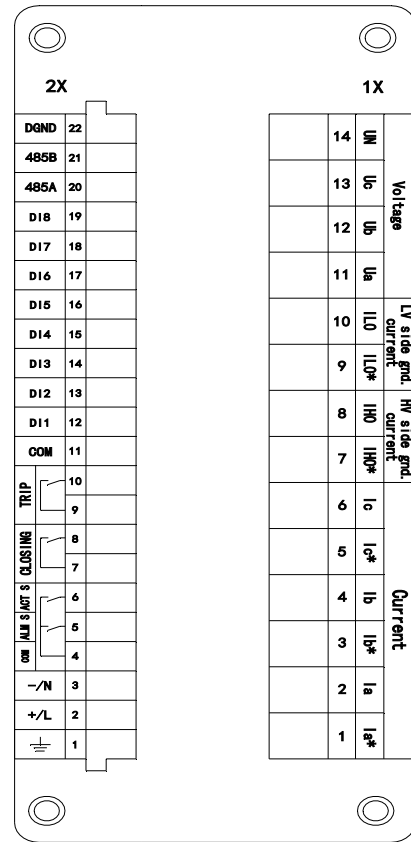
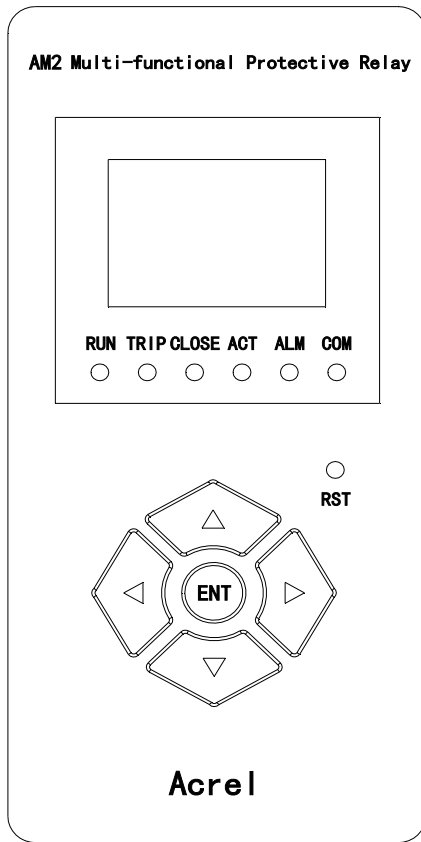
The system can tolerate the impulse response test of severity Class I stipulated in 4.2.1 of GB/T 14537-1993.

The system can tolerate the impulse endurance test of severity Class I stipulated in 4.2.2 of GB/T14537-1993.

2.9.3 Collision

The system can tolerate the collision test of severity Class I stipulated in 4.3 of GB/T 14537-1993.

2.10 Device appearance



二、 Technical Manual

1、 Basic function

- 3-stage compound voltage released over-current protection (Trip)
- Inverse time over-current protection (trip)
- HV side two-stage directional ground over-current protection (trip/warning optional)
- LV side ground over-current protection (trip/warning optional)
- Post acceleration protection(trip)
- Auto-reclosing (close)
- Under-voltage and over-voltage protection (trip/warning optional)
- Mechanical protection of high temperature (warning)
- Mechanical protection of over temperature (trip)
- Over-loading warning, Zero over-voltage warning, VT wire broken warning

Tele-metering of I, U, P, Q and Cos ϕ ; Tele-signaling of 8 binary inputs.

1.1 3-zone composite voltage overcurrent protection

As any phase current is higher than the setting, the protection will trip after a time delay.

3-zone overcurrent protection control words may be represented by an independent selection inputs or exit.

1.2 Inverse time over-current protection

The relay is equipped with inverse time over-current protection. With inverse time stage, the picking up current can be well adapted with line fault current. That is, the operating time delay can be well coordinated with line protection. The types of inverse curve are provided: normal inverse, very inverse and extremely inverse. The operating characteristic is determined by parameterized “inverse curve type”. The inverse curves are defined as below:

- Normal inverse
$$t = \frac{0.14t_p}{\left(\frac{I}{I_p}\right)^{0.02} - 1}$$

- Very inverse
$$t = \frac{13.5t_p}{\left(\frac{I}{I_p}\right) - 1}$$

- Extremely inverse
$$t = \frac{80t_p}{\left(\frac{I}{I_p}\right)^2 - 1}$$

Here, t_p is time factor (ranges 0.05~1) ; I_p is the base current; I is the fault current; t is the tripping time.

The criterions are as below:

- The mode of inverse time over-current is set to “ON” ;
- $I_{\phi} > I_{fn}$, I_{fn} is threshold of inverse time over-current, I_{ϕ} is phase current;
- $T > t$, t is time delay of inverse time over-current;

If all above criterions are fulfilled, phase A/B/C operates, the corresponding message is displayed on LCD, the corresponding LED is lit and tripping command is issued.

1.3 Two-stage grounding over-current protection (HV side)

The relay is equipped with two-stage grounding over-current protection. Both of the two stages have the same logic. The criterions are as below:

- The mode of the stage is set to “ON”
- $3I_0 > I_{0n}$, I_{0n} is the threshold of stage n;
- $T > T_{0n}$, T_{0n} is the time delay of stage n;

If all above criterions are fulfilled, the stage operates, the corresponding message is displayed on LCD, the corresponding LED is lit and tripping command is issued.

This function can operate with calculated zero-sequence current or measured 1-phase current. (This is an internal parameter. Factory setting is measured 1-phase current). This function can be optionally set to “warning” . In this case, the relay issues warning signal instead of tripping command.

When this function is used in transformer application, it is to protect HV side neutral grounding point.

1.4 LV side ground over-current

The criterions are as below:

The mode of this function is set to “ON”(This is an internal parameter and can only be set with “on” if customer requests) ;

- $3I_0 > I_{0n}$, I_{0n} is the threshold of LV side ground over-current;
- $T > T_{0n}$, T_{0n} is the time delay of LV side ground over-current.

When this function is used in transformer application, it is to protect LV side neutral grounding point.

1.5 Post accelerating over-current protection

The relay is equipped with an independent post-accelerating over-current protection in case of CB closing. This function can individually be set with “ON/OFF” . The threshold and time delay can be parameterized. This function is designed to quickly trip CB in case of switching-onto-fault by manual or ARC. If CB is in open status (logic value TWJ = “1”) for more than 30s, and CB position is changed from open to closed, post-accelerating over-current protection is activated. ARC operation will also activate post-accelerating over-current protection. This function is only available for 3s after the activation.

