ENERGY
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Technical Information

48TL200 ModBus Protocol

Rev 11

FZSoNick

GREEN & SAFE SALT BATTERY

Revision history

Rev.	Date	Author	Modifications
11	25/05/2023	B. Milani	Updated to FW version FW AF09 for solar application

Sommario

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1. Scope

This documents describes the RS485 MODBUS communication protocol of the 48TL200 batteries for solar application.

2. Reference document

[1] 48TL200 Installation & Operating Instructions Technical manual
[2] 48TL200 Check List Claim Notification Troubleshooting Rev1

3. UART Modes

The default communication is RTU mode with, 8 Bit, Odd, 1 Stop (7-E-1) bits per Byte and baund 115200. The ASCII mode is available on request (a firmware update is required), possible configurations are listed below.

	DATA BITS	PARITY	STOP BITS	BAUD
MODE RTU	8	EVEN	1	600 - 115200
MODE RTU	8	ODD	1	600 - 115200
MODE RTU	8	NONE	2	600 - 115200
MODE ASCII	7	EVEN	1	600 - 115200
MODE ASCII	7	ODD	1	600 - 115200
MODE ASCII	7	NONE	2	600 - 115200
MODE ASCII	**7**	**EVEN**	**1**	**115200**

The following standard MODBUS functions are implemented:

Function Name	Function Code
Read Input Register	0x04
Report Slave ID	0x11
Terminal Tunnel	0x41

4. Modbus addresses

Default battery address is 0x02.

0x00	BROADCAST MESSAGES	
0x01	RESERVED FOR BOOTLOADER	(115200,ASCII,**8**,N,1)
0x02	**DEFAULT ADDRESS**	**(115200,ASCII,7,E,1)**
0x03 - 0xF7	FREE	
0xF8 - 0xFF	RESERVED (MODBUS)	

5. Default Modbus configuration

Each firmware version is provided with a default Modbus protocol configuration that can be successively modified by the user. Following a summary of the default settings:

FW	Mode	Parity	Baud Rate	ID
A08C	RTU	ODD	115200	0x02
AF09	RTU	ODD	115200	0x02
AD9C	RTU	EVEN	38400	0x64 (100 dec)
AD8C	RTU	EVEN	38400	0x64 (100 dec)

6. Report Slave ID

Use this function to read the BMS serial number. The answer contains the following string:
"48TL200 " + <BMS SERIAL NUMBER>

7. Read Input Register

Use this function to read the input registers. Multiple registers can be read at the same time.
Please refer to MODBUS specification for details about message formatting.

