PicoLog®

Self-Help Guide

CONTENTS

1. Introduction

This *Self-Help Guide* 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 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: +44 (0) 1480 396395 (UK Headquarters)
               +1 800 591 2796 (USA Headquarters)

Skype: pico_tech_support

2. 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

plus:

> ANY of the older range of 3000 Series scopes that do NOT have an *A, B* or *MSO* suffix.

Function Generator and AWG output are not supported in PicoLog.

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

NONE of the PicoScope 4000, 5000, 6000 or 9000 Series scopes work under PicoLog.

3. Do not install 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.
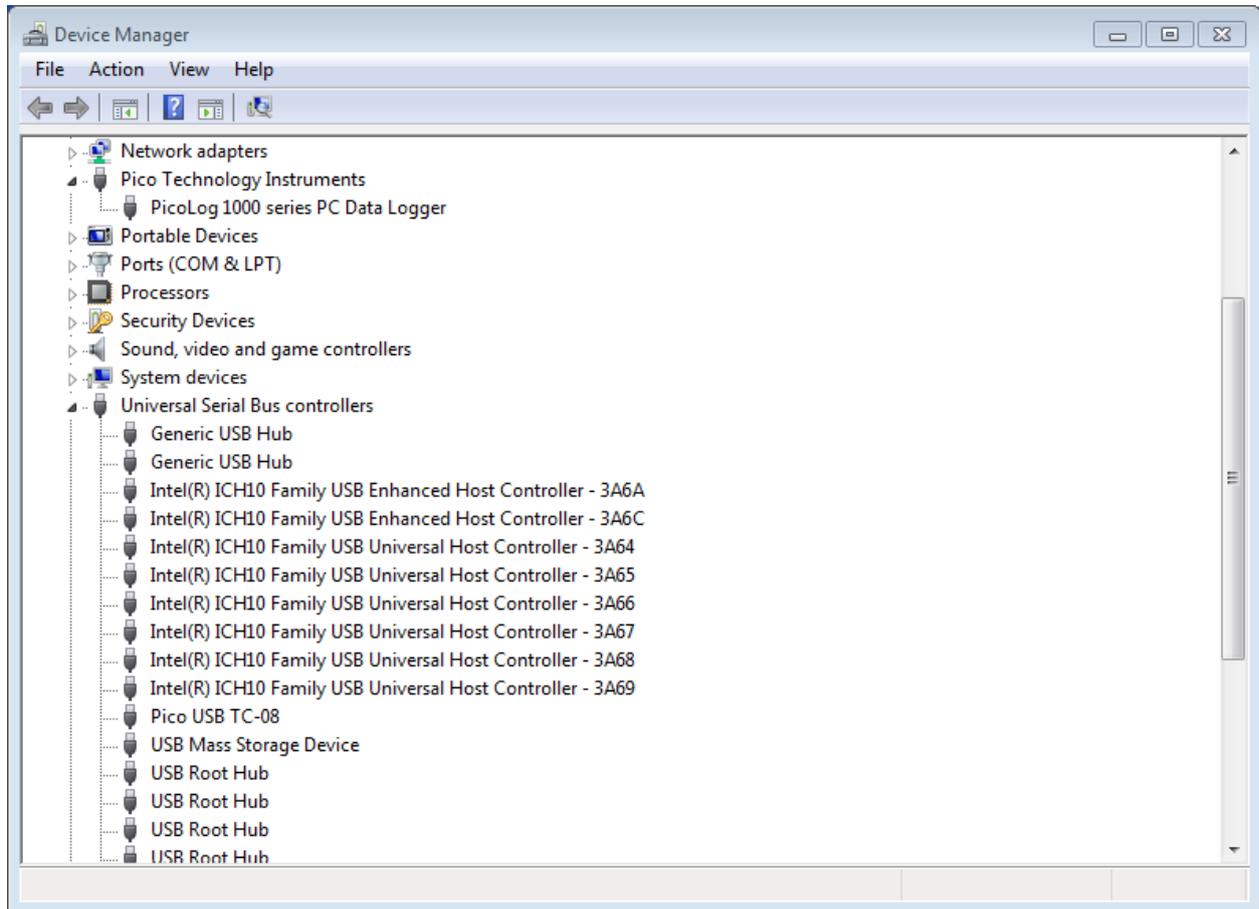
4. PicoLog does not recognise my device

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 in which case Windows will try 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 *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 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 *Device Manager* window again either under a *Pico Technology Instruments* sub-item or the *Universal Serial Bus controllers* as shown below:

Figure 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 recognise your logger, you may have installed it incorrectly or for the wrong device. Please rerun your PicoLog installation file, and 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, tick 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 the logger is not plugged into the PC. Now click the Windows *Start* button, 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 *support@picotech.com* and we can then see what has gone wrong with the installation.

5. Finding the PicoLog software version

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

For Windows 98 and earlier, use version R5.16.2 of PicoLog.

For Windows XP and later, use the latest version of PicoLog available.

6. PicoLog crashes on start-up

If the software is crashing as soon as you start up it is probably because of a 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 system)*
- *C:\Program Files (x86)\Pico Technology\Pico Full (64-bit operating system)*

PicoLog uses this file to hold information about the preferences you set when running the program. Please see if 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. This will need to be deleted as well.

