

EM773

EM773 SDK 2.0 Getting Started Guide

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Document information

Info	Content
Keywords	EM773, Cortex M0, LPC1343, Cortex M3, OL2381, RF, M-Bus, USB, Smart Metering, Secondary Metering, Plug Meter
Abstract	The purpose of this document is to assist new customers of the EM773 to understand what is included in the SDK and how to run the GUI demonstration application.



Revision history

Rev	Date	Description
01	20110125	EM773 SDK 1.2 Getting Started Guide Created
02	20120103	Updated for SDK 2.0 release

Contact information

For additional information, please visit: <http://www.nxp.com/smartmetering>

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1. Introduction

As the world strives to reduce its energy dependence, smart meters alone are not enough to give us the information we need to change our habits. Electricity measurements need to be available everywhere and in everything. With the EM773, NXP is the first to integrate flash based ARM Cortex M0 MCUs with metrology functionality into a single IC with focus on emerging energy monitoring markets outside of traditional billing meters. Developers can now integrate metrology into any type of product without significant software development and metrology knowledge required.

Included with the EM773 is an SDK (software development kit) designed for the purpose of enabling developers with access to the metrology capabilities of the EM773 with an easy to use API and software examples. The SDK also includes open source wireless M-Bus example code for using the OL2381 as a wireless M-Bus transceiver. The goal of this document is to help users get started.

2. Required tools for the EM773 SDK

2.1 Required Hardware

- PC running Windows XP or 7 (Windows Vista may also work, but not supported)
- EM773 Plug Meter Development Kit
 - OM13005: US Plug Version
 - OM13006: EU Plug Version



Fig 1. EM773 Plug Meter (OM13006 on left, OM13005 on right)



Fig 2. LPC1343 USB Dongle (Ships with both OM13005 and OM13006 kits)

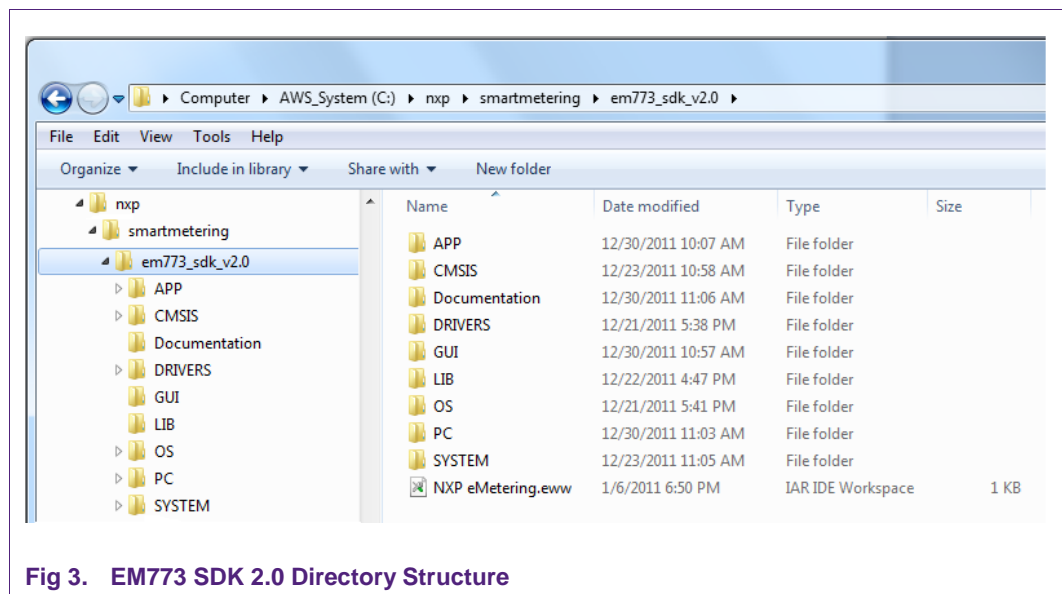
2.2 Required Software

- Microsoft .NET Framework 4
- EM773 SDK 2.0
- IAR Embedded Workbench for ARM v6.20 or newer *
- LPCXpresso v4.1 or newer *
- Microsoft Visual Studio C# Express 2010 *

* Tools needed only for development. To run the demonstration application, only Microsoft .NET Framework 4 and the EM773 SDK 2.0 are required.

3. What is included in the SDK?

3.1 EM773 SDK 2.0 Directory Structure



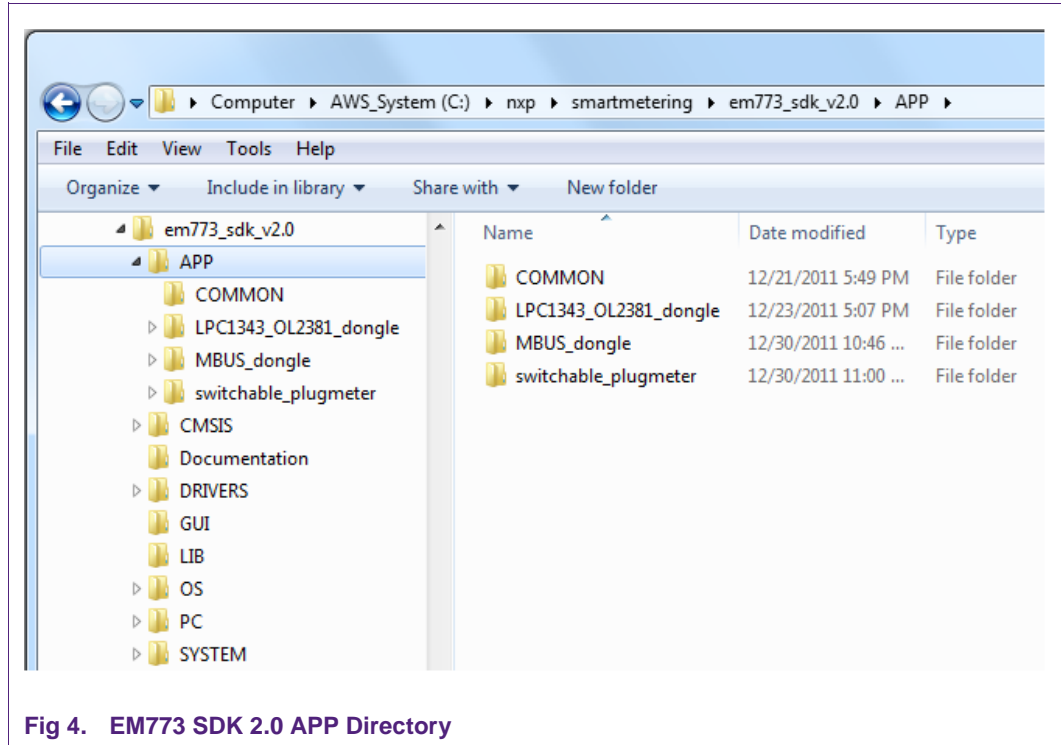
3.2 EM773 SDK Applications

Inside the “APP” directory, there is the source code for the IAR EWARM and LPCXpresso application projects for the EM773 based plug meter, and the following two IAR EWARM firmware projects for the LPC1343 based USB dongle:

- LPC1343_OL2381_dongle (legacy since SDK1.0)
- MBUS_dongle (new in SDK2.0)

