

Introduction:

LabChart 7.2 (or later) for Windows can record and analyze data from multiple devices simultaneously **into a single LabChart data file**. Devices currently supported include PowerLabs and the Zephyr BioHarness, which is displayed in its own device category when searching for devices at start-up. Future devices will connect to LabChart in the same way. For the remainder of this document, these devices are collectively referred to as non-PowerLab devices.

Up to 32 channels of data can now be simultaneously acquired into a single LabChart document. This will be very useful when there are not enough channels on one PowerLab to record all the parameters wanted in a single experiment. It also provides the convenience of analyzing the resulting data in a single file.

Main Features and Benefits:

- Users can record from multiple devices into a single document simultaneously.
- Users can take advantage of recording up to 32 raw and/or computed input channels
- LabChart uses sophisticated techniques to minimize data synchronization issues between devices.
Please see page 4 for further information.
- Users can assign LabChart channels to hardware inputs from the various devices in any order.
- Advanced scripting support allows users to automate advanced recording regimes.
- Analysis is made quicker and easier by having data in a single file.

Hardware Compatibility:

Support for Multiple Device Sampling is provided for PowerLab 15T, 20, 20T, 25, 25T, 26, 26T and 30 series using LabChart 7.2 or later for Windows.

Using Multiple Devices:

Finding Compatible Devices

When LabChart starts, it will search for devices that are connected to record data. The Device Discovery dialog allows you to choose the types of devices that LabChart searches for and initializes on startup.

Choose Setup > Device Discovery... to display the Device Discovery dialog.

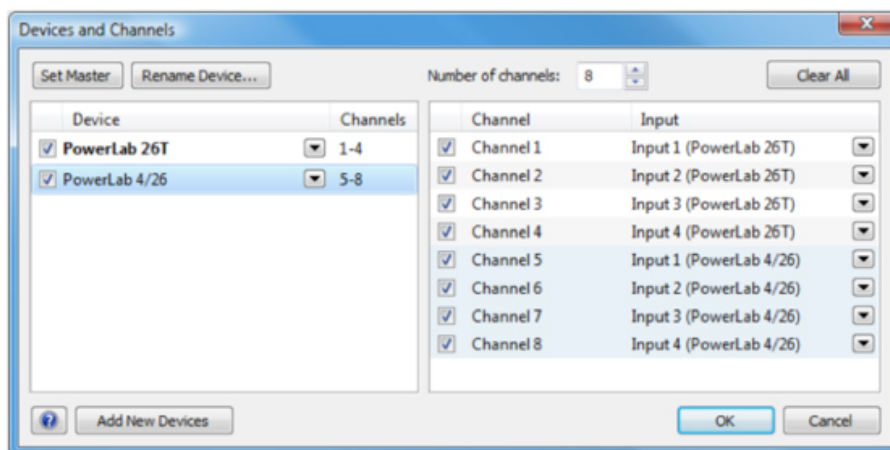


If no devices are checked, LabChart will not attempt to communicate with any devices and you will not be able to sample or change input settings. This is equivalent to the Analysis mode available in previous versions of LabChart.

Setting Up Devices and Channels

The Devices and Channels dialog allows you to choose which devices to record from, which to set as the Master device, and how to map the input channels.

Select: Choose Setup > Devices and Channels... to open the dialog and show the available devices and device inputs mapped to LabChart channels. The assignment of inputs to LabChart channels can be easily re-arranged.



The Device Panel

The Device panel allows you to enable and disable the devices that can record into the document and summarizes the channels associated with the device. Disabling a device that has existing channel associations disables the channels associated with the inputs and causes the Channels List panel to be updated. Note that this does not alter any settings associated with the channel.

If a device is disabled and then re-enabled, the channels previously used by that device will be reinstated.

Renaming a Device

Devices are labeled using their hardware type and a device name, if the device has a name.

You can provide a custom name for a device by selecting the device and choosing Rename Device.

