



METEL.EU
SECURITY & AUTOMATION

Heating System Controlled by PLC

IPLOG



Increasing energy prices pressure on replacing of old gas boilers with new condensing boilers with higher efficiency. However, for a truly efficient operation it is necessary to guarantee the individual heating of rooms to the optimum temperature depending on the type of workplace and its actual use. Therefore, in these applications we recommend using the PLC together with temperature measurement in all rooms with radiators and controlling radiators with thermoelectric heads. Convenient management of the entire system ensures visualization software.



OpenVPN - An Encrypted Remote Access



LINUX - Long-Term Stable and Open System



LAN - IP Based Solution



COM - Serial Modbus Interface



GSM - Remote Access over 2G / 3G / 4G-LTE



FBD & LD - Graphic Programming Languages

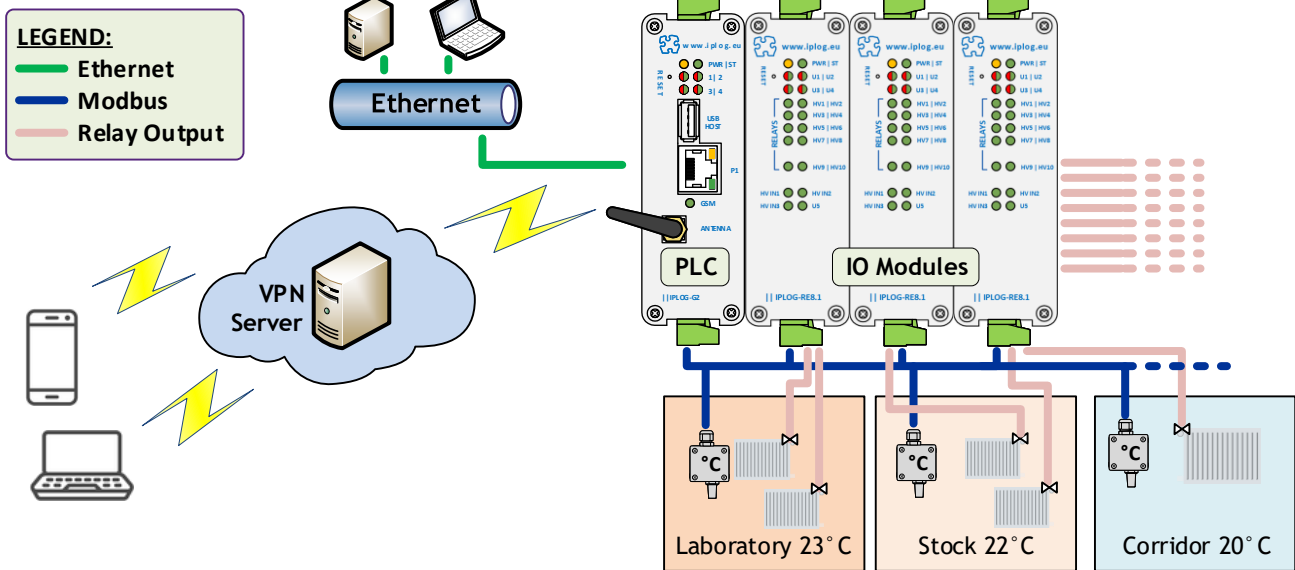


I & O - A Wide Range of Inputs and Outputs



We have used our own production facility to verify that the system is working properly and to derail it. Two obsolete gas boilers and radiators fitted with thermal actuators with manual control ceased to reliable function in 2017. As a replacement, we chose the Vaillant VU INT II 356 / 5-5 condensing boiler. Once the boiler has been put into operation, we have prepared the hardware needed for its management:

- ❖ The PLC IPLOG-G2-05 and three I/O modules RE8.1-05 were installed in the central cabinet
- ❖ The radiators were fitted with 24 VAC controlled thermal heads.
- ❖ Temperatures in all rooms have started to measure IPSEN-T2 thermometers.

