ALPHA OUTBACK ENERGY

Continuity Plus

Communication Protocol

VERSION: 2.16

CHECKED BY: Robin/Sam Wei PREPARED

BY: Charly

DATE: 08.02.2018

Item	DATA	DESCRIPTION	MODIFY BY
8	2018.08.02	Added Q4 command for Alarm Inquiry on page 11	Sam Wei
7	2018.03.14	Added BL command for Battery Live on page 10	Sam Wei
6	2017.12.14	Added At command for Autonomy Time on page 10	Sam Wei
5	2016.10.21	Q5 Description Error. 1. Vb, Vbc unit should be 0.01V on Page5 to Page6.	Robin
4	2016.9.26	1. Q1 Command : I/P fault voltage → Reversed 2. Q1's Battery voltage become Battery capacity. 3. #MMM.M QQQ SS.SS RR.R<cr> change to #MMM.M QQQ SSS.S RR.R<cr> 4. Q1 Flag : Detail description of Shutdown Active Flag.	Robin.
3	2015.12.01	Added Q5 Command on page 5 to page 6	Sam Wei
2	2010.12.30	Modify Shutdown Command item on page 7	Sam Wei/Robin/Charly

COMMUNICATION PROTOCOL

A. General:

This document specifies the RS232C communication protocol of the Advance-Intelligent UPS. The protocol provided the following features :

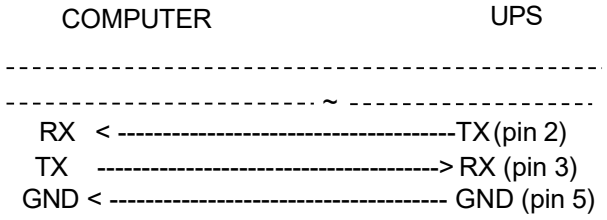
1. Monitor charger status.
2. Monitor battery status and condition.
3. Monitor the utility status.
4. Provide the power switch function for computer to turn on and off the utility on schedule for power saving.

Computer will control information exchange by a query followed by <cr> .UPS will respond with information followed by a <cr> or action.

B. Hardware:

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

CABLING :



(9 pins female D-type connector)

C. COMMUNICATION PROTOCOL:

1 Status Inquiry:

Computer: Q 1 <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 followed:

a. Start byte: (
b. I/P voltage: MMM.M
M is and integer number ranging from 0 to 9. The unit is Volt.
c. I/P fault voltage: NNN.N **(Reversed. Please don't use)** N is and integer number ranging from 0 to 9. The unit is Volt.

c.1 ** For OFF-LINE UPS**

Its purpose is to identify a short duration voltage glitch which
cause OFF line UPS to go to Inverter mode. If 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 same as I/P voltage until next glitch occurs.

c.2 ** For ON-LINE UPS**

Itspurposeistoidentify:ashortdurationutilityfailwhichcause
ON line UPS to go to battery mode. If 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 utility fail voltage till next query. After query, the I/P voltage will be same as I/P voltage until next utility fail occurs.

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

e. O/P load percentage: QQQ
QQQ is a load percentage.

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

g. Battery Capacity Parameter: SS.S or S.SS
S is an integer number ranging from 0 to 9.

For **on-line** units battery capacity parameter is provided in the form S.SS.

For **off-line** units battery capacity parameter is provided in the form SS.S.

UPS type in UPS status will determine which reading was obtained.

For Software: How to Calculation battery capacity?

Step 1: calculate Battery Capacity parameter On-line
Battery Capacity parameter = S.SS Off-line
Battery Capacity parameter = SS.S / [(F command's Battery voltage) /12].
Step 2: Please follow the Mapping Table A and B to get battery capacity from Battery Capacity parameter.

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 <b7b6b5b4b3b2blbO>.
Where bn is a ASCII character '0' or' 1 '.

UPS status :

Bit	Description
7	1 : Utility Fail (Immediate)
6	1 : Battery Low
5	1 : Bypass / 0 : OFF **(on-line)**
	1 : Boost or Buck Active / 0 : Normal **(off-line)**
4	1 : Battery abnormal
3	1 : UPS Type is off-line **("1" is off-line, "0" is On-line)**
2	1 : Test in Progress
1	1 : Shutdown Active
0	1 : Beeper On

Detail description of the Shutdown Active Flag:
Shutdown Active flag (bit 1) should be active/enabled only at shutdown process. It means: flag will enable when UPS is counting for shutting down, after that it should be disabled.

j. Stop Byte: <cr>

Example: Computer: Q 1 <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 load percentage is 34 %.
I/P frequency is 59.9 HZ.
Battery capacity parameter is 2.05.
Temperature is 35.0 degrees of centigrade.
UPS type is on-line, Battery abnormal. Bypass active, and shutdown not active.

