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INSTRUCTIONS

MODEL AV-155C

0 to 2 A AMPLITUDE, 0 to 500 mA OFFSET,
0 to 4V COMPLIANCE, 50 ns RISE TIME

PULSED CONSTANT CURRENT GENERATOR

SERIAL NUMBER: _____

WARRANTY

Avtech Electrosystems Ltd. warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. If, within one year after delivery to the original owner, and after prepaid return by the original owner, this Avtech product is found to be defective, Avtech shall at its option repair or replace said defective item. This warranty does not apply to units which have been disassembled, modified or subjected to conditions exceeding the applicable specifications or ratings. This warranty is the extent of the obligation assumed by Avtech with respect to this product and no other warranty or guarantee is either expressed or implied.

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INTRODUCTION

The Model AV-155C pulsed constant current generator is capable of producing pulses with amplitudes as high as 2 A into load voltages up to 4V, with 50 ns rise and fall times. A DC offset in the range of 0 to 500 mA may be added to the pulse output. The current and voltage polarities depend on the model number:

"-P" units: 0 to +2 A amplitude, 0 to +0.5 A offset, 0 to +4V compliance

"-N" units: 0 to -2 A amplitude, 0 to -0.5 A offset, 0 to -4V compliance

"-PN" units: 0 to ± 2 A amplitude, 0 to ± 0.5 A offset, -4V to +4V compliance

Several trigger modes are available:

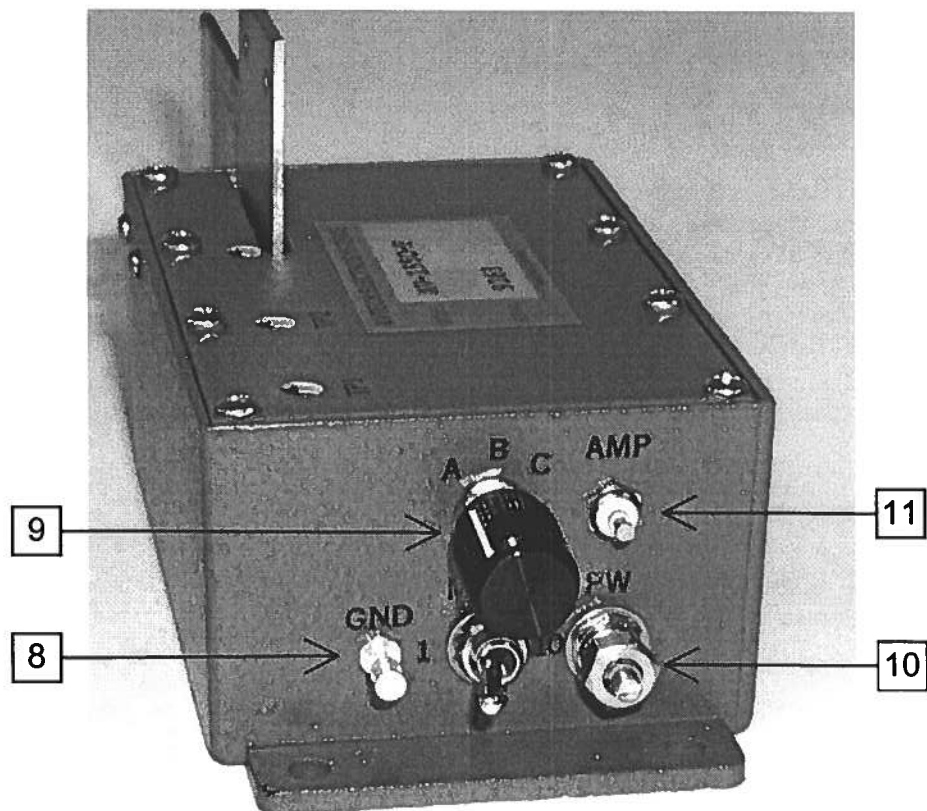
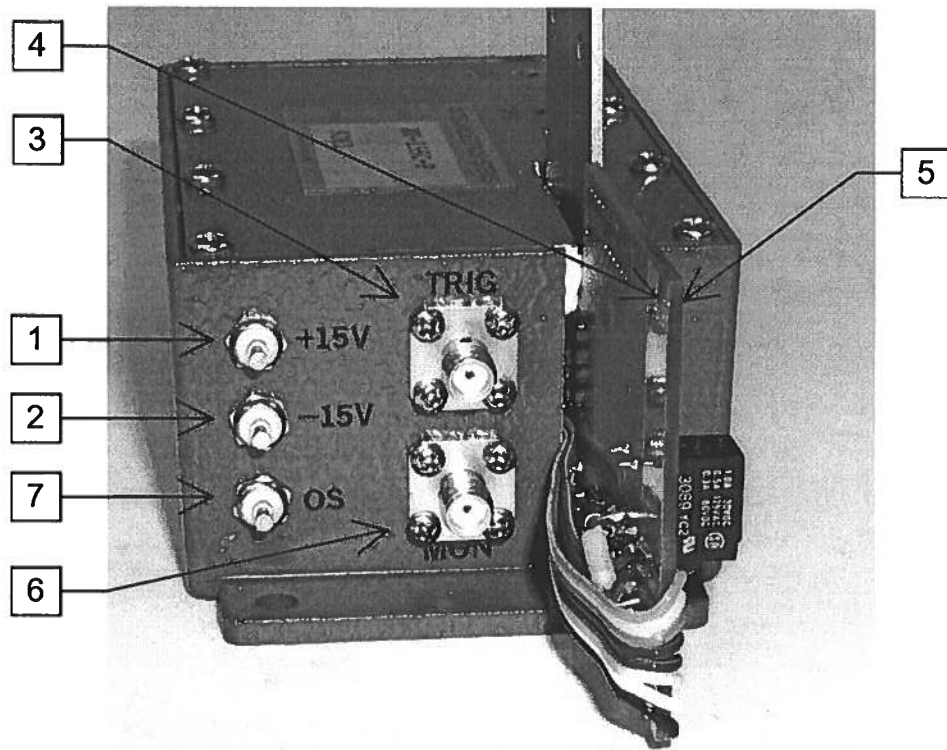
- Voltage-to-current amplifier mode ("A" mode). In this case, the output signal $I_{OUT} \approx V_{AMP} \times 500 \text{ mA/V}$, and the output current waveform tracks the input voltage waveform. The output follows the input by a minimal fixed delay.
- Normal external trigger mode ("B" mode). The output pulse width and amplitude are controlled by the front panel settings. The external trigger is TTL-level.
- $PW_{OUT} = PW_{IN}$ mode. The output pulse width tracks the input pulse width, but the amplitude is controlled by the panel settings. The output follows the input by a minimal fixed delay. The external trigger is TTL-level.

The Model AV-155C pulse generator is a current pulser. The current amplitude is largely independent of the load voltage. For proper operation, the load voltage ($V_{LOAD} = I_{LOAD} \times R_{LOAD}$) must lie in the range of 0 to $\pm 4V$.

SPECIFICATIONS

Model:	AV-155C
Amplitude:	
"-P" units:	Pulse: 0 to +2 A, DC Offset: 0 to +500 mA, Peak: +2.5 A, for load voltages of 0 to +4 Volts
"-N" units:	Pulse: 0 to -2 A, DC Offset: 0 to -500 mA, Peak: -2.5 A, for load voltages of 0 to -4 Volts
"-PN" units:	Pulse: 0 to ± 2 A, DC Offset: 0 to ± 500 mA, Peak: ± 2.5 A, for load voltages of -4 to +4 Volts
Pulse width:	100 ns to 10 μ s
Rise time:	≤ 50 ns
Fall time:	≤ 50 ns
PRF:	0 to 1 MHz
Max. duty cycle:	100%
Output current regulation:	$\leq 1\%$ for load change from ± 4 V to 0V
Trigger required: (external trigger mode)	Internal PW Mode: +5 Volt, 50 ns or wider (TTL)
Monitor output:	Provides an attenuated coincident replica of the main output current pulse. $V_{MON} = I_{LOAD} \times 0.5 \Omega$
Sync output:	+ 5 Volts, 50 ns wide, will drive 50 Ohm loads
Connectors:	Out: circuit board, Trig, Monitor: SMA
Power:	± 15 V
Mounting:	Any
Temperature range:	+ 10° to + 40° C