To access the *Application Data/AppData* folder and subfolders, the option to view hidden folders within Windows must be enabled:

Windows XP:

- Go to *C:\Documents and Settings\<User name>* in Windows Explorer
- Click *Tools > Folder Options…*

Windows Vista/7:

- Go to *C:\Users\<User Name>* in Windows Explorer
- Click *Organise* and select *Folder and search options*

Click the *View* tab, then under *Hidden Files and Folders*, select the tick box to *Show hidden files and folders*, and click *OK*:
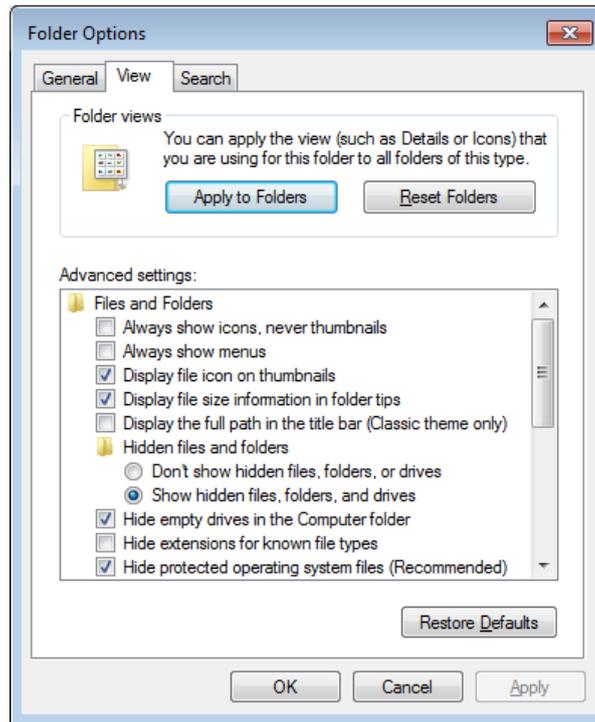
Windows 8:

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

If you navigate to the following folder on your PC: -

Windows XP: -

- *C:\Documents and Settings\<User name>\Local Settings\Application Data\Pico Technology*

Windows Vista/7/8: -

- *C:\Users\<User name>\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.

Having done all the above, return to Explorer and select *Do not show hidden files & folders*.

7. What power settings should my PC have?

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

For instance, in Windows XP:-

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

Windows Vista/7/8:

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

and:

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

8. When you start PicoLog, you get Player and not Recorder

If, when running PicoLog, you minimise the *Recorder* window, it will shrink to a small *PL* logo in the bottom right of the toolbar:

Figure 2 - PicoLog icon in System Tray

After a short while, the icon may disappear. Expand the System Tray to locate the icon:
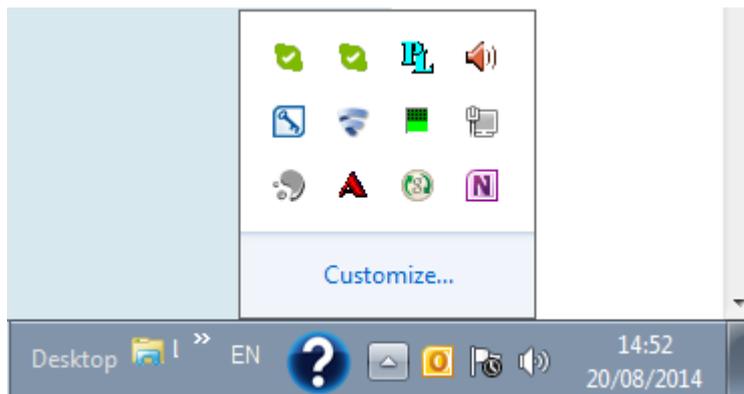
Figure 3 - PicoLog icon in expanded System Tray

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

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

9. 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 five TC-08s in via a powered USB hub. Start up PicoLog. Select *File*, then *New Settings*. In the *Recording* dialog box, tick the box for *Use multiple converters*.
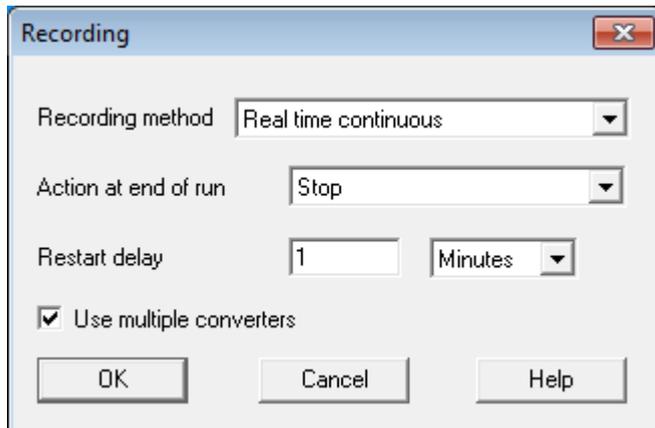
2. Continue to the *Converters* dialog:
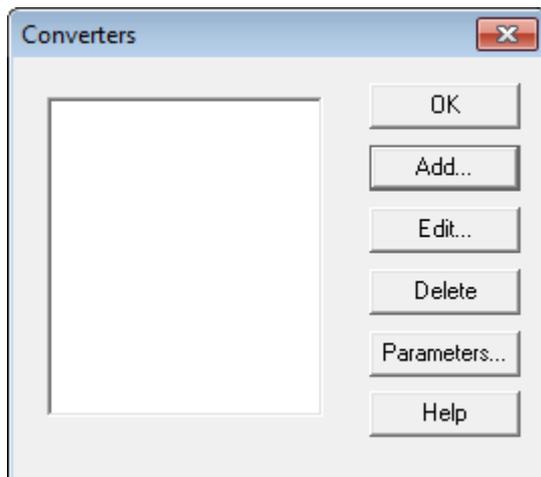
and select *Add*.

