XP PS Manager

User Manual

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Contents

1.0 Introduction 4

2.0 References 4

3.0 Setup 4

3.1 Quick Start Steps 4

3.2 PICkit Adapter 4

3.3 XP USB I²C Adapter 5

4.0 Using the XP PS Manager 6

4.1 Adapter Configurations 6

4.1.1 PICkit Serial Adapter 6

4.1.2 XP USB I²C Adapter 8

4.1.3 Connection Setting 10

4.1.3.1 Changing Communication interface 11

4.1.3.2 SCPI Protocol 13

4.1.3.3 Multiple 'XP USB I²C' Adapters 16

4.1.4 Multiple interfaces and Protocols 17

4.2 Monitor Tab 18

4.2.1 Controlling the device 19

4.2.2 Quick status assessment 19

4.2.3 Device's Information 19

4.2.4 HPx Input Readings 20

4.2.5 HPx Output Readings 20

4.2.6 PMBus and HPx Statuses 20

4.2.7 HPx System Statuses 21

4.2.8 Communication Log 22

4.3 Configure Tab 23

4.3.1 Vin Group 24

4.3.2 Vout Group 24

4.3.3 Iout Group 26

4.3.4 Temperature Group 26

4.3.6 Memory Group 29

4.3.7 Power Supply Manufacturer Limits Group 31

4.3.8 Input Reading Group 31
4.3.9 Output Reading Group 31
4.3.10 Communication Log Group 31
4.4 SCPI Tab 32
4.4.1 PMBus Manager Start up with SCPI system 35
4.5 Multi Units Tab 37
4.5.1 Device control 37
4.5.2 Status Displays 38
Appendix A: HPx Implemented SCPI commands 40
Appendix B: Install/Update XP USB I²C Device Driver 42
Appendix C: Things to remember 46
Appendix D: PMBus Status Bits Reference 47
Appendix E: Configuration Script File Format 51
Appendix F: Change Logs 52

1.0 Introduction

This document describes how to control XP Power HPx family of power supplies, utilizing 'XP PS Manager' utility program. This program also works with any PMBus compliant devices but 'Manufacturer Sp65ecific' commands, such as, System and PFC Statuses may not work.

NOTE: 1. Users of this utility should be familiar with PMBus protocol and its operations.

2. This utility supports both 'PICkit Serial Analyzer' and 'XP Power USB I²C' adapters. The PICkit adapter is limited to I²C/PMBus protocol only. Where the 'XP Power USB I²C' adapter supports RS232, RS485 (half & full duplex) and CAN interface. It can also handle various protocols, such as, PMBus, Modbus, SCPI and CANopen. The I²C operational differences between PICkit & XP USB I²C adapters are minor. Some displays (adapter name) and the speeds of executions (scan bus and monitor loops) are slower with PICkit.

2.0 References

1. PMBUS Power System Management Protocol Specification Revision 1.2
2. SMBUS Specification Version 3.0
3. Microchip PICkit Serial Analyzer user manual.

3.0 Setup

3.1 Quick Start Steps

Using PICkit adapter, follow steps in sections 3.2, 4.1.1, 4.2 and 4.2.1.

3.2 PICkit Adapter

1. Connect HPx to PICkit Serial Analyzer as shown in Figure 1 below.

2. Power up the power supply, run 'XP PS Manager' utility program.

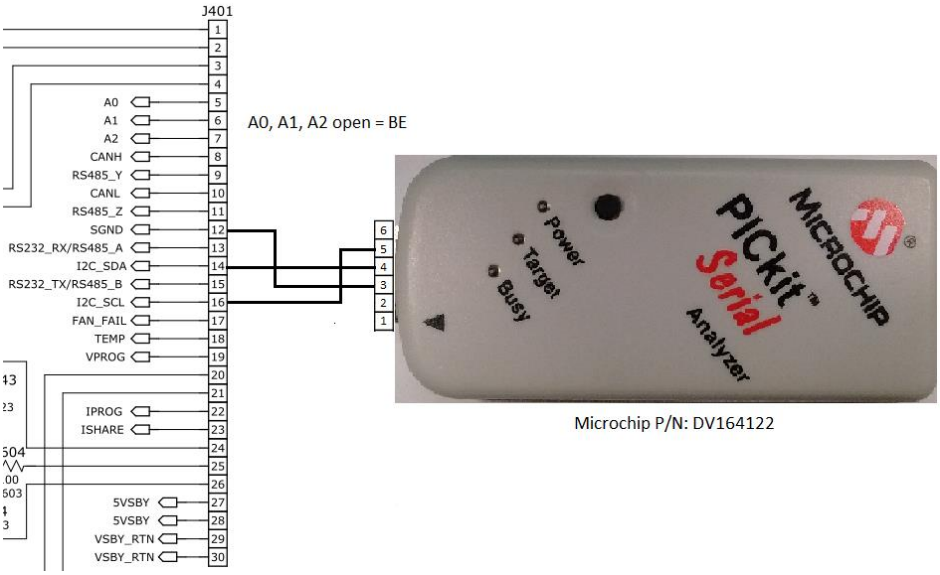


Figure 1: PICkit interface cable diagram.

3.3 XP USB I²C Adapter

1. Connect HPx to XP USB I²C adapter with desire interface cable (see Figure 2 below).
   Note: Factory fresh units' default is I²C interface.

2. Power up the HPx, run 'XP PS Manager' utility program.

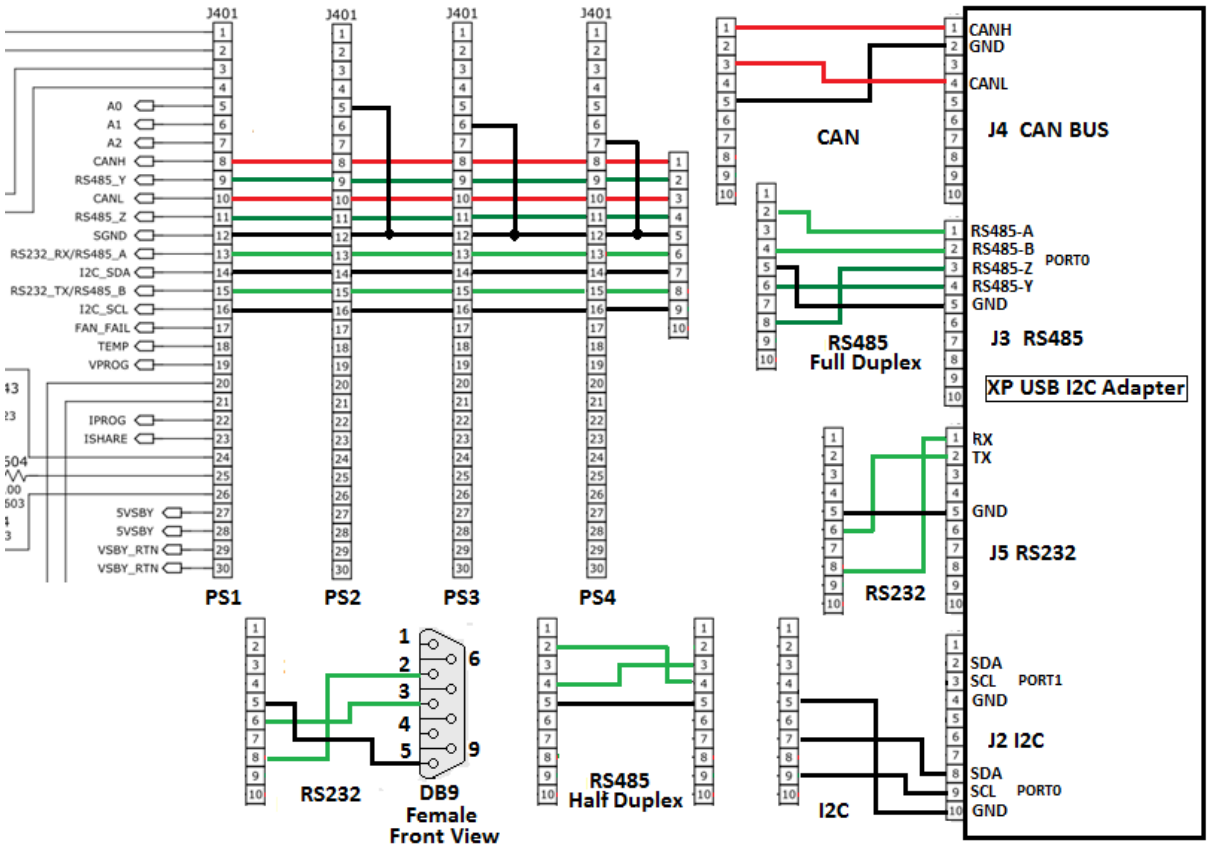


Figure 2: XP USB I²C multi-unit/multi-protocol cables diagram.

Note: Combination of I²C and RS485 (full or half duplex) connections is a convenient cable to use when switching interface (i.e. I²C to RS485 or I²C to SCPI). Similarly, I²C and CAN, I²C and RS232 cables are valid combination cables.

4.0 Using the XP PS Manager

4.1 Adapter Configurations

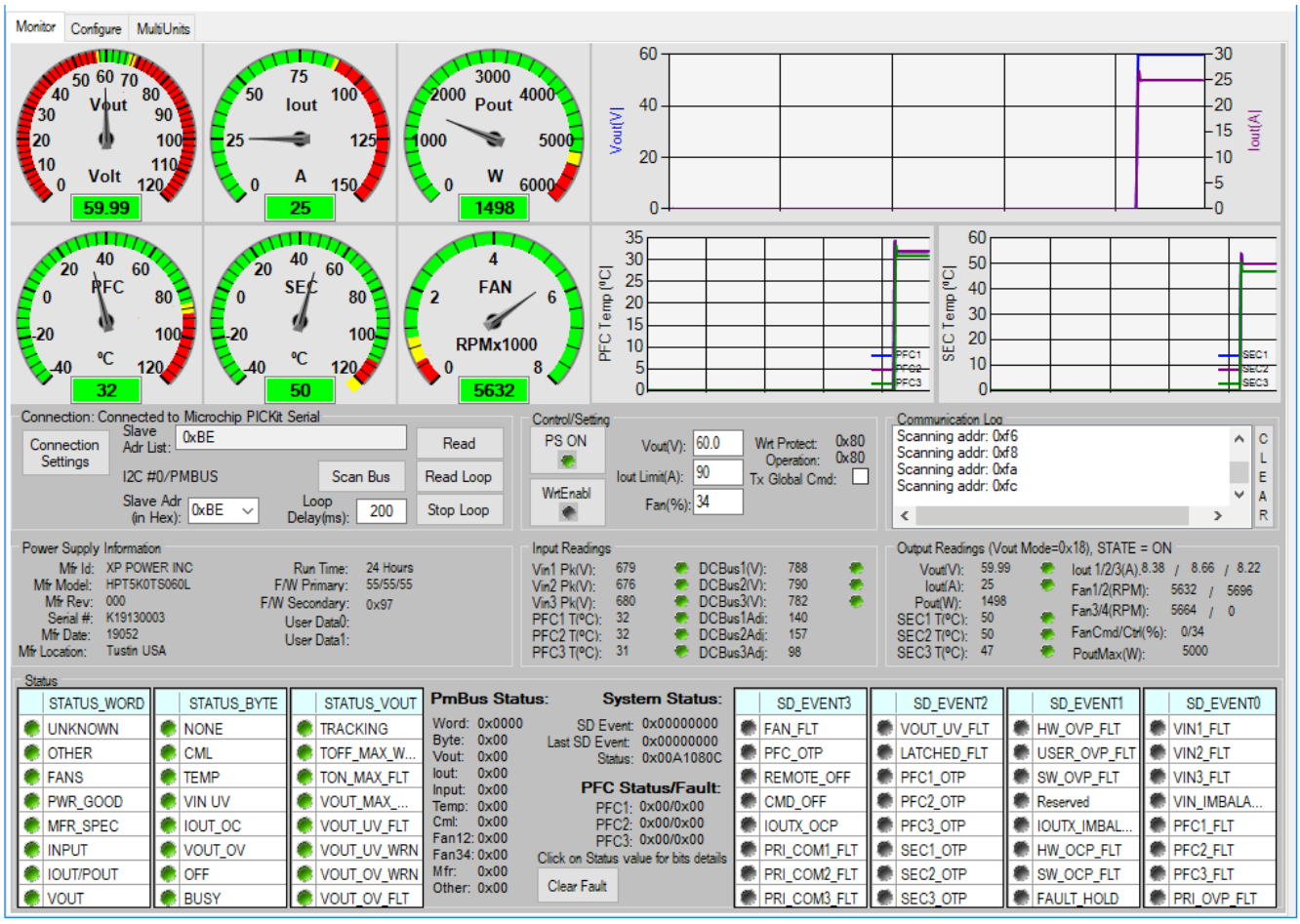


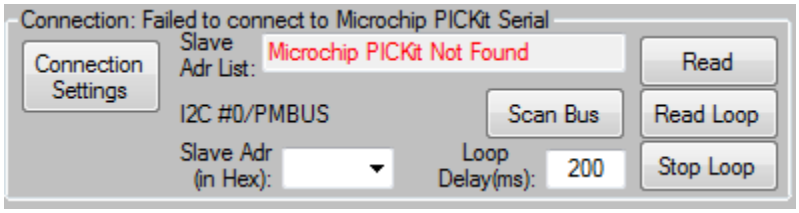
Figure 3: Typical startup display of the utility (PICkit adapter, no SCPI tap page).

4.1.1 PICkit Serial Adapter

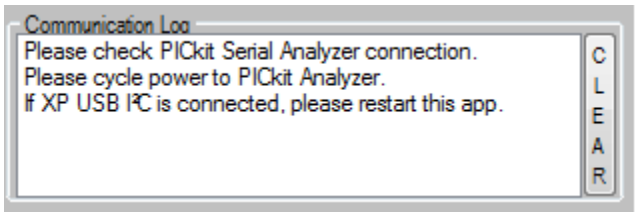
At start up, the utility looks for the last connected adapter.

4.1.1.1 PICkit Not Found

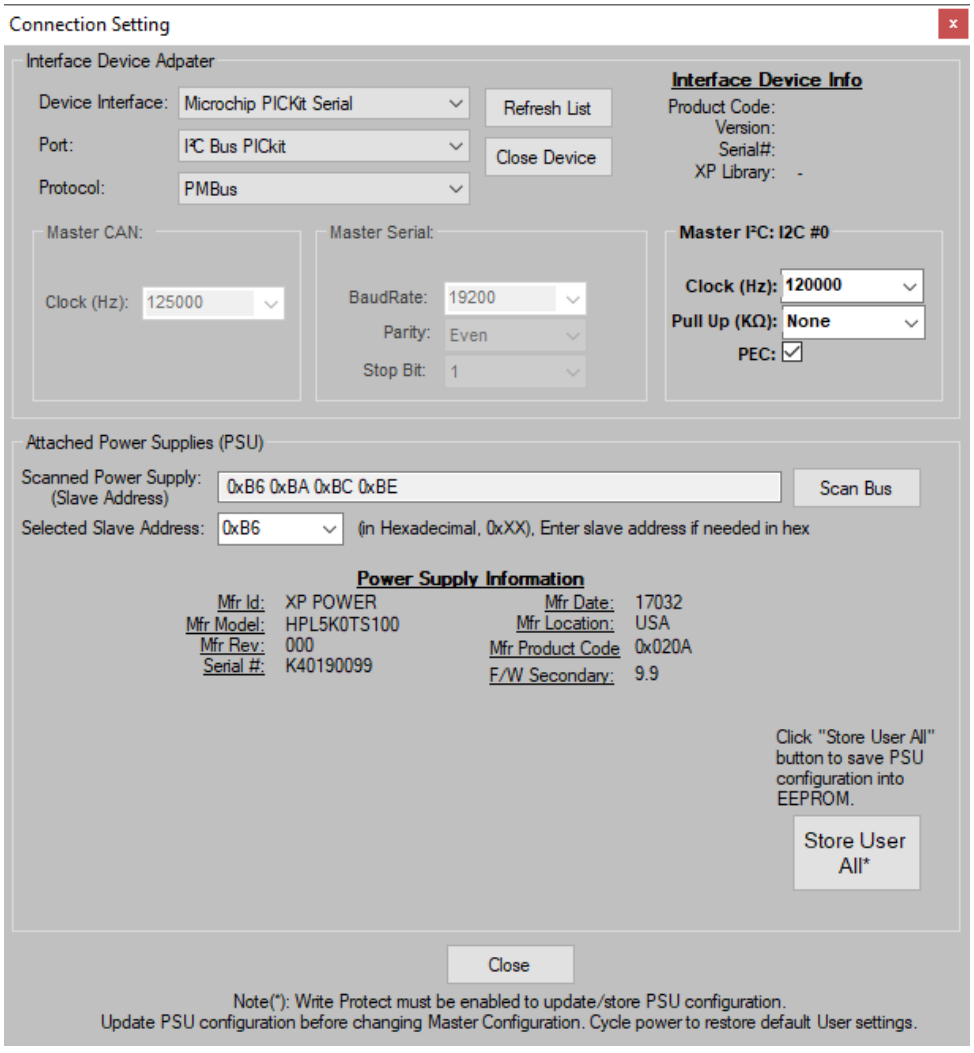
The utility may display 'PICkit Not Found', as shown below.



If switching from XP USB I²C adapter to PICkit, this utility must be restarted, as shown in 'Communication Log' window.



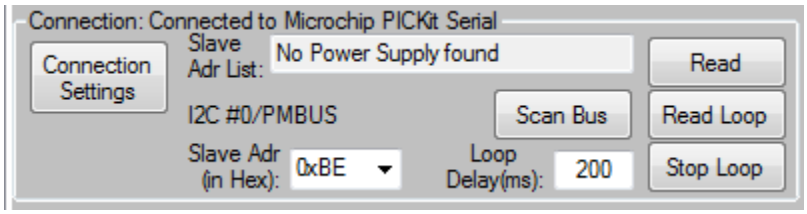
If PICkit is connected, try disconnecting and reconnecting USB cable to PICkit adapter. Also try clicking on 'Connection Setting' button, this will force the utility to search for connected adapter. Once the PICkit adapter is detected, the utility will scan for connected power supplies. This will take 4-5 seconds then the 'Connection Setting' window will pop up and display the interface adapter type and the addresses of the connected power supplies (0xB6, 0xBA, 0xBC & 0xBE shown below).



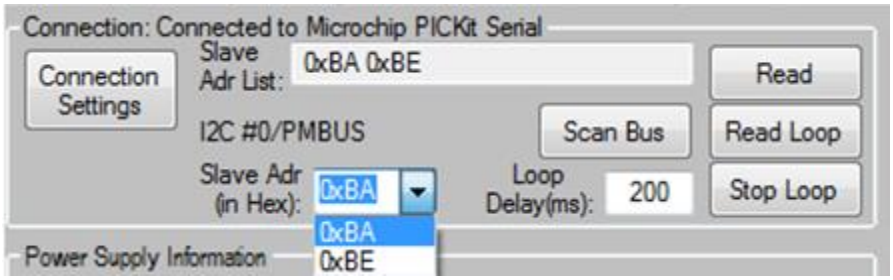
'Power Supply Information' of the selected address is displayed, click 'Close' button to return to 'Monitor' tab page (see section 4.2).

4.1.1.2 No Power Supply Found

The utility may display 'No Power Supply found', please check that the I²C interface cable is connected properly, power supply has input power and click on 'Scan Bus' button.

