

Energom-PR-80L

Power Line Protection Relay

User Manual



Version: 1.10

Revision: 2024-3

Read me

When you use EnergoM-PR-80L power line protection relay, be sure to read this user manual carefully, and be able to fully understand the implications, the correct guidance of operations in accordance with user manual, which will help you make better use of EnergoM-PR-80L power line protection relay, and help to solve the various problems at the scene.

1. This device must be installed and maintained by professionals.
2. Input signals and power must be isolated before any internal or external work is performed on the unit.
3. The signal and auxiliary power provided to device must be within the allowable range.
4. Is the current input phase sequence correct?
5. Are the rated parameter settings correct?
6. Is the transformation ratio setting correct?
7. Is the relay working mode setting correct?
8. Are the protection mode and setting time reasonable?



- **Please read this user manual carefully**
- **Please save this document**

Directory

1. - SUMMARIZE.....	- 4 -
2. - SPECIFICATIONS	- 6 -
3. - PRODUCT SELECTION GUIDE	- 8 -
3.1 - SELECTION INSTRUCTIONS	- 8 -
3.2 - EXTERNAL PROTECTION CT SELECTION GUIDE, TYPICAL IN 380V MOTOR SYSTEM	- 9 -
3.3 - DESCRIPTION OF CONTROLLER RELATED ACCESSORIES.....	- 11 -
4. - INSTALLATION AND START-UP.....	- 13 -
4.1 - INSTALLATION DIMENSION	- 13 -
4.2 - WIRING METHOD	- 14 -
4.3 - TERMINAL DEFINITION.....	- 16 -
5. - OPERATION MODE	- 15 -
5.1 - LCD DISPLAY SCREEN	- 15 -
5.2 - PANEL LED INDICATOR.....	- 16 -
5.3 - KEYS INTRODUCTION.....	- 17 -
6. - SCREEN INTRODUCTION.....	- 18 -
6.1. - DISPLAY SCREEN.....	- 18 -
6.2. - CONFIGURATION SCREEN	- 21 -
6.3. - PROTECTION MODE SUB-MENU SETTING	- 23 -
6.4. - SYSTEM SUB-MENU SETTING	- 26 -
7. - PORTECTION FUNCTION INTRODUCTION	- 31 -
7.1. - OVER CURRENT PROTECTION	- 31 -
7.2. - OVER LOAD PROTECTION.....	- 32 -
7.3. - GROUND FAULT PROTECTION	- 35 -
7.4. - OVER VOLTAGE PROTECTION	- 36 -
7.5. - UNDER VOLTAGE PROTECTION	- 36 -
7.6 - CUSTOM TRIP FUNCTION.....	- 36 -
8. - COMMUNICATION INTERFACE.....	- 37 -
8.1. - MODBUS © PROTOCOL.....	- 37 -
8.2. - REGISTER MAP.....	- 39 -
9. - SAFETY CONSIDERATIONS.....	- 47 -
10. - MAINTENANCE.....	- 47 -

1. - SUMMARIZE

Energom-PR-80L power line protection relay is suitable for protection and monitoring of low-voltage lines with rated voltage below 690V and rated current up to 820A.

Energom-PR-80L can monitor on-site signals in real time and provides system protection against harm to the line caused by faults such as overload, overcurrent, undervoltage, overvoltage, grounding or leakage. It can realize a variety of operation control functions and also has measurement functions, self-diagnosis, maintenance management, fieldbus communication and other functions.

Energom-PR-80L power line protection relay realize measurement functions, protection functions, opening and closing control functions and remote communication functions; it has 10 channels relay monitoring, can be configured as needed, and supports MODBUS-RTU communication.

Protection function (Details please refer to chapter 7)	Real-time monitor parameter
Start overtime (Max. start time)	Three-phase current
Over load	Current imbalance
Overcurrent stall	Heat capacity
Phase fault (Phase loss)	Ground residential current*
Jam in starting(Stall)	Thermal resistance*
Current imbalance	Three-phase line voltage*
Ground fault	Frequency*
Short circuit	Power factor*
Under load	Active power*
Current leakage*	Reactive power*
Under power	Apparent power*
External fault	Electrical energy*
Over temperature*	
Module fault	
Over voltage	
Under voltage	
Abnormal frequency	
Abnormal power factor	
Restart	
tE protection (Increased safety motor overload)	
Overflow fault (fault current exceeds contactor breaking capacity) trips circuit breaker	

Notes: * marked is optional functions

FEATURES

- Ultra-wide range working power supply AC85-265V.
- Undervoltage, overvoltage and frequency monitoring in AC systems.
- Digital measured value display via multi-functional LCD display.
- Save the latest 100 trip records.
- Internal test/reset button, Integrated energy backup.
- Asymmetry, phase fault and phase sequence monitoring.
- Adjustable start-up delay, response delay and delay on release.
- The protection functions are complete, and each protection function can realize protection shutdown, alarm or trip.
- Built-in 4-way relay, which can set to protection mode and measurement and control mode.
- Programmable analog output function, standard RS-485 communication interface.
- 96*96mm, Modular design, small size and flexible structure.
- Measurement voltage, current, temperature and frequency signals.

2. - SPECIFICATIONS

Electrical parameters

Power supply:	85-265V AC/DC
Power consumption:	<10 VA
Insulation resistance:	> 100MΩ
Alarm relay:	5A @ 250VAC, or 5A @ 30VDC (NO contact)

Measuring accuracy

Current:	± 0.5% @ 10%~200% of I _e
Voltage:	± 0.5% @ 10%~150%U _e
Frequency:	± 0.1% @ 45~65Hz
Power factor:	± 1.0% @ 0~1.000
Power:	± 1.0% @ 0~500kW
Leakage current:	± 1% @ 10%~100% of I _r
Analog output:	± 1% @ 4~20mA
Thermal resistance:	± 1% @ 0.1K~30K

Working environment

Motor rated voltage:	AC380V / AC660V
Motor rated current:	0.5-820A
Working temperature:	-10C ~ +55°C
Storage temperature:	-25C ~ +70°C
Relative humidity:	< 93% RH
Altitude:	No more than 3000 m
Atmospheric conditions:	Operating place must not have the explosive medium and contain Gases that corrode metals and damage insulating and conductive medium.

Electrical test

Electrostatic discharge:	IEC 61000-4-2, Level III
Electrical fast transient burst:	IEC 61000-4-4, Level III
Surge shock:	IEC 61000-4-5 , Level III
Withstanding voltage:	IEC 61010-1, AC2kV/1min Between power / input / output

Product standards

GB / T 14048.1 (IEC 60947-1)	Low-voltage switchgear and control equipment General Provisions
GB / T 14048.4 (IEC 60947-4)	Low voltage electromechanical contactors and motor starters requirements
JB / T 10613-2006	General specification for digital motor combined protection equipment
JB / T 10736-2007	Low voltage motor protection

3. - PRODUCT SELECTION GUIDE

3.1 - Selection instructions

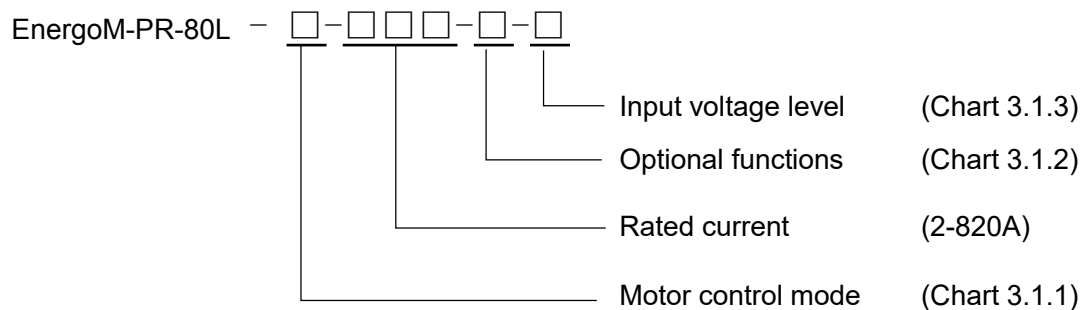


Chart 3.1.1

SN	Preset Motor Start method	Code
1	Line protection mode	H
2	Line measurement and control mode	K

Chart 3.1.2

SN	Optional function	Code
/	Standard type without additional functions	/
1	With zero-sequence CT	L
2	4~20mA analog port	M
3	Temperature probe	T
4	Profibus-DP communication port	P
5	Dual RS-485 communication ports	C2
Note:		
Standard type without additional function, If need multiple additional functions the coded arranged in sequence after main code.		

Chart 3.1.3

SN	Input voltage level	Code
1	380V direct input	V38
2	380/100V input via PT	V31
3	660/100V input via PT	V61
4	Non-standard voltage level input	Vf

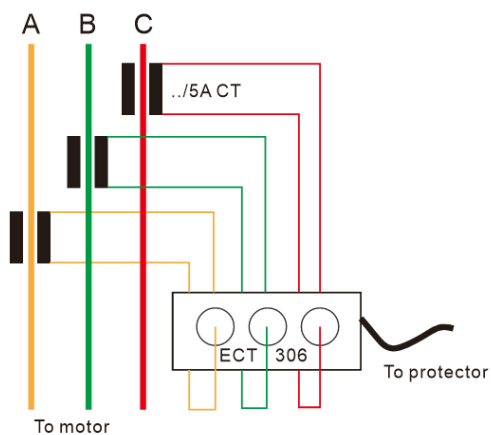
3.2 - External protection CT selection guide, typical in 380V motor system

Energom-PR-80L use outside external protect CT for current signal reference, on body have 4pin terminal block (see [chapter 4.3](#)), following is typical selection guide for motor rated current less than 200A:

Motor rated power (Kw)	Rated current (A)	Default CT range
0.06	0.22	10A (CT306)
0.12	0.42	
0.37	1	
0.55	1.5	
0.75	2	
1.1	2.5	
2.2	5	
3	6.5	
5.5	11	100A (CT305)
7.5	14.8	
11	21	
15	28.5	
18.5	35	
22	42	
30	57	
37	69	
45	81	200A (CT304)
55	100	
75	135	
90	165	
110	200	

Notes:

1. The external CT rating already set in Config. menu |> System| > Ext.CT.
2. If motor rated current more than 200A, need use ..1/5A external CT to expand measurement range. Typical wiring as following.



