

# MillTemp PT-100 Temperature Monitoring System Manual, v3.0

By

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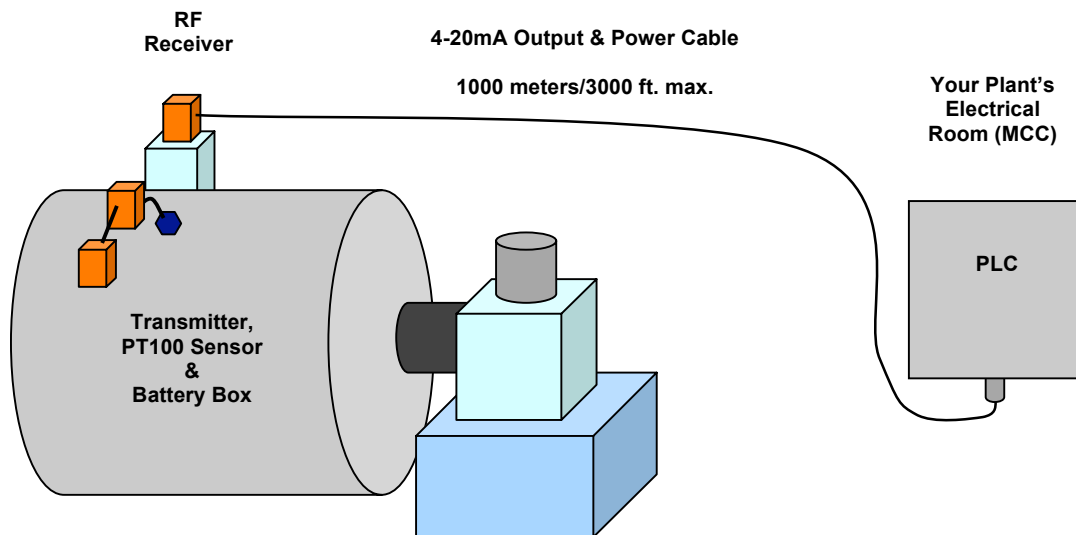
# 1.0 Physical Installation

## 1.1 Introduction

MillTemp is composed of three principle parts: a transmitter unit, a battery box and an RF receiver box. The transmitter and battery box are mounted on the mill shell nearby the PT100 sensor that will be sampled and wirelessly transmitted. The receiver is then mounted on a fixed pole or metal plate approximately 10 meters or closer to the circular path (rotation) traversed by the transmitter on the mill. See Figure 1.

The PT100 sensor is usually placed in the mill diaphragm between chambers and is generally pre-installed by the mill manufacturer.

The system is designed to measure temperature ranging from 0°C to 250°C (100 ohms to 194.0743 ohms). The temperature sensor is sampled, digitally transmitted via a 2.4GHz RF link and finally converted by the receiver to a typical linear 4-20mA output where 4mA corresponds to 0°C and 20mA corresponds to 250°C.

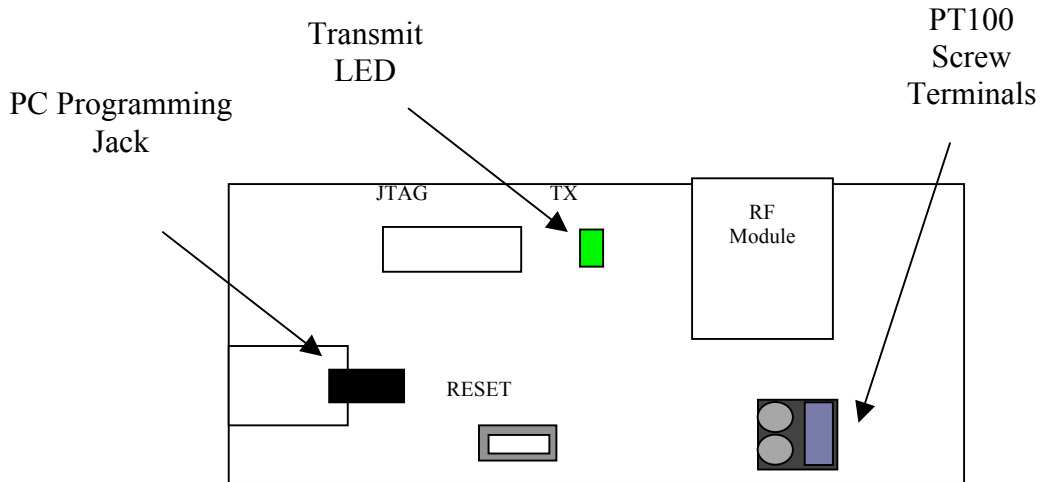


**Figure 1. MillTemp Basic Configuration**

The receiver requires a single four conductor cable where two of the conductors are +24V DC and ground (supplied by the PLC) for receiver power and two conductors for the 4-20mA signal. The 4-20mA signal must also have +24V DC loop power provided at the PLC connection in your MCC room.

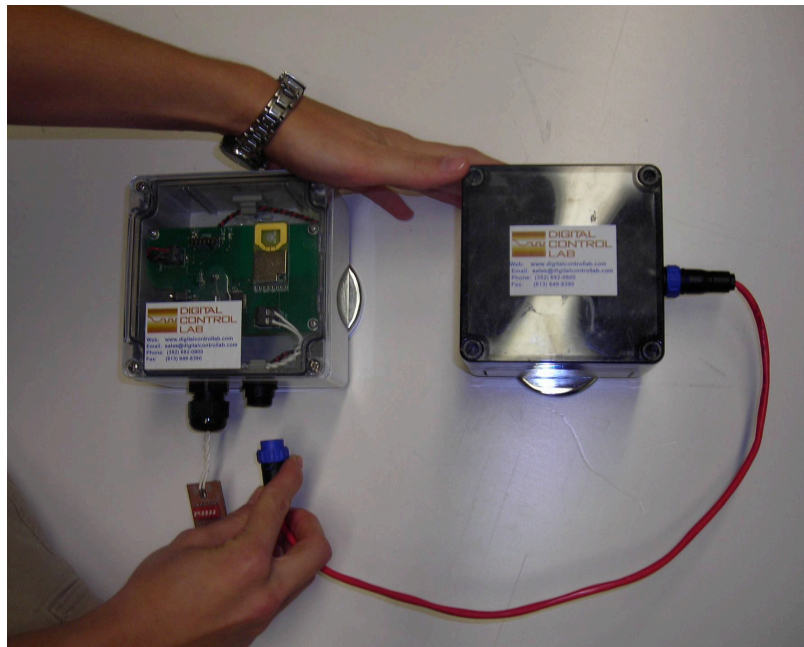
## 1.2 Transmitter Installation Procedure

