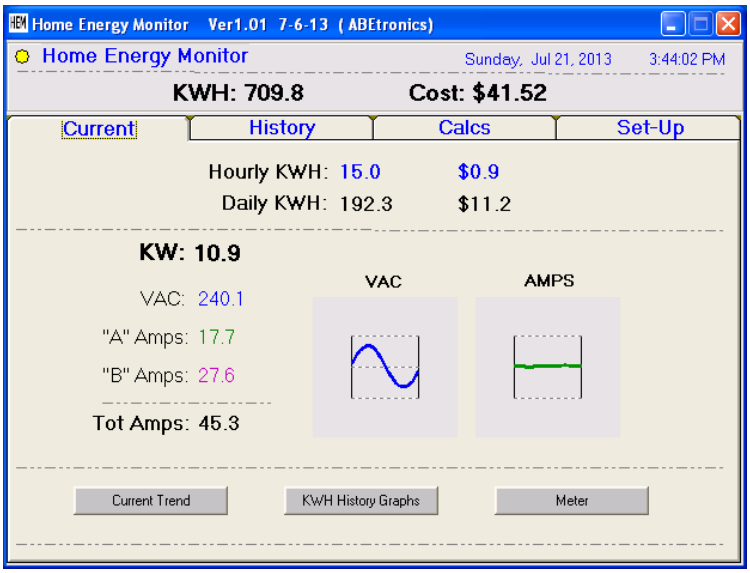
9-5-13

Home Energy Monitor

User Manual

V1.01



ABEtronics engineering services

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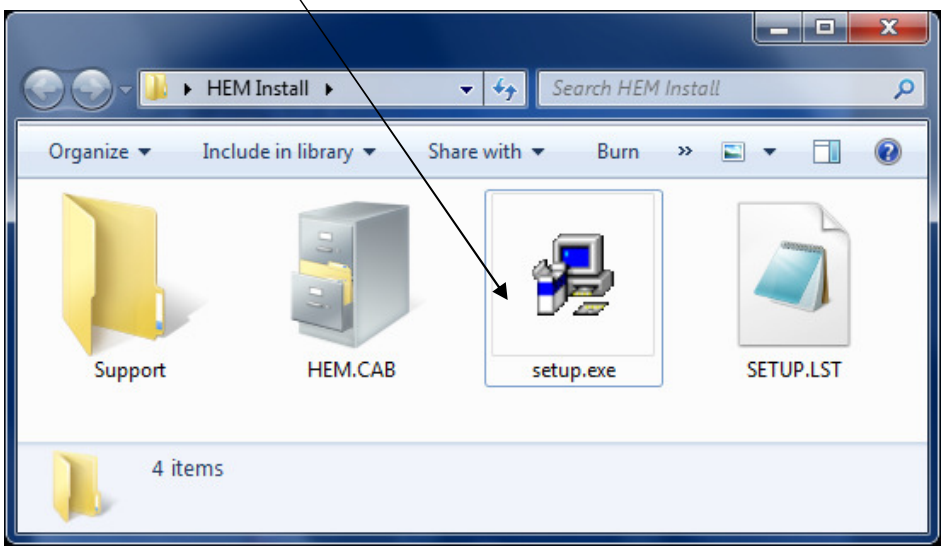
Down Loadable Files:

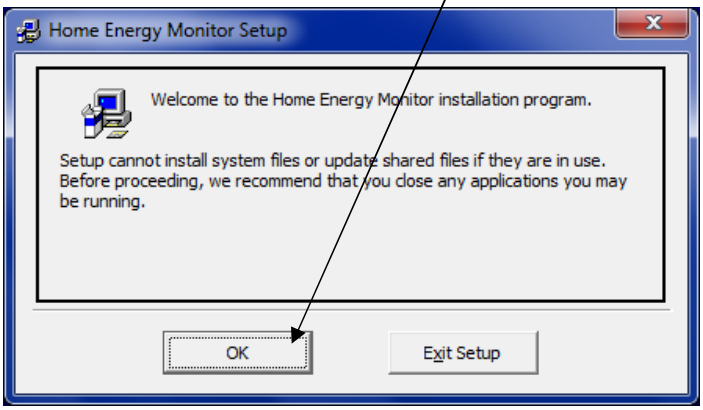
HEM User Manual	(HEM User Manual.pdf)
Home Energy Monitor PCB	(Home Energy Monitor PCB.pdf)
HEM PC software program.	(HEM install)
HEM PIC16F88 chip firmware.	(em.HEX)
PCB and software in action.	(HEM.mpg, HEM_pcb.mpg)

Install HEM software

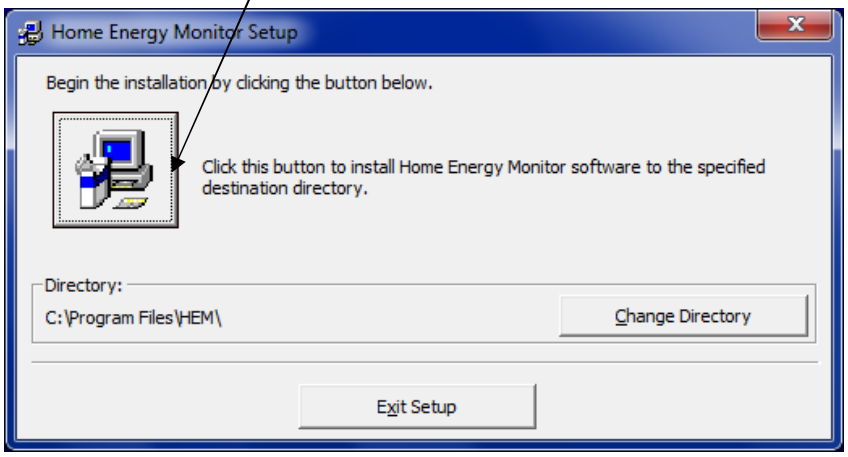
1. Download HEM files to local **c:** drive.
2. Open "**HEM Install**" folder.
3. Click on "**setup.exe**" file.



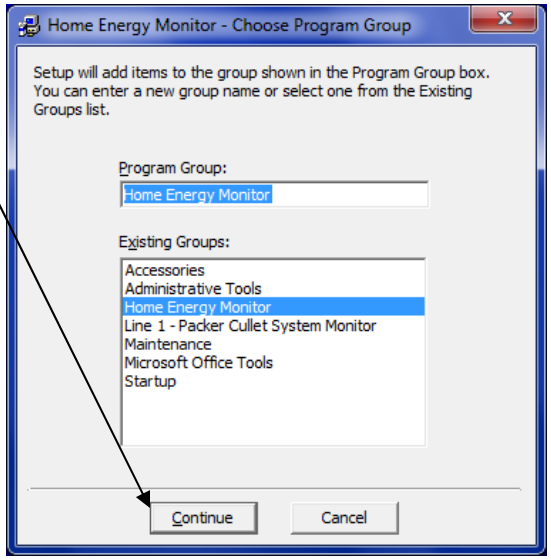
4. A "Welcome" window will appear. Click on "**OK**" button.



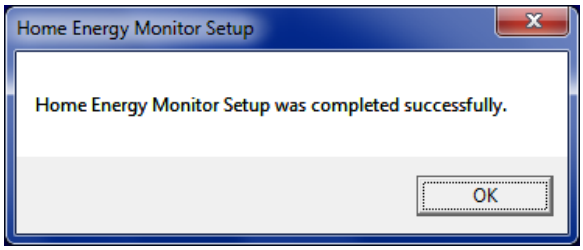
5. Install program in default directory (C:\Program Files\HEM)
6. Click on this button to start installation.



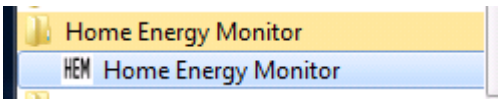
7. Click on "**Continue**" button to continue installation.



