CPS Inverter Model Data Mapping Specification For 403X

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ABSTRACT

This document describes the Shanghai Chint Powr System(CPS) Inverter model specificaton

Change history

Date	Version	Modification	Author
2012-7-17	0.1	The initial version	Jake Lee
2012-8-7	0.2	Update the data mapping	Jake Lee
2012-9-25	0.3	1）Add CEI standard RW registers. 2）Add the descriptions for DDH and addressing model.	Jake Lee
2012-11-7	0.4	Modify the register 0x0005 DD_MachVersion to D_FirmwareVersion.	Jeffrey
2012-12-1	0.4C	Add TFMaxTrip setting item	Jakelee
2013-1-28	0.4D	Add remote dispatch parameters , FaultCode3, FaultCode4 and the unit of VLvrtStart	zhangzf
2013-3-28	0.5	Modify the units of DCIMax and GFCI	zhangzf

ESSENTIAL COMPLIANCE INFORMATION

(1). In the CPS MODBUS protocol, implementations should leave unused or unsupported data points set to the “Not Implemented” value specified in the model mapping. The Not Implemented value for different data type has different value, here are the defined:

Not Implemented for a int8 is 0x80.

Not Implemented for a uint8 is 0xFF.

Not Implemented for a int16 is 0x8000.

Not Implemented for a uint16 is 0xFFFF.

Not Implemented for a int32 is 0x80000000.

Not Implemented for a uint32 is 0xFFFFFFFF.

Not Implemented for a string is 0x00.

(2). CPS Units：Units and Scale Factors are defined by CPS Units. As an alternative to floating point format, values are represented by integer values with a signed scale factor applied. For example:

Start	End	Size	R/W	Name	Type	CPS Units	Contents	Description
0x001F	0x001F	1	RO	Uab	uint16	0.1V		Grid voltage Uab

The Uab unit is V, if current real-time value is Uab=389.5V, the value Uab in register 0x001F is 3895 decimal (0x0F37 hex). So 0.1V indicates that the Uint is V, and Scale factor was Magnified 10 times, so real-time value is 3895/10=389.5

(3).Scale Factor：As an alternative to floating point format, values are represented by integer values with a signed scaled factor applied. The scale factor explicitly shifts the decimal point to the left (negative value) or the right (positive value). Scale factors had been fixed and specified in the documentation of a value. Scale factor signed range:-10----10. For example

Start	End	Size	R/W	Name	Type	Unit	Scale Factor	Description
0x001F	0x001F	1	RO	Uab	uint16	V	-1	Grid voltage Uab

The Uab unit is V, if current real-time value is Uab=389.5V, the value Uab in register 0x001F is 3895 decimal (0x0F37 hex).Scale Factor is -1, it explicitly shifts the decimal point to the left one bit, then real-time value is 389.5,

（4）Data Encoding

The MODBUS specification is not explicit on how to encode numbers other than 16-bit integers. Differences do exist between one manufacturer’s implementation and another’s.

32-bit intege Value

Values are stored in big-endian order per the MODBUS specification and consist of a single register.

MODBUS Register	1		2	
byte	0	1	2	3
bits	31---24	23---16	15---8	7---0

64-bit intege Value

64-bit integers are stored using for registers in big-endian order.

MODBUS Register	1		2	
byte	0	1	2	3
bits	63---56	55---48	47---40	39---32

MODBUS Register	3		4	
byte	4	5	6	7
bits	31---24	23---16	15---8	7---0

String Value

Store variable length string values in a fixed size register range using a NULL(0 value)to terminate or pad the string. For example, up to 14 characters can be stored in 7 contiguous registers as follows:

MODBUS Register	1		2		3		4		5		6		7	
byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13
character	S	C	1	0	0	K	T	L	/	C	N	0	0	0

Not_Implemented value:all registers filled with 0x0000.

(5) Basic register address is 0x0000.

1.0 Abbreviations

ADU Application Data Unit

IP Internet Protocol

MB MODBUS

MBAP MODBUS Application Protocol

PDU Protocol Data Unit

TCP Transport Control Protocol

CPS Chint Power System

uint8 unsigned char

uint16 unsigned int

uint32 unsigned long

Int8 signed char

int16 signed int

int32 signed long

2.0 Inverter Input Registers Data Mapping

The MODBUS read function code is 0x04,and the basic register address is 0x0000.

