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BOX 5120, LCD MERIVALE
OTTAWA, ONTARIO
CANADA K2C 3H5

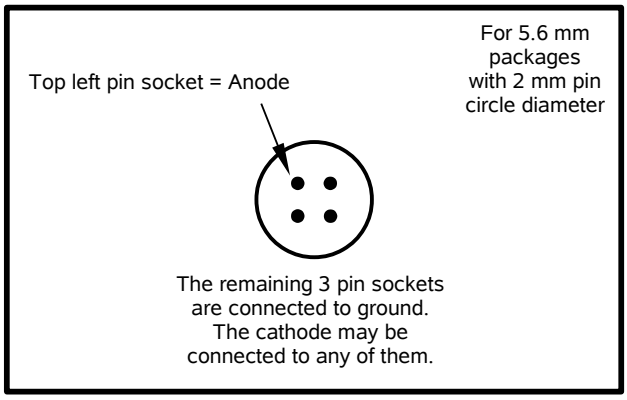
INSTRUCTIONS

MODEL AVO-9A3-B-P-P2D

800 mA, 200 ps RISE TIME

HIGH PERFORMANCE LASER DIODE DRIVER

WITH PLUG-IN SOCKET OUTPUT MODULE



AVX-S1-P2D OUTPUT MODULE, SOCKET VIEW

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 dissembled, 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 +1-613-686-6675 (Intl)
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Manual Reference: /fileserver2/officefiles/instructword/avo-9/AVO-9A3-B-P-P2D,ed1.odt.
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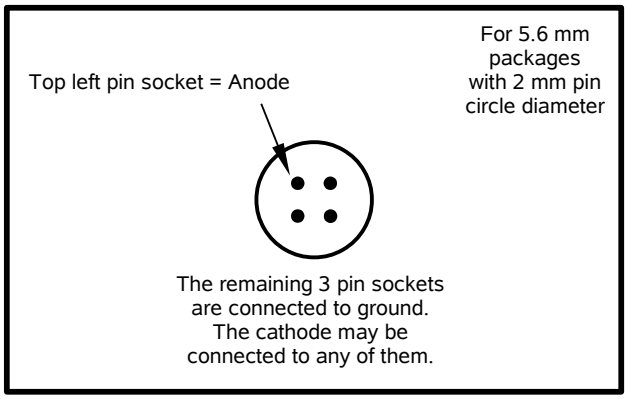
INTRODUCTION

The AVO-9A3-B-P2B is a high performance, GPIB and RS232-equipped instrument capable of generating up to 800 mA of current into diode loads, at repetition rates up to 1 MHz. The pulse width is adjustable from 0.4 to 2 ns (or 4 ns for units with the -W4 option). The rise times are 200 ps or less, and the fall times are 300 ps or less (450 ps or less for units with the -W4 option).

The AVO-9A3-B-P-P2D consists of a mainframe unit and an AVX-S1-P2D series output module, which provides a socket into which the user's laser diode may be inserted. The mainframe generates voltage pulses of up to +43V. The output module connects to the instrument mainframe via a detachable 2 foot long coaxial cable. The output module contains the necessary elements to match the laser diode to the pulse generator mainframe. A DC bias current of 0 to 100 mA may be applied to the laser diode by applying the desired DC current to a solder terminal on the output module. The output modules include an SMA output connector that provides an attenuated coincident replica of the diode current.

The AVX-S1-P2D output module is designed to accommodate a 2, 3 or 4 pin 5.6 mm package with a 2 mm pin circle diameter. Four pin sockets are provided, which accept pins of 0.38-0.56 mm diameter (15-22 mils). A positive pulse signal is applied to one pin socket (for the anode). The other three pin sockets (one of which will be the cathode) are grounded. The diode should have a parasitic resistance (dV/dI at lasing) of < 5 Ohms for proper impedance matching.



AVX-S1-P2D OUTPUT MODULE, SOCKET VIEW

The AVO-9A3-B-P-P2D is a highly flexible instrument. Aside from the internal trigger source, it can also be triggered or gated by external TTL-level signals. A front-panel pushbutton or a computer command can also be used to trigger the instrument.

The AVO-9A3-B-P-P2D features front panel keyboard and adjust knob control of the output pulse parameters along with a four line by 40-character backlit LCD display of the output amplitude, pulse width, pulse repetition frequency, and delay. The instrument

includes memory to store up to four complete instrument setups. The operator may use the front panel or the computer interface to store a complete “snapshot” of all key instrument settings, and recall this setup at a later time.

