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INSTRUCTIONS

MODEL AV-155C-C-PN-SDL1A

**±1 AMP, 1 MHz, TEN CHANNEL
PULSED LASER DIODE DRIVER**

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 AV-155C-C-PN-SDL1A pulsed laser diode driver features 10 output channels. Each channel will drive 0 to ± 1.1 A of pulsed current, with a compliance voltage of ± 4 V, and a maximum duty cycle of 50%. Each channel can also supply a constant DC bias current of 0 to ± 65 mA. The amplitudes and bias levels of the ten channels are individually controllable. The frequency (100kHz -1MHz) and pulse widths (0.5 - 5 μ s) for all ten channels are identical, and are controlled by a single set of dials.

The AV-155C-C-PN-SDL1A can also be triggered by a TTL-level (0 and +5V) pulse on the rear-panel EXT TRIG connector.

This instrument includes several "soft-start" and protection features. Each channel is short-circuited to ground until:

1. The power is applied AND
2. The ACTIVATE pushbutton has been pressed AND
3. The individual channel OP/SB (operate/standby) switch is set to "OP"

If these conditions have been met, but a proper load has not been attached, the channel "LOAD" indicator will light up. (This indicator turns on when the output voltage exceeds ± 5 V).

If the laser diode driver channels are drawing too much current, or if one of the DC power supply fuses has blown, the "OVERLOAD" indicator will light. If the instrument becomes too hot due to fan failure, misuse, or malfunction, the rear-panel "TEMP" indicator will light up and all outputs will switch to standby mode until the instrument has cooled and the ACTIVATE pushbutton has been pressed again.

A small non-zero offset (typically 5mA) is present on each channel to eliminate the possibility of accidentally reverse biasing diode loads. This offset can be adjusted by internal trimpots.

Each channel has a monitor output, which provides a voltage waveform which is proportional to the output current on the main output. If the monitor is terminated in high impedance (>10 k Ω), $V_{MON} = 1 \text{ VOLT/AMP} \times I_{OUT}$. If the monitor is terminated in 50 Ω , then the monitor voltage $V_{MON} = 0.1 \text{ VOLT/AMP} \times I_{OUT}$.

SPECIFICATIONS

Model:	AV-155C-C-PN-SDL1A
Number of channels:	10
Frequency:	100 kHz to 1 MHz. One common single-turn frequency control.
Pulse width:	0.5 to 5.0 μ s. One common single-turn pulse width control.
Maximum duty cycle:	50%
Pulse amplitude:	0 to ± 1.0 Amperes. Ten independent ten-turn controls plus ten polarity switches.
Bias:	0 to ± 50 mA. Ten independent ten-turn controls. Polarity same as pulse output.
Rise, fall time:	< 100ns
Compliance voltage:	4 Volts
Output connector:	SMA. 50 Ω cable length to diode must not exceed 24" or rise time and ringing performance degrades.
Monitor out:	Each channel has an SMA connector which provides a pulsed voltage replica of the output current: $V_{MON} = 1 \text{ VOLT/AMP} \times I_{OUT}$ into a high-impedance load. The monitor output impedance is 470 Ω .
Standby-Operate	Each channel has a standby-operate switch. In the standby position, the switch places a short circuit across the output terminals to protect the load (during normal operation and during power- up/power-down operations).
Load monitor:	Each channel has a load monitor LED which illuminates if load not connected and an attempt is made to apply current.
SYNC OUT:	+2V, 1 μ s (to 50 Ω)
EXT TRIG:	Rear panel BNC connector and two-position switch allow the frequency to be controlled by an externally applied TTL pulse (PW > 50ns)
Chassis size:	5.25" x 17" x 17.8" Includes 19" rack mount kit. Chassis is convection and fan cooled.
Prime power:	120V, 2.5A / 240V, 1.25A. 50-60 Hz

SUPPLIED ACCESSORIES

Several accessories are included with the AV-155C-C-PN-SDL1A. These include:

1. This manual
2. A detachable power cord
3. A rack mount kit
4. Ten 24" coaxial cables for general use
5. Ten 2.2Ω resistive test loads
6. One diode test load marked "+"
7. One diode test load marked "-"

INSTALLATION

VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs and the handles. Confirm that a power cord and instrumentation manual are with the instrument. (If the instrument has been damaged, file a claim immediately with the company that transported the instrument).

PLUGGING IN THE INSTRUMENT

Examine the rear of the instrument. There will be a male power receptacle, a fuse holder and the edge of the power selector card visible. Confirm that the power selector is in the correct orientation - it should be marked either 120 or 240, indicating whether it expects 120V AC or 240V AC. If it is not set for the proper voltage, remove the fuse and then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse. In the 120V setting, a 2.5A slow blow fuse is required. In the 240V setting, a 1.25A slow blow fuse is required.

Two DC slow-blow fuses are located above the power receptacle module. These are both 6.25A fuses, regardless of the AC line voltage.

OPERATIONAL CHECK

This check is to confirm that the instrument is fully operational. Set the controls to the following values, with the instrument turned off:

- FREQUENCY: fully counter-clockwise (minimum frequency, 100 kHz)
- PULSE WIDTH: fully counter-clockwise (minimum pulse width, 0.5 μ s)

- All ten AMPLITUDE controls: fully counter-clockwise (minimum amplitude)
- All ten BIAS controls: fully counter-clockwise (minimum bias)
- All ten +/- switches: +

- All ten OP/SB switches: SB

- INT/EXT switch (on rear panel): INT

Connect a 50 Ω coaxial cable from the SYNC connector to the TRIG input of an oscilloscope.

Steps 1 to 18 use one of the 2.2Ω test load and cables supplied with the instrument, and test the instrument's operation with a simple resistive load. The remaining steps test the instrument's operation with the diode test load and cable supplied with the instrument.