2 Alarm Inquiry:

PC → UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	Q4	<cr>

UPS → PC

Size (byte)	1	8	1
Field Definition	Head	Bit7~0	End
ASCII	(	00000000	<cr>

Bit7: 1 → Inverter on
0 → Inverter off

Bit6: 1 → UPS alarm
0 → UPS no alarm

Bit5~0: Reversed

3 Q5(0x0d): Extra power parameters Information

PC→ UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	Q5	(0x0d)

UPS → PC

Size (byte)	1	2	2	2	2	2	2	2	2	2	2	1
Field Definition	Head	fout	Rev	Rev	Vb (Each)	Vbc (Each)	InvW	ErCode	O_Cur	Rev	Rev	End
ASCII	(	Binary Unit:0.1	Binary Unit:N/A	Binary Unit:N/A	Binary Unit:0.01	Binary Unit:0.01	Binary Unit:1	Binary Unit:N/A	Binary Unit:0.1	Binary Unit:N/A	Binary Unit:N/A	(0x0d)

Note:

column	Explanation	Unit
Fout	UPS output frequency	0.1 Hz
Vb	Battery voltage per one battery	0.01 V
Vbc	UPS of Battery Cut per one battery	0.01 V
InvW	Watt of UPS output	1 W
ErCode	Error Code of UPS	N/A
O_Cur	Load Current of UPS	0.1 A

Example:
Computer: Q 5 <cr>
UPS: (0258 0000 0000 04B0 03E8 07D0 000C 000A 0000 0000 <cr>

Means: Fout is 60.0V.
Vb is 12.00V.
Battery Cut per one battery is 10.00V.
Watt is 2000W.
Error Code is Er12.
Load Curren is 1.0A.

4 Autonomy

Time PC → UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	At	<cr>

UPS → PC

Size (byte)	1	2	2	1
Field Definition	Head	High word	Low word	End
Data	'('	0x0000 Unit:65536 s	0x0000 Unit:1 s	<cr>

Autonomy Time = High word + Low word
Ex. Computer: At<cr>
UPS: (0001 0101 0x0d

Means: 0x010101 = 65793s = 18:16:33 (hh:mm:ss)

5 Battery Live

PC → UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	BL	<cr>

UPS → PC

Size (byte)	1	2	2	1
Field Definition	Head	High word	Low word	End
Data	'!'	0x0000	0x0000	<cr>

Battery Live = High word + Low word
Ex. Computer: BL<cr>
UPS: ! 0001 5630 0x0d

Means: 0x015630 = 87600 hours = 10 years

6 UPS Information Command:

Computer: I <cr>
UPS: #Company_ Name UPS_Model Version<cr>

This function will make the UPS respond with the basic information about the company who manufacture the UPS, the model name of the UPS and the version number of the UPS firmware. The length of every field is listed as follows:

Company-Name: 15 characters, leave space if less than 15 characters UPS
Model: 10 characters, leave space if less than 10 characters
Version: 10 characters, leave space if less than 10 characters

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

7 UPS Rating Information:

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

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

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

8 Self-test result:

PC → UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	TR	<cr>

UPS → PC

Size (byte)	1	4	1
Field Definition	Head	State	End
ASCII	#	RRRR	<cr>

This function makes the UPS answer the result of self-test. The UPS's response stands on the results of self-test. And the result just only two that is ok and fail.

a. OK: The basis of result is OK, UPS response two 'space' and 'O', 'K'.
b. Fail: The basis of result is failure, UPS response 'f', 'a', 'i', 'l'.

9 Test for 10 seconds:

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

If battery low occur during testing, UPS will return to utility immediately.

10 Test until battery low:

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

11 Test for specified time period :

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

a. During testing, UPS returns to utility immediately, if battery low occur.
b. <n> is a number ranging from 01 to 99.

