Projet :	POWERSPY	
DOCUMENT :	**POWERSPY TO PC PROTOCOL SPECIFICATION**	
REFERENCE :	**AL/LG/0838/003**	
DATE : **August 31th, 2012**	VERSION : **1G**	AUTEUR : **Laurent Goudet / ALCIOM** **T.Demarne / ALCIOM**
SUMMARY : Specification of the data flow protocol between PowerSpy device and PC		

DOCUMENT HISTORY			
DATE	VERSION	AUTHOR	COMMENT
15/09/08	1A	L. Goudet	Initial version
22/09/08	1B	L. Goudet	Few corrections
08/12/08	1C	T. Demarne	Switch to full ASCII protocol (exept binary transfert CMD)
25/03/09	1D	R. Lacoste	Update for real time data transfer and trigger followup
19/04/11	1E	T. Demarne	EEPROM parameters address added (use calibration parameters for reel time mode)
26/04/11	1F	R. Lacoste	Corrected format for uscale/iscale
31/08/12	1G	T.Demarne	New PowerSpy V2 commands added

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1   Introduction

This document is the specification of the low-level protocol used on the link between the PowerSpy energy meter and the host PC. It allows potential third parties developers to use the PowerSpy with custom applications. However ALCIOM strongly encourages users to drive the PowerSpy through the standard API, as this would reduce incompatibility risks with new versions of the PowerSpy devices.

2   Physical interface

The PowerSpy to PC link is a Bluetooth V2.0 connection, using Bluetooth Serial Port Profile (SPP). The PowerSpy is enumerated and recognized as a serial port device, and is usually mapped by the underlying operating system as a virtual COMx device (Windows). As the exact virtual COM port name is OS and PC dependant the application should either ask the user for the COM port used, or implement (as PowerSpy does) a plug and play process through auto discovery (scanning of all available COM ports).

3   Logical interface

3.1 Command framing

The protocol used is a query/answer protocol, the PC being always the requester.

All messages are ASCII-readable messages standing by a start character « < » followed by one-character command code, followed by a variable number of parameters and are ended by a end character « > ».

All parameters, except during binary reads, are hexadecimal values (two or four characters wide, 0-9 or A-F in uppercase) and are separated by one blank space. Answers are prefixed by the same command code as the request :

- Query from PC   :   \<X\>
- Answer from PowerSpy   :   \<X\>

Binary reads permit to transfer acquisition data without any conversion in order to upgrade the transfer speed. During a binay read, the data are sends, after the response message, by bytes and without any space as follow :

- Binary read request   :   \<B\>
- Answer from PowerSpy   :   \<B 0bXX 0bXX 0bXX 0bXX 0bXX........\>

3.2 Error management

After each command sent to the PowerSpy the PC must wait for the answer or for a time-out value of 1s before sending any new command. Time-out can occur if the device is malfunctioning or in case of link failure and should then be tested and managed by the host. In case of time out or erroneous answer received from the PowerSpy (wrong command code, wrong number of parameters, etc) the link should be reinitialized with the following procedure :

- Close the virtual com port connexion
- Re-open the virtual com port connexion
- Send one Reset command (see here after) and waits for the corresponding answer

3.3 Basic commands

3.3.1 [?] Identity request

Purpose	Check the availability and version of a PowerSpy on this virtual COM port
Command code	?
Command parameters	None
Return parameters	- "POWERSPY" string - Status (See details below) - PLL Locked (0x01 if locked, 0x00 if not) - Trigger status (8 bits, 2 characters, with each bit giving the status of a specific trigger condition : 0 if not satisfied, 1 if satisfied : bit7=Urmsabovr, bit6:Irmsabove, bit5:Prmsaboce, bit4: Urmsbelow, bit3: Irmbelow, bit2:Prmsbelow, bit1:Upeakabove, bit0:Ipeakabove) - SW version (1 byte / 2 characters) - HW version (1 byte / 2 characters) - HW serial number (2 bytes / 4 characters)
Example	→ <?> ← <POWERSPY R 01 01 02 01 4567>

System status are:
- 'R' : Ready
- 'W' : Waiting trigger
- 'A' : Acquisition in progress
- 'C' : Acquisition complete

3.3.2 [L] Capture length command

Purpose	The capture length command allows to define the number of periods recorded by the PowerSpy
Command code	L
Command parameter	- Number of periods recorded (1 byte / 2 characters - maximum: 100 periods)
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <L0A> ← <K> (well done message)

