FOXESS Modbus Communication Protocol

Content

1. Down transmission format (cloud server à PCS)

This data format is mainly used for that could server query the data of PCS, include: data querying, parameters setting, upgrading online, and so on. After PCS receive the querying command, response it immediately.

Server Require Device Parameters

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

PCS Responds Server Require

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

1.1 Data format explaination

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, please see below table in detail.
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。

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

Require Read Registers

Slave Address	1byte	0x01
Function Code	1byte	0x04(Read Input Register), 0x03(Read Holding Register)
Starting Register Adrress	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 Input Register), 0x03(Read Holding 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 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

1.2 Server require data in detail

1) Write/Read Device Parameters

Server Write Device Parameters

Frame Header	Function Code	Time Stamp	Data Length	User 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	Time Stamp	Data Length	User 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	Time Stamp	Data Length	User 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	Time Stamp	Data Length	User Data	Check Code	Frame End
2 Bytes	92	4 Bytes	2 Bytes	M Bytes	2 Byte	2 Bytes

No.	English Description	**Description**	**Remark**
1	StartParameters	Starting Parameter Setting Block	
2	GridVoltageParameters	Safty Parameter Setting Block	
3	GridFreqParameters		
4	PowerFreqParameters		
5	ReactiveConfig		
6	Fault ride-through		
7	DCI Config		
8	ActivePowerConfig		

1.3 Safty Parameter Setting Block

1.3.1 Starting Parameters

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 limit	0-1000	0,1%/min	int16
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

			grid-reconnect			
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

1.3.2 Grid Voltage Parameters

Starting Register Address=50900，Register Quantity=14，Data length=28

Address	Register	RW	Description	Range	Unit	Data type
50900	VoltProCon	RW	Voltage Protect Config	**Table 1**	NA	Uint16
50901	Vmax1Limit	RW	Grid Voltage protect level 1 high threshold	2000-3500	0,1 V	int16
50902	Vmax1ProtectTime	RW	Grid Voltage protect level 1 high trip time	0-65535	0,01 sec	Uint16
50903	Vmax2Limit	RW	Grid Voltage protect level 2 high threshold	2000-3500	0,1V	int16
50904	Vmax2ProtectTime	RW	Grid Voltage protect level 2 high trip time	0-65535	0,01 sec	Uint16
50905	Vmax3Limit	RW	Grid Voltage protect level 3 high threshold	2000-3500	0,1V	int16
50906	Vmax3ProtectTime	RW	Grid Voltage protect level 3 high trip time	0-65535	0,01 sec	Uint16
50907	Vmin1Limit	RW	Grid voltage protect level 1 low threshold	100-2500	0,1 V	int16
50908	Vmin1ProtectTime	RW	Grid voltage protect level 1 low trip time	0-65535	0,01 sec	Uint16
50909	Vmin2Limit	RW	Grid voltage protect level 2 low threshold	100-2500	0,1 V	int16
50910	Vmin2ProtectTime	RW	Grid voltage protect level 2 low trip time	0-65535	0,01 sec	Uint16
50911	Vmin3Limit	RW	Grid voltage protect level 3 low threshold	100-2500	0,1 V	int16
50912	Vmin3ProtectTime	RW	Grid voltage protect level 3 low trip time	0-65535	0,01 sec	Uint16
50913	Vgrid10minPro	RW	Grid voltage over 10 min protection	2000-3500	0,1 V	int16

NOTE: Vmin3Limit <= Vmin2Limit <= Vmin1Limit < Vmax1Limit <= Vmax2Limit <= Vmax3Limit

Table 1

BIT	Option	Remark
Bit0	OVP1Enable Vmax1Limit	0=disabled, 1=enabled
Bit1	OVP2Enable Vmax2Limit	0=disabled, 1=enabled
Bit2	OVP3Enable Vmax3Limit	0=disabled, 1=enabled
Bit3	UVP1Enable Vmin1Limit	0=disabled, 1=enabled
Bit4	UVP2Enable Vmin2Limit	0=disabled, 1=enabled
Bit5	UVP3Enable Vmin3Limit	0=disabled, 1=enabled
Bit6	OVPMovEnable Vgrid10minPro	0=disabled, 1=enabled
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit15-14	Trip time multiple selection	Occupied, should be zero