This will take you to the *Converter Details* box where you select TC-08 (USB). PicoLog should find all the data loggers:
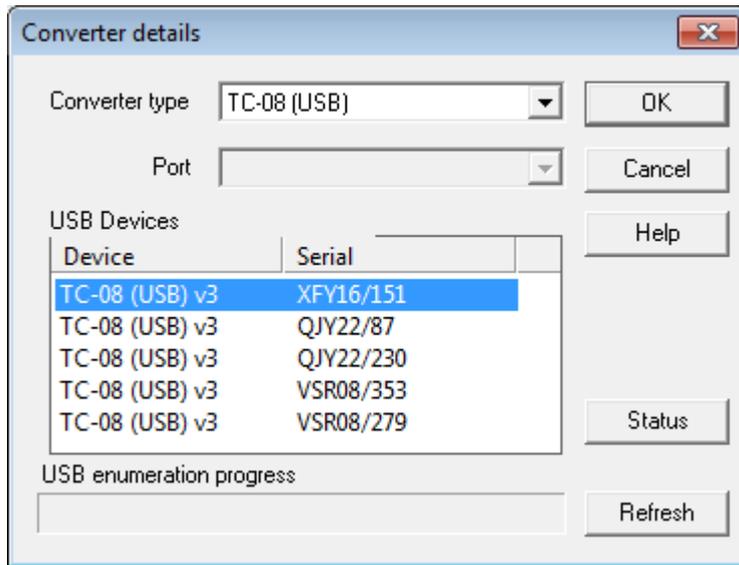
3. Click on the first one shown in the *USB Devices* box and click *OK*. You will be returned to the *Converters* dialog where you click *Add* again. This will take you to the *Converter Details* box where you select TC-08 (USB) for the second time.

4. 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:
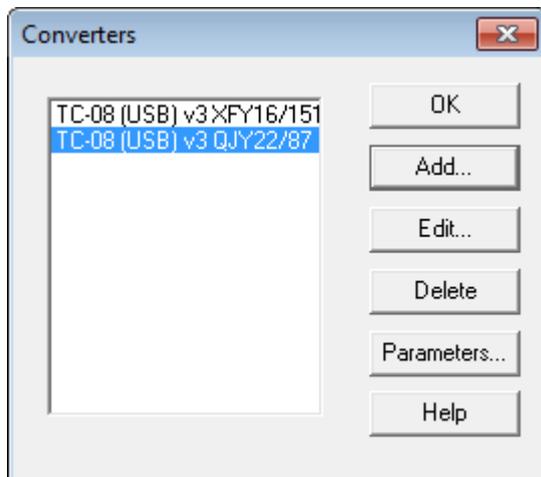
5. Repeat 3 and 4 until all five USB TC-08 devices are found:
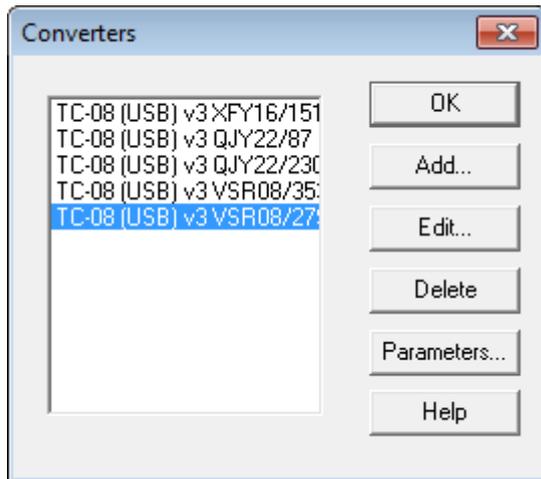
6. Click *Parameters* to set up each channel, for each TC-08, one at a time. All five TC-08s will now behave as if they are one 40-channel data logger:
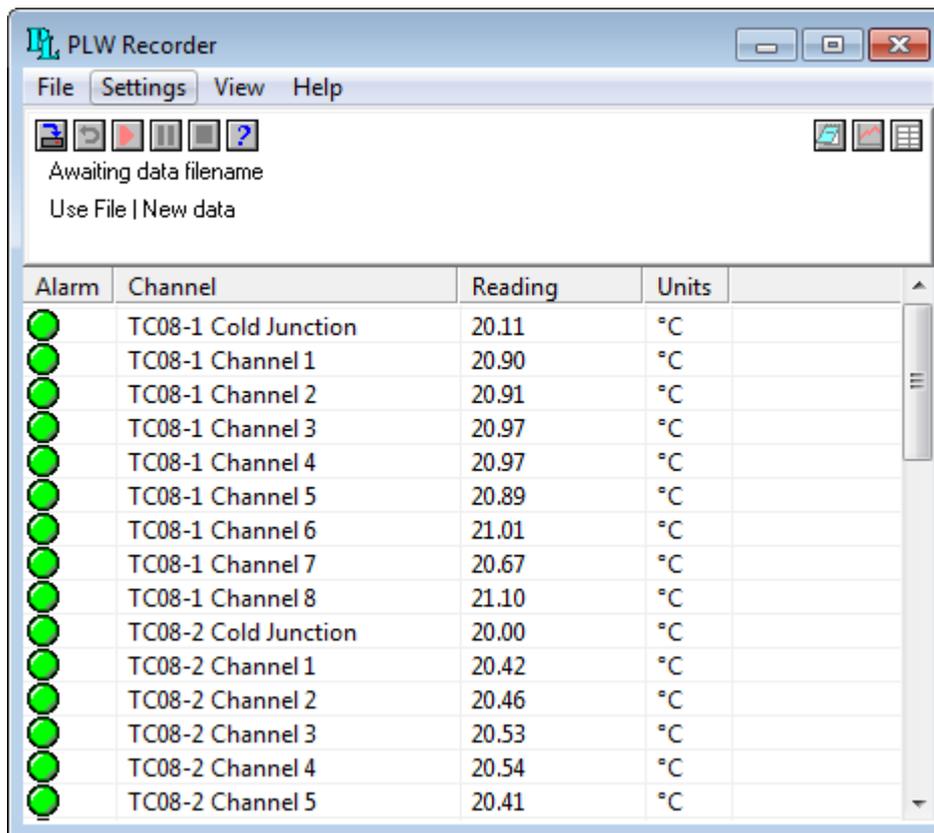
The data from all channels is saved to the data file and *Recorder* view can display all the channels at once. Only 20 channels can be displayed at any one time in *Graph* view and 16 channels in *Spreadsheet* view. (Viewing more than 20/16 channels at a time would be difficult to interpret.)

