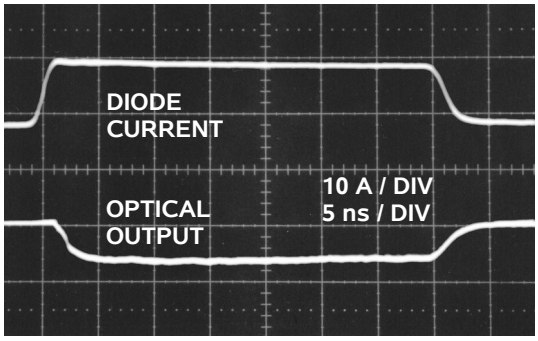
AVX-S SERIES

LASER DIODE BIAS INSERTION UNITS WITH SOCKET MOUNTING



- Simple socket mounting of laser diodes
- Standard and customized pinouts
- Interchangeable modules
- High bandwidths, fast rise times
- Diode voltage monitor and photodiode output options

AVX-S bias insertion units (or "output modules") provide a simple but effective way of connecting a laser diode to a pulse generator (and possibly a DC bias). The user-supplied laser diode is inserted into a specially-designed high-speed socket included on one side of the AVX-S unit. The socket is optimized to provide minimal rise time degradation. The AVX-S bias insertion unit includes the necessary networks to match the laser diode to the pulse source (typically an ultra-fast Avtech pulse generator). Contact Avtech for recommended pulse generator / output module combinations. See also the Avtech AVO-9 series of laser diode drivers - each AVO-9 laser diode driver includes a matched AVX-S output module.

Avtech can accommodate common laser diode packages from Lumics, Qphotonics, Fitel, Fujitsu, Mitsubishi, Bookham, Ulm Photonics, Nichia, and others.

Each model is customized for a specific diode's pinout and I-V characteristics. If a “generic” pinout option (e.g., -P0, -P1, -P2, -P3, -TO3) is selected, then a drawing showing the diode package size and electrical pinout must be provided to Avtech by the end-user, and a customized model number will be provided. If a “specific” pinout option has been selected (-P1B or -P1C, for instance), no additional information is required. Readily available socket configurations (butterfly, 5.6 and 9 mm cans, TO-3, etc) are shown on the following pages. Note that the laser diodes are not supplied by Avtech.

The AVX-S series includes four basic models (specifically the AVX-S1, AVX-S2, AVX-S3, and AVX-S5). The basic functional equivalent circuits are shown on the following pages. Model AVX-S1 is specifically designed for ultra high-speed, low current applications (rise times as low as 200 ps, bandwidths to 100 MHz, and peak currents to 400 mA). The AVX-S1 is employed in the AVO-9 series of diode drivers. Model AVX-S2 is intended for applications with rise times greater than 2 ns and currents above 1 Ampere. AVX-S3 models include special current-boosting and impedance-matching transformers. Model AVX-S5 is intended for use with the AV-1010-B series of pulse generators.

The input series blocking capacitor in Models AVX-S1 and AVX-S2 presents a low impedance to pulse signals, while the shunt inductor presents a high impedance to pulse signals but a low impedance to the DC bias. The resistor in series with the laser diode is selected to ensure that the impedance at the IN port is 50 Ω. Normally a laser diode resistance (i.e., dV/dI at the operating point) of approximately zero Ohms is assumed. For device configurations where the DUT dV/dI at lasing is several Ohms or more, the internal series resistance is reduced to compensate.

Monitor outputs are available, which are useful for observing the diode voltage and current waveforms.

The diode current monitor (MI) provides an output waveform (to 50 Ω) which is an attenuated replica of the voltage applied to the series combination of the laser diode and the series resistance. The output amplitude (V_{MI}) and diode current (I_D) are related as follows:

$$I_D \approx 11\times (V_{MI} - V_{MV}) / 50\Omega$$

The diode voltage monitor (MV) provides an output waveform that may be related to the voltage across the laser diode (V_D) as follows:

$$V_{MV} \approx V_D / 11$$

The -MD option provides a low-bandwidth connection to the photodiode detector output, if the user’s device incorporates a photodiode. (Avtech can provide high-bandwidth connections, if required.)