1.3.3 Grid Frequency Parameters

Starting Register Address=51100，Register Quantity=14，Data length=28。

Address	Register	RW	Description	Range	Unit	Data type
51100	FreProCon	RW	Frequency Protect Config	Table 2	NA	Uint16
51101	Fmax1Limit	RW	Grid frequency protect level 1 high threshold	4500-6500	0,01 Hz	int16
51102	Fmax1ProtectTime	RW	Grid frequency protect level 1 high trip time	0-65535	0,01 sec	Uint16
51103	Fmax2Limit	RW	Grid frequency protect level 2 high threshold	4500-6500	0,01 Hz	int16
51104	Fmax2ProtectTime	RW	Grid frequency protect level 2 high trip time	0-65535	0,01 sec	Uint16
51105	Fmin1Limit	RW	Grid frequency level 1 low threshold	4500-6500	0,01 Hz	int16
51106	Fmin1ProtectTime	RW	Grid frequency level 1 low trip time	0-65535	0,01 sec	Uint16
51107	Fmin2Limit	RW	Grid frequency level 2 low threshold	4500-6500	0,01 Hz	int16
51108	Fmin2ProtectTime	RW	Grid frequency level 2 low trip time	0-65535	0,01 sec	Uint16
51109	ROCOF	RW	Frequency jump too fast protection	0-50	0,1 Hz/sec	int16
51110	Grid frequency protect level 3 high threshold	RW	Grid frequency protect level 3 high threshold	4500-6500	0,01 Hz	int16
51111	Grid frequency protect level 3 high trip time	RW	Grid frequency protect level 3 high trip time	0-65535	0,01 sec	Uint16

51112	Grid frequency level 3 low threshold	RW	Grid frequency level 3 low threshold	4500-6500	0,01 Hz	int16
51113	Grid frequency level 3 low trip time	RW	Grid frequency level 3 low trip time	0-65535	0,01 s	Uint16

NOTE : Fmin3Limit <= Fmin2Limit <= Fmin1Limit < Fmax1Limit <= Fmax2Limit <= Fmax3Limit

Table 2

BIT	Option	Remark
Bit0	OFP1Enable Fmax1Limit	0=disabled, 1=enabled
Bit1	OFP2Enable Fmax2Limit	0=disabled, 1=enabled
Bit2	UFP1Enable Fmin1Limit	0=disabled, 1=enabled
Bit3	UFP2Enable Fmin2Limit	0=disabled, 1=enabled
Bit4	ROCOF	0=disabled, 1=enabled
Bit5	Italy 宽窄频	0=disabled, 1=enabled
Bit6	reserved	
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit15-14	Trip time multipler selection	Occupied, should be zero

1.3.4 Over Frequency Reduce Power Parameters

Starting Register Address=51300，Register Quantity=8，Data length=16。

Address	Register	RW	Description	Range	Unit	Data type
51300	PowerFreCon	RW	PowerFre Config	Table 3	NA	Uint16
51301	FreqPoint	RW	Start point of over frequency	4500-6500	0,01 Hz	int16
51302	FreqSpeed	RW	Reduce Frequrency speed	0-1000	0,1%/Hz	int16
51303	FbackUp	RW	Reload frequency point	4500-6500	0,01 Hz	int16
51304	FbackDown	RW	Lower limit of reload frequency	4500-6500	0,01 Hz	int16
51305	WaitTimeBack	RW	Reload waiting time	0-65535	1 sec	Uint16
51306	FreqbackSpeed	RW	Reload rate	0-1000	0.1%/min	int16
51307	WaittimeOverFreq	RW	Over-frequency and load-down waiting time	0-65535	0,01 sec	Uint16

NOTE : FbackDown <= FbackUp < FreqPoint

Table 3

BIT	Optin	Remark
Bit0	FreDeratingEnableOverFreqDownPower	0=disabled, 1=enabled
Bit1	PowerFollowFreq	0=disabled, 1=enabled
Bit2	reserved	

Bit3	reserved	
Bit4	reserved	
Bit5	reserved	
Bit6	reserved	
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit14	reserved	
Bit15	reserved	

