FOXESS Modbus Communication Protocol

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Content

1. Protocol Description

This protocol is to solve the data communication between PCS and cloud monitoring platform, complete data transmission and data decoding, and realize the two-way communication function.

2. Communication Protocol

2.1. Protocol Format

This section describes the format of data transfer between PCS and cloud server platform:

1) Upload data format: PCS sends data and cloud server receives data.
2) Data format of down transmission, that is, cloud server sends data and PCS receives data.

2.1.1. Uplink Data Format（PCS → Cloud Server）

This data format is mainly used for the inverter to upload data to the cloud server platform. The cloud server platform responds to the inverter after receiving the data from the inverter.

PCS Format for uploading data packets

Frame Header	Function Code	Time Stamp	Data Length	User Data	Check Code	Frame End
2 Bytes	1 Byte	4 Bytes	2 Bytes	N Bytes	2 Byte	2 Bytes

Data format explanation：

a) Frame Header：indicate the start byte, fixed data:7E7E.
b) Data Length：indicate the data pack length, include user data, data type is Uint16.
c) Function Code：indicate all function requirements and responses, please see below table in detail.
d) Timestamp: indicates the current time, in seconds.
e) User data: represents the monitoring data of the inverter.
f) Check Code：MODBUS CRC16 check, LSB first, don't contain frame header.
g) Frame End：indicate the end byte for data pack, fixed bytes: E7E7.

Details of PCS uploaded data

1) Device Attribute Information

NO.	Read The Item	Data Length	Data Type	Precision	Note
1	MasterVersion	3*2 Bytes	ASCII	-	
2	SlaveVersion	3*2 Bytes	ASCII	-	
3	ManagerVersion	3*2 Bytes	ASCII	-	

4	DevieFactory	2 Bytes	UINT16	-	Sheet1-1
5	DeviceType	2 Bytes	ASCII		Sheet1-2
6	DeviceModel	8*2 Bytes	ASCII	-	
7	DeviceCapacity	2 Bytes	UINT16	W	
8	AFCIVersion	3*2 Bytes	ASCII	-	
Note	Device type: ASCII left aligned, extra 0x00 Device model: ASCII left aligned, extra 0x00 Equipment capacity: the rated capacity of each model				

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NO.	Value	Description	Note
1	0	Fox Wenzhou Factory	-
2	1	Fox Wuxi Factory	-
3	16	Fox Wuxi Factory2	

Sheet1-2

NO.	Value	Description	Note
1	T	T series	
2	T2	T2 series	
3	T3	T3 series	

The inverter pushes device information data to the cloud server

Frame Header	Function Code	Time Stamp	Data Length	User Data	Check Code	Frame End
2 Bytes	01	4 Bytes	2 Bytes	46 Bytes	2 Byte	2 Bytes

2) Real-time information

NO.	Data Item	Data Export Description	Data Length	Data Type	Precision
1	GridPower	Feed in Power	2 Bytes	INT16	1W
2	GenerationPower	Output Power	2 Bytes	INT16	1W
3	LoadsPower	Load Power	2 Bytes	INT16	1W
4	GridVoltage_R		2 Bytes	UINT16	0.1V
5	GridCurrent_R		2 Bytes	INT16	0.1A
6	GridFrequency_R		2 Bytes	UINT16	0.01Hz
7	GridPower_R		2 Bytes	INT16	1W
8	GridVoltage_S		2 Bytes	UINT16	0.1V
9	GridCurrent_S		2 Bytes	INT16	0.1A
10	GridFrequency_S		2 Bytes	UINT16	0.01Hz
11	GridPower_S		2 Bytes	INT16	1W
12	GridVoltage_T		2 Bytes	UINT16	0.1V

