

Solax Power Single Phase External Communication Protocol V3.0

X1 Series



History list:

Data	Name	detail	Version	ARM Version
2015-09-23	Weir	Draft	V1.0	
2016-09-18	zhangxiangping	Add set Australia Safety Parameters	V1.1	
2017-03-27	zhangxiangping	Add Italy safety Parameters	V1.2	
2019-05-16	lintianyu	Add EarthDetect & SafetyMode Parameters	V1.3	
2020-04-15	lintianyu	Add Setting Language	V1.4	
2020-05-11	lintianyu	add read inverter config	V1.5	
2020-06-09	lintianyu	Modif safety	V1.6	
2020-06-18	lintianyu	Modif	V1.7	
2020-08-26	zhangxiangping	Add RD1699_island、CT Pgrid	V1.8	
2020-12-16	zhangxiangping	Add safety	V1.9	
2020-12-24	zhangxiangping	Add Machine Version	V2.0	
2021-02-06	zhangxiangping	Add get error information	V2.1	
2021-03-04	zhangxiangping	Add CT calibration	V2.2	
2021-03-31	zhangxiangping	1、 Add external command for itality Safety 2、 Add Lease Mode	V2.3	
2021-06-15	zhangxiangping	1.增加西班牙语语言	V2.4	
2021-08-20	zhangxiangping	1.ATE里增加设置老化模式	V2.5	
2021-12-13	张祥平	1.增加了四个安规，代号45~47	V2.6	
2022-02-24	张祥平	1、增加读取ARM的版本号 2、增加ACEA安规	V2.7	V1.38
2022-04-13	张祥平	1、ATE里增加支持意大利语的设置	V2.8	V1.39
2022-05-30	张祥平	1、新增一个捷克安规Czech_2021_2	V2.9	V1.42
2022-08-29	张祥平	1、ATE新增CheckingTime的设置	V3.0	V1.43

1. RS485 Parameter:

Parameter	Value
Speed	9600bps
Data bit	8
Parity	None
Stop bit	1
RS485 bus	2 wires A,B /4-wires T+, T-, R+, R-

Communication timing:

Timing parameter	Value
Delay before Inverter begins to send response	0~0.5 Sec
Inter-character delay	0~0.2 Sec
The least interval time between two instructions	0.5 Sec
Time out for Inverter communication	10 Min

2.Packet Format

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes (0x AA 55)	2 Bytes (0xXX 00)	2 Bytes (0x00 XX)	1 Byte	1 Byte	1 Byte (N)

Data0	Data1	Data2	Data3	...	Data(N-1)	Checksum
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Bytes

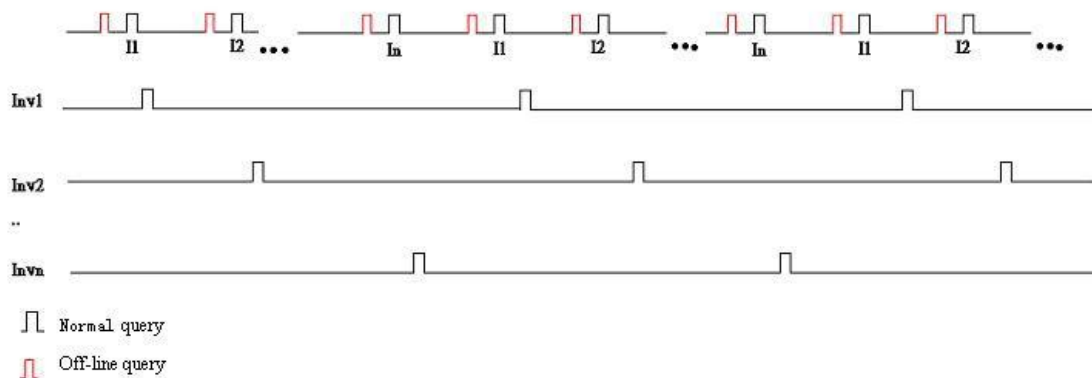
3.Description

	Description
Header (0xAA 0x55):	the header of each packet .
Source Address	designate the sender address . (it is XX00 for AP, or it is 00XX for Inverter)
Destination Address	designate the receiver address. (it is XX00 for AP, or it is 00XX for Inverter)
Control Code	there are 4 kinds: 1. Register(0x10) 2. Read(0x11) 3. Write(0x12) 4. Execute(0x13)

