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

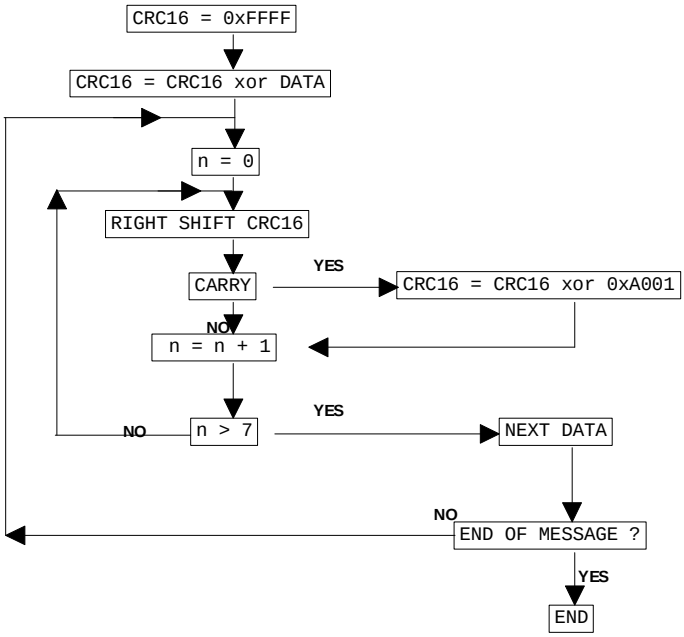
Slave number	Function Write word	Address High	Address Low	data to write high byte	data to write low byte	CRC Low	CRC High
1	0x64	0xCF	0x00	0x20	0x02		

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
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	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
CONFIGURATIONS	32	word	32 Configurations	3 (r) 6(w)	0xC080	0xC09F
COMMANDS	2	word	32 Commands	6 (w)	0xC0A0	0xC0A1
IDENTIFIERS	16	word	Identifiers	3 (r) 16 (w)	0xC0B0	0xC0BF
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
A00	Utility Voltage Over Rang	ˇ
A01	Utility Voltage Under Rang	ˇ
A02	Utility Frequency Over Rang	ˇ
A03	Utility Frequency Under Rang	ˇ

A04	Boost:1-Input Voltage Over Rang	ˇ
A05	Boost:1-Input Voltage Under Rang	ˇ
A06	Boost:2-Input Voltage Over Rang	ˇ
A07	Boost:2-Input Voltage Under Rang	ˇ
A08	Anti-islanding general alarm	ˇ
A09	Input voltage balance general alarm	
A10	Ground current fault general alarm	ˇ
A11	Ground impedance fault general alarm	ˇ
A12	System contact impedance fault general alarm	
A13	Utility Phase Fault	ˇ
A14	Utility Wave Fault	ˇ
A15	Standby (SANYO DENKI)	
A16	Communication Lost (SANYO DENKI)	
A17	Ups Abnormal (Software)	
A18	UPS Back-Up mode (Software)	
A19	UPS Bettery Low (Software)	
A20	UPS Bettery Bad (Software)	
A21 ~ 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	ˇ
E01	Inverter Fault (SANYO DENKI)	
E02	Reserve	
E03	Inverter Fault	ˇ
E04	Battery Weak or Bad	

E05	Reserve	
E06	EPO (Emergency Power Off Mode)	ˇ
E07	DC BUS Voltage Over-Rang	ˇ
E08	DC BUS Voltage Under-Rang	ˇ
E09	Inverter output current Over-Rang	ˇ
E10	Inverter temperature Over-Rang	ˇ
E11	Inverter output power Over-Rang	ˇ
E12	Charger Fault	
E13	Inverter output Short-Circuit	
E14	PLL(Phase-Locked Loop) Fault	ˇ
E15	Reserve	
E16	Reserve	
E17	EEPROM Data Error ,Use Default Value	ˇ
E18	Heatsink temperature Over-Rang	ˇ
E19	DCBUS voltage don’t Discharge	ˇ
E20	Reserve	
E21	Reserve	
E22	Inverter Relay Fault	ˇ
E23	Reserve	

E24	Inverter Current sense Fault	ˇ
E25	Booster _1 - Input current Over-Rang	ˇ
E26	Booster _2 - Input current Over-Rang	ˇ
E27	Booster input Short-Circuit	ˇ
E28	Charger Voltage Over-Rang	
E29	Inverter Output Current Balance Over-Rang	ˇ
E30	The Settings of Driver Board don’t match the EEPROM	ˇ
E31	Reserve	

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
0xC021	M01	AC voltage phase L1	V	ˇ
0xC022	M02	AC voltage phase L2	V	
0xC023	M03	AC voltage phase L1-L2	V	
0xC024	M04	AC output current L1	A*10(2)	ˇ
0xC025	M05	AC output current L2	A*10(2)	

0xC026	M06	AC frequency	Hz*10(2)	ˇ
0xC027	M07	DC-Bus Positive-voltage	V	ˇ
0xC028	M08	DC-Bus Negative-voltage	V	
0xC029	M09	Inverter internal temperature	℃	ˇ
0xC02A	M10	Inverter Heat sink temperature	℃	ˇ
0xC02B	M11	DC1 input voltage	V	ˇ
0xC02C	M12	DC2 input voltage	V	ˇ
0xC02D	M13	DC1 input current	A*10(2)	ˇ
0xC02E	M14	DC2 input current	A*10(2)	ˇ
0xC02F	M15	Input Power A	KW*100(1)	ˇ
0xC030	M16	Input Power B	KW*100(1)	ˇ
0xC031~ 0xC032	M17, M18	Total Output Power	KW-H(3)	ˇ
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)	
	M24~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. Configurations