The AVX-S3 models include a matching transformer that effectively boosts the laser diode current beyond that provided by the pulse source. Model AVX-S3A is designed to match 50 Ohm pulse generators to loads in the range of 10 to 12.5 Ω, with peak currents of up to 5 A. The series resistor R_S in the equivalent circuit for this model is normally 10 Ω (allowing 0 - 2.5Ω for R_{DIODE}). The series resistance of the laser diode and the series resistor (R_{DIODE} + R_S) should ideally equal the pulse generator’s specified load impedance divided by N^2. If the series resistance of the laser diode is higher it may be necessary to reduce the value of R_S.

Model AVX-S3C is designed to match Model AVO-9W-B to load resistances of 6 Ω, and will provide peak diode currents as high as 10 A.

The AVX-S5 omits the DC bias tee circuit. This allows operation at wider pulse widths (up to 10 ms), for compatibility with the AV-1010-B series of pulse generators.

All models include two-foot-long input cabling with SMA male connectors. All AVX-S models are available with a polarity inverting option. This adds (or re-configures) a transformer on the input, which will invert positive pulses to negative polarity, and vice versa.

Contact Avtech (info@avtechpulse.com) with your special requirements!

Model:	AVX-S1	AVX-S2	AVX-S2-HP	AVX-S5	AVX-S3A	AVX-S3C
Peak diode current (I_{PEAK}):	400 mA	2 Amps		2 Amps	5 Amps	10 Amps
Max. input amplitude:	20 Volts	100 Volts		100 Volts	150 Volts	150 Volts
Pulse width (PW):	0.4[1] - 200 ns	1 - 1000 ns		10 ns - 10 ms	2 - 100 ns	4 - 50 ns
Rise time (20%-80%):	0.2 ns[1]	0.5 ns		1 ns	0.5 ns	1 ns
Pulse repetition freq. (PRF)[8]:	DC - 25 MHz	DC - 100 kHz		DC – 1 MHz	DC - 20 kHz	DC - 20 kHz
Pulse input impedance:	50 Ω	50 Ω		50 Ω	50 Ω	25 Ω
N (transformer ratio[2,3]):	+1	+1		+1	+2	+2
$R_S + R_{DIODE}$[9,10,12]:	50 Ω, ½ W	50 Ω, 5 W		50 Ω, 5 W	12.5 Ω, ½ W	6 Ω, ½ W
Max. DC bias current:	100 mA	100 mA	320 mA	none	100 mA	100 mA
R_{DC} (in series with DC input)[11]:	50 Ω, ½ W	50 Ω, ½ W	50 Ω, 5 W	none	10 Ω, ½ W	10 Ω, ½ W
Max. DC bias voltage:	50 Volts	50 Volts		none	50 Volts	50 Volts
IN connector:	1 SMA					2 SMA
Included cables[7]:	1					2
Other connectors:	MV, MI, MD: SMA (female), DC bias: solder terminal					
Diode socket:	-P0 option: for 3-pin 5.6mm or 9mm package with 2.54mm PCD[4] -P1 option: for generic butterfly package, see footnote[4] -P1B option: for specific butterfly package, see footnote[5] -P1C option: for specific butterfly package, see footnote[6] -P2 option: for 3-pin 5.6mm package with 2.0mm PCD[4] -P3 option: for 8-pin DIP package[4] -TO3 option: for TO-3 package[4] *Other sockets available upon request.*					
Dimensions:	H x W x D: 42 mm x 67 mm x 76 mm (1.6" x 2.6" x 3.0")					
Material:	Cast aluminum, blue enamel					