Function Code	
Data length	designate the data length. (If there is not the data column, the data length is 0)
Data0,1,2..	Data column
Checksum	Header + Source Address + Destination Address + Control Code +Function Code + Data length +Data0 + .. +Data (N-1)

4.Packet Communication Method

- It is necessary to get address from AP for each Inverter and the register address is unique for each Inverter.
- The communication method is as follows: AP is master and Inverter is slave, that is, firstly AP sends out the instruction to each Inverter and Inverter executes the operation when receiving its own instruction. Inverter can't actively send the instruction.
- The packet must include the sender and receiver address when AP sends query or control instruction to each Inverter. These instructions will be seen by all on-line Inverters. But the Inverter can only do when the instruction is suitable to its own address and the packet should include the sender and receiver address when Inverter responds to the instruction in the same way.
- AP routine query using the periodic query method (according to address ranking) is as follows:



- It will firstly be sent when AP needs to write the data or allocate address while the routine query will be postponed.
- If AP can't receive the correct response to the sent command in 0.5Sec, AP will send the instruction again after 0.5Sec(the least interval between instructions). When it can't also receive the response for 3 times, AP will cancel the register and no longer send the instruction to the address.

5. Control Code :0x10 'register'

Control	Function code	Vector	Description
0x10	0x00	AP → Inverter	Off-line
0x10	0x80	Inverter → AP	register request
0x10	0x01	AP → Inverter	send register address
0x10	0x81	Inverter → AP	address confirm
0x10	0x02	AP → Inverter	remove register
0x10	0x82	Inverter → AP	remove confirm
0x10	0x03	AP → Inverter	re-connect removed
0x10	0x04	AP → Inverter	Re-register

Off-line query Example:

- AP queries whether there is a new Inverter added (Control Code:0x10 Function Code 0x00)

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Checksum
2 Bytes (0xAA 0x55)	2 Bytes (0XX 0x00)	2 Bytes (0x00 0XX)	1 Byte (0x10)	1 Byte (0x00)	1 Byte (0x00)	2 Bytes

- The off-line Inverter reply register request (Control Code:0x10, Function Code 0x80)

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data0
2 Bytes (0xAA 0x55)	2 Bytes (0x00 0x00)	2 Bytes (0XX 0x00)	1 Byte (0x10)	1 Byte (0x80)	1Byte (0x0E)	1 Byte

Data1	Data2	Data3	...	Data13	Checksum
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Bytes

Description: Data0 to Data13 is Inverter serial number

- AP allocates address for Inverter (Control Code:0x10 Function Code 0x01)

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data0
2 Bytes (0xAA 0x55)	2 Bytes (0x00 0x00)	2 Bytes (0XX 0x00)	1 Byte (0x10)	1 Byte (0x01)	1Byte (0x0B)	1 Byte

Data1	Data2	Data3	...	Data13	Data14	Checksum
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1Byte (register Address)	2 Bytes

Description: the rules of AP allocating address, Data0 to Data13 is Inverter serial number

- AP should record every allocated address of Inverter that has been registered and set up a

map for allocated address.

- AP will allocate a proper address to Inverter according to records of the map of allocated address.

■ Inverter reply address confirm (Control Code:0x10 Function Code 0x81)

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data0	Checksum
2 Bytes (0xAA 0x55)	2 Bytes (0x00 0xXX)	2 Bytes (0xXX 0x00)	1Byte (0x10)	1 Byte (0x81)	1Byte (0x01)	1Byte ACK(0x06)	2 Bytes

Description: The state of Inverter will be changed from 'not registration' state to 'registration' state after Inverter has finished the register program, then it will not respond to the 'off-line query' from AP.

