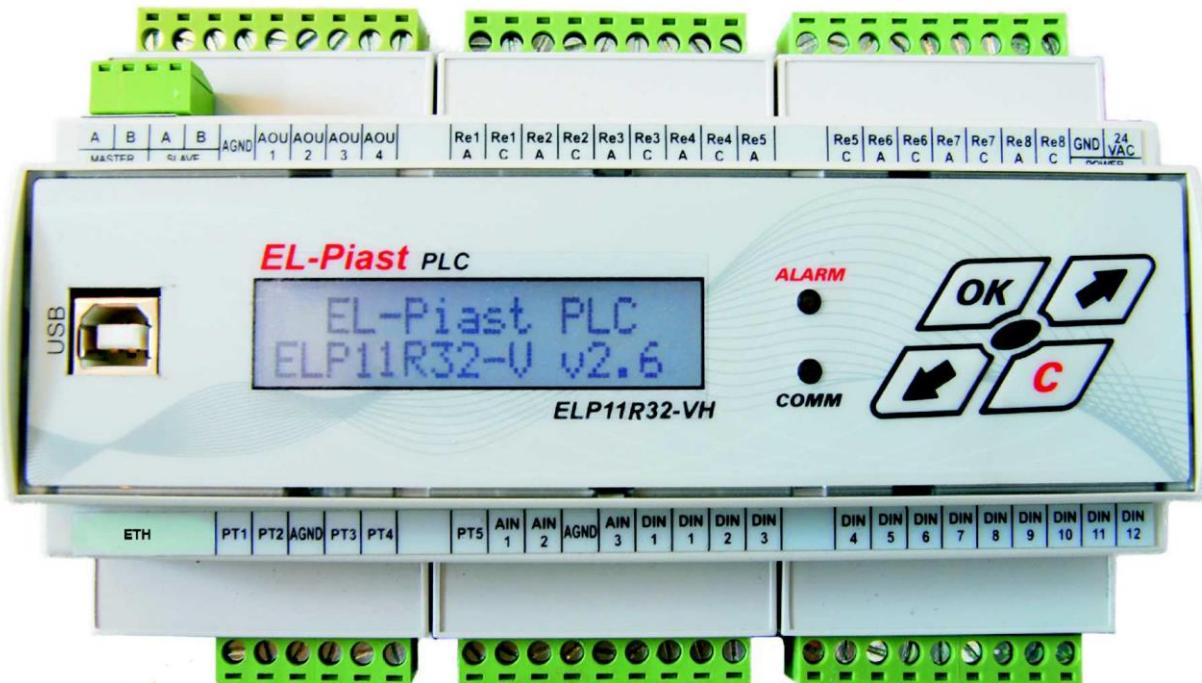


PLC ELP11r32-V(H) Controller



- 5 temperature inputs PT1000
- 3 analogue inputs
- 12 digital inputs
- 4 analogue outputs
- 8 transmission outputs
- RS485 SLAVE
- RS485 MASTER
- USB
- Ethernet
- Port HMI

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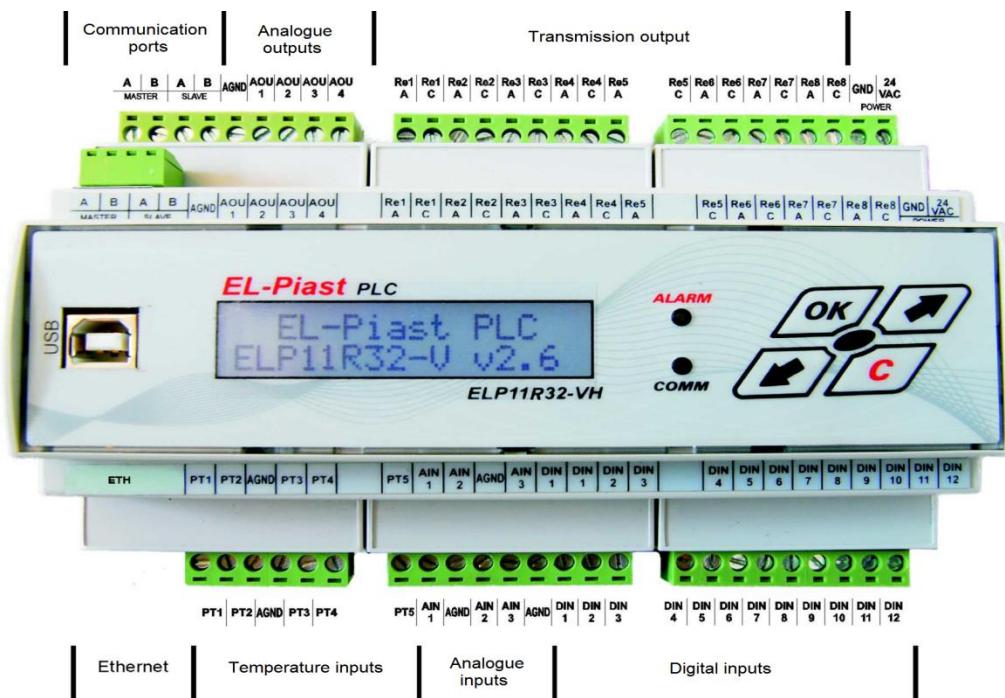
1. General information

ELP11R32-VH is a universal programmable controller used primarily to control air-conditioning / ventilation central units in BSM systems. The controller is equipped with network couplings **BACnet MS/TP**, **BACnet IP**, **Modbus RTU Serial / TCP**. It's versatile resources facilitate use of a event logging system. Control algorithms are programmed using **Macrocontrol** graphic environmental and a functional block language. Algorithm parameters can be reviewed and changed using equipment visualizations connected using a number of types of communication lines. The controller can be developed using additional control and communication modules. The controller's capabilities are presented further in the document.

