Reactive power compensation controller User Manual

Apply to:
WGK-31-605 series

JIANGSU SFERE ELECTRIC CO., LTD.

Safety Instructions for Use

Thank you for choosing the product developed by our company. In order to facilitate your purchase and safe, correct, and efficient use of this product, please read this manual carefully and pay attention to the following points when using it.

Note:

1. The controller must be installed and serviced by a qualified electrician.
2. After the controller is powered on, do not touch the connection between the controller and the power supply. Before touching any components located at the back of the controller, the working power must be cut off.
3. Do not open live circuits, as this can cause dangerous overvoltage; When replacing or disassembling the controller, the current transformer (CT) must be short-circuited first.
4. There is no need to open the controller chassis, as there are no components inside that require user maintenance.
5. The electrical parameters provided to the device must be within the rated range.

Contents

1. Overview

1.1 Product instruction

Quoted national standards

JB/T 9663-2013 Low voltage reactive power automatic compensating controller

DL/T 1028-2006 Verification code for power quality analyzer

GB-T14549-1993 Harmonics in public supply network

Relative international standards

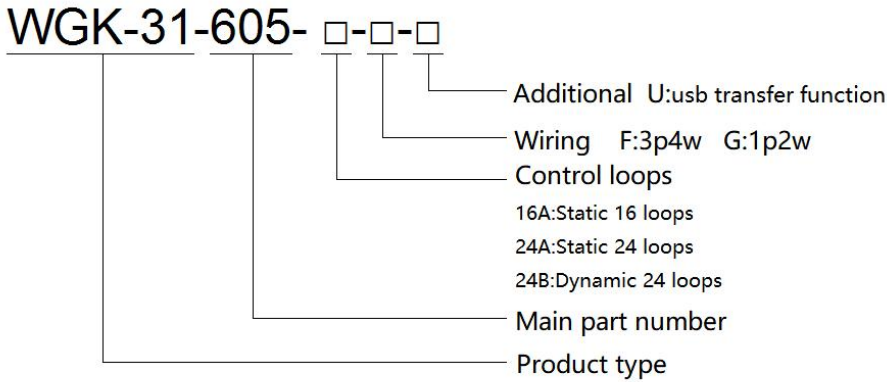
IEC 62053-23:2003 Electricity metering equipment (a.c.) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)

IEC 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use; part 1: general requirements

IEC 61000-2-11 Electromagnetic compatibility (EMC)-Part 2-11

IEC 60068-2-30 Environmental testing - Part 2-30

1.2 Model selection



1.3 Technical specifications

Type	16A-F	24A(B)-F	16A-G	24A(B)-G
Real time	Three-phase phase voltage,		Single phase line voltage	

<table>
<tr><td rowspan="7">measurement</td><td colspan="2">three-phase line voltage</td><td colspan="2"></td></tr>
<tr><td colspan="2">Three phase current</td><td colspan="2">Single phase current</td></tr>
<tr><td colspan="2">Three-phase active power,
total active power</td><td colspan="2">Total active power</td></tr>
<tr><td colspan="2">Three-phase reactive power,
total reactive power</td><td colspan="2">Total reactive power</td></tr>
<tr><td colspan="2">Three-phase apparent power,
total apparent power</td><td colspan="2">Total apparent power</td></tr>
<tr><td colspan="2">Three-phase power factor ,
total power factor</td><td colspan="2">total power factor</td></tr>
<tr><td colspan="2">Frequency, temperature</td><td colspan="2">Frequency, temperature</td></tr>
<tr><td>Harmonic measurement</td><td colspan="4">1-31st</td></tr>
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<tr><td>Control loops</td><td>16</td><td>24</td><td>16</td><td>24</td></tr>
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<tr><td>Control strategy</td><td colspan="4">Cyclic switching, steady-state cycling</td></tr>
<tr><td>Event record</td><td colspan="4">50 records</td></tr>
<tr><td>Alarm output</td><td colspan="4">2-way programmable relay output
Contact capacity AC250V/3A DC30V/3A</td></tr>
<tr><td>Temperature</td><td colspan="4">NTC temperature transducer 3m</td></tr>
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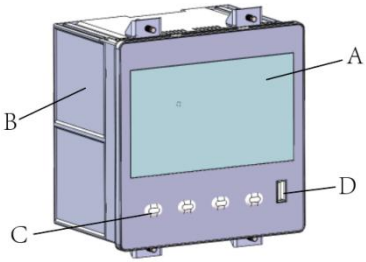
<tr><td>U disk function</td><td colspan="4">Optional U disk export measurement data function</td></tr>
<tr><td>Display mode</td><td colspan="4">5-inch TFT touch screen</td></tr>
</table>

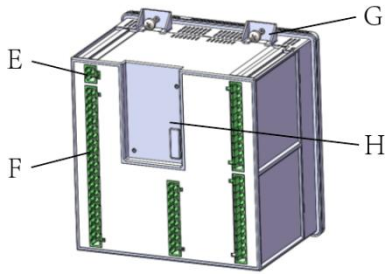
Note: The above product functions are the default optional function of the company, and customers can negotiate with the Marketing Department for special needs.

1.4 Outline structure

Front view:



Back view:



A	Display
B	Housing
C	Button
D	USB
E	Power supply terminal
F	Wiring terminal
G	Bracket
H	Optional WIFI/4Gmodule
Outline dimension (l×h)	144×144(mm)
Hole size (s×y)	138×138(mm)

2. Installation and wiring

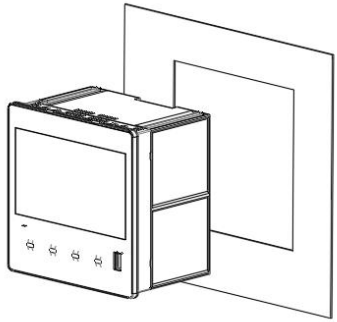
The controller design can be used for panel mounting (the hole size is 138 * 138mm). Use a screwdriver to operate and fix bracket according to the following steps:

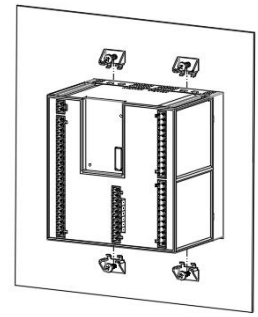
1) Drill a 138 x 138mm hole in the fixed electrical cabinet;

2) Remove the controller;

3) The controller shall be installed into the mounting hole from the front;

4) Insert the fixing bracket of the controller, and tighten the screws to fix the controller.





605 series terminals are uniformly numbered as follows:

Power supply	1, 2	AC/DC80～270V
Current signal	4,5,6,7,8,9	4,6,8 is the three-phase current incoming line end 5,7,9 is the three-phase current outgoing terminal
Voltage signal	11,12,13,14	Three-phase voltage input, A,B,C,N
Control output	21~44	16/24 loops control output
+12V	20	Corresponding to the dynamic control public end
COM	80	Corresponding to the static control public end
1*RS485	58,59,60	A+、 B- 、G
Alarm output	81~84	Two-way relay output(81,82) and (83,84)
NTC Temperature sensing	61, 62	

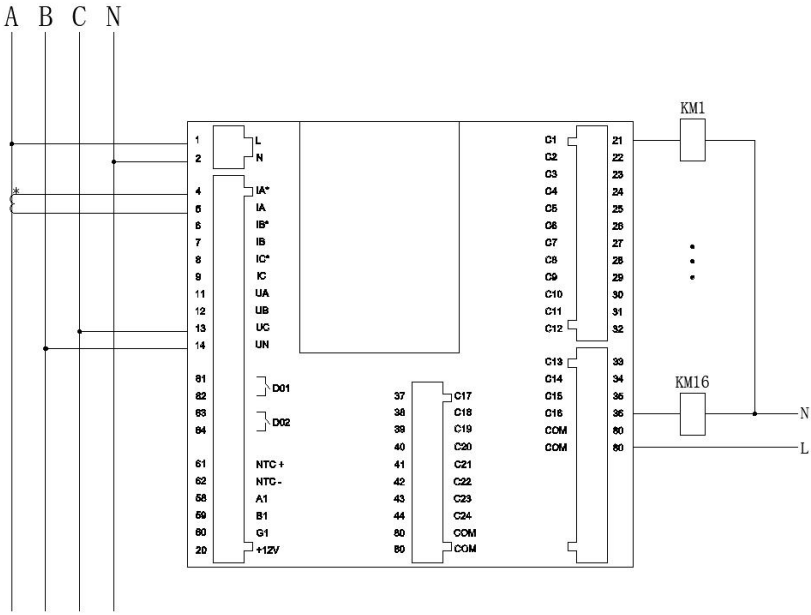
Note:

a. 1 and 2 are auxiliary power supplies for instrument operation, with a maximum power supply voltage of AC/DC80-270V. Please ensure that the power supply is suitable for this series of products to prevent damage to the products.