The criterions are as below:

- The mode of this function is set to “ON” ;
- CB position is changed from open to closed, or ARC operates;
- $I_{\phi} > I_{dj}$, I_{dj} is the threshold of post-accelerating over-current, I_{ϕ} is phase current;

- $T > T_{dj}$, T_{dj} is time delay of post-accelerating over-current;

If all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding LED is lit and tripping command is issued.

1.6 3-pole 1 cycle ARC

3-pole 1 cycle ARC is supported and it can be on/off.

- Readiness

If CB is closed and no blocking criterions are fulfilled, ARC is in readiness status after 15s time delay. In this case, LED for warning turns into constant lit instead of flashing.

- ARC starting

ARC is activated if, corresponding starting signal from protection function is activated, CB is open and line is dead(dead current threshold is 0.1A).

- ARC operation mode

ARC operation mode can be parameterized with: always ARC, dead voltage ARC and sync-check ARC.

Dead voltage means the maximum phase-phase voltage is less than 8V.

Operation mode of sync-check ARC is on request. Special statement is required when placing order.

- Blocking

The criterions are as below:

- The mode of ARC is set to “OFF” ;
- Spring is not ready;
- ARC picks up;
- Link piece for ARC blocking is connected.

If all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding LED is lit and closing command is issued.

1.7 Over-voltage protection

The criterions are as below:

- The criterions are as below;
- One of three phase-phase voltage overshoot the threshold;
- CB is closed;
- Time delay expired.

In case of under-voltage is set to trip, if all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding tripping LED is lit and tripping command is issued. In case of under-voltage is set to warning, the corresponding warning LED is lit but no tripping command is issued.

1.8 Under-voltage protection

The criterions are as below:

- The mode of under-voltage is set to “ON” ;
- All of three phase-phase voltage undershot the threshold;
- CB is closed;
- Time delay expired.

In case of under-voltage is set to trip, if all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding tripping LED is lit and tripping command is issued. In case of under-voltage is set to warning, the corresponding warning LED is lit but no tripping command is issued.

1.9 High temperature warning

The relay is equipped with function of high temperature warning. The mode can be set to “on/off” .

1.10 Over-temperature trip

The relay is equipped with function of over-temperature trip. The mode can be set to “on/off” .

1.11 Over-loading warning

Over-loading function is to supervise the phase current. The criterions are as below:

- The mode of over-loading protection is set to “ON”
- $\max(I_a, I_b, I_c) > I_{fh}$, I_{fh} is the pickup threshold of over-loading;
- $T > t_{fh}$, t_{fh} is the time delay.

If all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding LED is lit.

1.12 Zero sequence over-voltage warning

Zero sequence over-voltage function can be used to allocate grounding fault in non-earthed system. The earth fault location is determined by relays and control system. In case of grounding fault, control system can get the pickup of zero sequence over-voltage of the relay. Together with all tele-metering values of 3U0 and 3I0 of all relays, the system will make the determination of earth fault location.

The criterions are as below:

- The mode of zero sequence over-voltage protection is set to “ON” ;
- $3U_0 > U_{0d}$, U_{0d} is the pickup threshold of zero sequence over-voltage protection;
- $T > t$, t is the time delay.

If all above criterions are fulfilled, the function operates, the corresponding message is displayed on LCD, the corresponding LED is lit.

1.13 PT wire broken detection

Criterions for PT wire broken detection:

- The mode of PT wire broken detection is set to ON;
- $|U_a, U_b, U_c| > 8V$, $\min(U_a, U_b, U_c) < 30V$;

or CB is in closed status, $\max(U_a, U_b, U_c) < 8V$.

If all above criterions are fulfilled, the function operates, the corresponding message is displayed on

LCD, the corresponding LED is lit.

1. 14 Tele-functions

1. 14. 1 Tele-metering

The measured and calculated values of phase-phase voltages (U_{ab} , U_{bc} , U_{ca}), phase currents (I_a , I_b , I_c), active power, reactive power, power factor, etc., can be remotely accessed in primary display. The CT ratio and VT ratio must be correctly set in relay. For instance, CT ratio is set with 80 if 400A/5A is used, and PT ratio is set with 100 if $(10/\sqrt{3})\text{kV}/(0.1/\sqrt{3})\text{kV}$ is used.

1. 14. 2 Tele-control

The relay is equipped with two independent binary outputs which are respectively defined as CLOSE terminal 2X:7 - 2X8 and OPEN (terminal 2X:9 - 2X10). If KK switch is in REMOTE position, the CLOSE and OPEN commands from control system can be manually issued by operator and sent to relay. The operator can also simulate the control operation at device LCD panel by pressing “Data setting -> Tele-control” .

1. 14. 3 Tele-signaling

The relay is equipped with 8 binary inputs. The common positive power of binary inputs can be taken from +24V output of relay terminal 2X:11.

1. 15 Event log

The quantity of recorded logs for tripping and warning are not less than 200. The logs are stored against device power off. Even more logs can be accessed by software tool PGView.

2、Automation

2. 1 Communication connection and parameter setting

For peer-to-peer communication, serial protocol of RS-232 can be used. For communication with multi IED devices, serial protocol of RS-485 can be used. Either for peer-to-peer communication or multi IEDs' communication, only one master can be supported. Generally less IEDs per RS-485 bus result at higher communication availability. Normally up to 9 IEDs per RS-485 bus are proposed to achieve the good availability.

IEDs must be set with proper communication parameters if the device is connected.

Address: begins with 1, and +1 per device;

Baud rate: 9600; Data bits: 8;

Stop bits: 1; Parity check: None;

Communication protocol: Modbus-RTU.

2. 2 Description of Modbus-RTU

The standard Modbus-RTU frame format is supported. The default register in device is 16-bit. The elementary communication unit is byte (8-bit binary string). Detailed frame format is shown in below table,

Address field (1 byte)	Function code (1 byte)	Data(multi bytes)	CRC (2 bytes)
------------------------	------------------------	-------------------	---------------

Address field: is represented by 1 byte, ranges from 1 to 247;

Function code: 1 byte is used for reading/writing of various objects;

The function codes in device is listed in following table:

No.	Function code	Device data or function
1	0x 04	Tele-metering
2	0x 02	Tele-signaling
3	0x 05	Tele-control
4		

Device data: function code is attached with various data message. For data message which value is represented by with multi bytes, the floating point number format is used. It begins with high byte and ends with low byte.

