BEPR- 833U
Digital Station Transformer Protection Device
Technical Manual & Operation Manual

Contents

BUENO ELECTRIC

BUENO ELECTRIC

Part 1

Technical Manual

BUENO ELECTRIC

1 Brief Introduction

The BEPR- 833U Series Digital Station Transformer Protection is a packaged station transformer protection basically configured of current, voltage and non-electric quantity relays. It is applicable for substation or power plant transformers at the voltage levels of 66KV or less.

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.

1) Complete protection function configuration

function		BEPR- 833
inter-phase faults		√
Overload		√
Current acceleration protection		√
The zero-sequence current relay		√
Low-voltage protection		√
Non-electric quantity protection		√
Telemeter	Measurement TA	√
	Protection TA	√
Telesignal		√
Telecontrol		√
KWH	Pulse measurement	√
GPS time-checking		√
False blocking prevention		√
Remote management		√

- 2-zone phase to phase current relay that reacts to inter-phase faults.
- Overload alarm and tripping functions.
- Acceleration zone that can be individually set and react to the automatic switching-in onto the permanent faults.
- Zero-sequence current relay that can react to the single-phase ground faults in a directly grounded system.
- The zero-sequence current relay can operate both in the definite time limit or inverse time limit mode.

Contact: sales@bueno-electric.com

- Loss of voltage relay blocked by current and TV wire break.
- Auto-detection on TV wire break.
- Non-electric quantity protection for transformer.

2) Integrated design

- Telemeter, tele-control and tele-signal functions
- The precision of the selected measuring modules (including KWH metering) can reach to the class 0.5.
- For users having special KWH meters, accumulated pulse KWH connectors are provided.
- False blocking-preventive measures and signal indications for this partition.
- The device has its own operation circuit to trip or close circuit breakers and it is not necessary to in-stall the other equipments.
- Real moisture-proof, dust-proof, and shock-proof design, suitable to be installed in site, e.g., switchboard.

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.
- 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.

BUENO ELECTRIC

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　　　　　$100/\sqrt{3}$　V

　　b)A.C current　　　　　　5 A or 1 A (as required)

　　c) Rated frequency　　　　50 Hz

2.1.3　Power consumption :

　　a) D.C circuit　　　　　　normal : not larger than 8W

　　　　　　　　　　　　　　operation: not larger than 12W

　　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)

　　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 (5% tolerance)

　　　voltage : 0.4V ~120V

　　　current : $0.08I_n \sim 20I_n$

　　　Zero-sequence current: 20mA ~ 5.00A

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)

2.2.4 Precision of elements

　　current elements　　　　less than　$\pm$　5%

　　voltage element　　　　less than　$\pm$　5%

　　timing element　　　　　less than　$\pm$　20 ms

Contact: sales@bueno-electric.com

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

The inherent differential action time: 1.5 times of setting value :less than 30ms

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 500V megaohmmeter to be not less than 100MΩ 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 GB/T 2423.9. The alternating heat and moisture-proof test is to be done at the highest temperature +40℃±2℃, the maximum humidity（93±3）％, 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 Anti-electromagnetic interference

2.4.1 Pulse interference

The protection can withstand the interference test of 100 kHz and MHz (power frequency), 2500V (test voltage, common mode) and 1000V (differential mode) stipulated in GB/T 14598.13-1998. In the test, the power is first applied at the tested device and the interference test voltage is superimposed per the critical conditions listed in the Table 3.1.1of GB/T 14598.13. The protection will not misoperate or refuse to operate.

2.4.2 Fast transient interference

The protection can withstand the class IV (4 kV±10%) fast transient interference test stipulated in the Standard GB/T 14598.10-1998.

2.4.3 Electrostatic discharge

The protection can withstand the class IV (15 kV for air discharge, 8KV for contact discharge) electrostatic discharge test stipulated in the Standard GB/T 14598.10-1998.

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 16.3 of GB/T 7261.

2.5.2 Impact

The protection can withstand the impact duration test of the severity class I stipulated in the section 17.5 of GB/T 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/T 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).

BUENO ELECTRIC

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

The physical dimensions and holing dimensions are shown in the attached drawings.

On the operation panel, there are the LCD, signal lamps and keyboard. At the lower part of the panel there are the manual tripping and closing switches, change-over switches for discriminating local and remote operations and output pressure plates for tripping and closing. No other accessories are needed in installation. 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 module

AC modules are composed of voltage input and current input modules. There are 3 voltage input modules and 7 current input modules. 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 :

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

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

- Ground protective TA: when input is 5.5A,its out is $5/\sqrt{2}$,with 20mA~6A linear range

3.3 CPU module

The schematic diagram of CPU module is as follows :

BUENO ELECTRIC

RAM			To MMI	Clock	Measuring system

ROM	

FLASH			CPU	RS232 to PC

Ethernet			I/O	Terminal signals

Data acquisition system

Motherboard signals

Out put

Signals ,warnings output
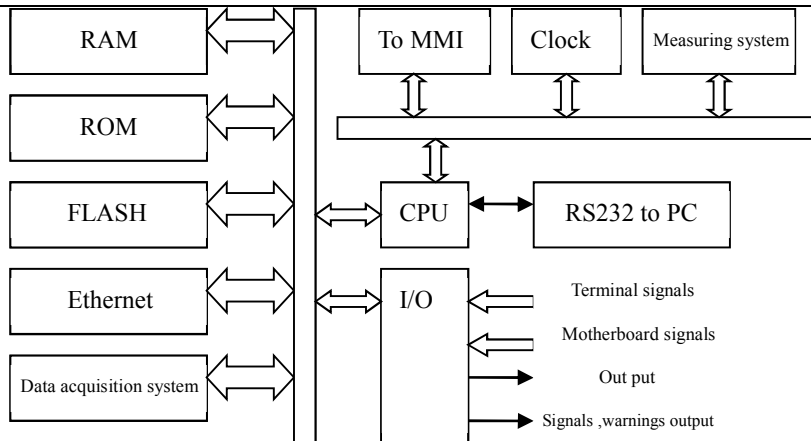
Fig 3-1 Schematic diagram of the CPU module