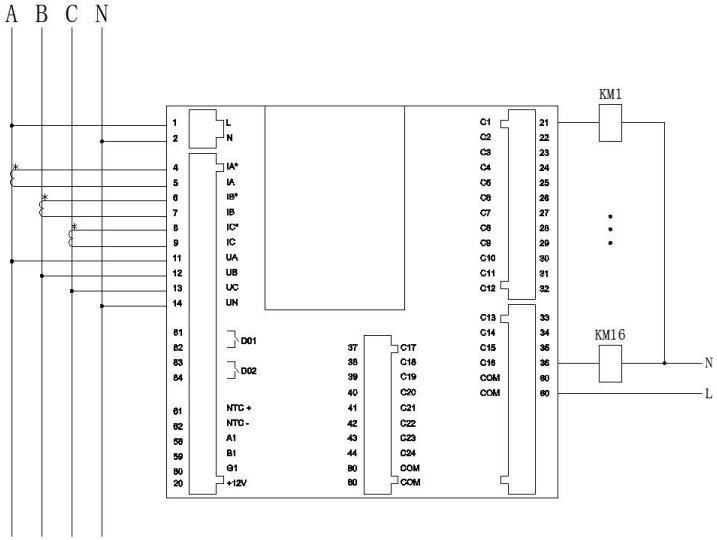
b. 4, 6, and 8 are the incoming terminals of the current transformer, with * indicating the incoming terminals of the current.

c. For detailed use of wiring terminals, please connect according to the wiring diagram on the specific product casing.

d. When using the one phase two wire connection method, the corresponding current signal Ia is connected to (4, 5), the corresponding voltage signal Uc is connected to 13, and Ub is connected to 14.

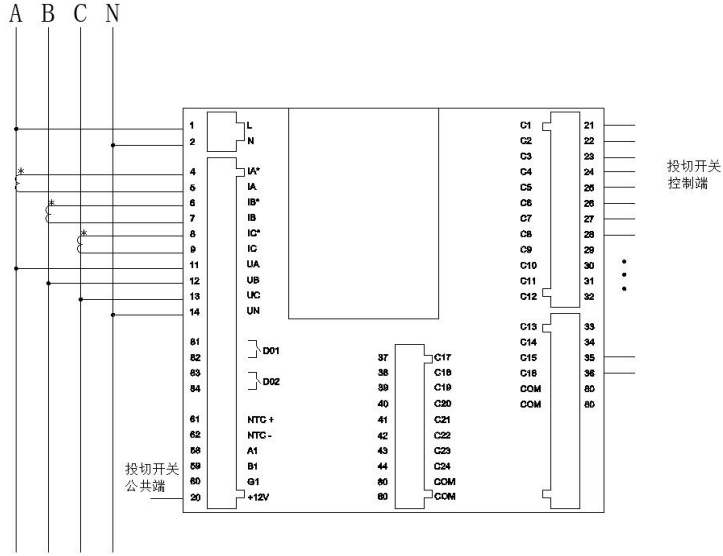


Total compensation (1P2W)Static wiring diagram



Total compensation and phase compensation (3P4W)

Static wiring diagram



Total compensation and phase compensation (3P4W)

Dynamic wiring diagram

3. Menu

3.1 Home page

The controller is equipped with a 5-inch color capacitive touch screen and four manual switching physical buttons. Under normal operation, touch operation between screens can be used to switch between different menus, but during operating system settings, to prevent unintentional modifications, password 0001 will be required for access.

Switching indication: The current control circuit status can be viewed.

Data measurement: Conventional electrical parameter measurement values can be viewed.

Harmonics: The total harmonic content and fractional 2-31 content of voltage and current can be viewed.

Data export: You can insert a USB drive to export data. (Optional function, default none)

Protection output: Two alarm output states can be viewed.

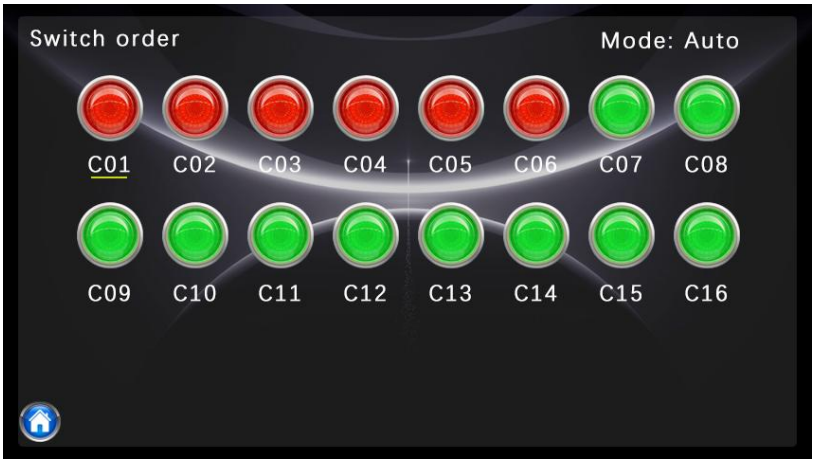
Event recording: 50 events were recorded, recording protection events.

Settings: Entering the programming state allows for parameter settings on the controller, such as current to current ratio.

Version information: System information and software version.

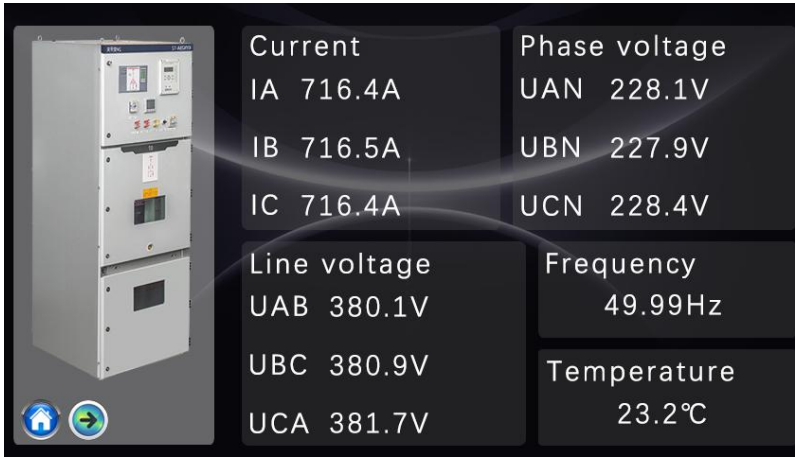
3.2 Manual switching

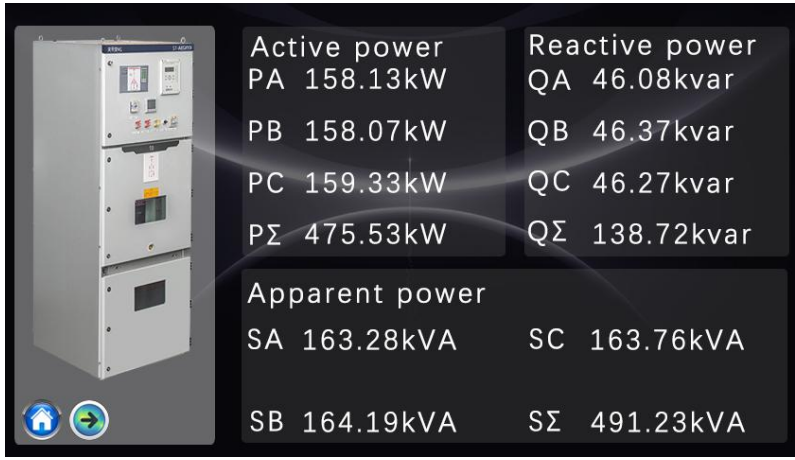
Under the "Switching Indication" menu, press the "Manual/Automatic" button to switch between manual and automatic modes. In manual mode, a yellow selection underline appears. Press the "Select" key to move the underline to select the specific number of paths, and then press "Cut" to achieve manual cutting or "On" to achieve manual switching. Red indicates that this route has been put into operation, while green indicates that this route has been cut off.