1) Lower pulse widths (to 0.2 ns) and faster rise times (0.1 ns) may be possible for laser diode packages with very low parasitic inductance. The -P0 and -P2 packages generally have very low inductance. The -P1, -P3, and -TO3 packages normally have somewhat higher parasitic inductance.
2) The transformer reduces the input voltage by a factor of N (approx) and increases the current by a factor of N (approx). The load resistance (R_S+R_{DIODE}) must equal 50Ω / N^2 (approx).
3) A polarity inverting option is available. Add the suffix -INV to the model number to specify this option. "N" is negative (≈ -70% of the standard value) when this option is installed.
4) Generic option. A drawing showing the diode package size and electrical pinout must be provided by the end-user, and the model number & price may change.
5) -P1B (specific pinout option). No further drawings are required. The socket will accept pins 8-14 of a standard butterfly package with 0.5 mm wide pins. A pulse will be applied to the diode anode (pin 10). Pins 8-9 and 11-13 will be grounded. Pin 14 will be made accessible through a solder terminal. Four mounting holes on a 8.9 x 26 mm grid will be provided. The diode parasitic resistance (dV/dI at lasing) must be < 1 Ohm. A low-bandwidth slide-on socket can also be provided for pins 1-7 of the diode, with the thermal control pins brought out to a standard DB-9 connector (-T1B option).
6) -P1C (specific pinout option). No further drawings are required. The socket will accept pins 8-14 of a standard butterfly package with 0.5 mm wide pins. A negative pulse will be applied to the diode cathode (pin 12). Pins 8-11 and 13-14 will be grounded. Four mounting holes on a 8.9 x 26 mm grid will be provided. The laser input impedance (dV/dI at lasing) must be 25 Ω (+/- 5 Ω). If the internal resistance is 0 Ω (instead of 25 Ω), use the -P1CR0 suffix instead. Not available on AVX-S3 models. A low-bandwidth slide-on socket can also be provided for pins 1-7 of the diode, with the thermal control pins brought out to a standard DB-9 connector (-T1C option).
7) 60 cm / 2 ft, SMA male to SMA male (except for the AVX-S5, which provides SMA male to BNC male).
8) These devices are generally intended for use with Avtech pulse generators (in pulse mode), and are not characterized for CW operation. An estimate of the upper bandwidth limit may be made from the rated rise time. The lower end of the CW passband may be estimated using the maximum rated pulse width.
9) Do not exceed the rated power dissipation. For pulse mode operation, the power dissipated in R_S is given by ($I_{PULSE}^2 \times R_S \times PW \times PRF$) + ($I_{DC}^2 \times R_S$).
10) If the diode resistance (dV/dI at lasing) is greater than one-tenth of R_S, R_S should be reduced. Contact a sales engineer for details (info@avtechpulse.com).
11) Do not exceed the rated power dissipation. The power dissipated in R_{DC} is given by ($I_{DC}^2 \times R_{DC}$).
12) R_{DIODE}, the dV/dI at lasing of the DUT, is assumed to be ≈ 0Ω for most pinout options. For the -P1C option, R_{DIODE} is 25Ω (a fixed resistance inside the DUT), so R_S (the fixed resistance inside the AVX-S) is correspondingly reduced to 25Ω. For the -P2B option, R_{DIODE} is ≈ 20Ω, so R_S is correspondingly reduced to 30Ω.

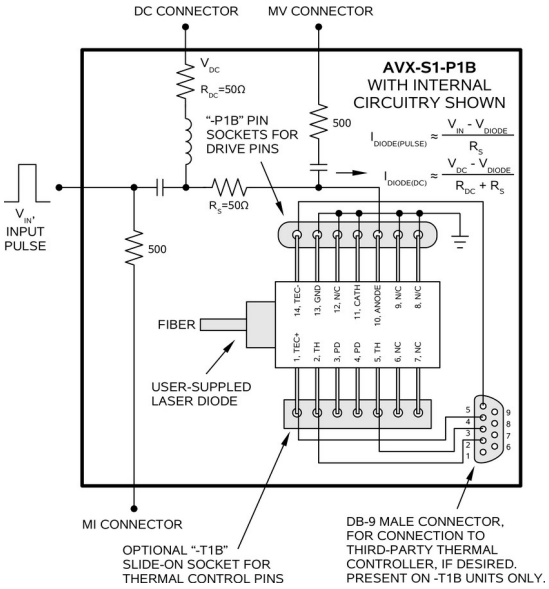


Fig 1. AVX-S1-P1B & AVX-S2-P1B Functional Equivalent Circuit.

