CEREBRUM

Automation and Telemetry Platform

Introduction

2019 Saint Petersburg

CEREBRUM - The Only Automation Platform Created with Telemetry In Mind

The Cerebrum automation platform is the set of tools designed for fast and efficient automation and telemetry in a vast majority of industrial automation fields such as HVAC, machinery, buildings automation, lightening and energy systems.

It includes two PLC (Programmable Logical Controller) lines, input/output expansion modules, mySCADA control and data acquisition system and the YART Studio the unified development environment system.

We are always keen on bringing more exiting products on the market. It's quite possible that there are few more devices in stock giving you more opportunities to design and develop a great automation and control systems in a quick and efficient way.

CEREBRUM. THE SYSTEM CONCEPT

The PLC was a central point for a most of the automation systems in the last decades. The systems were local with all their control networks being deployed around this central control brain.

However, the Internet brings a significantly different demands and challenges. The customers want to see all their data live on the Web page or even to control their plants remotely. Some are requesting the machines to talk to each other and do the tasks with almost no humans intervention.

From that point the distance is no longer an issue, and the only challenge to overcome is to let the machines to speak on the unified language and provide a data channels for them to speak over.

Above is a typical Industry 4.0 approach our platform have been specifically designed for.

We believe the PLC is one of many others which controls their machines locally and being able to communicate to the others and the central server by a known language via the Internet. The Industrial Internet Of Things as a lot of people understand it.

For the IIOT system it is normal to expect to receive the control setpoint from another PLC, for example the amount of the packing material available or the outdoor temperature and humidity.
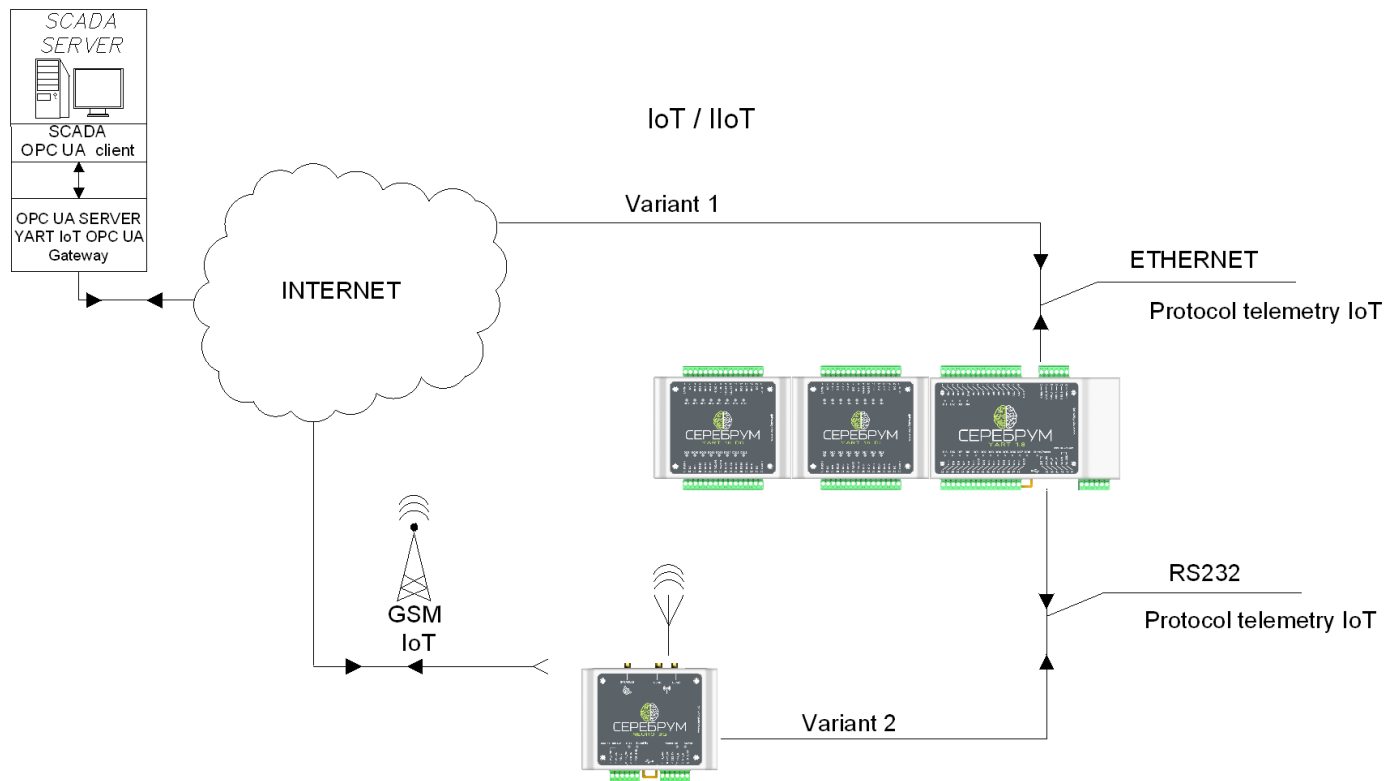
The data can be transferred via the Ethernet port or by the Neuro, the 3G/GPRS data communications modem, The Ethernet based systems are also capable to be deployed locally for a fast and convenient data gathering and control.

On the server's side the free of charge IoT server is provided. The server brings all remote PLCs together into a single big data object with commonly used OPC UA communication interface.

Thanks to the OPC UA standard all data is classified and becomes easy to access for third party SCADA systems.

For your convenience we recommend to use mySCADA platform as most advanced in Web data visualization and control.

The mySCADA OPC UA seamless connection helps to establish the links in a great and efficient way with almost no tradeoffs.

SCADA
SERVER

SCADA
OPC UA client

OPC UA SERVER
YART IoT OPC UA
Gateway

INTERNET

IoT / IIoT

Variant 1

ETHERNET

Protocol telemetry IoT

GSM
IoT

RS232

Protocol telemetry IoT

Variant 2

The Programmable Logic Controllers

CEREBRUM designs and manufactures programmable logic controllers, dedicated for use in industrial automation, remote telemetry and Industry 4.0 systems. The possibility of systems interconnection is a vital part for local and distributed control systems nowadays. Our PLCs are ideal choice for that.

All CEREBRUM PLC's are based on a single computational platform that makes every application software compatible within the entire product range. This also helps to verify the application by an emulator which guarantees the same program behaviour as a real controller.
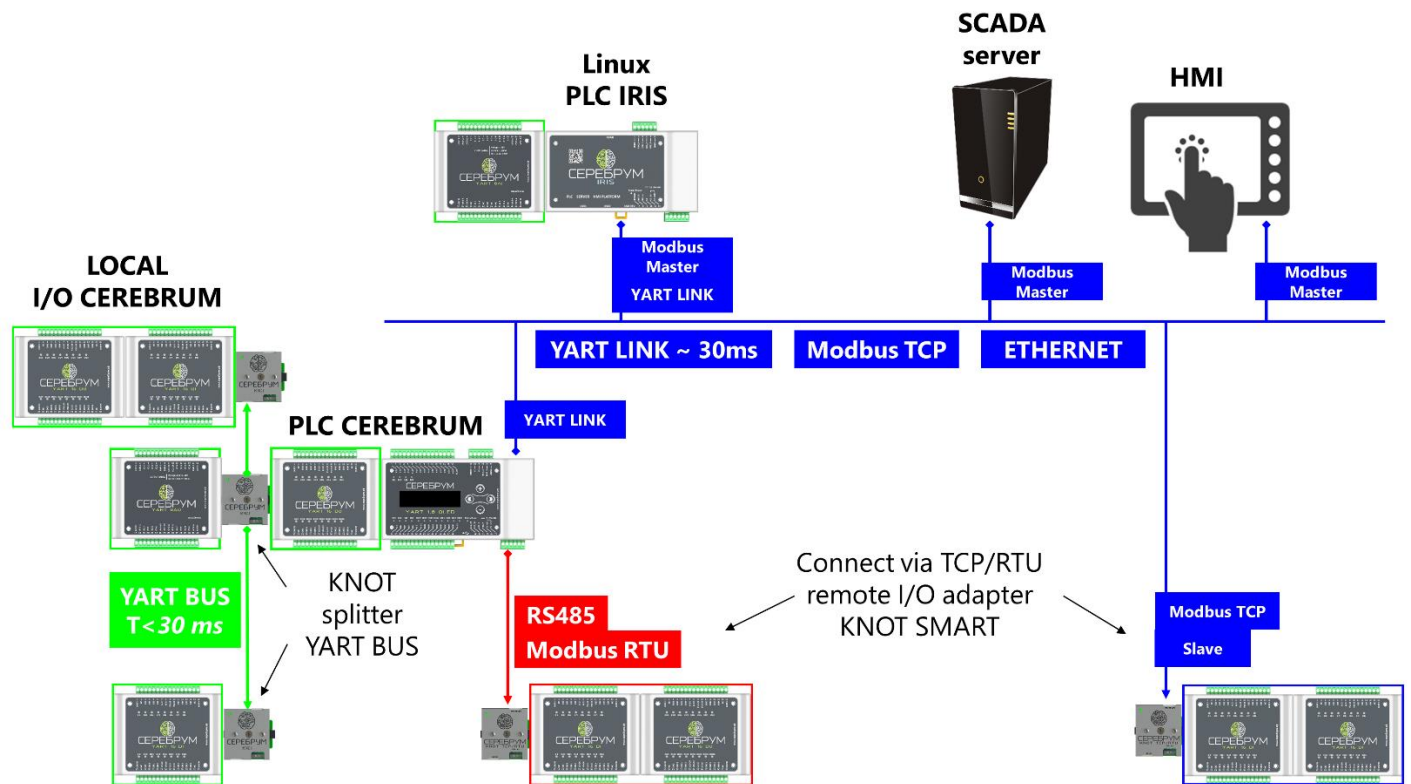
With such tools users can quickly achieve the goals in programming, debugging and SCADA integration.

All expansion modules are compatible across the entire CEREBRUM PLCs providing flexibility and cost efficiency along with extended communication interfaces on board the PLC itself. The communications library includes many standard protocols for third party equipment interaction.

The serial ports are ready to operate in Modbus RTU Master/Slave mode right out of the box. The IRIS PLC also includes a Modbus TCP Master library. A little programming is needed to convert the port into a dedicated protocol mode or to design your own communication block if required.

The CEREBRUM expansion modules include analog in, analog out, discrete in and discrete out modules. The YART BUS is the default PLC interface for IO expansion modules and it is able to interface up to 8 units by a single controller.

For even more flexibility the KNOT units help to distribute modules topology across the installation cabinet. It can be used for cross wiring and YART BUS length extension. A brand new Knot-Smart modules are a perfect fit as a remote IO terminal accessible via Modbus RTU/TCP interface or YART-Link seamless data communication protocol.

LOCAL
I/O CEREBRUM

Linux
PLC IRIS

SCADA
server

HMI

Modbus
Master
YART LINK

Modbus
Master

Modbus
Master

YART LINK ~ 30ms

Modbus TCP

ETHERNET

YART LINK

PLC CEREBRUM

YART BUS
T< 30 ms

KNOT
splitter
YART BUS

RS485
Modbus RTU

Connect via TCP/RTU
remote I/O adapter
KNOT SMART

Modbus TCP

Slave

 The CEREBRUM remote telemetry and monitoring subsystem is a key feature for the system outstanding IIoT functionality. The IIoT stands for Industrial Internet of Things meaning all devices are ready to share their data with others.
Normally it takes about three minutes to establish a successful remote telemetry connection starting from scratch. Moreover, there's no programming needed for that.

The design process is mostly about Dragging and Dropping for the variables that needs to be available on the server's side.
Our telemetry protocol is the payload size optimized, either the PLC or telemetry server sends the only application information with just tiny amount of service and protocol data. There's no abstract data inside, all information is transferred in a binary form, making almost no extra traffic required.

The YART Studio IDE provides a graphical interface for telemetry settings by selecting a binary tag to work as a publish trigger to enable a publishing process for the bonded tags when needed. All data are encrypted by AES128 algorithm, along with a special authentication procedure that is required for a PLC to be connected.

The server part of the system is IOT-OPCUA based. It can be deployed to the IRIS PLC or a normal Windows/Linux PC/server platform.