CPU module is composed of following elements:

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 have a high reliability, high plant ability 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

AC converter module	Low-pass 1	MUX	A/D	Microprocessor

Low-pass 2

Contact: sales

Operational

amplifier
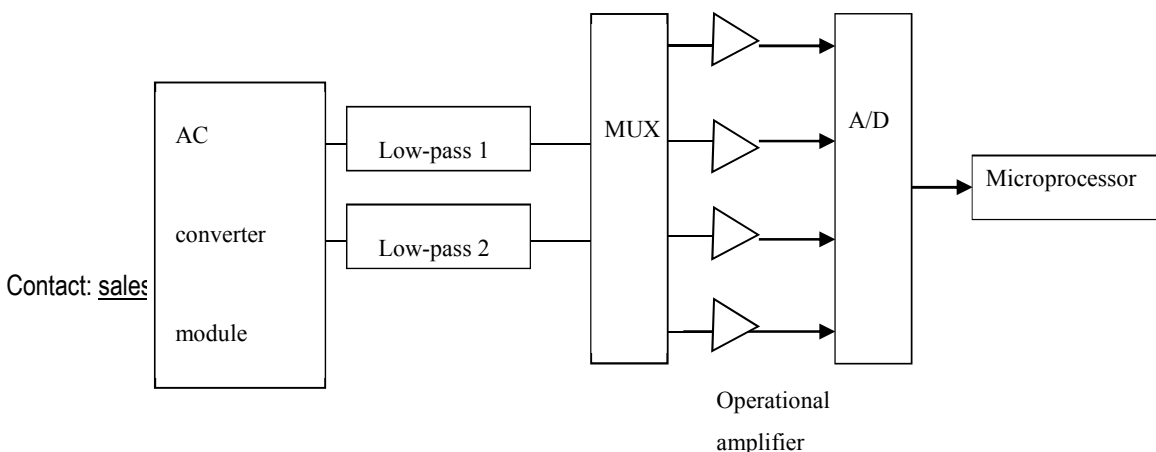
eliminates any measuring error caused by fluctuation of frequency without any software. Once the measuring precision is set in a single time, it will automatically get the memory function and it is unnecessary to adjust it at site. This data acquisition system is provided for selection in ordering.

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 UTPS 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-sealing 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.

See fig 3-1 for its function

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 three groups of DC voltage: i.e. 5V, 24V(1) and 24V(2), 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 (1) is used as the power supply to drive relays

c)   24V (2) is used as the power supply for 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.
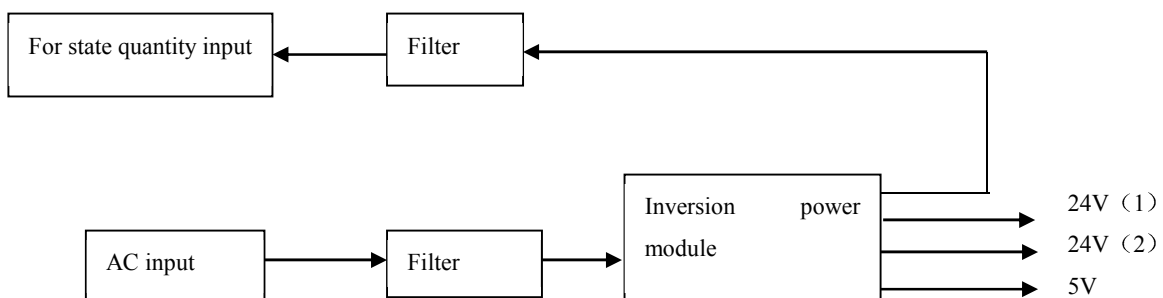
Fig 3-3   Schematic diagram of power supply module

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 Chinese 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.

BUENO ELECTRIC

4 Principle of Protection

Since the 32-bit micro-processors are adopted, the operational speed is greatly increased. It 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 Over-current element

The real-time computation and the over-current discrimination for two 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) .

The logic for the over-current discrimination for two 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

4.2 Overload element

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

MAX $(I\Phi) > Ifh$

Where, I fh is the overload current setting.

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

4.3 Current acceleration element

In the manual or automatic switching onto a permanent fault, when any phase current exceeds the current acceleration setting, the related breakers will be tripped after a time delay for current acceleration elements.

4.4 Zero-sequence over-current element

The element detects the zero-sequence current of the transformer neutral TA (CT)or the zero-sequence filters at the HV and LV sides of the transformer. It will serve as the transformer back-up protection as the load fuse is in failure. For the coordination with the time property of the fuse, the zero-sequence current protection at the neutral or LV side adopts the following inverse time limit performance curves :

$$t = \tau \ \times \ I_{wD}/(I_{eD} - I_{RE})$$

Where, I_{eD} is the rated current at the low voltage side of the transformer, the secondary value must be modified by the current ratio of the TA at the neutral.

I_{oD} is the present zero-sequence current.

I_{RE} is the maximum unbalanced current that is to be escaped by the protection in normal operation at the LV side. Normally, it is 0.25 times the rated current at the LV side. τ is the time constant for the coordination of the zero-sequence protection operation with the fuse.