1.3.5 Reactive Power Config

Starting Register Address 51500，Register Quantity=27，Data length=54。

Address	Register	RW	Description	Range	Unit	Data type
51500	ReactiveCon	RW	Reactive Mode Config	Table 4	NA	Uint16
51501	PF_mode	RW	Pf Mode	0-5	Table 5	Uint16
51502	Pfcosphi	RW	Pf Stable cosphi Value	80-100	0,01	int16
51503	PFQvar	RW	PF Stable Qvar Value	-1000-1000	0,1%	int16
51504	Pfcosphi1	RW	PF Curve Point 1 cosphi	80-100	0,01	int16
51505	Pfpowerpoint1	RW	PF Power Curve Point 1	0-100	1%	int16
51506	Pfcosphi2	RW	PF Curve Point 2 cosphi	80-100	0,01	int16
51507	Pfpowerpoint2	RW	PF Power Curve Point 2	0-100	1%	int16
51508	Pfcosphi3	RW	PF Curve Point 3 cosphi	80-100	0,01	int16
51509	Pfpowerpoint3	RW	PF Power Curve Point 3	0-100	1%	int16
51510	Pfcosphi4	RW	PF Curve Point 4 cosphi	80-100	0,01	int16
51511	Pfpowerpoint4	RW	PF Power Curve Point 4	0-100	1%	int16
51512	PflockinV	RW	PFP Trigger Voltage	0-3500	0,1 V	int16
51513	PflockoutV	RW	PFP Drop Out Voltage	0-3500	0,1 V	int16
51514	VU1	RW	Q(u) Voltage 1	0-3500	0,1 V	int16
51515	QU1	RW	Q(u)Reactive Power point 1	-1000-1000	0,1%	int16
51516	VU2	RW	Q(u) Voltage 2	0-3500	0,1 V	int16
51517	QU2	RW	Q(u)Reactive Power point 2	-1000-1000	0,1%	int16
51518	VU3	RW	Q(u) Voltage 3	0-3500	0,1 V	int16
51519	QU3	RW	Q(u)Reactive Power point 3	-1000-1000	0,1%	int16
51520	VU4	RW	Q(u) Voltage 4	0-3500	0,1 V	int16
51521	QU4	RW	Q(u)Reactive Power point 4	-1000-1000	0,1%	int16
51522	QulockinP	RW	Q(u) Trigger Power	0-100	1%	int16
51523	QulockoutP	RW	Q(u) Drop Out Power	0-100	1%	int16
51524	Qmax	RW	Q(u) Max Qvar	0-1000	0,1%	int16
51525	Waittime	RW	Qu mode entry delay	0-65535	0,01 sec	Uint16
51526	Fixed q time constant	RW	Stable q time constant	0-65535	0,01 sec	Uint16

NOTE:
Pfpowerpoint1 < Pfpowerpoint2 < Pfpowerpoint3 < Pfpowerpoint4
VU1 < VU2 < 230.0 V < VU3 < VU4
PflockoutV < PflockinV
QulockinP < QulockoutV

Table 4

BIT	Option	Remark
Bit0	reserved	0=disabled, 1=enabled
Bit1	Stable cosphiAhead	0=disabled, 1=enabled
Bit2	Stable cosphiHysteresis	0=disabled, 1=enabled
Bit3	PFLineMode	0=disabled, 1=enabled
Bit4	Stable Qvar	0=disabled, 1=enabled
Bit5	Q(u)mode	0=disabled, 1=enabled
Bit6	Voltage lock enable	0=disabled, 1=enabled
Bit7	Power lock enable	0=disabled, 1=enabled
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit14	reserved	
Bit15	reserved	

Table 5

Value	Mode
0	Invalid
1	Stable cosphi Ahead
2	Stable cosphi Hysteresis
3	PFLineMode
4	Stable Qvar
5	Q(u) mode

OverFreqPower data format like follow:

Read Register Command: 7f 7f 11 00 00 00 01 00 06 01 03 c9 2c 00 1b af e5 f7 f7

Respond Read Register: 7f 7f 91 00 00 00 01 00 39 01 03 36 00 ff 00 00 00 64 00 00 00 64 00 00 00 64 00 19 00 64 00 32 00 5a 00 64 08 fc 08 98 08 16 01 2c 08 98 00 00 09 c4 00 00 0a 5a 01 2c 00 14 00 05 03 e8 00 00 00 3c a6 fc f7 f7

Write Value to Registers: 7f 7f 12 00 00 00 01 00 3d 01 10 c9 2c 00 1b 36 00 ff 00 00 00 64 00 00 00 64 00 00 00 64 00 19 00 64 00 32 00 5a 00 64 08 fc 08 98 08 16 01 2c 08 98 00 00 09 c4 00 00 0a 5a 01 2c 00 14 00 05 03 e8 00 00 00 3c 16 fe f7 f7

Respond Write Register(success): 7f 7f 92 00 00 00 01 00 06 01 10 c9 2c 00 1b d0 24 f7 f7

1.3.6 DCI Config

Starting Register Address 51700，Register Quantity=6，Data length=12。

Address	Register	RW	Description	Range	Unit	Data type
51700	DCIProCon	RW	Dci protect Config	Table 6	NA	Uint16
51701	Dcilimit1	RW	Dci limit 1 trip value	0-1500	0,001 A	int16
51702	Dcilimit1time	RW	Dci limit 1 trip time	0-65535	0,01 sec	Uint16
51703	Dcilimit2	RW	Dci limit 2 trip value	0-1500	0,001 A	int16
51704	Dcilimit2time	RW	Dci limit 2 trip time	0-65535	0,01 sec	Uint16
51705	Dcitest	RW	Dci Testing	0-65535	NA	Uint16

