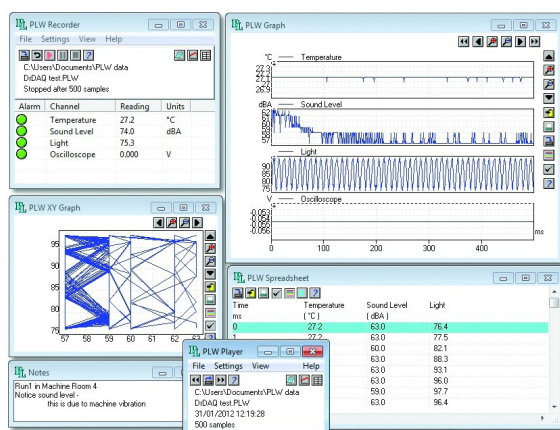


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## 1. Introduction

This FAQ aims to help PicoLog Data Logger users troubleshoot and solve common issues, in addition to providing device-specific setup information. The *Related Documents* section contains links to electronic versions of User's Guides that can be accessed from our website. Should you require any further information or assistance, please contact our Technical Support team:

Email: support@picotech.com  
Tel. (UK): +44 (0) 1480 396395  
Tel. (USA): +1 800 591 2796  
Skype: pico\_tech\_support

## 2. PicoLog does not recognize my device

If the logger has worked before on this PC, it might be that the correct USB driver for the logger has been corrupted. If this is a new installation, it is more likely that you plugged the logger into the USB port before loading the PicoLog software. Windows then tries to load a generic driver which will not work. It will not be overwritten by the correct driver until the wrong driver has been uninstalled.

Please try this: Plug in the logger and then go to Windows **Device Manager** (Windows XP: **Control Panel > System** and then look in the **Hardware** tab; Windows Vista/7/8: right-click **Computer**, select **Properties** then click the **Device Manager** link; Windows 10: right-click the **Start** button and select **Device Manager**).

If there is an "Unknown USB device" anywhere in the list or, under either "Pico Technology Instruments" or "Universal Serial Bus Controllers", a "Pico USB [xxxx] data logger" with a yellow warning triangle, click it once to highlight it and then right-click to bring up a list from which select **Uninstall**. Once that is done, unplug the logger and then plug it back in again. The Windows **New Hardware Found Wizard** will run. Follow the on-screen instructions and, if the wizard asks to connect to Windows Update, select **No** and allow Windows to automatically detect and configure your logger.

Note to Windows XP users: During installation, if Windows displays a warning message about Windows Logo testing, click **Continue Anyway** to complete the installation.

When plugged in, the logger should show up in the **Windows Device Manager** again either under a **Pico Technology Instruments** sub-item or under **Universal Serial Bus controllers** as shown below.

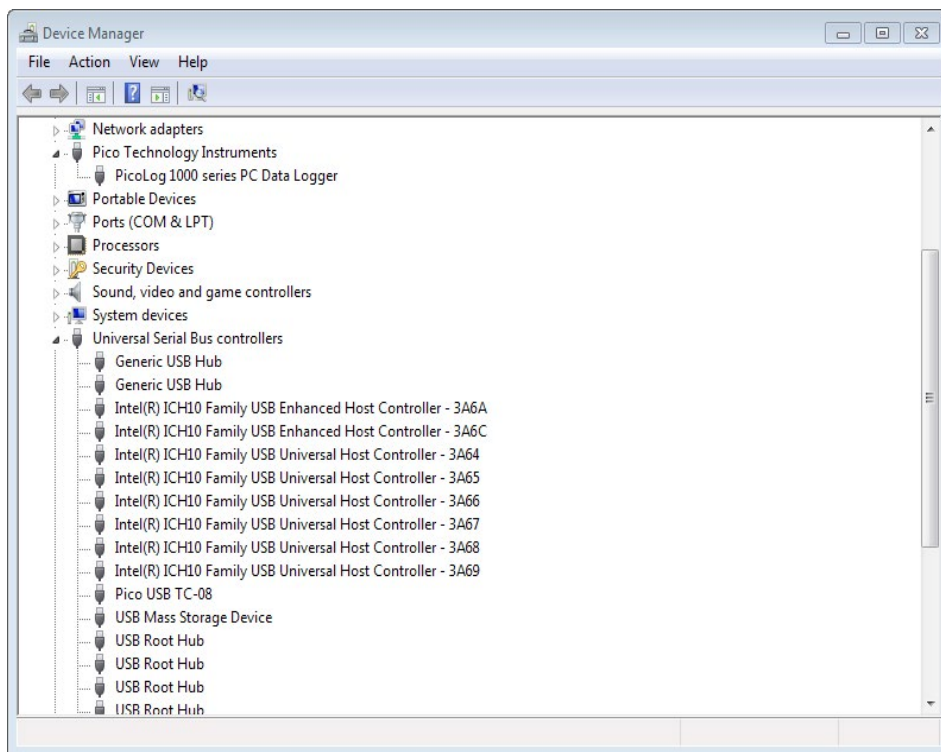


Figure 1.1 – Windows Device Manager showing PicoLog 1000 and USB TC-08 Data Loggers

If the drivers have installed correctly, your PicoLog software should now work. You should not need to reboot the PC.

If PicoLog still does not recognize your logger, you may have installed it incorrectly or for the wrong device. Please rerun your PicoLog installation file, select **Remove** when you are asked to select **Repair, Modify or Remove**. After removal, rerun the installer to install a fresh copy and when asked **For which device do you wish to install** select the primary device which you use with PicoLog. Also, for maximum compatibility, check the small box for **Install for other devices**. This will load all the other drivers for all other Pico loggers and allow you to select them if you need to use them with PicoLog at a later date. That should sort things out.

If there is still a problem with the settings of your PC that is preventing PicoLog from being installed, you will need to send an installation log file to enable us to work out the problem. Here is how to generate an `Install.log` file:

Create a `C:\Temp` directory and copy the `PicoLog_R5_23_0.exe` download file into it (or the latest version available). Make sure that the logger is not plugged into the PC. Now go to the Windows **Start** button, then select **Run** and in the command-line box copy and paste the following:

```
C:\Temp\PicoLog_R5_23_0.exe /v"/L Install.log"
```

Click **OK** and PicoLog will start to install in the usual way. At the end, whether the software has installed properly or not, there will be an `Install.log` file in the `C:\Temp` directory. Please email that file to us at the above address and we can then see what has gone wrong with the installation.

### 3. Finding the PicoLog software version

Click **Help > About**. The release number will then be displayed.

Visit the **Downloads** section of [www.picotech.com](http://www.picotech.com) to find the version of PicoLog that supports your data logger and operating system.

### 4. If PicoLog crashes on start-up

If the software crashes as soon as you start up it is probably because of some illegal, corrupted, setting in your `plw.ini` file. When you first run PicoLog, it creates a file called `plw.ini` and tries to save it in its working directory:

- `C:\Program Files\Pico Technology\Pico Full (32-bit operating systems)`
- `C:\Program Files (x86)\Pico Technology\Pico Full (64-bit operating systems)`

PicoLog uses this file to hold information about the preferences you set when running the program. Locate the `plw.ini` file in the above folder and delete it.

If you still have problems starting PicoLog, it could be that there is a second copy of `plw.ini` in a hidden directory under `Application Data` or `AppData`. This will need to be deleted as well.

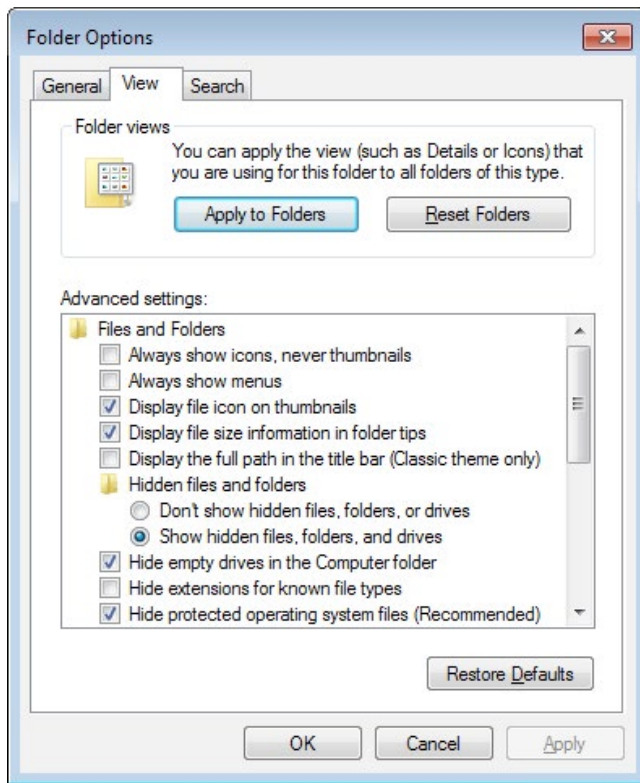
To access the `Application Data` or `AppData` folder and subfolders, you must enable the option within Windows to view hidden folders:

Windows XP:

- Go to `C:\Documents and Settings\` in Windows Explorer
- Click **Tools > Folder Options...**

Windows Vista/7:

- Go to `C:\Users\` in Windows Explorer
- Click **Organize** and select **Folder and search options**
- Click the **View** tab, then under **Hidden Files and Folders**, click the checkbox to **Show hidden files and folders**, and click **OK**:



Windows 8/10:

- Click the **View** tab and ensure that the **Hidden items** option is checked.

