User Manual

PolyGard®2 DGC6
Digital Gas-Controller-Series GC-06 Modbus

Modbus Supplement

December 09, 2022 – *Revision*

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1 General

1.1 Safety

The operating instructions must be carefully read and followed by all persons who install, use, maintain and check the product.
The product can only fulfill its intended functions if it is installed, used, maintained, cared for and checked in accordance with the instructions provided by INTEC Controls | MSR-Electronic GmbH.

1.2 Responsibility Installer and Operator

It is the responsibility of the installer and operator to ensure that all PolyGard®2/PolyXeta®2 equipment is installed and used in compliance with all national and local codes. The device must be checked for correct installation and functionality by a qualified person before measurement operation is started. In Germany, BGR 500 Chapter 2.33 must be applied for this purpose.
The PolyGard2 devices are tested for function by the manufacturer before delivery. During commissioning, a documented functional test is also required. The installation should only be carried out by trained installation technicians, taking into account the current safety procedures for control installations.
The required equipotential bonding connections (also e.g. secondary potential to ground) or grounding measures are to be carried out according to the respective project regulations. It must be ensured that no ground loops are created in order to avoid undesired interference in the measurement electronics.
It is necessary to follow all instructions as well as the user documentation.

1.3 Maintenance

It is recommended that PolyGard®2/PolyXeta®2 equipment be inspected on a regular basis. Performance deviations can be corrected based on regular maintenance. Recalibration and parts replacement can be performed in the field by a qualified technician using the appropriate tools.
Alternatively, the easily removable, plug-in sensor head can be returned to INTEC Controls | MSR-Electronic GmbH for service.
Regular maintenance is to be carried out according to the instructions.

1.4 Limited Warranty

INTEC Controls | MSR-Electronic GmbH does not assume any liability in case of improper or incorrect use of the de-vice. The installer and operator are exclusively responsible for the design and use of the product. If the product is not used, maintained or repaired in accordance with the instructions for use, warranty and product liability claims as well as claims arising from any guarantees assumed by INTEC Controls | MSR-Electronic GmbH for the product will be forfeited. INTEC Controls | MSR-Electronic GmbH warrants PolyGard®2/PolyXeta®2 devices against defects in material or work-manship for a period of 2 years (1 year for sensors) from the date of shipment. Should a defect in material or workmanship occur during the warranty period, INTEC Controls | MSR-Electronic GmbH will repair or re-place the unit at its option. This warranty does not apply to units that have been modified, after repair attempts, or that have been damaged unintentionally or intentionally. The warranty also does not apply to units in which the sensing element has been poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

A pre-authorized RMA number issued by INTEC Controls is required for returns.

This warranty applies only to PolyGard®2/PolyXeta®2 units. INTEC Controls | MSR-Electronic GmbH is not liable for consequential damages resulting from the purchase or use of PolyGard®2/PolyXeta®2 devices.

1.5 Dispose of Device

In accordance with Directive 2012/19/EU, the device must not be disposed of as municipal waste. Return the device for disposal to your national sales organization, which you can contact if you have any questions about disposal.
Outside the EU, you have to consider the corresponding directives.

2 Serial Modbus Interface at the X-BUS

This functionality is available from display version 1.00.06 on. The standard protocol for an additional serial port of the gas controller X bus is ModBus RTU.

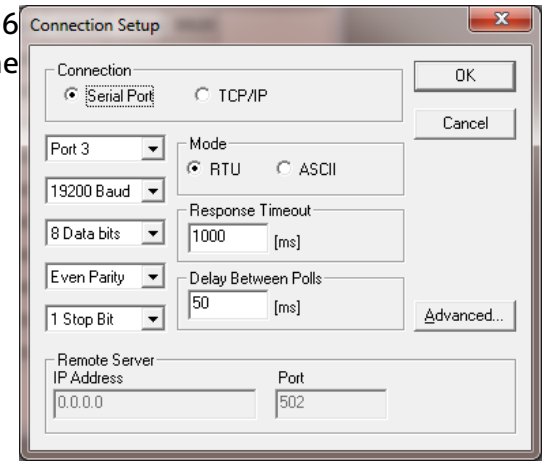


Figure 1: Connection Setup

Definition of communication
The gas controller operates at the interface X bus only as **Modbus slave**.

