BEPR- 860 Series
Digital Integrated Monitoring Device
Technical Manual
Operation Manual

Contents

Statement

Congratulation to you on purchasing the digital protection and automation system—a product of Bueno Electric. the leading company in digital protection and automation in the country.

All products in BEPR- series made by the Company meets the Standard ISO9001 for product quality and can tolerate the worst environments at site.

Being experienced in digital protection and automation system production, the Company will give users the all-year 24 hours technical support. You can completely trust in the products made by out Company.

BEPR- series products are totally displayed in English characters with a friendly man-machine interface to free from the troubles in searching operation manuals. Every product, connectors are provided with PC-based interfaces for debugging. With the help of the PSview software developed by the Company, the on-site debugging process becomes greatly feasible.

BEPR- 860 Series Digital Integrated Monitoring Device is mainly suitable to be used in the fields of measurement and control in the substations, open or closed substations of various voltage levels to implement the automation functions of four-teles and synchronized closing. It is totally adaptable to the worst field operational conditions. The panels of he cubicle are artistically designed for easy operation and nice appearance.

Under careful design, BEPR- 860 Series Digital Integrated Monitoring Device possesses the following features:

◆Modular design with high performance and high reliability

Motorla 32-bit single-chip processor is used as the main module for administration and internal bus 8MHz Motorola 68HC08 single-chip processor for the submodule to ensure the stability and operational speed of the product;

- The special power /energy chip is used for the AC acquisition module to obtain a wide acquisition dynamic range and high accuracy;
- The several independent attributes are provided for each telesignaling channel to meet the needs for the fast catch of the signals at different speed and nature. The resolution for telesignaling <1ms;
- The special isolating measures are taken as the weak current terminal of the DC acquisition module to remove the outside interference from any possible weak links;
- The functions of the multi-link blocking and dynamic self-detection are designed in the telecontrol module to obtain a high reliability;
- The high precise clock chip is provided with the GPS hardware time-checking circuit to realize the

clock synchronism in the overall system;

- The high-speed and reliable CAN network communication is adopted between the various internal modules and main module for administration to make the important information be transmitted upward fast and enhance the response speed of the system;
- The flexible on-line or off-line debugging tools and reliable functions for program upgrade, parameter download and data enquiry are provided to meet the requirements in the varying network information era;
- The high-speed Ethernet communication is provided for external interfaces and integrates the standard communication protocol IEC 60870-5-103;
- The visible and flexible picture programmable software function is provided to execute feasibly and fast the 5-protection functions and other automatic functions.

◆Field maintenance-free concept

- Under careful electric design, no user’s adjustment parts are provided;
- Only high quality elements are selected;
- Owing to its superior anti-interference properties, no additional anti- interference modules are needed in installation for the panel-assembling operations or its mounting onto the switchgear;;
- Perfect performance in self-diagnosis.

Safety Standards

BEPR- 860 Series Digital Integrated Monitoring Device conforms to the various safety standards.

GB 191-1990 Representation Marks for Packing Storage and Shipment

GB/T2423.1-1989 Fundamental Environmental Test Regulations for Electrotechnical and Electronic Products Test A: Low Temperature Test Methods

GB/T2423.2-1989 Fundamental Environmental Test Regulations for Electrotechnical and Electronic Products Test B: High Temperature Test Methods

GB/T2423.9-1989 Fundamental Environmental Test Regulations for Electrotechnical and Electronic Products Test Cb: Equipment Constant Humid and Heat Test Methods

GB/ T 2887-1989 Technical Specifications for Computation Station Site

GB/T 3047.4-1986 Basic Size Series for the Cubicles and Plug-in Units at a Height of 44.45 mm

GB/T 7261-1987 Basic Test Methods for Relays and Protections

GB 9361-1988 Safety Requirements for Computation Station Site

GB/T 13729-1992 General Technical Specifications for Telecontrol Terminals

GB/T 14537-1993 Impact and Crash Tests on Measuring Relays and Protections

GB/T14598.9-1995 Electric Relay Part 22: Electric Interference Test for Measuring Relays and Protections idt IEC 60255-22-3:1989 Section3: Radiated Electromanetic Field Interference Test

GB/T14598.10-1996 Electric Relay Part 22: Electric Interference Test for Measuring Relays and Protections idt IEC 60255-22-4:1992 Section 4: Fast Transient Interference Test

GB/T14598.13-1998 Electric Relay Part 22: Electric Interference Test for Measuring Relays and Protections eqv IEC 60255-22-1 1988 Section 1 1MHz Pulse Interference Test

GB/T14598.14-1998 Electric Relay Part 22: Electric Interference Test for Measuring Relays and Protections idt IEC 60255-22-2:1996 Section 2 Electrostatic Discharge Test

GB/T15153-1994 Operating Conditions for Telecontrol Equipment and System--Environmental Conditions and Power Supply

GB16836-1997 Safety Design Requirements for Measuring Relays and Protections

Q/SDNZ.B 24-1992 General Marks for Product Packages

IEC 60255-21-1:21-1: 1988 Electric Relay Part 21: Vibration, Impact, Shock and Earthquake Tests on Measuring Relays and Protections Section 1: Vibration test (Sinusoidal)

Part 1

Technical Manual

1 Brief Introduction

BEPR- 860 Series Digital Monitoring Device is a dispersed unit equipment-oriented monitoring device. It takes the Motorola MCU as its core processor. The internal part of each unit consists of the multi-CPU modules linked by the reliable and fast CAN bus. The functions of the various submodules of the device are allocated as follows: intelligent digital variable acquisition module (hereafter referred as DI), Intelligent AC acquisition modules (those containing 4TV and 4TA are hereafter referred as AC; those containing 8TA as AC-I, those containing 8TV as AC-U), intelligent temperature DC acquisition module (DC), intelligent control module (OUT), intelligent digital input and output module (DIO), non-intelligent AC input module (NAC), non-intelligent output module(NOUT), voltage parallel module (VP) network interface module(COMM) and other selectable module. The main module (CPU) is responsible for the management and collection of the information and configuration of the various submodules. Those special functions, e.g., synchronism, remote/ local, etc. are detected and discriminated by the main module. The functions of the module DI include the acquisition of the configurable switching variables, acquisition of the pulses and acquisition of the codes signals, etc.. The functions of the AC module include the acquisition of current, voltage, active power, reactive power, power factor, active electric energy and reactive electric energy. The DC modules acquire the external weak DC input variable, which may be the temperature or the DC voltage variables output by the DC transducer. The OUT module can implement the telecontrol / teleadjust functions. The DIO module can execute the telesignal, telecontrol / teleadjust functions to realize the function of the telesignal blocking telecontrol and slip blocking functions, etc..

There are two sizes for the cubicles of the monitoring device: 19 inch 4U standard cubicle and 19/2 inch 4U standard cubicle. A Power supply module and a main module for administration are mounted within each kind of cubicle and their positions in the cubicle are relatively fixed. They occupy the width of 60mm (for 19 inch cubicle, and 50mm for 19/2 inch cubicle) and 30mm. The width of the other modules is 30mm except the AC module whose width is 60mm. Moreover, the modules of 30 mm are inter-chargeable in the various slots of the cubicles. Their positions and configurations are relatively flexible. The main module for administration has the capability for a certain capacity of the switching variable acquisition (8-circuirt) analog variable acquisition (8-circuit) and signal output (8-circuit), which is usually used to drive the 8-circuit null contact output of the non-intelligent output module. If the function of synchronism is required, the NAC and NOUT modules can be configured at the left and right sides of the main module for administration to let the main module execute the discrimination and the command output of the synchronous closing function. The plugging-in position of these two modules is relatively fixed in their application.

Fig. 1-1 shows the schematic diagram for the configuration of the 19/2 inch cubicle (back view). Fig.1-2 shows that for 19 inch cubicle (back view). The AC module in the figure occupies the position for two DI (or

DC, OUT, DIO) modules in which two DI /DC / OUT / DIO modules can be inserted. The position of DI / DC / OUT / DIO in the figure can be interchanged or increased or decreased or in other capacity allocation modes. The slots of any two continuous DI / DC / OUT / DIO modules can be inserted by AC modules; the various input variables of the DI modules themselves can be also let as the inputs of the different natures. All these modes make the configuration of the device very flexible. But we suggest that the user's requirements be incorporated in the typical configuration schemes provided by our company. This is not only feasible for the administration of out manufacture, but also will realize the specification of the user's administration. (Attention: Fig.1-1 and 1-2 are only used as the reference for configuration and do not represent the actual dimensions and they are not the sole mode for configuration.)

Capacities of the various modules: 20-circuits of digital variable input for DI module, 12-circuits of input for DC module, 10-circuits of open contact output for OUT module (the output of the 11th circuit is output jointly with that of the 9th circuit. For the control of circuit breakers and isolator, starting from the output null contact of the first circuit, the order is recommended to be arranged as open, close, open, close…), 11 circuits digital variable input and 5 circuits open contact output for DIO module, 4 circuits of current and 4 circuits of voltage for AC module, 8 circuits of current for AC-I module, 8 circuits of voltage for AC-U module, 8 circuits of open contact output (there is a pair of jointly-operated contact output for the first and third circuit respectively), 4 circuits

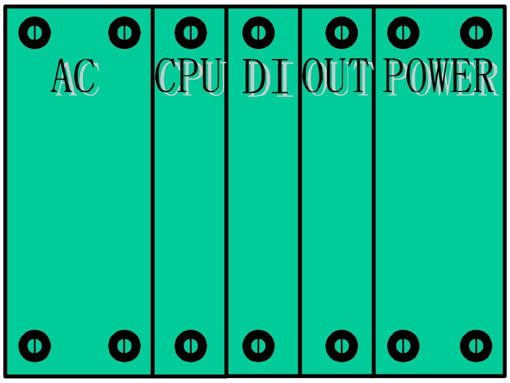


Fig.1-1 Schematic diagram for the configuration of the 19/2 inch cubicle

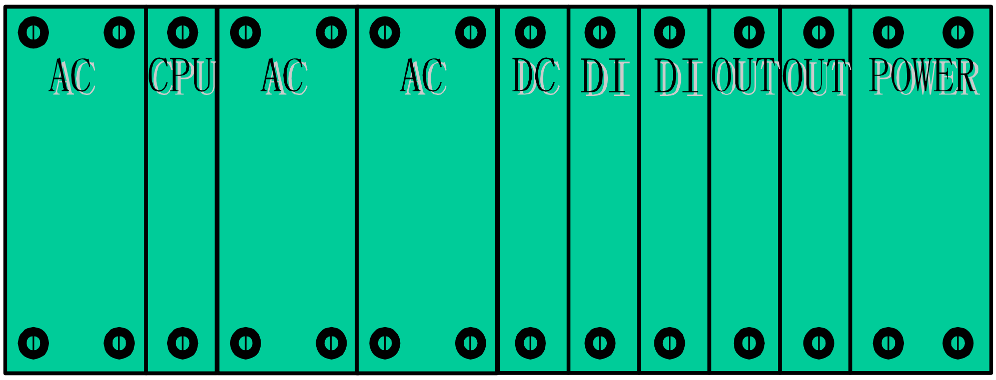


Fig 1-2 Schematic diagram for the configuration of the 19 inch cubicle

Table 1-1 Simplified list of the parameters for the modules of BEPR- 860 Series Device

Name of module	Slot occupied	Occupied width (mm)	Inserting position not fixed	Selectable or necessary	Is it an intelligent module	Terminals from module(note)	Acquired data capacity	Output data/contact
AC	√ (occupied)	2*30	√ (not fixed)	selectable	√ (yes)	10+12I	4*U, 4*I	I,U,P,Q, COS,+E_P, +E_Q, -E_P, -E_Q
AC-I	√	2*30	√	Selectable	√	24I	8*I	I
AC-U	√	2*30	√	Selectable	√	16	8*U	U_{AC}
DC	√	30	√	Selectable	√	14	12*DC	U_{DC}
DI	√	30	√	Selectable	√	22	20*DI/ coding/PI	DI, SOE, coding, PI
DIO	√	30	√	Selectable	√	22	11*DI	(ditto), 5*digit-out
OUT	√	30	√	Selectable	√	22	-	10*digit-out
VP	√	30	√	Selectable	×	22	-	10*N.O., 1*N.C.
NAC	√	2*30	×	Selectable	×	10+12I	4*U, 4*I	I, U_{AC} ,f
NOUT	√	30	×	Selectable	×	22	-	8*digit-out
CPU	√	30	×	Necessary	√	12+2* RJ45	8*DI, 1GPS	DI,SOE, data of various submodules
POWER	√	60 or 50	×	Necessary	×	12	-	-
MMI	×	-	×	Necessary	√	-	-	-
COMM	√	30	√	Selectable	√	3*RJ45, 2*DB9	-	(network/ communication: interface/ conversion/ rout/printing server)

Note 1: “I” denotes current terminal in this list. “DB9” denotes 9-pin serial interface. “RJ45”denotes Ethernet twin-twisted interface. Others are “MSTB2, 5” Series Phoenix terminals.

2 Technical Parameters

2.1 Rated parameters

2.1.1 Rated DC voltage input: 220V or 110V(indicate in ordering)Rated DC voltage output: +5V, ±12V, +24V(1), +24V (2)

2.1.2 Rated AC data:

2.1.2.1 AC voltage: 100V, $100/\sqrt{3}$ V

2.1.2.2 AC current: 5A or 1A (indicate in ordering)

2.1.2.3 Rated frequency 50Hz /60Hz

2.1.3 Power consumption

2.1.3.1 DC circuit: 19/2 inch cubicle: <30W;

19 inch cubicle: < 60W

2.1.3.2 AC voltage circuit: ≤0.5VA / phase

2.1.3.3 AC current circuit: ≤0.75VA / phase

2.1.4 Status variables, pulsing variable level 24V (18V-30V)Pulse width: ≥10ms (This parameter is related with the setting up or the time constant for the filtering of the pulsing variable inputs and can be set.)

2.2 Main technical property

2.2.1 AC circuit measuring range

Voltage: 0～120V

Current: 0～1.2In

2.2.2 Contact capacity

Control output contact current-carrying capacity: 10A (250V AC / DC)

Control output contact breaking capacity: 10A (30V DC); 10A (250V AC)

2.2.3 Accuracy of the analog variable measuring circuit

AC current, voltage: 0.2 class

Power, KWH: 0.5 class

Temperature, DC: 0.2 class

2.2.4 Event of sequence records resolution: ≤ 1ms

2.2.5 Overload capability

AC current circuit: continuous operation at 2 times the rated current

Continuous operation for 10s at 10 times the rated current

Continuous operation for 1s at 40 times the rated current

DC power supply circuit: continuous operation at 80%～115% the rated voltage

2.2.6 Response time for upward transmitted data:

Telesignaling position-variation < 1s;

Telemetering varied data < 2s

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 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 interconnected 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 GB/T2423.9. The test is done at the temperature of +40ºC±2ºC, the related humidity of (93±3)%. The constant heat and moisture-proof test is done for 48 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 1MHz at the severity class III, i.e. decaying oscillation wave at the test voltage of 2500V common mode and 1000V differential mode stipulated in GB/T14598.13-1998. As the pulsing group interface is applied, the protection will not misoperate or refuse to operate. In the test, the protection's properties are still consistent with the stipulations in the technical specifications.

2.4.2 Electrostatic discharge

The protection can withstand the class III (8kV for air discharge, 6kV for contact discharge) electrostatic discharge test stipulated in the Standard IEC255-22-2.

2.5 Mechanical performance

2.5.1 Vibration

The protection can withstand the vibration duration test and vibration response capability test of the severity class I stipulated in the IEC 60255-21-1: 1988.

2.5.2 Impact

The protection can withstand the impact duration test and impact response test of the severity class I stipulated in GB/ T 14537-1993.

2.5.3 Collision

The protection can withstand the collision test of the severity class I stipulated in the Section 4.3 of GB / T 14537-1993.

2.6 Environment conditions

a) Ambient temperature :

operation : -5ºC～+ 40ºC.

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.

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 %.

b) Atmospheric pressure: 80～110 kPa (relative altitude above sea level is less than 2 km).

3 Hardware

The requirements for the reliability have been fully considered both in the device's overall design and the design of the various modules and the detailed considerations have been given for the program execution and communication. The test has shown that as the 8kV space electrostatic discharge interference test or 6kV contact electrostatic discharge interference test is done at any parts of the device, the CPU resetting does not occur in this device.

Since a full consideration is given to the anti-interference capability of the device, no additional AC, DC input anti-interference modules are required to be mounted as the panel-assembling operations are made or the device is installed on the switchgear.

Actually, two systems made up of MCU act as the main module for administration of the device and their communications are made via the SPI bus. One is the main module formed by the Motorola 32-bit single-chip processor (hereafter referred as CPU), whose bus is not out of the board. Similar to other submodules, it is plugged in or pulled out from the back part of the device. The other is the keyboard display system formed by the Motorola 8-bit single-chip processor (hereafter referred as MMI). It is mounted at the internal side of the front panel as a peripheral equipment.

All the other submodules of the device are the systems whose buses are not out of chip with a high reliability and anti-interference capability.

Fig. 3-1 is the schematic diagram for the internal relationship or the device. As the NAC module and NOUT modules are primarily used in such applications as synchronous closing, the MCU systems are not contained in these modules.

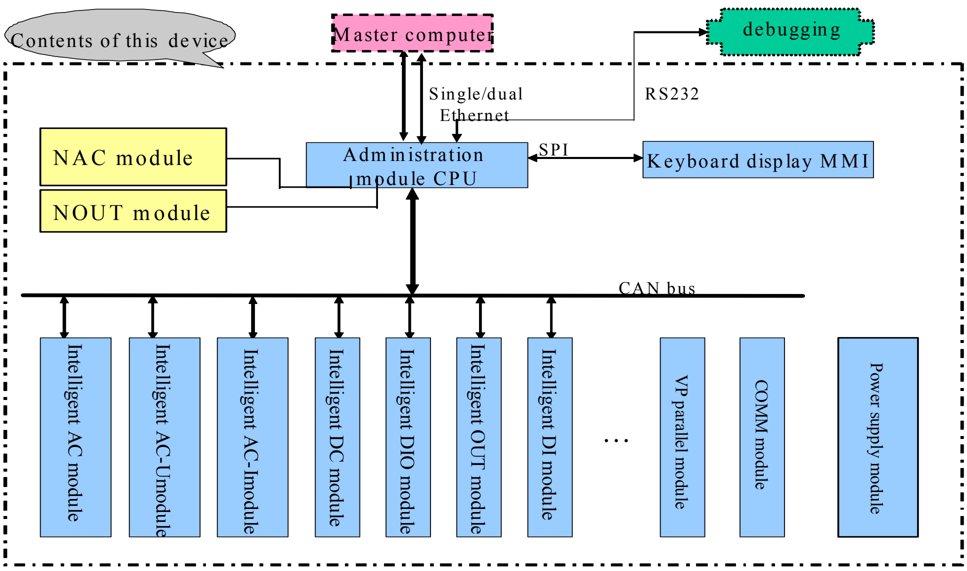


Fig.3-1 Schematic diagram for the relationship of the BEPR-860 Series modules

3.1 Cubicle structure

There are two kinds of the standard cubicle, i.e. 19 inch 4U and 19/2 inch 4U used as the physical dimensions of the device and they are all of the back-plugging structure. The modules are plugged-in or pulled out from the back part of the device and the integral base-plate is mounted with sockets and located at the front part of the cubicle. The base-plate is an integral pcb. The connecting wires for sockets are arranged on the base-plate. This structure has the following advantages:

a) The modules are self-provided with the pluggable terminals (Current terminals are unpluggable). On the base-plate, there are only the connecting wires for the 5V, 12V and 24V circuits and the strong and weak current parts of the functional submodules are totally isolated to significantly reduce the coupling of the external electromagnetic interference at the weak current side strengthen the anti-interference capability of the device as well as to enhance the reliability and safety of the device.

b) The base-plate connecting wires can be arranged in the bus mode to obtain a high flexibility in the provision of the functions. As required by a user, a part of modules can be replaced or added or decreased and the functions of the device can be expanded or altered.

c) It is feasible to make the module design for plug-in units.

d) The heavy current plug-in units of the AC module can be cancelled to enhance the reliability of the device.

The physical dimensions and hole dimensions of the cubicle are found in the appended diagrams in this Manual.

The integral panel is adopted for the device. On the panel, there are the Chinese characters LCD. Operating indicating lamps (green lamp for operation, red lamp for faults) and the operating keyboard. In installation of the device, no other accessories are required and the panel-assembling operations and field construction are significantly simplified.

3.2 Intelligent AC module (AC, AC-1, AC-U etc.)

Intelligent AC module contains 4-circuit voltage inputs (U1, U2, U3, U4) and 4-ciruict current input (I1, I2, I3, I4) and MCU processing subsystem as well as CAN controllers, etc.. The power computation for current and voltage is related in pairs, i.e., U1 and I, U2 and I2, U3 and I3, U4 and I4 are internally related in power respectively. For instance, as the two-table method is adopted for the connection to form power/energy, U1 is connected to Uab, I1 to Ia, U2 to Ubc, I2 to Ic and the related power group is set up on the MMI as the sum of the two variables. As the three-table method is adopted for connection to form power/energy, U1 is connected to Ua, I1 to Ia, U2 to Ub, I2 to Ib, U3 to Uc, I3 to Ic and the related power group is set up on the MMI as the sum of the three variables. Such tasks as the summation can be given to the upward computer system.

The principle and the outgoing terminals of the intelligent AC module are found in the appended diagram of the Manual.

The difference between the intelligent AC modules AC-I, AC-U and AC modules lines only in the measurement of 8-circuit current and 8-circuit voltage inputs and others are the same.

3.3 Main module for administration (CPU, MMI)

The simplified schematic diagram for the module is shown as follows:

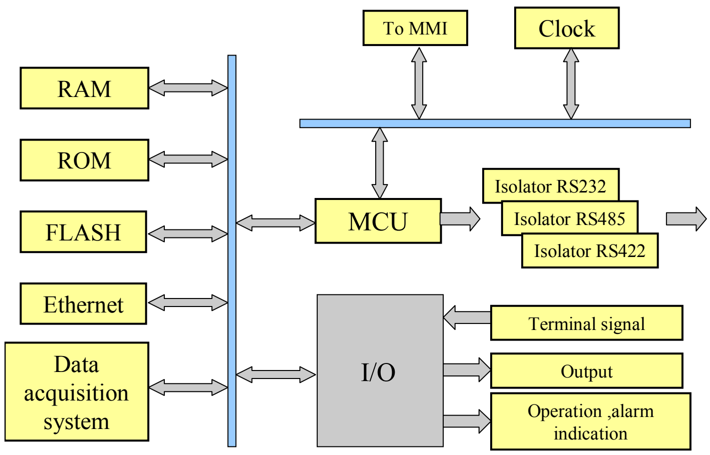


Fig.3-2 Schematic diagram for the main module for administration

The essential programs for the functions, e.g., synchronism, remote/local and selection of the single network or dual networks is stored in this module.

