



How to Test OnFILTER' Ground EMI Filters



Scope

- Ground EMI filters reduce high-frequency current in ground while preserving other grounding properties and meeting safety requirements
- This document outlines the methodology of testing performance of OnFILTER' ground EMI filters GLE30-1 and GLE04-01 using different instruments

OnFILTER' EMI
Adapter MSN12



You would also need
digital storage
oscilloscope



CT2 (preferable), CT1
or CT6 Tektronix
Current Probe

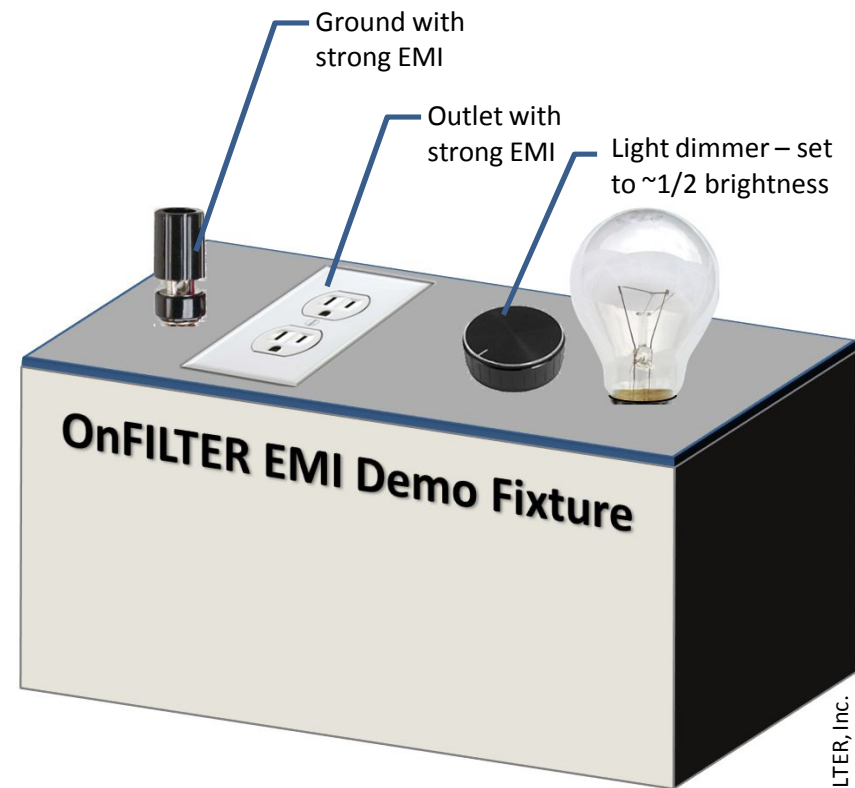


Test Fixtures

- In order to perform proper measurements you would need to have special fixtures
- The following section will provide information on how to build some of these fixtures. If you are unable or are having difficulties building these fixtures, they may be available from OnFILTER – contact us for information

EMI Test Fixture

- OnFILTER's special EMI fixture generates strong levels of EMI on power and ground of properties similar to those found in actual assembly environment
- If the ground filter provides good reduction of EOS using this fixture, it will do well under all circumstances
- OnFILTER' authorized distributors have access to such fixture. If you want to get it for yourself or to build it yourself, we can help you – please contact us



Appearance and outlet type may vary

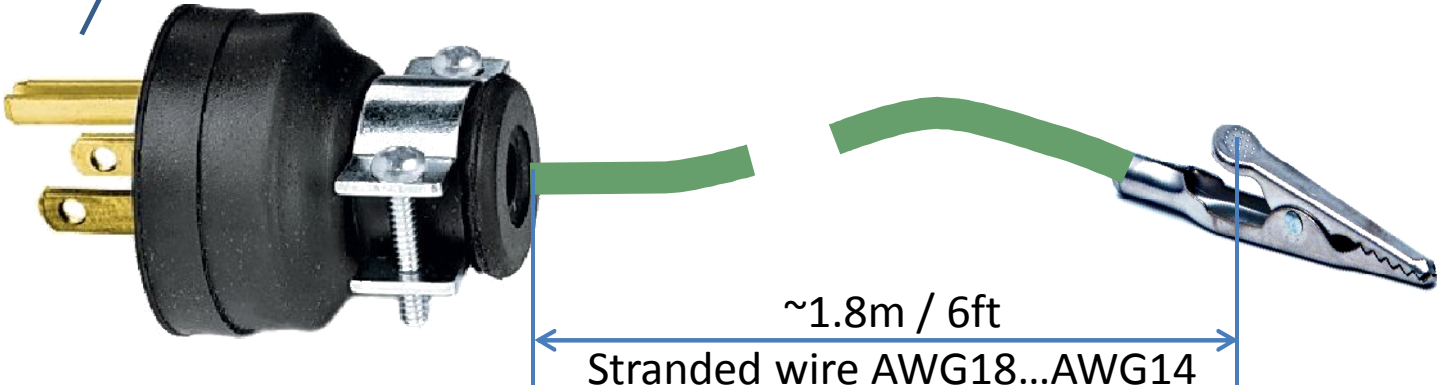
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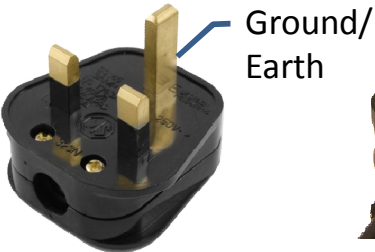
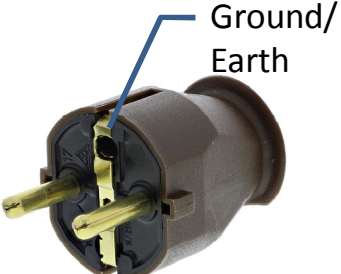
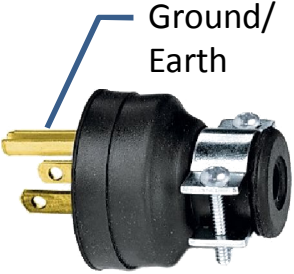
Power Plug Grounding Connection

Connect wire only to grounding contact

- You will need to make a plug ground connection
- Connect wire only to ground/earth connector in the plug
- Do not connect anything to other connectors



