

MODBUS PROTOCOL INDICATIONS

1.1 Parameters Serial Modbus DGM

- 1) “S7000”: choice of the drive protocol.
- 2) “S7100”: Drive address
- 3) “S7101”: Parity : 0= no parity, 1= parity-even, 2= parity-odd
- 4) “S7102”: Baud Rate 9600, 14400, 19200, 38400, 57600

1.2 Conventions

- The abbreviation “MSB” (Most Significant Byte), indicates the byte high
- The abbreviation “MSL” (Least Significant Byte), indicates the byte low

1.3 Telegrams (Function Code).

1.3.1 Function Code:

- 1) Function code: **01** - (Read coils) Reading of the coils
 - **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 5$), and when the sum is $(\text{address} + \text{quantity_coils}) > 6$
 - **exception code** 0x03 for $(\text{quantity_coils} = 0)$ or $(\text{quantity_inputs} > 2000)$
- 2) Function code: **02** - Read Discrete inputs
 - **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 5$), and when the sum is $(\text{address} + \text{quantity_inputs}) > 6$
 - **exception code** 0x03 for $(\text{quantity_inputs} = 0)$ or $(\text{quantity_inputs} > 2000)$
- 3) Function code: **03** - Read Multiple Register
 - **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 84$), and when the sum is $(\text{address} + \text{registers_number}) > 84$
 - **exception code** 0x03 for $(\text{registers_number} = 0)$ or $(\text{register_number} > 125)$
- 4) Function code: **04** - Read Input Registers
 - **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: 0), e and when the sum is $(\text{address} + \text{registers_number}) > 1$
 - **exception code** 0x03 for $(\text{registers_number} = 0)$ or $(\text{registers_number} > 125)$
- 5) Function code: **05** - Write Coils: single coil writing, this function code allows to enable or disable of a single input as for the external input. Note that some input must be enabled to be accepted when activated (id est when they are set at 1). Moreover the parameter “INPUT DIGITALI MODBUS S.7110-S.7118” must be set so as to enable selection from Modbus.
- 6)

- Coils map (corresponding to inputs),
 - 0) Bit address **0 : it coincide with input ENA “ Drive Enable “**
 - 1) Bit address **1:**
 - a) Mode **Electronic potentiometer**
 - I. 1 == Enable to reach the speed of the Electronic potentiometer
 - II. 0 == keep the present speed
 - b) In the other Mode, where expected, it can be used as limit switch CW if enabled.
 - 2) Bit address **2:**
 - a) Mode **Electronic potentiometer**
 - I. 1 == enable the reaching of zero speed.
 - II. 0 == keep the present speed
 - b) In the other Mode, where expected, it can be used as limit switch CCW if enabled.
 - 3) Bit address **3:**
 - a) Mode **Positioner**: switching this bit from 0 to 1, when the “Drive Enable” is enabled, starts the procedure of Home Position.
 - b) In the other Mode, where expected, it can work as Emergency stop and coincide with Input3, if enabled.
 - 4) Bit address **4: Reset Alarms.**
 - 5) Bit address **5 it coincides to the Start/Stop input: Run**
 - a) In the case of **Positioner** when this bit switch from 0 to 1, it enable the reaching of the position. If during the phase of achieving of the position it switch to 0, this causing an emergency stops alarm and it will appear an alarm of out of position (alarm code 19)
 - b) In the other cases the drive switch from “run” state and follows the presettet reference.
 - 6) Bit address **6:** Bit used to select the reference value or the value of the position or the value of the Jog CCW or to reset the index of ciclic position.
 - 7) Bit address **7:** Bit used to select the reference balue or the position value or the CW Jog value. In the speed control or torque control, if switched to 1, it enables the reverse reference.
 - 8) Bit address **8:** In Positioner Mode or Electric axes it allows to switch to Jog Mode (when set at 1)

- **exception code 0x01** for function code not implemented
- **exception code 0x02** for “address“ out of range (addresses allowed: $0 \div 8$).
- **exception code 0x03** coil setting wrong, only these two values are allowed :
 - 0) **FF00** (esadecimale): to enable the coil (to set it at 1).
 - 1) **0** : to disable the coil (to set it at 0).