8. ModBus register description

MODBUS DEC REGISTER INDEX	REGISTER INDEX	DATA	UNIT	SCALE FACTOR	OFFSET	MIN DATA VAL	MAX DATA VAL	EXAMPLE: ON PDU	EXAMPLE: RESULT	UNIT	NOTES
999	1	BATT VOLTAGE	V	100	0	0	100	**100000**	**10000000**	V	
1000	2	BATT CURRENT	A	100	-100	-400	100	**60000**	**5990000**	A	see section below
1001	3	BUS VOLTAGE	V	100	0	0	100	**5597**	**559700**	V	
1002	4	SOC	Ah	10	-1000	-500	500	**10066**	**90660**	Ah	
1003	5	Tbatt(AVE)	°C	10	-40	-40	500	**3654**	**36140**	°C	
1004	6	LedStat	bitmap	1	0	0x0000	0x00FF			bitmap	see LED bitmap
1005	7	Warning Flags (0-15)	bitmap	1	0	0x0000	0xFFFF			bitmap	see WARNINGS bitmap
1006	8	Warning Flags (16-31)	bitmap	1	0	0x0000	0xFFFF			bitmap	see WARNINGS bitmap
1007	9	Warning Flags (32-47)	bitmap	1	0	0x0000	0xFFFF			bitmap	see WARNINGS bitmap
1008	10	Warning Flags (48-63)	bitmap	1	0	0x0000	0xFFFF			bitmap	see WARNINGS bitmap
1009	11	Alarm Flags (0-15)	bitmap	1	0	0x0000	0xFFFF			bitmap	see ALARMS bitmap
1010	12	Alarm Flags (16-31)	bitmap	1	0	0x0000	0xFFFF			bitmap	see ALARMS bitmap
1011	13	Alarm Flags (32-47)	bitmap	1	0	0x0000	0xFFFF			bitmap	see ALARMS bitmap
1012	14	Alarm Flags (48-63)	bitmap	1	0	0x0000	0xFFFF			bitmap	see ALARMS bitmap
1013	15	IO Status	bitmap	1	0	0x0000	0xFFFF			bitmap	see IO bitmap
1014	16	Board_Temp	°C	10	-40	-40	150	**785**	**7450**	°C	
1015	17	Tc_Center_Temp	°C	10	-40	-40	500	**3683**	**36430**	°C	
1016	18	Tc_Lat1_Temp	°C	10	-40	-40	500	**3606**	**35660**	°C	
1017	19	Tc_Lat2_Temp	°C	10	-40	-40	500	**3620**	**35800**	°C	
1018	20	RiscC_pwm	per cent	10	0	0	100	**0**	**0**	per cent	
1019	21	RiscL_pwm	per cent	10	0	0	100	**0**	**0**	per cent	
1050	52	RTC_Counter_Lo	seconds	1	0			**47392**			
1051	53	RTC_Counter_Hi	seconds	1	0			**2538**			
1052	54	Time To TOC Request	minutes	1	0			**3600**	**3600**	minutes / 60	
1053	55	Battery SOC percent	%	10	0	0	100	**569**	**5690**	per cent	
1054	56	FW VERSION	string	-	-	0x0000	0xFFFF	**AF07**	**A.F.0.7**		Register contains BCD

MODBUS DEC	REGISTER	DATA	UNIT	SCALE	OFFSET	MIN	MAX	EXAMPLE:	EXAMPLE:	UNIT	NOTES
1055	57	SERIAL NUM 1	BCD	-	-	0x0000	0xFFFF	**0000**	**1223458**		Register contains BCD
1056	58	SERIAL NUM 2	BCD	-	-	0x0000	0xFFFF	**0000**			Register contains BCD
1057	59	SERIAL NUM 3	BCD	-	-	0x0000	0xFFFF	**0122**			Register contains BCD
1058	60	SERIAL NUM 4	BCD	-	-	0x0000	0xFFFF	**3458**			Register contains BCD
1059	61	Limp_Bit_map	bitmap	-	-	0x0000	0xFFFF	**0x0010**		bitmap	See LIMP bitmap
1060	62	Batt_State_1	ASCII	-	-	0x0000	0xFFFF	**C_**	**C_AL**		Register contains ASCII
1061	63	Batt_State_2	ASCII	-	-	0x0000	0xFFFF	**AL**			Register contains ASCII
1062	64	Total current	A	100	-100	-400	100				

Calculation formula:

finale_value = (Register Value / Scale Factor) – Offset

9. Battery current on ModBus

Battery current (mA)	Modbus contents (dec)	Modbus contents (hex signed int)
0	10000	2710
1000	10100	2774
8000	10800	2A30
40000	14000	36B0
-1000	9900	26AC
-50000	5000	1388
-99000	100	0064
-100000	0	0000
-120000	-2000	FFFFFFF830
-150000	-5000	FFFFFFEC78
-200000	-10000	FFFFFFD8F0
-220000	-12000	FFFFFFD120

10. LED bitmap – register 6 – 1004

The following table lists the meaning of used bits in LED bitmap registers

BIT INDEX	LED BITMAP register 6
0	GREEN_0
1	GREEN_1
2	AMBER_0
3	AMBER_1
4	BLUE_0
5	BLUE_1
6	RED_0
7	RED_1

LEDs status is encoded in two bits as explained below:

GREEN_1	GREEN_0	LED STATUS
BLUE_1	BLUE_0	
AMBER_1	AMBER_0	
RED_1	RED_0	
0	0	OFF
0	1	ON
1	0	BLINK SLOW
1	1	BLINK FAST

Please refer to [1] 48TL200 Technical Manual for more details (Light Emitting Diodes (LED's) Explanation).

