

Google PowerMeter Application Note using EVB-PIC24

version 1.0

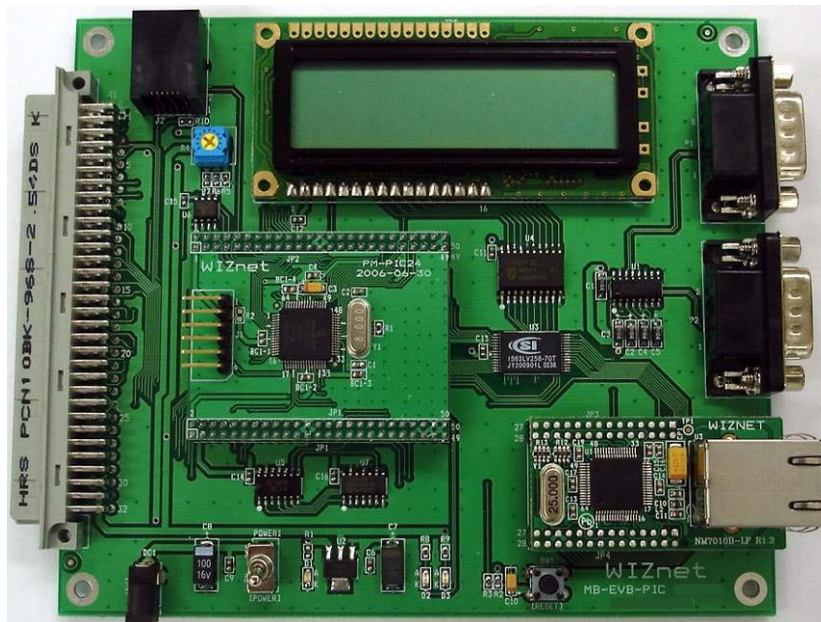


Table of Contents

1	Instruction.....	3
2	PowerMeter.....	3
3	How to implement PowerMeter??.....	5
4	PowerMeter Demonstration.....	6
4.1	How to upload firmware to PIC24-EVB	6
4.2	How to connect Google server??.....	7

1 Instruction

This application note is designed to help user to understand Google PowerMeter service and to implement this state-of-the-art application. We will use WIZnet's EVB-PIC24 board, Microchip TCPIP stack v5.2, AES encryption/decryption library from Microchip and WIZnet's H/W TCPIP stack for implementing PowerMeter. Basically the EVB-PIC24 contains NM7010B+ network module but you can use the latest network module WIZ810MJ instead of NM7010B+.

Microchip PIC24 MCU development tools and the according software are employed for PowerMeter implementation. In this application note, we will carry out PowerMeter application by means of using MPLAB IDE software, compiler and MPLAB ICD2 hardware tool. For more detail information about development environment for PIC24, please refer to the Microchip homepage www.microchip.com.

This document will not discuss about codes for implementing PowerMeter. Please refer to C code comments for details on codes for implementing PowerMeter.

2 PowerMeter

The PowerMeter service was introduced by Google in 2009. Google revealed its development information of PowerMeter to developers and started the service. The PowerMeter service can be used by anyone around the world if the user has a Google account and the equipment that can support PowerMeter service. The PowerMeter service shows the user's electricity usage and provides some analysis data that predicts the approximate electricity bill. The PowerMeter service is still being updated, so check the Google PowerMeter support webpage www.google.com/support/powermeter/ for more detailed information.



Fig. 1 EVB-PIC24 operation for PowerMeter

EVB-PIC24 can support Powermeter by using its internal firmware only. The user can control the EVB-PIC24 through its embedded HTTP server. Fig. 1 below shows the operation of PowerMeter.

The amount of electricity usage is entered through the RS232 serial port into the EVB-PIC24. The entered amount of electricity usage is changed into the data form that is provided from Google PowerMeter API, and is sent to the PowerMeter server. The EVB-PIC24 and Google server are securely connected using SSL (secure socket layer) protocol so other peoples cannot access the user's amount of electricity usage.

The user can also check his/her amount of electricity usage through the PowerMeter gadget from iGoogle webpage. The network setting of EVB-PIC24 or turning on/off setting of PowerMeter can be done by connecting to its HTTP server webpage, which is embedded in EVB-PIC24.