Table 2-1 Input Registers Data Mapping

Start	End	Size	R/W	Name	Type	CPS Units	Unit	Scale factor	Min value	Max value	Contents	Description
0x0000	0x0000	1	RO	Device	uint16	1	NULL	0			0x4031/ 0x4032 0x4033	a value that uniquely identifies the type of device model
0x0001	0x0001	1	RO	NodeNum	uint16	1	NULL	0	0	0x00FF		The data format of NodeNum is 0xAABB. AA indicates that there are 0xAA devices in front of this device, and BB indicates that there are 0xBB devices behind this device. This field is for internal use and can be neglected for third-party monitoring.
0x0002	0x0002	1	RO	NextNodeAdd	uint16	1	NULL	0	0	0xFFFF		The start input register address of next device. If no device connected (BB =00), the value will be 0xFFFF. This field is for internal use and can be neglected for third-party monitoring.
0x0003	0x0003	1	RO	RegNum	uint16	1	registers	0				Number of readable registers(R/W=RO) supported by this device, count from the register ProVer to the last input register, and one register consists of 16-bit.
0x0004	0x0004	1	RO	ProVer	uint16	0.01	NULL	-2				a value that identifies the latest supported communication protocol version.
0x0005	0x0005	1	RO	FirmVer	Uint16	0.01	NULL	-2				A manufacturer specific value that identifies the firmware version of this device;The data format of FirmVer is 0xAABB. AA indicates DSP firmware revision, and BB indicates MCU firmware revision.

0x0006	0x0009	4	RO	SN	uint64	BCD	NULL	0				a manufacturer specific value that uniquely identifies this device within the manufacturer name space.Remark: Serial number is composed of 16 characters(8 bytes)，the most significant 5 characters is not used, only used the left 11 characters. Such as 0X0000010091114001,it represents the inverter serial number is 10091114001
0x000a	0x0013	10	RO	model	string(20)	1	NULL	0				a value that identifies the current device model serial descriptor, e.g. SC20KTL-DO/IT
0x0014	0x0014	1	RO	RWRegSum	uint16	1	NULL	0				number of R/W registers supported by this device
0x0015	0x0015	1	RO	RWRegAdd	uint16	1	NULL	0			0x1000	R/W register start address offset
0x0016	0x0017	2	RO	TYield	uint32	1kWh	Kwh	0	0			Total energy to grid
0x0018	0x0018	1	RO	DYield	uint16	0.1kWh	Kwh	-1	0			The accumulated kWh of that day
0x0019	0x0019	1	RO	Eff	uint16	0.01%	%	-4	0	1000		Inverter efficiency. When reading this register is 0x1F40, representing Eff=0x1F40 *0.0001=0.8=80%
0x001A	0x001A	1	RO	PF	int16	0.001	NULL	-3		1000		Power factor. When reading this register is 0x0320, representing PF=0x0320 *0.001=0.8
0x001B	0x001B	1	RO	Pmax	uint16	0.1kW	Kw	-1				AC maximum active power of that day
0x001C	0x001C	1	RO	RunT	uint16	0.1Min	Min	-1				Number of time the Inverter starts feeding to the grid
0x001D	0x001D	1	RO	Pac	uint16	0.1kW	Kw	-1				AC active power
0x001E	0x001E	1	RO	Sac	uint16	0.1kVA	KVA	-1				AC Apparent power
0x001F	0x001F	1	RO	Uab	uint16	0.1V	V	-1				Grid voltage Uab
0x0020	0x0020	1	RO	Ubc	uint16	0.1V	V	-1				Grid voltage Ubc
0x0021	0x0021	1	RO	Uca	uint16	0.1V	V	-1				Grid voltage Uca
0x0022	0x0022	1	RO	Ia	uint16	0.1A	A	-1				Grid A phase current
0x0023	0x0023	1	RO	Ib	uint16	0.1A	A	-1				Grid B phase current
0x0024	0x0024	1	RO	Ic	uint16	0.1A	A	-1				Grid C phase current
0x0025	0x0025	1	RO	Upv1	uint16	0.1V	V	-1				PV voltage

