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This document provides a brief introduction and instructions to install and run the Power Manager II Hercules Standard and Advanced Development Kits on Windows 7/Vista/XP. More documentation can be downloaded from [www.latticesemi.com/herculesdevkit](http://www.latticesemi.com/herculesdevkit).

## 1 Check Kit Contents

The Power Manager II Hercules Development Kit contains the following items:

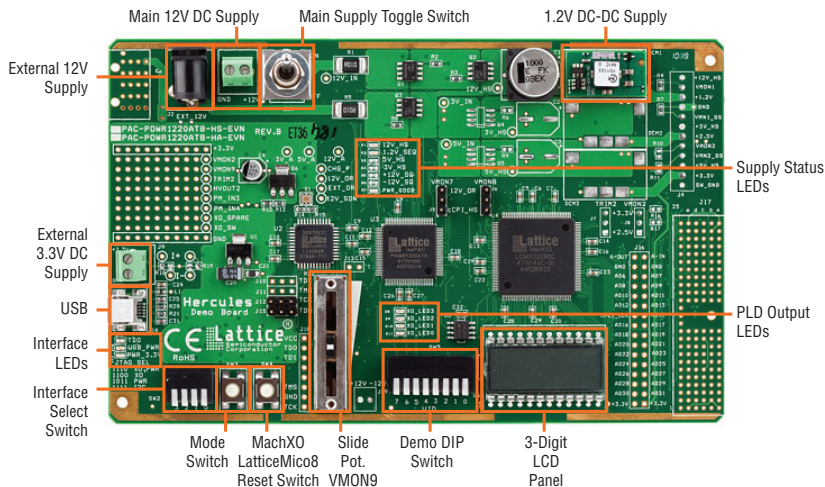
- Power Manager II Hercules Evaluation Board pre-loaded with Hercules support demos
- USB connector cable
- 12V DC wall adapter power supply
- QuickSTART Guide

*Static electricity can shorten the lifespan of electronic components. Please handle the kit components carefully.*



## 2 Powering the Evaluation Board

Running the pre-loaded demonstration does not require connecting the provided USB cable to a PC. The USB cable is required to modify the pre-loaded demo, interface to advanced demos, or load pre-configured designs. Do not plug the USB cable into the PC until after loading Lattice's USB drivers (included with ispVM). The default operating system drivers are not compatible with Lattice programming tools.



*This procedure is continued on the next page.*

# Power Manager II Hercules Development Kit

The Power Manager II Hercules Development Kit User's Guide is available for download along with the latest USB drivers and design software at [www.latticesemi.com/herculesdevkit](http://www.latticesemi.com/herculesdevkit).

In the following steps, the evaluation board will be powered and made ready to run the pre-loaded demonstrations. Verify the jumpers J5 (VMON7) and J6 (VMON8) select the "12V\_OR" option and not the "cPCL\_HS" option.

1. Connect the AC adapter from a wall outlet to the power socket. After a connection is made to the 12V wall adapter plug, the green **PWR\_3.3V** interface LED (D14) will light up indicating the on-board 3.3V regulator (U1) is operational. The Power Manager II will next illuminate three supply status LEDs: **12V\_HS**, **1.2V\_SEQ**, and **PWR\_GOOD** (D1, D2, and D7). The TDO (D12) and data (D8 through D11) LEDs may also light up.

## 3 Run the Demonstrations

This step describes the functionality of the pre-configured Power Manager II Hercules demos: voltage supply trimming, supply margining, voltage monitoring, fault monitoring and logging.

Operation of the pre-loaded demos is accomplished by setting the demo DIP switches and pressing the mode switch (SW3). The following tables summarize the demo and switch settings pertaining to each of the pre-loaded demos.

