BUENO ELECTRIC

BEPR- 811U
Digital Line Protection device
Technical Manual & Operation Manual

V2.00

Contents

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Part 1
Technical Manual
（**06.2012**）

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1. Brief Introduction

The **BEPR- 811U** Digital Line Protection is a packaged line protection basically configured of current, voltage and 3-phas e reclosing relays. It is applicable for the distribution lines at the voltage levels of 66kV or less.

The protection device adopts perfect software synchronous sampling technology, control on both sides of the sample synchronization error less than 4 degrees, improve the differential protection action precision.

Two fundamental CPU modules are provided. One of them is a relay constructed of the 32-bit microprocessors. This unit is fitted with the large volume RAM and Flash Memory, and is powerful enough to carry out data processing, logic calculation and information storage. Another CPU is a general man-machine interface constructed of a single-chip computer. Two CPUs are independent to each other. All protection and automation functions are implemented by software. The logic relations in protection comply with the principle of "four unification "

1) Features:

- All English character LCD display, and clear and easy man-machine interface.
- The precision of the selected measuring modules (including KWH metering) can reach to the class 0.5.
- To provide access to the accumulated pulse-degree side.
- High speed Ethernet interface is provided to integrated the IEC 870-5-103 standard communication protocol.
- High precision clock chips are used. The GPS time checking circuit is provided to realize the clock synchronism of the whole system.
- High speed Ethernet interface is provided to integrated the IEC 870-5-103 standard communication protocol.
- The core of CPU, the protection functional module is the powerful 32-bit micro- processors with large capacity RAM and Flash Memory. They are powerful to process data, perform logic calculation and store information. 8 to 50 recorded reports and 1000 events can be recorded. These information will not be lost even in power interruption.

2) Complete protection function configuration

Table 1 Types and functional configuration of this series products

Function	BEPR- 811U

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Phase current differential		
P-p directional current zones II, III		√
Zero-sequence directional current zone II, III		√
Current inverse time-limit		√
Zero-sequence inverse time-limit		√
Directional blocking		√
Voltage blocking		√
3-phase reclosing	Synchronism or no voltage	√
	Asynchronism	√
2nd shot reclosing		√
acceleration	Pre-acceleration	√
	Post-acceleration	√
	Manual closing acceleration	√
LF, LV load shedding		√
Overload		√
Telecontrol function pressure plate		√
Telemeter	Measurement TA	alternative use
	Protection TA	alternative use
Telesignal		alternative use
Telecontrol		alternative use
KWH	KWH measurement	√
GPS time-checking		√
False blocking prevention		√
Remote management		√

3) **Monitoring**

- Telemeter:Ia, Ib, Ic, Ua, Ub, Uc, P, Q, f and other analog telemetry

- Telecontrol:Division and the normal remote control circuit breaker

- Telesignal:16way telesignalling open into the volume of the collection, installation of remote signal deformation, events, letters and other remote

Contact: sales@bueno-electric.com

- Remote pulse: 2-way electric-degree pulse input
- Out: Device has a 13 way out, of which 10 road trip because of the export-driven relay, 3-way signal drive for the notice of police.
- GPS time-checking

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2. Technical Parameters

2.1 Rated parameters

2.1.1 Rated D.C. voltage : 220V or 110V (as required)

2.1.2 Rated A. C. data

a) Phase voltage $\qquad$ $100/\sqrt{3}$ V

b)Tapped voltage of the line: 100V or $100/\sqrt{3}$ V

c) A.C current $\qquad$ 5A or 1A(as required)

d) Rated frequency $\qquad$ 50 Hz

2.1.3 Power consumption :

a) D.C circuit $\qquad$ normal : not larger than 25W

operation: not larger than 40W

b) A.C voltage circuit not larger than 0.5VA for each phase

c) A.C current circuit not larger than 1VA for each phase (for 5A rating)

not larger than 0.5VA for each phase (for 1A rating)

2.1.4 Status voltage :

Input voltage to CPU and signal interface 24V (18V~ 30V)

Input voltage to GPS time checking 24V (18V ~ 30V)

Output status (optic coupled output) permissive voltage 24V (18V ~ 30V)

driving power 150 mA

2.2 Main technical performance

2.2.1 Operating range for sampling circuits (10% tolerance)

voltage : 0.4V ~120V

current : 0.08In ~ 20In

2.2.2 Contact capacity

current capacity of the signal circuit contact 400VA

arc-breaking capacity of the signal circuit contact 60VA

2.2.3 Tripping and closing current

CB tripping current 0.5A, 1A, 1.5A, 2A, 2.5A, 3A, 3.5A, 4A (as required)

CB closing current 0.5A, 1A, 1.5A, 2A, 2.5A, 3A, 3.5A, 4A (as required)

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2.2.4 Precision of elements

current elements	$\leq \pm 5\%$
voltage element	$\leq \pm 5\%$
synchronism-check angle:	$\leq \pm 1°$
timing element	$\leq \pm 20$ ms
frequency deviation:	$\leq \pm 0.02$Hz
slip rated value:	$\leq \pm 5\%$

2.2.5 Operating Time of the complete protection (including time needed by relay)

Fixed operating time of the instantaneous zone when measured at 1.2 times of setting value: not longer than 40 ms

2.2.6 Precision of measuring circuits for analog variables monitoring device equipped with the special measurement sub-module :

current, voltage :	class 0.2
power, KWH :	class 0.5

2.3   Insulation property

2.3.1 Insulation resistance

Insulating resistance between active parts and passive parts or casings and electrically unrelated circuits is measured by the 500 megaohmmeter to be not less than 50MΩ for the various circuits at different levels under the normal test atmospheric conditions.

2.3.2 Strength of insulating media

Under the normal test atmospheric conditions, the protection can withstand the power frequency withstand voltage test of 50 Hz, 2000V and 1 min. without any breakdown flashover and element damages. During the test, as a voltage is applied at any tested circuit, the other circuits are inter connected and grounded with an equivalent potential.

2.3.3 Impact voltage

Under the normal test atmospheric conditions, the short-duration impact voltage test of 1.2 /50 μs standard lightning wave is done on the power input circuits. AC input circuits, output contact circuit to the ground and between circuits. The open test voltage is 5 kV.

2.3.4 Heat and moisture-proof performance

The protection can withstand the heat and moisture-proof test stipulated in the Chapter 20, GB/T 7261. The alternating heat and moisture-proof test is to be done at the highest temperature +40ºC, the maximum humidity

95%, for 48 hrs and at a cycle of 24 hrs. In 2 hrs before the test is finished, according to the requirements in section 2.3.1, the insulation resistance between the conducting circuits and external passive metals and casings and electrically unrelated parts are measured to be not less than 1.5 MΩ, the withstand voltage strength of the media not less than 75% of the voltage magnitude of the media strength test stipulated in the section 2.3.2

2.4 Electromagnetic compatibility properties

2.4.1 Electrostatic discharge anti-interference

The protection conforms to the standard GB/T17626.2-1998, electrostatic discharge anti-interference test class 4

2.4.2 RF electromagnetic field radiation anti-interference

The protection conforms to the standard GB/T17626.3-1998, RF electromagnetic field radiation anti-interference test class 3

2.4.3 Electric fast transient pulse group anti-interference

The protection conforms to the standard GB/T17626.4-1998, electric fast transient pulse group anti-interference test class 4

2.4.4 Surge(impulse) anti-interference

The protection conforms to the standard GB/T17626.5-1998, surge (impulse) anti-interference test class3

2.4.5 RF field induced conduction interference

The protection conforms to the standard GB/T17626.6-1998, RF field induced conduction interference test class 3

2.4.6 Power frequency magnetic field anti-interference

The protection conforms to the standard GB/T17626.8-1998, Power frequency magnetic field anti-interference test class 5

2.4.7 Pulse magnetic field anti-interference

The protection conforms to the standard GB/T 17616.9-1998, Pulse magnetic field anti-interference test class 5

2.4.8 Damp oscillation magnetic field anti-interference

The protection conforms to the standard GB/T 17626.10, damp oscillation magnetic field anti-interference test class 5

2.4.9 Oscillation wave anti-interference

The protection conforms to the standard GB/T 17626.12-1998, Oscillation wave anti-interference test class 4

2.4.10 Radiated emission value limiting test

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The protection conforms to the standard GB9254-1998, radiated emission value limiting test class A

2.5 Mechanical performance

2.5.1 Vibration

The protection can withstand the impact duration test of the severity class I stipulated in the section 16.2of GB 7261.

2.5.2 Impact

The protection can withstand the impact duration test of the severity class I stipulated in the section 17.4 of GB 7261.

2.5.3 Crash

The protection can withstand the impact duration test of the severity class I stipulated in the Chapter 18 of GB 7261.

2.6 Environment conditions

a) Ambient temperature :

operation : -20ºC~ +55ºC , less than 35ºC after 24 hours operation

storage : -25ºC ~ +70ºC , no exciting variables are applied at the limit value and no irreversible changes occur. The protection will operate normally after the recovery of temperature.

b) Relative humidity : maximum monthly average humidity 90 % at the lowest temperature of 25ºC, (no condensation). At the highest temperature of +40ºC, maximum humidity must not be   over 50 %.

c) Atmospheric pressure : 86 ~ 106 kPa (relative altitude above sea level is less than 2 km).

3 Hardware

High reliability is fully considered both in the overall design and module design. It is reliable in program implementation signal indication and communication. Therefore in the panel-assembling operations or the installation of the protection into the switchboard, no additional AC and DC input anti-interference modules are required.

3.1 Casing structure

On the operation panel, there are the LCD, signal lamps and keyboard. Owing to its enclosed casing, water-proof, dust-free and shock-proof design will ensure its high reliability it even in the worst environmental situations.

3.2 AC modules

AC modules are composed of voltage input and current input modules. The number of the voltage and current input elements varies for the different types of the protections.

The voltage input modules are constructed of the voltage converters, whose input is 100 VAC, output about 3V. The linear range is 0.4V~120V.

