ENGINEERING

Modbus TCP Protocol for Nimbus - SLC TWIN PRO2 4-10 kVA, V 1.0

Indice general

MODBUS FUNCTION CODES.

The NIMBUS supports the following function codes:

- 01H - Read Coils
- 02H - Read Discrete Inputs
- 03H - Read Holding Registers
- 04H - Read Input Registers
- 05H - Write Single Coil

Please note a UPS must support this type of commands - the currently available function codes depend on the connected UPS. In general, standard UPS systems provide the functions 03H and 04H. The NIMBUS is designed not to distinct between these two functions.

Furthermore, the NIMBUS supports a query speed up to 38400 baud to allow a flexible integration into existing IT environments.

Communication Example:

The following tables contain the general command descriptions and examples with Modbus RTU framing.

Query

SLAVE NO	FUNCTION CODE	ADDRESS OF FIRST WORD TO READ		WORD COUNT		CHECKSUM LRC OR CRC
1 byte	1 byte	High byte	Low byte	High byte	Low byte	1 or 2 byte(s)

Answer

SLAVE NO	FUNCTION CODE	BYTE COUNT	HIGH BYTE OF FIRST WORD	LOW BYTE OF FIRST WORD	BYTES WITH CONTENTS OF N WORDS	CHECKSUM LRC OR CRC
1 byte	1 byte	1 byte	1 byte	1 byte	n * 2 bytes	1 or 2 byte(s)

Read Words (Functions 03h and 04h):

- Example: Read Words, Function 04h

Read one word at address 63h (= 99 decimal):

Query

BYTE	1	2, 3	4, 5	6, 7	8, 9	10, 11	12, 13	14, 15	16	17
Meaning	Leading colon	Slave number	Function code	address of first word to read		word count to read		LRC	Carriage return	line feed LF
				high byte	low byte	high byte	low byte			
HEX	[3A]	[30][31]	[30][34]	[30][30]	[36][33]	[30][30]	[30][31]	[39][37]	[0D]	[0A]

Answer

BYTE	1	2, 3	4, 5	6, 7	8, 9	10, 11	12, 13	14	15
Meaning	leading colon	Slave number	function code	byte count	contents of the word high byte	LRC low byte	carriage return	line feed LF	
HEX	[3A]	[30][31]	[30][34]	[30][32]	[31][32]	[33][34]	[42][33]	[0D]	[0A]

HEX: Hexadecimal values of the data

→ The word at address contains the value 1234h = 4660 decimal.

Example: Read Words, Function 04h, RTU Mode

Read one word at address 63h (= 99 decimal) (The word at address contains the value 1234h = 4660 decimal.):

Query

BYTE		1	2	3	4	5	6	7	8	
Meaning	silent interval >= 3,5 characters	Slave number	function code	address of first word to read		word count to read		CRC		silent interval >= 3.5 characters
				high byte	low byte	high byte	low byte	low byte	High byte	
RTU HEX		[01]	[04]	[00]	[63]	[00]	[01]	[C1]	[D4]	

Answer

BYTE		1	2	3	4	5	6	7	
Meaning	silent interval >= 3.5 characters	Slave number	function code	byte count	Contents of the word		CRC		Silent interval >= 3.5 characters
					high byte	low byte	low byte	high byte	
RTU HEX		[01]	[04]	[02]	[12]	[34]	[B4]	[47]	

Modbus error codes

Excepted broadcast messages, where the master device sends requests to the slave device, the master expects a clear and valid response from the slave he queried. If the answer does not match with expected specifications, the packet will be discarded with a corresponding error message.

There are several possible events that may occur when a slave answers to a master's request:

1. The slave responds accordingly with a data packet that is both, correct and valid.

   The master will handle it accordingly.

2. The slave unit does not receive the request the master device sends.

   This event occurs, for example, in case of a communication error. from the point of view of the master the request was not answered. As a consequence, the master will assume an appropriate timeout incident.

3. Master or slave will send invalid queries / answers.

Such a phenomenon can occur if the termination resistors are not set up correctly: Although data is being sent, there are clear parity, LRC, or CRC errors within the data packet. Since invalid packets are discarded, the slave will usually ignore an invalid request without answering. However, the master's reaction will differ: In general, he will handle a faulty slave response with a corresponding timeout message.

4. The slave receives a valid request that cannot be answered.

   This occurs if a requested register does not exist. If the slave unit receives a valid request, but the requested readings are not available, the slave unit will respond a specific exception message in order to inform the master about the reason for this error.

   The NIMBUS provides these error codes:

   - 02H Illegal Data Address.

     The address data obtained with the valid request is not a valid address servable by the slave.

   - 03H Illegal Data Value

     A contained value inside a valid request is not an allowed for this slave.