You would also need common wire jumpers with alligator clips

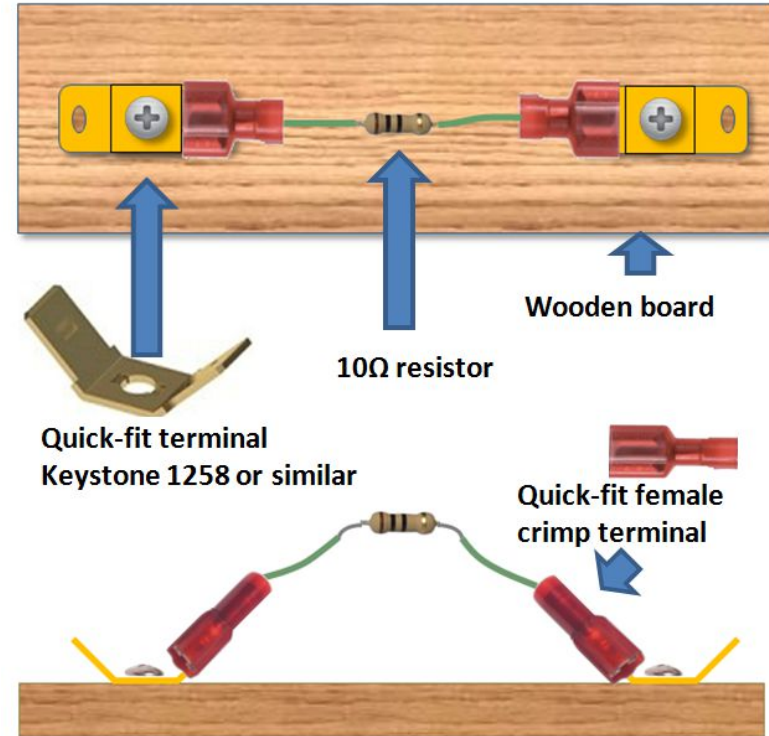


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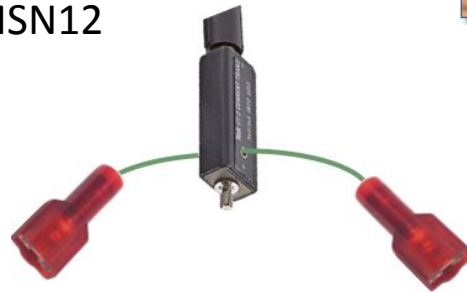
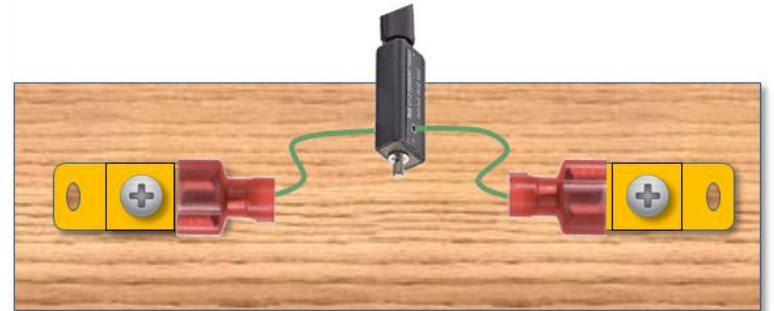
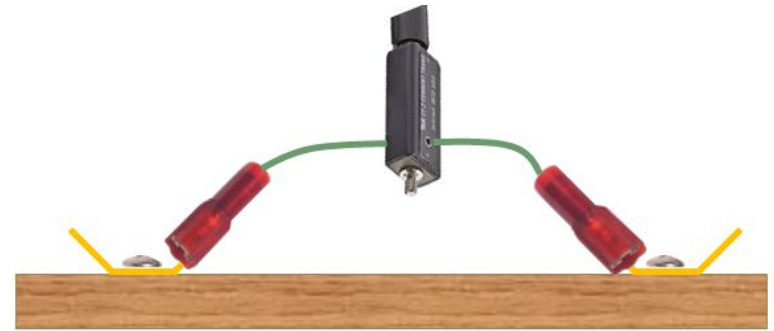
Test Fixture for Measuring Ground Current Using Voltage Measurements

- For the best efficiency it is recommended to build this simple fixture. If you have any problem building it, contact OnFILTER – we may be able to make one for you
- Find a small piece of wood ~15cm*5 cm (6"*2"). Plastic (not static dissipative) will work as well
- Obtain common quick fit terminals as shown and screw them into wood as shown. We trust you can find appropriate woodscrews
- Find a 10Ω resistor (0.25W to 1W), solder stranded wires to its leads and crimp other ends of the wires to ¼" (6.25mm) female quick terminals
- Plug these terminals as shown
- Voltage readings can be obtained between two terminals. Current value is calculated by dividing voltage by 10
- *Note:* 10Ω resistor prevents false pickup of EMI from the air. It is also 10 times bigger than required 1Ω ground resistance, reducing outside influence on measurements



Test Fixture for Measuring Current Using Tektronix CTx Current Probe

- If you have in your possession Tektronix' current probe CT1, CT2 (preferred) or CT6, you can use this fixture. If not, use the fixture shown on the previous page
- Using ~10cm/4" long thin stranded insulated wire (AWG24 or similar) put it through the hole in the current probe and crimp the stripped ends to 0.25"/6.25mm female quick-fit terminals
- Plug the terminals as shown
- Note that CTx current probes need 50Ω termination. The output signal may be quite high, exceeding some oscilloscope's limits. In order to avoid damage to oscilloscope, use 1M input and a 50Ω terminator such as supplied with OnFILTER' EMI Adapter MSN12

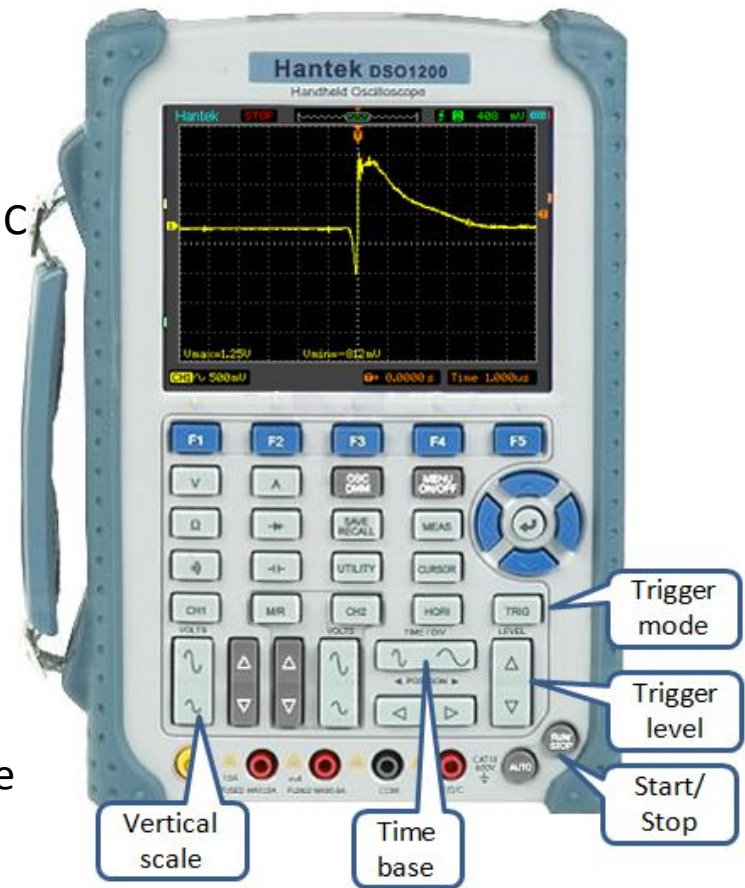




GROUND EMI FILTER GLE04-01

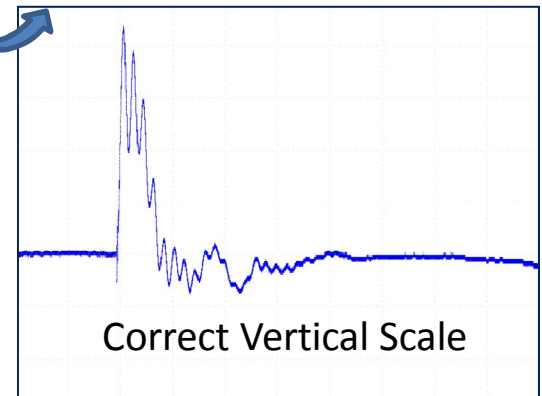
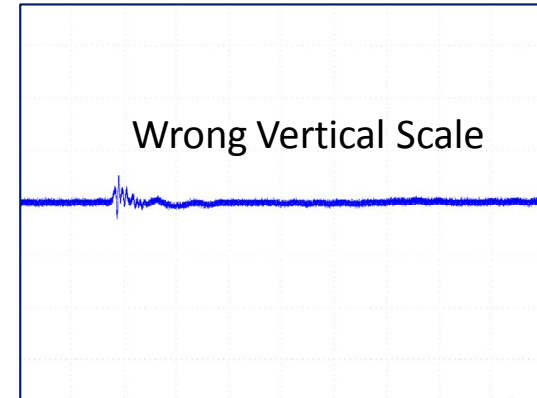
Oscilloscope Initial Setup for MSN12 EMI Adapters

- Initial input settings
- Enable CH1. All other channels should be disabled
- Input impedance: 1M Ω (50 ohms matching impedance will be provided by a terminator and BNC T-connector supplied with MSN series adapters)
- Input attenuation: 1:1 (your scope may be set by default to 10:1 probe – set it to 1:1)
- Vertical scale (Volts/div): 500mV/div
- Time base (Time/Div): 1...2 μ S/div to start with
- Trigger to Normal on CH1, trigger level: ~zero
- It helps to enable voltage peaks (not RMS) measurements on the screen
- Once successfully done, you may want to save these settings in the oscilloscope's memory so that you don't need to do it again
- The above settings may need to be adjusted as needed during the test

