User's Manual

Demo Kit (Pet Monitor)

User's Manual

Renesas Synergy™ Platform
Tools & Kits
Kit: Pet Activity Monitor v2.02

Renesas Electronics
www.renesas.com

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(Rev.3.0-1 November 2016)

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This Renesas Synergy™ Demo Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. - There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Renesas Synergy™ Development Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Contents

1. Overview

The PET MONITOR is a Demo Kit for the Renesas Synergy™ S3A3 Microcontroller Group in an LQFP64 package. The PET MONITOR is primarily intended for demonstration of the integration of various technologies. All source files are included so that developers can explore and alter the operations of the device.

This application is NOT a real product and is intended as a demonstration of technology and is not a commercial product. Since pets come in all shapes and sizes and therefore creating a generic device that can detect the steps and barks/noises of all these different animals is beyond the scope of the demo. These settings can be adjusted and tried using the Windows application to communicate with the device and setup the parameters. See Section 7.

2. Features

ARM Cortex-M4 Core with Floating Point Unit (FPU)

- ARMv7E-M architecture with DSP instruction set
- Maximum operating frequency: 48 MHz
- Support for 4-GB address space
- ARM Memory Protection Unit (MPU) with 8 regions
- Debug and Trace: ITM, DWT, FPB, TPIU, ETB
- CoreSight™ debug port: JTAG-DP and SW-DP

Memory

- ARMv7E-M architecture with DSP instruction set
- 512-KB code flash memory
- 8-KB data flash memory (up to 100,000 erase/write cycles)
- 96-KB SRAM
- Flash Cache (FCACHE)
- Memory Protection Units
- Memory Mirror Function
- 128-bit unique ID Power

Power and Analog

- Main power input of 5V to USB Device input of 5V
- High efficiency 5V to 3.0V system power DC-DC converter
- Low noise 5V to 3.0V power regulator for MCU analog functions
- Lithium coin cell holder for stand-alone operations
- Several jumper-configurable headers to allow selection of battery power source type and charging option
- ISL9120 Buck-Boost power module
- ISL9230 Battery Charger module
- ISL28133 Operational Amplifier

Connectivity

- USB 2.0 Full-Speed Module (USBFS) – For Setting of parameters, charging of battery and reading of data history.

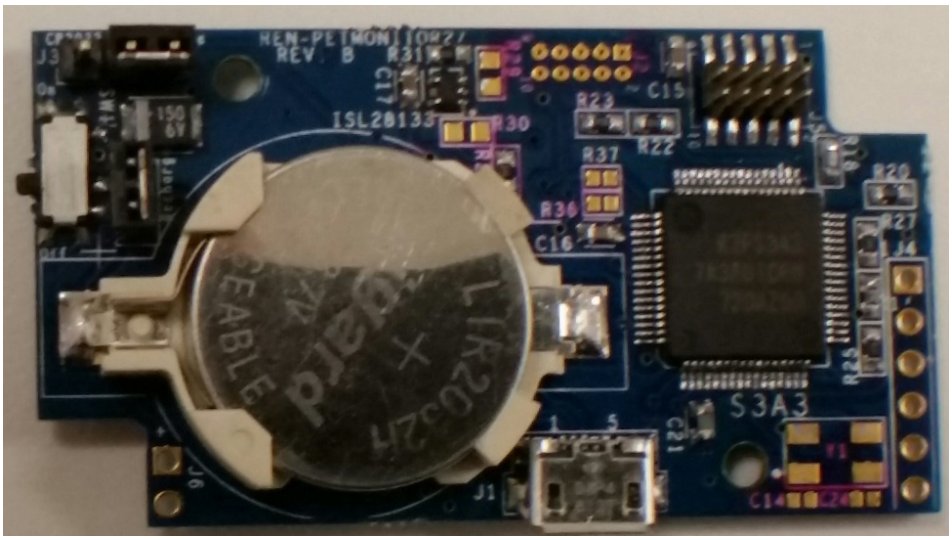


Figure 1 Main board components, top side

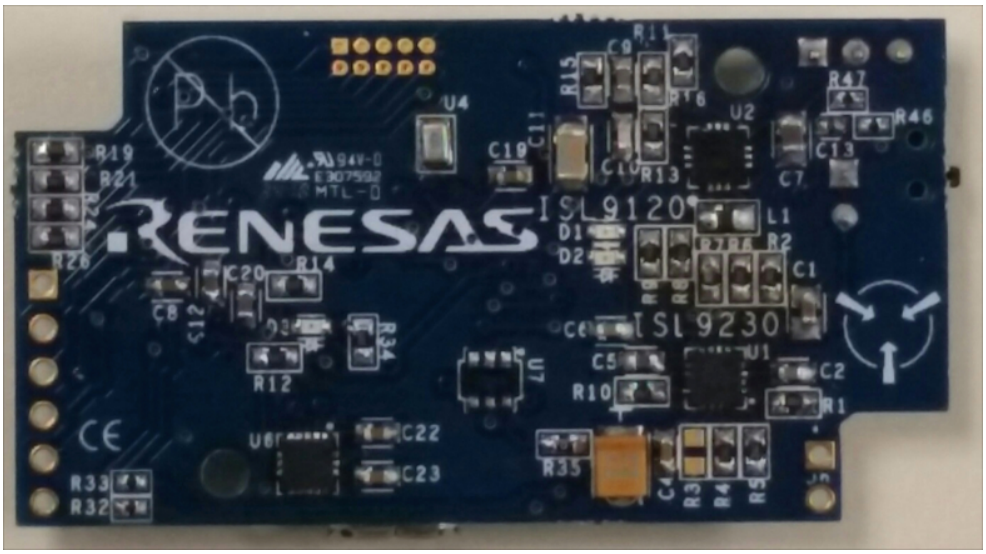


Figure 2 Main board components, bottom side

3. What's in the box

The following components are included in the Pet Activity Monitor Demo Kit:

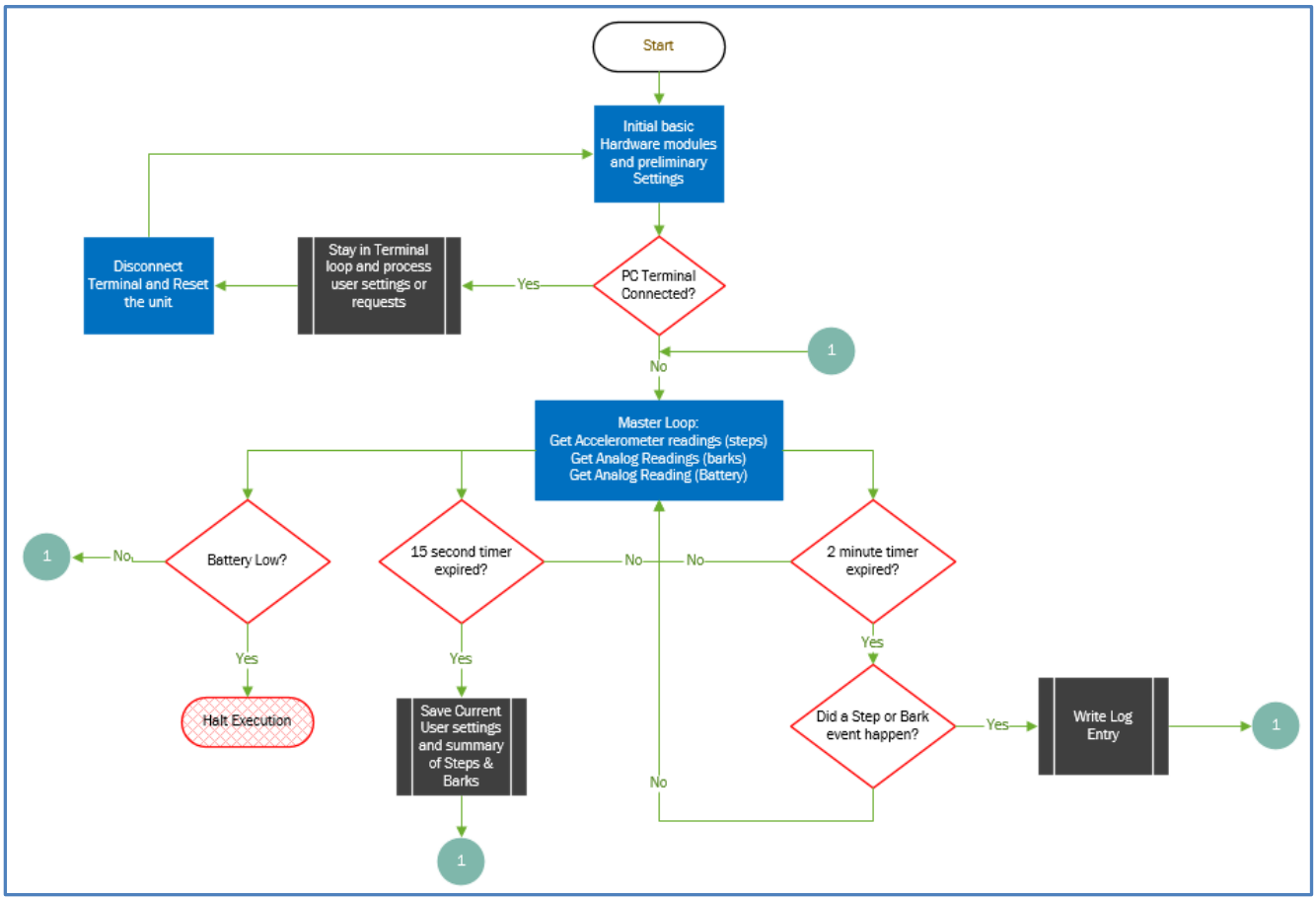
- Pet Activity Monitor main board with installed acrylic case. Part Number: **REN-PETMONITOR2Z**
- 2pc - shunt-jumpers for 0.1in. headers on the PET MONITOR; 1 each for J3, J7 (pre-installed)
- 1pc - LIR2032 Battery (rechargeable coin cell)
- 1pc - Micro-B USB cable
- 1pc - Pet Collar

3.1 Other requirements

1) Renesas YSJLINKLITE will be required for Programming or Debugging see note in section 5.3.2

4. Getting Started

Do not plug in the pet monitor into the PC until the PC App is running.