2. The main technical parameters

- Nominal power supply: 24 VAC, 50 Hz
- Permitted power supply: 15 ... 27 VAC or 21 ... 38 VDC
- Power consumption: max. 15 VA
- Operating temperature: -20 ... 50 °C
- Storage temperature: -30 ... 70 °C
- Protection level: IP20
- Installation: DIN 35 bus-bar
- Memory: 48 KB RAM, 8 KB EEPROM, 384 KB FLASH
- CPU: STM32 – ARM Cortex-M3 (32-bit) 72 MHz

3. Input / output



Group	Type	Quantity	Electric parameters	Marking
INPUT	Digital – voltage input	12	- Input voltage 24 VAC or 24 VDC - Voltage range 15 ... 27 VAC or 16 ... 38 VDC	DIN1 – DIN12
	Temperature input PT1000	5	- Probe current: 1mA - Minimal load resistance: 0 Ω - Measurement frequency: 2,5 ms - Measurement accuracy: ±0.2 °C - Resolution: 8 bit	PT1 – PT5
	Analogue voltage / current input	3	<i>Voltage inputs:</i> - Permitted input voltage: 0 – 10 VDC - Input resistance: 450 kΩ ± 5% - Measurement frequency: 2,5 ms - Measurement accuracy: ±0.005 V - Resolution: 12 bit <i>Current inputs:</i> - Permitted input current: 0 – 20 mA - Input resistance: 120 Ω ± 5% - Measurement frequency: 2,5 ms - Measurement accuracy: ±0.01 mA - Resolution: 8 bit / V	AIN1 – AIN3
OUTPUT	Analogue voltage outputs	4	- Nominal output voltage: 0 – 10 VDC - Maximal output load: 20mA - Minimal load impedance: 500 Ω - Resolution: 8 bit / V	AOU1 – AOU2
	Relay outputs	8	- Maximal contact voltage: 380 VAC, 125 VDC - Minimal contact voltage: 5VDC - Nominal resistance current: 5A / 250VAC; 5A / 30VDC - Nominal inductive current ($\cos\phi = 0,4$ L/R = 7ms): 2A / 250 VAC; 2A / 30 VDC - Minimal contact current: 10 mA - Long-term current carrying capacity: 5 A - Maximal connection power for resistance load: 1250 VA, 150 W - Maximal connection power for inductive load: 500 VA, 60 W - Maximal connection frequency under nominal load: 1800 cycles / h	Re1 – Re8
COMMUNICATION	RS485 SLAVE	1	- Serial port for communication with slave - Any transmission protocol - Transmission speed: 2,4 kbit – 115,2 kbit	AB (SLAVE)
	RS485 MASTER	1	- Serial port for communication with master - Protocol ModBus RTU, ModBus32, ELPBus, BACnet MS/TP - Transmission speed: 2,4 kbit – 115,2 kbit	AB (MASTER)
	USB	1	- Serial port for communication with PC - Protocol ModBus RTU, ModBus 32, ELPBus - Transmission speed: 115,2 kbit	USB
	Ethernet	1	- Ethernet port compliant with 10 Base-T standard - Protocol ModBus TCP/IP, ELPBus TCP/IP, HTTP port:80, Bacnet IP	ETH
	HMI RJ45 Port	1	- Serial port for communication with HMI - ELPBus protocol - Transmission speed: 9,6 kbit	RJ45

