



REMOTE DIGITAL CONTROLLER SHM-K USER'S MANUAL

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Shanghai Huaming Power Equipment Co., Ltd.

Catalogue

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1. Overview

SHM-D Transformer OLTC motor drive unit is a type of new generation intelligent products with independent intellectual property by Huaming, which consists of SHM-LC local control module(short for SHM-LC) and SHM-K remote digital controller(short for SHM-K) and other components.

SHM-K equipped with high-resolution touch screen, CPU is made from ARM9 chip, clocked 400M, FLASH 256M, RAM 64M, with a very fast speed and huge memory space. Through the optical fiber, it is communicates with the SHM-LC on both ways.

It can works under five working mode:

- ① manually independent regulator;
- ② automatic independent regulator;
- ③ manual regulator in parallel host mode;
- ④ automatic regulator in parallel host mode;
- ⑤ parallel slave regulator mode.

2. Technical specification

■ Receive information

Sampling voltage can be continual adjusting from 80V to 450V the position information from SHM-LC, including variety of working conditions and the operating temperature etc.,from SHM-LC and the transformer.

■ Send message

Send the “raise, stop, lower” command to SHM-LC to control the OLTC motor drive unit.

■ Automatic regulation (Option function)

- Sample bus voltage 0-400V or current 0-5A as a reference and set it as a default voltage.
- The setting voltage value can be set up to 120% of the nominal voltage of the bus bar.
- Adjust the accuracy from 0% to 10.99%, the default value is 5.00%.
- The maximum value of the upper limit is 130% of the setting value, the minimum value of the lower limit is 70% of the setting value.
- Adjust delay time from 10s to 180s, the default value is 30s. If the sampling value is beyond the setting value accuracy range and the value does not exceed the range of the upper and lower limit, when the set delay time is over, SHM-K will operate to the next position automatically.

■ Parallel regulation (Option function)

Supports up to 12 sets of SHM-K controllers to do parallel regulation.

■ Other features

- the database of operation history, record the local, remote, CNC operations.
- network communication functions can be carried out with other devices.

- RS485 communication with Huaming a variety of tap position transmitter and output of various forms of tap position information.
- BCD output tap position information (dry contact output can be defined as other content, see 6.3.6).
- support “raise , stop, lower” operation by external controller button.
- LCD touch screen