There's no need for a static ("white") IP address for PLCs. The only static address or URL is required for the server. This feature significantly simplifies system's deployment and maintenance because of decentralized topology when all PLC's are trying to establish their connection directly to a number of dedicated servers. It is up to the user to select IP or URL addressing mode. The URL mode is preferred.
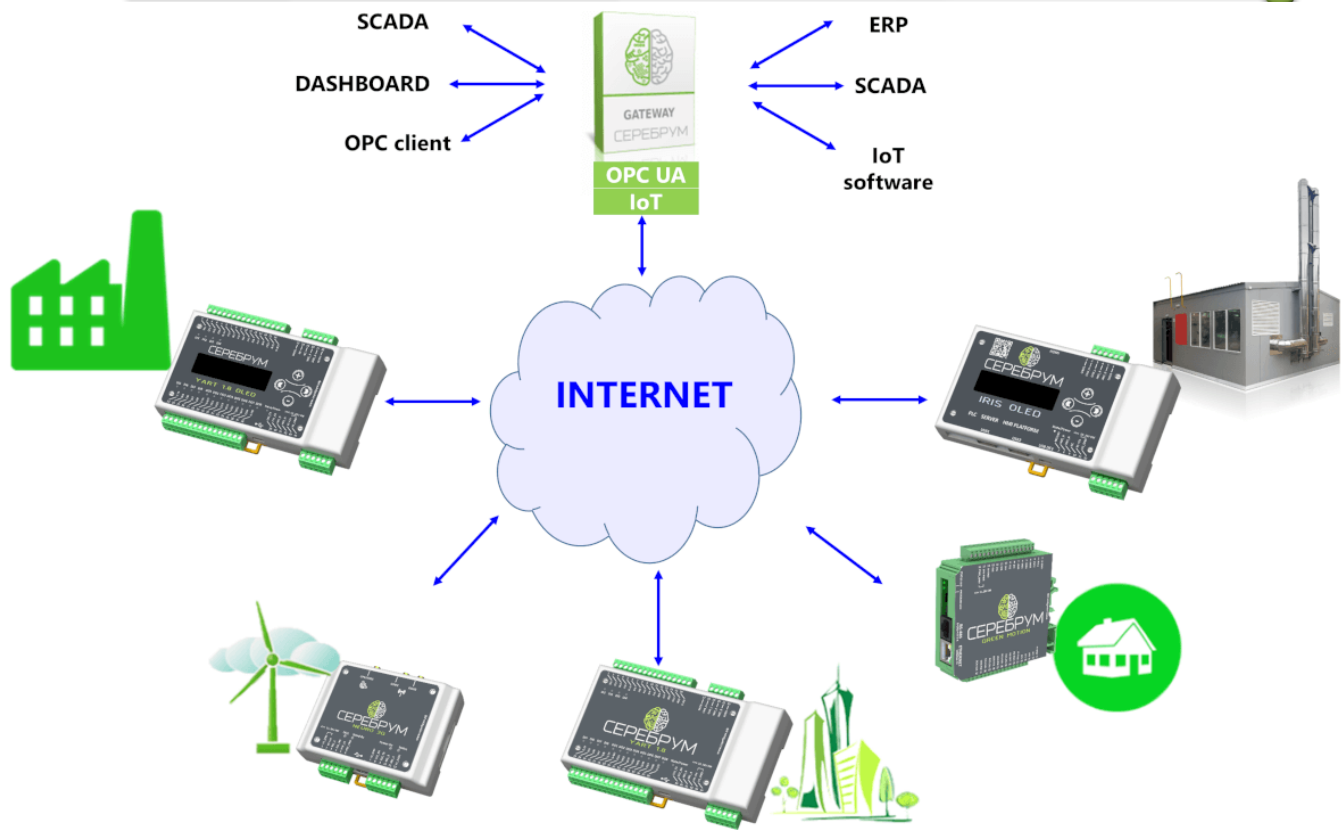
There are two options for the Internet connection. The Ethernet is available for all CEREBRUM PLCs and it's possible to use it as the main telemetry connection. The rest of the PLC communication feature remains functional.

Another option is the Neuro 3G/GSM modem. Once connected the Neuro module provides the link RSSI, connection mode and GPS/GLONASS in automatic mode directly within YART application program.

The Ethernet port is the main communication Fieldbus interface for all CEREBRUM PLCs. The built in Modbus TCP protocol helps to establish seamless connection to most of modern PLC and SCADA systems. In addition to a standard Modbus TCP Slave the IRIS PLC also supports Modbus TCP Master mode for better external device integration.

All CEREBRUM PLCs contains a custom YART-Link protocol for global data exchange. The protocol runs on top of the UDP and helps to build distributed automation systems based on different CEREBRUM PLC types.

By combining all available communication protocols it is easy to achieve a complex data processing and link media across each CEREBRUM PLC. This includes local Fieldbus communication, Internet telemetry and M2M Industry 4.0 topologies.

GSM Communications

The Neuro 3G/GPRS communications module is standalone unit required to maintain a stable data telemetry channel.

The YartStudio IDE contains all graphical tools required for a quick 3G modem integration into the Yart-PLC based telemetry systems.

The module also contains a sophisticated LUA scripts processor and GPS/GLONASS receiver for a position tracking applications. The programming is possible in open source IDE system.

There is a dedicated RS-232 interface for PLC connection and isolated RS-485 port for sensors and other peripherals. Thanks to the wide internal memory (4MB RAM and 63 MB Flash) the module can be used as a smart control and telemetry module when the PLC usage is not mandatory (energy meters, valves, etc.).

CEREBRUM GATEWAY

The CEREBRUM Gateway is a key component for building remote monitiring and Industry 4.0 systems.

Features

- Cross-platform software, it works on Windows, Linux and Embedded Linux

- Supports all CEREBRUM PLCs

- SCADA friendly OPC-UA interface on top of the communication stack

- Secure communications include PLC to Server and Server to SCADA

- Built in multiuser support, users are only able to work with the only assigned PLCs

- Modern, Industry 4.0 compatible data architecture

- Multilingual and arrays support, including compatibility modes for older platforms

CEREBRUM Gateway is a key part of our Internet based telemetry system. A single deployed gateway software pack is able to maintain remote communications between up to 1000 PLCs and a same amount of SCADA clients. One or more IRIS PLCs becomes acting as M2M coordinators to achieve Industry 4.0 targets within a single platform.

A remote PLCs are connected via well known MQTT protocol to form a gateway data space. The MQTT protocol is mainly a transport protocol to carry CEREBRUM encrypted data metaformats. This helps to significantly expand IoT functionality for a real industry demand. Thanks to MQTT subscription and publish nature the CEREBRUM IoT system stays compact even when a big amount of remote nodes is connected. Inside a PLC the data to be published are application software controlled, it makes the overall process flexible and clear for understanding. You just decide when to publish a particular algorithm data. For example, you'll decide how frequently data should be published in a machine normal state or what would change in case of fault. From a server's perspective, there's no need to hang in a waiting state whilst the remote PLC is expected to respond. Each connected PLC will tell about it when needed, instead.

The variables lists, process data and setpoints are using the technique above.

On the server the MQTT is based on a well known broker software empowered with a custom authentication and protection library to control remote connections and maintain system security.

The gap between the MQTT and OPC-UA is covered by a gateway core service program. It governs the data transition between the MQTT and OPC-UA information modeling and representation. The gateway is able to maintain variables and data format unchanged through the entire system starting from the Yart Studio IDE up to the SCADA system.

Some market available SCADA is already equipped with a direct Yart Studio IDE tags import feature.
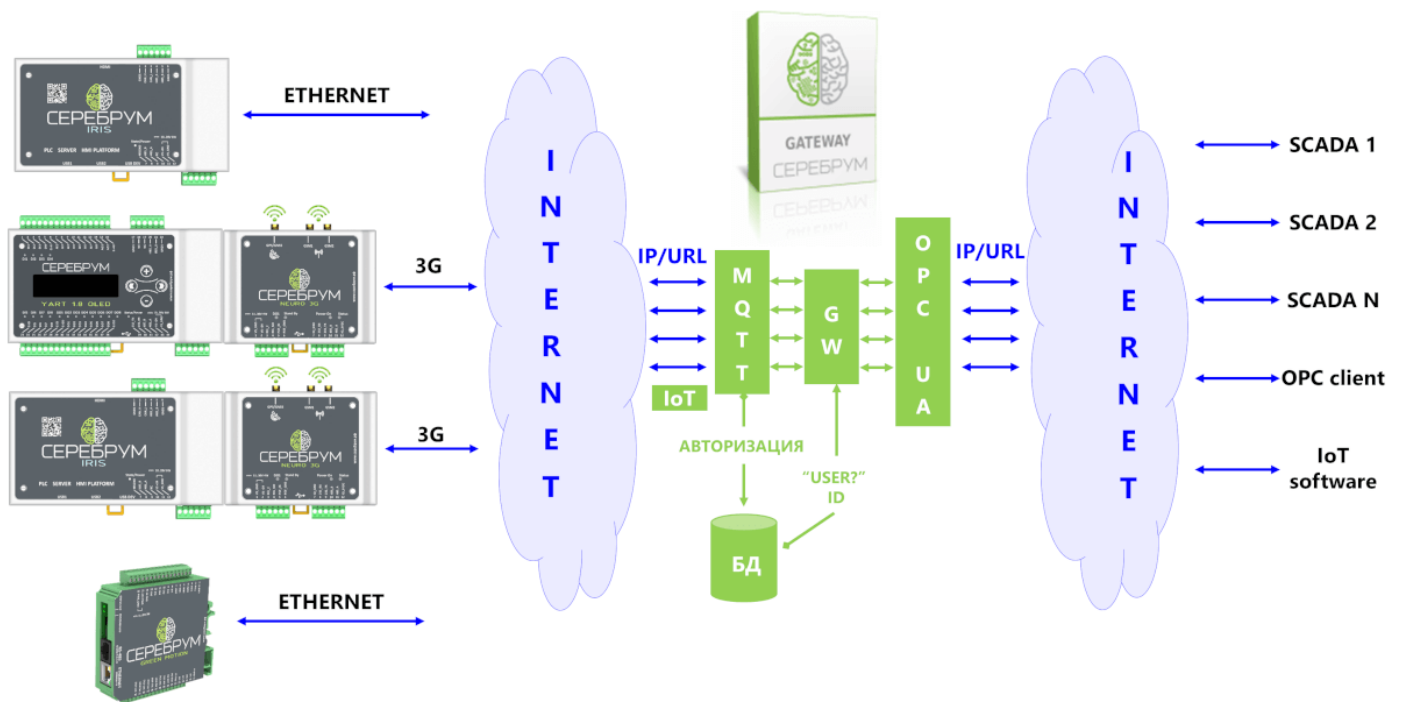
Depending on the settings there are a number of OPC-UA endpoints available for client's connection:

- Anonymous connection

- Username and password authentication

- Username and password authentication plus 128RSA15 data encryption and authentication

All endpoints, except anonymous one, require a pair of username/password to connect. Once connected the user can start browsing inside its valid OPC UA space.

USER	Access PLC
USER 1	PLC 1
USER 2	PLC 2, PLC 3
USER 3	PLC 3
USER N	PLC 1, PLC 2

www.serebrum.ru

The entire PLC set is divided and protected between different users. The user is only able to work with the only PLCs he is assigned for. There are no unassigned PLCs visible and accessible.

Besides of PLC's assignment, there's one more feature to set up a special alias name to the PLC's you'd like to change the name for. So for example a PLC with ID YA12345678963456789340912034 a new human readable name would be assigned as Conveyer_Belt_Main_PLC. Now it looks better, isn't it?

A special Gateway Admin software is dedicated to managing the PLCs, including aliases, access and a user's assignment.

The CEREBRUM GATEWAY is a cross platform software available for installation on Windows, Windows Server, Linux and Embedded Linux OS.

The Gateway is also a part of IRIS PLC firmware to help users to set up the telemetry infrastructure right on the automation site to provide OPC UA interfaces directly to the number of locally installed PLCs.

YART Studio
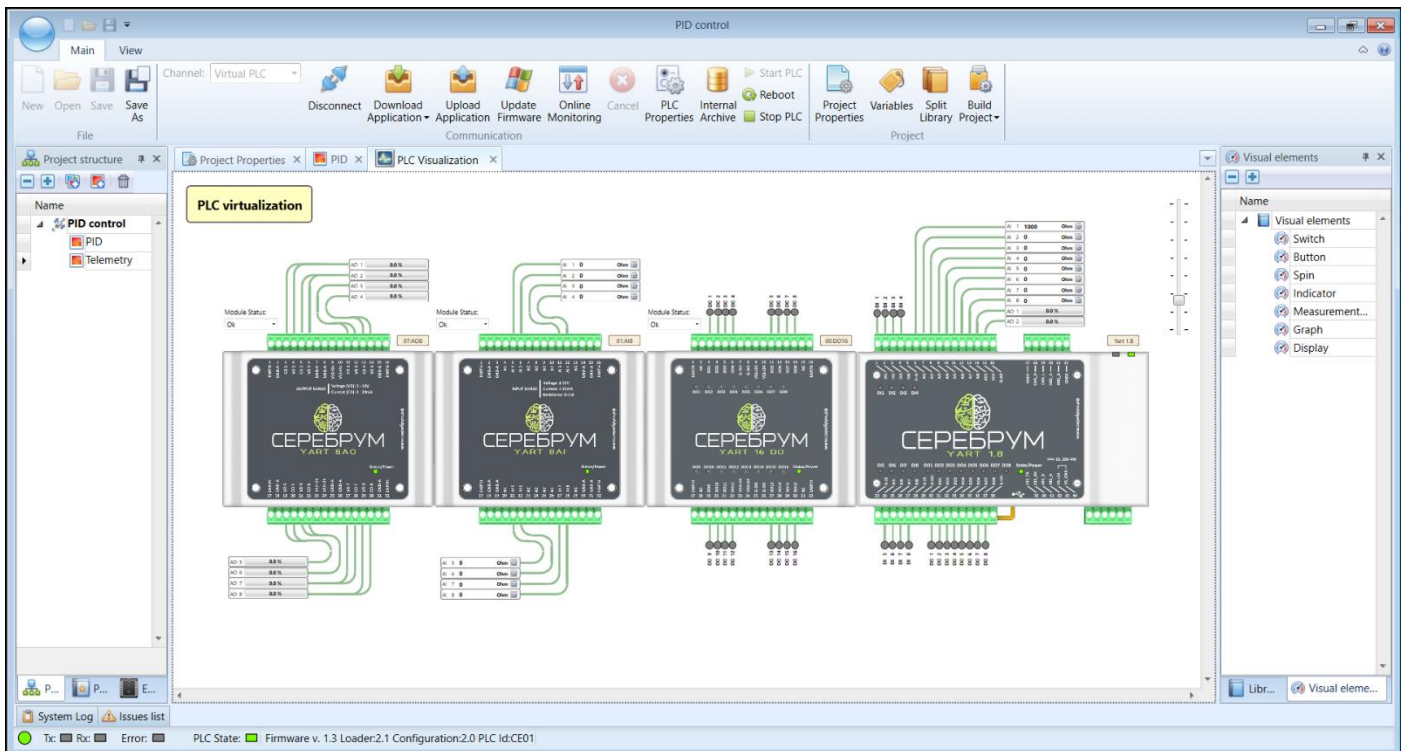
The free of charge YART Studio IDE provides a graphical way for PLC programming in IEC 61131-3 based FBD (functional diagrams) and C-like YART-C languages.

