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Acquire

Summary

Acquire is a program for high-speed multi-channel continuous recording to disk. Acquire supports recording, event markers, control outputs, and protocols.

Contents

Recording

Continuous Recording

Acquire performs continuous recording to disk. To set up recording, you specify the recording device, the channels to use, and the sampling interval. Then you can start and stop recording any number of times in the file.

For each analog input channel, Acquire stores an external amplifier gain. This allows a data analysis program to properly scale the data. For example, if the input range of your A/D converter is ±10V and an external amplifier is attached with a gain of 1000, Acquire displays the input signal as having a range of ±10mV. In a few cases of specific amplifiers, such as the HEKA elektronik EPC-9, Acquire can obtain the gain directly from the amplifier.

For each input signal, Acquire stores a signal name and units label. For example, an input signal might have the name *patch* and units of A (amperes).

Acquire displays data being recorded in an oscilloscope-like monitor window. Acquire runs the monitor window at lower priority than recording, so Acquire will allow the data in the monitor window to fall behind if it requires the time to record data.

Acquire records data using a lossless 2:1 compression, reducing the stored data size by almost a factor of 2 over what would be expected. This not only reduces the data file size, but allows Acquire to record data more quickly than would otherwise be possible. Computer processor speeds have increased much more quickly than disk data transfer rates, so using the processor to compress data provides better use of the limited disk data transfer rate.

Triggering and Timing

Acquire begins recording a sweep based on a manual or automatic trigger. That is, you can have Acquire begin recording a sweep whenever you start the sweep manually, or you can have it wait for a trigger. Whether or not a trigger input is available depends on your data acquisition device.

You can specify that a sweep has a specified duration, for example, 3 minutes. Acquire will stop the sweep after this time.

Once Acquire begins recording a sweep, it counts data sam-

ples. One sample on each input channel is called a *frame*. For example, if you are recording on five waveform input channels, after two frames you have ten samples. All timing within a sweep is in units of frames.

Event Screening

You may want to record data only when it is associated with activity. Acquire supports this capability as *event screening*. You specify the criteria by which Acquire screens data. When Acquire recognizes an event, it records with a pre- and post-trigger recording time.

For example, you might specify that Acquire should record only when the value on A/D channel 1 exceeds 5V. Whenever recording starts, you want Acquire to record the 100ms preceding the event and the 500ms following the event. Acquire retriggers if another event occurs while recording an event, extending the recording period.

Event screening is performed on only one input channel. When recording is performed, all active channels are recorded. For example, you might set event screening to operate on A/D channel 2. Whenever an event is detected, all active channels are recorded. A channel must be active to be used in event screening.

The event screening criteria supported by Acquire include:

1. Threshold: A signal exceeds a threshold either in a positive or negative direction. For example, if the threshold is 0V, you can have Acquire recognize an event whenever the input signal is either greater than 0V or less than 0V.

2. Transition: A signal transition exceeds a threshold. You specify the amplitude of the transition and the intervals over which the transition is measured. For example, you can have Acquire recognize a transition if a signal changes by more than 1V over a 10ms period, measured by averaging the signal for 1ms.

When Acquire records data in response to event screening, it generates a data *segment*. The time of this segment within the sweep is recorded to the frame, that is, the sample number. As a result, event screening does not reduce the accuracy with which time is recorded. Instead, it can be considered a method by which uninteresting data containing no activity is not recorded to disk.

The pretrigger recording time specified for an event in Acquire is limited only by the size of the acquisition buffer, a buffer used to hold input data from the data acquisition device for processing. You can set the size of this buffer. The usual size is many tens of thousands of samples. For example, if the acquisition buffer is set at 128k samples and a frame consists of data from four channels, the acquisition buffer is 32k frames long. At a 5kHz frame rate, this corresponds to 6.4s of data, so the pretrigger recording time is limited to 6.4s.

File Structure

The Acquire file structure is hierarchical. The structure is:

1. File: An Acquire recording session. All the data from a session is recorded in a single data file. You can create a new Acquire file at any time you are not recording.

