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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
PV MONITOR
DATA TABLE
FIXED
ADDRESS SPECIFICATION
*JBUS **P***
JBUS TRANSPORT PROTOCOL
HARDWARE
RS232 / RS485 / USB / TCP/IP

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

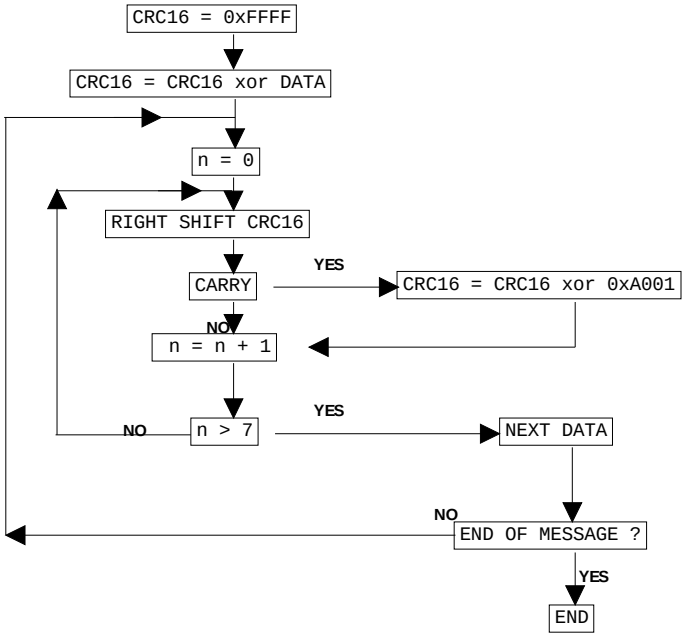
Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

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

GENERAL TABLE DATA AREA DEFINITION

DATA	Length in word	TYPE	Information	Jbus Function	Start Address	End Address
ALARMS	2	bit	32 Alarms	3 (r)	0xC000	0xC001
ERRORS	2	bit	32 Error	3 (r)	0xC010	0xC011
MEASUREMENTS	96	word	96 Measurements	3 (r)	0xC020	0xC07F

r : read w : write

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
A00	Utility Voltage Over Rang	
A01	Utility Voltage Under Rang	
A02	Utility Frequency Over Rang	
A03	Utility Frequency Under Rang	
A04	Boost:1-Input Voltage Over Rang	
A05	Reserve	
A06	Boost:2-Input Voltage Over Rang	
A07	Reserve	

A08	Anti-islanding general alarm	
A09	Input voltage balance general alarm	
A10	Ground current fault general alarm	
A11	Ground impedance fault general alarm	
A12	System contact impedance fault general alarm	
A13	Utility Phase Fault	
A14	Utility Wave Fault	
A15	Reserve	
A16	Reserve	
A17	Reserve	
A18	Reserve	
A19	Reserve	
A20	Reserve	
A21	Calculate Fail	
A22	Voltage Sensor Fail	
A23	Reserve	
A22 ~ A31	Reserve	

2. Errors

Ex. Request to slave number 1(errors)

Request

Slave Number	Function READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xC0	0x10	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	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
E00	DC BUS Charge Fault	
E01	Reserve	
E02	Slave CPU Fault	
E03	Inverter Fault	
E04	Reserve	
E05	Watch Dog	
E06	EPO (Emergency Power Off Mode)	
E07	DC BUS Voltage Over-Rang	
E08	DC BUS Voltage Under-Rang	
E09	Inverter output current Over-Rang	
E10	Inverter temperature Over-Rang	

E11	Inverter output power Over-Rang	
E12	Charger Fault	
E13	Inverter output Short-Circuit	
E14	PLL(Phase-Locked Loop) Fault	
E15	Slave Data fault	
E16	Reserve	
E17	EEPROM Data Error ,Use Default Value	
E18	Heatsink temperature Over-Rang	
E19	Reserve	
E20	Reserve	
E21	Reserve	
E22	Inverter Relay Fault	
E23	Reserve	
E24	Inverter Current sense Fault	
E25	Booster _1 - Input current Over-Rang	
E26	Booster _2 - Input current Over-Rang	
E27	Booster input Short-Circuit	
E28	Reserve	
E29	Inverter Output Current Balance Over-Rang	
E30	Reserve	
E31	Reserve	
E32	Reserve	
E33	Reserve	
E34	Reserve	
E35	Reserve	
E36	Reserve	
E37	Fan out of order	
E38	Reserve	
E39	Reserve	
E40	Reserve	
E41	Boost A current Sense Fault	
E42	Boost B current Sense Fault	
E43	Output Balance current Sense Fault	

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
0xC020	M00	Output power	KW*100(1)	ˇ Δ
0xC021	M01	AC voltage phase L1	V	ˇ Δ
0xC022	M02	AC voltage phase L2	V	Δ
0xC023	M03	AC voltage phase L1-L2	V	Δ
0xC024	M04	AC output current L1	A*10(2)	ˇ Δ
0xC025	M05	AC output current L2	A*10(2)	Δ
0xC026	M06	AC frequency (L1)	Hz*10(2)	ˇ Δ
0xC027	M07	DC-Bus Positive-voltage	V	ˇ Δ
0xC028	M08	DC-Bus Negative-voltage	V	Δ
0xC029	M09	Inverter internal temperature	℃	ˇ Δ
0xC02A	M10	Inverter Heat sink temperature	℃	ˇ ◯Δ
0xC02B	M11	DC1 input voltage	V	ˇ ◯Δ
0xC02C	M12	DC2 input voltage	V	ˇ Δ
0xC02D	M13	DC1 input current	A*10(2)	ˇ ◯Δ

0xC02E	M14	DC2 input current	A*10(2)	ˇ Δ
0xC02F	M15	Input Power A	KW*100(1)	ˇ ◯Δ
0xC030	M16	Input Power B	KW*100(1)	ˇ Δ
0xC031~ 0xC032	M17, M18	Total Output Power	KW-H(3)	ˇ ◯Δ
0xC033	M19	Battery voltage	V*10(2)	◯
0xC034	M20	Battery charge current	A*10(2)	◯
0xC035	M21	Battery discharge current	A*10(2)	
0xC036~ 0xC037	M22, M23	Total Charge Power	KW-H(3)	
0xC038	M24	Battery temperature Salf Test Vmin	℃	◯Δ ˇ
0xC039	M25	Salf Test Vmax		ˇ Δ
0xC03A	M26	Salf Test Fmin		ˇ Δ
0xC03B	M27	Salf Test Fmax		ˇ Δ
0xC03C	M28	AC voltage phase L2-L3	V	Δ
0xC03D	M29	AC frequency L2	Hz*10(2)	Δ
0xC03E	M30	AC voltage phase L3	V	Δ
0xC03F	M31	AC voltage phase L3-L1	V	Δ
0xC040	M32	AC frequency L3	Hz*10(2)	Δ
0xC041	M33	AC output current L3	A*10(2)	Δ
0xC042	M34	Event Code 1~2	Code1 (4) Code2	
0xC043	M35	Event Code 3~4	Code3 Code4	
0xC044	M36	Event Code 5~6	Code5 Code6	
	M34~M96	Reserve		

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)Event Code

1000 0000	Er00
1000 0001	Er01
…	…
1001 1110	Er30
1001 1111	Er31
1100 0000	AL00
1100 0001	AL01
…	…
1101 1110	AL30
1101 1111	AL31