XP PS Manager

User Manual

Revision 2.14

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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

4.1.2.1 Changing Communication interface 12

4.1.2.2 SCPI Protocol 14

4.1.2.3 Multiple 'XP USB I²C' Adapters 16

4.1.3 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 (HPT5K0 shown) 20

4.2.5 HPx Output Readings (HPT5K0 shown) 20

4.2.6 PMBus Device's Statuses 20

4.2.7 HPx Power Supplies 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 25

4.3.4 Temperature Group 25

4.3.5 User Config Group 25

4.3.6 H/W Config Group 26

4.3.7 Addr Config Group 26

4.3.8 Memory Group 27
4.3.9 Power Supply Manufacturer Limits Group 28
4.3.11 Power Supply Status 28
4.3.12 Output Reading Group 28
4.3.13 Communication Log Group 28
4.4 SCPI Tab 29
4.4.1 PMBus Manager Start up with SCPI system 32
4.5 Multi Units Tab 34
4.5.1 Device control 34
4.5.2 Status Displays 35
4.6 Update Firmware Tab 37
Appendix A: HPx Power Supplies Implemented SCPI commands 39
Appendix C: Install/Update XP USB I²C Device Driver 42
Appendix D: Things to remember 47
Appendix E: PMBus Status Bits Reference 48
Appendix F: XP USB I2C Cable Diagrams 52
Appendix G: Change Log 57

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 Specific' commands may not work.

NOTE: 1. HPx family = HPT, HPL, HPA, HPF and future designs. HPA1K5PS48 is use as an example in this document.

2. Users of this utility should be familiar with PMBus protocol and its operations.

3. 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 also has various protocols, such as, PMBus, Modbus, SCPI and CANopen. The I²C operational differences between PICkit & XP USB I²C adapters are minor, in some displays (adapter name) and the speeds of some executions (scan bus and monitor loops).

2.0 References

1. PMBUS Power System Management Protocol Specification Revision 1.2
2. SMBUS Specification Version 3.0
3. HPT5K0 Communication, Control and Status Specification.
4. Microchip PICkit Serial Analyzer user manual.

3.0 Setup

3.1 Quick Start Steps

For factory fresh HPx power supplies, 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 HTx, run 'XP PS Manager' utility program.

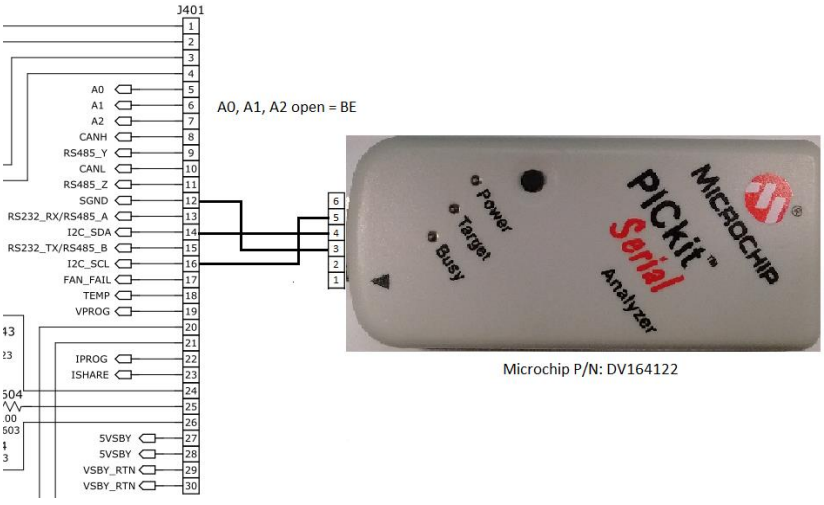


Figure 1: PICkit interface cable diagram.

3.3 XP USB I²C Adapter

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

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

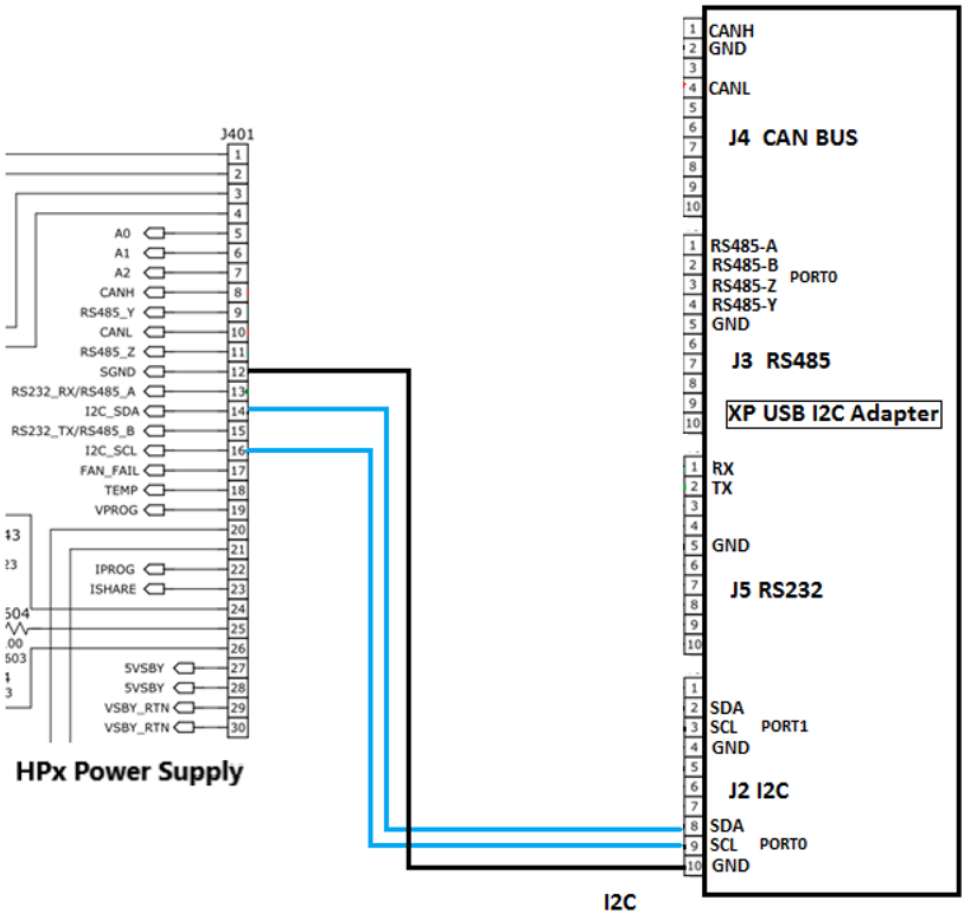


Figure 2: I²C connections

4.0 Using the XP PS Manager

4.1 Adapter Configurations

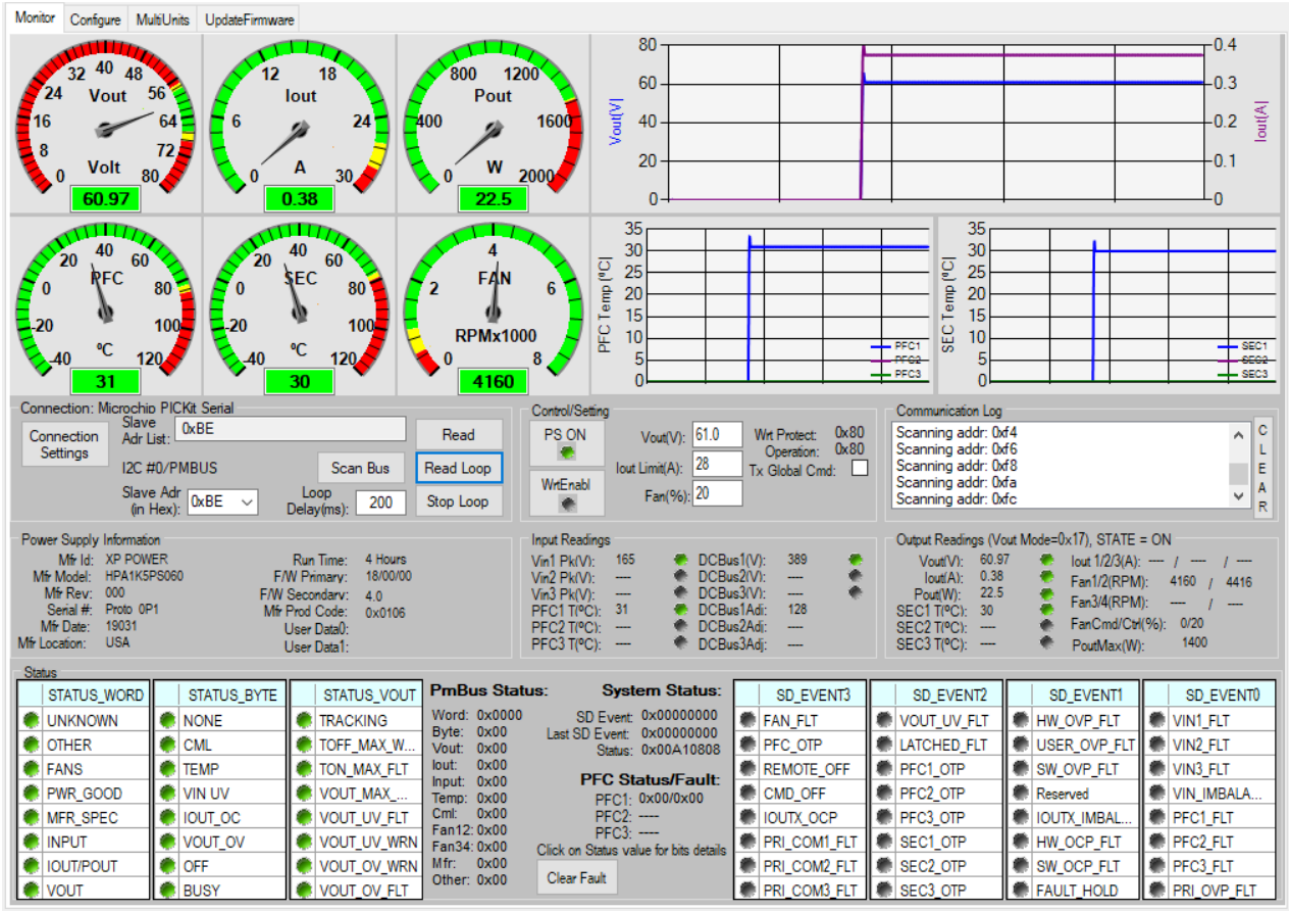


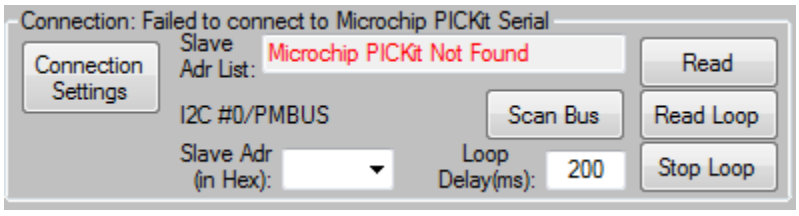
Figure 3: Startup display of the utility (PICkit adapter, no SCPI tap page).

4.1.1 PICkit Serial Adapter

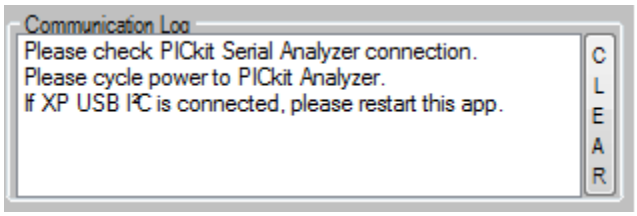
At start up, the utility looks for the last connected adapter.

4.1.1.1 PICkit Not Found

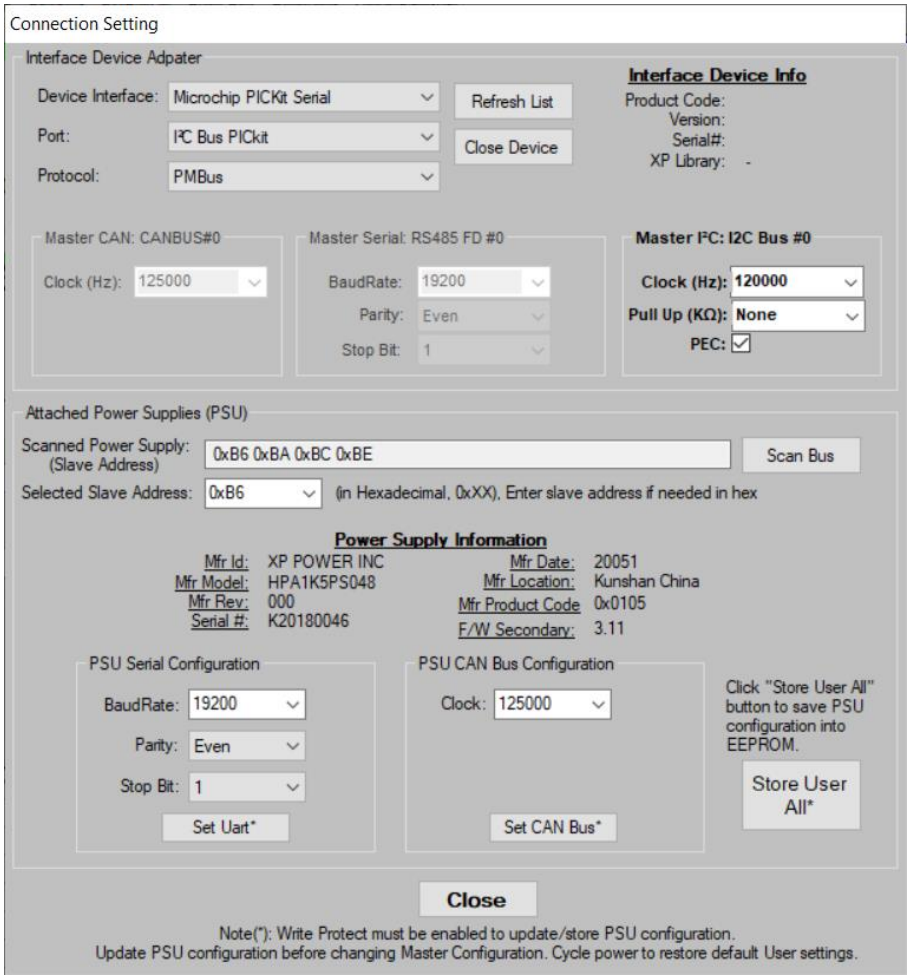
The utility may display 'PICkit Not Found', as shown below.



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. Lowest address is automatically selectred.

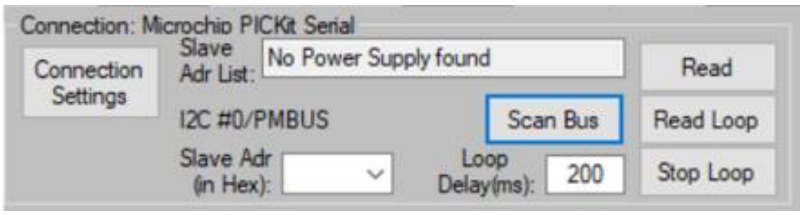


'Power Supply Information' of the selected address is displayed, click 'Close' button to return to 'Monitor' tab page (see section 4.2).

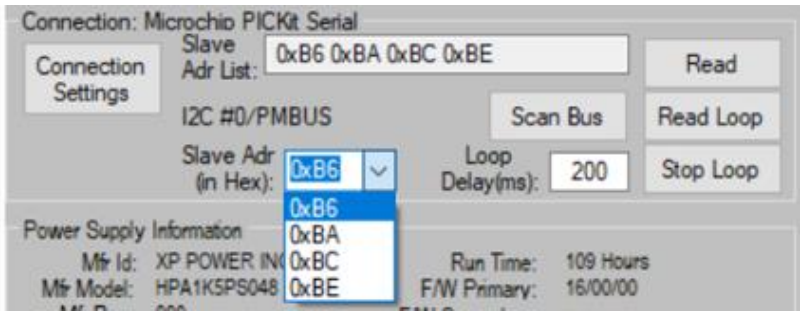
4.1.1.2 No Power Supply Found

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

In Multi-Unit connection configuration, I²C bus is held down by an un-powered unit and 'No Power Supply Found' is displayed in 'Slave Adr List' textbox.

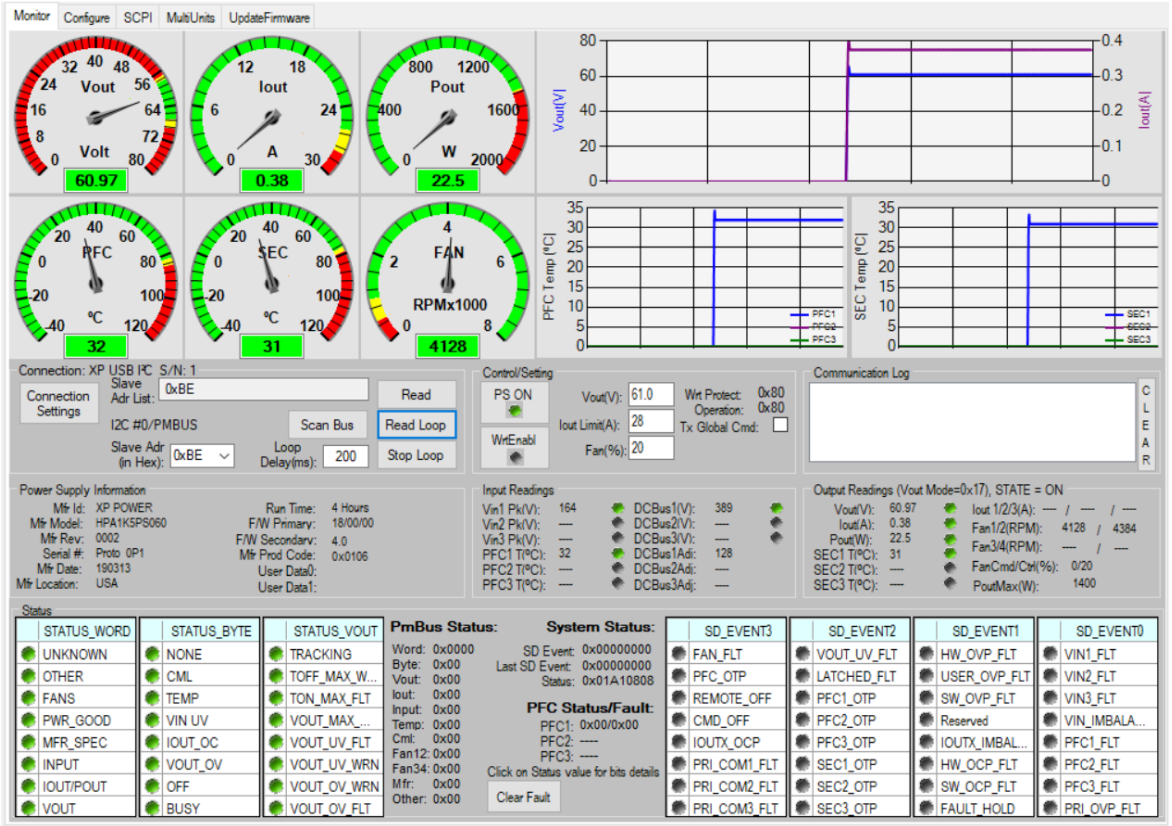


Once the power supplies are found, select the address to monitor in 'Slave Adr' combo-box as shown below. Default HPx address is 0xBE, go to section 4.2.