8. Set-Up completed successfully window will appear.



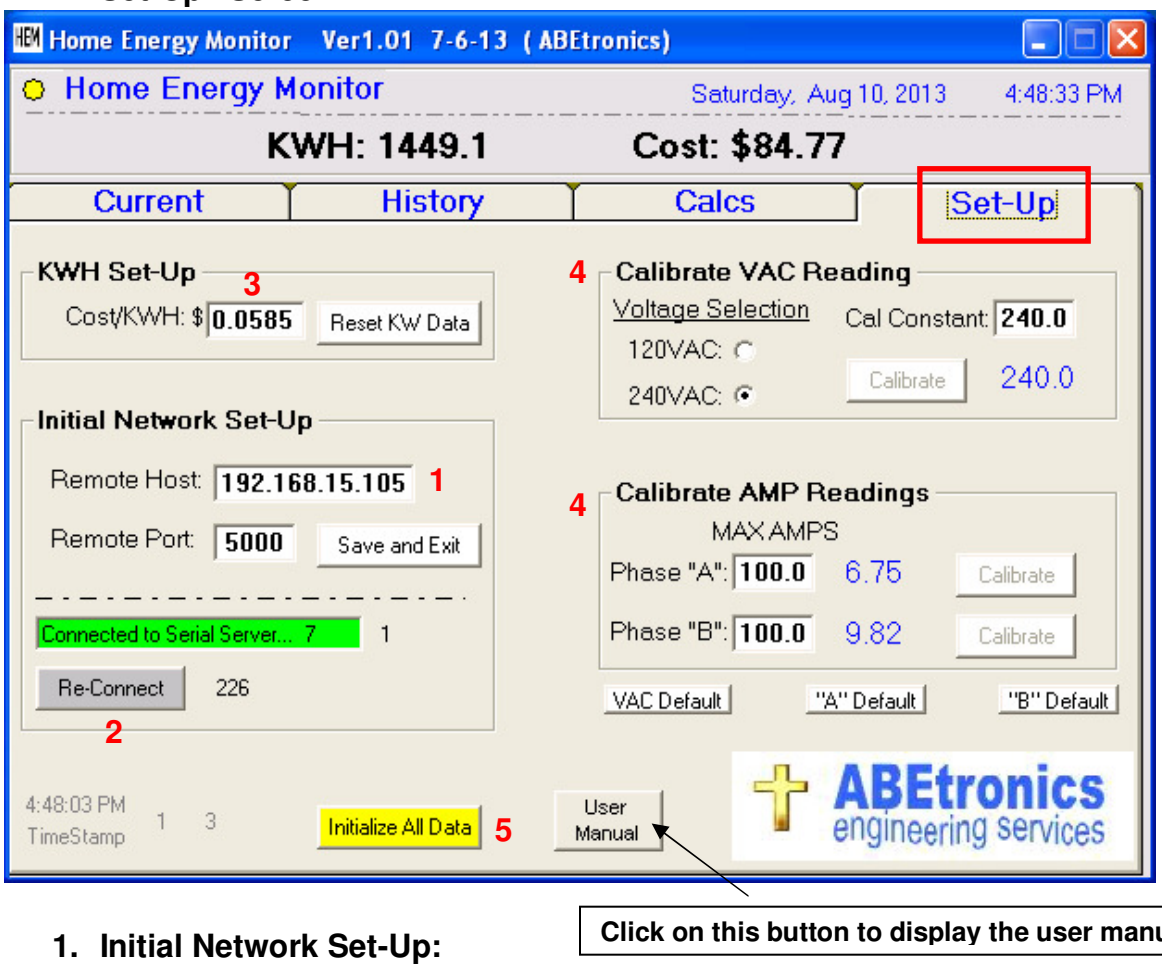
9. To run program, click on Start button then Home Energy Monitor icon in list.



Set-Up HEM software

1. Set-up network connection to the WIZ110SR PCB.
    - IP address and remote port.
2. Set-up Cost per KHW.
    - Enter Cost per KHW for electric bill.
3. Calibrate Readings.
    - Calibrate VAC and AC current readings if necessary.

HEM "Set-Up" Screen



1. **Initial Network Set-Up:**
   - Once the WIZ110SR PCB is set-up with a valid IP address, ping it to determine if the PCB can be reached and is communicating over the Ethernet connection.

   - If the PCB is communicating, enter it's IP address into the Remote Host entry field and it's Remote port number.

   - The "**save and exit**" button will be enabled so that the information entered can be saved. The program will terminate and will need re-started.

2. **Initial Network Set-Up:**
   - If communication is lost between PC and WIZ110SR PCB, click on the "**Re-Connect**" button to re-establish a communication link.

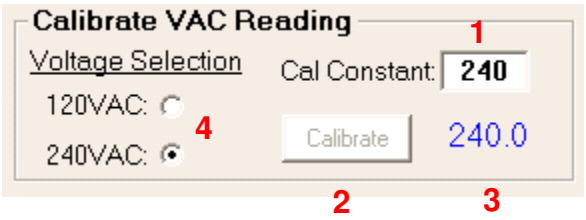
3. **KWH Set-Up:**
   - Enter the cost/KWH (from electric bill) into this entry field to calculate electric costs.

HEM "Set-Up" Screen (continued)

4. **Calibrations:**
   - If needed, enter voltage and current calibration constants to calibrate real-time readings.

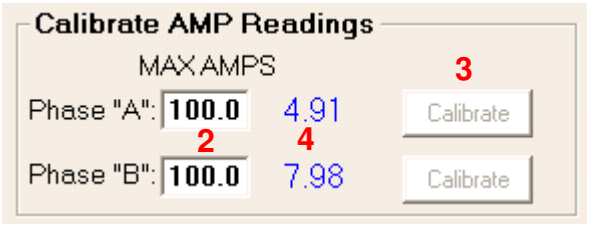
To Calibrate the AC Voltage:

1. Enter measured voltage in entry field.
2. Click on "**calibrate**" button.
3. Reading to the right should be around the entered value.
4. Voltage selection will automatically update. (used in calculations)

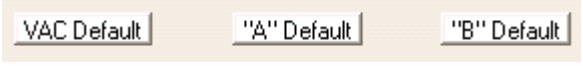


To Calibrate the AC Current:

1. Apply maximum ma signal to 2 pin connector on HEM PCB to represent the maximum current reading. (200 amp CT = 33ma)
2. Enter maximum AC current in entry field.
3. Click on "**calibrate**" button.
4. Reading to the left should be around the entered value.

