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# RS232 Communications Protocol

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## 1. 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 \*\*\*

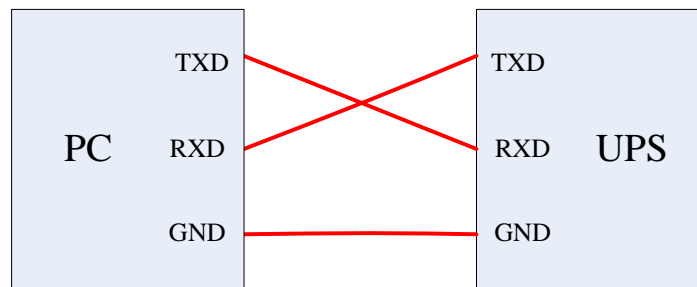
## 2. Hardware

### 2.1 Transmission mode

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

### 2.2 UPS RS232 Interface:

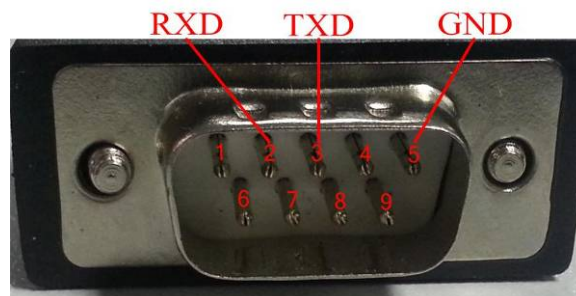
The connection rules of PC and UPS as follows:



Pic 1. Connection schematic

UPS RS\_232 interface:

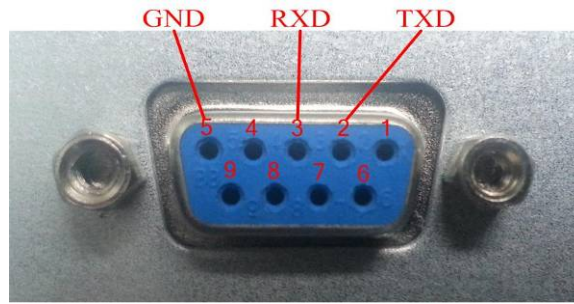
- 1) Male type pins definition of RS\_232 Port is shown in Pic 2.



Pic 2. Male type pins definition of RS\_232 Port

pin2--- RXD  
pin3--- TXD  
pin5--- GND

- 2) Female type holes definition of RS\_232 Port is shown in Pic 3.



Pic 3. Female type holes definition of RS\_232 Port

pin2--- TXD  
pin3--- RXD  
pin5 --- GND

### 3. Communication protocol

#### 3.1 UPS Information Command:

Computer : !<cr>

UPS: #Company 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:

Content	Byte number	Remark
Company	15	Fill in with space characters if data cannot complete the field length
UPS_Model	10	Fill in with space characters if data cannot complete the field length
Version	10	Fill in with space characters if data cannot complete the field length

#### 3.2 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".

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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.

### 3.3 UPS status inquiry 2

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>. “aN” is an ASCII character ‘0’ or ‘1’.

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’.

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’.

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

### 3.4 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”.

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Example:

Computer : G3<cr>

UPS : ! 222.0/222.0/222.0 221.0/221.0/221.0 220.0/222.0/222.0 014.0/015.0/014.0<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% .

### 3.5 UPS Rating Information 2

Computer: GF<cr>

UPS : !Rect\_Volt CCC Bpass\_Volt FFF O/P\_Volt QQQ SSS Power\_Rating <cr>

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

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

### 3.6 UPS Rating Information 1

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

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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

### 3.7 UPS Status Inquiry 1

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>.

" bN" is an ASCII character '0' or '1'.

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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.



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#### 4. Command summary

ITEM	COMMAND	Hex	DESCRIPTION	REMARKS
1	Q1	5131	Status Inquiry	
2	I	49	UPS Information	
3	F	46	UPS Rating Information 1	
4	G1	4731	UPS real time data	
5	G2	4732	UPS status 2 inquiry	
6	G3	4733	UPS real time data for 3 phase	
7	GF	4746	UPS Rating Information 2	