Slow control software for RACK power supply of gas system of ToF detector

Układ załączający zasilanie pierwotne RACK'ów, systemu zasilania gazem detektora ToF

Project relized during TeFeNICA 2018 program
under supervision of Marek Peryt

Dorota Zielińska, Faculty of Mechatronics, Warsaw University of Technology;
e-mail: dorotaa.zielinska@hotmail.com

In collaboration with Nikita Dunin, JINR, Dubna;
e-mail: nikitadunin@live.ru

Main goal of the project

In every cabinet rack, many electronic devices are going to be placed, thus it is needed to provide power supply firstly for the rack, where the current would be then distributed to those devices.

In order to supply rack with electrical power, dedicated LabVIEW software was designed, which <u>sets the high logic level for relay outputs</u> in LUMEL SM4 device <u>through RS-232 or RS-485 standard.</u>

Initial assumptions of the project

- Available additional power supply of 220 V, 50 Hz

- Interfaces and communication: RS-485, line up to 1200 m

- Controling executed by external unit, such as Laptop

- Software designed on NI LabVIEW platform

List of devices
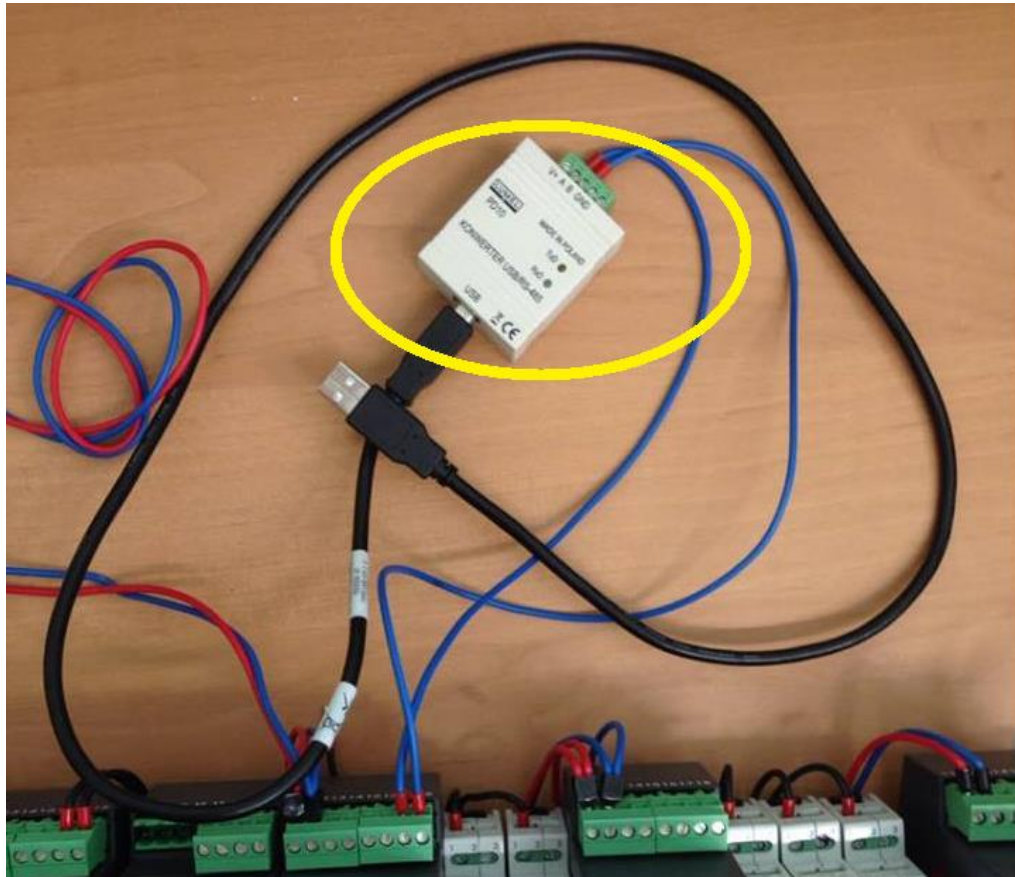
List of devices

- Computer with USB port

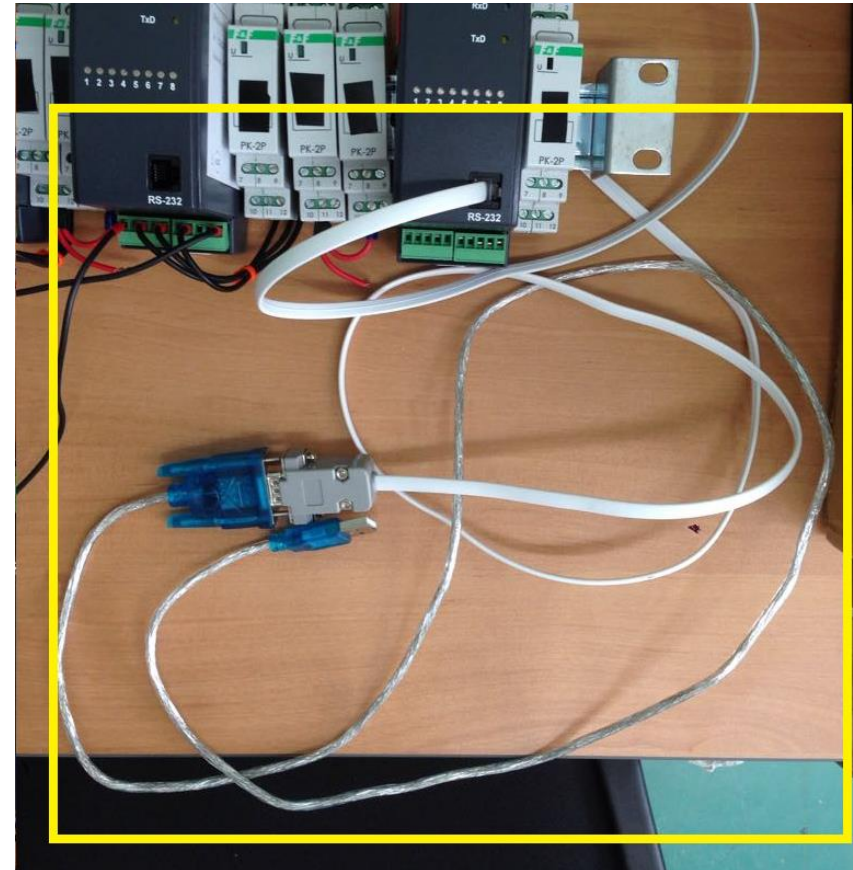- Module of logic outputs LUMEL SM4

List of devices

- LUMEL PD10 converter

(USB to RS-485)

- AOpen-QUST converter (USB – RS-232)

- RS-232 – RJ-11 cable

What is LUMEL SM4?

The SM4 module is a device designed to control simple actuators by assignment of logic states received from the master device through the RS-485 or RS-232 interface.