If you navigate to the following folder on your PC:

Windows XP:

C:\Documents and Settings\\Local Settings\Application Data\Pico Technology\

Windows Vista/7/8/10:

C:\Users\\AppData\Local\Pico Technology\

you will find one or more folders there with long numeric names. Look through each of them for `plw.ini` and delete it.

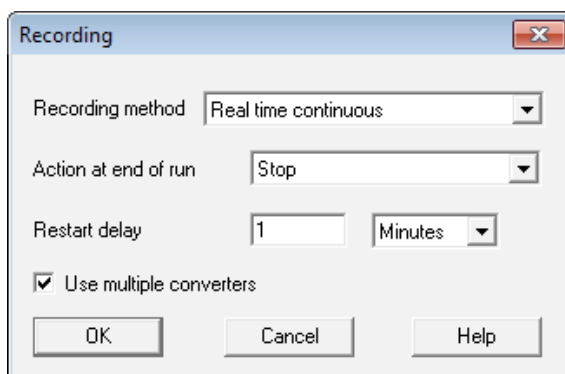
If deleting `plw.ini` does not fix the problem, you can also try creating backup copies of `Recorder.pls` and `Player.pls` and then deleting them from the above folders.

Having done all the above, it would be best to go back to Explorer and select **Do not show hidden files and folders**.

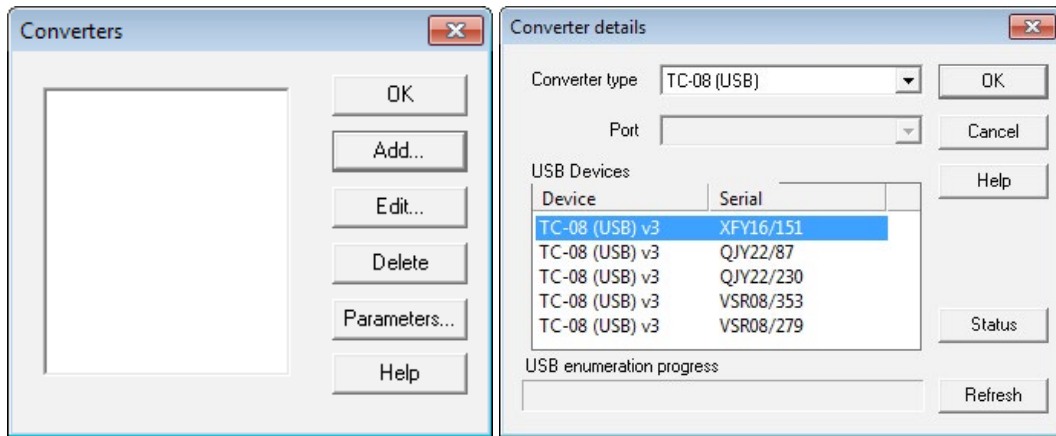
## 5. How do I record data from multiple devices?

Multiple identical or different loggers can be used at the same time on one PC running under one instance of PicoLog. Here are example instructions how to use, for instance, five TC-08 loggers at a time:

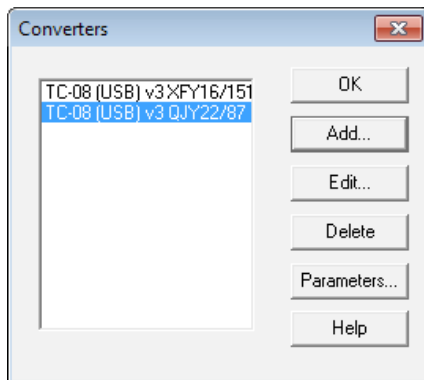
1. Plug in five TC-08s through a powered USB hub. Start up PicoLog. Select **File**, then **New Settings**. In the **Recording** dialog box, check the box for **Use multiple converters**.



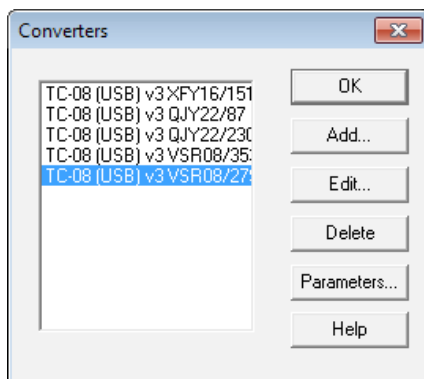
- Continue to the **Converters** dialog and select **Add**. This will take you to the **Converter Details** box where you select **TC-08 (USB)**. PicoLog should find all the data loggers.



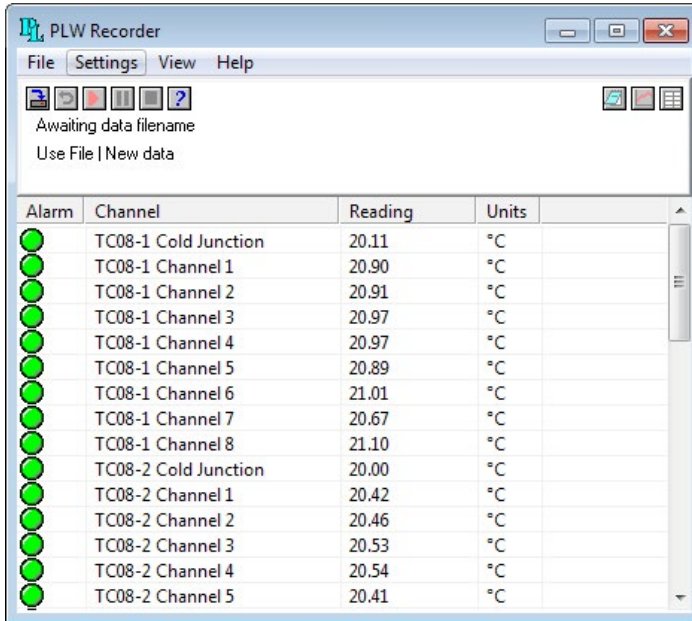
- Click the first one shown in the **USB Devices** box and click **OK**. You will be returned to the **Converters** dialog where you click **Add** again. This will take you to the **Converter Details** box where you select **TC-08 (USB)** for the second time.
- When the second TC-08 is found, click **OK**. This will return you to the **Converters** dialog where two USB TC-08 devices should be shown.



- Repeat steps 3 and 4 until all five USB TC-08 devices are found.



6. Click on **Parameters** to set up each individual channel, for each TC-08, one at a time. All five TC-08s will now behave as if they are one 40-channel data logger.



The screenshot shows the PLW Recorder application window. At the top, there is a menu bar with 'File', 'Settings', 'View', and 'Help'. Below the menu bar is a toolbar with several icons. The main area of the window contains a table with the following data:

Alarm	Channel	Reading	Units
●	TC08-1 Cold Junction	20.11	°C
●	TC08-1 Channel 1	20.90	°C
●	TC08-1 Channel 2	20.91	°C
●	TC08-1 Channel 3	20.97	°C
●	TC08-1 Channel 4	20.97	°C
●	TC08-1 Channel 5	20.89	°C
●	TC08-1 Channel 6	21.01	°C
●	TC08-1 Channel 7	20.67	°C
●	TC08-1 Channel 8	21.10	°C
●	TC08-2 Cold Junction	20.00	°C
●	TC08-2 Channel 1	20.42	°C
●	TC08-2 Channel 2	20.46	°C
●	TC08-2 Channel 3	20.53	°C
●	TC08-2 Channel 4	20.54	°C
●	TC08-2 Channel 5	20.41	°C

The data from all channels is saved to the data file, and **Recorder** view can display all the channels at once. Only 20 channels can be displayed at any one time in **Graph** and 16 channels in **Spreadsheet** view. (Viewing more than 16 to 20 channels at a time would be difficult to interpret).