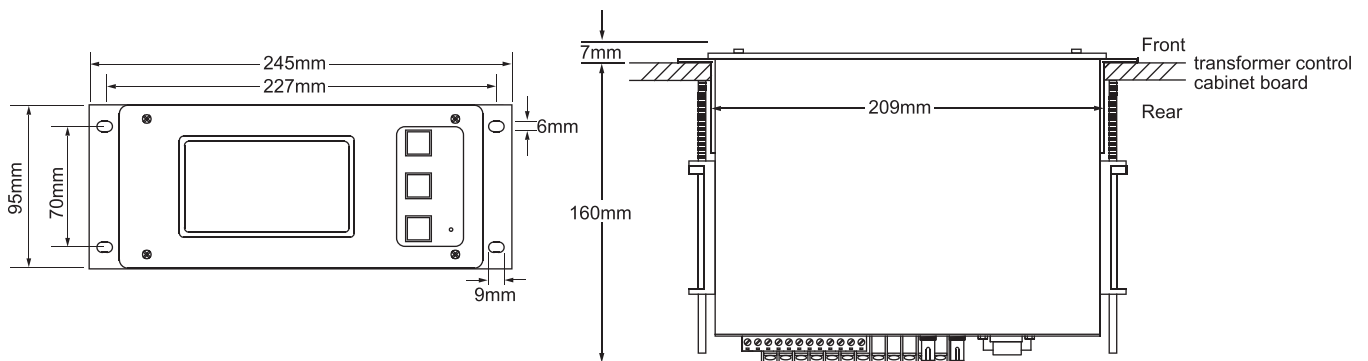
3 Technical specification

| | |
|------------------------|---|
| Power supply | AC 85 ~ 264V AC: 50 / 60HZ, DC 100V ~ 250V |
| Consumption | About 7W |
| CPU | ARM9,32bit,clock 400M |
| Main bus structure | AMBA |
| Memory | 256MB FLASH,64MB SDRAM |
| Operating system | Linux 2.6.30.4 |
| Switch output | Passive, relay output, contact capacity: 5A250VAC,5A30VDC One way running signal (motor rotation signal), one way 6 digit BCD code position signal(8421 code) , Dry contact output can be defined as other content |
| Status signal input | External lift stop signal, optical isolation> 2500V |
| *1 Analog input | Voltage sample: 0-400V Current sample: 0-5A |
| Statistical functions | Ascending, descending recording, fault recording, log space: 800 |
| Communication function | One fiber optic communication functions: multi-mode, 62.5 / 125μm, ST connector, wavelength 820nm, a maximum transmission distance of 1KM One RS485 communication port (RJ45) More than two for the local control module SHM-LC communication, mutual backup One RS485, 600 ~ 9600bps can communicate with position transmitters and other IDE devices , one RS232 maintenance port One TCP / IP 100M RJ45 Ethernet port *2 Support protocol :IEC60870-5-101,104;SC1801;MODBUS;CDT etc |
| LCD display | LCD 4.3 inch touch screen, 16-bit true color, 320 * 240pixel, 96dpi Tap position display Alarm function: communication failure, local equipment failure Status Display: local, remote / CNC status, hand cranks status, tap position action status, temperature, etc. Log record display Parameter settings |
| Operating Environment | Operating temperature -20 ℃ ~ 70 ℃ , relative humidity ≤RH95% non-condensing |
| Installation | Screen cabinet |

*1 For automatic regulation

*2 For parallel regulation,SHM-K regular version does not have the feature

4 Installation dimension and method

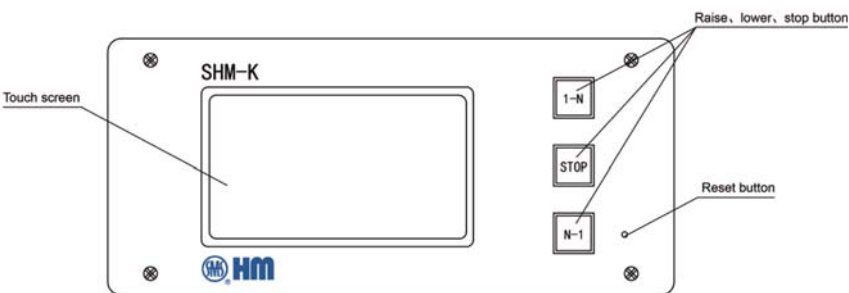


Installation can be done by the screws in front panel, also can be adopted as upper right side of the bayonet lock installation.

Hole size: 210mmx96mm (length X width)

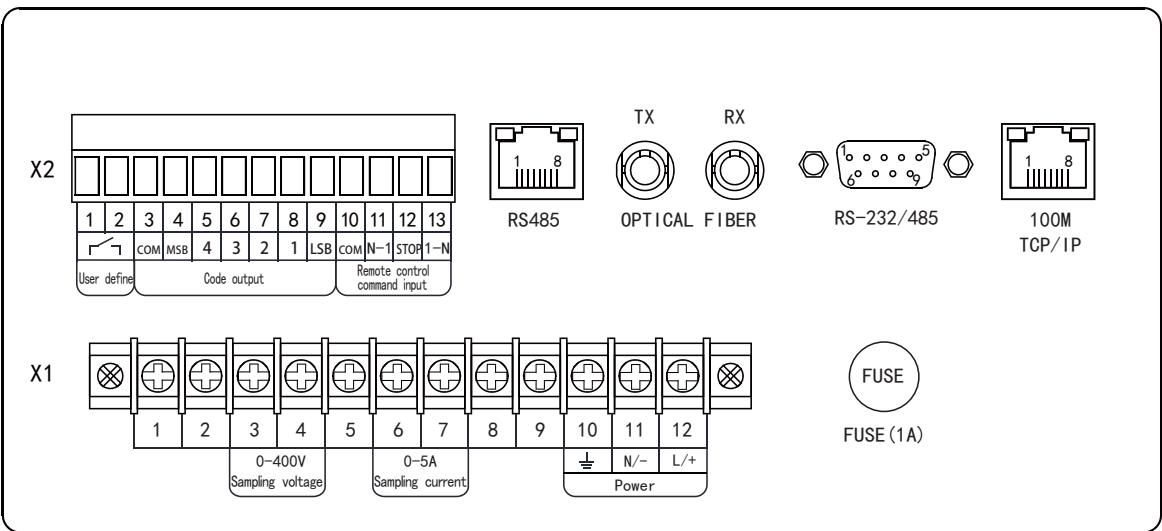
5 Panel and interface

Front panel



Reset button can be used for remote controller restart

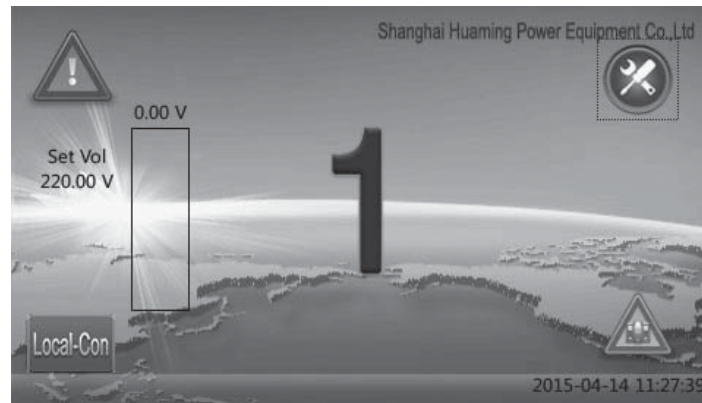
Real panel



Connection diagram see section 7

5.1 Touch screen interface






After the SHM-K turns on and the initial picture appears, need to wait the program load finish, about 10 seconds, the main interface will display.



