Contents

1 Introduction .................................................................................................................. 1

1 Overview ....................................................................................................................... 1

2 License agreement ......................................................................................................... 1

3 Trademarks .................................................................................................................. 2

4 Software updates ......................................................................................................... 2

2 Writing your own software ............................................................................................ 3

1 About the driver ............................................................................................................ 3

2 Installing the driver ....................................................................................................... 3

3 Connecting the logger .................................................................................................... 3

4 Capture modes .............................................................................................................. 3

5 USB DrDAQ scaling files (.DDS) .................................................................................. 4

3 USB DrDAQ API functions ............................................................................................ 7

1 UsbDrDaqCloseUnit ....................................................................................................... 9

2 UsbDrDaqEnableRGBLED .............................................................................................. 10

3 UsbDrDaqGetChannelInfo ............................................................................................. 11

4 UsbDrDaqGetInput ......................................................................................................... 12

5 UsbDrDaqGetPulseCount ............................................................................................... 13

6 UsbDrDaqGetScalings .................................................................................................... 14

7 UsbDrDaqGetSingle ....................................................................................................... 15

8 UsbDrDaqGetSingleF ..................................................................................................... 16

9 UsbDrDaqGetTriggerTimeOffsetNs .............................................................................. 17

10 UsbDrDaqGetUnitInfo ................................................................................................... 18

11 UsbDrDaqGetValues ..................................................................................................... 19

12 UsbDrDaqGetValuesF .................................................................................................. 20

13 UsbDrDaqOpenUnit ...................................................................................................... 21

14 UsbDrDaqOpenUnitAsync ............................................................................................ 22

15 UsbDrDaqOpenUnitProgress ....................................................................................... 23

16 UsbDrDaqPingUnit ....................................................................................................... 24

17 UsbDrDaqReady ........................................................................................................... 25

18 UsbDrDaqRun .............................................................................................................. 26

19 UsbDrDaqSetDO .......................................................................................................... 27

20 UsbDrDaqSetInterval ................................................................................................. 28

21 UsbDrDaqSetIntervalF ................................................................................................. 30

22 UsbDrDaqSetPWM ....................................................................................................... 31

23 UsbDrDaqSetRGBLED ................................................................................................. 32

24 UsbDrDaqSetScalings .................................................................................................. 33

25 UsbDrDaqSetSigGenArbitrary ..................................................................................... 34

26 UsbDrDaqSetSigGenBuiltIn ......................................................................................... 35

27 UsbDrDaqSetTrigger .................................................................................................... 36

28 UsbDrDaqStartPulseCount ......................................................................................... 37

29 UsbDrDaqStop ............................................................................................................. 38

30 UsbDrDaqStopSigGen ................................................................................................. 39
Contents

31 Channel numbers .......................................................................................................................... 39
32 PICO_STATUS values .................................................................................................................. 40
4 Example code ............................................................................................................................... 42
5 Glossary ......................................................................................................................................... 43
Index ............................................................................................................................................... 45
1 Introduction

1.1 Overview

The USB DrDAQ PC Data Logger is a medium-speed, multichannel voltage-input device for sampling data using a PC. This manual explains how to use the Application Programming Interface and drivers to write your own programs to control the unit. You should read it in conjunction with the USB DrDAQ User’s Guide.

The Software Development Kit for the USB DrDAQ is compatible with 32-bit and 64-bit editions of Microsoft Windows XP (SP3), Windows Vista, Windows 7, Windows 8 and Windows 10.

1.2 License agreement

**Grant of license.** The material contained in this release is licensed, not sold. Pico Technology Limited ("Pico") grants a license to the person who installs this software, subject to the conditions listed below.

**Access.** The licensee agrees to allow access to this software only to persons who have been informed of and agree to abide by these conditions.

**Usage.** The software in this release is for use only with Pico products or with data collected using Pico products.

**Copyright.** The software in this release is for use only with Pico products or with data collected using Pico products. You may copy and distribute the SDK without restriction, as long as you do not remove any Pico Technology copyright statements. The example programs in the SDK may be modified, copied and distributed for the purpose of developing programs to collect data using Pico products.

**Liability.** Pico and its agents shall not be liable for any loss or damage, howsoever caused, related to the use of Pico equipment or software, unless excluded by statute.

**Fitness for purpose.** No two applications are the same, so Pico cannot guarantee that its equipment or software is suitable for a given application. It is therefore the user's responsibility to ensure that the product is suitable for the user's application.

**Mission-critical applications.** Because the software runs on a computer that may be running other software products, and may be subject to interference from these other products, this license specifically excludes usage in "mission-critical" applications, for example life-support systems.
Viruses. This software was continuously monitored for viruses during production. However, the user is responsible for virus checking the software once it is installed.

Support. No software is ever error-free, but if you are dissatisfied with the performance of this software, please contact our technical support staff.

Upgrades. We provide upgrades, free of charge, from our web site at www.picotech.com. We reserve the right to charge for updates or replacements sent out on physical media.

1.3 Trademarks

Pico Technology, PicoScope, PicoLog and DrDAQ are trademarks of Pico Technology Limited, registered in the United Kingdom and other countries.

PicoLog and Pico Technology are registered in the U.S. Patent and Trademark Office.

Windows and Excel are registered trademarks of Microsoft Corporation in the USA and other countries.

1.4 Software updates

Our software is regularly updated with new features. To check what version of the software you are running, start PicoScope or PicoLog and select the Help > About menu. PicoScope can check for updates automatically and advise you if an update is available. You can download the latest versions of the software free of charge from the Pico Technology web site at:

https://www.picotech.com/downloads

Alternatively, the latest software can be purchased on disk from Pico Technology.

To be kept up-to-date with news of new software releases, click here to join our e-mail mailing list.
2 Writing your own software

2.1 About the driver

USB DrDAQ is supplied with a kernel driver and a DLL, *UsbDrDaq.dll*, containing routines that you can build into your own programs. The driver is supported by the following operating systems:

- Microsoft Windows XP (SP3 or later)
- Microsoft Windows Vista
- Microsoft Windows 7
- Microsoft Windows 8
- Microsoft Windows 10

and is supplied in 32-bit and 64-bit versions.

The SDK contains the drivers, a selection of examples of how to use them, and the current *Programmer's Guide*.

The driver supports up to 64 units at one time.

2.2 Installing the driver

The drivers are supplied with the USB DrDAQ SDK. You can download the latest 32-bit and 64-bit versions of the SDK from our website at: [https://www.picotech.com/downloads](https://www.picotech.com/downloads)

Click *PicoLog Data Loggers > DrDAQ > Software > PicoSDK*

2.3 Connecting the logger

**Before you connect your logger, you must first** install the driver.

To connect the data logger, plug the cable provided into any available USB port on your PC. The first time you connect the unit, some versions of Windows may display a New Hardware Wizard. Follow any instructions in the Wizard and wait for the driver to be installed. The unit is then ready for use.

2.4 Capture modes

Three modes are available for capturing data:

- **BM_SINGLE**: collect a single block of data and exit
- **BM_WINDOW**: collect a series of overlapping blocks of data
- **BM_STREAM**: collect a continuous stream of data

**BM_SINGLE** is useful when you wish to collect data at high speed for a short period: for example, to collect 1000 readings in 50 milliseconds. The maximum block size is 16,384 samples, shared between all active channels.
BM_WINDOW is useful when collecting several blocks of data at low speeds - for example when collecting 10,000 samples over 10 seconds. Collecting a sequence of single blocks like this would take 10 seconds for each block, so displayed data would not be updated frequently. Using windowing, it is possible to ask for a new block more frequently, for example every second, and to receive a block containing 9 seconds of repeat data and 1 second of new data. The block is effectively a 10-second window that advances one second per cycle.