Demo	SW3 Up=1 Pressed=0	Demo DIP Switch Setting								Comment
		Mode				VMON				
		7	6	5	4	3	2	1	0	
Default	n/a	0	0	0	0	0	0	0	0	LCD self-test
1	1=CLT, 0=OLT	0	0	0	0	0	0	0	1	Trim 1.2V to <1% error; SW3 = trim mode; VMON1/LCD = Measured supply voltage
2	1=CLT, 0=OLT	0	0	0	1	0	0	0	1	Margin 1.2V down 7.5%; SW3 = trim mode; VMON1/LCD = Measured supply voltage
2a	1=CLT, 0=OLT	0	0	1	0	0	0	0	1	Margin 1.2V up 7.5%; SW3 = trim mode; VMON1/LCD = Measured supply voltage
3	n/a	0	0	0	0	1	0	1	1	12V_HS voltage VMON11/LCD = Measured supply voltage
4	n/a	0	0	0	0	1	0	0	1	Fault monitoring of slide potentiometer voltage (Vpot); VMON9/LCD = Measured Vpot voltage (0V to 3.3V)
4a	1=Display 0=Clear All	1	x	x	x	x	x	x	x	LCD = Total count of faults logged; Press SW3 to reset count to zero

Demo	SW3 Default=1 Pressed=0	Demo DIP Switch Setting								Comment
		Mode				VID				
		7	6	5	4	3	2	1	0	
5	1=Hold, 0=Update	0	1	1	1	v8	v4	v2	v1	Add VID (DIP 0-3) value to 1.2V supply voltage; VID (v8, v4, v2, v1) is a binary value multiplied by 10mV; For example: 0000b=0*10mV=0V, 0100b=4*10mV=40mV, 1000b=8*10mV=80mV; 1100b=12*10mV=120mV; VMON1/LCD=Measured supply voltage
5a	1=Hold, 0=Update	0	1	1	0	v8	v4	v2	v1	Subtract VID (DIP 0-3) value to 1.2V supply voltage; VID (v8, v4, v2, v1) is a binary value multiplied by 10mV; VMON1/LCD=Measured supply voltage
5b	1=Hold, 0=Update	0	1	0	x	x	x	x	x	Turn off 1.2V supply; VMON1=LCD

Notes:

1. The mode switch (SW3) is equal to a logic one (1) when not pressed. Pressing the mode switch (SW3) enters a logic zero (0).
2. The demo DIP switches (SW5) are equal to a logic ones (1) when up. Placing the switches down makes them zeros (0).
3. CLT means closed loop trimming mode (supply setpoint is trimmed to an accurate value). OLT means open loop trim to pre-determined value (supply setpoint is a preset voltage and not trimmed). In other words, Demos 1 and 2 use either CLT or OLT trim mode depending on the condition of the mode switch (SW3).
4. Pressing the PLD reset switch (SW4) resets the LatticeMico8 controller in the MachXO (U4), not the POWR1220AT8 (U3).
5. The position of Interface Select Switches (SW2) does not affect any of the testing in the QuickSTART guide.