2) Function code: **06** - (Write Single Register) to write a single register in the RAM

- **exception code 0x01** for function code not implemented
- **exception code 0x02** for “address“ out of range (addresses allowed: $0 \div 84$)
- **exception code 0x04** register value out of range
- **exception code 0x06** when the system is busy (ep2prom in writing phase)

3) Function code: **15** - (Write Multiple Coils) writing multiple coils

- **exception code 0x01** for function code not implemented

- **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 8$), and when the sum is $(\text{address} + \text{numbers_coil}) > 9$.
 - **exception code** 0x03 for quantity of coil out of limit (range quantity : $1 \div 1968$), or number byte wrong.
- 4) Function code: **16** - (Write Multiple Registers) writing a block of registries in the RAM
- **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 84$), and when the sum is $(\text{address} + \text{registers_number}) > 84$
 - **exception code** 0x03 for “(registers_number = 0) or (registers_number > 123), and when the sum is $(\text{number_byte} \neq (2 * \text{registers_number}))$
 - **exception code** 0x04 register value out of range
 - **exception code** 0x06 as the system is busy (ep2prom in writing phase)
- 5) Function code: **22** - Mask Write Register in the RAM
- **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 84$)
 - **exception code** 0x04 value of register modified with mask out of range
 - **exception code** 0x06 as the system is busy (ep2prom in writing phase)
- 6) Function code: **23** - (Write/Read Multiple Registers) writing and reading of the block of registers in the RAM
- **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 84$), and when the sum is $(\text{address} + \text{registers_number}) > 84$
 - **exception code** 0x03 for “(registers_number = 0) or (registers_number > 123), and when the sum of writing parameters is $(\text{number_byte} \neq (2 * \text{registers_number}))$
 - **exception code** 0x04 registers value out of range
 - **exception code** 0x06 as the system is busy (ep2prom in writing phase)
- 7) Function code: **65** - (Write Multiple Registers) writing of multiple register in the RAM and in the E2PROM
- **exception code** 0x01 for function code not implemented
 - **exception code** 0x02 for “address“ out of range (addresses allowed: $0 \div 84$), and when the sum is $(\text{address} + \text{registers_number}) > 84$
 - **exception code** 0x03 for “(registers_number = 0) or (registers_number > 123), and when the sum is $(\text{number_byte} \neq (2 * \text{registers_number}))$
 - **exception code** 0x04 registers value out of range
 - **exception code** 0x06 as the system is busy (ep2prom in writing phase)

1.3.2 Broadcast message (Available only from firmware dgm2_07)

It is possible to send in only one telegram many values to the DGM connected on the modbus network. The structure of the telegram is the following:

BYTE	FIELD	DESCRIPTION	VALUE
1°	Address	address broadcast	0
2°	Function code	Instruction code	100
3°	Number Byte of data	Number byte sent	5*number DGM
4°	Sub function code	Instruction code	1

5°	address modbus DGM	address of DGM to update	from 1 to 247
6°	Variable address (MSB)	High part of the parameter address to Update	See table of addresses
7°	Variable address (MSL)	low part of the parameter address to Update	See table of addresses
8°	Variable Value (MSB)	High part of the parameter value to Update	
9°	Variable Value (MSL)	High part of the parameter value to Update	
10°-14°	Data for a second DGM (see from 5° to 9° Byte)		
...	For more DGM		
Second last	CRC		
Last	CRC		

The DGM give not any answer to this type of telegram.