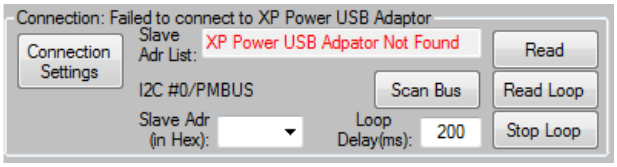
4.1.2 XP USB I²C Adapter

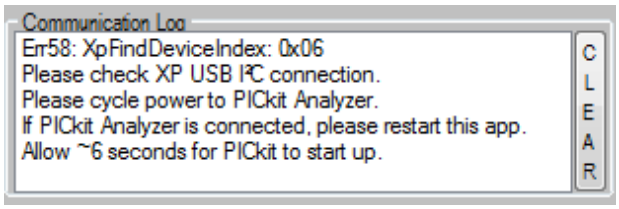
After performing the steps in section 3.3 (using I²C connection), the utility should detects XP USB I²C adapter, scans for connected power supplies and display similar information shown below.



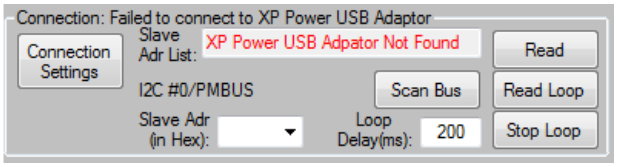
4.1.2.1 XP USB I²C Adapter Not Found

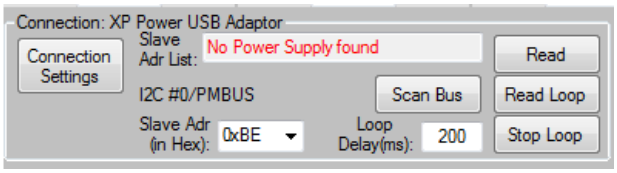
If switching from XP USB I²C adapter to PICkit adapter, the utility will need to be restarted as shown in the 'Communication Log' window below.





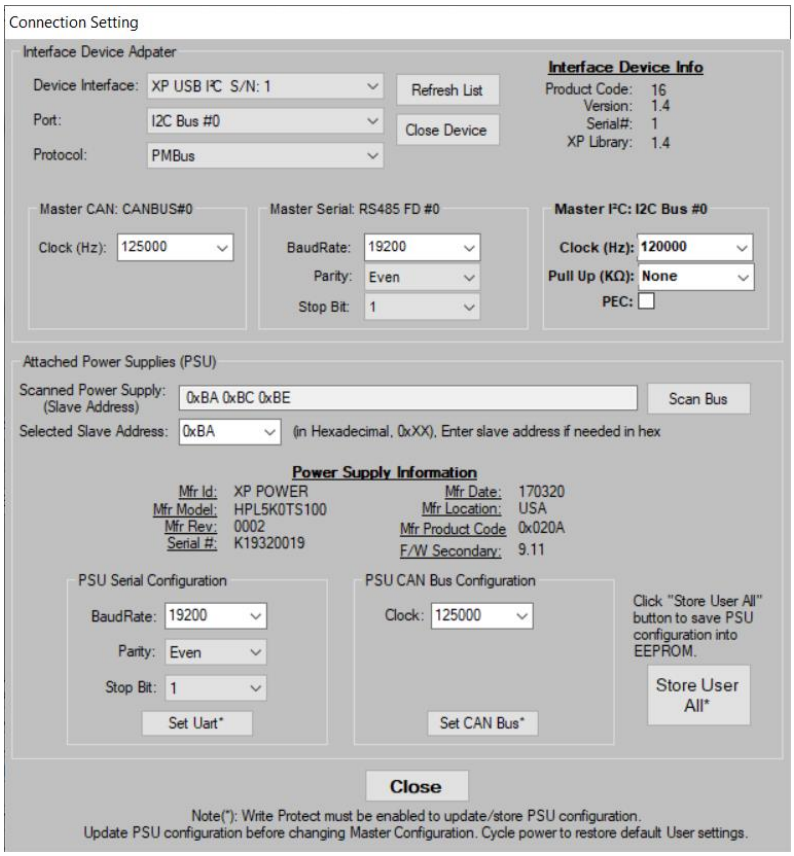
If XP USB I²C adapter is connected and the 'Connection' group is displaying one of the errors below, please verify connections cables (interface and USB), input power to the supplies then click on 'Connection Settings' button in 'Monitor' tab page.



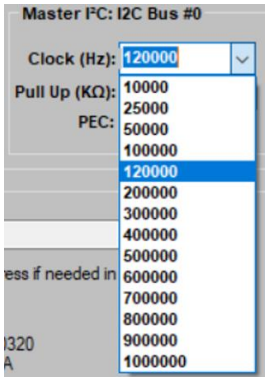


The utility will search for connected adapter and scan for connected power supplies. After successful operations, the 'Connection Setting' window will pop-up displaying addresses of the supplies found.

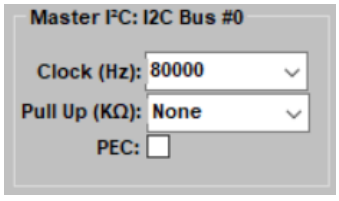
In Multi-Unit connection configuration, I²C bus is held down by an un-powered unit and 'No Power Supply Found' is displayed in 'Slave Adr List' textbox.



Optional: If you have other slow devices on the same I²C bus, select new I²C Clock setting from drop down menu:



If the desire clock rate not shown, type clock rate value in 'Clock (HZ)' box and press enter to set the new clock value.

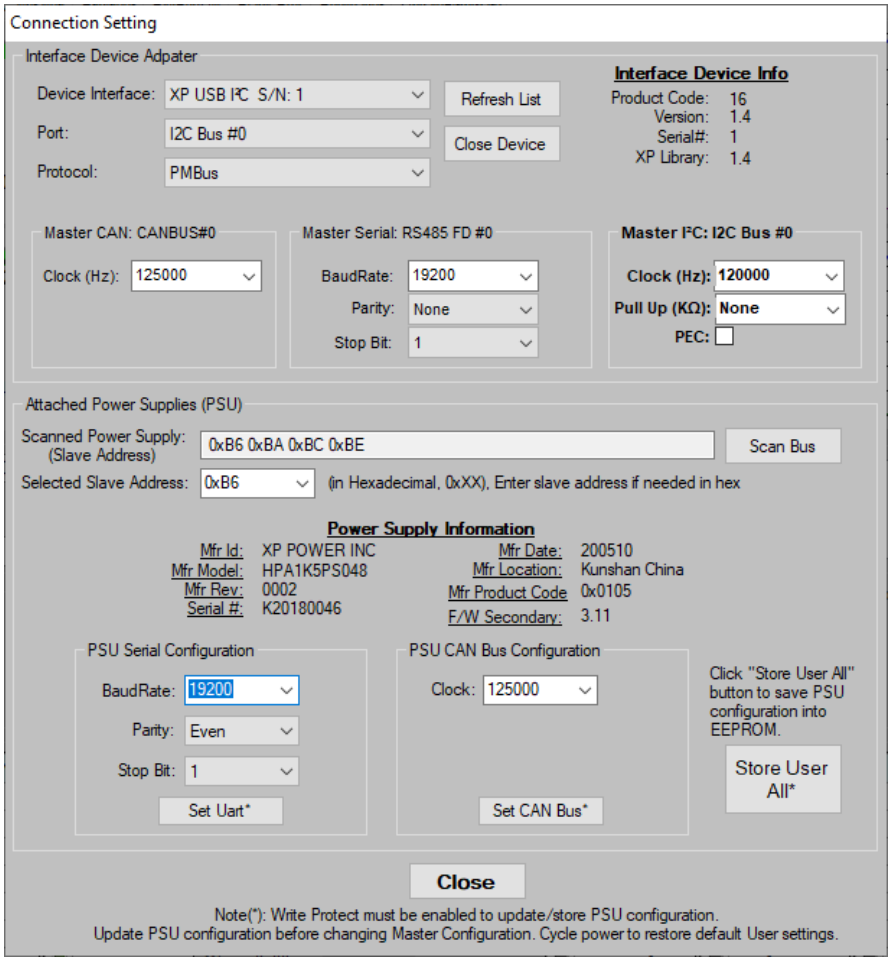


Check or uncheck ‘PEC’ (Packet Error Checl) box as required by slave unit. HPx power supply family will ignore PEC byte.

At this point, if no change of communication interface is needed, click ‘Close’ button and go to section 4.2.

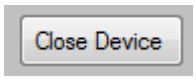
Note:

Master Serial & Master CANBus group are inactive (grayed-out) when I²C bus is selected.



‘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.

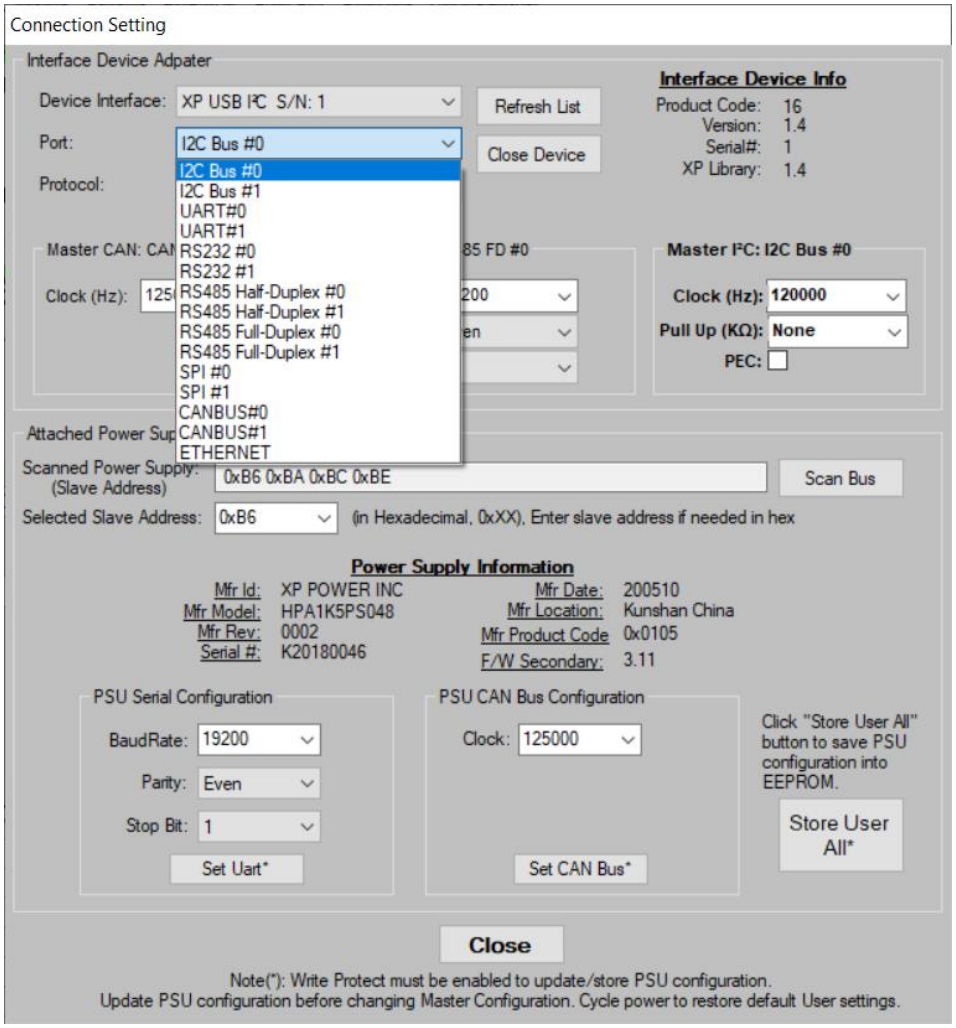
‘Close Device’ button, when clicked, the selected adapter’s resource/handle will be release for other application to use, handy when multiple XP PS Managers are running.



4.1.2.1 Changing Communication interface

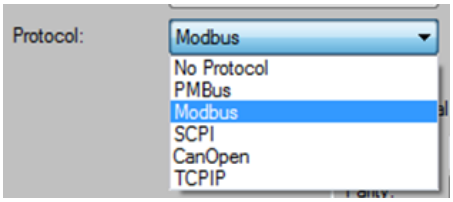
To change communication interface, a working communication interface must be established (I²C is the easiest to establish). Click on 'Port' combo-box and select a new interface port from the drop down menu. RS485 Full Duplex port #0 will be used as an example.

Note: Selected port must have corresponding interface chip installed on HPx controller board.

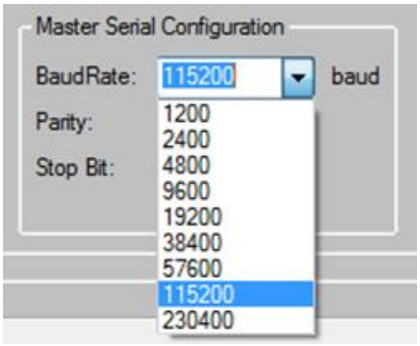


1. Select supported protocol of the interface:
   a. I²C >> PMBus
   b. RS232, RS485, UART >> Modbus, SCPI
   c. CAN >> CANopen
   d. Ethernet >> TCPIP

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

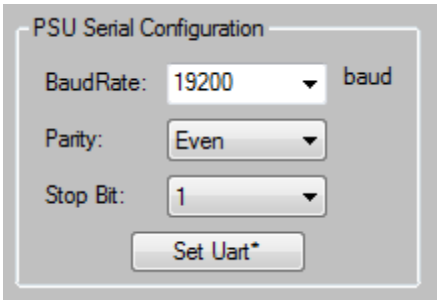


2. Set the Master interface configuration (BaudRate, Parity, etc.)



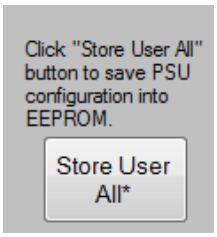
NOTE: Master and slave(s) configuration must match.

3. Set the slave (PSU) configuration to match master's configuration (Baud Rate, Parity, etc.).

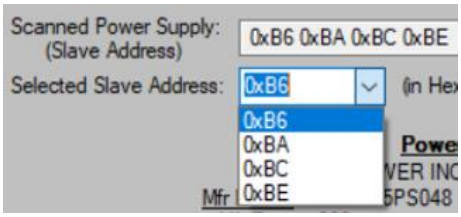


NOTE: Default parity is set to 'Even'

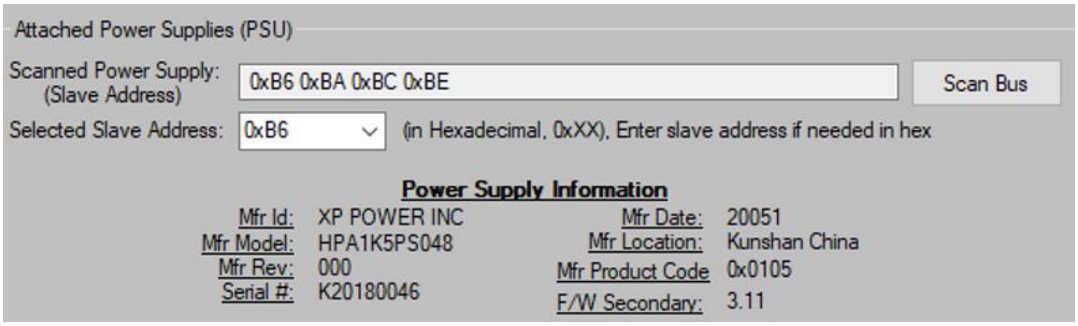
4. Click on 'Set Uart' button to send configuration to the selected power supply.
5. Click 'Store User All' button to save the configuration



6. If applicable, select other addresses and repeat step 3-5.



7. Click 'Close' button and return to 'Monitor' tab page.
8. At this point, remove the interface cable and connect the new selected interface cable.
9. Click 'Scan' button, wait a few seconds if configuration setup is successful, the address of the slave device(s) would be present and power supply information is displayed.



NOTE: If unsupported protocol is selected or configuration does not matched, '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 1-9). Also see the fine prints below 'Close' button.