Connect an oscilloscope probe (probe "A") to the signal side of the 2.2Ω test load. A second oscilloscope probe (probe "B") will be connected at a later time directly to the monitor outputs.

Set the oscilloscope to trigger externally with the vertical setting at 1 Volts/div and the horizontal setting at $2\ \mu\text{s}/\text{div}$. Then follow the instructions below and compare what is seen on the oscilloscope to what is described. Only approximate values are needed to confirm operation.

STEP	CONTROL	OPERATION	RESULTS
1	POWER	Push in (on).	Power light is on. LOAD indicators off. OVERLOAD indicator may flash on briefly, but is off in the steady-state.
2	ACTIVATE	Push pushbutton	No observable change.
3	CHANNEL #1 OP/SB switch	Switch to OP	Since no load is connected to Channel #1, the "LOAD" indicator will come on.
4	CHANNEL #1 OUT connector	Attach the 2.2Ω test load and probe "A" between the OUT connector and ground.	The "LOAD" indicator goes off. Probe "A" shows a small, near-zero DC output (typically 10mV). The instrument is shipped with a small DC offset current to ensure that a laser diode load can not be reverse biased.
5	CHANNEL #1 MON connector	Connect probe "B" between the MON connector output and ground.	Probe "B" shows no output (i.e. zero volts)

6	CHANNEL #1 AMPLITUDE dial	Rotate fully clockwise	Probe "A" shows waveform with 10 μ s period, 0.5 μ s pulse width, 2.4V amplitude, and 10mV offset. Probe "B" shows waveform with 10 μ s period, 0.5 μ s pulse width, 1.1V amplitude, and 0V offset.
7	CHANNEL #1 BIAS dial	Rotate fully clockwise	Probe "A" shows waveform with 10 μ s period, 0.5 μ s pulse width, 2.4V amplitude, and 0.15V offset. Probe "B" shows waveform with 10 μ s period, 0.5 μ s pulse width, 1V amplitude, and 0.07V offset.
8	CHANNEL #1 +/- switch	Switch to "-"	Probe "A" shows waveform with 10 μ s period, 0.5 μ s pulse width, -2.4V amplitude, and -0.15V offset. Probe "B" shows waveform with 10 μ s period, 0.5 μ s pulse width, -1.1V amplitude, and -0.07V offset.
9	FREQUENCY dial	Rotate fully clockwise, then back	The waveform period for probes "A" and "B" decreases to 1 μ s, and then increases back to 10 μ s.
10	PULSE WIDTH dial	Rotate fully clockwise, then back	The waveform pulse width for probes "A" and "B" increases to 5 μ s, and then decreases back to 0.5 μ s.
11	CHANNEL #1 AMPLITUDE and BIAS dials	Rotate both fully counter-clockwise	Probes "A" and "B" both show no output (i.e. zero volts)
12	CHANNEL #1 OP/SB switch	Switch to SB	No observable change.

13	CHANNEL #1 +/- switch	Switch to "+"	No observable change.
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Repeat steps 3 to 13 for each of the ten channels.

Steps 3 to 13 confirm that the internal trigger source and the output stages are functioning properly.

The steps 14 to 20 are optional, and are to confirm that the instrument can be triggered externally. First connect a pulse generator or other signal source with a 200 kHz frequency, a pulse with of at least 50ns, and TTL logic levels (0 and 5V) to the EXT TRIG input connector on the rear panel. (The voltage applied to this input must not go below zero volts, or exceed +5V.) Disconnect the 50Ω coaxial cable from the SYNC connector of the AV-155C-C-PN-SDL1A to the TRIG input of the oscilloscope. Connect the 50Ω coaxial cable from the SYNC connector of the 200 kHz TTL pulse generator to the TRIG input of the oscilloscope. Then proceed with step 14:

14	INT/EXT switch (on rear panel)	Switch to "EXT"	No observable change.
15	CHANNEL #1 OUT connector	Attach the 2.2Ω test load and probe "A" between the OUT connector and ground.	Probe "A" shows no output (i.e. zero volts)
16	CHANNEL #1 OP/SB switch	Switch to OP	Probe "A" shows no output (i.e. zero volts)
17	CHANNEL #1 AMPLITUDE dial	Rotate fully clockwise	Probe "A" shows waveform with 5μs period, 0.5μs pulse width, 2.4V amplitude, and 10mV offset.
18	CHANNEL #1 OP/SB switch	Switch to SB	Probe "A" shows no output (i.e. zero volts)
19	CHANNEL #1 AMPLITUDE and BIAS dials	Rotate both fully counter-clockwise	No observable change.
20	INT/EXT switch (on rear panel)	Switch to "INT"	No observable change.

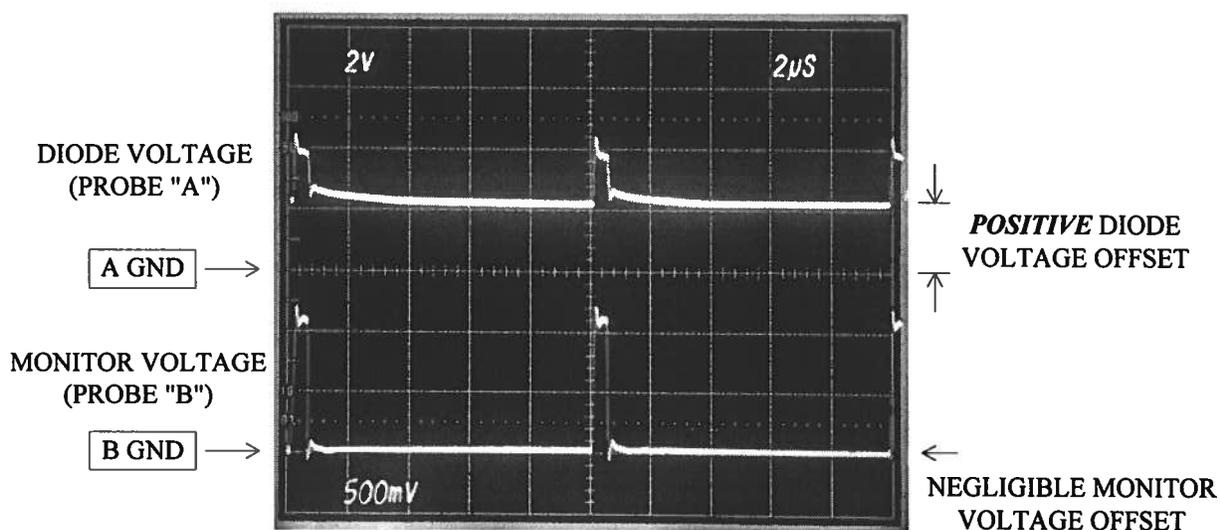
The previous steps confirm the instrument's operation into a simple, single resistive load. The user may also wish to check the unit under maximum power conditions by attaching all ten supplied 2.2Ω test loads, and repeating the previous steps with all ten channels in the "OP" mode.