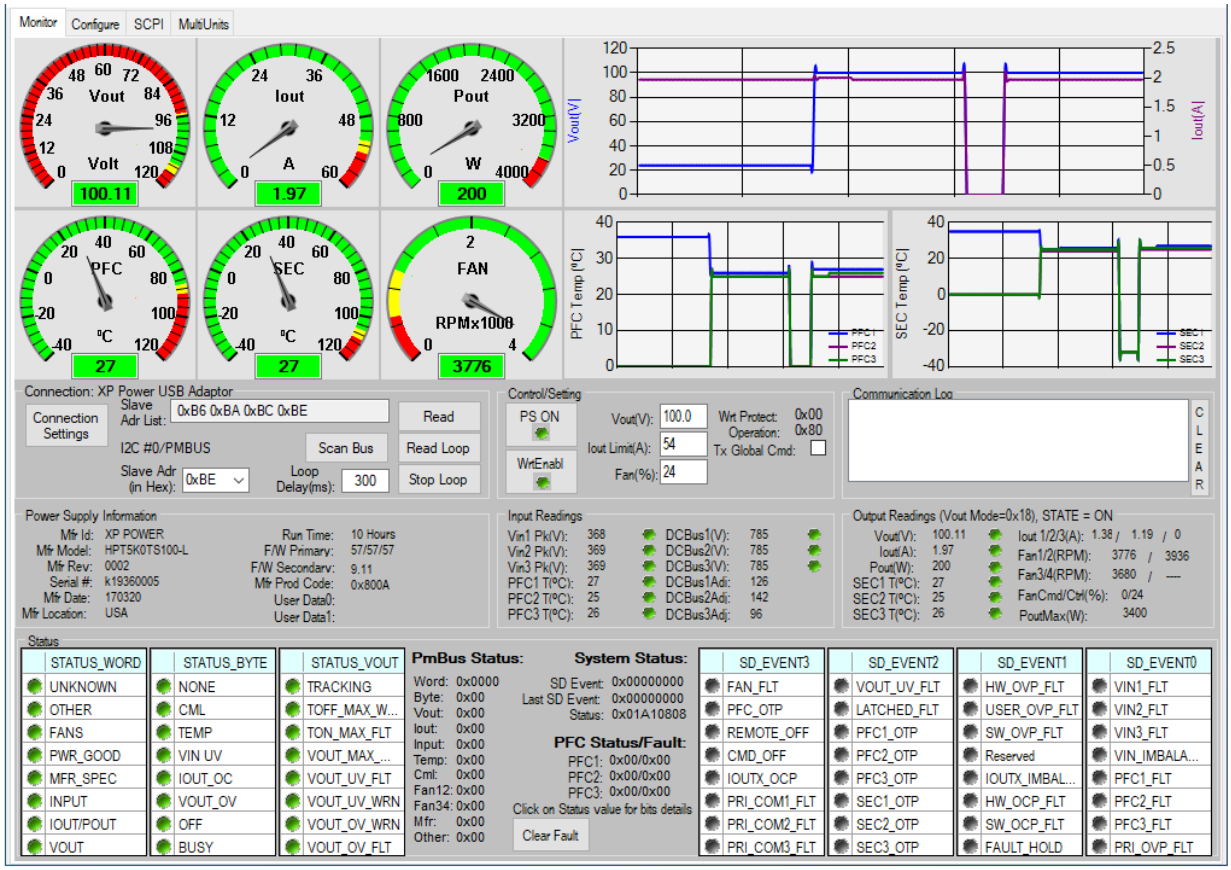


Once the power supplies are found, select the address to monitor in 'Slave Adr' combo-box as shown below. Default HPx address is 0xBE, go to section 4.2.



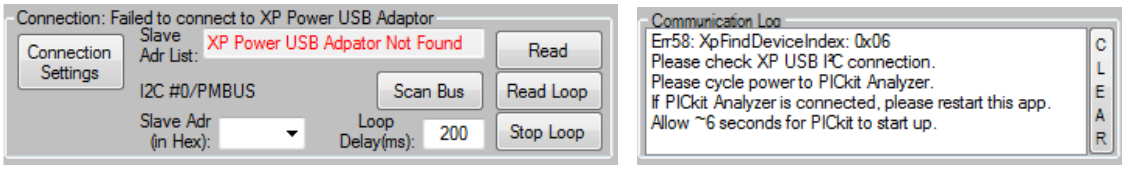
4.1.2 XP USB I²C Adapter

After performing the steps in section 3.3 (using I²C connection), the utility should detect XP USB I²C adapter, scans for connected power supplies and display similar information shown below.

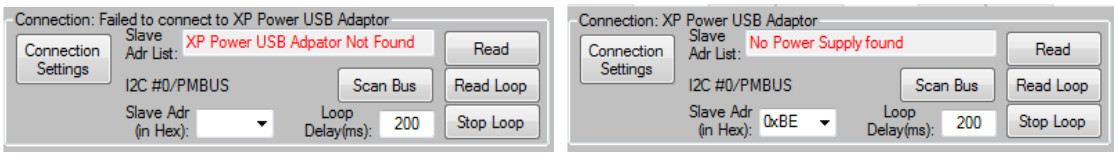


4.1.2.1 XP Power USB Adapter Not Found

If switching from XP Power USB adapter to PICkit adapter, the utility will need to be restarted as shown in the 'Communication Log' window below.

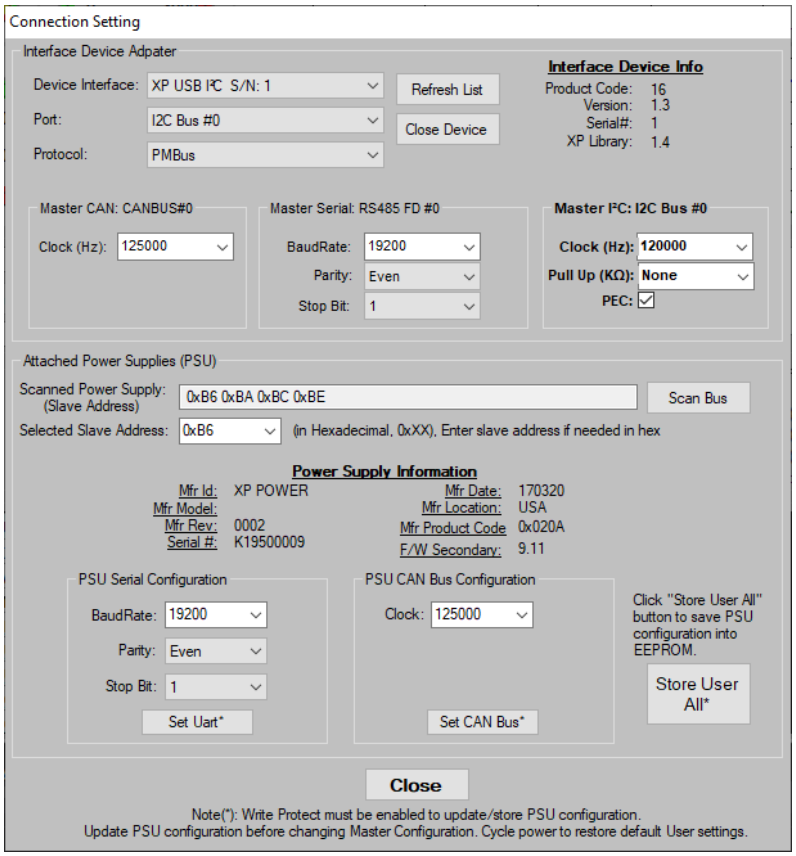


If XP Power USB adapter is connected and the 'Connection' group is displaying one of the errors below, please verify connections cables (interface and USB), input power to the supplies then click on 'Connection Settings' button in 'Monitor' tab page.



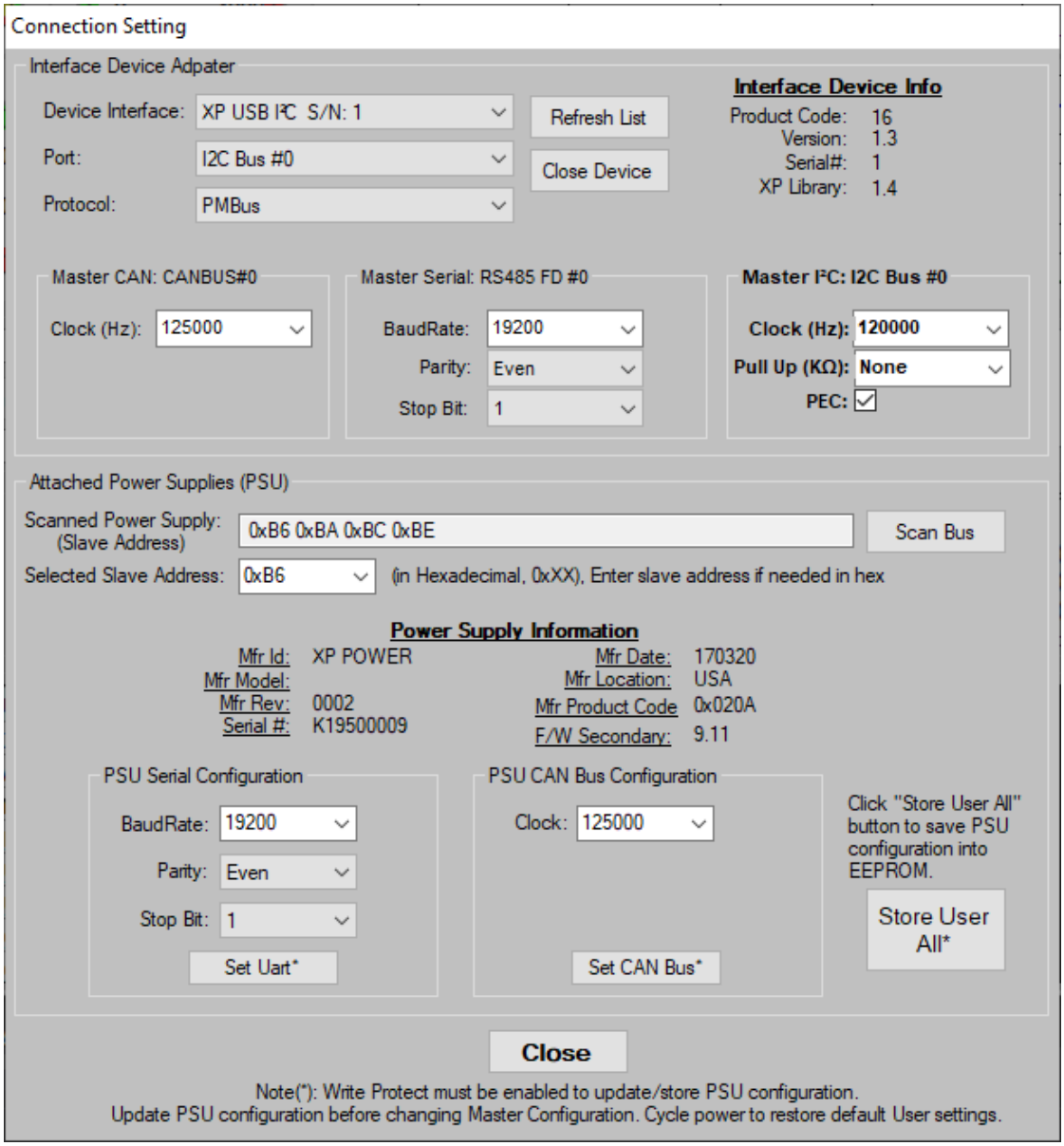
The utility will search for connected adapter(s) and scan for connected power supplies. After successful operations, the 'Connection Setting' window will pop-up displaying addresses of the supplies found (shown below). At this point, if no change of communication interface is needed, click 'Close' button and go to section 4.2.

Note: The active Master port text is set to **bold, 'I²C #0'** shown below.

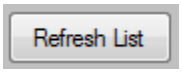


4.1.3 Connection Setting

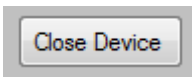
Connection Setting is invoked by clicking on 'Connection Setting' button on the 'Monitor' tab page.



'Refresh List' button will clear the existing list of adapters and slave addresses. Then search for connected adapters and connected slaves of each adapter. It should be use when adding/removing adapter(s) to the system.



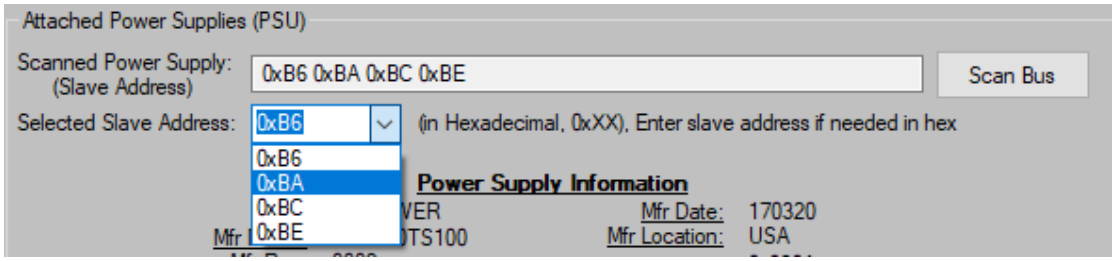
'Close Device' button, when clicked, the selected adapter's resource/handle will be release for other application to use, handy when multiple XP PS Managers are running.



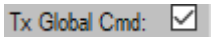
4.1.3.1 Changing Communication interface

To change communication interface, a working communication interface must be established (I²C is the always active). In general, using I²C/PMBus to set the HPx's port configuration first then set the interface box's port configuration and protocol. Perform scan function afterward to ensure that the communication is working. The following steps illustrates switching to RS485/MODBUS.

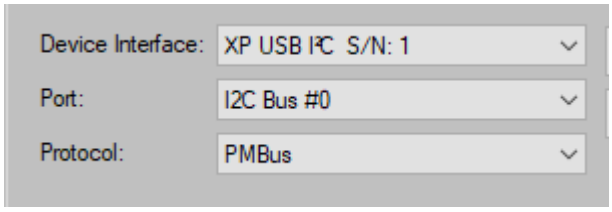
1. Select slave address to be switched (0xBA in this example). Ensure that the slave is capable of the desire interface & protocol (RS485 & MODBUS in this example). It may be an optional configuration.



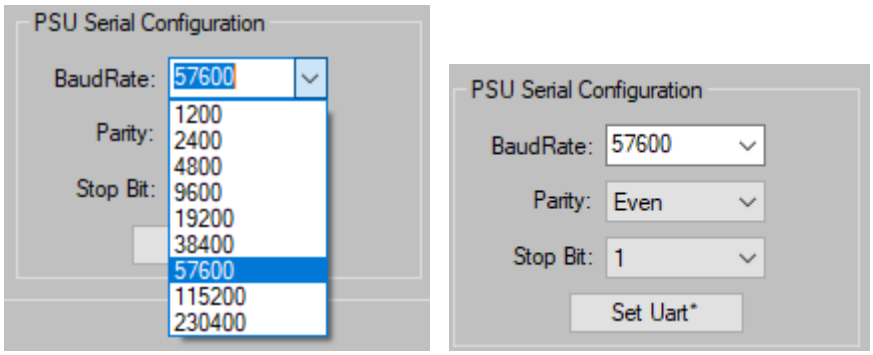
Optional: check 'Tx Global Cmd' check box (in 'Monitor' tab page) for switching all HPx(es) on the entire bus.



2. Ensure that Port & Protocol textboxes displays 'I2C Bus 0' & 'PMBus'.

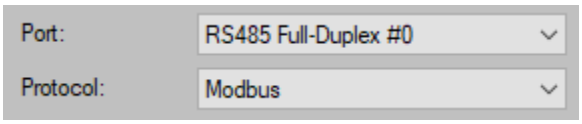


3. In 'PSU Serial Configuration' group box, using drop-down menu, set as shown below.

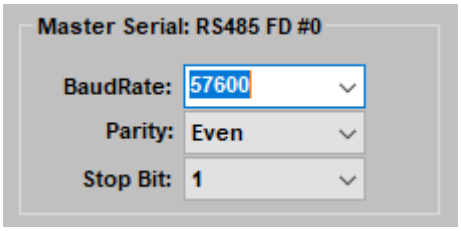


4. Click 'Set Uart *' button.

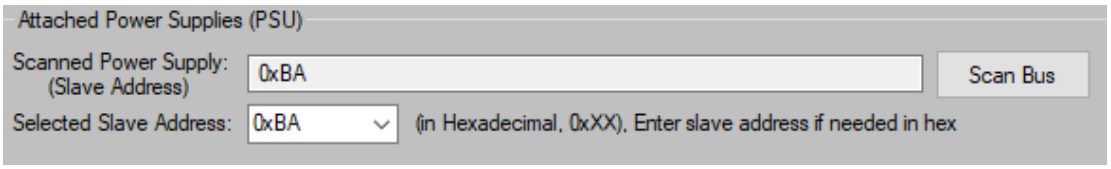
5. In the 'Interface Device Adapter' group box, set port & protocol (using drop-down menu) to RS485 Full Duplex & Modbus



6. Set ‘Master Serial’ group box to match the PSU’s parameters.

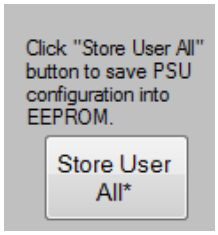


7. Click ‘Scan Bus’ button, ensure that the selected slave address is responding the new communication port & protocol.



NOTE: If unsupported protocol is selected or configuration does not match, ‘Scan Bus’ button will display ‘No Power Supply found’. Try a difference configuration values or use I²C/PMBus interface to re-establish communication and read/set configuration values (repeat step 1-7). Also see the fine prints below ‘Close’ button.

8. Click ‘Store User All’ button to save the configuration.

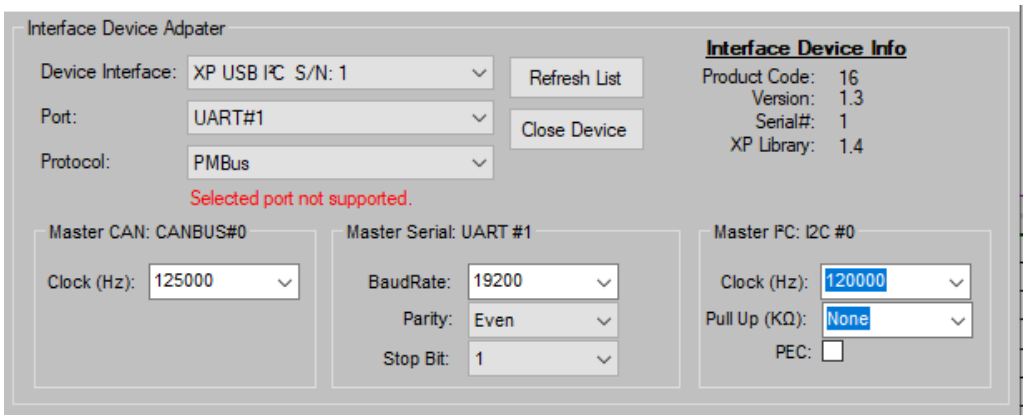


9. Repeat step 1-8 for other slave addresses.

10. Click ‘Close’ button and return to ‘Monitor’ tab page.

Some communication ports are currently not supported, red error message will be displayed. The selected unsupported ports will still be displayed (UART #1 shown), but it will not be active (un-bold text). Unsupported ports are:

CANBUS#1, UART#1, RS232#1, SPI#0, SPI#1, CANBUS#1, ETHERNET



Supported protocol of the interface ports:

a. I²C >> PMBus
b. RS232, RS485, UART >> Modbus, SCPI
c. CAN >> CANopen

Note: RS232 = +/-15V, RS485 = -7/+12V, UART = 0-5V

Note: If other PSU's are not set to the same port & protocol, it will ignore the command and 'Time-out' error will results when you switch PSU.

4.1.3.2 SCPI Protocol

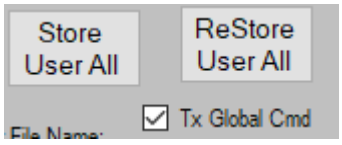
The **Standard Commands for Programmable Instruments** (**SCPI**; often pronounced "skippy") defines a standard for syntax and commands to use in controlling programmable test and measurement devices used in automated test environment. Procedure to switch to SCPI protocol is shown below. **A combination interface cable of I²C and RS485 would add the convenience to this procedure (no cable switching needed).**

4.1.3.2.1 Switch to SCPI Protocol

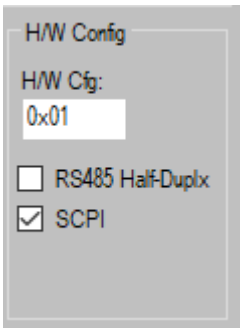
The entire communication bus (all devices) must be switch to SCPI. This application does not support simultaneous multiple protocols on the same communication bus.

1. Using established interface communication (I²C/PMBus is best), in 'Monitor' tab page, ensure that 'WrtEnabl' button indicator is green, click 'Stop Loop" button if 'Read Loop' is active. (Read Loop issues PMBus read commands which will cause error (time-out) in SCPI mode.)