CRC: 2-byte, including a 16-bit binary value. Each message begins with low byte and ends with high byte.

2.3 Tele-metering (remotely read out the device register by function code

0x 04)

No.	Register addr.	Device data	Remarks
1	0x 0000	Primary current phs. A	A single floating point number is represented by a 32-bit binary value. The four bytes are transmitted from high byte to low byte.
2	0x 0002	Primary current phs. B	
3	0x 0004	Primary current phs. C	
4	0x 0006	Primary ph-ph voltage UAB	
5	0x 0008	Primary ph-ph voltage UBC	
6	0x 000A	Primary ph-ph voltage UCA	
7	0x 000C	Primary active power P	
8	0x 000E	Primary reactive power Q	
9	0x 0010	Power Factor COS	
10	0x 0012	Frequency f	

Example: IA=5A, UA = 50V, PHI = 45° , CT ratio = 20, PT ratio = 100

Example: Master unit remotely calls for the tele-metering values:

Master unit transmits: 01 04 00 00 00 14 F0 05

Here:

01: device address;

04: function code that is to remotely access the measuring values;

00 00: address begins with 0x 00 00;

00 14: remotely access to 20 registers;

F0 05: CRC check code.

Slave unit replies: 01 04 28 42 C8 35 43 00 00 00 00 3D B2 D1 A0 40 9F D3 7D 3C 0B DE AA 40 9F BC A2 3E B4 33 C7 BE B5 64 B0 3F 34 20 77 42 48 00 01 08 0C

Here:

01: device address;
 04: function code that Slaver is to transmit the measuring values to remote control center;
 28: indicates the data length of 40 bytes;
 42 C8 35 43: floating point number 100.104027 which represents primary IA = 100A;
 00 00 00 00: : floating point number 0 which represents primary IB = 0A;
 3D B2 D1 A0: floating point number 0.087314 which represents primary IB = 0A;
 40 9F D3 7D: floating point number 4.994566 which represents primary UAB = 5kV;
 3C 0B DE AA: floating point number 0.008537 which represents primary UBC = 0kV;
 40 9F BC A2: floating point number 4.991776 which represents primary UCA = 5kV;
 3E B4 33 C7: floating point number 0.351958 which represents primary P = 0.35MW;
 BE B5 64 B0: floating point number -0.354284 which represents primary Q = -0.35MVar
 42 48 00 01: floating point number 50.00000 which represents frequency f = 50.0Hz
 08 0C: CRC check code

Remarks:

- 1) When 10 tele-metering values are configured for remote access, the maximum of available measuring values Master can remotely access is 10. If Master calls for more than the availability, then the device will response with message 0x 84 which indicates the error.
- 2) The tool float2hex of converting a 4-byte 16-bit binary value to a single floating point number can be found in internet.
- 3) The list of tele-metering values is dependent on actual device. The message displayed on LCD can be used for editing the list of tele-metering values.

2.4 Tele-signaling (remotely read out the scattered data by function code

0x 02)

The following scattered data is included: device healthy status and tele-signaling status:

Bit Addr.	Function	Length	Remarks
0	Device warning	1bit	Logic value is '1' if the device warns.
1	Device alarming	1bit	Logic value is '1' if the device alarms.
2	SOE on	1bit	Logic value is '1' if new SOE occurs.
3	Device healthy status	1bit	
4		1bit	
5		1bit	
6		1bit	
7		1bit	
8	Tele-si >CB closed	1bit	Logic value is '1' if CB is closed
9	gnaling (7stat >Disconnecter closed	1bit	Logic value is '1' if disconnecter is closed
10	us, please >Gnd disc. closed	1bit	Logic value '1' if ground disconnecter is closed

11	refer to relay configuration)	>Remote mode	1bit	Logic value is '1' if KK switch is in REMOTE position
12		>Spring un-ready	1bit	Logic value is '1' if spring is ready
13		High temperature trip	1bit	Logic value is '1' if high temperature detection operates
14		>Over-temp. warning	1bit	Logic value is '1' if over temperature detection operates
° ° °			1bit	

Non-electric binary input 2 is activated.

Example: Master unit remotely calls for the tele-signaling status.

Master unit transmits: 01 02 00 00 00 10 79 c6

Here,

01: device address;

02: function code that is to remotely access the signaling status;

00 00: address begins with 0x 00 00;

00 10: remotely access to 16 signaling status, ranges from 0 to 15;

79 c6: CRC check code

Slave unit replies: 01 02 02 00 80 B8 18

Here,

01: device address;

02: function code that Master is to call for the remote signaling status;

02: indicates the data length of 2 bytes;

00: expanded as bit byte with the 1st byte 00000000

80: expanded as bit byte with the 1st byte 10000000

Refer to the list of tele-signaling status, if non-electric binary input is activated, the output the logic is

1.

B8 18: CRC check code

Remarks:

1) When 16 tele-signaling statuses are configured for remote access, the maximum of available signals Master can remotely access is 16. If Master calls for more than the availability, then the device will response with message 0x 82 which indicates the error.

2) The list of tele-signaling status is dependent on actual device. The message displayed on LCD can be used for editing the list of tele-signaling status.

2.5 Tele-control (remotely write in the register, function code 0x 05)

Register address for tele-control is shown in below table

No.	Register addr.	Function	Remarks
1	0x0000	Remotely reset	Write in register: FF00 = ON;0000 = OFF
2	0x0001	Remotely open/close	

Example: Remotely reset device

Master unit transmit: 01 05 00 00 ff 00 8c 3a

Here,

01: Device address;

05: function code that is to remotely write in register, i.e, remotely reset;

00 00: register address which is 0x 00 00;

ff 00: write in register by value 0x ff 00 that is to execute the remote reset command;

8c 3a: CRC check code;

Slave unit replies: 01 05 00 00 FF 00 8C 3A

Here,

01: device address;

05: function code that Master write in register that is to remotely reset;

00 00: register address that is 0x 00 00;

ff 00: write in register by value 0x ff 00 that is to execute the remote reset command;

8c 3a: CRC check code;

Example: Remotely open/close CB

Remotely close CB

Master unit transmit: 01 05 00 01 ff 00 dd fa

Slave unit replies: 01 05 00 01 FF 00 DD FA

Remotely open CB

Master unit transmit: 01 05 00 01 00 00 9c 0a

Slave unit replies: 01 05 00 01 00 00 9C 0A

Remarks:

1) Message is transmitted by HEX format. English letters are case insensitive;

2) Master unit writes in the register by defined values to remotely reset the device or open/close CB.