It has RS-485 and RS-232 interfaces with MODBUS RTU and ASCII transmission protocols.

RS-232 and RS-485 ports are galvanically isolated from output signals and the supply. The module programming is possible by means of the RS-485 or RS-232 port.

In case of the project, the module is used in 4 relay outputs mode with following properties:

-the output 5 V with admissible load capacity 50 mA,

-one can use it to supply external circuits

RS-232 and RS-485 comparison

RS-232

- Connection up to 15 m.
- Good for quick testing and configurating.

RS-485

- Ability of remote control, up to 1200 m.
- Allows to connect directly up to 32 devices on a single serial link.
- Good stability

MODBUS RTU request in general

1st	**11**	Device ID
2nd	**03**	Function Code (Analog Output Holding Registers)
3rd	**006B**	Address of first register in HEX
4th	**0003**	Number of registers in HEX
5th	**7687**	CRC (Check sum)

| Code	Meaning
01 (01h)	Readout of n-bit registers
03 (03h)	Readout of n-registers
04 (04 h)	Readout of n-input registers
06 (06 h)	Write of a single register
15 (0Fh)	Write of n-bit registers
16 (10h)	Write of n-registers
17 (11h)	Identification of slave device

MODBUS RTU library

Modbus is a de facto standard for industrial communication which supports both serial- and TCP/IP-based communication. The core of the protocol consists of a function code (read or write) and data (what to read, what to write).

This library allows for low-level access to core function set and provides an API which includes both master (client) and slave device (server) functionality.

