



Green Energy Controller[®]

Product Specification



Jan Ekiel
IoT Oak CEO

Green Energy Controller is used to read data and control power devices operating in photo-voltaic installations.

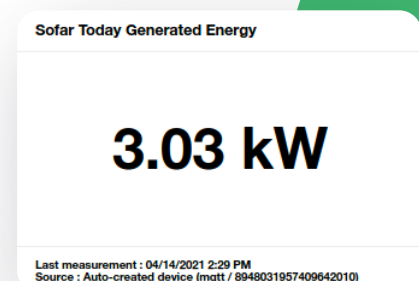
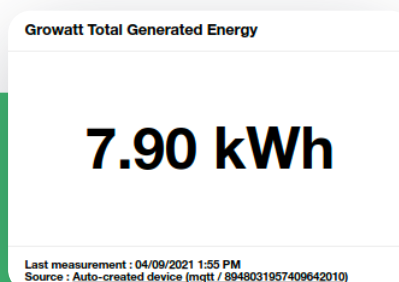
The basic functionality of the device is delivering information about the consumption and production of electricity, controlling its flow, and thus improving a return on investments and providing more effective usage.

This is achieved thanks to communication with inverters cooperating with photovoltaic panels and electricity meters. This enables **a more efficient operation of the photovoltaic system and a faster return on investments.**

The data on the production and consumption of electricity are sent to the server for a further analysis and interpretation. As a result of a long-term analysis of historical data, the user obtains knowledge that enables an effective cost optimization. This process is fully automated and adaptable to the requirements of individual and business customers.

Physical interface collects the data from inverters and energy meters, then data is sent **via RS-485 interfaces using the Modbus protocol.**

Data is collected in both local device's memory and a cloud instance using a direct connection to the Internet. It is implemented using the **LTE CAT-M1 communication modem** installed in the system. The collected data is sent to the cloud using the **MQTT protocol.**



WE SUPPORT VARIOUS
INVERTER MANUFACTURERS

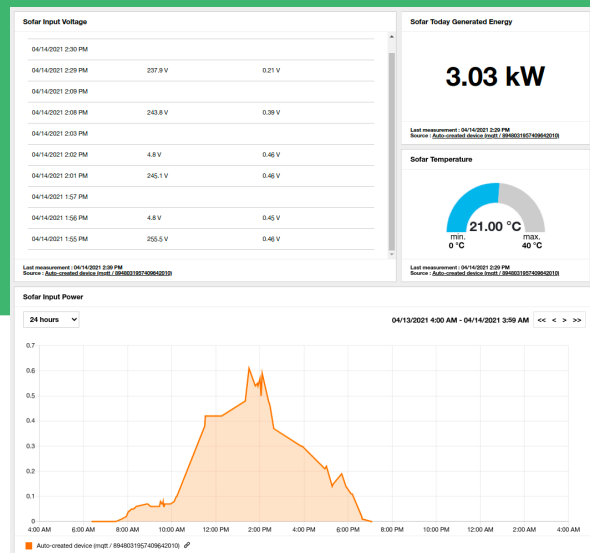
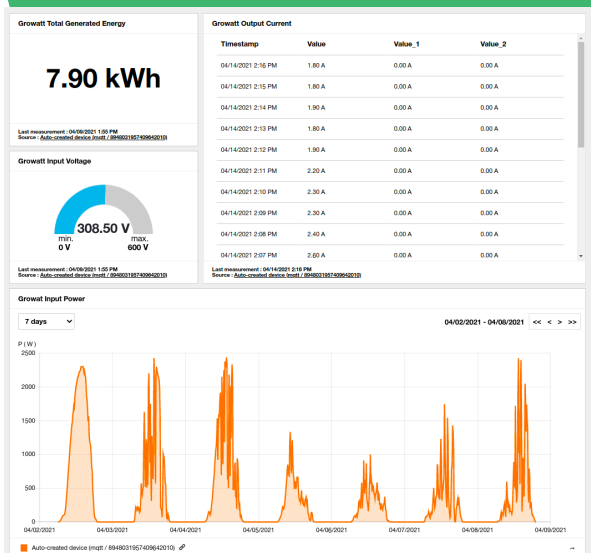