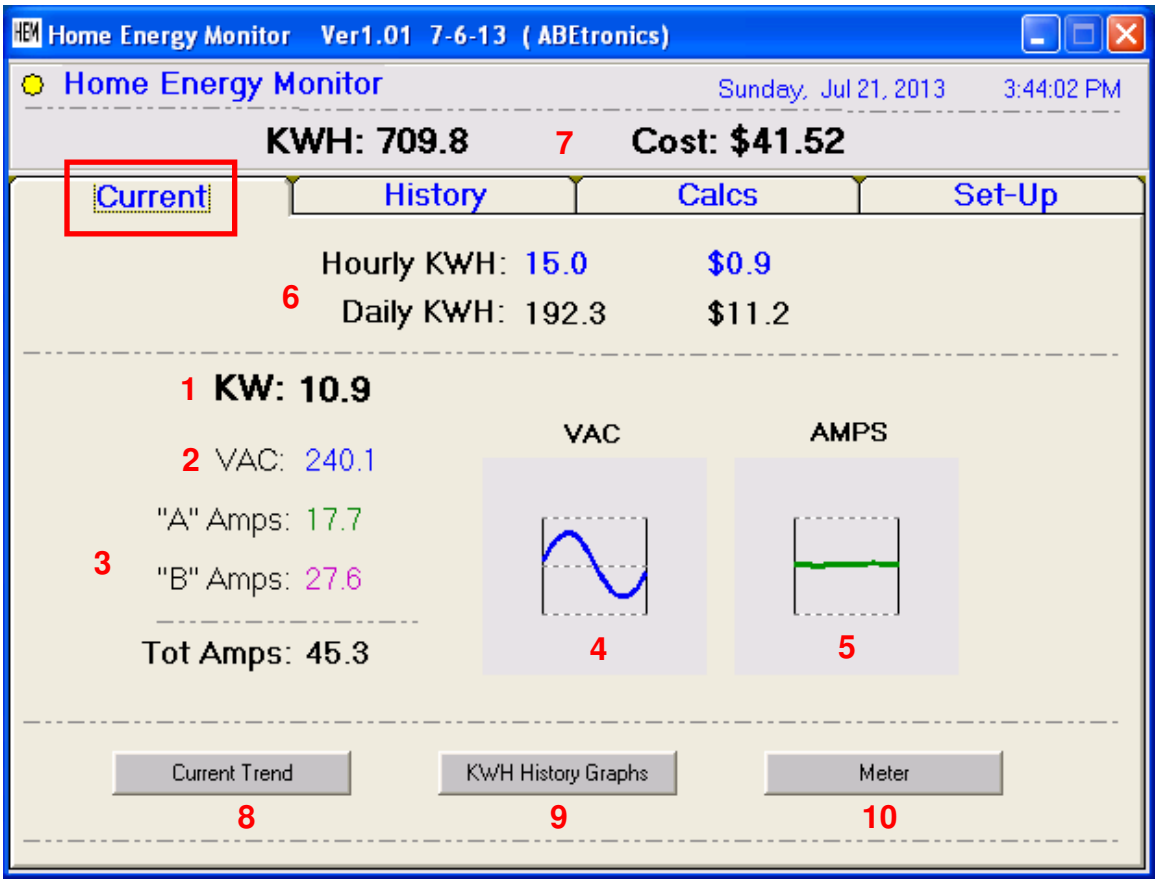


Note: If calibration went wrong, click on the "**Default**" button to return to original settings.



5. **Initial All Data:**
   - If desired, when this button is pressed - all current and historic readings in data files will be cleared. (an "are you sure" window will appear asking for confirmation to proceed with initialization)

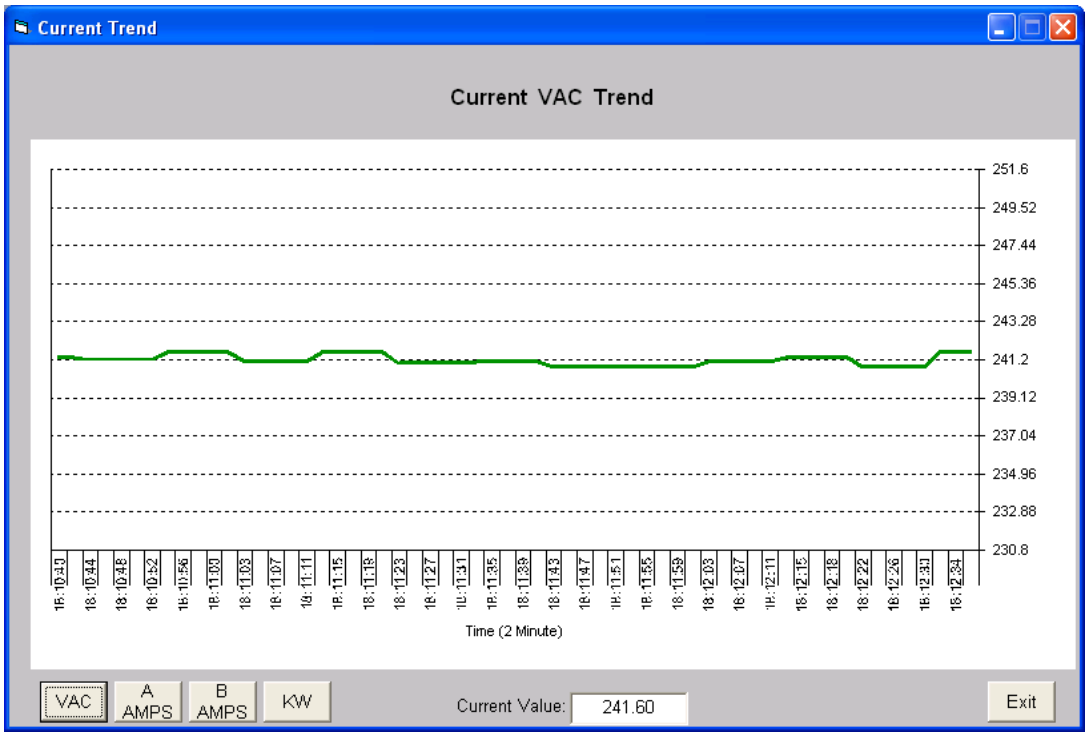
HEM "Current" Screen

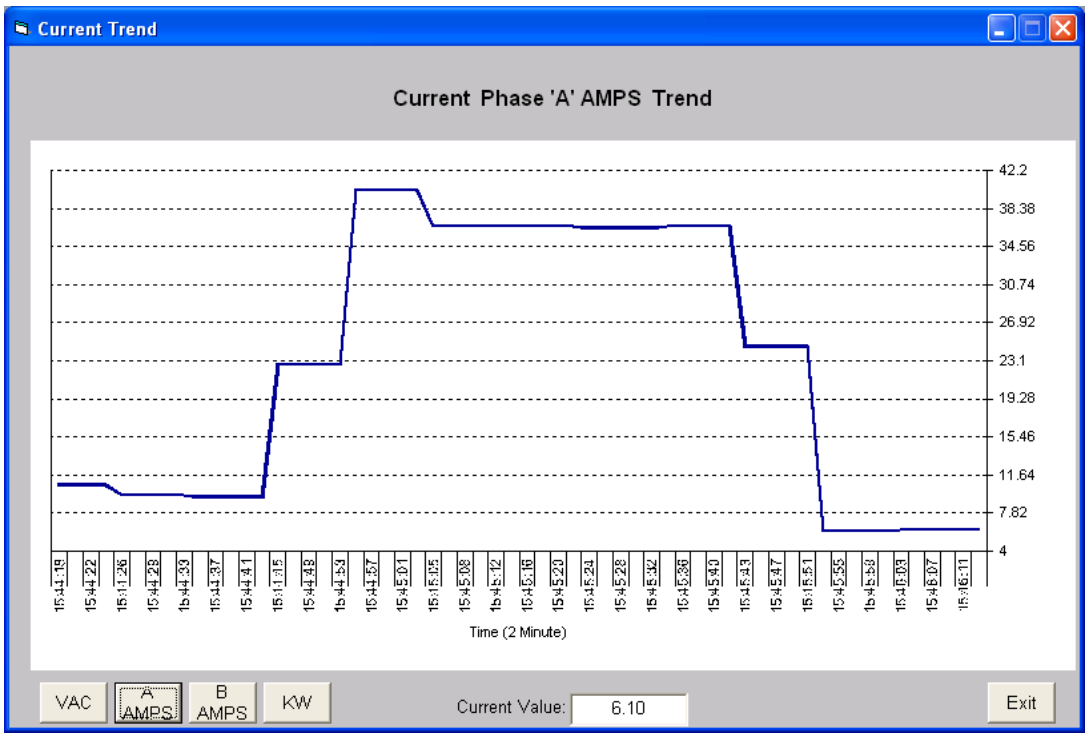


1. Real-Time KW readings.
2. Real-Time VAC readings.
3. Real-Time AC current readings.
4. Real-Time "Actual" VAC measured waveform. Verify reading accuracy.
5. Real-Time "Actual" Phase "A" measured waveform. Verify reading accuracy.
6. Hourly and Daily KWH usage with associated cost.
7. Real-Time KWH accumulated readings with associated cost.
    - Can reset values from the Set-Up screen. This will accumulate until the user resets values.
8. Trending: Display Real-Time VAC, AMP, KW readings. (last 2 minutes)
9. Trending: Display KWH history readings. (from 1 hour to 30 days)
10. Display Real-Time VAC, AMP, KW readings in meter form.