11. Warning / Alarm bitmap – register 7 / 14 – 1005 / 1012

The following table lists the meaning of used bits in bitmapped registers:

BIT INDEX	ALARM BITMAP registers 11-14	ALARM TYPE	WARNING BITMAP register 7-10	Description	Activated FW A0XX	Activated FW AFXX
0	Tam	RECOVERABLE		Ambient Temperature is low Environmental Temperature Low	Yes	Yes
1			TaM1	Ambient Temperature is high Environmental Temperature High	Yes	No
2	TaM2	RECOVERABLE		Ambient Temperature is too high Environmental Temperature High	Yes	Yes
3	Tbm	RECOVERABLE		Battery Temperature is low Min Battery Temperature	Yes	Yes
4			TbM1	Battery Temperature is high Max Battery Temperature	Yes	Yes
5	TbM2	RECOVERABLE		Battery Temperature is too high Max Battery Temperature	Yes	Yes
6			VBm1	Low Voltage on DC BUS Min Bus Voltage	Yes	No
7	VBm2	RECOVERABLE		Too Low Voltage on DC BUS Min Bus Voltage	Yes	Yes
8			VBM1	High Voltage on DC BUS Max Bus Voltage	Yes	No
9	VBM2	RECOVERABLE		Too High Voltage on DC BUS Max Bus Voltage	Yes	Yes
10			IDM1	Discharge Current is High Max Discharge Current	Yes	No
11	IDM2	RECOVERABLE		Discharge Current is Too High Max Discharge Current	Yes	Yes
12	ISOB	UNRECOVERABLE		Isolation error ISO Batt	Yes	Yes
13	MSWE	UNRECOVERABLE		Main Switch Error	Yes	No
14	FUSE	UNRECOVERABLE		Main Fuse blown	Yes	No
15	HTRE	RECOVERABLE		Warm Up Fault Hater Error	Yes	Yes
16	TCPE	UNRECOVERABLE		Thermocouple is not reliable Thermocouple Error	Yes	Yes
17	STRE	RECOVERABLE		Voltage measurement circuit fails Max Measurement Error on String Voltage	Yes	Yes
18	CM E	RECOVERABLE		Current measurement circuit fails String Current Measurement Error	Yes	Yes
19	HWFL	RECOVERABLE		BMS hardware fails Internal Can Bus Communication Error	Yes	Yes
20	HWEM	RECOVERABLE		BMS HW protection is activated Westinghouse Security	Yes	Yes
21	ThM	RECOVERABLE		Heatsink temperature too High Max Heatsink Temperature	Yes	Yes
22			vsm1	String Voltage Low Min String Voltage	Yes	No
23	vsm2	UNRECOVERABLE		String Voltage Too Low Min String Voltage	Yes	Yes
24			vsM1	String Voltage High Max String Voltage	Yes	No
25	vsM2	RECOVERABLE		String Voltage Too High Max String Voltage	Yes	Yes

BIT INDEX	ALARM BITMAP registers 11-14	ALARM TYPE	WARNING BITMAP register 7-10	Description	Activated FW A0XX	Activated FW AFXX
26			iCM1	String Charge Current High Max Charge String Current	Yes	No
27	iCM2	UNRECOVERABLE		String Charge Current Too High Max Charge String Current	Yes	Yes
28			iDM1	String Discharge Current ì High Max Discharge String Current	Yes	No
29	iDM2	RECOVERABLE		String Discharge Current Too High Max Discharge String Current	Yes	Yes
30			MID1	String voltages unbalance warning Max Midpoint Unbalance	Yes	No
31	MID2	RECOVERABLE		String voltages unbalance alarm Max Midpoint Unbalance	Yes	No
32			BLPW	Charging power is not available Bus Voltage Low	Yes	Yes
33			CCBF	Charger Circuit not working Battery Charger Error	Yes	Yes
35			Ah_W	if battery SOC < 10% String Empty	Yes	Yes
38			MPMM	Error on Midpoint wiring Midpoint Mismatch	Yes	No
40			TCdi	Difference temperature sensors Termocouples Differential Too High	Yes	No
42	HTFS	UNRECOVERABLE		Heaters Fuse Blown	Yes	Yes
43	DATA	UNRECOVERABLE		Parameter out of range	Yes	Yes
44			LMPW	String voltages unbalance warning	Yes	No
45	LMPA	UNRECOVERABLE		String voltages unbalance alarm	Yes	Yes
46	HEBT	RECOVERABLE		Loss of heartbeat Relay Error	Yes	No
47			TOCW	Top of Charge requested	Yes	Yes