The current input modules are constructed of the current converters and parallel-connected resistors. There are three sizes :

1) In=5A : when input is 100A, its output is $5/\sqrt{2}$ V, with 0.2A-100A. linear range

2) In=1A: when input is 20A , its output is $5/\sqrt{2}$ V, with 100mA-20A linear range

3) Ground protective TA: input 5.5A output when the $5/\sqrt{2}$ V, the input linear range 20mA-6A

3.3   CPU module

CPU module is composed of following elements :
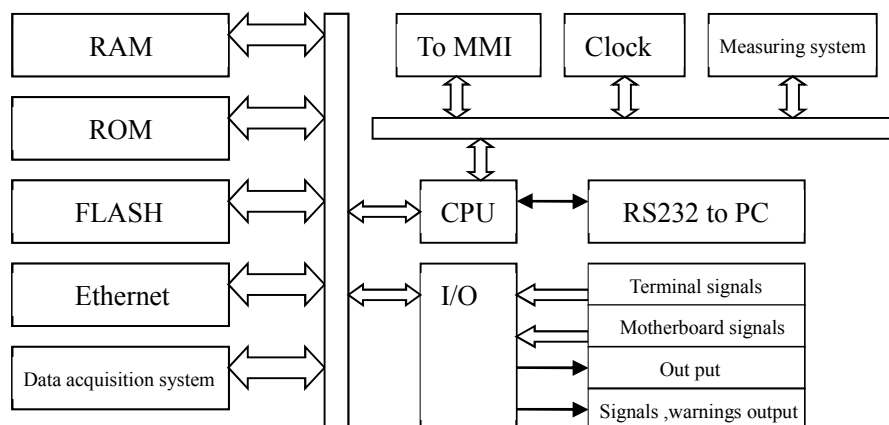
Fig 3-1 Schematic diagram of the CPU module

1) CPU system

CPU system is composed of CPU, RAM, ROM, and Flash Memory. The high-performance 32-bit microprocessor CPU, the large capacity ROM (1M bytes), RAM (1M bytes) and Flash Memory (1M bytes) make the CPU module have a powerful data processing and recording capability and is capable of treating all complicated faults and recording the large member of fault data. The recorded reports in Flash Memory can be 8 to 50, and events that can be recorded are 1000. And information like settings of protection can also be stored in it and will never be lost even in loss of power. Protection programs compiled by language C makes the program

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have a high reliability, high plantability and high maintainability.

2) Data acquisition system

Data acquisition system is composed of two parts.

One of the data acquisition components is the 14-bit A/D converter with multi- switches and filtering circuits. The latest A/D conversion chip contains the sampling hold and synchronism circuit which features more accurate, higher in speed, and less in power consumption and more stable. No adjustable part is installed and no adjustments are necessary at site and highly reliable.
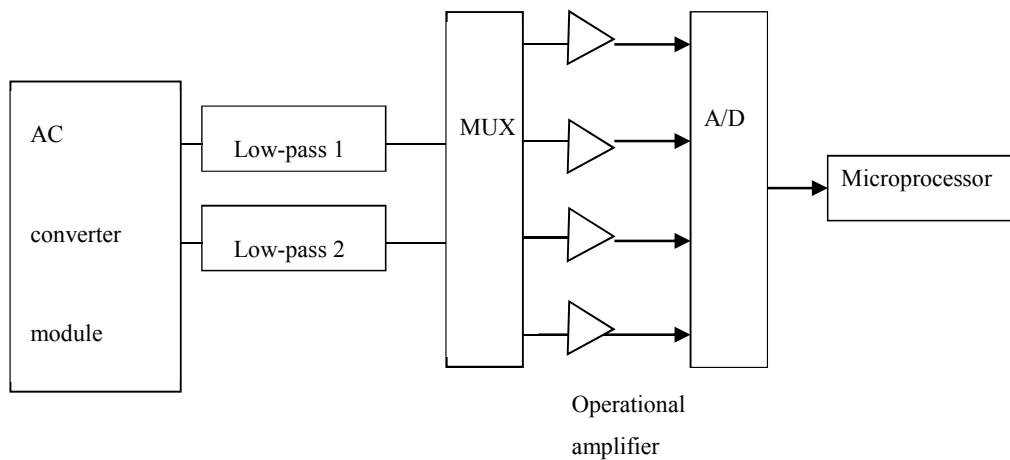
Fig 3-2 Schematic diagram of A / D system

Newly developed high precision 24-bit sample measuring chip is adopted in the measuring system, which eliminates any measuring error caused by fluctuation of frequency without any software. Once the measuring precision is set in a single time, it will automatically get the memory function and it is unnecessary to adjust it at site. This data acquisition system is provided for selection in ordering.

3) Communication

The communication module contains high speed and generally interfaced Ethernet chip which is the main communication interface for the connection of the protection with system. Generally, RJ45 acts as the communication interface UTP5 wire as the media. In the special case, optic fiber communication modules are added as the interface. This nodule is provided for selection and a special order should be tendered.

 4) Clock circuit

The hardware clock circuit is set up in the module.

Besides, the CPU module is constructed of the multi-layer PCBs and surface-sealed in technology. It is

small and compact in structure. The reliability and anti-interference capability of the protection are thus greatly enhanced. For the principle of the CPU module, refer to the appended diagrams.

3.4   Power supply module

This is a DC inverted power supply module 220V or 110V DC voltage input passing through the anti-interference filtering circuit, is converted into two groups of DC voltage: i.e. 5V, 24V, using the inversion principle. They are not in the common ground mode but in the floating ground mode without any connection with the casing.

a)   +5V is used as the CPU power supply

b)   24V is used as the power supply to drive relays and external switch-in variables

In order to improve anti-interference ability of the power supply module, filters were added for DC inputs and 24V power supply for the outgoing terminals. For the principle of the power supply module, see the appended diagrams.
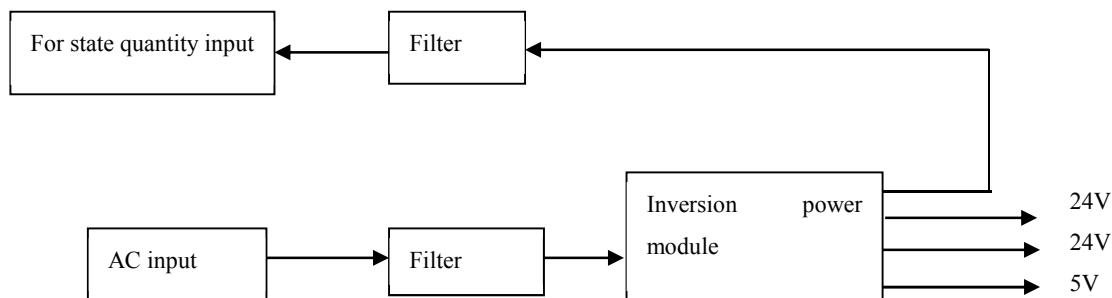
Fig 3-3   Schematic diagram of power supply module

3.5   Man-machine interaction (MMI) module

The man-machine interaction module is a single chip processor with its bus out of core. It is used to display the information from the protection's CPU and scan the key board status and then transmit it to the CPU. So the MMI module is one of its peripherals. The communication between protection's CPU and MMI is made via the SPI interface. It is high in its communication rate (up to 2Mb/s)and quite reliable. This configuration not only frees from the heavily outgoing of the CPU bus to enhance the reliability, but almost does not add the cost to lift the performance-price ratio of the protection.

The display window of the module uses the LCD unit of 4 lines and 12 English characters for each line. The man-machine interface is clear to see and easy to understand. It is provided with a general keyboard

operation for BEPR- series protections to make the MMI feasible and simple. At the same time, in view of the operating features of the LV protection, the sufficient lighting indication facilities are provided to make the operating information more visible. The MMI interface and feasible operating circuit have greatly riched the selection of the operating modes at site

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4. Principle of Protection

Since the 32-bit micro-processors are adopted, the operational speed is greatly increased. In this system, no starting element is provided and all the computations for the elements are made in real-time, which simplifies protection logic and makes the protection more reliable. There are five output circuits. User's output logic requirements can be satisfied by amending the protection logic diagram. The protection has an operation circuit of its own which is corresponding to the protection output 1. The others only output dead contact. If they are used to separate the circuit breakers, the related external operating mechanism will be required.

4.1 Directional element

4.1.1   The 90 °connection mode is adopted for the interphase directional elements of the protection. The directional element are started up for their own phases. The current elements of the various phases are only controlled by their correspondent directional elements as shown in the Table 4-1. the directional elements are provided with the memory function so as to eliminate the dead area.

p-p directional element	I	U
A	IA	UBC
B	IB	UCA
C	IC	UAB

Table 4-1 Correspondent relationship of the directional elements

For this protection, Arg(U/I)= -90°~30°, the angle edges are slightly fuzzy, the error<±5°.
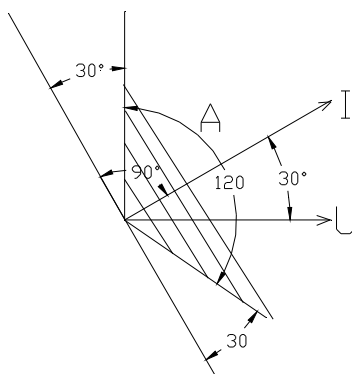
Fig.4-1 Operating area of the interphase directional element

4.1.2 The operating area of the zero-sequence directional element of the protection is Arg (3U0/3I0) =-180°~-120° or 120°~180°, 3U0 is self-produced. The connection of the external 3I0 terminals is not required to be inversed.

Note: If the field conditions are not satisfactory, the operating area of the directional elements will ensured by the software and its check can not be made but the check on the phase sequence of the analog-variables must be made.

4.2 Low voltage element

The low voltage element will operate to open the blocked protection elements as any one of the three line voltages is lower than the rated value for the low voltage. This element can be used to ensure that the protection will not misoperate in the non-faulted conditions, e.g., the inverse changing of the motor.

4.3 Over-current element

The real-time computation and the over-current discrimination for three zones can be done by the protection. As the any phase current is higher than 1.2 times the setting for zone 1, the output tripping of the instantaneous zone will occur within 40 ms. (including the fixed operating time of the relay) .In order to escape from the discharging time of the line arrester, the delay time that can be set separately is provided for the protection zone I.

The logic for the over-current discrimination for three zones is consistent with each other and their tripping conditions are :

1) $I\Phi > I\,dn$: where I dn is the current setting for zone n, $I\Phi$ is the phase current

2) $T > T\,dn$: where Tdn is the time delay setting for zone n

3) the conditions for the direction and low voltage correspondent to the over-current phase are satisfied (if necessary)   .