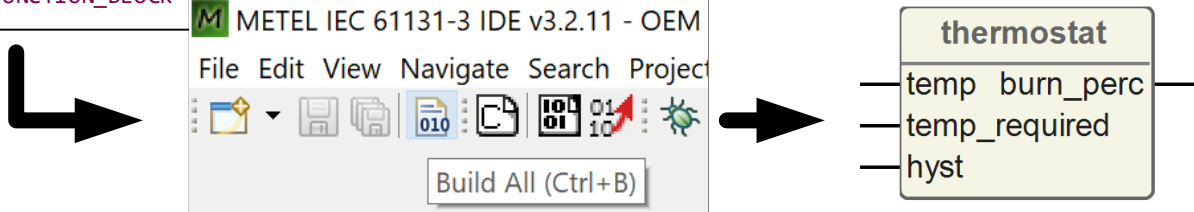


Another challenge was control program. The METEL IDE programming software with hundreds of available functions defined in IEC61131-3 simplifies this task, because also allows you to prepare customized blocks. To create a customized block, simply enter the keyword **FUNCTION_BLOCK** at the beginning of the ST program with the desired name, define constants, variables, inputs, outputs and end the program with keyword **END FUNCTION_BLOCK**. Clicking

```

FUNCTION_BLOCK thermostat
  VAR CONSTANT
    LEVEL_NUM : INT := 5;
    LEVEL_TEMP_STEP : INT := 10;
  END_VAR
  VAR
    (* local vars *)
    LEVEL_SIZE : INT;
    LEVEL_CURR : INT := 5;
    devi : INT;
  END_VAR
  VAR_INPUT
    temp : INT := 210;
    (* temp_is_connected : BOOL
    := TRUE; *)
    temp_required : INT := 210 ;
    hyst : INT := 10;
  END_VAR
  VAR_OUTPUT
    burn_perc : INT;
  END_VAR
  Program
END_FUNCTION_BLOCK
  
```

Build all then generates a function block that can be used in the FB language. In our project, for example we used this procedure to create a function block **thermostat** with inputs **temp** (the current temperature), **temp_required** (required temp.) and **hyst** (hysteresis). Depending on the current input values, the percentage output (how much it needs to heat) is calculated.



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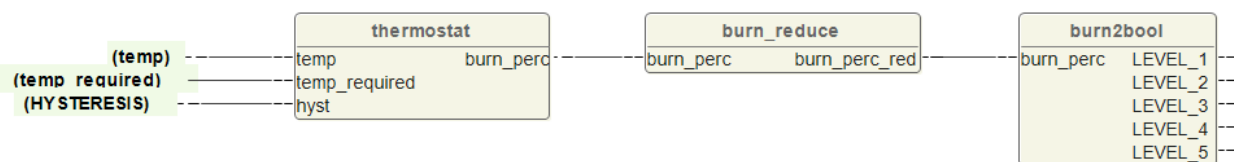
Description of a Typical Application

2G/3G/4G

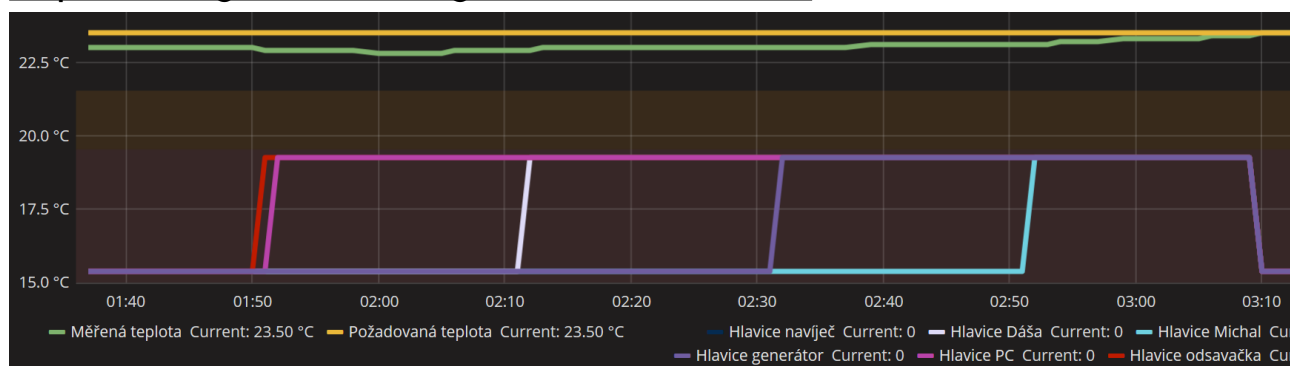
MODBUS

IEC 61131-3

The output from the generic **thermostat** block is recalculated by the **burn_reduce** block. If the expected room temperature increase does not happen, the **burn_reduce** block will correct the calculation. The result is the additional switching on of one or more radiators. The percentage calculated by the **burn_reduce** block converts the **burn2bool** block to the number of radiators to heat.