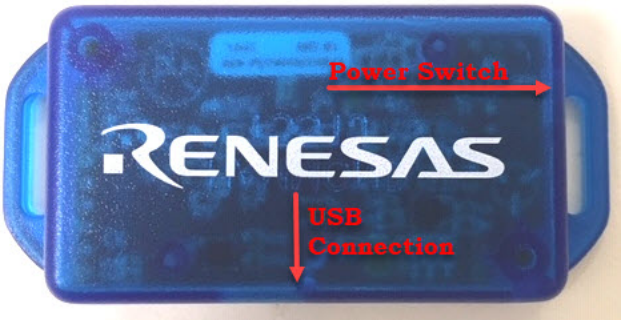


4.1 Minimum requirements to build Application project

The use of e2 studio version 6.3.0 with SSP 1.5.0 was used to create and build this project. Please assure that you use this version as newer versions have not been verified.

The PC application was build using the Visual Studio Community 2017 version 15.7.6 and is based on VB.NET

Both solution source projects are included in the download from the internet at: http://www.renesas.com/pet-monitor



4.2 Installation & Operation Procedure

Step 1: Do not connect the Pet Monitor to the computer yet.
Step 2: Install the software.
Step 3: Plug Pet Monitor into computer and let the software acknowledge the USB connection and install the driver. If driver doesn't install refer to Appendix C.
Step 4: Assure that pet monitor has full charge by switching on the power switch you should see a RED led light and wait for it to go out.
Step 5: Start the PC application and configure your Pet Monitor.
Step 6: Turn off the Pet Monitor before disconnecting from the computer. Once disconnected you can place the turn on the unit and place it on your pet.

Important Note:

Always make sure you turn the pet monitor OFF before connecting and disconnecting from the computer.

4.3 How to configure and setup you Pet Monitor

4.3.1 Installation of PC application, documentation, solution files, PCB design files and USB drivers

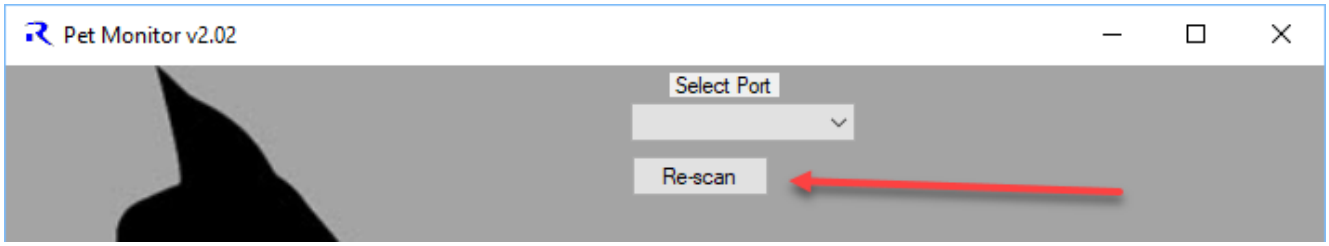
Installation requires Administrator rights as PC drivers are required to communicate with this device.

To configure the pet monitor hardware, you will require a Windows computer with a USB port. This has been checked on both Windows 7 and Windows 10. You must first run the PetMonitorSetup.exe program to install the application as well as the USB drivers for this example. Once done you can plug in the micro-USB cable into your Pet Monitor and computer and move the power switch to the on position and let the driver install and update your system

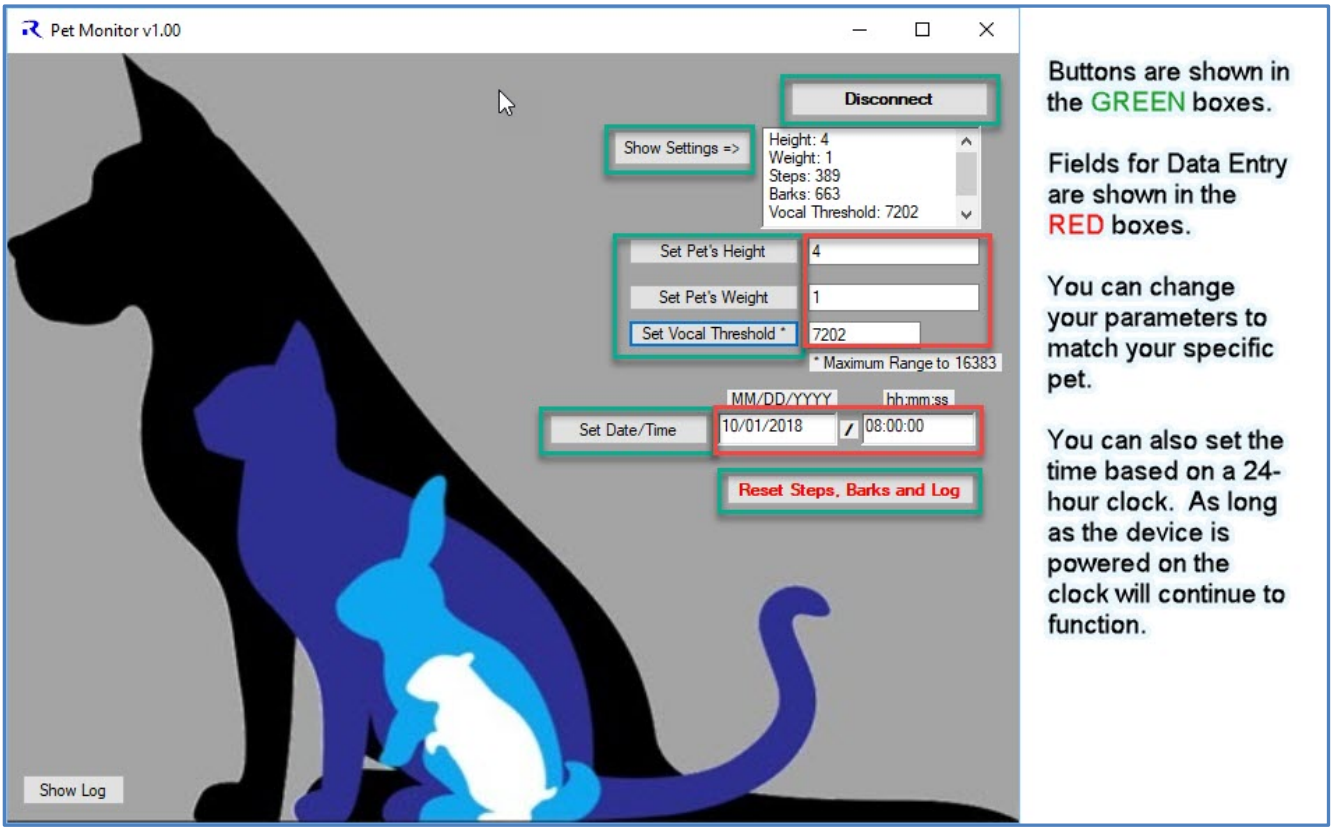
.

4.3.2 If you don't see a "Connect" button on the screen of the application like shown here.

Then you will see something more like the screen below. Then make sure you have the driver installed and then you can "Re-scan" for the hardware.



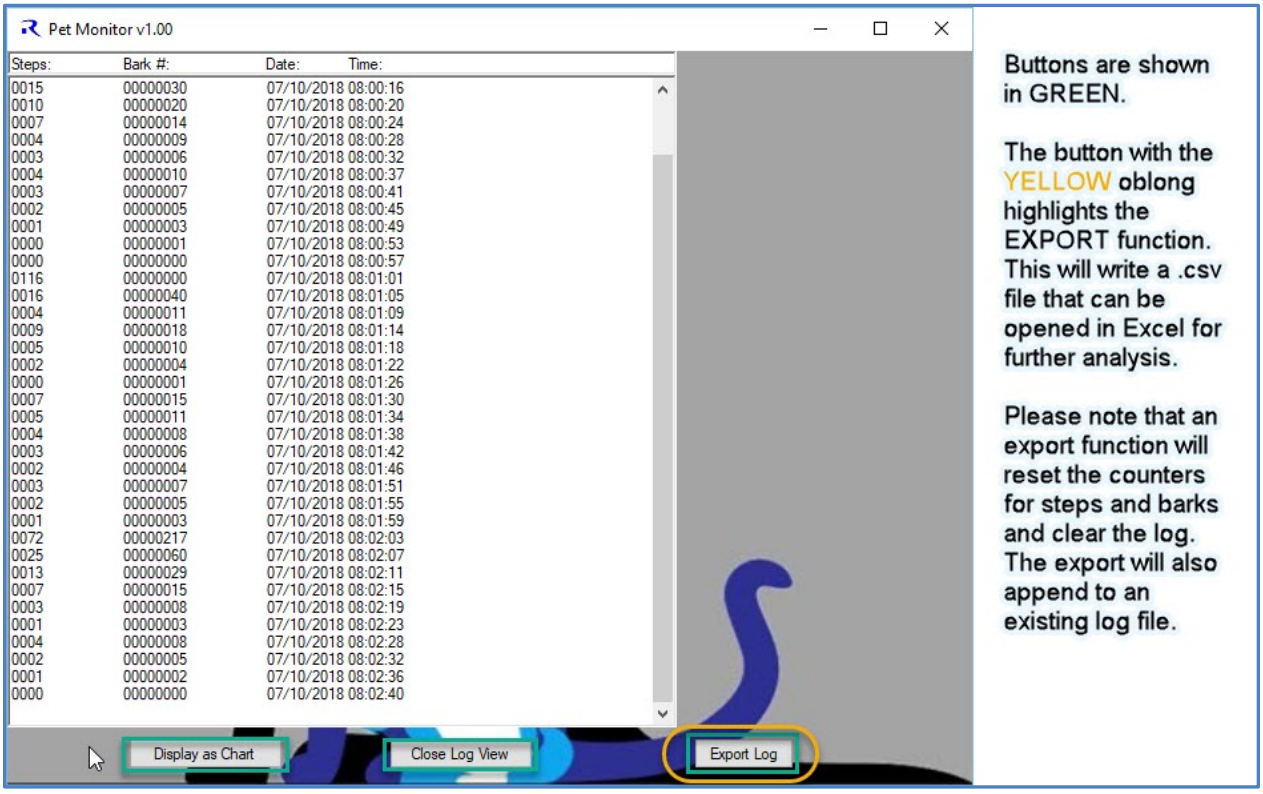
4.3.3 Using the PC application to setup and download from your Pet Monitor.