FIG. 1,2 THE CONTROLLER READS ALL THE DATA IMPORTANT FOR ENERGY PROSUMERS DIRECTLY FROM THE INVERTERS AND ENERGY METERS. DATA IS SENT TO THE IOT CLOUD WHERE IT CAN BE ANALYZED AND DISPLAYED

The sent data allows you to remotely manage devices, including checking their status and changing their work configuration. SMS communication is an alternative/fallback configuration channel. The device uses M2M SIM cards dedicated to IoT solutions.

Green Energy Controller is an industrial implementation of SBC (single-board computer). The computer case enables installation on a DIN rail inside electrical switchboards. The

computer has a built-in eMMC memory, which is much more resistant to failures than widely used SD cards.

The IoT Oak Controller was designed to deliver data from devices connected to the IoT cloud using the industrial **RS-485 / Modbus** protocol. The current version supports devices from several manufacturers related to photovoltaics (inverters and energy meters) and connection to any cloud. The team at IoToak

constantly expands the list of supported products and can implement the communication with any device at the customer's request.

The Green Energy Controller has a modern **Quectel LTE modem**, which allows for reliable communication using a narrowband LTE-M link, dedicated to IoT and M2M devices. At the customer's request, we can replace the modem with another communication device, such as a WiFi card or LoraWAN.



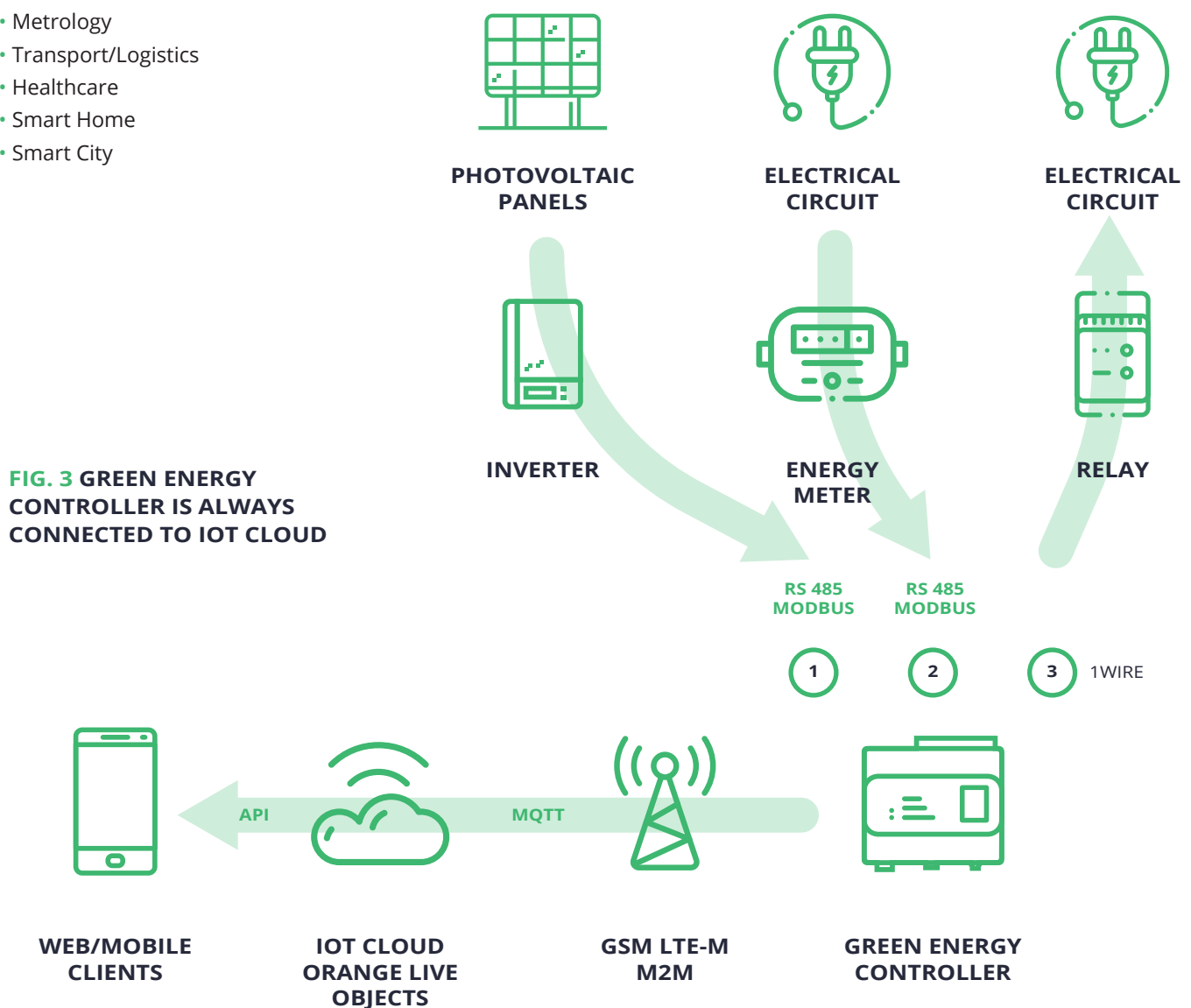
The device housing is mounted on a DIN rail, due to this it could be conveniently enclosed in any electrical switchboard. The software runs under Linux and uses the system's capabilities to ensure high reliability. The device also has several interfaces in addition to the RS-485 ports: **Ethernet, 1-wire, GPIO, USB and HDMI**, which allow extending the functionality. For example, a web interface in a local network, a physical interface in the form of a monitor or control of relays etc.

