

The Modbus protocol for EN54C-LCD

v1.1

Edition: 2 from 24-11-2020
Supersedes the edition: 1 from 23-04-2019

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1. Revision history

Version	Date	Author	Description
1.1	18.09.2020	BTR	Updated: Read Events, Read Parameter Chart, Read Battery Temperature Chart
1.0	04.04.2019	BTR	Initial release

2. Modbus protocol

The Modbus protocol is an industrial communication protocol that is currently used in EN54C-LCD. The power supplies use two type of connections:

- RS-485 - Modbus RTU – Default settings: Address: 1, Baud Rate: 9600 bps, 8E1
- TCP/IP - Modbus TCP/IP – Default settings: IP: 192.168.1.100, Port: 502

For more information about the Modbus protocol refer to the following application notes:

- Modbus_over_serial_line_V1_02.pdf
- Modbus_Application_Protocol_V1_1b.pdf
- Modbus_Messaging_Implementation_Guide_V1_0b.pdf

3. Function codes

The following Modbus function codes are supported by the implemented protocol:

Public function	Codes
Read Input Registers	04 (0x04)

User defined function	Codes
Service	65 (0x41)
Read Events	66 (0x42)
Read Parameter Chart	67 (0x43)
Read Battery Temperature Chart	68 (0x44)

3.1. Public function codes - Read Input Registers (0x04)

Register address	Register description	Function description	Position	Type	Format	Comments
3100-3103	LCD panel - serial number	Data 1	3100: 15...0	uint16_t	2 – EN54C	Hex format (xx-xxxx-xx-xxxx)
		Data 2	3101: 15...0	uint16_t		
		Data 3	3102: 15...0	uint16_t		
		Data 4	3103: 15...0	uint16_t		
3104-3106	LCD panel - software version	Major	3104: 15...0	uint16_t		Dec format (d.d.d)
		Minor	3105: 15...0	uint16_t		
		Release	3106: 15...0	uint16_t		
3107-3110	Power supply - serial number	Data 1	3107: 15...0	uint16_t	4 – version 2A 5 – version 3A 6 – version 5A 7 – version 10A	Hex format (xx-xxxx-xx-xxxx)
		Data 2	3108: 15...0	uint16_t		

		Data 3	3109: 15...0	uint16_t		
		Data 4	3110: 15...0	uint16_t		
3111-3113	Power supply - software version	Major	3111: 15...0	uint16_t		Dec format (d.d.d)
		Minor	3112: 15...0	uint16_t		
		Release	3113: 15...0	uint16_t		
3114	Error flags (1)	F01 – AC power fail	3114: 0	1-bit	0 – inactive 1 – active	
		F02 – AUX1 fuse fail	3114: 1	1-bit	0 – inactive 1 – active	
		F04 – Output overload	3114: 2	1-bit	0 – inactive 1 – active	
		F05 – Battery undercharged	3114: 3	1-bit	0 – inactive 1 – active	
		F06 – High AUX1 voltage	3114: 4	1-bit	0 – inactive 1 – active	
		F08 – Charge circuit fail	3114: 5	1-bit	0 – inactive 1 – active	
		F09 – Low AUX1 voltage	3114: 6	1-bit	0 – inactive 1 – active	
		F10 – Low battery voltage	3114: 7	1-bit	0 – inactive 1 – active	
		F11 – Low battery voltage – off	3114: 8	1-bit	0 – inactive 1 – active	
		F12 – External input EXTi	3114: 9	1-bit	0 – inactive 1 – active	
		F14 – Temperature sensor fault	3114: 10	1-bit	0 – inactive 1 – active	
		F15 – High battery temperature	3114: 11	1-bit	0 – inactive 1 – active	
		F16 – No battery	3114: 12	1-bit	0 – inactive 1 – active	
		F17 – Battery fail	3114: 13	1-bit	0 – inactive 1 – active	
		F18 – High battery circuit resistance	3114: 14	1-bit	0 – inactive 1 – active	
		F21 – PSU cover opened	3114: 15	1-bit	0 – inactive 1 – active	
3115	Error flags (2)	F22 – AUX2 fuse fail	3115: 0	1-bit	0 – inactive 1 – active	
		F26 – High AUX2 voltage	3115: 1	1-bit	0 – inactive 1 – active	
		F29 – Low AUX2 voltage	3115: 2	1-bit	0 – inactive 1 – active	
		F51 – Internal supply fail	3115: 3	1-bit	0 – inactive 1 – active	
		F52 – Internal supply fail	3115: 4	1-bit	0 – inactive 1 – active	
		F60 – Modbus no communication	3115: 5	1-bit	0 – inactive 1 – active	
		F61 – Control panel fail	3115: 6	1-bit	0 – inactive 1 – active	
		F64 – Control panel fail	3115: 7	1-bit	0 – inactive 1 – active	
		F65 – Access unlocked	3115: 8	1-bit	0 – inactive 1 – active	
				F69 – Default settings	3115: 9	1-bit