You need to define multiple groups of channels, no more than 20 (or 16) at a time from the channels you have. You can then at any time call up these groups for viewing, in quick succession. See the description of the **Select Parameters** dialog in the *PicoLog User's Guide* for how to set up a group.

In the **Recorder** view you can choose which of the groups you display by selecting **Settings > Monitor** and then, in the **Select Parameters** dialog, select the required group. (You can leave it set to display all channels in the recorder main window.) When viewing in **Graph**, select 20 or 16 channels at a time and when in **Spreadsheet** select just blocks of 16.

You can make up additional groups by selecting the channels you require using the **Select Channels** button and saving with a new group name. Use the different groups to switch between the different channels to be viewed. Be aware that sometimes in **Graph** view the new group cannot be fully drawn until you zoom in or out or stretch the window to force a redraw. For the groups to be saved with the data file, the groups must be set up before recording, not after.

Note: If you are looking to use different types of PicoLog data logger devices (such as a USB TC-08 and ADC-20), ensure that the checkbox to **Install for other devices** is selected in the **Default Device Selection** dialog during the PicoLog installation process.

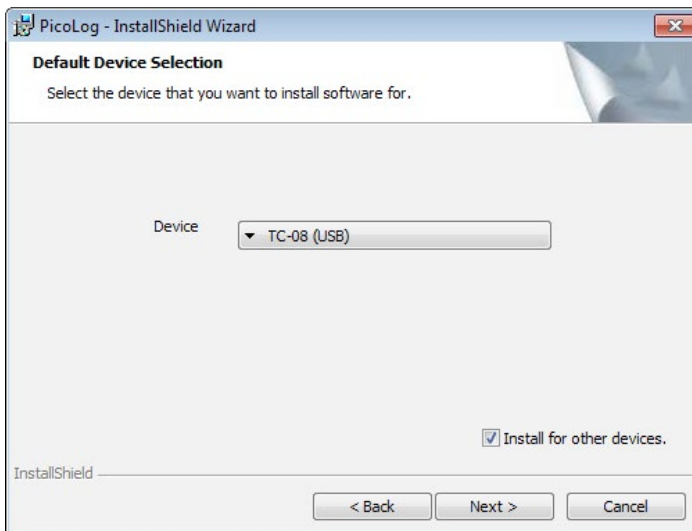


Figure 1.2 – PicoLog Installer: default device selection

If this option was not selected, it will be necessary to reinstall the software.

## 6. What power settings should my PC have?

If, for any reason, the USB port shuts down because of Windows settings for power saving, the logger will freeze and the logged file will probably be corrupt. Please ensure that all power-saving and screensaver settings are turned off in Windows.

For instance, in Windows XP:-

**Control Panel > Power Options > Turn off hard disks = Never**

Windows Vista/7/8:

**Control Panel > Hardware and Sound > Power Options > Change plan settings** to edit the power settings. Set **Put the computer to sleep** to **Never**.

and then:

**Device Manager > Universal Serial Bus Controllers > USB Root Hub (multiple instances) > Properties (right click) > Power management** > uncheck **Allow the computer to turn off this device to save power**

Windows 10:

Right-click the **Start** button > **Power Options > Change plan settings** and proceed as above for Windows 8.

and then:

Right-click the **Start** button > **Device Manager** and proceed as above for Windows 8.

## 7. Installing PicoLog 5.23 over PicoLog 5.16

It is best to uninstall R5.16.2 and then install R5.23.x so that auto-reconnect will still work.

## 8. When starting PicoLog, you get Player and not Recorder

If, when running PicoLog, you minimize the **Recorder** window, it will shrink to a small **PL** logo near the right-hand end of the toolbar:



Figure 7.1: PicoLog icon in System Tray

After a short while, the icon may disappear – expand the System Tray to locate the icon:

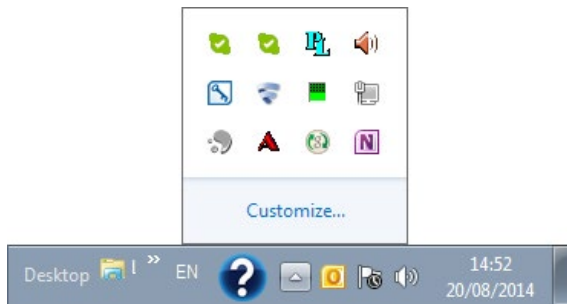


Figure 7.2: PicoLog icon in expanded System Tray

When you wish to restore to the original window size, just double-click on that small **PL** logo. The display will return to as before.

If, at any time **Recorder** is running, even when minimized, you double-click on the main PicoLog icon on the desktop, **Player** will start. (This will happen even if **Recorder** appears to have crashed, as it is often still running in the background. In that case, go to Windows **Task Manager > Processes**, highlight **plw32.exe** and click the **End Process** button.)

## 9. Remote data logging in PicoLog

It is possible to connect between two PCs on a network with the logger on one PC (server) and another PC acting as a client:

The following instructions are taken from the **Transfer data over an IP network** section of the *PicoLog User's Guide*:

The PicoLog IP socket facility is used to take measurements on one or more computers and record the data on another computer. The measurements are taken by PicoLog on the server. Another computer, the client, requests the data via an IP network.

**On the server:**

1. Click **Start**
2. Select **Run...**
3. Type `winiipcfg.exe`
4. Note the server name

**On the client:**

1. Open a DOS box
2. Type `ping` followed by the server name
3. The computer will display the time taken to send a message to the server and receive a response
4. Check that it is working and note the time

**On the server:**

1. Start PicoLog
2. From the **File** menu, select **Preferences**
3. Select **IP Sockets**
4. Check the **Enable Server** box
5. Click **OK**
6. Set up PicoLog to measure the channels that you require

**On the client:**

1. Start PicoLog
2. From the **File** menu, select **Preferences**
3. Select **IP Sockets**
4. Check the **Enable Client** box
5. Exit and restart PicoLog
6. Select **New Settings**
7. Enter recording details and click **OK**
8. Enter the sampling details and click **OK**
9. Select **Socket** in the **Converter type** combo box
10. Click **OK**
11. Type in the server name, e.g. `fred`  
Note: Server names are case sensitive! `Fred` is not the same as `fred`.
12. Click **Connect**
13. The computer should now display the channels from the server
14. Click on one of the channels
15. If you want to change the name, type in the local name
16. Click **OK**
17. The channel you selected is marked with an **X**
18. Repeat for each of the channels
19. Click **OK**
20. The monitor window should now display the readings from the server



## 10. PicoLog file size and recovery

The largest size file that can be generated by PicoLog contains about one million samples per channel (whatever the number of channels). If you wish to log for longer periods you need to set PicoLog to **Repeat Immediately** at the end of a run. A new file will be started with an auto-incremented file name. For ease of use do not use the maximum file size but choose a convenient number of samples that gives a reasonable logging time per file.

Once a file is saved to the hard drive it is safe from a PC crash or power loss. A long file that is interrupted before saving can be corrupted and unreadable. We can sometimes recover corrupted .plw files but only if you also have a good file available as well with exactly the same settings to allow us to clone the headers. Even a settings (.pls) file with no actual data will work as well, as long as the channels, sample rate and number of samples and other parameters are identical.

## 11. PicoLog frequency measurement

You can use PicoLog with the PicoLog 1000 series (and certain oscilloscopes: see *Pico devices* section) to measure AC volts, dB and frequency, presenting the values as a graph (real-time continuous mode only). Our other data loggers are too slow to be useful for frequency measurements.

- First, go to **File > New Settings**, select **Real Time Continuous**, and click **OK**.
- Select a sampling time of 1 second to take a reading of frequency once per second.
- Select the total number of samples or the total time of recording, and click **OK**.
- Select **PicoLog 1012/1216** and click **OK**.
- In **PicoLog1216 Measurements** click **Add**.
- In **Edit PicoLog1216 Measurement**, enter a name for the channel.
- Select **Channel 1**.
- For **Measurement**, select **Frequency**.
- Set the scan time to 100 000  $\mu$ s. This will give you a frequency range of 20 Hz to 11.626 kHz.
- Using **Options > Scaling** you can get PicoLog to display in RPM, not frequency, if you wish. (Click **Help** for instructions.)
- Back in **Edit PicoLog1216 Measurement** click **OK**.
- Back in **PicoLog1216 Measurements** click **OK**.
- Channel 1 should now be reading in Hz (or RPM if set).