Value of FF 00 written in register represents ON that is to remotely reset device or close CB. When the device successfully receives this command, it will immediately act and reply to the Master unit.

3) CB must be in ready status for successful remote open/close.

3、 Setting

List of setting:

Ser.No	Name of setting	Range	Unit	Notice
1	TA ratio	0.1-2000		Ratio 60 with 300A/5A CT
2	PT ratio	0.1-2000		Ratio 100 with (10/√3)kV/(0.1/√3)kV PT
3	Over-current def.-t 1 threshold	0.05-100	A	
4	Over-current def.-t 1 operate delay	0-100	S	
5	Over-current def.-t 1 mode	0-1		0 : Off 1 : On
6	Over-current def.-t 2 threshold	0.05-100	A	
7	Over-current def.-t 2 operate delay	0-100	S	
8	Over-current def.-t 2 mode	0-1		0 : Off 1 : On
9	Over-current def.-t 3 threshold	0.05-100	A	

10	Over-current def.-t 3 operate delay	0-100	S	
11	Over-current def.-t 3 mode	0-1		0 : Off 1 : On
12	Over-current inv.-t threshold	0.05-100	A	
13	Over-current inv.-t time dial	0.01-1		
14	Over-current inv.-t characteristic curve	0-2		0 : Normal inv 1 : Very inv 2 : Extremely inv
15	Over-current inv.-t mode	0-1		0 : Off 1 : On
16	Ground OC def.-t 1 threshold	0.01-100	A	
17	Ground OC def.-t 1 operate delay	0-100	S	
18	Ground OC def.-t 1 mode	0-2		0 : Off 1 : Warning 2 : Tripping
19	Ground OC def.-t 2 threshold	0.01-100	A	
20	Ground OC def.-t 2 operate delay	0-100	S	
21	Ground OC def.-t 2 mode	0-2		0 : Off 1 : Warning 2 : Tripping
22	Post-accelerating OC threshold	0.05-100	A	
23	Post-accelerating OC operate delay	0-100	S	
24	Post-accelerating OC mode	0-1		0 : Off 1 : On
25	ARC operate delay	0-900	S	
26	ARC mode	0-1		0 : Off 1 : On
27	Under-voltage threshold	1-100	V	Line Voltage
28	Under-voltage operate delay	0.1-100	S	
29	Under-voltage operate mode	0-2		0 : Off 1 : Warning 2 : Tripping
30	Over-voltage threshold	10-200	V	Line Voltage
31	Over-voltage operate delay	0.1-100	S	
32	Over-voltage operate mode	0-2		0 : Off 1 : Warning 2 : Tripping
33	Over-temperature warning delay	0-100		
34	Over-temperature mode	0-1		0 : Off 1 : On
35	High temperature trip delay	0-100		

36	High temperature trip mode	0-1		0 : Off 1 : On
37	Over-load warning threshold	0.05-100	A	
38	Over-load warning delay	0.1-100	S	
39	Over-load mode	0-1		0 : Off 1 : On
40	Zero over-voltage threshold	1-100	V	
41	Zero over-voltage operate delay	0.1-100	S	
42	Zero over-voltage mode	0-1		0 : Off 1 : On
43	Voltage supervision mode	0-1		0 : Off 1 : On

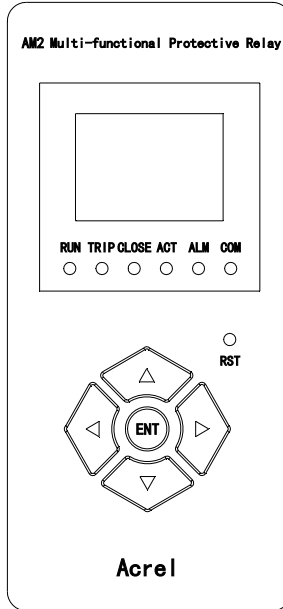
Remarks:

Relays produced since 13.04.2018 provide with two setting groups(SG): SG0 and SG1. Both of setting groups have the same setting list, but the parameters can be set with different values.

The factory setting group is SG0. This can be changed to SG1 by function of Setting Group Change. During setting, the setting group must be firstly selected, then set the parameters.

三、 Man-machine interface description

1、 Panel description



Picture 1.1

The device is equipped with 6 indicators, which are defined in the following table:

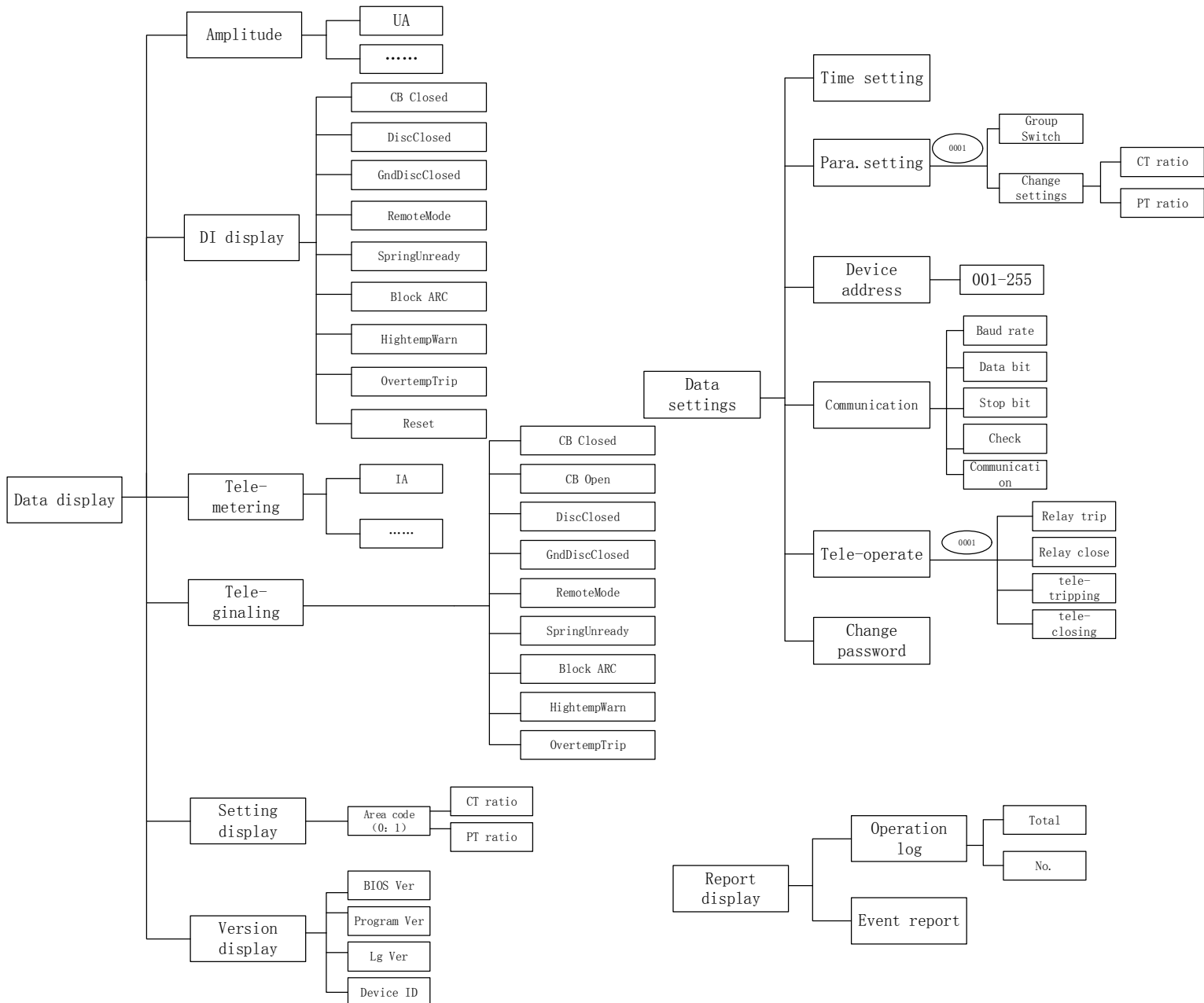
NUM	Name	Colour	Remarks
1	Run	Green	The normal operation of the device is flickering. When the device is in commissioning state, the running light goes out.
2	Trip	Green	When the circuit breaker is in sub-position, the "Trip" indicator will be on, otherwise it will be off.
3	Close	Red	When the circuit breaker is in position, the "Close" indicator will be on, otherwise it will be off.
4	ACT	Red	When the device trips,the indicator will be on, otherwise it will be off.
5	ALM	Red	When the device alarm,the indicator will be on, otherwise it will be off.
6	Com	Green	Indicator lights will flicker when communicating with external equipment.

The device is equipped with 6 keys, which are defined in the following table:

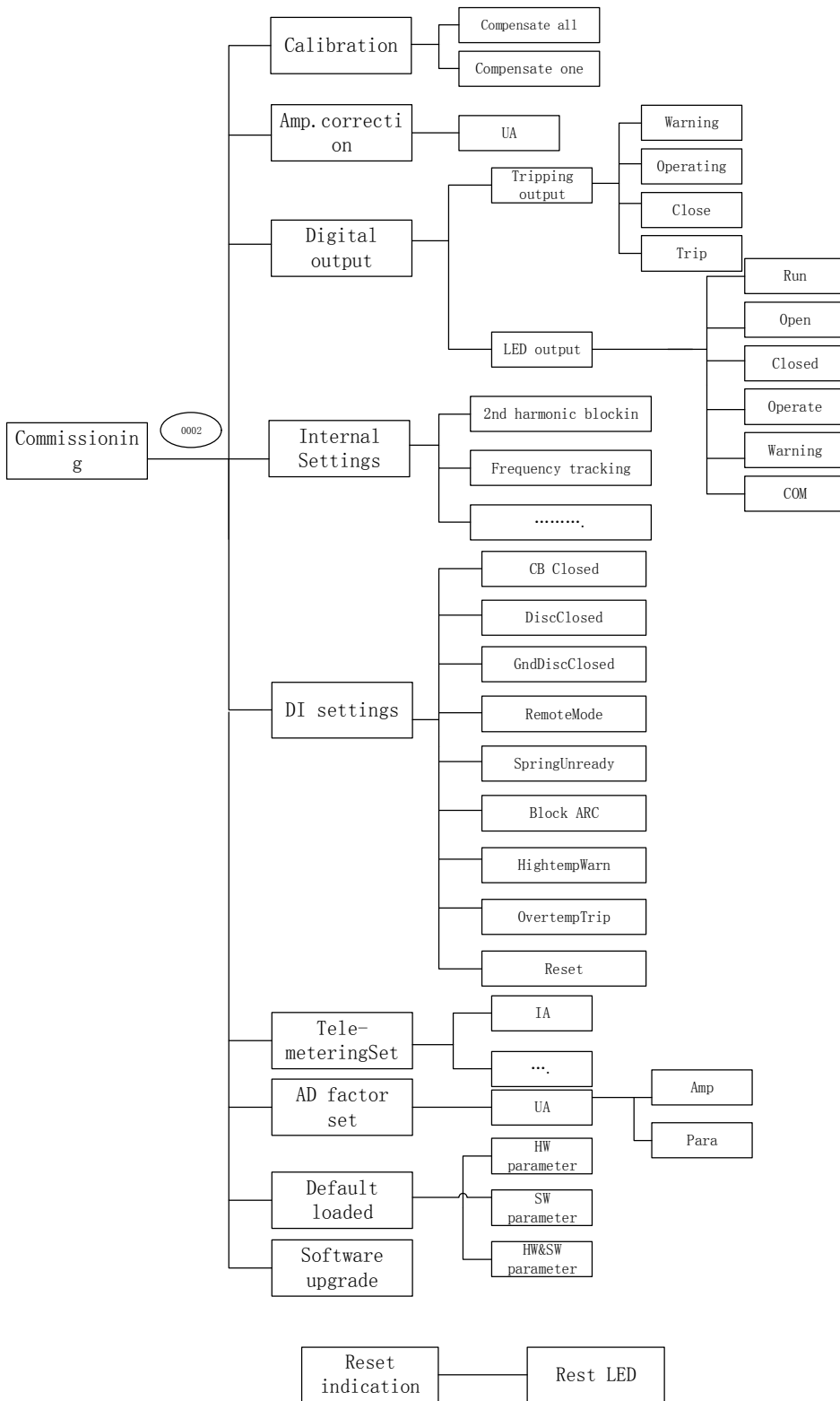
NUM	Name	Definition
1	↑	Used for data setting, control number increase and for cursor up or page up
2	↓	Used for data setting, control number reduce and for cursor down or page down
3	→	Used for cursor right shift