A comprehensive blocks library is a part of the YART-Studio IDE. It contains many commonly used blocks and algorithms used in industrial automation engineering.

A standard IEC 61313-3 library is expanded with many communication, measurement and interfacing functional blocks. The library also contains PLC support blocks to support YART/IRIS PLCs special hardware features.

The IEC 61131-3 ST language is changed to a C-like C-YART language with user friendly syntax and many modern programming features to expedite application development.

The YART Studio features graphical application design approach to help inexperienced users to quickly become familiar with a new design environment and keep the design progress fast. The user is welcome to use drag and drop for functional blocks, variables and data connections.

There's no 90 degrees connections in the software, the data flow is smooth and routed automatically.

For each data type a dedicated color is assigned. the system automatically prevents incorrect data connections.
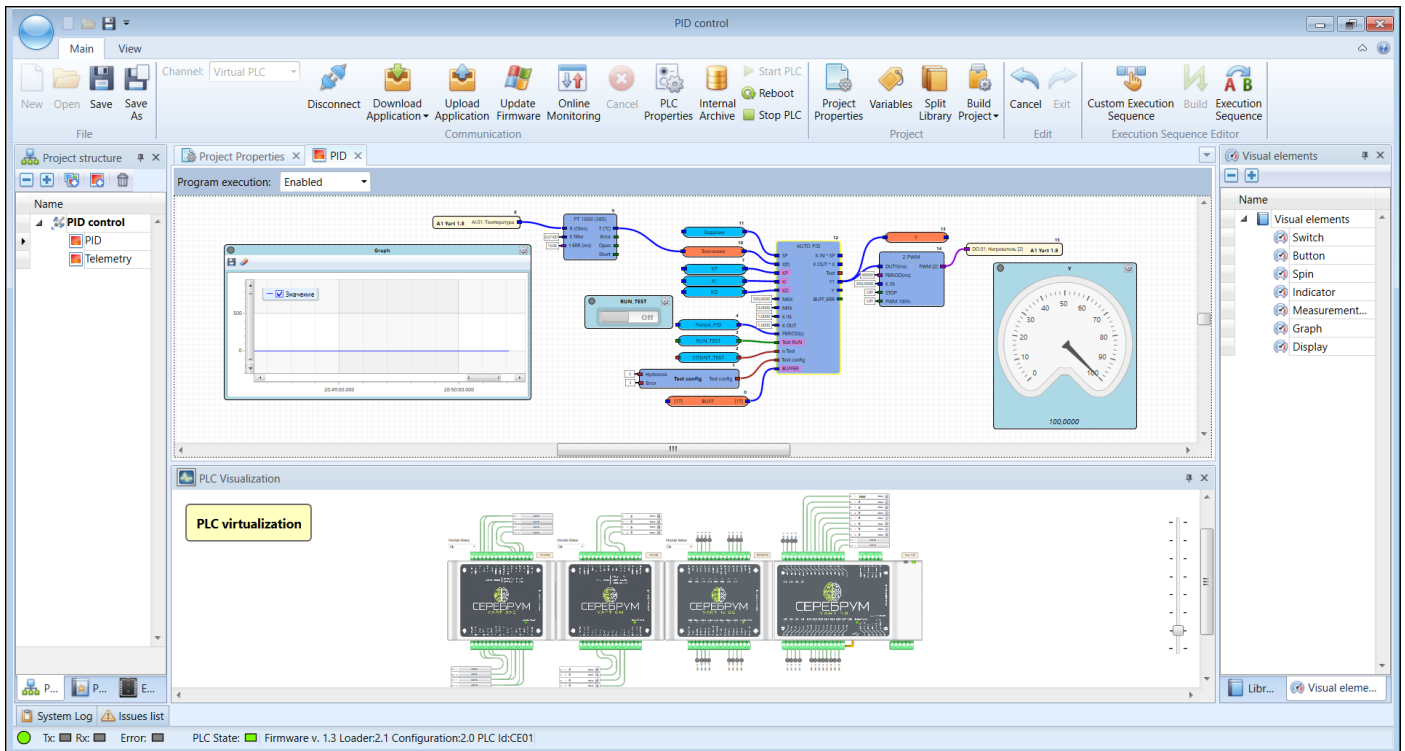
All communication features are also defined by selecting the data you'd like to send or receive and dragging them into the corresponding area. The process made in an intuitive way with minimum amount of unnecessary settings.

A built in data archiver is based on the same approach.
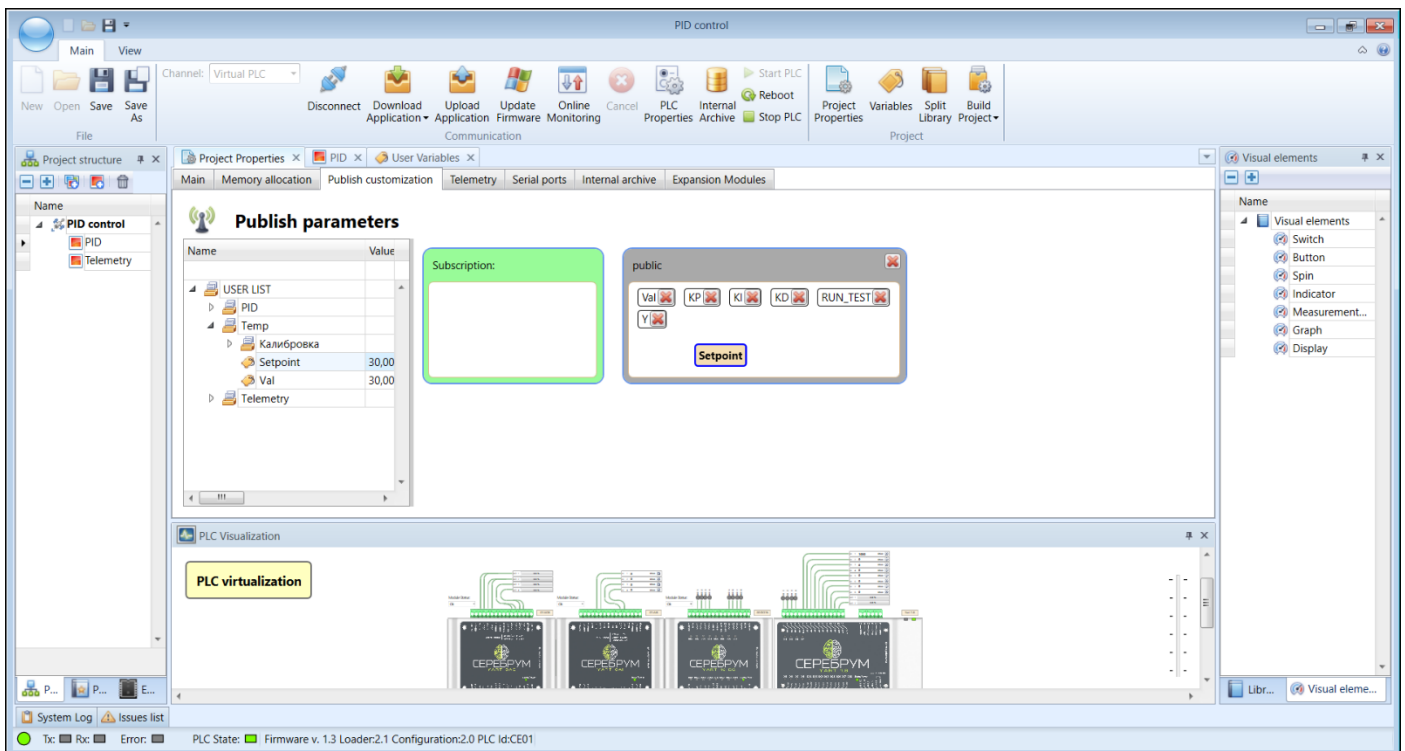
During a debug the working area shows the data values in a real time. There's no additional software installation/setup required.

www.serebrum.ru

The debug is possible when real or simulated PLC is connected. A simulator is based on a PLC execution platform and capable to run the user's applications exactly as it would run on a real equipment.

The YART Studio includes a set of graphical widgets to build in place control and indication areas. These blocks are only valid during debug and make no effect on a PLC program execution. The graph block is also capable to export captured data in CSV or JSON format for further analysis with third party tools.

The widgets' location is up to the user so it is possible to embed those blocks among the application ones or to create a special HMI screen for application control.

There's no limit to the amount of such HMI screens used in the project. Almost the entire project could be designed to work as HMI.
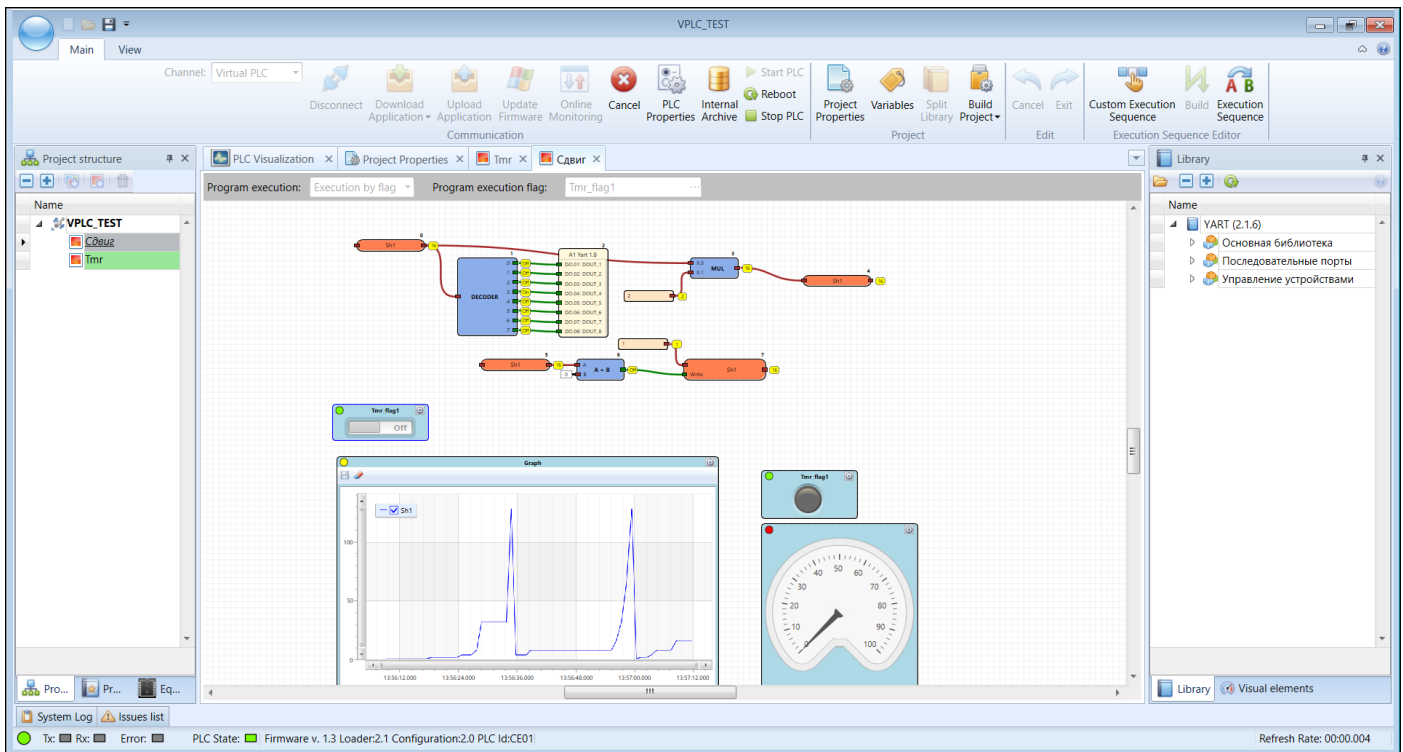
It is proven that combining the application logic and the indication and control widgets makes the design more readable and convenient for process understanding.