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. Please see page 37 of the PicoLog manual (issue 5) for how to set up a group (please refer to the *Related Documents* section).

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 in *Graph* view sometimes the new group can be not 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 (e.g. a USB TC-08 and ADC-20), please ensure that the tick box to *Install for other devices* is selected in the *Default Device Selection* dialog during the PicoLog installation process:
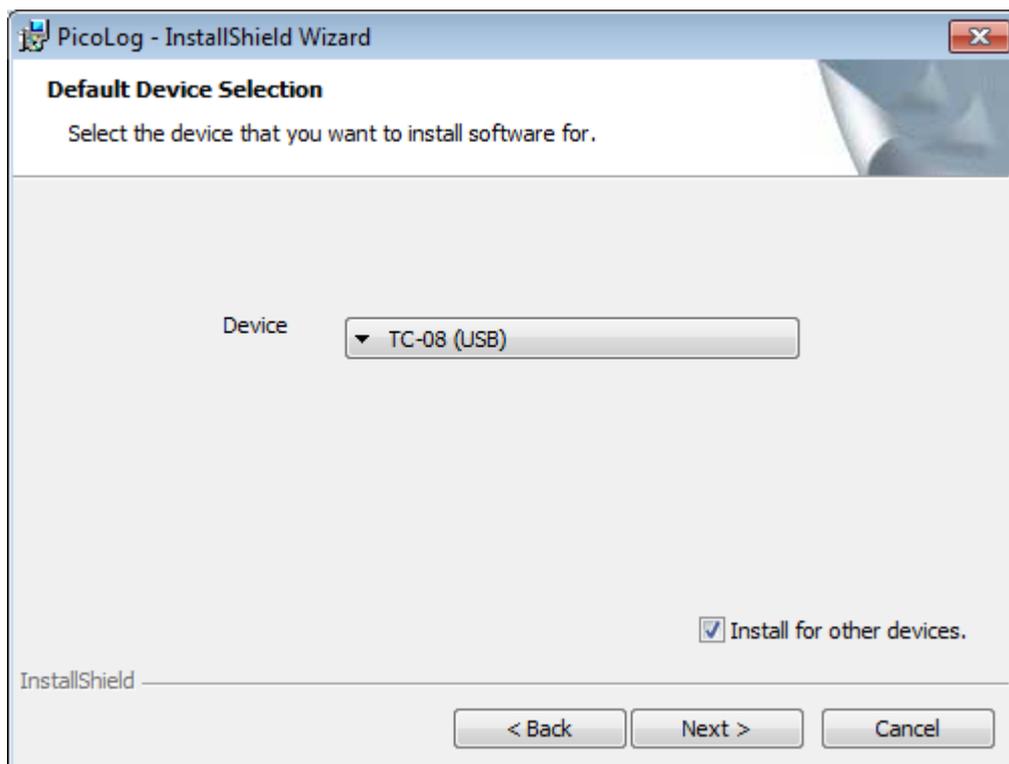
Figure 4 - PicoLog Installer: Default Device Selection

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

10. Configure Windows to open PicoLog data and settings files with a double-click

You can save multiple PicoLog settings files and configure Windows to open them with a double-click.

