Oscilloscope Current Probe Adapter Plus



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Assembly

To avoid damage during shipping, this unit is supplied with the four 4mm gold binding posts unattached from the board. Before use, these should be threaded through the four plated holes J1 to J4, and bolted on with the supplied nuts and washers.

The two red posts should be fitted to the upper holes, J1 and J3; and the black posts to the lower holes, J2 and J4. Finally, the remaining threads can be covered by the supplied rubber boots, insulating them from any conductive surface on which the unit may be placed.

Overview



This instrument passes through power and ground from the input to the output side by a choice of connectors, while monitoring the amount of current drawn by means of a shunt resistor placed in the positive side. All the positive inputs are connected together on one side of the shunt, as are all the outputs connected on the other. The ground connections remain uninterrupted, giving a low-impedence grounding path through the device.

Power input and output may be connected by a choice of 4mm banana plugs, 0.1" pitch header pins or socket, USB connectors, or bare wire threaded through the binding posts.

The USB sockets have a pass-through connection of the D+ and D- data lines, allowing USB communication to take place.

Monitor Output

The Current Monitor Output BNC connector, labelled **I**[out], gives a signal whose voltage level corresponds to the current being drawn by the load. This is amplified by a switchable-gain amplifier, offering a choice of gains in powers of ten from *x1* to *x1000*, such that a current draw of *1mA* can be indicated by voltages ranging from *1mV* to *1V*. As the output is referenced to the common ground this may be connected directly to an oscilloscope even while the oscilloscope is probing other points in the device under test.

A second BNC connector, labelled **V[out]**, is connected directly to the output voltage line, and allows the oscilloscope to also indicate the voltage directly.

Further to these, 3 connector pads provide the current and voltage output and another ground connection. These pads remain unpopulated to allow the user to solder in a pin header or socket if required.

Range Switching

The range selector switch allows a choice of amplification of the current indication signal, in four ranges from x1 to x1000, allowing a scale where 1mA is indicated by 1mV, 10mV, 100mV or 1V. Using a higher amplification within the Current Probe Plus unit itself means a stronger signal supplied to the oscilloscope and so less gain needs to be applied there, resulting in a cleaner, more accurate reading that is less susceptible to noise. The maximum voltage that can be output is about 1V less than the supply, so picking too high a range setting can mean the output is clipped and doesn't truly represent the current flow conditions. It is best to start at the lowest amplification setting initially and observe the nature of the signal on the oscilloscope screen, adjusting the gain upwards if necessary while ensuring no clipping happens.

The full device bandwidth of 5MHz is achieved at the lowest gain setting of x1, but higher gain settings reduce the bandwidth (see the Specifications table).

Power Supply

This instrument requires power for the amplifier circuit. This power must be sourced independently via the supply jumper connector. The unit requires a minimum of 7V to operate, but can accept a higher voltage up to 15V. As the output is driven from this supply, using a higher power supply voltage gives the unit more headroom to indicate a wider range of currents.

The ground connection of this power supply input is commoned with the test power and monitor output connections.

Zero Adjustment Trimming

The unit has a trimmer for cancelling out any zero offset that may be present in the amplifier circuit. To make use of this feature, connect and power up the supply side of the test, but leave the load side unconnected. Use a volt meter or oscilloscope to monitor the current indication output and adjust the trimmer until it reads zero. By performing this procedure with the supply side powered up, it can also take account of any remaining common-mode offset in the first stage of the amplifier.

The majority of zero offset error in the circuit will be produced before the effect of the gain switch, but to make the most of the accuracy of the unit it may be necessary to repeat this adjustment procedure again when switching between gain ranges.

Block Diagram



Major components:

- KOA Speer SLW1TTER100D; shunt resistor
- Maxim MAX9643U; first stage amplifier
- Analog Devices AD8253; second stage amplifier
- ICL7662; negative power rail generator

Limits and Specifications

Amplifier voltage range	7V to 15V
Amplifier current supply	< 12mA
Supply/Load voltage range	0V to 60V
Current monitor range	0A to 3A
Current monitor output	0V to (Vcc - 1.2V)
Relative error	< 0.6% ± 1.3mA ¹
Bandwidth	>5MHz at x1 gain 3.8MHz at x10 gain 550kHz at x100 gain 50kHz at x1000 gain
Shunt resistance	0.1Ω ±0.5%

¹ While the uncorrected offset error may be up to 1.3mA, this can be corrected by the zero adjustment trimmer.