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NANOSECOND WAVEFORM ELECTRONICS  
SINCE 1975

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## INSTRUCTIONS

MODEL AVO-9A-MTH-P1B-T1B-P-HC

400 mA, 200 ps RISE TIME

HIGH PERFORMANCE LASER DIODE DRIVER MODULE

WITH PLUG-IN SOCKET OUTPUT

FOR BUTTERFLY-PACKAGED LASER DIODES

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.

### TECHNICAL SUPPORT

Phone: 888-670-8729 (USA & Canada) or +1-613-226-5772 (Intl)

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Manual Reference: /fileserver1/officefiles/instructword/avo-9/AVO-9A-MTH-P1B-T1B-P-HC,ed1.odt.

Last modified February 29, 2024.

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## INTRODUCTION

The AVO-9A-MTH-P1B-T1B-P-HC is a high performance DC-powered laser diode driver module capable of generating up to +400 mA of current into diode loads, at repetition rates up to 1 MHz. The pulse width is adjustable from 0.4 to 4 ns. The rise and fall times are 200 ps or less.

The AVO-9A-MTH-P1B-T1B-P-HC module provides a socket into which the user's laser diode may be inserted. A DC bias current of 0 to > +100 mA may be applied to the laser diode.

The amplitude, pulse width, and DC bias current are controlled by user-accessible trim pots. The voltages (0 to +10V, approximately) generated on the wipers of these trim pots are available on terminals for measurement purposes.

The module includes an SMA output connector that provides an attenuated coincident replica of the diode current.

The AVO-9A-MTH-P1B-T1B-P-HC must be triggered by an externally-generated TTL-level pulse.

This instrument is intended for use in research, development, test and calibration laboratories by qualified personnel.

## SPECIFICATIONS

Model:	AVO-9A-MTH-P1B-T1B-P-HC
Amplitude, standard:	+40 to +400 mA
Allowed load voltage range:	0 to 3V
Pulse width (FWHM):	0.4 - 4 ns
Duty cycle limits:	N/A
Minimum PRF:	1 Hz
Maximum PRF:	1 MHz
Rise / fall times (20%-80%):	≤ 200 ps
Related 50Ω series:	AVP-AV-1
Polarity:	Positive
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)
Jitter:	± 35 ps ± 0.015% of sync delay (Ext trig in to pulse out)
DC offset or bias insertion:	+10 to +100 mA, adjustable
Trigger required (ext trig mode):	+3 to +5V (TTL), ≥ 50 ns
Connectors:	Out: -P1B socket, -T1B socket Other: Trig, Monitor: SMA
Power requirements:	+24V DC, 320 mA and -24V DC, 125 mA
Dimensions (H×W×D):	43 mm x 76 mm x 200 mm
Temperature range:	+5°C to +40°C

ORIGINAL QUOTATION

Date: Fri, 11 Dec 2009 10:31:14 -0500  
From: Avtech Sales  
To: XXXXX  
Subject: Re: Quote number: 14959

XXXXX,

The MTB and MTF versions have different methods of controlling the amplitude and DC offset, as you have requested various different arrangements over time.

Each time you change a specification, the model number and pricing is changed.

I am pleased to quote on a version that has internal trimpots, where the trimpot voltages are made accessible for measurement.

Quote number: 15046

Model number: AVO-9A-MTH-P1B-T1B-P-HC

Description: Laser Diode Driver Module. The instrument is provided in an DC-powered externally-triggered module format.

DC power required: +24V and -24V DC

Amplitude: +40 to +400 mA, adjustable. The amplitude is controlled by a ten-turn trimpot. The 0 to +10V voltage generated by this trimpot is available on one pin of the multi-square-pin header for measurement.

DC offset: +10 to +100 mA, adjustable. The DC offset is controlled by a ten-turn trimpot. The 0 to +10V voltage generated by this trimpot is available on one pin of the multi-square-pin header for measurement.

Pulse width (FWHM): 0.4 to 4 ns, adjustable.

Pulse width control: The pulse width is controlled by a 0 to +10V DC control voltage applied to one pin of a multi-square-pin header.