The synchronism function of the BEPR-860 Series Device is started by a switching-in variable on the CPU module. The serial No. of this switching-in variable is provided by the setting. The settings of 1-8 indicate respectively that the switching-in variables in the circuits Nos.1-8 of the CPU module start the synchronous detection. As the setting is 0, that is to indicate that the synchronism function has been exited (this is different from the concept “No detection” as the synchronism function is switched on!) The synchronous control output No. can be also provided by the setting. The settings of 1~8 indicates respectively that the synchronous outputs are output by the switching-out ports Nos.1~8 (note: the output of the circuits Nos.1, 3 have a gang output contact each). As the synchronism function is switched on, the synchronism mode is jointly decided by the setting of the CPU module and soft jumper, as shown in Table 3-1. The other details relating to the synchronism function can refer to the introduction to the NAC modules and the setting descriptions.

The remote/local function can be only implemented on the control and signal resetting. The objects of the remote/local function can be at most 4 groups designated by the internal settings.

The objects of the respectively functioned control and signal resetting can also be designed by the internal settings. The details can be found in the setting descriptions. The selection of single network or dual network can be set up by the internal setting control characters. For the single network operation, all the 4 bits of the IP address can set whether the selectable device, part A or port B is used to be connected to the external devices. For instance, if the IP address for Network A is set to be 172.20.1.1 for Network B, 172.21.1.1, the addresses of the device are required to be 1.1. For the dual network operation, as some problems occur in Network A, then the device will be automatically switched on to the Port B of the standby Ethernet, its IP address will be 172.21.1.1, if some problems occur in Network B, the device will still be automatically switched on to Network A, and its IP address will be 172.20.1.1.

Table 3-1 List of the true values for the provision of the synchronism settings

Settings					Soft jumper	Results
Setting subitems	Setting control characters				Synchronism jumper	
Synchronous telesignal No. or synchronous output No.	No check	Check no voltage	Check synchronism[2]	Catch synchronism[2]		
0 for an item	*[1]	*	*	*	*	No synchronism function
Not zeros for others	*	*	*	*	Exit	No check (i.e., output directly as there are synchronous telesignal)
	Switch on	*	*	*	Switch on	No check
	Exit	Switch on	Exit	Exit		Check no voltage
	Exit	Exit	Switch on	*		Check synchronism
	Exit	Exit	Exit	Switch on		Catch synchronism
	Exit	Switch on	Switch on	*		First decide check no voltage, then check synchronism
	Exit	Switch on	Exit	Switch on		First decide check no voltage, then catch synchronism
	Exit [3]	Exit [3]	Exit [3]	Exit [3]		No check

Note:

*1) Mark * in the Table indicates that this setting is not related.*

2) Differences between check synchronism and catch synchronism: the former will only decide the magnitude difference and phase angle difference of the voltage and LV blocking conditions, and the latter, besides the above items, will also decide the frequency difference blocking, frequency acceleration blocking, permissive closing angle and leading time, etc..

3) This provision is not recommended.

The main module for administration consists primarily of the following parts:

1) CPU system

The CPU system is composed of MCU, RAM, ROM, Flash Memory, etc.. The high-performance 32-bit MCU and the bulk storage space make the CPU module have the extremely capability powerful data processing and memory capability. The protection programs complied by the C language make them very reliable, plantable and maintainable.

The CPU system itself is provided with the such functions as a some quantity of switching-in (8 circuits), switch-out signal (8-circuits) and A/D sampling(8 circuits). These functions are mainly used for synchronous closing or remote/local switching and will not be used generally.

Fig. 3-3 is the principle schematic diagram for the A/D part.

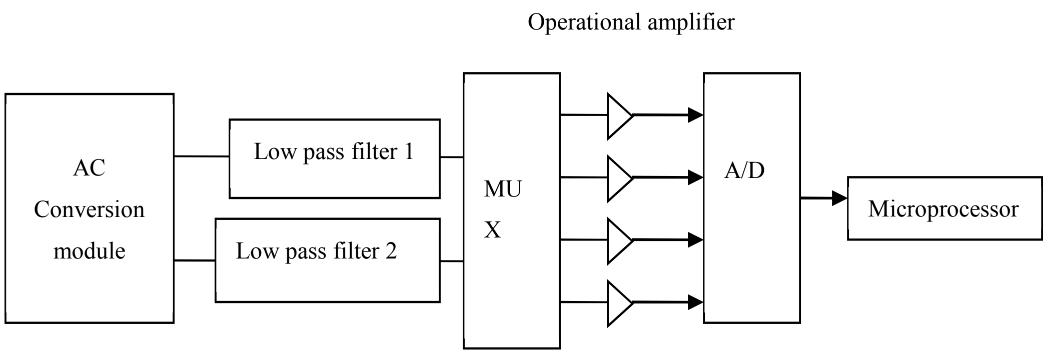


Fig.3-3 principle schematic diagram for the A/D system

The switching variable inputs and outputs are all isolated by the opto-coupler.

This system contains the Ethernet chip which has a very high speed and universal communication port. The Ethernet is the principal communication interface for the connection of the device to the system.

This system is also provided with a SPI interface which is used to communicate with the man-machine interaction (MMI) module; a SCI interface (isolated RS232 interface is led out on the panel) is used to connect to a PC, etc.. With the help of the PC's powerful functions and provided special debugging software packages, the various tests, debugging and provisions can be made for the whole device.

The hardware clock circuit is provided in the system. The precision of the clock chip used is high and no

Y2k problem. This device also considered the hardware time-checking circuit to receive the GPS pulse time-checking signals and simultaneously extend GPS signal to the various submodules.

The principle schematic diagram of the CPU module can be found in the appended diagrams.

2) MMI system

The essential part of the man-machine interaction (MMI) system is a single-chip computer whose bus is not out of the chip. Its principal functions are to display the device's information and scan the keyboard status on the panel and transfer it in real-time to CPU. So in the sense of CPU, MMI is equivalent to its one of the peripheral equipments. The CPU communicates with MMI via SPI at the high speed of 2Mb/s with a high reliability. In this configuration mode, not only the external connection of a large number of the CPU bus can be avoided to enhance the device's reliability, but also the performance-price ratio of the device can be lifted without increasing the product's cost.

The LCD unit of 4 lines 12 Chinese characters each line is used as the display window for the module.

The man-machine interface is clear and easy to understand and it is provided with the keyboard operating mode generally used by the BEPR- series protections to make the MMI operation feasible and simple.

3.4 Power supply module (POWER)

This module is a DC inverted power supply module. The 220V DC or 110V DC voltage inputs, through the anti-interference filtering circuit and based on the principle of inversion, output 4 groups of DC voltage required by this device, i.e., 5V ±12V, 24V(1) and 24V(2). 5V and ±12V voltages are commonly grounded but they are not commonly grounded with 24V(1) and 24V(2). They are floatly grounded not connected with the casing.

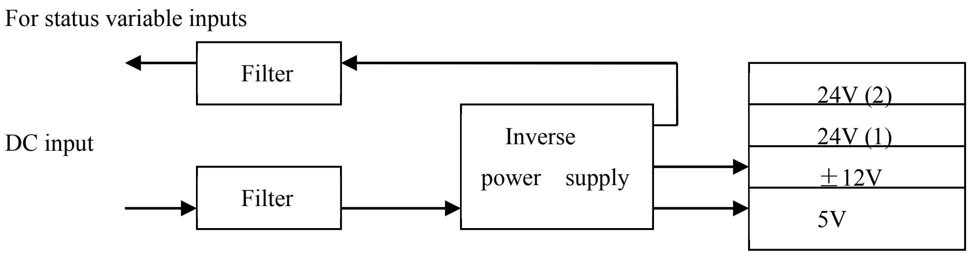


Fig.3-4 Principle schematic diagram for the power supply module

The uses of the various output voltage systems:

a) 5V is the operating power supply for the various processor systems;

b) ±12V is the operating power supply for the simulation system;

c) 24V(1) is the power supply to drive the signal outputs and relays;

d) 24V(2) is the power supply for the external switching-in variables.

In order to strengthen the anti-interference capability if the power supply module, the 24V power supply for the DC inputs and going terminals of this module is all filtered with filters. The terminals 5, 6 of the power supply module are used for the null contact outputs for loss of power signals of this device.

3.5 Intelligent digital variable input module (DI)

The functions of the digital variable input module include: switching variable input, encoded input, pulsing variable input. Specifically, switching variable inputs can acquire: switch position, isolator position (tap position), operating alarm signals for various protection and safety devices, other common signals, etc.. The encoded inputs can acquire: water level information,(tap position), etc.. The pulsing variable inputs can acquire: positive active KWH, negative active KWH, positive reactive KWH, negative reactive KWH.

It is necessary to indicate that the encoded inputs are permitted but as the slip blocking processing is unnecessary to be done by this device, such information as the tap position can be considered as one category with the switching variable inputs to be upward transmitted to let the system above the master computer form the tap position information according to the telesignaling status.

The encoded inputs here can be actually allowed to be connected in the four formats:

a) To be input in the single contact mode. The output value is the serial No. of the contact-blocked switching-in variables in the input signals. 1 denotes the lowest value and its serial No. lies in the first position. Since the value is restrained by the number of terminals, it will not be larger than 20. b) For the BCD code inputs, the lower bit lies in the first position, and its value is restrained by 99999. c) For the HEX code inputs, the lower bit lies in the first position, and its value is restrained by 0xFFFFF. d) For the carry code inputs, the lower bit lies in the first position, the first 10 bits are the bits for the natural number, and the bits coming after them (not larger than 10 bits) are the carry ones AND ITS VALUE IS RESTRAINEDBY 99. e) The first encoded input in any format is permitted to be analyzed in the count mode into telesignaling outputs in the single-contact mode.

All the input have their own filtering time constant for each circuit (or called debounce time) whose range to be set is 0ms~9999ms, at the step difference of 1ms. The specific set value is related to the maximum possible varying speed and minimum varying time. For common switching variables, 15ms can be set. But for some wire break signals in the operating circuit, since the short-duration wire break signals may be present as the switches are tripped or closed, a longer filtering time can be set according to conditions, e.g., 1000ms, The switching variables can be set as common status variables (SOE is not present) and SOE (also contains the status variable information). Similarly, it is suggested that the input attributes in the various circuits of the DI module be included in the given several typical configuration modes, though on principle, there can be various configuration modes. The special configuration requirements can be indicated in ordering.

There are 20-circuit inputs for this module, which are divided into two groups: the former group includes 16-circuit inputs and the related common negative terminals, which are mainly inclined to acquire switching variables and encoded signals; the latter group includes 4-cirucit inputs and related common negative terminals, which are mainly included to acquire the pulsing variables. These common negative terminals in two groups can not be interconnected and they can have their own 24V driving power supply respectively but also can have a common power supply, e.g., 24V(2) power supply provided by the device.

Fig. 3-5 shows the schematic diagram for the outgoing terminals of the DI module and the wiring example as the inputs in the former group use the device's 24V(2) as its driving power supply and the latter group uses the active inputs for reference.

3.6 Intelligent control module (OUT)

There are altogether 10-circuit separate null contact outputs for OUT Module. The 11th circuit null contact outputs are combined with the 9th-circuit outputs, i.e., the 9th-circuit control will simultaneously act on the outputs of the 11th circuit. The module will implement the control on the switches, isolators and loaded voltage-regulated (step up, step down shutdown) devices. The outputs in each circuit can be in the form of long-duration pulses or short-duration pulses, which will be decided by the orders from the monitoring system. The width of both long-duration and short-duration output pulses can be determined by the settings respectively. In the setting calibration for the device's settings, the permissive width range is 0 ~ 9.999s, at the step difference of 0.001s.

The details about output terminals can be found in the appended diagram for terminals.

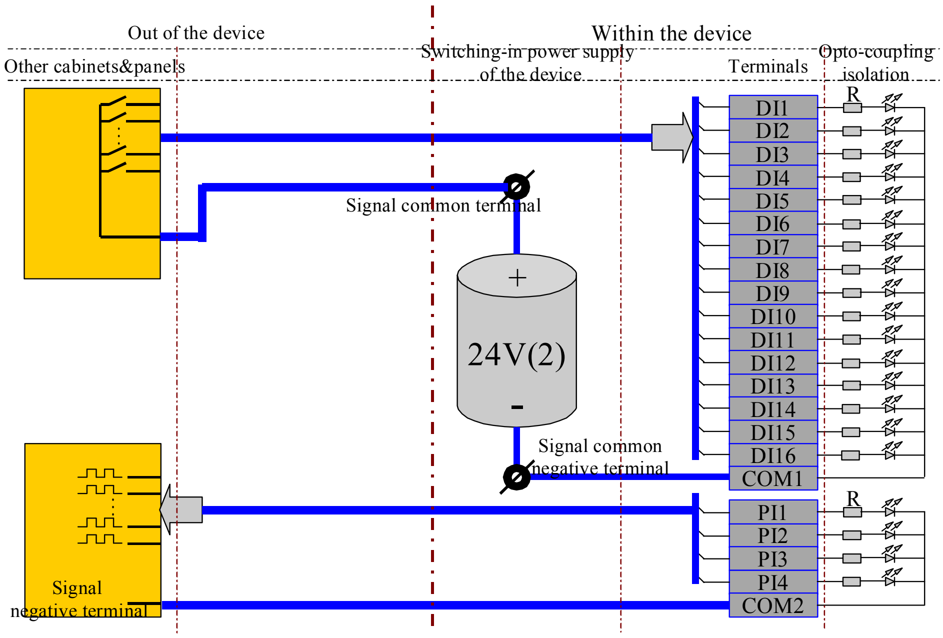


Fig.3-5 Terminals of DI module and wiring schematic diagram

3.7 Intelligent temperature DC acquisition module (DC)

This module can acquire the 12-circuit DC weak current signals output by the temperature transducer and DC transducer, e.g., 0~5V signals, to make the A/D sampling after isolation.

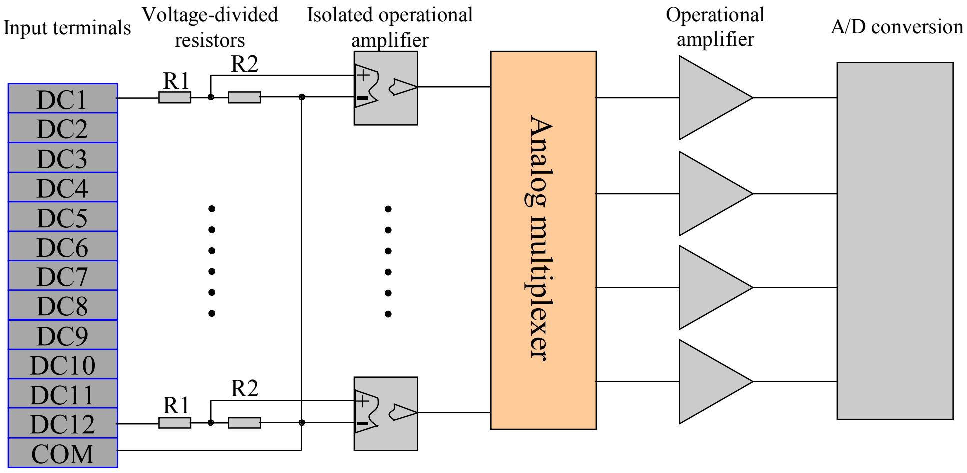


Fig.3-6 Schematic diagram for DC module acquisition

Fig 3-6 shows the schematic diagram for the input acquisition of the DC module.

3.8 Digital input and output module(DIO)

This module has the function 11-circuit switching variable input and 5-cirucit null contact outputs. It can be set to be used for the telesignal blocking telecontrol output and slip blocking applications and can also be used for the common telesignal acquisition and telecontrol outputs. As the slip blocking is set up, the last 3-circuit null contact outputs should be used for step up, step down and shutdown.

Fig.3-7 shows the principle schematic diagram for the input acquisition of the DIO module.

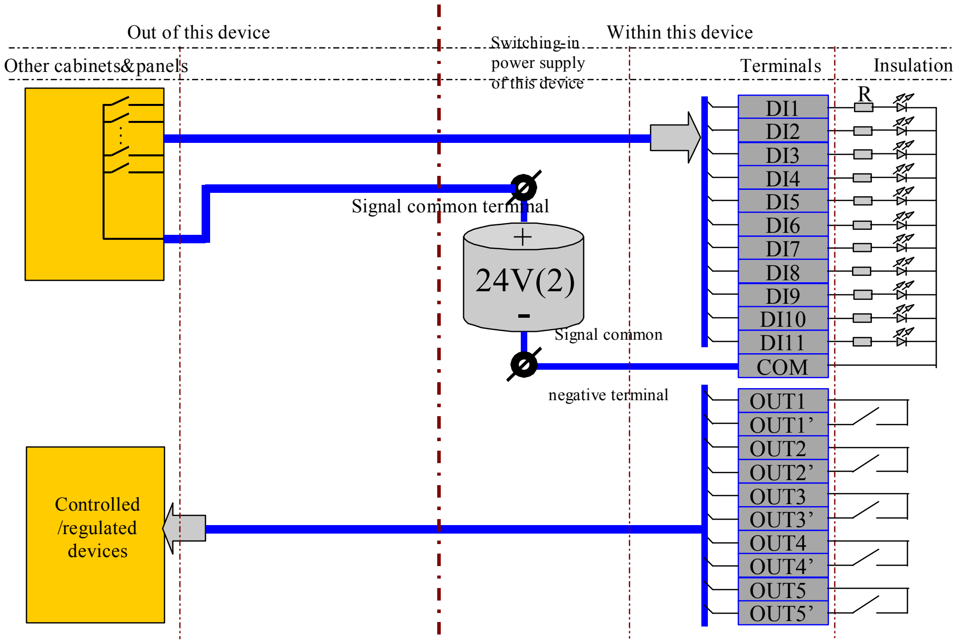


Fig.3-7 Terminals of DIO digital input and output module and wiring schematic diagram

3.9 Voltage parallel module (VP)

This module does not contain MCU system. It is primarily used for TV paralleling. It has 9 pairs of N.O. contact outputs and one pair N.C. contact outputs. The excitation voltage is 220V/ 110V. The schematic diagram is found in the appended diagrams.

3.10 Non-intelligent control output module (NOUT)

This module does not contain MCU system. It is primarily used for synchronous closing. It receive the signals from the main module for administration to make a relay's coils be excited and contact operate. As the NOUT module is used for synchronous closing, it can only located at the adjacent right side of the main module for administration (back view). Its schematic diagram can be found in the appended diagrams. This module has altogether 8 pairs null contact outputs of which the 1st and 3rd pairs have a pair combined contact outputs each. The remanent contacts after it is used for synchronous closing can also be used for other conventional controls.

3.11 Non-intelligent AC module (NAC)

The non-intelligent AC module is primarily used for the special cases, e.g., synchronous closing. At this time, the NAC module only contains 4TV, 4TA and does not contain such intelligent module as MCU. It sends the converted weak current signals to the main module for administration to do the A/D conversion sampling. As NAC is used for synchronous closing, it can be only located at the adjacent left side or the main module for administration (back view). This module can provide at most 4-circuit voltage and 4-circuit current acquisition. Its schematic diagram can be found in the appended diagrams.

As the NAC module is used for synchronism, the voltage input terminals, generally, only use the following voltage inputs in 4 groups, i.e., U1,U2, U3, Ux. Refer to Fig.3-8.

a) Single CB synchronism

This function is present only when the software version No. is no smaller that V1.61.

Synchronism type selection: Setting control characters bit14 ~ bit 12 are 0.

It is synchronism between two voltage systems determined by the both sides of a CB (hereafter referred as side I, side II)covering the conditions on a line or at a side of the main transformer. The settings of the device can decide the fixed phase angle difference between two synchronous voltages (mainly used in the main transformer application). For the single CB synchronism, the former angle difference setting is used.

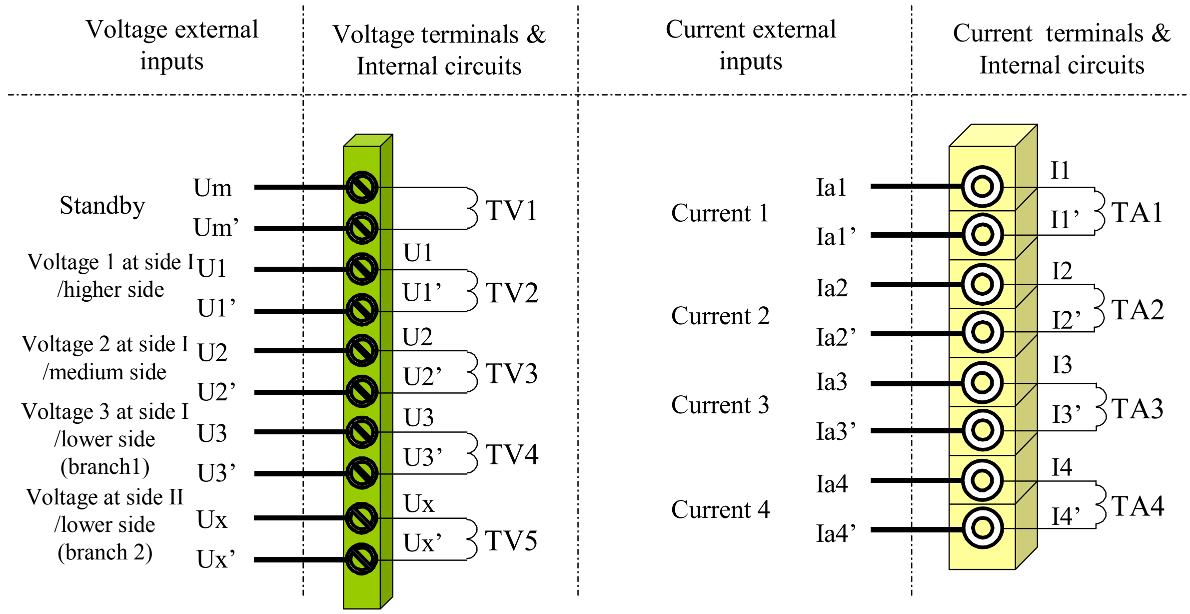


Fig.3-8 NAC module terminals diagram (mainly for synchronism)

The voltage connection for the single CB synchronism application is found in the following Table 3-2.