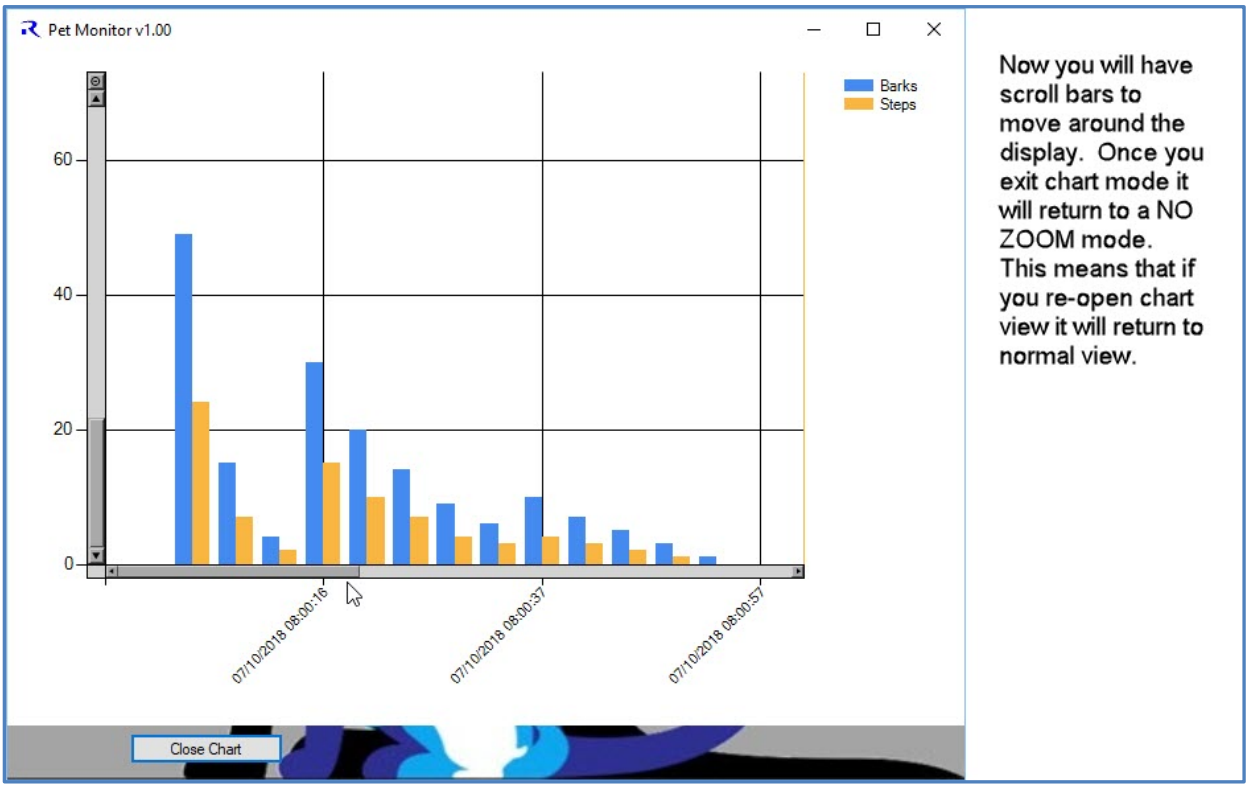


***NOTE:** The units of measurements are as follows: Pet's Height to be in inches, and the Weight to be in pounds (Lbs.)*

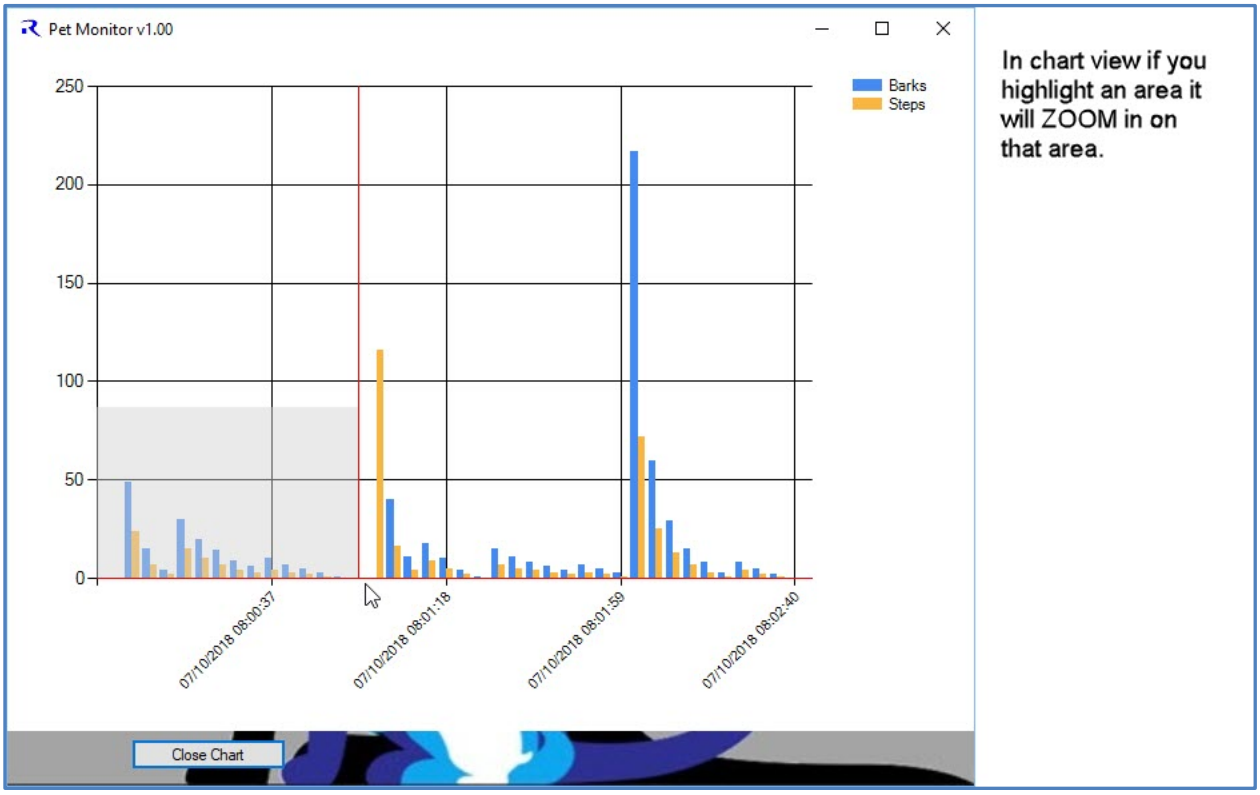
Some examples of settings for the Vocal Threshold.

Bread	Vocal Setting	Bread	Vocal Setting
Labrador Retriever	7667	Small Dog	6618
German Shepherd	6260	Puppy	6634
Dobermann	7371	Border Collie	6418
Pomeranian	8880	Beagle	5055
Chow Chow	5208	Yorkshire Terrier	5041
Pembroke Welsh Corgi	5052	Electronic Toy Dog	7202