External 500/5 CT as an example:

external CT should be 5P10, the measurement accuracy should be 0.5 class, and three transformers are a set.

Rated power (Kw)	Rated current (A)	Connected ECT	Expand CT
132	240	CT306 Set Ext. CT 5A	500/5
160	285		
200	352		
220	420		
250	480		

3.3 - Description of controller related accessories

3.3.1 - External current transformer (ECT)

External CT specifications and dimensions:

CT304	CT305	CT306
Measurement 100A-200A	10-100A	0-10A
Secondary to protector 100mA	100A/50mA	10A/5mA
Maximum cable size 30mm	20mm	9mm

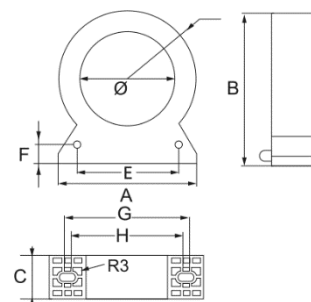
3.3.2 - Residual current sensor (ZCT)

Protector can connect separate residual current sensor to provide accuracy to measurement, need to do configuration in Menu |> System |> Addition |> GF. = External.

There are 2 types of residual current transformers: cable type and cooper bar type.

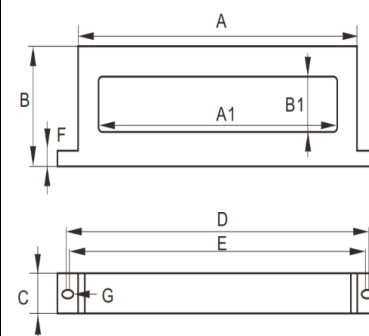
Wiring core for cable type:

Current range	Dimension (mm)								
	φ	A	B	C	D	E	F	G	H
16-100A	45	77	85	24	38	54	9	64	54
100-250A	80	112	122	28	56	80	14	89	80
250-400A	100	131	136	24	66	96	14	108	107
400-800A	150	200	209	28	100	145	16.5	184	177



Wiring core for cooper bar type:

Current range	Dimension (mm)								
	A1	B1	A	B	C	D	E	F	G
0-63A	100	20	133	50	16	144	140	3	2.0
0-100A	100	25	133	60	24	154	143	9	2.5
0-225A	140	32	172	72	24	189	184	9	2.5
0-250A	180	32	212	72	24	229	224	9	2.5
0-400A	220	45	254	86	24	269	264	11	2.5
0-630A	260	45	294	86	24	309	304	11	2.5
0-1600A	300	45	334	86	24	349	344	11	2.5
0-4000A	420	45	454	86	24	469	464	11	2.5



Note:

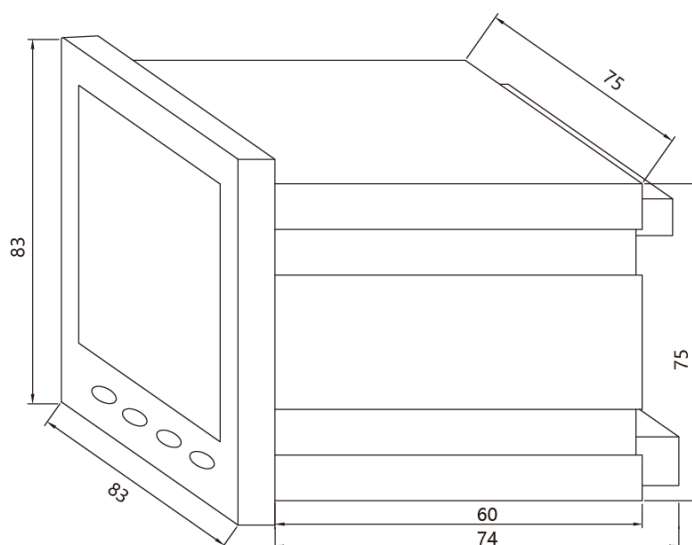
Protection function details, please refer to [chapter 7](#).

4. - INSTALLATION AND START-UP

4.1 - Installation dimension

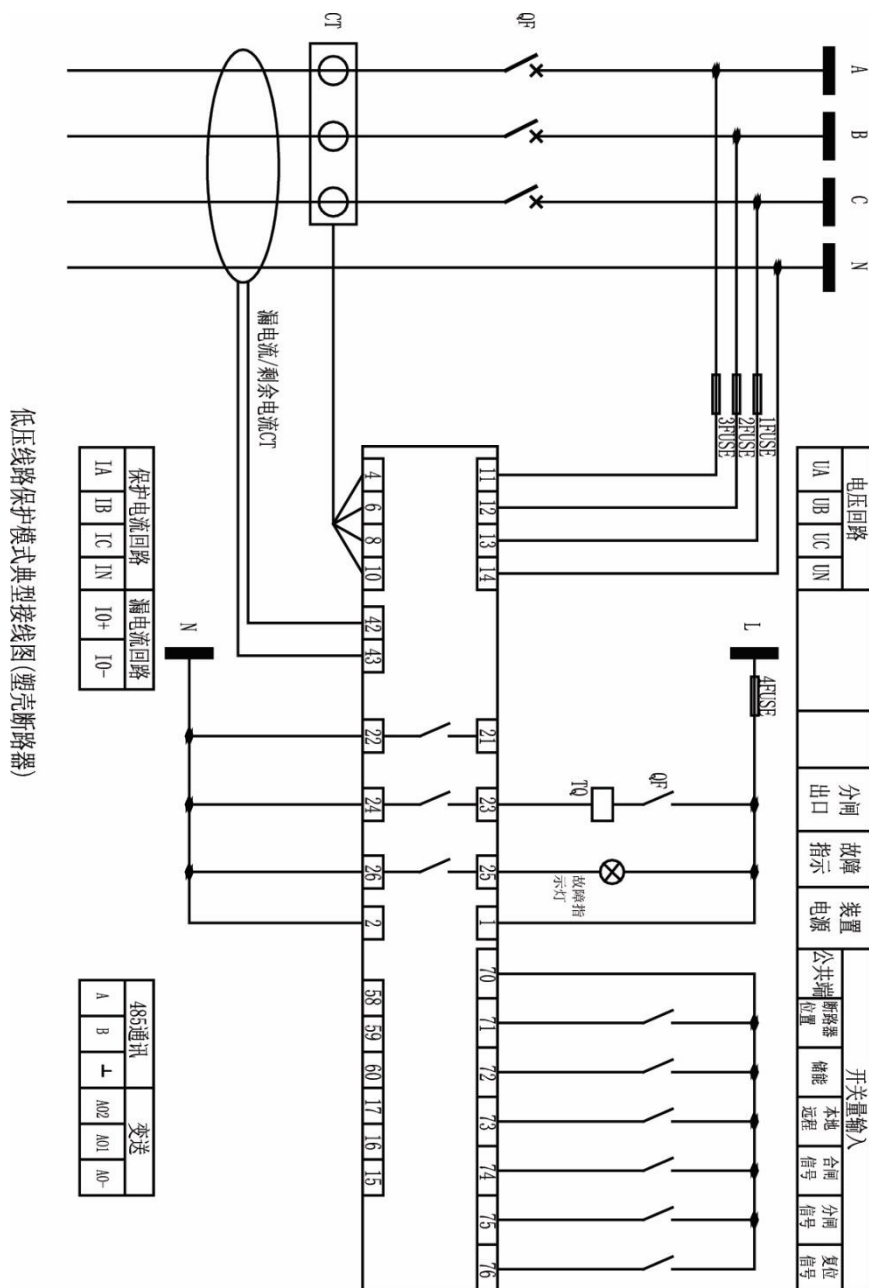
Note that with the instrument powered on, the terminals could be dangerous to touch and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be used until this is completely installed.

Dimension:



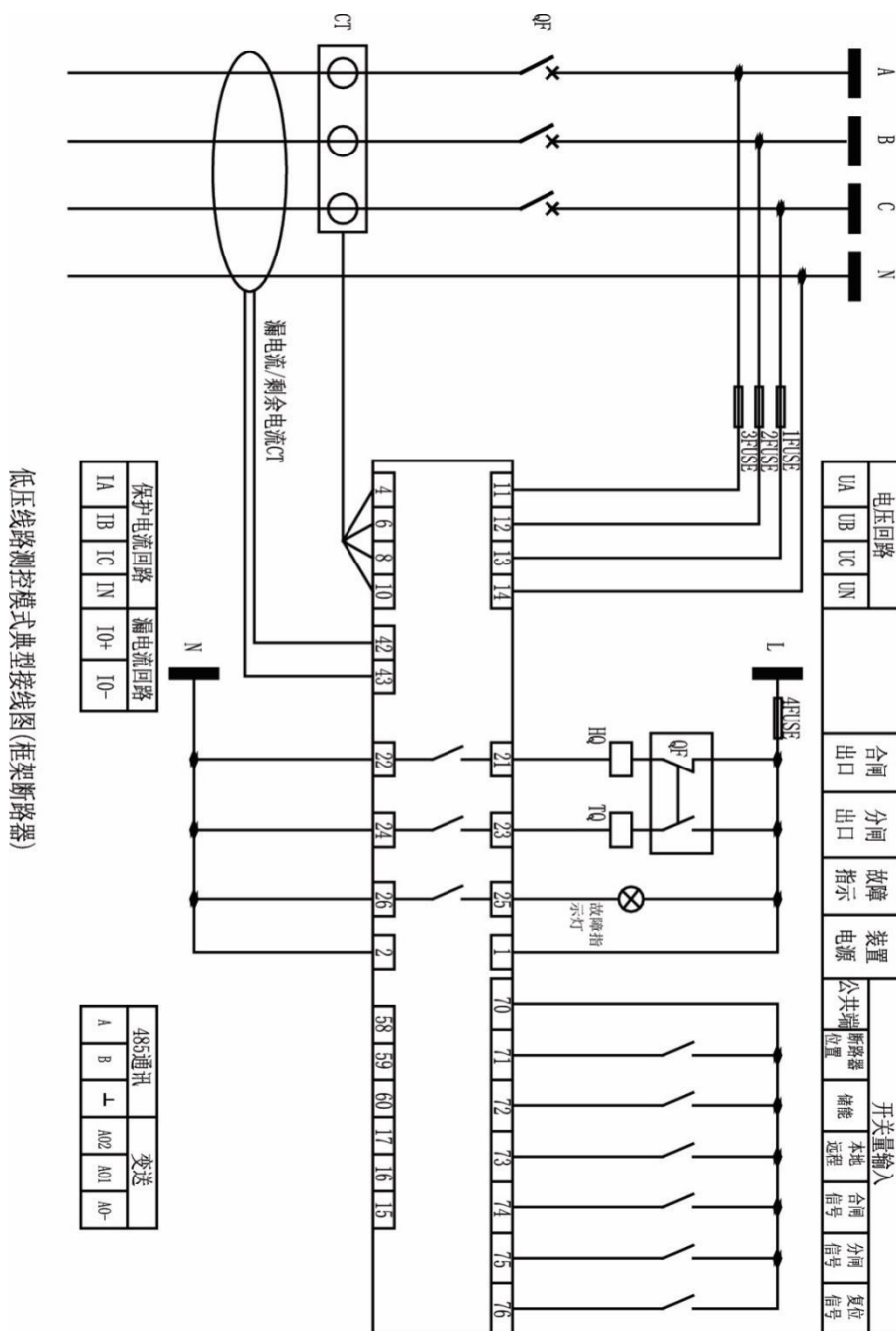
4.2 - Wiring method

4.2.1. Protection mode wiring (MCCB)



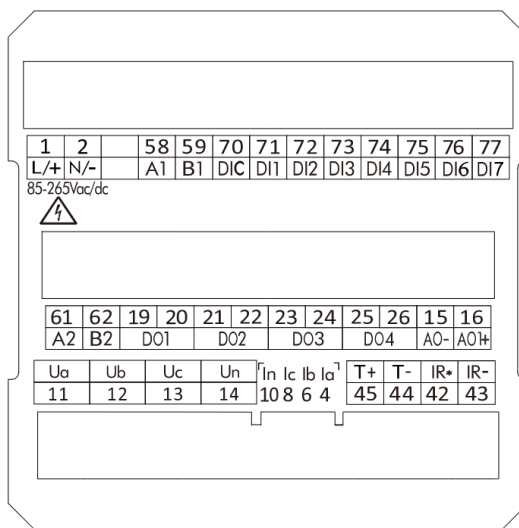
低压线路保护模式典型接线图(塑壳断路器)

4.2.2.- Measurement and control mode (frame circuit breaker)



低压线路测控模式典型接线图(框架断路器)

4.3 - Terminal definition

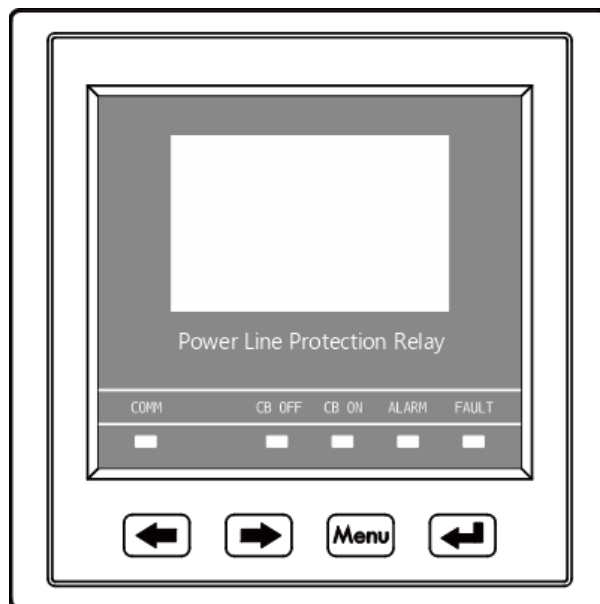


Terminal No.	Description	
L	AUX 85-265V	
N		
58	RS485-A1	
59	RS485-B1	
70	Common terminal of DI	
71	DI 1	
72	DI 2	
73	DI 3	
74	DI 4	
75	DI 5	
76	DI 6	
77	DI 7	
61	RS485-A2	
62	RS485-B2	
19	DO 1	NC
20	DO 1	NO
21	DO 1 ,DO 2 common terminal	
23-24	DO 3	
25-56	DO 4	
15	AO 4~20mA -	
16	AO1 - 4~20mA +	

Terminal No.	Description
11	A-phase voltage
12	B-phase voltage
13	C-phase voltage
14	N-phase voltage
4	A-phase current
6	B-phase current
8	C-phase current
10	N-phase current
42	Leakage current lo+
43	Leakage current lo-
44	R - for NTC
45	R + for NTC

5. - OPERATION MODE











5.1 - LCD display screen







After device be powered on, the default display interface is the measurement parameter. In this interface, short press the "Menu" button to return to the main menu. User can operate the buttons to select measurement parameters, graphic vectors, fault information, operating information, system settings, user help and other functions.

Press the "←" or "→" key on the main interface to select the menu interface you want to enter, and press "↵" to enter.

5.2 - Panel LED indicator

Indicator	Description	
"CB ON"		Line in "Non-CB ON" status
		Line in "CB ON" status
"CB OFF"		Line in "Non-CB OFF" status
		Line in "CB OFF" status
"ALM."		Line in "Non-alarm" status
		Line in "Alarm" status
"FAULT."		Line in "Non-trip" status
		Trip event occurs
"COMM."		No communication
		Communication normal

5.3 - Keys introduction

	<p>Short press: "Previous page": display measurement parameters, functions switch.</p> <p>Long press: "CB ON" function.</p>
	<p>Short press: "Next page": display measurement parameters, functions switch.</p>
	<p>Short press: "Return" function: to exit the menu step by step.</p> <p>Long press: "CB OFF" function.</p>
	<p>Short press: "Move down and confirm": Move down, confirm, and save the display/input information settings.</p> <p>Long press: "Reset" function.</p>

Note:



During programming operation, if there is no key operation for a period of time, the instrument will automatically exit to the measurement parameter interface.

6. - SCREEN INTRODUCTION

6.1. - Display screen

The default interface after power-on is the measurement interface. Under the measurement interface, the measurement parameters, startup, running status and fault information of the motor can be displayed. Enter the correct password (0001) by pressing the return key to enter the query setting interface.

6.1.1. - Measurement parameters screen

Press the  and  keys to switch to view the three-phase current and protection current percentage, three-phase current, three-phase current imbalance, line heat capacity, thermal resistance and leakage, three-phase line voltage, frequency, measurement values of voltage and current, active power, and reactive power, apparent power, power factor, active energy, reactive energy, signal input and other data.

```
Ia 000.0 %Ie
Ib 000.0 %Ie
Ic 000.0 %Ie
Iavg 000.0 %Ie
```

Value = I_x/I_e

I_x = measurement three phase current
 I_e =Rated current

```
Ia 0.000 A
Ib 0.000 A
Ic 0.000 A
Iavg 0.000 A
```

Three-phase current

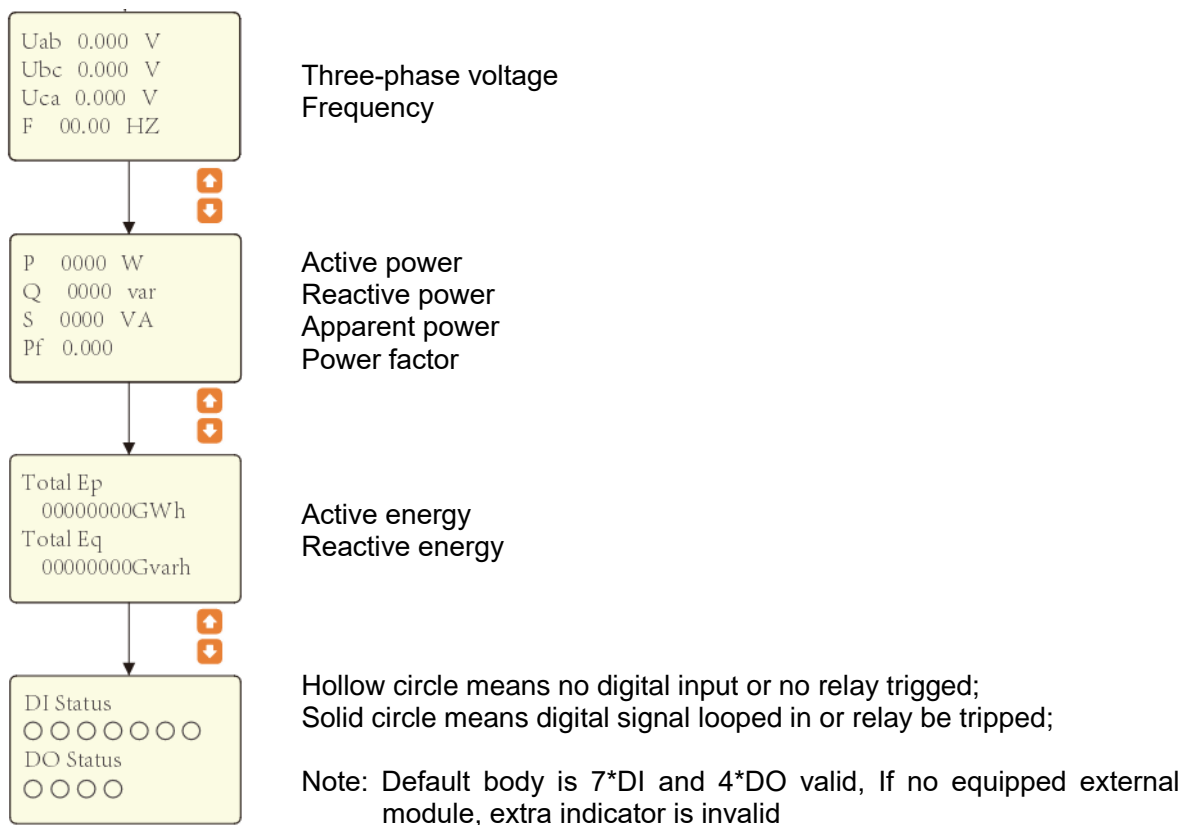
Note: When the measured current > 1.3 * Protect CT, display value of measurement error increasing.

```
Imbalance
Ia 000.0 %
Ib 000.0 %
Ic 000.0 %
```