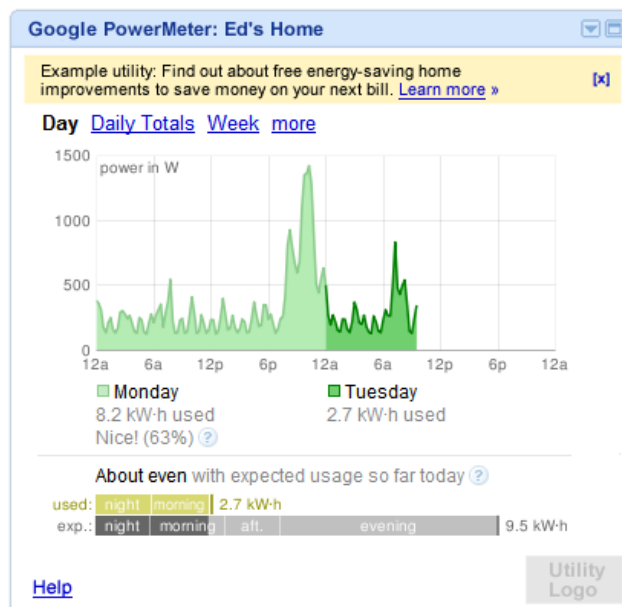


Fig. 2 PowerMeter gadget

3 How to implement PowerMeter??

As explained earlier, the operation of EVB-PIC24 is simply collecting the electricity usage and sending it to the Google PowerMeter server.

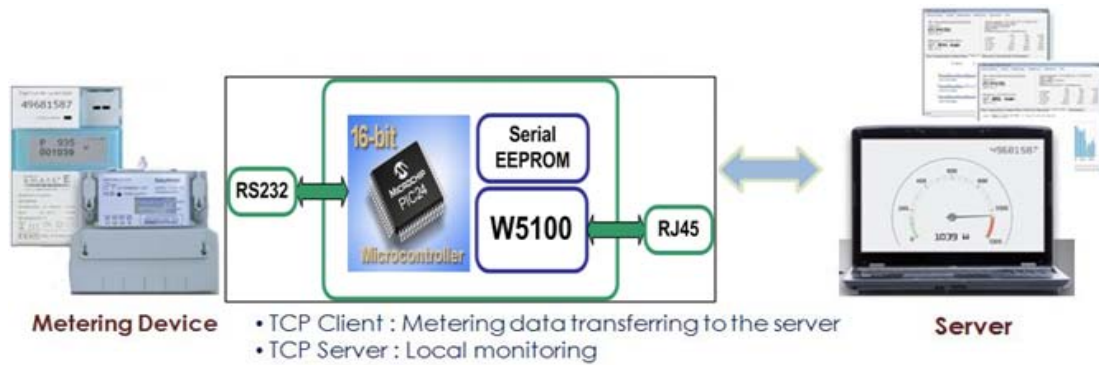


Fig. 3 Simplified PowerMeter working

For the operation of EVB-PIC24 to work the RS232 serial interface, Ethernet interface, TCP/IP protocol and following composition elements are required.

- HTTP server: Embedded HTTP server for WIZmeter's network setting and controlling PowerMeter's enable/disable.
- SSL: Protocol for secured communication with Google server.
- DNS: Protocol for finding IP of Google server, NTP (network time protocol) server.
- SNTP: Abbreviation of Simple Network Time Protocol. Protocol for finding out the standard time of using PowerMeter usage.
- PowerMeter: Collecting all protocols and implementing PowerMeter.

Now, the process of PowerMeter using the above elements will be explained.

- Step 1. Collect the user's amount of electricity usage from the RS232 port.
- Step 2. Updating and checking the time using SNTP protocol and DNS protocol. Finally after 10 minutes, sums all electricity usage data during 10 minutes and make it to Google API data format. Generally the PowerMeter send the usage data every 10 minutes. The minimum transmitting interval is 10 minutes but user can change it to longer than 10 minutes.
- Step 3. Find out the IP address of Google server using DNS protocol and send the amount of electricity usage to Google server using SSL protocol, TCP protocol, and HTTP protocol.