On the lower right corner it shows local time.

Motor drive unit's operation is divided into three types, local, remote, CNC, it can be choose via the local side switch. when this switch is in the "CNC" status, it means by SHM-K front panel "raise, stop, lower" button or external signal of "raise, stop, lower" input on the back panel can control the operation of the MDU.

At this point the SHM-K's screen lower left corner mark indicates the current mode of operation:

- ① manually independent regulator 
- ② automatic independent regulator 
- ③ manual regulator in parallel host mode 
- ④ automatic regulator in parallel host mode 
- ⑤ parallel slave regulator mode 

When the OLTC is on other working mode, the mark shows  Which means SHM-K operation is invalid.



This is a fault symbol of communication, when the local control module lost communication this mark blinks.



This is a symbol of maintenance. When the MDU hand crank inserted, or the sensors, Hall element's information is abnormal, then this marks appears.

On the middle of the Interface displays the current tap position. When it is changing the tap position, it will shows the " upward, downward" arrow on the right side of the tap position, indicating that 1-N / N-1 tap position changing is happening.

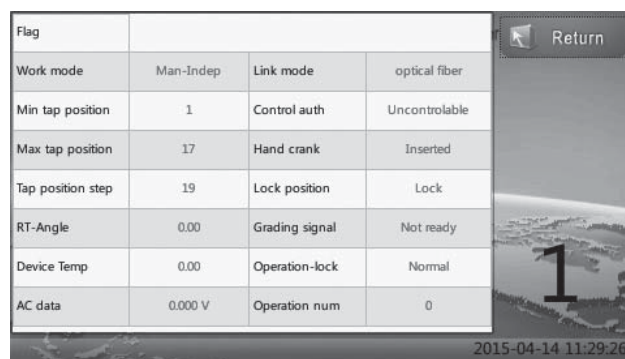
When the SHM-K works under automatic regulation mode, on the left of tap position, it will display the current sample

electric quantity by column chart, the left bar chart shows the reference electric quantity, the upper side display the real time value of current sample electric quantity, when the sample electric quantity is within set up value without voltage regulation, the column chart display in green, if exceed the adjust accuracy, display in red, if exceed time beyond set up delayed time, it will do auto voltage regulation.

SHM-K can add some special function such as synchronously unlock, parallel unlock and so on, and the interface will be adjusted accordingly by user's requirement.

After touching the tap position, it will display the working status, sample screen appears as follows:

5.2 Detail screen




| Flag | | | |
|-------------------|-----------|----------------|----------------|
| Work mode | Man-Indep | Link mode | optical fiber |
| Min tap position | 1 | Control auth | Uncontrollable |
| Max tap position | 17 | Hand crank | Inserted |
| Tap position step | 19 | Lock position | Lock |
| RT-Angle | 0.00 | Grading signal | Not ready |
| Device Temp | 0.00 | Operation-lock | Normal |
| AC data | 0.000 V | Operation num | 0 |

Return

2015-04-14 11:29:26

On the screen lower right corner it shows the current tap position, click the “return” button on the upper right corner can return to the main interface.

When SHM-K working mode is parallel host mode, below the the “return” button it will appear  Switch Button, press it you can check the status of the slave machines connected with the SHM-K in parallel.

● Working mode

Setting the remote controller to display the current operating mode. There are five working condition,

- ① manual-independent
- ② automatic-independent
- ③ manual -parallel host
- ④ automatic-parallel host
- ⑤ parallel-slave

● Link mode

Displays the current settings of the remote controller communication mode, usually optical

- Min tap position: Minimum value of motor drive unit
- Max tap position: maximum value of motor drive unit
- Tap position step

It shows the tap positions between the total minimum to maximum number of tap position (including the constant tap position). For example, 17 tap position OLTC, the tap position 9 is constant tap position, when it is 9a, 9b, 9c, the tap position step size is 19.

● Control authorization

Indicates whether the current operation can be controlled by the SHM-K such as raise, stop, lower, if yes, it is

controllable, otherwise it is uncontrollable.

- Hand cranks

Indicates the hand crank status, it has two status, inserted and not inserted.

- Locked position

It has locking and unlocking two types of status, Locking refers to the MDU is locked by external protection device locking, then at this time the MDU can not be operated the action of "raise, stop, lower" (unless operated via hand crank)

- Grading signal

Two types of running status and ready status. Run status refers to the motor rotate and the tap position is switching, Ready status refers to the tap position is in position.