Current imbalance

```
U.T.C. 000 %
THMS 00.4 K
Io(C) 005.0 A
Ir (%) 000.0 %
```

U.T.C. Used thermal capacity
 THMS* Temperature resistor (see chapter 7.9)
 Io(C) Calculated zero sequence current
 Ir(%) Value = ZTC measure / Ir Deno. (1A @ GF set External)
 or = ZTC measure / Io(C) if GF set Internal



Press Enter button can switch to Line status screen:

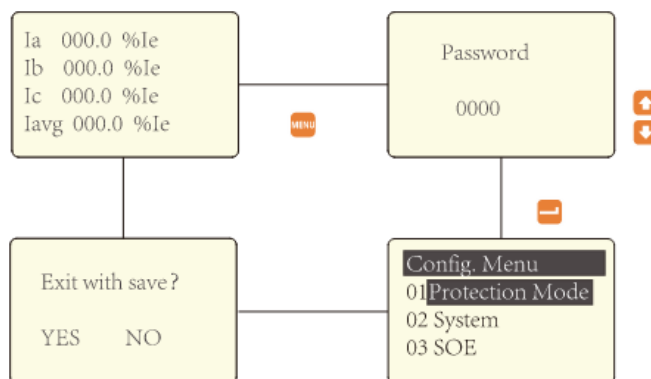


Notes


1. In the measurement interface, the voltage, power, frequency, power factor, and voltage measurement parameters are only valid when the voltage function is optioned; the thermal resistance parameters are only valid when the temperature function is optioned;
2. The leakage current in the figure is calculated by software when built-in is selected in the system parameter settings (the reference value is the rated current of the protection transformer), and measured by the external leakage current transformer when external is selected (the reference value is the leakage value entered in the menu). current rating).
3. About the status of DI/DO, the hollow circle indicates that there is no signal input or no relay output action occurs; if there is signal input or relay output action, the corresponding hollow circle becomes a solid circle.
4. When the real measured current exceeds 1.3 times the rated current of the protection transformer, the electrical parameter errors of the 2nd and 7th screens will gradually increase.

6.2. - Configuration screen


6.2.1. - Enter and exit configuration menu







Enter the configuration menu:

Press "" to enter in main menu to enter default password "0001", and confirm to set some parameters of the instrument. ("Debugging and Calibration" are used by manufacturers and are not open to users).

Exit configuration menu:

After parameter setting, press "" can return to first-level of configuration menu, then call out save selection page, you can choose following:

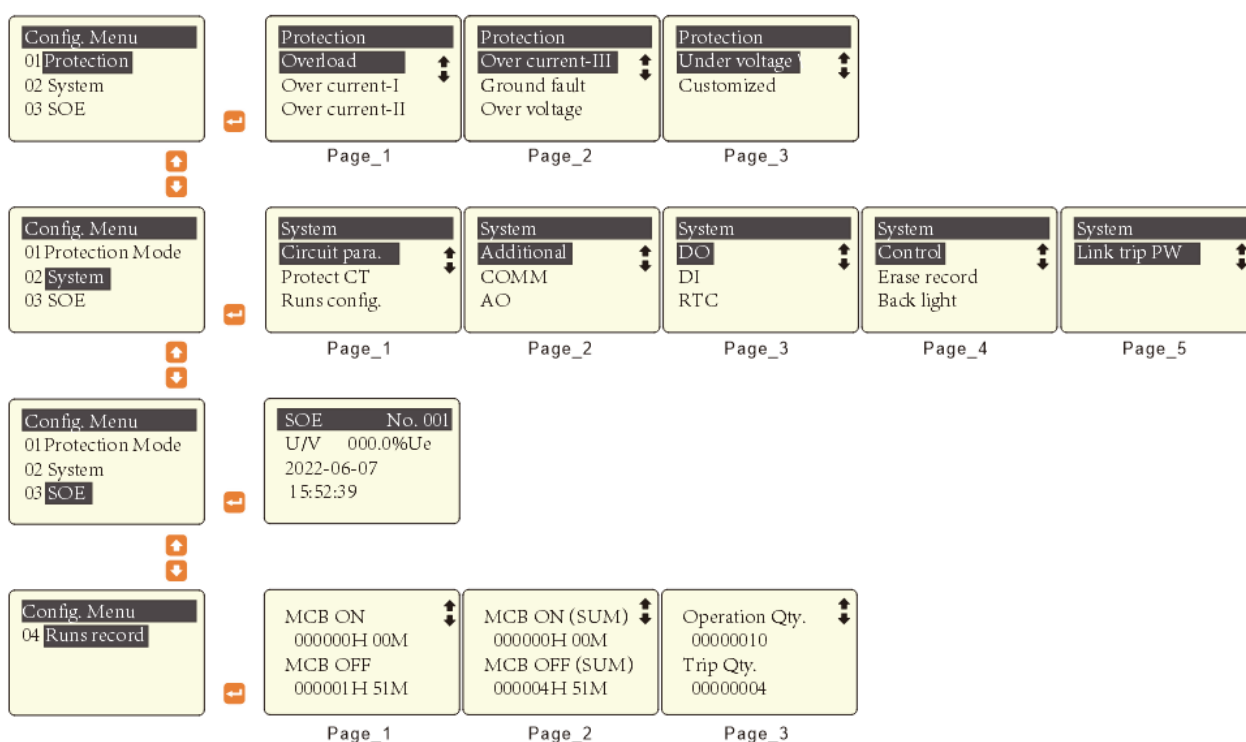
- (1) Press "" directly return to configuration menu without saving.
- (2) Press "" and select "YES", press "" for saving the parameter modify and exit.
- (3) Hold the setting status, press the "" key not to continue instrument setting.

6.2.2. - Configuration menu structure

The menu structure is as shown in the figure below, there have 4 sub parts can configuration or review in Config. Menu:

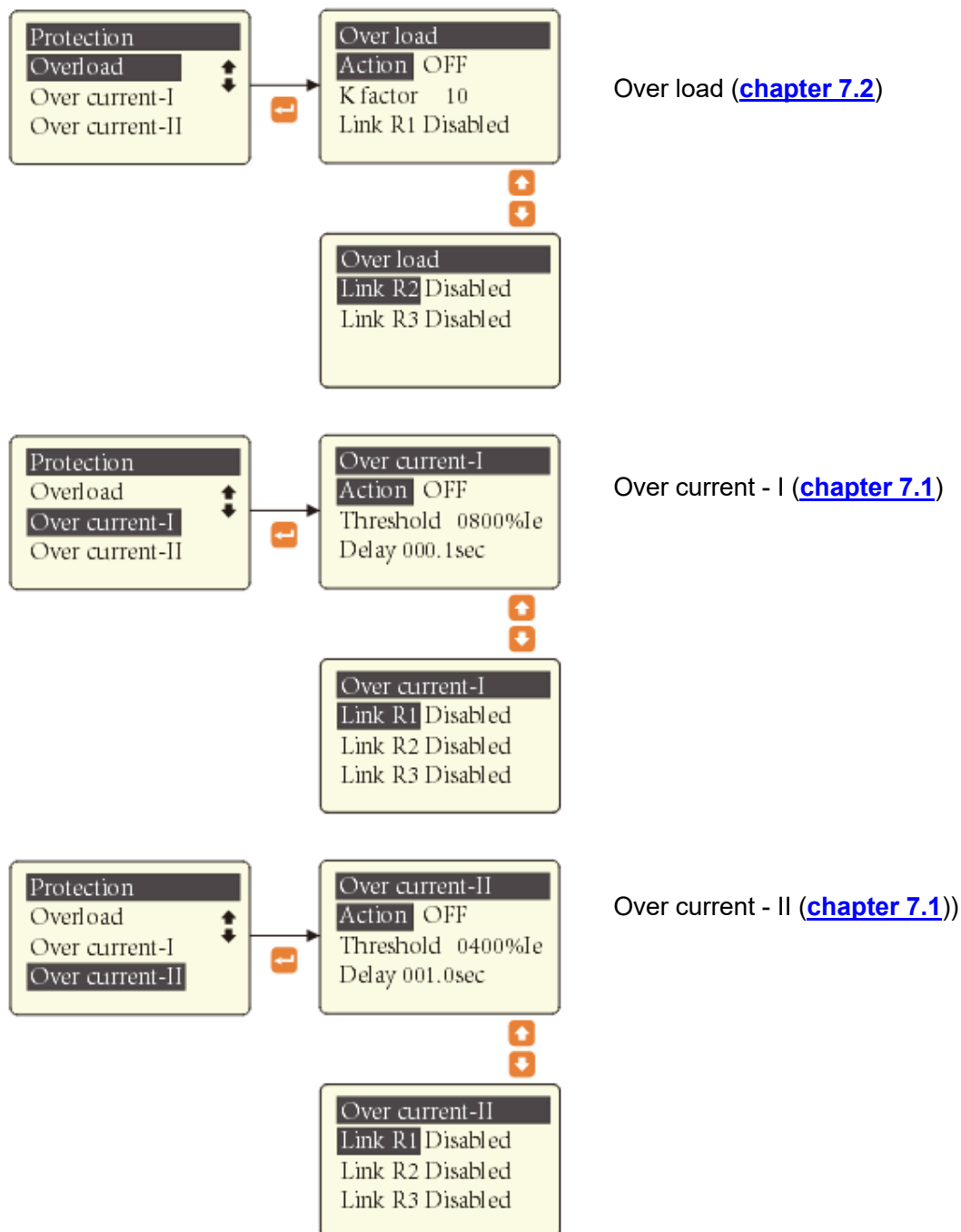
- Protection Mode
- System
- SOE
- Runs record