3.3.3 [T] Trigger configuration command

Purpose	The trigger configuration command allows to define trigger parameters of the PowerSpy
Command code	T
Command parameter	- Enable trigger (0x01 to enable trigger, 0x00 to disable it) - Pre-trigger value (1 byte / 2 characters - maximum: 100 periods) - Trig if above RMS Voltage (2 byte / 4 characters – 0x0000 to inhibit) - Trig if above RMS Current (2 byte / 4 characters – 0x0000 to inhibit) - Trig if above RMS Power (2 byte / 4 characters – 0x0000 to inhibit) - Trig if below RMS Voltage (2 byte / 4 characters – 0x0000 to inhibit) - Trig if below RMS Current (2 byte / 4 characters – 0x0000 to inhibit) - Trig if below RMS Power (2 byte / 4 characters – 0x0000 to inhibit) - Trig if above ABS peak Voltage (2 byte / 4 characters – 0x0000 to inhibit) - Trig if above ABS peak Current (2 byte / 4 characters – 0x0000 to inhibit)
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <T 00 00 00 00 0F 15 00 00 00 00 00 00 00 00 00 00 2A> ← <K> (well done message)

Notes : there is a logical AND between all trigger parameters. Two or more condition can set at the same time and all must be satisfied for trigger to occur.

3.3.4 [R] Reset command

Purpose	The reset command reinitialize the PowerSpy and should be used in case of communication or functional issue Nota : not supported on Powerspy V2
Command code	R
Command parameters	None
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <R> ← <K> (well done message)

3.3.5 [W] Write EEPROM byte command

Purpose	The Write EEPROM byte command allows to write one byte in powerspy EEPROM memory
Command code	W
Command parameter	- Address (1 byte / 2 characters - address range: 0 – 255) - Data(1 byte / 2 characters)
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <W0154> ← <K> (well done message)

3.3.6 [V] Read EEPROM byte command

Purpose	The Read EEPROM byte command allows to read one byte in powerspy EEPROM memory
Command code	W
Command parameter	- Address (1 byte / 2 characters - address range: 0 – 255)
Return parameters	-- Data read(1 byte / 2 characters)
Example	→ <V01> ← <54>

EEPROM Memory map:

Address	Parameter	Comments
0x00 to 0x01	Serialnum (16 bits LSB first)	PowerSpy serial numer (LSB first)
0x02 to 0x05	Uscale_factory (32 bits, REAL4)	Factory correction voltage coefficient
0x06 to 0x09	Iscale_factory (32 bits REAL4)	Factory correction current coefficient
0x0A to 0x0D	datecal_factory (32 bits LSB first)	Date of the factory calibration Bits 32 to 24 : Day Bits 24 to 16 : Month Bits 16 to 0 : Year
0x0E to 0x011	Uscale_current (32 bits REAL4)	Actual correction voltage coefficient
0x12 to 0x15	Iscale_current (32 bits REAL4)	Actual correction current coefficient
0x16 to 0x19	datecal_current (32 bits LSB first)	Date of the last calibration Bits 32 to 24 : Day Bits 24 to 16 : Month Bits 16 to 0 : Year
0x1A to 0x1B	Log period (16 bits LSB first)	Number of period averaged for each write on SD card

Nota : Uscale and Iscale parameters are coded using IEEE-compliant 32-bit float representation (one sign bit, 8 exponent bits, 23 mantissa bits). They could then be read and transcoded from a C program using direct memory allocation to a float variable, like the following pseudo-code :

```
float uscale;
ReadEepromByte(0x0E,((char*)&uscale)+0);
ReadEepromByte(0x0E+1,((char*)uscale)+1);
ReadEepromByte(0x0E+2,((char*)uscale)+2);
ReadEepromByte(0x0E+3,((char*).uscale)+3);
```

3.4 Capture commands

3.4.1 [S] Start command

Purpose	The start command allows to start the signal capture by the PowerSpy (awaiting trigger if enable)
Command code	S
Command parameter	None
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <S> ← <K> (well done message)

3.4.2 [C] Cancel command

Purpose	Cancel the current acquisition
Command code	C
Command parameter	None
Return parameters	- Result message: <K>(well done message) <Z>(error message)
Example	→ <C>) ← <K> (well done message)

3.4.3 [F] Frequency request

Purpose	Return the signal frequency
Command code	F
Command parameter	None
Return parameters	- Signal frequency (2 byte / 4 characters - precision 0,01Hz)
Example	→ <F> ← <F1F40> (80,00 Hz)

3.4.4 [A] ASCII Read command

Purpose	The ASCII Read command allows to read the data buffer in ASCII format
Command code	A
Command parameter	None
Return parameters	- Result code (00 if OK) - Number of records N (16 bits) - N*2 binary bytes of U/I values
Example	→ <A> ← <A20513180......>