					1 – active	
		F70 – Default settings	3115: 10	1-bit	0 – inactive 1 – active	
		F71 – Low LCD battery voltage	3115: 11	1-bit	0 – inactive 1 – active	
		F73 – Default settings	3115: 12	1-bit	0 – inactive 1 – active	
		F74 – Default settings	3115: 13	1-bit	0 – inactive 1 – active	
3116-3123	Measurements	Voltage Uout	3116: 15...0	uint16_t	mV	
		Voltage Aux1	3117: 15...0	uint16_t	mV	
		Voltage Aux2	3118: 15...0	uint16_t	mV	
		Battery voltage Ubat	3119: 15...0	uint16_t	mV	
		Charging current Ild	3120: 15...0	uint16_t	mA	
		Battery current Ibat	3121: 15...0	uint16_t	mA	
		Battery circuit resistance Rbat	3122: 15...0	int16_t	mΩ	-1: none
		Battery temperature Tbat	3123: 15...0	int16_t	°C	
3124	Signals	Charge level 30%	3124: 1...0	2-bit	0 – off 1 – on 2 – toggle	
		Charge level 60%	3124: 3...2	2-bit	0 – off 1 – on 2 – toggle	
		Charge level 90%	3124: 5...4	2-bit	0 – off 1 – on 2 – toggle	
		AC state	3124: 6	1-bit	0 – inactive 1 – active	
		Battery charging	3124: 7	1-bit	0 – inactive 1 – active	
		Battery test in progress	3124: 8	1-bit	0 – inactive 1 – active	
		Battery test is forbidden	3124: 9	1-bit	0 – inactive 1 – active	
3125	Inputs	Tamper	3125: 0	1-bit	0 – inactive 1 – active	
		EXTi	3125: 1	1-bit	0 – inactive 1 – active	
3126	Outputs	Led AC – Power supply	3126: 1...0	2-bit	0 – off 1 – on 2 – toggle	
		Led APS – Power supply	3126: 3...2	2-bit	0 – off 1 – on 2 – toggle	
		Led ALARM – Power supply	3126: 5...4	2-bit	0 – off 1 – on 2 – toggle	
		Led AC – LCD panel	3126: 7...6	2-bit	0 – off 1 – on 2 – toggle	
		Led AUX1 – LCD panel	3126: 9...8	2-bit	0 – off 1 – on 2 – toggle	
		Led AUX2 – LCD panel	3126: 11...10	2-bit	0 – off	

					1 – on 2 – toggle	
		Led ALARM – LCD panel	3126: 13...12	2-bit	0 – off 1 – on 2 – toggle	
		Technical output EPS	3126: 14	1-bit	0 – off 1 – on	
		Technical output ALARM	3126: 15	1-bit	0 – off 1 – on	
3127	Configuration bits	Lock bit	3127: 3	1-bit	0 – off 1 – on	
3128	Rated charging current		3128: 15...0	uint16_t	0 – 0.4A 1 – 0.8A 2 – 1.2A 3 – 1.8A 4 – 2.6A	
3129-3134	Date and time	Year	3129: 15...0	uint16_t	Range: 2015 – 2084	
		Month	3130: 15...0	uint16_t	Range: 1 – 12	
		Day	3131: 15...0	uint16_t	Range: 1 – 31	
		Hour	3132: 15...0	uint16_t	Range: 0 – 23	
		Minute	3133: 15...0	uint16_t	Range: 0 – 59	
		Second	3134: 15...0	uint16_t	Range: 0 – 59	
3135	Event log – records count		3135: 15...0	uint16_t		
3136	Parameter chart – records count		3136: 15...0	uint16_t		
3137	Battery temperature chart – records count		3137: 15...0	uint16_t		

3.2 User defined function codes - Service (0x41)

The function is used in order to execute service commands.

A command code is sent in the request.

A command status is sent in the response.

Request:

Function code	1 Byte	0x41
Data	1 Byte	0x80 – Start the test

Response:

Function code	1 Byte	0x41
Data	1 Byte	0x80 – The test is started 0xFF – The test is forbidden

Errors:

Function code	1 Byte	0xC1
Exception code	1 Byte	03 lub 04

3.3 User defined function codes - Read Events (0x42)

The function is used in order to get the event log. The Event log contains up to 2048 records. The record with index 0 is the youngest in the database. The size of record is 22 bytes. The current number of records should be checked in Input Register at 3135. The maximum records count in the request is 6.

The starting record number and the number of records are sent in the request.

The size of records in bytes and records are sent in the response.