BM_STREAM is useful when you need to collect data continuously for long periods. In principle, it could be used to collect data indefinitely. Every time UsbDrDaqGetValues is called, it returns the new readings since the last time it was called. The noOfValues argument passed to UsbDrDaqRun must be sufficient to ensure that the buffer does not overflow between successive calls to UsbDrDaqGetValues. For example, if you call UsbDrDaqGetValues every second and you are collecting 500 samples per second, noOfValues must be at least 500, or preferably 1000, to allow for delays in the operating system.

2.5 USB DrDAQ scaling files (.DDS)

The DrDAQ driver has built-in scaling for each of the built-in and Pico-supplied sensors. You can incorporate scaling for your own sensors by adding a file called scaling.dds (where "scaling" can be replaced with a name of your choice). This file will contain the details of your sensor.

The values returned by the driver are integers that represent fixed-point decimal numbers. For example, the driver treats pH as a value with two decimal places, so a pH of 7.65 is returned as 765.

You can call the routine UsbDrDaqGetChannelInfo to find out how many decimal places a channel is using, and also to get a divider that converts the integer value to the corresponding real number. For pH, the returned divider is 100, so 765 divided by 100 gives 7.65.

For some sensors, there is more than one possible scaling available. You can call UsbDrDaqGetScalings to get a list of valid scaling codes, then call UsbDrDaqSetScalings to select one of them. Once selected, UsbDrDaqGetChannelInfo will return full information about the selected scaling. If you do not use UsbDrDaqSetScalings, the driver will automatically select the first available scaling for each channel.

USB DrDAQ scaling files can be used to supplement the scalings built into the driver. Several DDS files may be used, and these must be placed in the current working directory where the USB DrDAQ software is installed. The total number of sets of scaling data in all the files used must not exceed 99.

Each scaling file may contain more than one set of scaling data. Each scaling must have a unique scaling number, contained in the [Scale...] section heading.

A set of typical entries from a .DDS file is shown below:

[Scale1]
Resistor=1
LongName=CustomTemperature1
ShortName=TempC
Units=C
MinValue=-40
MaxValue=120
OutOfRange=0
Places=1
Method=0
IsFast=Yes
NoOfPoints=32
Raw1=2.385
Scaled1=-30
...
Raw32=1.32
Scaled32=100

[Scale2]
Resistor=2.2
LongName=CustomTemperature2
ShortName=TempF
Units=F
MinValue=32
MaxValue=160
...
[Scale3]
Resistor=3.3
LongName=CustomLight
ShortName=Light
Units=lux
MinValue=0
MaxValue=20000
...

The meanings of the terms in the .DDS file are as follows:

[Scale1]

A unique number, from 1 to 99, to identify this entry. (Pico-created numbers are from 100 upwards.)

Resistor=1

The ID resistor value in kilohms. In this example "1" represents 1k, "2.2" represents 2k2 and so on.

For external sensors, this resistor should be fitted in the sensor. You must use one of the following resistors: 1k0, 2k2, 3k3, 5k6, 7k5 or 10k. The resistor must be 1% tolerance or better.

For internal sensors, use the following "virtual" resistor values:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Resistor value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Waveform</td>
<td>1200</td>
</tr>
<tr>
<td>Sound Level</td>
<td>1300</td>
</tr>
<tr>
<td>Voltage</td>
<td>1500</td>
</tr>
<tr>
<td>Resistance</td>
<td>1600</td>
</tr>
<tr>
<td>pH</td>
<td>1400</td>
</tr>
<tr>
<td>Temperature</td>
<td>1100</td>
</tr>
<tr>
<td>Light</td>
<td>1000</td>
</tr>
</tbody>
</table>

LongName=Temperature

Used in PicoLog
ShortName=TempC

This field is not used by USB DrDAQ running PicoScope or PicoLog.

Units=C

Displayed on graphs

MinValue=-40
MaxValue=120

Note: For PicoScope these values will determine the maximum and minimum values displayed in Scope View. For PicoLog these values determine what Maximum range is displayed in the Graph View (set in the Graph Options dialog).

Places=1

Number of decimal places. The options are 0, 1, 2 and 3. With places=1 the value 15.743 would be returned as 157, meaning 15.7. With places=2, the same value would be returned as 1574.

Method=0

This specifies the scaling method. 0 specifies table lookup and 1 specifies linear scaling.

Offset=0
Gain=1

These are the offset and gain values for linear scaling.

OutOfRange=0

This specifies what to do if the raw value is outside the range of the table lookup. The options are:
0 - treat as a sensor failure
1 - clip the value to the minimum or maximum table value
2 - extrapolate the value using the nearest two table entries.

ScopeRange=1.25V

This is used when scaling the oscilloscope channel. It specifies the range of the oscilloscope channel that should be used. Possible values are 10 V, 5 V, 2.5 V, and 1.25 V.

NoOfPoints=32

This is the number of table lookup points.

Raw1=2.385

Raw value for the first point in the look up table. The value is in V (volts) and should not be greater than 2.500 V.

Scaled1=-30

Scaled value for the first point in the look up table. The units are specified by the units parameter.
3 USB DrDAQ API functions

The following table explains each of the driver functions supplied with the USB DrDAQ data logger:

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UsbDrDaqCloseUnit</td>
<td>close the unit</td>
</tr>
<tr>
<td>UsbDrDaqEnableRGBLED</td>
<td>enable or disable RGB mode on the LED</td>
</tr>
<tr>
<td>UsbDrDaqGetChannelInfo</td>
<td>return a set of information about the currently selected scaling for the specified channel</td>
</tr>
<tr>
<td>UsbDrDaqGetInput</td>
<td>configure the general-purpose I/Os as digital inputs</td>
</tr>
<tr>
<td>UsbDrDaqGetInput</td>
<td>return the current pulse count</td>
</tr>
<tr>
<td>UsbDrDaqGetPulseCount</td>
<td>discover the scalings, both built-in and custom, that are available</td>
</tr>
<tr>
<td>UsbDrDaqGetSingle</td>
<td>get a single value from a specified channel</td>
</tr>
<tr>
<td>UsbDrDaqGetSingleF</td>
<td>get a single floating-point value</td>
</tr>
<tr>
<td>UsbDrDaqGetTriggerTimeOffsetNs</td>
<td>return the time between the trigger point and the first post-trigger sample</td>
</tr>
<tr>
<td>UsbDrDaqGetUnitInfo</td>
<td>return various items of information about the unit</td>
</tr>
<tr>
<td>UsbDrDaqGetValues</td>
<td>get a number of sample values after a run</td>
</tr>
<tr>
<td>UsbDrDaqGetValuesF</td>
<td>get floating-point values after a run</td>
</tr>
<tr>
<td>UsbDrDaqOpenUnit</td>
<td>open and enumerate the unit</td>
</tr>
<tr>
<td>UsbDrDaqOpenUnitAsync</td>
<td>report progress of UsbDrDaqOpenUnitAsync</td>
</tr>
<tr>
<td>UsbDrDaqOpenUnitProgress</td>
<td>check that a device is connected</td>
</tr>
<tr>
<td>UsbDrDaqPingUnit</td>
<td>indicate when UsbDrDaqRun has captured data</td>
</tr>
<tr>
<td>UsbDrDaqReady</td>
<td>tell the unit to start capturing data</td>
</tr>
<tr>
<td>UsbDrDaqRun</td>
<td>control the digital outputs</td>
</tr>
<tr>
<td>UsbDrDaqSetDO</td>
<td>set the sampling speed of the unit (integer)</td>
</tr>
<tr>
<td>UsbDrDaqSetInterval</td>
<td>set the sampling speed of the unit (floating-point)</td>
</tr>
<tr>
<td>UsbDrDaqSetIntervalF</td>
<td>configure the general-purpose I/Os as pulse-width modulation outputs</td>
</tr>
<tr>
<td>UsbDrDaqSetRGBLED</td>
<td>set the color of the LED once RGB mode has been enabled</td>
</tr>
<tr>
<td>UsbDrDaqSetScalings</td>
<td>set the scaling for a particular channel</td>
</tr>
<tr>
<td>UsbDrDaqSetSigGenArbitrary</td>
<td>allow full control of the arbitrary waveform generator</td>
</tr>
<tr>
<td>UsbDrDaqSetSigGenBuiltIn</td>
<td>set the arbitrary waveform generator using standard waveform types</td>
</tr>
<tr>
<td>UsbDrDaqSetTrigger</td>
<td>set the trigger on the unit</td>
</tr>
<tr>
<td>UsbDrDaqStartPulseCount</td>
<td>configure the general-purpose I/Os for pulse counting and start counting</td>
</tr>
<tr>
<td>UsbDrDaqStop</td>
<td>abort data collection</td>
</tr>
<tr>
<td>UsbDrDaqStopSigGen</td>
<td>turn the AWG off</td>
</tr>
</tbody>
</table>