3.4.5 [B] Binary Read command

Purpose	The Binary Read command allows to read the data buffer in binary format
Command code	B
Command parameter	None
Return parameters	- N*2 binary bytes of U/I values
Example	→ <B> ← <B XXXXXXXXXX......>

3.4.6 [J] Real Time Parameters command

Purpose	The Real Time Parameter command switches the Powerspy in a diferent mode. Waveforms are no longer monitored or stored, but the Powerspy locally calculates key RMS parameters and send them periodically to the host in ASCII format. This mode could be exited with the K command
Command code	J
Command parameter	Number of averaging periods (16bits / four ASCII characters)
Return parameters	- square of the RMS voltage (8 hex digits) - square of the RMS current (8 hex digits) - square of the RMS power (8 hex digits) - peak voltage (4 hex digits) - peak current (4 hex digits) (all averaged on the number of requested periods)
Example	→ <Jnnnn> ← XXXXXXXX XXXXXXXX XXXXXXXX XXXX XXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX XXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX XXXX ...

Nota: To be usable, values returned must be corrected with calibration coeficients as shown above:

- Corrected RMS voltage = squareroot [(square of the RMS voltage returned by fonction) x (Uscale_factory)²]

- Corrected RMS current = squareroot [(square of the RMS current returned by fonction) x (Iscale_factory)²]

- Corrected RMS power = squareroot [(square of the RMS current returned by fonction) x (Uscale_factory) x (Iscale_factory)]

- Corrected peak voltage = peak voltage returned by fonction x Uscale_factory

- Corrected peak current = peak current returned by fonction x Iscale_factory

See EEPROM parameters table page 6.

3.4.7 [Q] Stop read time parameters command

Purpose	Stop the effect of the J command, return to normal mode
Command code	Q
Command parameter	None
Return parameters	None
Example	→ <Q> ← <K.> (well done message)

3.4.8 [E] Set Real Time Clock command

Purpose	Allows to set Real Time Clock parameter from embedded in PowerSpy V2
Command code	E
Command parameter	- Year : 0 to 99 (1 byte /4 characters) - Month : 1 to 12 (1 byte /4 characters) - Day : 1 to 31 (1 byte /4 characters) - Hour : 0 to 23 (1 byte /4 characters) - Minute : 0 to 59 (1 byte /4 characters) - Second : 0 to 59 (1 byte /4 characters)
Return parameters	None
Example	→ <E0C081E100D00> set RTC to 31/08/2012 and 16h13m00s ← <K.> (well done message) ← <Z.> (bad parameters)

3.4.9 [G] Get Real Time Clock command

Purpose	Allows to get Real Time Clock parameters from embedded in PowerSpy V2
Command code	G
Command parameter	None
Return parameters	- Year : 0 to 99 (1 byte /4 characters) - Month : 1 to 12 (1 byte /4 characters) - Day : 1 to 31 (1 byte /4 characters) - Hour : 0 to 23 (1 byte /4 characters) - Minute : 0 to 59 (1 byte /4 characters) - Second : 0 to 59 (1 byte /4 characters)
Example	→ <G> ← <0C081E101621> time read 31/08/12 and 16h22m33s

3.4.10 [M] Set Log period

Purpose	Allows to set number of period averaged to log in SD card of PowerSpy V2
Command code	M
Command parameter	Number of averaging periods (2 byte / 4 characters - 0 – 5000)
Return parameters	
Example	→ <M0032> (50 périods : log every seconds) ← <K.> (well done message)

3.4.11 [O] Start Log

Purpose	Allows to start log in SD card of PowerSpy V2
Command code	O
Command parameter	None
Return parameters	
Example	→ <O> ← <K.> (well done message)

3.4.12 [P] Stop Log

Purpose	Allows to stop log in SD card of PowerSpy V2
Command code	P
Command parameter	None
Return parameters	
Example	→ <P> ← <K.> (well done message)

3.4.13 [U] Get available file list

Purpose	Allows to list available log file in SD card of PowerSpy V2
Command code	U
Command parameter	None
Return parameters	If Files available : <*filename* :size/*filename* :size/ …..../*filename* :size/> If no files available : <>
Example	→ ←

3.4.14 [Y] Delete file

Purpose	Allows to delete file in SD card of PowerSpy V2
Command code	Y
Command parameter	Full file name in ASCII (example : <Y120906.DAT>)
Return parameters	None
Example	→ ←

3.4.15 [X] Transfert File

Purpose	Allows to get file from SD card of PowerSpy V2
Command code	X
Command parameter	Full file name in ASCII (6 characters) Block id : position of block id of 2048 bytes wanted
Return parameters	File contents in binary
Example	→ ←

File format : binary file