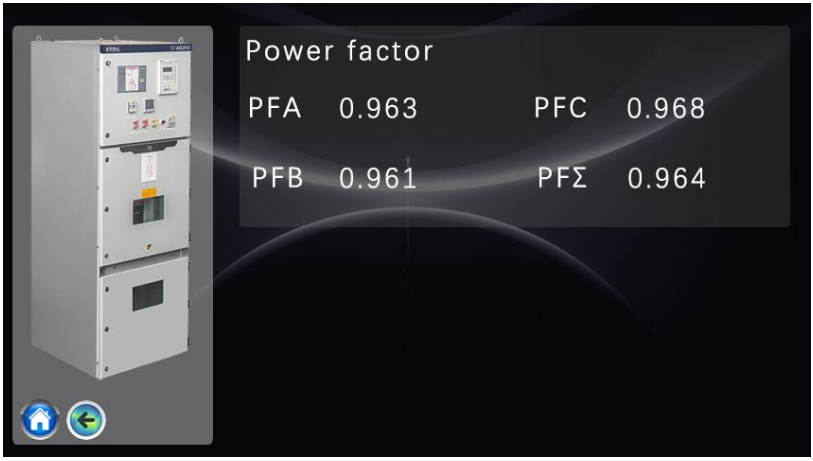


3.3 Data measurement

Measurement and display of conventional electricity quantity, including grid voltage, grid current, grid frequency, cabinet temperature, active power, reactive power, apparent power, and power factor.

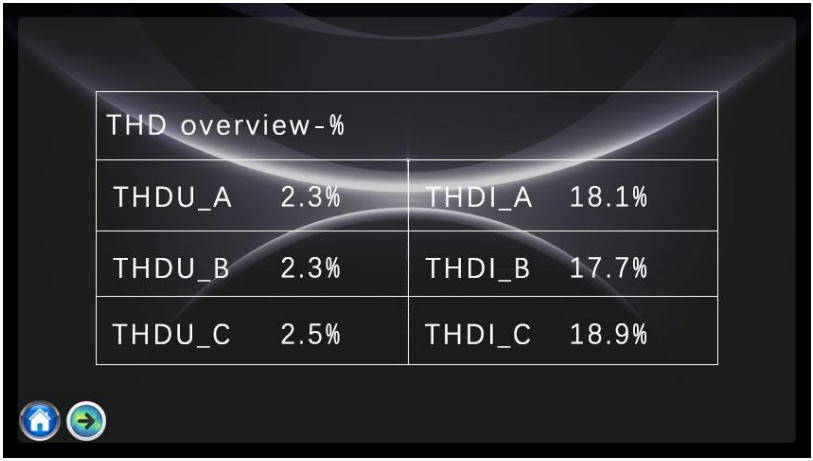

Current
IA 716.4A
IB 716.5A
IC 716.4A
Phase voltage
UAN 228.1V
UBN 227.9V
UCN 228.4V
Line voltage
UAB 380.1V
UBC 380.9V
UCA 381.7V
Frequency
49.99Hz
Temperature
23.2℃


Active power
PA 158.13kW
PB 158.07kW
PC 159.33kW
PΣ 475.53kW
Reactive power
QA 46.08kvar
QB 46.37kvar
QC 46.27kvar
QΣ 138.72kvar
Apparent power
SA 163.28kVA
SB 164.19kVA
SC 163.76kVA
SΣ 491.23kVA

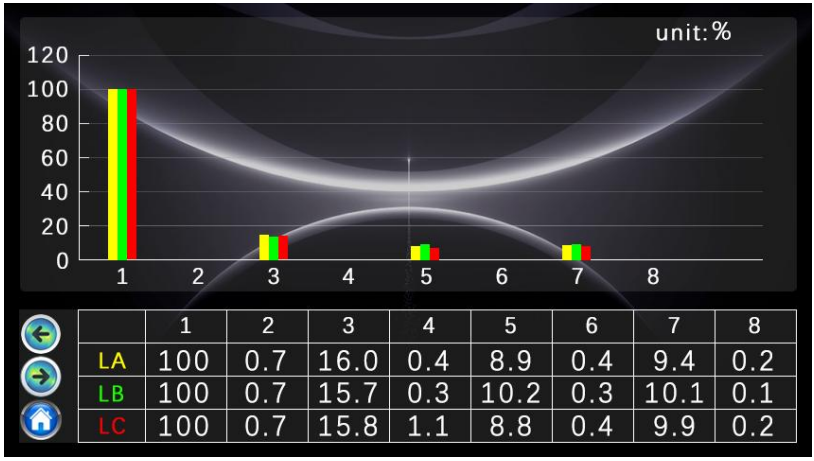


3.4 Harmonic

Total harmonic content of the voltage and current.



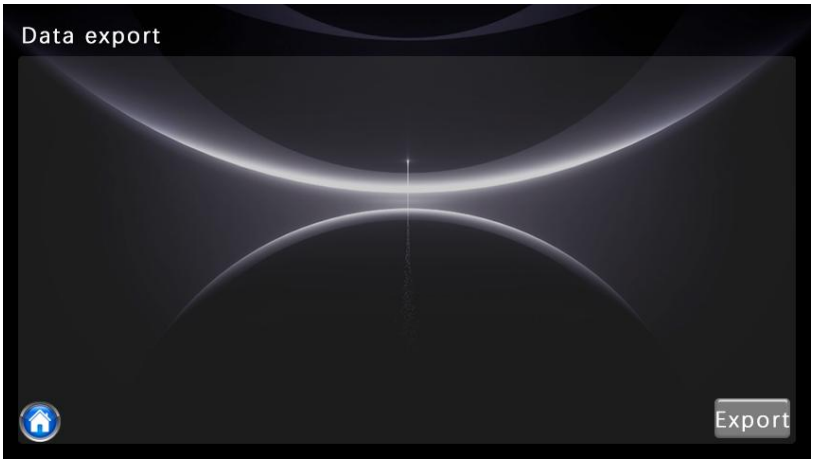
The bar chart shows the harmonic content of the split current from 2 to 31.



	1	2	3	4	5	6	7	8
LA	100	0.7	16.0	0.4	8.9	0.4	9.4	0.2
LB	100	0.7	15.7	0.3	10.2	0.3	10.1	0.1
LC	100	0.7	15.8	1.1	8.8	0.4	9.9	0.2

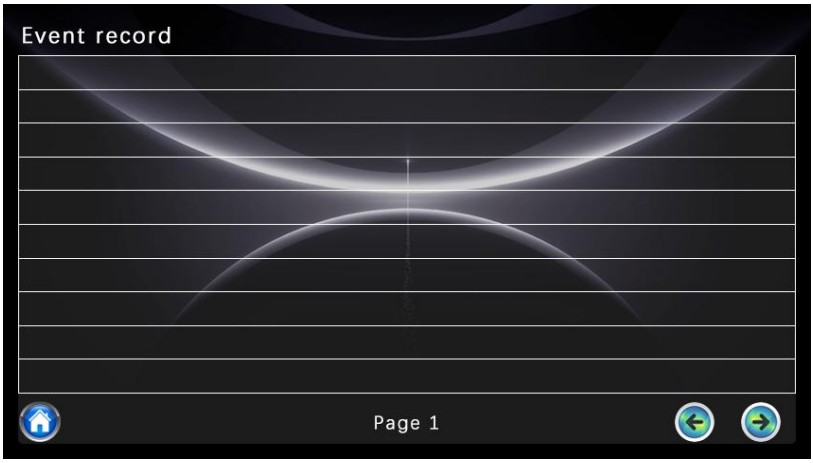
3.5 Data export

When selecting the USB flash drive function, the maximum, minimum, and average values of conventional electrical parameters for the past three months can be exported.