1. Stop & Lock out the Mill.
2. Remove the top of the transmitter box.
3. Run the PT100 sensor cable through the side cable strain on the transmitter and then connect the two PT100 sensor conductors to the terminal blocks marked resistive input. See Figure 2.

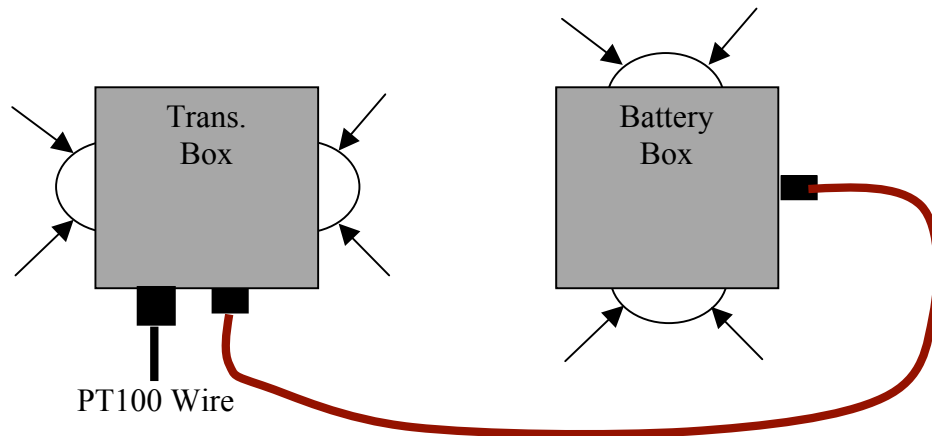


**Figure 2. Transmitter Board**

4. Tighten the PT100 cable strain.
5. Place the battery box (below right) nearby the transmitter & attach the power cable between the transmitter & battery as illustrated below.



6. Press the Reset button.
7. Verify that the transmit communication TX LED (green) flashes briefly every couple seconds (or the interval you programmed if it has been modified from the factory default).
8. Place the cover back on the transmitter.
9. Place the included high temperature mill epoxy (JB Weld or a similar high temperature engine epoxy) around the magnets as shown in Figure 3. There should be four spots (arrows) for each box. This prevents the boxes from migrating due to the high vibration environment. A 1cm arc of epoxy is sufficient at each arrow shown in Figure 3 to prevent the boxes from migrating on the shell of the mill.



**Figure 3. High Temp Epoxy Application**

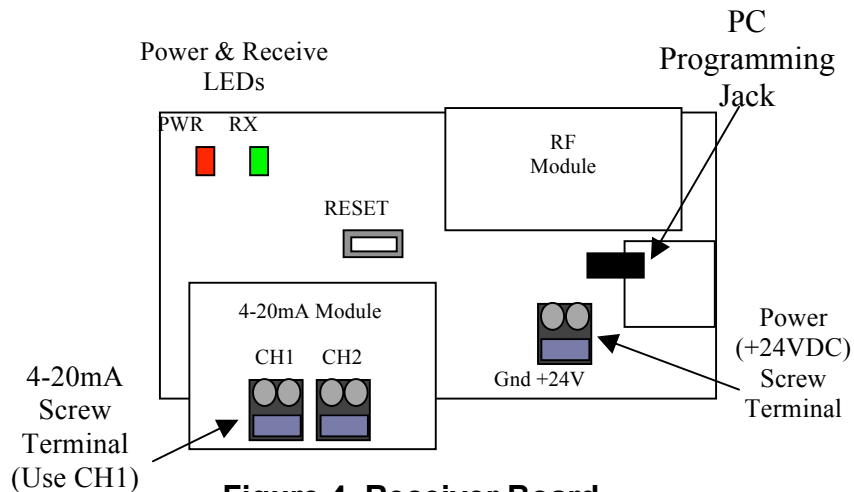
10. Allow the epoxy to set for 2 hours before starting up the mill. A warm or hot mill may be restarted in half this time. Check the epoxy settling time for more information on this subject.

### 1.3 Receiver Installation Procedure

1. Place the receiver on a metal pole or metal plate on a cement pillar nearby (10 meters or less) the receiver path. Do not place metal plates or objects around the receiver. The space around the receiver should be unrestricted (open) to allow complete RF signal transmission & reception with minimal interference.



2. Remove the top plate from the receiver box.
3. Run a four conductor cable through the black cable strain and connect two conductors to +24VDC and GND on the power screw terminal. Connect the remaining two connectors to the +/- 4-20mA screw terminals. See Figure 4.



**Figure 4. Receiver Board**

4. Tighten the cable strain and replace the cover on the receiver.
5. Supply +24VDC & GND to the receiver cable in your electrical room (MCC).
6. Connect the remaining two signals to your 4-20mA input on your PLC.

**Special Note:** ***You must also supply +24VDC to the 4-20mA signals at your PLC. The 4-20mA opto-isolated circuitry in the receiver must be externally (loop) powered by your PLC module (+24VDC switch or fuse).***

7. Press the Reset button in the receiver.
8. Verify that the RED power LED is on inside the receiver.
9. Verify that the receive communication LED flashes every two seconds (or the interval that was programmed into the transmitter if modified from the factory default).

