Cleverscope Ltd
Phone +64 9 524 7456
Fax +64 9 524 7457
Email support@cleverscope.com
28 Ranfurly Rd, Epsom
P.O. Box 26-527
Auckland 1003
New Zealand

V1.3
9 Oct 07

Cscope Driver vi Description

Summary

The Cscope Driver vi is used by Labview programs to communicate with the Cleverscope CS328 acquisition unit.

Cscope control driver.vi

This is the main user vi. Parameters are:

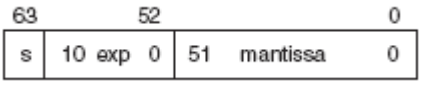
Command

Unsigned 16 bit value.
Values are:

- 0 - **Inititialize**. Call this once to initialise the acquisition system. Further calls are ignored.
- 1 – **Acquire**. Call to acquire data as defined by the Acquire Definition and other parameters.. Caalling acquire automatically updates the acquisition unit with any changed acquire values.
- 2 – **Replay**. Call this to re-decimate the capture buffer, and return new samples, based on the SamplesIn Replay, ReplayStartTime and ReplayStopTime values.
- 3 – **Wait for samples**. Call this to check if a trigger has occurred, and the samples are available. The Value GotSamples is set true when all the samples have been received. The call will wait up to 40ms for a trigger. After 40ms, the call times-out, returning false. The wait blocks the thread, but relinquishes control to the operating system during the wait. This maximizes throughput.
- 4 – **Update.** This call updates acquisition unit values if the acquisition unit is not acquiring, or is waiting for a trigger. Can be used to update the signal generator values for example.
- 5 – **Finish**. Call this to close down the acqusition system
- 8 - **Get Frames**. Gets a multi-frame sequence as one array. The value num_samples is the number of samples in one frame. The value num_frames are the number of frames included in the array. After sending the command, call 'Wait for Samples' until the samples are transferred.

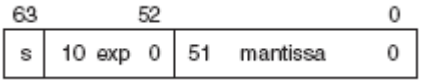
ReplayStartTime

Double.



This value specifies, in seconds, the start time of the samples to be returned in the decimated replay from the sample buffer. If the start time is outside the actual available buffer start and stop times (relative to the trigger), the start time will be clipped to either the beginning or end of the buffer, as necessary.

ReplayStopTime

Double. 

This value specifies, in seconds, the stop time (inclusive) of the samples to be returned in the decimated replay from the sample buffer. If the start time is outside the actual available buffer start and stop times (relative to the trigger), the start time will be clipped to either the beginning or end of the buffer, as necessary.

SamplesInReplay

Signed 32 bit number.

This value specifies the number of samples that will be returned in the decimated replay from the sample buffer. Values may vary from 0 to 4000000.

GotSamples

Boolean
Returns false if samples are not yet all received. True = received the values.

T0

Returned Value – pointer at double.
Returns the start time of the waveform being replayed relative to the trigger, which is time 0, in seconds.

dt

Returned Value – pointer at double.
Returns the interval between successive samples, in seconds.

NumSamples

Returned Value – pointer at U32.
Returns the number of samples in the sample array.

NumFrames

Returned Value – pointer at U32.
Returns the number of frames that the sample array is segmented into – only used when returning all the frames in a sequential capture in one transfer. As an example, assuming 2000 samples per frame, and 100 frames sequentially captured, one data array of 200,000 samples will be returned, being composed of 100 segments of 2000 samples.

ChanA

Returns the Channel A waveform as single precision reals.

ChanB

Returns the Channel B waveform as single precision reals.