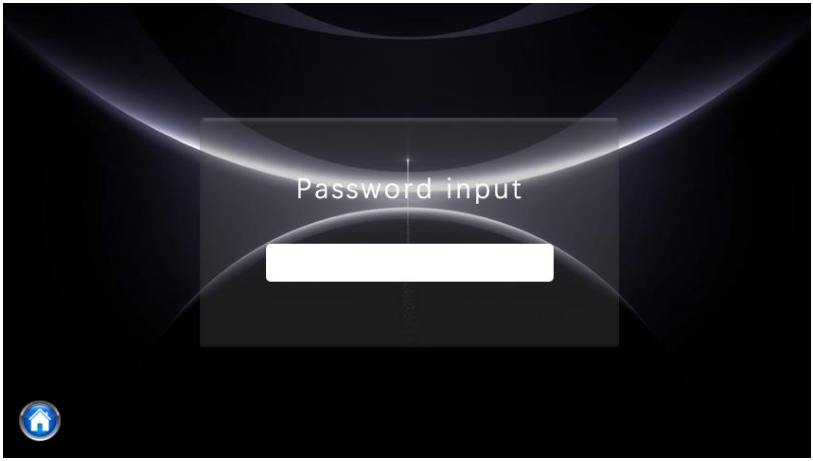


3.6 Event record

Record 50 protection events.



3.7 Programming menu



(1) Enter programming state:

Return to the main menu of the system, select the "Parameter Settings" option in the main menu, and press the "Confirm" button to enter the password authentication selection page. Enter the user password

authentication page, enter the correct password, and then enter the programming status page (default user input password is "0001"). **Note: If the page does not act after entering the password, it indicates that the password was entered incorrectly.**

(2) Exit programming status:

The changes to parameter settings will be automatically saved. When you have returned to the first level menu of the programming interface, simply press the "Home" button on the LCD panel.

3.7.1 Programming menu interface

Optional general settings (including wiring settings, communication settings, and time settings), protection settings (including settings for various protection functions), alarm settings, switching settings, and capacitor settings.

Programming menu interface

3.7.2 Programming menu operations

1) Regular Setting

External transformer ratio, wiring method, time, and event reset can be set. Set communication parameters, one communication line can be set, with instrument address range of 1-247 and baud rate of 480096001920038400; The data formats are N81, N82, E81, and O81 (with no parity, even parity, and odd parity, respectively), and the communication protocol is standard Modbus-RTU. The communication address table is shown in the appendix.

2) Protection Setting

Two types of protection can be enabled or disabled, one is voltage protection, and the other is harmonic protection. Voltage protection is divided into undervoltage protection and overvoltage protection, while harmonic protection is divided into harmonic voltage protection (THDu%) and harmonic current protection (THDi%).
Voltage protection can be directly selected as "enable" or "disable" to enable or shield protection.

Note: The protection voltage is set for phase voltage under three-phase four wire (- F), and for line voltage under one phase two wire (- G).

For example, the wiring method is three-phase four wire (- F):

1. Select "Enable" for voltage protection, set the undervoltage to 180V. When the measured phase voltage is less than 180V, enter the voltage protection, with a return difference of 8V.

2. Select "Enable" for voltage protection, and set the overvoltage to 250V. When the measured phase voltage is greater than 250V, enter the voltage protection with a return difference of 8V.

The setting value of harmonic protection is set to "0" to indicate protection shielding, and not set to "0" to indicate entering protection.

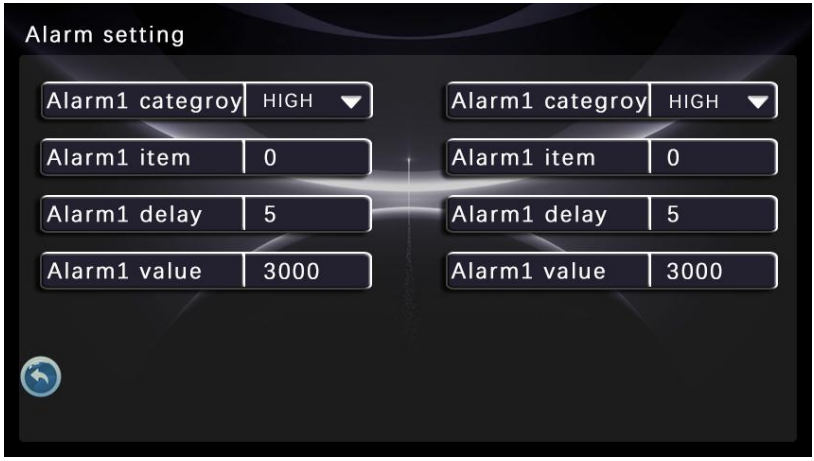
For example:

Setting THDu% to "0" indicates harmonic voltage protection shielding.

2. Set THDu% to 5%, and when the measured THDu% is greater than 5%, enter harmonic voltage protection.

3. The setting principle of harmonic current protection (THDi%) refers to harmonic voltage protection (THDu%).

3) Alarm settings and protection output



Alarm 1 and Alarm 2 represent the alarm outputs of the first and second channels, respectively. A high alarm indicates an alarm above the set value, and a low alarm indicates an alarm below the set value; When the project value is 0 and com is selected, it indicates that the alarm output is turned off and changed to remote control relay output (note that remote control output can only be set when the type is set to com). At this time, it is also necessary to set a set value, where the set value is a secondary value and the default delay is 5S. Please refer to the table below for the comparison of project values and names.

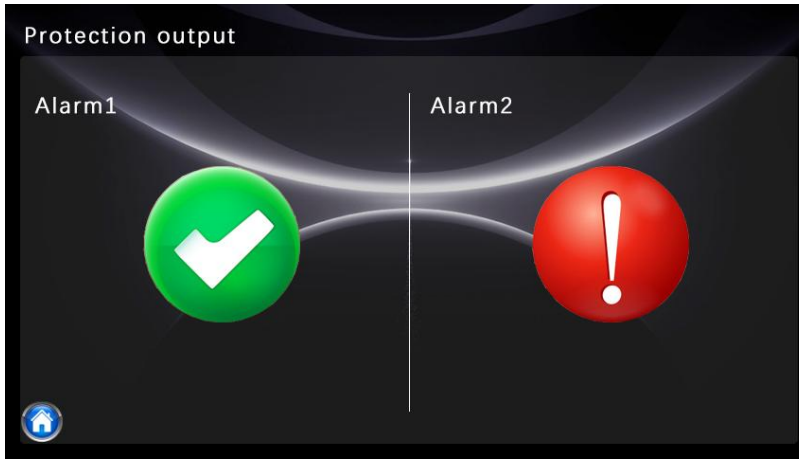
No	Item	Description	Data	No	Item	Description	Data
0	COM	Close the alarm		18	RAM_SA	apparent power	XXXX VA
1	RAM_IA	Current	X.XXX A	19	RAM_SB		
2	RAM_IB			20	RAM_SC		
3	RAM_IC			21	RAM_SZ		
4	RAM_UAN	Phase voltage	XXX.X V	22	RAM_PHASEA	power factor	XX. XX
5	RAM_UBN			23	RAM_PHASEB		
6	RAM_UCN			24	RAM_PHASEC		

7	RAM_UAB	Line voltage	XXX.X V	25	RAM_PHASEZ		
8	RAM_UBC			26	RAM_FREQ	Frequency	Hz
9	RAM_UCA			27	RAM_NTC1	Temperature	XXX.X ℃
10	RAM_PA	Active power	XXXX W	28	RAM_UA_THD	harmonic voltage	XXX.X %
11	RAM_PB			29	RAM_UB_THD		
12	RAM_PC			30	RAM_UC_THD		
13	RAM_PZ			31	RAM_IA_THD	harmonic current	XXX.X %
14	RAM_QA	Reactive power	XXXX var	32	RAM_IB_THD		
15	RAM_QB			33	RAM_IC_THD		
16	RAM_QC						
17	RAM_QZ						

Example 1: Require an alarm for phase A overvoltage of 280.0V, set the alarm item to "4", and set the value to "2800".