13	GridCurrent_T		2 Bytes	INT16	0.1A
14	GridFrequency_T		2 Bytes	UINT16	0.01Hz
15	GridPower_T		2 Bytes	INT16	1W
16	PV1Voltage		2 Bytes	UINT16	0.1V
17	PV1Current		2 Bytes	UINT16	0.1A
18	PV1Power		2 Bytes	UINT16	1W
19	PV2Voltage		2 Bytes	UINT16	0.1V
20	PV2Current		2 Bytes	UINT16	0.1A
21	PV2Power		2 Bytes	UINT16	1W
22	PV3Voltage		2 Bytes	UINT16	0.1V
23	PV3Current		2 Bytes	UINT16	0.1A
24	PV3Power		2 Bytes	UINT16	1W
25	PV4Voltage		2 Bytes	UINT16	0.1V
26	PV4Current		2 Bytes	UINT16	0.1A
27	PV4Power		2 Bytes	UINT16	1W
28	BoostTemperature		2 Bytes	INT16	1℃
29	InvTemperature		2 Bytes	INT16	1℃
30	AmbientTemperature		2 Bytes	INT16	1℃
31	TodayYield	EToday	2 Bytes	UINT16	0.1kWh
32	GenerationTotal	ETotal	4 Bytes	UINT32	0.1kWh
33	FromGridYieldGeneration		4 Bytes	UINT32	0.1kWh
34	FeedinGeneration1		4 Bytes	UINT32	0.1kWh
35	FeedinGeneration2		4 Bytes	UINT32	0.1kWh
36	ConsumptionGeneration1		4 Bytes	UINT32	0.1kWh
37	ConsumptionGeneration2		4 Bytes	UINT32	0.1kWh
38	LoadsGeneration		4 Bytes	UINT32	0.1kWh
39	EpsVoltageR		2 Bytes	Int16	0.1V
40	EpsCurrentR		2 Bytes	Int16	0.1A
41	EpsPowerR		2 Bytes	Int16	1W
42	Rev.1		2 Bytes	Int16	
43	Rev.2		2 Bytes	Int16	
44	Rev.3		2 Bytes	Int16	
45	Rev.4		2 Bytes	Int16	
46	Rev.5		2 Bytes	Uint16	
47	Rev.6		2 Bytes	Uint16	
48	Rev.7		2 Bytes	Uint16	
49	Rev.8		2 Bytes	Uint16	
50	Rev.9		2 Bytes	Uint16	
51	Rev.10		2 Bytes	Uint16	
52	FaultMessage.DWORD1		4 Bytes	UINT32	NULL
53	FaultMessage.DWORD2		4 Bytes	UINT32	NULL
54	FaultMessage.DWORD3		4 Bytes	UINT32	NULL
55	FaultMessage.DWORD4		4 Bytes	UINT32	NULL

56	FaultMessage.DWORD5		4 Bytes	UINT32	NULL
57	FaultMessage.DWORD6		4 Bytes	UINT32	NULL
58	FaultMessage.DWORD7		4 Bytes	UINT32	NULL
59	FaultMessage.DWORD8		4 Bytes	UINT32	NULL
60	Master State		2 Bytes	UINT16	NULL
61	PV Input Number		2 Bytes	UINT16	NULL

PCS pushes PCS data to the cloud server

Frame Header	Function Code	Time Stamp	Data Length	User Data	Check Code	Frame End
2 Bytes	0x02	4 Bytes	2 Bytes	152 Bytes	2 Byte	2 Bytes

3) The Heartbeat Packets

NO.	Read The Item	Data Length	Data Type	Precision	Note
1	ProtocolVersion	3*2 Bytes	ASCII	NULL	
2	SerialNumber	15Bytes	ASCII	NULL	

PCS pushes periodic heartbeat data to the cloud server

Frame Header	Function Code	Time Stamp	Data Length	User Data	Check Code	Frame End
2 Bytes	0x06	4 Bytes	2 Bytes	21 Bytes	2 Byte	2 Bytes

2.1.2. Downlink Data Format（Cloud Server → PCS）

This data format is mainly used for cloud servers to proactively request PCS data, including data query, parameter configuration, online upgrade, etc. When PCS receives the request from the server, it will reply accordingly.

