7KT134x MODBUS

Referenced Documents

ID	Title
[1]	MODBUS over Serial Line – Specification & Implementation guide V1.0 – 12/02/02
[2]	MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1a – June 4, 2004

Abbreviations and Notations

The following abbreviations and notations are used in this document.

RS485 EIA/TIA-485 standard

RTU One of the two transmission modes applicable to Modbus

Introduction

In the following volume the MODBUS communication system for the Siemens 7KT134x is described.
A brief general overview of the Modbus protocol is described first, in **"Overview on MODBUS Protocol"**.
In the following **"Modbus in Siemens 7KT134x instruments"**, the implementation on the Siemens 7KT134x is described.

Overview on MODBUS Protocol

MODBUS is a communication protocol which creates a hierarchical structure: 1 master and several slaves.
The physical access is based on a serial link half-duplex transmission. Modbus enables multi-point link connections via RS485 electrical interfaces. Each slave must have an unique address from 1 to 247 (see [1]).
The standard implementation over a serial link uses the RTU character and framing formatting.
The slaves share with the Modbus master a virtual database.

Modbus in Siemens 7KT134x instruments

This implementation of the Modbus protocol follows the standard slave mode. It uses the RTU format.
The 7KT134x models have the following features and constraints:

RS485 port options
baud rate: 9600 or 19200 bps. The baud rate can be adjusted on the instrument by means of "Baudrate Menu" (default 19200)
parity: fixed to none
data bits: fixed to 8
stop bits: fixed to 1
flow control: fixed to none

RTU Framing
The Modbus protocol requires the end of a frame to be recognized by the slave. An "End of frame timeout" is used.
The End of frame timeout is approximately 2 milliseconds when the baud rate is set to 19200, or 4 milliseconds when the baud rate is set to 9600.

Device addressing
Modbus requires the address of each device in the network be a one byte value in the range 1 to 247. The Modbus address can be adjusted on the instrument by means of "Modbus Menu".
It is of great importance to ensure, that there are no other devices with the same address on the bus. In such a case, an abnormal behavior of the whole serial bus can occur, the Master can't communicate with all present slaves on the bus.
Broadcast requests are not supported by this implementation; no values may be changed by a remote master into the slave database, because there are no parameters needed to be written.

Supported functions

Modbus function number	Description
03	Read N words
07	Read exception status
08	Diagnostics exchange
11	Read event counter
12	Read trace buffer
43/14	Read Device Identification

All other functions are not relevant in the Modbus implementation of the Siemens 7KT134x devices.

Layout of the exchange database
In the following table registers are mapped into the Modbus WORD READOUTS. The Modbusfunction used to read out the data is 3.

Double words (type is DW) are mapped as a 32Bit Interger value.
The conversion from hexadecimal to decimal is as follows:
Example: Register 1: 0003 (Hex)
Register 2: AF21 (Hex)
Conversion of 0003AF21 (Hex) gives 2141441 (decimal)

NOTE:
Some measures are reported, internally, as 64 Bit values (type is QW), using a 1000000000 base; in this case the first double word reported is the most significant double word.

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For instance the "Tariff 1 related consumed active energy [mWh]" can be calculated as
[(first double word (decimal) * 1000000000 (decimal)) + second double word(decimal)]
Example: Register 57: 0003
Register 58: EFD6
Register 59: 1003
Register 60: 3218

Register 57 + 58 : 0003EFD6 (Hex) gives 258006 (Dec)
258006 * 1000000000 = 258006000000000
Register 59 + 60 : 10033218 (Hex) gives 268644888 (Dec)
=> 258006000000000 + 268644888 = 258006268644888 [mWh]

Register	TYPE	Description
1 – 2	DW	L1 active power [1/100 W] (signed)
3 – 4	DW	L1 rms voltage [mV]
5 – 6	DW	L1 rms current [mA]
7 – 8	DW	L1 apparent power [1/100 VA]
9 – 10	DW	L1 power factor [1/1000 units] (signed)
11 – 12	DW	L1-L2 rms voltage [mV]
13 – 14	DW	L2 active power [1/100 W] (signed)
15 – 16	DW	L2 rms voltage [mV]
17 – 18	DW	L2 rms current [mA]
19 – 20	DW	L2 apparent power [1/100 VA]
21 – 22	DW	L2 power factor [1/1000 units] (signed)
23 – 24	DW	L2-L3 rms voltage [mV]
25 – 26	DW	L3 active power [1/100 W] (signed)
27 – 28	DW	L3 rms voltage [mV]
29 – 30	DW	L3 rms current [mA]
31 – 32	DW	L3 apparent power [1/100 VA]
33 – 34	DW	L3 power factor [1/1000 units] (signed)
35 – 36	DW	L3-L1 rms voltage [mV]
37 -38	DW	Measured temperature [m°]
39 – 40	DW	Live Irms [mA]
41 – 42	DW	frequency [mHz]
43 – 46	QW	L1-L2-L3 system active power [1/100 W].. See NOTE above
47 – 50	QW	L1-L2-L3 system apparent power [1/100 VA]. See NOTE above
51 – 52	DW	L1-L2-L3 system power factor [1/1000 units].
53 – 56	QW	L1-L2-L3 system reactive power [1/100 VAR]. See NOTE above
57 – 60	QW	Tariff 1 related consumed active energy [mWh]. See NOTE above
61 – 64	QW	Tariff 1 related supplied active energy [mWh]. See NOTE above
65 – 68	QW	Tariff 2 related consumed active energy [mWh]. See NOTE above
69 – 72	QW	Tariff 2 related supplied active energy [mWh]. See NOTE above
73 – 76	QW	Tariff 1 inductive reactive energy [mVARh]. See NOTE above
77 – 80	QW	Tariff 1 capacitive reactive energy [mVARh]. See NOTE above
81 – 84	QW	Tariff 2 inductive reactive energy [mVARh]. See NOTE above
85 – 88	QW	Tariff 2 capacitive reactive energy [mVARh]. See NOTE above
89 – 92	QW	Tariff 1 apparent energy [mVAh]. See NOTE above
93 - 96	QW	Tariff 2 apparent energy [mVAh]. See NOTE above

Although the implementation supports the exchange of a variable number of registers per frame, it should be noted that the whole database could be transferred in only one frame exchange, reading all registers.
Values transferred are the most recent values stored in the database by the measuring devices.

NOTE:
The slave doesn't answer requests more than 96 registers, because such requests are meaningless.

NOTE:
When the instrument is configured to be used in 1-L (one phase systems) or 3L (3 phases without neutral wire systems) a value "0" is assigned to the quantities meaningless in such systems, in Modbus exchange database.

Exception Status
Modbus function number 7:
All exceptions specified for the serial line implementation of the Modbus protocol are implemented. Therefore, the exception status report always returns 255 (hexadecimal 0xff) and all counters are returned when a function code of 08 is requested.

For a list of all exceptions refer to [1].

Installation

- Connect the instruments to the RS485 serial bus.
- set the modbus address using the "modbus menu" of the instruments. Each slave must have an unique address from 1 to 247. Setting the address of the instrument to "0" disables the modbus communication.
- set the baud rate using the "baudrate menu" of the instruments.
- the instrument is ready to start the communication with a modbus master now.
  (See **"Supported functions"** above)

Up to 32 instruments can be connected without repeaters. One or more repeaters must be used for further instruments. Valid Modbus addresses are from 1 to 247.

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