The remaining steps confirm the instrument's operation into a diode load. The diode test load supplied with the instrument consists of three standard 1N459A silicon switching diodes connected in series to simulate a laser diode. Set the oscilloscope to trigger externally with the vertical setting at 2 Volts/div for probe "A" and 500 mV/div for probe "B". Connect a 50 Ω coaxial cable from the SYNC connector of the AV-155C-C-PN-SDL1A to the TRIG input of an oscilloscope, if it is not already there.

STEP	CONTROL	OPERATION	RESULTS
21		Disconnect the 2.2 Ω load from the output, and remove Probe "A" from this load.	
22	CHANNEL #1 OP/SB switch	Switch to SB	Probes "A" and "B" both show no output (i.e. zero volts)
23	CHANNEL #1 AMPLITUDE and BIAS dials	Rotate both fully counter-clockwise	No observable change.
24	CHANNEL #1 +/- switch	Switch to "+"	No observable change.
25	CHANNEL #1 OUT connector	Attach the diode test load marked "+" (cathodes to ground) and probe "A" between the OUT connector and ground.	Probe "A" shows no output (i.e. zero volts)
26	CHANNEL #1 MON connector	Connect probe "B" between the MON connector output and ground.	Probe "B" shows no output (i.e. zero volts)
27	CHANNEL #1 OP/SB switch	Switch to OP	Probe "A" shows a DC voltage of approximately 2.1V. (Some voltage oscillations may be observed, since the diodes act as a radio detector at these low biases. The oscillations disappear at higher biases). Probe "B" is zero.

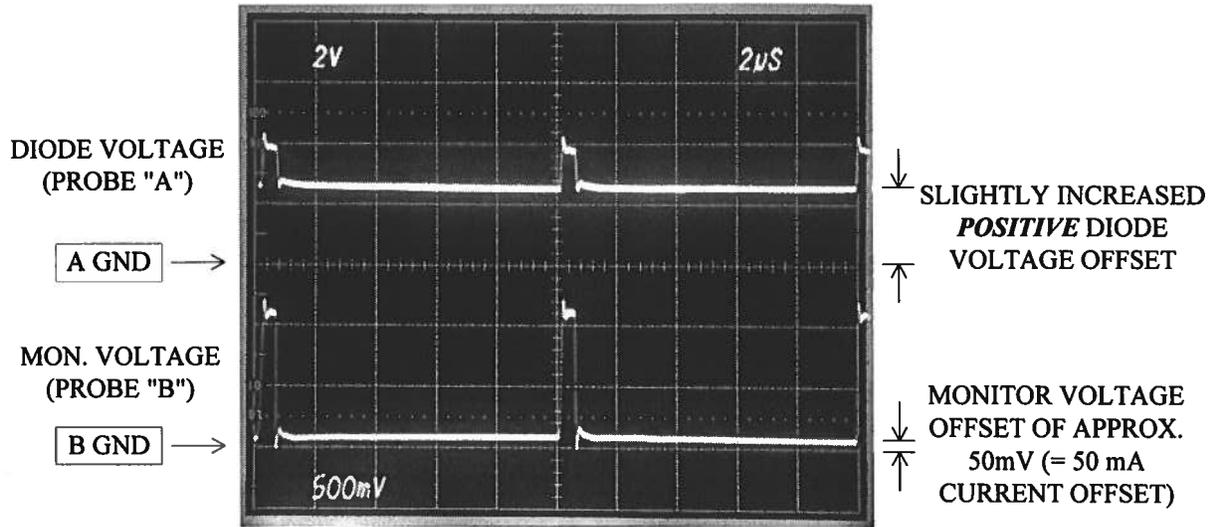
28	CHANNEL #1 AMPLITUDE dial	Rotate fully clockwise	See Photo #1 below. Your results should be similar. The voltage on probe "A" should not go below zero volts. (If it does, the channel <u>must</u> be recalibrated as described later in the manual to remove the slight negative bias that can potentially damage laser diode loads.)
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PHOTO #1