0x0026	0x0026	1	RO	Ipv1	uint16	0.1A	A	-1				PV current
0x0027	0x0027	1	RO	Upv2	uint16	0.1V	V	-1				PV2 voltage
0x0028	0x0028	1	RO	Ipv2	uint16	0.1A	A	-1				PV2 current
0x0029	0x0029	1	RO	Upv3	uint16	0.1V	V	-1				PV3 voltage
0x002A	0x002A	1	RO	Ipv3	uint16	0.1A	A	-1				PV3 current
0x002B	0x002B	1	RO	Freq	uint16	0.1Hz	Hz	-1				Grid frequency
0x002C	0x002C	1	RO	Tmod	int16	0.1C	C	-1				Module temperature
0x002D	0x002D	1	RO	Tamb	int16	0.1C	C	-1				Internal temperature
0x002E	0x002E	1	RO	Tcoil	int16	0.1C	C	-1				Transformer temperature
0x002F	0x002F	1	RO	Mode	uint16	1	NULL	0				Inverter mode code, for detail see "**Inverter Work Mode Descriptor**"
0x0030	0x0033	4	RO	Time	uint64	BCD	NULL	0				Error timestamp(yyyy-mm-dd-hh-mm-ss-NULL) of model 0,eg.0x2012071615181000=2012-7-16 15:18:10
0x0034	0x0034	1	RO	PFault	uint16	1	NULL	0				permanent fautl code of model 0,for detail see "**Inverter Events Descriptor**"
0x0035	0x0035	1	RO	Warn	uint16	1	NULL	0				warn code of model 0,for detail see "**Inverter Events Descriptor**"
0x0036	0x0036	1	RO	Fault0	uint16	1	NULL	0				fautl code0 of model 0
0x0037	0x0037	1	RO	Fault1	uint16	1	NULL	0				fautl code1 of model 0
0x0038	0x0038	1	RO	Fault2	uint16	1	NULL	0				fautl code2 of model 0
0x0039	0x0039	1	RO	Fault3	uint16	1	NULL	0				fautl code3of model 0
0x003A	0x003A	1	RO	Fault4	uint16	1	NULL	0				fautl code4 of model 0

3.0 Inverter Holding Registers Mapping

The MODBUS read function code is 0x03,and write function codes are 0x06 and 0x10.

Table 3-1 Holding Registers Data Mapping

Start	End	Size	R/W	Name	Type	CPS Units	Uint	Scale factor	Min value	Max value	Contents	Description
0x1000	0x1000	1	RW	OnOff	uint16	1	NULL	0	0x5555	0xAAAA	0x5555/ 0xAAAA	device power on or off command,0xAAAA power on，0X5555 power off
0x1001	0x1001	1	RW	PSet	uint16	0.10%	NULL	-3	0	1000		Remote electric dispatch Active Power setting value, range [0.0%,100.%], E.g. 70.7%,then PSet =0x02c3
0x1002	0x1002	1	RW	PFSet	int16	0.001	NULL	-3	-1000	1000		Remote electric dispatch Power factor Setting,Rang[-1.000，-0.9000]U[0.9000, 1.000],E.g. 0.931, then PFSet =0X03A3；-0.931 PFSet =0xFC5D
0x1003	0x1003	1	RW	QSet	uint16	0.10%	NULL	-1	0	1000		Remote electric dispatch Reactive Power setting value, range [0.0%,100.%], E.g. 70.7%,then QSet =0x02c3
0x1004	0x1007	4	RW	TimeSet	uint64	BCD	NULL	0				System time setting,format as :yyyy-mm-dd-hh-mm-ss-NUL, eg.0x2012071615181000=2012-7-16 15:18:10
0x1008	0x1008	1	RW	FProtectII	uint16	1	NULL	0	0	1		Enable of Protect FrepII（Only CEI-021）
0x1009	0x1009	1	RW	Reserved	uint16	1	NULL	0				
0x100A	0x100A	1	RW	Reserved	uint16	1	NULL	0				