1. First enter your desired settings into PicoLog.
2. Next, go to *File > Save as* and change the file type to *Settings files (*.pls)*. This will save a .pls file on your computer.
3. Now right-click the .pls file in Windows Explorer and select *Open with*.
4. Ignore the default programs and navigate to the PicoLog installation folder, where you will find the program *plw32.exe*:

    a. For 32-bit operating systems, this will be

       C:\Program Files\Pico Technology\Pico Full

    b. For 64-bit operating systems, this will be

       C:\Program Files (x86)\Pico Technology\Pico Full

5. Choose this as the new default program for .pls files.
6. Having done this, you can double-click any .pls file and instantly open PicoLog with your saved settings.

For data files, undertake steps 3 to 5 (where *plw32.exe* will be the new default program for .plw files.

11. How to run multiple instances of PicoLog Recorder

Normally, if the PicoLog application is loaded with an instance of PicoLog Recorder already running, PicoLog Player will be loaded.

Section 3.13 (*Run multiple recorders*) in the *PicoLog Data logging software User's Guide* demonstrates how to create separate settings files for each device in the event that two separate instances of PicoLog Recorder need to be loaded:

1. Attach one (or the first set) of the converters to the PC
2. Start PicoLog, select *New Settings* from the *File* menu, then follow the sequence of dialogs to set up your converter(s)
3. Select *Save as…* from the *File* menu, navigate to the folder where you wish to save the settings file, and from the *Save as type:* drop down box, select *Settings files (*.pls)*, then *Save*.
4. Disconnect the first converter and attach the second (or the second set) , then repeat the steps above.

The *User's Guide* then provides information on how to start the PicoLog Recorder instances using the Windows command line interface. Alternatively, a batch file can be created allowing a user to double-click the file and start the two instances of PicoLog Recorder.

Below is a sequence of steps to create such a batch file using settings files for two USB TC-08 devices which have been saved in the PicoLog installation folder:

1. In a folder, right-click empty space and select *New > Text Document*
2. Open the text document and enter the following text, adapting it for the name and location of your settings files:

   cd "C:\Program Files\Pico Technology\Pico Full\"
   START plw32.exe "C:\Program Files\Pico Technology\Pico Full\TC_08_1.pls"
   TIMEOUT /T 10 /NOBREAK
   START plw32.exe "C:\Program Files\Pico Technology\Pico Full\TC_08_2.pls"
   Pause

   NOTE: For 64-bit operating systems the path to the PicoLog installation directory should read:

   cd "C:\Program Files (x86)\Pico Technology\Pico Full\"

3. Save the text document and close it.
4. In the folder where the text file has been saved, right-click the file and select *Rename*.
5. Enter a new name for the file, and change the file extension from *.txt* to *.bat*
   a. If the file extension is not shown, open the *Folder Options* dialog as Section 3 in this document and uncheck the *Hide extensions for known file types* option.
6. If a *Rename* dialog appears, click *Yes* to confirm that the file extension should be changed.
7. Ensure that the required data logger devices are connected to the PC, then double-click the batch file to start two instances of PicoLog recorder.

12. 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:-

Taken from page 19 of the *PicoLog User's Guide* (see *Related Documents*):

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 *winipcfg.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 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

13. PicoLog file size and recovery

The largest file that is 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 across. Even a settings (.pls) file with no actual data will work as well, as long as the channels, sample rate and number of samples, etc. are identical.

14. PicoLog frequency measurement

You can use PicoLog with the PicoLog 1000 Series (and certain oscilloscopes, see below) 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* and select *Real Time Continuous*, then click *OK*.
- Select a sampling time of 1 second to take a reading 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 µs, which will give you a frequency range of 20 Hz to 11.626 kHz.
- Using *Options* and then *Scaling* you can get PicoLog to display in RPM, not frequency (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 is:-

> *C:\Users\<Your user name>\AppData\Local\Pico Technology42f31349-afb8-471d-8a4d4fb7672be39b*

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

> *QuickSampleMs=100*

under the section labelled:-

> *[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 this to a lower value.

Save and exit, and next time you go into PicoLog recorder this will become active.

This is covered in the *PicoLog User's Guide* on page 105 under *QuicksampleMs* (see *Related Documents*). Also take note of frequency ranges. When you set up the channel used for frequency, there is a section 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 three times the period of the frequency you want to measure.

15. Device-specific information

15.1 Device-specific – TC-08

Serial TC-08

To use the Serial TC-08 on a USB port you will need a USB to serial adapter, either ours or another manufacturer's. That needs to be installed first, using the supplied software driver, usually on a small CD. Once installed and working, you then need to go to Windows *Device Manager* and look under *Ports (COM* and *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 is greater than 4, force it into 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 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. The above instructions are for Windows XP but similar will apply for other versions of the Windows operating system.

Plug your TC-08 into the USB adapter 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 will frequently assume 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 recognised and to which COM port it is allocated. 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 moment). When installing, still select Serial TC-08 as the device, not USB TC-08.

TC-08 sample rate

The TC-08 takes 100 ms per thermocouple to read temperature, and once per cycle through all the active channels it must read the cold junction temperature as well, which takes another 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 x 100 + 100 = 300 ms or about three readings per channel per second.

If all 8 channels are in use, the cycle is 8 x 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 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, 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, then 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

Each channel can be adjusted to compensate for calibration errors.

