UPS - Protocol
A. General:

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

i. Monitor charger status.
ii. Monitor battery status and condition.
iii. Monitor the utility status.
iv. 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: 2400bps
- DATA LENGTH: 8 bit
- STOP BIT: 1 bit
- PARITY: NONE

RX ←----------------------- TX (pin 9)
TX ------------------> RX (pin 6)
GND ←--------------------- GND (pin 7)
(9 pins female D-type connector)
C. Communication protocol:

1. 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 followed:

   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 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 until next glitch occurs.

   ** For ON LINE UPS **
   Its purpose is to identify a short duration utility fail
   Which cause 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 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 actual battery voltage is provided in the form SS.S .
   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 from 0 to 9.
   The unit is degree of centigrade.

i. UPS Status : <U>
   <U> is one byte of binary information such as
   <b7b6b5b4b3b2b1b0>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1 : Utility Fail (Immediate)</td>
</tr>
<tr>
<td>6</td>
<td>1 : Battery Low</td>
</tr>
<tr>
<td>5</td>
<td>1 : Bypass/Boost Or Buck Active</td>
</tr>
<tr>
<td></td>
<td>2 : High Efficiency</td>
</tr>
<tr>
<td>4</td>
<td>1 : Ups Failed</td>
</tr>
<tr>
<td></td>
<td>2 : Overload</td>
</tr>
<tr>
<td>3</td>
<td>1 : UPS Type In Progress (0 is Online / 1 is Offline)</td>
</tr>
<tr>
<td></td>
<td>2 : Battery Fail (Online UPS)</td>
</tr>
<tr>
<td></td>
<td>3 : Battery Fail (Offline UPS)</td>
</tr>
<tr>
<td>2</td>
<td>1 : Test In Progress</td>
</tr>
<tr>
<td>1</td>
<td>1 : Shutdown Active</td>
</tr>
<tr>
<td>0</td>
<td>1 : Beeper ON</td>
</tr>
</tbody>
</table>
j. Stop Byte  :

Example : Computer: Q1

UPS :

(208.4 140.0 208.4 034 59.9 2.05 35.0 00110000

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 59.9HZ.
Battery voltage is 2.05V.
Temperature is 35.0 degrees of centigrade.
UPS type is on-line ,UPS failed. Bypass
Active, and shutdown not active.
2. Status Inquiry : Computer: \textbf{DQ1}<cr>

UPS : The same with Q1 command. The only difference is the CCC (Battery Level)
(MMM.M NNN.N PPP.P QQQ RR.R CCCC 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:

Battery Level : CCCC
C is an integer number ranging from 0 to 9.
CCCC is a percent of maximum battery capacity.

UPS :
(208.4 140.0 208.4 034 59.9 0100 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 59.9HZ.
\textbf{Battery Level is 100%}
Temperature is 35.0 degrees of centigrade.
UPS type is on-line ,UPS failed. Bypass
Active, and shutdown not active.
3. 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.

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

5. 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.

6. Turn On/Off beep – Toggle the UPS beeper:
   Computer : Q<cr>
   When the AC power failed, UPS will generate a warning beep to inform the manager.
   Manager could toggle the warning beep by sending this command.

7. Shutdown Command:
   Computer : S<n><cr>
   UPS : Shut UPS output off in <n> minutes.
   a. The UPS output will be off in <n> minutes, even if the utility power is present.
   b. If the battery low occurs before <n> minutes, the output is turned off immediately.
   c. After UPS shutdown, the controller of UPS monitors the utility power. If the utility is recovered,
      the UPS will wait for 10 seconds and connect the utility 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
8. 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.
    The shutdown sequence is the same as the previous command.
    When the <m> minutes expired, the utility do not restore, the UPS will wait until utility restore.
    If UPS is in restore waiting state, the “C” command can let the shutdown procedure cancelled.
    If UPS is in restore waiting state, the “C” command can let the UPS output turned on, but UPS must be hold off at least 10 seconds.(if utility is present )
    <n> is a number ranging form .2,.3,…,01,02,…,up to 10.
    <m>is a number ranging form 0001 to 9999.

9. Cancel Shutdown Command:
   Computer  : C<cr>
   UPS       : Cancel the SN<n><cr> and SN<n>R<m><cr> command.
   a. If UPS is in shutdown waiting state, the shutdown command is cancelled.
   b. If UPS is in shutdown waiting state, the UPS output is turned on, but UPS must be hold off at least 10 seconds.(if utility is present)

10. Cancel Test Command:
    Computer   : CT<cr>
    UPS        : Cancel all test activity and connect the utility to output immediately.

11. 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.
12. 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. Rating Voltage :MMM.M
b. Rating Current :QQQ
c. Battery Voltage :SS.SS or SSS.S
d. Frequency :RR.R

13. Estimated battery remaining time command

Computer :Rt<cr>
UPS :#XXX<cr>

X is integer number ranging from 0 to 9.
The unit is mins.
example : 999mins

14. Multi-Outlets Condition Command

Computer :OI<cr>
UPS :#<XX>B1B2B3…Bi…Bx<cr>

<XX> : 01 to 99
ex: 02 => means 2 outlets
ex: 10 => means 10 outlets
Bi : i means the sequence of outlets. In this place, 0 is OFF and 1 is ON.
<For example>
#0210 ➔ There are two outlets. The condition of the first one is ON and the second is OFF.

