

Instructions for running Current Measurement at the USB Workshop

Setup instructions

1. **Attach banana cables to Keithley and current tester**
 - 1.1. Plug the black banana cable into the far right back socket on the front of the Keithley. Plug the red banana cable into the white socket on the front of the Keithley.
 - 1.2. Plug the other end of the red banana cable into the socket on the current tester closest to the cable. Plug the black banana cable into the socket next to the red banana cable.
2. **Check Keithley configuration**
 - 2.1. Make sure the Keithley's INPUTS button is set for front inputs.
 - 2.2. The Keithley should be measuring Amps DC at its slow sampling with autoranging turned on. Its display will read ADC, SLOW, and AUTO if this is the case. To set the meter to Amps DC, press the DCI button. To change the sampling rate, press the RATE button. To turn on autoranging, press the AUTO button.
3. **Plug current tester into hub**



Figure 1: Typical Setup

Testing instructions

Four types of current measured on the device:

- **Unconfigured**
Device enumerated, but no configuration selected
- **Configured**
Device enumerated and configuration selected, but the device is not operating
- **Suspended**
Device enumerated, then put into suspend state
- **Operating**
Device enumerated and configuration selected, and the device is operating...i.e. scanning, capturing video, etc.

1. Unconfigured Current

- 1.1. Start USBcheck program.
- 1.2. Attach device behind current probe adapter. If the device fails to enumerate, take the Keithley out of autoranging mode by pressing the upwards pointing RANGE button located above the AUTO button. Unplug and replug the device—which should enumerate after it's been reattached—and put the Keithley back in autoranging mode by pressing the AUTO button.
- 1.3. Take current reading.
- 1.4. Exit USBcheck program.

2. Configured Current

- 2.1. Detach device and re-attach behind current probe adapter
- 2.2. Put device into “high power” state...i.e. turn on all LEDS, etc
- 2.3. Take current reading

3. Suspended Current

- 3.1. Put system into stand-by mode
- 3.2. Log whether or not the driver supports suspend
 - 3.2.1. Driver supports suspend if the system goes to sleep
- 3.3. Take current reading
- 3.4. Wake system back up

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4. Operating Current

- 4.1. Run application that will cause the device to go into an operating state
- 4.2. Put device into “high power” state...i.e. turn on LEDS, etc
- 4.3. Monitor the current, noting average reading while operating

Quick Table for Current Measurement Testing

Measurement	Program	Activity	Acceptance Critereon
Unconfigured	USBcheck	Start USBcheck Plug in device Record current (in mA) Exit USBcheck	< Max power and < 100 mA
Configured	None	Unplug device Plug in device Enable “high power” state Record current (in mA)	< Max power and < 500 mA
Suspended	Stand-by	Put system into stand-by Log driver support for suspend Record current (in uA) Wake up system	If system goes to sleep, driver supports suspend < 2500 uA (USB 1.1 spec)
Operating	App	Run application Enable “high power” state Monitor reading Record average current (in mA)	< Max power and < 500 mA