Baud rate 19,200 baud
1 start bit, 8 data bits
1 stop bit, even parity

Modbus-Master-Controller:
The Modbus master controller must have a resistor matrix at the fieldbus terminals as shown in the drawing on the right, so that the voltage level is maintained at min. 0.5 V at bus pin A when the driver is inactive. The resistor circuitry is already integrated in a Modbus master controller.

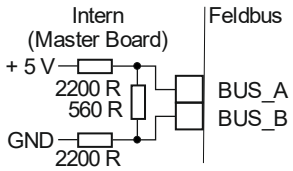


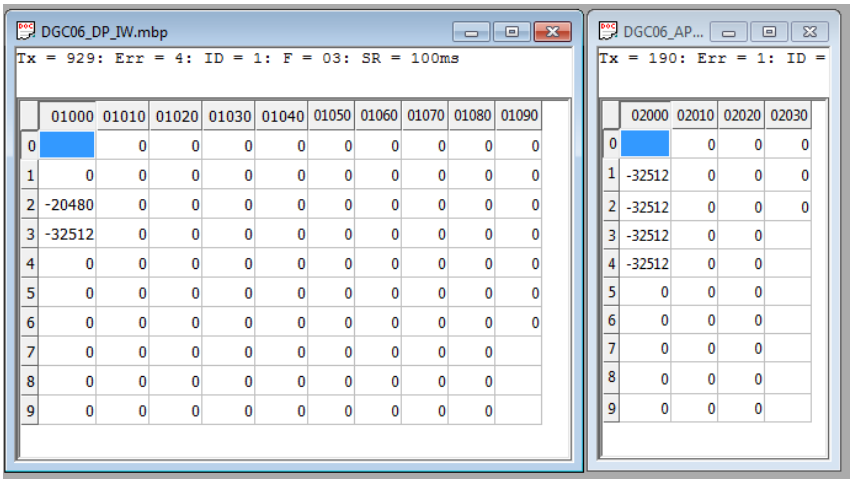
Figure 2: Modbus-Master

3 Modbus Function 03 (Reading of Registers)

Read Holding Registers (reading of holding registers) is used to receive data from the DGC-06 system. There are 9 data blocks:

3.1 Current value of digital sensors – sensor addresses 1–96, Modbus register addr. 1001–1096

3.2 Current value of analog sensors – sensor addresses 1–32, Modbus register addr. 2001–2032



	01000	01010	01020	01030	01040	01050	01060	01070	01080	01090
0		0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	-20480	0	0	0	0	0	0	0	0	0
3	-32512	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	

	02000	02010	02020	02030
0		0	0	0
1	-32512	0	0	0
2	-32512	0	0	0
3	-32512	0	0	
4	-32512	0	0	
5	0	0	0	
6	0	0	0	
7	0	0	0	
8	0	0	0	
9	0	0	0	

Figure 3: Current value of analog sensors – sensor addresses 1–32, Modbus register addr. 2001–2032

Representation of measured values:
The measured values are shown in the Integer format with a factor of 1, 10, 100 or 1000.

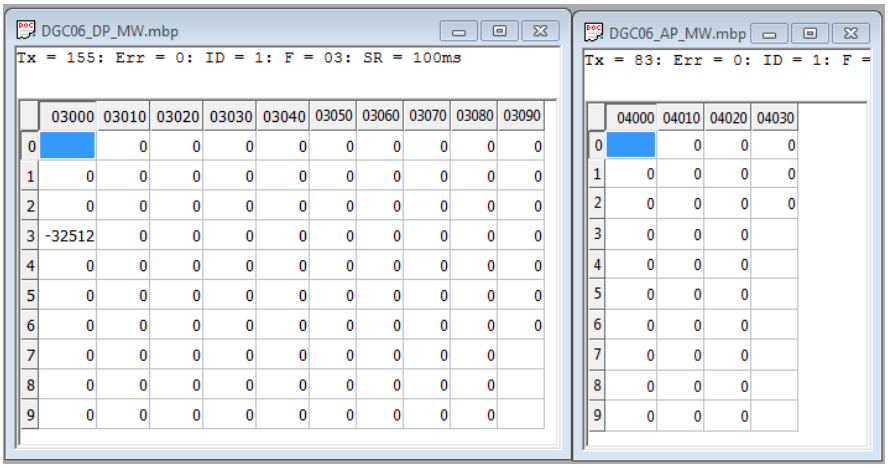
The factor depends on the respective measuring range and is used as follows:

Measuring range	Factor
1–9	1000
10–99	100
100–999	10
Ab 1000	1

If the value is below -16385, it is an error message and should be considered as a hexadecimal value in order to break the errors down.

3.3 Average value of digital sensors – sensor addr. 1–96, Modbus register addr. 3001–3096

3.4 Average value of analog sensors – sensor addr. 1–32, Modbus register addr. 4001–4032



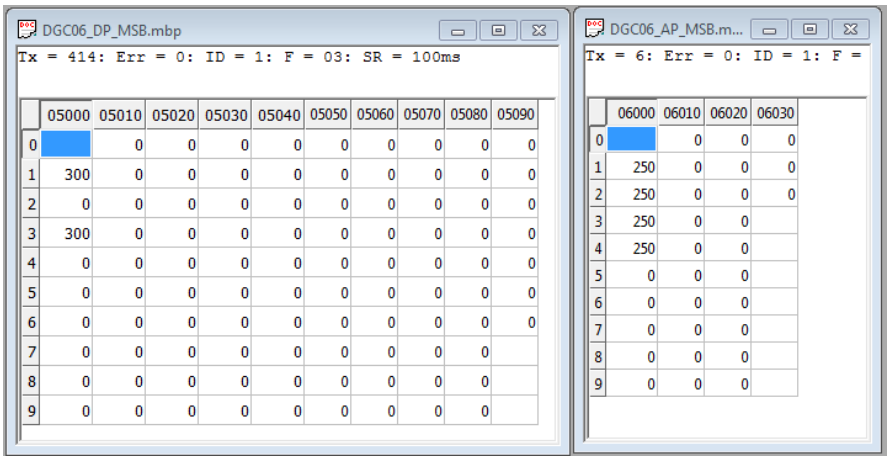
	03000	03010	03020	03030	03040	03050	03060	03070	03080	03090
0		0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	-32512	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	

	04000	04010	04020	04030
0		0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	
4	0	0	0	
5	0	0	0	
6	0	0	0	
7	0	0	0	
8	0	0	0	
9	0	0	0	

Figure 4: Average value of analog sensors – sensor addr. 1–32, Modbus register addr. 4001–4032

3.5 Measuring range of digital sensors– sensor addr. 1–96, Modbus register addr. 5001–5096

3.6 Measuring range of analog sensors – sensor addr. 1–32, Modbus register addr. 6001–6032



	05000	05010	05020	05030	05040	05050	05060	05070	05080	05090
0		0	0	0	0	0	0	0	0	0
1	300	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	300	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	

	06000	06010	06020	06030
0		0	0	0
1	250	0	0	0
2	250	0	0	0
3	250	0	0	
4	250	0	0	
5	0	0	0	
6	0	0	0	
7	0	0	0	
8	0	0	0	
9	0	0	0	

