RSGD 45mm Modbus Protocol

Rev 1.0

Contents

Modbus RTU Protocol

1.1 Introduction

Modbus RTU protocol is a messaging structure used to establish master-slave communication between devices in which only one device (called master) can initiate transactions (called queries); the other devices (called slaves) respond with the requested data to the master.

1.2 Modbus RTU functions

The following Modbus functions are available on the RSGD 45mm motor starters:

> ➢ Reading of n "Input register"   (code 04h)
> ➢ Writing of one "holding register"   (code 06h)
> ➢ Broadcast mode   (code 00h)

In this document, the Modbus address field is indicated in two modes:

> ➢ *Modicon address*: it is the 6-digit Modicon representation with Modbus function code 04h (Read input registers).
> ➢ *Physical address*: it is the word address value included in the communication frame.

Read Input Registers (04h):

This function code is used to read the contents of <u>1 input register</u> (word). The request frame specifies the starting register address and the number of registers to be read.

The register data in the response message is packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

The only exceptions are:

> ➢ History file readout

Request Frame:

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	04h	-
Starting Address	2 bytes	000h to 00D5h	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	1h to 78h (1 to 120)	Byte order: MSB, LSB – As stated above no contiguous registers can be read. The values 1 to 78h are the minimum and maximum numbers respectively that are accepted. Each read function should be separately called using the number stated in the field named 'Length (words)'.
CRC	2 bytes	-	-

Response Frame (correct action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	04h	-
Byte Count	1 byte	N word * 2	-
Register Value	N* 2 bytes	-	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (incorrect action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	84h	-
Exception Code	1 byte	01h, 02h, 03h, 06h	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 06h: slave device busy
CRC	2 bytes	-	-

Write Single Holding Register (06h):

This function code is used to write a single holding register. The Request frame specifies the address of the register (word) to be written and its contents.

The correct response is an echo of the request, returned after the register contents have been written.

Request Frame:

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	06h	-
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (correct action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	06h	-
Starting Address	2 bytes	0000h to 00E3h	Byte order: MSB, LSB
Register Value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (incorrect action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	86h	-
Exception Code	2 bytes	01h, 02h, 03h, 06h	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 06h: slave device busy
CRC	2 bytes	-	-

Broadcast Mode (00h)

In broadcast mode the master can send a request (command) to all the slaves. No response is returned to broadcast requests sent by the master. It is possible to send the broadcast message only with function code 06h and using address 00h.

1.3 Register Map

Data Format Representation

Format	IEC data type	Description	Bits	Range
UINT16	UINT	Unsigned integer	16	0…65535

Group Description

Group	Description
Communication Parameters	Includes the communication parameters of the device
Device Settings	Indicates the settings of the device
Device Status	Describes the status of the device and other parameters of the device
Control	Includes several functions to control the device
Delays	Includes the delays related to stop-to-start and start-to-start intervals
Protection Settings	Includes information on alarm limits
History File	Contains information about the last starts storef in the memory of the device. For further information on the history file refer to Appendix
Alarm Counters	Lists the number of times a particular alarm has occurred
General Counters	Includes counters related to operational use
Instantaneous Voltage and Current	Lists the instantaneous electrical variables (voltage and current)
Maximum Current Variables	Lists the maximum current measured on each phase during ramp-up, bypass and ramp-down
Instantaneous Power Variables	Lists all information related to power
Serial code	Contains information on the serial number of the device

Communication Parameters

Description	Function R	Function W	Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
Device Address	√	√	2000h	1	UINT16	1	Device Address [x1] 1: Device Address 1 2: Device Address 2 . . . 247: Device Address 247
Baud Rate	√	√	2001h	1	UINT16	0	Baud Rate [x1] 0: 9600bps 1: 19200bps 2: 38400bps 3: 57600bps
Parity	√	√	2002h	1	UINT16	0	Parity [x1] 0: No Parity, 2 stop bits 1: Odd Parity, 1 stop bit 2: Even Parity, 1 stop bit

Device Settings

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Ramp-up (s)	√	X	8000h	1	UINT16	1	N/A [x1000]
Ramp-down (s)	√	X	8001h	1	UINT16	0	N/A [x1000]
Full load current (A_{RMS})	√	√	8002h	1	UINT16	Device rated current	2.0 … Device rated current [x10]
Current Limit Ratio	√	X	8003h	1	UINT16	Device dependent	N/A [x10]
System Voltage	√	X	8007h	1	UINT16	Device dependent	110 / 230 VAC [x10]

