Mega System Technologies Inc.

MegaTec Extended Communications Protocol -- for Three- Phase UPS

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MEGATEC EXTENDED COMMUNICATIONS PROTOCOL FOR THREE-PHASE UPS

A. General: This document specifies the RS232C communication protocol of Advanced-Intelligent UPS. This protocol provides the following features :

1. Monitor charge status.
2. Monitor battery status and conditions.
3. Monitor main power status.

Computer gives command to UPS. All commands have to end with a < cr >.
UPS responds to computer. All responses have to end with a < cr> .

***** UPS must respond to every command within 500ms *****

B. Hardware:

BAUD RATE..... : 2400 bps
DATA LENGTH..... : 8 bits
STOP BIT..... : 1 bit
PARITY..... : NONE

CABLING :

COMPUTER		UPS
RX	<----------	TX (pin 3)
TX	---------->	RX (pin 2)
GND	<--------->	GND (pin 5)

(9 pins female D-type connector)

C. COMMUNICATION PROTOCOL:

1. UPS real time data
Computer : G1 <cr>

UPS :!SSS PPP NNNN RRR.R +TT.T FF.F EE.E QQ.Q <cr>

There should be a space character between every field for data separation. The meaning of each field is listed as follows:

a. Start byte : !

b. Battery voltage: SSS
SSS is an integer number ranging from 000 to 999.
The unit is “Volt”.

c. Battery Capacity percentage : PPP
PPP is an integer number ranging from 000 to 100.
The unit is “Percentage”..

d. Battery Time Remaining : NNNN
NNNN is an integer number ranging from 0000 to 9999.
The unit is “Minute”.

e. Battery current in charge mode or discharge mode: RRR.R
Battery is in charge or discharge mode depends on a2 (Rectifier Status),
When a2 =1 , means battery is in discharge mode.
When a2 = 0, means battery is in charge mode.
R is an integer number ranging from 0 to 9.
The unit is “Amp”.

f. Temperature : +TT.T
T is an integer number ranging from –99.9 to +99.9.
The unit is “Degree of centigrade”.

g. I/P frequency : FF.F
F is an integer number ranging from 0 to 9.
The unit is “Hz”.

h. Frequency of Bypass Source: EE.E
E is an integer number ranging from 0 to 9.
The unit is “Hz”.

i. O/P frequency : QQ.Q
Q is an integer number ranging from 0 to 9.
The unit is “Hz”.

j.Stop Byte : <cr>

Example: Computer : G1<cr>
UPS : !240 094 0123 025.0 +35.0 60.1 62.0 60.0<cr>

Means : Battery voltage is 240V.
Battery Capacity is 94 %.
Battery Time Remaining is 123 minutes.
Charge current is 25 Amps.
Temperature is 35.0 degrees centigrade.
I/P frequency is 60.1 Hz.
Frequency of Bypass Source is 62.0 Hz.
O/P frequency is 60.0 Hz.

2. UPS status inquiry

Computer : G2

UPS :!a7a6a5a4a3a2a1a0 b7b6b5b4b3b2b1b0 c7c6c5c4c3c2c1c0<cr>

There should be a space character between every field for data separation. The meaning of each field is listed as follows:

a. Start byte : !

b. The Status of Rectifier and DC : <U>
<U> is one byte of binary information such as <a7a6a5a4a3a2a1a0>.
“a<u>N</u>” is an ASCII character ‘0’ or ‘1’.

Status of Rectifier and DC :

Byte	Description
7	No Use
6	RECTIFIER ROTATION ERROR
5	1 : Low Battery Shutdown
4	1 : Low Battery
3	1 : Three in –One out 0 : three in –Three out
2	1 : Back Up 0 : AC Normal
1	1 : Boost Charge 0 : Float Charge
0	1 : Rectifier Operating

c. The Status of UPS : <U>
<U> is one byte of binary information such as <b7b6b5b4b3b2b1b0>.
"bN" is an ASCII character '0' or '1'.