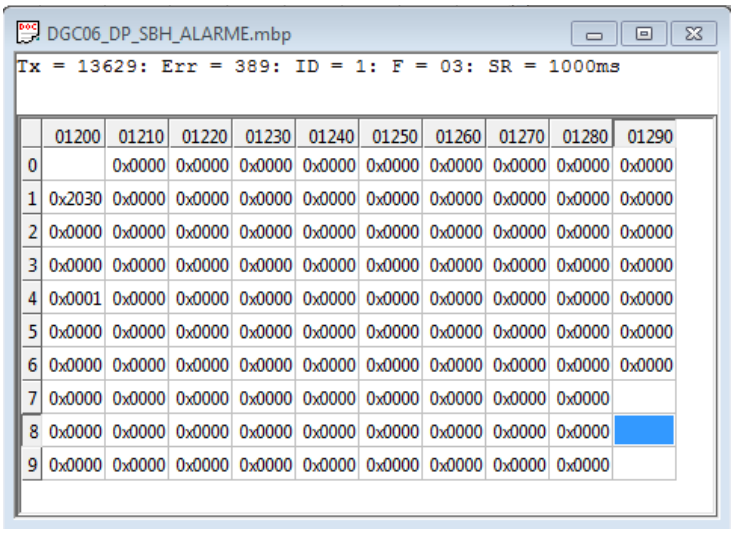
Figure 5: Measuring range of analog sensors – sensor addr. 1–32, Modbus register addr. 6001–6032

3.7 Display of the alarms and the respective latching bits of digital sensors

Display of the local alarms generated by the DGC-06 as well as of the respective latching bits of digital sensors – sensor addresses 1 to 96, Modbus register addresses 1201 to 1296

3.8 Display of the alarms and the respective latching bits of analog sensors

Display of the local alarms generated by the DGC-06 as well as of the respective latching bits of analog sensors – sensor addresses 1 to 32, Modbus register addresses 2201 to 2232



	01200	01210	01220	01230	01240	01250	01260	01270	01280	01290
0		0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
1	0x2030	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
2	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
3	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
4	0x0001	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
5	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
6	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
7	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
8	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
9	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	

Figure 6: Display of the alarms and the respective latching bits of analog sensors

Here, the representation in the hexadecimal form is easier to read because the data are transmitted in the following form:

0xFFFF =

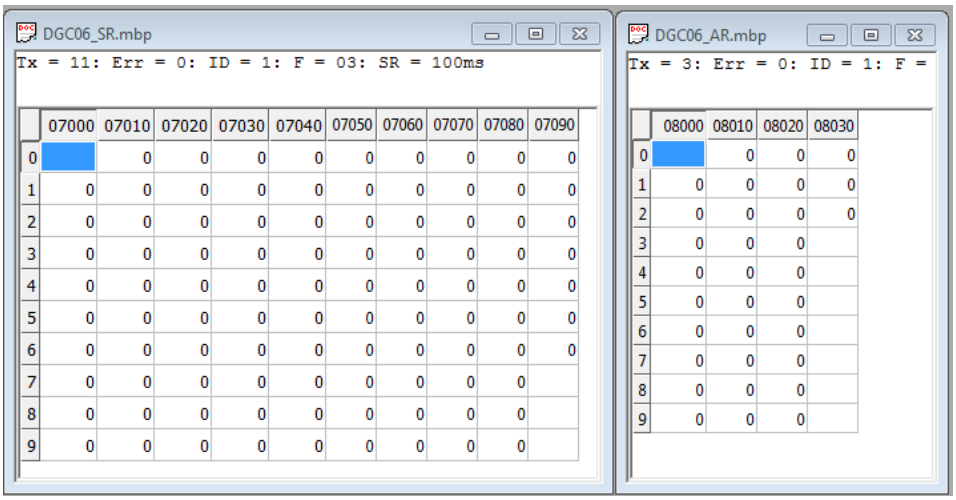
0x	F	F	F	F
0b	1111	1111	1111	1111
	Local latching	DGC-06 latching	Local alarms	DGC-06 Alarms

There are 4 status bits for the 4 alarm stages each.
1 = alarm or latching active
0 = alarm or latching not active

The above example:
There are 2 local alarms at DP1, with the 2. being in latching mode.
The 1. alarm generated by the DGC-06 is present at DP4.
The 1. alarm generated by the DGC-06 is present at AP5.

