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Introduction

This document describes the Helios Inverter protocol, adopted to communicate with all communication products, like Supervisor, Network communication, etc...

This protocol will be implemented in the PV equipment, in order to use the same driver for all products.

COMMUNICATION LAYERS

APPLICATIONS
<i>PV MONITOR</i>
DATA TABLE
<i>FIXED</i>
ADDRESS SPECIFICATION
<i>JBUS P</i>
JBUS TRANSPORT PROTOCOL
HARDWARE
<i>RS232 / RS485 / USB / TCP/IP</i>

GENERAL MESSAGE FORMAT

SLAVE NUMBER (1 byte)	Specified the destination node
FUNCTION CODE (1 byte)	Specified a READ or WRITE data command
DATA FIELD	Information to read or write data (Address, value, number of data...)
CONTROL WORD (CRC16) (2 bytes, 1 word)	Algorithm calculation of each data

JBUS FUNCTION

READ WORD:	code function 3
WRITE 1 WORD:	code function 6 (Ex. Commands)
WRITE SEVERAL WORDS:	code function 16 (Ex. Identifiers)

Introduction JBUS Function

FUNCTION 0x3

Ex. Request to slave number1, the data (10 words) beginning at 0xC000 (Address)

Request

Slave Number	Function READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x00	0	10		

Slave message

Response

Slave Number	Function READ	Nb of byte	First data hi byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	20	0x20	0x02		

Example: the first data is $(0x20 * 0x100) + 0x02 = 0x2002$

FUNCTION 0x6

Ex. Write the data 0x3003 to address 0xC010

Write

Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x06	0xC0	0x10	0x30	0x03		

Slave message

Response

Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x06	0xC0	0x10	0x30	0x03		

If slave number is 0 all slave executes the command, without sending message.

FUNCTION 0x10

Ex. This function is used to write several words to slave.

Write

Slave number	Funct. Write word	Address High	Address Low	B La N k	Nb Of word	Nb Of Byte To write	1. data to write high byte	1. data to write low byte	Next data	CRC Low	CRC High
1	0x10	0xC0	0x20	0	10	20	0x20	0x02		

Slave message:

Response

Slave Number	Funct. Write Word	Address High	Address Low	Blank	Nb Of word	CRC Low	CRC High
1	0x10	0xC0	0x20	0	10		

FUNCTION 0x64

Ex. Write to slave (only used Write Setting)

Write

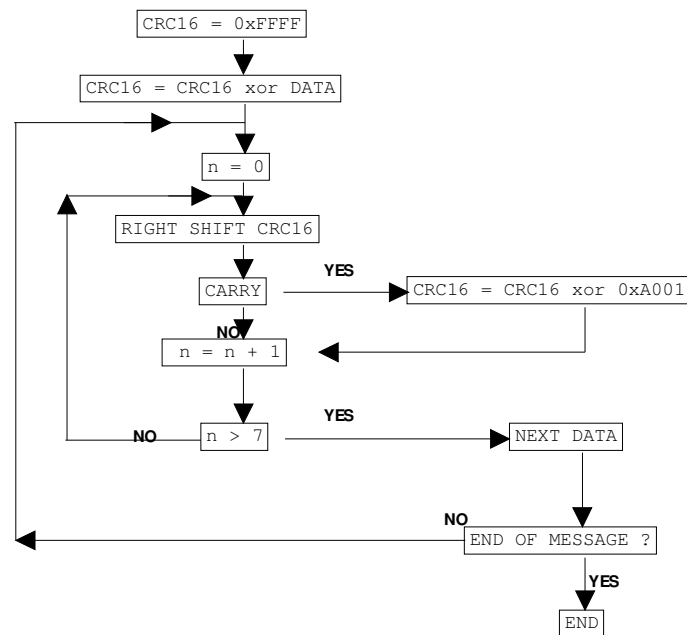
Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