Use cases in different industry sectors:

- Power engineering
- Industry
- Automation
- Metrology
- Transport/Logistics
- Healthcare
- Smart Home
- Smart City

SPECIFICATION

- **Green Energy Controller®** is an industrial solution resistant to interference, overvoltages and low temperatures.
- Ready-to-use integrated **2x RS-485, GPIO, 1-wire and Ethernet** interfaces do not require any installation of extensions.
- **Linux** operating system with a package of drivers and libraries allows for easy and quick implementation in any programming language.
- The **MQTT** protocol enables quick integration with IoT clouds.
- **Modbus** protocol enables flexible implementation of communication with many devices at the same time in power engineering and industry.
- An integrated **GSM** modem (LTE-M / IoT-MB) enables the use of a computer anywhere with access to the GSM mobile network.
- Removable **miniPCle** communication modules for connecting cards, **WiFi, Lora, Bluetooth** and others.
- Digital interfaces and the **RS-485** port enable control of several relays and other devices.



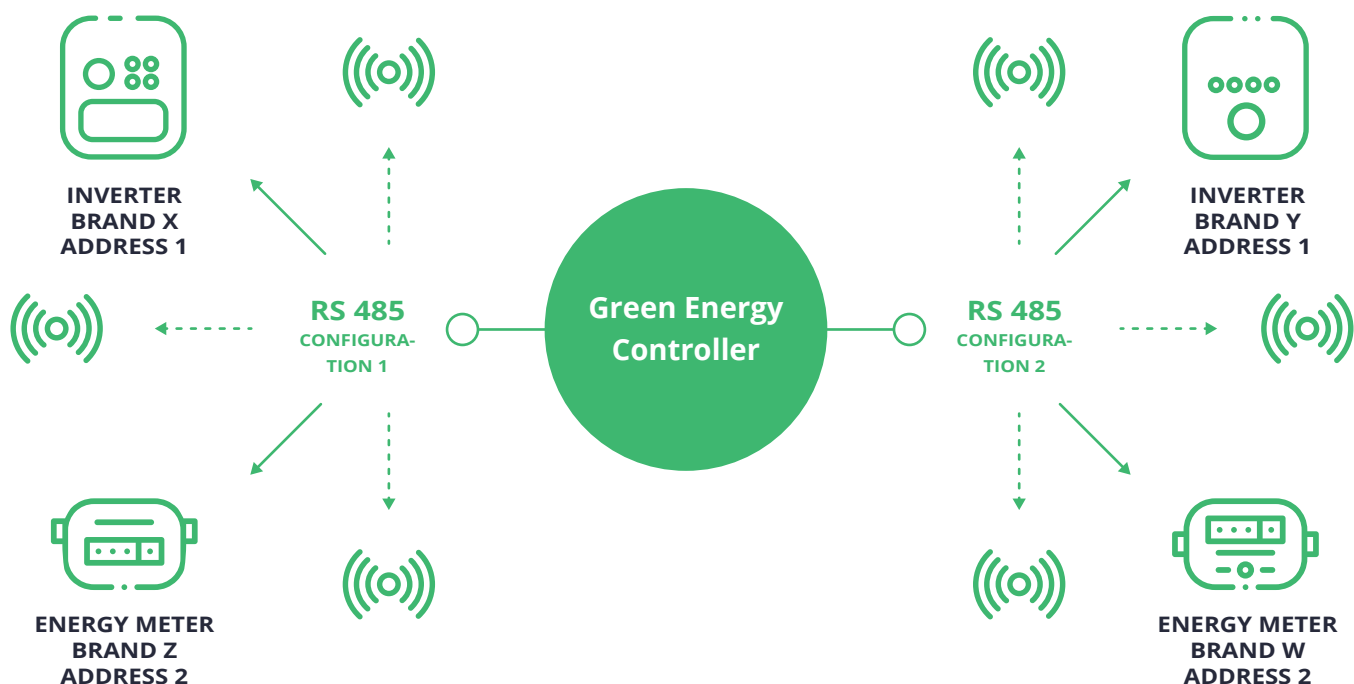


FIG. 4 GREEN ENERGY CONTROLLER COLLECTS DATA FROM MANY DEVICES CREATED BY DIFFERENT MANUFACTURERS AT THE SAME TIME

Specification

Processor Module (Raspberry Pi Compute Module 3+)	<ul style="list-style-type: none"> • powered by Quad-core Cortex-A53 4x1.2GHz processor, 1GB RAM and 4GB eMMC (up to 32GB) on-board. • SOM is used with built-in eMMC „disk“ instead of a SD card to avoid card failures
Modem LTE/GSM	<ul style="list-style-type: none"> • Quectel BG96 LTE Cat M1/NB1/EGPRS Module