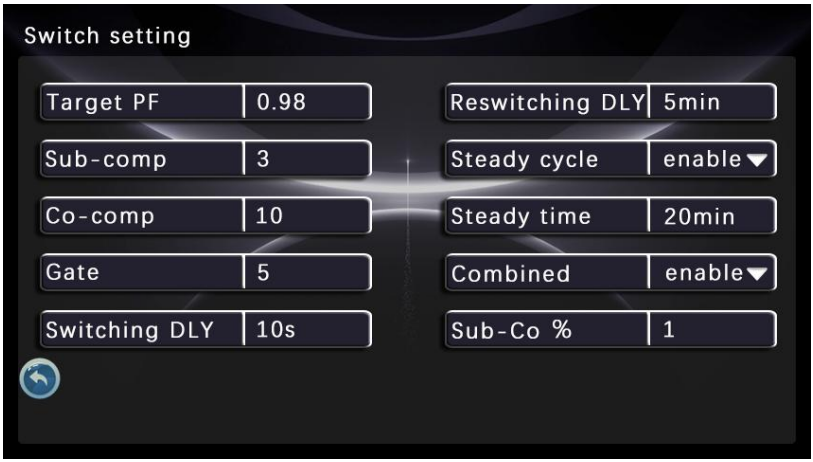
Example 2: An alarm is required for phase A overcurrent of 400.0A, with a CT ratio of 200. Set the alarm item to "1" and the set value to "2000".

Example 3: If a fan is required to operate at a temperature exceeding 40 degrees Celsius, the alarm item can be set to "27" and the set value to "0400".



After the above settings are completed, if an alarm occurs in the associated project, it can be seen in the "Protection Output".

4) Switching setting



Target power factor: refers to the setting of the target power factor, with a value range of 0.500 to 1.000;

Switching threshold: refers to the sensitivity of controlling switching. The lower the value, the easier it is to switch, with a value range of 0.5 to 1.2;

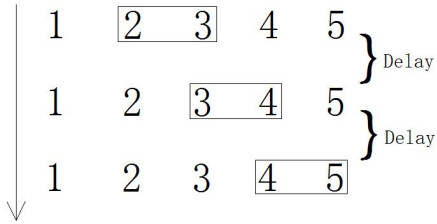
Switching delay: refers to the time interval between switching actions, with a value range of 0.1 to 999.9 seconds;

PF constant value: refers to setting the target power factor, with a value range of 0.500~1.000;

Returning delay: refers to the interval time allowed for the capacitor to be switched back on after being cut off, with a value range of 1-60min.

Steady state cycle enable: The steady state cycle function enable refers to the ability of modules of the same capacity to be recycled after the system stabilizes (as shown in the figure below), improving the overall service life of the system.

Steady state cycle time: Delay unit minute, with a value range of 1-90 minutes.



Total compensation loop

Phase compensation loop

*** Phase compensation is start from NO.1 loop, total compensation is after phase compensation!**

For example, 2 loops phase compensation, and 4 loops total compensation:

01：Phase A compensation 1

02：Phase B compensation 1

03：Phase C compensation 1

04：Phase A compensation 2

05：Phase B compensation 2

06：Phase C compensation 2

07：Three phase total compensation

08：Three phase total compensation

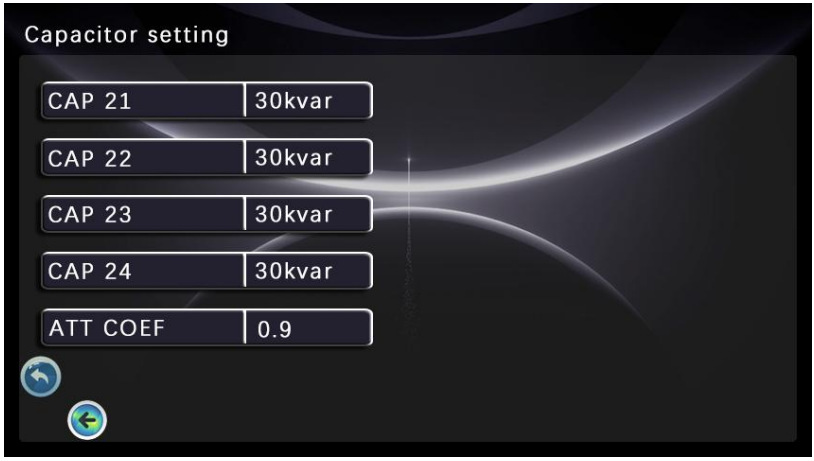
09：Three phase total compensation

10：Three phase total compensation

Total loops = total compensation loops + phase compensation loops×3,

Total loops should ≤16 (16A) or 24(24A/B);

5) Capacitive settings



Capacitance setting: Set the compensation capacity of each circuit according to the actual system configuration, with a range of 0-900kvar.

Attenuation coefficient: Setting this value after the capacitor has been running for a period of time can provide compensation accuracy.

Appendix MODBUS-RTU

Address		R/W	format	Data	Name	Description
HEX	DEC					
0x1	1	R	int	D*1	RAM_DO1_ST	Open
0x2	2	R	int	D*1	RAM_CON_ST1	1-16 Relay output status
0x3	3	R	int	D*1	RAM_CON_ST2	17-24 Relay output status
0x4	4	R	int	D*0.001	RAM_IA	I_A
0x5	5	R	int	D*0.001	RAM_IB	I_B
0x6	6	R	int	D*0.001	RAM_IC	I_C
0x7	7	R	int	D*0.1	RAM_UAN	U_A
0x8	8	R	int	D*0.1	RAM_UBN	U_B
0x9	9	R	int	D*0.1	RAM_UCN	U_C

0xA	10	R	int	D*0.1	RAM_UAB	U_{AB}
0xB	11	R	int	D*0.1	RAM_UBC	U_{BC}
0xC	12	R	int	D*0.1	RAM_UCA	U_{CA}
0xD	13	R	int	D*1	RAM_PA	P_A
0xE	14	R	int	D*1	RAM_PB	P_B
0xF	15	R	int	D*1	RAM_PC	P_C
0x10	16	R	int	D*1	RAM_PZ	Total active power
0x11	17	R	int	D*1	RAM_QA	Q_A
0x12	18	R	int	D*1	RAM_QB	Q_B
0x13	19	R	int	D*1	RAM_QC	Q_C
0x14	20	R	int	D*1	RAM_QZ	Total reactive power
0x15	21	R	int	D*1	RAM_SA	S_A
0x16	22	R	int	D*1	RAM_SB	S_B
0x17	23	R	int	D*1	RAM_SC	S_C
0x18	24	R	int	D*1	RAM_SZ	Total apparent power
0x19	25	R	int	D*0.001	RAM_PHASEA	PF_A
0x1A	26	R	int	D*0.001	RAM_PHASEB	PF_B
0x1B	27	R	int	D*0.001	RAM_PHASEC	PF_C
0x1C	28	R	int	D*0.001	RAM_PHASEZ	Total power factor
0x1D	29	R	int	D*0.01	RAM_FREQ	Frequency
0x1E	30	R	int	D*0.1	RAM_NTC1	Temperature
...						
0x2E	46	R	int	D*1	RAM_SYS	System running state
0x2F	47	R	int	D*0.1	RAM_UA_THD	Phase A voltage total harmonic content
0x30	48	R	int	D*0.1	RAM_UA_TH01	Phase A voltage 1st harmonic content
0x31	49	R	int	D*0.1	RAM_UA_TH02	Phase A voltage 2nd harmonic content
0x32	50	R	int	D*0.1	RAM_UA_TH03	Phase A voltage 3rd