Status of UPS :

Byte	Description
7	No Use
6	No Use
5	No Use
4	BYPASS FRQUENCY FAIL
3	1 : Manual Bypass Breaker On 0 : Manual Bypass Breaker Open
2	1 : Bypass AC Normal 0 : Bypass AC Abnormal
1	1 : Static Switch in Inverter Mode 0 : Static Switch in Bypass Mode
0	1 : Inverter Operating

d. The Fault Condition of Inverter: <U>
<U> is one byte of binary information such as <c7c6c5c4c3c2c1c0>.
" cN " is an ASCII character '0' or '1'.

The Fault Condition of Inverter :

Byte	Description
7	No Use
6	1 : Emergency Stop (EPO)
5	1 : High DC Shutdown
4	1 : Manual Bypass Breaker on Shutdown
3	1 : Over Load Shutdown
2	1 : Inverter O/P Fail Shutdown
1	1 : Over Temperature Shutdown
0	1 : Short Circuit Shutdown

Example: Computer : G2<cr>
UPS : !00000010 00000100 00000000<cr>

Means : Three in-Three out UPS.
Boost Charge.
Bypass AC Normal

3. UPS real time data for 3 phases

Computer : G3

UPS :!NNN.N/NNN.N/NNN.N PPP.P/PPP.P/PPP.P QQQ.Q/QQQ.Q/QQQ.Q SSS.S/SSS.S/SSS.S<cr>

There should be a space character between every field for data separation. The meaning of each field is listed as follows:

a. Start byte : !

b. I/P voltage of R/S/T 3 phases : NNN.N/NNN.N/NNN.N
N is an integer number ranging from 0 to 9.
The unit is “Volt”.

c. Bypass AC source voltage of R/S/T 3 phases : PPP.P/PPP.P/PPP.P
P is an integer number ranging from 0 to 9.
The unit is “Volt”.

d. O/P voltage of R/S/T 3 phases : QQQ.Q/QQQ.Q/QQQ.Q
Q is an integer number ranging from 0 to 9.
The unit is “Volt”.

e. Load percentage of R/S/T 3 phases : SSS.S/SSS.S/SSS.S
S is an integer number ranging from 0 to 9.
The unit is “Percentage”.

Example: Computer : G3<cr>
UPS :!222.0/222.0/222.0 221.0/221.0/221.0 220.0/220.0/220.0 014.0/015.0/014.0<cr>

Means : I/P voltage R phase is 222V , S phase is 222V , T phase is 222V.
Bypass AC voltage source R phase is 221V , S phase is 221V , T phase is 221V.
I/P voltage R phase is 220V , S phase is 220V , T phase is 220V.
Loading of R phase is 14 % , S phase is 15% , T phase is 14% ..

4. UPS Information Command:

Computer : I<cr>
UPS : !Company_Name UPS_Model Version<cr>

This function makes UPS respond with the basic information about UPS. This includes UPS manufacture’s name , UPS model name and UPS firmware version. The length of every field is listed as below:

Company_Name : 15 characters (bytes).Fill in with space characters if data cannot complete the field length .
UPS_Model : 10 characters(bytes), Fill in with space characters if data cannot complete the field length .
Version : 10 characters(bytes), Fill in with space characters if data cannot complete the field length .

There should be a space character between every field for data separation.

Example: Computer : I<cr>
UPS : !MegaTec^^^^^^^^ M1000K^^^^ V001203.12<cr>

Means : Company_Name: MegaTec^^^^^^^^
UPS_Model : M1000K^^^^
Version : V001203.12
”^’ means a space character.

5. UPS Rating Information:

Computer : GF<cr>
UPS : !Rect_Volt CCC Bpss_Volt FFF O/P_Volt QQQ SSS Power_Rating <cr>

This function makes UPS respond with rating value of UPS.