4	ENT	Determine, confirm the changes made or enter the menu options
5	←	Cancel the current menu function and return to the superior menu
6	RST	Reset all signal output,

2、Menu structure

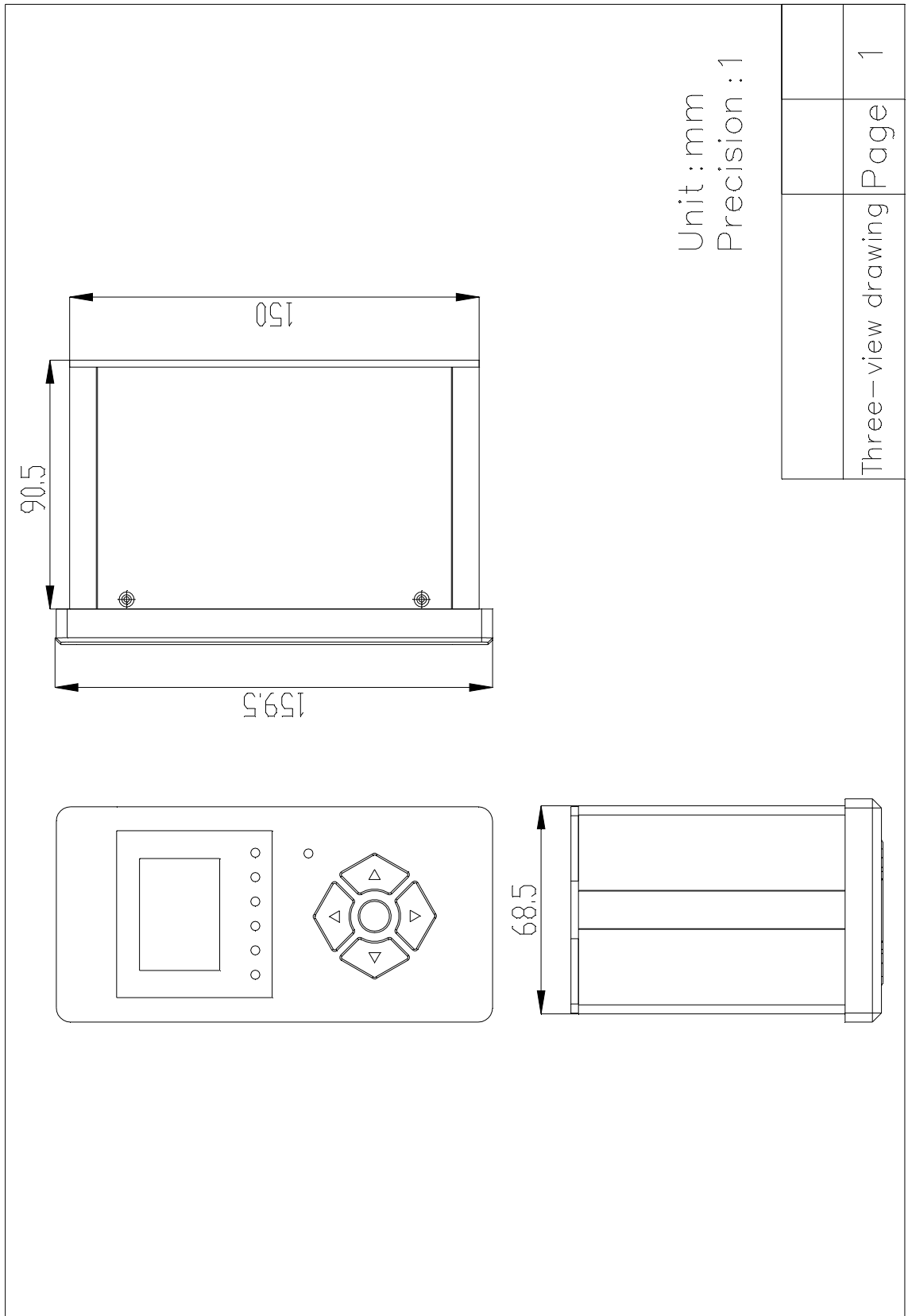


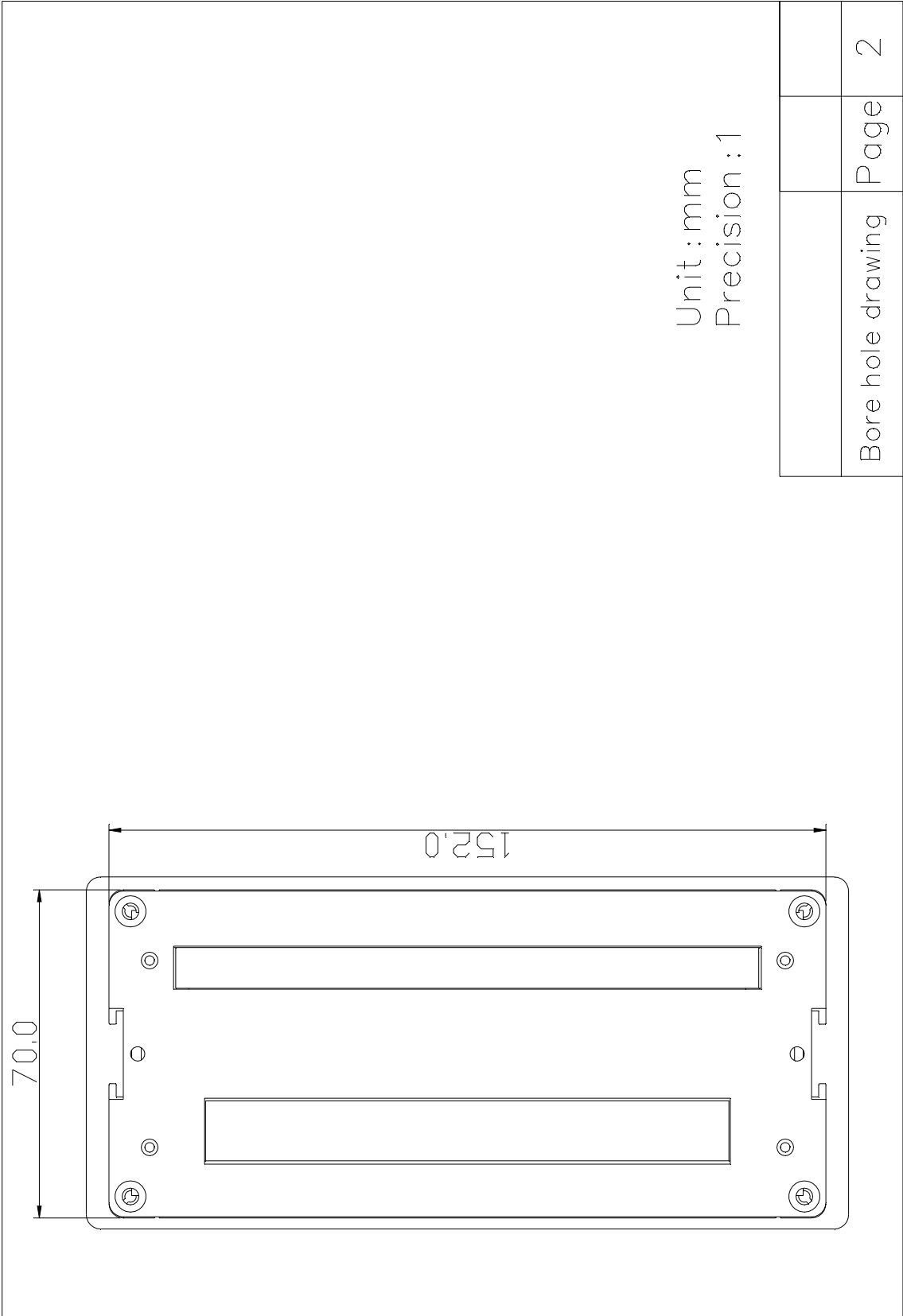
Picture 3.1 Menu1



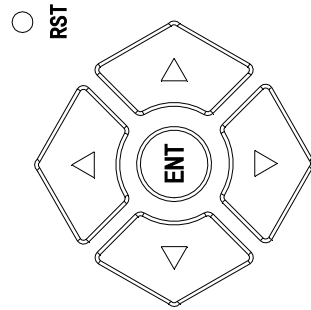
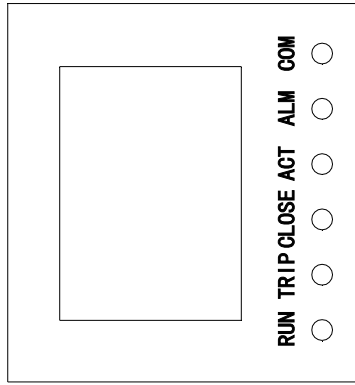
Picture 3.1 Menu2