Used functions of MODBUS Library

Create Serial Master VI - Creates a standard serial master. The transmission data unit used by the device is defined by the serial type input
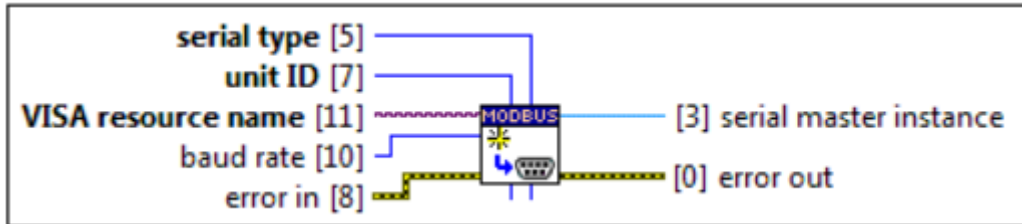

Write Multiple Registers VI - writes registers to write starting at starting address to the device holding registers
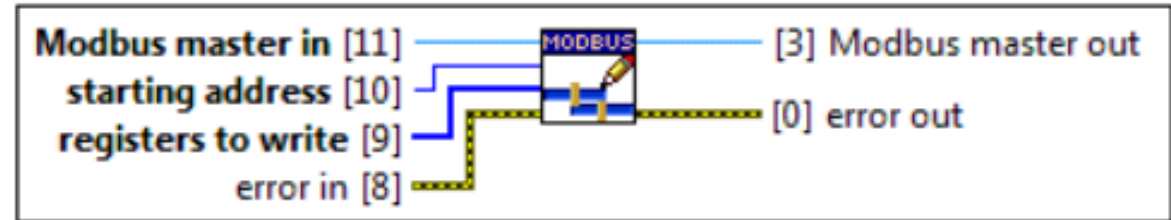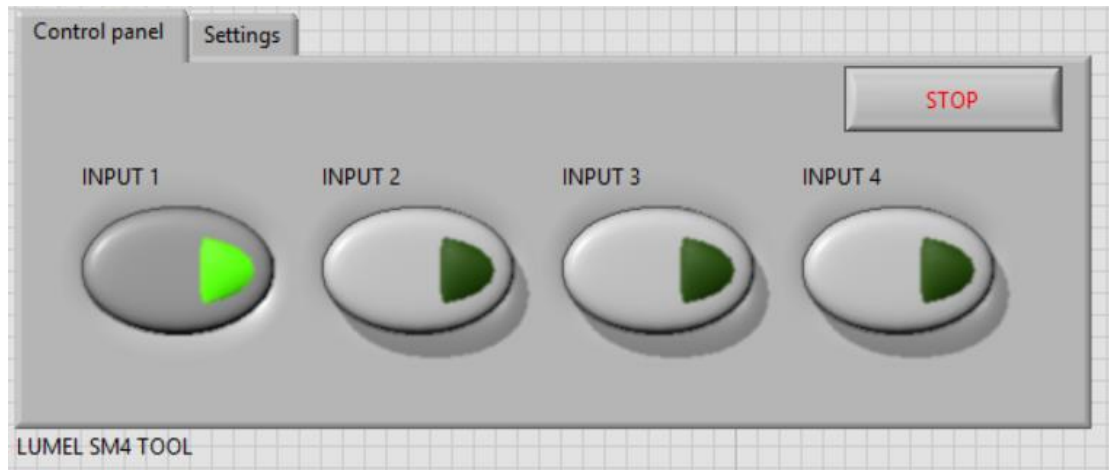

Shutdown VI - Performs any actions needed to shutdown and clean up the Modbus instance provided. For a Modbus master, this requires closing the connection to the physical bus.