HEM “Current” Screen

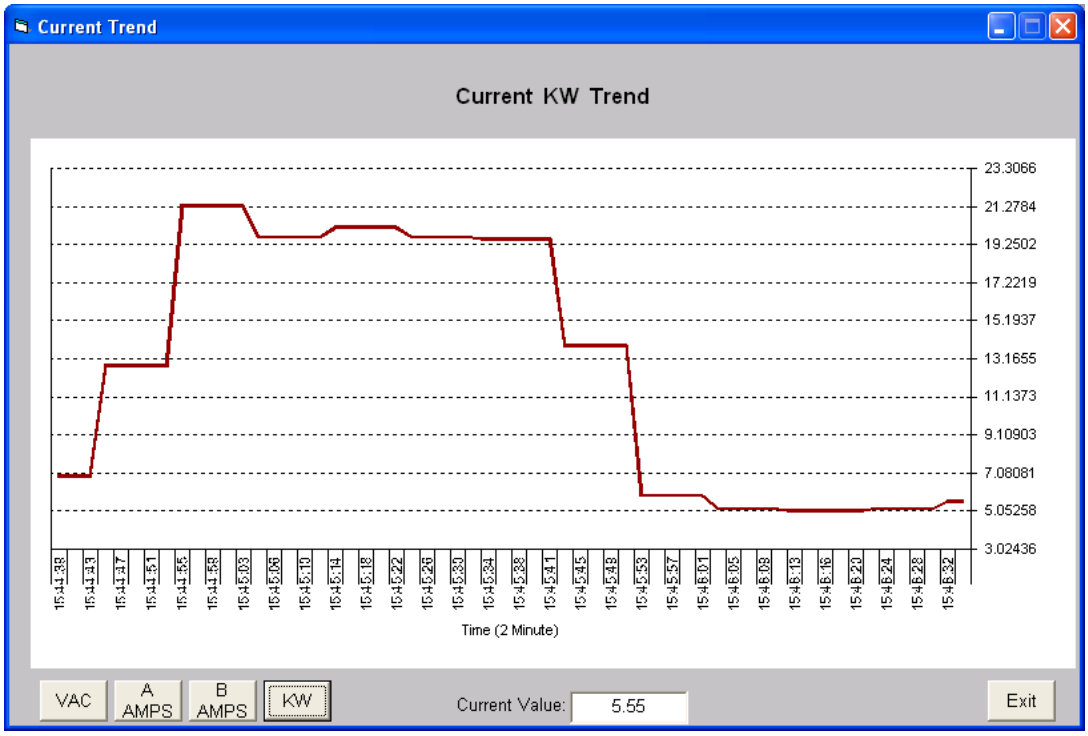
Current Trends:



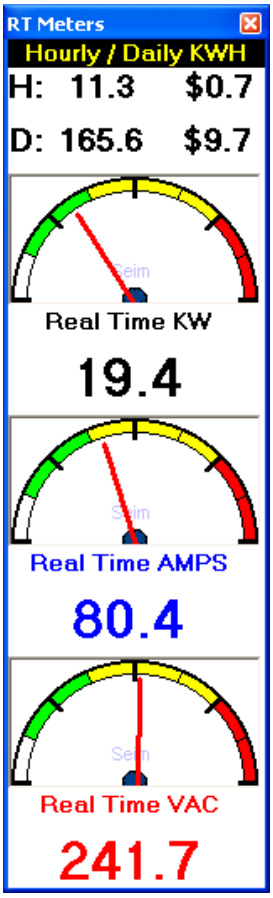


HEM “Current” Screen

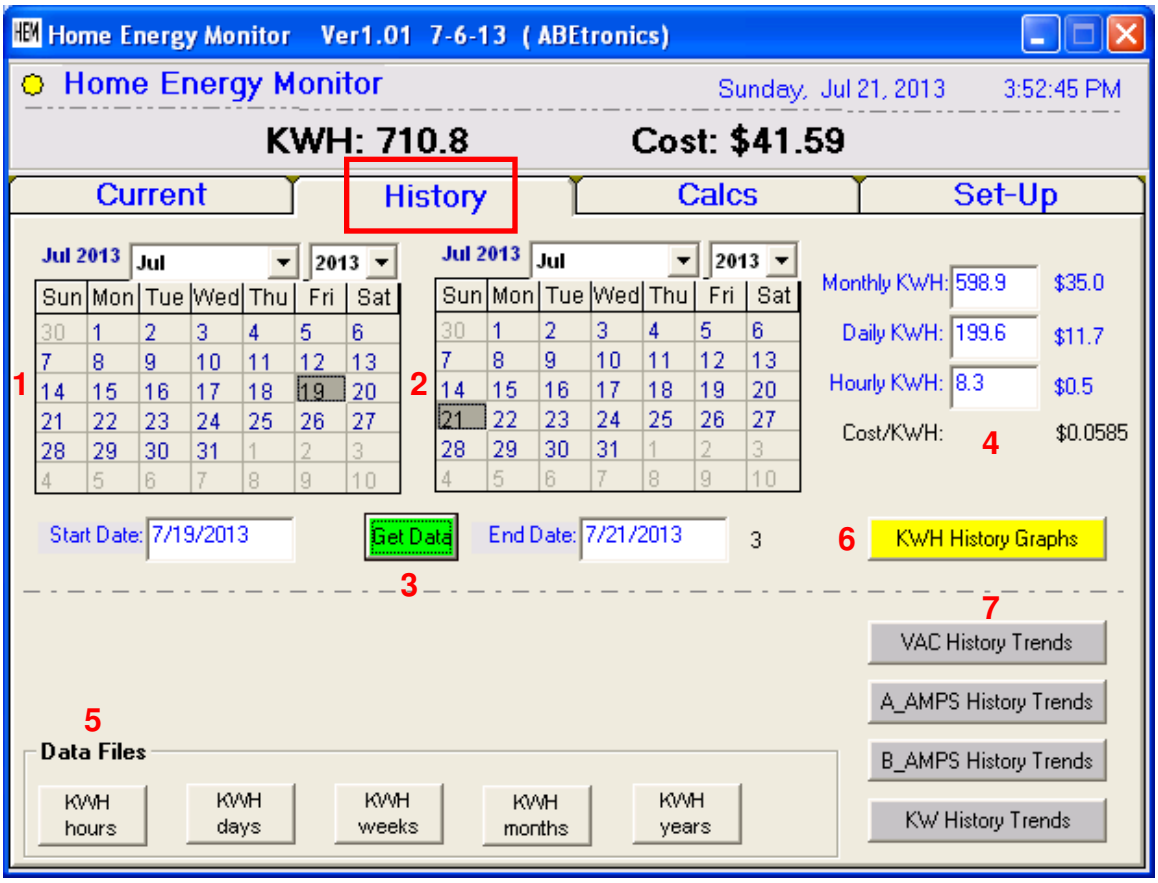
Current Trends: (continued)



Real-Time Meter Display:



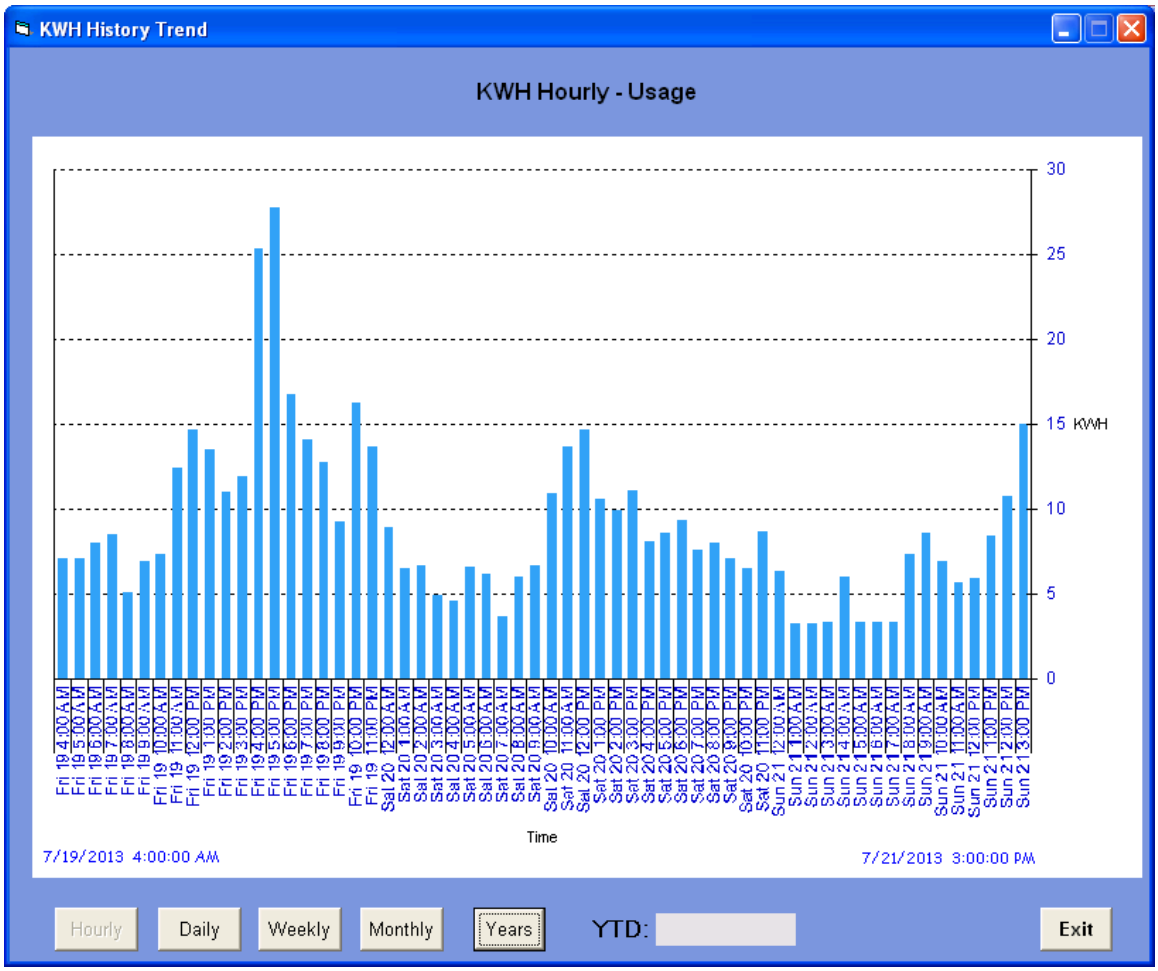
HEM "History" Screen



1. Start Day Calendar. (Select Month, Click on Start Day)
2. End Day Calendar. (Select Month, Click on End Day)
3. Get Data Button. (Click on button to display KWH data to the right)
4. KWH data display. (Use to compare with electric bill usage)
5. Data File buttons. (Open to check data values)
6. KWH History Graph button. (Open to see past KWH usage)
7. History Trends buttons. (Open to see VAC, Amp, KW history data)

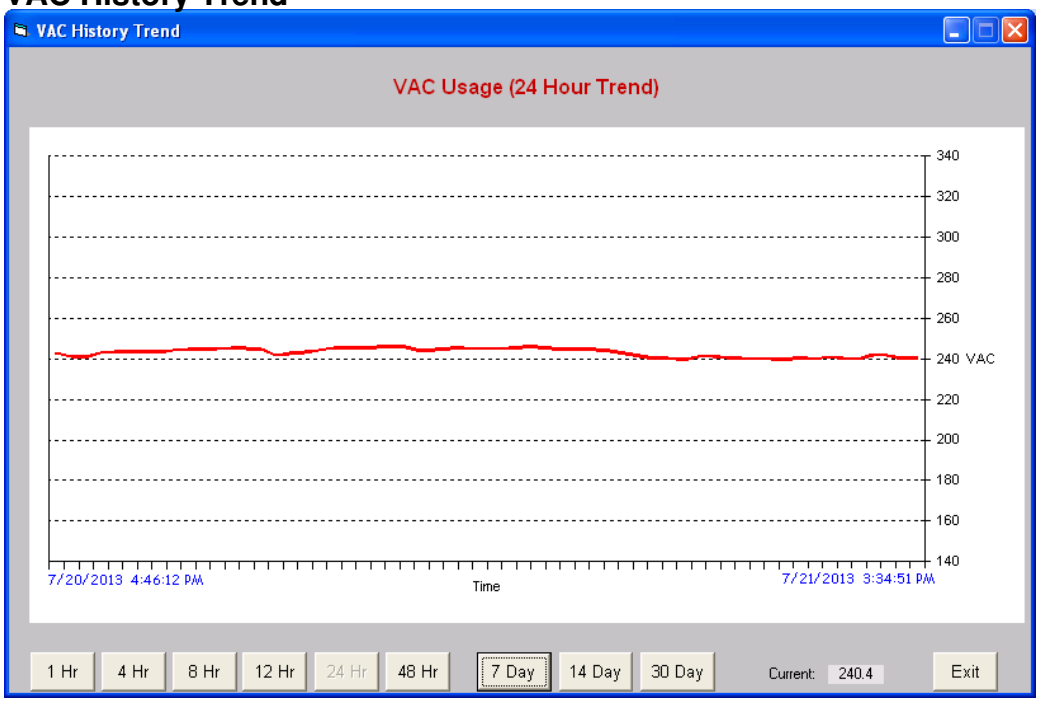
HEM “History” Screen (continued)

KWH History Graph: (60 Hourly, 60 Daily, 60 Weekly, 30 Monthly, 30 Yearly)

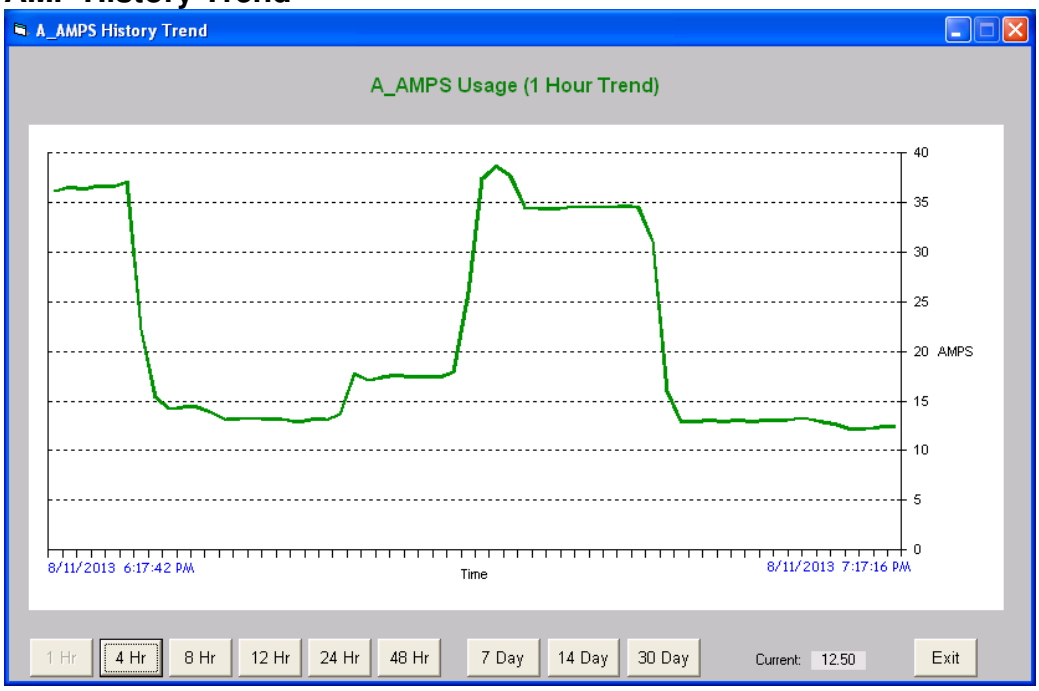


HEM “History” Screen (continued)