The process above is done every 10 minutes, and the data are displayed on iGoolge's homepage / PowerMeter gadget.

4 PowerMeter Demonstration

4.1 How to upload firmware to PIC24-EVB

As mentioned in the Introduction section, we use the MPLAB IDE development tool from Microchip inc. MPLAB can be downloaded from Microchip's homepage www.microchip.com. The attached Google PowerMeter code can be compiled only if "microchip TCPIP stack" and data encryption library "sw300052" are also downloaded and installed. The data encryption library "sw300052" is not free, so keep this in mind when downloading.

-MPLAB IDE: free

charge www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469#P171_5058

-Microchip TCPIP stack URL: free charge

www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2680&dDocName=en547784

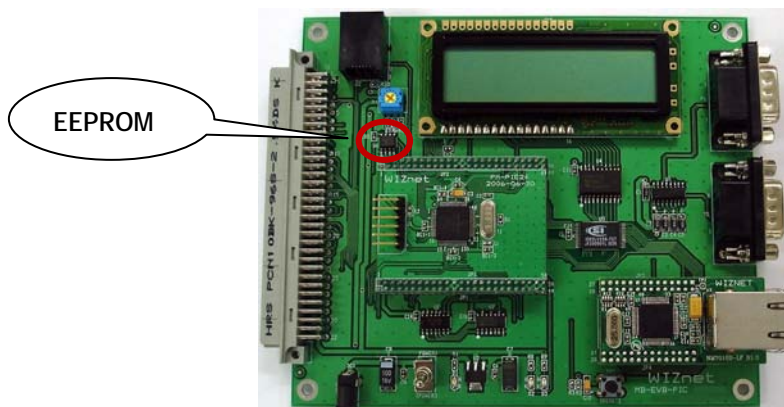
-sw300052 URL: \$5 charge for downloading

www.microchipdirect.com/productsearch.aspx?Keywords=sw300052

If all above software development tools are successfully installed, run MPLAB IDE and open Google PowerMeter project. If the compiler settings and development tools are successfully installed, compiling can be done.

Note: The EVB-PIC24 has two version, the first one has 24LC02 EEPROM and the second one has 24LC256 EEPROM. User must check the EEPROM because each EEPROM has different RD/WR protocol.

If you check what EEPROM did you have, user must check the file TCPIPConfig.h of the project. On the line 126, **define the EEPROM type what you have**. The EEPROM is used for saving network settings and PowerMeter settings.



Once compiling is done, upload PowerMeter firmware by using MPLAB ICD2 or other compatible equipment.