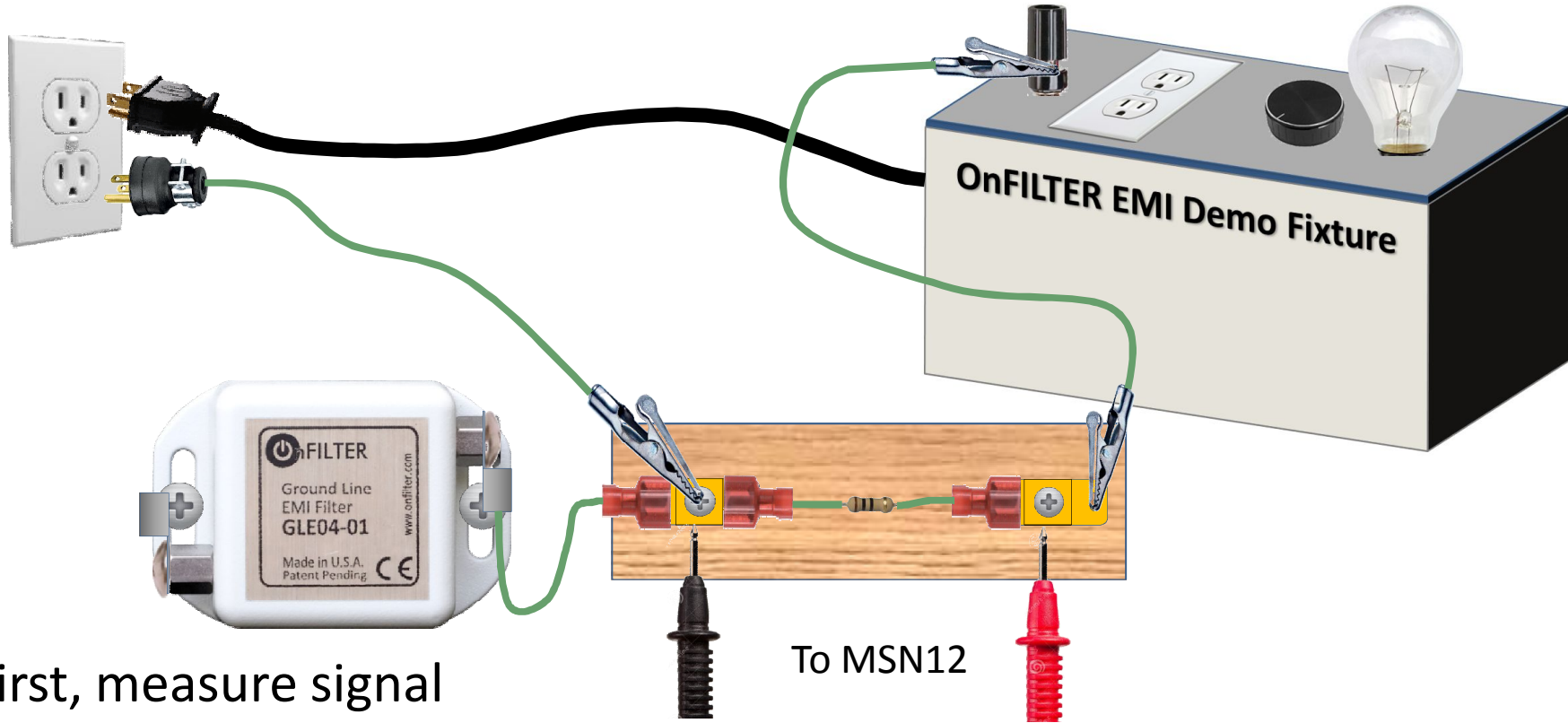


Setting Oscilloscope Properly: No Filter

- Set up equipment as shown on the appropriate slides
- Touch tip of soldering iron to the terminal - you should see activity on the screen
- Raise the trigger level up – you should see more pronounced waveform
- The waveform may have higher absolute amplitude in negative voltage – try trigger in both polarities
- Keep increasing trigger level until the signal no longer triggers and the waveform “freezes.” Wait for a minute or so – larger spikes may occur
- If you see that the signal is too high, i.e. it clips at the top or at the bottom, change vertical scale to a higher value, i.e. 1V/div or even higher until the captured waveform occupies ~2/3 of the screen – see the screens of the same waveform to the right as an example
- Adjust time base so that the waveform is clearly seen in full – similar to the one shown
- To freeze the waveforms use Run/Stop button



Basic Setup: Without Ground Filter GLE04-01

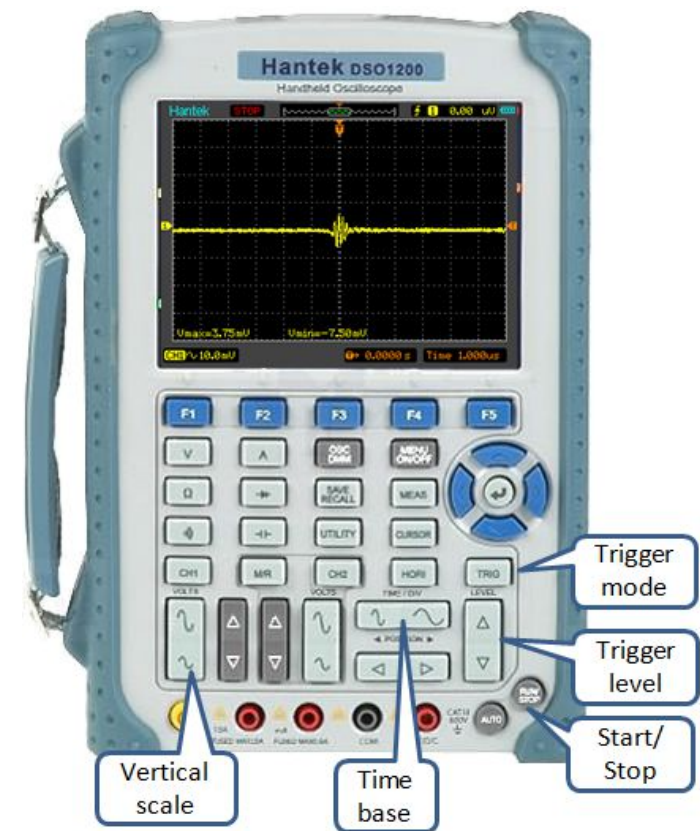


First, measure signal
across the resistor
without the filter in
the circuit

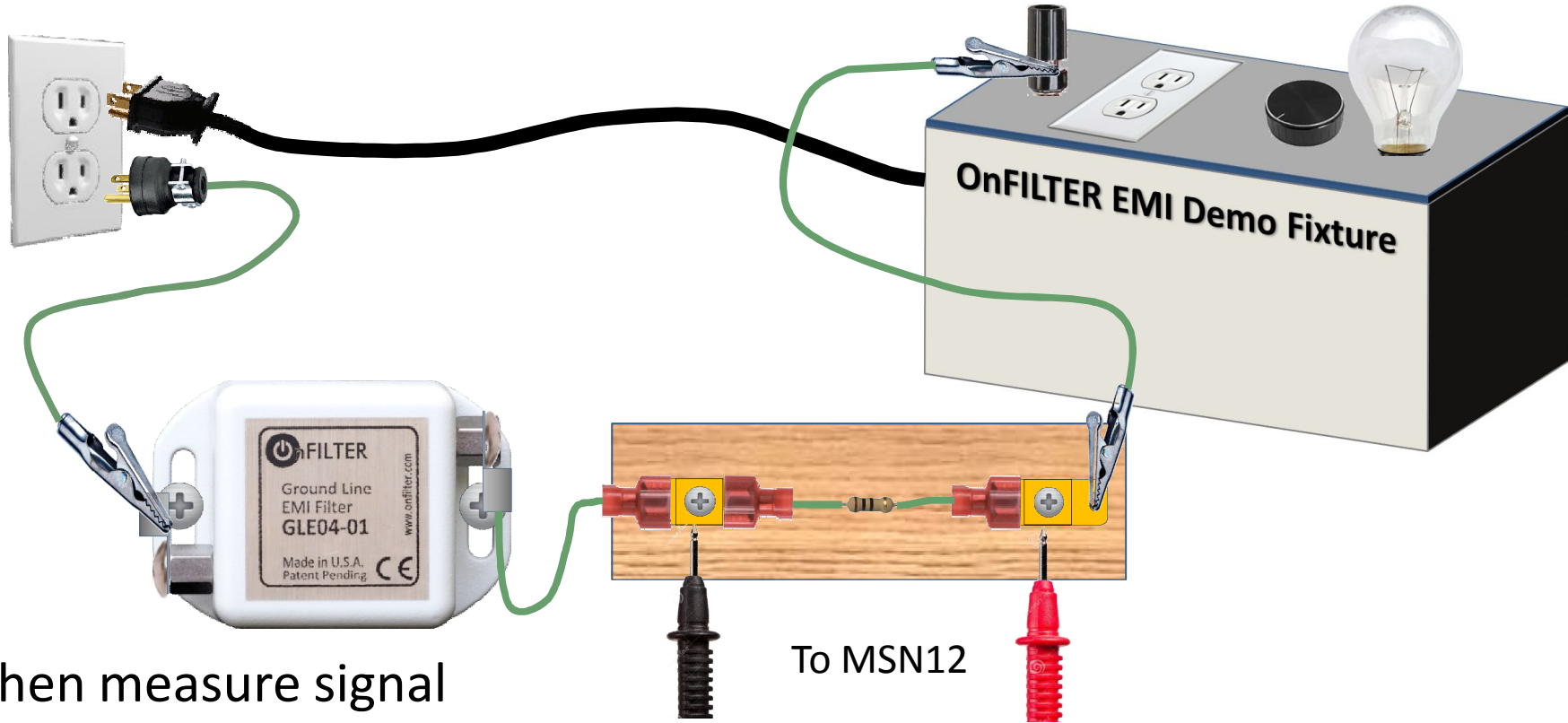
Voltage between the tip and ground across
the 10Ω resistor is measured
For current divide peak voltage value by 10