To get frequency measurements for PicoLog at less than 1 second intervals (say 100 ms) you need to modify your plw.ini file. This will be located in the following directory for Windows XP:

```
C:\Documents and Settings\USER_LOGIN\Local Settings\Application Data\Pico
Technology\42f31349-afb8-471d-8a4d4fb7672be39b\
```

where USER\_LOGIN is your user account.

(You will need to enable viewing of **Hidden Folders**).

The equivalent folder in Windows Vista/7/8/10 is:

```
C:\Users\<Your user name>\AppData\Local\Pico Technology\42f31349-afb8-471d-
8a4d4fb7672be39b\
```

Open plw.ini in Notepad or a similar text editor and add the following line:

```
QuickSampleMs=100
```

in the section labeled:

```
[Preferences]
```

Here is an example file:

```
[Window]
Recorder=0,1,-1,-1,-1,-1,614,1168,126,523
[Converter]
Type=3200
Port=0
```

```
Selection=0
[Preferences]
AllowRerecord=Yes
AllowPause=Yes
QuickSampleMs=100
```

(This will allow sample rates down to 100 ms, for example.)

By default this is at 1000 ms but you can change it to below 1000 ms. Save and exit, and next time you go into PicoLog recorder this will become active. This is covered in the *PicoLog User's Guide*, *.ini preferences file* section, under *QuicksampleMs*.

You may need to configure your frequency range. When you set up a channel to measure frequency, there a control called **Scan time**. By changing the scan time you can adjust the frequency range that you wish to measure. The scan time needs to be 3 times as long as the period of the frequency you want to measure.

## 12. Pico devices that can run under PicoLog

The only USB oscilloscopes that can run under PicoLog are:

```
PicoScope 2104
PicoScope 2105
PicoScope 2202
PicoScope 2203
PicoScope 2204
PicoScope 2205
PicoScope 2204A
PicoScope 2205A
```

Any of the older range of PicoScope 3000 Series scopes that do not have an **A, B, D** or **MSO** suffix.

Function generator and AWG outputs are not supported in PicoLog.

All data loggers and all parallel port scopes work under PicoLog on 32-bit operating systems. Parallel port products and the USB ADC-11 are not supported on 64-bit operating systems.

## 13. If copy to clipboard or printing in PLW Spreadsheet does not work

On selecting cells in the PLW Spreadsheet window and pasting to the Windows clipboard, no data is transferred to the clipboard. On attempting to print the cells, unexpected characters appear in the printout. These are intermittent problems that occur on certain versions of Windows.

There is a workaround:

1. Right-click the PicoLog icon or shortcut
2. Select **Properties > Compatibility**
3. Check the **Run this program in compatibility mode for:** checkbox
4. Select **Windows XP (Service Pack 3)**

After you have applied this workaround, PicoLog will start in compatibility mode every time you click the shortcut and the problems with the spreadsheet should not occur.

Alternatively, running PicoLog as Administrator should have the same effect.

## 14. How to export data to a file

1. Load the PicoLog data file into PicoLog Recorder or PicoLog Player.
2. Click **File > Save as...**
3. In the **Save file as...** dialog, set the **Save as type:** to **Text files (\*.txt)** or **Comma-separated value files (\*.csv)**.
4. Enter a filename and click **Save**.

## 15. If PicoLog loses connection with the data logger

1. In the **PicoLog Recorder** window, click **File > Preferences > Auto Reconnect**, set a time and ensure that the **Enable auto reconnection** checkbox is set.
2. Consider using powered USB hubs for multiple devices to ensure that sufficient current is delivered to the device.

## 16. Device-specific: TC-08

### Serial TC-08

To use the Serial TC-08 on a USB port you will need a USB to serial adaptor, either ours or another manufacturer's. That needs to be installed first, using the software driver that is usually supplied on a small CD. Once that is installed and working, you then need to go to **Windows Device Manager** and look under **Ports (COM & LPT)** where there will be an entry for a **Serial on USB port** with a COM port number in brackets next to it. (If the COM port number is greater than 4, force it be in the range 1 to 4 by manually selecting the COM port number). Go to **Windows Device Manager** and select the hardware serial port you wish to use. Right-click on it and select **Properties**. Select **Port Settings** and then **Advanced**.

There will be a selection box for **COM Port Number**. Select a number less than 5 and click **OK**. Windows might give a warning but ignore that. Use this new port number when setting up the TC-08. Above instructions are for XP but similar will apply to other versions of Windows.

Plug your TC-08 into the USB adaptor and run PicoLog. When asked for the COM port to use, enter the COM port allocated in **Device Manager**. If you use a different USB port next time, please be aware that the COM port number may change. If you restart a PC with the USB-to-serial converter and TC-08 already connected, Windows frequently assumes that a mouse is connected. This can happen with any device connected through a USB converter.

Please try this: Unplug both devices from the PC and each other. Plug in the USB converter, check it is recognized and which COM port is allocated to it, and finally plug in the TC-08. Use the COM port number found earlier to set up the TC-08 under PicoLog.

You can use the current version of PicoLog (R5.23.0 at the time of writing). When installing, still select Serial TC-08 as the device, not USB TC-08.

### TC-08 sampling rate

The TC-08 takes 100 ms per thermocouple to read temperature. Once per cycle through all the active channels it must also read the cold junction temperature, which takes 100 ms. Thus if only one thermocouple is active the full cycle takes  $100 + 100 = 200$  ms or 5 readings per second. If two channels are active the full cycle takes  $2 \times 100 + 100 = 300$  ms or about three readings per channel per second.

If all 8 channels are in use, the cycle is  $8 \times 100 + 100 = 900$  ms which means all 8 channels are read just quicker than once per second. When the cold junction is being read (once per cycle) the LED is green. It is red when any of the thermocouple channels are being read.

The above cycle is constant for the TC-08 and independent of the requested sample rate. If samples are requested faster than 100 ms, consecutive readings will often be of the same value until the value for that channel has been updated, so readings are never older than the sample time. If the samples are requested at a slower rate, the readings will always be the latest value which has been taken by the hardware, no more than 200 ms ago.

If **Filtering** is enabled, with say a filter factor of 3, the display is not updated until 3 samples are available and then the average of those three samples is the value displayed. It is generally best to set the sample rate to about the same as the cycle time to get readings from all enabled channels. Adding a filter factor will smooth out fluctuations in the readings at the expense of slower response to a fast temperature change.

### Using scaling to adjust the calibration of each channel

It is easy to add a calibration factor to each channel using the **Scaling** option during setup. The corrections can be saved to a settings (.p1s) file; this will allow the calibration data to be reapplied to each channel on startup without the need to type everything again. A greater number of points will give you a better calibration. You can use them to set up **Scaling** to give you accurate readings directly to your data file and graphical display.

You just need to set the scaling for the channel in question. We will illustrate how to scale **Temperature** for each channel.

Start PicoLog and set up your sample rates as required. When you get to setting up each channel, click **Edit > Options**.

In the **Parameter Options** dialog, click **Scaling** to go to the next dialog.

In the **Parameter Scaling** dialog, select **Table Lookup** as the **Scaling method**.

Assuming you just have data for the thermocouple for a two-point calibration (indicated and true readings for two different temperatures), type in the text box the two pairs of numbers:

aa bb  
cc dd

where **aa** = the indicated reading at the first temperature  
**bb** = the true reading at the first temperature  
**cc** = the indicated reading at the second temperature  
**dd** = the true reading at the second temperature

(taken from your calibration certificate for the thermocouple or from your own measurements).

Note that there is one space between the two numbers on each line.

The actual table will look like this:

```
9.5 10.1
94.5 95.0
```

This example tells the program to equate 9.5°C indicated reading to a true 10 °C and 94.5°C indicated reading to a true 95°C. When the scaling is applied, the readings will be corrected.

Click **OK** to go back through the open boxes and temperature should now be scaled correctly.

(Note: Lookup tables have a limit of 14 lines. Above that, use a scaling file. If you use a scaling file you must ensure that either:

1. All parameter formatting is done on the parameter formatting page only and none in the scaling file (just the equation or lookup table).  
or
2. Parameter formatting is not checked and all formatting is done in the scaling file only.