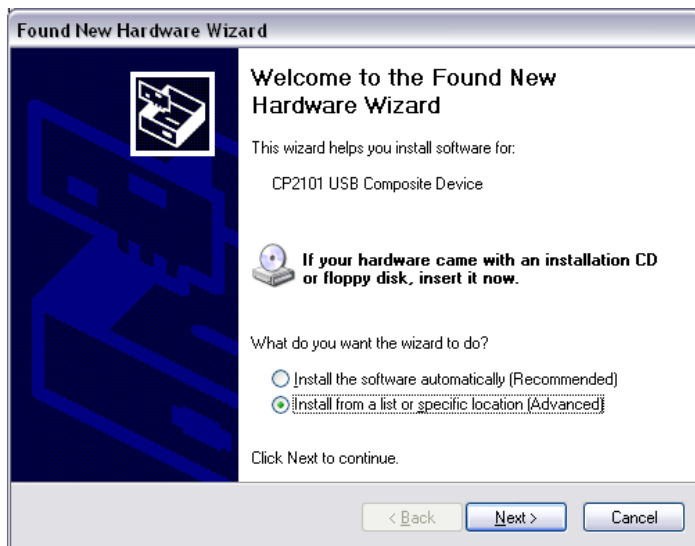
*This ends the hardware installation. The unit is now ready for use and the following driver & software installation is only required if you want to change the two second default sampling period to a slower rate.*

## 2.0 Software

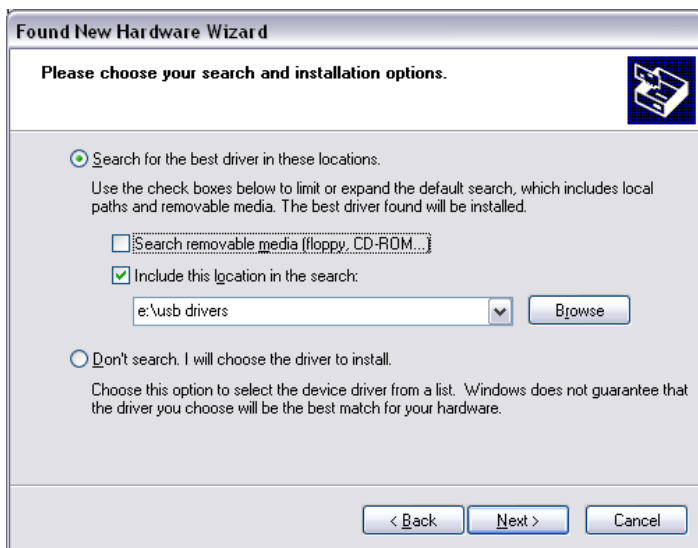
The following driver & software installation section is only required if you desire to change the factory default sampling rate of two seconds to a slower sampling value. If the sampling period of two seconds is acceptable skip this entire “Software” section.

### 2.1 USB Driver Installation

To install the driver, simply plug in the USB/RS485 adapter into an open USB port on your laptop or PC. Windows XP (requires **Service Pack 2**) should automatically detect the device and ask for a driver CD as shown in the next snapshot.



Select the ‘*Install from a list ...*’ option and press ‘*Next>*’. Follow procedure shown in the following Window’s snapshots.

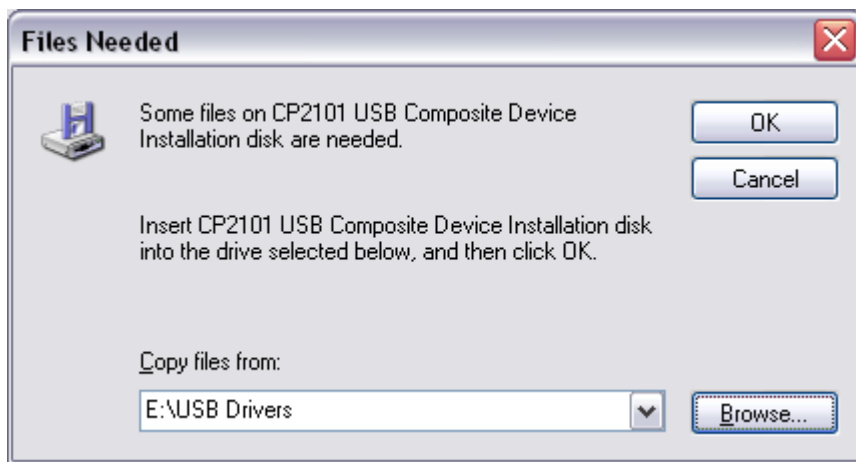


Select the ‘*Search for the best driver ...*’ and ‘*Include this location ...*’ options. Then browse the installation software CD for the directory labeled ‘*usb drivers*’. Select this directory and press ‘*Next>*’ to continue on.





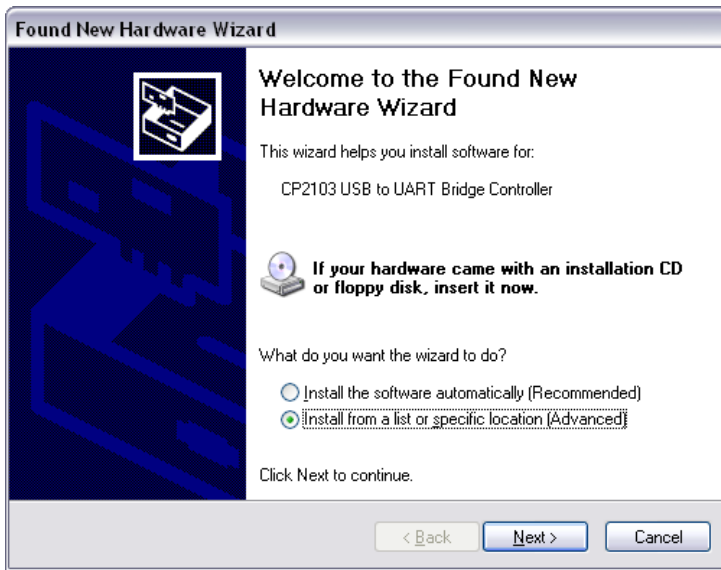
You will now see MicroSoft's warning that the driver manufacturer has not registered the driver officially with MicroSoft (MicroSoft's scam to charge driver manufacturers more money) and so just press 'Continue Anyway'.