Maximum PRF: 1 MHz. The output PRF equals the PRF of the external trigger.

Rise / fall times (20%-80%): < 200 ps

Sync output, Gate input, GPIB/RS-232 ports: none

Monitor output: The standard "MI" output is provided. No "MV" output is provided.

Approximate dimensions (H x W x D): 43 mm x 76 mm x 200 mm

External trigger required: A TTL-level pulse, 50 ns or wider. The input connector is SMA female, and the input impedance is 50 Ohms.

Other: the electrical output is similar to that provided by the standard AVO-9A models described at <http://www.avtechpulse.com/laser/avo-9a>.

-P1B option: Specifies this common diode configuration (typical of Lumics diodes, and others): The socket will accept pins 8-14 of a standard butterfly package with 0.5 mm wide pins. A positive pulse will be applied to the diode anode (pin 10). Pins 8-9 and 11-13 will be grounded. Four mounting holes on a 8.9 x 26 mm grid will be provided. The diode parasitic resistance (dV/dI at lasing) must be 0 to 2 Ohms.

-T1B option: Adds a secondary (low-bandwidth) slide-on socket board for pins 1-7 of a butterfly package. A flexible cable connects the slide-on socket to the output module. A male DB-9 connector is provided on the output module, which provides access to the thermal control pins of the diode. DB-9 pin 2 connects to diode pin 2 (TH). DB-9 pin 3 connects to diode pin 5 (TH). DB-9 pin 4 connects to diode pin 1 (TEC+). DB-9 pin 5 connects to diode pin 14 (TEC-). The remaining DB-9 pins are unconnected. Pins 3, 4, 6, and 7 of the diode are grounded. Access to the photodiode, if present, is not provided. This option is designed for compatibility with Thorlabs temperature controllers and Lumics laser diodes. It may be suitable for others as well.

Price (Quantity 1-2): \$XXXXX US each, Ex-works Ottawa, Canada.

Price (Quantity 3-4): \$XXXXX US each, Ex-works Ottawa, Canada.

Price (Quantity 5-7): \$XXXXX US each, Ex-works Ottawa, Canada.

Price (Quantity 8-10): \$XXXXX US each, Ex-works Ottawa, Canada.

Quote valid for: 8 weeks

Estimated delivery: 8-12 weeks after receipt of order (excluding export permit\* delays).

\*Export Permit: These instruments are very high performance pulse generators, which are considered to be "Nuclear-Related Dual-Use Goods" under government regulations. As such, an "End Use Statement" must be completed when ordering. The necessary form is attached (in PDF format). We will use the information in the completed form to apply for an export license from the Canadian government, which will take 1 to 6 weeks to obtain. We cannot ship your order without the license. Please return the completed form to us by fax.

WEEE/ROHS notes: The form available at [http://www.avtechpulse.com/green/weee\\_agreement.pdf](http://www.avtechpulse.com/green/weee_agreement.pdf) must be completed and faxed to Avtech prior to any direct sales by Avtech to European customers.

Please call or email me if I can be of further assistance.

Thank you for your interest in our products!

Regards,

Dr. Michael J. Chudobiak  
Chief Engineer

--- Avtech Electrosystems Ltd. ----- since 1975 ---





## REGULATORY NOTES

### FCC PART 18

This device complies with part 18 of the FCC rules for non-consumer industrial, scientific and medical (ISM) equipment.

This instrument is enclosed in a rugged metal chassis and uses a filtered power entry module (where applicable). The main output signal is provided on a shielded connector that is intended to be used with shielded coaxial cabling and a shielded load. Under these conditions, the interference potential of this instrument is low.

If interference is observed, check that appropriate well-shielded cabling is used on the output connectors. Contact Avtech ([info@avtechpulse.com](mailto:info@avtechpulse.com)) for advice if you are unsure of the most appropriate cabling. Also, check that your load is adequately shielded. It may be necessary to enclose the load in a metal enclosure.

If any of the connectors on the instrument are unused, they should be covered with shielded metal "dust caps" to reduce the interference potential.