2. Click on 'Configure' tab page , check the 'Tx Global Cmd' box.

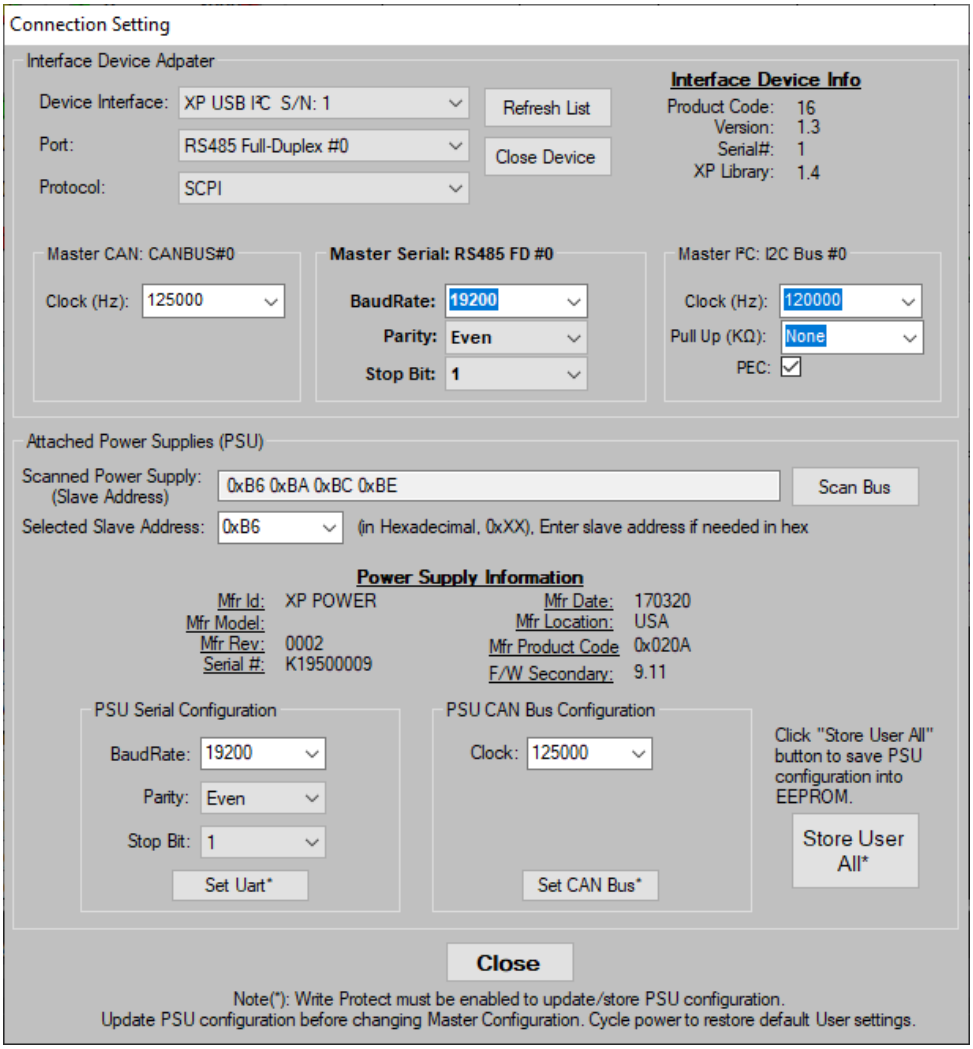


3. Check 'SCPI Protocol' box as shown.



4. From 'Monitor' tab page, click on 'Connection Setting' button, the 'Connection Setting' window will pop-up:
    a. Set 'Port' to RS485 Full-Duplex #0' from drop down menu (as an example).
    b. Set 'Protocol' to 'SCPI' from drop down menu.
    c. Click 'Close' button.

5. For detail operations on SCPI protocol, see section 4.4.
    Note: 'Scan Bus' and 'MultiUnit' tab are not functional with SCPI protocol.



Use optional settings below if default settings are not satisfactory:

a. Select communication port: RS232 or RS485 or UART.
b. Set 'Master Serial Configuration' parameters (Baud Rate, Parity, Stop-Bit) to match slaves' unit. **Note:** SCPI default is '19200 baud, Even parity, 1 stop bit'.
c. Set 'Select Slave Address' (0xB6 shown).
d. Set 'PSU Serial Configuration to match the master's configuration.
e. Click 'Set Uart' button.
f. Click 'Store User All' button to save the slave configuration
g. On 'Connection Setting' window, click 'Close' button or you can leave it open and move it to other part of the screen. Switch interface cable to the selected port type (RS232 or RS485, or UART).

4.1.3.2.3 Switch from SCPI (back to I²C) Protocol

Since HPx series power supply can simultaneously communicates on multiple interface ports, this method sets the utility to establish I²C communication with the power supply (while in SCPI mode) and use it to set the power supply back to I²C port from SCPI port (RS485, RS232, UART). This method is also applicable to switch back from other communication port (CAN, SPI, etc.). This is where multi-connection cable comes in handy (I²C & other serial port), no cable switching needed.

1. Click on 'Monitor' tap, click on 'Connection Settings' button.

2. Click on 'Port' drop down menu, select 'I2C Bus #0'

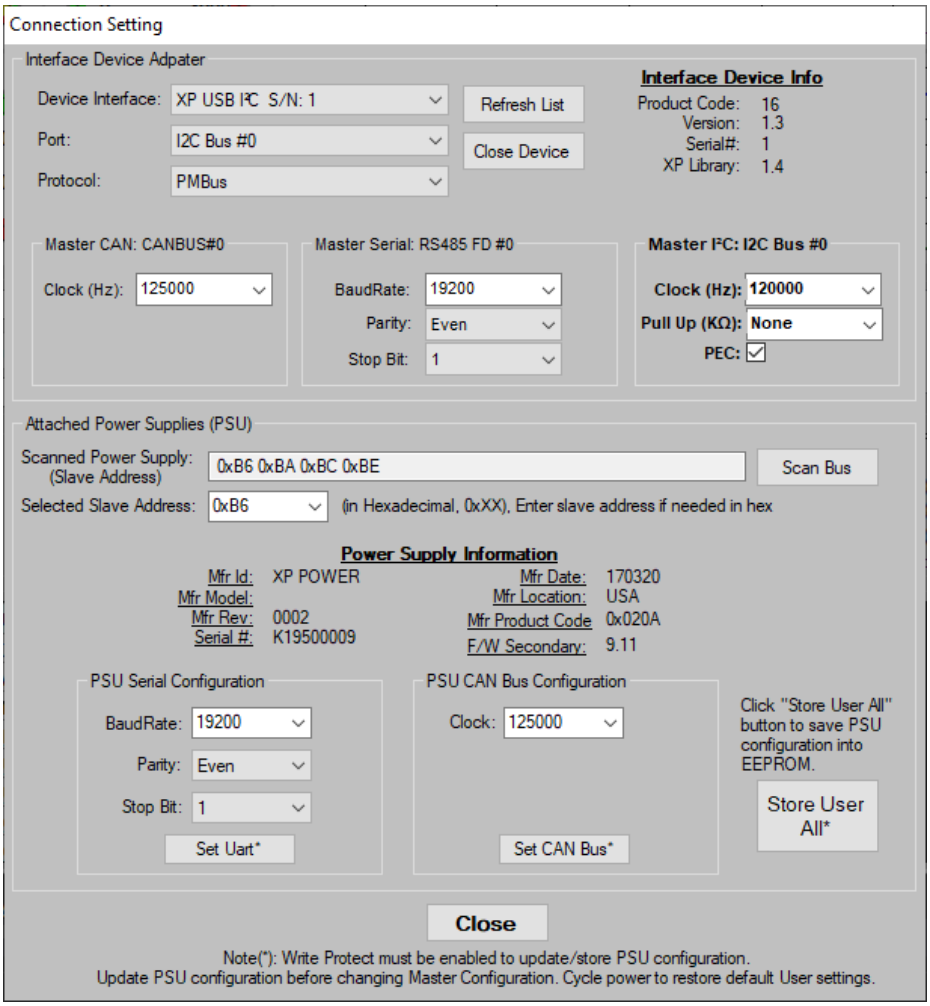
3. Click on 'Protocol' drop down menu, select 'PMBus'

4. Click 'Scan Bus' button, ensure that all connected power supplies addresses are shown.

5. Click 'Close' button to close 'Connection Settings' window.

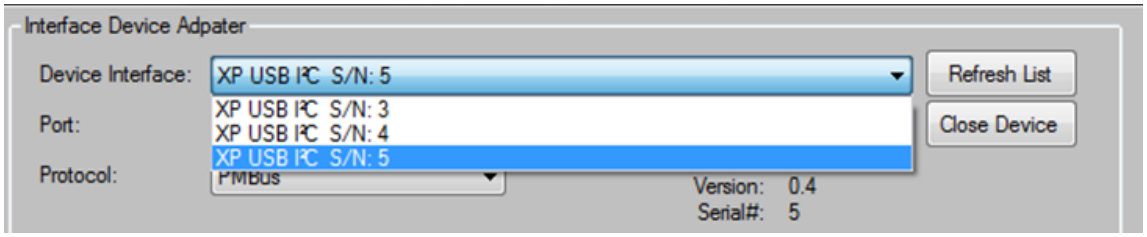
6. Click 'Configure' tab, ensure that 'Tx Global Cmd' box is checked.

7. Uncheck 'SCPI' box.

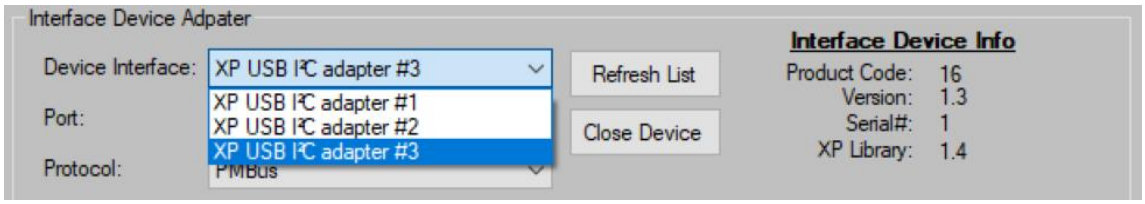


4.1.3.3 Multiple 'XP USB I²C' Adapters

More than one 'XP USB I²C' adapters can be active at the same time. Each adapter can be control by its own utility program or by one utility program. Using 'Connection Setting' and 'Refresh List' button to acquire all connected adapters. The 'Device Interface' drop down menu is used to select a specific adapter to control, as shown below.



If more than one adapters have the same serial number, the utility program will assigned unique number to each apadter, shown below.



Note: Each adapter must have its own communication bus to power supplies.

Example: 8 HPx units are on adapter S/N 5 another 8 units are on adapter S/N 4.

Below is a screen capture of multi instances of the utility program controlling one adapter each.

4.1.4 Multiple interfaces and Protocols

HPx family of power supply is capable of handling multiple interfaces & protocols simultaneously. For example, I²C/PMBus for monitoring the HPx parameters, RS485/Modbus for controlling the output voltage and adjusting warning limits or fault limits dynamically.

Note:

- Having multiple interfaces/protocols **controlling** the HPx supplies is **not recommended** but possible. The last duplicated command received from any interface overrides the previous one.
  For example, I²C set Vout to 45V then RS485 set Vout to 47V, the output is 47V.

4.2 Monitor Tab

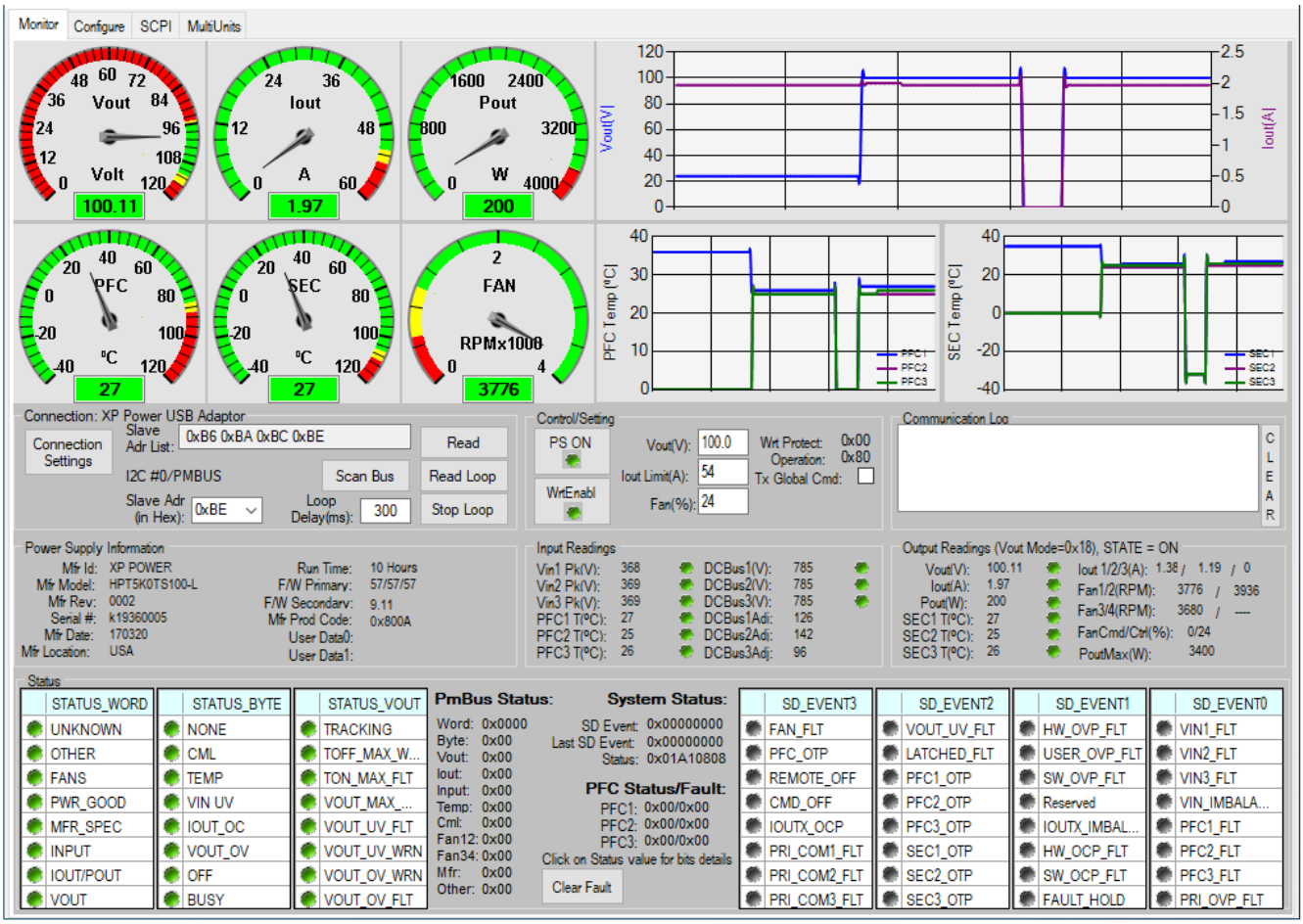
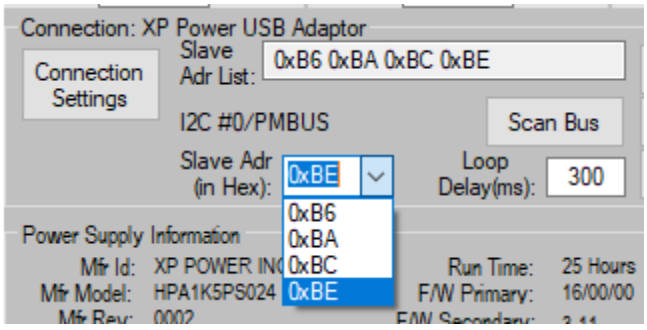


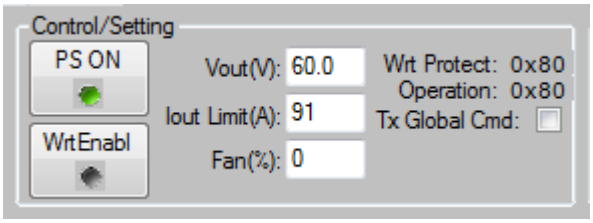
Figure 4: Typical 'Monitor' tab screen shot of a running utility.

Select the address to monitor in 'Slave Adr' combo-box as shown below. Default HPx address is 0xBE.



Click 'Read Loop' button to start monitoring the selected unit. Various parameters are displayed and updates at regular interval, as set by 'Loop Delay' textbox. The output voltage, current and power, device temperatures and fan speed are displayed on dial gauges for quick reference. Graphical representation of these parameters is also presented over time. Read button will change tone/blink when 'Read Loop' is active.

4.2.1 Controlling the device

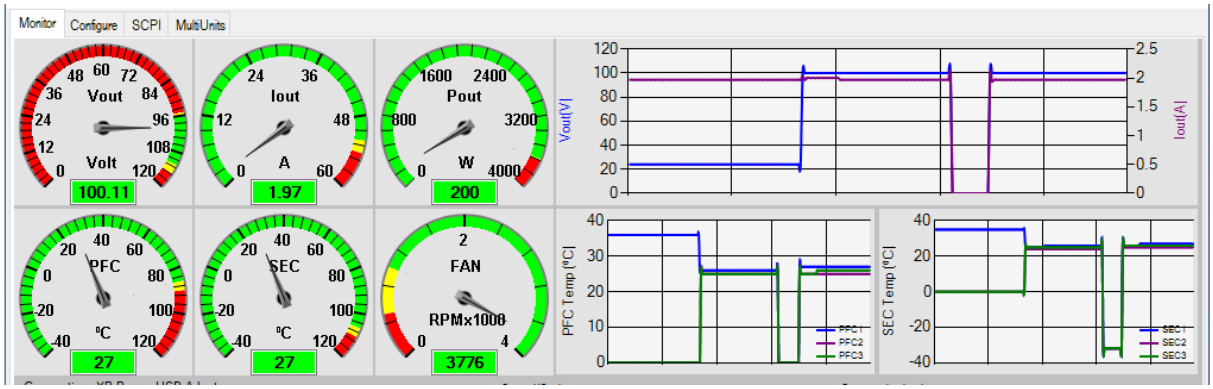


1. Click ‘WrtEnabl’ button to let the device accept commands, LED indicator turns green.
2. Type the desired output voltage in ‘Vout’ box and press ‘Enter’ key.
3. Enter output current limit in ‘Iout Limit’ box.
4. Click ‘PS ON’ button to enable the device output, LED indicator turns green.
5. Optional: enter a value in ‘Fan’ box for a constant fan speed.

   Note: If the device’s temperature rises above pre-program limit, automatic fan speed control will override the set fan speed. For automatic fan control, enter ‘0’ in ‘Fan’ box.

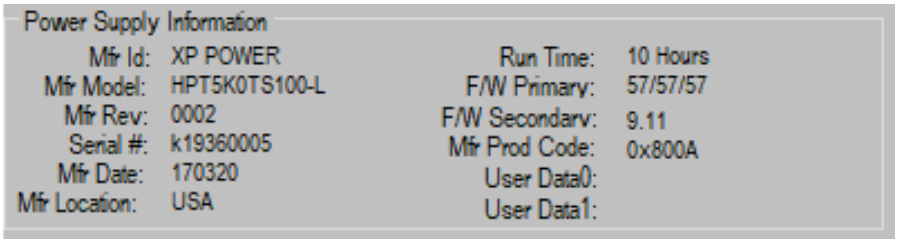
6. ‘Tx Global Cmd’ check box: If checked, device address of the write commands will be set to ‘00’. This caused all devices on the bus to implement the command. This check box is duplicated in ‘Configure’ tab.

4.2.2 Quick status assessment



Dials representing output voltage, current and power, PFC temperature, Secondary stage temperature and fan speed with warning limits (yellow) and fault limits (red) are shown to quickly access the status of the supply. Last 90 seconds of output voltage, current and temperatures are also shown over time in graphical form. For unit with multiple fans, FAN gauge only displays FAN1 RPM.

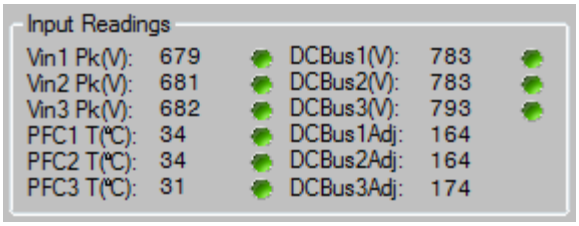
4.2.3 Device’s Information



Standard PMBus information is displayed in the ‘Information’ section. Some

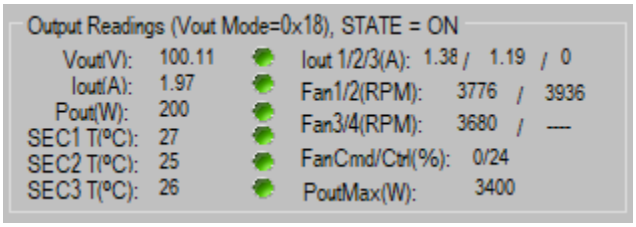
‘Manufacturer Specific’ information are also displayed (Run-Time, Firmware Revisions and Product Code).

4.2.4 HPx Input Readings



Each stage of the input phase is shown in this group. The indicator will turn red when its parameters exceeds pre-set limits.

4.2.5 HPx Output Readings



Higher resolution readings are displayed in this section. Output current and temperature of each input phase are shown here. Round indicator turns red when its parameter exceeds pre-set limits. For unit with multiple fans, their speed is shown in corresponding ‘Fan1/2’ & ‘Fan3/4’ lines. FAN gauge only displays FAN1’s speed.