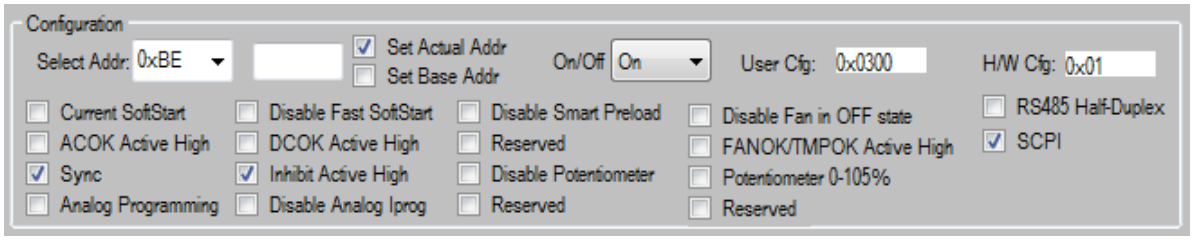
4.1.2.2 SCPI Protocol

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).**

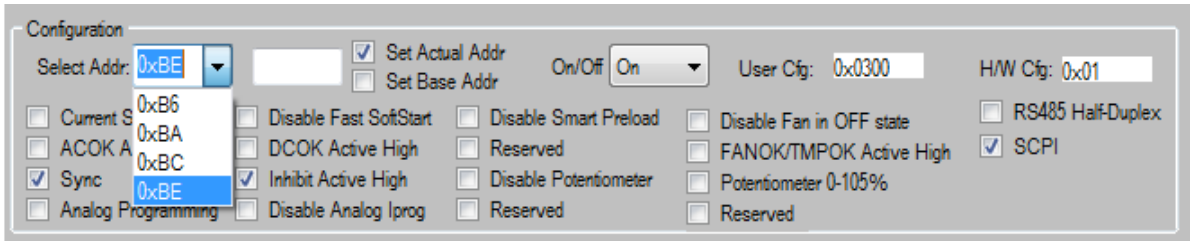
4.1.2.2.1 Switch to SCPI

1. Using established interface communication, in 'Monitor' tab page, ensure that 'WrtEnabl' button indicator is green, click 'Stop Loop" button if 'Read Loop' is active.

2. Click on 'Configuration' tab page, check 'SCPI Protocol' box as shown.



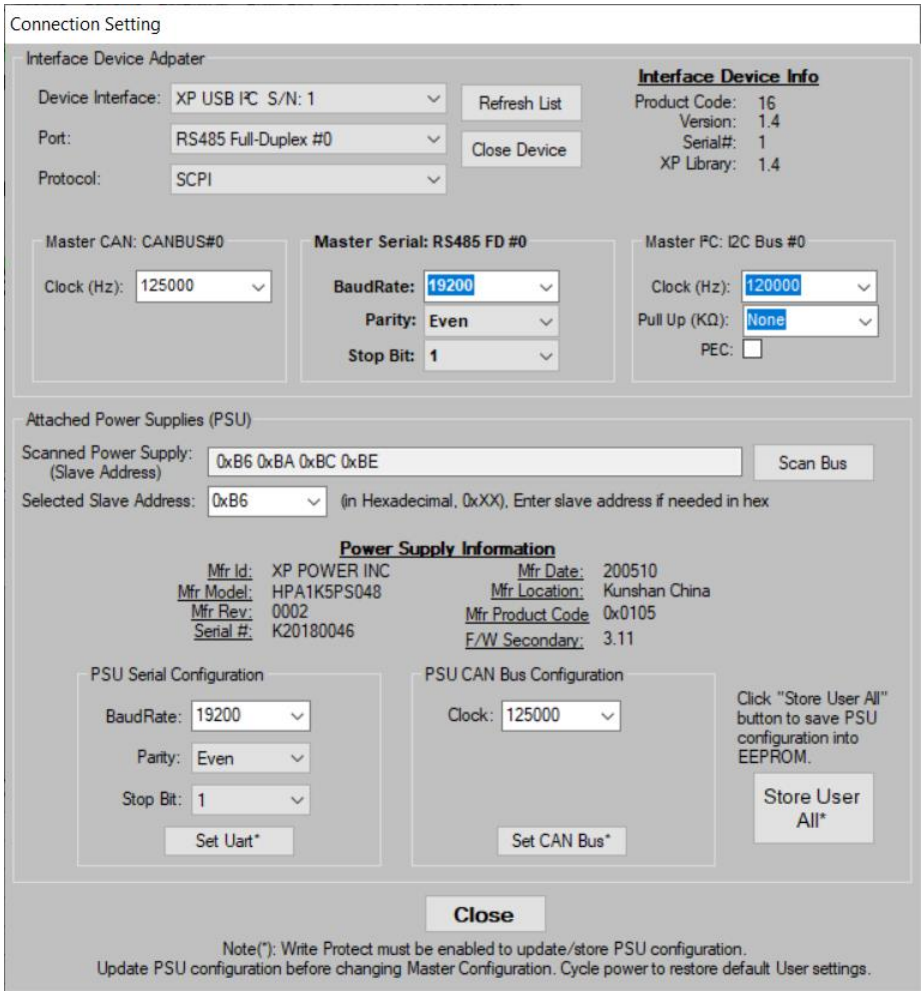
3. If applicable, repeat step 2 for all devices by selecting slave address from drop down menu.



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.

    Optional settings shown below if default settings are not satisfactory:

    c. Set ‘Master Serial Configuration’ parameters (Baud Rate, Parity, Stop-Bit) to match slaves’ unit. **Note:** HPx SCPI default is ‘19200 baud, Even parity, 1 stop bit’.
    d. Set ‘Select Slave Address’ (0xBA shown).
    e. Set ‘PSU Serial Configuration to match the master’s configuration.
    f. Click ‘Set Uart’ button.
    g. Click ‘Store User All’ button to save the slave configuration
    h. If applicable, select other slave address and repeat steps e to g.
    i. 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 RS485 cable.
    Note: ‘Scan Bus’ and ‘MultiUnit’ tab are not functional with SCPI protocol.



5. For detail operations on SCPI protocol, see section 4.4.

4.1.2.2.2 Switch from SCPI (back to I²C)

Since HPx power supplies can simultaneously communicates on multiple interface ports, this method sets the utility to establish I²C communication with HPx power supplies (while in SCPI mode) and use it to set the HPx power supplies 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.).

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, uncheck 'SCPI' box.

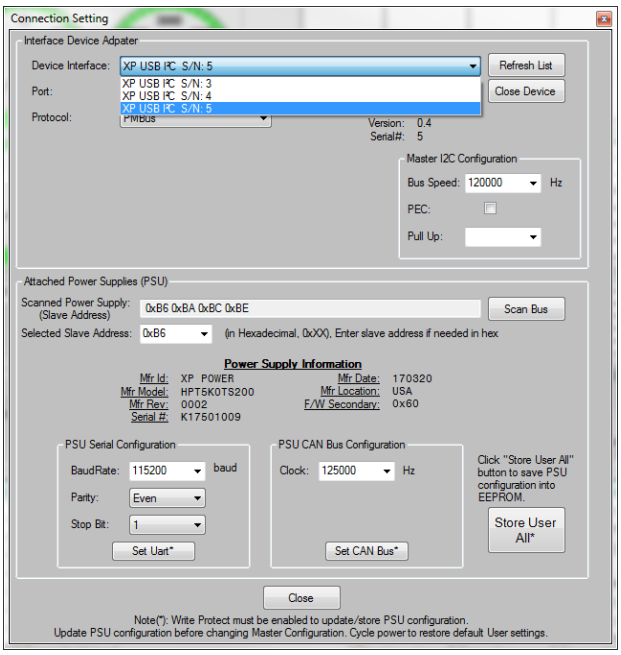
7. If applicable, repeat step 6 for other addresses.

4.1.2.3 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 'Device Interface' drop down menu to select a specific adapter to control, as shown below.

Note: Each adapter must have its own communication bus.

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



4.1.3 Multiple interfaces and Protocols

HPx power supplies can handle 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 **controlling** the HPx power supplies is not advised 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

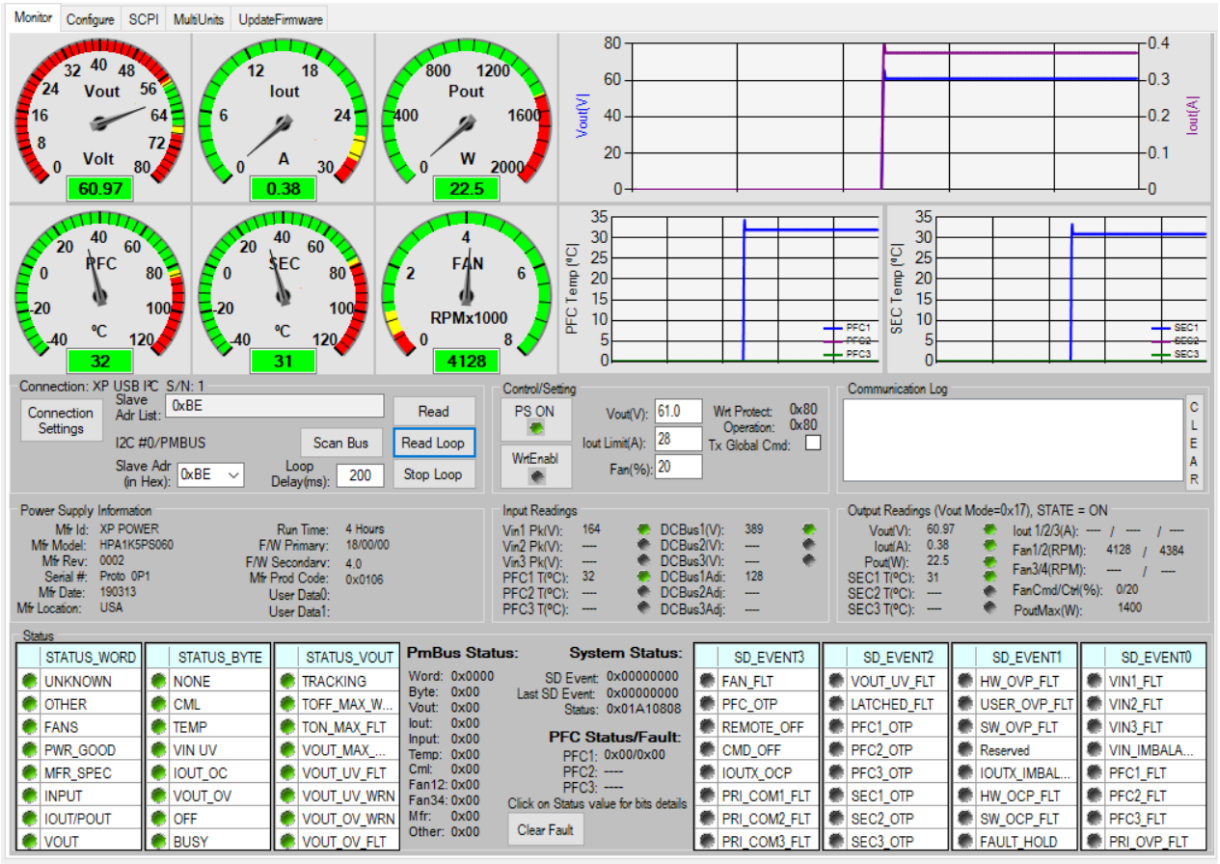
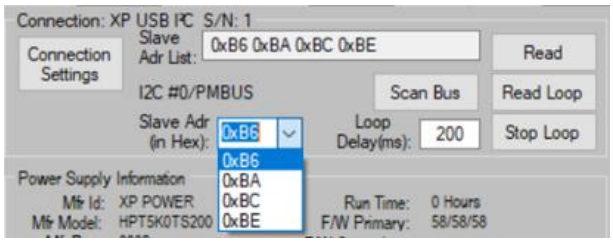


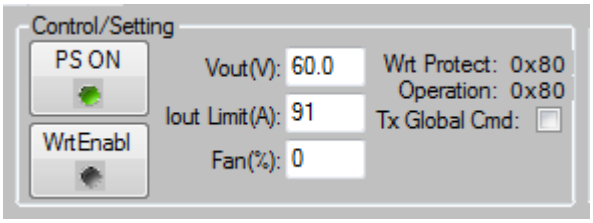
Figure 4: Typical ‘Monitor’ tab screen shot of a running utility.

Select the address to monitor in ‘Slave Adr’ combo-box as shown below. Default HPT5K0 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

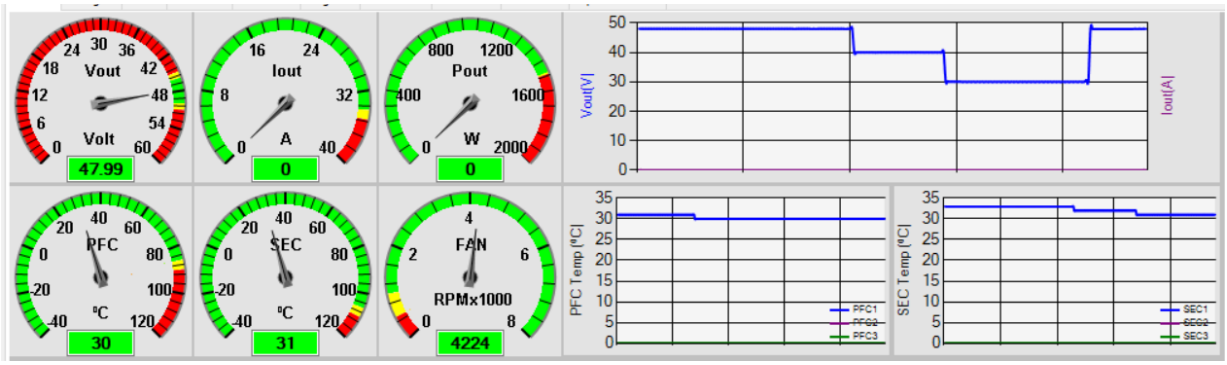


1. Click 'WrtEnabl' button to let the device accept commands, LED indicator turns green.
2. Type the desired output voltage in 'Vout' box and press 'Enter' key.
3. Enter output current limit in 'Iout Limit' box.
4. Click 'PS ON' button to enable the device output, LED indicator turns green.
5. Optional: 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.

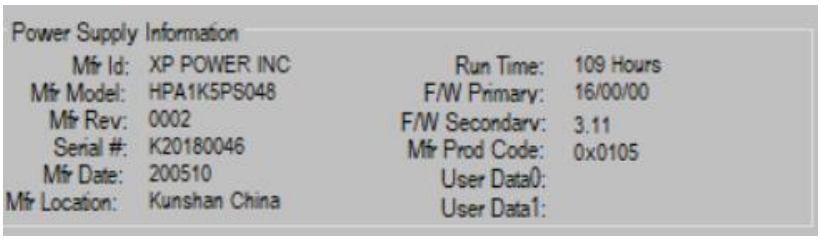
6. 'Tx Global Cmd' check box: If checked, device address of the write commands will be set to '00'. This caused all devices on the bus to implement the command. This check box is duplicated in 'Configure' tab.

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.

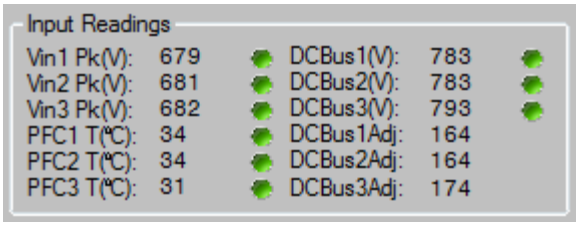
4.2.3 Device's Information



Standard PMBus information is displayed in the 'Information' section. Some

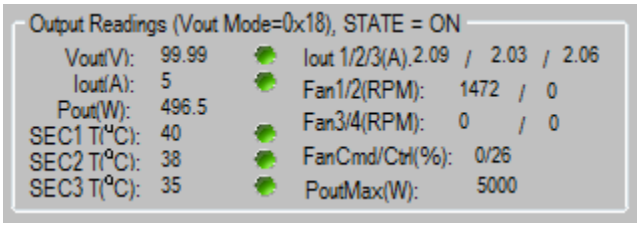
'Manufacturer Specific' information are also displayed (Run-Time, Firmware Revision).

4.2.4 HPx Input Readings (HPT5K0 shown)



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 (HPT5K0 shown)



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 Device's Statuses

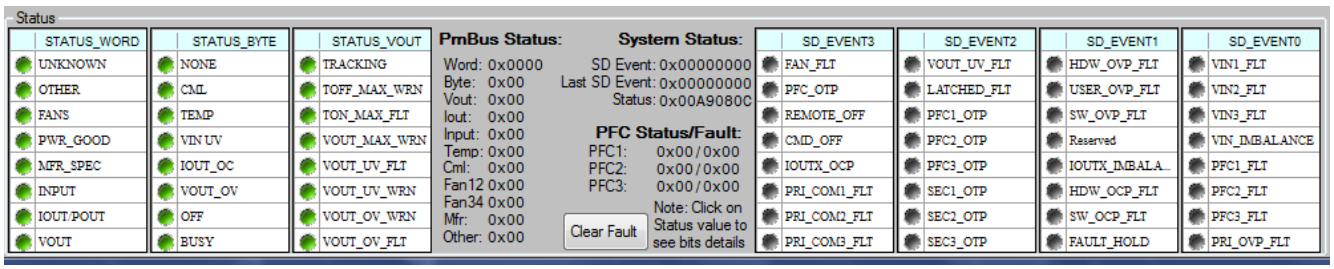


Figure 5: Normal operation = all statuses are 'green' or 0x00.

