600 A AC/DC Current Clamp (TA019) User's Guide

The TA019 current clamp is ideal for use with Pico automotive oscilloscopes to display starter current waveforms and charging currents, and for performing quick compression tests (see waveforms below).

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

Connecting the TA019 current clamp

The current clamp has a BNC-type connector so it can be plugged directly into the scope.

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

Using the TA019 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 the 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 ampere of current drawn.) If the reading 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 amps. First select **Settings | Custom Ranges** from the drop-down menu and click **Add**.

Next, fill in the scaling information as shown on the right. This simply scales from mV to amperes 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. There is more information on scaling in PicoScope's on-line manual.
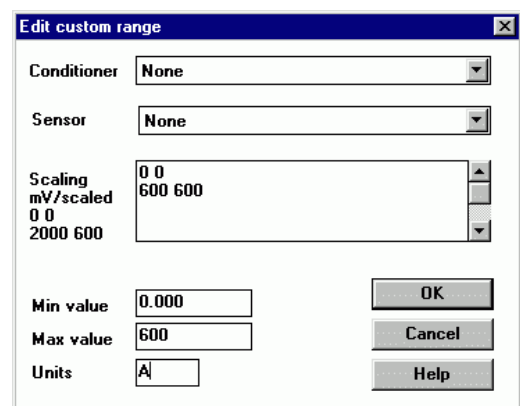
When you have filled in the scaling information click **OK** twice to return to the main menu. Now select **File | Save Settings** to save your custom range. This custom range now appears in the drop-down list of voltage ranges (see examples below.)

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 off the initial peak of current. A small amount of pre-trigger (-10%) has been used so that you can see events before the trigger.

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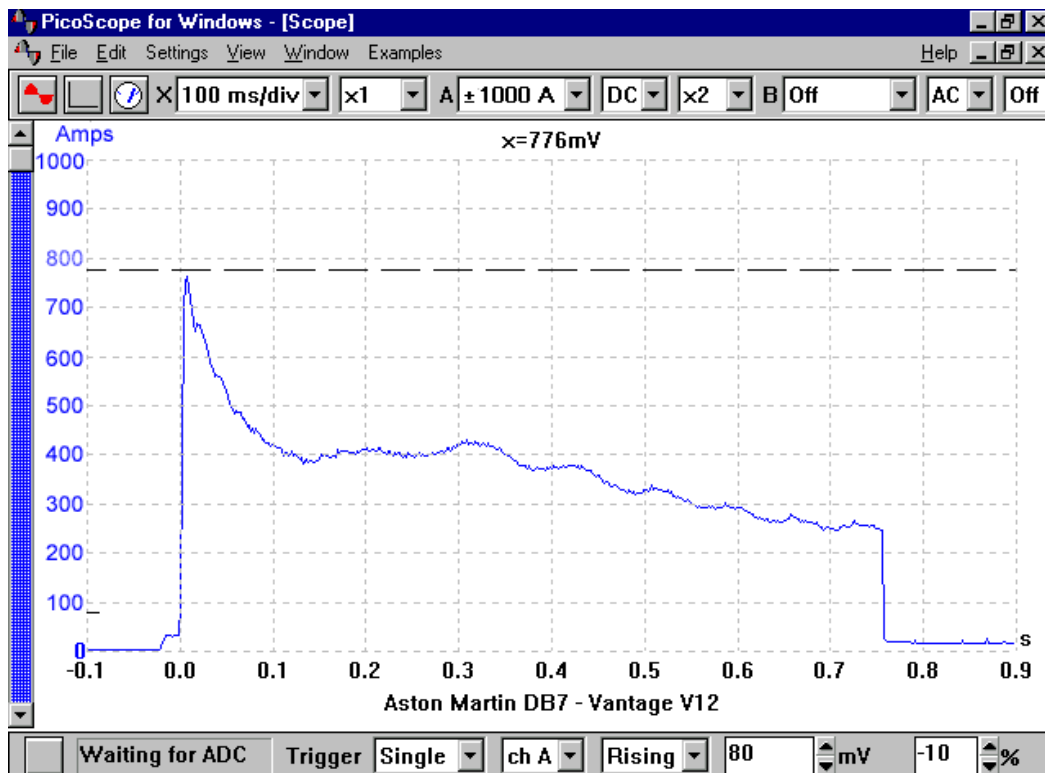
Example 2: Compression Testing

This example measures starter current again, but this time on a engine that will not fire. Notice the oscillation in the current drawn, which is caused as each cylinder compresses. You can use this measurement of starter current 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 No 1 cylinder ignition to the display, you can easily locate the cylinder that is causing the problem.

In this example we are not interested in the steady DC current drawn by the starter motor, and but 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.
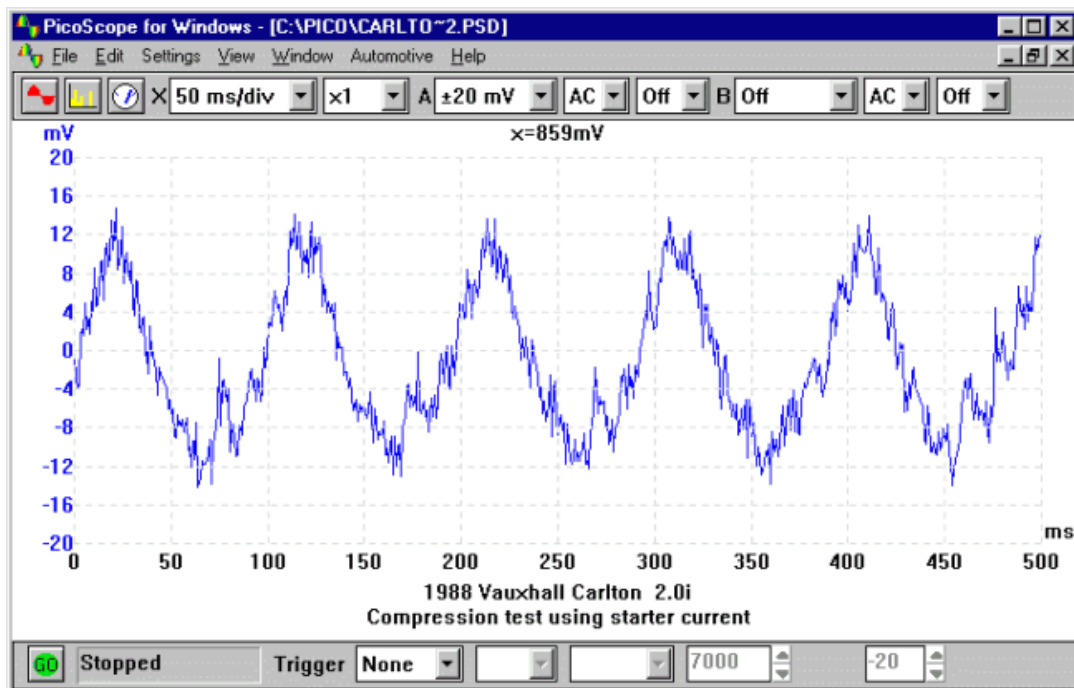
Example 3: Measuring Charging Current

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 one pointing to the battery negative (-) on the other side. If you connect them the wrong way round, you will get a reading with incorrect polarity. In this case the alternator is generating current and 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. If you clamping all positive wires at the battery, the clamp will read the difference between the total load 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 oscilloscopes allow you to measure much lower currents than with most automotive oscilloscopes.

To make measurements at low currents, the following advice may help:

- 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 picked up from ignition, injectors and so on may be a problem. Keep the clamp and its connecting cable as far away as possible from the noise sources.