

MR-A08

Expansion unit 8 analog outputs

MODBUS COMMUNICATION PROTOCOL

Modbus RTU communication protocol

- Modbus is a master-slave communication protocol able to support up to 247 slaves organized as a bus or as a star network.
- The Query-Response command is transmitted from the Master to an established Slave and generally it is followed by an answering message.
- The Broadcast command is transmitted from the Master to all Slaves and is never followed by an answer.

Generic Message Structure:

Start of frame	Address field	Function code	Data field	Error check	End of frame
START OF FRAME	=	Starting message marker [silence on line for time >=4 characters]			
ADDRESS FIELD	=	Includes device address in which you need to communicate in Query-Response mode. [1 character], broadcast type it is 0x00.			
FUNCTION CODE	=	Includes the operation code that you need to perform. [1 character]			
DATA FIELD	=	Includes the data field. [N characters]			
ERROR CHECK	=	Field for the error correction code. [16-bit CRC]			
END OF FRAME	=	End message marker. [silence on line for time >=4 characters]			

Reading of the registers [function code 03h]

Reads the binary contents of holding registers (2x references) in the slave. Broadcast is not supported.

The Query message specified the starting register and quantity of register to be read.

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6-7° Byte	
Start frame <i>Starting message marker</i>	Address field <i>Device address (0x01... 0xF7)</i>	Function code <i>(0x03)</i>	Start address <i>First address to be read</i>	Number of registers <i>4 bytes = 1 long for 1 measure value</i>	Checksum	End frame <i>End message marker</i>

WARNING: It is possible to read more than one variable at the same time (**max 128 bytes**) only if their addresses are consecutive and the variables on the same line cannot be divided.

The register data in the response message are packet as two bytes per register, with the binary contents right justified within each byte.

For each register, the first byte contains the high order bits and the second contains the low order bits.

	0° Byte	1° Byte	2° Byte	n° Byte	n+1 - n+2° Byte	
Start frame <i>Starting message marker</i>	Address field <i>Device address (0x01... 0xF7)</i>	Function code <i>(0x03)</i>	Number of data Bytes <i>1 register requires 2 data bytes</i>	Data <i>D0, D1, ..., Dn (Nr. of register x 2 = n. byte)</i>	Checksum	End frame <i>End message marker</i>

Setup of the parameters [function code 10h]

Write values into a sequence of holding registers (2x references).

WARNING: It is possible to write more than one variable at the same time only if their addresses are consecutive and the variables on the same line cannot be divided. (max of 4 consecutive register on the same message).

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6° Byte	n° Byte	n+1 - n+2° Byte	
Start frame <i>Starting message marker</i>	Address field <i>Device address (0x01... 0xF7)</i>	Function code <i>(0x10)</i>	Start address <i>First address to be read</i>	Number of registers to be written	Number of data Bytes <i>1 register requires 2 data bytes</i>	Data <i>D0, D1, ..., Dn (Nr. of register x 2 = n. byte)</i>	Checksum	End frame <i>End message marker</i>

The normal response returns the slave address, function code, starting address and quantity of register preset.

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6-7° Byte	
Start frame <i>Starting message marker</i>	Address field <i>Device address (0x01... 0xF7)</i>	Function code <i>(0x10)</i>	Start address <i>First register address to be read</i>	Number of registers to be written	Checksum	End frame <i>End message marker</i>

Error message from slave to master

When a slave device receives a not valid query, it does transmit an error message.

0° Byte		1° Byte	2° Byte	3 - 4° Byte
Start frame <i>Starting message marker</i>	Address field <i>Device address (0x01... 0xF7)</i>	Function code <i>Operation code with bit 7 high</i>	Error code <i>Message containing communication failure</i>	Checksum <i>End message marker</i>

ERROR EXAMPLE:

QUERY

Field Name	Example (Hex)
Slave Address	0x01
Function Code	0x03
Starting Address Hi	0x00
Starting Address Lo	0x00
Number Of Word Hi	0x00
Number Of Word Lo	0x05
Error Check (CRC)	0x??

RESPONSE

Field Name	Example (Hex)
Slave Address	0x 01
Function Code	0x83 (1)
Error Code	0x02 (2)
Error Check (CRC)	0x??

(1):Function Code transmitted by master with bit 7 high.

(2): Error type:

- 0x01 = Illegal Function
- 0x02 = Illegal data address
- 0x03 = Illegal data value

Registers

The following tables shown all the registers.

Outputs

Register HEX	Register DEC	Word	Description	R/W	Note
100	256	2	OUTPUT 1	R/W	0 ÷ 4095
102	258	2	OUTPUT 2	R/W	0 ÷ 4095
104	260	2	OUTPUT 3	R/W	0 ÷ 4095
106	262	2	OUTPUT 4	R/W	0 ÷ 4095
108	264	2	OUTPUT 5	R/W	0 ÷ 4095
10A	266	2	OUTPUT 6	R/W	0 ÷ 4095
10C	268	2	OUTPUT 7	R/W	0 ÷ 4095
10E	270	2	OUTPUT 8	R/W	0 ÷ 4095
110	272	2	RELAY 1	R/W	0: open 1: closed
112	274	2	RELAY 2	R/W	0: open 1: closed

Analog outputs range setup

Register HEX	Register DEC	Word	Description	R/W	Parameters
200	512	2	OUTPUT RANGE 1	R/W	0: 0 V to 5 V 1: 0 V to 10 V 2: ±5 V 3: ±10 V 4: 4 mA to 20 mA 5: 0 mA to 20 mA [Default]
202	514	2	OUTPUT RANGE 2	R/W	See previous register.
204	516	2	OUTPUT RANGE 3	R/W	See previous register.
206	518	2	OUTPUT RANGE 4	R/W	See previous register.
208	520	2	OUTPUT RANGE 5	R/W	See previous register.
20A	522	2	OUTPUT RANGE 6	R/W	See previous register.
20C	524	2	OUTPUT RANGE 7	R/W	See previous register.
20E	526	2	OUTPUT RANGE 8	R/W	See previous register.

COM setup **

Register HEX	Register DEC	Word	Description	R/W	Parameters
1400	5120	2	NODE ID*	R/W	0001h ÷ 00F7h (001 ÷ 247 dec) [Default: 1]
1402	5122	2	BAUD RATE*	R/W	0000h: 4800 Baud 0001h: 9600 Baud 0002h: 19200 Baud 0003h: 38400 Baud [Default] 0004h: 57600 Baud 0005h: 115200 Baud
1404	5124	2	STOP BITS*	R/W	0000h: 1 Stop Bit [Default] 0001h: 2 Stop Bits
1406	5126	2	PARITY*	R/W	0000h: None [Default] 0001h: Parity Odd 0002h: Parity Even
1408	5128	2	MINIMUM RESPONSE DELAY*	R/W	5 ÷ 100 ms [Default: 10]

*: The Serial setting will be changed after the command response.

** : valid only when DIPs are all OFF.



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