CARLO GAVAZZI
Automation Components

CARLO GAVAZZI

ISMG1xx
Communication Protocol

Ver. 2.01 - 06/12/2010

EcoEnergy

Command 3 : Read Single Holding Register

Master Query

Start Byte	Slave Address	Function	Starting Address HiByte	Starting Address LoByte	No. of Data HiByte	No. of Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	0~1	1~0FFH	0	1	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Byte Count	Data Hi	Data Lo	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	2	*	*	_	_	0DH

** CS(Check Sum) : CRC16

Command 3 : Read n Holding Registers (n < =15)

Master Query

Start Byte	Slave Address	Function	Starting Address HiByte	Starting Address LoByte	No. of Data HiByte	No. of Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	0~1	1~0FFH	0	n	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Byte Count	Data 1 HiByte	Data1 LoByte	……	Data n HiByte	Datan LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	2*n	*	*		*	*	_	_	0DH

Command 6 : Preset Single Register

Master Query

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	06	0	1~14H	*	*	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	06	0	1~14H	*	*	_	_	0DH

Command 8 : Setting new 485 Address

Master Query

Start Byte	Slave Address	Function	MODEL HiByte	MODEL LoByte	SN_ HIGH HiByte	SN_ HIGH LoByte	SN_ LOW HiByte	SN_ LOW LoByte	New Address	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	XX	08	1	CCH	2	62H	0	1	1~0FFH	_	_	0DH

XX:DON'T CARE (MODEL=460 , SN_HIGH=610 , SN_LOW=1)

Slave Response

Start Byte	Slave Address	Function	TYPE HiByte	TYPE LoByte	SN_ HIGH HiByte	SN_ HIGH LoByte	SN_ LOW HiByte	SN_ LOW LoByte	New Address	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	XX	08	1	CCH	2	62H	0	1	1~0FFH	_	_	0DH

XX:DON'T CARE (TYPE=460 , SN_HIGH=610 , SN_LOW=1)

Command 6C :

Master Query

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	6C	0	XXH	*	*	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	6C	0	XXH	*	*	_	_	0DH

Command AA :

Master Query

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	AA	3	9DH	*	*	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	AA	3	9DH	*	*	_	_	0DH

SN COMMAND

Master Query

Start Byte	Slave Address	Function	Starting Address HiByte	Starting Address LoByte	No. of Data HiByte	No. of Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	1	9	0	3	_	_	0DH

Slave Response

Start Byte	Slave Address	Function	Byte Count	Type Hi	Type Lo	SN_H Hi	SN_H Lo	SN_L Hi	SN_L Lo	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	1~0FFH	03	6	*	*	*	*	*	*	_	_	0DH

BROADCAST COMMAND

Query

Start Byte	Slave Address	Function	Register Address HiByte	Register Address LoByte	Preset Data HiByte	Preset Data LoByte	CS (CRC) LoByte	CS (CRC) HiByte	Stop Byte
0AH	0	0BH	0	xxH	0	XX	_	_	0DH

* xxH=13H ADDRESS = XX (XX= 0~255) → No Response

* xxH=14H Baudrate = XX (XX= 0~1, 0:9600, 1:19200) → No Response

* xxH=15H Language = XX → No Response

XX=0→ English, XX=1→ Italian, XX=2→ Spanish

XX=3→ French, XX=4→ German

* xxH=18H XX=1

ADDRESS = S/N MOD 250 (IF 0=>250) → No Response

(ADDRESS=DEFAULT)

The CRC field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

The CRC is started by loading a 16-bit register with FFFF hex(all '1's), called the CRC register. Then exclusive OR the first 8-bit byte of the message with the low order byte of the 16-bit CRC register. Then the result is shifted in the direction of the least significant bit(LSB), zero-filling the most significant bit(MSB). The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value A001 hex. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is exclusive ORed with the current CRC register, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

When the CRC is appended to the message, the low order byte is appended first, followed by the high order byte.

