

Fox Hybrid/AC Modbus Protocol

1. Data types

Name	Description
U16	Unsigned integer (16 bits)
U32	Unsigned integer (32 bits)
I16	Signed integer (16 bits)
I32	Signed integer (32 bits)
STR	Character string
Bitfield16	16-bit data expressed by bit
Bitfield32	32-bit data expressed by bit
RO	Data that is readable only
RW	Data that is readable and writable
WO	Data that is writable only

2. Function code

Function Code	Meaning	Remarks
0x04	Read registers.	Continuously reads a single register or multiple registers.
0x06	Write a single register.	Writes into a single register.
0x10	Write multiple registers.	Continuously writes into multiple registers.

3. The function code 0x04 read multiple registers

Request frame format

The machine address	1byte	0x01
The function code	1byte	0x04Read hold registers
Register start address	1byte	Higher byte
	1byte	Lower byte

The number of register	1byte	Higher byte
	1byte	Lower byte
CRC verify	1byte	Lower byte
	1byte	Higher byte

Answer frame format

The machine address	1byte	0x01
The function code	1byte	0x04Read hold registers
The number of bytes	1byte	Register data * 2
Register value	1byte	Higher byte
	1byte	Lower byte

CRC verify	1byte	Lower byte
	1byte	Higher byte

The function code 0x06 write a single register

Request frame format

The machine address	1byte	0x01
The function code	1byte	0x06
Register address	1byte	Higher byte
	1byte	Lower byte
Register value	1byte	Higher byte
	1byte	Lower byte
CRC verify	1byte	Lower byte
	1byte	Higher byte

Answer frame format

The machine address	1byte	0x01
The function code	1byte	0x06
Register address	1byte	Higher byte
	1byte	Lower byte
Register value	1byte	Higher byte
	1byte	Lower byte
CRC verify	1byte	Lower byte
	1byte	Higher byte

The function code 0x10 write multiple registers

Request frame format

The machine address	1byte	0x01
The function code	1byte	0x10
Register address	1byte	Higher byte
	1byte	Lower byte
The number of registers	1byte	Higher byte
	1byte	Lower byte
The length of the data	1byte	The length of the data
Data	1byte	Higher byte
	1byte	Lower byte

CRC verify	1byte	Lower byte
	1byte	Higher byte

Answer frame format

The machine address	1byte	0x01
The function code	1byte	0x10
Register address	1byte	Higher byte
	1byte	Lower byte
The number of registers	1byte	Higher byte
	1byte	Lower byte
CRC verify	1byte	Lower byte
	1byte	Higher byte

4. Register definition

It is recommended to read power-on only once.

Signal Name	Read/Write	Type	Unit	Address	Scope
Model	RO	STR	N/A	1000---- 10007	16Chars
SN	RO	STR	N/A	10008---- 10015	15Chars, MSB= SN[15]
Firmware Master	RO	U16	N/A	10016	100=V1.00
Firmware Slave	RO	U16	N/A	10017	110=V1.10
Firmware Manager	RO	U16	N/A	10018	110=V1.10
Firmware Battery Master	RO	U16	N/A	10019	0x108= V1.08
Firmware Battery Slave1	RO	U16	N/A	10020	ditto
Firmware Battery Slave2	RO	U16	N/A	10021	
Firmware Battery Slave3	RO	U16	N/A	10022	
Firmware Battery Slave4	RO	U16	N/A	10023	
Firmware Battery Slave5	RO	U16	N/A	10024	
Firmware Battery Slave6	RO	U16	N/A	10025	
Firmware Battery Slave7	RO	U16	N/A	10026	
Firmware Battery Slave8	RO	U16	N/A	10027	

Read in real time

Signal Name	Read/Write	Type	Unit	Address	Scope
PV1 voltage	RO	I16	0.1V	11000	
PV1 current	RO	I16	0.1A	11001	
PV1 power	RO	I16	1W	11002	
PV2 voltage	RO	I16	0.1V	11003	
PV2 current	RO	I16	0.1A	11004	
PV2 power	RO	I16	1W	11005	