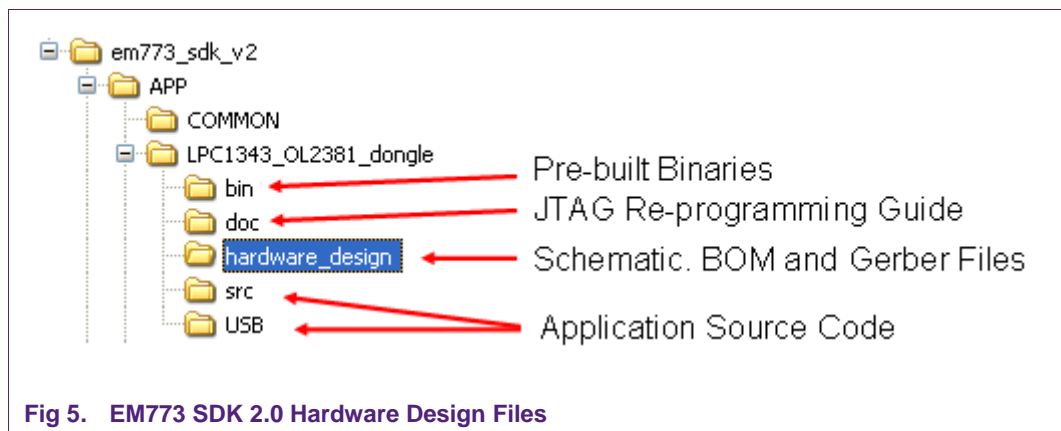
The PlugMeterControl GUI v2.0.0.0 works together with both firmware versions. The firmware from the MBUS_dongle project is more generic and more flexible than that of the LPC1343_OL2381_dongle project. The MBUS_dongle firmware can be used to receive and transmit (almost) any MBUS messages, since the payload data of the MBUS message must be passed by the PC application to the dongle.

The MBUS_dongle firmware will add the MBUS header and the needed CRCs over the payload data. So the MBUS_dongle firmware can be used to control the NXP plugmeter and also other MBUS hardware (e.g. the valve in a MBUS gas meter).



3.3 Plug Meter / USB Dongle Hardware Documentation

Hardware documentation is also included in the “APP” directory. There is a “hardware design” sub-directory for each application containing the schematic, gerber and BOM files for both the plug meter and the USB dongle. The other sub-directories for each application are described below.



3.4 EM773 SDK CMSIS and Peripheral Drivers

For both the EM773 ARM Cortex M0 and LPC1343 ARM Cortex M3, the SDK includes CMSIS peripheral drivers and system memory map configuration files that are used by the example applications and available for additional application development.

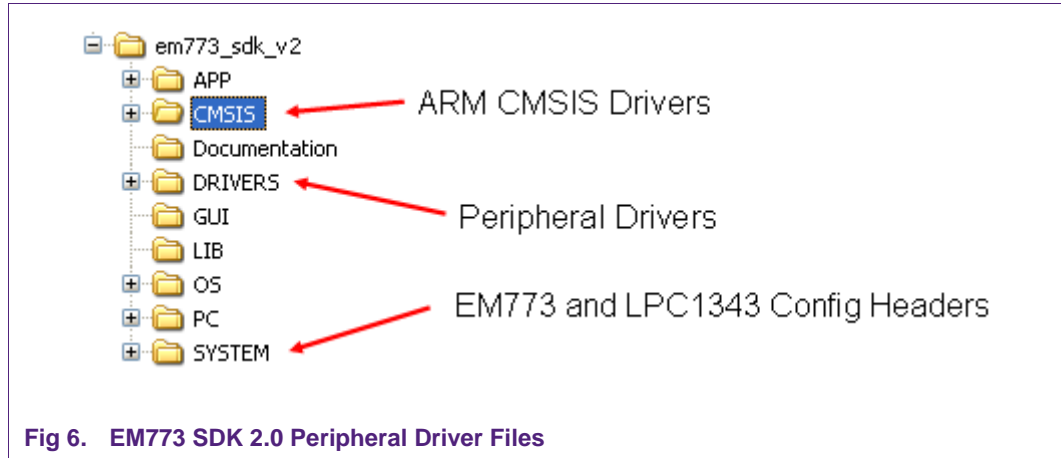


Fig 6. EM773 SDK 2.0 Peripheral Driver Files

3.5 EM773 Silicon Documentation

EM773 hardware documentation including this SDK Getting Started Guide can be found within the “Documentation” directory.

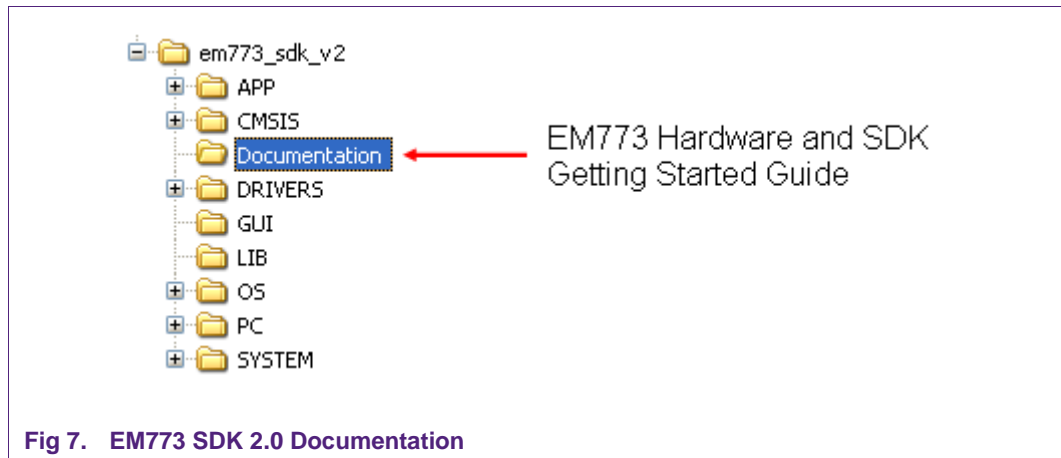


Fig 7. EM773 SDK 2.0 Documentation

3.6 EM773 SDK Remaining Directories

The remaining directories contain the PC demo, the metrology engine driver library, the FreeRTOS source code for both the EM773 and LPC1343, and the source code for the PC demo GUI developed with Microsoft Visual Studio C# Express 2010 and Microsoft .NET Framework 4.

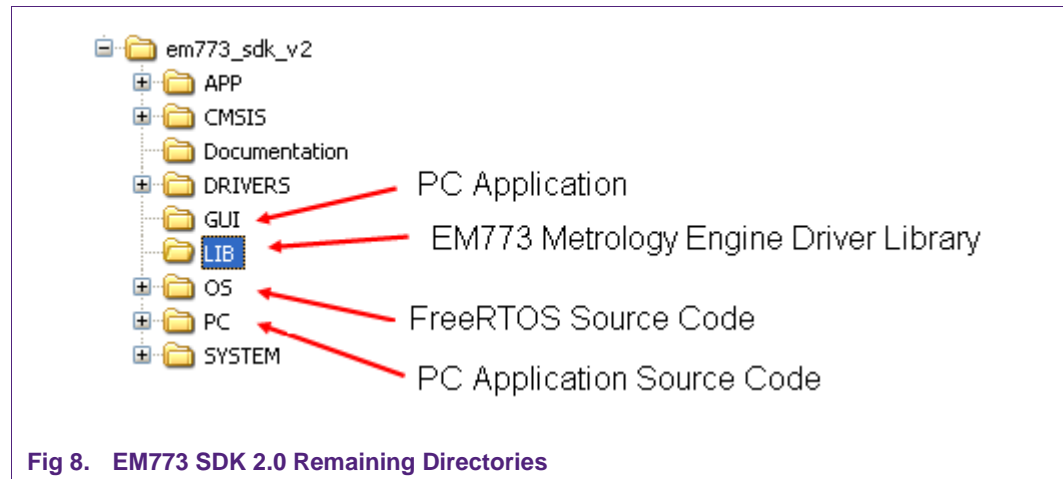


Fig 8. EM773 SDK 2.0 Remaining Directories

4. Running the EM773 SDK Demonstration

4.1 Microsoft .NET Framework 4

The EM773 SDK 2.0 demonstration requires a PC running Microsoft Windows XP or Windows 7 and an installation of Microsoft .NET Framework 4. As a first step for running the demo, download Microsoft .NET Framework 4 from the link below, if it is not already installed on the demonstration PC.