EX: Stop inverter

Master : 0AH 01H 06H 00H 89H 00H 00H 58H 20H 0DH

Slave : 0AH 01H 06H 00H 89H 00H 00H 58H 20H 0DH

BAUDRATE=9600 => 1 BYTE=1 mS

READ COMMAND(3) Read 10 Parameters

10 (Query)+ 7 (Response)+2*10 (Response)=37(Bytes)

=➔ 40 mS

READ COMMAND(3) Read 40 Parameters

40*4=160

=➔ 160 mS

BAUDRATE=19200 => 1 BYTE=0.5 mS

=➔ 80 mS READ 40 Parameters

ISMGxxx Parameter List

READ COMMAND (3)

No.	Addr.	Variable	Description	Range (German)	Range (Italy)	Range (Spain)	Unit	RS485 Command	Password
1	1H	FacH_TRIP	Higher limits of the allowable utility frequency, before the utility grid monitoring system disconnects the device from the utility grid.	1~20	10~450	1~450	0.01Hz	3&6	0
2	2H	FacH_CYCLE	Trip cycles of the higher limits frequency	1~10	3~250	1~100	CYCLE	3&6	0
3	3H	FacL_TRIP	Lower limits of the allowable utility frequency, before the utility grid monitoring system disconnects the device from the utility grid.	1~250	10~450	1~450	0.01Hz	3&6	0
4	4H	FacL_CYCLE	Trip cycles of the lower limits frequency	1~10	3~250	1~100	CYCLE	3&6	0
5	5H	VacH_TRIP	Higher limits of the nominal utility voltage, before the utility grid monitoring system disconnects the device from the utility grid.	2300~2640	2300~3000	2300~3000	0.1V	3&6	0
6	6H	VacH_CYCLE	Trip cycles of the higher limits voltage	1~10	3~250	1~150	CYCLE	3&6	0
7	7H	VacL_TRIP	Lower limits of the nominal utility voltage, before the utility grid monitoring system disconnects the device from the utility grid.	1980~2300	1600~2300	1600~2300	0.1V	3&6	0
8	8H	VacL_CYCLE	Trip cycles of the lower limits voltage	1~10	3~250	1~150	CYCLE	3&6	0
9	9H	DELTA_Zac_TRIP	Differential of AC impedance trip setting	30~100	30~2000	30~2000	0.01Ohm	3&6	0
10	AH	Zac_TRIP	AC impedance trip setting	30~2000	30~2000	30~2000	0.01Ohm	3&6	0

No.	Addr.	Variable	Description	Range (German)	Range (Italy)	Range (Spain)	Unit	RS485 Command	Password
11	BH	FastIearth_TRIP	Change of the leakage current trip setting	5~30	5~300	5~300	1mA	3&6	0
12	CH	SlowIearth_TRIP	Leakage current trip setting	5~300	5~300	5~300	1mA	3&6	0
13	DH	Riso_TRIP	Insulation resistance trip setting	5~1000	5~1000	5~1000	0.1MOhm	3&6	0
14	EH	Vpv_START	The DC voltage required before the ISMG begins feeding power into the utility grid.	1200~5000	1200~5000	1200~5000	0.1V	3&6	0
15	FH	ONGRID_DELAY	On grid delay time	20~300	20~600	20~600	Sec	3&6	0
16	10H	VacH_LIMIT	Higher clamp voltage of the nominal utility	2530~2640	2530~3000	2530~3000	0.1V	3&6	0
17	11H	VacH_LIMIT_CYCLE	The maximum cycles over clamp voltage	30~600	30~600	30~600	Sec	3&6	0
18	12H	Type_No	Machine type	0	1	5	0 : Germany 1 : Italy 2 : Taiwan 3 : Special 4 : USA 5 : Spain	3&6	1
19	13H	ADDRESS	RS485 address	1~255	1~255	1~255		3&6	0
20	14H	BAUDRATE	Communication baud rate	0~1	0~1	0~1	0 : 9600 1 : 19200	3&6	0
21	15H	LANGUAGE	Language	0~4	0~4	0~4	0 : English 1 : Italian 2 : Spanish 3 : French 4 : German	3&6	0

