



The Modbus protocol for HPSG3-LCD

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## 1. Revision history

Version	Date	Author	Description
1.2	04.11.2021	BTR	Added info flags in Input Registers
1.1	08.09.2021	BTR	Removed F02
1.0	23.06.2021	BTR	Initial release

## 2. Modbus protocol

The Modbus protocol is an industrial communication protocol that is currently used in HPSG3-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	24 – HPSG3-LCD	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	18 – HPSG3_12V/2A 19 – HPSG3_12V/3A 20 – HPSG3_12V/5A 21 – HPSG3_12V/10A 22 – HPSG3_24V/2A 23 – HPSG3_24V/5A	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	
		F04 - Output overload	3114: 1	1-bit	0 – inactive 1 – active	
		F05 - Battery undercharged	3114: 2	1-bit	0 – inactive 1 – active	
		F06 - High AUX voltage	3114: 3	1-bit	0 – inactive 1 – active	
		F08 - Charge circuit fail	3114: 4	1-bit	0 – inactive 1 – active	
		F09 - Low AUX voltage	3114: 5	1-bit	0 – inactive 1 – active	
		F10 - Low battery voltage	3114: 6	1-bit	0 – inactive 1 – active	
		F11 - Low battery voltage – off	3114: 7	1-bit	0 – inactive 1 – active	
		F12 - External input EXTi	3114: 8	1-bit	0 – inactive 1 – active	
		F14 - Temperature sensor fault	3114: 9	1-bit	0 – inactive 1 – active	
		F15 - High battery temperature	3114: 10	1-bit	0 – inactive 1 – active	
		F16 - No battery	3114: 11	1-bit	0 – inactive 1 – active	
		F17 - Battery fail	3114: 12	1-bit	0 – inactive 1 – active	
		F30 – PSU overload	3114: 13	1-bit	0 – inactive 1 – active	
		F51 - Internal supply fail	3114: 14	1-bit	0 – inactive 1 – active	
F52 - Internal supply fail	3114: 15	1-bit	0 – inactive 1 – active			
3115	Error flags (2)	F60 - Modbus no communication	3115: 0	1-bit	0 – inactive 1 – active	
		F61 - Control panel fail	3115: 1	1-bit	0 – inactive 1 – active	
		F64 - Control panel fail	3115: 2	1-bit	0 – inactive 1 – active	
		F65 - Access unlocked	3115: 3	1-bit	0 – inactive 1 – active	
		F69 - Default settings	3115: 4	1-bit	0 – inactive 1 – active	
		F70 - Default settings	3115: 5	1-bit	0 – inactive 1 – active	
		F71 - Low LCD battery voltage	3115: 6	1-bit	0 – inactive 1 – active	
		F73 - Default settings	3115: 7	1-bit	0 – inactive	

					1 – active	
		F74 - Default settings	3115: 8	1-bit	0 – inactive 1 – active	
3116	Info flags	I00 – Power supply start-up	3116: 0	1-bit	0 – inactive 1 – active	
		I01 - AC power back	3116: 1	1-bit	0 – inactive 1 – active	
		I05 - Battery OK	3116: 2	1-bit	0 – inactive 1 – active	
		I06 - Battery temperature OK	3116: 3	1-bit	0 – inactive 1 – active	
		I10 - Battery test – Start	3116: 4	1-bit	0 – inactive 1 – active	
		I29 - PSU current exceeded	3116: 5	1-bit	0 – inactive 1 – active	
		I30 - PSU current OK	3116: 6	1-bit	0 – inactive 1 – active	
		I31 – Charging in progress	3116:7	1-bit	0 – inactive 1 – active	
3117-3120	Measurements	Voltage Uaux	3117: 15...0	uint16_t	mV	
		Current Iaux	3118: 15...0	uint16_t	mA	
		Charging current Ild	3119: 15...0	uint16_t	mA	
		Battery temperature Tbat	3120: 15...0	int16_t	°C	
3121	Signals	Charge level 30%	3121: 1...0	2-bit	0 – off 1 – on 2 – toggle	
		Charge level 60%	3121: 3...2	2-bit	0 – off 1 – on 2 – toggle	
		Charge level 90%	3121: 5...4	2-bit	0 – off 1 – on 2 – toggle	
		AC state	3121: 6	1-bit	0 – inactive 1 – active	
		Battery charging	3121: 7	1-bit	0 – inactive 1 – active	
		Battery test in progress	3121: 8	1-bit	0 – inactive 1 – active	
		Battery test is forbidden	3121: 9	1-bit	0 – inactive 1 – active	
3122	Inputs	EXTi	3122: 0	1-bit	0 – inactive 1 – active	
3123	Outputs	Led CHARGE - Power supply	3123: 1...0	2-bit	0 – off 1 – on 2 – toggle	
		Led AC – LCD panel	3123: 3...2	2-bit	0 – off 1 – on 2 – toggle	
		Led AUX – LCD panel	3123: 5...4	2-bit	0 – off	