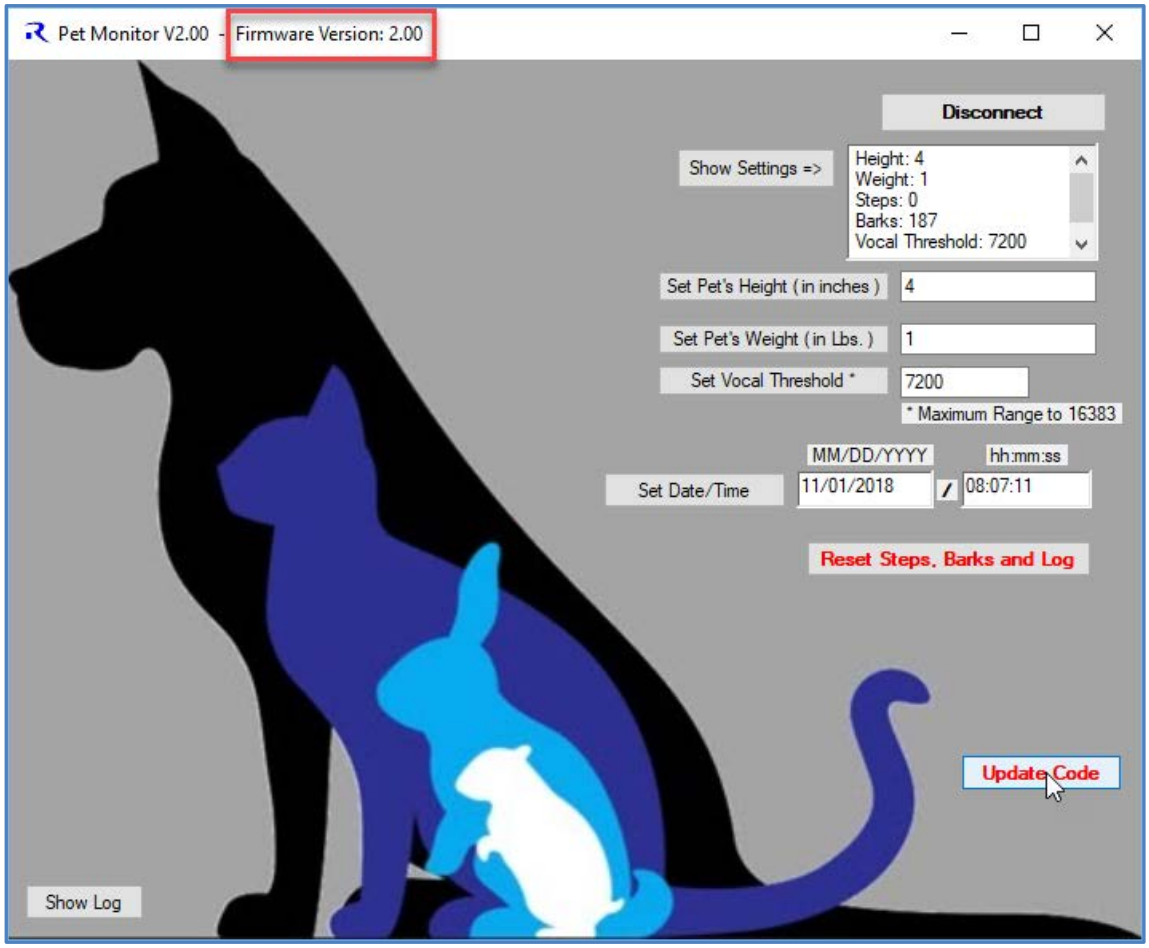




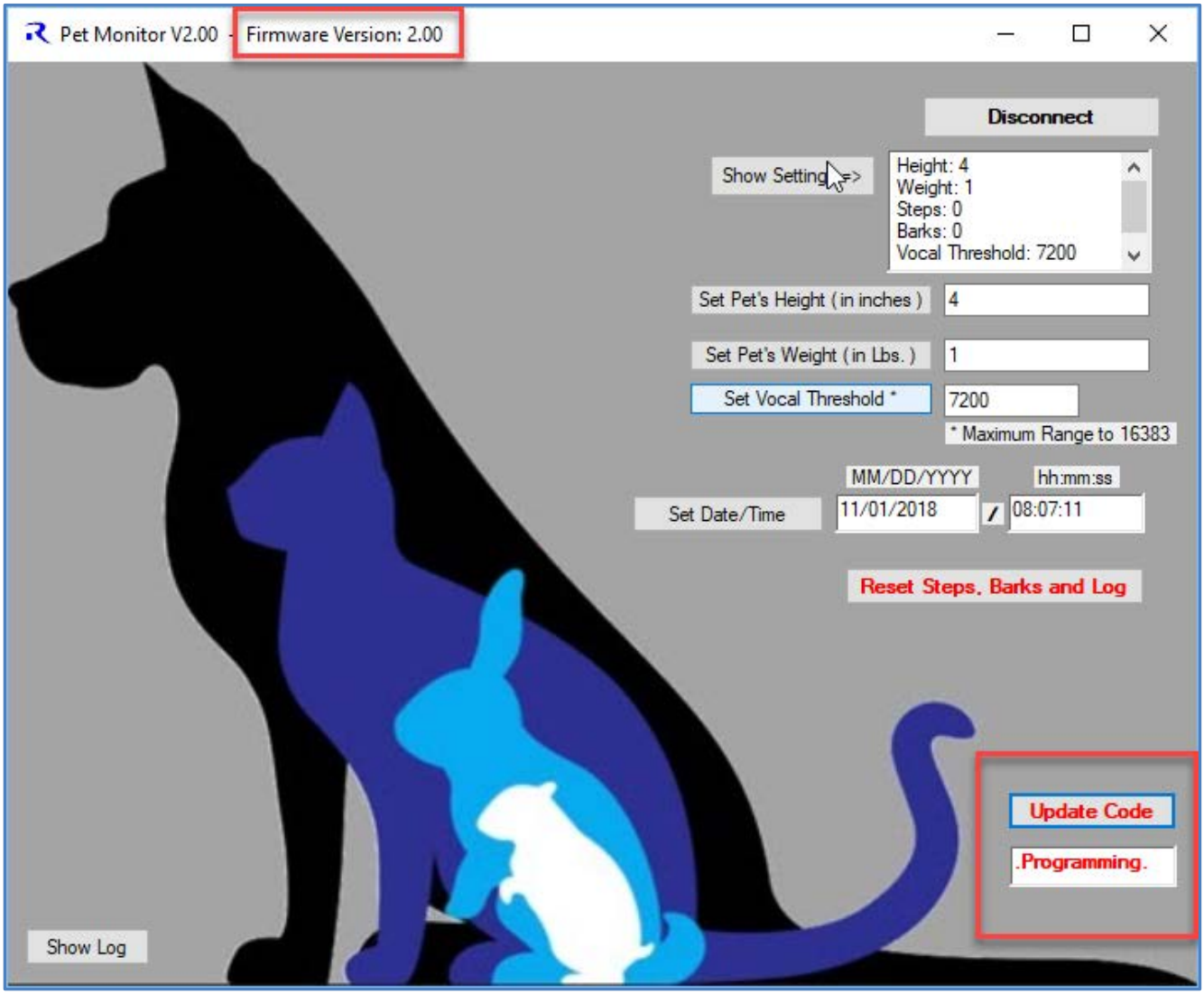
Additional Options in the Version 2.00 of the application.



The Title bar will so the Firmware version loaded into the Pet Monitor.


Pet Monitor V2.00 - Firmware Version: 2.00
Disconnect
Show Settings =>
Height: 4
Weight: 1
Steps: 0
Barks: 187
Vocal Threshold: 7200
Set Pet's Height (in inches)
4
Set Pet's Weight (in Lbs.)
1
Set Vocal Threshold *
7200
* Maximum Range to 16383
MM/DD/YYYY
hh:mm:ss
Set Date/Time
11/01/2018
08:07:11
Reset Steps, Barks and Log
Update Code
Show Log

Also, with version 2.00 of the firmware code (bootloader version) and above you will be able to update the application firmware code over the USB connection. Using the **Update** button.



4.4 Operation Information

4.4.1 Battery Charging

If you are using an LIR2032 rechargeable battery and wish to charge the battery you must place the jumpers for J3 & J7 into the recharge positions. Now turn the power switch to the ON position and connect the USB micro cable to your computer. During the charging the RED led will be lite and the computer will most likely report “unknown USB device”.

Once the battery is fully changed the RED led will turn off.

Using J6 with an external battery pack will work but the charging will not be accurate and will take an extremely long time and is not advisable without modifications to the hardware. Please refer to the ISL9230 documentation.

4.4.2 Normal CR2032 Battery Operation

The use of a normal CR2032 battery to run the device will have J3 in the CR2032 position and J7 will be removed. Turn on the device with SW1 (power switch) and the YELLOW led should flash three times to indicate that the program is running.

4.4.3 Jumper and switch operation when using PC application

With the switch (S1) is in the OFF position connect your PC to the Pet Activity Monitor using the Micro-B cable.

Note: If you are using the standard CR2032 battery you will need to move the power switch (S1) to the ON position.

Once connected the PC application will look in the systems registry for the Synergy communications port and connect if found after you press the Connect button.

5. Working with the Pet Monitor Hardware

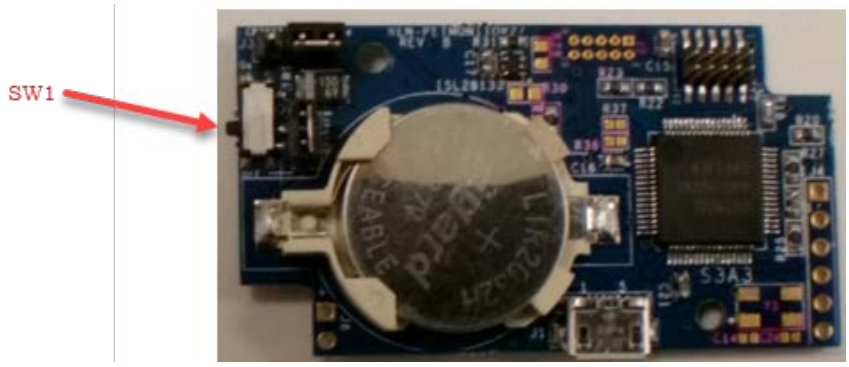
If you wish to change, debug the application for your Pet Activity Monitor board, you will need the latest version of the Renesas Synergy™ Software Package (SSP), as well as the development tools needed to work with it.

If you are new to Renesas Synergy™ Platform development, visit our *Getting Started Guide* on the web. This guide will provide detailed instructions on how to register an account on the Renesas Synergy™ Gallery to obtain a developer license, and how to download and install all the software and tools that are required. Once you have completed these steps, return to this section for more in-depth information on how to work with your board.

1. **sign in** to your My Renesas account. If you do not have an account, please **sign up** for one.
2. How to download and install the necessary development tools

5.1 Jumpers and DIP Switch settings

5.1.1 Default Board Configuration



5.1.2 Jumper and Switch functionalities

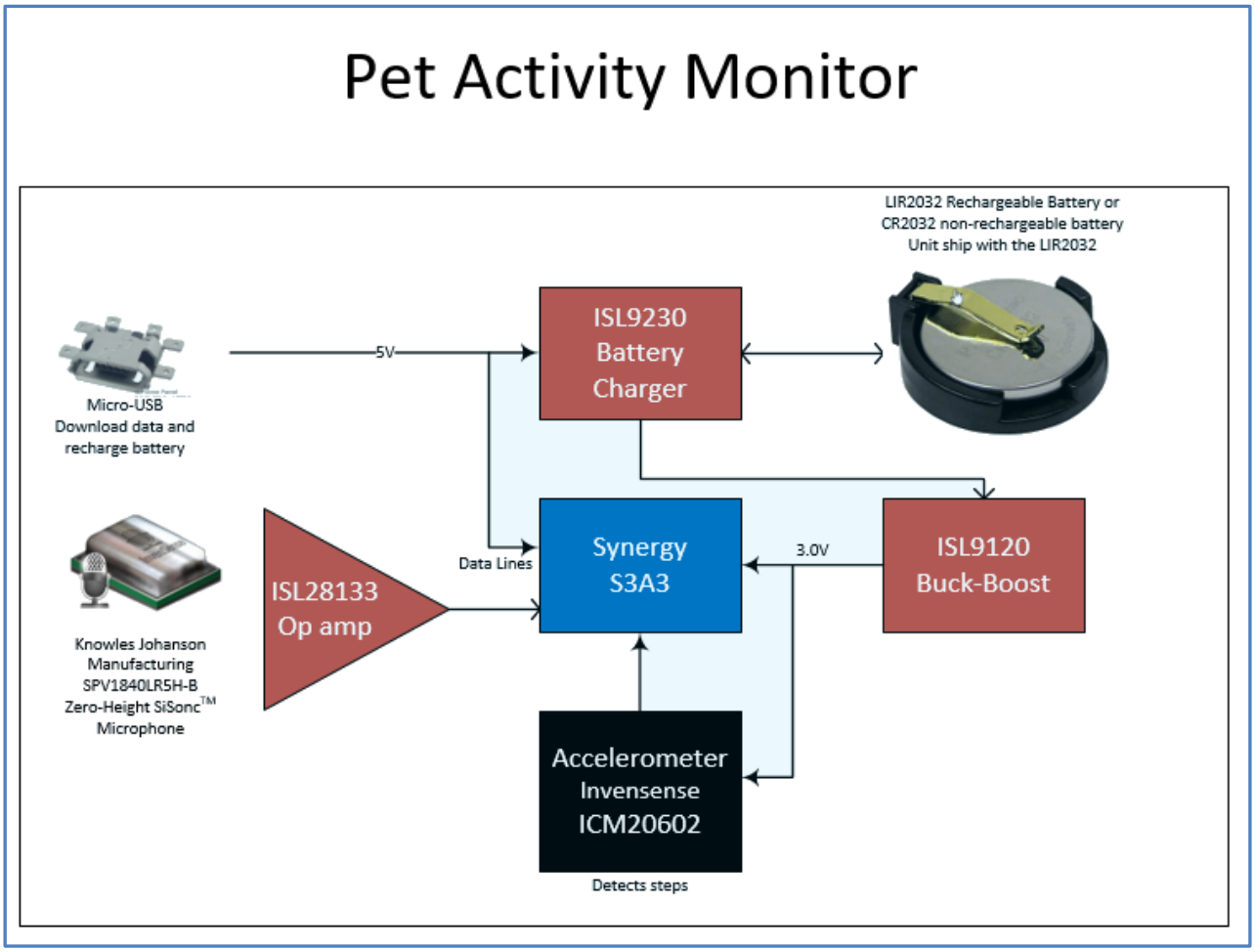
Jumper / Switch	Function	Default Setting
SW1	Power On/Off switch	Off
J1	Micro USB connection for Data communications and Charging	N/A
J2	Debugger Header	N/A
J3	Used to select power source.	Using a regular CR2032 short J3 pins 2 & 3 and J7 left open. Using a Rechargeable LIR2032 then short J3 pins 1 & 2 and short J7.
J4	PMOD Connection	Not used
J5	Debug Connection Header	N/A
J6	placeholder if using a wired li-ion cell instead of the coin cell battery. Pin 1 is the + and pin 2 in GND	Open
J7	Used to include or remove the battery charging circuit from the system. If using the rechargeable battery, short the pins that say “Recharge” with a jumper (J7 pins 1 & 2)	Removed