2. Series: An Acquire file consists of one or more *series*. Each time you perform a protocol, you create one series.

3. Sweep: An Acquire series consists of a sequence of *sweeps*. Each time Acquire starts and stops recording it generates one sweep. Within a sweep, timing is accurate to a frame.

4. Segment: Acquired data is collected into *segments*. If event screening is not used, each sweep contains one data segment. If event screening is used, Acquire generates one segment each time it finds input data to record.

Control and Markers

Markers

Acquire writes event markers to the data file under the following conditions:

1. When explicitly requested. You can predefine markers. During recording, you can instruct Acquire to insert a marker into the file.

2. On control output. You can associate a marker with each control output change. For example, if Acquire controls a valve system through a control output, you can have Acquire write a marker each time you select a valve.

3. On control input. You can associate a marker with control input events. For example, if you have a switch tied to a digital input, you can have Acquire write a marker each time the switch is activated.

Control Outputs

Acquire controls external devices through control outputs. Control outputs include:

1. Analog outputs: An analog control output can be a level. For example, a control operation might set an analog output to -50mV.

2. Digital outputs: A digital control output can be a binary value. For example, a control operation might set a digital output to 0. A single digital output register can be divided into different control output channels. For example, an 8-bit digital output register A might be divided into one channel for bits 0-3 and another for bits 4-7. Each of the channels can then be controlled independently.

3. Serial outputs: A serial output is a string of bytes. For example, a serial output operation might send the string "Filter0" to an external device. Acquire can send control characters as well as ASCII text.

4. Specific devices: Acquire supports certain specific devices for control output, such as Sutter Instrument filter

wheels.

A control operation can include a time, for example, set a level of +150mV at 2.5s following the beginning of the sweep. The temporal accuracy with which the control output takes place depends on your data acquisition device and your system. Generally, if your data acquisition device supports waveform output, Acquire uses the waveform output mode, and control output updates are accurate to a frame. If your data acquisition device does not support waveform output, Acquire must perform the update in software, and the accuracy depends on your system. The accuracy of software update is unlikely to be better than a few tens of milliseconds.

To use control outputs, you can create a list of possible output values for the channel. During recording, you select an output value.

Waveform Output

Acquire can perform waveform analog and digital output. Waveform output is controlled by protocols. To perform waveform output:

1. Your data acquisition device must be capable of waveform output.

2. You must enable the desired output channels for waveform output.

3. You must supply waveform data in a file or from another program using Automation.

4. You must supply waveform data for all active waveform output channels. That is, if an active output channel is set to waveform output, and you supply waveform data, you must supply waveform data for the channel.

For example, suppose you have an Instrutech ITC-18, and you enable D/A 0 and D/A 1. You can supply control outputs for the two channels independently, for example, setting the output voltage to a specified value. However, if you supply an output waveform, you must supply waveform data for both channels.

You need not supply waveform output continuously. When you do not supply waveform output, the channel will revert to the holding value

Control Channels

Acquire identifies an output channel as a control channel. A control channel can be an analog output channel, a digital output channel, a serial channel, or a specialized control device. Digital output channels can be subdivided into multiple control channels, each with an independent set of output bits (output mask).

For each control channel, you can create a list of possible control output values. During recording, you need only select one of the control output values to cause that value to be written.

For example, you might set device D/A 0 to be an output channel “Holding”. You might create output values -80mV, -60mV, and -40mV. You need only select an output value to cause Acquire to output the specified value.

Marker Data

Markers are closely tied to control outputs, because you can have Acquire automatically write a marker into the data file whenever a control output is selected. You can also create markers not tied to control outputs.

Markers are divided into channels, closely associated with control channels. For each marker channel, the following information is stored in the data file:

1. Name: The name of the marker channel.

2. Units: The units used for marker values. For example, 'V' for 'Volts'. SI units should be used for simplicity during analysis.