Slave message

Response

Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

CRC 16 CALCULATION



Example of CRC calculation

```

unsigned int CALCUL_CRC(unsigned int *Msg, unsigned int lenght)
{
    unsigned int Crc;
    int i,n;
    Crc = 0xFFFF;
    for ( i = 1 ; i <= lenght ; i++)
    {
        Crc ^= Msg[i];
        for ( n = 1 ; n <= 8 ; n++)
        {
            /* if CRC is even */
            if ((Crc % 2) == 0)
            /* to right decrement */
                Crc >>= 1;
            else
            {
                Crc >>= 1;
                Crc ^= 0xA001;
            }
        }
    }
    return( Crc );
}

```

PV Protocol for J-BUS

DATA BASE	INFORMATION CODING
Alarms	Axx for alarms
Errors	Exx for errors
Measurements	Mxx for measurements
Configurations	Cxx for configurations
Commands	Txx for commands

GENERAL TABLE DATA AREA DEFINITION

DATA	Length in word	TYPE	Information	Jbus Function	Start Address	End Address
ALARMS	4	bit	32 Alarms	3 (r)	0xC000	0xC001
ERRORS	4	bit	32 Error	3 (r)	0xC010	0xC011
MEASUREMENTS	96	word	96 Measurements	3 (r)	0xC020	0xC07F
CONFIGURATIONS	32	word	32 Configurations	3 (r) 16(w)	0xC080	0xC09F
COMMANDS	2	word	32 Commands	6 (w)	0xC0A0	0xC0A1
IDENTIFIERS	32	word	Identifiers	3 (r) 16 (w)	0xC0B0	0xC0CF
SETTING	16	word	Setting	3 (r) 100 (w)	0xCF00	0xCF0F
SENSOR BOX	16	word	16 Measurements	3 (r)	0xD0n0 (1)	0xD0nF (1)

r : read w : write

P.S: (1) The “n” identifies number of the Sensor Box.

JBUS Table

1. Alarms

Ex. Request to slave number 1(alarms)

Request

Slave Number	Function READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x00	0	0x02		

Response

Slave Number	Function READ	Nb of byte	First data high byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	0x04	A15~A08	A07~A00		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0x00	0xC001	Alarms	2

Alarms Data Sequence

Word 0		Word 1	
High	Low	High	Low
A15.....A08	A07.....A00	A31.....A24	A23.....A16

Alarms Data Area

CODE Type(bit)	Description	Necessary
A04	Input Voltage Over Rang	<input type="radio"/>
A05	Input Voltage Under Rang	<input type="radio"/>

P.S: Symbol O shows that is used in charger

2. Errors

Ex. Request to slave number 1(errors)

Request

Slave Number	Function	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x10	0	0x02		

Response

Slave Number	Function	Nb of byte	First data high byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	0x04	E15~E08	E07~E00		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0x10	0xC011	Errors	2

Errors Data Sequence

Word 0		Word 1	
High	Low	High	Low
E15.....E08	E07.....E00	E31.....E24	E23.....E16

Errors Data Area

CODE Type(bit)	Description	Necessary
E04	Battery Weak or Bad	<input type="radio"/>
E11	output power Over-Rang	<input type="radio"/>
E13	output Short-Circuit	<input type="radio"/>
E17	EEPROM Data Error ,Use Default Value	<input type="radio"/>
E18	Heatsink temperature Over-Rang	<input type="radio"/>
E25	Input current Over-Rang	<input type="radio"/>
E28	Charger Voltage Over-Rang	<input type="radio"/>
E30	The Settings of Driver Board don't match the EEPROM	<input type="radio"/>
E32	Memory Error	<input type="radio"/>
E33	Charger is self-locked	<input type="radio"/>
E34	Crystal damage	<input type="radio"/>

E35	Charger Voltage Under-Rang	○
E36	Bat. Over-heat	○
E37	Fan out of order	○
E38	AUTO Function Enable	○
E39	Failure in “save”	○

P.S: Symbol O shows that is used in charger

3. Measurements

Ex. Request to slave number 1(measurements)

Request

Slave Number	Function READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x20	0	10		

Response

Slave Number	Function READ	Nb of byte	First data high byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	20	0x20	0x02		

Example: the first data is $(0x20 * 0x100) + 0x02 = 0x2002$

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0x20	0xC07F	Measurements	96

Measurements Data Area

ADRESS INDEX	CODE	Description	Unit	Necessary
0xC02A	M10	Heat sink temperature	°C	○
0xC02B	M11	input voltage	V	○
0xC02D	M13	input current	A*10(2)	○
0xC02F	M15	Input Power	KW*100(1)	○
0xC031~ 0xC032	M17, M18	Total Output Power	KW-H(3)	○
0xC033	M19	Battery voltage	V*10(2)	○
0xC034	M20	Battery charge current	A*10(2)	○
0xC038	M24	Battery temperature	°C	○

P.S: Symbol O shows that is used in charger

P.S: (1) The number must be in unit*100 format.