This instrument does not normally require regular maintenance to minimize interference potential. However, if loose hardware or connectors are noted, they should be tightened. Contact Avtech ([info@avtechpulse.com](mailto:info@avtechpulse.com)) if you require assistance.

### EC DECLARATION OF CONFORMITY



We                    Avtech Electrosystems Ltd.  
                          P.O. Box 5120, LCD Merivale  
                          Ottawa, Ontario  
                          Canada K2C 3H4

declare that this pulse generator meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emission

EN 50082-1 Immunity

and that this pulse generator meets the intent of the Low Voltage Directive 72/23/EEC as amended by 93/68/EEC. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use

#### DIRECTIVE 2002/95/EC (RoHS)

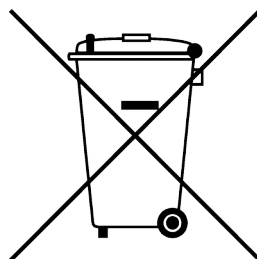
This instrument is exempt from Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment. Specifically, Avtech instruments are considered "Monitoring and control instruments" (Category 9) as defined in Annex 1A of Directive 2002/96/EC. The Directive 2002/95/EC only applies to Directive 2002/96/EC categories 1-7 and 10, as stated in the "Article 2 - Scope" section of Directive 2002/95/EC.

#### DIRECTIVE 2002/96/EC (WEEE)

European customers who have purchased this equipment directly from Avtech will have completed a "WEEE Responsibility Agreement" form, accepting responsibility for WEEE compliance (as mandated in Directive 2002/96/EC of the European Union and local laws) on behalf of the customer, as provided for under Article 9 of Directive 2002/96/EC.

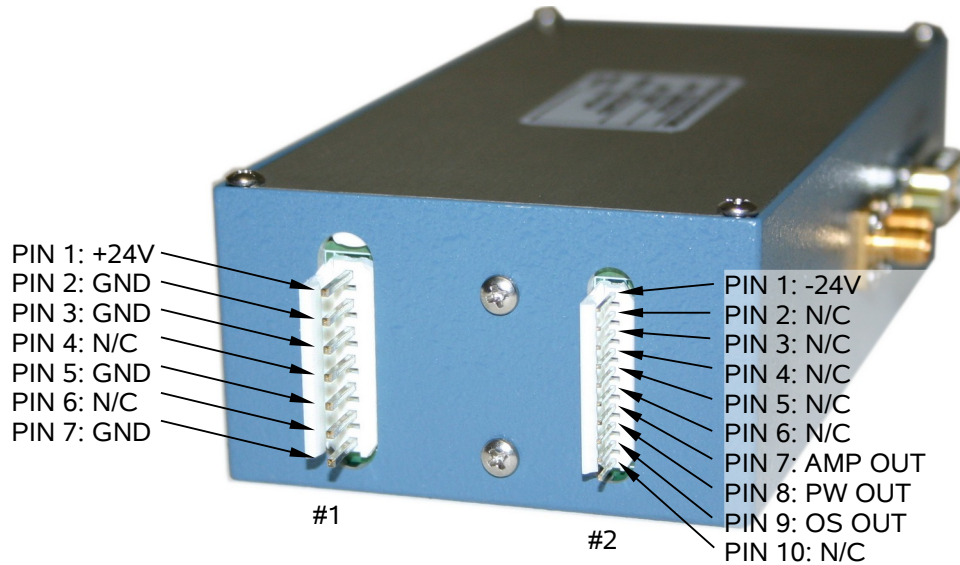
Customers who have purchased Avtech equipment through local representatives should consult with the representative to determine who has responsibility for WEEE compliance. Normally, such responsibilities will lie with the representative, unless other arrangements (under Article 9) have been made.

Requirements for WEEE compliance may include registration of products with local governments, reporting of recycling activities to local governments, and financing of recycling activities.



## CONTROLS AND CONNECTORS

### TERMINAL CONNECTORS



Connectors #1 and #2 are shown above. These supply the DC power and the amplitude and pulse width signals to the module, as well as any required DC offset for the output.

+24V must be connected to pin 1 of connector #1.

-24V must be connected to pin 1 of connector #2.

Ground must be connected to pin 2 of connector #1.