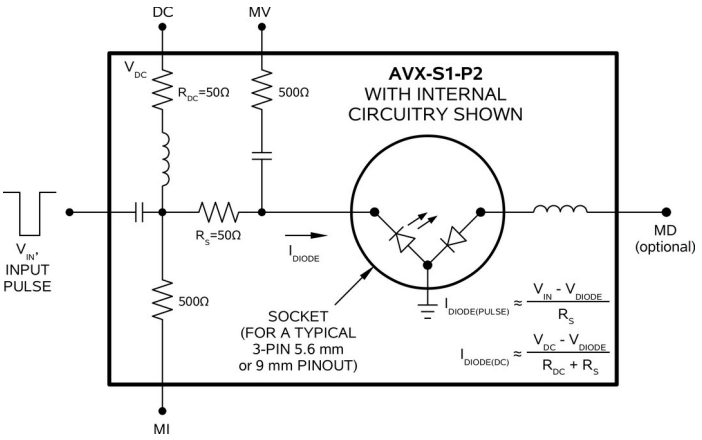
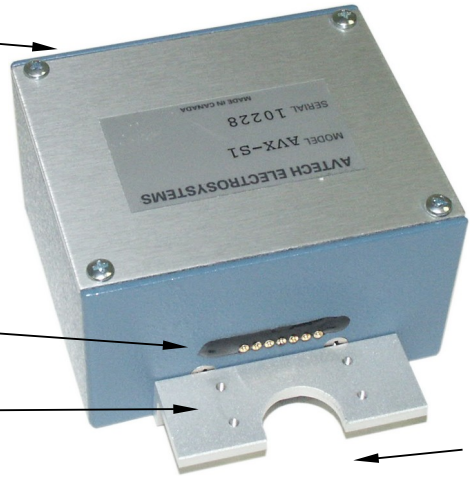


Fig. 2 – AVX-S1-P0 & AVX-S1-P2 Functional Equivalent Circuit

OUTPUT MODULE FOR A BUTTERFLY-PACKAGED DIODE, WITHOUT THE -T1B OR -T1C OPTIONS



SMA connectors are on the back side

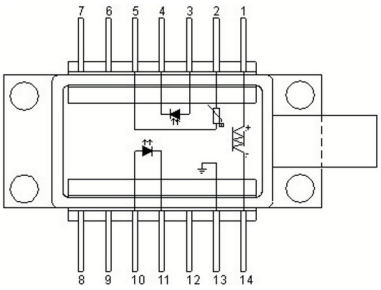
High-speed pin sockets for pins 8-14 of a butterfly package

Mounting bracket with tapped holes for butterfly package

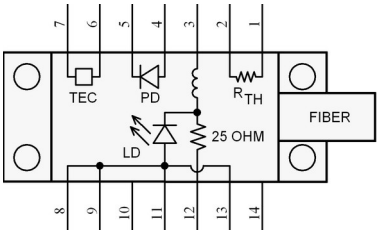
Pins 1-7 of the butterfly package would be user-accessible in free space in this region. See the next page for an example of the -T1B connectorization scheme for these pins.

COMMON PACKAGES THAT CAN BE ACCOMODATED

For butterfly devices, Avtech can provide output modules that either mate to just one side of the package (the side with the anode and cathode), or to both sides of the package (to permit access to the thermoelectric cooler and thermistor pins).

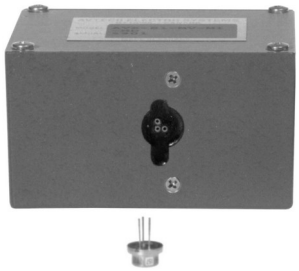


-P1B / -T1B Package Options, *for butterfly packages with the anode on pin 10 and the cathode on pin 11. The -P1B option provides high-speed pin sockets for pins 8-14. To specify an additional low-bandwidth slide-on socket for pins 1-7, add the -T1B option.*

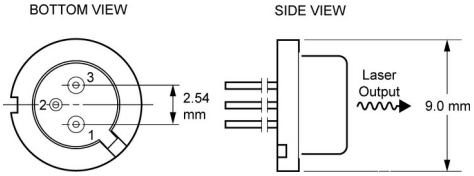


-P1C / -T1C Package Options, *for butterfly packages with the anode on pin 11 and the cathode on pin 12, and an internal series resistance of ≈ 25 Ω. The -P1C option provides high-speed pin sockets for pins 8-14. To specify an additional low-bandwidth slide-on socket for pins 1-7, add the -T1C option. If the internal resistance is 0 Ω, use the -P1CR0 suffix instead.*

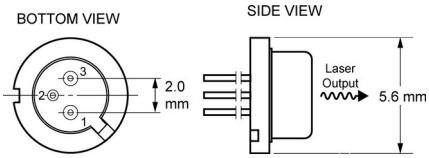
Other packages can be accommodated. Contact Avtech with your special requirement!



