

Filename = Magnum Networking Communications Protocol.XLS

7-May-03 Update 10-Oct-03

Update 23-May-05 add 0% charge rate and 250 VAC Dropout for ac disconnect for EMS support

Update 28 March 2006 for new fault codes and new VAC dropout values

Update Oct 06 for sending VACin and VAC output and new fault codes:

RELAY_FAULT

CHARGER_FAULT

Update Nov 06 for new battery sizes and new TCO FAULT

Update Jan 23-07 added EOF (0xFF) value and third party notes.

Update Apr-23-07 added (0x91) CB3 open fault

Update Aug-13-07 corrected VAC dropout values

Update Oct-15-09 Added new packet information

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Clarification and general updates

12/16/2010

Software definition of comm system:

This is a definition of the "TICS" (Temp Comm Sys) for the "Charger" part of the Magnum Energy Inverter/Charger/Remote pair.

TICS-C is the "Charger/Inverter" end.

TICS-R is the "Remote" end.

OVERVIEW:

This implementation works as:

"Charger/Inverter" is the MASTER of communications, and will transmit its data once every 100ms. During this time

TICS-C will:

1. Enable the RS-485 transmit driver
2. (internally) disable the Receiver (RE)
3. Reset the RECEIVE DATA POINTER
4. Reset the TRANSMIT DATA POINTER, and transmit 16 bytes of data.

At the "end" of the transmission:

1. Disable the RS-485 transmit driver
2. (internally) ENABLE the Receiver (RE)

On reception of bytes (from the Remote):

1. Store data sequentially
2. advance the RECEIVE DATA POINTER
3. after the 16th byte,
(internally) disable the Receiver (RE).

(repeat)

"Remote" is the SLAVE and responds to messages by transmitting its own message 10ms after the MASTER's message ends.

TCS-R operates in the following manner:

1. Receives bytes of data, storing to ram, advancing the RAM_POINTER, and RESETING the Rx_CLOCK (2ms step) to ZERO.

When Rx_CLOCK reaches 5 (10ms) do:

1. (internally) disable Receiver (RE),
2. enable the RS-485 transmit driver
3. reset the TRANSMIT DATA POINTER
4. reset the RECEIVE DATA POINTER
5. trigger the TRANSMITTER
6. Every fourth send extends data transmission with AGS or BMK settings

When the transmitter is complete:

1. disable Transmitter
2. disable the RS-485 transmit driver
3. (internally) enable the Receiver (RE)

When AGS clock reaches 10ms, or BMK clock reaches 14ms:

1. "Remote" receives bytes of data, storing to ram

* Note: AGS and BMK do not communicate on every cycle

* After sending an AGS a hex A0, or hex A1, the AGS will respond in the next cycle.

(repeat)

Hardware definition of comm system:

This is a simple communications systems, where the physical link is RS-485, which is defined as:

true 2 wire only
5V differential,
half-duplex,
multi-drop up to 32 connected transceivers.

RJ-11 wiring on inverter is (from top to bottom) :

1 = "B" RS485 comm

2 = +14

3= Ground

4 = "A" RS485 comm

Comm rate = 19.2K BPS
Each bit time = about 50usec
Each byte = about 500usec
All 16 bytes = about 8 msec
Time each packet is sent = about every 100 msec

Communications from inverter and remote:

Every 100 msecs, the inverter sends a packet of data, one right after the other, whether remote is connected or not.

MS rev 3.9 and earlier / All ME, RD, MM, MMS series
MS rev 4.0 and later

Inverter sends **16** bytes of data
Inverter sends **21** bytes of data

If remote is connected it will receive the packet and then after a short delay will begin sending a packet back to the inverter.

ME-RC rev 1.4 and earlier / All MM-R, MM-RC, ME-RB, and ME-MR
ME-RC rev 1.5 and later / All ME-ARC

Remote sends **16** bytes of data
Remote sends **21** bytes of data

The definition of remote byte order:

Scope picture of comm string:



Third Party Notes

If your company is considering building a product to connect to the Magnum Network:

- 1 Please contact someone in the Engineering Department at Magnum for approval.
- 2 Understand that no power is available for third party devices on the network.
- 3 You should design your product so that it looks like a "wire" to the network. This is so that the timing of the data is not affected adversely and so that the

devices on the network will operate properly. Also, when your product is off or not operational, it will not affect existing communication on the network.