The output amplitude is controlled by a ten-turn trimpot. The 0 to +10V voltage generated by this trimpot is available on pin 7 of connector #2, for measurement purposes. 0V on this terminal corresponds to minimum amplitude (0), and +10V corresponds to maximum amplitude (400 mA), approximately.

The output pulse width is controlled by a ten-turn trimpot. The 0 to +10V voltage generated by this trimpot is available on pin 8 of connector #2, for measurement purposes. 0V on this terminal corresponds to minimum pulse width (< 0.4 ns), and +10V corresponds to maximum pulse width (> 4 ns), approximately. The pulse width varies linearly with the control voltage.

A forward DC bias may be applied to the laser diode by adjusting a ten-turn trimpot. The application of a small forward bias often yields a more ideal diode current waveform, as observed on the MI port. The 0 to +10V voltage generated by this trimpot is available on pin 9 of connector #2, for measurement purposes. 0V on this terminal

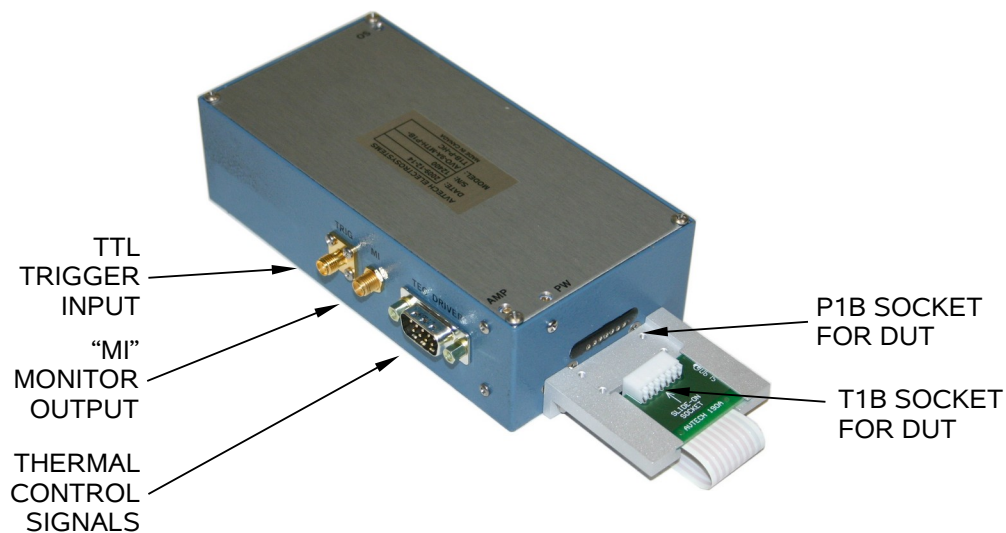
corresponds to minimum DC bias (0), and +10V corresponds to maximum DC bias (123 mA), approximately. The current varies linearly with the control voltage. This voltage controls an internal constant current generator.

Measurements of voltages on pins 7, 8, and 9 of connector #2 should only be made using high-input-impedance measuring devices (DMMs or oscilloscope probes with  $R_{IN} > 1 \text{ M}\Omega$ ). Connecting lower impedances may affect the measured voltage and the related output pulse characteristics.

Connector #1 is an AMP 640445-7 connector. This connector is shipped with a mating AMP 640600-7 insulation-displacement connector installed, for the convenience of the user. The 640600-7 is designed to accept AWG #20 hookup wire.

Connector #2 is an AMP 1-640456-0 connector. This connector is shipped with a mating AMP 4-640621-0 insulation-displacement connector installed, for the convenience of the user. The 4-640621-0 is designed to accept AWG #24 hookup wire.