Structure diagram for RS-485 interface written in 'G' language in LabVIEW 2018
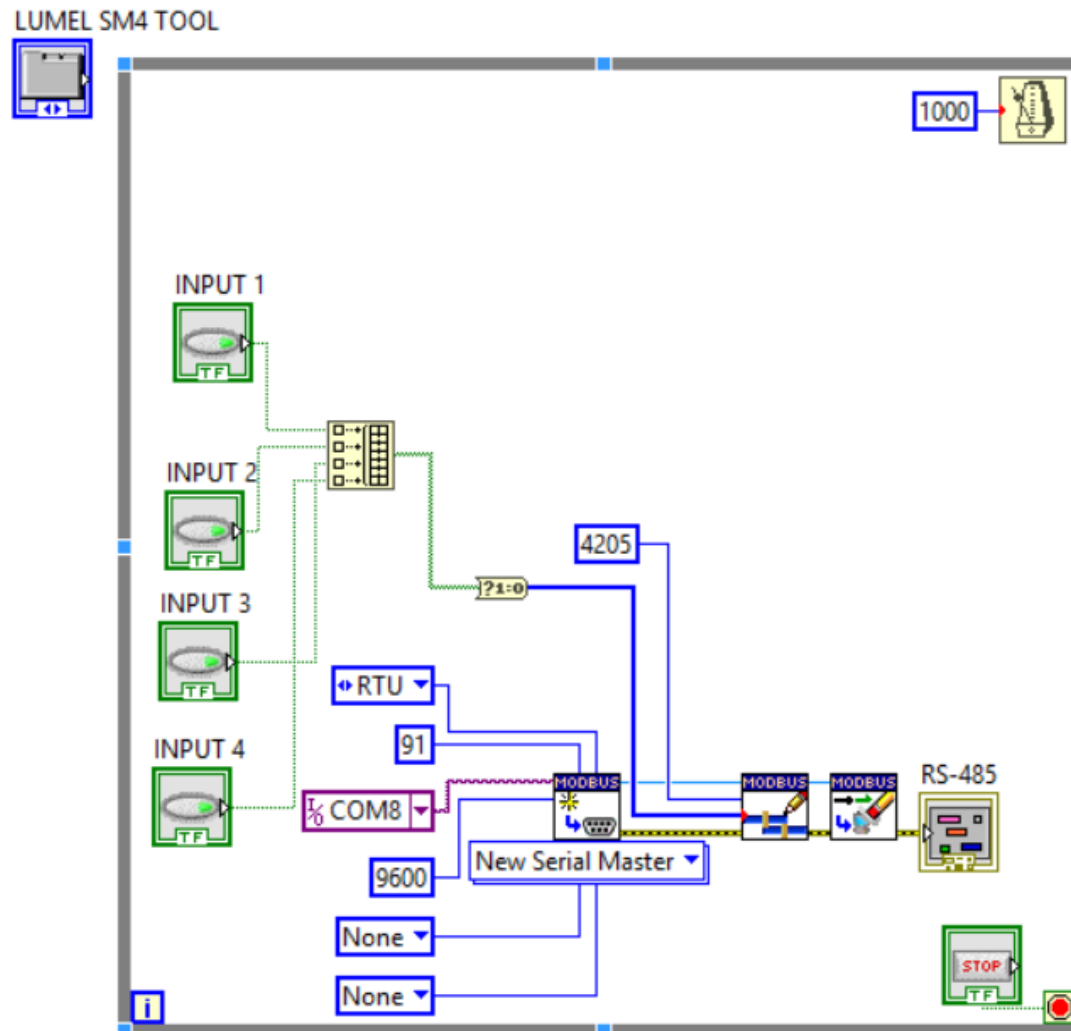
Control panel

Error handler

Byte request through RS-232 interface

In order to set a high logic level for output 1, a special request should be sent:

01 0F 08 98 00 01 01 03 4E02

where **01** is the address of device,

0F is the function code (*Force Multiple Coils*),

0898 is the address of the register,

0001 is the number of registers,

01 is the number of bytes,

03 is the value written to the register,   **4E02** – checksum (CRC)