4.4   Zero-sequence over-current element

The mode for the realization of the zero-sequence over-current element is basically same as the over-current element, the output tripping will occur as the following conditions are satisfied:

1) $3I0 > I0n$; I0n: rated valued for the ground zone n;

2) $T > T0n$; T0n : rated value for the delay of the ground zone N;

3)   The correspondent directional conditions are satisfied (If necessary) .

For the transient zone of this element, as the zero-sequence current 3I0 is higher than the 1.2 times the rated value for zone I, the time of the output tripping of the protection is not longer than 40ms (including the

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fixed operating time of the relay).

4.5 Inverse time-limit element

The inverse time-limit element is a protection element in which the operating time-limit can be coordinated naturally with the magnitude of the current in the protected line. The operating curves can be horizontally shifted to realize the coordination of the overall line very feasibly. The common expressions for the inverse time-limit property can be classified into three sorts: the standard inverse time-limit, the very inverse time-limit, the extremely inverse time-limit. The inverse time-limit property of the protection is set by the inverse time-limit index in the rated values. The expressions for the various inverse time-limit properties are as follows:

    a.   general inverse time-limit

$$t = 0.14tp / (I / Ip)\ 0.02\ -1$$

    b.   very inverse time-limit

$$t = 13.5tp / (I/Ip) - 1$$

    c.   extremely inverse time-limit

$$t = 80tp / (I/Ip)^2 - 1$$

Where,   tp is the time constant, its range is (0.05~1)

            Ip is the current reference value

            I is the fault current

            T is the tripping time

Attention: The inverse time-limit time in the part of the rated values is the product of the numeraters in the above expressions in second. The setting range is 0.005~127. Therefore, this can be also be realized for the long-time inverse time-limit. The expression for the long-time inverse time-limit is as follows:

$$T = 120tp / (I / Ip) - 1$$

Both the interphase current element can perform the protection functions of the definite time-limit and inverse time-limit. The mode of the definite time-limit or the inverse time limit can be selected by setting up the related bits of the control characters. As the mode of the inverse time-limit is selected, the over-current elements zones II,III and the zero-sequence current elements zones II, III will be automatically switched off. The functional pressure plates for the interphase element zone III and the zero-sequence current III, will become the

functional on-off pressure plates for the interphase inverse time-limit and the zero-sequence current inverse time-limit.

4.6 Acceleration

The acceleration circuit of the protection contains the manual acceleration and protection acceleration. The separate on-off pressure plates are provided for the acceleration function.

The manual acceleration circuit of the protection does not need to be started by the contact for the external closing handle. This measuring is taken because of the fact that in the present integrated automation substations the control panels have been cancelled and the only simple operating handles are installed in the field instead of the manual operating handles. The similar consideration has also been taken into for the non-correspondent start reclosing circuit of the protection. This is detailed later.

The conditions for the startup of the manual acceleration circuit are as follows:

1) The time for the breaker at the tripping position is over 36s;

2) The position of the breaker is converted to closing from tripping and the acceleration permissive time is extended for 3s.

The protection acceleration is classified into the re-acceleration or the post-acceleration, one of the which can be selected by the control characters.

The rated values for the over-current and the zero-sequence acceleration zone and their correspondent time rated values are set for the protection. In comparison to the traditional protections, this practice make the configuration of the protection more flexible. The over-current acceleration zone of the protection can be selected to be with the low voltage blocking function but no directional blocking function is considered for all the acceleration zones.

4.7 Charging protection

As the protection is used as the charging protection(e.g., in the bus-tiers), it can be realized by switching on the acceleration pressure plate and setting the rated values for the acceleration current and time and selecting the post acceleration mode by the control characters. This function will be switched on 30s after the breaker is at the trip position. The function of the charging protection can be extended for 3s after the breaker is closed.

4.8 3-phase reclosing

The 3-phase reclosing function is provided in the all types of this series protection and can be switched on/off by the pressure plates.

4.8.1 Startup circuit

a) Protection tripping startup;

b) Non-correspondent breaker position startup;

In the non-corresponding reclosing starting circuit the breaker Position is monitored only by TWJ contacts. As a mater of the fact that newly designed substations, especially the integrated automation substations, there could be no manual handles, this protection system avoid using contacts of the handle, and the reclosing block is realized by the STJ contacts on the panel.

4.8.2 Blocking conditions

As the breaker is at the close position, the reclosing charging time is 15s, The reclosing "discharging" conditions provided for the series protection are as follows:

a) For the wire break of the control circuit, the reclosing discharging occurs automatically after a delay 10s;

b) For the higher potential of the spring unstressed terminal, the reclosing discharging occurs automatically after a delay of 2s;

c) For the higher potentials of the blocking reclosing terminal, the reclosing discharging occurs at once.

In the no-voltage-check mode, both the bus no-voltage and the line tapped voltage no-voltage are judged as no-voltage

4.8.3 Manual catch of sub-synchronism

If there are the inputs of the manual or the remote closing switch-in variables, check whether the conditions for sub-synchronism are satisfied. If they are satisfied, the closing command is sent out ahead for a leading time to close the breaker, otherwise, not close the breaker. If the bus voltage or the line tapped voltage is too low, the conditions for sub-synchronism will not be checked again. The selection for the sub-synchronism mode and the synchronous voltage phase is similar to the reclosing, please refer to the rated values. The special output for sub-synchronism is the standby

Spare output 2(X6:11-12). The conditions for sub-synchronism include:

1) The difference between the bus voltage and the line tapped voltage is less than the rated value;

2) The frequency difference is less than the rated value;

3) The acceleration is less than the rated value;

4) The leading angle is less than the rated value;

5) The breaker is at the trip position;

6) Manual or remote closing switch-in variable inputs (X4:4)

4.8.4 2-shot reclosing

For a one-shot reclosing after the instantaneous operation of the protection, if the arc still exits to make the

one-shot reclosing not successful and the protection re-trips, a longer time delay is permitted to let the arc extinguished and the a two shot reclosing occurs for the protection.

The instantaneous contacts for the reclosing outputs are: reclosing re-operation(X6:3~4) and reclosing operating circuit.

4.9 Low frequency element

This element is used to implement the dispersed frequency control. As the system frequency is lower than the rated frequency, this element can judge automatically whether to cut off the load.

A slip blocking element is provided in the low frequency load shedding functional logic to separate the faulted conditions, motor inverse charging from the real defaulted values of the active power.

In view of the fact that the low frequency load shedding element functions only in the stable state, the interphase(AB) voltage is taken for computation. In the test. 3-phase balanced voltage is required to be applied. As this voltage(UAB) is lower then than blocking frequency computed voltage, the low frequency load shedding element will be automatically switched off.

To sum up, the criteria of the low frequency load shedding element is as follows:

1) 3-phase balanced voltage, and $Uab > VBF$;
2) $df/dt < F/T$;
3) $f > F$;
4) $T > TF$;
5) This line is loaded, the load current $> 0.5A$

Descriptions: If the field conditions are not properly provided, this test may not be done. As the analog variables are correct, the accuracy will be ensured by the software.

4.10 Low voltage breakdown element

This low voltage element is used to implement low voltage control. When the system voltage drops below the rated voltage, the element will automatically decide if the load should be cut off.

The criteria of the low voltage breakdown element is as follows:

1) 3-phase balanced voltage, phase $U < VDY$
2) $dV/dt < V/T$
3) $T > Tudy$
4) Negative-sequence line voltage $< 5V$
5) This line is loaded (load current $> 0.5A$)

This function is switched on/off by the control characters.

4.11 Overload element

The overload element monitors the three-phase current, their operating conditions are.

MAX (IΦ)＞Ifh

Where, I fh is the overload current setting.

Overload alarm and tripping time delay are controlled by the setting.

The instantaneous contacts for the tripping outputs of the protection include:

Tripping re-operation(X5:1~2) and trip operating circuit. The protection operating signals (X6:17~18) are commonly used by the tripping and closing magnetic-hold signals.

4.12 TV wire break detection

When one of the following conditions occurs, the alarm lamp will be lit and the information "TV wire break" will be sent :

1. All the three phase voltages are lower than 8V, one of the phase current (phase a or c) is higher than 0.25A, it is the three phase loss of voltage.

2. When the sum of the three phase voltages is larger than 8V, and the minimum line voltage is lower than 16V. When the sum of the three phase voltage is larger than 8V, and the difference between the maximum and the minimum line voltage is greater than 16V, the condition is 2-phase or a single phase TV wire break.

As the TV wire break is detected by the protection, the selection can be made by the control characters to switch off the protections in the various zones of the directional element, voltage element or switch off the directional and voltage elements. The TV wire break detection function can be switched on/off by the control characters" analog variable summation self-detection".

4.13 Lower current ground wire selection

The lower current ground wire selection system is configured of the BEPR-811 Protection and the master station. As the system is grounded, 3U0 rises. As the protection senses the sudden variation of the self-produced 3U0 and it is higher than 10V, the present 3U0 and 3I0 will be recorded immediately. Meanwhile, the bus open tri-angle voltage monitoring station will send the ground signals to the master station, which, having received the ground signals will call the variables 3U0, 3I0 recorded in the various protections and work out the ground strategy after computation.

For the system without the master station, the criteria for the single-protection ground trial tripping is:at close position, 3U0 is larger than 18V,and at trip position after a trial tripping, 3U0 is less than 18V. Then it can be judged that this line is grounded.

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4.14 Data recording

This protection can perform the fault recording function. The analog variables that can be recorded are : Ia, Ib, Ic, IoD, Ua, Ub, Uc, IoG, and the status variable CB position, tripping and closing commands of the protection.

To avoid storing too much unnecessary data during the frequent startings caused by system disturbances, the necessary recorded data will only be recorded in the Flash RAM (hold for loss of power) after the protection operates, otherwise, these data will be stored in the RAM, (no hold for loss of power).

8 to 50 reports can be recorded and can be read by PC, and no less than 1000 events can be recorded. These data will be stored in FLASH RAM. Besides the system disturbance data, the operating events, status input change event, setting change events and alarm events can also be recorded.