12. IO status bitmap – register 15 - 1013

BIT INDEX	IO BITMAP register 15	Status
0	MAIN_SWITCH_CLOSED	Open = 1 / Closed = 0
1	ALARM_OUT_ACTIVE	No alarm = 1 / Alarm = 0
2	INTERNAL_FAN_ACTIVE	Activated = 1 / No activated = 0
3	VOLT_MEASUREMENT_ALLOWED	Allowed = 1 / Not allowed = 0
4	AUX_RELAY	bus = 0 / batt = 1
5	REMOTE_STATE	On = 1 / Off = 0
6	RISC_ON	On = 1 / Off = 0

13. Battery State – register 62/63 – 1060/1061

Battery logic state Modbus registers have been created in order to have an indication of the battery status.
The status of the battery can be read as following:
register 1060 --> MB_INPUT_REG_Batt_State_1 , unit ASCII --> high part of the battery status
register 1061 --> MB_INPUT_REG_Batt_State_2 , unit ASCII --> low part of the battery status

Battery status = high part + low part

Battery status	**Status description**
VERS	Firmware version display
M_AL;	Battery in warm-up if Vbus is present with main contactor close. Voltage reading is allowed. The battery temperature is between 235°C and 345°C (for FW AFXX) Refer to [1] for details. The battery is not available for charge and discharge.
M_NA;	Battery in warm-up if Vbus is present with main contactor open. Voltage reading not allowed. The state remains until the battery temperature reaches 234°C. Refer to [1] for details. The battery is not available for charge and discharge.
INIT;	Battery Initialization
RALR;	Recoverable alarm. Please refer to [1] and [2] for details
UALR;	Unrecoverable alarm. Please refer to [1] and [2] for details
CHEQ	Automatic battery balancing before cool down when the battery switch is turned to the OFF position.
EDCH;	End of discharge. Discharge not allowed. Set the Vbus voltage to allow battery charging
C_NA;	Operative temperature reached but the Vbus value is not enough and charge phase is not allowed.
C_AL;	Charge allowed with Ibat > 0
DISC	Discharge phase with Ibat < 0
BURN	First activation
EOC_	End of charge reached

14. End of charge

The 48TL200 batteries need to reach the top of charge after a fixed period of operation. The End of Charge (EOC) procedure is necessary to reset the SOC measurement errors due to the current integration.

The EOC procedure is possible the DC power (Vbus) is fixed between 54Vdc and 60Vdc or in any case with Vbus > Vbatt.

The EOC is reached when all the active strings of the battery have reached the EOC. The EOC is set when the charge current drops below the minimum value (refer chapter 14.c).

The EOC status remains until all strings drop below 39 Ah. In EOC state the battery cannot be charged.

a. Max charge current modification

Terminal Tunnel is a way to access set point register (normally accessed via USB) using Modbus

Battery charging current upper limit can be modified by user if needed.
the max charge currents defined by parameter number 050 as a current per string in mA.

	A0XX	**AFXX**
BMS parameter Number	050	050
Default value	8000	9000
Min value	1000	1000
Max Value	10000	10000

The Battery total charge current is defined by the number of active strings present in the battery

Battery type	**Max number of active strings**	**Default charge current set point per string (mA)**	**Default tot charge current (A)**
48TL120	3	8000	24
48TL160	4	8000	32
48TL160	4	9000	32
48TL200	5	8000	40
48TL200	5	9000	45

Sintax to send the ascii command (Note : Data bit on COM port = 7, EVEN)

:	Colon start code
ADDRESS	ModBus address in HEX
TUNNEL CODE	0x41
COMMAND CODE	ASCII CODE for command (W for write , R for read)
DATA1….DATAn	DATA
ENTER	0x0D
CRC	CRC calculated as 2 complement of 8 bit data sum from ADDRESS to ENTER