0x100B	0x100B	1	RW	TFMaxTrip	uint16	0.01S	S	-2				Maximum grid frequency trip time
0x100C	0x100C	1	RW	VMax	uint16	0.1V	V	-1				Maximum operational grid voltage
0x100D	0x100D	1	RW	TVmaxTrip	uint16	0.01S	S	-2				Maximum grid voltage trip time
0x100E	0x100E	1	RW	VMin	uint16	0.1V	V	-1				Minimum operational grid voltage
0x100F	0x100F	1	RW	TVminTrip	uint16	0.01S	S	-2				Minimum grid voltage trip time
0x1010	0x1010	1	RW	FMax	uint16	0.01Hz	Hz	-2				Maximum operational grid frequency
0x1011	0x1011	1	RW	FMin	uint16	0.01Hz	Hz	-2				Minimum operational grid frequency
0x1012	0x1012	1	RW	TFMinTrip	uint16	0.01S	S	-2				Minimum grid frequency trip time
0x1013	0x1013	1	RW	P_EE	uint16	0.10%	%	-1				Local Active Power setting, range [0.0%,100.%], E.g. 70.7%,then P_EE =0x02c3
0x1014	0x1014	1	RW	PF_EE	int16	0.001	NULL	-3				Local Power Factor Setting, Rang[-1.000，-0.9000]U[0.9000，1.000],E.g. 0.931，then PF_EE =0X03A3 ； -0.931 PF_EE =0xFC5D
0x1015	0x1015	1	RW	StartDelay	uint16	0.1Min	Min	-1				Setup delay time
0x1016	0x1016	1	RW	Risomin	uint16	0.1kOhm	Kohm	-1				Minimum insulation resistance
0x1017	0x1017	1	RW	PVStartVol	uint16	0.1V	V	-1				PV start-up voltage
0x1018	0x1018	1	RW	DCIMax	uint16	1mA	mA	-1				maximun DCI value
0x1019	0x1019	1	RW	TambMax	uint16	0.1C	C	-1				Maximum internal temperature
0x101A	0x101A	1	RW	TmodMax	uint16	0.1C	C	-1				Maximum module temperature
0x101B	0x101B	1	RW	OffsetDiffMax	uint16	1	NULL	0				Maximum sampling offset value
0x101C	0x101C	1	RW	VUnbal	uint16	0.10%	%	-1				Unbalance rate of grid voltage
0x101D	0x101D	1	RW	SoftPStep	uint16	0.01KW	Kw	-2				Software control Power step
0x101E	0x101E	1	RW	VMaxII	uint16	0.1V	V	-1				The 2nd maximum operational grid voltage
0x101F	0x101F	1	RW	TVmaxTripII	uint16	0.01S	S	-2				The 2nd maximum grid voltage trip time

0x1020	0x1020	1	RW	VMinII	uint16	0.1V	V	-1				The 2nd minimum operational grid voltage
0x1021	0x1021	1	RW	TVminTripII	uint16	0.01S	S	-2				The 2nd minimum grid voltage trip time
0x1022	0x1022	1	RW	FMaxII	uint16	0.01Hz	Hz	-2				The 2nd maximum operational grid frequency
0x1023	0x1023	1	RW	TFMaxTripII	uint16	0.01S	S	-2				The 2nd minimum grid frequency trip time
0x1024	0x1024	1	RW	FMinII	uint16	0.01Hz	Hz	-2				The 2nd minimum operational grid frequency
0x1025	0x1025	1	RW	TFMinTripII	uint16	0.01S	S	-2				The 2nd minimum grid frequency trip time
0x1026	0x1026	1	RW	VMaxRcov	uint16	0.1V	V	-1				
0x1027	0x1027	1	RW	VMinRcov	uint16	0.1V	V	-1				
0x1028	0x1028	1	RW	VRcovT	uint16	0.01S	S	-2				
0x1029	0x1029	1	RW	FMaxRcov	uint16	0.01HZ	HZ	-2				
0x102A	0x102A	1	RW	FMinRcov	uint16	0.01HZ	HZ	-2				
0x102B	0x102B	1	RW	FRcovT	uint16	0.01S	S	-2				
0x102C	0x102C	1	RW	FDeratStart	uint16	0.01HZ	HZ	-2				
0x102D	0x102D	1	RW	FDeratStop	uint16	0.01HZ	HZ	-2				
0x102E	0x102E	1	RW	LvrtEn	uint16	1	NULL	0				LVRT enable
0x102F	0x102F	1	RW	VLvrtStart	uint16	0.1%	%	-1				
0x1030	0x1030	1	RW	GFCIMax	uint16	1mA	mA	-1				
0x1031	0x1031	1	RW	MPPTScanEN	uint16	1	NULL	0	0	1	MPPTScan	Enable
0x1032	0x1032	1	RW	MPPTTime	uint16	1	Min	0	30	540	MPPTScan	Cycle
0x1033	0x1033	1	RW	PF_PCurveActPw1	uint16	0.1%	%	-1				
0x1034	0x1034	1	RW	PF_PCurvePF1	uint16	0.001	NULL	-3				
0x1035	0x1035	1	RW	PF_PCurveActPw2	uint16	0.1%	%	-1				
0x1036	0x1036	1	RW	PF_PCurvePF2	uint16	0.001	NULL	-3				
0x1037	0x1037	1	RW	PF_PCurveLockInV	uint16	0.1V	V	-1				
0x1038	0x1038	1	RW	PF_PCurveLockOutV	uint16	0.1V	V	-1				