Table 3-2 List for the single CB synchronism connection

Mode	(Wiring) input mode				Remarks
	U1	U2	U3	Ux	
1	Synchronous voltage at side I			Synchronous voltage at side II	It may be one of the following voltages: Ua/Ub/Uc/Uab/Ubc/Uca
2	Phase voltage Ua at side I	Phase voltage Ub at side I	Phase voltage Uc at side I	Synchronous voltage at side II	The voltage at side II can be one of the following voltage: Ua/Ub/Uc/Uab/Ubc/Uca

b) Synchronism each other of several sides of the main transformer

This function is present only when the CPU software version No. is larger than or equal to V1.65.

Selection of synchronism type: the setting control characters bit 14～bit 12 is 1～5. The details can be found in Table 3-3. Mutual synchronism of several sides of the main transformer includes: mutual synchronism of high and low sides of two-winding transformer, mutual synchronism of high and medium sides of three-winding transformer, mutual synchronism of high and medium sides to low side of three-winding transformer, mutual synchronism of high, medium and low sides of three-winding transformer, mutual synchronism of low sides with branches of main transformer, etc.. These conditions can be integrated to select the mode consistent with the actual application conditions through the setting of rated values. For mutual synchronism, the voltage should be connected in sequence from high side to low side, the details are found in Table 3-3. The CB position for mutual synchronism should also be connected in sequence to the switching-in terminals of the CPU module and this connection should begin from the filter-circuit switching-in variables. Among the conditions listed in Table 3-3, generally only a part of them is common in reality. Attention: the remote/local signals for 4-side synchronism cannot be arranged on the CPU module but can be arranged (defined) on the functional submodule.

Table 3-3 Wiring list for mutual synchronism of several sides of main transformer

Connection	Mode of mutual synchronism						
	Mutual synchronism of two sides		Mutual synchronism of "two sides" +1	Mutual synchronism of "two sides" +2	Mutual synchronism of "three sides"		Mutual synchronism of "four sides"
	Mutual synchronism of high & low sides of two-winding transformer	Mutual synchronism of high & medium sides of three-winding transformer	Synchronism of high & medium sides including the low side without branches	Synchronism of high & medium sides including the low side with branches	Low side with branches of two-winding transformer	three – winding transformer	Low side with branches of three-winding transformer
Type	1		2	3	4		5
U1	Uh/Uha	Uh/Uha	Uh	Uh	Uh	Uh	Uh
U2	--/Uhb	--/Uhb	Um	Um	Ul	Um	Um
U3	--/Uhc	--/Uhc	Ul	Ul	(Ul')	Ul	Ul
Ux	Ul	Um		(Ul')			(Ul')
DI1							[TQh]
DI2					[TQh]	[TQh]	[TQm]
DI3	[TQh]	[TQh]	[TQh]	[TQh]	[TQl]	[TQm]	[TQl]
DI4	[TQl]	[TQm]	[TQm]	[TQm]	[(TQl')]	[TQl]	[(TQl')]
DI5	DLh	DLh	DLh	DLh	DLh	DLh	DLh
DI6	DLl	DLm	DLm	DLm	DLl	DLm	DLm
DI7			DLl	DLl	(DLl')	DLl	DLl
DI8				(DLl')			(DLl')
Remarks							

Descriptions about legends:

☆ ( ) indicate the other branch of the LV side with branches

☆ [TQ*] indicate that the synchronous telesignal input terminal No. can be set and it is unnecessarily connected as per the above table.

☆ DLh, DLm, DL1 indicate respectively the CB position signal connection at the high, medium and low sides of main transformer.

☆ The various voltage variables U in the table are located at the NAC module and the various switching-in variables DI at the CPU module.

☆ Mutual synchronism of "two sides" +1 or +2 indicates that synchronism is required for CBs at high medium sides, but besides they are mutual synchronous , they are possible synchronous with LV side.

c) 3/2 CB synchronism

This function is present only when the CPU software version No. is larger than or equal to V1.70. Selection of the synchronism type: the setting control characters bit14～bit 12 is 6. Refer to the 3/2 CB connections in Fig.3-9. In this case, U1, U2, U3, Ux, of the NAC module are connected respectively to U_I, U_{12}, U_{23}, U_{II}. The switching-in variables DI1～DI8 of the CPU module are connected in sequence to the synchronous switching-in signals TQ1, TQ2, TQ3 and the CB (or isolator) position signals DL1, DZ1, DL2, DZ2, DL3 respectively.

Attention: here the remote/local signals can not be arranged on the CPU module but can be arranged (defined) on the functional module.

The main difference between the various CB synchronism in this mode and the single CB synchronism is to search what the two synchronous voltage should take. For DL1 synchronism, the synchronous voltage at one side is U_I , the that of the other side will be discriminated and selected according to the CB and isolator position. First to decide if the DZ1 is in close state, if it is, the synchronous voltage at the other side is taken as U_{12}; otherwise again to decide if DL2 is in close state, if it is not, there is no voltage at the other side; if it is, decide in sequence according to DL3, DZ2. And so on and so forth for synchronism of DL2, DL3.

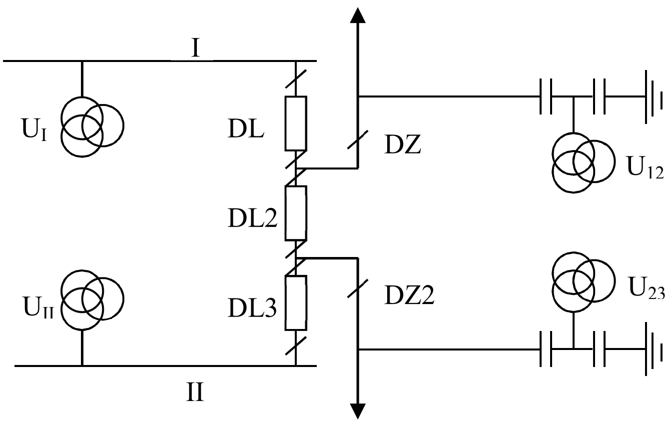


Fig.3-9 Example for the connection of the 3/2 CB

For b) Mutual synchronism of several sides of main transformer and c) 3/2 CB synchronism, the recognition and acquisition of the synchronous voltage are considered, and if the CB position is required, it can be designed that the CB position signals and the isolator signals at both sides are connected in series to obtain the integrated signal contacts to reflect if this series equipment circuit is open or closed. For c) 3/2 CB synchronism, if the TVs of U_{12} and U_{23} are located before DZ1 and DZ2 or there is no DZ1 and DZ2, the related DZ1 and DZ2 position contact input terminals can be short-circuited to be always closed.

d) Synchronism between two separate CBs

This function is present only when CPU software version No. is larger than or equal to V1.70.

Selection of synchronism type: the setting control character bit14 ~bit12 is 7.

In this case, U1, U2, U3, and Ux of the NAC module are respectively connected to U_I, U_{II} of a CB and U_I U_{II} of another CB. It is mainly used to satisfy that one set BEPR-861 or BEPR-862 Device implements two-circuit separate synchronous function or that of two branches at the LV side of the main transformer. At an instant, there should be only one synchronism detection task that is being implemented.

If there is the fixed angle difference, the former uses the first fixed angle difference setting, i.e., the setting item "fixed angle difference value", and the latter uses the second fixed angle difference setting, i.e., the setting item "fixed angle difference at the medium and low sides" can be used to replace it.

3.12 Network interface module (COMM)

The network interface module contains 3 Ethernet ports and 2 serial ports (RS232/485/422). The module can be used for interface converters and routers. The terminal diagram and schematic diagram are found in the appended diagrams of this Manual.

a) For interface converter

- ☆ It is used to convert the protocols for other IED devices (via serial port) to Ethernet 103 protocol (single network/dual network).
- ☆ It is used to convert the Ethernet 103 protocol (single network/dual network) to the protocols for other IED devices (serial port).

b) For router

It is used to convert single network to dual network.

There are two indicating lamps for each of five communication ports of the module, from top to bottom, they are: Link indicating lamp for Ethernet port 1 (LAN 1), Act indicating lamp; Link, Act indicating lamps of LAN2; Link, Act indicating lamps of LAN3; Receive or transmit indicating lamp of serial port1; receive or transmit indicating lamp serial port 2.

As this module is used for different functions, the recording programs may be different. As the programs are recorded, the pins 2-3 of JP2 on PCB should be short-circuited and after its completion, short-circuit the pins 1-2.

As this module is inserted in BEPR-861/862 Device, the 5V power supply is only used without any other signal liaisons.

As the module is used for the interface converter or the conversion of single of network to dual network, its external resources are as follows:

- ☆ Three Ethernet interfaces
- ☆ As it is connected to the device terminal, the crossed wires should be used, but to HUB, straight wires should be used.

The network number parts of the three interfaces(the higher two bytes of the IP address) can not be same and the network numbers of the subnetwork (the lower two bytes of the IP address) should be respectively same as the correspondingly connected network number of the subnetwork.

Now the sheltered codes of the subnetwork remains 255.255.0.0.

In the conversion of single-network to dual-network, the LAN 3 port is used for the single-network port and at the same time its network number part should be kept as alone in the whole system. The master station and the printing server, etc., that need to communicate with devices on the single network should be provided with the RIP1.0 monitor module. The LAN1, LAN2 ports are respectively connected to the two ports of the dual-network.

☆ Two RS232/422/485 interface

Definitions of pins of RS232: 2 = receive,
3 = transmit
5 = common ground

Definitions of pins of RS433: 1 = OUT-
2 = OUT+
3 = IN+
4 = IN-

Definitions of pins of RS485: 1 = OUT-
2 = OUT+

The mode selection of RS 232/422/485 is decided by the thumb wheel switch (see the descriptions about the thumb wheels switch) The electric connections of RS 232/422/485 are provided respectively by JP5-JP6 (Serial port 1) and JP7-JP8 (Serial port 2), of which 1-2 are short-circuited to be in the 422/ 485 mode, 2-3 in the 232 mode.

☆ One 8-bit thumb wheel switch S2

☆ Bits 1,2 switches are used for the mode selection of serial port 1, if 1,2 are at the OFF position, it is in the 232 mode, if only 1 is at the ON position, it is in the 422 mode, if only 2 is at the ON position, it is in the 485 mode.

Bits 3,4 switches are used for the mode selection of the serial port 2, the methods are same as above.

Bits 5, 6, 7 switches remain unused. If the bit 8 switch is at the ON position, the system will enter into the super terminal mode to set parameters. It is required to note that as the switch setup is varied, it will be valid only when the module is re-energized.

Parameter setting:

✧ Place the bit 8 switch at the ON position and the serial port 2 jumper (i.e., JP7-JP8) in the 232 mode and use (crossed) serial port wire to connect PC to serial port 2, energization is done.

✧ Start the Windows super terminal and set the PC serial port baud rate at 9600, data bits as 8, no check, bit 1 is the stop bit, press the 【Enter】, the menu selection will be displayed, the setting up of the corresponding parameters can be made.

✧ As the setting up is completed, select the menu【Hold and alter】and finally, the bit 8 switch must be placed at the OFF position.

3.13 Calibration

The calibration for the related modules for analog variable acquisition of BEPR-860 Series Device contain mainly the offset calibration and gain calibration, e.g., AC, AC-2, AC-U, DC, etc. modules. The NAC module is used in collaboration with the CPU module and the gain calibration is only required for it. Generally, "all" the channels are selected to calibrate simultaneously. Before calibration, the input of the calibration channel should be made zero for offset calibration (attention: the standard testing instrument cannot be connected with the input terminal of the device. Set up the output of the testing instrument as zero. The offset calibration is made for the opening mode of the power supply for the testing instrument, because at this time there are still some excitation variables that are applied at the input terminals of the device and the precision of the offset calibration is thus affected. For the gain calibration, the AC voltage of 100V is applied and AC current of 5V (or 1A, dependent on the project application) is applied. The excitation variables of 5V are applied at the DC inputs of the DC module.

If the single channel gain calibration is selected, the relationship between the selected channel and input terminals or input variables is found in Table 3-4.

Table 3-4 Relationship between the gain calibration channel and corresponding connected variables

Channel selection	Module				
	AC	AC-I	AC-U	NAC	DC
1	U1&I1	I1&I5	U1&U2	I1	DC1
2	U2&I2	I2&I6	U3&U4	I2	DC2
3	U3&I3	I3&I7	U5&U6	I3	DC3
4	U4&I4	I4&I8	U7&U8	I4	DC4
5	(Illegal)	(Illegal)	(Illegal)	U1	DC5
6	(Illegal)	(Illegal)	(Illegal)	U2	DC6
7	(Illegal)	(Illegal)	(Illegal)	U3	DC7
8	(Illegal)	(Illegal)	(Illegal)	U4	DC8
9	(Illegal)	(Illegal)	(Illegal)	(Illegal)	DC9
10	(Illegal)	(Illegal)	(Illegal)	(Illegal)	DC10
11	(Illegal)	(Illegal)	(Illegal)	(Illegal)	DC11
12	(Illegal)	(Illegal)	(Illegal)	(Illegal)	DC12

13	（Illegal）	（Illegal）	（Illegal）	（Illegal）	（Illegal）
14	（Illegal）	（Illegal）	（Illegal）	（Illegal）	（Illegal）
15	（Illegal）	（Illegal）	（Illegal）	（Illegal）	（Illegal）
16	（Illegal）	（Illegal）	（Illegal）	（Illegal）	（Illegal）
All	U1～U4,I1～I4	I1～I8	U1～U8	I1～I4,U1～U4	DC1～DC12

4 Typical Configuration Scheme

The typical configuration scheme contains that for single module and that for the device which consists of single modules

4.1 Typical configuration scheme for single modules

Typical configuration scheme for single modules is mainly related to the AC module (AC), digital variable input module (DI), control module (OUT), temperature DC module (DC) and digital input and output module (DIO). The application of the power supply module, main module for administration, NAC module and NOUT module is relatively simple and their inserting slot positions in cubicle are also fixed. There are two types of power supply modules (POWER) for BEPR-860 Digital Integrated Monitoring Device, one is 220V DC input and other is 110V DC input, which should be indicated in ordering. Their outputs are same, i.e., +5V, ±12V, +24(V), +24V(2). BEPR-862 Digital Integrated Monitoring Device uses the 19/2 inch cubicle, whose power supply module occupies 50mm(width) for its inserting slot; BEPR-861 Digital Integrated Monitoring Device uses the 19 inch cubicle, whose power supply module occupies 60mm (width) for its inserting slot. The main modules for administration (CPU) for different devices are same.

4.1.1 AC modules (AC,AC-I, AC-U etc.)

The different configuration/connection mode of the intelligent AC modules is mainly represented by the selection of the power groups, which is related to the computation methods of the power/energy. The selection is realized by the setting of the rated values, i.e., for the different connection modes, the hardware of the submodules does not vary. Since the basic power group that this module can realize is U1*I1 (the correct expression is {vector U}×{common conjugate of the vector I}, here to simplify, it is written as U1*I1, the same below), U2*I2, U3*I3, U4*I4. Therefore, as soon as the connection of the voltage terminals of the power group is determined, the connection of the corresponding current terminals is determined. Each input variable can produce the corresponding rms values of voltage and current, and each group of input variables can produce the corresponding power, power factor and energy. The group number of the power, power factor and energy is decided by the corresponding connection modes, The configuration of the power group is carried out via the setting item "AC input module type", whose setting range is: 0~5, their implications are found in Table 4-1.

Table 4-1 Implications of the settings for AC input module type

Type	Description	（Connection）input mode								Implications of the output power group
		I1	I2	I3	I4	U1	U2	U3	U4	
0	User self-definitions									
1	Connection mode 1	I1	I2	I3	I4	U1	U2	U3	U4	S1=U1*I1, S2=U2*I2, S3=U3*I3, S4=U4*I4
2	Connection	Ia	Ib	Ic	I4	Ua	Ub	Uc	U4	S1=Ua*Ia

	mode 2									+Ub*Ib +Uc*Ic S2=U4*I4
3	Connection mode 3	Ia1	Ic1	Ia2	Ic2	Uab1	Ubc1	Uab2	Ubc2	S1=Uab1*Ia1 -Ubc1*Ic1 S2=Uab2*Ia2 -Ubc2*Ic2
4	Connection mode 4	Ia	I2	Ic	I4	Uab	U2	Ubc	U4	S1=Uab*Ia -Ubc*Ic S2=U2*I2, S3=U4*I4
5	Connection mode 5	Ia	Ic	I3	I4	Uab	Ubc	U3	U4	S1=Uab*Ia -Ubc*Ic S2=U3*I3, S3=U4*I4

The typical connection mode 1 of the intelligent AC modules is equivalent to the acquisition computation module formed by the four single-table methods. The four voltages and corresponding four currents are connected in this mode, which only emphasizes on the output results: I1, I2, I3, I4; U1, U2, U3, U4; P1, Q1, COS Φ 1; P2, Q2, COS Φ 2; P3, Q3, COS Φ 3; P4, Q4, COS Φ 4 and energy: positive active electric energy +Ep1, +Ep2, +Ep3, +Ep4; positive reactive electric energy +Eq1, +Eq2, +Eq3, +Eq4; negative active electric energy -Ep1, -Ep2, -Ep3, -Ep4; negative reactive electric energy -Eq1, -Eq2, -Eq3, -Eq4。Among these Pn, Qn, COS Φ n, +Epn, +Eqn, -Epn, -Eqn corresponding to In, Un， n=1～4. This setting mode can be the application mode in Fig.4-1 or that in Fig.4-2, Now the upward computer system is required to compute the power of the corresponding circuits e.g., P = P1 + P2 + P3.

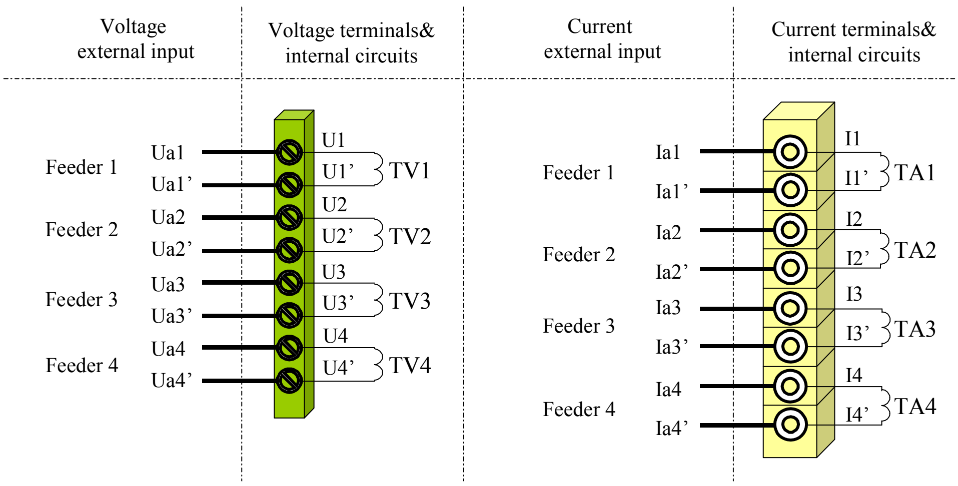
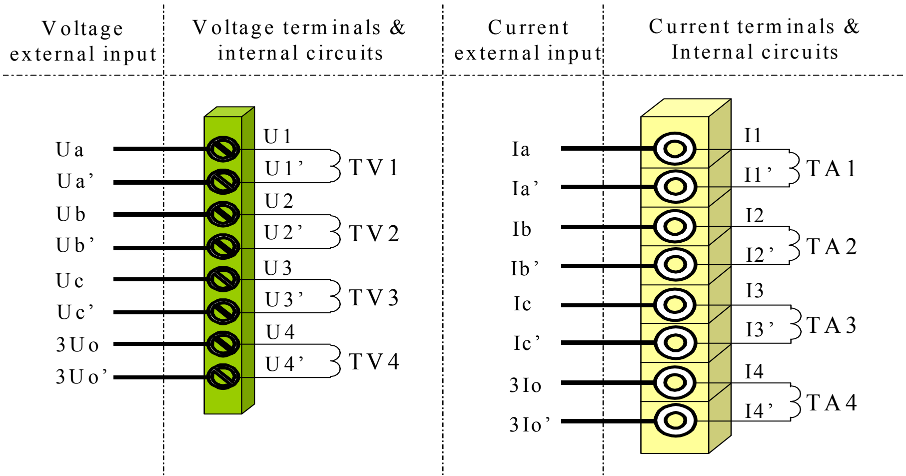


Fig.4-1 Connection mode 1 for intelligent AC modules

The typical connection mode for intelligent AC modules is shown as Fig.4-2. The three phase voltages and one zero-sequence voltage of the corresponding equipment are connected in this mode. The currents are corresponding to the three phase currents and zero-sequence current. The output results in this mode: I1=Ia, I2=Ib, I3=Ic, I4; U1=Ua, U2=Ub, U3=Uc, U4; P1, Q1, COSΦ1; P2, Q2, COSΦ2; (P3, Q3, COSΦ3); (P4,Q4,COSΦ4); and energy: positive active electric energy +Ep1, +Ep2, (+Ep3), (+Ep4); positive reactive electric energy +Eq1, +Eq2, (+Eq3), (+Eq4); negative active electric energy -Ep1, -Ep2, (-Ep3), (-Ep4); negative reactive electric energy -Eq1, -Eq2, (-Eq3), (-Eq4). Among these P1, Q1, COSΦ1, +Ep1, +Eq1, -Ep1,



-Eq1 are corresponding to the connection inputs I1, U1, I2, U2, I3, U3 in three-table method; P2, Q2, COSΦ2, +Ep2, +Eq2, -Ep2, -Eq2 to the connection inputs I4, U4 in the single-table method.. Now P3, Q3, COSΦ3, +Ep3, +Eq3, -Ep3, -Eq3; P4, Q4, COSΦ4, +Ep4, +Eq4, -Ep4, -Eq4 are meaningless.

Fig. 4-2 Connection mode 2 for intelligent AC modules

This connection module only emphasize on that S1=P1+jQ1=U1*I1+U2*I2+U3*I3; S2 = P2+jQ2 = U4*I4. In this scheme, if no Ib is introduced for user, Ib can be self-produced through the external connections. U4, I4 can be connected to the voltage and current variables in other senses.

No details for other three typical connection modes are provided here.

The above-mentioned 5 sorts of typical connection modes can meet the requirements in the most applications. For the special requirements, the AC input module type can be set as zero. At this time, the setting item power group 1 attribute 1, power group 2 attribute, power group 3 attribute and power group 4 attribute will act (as the AC input module type value is non-zero, these power group attribute setting items are meaningless. They are corresponding to the values in the related typical connection mode1, unless they are set again in delivery).