For each marker, the following information is stored in the data file:

1. Name: A text string associated with the marker, for example: 'red'.

2. Value: A numeric value associated with the marker, for example, '-0.050'. This value is in the units specified for the marker channel.

3. Output: The output value written for the marker, for example, “filter1=4”.

Control Inputs

Acquire can monitor input channels, automatically generating markers when it recognizes transitions.

Acquire monitors digital input channels. For each digital input channel you can define control input channels. Each control input channel is defined as a set of bits, that is, an input mask. Each time a transition occurs on the bits specified by the mask, Acquire places a marker in the recorded data file. For each control input channel you define a set of marker values. Acquire writes a marker with the value corresponding to the control input.

For example, suppose that you have defined bits 0-3 of a digital input channel as the control input channel “Selector1”. Suppose you defined one marker with the name “Position1” with the value 1 and a marker with the name “Position2” with the value 3. If Acquire detects a transition on bits 0-3 to the value 1, it writes the marker “Position1” into the file. If it detects a transition to the value 3, it writes the marker “Position2”. Acquire ignores transitions to values not corresponding to markers.

Protocols

You can write sequences of acquisition operations as named protocols. A protocol can start and stop acquisition, send control

outputs, write markers, and wait for events. For example, a protocol might be written as follows:

```
repeat 10 begin
  sweep 60 begin
    at 0 control filter.red
    at 10 control filter.blue
    at 50 control filter.closed
  end
end
```

Each protocol generates a *series*, consisting of a sequence of *sweeps*.

Protocols are named. Acquire presents a control panel listing the available protocols. To perform an experiment using protocols, create a protocol for each measurement you want to perform. Then simply choose the protocols in sequence to perform the measurement.

Automation

Automation allows you to control Acquire from another program. Automation is available under Microsoft Windows only, using ActiveX Automation. Using Automation, you can:

1. Perform any operation available to a protocol, such as starting and stopping recording, writing markers, and performing control outputs.
2. Write output waveforms.
3. Obtain acquired data in real time.

Since Automation can obtain acquired data in real time, you can create controllers for Acquire that perform data-dependent recording, such as recording until a particular condition is met.

Hardware Devices

The following digitizers (A/D converters) are supported:

Table 1: Digitizers

Device	Analog Inputs	Notes
Axon Instruments Digidata 1200A/B	12 bits, 330ks/s	
Instrutech ITC-16	16 bits, 200ks/s	1
Instrutech ITC-18	16 bits, 200ks/s	1, 2
National Instruments PCI-1200	12 bits, 100ks/s	
National Instruments PCI-6110E, 6111E	12 bits, 5Ms/s	2

Notes:

1. Optically isolated: The analog inputs and outputs are isolated electrically from the computer power supply and ground. This eliminates noise coupled from the computer through the analog outputs.

2. A/D per channel: A separate A/D converter is used for each analog input channel. This eliminates the crosstalk that can occur in a multiplexer. Since all channels can be sampled simultaneously, phase error between analog input channels is eliminated. Depending on the digitizer design, it may permit all channels to be sampled at the same rate

The following specialized digitizers are supported:

Table 2: Specialized Digitizers

Device	Type
HEKA elektronik EPC-9	Patch-clamp amplifier
HEKA elektronik PG 300	Potentiostat
Instrutech VR-10(B)	PCM recorder
Instrutech VR-100(B)	PCM recorder

The following specialized control devices are supported:

Table 3: Control Devices

Device	Type
Sutter Instrument Lambda 10	Optical filter wheel/shutter

Axon Instruments Digidata 1200A/B

The capabilities supported by Acquire are:

Table 4: Axon Instruments Digidata 1200A/B

Manufacturer	Axon Instruments
Device	Digidata 1200A, Digidata 1200B
Connection	ISA bus
Support	Microsoft Windows 95/98
Waveform sampling	330ks/s total on all channels
Waveform analog inputs	12-bit A/D, 32-channel multiplexer
Control digital inputs	16 bits
Control analog outputs	12-bit D/A, 2 channels
Control digital outputs	16 bits

The Digidata 1200A/B are supplied with an external BNC front panel. The BNC front panel supplied by Axon Instruments has connections for only 16 channels. To use more than 16 channels, you need a special front panel, or you have to make direct connections to the Digidata 1200A/B board.