There should be a space character between every field for data separation.
The UPS response contains the following information fileds.

a. Rectifier Voltage of Phase to Neutral and Phase to Phase (Rect_Volt) :
14 characters(bytes).
Fill in with space characters if data cannot complete the field length .
For example : 220V 3P3W, 220V/380V 3P4W

b. Rectifier Frequency : CCC

c. Bypass Source Voltage of Phase to Neutral and Phase to Phase (Bpass_Volt) :
14 characters(bytes).
Fill in with space characters if data cannot complete the field length .
For example : 220V 3P3W, 220V/380V 3P4W

d. Bypass Source Frequency : FFF

e. O/P Voltage of Phase to Neutral and Phase to Phase (O/P_Volt) :
14 characters(bytes).
Fill in with space characters if data cannot complete the field length .
For example : 220V 3P3W, 220V/380V 3P4W

f. O/P Frequency : QQQ

g. Battery Voltage: SSS

h. Power_Rating :
10 characters(bytes),
Fill in with space characters if data cannot complete the field length .

Example: Computer : GF<cr>
UPS : !220V/380V^3P4W 060 220V/380V^3P4W 061 220V/3P3W^^^^^ 060 396 150KVA^^^^<cr>

Means : UPS Id: 01
Rectifier Voltage of Phase to Neutral and Phase to Phase: 220V/380V^3P4W .
Rectifier Frequency : 60Hz
Bypass Source Voltage of Phase to Neutral and Phase to Phase: 220V/380V^3P4W
Bypass Source Frequency : 61Hz
O/P Voltage of Phase to Neutral and Phase to Phase: 220V/3P3W^^^^^
O/P Frequency : 60Hz
Battery Voltage : 396Vdc
Power_Rating : 150KVA^^^^
”^’ means a space character

(The document stated below is Megatec Protocol. We suggest integrating Megatec Protocol into MegaTec Extended Communication Protocol for complete UPS safeguarding and control.)

7. Test for 10 seconds:

Computer : T<cr>
UPS : Test for 10 seconds and return to main power .

UPS will return to main power immediately if battery low occurs during testing.

8.Test until battery low :

Computer : TL<cr>
UPS : Test until battery low and return to main power.

9.Test for specified time period :

Computer : T<n><cr>
UPS : Test for <n> minutes.

a. UPS will return to main power immediately if battery low occurs during testing.
b. <n> is a number ranging from 01 to 99.

10. Turn On/Off beep -- Toggle the UPS beeper :

Computer : Q<cr>

When main power fails, UPS will generate a warning beep to inform the network manager. The net work manager can toggle the warning beep by sending this command .

11. Shutdown Command :

Computer : S<n><cr>
UPS : Shut UPS output off in <n> minutes.

a. The UPS output will be turned off in <n> minutes, even if main power is present .
b. If battery low occurs during <n> minutes, the output will be turned off immediately.
c. After UPS shutdown, the controller of UPS will keep monitoring main power . If main power restores, UPS will wait for 10 seconds and connect to main power to output.
d. <n> is a number ranging from .2, .3, ..., 01, 02, ..., up to 10.

For example : S.3<cr> --- shut output off in (.3) minutes

12. Shutdown and Restore Command :

Computer : S<n>R<m><cr>
UPS : **Shut UPS output off in <n> minutes, and wait for <m> minutes then turn on UPS output again.**

a. The shutdown sequence is the same as the previous command. When the <m> minutes times is out, if main power does not restore, UPS will wait until main power restores.
b. If UPS is in shutdown waiting state, "C" command can cancel the shutdown procedures .
c. If UPS is in restore waiting state, "C" command can turn on UPS output , but UPS must be hold off at least 10 seconds. (if main power is present.)
d. <n> is a number ranging from .2, .3, ..., 01, 02, ..., up to 10.
e. <m> is a number ranging from 0001 to 9999.

13. Cancel Shutdown Command :

Computer : C<cr>
UPS : Cancel the SN<n><cr> and SN<n>R<m><cr> command.

a. If UPS is in shut down waiting state, the shutdown command will be cancelled.
b. If UPS is in restore waiting state, the UPS output will be turned on, but UPS must be hold off at least 10 seconds. (if main power is present)

14. Cancel Test Command :

Computer : CT<cr>
UPS : Cancel all test activities and connect to main power to output immediately.