Duplication of parameter formatting will cause a crash!

When all channels are done, save a settings (.p1s) file and next time, when you want to reapply the same calibration to a logging session, just start PicoLog by double-clicking on the settings file instead of the PicoLog icon.

#### 4–20 mA on the TC-08 using the TC-08 Terminal Board

Here are some standard instructions for scaling a 4–20 mA sensor for use with the TC-08:

The sensor requires a +24 V supply. Feed the positive of the supply to the positive of the sensor. Feed the negative of the sensor to the **+5V/4–20 mA** input of the TC-08 Terminal Board. Connect the 0 V of the power supply to the **COM** terminal of the TC-08 Terminal Board. Set the switch of the TC-08 Terminal Board to **4–20 mA**.

Here is the setup process:

The 4–20 mA will flow through a load resistor on the adaptor board, generating between 9.5 mV (at 4 mA) and 47.5 mV (20 mA). To convert these voltages into properly scaled readings, you must use the **Scaling** option in PicoLog.

For example, if the sensor pressure is 0 psi when the current through the load resistor is 4 mA and 30 psi at 20 mA, you would set up a lookup table to equate 9.5 mV to 0 psi and 47.5 mV to 30 psi.

1. Start PicoLog and set up your sample rates as required. When you get to setting up channel 1 (**Edit TC-08 channel**), type **psi** as the **Name** and **mV** as the **Thermocouple**.
2. Now click **Options**.
3. In the **Parameter options** box, check **Use Parameter Formatting** and set **Units** to **psi**, set **Formatting** to your own preference (such as three digits, one after the decimal point), select 0 (min) and 30 (max) for the graph scaling, and then click **Scaling**.
4. In the **Parameter Scaling** box, set **Scaling method** to **Table look-up**.
5. In the blank box, you can now enter two pairs of **Raw** and **Scaled** readings. In this case the table looks like this:

```
9.5 0
47.5 30
```

Note the single space between the two numbers on each line.

Explanation: The 9.5 is derived from 4 mA times 240 Ω divided by 101 (attenuation in the terminal board) = 9.5 mV.

The 47.5 is 20 mA times 240 Ω divided by 101 = 47.5 mV.

6. Click **OK** to go back through the open boxes and channel 1 should now be scaled from 0 to 30 psi.

Click **Help** to read an explanation of the process.

## TC-08 channels all showing incorrect and variable readings

The 8 channels of the TC-08 are differential inputs. There are two pins per channel, each with a 1 M $\Omega$  resistance to ground. The differential input resistance is thus 2 M $\Omega$ . The TC-08 measures the difference in voltage between the two pins with a working range of  $\pm 70$  mV maximum. For correct operation, both input voltages must stay in the range  $\pm 7.0$  V with respect to ground (0 V). No damage will result if this common-mode voltage is higher than  $\pm 7.0$  V unless the voltage increases to above  $\pm 30$  V. As long as all the absolute values of voltage with respect to 0 V stay within  $\pm 7.0$  V of 0 V, the channels will read correctly.

Incorrect and variable readings are usually caused by a thermocouple being used touching something that is at a different potential to the TC-08 or PC earth. If this voltage is greater than about  $\pm 7$  V the channel is pulled out of the common-mode range of the TC-08. This causes all channels to read very incorrect values. You must ensure that the metal object you are touching with the exposed end of the thermocouple is earthed correctly and at the same potential as the PC earth. If that cannot be done, the thermocouple must be electrically isolated from the metal surface. Failing that, for short-term logging, you can use a laptop running on batteries, as that is not connected to mains earth.

An overload can be on one channel or between two channels. The TC08 has an input range of about 70 mV. If more than 7 V difference occurs between any of the inputs to the TC-08, incorrect readings will result. Additionally, if more than 7 V difference occurs between any input and the TC-08's ground (also computer ground and usually mains earth), errors will occur. A typical example where this may occur would be if a thermocouple is used to measure the temperature of the motor on a machine tool. The casing of the motor, although earthed, may be at a potential of several volts from the earth of the computer.

Plug in the thermocouples one at a time to locate which are causing the problems. If possible, electrically isolate the thermocouple. If this is not possible, run a wire from the metal outer shell of the TC-08 USB connector to a point near the thermocouple tip. This earths the area near the thermocouple tip and can often pull the two grounds close enough together for normal operation.

Laptops running on mains adaptors can also cause problems. Some laptop power supplies do not have an earth connection and produce large amounts of interference which can be picked up by the sensitive TC-08. If you have problems when the laptop is run off its mains adaptor, but not on battery, try earthing the laptop. There is often a screw on the back of the laptop that can be used for this purpose. Alternatively, run a wire from the TC-08 USB connector shell to mains earth. The USB TC-08 can be modified to have a 4 mm ground socket if required. Contact Technical Support at the above address for further details.

## 17. Device-specific: PicoLog 1012 and 1216

### Sampling at 1 ms in PicoLog with the PicoLog 1012 and 1216

If you find that you only log at about 20 to 50 ms sampling rates, you are probably running in real-time continuous mode. This allows you to use multiple loggers at one time but the sampling rate is slow (20 to 50 ms, depending on PC speed). 1 ms cannot be obtained even if requested. It does, however, allow you to plot AC voltage, frequency and dB figures for signals that are too fast for the logger to capture the actual waveform.

To get a sampling rate of 1 ms you need to be in **Streaming (single converter only)** mode:

1. Click **File > New Settings**.
2. In the **Recording** dialog, for **Recording method** select **Streaming (single converter only)** and then click **OK**.
3. When the PicoLog 1216 has been detected, click **OK** again. Now you can select the sampling rate and number of samples.

In this mode you can sample on all 16 channels, getting one reading from each in a 1 ms period, but AC voltage, frequency and dB readings will not be offered.

### Triggering in PicoLog

The PicoLog 1012 and 1216 data loggers can trigger from any of the available input channels, but only in block mode.

### Sampling modes

PicoLog 1000 series loggers can run in various sampling modes. At high sampling rates, the logger collects data much faster than it can be sent to the PC. To compensate for this, the logger stores a block of data in an internal memory buffer, delaying transfer to the PC until a preset number of data points have been sampled. This is called block mode. At very low sampling rates, you may want to switch to streaming mode. This allows accurately timed data to be transferred back to the PC in short blocks, without gaps. Real-time continuous mode is also provided for use at low sampling rates when immediate data transfer without gaps is required but timing accuracy is not critical.

## Block mode

A sampling mode in which the computer prompts the oscilloscope to collect a block of data into its internal memory before stopping the oscilloscope and transferring the whole block into computer memory. This mode of operation is suitable when the input signal being sampled contains high frequencies. Note: To avoid aliasing effects, the sampling rate must be greater than twice the highest-frequency component of the input signal.

## Streaming mode

A sampling mode in which the oscilloscope samples data and returns it to the computer in an unbroken stream. This mode of operation is suitable when the input signal being sampled contains only low frequencies.

## Real-time continuous mode

A sampling mode in which the software repeatedly requests single samples from the oscilloscope. This mode is suitable for low sampling rates when you require the latest sample to be displayed as soon as it is captured.

## Monitor 4–20 mA signals with the PicoLog 1012 logger

For more information, refer to the *PicoLog 1000 Series Data Logger User's Guide* and the *PicoLog User's Guide*.

With the addition of one 120R resistor per channel used, the PicoLog 1012 can accept 4–20 mA signals which will develop 0.48 to 2.4 V across the 120R resistors. This can be easily scaled within our free PicoLog program to the correct engineering units, displayed live on screen and saved to a file on the hard drive of the attached PC or laptop. Files can be exported as .txt or .csv for loading into Microsoft Excel or other spreadsheet application.

### How to set up for 4–20 mA operation with an example of a 0 to 10 bar pressure sensor

Just pass the 4–20 mA current output by the sensor through a 120R resistor to generate a voltage varying from 480 mV to 2400 mV. The resistor is best placed in parallel with the input terminals of the PicoLog 1012 (from the channel input pin to ground). The 0V terminal of the +12 V to +24 V sensor supply is connected also to the ground of the PicoScope 1012. The resistors used can be soldered to the terminal board permanently or just gripped by the screw terminals on the board.

The positive output of the supply goes to the positive terminal of the sensor. The sensor negative terminal loops back to the other end of the 120R resistor. Thus the sensor current goes round in a loop through the sensor, resistor and supply.