Acquire does not support analog waveform output to the Digidata 1200A/B.

The Digidata 1200A/B have a maximum transfer rate of 330ks/s. However, since the Digidata 1200A/B use ISA bus DMA data transfer, you may not be able to achieve this rate on your customer. The Digidata 1200A/B use a single A/D converter with a multiplexer, so analog performance may be poor when sampling at high speed from multiple channels.

For more information about the Digidata 1200A/B, see the Axon Instruments Web site at www.axon.com.

HEKA elektronik EPC-9

The capabilities supported by Acquire are:

Table 5: HEKA elektronik EPC-9

Manufacturer	HEKA elektronik
Device	EPC-9, EPC-9/2, EPC-9/3
Connection	PCI bus, ISA bus, NuBus
Support	Microsoft Windows 95/98/NT Apple Macintosh
Waveform sampling	200ks/s total on all channels
Waveform analog inputs	16-bit A/D, 8-channel multiplexer
Waveform digital inputs	16 bits
Waveform analog outputs	16-bit D/A, 4 channels
Waveform digital outputs	15 bits

The EPC-9 is a patch-clamp amplifier with a built-in Instrutech ITC-16. The unit is available with 1 (EPC-9), 2 (EPC-9/2), or 3 (EPC-9/3) patch-clamp inputs. Each patch-clamp input occupies one analog input. The remaining analog inputs are available as general signal inputs. Only 15 digital outputs are available, as one of the ITC-16 digital outputs is used to control the patch-clamp portion of the device.

You can control the EPC-9 using the E9Screen program supplied with the amplifier by HEKA elektronik. Acquire cooperates with E9Screen, reading gain settings from the amplifier. You cannot change amplifier gain while recording with Acquire, that is, during an Acquire sweep. You can also use the HEKA Pulse program to control the EPC-9. Acquire cooperates with Pulse as well.

For a description of the analog performance, see the discussion of the Instrutech ITC-16. The ITC-16 is optically isolated, so the patch-clamp portion of the EPC-9 is optically isolated from the computer ground.

Acquire can use the EPC-9 analog outputs, digital inputs, and digital outputs as simulated control outputs. For example, Acquire can set an analog output voltage as a holding potential. If Acquire uses a waveform output as a control output, the output update may be deferred because of buffering within the EPC-9. The EPC-9 has a built-in 16k sample buffer. For example, if you change an analog control output, and the output buffer contains 8k samples, the output update will not occur until all 8k samples have been output, which requires 8k sample intervals. At a sampling rate of 10ks/s, this would be 0.8 seconds.

For more information about the EPC-9, see the HEKA elektronik Web site at www.heka.com.

HEKA elektronik PG 300

The capabilities supported by Acquire are:

Table 6: HEKA elektronik PG 300

Manufacturer	HEKA elektronik
Device	PG 310, PG 390
Connection	PCI bus, ISA bus, NuBus
Support	Microsoft Windows 95/98/NT Apple Macintosh
Waveform sampling	200ks/s total on all channels
Waveform analog inputs	16-bit A/D, 8-channel multiplexer
Waveform digital inputs	16 bits
Waveform analog outputs	16-bit D/A, 4 channels
Waveform digital outputs	15 bits

The PG 300 is a potentiostat with a built-in Instrutech ITC-16. The potentiostat input occupies one analog input. The remaining analog inputs are available as general signal inputs. Only 15 digital outputs are available, as one of the ITC-16 digital outputs is used to control the potentiostat portion of the device.

You can control the PG 300 using the POTPULSE program supplied with the device by HEKA elektronik. Acquire cooperates with POTPULSE, reading gain settings from the device. You cannot change device gain while recording with Acquire, that is, during an Acquire sweep.