The driver allows you to do the following:

- Identify and open the logger
- Take a single reading from a particular channel
- Collect a block of samples at fixed time intervals from one or more channels
- Set up a trigger event for a particular channel
- Get information about scalings available for a channel
- Select a scaling for a channel
- Control and read general-purpose I/Os
- Control arbitrary waveform generator
You can specify a sampling interval from 1 microsecond to 1 second. The shortest interval that the driver will accept depends on the capture mode selected.

The normal calling sequence to collect a block of data is as follows:

Check that the driver version is correct
Open the driver
Set trigger mode (if required)
Set sampling mode (channels and time per sample)

While you want to take measurements,  
Run
  While not ready
    Wait
  End while
  ... Get a block of data ...
End While
Close the driver
3.1 UsbDrDaqCloseUnit

PICO_STATUS UsbDrDaqCloseUnit
(
    int16_t handle
)

This function closes the unit.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from UsbDrDaqOpenUnit or UsbDrDaqOpenUnitProgress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns:</td>
<td>PICO_OK</td>
</tr>
<tr>
<td></td>
<td>PICO_HANDLE_INVALID</td>
</tr>
</tbody>
</table>
3.2 UsbDrDaqEnableRGBLED

```c
PICO_STATUS UsbDrDaqEnableRGBLED
(
    int16_t handle,
    int16_t enabled
)
```

This function enables or disables RGB mode on the LED.

| Arguments: | handle: device identifier returned from `UsbDrDaqOpenUnit` or `UsbDrDaqOpenUnitProgress`
| enabled: if non-zero, RGB mode is enabled. If zero RGB mode is disabled and the LED returns to normal operation (flashing when sampling). |
| Returns: | PICO_OK
| PICO_NOT_FOUND
| PICO_NOT_RESPONDING |
3.3 UsbDrDaqGetChannelInfo

```c
PICO_STATUS UsbDrDaqGetChannelInfo
{
    int16_t      handle,
    float       * min,
    float       * max,
    int16_t      * places,
    int16_t      * divider,
    USB_DRDAQ_INPUTS   channel
}
```

This procedure returns a set of information about the currently selected scaling for the specified channel. If a parameter is not required, you can pass a null pointer to the routine.

**Arguments:**
- **handle:** device identifier returned from `UsbDrDagOpenUnit` or `UsbDrDagOpenUnitProgress`
- **min:** on exit, the minimum value that the channel can take
- **max:** on exit, the maximum value that the channel can take
- **places:** on exit, the number of decimal places
- **divider:** on exit, the number that values should be divided by to give real numbers
- **channel:** the channel to return details for. See `Channel numbers`.

**Returns:**
- PICO_OK
- PICO_NOT_FOUND
- PICO_INVALID_PARAMETER
3.4 UsbDrDaqGetInput

```c
PICO_STATUS UsbDrDaqGetInput
{
    int16_t     handle,
    USB_DRDAQ_GPIO IOChannel,
    int16_t     pullUp,
    int16_t     * value
}
```

This function is used to configure the general-purpose I/Os as digital inputs.

**Arguments:**
- `handle`: device identifier returned from `UsbDrDaqOpenUnit` or `UsbDrDaqOpenUnitProgress`
- `IOChannel`: all GPIOs can be used as digital inputs. See Channel numbers
- `pullUp`: used to specify whether pull-up resistor is used
- `value`: on exit, indicates the state of the input (0 or 1)

**Returns:**
- `PICO_OK`
- `PICO_NOT_FOUND`
- `PICO_NOT_RESPONDING`
- `PICO_INVALID_PARAMETER`
3.5 **UsbDrDaqGetPulseCount**

```c
PICO_STATUS UsbDrDaqGetPulseCount
(
    int16_t            handle,
    USB_DRDAQ_GPIO     IOChannel,
    int16_t          * count
)
```

This function will return the current pulse count. It should be called after pulse counting has been started using `UsbDrDaqStartPulseCount`.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>device identifier returned from <code>UsbDrDaqOpenUnit</code> or <code>UsbDrDaqOpenUnitProgress</code></td>
</tr>
<tr>
<td>IOChannel</td>
<td>which GPIO to use. See Channel numbers</td>
</tr>
<tr>
<td>count</td>
<td>on exit, contains the current count</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO_OK</td>
<td></td>
</tr>
<tr>
<td>PICO_NOT_FOUND</td>
<td></td>
</tr>
<tr>
<td>PICO_NOT_RESPONDING</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_PARAMETER</td>
<td></td>
</tr>
</tbody>
</table>
3.6 UsbDrDaqGetScalings

```c
PICO_STATUS UsbDrDaqGetScalings
{
    int16_t handle
    USB_DRDAQ_INPUTS channel,
    int16_t * nScales,
    int16_t * currentScale,
    int8_t * names,
    int16_t namesSize
}
```

This function discovers the scalings, both built-in and custom, that are available for a particular channel.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle: device identifier returned from <a href="#">UsbDrDaqOpenUnit</a> or <a href="#">UsbDrDaqOpenUnitProgress</a></td>
<td></td>
</tr>
<tr>
<td>channel: the channel number</td>
<td></td>
</tr>
<tr>
<td>nScales: output. The function writes the number of available scales here.</td>
<td></td>
</tr>
<tr>
<td>currentScale: output. An index to the currently selected scale here.</td>
<td></td>
</tr>
<tr>
<td>names: output. A string containing the scaling names and indices.</td>
<td></td>
</tr>
<tr>
<td>namesSize: the size of names</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO_OK</td>
</tr>
<tr>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td>PICO_INVALID_CHANNEL</td>
</tr>
</tbody>
</table>
3.7  **UsbDrDaqGetSingle**

```
PICO_STATUS UsbDrDaqGetSingle
(  
    int16_t           handle,  
    USB_DRDAQ_INPUTS  channel,  
    int16_t           * value,  
    uint16_t          * overflow
)
```

This function returns a single sample value from the specified input channel.

See **UsbDrDaqGetSingleF** for a similar function that returns a floating-point sample value.