4.2.6 PMBus and HPx Statuses

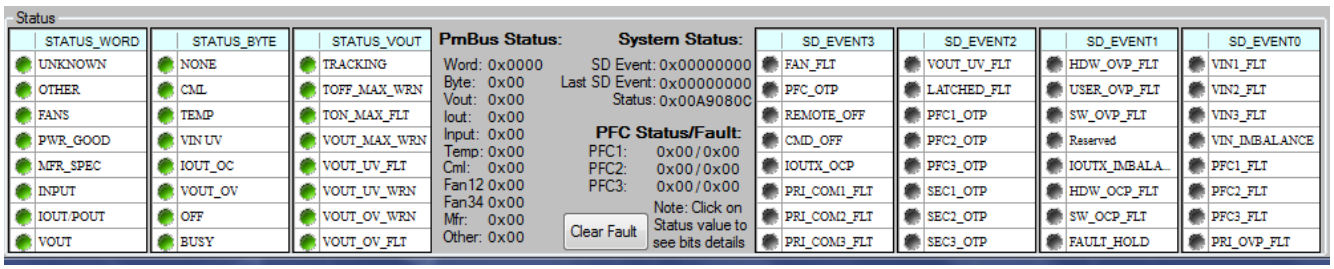


Figure 5: Normal operation = all statuses are ‘green’ or 0x00.

Main status bits are displayed in round LED indicator, Green = good, Red = bad.

Other status registers are shown in hexadecimal value under ‘PMBus Status’ column. Please refer to PMBus Specification for more details, a condense status bits definitions are shown in Appendix D.

Note: Bit0 = Top row, Bit7 = Bottom row

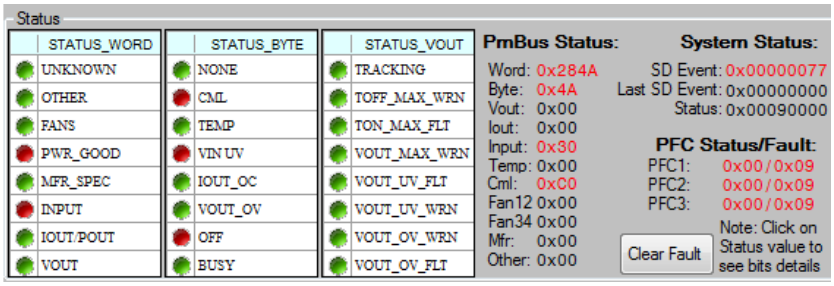
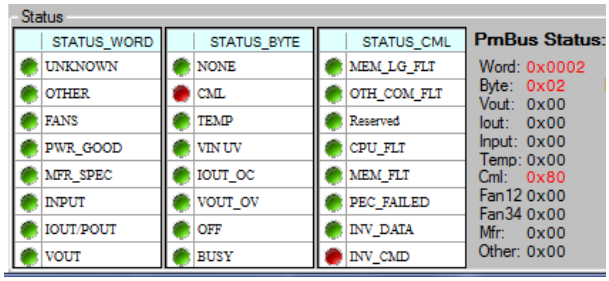
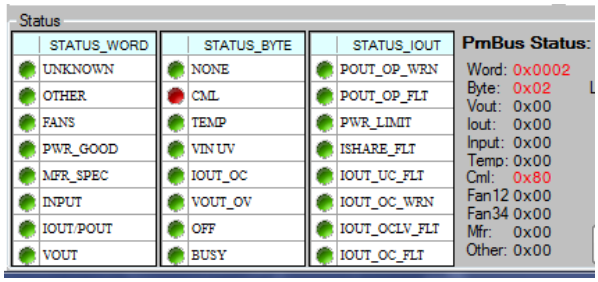
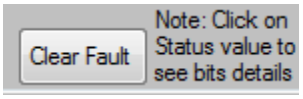


Figure 6: When faults are detected, indicators turns ‘red’ and status values are non-zero and in red also.

These fault indicators are latched until cleared by the ‘Clear Fault’ button. ‘Clear Fault’ button resets all fault indicators to ‘green’, if fault(s) still exists, the indicator will turn ‘red’ again.



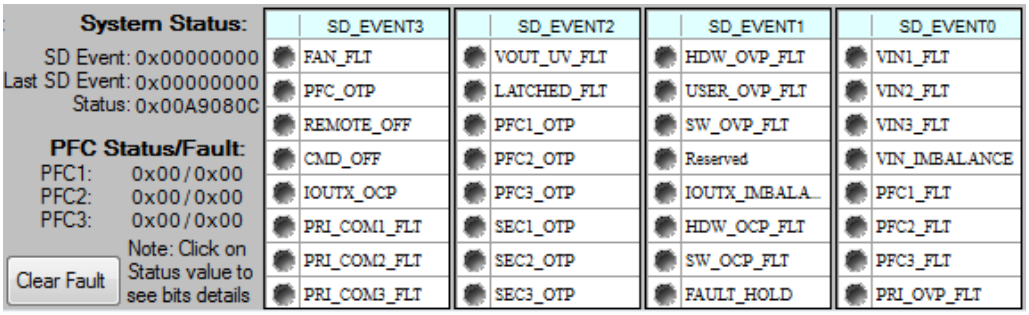




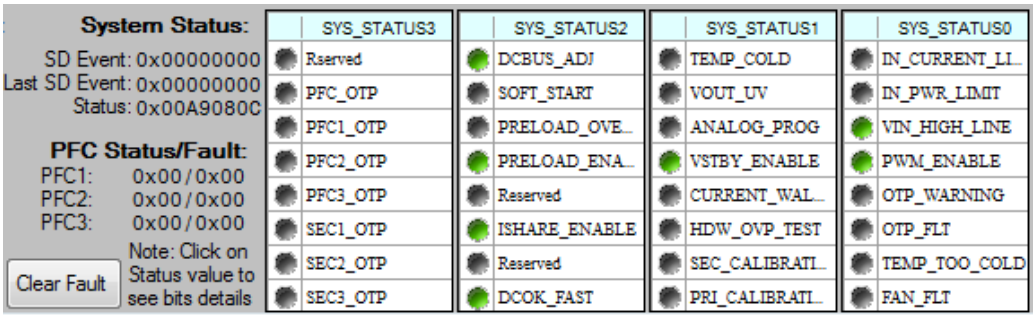
A status detail is shown on the 3rd panel when individual status value is clicked, as indicated next to the ‘Clear Fault’ button. STATUS_CML and STATUS_IOUT are shown in the 3rd panel above.

4.2.7 HPx System Statuses

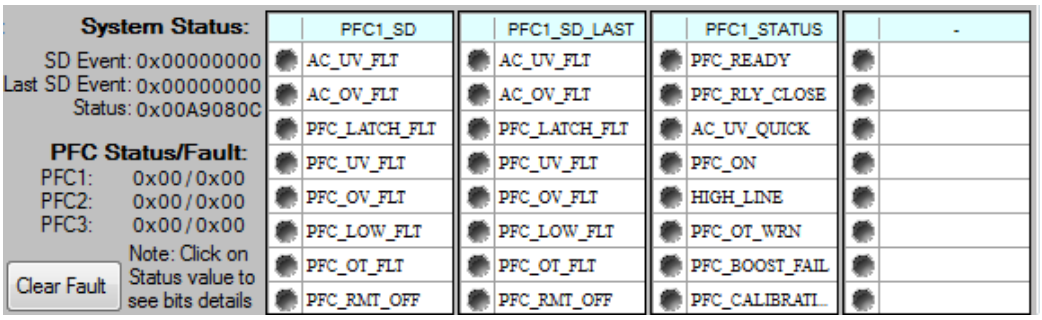
Shutdown events represented by round indicators shown above. Grey = normal, Red = faulted.
Click on ‘Last SD’ value to see last shutdown events.



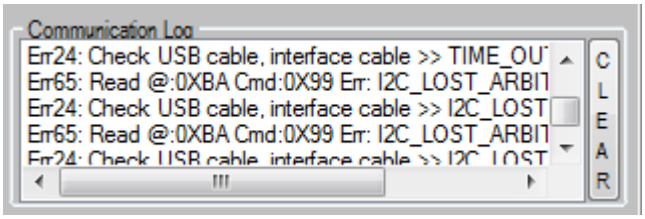
Similarly, click on ‘Status’ value will display the details of the system status, as shown below.
Grey = normal/not enabled, Green = enabled, Red = faulted



Click on ‘PFC1’ **value** will display the details of the PFC1 shutdown and status, none, as shown below.



4.2.8 Communication Log



This window display communication errors, read/write, device address, command that has the error and total error count. ‘Communication Log’ window is duplicated in ‘Configure’ tab.

‘Clear’ button will clear the displayed errors but will not reset error counter, restart this utility will.

Using horizontal scroll bar to read the entire error line.

Note: Once the communication is lost, PICkit adapter **may** need to be reset (cycle power) and using ‘Connection’ button to re-establish communication. If all else failed, this utility program may need to be restarted

4.3 Configure Tab

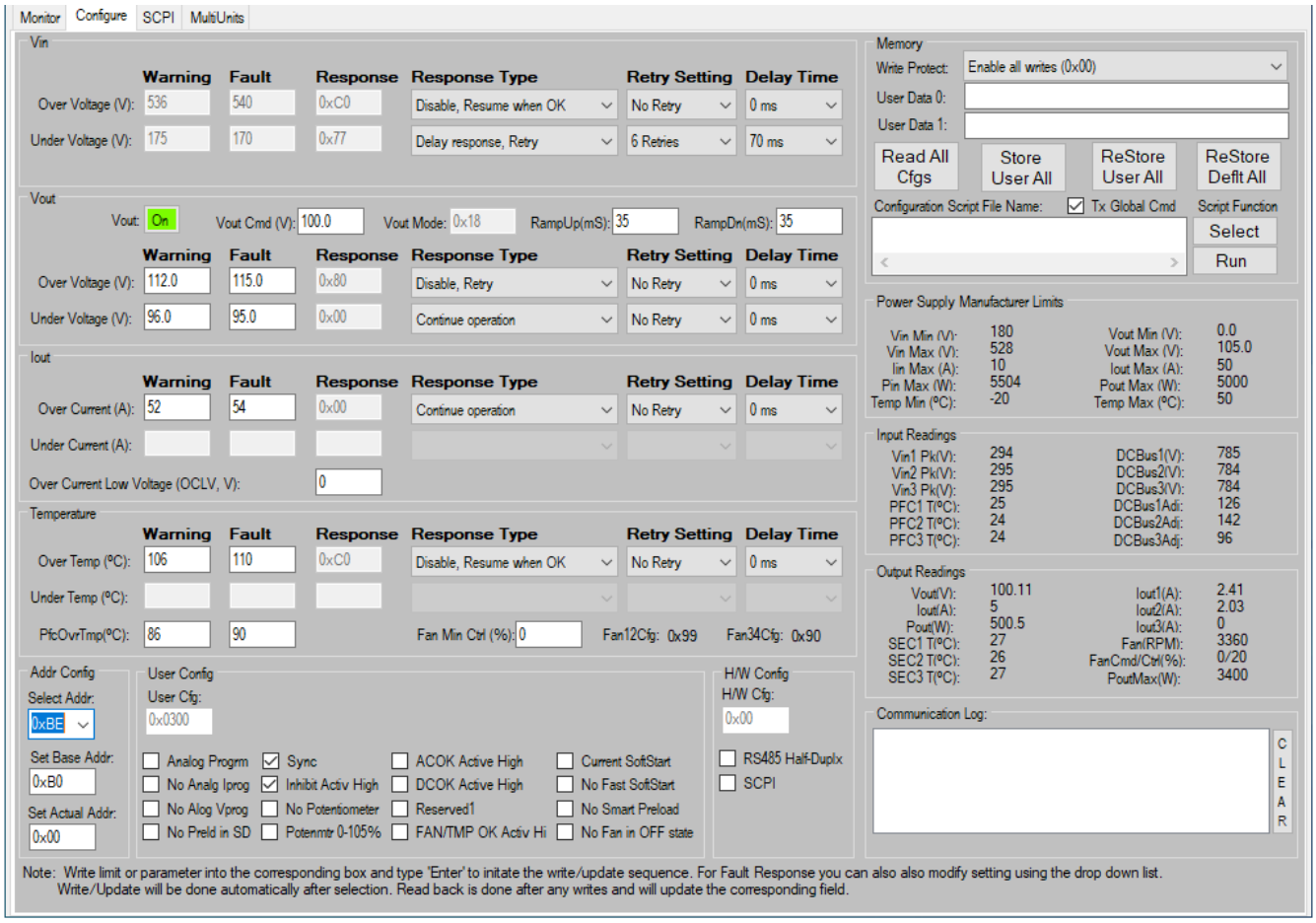
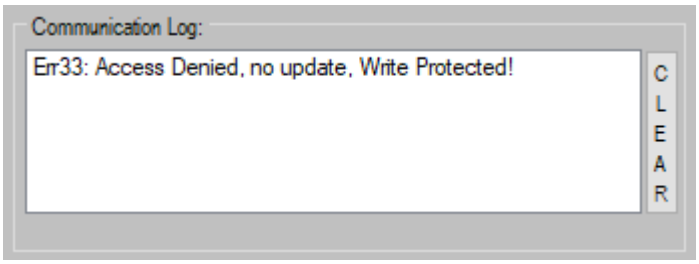


Figure 7: Configuration parameters of the selected address (0xBE shown in 'Addr Config' box).

This tab allows user to change warning limits, fault limits, fault responses and save these limits to user's setting. Please read the 'fine print' on the bottom of the tab. ☺

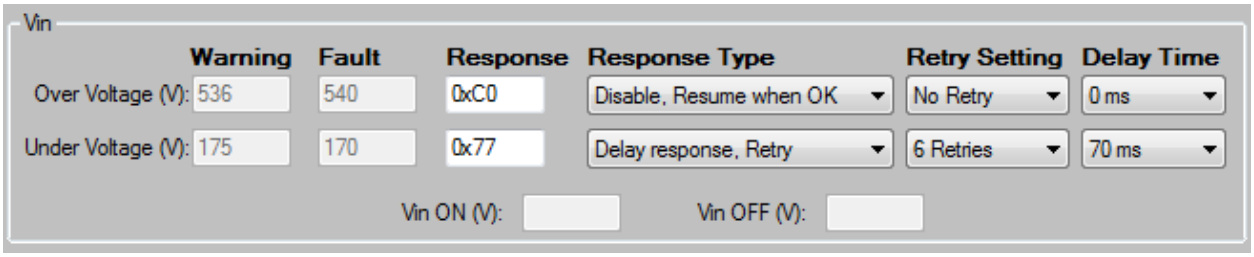
Note: Some fault responses are hard-coded and will not accept invalid/unsupported selections. 'Communication Log' window will display error message.

Example: Error message for setting Over Temp Fault Response to 'Continue operation' is shown below.

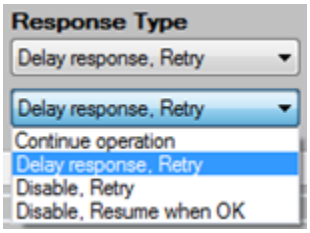


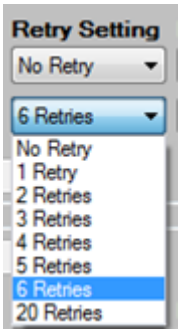
Similarly, OVP fault response is hard-coded to 'Disable' with 'No Retry', see section 4.3.2.

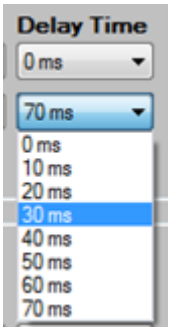
4.3.1 Vin Group



Input 'Over Voltage' and input 'Under Voltage' warning and fault parameters are set to default values and cannot be modified. However, the 'Response Type', Retry Setting' and 'Delay Time' can be modify by selecting the drop-down menu when you click on the combo-box as shown below.

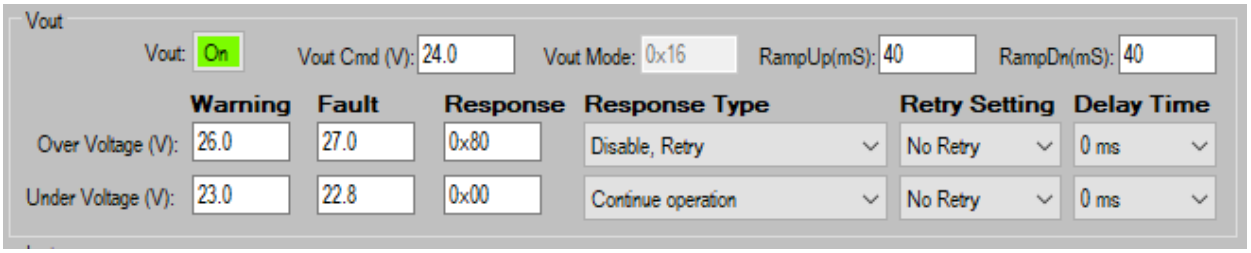






On Retry Setting, HPx waits 1 second (for internal filters and voltages to stabilize) before start checking for faults. So, 5 retries will take 5 seconds + delay between retries.

4.3.2 Vout Group



Each parameter can be change by highlighting the value in the corresponding text box and type in the new value then press 'Enter' key to transmit the command the device. Similarly, 'Response' behavior can be modified with the drop-down menu.

Vout button toggles between on and off when clicked. When 'On' the button is green.

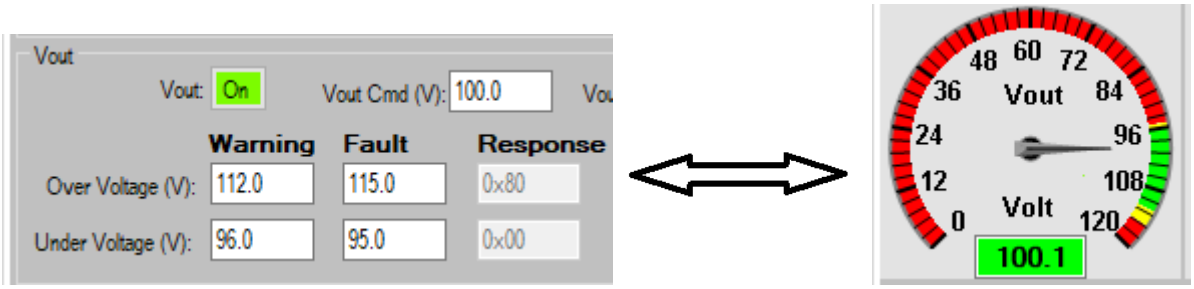
Sets Vout ramp up time (35 - 1000 miliseconds) from 0V to max norminal volt (0% to 100%). This is a ramp up slope rate. For example: Vmax=100V with 100mS ramp-up value, the ramp-up time from 0V to 60V is 60 milisecond.

Sets Vout ramp down time (35 - 1000 miliseconds) from max norminal volt to 0V (100% to 0%). This is a ramp down slope rate. For example: Vmax=100V with 100mS ramp-down value, the ramp-down time from 50V to 0V is 50 milisecond.

Note:

1. Ramp-up value is applicable only when option 'Disable Fast SoftStart' is checked and 'Current SoftStart' is unchecked. In other words, ramp up is active only when the unit is in 'Regular SoftStart' mode, see section 4.3.5. Ramp-Down always active since we do not have soft ShutDown mode.

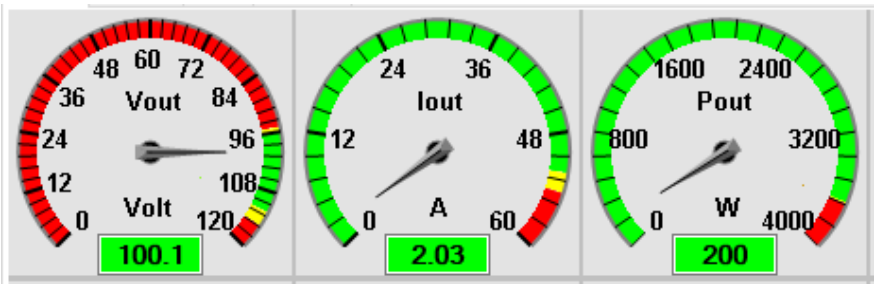
2. Over Voltage Fault response is hard-coded to immediate shutdown and the fault is latched. To clear Over Voltage Fault is to turn the power supply off and on via 'Vout' button.



Vout warning & fault limits are displayed as color band on Vout guage in 'Monitor' tab.

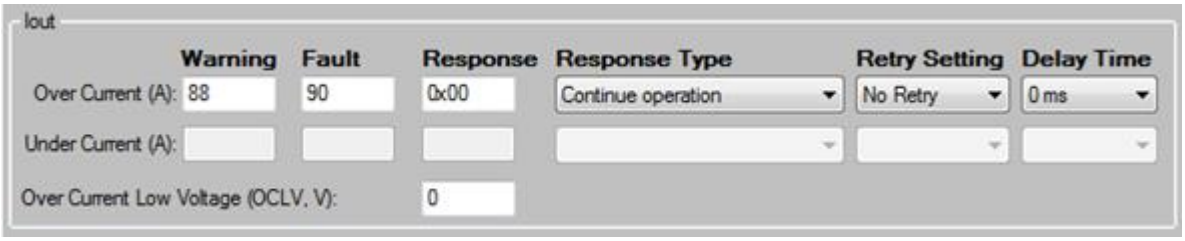
To avoid unintentional shutdown set limit values in the following order (left to right):

UV_FAULT < UV_WARN < Vout < OV_WARN < OV_FAULT

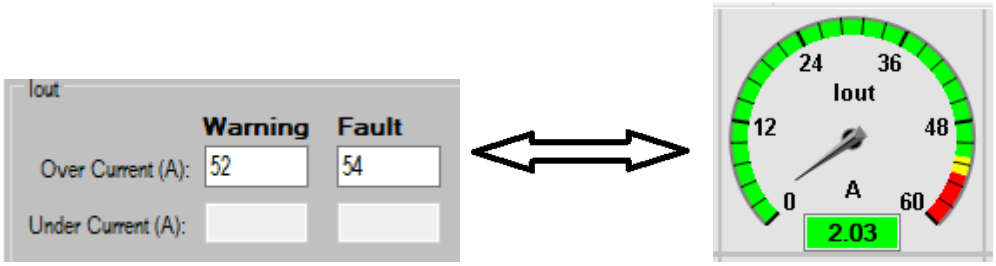


Power gauge scale is left @ Pmax, will not be adjust to OV_FAULT x OC_FAULT values.