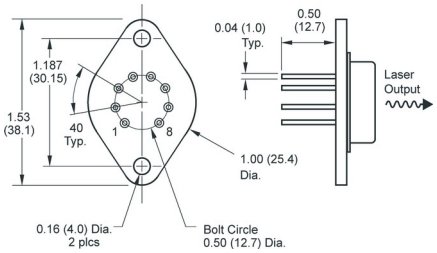
Example of an output module with a socket for a 9 mm package (-P0 option)



-P0 Option, *generic* 5.6 mm or 9 mm Package with 2.54 mm pin circle diameter (PCD)*



-P2 Option, *generic* 5.6 mm Package with 2.0 mm pin circle diameter (PCD)*



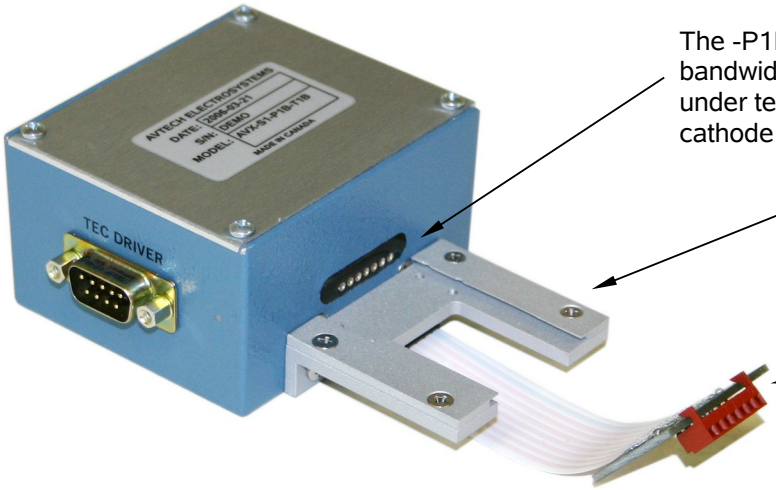
-TO3 Option, *generic* TO-3 Package*

** Additional details (pinout, diode resistance) must be supplied by the end-user if this option is specified.*

SAMPLE OUTPUT MODULE FOR A BUTTERFLY-PACKAGED DIODE, WITH THE -T1B OR -T1C OPTIONS

The photos below show the procedure from inserting a typical pigtailed device into an output module with the -P1B and -T1B options (or the -P1C and -T1C options). This is just an example; your diode may differ. (For instance, the fiber may exit the diode on the opposite side.)

Step 1 - Understand the Mechanical Aspects

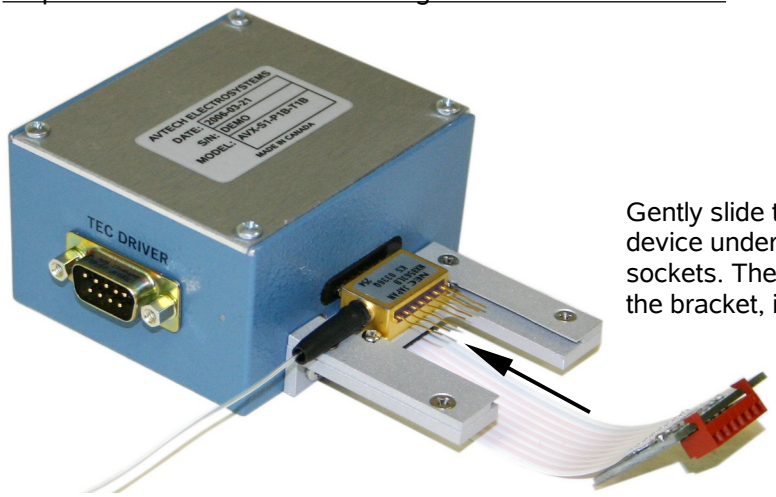


The -P1B and -P1C options provide ultra-high-bandwidth pins sockets for pins 8-14 of the device under test, where the high-bandwidth anode and cathode pins are normally located.