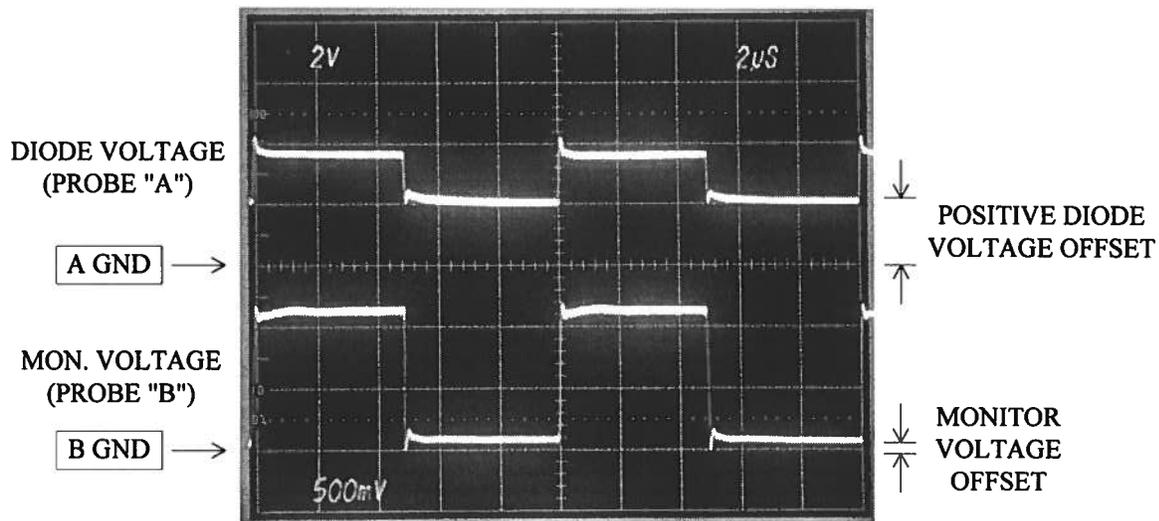
29	CHANNEL #1 BIAS dial	Rotate fully clockwise	See Photo #2 below. Your results should be similar.
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PHOTO #2



30	PULSE WIDTH dial	Rotate fully clockwise. Do not exceed 50% duty cycle, and do not prolong this step longer than necessary since the diode test load will become warm.	See Photo #3 below. Your results should be similar.
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PHOTO #3



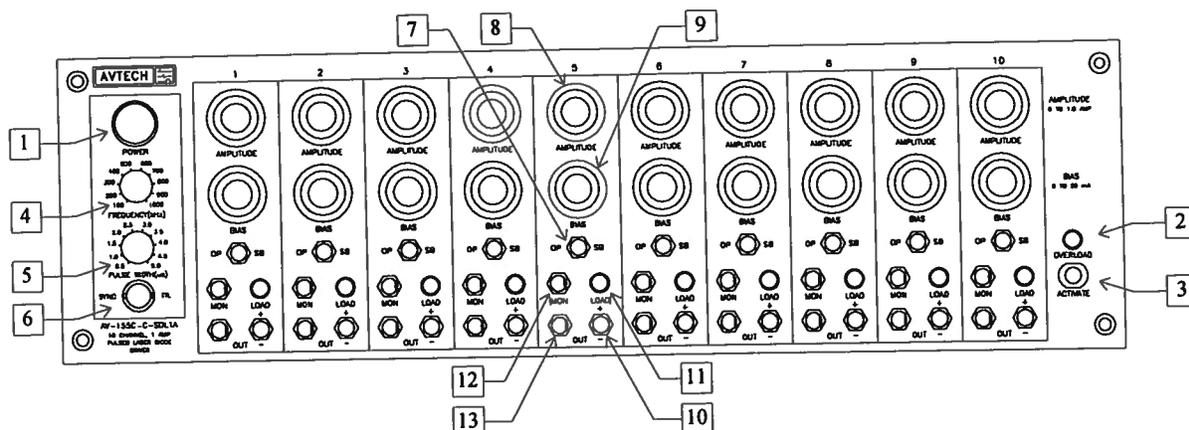
31	CHANNEL #1 AMPLITUDE and BIAS dials	Rotate both fully counter-clockwise	No observable change.
32	CHANNEL #1 OP/SB switch	Switch to SB	Probes "A" and "B" both show no output (i.e. zero volts)

Repeat steps 21 to 32 for each of the ten channels.

Steps 21 to 32 used the diode load marked "+", which had diode anodes connected to the signal line and the cathodes to ground. A second load, marked "-", with diode cathodes connected to the signal line and the anodes to ground has also been supplied. Steps 21 to 32 can optionally be repeated with this load, with the polarity switches in the "-" position. The results should be similar, except for a voltage polarity reversal in all measurements.

This completes the operational check.

FRONT PANEL CONTROLS



COMMON CONTROLS

(1) **POWER switch.** The POWER pushbutton switch applies AC prime power to the internal power supply circuitry, turning the instrument on.

(2) **OVERLOAD indicator.** This indicator light turns on if the internal power supply circuitry is supplying more current to the output stages than it is designed to handle. In normal operation, this indicator may flash briefly on power-up. It should not be on at other times. If it does come on, check to make should that all outputs are operating properly, and all operating specifications are being observed. In particular, note that all outputs have a 50% maximum duty cycle limit. This indicator will come on if one or both of the 6.25A DC fuses on the rear panel has blown. (The overload condition does not automatically force the channels into the standby mode.)

(3) **ACTIVATE pushbutton.** After power-up, all ten outputs are shorted to ground (regardless of the position of the OP/SB switches) until the ACTIVATE pushbutton is pressed. This is a soft-start protection feature. After this button is pressed, the output channels are shorted to ground only if the associated OP/SB switch is in the "SB" position. After the ACTIVATE pushbutton has been pressed once, further presses have normally have no effect. However, if the over-temperature circuit has tripped (see rear panel control 17), the ACTIVATE pushbutton must be pressed after the instrument has cooled, and the TEMP indicator has gone off again, in order to resume normal pulsing.

(4) **FREQUENCY control.** When the INT/EXT switch (on the rear-panel) is in the "INT" position, this dial controls the pulse repetition frequency (PRF) of the ten output channels.

(5) **PULSE WIDTH control.** When the INT/EXT switch (on the rear-panel) is in the "INT" position, this dial controls the pulse width (PW) of the ten output channels. The pulse width can be adjusted between 0.5 and 5 μ s.

(6) SYNC connector. This output supplies a +2V, 1 μ s wide pulse to trigger oscilloscopes or other measurement equipment. This pulse is approximately coincident with the main output pulses.