If the inverse time characteristic is not used, the definite-time zero-sequence over- current element can be selected by the control characters K 1.2.

At the HV side, the zero-sequence current protection is generally in the definite time mode to match with the time property of transformer load fuse.

4.5 Low voltage 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 for low voltage element are :

- when all the three line voltages are lower than the setting for under-voltage, but higher than 10V :
- when all the three phase currents are lower than the current setting , and no signals for TV (PT) wire break are found :
- When the circuit breaker is at close state :
- When the time delay is up.

4.6 Non-corresponding circuit breaker position starting.

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 not the manual handles. This protection system avoid using contacts of the handle, and the reclosing block is realized by the STJ contacts on the panel.

4.7 Non-electric quantity protection

This protection must be coordinated with the optic-controlled relay. The non-electric quantity contacts from the transformer proper are converted into the 24V signals and the signals are output to the switching variable input terminals of the protection. As the non-electric quantity signals are received, it is up to the soft pressure plates to decide whether to trip or not. If the soft pressure plates are out of service, then only the alarm signals will be sent out, otherwise the related breakers will be simultaneously tripped. As the protection trips and the alarm signals are sent, the event recording will be done and the records can be upstream transmitted to the background computer via MMI.

In order to be more flexible, the signal lamps on the panel are named the non-electric quantity 1, 2, 3, 4 respectively. The specific meanings for these non-electric quantity signal lamps will depend upon the

connections of the terminals for the various projects. Generally, it is recognized that the non-electric quantity 1 denotes the input terminal of the heavy gas relay; 2, light gas relay; 3, voltage-regulating heavy gas relay and 4, voltage-regulating light gas relay or over-heat relay.

4.8 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, the condition is a two-phase TV wire break.

3. 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 a single phase TV wire break.

When the TV wire break is detected, the low voltage element is withdrawn. The in-service or out of service of the function of TV wire break detection can be performed by the control characters "self-detection of analog variables summation".

4.9 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.

BUENO ELECTRIC

5 Rated Values and Setting Descriptions

1）List of the rated values for the BEPR- 833 Digital Station Transformer Protection and setting descriptions

Ser. No	Names of rated values	Range	Unit	Remarks
1	Control character 1	0000~FFFF	none	See the descriptions for control character
2	Control character 2	0000~FFFF	none	Stand by
3	Current zone I	0.05~100.0	A	
4	Current zone II	0.05~100.0	A	
5	Time for current zone I	0.0~5.00	S	
6	Time for current zone II	0.1~20.00	S	
7	Overload current	0.05~10.0	A	
8	Time for overload alarm	2~9000	S	
9	Time for overload trip	2~9000	S	
10	Zero-sequence current (HV)	0.05~20.0	A	
11	Time for zero-sequence current (HV)	0.00~32.0	S	
12	Zero-sequence current (LV)	0.05~20.0	A	
13	Time for zero-sequence current (LV)	0.10~32.0	S	
14	Rated current (LV)	0.05~20.0	A	
15	Reference for zero-sequence inverse-time limit	0.10~100.0	A	
16	Current acceleration zone	0.05~100.0	A	
17	Time for current acceleration zone	0.0~5.00	S	
18	Rated value for under voltage	0.0~100.0	V	
19	Time for under voltage	0.0~100.0	S	
20	Under voltage atresia current	0.05~100.0	A	
21	CT ratio (KA/A)	0.001~10.0	N.A	Primary current / (Secondary current*1000)
22	PT ratio (KV/A)	0.01~10.0	N.A	Primary voltage / (Secondary voltage*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	ZS current (LV) 5 A	ZS current (LV) 1A
12	Measuring CT: three-phase	Measuring CT: two-phase
11	Control power off input	Control power off quit
4-10	Spare	Spare
3	Spare	Spare
2	No reclosing after CB tripping	Reclosing after CB tripping
1	Zero-sequence definite-time limit voltage at LV side	Zero-sequence inverse time limit at LV side
0	Tripping from overload	No tripping from overload (alarm signals are only sent)

2） List of soft pressure plates in the BEPR- 833 Digital Transformer Protection

Names of pressure plates	Related functions
Current zone 1	In-service and out of service of the current relay zone I
Current zone 2	In-service and out of service of the current relay zone II
Overload	In-service and out of service of the overload relay
Acceleration	In-service and out of service of the acceleration zone
Zero-sequence current	In-service and out of service of the zero-sequence relay
Low voltage	In-service and out of service of the low voltage relay
Switch-in 1 (defaulted)	In-service and out of service of the heavy gas relay
Switch-in 2 (defaulted)	In-service and out of service of the light gas relay
Switch-in 3 (defaulted)	In-service and out of service of the voltage-regulating heavy gas relay
Switch-in 4 (defaulted)	In-service and out of service of the over-heat relay

BUENO ELECTRIC

6 Figure

Fig.1：DC BEPR- 833U digital station transformer protection device terminal diagram:

BUENO ELECTRIC
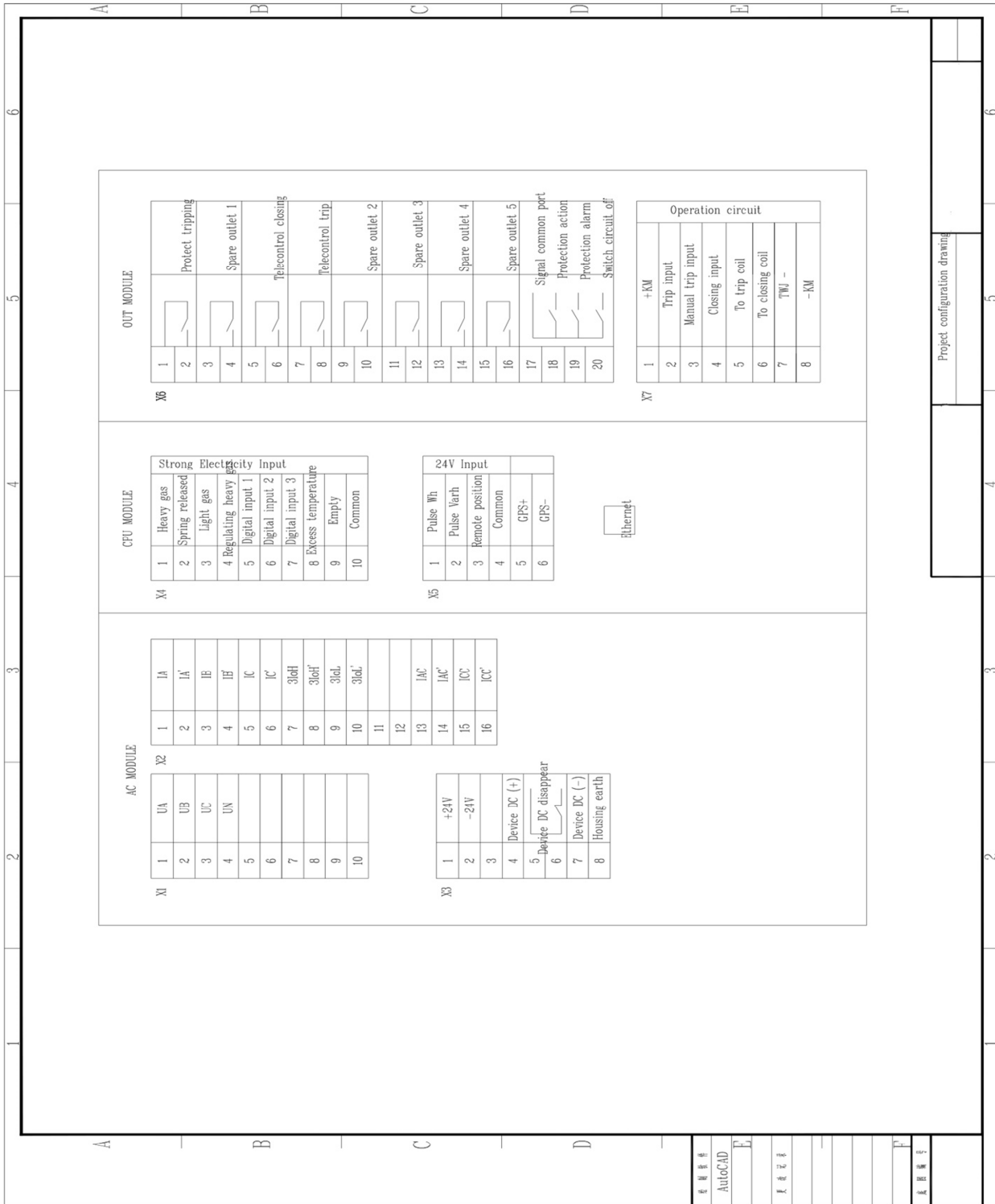
Fig.2：DC BEPR- 833Udigital station transformer protection device installation diagram：

