1. Eastron SDM630Modbus Smart Meter Modbus Protocol Implementation V1.7

1.1 Modbus Protocol Overview

This section provides basic information for interfacing the Eastron Smart meter to a Modbus Protocol network. If background information or more details of the Eastron implementation is required please refer to section 2 and 3 of this document.

Eastron offers the option of an RS485 communication facility for direct connection to SCADA or other communications systems using the Modbus Protocol RTU salve protocol. The Modbus Protocol establishes the format for the master's query by placing into it the device address, a function code defining the requested action, any data to be sent, and an error checking field. The slave's response message is also constructed using Modbus Protocol. It contains fields confirming the action taken, any data to be returned, and an error-checking field. If an error occurs in receipt of the message, SDM630Modbus will make no response. If the SDM630Modbus is unable to perform the requested action, it will construct an error message and send it as the response.

The electrical interface is 2-wire RS485, via 2 screw terminals. Connection should be made using twisted pair screened cable (Typically 22 gauge Belden 8761 or equivalent). All "A" and "B" connections are daisy chained together. Line topology may or may not require terminating loads depending on the type and length of cable used. Loop (ring) topology does not require any termination load. The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 ohm (0.25 Watt min.) resistor. A total maximum length of 3900 feet (1200 meters) is allowed for the RS485 network. A maximum of 32 electrical nodes can be connected, including the controller. The address of each Eastron can be set to any value between 1 and 247. Broadcast mode (address 0) is supported.

The format for each byte in RTU mode is:

Coding System:	8-bit per byte
Data Format:	4 bytes (2 registers) per parameter. Floating point format (to IEEE 754) Most significant register first (Default). The default may be changed if required -See Holding Register "Register Order" parameter.
Error Check Field:	2 byte Cyclical Redundancy Check (CRC)
Framing:	1 start bit 8 data bits, least significant bit sent first 1 bit for even/odd parity (or no parity) 1 stop bit if parity is used; 1 or 2 bits if no parity

Data Coding

All data values in the SDM630Modbus smart meter are transferred as 32 bit IEEE754 floating point numbers, (input and output) therefore each SDM630Modbus meter value is transferred using two Modbus Protocol registers. All register read requests and data write requests must specify an even number of registers. Attempts to read/write an odd number of registers prompt the SDM630Modbus smart meter to return a Modbus Protocol exception message. However,

for compatibility with some SCADA systems, SDM630Modbus Smart meter will response to any single input or holding register read with an instrument type specific value.

The SDM630Modbus can transfer a maximum of 30 values in a single transaction; therefore the maximum number of registers requestable is 60. Exceeding this limit prompts the SDM630Modbus to generate an exception response.

Data transmission speed is selectable between 2400, 4800, 9600, 19200, 38400 baud.

1.2 Input register

Input registers are used to indicate the present values of the measured and calculated electrical quantities. Each parameter is held in two consecutive16 bit register.The following table details the 3X register address, and the values of the address bytes within the message. A (*) in the column indicates that the parameter is valid for the particular wiring system. Any parameter with a cross(X) will return the value zero. Each parameter is held in the 3X registers. Modbus Protocol function code 04 is used to access all parameters.

For example, to request: Amps 1 Start address=0006
No. of registers =0002
Amps 2 Start address=0008
No. of registers=0002

Each request for data must be restricted to 40 parameters or less. Exceeding the 40 parameter limit will cause a Modbus Protocol exception code to be returned.

1.2.1 SDM630Modbus Input Registers

Address (Register)	Parameter Number	SDM630Modbus Input Register Parameter		Modbus Protocol Start Address Hex		3 Ø	3 Ø	1 Ø
		Description	Units	Hi Byte	Lo Byte	4 W	3 W	2 W
30001	1	Phase 1 line to neutral volts.	Volts	00	00	√	X	√
30003	2	Phase 2 line to neutral volts.	Volts	00	02	√	X	X
30005	3	Phase 3 line to neutral volts.	Volts	00	04	√	X	X
30007	4	Phase 1 current.	Amps	00	06	√	√	√
30009	5	Phase 2 current.	Amps	00	08	√	√	X
30011	6	Phase 3 current.	Amps	00	0A	√	√	X
30013	7	Phase 1 power.	Watts	00	0C	√	X	√
30015	8	Phase 2 power.	Watts	00	0E	√	X	√
30017	9	Phase 3 power.	Watts	00	10	√	X	X
30019	10	Phase 1 volt amps.	VA	00	12	√	X	√
30021	11	Phase 2 volt amps.	VA	00	14	√	X	X
30023	12	Phase 3 volt amps.	VA	00	16	√	X	X