Setting the Master Device

When multiple devices are present, a Master Device is chosen automatically. For new documents, the Master device defaults to the PowerLab having the largest number of inputs. You can override the default and choose a different device as Master by selecting a device and clicking the Set Master button. The Master device is displayed in bold.

Adding New Devices

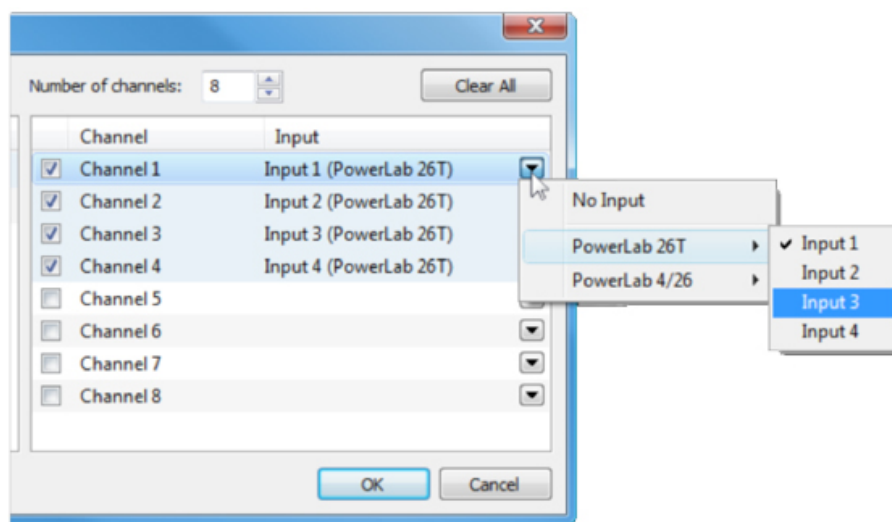
To add a new device, simply scan for newly added PowerLab units or other devices. Note that Device Discovery must be configured to scan for the required device type.

Channels

The Channels panel allows you to choose the source device input for each LabChart channel.

Re-assigning Inputs to Channels

For each channel, use the input menu to choose a new input.



You can quickly disable channels using the channel checkbox. The Inputs for disabled channels will become grayed out and can be quickly reinstated by checking the checkbox.

Setting the Number of Channels

You can use this control to change the number of channels displayed in the Chart View and Scope View.

Renaming Channels

You can rename Channels by double-clicking on the existing Channel name, or by selecting the channel and choosing Rename Channel.

Clearing All Channels

You can clear all of the input and channel settings by using the Clear All button, or selecting a channel and choosing Clear Channel from the right-click menu.

Master Device:

When multiple devices are present, a *Master Device* is chosen. This device determines the overall timing of samples in the document, which any other connected devices follow (Slave devices). Also, certain features such as the Stimulator and Triggering are tied to the Master Device. For new documents, the Master defaults to the USB PowerLab having the largest number of inputs. The user can override the default and choose a different device as Master on a per-document basis.

Stimulator

The only Stimulator available per document is the one of the Master Device. If the Master Device is a non-PowerLab device that doesn't provide this functionality, the Stimulator menu is disabled.

Sampling Dialog/Triggering

It is possible to trigger from analog channels across all devices. However, External Trigger or Stimulator Event options work from the Master Device only (if supported by the device).

Non-PowerLab Master Devices

Non-PowerLab devices can be used as the Master devices; however this can limit functionality of the system as any unavailable hardware and software features will be disabled. If not otherwise required, it is recommended to retain a PowerLab as the Master device as this will provide better inter-device time synchronization (see above). Generally, changing the master device to a non-PowerLab device will:

- Disable the Stimulator.
- Disable trigger from the External Trigger or Stimulator Event.
- Disable Digital Output. This also disables the Event Manager Digital Output feature.
- Disable Preset Comments from the External Trigger or Stimulator Event and Digital IO.