Once you have connected up the sensor, resistor and supply as described above, you just need to set the scaling for the channel in question. We will illustrate how to set up channel 1 for 4–20 mA operation with graph scaling from 0 bar to 10 bar as an example.

1. Start PicoLog and set up your sample rates as required.
2. When you get to the **PicoLog 1012 measurements** dialog, click **Add**.
3. Type Pressure as the **Name**, select **DC Volts** and leave the **Scan time** as the default 10 000  $\mu$ s.
4. Now click **Options**. (If you are asked to save the present setup, click **OK**).
5. In the **Parameter Options** dialog, check **Use parameter Formatting** and type bar in the **Units** box. Set **Field Width** to 4, **Decimal places** to 2, **Minimum value** to 0 and **Maximum value** to 10. Now click **Scaling** to go to the next dialog.
6. In the **Parameter scaling** dialog, select Table Lookup as the **Scaling method** and in the text box, type:

```
0.48 0
2.4 10
```

This tells the program to equate 0.48 V to 0 bar on the graph and 2.4 V to 10 bar on the graph.

Explanation: The 0.48 is derived from  $4 \text{ mA} \times 120 \Omega = 0.48 \text{ V}$ . The 2.4 is  $20 \text{ mA} \times 120 \Omega = 2.4 \text{ V}$ .

7. Click **OK** to go back through the open boxes and channel A should now be scaled from 0 to 10 bar.

If the sensor is not powered up, the reading will be about –1.2 bar as that is the equivalent reading for 0 mA. (0 bar = 4 mA).

See the *PicoLog User's Guide* for information on using PicoLog or click **Help** at any stage in PicoLog.

## Using the DD100 thermistor from the DrDAQ on the PicoLog 1216

To use the DD100 thermistor from the DrDAQ with the PicoLog 1216, you will need to cut off the 4-pin connector and use just the two outside wires to connect to the PicoLog small terminal board. (The two inside wires connect to a fixed resistor that is only used with the DrDAQ.)

Connect one of the outside wires (it does not matter which) to one of the **GND** terminals of the PicoLog small terminal board.

Connect the other outside wire to the **C1** (channel 1) input terminal of the PicoLog terminal board. You will now require a 39k resistor to connect between the channel 1 input and the **+2.5** terminal of the PicoLog terminal board. If this resistor has leads, you can easily connect it by clamping it in position using the terminal screws **C1** and **2.5**. If you have only a surface-mount 39k resistor, you can mount it in the **R33** position on the terminal board: see the *DO161 Small Terminal Board User's Guide*.

Assuming you have connected up the sensor, resistor and supply as described above, you just need to set the scaling for the channels in question. Below is an illustration of how to set up channel 1 for temperature measurement from  $-10\text{ }^{\circ}\text{C}$  to  $100\text{ }^{\circ}\text{C}$  using a DD100 sensor.

1. Start PicoLog and set up your sample rates as required.
2. When you get to setting up channel 1 (**PicoLog 1000 Channels**), select **Channel 1** and click **Edit**.
3. Type **Temperature** as the **Name**.
4. Now click **Options**. (If you are asked to save the present setup, click **OK**).
5. In the **Parameter Options** dialog, check **Use parameter Formatting** and type  $^{\circ}\text{C}$  in the **Units** box. Set **Field Width = 5**, **Decimal places = 2**, **Minimum value = -10** and **Maximum value = 100**. Now click **Scaling** to go to the next dialog.
6. In the **Parameter scaling** dialog, select **Table Lookup** as the **Scaling method** and in the visible text box, copy and paste the table below exactly:

```

2.247 -10
2.152  0
2.020 10
1.848 20
1.643 30
1.417 40
1.187 50
0.970 60
0.777 70
0.614 80
0.481 90
0.375 100

```

Note that there is a single space between each pair of numbers.

This tells the program to equate 2.247 V to  $-10^{\circ}\text{C}$  on the graph and 0.375 V to  $100^{\circ}\text{C}$  on the graph (plus intermediate values).

7. Click **OK** to go back through the open boxes and channel 1 should now be scaled from  $-10\text{ }^{\circ}\text{C}$  to  $100\text{ }^{\circ}\text{C}$ .

See the *PicoLog User's Guide* for information on using PicoLog or click **Help** at any stage in PicoLog.

Note: Lookup tables have a limit of 14 lines. Above that, use a scaling file (see below).

If you use a scaling file you must ensure that either:

1. All parameter formatting is done on the parameter formatting page only and none in the scaling file (just the equation or look-up table).

or

2. **Parameter formatting** is not checked and all formatting is done in the scaling file only.

Duplication of parameter formatting will cause a crash!

### To use a "Scaling file" instead of "Equation" or "Table Lookup"

We will assume that you are going to use a thermistor type NJ28 RA 0104 FCC ( $100\text{ k}\Omega$  @  $25\text{ }^{\circ}\text{C}$ ) with a 47k series resistor.

The PicoLog 1012 has an input resistance of  $1\text{ M}\Omega$  and this is in parallel with the thermistor, so the thermistor resistance value is reduced to  $(100 \times 1000)/(100 + 1000)\text{ k}\Omega = 90.91\text{ k}\Omega$  (at  $25\text{ }^{\circ}\text{C}$ ). Assuming you are using the  $+2.5\text{ V}$  sensor supply of the PicoScope 1012, this is fed to the 47k resistor and thermistor in series and the voltage at their junction will be  $(2.5 \times 90.91)/(90.91 + 47)\text{ V} = 1.648\text{ V}$ .

Doing the same calculations from  $0\text{ }^{\circ}\text{C}$  to  $150\text{ }^{\circ}\text{C}$  gives values:

```

2.023 (V) = 5 (deg C)
1.853 = 15

```

1.648 = 25  
 1.419 = 35  
 1.185 = 45  
 0.964 = 55  
 0.767 = 65  
 0.602 = 75  
 0.468 = 85  
 0.363 = 95  
 0.282 = 105  
 0.219 = 115  
 0.171 = 125  
 0.135 = 135  
 0.107 = 145

Assuming you have connected up the sensor, resistor and supply as described above, you just need to set the scaling for the channels in question. Below is an illustration of how to set up channel 1 for temperature measurement from 0 °C to 150 °C:

1. Start PicoLog and set-up your sample rates as required.
2. When you get to setting up Channel 1 (**PicoLog 1000 Channels**), highlight **Channel 1** and click **Edit**.
3. Type Temp Chan 1 as the **Name**.
4. Now click **Options**. (If you are asked to save the present setup, click **OK**).
5. In the **Parameter options** dialog, select **Scaling**.
6. For **Scaling method**, select **Use scaling from file** and click **File**.
7. Navigate to where you have saved the scaling file below, with the filename `100k_thermistor.scl`.
8. Open the file. Click **OK** several times to get back to the main PicoLog window.

You should be reading temperature on channel 1.

```

Notes=100kthermistor/47kload/2.5V
Type=Table
Units=°C
Width=4
Places=1
MinValue=0
MaxValue=150
2.023 5
1.853 15
1.648 25
1.419 35
1.185 45
0.964 55
0.767 65
0.602 75
0.468 85
0.363 95
0.282 105
0.219 115
0.171 125
0.135 135
0.107 145
  
```

Note that there is a single space between each pair of numbers.

This tells the program to equate 2.023 V to 5 °C on the graph and 0.107 V to 145 °C on the graph.

Click **OK** to go back through the open boxes and channel 1 should now be scaled from 0 to 150 °C.

Repeat the above for the five other channels you are using.

See the PicoLog manual for information on using PicoLog or click **Help** at any stage in PicoLog.



## Offsetting the input with the PicoLog 1000 Series

The PicoLog 1000 series has a nominal voltage range of 0 V to +2.5 V.

It is possible to offset and scale a negative signal. There is a +2.5 V, 10 mA source available on pin 17 of the PicoLog device. To start with, you will need to add resistors to the terminal board exactly as described in the *Small Terminal Board User's Guide*. Here are the values to obtain a  $\pm 5$  V range:

1. Assuming you are using channel 1, add a 20k surface-mount resistor in position R1 (also cutting the track).
2. Fit another 20k resistor in position R2.
3. Finally, to give the correct offset and final scaling, you must add a 10k surface-mount resistor in position R33 (on the back of the PCB, near the 25-way connector).

These three resistors will scale a +5 V to -5 V input to reach the logger as a signal varying from 0 V to +2.5 V. The scaling function of PicoLog can convert this reduced and offset range back to the original voltage reading by multiplying the raw value by 4.02 and subtracting 5 V. To compensate for any residual errors, the actual scaling offset and multiplier can be slightly varied to give exact readings by doing a simple calibration, if required.