Ex. Request to slave number 1(configurations)

Request

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

Response

Slave Number	Function READ	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 La 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		ˇ
0xC081	C01	Standard		ˇ
0xC082	C02	Stand-Alone Output AC voltage	V	
0xC083	C03	Stand-Alone Output AC Frequency	Hz	
0xC084	C04	Below Inverter Output Power Percent, Inverter Sleep Test Begin	%	ˇ
0xC085	C05	AC and DC Fault Retry Time	Seconds	ˇ
0xC086	C06	Long Time Above voltage (10 Minutes)	V	
0xC087	C07	Battery Capacity	AH*10(1)	
0xC088	C08	AC Over Voltage Level_2	V	ˇ
0xC089	C09	AC Over Voltage Level_1	V	ˇ
0xC08A	C10	AC Under Voltage Level_1	V	ˇ
0xC08B	C11	AC Under Voltage Level_2	V	ˇ
0xC08C	C12	AC Over Voltage Level_2 Disconnect Time	Cycles	ˇ
0xC08D	C13	AC Over Voltage Level_1 Disconnect Time	Cycles	ˇ
0xC08E	C14	AC Under Voltage Level_1 Disconnect Time	Cycles	ˇ
0xC08F	C15	AC Under Voltage Level_2 Disconnect Time	Cycles	ˇ
0xC090	C16	Over Frequency for 50Hz	Hz*10(1)	ˇ

0xC091	C17	Under Frequency for 50Hz	Hz*10(1)	ˇ
0xC092	C18	Over Frequency for 60Hz	Hz*10(1)	ˇ
0xC093	C19	Under Frequency for 60Hz	Hz*10(1)	ˇ
0xC094	C20	Over Frequency Disconnect Time	Cycles	ˇ
0xC095	C21	Under Frequency Disconnect Time	Cycles	ˇ
	C22~C31	Reserve		

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

Example: C03 = 500 mean 50.0 Hz

5. Commands

Ex. Request to slave number 1(commands)

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	0x06	0xC0	0xA0	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	0x06	0xC0	0xA0	0x20	0x02		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xC0	0xA0	0xC0A1	Commands	2(w)

Alarms Data Sequence

Word 0		Word 1	
High	Low	High	Low
T15……T08	T07……T00	T31……T24	T23……T16

Commands Data Area

CODE Type(bit)	Description	Necessary
T00	Buzzer ON/OFF Command； 0 : OFF, 1 : ON	
T01 ~ T31	Reserve	

6. Identifiers

Ex. Request to slave number 1(identifiers)

Request

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

Response

Slave Number	Function READ	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 La 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	0xC0BF	Identifiers	16

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	Reserve

Inverter Type :

VALUE	Device	Type
0x0014	EnerSolis 2000	Inverter
0x001E	EnerSolis 3000	Inverter
0x0028	EnerSolis 4000	Inverter
0x0032	EnerSolis 5000	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 READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xCF	0x00	0	2		

Response

Slave Number	Function READ	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 La 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

ADRESS INDEX	CODE	Description	Unit	Necessary
0xCF00	C00	Baud Rate	bp/10(1)	ˇ
0xCF01~ 0xCF02	C01, C02	Total Output Power	KW-H(2)	ˇ
0xCF03	C03	Calibrate DC1 input voltage	Gain Offset(3)	ˇ
0xCF04	C04	Calibrate DC2 input voltage	Gain Offset(3)	ˇ
0xCF05	C05	Calibrate DCBus voltage	V	ˇ
0xCF06	C06	Calibrate DC1 input current	Gain Offset(3)	ˇ
0xCF07	C07	Calibrate DC2 input current	Gain	ˇ

			Offset(3)	
0xCF08	C08	Calibrate AC voltage	V	ˇ
0xCF09	C09	Calibrate AC Current	Gain A*10(4)	ˇ
	C10~C15	Reserve		

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

8. Sensor Boxs

Ex. Request to slave number 1(sensor boxs)

Request

Slave Number	Function READ	Address High	Address Low	0	Nb of word to read	CRC Low	CRC High
1	0x03	0xD0	0xn0(1)	0	10		

P.S: (1) The "n" identifies number of the Sensor Boxs.

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	…		

GENERAL VECTOR INDEX

Address High	Address Low	End Address	DATA AREA	LENGTH (IN WORDS)
0xD0	0x00	0xD00F	Sensor Box 1	16
0xD0	0x10	0xD01F	Sensor Box 2	16
. .			. .	
0xD0	0xE0	0xD0EF	Sensor Box 15	16
0xD0	0xF0	0xD0FF	Sensor Box 16	16

Sensor Boxs Data Area

Address High	Adress Index	Description	Unit	Necessary
0xD0	0xn0	Voltage	V	ˇ
	0xn1	Current	A*10 (2)	ˇ
	0xn2	Illumination	W/m²	ˇ

	0xn0	Ambient Temperature	℃	ˇ
	0xn0	Surface Temperature	℃	ˇ
	0xn5 ~ 0xnF(1)	Reserve		

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

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

Example: M04 = 1234 mean 123.4 A