Example

The following example explains the sequence to write 2000 mA as charge current per string
Register to write is 50. Total char sent is 29

STRING TO SEND : W050=2000<ENTER>

1) PC->BATTERY :0241573035303D323030300DC5<CR><LF>
CRC is C5 calculated as --> {NOT[((02+41+57+30+35+30+3D+32+30+30+30+0D) AND 0xFF)]} + 1

2) BATTERY->PC :0241573035303D323030300DC5<CR><LF>

The following example explains the sequence to read the charge current.
Register to read is 50

STRING TO SEND : R050<ENTER>

1) PC->BATTERY :0241523035300DC9<CR><LF>
2) BATTERY->PC :0241523035300DC9<CR><LF>
3) PC->BATTERY :0241BD<CR><LF> Get Data
4) BATTERY->PC :0241303530203D20323030300DDC<CR><LF> 050 = 2000

Sintax to send rtu command (Note : Data bit on COM port = 8)

ADDRESS	ModBus address in HEX
0x41	TUNNEL CODE
COMMAND CODE	HEX ASCII CODE for command (W (0x57) for write , R (0x52) for read)
DATA1….DATAn	DATA Insert here the string of the command. https://www.rapidtables.com/convert/number/ascii-to-hex.html
ENTER	0x0D
CRC	CRC 16 bit compliant to MODBUS standard (http://www.tahapaksu.com/crc/)

Example

The following example explains the sequence to write 2000 mA as charge current per string.
Register to write is 50. Total char sent is 14

STRING TO SEND: W050=2000<ENTER>

1) PC->BATTERY 02 41 57 30 35 30 3D 32 30 30 30 0D 3E A9
2) BATTERY->PC 02 41 57 30 35 30 3D 32 30 30 30 0D 3E A9
3) PC->BATTERY 02 41 41 43 54 2D 3E 46 4C 41 53 48 0D 85 B2 (ACT->FLASH)
4) BATTERY->PC 02 41 41 43 54 2D 3E 46 4C 41 53 48 0D 85 B2 (ACT->FLASH)

The following example explains the sequence to read the charge current.
Register to read is 50

STRING TO SEND: R050<ENTER>

1) PC->BATTERY 02 41 52 30 35 30 3D 44 C2
2) BATTERY->PC 02 41 52 30 35 30 3D 44 C2
3) PC->BATTERY 02 41 C0 E0 Get Data
4) BATTERY->PC 02 41 30 35 30 20 3D 20 32 30 30 30 0D 49 0E 050 = 2000

b. Time to TOC request – register 54 – 1052

The value is expressed in minutes and indicates the time elapsed since the last end of charge. The maximum value is 3600 minutes (7 days) and this means that it is necessary to carry out the end of charge at least once every 7 days of battery operation.

In order to know the remaining time before the next top of charge request the formula is as following:

3600 minutes – value of register 54 = remaining time before next top of charge

The maximum charge current is defined in chapter 14.a) of this document. When the BMS measures a current lower than a fixed threshold (refer to chapter 14.c) the EOC is recognized and the counter is set to the maximum value (7 days) and the counter is set to the maximum value.

Warning 47 (Top of Charge requested) will be set when register 54 (Time to TOC request) is 3600 or the result of the formula above is <=0 (remaining time before next top of charge).

c. Setting min charge current for EOC

Terminal Tunnel is a way to access set point register (normally accessed via USB) using Modbus
Battery minimum current can be modified by user if needed.
The min charge currents defined by parameter number 052 as a current per string in mA.