Example: M04 = 1234 mean 12.34 KW

(2) The number must be in unit*10 format.

Example: M04 = 1234 mean 123.4 A

(3) The data is $(0xC031 * 65536) + 0xC032$.

Example: $0xC031 = 1234$, $0xC032 = 5678$, Total Power = $1234 * 65536 + 5678$.

4. Configurations

Ex. Request to slave number 1(configurations)

Request

Slave Number	Function	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x80	0	2		

Response

Slave Number	Function	Nb of byte	First data hi byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	4	0x20	0x02	...		

Ex. Write configuration to a slave.

Write

Slave Number	Funct. Write word	Address High	Address Low	B L a n k	Nb Of word	Nb Of Byte	1.data to write high byte	1.data to write low byte	Next data	CRC Low	CRC High
1	0x10	0xC0	0x80	0	12	24	0x30	0x03	...		

Response

Slave Number	Funct. Write word	Address High	Address Low	Blank	Nber Of word	CRC low	CRC High
1	0x10	0xC0	0x80	0	12		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0x80	0xC09F	configurations	32

Configurations Data Area

ADRESS INDEX	CODE	Description	Unit	Necessary
0xC080	C00	Slave Address		<input type="radio"/>

ADRESS INDEX	CODE	Description	Unit	Necessary
0xC090	C16	Battery Voltage Select (0->48V 1->36V 2->24V 3->12V 4->AUTO)		<input type="radio"/>
0xC091	C17	Battery AH	1~999AH	<input type="radio"/>
0xC092	C18	48V Battery Under Voltage	V / 10	<input type="radio"/>
0xC093	C19	48V Battery Over Voltage	V / 10	<input type="radio"/>
0xC094	C20	36V Battery Under Voltage	V / 10	<input type="radio"/>
0xC095	C21	36V Battery Over Voltage	V / 10	<input type="radio"/>
0xC096	C22	24V Battery Under Voltage	V / 10	<input type="radio"/>
0xC097	C23	24V Battery Over Voltage	V / 10	<input type="radio"/>
0xC098	C24	12V Battery Under Voltage	V / 10	<input type="radio"/>
0xC099	C25	12V Battery Over Voltage	V / 10	<input type="radio"/>
0xC09A	C26	0->Pulse OFF 1->ON Pulse		<input type="radio"/>

P.S: Symbol O shows that is used in charge

P.S: (1) The number must be in unit*10 format.

Example: C03 = 500 mean 50.0 Hz

6. Identifiers

Ex. Request to slave number 1(identifiers)

Request

Slave Number	Function	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0xB0	0	2		

Response

Slave Number	Function	Nb of byte	First data hi byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	4	0x20	0x02	...		

Ex. Write Identifiers to a slave.

Write

Slave Number	Funct. Write word	Address High	Address Low	B L a N k	Nb Of word	Nb Of Byte	1.data to write high byte	1.data to write low byte	Next data	CRC Low	CRC High
1	0x10	0xC0	0xB0	0	12	24	0x30	0x03	...		

Response

Slave Number	Funct. Write word	Address High	Address Low	Blank	Nber Of word	CRC low	CRC High
1	0x10	0xC0	0xB0	0	12		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0xB0	0xC0CF	Identifiers	32

Identifiers Data Sequence

WORD 0	WORD 1	WORD 2 ~ WORD 6	WORD 7 ~ WORD 11	WORD 12 ~ WORD 15
Inverter Type	POWER (*10)	Model Name	Company	DSP Version

WORD 16 ~ WORD 23	WORD 24 ~ WORD 27	WORD 28 ~ WORD 31
Product Serial Number	LCD Version	Reserve

Inverter Type :

VALUE	Device	Type
0x0014	EnerSolis 2000	Inverter
0x001E	EnerSolis 3000	Inverter
0x0028	EnerSolis 4000	Inverter
0x0032	EnerSolis 5000	Inverter
0x0040	Solar charger 1500	Charger
0x0041	Solar charger 1000	Charger
0x0050	EnerSolis 10000	Inverter
0x00FF ~ 0xFFFF	Reserve	

POWER :

The number must be in KVA*10 format.