[illegible]

Remote sends				Date Modified:			December 16, 2010
Byte order	Data name	bits	value assignments / signed	Value sent / Units	Default Value	Implemented at Revision	Comments
0	Inverter ON/OFF Charger ON/OFF Future use	Bit 0 Bit 1 Bit 2	momentary high momentary high	0	0		Toggle inverter on/off Toggle charger on/off (only when AC is in use) Not used
	EQ Mode	Bit 3	Bit 1 & 3(0x0A), momentary high		0		Toggle EQ mode (only when AC is in use, only in float mode)
	Future use	4, high order		0	0		Not used
1	Search watts	8	0-50	1Watt	5		0 means Off, below 5 watts very course, not meter grade
2	Battery size	8	from 20 to 160 in 20Ah increments	10Ah/count	3.6	20 for MM-RC / MM-R went to absorb don time at ARC	In older inverters this is how absorb time was set. 200Ah = 1Hour each additional Ah is .5hours / 200Ah
			from 180 up	200 + (100AH / count)	40 for ME-RC		1 count = 10Amp hours; Inverter accepts increments of 20, from 20-160
3	Battery Type	8	Gel Flooded AGM AGM2	2 4 8 10	(default)		
	Absorption, if set to Custom		Custom when value is +100	0.1V*		RC 2.1	Absorbtion Voltage Scaled to 12V numbers ex: MS4024, 145 = 29.0V
4	Charger Amps	8	0-100 Must be in steps of 10	1%	80	0% RC 1.5	Maximum, inverter will default to 80 if any other value is sent
5	Input Amps / Shore Amps	8	Range is 5 - 60, in steps of 1	1A	30		
6	Remote revision	8	unsigned	0.1			i.e. 10 = 1.0 * MM-R & MM-RC starts at 3.6 ** ME-RB starts at 8.0 *** If using a BMK, the revision must be greater than 1.8, or the BMK will not communicate
7	Ambient temp	8	0-150 = 0-150 deg-C				
7	Parallel threshold /	4, low order	0-10	10%		ARC	Parallel threshold 1 count = 10% of unit capacity
	Force Charge	4, high order	Disable Refloat Force Silent Force Float Force Bulk	BIT 4 BIT 5 BIT 6 BIT 7	0 0 0 0	ARC ARC ARC ARC	
8	Auto Genstart	8	Off Enable Test Enable with Quiet Time On	0 1 2 4 5	(default)		Allow Auto Gen Start
						ARC 2.0	Don't start during quiet time hours Only in AGS rev 5.0 and later
9	Low Battery Cut Out (LBCO)	8	unsigned (90 - 160)	0.1V	100		12 Volt Inverter
	** 24 volt values		unsigned (190 - 255)	0.1V	200		24 Volt Inverter
	*** 48 volt values		unsigned (190 - 255)	0.2V	200	RC 1.6	48V Same range as 24volt, display shows double the value sent.
10	VAC cut out voltage	8	60VAC 65V 70V 75V 80V 85V 90V 95V 100V "EMS over-ride- open relay"	110 122 135 145 155 165 175 182 190 255	(default)	Exports: RC 2.5	Range is 0 to 255, but is not linear Export models (230 VAC/50 Hertz) have the same range, just double - 10 the displayed AC voltage
						ARC	This will cause inverter to ignore AC input
11	Float Volts	8	unsigned	0.1V*	132	RC 2.1	Scaled to 12V numbers
12	EQ Volts	8	unsigned	0.1V*	12	RC 2.1	Range is 0 - 2.0 volts (0 - 20), this is added to Absorption voltage
13	Absorb Time	8	unsigned	0.1 Hours	20	ARC	25 would be two and half hours; 0.1 hr = 6 minutes
14	Hours	8	0-23	1 hour	0		Remote always sends Hours
15	Minutes	8	0-59	1 minute	0		and minutes, unless otherwise noted
Bytes 16-20 were added for AGS in ME-RC Rev 1.5 and later.				RC 1.5			Works with AGS revision 3.5 and later
16	Gen run time	8	unsigned	0.1 Hours	20		x.x hrs; 0-255, 25 would be two and half hours; 0.1 hr = 6 minutes
17	Start Temp	8	unsigned	1F	0		Range 33 to 104 Fahrenheit (33 - 104); cooling only
18	Start VDC	8	unsigned	0.1V*	110		Scaled to 12 volt numbers; 0.1 = 1 Range, 1 to 255
19	Quiet time hours	8	Off 9pm to 7am	0 1	0		** AGS revision 5.0 and later use this byte to enable quiet time

			9pm to 8am	2		
			9pm to 9am	3		
			10pm to 8am	4		
			11pm to 8am	5		
20	Footer	8			0xA0 Hex	Bytes 14 through 19 can be used to communicate to other network devices. Byte 20 is used to address the device.