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 (.pls) file, allowing 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 on *Edit*, then click on *Options*.

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

In the *Parameter scaling* dialog box, 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), then type into 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 your own measurements)

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

The actual table will look similar to 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 ticked 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 (.pls) file and next time, when you want to reapply the same calibration to a logging session, just start PicoLog by double-clicking the settings file instead of the PicoLog icon.

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

Here are some standard instructions for this sort of scaling of a 4–20 mA sensor to the TC-08: -

The sensor will require a +24V supply. Feed the positive of the supply to the positive of the sensor. Feed the negative of the sensor to the *+5V/4-20mA* input of the single

channel terminal board. Connect the 0 V of the power supply to the *Com* terminal of the single-channel terminal board. Set the switch of the single-channel terminal board to *4-20 mA*.

The text below explains the setup process:-

The 4-20 mA will flow through a load resistor on the adapter board, generating between 9.5 mV (@ 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 on *Options*.

3. In the *Parameter options* box, tick *Use Parameter Formatting* and set *Units* to *psi*, *Formatting* to your own preference (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:-

> *9.5 0*
> *47.5 30*

> (Note the space between the two numbers on each line.)

The 9.5 is derived from 4 (mA) times 240 (Ω) divided by 101 (attenuation in the single channel 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 on *Help* for 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 MΩ resistance to ground. The differential input resistance is thus 2 MΩ. The TC-08 measures the difference in voltage between the two pins with a working range of ±70 mV maximum. For correct operation, both input voltages must stay in the range ±7.0 V with respect to ground (0 V). No damage will result if this common-mode voltage is higher than ±7.0 V unless the voltage increases to above ±30 V. As long as all the voltages stay within ±7.0 V of 0 V, the channels will read correctly.

Incorrect and variable readings are usually caused by a thermocouple touching something that is at a different potential to the TC-08 or PC earth. If this voltage is greater than about ±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.

The overload can be on one channel, or between channels. The TC08 has an input range of approx 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 the TC-08's ground (also computer ground and usually mains earth) then errors will occur. A typical example where this may occur is when 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 several volts different to that of the earth of the computer.

Plug in the thermocouples one by one 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 will earth the area near the thermocouple tip and is often enough to pull the two grounds close enough 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 adapter, 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 for further details: support@picotech.com.

For links to the *USB TC-08 Temperature Logger User's Guide* and the *USB TC-08 Single Channel Terminal Board* please refer to the *Related Documents* section in this document.

15.2   Device-specific – PicoLog 1012 and 1216

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

If you find that you any only log at about 20 to 50 ms sampling rates, you are probably running in "Real Time Continuous" mode.

This mode allows you to use multiple loggers at one time but the sample rate is slow (20 to 50 ms, dependant on PC speed). 1 ms cannot be obtained even if requested.

It does, however, allow you to also 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. First click *File*, then *New Settings*.
2. In the *Recording* dialog, for *Recording method* select *Streaming (single converter only)* and then click *OK*.
3. When the 1216 has enumerated, click *OK* again and now you can select the sample 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. AC voltage, frequency and dB readings will not be offered, though.

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 that of the highest-frequency component of the input signal.

Streaming mode

This is 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

This is 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 4-20mA signals with the PicoLog 1012 logger

With the addition of one 120 Ω resistor per channel used, the 1012 can accept 4–20 mA signals, which will develop 0.48 to 2.4 volts across the 120 Ω resistors. This can be easily scaled within our free PicoLog program to the correct engineering units and 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.

Here are some instructions on how to setup for 4–20 mA operation with an example of a 0 to 10 bar pressure sensor: -

All you have to do is to pass the 4–20 mA current output by the sensor through a 120 Ω 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 0 V terminal of the +12 V to 24 V sensor supply is connected also to the ground of the 1012. The resistors used can be soldered to the terminal board permanently or just gripped by the screws used to connect wires to the terminal board.

The positive output of the supply goes to the positive terminal of the sensor. The negative terminal loops back to the other end of the 120 Ω 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. 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 µs.*
4. Now click *Options*. (You might be asked to save the present setup. If so, click *OK*.)
5. In the *Parameter Options* dialog box tick *Use parameter Formatting*, and type *bar* in the *Units* box. *Field Width = 4*, *Decimal places = 2*, *Minimum value = 0*, *Maximum value = 10*. Now click *Scaling* to go to the next dialog.
6. In the *Parameter scaling* dialog box, select *Table Lookup* as the *Scaling method* and in the visible 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.

   The *0.48* is derived from 4 (mA) times 120 (Ω) = 0.48 V.
   The *2.4* is 20 (mA) times 120 (Ω) = 2.4 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 zero mA. (0 bar = 4 mA).

Look through the PicoLog manual for information on using PicoLog or click on the *Help* button 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 1216, you will need to cut off the 4-pin connector and just use the two outside wires to connect to the 1216 terminal board. (The two inside wires just connect to a fixed resistor which is only used with the DrDAQ.)

Connect one of the outside wires (does not matter which) to one of the *Gnd* terminals of the 1216 terminal board. Connect the other outside wire to the *C1* (Channel 1) input terminal of the 1216 terminal board. You will now require a 39 kΩ resistor to connect between the channel 1 input and the *+2.5* terminal of the 1216 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 can only get a surface-mount 39 kΩ resistor, you can mount it in the *R33* position on the terminal board as shown in page 4 of the *PicoLog 1000 Small Terminal Board User's Guide* (see *Related Documents*).