WORD 1 = 20 mean 2.0 KVA

Model Name / Company:

LSB Ch.1	MSB Ch.2	LSB Ch.3	MSB Ch.4	LSB Ch.5	MSB Ch.6	LSB Ch.7	MSB Ch.8	LSB Ch.9	MSB Ch.10
WORD		WORD		WORD		WORD		WORD	

Ch.1 ~ Ch.10 are character with a ASCII code.

7. Setting

Ex. Read setting data to a slave.

Request

Slave Number	Function	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xCF	0x00	0	2		

Response

Slave Number	Function	Nb of byte	First data hi byte	First data low byte	Next data	CRC Low	CRC High
1	0x03	4	0x20	0x02	...		

Ex. Write setting data to a slave.

Write

Slave Number	Funct. Write word	Address High	Address Low	B L a n k	Nb Of word	Nb Of Byte	1.data to write high byte	1.data to write low byte	Next data	CRC Low	CRC High
1	0x64	0xCF	0x03	0	7	14	0x30	0x03	...		

Response

Slave Number	Funct. Write word	Address High	Address Low	Blank	Nber Of word	CRC low	CRC High
1	0x64	0xCF	0x03	0	7		

Write

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

Response

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xCF	0x00	0xCF0F	settings	16

Settings Data Area

ADDRESS INDEX	CODE	Description	Unit	Necessary
0xCF01~0xCF02	C01, C02	Total Output Power	KW-H(2)	<input type="radio"/>
0xCF0A	C10	Calibrate output voltage offset		<input type="radio"/>
0xCF0B	C11	Calibrate output current offset		<input type="radio"/>
0xCF0C	C12	Calibrate input current offset		<input type="radio"/>
0xCF0D	C13	Calibrate input voltage offset		<input type="radio"/>
0xCF0E	C14	Calibrate output voltage gain		<input type="radio"/>
0xCF0F	C15	Calibrate output current gain		<input type="radio"/>
0xCF10	C16	Calibrate input current gain		<input type="radio"/>
0xCF11	C17	Calibrate input voltage gain		<input type="radio"/>

P.S: (1) The number must be in unit/10 format.

Example: C00 = 960 mean 9600 bps

(2) The data is $(0xCF01 * 65536) + 0xCF02$.

Example: $0xCF01 = 1234$, $0xCF02 = 5678$, Total Power = $1234 * 65536 + 5678$.

(3) The high byte is Gain, the low byte is Offset.

Example: C03 = 0xABCD, AB mean Gain = 172, CD mean Offset = -51.

(4) The number must be in unit*10 format.

Example: C09 = 1234 mean 123.4 A

9. Charger Mode Select

Select Client Mode

Request

Slave Number	Function READ	Address High	Address Low	First data hi byte	First data low byte	CRC Low	CRC High
1	0x64	0xDF	0x02	0xB0	0xC5		

Response

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xDF	0x02	0x00	0x01		

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	Description
1	0x64	0xDF	0x02	0x00	0x00	Fail
1	0x64	0xDF	0x02	0x00	0x01	Success (Client Mode)

Select Calibrate Mode

Request

Slave	Function	Address	Address	First	First	CRC	CRC
-------	----------	---------	---------	-------	-------	-----	-----

Number	READ	High	Low	data hi byte	data low byte	Low	High
1	0x64	0xDF	0x02	0xB3	0x65		

Response

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xDF	0x02	0x00	0x01		

Slave number	Funct. Write word	Address High	Address Low	data to write high byte	data to write low byte	Description
1	0x64	0xDF	0x02	0x00	0x00	Fail
1	0x64	0xDF	0x02	0x00	0x01	Success (Calibrate Mode)