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5 Rated Values and Setting Descriptions

5.1 List of the rated values for the BEPR-811 Digital Line Protection and descriptions

Ser. No	Names of rated values	Range	Unit	Remarks
1	Control character 1	0000～FFFF	none	See the descriptions about control characters
2	Control character 2	0000～FFFF	none	See the descriptions about control characters
3	Current zone I	0.05～100.0	A	
4	Time for current zone I	0.00～32.0	s	
5	Current zone II	0.05～100.0	A	
6	Time for current zone II	0.10～32.0	s	
7	Current zone III	0.05～100.0	A	
8	Time for current zone III	0.10～32.0	s	
9	Current protection blocking voltage	1.0～120.0	V	
10	Zero-sequence zone I current	0.05～20.0	A	
11	Zero-sequence zone I time	0.0～32.0	s	
12	Zero-sequence zone II time	0.05～20.0	A	
13	Zero-sequence zone II time	0.10～32.0	s	
14	Zero-sequence zone III current	0.05～20.00	A	
15	Zero-sequence zone III time	0.10～32.0	s	
16	Current acceleration zone	0.2～100.0	A	
17	Current acceleration zone time	0.00～3.00	s	
18	Zero-sequence acceleration zone current	0.1～20.0	A	
19	Zero-sequence acceleration zone time	0.00～3.00	s	

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Ser. No	Names of rated values	Range	Unit	Remarks
20	Current inverse time-limit reference current	0.2～100.0	A	
21	Current inverse time-limit time	0.005～250	s	
22	Zero-sequence inverse time-limit reference current	0.1～20.0	A	
23	Zero-sequence inverse time-limit time	0.005～250	s	
24	Inverse time-limit index	0.01～10.0	none	Set 0.02,1,or 2
25	Overload current	0.2～10.0	A	
26	Overload alarm time	6.0～6000	s	
27	Overload tripping time	0.1～6000	s	
28	Rated value for the reclosing synchronism-check	10.0～50.0	degree	
29	Reclosing time	0.2～32.0	s	
30	LF load shedding frequency	45.0～49.5	Hz	
31	LF load shedding time	0.00～32.0	s	
32	LF load shedding block voltage	10～120	V	Line voltage
33	LF load shedding block slip	1.0～10.0	Hz/s	
34	LV breakdown current	0.00～10.00	A	
35	LV breakdown voltage	20.0～100.0	V	Phase voltage
36	LV breakdown time	0.1～32.0	s	
37	Blocking voltage rate-of-change	1.0～60.0	V/s	Phase voltage
38	TA ratio(KA/A)	0.001～10.0	none	Primary protection, TA ratio/1000
39	TV ratio(KV/V)	0.01～10.0	none	Primary TV ratio/1000

Definition of control character 1 :

Bit	Meanings for 1	Meanings for 0
15	Summation of analog variable and in-service of self-detection	Summation of analog variables and out of service of self-detection
14	TA rated current 1 A	TA rated current 5 A
13	For TV wire break, the directional or voltage-blocked protection zones switched off	For TV wire break, only the directional and voltage for the directional or voltage-blocked protection zones switched off
12	Current zone I is Delay -T1	Current zone I is quick-break
11	Zero-sequence inverse time-limit with direction	Zero-sequence inverse time-limit without direction
10	Current inverse time-limit with direction	Current inverse time-limit without direction
9	Zero-sequence zone III with direction	Zero-sequence zone III without direction
8	Zero-sequence zone II with direction	Zero-sequence zone II without direction
7	Zero-sequence zone I with direction	Zero-sequence zone I without direction
6	Current acceleration zone blocked by voltage	Current acceleration zone not blocked by voltage
5	Current zone III blocked by voltage	Current zone III not blocked by voltage
4	Current zone II blocked by voltage	Current zone II not blocked by voltage
3	Current zone I blocked by voltage	Current zone I not blocked by voltage
2	Current zone III with direction	Current zone III without direction
1	Current zone II with direction	Current zone II without direction
0	Current zone I with direction	Current zone I without direction

Definitions of the control characters 2

Bit	Meanings for 1	Meanings for 0
15	Inverse time-limit is selected for protection	Definite time-limit is selected for protection
14	Pre-acceleration is selection	Post-acceleration is selected
13	Overload tripping	Overload not tripping(only send the alarm signals)
12	Spare	Spare
11	Spare	Spare
10	Stator 3U0 alarm on	Stator 3U0 alarm off

9	Reclosing without voltage check any side	Reclosing without voltage check the Ux
8	LV breakdown switched on	LV breakdown switched off
7	Two-shot reclosing switched on	Two-shot reclosing switched off
6	Measure CT: 3-phase	Measure CT: 2-phas
5	Control circuit line breaking alarm of	Control circuit line breaking alarm on
4	Synchronous voltage (Ux) phase selection	
3		
2		
1	Reclosing synchronism mode selection	
0		

Descriptions about the reclosing synchronism-check mode selection

Bit 1	Bit 2	Reclosing synchronism mode
0	0	Asynchronism-check
0	1	Synchronism-check
1	0	No-voltage-check
1	1	No-voltage-check & synchronism

Descriptions about the synchronous voltage(Ux) selection:

Bit 5	Bit 4	Bit 3	Bit 2	Synchronism-check mode
0	0	0	0	None
0	0	0	1	p-A selected for synchronous voltage
0	0	1	0	p-B selected for synchronous voltage
0	1	0	0	p-C selected for synchronous voltage
1	0	0	0	No choice
1	0	0	1	p-AB selected for synchronous voltage
1	0	1	0	p-BC selected for synchronous voltage
1	1	0	0	p-CA selected for synchronous voltage

Descriptions:

The TA and TV ratios are the ratios for protection, their setting method is as follows:

For example, primary side TA ratio is 600/5=120, then the ratio is set to be 120/1000=0.12; 10kV TV ratio is 10000/100=100, then the ratio is set to be 100/1000=0.10;

Those functions with the mark * before "ser .No." or "Bit" of the control characters are specially used for

BEPR-811.

If some of the above functions are not to be performed, they will be completely switched off only by withdrawing the correspondent soft pressure plates or the control characters. It is unnecessary to set the rated values specially for the correspondent functions.

5.2 List of soft pressure plates in the BEPR-811 Digital Line Protection.

Platen name	functional
Current zone I	Current zone I Protection function for refund
Current zone II	Current zone II Protection function for refund
Current zone III	Current zone III Protection function for refund
Zero-sequence zone I	Zero-sequence zone I Protection function for refund
Zero-sequence zone II	Zero-sequence zone II Protection function for refund
Zero-sequence zone III	Zero-sequence zone III Protection function for refund
accelerate	Accelerate Protection function for refund
overload	overload Protection function for refund
Underfrequency load shedding	Underfrequency load shedding Protection function for refund
Reclosing input	Reclosing input Protection function for refund

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6 Figure

Figure 1: BEPR- 811 U digital line protection device terminal diagram:

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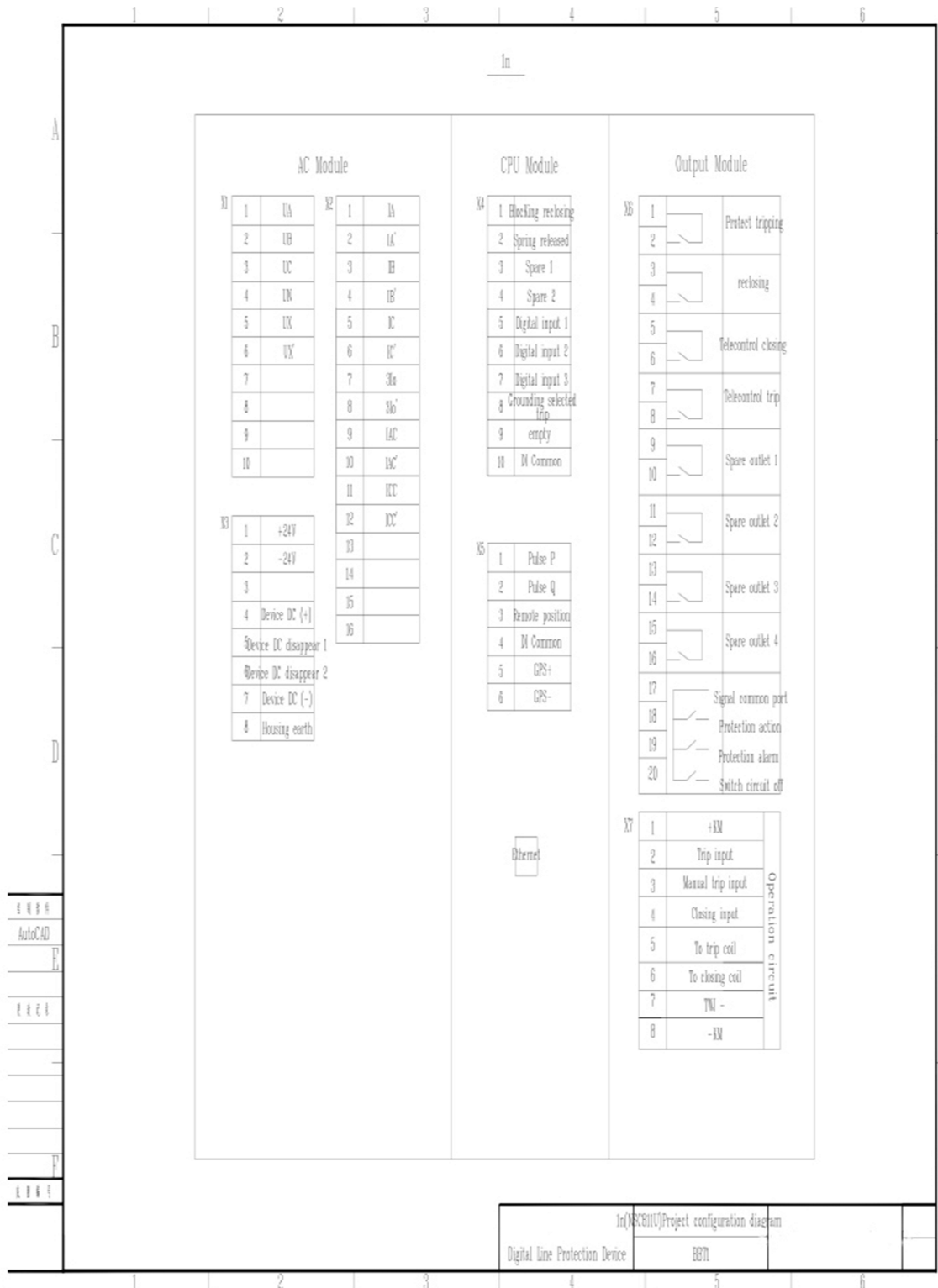
Fig.2：BEPR- 811Udigital line protection device installation diagram：