Oscilloscope Setup With the Filter for MSN12 EMI Adapters

- The same setup as without the filter (see Page 12)
- You may need to increase the vertical scale to perhaps 20...50mV/div.
- It may be difficult to trigger oscilloscope in Normal trigger mode due to very small signal level – set oscilloscope trigger to Auto and set trigger level close to zero and adjust further as needed to be able to see the signal



Basic Setup: With Ground Filter GLE04-01



Then measure signal
across the resistor
with the filter in the
circuit

To MSN12

Voltage between the tip and ground
across 10Ω resistor is measured
For current divide peak voltage
value by 10



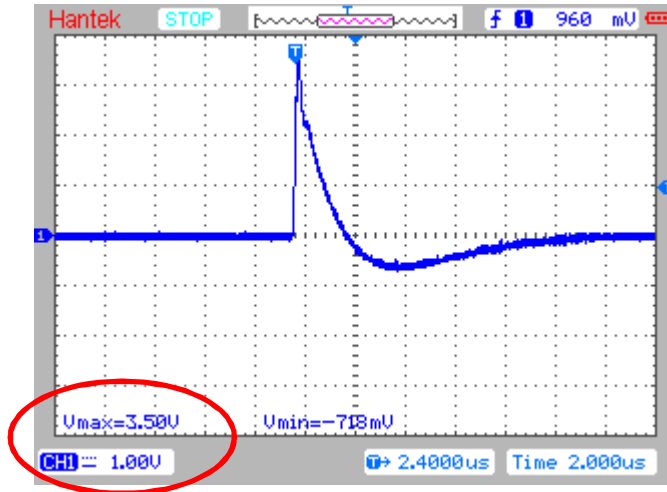
What to Expect: GLE04-01 Measured with MSN12