INDIVIDUAL CHANNEL CONTROLS

(7) OP/SB switch. When this switch is in the "SB" (standby) position, the associated channel stops pulsing and the associated output is shorted to ground. This switch must be in the "OP" (operate) position to obtain an output.

(8) AMPLITUDE control. This varies the magnitude of the output amplitude of the associated channel between 0 and 1.1 Amperes. (The +/- switch sets the polarity.)

(9) BIAS control. This varies the magnitude of the bias (DC offset) of the associated channel between 0 and 65 mA. (The +/- switch sets the polarity.)

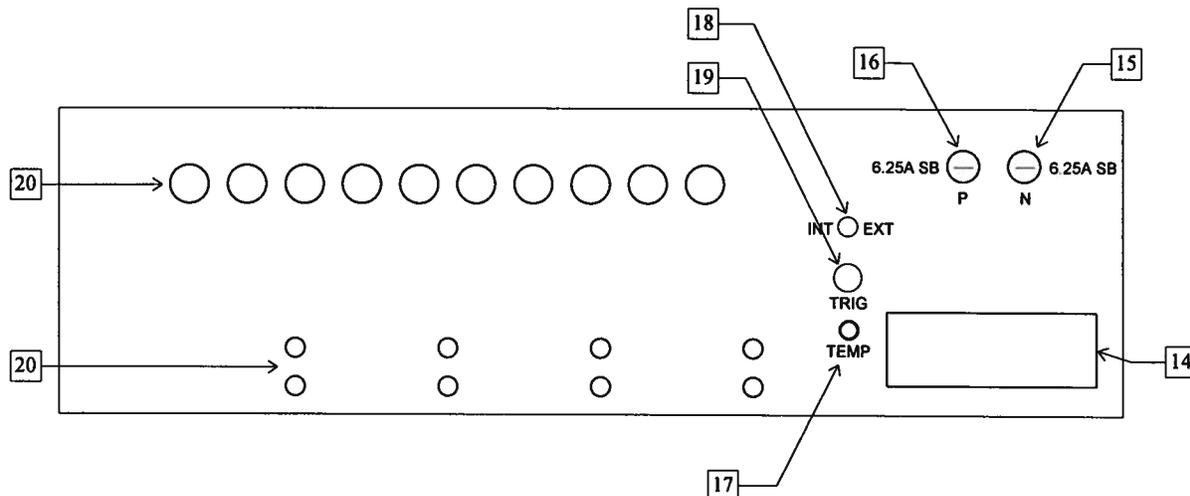
(10) +/- switch. This switch determines whether the associated output channels sources current (+) or sinks current (-).

(11) LOAD indicator. If the associated OP/SB switch is in the "OP" position and no load has been connected to the associated output connector, this indicator light will come on. This light will also come on if a load has been attached but the output voltage exceeds $\pm 5V$. (The specifications allows load voltages of up to $\pm 4V$.)

(12) MON connector. Each channel has an associated monitor output, which provides a voltage waveform which is proportional to the output current on the main output. If the monitor is terminated in high impedance ($>1k\Omega$), $V_{MON} = 1 \text{ Volt/Amp} \times I_{OUT}$. If the monitor is terminated in 50Ω , then the monitor voltage $V_{MON} = 0.1 \text{ Volt/Amp} \times I_{OUT}$. The monitor output has an output impedance of 470Ω , and is protected against short circuits. Caution: output cable lengths in excess of 48" may cause oscillations to occur on the monitor output.

(13) OUT connector. This is the main output connector for the associated channel, and it is capable of supply up to $\pm 1A$ of pulsed current and $\pm 50mA$ of DC current, into a load voltage of up to $\pm 4V$. If no load is connected, and the associated OP/SB switch is in the OP position, the LOAD indicator (item 11) will turn on. The output cable length should normally not exceed 24" if the rise time specification of 100ns is to be met.

REAR PANEL CONTROLS



(14) Power entry module. This module contains the line cord receptacle, the AC voltage selector (120V/240V), the AC fuse (2.5A for 120V) and a power line filter.

(15) Negative DC fuse. This is a 6.25A SB fuse for the internal negative DC power supply. Failure of this fuse will cause the "OVERLOAD" indicator to light up.

(16) Positive DC fuse. This is a 6.25A SB fuse for the internal positive DC power supply. Failure of this fuse will cause the "OVERLOAD" indicator to light up.

(17) TEMP indicator. This indicator will come on if the temperature inside the instrument is too high due to fan failure, misuse, or malfunction. All outputs will switch to standby mode (regardless of the position of the individual channel OP/SB switches) until the instrument has cooled sufficiently and the ACTIVATE pushbutton has been pressed again. (Pushing the ACTIVATE pushbutton while the TEMP light is still on will have no effect.)

(18) INT/EXT switch. This select the trigger source. The "INT" position selects the internal clock, which is controlled by the front-panel "FREQUENCY" control (4). The "EXT" position selects the TTL signal that the user can apply to the "TRIG" connector (19).