If required, the first four channels can be easily offset in this way. (Other channels can too but the pull-up resistor has to be added externally to the PCB as there are only four resistor positions available: R33, R34, R35 and R36.)

1. Start PicoLog and set up your sample rates as required. In **PicoLog1216 measurements**, click to **Add** the first channel. In the **Name** box, type **Volts**.
2. Leave the **Measurement** as **DC Volts** and the **Scan Time** unchanged.
3. Now click **Options**. (You will be asked to save channel settings to continue.)
4. Now click **Scaling** to go to the next dialog.
5. In the **Parameter scaling** dialog, select **Equation** as the **Scaling method** and in the text box, type:  
$$4.02 * X - 5$$
6. Click **OK** to go back through the open boxes and channel 1 should now be scaled from about +5 V to -5 V.

See the *PicoLog User's Guide* for information on using PicoLog or click **Help** at any stage in PicoLog.

See the *PicoLog 1000 Series User's Guide* for more information.

When no input is connected, the DC voltage measured will float up to near +1.67 V. As long as the series resistance of the voltage you are feeding to the input of the PicoLog terminal board is much lower than input impedance of the circuit above, the DC level is pulled to the correct value upon connection.

## 18. Device-specific: ADC-20 and ADC-24

### 4–20 mA on the ADC-20 and ADC-24

All you have to do is to pass the 4–20 mA current output from the sensor through a 120R resistor to generate a voltage varying from 480 mV to 2400 mV. The resistor is best placed in parallel with the input terminals of the ADC-24 (from the channel input pin to analog ground). The 0 V terminal of the +12 V to +24 V sensor supply is connected also to the analog ground of the ADC-24 (and the sensor **COM** terminal if it is a 3-wire sensor).

The positive output of the supply goes to the positive terminal of the sensor and the sensor output terminal loops back to the other end of the 120R resistor. Thus the sensor current goes round in a loop through the sensor, resistor and supply.

Assuming you have connected up the sensor, resistor and supply as described above, you just need to set the scaling for the channel in question. Below is an illustration of how to set up channel 1 for 4–20 mA operation with graph scaling from 0 bar to 10 bar as an example:

1. Start PicoLog and set up your sample rates as required.
2. When you get to setting up Channel 1 (**ADC-24 Channels**), highlight **Channel 1** and click **Edit**.
3. Type **Pressure** as the **Name**, choose a **Conversion time** between 60 ms and 660 ms, and select  $\pm 2500$  mV as the **Voltage range**.
4. Leave **Differential input enable** unchecked.
5. Now click **Options**. (If you are asked to save the present setup, click **OK**.)

6. In the **Parameter Options** dialog, check **Use parameter Formatting**, and type bar in the **Units** box. Set **Field Width = 4, Decimal places = 2, Minimum value = 0, and Maximum value = 40**. Now click **Scaling** to go to the next dialog.
7. In the **Parameter scaling** dialog select **Table Lookup** as the **Scaling method** and in the text box, type:
 

```
480 0
2400 10
```

This tells the program to equate 480 mV to 0 bar on the graph and 2400 mV to 10 bar on the graph.

Explanation: the 480 mV is derived from  $4 \text{ mA} \times 120 \Omega = 480 \text{ mV}$ . The 2400 is  $20 \text{ mA} \times 120 \Omega = 2400 \text{ mV}$ .

8. Click **OK** to go back through the open boxes and channel A should now be scaled from 0 to 10 bar.

If the sensor is not powered up, the reading will be about  $-1.2$  bar as that is the equivalent reading for 0 mA (0 bar = 4 mA).

See the *PicoLog User's Guide* for information on using PicoLog or click **Help** at any stage in PicoLog.

### Sampling rate of ADC-20 or ADC-24

The ADC-24 takes readings on a single channel at about 1.5 to 17 samples/second depending on your requested conversion (settling) time. When setting up each channel, you are asked to select the conversion time from 60, 100, 180, 340 or 660 ms. To obtain the full resolution of the converter select 660 ms. For information on the ADC-20, see the *ADC-20 and ADC-24 User's Guide*.

The settling time for the ADC-24 is based on the hardware and is independent of the requested sample rate set in PicoLog. If samples are requested faster than the settling time chosen, consecutive readings will often be of the same value until the value for that channel has been updated, so readings are never older than the sample time at worst. If the samples are requested at a slower rate than the settling time, the readings will always be the latest value which has been taken by the hardware.

The sampling rate quoted is per channel, not per cycle around all the channels. There is a single ADC with a multiplexer to give multiple channels. The fastest that an ADC-24 can sample all 16 channels is 960 ms with 60 ms conversion time.

### Thermistor temperature sensing with the ADC-20 or ADC-24

As an example we will use the B57891-M104-K thermistor from Elfa Distrelec and will assume measurement in the range of 60 to 110 °C. The centre of the range is 85 °C so we will optimize for that value.

The thermistor above has a resistance of 8376  $\Omega$  at 85 °C so  $R_a$  needs to match that for a centre scale reading of volts (+1.25 V) at this temperature. Use an 8k2 resistor as the nearest standard value. Do not use a variable resistor as you will never know where you are for calibration.

The ADC-24 has an input resistance of 1 M $\Omega$  and this is in parallel with the thermistor, so the thermistor resistance value is reduced to  $(8.376 \times 1000) / (8.376 + 1000) \text{ k}\Omega = 8306.4 \text{ k}\Omega$  (at 85 °C). Assuming you are using the +2.5 V sensor supply of the ADC-24, this is fed to the 8k2 resistor and thermistor in series and the voltage at their junction will be  $(2.5 \times 8306.4) / (8306.4 + 8200) \text{ V} = 1.2581 \text{ V}$ .

Doing the same calculations from 60 °C to 110 °C gives these values:

```
60C = 1.7997V
65C = 1.6987V
70C = 1.5931V
75C = 1.4828V
80C = 1.3707V
85C = 1.2581V
90C = 1.1473V
95C = 1.0419V
100C = 0.9415V
105C = 0.8464V
110C = 0.7579V
```

Assuming you have connected up the sensor, resistor and supply as described above, you just need to set the scaling for the channels in question. Below is a series of steps describing how to set up channel 1 for temperature measurement from 60 °C to 110 °C.

1. Start PicoLog and set up your sample rates as required.
2. When you get to setting up Channel 1 (**ADC-24 Channels**), highlight **Channel 1** and click **Edit**.
3. Type Temp Chan 1 as the **Name**, leave **Conversion time** as 60 ms and select  $\pm 2500$  mV as the **Voltage range**.

4. Leave **Differential input enable** unchecked.
5. Now click **Options**. (If you are asked to save the present setup, click **OK**).
6. In the **Parameter Options** dialog, check **Use parameter Formatting**, and type °C in the **Units** box. Set **Field Width = 4**, **Decimal places = 1**, **Minimum value = 50** and **Maximum value = 120**. Now click **Scaling** to go to the next dialog.
7. In the **Parameter scaling** dialog, select **Table Lookup** as the **Scaling method** and in the text box type the following:

```

1799.7 60
1698.7 65
1593.1 70
1482.8 75
1370.7 80
1258.1 85
1147.3 90
1041.9 95
941.5 100
846.4 105
757.9 110

```

Note that there is a single space between each pair of numbers.

This tells the program to equate 1799.7 mV to 60 °C on the graph and 757.9 mV to 110 °C on the graph.

8. Click **OK** to go back through the open boxes and channel A should now be scaled from 50 to 120 °C.

(This sensor is not the most accurate: the data sheet quotes  $\pm 2.4$  °C at 60 °C,  $\pm 3.5$  °C at 85 °C and  $\pm 4.6$  °C at 110 °C. You may want to choose a better one.)

## 19. Device-specific: PT-104

The PT-104 logger is designed to be very accurate but requires stable temperatures as the thermal response of the PT-100 sensors is quite slow. Each PT-104 logger takes 720 ms per channel activated, so four channels are read in 2.88 seconds. The temperatures are measured in sequence to a regular time pattern but the readings are only updated once per cycle, all at the same time.

The PicoLog program, running on the local PC, can only access the data by polling the PT-104 on a regular basis. Normally it requests samples from the logger at a slower rate than the logger cycles through so that there is always a new reading available. It is possible to set the sample rate of PicoLog faster than that so it can detect a change in reading with a worst-case delay of one sample period.