Digital Inputs

Returns the digital inputs waveform

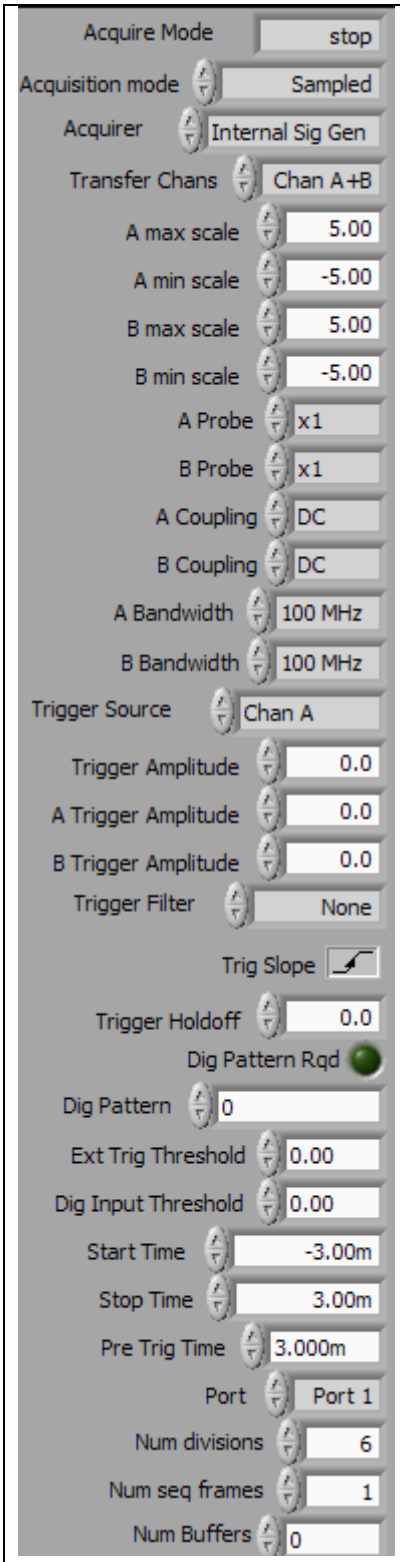
Error In

Defines any input errors. If there is an error, the unit will not acquire (but will close).

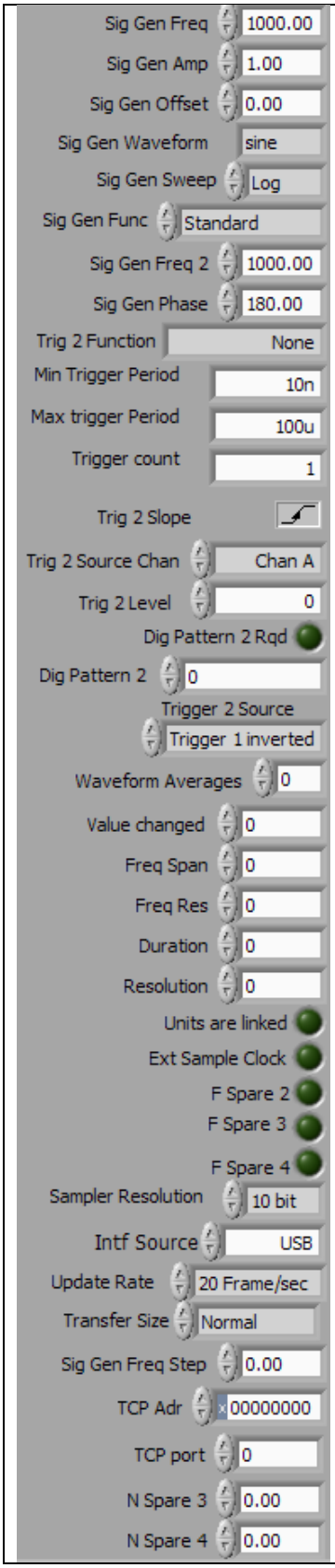
Error Out

Defines any errors generated while acquiring a signal.