<table>
<thead>
<tr>
<th>Arguments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle: device identifier returned from <strong>UsbDrDaqOpenUnit</strong> or <strong>UsbDrDaqOpenUnitProgress</strong></td>
</tr>
<tr>
<td>channel: which channel to sample. See <strong>Channel numbers</strong>.</td>
</tr>
<tr>
<td>value: on exit, the sample value</td>
</tr>
<tr>
<td>overflow: on exit, a bit field indicating which, if any, input channels overflowed the input range of the device. A bit set to 1 indicates an overflow. The least significant bit corresponds to channel 1. May be NULL if an overflow warning is not required.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO_OK</td>
</tr>
<tr>
<td>PICO_INVALID_HANDLE</td>
</tr>
<tr>
<td>PICO_NO_SAMPLES_AVAILABLE</td>
</tr>
<tr>
<td>PICO_DEVICE_SAMPLING</td>
</tr>
<tr>
<td>PICO_NULL_PARAMETER</td>
</tr>
<tr>
<td>PICO_INVALID_PARAMETER</td>
</tr>
<tr>
<td>PICO_DATA_NOT_AVAILABLE</td>
</tr>
<tr>
<td>PICO_INVALID_CALL</td>
</tr>
<tr>
<td>PICO_NOT_RESPONDING</td>
</tr>
<tr>
<td>PICO_MEMORY</td>
</tr>
</tbody>
</table>
3.8 UsbDrDaqGetSingleF

```c
PICO_STATUS UsbDrDaqGetSingleF
{
    int16_t handle,
    USB_DRDAQ_INPUTS channel,
    float * value,
    uint16_t * overflow
}
```

This function returns a single floating-point sample value from the specified input channel. In all other respects it is the same as `UsbDaqGetSingle`. 
3.9 UsbDrDaqGetTriggerTimeOffsetNs

```c
PICO_STATUS UsbDrDaqGetTriggerTimeOffsetNs
(
    int16_t handle,
    int64_t * time
)
```

This function returns the time between the trigger point and the first post-trigger sample. This is calculated using linear interpolation.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <code>UsbDrDaqOpenUnit</code> or <code>UsbDrDaqOpenUnitProgress</code></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>time: on exit, trigger time in nanoseconds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
</tbody>
</table>
3.10 **UsbDrDaqGetUnitInfo**

```c
PICO_STATUS UsbDrDaqGetUnitInfo

(int16_t handle,
 int8_t * string,
 int16_t stringLength,
 int16_t * requiredSize,
 PICO_INFO info)
```

This function returns a string containing the specified item of information about the unit.

If you want to find out the length of the string before allocating a buffer for it, call the function with `string = NULL` first.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <strong>UsbDrDaqOpenUnit</strong> or <strong>UsbDrDaqOpenUnitProgress</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><code>string</code>: location of a buffer where the function writes the requested information, or NULL if you are only interested in the value of <code>requiredSize</code></td>
</tr>
<tr>
<td></td>
<td><code>stringLength</code>: the maximum number of characters that the function should write to <code>string</code></td>
</tr>
<tr>
<td></td>
<td><code>requiredSize</code>: on exit, the length of the information string before it was truncated to <code>stringLength</code>. If the string was not truncated, <code>requiredSize</code> will be less than or equal to <code>stringLength</code>.</td>
</tr>
<tr>
<td></td>
<td><code>info</code>: the information that the driver should return. These values are specified in <code>picoStatus.h</code>.</td>
</tr>
<tr>
<td></td>
<td>PICO_DRIVER_VERSION</td>
</tr>
<tr>
<td></td>
<td>PICO_USB_VERSION</td>
</tr>
<tr>
<td></td>
<td>PICO_HARDWARE_VERSION</td>
</tr>
<tr>
<td></td>
<td>PICO_VARIANT_INFO</td>
</tr>
<tr>
<td></td>
<td>PICO_BATCH_AND_SERIAL</td>
</tr>
<tr>
<td></td>
<td>PICO_CAL_DATE</td>
</tr>
<tr>
<td></td>
<td>PICO_KERNEL_DRIVER_VERSION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_INVALID_HANDLE</td>
</tr>
<tr>
<td></td>
<td>PICO_NULL PARAMETER</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_INFO</td>
</tr>
<tr>
<td></td>
<td>PICO_INFO_UNAVAILABLE</td>
</tr>
</tbody>
</table>
3.11 UsbDrDaqGetValues

```c
PICO_STATUS UsbDrDaqGetValues(
    int16_t handle,
    int16_t *values,
    uint32_t *noOfValues,
    uint16_t *overflow,
    uint32_t *triggerIndex
)
```

This function is used to get values after calling `UsbDrDaqRun`.

See `UsbDrDaqGetValuesF` for a similar function that gets floating-point values.

**Arguments:**
- **handle**: device identifier returned from `UsbDrDaqOpenUnit` or `UsbDrDaqOpenUnitProgress`
- **values**: an array of sample values returned by the function. The size of this buffer must be the number of enabled channels multiplied by the number of samples to be collected.

Note: The order of the channels will be as stated in `Channel numbers`, regardless of the order used in the `UsbDrDaqSetInterval` channels array.

- **noOfValues**: on entry, the number of sample values per channel that the function should collect. On exit, the number of samples per channel that were actually written to the buffer.

- **overflow**: on exit, a bit field indicating which, if any, input channels overflowed the input range of the device. A bit set to 1 indicates an overflow. The least significant bit corresponds to channel 1. May be `NULL` if an overflow warning is not required.

- **triggerIndex**: on exit, a number indicating when the trigger event occurred. The number is a zero-based index to the `values` array, or `0xFFFFFFFF` if the information is not available. On entry, the pointer may be `NULL` if a trigger index is not required.

**Returns:**
- `PICO_OK`
- `PICO_INVALID_HANDLE`
- `PICO_NO_SAMPLES_AVAILABLE`
- `PICO_DEVICE_SAMPLING`
- `PICO_NULL_PARAMETER`
- `PICO_INVALID_PARAMETER`
- `PICO_TOO_MANY_SAMPLES`
- `PICO_DATA_NOTAVAILABLE`
- `PICO_INVALID_CALL`
- `PICO_NOTRESPONDING`
- `PICO_MEMORY`
3.12 UsbDrDaqGetValuesF

```c
PICO_STATUS UsbDrDaqGetValuesF
{
    int16_t handle,
    float * values,
    uint32_t * noOfValues,
    uint16_t * overflow,
    uint32_t * triggerIndex
}
```

This function is used to get floating-point values after calling `UsbDrDaqRun`. In all other respects it is the same as `UsbDrDaqGetValues`.
### 3.13 UsbDrDaqOpenUnit

```c
PICO_STATUS UsbDrDaqOpenUnit
{
    int16_t       * handle
}
```

This function opens and enumerates the unit.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: on exit, a value that uniquely identifies the data logger that was opened. Use this as the handle parameter when calling any other UsbDrDaq API function.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns:</td>
<td>PICO_OK</td>
</tr>
<tr>
<td></td>
<td>PICO_OS_NOT_SUPPORTED</td>
</tr>
<tr>
<td></td>
<td>PICO_OPEN_OPERATION_IN_PROGRESS</td>
</tr>
<tr>
<td></td>
<td>PICO_EEPROM_CORRUPT</td>
</tr>
<tr>
<td></td>
<td>PICO_KERNEL_DRIVER_TOO_OLD</td>
</tr>
<tr>
<td></td>
<td>PICO_FW_FAIL</td>
</tr>
<tr>
<td></td>
<td>PICO_MAX_UNITS_OPENED</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT RESPONDING</td>
</tr>
</tbody>
</table>
3.14  **UsbDrDaqOpenUnitAsync**

```c
PICO_STATUS UsbDrDaqOpenUnitAsync
{
    int16_t    * status
}
```

This function opens a USB DrDAQ data logger without waiting for the operation to finish. You can find out when it has finished by periodically calling **UsbDrDaqOpenUnitProgress** until that function returns a non-zero value and a valid data logger handle.