- Equipment Temperature: sample temperature inside SHM-LC.

- External Temperature: The MDU's outside temperature sensor feedback temperature.

- AC data: When it works on auto regulation mode, the real time sampling value will adopt the calculated electric quantity value

- Operation count: The total number of operations.

- Real-time Flag: Displays the current real time status of the electric sector, including alarms, operating status, etc.

The following is the mark may appear on the screen in real-time content list.

| | |
|------------------------------|--|
| Sensor alarm | This status shows hardware error |
| Hall alarm | This status shows hardware error |
| Configuration error | MDU configuration error or illegal |
| Manually clear the error | Status error, need engineer |
| On Configuration | The MDU is under configuration |
| Test mode | The MDU is under testing |
| Motor release | This status shows the motor release signal is output |
| Filters work | This status shows the filter working status signal is output |
| Cam signal | It shows the cam signal is output |
| Rise | The MDU tap position is rising |
| Decline | The MDU tap position is declining |
| Min tap position | |
| Max tap position | |
| OverVolt | |
| UnderVolt | |
| Parallel communication error | As a mater, will not be able to get the slave working status so at this moment, parallel operation is not workable. |
| Parallel status error | As a master, judged that the slave tap position or working status is not consistant with the master. So at this moment, parallel operation is not workable. |


5.3 Log screen



It is the log record mark, after touching can check the history, also can check the local/remote operation history, fault information. etc 800 items, when it is more than 800, the new record will cover the old one in chronological sequence

| | Time | Event | |
|---|---------------------|------------------------|---------------------|
| 1 | 2015-04-14 12:25:04 | Comm offline | Return |
| 2 | 2015-04-14 12:23:01 | Tap change to 10 | |
| 3 | 2015-04-14 12:22:55 | Tap change to 9C | Previous |
| 4 | 2015-04-14 12:22:50 | Remote-raise operation | Next |
| 5 | 2015-04-14 12:22:48 | Tap change to 9B | |
| 6 | 2015-04-14 12:22:43 | Tap change to 9A | |
| 7 | 2015-04-14 12:22:38 | Remote-raise operation | Empty |
| | | | 2015-04-14 12:25:31 |

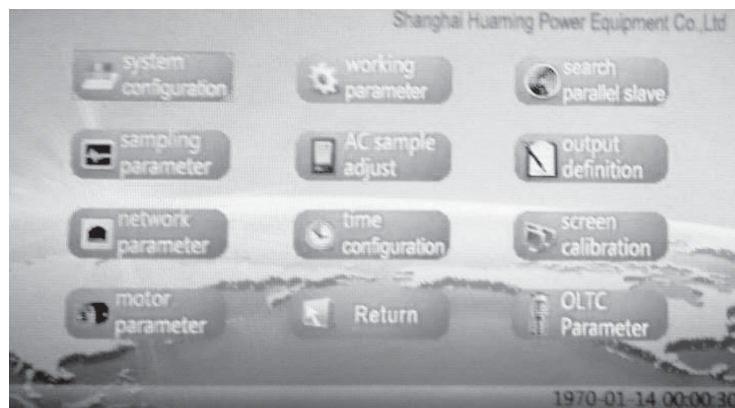
6 Parameter setting

Press the sign  on the upper right corner of the display interface then enter the setting menu for parameter setting.

For regular using, it is not necessary to set.

6.1 Main-menu

Select the parameters for modifying as in the below picture (it may be a little different because of the varieties requirements) and some of them are encrypted which means it is not allowed to modify.



'Motor Parameter' and 'OLTC Parameter' are extended functions which do not involve OLTC parameter setting.

(1) System configuration

The way to obtain the SHM-LC real time data and the communication parameters with the SHM-LC.

(2) Working parameter

It is mainly to set up equipment working mode and related parameters.

(3) Search parallel slave

When the SHM-K is operating in parallel host mode (including manual or automatic mode), you can dynamically obtain the IP address from which the current link has been set on the parallel slave mode SHM-K.

(4) Sampling parameter

When the SHM-K is set to work in automatic mode (including parallel or independent way), you need choose one parameter from the bus 3 phase voltage, current in a total of six parameters as regulator reference, and modify the regulation parameters.

(5) AC sample adjust (for factory commissioning, operation is not recommended)

When in automatic mode (including parallel or independent way), within a fraction of the demand can adjust the device settings work sampling precision reference voltage or current reference, the general sampling accuracy is within 2‰.

(6) Output definitions

According to user's demand, the 7-way switch outputs can be defined on the back of the device. The default six tap position output is BCD code output, one way of running signal output.