For a description of the analog performance, see the discussion of the Instrutech ITC-16. The ITC-16 is optically isolated, so the potentiostat portion of the PG 300 is optically isolated from the computer ground.

Acquire can use the PG 300 analog outputs, digital inputs, and digital outputs as simulated control outputs. For example, Acquire can set an analog output voltage as a holding potential. If Acquire uses a waveform output as a control output, the output update may be deferred because of buffering within the PG 300. The PG 300 has a built-in 16k sample buffer. For example, if you change an analog control output, and the output buffer contains 8k samples, the output update will not occur until all 8k samples have been output, which requires 8k sample intervals. At a sampling rate of 10ks/s, this would be 0.8 seconds.

For more information about the PG 300, see the HEKA elektronik Web site at www.heka.com.

Instrutech ITC-16

The capabilities supported by Acquire are:

Table 7: Instrutech ITC-16

Manufacturer	Instrutech Corporation
Device	ITC-16
Connection	PCI bus, ISA bus, NuBus

Table 7: Instrutech ITC-16

Support	Microsoft Windows 95/98/NT Apple Macintosh
Waveform sampling	200ks/s total on all channels
Waveform analog inputs	16-bit A/D, 8-channel multiplexer
Waveform digital inputs	16 bits
Waveform analog outputs	16-bit D/As, 4 channels
Waveform digital outputs	16 bits

The ITC-16 uses a single 16-bit A/D converter, and has an absolute accuracy of approximately 14 bits. It is an external device connected to the host computer through a proprietary interface card. Interface cards are available for the PCI bus, AT bus, and NuBus.

The ITC-16 is optically isolated. The analog inputs and outputs float with respect to the computer ground, and the analog electronics are powered by an independent power supply not connected to the computer ground. This makes the ITC-16 well suited to low-noise recording and control, as well as use in instrumentation systems, where isolation from the computer ground helps eliminate ground loops.

Since the ITC-16 uses a single A/D converter with a multiplexer, analog performance may be poor when sampling at high speed from multiple channels. In general, sampling at more than 100ks/s on multiple analog inputs results in noticeable crosstalk.

Acquire can use the ITC-16 analog outputs, digital inputs, and digital outputs as simulated control outputs. For example, Acquire can set an analog output voltage as a holding potential. If Acquire uses a waveform output as a control output, the output update may be deferred because of buffering within the ITC-16. The ITC-16 has a built-in 16k sample buffer. For example, if you change an analog control output, and the output buffer contains 8k samples, the output update will not occur until all 8k samples have been output, which requires 8k sample intervals. At a sampling rate of 10ks/s, this would be 0.8 seconds.

The ITC-16 has a trigger input. You can use this trigger input to start recording in Acquire.

For more information about the ITC-16, see the Instrutech Web site at www.instrutech.com.

Instrutech ITC-18

The capabilities supported by Acquire are:

Table 8: Instrutech ITC-18

Manufacturer	Instrutech Corporation
Device	ITC-18
Connection	PCI bus, ISA bus, NuBus
Support	Microsoft Windows 95/98/NT Apple Macintosh

Table 8: Instrutech ITC-18

Waveform sampling	200ks/s total on all channels
Waveform analog inputs	16-bit A/Ds, 8 channels
Waveform digital inputs	16 bits
Waveform analog outputs	16-bit D/As, 4 channels
Waveform digital outputs	16 bits, 2 channels
Control digital outputs	16 bits

The ITC-18 uses an 18-bit A/D converter for each analog input channel, and has an absolute accuracy of almost 16 bits. The 18-bit data is reduced to 16 bits inside the ITC-18. Since each channel has a separate A/D converter, crosstalk between channels is minimized, and all channels sample simultaneously, essentially eliminating phase error for multi-signal acquisition. Each input channel has a software-selectable input range between ±1V and ±10V. The ITC-18 is an external device, connected to the host computer through proprietary interface cards. Interface cards are available for the PCI bus, AT bus, and NuBus.