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

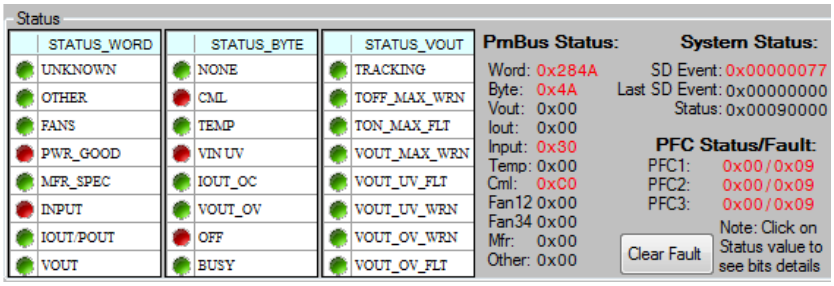
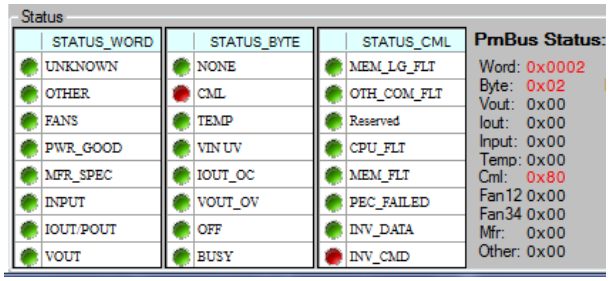
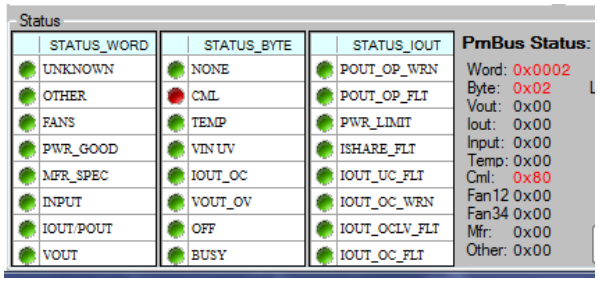
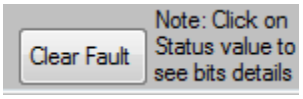


Figure 6: When faults are detected, indicators turns ‘red’ and status values are non-zero and in red also.

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.



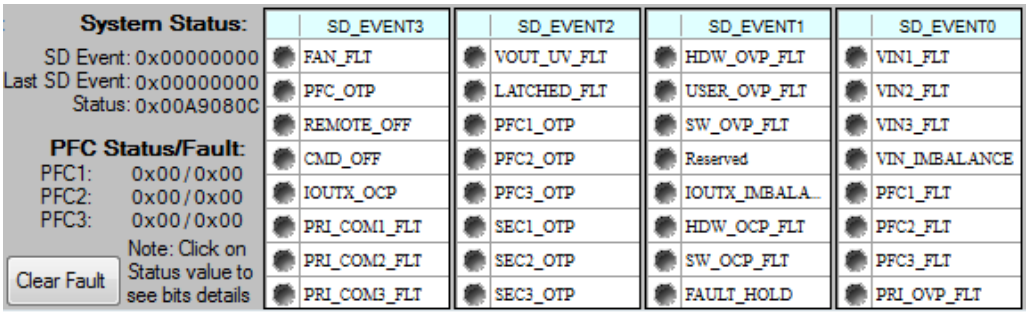




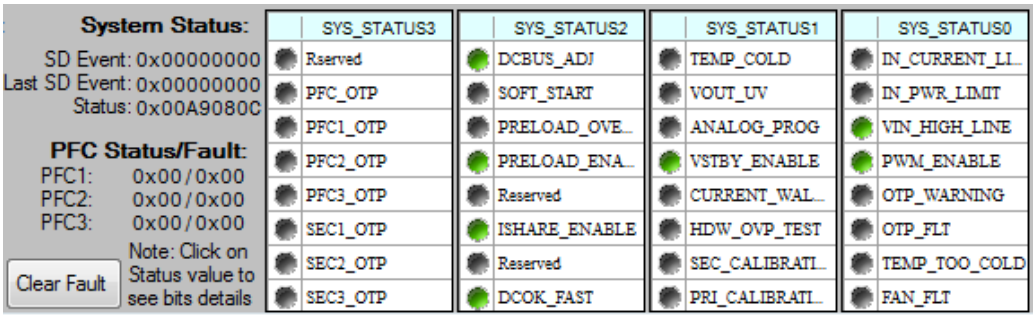
A status detail is shown on the 3rd panel when individual status value is clicked, as indicated next to the ‘Clear Fault’ button. STATUS_CML and STATUS_IOUT are shown in the 3rd panel above.

4.2.7 HPx Power Supplies System Statuses

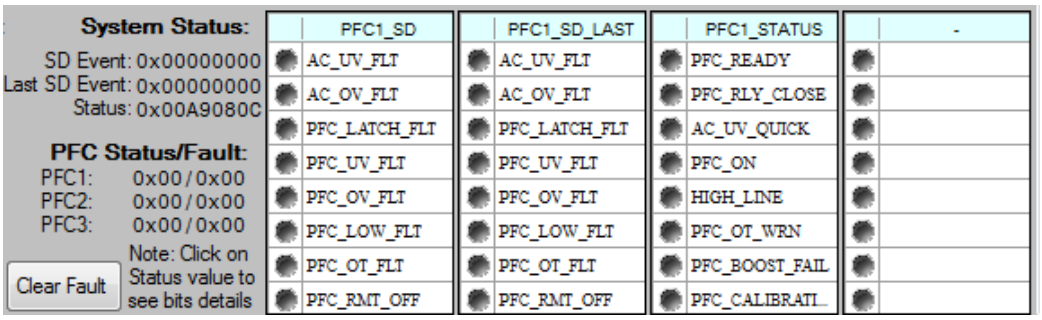
Shutdown events represented by round indicators shown above. Grey = normal, Red = faulted.
Click on ‘Last SD’ value to see last shutdown events.



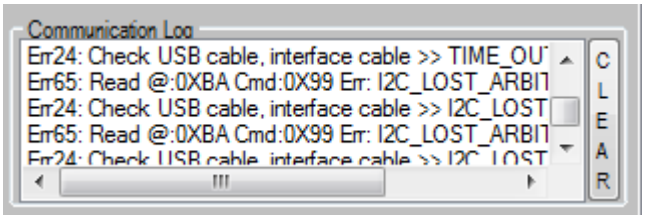
Similarly, click on ‘Status’ value will display the details of the system status, as shown below.
Grey = normal/not enabled, Green = enabled, Red = faulted



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

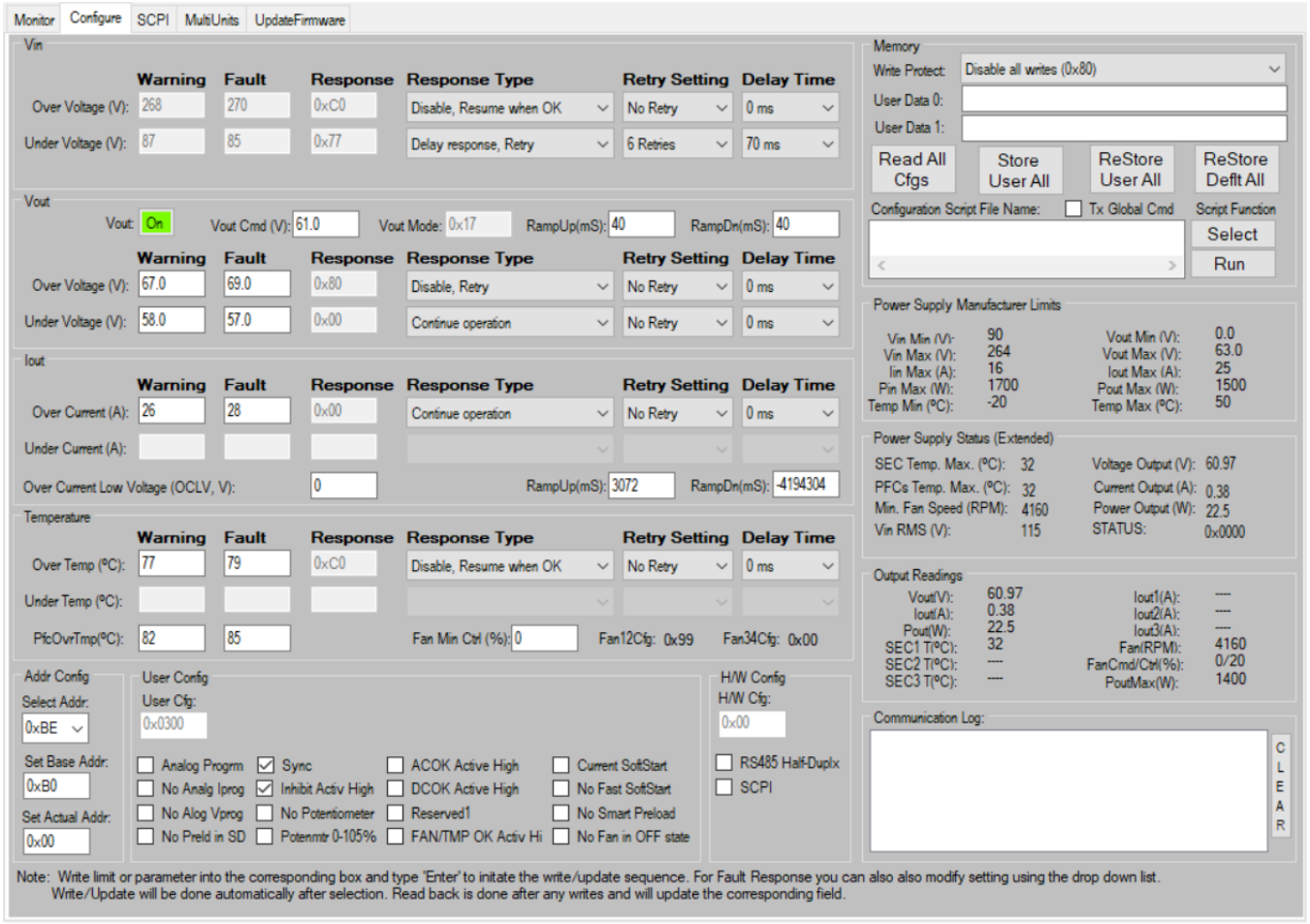
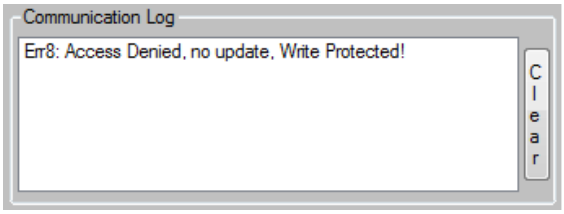


Figure 7: Configuration parameters of the selected address (0xB6 shown in 'Addr Config' groupbox).

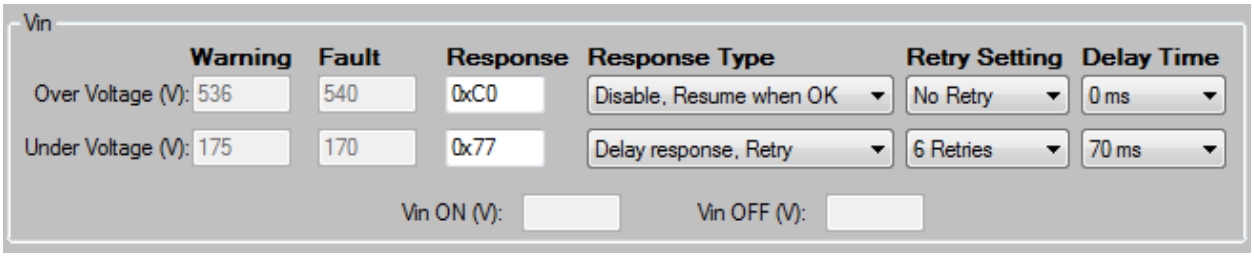
This tab allows user to change warning limits, fault limits, fault responses and save these limits to user's setting. Please read the 'fine print' on the bottom of the tab. ☺

Note: Some fault responses are hard-coded and will not accept invalid/unsupported selections. 'Communication Log' window will display error message "Err8".

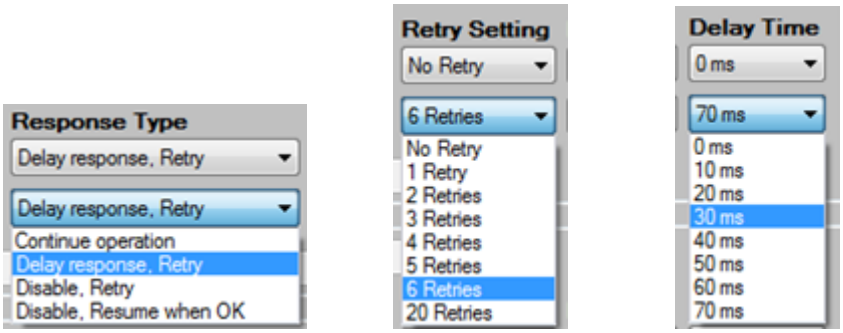


OVP fault response is hard-coded to 'Disable' with 'No Retry', see section 4.3.2.

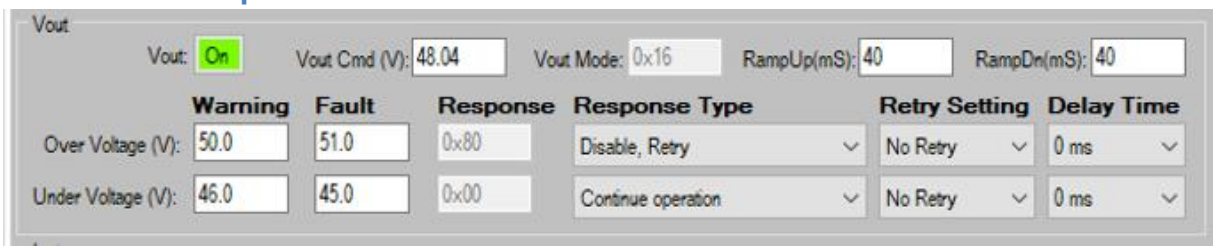
4.3.1 Vin Group



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.



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 command, warning and fault limits should be set as follow:

UV_FAULT < UV_WARN < Vout < OV_WARN < OV_FAULT

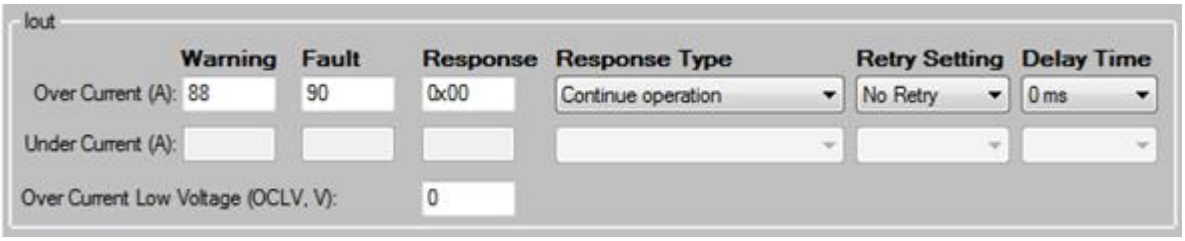
If not, Vout command may cause shutdown when it is set below UV_FAULT limit and fault response is set to 'Disable'.

Note:

1. Over Voltage Fault response is hard-coded to immediate shutdown and the fault is latched. To clear OVP is to turn the power supply off and on using 'PS ON' button in the 'Monitor' tab.

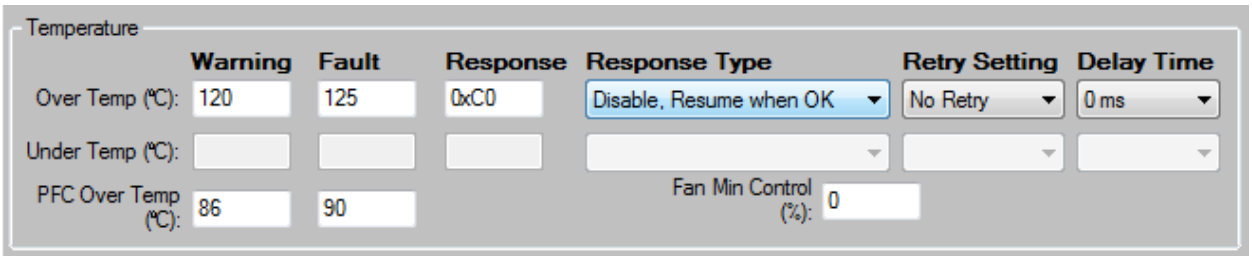
2. On recovery retries, HPT5K0 wait 1 second (for internal filters and voltages to stabilize) before start checking for faults. So, 5 retries will take 5 seconds + delay between retries.

4.3.3 Iout Group



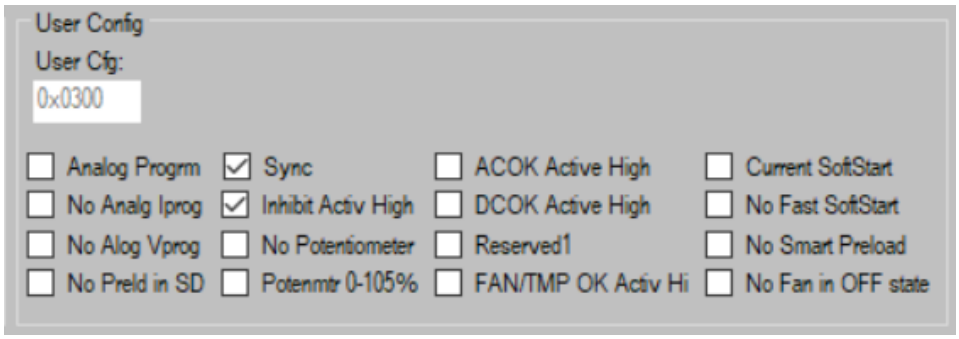
Under Current response are not implemented. Other parameters can be change in the same manners as with other groups.

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 User Config Group



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

Analog Programming: J401 pin 19 (VPROG) is used to control output voltage by applying 0-5VDC.

No Analog Iprog: J401 pin 22 (IPROG) is disabled.

No Analog Vprog: J401 pin 19 (VPROG) id disabled

No Preld in SD: Pre-Load is disabled on shutdown (Vout slowly float down to 0V @ no load).

Sync: J401 pin 18 is utilized by paralleled units to enable output voltage 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.

Reserve1: Reserved for future function.