The driver can support up to 64 data loggers.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>status: on exit, a status flag:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 if there is already an open operation in progress</td>
</tr>
<tr>
<td></td>
<td>1 if the open operation is initiated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_OPEN_OPERATION_IN_PROGRESS</td>
</tr>
<tr>
<td></td>
<td>PICO_OPERATION FAILED</td>
</tr>
</tbody>
</table>
3.15  **UsbDrDaqOpenUnitProgress**

```c
PICO_STATUS UsbDrDaqOpenUnitProgress
{
    int16_t      * handle,
    int16_t      * progress,
    int16_t      * complete
}
```

This function checks on the progress of **UsbDrDaqOpenUnitAsync**.

| **Arguments:** | * handle: on exit, the device identifier of the opened data logger, if the operation was successful. Use this as the handle parameter when calling any other USB DrDAQ API function.  
0: if no unit is found or the unit fails to open  
<>0: handle of unit (valid only if function returns PICO_OK)  
progress: on exit, an estimate of the progress towards opening the data logger. The value is between 0 to 100.  
complete: on exit, a non-zero value if the operation has completed, otherwise zero |
| **Returns:**  | PICO_OK  
PICO_NULL_PARAMETER  
PICO_OPERATION_FAILED |
3.16 UsbDrDaqPingUnit

```c
PICO_STATUS UsbDrDaqPingUnit
    (int16_t * handle)
```

This function checks that the specified USB DrDAQ is connected.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: the device identifier returned by UsbDrDaqOpenUnit or related function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns:</td>
<td>PICO_OK</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_RESPONDING</td>
</tr>
<tr>
<td></td>
<td>PICO_BUSY</td>
</tr>
<tr>
<td></td>
<td>PICO_DRIVER_FUNCTION</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
</tbody>
</table>

Copyright © 2010–2016 Pico Technology Ltd. All rights reserved.
3.17 **UsbDrDaqReady**

```c
PICO_STATUS UsbDrDaqReady
{
    int16_t handle,
    int16_t * ready
}
```

This function indicates when **UsbDrDaqRun** has captured the requested number of samples.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <strong>UsbDrDaqOpenUnit</strong> or <strong>UsbDrDaqOpenUnitProgress</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ready: TRUE if ready, FALSE otherwise</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_INVALID_HANDLE</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_RESPONDING</td>
</tr>
</tbody>
</table>
3.18 UsbDrDaqRun

```c
PICO_STATUS UsbDrDaqRun
{
    int16_t handle,
    uint32_t no_of_values,
    BLOCK_METHOD method
}
```

This function tells the unit to start capturing data.

**Arguments:**
- **handle**: device identifier returned from `UsbDrDaqOpenUnit` or `UsbDrDaqOpenUnitProgress`
- **no_of_values**: the number of samples the unit should collect
- **method**: which method to use to collect the data, from the following list:
  - BM_SINGLE
  - BM_WINDOW
  - BM_STREAM

  See [Capture modes](#) for details.

**Returns:**
- PICO_OK
- PICO_INVALID_HANDLE
- PICO_USER_CALLBACK
- PICO_INVALID_CHANNEL
- PICO TOO_MANY_SAMPLES
- PICO_INVALID_TIMEBASE
- PICO_NOT RESPONDING
- PICO_CONFIG_FAIL
- PICO_INVALID_PARAMETER
- PICO NOT RESPONDING
- PICO_TRIGGER_ERROR
3.19  UsbDrDaqSetDO

PICO_STATUS UsbDrDaqSetDO
{
    int16_t            handle,
    USB_DRDAQ_GPIO     IOChannel,
    int16_t            value
}

This function is used to configure the general-purpose I/Os as digital outputs.

| Arguments: | handle: device identifier returned from UsbDrDaqOpenUnit or UsbDrDaqOpenUnitProgress |
|           | IOChannel: identifies the channel. See Channel numbers. |
|           | value: any non-zero value sets the digital output and zero clears it |

| Returns:  | PICO_OK |
|           | PICO_NOT_FOUND |
|           | PICO_NOT_RESPONDING |
|           | PICO_INVALID_PARAMETER |
3.20  UsbDrDaqSetInterval

```c
PICO_STATUS UsbDrDaqSetInterval
{
    int16_t handle,
    uint32_t * us_for_block,
    uint32_t ideal_no_of_samples,
    USB_DRDAQ_INPUTS * channels,
    int16_t no_of_channels
}
```

This function sets the sampling interval of the unit. Sampling of multiple channels is sequential.

The minimum possible sampling interval \( si_{\text{min}} \) (in microseconds) depends on the capture mode and number of active channels \( n \) as follows:

- **BM SINGLE** mode:
  \[ si_{\text{min}} = n \]

- **BM WINDOW** and **BM STREAM** modes:
  \[ si_{\text{min}} = 10*n \]

If you wish to know the effective sampling interval \( si \) (in microseconds) set by this function, you can calculate it as follows:

\[
si = \frac{\text{ideal_no_of_samples} \times \text{no_of_channels}}{\text{us_for_block}}
\]

**Arguments:**
- **handle**: on exit, device identifier returned from `UsbDrDaqOpenUnit` or `UsbDrDaqOpenUnitProgress`
- **us_for_block**: on entry, the target total time in which to collect `ideal_no_of_samples`, in microseconds. On exit, the actual total time that was set. For more accurate setting of total time as a floating-point value, use `UsbDrDaqSetIntervalF`.
- **ideal_no_of_samples**: the number of samples per channel that you want to collect. This number is used only for timing calculations. In **BM SINGLE** mode, the total for all active channels must not exceed 16,384 samples.
- **channels**: an array of constants identifying the channels from which you wish to capture data. See the list at Channel numbers. If you specify the channels in a different order from that shown in that list, the function will re-order them.
- **no_of_channels**: the number of channels in the `channels` array.
<table>
<thead>
<tr>
<th>Returns</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO_OK</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_HANDLE</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_CHANNEL</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_TIMEBASE</td>
<td></td>
</tr>
<tr>
<td>PICO_NOT_RESPONDING</td>
<td></td>
</tr>
<tr>
<td>PICO_CONFIG_FAIL</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_PARAMETER</td>
<td></td>
</tr>
<tr>
<td>PICO_NOT_RESPONDING</td>
<td></td>
</tr>
<tr>
<td>PICO_TRIGGER_ERROR</td>
<td></td>
</tr>
</tbody>
</table>
3.21 **UsbDrDaqSetIntervalF**

```c
PICO_STATUS UsbDrDaqSetIntervalF
(
    int16_t            handle,
    float              * us_for_block,
    uint32_t           ideal_no_of_samples,
    USB_DRDAQ_INPUTS  * channels,
    int16_t            no_of_channels
)
```

This function sets the sampling interval of the unit. It works in the same way as `UsbDrDaqSetInterval` except that the `us_for_block` argument is a `float` instead of an integer.
3.22 **UsbDrDaqSetPWM**

```c
PICO_STATUS UsbDrDaqSetPWM(
    int16_t handle,
    USB_DRDAQ_GPIO IOChannel,
    uint16_t period,
    uint8_t cycle
)
```