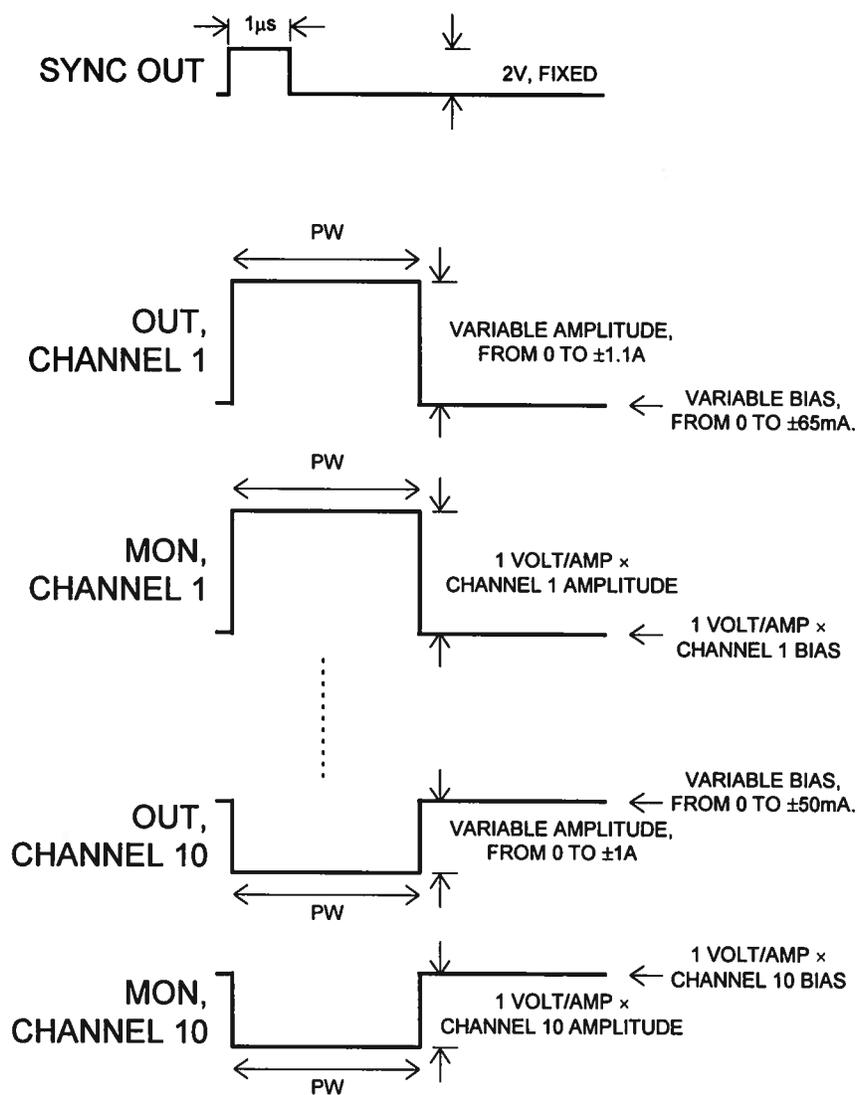
(19) TRIG connector. When the "INT/EXT" switch (18) is in the "EXT" position, a TTL-level pulse on this input will trigger the instrument.

(20) Ventilation holes. These holes provide air flow for the fan.

APPLICATION INFORMATION

BASIC PULSE CONTROL

This pulsed laser diode driver can be triggered by its own internal clock or by an external TTL trigger signal. In either case, eleven output channels respond to the trigger: SYNC, and the ten main channel outputs. The SYNC pulse is a fixed-width pulse that is generated immediately after triggering. This pulse can be used to trigger oscilloscopes or other measurement systems. The other output channels are referenced to the SYNC pulse. This relationship is illustrated below:

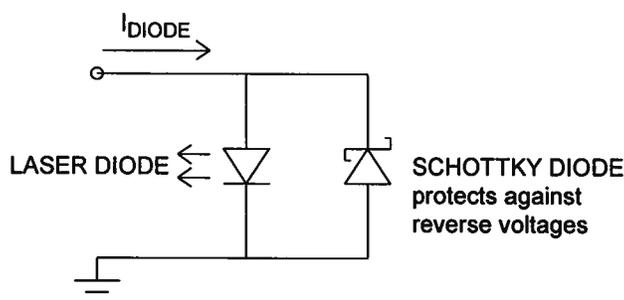


Basic Output Pulses

In the figure, it is assumed that the monitor output is terminated in a high impedance load ($>10\text{ k}\Omega$). If the monitor output is terminated in 50Ω , the monitor output will be scaled down by a factor of ten since the monitor output impedance is 470Ω .

LASER DIODE PROTECTION

It is suggested that when driving a laser diode, an opposing Schottky diode (such as a 1N5818) should be connected in parallel with the laser diode to protect against possible reverse-polarity excursions in the output pulse which could breakdown the laser diode. (This can occur if a small bias offset of the incorrect polarity exists on the output. This should not occur in a properly calibrated unit as shipped from the factory. If this does occur, see the later section on calibrating the instrument.) This configuration is shown below:



START-UP SEQUENCE FOR LASER DIODE LOADS

The following sequence should be followed for powering-up the instrument for use with laser diode loads:

1. Instrument is off.
2. Switch all OP/SB switches to the "SB" position.
3. Rotate all AMPLITUDE and BIAS dials to their minimum settings.
4. Attach the laser diode load, with a Schottky diode for protection as shown above.
5. Turn the instrument on.
6. Adjust the FREQUENCY and PULSE WIDTH dials to the desired settings.
7. Press the ACTIVATE pushbutton.
8. Switch the OP/SB switches on the channels that are to be used to the "OP" position.
9. Rotate the AMPLITUDE and BIAS dials on the channels that are to be used to the desired settings.

Note that the outputs are shorted to ground when the instrument is turned off, when the instrument is on but the ACTIVATE pushbutton has not been pressed, and when the channel OP/SB switch is in the "SB" position.

SHUT-DOWN SEQUENCE FOR LASER DIODE LOADS

The following sequence should be followed for powering-down the instrument for use with laser diode loads:

1. Instrument is on.
2. Rotate all AMPLITUDE and BIAS dials to their minimum settings.
3. Switch all OP/SB switches to the "SB" position.
4. Turn the instrument off.
5. Remove the laser diodes if desired.

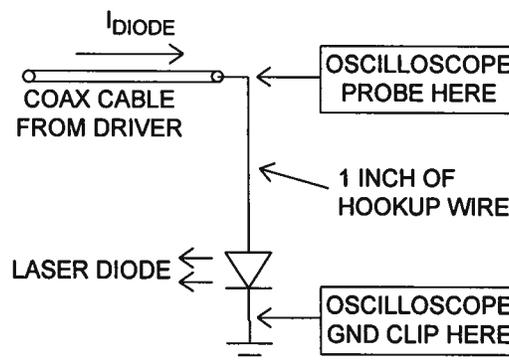
Note that the outputs are shorted to ground when the instrument is turned off, when the instrument is on but the ACTIVATE pushbutton has not been pressed, and when the channel OP/SB is in the "SB" position.

