

# LabSplits (version 2.5) User Manual

## Quick start

You should always read the individual instructions for each lab activity, but for most labs, here's what you'll do with LABSPLITS:

1. Set the "Rise/Fall" switch as needed/specified (usually "↑↓", but it could be "↑" or "↓" if you're collecting a lot of data).
2. Plug a sensor (commonly a photogate) into one of the jacks.
3. Attach LABSPLITS to your computer with a USB cable. (No power supply needed.)
4. Open a spreadsheet, and put the cursor in a cell below any existing data.
5. Push the "Record" button to start recording. (The status LED turns red.)
6. Do whatever it is that you are timing.
7. Push the "Record" button again to stop recording. (The status LED turns green.)

*Voila!* The times at which the photogate beam was broken and/or restored (or whatever your sensor measured) are now typed into your spreadsheet, ready for you to analyze.

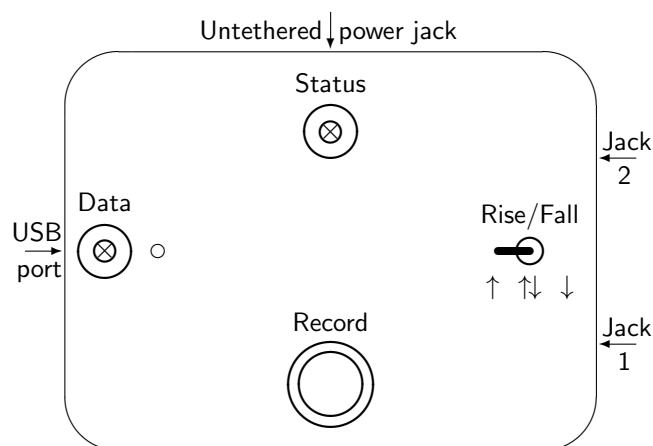
## What is LabSplits?

LABSPLITS is basically an electronic stopwatch, but instead of displaying its "splits" (times) on a screen or dial, it types them into a computer. LABSPLITS watches for activity on two  $\frac{1}{4}$ " phone jacks; a device (usually a photogate or a rangefinder) that is plugged into one of these jacks can trigger a "split" time, rather like a human pushing the split button on an ordinary stopwatch. To the computer, LABSPLITS appears to be a standard keyboard, on which someone is typing the split times; thus, LABSPLITS can be used with *any* program that accepts keyboard input (such as EXCEL or *Notepad*); no proprietary software is needed.

## Guide to the switches, LEDs, and jacks

**Status (multicolor) LED:** Tells you what LABSPLITS is doing or is ready to do:

<i>Dark:</i>	Off (no power, initializing, or defective).
<i>Steady green (or yellow):</i>	Standby/ready (Nothing is being timed...yet.)
<i>Steady red:</i>	Recording (Events are being timed.)
<i>Blinking green (or yellow):</i>	Buffer is full (No new events will be timed.)
<i>Blinking red:</i>	Error (Data LED will blink error code.)



[Arrows indicate side connectors.]

**Data (blue) LED:** Lights whenever times are buffered and waiting to be typed to the computer. (Thus, it normally blinks once for each timed event, but it remains lit if the times “build up” in the buffer.) Also, blinks an error code when an error occurs.

**Record button:** Starts recording event times (or stops, if recording is already in progress), and resets the internal “stopwatch” in LABSPLITS to time zero. Also, holding this button down during power-up selects the alternate configuration (see below).

**Rise/fall switch:** Selects which sort of event LABSPLITS will record: falling signal (e.g., photogate beam blocked), or rising signal (e.g., photogate beam restored), or both. Also, changing this switch clears any error codes.

**Jack 1 and jack 2:** LABSPLITS watches whatever is plugged into either of these jacks (typically a photogate or rangefinder) for changes in its voltage/logic level.

**USB port:** Connect LABSPLITS to your computer here with a USB cable (standard A to micro-B). This supplies both power and communication.

**Untethered power jack:** Use this jack *only* if you are using untethered mode (see below), or if you want to suspend the typing of times.