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

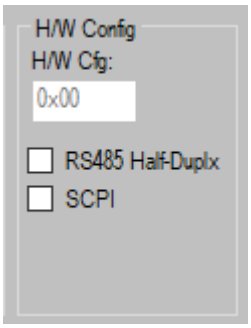
Current Soft Start: Output current is ramp up slower than normal, ~200mS to full load.

No Fast Soft Start: Vout will rise to the set value as fast as possible otherwise ~35mS rise time.

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

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

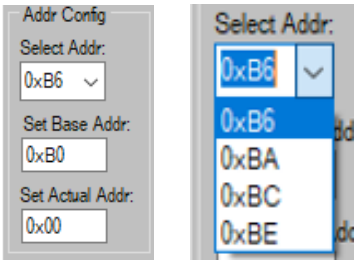
4.3.6 H/W Config Group



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

SCPI: If checked, the utility will send the command to HPx power supplies to use '**S**tandard **C**ommand for **P**rogrammable **I**nstrument' protocol. This is applicable to RS232, RS485 interface only (XP USB I^2C adapter). If not checked, Modbus protocol will be used (default).

4.3.7 Addr Config Group



Select Address: Using drop down menu to select available address to communicate with.

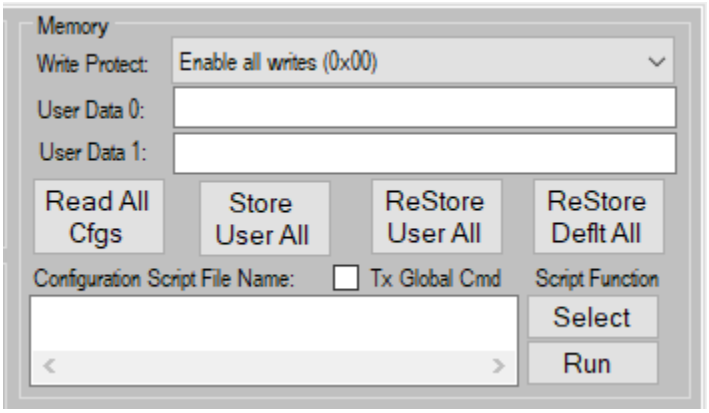
Set Base Addr: Change base address, the utility will automatically masks 3 LSB to 0's.

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

Set Actual Addr: Change unit address to the value entered (0x02-0xFE), A0, A1, A2 pins are ignored.

Enter 00 = base address + (A0, A1, A2) (base address factory default is 0xB0).

4.3.8 Memory Group



This is where you save and recall various parameter values.

Write Protect: must be disabled (set to 0x00) before any command will be accepted.

'User Data0': Enter 16 characters maximum here.

'User Data1': Enter 16 characters maximum here.

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

'Store User All' button: Save all parameter values to user's memory.

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

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

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

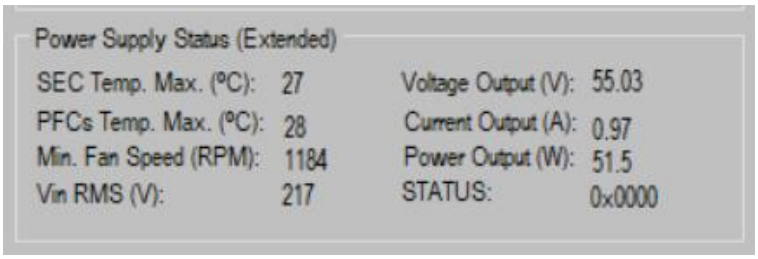
'Script Function Select' button: Select script file from C:\HPT5K0_Scripts directory (default) to execute.

'Run' button: Execute the selected script file. Example script file is included in the installation. It is a convenient tool to configure multiple power supplies to the same configuration. See Appendix B for script file example.

4.3.9 Power Supply Manufacturer Limits Group

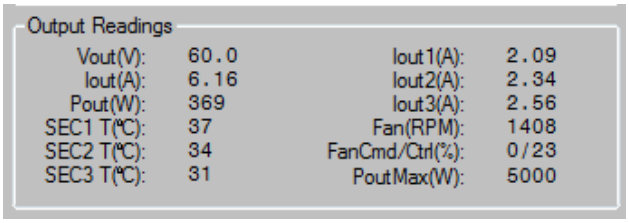
This group displays factory's value for the limits shown and cannot be altered.

4.3.11 Power Supply Status



This group duplicates 'Monitor' tab page information, shown here for convenient.

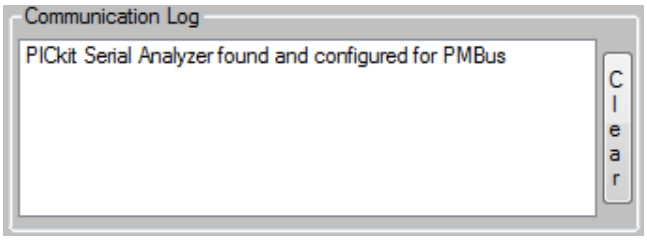
4.3.12 Output Reading Group



This group duplicates 'Monitor' tab page information, shown here for convenient.

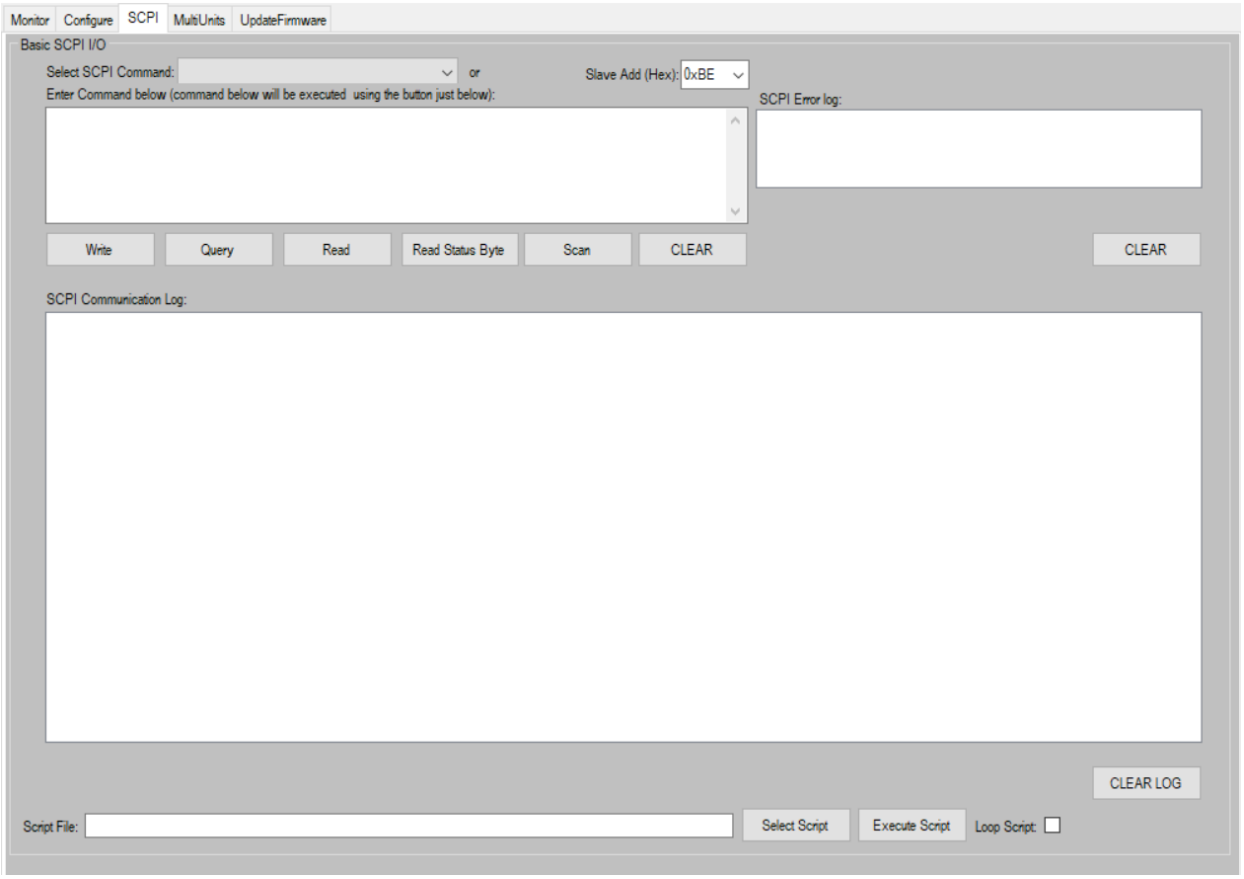
4.3.13 Communication Log Group

Duplication of 'Monitor' tab presented here for convenience.
Note: 'Clear' button in any tab will clear Communication Log windows in all tabs.

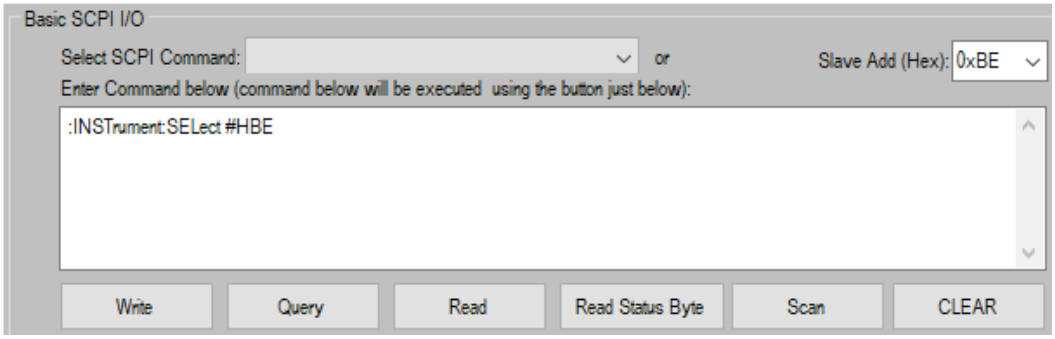


4.4 SCPI Tab

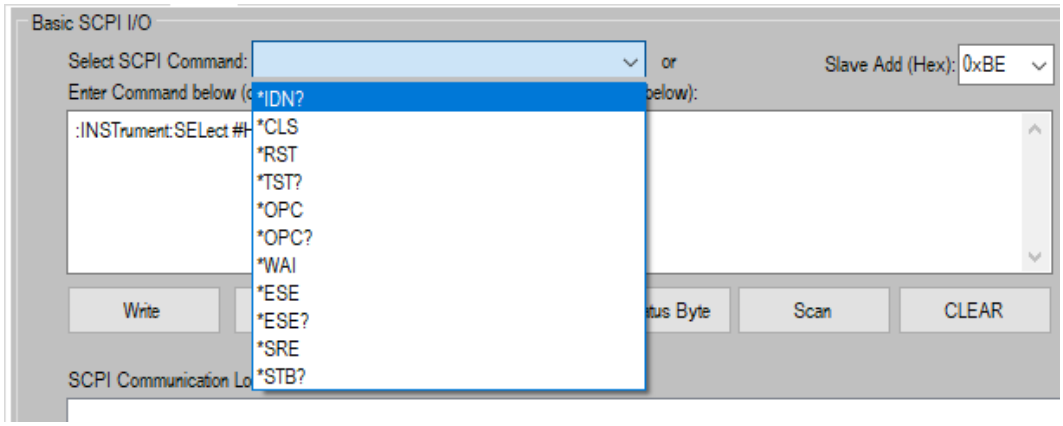
See section 4.1.2.2.1 for switching to SCPI protocol instruction.



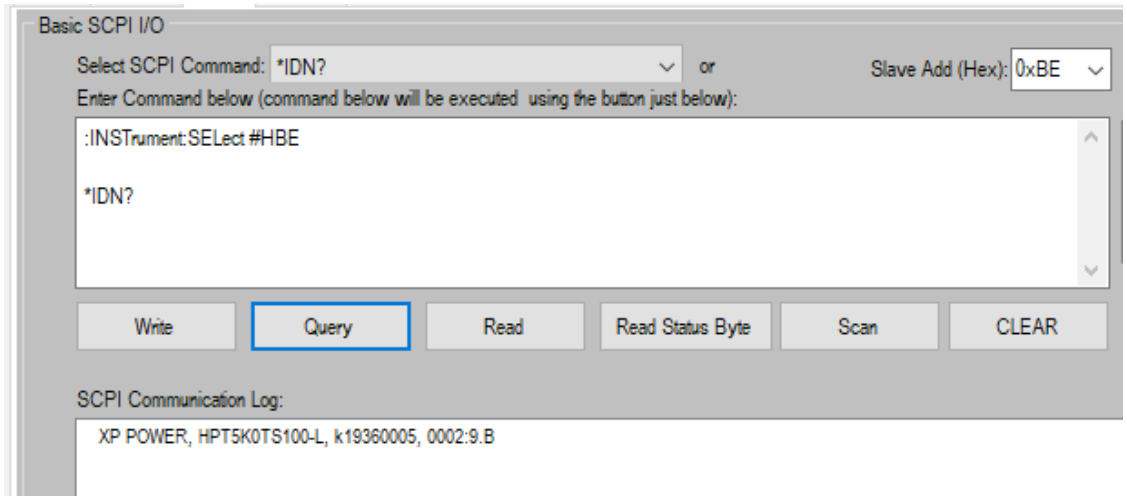
1. Select ‘Slave Add’ from drop down menu, :INSTrumentSELect command is transmitted as shown.
   Note: ‘:INSTrumentSELect’ command will not be issued if SCPI protocol is not active.



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

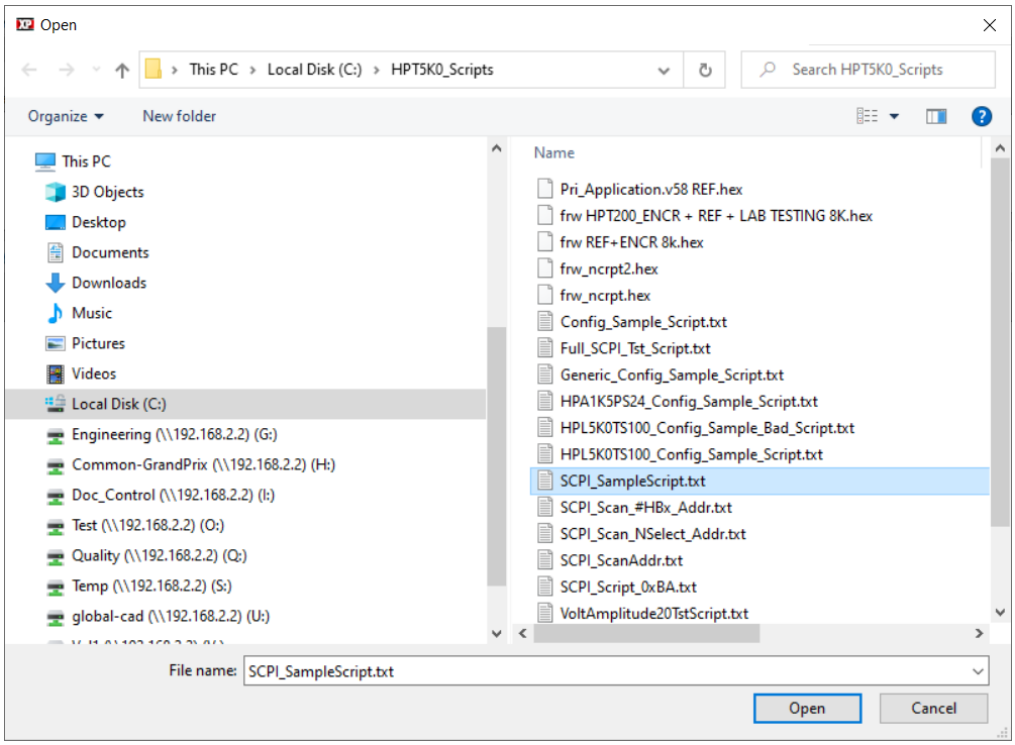


3. Click 'Query' button, information of the selected slave unit is displayed in log window.

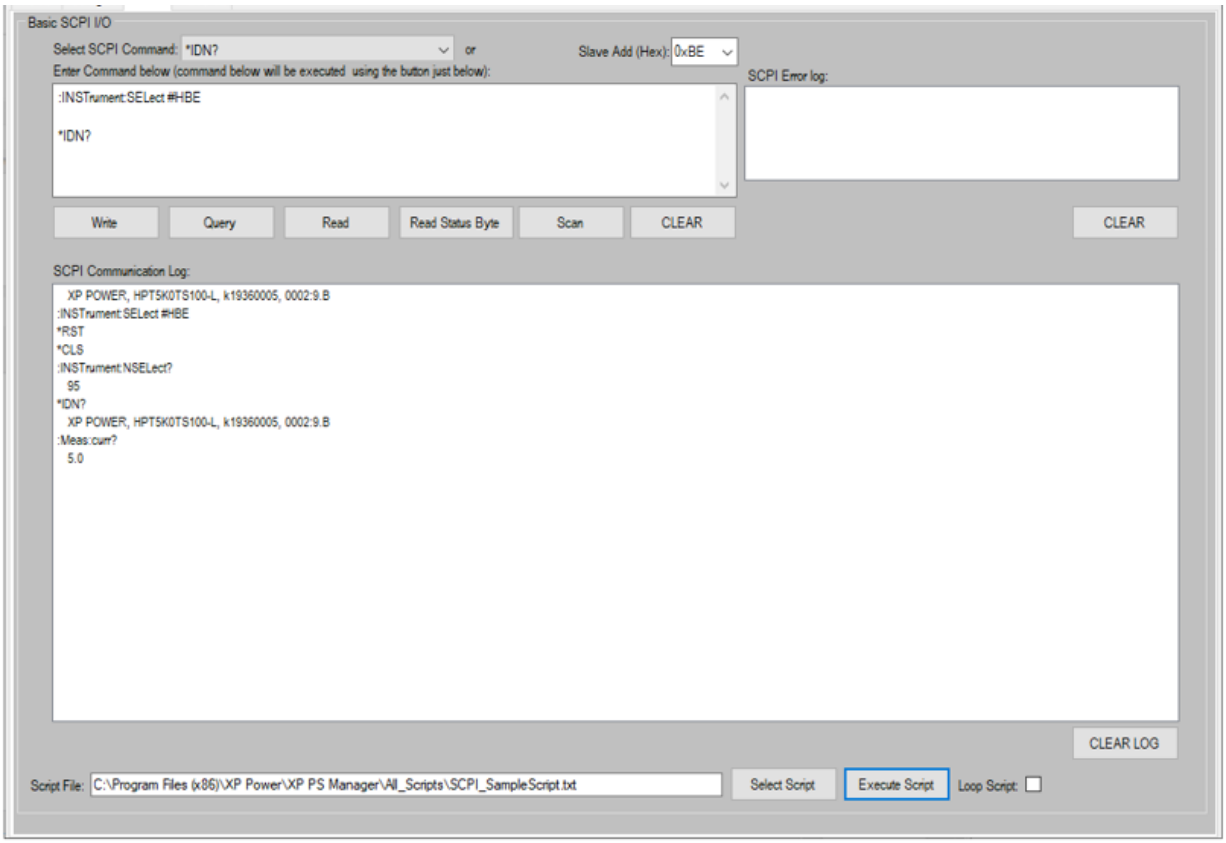


4. Click on 'Select Script' button and select one of the SCPI script file.

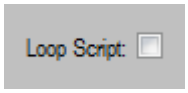
   Sample scripts files are provided with the installation of this utility.