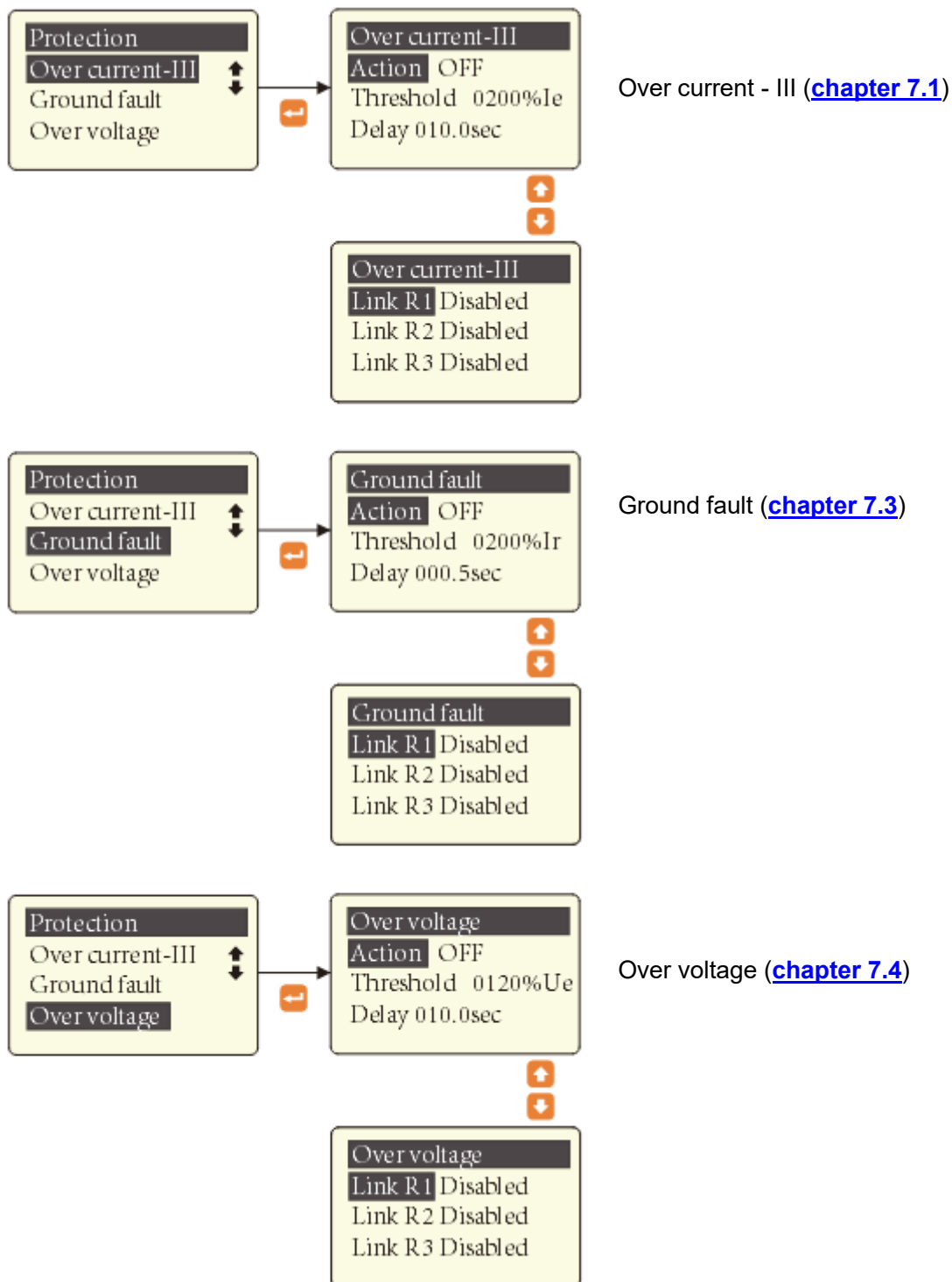
Each parts contains multiple sub-menus.

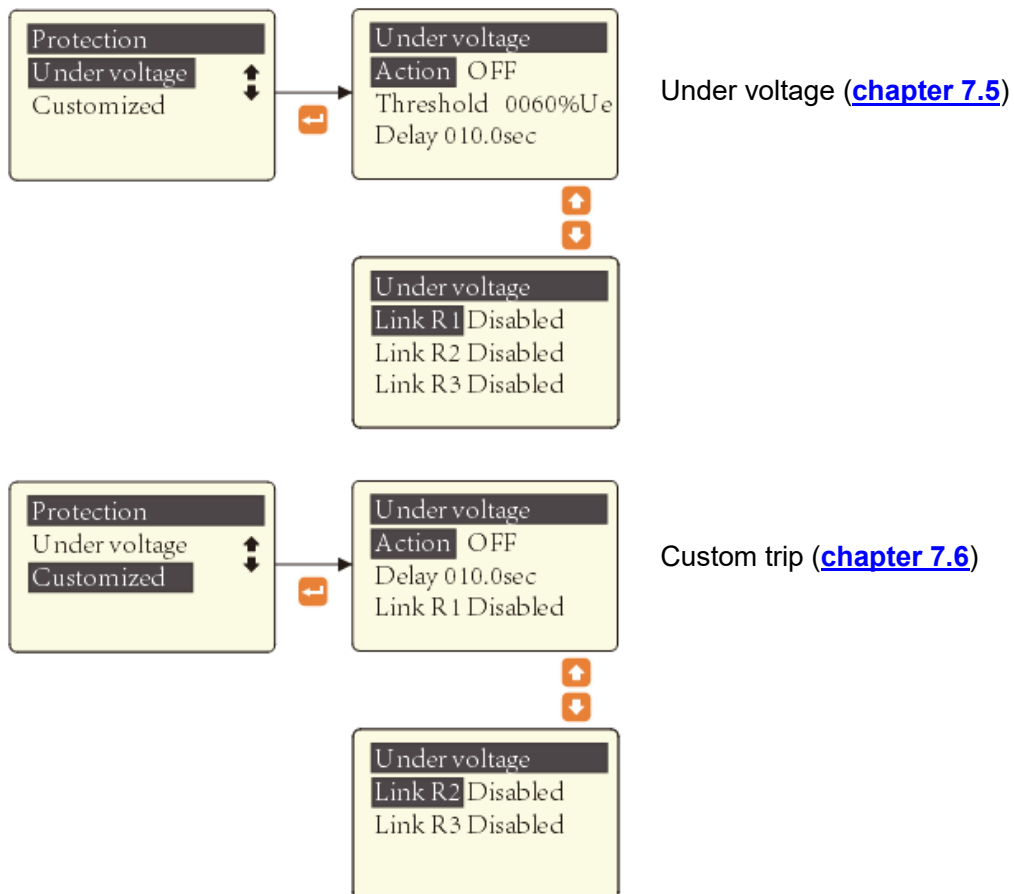


6.3. - Protection mode sub-menu setting

There have 8 different protection mode can configuration, detail function descriptions please refer to [chapter 7](#).

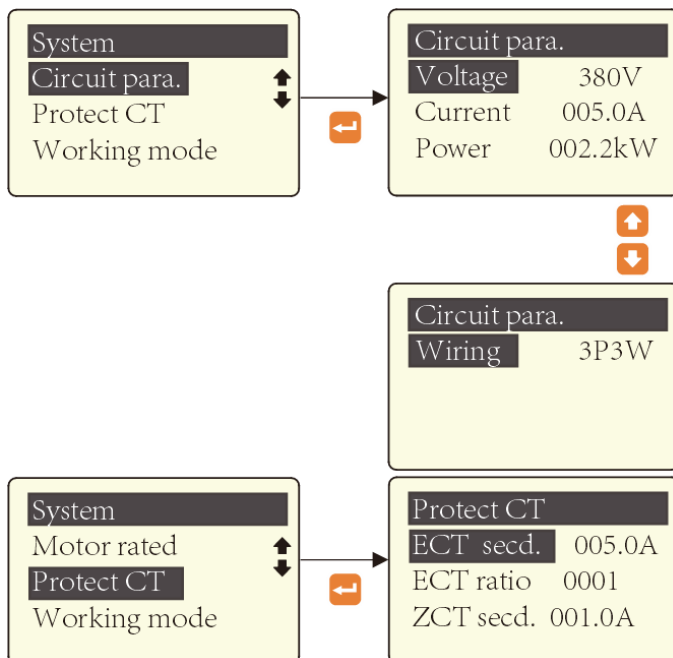






6.4. - System sub-menu setting

6.4.1 - Sub menu-1



This page must set value match protected line

Current = Ie, already set in factory.

Caution:

This screen value only accepts fine-tuning to suit different site.

If wrong setting will make trip time point error and damage to line!

For external protection CT, can choose:

Ext. CT: CT306 for 0-10A motor
 CT305 for 10-100A motor
 CT304 for 100A-200A motor see [chapter 3.2](#).

Protector allowed connect CT to expand Ext.CT over 200A, default use CT306 as current sampling, expand CT use ./.5A, then set the expand CT ratio ;

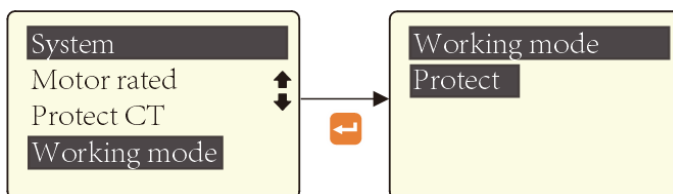
Rated secondary value of zero sequence transformer for Ground fault detect, default 1A. Related Ir(%) calculate, see [chapter 6.1](#).

For example: Protect target is 132kW motor, rated current 240A, need set

Voltage=380V
 Current=240A
 Power=132Kw
 Wiring =3P3W

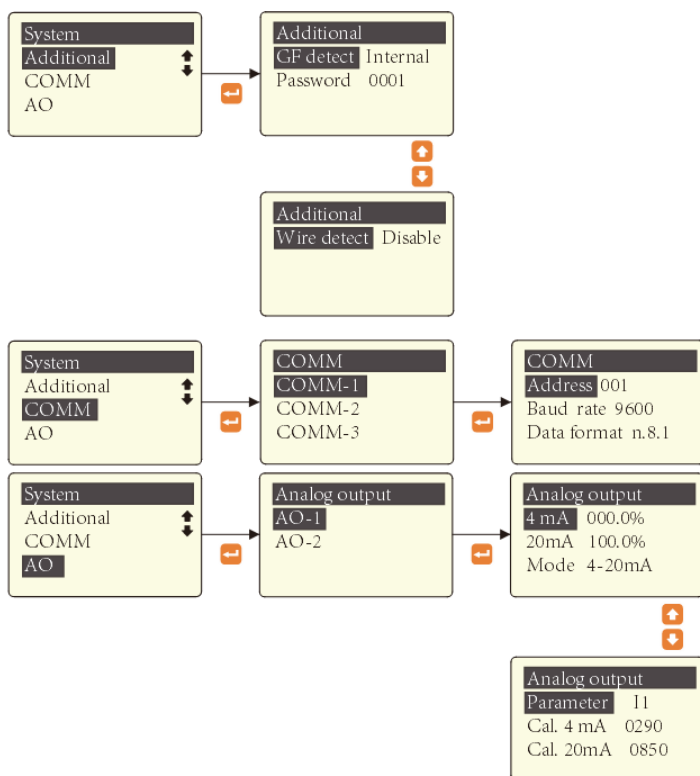
Ext.CT=5A
 CT ratio=50
 Ir Deno.=1A

Outside protect CT connect expand. /5A CT, 3pcs, see typical wiring in [chapter3.2](#).