AcquireDefinition



Item	Description	Data Type
Acquire Mode	How to acquire: 0 = Single, 1= automatic, 2 = triggered, 3 = stop	U16
Acquisition Mode	Method of acquisistion: 0 = sampled, 1= Peak captured, 2 = Filtered, 3= Repetitive, 4= Waveform avg If Waveform avg, make sure there are at least waveform avg +1 buffers.	U16
Acquirer	Sets the acquirer to use. Always use 4 = cleverscope	U16
Transfer Chans	Always set to 2 = transfer all channels.	U16
A max scale	Maximum A channel scale value.	Double
A Min scale	Minimum A channel scale value – make lower than max	Double
B max scale	Maximum B channel scale value.	Double
B min scale	Minimum B channel scale value – make lower than max	Double
A probe	A Probe Multiplier 0 = x1, 1 = x 10, 2 = x100, 3 = x1000	U16
B probe	A Probe Multiplier 0 = x1, 1 = x 10, 2 = x100, 3 = x1000	U16
A Coupling	A Coupling, 0 = AC, 1= DC	U16
B Coupling	B Coupling, 0 = AC, 1= DC	U16
A Bandwidth	A Bandwidth, 0 = 25MHz, 1 = 100 MHz	U16
B Bandwidth	B Bandwidth, 0 = 25MHz, 1 = 100 MHz	U16
Trigger Source	Sets trigger source. 0 = A chan, 1 = B chan, 2 = Ext Trigger, 3 = Dig Input, 4 = Rear Input	U16
Trigger Amplitude	Level at which to trigger	Double
A Trigger Amplitude	Not used in driver.	Double
B Trigger Amplitude	Not used in driver.	Double
Trigger Filter	Sets filter on trigger. 0 = None, 1 = Low Pass, 2 = Hi Pass, 3 = noise (2 divisions of hysteresis)	U16
Trig Slope	Sets the trigger slope. 0 = rising, 1 = falling	U8
Trigger Holdoff	Not used in driver.	Double
Dig Pattern Rqd	Sets if the digital pattern qualifies the analog trigger. 0 = not required. 1= required.	U8
Dig Pattern	Sets the digital pattern for digital input triggering. Byte 0 = Select mask, 1= input is used. Byte 1 = Pattern required before trigger Byte 2 = Pattern required to trigger Byte 3 not used. Bit 0 is input 1 .. Bit 7 is input 8	U32
Ext Trig Threshold	Sets the amplitude of the external trigger input, -6..+18V	Double
Dig Inp Threshold	Sets the amplitude of the digital input threshold, 0 .. 10V	Double
Start Time	Sets the start time relative to the trigger, at which acquisition will begin. If positive delayed triggering is used.	Double
Stop Time	Sets the stop time relative to the trigger. Range is –22 .. + 22 seconds. Resolution is 10 ns.	Double
Pre Trig Time	Not used in driver.	Double
Port	Not used in driver.	U16
Num divisions	Set to 10.	I16
Num seq frames	Sets the number of frames captured sequentially. If not waveform avg method of capture set to 1. If waveform avg capture, set to the number of averages used, 4,16,64,128. If capturing sequential frames, set to number of frames to capture.	I16
Num Buffers	Sets the number of buffers allocated for frame capture. Must be at least num waveform averages + 1.	I32