READ COMMAND (3)

No.	Addr.	Variable	Description	Range	Unit	RS485 Command	Password Level
25	19H	BridgeRelay_ON_NumH	Relay Turn on Times High word	0~65535	65536 times	3&6C	2
26	1AH	BridgeRelay_ON_NumL	Relay Turn on Times Low word	0~65535	times	3&6C	2
27	1BH	TIME_HR_CNT	Total output hours	0~65535	hour	3&6C	2
28	1CH	TIME_MIN_CNT	Total output minutes	0~59	minuit	3&6C	2
29	1DH	TIME_SEC_CNT	Total output seconds	0~59	second	3&6C	2
30	1EH	Eac_H	Total output energy high word	0~65535	1000kWh	3&6C	2
31	1FH	Eac_L	Total output energy low word	0~9999	0.1kWh	3&6C	2
32	20H						
33	21H	EpvA_H	Pv input energy A high word	0~65535	1000kWh	3&6C	2
34	22H	EpvA_L	Pv input energy A low word	0~9999	0.1kWh	3&6C	2
35	23H						
36	24H	EpvB_H	Pv input energy B high word	0~65535	1000kWh	3&6C	2
37	25H	EpvB_L	Pv input energy B low word	0~9999	0.1kWh	3&6C	2
38	26H						
39	27H	EpvC_H	Pv input energy C high word	0~65535	1000kWh	3&6C	2
40	28H	EpvC_L	Pv input energy C low word	0~9999	0.1kWh	3&6C	2
41	29H						
87	57H	Zac_OFF_SW	Zac measurement enable switch	0~65535	5555H: Disable Others: Enable	3&6C	2

Bridge Relay turn ON/OFF count = BridgeRelay_ON_NumH*65536 + BridgeRelay_ON_NumL

H(total operation time) = TIME_HR_CNT hours + TIME_MIN_CNT minuits + TIME_SEC_CNT seconds

Eac(total output power) = Eac_H*1000kWh + Eac_L*0.1kWh

Epv(total input power) = EpvA_H*1000kWh + EpvA_L*0.1kWh
+ EpvB_H*1000kWh + EpvB_L*0.1kWh
+ EpvC_H*1000kWh + EpvC_L*0.1kWh

READ COMMAND (3)

No.	Addr.	Variable	Description	Range	RS485 Command	Password Level
103 | 110	67H | 6EH	BRAND_NAME	LCD display BRAND DATA (16 Bytes of ASCII Code)	0~65535	3&6C	3
111 | 118	6FH | 76H	TYPE_NAME	LCD display TYPE DATA (16 Bytes of ASCII Code)	0~65535	3&6C	3
119 | 126	77H | 7EH	SN_NAME	LCD display SN DATA (16 Bytes of ASCII Code)	0~65535	3&6C	3

READ COMMAND (3)