## Special operation

### *Untethered mode*

If you are working in a location that is far from any computer, untethered mode lets you collect data on LABSPLITS and bring it back to your computer. To use it:

1. *Do not plug LabSplits into a computer* (yet). Instead, provide 7–12 VDC to the untethered power jack (see above) using a 2.1 mm barrel plug (center positive). A standard 9 V “transistor” battery (type E) generally works fine.
2. Attach your sensor and collect your data as usual. After you stop recording, the Data LED should be solid blue (indicating that times have been recorded, but not yet typed out) and the Status LED should be solid green.
3. Bring LABSPLITS to your computer and attach it with a USB cable. Set up EXCEL (or whatever program you will use). When you are sure that you are ready to go, remove the barrel plug from untethered power jack. All of your event times will then be typed rapidly into your computer.

### *Alternate configuration*

There are several options affecting the behavior of LABSPLITS that the instructor can set in its firmware. These cannot be changed individually by you (the user), but LABSPLITS supports two “configurations” (sets of options)—standard and alternate—which you can choose between. To select the alternate configuration, simply hold down the Record button as you power up your LABSPLITS unit. The Status LED will glow yellow instead of green, and the version number will be printed in the header, to remind you of your choice.

The instructor (or whoever maintains the LABSPLITS units) can choose among several options for either configuration, but by default, the standard configuration operates as described in this manual, and the alternate configuration has the following differences:

- ▷ Typing pauses briefly after every line.
- ▷ Button push times are typed out. (The button is reported as jack #0.)
- ▷ Illogical events are typed (instead of being ignored).

### *Error handling*

A blinking Status LED indicates an internal error in LABSPLITS; recording will stop, and the Record button will be disabled.

*Blinking green (or yellow)* indicates a full buffer. Times already in the buffer will continue to be typed, until the buffer is empty or the error status is cleared. The Data (blue) LED will continue to function normally.

*Blinking red* indicates a more serious error. Untyped times are lost. The Data (blue) LED will blink several times, then pause, then repeat. Count the number of blinks between pauses (which is the error number) and report it to the instructor.

Once you have responded to the error, you can restore LABSPLITS to normal operation by moving the Rise/Fall switch to another position and back again.

## Frequently asked questions

*How can I tell what version of LabSplits I have?* Start LABSPLITS in “alternate configuration” (see above); the header will include the version number (currently 2.50).

*What exactly is LabSplits’s output?* When you start recording, LABSPLITS types a header line, followed by one or two events per line, with tab-delimited fields. The first field is always the sensor/jack number. When recording both rising and falling transitions, the next fields are the times of the two matching transitions (rising then falling or *vice versa*), followed by the time interval between them. For single-transition recording, the next fields are the “split” time (the time since the last event) and then the running (or cumulative) time.

*What devices can I plug into LabSplits?* LABSPLITS was designed to be used with Pasco photogates, but it will work with any TTL compatible sensor. The phone plug’s *sleeve* is at ground, and its *tip* supplies +5 V (at a few hundred mA max). The device should apply either ground or +5 V to the phone plug’s *ring*; changes in this voltage trigger LABSPLITS events.

*What’s different about using a rangefinder?* Unlike photogates, the Pasco Motion Sensors (and other rangefinders) do not operate continuously—they send out bursts of high frequency sound and then listen for echoes—so they must be actively triggered. You will use a separate device to trigger rangefinders in lab, as described elsewhere.

*What is the small hole next to the Data LED?* If you look directly down the hole, you can see an internal LED (usually green) which turns off or on whenever an event occurs, *even when LabSplits is not recording*. This can help you with configuring, aligning, or troubleshooting your sensor or other equipment.

## Troubleshooting

*LabSplits is randomly typing stuff!* Usually, this is because you forgot to stop timing when you were done collecting data. Make sure that the Status LED is green (or yellow) except when you are actually collecting data.

*Sometimes, after typing a lot of events into a spreadsheet, LabSplits will start typing gibberish!* This is actually your spreadsheet app’s fault: it can’t keep up with LABSPLITS’s typing speed. It may help to time only rising or only falling transitions (not both), and/or to pause between lines (see “alternate configuration”, above). If these don’t work, have LABSPLITS type into a simpler, faster program (such as *Notepad*), and then copy and paste from there into your spreadsheet.

*The computer wants me to install an Arduino driver; should I?* You don’t need this driver to use LABSPLITS, and may safely ignore any messages about it.

*The Status LED is blinking; what do I do?* See the error handling section above.