The ITC-18 is optically isolated. The analog inputs and outputs float with respect to the computer ground, and the analog electronics are powered by an independent power supply not connected to the computer ground. This makes the ITC-16 and ITC-18 well suited to low-noise recording and control, as well as use in instrumentation systems, where isolation from the computer ground helps eliminate ground loops.

Acquire supports the ITC-18 on all platforms. Acquire supports both control and waveform output on the analog outputs.

Acquire can use the ITC-18 analog outputs, digital inputs, and digital outputs as simulated control outputs. For example, Acquire can set an analog output voltage as a holding potential. If Acquire uses a waveform output as a control output, the output update may be deferred because of buffering within the ITC-18. The ITC-18 has a built-in 256k sample buffer. For example, if you change an analog control output, and the output buffer contains 8k samples, the output update will not occur until all 8k samples have been output, which requires 8k sample intervals. At a sampling rate of 10ks/s, this would be 0.8 seconds.

The ITC-18 also has a separate 16-bit control digital output. Acquire can use this for control digital output as well.

The ITC-18 has a trigger input. You can use this trigger input to start recording in Acquire.

For more information about the ITC-18, see the Instrutech Web site at www.instrutech.com.

Instrutech VR-10(B)

The capabilities supported by Acquire are:

Table 9: Instrutech VR-10(B)

Manufacturer	Instrutech Corporation
Device	VR-10, VR-10B

Table 9: Instrutech VR-10(B)

Connection	VR-111: ISA bus ITC-16: PCI bus, ISA bus, NuBus
Support	VR-111: Microsoft Windows 95/98/NT ITC-16: Microsoft Windows 95/98/NT ITC-16: Apple Macintosh
Waveform sampling	94ks/s total on all channels
Waveform analog input	14 bit A/D, 2 channels

The VR-10(B) is a PCM recorder that converts analog input signals to a digital form for recording to video tape using a VCR. This provides large amounts of data storage at very low cost. Acquire communicates with the PCM recorders using an interface from Instrutech, either an ITC-16 or a VR-111.

The VR-10 and VR-10B PCM recorders digitizes analog signals with 14 bit resolution at 94k samples/s. The recorder has two analog channels, and can be operated with one channel at 94ks/s or two channels, each at 47ks/s.You can record signals on analog inputs to tape, replay recordings from tape to analog outputs, or use the unit as an on-line digitizer.

The PCM recorders store a time code on tape. Acquire can trigger recording based on the time code. For example, you can instruct Acquire to record a 10 minute segment from tape beginning at 11:00:00. You then play the tape into Acquire, and it will begin recording when it recognizes the specified time from tape.

For more information about the VR-10(B), see the Instrutech Web site at www.instrutech.com.

Instrutech VR-100(B)

The capabilities supported by Acquire are:

Table 10: Instrutech VR-100(B)

Manufacturer	Instrutech Corporation
Device	VR-100, VR-100B
Connection	VR-111: ISA bus ITC-16: PCI bus, ISA bus, NuBus
Support	VR-111: Microsoft Windows 95/98/NT ITC-16: Microsoft Windows 95/98/NT ITC-16: Apple Macintosh
Waveform sampling	94ks/s total on all channels
Waveform analog input	14 bit A/D, 8 channels

The VR-100(B) is a PCM recorder that converts analog input signals to a digital form for recording to video tape using a VCR. This provides large amounts of data storage at very low cost. Acquire communicates with the PCM recorders using an interface from Instrutech, either an ITC-16 or a VR-111.

The PCM recorders digitize analog signals with 14 bit resolution at 94k samples/s. You can record signals on analog inputs to tape, replay recordings from tape to analog outputs, or use the unit as an on-line digitizer.

The VR-100 and VR-100B support a variety of recording modes. The VR-100 records at 94ks/s on 1, 2, 4, or 8 channels, with the sampling rate divided equally between the recorded channels. Acquire supports recording data acquired in these modes.