Verify that the driver directory 'USB Drivers' shown above is displayed and if it is not shown, use the 'Browse...' button to select this directory on the install CD. Press 'OK' to continue.

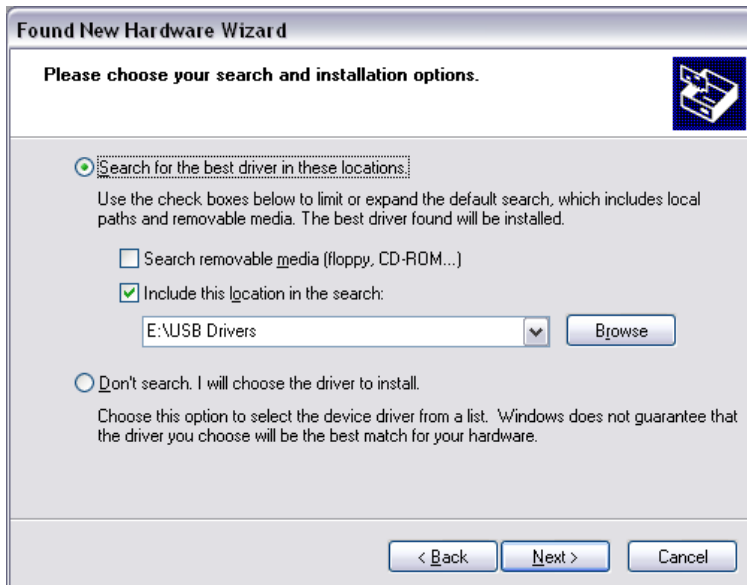


This completes installation of the driver for the USB to RS484 Bridge device. Press 'Finish' to continue.



**DO NOT 'Cancel'**. You now must go through the process one more time to install the driver for USB Virtual Com Port driver needed for your laptop or PC. You should now see the following windows and **MUST PERFORM THIS TYPICAL DRIVER INSTALLATION ONE MORE TIME**.

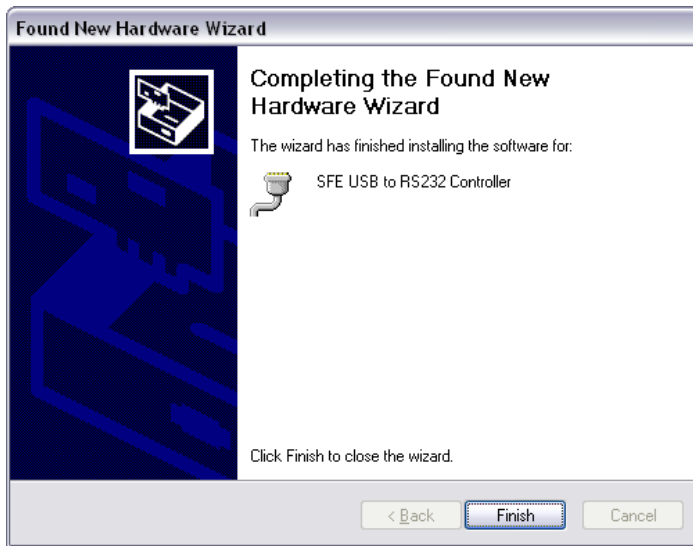
Select the 'Install from a list ...' option and press 'Next>'. Follow through now as shown in the following Window's snapshots.



Verify that the driver directory 'USB Drivers' shown above is displayed and if it is not shown, use the 'Browse...' button to select this directory on the install CD. Press 'Next >' to continue.



Press 'Continue Anyway'.



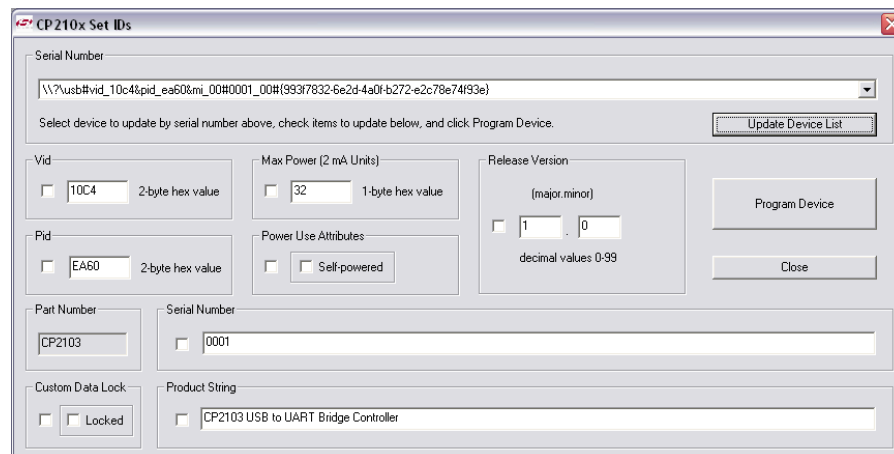
This completes the driver installation for both the USB/RS485 Adapter and Virtual COM Port. Press 'Finish' to continue.