[1] Microsoft .NET Framework 4 Client Profile:

<http://www.microsoft.com/downloads/en/details.aspx?FamilyID=5765d7a8-7722-4888-a970-ac39b33fd8ab&displaylang=en>

4.2 EM773 SDK 2.0

Download and install the EM773 SDK 2.0 from the EM773 product page link below. When installing the SDK, the default install directory will be "C:\npx\SmartMetering\em773_sdk_v2.0". This directory can be changed to any directory on the PC. All install files will go into this directory including the registration of the SDK with the Windows registry.

[2] EM773 Product Page:

<http://ics.nxp.com/support/design/microcontrollers/smart.metering/>

4.3 LPC1343 USB Dongle

Only after the EM773 SDK 2.0 is installed, connect the USB dongle that is included with the development kit to a USB port of the PC. There will be a prompt for a new driver installation. The driver file is called "LPC1343_OL2381_dongle_vcom.inf" (the MBUS_dongle firmware uses the same driver) and is located in the "GUI" sub-directory of the SDK installation. Please follow the steps shown in the images below when installing the USB driver.

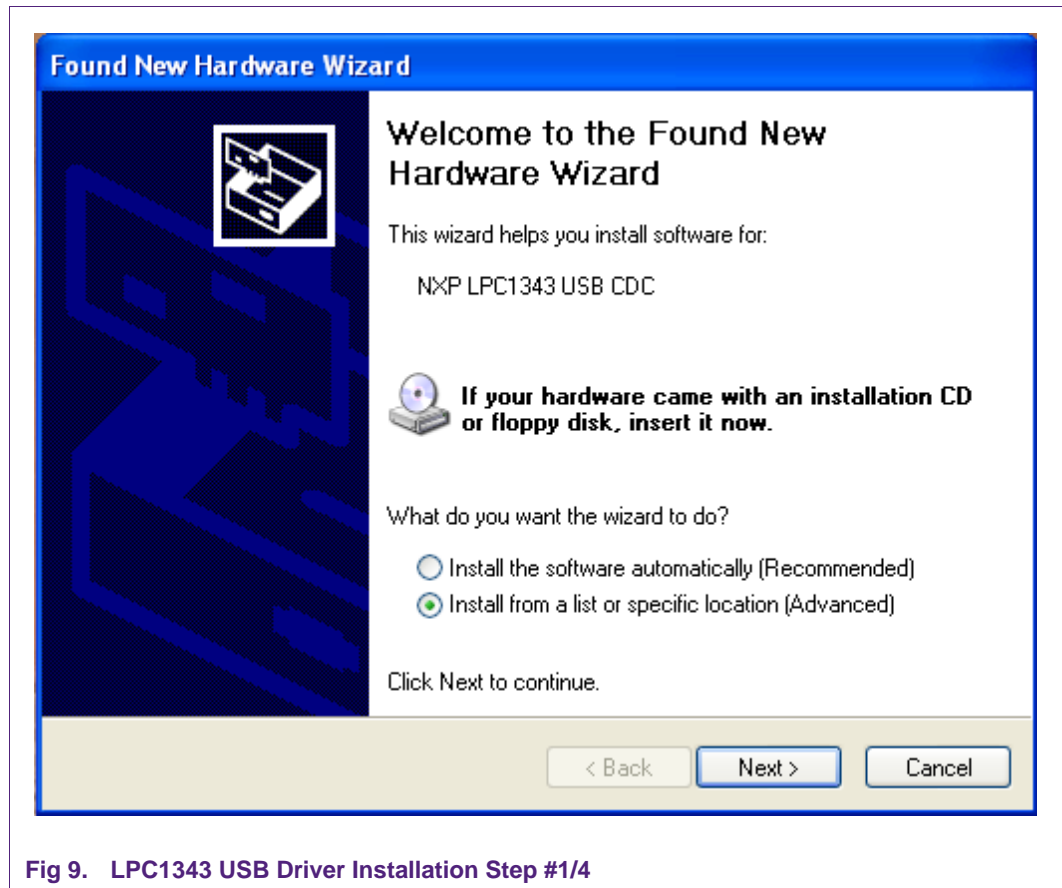


Fig 9. LPC1343 USB Driver Installation Step #1/4

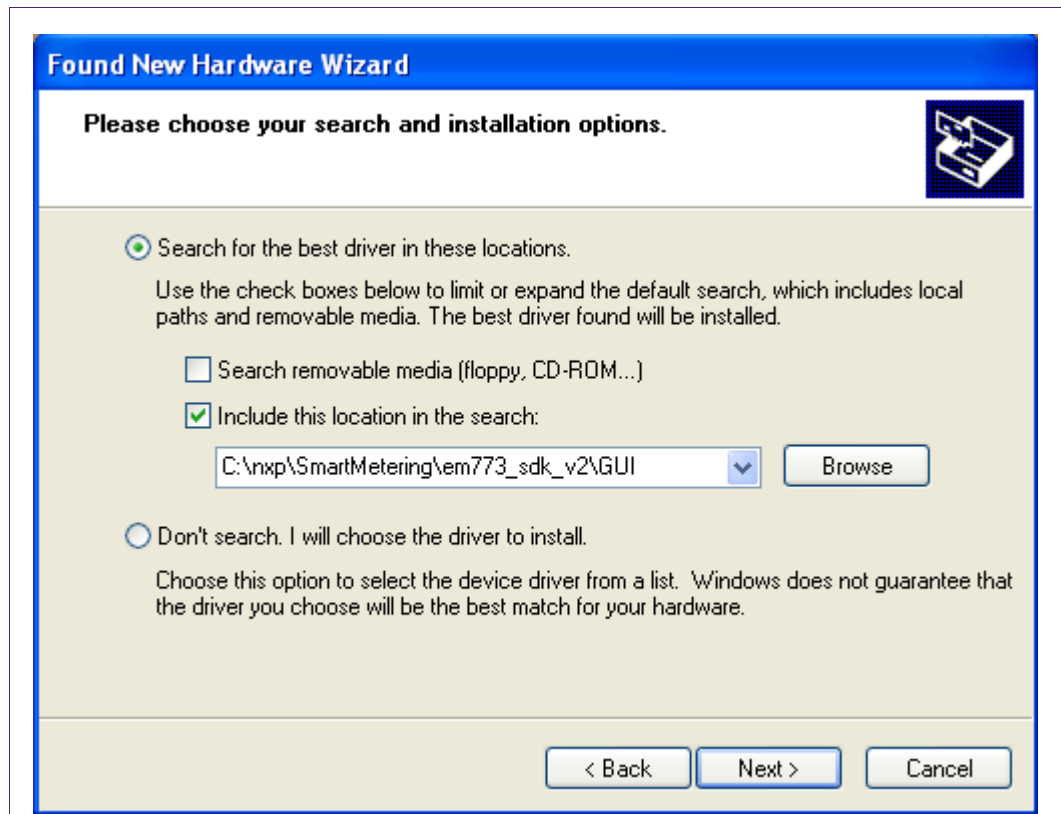


Fig 10. LPC1343 USB Driver Installation Step #2/4

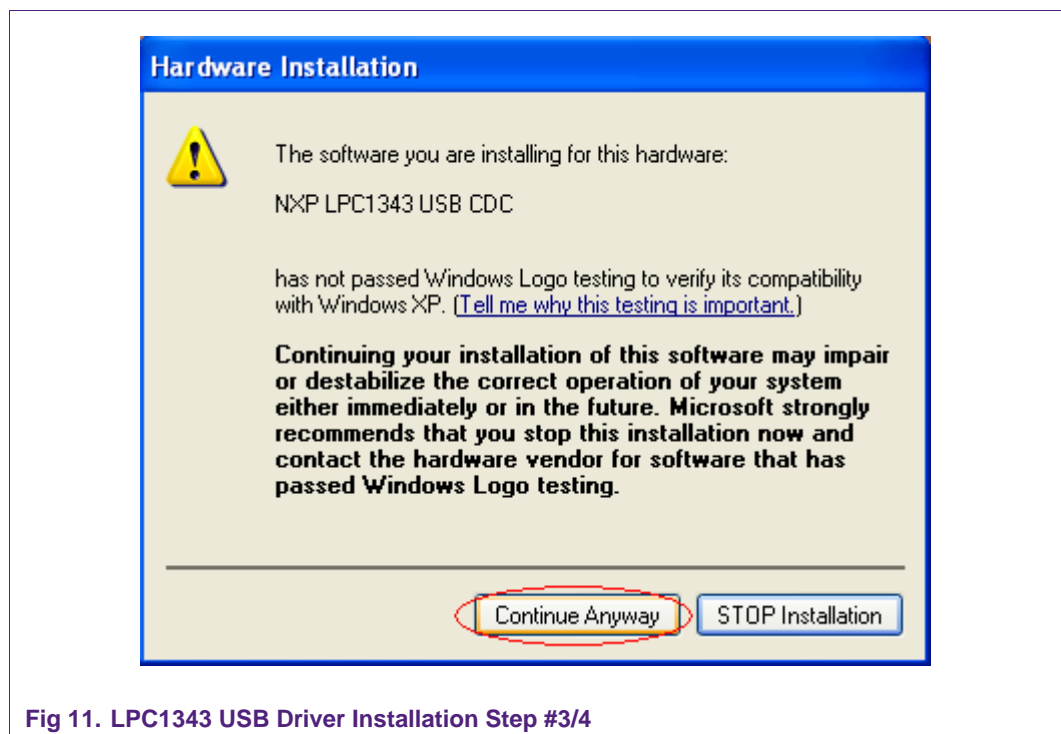


Fig 11. LPC1343 USB Driver Installation Step #3/4

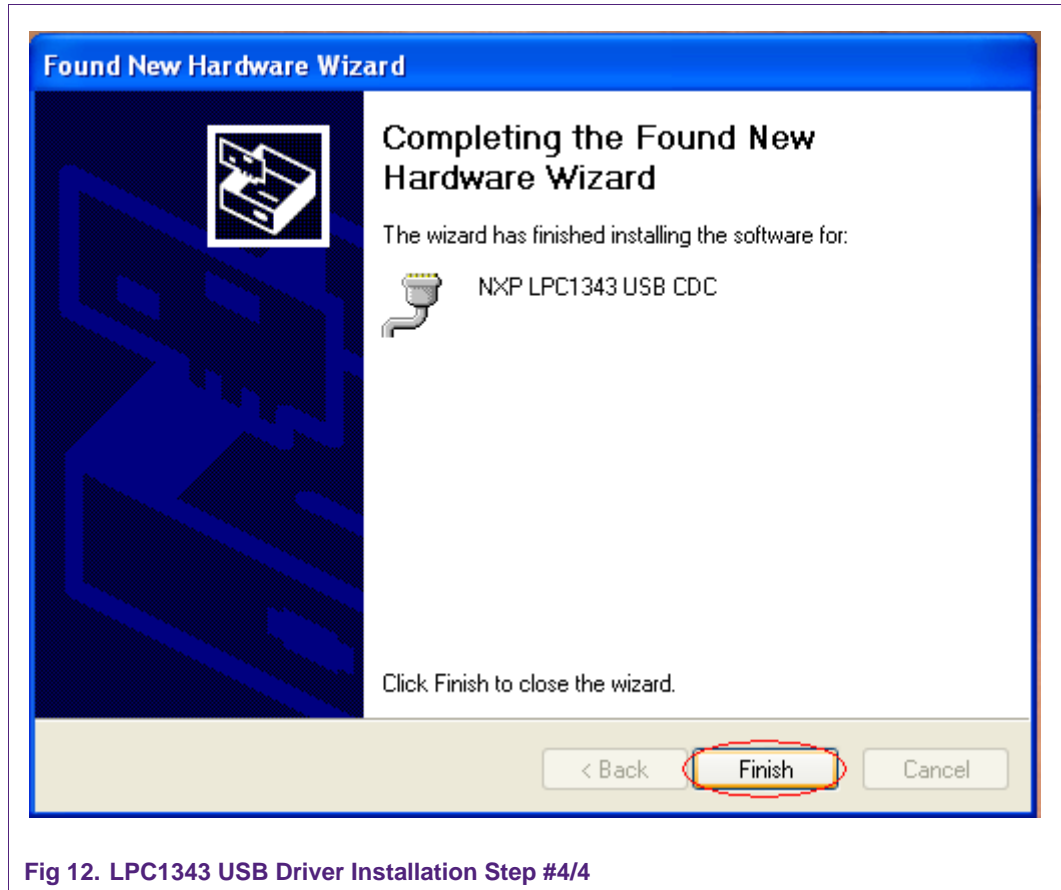


Fig 12. LPC1343 USB Driver Installation Step #4/4

4.4 LPC1343 USB Virtual COM Port

This driver will install the LPC1343 based USB dongle as a virtual COM port on the host PC (same for both USB dongle firmware projects). As this dongle receives wireless M-Bus consumption data from the EM773 based plug meter, it will send this data to the host PC demo application via this virtual COM port.