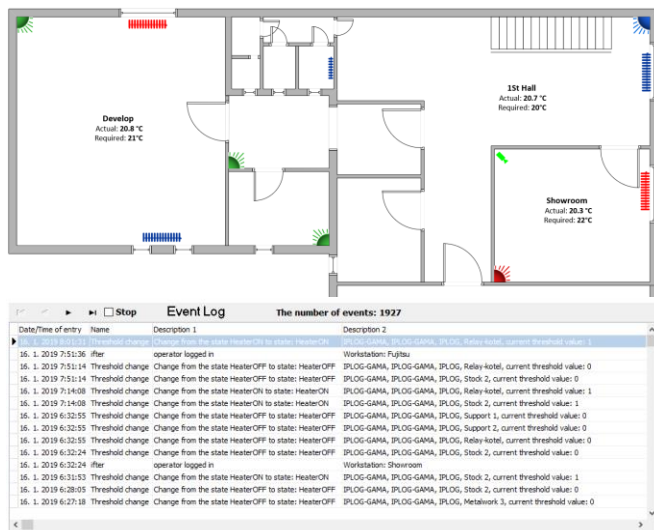


Graph with Progressive Switching ON and OFF of Radiators



In the event there is no demand for heating with at least one radiator, the PLC boiler will automatically switch off. An outdoor equithermal sensor is also connected to the system to help control the boiler's output power depending on the outside temperature.

Other Useful Features






LOGGER - in each such system, it is advisable to know in addition to the current data its history. Therefore, all measured data are stored in a local MySQL database in the PLC and in the visualization software database.

WATCHDOG - block **wdg.fbd** periodically writes value 1 into file. This writing is periodically controlled by a Linux system and in the case of deadlock the program restarts it and informs the relevant person by SMS message.

HARMOGRAMS AND VISUALIZATION - the IFTER-EQU visualization software is used to visualize the whole system and to set schedules to determine when it is warming to daytime temperature and when it is not used at night.

The heating-controlled PLC system has helped greatly reduce the cost of heating. Each room is only heated to the optimum temperature. When not in use, the temperature is automatically reduced, which further increases cost savings. The built-in GSM router provides remote online surveillance and alerts about emergency situations via SMS.

METEL DEVICE	NAME AND CODE	NOTE
Industrial PLC with 2G/3G Modem 	IPLOG-G2-05⁽¹⁾ 5607-0000	PLC unit with 2G / 3G modem, RS485 Modbus RTU bus for connection of external IO modules and sensors, 2x alarm / digital 5 V inputs. ⁽¹⁾ You can configure the PLC with other inputs, outputs, and serial interfaces in the online configurator at http://www.metel.eu/en/iplog-configurator .
Bus IO Module 	RE8.1-05-BOX 5000-0507	Bus IO module with: 8x NO 230V relay outputs, 3x optically isolated 230V inputs, 2x NOC 230V relay outputs, 1x RS485 Modbus port, 2x alarm / digital 5V inputs, operating temperature -40°C to +70°C, 600W integrated overvoltage protections
Bus T/RH Sensor 	IPSEN-TH2-MOD 5-202-283	RS485 Modbus-RTU bus temperature / humidity sensor, temperature: -40°C to +80°C, relative humidity: 0-100% RH, accuracy: ± 0.4 °C / 3% RH (25 °C) , 12VDC

3RD PARTY DEVICES

24V Thermoelectric Heads



The IFTER-EQU Visualization Software



For more information about the applications, visit: <http://www.metel.eu/en/products/success-stories>

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