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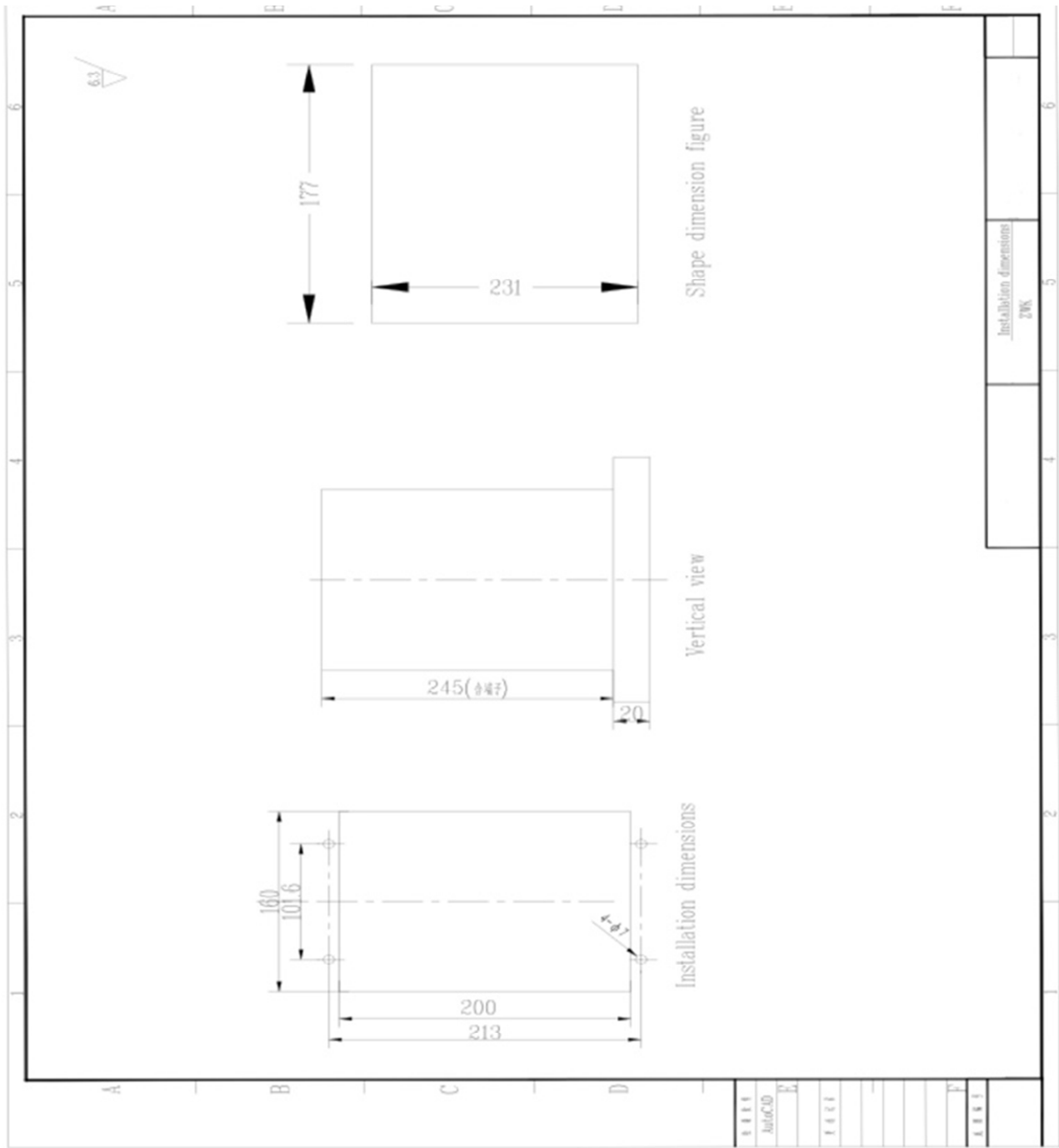
Part 2

Operation Manual

(04.2015)

1 Introduction

1.1 Panel layout

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BEPR811U   Digital Line Protection Device

Run
Over-current
Zero-current
Accelerate
Overload
low-frequency
Reclosing
Charging
Closing
Alarm   Triping

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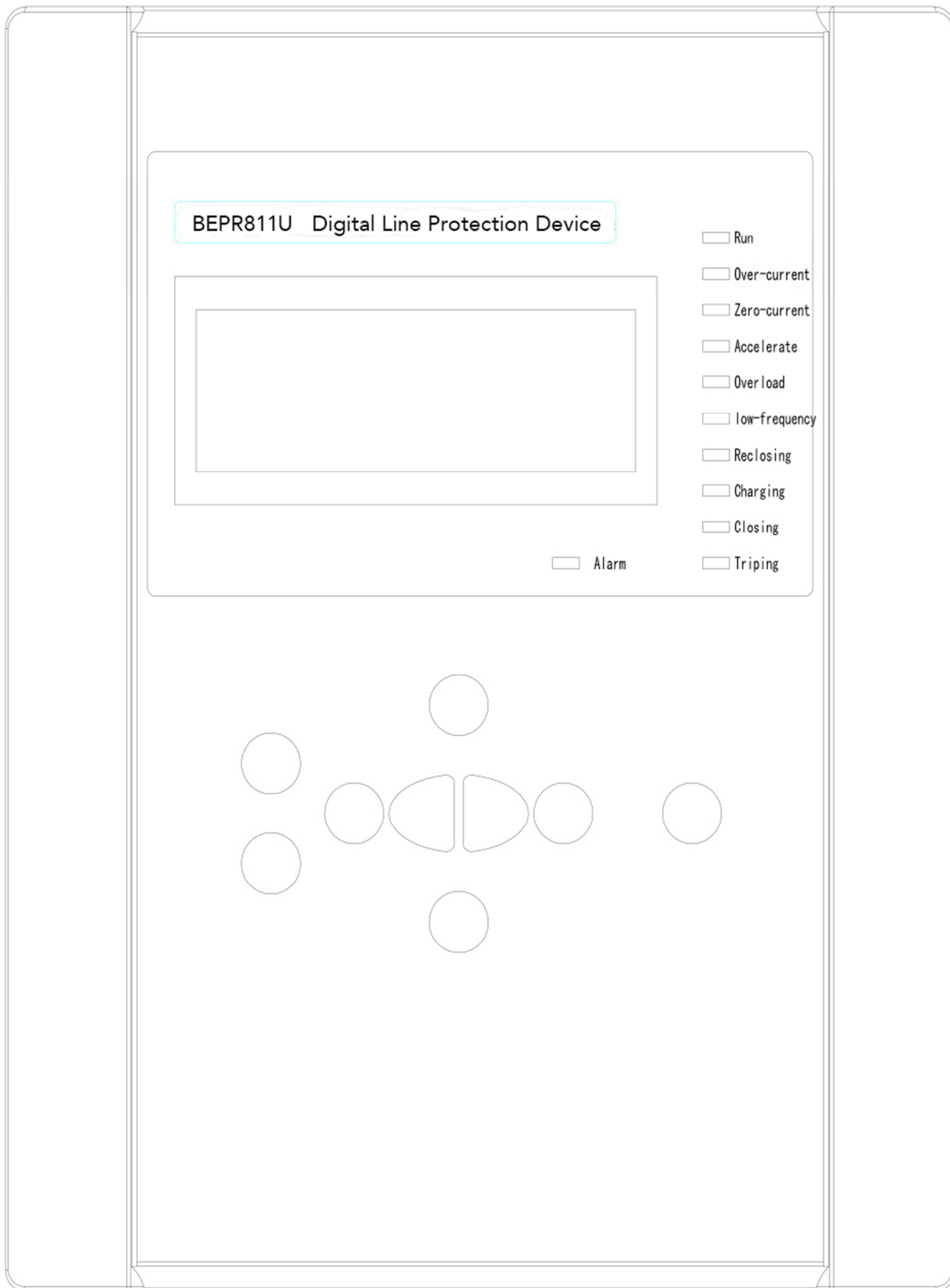
1.2 keyboard introduction
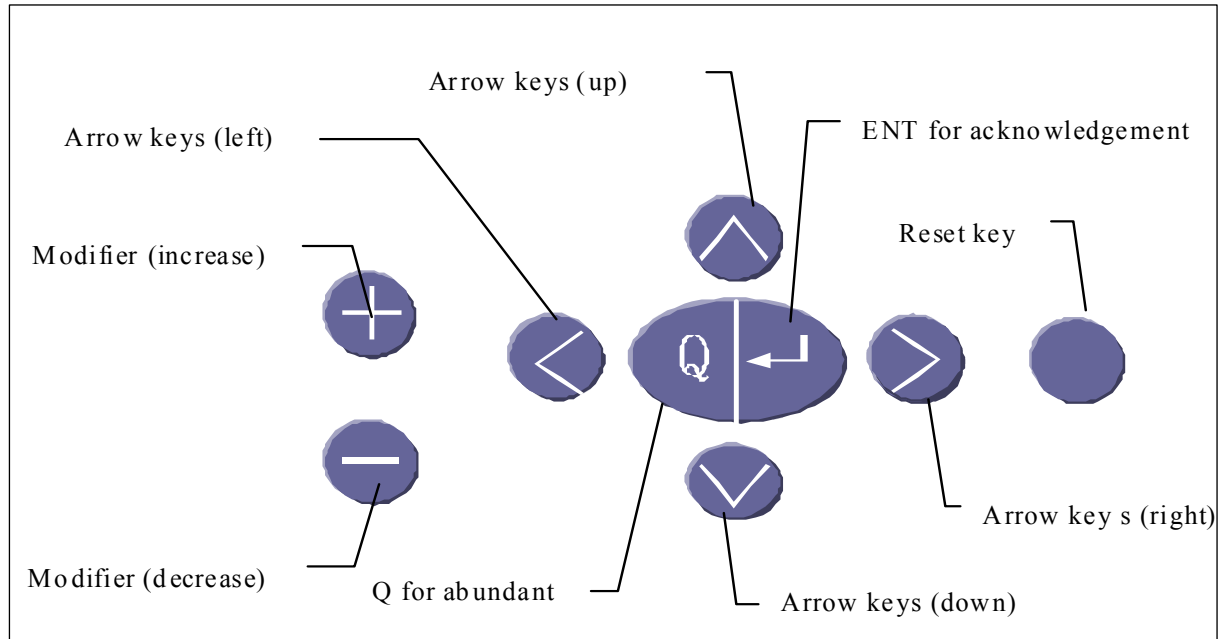
BEPR- 800U **Schematic Diagram for the keyboard**

2 Menu operation

The keyboard for the BEPR- 811U Series Digital Protection and LCD interface are operated in the way of the interaction block in combination with the menus.

```
                        ┌──────────────────┐
                        │  Normal display  │
                        └────────╥─────────┘
                        ┌────────╨─────────┐
                        │    Main menu     │
                        └────────╥─────────┘
   ┌──────────┬──────────┬──────────┼──────────┬──────────┬──────────┐
```

Setting operation	Report Builder	Running status	Run set	Hardware test	Other
Setting display Setting switch Setting management Delete setting	Action Recording Alarm Recording Wave Recording Operation Recording Delete Recording	RMS value Intermediate variable Electrical measurement on-off state platen state	Setting switch Platen set Time set	Open test DI test Lighting test Precision test Exercise Test Trystate	Device set Factory settings Zero drift Test Version information

Schematic diagram for the general structure of the displayed picture

2.1 Functions

2.1.1 Running states

RMS value　　: shows in real-time the RMS values and phase angles for all the analog channels;

Intermediate　variable：shows in real-time the magnitudes of the measured-variables;

Electrical measurement: shows in real-time KWHs.