						harmonic content
0x33	51	R	int	D*0.1	RAM_UA_TH04	Phase A voltage 4th harmonic content
0x34	52	R	int	D*0.1	RAM_UA_TH05	Phase A voltage 5th harmonic content
0x35	53	R	int	D*0.1	RAM_UA_TH06	Phase A voltage 6th harmonic content
0x36	54	R	int	D*0.1	RAM_UA_TH07	Phase A voltage 7th harmonic content
0x37	55	R	int	D*0.1	RAM_UA_TH08	Phase A voltage 8th harmonic content
0x38	56	R	int	D*0.1	RAM_UA_TH09	Phase A voltage 9th harmonic content
0x39	57	R	int	D*0.1	RAM_UA_TH10	Phase A voltage 10th harmonic content
0x3A	58	R	int	D*0.1	RAM_UA_TH11	Phase A voltage 11th harmonic content
0x3B	59	R	int	D*0.1	RAM_UA_TH12	Phase A voltage 12th harmonic content
0x3C	60	R	int	D*0.1	RAM_UA_TH13	Phase A voltage 13th harmonic content
0x3D	61	R	int	D*0.1	RAM_UA_TH14	Phase A voltage 14th harmonic content
0x3E	62	R	int	D*0.1	RAM_UA_TH15	Phase A voltage 15th harmonic content
0x3F	63	R	int	D*0.1	RAM_UA_TH16	Phase A voltage 16th harmonic content
0x40	64	R	int	D*0.1	RAM_UA_TH17	Phase A voltage 17th harmonic content
0x41	65	R	int	D*0.1	RAM_UA_TH18	Phase A voltage 18th harmonic content

0x42	66	R	int	D*0.1	RAM_UA_TH19	Phase A voltage 19th harmonic content
0x43	67	R	int	D*0.1	RAM_UA_TH20	Phase A voltage 20th harmonic content
0x44	68	R	int	D*0.1	RAM_UA_TH21	Phase A voltage 21st harmonic content
0x45	69	R	int	D*0.1	RAM_UA_TH22	Phase A voltage 22nd harmonic content
0x46	70	R	int	D*0.1	RAM_UA_TH23	Phase A voltage 23rd harmonic content
0x47	71	R	int	D*0.1	RAM_UA_TH24	Phase A voltage 24th harmonic content
0x48	72	R	int	D*0.1	RAM_UA_TH25	Phase A voltage 25th harmonic content
0x49	73	R	int	D*0.1	RAM_UA_TH26	Phase A voltage 26th harmonic content
0x4A	74	R	int	D*0.1	RAM_UA_TH27	Phase A voltage 27th harmonic content
0x4B	75	R	int	D*0.1	RAM_UA_TH28	Phase A voltage 28th harmonic content
0x4C	76	R	int	D*0.1	RAM_UA_TH29	Phase A voltage 29th harmonic content
0x4D	77	R	int	D*0.1	RAM_UA_TH30	Phase A voltage 30th harmonic content
0x4E	78	R	int	D*0.1	RAM_UA_TH31	Phase A voltage 31st harmonic content
0x4F	79	R	int	D*0.1	RAM_UB_THD	Phase B voltage total harmonic content
0x50	80	R	int	D*0.1	RAM_UB_TH01	Phase B voltage 1st harmonic content
0x51	81	R	int	D*0.1	RAM_UB_TH02	Phase B voltage 2nd

						harmonic content
0x52	82	R	int	D*0.1	RAM_UB_TH03	Phase B voltage 3rd harmonic content
0x53	83	R	int	D*0.1	RAM_UB_TH04	Phase B voltage 4th harmonic content
0x54	84	R	int	D*0.1	RAM_UB_TH05	Phase B voltage 5th harmonic content
0x55	85	R	int	D*0.1	RAM_UB_TH06	Phase B voltage 6th harmonic content
0x56	86	R	int	D*0.1	RAM_UB_TH07	Phase B voltage 7th harmonic content
0x57	87	R	int	D*0.1	RAM_UB_TH08	Phase B voltage 8th harmonic content
0x58	88	R	int	D*0.1	RAM_UB_TH09	Phase B voltage 9th harmonic content
0x59	89	R	int	D*0.1	RAM_UB_TH10	Phase B voltage 10th harmonic content
0x5A	90	R	int	D*0.1	RAM_UB_TH11	Phase B voltage 11th harmonic content
0x5B	91	R	int	D*0.1	RAM_UB_TH12	Phase B voltage 12th harmonic content
0x5C	92	R	int	D*0.1	RAM_UB_TH13	Phase B voltage 13th harmonic content
0x5D	93	R	int	D*0.1	RAM_UB_TH14	Phase B voltage 14th harmonic content
0x5E	94	R	int	D*0.1	RAM_UB_TH15	Phase B voltage 15th harmonic content
0x5F	95	R	int	D*0.1	RAM_UB_TH16	Phase B voltage 16th harmonic content
0x60	96	R	int	D*0.1	RAM_UB_TH17	Phase B voltage 17th harmonic content

0x61	97	R	int	D*0.1	RAM_UB_TH18	Phase B voltage 18th harmonic content
0x62	98	R	int	D*0.1	RAM_UB_TH19	Phase B voltage 19th harmonic content
0x63	99	R	int	D*0.1	RAM_UB_TH20	Phase B voltage 20th harmonic content
0x64	100	R	int	D*0.1	RAM_UB_TH21	Phase B voltage 21st harmonic content
0x65	101	R	int	D*0.1	RAM_UB_TH22	Phase B voltage 22nd harmonic content
0x66	102	R	int	D*0.1	RAM_UB_TH23	Phase B voltage 23rd harmonic content
0x67	103	R	int	D*0.1	RAM_UB_TH24	Phase B voltage 24th harmonic content
0x68	104	R	int	D*0.1	RAM_UB_TH25	Phase B voltage 25th harmonic content
0x69	105	R	int	D*0.1	RAM_UB_TH26	Phase B voltage 26th harmonic content
0x6A	106	R	int	D*0.1	RAM_UB_TH27	Phase B voltage 27th harmonic content
0x6B	107	R	int	D*0.1	RAM_UB_TH28	Phase B voltage 28th harmonic content
0x6C	108	R	int	D*0.1	RAM_UB_TH29	Phase B voltage 29th harmonic content
0x6D	109	R	int	D*0.1	RAM_UB_TH30	Phase B voltage 30th harmonic content
0x6E	110	R	int	D*0.1	RAM_UB_TH31	Phase B voltage 31st harmonic content
0x6F	111	R	int	D*0.1	RAM_UC_THD	Phase C voltage total harmonic content
0x70	112	R	int	D*0.1	RAM_UC_TH01	Phase C voltage 1st

						harmonic content
0x71	113	R	int	D*0.1	RAM_UC_TH02	Phase C voltage 2nd harmonic content
0x72	114	R	int	D*0.1	RAM_UC_TH03	Phase C voltage 3rd harmonic content
0x73	115	R	int	D*0.1	RAM_UC_TH04	Phase C voltage 4th harmonic content
0x74	116	R	int	D*0.1	RAM_UC_TH05	Phase C voltage 5th harmonic content
0x75	117	R	int	D*0.1	RAM_UC_TH06	Phase C voltage 6th harmonic content
0x76	118	R	int	D*0.1	RAM_UC_TH07	Phase C voltage 7th harmonic content
0x77	119	R	int	D*0.1	RAM_UC_TH08	Phase C voltage 8th harmonic content
0x78	120	R	int	D*0.1	RAM_UC_TH09	Phase C voltage 9th harmonic content
0x79	121	R	int	D*0.1	RAM_UC_TH10	Phase C voltage 10th harmonic content
0x7A	122	R	int	D*0.1	RAM_UC_TH11	Phase C voltage 11th harmonic content
0x7B	123	R	int	D*0.1	RAM_UC_TH12	Phase C voltage 12th harmonic content
0x7C	124	R	int	D*0.1	RAM_UC_TH13	Phase C voltage 13th harmonic content
0x7D	125	R	int	D*0.1	RAM_UC_TH14	Phase C voltage 14th harmonic content
0x7E	126	R	int	D*0.1	RAM_UC_TH15	Phase C voltage 15th harmonic content
0x7F	127	R	int	D*0.1	RAM_UC_TH16	Phase C voltage 16th harmonic content