4.3.3 Iout Group



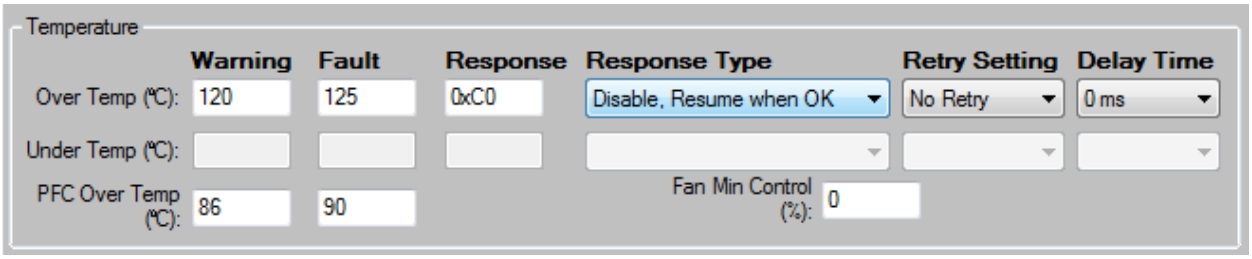
Under Current response are not implemented. Other parameters can be change in the same manners as with other groups.



Iout warning & fault limits are displayed as color band on Iout guage in 'Monitor' tab.

Note: OC_FAULT can be < Iout if fault response is be set to 'Continue operation'.

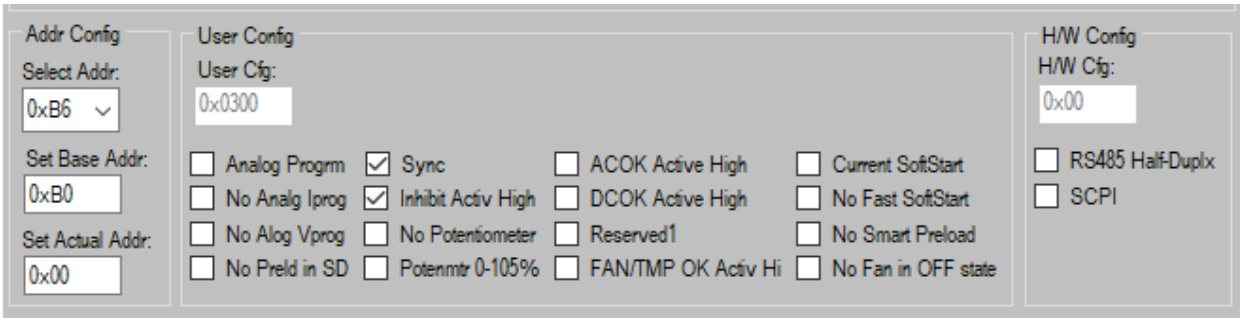
4.3.4 Temperature Group



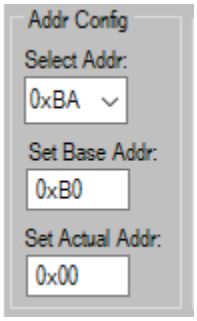
Under Temperature responses are not implemented. Other parameters can be change in the same manners as with other groups.

4.3.5 Configuration Group

This group is subdivided into 3 groups: Address Config, User Config and Hardware Config.



Addr Config group



Select Addr: Select the unit that will receive new address command.

Set Base Addr: Base address value in conjunction with A0, A1, A2 pins = actual address.

Valid Base address: 0x10, 0x20, 0x30…..0xF0

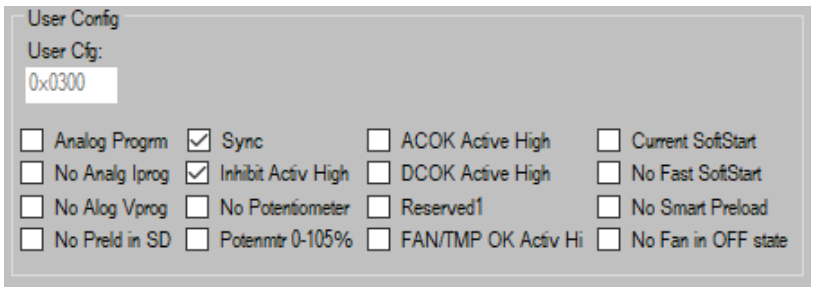
Base address factory default is 0xB0.

Note: 'Set Actual Addr' must be 0x00 to change 'Base Addr'.

Set Actual Addr: Enter **even** value (0x02-0xFE) for actual address. This address overrides the base address value and A0, A1, A2 pins.

Note: User must save the new address/base address via 'Store User All' button.

User Config Group



Check each box to activate its function. Some features are HPx specific, some are PMBus standard.

Analog Progrm: J401 pin 19 enables VPROG & IPROG analog controls by applying 0-5VDC.

No Analog Iprog: J401 pin 22 (IPROG) is used to control output current by applying 0-5VDC.

No Analg Vprog: Set unit to accepts commands via communication bus only. Over-riding PMBUS_EN signal (J401-24) and VPROG is enabled signal (J401-19).

No Preld in SD: Disable pre-load during shutdown sequence.

Sync: Utilized by paralleled units on power up to enable their output voltages simultaneously.

Inhibit Active High: Vout is set to 0V when this signal is high.

No Potentiometer: Vout cannot be controlled by back panel potentiometer.

Potentiometer 0-105%: The back-panel potentiometer adjusts Vout from 0V to 105% of nominal value.

If unchecked, potentiometer adjusts Vout to +/-10% of set Vout value.

ACOK Active High: When AC stage is in normal operation, this signal will be high.

DCOK Active High: When DC stage is ready to supply output voltage, this signal will go high.

Reserved1: The corresponding Configuration bit will be toggled and transmitted but HPx will ignore it.

FANOK/TMPOK Active High: If fan speed and temperature are as expected, this signal will be high.

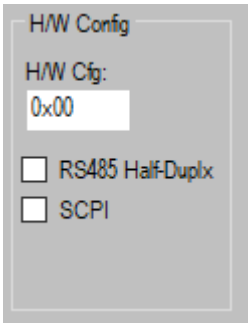
Current Soft Start: Output current is ramp up slower than normal, ~200mS to full load.

No Fast Soft Start: Vout will rise to the set value as fast as possible otherwise, 'RampUp' time is used.

No Smart Preload: Disable preload circuit which is used to speed up output voltage fall time.

No FAN in OFF state: Fan will also be off when OPERATION is set to off, if temperature allowed.

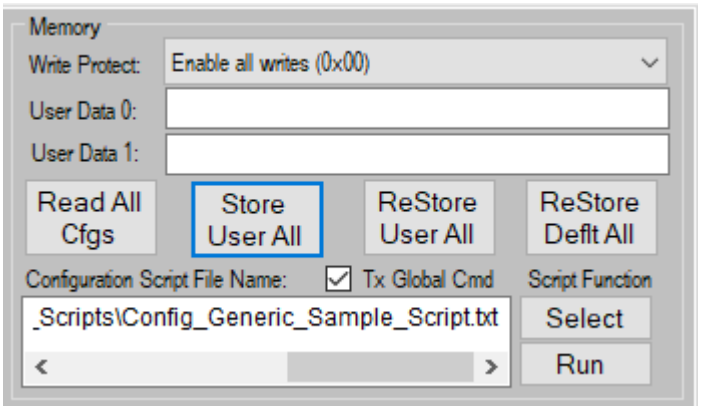
Hardware Config Group



RS485 Half-Duplex: If checked, the utility will send command to the HPx to communicate via RS485 Half-Duplex interface. If not checked, RS485 Full-Duplex will be utilized (default).

SCPI Protocol: If checked, the utility will send the command to HPx to use '**S**tandard **C**ommand for **P**rogrammable **I**nstrument' protocol. This is applicable to RS232, RS485 interface only (using XP USB I2C adapter). If not checked, MODbus protocol will be used (default).

4.3.6 Memory Group



This is where you save and recall various parameter values.

'Write Protect' must be disabled before any command will be accepted.

'User Data 0 & 1': User can store 16 characters in each of these memories space.

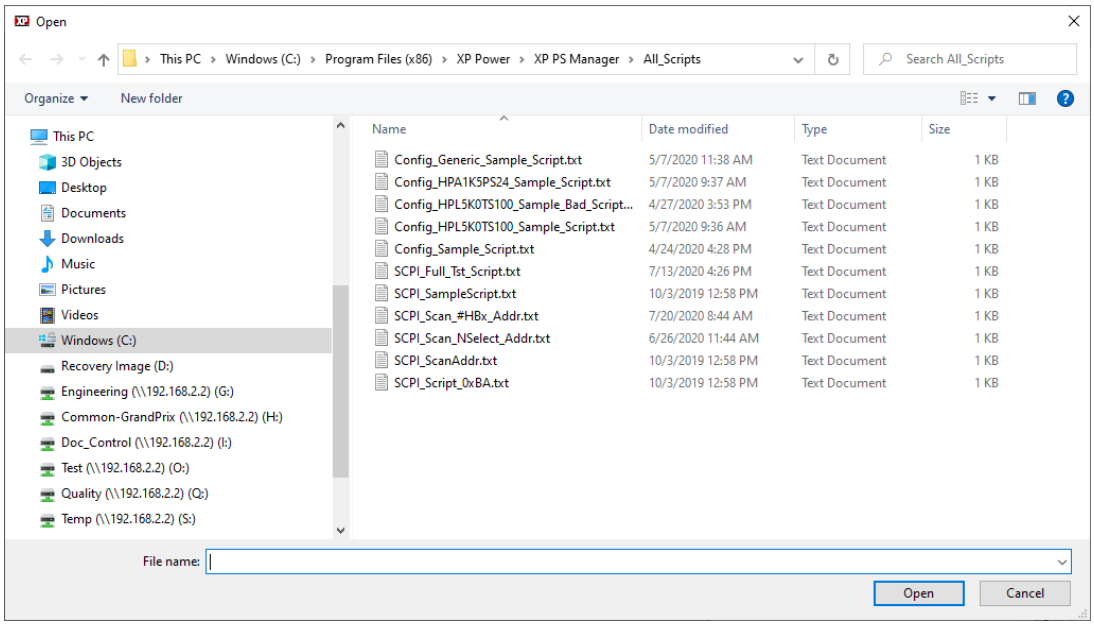
'Store User All' button: Save all parameters values to designated user's memory area.

'Select' button: Select Configuration script file.

When clicked, a file dialog is activated, select a script file to be executed.

Sample script files are included under the installation in directory:

'C:\Program Files (x86)\XP Power\XP PS Manager\All_Scripts'.



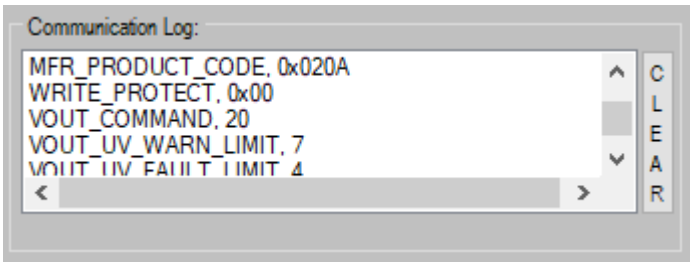
Note:

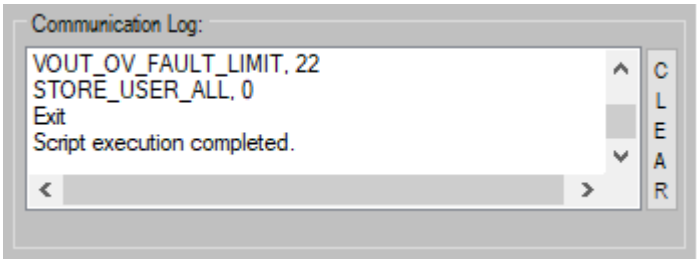
a. SCPI script files & Config script files are in the same directory, careful to select the appropriate one.

b. Optional: Browse to your favorite scripts directory in file dialog window.

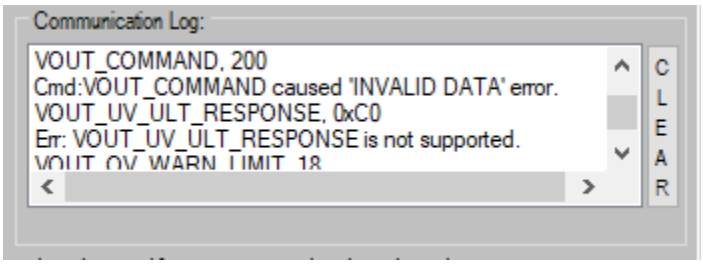
Selected script file is shown (above), move scroll to the right to ensure correct filename.

'Run' button: Executes the selected script file. Each step of the script file is displayed in 'Communication Log' text box.





Completed script execution log shown above.



Use vertical slide bar to verify error free script execution.

>> VOUT_COMMAND, **200** error shown above, it should be **20**.

>> VOUT_UV_**ULT**_RESPONSE, 0xC0 not supported error….'**FAULT**' is miss spelled.

See **Appendix E** for script file format and option.

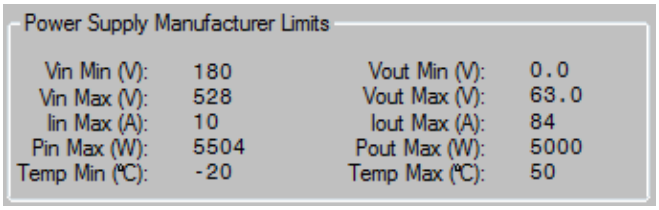
'ReStore User All' button: Set all parameter values to user's memory values.

'ReStore Default All' button: Set all parameter values to factory's default values.

'Read All Config' button: Read all parameter values from power supply.

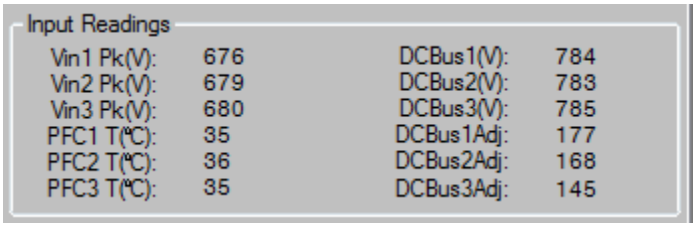
Tx Global Cmd: If checked, device address of the write commands will be set to '00'.

4.3.7 Power Supply Manufacturer Limits Group



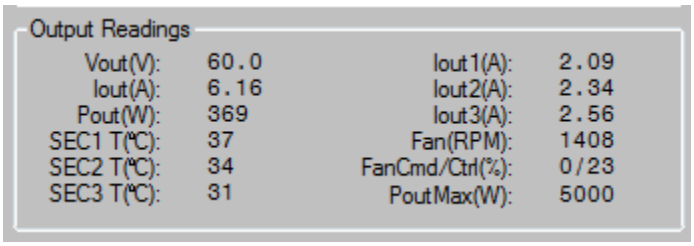
This group displays factory's value for the limits shown and cannot be altered.

4.3.8 Input Reading Group



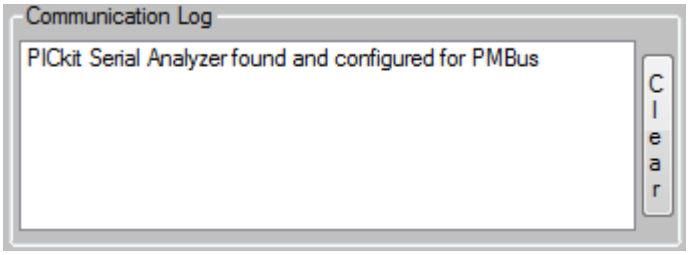
Duplication of 'Monitor' tab but without fault indicators, presented here for convenience.

4.3.9 Output Reading Group



Duplication of 'Monitor' tab but without fault indicators, presented here for convenience.

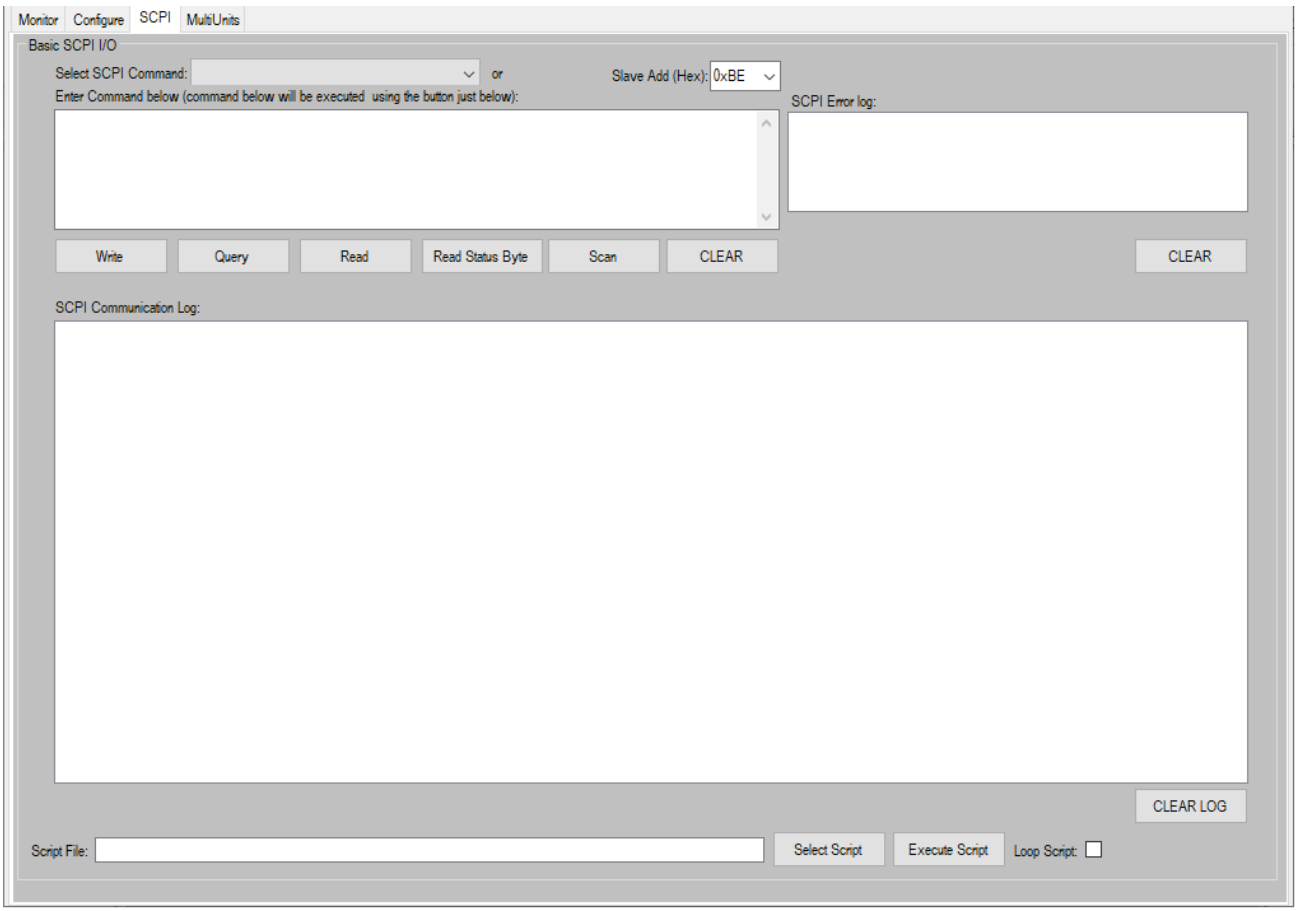
4.3.10 Communication Log Group



Duplication of 'Monitor' tab but without fault indicators, presented here for convenience.