Battery voltage	RO	I16	0.1V	11006	
Battery current	RO	I16	0.1A	11007	
Battery power	RO	I16	1W	11008	
Grid voltage	RO	U16	0.1V	11009	
Inv current	RO	I16	0.1A	11010	
Inv power_P	RO	I16	1W	11011	
Inv Power_Q	RO	I16	1Var	11012	
Inv Power_S	RO	I16	1VA	11013	
Grid Frequency	RO	U16	0.01Hz	11014	
Eps voltage	RO	U16	0.1V	11015	
Eps current	RO	I16	0.1A	11016	
Epspower_P	RO	I16	1W	11017	
Epspower_Q	RO	I16	1Var	11018	
Epspower_S	RO	I16	1VA	11019	
Eps Frequency	RO	U16	0.01Hz	11020	
Meter1 power	RO	I16	1W	11021	
Meter2 power	RO	I16	1W	11022	
Load power	RO	I16	1W	11023	
temperatureInv	RO	I16	0.1°C	11024	
temperatureEnv	RO	I16	0.1°C	11025	
ClusterCtrl.f32_PwrFeedback_P	RO	U16	1W	11026	
ClusterCtrl.f32_PwrFeedback_Q	RO	U16	1W	11027	
ClusterCtrl.f32_PwrSet_P_DnLimit	RO	U16	1W	11028	
ClusterCtrl.f32_PwrSet_P_UpLimit	RO	U16	1W	11029	
ClusterCtrl.f32_PwrSet_Q_DnLimit	RO	U16	1W	11030	
ClusterCtrl.f32_PwrSet_Q_UpLimit	RO	U16	1W	11031	
AcPowerLimit_Flag	RO	U16		11032	AC side power limit signal bit
BatPowerLimit_Flag	RO	U16		11033	Bat side power limit signal bit
BatVoltage	RO	I16	0.1V	11034	BMS
BatCurrent	RO	I16	0.1A	11035	BMS

SoC	RO	U16	1%	11036	BMS
ResidualEnergy	RO	U16	10Wh	11037	BMS The remaining battery power
BatTemperature	RO	I16	0.1°C	11038	BMS
ChargeCutVoltage	RO	U16	0.1V	11039	BMS
DischargeCutVoltage	RO	U16	0.1V	11040	BMS
MaxChargeCurrent	RO	U16	0.1A	11041	BMS
MaxDischargeCurrent	RO	U16	0.1A	11042	BMS
CellTemperatureHigh	RO	I16	0.1°C	11043	BMS
CellTemperatureLow	RO	I16	0.1°C	11044	BMS
CellVoltageHigh	RO	U16	0.1V	11045	BMS
CellVoltageLow	RO	U16	0.1V	11046	BMS
SubsystemNumber	RO	U16		11047	BMS
BatCycleCount	RO	U16		11048	BMS
EnergyThroughput	RO	U16		11049	BMS
BatMinSoc	RO	U16		11050	BMS
BatChargeRequest	RO	U16	0/1	11051	0: No 1: Yes BMS
BatChargeLimit	RO	U16	0/1	11052	BMS
BatDischargeLimit	RO	U16	0/1	11053	BMS
BatModuleType		U16		11054	BMS
ConnectTimeCnt	RO	U16	1S	11055	
Inverter state	RO	U16	N/A	11056	0: wait 1: check 2: on grid 3: off grid 4:recoverable fault 5:unrecoverable fault
BatStatus	RO	U16	DSP	11057	0: Idle