1.4 Addresses table Variables (at 16 bit):

Indications	
Variable	All variables are at 16 bit
Reading/writing	<ul style="list-style-type: none"> r/w: means that variables are both readable both writable r : only readable variables
(BIT)	It indicate a variable of Bit

Indir.	Variable	Range	Display	U.M	r/w
Generical data Inverter					
0	Control type	0 ÷ 3	<ul style="list-style-type: none"> 0 = speed 1 = torque 2 = Position 3 =electric Axis 	-	r/w
1	Main speed type	0 ÷ 4	<ul style="list-style-type: none"> 0 = Analog 1 = Internal 2 = Jog 3 = El.potent. 4 = Frequency 	-	r/w
2	Aux speed type	0 ÷ 2	<ul style="list-style-type: none"> 0 = Analog 1 = Internal 2 =Speed torque limit 	-	r/w
3	Position control type	0 ÷ 2	<ul style="list-style-type: none"> 0 =position selected 1 = ciclic quote 2 = Vibration 		
4	Display data selected	0 ÷ 9	0 = Drive state 1 = speed 2 = current 3 = voltage 4 = axes ratio 5 = Turns 6 = fraction of the turn 7 = Resolver Home Pos.		

			8 = Size current 9 = Size voltage		
5	Kp speed	1 ÷ 3000	1 ÷ 3000	-	r/w
6	Ki speed	0 ÷ 3000	1 ÷ 3000	-	r/w
7	Kp speed	0 ÷ 1000	0 ÷ 1000	-	r/w
8	Kp position	1 ÷ 4000	1 ÷ 4000	-	r/w
9	Speed limit	1 ÷ 9999	1 ÷ 9999	rpm	r/w
10	Current Limit	0 ÷ 300	0 ÷ 300	%	r/w
11	Encoder sim. resolution	0 ÷ 3	<ul style="list-style-type: none"> 0 = 10 bit 1 = 12 bit 2 = 14 bit 3 = 16 bit 		r/w
12	Notch frequency	50 ÷ 400	100 ÷ 400	Hz	r/w
13	Bandwidth Notch	8000 ÷ 9900	0.8000 ÷ 0.9900	-	r/w
14	Current ref. filterIq	1 ÷ 3000	0.01 ÷ 30.00	ms	r/w
15	Current Limit (Phase Fault alarm)	0 ÷ 250	0 ÷ 250	%	r/w
16	Thresold speed (Phase Fault alarm)	0 ÷ 1000	0 ÷ 1000	rpm	r/w
17	position error	1 ÷ 1790	0.1 ÷ 179.0	°	r/w
18	Input Modbus setting Bit (0 ÷ 1): Input 0 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (2 ÷ 3): Input 1 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (4 ÷ 5): Input 2 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (6 ÷ 7): Input 3 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (8 ÷ 9): Input 4 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (10 ÷ 11): Input 5 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus Bit (12 ÷ 13): Input 6 <ul style="list-style-type: none"> 0 = Series 1 = Parallel 			-	r/w

	<ul style="list-style-type: none"> • 2 = from external • 3 = from Modbus <p>Bit (14 ÷ 15): Input 7</p> <ul style="list-style-type: none"> • 0 = Series • 1 = Parallel • 2 = from external • 3 = from Modbus 				
19	<p>Flag Setting (BIT)</p> <p>Bit (0): Enable speed Aux</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (1): Enable Ramps</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (2): Enable Ramps S</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (3): Enable Filter Notch</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (4): Type of Torque</p> <ul style="list-style-type: none"> • 0 = Analog • 1 = Internal <p>Bit (5): Hall sensor Automatic Set.</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (6): Hall Sensor Compensation</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (7): Jog. commands</p> <ul style="list-style-type: none"> • 0 = Buttons (+/-) • 1 = External <p>Bit (8): type of frequency encod. speed.</p> <ul style="list-style-type: none"> • 0 = Channel A-B • 1 = Frequency Direction. <p>Bit (9): Enable Ref. Filter Iq</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (10): Reverse reference ω analog.</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (11 ÷ 15): Null 0</p>			-	