This function is used to configure the general-purpose I/Os as pulse-width modulation outputs.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <a href="#">UsbDrDaqOpenUnit</a> or <a href="#">UsbDrDaqOpenUnitProgress</a></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IOChannel: GPIOs 1 and 2 can be used as PWM outputs. See <a href="#">UsbDrDaqSetDO</a> for values.</td>
</tr>
<tr>
<td></td>
<td>period: the period of the waveform in microseconds</td>
</tr>
<tr>
<td></td>
<td>cycle: duty cycle as a percentage</td>
</tr>
</tbody>
</table>

| Returns:   | PICO_OK                                            |
|            | PICO_NOT_FOUND                                     |
|            | PICO_NOT_RESPONDING                                |
|            | PICO_INVALID_PARAMETER                            |
3.23  **UsbDrDaqSetRGBLED**

```c
PICO_STATUS UsbDrDaqSetRGBLED

(int16_t            handle,
 uint16_t           red,
 uint16_t           green,
 uint16_t           blue)
```

This function is used to set the color of the LED once RGB mode has been enabled using **USBDRDaqEnableRGBLED**.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <strong>UsbDrDaqOpenUnit</strong> or <strong>UsbDrDaqOpenUnitProgress</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>red, green, blue: components of the required LED color, in the range 0 to 255.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT RESPONDING</td>
</tr>
</tbody>
</table>
3.24  **UsbDrDaqSetScalings**

```c
PICO_STATUS UsbDrDaqSetScalings
{
    int16_t handle
    USB_DRDAQ_INPUTS channel,
    int16_t scalingNumber
}
```

This function sets the scaling for a specified channel.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from  <a href="#">UsbDrDaqOpenUnit</a> or <a href="#">UsbDrDaqOpenUnitProgress</a></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>channel: the channel to set. See <a href="#">Channel numbers</a>.</td>
</tr>
<tr>
<td></td>
<td>scalingNumber: the number of the required scale, as given by <a href="#">UsbDrDaqGetScalings</a>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_CHANNEL</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_PARAMETER</td>
</tr>
</tbody>
</table>
3.25 UsbDrDaqSetSigGenArbitrary

```
PICO_STATUS UsbDrDaqSetSigGenArbitrary
{
    int16_t handle,
    int32_t offsetVoltage,
    uint32_t pkToPk,
    int16_t * arbitraryWaveform,
    int16_t arbitraryWaveformSize,
    int32_t updateRate
}
```

This function allows full control of the arbitrary waveform generator by allowing an arbitrary waveform to be passed to the driver.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from UsbDrDaqOpenUnit or UsbDrDaqOpenUnitProgress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>offsetVoltage: the offset voltage in microvolts. The offset voltage must be in the range –1.5 V to 1.5 V.</td>
</tr>
<tr>
<td></td>
<td>pkToPk: the peak-to-peak voltage in microvolts. The maximum allowed is 3 V.</td>
</tr>
<tr>
<td></td>
<td>arbitraryWaveform: an array containing the waveform. The waveform values must be in the range –1000 to 1000.</td>
</tr>
<tr>
<td></td>
<td>arbitraryWaveformSize: the number of points in the waveform.</td>
</tr>
<tr>
<td></td>
<td>updateRate: the rate at which the AWG steps through the points in the waveform. This value must be in the range 1 to 2,000,000 points per second.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_RESPONDING</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_PARAMETER</td>
</tr>
</tbody>
</table>
3.26 **UsbDrDaqSetSigGenBuiltIn**

```c
PICO_STATUS UsbDrDaqSetSigGenBuiltIn
{
    int16_t     handle,
    int32_t     offsetVoltage,
    uint32_t    pkToPk,
    int16_t     frequency,
    USB_DRDAQ_WAVE  waveType
}
```

This function sets the arbitrary waveform generator using standard waveform types.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from <strong>UsbDrDaqOpenUnit</strong> or <strong>UsbDrDaqOpenUnitProgress</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>offsetVoltage: the offset voltage in microvolts. The offset voltage must be in the range –1.5 V to 1.5 V.</td>
</tr>
<tr>
<td></td>
<td>pkToPk: the peak-to-peak voltage in microvolts. The maximum allowed is 3 V.</td>
</tr>
<tr>
<td></td>
<td>frequency: frequency in hertz. The maximum allowed frequency is 20 kHz.</td>
</tr>
<tr>
<td></td>
<td>waveType: an enumerated data type that has the following values corresponding to standard waveforms:</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_SINE</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_SQUARE</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_TRIANGLE</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_RAMP_UP</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_RAMP_DOWN</td>
</tr>
<tr>
<td></td>
<td>USB_DRDAQ_DC</td>
</tr>
</tbody>
</table>

| Returns: | PICO_OK |
|          | PICO_NOT_FOUND |
|          | PICO_NOT_RESPONDING |
|          | PICO_INVALID_PARAMETER |

```
3.27 UsbDrDaqSetTrigger

```c
PICO_STATUS UsbDrDaqSetTrigger
{
    int16_t handle,
    uint16_t enabled,
    uint16_t auto_trigger,
    uint16_t auto_ms,
    uint16_t channel,
    uint16_t dir,
    int16_t threshold,
    uint16_t hysteresis,
    float delay
}
```

This function sets up the trigger, which controls when the unit starts capturing data.

<table>
<thead>
<tr>
<th>Arguments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>handle</strong></td>
<td>device identifier returned from <code>UsbDrDaqOpenUnit</code> or <code>UsbDrDaqOpenUnitProgress</code></td>
</tr>
<tr>
<td><strong>enabled</strong></td>
<td>whether to enable or disable the trigger: 0: disable the trigger 1: enable the trigger</td>
</tr>
<tr>
<td><strong>auto_trigger</strong></td>
<td>whether or not to re-arm the trigger automatically after each trigger event: 0: do not auto-trigger 1: auto-trigger</td>
</tr>
<tr>
<td><strong>auto_ms</strong></td>
<td>time in milliseconds after which the unit will auto-trigger if the trigger condition is not met</td>
</tr>
<tr>
<td><strong>channel</strong></td>
<td>which channel to trigger on. See Channel numbers.</td>
</tr>
<tr>
<td><strong>dir</strong></td>
<td>which edge to trigger on: 0: rising edge 1: falling edge</td>
</tr>
<tr>
<td><strong>threshold</strong></td>
<td>trigger threshold (the level at which the trigger will activate) in the currently selected scaling, multiplied to remove any decimal places. The number of decimal places can be found by calling <code>UsbDrDAQGetChannelInfo</code>.</td>
</tr>
<tr>
<td><strong>hysteresis</strong></td>
<td>trigger hysteresis in ADC counts. This is the difference between the upper and lower thresholds. The signal must then pass through both thresholds in the same direction in order to activate the trigger, so that there are fewer unwanted trigger events caused by noise. The minimum value allowed is 1.</td>
</tr>
<tr>
<td><strong>delay</strong></td>
<td>delay between the trigger event and the start of the block as a percentage of the block size. 0% means that the trigger event is the first data value in the block, and –50% means that the trigger event is in the middle of the block.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO_OK</td>
<td></td>
</tr>
<tr>
<td>PICO_INVALID_HANDLE</td>
<td></td>
</tr>
<tr>
<td>PICO_USER_CALLBACK</td>
<td></td>
</tr>
<tr>
<td>PICO_TRIGGER_ERROR</td>
<td></td>
</tr>
<tr>
<td>PICO_MEMORY_FAIL</td>
<td></td>
</tr>
</tbody>
</table>
3.28 UsbDrDaqStartPulseCount