Device Status

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Soft Starter Status	√	X	5000h	1	UINT16	-	0: Idle 1: Ramp-up 2: Bypass 3: Ramp-down 4: Alarm 5: Alarm Recovery
Top of ramp (TOR) relay status	√	X	5001h	1	UINT16	-	0: TOR relay is OFF 1: TOR relay is ON
Alarm relay status	√	X	5002h	1	UINT16	-	0: Alarm relay is OFF 1: Alarm relay is ON
Control Input – Status A1-A2 / Modbus	√	X	5006h	1	UINT16	-	0: Switch OFF 1: Switch ON
Alarm status	√	X	5007h	1	UINT16	-	Outputs a number equal to number of flashes of alarm issued. (see table below)
Soft Alarm Reset	X	√	5009h	1	UINT16	-	0: No action 1: Reset alarm

Alarm status (5007h) flash table:

No of Flashes	Alarm Status
0	No alarm
1	Internal fault
2	Wrong phase sequence
3	Line voltage out of range
4	Phase loss (Wiring fault)
5	Locked rotor
6	Dry-run
7	Over temperature
8	Overload
9	Voltage unbalance
10	Short-circuit

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
User Interface	√	X	500Ah	1	UINT16	-	0: No communication 1:Initialized but stopped responding 17: Communicating properly 170: No "remote" UI installed

Control

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Control Mode	√	√	7000h	1	UINT16	0	0: A1, A2 control mode 1: Modbus control mode
Control Input Status - Modbus	√	√	7001h	1	UINT16	-	0: Switch OFF 1: Switch ON
Force Refresh Signal	√	√	7002h	1	UINT16	0	0: Disable 1: Enable
Refresh Interval (s)	√	√	7003h	1	UINT16	10	1 … 600 [x1]
Force Refresh Signal (Heartbeat Signal)	√	√	7004h	1	UINT16	-	1: To send force refresh signal. If force refresh signal mode is enabled, this register has to be set to 1 within every refresh interval otherwise the RSGD 45mm unit will switch OFF the output.

Delays

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Minimum Stop to Start Delay (s)	√	√	9000h	1	UINT16	0	0 … 65535 [x1]
Minimum Start to Start Delay (s)	√	√	9001h	1	UINT16	0	0 … 65535 [x1]
Time from Last Stop (s)	√	X	9002h	1	UINT16	-	0 … 65535 [x1]
Time from Last Start (s)	√	X	9003h	1	UINT16	-	0 … 65535 [x1]

Protection Settings

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Voltage supply limit (%)	√	√	A000h	1	UINT16	20.0	1.0…100.0 [x1]
Over Voltage Supply Limit (%)	√	X	A001h	1	UINT16	20.0	1.0 … 20.0 [x10]
Under Voltage Supply Limit (%)	√	X	A002h	1	UINT16	20.0	1.0 … 20.0 [x10]
I_{MAX} Bypass (A_{rms})	√	X	A004h	1	UINT16	Device dependent	12.0 … 90.0 [x10]

Phase sequence alarm mode	✓	✓	A005h	1	UINT16	0001h	0: Enable 1: Disable
Motor Overload alarm mode	✓	✓	A006h	1	UINT16	0000h	0: Enable 1: Disable
Dry run alarm mode	✓	✓	A007h	1	UINT16	0001h	0: Enable 1: Disable
Dry run alarm limit (%)	✓	✓	A008h	1	UINT16	50.0	0.0…100.0 (x10)
Dry run alarm delay (s)	✓	✓	A009h	1	UINT16	5	0…30 [x1]
Auto adapt	✓	✓	A00Ah	1	UINT16	Enable	0: Disable 1: Enable

History File

The history file allows you to download a series of data related to the last 32 starts done by the device.

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Start 1 to Start 4	✓	X	C000h	64	UINT16	-	N/A [x1]
Start 5 to Start 8	✓	X	C001h	64	UINT16	-	N/A [x1]
Start 9 to Start 12	✓	X	C002h	64	UINT16	-	N/A [x1]
Start 13 to Start 16	✓	X	C003h	64	UINT16	-	N/A [x1]
Start 17 to Start 20	✓	X	C004h	64	UINT16	-	N/A [x1]
Start 21 to Start 24	✓	X	C005h	64	UINT16	-	N/A [x1]
Start 25 to Start 28	✓	X	C006h	64	UINT16	-	N/A [x1]
Starts 29 to Start 32	✓	X	C007h	64	UINT16	-	N/A [x1]

Alarm Counters

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Internal fault	✓	X	6000h	1	UINT16	-	0 … 65535 [x1]
Short-circuit	✓	X	6001h	1	UINT16	-	0 … 65535 [x1]
Wrong phase sequence	✓	X	6002h	1	UINT16	-	0 … 65535 [x1]
Line voltage out of range	✓	X	6003h	1	UINT16	-	0 … 65535 [x1]
Phase loss (Wiring fault)	✓	X	6004h	1	UINT16	-	0 … 65535 [x1]
Locked Rotor	✓	X	6005h	1	UINT16	-	0 … 65535 [x1]
Dry run	✓	X	6006h	1	UINT16	-	0 … 65535 [x1]