20	<p>Input-Output setting (BIT)</p> <p>Bit (0): Enable limit switch CW</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (1): Volt limit switch CW</p> <ul style="list-style-type: none"> 0 = 0 V 1 = 24 V <p>Bit (2): Enable limit switch CCW</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (3): Volt limit switch CCW</p> <ul style="list-style-type: none"> 0 = 0 V 1 = 24 V <p>Bit (4): Enable Stop Emerg.</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (5): Enable Reset Alarms</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (6): Reverse reference</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (7): Enable Input 8</p> <ul style="list-style-type: none"> 0 = disable 1 = Enable <p>Bit (8 ÷ 9): Analog Out 1</p> <ul style="list-style-type: none"> 0 = Rif. speed 1 = Rif. current 2 = speed Measured 3 = current Measured <p>Bit (10 ÷ 11): Analog Out 2</p> <ul style="list-style-type: none"> 0 = Rif. speed 1 = Rif. current 2 = speed Measured 3 = current Measured <p>Bit (12 ÷ 13): Input Modbus 8</p> <ul style="list-style-type: none"> 0 = Series 1 = Parallel 2 = from external 3 = from Modbus <p>Bit (14 ÷ 15): Null 0</p>			-	r/w
21	<p>Position Setting(BIT)</p> <p>Bit (0): Home Limit Switch</p> <ul style="list-style-type: none"> 0 = Limit Switch CW 1 = Limit Switch CCW <p>Bit (1): Position of Stop in ramp</p>			-	r/w

	<ul style="list-style-type: none"> • 0 = disable • 1 = Enable <p>Bit (2): Home Position On/Off</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Abilitata <p>Bit (3): Type Home Position</p> <ul style="list-style-type: none"> • 0 = with Limit Switch • 1 = without Limit Switch <p>Bit (4): Mode Selected positions</p> <ul style="list-style-type: none"> • 0 = Absolute Shift • 1 = Relative Shift <p>Bit (5): Mode Ciclic position</p> <ul style="list-style-type: none"> • 0 = Absolute shift • 1 = Relative shift <p>Bit (6): Type of encoder frequency</p> <ul style="list-style-type: none"> • 0 = channel A-B • 1 = Frequency-direction <p>Bit (7): Electric Axis mode</p> <ul style="list-style-type: none"> • 0 = Mod. external(+/-) • 1 = Internal selection <p>Bit (8): Mode end of position</p> <ul style="list-style-type: none"> • 0=stop in position control • 1=Stop in speed control with zero speed. <p>Bit (9): Position Sensor</p> <ul style="list-style-type: none"> • 0=Resolver • 1=External encoder <p>Bit (10): Position: (Input8, Switch - speed)</p> <ul style="list-style-type: none"> • 0=speed Jog • 1= Analog speed <p>Bit (11 ÷ 15): Null 0</p>				
22	<p>Alarms setting (BIT)</p> <p>Bit (0): Mode position error</p> <ul style="list-style-type: none"> • 0 = Warning Error Pos. • 1 = Alarm Error Pos. <p>Bit (1):Mode Min voltage</p> <ul style="list-style-type: none"> • 0 = Memorized. • 1 = Automatic reset <p>Bit (2):Mode Max voltage</p> <ul style="list-style-type: none"> • 0 = Memorized • 1 = Automatic reset <p>Bit (3): Enable Motor Brake</p> <ul style="list-style-type: none"> • 0 = disable • 1 = Enabled 				r/w

	Bit (4 ÷ 5): ModeFault voltage <ul style="list-style-type: none"> 0 = disable 1 = only Warning 2 = Alarm 3 = Enable Braking 				
	Bit (6 ÷ 7): Mode Fault Phase supply <ul style="list-style-type: none"> 0 = disable 1 = Only Warning 2 = Alarm 3 = Enable Braking 				
	Bit (8 ÷ 15): Null 0				

Main speed parameters					
23	Full scale of analog speed	9999 ÷ 250	9999 ÷ 250	rpm	r/w
24	Full scale for fraction of analog speed	-9999 ÷ 9999	-999.9 ÷ 999.9	rpm	r/w
25	Analog Lowpass filter time	0 ÷ 1000	0.00 ÷ 10,00	s	r/w
26	internal speed 1	-9999 ÷ 9999	-9999 ÷ 9999	rpm	r/w
27	internal speed 2	-9999 ÷ 9999	-9999 ÷ 9999	rpm	r/w
28	internal speed 3	-9999 ÷ 9999	-9999 ÷ 9999	rpm	r/w
29	internal speed 4	-9999 ÷ 9999	-9999 ÷ 9999	rpm	r/w
30	speed Jog	0 ÷ 9999	0 ÷ 9999	rpm	r/w
31	Max speed Electronic potentiometer	0 ÷ 9999	0 ÷ 9999	rpm	r/w
32	Frequency of pulses per turn	200 ÷ 16384	200 ÷ 16384	imp/r	r/w