## Power Manager II Hercules Demos:

- **Default State** – With demo DIP switches set as shown (all 0's) the LCD will cycle through its self-test sequence along with the PLD output LEDs. This is the default (shipped) turn-on condition.
- **Demo 1: Switching Power Supply Trim** – The Power Manager II Trim-DAC output trims the 1.2V supply to better than 1% of its factory set value. This is done by the ispPAC®-POWR1220AT8 and MachXO™ using an external closed loop trim to adjust the feedback into the regulator trim pin. The LCD displays the output voltage of the 1.2V switching regulator at VMON1 using the ADC in the POWR1220AT8. Pressing and holding down the mode (SW3) switch changes the trim mode from closed loop to open loop. In this mode, the Trim-DAC output is set to a fixed (stored) digital value which is selected by the Voltage Profile Select pins of the Power Manager II.
- **Demo 2: Power Supply Margin Down** – With demo DIP switches set as shown, the supply is trimmed to -7.5% of its factory value ( $1.2V - 0.09V = 1.11V$ ) using closed loop trim. VMON1 is chosen to measure the 1.2V DC-DC power supply and the value is read by the POWR1220AT8 ADC and displayed on the LCD. Pressing the mode switch results in the trim mode switching from closed loop to open loop trim. This means the output is set to a fixed (stored) digital value and will not be as accurate as closed loop trim.
- **Demo 2a: Power Supply Margin Up** – With demo DIP switches set as shown, the supply is trimmed to +7.5% of its factory value ( $1.2V + 0.09V = 1.29V$ ) using closed loop trim. VMON1 is chosen to measure the 1.2V DC-DC power supply and the value is read by the POWR1220AT8 ADC and displayed on the LCD. Pressing the mode switch results in the trim mode switching from closed loop to open loop trim. This means the output is set to a fixed (stored) digital value and will not be as accurate as closed loop trim.
- **Demo 3: 12V Voltage** – This is a POWR1220AT8-enabled version of the input 12V. The input 12V can come from the 12V wall plug input or an external source. This voltage exceeds VMON's 6V maximum input limit. An intermediate voltage is created by dividing by a 4:1 resistor divider network. The intermediate voltage is read at VMON11 and applied to the internal ADC for measurement. The measured value is then digitally multiplied by 4 and displayed on the LCD.
- **Demo 4: Power Supply Fault Monitoring** – The slider potentiometer simulates an over/under voltage condition on a 2.5V power supply and is monitored by VMON9. The full range of voltage is 0V to 3.25V. The LCD displays the voltage. VMON9 is configured in the Power Manager II in "window" mode with a lower trip point of 0.75V and an upper trip point of 2.25V. When the voltage at VMON9 is above the upper or below the lower trip point a fault is detected by the Power Manager II. These faults are detected and counted for readout in Demo 4a. Cycling board power will also result in a fault being recorded. *Note: These faults were not programmed to cause a PWR\_GOOD failure.*
- **Demo 4a: Fault Logging** – The LCD displays the total count of faults recorded by the Power Manager II and MachXO. Pressing the mode switch (SW3) clears all the recorded faults. Faults are detected by the Power Manager II when the slider potentiometer is outside the window limits (see Demo 4) or when power is removed from the board.
- **Demos 5 and 5a: VID Voltage** – The Trim-DAC output of the Power Manager II is used to step the 1.2V DC-DC supply based on the value of the VID-DIP switches. Switches 3-0 provide a 4-bit unsigned binary value ranging from 0-15. This value is multiplied by 10mV and added to, or subtracted from, the nominal 1.2V based on the polarity of demo DIP switch 4. For example,  $0000b=0*10mV=0V$ ,  $0100b=4*10mV=40mV$ ,  $1000b=8*10mV=80mV$ ;  $1100b=12*10mV=120mV$ .

*This procedure is continued on the next page.*

# Power Manager II Hercules Development Kit

When the mode switch (SW3) is pressed the value is computed from the DIP switch settings and stored as a target value for the closed loop trim. Note: the trimming of the 1.2V supply is limited to +/- 150mV of 1.2V based on Trim-DAC range and interface circuits. Not all positive VID values inside this range can be realized. The guaranteed positive VID range is 110mV, or a setting of 1011b.

- **Demo 5b: VID Supply Shut-Down** – Setting DIP switch 5 to a logic zero (0) and pressing the mode switch (SW3) will result in disabling the 1.2V supply. Setting DIP switch 5 to a logic one (1) and pressing the mode switch (SW3) will enable the 1.2V supply. Note: Without an external load, the output of the 1.2V DC-DC supply will float up to a few tenths of a volt.

## 4 Done!

Congratulations! You have successfully demonstrated the Power Manager II Hercules Development Kit. Please refer to the Power Manager II Hercules Development Kit User's Guide available on the Lattice web site at [www.latticesemi.com/herculesdevkit](http://www.latticesemi.com/herculesdevkit) for the following:

- Running advanced demos, including voltage monitoring, via I<sup>2</sup>C using the POWR1220AT8
- Details on additional development board features and operation
- Modifying the generating the demo program files from the PAC-Designer<sup>®</sup> project sources
- Schematics
- Gerber PCB layout artwork

## Technical Support

If you experience problems running the kit demos please refer to the Troubleshooting appendix in the Power Manager II Hercules Development Kit User's Guide. If problems persist or if any kit contents are missing, please email us at [techsupport@latticesemi.com](mailto:techsupport@latticesemi.com) or call 1-800-528-8423 (USA) or +1 503-268-8001 (other locations).