No Filter

Peak Voltage: 3.5V

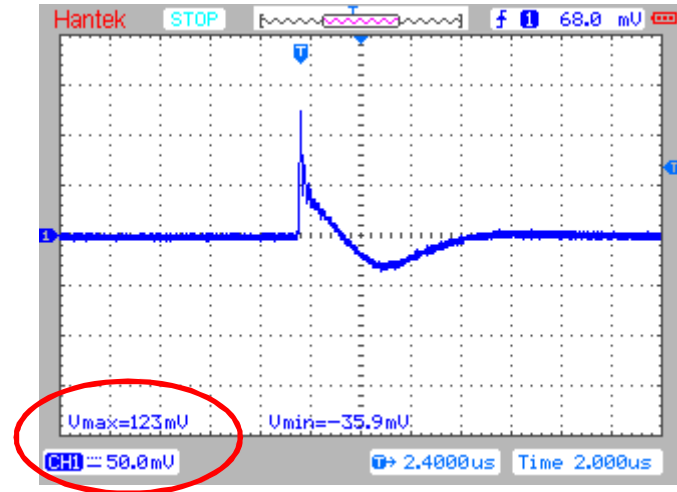
Peak Current: 350mA



GLE04-01

Peak Voltage: 0.123V

Peak Current: 12.3mA

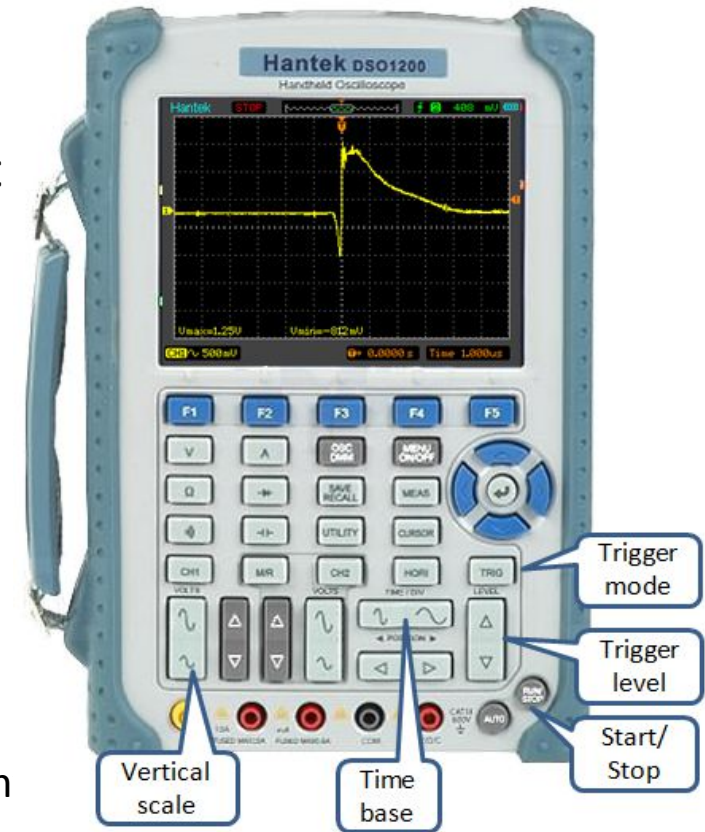


Note change of scale of the oscilloscope

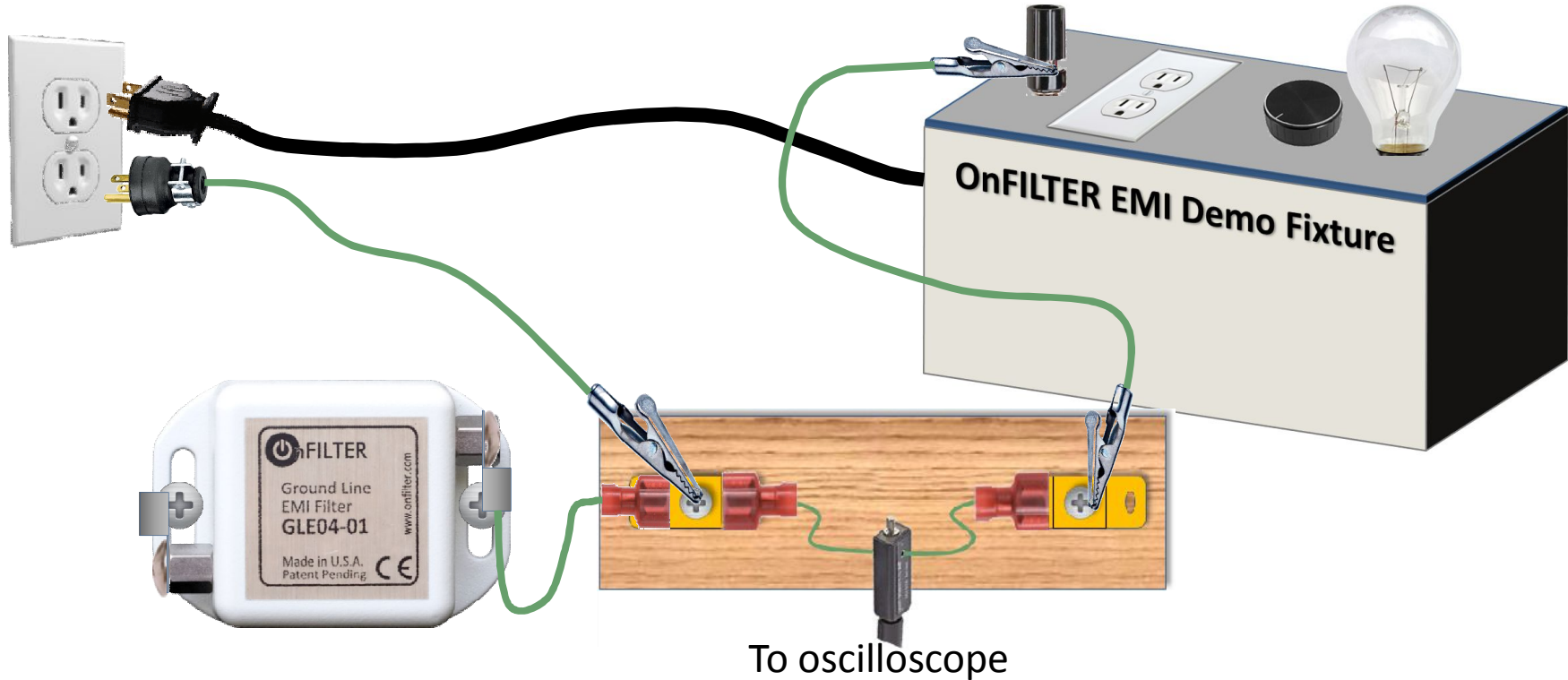
Data are typical. Performance of individual filters may vary

Oscilloscope Initial Setup for CTx Current Probes

- Initial input settings
- Enable CH1. All other channels should be disabled
- Input impedance: 1M Ω hms (50 ohms matching impedance will be provided by a terminator and BNC T-connector supplied with MSN series adapters)
- Input attenuation: 1:1 (your scope may be set by default to 10:1 probe – set it to 1:1)
- Vertical scale (Volts/div): 200mV/div
- Time base (Time/Div): 1...2 μ S/div to start with
- Trigger to Normal on CH1, trigger level: ~zero
- It helps to enable voltage peaks (not RMS) measurements on the screen
- Once successfully done, you may want to save these settings in the oscilloscope's memory so that you don't need to do it again
- The above settings may need to be adjusted as needed during the test



Basic Setup: With Ground Filter GLE04-01



First, measure current
without the filter in the
circuit

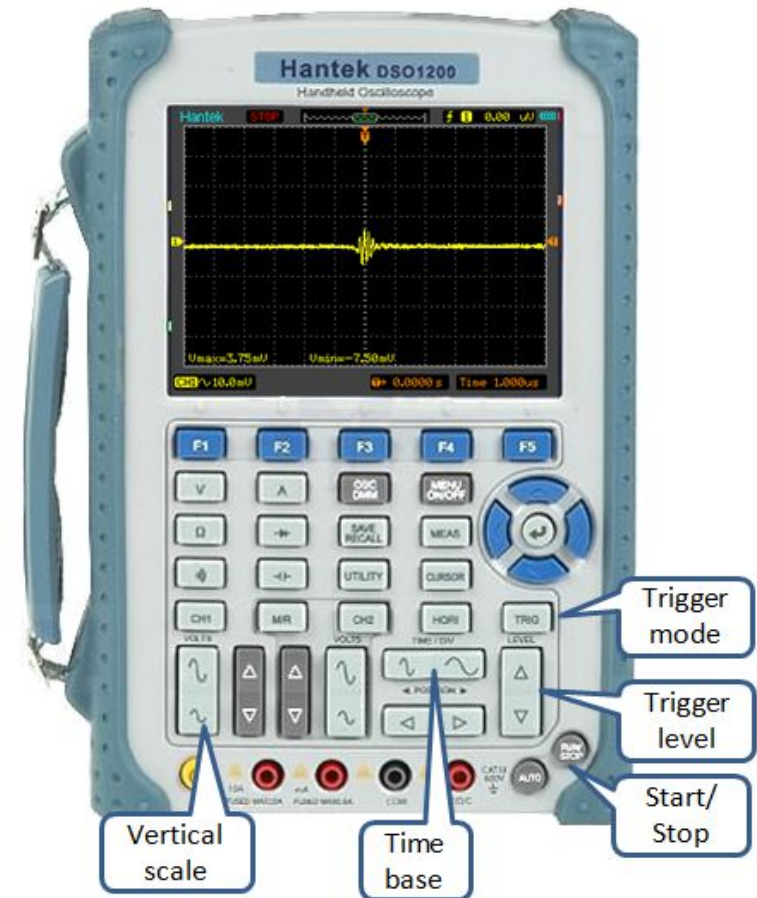
Use proper conversion:

- 5mV/mA for CT1 and CT6 probes
- 1mV/mA for CT2 probe

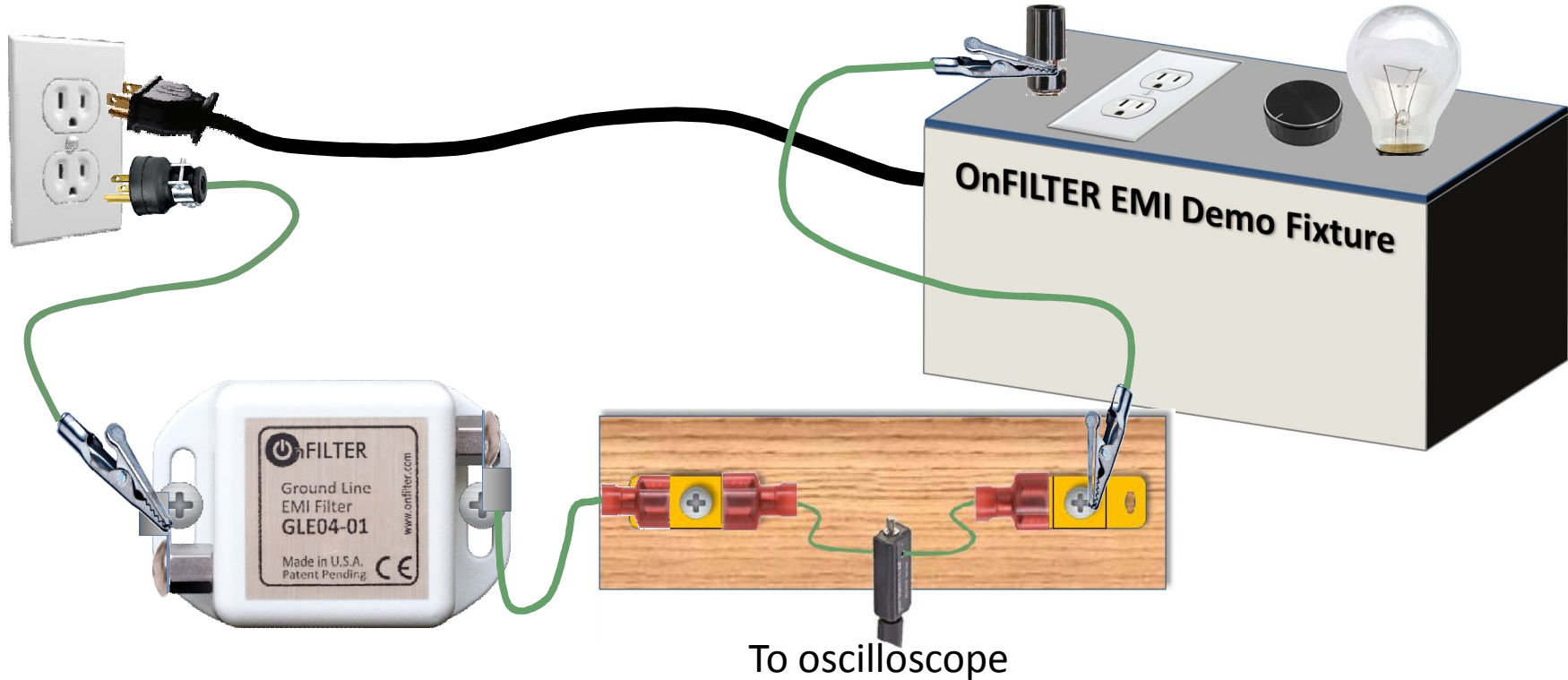


Oscilloscope Setup With the Filter for CTx Current Probes

- The same setup as without the filter (see Page 19)
- You may need to increase the vertical scale to perhaps 10...20mV/div.
- It may be difficult to trigger oscilloscope in Normal trigger mode due to very small signal level – set oscilloscope trigger to Auto and set trigger level close to zero and adjust further as needed to be able to see the signal