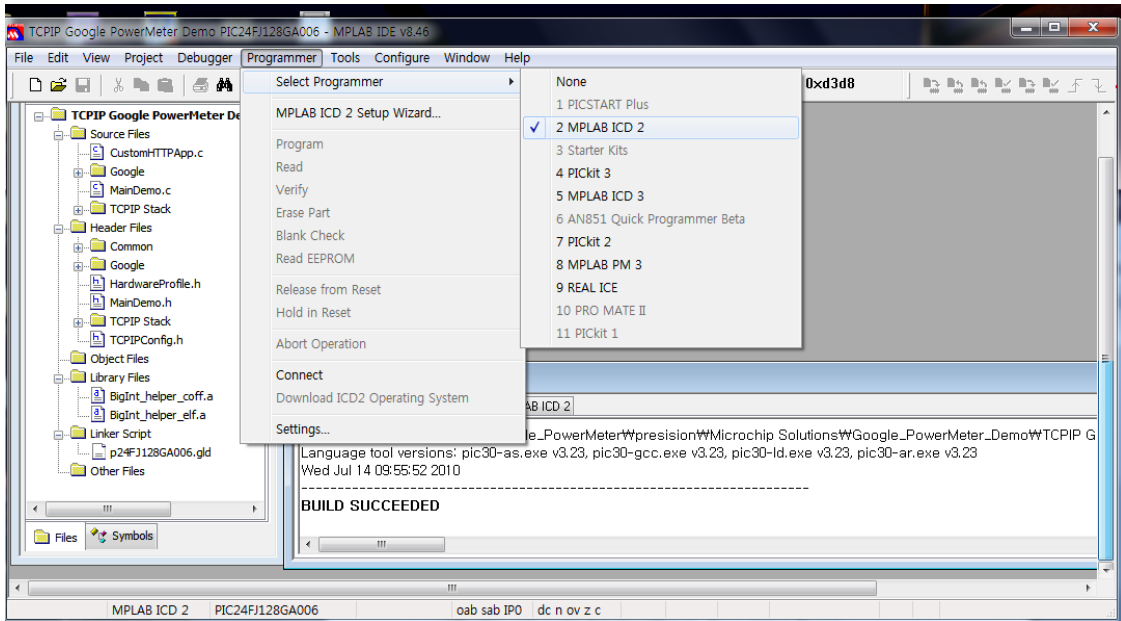


Fig. 4 MPLAB software

Please refer to microchip's homepage for MPLAB software manual and MPLAB ICD2 equipment manual.

4.2 How to connect Google server??

If firmware is successfully uploaded, board can be found by using the provided board searching tool "wizDiscover" tool. Connect the LAN cable to the EVB-PIC24 board and run the wizDiscover tool. Click the Discover 'WizMeter' button and find the board. If the board appears on the list, click the list or run the web browser to connect to the IP address of the board. The uploaded firmware has embedded HTTP server function; therefore web page can be checked as shown in Fig. 6.

User can find the IP address also on the character LCD of the board.