## SIGNAL CONNECTORS

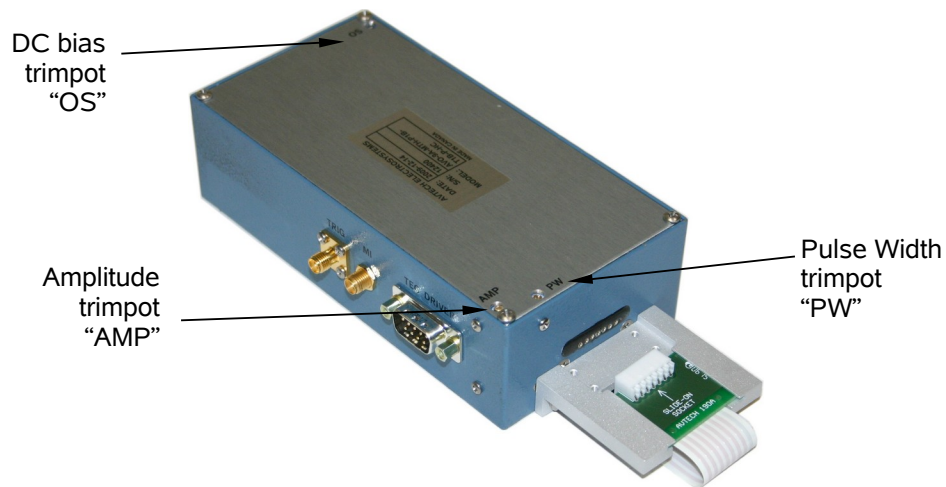


The externally-generated TTL trigger signal must be applied to the SMA connector shown above. The input impedance is 50 Ohms.

An oscilloscope may be used to monitor the MI monitor outputs, as discussed in later sections.

## TRIMPOT LOCATIONS

The locations of the ten-turn trimpots controlling the output amplitude, pulse width, and DC offset bias are shown below:



Rotating a trimpot clockwise will increase the controlled parameter (amplitude, pulse width, or DC bias current).

### COOLING

The AVO-9A-MTH-P1B-T1B-P-HC may become warm to the touch, particularly if a large DC offset is generated internally. To prevent this, the AVO-9A-MTH-P1B-T1B-P-HC may be secured to a heat sink using the four 4-40 threaded holes on the bottom side of the module.

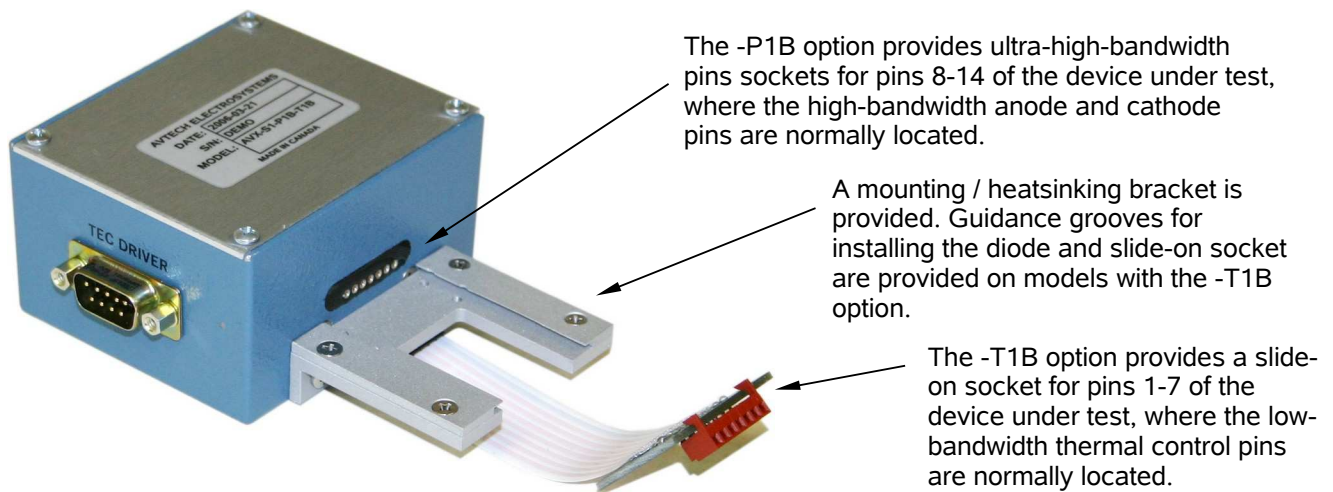
## INSTALLING THE DEVICE UNDER TEST

The module will have a “P1B” high-speed socket for pins 8-14 of the diode under test. If the “-T1B” option has been specified, a slide-on socket for pins 1-7 of the diode will also be present.