Basic Setup: With Ground Filter GLE04-01



First, measure current
with the filter in the circuit

Use proper conversion:

- 5mV/mA for CT1 and CT6 probes
- 1mV/mA for CT2 probe

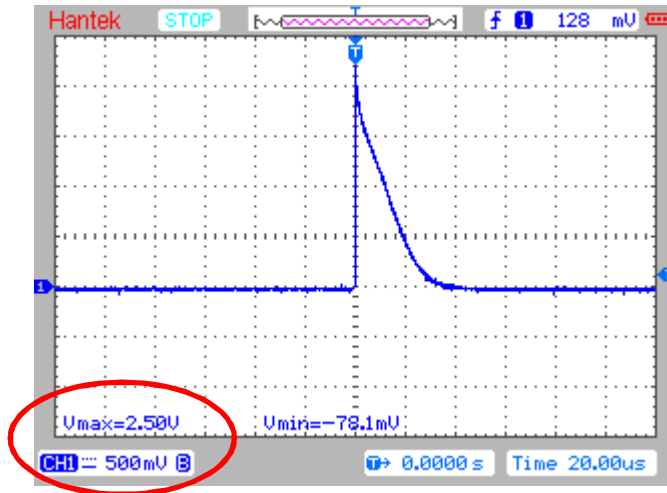
What to Expect: GLE04-01



No Filter

Peak Current: 500mA

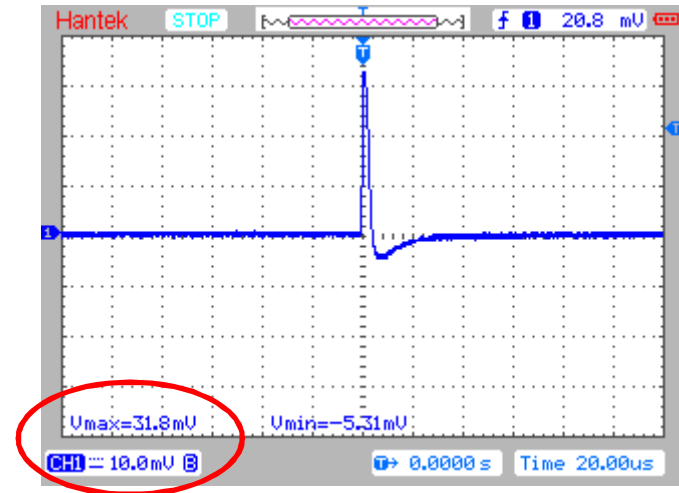
CT1 probe has 5mV/mA transfer function



GLE04-01

Peak Current: 6.36mA

CT1 probe has 5mV/mA transfer function



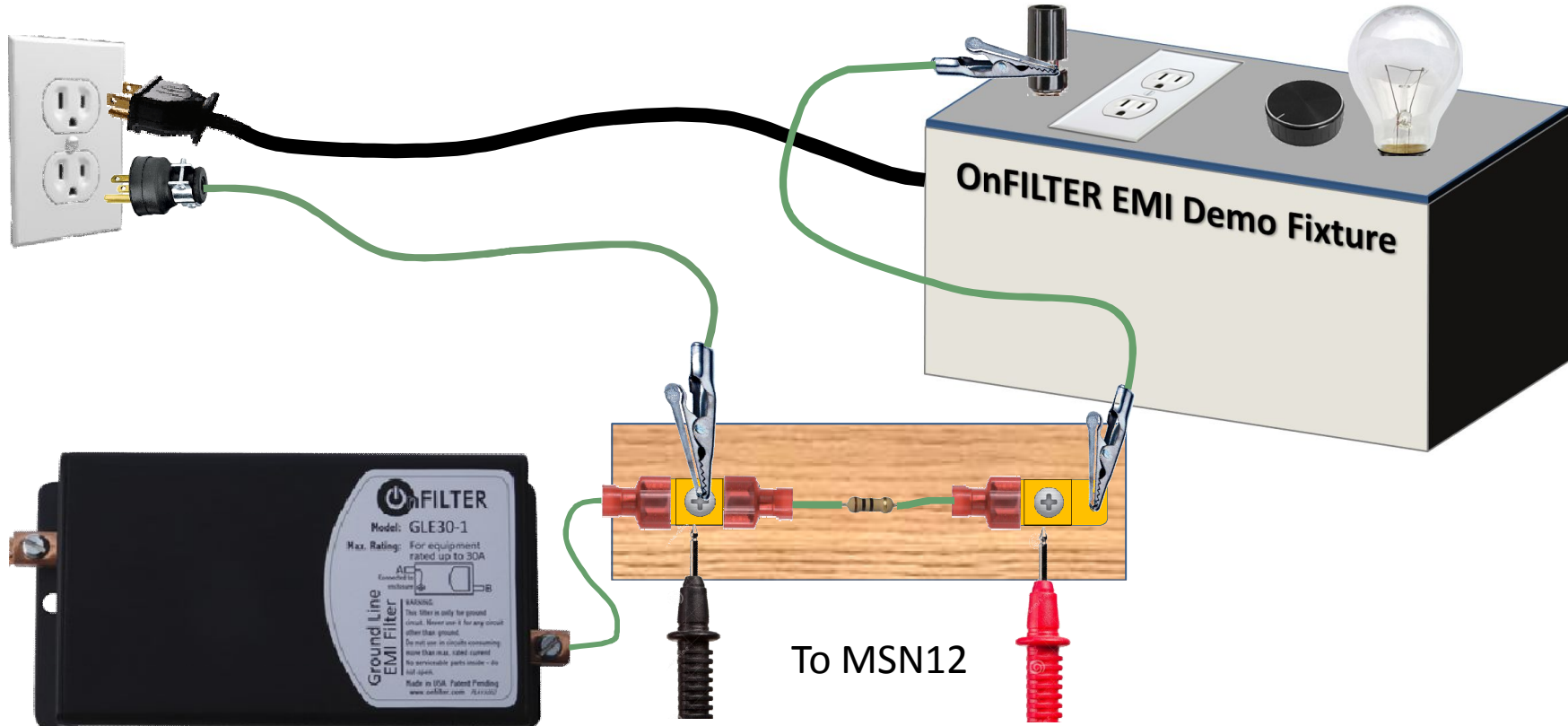
Note change of scale of the oscilloscope