The widgets setup process is simple, a corresponding data variable is accessible via pop up lists or by dragging and dropping a variable the user is going to see/control inside the widget.
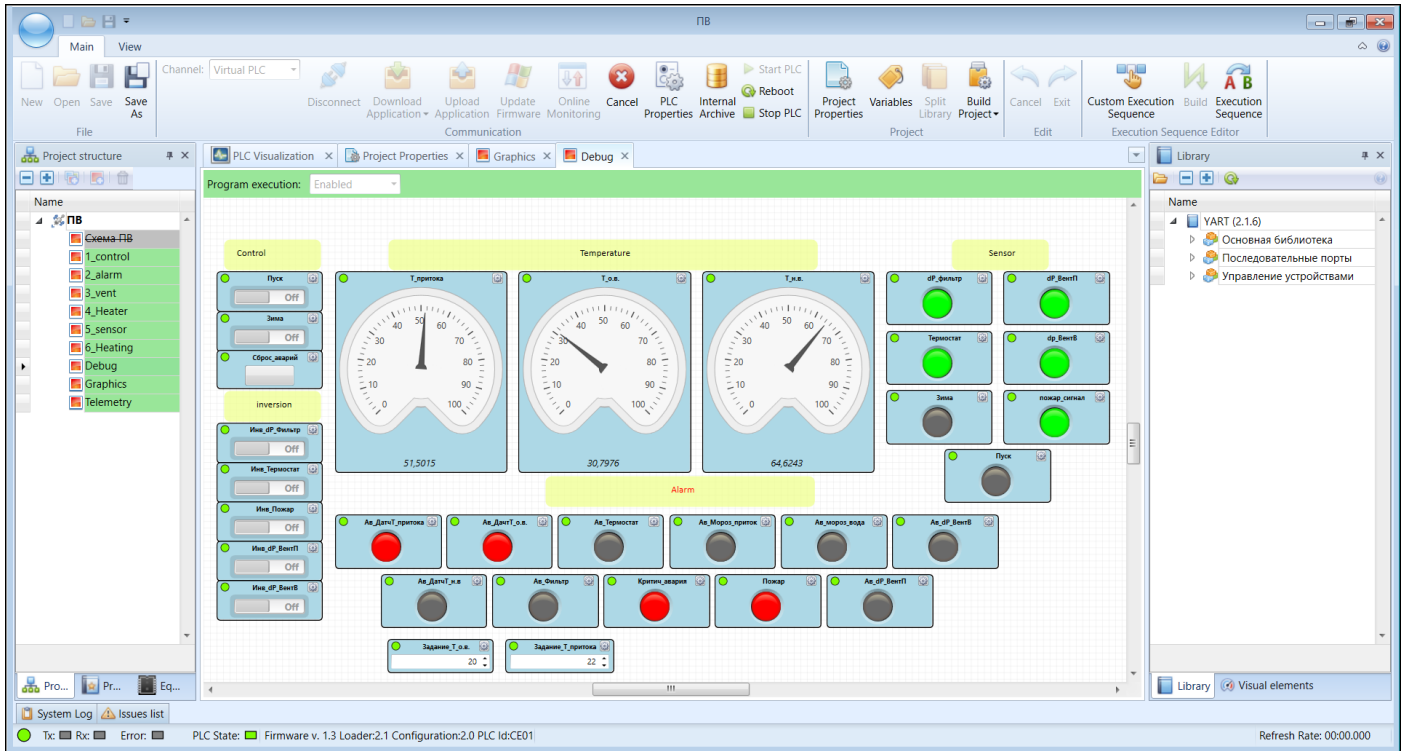
The user's environment is docking windows based and capable to be customized depending on current design demands. This could be debug, programming or HMI layout specifically adjust to the user's particular needs.
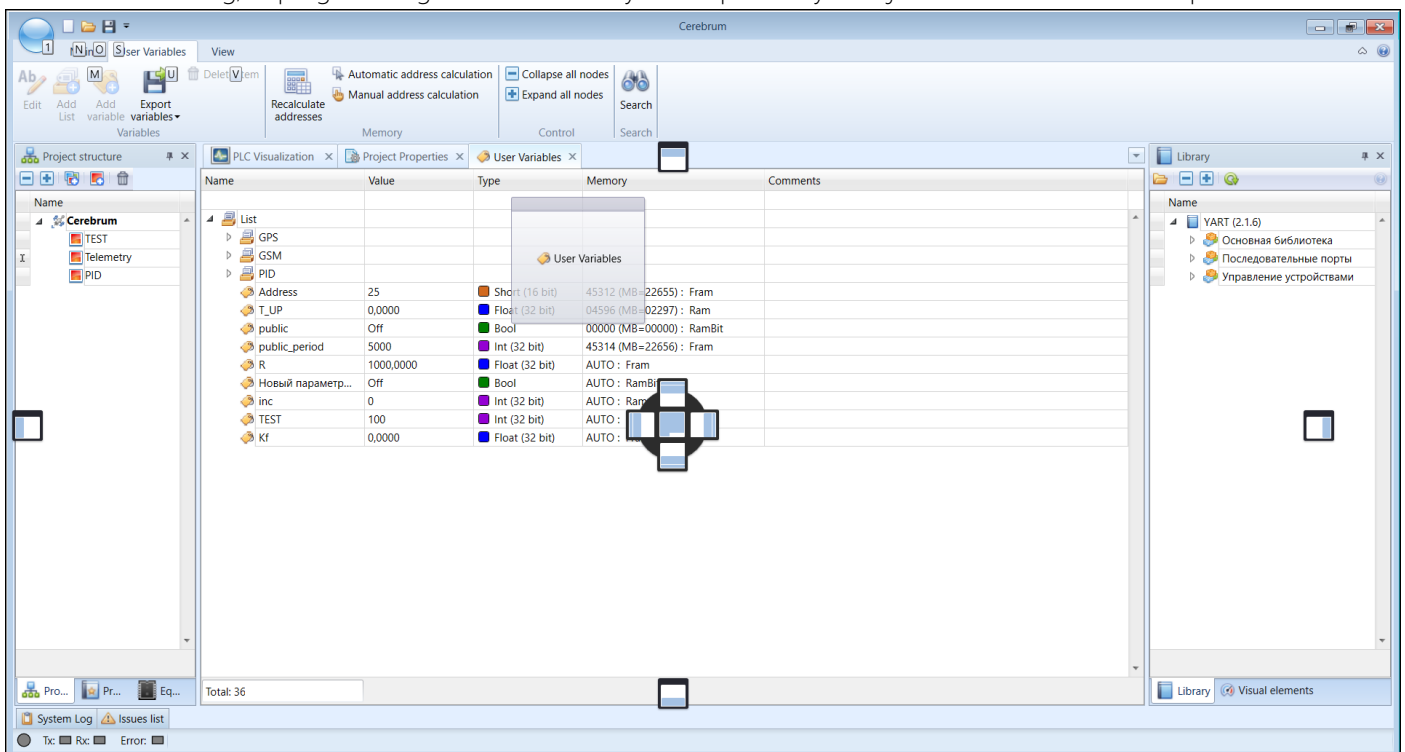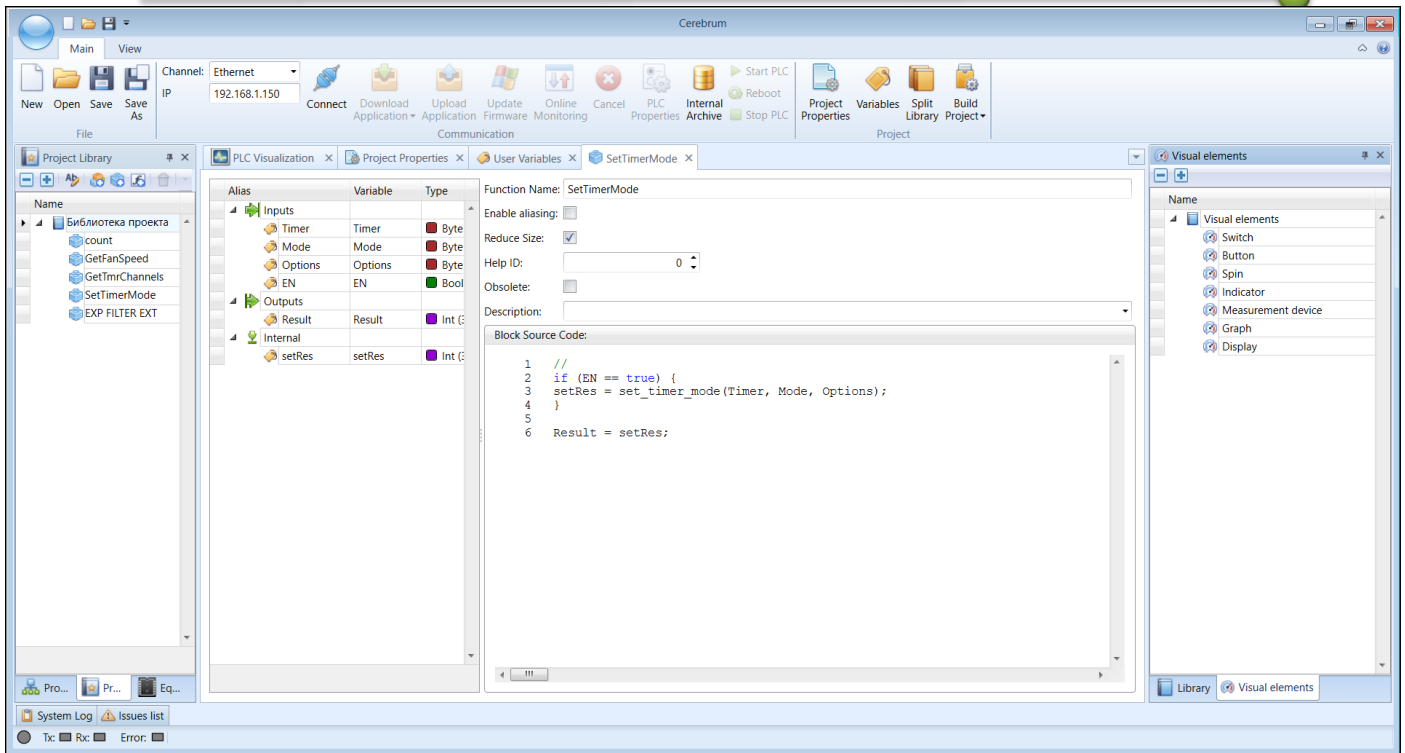
The simulation PLC is a part of YART Studio. Depending on the project settings the simulator behaves as YART, GREEN MOTION or IRIS PLC, featuring some special hardware units and interfaces.

To configure the project to be executed in a simulated environment the "Virtual PLC" channel must be selected in a connection setup window. The simulator will launch automatically.

Once started the simulator becomes able to work with CEREBRUM Telemetry server and exchange data via the Modbus protocol just like the normal CEREBRUM PLC. For example, you can access the application data by any HMI screens or SCADA.

A special hardware state interface helps to simulate a virtual controller hardware inputs. In a case the real PLC is connected, the software shows a real input and output line states.

PROGRAMMABLE LOGIC CONTROLLERS

GREEN MOTION

Programmable logic controller for automated electric drive
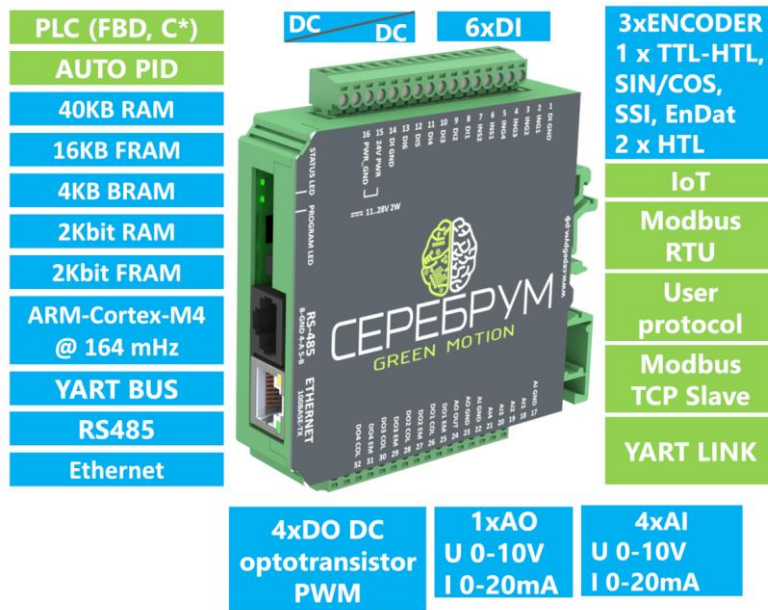
Features

Seamless position sensors connection

HTL, TTL, Sin/Cos, SSI, EnDat encoders support

GREEN MOTION is a PLC with extended motion control features on board. The GREEN MOTION PLC core is extended to support most of the commonly used speed and position sensors.

Types of encoders supported

type port	TTL inc	HTL inc	HTL inc	SSI	En Dat
Port 1	Yes	Yes	Yes	Yes	Yes
Port 2		Yes			

Addition to the speed sensors a specifically designed library is used for further data processing.

The calculated position value is stored inside on board FRAM memory in such way the unexpected power fault could neved corrupt the data that enables an incremental encoders to act as an absolute ones.
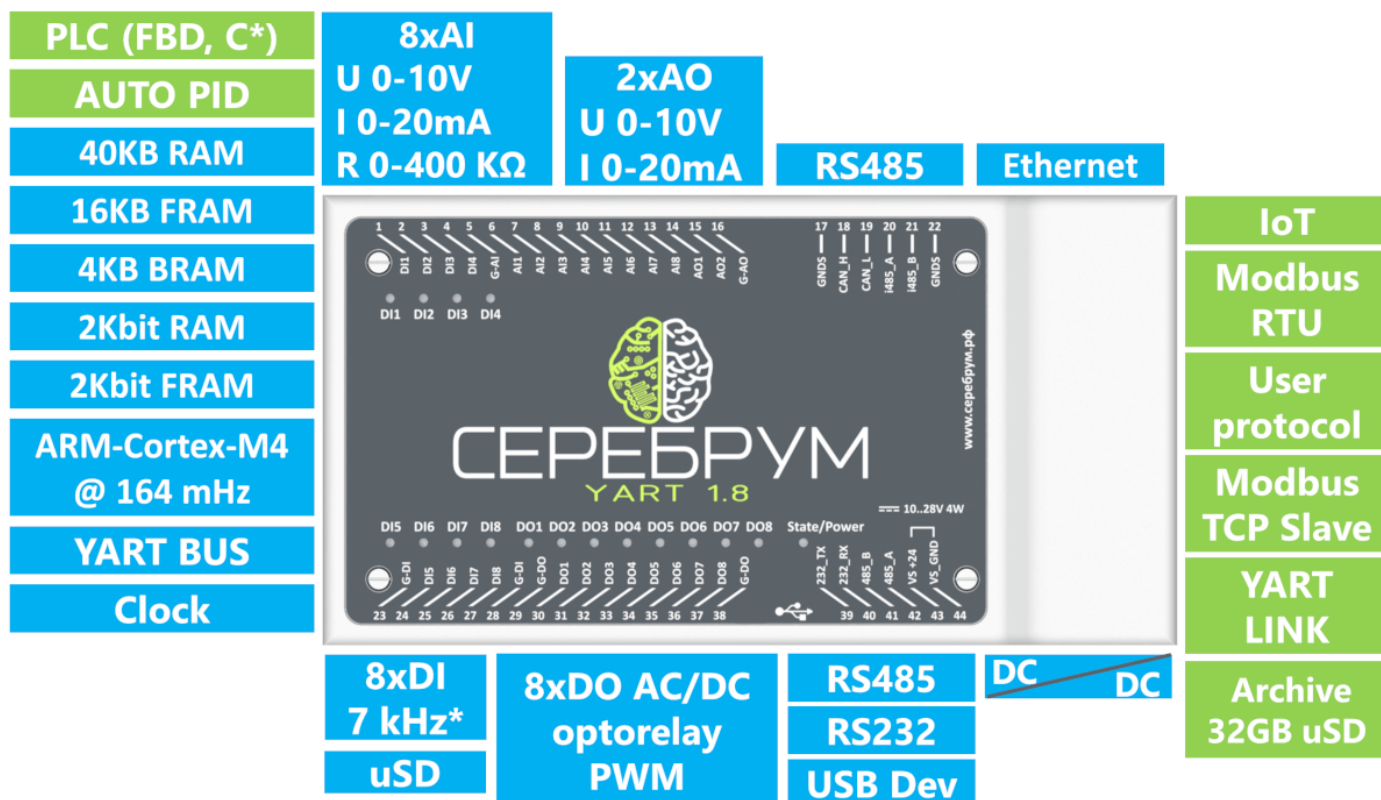
This feature is significant for cost optimized applications where the extra sensors are quite expensive.