CONTROLS AND CONNECTORS



1. +15V DC Power Input. +15V must be supplied to this input. The quiescent current is approximately 300 mA. The current draw can be substantially higher if the output amplitude and duty cycle are higher (up to 2.5A, approximately.)
2. -15V DC Power Input. -15V must be supplied to this input. The quiescent current is approximately 200 mA.
3. TRIG Connector. This input is used to trigger the instrument. The instrument normally triggers on the rising edge of this input.
4. OUT. This wide section of circuit board metallization is the main output. The load should be connected to this output.
5. GROUND. The wide section of circuit board metallization on the side of the circuit board opposite the main output is a ground connection. The ground-side of the load may be connected to this point.
6. MON Connector. This is a current monitor output. This output provides a voltage waveform that is proportional to the current waveform on the output. The monitor relationship is: $V_{MON} = I_{OUT} \times 0.5\Omega$, for a load of $> 1\text{ k}\Omega$. (The monitor output can also drive a 50Ω load, but the output voltage will be reduced by a factor of 2. This output is short-circuit protected.)
7. OS Connector. When the PW mode switch is in the "B" or "C" positions, a voltage applied to this input will generate a DC offset on the main output. 0V in corresponds to a 0 Amp offset, and +10V in corresponds to a +500 mA offset, approximately.
8. GROUND. This is a ground lug. The ground from the DC power supplies should be connected to this point.
9. PW Mode Switch. This switch selects the PW mode. The available choices are:

"A" mode: In this mode, the instrument acts as a voltage-to-current converter. The output current is approximately equal to $I_{OUT} = V_{TRIG} \times 0.5\text{ A/V}$, where V_{TRIG} is the signal on the TRIG connector.

"B" mode: In this mode, the instrument is triggered by a TTL-level pulse on the TRIG connector. The output amplitude, offset, and pulse width are controlled by the controls shown in the diagrams above.

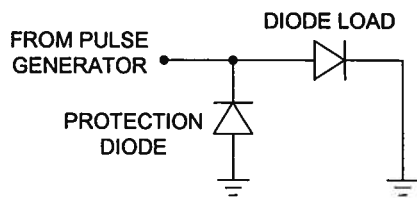
"C" mode: In this mode, the instrument is triggered by a TTL-level pulse on the TRIG connector. The output amplitude and offset are controlled by the controls shown in the diagrams above, but the output pulse width is equal to the input pulse width. In other words, the output pulse width tracks the input pulse width, and the pulse width controls are inoperative.

10. Pulse Width Controls. When the PW Mode switch is set to "B" mode, the PW range switch and fine control vary the output pulse width. The switch selects either the 0.1 to 1 us range or the 10 to 100 us range.
11. AMP Connector. When the PW mode switch is in the "B" or "C" positions, the voltage applied to this input controls the amplitude of the main output. 0V in corresponds to a 0 mA amplitude, and +10V in corresponds to a +2A amplitude, approximately.

LOAD AND INSTRUMENT PROTECTION

PROTECTING DIODE LOADS

It is possible for a small offset current to be generated on the output, if the trimpots (see the "Calibration Adjustments" section) are not correctly adjusted. This can lead to the development of a negative voltage on a diode load. If the diode breakdown voltage is less than 15V, breakdown can occur. If your load is sensitive to this, the load should be protected by adding a low capacitance shunt diode, as illustrated below:



(This assumes that the diode is to be driven with a positive current.) This circuit will prevent the output voltage going below approximately -0.7V.