Auxiliary speed parameters					
33	Full scale analog Aux speed	9999 ÷ 250	9999 ÷ 250	rpm	r/w
34	Full scale for fraction of the aux analog speed	-9999 ÷ 9999	-999.9 ÷ 999.9	rpm	r/w
35	internal speed Aux	-9999 ÷ 9999	-9999 ÷ 9999	rpm	r/w
36	Full scale torque limit	0 ÷ 250	0 ÷ 250	%	r/w
37	Full scale torque limit	-100 ÷ 100	-100 ÷ 100	%	r/w

Parameters Ramps speed					
38	Acceleration CW	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
39	DecelerationCW	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
40	Acceleration CCW	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
41	Deceleration CCW	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
42	Jerk speed	2 ÷ 60000	2 ÷ 60000	rpm/s ²	r/w

Torque parameters					
43	Torque Reference Full scale	0 ÷ 250	0 ÷ 250	%	r/w
44	Torque Ref. Fraction	-100 ÷ 100	-100 ÷ 100	%	r/w
45	Internal torque	-250 ÷ 250	-250 ÷ 250	%	r/w

Positioner parameters					
46	Jerk Positioner	2 ÷ 60000	2 ÷ 60000	rpm/s ²	r/w
47	Multiplier value for positioner ramp parameters.	1 ÷ 100	1 ÷ 100	-	r/w
48	Positioner type of profile	0 ÷ 2	<ul style="list-style-type: none"> 0 = Profile "S" 1 = Standard profile 2 = Continuous standard profile 	-	r/w

49	Encoder pulses of Reference	16384 ÷ 200	16384 ÷ 200	imp/r	r/w
50	Encoder pulses measured	16384 ÷ 200	16384 ÷ 200	imp/r	r/w
51	Mode Restart position. (it happens when out of position)	3 ÷ 0	<ul style="list-style-type: none"> 0=Wait for Home Pos. 1=Retrives the position 2=Retrives + new position 3=Always reset the home position 		r/w

Parameters of Home Position					
52	Home Turns (with limit switch)	0 ÷ 32767	0 ÷ 32767	-	r/w
53	Home Offset (with limit switch)	See Note 1 at the end of document	See Note 1 at the end of document	-	r/w
54	Home speed (with limit switch)	10 ÷ 9999	10 ÷ 9999	rpm	r/w
55	Home Offset (without limit switch)	see Note 1 at the end of document	see Note 1 at the end of document		r/w
56	Home speed (without limit switch)	10 ÷ 9999	10 ÷ 9999	rpm	r/w
57	Home setting (without limit switch)	0 ÷ 2	0 = shortest run 1 = direction CW 2 = direction CCW	-	r/w

Parameters positioner – positions selectable					
58	Selected position 1: Turns position	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
59	Selected position 1: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
60	Selected position 1:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
61	Selected position 1:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
62	Selected position 1:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
63	Selected position 2:Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
64	Selected position 2:fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
65	Selected position 2:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
66	Selected position 2:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
67	Selected position 2:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
68	Selected position 3:Turns position	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
69	Selected position 3:fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
70	Selected position 3:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
71	Selected position 3:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
72	Selected position 3:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
73	Selected position 4:Turns position	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
74	Selected position 4:fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
75	Selected position 4:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
76	Selected position 4:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
77	Selected position 4:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w

Parametri Posizionatore – Quote Cicliche					
78	Cyclic position 1: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
79	Cyclic position 1: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
80	Cyclic position 1:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
81	Cyclic position 1:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w