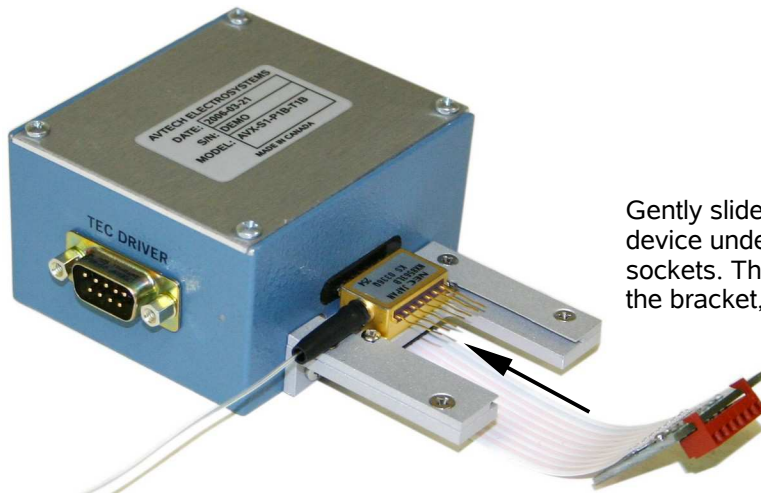
The “P1B” socket consists of seven high-bandwidth pin sockets. This socket arrangement will accept pins 8-14 of a standard butterfly package with 0.5 mm wide pins. A positive pulse will be applied to the diode anode (pin 10). Pins 8-9 and 11-13 will be grounded.

The optional “T1B” socket consists of a low-bandwidth slide-on socket board for pins 1-7 of a butterfly package. A flexible cable connects the slide-on socket to the output module. A male DB-9 connector is provided on the output module, which provides access to the thermal control pins of the diode. DB-9 pin 2 connects to diode pin 2 (TH). DB-9 pin 3 connects to diode pin 5 (TH). DB-9 pin 4 connects to diode pin 1 (TEC+). DB-9 pin 5 connects to diode pin 14 (TEC-). The remaining DB-9 pins are unconnected. Pins 3, 4, 6, and 7 of the diode are grounded. Access to the photodiode, if present, is not provided. This option is designed for compatibility with Thorlabs temperature controllers and Lumics laser diodes. It may be suitable for others as well.

With no diode installed, the module will look similar to this:



The diode is first installed by sliding pins 8-14 into the “P1B” pin sockets, as shown below:



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.

If present, the T1B slide-on socket assembly can then be slid onto pins 1-7, as shown below:



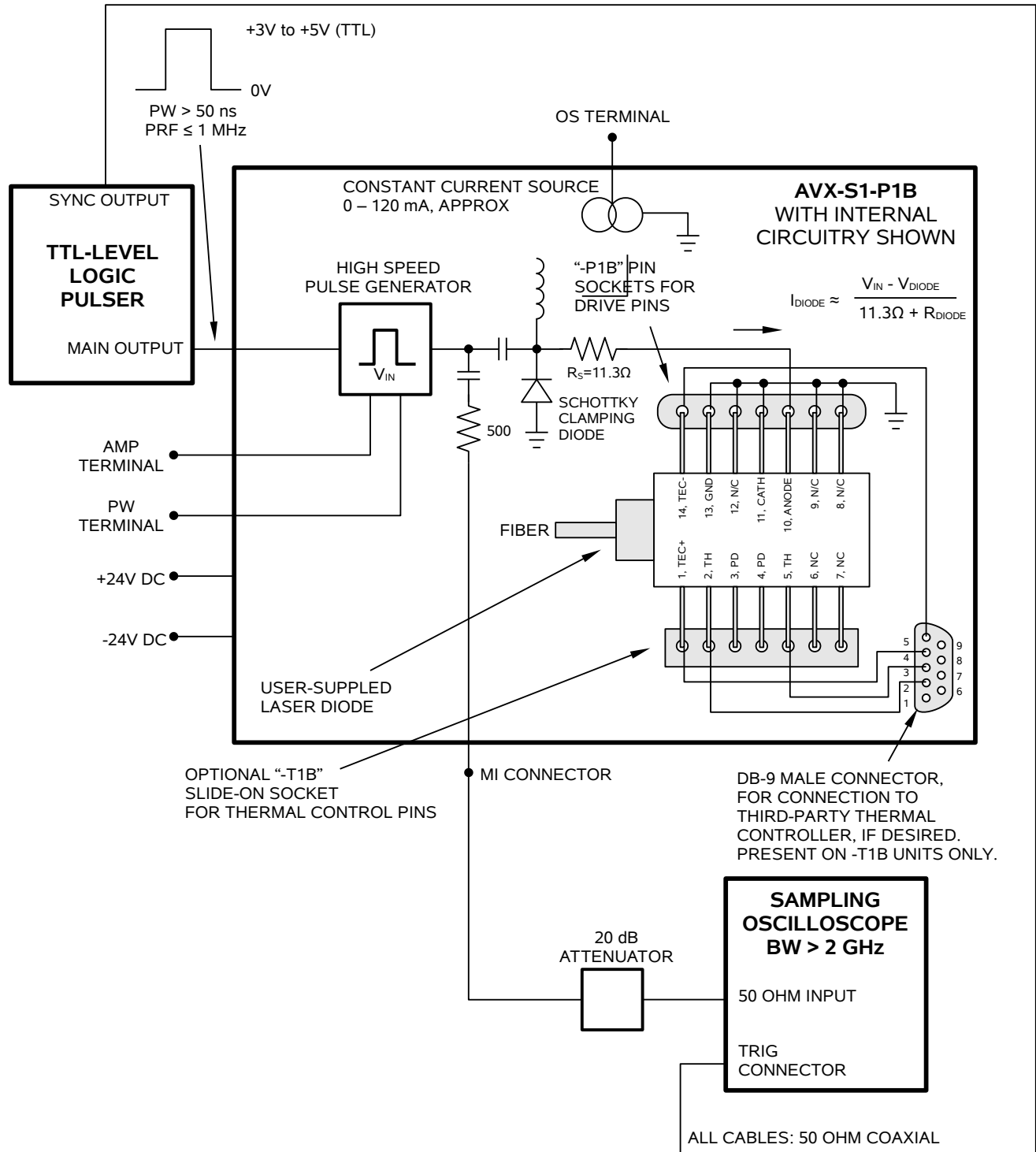
Gently slide the low-bandwidth slide-on socket onto the matching pins of the device under test. The slide-on socket is connected to the output module using a short length of flexible ribbon cable. The thermoelectric cooler and thermistor pins are made accessible to the user through the "TEC DRIVER" DB-9 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.

NORMAL TEST ARRANGEMENT

To fully test the instrument, and for normal operation, the module must be connected as shown below. The basic functional equivalent circuit of the output module is shown below:





### THERMAL CONTROL (-T1B UNITS)

Models with the “-T1B” option include a DB-9 male connector that will mate to third-party temperature controllers. These third-party controller provide a means of controlling the thermoelectric cooler that is typically present in butterfly-packaged laser diodes, if desired. The need for cooling is dependent on the user's application. Cooling is generally recommended by device manufacturers.

### AMPLITUDE CONTROL

The pulse current through the diode load installed in the module is given by:

$$I_{\text{DIODE}} = (V_{\text{IN}} - V_{\text{DIODE}}) / (11.3\Omega + R_{\text{DIODE}})$$

where  $V_{\text{SET}}$  is the amplitude of the internal high-speed voltage pulse generator (between 0 and 7V),  $V_{\text{DIODE}}$  is the forward voltage drop across the diode (typically 2V), and  $R_{\text{DIODE}}$  is typically ~ 1.2 Ohms.

## PROTECTING YOUR INSTRUMENT

### DO NOT EXCEED 1 MHz

The output stage may be damaged if triggered by an external signal at a pulse repetition frequency greater than 1 MHz.

PERFORMANCE CHECKSHEET