0x1039	0x1039	1	RW	Q_UCurveVolt1s	uint16	0.1V	V	-1				
0x103A	0x103A	1	RW	Q_UCurveReactPw1s	uint16	0.1%	%	-1				
0x103B	0x103B	1	RW	Q_UCurveVolt2s	uint16	0.1V	V	-1				
0x103C	0x103C	1	RW	Q_UCurveReactPw2s	uint16	0.1%	%	-1				
0x103D	0x103D	1	RW	Q_UCurveVolt1i	uint16	0.1V	V	-1				
0x103E	0x103E	1	RW	Q_UCurveReactPw1i	uint16	0.1%	%	-1				
0x103F	0x103F	1	RW	Q_UCurveVolt2i	uint16	0.1V	V	-1				
0x1040	0x1040	1	RW	Q_UCurveReactPw2i	uint16	0.1%	%	-1				
0x1041	0x1041	1	RW	Q_UCurveLockInP	uint16	0.1%	%	-1				
0x1042	0x1042	1	RW	Q_UCurveLockOutP	uint16	0.1%	%	-1				
0x1043	0x1043	1	RW	FreqDeratOption	uint16	1	NULL	0				
0x1044	0x1044	1	RW	FDeratStart	uint16	0.01HZ	HZ	-2				
0x1045	0x1045	1	RW	FDeratStopOrRatio	uint16	0.1%/HZ	%/HZ	-1				
0x1046	0x1046	1	RW	RemoteActivePwDispatchModeOption	uint16	1	NULL	0				
0x1047	0x1047	1	RW	RemoteReactivePwModeSeclect	uint16	1	NULL	0				

4.0 Inverter Work Mode Descriptor

Table 4-1

Start	End	Size	R/W	Name	Type	Units	Contents	Description
0x002F	0x002F	1	R	Mode	uint16	1	0x8000/ 0x4000/ 0x2000/ 0x1000/ 0x0800/	0x8000: Fault 0x4000：Check 0x2000：Standby 0x1000：Running 0x0800: Derate

5.0 Inverter Events Descriptor

When one bit is set to "1", it indicates that the representative of the fault is occurring, and if the bit is set to "0", it indicates that the representative of the fault has not occurred.

Table 5-1

Name	bit	Display content	Description
Warn	Bit15	Warn0150	
	Bit14	Warn0140	
	Bit13	Warn0130	
	Bi12	Warn0120	
	Bit11	Warn0110	
	Bit10	Warn0100	
	Bit9	Warn0090	
	Bit8	Warn0080	
	Bit7	Warn0070	
	Bit6	Warn0060	
	Bit5	Warn0050	
	Bit4	Warn0040	
	Bit3	Warn0030	
	Bit2	CommErr	
	Bit1	Warn0020	
	Bit0	Warn0010	
Fault0	Bit15	Protect0010	
	Bit14	TempOver	
	Bit13	Protect0020	
	Bi12	GridV.OutLim	
	Bit11	GridV.OutLim	
	Bit10	GridF.OutLim	
	Bit9	Protect0030	

	Bit8	GridV.OutLim	
	Bit7	GridV.OutLim	
	Bit6	Protect0040	
	Bit5	PVVoltOver	
	Bit4	Protect0050	
	Bit3	Protect0060	
	Bit2	Protect0070	
	Bit1	Protect0080	
	Bit0	Protect0090	
Fault1	Bit15	Protect0100	
	Bit14	Protect0110	
	Bit13	ACContErr	
	Bit12	Protect0120	
	Bit11	Protect0130	
	Bit10	Protect0270	
	Bit9	GridV.OutLim	
	Bit8	Protect0140	
	Bit7	Protect0150	
	Bit6	PVReverse	
	Bit5	Protect0160	
	Bit4	GFCIErr	
	Bit3	IsolationErr	
	Bit2	Protect0170	
	Bit1	Protect0180	
	Bit0	Protect0190	
Fault2	Bit15	EmergencyStp	
	Bit14	Protect0290	
	Bit13	Protect0300	
	Bi12	PV3VoltOver	
	Bit11	PV3Reverse	

	Bit10	PV1VoltOver	
	Bit9	PV1Reverse	
	Bit8	GFDIErr	
	Bit7	Protect0230	
	Bit6	Protect0260	
	Bit5	PV2VoltOver	
	Bit4	Protect0240	
	Bit3	PV2Reverse	
	Bit2	Protect0220	
	Bit1	Protect0210	
	Bit0	Protect0200	
PFault	Bit15	Fault0160	
	Bit14	Fault0150	
	Bit13	Fault0140	
	Bit12	Fault0010	
	Bit11	Fault0020	
	Bit10	Fault0030	
	Bit9	Fault0040	
	Bit8	Fault0050	
	Bit7	Fault0060	
	Bit6	Fault0070	
	Bit5	Fault0080	
	Bit4	Fault0090	
	Bit3	Fault0100	
	Bit2	Fault0110	
	Bit1	Fault0120	
	Bit0	Fault0130	