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°C to +100°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*), highlight *Channel 1* and click *Edit*.
3. Type *Temperature* as the *Name*.
4. Now click *Options*. (You might be asked to save the present setup. If so, click *OK*).
5. In the *Parameter Options* dialog box tick *Use parameter Formatting*, put *°C* in the *Units* box. *Field Width = 5*, *Decimal places = 2*, *Minimum value = -10*, *Maximum value = 100*. Now click *Scaling* to go to the next dialog.
6. In the *Parameter scaling* dialog box, select *Table Lookup* as the *Scaling method* and in the 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*

    (Please note there is a single space between the pairs of numbers.)

    This tells the program to equate 2.247 V to −10 °C on the graph and 0.375 V to 100 °C on the graph (plus intermediate values).

7. Go *OK* to go back through the open boxes and channel 1 should now be scaled from −10°C to +100°C.

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

Note:- Lookup tables seem to 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 ticked 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

If you are using, for example, a thermistor, type:-*NJ28 RA 0104 FCC (100k ohm @ 25 °C)* and you are using a 47 kilohm resistor as a load resistor to the +2.5V reference to give a working range of 5 °C to 145 °C.

The PicoLog 1012 has an input resistance of 1 MΩ and this is in parallel with the thermistor. Thus the thermistor resistance value is reduced to:

(100 x 1,000) / (100 + 1,000) kΩ = 90.91 kΩ (@25 °C)

The +2.5 V sensor supply of the PicoLog 1012 is fed through the 47 kΩ resistor to the thermistor wired across the input channel and @25 °C the voltage at their junction will be:

(2.5 x 90.91) / (90.91 + 47) volts = 1.648 V.

Doing the same calculations from 0 °C to 150 °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*. (You might be 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, as *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 the pairs 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.

Go *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.

Look through the PicoLog manual for information on using PicoLog or click the *Help* button 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. To start with, you will need to add resistors to the terminal board exactly as described in the *PicoLog 1000 Small Terminal Board User's Guide* (see *Related Documents*).

Here are the values to obtain a ±5 V range:

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

   These three resistors, will scale a +5 V to –5 V input to be seen at 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, 34, 35 and 36.)

4. 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*.
5. Leave the *Measurement* as *DC Volts* and the *Scan Time* as it is.
6. Now click *Options*. (You will be asked to save channel settings to continue.)
7. Now click *Scaling* to go to the next dialog.
8. In the *Parameter scaling* dialog, select *Equation* as the *Scaling method* and in the text box, type:-
   4.02*X-5

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

See *Related Documents* for a link to the *PicoLog 1000 Series User's Guide*.

When no input is connected, the DC voltage measured will float up to near +1.67 volts. 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.

15.3   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 120 Ω 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 120 Ω 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 then select ±2500 mV as the *Voltage range*.
4. Leave *Differential input enable* unchecked.
5. Now click *Options.* (You might be asked to save the present setup. Click *OK*.)
6. In the *Parameter Options* dialog box tick *Use parameter Formatting*, type *bar* in the *Units* box. Field Width = 4, Decimal places = 2, Minimum value = 0, Maximum value = 40. Now click on *Scaling* to go to the next dialog.
7. In the *Parameter scaling* dialog box, 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.

   For your information, the 480 mV is derived from 4 (mA) times 120 (Ω) = 480 mV. The 2400 is 20 (mA) times 120 (Ω) = 2400 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 zero mA. (0 bar = 4 mA).

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

Sample rate for ADC-20/24

The ADC-24 will take 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. For short settling times, the full resolution of the converter cannot be reached. For 660 ms, the full resolution is obtained. Please see page 12 of the *ADC-20/ADC-24 High_Resolution Data Loggers User's Guide* (see *Related Documents*).

The settling time for the ADC-24 is fixed by the hardware and is independent of the requested sample rate set in PicoLog. If samples are requested faster than the settling time chosen, then 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 that has been taken by the hardware.

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

Thermistor temperature sensing with the ADC-20/24

As an example we will use the following thermistor:-

https://www.elfa.se/elfa3~se_sv/elfa/init.do?item=60-290-84&toc=19509

and we will assume measurement in the range of 60 to 110 °C. The centre of the range is 85 °C so we will optimise for that value.

The thermistor above has a resistance of 8376 Ω at 85 °C so Ra needs to match that for a centre-scale reading of volts (+1.25 V) at this temperature. Use an 8.2 kΩ 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 MΩ and this is in parallel with the thermistor. Thus the thermistor resistance value is reduced to (8.376 x 1000)/(8.376 + 1000) kΩ = 8306.4 kΩ (@85 °C). Assuming you are using the +2.5 V sensor supply of the ADC-24, this is fed to the 8.2 kΩ resistor and thermistor in series and the voltage at their junction will be (2.5 x 8306.4) / (8306.4 + 8200) volts = 1.2581 V.