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.

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 SCPI tab and perform scan function to find SCPI slave addresses.

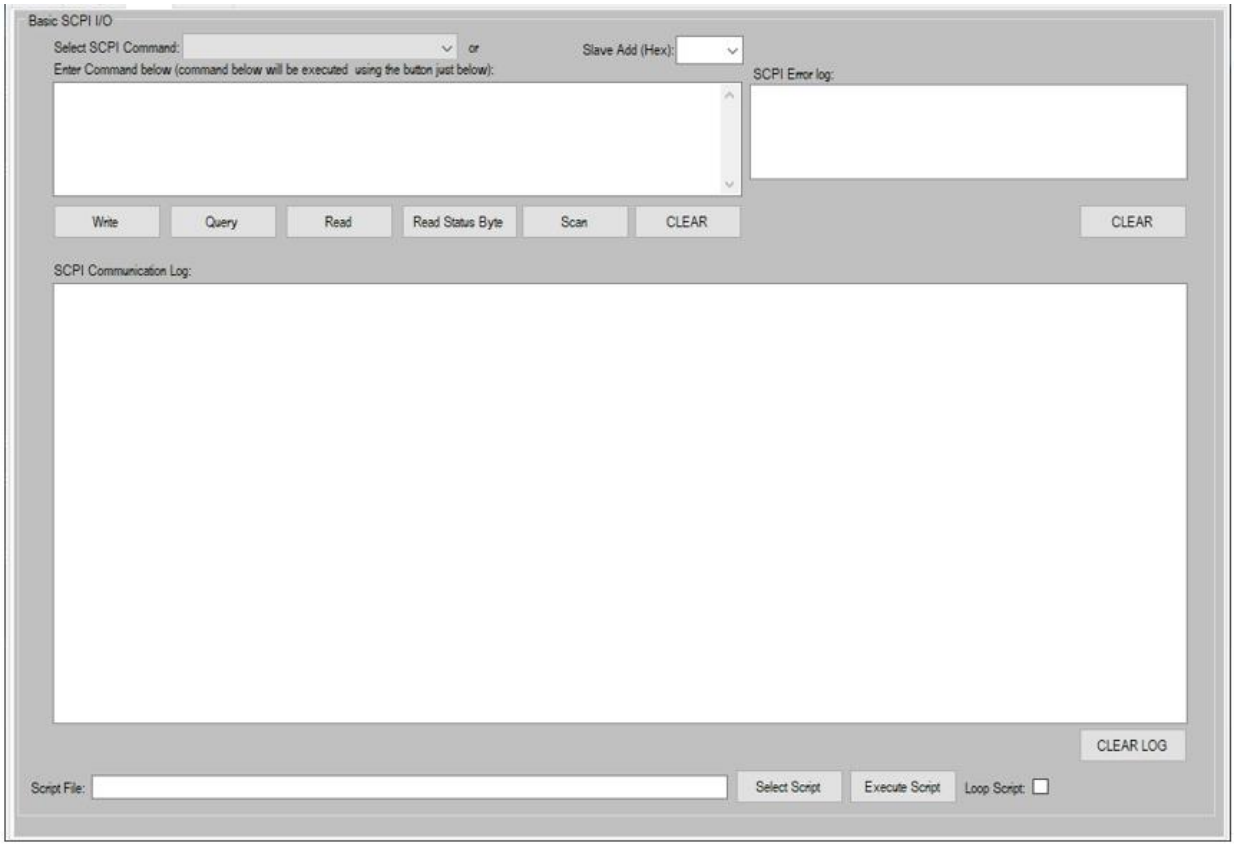
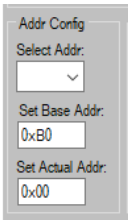


Figure 8: Blank SCPI page upon start up with SCPI protocol already running.

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.

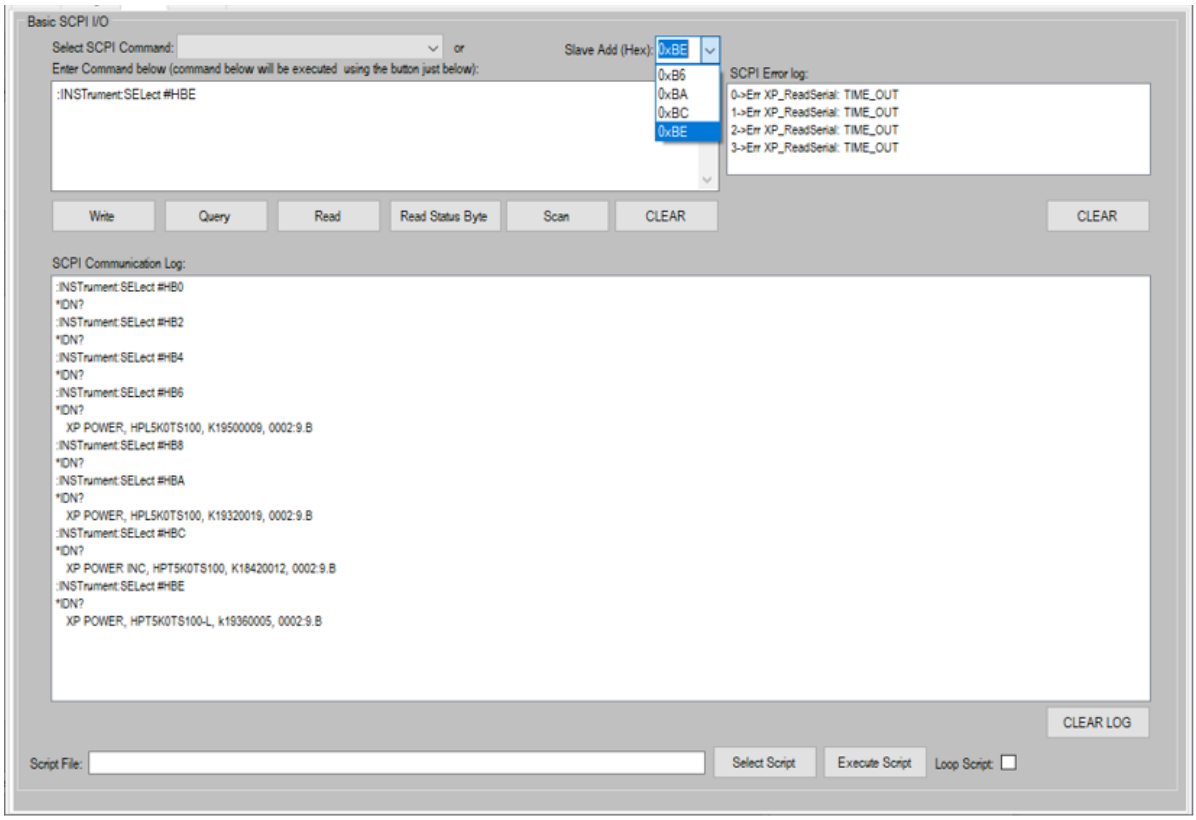


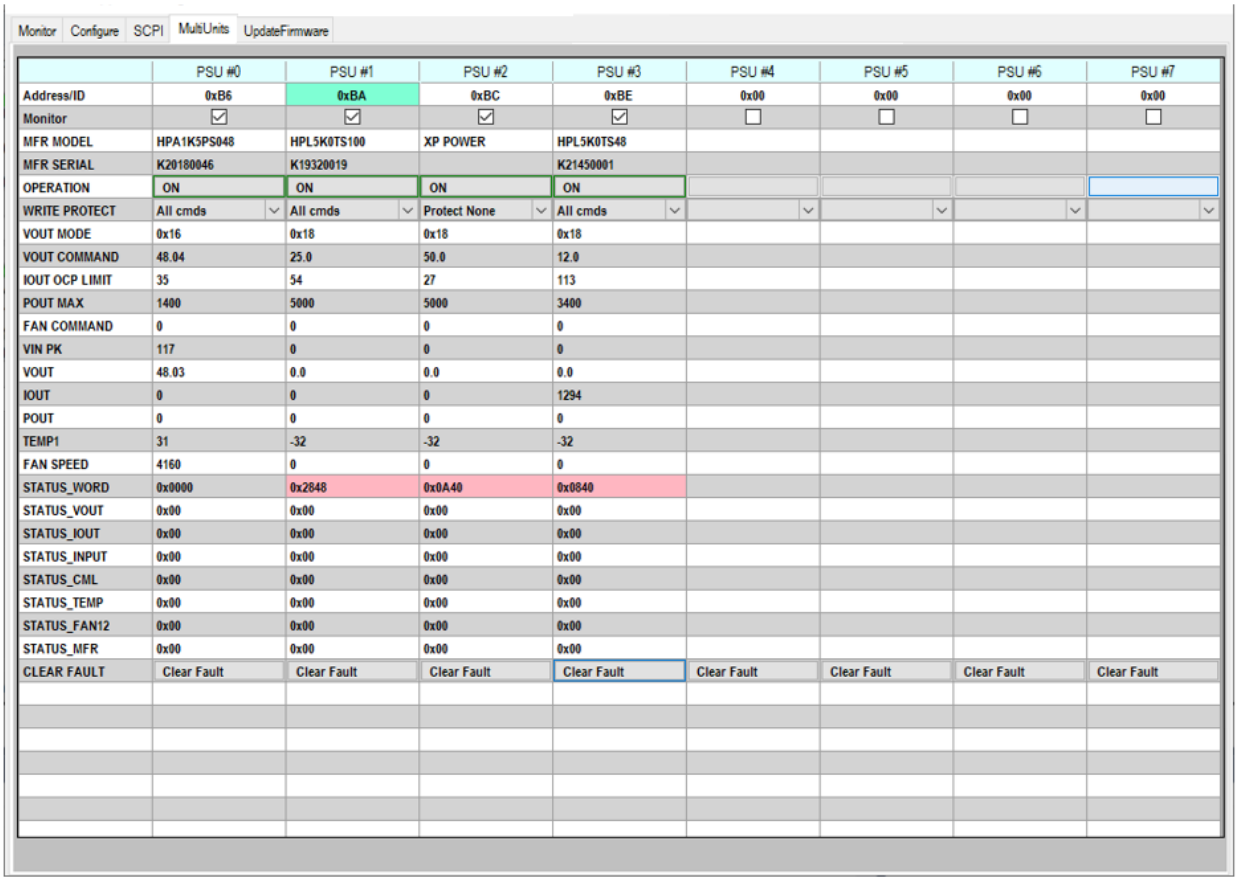
Figure 9: Scan function completed display. Only 0xB6, 0xBA, 0xBC and 0xBE show response to the query command.

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.

4.5.1 Device control



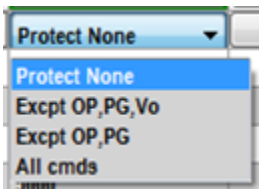
	PSU #0	PSU #1	PSU #2	PSU #3	PSU #4	PSU #5	PSU #6	PSU #7
Address/ID	0xB6	0xBA	0xBC	0xBE	0x00	0x00	0x00	0x00
Monitor	☑	☑	☑	☑	☐	☐	☐	☐
MFR MODEL	HPA1K5PS048	HPL5K0TS100	XP POWER	HPL5K0TS48				
MFR SERIAL	K20180046	K19320019		K21450001				
OPERATION	ON	ON	ON	ON				
WRITE PROTECT	All cmds	All cmds	Protect None	All cmds				
VOUT MODE	0x16	0x18	0x18	0x18				
VOUT COMMAND	48.04	25.0	50.0	12.0				
IOUT OCP LIMIT	35	54	27	113				
POUT MAX	1400	5000	5000	3400				
FAN COMMAND	0	0	0	0				
VIN PK	117	0	0	0				
VOUT	48.03	0.0	0.0	0.0				
IOUT	0	0	0	1294				
POUT	0	0	0	0				
TEMP1	31	-32	-32	-32				
FAN SPEED	4160	0	0	0				
STATUS_WORD	0x0000	0x2848	0x0A40	0x0840				
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 10: Two 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

	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	HPA1K5PS048	HPL5K0TS100	XP POWER	HPL5K0TS48				
MFR SERIAL	K20180046	K19320019	170320[R	K21450001				
OPERATION	ON	ON	ON	ON				
WRITE PROTECT	Protect None	All cmds	Protect None	All cmds				
VOUT MODE	0x16	0x18	0x18	0x18				
VOUT COMMAND	48.0	25.0	50.0	12.0				
IOUT OCP LIMIT	35	54	27	113				
POUT MAX	1400	5000	5000	3400				
FAN COMMAND	0	0	0	0				
VIN PK	116	0	0	0				
VOUT	47.99	0.0	0.0	0.0				
IOUT	0	0	0	163.25				
POUT	0	0	0	0				
TEMP1	32	-32	-32	-32				
FAN SPEED	4160	0	0	0				
STATUS_WORD	0x0000	0x2848	0x2A48	0x6848				
STATUS_VOUT	0x00	0x00	0x00	0x00				
STATUS_IOUT	0x00	0x00	0x00	0x20				
STATUS_INPUT	0x00	0x30	0x30	0x30				
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

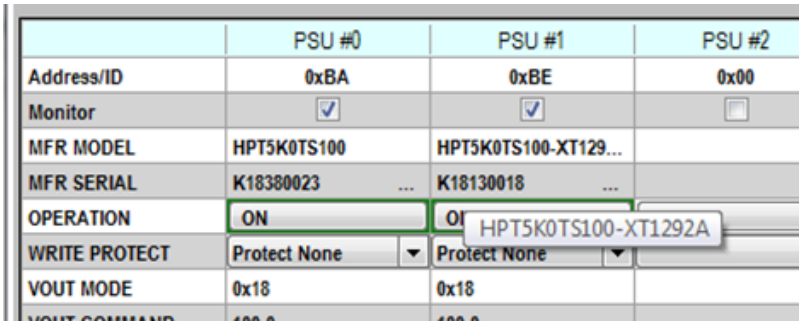
STATUS_INPUT
UNIT OFF
PWR_GOOD_NEGATED
INPUT_FAULT
IOUT/POUT_FAULT

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).

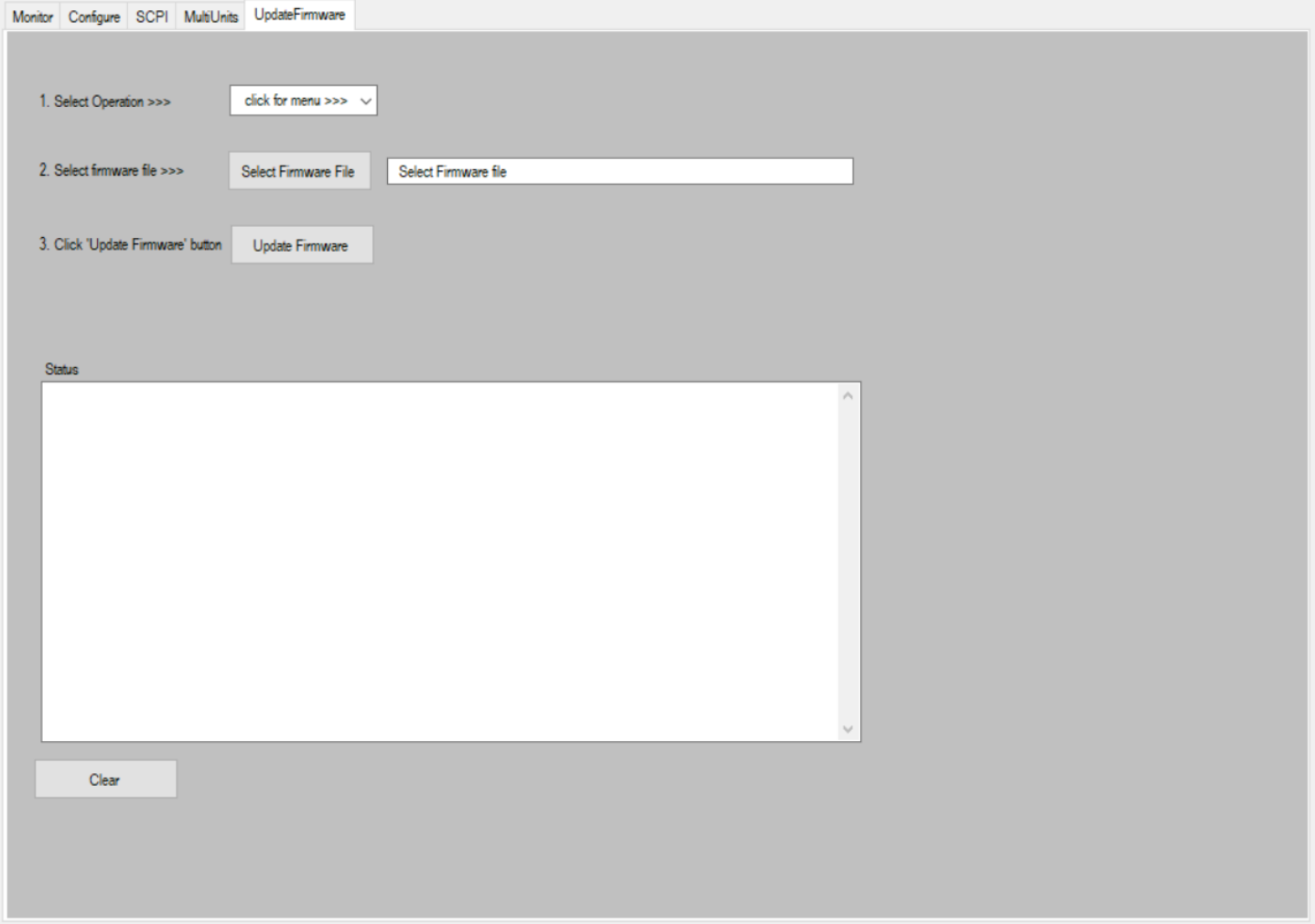
Hovering the mouse over the model number cell displays the full model number.