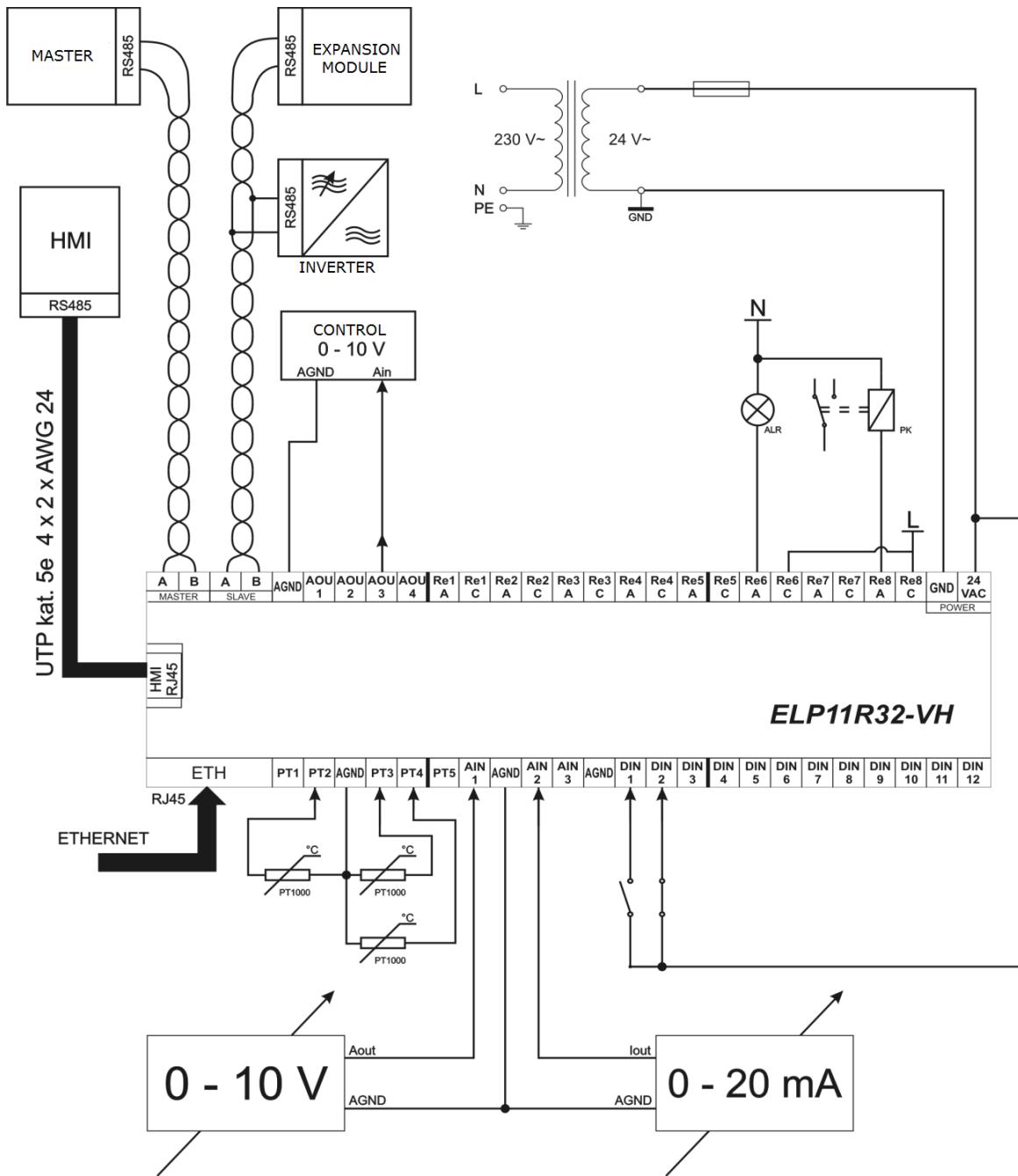
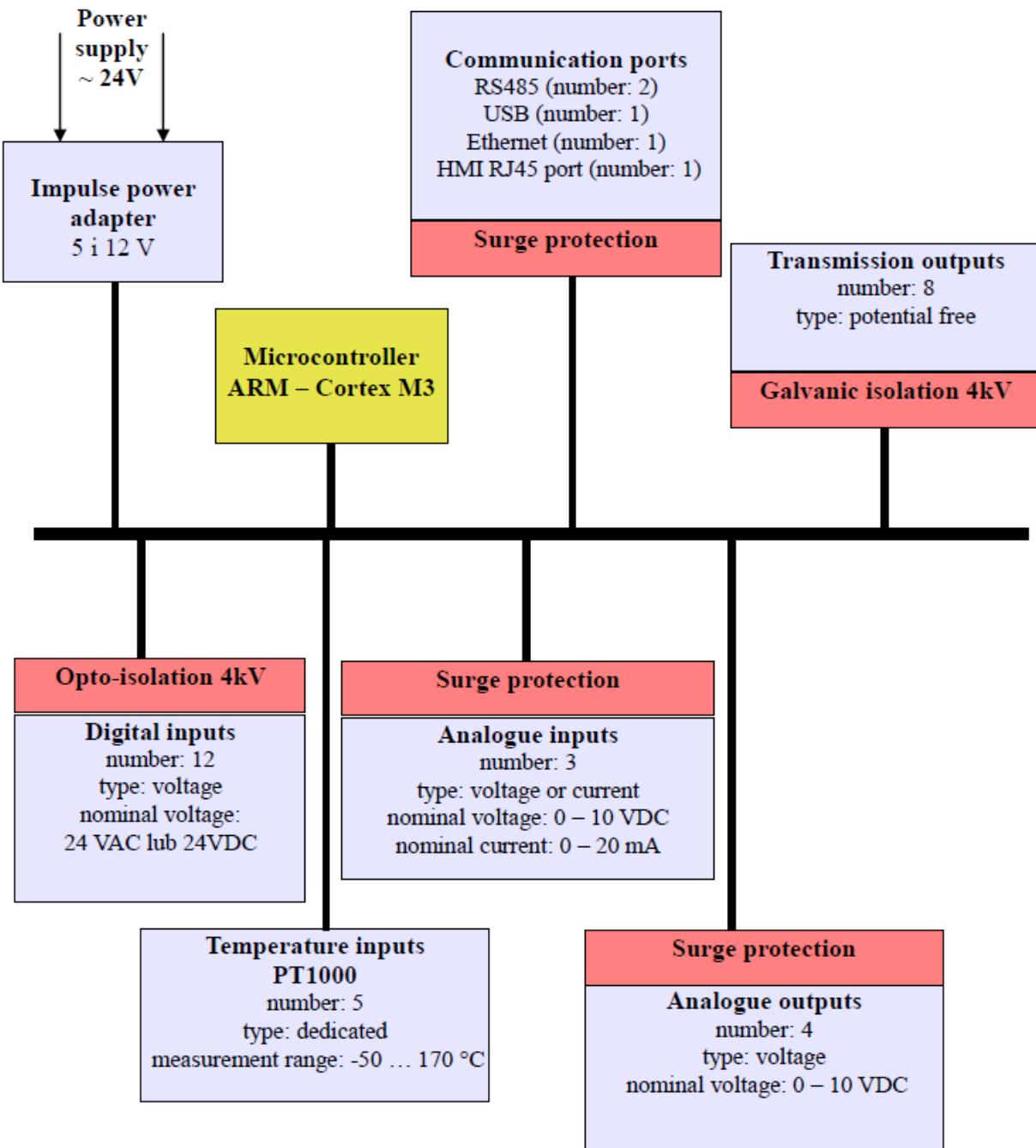


Chart of example input / output connections

4. Block diagram



5. Real time clock

The real time clock module (RTC) facilitates time and date related control. Therefore it is possible to program calendar time zones and log system alarms and events. It is possible to save up to 33 different calendar programs. Parameters available from the calendar level are defined during design of the control algorithm. The clock is powered by a battery in an event of a power shortage. A battery can maintain the clock for 15 years. A clock can slow down if the controller works in high temperatures. Therefore it is required to synchronize the clock from time to time (annually).

