UPS communication protocol

Protocol:	GPSER	
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Version:	1.0 18/11/1999	Preliminary document
	1.1 20/04/2000	First official revision
	1.2 07/08/2000	Added D/S & D/C commands
	1.3 08/10/2001	Added Cod_err. ‘6’ Defined obligatory commands
	1.4 23/11/2006	Added R/E & R/K commands

- Introduction

The communication protocol is a half duplex protocol where the PC is the master and the UPS is the slave; only the PC can send to the UPS a request message : the UPS can only send back a response message.

- Default communication setting

The default communication setting is : **1200 baud, 8 bits, NO PARITY, 1 stop bit**

- Control characters

Stx = 02hex Start of Trasmission
Etx = 03hex End of Trasmission
Ack = 06hex Acknowledge
Nak = 15hex No Acknowledge
Src = 20hex÷FFhex Source address (for multi-point communication)
Dest = 20hex÷FFhex Destination address (for multi-point communication)
Chk / Chk / Chk / Chk = 16 bits checksum from Src to the last byte of Data
Crc / Crc / Crc / Crc = CRC or 16 bits checksum from Src to the last byte of Data

- Simbology

<< = Trasmission from PC to UPS (PC request)
>> = Trasmission from UPS to PC (UPS reply)

- Notes on data coding

Each datum byte consists of a high nibble (4 most significant bits with fixed value 0011) and of a low nibble containing the real datum.
Therefore in order to show a 8-bits number you need 2 bytes, whereas to show a 16-bits number you need 4 bytes.

Example: **5Ahex** becomes **35hex / 3Ahex**
1F3Chex becomes **31hex / 3Fhex / 33hex / 3Chex**

For a datum not available the correspondent field must be filled with characters 3Fhex.
For example if an UPS doesn't calculate the Battery Estimated Time, it must send the value "???".

- **Protocol format**

<< Stx / Src / Dest / Main_Cmd / Sub_Cmd / Lenght / Lenght / [Data] / Crc / Crc / Crc / Crc / Etx

>> Stx / Src / Dest / Main_Cmd / Sub_Cmd / Lenght / Lenght / [Data] / Crc / Crc / Crc / Crc / Etx

or if the request is not acknowledge:

>> Stx / Src / Dest / Nak / Cod_err / "0" / "0" / Crc / Crc / Crc / Crc / Etx

Cod_err: "0" =
"1" = **Main_Cmd** doesn't recognized
"2" = **Sub_Cmd** doesn't recognized
"3" = **Data Lenght** doesn't correct
"4" = **CRC** or **Checksum** doesn't correct
"5" = It's not possible to execute the command in this moment
"6" = Security PIN doesn't recognized

) “G”et / “I”dentification (obligatory)
<< Stx / Src / Dest / “G” / “I” / “0” / “0” / Chk / Chk / Chk / Chk / Etx
>> Stx / Src / Dest / “G” / “I” / “3” / “8” / [Data] / Chk / Chk / Chk / Chk / Etx

[Data]:
Char01÷Char16: Serial Number (Ascii characters from 20hex to 7Fhex)
Char17÷Char32: UPS Model (Ascii characters from 20hex to 7Fhex)
Char33÷Char44: UPS Software Version (Ascii characters from 20hex to 7Fhex)
Char45: Input/Output Configuration: “1” = Single-phase IN → Single-phase OUT
“2” = Single-phase IN → Tri-phase OUT
“3” = Tri-phase IN → Single-phase OUT
“4” = Tri-phase IN → Tri-phase OUT
Char46: UPS Type……: “1” = Line Interactive (Stand-by) with Step-Wave Output
“2” = Line Interactive (Stand-by) with Sinus-Wave Output
“3” = On Line
“4” = On Line and Line Interactive (Double Function)
Char47: Boost Configuration……..: “0” = No Boost
“1” = Boost
“2” = Double Boost
Char48: Buck Configuration……...: “0” = No Buck
“1” = Buck
“2” = Double Buck
Char49: Error Control……..: “0” = 16 bits checksum
“1” = CRC
Char50: Power Share Socket……..: “0” = No Power Share function
“1” = 1 Socket
Char51: Battery Benches…...…….: “1” = One Bench (0→+)
“2” = Two Benches (-←0→+)
Char52: Batteries Number for bench. If “0” then calculate the Batteries Number using the formula:
Nominal Battery Voltage (**G/N** command)/ 12V
Char53: Parallel system……..…..: “0”= Single UPS
“1”= Parallel UPS – Slave
“2”= Parallel UPS – Master
Char54: For future pourpose……..: “0”
Char55: For future pourpose……..: “0”
Char56: For future pourpose……..: “0”

