

## Pico MI077 600A AC/DC Current Clamp

The MI077 current clamp is ideal for use with the ADC-212 PicoScope automotive oscilloscope to display starter current waveforms and charging currents, and for performing quick compression tests (see waveforms below).

The current clamp can measure up to 600A (AC or DC). There is no need to break into the circuit or disturb the isolation as the jaws simply clamp around the current-carrying conductor. No electrical contact is required.



### **Connecting the MI077 current clamp**

The current clamp is supplied with 4 mm (banana) plug-type connectors so can not be plugged directly into the ADC-212. To connect it to the ADC-212 we recommend the use of the TA000 BNC to 4 mm test lead. Alternatively the MI078 BNC to 4 mm plug adaptor can also be used.

Once the current clamp is connected to the ADC-212, switch it on (the green LED should light) and then clamp the jaws around the current-carrying conductor as shown.

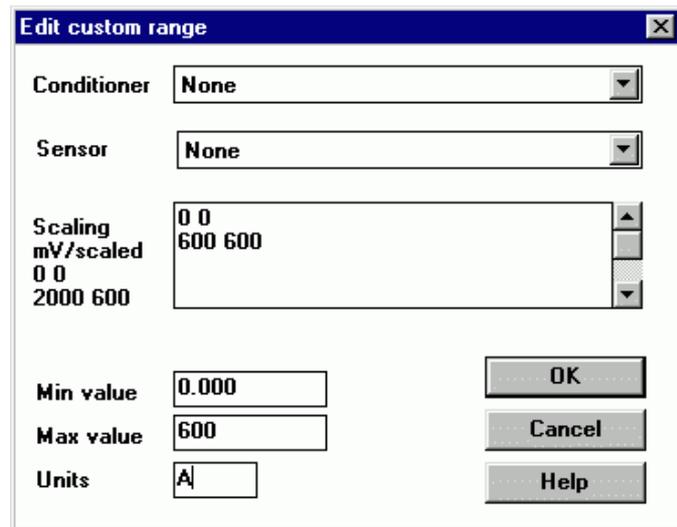


### **Using the MI077 Current Clamp with PicoScope**

The current clamp is calibrated to provide 1 mV of output for every 1 A of measured current. You can quickly check that clamp is working by measuring the current drawn when a car's headlamps are switched on. To do this, start PicoScope and select the 100 mV range (DC-coupled) on either the scope or the meter. Connect the clamp around the ground connection to the car battery. With nothing on the car switched on, the reading on PicoScope should be near 0 mV. Now switch the headlamps on, and the reading should jump up a few mV (1 mV per A of current drawn). If the reading instead jumps down, don't worry—current clamps are directional, so just reverse the clamp on the conductor.

Using PicoScope it is easy to scale the output from the clamp from mV to A. First select **Settings | Custom Ranges** from the drop down menu and click the **Add** button.

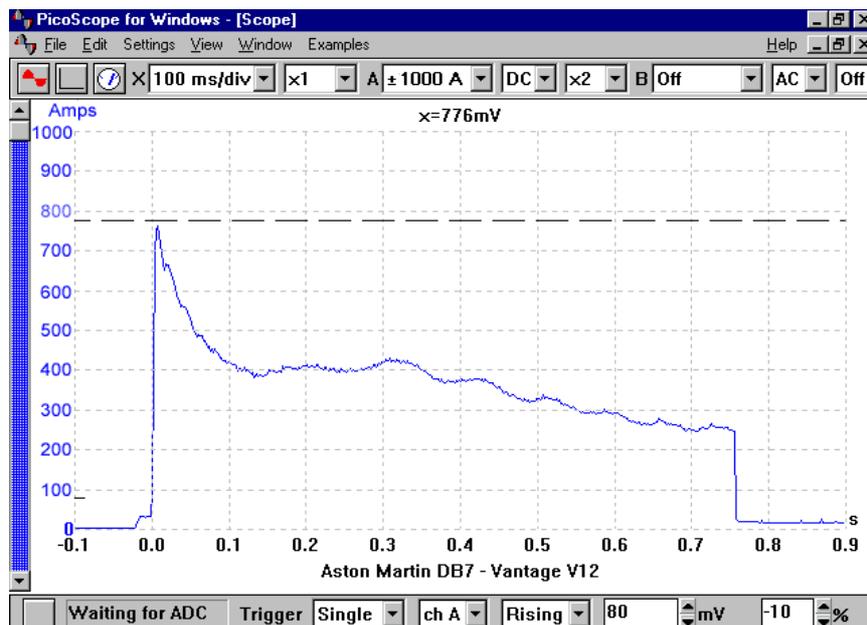
Next, fill in the scaling information as shown on the right. This just scales from mV to A and provides a 0 to 600 A range (the maximum the clamp can measure). Other ranges can be added in a similar way: for example, for a 0 to 100 A range, change each occurrence of the number 600 to 100. More information on scaling can be found in PicoScope's online manual.