Sig Gen Freq	Set the signal generator frequency in Hz. Range is 0.003..10e6 Hz.	Double
Sig Gen Amp	Amplitude of signal generator output. Range is 0..8V	Double
Sig Gen Offset	Offset of signal generator output. Range is –5..+5V	Double
Sig Gen Waveform	Sets the signal generator waveform. 0 = sine, 1= triangle, 2 = square, 3 = DC, 4 = 0V.	U16
Sig Gen Sweep	Not used in driver	U16
Sig Gen Func	0 means normal sig gen use, 1 means step the sig gen upwards by Sig Gen Freq Step automatically following a trigger.	U16
Sig Gen Freq 2	Not used in driver.	Double
Sig Gen Phase	Not used in driver.	Double
Trig 2 Function	Sets the use of Trigger 2. 0 = Not used, 1 = T1~2 < min, 2 = min<= T1~2 <= max, T1~2 > max, 3 = Count T1, 4 = Wait for T1, then count T2. T1~2 = time duration from trigger 1 to trigger 2.	U16
Min Trigger Period	Sets the min period. 0..22 secs, resolution is 10 ns.	Double
Max Trigger Period	Sets the max period. 0..22 secs, resolution is 10 ns.	Double
Trigger Count	Sets the number of counts for counting. 0..4,294,967,295	U32
Trig 2 slope	Sets the slope for trigger 2. 0 = rising, 1 = falling	U8
Trig 2 Source han	Sets the trigger 2 source channel. 0 = A chan, 1 = B chan, 2 = Ext Trigger, 3 = Dig Input, 4 = Rear Input	U16
Trig 2 Level	Sets the trigger 2 threshold level.	Double
Dig Pattern 2 Rqd	Sets if Trigger 2 is qualified by the pattern.	U8
Dig Pattern 2	Defines the trigger 2 digital pattern.	U32
Trigger 2 Source	Defines the trigger 2 source – 0 = Trigger 1 inverted, 1= Use the Trigger 2 definition	U16
Waveform Averages	Sets how many waveforms to average if acquisition mode = waveform avg. Values are 0 = 4, 1 = 16, 2 = 64, 3 = 128.	I32
Value Changed	Change this value to cause the driver to check for changes in all the values in this data structure. If not changed, data structure values will not update.	I32
Freq Span	Not used in driver	Double
Freq Res	Not used in driver	Double
Duration	Not used in driver	Double
Resolution	Not used in driver	Double
Units are linked	0 means not linked, 1 means linked, and Link port is active	U8
Ext Sample Clock	0 means use internal 100 MHz sample clock. 1 means use external sample clock. Clock must be a sine or square wave, with 45-55% duty cycle, amplitude 0.3V – 3V p-p, biased to 0V or CMOS logic levels. The external clock range currently supported is 10 – 49 MHz.	U8
Fspare 2	Reserved for future use	U8
Fspare 3	Reserved for future use	U8
Fspare 4	Reserved for future use	U8
Sampler Resolution	Sets the sampler resolution to be used, 0 = 10 bits, 1 = 12 bits, 2 = 14 bits. Will clip to maximum resolution available.	U16
IntfSource	Source for connections – 0 = USB, 1 = Ethernet	U16
Update Rate	Not used in driver	U16
Transfer Size	Use 0 to transfer one frame. Use 6 to transfer all the frames in a sequential capture as one array. See num frames value in next section.	
Sig Gen Freq Step	Frequency increment used when acquisition unit automatically steps the signal generator frequency following a trigger, if Sig gen Func = 1.	Double
TCPAdr	TCP address of acquisition unit. Format is bb.bb.bb.bb	U32
TCPPort	TCP port used for acquisition unit.	U32
NSpare3	Reserved for future use	Double
NSpare4	Reserved for future use	Double