Format of data packets to be transferred from the cloud server

Frame Header	Function Code	Require Sequence	Data Length	Instructions Data	Check Code	Frame End
2 Bytes	1 Byte	4 Bytes	2 Bytes	N Bytes	2 Byte	2 Bytes

PCS response command data format

Frame Header	Function Code	Respond sequence	Data Length	Respond data	Check Code	Frame End
2 Bytes	1 Byte	4 Bytes	2 Bytes	M Bytes	2 Byte	2 Bytes

Data format explanation：

a) Frame Header：indicate the start byte, fixed data:7F7F.

b) Data Length：indicate the data pack length, include user data, data type is Uint16.

c) Function Code：indicate all function requirements and responses.

d) Require Sequence：Server send specific data.

e) Instructions Data：Indicates the requested data instruction.

f) Respond Data：Indicates that PCS responds to Require.

g) Respond Sequence：PCS reply service same data as Require Sequence.

h) Check Code：MODBUS CRC16 check, LSB first, don't contain frame header.

i) Frame End：indicate the end byte for data pack, fixed bytes: F7F7.

Note: The format of instructions data and Respond data is as follows.

- **Instructions Data and Respond Data：** Require Read registers data and respond Instruction

Require Read Registers

Slave Address	1byte	0x01
Function Code	1byte	0x04：Read Holding Register 0x03：Read Input Register
Starting Register Address	1byte	High
	1byte	Low
Register Quantity	1byte	High（Max 125）
	1byte	Low（Max 125）

Respond Read Instruction

Slave Address	1byte	0x01
Function Code	1byte	0x04：Read Holding Register 0x03：Read Input Register
Bytes Quantity	1byte	Register Quantity* 2
Value	1byte	High
	1byte	Low
	…	…
	…	…

- **Instructions Data and Respond Data：** Require write Single register data and respond data

Require Write Single Register

Slave Address	1byte	0x01
Function Code	1byte	0x06
Register Address	1byte	High
	1byte	Low
Value	1byte	High
	1byte	Low

Respond Write Instruction

Slave Address	1byte	0x01
Function Code	1byte	0x06
Register Address	1byte	High
	1byte	Low
Value	1byte	High
	1byte	Low

- **Instructions Data and Respond Data：** Require write multiple register data and respond data

Require Write Multiple Register

Slave Address	1byte	0x01
Function Code	1byte	0x10
Register Address	1byte	High
	1byte	Low
Register Quantity	1byte	High
	1byte	Low
Data Length	1byte	Data Length
Data Value	1byte	High
	1byte	Low
	…	….

Respond Require

Slave Address	1byte	0x01
Function Code	1byte	0x10
Register Address	1byte	High
	1byte	Low
Register Quantity	1byte	High
	1byte	Low

Cloud server down transmission instruction data details

1) Read/Write Device Parameters

Server Read Device Parameters

Frame Header	Function Code	Require Sequence	Data Length	Instructions Data	Check Code	Frame End
2 Bytes	11	4 Bytes	2 Bytes	N Bytes	2 Byte	2 Bytes

PCS Respond Server Read

Frame Header	Function Code	Respond sequence	Data Length	Respond data	Check Code	Frame End
2 Bytes	91	4 Bytes	2 Bytes	M Bytes	2 Byte	2 Bytes

Server Write Device Parameters

Frame Header	Function Code	Require Sequence	Data Length	Instructions Data	Check Code	Frame End
2 Bytes	12	4 Bytes	2 Bytes	N Bytes	2 Byte	2 Bytes

PCS Respond Server Write

Frame Header	Function Code	Respond sequence	Data Length	Respond data	Check Code	Frame End
2 Bytes	92	4 Bytes	2 Bytes	M Bytes	2 Byte	2 Bytes

Device Configuration Information

Starting Register Address=50200,Register Quantity=20,Data length=40.