3.9 Relay status of the signal relays – signal relay addr. 1–96, Modbus register addr. 7001–7096

3.10 Relay status of the alarm relays – alarm relay addr. 1–32, Modbus register addr. 8001–8032



	07000	07010	07020	07030	07040	07050	07060	07070	07080	07090
0		0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	

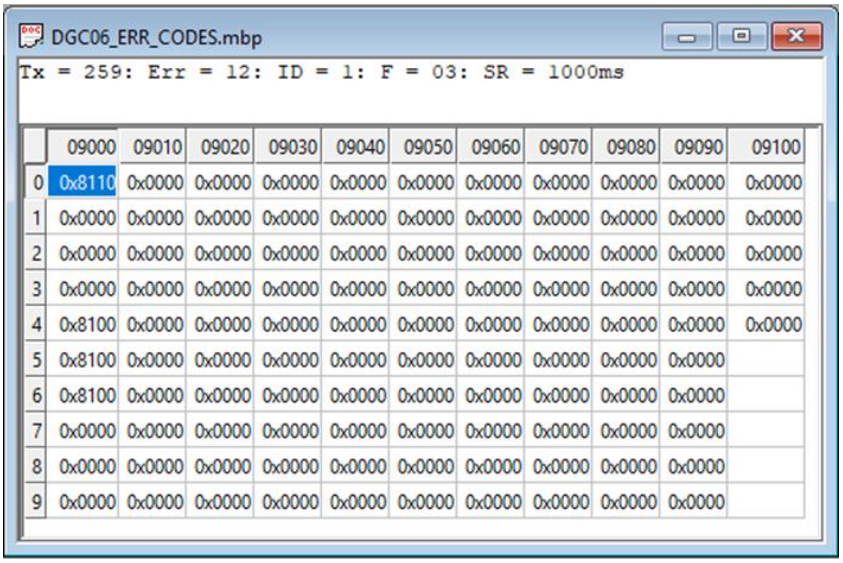
	08000	08010	08020	08030
0		0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	
4	0	0	0	
5	0	0	0	
6	0	0	0	
7	0	0	0	
8	0	0	0	
9	0	0	0	

Figure 7: Relay status of the alarm relays – alarm relay addr. 1–32, Modbus register addr. 8001–8032

The relay status of the controller's fault message relay is in register 8000.
The following values are possible:

- -1: Relay is not active
- 0: Relay is active, not energized
- 1: Relay is active, energized

3.11 Error codes, Modbus register addresses 9000–9104



	09000	09010	09020	09030	09040	09050	09060	09070	09080	09090	09100
0	0x8110	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
1	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
2	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
3	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
4	0x8100	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
5	0x8100	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
6	0x8100	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
7	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
8	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
9	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	

Figure 8: Error codes, Modbus register addresses 9000–9104

a) Register address 9000d: Local error of the connected GC device – errors apply to the devices not to the readings of these devices.

Here 0x8110: 0x0100 => MP error, 0x0010 => EEPROM or configuration error.

Nibble 4: =x8110				Nibble 3: =x8110				Nibble 2: =x8110				Nibble 1: =x8110			
Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
Error Indicator, always 1 for failures	Error Indicator, always 0 for failures	Not used	Not used	Special mode ON	Not used	UPS detected (only information)	Failure in connected devices	Maintenance information bit	Not used	Not used	Configuration error or EE Flash failure	Not used	Power failure – battery mode	Not used	UPS error

b) Register address 9001d– 9096d: Local error of the connected devices like WSB2, SB2 or MSB2. The errors concern the devices, but not the errors of the heads, because these are displayed in the registers of the measured values.

c) Register address 9097d– 9104d: Local error of the 8 Gas Controller Modules (1x GC06 + 7x EP06))

Here 0x8100 = MP error, Error with any locally connected MP.

Nibble 4: =x8100				Nibble 3: =x8100				Nibble 2: =x8100				Nibble 1: =x8100			
Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0	Bit 3	Bit 2	Bit 1	Bit 0
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
Error Indicator, always 1 for failures	Error Indicator, always 0 for failures	Horn feedback error	Warning sign feedback error	Special mode ON	Not used	Not used	Failure in connected devices	Maintenance information bit	Over- / under-temperature failure	Wrong analog output current or relay failure	Configuration error or EE Flash failure	CPU diagnostic errors	Over- / undervoltage failure	AD converter failure	Not used

3.12 DGC-06 Watch Outputs (WI), Modbus register addresses 50–57

In register 50, all watch outputs are shown as a byte as used for evaluation in the DGC-06 system.
In the registers 51–57 the individual bit values are available as Integer values.