Example shown below is a ‘Modified Standard’ model.



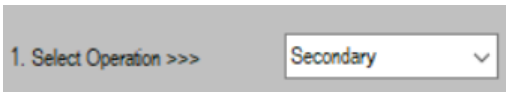
4.6 Update Firmware Tab

This tab is a simplified way to download new firmware to HPx family of power supplies. Ensure that the power supply has boot loader code programmed into the controller boards (primary & secondary). Error is produce if not.



1. Select slave address of the HPx unit to be updated from ‘Monitor’ tab.

2. Select from drop down menu which firmware to update.



Secondary selected.

3. Select firmware file (.hex) file to update.

4. Click 'Update Firmware' button. Operation is completed when 'Unit is running application firmware' is displayed.

Verify that 'App Calculated Checksum' value is the same as 'Stored Checksum' value in the status textbox.

Goto 'Monitor' tap page to verify that the HPx unit is operating normally.

Appendix A: HPx Power Supplies 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: Script file example

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 C: 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.

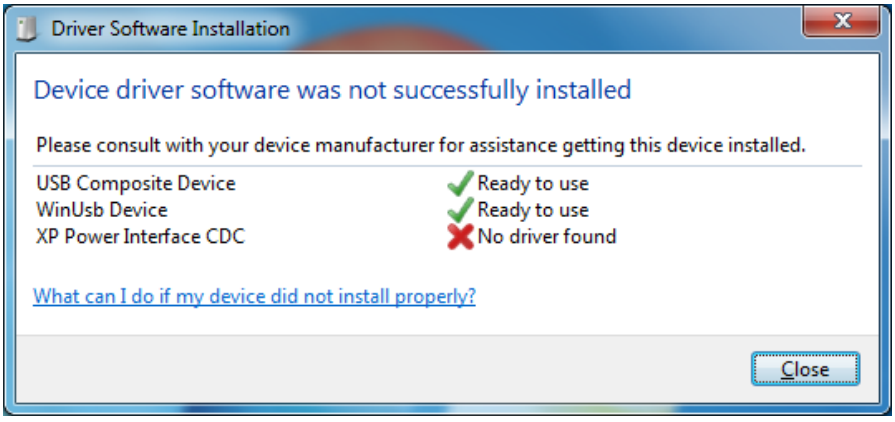
2. Connect XP USB I²C device to PC.

3. **NOTE:**

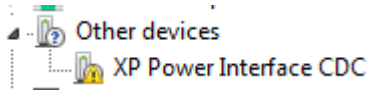
   - **Skip this step if 'XP Power Interface CDC' has been installed (go to step 4).**

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

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



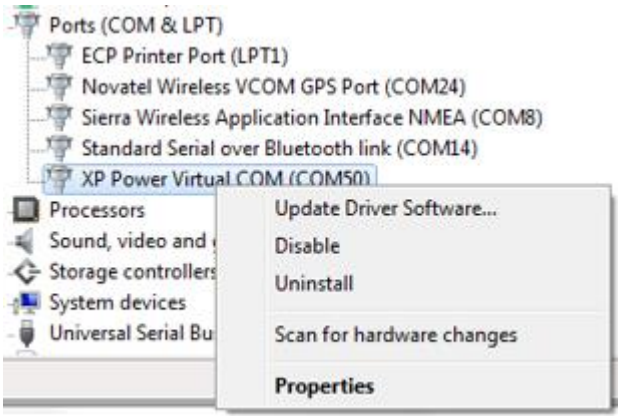
   Open 'Control Panel, Device Manager', locate 'XP Power Interface CDC' and right click on it.



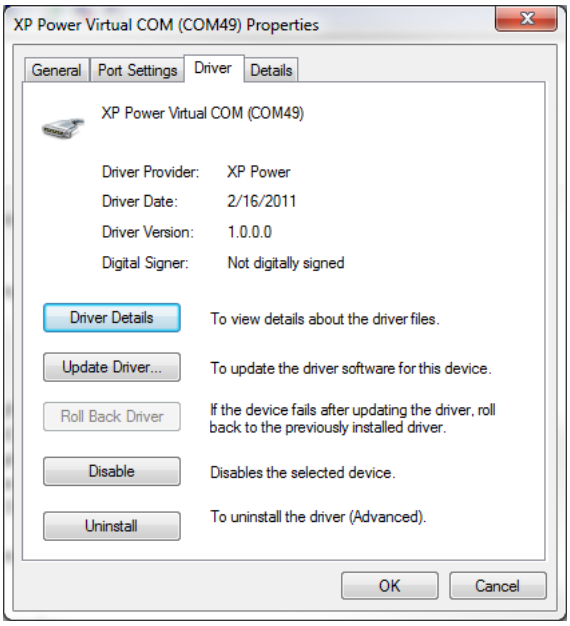
   a. If available, select 'Update Driver Software' otherwise select 'Property', 'Driver' tab, 'Update Driver' button.
   b. 'Browse to C:\Program Files (x86)\XP Power\XP PS Manager\XPPowerWinUSBdrv directory, ensure that 'Include subfolders' box is checked.
   c. Click 'Next' button to update driver.

   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.

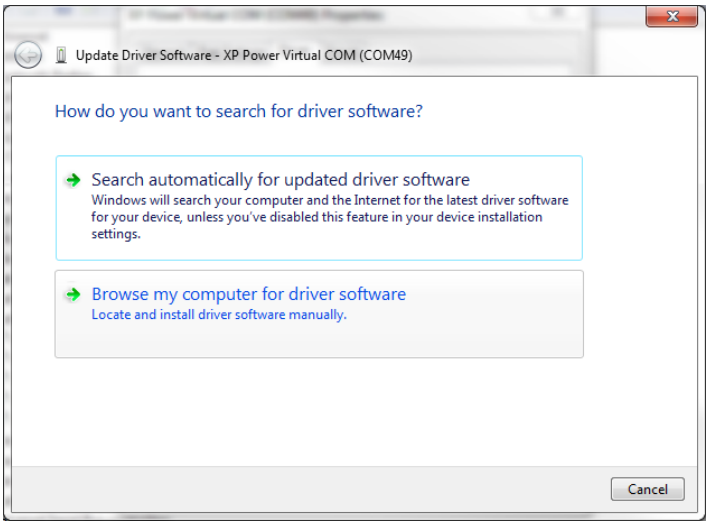
4. Locate 'XP Power Virtual COM' device under 'Ports', right click on it.
   If available, select 'Update driver'….



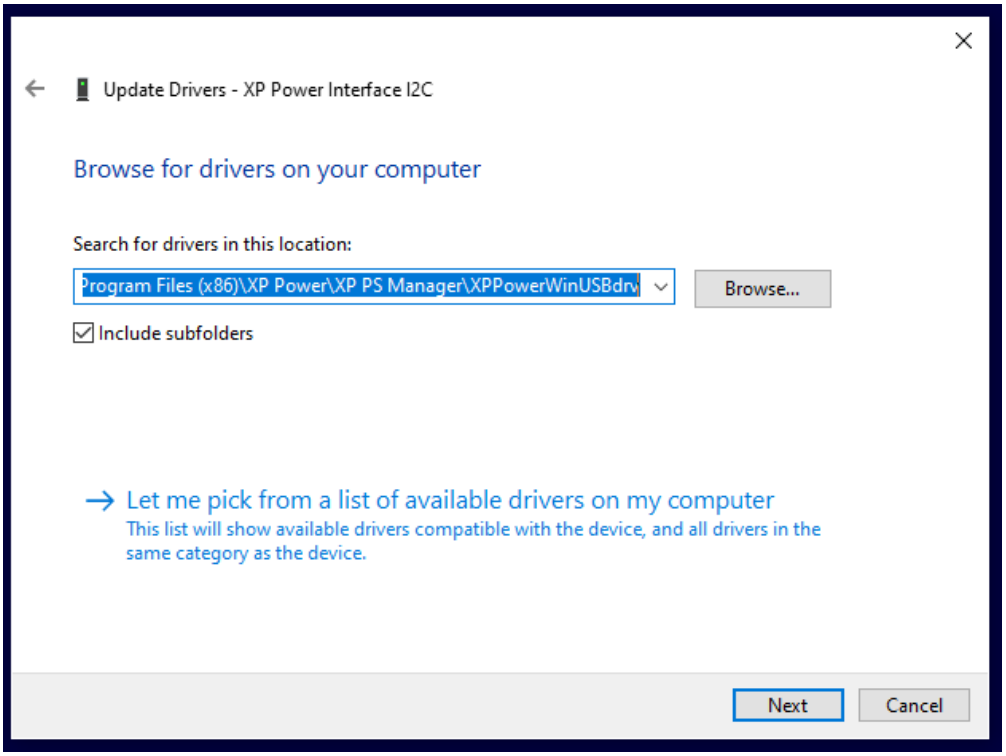
… otherwise, select 'Property', 'Driver' tab, click on 'Update driver'.



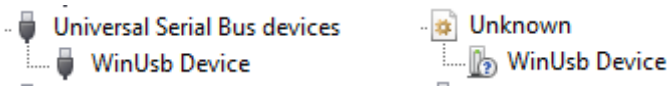
5. Select 'Browse my computer'



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

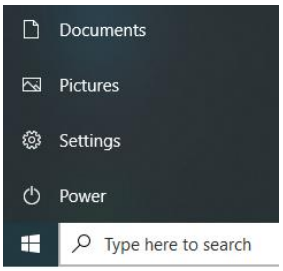


8. Once the update for ‘WinUsb Device ‘process is completed, close all opened control windows. Driver software Installation/update is completed.

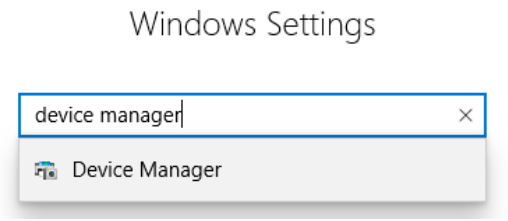
---

9. **For Windows 10**

Click on ‘Settings’ icon

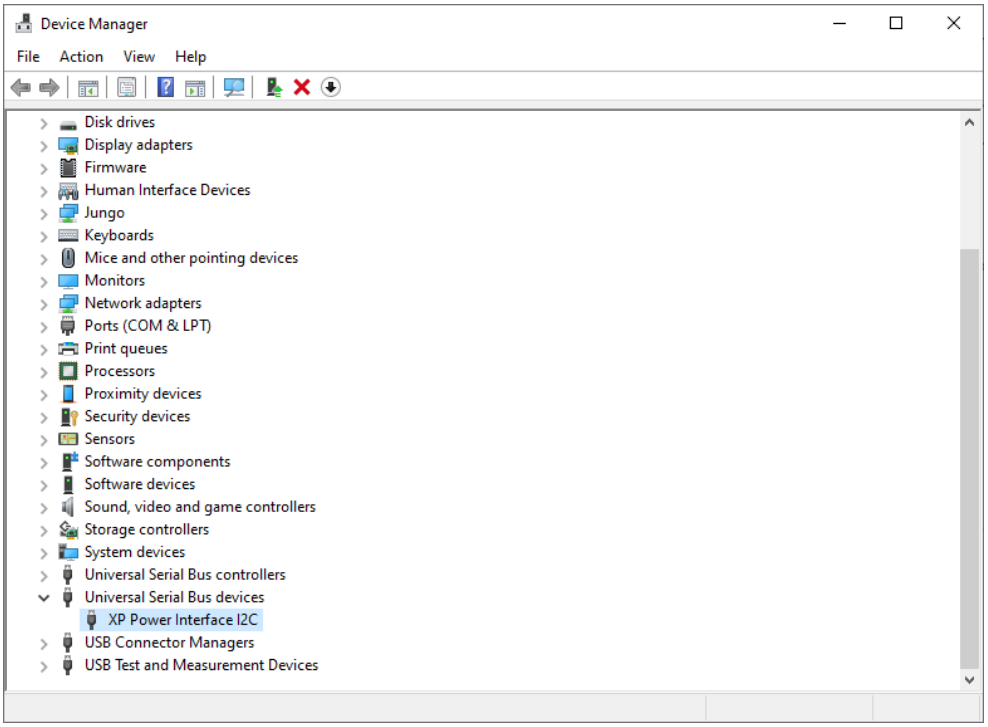


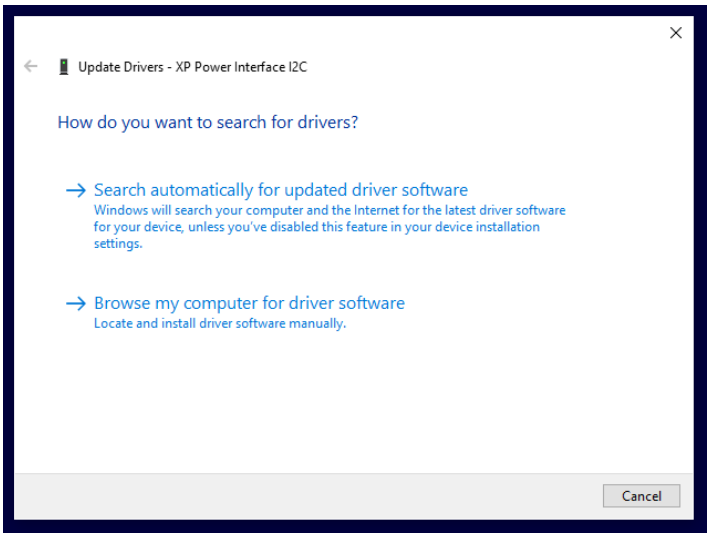
On the ‘Setting’ window, type ‘Device Manager’ and press ‘Enter’ key.



On device Manager window,

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





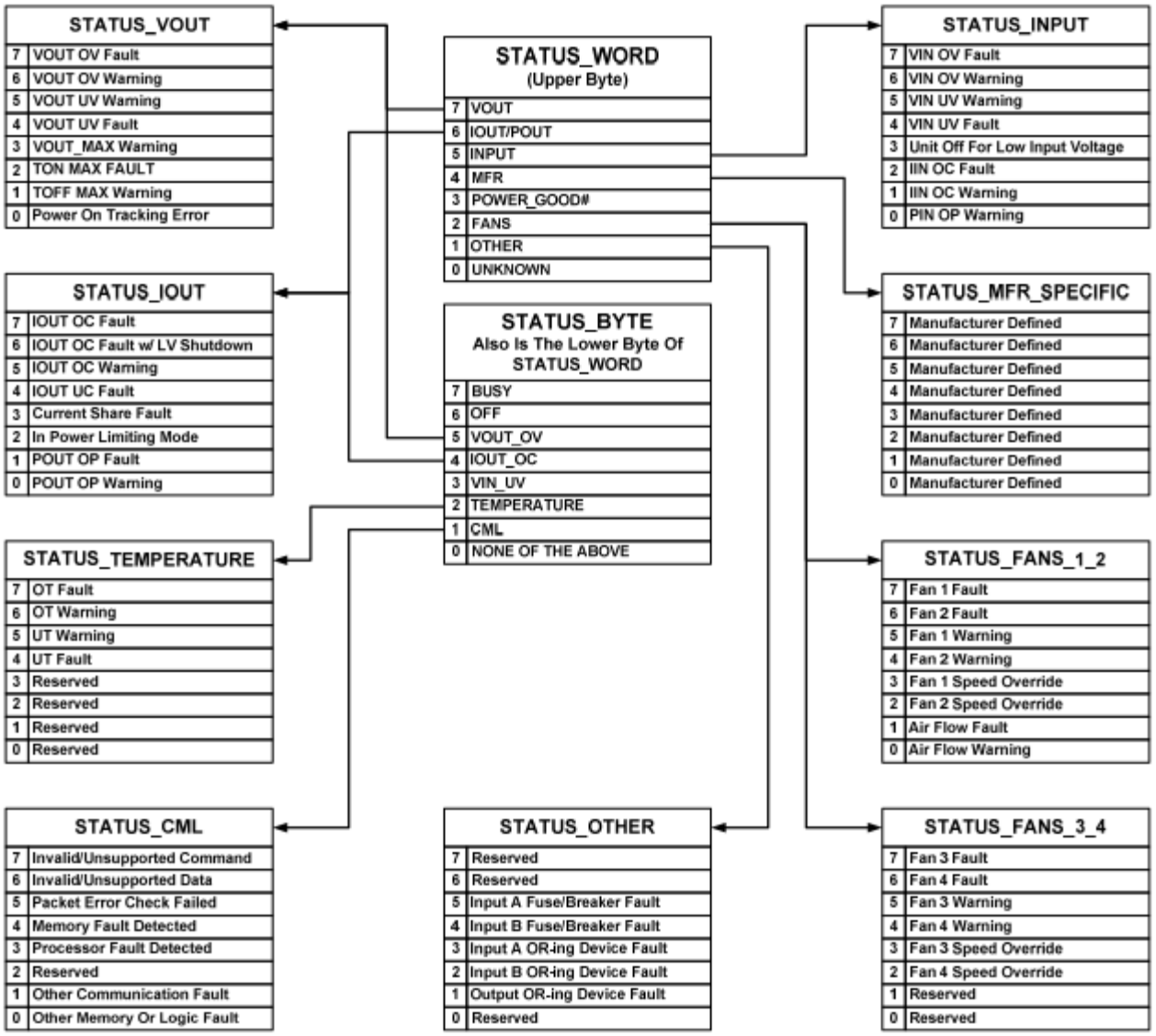
Select ‘Browse my computer’ and follow step 6 above.

