

The laser diode drivers in the Avtech AVO-8 and AVOZ-B families of products are voltage pulsers which require a resistance in series with the diode device under test (DUT) to define and limit the current. To maintain fast rise and fall times, it is important that this resistance have a very low parasitic inductance. The rise time degradation introduced by a resistor R with a parasitic inductance L can be estimated as  $2.2 \times L / R$ .

This resistance may also have a very high power dissipation requirement. For instance, the AVO-8C3-B can deliver up to 40V and 200A at duty cycles up to 50%, resulting in a power dissipation of  $40V \times 200A \times 50\% = 4000$  Watts!

The Avtech AV-HTL series of water-cooled resistors is provided to meet this need.

The AV-HTL resistors models each consist of ten discrete high-power resistors wired in parallel on a large heavy-duty water-cooled aluminum base. The maximum power rating is 4000 Watts, and the parasitic inductance is typically 20 nH.

A 1 meter length of AV-CLZ1 (or AV-HLZ1 on -HLZ units) transmission line cabling is connected to the input side of most models, except AV-CLZ2 (or AV-HLZ2) cabling is used on the AV-HTL-2R2.

The input end of this cabling is terminated with a male DB-37 connector on standard units, which will mate to the female DB-37 output connector present on certain Avtech models.

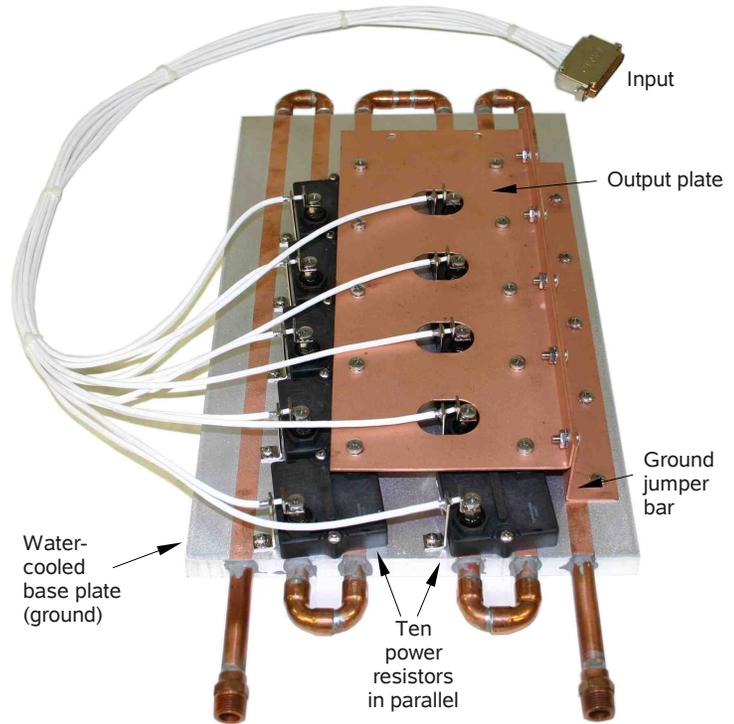
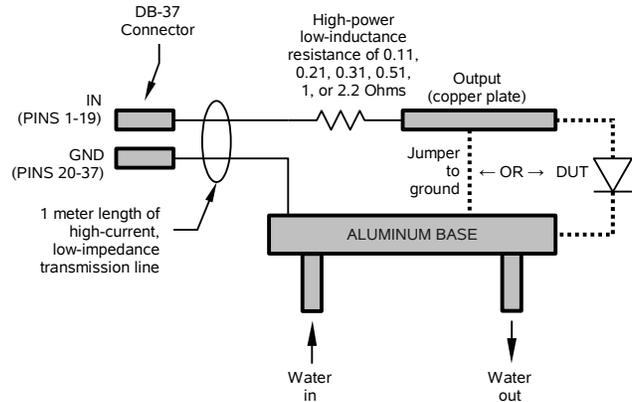
The cable can also be configured with a high-voltage, high-current Positronic connector suitable for use with the current generation of Avtech AVO-8 models. Specify the -HLZ option to use this connector. Other input connector styles can be provided upon request.