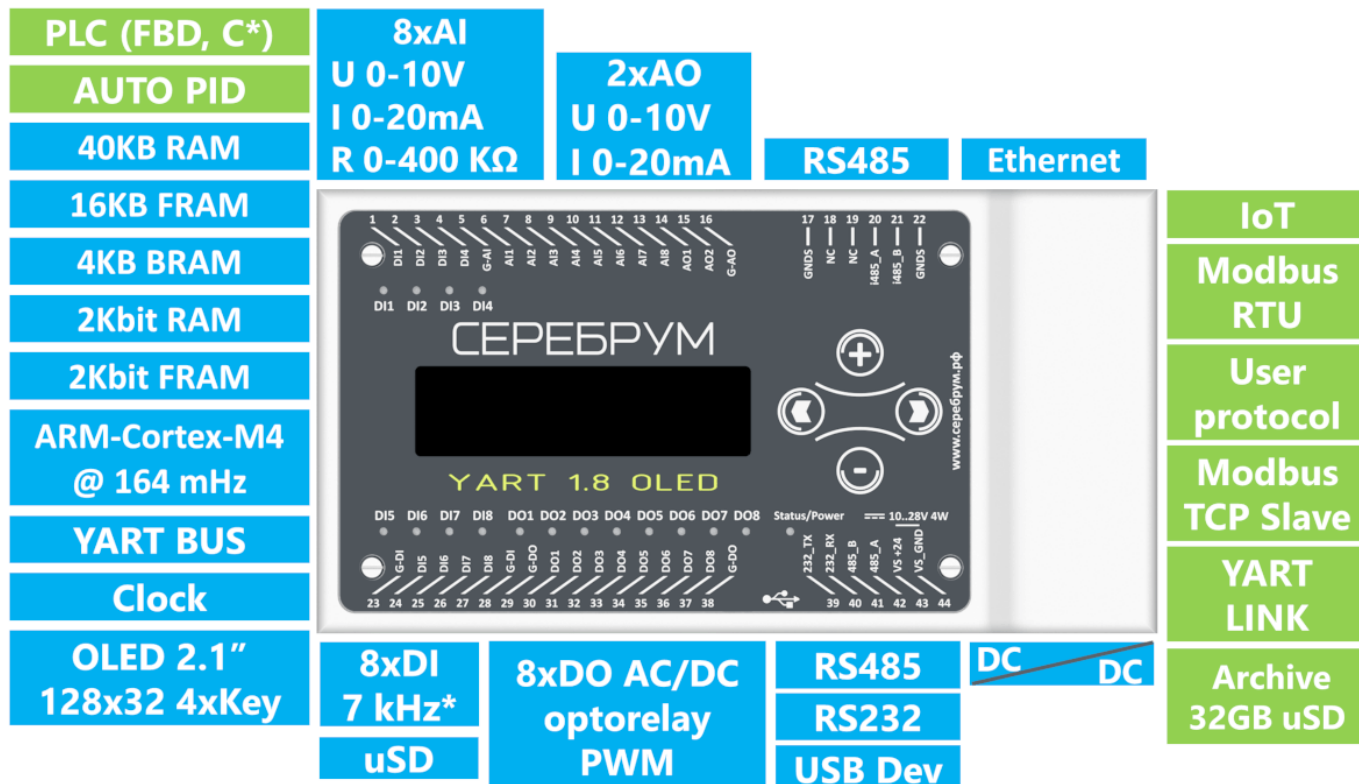| Parameter		Value
Supply voltage		10 to 28 VDC
Terminal block connector type		Removable, screw terminated, max. wire cross section 1.5 mm2
Programming		FBD, C-YART, YART Studio IDE
Memory	Programs	256 KB non-volatile memory (more than 200 block types, 2000 block calls)
	RAM	40 KB memory for user variables
	FRAM	16 KB non-volatile memory for user variables
	BRAM	4 KB, nonvolatile (battery backed) memory for user variables
	RAM BIT	2 KBIT memory for user variables
	FRAM BIT	2 KBIT non-volatile memory for user variables
Program execution cycle time		1 ms min
Inputs	Discrete	6DI x 7-28 VDC, galvanically isolated from the processor circuits
	Analog	4AI x 10 bit, Modes - (0-10VDC/0-20mA)
	Encoders	1 x TTL-HTL, SIN/COS, SSI, EnDat, 2 x HTL
Outputs	Discrete	4DO x x solid-state relays, VDC / VAC, up to 100mA. Galvanically isolated from the processor circuits
	Analog	1AO x U/I (0-10VDC/0-20mA)
Communication ports	ETHERNET	Connector RJ-45, 100 / 10Base-T auto-detect the type of cable. YART-LINK, MODBUS TCP, IOT, YART-BUS, IoT
	RS485	MODBUS RTU, dedicated library protocols, custom protocols
	YART-BUS	Expansion modules bus, fast interface for expansion modules

YART 1.8

Programmable logic controller

Left column (blocks):
- PLC (FBD, C*)
- AUTO PID
- 40KB RAM
- 16KB FRAM
- 4KB BRAM
- 2Kbit RAM
- 2Kbit FRAM
- ARM-Cortex-M4 @ 164 mHz
- YART BUS
- Clock

Top blocks:
- 8xAI U 0-10V I 0-20mA R 0-400 KΩ
- 2xAO U 0-10V I 0-20mA
- RS485
- Ethernet

Right column (blocks):
- IoT
- Modbus RTU
- User protocol
- Modbus TCP Slave
- YART LINK
- Archive 32GB uSD

Bottom blocks:
- 8xDI 7 kHz*
- uSD
- 8xDO AC/DC optorelay PWM
- RS485
- RS232
- USB Dev
- DC / DC

Board labels: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 — 17 18 19 20 21 22
DI1 DI2 DI3 DI4 G-AI AI1 AI2 AI3 AI4 AI5 AI6 AI7 AI8 AO1 AO2 G-AO — GNDS CAN_H CAN_L i485_A i485_B GNDS
DI1 DI2 DI3 DI4
СЕРЕБРУМ
YART 1.8
⎓ 10..28V 4W
DI5 DI6 DI7 DI8 DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8 State/Power
G-DI DI5 DI6 DI7 DI8 G-DI G-DO DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8 G-DO 232_TX 232_RX 485_A 485_B VS+24 VS_GND
23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 — 39 40 41 42 43 44
www.серебрум.рф

YART 1.8 OLED*

Left column (blocks):
- PLC (FBD, C*)
- AUTO PID
- 40KB RAM
- 16KB FRAM
- 4KB BRAM
- 2Kbit RAM
- 2Kbit FRAM
- ARM-Cortex-M4 @ 164 mHz
- YART BUS
- Clock
- OLED 2.1" 128x32 4xKey

Top blocks:
- 8xAI U 0-10V I 0-20mA R 0-400 KΩ
- 2xAO U 0-10V I 0-20mA
- RS485
- Ethernet

Right column (blocks):
- IoT
- Modbus RTU
- User protocol
- Modbus TCP Slave
- YART LINK
- Archive 32GB uSD

Bottom blocks:
- 8xDI 7 kHz*
- uSD
- 8xDO AC/DC optorelay PWM
- RS485
- RS232
- USB Dev
- DC / DC

Board labels: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 — 17 18 19 20 21 22
DI1 DI2 DI3 DI4 G-AI AI1 AI2 AI3 AI4 AI5 AI6 AI7 AI8 AO1 AO2 G-AO — GNDS NC NC i485_A i485_B GNDS
DI1 DI2 DI3 DI4
СЕРЕБРУМ
YART 1.8 OLED
⎓ 10..28V 4W
DI5 DI6 DI7 DI8 DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8 Status/Power
G-DI DI5 DI6 DI7 DI8 G-DI G-DO DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8 G-DO 232_TX 232_RX 485_A 485_B VS+24 VS_GND
23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 — 39 40 41 42 43 44
www.серебрум.рф

Features

- Many industrial interfaces on board: Ethernet, 2xRS-485, RS-232, USB, YART BUS
- 8 universal analog inputs configurable as current, voltage or resistance measurement modes
- 8 digital inputs with counter/capture options
- 8 AC/DC load switches
- 2 0-20mA 0-10V analog outputs
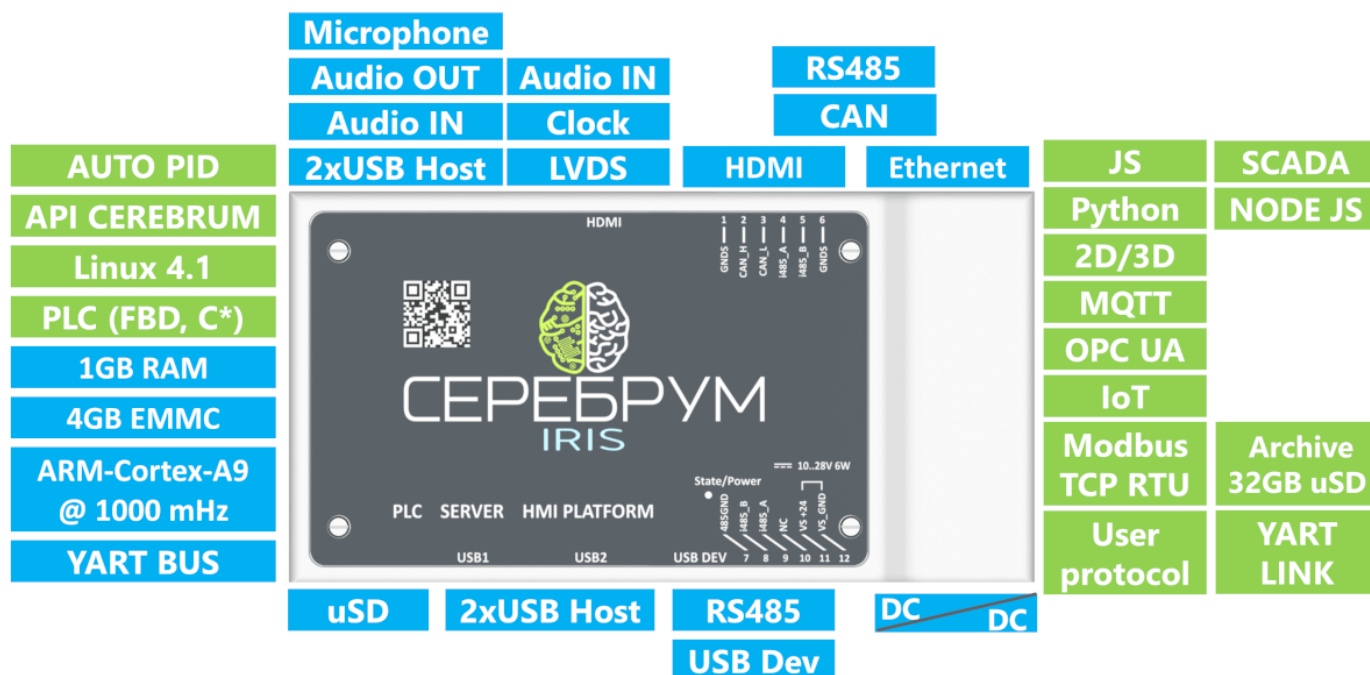- *modification with OLED display 2.1' 128x32 and 4 control keys

The outstanding on board peripherals range helps for efficient design and engineering in HVAC, energy metering, pumps, machines and many others applications.

A built in uSD card slot helps for YART application data logging. All necessary settings can be done in Yart Studio IDE.