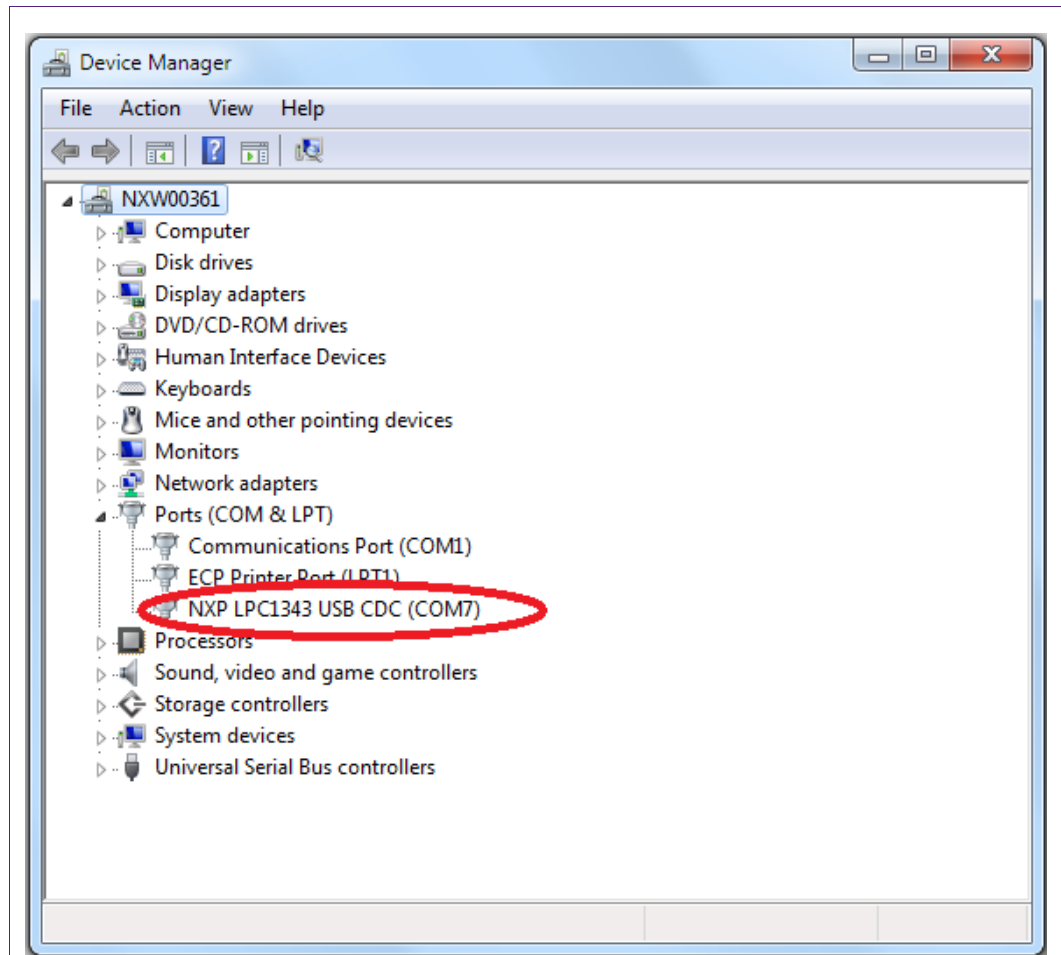


Fig 13. LPC1343 USB Virtual COM Port Driver

4.5 Plug Meter Control Application

Run the EM773 “PlugMeterControl.exe” demo application located in the same “GUI” directory of the SDK.

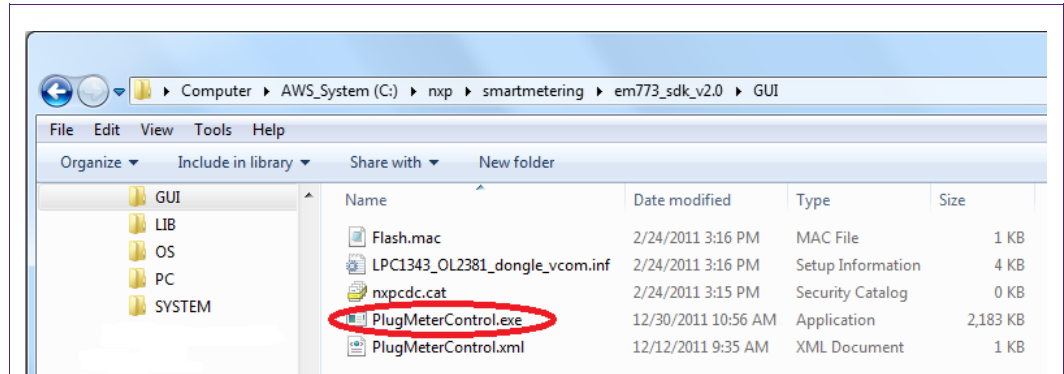


Fig 14. EM773 SDK 2.0 PlugMeterControl Application

4.6 LPC1343 USB Dongle Connect Status

In the bottom left of the GUI, there is an indicator showing connection to the USB dongle. For now, it should indicate “Port: closed” showing that the demo application is not yet connected to the USB dongle.



Fig 15. EM773 SDK 2.0 PlugMeterControl Application Main Window

4.7 Plug Meter Control Version Information

Verify that the GUI version is correct for SDK 2.0 by running the “Help” -> “About” option from the GUI menu at the top.

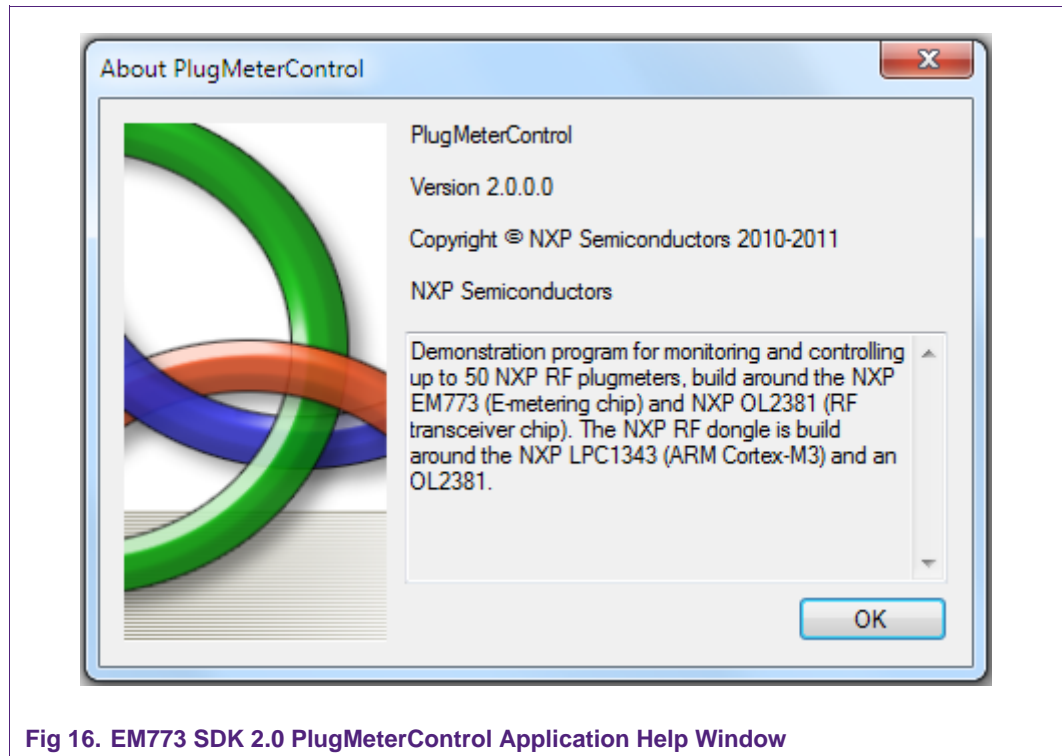


Fig 16. EM773 SDK 2.0 PlugMeterControl Application Help Window

4.8 Connect LPC1343 USB Dongle

To connect the LPC1343 USB dongle to the PC demo GUI application, select “Setup” -> “Open com port...” from the menu as shown below.



Fig 17. EM773 SDK 2.0 PlugMeterControl Application COM Port Setup #1/2

4.9 Select LPC1343 Virtual COM Port

In the “Open communication port” dialog select the port with the name corresponding to the “NXP LPC1343 USB CDC” virtual COM port.