BUENO ELECTRIC
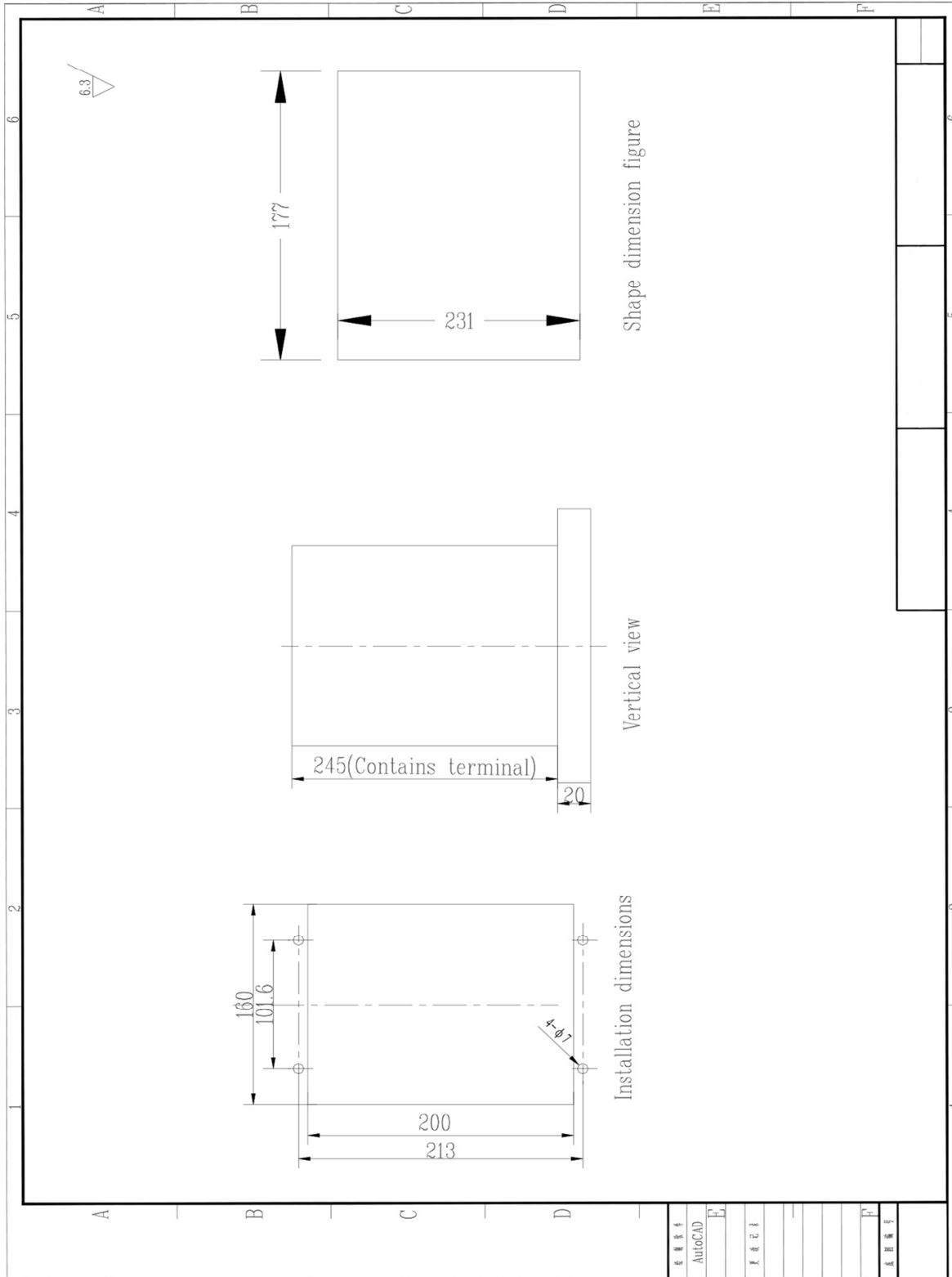
Part 2

Operation Manual

BUENO ELECTRIC

1 Introduction

1.1 Panel layout

BUENO ELECTRIC

1.2 Keyboard

Arrow keys (up)

ENT for acknowledgement

Arrow keys (left)

Reset key

Modifier (increase)

Q

Modifier (decrease)

Q for abundant

Arrow keys (right)

Arrow keys (down)
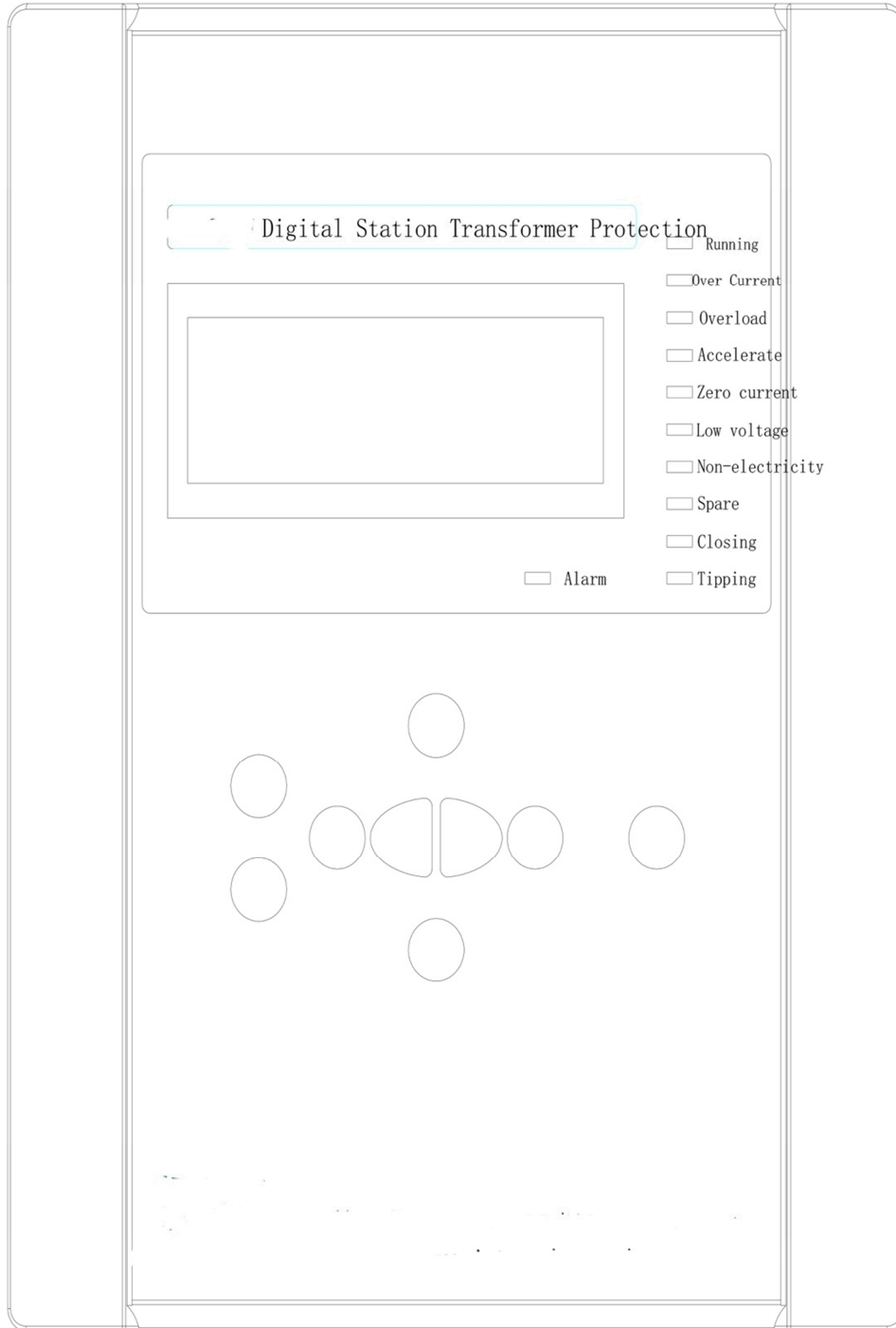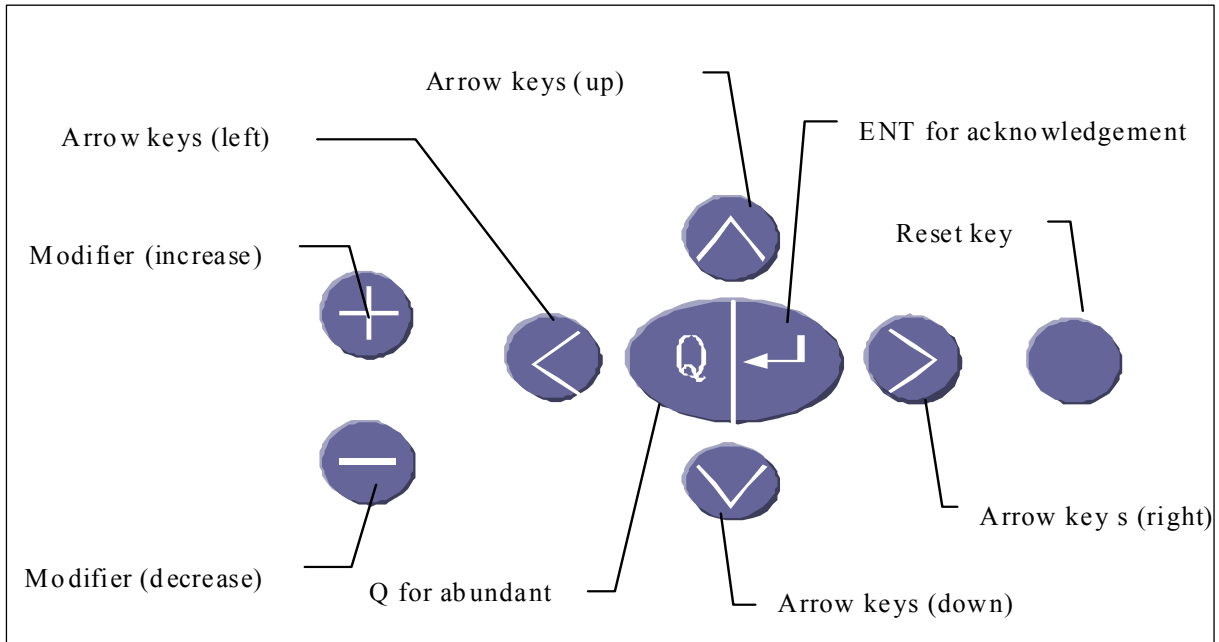
BEPR- 800U **Schematic Diagram for the keyboard**