## 2.2 USB Adapter Driver Verification of Installation

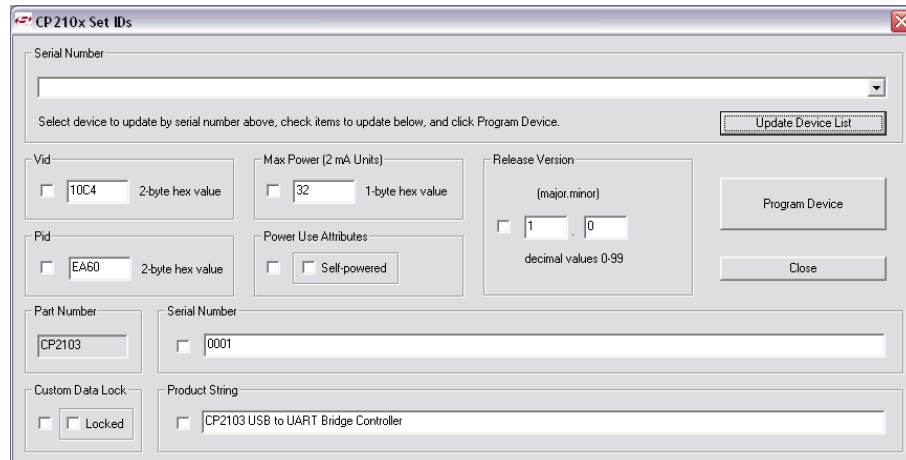
Upon completion of the driver installation, check to see if the device shows up under the 'ports' listing in the Window's system hardware window. This is performed by right clicking the 'My Computer' icon, select 'properties', select the 'Hardware' tab, select the 'Device Manager' button and then finally scroll down and open 'Ports (COM & LPT)'.

You should see **SFE USB to RS232 Controller (COM x)**; where x is COM port assigned to the new adapter. *Note: The IC used in the USB/RS485 adapter is actually a USB/RS232 bridge and we have added interface hardware to convert from RS232 to RS485.*

Another test to see if the driver is functional is the adapter detection utility, **CP210xSetIDs.exe**, found on the software installation CD in the 'USB Detect Utility' directory. Upon running this utility, if an adapter has been found in the system, the 'Serial Number' field will have a long string indicating the device & manufacturer IDs as shown below.



## Adapter Found & Registered in Windows (above)

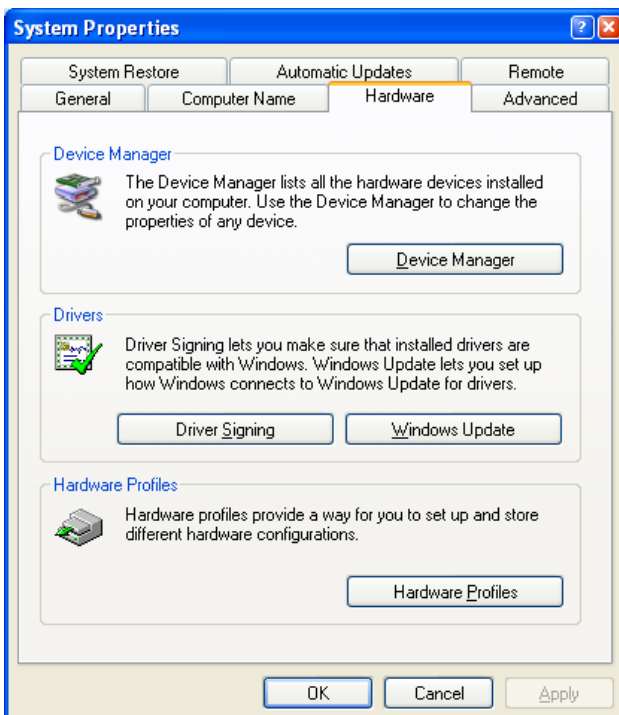


## No Adapter Found (Serial Number field is blank)

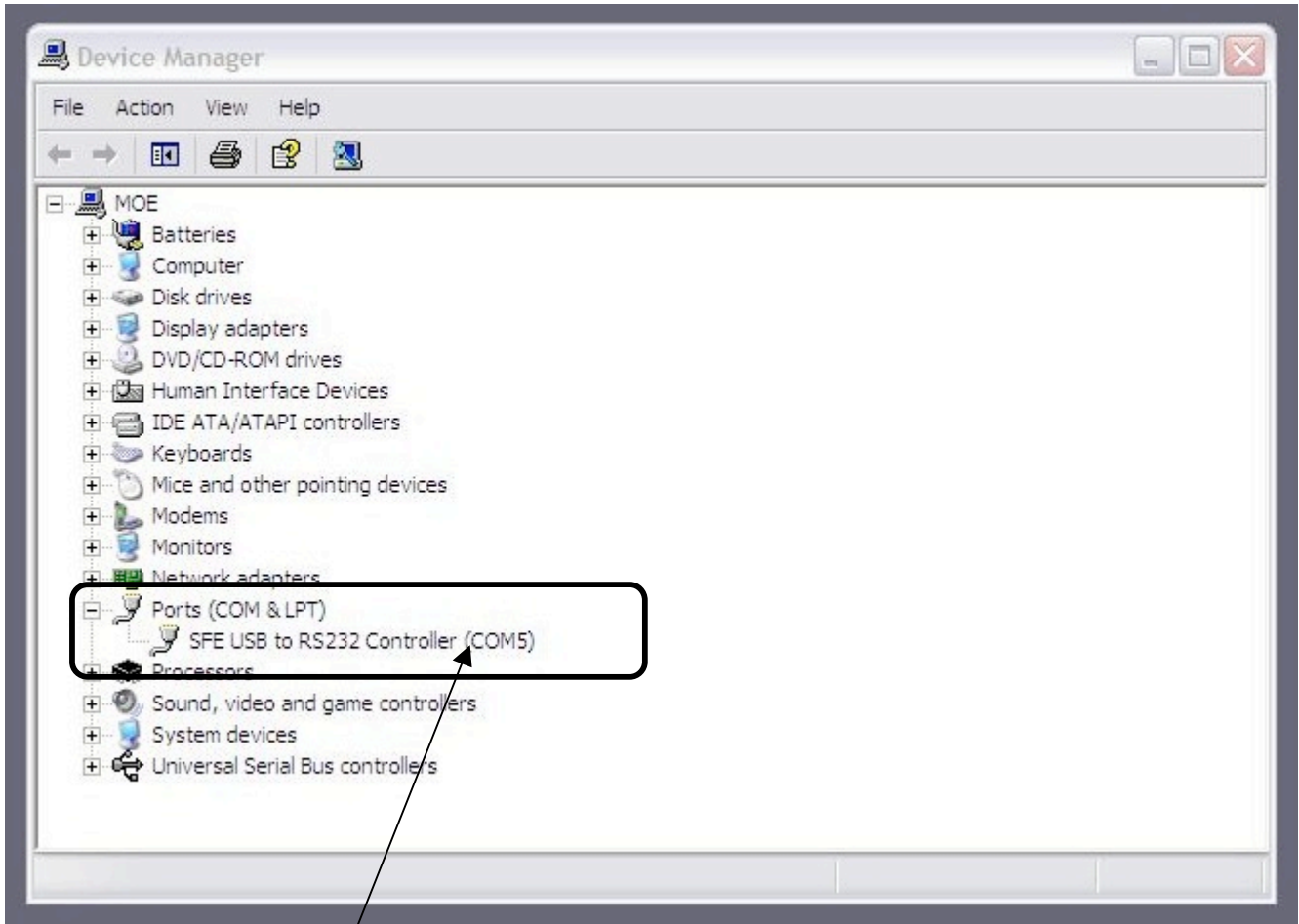
If no adapter is found, try re-plugging the adapter in/out the USB port and re-running this application. As a final option, un-install the driver and re-install according to section 2.1.