No.	Addr.	Variable	Description	Unit	RS485 Command	Read / Write
181	B5H	State	See P.21		3	R
182	B6H	Error_Code1	See P.21		3	R
183	B7H	Error_Code2	See P.22		3	R
184	B8H	Error_Code3	See P.22		3	R
185	B9H	Error_Code4	See P.23		3	R
186	BAH	Vpv_A	Vpv input voltage A	0.1V	3	R
187	BBH	Vpv_B	Vpv input voltage B	0.1V	3	R
188	BCH	Vpv_C	Vpv input voltage C	0.1V	3	R
189	BDH	Ppv_A	Pv input power A	1W	3	R
190	BEH	Ppv_B	Pv input power B	1W	3	R
191	BFH	Ppv_C	Pv input power C	1W	3	R
192	C0H	Vac	Output voltage	0.1V	3	R
193	C1H	Pac	Output power	1W	3	R
194	C2H	Iac	Output current	0.1A	3	R
195	C3H	Fac	Output frequency	0.01Hz	3	R
196	C4H	Eac_H	Total output energy high word	1000KWHr	3	R
197	C5H	Eac_L	Total output energy low word	0.1KWHr	3	R
198	C6H	EpvA_H	Pv A total input energy high word	1000KWHr	3	R
199	C7H	EpvA_L	Pv A total input energy low word	0.1KWHr	3	R
200	C8H	EpvB_H	Pv B total input energy high word	1000KWHr	3	R

Examples :

If the readings of the Eac_H = 12345 and Eac_L = 6789, then the cumulated energy generated by the inverter is (Eac_H * 1000 + Eac_L * 0.1) which is (12345 * 1000) + (6789 * 0.1) = 12345678.9 kWHr.

READ COMMAND (3)

No.	Addr.	Variable	Description	Unit	RS485 Command	Read / Write
201	C9H	EpvB_L	Pv B total input energy low word	0.1KWHr	3	R
202	CAH	EpvC_H	Pv C total input energy high word	1000KWHr	3	R
203	CBH	EpvC_L	Pv C total input energy low word	0.1KWHr	3	R
204	CCH	Ton_today	Output time today	1/2048 Hr	3	R
205	CDH	Ires	Leakage current	1mA	3	R
206	CEH	Heatsink_Temp	Heatsink temperature	0.1℃	3	R
207	CFH	Zac	AC impedance	0.01Ω	3	R
208	D0H	Riso	Insulation resistance	0.01MΩ	3	R
209	D1H	Ton_total_Hr	Total output hours	Hr	3	R
210	D2H	Ton_total_Min	Total output minutes	Min	3	R
211	D3H	Ton_total_Sec	Total output seconds	Sec	3	R
212	D4H	Relay_Turn_On_Times_H	Relay turn on times high word	65536 times	3	R
213	D5H	Relay_Turn_On_Times_L	Relay turn on times low word	times	3	R
214	D6H	Vac_TRIP	The voltage at tripping	0.1V	3	R
215	D7H	Fac_TRIP	The frequency at tripping	0.01Hz	3	R

READ COMMAND (3)

No.	Addr.	Variable	Description	Range	RS485 Command	Read / Write
265	109H	MODEL_NAME	model	330,380,460	3	R
266	10AH	SN_HIGH	Serial number high word	0~9999(YYMM)	3	R
267	10BH	SN_LOW	Serial number low word	0~9999	3	R
268	10CH	DEVICE_VER	Hardware Version		3	R
269	10DH	Version_SEQU	DSP1 Version		3	R
270	10EH	Version_CURR	DSP2 Version		3	R

YY : Year MM : Month

EX: Command 3 Reading 10 datas from inverter. (Address 2 , parameters from address 181 to 190)
Master : 0AH 02H 03H 0H B5H 0H 0AH D4H 18H 0DH
Slave : 0AH 02H 03H 14H 0H 1H 0H 2H 0H 3H 0H 4H 0H 5H 0H 6H 0H 7H 0H 8H 0H 9H 0H 0AH CS(L) CS(H) 0DH

EX: Read inverter model and serial number (S/N 46006100001)
Master : 0AH 02H 03H 01H 09H 0H 03H D4H 06H 0DH
Slave : 0AH 02H 03H 06H 01H CCH 02H 62H 00H 01H CS(L) CS(H) 0DH

State_COD :

10	Initialize mode
11	Utility frequency detect mode
20	Renew(restart) mode
30	Wait mode
40	Monitoring mode
50	Output mode
60	Fault mode
61	Idle mode
70	Default mode
80	Stop mode
90	Calibrate mode