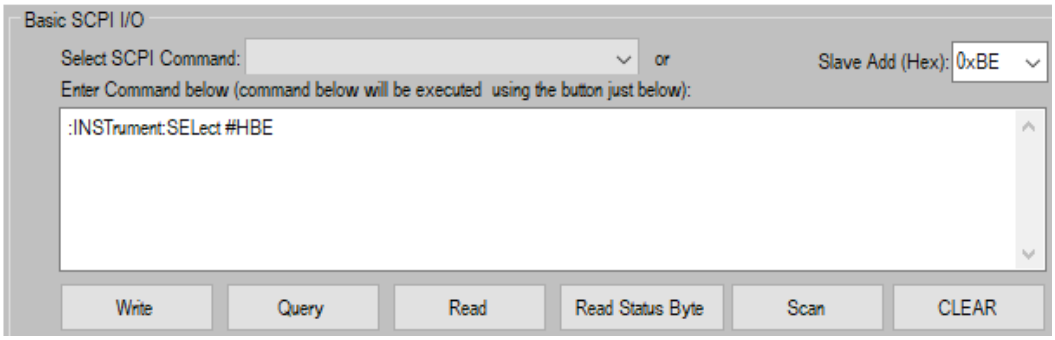
Note: 'Clear' button in any tab will clear Communication Log windows in all tabs.

4.4 SCPI Tab

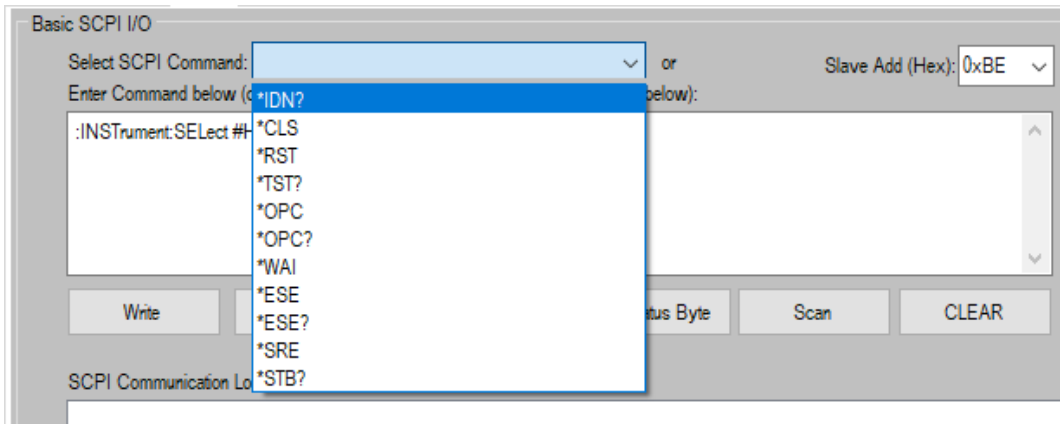


See section 4.1.1.2.1 for activating SCPI protocol.

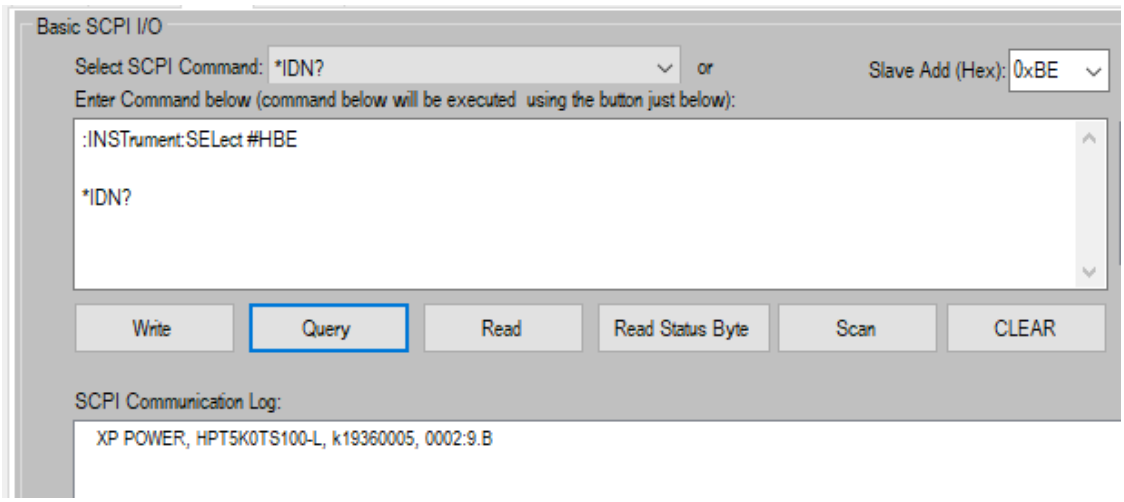
1. Select 'Slave Add' from drop down menu, :INSTrumentSELect command is transmitted as shown. Note: ':INSTrumentSELect' command will not be issued if SCPI protocol is not active.



2. Select '*IDN?' from drop down menu.

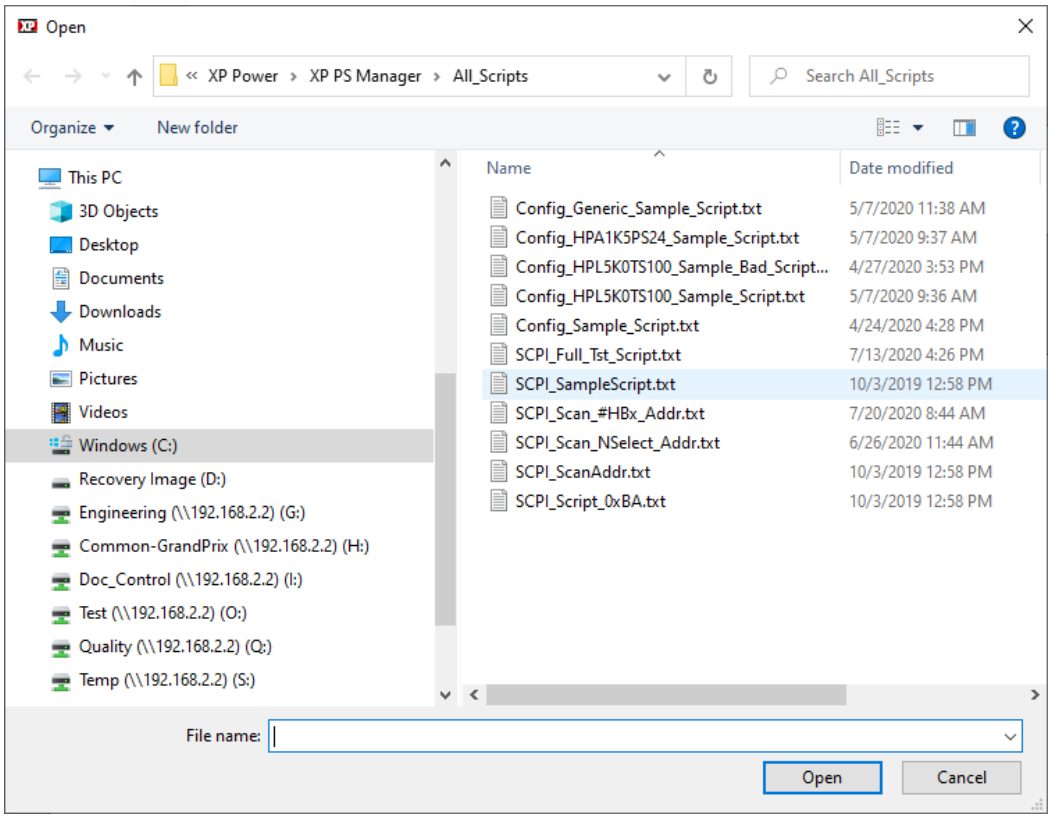


3. Click ‘Query’ button, information of the selected slave unit is displayed in log window.

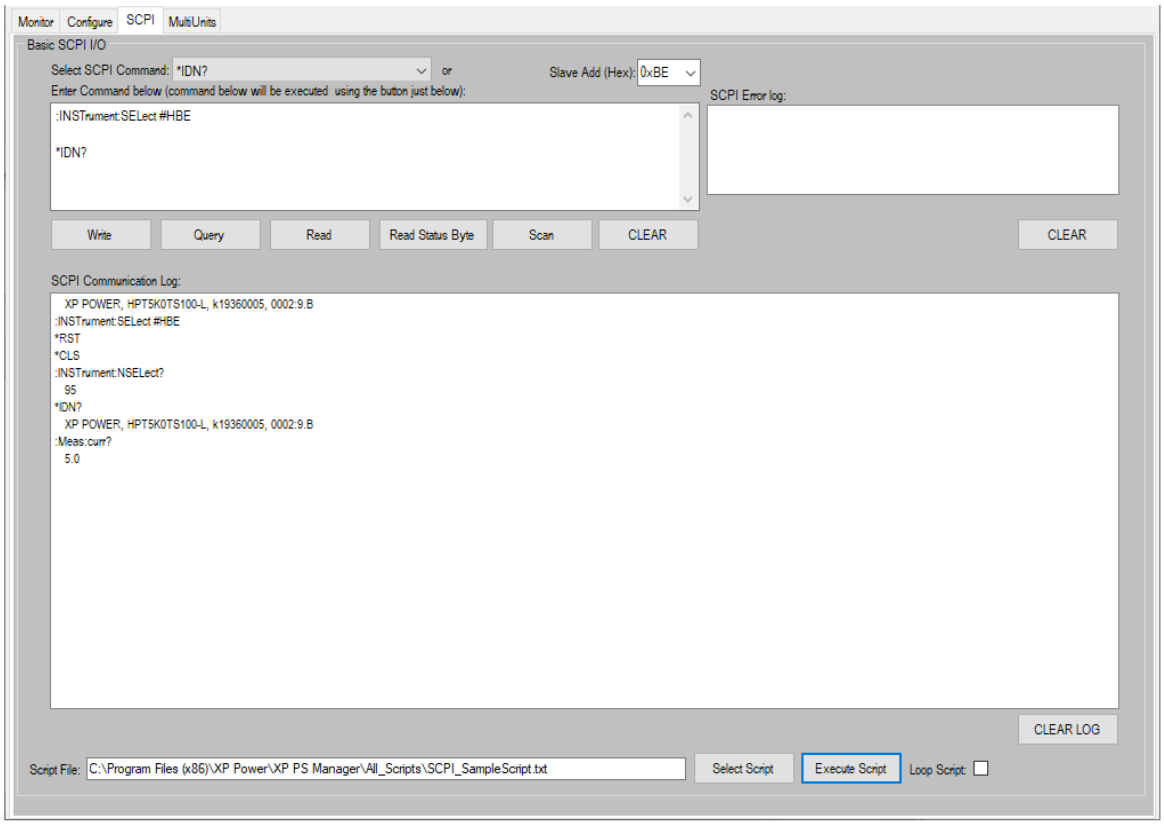


4. Click on ‘Select Script’ button and select one of the SCPI script file.

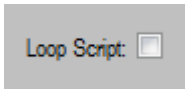
   Sample scripts files are provided with the installation of this utility.



Click on ‘Execute Script’ button. The communication log of the script execution is display in the ’SCPI Communication Log’ window, shown below.



5. ‘Loop Script’ check-box, if checked will continuously run the selected script file.



At this point, user must be familiar with SCPI protocol’s read and write commands to control the HPx power supply. Appendix A lists HPx’s implemented SCPI commands.

Note:

- Command ‘:INSTrument:SELect #HBE’ on the first line of the script sets slave address to 0xBE for all of the commands that follows.

  ‘SCPI_SampleScript’ selects 0xBE slave address; edit this line for other addresses.

4.4.1 PMBus Manager Start up with SCPI system

When the communication protocol is already running in SCPI protocol, ignore the ‘Monitor’ tab start up page information. Click on SPCPI tab and perform scan function to find SCPI slave addresses.

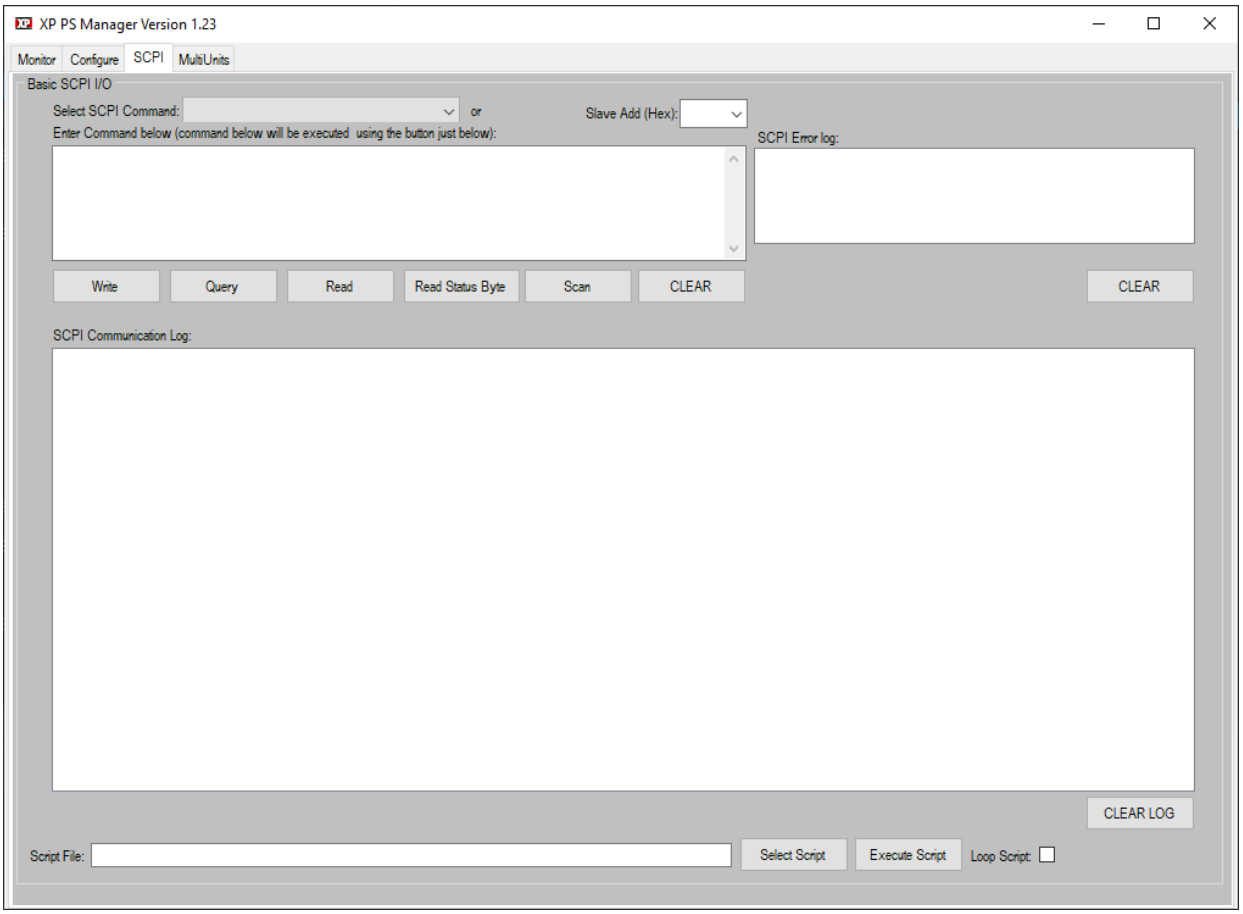
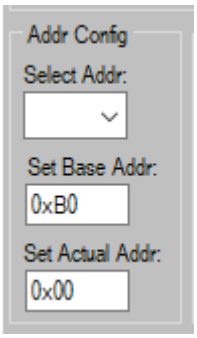


Figure 8: Blank SCPI page upon start up with SCPI protocol already running.

1. Click on ‘Configure’ tab and set ‘Base Addr’ value as starting scan address, 0xB0 shown (default).



2. Click on ‘SCPI’ tab and click on ‘Scan’ button. Scan function will issue ‘IDN?’ query command starting with ‘Base Addr’ to ‘Base Addr’+0x0E with even address values. (0xB0, 0xB2, 0xB4… 0xBE). The responding slave address is added to the ‘Slave Addr’ combo-box. Selecting a slave address from the combo-box drop down menu to control its functions.

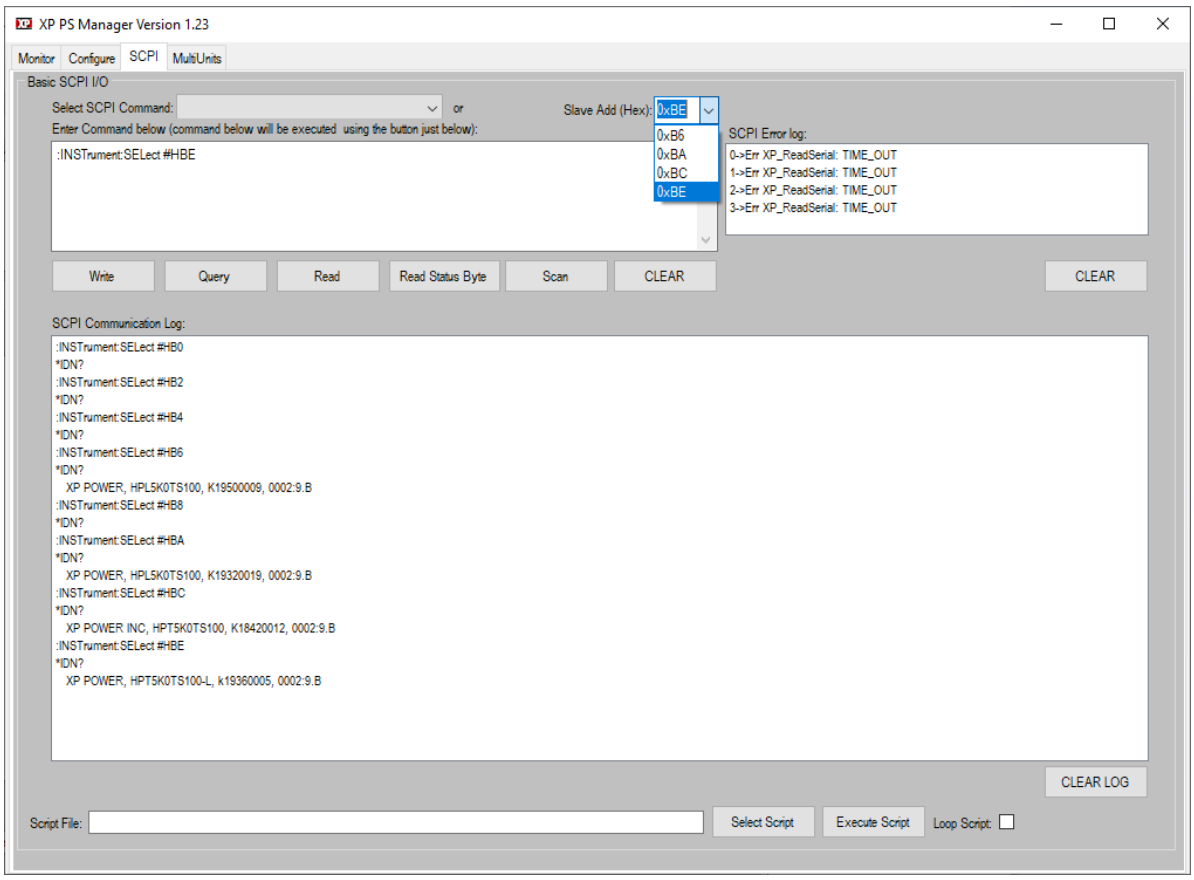


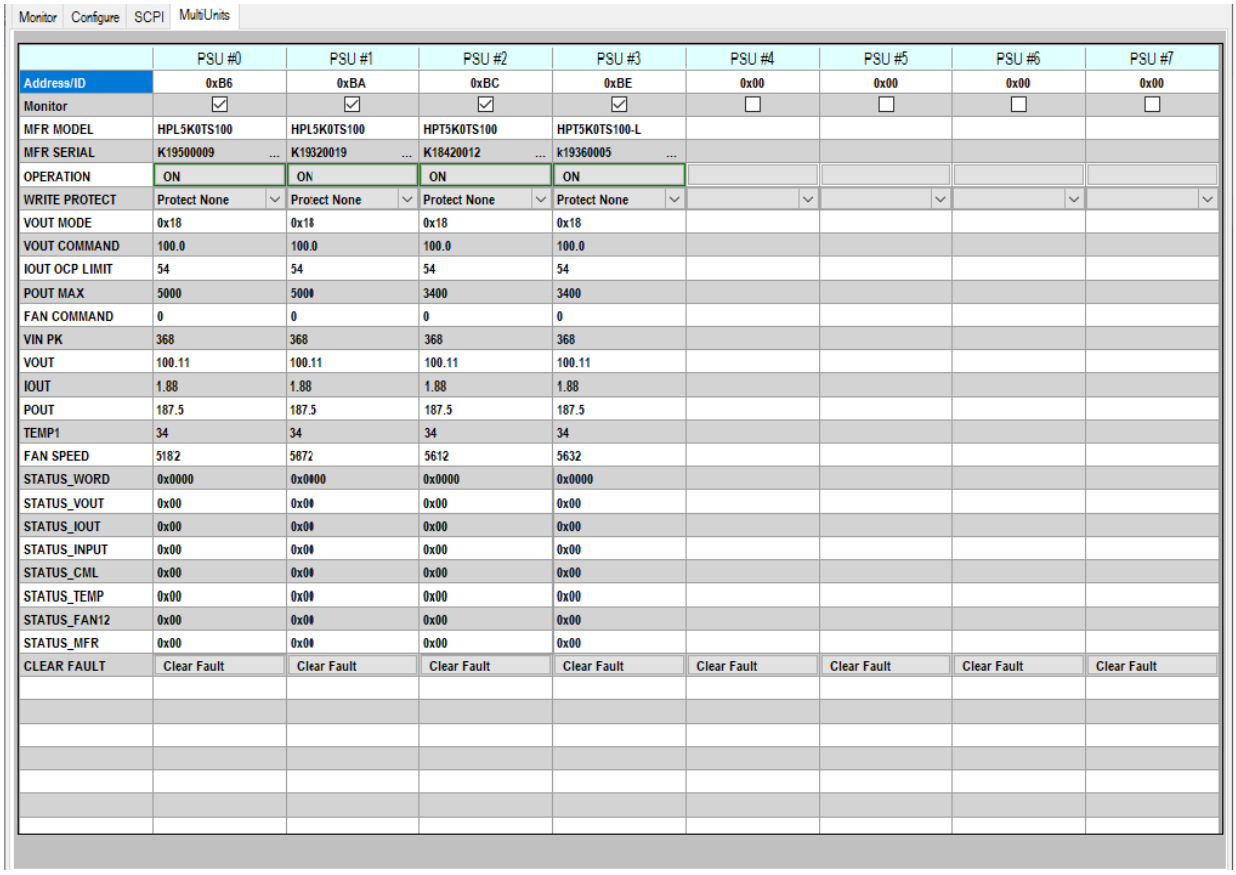
Figure 9: Scan function completed display. Only 0xB6, 0xBA, 0xBC and 0xBE show response to the query command.