## 2.3 Identifying the COM Port

1. Ensure the USB driver has been installed.
2. Click **Start**
3. **Right Click** on **My Computer**
4. Click on **Properties** and a **System Properties** will appear. Click on **Hardware** tab.

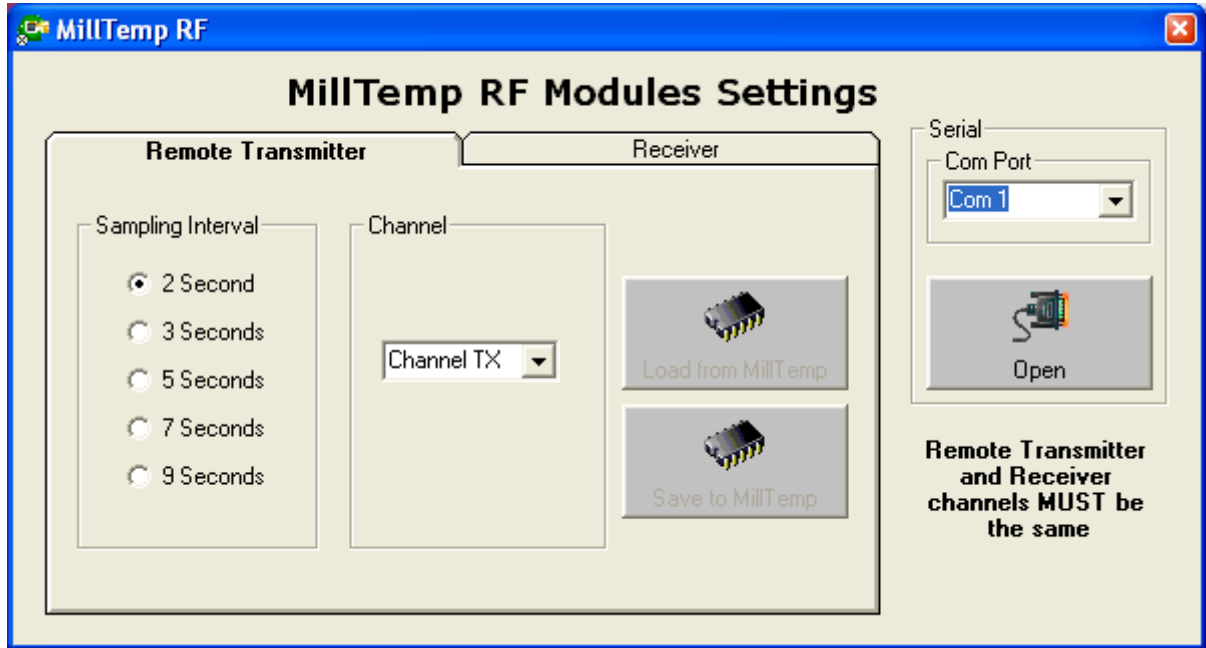


5. Click on **Device Manager** and a Device Manager will appear as shown in the figure below

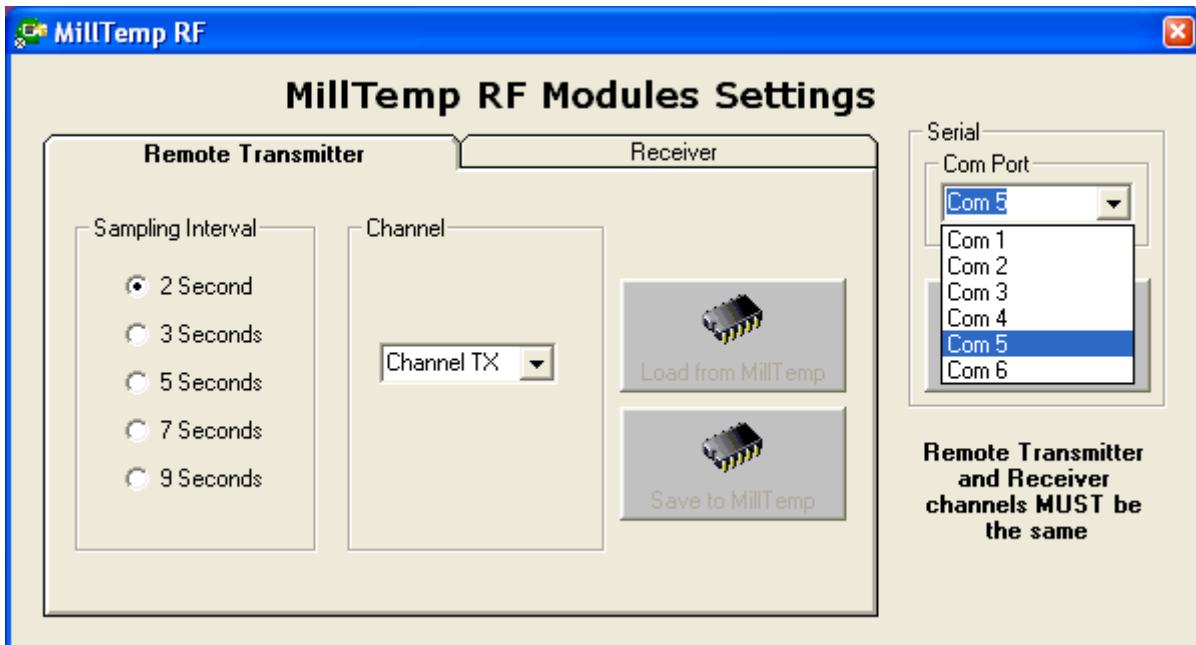


6. Observe the **COM Port Number** and write it down. Example shown has COM5; however, it may differ for your computer.

## 2.4 Using the MillTemp PC Software to Alter the Default Receiver/Transmitter Settings



1. Ensure MillTemp Transmitter and Receiver have power.
2. Remove the top of the transmitter box.
3. Insert programmer into USB port.
4. Insert programmer cable into the jack illustrated in Figure 2.
5. Launch MillTemp RF software (ensure steps 3 and 4 are done first).

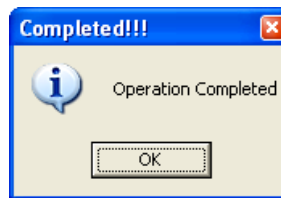


6. Select the **COM Port** from the Serial pull down menu. See Section 2.3 *Identifying the COM Port* to identify the required COM Port for your computer.

- Click **Open**. If the wrong COM Port was selected, the following error stating **Invalid Port Number** is displayed. Please refer to Section 2.3 to verify/obtain the proper COM Port assigned to the driver.



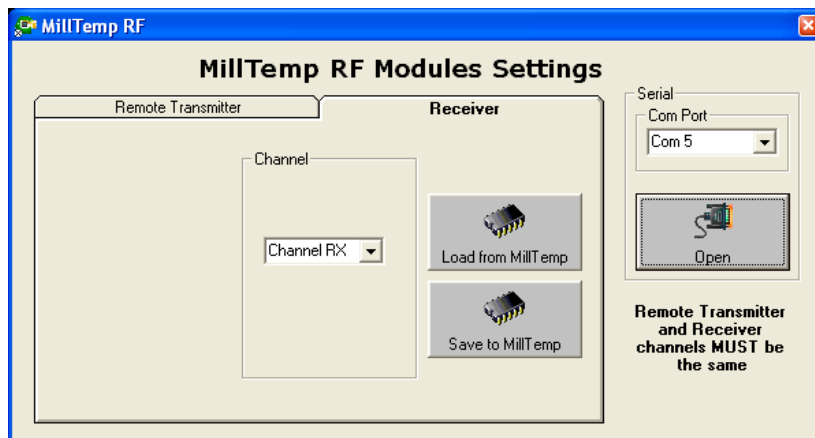
- Select the **Remote Transmitter** tab.
- Click **Load from MillTemp**. If successful, the **Operation Completed** message is displayed as shown below.



- The current settings preloaded in the MillTemp unit are now displayed in the software.
- Select the new desired sampling rate or transmitter channel setting.
- Click **Save to MillTemp**. If programming is successful, the **Operation Completed** message is shown as given in #9.
- The MillTemp transmitter is now programmed and ready to be unplugged.

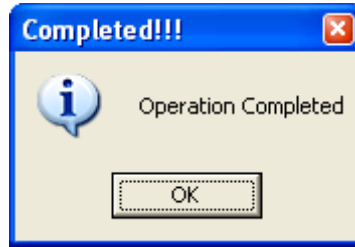