The transmission line nature of the cabling largely eliminates inductive cabling effects. The AV-CLZ1 / AV-HLZ1 line has a characteristic impedance ( $Z_0$ ) of 1.0Ω, and the AV-CLZ2 / AV-HLZ2 cabling has a  $Z_0$  of 1.8Ω. More information about Avtech low-inductance transmission line cabling is available at:

<http://www.avtechpulse.com/transmission>

The other end of the resistance (the "output") is provided on a copper plate with bolt holes for external connections. A copper-plate "jumper bar" is provided allowing the output to be shorted to the base plate (ground). In this configuration, the resistance can be used as a test load, without any diode. The jumper bar can be removed, and the user may connect a diode load between the output and the grounded base. Bolt holes are provided in the base and the output plate for this purpose. (These models are shipped from the factory with the ground jumper bar installed.)

Other mechanical and electrical configurations can be provided upon request ([info@avtechpulse.com](mailto:info@avtechpulse.com)).



AV-HTL-0R1 (with ground jumper installed)

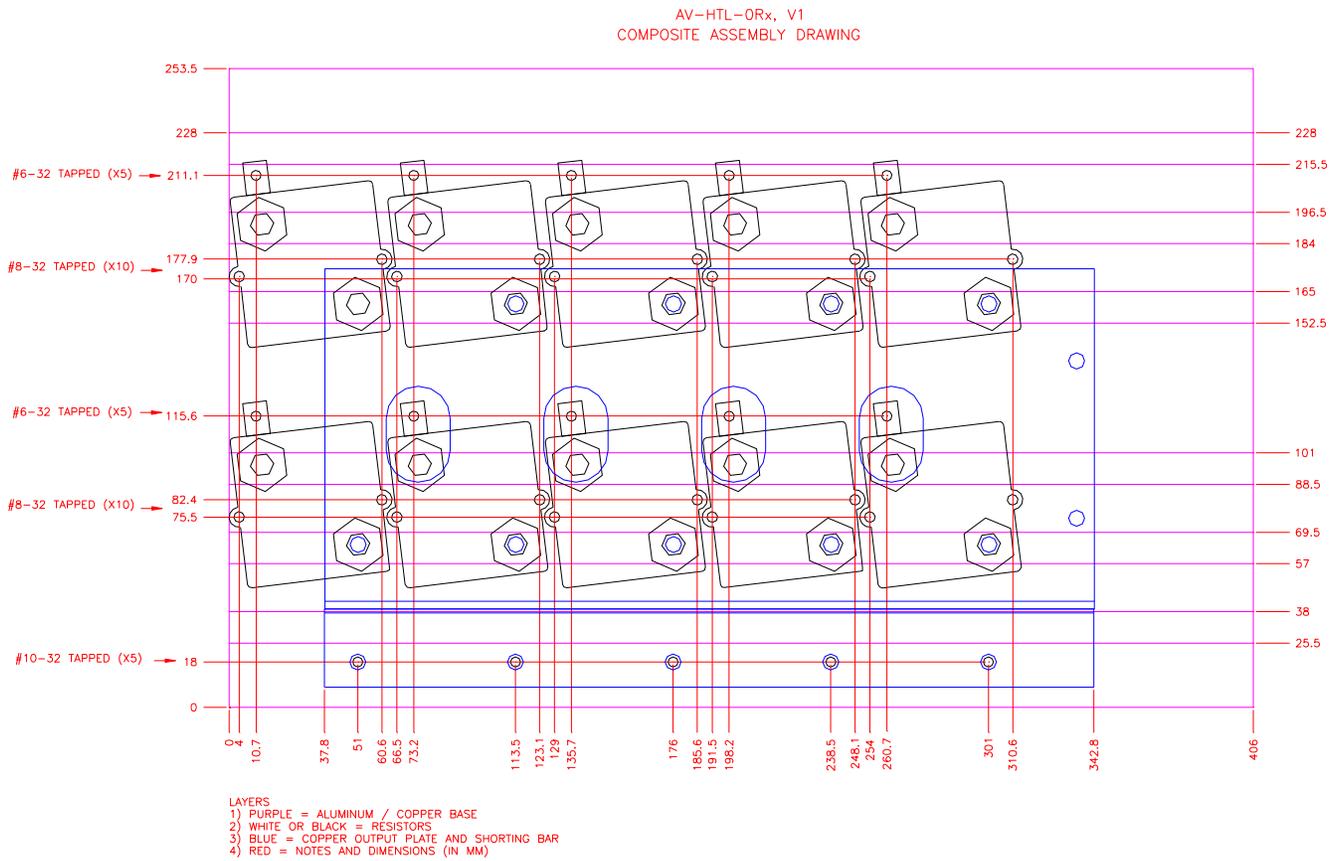
Model:	AV-HTL-0R1	AV-HTL-0R2	AV-HTL-0R3	AV-HTL-0R5	AV-HTL-1R0	AV-HTL-2R2
Load resistance ( $R_L$ , $\pm 10\%$ ):	0.11 Ω	0.21 Ω	0.31 Ω	0.51 Ω	1.0 Ω	2.2 Ω
Parasitic inductance:	20 nH typically					
Max. power dissipation:	4000 Watts					
Base plate thermal resistance, $R_{TH}$ :	0.005 °C/W, for a water flow rate of 6 liters / 1.5 gallons per minute					
Max. operating temperature	65 °C. The water cooling must be used to keep the resistor temperature below this rating.					
Water cooling connections:	1/2" NPT <sup>1</sup> male connectors on both ends					
Water flow rate:	6 liters / 1.5 gallons per minute is recommended					
Input connection:	Standard models: Male DB-37 connector on the end of a non-detachable 1 meter length <sup>2</sup> of AV-CLZ1 or AV-CLZ2 cabling. Pins 1-19 = input, pins 20-37 = ground. Optional: Specify the "-HLZ" option for an input connector that will mate to the Positronic connectors on current-generation AVO-8 models. Also available: Customized terminations (Multi-Contact 6 mm plugs, for example). Contact Avtech with your requirements.					
Output connections:	Multiple bolt holes are provided in the output copper plate and the aluminum base (ground).					
Supplied accessory:	Output-to-ground jumper bar					
Base size (H×W×D, approx):	0.75 × 16 <sup>3</sup> × 10 inches, 2 × 41 <sup>3</sup> × 25 cm					

