LabSplits (ver. 1.40) User Manual

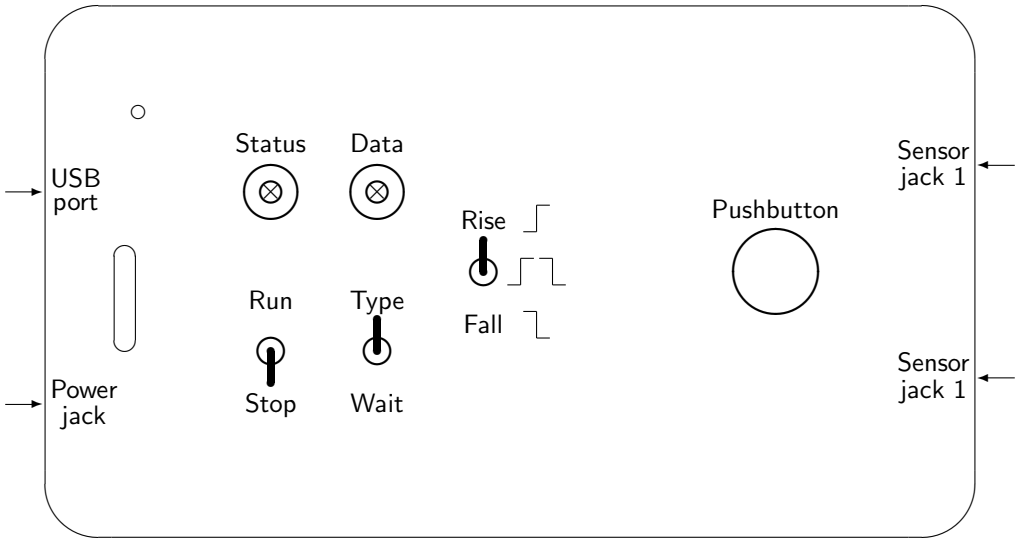
LabSplits is basically a stopwatch, but instead of displaying its splits (times) on a screen or dial, it types them into a computer. (When attached to a computer, LabSplits appears to be an ordinary computer keyboard. It can be used with any program that accepts keyboard input, but most commonly is used with Excel.) LabSplits watches for activity ("events") from three sources: a pushbutton and two jacks (which accept standard Pasco photogates and similar digital sensors).

Quick start guide

For most labs, here's all you'll need to do:

- Set the "Run/Stop" switch to Stop, the "Type/Wait" switch to Type, and the "Rise/Fall" switch to "Rise" or "Both" (as appropriate for your activity).
- Hook up a photogate to one of the jacks.
- Hook up LabSplits to your computer with a USB cable. (No power supply needed.)
- Launch Excel, and make sure the cursor is in the top left cell (A1).
- Set the "Run/Stop" switch to Run, do whatever it is that you are timing, and then set the "Run/Stop" switch back to "Stop". The event times will now be in a table in Excel.

Guide to the switches, LEDs, and jacks



[The switch positions shown in the diagram are the recommended default positions.]

Run/Stop switch: Turn on (Run) to initialize the stopwatch and start it running; turn off (Stop) to stop the stopwatch.

Type/Wait switch: If on (Type), splits will be sent to the computer immediately; otherwise (Wait), splits will be saved until the switch is on again.

Rise/fall switch: Selects which sorts of event LabSplits will record: falling signal (button pushed or photogate beam blocked), or rising signal (button released or photogate beam restored). This switch also has a center position, in which both types of event are recorded.

Status (multicolor) LED: Tells you what LabSplits is doing.

Dark:	Off (no power or initializing).
Red:	Timer not running (events are ignored).
Green:	Timer running (events are timed).
Yellow blinking:	Error condition (Yellow/green: buffer overflow; yellow/red: internal logic error.)

Data (blue) LED: Tells you if events are ready to be typed to your computer. In practice, this means that if the Type/Wait switch is set to Type (the usual case), the Data LED will blink each time an event is recorded and typed out; however, if the switch is set to Wait, the Data LED will light when the first event is timed, and remain lit until all of the events are sent to the computer (or cleared).

Pushbutton: Pushing or releasing this button generates an event that LabSplits can time. This button can be used for actual lab measurements, but it is mainly used for testing/playing with LabSplits.