15. Immediately switch the <XX>-outlet ON Command

Computer :O<XX>ON<cr>
Turn ON the <XX> outlet
<XX> : 01 to 99
<For example>
O01ON<cr> ➔ Turn outlet 1 ON
16. Immediately switch the <XX>-outlet OFF Command
   Computer : O<XX>OFF<cr>
   Turn OFF the <XX> outlet
   <XX>: 01 to 99
   <For example>
   O02OFF<cr> ➔ Turn outlet 2 OFF

17. Shutdown the XX-outlet Command (Condition : AC Fail)
   Computer : O<XX>S<NN><cr>
   ➔ Shutdown the <XX> Outlet in <NN> minutes
   <XX>:01 to 99
   <NN>:01 to 99
   <For example>
   O01S02<cr> ➔ Shutdown the outlet 1 after 2 minutes

18. Shutdown Outlet and Restore Command (Condition : Schedule)
   Computer : O<XX>S<NN>R<MMMMM><cr>
   Shutdown UPS <XX>-Outlet in <NN> minutes and waiting for <MMMMM> minutes then turn on <XX> outlet.
   <XX>:01 to 99
   <NN>:01 to 99
   <MMMMM>:00001 to 99999
   <For example>
   O02S02R00005<cr> ➔ Shutdown the outlet 2 after 2 minutes and automatically turn its ON after 5 minutes

19. Achieve both minimum battery capacity <AA> and waiting time <BBBB>, the ups auto supply its power
   Computer:   WX02<s>AA<s>BBBB<cr>
   <s>space char
   AA:Battery capacity % (default : 00)
   <s>space char
   BBBB:Waiting time seconds (default : 0030)
   UPS:   WX02A<cr>
   A:1 Success
   A: the other number : Fail
20. Get the ups minimum battery capacity and waiting time from point 19
   
   Computer: RX02 <cr>
   UPS: RX02AABBBB <cr>
      AA: Battery capacity (default: 00)
      BBBB: Waiting time seconds (default: 0030)

21. Output Power (w)
   
   Computer: Yop <cr>
   UPS: *XXXXX <cr>
   
   X is integer number ranging from 0 to 9.
   The unit is watt.
   Example: *00999

22. Output VA
   
   Computer: Yva <cr>
   UPS: *XXXXX <cr>
   
   X is integer number ranging from 0 to 9.

23. UPS unit power factor
   
   Computer: Yof <cr>
   UPS: *XXX <cr>

24. Green Mode
    
    Set Green Mode ON: G1
    Set Green Mode OFF: G0

25. UPS enter idle mode >> Turn OFF ups output power
    
    Computer: IDLE <cr>
    UPS: *R00 <cr> >> success
    UPS: * >> fail
26. UPS enter line mode from idle >> Turn ON ups output power
   Computer : WAKE <cr>
   UPS : *R00 <cr> >> success
   UPS : *R01 <cr> >> fail

27. UPS output voltage setting >> setup ups output voltage 100, 110, 120, 127, 208, 220, 230, or 240
   Computer : PMo100 <cr>
   Computer : PMo110 <cr>
   Computer : PMo120 <cr>
   Computer : PMo127 <cr>
   Computer : PMo208 <cr>
   Computer : PMo220 <cr>
   Computer : PMo230 <cr>
   Computer : PMo240 <cr>
   UPS : OK <cr> >> success
   UPS : NOK <cr> >> fail

28. UPS serial number and date : Read
   Computer : RX03 <cr>
   UPS : RX03AAAAAAAAAAABBBBBB<cr>
         AAAAAAAAAAAA : serial number >> 11 char
         BBBBBB : manufacturing date >> 6 char
         Ex : 2014/12/24 >> 141224

29. UPS serial number and date: Write
   Computer : WX03<cr>AAAAAAAAAAA<cr>BBBBBB<cr>
         <s> : space char
         AAAAAAAAAAAA : serial number : 11 char
         BBBBBB : manufacture date : 6 char
         Ex : 2014/12/24 >> 141224
   UPS : WX03A<cr>
         A:1 Success
         A: the other number : Fail
30. UPS return to factory default:
   Computer : WXSD <cr>
   Computer : PCMUPS <cr>
   UPS : Saty at idle mode

31. UPS external battery packages number : Read
   Computer : RX05 <cr>
   UPS : RX05AA<cr>
       AA: external battery number >> 2 characters
       Ex : RX0502 >> 2 external battery packages

32. UPS external battery packages number : Write
   Computer : WX05<s>XX<cr>
       <s> : space char
       XX: character : the number of packages
   UPS: WX05A<cr>
       A:1 Success
       A: the other number : Fail