12 Turn On/Off beep --Toggle the UPS beeper : (Default : beep on)

Computer : Q<cr>

a. OFF-line UPS :

UPS alarm can be turned on or turned off by sending this command if AC power failed and battery energy is higher than low battery level.

b. On-line UPS:

UPS alarm can be turned on or turned off by sending this command if UPS occurred a alarm condition.

13 Shutdown Command :

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

a. The UPS output will be off after <n> minutes, even if the utility power is present or not. After then, if Utility power was removed, UPS will completely shutdown.
b. The UPS will be auto restart if UPS was completely shutdown and then awaked by utility.
c. <n> is a number ranging form .2, .3. ..., 01,02, ..., up to 10.

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

14 Shutdown and Restore Command :

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

a. The shutdown sequence is the same as the previous command.
b. If UPS is in restore waiting state:
   b.1 The UPS will be completely shutdown if the utility was removed and battery low occurred. After then, UPS will be auto restart if the utility restore.
c. If the <m> minute is time out and utility is present but abnormal
   c.1 The UPS will wait to restart until utility back to normal.
   c.2 The UPS will be completely shutdown if the utility was removed.
   c.3 After step c.2, the UPS will be auto restart once utility restore.
d. <n> is a number ranging form .2, .3, 01, 02. ..., up to 10.
e. <m> is a number ranging form 0001 to 9999.

15 Cancel Shutdown Command :

Computer: C<cr>
UPS: Cancel the S<n><cr> and S<n>R<m><cr> command Turn on UPS from standby mode.

a. If UPS is in shutdown waiting state (still in countdown situation), the shut down command will be cancelled.
b. The UPS will be turn on except for UPS occurred error or UPS is completely off.

16 Cancel Test Command :

Computer: CT <cr>
UPS: Cancelalltestactivityandbacktopreviouslycondition immediately.

17 Outlet functions group A parameters setting command

Computer:

Field Size (Byte)	2	4	4	4	2	1	1	1	1	1
Field Definition	Head	Timer1	Timer2	Timer3	Capacity	Sw1	Sw2	Sw3	Sw4	Ending Character
ASCII	PA	0000	0000	0000	50	0	0	0	0	(0x0d)

UPS: Setting parameters for programmable outlet group A

18 Outlet functions group B parameters setting

Computer:

Field Size (Byte)	2	4	4	4	2	1	1	1	1	1
Field Definition	Head	Timer1	Timer2	Timer3	Capacity	Sw1	Sw2	Sw3	Sw4	Ending Character
ASCII	PB	0000	0000	0000	50	0	0	0	0	(0x0d)

UPS: Setting parameters for programmable outlet group B

a. Timer1/Timer2/Timer3：
   Unit: Second
   Default：0Sec
b. Battery Capacity：
   Unit: %
   Default：50%
c. Sw1/Sw2/Sw3/Sw4：
   0 → Disable
   1 → Enable Default：Disable

19 Outlet A manual switch command

Computer:

Field Size (Byte)	2	1	1
Field Definition	Head	Switch	Ending Character
ASCII	pa	0	<cr>