2.1.2 Report Builder

Action record: according to print the protection action of the action and trip time, according to the time order, over storage capacity in order to update

Alarm record: display, print each alarm type and occurrence time, according to the alarm time order, the more storage capacity in order to update.

Wave record record: display, print, wave record report

Operation record: display, print all operation records

record delet: classification to delet report record

2.1.3 Setting operation

Setting display: display the fixed value area setting value;

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Setting switch: From a fixed value area to switch to another setting area runs (only in the setting of the switch between effective fixed value area);

Setting Set: `modify` choose fixed value area setting value;

Setting delete: delete choose fixed value area setting value（only delete effective fixed value area）.

2.1.4 Run set

Protect the soft platen、time set and swiching fixed value area.

2.1.5 Hardware test

Open test: any output switch manual control output or return；

DI test: input real-time display;

Lighting test: Check whether the indicator light on the LCD panel to work properly;

Precision test: The analog channels of the effective value and phase Angle of real-time display;

Exercise test: used for background monitoring and remote host information to point.

Motion events：item by item display the send detailed SOE message;

✓ Alarm events: item by item display to send alarm message;

✓ Remote communication to the point: item by item to send remote communication quantity information;

✓ Telemetry to point: item by item to send telemetry,Fixed send half of the value in full scale value;

✓ Remote control to point: item by item to send Remote control quantity information;

Test states : Running state of device by switching between protection status and test status.

2.1.6 Other

Display the program version information, factory Settings (can be measurement calibration and internal fixed value), device Settings and zero drift testing.

2.2 Operating instructions

2.2.1 Normal display

When the protection is energized and the mode switch is pointed at "Local" or "Remote", the MMI turns to normal display :

```
 2012-07-01   09:38:31*[00]
1  Iat   0.023A   -20.06°
2  Ibt   0.031A    41.46°
3  Ict   0.025A   -19.29°
```

```
 2012-07-01    09:38:31*[00]
1   Diff. platen          ●
2   Over voltage          ○
3   field loss protection ○
```

As shown in the figure are the two typical normal display screen used in the BEPR- 811U digital line protection . Screen 1 shows the effective value of the three-phase voltages and three-phase current and angle the screen 2 Display protection platen state

2.2.2 Main menu

When 【←┘】 key is pressed under the normal interface , the main menu will show :

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```
                        Main menu
        Run statues          Report builder
        Run set              Hardware test
        Setting operation    other
```

Then press "∧" or "˅", "<" or ">" keys to select menu and press 【←┘】 key to select the sub menu. press 【Q】 to return to previous display.

2.2.3 Run status

2.2.3.1 RMS value

After entering the menu, MMI begins to indicate which setting zone you want to select. Press "+" or "－" key to select zone number. Press 【←┘】 key to perform the setting display.

```
                RMS value-1/12
        1  Iat   0.023A   -20.06°
        2  Ibt   0.031A    41.46°
        3  Ict   0.025A   -19.29°
```

Press "∧" or "∨" key for turn the lines. Press "+" or "－" key to turn the pages. To observe the effective value and phase Angle of the analog channels.

For printing press 【←┘】 key will appear Printing Tips,

```
                Analog print

                Analog print？
```

3 seconds click 【←┘】 key to print analog information, or exit the print screen, if print completed.

```
                Analog print

                Analog print completed
```

If the printer or communications failure , prompting

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```
┌─────────────────────────────────┐
│           Analog print          │
│                                 │
│        Print server is busy     │
│                                 │
└─────────────────────────────────┘
```

2.2.3.2 Measurable quantity

After entering this menu, the menu MMI will renew the KWHs every 3 seconds.

```
┌─────────────────────────────────┐
│  Measurable quantity  -1/10     │
│  1   Measur. Ia      0.000A     │
│  2   Measur. Ib      0.000A     │
│  3   Measur. Ic      0.000A     │
└─────────────────────────────────┘
```

Press "∧" or "∨" key for turn the lines. Press "+" or "—" key to turn the pages. can see any measurable quantity。

```
┌─────────────────────────────────┐
│     Measurable quantity print   │
│                                 │
│    Measurable quantity print?   │
│                                 │
└─────────────────────────────────┘
```

For printing press 【←┘】 key will appear Printing Tips,

2   seconds click 【←┘】 key to print analog information, or exit the print screen, if print completed.

```
┌─────────────────────────────────┐
│    Measurable quantity print    │
│                                 │
│ Measurable quantity print completed │
│                                 │
└─────────────────────────────────┘
```

3

If the printer or communications failure , prompting

```
┌─────────────────────────────────┐
│    Measurable quantity print    │
│                                 │
│        Print server is busy     │
│                                 │
└─────────────────────────────────┘
```

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2.2.3.3 Electric quantity

After entering this menu, the menu MMI will renew the KWHs every 3 seconds.

```
                 KWHS
Pulse P          0 个
Pulse Q          0 个
+KWh             0.0KWh
```

Press "∧" or "∨" key to turn the lines and press "+" or " − " key to turn pages, to observe the effective value and phase Angle of the analog channels.   If you want to print, refer to RMS print operation.

2.2.4 Report builder

2.2.4.1 Action report

Press 【←┘】 key to select "action report" sub-menu under "report builder" menu .

```
Action report list—1/40
1    2012-07-01 10:23:26.790
2    2012-07-01 10:22:25.791
3    2012-07-01 10:21:26.798
```

The record of the action list "∧" key or "∨" key to select the event of a failure record . Event record in the list is arranged in chronological order of events , to facilitate the users to find . Press [←┘] key to enter the event to display the dialog box . The event displays the dialog box for each event log entry preceded by a relative time in milliseconds , the time in the title bar of the reference time for this relative time . Display LCD size due to device size limitations , the event parameters can not be fully displayed , For more information see the event parameters using the "∧" key or "∨" key to view .

```
        Action report—1/40
■07-01 10:23:26.790
  00000      " Protection start
  1.015    " Reverse power action
```

If you need to print press "←┘" key , otherwise press the "Q" key returned to the record of the action list to display the menu. Press the key "←┘" Print event , if it is a failure events into asking whether print wave recording dialog , if you choose 'yes' and then press the "←┘" button to start printing the recorded wave pattern , the recorded data from recorded wave protection " read .

```
        Action report

Whether to print the current action
      wave record graphics?
```

If the printer is not connected or failure will be reported :

```
Action report print

Print server is busy
```

2.2.4.2 Alarm report
Press 【←┘】 key to select "alarm report" sub-menu under "report builder" menu .
    The record of the action list "∧" key or "∨" key to select the event of a failure record . Event
record in the list is arranged in chronological order of events , to facilitate the users to find .

```
Alarm report list—1/16
1    2012-07-01 10:33:26.790
2    2012-07-01 10:21:25.791
3    2012-07-01 10:19:26.798
```

Press [←┘] key to enter the event to display the dialog box . The event displays the dialog box
for each event log entry preceded, the time in the title bar of the reference time for this event
happened time .

```
Alarm report—1/16
■07-01 10:33:26.790
 PT break line
```

For print alarm report , operating with a record of the action .
2.2.4.3 Operation record
Press 【←┘】 key to select "operation report" sub-menu under "report builder" menu .

```
Operation record—1/40
1、 2012-07-01    09:37:20
   Factory set  internal setting
2、 2012-07-01    09:35:25
```

The record of the action list "∧" key or "∨" key to select the event of a operation record .
 2.2.4.4 Report delete
Press 【←┘】 key to select "report delete " sub-menu under "report builder" menu .

```
【Report delete】
Action report delete
Alarm report delete
Wave report delete
```

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2.2.4.4.1 Action report delete

Press 【←┘】 key to select "action report delete " sub-menu under "report delete" menu , System will prompts for password：

```
                   Action report delete

               Please input password: 0000
```

Press 【←┘】 key, If password is wrong，display password wrong dialog box，or display action report delete

```
     Action report delete

       Password wrong!
    Please input password again
```

```
     Action report delete

    Action report delete complete
```

result dialog box.

In any state, press the "Q" key will return to the first menu.

2.2.4.4.2 Alarm report delete

Press 【←┘】 key to select "aLarm report delete " sub-menu under "report delete" menu , The rest of the operating the same with action record .

2.2.4.4.3 Wave report delete

Press 【←┘】 key to select "wave report delete " sub-menu under "report delete" menu , The rest of the operating the same with action record .

2.2.5 Setting operation

2.2.5.1 Setting display

After entering the menu, MMI begins to indicate which setting zone you want to select. Press "+" or "一" key to select zone number. Press 【←┘】 key to perform the setting display.

```
           Setting display
   1/1
   Select fixed value zone:00±
   The current running zone:00
```

```
        Setting display【0 zone】
   Control word one………… 0000
   Control word two………… 0000
   Current Ⅰsection………… 100.0A
```

Setting region choice   setting display

Note : The system defaulted setting will be displayed for the invalid setting zones.