0 or 0x0000 = No output set
1 or 0x0001 = Switch on by clock
256 or 0x0100 = Switch on by Modbus
257 or 0x0101= Switch on by Modbus and clock

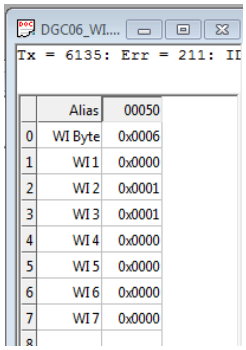


Figure 9: DGC-06 clock outputs (WI)

Digital inputs are not represented in registers (only possible by assigning to a relay output and using its output information).

3.13 Data block: Output

Address 0: Own slave Modbus address at the X Bus
Address 1: Relay information bits of the first module (Controller Module)
Relay 1 is bit 0 to relay 4 is bit 3
Address 2: Relay information bits of the extension module address_1
Relay 5 is bit 0 to relay 8 is bit 3
Address 3: Relay information bits of the extension module address_2
Relay 9 is bit 0 to relay 12 is bit 3
Address 4: Relay information bits of the extension module address 3
Relay 13 is bit 0 to relay 16 is bit 3
Address 5: Relay information bits of the extension module address_4
Relay 17 is bit 0 to relay 20 is bit 3
Address 6: Relay information bits of the extension module address_5
Relay 21 is bit 0 to relay 24 is bit 3
Address 7: Relay information bits of the extension module address_6
Relay 25 is bit 0 to relay 28 is bit 3
Address 8: Relay information bits of the extension module address_7
Relay 29 is bit 0 to relay 32 is bit 3

The addresses 9 to 24 stand for hardware analog output 1 to analog output 16.
The definition of the values is done between 0 and 10000 (full scale value of the sensor).

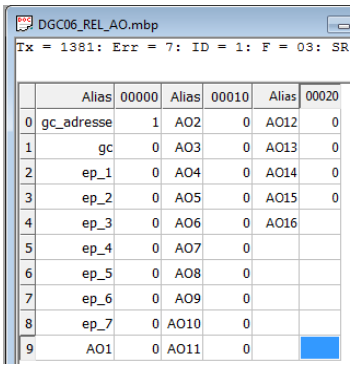


Figure 10: DCG06_REL_AO

4 Modbus-Function 05 (Write Single Coil)

Write Single Coil (writing of single states ON/OFF) is used to acknowledge the latching mode or the horns as well as to set clock outputs individually.

4.1 Acknowledgement of latching mode

For this purpose, the command 05 is sent to the address of the DGC-06 with the indication of the respective chapter 3.7 or 3.8
The acknowledgment only takes place when the value ON(0xFF00) has been sent.

4.2 Acknowledgement of horn

For this purpose, command 05 is sent to the address of DGC-06 and register 0x7000.
The acknowledgment only takes place when the value ON(0xFF00) has been sent.

4.3 Activation of the single Watch Output via Modbus

For this purpose, the command 05 is sent to the address of the DGC-06 with the indication of the respective chapter 3.12 with register 50 not being allowed.

5 Modbus Function 06 (Write Single Registers)

Write Single Registers (writing of single registers) is used to write on individual registers in the DGC-06. Currently, it is only possible to write on the own slave address.
Modbus address 0 (see chapter 3.12).

6 Modbus-Function 15 (Write Multiple Coils)

Write Multiple Coils (writing multiple states OFF/ON) is used to set all watch outputs at once. The command must be sent to DGC-06 address with the indication of register 50 with a maximum length of 7 bits.

7 Modbus Function 16 (Write Multiple Registers)

Write Multiple Registers (writing of several registers) is used to write on several registers in the DGC-06. Currently, it is only possible to write on the own slave address.
Modbus address 0 (see chapter 3.12).
All other parameter changes are not permitted for safety reasons; therefore, the data direction is clearly defined from the warning system to the open Modbus side. Retroaction is not possible.

List of Revisions

Version	Date	Chapter	Changes
2022-04	05.04.2022	All	New Design