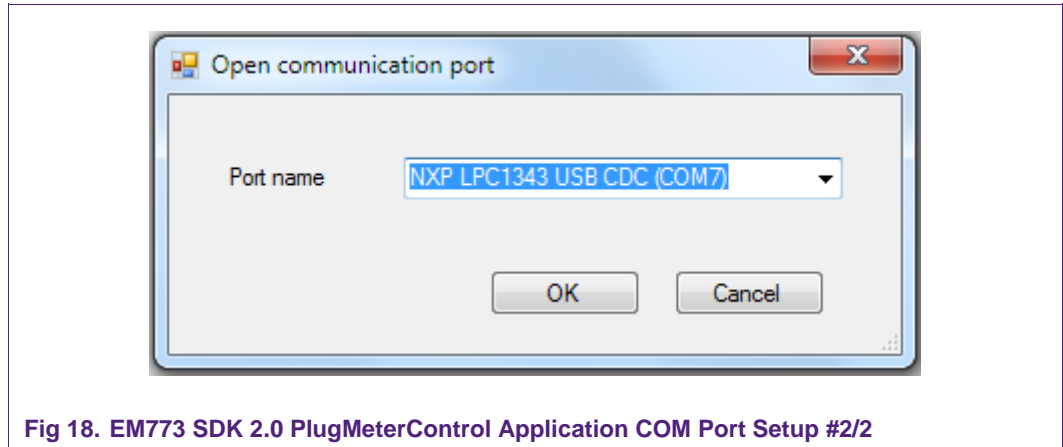


Fig 18. EM773 SDK 2.0 PlugMeterControl Application COM Port Setup #2/2

4.10 Successful Demonstration

Congratulations! If you have reached this step, the demo is now running as can be seen in the lower left hand corner of the GUI showing that the COM port is open and the RF dongle (firmware from LPC1343_OL2381_dongle project) is connected, or that the MBUS dongle (firmware from MBUS_dongle project) is connected.