Error_COD1 :

BIT0	GridNA	**No AC voltage is detected on the grid side**
BIT1	VacH	**The AC voltage of mains utility is over the upper limit**
BIT2	VacL	**The AC voltage of mains utility is under the lower limit**
BIT3	FacH	**The frequency of AC voltage of the utility is over the upper limit**
BIT4	FacL	**The frequency of AC voltage of the utility is under the lower limit**
BIT5	Zac	**The AC impedance of the grid is out of range**
BIT6	DeltaZ	**The rate of change of the AC grid impedance is higher than setting value**
BIT7	Drift Fac	**Islanding is detected**
BIT8	FastEarthCurrent	**The drastic change of the leakage current has been detected**
BIT9	SlowEarthCurrent	**The leakage current has exceeded a safe operating limit**
BIT10	DCInjectCurH	**Over DC current injected into the AC grid is detected**
BIT11	Imax_AC	**Over current on the AC side**
BIT12	InvTempMax	**The internal temperature of the inverter exceeded the safe operating limit**
BIT13	VpvH	**The DC voltage of PV array is over the upper limit**
BIT14		**N/A**
BIT15	Riso	**The insulation resistance between PV array and the ground is below the safe operating limit**

Error_COD2

BIT0	VdcbusH	**Internal DC bus voltage is over the upper limit**
BIT1		**N/A**
BIT2		**N/A**
BIT3	Relay1	**Grid connection relay failed**
BIT4	Relay2	**Grid connection relay failed**
BIT5	Relay3	**Grid connection relay failed**
BIT6	Relay4	**Grid connection relay failed**
BIT7	Internal COMM	**Internal communication failed**
BIT8		**N/A**
BIT9		**N/A**
BIT10		**N/A**
BIT11		**N/A**
BIT12		**N/A**
BIT13		**N/A**
BIT14	COMM	**External communication failed *waring message**
BIT15	EEPROM	**EEPROM writing failed *waring message**

Error_COD3

BIT0	L<－>N SWAPPED	**LN wiring error**
BIT1	Idc Test	**The DC injection current measurement function failed**
BIT2	RCMA Test	**The leakage current measurement function failed**
BIT3	RCMA	**The leakage current exceeded standard value**
BIT4	IR Test	**The insulation resistance measurement function failed**
BIT5	Offset	**Offset check for grid monitoring failed**
BIT6	Temp. Sensor	**The internal temperature sensor failed**
BIT7	Auto test	**Auto test failed**
BIT8	CPU Delta	**Internal measurement comparison error or defective hardware**
BIT9		**N/A**
BIT10		**N/A**
BIT11		**N/A**
BIT12		**N/A**
BIT13		**N/A**
BIT14		**N/A**
BIT15		**N/A**

Error_COD4

BIT0	Zac	**AC grid impedance out of range, continuously**
BIT1	DeltaZ	**The rate of change of the AC grid impedance out of range, continuously**
BIT2	FastEarthCurrent	**The drastic change of the leakage current has been detected, continuously**
BIT3	SlowEarthCurrent	**The leakage current has exceeded a safe operating limit, continuously**
BIT4	DCInjectCurH	**Over DC current injected into the AC grid is detected, continuously**
BIT5	Imax_AC	**Over current on the AC side, continuously**
BIT6	Relay	**Relay test failed, continuously**
BIT7	RAM Test	**Memory self test failed**
BIT8	CalDataError	**Calibration data is out of range**
BIT9	EEPROM Test	**EEPROM test failed**
BIT10	Version Error	**The firmware version is not correct**
BIT11	CPU Delta	**Internal measurement comparison error or defective hardware**
BIT12	Watchdog	**Internal watchdog function triggered**
BIT13	System Error	**The system failed**
BIT14	Inter COMM Test	**Internal communication test failed**
BIT15	CalDataLoss	**Calibration data is lost**