6. Communication ports

6.1 USB



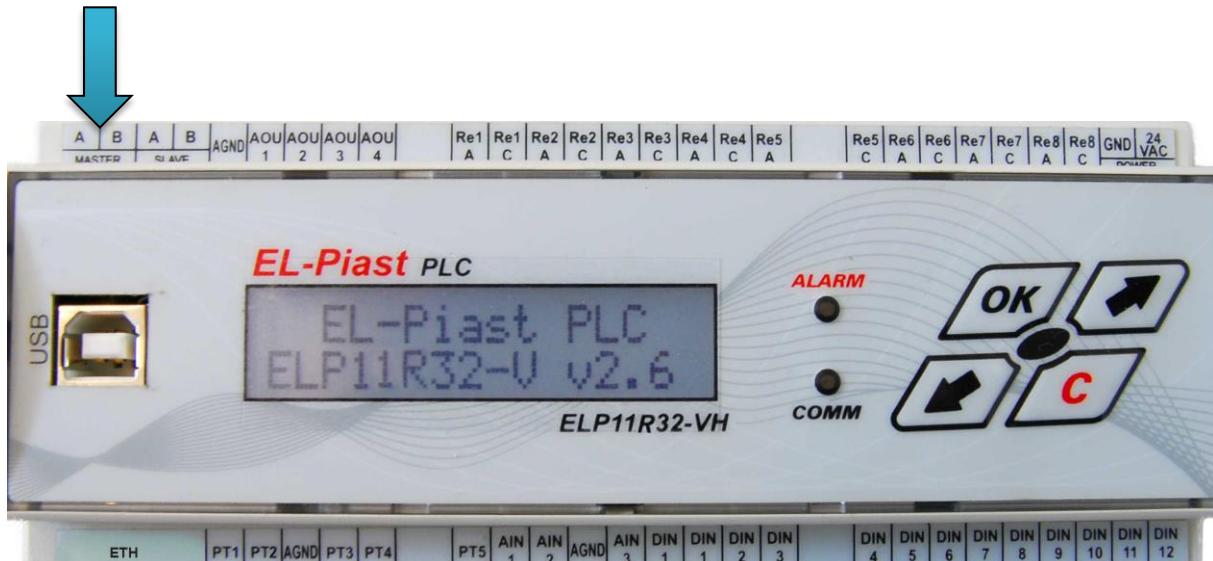
USB port is located on the upper controller panel. A standard USB cable is used to connect the controller with a PC. Appropriate drivers are stored on the CD attached to the controller or can be downloaded from EL-Piast Web site:

Windows XP/Vista/7 version 32-bit http://www.el-piast.com/files/soft/VCP_V1.3.1_Setup.exe

Windows Vista/7 version 64-bit http://www.el-piast.com/files/soft/VCP_V1.3.1_Setup_x64.exe

USB port is primarily used to program, test and perform diagnostic checks of the controller. The transmission speed of 115.2 kbit/s is preset and cannot be changed. If connected using USB, the controller's address is not significant.

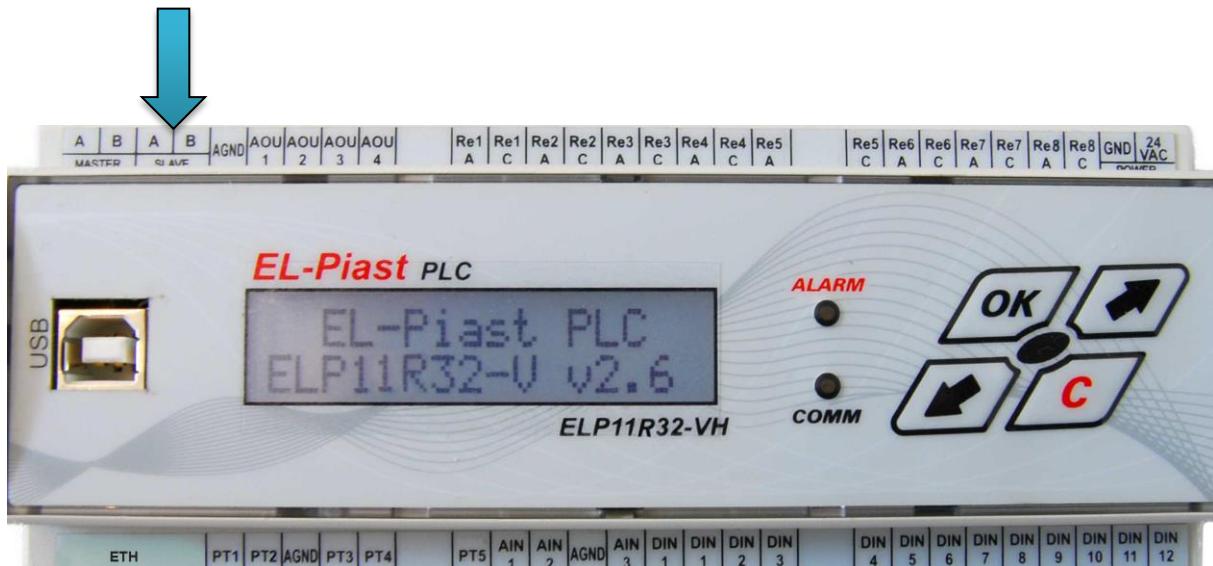
6.2 RS485 MASTER



BACnet® jest zastrzeżonym znakiem towarowym ASHRAE

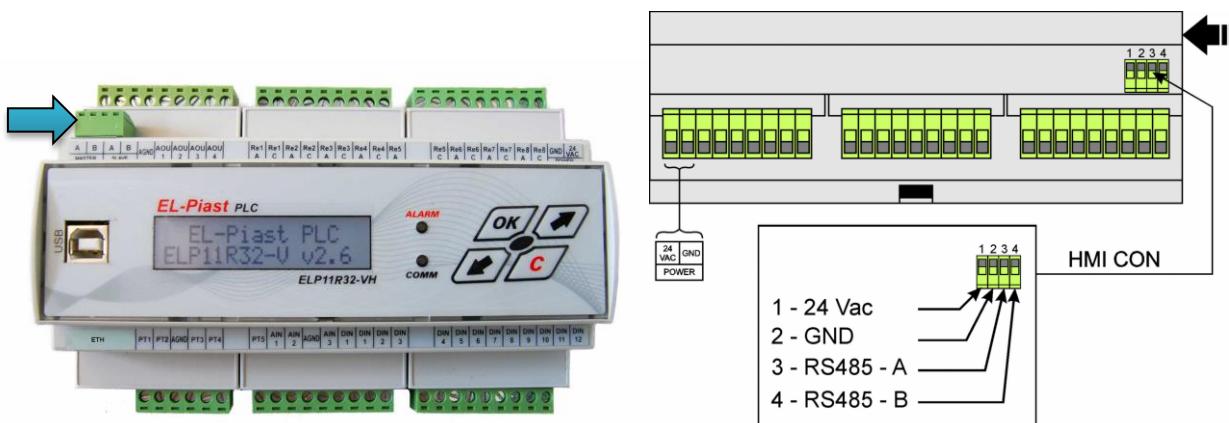
RS485 MASTER port is used to connect the controller's master. It can be a PC (using RS485/USB converter), PDA (using RS485/232 converter or Bluetooth module), a mobile phone (using Bluetooth module), or a dedicated HMI panel. Communication is handled by **ModBus RTU** protocol or its extended, 32-bit version. The port also use **BACnet MS/TP** protocol. In order to control the controller using an appropriate HMI menu, communication has to be handled by a dedicated **ELPBUS** protocol. Transmission speed or protocol is selected from a menu of the controller's front panel. Controller's address required to facilitate the communicatrion is set using jumpers under the controller.