) “G”et / “N”ominal value
<< Stx / Src / Dest / “G” / “N” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “G” / “N” / “1” / “6” / [Data] / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: Nominal Power in VA (very-high)
Char02: ‘’ ‘’ (high)
Char03: ‘’ ‘’ (medium-high)
Char04: ‘’ ‘’ (medium-low)
Char05: ‘’ ‘’ (low)
Char06: Nominal Power in Watt (very-high)
Char07: ‘’ ‘’ (high)
Char08: ‘’ ‘’ (medium-high)
Char09: ‘’ ‘’ (medium-low)
Char10: ‘’ ‘’ (low)
Char11: Nominal Battery Voltage in Volt (high)
Char12: ‘’ ‘’ ‘’ (medium)
Char13: ‘’ ‘’ ‘’ (low)
Char14: Nominal Battery Capacity in Ah (high)
Char15: ‘’ ‘’ ‘’ (medium)
Char16: ‘’ ‘’ ‘’ (low)
Char17: Nominal Output Voltage in Volt (high)
Char18: ‘’ ‘’ ‘’ (medium)
Char19: ‘’ ‘’ ‘’ (low)
Char20: Nominal Output Frequency in 0.1 Hz (high)
Char21: ‘’ ‘’ ‘’ (medium)
Char22: ‘’ ‘’ ‘’ (low)

) “R”equest / “S”tatus (obligatory)
<< Stx / Src / Dest / “R” / “S” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “R”/ “S” / Lenght / Lenght / [Data] / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: 4 Bits Status Flags (low nibble. High nibble is fixed to 0011bin)
Bit3: Output Powered [0=No 1=Yes]
Bit2: UPS Locked [0=No 1=Yes]
Bit1: Battery Working [0=No 1=Yes]
Bit0: Battery Low [0=No 1=Yes]
Char02: 4 Bits Status Flags (low nibble. High nibble is fixed to 0011bin)
Bit3: On Bypass [0=No 1=Yes]
Bit2: O.L./L.I. function [0=O.L. 1=L.I.]
Bit1: Boost Actived [0=No 1=Yes]
Bit0: Buck Active [0=No 1=Yes]
Char03: 4 Bits Status Flags (low nibble. High nibble is fixed to 0011bin)
Bit3: Bypass Bad [0=No 1=Yes]
Bit2: Battery Charging [0=No 1=Yes]
Bit1: Battery Charged [0=No 1=Yes]
Bit0: Replace Battery [0=No 1=Yes]
Char04: 4 Bits Status Flags (low nibble. High nibble is fixed to 0011bin)
Bit3: Shutdown Active [0=No 1=Yes]
Bit2: Shutdown Imminent [0=No 1=Yes]
Bit1: Test in progress [0=No 1=Yes]
Bit0: Beeper On [0=No 1=Yes]
Char05: 4 Bits Status Flags (low nibble. High nibble is fixed to 0011bin)
Bit3: UPS Failure [0=No 1=Yes]
Bit2: Alarm Overload [0=No 1=Yes]
Bit1: Alarm Temperature [0=No 1=Yes]
Bit0: [0=No 1=Yes]