(7) Network parameter

Set up the network address and the parameters of the equipment. through each device communication links and require communication port settings, such as the host and slave devices when it's working under parallel mode, via the network port for each device expansion. The network address must be routed to each other, but are not limited to the same LAN.

(8) Time Settings: Set the device time.

(9) Screen calibration: Adjust the touch screen accuracy. Not recommended for the user to adjust.

6.2 Quick setup guide

The procedure of setting up the parameters for normal use.

Auto voltage regulation parameter set up

- ① Set up the sampling parameters menu
- ② Setup working parameters menu

Voltage regulation on parallel , the host and slave devices parameter set up

- ① Set up working parameter menu
- ② Set up network parameter menu
- ③ If host device is automatic regulation mode, then follow above auto regulation procedure.
- ④ After the host, slave device set up finished, host device enter the search parallel slave menu, search all the slave device's network address, confirm all the slave devices connect correctly.

External tap position transmitter.

Enter the system configuration menu, local expansion set up is turned on.

6.3 Sub-menu

Next, please see a detailed description of each sub-menu

In the sub-menu, use the interface up and down or left and right buttons to select items in most cases, use the + or press the drop-down list box on the interface to modify the parameters.

• refers to confirm, refers to cancel.

6.3.1 System configuration

System configuration screen have a total of six pages.



The way of linking: It is used to obtain real-time data from the MDU. The default mode is by optical fiber. A total of four modes can be selected: optical fiber, optical fiber mode 2, the fiber mode 3, the network synchronization.

Optical fiber mode refers to the current SHM-K connected with MDU by optical fiber , it receives the data transmission from the MDU and operate the MDU.

Optical fiber mode 2 and mode 3 is for special way, refers to the current SHM-K simultaneously connect with 2,3 MDU via optical fiber, and operate them (typically used for large transformers).

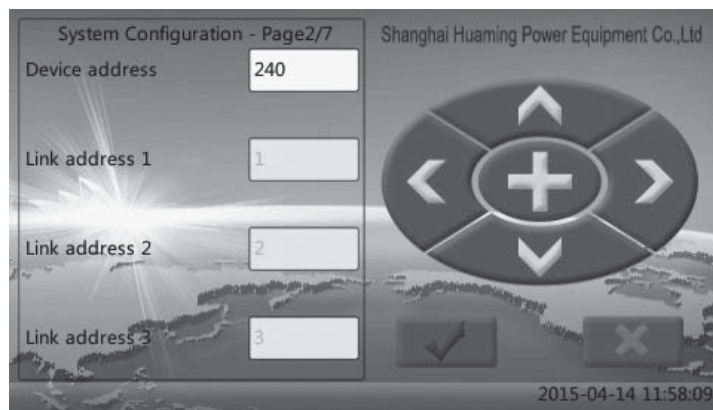
Network synchronization refers to the current SHM-K is not directly connected to the MDU. It is connect with destination SHM-K by network port which transmit the data of the MDU, and can also operate this MDU. Mainly used as an expansion of other SHM-K, also used for remote control and remote monitor.

Authorization of operating the MDU, when destination SHM-K and network synchronized SHM-K are set to manual mode, prior to the operation as a priority. Under other operation mode, destination SHM-K is prior to the network synchronize SHM-K. then at this moment the network synchronize SHM-K can only display the data, or just for data expansion.

Local Expansion: The default is disable, if you need to expand the tap position transmitter, then turn on the option to “enable”, Set the RS485 port output the CDT protocol, and transfer the tap position information to tap position transmitter. Usually it will be used when there is not enough output terminals on the back of the device, for expansion.

Network Expansion: The default is disable, if you have other devices need to get the status of the device through the network, then the port should be open for other user to visit. Currently the supported protocols are IEC104 and Huaming user defined, Please select Huaming user defined. so that other SHM-K will be able monitor the operation remotely (need to set the distant link mode on the network synchronization). If you choose to IEC104 protocol, it only used for provide RTU or remote scheduling use.

The following three screens are used for setting up the optical parameters and the optical way of linking between SHM-K and the MDU.



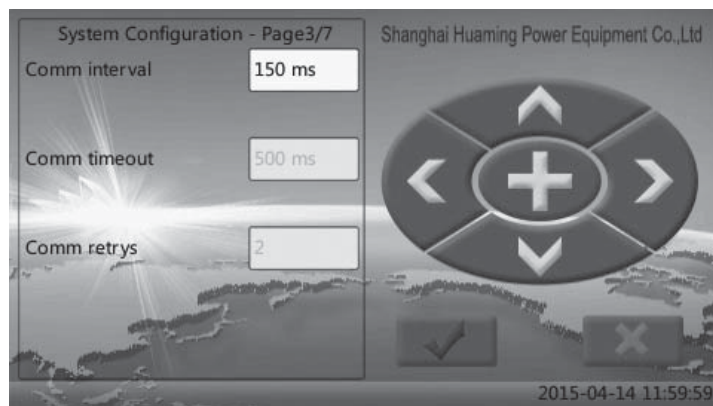
Device address: Set up SHM-K communication protocol's device address, the default value is OK.