Data	Unit	Description	Length
Temperature	1°C	Temperature	2Bytes
E-today	0.1KWH	Yield today	2Bytes
Vpv1	0.1V	PV1 voltage	2Bytes
Vpv2	0.1V	PV2 voltage	2Bytes
Ipv1	0.1A	PV1 current	2Bytes
Ipv2	0.1A	PV2 current	2Bytes
Iac	0.1A	Current output	2Bytes
Vac	0.1V	Grid voltage	2Bytes
Frequency	0.01Hz	Grid frequency	2Bytes
power	1W	Power output	2Bytes
Not use	-	Not use	2Bytes
E-total	0.1kwh	Yield total	4Bytes
T-total	1hour	Runtime total	4Bytes
Mode	-	Inverter mode	2Bytes
GridVoltFault	0.1V	Grid voltage fault value	2Bytes
GridFreqFalut	0.01Hz	Grid frequency fault value	2Bytes
DCIFault	1mA	DC injection fault value	2Bytes
TemperatureFault	-	Temperature fault value	2Bytes
PV1Fault	0.1V	Pv1 voltage fault value	2Bytes
PV2Fault	0.1V	PV2 voltage fault value	2Bytes
GFCFault	1mA	GFC fault value	2Bytes
ErrMsgage	-	Error Message	4Bytes
CT_Pgrid	1W	CT Pgrid	2Bytes
ARM Version	-	ARM Firmware Version	2Bytes
DSP Version	-	DSP Firmware Version	2Bytes

When sending the MSB will be firstly transmitted as a packet of word format.

The detail of “Run Mode”:

Value	Mode
0	Wait Mode
1	Check Mode
2	Normal Mode
3	Fault Mode
4	Permanent Fault Mode
5	Update Mode
6	SelfTest Mode

//逆变器报错信息表

```
typedef union Inverter_FaultMessage_t
{
    uint32_t ALL;
    struct
    {
        uint8_t BYTE0: 8;
        uint8_t BYTE1: 8;
        uint8_t BYTE2: 8;
        uint8_t BYTE3: 8;
    } BYTE;
    struct
    {
        uint16_t WORD0: 16;
        uint16_t WORD1: 16;
    } WORD;
    struct
    {
        //BYTE0
        uint8_t TzProtectFault: 1; //trip zone err
        uint8_t MainsLostFault: 1; //Mains lost
        uint8_t GridVoltFault: 1; //OVP/UVF
        uint8_t GridFreqFault: 1; //OFP/UFP
        uint8_t PLLLostFault: 1; //PLL unlocked
        uint8_t BusVoltFault: 1;
        uint8_t BIT6: 1; //Boost_OCP_Fault
        uint8_t Inv_OCP_Fault: 1;
        //BYTE1
        uint8_t Dci_OCP_Fault: 1;
        uint8_t ResidualCurrentFault: 1;
        uint8_t PvVoltFault: 1;
        uint8_t Ac10Mins_Voltage_Fault: 1;
        uint8_t IsolationFault: 1;
        uint8_t TemperatureOverFault: 1;
        uint8_t BIT14: 1;
        uint8_t EarthFault: 1; //20190221 add
        //BYTE2
        uint8_t SpiCommsFault: 1; //internal comms err
        uint8_t SciCommsFault: 1; //rs232(dbgu) comms err
        uint8_t BIT18: 1; //interface comms err
        uint8_t InputConfigFault: 1;
        uint8_t EepromFault: 1;
        uint8_t RelayFault: 1;
        uint8_t SampleConsistenceFault: 1;
        uint8_t ResidualCurrent_DeviceFault: 1;
        //BYTE3
        uint8_t BIT24: 1;
        uint8_t BIT25: 1;
        uint8_t BIT26: 1;
        uint8_t BIT27: 1;
        uint8_t BIT28: 1;
        uint8_t DCI_DeviceFault: 1;
        uint8_t Other_DeviceFault: 1;
        uint8_t BIT31: 1;
    } BIT;
}Inverter_FaultMessage_t;
```

The data response for ID info query from inverter:

array	detail
Data9	1: single phase
Data10~data15	Rated power,(ascii char)
Data16~data20	Firmware ver (ascii char)
Data21~data34	Module name(ascii char)
Data35~data48	Factory name(ascii char)
Data49~data62	SerialNumber(ascii char)
Data63~data66	Rated bus voltage(ascii char)

The data response for inverter Config:

Item	Data	Unit	Length
1	wVpvStart[9.10]	0.1V	2Bytes
2	wTimeStart[11.12]	1S	2Bytes
3	wVacMinProtect[13.14]	0.1V	2Bytes
4	wVacMaxProtect[15.16]	0.1V	2Bytes
5	wFacMinProtect[17.18]	0.01Hz	2Bytes
6	wFacMaxProtect[19.20]	0.01Hz	2Bytes
7	wDciLimits[21.22]	1mA	2Bytes
8	wGrid10MinAvgProtect[23,24]	0.1V	2Bytes
9	wVacMinSlowProtect[25.26]	0.1V	2Bytes
10	wVacMaxSlowProtect[27.28]	0.1V	2Bytes
11	wFacMinSlowProtect[29.30]	0.01Hz	2Bytes
12	wFacMaxSlowProtect[31.32]	0.01Hz	2Bytes
13	wSafety[33.34]		2Bytes
14	wPowerfactor_mode[35]	NA	1Byte
	wPowerfactor_data[36]	NA	1Byte
15	wUpperLimit[37]	NA	1Byte
	wLowerLimit[38]	NA	1Byte
16	wPowerLow[39]	NA	1Byte
	wPowerUp[40]	NA	1Byte
17	Qpower_set[41.42]	NA	2Bytes
18	WFreqSetPoint[43.44]	0.01Hz	2Bytes
19	WFreqDroopRate[45.46]	NA	2Bytes
20	QuVupRate[47.48]	NA	2Bytes
21	QuVlowRate[49.50]	NA	2Bytes

22	WPowerLimitsPercent[51.52]	NA	2Bytes
23	WWgra[53.54]	0.01%	2Bytes
24	wWv2[55.56]	0.1V	2Bytes
25	wWv3[57.58]	0.1v	2Bytes
26	wWv4[59.60]	0.1v	2Bytes
27	wQuranceV1[61.62]	1%	2Bytes
28	wQuranceV4[63.64]	1%	2Bytes
29	BVoltPowerLimtit[65.66]	NA	2Bytes
30	WPowerManagerEnable[67.68]	NA	2Bytes
31	WGlobalSeachMPPTStrartFlg[69.70]	NA	2Bytes
32	WFrqProtectRestrictive[71.72]	NA	2Bytes
33	WQuDelayTimer[73.74]	s	2Bytes
34	WFreqActivePowerDelayTimer[75.76]	ms	2Bytes
35	wCheckingTime[77.78]	s	2Bytes

7. Control Code :0x12 'Write

Control code	Function code	Vector	Description
0x12	0x0x	AP → Inverter	Write
0x12	0x8x	Inverter → AP	Return ACK

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data MSB	Data LSB	Checksum
2 Bytes (0xAA 0x55)	2 Bytes (0xXX 0x00)	2 Bytes (0x00 0xXX)	1 Byte (0x12)	1 Byte (0x0x)	1 Byte (0x02)	1Byte	1Byte	2 Byte

The following is the data part of the response package.

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes (0x AA 55)	2 Bytes (0xXX 00)	2 Bytes (0x00 XX)	1 Byte (0x12)	1 Byte (0x8x)	1 Byte

Data	Checksum
ACK(0x06)	2 Bytes
NACK(0x15)	

Function Code	-	-	-
0x00	0.1v	PV start volt	2Bytes
0x01	1s	Reconnect time	2Bytes
0x04	0.1v	GridVoltLow	2Bytes
0x05	0.1v	GridVoltHigh	2Bytes
0x06	0.01Hz	GridFreqLow	2Bytes
0x07	0.01Hz	GridFreqHigh	2Bytes
0x08	0.1v	10min avg volt high	2Bytes
0x09	1mA	DCI limits	2Bytes
0x0A	0.1v	GridVoltLowSlow	2Bytes
0x0B	0.1v	GridVoltHighSlow	2Bytes
0x0C	0.01Hz	GridFreqLowSlow	4Bytes
0x0D	0.01Hz	GridFreqHighSlow	4Bytes
0x0E	NA	wPvStringCommType	2Bytes
0x0F	NA	MSB:wPfSettingPoint1_Mode LSB:wPfSettingPoint2_PF	2Bytes
0x10	NA	MSB:wPfSettingPoint3_PFULP LSB:wPfSettingPoint4_PFLOW	2Bytes
0x11	NA	MSB:wPfSettingPoint5_PLOW LSB:wPfSettingPoint6_PUP	2Bytes
0x12	1%	wAcPowerLimit	2Bytes
0x13	0.01Hz	fFreqPoint	2Bytes