VAC History Trend

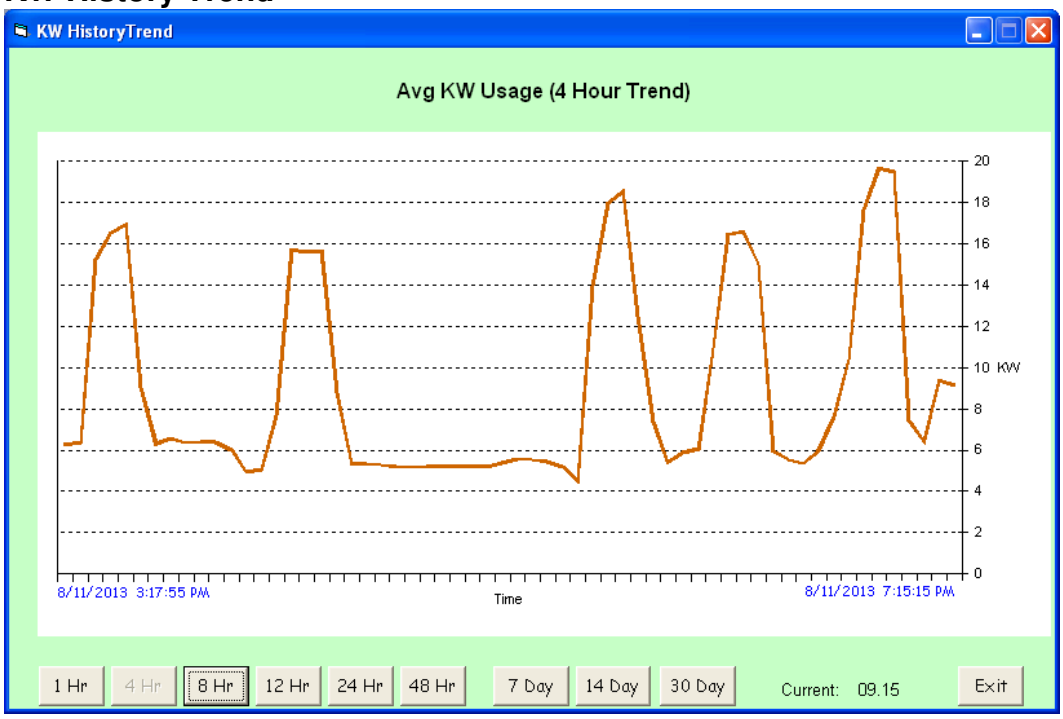


AMP History Trend



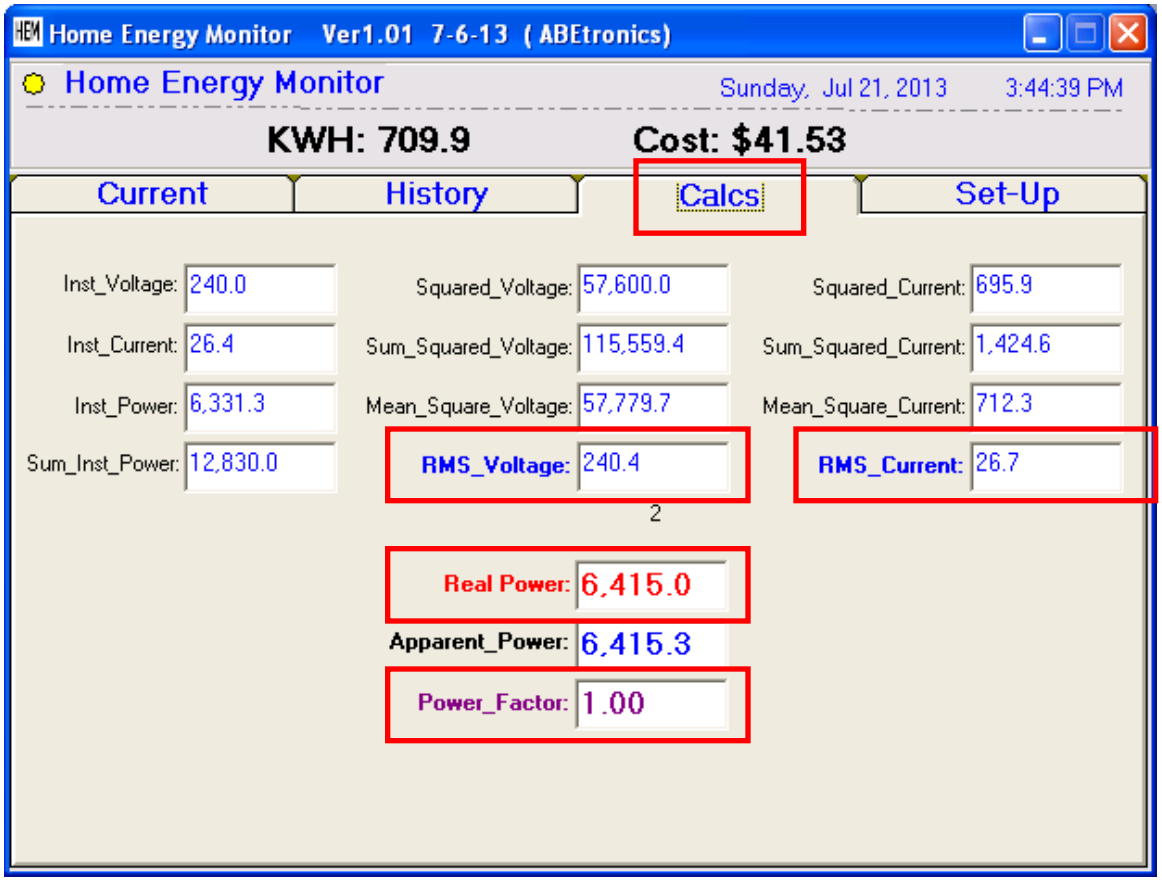
HEM “History” Screen (continued)

KW History Trend



HEM "Calculation" Screen

- Real-Time RMS AC voltage and current calculations.
- Real-Time calculations for Real and Apparent Power and Power Factor.



WIZ110SR PCB Set-Up

Initial Set-Up Instructions for the WIZ110SR Board.

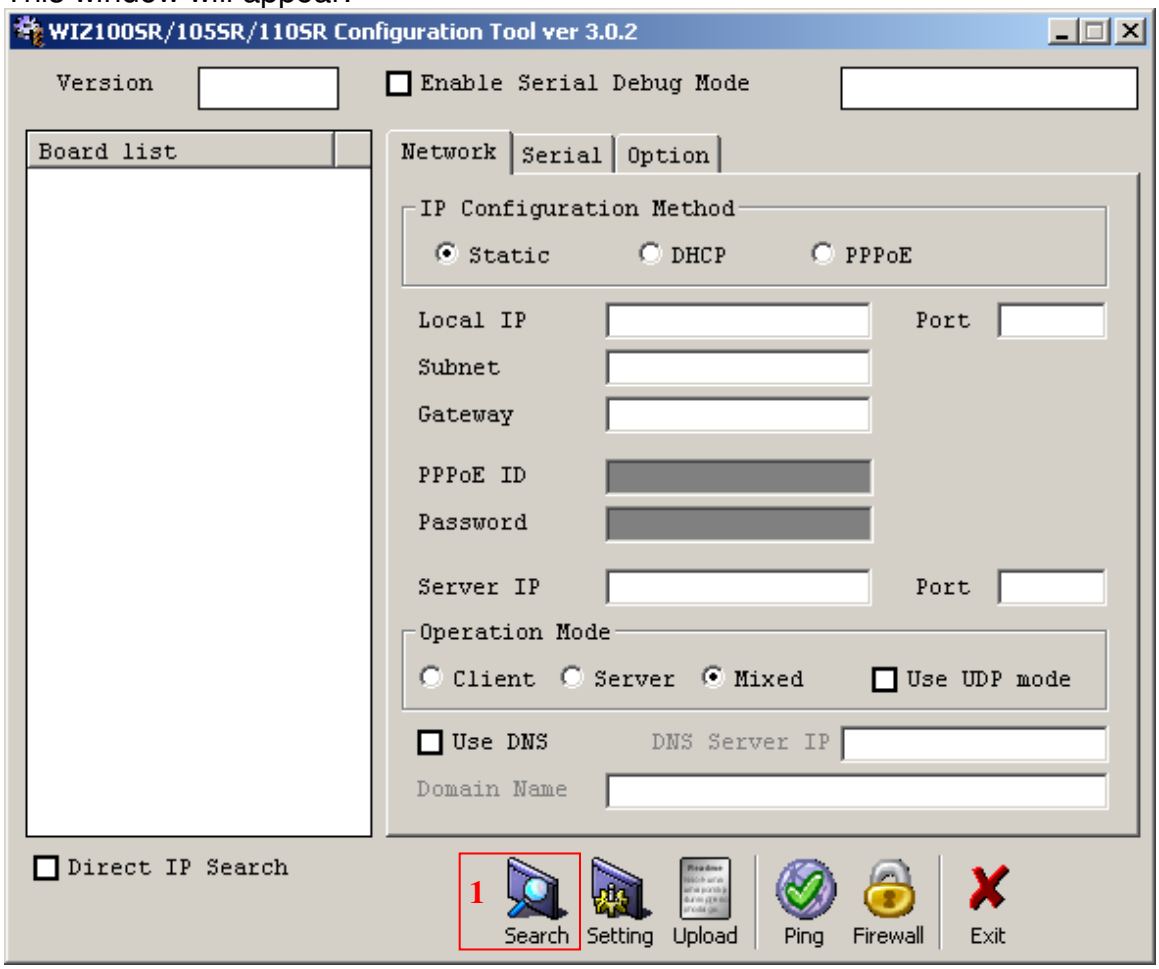
a. Connect WIZ110SR board to the Ethernet hub that is also connected to your computer. Use a LAN cable (RJ45 CAT-5 Ethernet cable)