0x80	128	R	int	D*0.1	RAM_UC_TH17	Phase C voltage 17th harmonic content
0x81	129	R	int	D*0.1	RAM_UC_TH18	Phase C voltage 18th harmonic content
0x82	130	R	int	D*0.1	RAM_UC_TH19	Phase C voltage 19th harmonic content
0x83	131	R	int	D*0.1	RAM_UC_TH20	Phase C voltage 20th harmonic content
0x84	132	R	int	D*0.1	RAM_UC_TH21	Phase C voltage 21st harmonic content
0x85	133	R	int	D*0.1	RAM_UC_TH22	Phase C voltage 22nd harmonic content
0x86	134	R	int	D*0.1	RAM_UC_TH23	Phase C voltage 23rd harmonic content
0x87	135	R	int	D*0.1	RAM_UC_TH24	Phase C voltage 24th harmonic content
0x88	136	R	int	D*0.1	RAM_UC_TH25	Phase C voltage 25th harmonic content
0x89	137	R	int	D*0.1	RAM_UC_TH26	Phase C voltage 26th harmonic content
0x8A	138	R	int	D*0.1	RAM_UC_TH27	Phase C voltage 27th harmonic content
0x8B	139	R	int	D*0.1	RAM_UC_TH28	Phase C voltage 28th harmonic content
0x8C	140	R	int	D*0.1	RAM_UC_TH29	Phase C voltage 29th harmonic content
0x8D	141	R	int	D*0.1	RAM_UC_TH30	Phase C voltage 30th harmonic content
0x8E	142	R	int	D*0.1	RAM_UC_TH31	Phase C voltage 31st harmonic content
0x8F	143	R	int	D*0.1	RAM_IA_THD	Phase A current total

						harmonic content
0x90	144	R	int	D*0.1	RAM_IA_TH01	Phase A current 1st harmonic content
0x91	145	R	int	D*0.1	RAM_IA_TH02	Phase A current 2nd harmonic content
0x92	146	R	int	D*0.1	RAM_IA_TH03	Phase A current 3rd harmonic content
0x93	147	R	int	D*0.1	RAM_IA_TH04	Phase A current 4th harmonic content
0x94	148	R	int	D*0.1	RAM_IA_TH05	Phase A current 5th harmonic content
0x95	149	R	int	D*0.1	RAM_IA_TH06	Phase A current 6th harmonic content
0x96	150	R	int	D*0.1	RAM_IA_TH07	Phase A current 7th harmonic content
0x97	151	R	int	D*0.1	RAM_IA_TH08	Phase A current 8th harmonic content
0x98	152	R	int	D*0.1	RAM_IA_TH09	Phase A current 9th harmonic content
0x99	153	R	int	D*0.1	RAM_IA_TH10	Phase A current 10th harmonic content
0x9A	154	R	int	D*0.1	RAM_IA_TH11	Phase A current 11th harmonic content
0x9B	155	R	int	D*0.1	RAM_IA_TH12	Phase A current 12th harmonic content
0x9C	156	R	int	D*0.1	RAM_IA_TH13	Phase A current 13th harmonic content
0x9D	157	R	int	D*0.1	RAM_IA_TH14	Phase A current 14th harmonic content
0x9E	158	R	int	D*0.1	RAM_IA_TH15	Phase A current 15th harmonic content

0x9F	159	R	int	D*0.1	RAM_IA_TH16	Phase A current 16th harmonic content
0xA0	160	R	int	D*0.1	RAM_IA_TH17	Phase A current 17th harmonic content
0xA1	161	R	int	D*0.1	RAM_IA_TH18	Phase A current 18th harmonic content
0xA2	162	R	int	D*0.1	RAM_IA_TH19	Phase A current 19th harmonic content
0xA3	163	R	int	D*0.1	RAM_IA_TH20	Phase A current 20th harmonic content
0xA4	164	R	int	D*0.1	RAM_IA_TH21	Phase A current 21st harmonic content
0xA5	165	R	int	D*0.1	RAM_IA_TH22	Phase A current 22nd harmonic content
0xA6	166	R	int	D*0.1	RAM_IA_TH23	Phase A current 23rd harmonic content
0xA7	167	R	int	D*0.1	RAM_IA_TH24	Phase A current 24th harmonic content
0xA8	168	R	int	D*0.1	RAM_IA_TH25	Phase A current 25th harmonic content
0xA9	169	R	int	D*0.1	RAM_IA_TH26	Phase A current 26th harmonic content
0xAA	170	R	int	D*0.1	RAM_IA_TH27	Phase A current 27th harmonic content
0xAB	171	R	int	D*0.1	RAM_IA_TH28	Phase A current 28th harmonic content
0xAC	172	R	int	D*0.1	RAM_IA_TH29	Phase A current 29th harmonic content
0xAD	173	R	int	D*0.1	RAM_IA_TH30	Phase A current 30th harmonic content
0xAE	174	R	int	D*0.1	RAM_IA_TH31	Phase A current 31th

						harmonic content
0xAF	175	R	int	D*0.1	RAM_IB_THD	Phase B current total harmonic content
0xB0	176	R	int	D*0.1	RAM_IB_TH01	Phase B current 1st harmonic content
0xB1	177	R	int	D*0.1	RAM_IB_TH02	Phase B current 2nd harmonic content
0xB2	178	R	int	D*0.1	RAM_IB_TH03	Phase B current 3rd harmonic content
0xB3	179	R	int	D*0.1	RAM_IB_TH04	Phase B current 4th harmonic content
0xB4	180	R	int	D*0.1	RAM_IB_TH05	Phase B current 5th harmonic content
0xB5	181	R	int	D*0.1	RAM_IB_TH06	Phase B current 6th harmonic content
0xB6	182	R	int	D*0.1	RAM_IB_TH07	Phase B current 7th harmonic content
0xB7	183	R	int	D*0.1	RAM_IB_TH08	Phase B current 8th harmonic content
0xB8	184	R	int	D*0.1	RAM_IB_TH09	Phase B current 9th harmonic content
0xB9	185	R	int	D*0.1	RAM_IB_TH10	Phase B current 10th harmonic content
0xBA	186	R	int	D*0.1	RAM_IB_TH11	Phase B current 11th harmonic content
0xBB	187	R	int	D*0.1	RAM_IB_TH12	Phase B current 12th harmonic content
0xBC	188	R	int	D*0.1	RAM_IB_TH13	Phase B current 13th harmonic content
0xBD	189	R	int	D*0.1	RAM_IB_TH14	Phase B current 14th harmonic content

0xBE	190	R	int	D*0.1	RAM_IB_TH15	Phase B current 15th harmonic content
0xBF	191	R	int	D*0.1	RAM_IB_TH16	Phase B current 16th harmonic content
0xC0	192	R	int	D*0.1	RAM_IB_TH17	Phase B current 17th harmonic content
0xC1	193	R	int	D*0.1	RAM_IB_TH18	Phase B current 18th harmonic content
0xC2	194	R	int	D*0.1	RAM_IB_TH19	Phase B current 19th harmonic content
0xC3	195	R	int	D*0.1	RAM_IB_TH20	Phase B current 20th harmonic content
0xC4	196	R	int	D*0.1	RAM_IB_TH21	Phase B current 21st harmonic content
0xC5	197	R	int	D*0.1	RAM_IB_TH22	Phase B current 22nd harmonic content
0xC6	198	R	int	D*0.1	RAM_IB_TH23	Phase B current 23rd harmonic content
0xC7	199	R	int	D*0.1	RAM_IB_TH24	Phase B current 24th harmonic content
0xC8	200	R	int	D*0.1	RAM_IB_TH25	Phase B current 25th harmonic content
0xC9	201	R	int	D*0.1	RAM_IB_TH26	Phase B current 26th harmonic content
0xCA	202	R	int	D*0.1	RAM_IB_TH27	Phase B current 27th harmonic content
0xCB	203	R	int	D*0.1	RAM_IB_TH28	Phase B current 28th harmonic content
0xCC	204	R	int	D*0.1	RAM_IB_TH29	Phase B current 29th harmonic content
0xCD	205	R	int	D*0.1	RAM_IB_TH30	Phase B current 30th