30025	13	Phase 1 volt amps reactive.	VAr	00	18	√	X	√
30027	14	Phase 2 volt amps reactive.	VAr	00	1A	√	X	X
30029	15	Phase 3 volt amps reactive.	VAr	00	1C	√	X	X
30031	16	Phase 1 power factor (1).	None	00	1E	√	X	√
30033	17	Phase 2 power factor (1).	None	00	20	√	X	X
30035	18	Phase 3 power factor (1).	None	00	22	√	X	X
30037	19	Phase 1 phase angle.	Degrees	00	24	√	X	√
30039	20	Phase 2 phase angle.	Degrees	00	26	√	X	X
30041	21	Phase 3 phase angle.	Degrees	00	28	√	X	X
30043	22	Average line to neutral volts.	Volts	00	2A	√	X	X
30047	24	Average line current.	Amps	00	2E	√	√	√
30049	25	Sum of line currents.	Amps	00	30	√	√	√
30053	27	Total system power.	Watts	00	34	√	√	√
30057	29	Total system volt amps.	VA	00	38	√	√	√
30061	31	Total system VAr.	VAr	00	3C	√	√	√
30063	32	Total system power factor (1).	None	00	3E	√	√	√
30067	34	Total system phase angle.	Degrees	00	42	√	√	√
30071	36	Frequency of supply voltages.	Hz	00	46	√	√	√
30073	37	Total Import kWh	kWh	00	48	√	√	√
30075	38	Total Export kWh.	kWh	00	4A	√	√	√
30077	39	Total Import kVArh .	kVArh	00	4C	√	√	√
30079	40	Total Export kVArh .	kVArh	00	4E	√	√	√
30081	41	Total VAh	kVAh	00	50	√	√	√
30083	42	Ah	Ah	00	52	√	√	√
30085	43	Total system power demand (2).	W	00	54	√	√	√
30087	44	Maximum total system power demand (2).	VA	00	56	√	√	√
30101	51	Total system VA demand.	VA	00	64	√	√	√
30103	52	Maximum total system VA demand.	VA	00	66	√	√	√
30105	53	Neutral current demand.	Amps	00	68	√	X	X
30107	54	Maximum neutral current demand.	Amps	00	6A	√	X	X
30201	101	Line 1 to Line 2 volts.	Volts	00	C8	√	√	X
30203	102	Line 2 to Line 3 volts.	Volts	00	CA	√	√	X
30205	103	Line 3 to Line 1 volts.	Volts	00	CC	√	√	X
30207	104	Average line to line volts.	Volts	00	CE	√	√	X

30225	113	Neutral current.	Amps	00	E0	√	X	X
30235	118	Phase 1 L/N volts THD	%	00	EA	√	X	√
30237	119	Phase 2 L/N volts THD	%	00	EC	√	X	X
30239	120	Phase 3 L/N volts THD	%	00	EE	√	X	X
30241	121	Phase 1 Current THD	%	00	F0	√	√	√
30243	122	Phase 2 Current THD	%	00	F2	√	√	X
30245	123	Phase 3 Current THD	%	00	F4	√	√	X
30249	125	Average line to neutral volts THD.	%	00	F8	√	X	√
30251	126	Average line current THD.	%	00	FA	√	√	√
30259	130	Phase 1 current demand.	Amps	01	02	√	√	√
30261	131	Phase 2 current demand.	Amps	01	04	√	√	X
30263	132	Phase 3 current demand.	Amps	01	06	√	√	X
30265	133	Maximum phase 1 current demand.	Amps	01	08	√	√	√
30267	134	Maximum phase 2 current demand.	Amps	01	0A	√	√	X
30269	135	Maximum phase 3 current demand.	Amps	01	0C	√	√	X
30335	168	Line 1 to line 2 volts THD.	%	01	4E	√	√	X
30337	169	Line 2 to line 3 volts THD.	%	01	50	√	√	X
30339	170	Line 3 to line 1 volts THD.	%	01	52	√	√	X
30341	171	Average line to line volts THD.	%	01	54	√	√	X
30343	172	Total kwh(3)	kwh	01	56	√	√	√
30345	173	Total kvarh(3)	kvarh	01	58	√	√	√
30347	174	L1 import kwh	kwh	01	5a	√	√	√
30349	175	L2 import kwh	kwh	01	5c	√	√	√
30351	176	L3 import kWh	kwh	01	5e	√	√	√
30353	177	L1 export kWh	kwh	01	60	√	√	√
30355	178	L2 export kwh	kwh	01	62	√	√	√
30357	179	L3 export kWh	kwh	01	64	√	√	√
30359	180	L1 total kwh(3)	kwh	01	66	√	√	√
30361	181	L2 total kWh(3)	kwh	01	68	√	√	√
30363	182	L3 total kwh(3)	kwh	01	6a	√	√	√
30365	183	L1 import kvarh	kvarh	01	6c	√	√	√
30367	184	L2 import kvarh	kvarh	01	6e	√	√	√
30369	185	L3 import kvarh	kvarh	01	70	√	√	√
30371	186	L1 export kvarh	kvarh	01	72	√	√	√
30373	187	L2 export kvarh	kvarh	01	74	√	√	√
30375	188	L3 export kvarh	kvarh	01	76	√	√	√
30377	189	L1 total kvarh (3)	kvarh	01	78	√	√	√