Data are typical. Performance of individual filters may vary



GROUND EMI FILTER GLE30-1

Basic Setup: Without Ground Filter GLE04-01

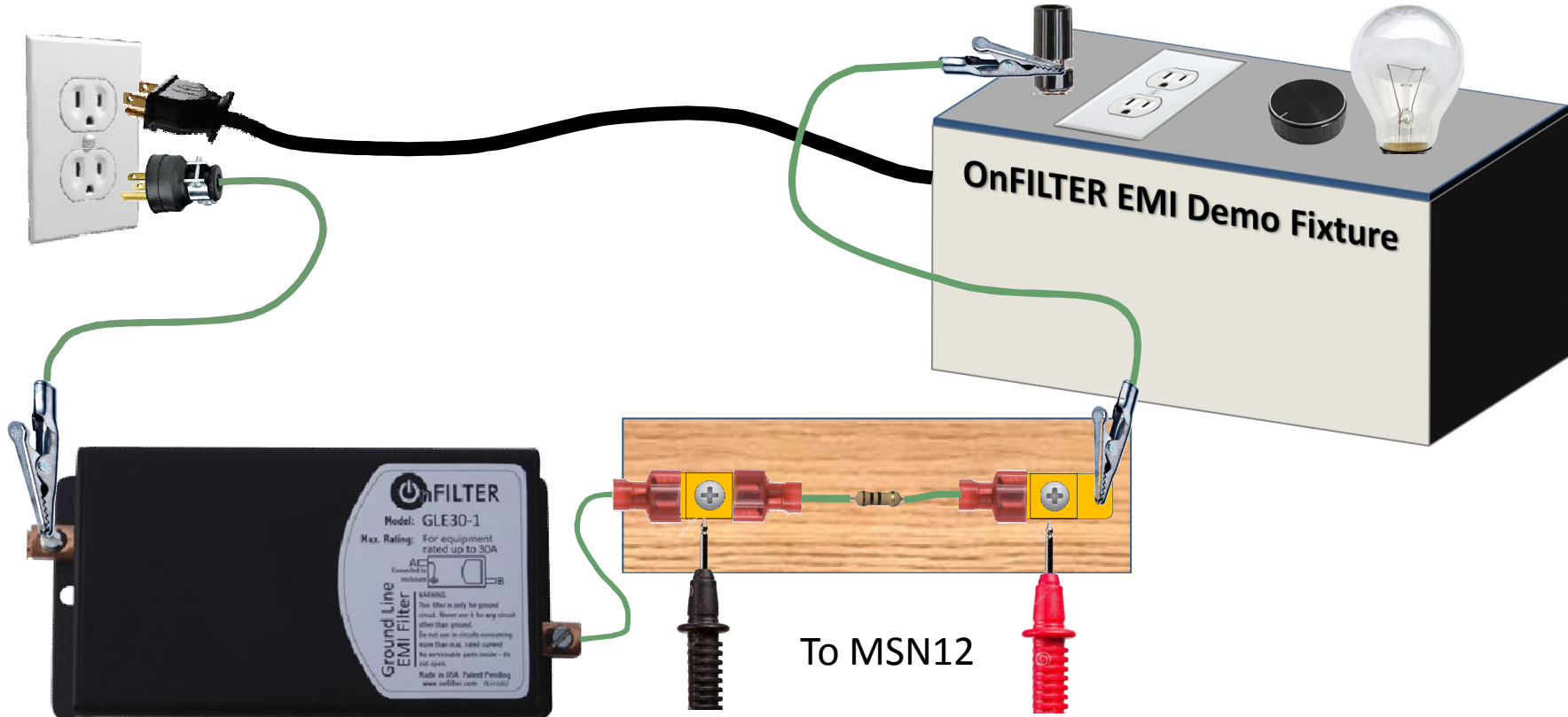


First, measure signal across the resistor without the filter in the circuit

Voltage between the tip and ground across 10Ω resistor is measured
For current divide peak voltage value by 10



Basic Setup: With Ground Filter GLE04-01

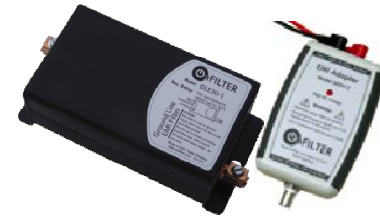


First, measure signal across the resistor without the filter in the circuit

Voltage between the tip and ground across 10Ω resistor is measured
For current divide peak voltage value by 10