6.3 RS485 SLAVE



Control of slaves (e.g., inverters, controllers, extension modules). Control of slaves requires use of functional blocks appropriate for the equipment in the control algorithm. There are various transmission protocols and speeds set from a control application.

6.4 HMI panel dedicated port



6.5 Ethernet port



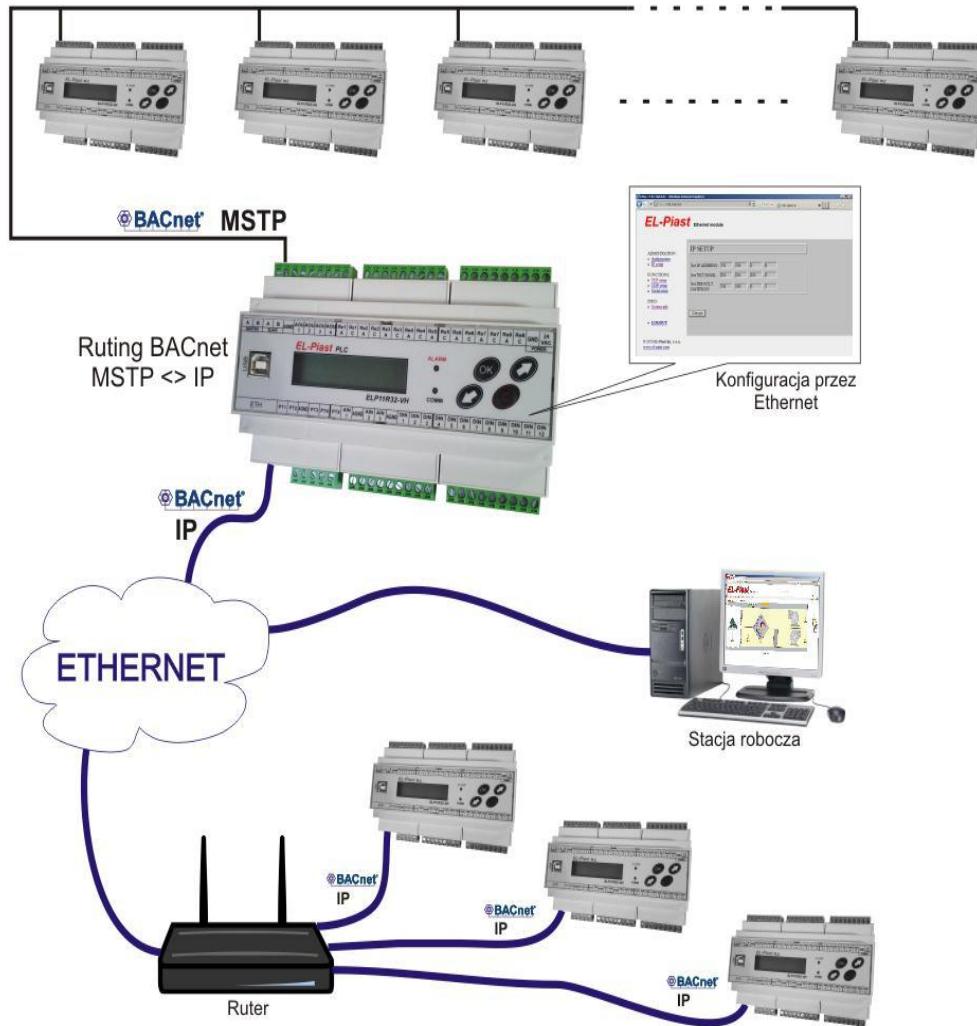
BACnet® is a reserved trademark of ASHRAE

Ethernet port facilitates connection with Ethernet infrastructure. The controller includes a setup panel using a standard 80 port available from Web browser. 47808 (0xBAC0) port handles **BACnet IP** services. The port 56789 by default provides access to programming, diagnosis and communication services using **Macrocontrol** or **Virtual HMI** software or any other software using Modbus TCP/IP. The controller can also be used as a router between **BACnet IP** and **BACnet MS/TP** networks connected to the controller. The controller's IP address and all ports and services can be freely setup from a setup panel.

Detailed description of setup of and communication through Ethernet port is provided in a separate document entitled *Setup of the controller ELP11R32-VH*.

Note: Ethernet port does not constitute a part of standard controller's equipment and is supplied as a module (electronic board) added inside the controller. The range of services facilitated by Ethernet line is constantly growing. In addition to other services, it is planned to provide access to HMI panel using Web browsers.

6.6 Chart of BACnet network



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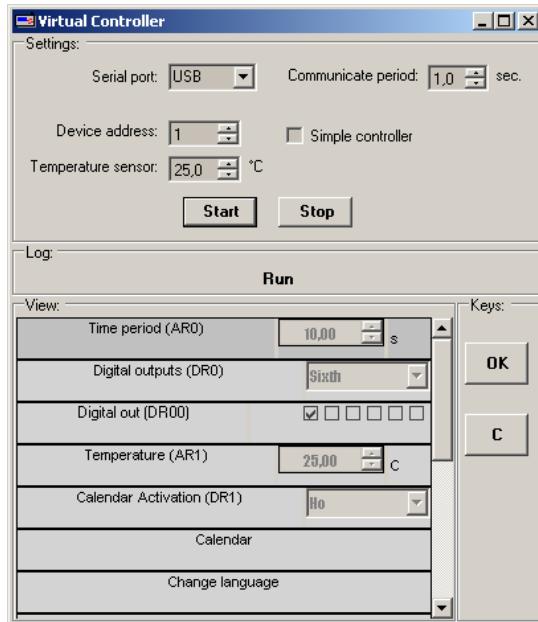
7. Visualization equipment