Bytes 14-20 were added for AGS in ME-ARC.					ARC	Works with AGS revision 5.0 and later
14	AGS Start Time	8	0-96	15 minutes	0	0 = 12:00 AM; 5 = 1:15AM
15	AGS Stop Time	8	0-96	15 minutes	0	* If start/stop are set the equal, function is disabled
16	AGS Vdc Stop	8	unsigned	0.1V*	144	Voltage scaled in 12 numbers
			Float	255		Stop on inverter float mode
17	AGS V Start Delay	8	AGS delay units		120	MSB bit controls minute/second selection; Range 0 - 127
					248	MSB = 1 = Minute; MSB = 0 = Seconds
18	AGS V Stop Delay	8	AGS delay units		120	All "delays" use the above format
19	AGS Max Run Time	8	unsigned	0.1 Hours	120	x.x hrs; 0-255, 25 would be two and half hours; 0.1 hr = 6 minutes
20	Footer	8			0xA1 Hex	

Bytes 14-20 were added for AGS in ME-ARC					ARC	Works with AGS revision 5.0 and later
14	AGS SOC Start	8	Off	1%	0	1 count = 1%
15	AGS SOC Stop	8	90%	1%	90	1 count = 1%
16	AGS Amps Start	8	unsigned	1 Amp	0	1 count = 1 Amp
17	AGS Amps Start Delay	8	AGS delay units		120	MSB bit controls minute/second selection; Range 0 - 127 MSB = 1 = Minute; MSB = 0 = Seconds
18	AGS Amps Stop	8	unsigned	1 Amp	5	1 count = 1 Amp
19	AGS Amps Stop Delay	8	AGS delay units		120	MSB bit controls minute/second selection; Range 0 - 127 MSB = 1 = Minute; MSB = 0 = Seconds
20	Footer	8			0xA2 Hex	

Bytes 14-20 were added for AGS in ME-ARC						ARC	Works with AGS revision 5.0 and later
14	AGS Quiet Time begin	8	0-96	15 minutes	80 = 8:00pm	0 = 12:00 AM one count = 15 minutes	
15	AGS Quiet Time end	8	0-96	15 minutes	40 = 10:00A	0 = 12:00 AM one count = 15 minutes ** Byte 19 in footer A0 must be set to 1 to enable function * If begin/end are set equal, function is disabled	
16	AGS Exercise Days	8	Off	1 Day	0	1 Count = 1 Day; Range 0 - 255	
17	AGS Exercise Start Time	8	0-96	15 minutes	32	0 = 12:00 AM one count = 15 minutes	
18	AGS Exercise Runtime	8	unsigned	0.1 Hours	10	x.x hrs; 0-255, 25 would be two and half hours; 0.1 hr = 6 minutes	
19	Top off	8	unsigned	1 minute	0 = Off	1 count = 1 minute; Range 0 - 255	
20	Footer	8			0xA3 Hex		

Bytes 14-20 were added for AGS in ME-ARC					ARC	Works with AGS revision 5.0 and later
14	AGS Warm up	8	AGS delay units	60	MSB bit controls minute/second selection; Range 0 - 127	
					MSB = 1 = Minute; MSB = 0 = Seconds	
15	AGS Cool down	8	AGS delay units	60	MSB bit controls minute/second selection; Range 0 - 127	
					MSB = 1 = Minute; MSB = 0 = Seconds	
16	Empty / Not used	8		0	Possible future settings	
17	Empty / Not used	8		0		
18	Empty / Not used	8		0		
19	Empty / Not used	8		0		
20	Footer	8		0xA4 Hex		

Bytes 16-20 were added for BMK in ME-RC Rev 1.7 and later.					RC 1.7	Works with BMK revision 1.0 and later
16	Battery efficiency	8	0-100	1%	0 = Auto	1 count = 1%, 0 = Auto
17	Resets	8	Normal running	0	0	
			Reset minimum volts DC	1		
			Reset maximum volts DC	2		
			Reset Amp Hour "Trip"	3		
			Reset kAmp Hours	4		
18	Battery size	8	unsigned	10Ah	40	1 count = 10 Amp Hours; 200 amp hour minimum
19	Empty / Not used	8			0	
20	Footer	8			0x80 Hex	

AGS delay units	MSB = 1 indicates minutes MSB = 0 indicates seconds Lower 7 bits amount of time. 0x8A = 10 Minutes 0x06 = 6 Seconds
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The Progretron
RC 1.0 - 2.5
Everything
in RC 2.5 is
in ARC

ME-AGS Sends	Date Modified:	December 16, 2010
AGS transmits every time a remote transmits a footer 0xA0 or 0xA1 hex		