1) NPT = National Pipe Thread. Contact Avtech for suggested NPT-to-hose-barb adapters, if required.

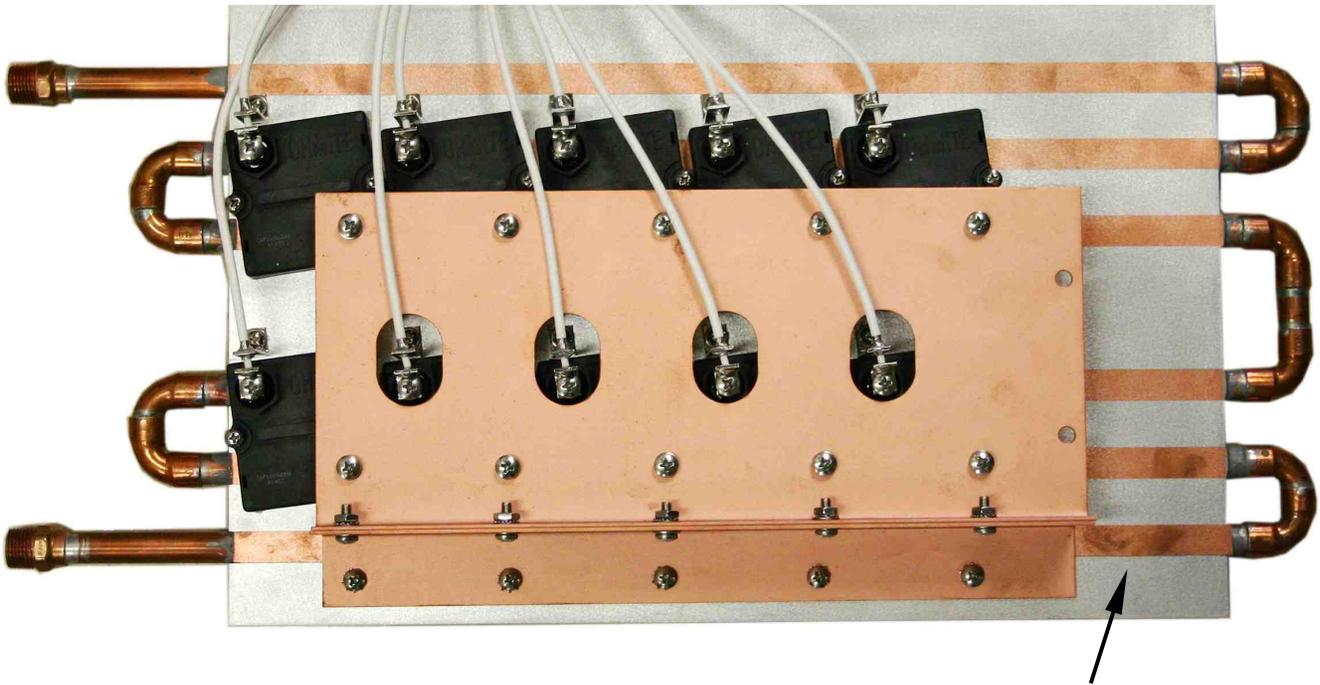
2) Optionally 2 meters. Specify -L200 option.