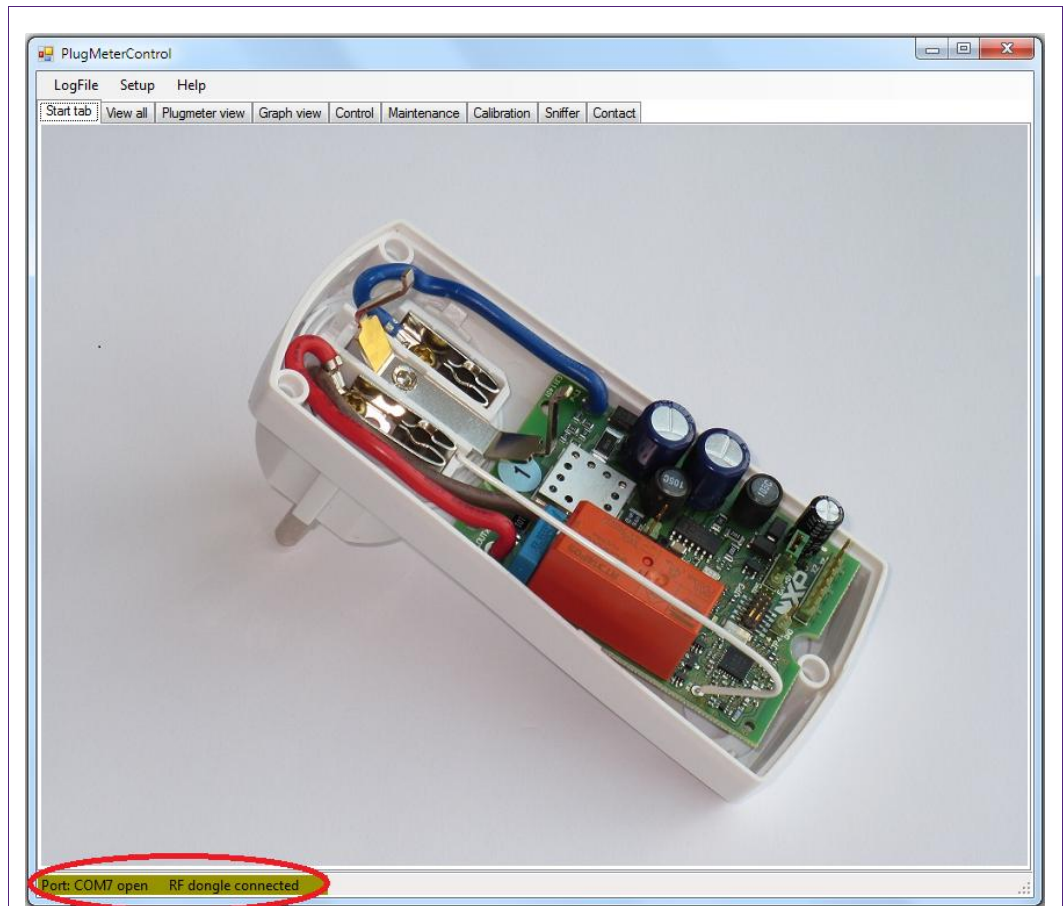


Fig 19. EM773 SDK 2.0 PlugMeterControl App LPC1343_OL2381_dongle Connected



Fig 20. EM773 SDK 2.0 PlugMeterControl App MBUS_dongle Connected

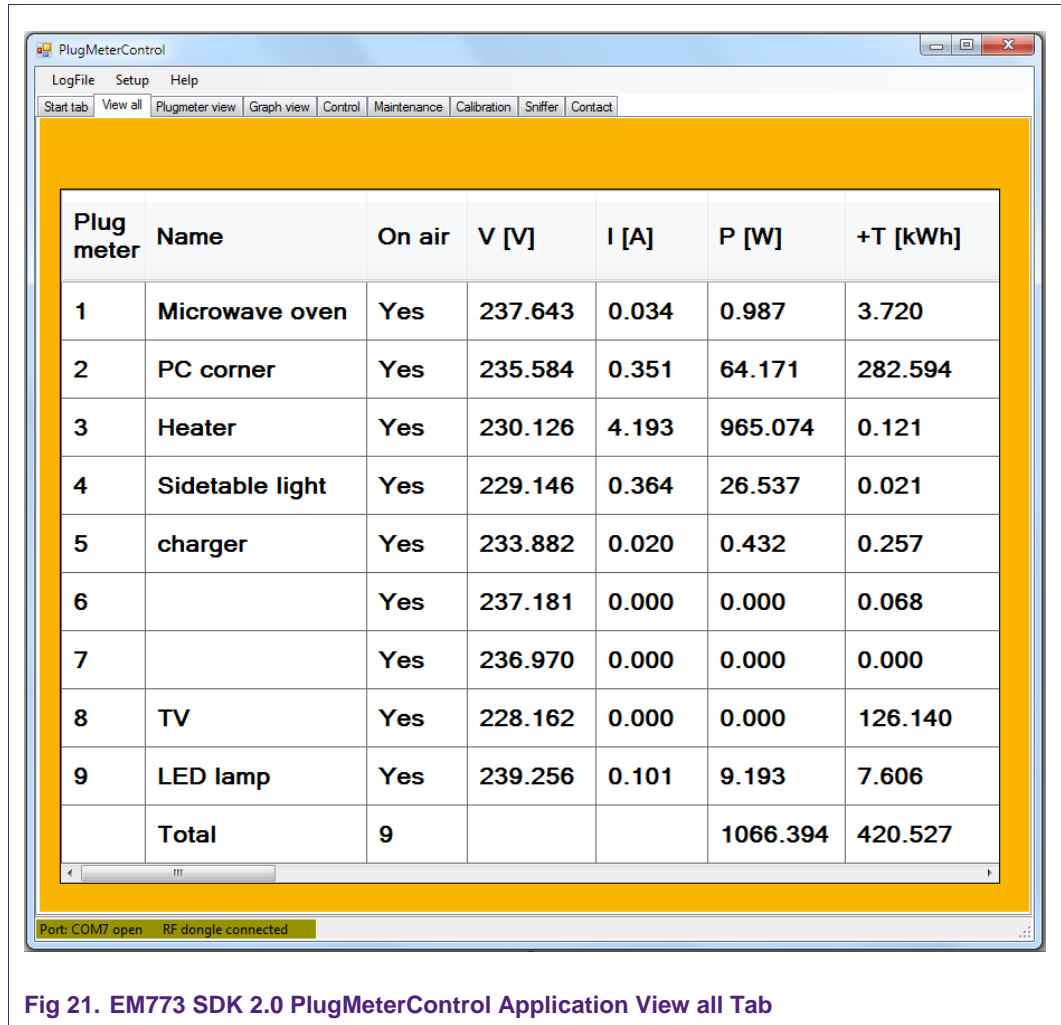


Fig 21. EM773 SDK 2.0 PlugMeterControl Application View all Tab

5. Additional Information

The EM773 SDK 2.0 demonstration application is designed to communicate with up to 50 plug meters at the same time.

From the “View all” tab, it is possible for the user to enter labels for what is connected to each of the plug meters in the system. These labels are persistently stored to make the application very user friendly.

From the “Plugmeter view” tab, users can see all of the metrology values calculated by the EM773, and even send messages to each of the 50 plug meters individually with the communications options shown in the upper right corner of the screen shot below. For an explanation of all of these metrology calculations, please refer to the chapter of the EM773 user manual covering the metrology engine in detail.

The “Relay” option is for turning on and off the control of the load connected to the plug meter and the “Transmit interval” option is for telling the plug meter how often it should send new data communications message to the USB dongle.

The OL2381 based wireless communication between the plug meters and the USB dongle is compliant with wireless M-Bus T2 mode at both the 32kcps and 100kcps data

rates. The messages from the plug meters to the USB dongle operate at the 100kcps data rate, while the messages from the USB dongle to the plug meters operate at the 32kcps data rate.

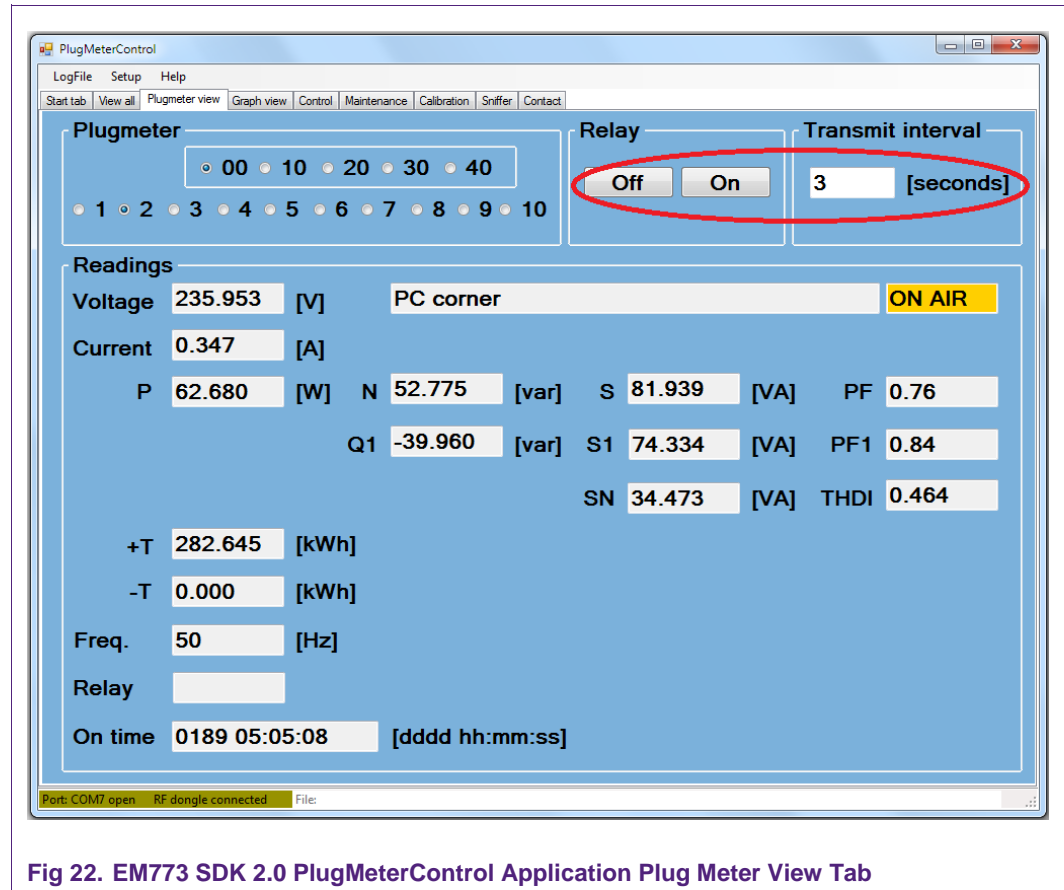


Fig 22. EM773 SDK 2.0 PlugMeterControl Application Plug Meter View Tab

6. Maintenance and Calibration

Please be aware of the “Maintenance” and “Calibration” tabs of the PlugMeterControl GUI application. With these tabs, it is possible to reconfigure the calibration settings of a plug meter. By entering incorrect values, the accuracy of the EM773 metrology engine will be significantly reduced.

The purpose of these tabs is to make it easier for users to go through the EM773 calibration routine without having to actually write any software or reprogram the plug meter via JTAG.