Address	Register	RW	Description	English display	Range	Unit	Data type
50200	Language	RW	Language	Language	Sheet 1	NA	Uint16
50201	Safetytype	RW	Safety Country	Safetycountry	Sheet 2	NA	Uint16
50202	Modbus addr	RW	Modbus Address	Modbusaddr	0-20	NA	Uint16
50203	Factory mode	RW	Factory Pattern	0 :Disable 1 :UserPattern 2 :FactoryPattern	0-2	NA	Uint16
50204	PV Connfig	RW	PV Input Mode Configuration	0 :Disable 1 :Independence 2 :grid-connect	0-2	NA	Uint16
50205	DRM Enable	RW	DRM Enable Setting	DRMEnble	0=disable 1=enable	NA	Uint16
50206	Mute Enable	RW	Mute Enable Setting	MuteEnable	0=disable 1=enable	NA	Uint16
50207	startSelftest	RW	Start Self test	Start Selftest	1	NA	Uint16
50208	SaftyModeLock	RW	Safety Mode Lock	SaftyModeLock	0=disable 1=enable	NA	Uint16
50209	DI ONOFF	RW	External Switch Signal Enabled	DI ONOFF	0=disable 1=enable	NA	Uint16
	TBD						

Sheet1：Display Language List

NO.	Language	Value	Note
1	English	0	
2	Deutsch	1	
3	Polski	2	
4	French	3	
5	Portugal	4	

Sheet2：Enforced Regulations List

NO.	Country	Display	Note
0	Australia	AS4777_AU	
1	New Zealand	AS4777_NZ	
2	England	G98_UK	
3	England	G99_UK	
4	Netherlands	EN50549_NL	
6	Germany	VDE0126	
7	Germany	ARN4105_DE	
8	Brazil	NBR-220_BR	
9	Brazil	NBR-240_BR	
10	India	IEC61727	
11	Philippines	Philippines	
12	South Africa	NRS_SA	
13	Vietnam	Vietnam	
14	Poland	EN50549_PL	
15	Portugal	EN50549_PT	
16	Czech	PPDS_CR	
17	Spanish	UNE-206_SP	
18	Spanish	RD1699_SP	
19	Belgium	Belgium	
20	French	VFR2019_FR	
21	French	UTE_FR	
22	Singapore	Singapore	
23	Indonesia	Indonesia	
24	Malaysia	Malaysia	
25	Cambodia	Cambodia	
26	Thailand	PEA_TH	
27	Thailand	MEA_TH	
28	Sri Lanka	Sri Lanka	
29	Pakistan	Pakistan	
30	Ireland	Ireland	
31	Denmark	Denmark	
32	Slovakia	Slovakia	
33	Austria	Austria	

34	Switzerland	Switzerland	
35	Slovenia	Slovenia	
36	Hungary	Hungary	
37	Serbia	Serbia	
38	Croatia	Croatia	
39	Turkey	Turkey	
40	Cyprus	Cyprus	
41	Bulgaria	Bulgaria	
42	Romania	Romania	
43	Greece	Greece	
44	Latvia	Latvia	
45	Lithuania	Lithuania	
46	Estonia	Estonia	
47	Sweden	Sweden	
48	Norway	Norway	
49	Finland	Finland	
50	Argentina	Argentina	
51	Chile	Chile	
52	Mexico	Mexico	
53	USA	USA	
54	Canada	Canada	
55	China	CQC_CN	
56	Japan	Japan	
57	China（wide rang1）	CQC_CN-1	
58	India（wide rang）	Local	
59	Saudi Arabia	Saudi Arabia	
60	Australia A district	AS4777_AU-2020A	
61	Australia B district	AS4777_AU-2020B	
62	Australia C district	AS4777_AU-2020C	
63	New Zealand	AS4777_NZ-2020	
64	China（wide rang2）	CQC_CN-2	

Safety Parameter Setting Block

◆ Starting Parameter:Starting Register Address=50800,Register Quantity=12,Data length=24.