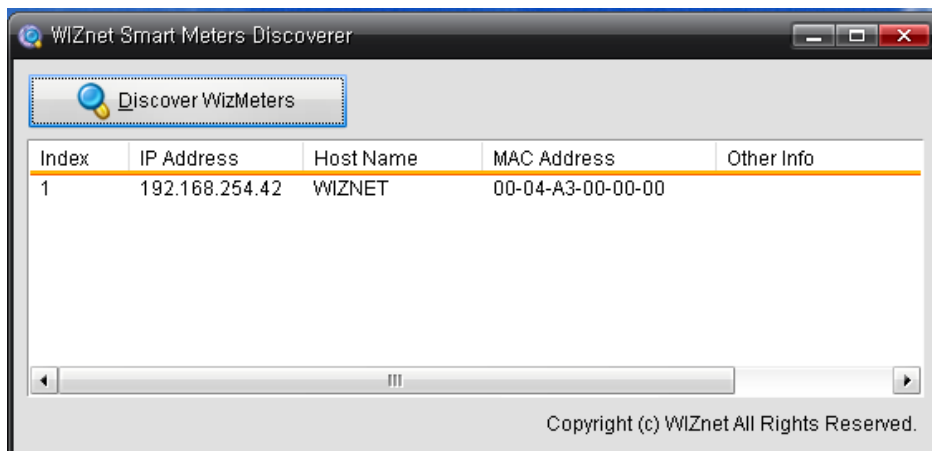


Fig. 5 wizDiscover tool

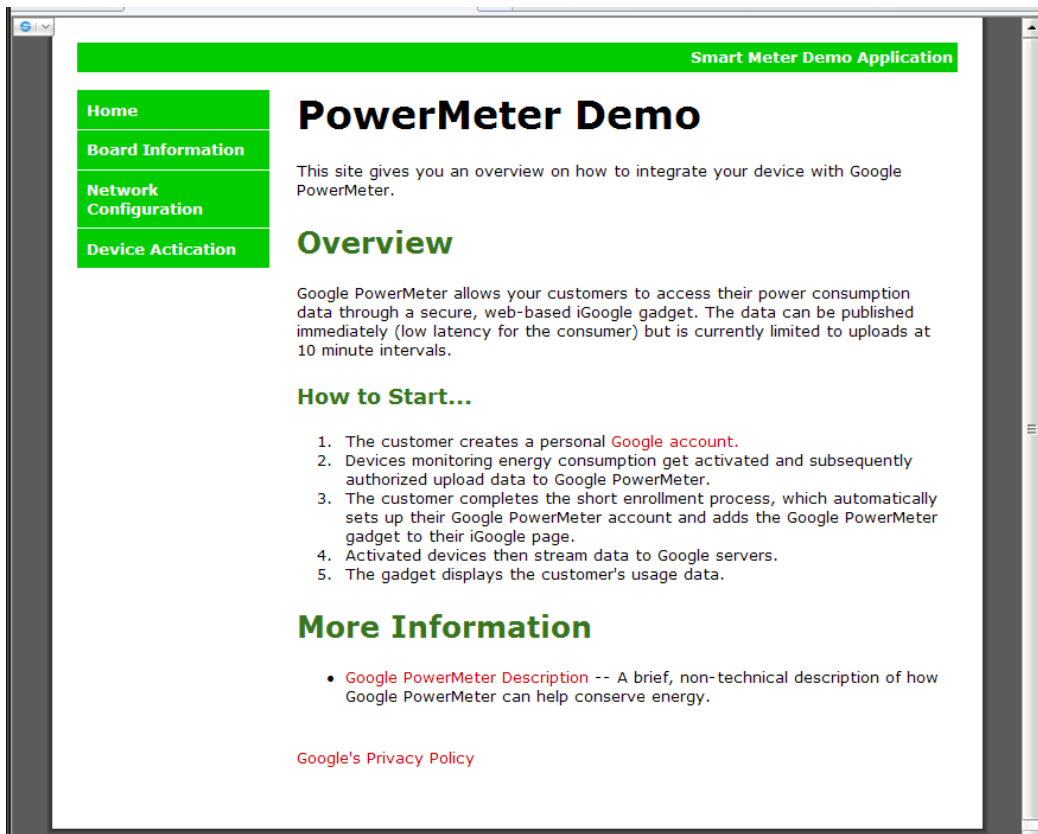


Fig. 6 EVB-PIC24 HTTP server webpage

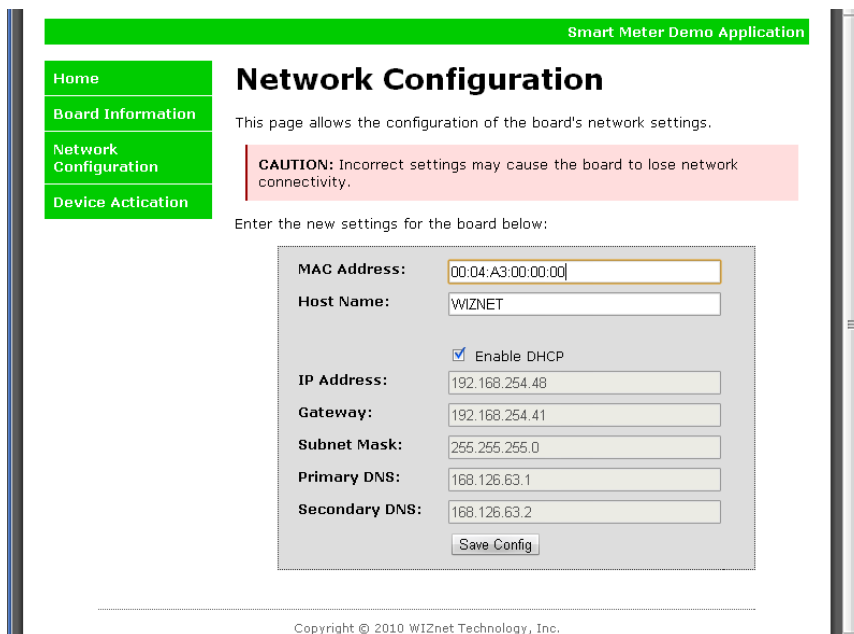


Fig. 7 EVB-PIC24 HTTP server network setting page

As in Fig. 7, click the network configuration menu from the Web page's left menu, and modify the values of the board's network setting and MAC address in order to communicate with the Google server. If the network setting information is not assigned by the DHCP server,

do not select "Enable DHCP" and manually enter the network setting values yourself. Since the network settings could be changed depending on the user's network environment, if you don't exactly know your network settings you should ask to network manager to get correct network settings. Especially the MAC address default value "00:08:DC:00:00:00" is just for test assigned by WIZnet so if you want use PowerMeter service well, you should change the MAC address to a unique value because network don't allow same MAC address. For more detail information about MAC address allocation, please refer to the iee homepage <http://standards.ieee.org/regauth/oui/forms/>.

After all set the network settings, then click Device Activation menu.