BUENO ELECTRIC

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;

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;

Contact: sales@bueno-electric.com

BUENO ELECTRIC

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  Ia   0.023A   -20.06°
2  Ib   0.031A    41.46°
3  Ic   0.025A   -19.29°
```

```
2012-07-01    09:38:31*[00]
1   Overcurrent zone Ⅰ        ●
2   Overcurrent zone Ⅱ        ○
3   Overcurrent zone Ⅲ        ○
```

As shown in the figure are the two typical normal display screen used in the BEPR- 833U digital station transformer 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 :

```
              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   Ia    0.023A    -20.06°
2   Ib    0.031A     41.46°
3   Ic    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

```
          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 "一" 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
```

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
  0.984     "z-s inverse time 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?
```

```
          Action report print

          Print server is busy
```

If the printer is not connected or failure will be reported :
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
```
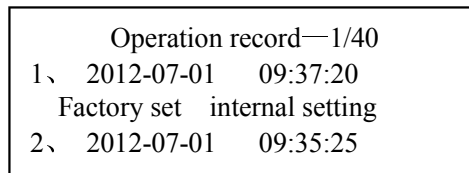
Press [←⌐] key to enter the event to display the dialog box . The event displays the dialog box for each event log entry preceded, the time in the title bar of the reference time for this event happened time .

```
            Alarm report—1/16
■07-01 10:33:26.790
   Invalid setting value area
```

BUENO ELECTRIC

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
```
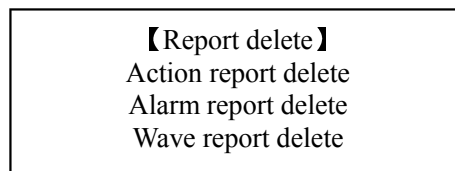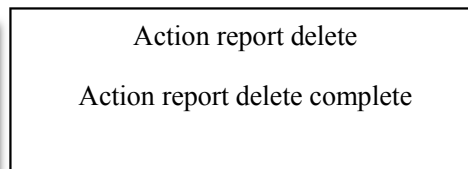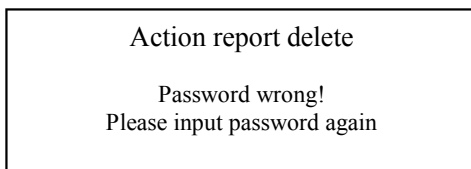
2.2.4.4.1 Action report delete

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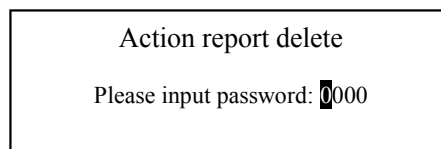
Press 【←┘】 key, If password is wrong，display password wrong dialog box,or display action report delete