			judgment		1: Normal 2:offline
BMS connect state	RO	U16	N/A	11058	0: Initial state 1: OK 2: NG
Meter1 connect state	RO	U16	N/A	11059	0: NG 1: OK
Meter2 connect state	RO	U16	N/A	11060	0: NG 1: OK
Fault 1	RO	Bitfield16	N/A	11061	See Appendix 1
Fault 2	RO	Bitfield16	N/A	11062	
Fault 3	RO	Bitfield16	N/A	11063	
Fault 4	RO	Bitfield16	N/A	11064	
Fault 5	RO	Bitfield16	N/A	11065	
Fault 6	RO	Bitfield16	N/A	11066	
Fault 7	RO	Bitfield16	N/A	11067	
Fault 8	RO	Bitfield16	N/A	11068	
Total PV energy	RO	U32	0.1KWh	11069-- --11070	2
Today PV energy	RO	U16	0.1KWh	11071	1
Total charge energy	RO	U32	0.1KWh	11072-- --11073	2
Today charge energy	RO	U16	0.1KWh	11074	1
Total discharge energy	RO	U32	0.1KWh	11075-- --11076	2
Today discharge energy	RO	U16	0.1KWh	11077	1
Total feed-in energy	RO	U32	0.1KWh	11078-- --11079	2
Today	RO	U16	0.1KWh	11080	1

feed-in energy					
Total Consumption energy	RO	U32	0.1KWh	11081-- --11082	2
Today Consumption energy	RO	U16	0.1KWh	11083	
Total output energy	RO	U32	0.1KWh	11084-- --11085	
Today output energy	RO	U16	0.1KWh	11086	
Total input energy	RO	U32	0.1KWh	11087-- --11088	
Todayinput energy	RO	U16	0.1KWh	11089	
Total load energy	RO	U32	0.1KWh	11090-- --11091	
Today load energy	RO	U16	0.1KWh	11092	
year-month	RO	U16		11093	high8:year 00--99 low8: month0-12
Day-hour	RO			11094	high8 0-31 low8:0-23
Minute-Second	RO			11095	high8 0-59 low8:0-59

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
RTC-year	RW	U16	N/A	1	40000	1	2000-2099
RTC-month	RW	U16	N/A	1	40001	1	1-12
RTC-day	RW	U16	N/A	1	40002	1	1-31
RTC-hour	RW	U16	N/A	1	40003	1	0-59
RTC-minute	RW	U16	N/A	1	40004	1	0-59
RTC-second	RW	U16	N/A	1	40005	1	0-59
Grid code	RW	U16	N/A	1	40006	1	
Reserve					40007		
PV config	RW	U16	N/A	1	40008	1	0: independent 1: parallel
DRM0 state	RW	U16	N/A	1	40009	1	0: disable 1: enable
Meter1/CT1	RW	U16	N/A	1	40010	1	0: meter 1: ct 2: disable
Meter2/CT2	RW	U16	N/A	1	40011	1	0: meter 1: ct 2: disable
Modbus Addr	RW	U16	N/A	1	40012	1	1-247
Password	RW	U16	N/A	1	40013	1	0-9999

Work mode	RW	U16	N/A	1	41000	0: Self use 1: Feed-in First 2: Back up
P1GridCharge Flag	RW	U16	N/A	1	41001	0: disable 1: enable
ChargeStartTime1 HourMinute	RW	U16	N/A	1	41002	High byte: hour; Low byte: minute
ChargeEndTime1 HourMinute	RW	U16	N/A	1	41003	High byte: hour; Low byte: minute
P2GridCharge	RW	U16	N/A	1	41004	0: disable

Flag						1: enable
ChargeStartTime2 HourMinute	RW	U16	N/A	1	41005	High byte: hour; Low byte: minute
ChargeEndTime2 HourMinute	RW	U16	N/A	1	41006	High byte: hour; Low byte: minute
Maximum set charge current	RW	U16	A	10	41007	0-50
Maximum set discharge current	RW	U16	A	10	41008	0-50
Minimum SoC	RW	U16	N/A	1	41009	0-100%
Maximum SoC	RW	U16	N/A	1	41010	0-100%
Minimum SoC-On Grid	RW	U16	N/A	1	41011	0-100%
Export limit	RW	U16	W	1	41012	0-60000
Sys on/off	RW	U16	N/A	1	41013	0: off 1: on
Eps frequency select	RW	U16	N/A	1	41014	0: 50Hz 1: 60Hz
Eps output	RW	U16	N/A	1	41015	0: disable 1: enable
GroundEn	RW	U16	N/A	1	41016	0:disable 1: enable