b. Connect the 5vdc power supply to the board.

Run the "Configuration Tool" Software:

Launch WIZ1x0SR_105SR_CFG_V3_0_2.exe

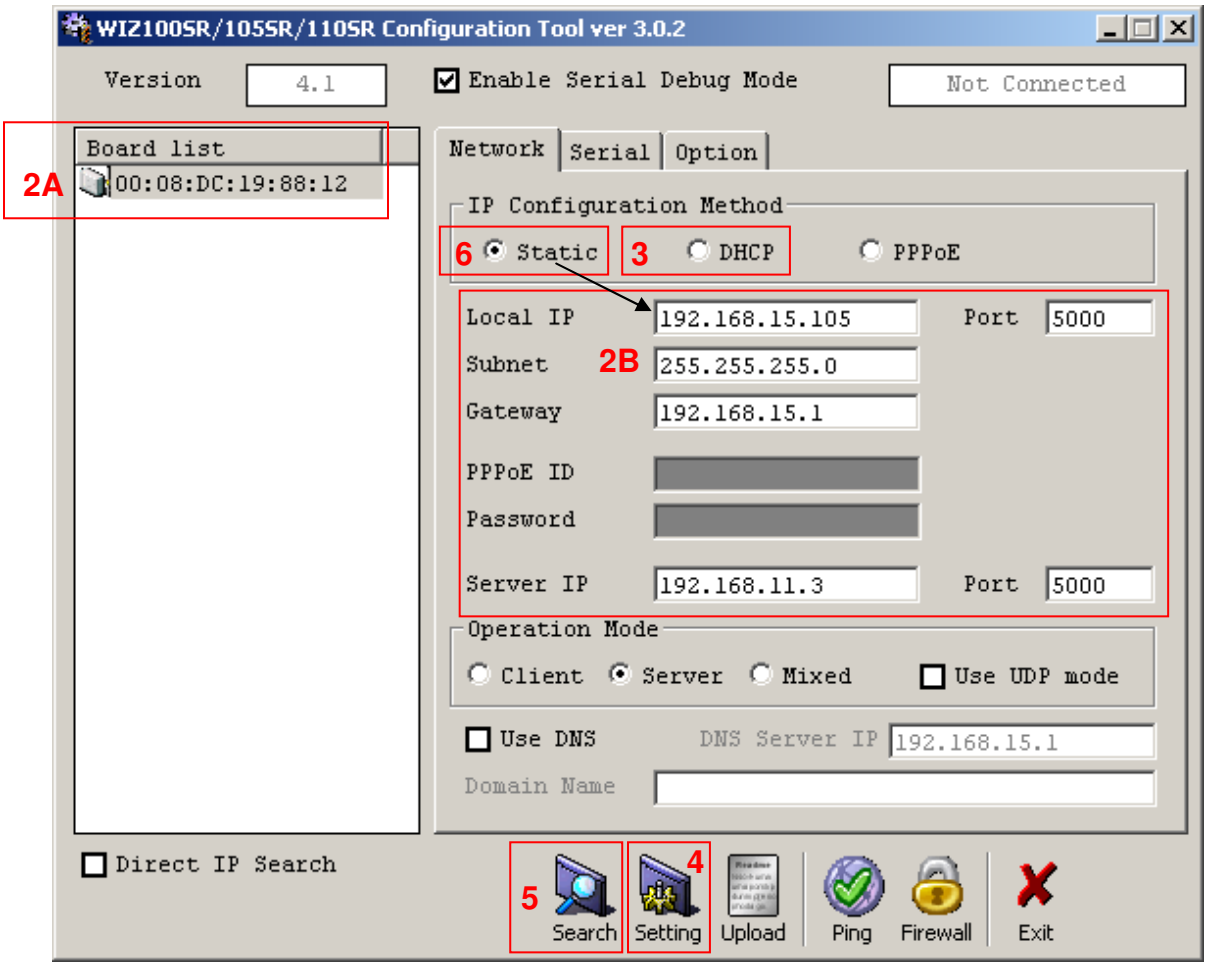
This window will appear:



1. Search for the WIZ110SR board. Click on the "**Search**" button.

Initial Set-Up Instructions for the WIZ110SR Board.

2. After the search is complete:
   A. The MAC address of the board will be listed in the board list to the left.
   B. The fields to the right will now contain network information.



3. To get an Local IP address assigned automatically, click on the "**DHCP**" option button.

4. Click on the "**Setting**" button, to send new set-up to WIZ110SR board.

5. Click on the "**Search**" button, to retrieve the new board set-up parameters.

6. To make sure that the Local IP address does not change, click on the "**Static**" option button and then repeat steps 4 and 5 above.