```
     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

BUENO ELECTRIC

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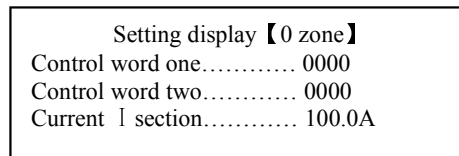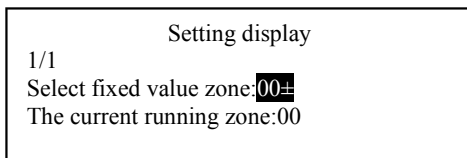
2.2.4.4.3 Wave report delete

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
```
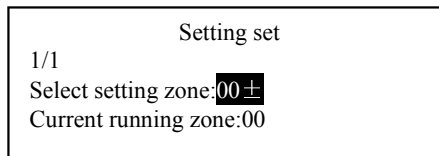
Setting   region   choice   setting display

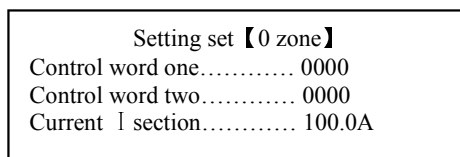**Note : The system defaulted setting will be displayed for the invalid setting zones.**

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

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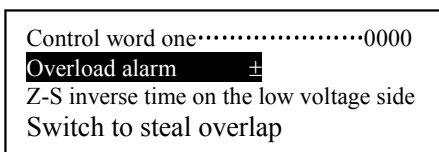
```
        Setting set
1/1
Select setting zone:00±
Current running zone:00
```

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 Ⅰsection………… 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 "一" 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
Overload alarm          ±
Z-S inverse time on the low voltage side
Switch to steal overlap
```

BUENO ELECTRIC

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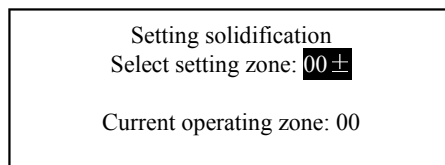
When the target solidification zone is selected, press 【←┘】 key to solidify. The system asks you entering the password.

```
         Setting solidification

      Please input password: 0000
```
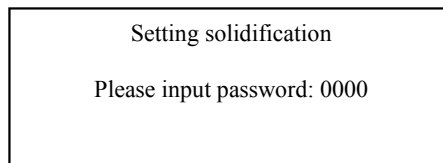
Press 【 ←┘ 】 button to solidification operation, Setting solidification:

```
          Setting solidification

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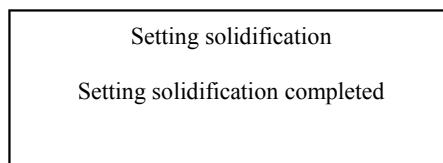
the operation of this protection device password is "8888" if password input error will have prompt, press the "Q" key to return to, or the absence of key images automatically after 3 seconds to return to the superior to re-enter the password.

```
          Setting solidification

            Password wrong
        Please input password again
```
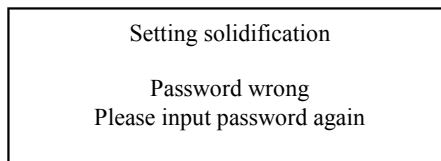
2.2.5.3 **S**etting switchover

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.

Contact: sales@bueno-electric.com
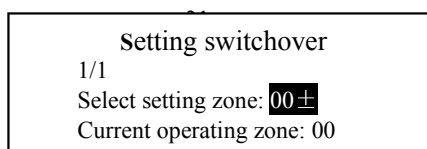
```
          Setting switchover
        1/1
        Select setting zone: 00 ±
        Current operating zone: 00
```

BUENO ELECTRIC

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
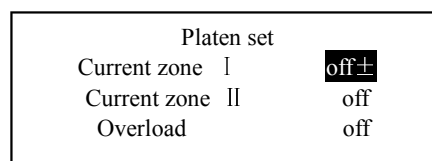.

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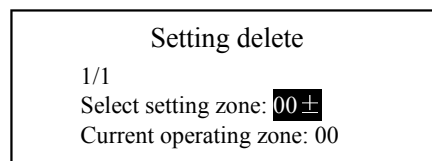
select setting zone

Use "∧" or "∨" key to turn the lines, "+" or "—" 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
     Overload                  off
```

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

Use "∧" or "∨" key to select different platens, "+" or "—" 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.

```
                Platen set

     Please input password: 0000
```

BUENO ELECTRIC
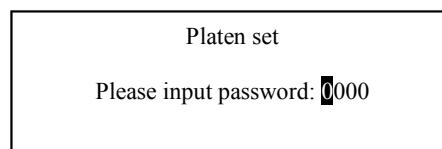
```
            Platen set

          Password wrong!
       Please input password again
```

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

2.2.6.2 Time set

Select the "time adjustment", use "∧" or "∨" key to turn the lines "+" or "−" 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
```