30379	190	L2 total kvarh (3)	kvarh	01	7a	√	√	√
30381	191	L3 total kvarh (3)	kvarh	01	7c	√	√	√

Notes:

1. The power factor has its sign adjusted to indicate the direction of the current. Positive refers to forward current, negative refers to reverse current.
2. The power sum demand calculation is for import – export.
3. Total kWh / kVarh equals to Import + export.

1.3 Modbus Protocol Holding Registers and Digital meter set up

Holding registers are used to store and display instrument configuration settings. All holding registers not listed in the table below should be considered as reserved for manufacturer use and no attempt should be made to modify their values.

The holding register parameters may be viewed or changed using the Modbus Protocol. Each parameter is held in two consecutive 4X registers. Modbus Protocol Function Code 03 is used to read the parameter and Function Code 16 is used to write. Write to only one parameter per message.

1.3.1 SDM630Modbus MODBUS Protocol Holding Register Parameters

Address Register	Parameter Number	Paramet-er	Modbus Protocol Start Address Hex		Valid range	Mode
			High Byte	Low Byte		
40003	2	Demand Period	00	02	Write demand period: 0, 5,8, 10, 15, 20, 30 or 60 minutes, default 60. Setting the period to 0 will cause the demand to show the current parameter value, and demand max to show the maximum parameter value since last demand reset. **Length : 4 byte** **Data Format : Float**	r/w
40011	6	System Type	00	0A	Write system type: 3p4w = 3, 3p3w = 2 & 1p2w= 1 Requires password, see parameter 13 **Length : 4 byte**	r/wp

					Data Format : Float	
40013	7	Pulse1 Width	00	OC	Write pulse1 on period in milliseconds: 60, 100 or 200, default 100. **Length : 4 byte** **Data Format : Float**	r/w
40015	8	Password Lock	00	OE	Write any value to password lock protected registers. Read password lock status: 0 = locked. 1 = unlocked. Reading will also reset the password timeout back to one minute. **Length : 4 byte** **Data Format : Float**	r
40019	10	Network Parity Stop	00	12	Write the network port parity/stop bits for MODBUS Protocol, where: 0 = One stop bit and no parity, default. 1 = One stop bit and even parity. 2 = One stop bit and odd parity.3 = Two stop bits and no parity.Requires a restart to become effective. **Length : 4 byte** **Data Format : Float**	r/w
40021	11	Network Node	00	14	Write the network port node address: 1 to 247 for MODBUS Protocol, default 1. Requires a restart to become effective. **Length : 4 byte** **Data Format : Float**	r/w
40023	12	Pulse1 Divisor1	00	16	Write pulse divisor index: n = 0 to 5 0--0.0025 kWh(kVArh)/imp 1--0.01 kWh(kVArh)/imp 2--0.1 kWh(kVArh)/imp 3—1 kWh(kVArh)/imp 4-10 kWh(kVArh)/imp 5-100 kWh(kVArh)/imp **Length : 4 byte** **Data Format : Float**	r/w
40025	13	Password	00	18	Write password for access to protected registers.	r/w