	A0XX	**AFXX**
BMS parameter Number	052	052
Default value	200	500
Min value	200	200
Max Value	10000	10000

Sintax to send rtu command (Note : Data bit on COM port = 8)

ADDRESS	ModBus address in HEX
0x41	TUNNEL CODE
COMMAND CODE	HEX ASCII CODE for command (W (0x57) for write , R (0x52) for read)
DATA1….DATAn	DATA Insert here the string of the command. For example, "052" for read parameter 52 or "052=500 for write parameter 52" https://www.rapidtables.com/convert/number/ascii-to-hex.html
ENTER	0x0D
CRC	CRC 16 bit compliant to MODBUS standard (http://www.tahapaksu.com/crc/)

15. Battery serial number – register 57/60 – 1055/1058

Use this function to read the Battery serial number. The answer contains the following information:

SERIAL NUM 1, SERIAL NUM 2, SERIAL NUM 3, SERIAL NUM 4 = battery serial number
Example: 0000 0000 0122 3458 = 1223458

16. Limp bitmap – register 61 – 1059

The following table lists the meaning of used bits in bitmapped registers:

BIT INDEX	Value HEX	Value BCD	Limp Bitmap – register 61
0	0000	0000 0000	All 5 strings activated
1	0001	0000 0001	String 1 disabled
2	0002	0000 0010	String 2 disabled
3	0004	0000 0100	String 3 disabled
4	0008	0000 1000	String 4 disabled
5	0010	0001 0000	String 5 disabled

Example: value 18 = Strings 4 and 5 are disabled.

If the value of register 61 is > 0 a limitation in the discharge current must be introduced respect the number of disabled strings. Refer to the following table:

Conditions	Current
All 5 strings activated	Maximum current
If 1 string is disabled	Reduction 20% rispect maximum current
If 2 strings are disabled	Reduction 40% rispect maximum current

This limitation must be implemented by the inverter AC/DC

17. Total current – register 64 - 1062

Total current is defined as

Total current (register 1062) = Battery current (register 1000) + Heater current (battery consumption)

During a discharge phase the value of the Heater current is calculated as:

Heater current = Total current (register 1062) – Battery current (register 1000).

18. Setting a new MODBUS address

The MODBUS address can be changed with SMCMonitor300 application connected via USB to the battery: create a text file **ChangeAddress.txt** with the new address (in the example new address will be 100 decimal)

209 = 100 ; 2 = default 2 to 128 DEC

In the Parameter Upgrade function select **Load from file,** load file **ChangeAddress.txt** file and then **Write to MCU**

The MODBUS address can be changed using the "SMCMonitor200.exe" program connected via USB to the battery. Save the new address in a .xml file like the following and then load the file into the battery using the UTILITY-->UPGRADE function of the program. Please be sure to copy the text exactly as it appears here below, apart from the updated value. The value is expressed in hexadecimal value; free addresses are in the range 03 - F7.

```
<?xml version="1.0"?>
<NewParameter>
  <ConfigurationData>
    <Name Value="MODBUS ID" />
    <Version Value="1.0" />
    <Date Value="13-02-2012 08:26:16" />
  </ConfigurationData>
  <MCU>
    <NewParameters>
      <Parameter Name="MODBUS ID" Value="02" />
    </NewParameters>
  </MCU>
</NewParameter>
```

19. Battery log download via Modbus RTU

During the 48TL200 operation, it is possible to request the download of the data logging.

In the battery microcontroller's memory, the data logging is organized as follows:

- the memory is divided into 32 pages or sections;
- each page is divided into 1024 records;
- each record is divided into 64 bytes of data.
-

There is an overall of HEX 0x20 0000 bytes of data.
The data is written in the memory in a circular way, starting from the record's address 0x00 0000; once a data is written in the last record (address 0x20 0000), the next data will overwrite the previous one written in the record's address 0x00 0000.
Each record contains the battery time stamp of the stored data.

Modbus functions are available to request the address of the last data written in the memory or a data in a certain record's address.

Request for the last written log record address

Slave address	Command	SubFunction	CRC
1 byte	x42	x00	2 byte

For the CRC, refer to www.tahapaksu.com/crc, input type HEX, output field CRC-16 (Modbus).
It is calculated with address, command and subfunction fields. In the CRC field request, LSB is written before of MSB.

Battery answer

Slave address	Command	SubFunction	Data	CRC
1 byte	x42	x00	4 byte	2 byte

The "Data" field includes 4 bytes in HEX to indicate the address; in the address, the bytes start from MSB up to LSB.

Request to download a log record

Slave address	Command	SubFunction	Data	CRC
1 byte	x42	x01	4 bytes	2 bytes

The "Data" field includes the starting address of the record to download.
For the CRC, refer to www.tahapaksu.com/crc, input type HEX, output field CRC-16 (Modbus).
It is calculated with address, command, subfunction and data fields. In the CRC field request, LSB is written before of MSB.