Each power group will be defined by the dual-bytes hexadecimal system. The higher bytes are located at prior locations. The implication for each bit are found in Table 4-2.

Table 4-2 Description table for the settings for AC module power group attributes

Bit No.	Implications
15	Is the summation item 4 effective?

14	Symbols for the summation item 4
13	Summation item 4: phase No. Is t
12	
11	Is the summation item3 effective?
10	Symbols for the summation item 3
9	Summation item 3: phase No.
8	
7	Is the summation 2 effective?
6	Symbols for the summation item 2
5	Summation item 2: phase No.
4	
3	Is the summation 1 effective?
2	Symbols for the summation item 1
1	Summation item 1: phase No.
0	

4.1.2 Intelligent digital variable input module (DI)

The different configuration / connection mode of the intelligent digital variable input module is represented by the definitions of the inputs for each circuit. This selection is realized by the setting of the rated values, i.e., for the different acquisition modes, the hardware of the submodule will not vary. The inputs for each circuit enjoy the following features: filtering time constant (FT), whether are they upward transmitted as the sequence of event(SOE) records, whether are they taken as the pulsing variable inputs or as the switching variable inputs or the encoded inputs, whether is the status taken as a count one, etc..

The configuration of the digital variables inputs is mainly carried out through the setting item "Digital input module type", whose setting range is 0～10. The implications of each setting are found in Table4-4. As the digital input module type is non-zero, the setting for the following item of this setting will not be used, but the software of the device is used to fill in the setting in the related meanings automatically according to the type setting. As the setting is called again, the setting contents for the very type can be seen. As the digital input module type is 0, i.e., the self-defined type, the setting item following this setting will be used, i.e., the item following this setting will be determined by user itself as required. These settings define the features of the signal inputs for each circuit: including one byte for attribute and one byte for the filtering time constant. In order to reduce the number of the setting items, merge the attribute bytes into one setting item. The attribute of the switching-in variables in the prior serial number is located at the lower bytes. The whole setting item takes the mode of hexadecimal system. The filtering time constants will occupy one setting item respectively and their inputs take the mode of decimal system.

4.1.2.1 The implications of each bit of the attribute byte for the signal input setting of the digital input module (simplifies as Attr) are found in Table 4-3:

This setting will be input in the mode of hexadecimal system. The bit 7～0 is the attribute definition of one signal input and the bit 15-8, that of the signal input for the next terminal. The signal inputs here include all the telesignal inputs, encoded inputs and pulsing inputs etc., i.e., all the terminal signal input for this module need to be defined respectively. Take the bit 0～7 as an example:

4.1.2.1.1 The bit 2～0 defines whether the SOE information is formed, whether the general event / electric bell bit is formed, whether the general alarm/ electric flute bit is formed:

As bit 0 (general alarm/electric flute) = 1 and the telesignal variables of this bit introduced by the module terminal are 1, the general alarm/ electric flute bit is lifted, i.e., set the telesignal variable 21 as 1; for DIO module, set the telesignal 12 as 1. This function is valid only for V1.80 and later versions. The general alarm / electric flute bit can be cleared only through the signal resetting (the implications of the older software versions before V1.80: it is upward transmitted in the form of SOE which is taken as the special general alarm code within this module. The code value is located after all the inputs plus the extended telesignal variables. The value of the DI module is usually 52, and that of the DIO module is usually 43. Generally, this mode is not used.)

As the bit 1 (general event/electric bell bit) = 1 and the telesignal variables of this bit introduced by the module terminal are 1, the general event/ electric bell bit is lifted, i.e., set the telesignal variable 22 as 1; for DIO module, set the telesignal variable 13 as 1. This function is valid only for V1.80 and later versions. The general event / electric bell bit can be cleared only through the signal resetting (the implications of the older software versions before V1.80: it is upward transmitted in the form of SOE which is taken as the special general alarm code within this mode. The code value is located after the general alarm code. The value of the DI module is usually 53, and that of the DIO module is usually 44. Generally, this mode is not used. As the bit 2 (SOE formed bit) = 1, it is upward transmitted in the form of SOE which takes the actually corresponding terminal number (beginning from 0) as code within the module. This mode is generally used, i.e., usually set the bit2 = 1;

As there exist the definitions for signal terminals, e.g. telesignal after the pulsing variable input terminals, the number occupied by the previous pulsing variable input terminals should be considered for its SOE code number, i.e., SOE code number should be always corresponding to the actual terminal number and it has no relation with the fact whether there exist pulsing variable input terminals. This should be known as the background system data is defined.

4.1.2.1.2 The bit 5~3 defines the natures of the signal inputs:

As it =1 (i.e., bit 5 = 0, bit 4 = 0, bit 3 = 1), the input signals for signal terminal are the encoded inputs, e.g., single contact mode, BCD code inputs, HEX code input and carry code input, etc. The specific encoding mode will be decided by the settings.

As it = 3 (i.e., bit 5 = 0, bit 4 = 1, bit 3 = 1), the input signals for the signal terminal are the pulsing variable inputs.

As it = 4 (i.e., bit 5 = 1, bit 4 = 0, bit 3 = 0), the input signals for the signal terminal are the common telesignal inputs, and generally, it will simultaneously define them as SOE, i.e., bit 0~2 = 4.

4.1.2.1.3 The bit 7 defines whether the counter form is taken for the status of the signal inputs.

As it = 0, the counter form is not taken. At this time, as the input contact signals are open, or as there is no 24V+ power input for the switching-in terminal, the program considers the status value as 1. As the input contact signals are closed, or as there is the 24V+ power input for the switching-in terminal, the program considers the status value as 0. As it = 1, the counter form is taken. At this time, as the input contact signals are open, or as there is no 24V+ power input for the switching-in terminals, the program considers the status value as 0. As the input contact signals are closed or as there is the +24V power input for the switching-in terminal, the program considers the status value as 1.

For BEPR- 860 Device, this module usually takes bit 7 = 1; For the attribute byte attr, the commonly used values: Telesignal input: = 0 A4; (note: 0x indicates that the digital values after that are input in the hexadecimal system).

Encoded inputs: = 0×88

Pulsing inputs: = 0×98

4.1.2.2 Filtering time constant(or called) setting (simplified as FT):

This setting is input in the decimal system in second, input range 0～9.999s. The signal input in each circuit has its own FT.

4.1.2.3 Related settings for the encoded inputs for the digital input modules.

4.1.2.3.1 Setting for total items for the encoded inputs: it defines how many encoded items there arefor this module. The setting will be input in the decimal system.

4.1.2.3.2 Setting for the encoded type n:

= 0, 4 or 8: Single contact mode

= 1, 5 or 9: BCD code inputs

= 2, 6 or 10: HEX code inputs

= 3, 7 or 11: Carry code input; connection order is 0, 1…9, decimal carry 0,1…. As the abnormal condition occurs, i.e., all the telesignal time contents are input in minute, the software will consider the decimal carry value as 0.

=12: it is similar to the carry code inputs, but the 0～valued telesignal variables in decimal system are not connected (connection order is 0, 1…9, decimal carry 1, 2…). As all the telasignal time constants are input in minute, the software will consider the decimal carry value as 0. This mode is mainly used to save one bit's telesignal input e.g., the telesignal inputs in 11 bit carry code for DIO module can express the transformer taps at the steps 1～19.

= 13: Carry code inputs: Connection order is 0, 1…9 decimal carry 0,1… . As the abnormal condition occurs, e.g., all the telesignal time constants are input in minute, the software will consider the decimal carry value as 1.

Note: = 0 ~ 3: = 4～7. The encoded values are only upward transmitted in the telesignal mode and the encoded values are not transmitted. The encoded values are calculated by the background computer itself.

=8～13: upward transmitted simultaneously in the encoded values and telesignal mode.

The specific values used (hereafter called "encoded value upward transmission mode" are related to the data that the upward computer can recognize or will need. As there are several encoded inputs, the encoded value upward transmission mode is only dependent on the first encoding type. All the encoded values for one submodule are identical in their upward transmission mode, and the definitions for the first encoded type are taken as the reference.

4.1.2.3.3 Beginning No. of the encoded value n: i.e., the signal input terminal No. at the lowest bit for this encoded value, which is counted from 1. No counting is made for common terminals. At the prior positions are the encoded values at the lower bits, i.e., the smaller terminal numbers. The setting is input in the decimal system.

4.1.2.3.4 Switching-in variable number occupied by the encoded value n: how many signal terminals will be occupied excluding common terminals. The setting is input in the decimal system.

Table 4-3 Implications of the various bits of the bytes for the attribute settings for the digital input module

<table>
<tr><th>Bit No.</th><th>Implications</th></tr>
<tr><td>15</td><td>= 1 counter form is taken, 0 =, counter form not taken</td></tr>
<tr><td>14</td><td>Retain</td></tr>
<tr><td>13</td><td rowspan="3">= 1 Encoded inputs;
= 3 Pulsing variable inputs;
= 4 Telesignal inputs;
= Others are not used.</td></tr>
<tr><td>12</td></tr>
<tr><td>11</td></tr>
<tr><td>10</td><td>= 1 Indicates the occurrence of SOE</td></tr>
<tr><td>9</td><td>= 1 Indicates that the general event is formed</td></tr>
<tr><td>8</td><td>= 1 Indicates that the general alarm is formed</td></tr>
<tr><td>7</td><td>=1 Counter form is taken, = 0, counter form not taken</td></tr>
<tr><td>6</td><td>Remain</td></tr>
<tr><td>5</td><td rowspan="3">= 1 Encoded inputs;
= 3 Pulsing variable inputs;
= 4 Telesignal inputs;
= Others are not used.</td></tr>
<tr><td>4</td></tr>
<tr><td>3</td></tr>
</table>

2	= 1 Indicates the occurrence of SOE
1	= 1 Indicates that the general event is formed
0	= 1 Indicates that the general alarm is formed

Table 4-4 Implications of the type settings for the digital input module

Module type	Type descriptions	Simplified name	Descriptions about digital variable inputs
0	User self-defined		(See the detailed setting descriptions)
1	Application mode 1	16 SYX, 4 PI	Those in the prior 16 circuits are the telesignal inputs of FT = 15ms, following 4 circuits, pulsing variable inputs of FT=10ms
2	Application mode 2	12 SYX, 4 LYS, 4 PI	Those in the prior 12 circuits are telesignal inputs of FT=15ms, following 4 circuits, those of FT-1s, following 4 circuits, pulsing variable inputs of FT=10ms
3	Application mode 3	20 SYX	Those in the 20 circuits are all the telesignal circuits of FT = 15ms
4	Application mode 4	20 LYX	Those in the 20 circuits are all the telesignal circuits of FT = 1s
5	Application mode 5	16LYX, 4PI	Those in the prior 16 circuits are the telesignal inputs of FT=1s, following 4 circuits, pulsing variable inputs of FT = 10ms
6	Application mode 6	9SYX, 1LYX, 6HEX, 4PI	Those in the prior 9 circuits are the telesignal inputs of FT = 15ms, following 1 circuit, those of FT = 1s, following 6 circuits, HEX code inputs of FT = 50ms, last 4 circuits, pulsing variable inputs of FT=10ms
7	Application mode 7	4SYX, 6HEX, 6HEX, 4PI	Those in the prior 4 circuits are the telesignal inputs of FT-15ms, following 6 circuits, HEX code inputs of FT-50ms; following 6 circuits, HEX code inputs of FT – 50ms; last 4 circuits, pulsing variable input of FT=10ms.
8	Application mode 8	6SYX, 14ACC	Those in the prior 6 circuits are the telesignal inputs of FT = 15ms; following 14 circuits, carry code inputs of FT = 50ms.
9	Application mode 9	20BIN	Those in the 20 circuits are all code inputs in the signal contact mode.
10	Application mode 10	16PI,4SYX	Those in the prior 16 circuits are the pulsing variable inputs of FT = 10ms, last 4 circuits, telesignal inputs of FT = 15ms

4.1.3 Intelligent digital input and output module (DIO)

Except the following settings that will determined according to the actual conditions, i.e., slip step blocking on / off, serial No. of the voltage-regulated signal, tap contact step, control pulse width long time delay, control pulse width short time delay, control blocking logic etc. (i.e., no typical types are provided for these setting and the related values will be filled in automatically as per the type value), other settings that can be determined include those for the digital variable input part, whose practice is similar to that of the intelligent digital variable input module(DI), i.e., there is the setting for the digital input module type. As this setting is 0, the setting after this setting is valid. But as this setting, or the type setting is not zero, the setting after this setting is ineffective and the corresponding sequent setting will be filled in automatically by the program as per type setting. The setting range of the type setting of the DIO module is 0～9, whose implications are found in Table 4-5. The setting methods for the related settings and their implications are completely identical to the DI module.

Table 4-5 Implications of the type settings for the digital inputs module in the digital input and output module

Module type	Type descriptions	Simplified name	Descriptions about digital variable inputs
0	User self-defined		(See the detailed setting descriptions about DI module)
1	Application mode 1	5SYX, 6HEX	Those in the prior 5 circuits are the telesignal inputs of FT-15ms, following 6 circuits, HEX code inputs of FT = 50ms
2	Application mode 2	5SYX, 6HEX	Those in the prior 5 circucits are the telesignal inputs of FT = 1s, following 6 circuits, HEX code inputs of FT = 50ms
3	Application mode 3	11SYX	Those in the 11 circuits are all the telesignal inputs of FT = 15ms
4	Application mode 4	11LYX	Those in the 11 circuits are all the telesignal inputs of FT = 1ms
5	Application mode 5	7SYX, 4PI	Those in the prior 7 circuits are the telesignal inputs of FT = 15ms, the following 4 circuits, the pulsing variable inputs of FT = 10ms
6	Application mode 6	6SYX, 1LYX, 4PI	Those in the prior 6 circuits are the telesingal inputs of FT = 15ms, following 1 circuit, those of FT = 1s, following 4 circuits the pulsing variable inputs of FT = 10ms.
7	Application mode 7	11BIN	Those in the 11 circuits are all the encoded inputs in the single contact mode.
8	Application mode 8	9SYX, 2PI	Those in the prior 9 circuits are the telesignal inputs of FT – 15ms, following 2 circuits, the pulsing variable inputs of FT = 10 ms.
9	Application mode 9	8SYX, 1LYX, 2PI	Those in the prior 8 circuits are the telesignal inputs of FT = 15ms, following 1 circuit, those of FT = 1s, following 2 circuits, the pulsing variable inputs of FT = 10ms

4.1.4 Other modules

The setting ranges for the type settings of the above-mentioned 3 sorts of modules can be increased in the new version. The corresponding implications can be known from the following settings or the random help of the device.

Since the application of the intelligent control module (OUT) and the intelligent temperature DC acquisition module (DC) is relatively simple, the typical configuration modes are not provided for them.

4.2 Typical configuration scheme of the device

Since one of the features of the BEPR- 860 Series Digital Integrated Monitoring Device is its relative flexibility in configuration, the following two configuration schemes for the device are suggested on the one hand, and on the other hand, there still exist other configuration applications different from these two schemes. Generally, BEPR-861 is taken as the representative cubicle structure at a whole layer, BEPR-862 as that at the half layer. The installation and hole dimensions for two combined BEPR- 862 devices are equivalent to one BEPR- 861.

4.2.1 BEPR- 861 Digital Integrated Monitoring Device

This device uses the 19 inch cubicle, which is provided with the following modules:

3 AC acquisition modules (AC): acquire 12-circuit current and 12-circuit voltage;

1 DC temperature acquisition module (DC) (selectable): 12 circuits;

2 digital variable acquisition module (DI): 40 circuits (including pulsing variables)2 intelligent control modules (OUT): 20-circuit open contact outputs;

And CPU (8-cirucit telesignal inputs but often used for special functions), MMI, POWER module, one for each.

The specific configuration can be found in the appended diagrams- Diagram for the back panel and terminals of BEPR-861 Device.

The submodules can be added or reduced based on this configuration in actual applications.

Application: device can be used in the monitoring applications in HV lines or at all sides of the main transformer.

4.2.2 BEPR- 862 Digital Integrated Monitoring Device

This device used the 19/2 inch cubicle, which is provided with the following modules:

1 AC acquisition module (AC): acquire 4-cirucit current, 4-circuit voltage;

1 digital variable acquisition module (DI):20 circuits(including pulsing variables);

1 intelligent control module (OUT): 10-circuit open contact output;

CPU(8-circuit telesignal inputs, but they are often used for special functions), MMI, POWER module, one for each.

The specific configuration can be found in the appended diagram-Diagram for the back panel and terminals of the BEPR- 862 Device. The submodules can be added or reduced based on this configuration in actual applications.

Application: device can be used in the monitoring applications in the line units at various voltage levels and at the MV and LV side of a transformer.

5 Setting Descriptions

The settings for BEPR- 860 series products are stored in the respective corresponding modules, i.e., the settings for the various functional submodules are stored in the EEPROM of the corresponding submodules. The related settings for the CPU module are stored in the EEPROM of the CPU module. Therefore, as the functional submodules or the device are replaced, the correct settings are required to be set once again.

Only one set of settings, i.e. zone 0 settings, is permitted for the settings of the functional modules of BEPR- 860 series products. The other setting zones will not be used.

The settings of the various functional submodules will be introduced in detail in the following sections. The setting of the blackfaced characters in the setting names is the type setting of this module, through (as it is not zero) the settings of the setting item in italics for setting name can be filled in automatically by the software. These are feasible for some common settings provided for some settings which are hard to input. Generally, these typical settings can meet the requirements of most users. For special requirements, the type setting of the module can be set as 0, i.e., user self-defined type, then user can set itself the settings shown in italics. As the module type is set as the no user self-defined type (non-zero), the settings shown in italics will be displayed as per the related settings of the corresponding module when the settings are called for display next time. So doing can help user to amend the setting on the basis of this setting to meet the special requirements of user. But at this time, do not forget changing the type setting of the module to 0.

5.1 Intelligent AC modules (AC, AC-1, AC-U)

The settings for these modules are shown in Table 5-1.

Table 5-1 Setting list of the intelligent AC modules

No	Setting name	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	AC input module type	Decimal system	0~5	1	Details are found in descriptions in 4.1.1
2	Power group 1 attribute	Hexadecimal system	0x0000~0xFFFF	0X0008	Details are found in descriptions in 4.1.1. As setting 1 (AC input module type) is set as non-zero, settings 2~5 need not to be set.
3	Power group 2 attribute	Hexadecimal system	0x0000~0xFFFF	0x0009	
4	Power group 3 attribute	Hexadecimal system	0x0000~0xFFFF	0x000A	
5	Power group 4 attribute	Hexadecimal system	0x0000~0xFFFF	0x000B	
6	Ta type selection: 5A/1A	Decimal system	1, 5	5	Only acts on the display of the secondary measured values shown by the LCD of the device.
7	I relative compression factor	Decimal system	0.000~1.000	0.002	They will only effect on the frequency at which the functional submodules upward transmit the measured values.
8	U relative compression factor	Decimal system	0.000~1.000	0.002	

9	P relative compression factor	Decimal system	0.000~1.000	0.005	
10	Q relative compression factor	Decimal system	0.000~1.000	0.005	
11	COS relative compression factor	Decimal system	0.000~1.000	0.005	

Attention: the tacitly approved AC input module type value is 4 one-table method cases. For other settings (6~11), the tacitly approved value can generally meet the needs in the most applications.

For AC modules, the settings for Nos. 1~5 are the key ones, which will effect on the computation of the active and reactive power, power factor, active electric energy and reactive electric energy. But for AC-I and AC-U modules, since these computed values are generally not required, the settings 1~5 are not so important.

The setting 6 will effect primarily on the displayed value of the current value of the AC and AC-1 modules on the LCD of the device and will made no effects on the upward transmission of the measured values with the quality descriptions (mainly used for the upward computer system). The setting 6 will also make no effects on the AC-U module. The offset calibration and gain calibration can be made once totally and respectively or can be made one channel by one channel separately. After these calibrations are made, the parameters hold will be finished automatically following the gain calibration. The offset calibration should be made before the gain calibration. As the gain calibration is made, the reference voltage of 100V is applied, the current of 5A (as the setting 6 is 5) or the current of 1A (as the setting 6 is 1) is applied.

The settings 7~11 are mainly used for the functional submodules to upward transmit the varied measured values to CPU via the internal CAN network. The functional sunmodules stick on an overreach mark for the overreach data for upward transmission (for the non-overreach data, the previous data is still upward transmitted and no overreach mark). The settings 7~11 have a same ratio, whose computation formula is: =∣current value-previous value∣/ full scaled value. Those analog variables that exceed the ratio for setting variation are considered as overreach. The full scaled values of voltage and current are 1.2 times the "rated value", those of the active and reactive power, 1.44 times the "rated value". The ratio of the discounted secondary values of the upward transmitted P, Q data is 1.44*1500/4095=0.52747 (And for the program two-table method used in the older version 1.11 or less of the AC modules, that is 1.44 * 866.0254/4095=0.30454). The full sealed value of the power factor is the actual value 1.000, the ratios are found in Table 6-1-6. Generally, the delivery tacitly approved values are used as the settings 7~11. Usually, the functional submodules will be active to upward transmit circularly the current latest telemetered values to CPU at an interval of 30s and similarly, CPU will upward transmit circularly the data also at an interval of 30s.

Here some descriptions are made about the active and reactive electric energy : in BEPR- 860 series products, the active and reactive electric energy computed via samples are similar to the pulsing KWH concepts, i.e., the electric energy values are also expressed in the mode of the pulsing numbers: the addition of 1 represents 2/3 of the accumulated full scaled active and reactive power values. ① For the rated voltage of 100V, and the rated current of 5A: for the single-phase KWH meter, the addition of 1 for electric energy value represents 1.44*100V *5A*2/3=480Ws, in other words, it is equivalent to a 7500 rounds/ KWH single-phase KWH meter, here one round is corresponding to 1 for the electric energy value. As the 3-phase electric energy is required to be computed, no matter whether the connection is made in one-table method, two-table method or three-table method, the computed electric energy output values are all equivalent to 2500 rounds/ KWH (for the program two-table method of the older version 1.11 or less for the AC modules, it is 4330 rounds/KWH), this is a often case. ② For the rated voltage of 100V, the rated current of 1 A; for the single-phase KWH meter, the addition of 1 for the electric energy value represents 1.44*100V*1A*2/3=96Ws, in other words, it is equivalent to a 37500 rounds/KWH single-phase KWH meter. As the three-phase electric energy is required to be computed, no matter whether the connection is mad in the one-table method, two-table method or three-table method, the computed electric energy output values are all equivalent to 12500 rounds/KWH (for the program two-table method of the older version 1.11 or less for the AC modules, it is 21650.6 rounds/KWH). The ratios are found in Table 6-1-5.