Char06: Input Frequency in 0.1Hz (high)
Char07: ‘’ ‘’ (medium)
Char08: ‘’ ‘’ (low)
Char09: Input Voltage in Volts rms (high)
Char10: ‘’ ‘’ (medium)
Char11: ‘’ ‘’ (low)
Char12: Output Frequency in 0.1Hz (high)
Char13: ‘’ ‘’ (medium)
Char14: ‘’ ‘’ (low)
Char15: Output Voltage in Volts rms (high)
Char16: ‘’ ‘’ (medium)
Char17: ‘’ ‘’ (low)
Char18: Output Load in % (high)
Char19: ‘’ ‘’ (low)

Char20: Bypass Frequency in 0.1Hz (high)
Char21: ‘’ ‘’ (medium)
Char22: ‘’ ‘’ (low)
Char23: Bypass Voltage in Volts rms (high)
Char24: ‘’ ‘’ (medium)
Char25: ‘’ ‘’ (low)
Char26: Battery Voltage in 0.1Volts (high) (Total Voltage)
Char27: ‘’ ‘’ (medium-high)
Char28: ‘’ ‘’ (medium-low)
Char29: ‘’ ‘’ (low)
Char30: Battery Estimated Charge in % (high)
Char31: ‘’ ‘’ (low)
Char32: Battery Estimated Time in Minutes (high)
Char33: ‘’ ‘’ (medium)
Char34: ‘’ ‘’ (low)
Char35: System Temperature in °C (high)
Char36: ‘’ ‘’ (low)

Only for UPS with tri-phase input
Char37: Input Voltage 2 in Volts rms (high)
Char38: ‘’ ‘’ (medium)
Char39: ‘’ ‘’ (low)
Char40: Input Voltage 3 in Volts rms (high)
Char41: ‘’ ‘’ (medium)
Char42: ‘’ ‘’ (low)

Only for UPS with tri-phase output
Char43: Output Voltage 2 in Volts rms (high)
Char44: ‘’ ‘’ (medium)
Char45: ‘’ ‘’ (low)
Char46: Output Load 2 in % (high)
Char47: ‘’ ‘’ (low)
Char48: Bypass Voltage 2 in Volts rms (high)
Char49: ‘’ ‘’ (medium)
Char50: ‘’ ‘’ (low)
Char51: Output Voltage 3 in Volts rms (high)
Char52: ‘’ ‘’ (medium)
Char53: ‘’ ‘’ (low)
Char54: Output Load 3 in % (high)
Char55: ‘’ ‘’ (low)
Char56: Bypass Voltage 3 in Volts rms (high)
Char57: ‘’ ‘’ (medium)
Char58: ‘’ ‘’ (low)

) “R”equest / “Extended” (only for UPS with tri-phase output)
<< Stx / Src / Dest / “R” / “E” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “R” / “E” / “3” / “:” / [Data] / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: For future pourpose
Char02: ‘’ ‘’
Char03: ‘’ ‘’
Char04: ‘’ ‘’
Char05: ‘’ ‘’
Char06: ‘’ ‘’
Char07: ‘’ ‘’
Char08: ‘’ ‘’
Char09: ‘’ ‘’
Char10: ‘’ ‘’
Char11: ‘’ ‘’
Char12: ‘’ ‘’
Char13: ‘’ ‘’
Char14: ‘’ ‘’
Char15: ‘’ ‘’
Char16: ‘’ ‘’
Char17: Output Current 1 in 0.1A rms (high)
Char18: ‘’ ‘’ (medium high)
Char19: ‘’ ‘’ (medium low)
Char20: ‘’ ‘’ (low)
Char21: Output Current 2 in 0.1A rms (high)
Char22: ‘’ ‘’ (medium high)
Char23: ‘’ ‘’ (medium low)
Char24: ‘’ ‘’ (low)
Char25: Output Current 3 in 0.1A rms (high)
Char26: ‘’ ‘’ (medium high)
Char27: ‘’ ‘’ (medium low)
Char28: ‘’ ‘’ (low)
Char29: Output Power 1 in Watt (very-high)
Char30: ‘’ ‘’ (high)
Char31: ‘’ ‘’ (medium-high)
Char32: ‘’ ‘’ (medium-low)
Char33: ‘’ ‘’ (low)
Char34: Output Power 2 in Watt (very-high)
Char35: ‘’ ‘’ (high)
Char36: ‘’ ‘’ (medium-high)
Char37: ‘’ ‘’ (medium-low)
Char38: ‘’ ‘’ (low)
Char39: Output Power 3 in Watt (very-high)
Char40: ‘’ ‘’ (high)
Char41: ‘’ ‘’ (medium-high)
Char42: ‘’ ‘’ (medium-low)
Char43: ‘’ ‘’ (low)