Press "∧" or "∨" key to turn the lines and press "+" or "一 " key to turn pages.

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2.2.5.2 Setting set

Select "setting set" sub-menu under "setting operation" menu, The system will indicate which area you want to alter setting zone :

```
                      Setting set
    1/1
    Select setting zone:00±
    Current running zone:00
```

After the setting zone is selected, press 【←┘】 key to enter the setting alteration window :

```
                  Setting set【0 zone】
    Control word one………… 0000
    Control word two………… 0000
    Current Ⅰ section………… 100.0A
```

Note : The system defaulted setting will be displayed for the invalid setting zones.

After entering the setting alteration window, press "∧" or "∨" key, "<" or ">" key to select the alteration position press "+" or "—" key to make alteration For the contents in the effective bit of the control Character press ">" key and hold it for 3 second, the selective sub-menu containing the contents in the effective bit of the control character are displayed. In the sub-menu, the effective bit of the control character can be easily put in-service   or out of service.

```
Control word one·················0000
Corrent zone Ⅰ without direction        ±
Current zone Ⅱ without direction
Current zone  Ⅲwithout direction
```

```
Control word two·················0000
LV breakdown switched off               ±
Measure CT: 2-phas
Switch to steal overlap
```

After alteration, press 【←┘】 key to confirm. In case of giving up the alteration, press "Q" key. The system will give up the alteration and return to the previous menu.

After all the alteration are confirmed to be completed, press 【←┘】 key to solidify. In case of giving up the alteration, press "Q" key, the system will give up the alteration and return to the previous menu.

Before solidification, the system wants you to identify the target for solidification. By doing so, the   alteration   zone   and   duplication   of   a   setting zone can be completed.

```
                  Setting solidification
            Select setting zone: 00±

            Current operating zone: 00
```

When the target solidification zone is selected, press 【←┘】 key to solidify. The system asks you entering the password.

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```
        Setting solidification

    Please input password: 0000
```

Press 【 ←┘ 】 button to   solidification operation, Setting solidification:

```
        Setting solidification

    Setting solidification completed
```

the operation of this protection device password is "8888" if password input error will have prompt, press the "Q" key to return to, or the absence of key images automatically after 3 seconds to return to the superior to re-enter the password.

```
        Setting solidification

        Password wrong
    Please input password again
```

2.2.5.3 Setting switchover

Select the submenu "setting switchover" under the menu "operation setup" or select the submenu "setting switchover" under the menu "Run set", a setting change window will be seen directly.

```
    Setting switchover
    1/1
    Select setting zone: 00±
    Current operating zone: 00
```

Use "+" or "—" key to select   setting area you want to change (also it can be done by the setting switchover keys). If you want to give up the switchover, just press "Q" key. press【 ←┘ 】key to start the switchover. The system asks you entering the secret code. The process is the same as the Setting solidification operation and will not be repeated here.

Several setting zone are provided for storage. Before operating a setting switchover, care must be taken that the zone you want to switch over must have its settings otherwise you cannot make any switch. By using the command "setting alteration" you can write several sets of setting into the zone and then make switchover.

2.2.5.4 Setting delete

Enter this menu, MMI will be prompted to select fixed value area in the first place. With "+" and "-" keys to choose to delete the setting value of the area code, press 【 ←┘ 】 button to perform constant value delete, there will be a password prompt operation with Setting solidification
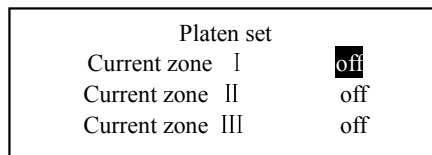
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.

```
              Setting delete
1/1
Select setting zone: 00±
Current operating zone: 00
```
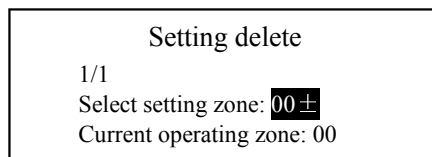
select setting zone

Use "∧" or "∨" key to turn the lines, "+" or "一" key to turn the pages .

2.2.6 Run set

2.2.6.1 Platen set

```
              Platen set
Current zone  Ⅰ          off
Current zone  Ⅱ          off
Current zone  Ⅲ          off
```

Select sub-menu "platen set" under "run set" menu, enter platen set window:

Use "∧" or "∨" key to select different platens, "+" or "一" key to select on-off. If you want to give up the set, just press "Q" key to exit. Press 【←┘】 to set platen，The system asks you entering the password.

If the wrong password, password error message dialog, otherwise the message box displays platen sets the result.

In any state, press the "Q" key to return previously menu.

```
              Platen set
          ut password: 0000
```

```
       Platen set
   Password wrong!
Please input password again
```

```
       Platen set
  Platen set completed!
```
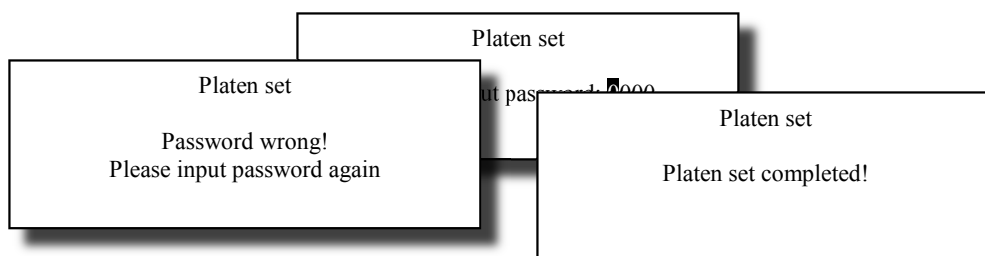
2.2.6.2 Time set

Select the "time adjustment", use "∧" or "∨" key to turn the lines "+" or "一" key to switch for the in service or out of service of the function, press the "Q" key to return previously menu.
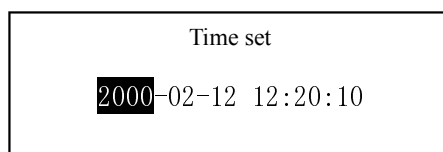
```
              Time set
         2000-02-12 12:20:10
```

2.2.6.3 Setting switchover

Select the submenu "setting switchover" under the menu "Run set", a setting change window will be seen directly.

```
                  Setting switchover
          1/1
          Select setting zone: 00±
          Current operating zone: 00
```
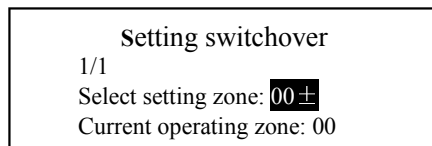
Use "+" or "－" key to select setting area you want to change (also it can be done by the setting switchover keys). If you want to give up the switchover, just press "Q" key. press【←】】key to start the switchover. The system asks you entering the secret code. The process is the same as the pressure plate switchover and will not be repeated here.

Several setting zone are provided for storage. Before operating a setting switchover, care must be taken that the zone you want to switch over must have its settings otherwise you cannot make any switch. By using the command "setting alteration" you can write several sets of setting into the zone and then make switchover..

3.2.6 Device test

A set of the interaction block is provided in the BEPR- 8000 Series Digital Protection. By operating this set of the interaction block. Users can perform the tests on the switch out (relay) drive, switch-in real-time display (manual detection of the switch-in signals), lamp whether can work normally , real-time display of the analog variables in the AC input channels and the related functions for the integrated automation. Since this set of operations is generally used to test the perfect state of the definitions for the protection, monitoring and tele-control back ground data bases, it is called the "system test" operations. For the "switch-out drive", "AC test" operations, the position of the switch must be put at "local" position, and for the integrated automation "function" at the "remote" position. But for the "switch-in chock" operation, both the "local" and "remote" modes will do.
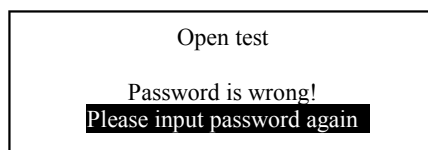
2.2.7.1 Open test

Select "device test" menu under "open test" sub-menu，the system prompts for a password:

```
                   Open test

          Please input password: 0000
```
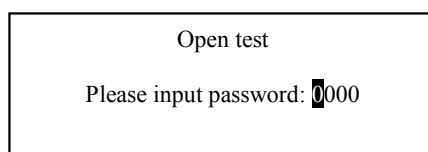
Password is"8888"can use"＜"、"＞"to select input bite，use"＋"and"－"to input password, press【←】】button to enter。   If password is wrong，will display password wrong   message box:

```
                   Open test

            Password is wrong!
          Please input password again
```

After password input is correct, the system prompts to enter Open transmission operation menu:

```
                    Open test
   start                    ○
   Protection operation          ○
   Triping X:1-2             ○
```

Use "∧"key、"∨"key to choice different action type, press 【←⌐】 key to choice output operation act.Then press 【←⌐】 key to select output action return.

Note: only start relay in the action state, tripping relay action. Open after the test select the reset to reset signal, press the Q key to return to the interface of the superior press reset button to complete the total reset after action.

2.2.7.2 DI test

Choice "device test "menu under "DI test "sub-menu，system enter input test directly，MMI under this

```
                    DI test
   DI1 Block overlap          open
   DI2 Spring released         open
   DI3 Spare input 1           open
```

state every 2 seconds refresh open intake status regularly
Use "∧" key 和"∨" key to turn over line，"＋"和"－"to turn page to see

2.2.7.3 Precision test

when in accuracy test mode, protection will quit, to provide a large current channels precision testing ！

Select "unit tests" menu under "precision test" sub menu, the

```
        AC test

   Please input password: 0000
```

```
        AC test
     Password is wrong!
   Please input password again
```

system prompts for a password:

Password check window   password wrong message window

After password input is correct, the system prompts the precision test menu. MMI every 3 seconds timer refresh the effective value and phase Angle of the analog channels.

```
        Precision test-1/12
1、   Ia     0.013 A  -153.7°
2、   Ib     0.010 A  -164.5°
3、   Ic     0.014 A  -168.6°
```

Use "∧" key 和"∨" key to   turn over line，"＋"和"－"to turn page to
see the all value analog channels

2.2.7.4 Remote test

Enter"remote test"   menu disappear interface

```
        【remote test】
Action event        tele.command
Alarm event         Remote measure
Remote control
```

2.2.7.4.1 Action events

Enter "action events"， enter security code successfully interface appears.