Safety rules - start-up parameters: Film reading, film writing

Signal Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Scope
ConnectReconnectEnable	RW	Bitfield16	N/A	1	42000	1	bit 0: Voltage parameters bit 1: Frequency parameters bit 2: Soft-start parameters

Connect time	RW	U16	s	1	42001	1	
Connect power gradient	RW	U16	% / min	10	42002	1	
Reconnect time	RW	U16	s	1	42003	1	
Reconnect power gradient	RW	U16	% / min	10	42004	1	
Connect voltage high limit	RW	U16	V	10	42005	1	
Connect voltage low limit	RW	U16	V	10	42006	1	
Connect frequency high limit	RW	U16	Hz	100	42007	1	
Connect frequency low limit	RW	U16	Hz	100	42008	1	

Ange-Voltage Parameters: Sheet Reading, Tablet Writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
Voltage protect Enable	RW	Bitfield16	N/A	1	42100	1	bit 0: Level 1 protection bit 1: Secondary protection bit 2: Level 3 protection bit 3: Ten minutes overpressure protection

							n
Voltage high limit1	RW	U16	V	10	42101	1	
Voltage high limit1 protect time	RW	U16	ms	1	42102	1	
Voltage high limit2	RW	U16	V	10	42103	1	
Voltage high limit2 protect time	RW	U16	ms	1	42104	1	
Voltage high limit3	RW	U16	V	10	42105	1	
Voltage high limit3 protect time	RW	U16	ms	1	42106	1	
Voltage low limit1	RW	U16	V	10	42107	1	
Voltage low limit1 protect time	RW	U16	ms	1	42108	1	
Voltage low limit2	RW	U16	V	10	42109	1	
Voltage low limit2 protect time	RW	U16	ms	1	42110	1	
10min voltage high limit	RW	U16	V	10	42111	1	

Ange-Frequency Parameters: Tablet Reading, Tablet Writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
Frequency protect Enable	RW	Bitfield16	N/A	1	42200	1	bit 0: Level 1 protection bit 1: Secondary protection

							bit 2: Rocof
Frequency high limit1	RW	U16	Hz	100	42201	1	
Frequency high limit1 protect time	RW	U16	ms	1	42202	1	
Frequency high limit2	RW	U16	Hz	100	42203	1	
Frequency high limit2 protect time	RW	U16	ms	1	42204	1	
Frequency low limit1	RW	U16	Hz	100	42205	1	
Frequency low limit1 protect time	RW	U16	ms	1	42206	1	
Frequency low limit2	RW	U16	Hz	100	42207	1	
Frequency low limit2 protect time	RW	U16	ms	1	42208	1	
Rocof	RW	U16	Hz/s	10	42209	1	

Ange-P(f): Film reading, film writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
P(f) flag	RW	Bitfield16	N/A	1	42300	1	
Under frequency point recover	RW	U16	Hz	100	42301	1	
Under frequency point enter	RW	U16	Hz	100	42302	1	
Under frequency point exit	RW	U16	Hz	100	42303	1	
Under frequency power decline slope	RW	U16	% / min	10	42304	1	

Over frequency point recover	RW	U16	Hz	100	42305	1	
Over frequency point enter	RW	U16	Hz	100	42306	1	
Over frequency point exit	RW	U16	Hz	100	42307	1	
Over frequency power decline slope	RW	U16	% / min	10	42308	1	
P(f) Enter delay	RW	U16	ms	1	42309	1	
P(f) Exit delay	RW	U16	s	1	42310	1	
P(f) Power increase gradient	RW	U16	% / min	10	42311	1	
Under frequency stop point decline slope	RW	U16	%	1	42312	1	
Over frequency stop point decline slope	RW	U16	%	1	42313	1	
P(f) enable	RW	U16	N/A	1	42314	1	1: enable 0: unable

Ange-P(u): Film reading, film writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
P(u) flag	RW	Bitfield16	N/A	1	42700	1	
V1	RW	U16	V	10	42701	1	
V2	RW	U16	V	10	42702	1	
V3	RW	U16	V	10	42703	1	
V4	RW	U16	V	10	42704	1	
P(u) Delay	RW	U16	ms	1	42705	1	
P(u) Power increase gradient	RW	U16	% / min	10	42706	1	
P(u) enable	RW	U16	N/A	1	42707	1	1: enable 0: unable