Char44:	Output Power 1 in VA		(very-high)
Char45:	‘’	‘’	(high)
Char46:	‘’	‘’	(medium-high)
Char47:	‘’	‘’	(medium-low)
Char48:	‘’	‘’	(low)
Char49:	Output Power 2 in VA		(very-high)
Char50:	‘’	‘’	(high)
Char51:	‘’	‘’	(medium-high)
Char52:	‘’	‘’	(medium-low)
Char53:	‘’	‘’	(low)
Char54:	Output Power 3 in VA		(very-high)
Char55:	‘’	‘’	(high)
Char56:	‘’	‘’	(medium-high)
Char57:	‘’	‘’	(medium-low)
Char58:	‘’	‘’	(low)

) “R”equest / pea“K” (only for UPS with tri-phase output)
<< Stx / Src / Dest / “R” / “K” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “R” / “K” / “3” / “:” / [Data] / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: For future pourpose
Char02: ‘’ ‘’
Char03: ‘’ ‘’
Char04: ‘’ ‘’
Char05: Input Voltage 1 in V peak (high)
Char06: ‘’ ‘’ (medium)
Char07: ‘’ ‘’ (low)
Char08: Input Voltage 2 in V peak (high)
Char09: ‘’ ‘’ (medium)
Char10: ‘’ ‘’ (low)
Char11: Input Voltage 3 in V peak (high)
Char12: ‘’ ‘’ (medium)
Char13: ‘’ ‘’ (low)
Char14: Reserved (high)
Char15 ‘’ (medium high)
Char16: ‘’ (medium low)
Char17: ‘’ (low)
Char18: Reserved (high)
Char19: ‘’ (medium high)
Char20: ‘’ (medium low)
Char21: ‘’ (low)
Char22: Reserved (high)
Char23: ‘’ (medium high)
Char24: ‘’ (medium low)
Char25: ‘’ (low)
Char26: Output Voltage 1 in V peak (high)
Char27: ‘’ ‘’ (medium)
Char28: ‘’ ‘’ (low)
Char29: Output Voltage 2 in V peak (high)
Char30: ‘’ ‘’ (medium)
Char31: ‘’ ‘’ (low)
Char32: Output Voltage 3 in V peak (high)
Char33: ‘’ ‘’ (medium)
Char34: ‘’ ‘’ (low)
Char35: Output Current 1 in 0.1A peak (high)
Char36: ‘’ ‘’ (medium high)
Char37: ‘’ ‘’ (medium low)
Char38: ‘’ ‘’ (low)
Char39: Output Current 2 in 0.1A peak (high)
Char40: ‘’ ‘’ (medium high)
Char41: ‘’ ‘’ (medium low)
Char42: ‘’ ‘’ (low)
Char43: Output Current 3 in 0.1A peak (high)
Char44: ‘’ ‘’ (medium high)
Char45: ‘’ ‘’ (medium low)
Char46: ‘’ ‘’ (low)

Char47: Power Temperature 1 in °C (high)
Char48: ‘’ ‘’ (low)
Char49: Power Temperature 2 in °C (high)
Char50: ‘’ ‘’ (low)
Char51: Power Temperature 3 in °C (high)
Char52: ‘’ ‘’ (low)
Char53: Battery Charger Temperature in °C (high)
Char54: ‘’ ‘’ ‘’ (low)
Char55: Reserved (high)
Char56: ‘’ (low)
Char57: External Battery Temperature in °C (high)
Char58: ‘’ ‘’ ‘’ (low)