5.1.3 Indicators

ID	Function	Color
D1	**Power Good**	GREEN
D2	**Charging Indicator** When an End of Charge (EOC) condition is reached, the CHG pin changes to Hi-Z to indicate the end-of-charge condition and the charging is terminated if the CONT pin is in logic low. When a recharge condition is met, the safety timer will be reset to zero and the charging re-starts. In the event a timeout interval has elapsed before the EOC condition is reached, a timeout fault condition is triggered. The timeout fault condition is indicated by the CHG pin being toggled between HI and LO every 0.5s. The timeout fault condition can be cleared by removing and reapplying the input power to the IC. Under the EOC, timeout and timeout fault conditions, the power delivery to VOUT is not impacted. The battery continues to supply current to VOUT if needed, as described in “Dynamic Power Path Management” on page 15 of the ISL9230 Data Sheet.	RED
D3	**Status Indicator** • Long flashes on program startup to indicate operation • Short flashes on writes to Data Flash • Long flashes on Battery Low Indicator (stops program) and LED remains on.	YELLOW
		

6. Hardware Layout

6.1 System block diagram



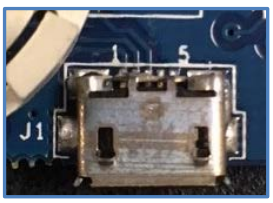
6.2 Power Requirements

This section covers information related to power supplies for PET MONITOR. It includes input power supply sources, power up behavior, battery supply configuration, and how to measure current consumption for the PET MONITOR and other key components.

6.2.1 Power supply options

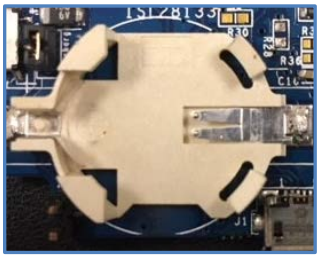
This section provides details on various input power supply options available on the PET MONITOR. The primary supply is from the Coin Cell. But with the USB connection to the device you can communicate with the device as well as power the unit. If you use a rechargeable **LIR2032** then this connection will be used to charge the battery.

USB Micro-B (Default)



J-Link USB Micro-B connector J1, located near the battery holder. This connector is used for configuring and downloading from the PET MONITOR. The current limit through the USB connector is 500 mA.

LIR2032 lithium coin cell Installed in BAT1 holder near the right edge of the circuit board.



When power to the PET MONITOR is supplied from the lithium coin cell and J-Link circuitry operation is required for operation, connection of the JLINK interface will not supply power to the unit.

Installed in BAT1 holder near the right edge of the circuit board.

When power to the PET MONITOR is supplied from the lithium coin cell and J-Link circuitry operation is required for operation, connection of the JLINK interface will not supply power to the unit.

6.2.2 Power-up behavior

The PET MONITOR is delivered preloaded with a demonstration program. The demonstration program shows several features of the PET MONITOR and source code is available as a programming example for developers. When you power on the device the LED D3 (Yellow) will do three Blinks then turn off to let you know the application is running.

6.2.3 Battery supply configuration

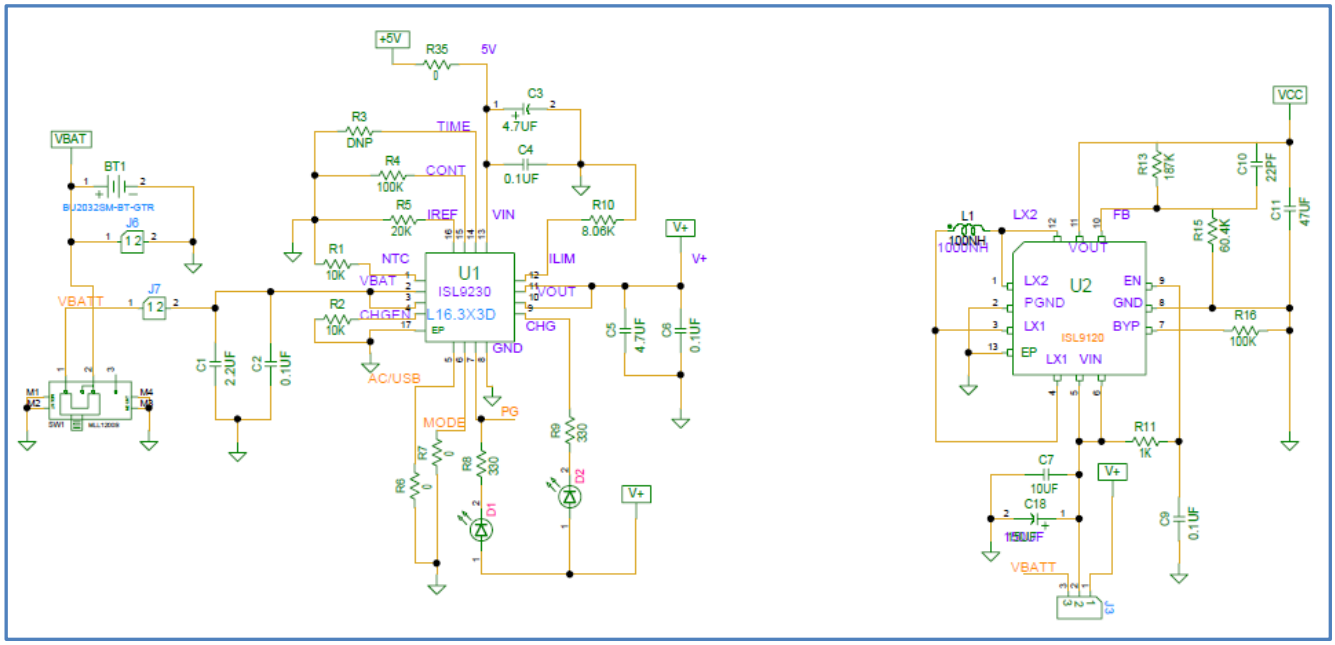
A lithium button cell battery must be used to provide power to the board. There are two possible batteries that can be used with this unit, either a CR2032 or a rechargeable LIR2032.

Jumper	Function	Default Setting
J3	Used to select power source type.	**Shorted Pin1 to Pin2** Using a regular CR2032 short J3 pins 2 & 3 and J7 left open. Using a Rechargeable LIR2032 then short J3 pins 1 & 2 and short J7.
J7	Used to include or remove the battery charging circuit from the system. If using the rechargeable battery, short the pins that say “Recharge” with a jumper (J7 pins 1 & 2)	**Installed**

6.2.4 Power-rails on the board

+5V Main voltage rail

To power supplies for the circuitry on the PET MONITOR. This is controlled and monitored by the ISL9330 and ISL9120 devices. The ISL9230 will also handle the charging of the battery if a rechargeable version is used.



3.0V Main power subsystem

Almost all the circuits on the board require 3.0 V, including S3A3 memory, and logic. The +5V Main Voltage Rail power is delivered to the Intersil ISL9120 buck-boost switcher. This switcher, using a tiny inductor, creates 3.0V at up to 1.5A to the S3, and can operate with +5V rail voltage between 3.0V and 5.8V.

Low Battery power detect

VBAT will be read by one of the MCUs A/D channels and will force unit into a stop condition if the voltage falls below 1.3 volts on the battery.

6.3 Connectivity and Settings

This section describes the various connectivity blocks along with any configuration options on the S3. The connector interface pinouts and signal definitions are included, along with any jumper or DIP switch settings that are required for each functional block.

6.3.1 USB Device (J1)

This USB Micro-B connection jack connects the S3 to an external USB Host, the FS capable, will accept power from the host. Host power voltage is checked to detect connection.

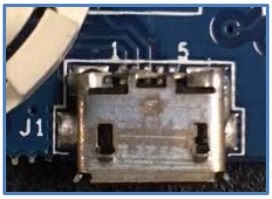


Table 1: USB device connector (J1)

USB Device Connector		PET MONITOR	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	VBUS, +5VDC	P4_7	P4_7/USB_VBUS
2	Data-	USB_DM	P9_15/USB_DM
3	Data+	USB_DP	P9_14/USB_DP
4	USB ID, jack internal switch, cable inserted	-	(Not connected)
5	Ground	VSS	(Circuit Ground)

Connection through IP4220CZ6 Dual USB 2.0 integrated ESD protection IC.

6.3.2 PET MONITOR Programming and Debug

This 0.05 in. pitch, 2x5 pin non-polarized header. The PET MONITOR Programming and Debug connector allows programming and debug of the PET MONITOR using Serial Wire interface only.

Table 2: S3A3 Programming and Debug connector (J5)

S3A3 Programming and Debug Connector		PET MONITOR	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	ARM VCC, connected to +3V3 bus	+3V3MCU	MCU VCC
2	ARM SWDIO, Serial Wire Debug Data I/O	P1_8	P1_8/SWDIO
3	ARM GND	VSS	(Circuit Ground)
4	ARM SWCLK, Serial Wire Debug Clock	P3_0	P3_0/SWCLK
5	ARM GND	VSS	(Circuit Ground)
6	ARM SWO, Serial Wire Trace Output (optional)	-	(Not connected)
7	(pin removed)	N/A	N/A
8	Not Used	-	(Not connected)
9	GND	VSS	(Circuit Ground)
10	ARM RESET#, Pin low resets target CPU	RESET_L	RESET_L

NOTE:
To work with the debugging or programming of this unit you will require a J-LINK LITE from Renesas (P/N: YSJLINKLITE) or a J-Link Debugger with the Cortex-M adaptor from SEGGER Microcontroller GmbH.