Ange-DCI: Film reading, film writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
DCI protect Enable	RW	Bitfield16	N/A	1	42800	1	bit 0: Level 1 protection bit 1: Secondary protection
DCI high limit1	RW	U16	mA	1	42801	1	
DCI high limit1 protect time	RW	U16	ms	1	42802	1	
DCI high limit2	RW	U16	mA	1	42803	1	
DCI high limit2 protect time	RW	U16	ms	1	42804	1	

Ange-No work: film reading, film writing

Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity	Scope
Reactive power mode enable	RW	Bitfield16	N/A	1	43000	1	Reactive parameters are the same as single cameras, with different data order
Reactive power control mode	RW	U16	N/A	1	43001	1	
Reactive power rise time	RW	U16	s	1	43002	1	
Fixed PF	RW	U16	N/A	100	43003	1	
Fixed Q	RW	I16	Var	1	43004	1	
CosphiP_Lockin V	RW	U16	V	10	43005	1	

CosphiP_Lockout V	RW	U16	V	10	43006	1	
CosphiP_PF1	RW	I16	N/A	100	43007	1	
CosphiP_P1	RW	U16	%	1	43008	1	
CosphiP_PF2	RW	I16	N/A	100	43009	1	
CosphiP_P2	RW	U16	%	1	43010	1	
CosphiP_PF3	RW	I16	N/A	100	43011	1	
CosphiP_P3	RW	U16	%	1	43012	1	
CosphiP_PF4	RW	I16	N/A	100	43013	1	
CosphiP_P4	RW	U16	%	1	43014	1	
Qu_V1	RW	U16	V	10	43015	1	
Qu_Q1	RW	I16	%	1	43016	1	
Qu_V2	RW	U16	V	10	43017	1	
Qu_Q2	RW	I16	%	1	43018	1	
Qu_V3	RW	U16	V	10	43019	1	
Qu_Q3	RW	I16	%	1	43020	1	
Qu_V4	RW	U16	V	10	43021	1	
Qu_Q4	RW	I16	%	1	43022	1	
Qu_LockinP	RW	U16	%	1	43023	1	
Qu_LockoutP	RW	U16	%	1	43024	1	
Qu_Qlimit	RW	I16	Var	1	43025	1	
Qu_Enterdelay	RW	U16	s	1	43026	1	

Remote-Data

Signal Name	R/W	Type	Unit	Gain	Address	Relation Protocol	Scope
Remote Enable	WR	U16	N/A	1	44000	0x4 add:178	
Remote Timeout_Set	WR	U16	s	1	44001	NA	Information is provided by ARM
Remote control-Active power command	WR	I16	W	1	44002	0x3 add:150	
Remote control-Reactive power command	WR	I16	Var	1	44003	0x3 add:152	
Remote TimeoutCountdown	RO	U16	s	1	44004	NA	Information is provided by ARM
RemoteTakeEffect	RO	U16	N/A	1	44005	0x3	0 Not active

						add:154	1 Active
Remote Not active Reasons	RO	U16	N/A	1	44006	0x3 add:155	0 Nothing 1 EnSet 2 HostOffline 3 OffGrid 4 BatInput 5 Unknown
Pwr_limit Ac_P_Up	RO	I16	W	1	44007	0x3 add:156	The maximum Ac output active power that the inverter can provide
Pwr_limit Ac_P_Dn	RO	I16	W	1	44008	0x3 add:158	Maximum Active Power (Negative) provided by inverter
Pwr_limit Ac_Q_Up	RO	I16	Var	1	44009	0x3 add:160	逆变器能提供的最大 Ac 输出无功功率
Pwr_limit Ac_Q_Dn	RO	I16	Var	1	44010	0x3 add:162	Maximum Ac loser reactive power (negative) provided by the inverter
Pwr_limit Bat_up	RO	I16	W	1	44011	0x3 add:164	The maximum battery output power that an inverter can provide
Pwr_limit Bat_up	RO	I16	W	1	44012	0x3 add:166	Maximum battery transfer power (negative) that the inverter can provide
Pwr_limit Pv	RO	I16	W	1	44013	0x3 add:168	The maximum Pv input power that the inverter can accept
Pwr_limit_Reason Ac	RO	U16	N/A	1	44014	0x3 add:170 add:171	bit0~7 Outputlimit bit8~15 Outputlimit
Pwr_limit_Reason Dc	RO	U16	N/A	1	44015	0x3 add:172 add:173	bit0~3 BatDischarge bit4~7 BatCharge bit8~11 Pv bit12~15 Rev