Link address: must be compatible with the remote controller's address. SHM-K module default address is 1.

When on optical fiber mode, only address 1 is valid.

When on optical fiber mode 2, address 1 and address 2 will be effective, normally it is 1, 2.

When on optical fiber 3 mode, both address 1 and 2 is valid, normally it is 1,2,3.



Communication interval: it shows the shortest time difference between the two communications

Timed out (ms): when the checking command is placed, if exceed this data, then can judge the MDU is no responding

Retry number: when the inquiry is failed, after several times failed inquiries, then can judge the MDU is offline.



Set up the optical fiber communication parameters, normally use default value is OK.



When the way of linking is network synchronization, then this screen is to set up the destination SHM-K's network address and its communication parameters. When the way of linking is optical, the parameter is not meaningful. The destination SHM-K must open the network expansion function and the protocol must be Huaming user defined.



When turn on the local expansion function, it is used for setting up the CDT protocol communication parameters. If the local expansion not opened, the parameter is not meaningful.

6.3.2 Working parameter



Working Mode

The remote controllers currently have 5 options of working mode, they are manual - independent, automatic - independent, manual - parallel, automatic - parallel, parallel - slave.

The following five projects are related to automatic regulator function, and if the device does not work in the automatic voltage regulator mode then the parameters is not meaningful.

Delay time

Regulator reference data overrun a period of time to carry out an automatic regulator operation. Adjustment range is from 10s-180s, default is 60s.

Regulator reference

Can choose one of the bus 3 phase voltage, current in a total of six parameters as regulator reference, generally choose the default A-phase voltage, indicating that the equipment have calculated the sampling value of the parameter and compared with upper and lower limits, the adjustment accuracy, and thus determines whether the regulator operation should be done.

Adjustment accuracy, the upper and lower limits

Adjustment accuracy range is from 0.00%-10.99%, default is 6.00%

The upper and lower limits data filled here is the value of the regulator reference should be on the primary side.

Voltage exceeds the upper / lower limit, the device is on over voltage condition, the system alarms.

Voltage beyond the adjustment accuracy, below the upper limit, the device is in a state of over regulation, then it will do the down regulation

If voltage below the adjustment accuracy, above the lower limit, the device is in a state of need regulation, then it will do the upper regulation.

For the current it is the same.

Note: The reference data, the upper and lower limits must match the selected regulator reference.

6.3.3 Sampling parameter



When the system is operating in auto voltage regulation mode, the screen is used to set the parameters in compliance with AC-tuning to ensure the accuracy of the data.

Sampling switch: When the equipment required operating in auto voltage regulation mode, and the associated hardware have been installed, you need to turn on sampling switch.

Sampling Phase: The system can sample three-phases, ABC, each phase's current and voltage values can be sampled, generally on auto voltage regulation mode, it only requires one phase voltage value.

Voltage nominal value: Fill the primary circuit value, for example 35kVde transformer, then it should fill 35 kv.

Current nominal value: Fill the primary circuit value, for example 600A, it should only fill 600A.

PT CT secondary circuit of the device default is 100V 5A, if you need to change or re-definition, please indicate when ordering.

After modifying the nominal value of the equipment, be sure to enter the working parameters of the interface, and also modify the upper and lower limits.

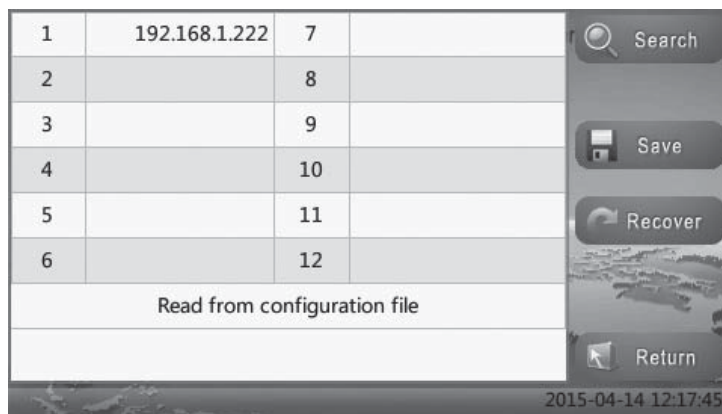
6.3.4 Network parameter



When the SHM-K working under parallel mode or under network synchronization need to set up network address or related parameters, the network address must be routable

6.3.5 Search parallel slave

When the device working under parallel host mode, the system configuration files will read the parallel slave device address, this address can be designated by the user, and written into the configuration files, also can be checked and obtained through this interface by means of auto search.