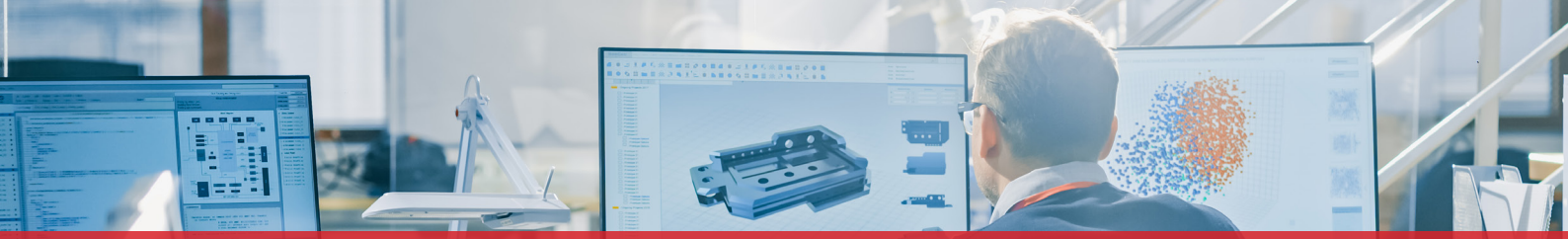
   - 06H Slave device busy

     The slave has received a valid request, but is currently busy with a time-consuming or time-critical process. As a result, he cannot serve the master for now. For the master, there is no reason to assume a timeout- he will repeat the request some time later.

UPS PARAMETERS.

Please note: The type U/S defines if the answer contains has a mathematical sign(+/-) or not. Type U means unsigend (without a mathematical sign), type S means sigend (with a mathematical sign). The answer may be true or false. Some clients (f.e. MODBUS Poll) use MODBUS addresses with a valid range between 0-65535. Some clients use as the valid range 1-65536, so it may be necessary to add 1 to the address.

type_ reg	address_ reg	type_ cod_ reg	num_ reg	description_reg	multiplying_ factor	units	cloud_ sensor_ type	cloud_ sensor_ subtype	sensor_ group	backup
r	2	dec	1	Protocol ID	1	---	info	misc	System	false
r	3	ascii	6	UPS serial number	1	---	info	misc	System	false
r	11	ascii	3	UPS model	1	---	info	misc	System	false
r	14	dec	1	UPS type	1	0=Standby/1=Line Interactive /./.../.../10=Online	info	misc	System	false
r	18	dec	1	DSP1 firmware number	1	---	info	misc	System	false
r	19	dec	1	DSP1 firmware version	1	---	info	misc	System	false
r	20	dec	1	DSP1 firmware extra version	1	---	info	misc	System	false
r	21	dec	1	MCU firmware number	1	---	info_cloud	misc	System	false
r	22	dec	1	MCU firmware version	1	---	info	misc	System	false
r	23	dec	1	MCU firmware extra version	1	---	info	misc	System	false
r	24	dec	1	Input phase	1	./1=Mono Phase/./3=Tri Phase	info_cloud	misc	System	false
r	25	dec	1	Output phase	1	./1=Mono Phase/./3=Tri Phase	info_cloud	misc	System	false
r	26	ascii	1	UPS operating mode	1	P=Power On/S=Standby/ Y=Bypass/L=OnLine/ B=Batteries/T=Battery Test/ F=Fault/E=ECO/C=Frequency Converter/D=Power Off	info_cloud	misc	System	false
r	400	ascii	5	General status of the UPS	1	0=False/1=True	alarm	alarm	Alarm	false
r	405	ascii	1	UPS failure	1	---	alarm	alarm	Alarm	false
r	414	ascii	4	info.ups_fail_status	1	0=False/1=True	alarm	alarm	Alarm	false
r	418	ascii	5	desc.warning_status	1	---	alarm	alarm	Alarm	false
r	423	dec	1	EPO status	1	0=Open (auto restart)/1=Close (auto restart)/2=Open (manual restart)/3=Close (manual restart)/4=Disable	alarm	alarm	Alarm	false
r	424	dec	1	Input voltage before fault	0.1	V	data	voltage	Input	false
r	425	dec	1	Input frequency before fault	0.1	Hz	data	frequency	Input	false
r	426	dec	1	Output voltage before fault	0.1	V	data	voltage	Output	false
r	427	dec	1	Output frequency before fault	0.1	Hz	data	frequency	Output	false
r	428	dec	1	Output current before fault	0.1	A	data	current	Output	false
r	429	dec	1	Percentage of charge before failure	1	%	data	load	Output	false
r	430	dec	1	Positive DC bus voltage before fault	0.1	V	data	internal_data	Inverter	false
r	431	dec	1	Negative DC bus voltage before fault	0.1	V	data	internal_data	Inverter	false
r	432	dec	1	Battery voltage before failure	0.1	V	data	voltage	Battery	false