There have 2 types of Working Mode, Other details see [Chapter 4.2](#).

6.4.2 - Sub menu-2



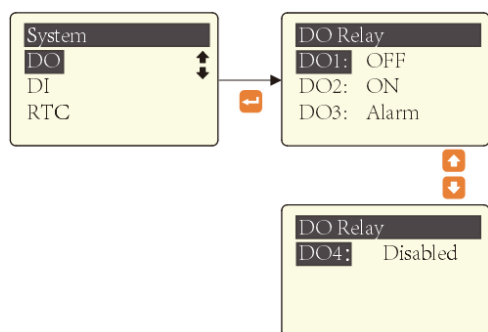
GF.: Internal, protector will calculate zero sequence current (Io(C)) to for Ir(%) display; (see [chapter 6.1](#))

If enable this function, in starting period will check wiring error or not, HMI will show alarm info

Communication setting (see [chapter 8](#)).

Caution: If need to re-calibrate, please contact technical team to get admin password.

6.4.3 - Digital output setting



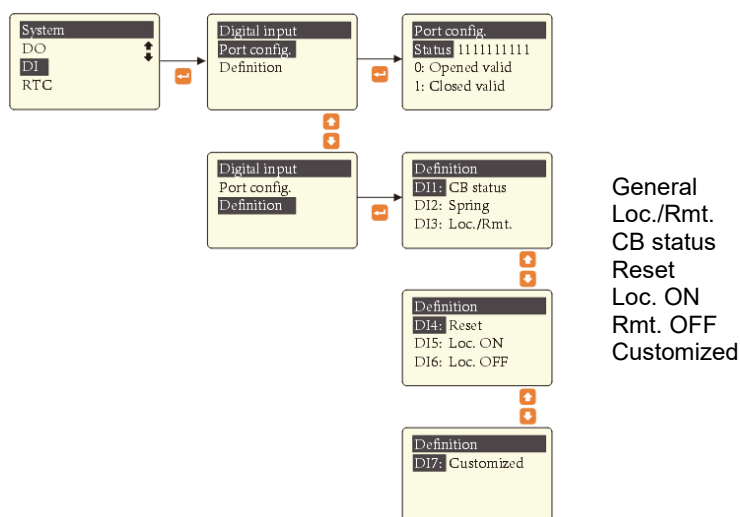
Energom-PR-80L provide flexible external control methods, there main body have 4*DO port.

DO configuration	
ON	CB ON Trip
OFF	CB OFF Trip
Disabled	Disabled
Alarm	Alarm DO
Link R1	When Energom-PR-80L action by protection trip, the configured DO port also synchronous act.
Link R2	
Link R3	

6.4.4 - Digital output setting

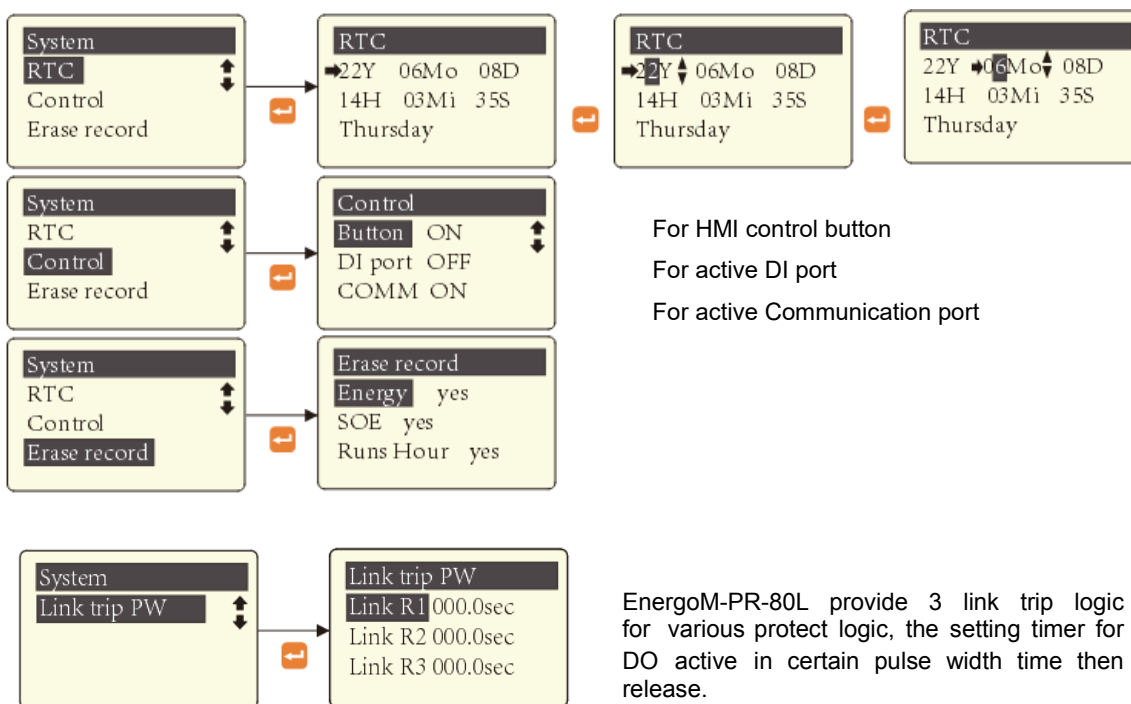
Energom-PR-80L definition 7 items of DI function, with DO setting can build many different motor control wiring and alarm signal.

To active the DI functions, please set DI port “Enable” under Control sub-menu, valid status of the DI port can be set under Port config. Page.



DI configuration	
General	Status signal monitoring, does not participate in protection and control logic
Loc./Rmt.	Selective control of local and remote permissions. Default, when this DI is closed, the control permission is remote; when DI is opened, the control permission is local (when the DI mode is changed to 0, the logic is opposite)
CB status	Circuit breaker status
Reset	Device protection reset signal has the same function as the reset button and is not affected by "local/remote"
Loc. ON	Local CB ON signal, Only valid when "local/remote" is local
Rmt. OFF	Remote CB OFF signal ,
Customized	Active “custom trip” by external signal

6.4.5 - Sub menu-3



7. - PROTECTION FUNCTION INTRODUCTION

7.1. - Over current protection

Used to quickly cut off fault of phase-to-phase short-circuit and ground faults on lines.

Parameters:

Over current protection - I

Protect action	OFF / Alarm / Trip DO
Start timer	100 ~ 1000% I_e
Action delay	0.1 ~ 1.0 s

Over current protection - II

Protect action	OFF / Alarm / Trip DO
Start timer	100 ~ 1000% I_e
Action delay	0.5 ~ 20.0 s

Over current protection - III

Protect action	OFF / Alarm / Trip DO
Start timer	100 ~ 1000% I_e
Action delay	1.0 ~ 100.0 s

7.2. – Over load protection

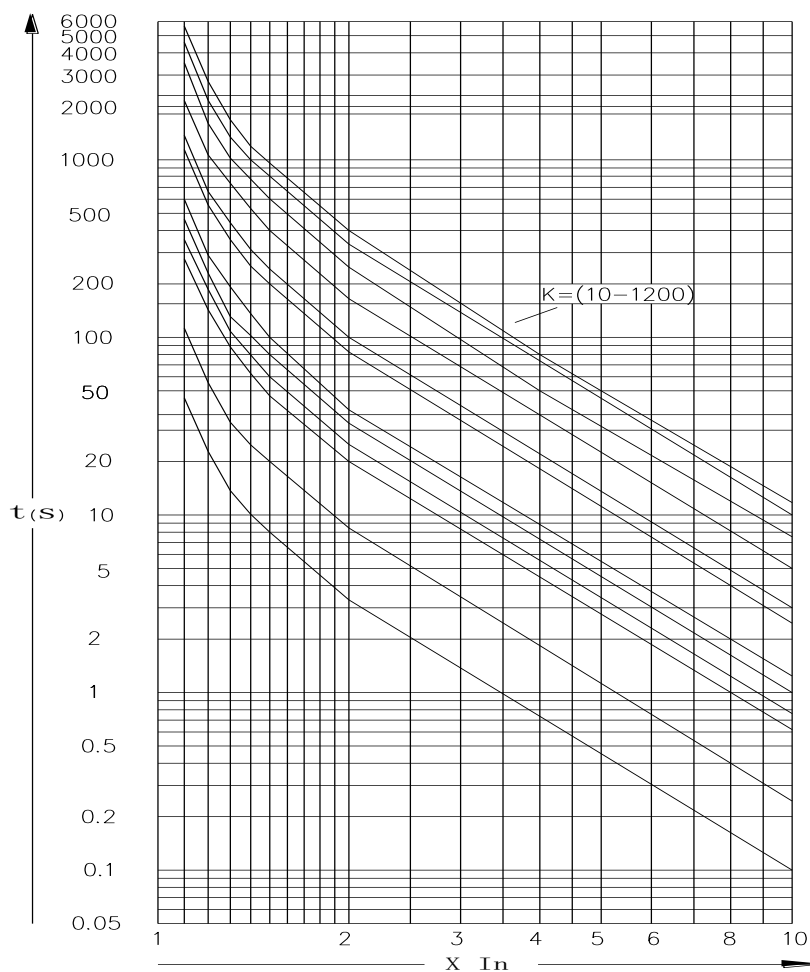
Device can calculate used thermal capacity (UTC) of the motor to avoid motor from overheating damage. Internal program simulates the used thermal capacity of the motor in a variety of operating conditions, can real-time monitoring of motor heating conditions. Ensure effective protection of the repeated starting of the motor overheating condition continuous run.

Device provide 12 inverse time protection curves; user can select suitable curve for different motor working condition.