```
        Action events virtual point
1/16
Current Ⅰsection action          ±
Measure NO.: 0
```

Press【←┘】 button send one protect Ⅰsection action to the monitoring of remote communication and remote background

Use the "+" button or "-" key to switch to a different item, press the ENTER key to send corresponding entry information.

Press "Q" key to exit the protection upload function returns the remote test menu.

2.2.7.4.2 Alarm events

enter "alarm events"，   enter security code successfully interface appears.

```
        Alarm events virtual point
1/12
Device on power                  ±
Measure NO.: 0
```

Press【←┘】 button send one device on power alarm message to the monitoring of remote communication and remote background
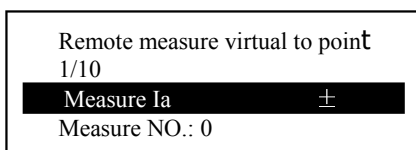
Use the "+" button or "-" key to switch to a different item, press the ENTER key to send corresponding entry information.

Press "Q" key to exit the alarm events function returns the remote test menu.

2.2.7.4.3 Remote command to point

Enter" remote command to point", enter security code successfully interface appears.

```
        Remote command virtual point
1/16
 DI1 Block overlap    ±
Measure NO.: 0
```

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Press【↵】 button send a spare telesignalling 1 to the monitoring of remote communication and remote background

Use the "+" button or "-" key to switch to a different item, press the ENTER key to send corresponding entry information.

Press "Q" key to exit the remote communication upload function returns the remote test menu.

2.2.7.4.4 Remote measure to point

Enter "Telemetry to point", enter security code successfully interface appears.

```
Remote measure virtual to point
1/10
 Measure Ia                    ±
Measure NO.: 0
```

Press【↵】 button after Ia a single measurement information sent to the monitoring and remote backend, At this time of sending half of value into full scale value.

Use the "+" button or "-" key to switch to a different item, press the ENTER key to send corresponding entry information.

Press "Q" key to exit the remote communication upload function returns the remote test menu.
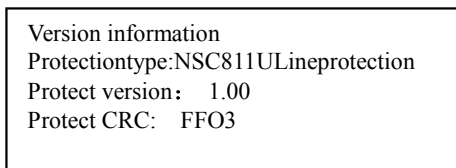
2.2.8 Others

BEPR- 811U series digital protection provide a group operation menu（dialog box）, this menu include version information、 device setting ,factory-set , Zero setting and so on function.

2.2.8.1 Version information

Select the sub-menu "Version information" under the menu "Other"

```
Version information
Protectiontype:NSC811ULineprotection
Protect version： 1.00
Protect CRC:   FFO3
```
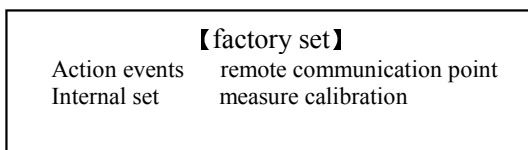
Use "∧" key and "∨" key to turn over line，"＋"and"－"to turn page to see the all device version and logical information.
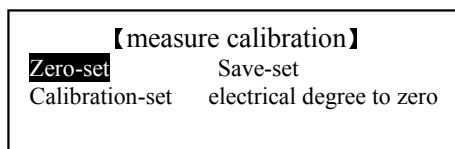
2.2.8.2 Factory set

Select the sub-menu "factory set" under the menu "Other"

Enter "factory set" menu interface :

```
            【factory set】
Action events     remote communication point
Internal set      measure calibration
```

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Select "measure calibration" sub-menu, "∧and"∨"to choice :

```
【measure calibration】
Zero-set          Save-set
Calibration-set   electrical degree to zero
```

2.2.8.2.1 Zero setting

select the "Zero-set" menu to enter，enter security code successfully saved message appears.

```
Zero-set

zero-set ongoing
```

```
Zero-set

zero-set succesful
```
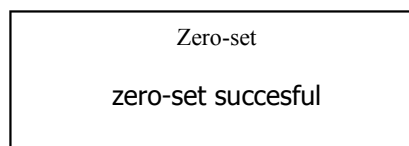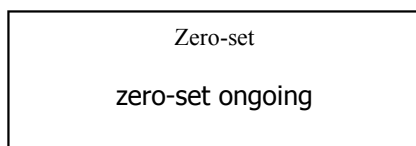
Complete end interface appear, then return "Measurement calibration" menu

2.2.8.2.2 Calibration Setting

Choose "zero setting" menu to enter, enter security code appear waiting for the pictureComplete end interface appear, then return "Measurement calibration" menu

2.2.8.2.3 Save

Select the "save Setting" menu to enter, enter security code successfully saved message appears.
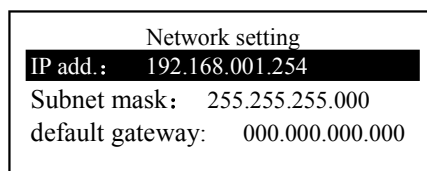
```
Save setting

Save setting success
```
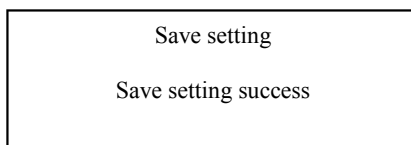
Complete end interface appear, then return "Measurement calibration" menu

Note: under the factory Settings menu operation belongs to modify internal parameters, the operation password is "7777".

2.2.8.3 Indentification

Select the sub-menu "device setting" under the menu "Others"

Select the sub-menu "network setting" when entrance the menu "device setting"

```
Network setting
IP add.：      192.168.001.254
Subnet mask：   255.255.255.000
default gateway:    000.000.000.000
```

IP address is composed with four bytes divided by dots. Each byte is the decimal integral number from 0 to 255. It is used for identification in network communication within sub-stations. The same IP address is not allowed in one sub-station. The first and second bytes were decided by the network. The third and fourth (00.XX), (01. XX), 255.XX), (XX. 00), (XX. 255) are to be saved and can not be used.

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As the protection is connected into the signal network configured system, the network no. of the IP address is recognized as "192.168". As protection is connected into the dual-network configured system, for the network no. of the IP address, refer to the description about the "network interface module COMM" in the "Manual for the BEPR- 861 Integrated Monitoring Device". It is dependent upon the setting of the module in the system.

Use "<" or ">" to select the position to enter. Use "+" or "―" key to enter the address. press 【←┘】 key to setup, then the system indicates that the secret codes can be entered, if it is correctly entered system will indicate that the address is correctly setup and exit from the submenu.

2.2.9 Note

Reset key is pressed to reset all lamp signals and switching-outs.

Press "Q" key for more than 1 second, the display will directly return to the main picture.

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3 Debugging Outlines for Users.

      This protection and its panel-assembled cabinet have been strictly debugged in the factory and as they are delivered, they are in the perfect conditions and correctly connected. The user's debugging on the protection is to check whether any damages have occurred in the transportation and installation and whether the outgoing connections are correct. Since the perfect self-detection functions of the software and hardware are provided in the protection, the failed parts can be precisely located at the modules or ever chips. No adjustable components are mounted in the AC sampling circuit, which is excellent in its vibration-proof capability and temperature property, so the precision of the protection can be ensured by the delivery test. The test emphasis can be thus placed on the parts of the status variable inputs(opto-coupler) ,

      AC inputs, tripping and closing output circuits and signal circuits (relay contacts). Although the following debugging procedures are directed at the protection as whole the debugging operations had better to be made on the panels and cabinets, that is, the internal panel connections should be included in the detection.

3.1 Check before energization

      The advanced manufacturing technology is adopted and no adjustable components are used and. A large quantity of the LSI circuits is employed in the protection. For the sake of its reliability, in the normal test state, don't pullout any, even in the insulation check.

      Before energization check whether the surface is perfect without any damages and loosen parts for terminals and whether the parameters are consistent with the specifications. The special tests should be made on the power supply voltage. TA rated current, tripping rated current and closing rated current, etc.

3.2 Insulation check

      The modules and terminals are connected in parallel (insulation test may be done on the communication terminals). The insulation to the ground for modules is tested by the 500V megaohmmeter and the tested insulation resistance should be larger than 100 MΩ. As the filters are located at the 24V, 200V output and input inlets of the power supply module and the capacitance to ground is present, the power supply socket can be pulled out in the insulation test.

3.3 Energization check

    a. The groups at the settings are input into the related setting zones per the setting list and the setting zones are switched into the operating setting zones.

    b. The protection pressure plates are put in service and the lamp signals on the panel will indicate the in-service conditions of the protection.

3.4 Sampling precision check

      No adjustments are required for the sampling precision of the protection and the sampling error should not larger than 2%. Generally, the check can be specifically done by the

microprocessor-based protection testing instrument. To meet the more strict requirements, the phase current input terminals of the protection can be connected in-series to the current of 5A, the TVs for the various phases are connected in parallel to the voltage of 50V. Now the accurate values are displayed and consistent for the various phases. In the meantime, the check should be done to see whether the phases for the analog channels are correct.

3.5 Contact output check

The contact output check, including the signal contact output check, can be done in combination with the setting check. The contact output for each channel is once checked, in the other tests, only the signal indications and LCD display are required to be observed.

The contact output check can also be done via the menu "Switch-out drive" of the protection. The functions of this menu can be driven separately for each output. The operating methods can be seen in the "Operating Guidelines" of the Operation Manual.

The tripping drive and closing drive test with the circuit breakers should be done for onetime to confirm the correct operation of the circuit breakers.

3.6 Setting check

The dynamic simulation tests or other tests on the protection functions and operational logic hare been done for several times. The field debugging can only be done to check the settings.

3.7 Tripping and closing current hold test

Put the tripping and closing pressure plates in service and simulate the faults to make the protection operate and confirm the perfect conditions of the tripping and closing currents. The manual tripping and closing operations can also be done to inspect the perfect state of the circuit. The protection should not be reclosed after the manual tripping of the circuit breakers.

3.8 Phase sequence check

As the line is energized, observe whether the currents, voltages for phases and their phase angles are consistent with the actual conditions.

3.9 Calibration of the clock

Check whether the clock is accurate in time. If it is not accurate, the calibration can be made. The operating methods are shown in the "Operating Guidelines".

It is convinced from the above chocks that the protection and panels as well as cabinets are correctly connected and they can function normally and can be put in operation.