** Only revision 3.5 and later communicates on the network

Byte order	Data name	bits	value assignments / signed	Value sent / Units	Implemented at Revision	Comments
0	Header	8		0xA1 Hex		This defines the packet
1	Status	8	Not valid	0		No Comm on remote
			Off	1		Not enabled
			Ready	2		Enabled
			Manual Run	3		Generator manually started
			AC In	4		Inverter is in charge mode
			In quiet time (hours)	5		
			Start in test mode	6		30 second run, then shutdown
			Start on temperature	7		
			Start on voltage	8		
			Fault start on test	9		
			Fault start on temp	10		
			Fault start on voltage	11		
			Start Time of Day	12	AGS 5.0	
			Start State of charge	13	AGS 5.0	SOC comes from BMK
			Start Exercise	14	AGS 5.0	
			Fault start Time of Day	15	AGS 5.0	
			Fault start State of charge	16	AGS 5.0	
			Fault start Exercise	17	AGS 5.0	
			Start on Amp	18	AGS 5.0	
			Start on Topoff	19	AGS 5.0	
			Not used	20		
			Fault start on Amp	21	AGS 5.0	
			Fault on Topoff	22	AGS 5.0	
			Not used	23		
			Fault max run	24	AGS 5.0	Max run time exceeded
			Gen Run Fault	25		
			Gen in Warm up	26	AGS 5.0	
			Gen in Cool down	27	AGS 5.0	
2	Revision	8	unsigned	0.1	Started TX at 3.5	i.e. 10 = 1.0
3	Temperature	8	33 to 104	1 Fahrenheit		In degrees Fahrenheit (33-104F)
4	Gen Runtime	8	unsigned	0.1 Hours		Gen running for h.m, so 2.5 would be two and half hours
						x.x hrs; 0-255, 25 would be two and half hours; 0.1 hr = 6 minutes
						xx.x VDC (Scaled to 12V numbers) by looking at inverter model number
5	AGS Vdc	8	unsigned	0.1V*		

** Only revision 3.5 and later communicates on the network

0	Header	8		0xA2 Hex	AGS 5.0	This defines the packet this Packet is only sent when a remote sends out footer X
1	Days since last generator run	8	unsigned	1 Day	AGS 5.0	1 Day is 24 Hours from when the Gen Stopped
2	Empty / Not used			0		
3	Empty / Not used			0		
4	Empty / Not used			0		
5	Empty / Not used			0		

ME-BMK Sends				Date Modified:			December 16, 2010
Requires Remote Rev to be 1.7 and later.							
Byte order	Data name	bits	value assignments / signed	Value sent / Units		Implemented at Revision	Comments
0	Header	8		0x81 Hex			8 means ME-BMK
1	State of Charge	8	0-100 255	1% Think'n			0-100 - 0 - 100% or 1 count / 1% (255 = Think'n)
2,3	DC volts	16*	unsigned	0.01 Volts	1260		0-64K = 0 - 640.00V or 1 count/ 0.01V (real range = 0-70.00V)
4,5	DC amps	16*	signed	0.1 Amps	101		0-64K = -3.2K to 3.2KAmps or 1 count/ 0.1A (real range +-1000A)
6,7	Min Volts	16*	unsigned	0.01 Volts	1261		0-64K = 0 - 640.00V or 1 count/ 0.01V (real range = 0-70.00V)
8,9	Max Volts	16*	unsigned	0.01 Volts	1259		0-64K = 0 - 640.00V or 1 count/ 0.01V (real range = 0-70.00V)
10,11	AmpH in/out	16*	signed	1Ah	220		0-64K = -32K to 32KAmpH or 1 count/ 1AmpH (real range = -9999 to 9999 AmpH)
12,13	AmpH Trip	16*	unsigned	0.1Ah	2202		0-64k = 0 to 6.4KAmpH or 1 count/ 0.1AmpH
14,15	Cumulative AmpH out	16*	unsigned	100Ah			0-64k = 0 to 6.4MAmpH or 1 count/ 100AmpH
16	Revision	8	unsigned	0.1			i.e. 10 = 1.0
17	Fault	8	Reserved		0		Used at factory
			Normal		1		
			Fault start		2		
BMK TX every 0.5 seconds with a deadtime of 14msec after a ME-RC revision 2.0 or more							

BMK TX every 0.5 seconds with a deadtime of 14msec after a ME-RC revision 2.0 or more

16* = NOTE that for all 16 bit variables, they are sent in two bytes, the high byte sent first. So for DC volts, high byte is sent in third position (byte 2) and low byte is sent in fourth position or byte 3.

ME-RTR Sends				Date Modified:				December 16, 2010	
Byte order	Data name	bits	value assignments / signed	Value sent / Units		Implemented at Revision	Comments		
0	Header	8		0x91 Hex					
1	Revision	8	unsigned	0.1	10		i.e. 10 = 1.0 i.e. 11 = 1.1		
RTR TX every 0.5 seconds with a deadline of 18msec after									