四、Reference drawing

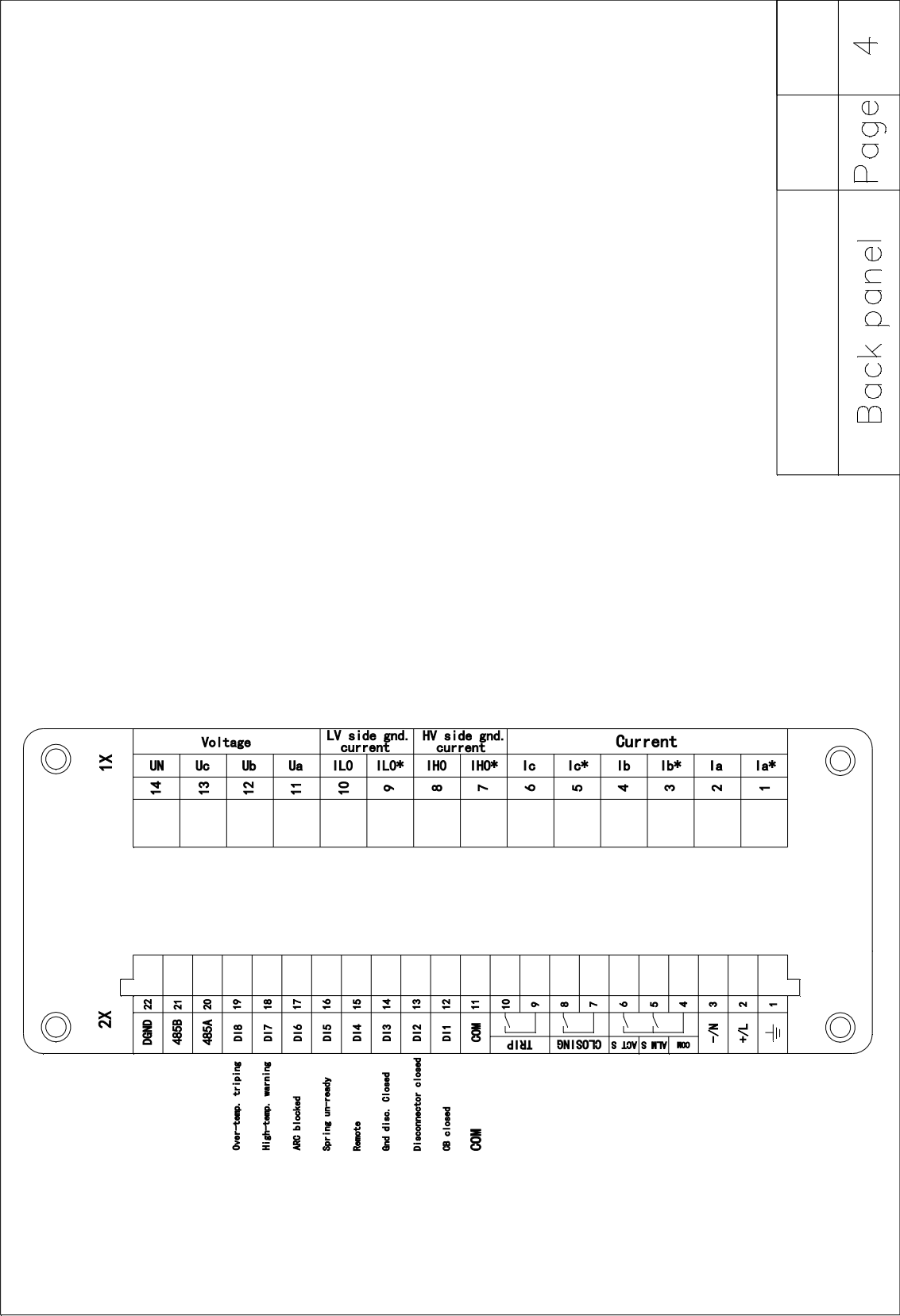


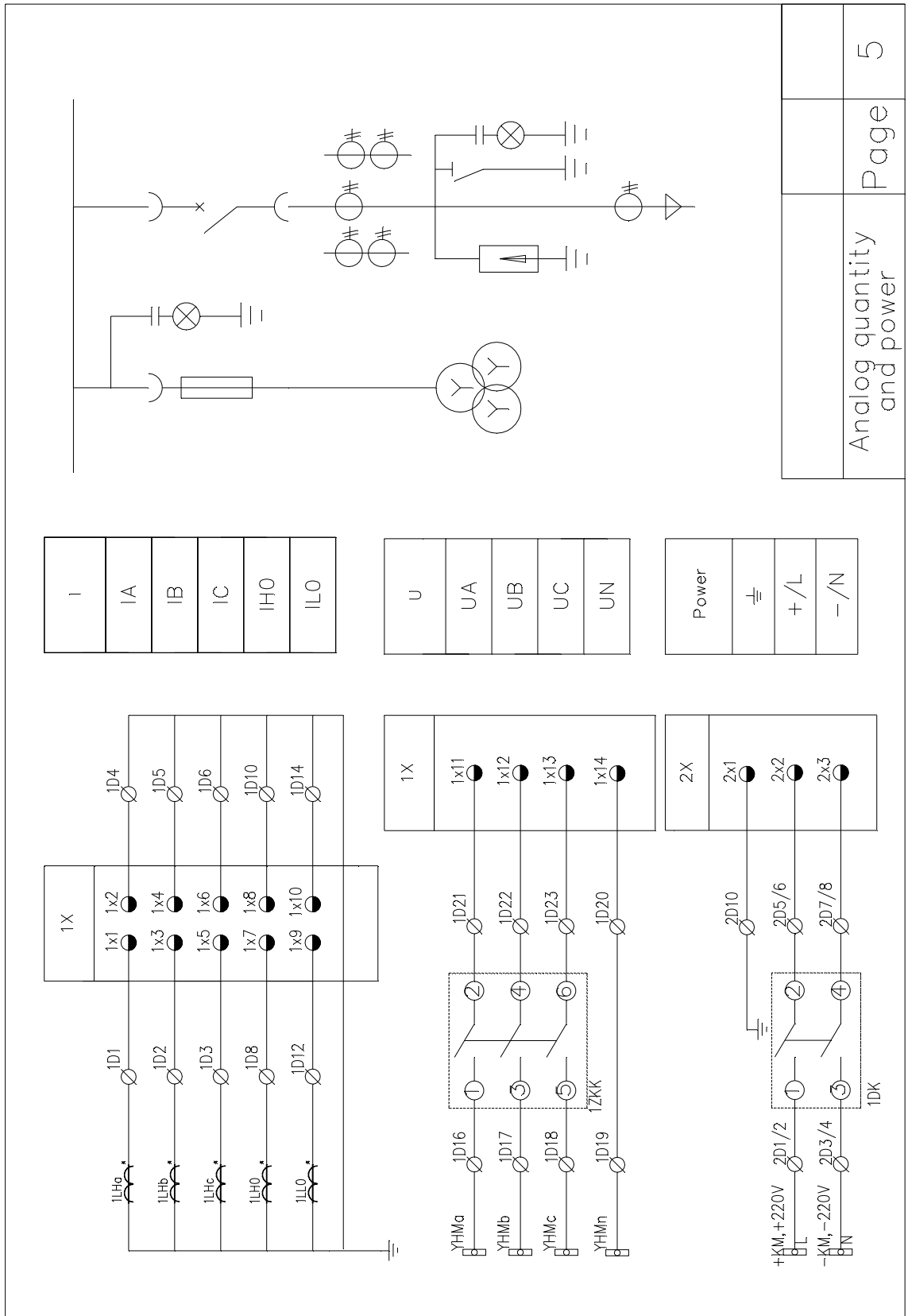


AM2 Multi-functional Protective Relay



Acrel

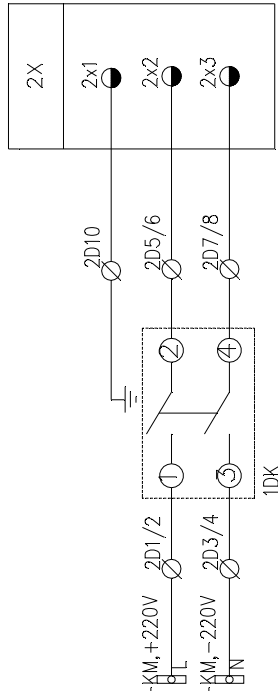