Main board features	<ul style="list-style-type: none"> • 4x Digital Input, 4x Digital Output, 4xDIO, 4xAnalog Input • 2 x Serial Ports(RS-232/RS-485) • Ethernet • USB host • mini-pcie slot for replecable LTE/GSM modem • Optionally additional mini-pcie slot for WiFi/other wireless modem. • 1-Wire • 1x CAN

Green Energy Controller

– use cases

Green Energy Controller was built and implemented in collaboration with **Orange Polska** and the **Space3ac Accelerator**.

The computer was implemented within the offering of photovoltaic installations by Orange.

Green Energy Controller also gains popularity among entrepreneurs and institutions who want to monitor and manage their energy consumption, even without using photovoltaic systems.



Case Study of Green Energy Controller's implementation at Orange



IoT Oak Team

The skilled team of **IoT Oak** has a long experience in building integrated solutions. The team of designers and developers implements and maintains IoT systems using embedded devices, websites, utility, Internet and mobile applications.

Along with Smart Energy Controllers, the company offers **design, implementation, development and software services**. Our consultant team supports clients

and partners in building requirements and designing systems. The team of developers takes care of the design of user interfaces, implementation of web applications and client applications as well as quality assurance and project control.

The IoT Oak team provides **system development services, maintenance and DevOps after implementation**.