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type_ reg	address_ reg	type_ cod_ reg	num_ reg	description_reg	multiplying_ factor	units	cloud_ sensor_ type	cloud_ sensor_ subtype	sensor_ group	backup
r	433	dec	1	Maximum temperature before failure	0.1	°C	data	internal_data	Other	false
r	500	dec	1	Input voltage at L1	0.1	V	data_ cloud_plot	voltage	Input	false
r	501	dec	1	Input frequency	0.1	Hz	data_cloud	frequency	Input	false
r	502	dec	1	Output voltage	0.1	V	data_ cloud_plot	voltage	Output	false
r	503	dec	1	Output frequency	0.1	Hz	data_cloud	frequency	Output	false
r	504	dec	1	Ouput current	0.1	A	data_ cloud_plot	current	Output	false
r	505	dec	1	Load percentage	0.1	%	data_cloud	load	Output	false
r	506	dec	1	Positive DC bus voltage	0.1	V	data	data	Other	false
r	507	dec	1	Negative DC bus voltage	0.1	V	data	data	Other	false
r	508	dec	1	Positive battery voltage	0.1	V	data_cloud	voltage	Battery	false
r	511	dec	1	Number of batteries in parallel	1	---	data	data	Battery	false
r	512	dec	1	Battery capacity	1	%	data_cloud	load	Battery	false
r	513	dec	1	Remaining backup time	1	min	data_cloud	misc	Battery	false
r	520	dec	1	Maximum temperature	0.1	°C	data_cloud	data	Other	false
r	700	dec	1	Rated output power	1	VA	info	power	Output	false
r	701	dec	1	Nominal output power factor	0.001	---	info	misc	Output	false
r	702	dec	1	Nominal input voltage	0.1	V	info	voltage	Input	false
r	703	dec	1	Nominal output voltage	0.1	V	info	voltage	Output	false
r	704	dec	1	Number of units in the battery string (Semi-Bus)	1	---	data	data	Battery	false
r	705	dec	1	Nominal battery voltage	0.1	V	info	voltage	Battery	false
r	706	dec	1	Nominal output frequency	0.1	Hz	info	frequency	Output	false
r	707	dec	1	Nominal battery bus voltage	0.1	V	info	voltage	Battery	false
r	708	dec	1	Rated output current	0.1	A	info	current	Output	false
r	1000	dec	1	Enable / disable all audible alarms	1	0=Disable/1=Enable	info	misc	Flags	false
r	1001	dec	1	Enable / Disable Audible Alarm Battery Mode	1	0=Disable/1=Enable	info	misc	Flags	false
r	1002	dec	1	Enable / disable high efficiency mode (ECO mode)	1	0=Disable/1=Enable	info	misc	Flags	false
r	1003	dec	1	Enable / disable forbidden bypass	1	0=Disable/1=Enable	info	misc	Flags	false
r	1004	dec	1	Enable / disable inverter clear function	1	0=Disable/1=Enable	info	misc	Flags	false
r	1005	dec	1	Enable / disable bypass function when UPS shuts down	1	0=Disable/1=Enable	info	misc	Flags	false
r	1006	dec	1	Enable / Disable Static Bypass Transfer	1	0=Disable/1=Enable	info	misc	Flags	false
r	1007	dec	1	Enable / disable audible bypass warning	1	0=Disable/1=Enable	info	misc	Flags	false
r	1008	dec	1	Enable / disable converter mode	1	0=Disable/1=Enable	info	misc	Flags	false
r	1200	dec	1	Battery Output Voltage Calibration	1	V	info	misc	Calibrations	false

type_ reg	address_ reg	type_ cod_ reg	num_ reg	description_reg	multiplying_ factor	units	cloud_ sensor_ type	cloud_ sensor_ subtype	sensor_ group	backup
r	1201	dec	1	Output voltage calibration	1	V	info	misc	Calibrations	false
r	1210	dec	1	Bypass voltage high range	1	V	info_cloud	misc	Calibrations	false
r	1211	dec	1	Low margin of bypass voltage	1	V	info_cloud	misc	Calibrations	false
r	1212	dec	1	Bypass frequency high range	0.1	Hz	info_cloud	misc	Calibrations	false
r	1213	dec	1	Low margin of bypass frequency	0.1	Hz	info_cloud	misc	Calibrations	false
r	1214	dec	1	High voltage range in ECO mode	1	V	info	misc	Calibrations	false
r	1215	dec	1	Low voltage range in ECO mode	1	V	info	misc	Calibrations	false
r	1216	dec	1	High frequency range in ECO mode	0.1	Hz	info	misc	Calibrations	false
r	1217	dec	1	Low frequency range in ECO mode	0.1	Hz	info	misc	Calibrations	false