5.2 Intelligent digital variable input module (DI)

The settings for this module are shown in Table 5-2

Table 5-2 Setting list for intelligent Digital Variable input module

No	Setting name	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Digital input module type	Decimal system	0~10	1	Details are found in descriptions in 4.1.2
2	Switch-in/pulse overall circuits	Decimal system	1~20	20	Details are found in descriptions in 4.1.2. As the setting 1 (digital input module type) is set as non-zero, the settings 2-39
3	Switch-in 1, 2 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
4	Switch-in 1 debounce time	Decimal system	0~9.999s	0.015	
5	Switch-in 2 debounce time	Decimal system	0~9.999s	0.015	
6	Switch-in 3, 4 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
7	Switch-in 3 debounce time	Decimal system	0~9.999s	0.015	
8	Switch-in 4 debounce time	Decimal system	0~9.999s	0.015	
9	Switch-in 5, 6 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
10	Switch-in 5 debounce time	Decimal system	0~9.999s	0.015	
11	Switch-in 6 debounce time	Decimal system	0~9.999s	0.015	
12	Switch-in 7, 8 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	

13	Switch-in 7 debounce time	Decimal system	0~9.999s	0.015	need not to be set. (Each signal input needs to define the settings 3-32, including telesignal, pulses counting, encoded inputs, etc. But of course, these will be filled in automatically by the program after the digital input nodule type is set).
14	Switch-in 8 debounce time	Decimal system	0~9.999s	0.015	
15	Switch-in 9, 10 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
16	Switch-in 9 debounce time	Decimal system	0~9.999s	0.015	
17	Switch-in 10 debounce time	Decimal system	0~9.999s	0.015	
18	Switch-in 11, 12 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
19	Switch-in 11 debounce time	Decimal system	0~9.999s	0.015	
20	Switch-in 12 debounce time	Decimal system	0~9.999s	0.015	
21	Switch-in 13, 14 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
22	Switch-in 13 debounce time	Decimal system	0~9.999s	0.015	
23	Switch-in 14 debounce time	Decimal system	0~9.999s	0.015	
24	Switch-in 15, 16 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
25	Switch-in 15 debounce time	Decimal system	0~9.999s	0.015	
26	Switch-in 16 debounce time	Decimal system	0~9.999s	0.015	
27	Switch-in 17, 18 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
28	Switch-in 17 debounce time	Decimal system	0~9.999s	0.015	
29	Switch-in 18 debounce time	Decimal system	0~9.999s	0.015	
30	Switch-in 19, 20 attribute	Hexadecimal system	0x0000~0xFFFF	0xA4A4	
31	Switch-in 19 debounce time	Decimal system	0~9.999s	0.015	
32	Switch-in 20 debounce time	Decimal system	0~9.999s	0.015	
33	Encoded input overall items	Decimal system	0~2	0	
34	Encoded input 1 type	Decimal system	0~13	10	
35	Encoded input 1 initiating No	Decimal system	1~20	11	
36	Encoded input 1 occupied switch-in numbers	Decimal system	1~20	6	
37	Encoded input 2 type	Decimal system	0~13	10	
38	Encoded input 2 initiating No	Decimal system	1~20	11	
39	Encoded input 2 occupied switch-in numbers	Decimal system	1~20	6	

Generally, the setting for the digital input module type is only required to set for the settings of the DI module. At this time, only one sort of the type that can meet the requirements of a user is required to be selected (it should be non-zero, details are found in 4.1.2). Only when the type provided by the manufacturer can not meet the special requirements of a user, it is necessary to set the digital input module type as 0 and at the same time, it is necessary to set the settings 2~39 separately. The details are found in 4.1.2 about these settings.

5.3 Intelligent control module (OUT)

The settings for this module are shown in Table 5-3. Generally, the tacitly approved values are accepted.

Table 5-3 Setting list for intelligent control module

No	Setting name	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Control pulse width long time	Decimal system	0~9.999s	0.120	Hold time for

	delay				the control output contact operation
2	Control pulse width short time delay	Decimal system	0~9.999s	0.120	

There are two selections for the control pulse width of the outputs in each circuit of an OUT module: long pulse width and short pulse width. Which pulse width will be selected for the outputs in each circuit is defined by the upward computer and then is given in the execution of orders. The hold time for the telecontrol operation is usually about 120 ms. In some special conditions, a longer time may be required.

5.4 Intelligent DC module (DC)

The settings for this module are shown in Table 5-4. Generally, the tacitly approved values are accepted.

Table 5-4 Setting lost for intelligent DC module

No	Setting name	Input mode	Setting range	Tacitly approved value	Brief descriptions	
1	Full scaled input voltage	Decimal system	1~10V	6	Input the possible maximum DC voltage	
2	Relative compression factor 1	Decimal system	0.0000~1.000	0.001	Act on the external input measurement	They will only effect on the frequency at which the functional sub module upward transmits the measured values.
3	Relative compression factor 2	Decimal system	0.0000~1.000	0.900	Act on the internal power supply measurement	

The full scaled input voltage for the setting 1 can be considered based on the 1.2 times the safety coefficient. Usually, 0~5V can be selected for the DC transducer and temperature transducer. So, the setting for the fully scaled input voltage can be set as 6V. The offset calibration and gain calibration for DC module can be made once totally and respectively or can be made one channel by one channel separately. After these calibrations are made, the parameters hold will be finished automatically following the gain calibration. The offset calibration should be made before the gain calibration. The reference voltage of 5V will be applied without exception, and it has no connection with the fully scaled input voltage of the setting 1. The DC module can acquire 12-circuit DC weak voltage inputs (maximum range: -10 ~ +10V). In addition, the sampled values used to inspect the internal power suppliers VCC and AGND in the AD circuit are also upward transmitted, altogether there are four circuits: VCC1, AGND1, VCC2, AGND2. Usually, VCC1≈VCC2≈5V, AGND1≈AGND2≈0V. The specific AD inspection will be completed by the program. The setting 2 (relative compression factor 1) is corresponding to the 12-circuit external DC input acquisition; the setting 3 (relative compression factor 2) is corresponding to the internal power supply 4-circuit acquired values; once there is an overreach in the 16 measured values, the active upward transmission of the message for measured values is instigated once and the overreach data is stuck on with a overreach mark. Usually, the functional submodules will be active to upward transmit circularly the current (latest) tetemetered values to CPU at an interval of 30s and similarly, CPU will upward transmit circularly the data also at an interval of 30s.

5.5 Intelligent digital input and output module (DIO)

The settings for this module are shown in Table 5-5.

The tacitly approved values are taken as the most settings. The setting 1 (slip step blocking function on/off) is used to switch on/off the slip step blocking function. As the slip step is switched on, if the program catches the order for lifting or falling of the taps, the logic discrimination for the slip step blocking is initiated. There are 5-circuit outputs, i.e., circuits 1, 2, 3, 4, 5. the lifting, falling and shutting down switches of the taps are connected to the outputs of the circuits 3, 4 and 5 respectively. The programs will detect the control outputs 3, 4、 to discriminate the lifting or falling of the taps. And for slip, it will control the outputs in circuit 5, i.e. shutting down. The slip step blocking discrimination has no logic relations with other settings.

The setting 2 (No. of the blocking voltage-regulated signal) consists of 4-bit digits in hexadecimal system and is used to define the 4 –bit digits in hexadecimal system and is used to define the 4 telesignal numbers, each of which is defined by one bit digit in hexadecimal system (i.e., 4 bits). The telesignal numbers are selected from the 11 telesignal inputs of this module. They are counted from 1. As the number is 0, it is indicated that it will not take part in the blocking discrimination logic. The logic “or” relations exist among the several numbers, i.e., once the telesignal status of one member is “1” (telesignal input contacts are closed), the control outputs 3、 4 are blocked. This logic discrimination has no relation with the setting conditions of the rated values. In order words, once this setting is non-zero, and the telesignal status with corresponding member is “1”, the control outputs in circuits 3, 4 are blocked.

The settings 3, 4, 5 are used to define the central steps. The 4-bit digits in decimal system for each setting are divided into two parts, which can define two central step separately. The two unused bits are set as 00 or 99. For example, if the settings is 809, it is indicated that steps 8 and 9 are the central steps. Again for example, if the settings 3, 4, 5 are set as 6, 7, 8 separately , it is indicated that steps 6, 7, 8 are the central steps respectively.

The implications for the setting 6 (control pulse width long time delay) and the setting 7 (control pulse width short time delay) are same as the OUT module.

The settings 8, 9, 10, 11 (control A blocking logic characters) commonly form a control blocking logic. The lower bytes of the setting 8 define the control outputs numbers of this group logic blocking and its setting range is 0~5. As it = 0, this group logic is invalid. As it = outputs members 1~5, if the expression of this group logic is “true”, the corresponding control outputs are blocked. The definitions for the individual bits of the logic expressions for the various bytes are shown in Table 5-7. It should be noted that in the logic computation, the programs consider that the priority levels for the operation of “OR” “AND” “exclusive OR” are the same, unless the brackets are used to change the operational priority levels. The programs support one level brackets and do not support the multiple brackets. The programs will first process the lower bytes (or lower characters) of a setting. This blocking logic discrimination is independent of two there setting of the rated values.

Table 5-5-1 Setting list for intelligent digital input and output module.

<table>
<tr><th>No.</th><th>Setting name</th><th>Input mode</th><th>Setting range</th><th>Tacitly approved value</th><th colspan="2">Brief descriptions</th></tr>
<tr><td>1</td><td>Slip step blocking function on/off</td><td>Decimal system</td><td>0,1</td><td>0</td><td colspan="2">1: on
0: off</td></tr>
<tr><td>2</td><td>No. of blocking voltage-regulated signal</td><td>Hexadecimal system</td><td>0x0000 ～0xFFFF</td><td>0x0000</td><td colspan="2">As one of the defined telesignal contacts is closed, the voltage-regulated signals are blocked.</td></tr>
<tr><td>3</td><td>Tap central steps A,B</td><td>Decimal system</td><td>0～9999</td><td>0</td><td colspan="2" rowspan="3">One central step can be defined by the unit position digit or decimal digit. At most 6 central steps/ null steps can be defined.</td></tr>
<tr><td>4</td><td>Tap central steps C,D</td><td>Decimal system</td><td>0～9999</td><td>0</td></tr>
<tr><td>5</td><td>Tap central steps E,F</td><td>Decimal system</td><td>0～9999</td><td>0</td></tr>
<tr><td>6</td><td>Control pulse width long time delay</td><td>Decimal system</td><td>0～9.999s</td><td>0.800</td><td colspan="2" rowspan="2">Control the hold time of the output contact operation.</td></tr>
<tr><td>7</td><td>Control pulse width short time delay</td><td>Decimal system</td><td>0～9.999s</td><td>0.800</td></tr>
<tr><td>8</td><td>Control A blocking logic characters 1</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td colspan="2">The lower bytes are used for blocking control No. A, the higher ones are used for group A blocking logic 1</td></tr>
<tr><td>9</td><td>Control A blocking logic characters 2</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td rowspan="3">The lower and higher bytes are used to telesignal blocking telecontrol group A:</td><td>Logic 2,3</td></tr>
<tr><td>10</td><td>Control A blocking logic characters 3</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td>Logic 4,5</td></tr>
<tr><td>11</td><td>Control A blocking logic characters 4</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td>Logic 6,7</td></tr>
<tr><td>12</td><td>Control B blocking logic characters 1</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td colspan="2">The lower bytes are used for blocking control No. B, the higher ones are used for group B blocking logic 1</td></tr>
<tr><td>13</td><td>Control B blocking logic characters 2</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td rowspan="3">The lower and higher bytes are used to telesignal blocking telecontrol group B:</td><td>Logic 2,3</td></tr>
<tr><td>14</td><td>Control B blocking logic characters 3</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td>Logic 4,5</td></tr>
<tr><td>15</td><td>Control B blocking logic characters 4</td><td>Hexadecimal system</td><td>0x0000～ 0xFFFF</td><td>0x0000</td><td>Logic 6,7</td></tr>
<tr><td>16</td><td>Digital input module type</td><td>Decimal system</td><td>0～9</td><td>1</td><td colspan="2" rowspan="3">The details are found in the descriptions in the sections 4.1.2 and 4.1.3. As the setting 13 (digital input module type) is set to be non-zero, the</td></tr>
<tr><td>17</td><td>Switch-in/pulse Overall circuits</td><td>Decimal system</td><td>1～11</td><td>11</td></tr>
<tr><td>18</td><td>Switch-in 1,2</td><td>Hexadecimal</td><td>0x0000～</td><td>0xA4A4</td></tr>
</table>

	attribute	system	0xFFFF		settings 14 ~ 35 are not required to set.
19	Switch-in 1 debounce time	Decimal system	0～9.999s	0.015	
20	Switch-in 2 debounce time	Decimal system	0～9.999s	0.015	
21	Switch-in 3,4 attribute	Hexadecimal system	0x0000～0xFFFF	0xA4A4	
22	Switch-in 3 debounce time	Decimal system	0～9.999s	0.015	
23	Switch-in 4 debounce time	Decimal system	0～9.999s	0.015	
24	Switch-in 5,6 attribute	Hexadecimal system	0x0000～0xFFFF	0x88A4	
25	Switch-in 5 debounce time	Decimal system	0～9.999s	0.015	
26	Switch-in 6 debounce time	Decimal system	0～9.999s	0.050	
27	Switch-in 7,8 attribute	Hexadecimal system	0x0000～0xFFFF	0x8888	
28	Switch-in 7 debounce time	Decimal system	0～9.999s	0.050	
29	Switch-in 8 debounce time	Decimal system	0～9.999s	0.050	
30	Switch-in 9,10 attribute	Hexadecimal system	0x0000～0xFFFF	0x8888	
31	Switch-in 9 debounce time	Decimal system	0～9.999s	0.050	
32	Switch-in 10 debounce time	Decimal system	0～9.999s	0.050	
33	Switch-in 11,12 attribute	Hexadecimal system	0x0000～0xFFFF	0x8888	
34	Switch-in 11 debounce time	Decimal system	0～9.999s	0.050	
35	Encoded input overall items	Decimal system	0～1	1	
36	Encode 1 type	Decimal system	0～13	10	
37	Encode 1 beginning No.	Decimal system	1～11	6	
38	Encode 1 occupied switch-in number	Decimal system	1～11	6	

Table 5-5-2 Control A blocking logic characters array

Setting 11 Higher bytes	Setting 11 Lower bytes	Setting 10 Higher bytes	Setting 10 Lower bytes	Setting 9 Higher bytes	Setting 9 Lower bytes	Setting 8 Higher bytes	Setting 8 Lower bytes
Logic	Logic	Logic	Logic	Logic	Logic	Logic	Blocking

expressions 7	expressions 6	expressions 5	expressions 4	expressions 3	expressions 2	expressions 1	control output No A

Table 5-5-3 Implications for the bits of the bytes for logic expression

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
=1: with brackets =0: without brackets (left / right brackets are discriminated automatically by programs)	They indicate the operation of the general formula using the logic expression for this bytes: =00 (bit 6=0, bit5=0): or =01 (bit6=0, bit 5=1): and =10 (bit6=1, bit5=0): exclusive or (for the first bytes, bit 6~5 are not used and they are valuated directly)		As the telesignal status corresponded by bit 3~0 is equivalent to bit 4, the results of the logic expression for this byte are true, otherwise, false.	Used to define the telesignal number. As OR=0, it is indicated that this byte is invalid. bit3 ~ 0=1 indicates the first telesignal input bit3 ~ 0 = n indicates the nth telesignal input			

For example: if the logic expression ((YX1==1) + (YX2==0)) * (YX3==0) * ((YX4==1) + (YX5==0)) is true, the output 2 is blocked and its settings 8 ~ 11 can be set respectively as follows: 0x1102, 0x2302, 0x85B4, 0x0000.

The settings 12, 13, 14, 15 (control B blocking logic characters) commonly form another control blocking logic, whose defining method is same as the settings 8~11.

The control A blocking logic and control B blocking logic are independent each other. Both can block simultaneously an output number and at this time, the two logics are equivalent to "OR" relationship.

The defining method for the settings 16~38 is completely same as the DI module. It should be necessary to note that as the slip step blocking function is switched on, there must be a group or the encoded inputs used to introduce the tap position signals i.e., the setting 35 (encoded input overall items) = 1.

In connections, the lower bits of the encoded inputs are located at the prior positions and the higher ones at the later positions. For example, as the setting 16 of the DIO module (digital input module type) is set as 1, the prior 5 circuits of the 11-circuit switching-in variables are for the telesignal inputs, and the later 6 circuits, the HEX code (hexadecimal codes or 8421 codes) inputs. In this case, the signals in the circuit 6 should be connected to the lowest bit of the HEX codes and those in the circuit 11 to the highest bit of the HEX codes. If the actual input code bits are less than 6, the signals can not be connected to the highest bit terminal inputs or can be securely connected to the negative terminal to prevent the interference.

The setting for the user self-defined type can be amended on the basis of the typical setting. For example, if the self-defined setting is made to be similar to that as the setting for the digital input module type is 1, the digital input module type is first set as 1 and hold the setting and call it again, then the settings 16~38 will be displayed automatically by programs according to the meanings of the type. Now set the digital input module type as 0 and then amend partly the settings 16~38 and finally hold them.

5.6 Main module for administration (CPU)

The settings for this module are shown in Tables 5-6-1, 5-6-2, 5-6-3. Those settings whose numbers are in blackface type are the corresponding settings required for synchronism of the single CBs. There is only synchronous function for the single CBs in the software version V1.61 for the CPU module. There is the synchronous function for the multiple CBs in the software version not lower than V1.65. The setting control characters can be set separately by pressing the “>”key for a long time to enter into the various visible subitems, see Tables 5-6-2、5-6-3.

Table 5-6-1 Setting list for the main module for administration (CPU)

No.	Setting name	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Control words 1	Hexadecimal system	0x0000 ～ 0xFFFF	0x0004	See the descriptions about the setting control words 1
2	Control words 2	Hexadecimal system	0x0000～0xFFFF	0x0000	See the descriptions about the setting control words 2
3	Control pulse width long time delay	Decimal system	0.000～99.99s	0.12	Control the hold time of the output contact operation.
4	Control pulse width short time delay	Decimal system	0.000～99.99s	0.12	
5	Synch telesignal number 1	Decimal system	0～8	0	As it is 0, the synch function is switched off.
6	Synch output number 1	Decimal system	0～8	0	As it is 0, the synch function is switched off.
7	Synch resetting time 1	Decimal system	0～99.99s	40	If synchronism is not caught during this time, the synch overtime is discriminated and the synch function is switched off.
8	Synch permissive closing angle 1	Decimal system	0～180.0°	15	
9	LV blocking value 1	Decimal system	0～100.0V	40	
10	Voltage differential blocking value 1	Decimal system	0～100.0V	10	
11	Frequency differential blocking value 1	Decimal system	0～2.000Hz	0.5	
12	Frequency differential acceleration blocking value 1	Decimal system	0～2.000Hz/s	1	
13	Switching operation overall time 1	Decimal system	0～2.000s	0.2	
14	Synch telesignal	Decimal system	0～8	0	As it is 0, the synch function is

	number 2				switched off.
15	Synch output number 2	Decimal system	0～8	0	As it is 0, the synch function is switched off.
16	Synch resetting time 2	Decimal system	0～99.99s	40	If synchronism is not caught during this time, the synch overtime is discriminated and the synch function is switched off.
17	Synch permissive closing angle 2	Decimal system	0～180.0°	15	
18	LV blocking value 2	Decimal system	0～100.0V	40	
19	Voltage differential blocking value 2	Decimal system	0～100.0V	10	
20	Frequency differential blocking value 2	Decimal system	0～2.000Hz	0.5	
21	Frequency differential acceleration blocking value 2	Decimal system	0～2.000Hz/s	1	
22	Switching operation overall time 2	Decimal system	0～2.000s	0.2	
23	Synch telesignal number 2	Decimal system	0～8	0	As it is 0, the synch function is switched off.
24	Synch output number 2	Decimal system	0～8	0	As it is 0, the synch function is switched off.
25	Synch resetting time 2	Decimal system	0～99.99s	40	If synchronism is not caught during this time, the synch overtime is discriminated and the synch function is switched off.
26	Synch permissive closing angle 3	Decimal system	0～180.0°	15	
27	LV blocking value 3	Decimal system	0～100.0V	40	
28	Voltage differential blocking value 3	Decimal system	0～100.0V	10	
29	Frequency differential blocking value 3	Decimal system	0～2.000Hz	0.5	
30	Frequency differential acceleration blocking value 3	Decimal system	0～2.000Hz/s	1	
31	Switching operation overall time 3	Decimal system	0～2.000s	0.2	
32	Synch telesignal number 3	Decimal system	0～8	0	As it is 0, the synch function is switched off.

33	Synch output number 3	Decimal system	0～8	0	As it is 0, the synch function is switched off.
34	Synch resetting time 3	Decimal system	0～99.99s	40	If synchronism is not caught during this time, the synch overtime is discriminated and the synch function is switched off.
35	Synch permissive closing angle 4	Decimal system	0～180.0°	15	
36	LV blocking value 4	Decimal system	0～100.0V	40	
37	Voltage differential blocking value 4	Decimal system	0～100.0V	10	
38	Frequency differential blocking value 4	Decimal system	0～2.000Hz	0.5	
39	Frequency differential acceleration blocking value 4	Decimal system	0～2.000Hz/s	1	
40	Switching operation overall time 4	Decimal system	0～2.000s	0.2	
41	Fixed angle difference value	Decimal system	0～360.0°	0	For example, -30° can be expressed by 330° . It is mainly used in the case when the phases are different between the synch voltages at both sides (or HV and MV sides) of a main transformer. It is defined as the angle between the prior connected voltage and the latterly connected voltage.
42	Fixed angle difference between MV & LV sides	Decimal system	0～360.0°	0	For example, -30° can be expressed by 330° . It is mainly used in the case when the phases are different between the synch voltages of the MV and LV sides.
43 | 47	Timer T3 | Timer 7	Decimal system	0～99.99s	0.120	They are used for the programmable five-protection blocking logics. As it is not used, no setting is required.