Battery answer

Slave address	Command	SubFunction	Data	CRC
1 byte	x42	x01	4 bytes + 128 bytes	2 bytes

Every answer contains 128 bytes, that is 2 log records.

Memory Data Log

0x00 0000	byte 0x00 0000	page 1/record 1
0x00 0040	page 1 / record 2	
0x00 0080	..	
0x00 00C0	page 1 ..	
0x00 0100	..	
	..	
0x00FFC0	page 1 / record 1024	
0x01 0000	page 2/record 1	
	page 2/record 2	
	..	
page 2	..	
	..	
	..	
0x01 FFC0	page 2 / record 1024	
record = 64 bytes		
	..	
	..	
0x1F 0000	page 32 / record 1	
	page 32/record 2	
	..	
page 32	..	
	..	
	..	
0x1F FFC0	page 32/record 1024	byte x20 0000

The addresses are defined by 3 bytes in the memory, in fact the byte 00 on the left which is obtained as answer from the battery isn't significant.

Examples

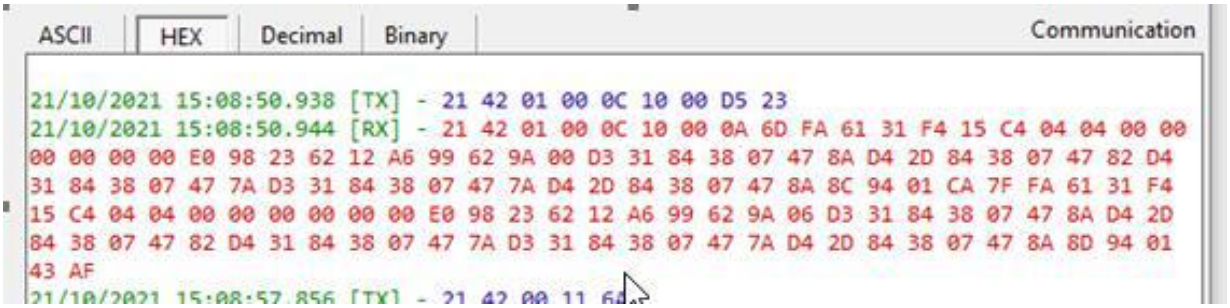
- Request for the last written log record address
02 42 00 E0 A0
Battery address: x02
CRC is xA0E0 (bytes have been inverted).

Battery answer
02 42 00 00 00 7C C0 17 72
0x00 00 7C C0 is the address received as answer
CRC is 0x7217 (bytes have been inverted).

- Request to download a log record
21 42 01 00 0C 10 00 D5 23
Battery address: x21
Log requested from address 0x00 0C 10 00
CRC is x23D5 (bytes have been inverted).

Battery answer

128 bytes answer, it ends with the CRC (in this example: 0xAF43).



For example, the command to request the first two records of the battery with ID 2 is:
02 42 01 00 00 00 00 0A 22

– BIN file generation
The records obtained from the battery answer have to be included in a BIN file and sent to FZSoNick.

The BIN file data consists of lines with the following format: the address of the record in three bytes, followed by the symbol ":", followed by the 64 bytes of data from that address obtained from the battery answer, without the CRC.

Therefore, to every battery answer corresponds two lines in the BIN file.
Since the battery answers with 128 bytes, or two lines/records, the second request will be sent for the data in the address 0x00 0080 (after the first one sent for the data in the address 0x00 0000).

Examples

Management of a single request of battery data (corresponding to two records or lines)
Data request to battery x02, address 0x00 0000
02 42 01 00 00 00 00 0A 22
Battery answer (not real data, we are assuming that data values are progressive numbers)
02 42 01 00 00 00 00 01 02 03 04 05 …….. 7F 80 CRC_LOW CRC_HIGH

BIN file data structure
000000:010203……40
000040:414243……..80

In the BIN file:
- a line includes only 64 bytes of data;
- CRC is not included

The number of requests allows to read the entire memory or just the most recent data.

FZSoNick

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