					1 – on 2 – toggle	
		Led ALARM – LCD panel	3123: 7...6	2-bit	0 – off 1 – on 2 – toggle	
		Technical output EPS	3123: 8	1-bit	0 – off 1 – on	
		Technical output APS	3123: 9	1-bit	0 – off 1 – on	
		Technical output PSU	3123: 10	1-bit	0 – off 1 – on	
3124	Rated charging current		3124: 15...0	uint16_t	mA	
3125-3130	Date and time	Year	3125: 15...0	uint16_t	Range: 2015 – 2084	
		Month	3126: 15...0	uint16_t	Range: 1 – 12	
		Day	3127: 15...0	uint16_t	Range: 1 – 31	
		Hour	3128: 15...0	uint16_t	Range: 0 – 23	
		Minute	3129: 15...0	uint16_t	Range: 0 – 59	
		Second	3130: 15...0	uint16_t	Range: 0 – 59	
3131	Events – records count		3131: 15...0	uint16_t		
3132	Parameter chart – records count		3132: 15...0	uint16_t		
3133	Battery temperature chart – records count		3133: 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:

<b>Function code</b>	1 Byte	0x41
<b>Data</b>	1 Byte	0x80 – Start the test

Response:

<b>Function code</b>	1 Byte	0x41
<b>Data</b>	1 Byte	0x80 – The test is started 0xFF – The test is forbidden

### 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 16 bytes. The current number of records should be checked in Input Register at 3131. The maximum records count in the request is 7. 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		
<b>Seconds</b>	uin32_t	Time is counted in seconds from the year 2000. The value 0 corresponds to the time 2000.01.01, 00:00:00		
<b>Event code</b>	uint16_t	The event code is in the range 1-254. <a href="#">The Event codes</a> section contains a detailed description of each code.		
<b>Signals</b>	uint16_t	<b>Signal</b>	<b>Position</b>	<b>Description</b>
		AC	Bit 0	0 – off 1 – on
		LoB	Bit 1	0 – off 1 – on
		EXTi	Bit 2	0 – off 1 – on
		EPS	Bit 3	0 – off 1 – on
		APS	Bit 4	0 – off 1 – on
		PSU	Bit 5	0 – off 1 – on
		ALARM	Bit 6	0 – off 1 – on
		CHARGE	Bit 7	0 – off 1 – on
<b>Voltage Uaux</b>	uint16_t	mV		
<b>Current Iaux</b>	uint16_t	mA		
<b>Charging current Ild</b>	uint16_t	mA		
<b>Battery temperature Tbat</b>	int16_t	°C		

#### Request:

<b>Function code</b>	1 Byte	0x42
<b>Record number</b>	2 Bytes	Range: 0 – 2047
<b>Records count</b>	2 Bytes	1 – 7

#### Response:

<b>Function code</b>	1 Byte	0x42
<b>Byte count</b>	1 Byte	The size of records in bytes
<b>Data</b>	16 - 112 Bytes	

### 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 28 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 3132. The maximum records count in the request is 4.

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
<b>Seconds</b>	uin32_t	Time is counted in seconds from the year 2000. The value 0 corresponds to the time 2000.01.01, 00:00:00
<b>Voltage Uaux</b>	uint16_t	mV
<b>Voltage Uaux min</b>	uint16_t	mV
<b>Voltage Uaux max</b>	uint16_t	mV
<b>Current Iaux</b>	uint16_t	mA
<b>Current Iaux min</b>	uint16_t	mA
<b>Current Iaux max</b>	uint16_t	mA
<b>Charging current Ild</b>	uint16_t	mA
<b>Charging current Ild min</b>	uint16_t	mA
<b>Charging current Ild max</b>	uint16_t	mA
<b>Battery temperature Tbat</b>	int16_t	°C
<b>Battery temperature Tbat min</b>	int16_t	°C
<b>Battery temperature Tbat max</b>	int16_t	°C

Request:

<b>Function code</b>	1 Byte	0x43
<b>Record number</b>	2 Bytes	Range: 0 – 32767
<b>Records count</b>	2 Bytes	1 – 4

Response:

<b>Function code</b>	1 Byte	0x43
<b>Byte count</b>	1 Byte	The size of records in bytes
<b>Data</b>	28 - 112 Bytes	

### 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 3133. 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:

<b>Function code</b>	1 Byte	0x44
<b>Record number</b>	2 Bytes	Range: 0 – 7423
<b>Records count</b>	2 Bytes	1 – 13

Response:

<b>Function code</b>	1 Byte	0x44
<b>Byte count</b>	1 Byte	The size of records in bytes
<b>Data</b>	10 - 130 Bytes	Record 1 – 13

## 4. Event codes

Failure code	Event code	Description
F01	1	AC power fail
F04	4	Output overload
F05	5	Battery undercharged
F06	6	High AUX voltage
F08	8	Charge circuit fail
F09	9	Low AUX 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
F30	30	PSU overload
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

<b>Info code</b>	<b>Event code</b>	<b>Description</b>
<b>I00</b>	254	Power supply start-up
<b>I01</b>	253	AC power back
<b>I05</b>	249	Battery OK
<b>I06</b>	248	Battery temperature OK
<b>I10</b>	244	Battery test – Start
<b>I29</b>	225	PSU current exceeded
<b>I30</b>	224	PSU current OK
<b>I31</b>	223	Charging in progress