NOTE: Dcilimit1 < Dcilimit2

Table 6

BIT	Option	Remark
Bit0	DCI1Enable Dcilimit1	0=disabled, 1=enabled
Bit1	DCI2Enable Dcilimit2	0=disabled, 1=enabled
Bit2	DCITestEnable Dcitest	0=disabled, 1=enabled
Bit3	reserved	
Bit4	reserved	
Bit5	reserved	
Bit6	reserved	
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit14	reserved	
Bit15	reserved	

1.3.7 Fault ride-through

Starting Register Address=51600，Register Quantity=21

Address	Register	RW	Description	Range	Unit	Data type
51600	Enable	RW	Enable	Table 7	NA	Uint16
51601	LT1	RW	LVRT curve, point 1, time (10 millisecond per count, the same below)	0-65535	0,01 sec	Uint16
51602	LV1	RW	LVRT curve, point 1, voltage ratio (per-mill of grid rated voltage, the same below)	0-2000	0,1%	int16
51603	LT2	RW	LVRT curve, point 2, time	0-65535	0,01 sec	Uint16
51604	LV2	RW	LVRT curve, point 2, voltage ratio	0-2000	0,1%	int16
51605	LT3	RW	LVRT curve, point 3, time	0-65535	0,01 sec	Uint16
51606	LV3	RW	LVRT curve, point 3, voltage ratio	0-2000	0,1%	int16
51607	LT4	RW	LVRT curve, point 4, time	0-65535	0,01 sec	Uint16
51608	LV4	RW	LVRT curve, point 4, voltage ratio	0-2000	0,1%	int16
51609	LT5 (reserved)	RW	LVRT curve, point 5, time	0-65535	NA	Uint16
51610	LV5 (reserved)	RW	LVRT curve, point 5, voltage ratio	0-65535	NA	Uint16
51611	HT1	RW	HVRT curve, point 1, time	0-65535	0,01 sec	Uint16
51612	HVT	RW	HVRT curve, point 1, voltage ratio	0-2000	0,1%	int16
51613	HT2	RW	HVRT curve, point 2, time	0-65535	0,01 sec	Uint16
51614	HV2	RW	HVRT curve, point 2, voltage ratio	0-2000	0,1%	int16
51615	HT3	RW	HVRT curve, point 3, time	0-65535	0,01 sec	Uint16
51616	HV3	RW	HVRT curve, point 3, voltage ratio	0-2000	0,1%	int16

51617	HT4	RW	HVRT curve, point 4, time	0-65535	0,01 sec	Uint16
51618	HV4	RW	HVRT curve, point 4, voltage ratio	0-2000	0,1%	int16
51619	HT5 (reserved)	RW	HVRT curve, point 5, time	0-65535	NA	Uint16
51620	HV5 (reserved)	RW	HVRT curve, point 5, voltage ratio	0-65535	NA	Uint16

NOTE: LV1 <= LV2 <= LV3 <= LV4 <= LV5 <= HV5 <= HV4 <= HV3 <= HV2 <= HV1

Table 7

BIT	Option	Remark
Bit0	Low/under voltage ride through	0=disabled, 1=enabled
Bit1	High/over voltage ride through	0=disabled, 1=enabled
Bit2	reserved	
Bit3	reserved	
Bit4	reserved	
Bit5	reserved	
Bit6	reserved	
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	
Bit14	reserved	
Bit15	reserved	

1.3.8 Active Power Config

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

Address	Register	RW	Description	Range	Unit	Data Type
51800	PowerRemoteCon	RW	Power Remote Config	Table 8	NA	Uint16
51801	ActivePowerLimit	RW	Active Power Limit	0-100	1%	int16
51802	RemoteONorOFF	RW	Remote NO/OFF	0-1	NA	Uint16
51803	ExportPower	RW	Export Power Value	0-32767	1 W	int16
51804	Power decrease rate	RW	Power decrease rate	0-100	0,01%/sec	int16

Table 8

BIT	Option	Remark
Bit0	RemoteDeratingEnableExportLimit	0=disabled, 1=enabled
Bit1	RemoteONOFFEnableRemoteONorOFF	0=disabled, 1=enabled
Bit2	Export limit enable	0=disabled, 1=enabled
Bit3	Power decrease rate enable	0=disabled, 1=enabled
Bit4	reserved	
Bit5	reserved	
Bit6	reserved	
Bit7	reserved	
Bit8	reserved	
Bit9	reserved	
Bit10	reserved	
Bit11	reserved	
Bit12	reserved	
Bit13	reserved	

Bit14	reserved	
Bit15	reserved	