Two or more PT-104 loggers can be controlled by PicoLog and data recorded and displayed together but the units are not synchronized with respect to sample time. The PT-104 loggers are independent so they each log at 2.88 second cycles when four PT-100 probes are used on each.

## 20. Device-specific: PicoLog CM3 Current Data Logger

The logger itself has a full-scale reading capability (using a standard 1 mV/A clamp) of 1000 A. It is supplied with 200 A AC clamps, which is the normal recommended working range. The lower the current, the longer the settling time. It takes about 30 seconds to decay from 7 A down to under 2 A and the step back up to 7 A takes only about 5 seconds. The CM3 is not suitable for measuring current transients. The settling time can be reduced by using current clamps with a higher mV/A rating or looping the current-carrying cable through the clamp multiple times. The PicoLog software can be set to scale these readings back to the correct value. The higher the voltage into the CM3, the faster the settling time will be.

Each CM3 logger takes 720 ms per channel activated, so three channels are read in 2.16 seconds. The currents are measured in sequence to a regular time pattern but the readings are only updated once per cycle, all at the same time. The PicoLog program, running on the local PC, can only access the data by regularly polling the CM3. Normally it requests samples from the logger at a slower rate than the logger cycles through so that there is always a new reading available. It is possible to set the sampling rate of PicoLog faster than that so it can detect a change in reading with a worst-case delay of one sample period.

Two or more CM3 loggers can be controlled by PicoLog and data recorded and displayed together but the units are not synchronized with respect to sample time. The CM3 loggers are independent so they each log at 2.16-second cycles when three current clamps are used on each.

Note: The PicoLog CM3 Current Data Logger is only suitable for AC current measurements. For DC current monitoring, we suggest using a DC current clamp with a PicoScope oscilloscope.

## 21. Device-specific: USB DrDAQ

To use any of the three external sensor inputs as plain voltage channels, you must have a fixed and defined resistor fitted between pins 2 and 3 of the external socket to tell the DrDAQ which scaling to use.

The scaling is defined by a `Scaling.dds` file which you must generate and put in the root directory of PicoLog. Below is an example file `Ext Volts.dds` which you can use as a start.

If you put a 3.3k resistor between pins 2 and 3, that will tell PicoLog to use `[Scale1]`, which will then give you voltage readings between 0 V and 2.5 V on any **Ext** input that is connected.

The section on *USB DrDAQ scaling files (.DDS)* in the *USB DrDAQ User's Guide* provides details on this process.

```
Ext Volts.dds:
  [Scale1]
  Resistor=3.3
  LongName=Voltage
  Units=Volts
  MinValue=0
  MaxValue=2.5
  OutOfRange=2
  Places=3
  Method=0
  NoOfPoints=2
  Raw1=0
  Scaled1=0
  Raw2=2.5
  Scaled2=2.5
```

If your external voltage has already been attenuated from a higher value (for instance if you are measuring +5 V), you can adjust the scaling to suit such that the correct voltage is displayed in PicoLog. Simply change two lines in the `Ext Volts.dds` file:

```
[Scale1]
Resistor=3.3
LongName=Voltage
Units=Volts
MinValue=0
MaxValue=5.0
OutOfRange=2
Places=3
Method=0
NoOfPoints=2
Raw1=0
Scaled1=0
Raw2=2.5
Scaled2=5.0
```

## 22. Device-specific: PicoScope 2203, 2204, 2204A, 2205, 2205A

### Clicking relay noise

The PicoScope 2000 Series scopes have relays that switch between the high and low voltage ranges on each channel. When running in PicoLog, the input signal is fed through from one input connector to both channels' ADCs in parallel to get twice the sampling rate. Then the other input connector is routed through the same pair of ADCs and so on in a cycle. At any one time, the unused input connector and preamplifier chain is set to the highest voltage (lowest gain) condition to avoid injecting crosstalk onto the live channel. If either channel is set to  $\pm 1$  V or lower, the gain relay will cycle continuously.

To use two channels without the relay noise, set both to any voltage greater than  $\pm 1$  V ( $\pm 2$  V to  $\pm 20$  V, and they can be different).

For the smaller voltage ranges less than  $\pm 2$  V ( $\pm 1$  V to  $\pm 50$  mV) the clicking can be reduced or eliminated by increasing the scan time under the **Edit Measurements** section. You will need to do this for both channels.

This is inherent in the hardware design and cannot be changed or fixed in software.

## Streaming at 1 ms sample time to multiple 1 megasample files

For PicoLog, you must select in the **Recording** dialog:

- **Streaming (Single converter only)** and not **Real Time Continuous** for the recording method.
- **Repeat after Delay** as the action at end of run.
- **1 second** as the restart delay.

In the **PicoScope2000 Streaming** dialog:

- **Number of Samples = 1000000**
- **Sample Interval = 1 (ms)**
- Channel A and Channel B range must be  $\pm 2$  V (or higher if you wish, but not lower).
- **AC** or **DC** as required.

When you start logging, 1 million samples per channel will be saved to the data file you have set up at 1 ms sampling. When 1 million samples are reached, a new file is started with an auto-incremented file name. This cycle will continue as long as there is hard disk space available.

## Logging a 4–20 mA sensor

Below is a description on how to use an 8-bit PicoScope 2203 scope but the 10-bit PicoLog 1012 or 12-bit PicoLog 1216 would give more resolution if required.

With the PicoScope 2000 Series scopes, it would be simple for you to use a  $50\ \Omega$  through-terminator for the load resistor necessary at the BNC input. This is a standard product from RS Components 546-4695, £9.80 (2016 price). It is in fact just a BNC male to female connector with a  $50\ \Omega$  resistor in parallel internally. Calculating for  $50\ \Omega$ , 4 mA now equals 200 mV input, and 20 mA now equals 1 V input.

Assuming you have connected up the sensor, terminator and scope, you just need to set the scaling for the channel in question. We will illustrate how to set up channel 1 for 4–20 mA operation with graph scaling from 0 bar to 10 bar.

1. Start PicoLog and set up your sample rates as required.
2. When you get to setting up channel A (**PicoScope 2000 Edit Measurement**):
  - a. Type Pressure as the **Name** and select  $\pm 1$  V as the **Voltage range**.
  - b. Leave the **Measurement** as **DC Volts** and the **Scan Time** as it is.
3. Now click **Options**.
4. In the **Parameter Options** dialog, check **Use parameter Formatting** and type bar in the **Units** box. Set **Field Width** = 4, **Decimal places** = 2, **Minimum value** = 0 and **Maximum value** = 10.
5. Now click **Scaling** to go to the next dialog.
6. In the **Parameter scaling** dialog, select **Table Lookup** as the **Scaling method** and in the text box, type:  
0.2 0  
1.0 10

Note that there is a single space between the two numbers on each line.

This tells the program to equate 0.2 V to 0 bar on the graph and 1.0 V to 10 bar on the graph.

Explanation: The 0.2 is derived from  $4\ \text{mA} \times 50\ \Omega = 0.2\ \text{V}$ . The 1.0 is  $20\ \text{mA} \times 50\ \Omega = 1.0\ \text{V}$ .

7. Click **OK** to go back through the open boxes and channel A should now be scaled from 0 to 10 bar.

See the *PicoLog User's Guide* for information on using PicoLog or click **Help** at any stage in PicoLog.

If you wish to use the PicoLog 1000 series it is very similar but you need to use a 120R resistor across the input channel in order to generate the following voltages at the input channel:

- $120\ \Omega \times 4\ \text{mA} = 480\ \text{mV}$
- $120\ \Omega \times 20\ \text{mA} = 2400\ \text{mV}$

## 23. Related documents

*ADC-20/ADC-24 High-Resolution Data Loggers User's Guide*

*ADC-20/ADC-24 Terminal Board User's Guide*

*PicoLog 1000 Small Terminal Board User's Guide*

*PicoLog 1000 Series User's Guide*

*PicoLog CM3 Current Data Logger User's Guide*

*PicoLog User's Guide*

*PicoScope 2200 Series PC Oscilloscopes User's Guide*

*PicoScope 2200A Series PC Oscilloscopes User's Guide*

*PT-104 Data Logger User's Guide*

*PT-104 Screw Terminal Adapter (PP660) User's Guide*

*USB DrDAQ Data Logger User's Guide*

*USB TC-08 Single-Channel Terminal Board User's Guide*

*USB TC-08 Temperature Logger User's Guide*



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PicoLog Frequently asked questions

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