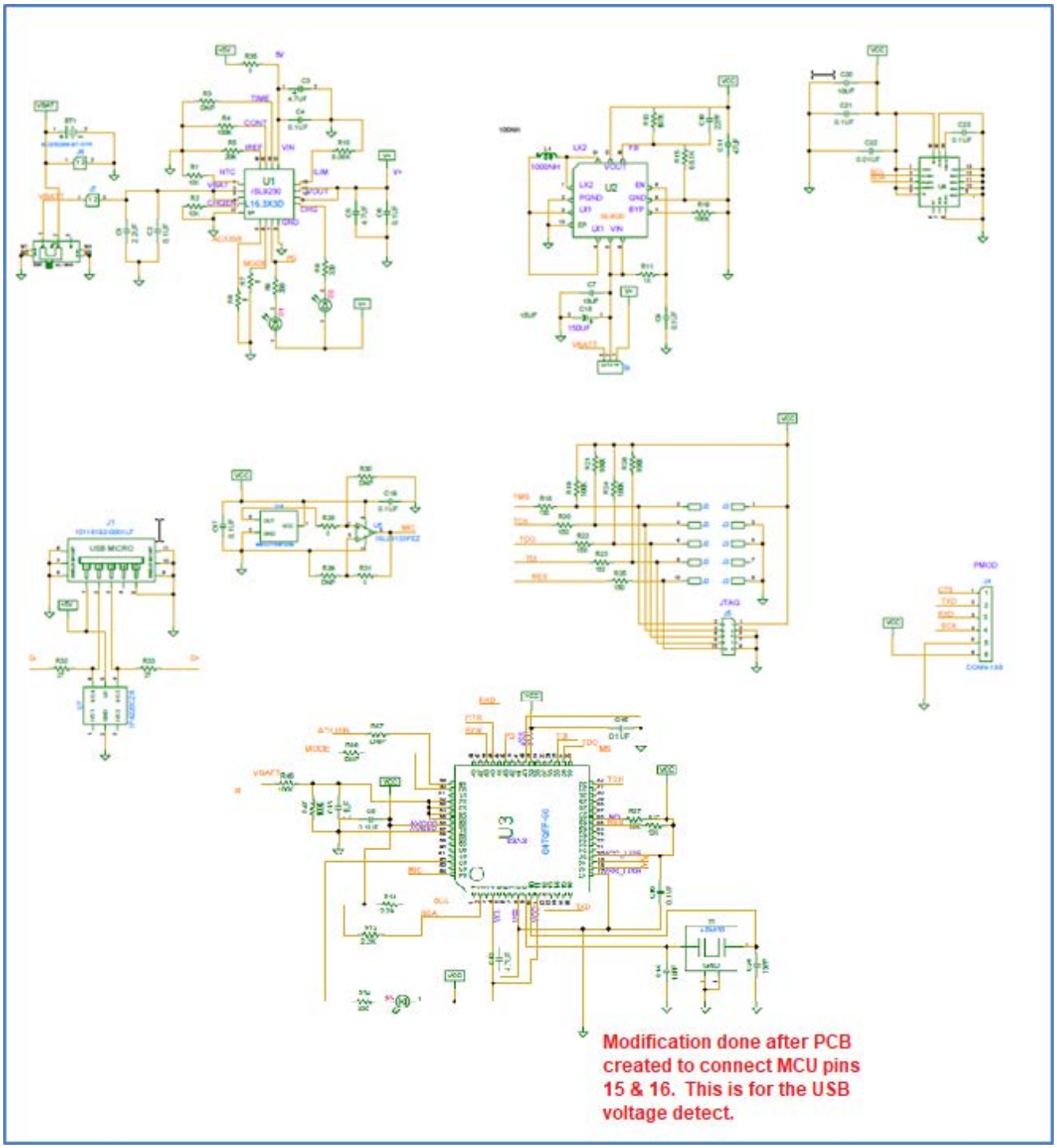
7. PMOD (Expansion Port) J4

Currently this is not used.

Table 3: PMOD Pin Out

Pin	Function	MCU
1	CTS	P1_03
2	TXD	P4_11
3	RXD	P1_04
4	SCK	P1_02
5	GND	
6	Vcc (+3.0v)	

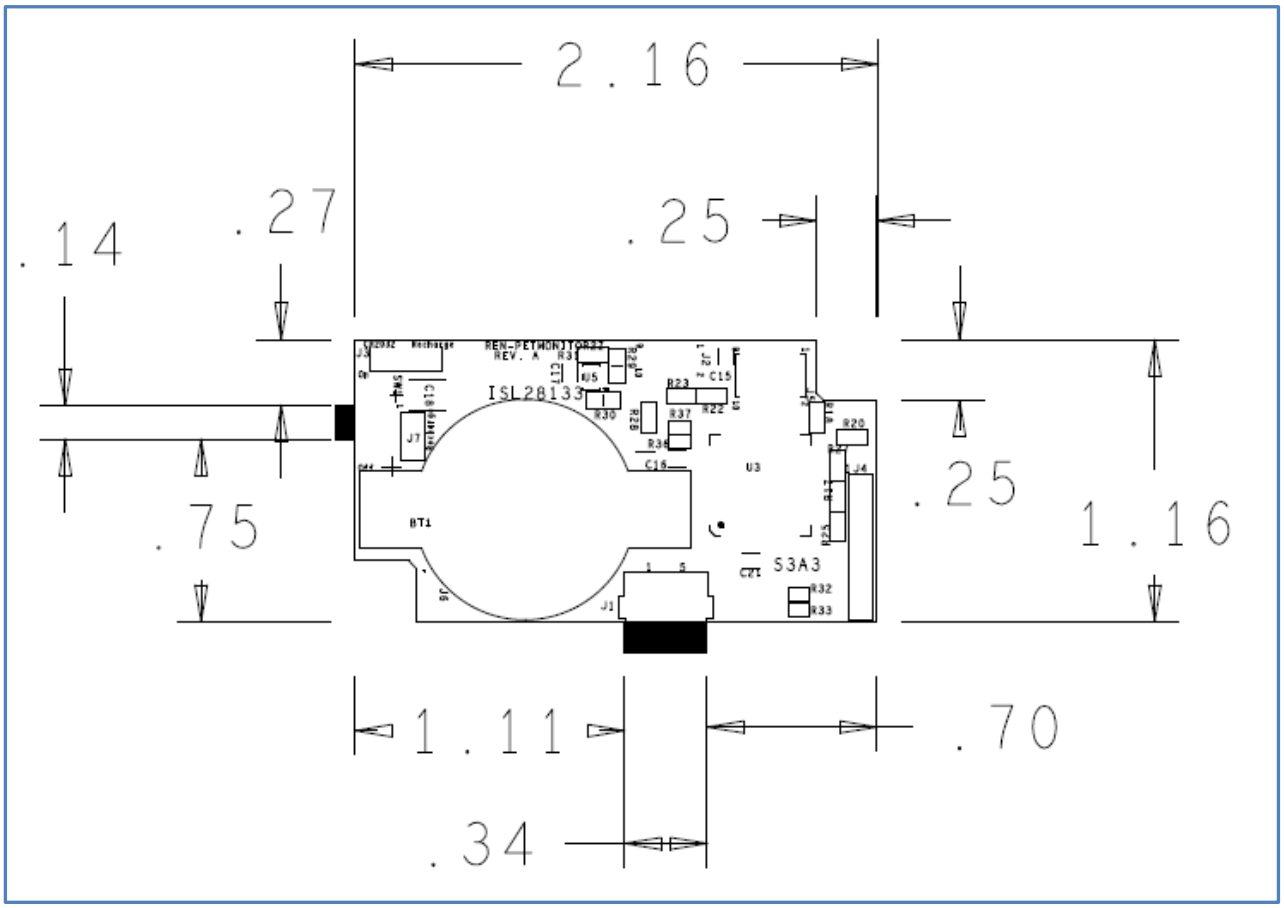
8. Electrical Schematics



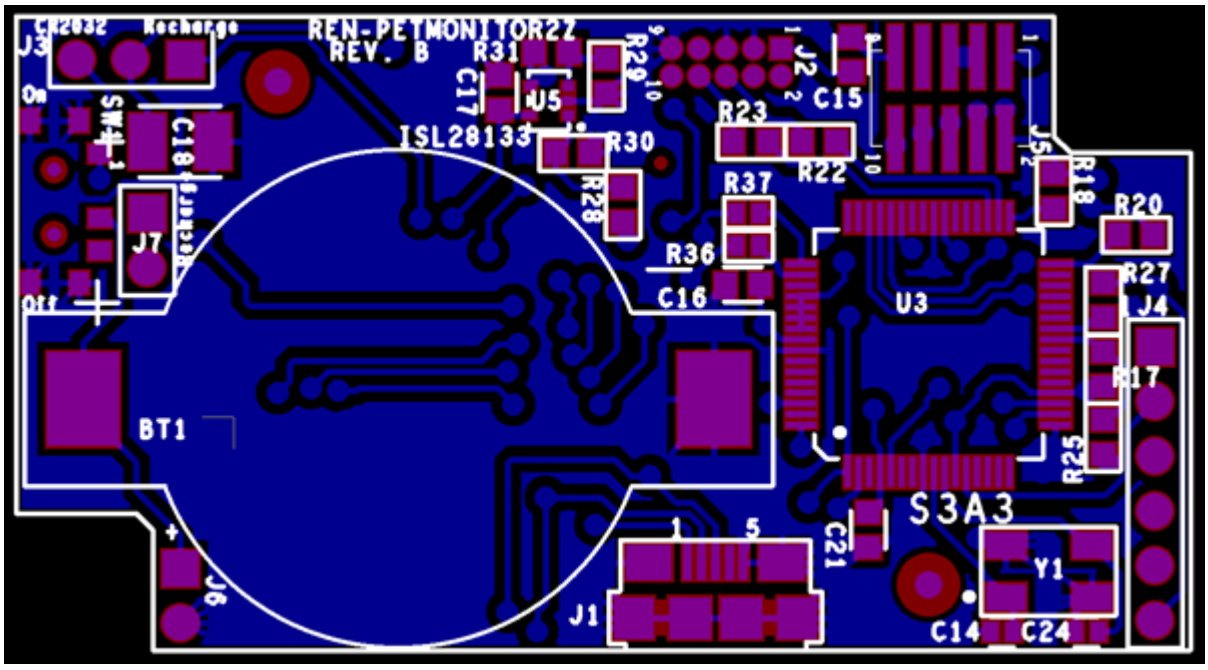
Note: Modification to schematic: Short Pins 15 & 16 together on U3