3) Optionally 20 inches / 51 cm. Specify -W20 option.

## Mechanical Drawing of the AV-HTL (Top View)



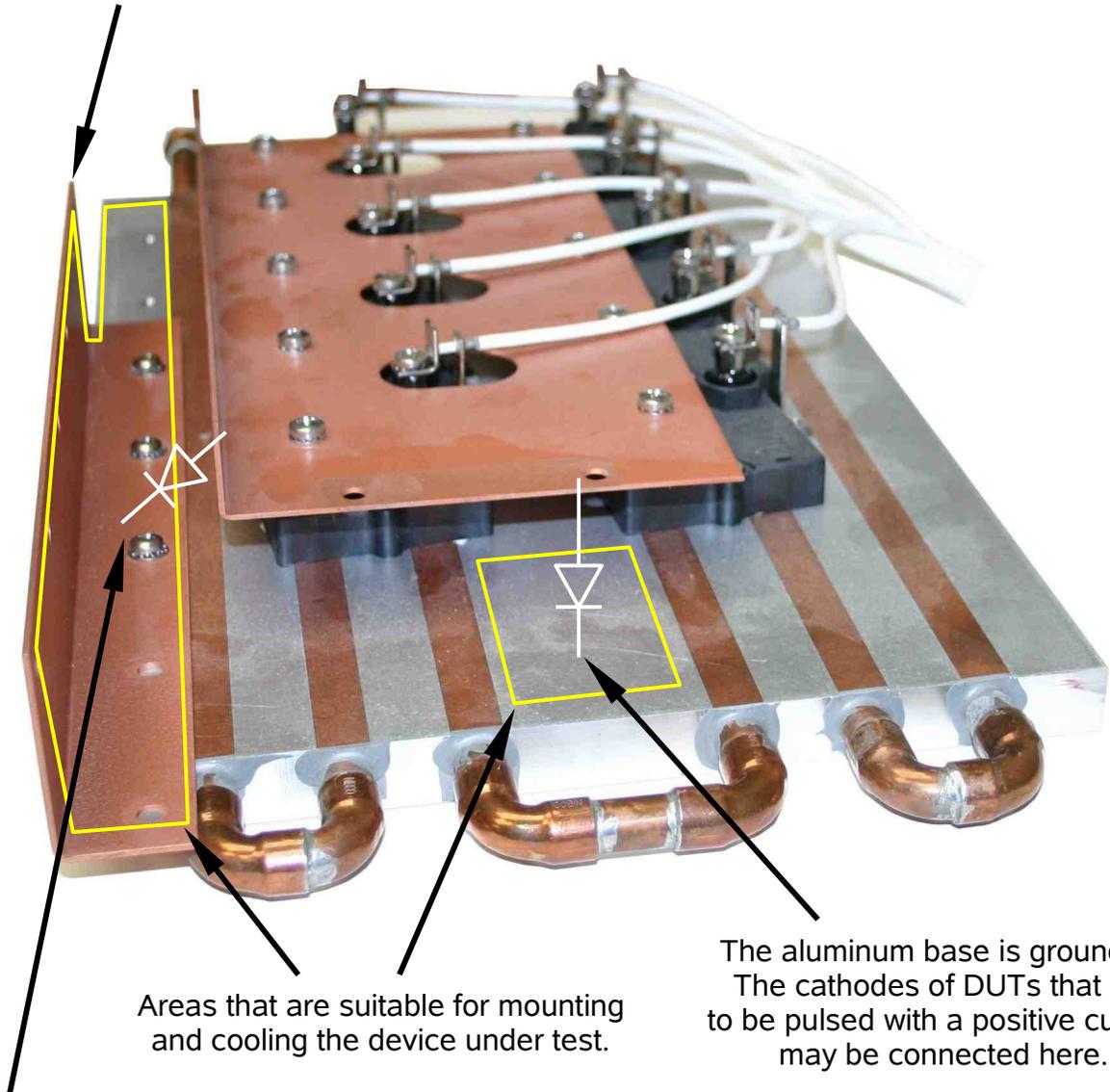
## Corresponding Photograph (Top View)