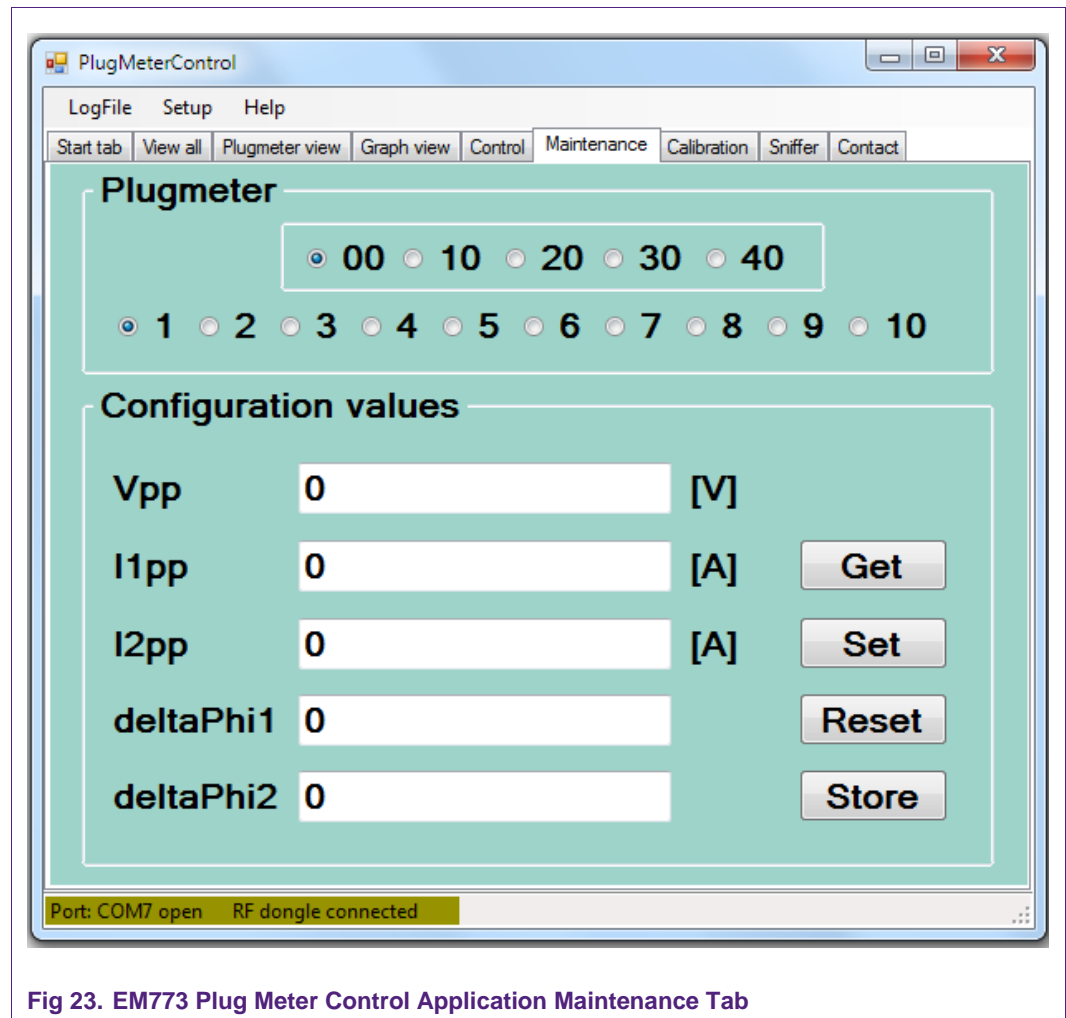


Fig 23. EM773 Plug Meter Control Application Maintenance Tab

6.1 Calibrating the EM773 Metrology Engine

Please refer to the EM773 user manual chapter covering the metrology engine for the steps required to determine the correct calibration values for a specific plug meter. Using the calibration window of the EM773 plug meter control application, the calibration procedure may be followed without writing a single line of code or reprogramming the software in the plug meter itself. Once the plug meter is calibrated the settings are persistent and will remain. Calibration can be done at any time and as often as a user wishes while the plug meter is in operation.

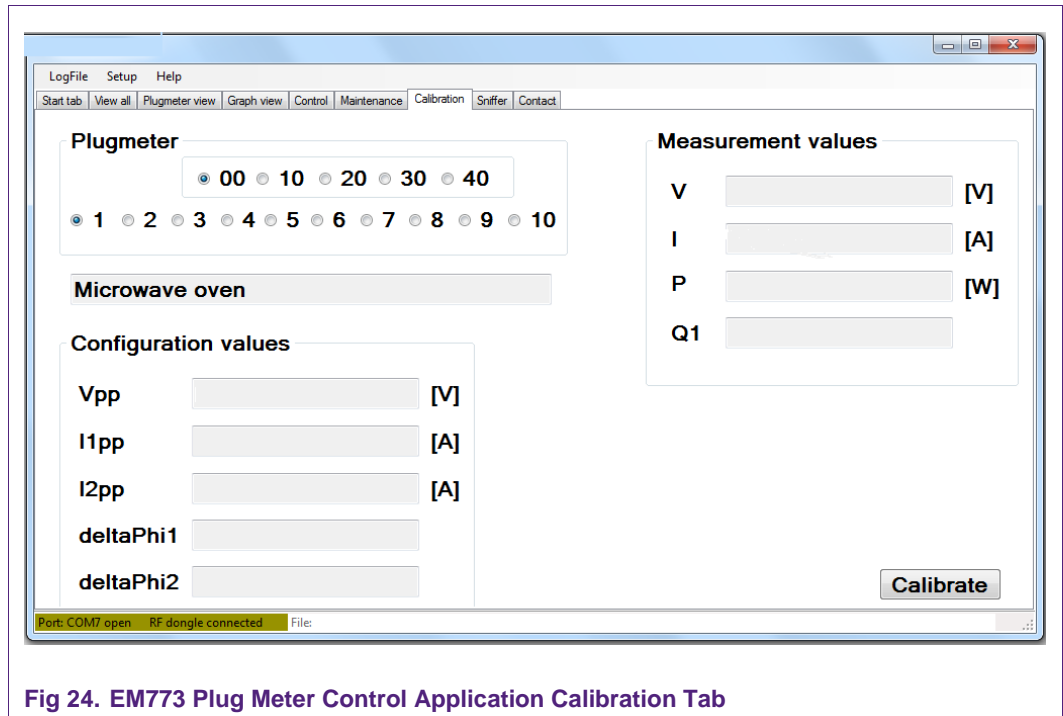


Fig 24. EM773 Plug Meter Control Application Calibration Tab

6.2 Reconfiguring Factory Calibration Settings

Should incorrect calibration values be configured into a plug meter, factory calibration settings may be restored by following the steps below.

6.2.1 Maintenance Tab

Inside the “Maintenance” tab, make sure the correct plug meter that needs to be reconfigured is selected by selecting the correct number from 01 – 50 on the top option.

6.2.2 Factory Default Values

Enter the following factory default values for the calibration settings depending on whether the plug meter is connected to a 50 Hz power grid or a 60 Hz power grid.

	50 Hz Settings	60 Hz Settings
Vpp	945.4793636	944.3160455
I1pp	2.546045455	2.569045455
I2pp	39.98545455	39.90036364
deltaPhi1	-0.020022045	-0.0117395
deltaPhi2	-0.016616318	-0.012733636

Fig 25. EM773 Plug Meter Factory Default Settings

6.2.3 Set and Store

Once the above values have been entered for the appropriate net frequency of the electricity grid that the plug meter is connected to, select “Set” followed by “Store” to overwrite the calibration settings of the plug meter. The plug meter should now be restored to factory settings, and the values will be kept persistently.

6.2.4 Verification of Re-calibration

Unplug the plug meter and plug it back in. Wait for it to be listed as “ON AIR” again. Once it is up and running again, go to the “Maintenance” tab, select the re-calibrated plug meter, and then press the “Get” option. The re-calibrated configuration settings should once again appear showing that they are now persistently programmed.

7. Conclusion

Using this EM773 SDK 2.0 Getting Started Guide, users of the EM773 should now be familiar with where to find all the software included within the development kit. Users should also be able to successfully run the EM773 SDK 2.0 demonstration GUI, and see the EM773 metrology engine in action. The next step for EM773 developers is to get started with application development and creating energy metering products and solutions. NXP is very excited to see the innovative products created with the EM773.

8. Legal information

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8.3 Licenses

Purchase of NXP EM773 components

Please note that the metrology engine driver library included in the "LIB" directory of the SDK may not be modified. All other open source example code included in the SDK is free for users to modify and distribute with their own EM773 based products. Please carefully review the license agreement included with the EM773 SDK for details.

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10. References

- [1] Microsoft .NET Framework 4 Client Web Link
- [2] EM773 Product Page and SDK Web Link
- [3] EM773 Datasheet
- [4] EM773 User Manual

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