When you have filled in the scaling information, press the **OK** button (twice) to return to the main menu. Now select **File | Save Settings** to save your custom range. This custom range now appears in the drop down list of voltage ranges (see examples below).

## Example 1: Measuring Starter Current

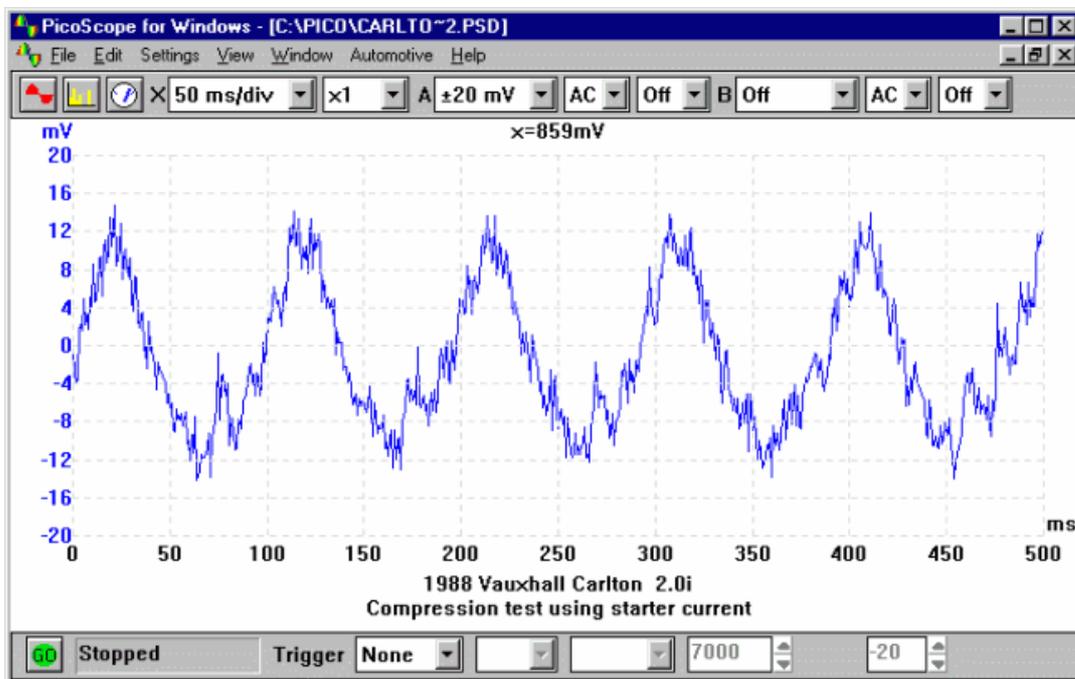
The example below was obtained by measuring the current in the battery-to-starter-motor lead. The high initial peak of current is caused by the starter motor struggling to overcome the inertia of the stationary engine. As the engine begins to rotate, the current drops. Once the engine has fired, the starter motor is disengaged and the current drops to zero. As well as the scaling, note how PicoScope is set to trigger on the initial peak of current. A small amount of pre-trigger (-10%) has been used so that events before the trigger can be seen.



## Example 2: Compression Testing

This example again measures starter current, but this time on an engine that will not fire. Notice the oscillation in the current drawn. This is caused as each cylinder compresses. Measuring starter current in this way can be used as a quick compression test. Cylinders with low compression are easier to turn, so have a smaller peak. By using the second oscilloscope channel to add a display of No. 1 cylinder ignition, it is easy to locate which cylinder is causing the problem.

In this example we are not interested in the steady DC current drawn by the starter motor. Instead, we are concerned with the AC ripple caused by the cylinders compressing. For this reason we have AC-coupled the signal from the current clamp.



## Example 3: Measuring Charging Current

The current clamp needs to be switched on and facing the correct way. There is an arrow pointing to the battery positive (+) on one side and another pointing to the battery negative (-) on the other side. Incorrect connection will lead to a reading of the wrong polarity. In this case the alternator is generating current so we would expect to see a positive reading.



The clamp needs to be positioned around the wires on the back of the alternator. If this is not possible, then the clamp can be positioned at the battery positive cables. If possible, identify the wire that connects the alternator to the battery. With all the positive wires clamped at the battery, the clamp will read a balance between loads and the charging current.



## **Additional Advice for Low-Current Measurement**

Although the current clamp is designed primarily for measuring 'high' currents, the high resolution and flexible input ranges of the PicoScope ADC-212 allow much lower currents to be measured than with most automotive oscilloscopes.

To make measurements at low currents, consider the following advice:

- Before connecting the clamp, use the zero adjust wheel to trim out any offset
- If possible, loop a number of turns of the cable to be measured through the jaws. The actual current is the measured value divided by the number of turns
- At low currents, noise pickup from ignition, injectors and so on may be a problem. Keep the clamp and its connecting cable as far away from the noise sources as possible