Parameter		Value
Supply voltage		10 to 28 VDC
Terminal block connector type		Removable, screw terminated, max. wire cross section 1.5 mm2
Programming		FBD, C-YART, YART Studio IDE
Memory	Programs	640 KB non-volatile memory (more than 500 block types, 5000 block calls)
	RAM	40 KB memory for user variables
	FRAM	16 KB non-volatile memory for user variables
	BRAM	4 KB, nonvolatile (battery backed) memory for user variables
	RAM BIT	2 KBIT memory for user variables
	FRAM BIT	2 KBIT non-volatile memory for user variables
uSD memory card		Up to 32 GB for archive storage
Program execution cycle time		1 ms min
Inputs	Discrete	8DI x 7-28 VDC, LED indication, galvanically isolated from the processor circuits
	Analog	8AI x 14 bit, PGA. Modes - U/I/R/DI (0-10VDC/0-20mA/0-400kOm)
Outputs	Discrete	8DO x solid-state relays, VDC / VAC, up to 100mA, LED indication. Galvanically isolated from the processor circuits
	Analog	2AO x U/I (0-10VDC/0-20mA)
Communication ports	ETHERNET	Connector RJ-45, 100 / 10Base-T auto-detect the type of cable. YART-LINK, MODBUS TCP, IOT, YART-BUS, WEB SERVER status
	mini-USB	MODBUS RTU, debug port
	RS232	MODBUS RTU, dedicated library protocols, custom protocols
	RS485	MODBUS RTU, dedicated library protocols, custom protocols
	RS485I	MODBUS RTU, dedicated library protocols, galvanically isolated
	YART-PORT	Expansion modules bus, fast interface for expansion modules
Real-Time Clock (RTC)		Battery powered (accuracy at normal conditions - ± 2s/day max)

IRIS

High-performance PLC with advanced communication capabilities based on Linux OS


IRIS OLED*
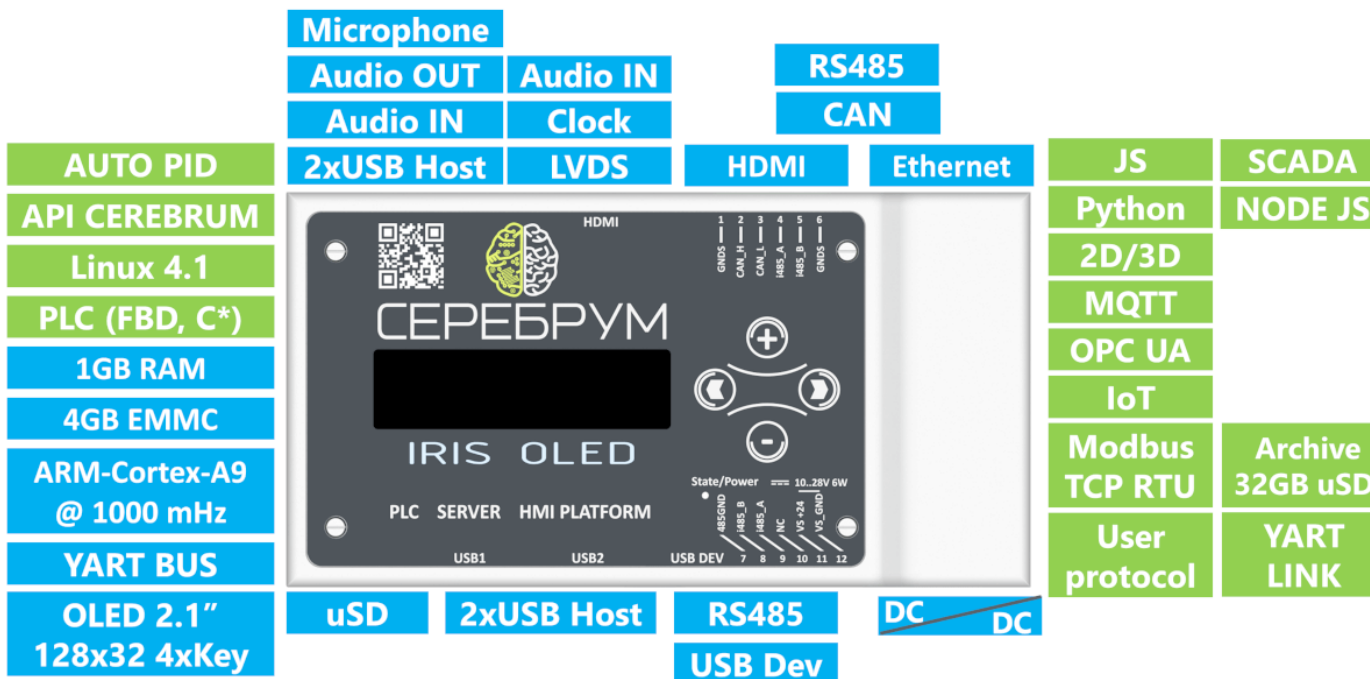
Features:

- high performance CPU
- HDMI displays support
- 4xUSB Host, uSD card slot, YART BUS, 2xRS-485, CAN
- Programming in YART-PLC, Java, Node JS, Python
- Built in telemetry facilities: CEREBRUM IIoT, OPC UA, MQTT
- *modification with OLED display 2.1' 128x32 and 4 control keys

There are three main roles the IRIS PLC can be used for, a high performance PLC, a data indication and supervisory unit and an industrial OEM automation platform.
The OEM customers will found IRIS as the great improvement to the non industrial hand held developing tools and kits. The Java VM is installed on default file system image to help with easy device migration.

Up to 1920x1080 pixels resolution displays are supported on the HDMI port. The internal 2D and 3D hardware accelerator helps to speed up the SCADA/HMI mimics animations for better user's experience.
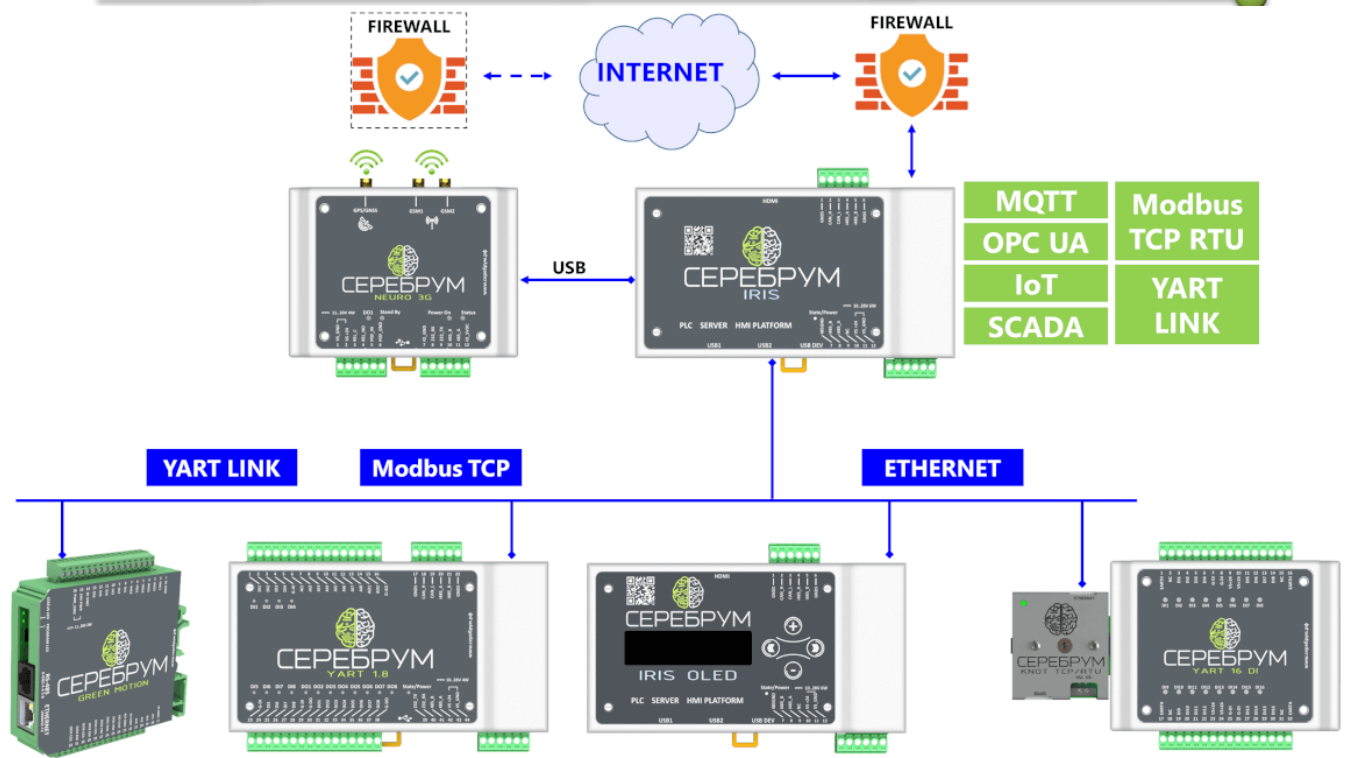In a case of the touch screen is used the on board USB ports can connect the majority of a standard input controllers.
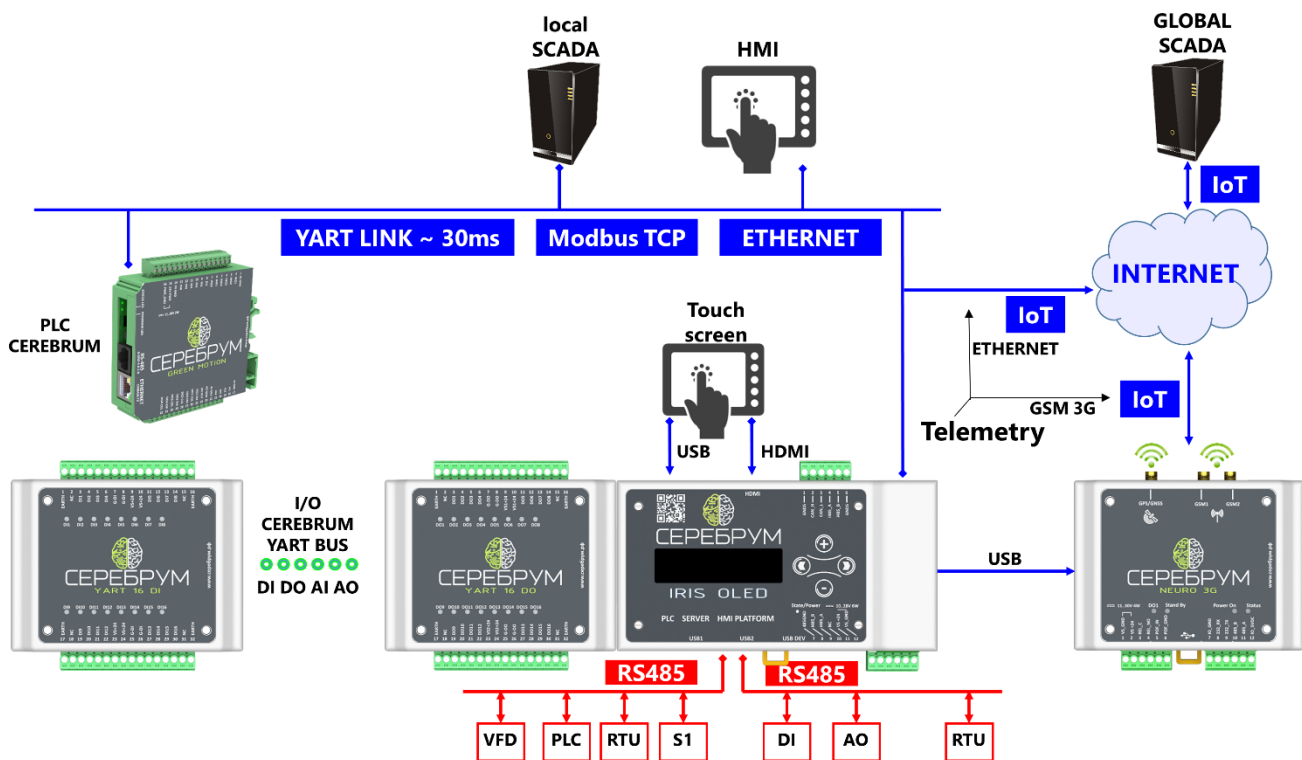
The system is based around Linux and capable to support many standard IO USB devices such as mouse, keypad, trackballs, printers and data storage.
Regardless of the task being executed it is still possible to connect many external CEREBRUM PLCs to the embedded IoT-OPCUA gateway, generating a modern Industry 4.0 infrastructure.
 IRIS can also be configured as a LAN router and firewall unit to let surrounding equipment to access the Internet for safe data communication.