Table 5-6-2 List of definitions for the setting item "Control characters 1" of the main module for administration (CPU)

No.	Setting bit No.	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Bit 0	No check 1	Off / on	Off	

2	Bit 1	Check no voltage 1	Off / on	Off	
3	Bit 2	Check synchronism 1	Off / on	On	
4	Bit 3	Catch synchronism 1	Off / on	off	
5	Bit 6,5,4	Phases of the synch voltages	Ua/Ub/Uc/Uab/Ubc/Uca	Ua	
6	Bit 7				Remains unused
7	Bit 8	Synch rated voltage	57.7V / 100V	57.7V	Mainly used for no voltage criteria
8	Bit 9	TA type selection	5A/1A	5A	
9	Bit 10～11				For the selection of the TAs
10	Bit 14,13,12	Synchronism types	0: single CB synchronism 1: synchronism at both sides of a main transformer 2: synchronism at both sides +1 of a main transformer 3: synchronism at both sides +2 of a main transformer 4: synchronism at three sides of a main transformer 5: synchronism at four sides of a main transformer 6: synchronism of 3/2 CB 7: synchronism of dual CBs	Single CB synchronism	
11	Bit 15				Remains unused

As mutual synchronism occurs among the several sides, the search sequence for the synch voltage is from the HV side to LV side or from 1 to 4 in sequence and correspondingly. As the two methods are inconsistent, the latter will be taken as the reference. The angle difference is searched also in the sequence of $\Phi_{high}-\Phi_{low}$ or $\Phi_1-\Phi_2$ or $\Phi_2-\Phi_3$ etc.. Similarly, as the two methods are inconsistent, the latter will be taker as the reference. It is suggested that 1~4 are corresponding respectively to the HV、MV、LV sides and branches at LV sides.

Table 5-6-3 List of definitions for the setting item “Control characters 2” of the main module for administration (CPU)

No.	Setting bit No.	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Bit 0	No check 2	Off / on	Off	
2	Bit 1	Check no voltage 2	Off / on	Off	
3	Bit 2	Check synchronism 2	Off / on	Off	
4	Bit 3	Catch synchronism 2	Off / on	Off	

5	Bit 4	No check 3	Off / on	Off	
6	Bit 5	Check no voltage 3	Off / on	Off	
7	Bit 6	Check synchronism 3	Off / on	Off	
8	Bit 7	Catch synchronism 3	Off / on	Off	
9	Bit 8	No check 4	Off / on	Off	
10	Bit 9	Check no voltage 4	Off / on	Off	
11	Bit 10	Check synchronism 4	Off / on	Off	
12	Bit 11	Catch synchronism 4	Off / on	off	
13	Other bits				Remain unused

The soft jumpers of the module are shown in Table 5-6-4.

Table 5-6-4 Definitions for the soft jumpers of the main module for administration

No.	Name of jumper	Status of jumper	Tacitly approved value	Brief descriptions
0	Synch jumper 1	Off / on	off	
1	Synch jumper 2	Off / on	off	
2	Synch jumper 3	Off / on	off	
3	Synch jumper 1	Off / on	off	
4	Test mode jumper	Off / on	off	Test mode: causes for the data transfer of the upward transmitted messages are set as the test mode to let the upward computer process according to the conditions; it is mainly used for the maintenance of the corresponding equipments of the device.

The internal settings for this module are shown in Table 5-6-5. The internal settings are decided by manufacturer and usually it is unnecessary for user to amend. The setting control characters can be set separately by pressing the【>】 key for a long time to enter into the various visible subitems, see Table 5-6-6.

Table 5-6-5 Internal setting list for the main module for administration (CPU)

No.	Setting bit No.	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Internal control words 1…	Hexadecimal system	0x0000 ～0xFFFF	0x0000	See the descriptions about the setting control words
2	MMI switch-in attribute setting	Hexadecimal system	0x0000 ～0xFFFF	0x0000	See the descriptions about the MMI switch-in attribute setting
3	Remote / local 1 selection	Decimal System	0～1220	1	0: remote / local 1 function is switched off. The lower 2 bits are used for the telesignal switch-in number. The higher 2 bits are used for the CPU number.

					As the higher 2 bits are Q, it is equivalent to 12.
4	Remote / local 1 object group A	Hexadecimal system	0x0000 ～0xFFFF	0x1C1A	Higher bytes: submodule range; Lower bytes: output range
5	Remote / local 1 object group B	Hexadecimal system	0x0000 ～0xFFFF	0x0000	
6	Remote / local 2 selection	Decimal system	0～11	0	0: remote / local 1 function is switched off. The lower 2 bits are used for the telesignal switch-in number. The higher 2 bits are used for the CPU number. As the higher 2 bits are Q, it is equivalent to 12.
7	Remote / local 2 object group A	Hexadecimal system	0x0000 ～0xFFFF	0x0000	Higher bytes: submodule range; Lower bytes: output range
8	Remote / local 2 object group B	Hexadecimal system	0x0000 ～0xFFFF	0x0000	
9	Remote / local 3 selection	Decimal system	0～11	0	0: remote / local 1 function is switched off. The lower 2 bits are used for the telesignal switch-in number. The higher 2 bits are used for the CPU number. As the higher 2 bits are Q, it is equivalent to 12.
10	Remote / local 3 object group A	Hexadecimal system	0x0000 ～0xFFFF	0x0000	Higher bytes: submodule range; Lower bytes: output range
11	Remote / local 3 object group B	Hexadecimal system	0x0000 ～0xFFFF	0x0000	
12	Remote / local 4 selection	Decimal system	0～11	0	0: remote / local 1 function is switched off. The lower 2 bits are used for the telesignal switch-in number. The higher 2 bits are used for the CPU number. As the higher 2 bits are Q, it is equivalent to 12.
13	Remote / local 4 object group A	Hexadecimal system	0x0000 ～0xFFFF	0x0000	Higher bytes: submodule range; Lower bytes: output range
14	Remote / local 4 object group B	Hexadecimal system	0x0000 ～0xFFFF	0x0000	
15	Group A dual telesignal CPU selection	Decimal system	1～12	0	Define the module CPU number of dual telesignal inputs
16	Group A dual telesignal YX range	Decimal system	0～2020	0	The higher 2 bits are for the initial telesignal number, lower 2 bits are

					for the terminal telesignal number
17	Group B dual telesignal CPU selection	Decimal system	1～12	0	Define the module CPU number of dual telesignal inputs
18	Group B dual telesignal YX range	Decimal system	0～2020	0	The higher 2 bits are for the initial telesignal number, lower 2 bits are for the terminal telesignal number
19	Group C dual telesignal CPU selection	Decimal system	1～12	0	Define the module CPU number of dual telesignal inputs
20	Group C dual telesignal YX range	Decimal system	0～2020	0	The higher 2 bits are for the initial telesignal number, lower 2 bits are for the terminal telesignal number
21	Primary TA ratio primary	Decimal system	0 ～99.99kA	0.6	Display the primary rms
22	Primary TA ratio secondary	Decimal system	0～1000A	5	
23	Primary TV ratio primary	Decimal system	0～999.9kV	10	
24	Primary TV ratio secondary	Decimal system	0 ～999.9V	100	
25	Measurement threshold constant 0	Decimal system	0～4096	0	They are used for the programmable logics. As the comparison between the measured values and settings exists in the input elements, the settings will be set and the corresponding range is the value which the device upward transmits: 4095 is corresponding to the full scale value.
26	Measurement threshold constant 1	Decimal system	0～4096	0	
27	Measurement threshold constant 2	Decimal system	0～4096	0	
28	Measurement threshold constant 3	Decimal system	0～4096	0	
29	Measurement threshold constant 4	Decimal system	0～4096	0	
30	Measurement threshold constant 5	Decimal system	0～4096	0	
31	Measurement threshold constant 6	Decimal system	0～4096	0	
32	Measurement threshold constant 7	Decimal system	0～4096	0	
33	Measurement threshold constant 8	Decimal System	0～4096	0	
34	Measurement threshold constant 9	Decimal System	0～4096	0	
35	Time setting for circular upward transmission	Decimal System	0～9900s	900	As the setting is 0, no data for circular upward transmission. This setting is only valid when the control words for circular upward transmission are switched on.

The internal setting items 2~13 are used to define the remote / local functions. They can at most define 4 groups, for which the definitions are made in the same way.

The setting item “Remote /local n selection” is used to define the telesignal points connected by the remote / local function (the lower 2 bits are for the telesignal switch-in number and the higher 2 bits are for the module CPU number. As the higher bits are 0, it is equivalent to 12). As 0 is filled in, it is indicated that the remote / local functions of this group are not used. For example, the setting 1202 indicates that the connection point of the remote / local function is the switch-in 2 of the CPU 12#; the setting 201 indicates that the connection point of the remote /local function is the switch-in 1 of the CPU 2#; the setting 1 indicates that the connection point of the remote /local function is the switch-in 1 of the CPU 12#.

As the telesignal value of the remote / local function is 0 for remote, 1 for local.

The “Remote / local n object group A” and the “Remote / local n object group B” indicate which control outputs the remote / local function of this group will act on. The settings of each item occupy 4 bits in hexadecimal system. Assuming 0xHMSL, it indicates that the control outputs 0xS~0xL of the functional submodules 0xH~0xM are controlled by the remote / local functions of this group. The module numbers and control output numbers are counted from 1. As this setting is 0x0000, it is indicated that no definitions are made for this item.

Table 5-6-6 List of the definitions for the “Internal control characters 1” of the main module for administration (CPU)

No.	Setting bit No.	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Bit 0	Network mode	Single-network / dual network	Single network	
2	Bit 1	Single-network operational network	Network A / network B	Network A	
3	Bit 2	A/D sample module	Off / on	Off	
4	Bit 3	Logic function module	Off / on	off	
	…				
5	Bit 12	Operational lamp	Fixed frequency flashes / disturbed data flashes	Fixed frequency flashes	
6	Bit 13	Dual-bit telesignal function	Off / on	Off	
7	Bit 14		Multi-CPU / single-CPU	Multi-CPU	As there is no intelligent functional submodules, the single CPU is set
8	Bit 15	Circular upward transmission	On / off	on	As the control words are switched on, the time setting for circular upward transmission is valid.

Table 5-6-7 List of definitions for the item "MMI switch-in attribute setting" of the main module for administration (CPU)

No.	Setting bit No.	Input mode	Setting range	Tacitly approved value	Brief descriptions
1	Bit 0	MMI switch-in 1	No counter way / counter way	No counter way	
2	Bit 1	MMI switch-in 1	No counter way / counter way	No counter way	
3	Bit 2	MMI switch-in 1	No counter way / counter way	No counter way	
4	Bit 3	MMI switch-in 1	No counter way / counter way	No counter way	
5	Bit 4	MMI switch-in 1	No counter way / counter way	No counter way	
6	Bit 5	MMI switch-in 1	No counter way / counter way	No counter way	
7	Bit 6	MMI switch-in 1	No counter way / counter way	No counter way	
8	Bit 7	MMI switch-in 1	No counter way / counter way	No counter way	

6 Input and Output Data

This section will present the contents, types, sequences and serial numbers of the data upward transmitted by the various functional submodules. These will be primarily useful for the database of the upward computer system. Finally, this section will introduce the data definitions of the CPU module. The list of definitions for the event information of the various intelligent functional submodules of BEPR- 860 series devices are unified (excluding the CPU module), see Table 6-1.

Table 6-1 List of the event information of the intelligent functional submodules

External No.	Internal No.	Event name	Remarks
1	1	Power on	It is found in all the intelligent submodules.
2	2	RAM error	It is found in all the intelligent submodules.
3	3	EPROM error	It is found in all the intelligent submodules.
4	4	Flash error	It is found in all the intelligent submodules.
5	5	EEPROM error	It is found in all the intelligent submodules.
6	6	Void setting zone	It is found in all the intelligent submodules.
7	7	Setting check error	It is found in all the intelligent submodules.
8	8	Switch-in abnormal	It is primarily found in the DI, DIO modules.
9	9	Switch-out abnormal	It is primarily found in the OUT, DIO modules
10	10	AD error	It is primarily found in the AC, AC-I, AC-U DC modules
11	11	Internal SPI abnormal	It is primary found in the AC, AC-I, AC-U modules
12	12	Hard time-checking switch-in abnormal	It is found in all the intelligent submodules
13	17	Voltage-regulated blocking operation	It is only found in the DIO module
14	18	Logic blocking operation	
15	19	Slip step blocking operation	
16	21	Monitoring output 1 order sent	It is only found in the DIO, OUT modules(used to record all the soft orders for the operation outputs passing through this device
17	22	Monitoring output 2 order sent	
18	23	Monitoring output 3 order sent	
19	24	Monitoring output 4 order sent	
20	25	Monitoring output 5 order sent	
21	26	Monitoring output 6 order sent	It is only found in the OUT modules(used to record all the soft orders for the operation outputs passing through this device
22	27	Monitoring output 7 order sent	
23	28	Monitoring output 8 order sent	
24	29	Monitoring output 9 order sent	
25	30	Monitoring output 10 order sent	
26	31	Monitoring output 11 order sent	

6.1 Intelligent AC modules (AC, AC-I, AC-U)

The principal data upward transmitted by this module includes: telemetered variables (current, voltage, active power, reactive power and power factor, etc.). computed KWHs (only for the AC module: positive active KWHs, negative active KWHs, positive reactive KWHs and negative reactive KWHs, etc.) event information (device energization, device error, etc.).

Attention should be paid to the fact that the sequence for the upward transmission of data is different from that for the display at the panels of the device.

Table 6-1-1 List of the telemetered information of the intelligent AC module

No.	Name	Remarks	No.	Name	Remarks
1	I1	They are corresponding to the 4-circuit current inputs of the modules	11	COS Φ1	It is corresponding to the set power of group 1
2	I2		12	P2	If they are set, they are corresponding to the set power of group 2
3	I3		13	Q2	
4	I4		14	COSΦ2	
5	U1	They are corresponding to the 4-circuit voltage inputs of the modules	15	P3	If they are set, they are corresponding to the set power of group 3
6	U2		16	Q3	
7	U3		17	COSΦ3	
8	U4		18	P4	If they are set, they are corresponding to the set power of group 4
9	P1	If they are set, they are corresponding to the set power of group 1	19	Q4	
10	Q1		20	COSΦ4	

Table 6-1-2 List of the telemetered information of the intelligent AC-I module

No.	Name	Remarks	No.	Name	Remarks
1	I1	They are corresponding to the 8-circuit current input of the modules	11	COSΦ(I1_I5)	It is corresponding to the set power of group 1
2	I2		12	P(I2_I6)	They are usually meaningless and corresponding to the set power of group 2
3	I3		13	Q(I2_I6)	
4	I4		14	COSΦ (I2_I6)	
5	I5		15	P(I3_I7)	They are usually meaningless and corresponding to the set power of group 3
6	I6		16	Q(I3_I7)	
7	I7		17	COSΦ(I3_I7)	
8	I8		18	P(I4_I8)	They are usually meaningless and corresponding to the set power of group 4
9	P(I1_I5)	They are usually meaningless and corresponding to the set power of group 1	19	Q(I4_I8)	
10	Q(I1_I5)		20	COS Φ (I4_I8)	

Table 6-1-3 List of the telemetered information of the intelligent AC-I module

No.	Name	Remarks	No.	Name	Remarks

1	U1	They are corresponding to the 8-circuit voltage input of the modules	11	COSΦ (U1_U2)	It is corresponding to the set power of group 1
2	U2		12	P(U3_U4)	They are usually meaningless and corresponding to the set power of group 2
3	U3		13	Q(U3_U4)	
4	U4		14	COSΦ (U3_U4)	
5	U5		15	P(U53_I6)	They are usually meaningless and corresponding to the set power of group 3
6	U6		16	Q(U5_U6)	
7	U7		17	COSΦ (U5_U6)	
8	U8		18	P(U7_U8)	They are usually meaningless and corresponding to the set power of group 4
9	P(U1_U 2)	They are usually meaningless and corresponding to the set power of group 1	19	Q(U7_U8)	
10	Q(U1_U 2)		20	COS Φ (U7_U8)	

Table 6-1-4 List of information of the computed KWHs of the intelligent AC modules

No.	Name	Remarks	No.	Name	Remarks
0	Positive active KWHs 1	It is corresponding to P1	8	Negative active KWHs 1	It is corresponding to P1
1	Positive active KWHs 2	It is corresponding to P2	9	Negative active KWHs 2	It is corresponding to P2
2	Positive active KWHs 3	It is corresponding to P3	10	Negative active KWHs 3	It is corresponding to P3
3	Positive active KWHs 4	It is corresponding to P4	11	Negative active KWHs 4	It is corresponding to P4
4	Positive reactive KWHs 1	It is corresponding to Q1	12	Negative reactive KWHs 1	It is corresponding to Q1
5	Positive reactive KWHs 2	It is corresponding to Q2	13	Negative reactive KWHs 2	It is corresponding to Q2
6	Positive reactive KWHs 3	It is corresponding to Q3	14	Negative reactive KWHs 3	It is corresponding to Q3
7	Positive reactive KWHs 4	It is corresponding to Q4	15	Negative reactive KWHs 4	It is corresponding to Q4

Table 6-1-5 List of ratios for the upward transmitted data of the computed KWHs

Conditions: (AC modules are calibrated using 100V /5A) TA: 5A, TV: line voltage 100V, phase voltage 57.735V directed at 3-phase system	
Ratio(KWH) as it is reduced to the secondaries	Running speed of the secondary electric meter
1 /2500 = 0.0004	2500pulse/KWH

Table 6-1-6 List of ratios for the upward transmitted data of I, U, P, Q, COSΦ

Item	Conditions: (AC modules are calibrated using 100V / 5A) TA: 5A, TV: line voltage 100V, phase voltage 57.735V
	Ratio(KWH) as it is reduced to the secondaries

I (5A)	1.2*5 /4095 = 6 /4095 = 0.0014862
U	1.2*100 /4095 = 120 /4095 = 0.029304
P,Q	1.44*1500 / 4095 = 2160 / 4095 = 0.52747(directed at 3-phase system
COS Φ	1.000 / 4095 = 0.00024420

6.2 Intelligent digital variable input module (DI)

Table 6-2-1 List of the telesignal, SOE of the intelligent DI module

No.	Name	Remarks	No.	Name	Remarks
0	Switch-in 1	It is corresponding to the terminal inputs of the module 1	27	Extended telesignal 6	If the encoded signal inputs are set to be upward transmitted in the telesignal mode, the software will upward transmit the first encoded value in the single-contact telesignal mode, i.e. for the encoded value n, the extended telesignal n is 1 state, the other extended telesignal states are 0.
1	Switch-in 2	It is corresponding to the terminal inputs of the module 2	28	Extended telesignal 7	
2	Switch-in 3	It is corresponding to the terminal inputs of the module 3	29	Extended telesignal 8	
3	Switch-in 4	It is corresponding to the terminal inputs of the module 4	30	Extended telesignal 9	
4	Switch-in 5	It is corresponding to the terminal inputs of the module 5	31	Extended telesignal 10	
5	Switch-in 6	It is corresponding to the terminal inputs of the module 6	32	Extended telesignal 11	
6	Switch-in 7	It is corresponding to the terminal inputs of the module 7	33	Extended telesignal 12	
7	Switch-in 8	It is corresponding to the terminal inputs of the module 8	34	Extended telesignal 13	
8	Switch-in 9	It is corresponding to the terminal inputs of the module 9	35	Extended telesignal 14	
9	Switch-in 10	It is corresponding to the terminal inputs of the module 10	36	Extended telesignal 15	
10	Switch-in 11	It is corresponding to the terminal inputs of the module 11	37	Extended telesignal 16	
11	Switch-in 12	It is corresponding to the terminal inputs of the module 12	38	Extended telesignal 17	
12	Switch-in 13	It is corresponding to the terminal inputs of the module 13	39	Extended telesignal 18	
13	Switch-in 14	It is corresponding to the terminal inputs of the module 14	40	Extended telesignal 19	
14	Switch-in 15	It is corresponding to the terminal inputs of the module 15	41	Extended telesignal 20	
15	Switch-in 16	It is corresponding to the terminal inputs of the module 16	42	Extended telesignal 21	
16	Switch-in 17	It is corresponding to the terminal inputs of the module 17	43	Extended telesignal 22	
17	Switch-in	It is corresponding to the terminal inputs of the module 18	44	Extended telesignal 23	

18	Switch-in	It is corresponding to the terminal inputs of the module 19	45	Extended telesignal 24	
19	Switch-in	It is corresponding to the terminal inputs of the module 20	46	Extended telesignal 25	
20	General alarm	General alarm for switch-in signal	47	Extended telesignal 26	
21	General event	General event for switch-in signal	48	Extended telesignal 27	
22	Extended telesignal 1		49	Extended telesignal 28	
23	Extended telesignal 2		50	Extended telesignal 29	
24	Extended telesignal 3		51	Extended telesignal 30	
25	Extended telesignal 4		52	Extended telesignal 31	
26	Extended telesignal 5		53	Extended telesignal 32	

The principal data upward transmitted by this module includes: telesignal state, SOE, pulse counts, encoded values, event information (device energization, device error, etc.). The upward transmitted data are found in Tables 6-2-1 ~ 6-2-3.

In the cases when the switch-in signals are connected from the encoded values and pulses, no effects will be made on the definitions of the other telesignal serial numbers.

Table 6-2-2 List of information of the pulses of the intelligent DI modules

No.	Name	Remarks	No.	Name	Remarks
0	Pulse count 1	It is corresponding to the set pulses in circuit 1	2	Pulse count 3	It is corresponding to the set pulses in circuit 3
1	Pulse count 2	It is corresponding to the set pulses in circuit 2	3	Pulse count 4	It is corresponding to the set pulses in circuit 4

One DI module can set at most 20 circuits for the pulsing variable inputs. The terminal number corresponding to the circuit 1 pulses is set as the first inputs of the pulsing variables. It is necessary to define continuously the several pulsing variable inputs.

Table 6-2-3 List of information of the encoded values of the intelligent DI module

No.	Name	Remarks	No.	Name	Remarks
0	Encoded value 1	It is corresponding to the first set and encoded HEX format	3	Encoded value 4	It is corresponding to the second set and encoded HEX format
1	Encoded value 2	BCD format of the encoded value 1	4	Encoded value 5	BCD format of the encoded value 4
2	Encoded value 3	One to one format of the encoded value 1	5	Encoded value 6	One to one format of the encoded value 4

The continuous defining is necessary for the several encoded inputs. The definitions for the lower bits within an encoded value are located at the prior positions.

6.3 Intelligent control module (OUT)

The principal data upward transmitted by this module includes: event information (device energization, device error). The principal data to be received is: orders for the operational outputs of switches, isolators and taps, see the definitions in Table 6-3-1.