LENZ'S LAW AND INDUCTIVE VOLTAGE SPIKES

This instrument is designed to pulse resistive and diode loads and will exhibit a large output spike when used to drive a load with significant inductance (as predicted by LENZ'S LAW). For this reason the load should be connected to the output using low inductance leads (**as short as possible** and as heavy a gauge as possible).

The voltage developed across an inductance L (in Henries), when the current is changing at a rate given by di_{LOAD}/dt (in Amps/sec), is: $V_{SPIKE} = L \frac{di_{LOAD}}{dt}$.

OPEN AND SHORT CIRCUITS

The AV-155C will operate properly into a short circuit to ground. Operation into an open circuit will not damage the instrument in any way.

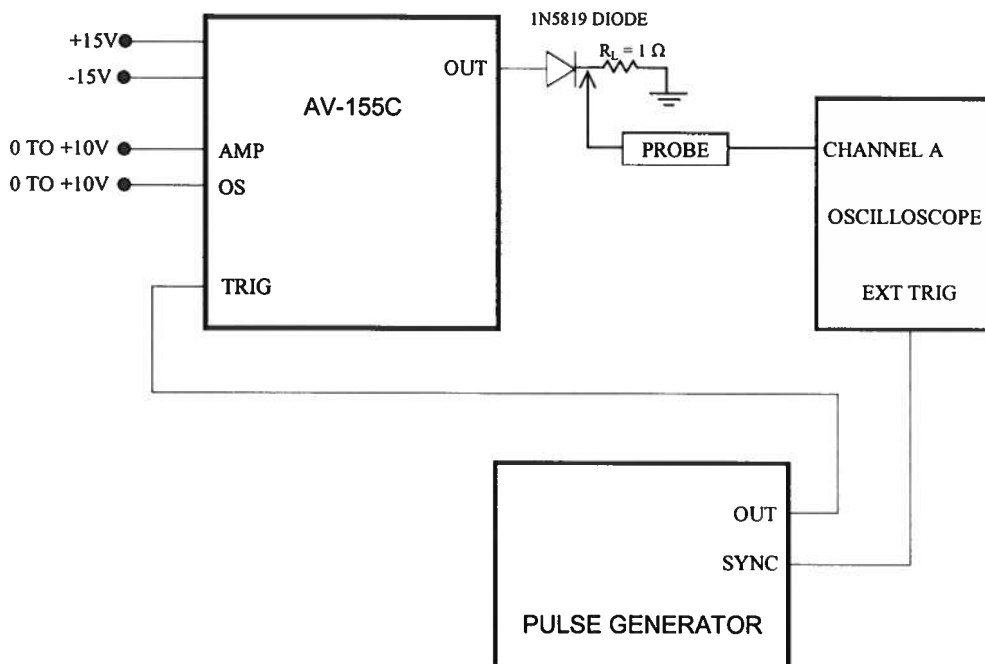
HEATSINKING

The module must be bolted to a heatsink capable of dissipating about 20 Watts. It is also recommended that a heat sink be attached to the copper tab protruding from the top surface of the module.

TRIGGER LEVELS

The voltage on the TRIG input must be kept between 0 and +5V. Voltages outside of this range may damage the instrument.