) “C”ommand / “S”hutdown (obligatory)
<< Stx / Src / Dest / “C” / “S” / “0” / “4” / [Data] / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “C” / “S” / “0” / “0” / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: Shutdown Delay Time in seconds (high)
Char02: ‘’ ‘’ ‘’ (medium-high)
Char03: ‘’ ‘’ ‘’ (medium-low)
Char04: ‘’ ‘’ ‘’ (low)

If the Shutdown Delay Time is “0000” the UPS turn off immediately

) “C”ommand / shutdown and “R”estore (obligatory)
<< Stx / Src / Dest / “C” / “R” / “0” / “8” / [Data] / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “C” / “R” / “0” / “0” / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: Shutdown Delay Time in seconds (high)
Char02: ‘’ ‘’ ‘’ (medium-high)
Char03: ‘’ ‘’ ‘’ (medium-low)
Char04: ‘’ ‘’ ‘’ (low)
Char05: Restore Delay Time in minutes (high)
Char06: ‘’ ‘’ ‘’ (medium-high)
Char07: ‘’ ‘’ ‘’ (medium-low)
Char08: ‘’ ‘’ ‘’ (low)

If the Shutdown Delay Time is “0000” the UPS turn off immediately.
If the Restore Delay Time is “0000” the UPS turn on after 10 seconds.
The Restore Count start when the UPS turn off.

) “C”ommand / “D”elete (obligatory)
<< Stx / Src / Dest / “C” / “D” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “C” / “D” / “0” / “0” / Crc / Crc / Crc / Crc / Etx

If UPS is in shutdown waiting state, the shutdown command is cancelled
If UPS is in restore waiting state, the restore command is cancelled

) “T”est / “B”attery (obligatory)
<< Stx / Src / Dest / “T” / “B” / “0” / “3” / [Data] / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “T” / “B” / “0” / “0” / Crc / Crc / Crc / Crc / Etx

[Data]:
Char01: “0” (fixed)
Char02: “0” (fixed)
Char03: “5” (fixed)

) “T”est / “P”anel
<< Stx / Src / Dest / “T” / “P” / “0” / “0” / Crc / Crc / Crc / Crc / Etx
>> Stx / Src / Dest / “T” / “P” / “0” / “0” / Crc / Crc / Crc / Crc / Etx

Checksum calculation:
The result (16bits) is the sum of each single byte from the second character of the message Src to the last character of the Data field if it's present or to the second character of the Lenght field if there are no data. The 17th bit of the sum (carry) is ignored if it's present.

For example the command "G"et / "I"dentification << Stx / Src / Dest / "G" / "I" / "0" / "0" / Chk....

is:
02hex / 30hex / 31hex / 47hex / 49hex / 30hex / 30hex / ..... / 03hex (Src / Dest are examples)

the checksum is :
30hex + 31hex + 47hex + 49hex + 30hex + 30hex = **0151hex** --> **30hex / 31hex / 35hex / 31hex**

the command is therefore :
02hex / 30hex / 31hex / 47hex / 49hex/ 30hex / 30hex / **30hex / 31hex / 35hex / 31hex** / 03hex

CRC calculation
The Cyclic Redundancy Check (CRC) uses a **standard CRC_CCITT** polynomial calculation (X^16 + X^12 + X^5 + 1) to generate a 16-bit CRC code. The 16-bit initial value for the calculation is 554Dhex.

Src and Dest field
The UPS must exchange Src and Dest

Example:
<< Stx / 30hex / 34hex /….
>> Stx / 34hex / 30hex /….

Data coding examples
Output Voltage: “0>6”→0E6hex→230dec→230Volts
Battery Voltage: “019:”→019Ahex→410dec→41.0Vdc