Sample SCPI script ‘SCPI_Scan_#HBx_Addr.txt’ performs the same scan function but will not save the responding addresses to the ‘Slave Addr’ combo-box.

4.5 Multi Units Tab

'Multi Units' tab displays essential parameters of all power supplies (up to 8 units) that are connected to the I²C bus. The parameters for all devices are constantly read with pause period set by 'Loop Delay' value in the 'Monitor' tab. This tab page is not enabled when SCPI protocol is active.

4.5.1 Device control



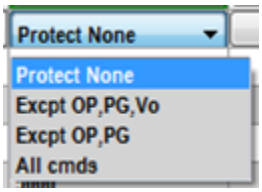
	PSU #0	PSU #1	PSU #2	PSU #3	PSU #4	PSU #5	PSU #6	PSU #7
Address/ID	0xB6	0xBA	0xBC	0xBE	0x00	0x00	0x00	0x00
Monitor	☑	☑	☑	☑	☐	☐	☐	☐
MFR MODEL	HPL5K0TS100	HPL5K0TS100	HPT5K0TS100	HPT5K0TS100-L				
MFR SERIAL	K19500009 ...	K19320019 ...	K18420012 ...	k19360005 ...				
OPERATION	ON	ON	ON	ON				
WRITE PROTECT	Protect None	Protect None	Protect None	Protect None				
VOUT MODE	0x18	0x18	0x18	0x18				
VOUT COMMAND	100.0	100.0	100.0	100.0				
IOUT OCP LIMIT	54	54	54	54				
POUT MAX	5000	5000	3400	3400				
FAN COMMAND	0	0	0	0				
VIN PK	368	368	368	368				
VOUT	100.11	100.11	100.11	100.11				
IOUT	1.88	1.88	1.88	1.88				
POUT	187.5	187.5	187.5	187.5				
TEMP1	34	34	34	34				
FAN SPEED	5182	5672	5612	5632				
STATUS_WORD	0x0000	0x0000	0x0000	0x0000				
STATUS_VOUT	0x00	0x00	0x00	0x00				
STATUS_IOUT	0x00	0x00	0x00	0x00				
STATUS_INPUT	0x00	0x00	0x00	0x00				
STATUS_CML	0x00	0x00	0x00	0x00				
STATUS_TEMP	0x00	0x00	0x00	0x00				
STATUS_FAN12	0x00	0x00	0x00	0x00				
STATUS_MFR	0x00	0x00	0x00	0x00				
CLEAR FAULT	Clear Fault	Clear Fault	Clear Fault	Clear Fault	Clear Fault	Clear Fault	Clear Fault	Clear Fault

Figure 8: Four power supplies connected to the same I²C bus shown.

'Monitor' Check box: When checked, the corresponding device's parameters are updated.

'On/Off' buttons: When clicked, the output voltage of the corresponding device is toggle between enable and disable state (0 volt or commanded volts).

'WRITE PROTECT' buttons: Select command protection level from the drop down menu items.



The intended way to read these cells is:

WRITE PROTECT >> Protect None = all commands are writable

WRITE PROTECT >> Except OPERATION, PAGE, VOUT COMMAND

WRITE PROTECT >> Except OPERATION and PAGE commands

WRITE PROTECT >> All commands = Only WRITE_PROTECT command is accepted, all others are rejected.

Note: WRITE_PROTECT itself is never protected, always writeable.

'Clear Fault' buttons: When clicked, CLEAR_FAULT command is transmit to the corresponding device.

'VOUT COMMAND' cells: Can be highlighted, type in the new value and press 'Enter' key to set Vout voltage of the corresponding device.

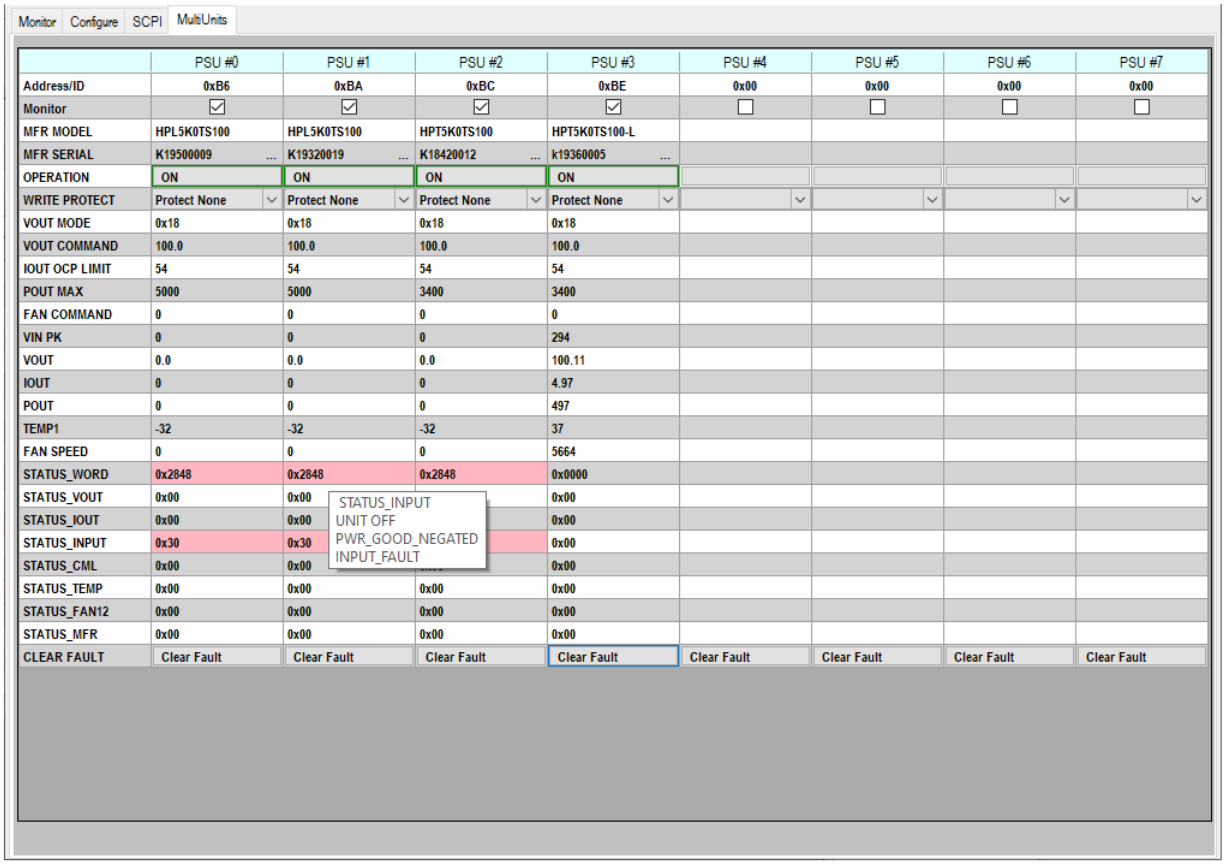
'IOUT OCP LIMIT' cells: Current limit can be set by entering new value.

'FAN COMMAND' cells: Same as described in section 4.1.3, 0=auto speed, nn=constant nn% speed

Other cells are 'read' only cells and cannot be modified.

NOTE: Any value exceeding unit's limit will be rejected and indicated by STATUS_CML.

4.5.2 Status Displays

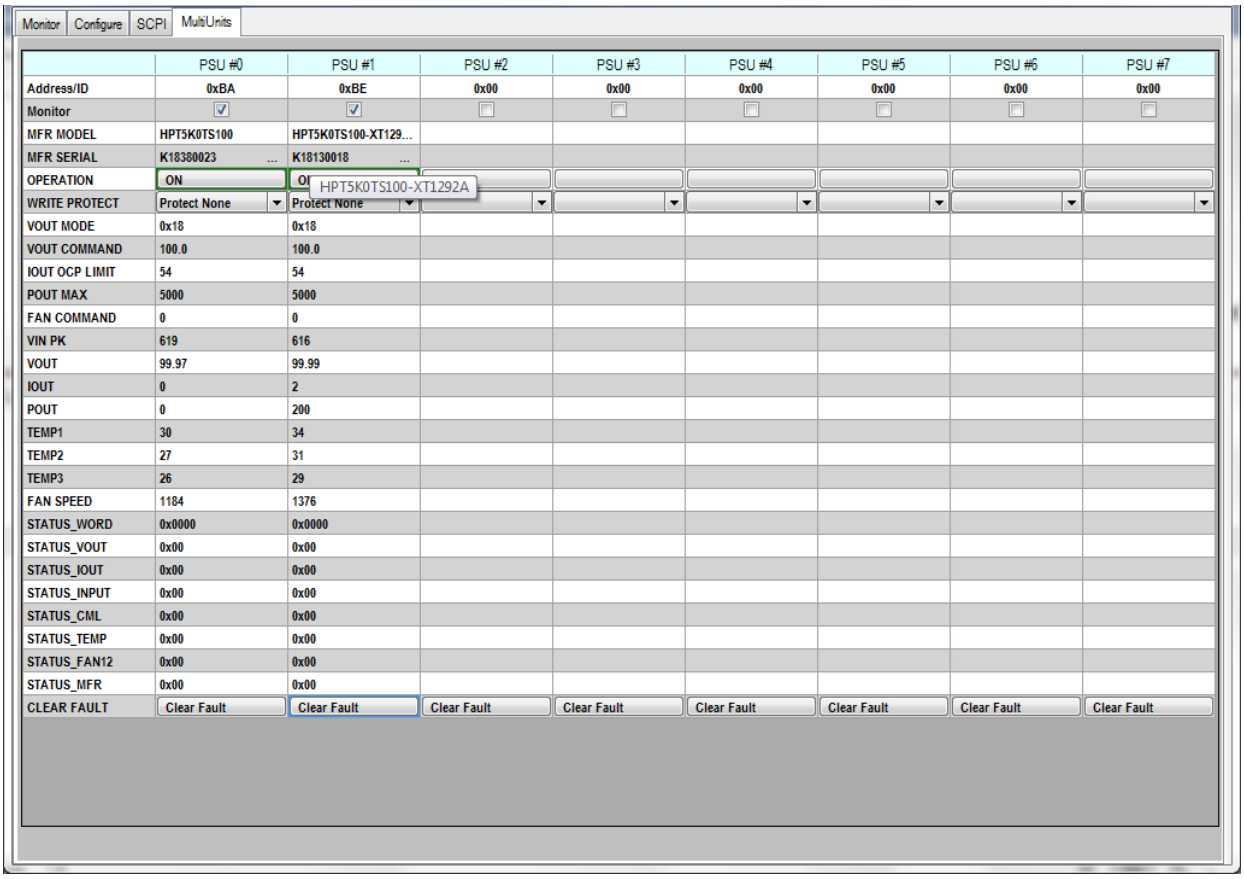


When a status cell is non-zero, the cell color change to 'Light Pink' to highlight the faults.

Hovering the mouse over the faulted cell displays the details of the fault (STATUS_WORD shown above).

Hovering the mouse over the model number cell displays the full model number.

Example shown below is a 'Modified Standard' model.


Monitor
Configure
SCPI
MultiUnits
PSU #0
PSU #1
PSU #2
PSU #3
PSU #4
PSU #5
PSU #6
PSU #7
Address/ID
0xBA
0xBE
0x00
Monitor
MFR MODEL
HPT5K0TS100
HPT5K0TS100-XT129...
MFR SERIAL
K18380023
K18130018
OPERATION
ON
HPT5K0TS100-XT1292A
WRITE PROTECT
Protect None
VOUT MODE
0x18
VOUT COMMAND
100.0
IOUT OCP LIMIT
54
POUT MAX
5000
FAN COMMAND
0
VIN PK
619
616
VOUT
99.97
99.99
IOUT
0
2
POUT
0
200
TEMP1
30
34
TEMP2
27
31
TEMP3
26
29
FAN SPEED
1184
1376
STATUS_WORD
0x0000
STATUS_VOUT
0x00
STATUS_IOUT
STATUS_INPUT
STATUS_CML
STATUS_TEMP
STATUS_FAN12
STATUS_MFR
CLEAR FAULT
Clear Fault

Appendix A: HPx Implemented SCPI commands

Note: Lower case letters can be omitted, e.g. :CURRent = :CURR, :CURRent:AMPLitude = :CURR:AMPL

:CURRent

:CURRent:AMPLitude

:CURRent:AMPLitude?

:CURRent:PROTection

:CURRent:PROTection?

:CURRent?

:INSTrument:NSELect

:INSTrument:NSELect?

:INSTrument:SELect

:INSTrument:SELect

:MEASure:CURRent?

:MEASure:POWer?

:MEASure:TEMPerature?

:MEASure:VOLTage?

:OUTPut:STATe

:OUTPut:STATe?

:PMBUs

:PMBUs?

:STATus:OPERation:CONDition?

:STATus:OPERation:ENABle

:STATus:OPERation:ENABle?

:STATus:OPERation:EVENt?

:STATus:OPERation?

:STATus:PRESet

:STATus:QUEStionable:CONDition?

:STATus:QUEStionable:ENABle

:STATus:QUEStionable:ENABle?

:STATus:QUEStionable:EVENt?

:STATus:QUEStionable?

:SYSTem:CAPability?

:SYSTem:ERRor?

:SYSTem:VERSion?

:VOLTage

:VOLTage:AMPLitude

:VOLTage:AMPLitude?

:VOLTage:LIMit:LOW

:VOLTage:LIMit:LOW?

:VOLTage:PROTection:LEVel

:VOLTage:PROTection:LEVel?

:VOLTage?

Appendix B: Install/Update XP USB I²C Device Driver

1. If not already there, copy the entire directory (XPPowerWinUSBdrv) of the new XP USB I²C device driver to C:\Program Files (x86)\XP Power\XP PS Manager\XPPowerWinUSBdrv.

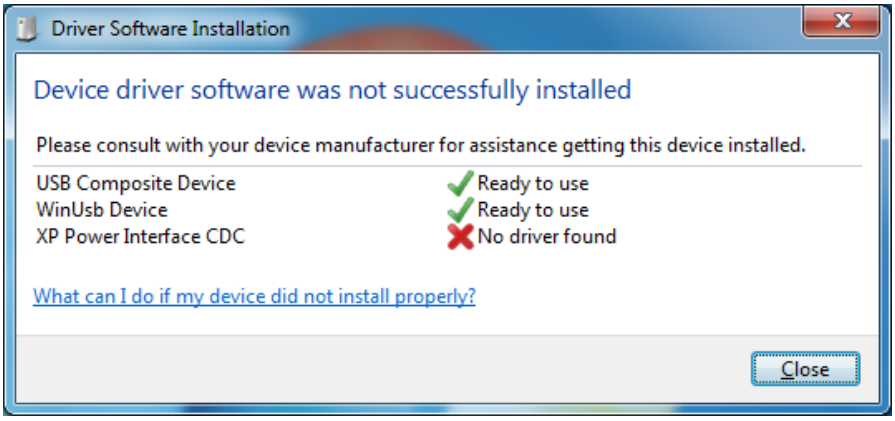
2. Connect XP USB I²C device to PC.

3. **NOTE:**

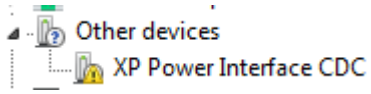
   - **Skip this step if 'XP Power Interface CDC' has been installed (go to step 4).**

   - **For Windows 10, see step 9 below.**

   Once Windows finished installing available drivers, CDC driver is left.



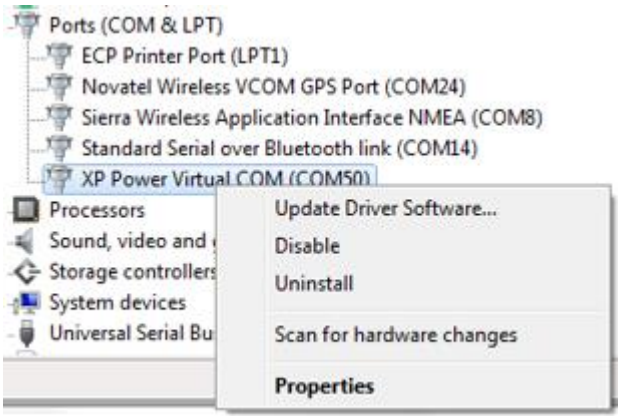
   Open 'Control Panel, Device Manager', locate 'XP Power Interface CDC' and right click on it.



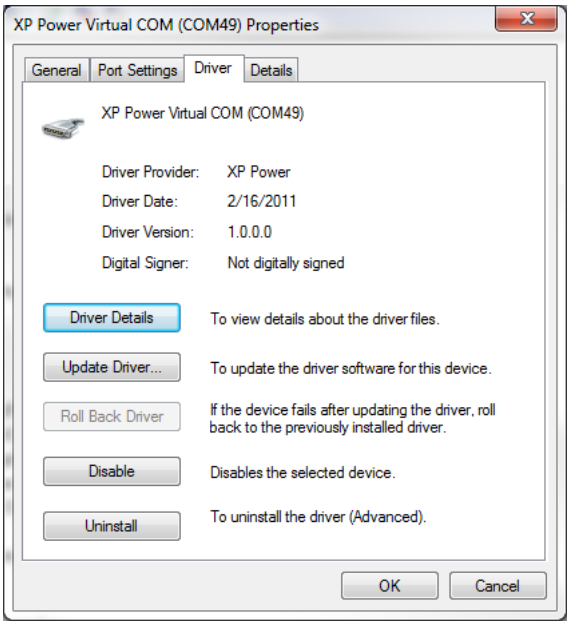
   a. If available, select 'Update Driver Software' otherwise select 'Property', 'Driver' tab, 'Update Driver' button.
   b. 'Browse to C:\Program Files (x86)\XP Power\XP PS Manager\XPPowerWinUSBdrv directory, ensure that 'Include subfolders' box is checked.
   c. Click 'Next' button to update driver.

   Once the CDC driver is installed, you'll have new 'Virtual COM' device, shown in the following steps and CDC device will disappeared from Device Manager list.

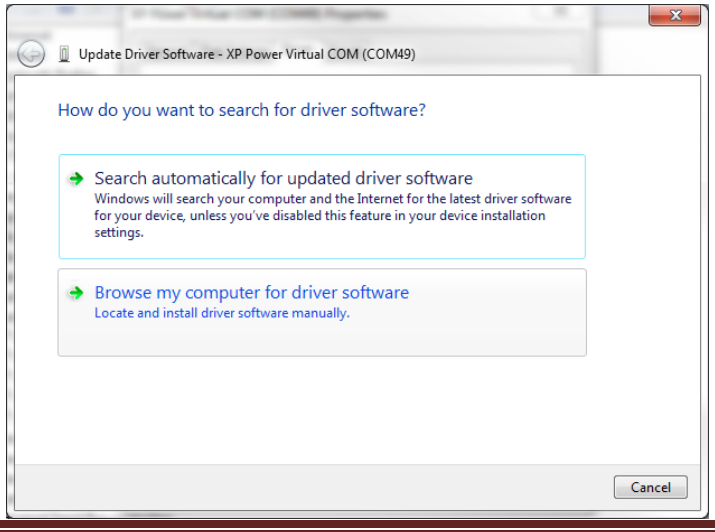
4. Locate 'XP Power Virtual COM' device under 'Ports', right click on it.
   If available, select 'Update driver'….