**NOTE: If the MillTemp Transmitter's RF channel has been changed, you must match it on the receiver. Steps 14-23 describe how to match the receiver RF channel to the new transmitter channel. If you have not modified the Transmitter's RF channel you can skip steps 14-23.**

- Plug programming jack into the MillTemp Receiver unit as illustrated in Figure 4.
- Relaunch the MillTemp PC software.
- Select the **COM Port** from the Serial pull down menu. See Section 2.3 *Identifying the COM Port* to obtain the required COM Port.
- Click **Open**.



18. Select the **Receiver Tab**.

19. Click **Load from MillTemp**. If successful, the **Operation Completed** message will be shown as illustrated below.



20. Select the same Channel number that was programmed in the Transmitter from the pull down menu. It is crucial that the Channels are exactly the same for both Transmitter and Receiver to communicate properly.

21. Click **Save to MillTemp**.

22. Make sure that the **Receiver RX LED** blinks periodically to the expected sampling interval. If the LED is not blinking, the channels have not been properly programmed on either the transmitter or receiver. To fix this, repeat steps 1-21 to program both the receiver and transmitter to the same RF channel.

23. Once the Receiver RX LED is blinking periodically, the transmitter & receiver are ready for temperature measurement.

### 3.0 FAQ (Frequently Asked Questions)

1. Why is the transmitter LED not blinking?

Unplug the battery connector and reconnect it to ensure a tight/secure connection. Press RESET and observe the LED again. In necessary, also verify that 3.6V DC is present at the transmitter power terminals inside the box.

2. Why does the receiver LED does not blink?

One possibility is that the transmitter is out of range. Try moving the receiver closer to the transmitter. Ensure the Transmitter has a clear unobstructed 'line-of-sight' path to the receiver. If moving the transmitter doesn't work, open the receiver and try RESETing both the receiver and transmitter.