7.1 Dedicated HMI panel



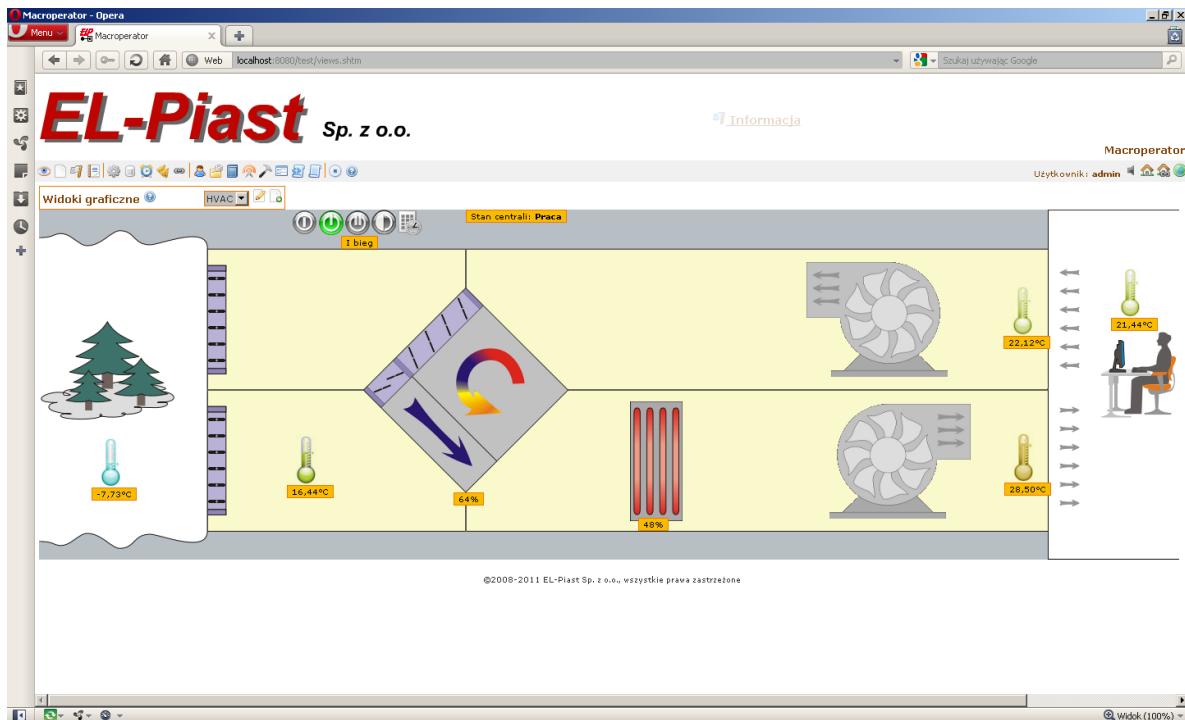
Controllers include alphanumeric displays with 2x16 digits or graphic displays 128x64, four keys or a know with a button, two signaling LEDs, and a temperature probe measuring ambient temperature. HMI panel is powered with 24 VAC, usually provided by the controller. Communication is handled by a dedicated HMI port or RS-485 Master port. The controller can operate in two modes: simple or standard. The simple mode does not allow to change critical parameters selected during design of HMI menu in **Macrocontrol** environment. The maximal length of a cable between HMI panel and the controller amounts to 1200 m.

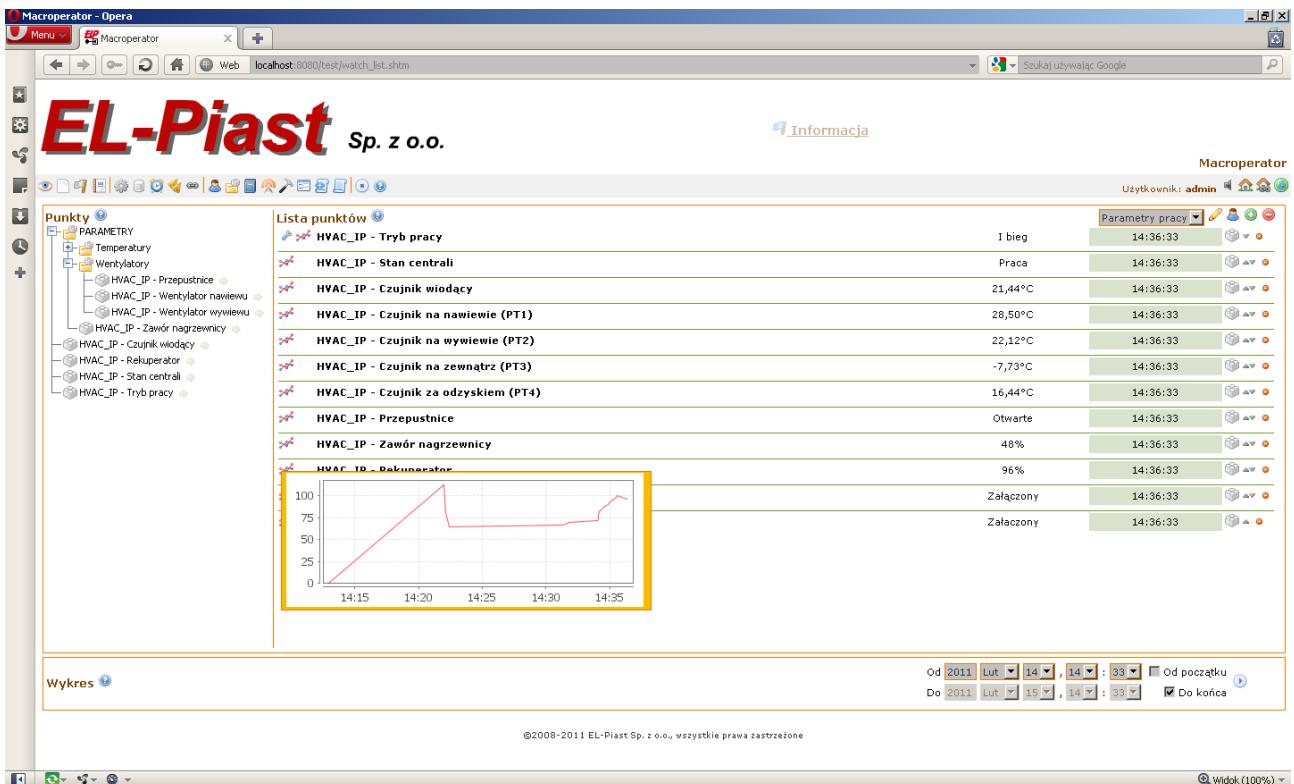
7.2 PC



A PC can be connected using USB port or RS485 Master port with an appropriate converter (RS485/USB or RS485/232). Simple visualization or a change of parameters is handled by the dedicated application **Virtual HMI** from **Macrocontrol** software packet. The application presents all available parameters available also from the level of standard HMI equipment.