82	Cyclic position 1:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
83	Cyclic position 2: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
84	Cyclic position 2: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
85	Cyclic position 2:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
86	Cyclic position 2:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
87	Cyclic position 2:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
88	Cyclic position 3: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
89	Cyclic position 3: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
90	Cyclic position 3:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
91	Cyclic position 3:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
92	Cyclic position 3:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
93	Cyclic position 4: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
94	Cyclic position 4: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
95	Cyclic position 4:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
96	Cyclic position 4:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
97	Cyclic position 4:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
98	Cyclic position 5: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
99	Cyclic position 5: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
100	Cyclic position 5:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
101	Cyclic position 5:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
102	Cyclic position 5:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
103	Cyclic position 6: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
104	Cyclic position 6: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
105	Cyclic position 6:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
106	Cyclic position 6:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
107	Cyclic position 6:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
108	Cyclic position 7: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
109	Cyclic position 7: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
110	Cyclic position 7:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
111	Cyclic position 7:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
112	Cyclic position 7:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
113	Cyclic position 8: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
114	Cyclic position 8: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
115	Cyclic position 8:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
116	Cyclic position 8:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
117	Cyclic position 8:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
118	Cyclic position 9: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
119	Cyclic position 9: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
120	Cyclic position 9:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
121	Cyclic position 9:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
122	Cyclic position 9:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
123	Cyclic position 10: Turns Quota	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
124	Cyclic position 10: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
125	Cyclic position 10:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
126	Cyclic position 10:acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
127	Cyclic position 10:deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
128	Cyclic position 11: Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
129	Cyclic position 11: fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
130	Cyclic position 11:speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w

131	Cyclic position 11 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
132	Cyclic position 11 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
133	Cyclic position 12 : Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
134	Cyclic position 12 : fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
135	Cyclic position 12 :speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
136	Cyclic position 12 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
137	Cyclic position 12 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
138	Cyclic position 13 : Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
139	Cyclic position 13 : fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
140	Cyclic position 13 :speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
141	Cyclic position 13 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
142	Cyclic position 13 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
143	Cyclic position 14 : Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
144	Cyclic position 14 : fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
145	Cyclic position 14 :speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
146	Cyclic position 14 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
147	Cyclic position 14 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
148	Cyclic position 15 : Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
149	Cyclic position 15 : fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
150	Cyclic position 15 :speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
151	Cyclic position 15 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
152	Cyclic position 15 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
153	Cyclic position 16 : Turns	-32768 ÷ 32767	-32768 ÷ 32767	-	r/w
154	Cyclic position 16 : fraction of turn	see Note 1 at the end of document	see Note 1 at the end of document	-	r/w
155	Cyclic position 16 :speed Max	1 ÷ 9999	1 ÷ 9999	rpm	r/w
156	Cyclic position 16 :acceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
157	Cyclic position 16 :deceleration	1 ÷ 60000	1 ÷ 60000	rpm/s	r/w
158	Index cyclic positions	1 ÷ 16	<ul style="list-style-type: none"> • 1 = max position 1 • • • 16 =max position16 		r/w

Vibration parameters

159	Beats	3000 ÷ 1	3000 ÷ 1	-	r/w
160	Turns	3000 ÷ 0	3000 ÷ 0	s	r/w
161	Fraction of turn	3599 ÷ 0	359.9 ÷ 0.00	°	r/w

Electric axis parameters

162	Pulses per rotation Master	16384 ÷ 200	16384 ÷ 200	p/t	r/w
163	Time of phase displacement	1000 ÷ 1	10.00 ÷ 0.01	s	r/w
164	Increase ratio	1000 ÷ 1	10.00 ÷ 0.01	-	r/w
165	Time of increase ratio	1000 ÷ 1	10.00 ÷ 0.01	s	r/w
166	Ramp of phase displacement	10000 ÷ 1	10000 ÷ 1	rpm/s	r/w
167	Speed of phase displacement	200 ÷ 0	200 ÷ 0	rpm	r/w
168	Internal ratio selection 1	8000 ÷ 1	8.000 ÷ 0.001	-	r/w
169	Internal ratio selection 2	8000 ÷ 1	8.000 ÷ 0.001	-	r/w
170	Internal ratio selection 3	8000 ÷ 1	8.000 ÷ 0.001	-	r/w
171	Internal ratio selection 4	8000 ÷ 1	8.000 ÷ 0.001	-	r/w