The VR-100B supports the same modes as the VR-100, and additionally supports recording in 3, 5, 6, and 7 channel modes. Acquire does not support these modes. Acquire supports only recording data acquired in 1, 2, 4, or 8 channel mode.

The PCM recorders store a time code on tape. Acquire can trigger recording based on the time code. For example, you can instruct Acquire to record a 10 minute segment from tape beginning at 11:00:00. You then play the tape into Acquire, and it will begin recording when it recognizes the specified time from tape.

For more information about the VR-100(B), see the Instrutech Web site at www.instrutech.com.

National Instruments PCI-1200

The capabilities supported by Acquire are:

Table 11: National Instruments PCI-1200

Manufacturer	National Instruments
Device	PCI-1200
Connection	PCI bus
Support	Microsoft Windows 95/98/NT
Waveform sampling	100ks/s total on all channels
Waveform analog inputs	12-bit A/D, 8-channel multiplexer
Control digital inputs	8 bit channels, 3 channels
Control analog outputs	12-bit D/A, 2 channels
Control digital outputs	8 bit channels, 3 channels

The PCI-1200 is a low-cost 8 channel 100ks/s 12 bit digitizer. The PCI-1200 has two analog output channels and three 8 bit digital input/output channels. Each digital I/O channel can be configured either as an input or an output. Acquire does not support waveform output on the PCI-1200.

For more information about the PCI-1200, see the National Instruments Web site at www.natinst.com.

National Instruments PCI-6110E, 6111E

The capabilities supported by Acquire are:

Table 12: National Instruments PCI-6110E and PCI-6111E

Manufacturer	National Instruments
Device	PCI-6110E, PCI-6111E
Connection	PCI bus
Support	Microsoft Windows 95/98/NT
Waveform sampling	5Ms/s on each analog input channel

Table 12: National Instruments PCI-6110E and PCI-6111E

Waveform analog inputs	PCI-6110E: 12-bit A/Ds, 4 channels PCI-6111E: 12-bit A/Ds, 2 channels
Control digital inputs	8 bits
Control analog outputs	12-bit D/A, 2 channels
Control digital outputs	8 bit

The PCI-6110E and PCI-6111E are 5M samples/s 12-bit digitizers. The PCI-6110E has four analog input channels, while the PCI-6111E has two analog input channels. Each analog input channel has a separate A/D converter. This reduces crosstalk compared to designs based on a single A/D converter and a multiplexer. Since the A/D converters sample simultaneously, phase shift between channels is eliminated for multichannel recording.

The boards have two analog output channels and one 8 bit digital I/O channel. Acquire supports control output on the analog outputs. Acquire supports either control input or control output on the digital I/O port. The digital I/O port cannot be used simultaneously for both input and output. Acquire does not support waveform output.

The PCI-6110E and PCI-6111E can acquire data at 5M samples/s on each input channel, that is, a total of 20M s/s for the PCI-6110E and 10M s/s for the PCI-6111E. This is faster than many computers can process data and record it to disk. Acquire has been tested successfully recording 5M s/s to disk on a fast computer with a fast hard drive. It failed to record significantly faster than this.

For more information about the PCI-6110E and PCI-6111E, see the National Instruments Web site at www.natinst.com.

Sutter Instrument Lambda 10

The capabilities supported by Acquire are:

Table 13: Sutter Instruments Lambda 10

Manufacturer	Sutter Instrument
Device	Lambda 10
Connection	RS-232 serial
Filters	10-position filter wheels, 1 or 2
Shutters	open/closed shutters, 0, 1, or 2

The Sutter Lambda-10 series provide independent control of up to two filter wheels and up to two shutters. Acquire provides built-in control of the Lambda-10 series, allowing you to specify a device operation as a sequence of logical statements, such as “filter=4 shutter=open”.

For more information about the Lambda-10 series, see the Sutter Instrument Web site at www.sutter.com.