Inverse-time formula	$t = \frac{K}{\left(\frac{I}{I_e}\right)^2 - 1}$	t Operating inverse time
		I Motor working current value
		I_e Motor rated current
		K K factor curve need set

Parameters:

Protect action	OFF / Alarm / Trip DO
K factor value	10 ~ 1200



Overload inverse time curve

Typical trip time in different K factor and protection class

K factor	Class	I/le = 1.0	I/le 1.2	I/le 1.5	I/le 7.2
125	10S	Without trip in 2h	Trip in 1h	$T_p \leq 2\text{min}$	$2\text{s} < T_p \leq 10\text{s}$
250, 300	10			$T_p \leq 4\text{min}$	$4\text{s} < T_p \leq 10\text{s}$
500	20			$T_p \leq 8\text{min}$	$6\text{s} < T_p \leq 20\text{s}$
750	30			$T_p \leq 12\text{min}$	$9\text{s} < T_p \leq 30\text{s}$

Overload inverse time curve quick select chart (time unit: sec)

$\frac{K}{I/e}$	10	25	60	75	100	125	250	300	500	750	1000	1200
1.1	47.62	119.05	285.71	357.14	476.19	595.24	1190.48	1428.57	2380.95	3571.43	4761.90	5714.28
1.2	22.73	56.82	136.36	170.45	227.27	284.09	568.18	681.82	1136.36	1704.55	2272.73	2727.27
1.3	14.49	36.23	86.96	108.70	144.93	181.16	362.32	434.78	724.64	1086.96	1449.28	1739.13
1.4	10.42	26.04	62.50	78.13	104.17	130.21	260.42	312.50	520.83	781.25	1041.67	1250.00
1.5	8.00	20.00	48.00	60.00	80.00	100.00	200.00	240.00	400.00	600.00	800.00	960.00
2.0	3.33	8.33	20.00	25.00	33.33	41.67	83.33	100.00	166.67	250.00	333.33	400.00
2.5	1.90	4.76	11.43	14.29	19.05	23.81	47.62	57.14	95.24	142.86	190.48	228.57
3.0	1.25	3.13	7.50	9.38	12.50	15.63	31.25	37.50	62.50	93.75	125.00	150.00
3.5	0.89	2.22	5.33	6.67	8.89	11.11	22.22	26.67	44.44	66.67	88.89	106.67
4.0	0.67	1.67	4.00	5.00	6.67	8.33	16.67	20.00	33.33	50.00	66.67	80.00
4.5	0.52	1.30	3.12	3.90	5.19	6.49	12.99	15.58	25.97	38.96	51.95	62.34
5.0	0.42	1.04	2.50	3.13	4.17	5.21	10.42	12.50	20.83	31.25	41.67	50.00
5.5	0.34	0.85	2.05	2.56	3.42	4.27	8.55	10.26	17.09	25.64	34.19	41.03
6.0	0.29	0.71	1.71	2.14	2.86	3.57	7.14	8.57	14.29	21.43	28.57	34.29
6.5	0.24	0.61	1.45	1.82	2.42	3.03	6.06	7.27	12.12	18.18	24.24	29.09
7.0	0.21	0.52	1.25	1.56	2.08	2.60	5.21	6.25	10.42	15.63	20.83	25.00
7.2	0.20	0.49	1.18	1.48	1.97	2.46	4.92	5.90	9.83	14.75	19.67	23.60
7.5	0.18	0.45	1.09	1.36	1.81	2.26	4.52	5.43	9.05	13.57	18.10	21.72
8.0	0.16	0.40	0.95	1.19	1.59	1.98	3.97	4.76	7.94	11.90	15.87	19.05

7.3. - Ground fault protection

The magnitude of the leakage current depends on the position of the fault point on the coil of the motor. It is desirable to set a low leakage current fault action value to protect as many stator coils as possible and prevent the motor casing from becoming dangerous due to electrification.

In the direct grounding system, the action time should be set as short as possible to avoid system damage; in the grounding system through resistance, the leakage current value is limited in a safer range, and a longer action time can be selected.

Parameters:

Protect action	OFF / Alarm / Trig DO
Threshold ⁽¹⁾	10 ~ 100%I _r
Action delay ⁽²⁾	0.1 ~ 50.0 s

Notes:

1. When the residual current mode is set to built-in, the controller calculates the residual current according to the three-phase current vector sum.
2. When the residual current mode is external, the controller measures the residual current according to the external residual current transformer.

7.4. - Over voltage protection

Any of the three phase voltage > Threshold set value

Parameters:

Protect action	OFF / Alarm / Trip DO
Threshold	105 ~ 150% Ue
Trip delay	0.1 ~ 50.0s

Notes: This protection will valid in both starting and running period.

7.5. - Under voltage protection

Any of the three phase voltage < Threshold set value

Parameters:

Protect action	OFF / Alarm / Trip DO
Threshold	50 ~95% Ue
Trip delay	0.1 ~ 50.0s

7.6 - Custom trip function

The user provides a pair of passive contacts to the device, which are connected to the "custom trip" DI (it needs to be configured), and will act after a set delay. Protection can choose to trip or alarm.

8. - COMMUNICATION INTERFACE

8.1. - MODBUS © protocol

8.1.1. - Modbus RTU frame format:

Address code	1 BYTE	<i>Slave device address 1-247</i>
Function code	1 BYTE	<i>Indicates the function codes like read coils / inputs</i>
Data code	4 BYTE	<i>Starting address, high byte Starting address, low byte Number of registers, high byte Number of registers, low byte</i>
Error check code	2 BYTE	<i>Cyclical redundancy check (CRC)</i>

8.1.2. - Modbus function code

Code	Meaning	Description
FUNCTION 01	Read multiple coils	<i>This function permits to read internal bits or physical coils</i>
FUNCTION 02	Read signal coils	<i>This function permits to read physical discrete inputs</i>
FUNCTION 03	Reading of n words of holding register	<i>Read protection setting, system parameters, starting parameters, etc.</i>
FUNCTION 04	Reading of n words of input register	<i>Read measurement values (voltage, current, power, etc.)</i>
FUNCTION 05	Force single coil	<i>This function permits to write internal bits or physical coils</i>
FUNCTION 06	Write single register	<i>This function permits to write</i>

8.1.3. - Command example

Example_1: Read A, B, C phase current value

Host inquiry:

Addr.	Func.	Data Address (high)	Data Address (low)	Data Number (high)	Data number (low)	CRC	
01	04	00	00	00	03	BE	F7

Slave response:

Addr.	Func.	Data length	A-phase current		B-phase current		C-phase current		CRC	
01	04	06	03	E8	03	E8	03	E7	C0	7D

Example_2: Write motor rated current from 1A to 1.5A

Host inquiry:

Addr.	Func.	Data Address (high)	Data Address (low)	Data Value (high)	Data Value (low)	CRC	
01	06	02	05	00	0F	80	7E

Slave response:

Addr.	Func.	Data Address (high)	Data Address (low)	Data Value (high)	Data Value (low)	CRC	
01	06	02	05	00	0F	80	7E

Example_3: MODBUS command control relay to tripped

Host inquiry:

Addr.	Func.	Data Address (high)	Data Address (low)	Data Value (high)	Data Value (low)	CRC	
01	05	00	01	FF	00	DD	DA

Slave response:

Addr.	Func.	Data Address (high)	Data Address (low)	Data Value (high)	Data Value (low)	CRC	
01	05	00	01	FF	00	DD	DA

8.2. - Register map

Cautions!

1. This chapter register map in default products the write function is disable in standard EnergoM-PR-80L,
that to avoid unexpected damage due to frequent write operations, only opened for customer requirement!!
2. Registers support maximum 100,000 times writes, wrong write registers may cause device irreparable damage! Please ensure that host software engineer proficient in RS485 MODBUS protocol.

8.2.1 - Motor status parameter (Read only, Funx04)

Address	Item	Description
0x00	A-phase current	Unit: 0.01A
0x01	B-phase current	
0x02	C-phase current	
0x03	AB line voltage	Unit: 0.01V
0x04	BC line voltage	
0x05	CA line voltage	
0x06	Active power (Ps_avg)	Unit: 0.01KW
0x07	Reactive power (Qs_avg)	Unit: 0.01KVar
0x08	Apparent power (Ss_avg)	Unit: 0.01KVA
0x09	Power factor	Unit: 0.001
0x0A	Frequency	Unit: 0.01Hz
0x0B	Residual current	Unit: 0.1mA
0x0C	Reserve	
0x0D	I_poit	
0x0E	U_poit	
0x0F	PQS_poit	
0x12	Digital input status	0: without signal 1: with signal in BIT0:DI1 BIT1:DI2 BIT2:DI3 BIT3:DI4 BIT4:DI5 BIT5:DI6 BIT6:DI7

0x13	Digital output status	0: Opened 1: Closed BIT0:DO1 BIT1:DO2 BIT2:DO3 BIT3:DO4
0x14	A-phase current percentage	Unit: 0.1%
0x15	B-phase current percentage	Unit: 0.1%
0x16	C-phase current percentage	Unit: 0.1%
0x17	AB line voltage percentage	Unit: 0.1%
0x18	BC line voltage percentage	Unit: 0.1%
0x19	CA line voltage percentage	Unit: 0.1%
0x1A	Active power percentage	Unit: 0.1%
0x1B	Reactive power percentage	Unit: 0.1%
0x1C	Apparent power percentage	Unit: 0.1%
0x1D	Power factor percentage	Unit: 0.1%
0x1E	Frequency percentage	Unit: 0.1%
0x1F	Residual current percentage (External)	Unit: 0.1% Sampling from external zero-sequence sensor
0x20	Residual current percentage (Internal)	Unit: 0.1% Calculated from fundamental frequency
0x23	Average voltage percentage	Unit: 0.1%
0x24	Average current percentage	Unit: 0.1%
0x25	Peak voltage percentage	Unit: 0.1%
0x26	Peak current percentage	Unit: 0.1%
0x28	A-phase current imbalance	Unit: 0.1%
0x29	B-phase current imbalance	Unit: 0.1%
0x2A	C-phase current imbalance	Unit: 0.1%
0x32-0x35	Active energy (Ep)	Unit: 1WH
0x36-0x39	Reactive energy (Eq)	Unit: 1varH
0x42	A phase voltage angle	0.1°
0x43	B phase voltage angle	0.1°
0x44	C phase voltage angle	0.1°
0x45	A phase current angle	0.1°
0x46	B phase current angle	0.1°
0x47	C phase current angle	0.1°
0x48	Reserve	
0x49	Device present alarm type	0x0000: No alarm 0x0001: Over load 0x0002: Over current I 0x0004: Over current II 0x0008: Over current III 0x0010: Residual current 0x0020: Over voltage 0x0040: Under voltage 0x0080: Customized 0x0100: CB off fault 0x0200: Trip fault