Macrooperator applications which graphically present status of the system and allow registration of any selected parameters can be used to visualize the control process.





Macrooperator operates as a www server on PC by providing a user interface from Web browser level in a local network or remotely from any place around the world if Internet access to the server is granted. Detailed description of **Macrooperator** application is presented in the separate document *Macrooperator DTR*.

7.3 PDA



A palmtop computer can be connected using RS485 Master port with a RS485/232 converter provided that the palmtop includes RS232 port. Most of modern palmtop computers require wireless Bluetooth connection. This option can be handled by Bluetooth module provided by EL-Piast. Use of PDA to manage the controller requires **PDA Ctrl** handled by Windows Mobile system.

7.4 Mobile phones



A mobile phone can communicate with the controller using a wireless Bluetooth connection. Bluetooth module is required to establish the communication. **Mobile Ctrl** application installed on a mobile phone and using Java environment can be used to change parameters.

7.5 Bluetooth module

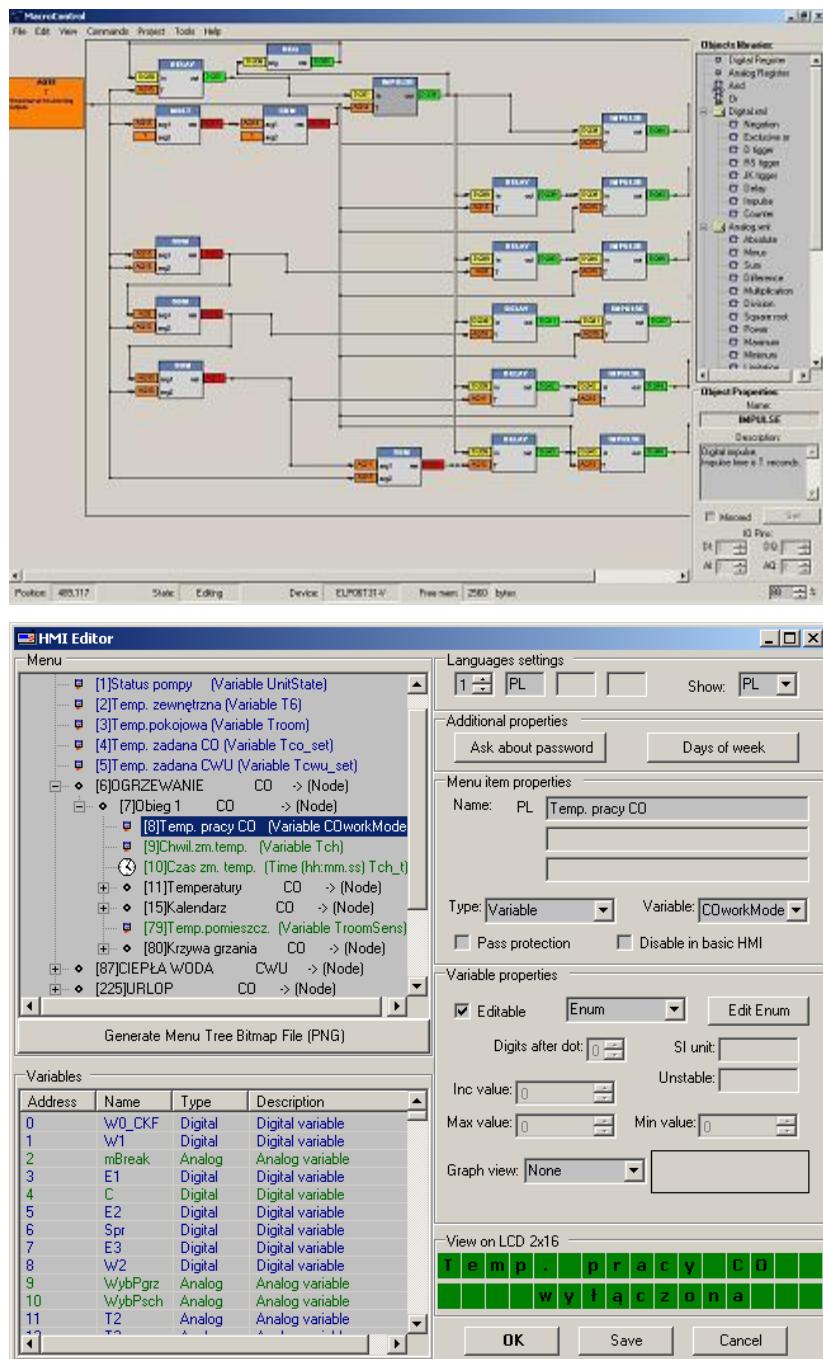


Bluetooth module facilitates wireless communication with visualization hardware including mobile phones, PDA, Notebook computers. The module ought to be connected to the controller using RS485 Master port. Communication parameters can be modified using appropriate jumpers located under a cover in the front panel of the module. The controller is equipped with a built-in antennae which facilitates communication in the radius of 100 m (Class 1). Module's operating manual is added to the module.