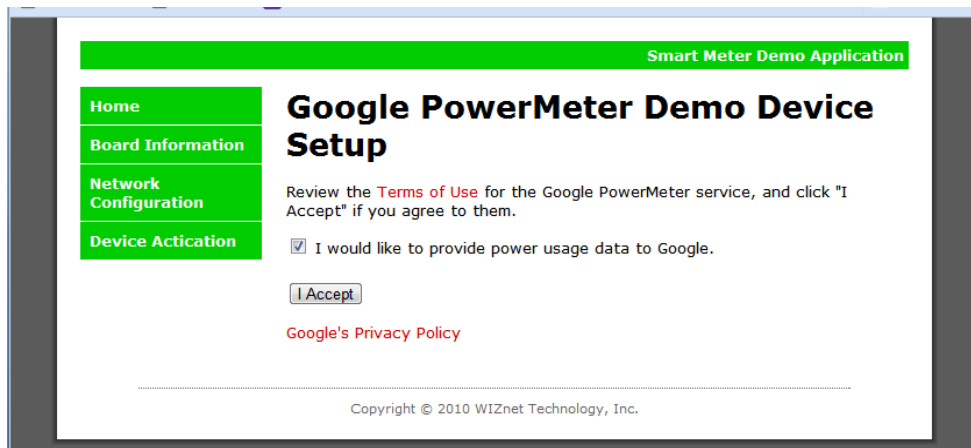
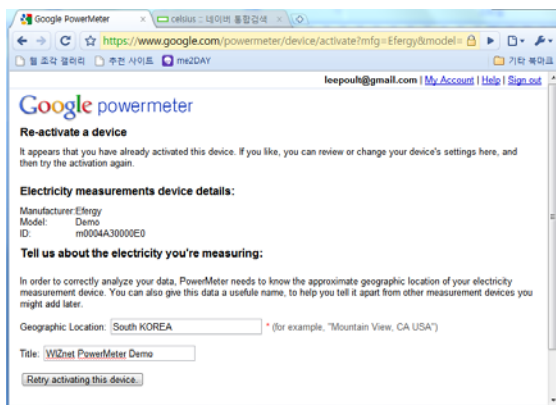


Fig. 8 EVB-PIC24 Activation menu

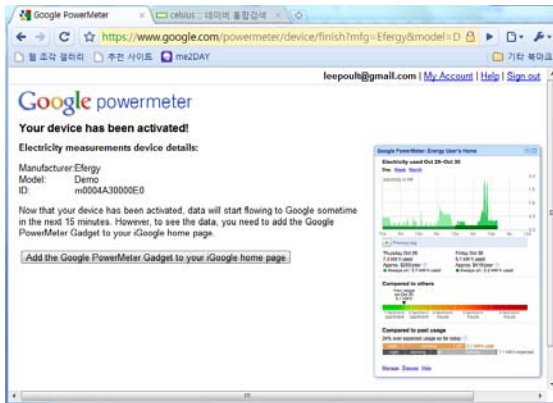
Click "I Accept" button to activate PowerMeter function. User must have a Google account in order to activate PowerMeter. After clicking the button, enter other requirements from the Google page.



Step 1. Login to Google



Step 2. Input user information



Step 3. Add PowerMeter gadget



Step 4. View usage data on gadget

After entering all the requirements add the PowerMeter gadget to the user's iGoogle page; and then the information of electricity usage will show as Step 4. The update period of the data is 10 minutes. The electricity usage data can be downloaded in Microsoft Excel sheet format from the setting menu, and PowerMeter can be enabled/disabled from the setting menu also. Refer to Google's homepage www.google.com/support/powermeter/ for more details on PowerMeter functions. The example code basically shows the usage information of two sensors. One sensor shows the usage that periodically changes from 0 to 360W. The other sensor shows a random value (variable range: 0 ~ 3); the value is added every two seconds and it is displayed on the character LCD.

Document History Information

Version	Date	Descriptions
ver. 1.0	Nov. 2010	Release

Copyright Notice

Copyright 2010 WIZnet, Inc. All Rights Reserved.

Technical Support: support@wiznet.co.kr

Sales & Distribution: sales@wiznet.co.kr

For more information, visit our website at <http://www.wiznet.co.kr>