Pwr_limit_Reason_Ac

- 0 Invalid
- 1 GridVolt

- 2 SoftUp
- 3 FreDroop
- 4 PU
- 5 ReactivePower
- 6 InvTemp
- 7 PwrLimitRatioSet
- 8 ExportLimitSet

Pwr_limit_Reason_Bat

- 0 Invalid
- 1 CurrentSet
- 2 BMS
- 3 SOC
- 4 CutVolt
- 5 AC
- 6 RatedPower
- 7 InvTemp

Pwr_limit_Reason_Pv

- 0 Invalid
- 1 ExportLimitSet
- 2 Ac&Bat

CleanMem-Act

Clear events	WO				45000	1	
Clear energy	WO				45001	1	
Factory reset	WO				45002	1	

Appendix 1 Fault message

Fault 1

Bit	Fault message		
0	GridLostFault		
1	GridVoltFault		
2	GridFreqFault		
3	Grid10minVoltFault		
4	EpsVoltFault		
5	SwInvCurFault		
6	DciFault		
7	TBD		
8	HwInvCurFault		
9	SwBusVoltFault		
10	BatVoltFault		
11	SwBatCurFault		
12	IsoFault		
13	ResCurFault		

14	PvVoltFault		
15	SwPvCurFault		

Fault 2

Bit	Fault message		
0	TempFault		
1	GroundConnFault		
2	TBD		
3	EpsOverLoadFault		
4	BatPowerLowFault		
5	HwBusVoltFault		
6	HwPvCurFault		
7	HwBatCurFault		
8	SciFault		
9	MasterSpiFault		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		

Fault 3
Reserved

Fault 4

Bit	Fault message		
0	MasterSampleFault		
1	ResCurDeviceFault		
2	InvEepromFault		
3	PvConnDirFault		
4	BatRelayOpenFault		
5	BatRelayCloseFault		
6	BatBuckFault		
7	BatBoostFault		
8	EpsRelayFault		
9	TBD		
10	BatConnDirFault		
11	MainRelayOpenFault		
12	S1CloseFault		
13	S2CloseFault		
14	M1CloseFault		
15	M2CloseFault		

Fault 5

Bit	Fault message		
0	GridVoltConsFault		
1	GridFreqConsFault		
2	DciConsFault		
3	ResCurConsFault		
4	TBD		
5	TBD		
6	SlaveSpiFault		
7	SlaveSampleFault		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		

Fault 6

Bit	Fault message		

0	ArmEepromFault		
1	MeterLostFault		
2	TBD		
3	TBD		
4	TBD		
5	TBD		
6	TBD		
7	TBD		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		

Fault 7

Bit	Fault message		
0	BmsExternalFault		
1	BmsInternalFault		

2	BmsVoltHighFault		
3	BmsVoltLowFault		
4	BmsChgCurHighFault		
5	BmsDischgCurHighFault		
6	BmsTempHighFault		
7	BmsTempLowFault		
8	BmsCellImbalance		
9	BmsHardwareProtect		
10	BmsCircuitFault		
11	BmsInsulationFault		
12	BmsVoltSensorFault		
13	BmsTempSensorFault		
14	BmsCurSensorFault		
15	BmsRelayFault		

Fault 8

Bit	Fault message		
0	BmsTypeUnmatch		
1	BmsVersionUnmatch		
2	BmsManufacturerUnmatch		
3	BmsSwHwUnmatch		

4	BmsMSUnmatch		
5	BmsChgReqNoReply		
6	TBD		
7	TBD		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		