Address	Register	RW	Description	Range	Unit	Data type
50800	ConnectTime	RW	Start connect time	0-65535	1 sec	Uint16
50801	LoadSpeed	RW	Start load speed,100 no limit	0-1000	0,1%/min	int16
50802	ReconnectTime	RW	Reconnect time	0-65535	1 sec	Uint16
50803	ReloadSpeed	RW	Reconnect connect load speed,100 no	0-1000	0,1%/min	int16

			limit			
50804	VgridBackHigh	RW	Grid voltage high limit value before grid-connect	2000-3500	0,1 V	int16
50805	VgridBackLow	RW	Grid voltage low limit value before grid-connect	100-2500	0,1 V	int16
50806	FgridBackHigh	RW	Grid frequency high limit value before grid-connect	4500-6500	0,01 Hz	int16
50807	FgridBackLow	RW	Grid frequency low limit value before grid-connect	4500-6500	0,01 Hz	int16
50808	Grid voltage reconnect high threshold	RW	Grid voltage high limit value before grid-reconnect	2000-3500	0,1 V	int16
50809	Gird voltage reconnect low threshold	RW	Grid voltage low limit value before	100-2500	0,1 V	int16
50810	Grid frequency reconnect high threshold	RW	Grid frequency high limit value before grid-reconnect	4500-6500	0,01 Hz	int16
50811	Grid frequency reconnect low threshold	RW	Grid frequency low limit value before grid-reconnect	4500-6500	0,01 Hz	int16

◆ Active Power Configuration：

Starting Register Address=51800,Register Quantity=5,Data length=10.

Address	Register	RW	Description	Range	Unit	Data type
51800	PowerRemoteCon	RW	Power remote control module setting	Meter	NA	Uint16
51801	ActivePowerLimit	RW	Remote power limit value	0-100	1%	int16
51802	RemoteONorOFF	RW	Remote power on or off	0-1	NA	Uint16
51803	ExportPower	RW	Allowable export power to grid	0-32767	1 W	int16
51804	Power decrease rate	RW		0-100	0.01%/sec	int16

BIT	Options	Note
Bit0	RemoteDeratingEnable	0=disabled, 1=enabled
Bit1	RemoteONOFFEnable	0=disabled, 1=enabled
Bit2	Export limit enable	0=disabled, 1=enabled
Bit3	Power decrease rate enable	0=disabled, 1=enabled
Bit4 ~ Bit15	reserved	

◆ System Time Setting：

Starting Register Address=52100,Register Quantity=0x04,Data length=0x08.

Address	Register	RW	Description	Range	Unit	Data Type
52100	SYSTimer.u16_Year	R/W	System time.	2000~2100	NA	Uint16

			Year			
52101	SYSTimer.u16_Month	R/W	System time. Month	1~12	NA	Uint8
	SYSTimer.u16_Day	R/W	System time. Day	1~31	NA	Uint8
52102	SYSTimer.u16_Hour	R/W	System time. Hour	0~23	NA	Uint8
	SYSTimer.u16_Minute	R/W	System time. Minute	0~59	NA	Uint8
52103	SYSTimer.u16_Second	R/W	System time. Secon	0~59	NA	Uint8
	TBD					

◆ Meter/CT Parameter：

Starting Register Address=52200,Register Quantity=0x03,Data length=0x06.

Address	Register	RW	Description	Range	Unit	Data Type	Remark
52200	Function	R/W	Meter/CT Enable switch	**Meter1**	NA	Uint16	
52201	Meter1 Address	R/W	Meter 1 Address	**0-255**	NA	Uint16	Reserved
52202	Meter2 Address	R/W	Meter 2 Address	**0-255**	NA	Uint16	Reserved

Sheet1

Model	Description	Value
Disable	Disable	0
Meter	Meter	1