Similarly, for output 2:   010F 0898 0002 0103 BE02

For output 3:   010F 089A 0001 0103 37C2

For output 4:   010F 089A 0002 0103 C7C2

Request for switching off (no checksum): 010F 0001 001A 85C0

Request for device identification: 0111 C02C

Byte request through RS-232 interface
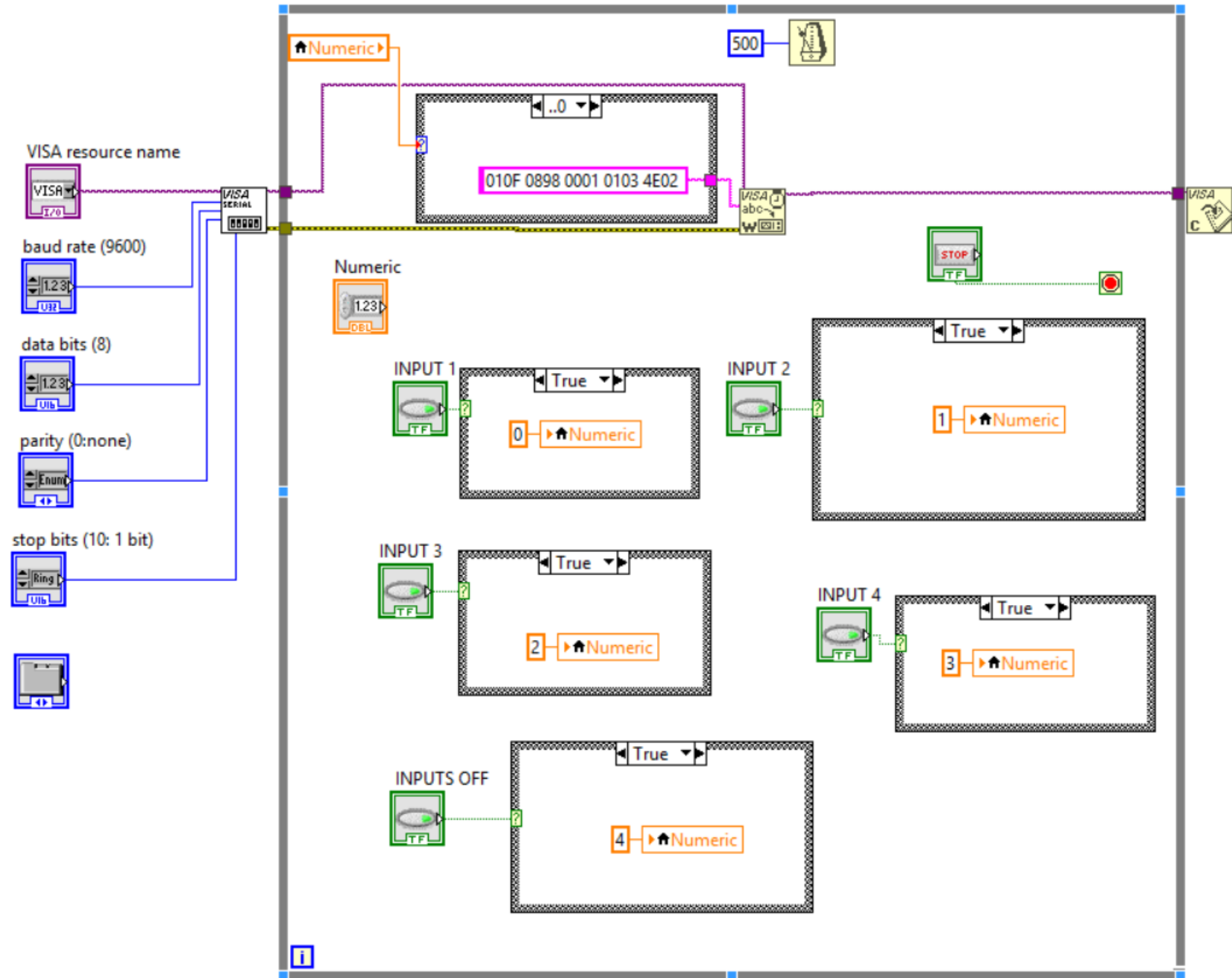
Similarly, for output 2:   010F 0898 0002 0103 BE02