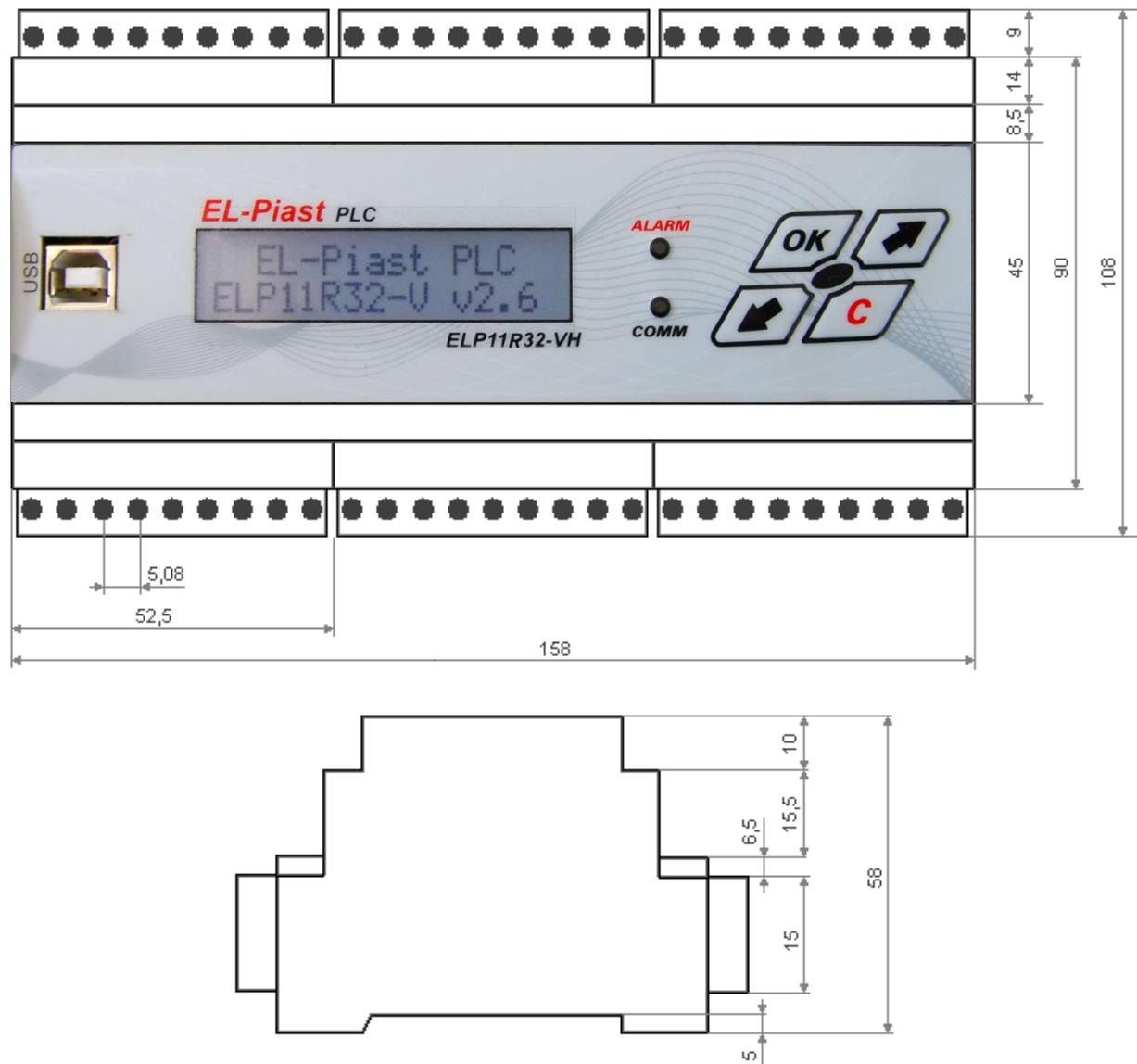
Note: power supply of the controller and the module is rectified forcing appropriate connection of the module and the controller (GND with GND, 24 VAC with 24 VAC).

8. Programming

The controller can be programmed using a user-friendly, graphic environment of ***Macrocontrol***. Functional blocks stored in libraries are used to develop algorithms. It is also possible to create user's simple block and macro libraries. The environment also facilitates visualization of HMI menu, BACnet objects, and diagnostics and testing of a control algorithm. Full ***Macrocontrol*** environment operating manual is presented in the document *Macrocontrol DTR*.



9. External dimensions



Weight: approx.. 400 g.

10. Internal error codes and system logs

Information about internal errors and logs can be obtained using *Virtual HMI* application available in *Macrocontrol* packet.

Code	Description
1	Controller connected to a network
2	No external eeprom memory
3	Reading from external eeprom memory failed
4	Saving on external eeprom memory failed
6	Reading from RTC failed
7	Saving at RTC failed
8	Exceeded capacity of the program stack
9	Controller disconnected from network (loss of power supply)

11. BACnet protocol

11.1 Available physical layer

BACnet IP

BACnet MS/TP EIA-485, baud rate: 9600, 19200, 38400, 76800

11.2 Available types of objects

Object type	Optional properties	Modifiable properties
Analog input	Description, Device_Type, Reliability, Min_Pres_Value, Max_Pres_Value, Resolution	Present_Value, Out_Of_Service
Analog output	Description, Device_Type, Min_Pres_Value, Max_Pres_Value, Resolution	Present_Value, Out_Of_Service, Relinquish_Default
Analog value	Description	Present_Value
Binary input	Description, Device_Type	Present_Value, Out_Of_Service
Binary output	Description, Device_Type	Present_Value, Out_Of_Service, Relinquish_Default
Binary value	Description	Present_Value
Bitstring value	Description	Present_Value
Integer value	Description	Present_Value
Time value	Description	Present_Value
Date value	Description	Present_Value
Multi-state value	Description, State_Text	Present_Value
Device	Description, Max_Master, Max_Info_Frames	Max_Info_Frames, Max_Master, Object_Name
Program	Description	Program_Change
Schedule	Exception_Schedule, Weekly_Schedule	Effective_Period, Exception_Schedule, Weekly_Schedule, List_of_Object_Property_Reference, Priority_For_Writing

11.3 Available services

Who Is
Who Has
I Am
Read Property
Read Property Multiple
Read Property
Reinitialize Device
Device Communication Control
Private Transfer

11.4 Network options

Router – routing between networks BACnet MS/TP and BACnet IP

11.5 The character encoding

ANSI X3.4