UPS: Switch outlet A immediately

0 → Turn Off
1 → Turn On Default：Turn Off

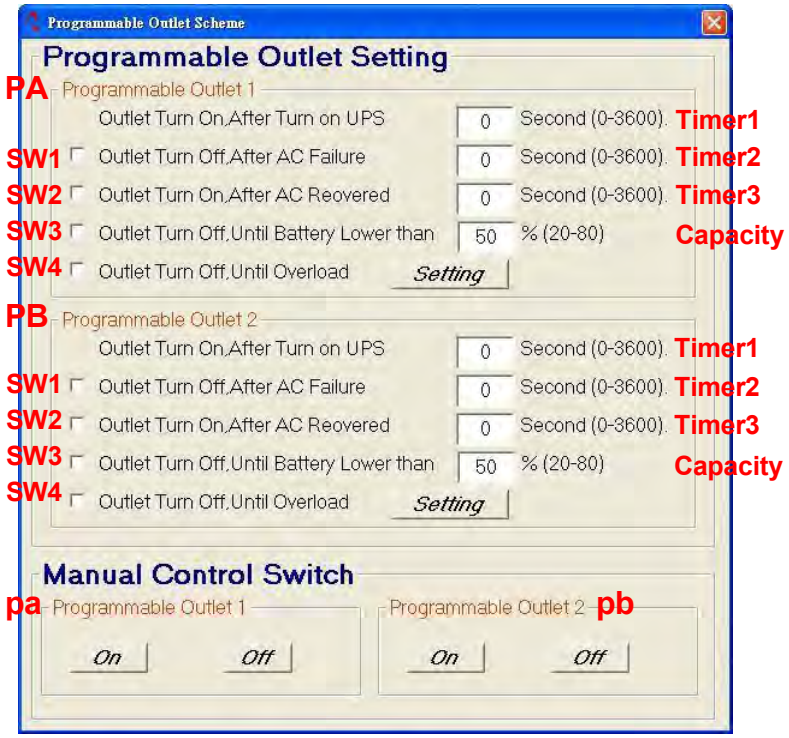
20 Outlet B manual switch command

Computer:

Field Size (Byte)	2	1	1
Field Definition	Head	Switch	Ending Character
ASCII	pb	0	<cr>

UPS: Switch outlet B immediately
0 → Turn Off
1 → Turn On
Default：Turn Off

Example :



21 Ground fault (site wiring fault) function of switch command Computer:

Field Size (Byte)	2	1	1
Field Definition	Head	Switch	Ending Character
ASCII	Gf	0	<cr>

UPS: Ground fault function is used to detect the voltage between Ground and Neutral

0 → Enable Ground fault function
1 → Disable Ground fault function

22 EPO status of Switch command

Computer:

Field Size (Byte)	3	1	1
Field Definition	Head	Switch	Ending Character
ASCII	EPO	0	<cr>

UPS: Emergency power off switch
0 → NO, Emergency power off when switch is closed
1 → NC, Emergency power off when switch is opened

D. COMMAND SUMMARY:

ITEM	COMMAND	DESCRIPTION
1	QI	Status Inquiry
2	Q4	Alarm Inquiry
3	Q5	Extra power parameters Information
4	At	Autonomy Time
5	BL	Battery Live
6	I	UPS Information Command
7	F	UPS Rating Information
8	TR	Self-test Result
9	T	10 Seconds Test
10	TL	Test until Battery Low
11	T<n>	Test for Specified Time Period
12	Q	Turn On/Off beep
13	S<n>	Shutdown Command
14	S<n>R<m>	Shutdown and Restore Command
15	C	Cancel Shutdown Command / Turn on UPS
16	CT	Cancel Test Command
17	PA	Outlet functions group A parameters setting command
18	PB	Outlet functions group B parameters setting command
19	pa	Outlet A manual switch command
20	pb	Outlet B manual switch command
21	Gf	Ground fault (site wiring fault) function of switch command
22	EPO	EPO status of switch command

Table A: Online Battery Capacity mapping table

On-line Battery Capacity parameter	Battery Capacity
2.22	100%
2.21	90%
2.20	88%
2.19	87%
2.18	85%
2.17	83%
2.16	82%
2.15	80%
2.14	78%
2.13	77%
2.12	75%
2.11	73%
2.10	72%
2.09	70%
2.08	68%
2.07	65%
2.06	65%
2.05	62%
2.04	62%
2.03	58%
2.02	58%
2.01	55%
2.00	55%
1.99	53%
1.98	52%
1.97	50%
1.96	48%
1.95	47%
1.94	45%
1.93	43%
1.92	42%
1.91	40%
1.90	38%
1.89	37%
1.88	35%
1.87	33%
1.86	32%
1.85	30%

On-line Battery Capacity parameter	Battery Capacity
1.84	28%
1.83	27%
1.82	25%
1.81	23%
1.80	22%
1.79	20%
1.78	18%
1.77	17%
1.76	15%
1.75	13%
1.74	12%
1.73	10%
1.72	8%
1.71	7%
1.70	5%
1.69	3%
1.68	2%
1.67	0%

Table B: Offline Battery Capacity mapping table

Off-line Battery Capacity parameter	Battery Capacity
13.5	100%
13.3	90%
13.2	88%
13.1	86%
13	83%
12.9	80%
12.8	77%
12.7	74%
12.6	72%
12.5	69%
12.4	66%
12.3	63%
12.2	61%
12.1	58%
12	55%
11.9	52%
11.8	49%
11.7	47%
11.6	44%
11.5	41%
11.4	38%
11.3	36%
11.2	33%
11.1	30%
11	27%
10.9	24%
10.8	22%
10.7	19%
10.6	16%
10.5	13%
10.4	11%
10.3	8%
10.2	5%
10.1	2%
10	0%

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