Motors parameters

172	identifier	255 ÷ 1	255 ÷ 1	-	r/w
173	Rated speed	9999 ÷ 0	9999 ÷ 0	rpm	r/w

174	Rated current	60000 ÷ 0	600.00 ÷ 0.00	A	r/w
175	Peak current	60000 ÷ 0	600.00 ÷ 0.00	A	r/w
176	Stall current	60000 ÷ 0	600.00 ÷ 0.00	A	r/w
177	Voltage	500 ÷ 100	500 ÷ 100	V	r/w
178	Phase resistor	10000 ÷ 10	10000 ÷ 10	mΩ	r/w
179	Sincronous inductance	400 ÷ 10	40.0 ÷ 1.0	mH	r/w
180	Time I2t	3000 ÷ 1	3000 ÷ 1	s	r/w
181	Poles Motor	8 ÷ 1	<ul style="list-style-type: none"> • 1 = Motor 2 Poles • 2 = Motor 4 Poles • • 8 = Motor 16 poles 		r/w
182	poles Resolver	4 ÷ 1	<ul style="list-style-type: none"> • 1 Resolver = 2 poles • 2 Resolver = 4 poles • 3 Resolver = 6 poles • 4 Resolver = 8 poles 		
183	Resolver Offset	1 ÷ 36000	0.01 ÷ 360.00	°	r/w
184	Kp current	1 ÷ 2000	1 ÷ 2000	-	r/w
185	Ki current	1 ÷ 2000	1 ÷ 2000	-	r/w
186	Kp current	1 ÷ 1000	0 ÷ 1000	-	r/w

State Variables (only read)					
10000	Alarms variable 1 (BIT) Bit (0): Warning over speed Bit (1): Null Bit (2): Warning out of position Bit (3÷15): Null 0	Display code Code: 17 ----- Code: 19			r
10001	Alarms variable 2 (BIT) Bit (0): Error E ² Prom Bit (1): Hall sensor broken Bit (2): Over current (Fault IGBT) Bit (3): Over voltage Bit (4): Voltage fault Bit (5): phase fault Bit (6): Resolver error Bit (7): Null Bit (8): Over Temperatur Motor Bit (9): Braking resistor Bit (10): 24 V fault Bit (11): Under Voltage Bit (14): position error Bit (13): Error Home Position Bit (14): Warning I ² t Inverter Bit (15): Warning I ² t Motor	Display code Code: 01 Code: 02 Code: 03 Code: 04 Code: 05 Code: 06 Code: 07 ----- Code: 09 Code: 10 Code: 11 Code: 12 Code: 13 Code: 14 Code: 15 Code: 16			r
10002	Type of alarms/Warning 1 (BIT) Bit (0): Over speed Bit (1): Null Bit (2): Warning out of position Bit (3÷15): Null 0 NOTE <ul style="list-style-type: none"> • if bit at 1 = Alarm • if bit at 0 = Warning 				

10003	Type of alarms/Warning 2 (BIT) Bit (0): Errore E ² Prom Bit (1): Hall sensor broken Bit (2): Over current (Fault IGBT) Bit (3): Over voltage Bit (4): Voltage fault Bit (5): Phase Fault Bit (6): Resolver error Bit (7): Null Bit (8): Over Temperature Motor Bit (9): braking resistor Bit (10): 24 V fault Bit (11): Under Voltage Bit (14): position error Bit (13): Error Home Position Bit (14): I ² t Inverter Bit (15): I ² t Motor NOTA <ul style="list-style-type: none"> • If bit at 1 = Alarm • If bit at 0 = Warning 				r
10004	Sistem status (BIT) Bit (0): I ² t Bit (1): Drive Ok Bit (2): Direction Bit (3): Power Enable Bit (4): Zero Speed/Position reached Bit(5) : OverSpeed/Err. Position Bit (6): Alarm status Bit (7): Home Position status Bit (8): Position status(speed: Jog/An.) Bit (9÷15): Null 0				
10005	Measured speed			rpm	r
10006	Measured current			A	r
10007	Measured voltage			V	r
10008	axes ratio				r
10009	Measured Turns				r
10010	fraction of the turn measured				r
10011	Posizione Resolver measured				r
10012	Size Current index				r
10013	Size Voltage index				r