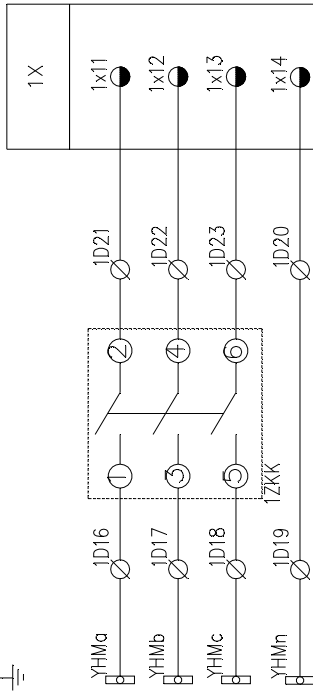
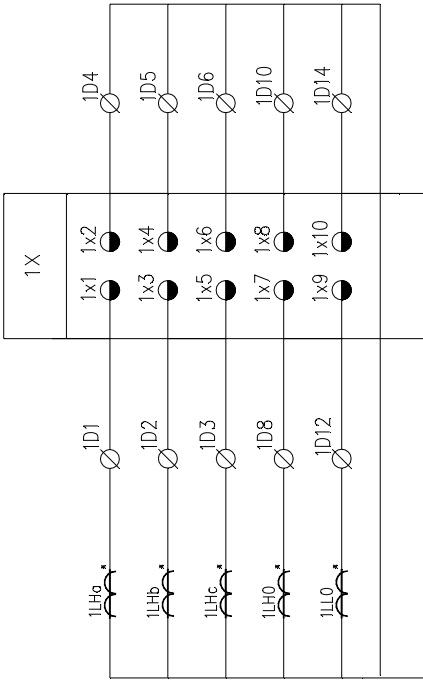




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Analog quantity and power
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