Appendix D: 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 I^2C/PMBus communication.
6. Switch interface cable when you switch communication port.
7. When changing communication port, verify ‘parity’, default is ‘Even’.

Appendix E: 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 F: XP USB I2C Cable Diagrams

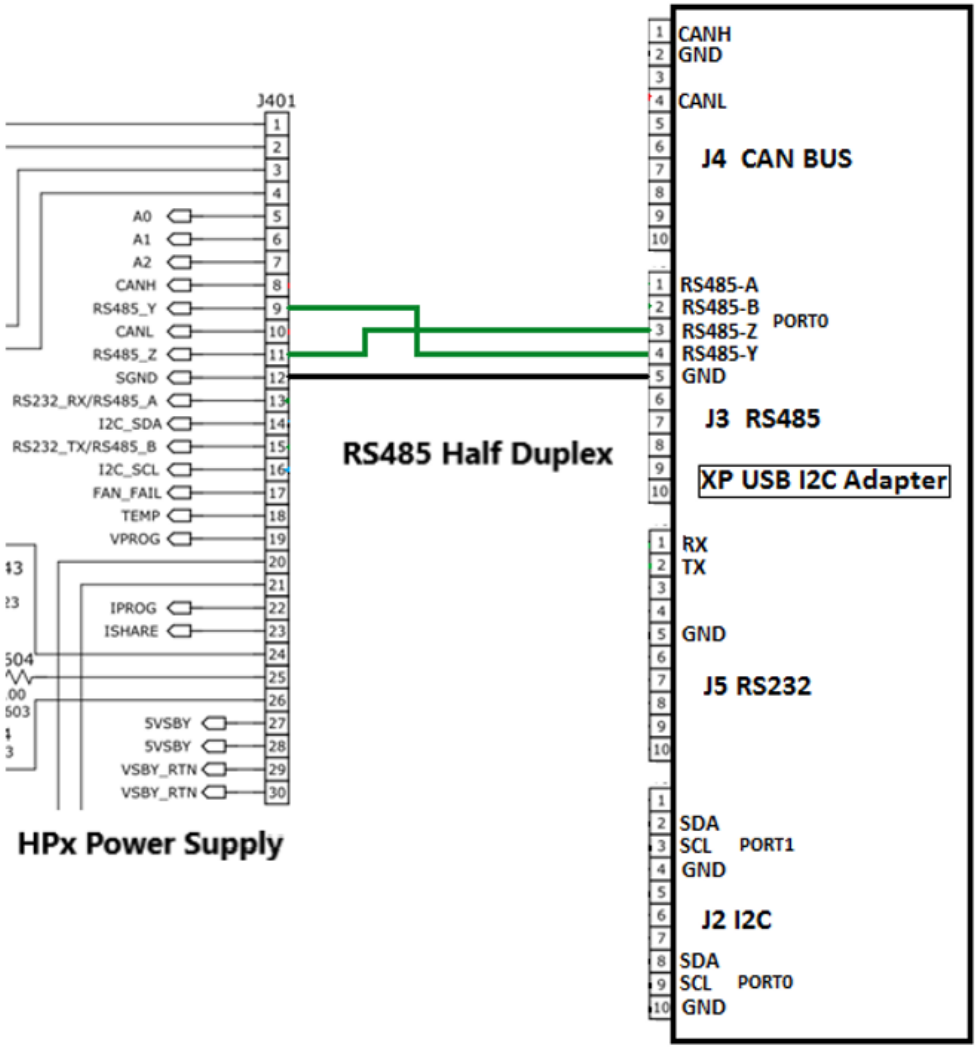


Figure F-1: RS485 Half Duplex connections.

Note: 1. Use I²C connection to configure RS485 port (full or half duplex) then switch connection. See section 4.1.2.1 for details.

2. Optional: For ease of use (switching back and forth, comm test, etc.), combine I²C connection with another connection. See section 4.1.2.2.2 for details.

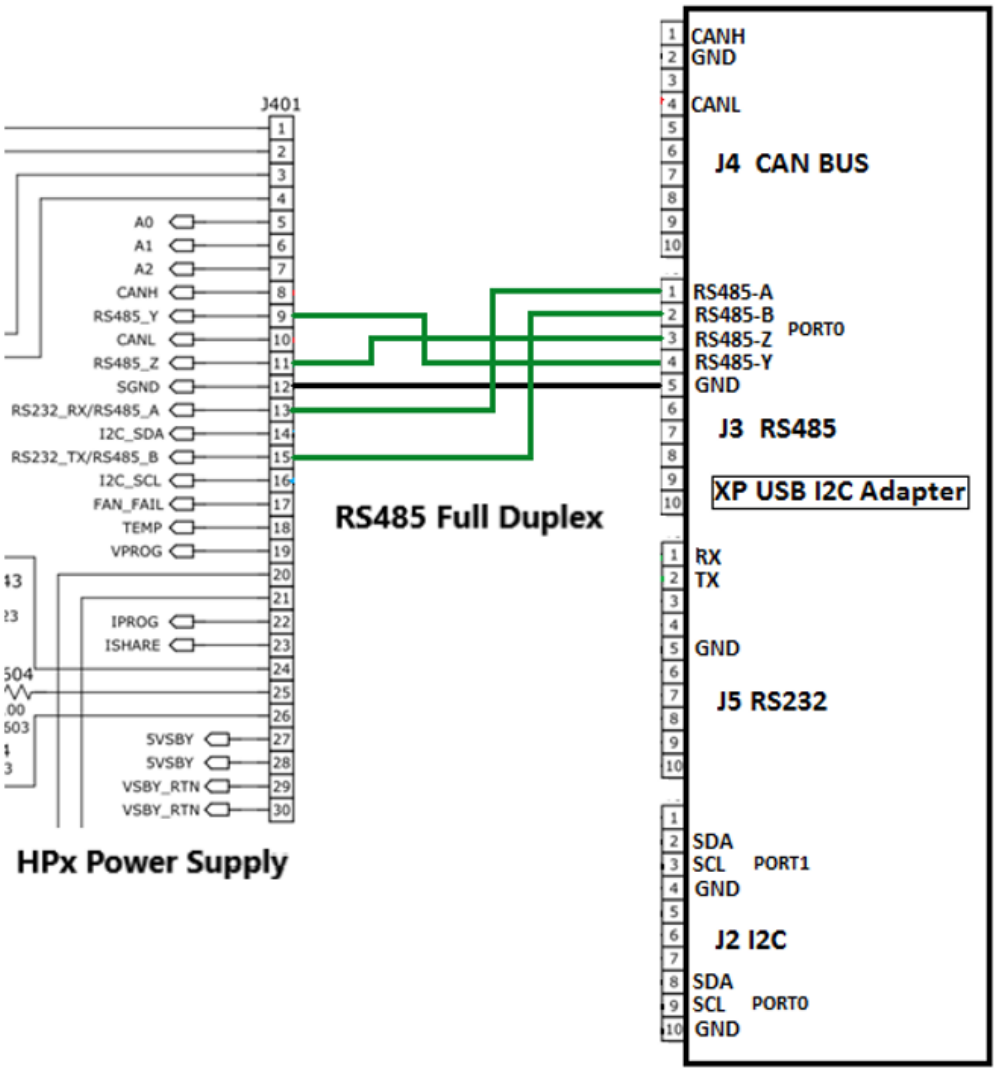


Figure F-2: RS485 Full Duplex connections.

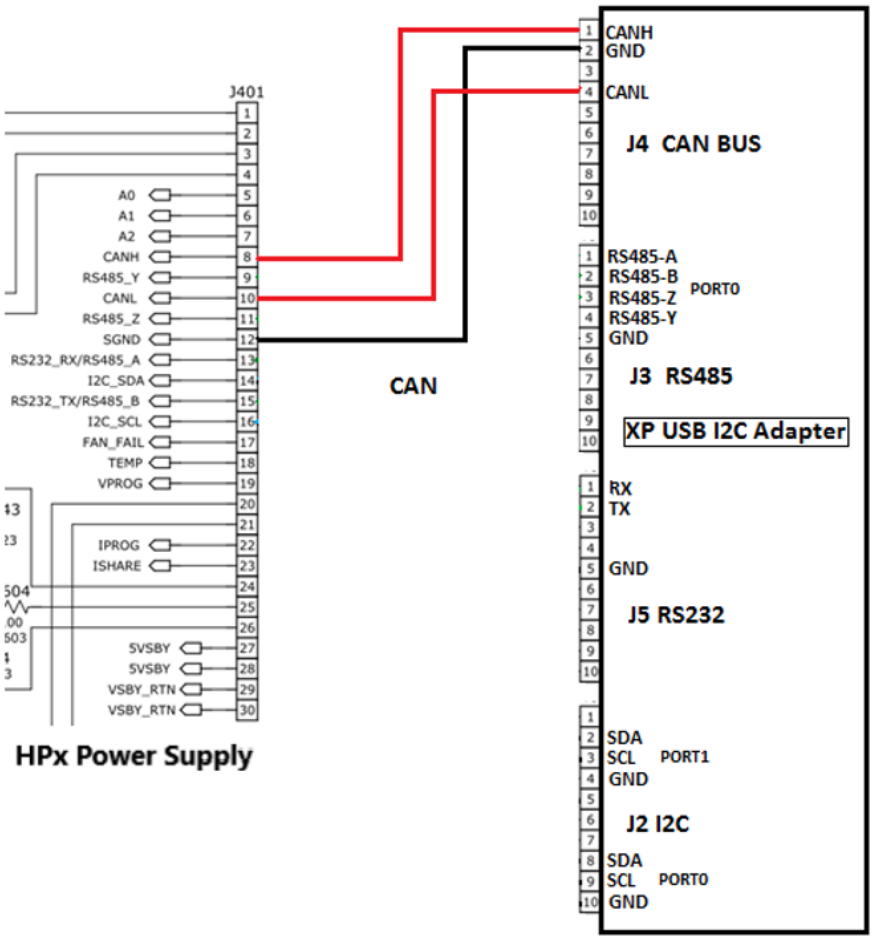


Figure F-3: CAN connections.

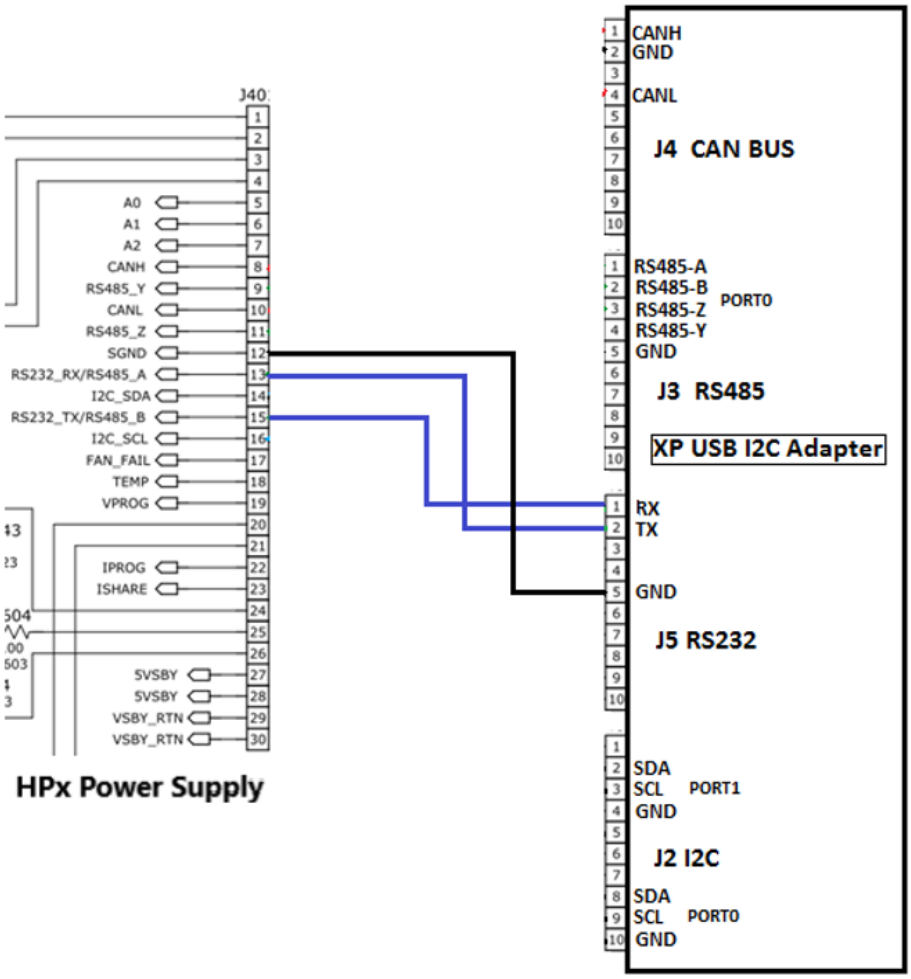


Figure F-4: RS232 connections.

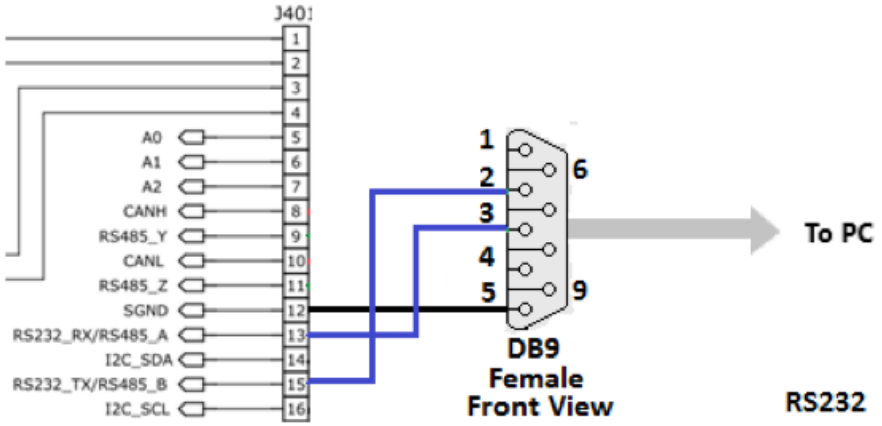


Figure F-5: Optional RS232 connection diagrams.

Note: This connection is not compatible with XP Power Supplies Manager.

Note: 1**.** Combination of I²C and RS485 (full or half duplex) connections is a convenient cable to use when switching interface (i.e. I²C to RS485). Similarly, I²C and CAN, I²C and RS232 cables are valid combination cables.

2. In Multi-Unit connection, I²C bus is held down by an un-powered unit and 'No Power Supply Found' is displayed in 'Monitor' tab, 'Slave Adr List' textbox.

Appendix G: Change Log

```
Rev 2.14
- Add more bootloader error handling/display logic.
- Delete bootloader 'Verify' button.
- Fixed the need to have 'Read Loop' running while in bootloader mode.
- Added more primary specific BL error dectection.
- Correct double display of "ProgramBlockOK @: xxxx".
- In 'UpdateFirmware' tab, verify that selected secondary f/w file name match h/w model number.
- Bootloader.cs: Clean up commnted-out code
- Bootloader.cs: Add function seperator (//====....)
- Add logic to detect primary missmatch f/w file & h/w (using filename & h/w model name).
- Naming convention: (for XP PS Mngr 2.14 version)
   - Primary Bootloader model name (hard coded) must contain 3 letters of the h/w model (HPA, HPF, HPT, etc).
   - Primary app file name must contain 3 letters of the h/w model (HPA, HPF, HPT, etc).
   - Secondary file name must contain full model number (HPA1K5PS60, HPT5K0TS060, etc.)
```

```
Rev 2.13
- Added support for current ramp up/down (0xDB, 0xDD) command codes.
- Fixed formatting for READ_OUTPUT, READ_CONFIGURATION commands.
- Add checksum print on secondary firmware update completion
- Add error prompt if checksum values are mismatching, tell user there is an issue.
- Make 'BootLoader' tap page, 'Target Level' into 'Select Process' drop down menu.
- Rearrange 'BootLoader' tap page layout.
```

```
Rev2.12
- Fixed Primary f/w update bug:
   >> slow down when writing to FLASH
   >> Add pause between Enter BL to Erase to Pgm operations.
- Following window size got reduced, increased size back to original:
  - Configure Tab, Communication Log window
  - SCPI tab, SCPI Error Log window
  - Calibration tab, Communication Log windows
- Added missing parameters logic for 'Write' & 'Read' btns in 'PMBusUtil' tab.
- New 'Loop Delay' logic, share same txtbox with 'GFR'.
- Removed PFC1-3 from Update_F/w menu; Primary & Secondary operation only.
- Save factory Data >> using btnEraseAppFlash_Click()
- New 'OK2Update' logic >> multiple units updades with out reselecting 'operation' & f/w file.
- Minor bug when update Primary f/w, bootloader did not restart, must 'Enter' bootloader & 'Exit' again.
- Change f/w file size in Update f/w check logic
- Publish factory & user installation package
- Added logic to check selected firmware file match the operation (promary/secondart) selected.
```

```
- Rev 2.11
- Adjust byte_num read cmd for PICkit or XP_USB interface, in Utility tab.
- Install this app under 'XP Power' folder.
```