0x14	2~12	fFreqDroop	2Bytes
0x15	1%	wQuVrateUp	2Bytes
0x16	1%	wQuVrateLow	2Bytes
0x17	1Var	wQsetTemp	2Bytes
0x18	0.01%	Wgra	2Bytes
0x19	0.1v	Wv2	2Bytes
0x1a	0.1v	Wv3	2Bytes
0x1b	0.1v	Wv4	2Bytes
0x1c	NA	wSetQurangeV1	2Bytes
0x1d	NA	wSetQurangeV4	2Bytes
0x1e	0.1v	wSetVoltPowerLimtit	2Bytes
0x1f	0.1v	wPowerManagerEnable	2Bytes
0x20	NA	wGlobalSeachMPPTStartFlg	2Bytes
0x21	NA	wFrqProtectRestrictive	2Bytes
0x22	1s	wQuDelayTimer	2Bytes
0x23	1ms	wFreqActivePowerDelayTimer	2Bytes
0x24	NA	wEarthDetect	2Bytes
0x25	NA	Saftymode	2Bytes
0x26	NA	Meter/CT Enable 0:disable 1:Meter Enable 2:CT Enable	2Bytes
0x27	NA	Machine Version	2Bytes
0x28	NA	CT Calibration	2Bytes
0x29	0~1	ExternalCommand	2Bytes
0x30	0~1	LeaseMode	2Bytes
0x31	1s	CheckingTime	2Bytes

8. Control Code :0x13 'Execute

Control code	Function code	Vector	Description
0x13	0x0x	AP → Inverter	Execute
0x13	0x8x	Inverter → AP	Return ACK

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data MSB	Data LSB	Checksum
2 Bytes (0xAA 0x55)	2 Bytes (0xFF 0x00)	2 Bytes (0x00 0xFF)	1 Byte (0x13)	1 Byte (0x0x)	1 Byte (0x02)	1Byte	1Byte	2 Byte

The following is the data part of the response package.

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes (0x AA 55)	2 Bytes (0xFF 00)	2 Bytes (0x00 XX)	1 Byte (0x13)	1 Byte (0x8x)	1 Byte

Data	Checksum
ACK(0x06)	2 Bytes
NACK(0x15)	

Function Code	-	-	Length
0x00		Clean history	0
0x01	0.1A	PV current calibration	4bytes
0x02	0.1v	Grid Volt calibration	2bytes
0x03	0.1A	Grid current calibration	2bytes
0x07		safty	2bytes
0x0C	0.1V	PV volt calibration	2Bytes
0x0D	0.1w	Power calibration	2bytes
0x0F		SN	14bytes
0x10		Module name	14bytes
0x11		Factory name	14bytes
0x14		reserved	6bytes
0x15		Default EEPROM	2bytes

0x16	Set Language 0:English 1: German 2: Polish 3: French 4: Portuguese 5: Spanish 6:中文 7: 意大利语 Default:English	2bytes
0x17	Ageing Enable 1:使能老化模式 0:不使能老化模式	2Bytes

Safty:

VDE0126	0
VDE4105	1
AS4777_A	2
G98	3
C10_11	4
TOR	5
EN50438_NL	6
Denmark2019_W	7
CEB	8
Cyprus2019	9
cNRS097_2_1	10
VDE0126_Greece	11
UTE_C15_712_Fr	12
IEC61727	13
G99	14
CQC	15
VDE0126_Greece_is	16
C15_712_Fr_island_50	17
C15_712_Fr_island_60	18
Guyana	19
MEA_Thailand	20
PEA_Thailand	21
cNewZealand	22
cIreland	23
cCE10_21	24
cRD1699	25
EN50438_Sweden	26
EN50549_PL	27

Czech PPDS	28
EN50438_Norway	29
EN50438_Portug	30
cCQC_WideRange	31
BRAZIL	32
EN50438_CEZ	33
IEC_Chile	34
Sri_Lanka	35
BRAZIL_240	36
EN50549-SK	37
EN50549_EU	38
G98/NI	39
Denmark2019_E	40
RD1699_island	41
EN50549_Romania	42
Philippines60Hz	43
Mexico	44
AS4777_B	45
AS4777_C	46
Chile_MTU	47
Chile_MTR	48
ACEA	49
Czech_2021_2	50

校验和计算:

Checksum:

```
void sFillChecksum(UInt8 bLen)
{
    UInt8 i;
    UInt16 wChkSum;

    wChkSum = 0;
    for(i = 0; i <= (bLen + 8); i++)
    {
        wChkSum = wChkSum + bExternTxPackage[i];
    }
    bExternTxPackage[(bLen + 9)] = (UInt8)(wChkSum / 256);
    bExternTxPackage[(bLen + 10)] = (UInt8)(wChkSum % 256);
}
```