9. Mechanical drawings

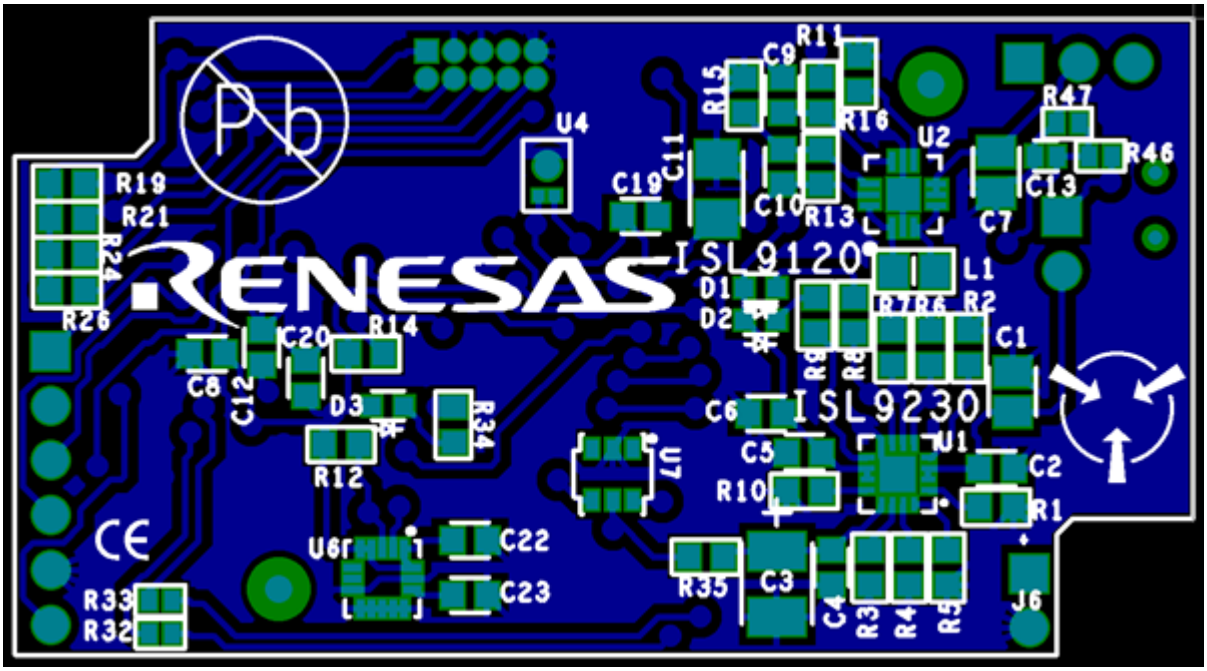
9.1 Dimensions



9.2 Top View (component placements)



9.3 Bottom View (component placements)



10. Certifications

Renesas certifies that this unit complies with the following requirements:

- China SJ/T 11364-2014, 10-year environmental protection use period
- EU/RoHS

11. Appendix A – Version 2 Pet Monitor Recovery

11.1 Abstract

There is a condition that can occur on the Pet Monitor version 2 (Bootloader version). With the power switch in the on position and the USB cable is attached to charge the battery if you remove the USB cable without turning off the switch it is likely that the application will be put into a condition waiting for a new program version to be downloaded. This is indicated by the YELLOW LED being on solid.

*It is recommended that you **always** turn off the switch before removing the USB cable.*

11.2 Requirements

A terminal program called **Tera Term** (download link).

11.3 Procedure

11.3.1 Step 1

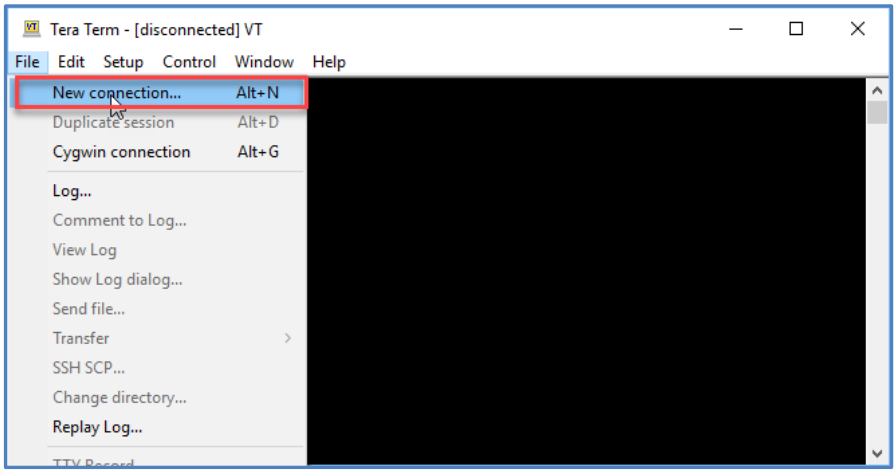
Download and Install the Tera Term application. Turn off the power on the Pet monitor and remove the USB connection cable to the PC. Make sure the PC application for the Pet Monitor is **not** running.

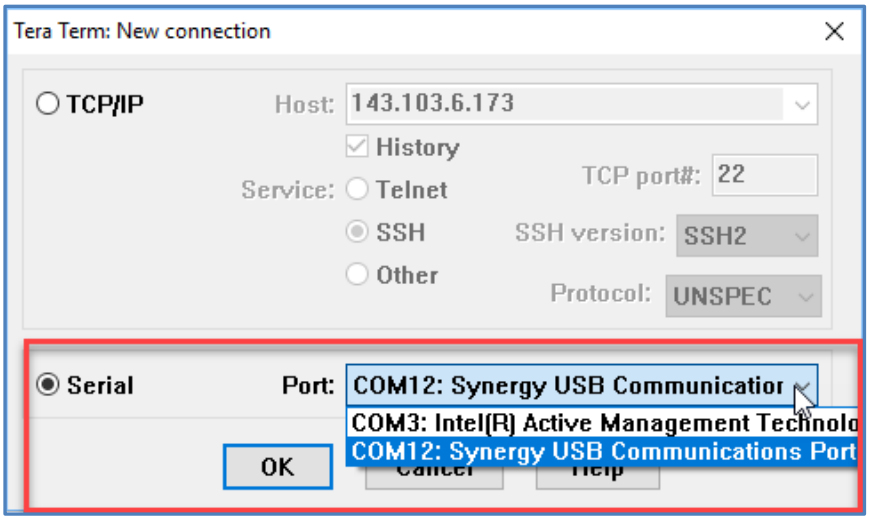
11.3.2 Step 2

Leaving the switch on the Pet Monitor in the **OFF** position, connect the USB cable and the PC should identify the serial port connection.

11.4 Step 3

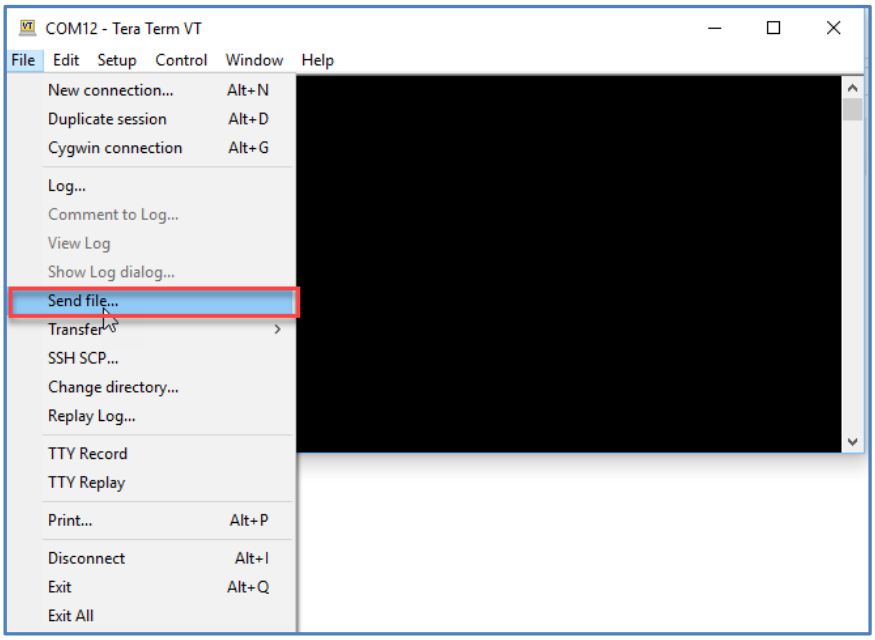
Launch the Tera Term application and open a Serial connection to the Pet Monitors Port.





11.5 Step 4

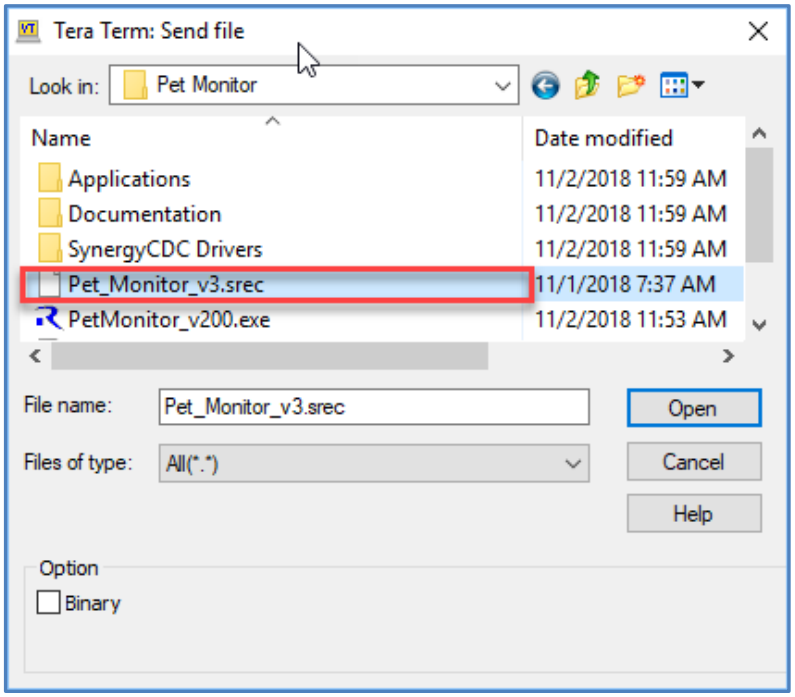
Once connected under the File menu select **Send file…**



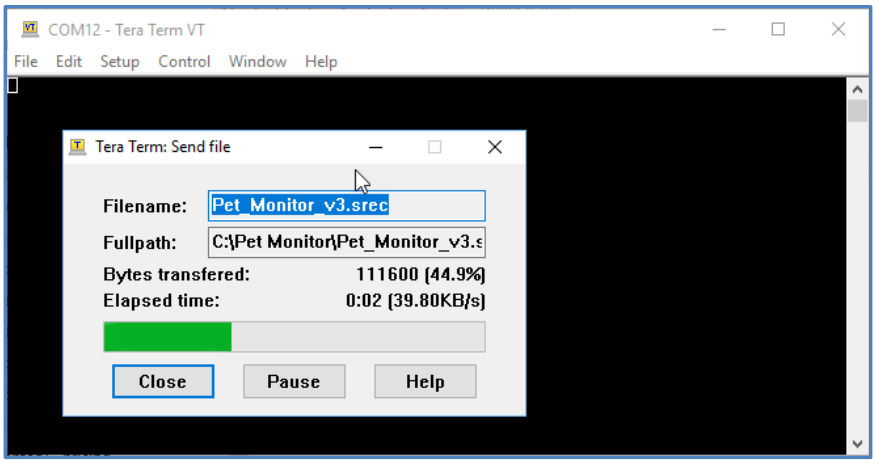
This will open a File Browser dialog box. If you installed using the standard directory then browse to the directory **c:\Pet Monitor**.