Jack 1 and jack 2: These are the other two inputs (besides the pushbutton) that LabSplits watches. Most commonly, a photogate is plugged into one or both of these. [+5 V is supplied to the tip, and the sleeve is at ground; the (digital) signal is expected on the ring.]

USB port: Connect LabSplits to your computer here with a standard USB A/micro-B cable.

Power jack: Normally, you will *not* use this jack, because LabSplits gets all the power it needs from the USB cable. However, you will need to connect an external power supply here (7–12 V, center positive) if you are working in "untethered" mode, or if you have a power-hungry sensor attached.

"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.

- Set the Type/Wait switch to Wait, and attach an external power supply to the power jack. (A standard 9 volt battery is usually fine.)
- Collect your data as usual. (The Data LED should stay solid blue after the first event.) Be sure to set the Run/Stop switch to Stop when you're done.
- Attach LabSplits to your computer, and set up Excel (or whatever program you will use). When you are sure you are ready to go, switch the Type/Wait switch to Type. All of your events should be rapidly typed into your computer. (You may disconnect the battery at any time after connecting LabSplits to the computer.)

Frequently Asked Questions

What exactly does LabSplits type? Whenever an event occurs, LabSplits types the time (in seconds, since the Status LED turned green), the source (the pushbutton or one of the jacks), and the transition type (rising or falling), into your computer. It also prints a header when you first start a run. (These three fields are separated by tabs, with a newline at the end.)

Can I switch the Type/Wait switch back and forth during a data run, to temporarily suspend typing? Yes (provided that you don't get so much data that the LabSplits buffer overflows).

Do I lose my data when I switch the Run/Stop switch to Stop? No. LabSplits will stop collecting new events, but will keep the ones it has already collected, and will type them to your computer as soon as it has a chance.

Do I lose my data when I switch the Run/Stop switch back to Run? Yes. Switching to Run will [a] clear the buffer (erase all events that have been collected but not yet typed), [b] clear any error conditions, [c] restart the timer at 0 seconds, [d] type a header, and [e] start collecting new events.

How do I pause data collection and then resume it, without starting a new data run? Sorry; LabSplits does not support that, and there are no plans to do so in the future.

Is there a way to tell if events are occurring, even when LabSplits is not monitoring them? (To help when aligning my equipment, for example?) Yes; look down the slot in the top of the LabSplits case. As long as LabSplits is powered up and a sensor is attached, a yellow LED will change state (lit to dark or vice versa) every time an event occurs, even if the LabSplits timer is not actually running.

What are the hole and slot in the case for? They allow access to the reset button and LEDs (respectively) of the Arduino Leonardo, around which LabSplits is built. Their use is beyond the scope of this manual (except as described above).

How can I tell what version of LabSplits I have? Start LabSplits in "alternate mode" (see below).

How can I change the behavior of LabSplits? LabSplits is open source, so feel free to build your own modified version. Also, if you are using the standard version, you can start LabSplits in "alternate mode" by holding down the pushbutton as LabSplits powers up (until the Status LED comes on). In this mode, LabSplits will [a] type more slowly, [b] ignore non-critical internal logic errors, and [c] print the version number in each header.

Troubleshooting

LabSplits is randomly typing stuff! Keep the Run/Stop switch set to Stop except when you are actually collecting data, especially when you are connecting or disconnecting sensors.

The Status LED is dark. This is normal for the first several seconds after you power up LabSplits. (If it persists, you unit may be defective.)

The computer wants me to install an Arduino driver; should I? You don't need this driver to use LabSplits; just ignore any messages about it. (Or go ahead and install the driver if you want; it doesn't matter either way.)

The Run/Stop switch is set to Run, but the Status LED is still red. This is normal when you power up LabSplits with the switch set to Run; just change the switch to Stop, and then back to Run when you are ready to collect data.

The Status LED is blinking yellow/green; what now? This means LabSplits has run out of memory to save your events. Events that have already been recorded can still be typed out to your computer, but no new events will be recorded until you start a new data run.

The Status LED is blinking yellow/red; what now? Your LabSplits unit is defective, or you have found a bug in LabSplits. Notify the instructor.

Sometimes, after typing a lot of events quickly into Excel, LabSplits will start typing gibberish! This is because Excel cannot keep up with LabSplits's typing speed. To work around it, either start LabSplits in "alternate mode", or have LabSplits type into a simpler, faster program (such as Notepad), and copy and paste the results into Excel.