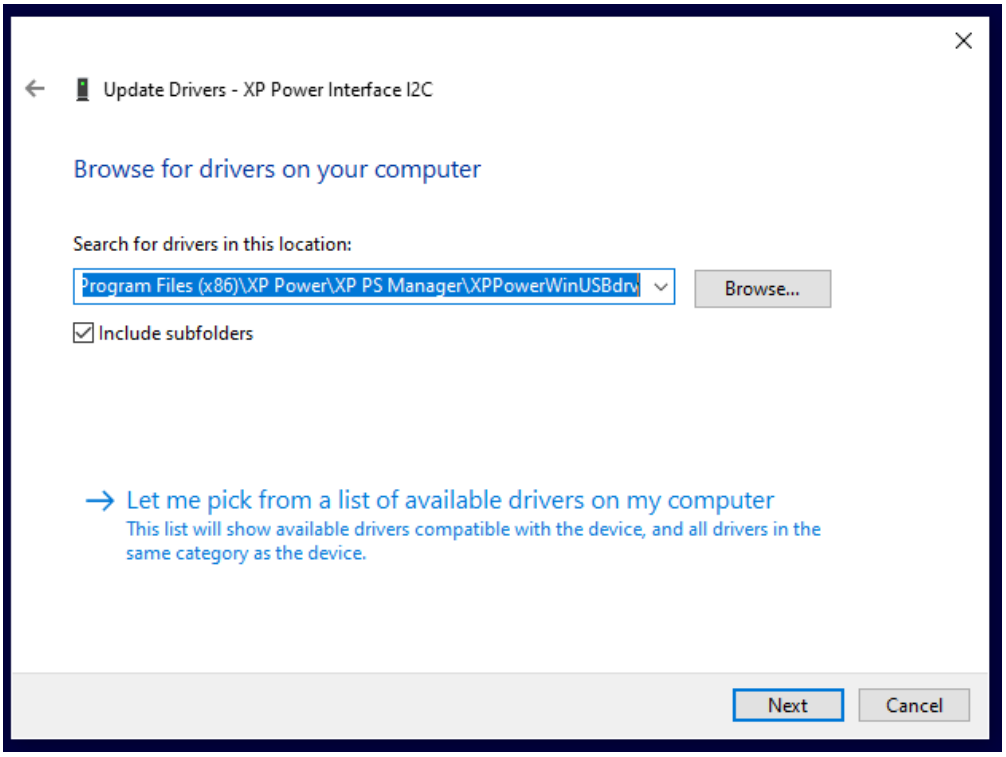
… otherwise, select 'Property', 'Driver' tab, click on 'Update driver'.



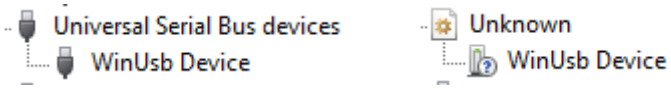
5. Select 'Browse my computer'



6. Browse to
   C:\Program Files (x86)\XP Power\XP PS Manager\XPPowerWinUSBdrv directory, ensure that 'Include subfolders' box is checked.
   Click 'Next' button, update process begins.



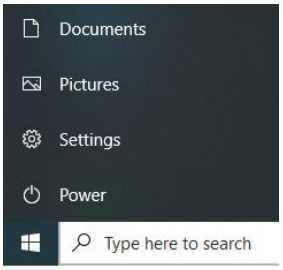
7. Once update process is completed, locate 'WinUsb Device'. It may be under other device folder, repeat step 4-6



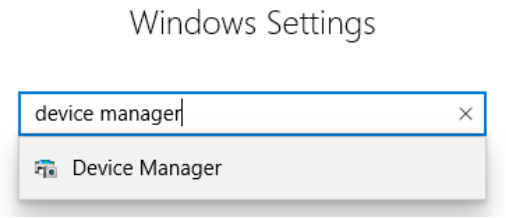
8. Once the update for 'WinUsb Device 'process is completed, close all opened control windows. Driver software Installation/update is completed.

---

9. **<u>For Windows 10</u>**
   Click on 'Settings' icon

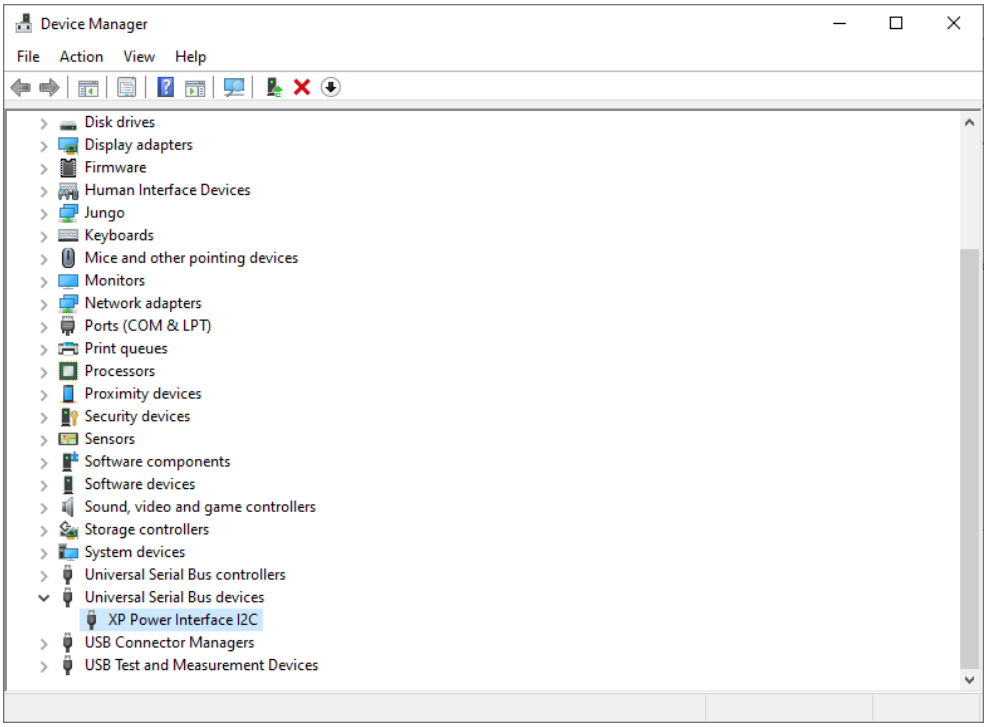


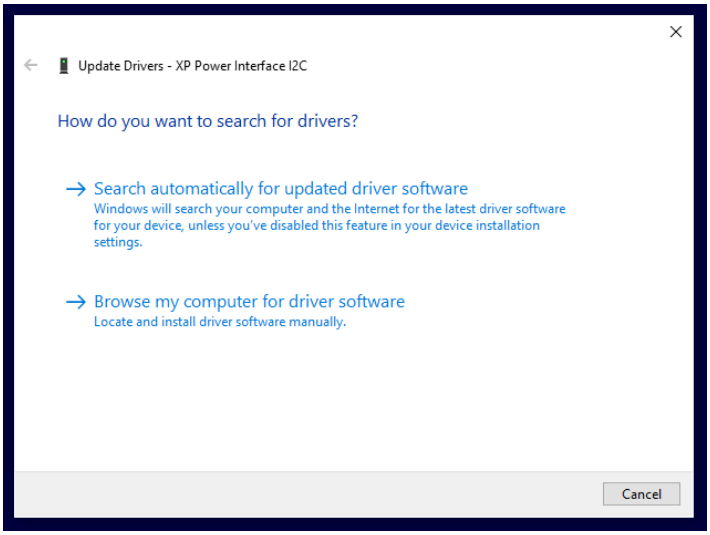
On the ‘Setting’ window, type ‘Device Manager’ and press ‘Enter’ key.



On device Manager window,

Right click on ‘XP Power Interface I2C’ and select ‘Update Driver’.





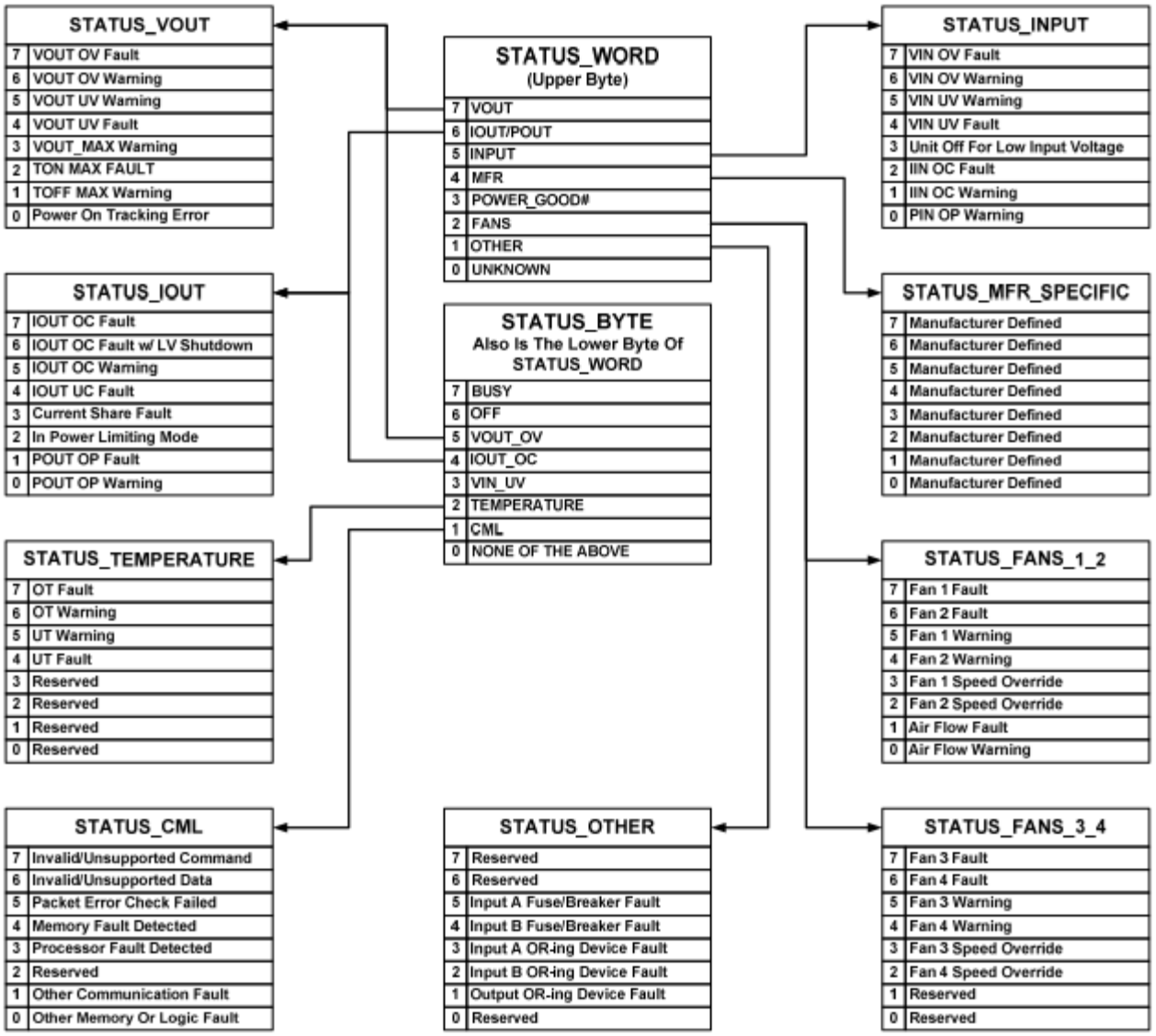
Select ‘Browse my computer’ and follow step 6 above.

Appendix C: Things to remember

1. Enable write command.
2. If you add/remove power supply on the bus, click ‘Scan Bus’ button.
3. Might want to click ‘Stop Loop’ before switching to SCPI tab.
4. ‘Scan’ buttons and ‘MultiUnit’ tab are not functional while in SCPI protocol.
5. PICkit Serial USB adapter only work with I²C/PMBus communication.
6. Switch interface cable when you switch communication port.
7. When changing communication port, verify ‘parity’, default is ‘Even’.

Appendix D: PMBus Status Bits Reference

Status Summary:



STATUS_WORD

Byte	Bit Number	Status Bit Name	Meaning
Low	7	BUSY	A fault was declared because the device was busy and unable to respond.
	6	OFF	This bit is asserted if the unit is not providing power to the output, regardless of the reason, including simply not being enabled.
	5	VOUT_OV	An output overvoltage fault has occurred
	4	IOUT_OC	An output overcurrent fault has occurred
	3	VIN_UV	An input undervoltage fault has occurred
	2	TEMPER-ATURE	A temperature fault or warning has occurred
	1	CML	A communications, memory or logic fault has occurred
	0	NONE OF THE ABOVE	A fault or warning not listed in bits [7:1] of this byte has occurred
High	7	VOUT	An output voltage fault or warning has occurred
	6	IOUT/POUT	An output current or output power fault or warning has occurred
	5	INPUT	An input voltage, input current, or input power fault or warning has occurred
	4	MFR	A manufacturer specific fault or warning has occurred
	3	POWER_ GOOD#	The POWER_GOOD signal, if present, is negated
	2	FANS	A fan or airflow fault or warning has occurred
	1	OTHER	A bit in STATUS_OTHER is set
	0	UNKNOWN	A fault type not given in bits [15:1] of the SATUS_WORD has been detected

STATUS_VOUT

Bit	Meaning
7	VOUT Overvoltage Fault
6	VOUT Overvoltage Warning
5	VOUT Undervoltage Warning
4	VOUT Undervoltage Fault
3	VOUT_MAX Warning (An attempt has been made to set the output voltage to value higher than allowed by the VOUT_MAX command (Section 13.5).
2	TON_MAX_FAULT
1	TOFF_MAX Warning
0	VOUT Tracking Error [1]

STATUS_IOUT

Bit	Meaning
7	IOUT Overcurrent Fault
6	IOUT Overcurrent And Low Voltage Shutdown Fault
5	IOUT Overcurrent Warning
4	IOUT Undercurrent Fault
3	Current Share Fault [1]
2	Power Limiting [2]
1	POUT Overpower Fault
0	POUT Overpower Warning

STATUS_INPUT

Bit	Meaning
7	VIN Overvoltage Fault
6	VIN Overvoltage Warning
5	VIN Undervoltage Warning
4	VIN Undervoltage Fault
3	Unit Is Off For Insufficient Input Voltage [1]
2	IIN Overcurrent Fault
1	IIN Overcurrent Warning
0	PIN Overpower Warning

STATUS_TEMPERATURE

Bit	Meaning
7	Overtemperature Fault
6	Overtemperature Warning
5	Undertemperature Warning
4	Undertemperature Fault
3	Reserved
2	Reserved
1	Reserved
0	Reserved

STATUS_CML

Bit	Meaning
7	Invalid Or Unsupported Command Received
6	Invalid Or Unsupported Data Received
5	Packet Error Check Failed
4	Memory Fault Detected [1]
3	Processor Fault Detected [2]
2	Reserved
1	A communication fault other than the ones listed in this table has occurred
0	Other Memory Or Logic Fault has occurred. [3]

STATUS_OTHER

Bit	Meaning
7	Reserved (Replaced by STATUS_FANS)
6	Reserved (Replaced By STATUS_FANS)
5	Input A Fuse Or Circuit Breaker Fault [1]
4	Input B Fuse Or Circuit Breaker Fault [1]
3	Input A OR-ing Device Fault [2]
2	Input B OR-ing Device Fault [2]
1	Output OR-ing Device Fault [3]
0	Reserved

STATUS_FAN_1_2

Bit	Meaning
7	Fan 1 Fault [1]
6	Fan 2 Fault [1]
5	Fan 1 Warning [2]
4	Fan 2 Warning [2]
3	Fan 1 Speed Overridden [3]
2	Fan 2 Speed Overridden [3]
1	Airflow Fault [4]
0	Airflow Warning [4]

Appendix E: Configuration Script File Format

REM This sample script file is for HPA1K5PS24

REM script line format:

REM PMBusCommand, value

REM 0xYY for hex value (ie; 0xAB)

REM See user manual for details

REM Optional: MFR_PRODUCT_CODE on 1st command line

REM -------- NO BLANK LINE! (use REM) ----------

REM

MFR_PRODUCT_CODE, 0x0102

WRITE_PROTECT, 0x00

VOUT_COMMAND, 20

VOUT_UV_WARN_LIMIT, 7

VOUT_UV_FAULT_LIMIT, 4

REM Add more commands as needed

REM Add more commands as needed

VOUT_OV_FAULT_LIMIT, 22

STORE_USER_ALL, 0

WRITE_PROTECT, 0x80

Exit

NOTE: MFR_PRODUCT_CODE is optional. If present, script will not be executed if connected supply's code does not match.

This is optional safety to prevent model specific script to run on other models.

You can have non-specific/generic scripts (*no MFR_PRODUCT_CODE command line*) that can be run for all models.

Product Code: (as of April 2020)

HPA1K5PS24: 0x0102	HPL5K0TS048: 0x0205	HPT5K0TS048: 0x0005	HPT5K0TS048-L: 0x8005
HPA1K5PS48: 0x0105	HPL5K0TS060: 0x0206	HPT5K0TS060: 0x0006	HPT5K0TS060-L: 0x8006
	HPL5K0TS100: 0x020A	HPT5K0TS100: 0x000A	HPT5K0TS100-L: 0x800A
	HPL5K0TS200: 0x0214	HPT5K0TS200: 0x0014	HPT5K0TS200-L: 0x8014

Appendix F: Change Logs

```
Rev 1.23
1. Added SCPI address scan button/function for start-up in SCPI mode.
2. Reduced to 1 (from3) btmRead_Click() when btnScanBus is clicked (in FormMain & FormConnection).
3. Move script files to C:\Program Files (x86)\XP Power\XP PS Manager\All_Scripts directory.
4. No Tx of SCPI address select message when selected new slave address if not in SCPI protocol.
5. Convert SCPI error code to text string.
6. Added more error messages associated with slaves addr comboboxes.
7. New Configuration script buttons & display to accomodate longer file path.
8. Add more code to catch run_script() function erors.
```

```
Rev 1.22
1. Removed OV, UV, OC protection logic, Arnaud wants user to do anything they want, just manage gauge color band.
2. Add Configuration script execution button.
3. Bug fix:
    - No rescan when 'Restore User All' & 'Restore Default All', it displays the lowest addr configurations when
      multiple supplies are connected, not current sellected address.
    - Open only one 'Connection Settings' window when 'Connection Settings' button clicked multiple times.
    - When user click 'Connection Settings' button when NO interface box connected.
    - When 'Refresh' button clicked after XP I²C or PICkit interface box is connected (from no connection).
    - Make error message visible in 'Connection Settings' window.
    - Shows all default ports# & its configs at startup, even when it not selected, per Arnaud direction.
    - Save last selections of 'Connection Settings' window for next startup.
```

```
Rev 1.21
1. For multiple XP I2C USB adapters conections, assign unique adapter number when any adapter have the same serial number.
2. Clear and restart MultiUnit tab display when switching betwen adapters.
3. Verify 'ramp up/ramp dn value to be within valid range and read back when set.
4. Miscellaneous cosmeic changes (texbox size & labels, '----', etc.).
5. Added protection logic for OV, UV, OC warning & fault limits, see section 4.3.2
6. Modified Configuration tab groupings, added 'Addr Config' & 'User Config' groupboxes.
7. In 'Connection' window, 'Inrerface Device Adapter' groupbox, added selected port label to 'Master' groupbox text.
8. Fix 'Firmware version' from Hex to decimal (ie; 0x9B >> 9.11).
9. Synchronize unstall version number to installed version number.
10. Eliminated communication errors when switching between adapters.
11. Correctly display info when unplug interface cable from one power supply to another while 'Read Loop' is active.
12. Move Vout on/off combobox from User Config group to Vout on/off button in Vout group in Configuration tab.
13. Add logic to check/correct 'Set Base Addr' & 'Set Actual Addr' entry in 'Configure' tab page.
14. Add new User Config bits: 'No Analog Vprog' & 'No Prteload in Shutdown'.
15. Chk syntax & range from screen input voltage & current values.
```

```
Rev 1.20
- Fixed the CAN bus clock speed change bug.
- No warninig range (yellow) in power gauge.
- All port types are enabled in 'Connection' window, selected port has bold lettering.
- Automatically adjust power guage scale and ranges per model number.
- Added Power LED and update its color according to power level.
- Fixed I2C comm port error when startup with CAN.
- Added Fan Config 1/2 & 3/4 values in Configure tab.
```