11.6 Step 5

Now select the **.srec** file "**Pet_Monitor_V3.srec**" and click the Open button. This will allow the application to send down the programming file.



You will see an indicator of this that will look something like this:



When the programming is completed this box will go away and you can then disconnect from the Pet Monitor with the **Tera Term** application, by selecting File | Disconnect or File | Exit All.

Now your Pet Monitor should be back in normal operation.

Disconnect the USB cable from the unit.

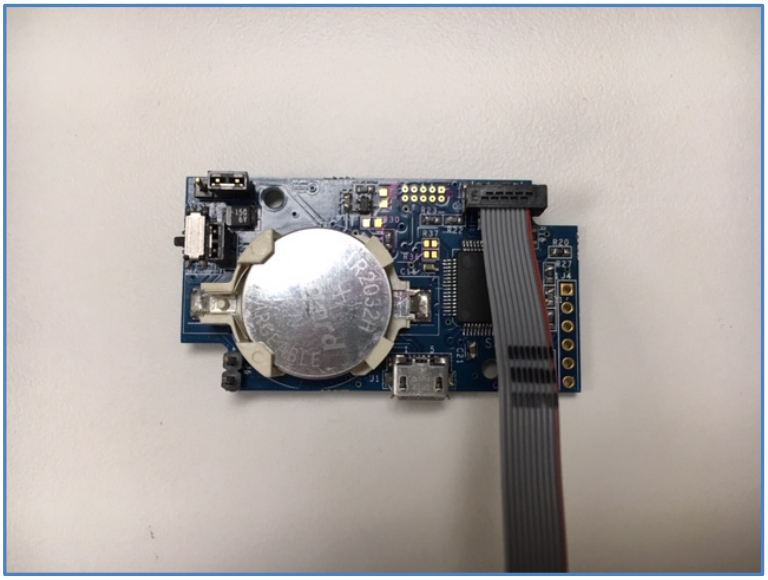
12. Appendix B – Pet Monitor Version 1 vs. Version 2

12.1 General Information

The easiest way to tell if you have version 1 or version 2 is to look at the plastic case. If you have a case that has a black bottom then you have version 1. There is no difference in the hardware, the only difference is in the software programmed into the unit.

The version 2 of the software project using a USB bootloader. This means that a user can change their program by using the e2 studio and the version 2 project and upload the program to the Pet Monitor without the use of a JTAG programmer.

If you have version 1 of the software you can reprogram the unit by using the version 2 project along with a JTAG programmer connected to J2 as shown here.



Version 1 Pet Monitor	Version 2 Pet Monitor
	

Please also note that both version 1 and version 2 projects are included in your installation.

12.2 e² Studio importable projects:

Project file for version 1: S3A3_Pet_Monitor_v1.zip

Project file for version 2: PetMonitor_v3_0x20000.zip

13. Appendix C (Driver installation Notes)

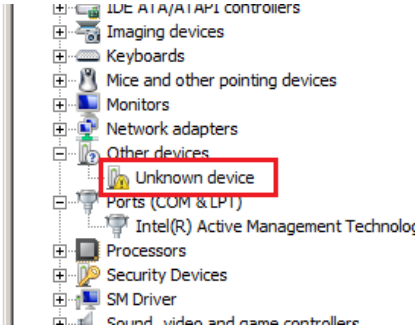
Installing USB CDC drivers in Windows 7/8 and Windows 10

With Windows 10 there is no need for a special driver as this version of Windows will automatically install its own internal USB CDC driver.

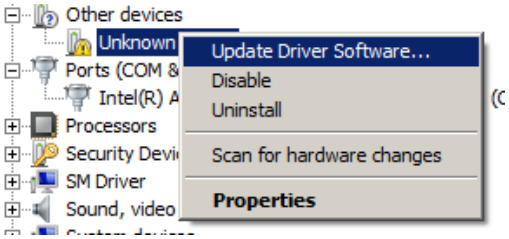
When your host is Windows 7 or Windows 8 you will need to install a driver so that the board can communicate with the target. The drivers are provided in the folder during the installation.

Step 1.1 **Connect the board running the LAB with the USB cable**

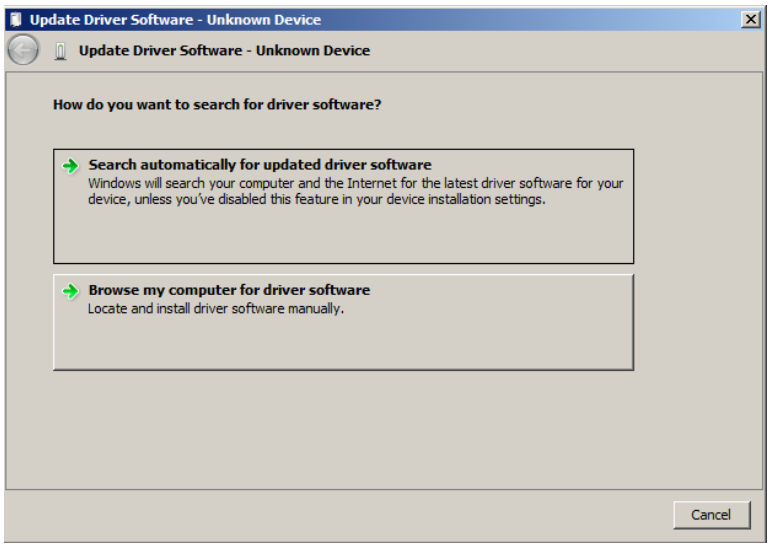
Step 1.2 **The USB device will show up in the Windows device manager as an 'Unknown device'.**



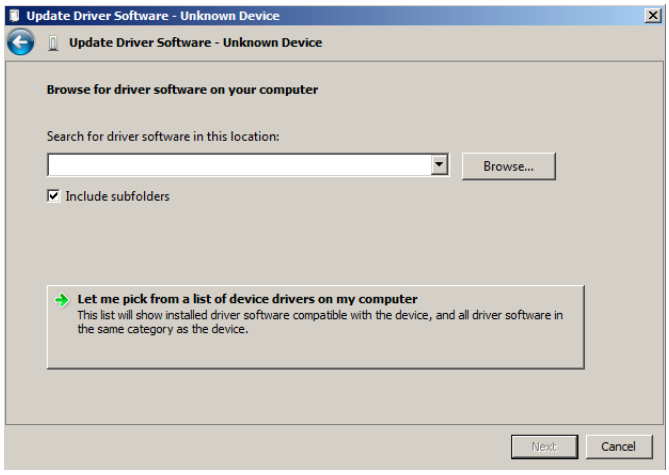
Step 1.3 **To install the drivers in Windows, right click on this device and select Update Driver Software…**



Step 1.4 **Select Browse my computer for driver software.**

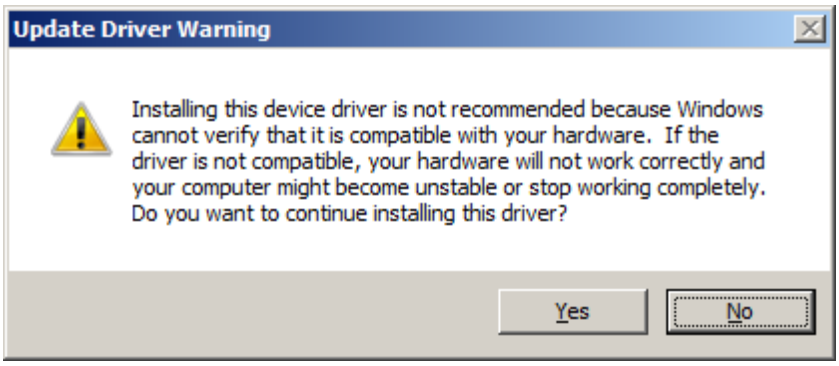


Step 1.1 **Select LET me pick from a list of device drivers on my computer.**



Step 1.2 **Navigate to the C:\Pet Monitor\SynergyCDC Drivers folder where the driver is and click OK then Next**

Step 1.3 **You may see the following message. Click Yes.**



Step 1.4 **Click the check box and click Install**

14. Additional Resources

For more information on how to order this kit from Renesas or from a local distributor, please visit the kit page on our website. In addition to ordering information, you will also be able to download schematics, relevant application projects, technical updates and more. The Out of Box demo that came with this development board can also be found on the kit page, should you ever wish to restore your kit to its default configuration.

- PET MONITOR Kit page: http://www.renesas.com/pet-monitor
- To learn more about Renesas Synergy development tools, MCUs and utilities: https://www.renesas.com/products/synergy.html
- For technical support resources, including access to live chat with a Renesas Synergy Platform expert, visit http://www.renesas.com/contact

Items available through Amazon.
USB Micro-B Cable
CR2032 Battery
LIR2032 Battery

More information on specific Renesas Synergy resources can be found by following the links below.

Synergy Kits - https://www.renesas.com/products/synergy/hardware/kits.html
Synergy Microcontrollers - https://www.renesas.com/products/synergy/hardware/microcontrollers.html
Synergy Software - https://www.renesas.com/products/synergy/software.html
Synergy Solutions - https://www.renesas.com/products/synergy/gallery.html

- The Renesas Synergy Knowledge Base contains many useful articles for Renesas Synergy developers. Renesas Synergy Knowledge Base
- Please also visit our Professor IoT blog for technical articles on the latest additions to the Renesas Synergy platform: Professor IoT Blog
- For regional support resources:
  America - https://renesas.zendesk.com/anonymous_requests/new
  Europe - http://www.renesas.eu/support/index.jsp
  Japan – https://www.renesas.com/ja-jp/support/contact.html

Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Sept 15, 2018	-	Initial release
1.01	Oct 09, 2018	Various	Updated to SSP 1.5.0
1.02	Oct 16, 2018	10	Links have changed / fixed
2.00	Nov 09, 2018	Various	Added Information for bootloader and Appendixes

Demo Kit (PET MONITOR) User's Manual

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Colophon 4.1

Renesas Synergy™ Platform
Demo Kit (Pet Monitor)

Renesas Electronics Corporation