BASIC TEST ARRANGEMENT



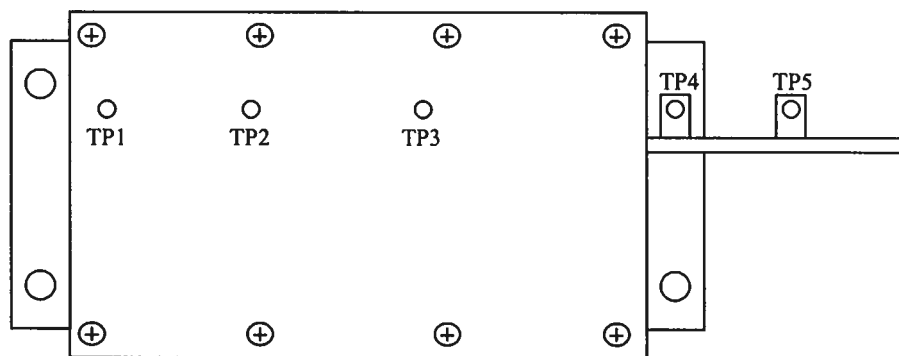
The bandwidth capability of components and instruments used to display the pulse generator output signal (probes, cables, connectors, etc.) should exceed 100 MHz. It is recommended that 2N5819 diode and a 1 Ohm non-inductive resistor be used as the load as shown in the drawing.

A low-inductance resistor should be used as the test load. Note that an inductance of 50 nH will yield an inductance spike of about one Volt. With a low-inductance one Ohm load, the overshoot may be as high as 10%. The overshoot will significantly decrease as the load resistance is increased to 2 or 3 Ohms.

CALIBRATION ADJUSTMENTS - INTERNAL TRIMPOTS

The output module has five trimming potentiometers ("trimpots") that can be used to adjust the performance of the output. These trimpots are preset at the factory and should not normally require adjusting after delivery. These controls can be accessed by removing the top panel of the instrument, and by locating the output-stage module. It is near the rear of the instrument.

The locations of the trimpots (designated TP1-TP5) are shown below. All should be accessible through any heatsinking.



Location of Trimpots

These trimpots can be used to adjust or calibrate the followings properties:

- Current offsets on the main outputs.
- Voltage offsets on the monitor outputs.
- Monitor calibration.
- Output impedance.

NULLING CONSTANT CURRENT OFFSETS

If a small constant current offset is observed on one of the main outputs, TP2 can be rotated to reduce it to zero. Note that the output stage is incapable of generating a negative current, due to the presence of a diode in series with the output.

NULLING AMPLITUDE-DEPENDENT CURRENT OFFSETS

If a small amplitude-dependent current offset is observed on one of the main outputs, TP1 can be rotated to null it out. Rotate TP1 while adjusting the output amplitude from the front panel, until the offset does not vary with amplitude.

NULLING CONSTANT MONITOR OFFSETS

If a small constant voltage offset is observed on one of the monitor outputs, TP5 can be rotated to reduce it to zero.

ADJUSTING OUTPUT IMPEDANCE

Ideally, the outputs of the pulsed current sources should be independent of the output voltages, within the 0 to $\pm 4\text{V}$ compliance voltage range. This condition represents infinite output impedance. If a load voltage/output current dependence is present, the output impedance needs to be adjusted.

To adjust the output impedance, connect a 1Ω load to the output to be adjusted. Set the output amplitude to 2A and observe the load voltage on an oscilloscope. The load voltage should have an amplitude of approximately 2V (i.e. $2\text{A} \times 1\Omega = 2\text{V}$). Note the exact value. Now replace the 1Ω load with a 0.5Ω load. The load voltage should fall by to approximately 1V (i.e. $2\text{A} \times 0.5\Omega = 1\text{V}$). Note the exact value. If the second voltage is not exactly one-half of the first voltage, adjust TP3 and repeat *both* measurements (1Ω and 0.5Ω) again. Repeat as required.

ADJUSTING MONITOR CALIBRATION

Just as the current amplitude of the main outputs can exhibit a load-voltage dependence, the voltage amplitude of the current monitors can also exhibit such a dependence if not adjusted properly.

To null out the monitor load voltage dependence, connect a 1Ω load to the main output. Set the output amplitude to 2A and observe the monitor voltage on an oscilloscope. The monitor voltage should have an amplitude of approximately 2V. Note the exact value. Now replace the 1Ω load with a 0.5Ω load. The monitor voltage should not change, since the current amplitude has not changed. Note the exact value. If the second voltage is not exactly equal to the first voltage, adjust TP4 and repeat *both* measurements (1Ω and 0.5Ω) again. Repeat as required.