15. UPS Rating Information:

Computer : F<cr>
UPS : #MMM.M QQQ SS.SS RR.R<cr>

This function makes the UPS response the rating value of UPS.
There should be a space character between every field for separation. The UPS's response contains the following information fields:

a. Rating Voltage : MMM.M
b. Rating Current : QQQ
c. Battery Voltage : SS.SS or SSS.S
d. Frequency : RR.R

16. Status Inquiry:

Computer : Q1<cr>
UPS : UPS status data stream, such as
(MMM.M NNN.N PPP.P QQQ RR.R S.SS TT.T b7b6b5b4b3b2b1b0<cr>

UPS status data stream :
There should be a space character between every field for data separation. The meaning of each field is list as follows:

a. Start byte : (

b.I/P voltage : MMM.M
M is an integer number ranging from 0 to 9.
The unit is " Volt".

c.I/P fault voltage : NNN.N
N is an integer number ranging from 0 to 9.
The unit is Volt.

** For OFF LINE UPS**

Its purpose is to identify a short duration voltage glitch that causes OFF-line UPS to go to Inverter mode. When this occurs, input voltage will appear normal at query prior to glitch and will still appear normal at next query.
The I/P fault voltage will hold glitch voltage till next query. After query, the I/P fault voltage will be as same as I/P voltage until next glitch occurs.

** For ON- LINE UPS**

Its purpose is to identify a short duration main power failure which causes ON- line UPS to go to battery mode. When this occurs, input voltage will appear normal at query prior to fail and will still appear normal at next query.
The I/P fault voltage will hold main power failure voltage till next query. After query, the I/P voltage will be same as I/P voltage until next main power failure occurs.

d.O/P voltage : PPP.P
P is an integer number ranging from 0 to 9.
The unit is “Volt”.

e.O/P current : QQQ
QQQ is a percent of maximum current, not an absolute value.

f.I/P frequency : RR.R
R is an integer number ranging from 0 to 9.
The unit is “ Hz”.

g.Battery voltage : SS.S or S.SS
S is an integer number ranging from 0 to 9.
For on-line units battery voltage/cell is provided in the form S.SS .
For standby units actual battery voltage is provided in the form SS.S .
UPS type in UPS status will determine which reading was obtained.

h.Temperature : TT.T
T is an integer number ranging form 0 to 9.
The unit is “degree of centigrade”.

i.UPS Status : <U>
<U> is one byte of binary information such as
<b7b6b5b4b3b2b1b0>.
“ b**N**” is an ASCII character ‘0’ or ‘1’.

.

UPS status :

Bit	Description
7	1 : Utility Fail (Immediate)
6	1 : Battery Low
5	1 : Bypass/Boost or Buck Active
4	1 : UPS Failed
3	0 : UPS Type is Online (1 is Standby)
2	1 : Test in Progress
1	1 : Shutdown Active
0	1 : Beeper On

j.Stop Byte : <cr>

Example: Computer : Q1<cr>
UPS :
(208.4 140.0 208.4 034 59.9 2.05 35.0 00110000<cr>

Means : I/P voltage is 208.4V.
I/P fault voltage is 140.0V.
O/P voltage is 208.4V.
O/P current is 34 %.
I/P frequency is 59.9 HZ.
Battery voltage is 2.05V.
Temperature is 35.0 degrees centigrade.
UPS type is on-line , UPS failed. Bypass active , and shutdown not active.

D. COMMAND SUMMARY:

ITEM	COMMAND	DESCRIPTION
1	G0	Scan UPS
2	G1	UPS real time data
3	G2	UPS status inquiry
4	G3	UPS real time data for 3 phase
6	GF	UPS Rating Information
7	Q1	Status Inquiry
8	T	10 Seconds Test
9	TL	Test until Battery Low
10	T<n>	Test for Specified Time Period
11	Q	Turn On/Off beep
12	S<n>	Shut Down Command
13	S<n>R<m>	Shut Down and Restore Command
14	C	Cancel Shut Down Command
15	CT	Cancel Test Command
16	I	UPS Information Command
17	F	UPS Rating Information