INDUCTIVE VOLTAGE SPIKES

When monitoring the voltage across a load driven by a pulsed constant current source, inductive voltage spikes can appear, as predicted by Lenz's Law:

$$V = L \frac{di}{dt}$$

For instance, consider the experimental setup illustrated below:



If the hookup wire length is 1", it will have an inductance of approximately 10 nH. The laser diode leads might contribute a similar amount. So for a 1A pulse, with an 80ns rise time, a voltage spike of:

$$V = (10\text{nH} + 10\text{nH}) \frac{1\text{A}}{80\text{ns}} = 0.25\text{V}$$

will be generated.

The amount of inductance should be minimized to avoid these spikes. Note that all devices (resistors, diodes, etc.) have a parasitic inductance associated with them.

HIGH DUTY CYCLE OPERATION

This instrument will operate at duty cycles as high as 50%, with all ten channels set at $\pm 1.0A$. Attempts to exceed this duty cycle limit may result in the following:

1. Overheating of the unit may occur, triggering the over-temperature protection circuit. The "TEMP" indicator on the rear panel will light up if this occurs. All outputs will automatically switch to the standby mode until the instrument has cooled and the ACTIVATE button has been re-pressed.
2. One or both of the rear panel 6.25A SB fuses may blow.
3. The 2.5A AC line fuses may blow.
4. The OVERLOAD light may come on.

MAINTENANCE

TOP COVER REMOVAL

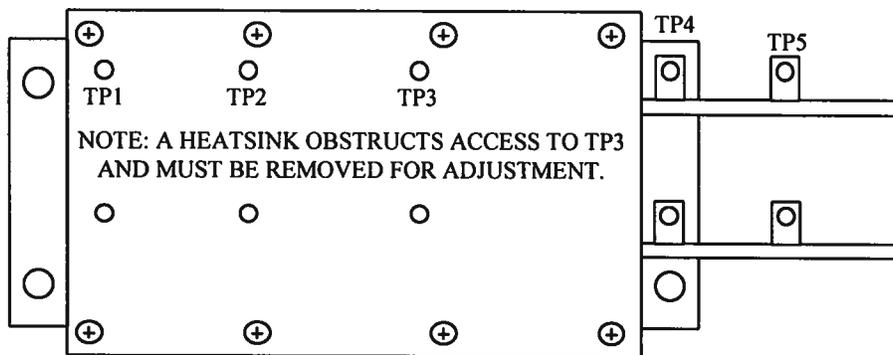
The top cover of the instrument may be removed by removing the four Phillips screws on the top panel. With these four screws removed, the top panel may be slid off by pulling it towards the rear.

RACK MOUNTING

The -R5 rack mount kit may be installed after first removing the one Phillips screw on the side panel adjacent to the front handle.

USER-ACCESSIBLE INTERNAL CALIBRATION ADJUSTMENTS

Each output channel has five trimming potentiometers ("trimpots") that can be used to adjust the performance of the output channels. 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 five identical -PGNM blue modules which each contain the circuitry for two output channels. The locations of the trimpots (designated TP1-TP5) for each channel are shown below:



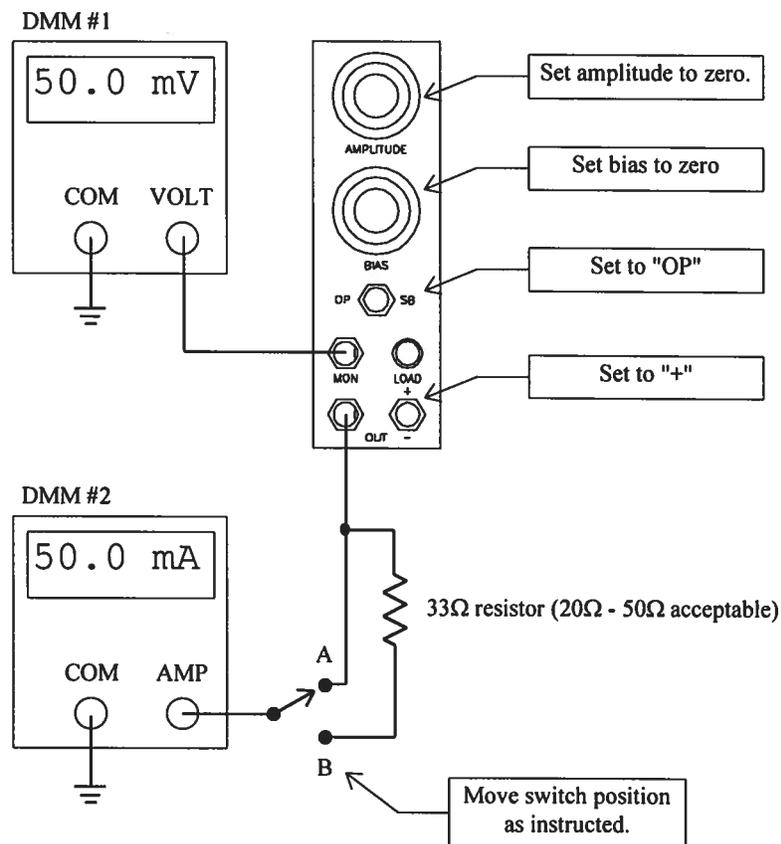
Location of Trimpots (One set out of two per module is labeled)

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

1. Current offsets on the main outputs.
2. Voltage offsets on the monitor outputs.
3. Monitor calibration.
4. Channel output impedance.