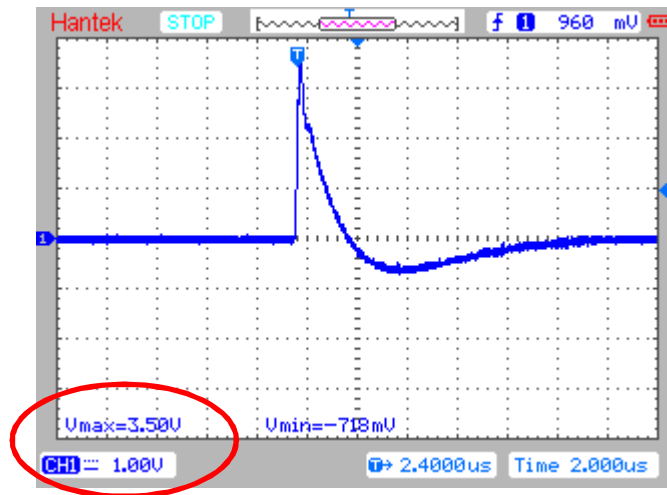
What to Expect: GLE30-1



No Filter

Peak Voltage: 3.5V

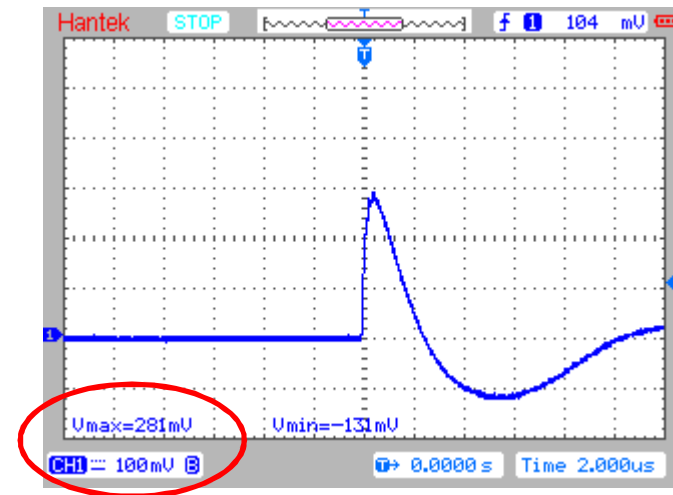
Peak Current: 350mA



GLE04-01

Peak Voltage: 0.281V

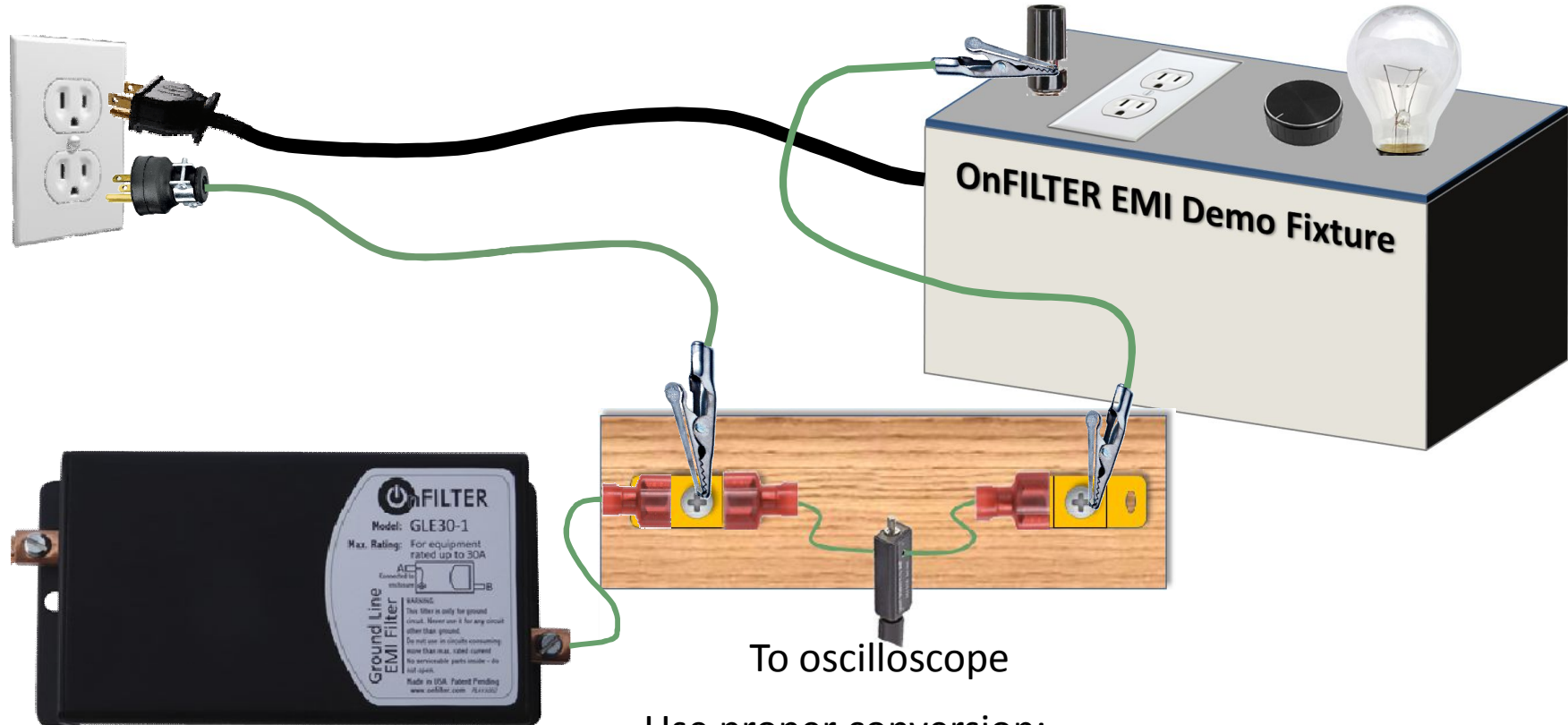
Peak Current: 28.1mA



Note change of scale of the oscilloscope

Data are typical. Performance of individual filters may vary

Basic Setup: With Ground Filter GLE04-01



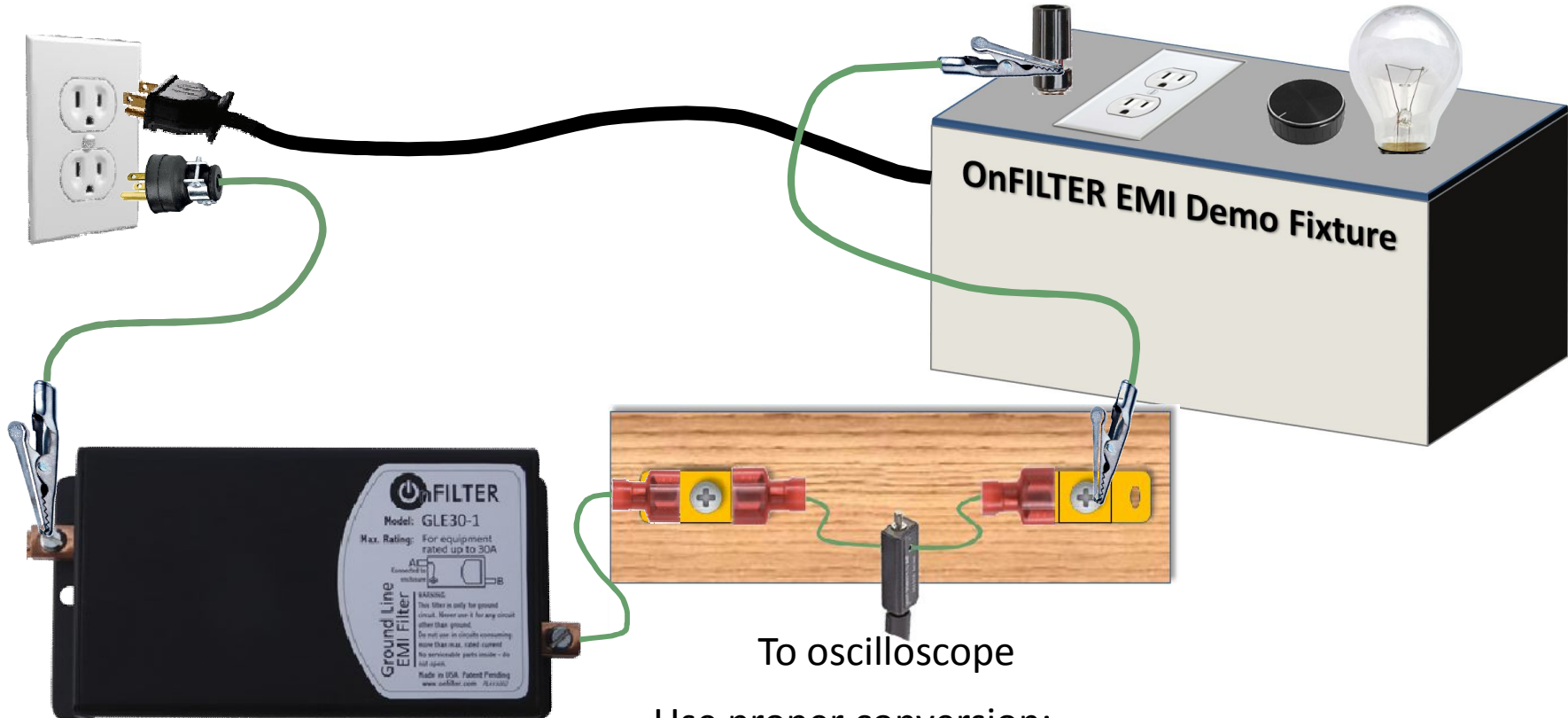
First, measure current without the filter in the circuit

Use proper conversion:

- 5mV/mA for CT1 and CT6 probes
- 1mV/mA for CT2 probe



Basic Setup: With Ground Filter GLE04-01



First, measure current
with the filter in the circuit

Use proper conversion:

- 5mV/mA for CT1 and CT6 probes
- 1mV/mA for CT2 probe

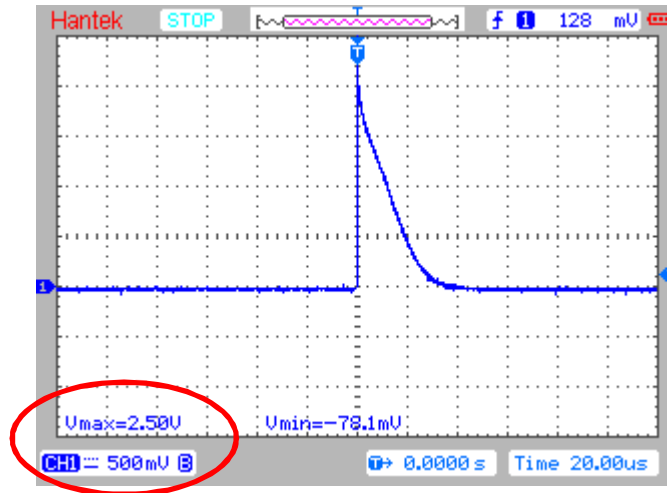
What to Expect: GLE30-1



No Filter

Peak Voltage: 3.5V

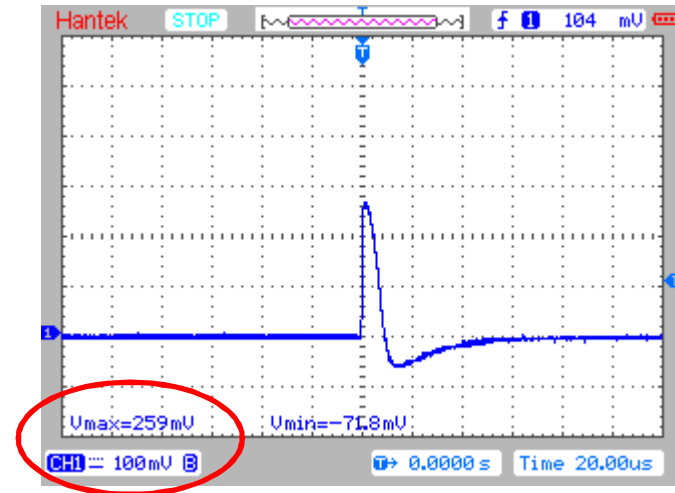
Peak Current: 350mA



GLE30-1

Peak Voltage: 0.259V

Peak Current: 25.9mA



Note change of scale of the oscilloscope

Data are typical. Performance of individual filters may vary

Contact Information

Vladimir Kraz

OnFILTER, Inc.

www.onfilter.com

info@onfilter.com

Tel. +1.831.824.4052

FAX +1.206.350.7458