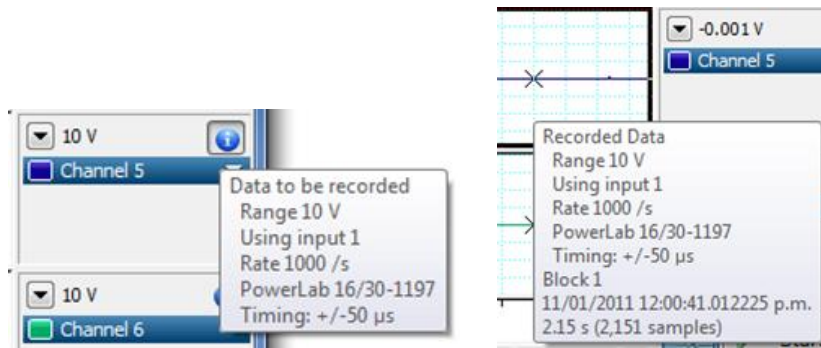
Sampling Rates

Enabled devices can only sample as fast as the fastest channel of the Master Device.

Inter-device Time Synchronization:

It is not possible to achieve perfect synchronization between different devices; however the synchronization error can be minimized to as little as 0.05 ms. Generally, the overall synchronization error is composed of an initial timing offset at the start of sampling and an acquired timing error during sampling.

The total maximum synchronization error is displayed in the Channel information pop-up under the heading *Timing*. The Master device shows *Timing: Master*, and any Slave devices show an upper limit of the expected timing error that is calculated from the USB connectivity and sampling rate for this channel. Synchronization information is also available for data that has already been recorded. This shows the synchronization error at the time the data was recorded.



Device Synchronization at Sampling Start

LabChart ensures that the first samples in every channel are measured at as close as possible to the same time.

For USB PowerLab units, the time accuracy of the first sample depends on both whether the PowerLabs are running on the same USB version, and are on the same host controller. **The error is minimized if the same USB version (for example USB 2.0) and host controller (for example, connecting all devices to a single USB hub) are used.**

For non-PowerLab devices, the time accuracy of the first sample depends heavily on the characteristics of the device. If a device behaves consistently and LabChart can compensate for delays in the device using a calibration, accuracies in the order of +/- 2 samples or 20 ms whichever is larger, are achieved.

Device Synchronization while Sampling

LabChart ensures that the rates of sampling in every channel matches as accurately as possible (after correcting for any differences in the nominal sample rate).

To compensate for the fact that hardware (sampling clocks) in different devices will be running at slightly different rates, the non-Master (or 'Slave') devices have their data streams re-sampled, which changes their rate to match the rate of the Master device.

Expected Synchronization Timings

The following table shows the device synchronization timings delivered in LabChart 7.2:

Scenario	Max synch error at sampling start	Max synch error while sampling	Long term drift between devices after 12 hours sampling
PowerLabs in same USB mode and connected to computer optimally [3]	Larger of +/- 2 sample periods or +/- 0.02 ms	Not significantly worse than the start error [1]	+/- 0.05 ms [1]
PowerLabs in different USB modes and connected non-optimally [3]	Larger of +/- 2 sample periods or +/- 0.5 ms	Not significantly worse than the start error [1]	+/- 0.05 ms [1]
Non-PowerLab devices	Larger of +/- 2 sample periods or +/- 20 ms	Larger of +/- 2 sample periods or +/- 50 ms [2]	+/- 50 ms likely

[1] This assumes the USB frame rates of the ports that the devices are plugged into are identical (which can be achieved by using a USB hub).

[2] These measurements assume that the device sample rates are accurate to better than 1 in 10^4 .

[3] For PowerLabs, the timing synchronization accuracy can vary depending on how they are connected to the user's computer. The best results are achieved if the devices are running in the same USB mode (e.g. all devices running at USB 2.0). Also, the initial synchronization of devices is improved if the devices are working off the same USB host controller on the computer. One can ensure this happens by connecting all devices to a single USB hub.

More information on using multiple devices with LabChart is available in the **LabChart Help Center** and the online [Video Learning Center](#).