Record:

Position	Type	Description		
Seconds	uin32_t	Time is counted in seconds from the year 2000. The value 0 corresponds to the time 2000.01.01, 00:00:00		
Event code	uint16_t	The event code is in the range 1-254. The Event codes section contains a detailed description of each code.		
Signals	uint16_t	Signal	Position	Description
		AC	Bit 0	0 – off 1 – on
		LoB	Bit 1	0 – off 1 – on
		EXTi	Bit 2	0 – off 1 – on
		APS	Bit 3	0 – off 1 – on
		EPS	Bit 4	0 – off 1 – on
		ALARM	Bit 5	0 – off 1 – on
Voltage Aux1	uint16_t	mV		
Voltage Aux2	uint16_t	mV		
Battery voltage Ubat	uint16_t	mV		
Charging current Ild	uint16_t	mA		
Battery current Ibat	uint16_t	mA		
Battery circuit resistance Rbat	int16_t	mΩ -1: none		
Battery temperature Tbat	int16_t	°C		

Request:

Function code	1 Byte	0x42
Record number	2 Bytes	Range: 0 – 2047
Record count	2 Bytes	1 – 6

Response:

Function code	1 Byte	0x42
Byte count	1 Byte	The size of records in bytes
Data	22 – 132 Bytes	Records count: 1 – 6

Errors:

Function code	1 Byte	0xC2
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Exception code	1 Byte	03 lub 04
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3.4 User defined function codes - Read Parameter Chart (0x43)

The function is used in order to get the parameters chart. The parameters chart contains up to 32768 records. The record with index 0 is the youngest in the database. The size of record is 42 bytes. Records are saved every 5 minutes and they are stored for 113 days. The current number of records should be checked in Input Register at 3136. The maximum records count in the request is 3.

The starting record number and the number of records are sent in the request.

The size of records in bytes and records are sent in the response.

Record:

Position	Type	Description
Seconds	uin32_t	Time is counted in seconds from the year 2000. The value 0 corresponds to the time 2000.01.01, 00:00:00
Voltage Aux1	uint16_t	mV
Voltage Aux1 min	uint16_t	mV
Voltage Aux1 max	uint16_t	mV
Voltage Aux2	uint16_t	mV
Voltage Aux2 min	uint16_t	mV
Voltage Aux2 max	uint16_t	mV
Battery voltage Ubat	uint16_t	mV
Battery voltage Ubat min	uint16_t	mV
Battery voltage Ubat max	uint16_t	mV
Charging current Ild	uint16_t	mA
Charging current Ild min	uint16_t	mA
Charging current Ild max	uint16_t	mA
Battery current Ibat	uint16_t	mA
Battery current Ibat min	uint16_t	mA
Battery current Ibat max	uint16_t	mA
Battery circuit resistance Rbat	int16_t	mΩ -1: none
Battery temperature Tbat	int16_t	°C
Battery temperature Tbat min	int16_t	°C
Battery temperature Tbat max	int16_t	°C

Request:

Function code	1 Byte	0x43
Record number	2 Bytes	Range: 0 – 32767
Record count	2 Bytes	1 – 3

Response:

Function code	1 Byte	0x43
Byte count	1 Byte	The size of records in bytes
Data	42 - 126 Bytes	

Errors:

Function code	1 Byte	0xC3
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Exception code	1 Byte	03 lub 04
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3.5 User defined function codes - Read Battery Temperature Chart (0x44)

The function is used in order to get the battery temperature chart. The battery temperature chart contains up to 7424 records. The record with index 0 is the youngest in the database. The size of record is 10 bytes. Records are saved every 6 hours and they are stored for 5 years. The current number of records should be checked in Input Register at 3137. The maximum records count in the request is 13.

The starting record number and the number of records are sent in the request.

The size of records in bytes and records are sent in the response.

Record:

Position	Type	Description
Seconds	uin32_t	Time is counted in seconds from the year 2000. The value 0 corresponds to the time 2000.01.01, 00:00:00
Battery temperature Tbat	int16_t	°C
Battery temperature Tbat min	int16_t	°C
Battery temperature Tbat max	int16_t	°C

Request:

Function code	1 Byte	0x44
Record number	2 Bytes	Range: 0 – 7423
Record count	2 Bytes	1 – 13

Response:

Function code	1 Byte	0x44
Byte count	1 Byte	The size of records in bytes
Data	10 – 130 Bytes	

Errors:

Function code	1 Byte	0xC4
Exception code	1 Byte	03 lub 04

3.6 Event codes

Failure code	Event code	Description
F01	1	AC power fail
F02	2	AUX1 fuse fail
F04	4	Output overload
F05	5	Battery undercharged
F06	6	High AUX1 voltage
F08	8	Charge circuit fail
F09	9	Low AUX1 voltage
F10	10	Low battery voltage
F11	11	Low battery voltage – off
F12	12	External input EXTi
F14	14	Temperature sensor fault
F15	15	High battery temperature
F16	16	No battery

F17	17	Battery fail
F18	18	High battery circuit resistance
F21	21	PSU cover opened
F22	22	AUX2 fuse fail
F26	26	High AUX2 voltage
F29	29	Low AUX2 voltage
F51	51	Internal supply fail
F52	52	Internal supply fail
F60	60	Modbus no communication
F61	61	Control panel fail
F64	64	Control panel fail
F65	65	Access unlocked
F69	69	Default settings
F70	70	Default settings
F71	71	Low LCD battery voltage
F73	73	Default settings
F74	74	Default settings

Info code	Event code	Description
I00	254	Power supply start-up
I01	253	AC power back
I02	252	AUX1 fuse replaced
I04	250	Battery connected
I05	249	Battery OK
I06	248	Battery temperature OK
I10	244	Battery test – Start
I11	243	PSU cover closed
I28	226	AUX2 fuse replaced