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Over temperature	✓	X	6007h	1	UINT16	-	0 … 65535 [x1]
Overload	✓	X	6008h	1	UINT16	-	0 … 65535 [x1]
Voltage unbalance	✓	X	6009h	1	UINT16	-	0 … 65535 [x1]

General Counters

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
kWh	✓	X	4000h	1	UINT16	-	0 … 65535 [x1]
Overflow of kWh counter	✓	X	4001h	1	UINT16	-	0 … 65535 [x1]
Number of starts	✓	X	4002h	1	UINT16	-	0 … 65535 [x1]
Overflow of number of starts	✓	X	4003h	1	UINT16	-	0 … 65535 [x1]
Running hours (hr)	✓	X	4004h	1	UINT16	-	0 … 65535 [x1]
Running seconds (s)	✓	X	4005h	1	UINT16	-	0 … 65535 [x1]
Maximum start time (ms)	✓	X	4006h	1	UINT16	-	0 … 65535 [x1]
Number of HP starts	✓	X	4007h	1	UINT16	-	0 … 65535 [x1]
Number of power up	✓	X	4008h	1	UINT16	-	0 … 65535 [x1]
Number of power down	✓	X	4009h	1	UINT16	-	0 … 65535 [x1]

Instantaneous Voltage and Current

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
V 1-2 (V_{RMS})	✓	X	3000h	1	UINT16	-	N/A [x10]
V 2-3 (V_{RMS})	✓	X	3001h	1	UINT16	-	N/A [x10]
V 3-1 (V_{RMS})	✓	X	3002h	1	UINT16	-	N/A [x10]
I L1 (A_{RMS})	✓	X	3003h	1	UINT16	-	N/A [x10]
I L2 (A_{RMS})	✓	X	3004h	1	UINT16	-	N/A [x10]
I L3 (A_{RMS})	✓	X	3005h	1	UINT16	-	N/A [x10]

Maximum Current Variables

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
I L1 Ramp-up (A$_{RMS}$)	✓	X	4100h	1	UINT16	-	N/A [x10]
I L2 Ramp-up (A$_{RMS}$)	✓	X	4101h	1	UINT16	-	N/A [x10]
I L3 Ramp-up (A$_{RMS}$)	✓	X	4102h	1	UINT16	-	N/A [x10]
I L1 Bypass (A$_{RMS}$)	✓	X	4103h	1	UINT16	-	N/A [x10]
I L2 Bypass (A$_{RMS}$)	✓	X	4104h	1	UINT16	-	N/A [x10]
I L3 Bypass (A$_{RMS}$)	✓	X	4105h	1	UINT16	-	N/A [x10]
I L1 Ramp-down (A$_{RMS}$)	✓	X	4106h	1	UINT16	-	N/A [x10]
IL2 Ramp-down (A$_{RMS}$)	✓	X	4107h	1	UINT16	-	N/A [x10]
I L3 Ramp-down (A$_{RMS}$)	✓	X	4108h	1	UINT16	-	N/A [x10]

Instantaneous Power Variables

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
P$_{output}$ (kW)	✓	X	3100h	1	UINT16	-	N/A [x10]
Q$_{output}$ (kVAr)	✓	X	3101h	1	UINT16	-	N/A [x10]
S$_{output}$ (kVA)	✓	X	3102h	1	UINT16	-	N/A [x10]
PF Total Total	✓	X	3103h	1	UINT16	-	N/A [x1000]
Frequency (Hz)	✓	X	3104h	1	UINT16	-	N/A [x100]
TCU (%)	✓	X	3108h	1	UINT16	-	N/A [x10]
NTC Temperature	✓	X	3109h	1	UINT16	-	N/A [+27300 & x100]

Serial Code

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Order number	✓	X	8F00h	1	UINT16	-	Manufacturing plant [x1] (Change to ASCII)
	✓	X	8F01h	1	UINT16	-	Year of manufacture [x1] (Change to ASCII)
	✓	X	8F02h	1	UINT16	-	Week of manufacture [x1]
	✓	X	8F03h	1	UINT16	-	Order number (LSW) [x1]

	✓	X	8F04h	1	UINT16	-	Order number (MSW) [x1]
Serialisation	✓	X	8F05h	1	UINT16	-	Device number within particular order [x1]

⚠️ The complete device serial number is made up of the combination of the *Order Number* and *Serialisation*.