A mounting / heatsinking bracket is provided. Guidance grooves for installing the diode and slide-on socket are provided on models with the -T1B option.

The -T1B and -T1C options provide a slide-on socket for pins 1-7 of the device under test, where the low-bandwidth thermal control pins are normally located.

Step 2 - Insert the Diode into the High-Bandwidth Pin Sockets



Gently slide the high-bandwidth side of the device under test into the matching pin sockets. The device can be screwed down to the bracket, if desired.

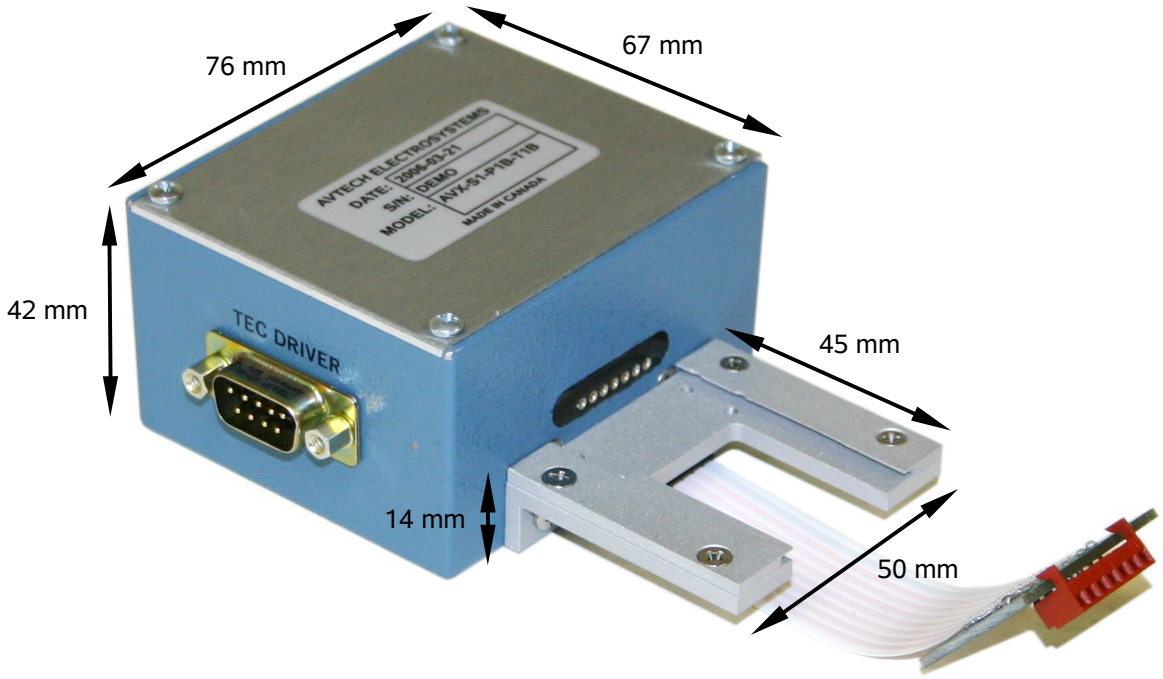
Step 3 - Install the Slide-On Socket on the Low-Bandwidth Pins

Gently slide the low-bandwidth slide-on socket onto the matching pins of the device under test. The slide-on socket is connected to the output module using a short length of flexible ribbon cable. The thermoelectric cooler and thermistor pins are made accessible to the user through the “TEC DRIVER” DB-9 connector, which will mate to cables from common third-party TEC controllers.

(The SMA connectors which connect to the cabling from the mainframe are on the module side opposite the pin socket. They are not visible in these photos.)

To optional third-party TEC controller.

TYPICAL OUTPUT MODULE DIMENSIONS (APPROXIMATE)



TYPICAL MOUNTING HOLE PATTERN (BOTTOM VIEW)