3. The 4-20mA is not responding?

Check the wiring for the 4-20mA. Verify the positive and negative connections to the transmitter's 4-20mA board are the proper polarity. If the wiring is in place and the green LED on the 4-20mA module (inside the transmitter) is on, the 4-20mA board may be faulty and require replacement.



## 4.0 Specifications

### 4.1 Transmitter & Battery Specifications

The transmitter, battery and receiver are housed in high impact air & water tight ultra-durable ABS plastic boxes. The size of this box is 10x10x10 cm (4x4x4 inches).

Battery life is estimated to be 5-7 years and consists of multiple Lithium Thionyl Chloride 3.6VDC cells connected in parallel to form a single 3.6VDC battery pack.

After 5 or more years, when the transmitter battery drains too low, RF communication will cease operation and the TX green LED will remain on forever signaling that the battery pack needs to be changed.

### 4.2 Receiver Specifications

The transmitter/receiver RF communication is a robust digital 2.4 GHz band signal. The frequency channels are user configurable via the supplied programmer & PC software.

The cable from the receiver can be up to 1000 meters (~3000 feet) long. The four conductors should be 16 gauge/1.5mm in diameter. Another suggested cable that can be used is standard Ethernet (8) conductor cable. If you use this cable, use two conductors for the 4-20mA signals and the remaining (6) conductors for +24VDC (3 conductors) and GND (3 conductors).

### 4.3 PT-100 Specifications

The PT-100 sensor should have the following specifications:

1. 100 Ohms resistance at 0°C
2. European curve A = 0.00385 ohms/ °C. Section 5.0 has a complete PT-100 Temperature vs. Resistance table corresponding to this slope.

An Example of an Industrial type sensor can be found at:

[www.Omega.com](http://www.Omega.com)

**Part #: PR-14-2-100**

Note: For non-preinstalled PT-100 sensors, the mill diaphragm should have a threaded port to screw in the PT-100 sensor in from the outside. If the mill was not prepared for a PT-100 sensor upon purchase, it will need to be added and is a difficult but common task. Consult your own company's corporate technology center for more information on this subject.

## 5.0 Temperature vs. PT-100 Resistance Table

°C	0	1	2	3	4	5	6	7	8	9	°C
0	100	100.3907	100.7814	101.1719	101.5623	101.9526	102.3427	102.7328	103.1227	103.5125	0
10	103.9022	104.2918	104.6813	105.0706	105.4599	105.849	106.238	106.6269	107.0156	107.4043	10
20	107.7928	108.1813	108.5696	108.9578	109.3458	109.7338	110.1216	110.5094	110.897	111.2845	20
30	111.6718	112.0591	112.4463	112.8333	113.2202	113.607	113.9937	114.3802	114.7667	115.153	30
40	115.5392	115.9254	116.3113	116.6972	117.083	117.4686	117.8541	118.2395	118.6248	119.01	40
50	119.3951	119.78	120.1648	120.5495	120.9341	121.3186	121.703	122.0872	122.4713	122.8554	50
60	123.2392	123.623	124.0067	124.3902	124.7737	125.157	125.5402	125.9233	126.3063	126.6891	60
70	127.0718	127.4545	127.837	128.2194	128.6016	128.9838	129.3658	129.7478	130.1296	130.5113	70
80	130.8928	131.2743	131.6556	132.0369	132.418	132.799	133.1799	133.5606	133.9413	134.3218	80
90	134.7022	135.0825	135.4627	135.8428	136.2227	136.6026	136.9823	137.3619	137.7414	138.1207	90
100	138.5	138.8791	139.2582	139.6371	140.0159	140.3945	140.7731	141.1515	141.5299	141.9081	100
110	142.2862	142.6642	143.042	143.4198	143.7974	144.1749	144.5523	144.9296	145.3068	145.6838	110
120	146.0608	146.4376	146.8143	147.1909	147.5673	147.9437	148.3199	148.696	149.0721	149.4479	120
130	149.8237	150.1994	150.5749	150.9504	151.3257	151.7009	152.0759	152.4509	152.8257	153.2005	130
140	153.5751	153.9496	154.324	154.6982	155.0724	155.4464	155.8203	156.1941	156.5678	156.9414	140
150	157.3149	157.6882	158.0614	158.4345	158.8075	159.1804	159.5531	159.9258	160.2983	160.6707	150
160	161.043	161.4152	161.7872	162.1592	162.531	162.9027	163.2743	163.6458	164.0172	164.3884	160
170	164.7596	165.1306	165.5015	165.8723	166.2429	166.6135	166.9839	167.3542	167.7245	168.0945	170
180	168.4645	168.8344	169.2041	169.5737	169.9432	170.3126	170.6819	171.0511	171.4201	171.789	180
190	172.1579	172.5266	172.8951	173.2636	173.6319	174.0002	174.3683	174.7363	175.1042	175.4719	190
200	175.8396	176.2071	176.5746	176.9419	177.309	177.6761	178.0431	178.4099	178.7766	179.1432	200
210	179.5097	179.8761	180.2424	180.6085	180.9745	181.3405	181.7063	182.0719	182.4375	182.8029	210
220	183.1683	183.5335	183.8986	184.2636	184.6284	184.9932	185.3578	185.7223	186.0867	186.451	220
230	186.8152	187.1793	187.5432	187.907	188.2707	188.6343	188.9978	189.3611	189.7244	190.0875	230
240	190.4505	190.8134	191.1762	191.5389	191.9014	192.2638	192.6262	192.9884	193.3504	193.7124	240
250	194.0743	194.436	194.7976	195.1591	195.5205	195.8818	196.2429	196.604	196.9649	197.3257	250
°C	0	1	2	3	4	5	6	7	8	9	°C

## 6.0 Contact Information

### Technical Sales

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