0x4A	Device present fault type	0x0000: No alarm 0x0001: Over load 0x0002: Over current I 0x0004: Over current II 0x0008: Over current III 0x0010: Residual current 0x0020: Over voltage 0x0040: Under voltage 0x0080: Customized 0x0100: CB off fault 0x0200: Trip fault
0x4B	Present CB ON hours (Lower 16 bits)	Unit: Second
0x4C	Present CB ON (High 16 bits)	
0x4D	Present CB OFF hours (Lower 16 bits)	Unit: Second
0x4E	Present CB OFF hours (High 16 bits)	
0x4F	Total CB ON hours (Lower 16 bits)	Unit: Second
0x50	Total CB ON hours (High 16 bits)	
0x51	Total CB OFF hours (Lower 16 bits)	Unit: Second
0x52	Total CB OFF hours (High 16 bits)	
0x53	Total operation times(Lower 16 bits)	Unit: Times
0x54	Total operation times(High 16 bits)	
0x55	Total tipped number(Low 16 bits)	Unit: Times
0x56	Total tipped number(High 16 bits)	
0x57	The number of SOE	Unit: Pieces
0x64	Year	RTC info
0x65	Month	
0x66	Date	
0x67	Hour	
0x68	Minute	
0x69	Second	
0x6A	Week	

8.2.2 - Motor basic configuration (Read and write)

Address	Item	Description
0x200	Password	Range: 1-9999
0x201	External CT rating value	Range: 1-9999 (real value 0.1-999.9 A)
0x202	CT ratio	Range: 1-9999
0x203	Leakage current transformer rating (Ir)	Range: 1-9999 (real value 0.1-999.9 A)
0x204	Motor rated voltage	Range: 0-690
0x205	Motor rated current (Ie)	Range: 1-9999 (real value 0.1-999.9 A)
0x206	MODBUS ID-1	Range: 1~247
0x207	Baud ratio-1	0:2400 1:4800 2:9600 3:19200
0x208	Data format-1	0: n.8.1 1: o.8.1 2: e.8.1 3: n.8.2
0x209	Wiring method	0:3P4W 1:3P3W
0x20A	Leakage current detect mode	0: Internal Calculated from fundamental frequency component 1: External Sampling from external zero- sequence sensor
0x20B-0x20F	Reserve	
0x210	Motor rated power	Unit: KW
0x211	MODBUS ID-2	Range: 1~247
0x212	Baud ratio-2	0:2400 1:4800 2:9600 3:19200
0x213	Data format-2	0: n.8.1 1: o.8.1 2: e.8.1 3: n.8.2

8.2.3. - Motor protection functions configuration (Read and write)

Address	Parameters	Description	
0x300	Reserve		
0x301	Over load protect action	0: Invalid 1: Alarm 2: Trig DO	
0x302	Over load K factor	0: K=10 1: K=25 2: K=60 3: K=75 4: K=100 5: K=125	6: K=250 7: K=300 8: K=500 9: K=750 10: K=1000 11: K=1200
0x303-0x304	Reserve		
0x305	Over current I protect action	0: Invalid 1: Alarm 2: Trig DO	
0x306	Over current I protect threshold	Range: 100-1000% I _e	
0x307	Over current I protect timer	Range: 0.5-50.0sec	
0x308	Reserve		
0x309	Over current II protect action	0: Invalid 1: Alarm 2: Trig DO	
0x30A	Over current II protect threshold	Range: 100-1000% I _e	
0x30B	Over current II protect timer	Range: 0.5-50.0sec	
0x30C-0x311	Reserved		
0x312	Leakage current protect action	0: Invalid 1: Alarm 2: Trig DO	
0x313	Leakage current protect threshold	Range: 10-100% I _r	
0x314	Leakage current protect timer	Range: 0.1-50.0sec	
0x315-0x31B	Reserved		
0x31C	Over current III protect action	0: Invalid 1: Alarm 2: Trig DO	
0x31D	Over current III protect threshold	Range: 100-1000% I _e	
0x31E	Over current III protect timer	Range: 0.1-50.0sec	
0x31F	Over voltage protect action	0: Invalid 1: Alarm 2: Trig DO	
0x320	Over voltage protect threshold	Range: 105-150% U _e	
0x321	Over voltage protect timer	Range: 0.1-50.0sec	
0x322	Under voltage protect action	0: Invalid 1: Alarm 2: Trig DO	
0x323	Under voltage protect threshold	Range: 50-95% U _e	
0x324	Under voltage protect timer	Range: 0.1-50.0sec	
0x325-0x32E	Reserved		

8.2.4 - Motor start mode configuration (Read and write)

Address	Parameters	Description
0x32F	CB ON/OFF fault judgment delay	Range: 1.0~600.0sec
0x330-0x331	Reserved	
0x332	Control switch permissions	BIT0: Panel button control, 0: disabled, 1: abled BIT1: DI control, 0: disabled, 1: abled BIT2: Communication control, 0: disabled, 1 :abled
0x333	Motor start mode	0: Protection mode 1: Measurement and control mode
0x334-0x336	Reserved	
0x337	Customized action	0: Invalid 1: Alarm 2: Trig DO
0x338	Customized timer	Range: 0.1-50.0sec
0x339-0x33F	Reserved	
0x340	AO1 output zero span(0mA)	Default 0.0%, modifiable
0x341	AO1 output full span(20mA)	Default 100.0%, modifiable
0x342	AO1 output selection	0: 0-20mA 1: 4-20mA
0x343	AO1 transmit parameters	0: I1 1: I2 2: I3 3: U1 4: U2 5: U3 6: Ps 7: Qs 8: Ss 9: Pf 10: Fr
0x344H	AO2 output zero span(0mA)	Default 0.0%, modifiable
0x345H	AO2 output full span(20mA)	Default 100.0%, modifiable
0x346H	AO2 output selection	0: 0-20mA 1: 4-20mA
0x347H	AO2 transmit parameters	0: I1 1: I2 2: I3 3: U1 4: U2 5: U3 6: Ps 7: Qs 8: Ss 9: Pf 10: Fr
0x348-0x34F	Reserved	
0x350-0x352	Overload linkage R1-R3	0: ON 1: OFF
0x353-0x355	Over current I-stage linkage R1-R3	0: ON 1: OFF
0x356-0x358	Over current II-stage linkage R1-R3	0: ON 1: OFF
0x359-0x35B	Over current III-stage linkage R1-R3	0: ON 1: OFF
0x35C-0x35E	Leakage linkage R1-R3	0: ON 1: OFF
0x35F-0x361	Overvoltage linkage R1-R3	0: ON 1: OFF
0x362-0x364	Undervoltage linkage R1-R3	0: ON 1: OFF
0x365-0x367	Customized linkage R1-R3	0: ON 1: OFF
0x368-0x37F	Reserve	
0x380	R1 linkage pulse time	0-999.9 sec., setting to 0 means level mode
0x381	R2 linkage pulse time	0-999.9 sec., setting to 0 means level mode

0x382	R3 linkage pulse time	0-999.9 sec., setting to 0 means level mode
0x383	DO1 output mode	0: Reserve DO 1: Protection alarm 2: CB ON 3: CB OFF 4: Linked DO R1 5: Linked DO t R2 6: Linked DO R3
0x384-0x387	DI2-DO5 output mode	Functions same as above (Only 0 can be set repeatedly)
0x388-0x38F	Reserve	
0x390	DI1 output mode	0: Normal state 1: Local/remote 2: Circuit breaker status 3: Energy storage 4: Protection reset 5: Local CB OFF 6: Local CB ON 7: Remote CB OFF 8: Remote CB ON 9: CB OFF 10: CB ON 11: Customized
0x391-0x399	DI2-DI10 output mode	Functions same as above (Only 0 can be set repeatedly)
0x3A0	Signal input mode	BIT0-BIT9: DI0-DI10 judgment method 0: closed valid, 1: disconnected valid

8.2.5 - Sequence of event record (Read only, code 04)

Address	Parameters	Description
0x500-0x504	SOE_001	SOE_001 is latest record Details see Notes
0x505-0x509	SOE_002	
0x50A-0x50E	SOE_003	
0x50F-0x513	SOE_004	
0x514-0x518	SOE_005	
0x519-0x51D	SOE_006	
...	...	
0x6EF-0x6F3	SOE_100	...
...
0x800H	Clear SOE	Write:0A0A
0x900H	Clear heat capacity	Write:0A0A
0xA00H	Clear running information	Write:0A0A
0xD00H	Control start A, start B, stop, reset	Restart:0x10 Stop:0x20 Start B:0x40 Start A:0x80
0xF00H	Clear energy	Write:0A0A

Note: Each event is represented by 10 bytes.

BYTE 0-1 for fault type	01: Start overtime 02: Over load 03: Phase fault 04: Jam in starting 05: Current imbalance	06: Under power 07: Jam in running 08: Ground fault 09: Customized 10: Over voltage	11: Under voltage 12: Abnormal frequency 13: Abnormal power factor 14: Over temperature 15: Short circuit
BYTE 2-3	Fault value		
BYTE 4-9	Fault event timestamp		
BYTE 4	Year		
BYTE 5	Month		
BYTE 6	Date		
BYTE 7	Hour		
BYTE 8	Minute		
BYTE 9	Second		

9. - SAFETY CONSIDERATIONS



All installation specification described at the previous chapters named: **INSTALLATION AND STARTUP, INSTALLATION MODES and SPECIFICATIONS.**

Note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. This instrument is factory-shipped at proper operation condition.

10. - MAINTENANCE

The EnergoM-PR-80L not require any special maintenance. No adjustment, maintenance or repairing action should be done when the instrument is open and powered on, should those actions are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out; the instrument must be disconnected from any power supply source.

When any protection fault is suspected to exist, the instrument must be immediately put out of service. The instrument's design allows a quick replacement in case of any fault.