```c
PICO_STATUS UsbDrDaqStartPulseCount
    (int16_t            handle,
    USB_DRDAQ_GPIO     IOChannel,
    int16_t            direction)
```

This function is used to configure the general-purpose I/Os for pulse counting and to start counting.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from UsbDrDaqOpenUnit or UsbDrDaqOpenUnitProgress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IOChannel: specifies the GPIO channel to use, either GPIO 1 or GPIO 2. See Channel numbers.</td>
</tr>
<tr>
<td></td>
<td>direction: the direction of the edges to count (0: rising, 1: falling).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Returns:</th>
<th>PICO_OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICO_NOT_FOUND</td>
</tr>
<tr>
<td></td>
<td>PICO_NOT_RESPONDING</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_PARAMETER</td>
</tr>
</tbody>
</table>
3.29  **UsbDrDaqStop**

```c
PICO_STATUS UsbDrDaqStop
(
    int16_t    handle
)
```

This function aborts data collection.

<table>
<thead>
<tr>
<th>Arguments</th>
<th>Handle: device identifier returned from <a href="#">UsbDrDaqOpenUnit</a> or <a href="#">UsbDrDaqOpenUnitProgress</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns</td>
<td>PICO_OK</td>
</tr>
<tr>
<td></td>
<td>PICO_INVALID_HANDLE</td>
</tr>
</tbody>
</table>
3.30 UsbDrDaqStopSigGen

    PICO_STATUS UsbDrDaqStopSigGen
    (   int16_t    handle)

This function turns the AWG off.

<table>
<thead>
<tr>
<th>Arguments:</th>
<th>handle: device identifier returned from UsbDrDaqOpenUnit or UsbDrDaqOpenUnitProgress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns:</td>
<td>PICO_OK, PICO_NOT_FOUND, PICO_NOT_RESPONDING</td>
</tr>
</tbody>
</table>

3.31 Channel numbers

Use the following values for the channel argument in those API functions that deal with a specified input channel or channels:

```
typedef enum enUsbDrDaqInputs
{   USB_DRDAQ_CHANNEL_EXT1 = 1,  //Ext. sensor 1          // 1
    USB_DRDAQ_CHANNEL_EXT2,      //Ext. sensor 2          // 2
    USB_DRDAQ_CHANNEL_EXT3,      //Ext. sensor 3          // 3
    USB_DRDAQ_CHANNEL_SCOPE,     //Scope channel          // 4
    USB_DRDAQ_CHANNEL_PH,        //PH                      // 5
    USB_DRDAQ_CHANNEL_RES,       //Resistance              // 6
    USB_DRDAQ_CHANNEL_LIGHT,     //Light                    // 7
    USB_DRDAQ_CHANNEL_TEMP,      //Thermistor               // 8
    USB_DRDAQ_CHANNEL_MIC_WAVE,  //Microphone waveform       // 9
    USB_DRDAQ_CHANNEL_MIC_LEVEL, //Microphone level          //10
    USB_DRDAQ_MAX_CHANNELS = USB_DRDAQ_CHANNEL_MIC_LEVEL
} USB_DRDAQ_INPUTS;
```

Use the following values for the IOChannel argument in the API functions that deal with a specified GPIO channel:

```
typedef enum enUsbDrDaqDO
{   USB_DRDAQ_GPIO_1 = 1,       // 1
    USB_DRDAQ_GPIO_2,           // 2
    USB_DRDAQ_GPIO_3,           // 3
    USB_DRDAQ_GPIO_4            // 4
} USB_DRDAQ_GPIO;
```

Source: usbDrDaqApi.h 2013-01-22
3.32 PICO_STATUS values

Every function in the USB DrDAQ API returns a status code from the following list of PICO_STATUS values:

<table>
<thead>
<tr>
<th>Code (hex)</th>
<th>Enum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>PICO_OK</td>
<td>The Data Logger is functioning correctly</td>
</tr>
<tr>
<td>01</td>
<td>PICO_MAX UNITS_OPENED</td>
<td>An attempt has been made to open more than <code>UsbDrDaq_MAX_UNITS</code></td>
</tr>
<tr>
<td>02</td>
<td>PICO_MEMORY_FAIL</td>
<td>Not enough memory could be allocated on the host machine</td>
</tr>
<tr>
<td>03</td>
<td>PICO_NOT_FOUND</td>
<td>No USB DrDAQ device could be found</td>
</tr>
<tr>
<td>04</td>
<td>PICO_FW_FAIL</td>
<td>Unable to download firmware</td>
</tr>
<tr>
<td>05</td>
<td>PICO_OPEN_OPERATION_IN_PROGRESS</td>
<td>A request to open a device is in progress</td>
</tr>
<tr>
<td>06</td>
<td>PICO_OPERATION_FAILED</td>
<td>The operation was unsuccessful</td>
</tr>
<tr>
<td>07</td>
<td>PICO_NOT_RESPONDING</td>
<td>The device is not responding to commands from the PC</td>
</tr>
<tr>
<td>08</td>
<td>PICO_CONFIG_FAIL</td>
<td>The configuration information in the device has become corrupt or is missing</td>
</tr>
<tr>
<td>09</td>
<td>PICO_KERNEL_DRIVER_TOO_OLD</td>
<td>The <code>picopp.sys</code> file is too old to be used with the device driver</td>
</tr>
<tr>
<td>0A</td>
<td>PICO_EEPROM_CORRUPT</td>
<td>The EEPROM has become corrupt, so the device will use a default setting</td>
</tr>
<tr>
<td>0B</td>
<td>PICO_OS_NOT_SUPPORTED</td>
<td>The operating system on the PC is not supported by this driver</td>
</tr>
<tr>
<td>0C</td>
<td>PICO_INVALID_HANDLE</td>
<td>There is no device with the handle value passed</td>
</tr>
<tr>
<td>0D</td>
<td>PICO_INVALID_PARAMETER</td>
<td>A parameter value is not valid</td>
</tr>
<tr>
<td>0E</td>
<td>PICO_INVALID_TIMEBASE</td>
<td>The sampling interval is not supported or is invalid</td>
</tr>
<tr>
<td>0F</td>
<td>PICO_INVALID_VOLTAGE_RANGE</td>
<td>The voltage range is not supported or is invalid</td>
</tr>
<tr>
<td>10</td>
<td>PICO_INVALID_CHANNEL</td>
<td>The channel number is not valid on this device or no channels have been set</td>
</tr>
<tr>
<td>11</td>
<td>PICO_INVALID_TRIGGER_CHANNEL</td>
<td>The channel set for a trigger is not available on this device</td>
</tr>
<tr>
<td>12</td>
<td>PICO_INVALID_CONDITION_CHANNEL</td>
<td>The channel set for a condition is not available on this device</td>
</tr>
<tr>
<td>13</td>
<td>PICO_NO_SIGNAL_GENERATOR</td>
<td>The device does not have a signal generator</td>
</tr>
<tr>
<td>14</td>
<td>PICO_STREAMING_FAILED</td>
<td>Streaming has failed to start or has stopped without user request</td>
</tr>
<tr>
<td>15</td>
<td>PICO_BLOCK_MODE_FAILED</td>
<td>Block failed to start - a parameter may have been set wrongly</td>
</tr>
<tr>
<td>16</td>
<td>PICO_NULL_PARAMETER</td>
<td>A parameter that was required is NULL</td>
</tr>
<tr>
<td>18</td>
<td>PICO_DATA_NOT_AVAILABLE</td>
<td>No data is available from a run block call</td>
</tr>
<tr>
<td>19</td>
<td>PICO_STRING_BUFFER_TOO_SMALL</td>
<td>The buffer passed for the information was too small</td>
</tr>
<tr>
<td>1A</td>
<td>PICO_ETS_NOT_SUPPORTED</td>
<td>ETS is not supported on this device</td>
</tr>
<tr>
<td>1B</td>
<td>PICO_AUTO_TRIGGER_TIME_TOO_SHORT</td>
<td>The auto trigger time is less than the time it will take to collect the data</td>
</tr>
<tr>
<td>1C</td>
<td>PICO_BUFFERSTALL</td>
<td>The collection of data has stalled as unread data would be overwritten</td>
</tr>
<tr>
<td>1D</td>
<td>PICO_TOO_MANY_SAMPLES</td>
<td>The number of samples requested is more than available in the current memory segment</td>
</tr>
<tr>
<td>1E</td>
<td>PICO_TOO_MANY_SEGMENTS</td>
<td>Not possible to create number of segments requested</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1F</td>
<td>PICO_PULSE_WIDTH_QUALIFIER A null pointer has been passed in the trigger function or one of the parameters is out of range</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>PICO_DELAY One or more of the hold-off parameters are out of range</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>PICO_SOURCE_DETAILS One or more of the source details are incorrect</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>PICO_CONDITIONS One or more of the conditions are incorrect</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>PICO_USER_CALLBACK The driver's thread is currently in the <code>UsbDrDaqReady</code> callback function and therefore the action cannot be carried out</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>PICO_DEVICE_SAMPLING An attempt is being made to get stored data while streaming. Either stop streaming by calling <code>UsbDrDaqStop</code>.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>PICO_NO_SAMPLES_AVAILABLE ...because a run has not been completed</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>PICO_SEGMENT_OUT_OF_RANGE The memory index is out of range</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>PICO_BUSY Data cannot be returned yet</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>PICO_STARTINDEX_INVALID The start time to get stored data is out of range</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>PICO_INVALID_INFO The information number requested is not a valid number</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>PICO_INFO_UNAVAILABLE The handle is invalid so no information is available about the device. Only <code>PICO_DRIVER_VERSION</code> is available.</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>PICO_INVALID_SAMPLE_INTERVAL The sample interval selected for streaming is out of range</td>
<td></td>
</tr>
<tr>
<td>2C</td>
<td>PICO_TRIGGER_ERROR Not used</td>
<td></td>
</tr>
<tr>
<td>2D</td>
<td>PICO_MEMORY Driver cannot allocate memory</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>PICO_DELAY_NULL NULL pointer passed as delay parameter</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>PICO_INVALID_BUFFER The buffers for overview data have not been set while streaming</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>PICO_CANCELLED A block collection has been canceled</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>PICO_SEGMENT_NOT_USED The segment index is not currently being used</td>
<td></td>
</tr>
<tr>
<td>3C</td>
<td>PICO_INVALID_CALL The wrong <code>GetValues</code> function has been called for the collection mode in use</td>
<td></td>
</tr>
<tr>
<td>3F</td>
<td>PICO_NOT_USED The function is not available</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>PICO_INVALID_STATE Device is in an invalid state</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>PICO_DRIVER_FUNCTION You called a driver function while another driver function was still being processed</td>
<td></td>
</tr>
</tbody>
</table>
4 Example code

Your PicoScope SDK installation includes programming examples in various languages and development environments. Please refer to the SDK for details.
5 Glossary

**Driver.** A program that controls a piece of hardware. The driver for the USB DrDAQ is supplied in the form of 32-bit and 64-bit versions of a Windows DLL, *UsbDrDaq.dll*. This is used by the PicoScope and PicoLog software, and by user-designed applications, to control the data logger.

**PicoLog software.** A program supplied with all PicoLog devices that turns your PC into a data logger with charting, spreadsheet and monitoring features.

**PicoScope software.** A software product that accompanies all PicoScope oscilloscopes. It turns your PC into an oscilloscope, spectrum analyzer and multimeter.

**Sampling interval.** The time interval between samples as the USB DrDAQ acquires data. The sampling interval can be set to any value returned by the *UsbDrDaqSetInterval* and *UsbDrDaqSetIntervalF* functions.

**USB 2.0.** Universal Serial Bus. This is a standard port that enables you to connect external devices to PCs. A full-speed USB 2.0 port operates at up to 480 megabits per second. The PicoLog 1000 Series is also compatible with any USB port from USB 1.1 upwards.

**Voltage range.** The range of input voltages that the oscilloscope can measure. For example, a voltage range of ±100 mV means that the oscilloscope can measure voltages between −100 mV and +100 mV. Input voltages outside this range will not damage the instrument as long as they remain within the protection limits stated in the Specifications table in the User's Guide.
Index

A
Arbitrary waveform generator 34, 35
Asynchronous operation 3

B
BM_SINGLE mode 3
BM_STREAM mode 3
BM_WINDOW mode 3

C
Capture modes
  BM_SINGLE 3
  BM_STREAM 3
  BM_WINDOW 3
Channel information, obtaining 11
Channel numbers 39
Closing a unit 9
Connecting to the PC 3

D
Data, reading 15, 16, 19, 20
Device information, obtaining 18
Device status, querying 25
Digital inputs 12
Digital outputs 27
DLLs 3
Driver routines
  list of 7
  UsbDrDaqCloseUnit 9
  UsbDrDaqEnableRGBLED 10
  UsbDrDaqGetChannelInfo 11
  UsbDrDaqGetInput 12
  UsbDrDaqGetPulseCount 13
  UsbDrDaqGetScalings 14
  UsbDrDaqGetSingle 15
  UsbDrDaqGetSingleF 16
  UsbDrDaqGetTriggerTimeOffsetNs 17
  UsbDrDaqGetUnitInfo 18
  UsbDrDaqGetValues 19
  UsbDrDaqGetValuesF 20
  UsbDrDaqOpenUnit 21
  UsbDrDaqOpenUnitAsync 22
  UsbDrDaqOpenUnitProgress 23
  UsbDrDaqPingUnit 24
  UsbDrDaqReady 25
  UsbDrDaqRun 26
  UsbDrDaqSetDO 27
  UsbDrDaqSetInterval 28
  UsbDrDaqSetIntervalF 30
  UsbDrDaqSetPWM 31
  UsbDrDaqSetRGBLED 32
  UsbDrDaqSetScalings 33
  UsbDrDaqSetSigGenArbitrary 34
  UsbDrDaqSetSigGenBuiltIn 35
  UsbDrDaqSetTrigger 36
  UsbDrDaqStartPulseCount 37
  UsbDrDaqStop 38
  UsbDrDaqStopSigGen 39

I
Information on device, obtaining 18
Installation 3

L
LED 10, 32
Legal information 1

N
New Hardware Wizard 3

O
Opening a device 21, 22, 23

P
PICO_STATUS 40
Programming 3
Pulse counter 13, 37
PWM outputs, setting up 31

Q
Querying a device 24

R
Running a device 26

S
Sampling interval, setting 28, 30
Scaling
  files 4
  querying 14
  setting 33
Signal generator
    configuring 35
    stopping 39
Software updates 2
Stopping a unit 38
Streaming 3

T
Trademarks 2
Trigger
    configuring 36
    reading times 17

U
USB DrDAQ 1

W
Windows
    64-bit 3
    WoW64 3
    XP/Vista/7/8 support 3