Table 6-3-1 List of the control information of the intelligent OUT module

No.	Name	Remarks	No.	Name	Remarks
1	Output 1	It is corresponding to the output terminal circuit 1	6	Output 6	It is corresponding to the output terminal circuit 6
2	Output 2	It is corresponding to the output terminal circuit 2	7	Output 7	It is corresponding to the output terminal circuit 7
3	Output 3	It is corresponding to the output terminal circuit 3	8	Output 8	It is corresponding to the output terminal circuit 8
4	Output 4	It is corresponding to the output terminal circuit 4	9	Output 9,11	It is corresponding to the output terminal circuit 9,11
5	Output 5	It is corresponding to the output terminal circuit 5	10	Output 10	It is corresponding to the output terminal circuit 10

6.4 Intelligent DC module (DC)

The principal data upward transmitted by this module includes: telemetered values, event information (device energization, device error, etc.). The upward transmitted data is found in Table 6-4-1.

Table 6-4-1 List of the telemeter information of the intelligent DC module

No.	Name	Remarks	No.	Name	Remarks
1	DC 1	It is corresponding to the input terminal circuit 1	9	DC 9	It is corresponding to the input terminal circuit 9
2	DC 2	It is corresponding to the input terminal circuit 2	10	DC 10	It is corresponding to the input terminal circuit 10
3	DC 3	It is corresponding to the input terminal circuit 3	11	DC 11	It is corresponding to the input terminal circuit 11
4	DC 4	It is corresponding to the input terminal circuit 4	12	DC 12	It is corresponding to the input terminal circuit 12
5	DC 5	It is corresponding to the input terminal circuit 5	13	Internal 5V measurement 1	For reference only, the ratio for the upward transmission 10 / 4095
6	DC 6	It is corresponding to the input terminal circuit 6	14	Internal ground measurement 1	
7	DC 7	It is corresponding to the input terminal circuit 7	15	Internal 5V measurement 2	
8	DC 8	It is corresponding to the input terminal circuit 8	16	Internal ground measurement 2	

Table 6-4-2 List of the ratios for the upward transmitted data DC 1-12

Item	Conditions: assume that the full scaled setting is set as M
	Ratio as it is reduced to the secondaries of a transducer
Ratio	M / 4095

6.5 Intelligent digital input and output module (DIO)

The principal data upward transmitted by this module includes: telesignal status, SOE, pulse counts, encoded values, event information (device energization, device error, etc.). The upward transmitted data is found in Tables 6-5-1 ~ 6-5-3 respectively.

The principal data received by this module is the orders for the operational outputs of switches, isolators and taps.

Table 6-5-1 List of the telesignal, SOE of the intelligent DIO module

No	Name	Remarks	No.	Name	Remarks
0	Switch-in 1	It is corresponding to the terminal inputs of the module 1	23	Extended telesignal 11	If the encoded signal inputs are set to be upward transmitted in the telesignal mode, the software will upward transmit the first encoded value in the single-contact telesignal mode, i.e. for the encoded value n, the extended telesignal n is 1 state, the other extended telesignal states are 0.
1	Switch-in 2	It is corresponding to the terminal inputs of the module 2	24	Extended telesignal 12	
2	Switch-in 3	It is corresponding to the terminal inputs of the module 3	25	Extended telesignal 13	
3	Switch-in 4	It is corresponding to the terminal inputs of the module 4	26	Extended telesignal 14	
4	Switch-in 5	It is corresponding to the terminal inputs of the module 5	27	Extended telesignal 15	
5	Switch-in 6	It is corresponding to the terminal inputs of the module 6	28	Extended telesignal 16	
6	Switch-in 7	It is corresponding to the terminal inputs of the module 7	29	Extended telesignal 17	
7	Switch-in 8	It is corresponding to the terminal inputs of the module 8	30	Extended telesignal 18	
8	Switch-in 9	It is corresponding to the terminal inputs of the module 9	31	Extended telesignal 19	
9	Switch-in 10	It is corresponding to the terminal inputs of the module 10	32	Extended telesignal 20	
10	Switch-in 11	It is corresponding to the terminal inputs of the module 11	33	Extended telesignal 21	
11	General alarm	General alarm for switch-in signal	34	Extended telesignal 22	
12	General event	General event for switch-in signal	35	Extended telesignal 23	
13	Extended telesignal 1		36	Extended telesignal 24	
14	Extended telesignal 2		37	Extended telesignal 25	

15	Extended telesignal 3		38	Extended telesignal 26	
16	Extended telesignal 4		39	Extended telesignal 27	
17	Extended telesignal 5		40	Extended telesignal 28	
18	Extended telesignal 6		41	Extended telesignal 29	
19	Extended telesignal 7		42	Extended telesignal 30	
20	Extended telesignal 8		43	Extended telesignal 31	
21	Extended telesignal 9		44	Extended telesignal 32	
22	Extended telesignal 10				

As the input signals, i.e., encoded values and pulsing variables, are inserted, no effects will be made on the definitions for the telesignal serial numbers.

Table 6-5-2 List of information of the pulse counts of the intelligent DIO module

No.	Name	Remarks	No.	Name	Remarks
0	Pulse count 1	It is corresponding to the set pulses in circuit 1	2	Pulse count 3	It is corresponding to the set pulses in circuit 3
1	Pulse count 2	It is corresponding to the set pulses in circuit 2	3	Pulse count 4	It is corresponding to the set pulses in circuit 4

One DIO module can set at most circuits for the pulsing variable inputs. The terminal numbers are corresponding to the circuit 1 pulses as the first input of the pulsing variables.

Table 6-5-3 List of information of the encoded values of the intelligent DIO module

No.	Name	Remarks	No.	Name	Remarks
0	Encoded value 1	It is corresponding to the first set and encoded HEX format	2	Encoded value 3	One to one format of the encoded value 1
1	Encoded value 2	BCD format of the encoded value 1			

The continuous defining is necessary for the several encoded inputs. The definitions for the lower bits within an encoded value are located at the prior positions.

Table 6-5-4 List of control information of the intelligent DIO module

No.	Name	Remarks	No.	Name	Remarks
1	Output 1	It is corresponding to the output terminal circuit 1	4	Output 4	It is corresponding to the output terminal circuit 4 / fall
2	Output 2	It is corresponding to the output terminal circuit 2	5	Output 5	It is corresponding to the output terminal circuit 5 / shunt down

3	Output 3	It is corresponding to the output terminal circuit 3 / lift			

As the slip step blocking function is switched on, the outputs 3, 4, 5 must be separately defined as the lift, fall, shut down of the taps.

6.6 Main module for administration (CPU)

All the following data of this module is corresponding to the CPU software version V1.61 or the amended versions.

The principal upward and downward data of this module includes: telemetered values, telesignal states, SOE, event information (device energization, device error, etc.). telecontrol, soft jumpers (for soft jumpers, settings and internal settings, see the section “Setting”. The upward transmitted data is found in Tables 6-6-1 ~ 6-6-3.

Table 6-6-1 List of the event information of the CPU module

External No.	Internal No.	Event name	Remarks
1	1	Power on	
2	2	RAM self-check error	Storage self-check error
3	3	ROM self-check error	Program self-check error
4	4	FLASH error	Flash self-check error
5	5	EEPROM error	
6	6	Clock chip error	
7	7	Panel communication error	
8	8	CAN communication error	
9	9	LAN communication error	Ethernet communication error
10	10	Serial port communication error	This item is not present in the new version but this No. is occupied
11	11	Switch-in self-check error	
12	12	Switch-out abnormal	
13	13	AD self-check error	
14	14	TCP communication overtime	Ethernet part
15	15	UDP communication overtime	
16	16	TCP connection overtime	
17	17	TCP communication interrupt	
18	18	Module 1 communication interrupt	Functional sub-module communication interrupt
19	19	Module 2 communication interrupt	
20	20	Module 3 communication interrupt	
21	21	Module 4 communication interrupt	
22	22	Module 5 communication interrupt	
23	23	Module 6 communication interrupt	
24	24	Module 7 communication interrupt	
25	25	Module 8 communication interrupt	
26	26	Module 9 communication interrupt	
27	27	Module 10 communication interrupt	
28	28	Module 11 communication interrupt	

29	29	Void setting zone	The setting need to be set and solidified and switched to the operational setting
30	30	Void AC ratio	For NAC, gain calibration is needed.
31	31	Logic setting error	As logic functions are present
32	32	Logic input error	As logic functions are present
33	33	Logic output error	
34	34	Logic setting CPU error	
35	50	Synch 1 operation overtime	
36	51	Synch 1 operation success	
37	52	Synch 2 operation overtime	
38	53	Synch 2 operation success	
39	54	Synch 3 operation overtime	
40	55	Synch 3 operation success	
41	56	Synch 4 operation overtime	
42	57	Synch 4 operation success	
43	58	Dual-bit telesignal abnormal	
44	59	Dual-bit telesignal return to normal state	As the dual-bit telesignal function is present
45	60	Monitoring output 1 order sent	
46	61	Monitoring output 2 order sent	
47	62	Monitoring output 3 order sent	
48	63	Monitoring output 4 order sent	
49	64	Monitoring output 5 order sent	
50	65	Monitoring output 6 order sent	
51	66	Monitoring output 7 order sent	
52	67	Monitoring output 8 order sent	
53	68	Logic output order sent	
54	69	Logic output unsuccessful	
55	70	Logic blocking output	
56	71	Self-defined event 0	Produced by the logic module
57	72	Self-defined event 1	
58	73	Self-defined event 2	
59	74	Self-defined event 3	
60	75	Self-defined event 4	
61	76	Self-defined event 5	
62	77	Self-defined event 6	
63	78	Self-defined event 7	
64	79	Self-defined event 8	
65	80	Self-defined event 9	

Table 6-6-2 List of the telemeter information of the CPU module

No.	Name	Full scale value	Remarks
1	I1	1.2 Ie	
2	I2		
3	I3		
4	I4		
5	U1	120V	i.e. : Ua

6	U2		i.e. : Ub
7	U3		i.e. : Uc
8	Ux		
9	U12		i.e. : Uaa
10	U23		i.e. : Ubc
11	U31		i.e. : Uca
12	FI	65Hz	Only for reference in synchronism
13	Fx		
14	Df / dt	10Hz /s	
15	Phase angle difference	180°	
16	f1	65Hz	Only for reference in synchronism. They are corresponding to the frequencies of U1-U4 respectively
17	f2		
18	f3		
19	f4		

Table 6-6-3 List of information of telesignal SOE of the CPU module

No.	Name	Remarks		
0	Switch-in 1	It is corresponding to the module terminal input 1		They can be used for the common telesignal, synch starting signals, CB status input in synchronism, remote / local selection of the signal inputs, etc.
1	Switch-in 2	It is corresponding to the module terminal input 2		
2	Switch-in 3	It is corresponding to the module terminal input 3		
3	Switch-in 4	It is corresponding to the module terminal input 4	As the 3/2 CB is in synchronous status, the states of CB/ isolator are connected in sequence from this place.	
4	Switch-in 5	It is corresponding to the module terminal input 5	As the several sides of a main transformer are mutually synchronous, the CB status is connected in sequence from the HV side to LV side from this place.	
5	Switch-in 6	It is corresponding to the module terminal input 6		
6	Switch-in 7	It is corresponding to the module terminal input 7		
7	Switch-in 8	It is corresponding to the module terminal input 8		
9	Telesignal 9	False telesignal 1	Altogether 21, produced by the logic modules and equivalent to the soft telesignal inputs	Application range: CPU software versions not less than V1.80
…	…	…		
28	Telesignal 29	False telesignal 21		
29	General alarm			

30	General event			

Table 6-6-4 List of the control information of the CPU module

No.	Name	Remarks	No.	Name	Remarks
1	Output 1	It is corresponding to the output terminal pairs 1, 2	5	Output 5	It is corresponding to the output terminal pair 7
2	Output 1	It is corresponding to the output terminal pair 3	6	Output 6	It is corresponding to the output terminal pair 8
3	Output 1	It is corresponding to the output terminal pairs 4, 5	7	Output 7	It is corresponding to the output terminal pair 9
4	Output 1	It is corresponding to the output terminal pair 6	8	Output 8	It is corresponding to the output terminal pair 10

7 Version Descriptions

Table 8-1 Records for the version amendments of the CPU module

Version No.	Functions	Amending time	Remarks
V1.51	Setting display optimization ; change the data format for 103 data pulsing variables into the no-symbol type; vary the step length in the setting range to 0.001; pulsing variable display optimization; device self-restoration consideration; expand the capacity for switch-in variable to 64; expand the capacity for taps to 12; cancel the tag for the overreach bit for telemeter upward transmission.		Published
V1.52	Hold the menu for the current calibration parameters; help the display of the menus; remote/local, reduce the time-checking interval of the downward GPS to 1s.		Published
V1.61	Remote /local selections of at most 4 groups that can be set; single CB synchronism, single network /dual network, dual network switching, active upward transmission of soft jumper; connection conditions of the submodules.	2001-7-16	Published
V1.83	Transmit null messages as there is no data in Ethernet.	2002/04/01/	Published
V1.86	Setting of the rated value addition of the time interval for the circular upward transmission of Ethernet (setting can be done in the internal settings of the CPU module and this setting will be valid as the control characters for circular upward transmission are switched on); add the false telesignal inputs and outputs in the five-protection logic functions.	2002/07/25/	Published

Table 8-2 BEPR- 860 Universal amendments for BEPR- 860 functional sub-module

Version No.	Functions	Amending time	Remarks
V1.20	CAN drive: add the calibrations on the transmitted messages, clear BUF in the error case or reset as too many errors occur;2)Safety read and write words/ dual words alteration; #) SCI_drv interrupt and as big circulation interface is not safe, close the interrupt switch in time.	2001/04/08/	Published
V1.22	Detection of the background overreach settings	2001/07/14/	Published
V1.31	Add a heavy FLASH write blocking: CRC self-detection	2001/08/23/	Published
V1.35	Change the prompt “GPS switch-in abnormal” with the device into “Hard time-checking switch-in abnormal”; its overtime from 6h-→ 6min	2001/11/16/	Published
V1.81	Amend the CAN-related contents	2002/04/01/	Published
V1.86	Add the safety read write: amend the CRC check	2002/07/25/	Published

Table 8-3 Version amendments of BEPR- 860 functional submodules AC,AC-I,AC-U

Version No.	Functions	Amending time	Remarks
V1.20	(See the universal amendments)	2001/04/08/	Published
V1.22	(See the universal amendments)	2001/07/14/	Published
V1.31	(See the universal amendments)	2001/08/23/	Published
V1.32	Add the display for the primary values, one mutiple larger for the compression factor	2001/09/16/	Unpublished

V1.35	(See the universal amendments)	2001/11/16/	Published
V1.81	The overreach is not totally set up for the circular upward transmissions, alter the related tags to adapt to the demands that the latest data should be upward transmitted completely. But those that do not overreach remain not overreached settings. All the firstly upward transmitted settings are set up as the overreached ones.	2002/04/01/	Published
V1.86	(See the universal amendments)	2002/07/25/	Published

Table 8-4 BEPR- 860 Version amendments of BEPR- 860 functional submodules DI

Version No.	Functions	Amending time	Remarks
V1.13	Add encoded variables to extend telesignal function		
V1.20	(See the universal amendments)	2001/04/08/	Published
V1.22	(See the universal amendments)	2001/07/14/	Published
V1.23	Add encoded variables to convert them into the telemetered variable for upward transmission	2001/08/01/	Unpublished
V1.31	Add a heavy Flash write blocking: CRC self-check	2001/08/23/	Published
V1.35	(See the universal amendments)	2001/11/16/	Published
V1.81	The general alarm and general event are placed at the positions after the hard telesignal inputs. Only telesignal inputs(can be reset) are considered and SOE are not considered. As the telesignal functions are extended, two numbers are went backward; the original processing method for the general alarm, general event and SOE is not used.	2002/04/01/	Published
V1.86	Add the encoded types 12, 13	2002/07/25/	Published

Table 8-5 Version amendments of BEPR- 860 functional submodules DIO

Version No.	Functions	Amending time	Remarks
V1.11	Add 8 encoded types：4～11。		
V1.12	Slip step blocking: Setting for central step is added and the principle for the slip step blocking is altered.	2000/12/23	
V1.13	Add the encoded variables to extend telesignal functions		
V1.14	Add the telecontrol general resetting		
V1.20	(See the universal amendments)	2001/04/08/21:00	Published
V1.21	Add the slip step blocking with hard controlled taps	2001/05/24/21:00	Published
V1.22	(See the universal amendments)	2001/07/14/11:00	Published
V1.23	Add the encoded variables and convert them into the telemetered variables for upward transmission.	2001/08/01/23:30	Published
V1.24	Add the event report for any output.。	2001/08/20/16:30	Unpublished
V1.31	(See the universal amendments)	2001/08/23/18:00	Published
V1.35	(See the universal amendments)	2001/11/16/	Published
V1.81	Add the integral debunce; The general alarm and general event are placed at the positions after the hard telesignal inputs. Only telesignal inputs(can be reset) are considered and SOE are not considered. As the	2002/04/01/	Published

	telesignal functions are extended, two numbers are went backward; the original processing method for the general alarm, general event and SOE is not used.		
V1.86	Add the encoded types 12, 13	2002/07/25/	Published

Table 8-6 Version amendments of BEPR- 860 functional submodules DC

Version No.	Functions	Amending time	Remarks
V1.20	(See the universal amendments)	2001/04/08/	Published
V1.22	Detection of the background overreach settings	2001/07/14/	Published
V1.31	(See the universal amendments)	2001/08/23/	Published
V1.34	Calibration parameters check in calibration and in normal operation. The single-circuit offset calibration is permitted.	2001/10/18/	Unpublished
V1.35	(See the universal amendments)	2001/11/16/	Published
V1.81	The overreach is not totally set up for the circular upward transmissions, alter the related tags to adapt to the demands that the latest data should be upward transmitted completely. But those that do not overreach remain not overreached settings. All the firstly upward transmitted settings are set up as the overreached ones.	2002/04/01/	Published
V1.86	(See the universal amendments)	2002/07/25/	Published

Table 8-7 Version amendments of BEPR- 860 functional submodules YK

Version No.	Functions	Amending time	Remarks
V1.20	(See the universal amendments)	2001/04/08/	Published
V1.22	(See the universal amendments)	2001/07/14/	Published
V1.24	Add the event report for any outputs	2001/08/20/	Unpublished
V1.31	(See the universal amendments)	2001/08/23/	Published
V1.35	(See the universal amendments)	2001/11/16/	Published
V1.81	Amend the telecontrol self-check return。	2002/04/01/	Published
V1.86	Amend the output blocking conditions	2002/07/25/	Published

PART 2

Operation Manual

Precautions

Congratulation to you for purchasing the
BEPR- 860 Series Digital Integrated Monitoring Device of Bueno Electric.. To use the device safely, correctly and effectively, please read carefully the following information.
.

* Do not pull out or plug in the device's modules when power supply is connected to protect the precision parts from damages.

* Only reliable instruments are to be used for testing the device, the comprehensive OMCRON 56 test device is recommended.

* Contact our Company in case of the abnormal conditions.

User' operating secret codes: 99

Company' debugging level secret code: 77

Keep it confidential to avoid malfunction.

1 Introduction

1.1 Panel layout

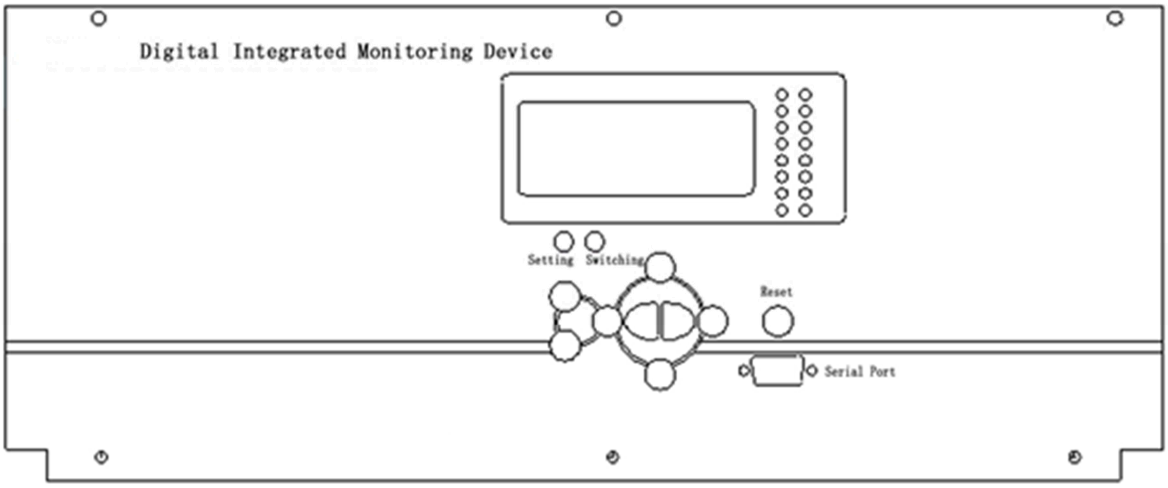


Fig.1-1 Panel layout for BEPR-862 Digital Integrated Monitoring Device

Fig.1-1 shows the panel layout for BEPR-862 Digital Integrated Monitoring Device. It is for reference only and not corresponding to the actual dimensions. The essential parts of the BEPR-861 Digital Integrated Monitoring Device are same as those for BEPR-862 and not detailed here.