```
            Platen set

         Platen set completed!
```

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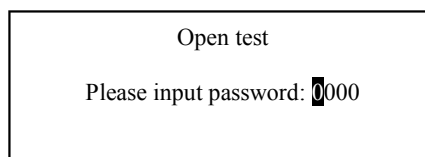
Several setting zone are provided for storage. Before operating a setting switchover, care must be taken that the zone you want to switch over must have its settings otherwise you cannot make any switch. By using the command "setting alteration" you can write several sets of setting into the zone and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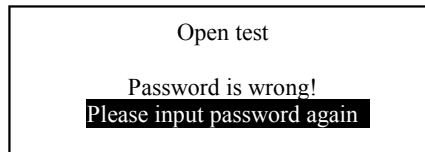
BUENO ELECTRIC

2.2.7   Device test

A set of the interaction block is provided in the BEPR- 800 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.
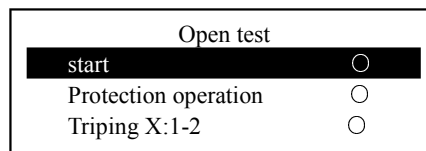
2.2.7.1 Open test

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              │
│  1 X3：1 Heavy gas       open    │
│  2 X3：2 Spring released  open    │
│  3X3：3 Light gas        open    │
└─────────────────────────────────┘
```
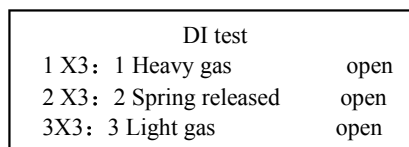
state every 2 seconds refresh open intake status regularly

Contact: sales@bueno-electric.com

BUENO ELECTRIC

Use "∧" keyand"∨" key to turn over line，"＋"and"－"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 ！
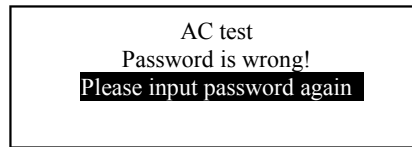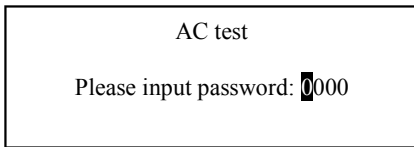
Select "unit tests" menu under "precision test" sub menu, the system prompts for a password:

```
         AC test

Please input password: 0000
```

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

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 "∧" keyand"∨" key to turn over line，"＋"and"－"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
```
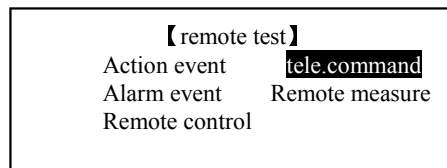
2.2.7.4.1 Action events

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

```
Action events virtual point
1/16
Current Ⅰ section action        ±
Measure NO.: 0
```
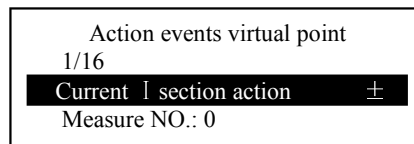
Press 【←┘】 button send one protect Ⅰ section action to the monitoring of remote communication and remote background

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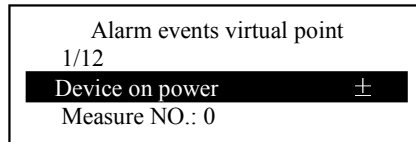
information.

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
```
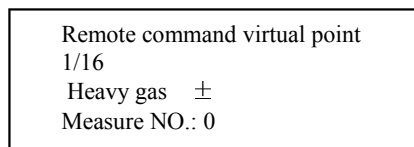
Press【←┘】button send one device on power alarm message to the monitoring of remote communication and remote background

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
         Heavy gas    ±
        Measure NO.: 0
```
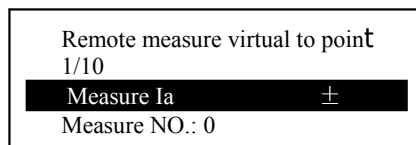
Press 【←┘】 button send a spare telesignalling 1 to the monitoring of remote communication and remote background

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.

Contact: sales@bueno-electric.com

BUENO ELECTRIC

2.2.8.1 Version information

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

> Version information
> Protectiontype:BEPR833Utansformoerprotection
> Protect version： 1.00
> Protect CRC: FFO3
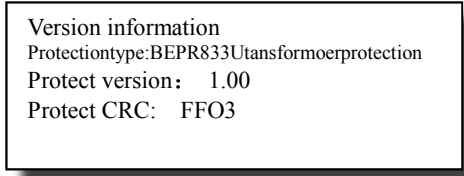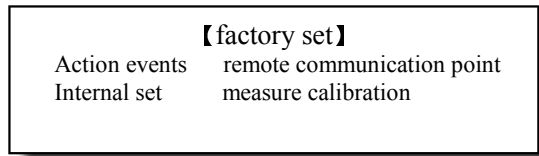
Use "∧" keyand"∨" key to turn over line，"＋"and"－"to turn page to see the all device version and logical information.

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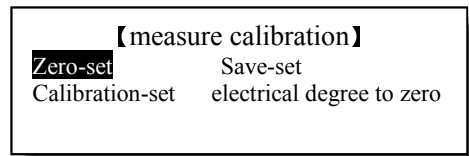
Select the sub-menu "factory set" under the menu "Other"

Enter "factory set" menu   interface :

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

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
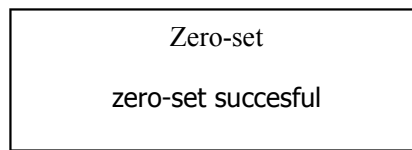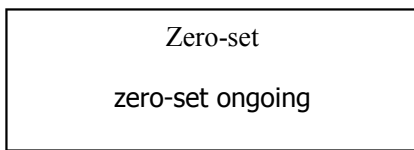
Complete end interface appear, then return "Measurement calibration" menu

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
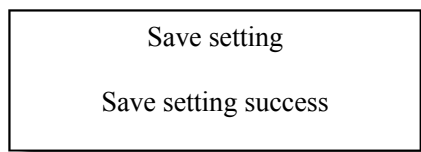
Complete end interface appear, then return "Measurement calibration" menu

Contact: sales@bueno-electric.com

BUENO ELECTRIC

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.

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.

BUENO ELECTRIC

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.

3.5Contact 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 cleck

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.