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Modbus communication for DEGA UPA III control panel

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Version record

Version	Description	Date	Worked out by
A	First edition of the document	28.2.2017	E. Jakuba
B	Addition of 40100 register description (configuration data)	26.4.2019	T. Kupilík
C	Added chapter of Modbus RTU specification	8.8.2019	T. Kupilík
D	Addition of the 411xx register map	27.8.2019	T. Kupilík
E	Addition of the easymodbus program	24.9.2021	Willow

Setting the control panel to ModBus RTU mode

The control panel is set to the ModBus RTU communication mode on the "RS485_HOST" channel using a jumper installed on a jumper marked "JP4" or "RFU # 1". The actual address for addressing the ModBus device on the RS485 bus is identical to the address set for the Dega communication protocol.

Modbus RTU specification

Node type	Slave
Baud rate	9600
Data bits	8
Stop bits	1
Parity	none
Address	To be set in DegaConfig
Protocol	RTU
Supported function code	3 – read holding register
Broadcast	No

What UPA III will respond to

The control panel is always slave in communication, it only answers questions. The control panel implements ModBus RTU instruction 03H, read holding registers from slave station. Always observe the required number of registers when querying. The specified registry address calculates with an offset of 40001 by default, as specified on the page http://www.simplymodbus.ca/FC03.htm, which means that address 0 is physically transmitted in the ModBus packet for register address 40001.

As of version 21, it is possible to read data from any address of any length. A maximum of 125 registers can be read with one instruction. The value 0EEEEH is read from addresses where no register is implemented.

The individual registers contain the following data:

40001 Returns name, firmware, SN in ASCII, e.g. "UPAIII, 13,15000000001" contains 11 registers

40100 Returns the transmitter configuration. Each transmitter occupies 10 registers (transmitter number 1 occupies registers 40100 to 40109), transmitters 1 to 32 correspond to digital transmitters, and transmitters with numbers 41 to 48 correspond to analog transmitters). Transmitters 33 to 40 do not exist and zero data is returned

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instead.

41000 Returns the temperature of the external temperature sensor, if installed in tenths of °C, 1 register

41002 Returns the status of the control panel, 1 register

41010 Returns the current time in Linux format, 2 registers (higher, lower word).

41100 Returns the value and status of transmitters connected to the control panel and unconfigured, a total of 80 registers (2 registers per transmitter).

41200 Returns the values of temperature sensors in all transmitters, a total of 96 registers (3 registers per transmitter).

Data format in registers 40100

Contains configuration data for channels 1-32 (digital transmitters) and 33-48 (analog channels). The units of values in the register correspond to the units of data in register 41100 (the same divisor is applied to them). For each channel, the structure of the 10 registers is as follows:

Register	Description
+0	upper byte: transmitter address on the RS485 bus (== channel number); Analog channels here have 0. lower byte: is the sensor ID (type of detected gas)
+1	dead zone
+2	transmitter alarm offset
+3	alarm1 – concentration value for alarm1
+4	alarm2
+5	alarm3
+6	alarm4
+7	range_min (0)
+8	range_max – channel detection range (max indicated channel value)
+9	upper byte: divisor – is either 10 or 100 according to the channel range (range_max) and also corresponds to how the value is divided in register 41100. UPA natively stores values as [units * 1000] – 1000 therefore corresponds to 1DMV / 1PPM => applies divisor and the value is sent to modbus. Bottom byte: 0

It is possible to read only a part of registers. If the superior system requests e.g. 4 registers from address 40100, the control panel sends only 4 registers.

Register data format 41100

This instruction is sufficient for reading the detected concentrations, it is not necessary to download the configuration for the customer, etc.

A total of 40 sensors are transmitted, each sensor having 4 bytes reserved. It is up to the user of the protocol interface to download only the channels he needs. Channel 1 has bytes 1 to 4, channel 2 uses bytes 5 to 8, channel 32 125 to 128. For analog channels, the sequence is continued, i.e. bytes 129 to 132 correspond to channel 41, and finally bytes 157 to 160 belong to channel 48. These 4 bytes are divided into 1st and 2nd pair. Pair 1 represents the detected channel concentration. Here it depends on the detection range. If the detection range is numerically greater than 99 (e.g. detection of CFCs, carbon monoxide, ammonia), the value is in tenths of the actual concentration, e.g. 1234 represents a concentration of 123.4 ppm. If the detection range is less than 99 (all flammable gases,

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oxygen, chlorine, …), the value in hundredths of the actual concentration, e.g. 5678 represents a concentration of 57.78% DMV. The meaning of the 2nd pair is a bitmap of the transmitter status.

```
ds_state_none = 0,          // transmitter is OK, measures value below limits
ds_state_alarm1 = 1,        // first alarm level (e.g. for explosive gases 5% DMV)
ds_state_alarm2 = 2,        // 10% DMV (lower explosion limits)
ds_state_alarm3 = 4,        // 15% DMV
ds_state_alarm4 = 8,        // 20% DMV
ds_state_pel1 = 16,         // PEL time average exceeded
ds_state_pel2 = 32,         // short-term time average STEL exceeded
ds_state_calib12 = 64,      // more than 12 months have passed since the last calibration
ds_state_overflow = 128,    // transmitter measuring range exceeded
ds_state_error = 256,       // transmitter error (does not communicate with the control panel or
                               the transmitter has a fault)
```

It is true that several bits can be activated at the same time.

Channel data register map

Modbus address	Modbus register	Dega channel (address)	Type	Name	Description
1099	41100	1 (digital 1)	INT16	Concentration	Measured concentration, digital channel 1
1100	41101		WORD	Status	Channel status (bit flags)
1101	41102	2 (digital 2)	INT16	Concentration	Measured concentration, digital channel 2
1102	41103		WORD	Status	Channel status (bit flags)
…					
1161	41162	32 (digital 32)	INT16	Concentration	Measured concentration, digital channel 32
1162	41163		WORD	Status	Channel status (bit flags)
1163	41164	41 (analog 1)	INT16	Concentration	Measured concentration, analog channel 1
1164	41165		WORD	Status	Channel status (bit flags)
…					

Register data format 41200

Contains data read from digital sensors (32 sensors). Each sensor occupies 3 registers (sensor 1 from address 41200, sensor 2 from address 41203, etc.). The first register contains the status of the temperature sensors in the transmitter. The second register contains the temperature in the gas sensor, which is inserted in the transmitter, and the third register contains the internal temperature of the transmitter processor.

Registry data format 41002

The instruction returns a bitmap in a higher byte format:

```
Temp1 = 0x01          // 1st stage temperature alarm exceeded
Temp2 = 0x02,         // 2nd stage temperature alarm exceeded
```

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TempError = 0x04,	// temperature sensor error
Deluge = 0x08,	// flood detected
DelugeError = 0x10,	// flood transmitter error
Disabled = 0x20,	// the control panel is in service mode or in output testing mode
HilaAlarm = 0x40	// at least the 1st alarm level has occurred since the user time was reset

Example

EasyModbus.exe can be used to test the communication
https://sourceforge.net/projects/easymodbustcp/

Below is an example of communication with the control panel – reading data from the 40001 register:
Set the Starting Address to 1 (corresponds to register 40001) and Number of values to 11.

To verify the correctness of the communication, it is verified, for example, by the serial number – 31 32 33 34 35 36 37 38 39 30 31 in hex corresponds to the serial number 1234567891