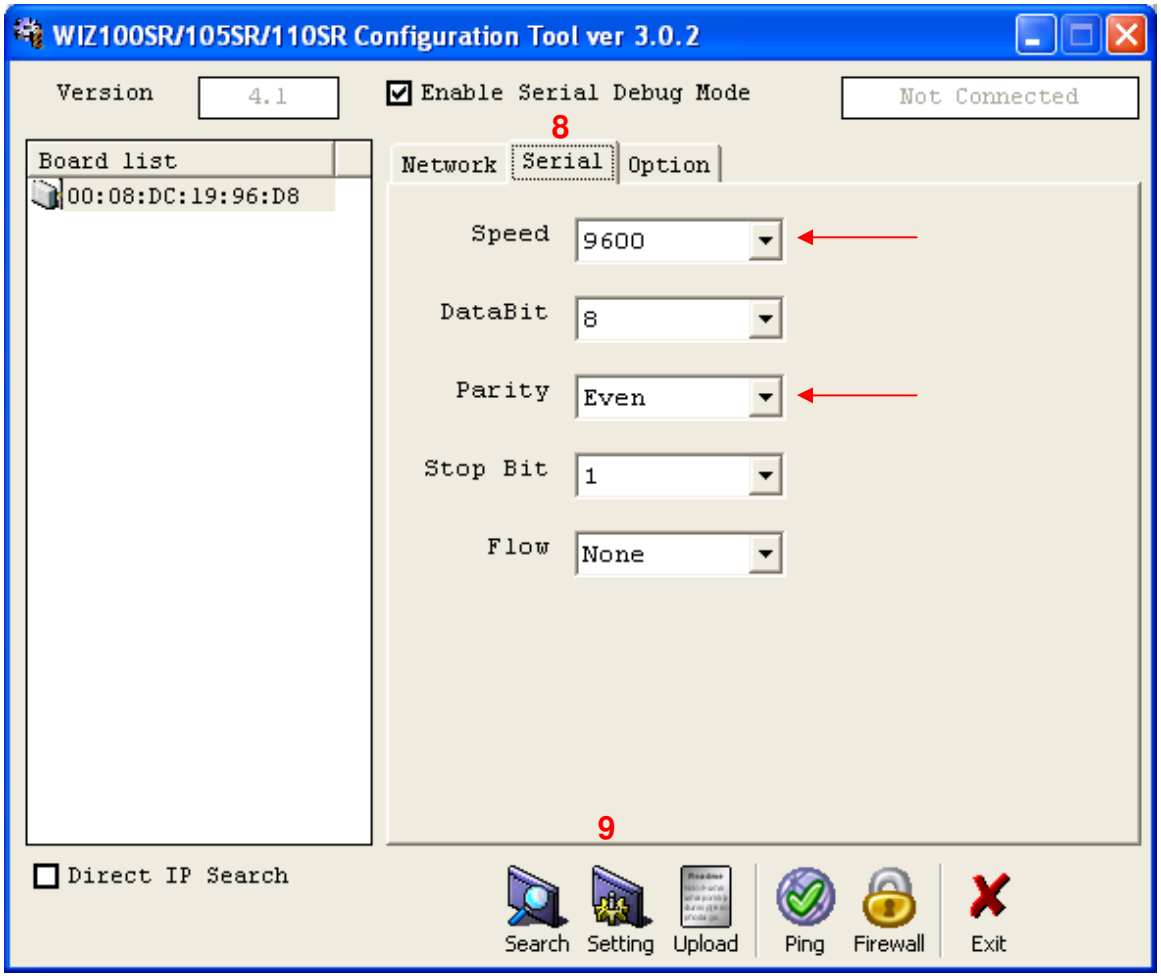
7. Enter IP address in the HEM software program under Set-Up tab.

Initial Set-Up Instructions for the WIZ110SR Board. (continued)

Set-Up Serial Interface:

8. Click on "**Serial**" Tab and make changes below:

Speed:	**9600** baud
Data Bits:	**8**
Parity:	**Even**
Stop Bit:	**1**
Flow:	**none**



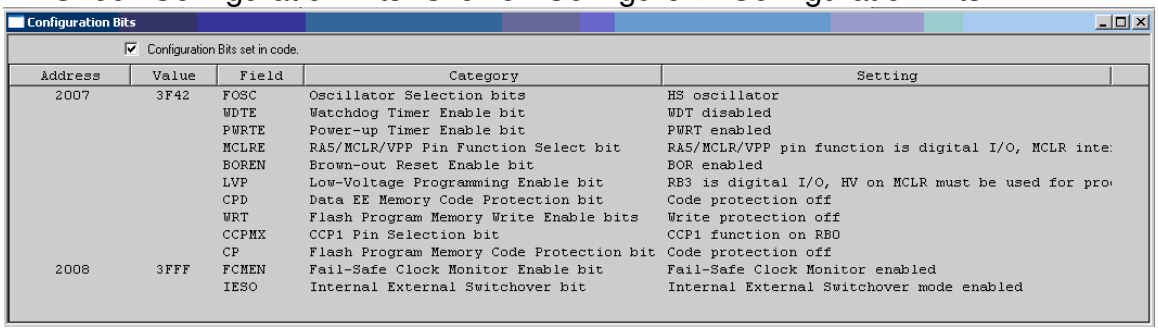
9. Click on the "**Setting**" button, to send new set-up to WIZ110SR board.

10. Board Set-Up Complete.

Programming PIC16F88 chip

Program PIC16F88 from Hex File Instructions:

1. Open MPLAB IDE v8.xx
2. Click on File -> New
3. Click on File -> Import... then select file: **EM.HEX**
4. Check Configuration Bits: Click on Configure -> Configuration Bits



Address	Value	Field	Category	Setting
2007	3F42	FOSC	Oscillator Selection bits	HS oscillator
		WDTE	Watchdog Timer Enable bit	WDT disabled
		PWRTE	Power-up Timer Enable bit	PWRT enabled
		MCLRE	RA5/MCLR/VPP Pin Function Select bit	RA5/MCLR/VPP pin function is digital I/O, MCLR inte:
		BOREN	Brown-out Reset Enable bit	BOR enabled
		LVP	Low-Voltage Programming Enable bit	RB3 is digital I/O, HV on MCLR must be used for pro:
		CPD	Data EE Memory Code Protection bit	Code protection off
		WRT	Flash Program Memory Write Enable bits	Write protection off
		CCPMX	CCP1 Pin Selection bit	CCP1 function on RB0
		CP	Flash Program Memory Code Protection bit	Code protection off
2008	3FFF	FCMEN	Fail-Safe Clock Monitor Enable bit	Fail-Safe Clock Monitor enabled
		IESO	Internal External Switchover bit	Internal External Switchover mode enabled

5. Put PIC16F88 chip into programmer.
6. Select Programmer.
7. Enable Programmer.
8. Select “Erase Flash Device”
9. Select “Program”
10. Remove PIC16F88 chip from Programmer.
11. **PIC16F88 chip is now programmed and ready to use.**
    Insert into HEM PCB.

Hardware Parts List

#	Component Name	Quantity	Jameco Part Number	Manufacturer Number
1	U3:Serial to Ethernet Gateway Module	1	2124322	WIZ110SR
2	U1:MCU 8-Bit PIC16F88	1	312733	PIC16F88-I/P
3	R1-R6:100 ohm Resistor	6	690620	CF1/4W101JRC
4	U2:RS-232 interface chip	1	106163	MAX233CPP
5	C1-C2:0.1uF Ceramic Disc Capacitor	2	151116	DC.1/25
6	C5-C7:10uF Ceramic Disc Capacitor	3	29891	R10/50
7	C3-C4:22pf 50 Volt Ceramic Disc Capacitor	2	15405	DC22
8	R9, R11-R14:10K ohm Resistor	5	691104	CF1/4W103JRC
9	R7-R8:470K ohm Resistor	2	691500	CF1/4W474JRC
10	R10:100K ohm Resistor	1	691340	CF1/4W104JRC
11	LED3:LED Uni-Color Red 635nm 2-Pin T-1	1	2006713	LTL-16KE
12	LED2,LED4-LED6:Uni-Color Green	4	697629	LTL-4231
13	X1:20MHz Crystal	1	325068	TQR49S20M0000A2010-R
14	PS1/2:5vdc Power Supply	1	1940740	GS12U05-P1I
15	PS3:12VAC power Supply	1	101258	ACU120050F4031
16	CT1,CT2: 0- 200 AMP CT	2		SCT-19-000
17	2 pin cable/connector for CT/VAC	3		CON-242
18	PS2: PCB Plug	1	101179	GCD014-R
19	R15, R16: 47 OHM,1/4 WATT,5%	2	690540	CF1/4W470JRC
20	CONNECTOR DSUB, RIGHT ANGLE, DB-9F	1	104978	1011-92-R
21	LED1:Uni-Color Yellow	1	697688	LTL-4251N
22	2.1MM COAX PLUG Y-ADAPTER, FEM - 2 MALE	1		CB-207
23	Socket IC 18 Pin	1	65585	6100-18-R
24	Socket IC 20 Pin	1	38623	6100-20

Item 16:
http://www.elecfreaks.com/store/noninvasive-ac-current-sensor-sct019-200a-max-p-89.html

Item 17:
http://www.allelectronics.com/make-a-store/item/CON-242/2-PIN-CONNECTOR-W/HEADER-.10/1.html

Item 22:
http://www.allelectronics.com/make-a-store/item/CB-207/2.1MM-COAX-PLUG-Y-ADAPTER-FEM-2-MALE/1.html