This unused area is available for mounting the end-user's devices. Holes can be drilled in the aluminum areas of the base plate, as desired. The width of this area can be increased by 4 inches / 10 cm by using a 20-inch wide base plate (specify the -W20 option) instead of the standard 16-inch wide version (shown above).

Possible Locations for a Diode DUT

When used as a series resistance for a diode DUT, the ground jumper bar is not used. In this photo, it has been rotated away from the output plate. In this configuration, it may be used as a convenient grounding point for the diode device under test.



Areas that are suitable for mounting and cooling the device under test.

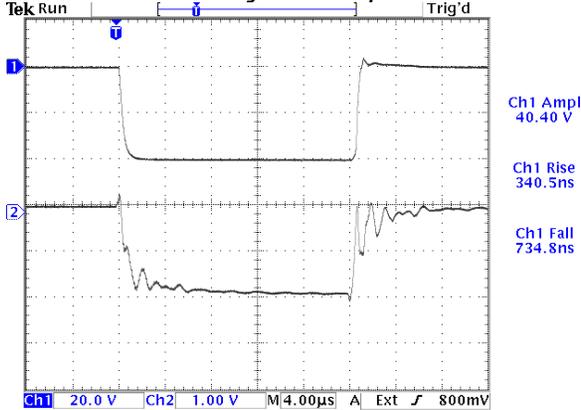
The aluminum base is grounded. The cathodes of DUTs that are to be pulsed with a positive current may be connected here.

These mounting holes on the aluminum base are also suitable for grounding cathodes.

## Typical Waveforms

An Avtech pulse generator was used to generate 200 Amp pulses into a load attached directly to its output connector, and to an AV-HTL-0R2 for comparison:

### With Load Directly on Output Connector



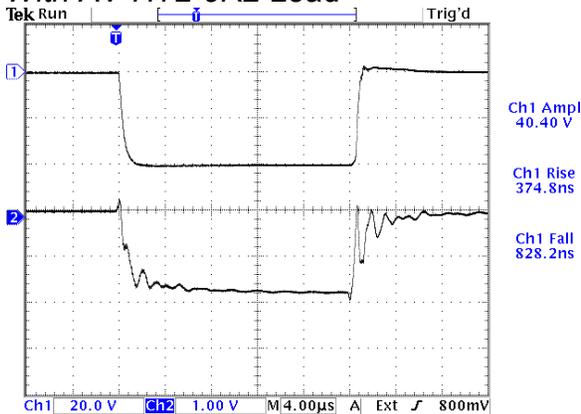
Top: output into the 0.2Ω load. 20 V/div.  
Bottom: monitor output. 100 A/div.