Parameter		Value
Supply voltage		12 to 28 VDC, galvanically isolated power source
CPU type		ARM-Cortex-A9 @ 1000МГц, NEON SIMD
Terminal block connector type		Removable, screw terminated, max. wire cross section 1.5 mm2
OS		Linux 4.1, Buildroot
Programming		FBD, C-YART, IDE YART Studio or MasterSCADA 4D ИнСАТ
Memory	Programs	1024 KB non-volatile memory (more than 500 block types, 5000 block calls)
	RAM	40 KB memory for user variables
	Disk Linux	4/8 GB NAND or eMMC
	FRAM	16 KB non-volatile memory for user variables
	RAM Linux	1024/512 MB DDR3-800, 32 bit
	RAM BIT	2 KBIT memory for user variables
	FRAM BIT	2 KBIT non-volatile memory for user variables
uSD memory card		Up to 32 GB for archive storage
Program execution cycle time		0,3 ms min
Display port	HDMI	A standard HDMI 1.4 port monitor
	LVDS	LVDS panel connection, 1366x786 max, I2C for touch screen
Audio	Input	Stereo line input + microphone input
	Output	Line-in stereo output, headphone connection output, 16 Ohm max.
Communication ports	ETHERNET	Connector RJ-45, 100 / 10Base-T auto-detect the type of cable. YART-LINK, MODBUS TCP, IOT, YART-BUS, WEB SERVER status
	USB Host	2 built-in, 2 USB-A ports
	USB Device	Serial Port, Modbus RTU
	RS485	MODBUS RTU, dedicated library protocols, custom protocols
	RS485I	MODBUS RTU, dedicated library protocols, galvanically isolated
	CAN	CANOpen using CAN Festival
	YART-PORT	Expansion modules bus, fast interface for expansion modules
	Real-Time Clock (RTC). Battery powered (accuracy at normal conditions - ± 2s/day max)	

UNIVERSAL EXPANSION MODULES

YART DO16

Expansion module with 16 discrete outputs
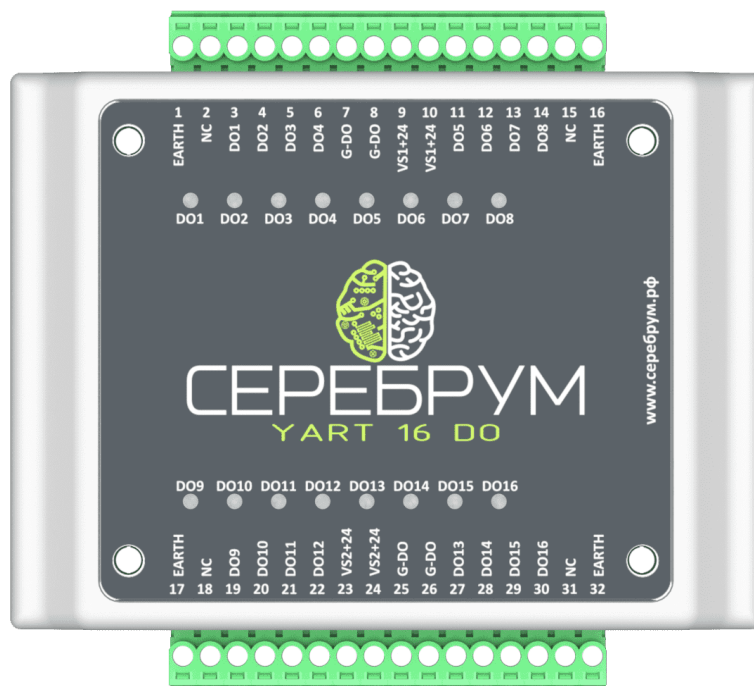
The module is Yart-BUS compatible, it can work together with any CEREBRUM host unit including Smart-KNOT remote IO unit to communicate over serial or Ethernet line.
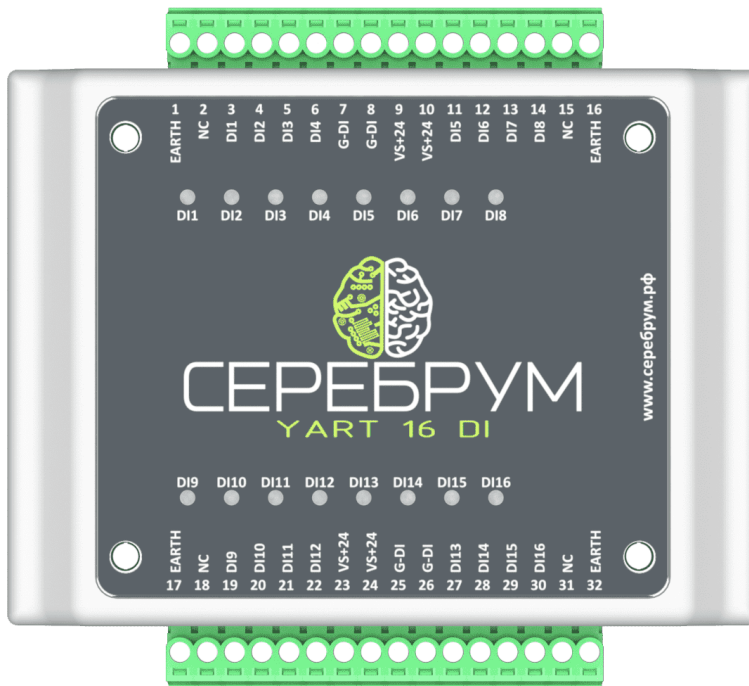
No programming is needed, the required configuration is based on Yart Studio IDE.

Parameter		Characteristics
Supply voltage		11 to 45 VDC for two output power rails. 2x8.
Terminal block connector type		Connectors, screwed, max. wire cross section 1.5 mm2
Programming		Not required
Outputs	Discrete	16DO high side switches, current up to 500mA, LED indication, conform with IEC 61000-4 standard, galvanically isolated from processor circuits
Communication ports	YART-PORT	Expansion bus port

YART DI16

Expansion module with 16 digital inputs

The module is Yart-BUS compatible, it can work together with any CEREBRUM host unit including Smart-KNOT remote IO unit to communicate over serial or Ethernet line.

No programming is needed, the required configuration is based on Yart Studio IDE.

Parameter		Characteristics
Supply voltage		11 to 30 VDC
Terminal block connectors type		Connectors, screwed, max. wire cross section 1.5 mm2
Programming		Not required
Inputs	Discrete	16DO x 5 to 30 VDC, LED indication, conform to IEC61000-4 standard, galvanically isolated from processor circuits
Communication ports	YART-PORT	Expansion bus interface

YART AI8

Eight Universal Analog Inputs Expansion Module
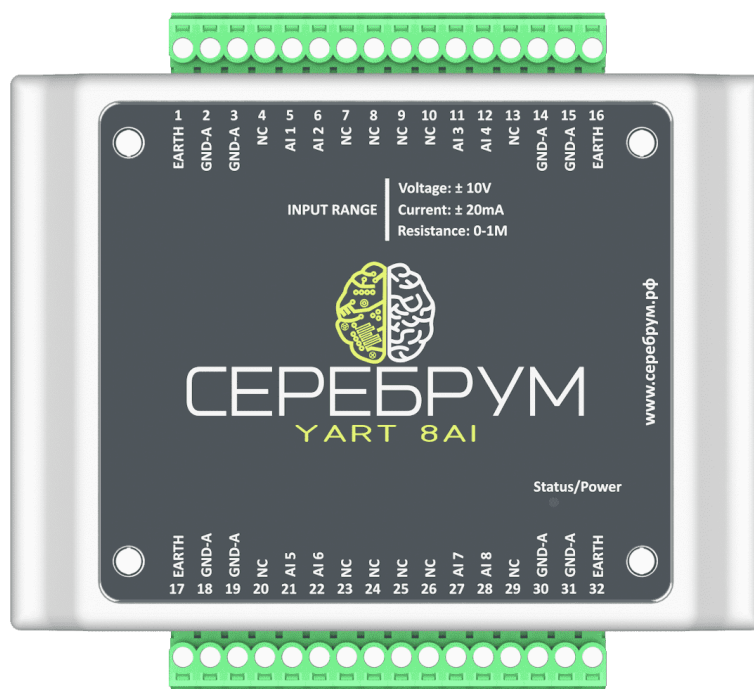
The universal expansion module containing eight high precision analog inputs.

Each channel can work in one of three different modes - Voltage measurement, Current Measurement and Resistance measurement.
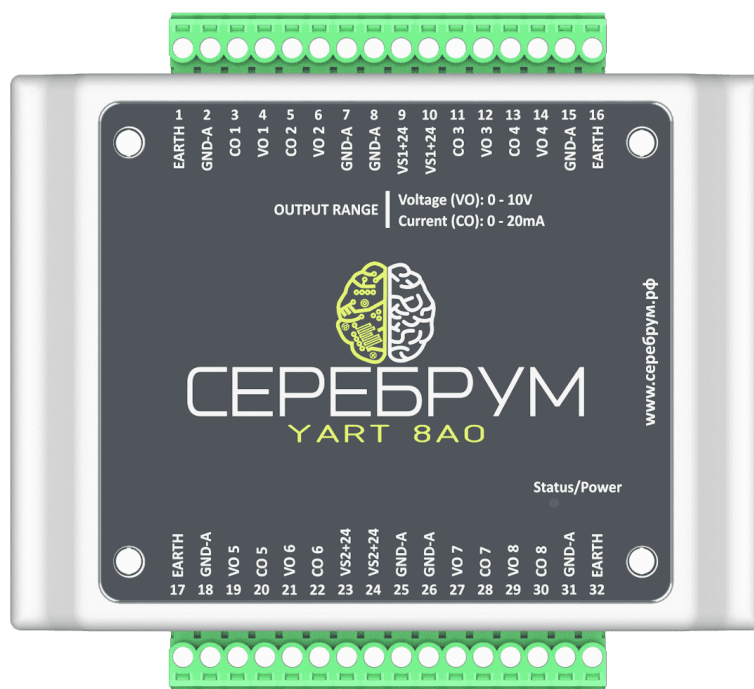
The module is Yart-BUS compatible, it can work together with any CEREBRUM host unit including Smart-KNOT remote IO unit to communicate over serial or Ethernet line.

No programming is needed, the required configuration is based on Yart Studio IDE.

Parameter		Value
External Power Supply		Not needed
Terminals Type		Screw connection, 16-30 AWG
Programming		YART Studio configuration only
Inputs	Analog	8AI x 12 bit ADC, with on chip PGA • 0 +10V voltage input mode • -10V +10V voltage input mode • 0 +20 mA current input mode • -20 +20 mA current input mode • Input resistance measurement 0 to 1M Ohm Inputs are IEC 61000-4 compliant; Protection in according to: IEC61000-4-5 (8/20 µs): 35 A IEC61643-321 (10/1000 µs): 4 A
Communication ports	YART-PORT	Expansion bus, scan time less than 30 ms, total units on bus – 8

YART AO8

Expansion module for 8 universal analog outputs

The module is Yart-BUS compatible, it can work together with any CEREBRUM host unit including Smart-KNOT remote IO unit to communicate over serial or Ethernet line.
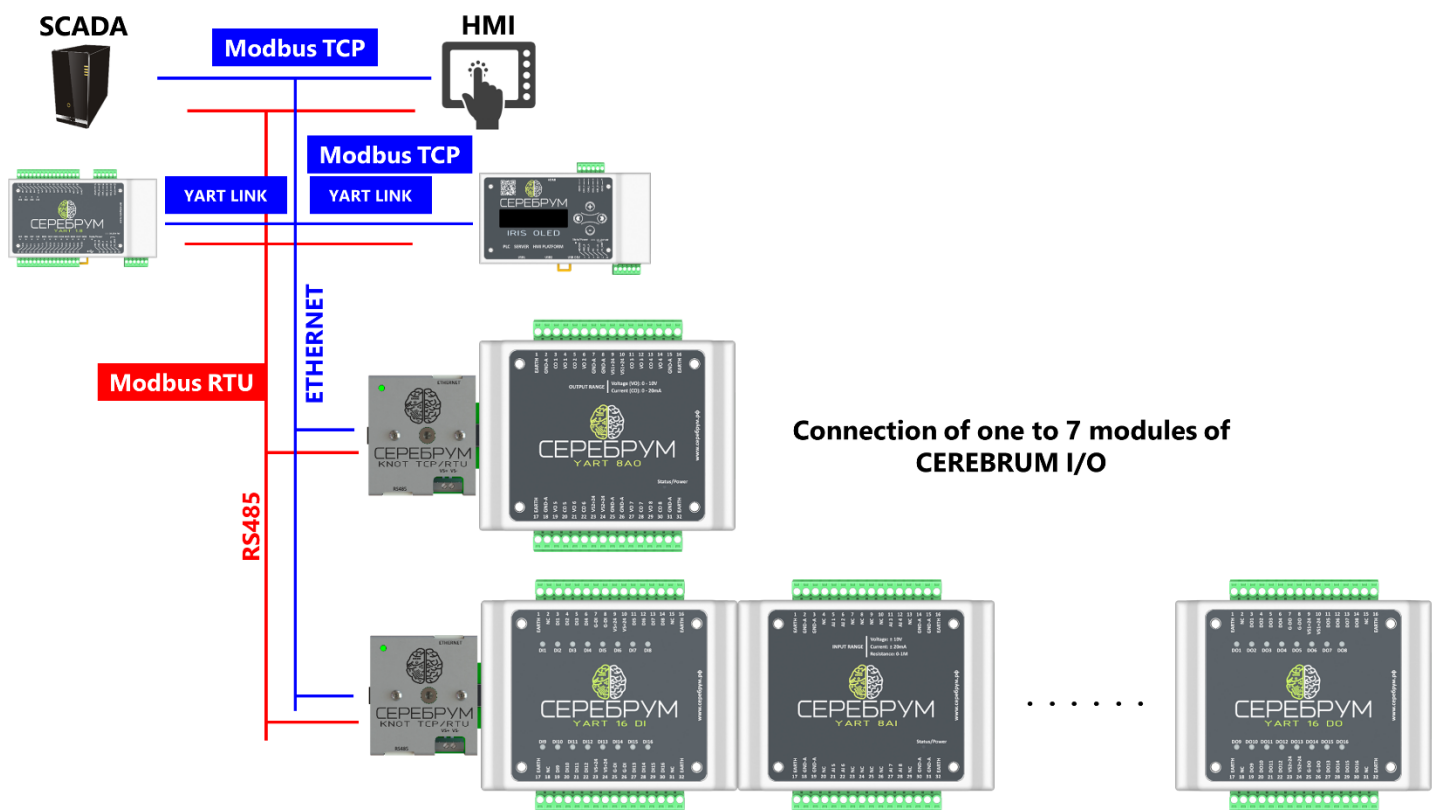
No programming is needed, the required configuration is based on Yart Studio IDE.