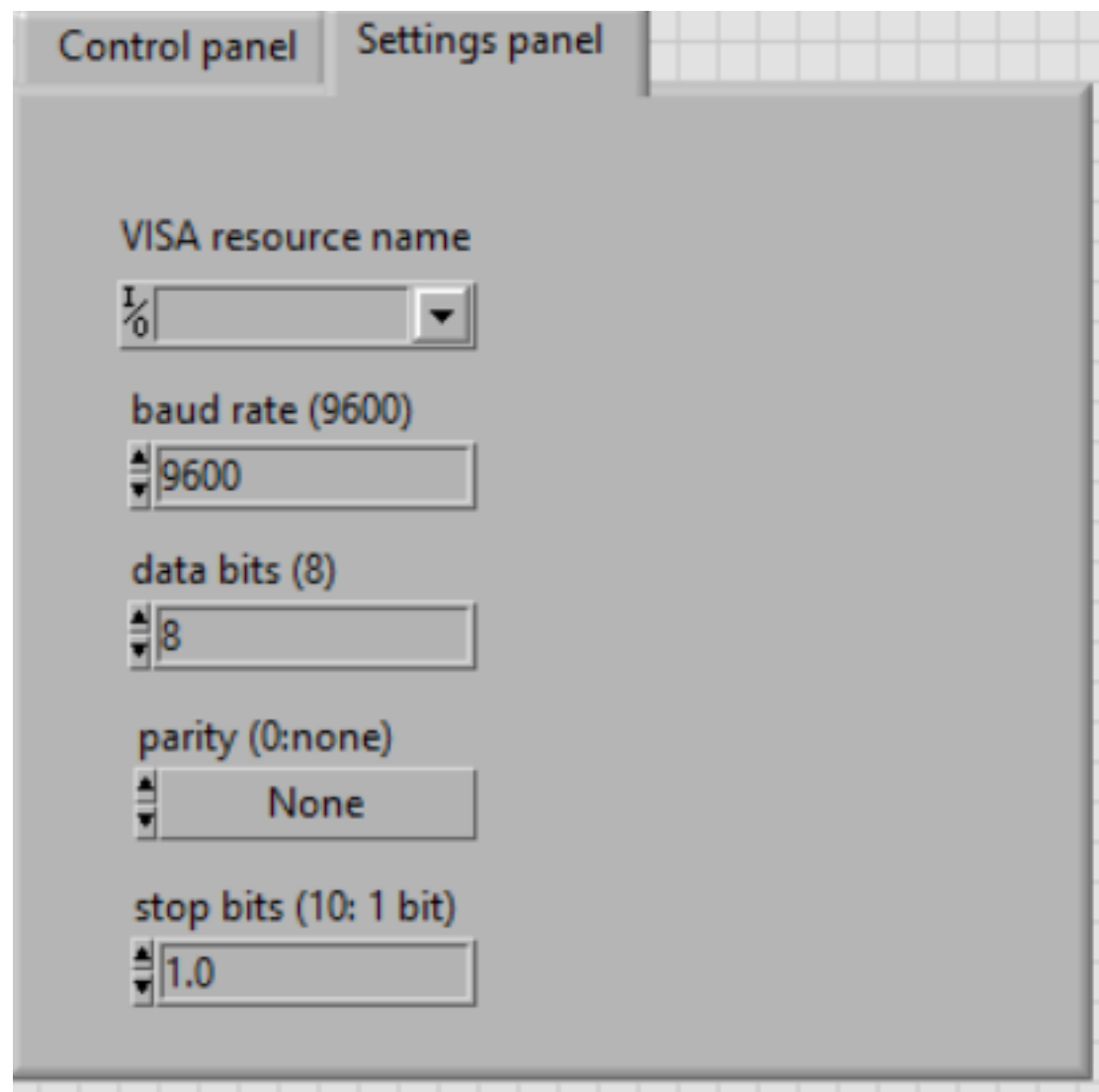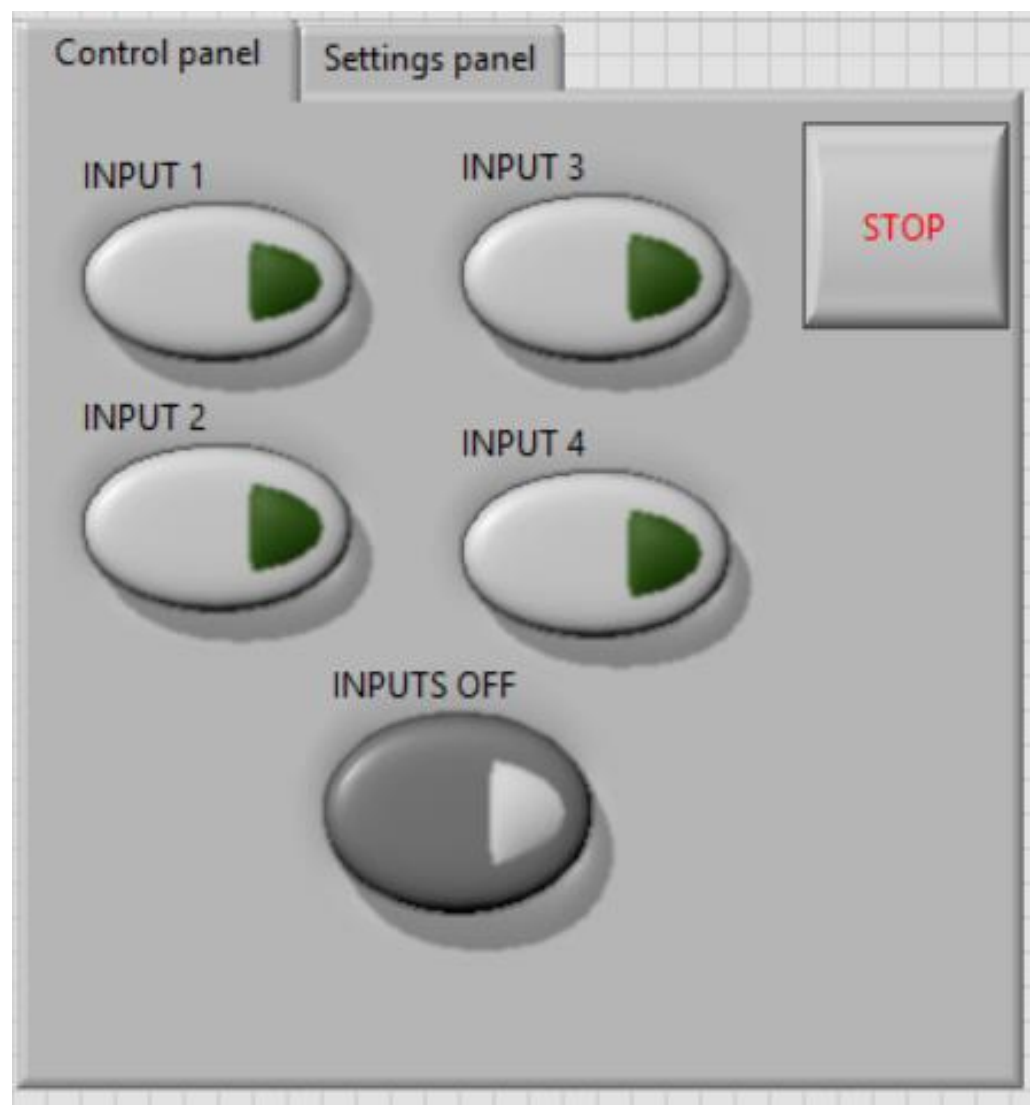 For output 3:   010F 089A 0001 0103 37C2