### Photo of Test Load



The test load consisted of five Ohmite AX10GK 1.0Ω high-impulse ceramic composition resistors wired in parallel and installed directly on the output connector (using an adapter)

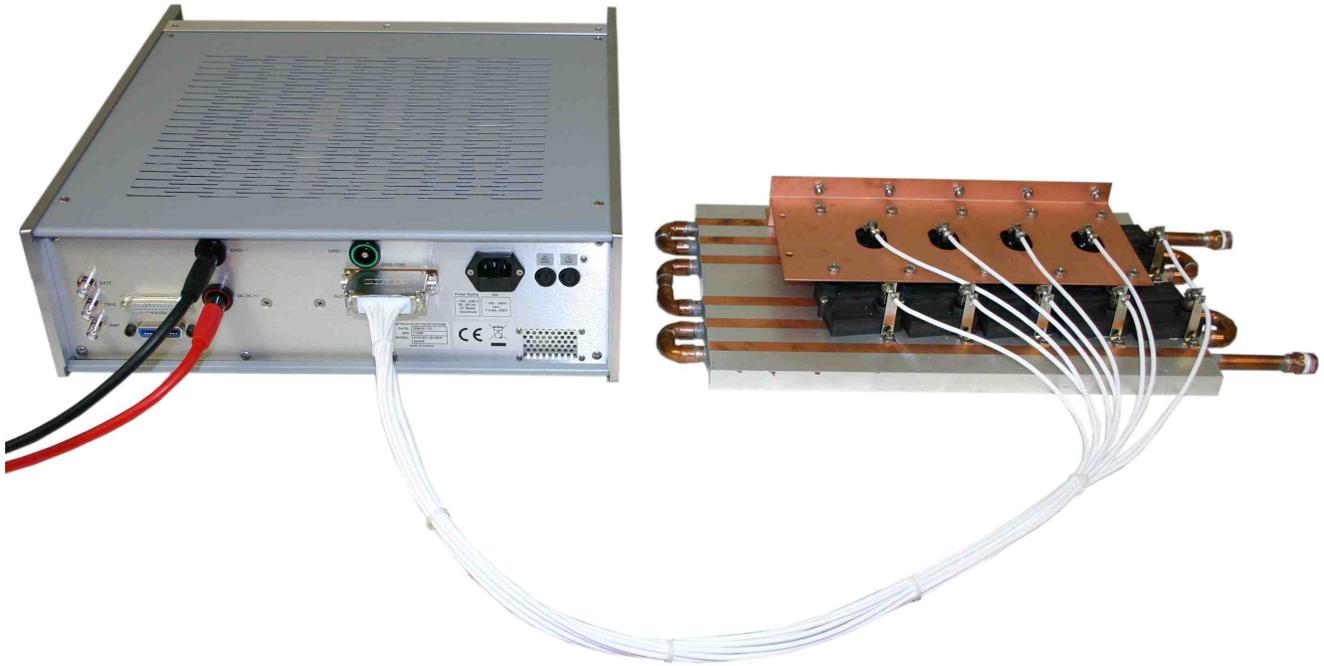
### With AV-HTL-0R2 Load



The transition time of the leading edge of the voltage waveform across the resistor has increased slightly from 734 ns to 828 ns (10%-90%). The monitor waveform, which is generated by a LEM LA 150-P current transducer, is only slightly degraded as well. (This current transducer has a maximum di/dt rating of 200 V/μs, so it introduces some ringing into the measurements, since the AVO-8C1-B is generating faster di/dt rates. These are measurement artefacts, rather than actual ringing.)

*It can be concluded from these waveforms that the AV-HTL-0R2 does not introduce significant amounts of parasitic inductance.*

Photo of an AVO-8C1-B-P with an AV-HTL-0R2 Resistive Load



With the AVO-8C1-B delivering 40V into the 0.2 Ohm load, at a frequency of 1 kHz and a duty cycle of 35%, the average power delivered to the load is 2800 Watts. Under these conditions, with water flow from a conventional tap (at 4°C), a base plate temperature of 16°C was measured.

Alternative Input Connector (-HLZ Option)



The -HLZ connector mates to the output connector of Avtech AVO-8 models, replacing the standard DB37 connector.