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

The following paragraphs describe an overall calibration procedure can be used to null out offsets and to set the output impedance to an optimum levels. Two digital multimeters (DMMs) are required, one to measured currents in the $0\text{-}100\text{mA}$ range, and one to measure voltages in the $0\text{-}100\text{mV}$ range. An oscilloscope, a 33Ω , $1/4\text{W}$ resistor, and a 2Ω , 2W resistor are also required.



Initial Calibration Setup

To perform the calibration:

1. Setup the DMMs and the channel to be calibrated as shown above. Initially, the switch should be in the "A" position.
2. Set the INT/EXT switch to "INT", the FREQUENCY dial to 100kHz, and the PULSE WIDTH dial to 0.5 μ s.
3. Turn on the AV-155C-C-PN-SDL1A and press the ACTIVATE pushbutton.

Steps 4 and 5 null out the DC current offset present on the output when the amplitude and bias controls are set at zero:

4. Adjust TP2 until DMM #2 indicates that the current is approximately zero (but is not negative!)
5. Flip to polarity switch to "-". Check that the current reading on DMM #2 is approximately zero (but is not positive!) Repeat steps 4 and 5 until satisfactory results are obtained.

Steps 6 to 8 adjust the output impedance of the channel:

6. Flip to polarity switch to "+" and turn the BIAS dial to its maximum setting.
7. Place the switch in the "A" position. DMM #2 should read approximately 50mA. Record this value.
8. Move the switch to the "B" position. Compare the new reading on DMM #2 to the reading obtained in step 7. If they differ significantly, adjust TP3 and repeat steps 7 and 8 until the readings are identical, adjusting TP3 as required.

Steps 9 and 10 adjust the monitor calibration:

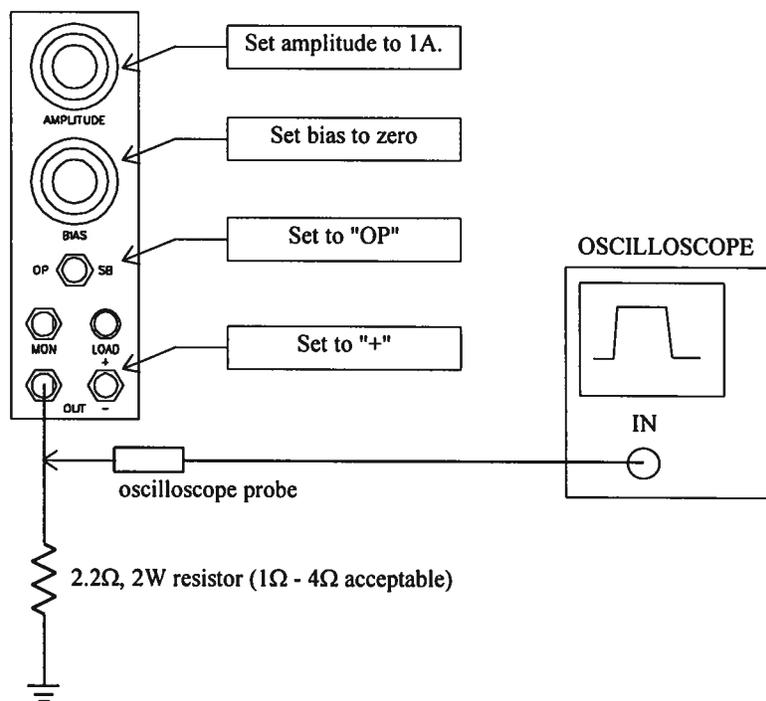
9. Place the switch in the "A" position. DMM #1 should read approximately 50mV. Record this value.
10. Move the switch to the "B" position. Compare the new reading on DMM #1 to the reading obtained in step 9. If they differ significantly, adjust TP4 and repeat steps 9 and 10 until the readings are identical, adjusting TP4 as required.

Steps 11 and 12 adjust the monitor offset:

11. Turn the BIAS dial to its minimum setting.
12. Adjust TP5 until the reading on DMM #1 (in millivolts) is equal to the reading on DMM #2 (in milliamps).

Steps 13 and 14 adjust any amplitude-dependent offset on the main output:

13. For the final adjustment, rewire the setup as shown below:



TP1 Calibration Setup

14. Vary the AMPLITUDE dial and observe the output waveform. The amplitude should change, but the bias (DC offset) should remain constant. If the bias does change noticeably, adjust TP1 until it does not.

This completes the calibration procedure.

OTHER USER-ACCESSIBLE INTERNAL ADJUSTMENTS

The -OL-SDL module has a trimpot marked "TEMP". This adjusts the temperature at which the over-temperature circuit switches all outputs to standby mode and drives the "TEMP" indicator on the rear panel. To increase the trip temperature, rotate the trimpot clockwise. To decrease the trip temperature, rotate the trimpot counter-clockwise. At the time of shipping, the trip temperature is set at 50°C and it should not be necessary to adjust this.

POWER SWITCH LAMP

If this power switch lamp burns out, pry off the red cap and replace the bulb with a standard #382 bulb.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE
Power light not on, but fan is on.	Power switch light bulb has burnt out. Pry off red cap and replace lamp with a standard #382 bulb.
Power light not on, and fan is not on.	AC fuse in power entry module needs to be replaced.
OVERLOAD indicator stays on at power-up.	One or both of the DC fuses on the back panel above the power entry module need to be replaced.
	Outputs are being over-driven. Reduce the duty cycle to below 50%.
OVERLOAD indicator comes on when frequency or pulse width is adjusted.	Outputs are being over-driven. Reduce the duty cycle to below 50%.
TEMP indicator comes on.	The instrument is too hot. The fan may have failed.
	The over-temperature circuit may be set too low. See the maintenance section.
No output.	The ACTIVATE button has not been pressed.
	The channel's OP/SB switch is not set at "OP".
	The instrument is too hot, and the over-temperature circuit has fired.

Aug. 21/97

Michael did this set