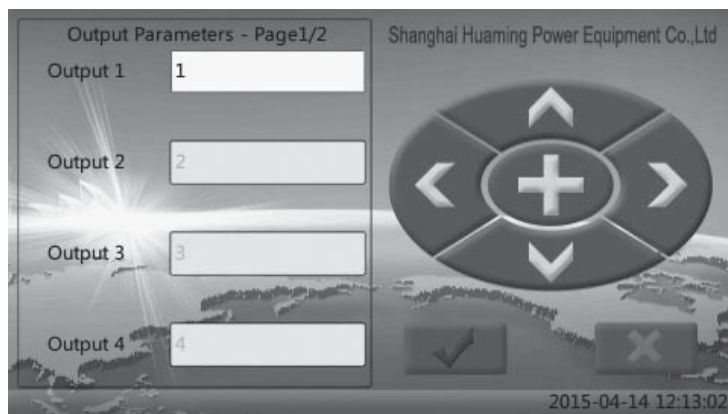
When this interface starts, system will read the default slave address from configuration files. Below the screen it displays “obtain from the files”

Click the search, it will search the slave device network address from the current LAN. The search result will be showed on the picture, the screen will display “obtain from the search”, Note, the SHM-K set up as slave device, its way of connection normally is optical.

Click “save”, it will save the searched result or displayed screen content into the configuration files.

Click “recover”, if any misoperation occurred, then the scanned information will be recovered back to the screen start.

6.3.6 Output definition



The device have 7 relay output interface, supply the passive bus for the user. Can be modified as per user's request.

The default set up is, the first 6 tap position is BCD code, the following one is device working situation.

User can choose the parameters according to the below table.

| | Parameters | | Parameters |
|--|------------|---------------------------------|------------|
| Tap position BCD code output definition the 1st bit | 1 | MDU error signal | 19 |
| Tap position BCD code output definition the second bit | 2 | MDU local control | 20 |
| Tap position BCD code output definition the third bit | 3 | MDU remote control | 21 |
| Tap position BCD code output definition the fourth bit | 4 | MDU working | 22 |
| Tap position BCD code output definition the fifth bit | 5 | MDU Max tap position | 23 |
| Tap position BCD code output definition the sixth bit | 6 | MDU Min tap position | 24 |
| Tap position BCD code output definition the seventh bit | 7 | MDU rising movement | 25 |
| Step position BCD code output definition the 1st bit | 8 | MDU lower movement | 26 |
| Step position BCD code output definition the second bit | 9 | MDU cam signal , lacking signal | 27 |
| Step position BCD code output definition the third bit | 10 | MDU filter output signal | 28 |
| Step position BCD code output definition the fourth bit | 11 | MDU motor release signal | 29 |
| Step position BCD code output definition the fifth bit | 12 | MDU auto run signal | 30 |
| Step position BCD code output definition the sixth bit | 13 | MDU configuration situation | 31 |
| Step position BCD code output definition the seventh bit | 14 | MDU clear error situation | 32 |
| MDU communication online situation | 15 | MDU configuration error | 33 |
| MDU hand crank | 16 | MDU Hall component error | 34 |
| MDU controllable | 17 | MDU sensor error | 35 |
| MDU grading signal | 18 | MDU cam lacking error | 36 |