						harmonic content
0xCE	206	R	int	D*0.1	RAM_IB_TH31	Phase B current 31th harmonic content
0xCF	207	R	int	D*0.1	RAM_IC_THD	Phase C current total harmonic content
0xD0	208	R	int	D*0.1	RAM_IC_TH01	Phase C current 1st harmonic content
0xD1	209	R	int	D*0.1	RAM_IC_TH02	Phase C current 2nd harmonic content
0xD2	210	R	int	D*0.1	RAM_IC_TH03	Phase C current 3rd harmonic content
0xD3	211	R	int	D*0.1	RAM_IC_TH04	Phase C current 4th harmonic content
0xD4	212	R	int	D*0.1	RAM_IC_TH05	Phase C current 5th harmonic content
0xD5	213	R	int	D*0.1	RAM_IC_TH06	Phase C current 6th harmonic content
0xD6	214	R	int	D*0.1	RAM_IC_TH07	Phase C current 7th harmonic content
0xD7	215	R	int	D*0.1	RAM_IC_TH08	Phase C current 8th harmonic content
0xD8	216	R	int	D*0.1	RAM_IC_TH09	Phase C current 9th harmonic content
0xD9	217	R	int	D*0.1	RAM_IC_TH10	Phase C current 10th harmonic content
0xDA	218	R	int	D*0.1	RAM_IC_TH11	Phase C current 11th harmonic content
0xDB	219	R	int	D*0.1	RAM_IC_TH12	Phase C current 12th harmonic content
0xDC	220	R	int	D*0.1	RAM_IC_TH13	Phase C current 13th harmonic content

0xDD	221	R	int	D*0.1	RAM_IC_TH14	Phase C current 14th harmonic content
0xDE	222	R	int	D*0.1	RAM_IC_TH15	Phase C current 15th harmonic content
0xDF	223	R	int	D*0.1	RAM_IC_TH16	Phase C current 16th harmonic content
0xE0	224	R	int	D*0.1	RAM_IC_TH17	Phase C current 17th harmonic content
0xE1	225	R	int	D*0.1	RAM_IC_TH18	Phase C current 18th harmonic content
0xE2	226	R	int	D*0.1	RAM_IC_TH19	Phase C current 19th harmonic content
0xE3	227	R	int	D*0.1	RAM_IC_TH20	Phase C current 20th harmonic content
0xE4	228	R	int	D*0.1	RAM_IC_TH21	Phase C current 21st harmonic content
0xE5	229	R	int	D*0.1	RAM_IC_TH22	Phase C current 22nd harmonic content
0xE6	230	R	int	D*0.1	RAM_IC_TH23	Phase C current 23rd harmonic content
0xE7	231	R	int	D*0.1	RAM_IC_TH24	Phase C current 24th harmonic content
0xE8	232	R	int	D*0.1	RAM_IC_TH25	Phase C current 25th harmonic content
0xE9	233	R	int	D*0.1	RAM_IC_TH26	Phase C current 26th harmonic content
0xEA	234	R	int	D*0.1	RAM_IC_TH27	Phase C current 27th harmonic content
0xEB	235	R	int	D*0.1	RAM_IC_TH28	Phase C current 28th harmonic content
0xEC	236	R	int	D*0.1	RAM_IC_TH29	Phase C current 29th

						harmonic content
0xED	237	R	int	D*0.1	RAM_IC_TH30	Phase C current 30th harmonic content
0xEE	238		int	D*0.1	RAM_IC_TH31	Phase C current 31th harmonic content
...						
0xF2	242	R/W	int	D*1	COMM_ADDR	External communication address
0xF3	243	R/W	int	D*1	COMM_BAUD	External communication baud rate
0xF4	244	R/W	int	D*1	COMM_DATA	External communication data format
0xF5	245	R/W	int	D*1	CT_MULT	CT ratio of incoming cabinet
...						
0xF7	247	R/W	int	D*1	ALM1_HL	Alarm 1 type
0xF8	248	R/W	int	D*1	ALM1_SET	Alarm 1 item
0xF9	249	R/W	int	D*1	ALM1_VALUE	Alarm 1 value
0xFA	250	R/W	int	D*1	ALM1_DELAY	Alarm 1 delay
0xFB	251	R/W	int	D*1	ALM2_HL	Alarm 2 type
0xFC	252	R/W	int	D*1	ALM2_SET	Alarm 2 item
0xFD	253	R/W	int	D*1	ALM2_VALUE	Alarm 2 value
0xFE	254	R/W	int	D*1	ALM2_DELAY	Alarm 2 delay
0xFF	255	R/W	int	D*1	SET_YEAR_MONTH	Time year|month
0x100	256	R/W	int	D*1	SET_DAY_HOUR	Time date|hour
0x101	257	R/W	int	D*1	SET_MIN_SEC	Time minute|second
0x102	258	R/W	int	D*0.1	TQMX_SET	Switching threshold limit
0x103	259	R/W	int	D*0.1	TQ_YS	Switching delay
0x104	260	R/W	int	D*0.001	PH_SET	Target power factor

0x105	261	R/W	int	D*1	CYC_EN	Steady-state cyclic enabling
0x106	262	R/W	int	D*1	CTL_CYC	Steady-state cycle time
0x107	263	R/W	int	D*1	ZTYS	Re-switch delay
0x108	264	R/W	int	D*1	CONC_K	Capacitance attenuation coefficient
0x109	265	R/W	int	D*1	P_U_EN	Voltage protection
0x10A	266	R/W	int	D*1	P_U_MIN	low-voltage protection
0x10B	267	R/W	int	D*1	P_U_MAX	over-voltage protection
0x10C	268	R/W	int	D*1	P_THD_IMAX	Harmonic current protection
0x10D	269	R/W	int	D*1	P_THD_UMAX	Harmonic voltage protection
0x10E	270	R/W	int	D*1	CTL_MODE	Compound mode
0x10F	271	R/W	int	D*1	CTL_ZHBL	Total and phase percent
0x110	272	R/W	int	D*1	CONC1	Capacitor # 1 capacity
0x111	273	R/W	int	D*1	CONC2	Capacitor # 2 capacity
0x112	274	R/W	int	D*1	CONC3	Capacitor # 3 capacity
0x113	275	R/W	int	D*1	CONC4	Capacitor # 4 capacity
0x114	276	R/W	int	D*1	CONC5	Capacitor # 5 capacity
0x115	277	R/W	int	D*1	CONC6	Capacitor # 6 capacity
0x116	278	R/W	int	D*1	CONC7	Capacitor # 7 capacity
0x117	279	R/W	int	D*1	CONC8	Capacitor # 8 capacity
0x118	280	R/W	int	D*1	CONC9	Capacitor # 9 capacity
0x119	281	R/W	int	D*1	CONC10	Capacitor # 10 capacity
0x11A	282	R/W	int	D*1	CONC11	Capacitor # 11 capacity
0x11B	283	R/W	int	D*1	CONC12	Capacitor # 12 capacity
0x11C	284	R/W	int	D*1	CONC13	Capacitor # 13 capacity
0x11D	285	R/W	int	D*1	CONC14	Capacitor # 14 capacity
0x11E	286	R/W	int	D*1	CONC15	Capacitor # 15 capacity

0x11F	287	R/W	int	D*1	CONC16	Capacitor # 16 capacity
0x120	288	R/W	int	D*1	CONC17	Capacitor # 17 capacity
0x121	289	R/W	int	D*1	CONC18	Capacitor # 18 capacity
0x122	290	R/W	int	D*1	CONC19	Capacitor # 19 capacity
0x123	291	R/W	int	D*1	CONC20	Capacitor # 20 capacity
0x124	292	R/W	int	D*1	CONC21	Capacitor # 21 capacity
0x125	293	R/W	int	D*1	CONC22	Capacitor # 22 capacity
0x126	294	R/W	int	D*1	CONC23	Capacitor # 23 capacity
0x127	295	R/W	int	D*1	CONC24	Capacitor # 24 capacity
0x128	296	R/W	int	D*1	GB_CNT	Total compensation loops
0x129	297	R/W	int	D*1	FB_CNT	Phase compensation loops