Note 1 (position fraction) :

- (0 ÷ 32767) with Resolver
- (0 ÷ (Reference pulses of the encoder - 1) address 49) when it's linked to an external encoder

1.5 Examples of Modbus Telegrams

Here Below you will find some Modbus telegrams. It's also shown the “CRC” calculation made according to official Modbus indications (“Modbus_over_serial_line_V1.pdf” official document). The numerical values of the telegrams on the tables are indicated in Hex (hexadecimal).

1.5.1 Register writing (Function code 06)

Writing of the value 10000 (2710h) on the register 58 (3Ah) using function code 06 to the slave address 1 : The register of the address 58 corresponds to the turns of the position with selection 1.

Packet sent from the Master							
1	2	3	4	5	6	7	8
Slave address	Function Code	Register Address		value		CRC	
01	06	00	3A	27	10	B3	FB

Answer packet sent from the Slave							
1	2	3	4	5	6	7	8
Slave address	Function Code	Register Address		value		CRC	
01	06	00	3A	27	10	B3	FB

1.5.2 Enabling the drive using the function code 05

To enable the drive via Modbus can be done using the telegram function code 05 that allows to set a single “coils” (output) on the basis of the address sent, in this case you set at 1 the “coils” at the address 0,that corresponds to enable the power..

Packet sent from the Master							
1	2	3	4	5	6	7	8
Slave address	Function Code	Coil Address		value to enable the “Coil”		CRC	
01	05	00	00	FF	00	8C	3A

Answer packet sent from the Slave							
1	2	3	4	5	6	7	8
Slave address	Function Code	Coil Address		value to enable the "Coil"		CRC	
01	05	00	00	FF	00	8C	3A

1.5.3 Run command to use function code 05

The “Run” command to enable the reference can be sent using the telegram with the function code 05 and setting at 1 the “coils” at the address 5,that correspond to enable the reference.

Packet sent from the Master							
1	2	3	4	5	6	7	8
Slave address	Function Code	Coil Address		value to enable the "Coil"		CRC	
01	05	00	05	FF	00	9C	3B

Answer packet sent from the Slave							
1	2	3	4	5	6	7	8

Slave address	Function Code	Coil Address		value to enable the "Coil"		CRC	
01	05	00	05	FF	00	9C	3B

1.5.4 Disable the drive using the function code 05

To disable the drive via Modbus it is always possible using the telegrams with function code 05 and setting at 0 the “coils” at the address 0, that corresponds to disable the power.

Packet sent from the Master							
1	2	3	4	5	6	7	8
Slave address	Function Code	Coil Address		Value to disable the "Coil"		CRC	
01	05	00	00	00	00	CD	CA

Answer packet sent from the Slave							
1	2	3	4	5	6	7	8
Slave address	Function Code	Coil Address		Value to disable the "Coil"		CRC	
01	05	00	00	00	00	CD	CA

1.5.5 Reading of the slave register using the function code 03

The reading of the register can be done using the function code 03, in this case the register read is at the address 10005 (2715h) that corresponds to the measured speed.

In the telegram the speed read is of 107 rpm (in Hex 6B)

Packet sent from the Master							
1	2	3	4	5	6	7	8
Slave address	Function Code	Register Address		Number of register to read		CRC	
01	03	27	15	00	01	9F	7A

Answer packet sent from the Slave						
1	2	3	4	5	6	7
Slave address	Function Code	Number of bytes registers read	value of the register		CRC	
01	03	02	00	6B	F9	AB