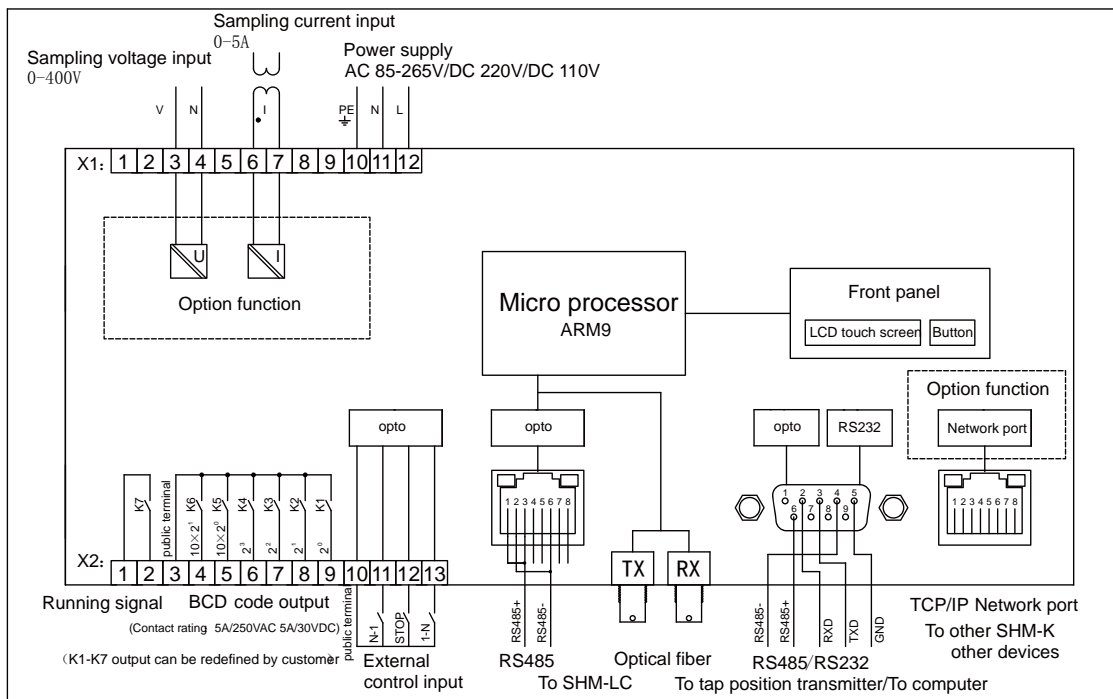
| | Parameters | | Parameters |
|---|------------|---|------------|
| Control device error | 37 | Tap position Gray Code output definition the sixth bit | 57 |
| Tap position binary code output definition 1st bit | 38 | Tap position Gray Code output definition the seventh bit | 58 |
| Tap position binary code output definition second bit | 39 | Step position Gray code output definition the 1st bit | 59 |
| Tap position binary code output definition third bit | 40 | Step position Gray code output definition the second bit | 60 |
| Tap position binary code output definition fourth bit | 41 | Step position Gray code output definition the third bit | 61 |
| Tap position binary code output definition fifth bit | 42 | Step position Gray code output definition the fourth bit | 62 |
| Tap position binary code output definition sixth bit | 43 | Step position Gray code output definition the fifth bit | 63 |
| Tap position binary code output definition seventh bit | 44 | Step position Gray code output definition the sixth bit | 64 |
| Step position binary code output definition the 1st bit | 45 | Step position Gray code output definition the seventh bit | 65 |
| Step position binary code output definition the second bit | 46 | Synchronously unlock | 66 |
| Step position binary code output definition the third bit | 47 | Automatic voltage regulation, overvoltage output | 67 |
| Step position binary code output definition the fourth bit | 48 | Automatic voltage regulation, undervoltage output | 68 |
| Step position binary code output definition the fifth bit | 49 | Automatic voltage regulation, overregulation output | 69 |
| Step position binary code output definition the sixth bit | 50 | Automatic voltage regulation, underregulation output | 70 |
| Step position binary code output definition the seventh bit | 51 | Parallel communication error | 71 |
| Tap position Gray Code output definition the 1st bit | 52 | Parallel status error | 72 |
| Tap position Gray Code output definition the second bit | 53 | Synchronous unlock status-a | 73 |
| Tap position Gray Code output definition the third bit | 54 | Synchronous unlock status-b | 74 |
| Tap position Gray Code output definition the fourth bit | 55 | Synchronous unlock status-c | 75 |
| Tap position Gray Code output definition the fifth bit | 56 | | |

6.3.7 Time setup



System time setup , select the year, month, day ,hour, minute, second by press left, right button, and upper and lower buttons to increase or decrease. The setup of timing can help the user to know the working record of the motor drive unit from the history log.

7 Connection diagram



- Power Supply AC 85 ~ 265V or DC 110V, 220V input

AC input terminals L and N respectively refers to the AC power supply's live line and neutral line terminals. When it is the DC input +, - can be any connection.

- All communication with the outside world ports will have optical or electromagnetic isolation;

- Network 100M TCP / IP port, support IEC104 protocol, etc., connected with other SHM-K coupled to achieve parallel operation function, but also with other devices (IDE) connection;
- Communication with SHM-LC by optical fiber, default speed is 4800 bps;
- Communication with tap position transmitter by RS485. by our various models of one or more transmitters will send the tap position signal through BCD code, resistance, 4-20mA other forms of output to meet the needs of users;
- RS232 maintenance port connected to your computer for program downloading, maintenance;
- SHM-K comes with BCD code tap position signal and running signal output (ie, the motor rotation signal) for relay contact outputs. The output can also be customized defined as dry contact output for other content.
- SHM-K supports external button, can be upgraded via external button to operate the MDU do the "raise, lower, stop" action.
- The bus voltage, bus current can be entered into the SHM-K through PT / CT for automatic regulator function.

8 Announcements

The environment temperature will not exceed $-25\text{ }^{\circ}\text{C} \sim 65\text{ }^{\circ}\text{C}$, if working in harsh environments need to be specially ordered.

The environment of using (surrounding) the relative humidity should be below 95%, and no condensation.

If it has a lot of dust and other metal dust occasions, please install protective box or protective cabinet.

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