1.2 Introduction to keyboard

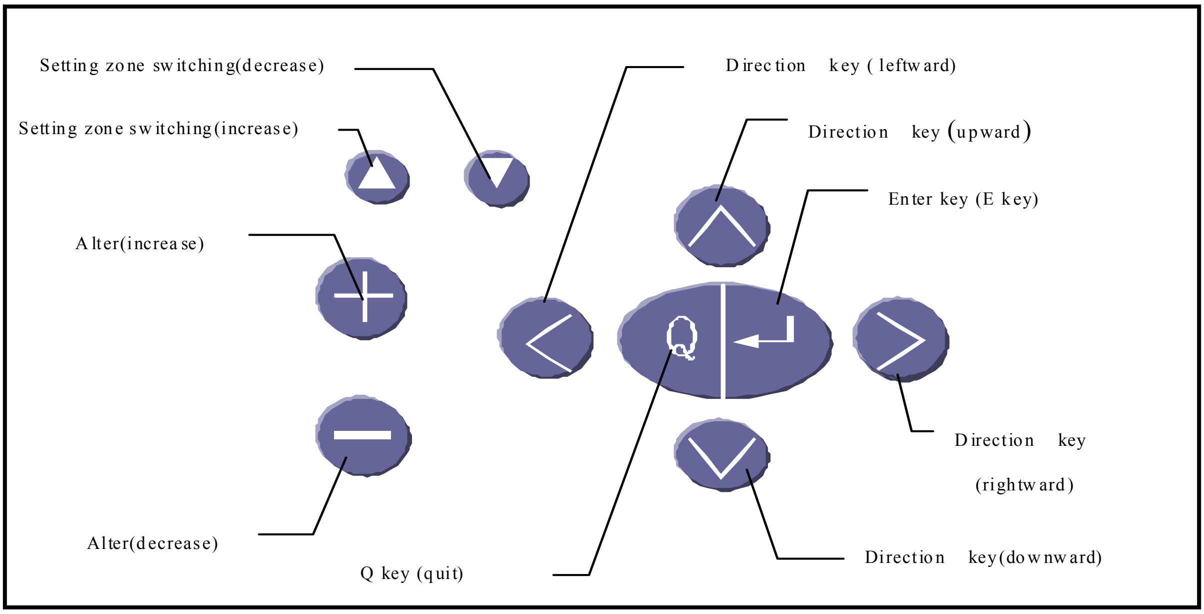
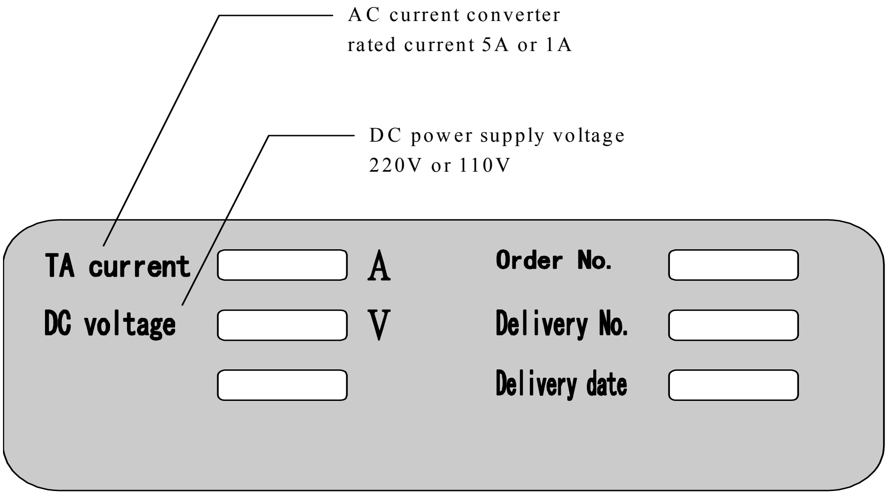


Fig 1-2 Schematic diagram for the keyboard of BEPR-860 Digital Integrated Monitoring Device

1.3 Nameplate



2 Menu Operations

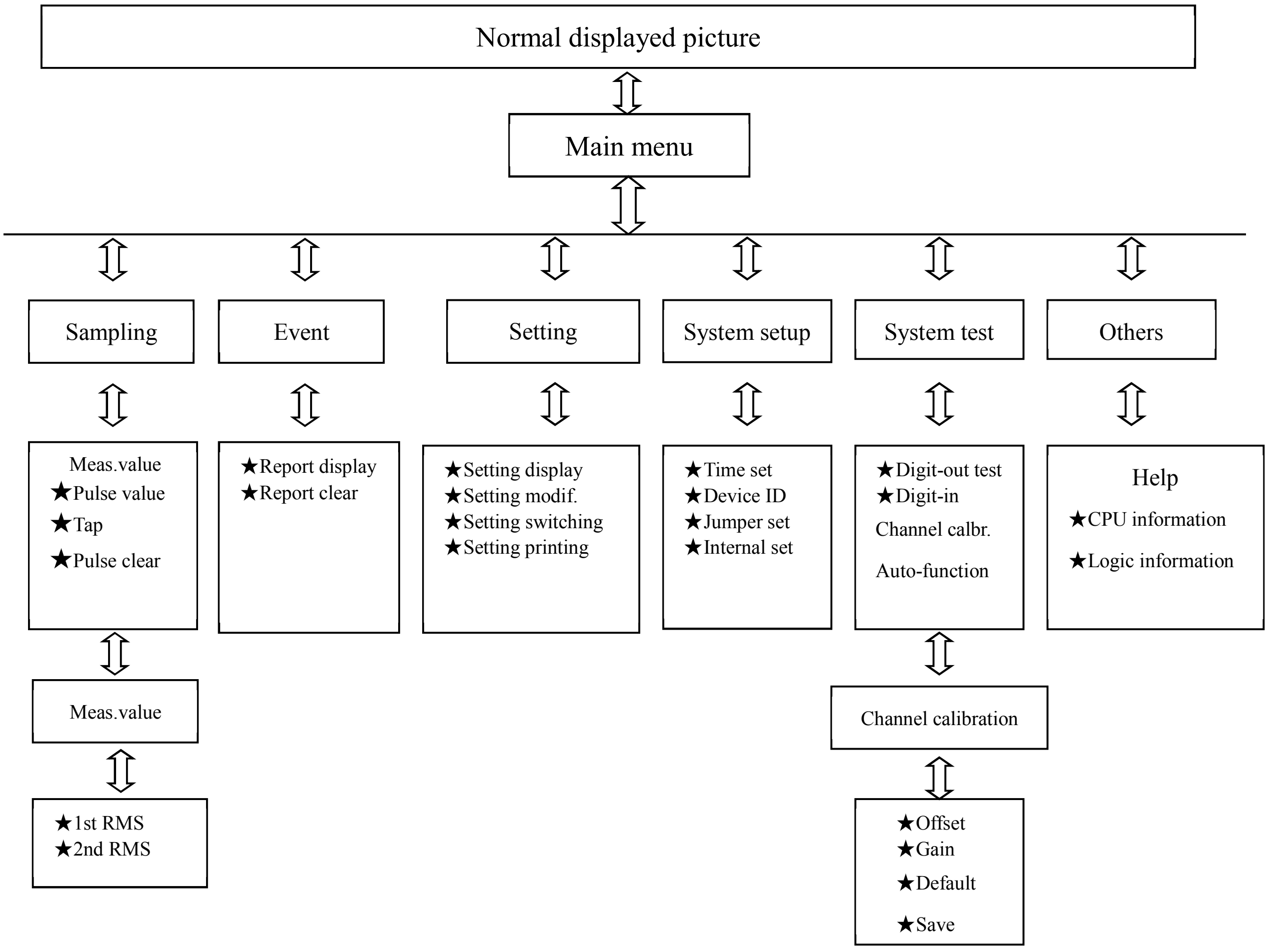


Fig.2-1 Schematic diagram for the menu structure

Note: the menu items with the mark ★ are responsible for the execution of the specific functions.

2.1 Functions

2.1.1 Sampling

For intelligent AC submodule (AC): various analog variables are displayed is real-time, e.g., current I , voltage U, active power P, reactive power Q, power factor cos Φ, etc., electric energy/pulse display.

For DC temperature acquisition submodule (DC): various analog variables are displayed in real-time, e.g., DC voltage, temperature, converted voltage.

For digital input submodule (DI) and digital input and output submodule (DIO): tap position display, pulse display.

For other submodules: no corresponding functions.

2.1.2 Event

Device energization and glancing over and active display of various alarm events.

2.1.3 Setting

Setting display and alteration, setting zone switching and printing. There is a setting zone for the submodules of BEPR-860 Series Monitoring Device, i.e., AC, DC, DI, OUT, DIO, etc., and setting zone switching is not required.

2.1.4 System setup

The device's time adjustment and IP address for upward transmission.

2.1.5 System test

Switching-out device, switching-in check (real-time display of switching-in variables), AC/DC channel calibration and detection, etc..

2.1.6 Others

Display the names and version Nos. of the various functional submodules.

2.2 Operating instructions

2.2.1 Normal displayed pictures

As the device is energized, the various functional submodules transmit upward the event information "Device energization" to the main module for administration. Since the event display is made in the way of showing actively the picture for the lastest information, the energization information of a certain submodule may be displayed on the LCD unit at this time. Press the key "Q" to exit from the display, the names and device time of the submodules searched fast by the main module for administration are displayed on the interface. Press the key 【←┘】 to show the interface "CPU selection", i.e., select the functional submodule to operate.

Control output module Setting zone 00
2008-02-18 09:09:30

CPU selection
CPU No.：01±
CPU name：Control output module

2.2.2 Main menu

【Main menu】	
Sampling	System setup
Event	System test
Setting	Others

As the functional submodule to operate is selected, press the key【←┘】to enter the main menu, which is as follows:

After entering the main menu, the keys "∧" "∨" "<" ">" can be used to select the corresponding menu items. Press the key 【←┘】to enter the corresponding submenu or execute the corresponding operations. Press the "Q" to return to the previous picture.

2.2.3 Sampling

2.2.3.1 Sampling-rms(analog variable display)After entering the menu, MMI will renew the required analog variables regularly at an interval of 3s.

RMS	
I1	5.000 A
U1	100.0 V
P1	750.1 W

The key "∧" and "∨" are used to turn lines and keys "+" and "-" to turn pages.

2.2.3.2 Sampling-pulses

As this menu is executed, the accounted pulse /accumulated electric energy are displayed.

2.2.3.3 Sampling-taps

As this menu is executed, the coded and acquired variables, e.g., tap position, are displayed.

2.2.3.4 Sampling-pulse clearance

As this menu is executed, all the accounted pulses/accumulated electric energy are cleared.

2.2.4 Event

2.2.4.1 Event-report display

Report display
No event report!

If there is no event report in the system, MMI will show a news block to indicate no report (if, under news block, operator does not press the key “Q” to return, an automatic return will occur in 2s.

If there is an event report, a window for reading event report will be shown. The keys “+” and “-” are used to read the previous or next report, the keys “∧” and “∨” to read the previous or next records of the current report.

> 08-02-18 10: 30: 59. 002
> 0ms Power on

Report display format:

Ser. No. year month day hour minute second millisecond Relative time event name

Note: The smaller the serial number, the closer to current time; the larger the serial number, the earlier the event occurs.

The relative time indicates the instant when the event occurs at year-month-day hour: minute: second: millisecond plus relative time (ms).

2.2.4.2 Event-report clearance

As the functions in this menu are executed, all the stored event reports (they are stored in the loss of power nonvolatile units) in the corresponding functional submodule are cleared.

2.2.5 Setting

2.2.5.1 setting-setting display

After entering this menu, MMI will first prompt you to select setting zone. The keys “+” and “-” can be used to select the number for the setting zone to be displayed.

Press the key【←┘】to execute the setting display operations.

> Setting display
> Select setting zone:
>
> Current operational zone: 00

Setting zone selection

> Setting display (zone 0)
> Control pulsewidth long time-delay 0.800S
>
> Control pulsewidth short time-delay 0.120S

Setting display

The keys "∧" and "∨" are used to turn lines, the keys "+" and "- " to turn pages.

Note: a) Display "Current operational zone": the mark ※ indicates that the current setting operational zone has not been fitted;

b) For invalid setting zones, the system defaulted settings are displayed.

2.2.5.2 Setting- setting alteration

Select the submenu "Setting alteration" under the menu "Setting", the system will prompt you to select the setting zone to alter.

Setting modification
Select setting zone: 00±
Current operational zone: 00

As the setting zone is selected, press the key【←┘】to enter the window for setting alteration.

Setting modification (zone 0)
Control pulsewidth long time-delay 0.800S
Control pulsewidth short time-delay 0.120S

After entering the window for setting alteration, the keys "∧", "∨", "<", or "> " can be used to select the alteration position and the keys "+" and "-"can be used to make the digital alteration. As the complement of all the alterations is confirmed, press the key【←┘】to make save operations. If the alteration is required to be given up, press the key " Q", the system will give up the alteration operations and return to the menu at the superior level. The setting control words can be set respectively by pressing the key "> " for a long time to enter the various visible submenus.

Before the save operations are made, the system will prompt you to select the object save zone. By selecting

Setting save
Select setting zone: 00±
Current operational zone: 00

the object setting zone to be saved, the alteration or duplication of a certain setting zone can be completed.

As the object save zone is selected, press the key【←┘】to make the save operation. The system will prompt you to input the save secret codes. Its operating process is same as the setting switching in the following section.

Attention: For the submodules with their automation settings, e.g., DIO, AC, DI, etc., if automation setting are required to alter, the type of the module must be set as 0, otherwise, it can not be altered. (“Automation setting” can be referred to the part in italics of the setting list of the Technical Manual)

2.2.5.3 Setting-setting switching

Select the submodule “setting switching” under the menu “Setting” or press key “Setting switching”. Both will spring out the window for setting switching directly:

Setting switching
Select setting zone: 00±
Current operational zone: 00

The keys “+” and “-” can be used to select the setting zone to be switched (the key “Setting switching” can also be used). At this time, if you want to give up setting switching, pressing the key “Q” will do. Press the key【←┘】to begin switching the setting and the system will prompt you to input the secret codes. Inputting the secret codes at user level will do. In general, several setting zones will not be provided for PRS 650 Series Digital Integrated Monitoring Device.

2.2.5.4 Setting-setting printing

Select the submodule “Setting printing” under the menu “Setting” to print the settings via the network printer.

2.2.6 System setup

2.2.6.1 Time adjustment

After entering this window, the keys “+” and “-” can be used to adjust the time to the precise time. Press the

Time setup
2008-02-18 09:40:47

Contact: sales@bueno-electric.com

key 【←┘】to begin setting up. As the setting up is finished, MMI will return to the previous menu automatically.

2.2.6.2 Device identification

Device Identification
Network A IP: 172.020.010.010
Network B IP: 172.021.010.010
Device name: Integrated Monitoring Device

Select the submenu "Device identification" under the menu "System setup":

The device address is provided mainly for the purpose of identification for the network communication within substation. This address can not be duplicated within a substation. The keys "<" and ">" can be used to select the input position and the keys "+" and "-" to input the address. Press the key【←┘】to carry out the setting up. Now the system will prompt you to input the secret codes. As the secret codes are correctly input, the system will indicate that the device address is setup correctly and it will exit from this submenu automatically.

The name of the device is used for identification and can be set via the inputting of the internal codes.

2.2.7 System test

BEPR- 860 Series Digital Integrated Monitoring Device provides a set of dialog blocks. The user's operations on this set of dialog block are utilized to perform the switching-out variable (relay) drive, switching-in variable real time display(to detect the switching variable input signals) and calibrate the analog variable channel offsets and gains as well as check the correctness of the analog variable channels.

2.2.7.1 Switching-out drive

Select the submenu " Switching-out drive" under the menu "System test". The system will prompt you to input the secret codes:

Digit-out drive

Input secret code：00

The keys "<" and ">" can be used to select the input position, the keys "+" and "-" to input the secret codes. Press the key 【←┘】 to enter. If the secret codes are erroneous, the new block for erroneous secret codes is

Digit-out drive
Secret code error!
Re-input secret code!

shown.

As the secret codes are correctly input, the system will prompt you to enter the menu for the switching-out drive operations:

The keys "∧", "∨ " are used to select the different input items and the keys "+", "-" to select the names and the operating modes of the switching-out variables. Press the key【←┘】to begin switching-out operations. There are no switching-out drive function in the modules, e.g., AC (AC module), DI (Digital variable acquisition module), DC (DC acquisition module), etc. There are 10-circuit null contact outputs in the OUT (intelligent control) module. The other one is connected with the output of the tenth one for blocking. The operating modes include: operation, return, general resetting. The output pulse-width of the switching-out drive is 1min., unless the command for the return operations is actively executed. The general resetting operation will make all the outputs of this module return. But the press button "Reset" will operate on all the OUT modules in the whole device to make all the outputs of this device return.

The key "Reset" at the panel is pressed to reset all the outputs of this device.

2.2.7.2 Switching-in check

Select the submenu "Switching-in check" under the menu "System test". The system will directly enter the

Digit-in check	
Digit-in 1	open
Digit-in 2	open
Digit-in 3	open

menu for switching-in check. Under this state, MMS will regularly renew the switching-in variable state.

The keys "∧" and "∨" are used to turn the lines, the keys "+" and "-" to turn the pages. If the displayed state is the open state, it is shown that 24V+ is not input by the switching-in of the device. It is also called disconnection. The data is 0 in upward transmission.

If the displayed state is the close state, it is shown that 24V+ is input by the switching-in of the device. It is also called closing. The data is 1 in upward transmission.

2.2.7.3 Channel calibration

Select the submenu "Channel calibration" under the menu "System test". The system will prompt you to input the secret codes (here the secret codes at the debugging level of the manufacture must be input to prevent the

Channel calibration

Input secret code： 00

unauthorized operator from losing falsely the calibrated data):

Secret code check window

Channel calibration

Secret code error! !

Please re-input secret code!

news window for secret code error

Channel calibration

Offset regulation	Default configuration
Gain regulation	Save configuration

As the secret codes are correctly input, the system will prompt user to select a certain operations.

The keys “∧” and “∨” can be used to turn the lines for the selection.

Offset regulation: for the AC analog variable acquisition module, used to regulate DC offsets and AC offsets; for the DC analog variable acquisition module, used to regulate DC offsets.

Gain regulation: for the AC, DC analog variable acquisition module, used to regulate the gain coefficient automatically to make the outputs consistent with the inputs, As the gain regulation is finished, the device will store the regulated parameters automatically. But if each channel is calibrated separately, the regulated parameters must be stored as all the channels are calibrated.

Storage configuration: as all the channels are calibrated simultaneously, it is not used usually. Its action is to store the currently-used parameters.

Default configuration: it is mainly used to detect the hardware acquisition circuit. The fore-mentioned two kinds of regulation are performed in an automatic way, especially the gain regulation, i.e., the debugging personnel firstly input the rated current and voltage, then the device will regulate the gain coefficient automatically to make the outputs reach the coefficient of the rated current and voltage, i.e., gain coefficient and store it in the loss of power non-volatile unit. In this way, it is possible that the hardware parameters may be diverse significantly or erroneous. So although the regulation results are correct, the hidden peril still exists. The default configuration is thus provided to check if the hardware is in normal state. The too significant diversion between the output analog variables for default configuration and the actual values indicates that there may be some problem in the hardware.

2.2.8 Others

Besides the submenu ”Help” in this menu, there is a window for CPU information, which is used to display

Version information

Protection name	AC sampling module
Version No.	1.01
CRC code	0509

the name, version and check codes of a CPU functional submodule.

2.2.9 Additional instructions

2.2.9.1 It is able to reset all the switching-out variables by pressing the key “Reset”.

2.2.9.2 It is able to return directly to the main picture by pressing the key “Q” for 1s.

2.2.9.3 In the normal operation, the operational lamp, the green lamp, flashes regularly. In debugging, it can be set by the control word in the internal setting as the conditions that as the disturbed data is upward transmitted, the green lamp will flash. The disturbed data include the telesignaling position variation and overreach upward transmission of the analog variables.

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 even 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 the status variable inputs of the protection (opto-coupling part), AC / DC / temperature inputs, output circuits (relay contacts output). Although the following debugging procedures are directed at the protection as a 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 pull out any module, 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, 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. Check if the setting inputs are correct per the types of the module.

b. Check if the lamp signals on the panel are normal: green lamps are lit, red lamps are not lit. There should be no display for alarm event on LCD (device energization is not alarm information

3.4 Sampling precision check

No adjustments are required for the sampling precision of the protection. Generally, the check can be specifically done by the microprocessor-based protection testing instrument. To meet the more strict requirements, the high-precision test instrument can be used to input current and voltage, the device should display the correct values and related P, Q, cos Φ should be correct.

3.5 Contact output check

The contact output check can also be done via the system telecontrol operation or menu “Switch-out drive” of the protection. The functions of this menu can be driven and returned separately for each output.

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

3.6 Digital variable input check

The test on the various input circuits is done per the types of the digital variable input modules to check if the related switching-in variables and pulsing variable are correct.

3.7 Setting check

The setting check can be done with other tests synchronously.

3.8 Clock calibration

Check whether the clock is accurate in time. If it is not accurate, the setup can be made again.

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

Contact: sales@bueno-electric.com

4 List of Event Information

Table 4-1 List of normal events and alarm events for BEPR- 860 Series Device

Name of event	Reaction	Processing measures	Remarks
Power on			
RAM error	Alarm, block output (As there is any output)	Shutdown, trouble-shooting	
EPROM error	Alarm, block output (As there is any output)	Shutdown, trouble-shooting	
Flash memory error	Alarm, block output (As there is any output)	Shutdown, trouble-shooting	
EEPROM error	Alarm, block output (As there is any output)	Shutdown, trouble-shooting	For AC and DC modules, re-calibrate their settings
Setting zone error	Alarm, block output (As there is any output)	Re-set the correct setting	If it is still erroneous after energization, shuntdown for trouble-shooting.
Setting check error	Alarm, block output (As there is any output)	Re-set the correct setting	If it is still erroneous after energization, shuntdown for trouble-shooting.
Digit-input error	Alarm, block output (As there is related output)	Shutdown, trouble-shooting	
Digit-out error	Alarm, block output (As there is any output)	Shutdown, trouble-shooting	
AD error	Alarm, block output (As there is related output)	Shutdown, trouble-shooting	
Clock chip error	Alarm	Shutdown, trouble-shooting	
Panel communication error	Alarm	Shutdown, trouble-shooting	
CAN communication error	Alarm	Shutdown, trouble-shooting	
LAN communication error	Alarm	Check network	If it is still erroneous after check, shuntdown for trouble shooting
Serial communication error	Alarm	Shutdown, trouble shooting	
TCP communication over-time	Alarm	Check network	If it is still erroneous after check, shuntdown for trouble shooting
UDP communication over-time	Alarm	Check network	If it is still erroneous after check, shuntdown for trouble shooting
TCP connection over-time	Alarm	Check network	If it is still erroneous after check, shuntdown for trouble shooting

TCP communication interruption	Alarm	Check network	If it is still erroneous after check, shuntdown for trouble shooting
1#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule1# or motherboard
2#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 2# or motherboard
3#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 3# or motherboard
4#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 4# or motherboard
5#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 5# or motherboard
6#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 6# or motherboard
7#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 7# or motherboard
8#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 8# or motherboard
9#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule9# or motherboard
10#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 10# or motherboard
11#submodule communication interruption	Alarm	Shutdown, trouble-shooting	Troubleshooting is done for submodule 11# or motherboard
Logic setting error	Alarm, block output (As there is any output)	Re-save the logic setting.	If it is still erroneous after energization, shunt-down for troubleshooting.
Logic input error	Alarm, block output (As there is any output)	Check if the logic parameters are consistent with those actually provided by the device.	Check is the logic diagram If it is still erroneous after energization
Logic output error	Alarm, block output (As there is any output)		
Logic setting #CPU error	Alarm, block output (As there is any output)		

Contact: sales@bueno-electric.com