Parameter		Value
External Power Supply		15 to 30 VDC
Terminal block connectors type		Screw connection, 16-30 AWG
Programming		YART Studio configuration only

Outputs	Analog	8AO x 8xDAC: 10 bit, dual current / voltage modes
		
		• output voltage 0 +10 VDC
		• output current 0 + 20 mA
		• IEC 61000-4 complient
		• Integral nonlinearity +-2 bit
		• Output error, (max) : - 0.9 %, full scale
		• Resolution 9.7 mV (voltage outputs), 19.5 uA (current outputs);
		• Maximum output current (voltage outputs): 3mA, for 0-10V output voltages
		• Minimum load impedance, (voltage output): 1k Ohm, IEC 61131-2;
		• Maximum load impedance, (current output): 600 Ohm, IEC 61131-2;
		• Full scale settling time, 1 ms, max
		• Output protectio
		   o IEC61000-4-5 (8/20 µs): 35 A
		   o IEC61643-321 (10/1000 µs): 4 A

Communication ports	YART-PORT	Expansion bus, scan time less than 30 ms, total units on bus – 8

Distributed IO

KNOT SMART

Distributed IO Carrier Module: Modbus TCP, Modbus RTU, YART LINK

Smart-KNOT is a distributed IO host unit, capable of carrying up to seven different Yart-BUS IO modules. The unit is connecting to the serial or Ethernet control Fieldbus line.

Modbus TCP/RTU is the first choice, however the Smart-KNOT is also Yart-LINK compatible which helps to use such devices with almost no programming needed. The Yart PLC will automatically detect the online unit and put the read values into a predefined memory area.

During the system operations the corresponding input and output data will be transferred automatically. The only action required is to select one or more available data channels in Yart Studio IDE.

In a case of Modbus communication the unit works as Modbus-Slave with a list of predefined registers representing connected IO modules.

www.serebrum.ru

Parameter		Value
Supply Voltage		11 to 28 VDC
Terminals Type		Screw connection, 16-30 AWG
Communication Ports	Ethernet	RJ-45, 100/10Base-T with auto negotiation. YART-LINK, Modbus TCP Slave
	RS485	Modbus RTU Slave
Indication		LEDs for status and activity
Mounting		35 mm DIN Rail

COMMUNICATION MODULES

NEURO 3G

3G/GPRS/GLONASS/GPS Communication Module
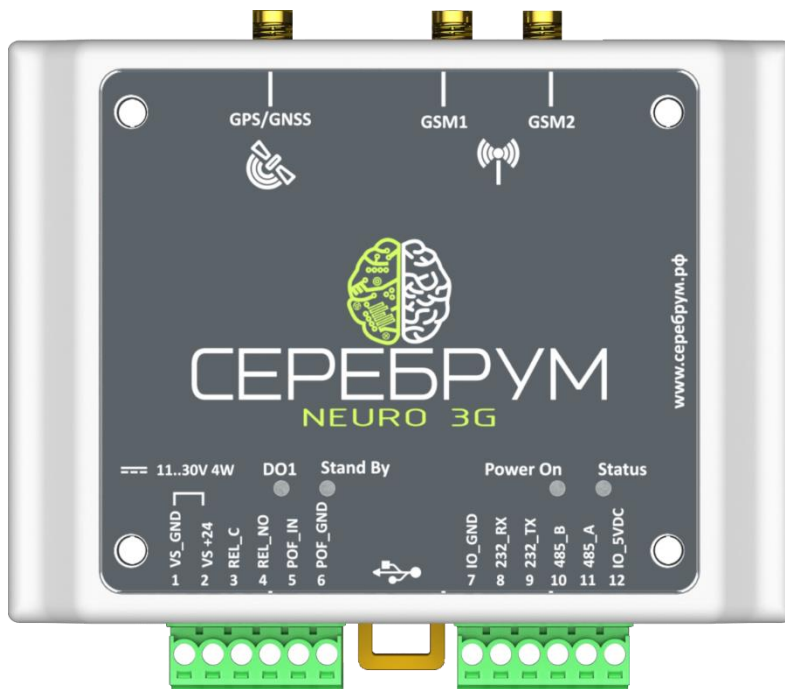
The GSM/GPS/GLONASS NEURO 3G module is an integrated communication module to provide YART and IRIS PLCs Internet telemetry connection. A complex GSM/GPS module inside gives online GPS/Glonass position and time information. These auxiliary positioning data become available in automatic mode whenever the Neuro module connection is established.

The module is designed to support stand alone and PLC operations.

In PLC mode the unit works as an Internet connection module. The connection parameters are only PLC application defined.

A stand alone mode turns the Neuro into a small programmable controller with a rich amount of programming RAM and ROM for LUA applications. The on board RS-485 port can be used for an external Smart-KNOT modules as expansion.

A single 100mA load output solid state relay is also available for immediate action from LUA script.

| Parameter		Characteristics
Supply voltage		12 to 28 VDC, isolated power supply
Terminal block connectors type		Screw connection, 16-30 AWG
Programming		AT Commands, LUA scripting
Memory	Program	60 MB non-volatile memory for program and data
	RAM	3 MB
SIM card		mini SIM
Communication module		SIM5360E
Network standard		GSM
uSD memory card		up to 32 GB for data, LUA scripts accessible
Bands supported		GSM-GPRS 850/900/1800/1900 МГц
Navigation systems		GPS, GLONASS, A-GPS, Cell Location (determining the coordinates by the base stations)
Inputs	Discrete	1DI x 7-28 VDC, for "cold" restart of the module, LED indication, galvanically isolated from the processor circuits
Outputs	Discrete	1DO x solid-state relays, VDC / VAC, up to 100mA, LED indication. Galvanically isolated from the processor circuits
Communication ports	miniUSB	AT, Control, NEMA, LUA
	RS232	Modem port
	RS485	LUA script controllable
Real-Time Clock (RTC)		The accuracy of the stroke at 25 ° C - no more than ± 2 s per day, the course does not last more than 2 hours
RF power	Class 4	2 W EGSM900
	Class 1	1 W DCS1800 0.25 W UMTS 900/2100
AT Comands		GSM 07.07, 07.05, SIMCOM
Data transmition	GPRS	Class 12
	EDGE DTM	Class 12
	HSDPA+	14 Mbps incoming, 5.76 Mbps outgoing
	CSD	Up to 64 Kbps
TCP / IP stack		Built-in, with support for IPv4, IPv6, FTP / SFTP / HTTP / HTTPS / SMTP / POP3

KNOT

YART BUS Topology Expansion Module

I/O CEREBRUM

PLC CEREBRUM

KNOT
splitter
YART BUS
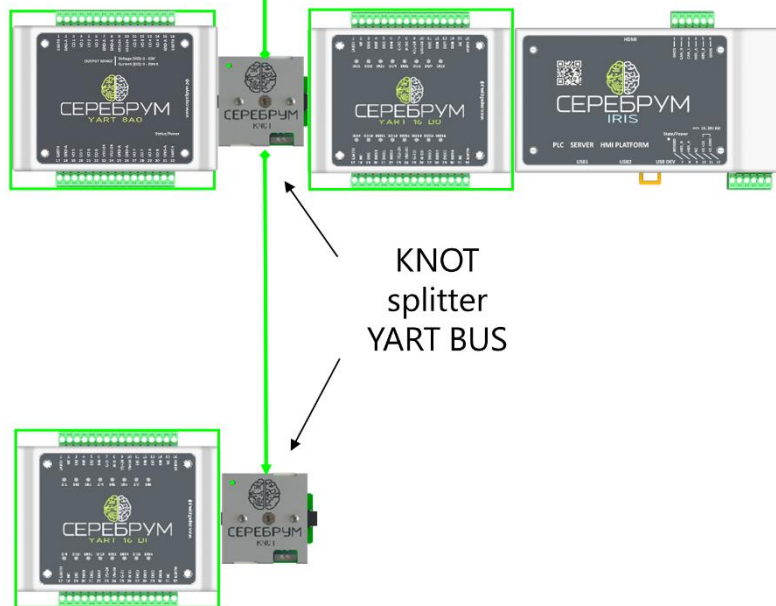
The KNOT module is created to expand YART-Bus network geometry. It is suitable for Yart, IRIS and Green Motion PLCs and a distributed IO Smart-KNOT module.

An installed module helps to adjust the YART-BUS topology inside an electrical cabinet in a most convenient way.

Parameter	Value
Supply Voltage	11 to 28 VDC
Terminals Type	Screw connection, 16-30 AWG
Communication Connectors Type	Two RJ45 connector (RJ45-1 и RJ45-2) for Yart-Bus expansion CAT5 wires.
Indication	LED power state
Mounting	DIN-rail, 35 mm

PLM-2000

Power Line Modem For Street Lighting
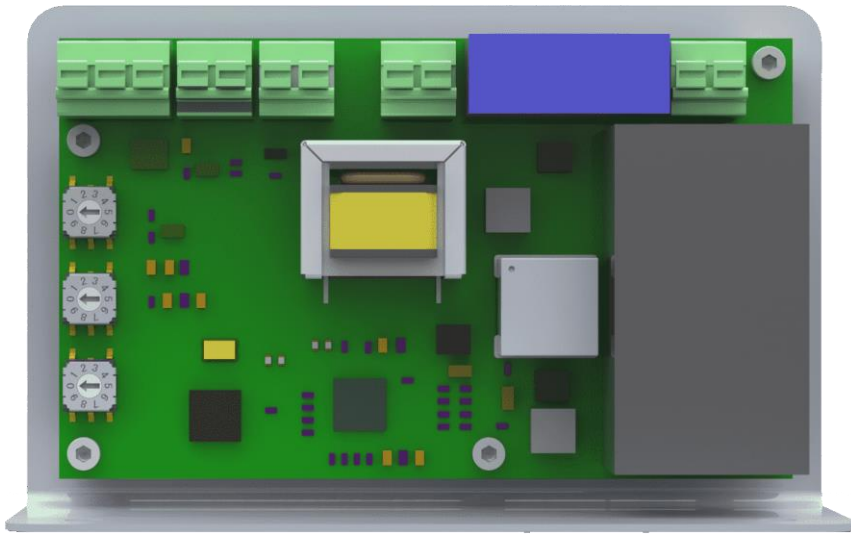
The PLM-2000 power line model is deigned for autated street lighting systems.

The host controller command is transferred over the AC supply line to the remote bulbs/LED controller. On a bulb side the PLM-2000 is receiving the dimming command and sets its PWM or 0-10V control value.

The AC current sensor works as the power feedback to the host controller indicating the bulb operating state. The host PLC algorithm monitors every bulb in the network, sending the diagnosis information in a case of fault.

Features

- Broadcast or daisy chain transmission modes
- Universal output compatible with mode bulb / LED controllers
- On board AC current sensor
- Simple setup
- RS-485 interface for host PLC

Parameter		Characteristics
Purpose		Bidirectional data exchange via the power network (up to 250 V AC /DC RMS)
Supply voltage		100 to 250 VAC VDC RMS
Type of connection		DIP for soldering wires 1 mm2
Programming		Not required
Outputs	PWM	100 Hz 10 V
	Analog	0 - 10 V Voltage Output
Current sensor		1 x 0.1 to 10.0 A, +-10%
Communication ports	RS485	Modbus RTU Slave
PLM	Carrier frequency	70 to 90 kHz
	Output voltage	From 90 to 120 dBµV
	Distance of stable connection	Without retransmission - from 0 to 2000* m * Depends on the quality of the power network
Addressing		Individual, for each modem in the network.

RS485-PLM-RS485

110/220V AC/DC Power Line Modem To RS485 Conversion Modem
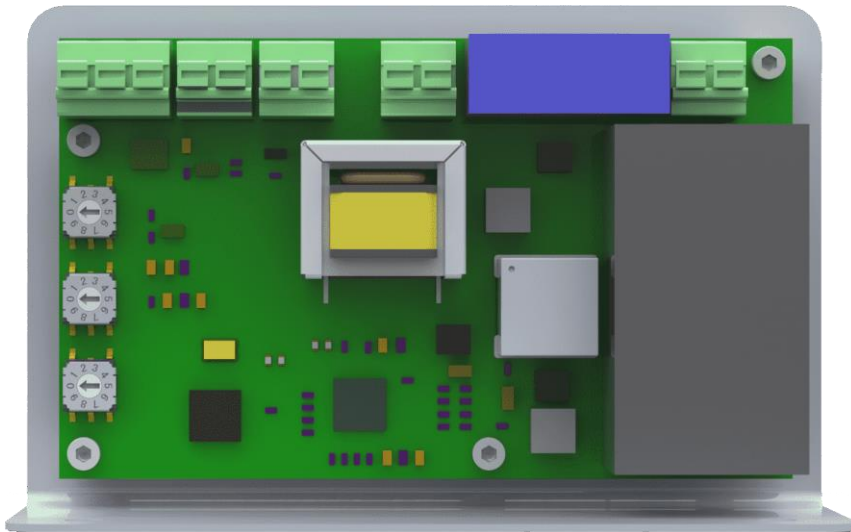
The RS485-PLM-RS485 modem is a data communication device designed to transfer serial RS485 data by the existing local power lines.

It is possible to use both AC and DC lines with voltage up to 250V RMS.

The modem is protocol agnostic, it just retransmits the data being received from the RS485 or power line network. Moreover the RS485 communication parameters may change from side to side turning the modems into protocol converters.

There are up to 16 data communication groups defines to isolate two or more different RS485 network from each other. The group ID is changeable by the on board rotary switch.

The RS485 data must be frame separated with maximum frame length of 200 bytes each. The symbol to symbol delay is interpreted as a frame separator and preprogrammed to be 30 ms.

The solution has been widely used in many field applications that require PLC to IO communications with no physical wiring access availability.

Parameter		Value
IP Rating (IEC 60509:1989)		IP 20
Supply Voltage		80 - 250 V RMS AC/DC
Terminals Type		Screw connection, 16-30 AWG
Programming		Not applicable
Communcation Ports	RS485	1
PLM	Carrier Frequency	от 70 до 90 kHz
	Output Signal Strength	90 to 120 dBuV
	Expected Communication Distance	0 to 2000* meters * depending on line characteristics
Addressing		Individual, rotary switches.