Doing the same calculations from 60 °C to 110 °C gives 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 ±2500 mV as the *Voltage range*.
4. Leave *Differential input enable* unchecked.
5. Now click *Options*. (You might be asked to save the present setup. Click *OK*.)
6. In the *Parameter Options* dialog box tick *Use parameter Formatting*, put *°C* in the *Units* box. *Field Width = 4, Decimal places = 1, Minimum value = 50, Maximum value = 120*. Now click on *Scaling* to go to the next dialog.

7. In the *Parameter scaling* dialog box, select *Table Lookup* as the *Scaling method* and in the text box, type:-

   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

   (Please note: there is a single space between the pairs 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 ±2.4 °C at 60 °C, ±3.5 °C at 85 °C and ±4.6 °C at 110 °C. You may want to choose a better one.)

For a link to the *ADC-20/ADC-24 Terminal Board User Guide*, please refer to the *Related Documents* section in this document.

15.4 Device-specific – PT-104

The PT-104 logger is designed to be very accurate but is designed for fairly stable temperatures since 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.

For links to the *PT-104 Data Logger User's Guide* and the *PT-104 Screw Terminal Adapter (PP660) User's Guide* please refer to the *Related Documents* section in this document.

15.5 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, that being 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 polling the CM3 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 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 suitable only for AC current measurements. For DC current monitoring, we suggest using a DC current clamp with one of our PicoScope oscilloscope models.

For a link to the *PicoLog CM3 Current Data Logger User's Guide*, please refer to the *Related Documents* section in this document.

15.6   Device-specific – USB DrDAQ

To be able 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 3.3 kΩ 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.

Pages 27 to 37 in the *USB DrDAQ Data Logger User's Guide* (see *Related Documents*):

> *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) then 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*

15.7   Device-specific – PicoScope 2203, 2204, 2204A, 2205, 2205A

Clicking relay noise with PicoScope 2203/4/5 including 'A' models

The PicoScope 2203/3A/4/4A/5/5A 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 channel's A to D converters in parallel to get twice the bandwidth. Then the other input connector is routed through the same pair of A to D converters 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 ±1 V or lower, the gain relay will cycle continuously.

The way to have two channels in use without the relay noise is to have both set to any voltage greater than ±1 V (±2 V to ±20 V, and they can be different).

For the smaller voltage ranges less than ±2 V (±1 V to ±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 MS 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 ranges must be ±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 4-20mA sensor using a PicoScope 2203, 2204 or 2205

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

With the PicoScope 2203/4/5, it would be simple to use a 50 Ω, through-terminator for the load resistor necessary at the BNC input. This is a standard product from RS Components. 546-4695, £9.80. It is in fact just a BNC male to female connector with a 50 Ω resistor in parallel internally. Calculating for 50 Ω, 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 (*PicoScope2000 Edit Measurement*):
    a. Type *Pressure* as the *Name* and ±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, tick *Use parameter Formatting*, and put *bar* in the *Units* box. *Field Width = 4, Decimal places = 2, Minimum value = 0, 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: there is a 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.

For reference, the 0.2 is derived from 4 (mA) times 50 (Ω) = 0.2 V.
The 1.0 is 20 (mA) times 50 (Ω) = 1.0 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 manual for information on using PicoLog or click the *Help* button at any stage in PicoLog.

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

- 120 Ω x 4 mA = 480 mV
- 120 Ω x 20 mA = 2400 mV

For a link to the *PicoScope 2200 Series User's Guide* and *PicoScope 2200A Series User's Guide*, please refer to the *Related Documents* section in this document.

16.Related documents

ADC-20/ADC-24 High_Resolution Data Loggers User's Guide:
http://www.picotech.com/document/pdf/adc20.en-5.pdf

ADC-20/ADC-24 Terminal Board User Guide:
http://www.picotech.com/document/pdf/adc2024_terminal_board_user_guide-5.pdf

PicoLog 1000 Small Terminal Board User's Guide:
http://www.picotech.com/document/pdf/DO161-SmallTerminalBoardUsersGuide-3.pdf

PicoLog 1000 Series User's Guide:
http://www.picotech.com/document/pdf/pl1000-en-2.pdf

PicoLog CM3 Current Data Logger User's Guide:
http://www.picotech.com/document/pdf/plcm3.en-2.pdf

PicoLog User's Guide:
http://www.picotech.com/document/pdf/plw.en-5.pdf

PicoScope 2200 Series PC Oscilloscopes User's Guide:
http://www.picotech.com/document/pdf/ps2200.en-2.pdf

PicoScope 2200A Series PC Oscilloscopes User's Guide:
http://www.picotech.com/document/pdf/PicoScope_2200ASeriesUsersGuide-1.pdf

PT-104 Data Logger User's Guide:
http://www.picotech.com/document/pdf/usbpt104.en-2.pdf

PT-104 Screw Terminal Adapter (PP660) User's Guide:
http://www.picotech.com/document/pdf/DO172-PT-104_Screw_Terminal_Adapter_User_Guide-1.pdf

USB DrDAQ Data Logger User's Guide:
http://www.picotech.com/document/pdf/usbdrdaq_en-2.pdf

USB TC-08 Single-Channel Terminal Board User's Guide:
http://www.picotech.com/document/pdf/DO167-USB-TC08-Terminal-Board-Users-Guide.en-1.pdf

USB TC-08 Temperature Logger User's Guide:
http://www.picotech.com/document/pdf/usbtc08.en-7.pdf