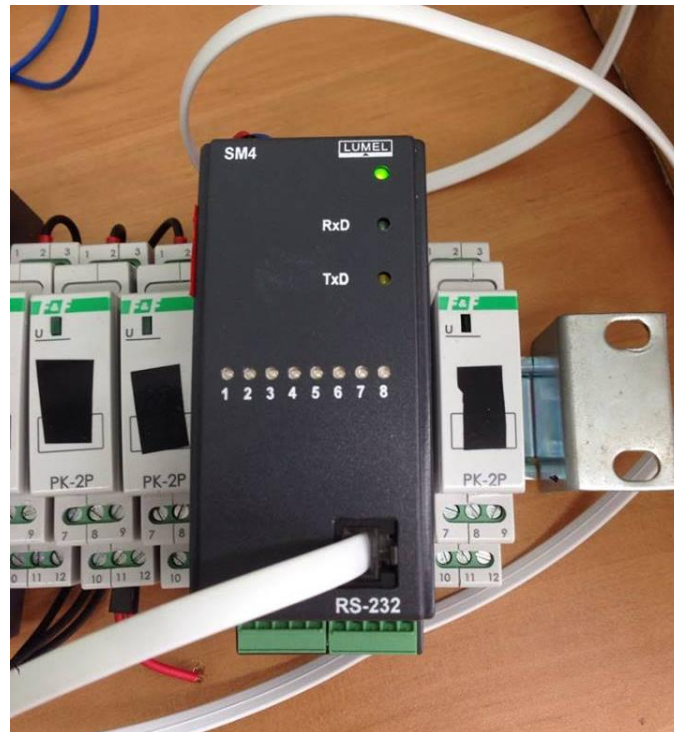 For output 4:   010F 089A 0002 0103 C7C2

Request for switching off (no checksum):   010F 0001 001A 85C0

Request for device identification: 0111 C02C

Structure diagram for RS-232 interface written in 'G' language in LabVIEW 2018

Control panel | Settings panel

INPUT 1

INPUT 3

STOP

INPUT 2

INPUT 4

INPUTS OFF

Control panel | Settings panel

VISA resource name

baud rate (9600)

9600

data bits (8)

8

parity (0:none)

None

stop bits (10: 1 bit)

1.0

Thank you for your attention