Using the vi

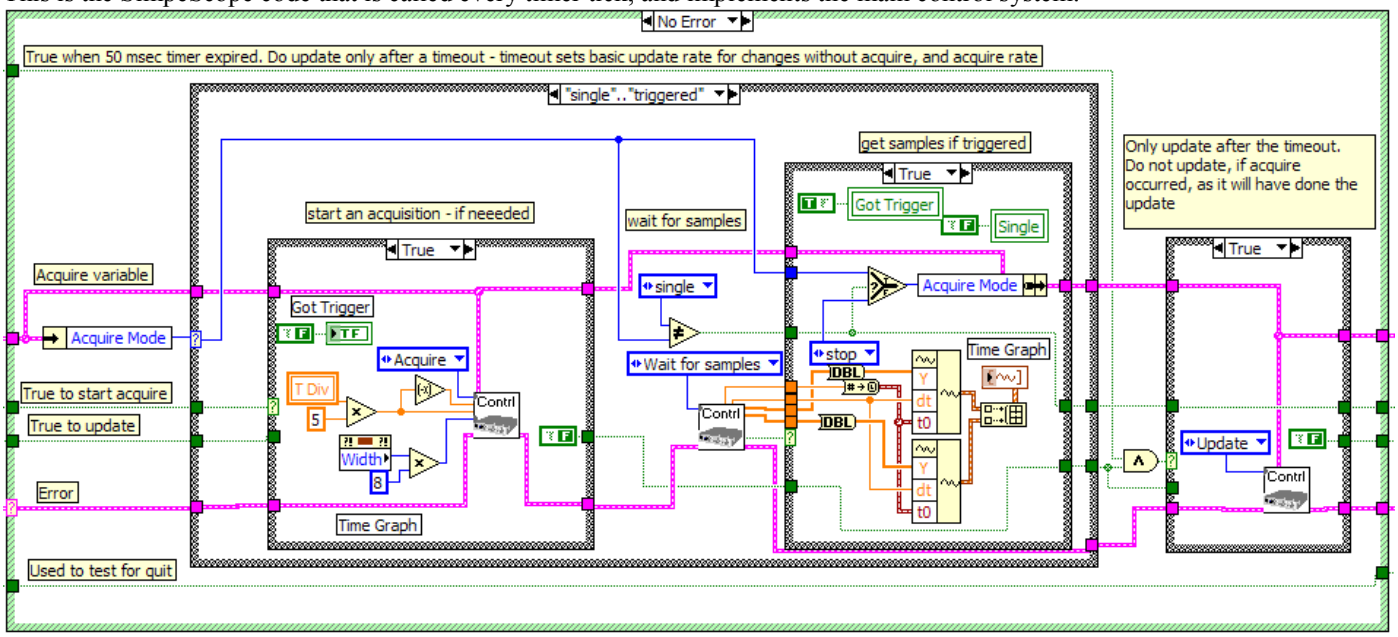
To use the vi carry out the following steps:

1. Call the DLL with the **Inititialize (**0) command.
2. Setup the Acquire Definition, and call using the **Acquire** (1) command. The Acquire call automatically updates the acquisition unit to the contents of the acquire structure.
3. Use a timed loop that achieves the desired throughput. Maximum throughput is typically 20 updates per second (50msec intervals). Call the **Wait for samples** (3) command until GotSamples = 1. The data will now be in the data array. Note that the call may delay up to 40msec for a trigger event to occur. During the wait, the active thread hibernates and returns control to the operating system.
4. If you want to replay another portion of the acquired data, use the **Replay** (2) command followed by **Wait for samples** (3) to check for the samples being transported. Any returned signal subset will be clipped to the start and end times specified when the acquire was made.
5. If you want to update the acquisition unit, without making an acquisition, or while waiting for a trigger, use the **Update** (4) command. You can control the signal generator this way.
6. Finally finish by calling the **Finish** (5) command.

Examples

Examples that perform the functions of a simple oscilloscope, and a band pass response estimator are provided.

This is the SimpeScope code that is called every timer tick, and implements the main control system:



Control flow is:

1. If the user has clicked either single or auto, the acquire mode will be set to single or triggered. In this case, we check to see if an acquire should be started. If so, start the acquire. Other control changes update the acquire variable, and set the Update input Boolean to True.
2. Once started, we wait for samples to be available. The wait for samples command will wait to 40msec for a trigger, and sample transfer.
3. Assuming we got a trigger, we display the samples, and set front panel controls accordingly. We set the acquire mode correctly.
4. If after having completed previous tests, there are still changes to be made (because we are not acquiring, or we are waiting for a trigger), we update the acquisition unit with remaining changes.
5. If we should not acquire, the start an acquisition case does nothing. If there are no samples to display, the get samples if triggered case does nothing.