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

SPECIFICATIONS

Model[1]:	AVO-9A3-B
Maximum amplitude[2,10]:	800 mA
Max. output of mainframe into 50Ω ($V_{MAINFRAME}$)[10]:	43V
R_S + R_{DIODE}:	50Ω
Transformer ratio, N:	1
Allowed load voltage range:	0 to 3V. (Contact Avtech if your diode has a higher forward voltage drop)
Pulse width (FWHM):	0.4 - 2 ns std, 0.4 - 4 ns opt[7]
Maximum PRF[8]:	1 MHz
Rise times (20%-80%):	≤ 200 ps
Fall times (80%-20%)[11]:	≤ 300 ps[7]
Related 50Ω series:	AVP-AV-HV3
Included output module:	AVX-S1
Polarity[3]:	Positive or negative (specify)
GPIB and RS-232 control[1]:	Standard on -B units.
LabView drivers:	Check http://www.avtechpulse.com/labview for availability and downloads
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[4]. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.
Double pulse separation: (option[5])	0 to +50% of the period
Propagation delay:	≤ 150 ns[9] (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:	Apply required DC bias current in the range of ± 100 mA to solder terminal on output module.
Sync delay:	Variable 0 to 200 ns (±1 second for -B units), sync out to pulse out
Sync output (to 50Ω):	+3V, 100 ns
Gate input:	Synchronous or asynchronous, active high or low, switchable. Suppresses triggering when active.
Trigger required:	Ext trig mode: +5 V (TTL), ≥ 50 ns
Monitor output option[6]:	Provides connection to output of photo diode detector.
Connectors: Out: Other:	User-specified socket. Sockets can be provided for 5.6 mm, 9 mm, butterfly, and other packages. Trig, Sync, Gate: BNC, Monitor: SMA
Recommended accessory kit:	Add the suffix "-AK1" to the model number to include the recommended accessory kit. Consists of three SMA, 18 GHz, 2 Watt attenuators (10, 20 & 30 dB) for use on the output, and two 50 Ohm, 1 GHz, 1 Watt feed-through terminators (one SMA, one BNC) for use on external trigger inputs.
Power requirements:	100 - 240 Volts, 50 - 60 Hz
Dimensions, Mainframe: (H×W×D)	100 x 430 x 375 mm (3.9" x 17" x 14.8"). Anodized aluminum, with blue plastic trim.
Dimensions, Output Module:	41 x 66 x 76 mm (1.6" x 2.6" x 3.0"), cast aluminum, blue enamel
Temperature range:	+5°C to +40°C

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude and frequency. See http://www.avtechpulse.com/gpib/ for details.
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output, between the mainframe and the output module. Attenuators are available in the -AK1 accessory kit option.
3) Indicate desired polarity by suffixing model number with -P or -N.
4) Add the suffix -VXI to the model number to specify the Ethernet port.
5) For the double pulse option, add the suffix -DP. This option causes the maximum amplitude to be reduced by 30%.
6) For photo diode output monitor option add suffix -MD.
7) For 0.4 to 4.0 pulse width, suffix model number with -W4. Fall time specification increases to 450 ps for units with the -W4 option.
8) The minimum PRF of the internal oscillator is 1 Hz on -B units. In the external trigger mode, the minimum frequency is 0 Hz.
9) Add 200 ns to propagation delay specification for units with the -DP double-pulse option.
10) At maximum pulse width. The maximum amplitude may fall for narrower pulse widths, with reduction of < 25% at the minimum specified pulse width.
11) The pulse width thresholds are approximate.

REGULATORY NOTES

FCC PART 18

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

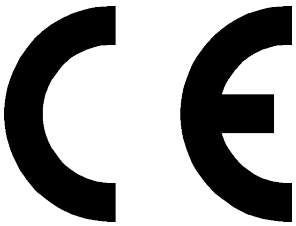
This instrument is enclosed in a rugged metal chassis and uses a filtered power entry module (where applicable). The main output signal is provided on a shielded connector that is intended to be used with shielded coaxial cabling and a shielded load. Under these conditions, the interference potential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

EC DECLARATION OF CONFORMITY



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declare that this pulse generator meets the intent of Directive 2004/108/EG 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 2006/95/EC. 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 2011/65/EU (RoHS)

We Avtech Electrosystems Ltd.
P.O. Box 5120, LCD Merivale
Ottawa, Ontario
Canada K2C 3H5

declare that, to the best of our knowledge, all electrical and electronic equipment (EEE) sold by the company are in compliance with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (also known as “RoHS Recast”). In addition, this declaration of conformity is issued under the sole responsibility of Avtech Electrosystems Ltd. Specifically, products manufactured do not contain the substances listed in the table below in concentrations greater than the listed maximum value.

Material/Substance	*Threshold level*
Lead (Pb)	< 1000 ppm (0.1% by mass)
Mercury (Hg)	< 1000 ppm (0.1% by mass)
Hexavalent Chromium (Cr6+)	< 1000 ppm (0.1% by mass)
Polybrominated Biphenyls (PBB)	< 1000 ppm (0.1% by mass)
Polybrominated Diphenyl ethers (PBDE)	< 1000 ppm (0.1% by mass)
Cadmium (Cd)	< 100 ppm (0.01% by mass)

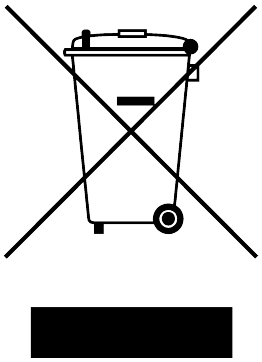
DIRECTIVE 2002/96/EC (WEEE)

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 with 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.



FIRMWARE LICENSING

Instruments with firmware versions 5.00 or higher use open-source software internally. Some of this software requires that the source code be made available to the user as a condition of its licensing. This source code is available upon request (contact info@avtechpulse.com).

Earlier firmware versions do not contain any open source software.

INSTALLATION

VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, liquid crystal displays (LCDs), and the handles. Confirm that a power cord, a GPIB cable, two instrumentation manuals (this manual and the “Programming Manual for -B Instruments”), and the output module are with the instrument. If the instrument has been damaged, file a claim immediately with the company that transported the instrument.

POWER RATINGS

This instrument is intended to operate from 100 - 240 V, 50 - 60 Hz.

The maximum power consumption is 57 Watts. Please see the “FUSES” section for information about the appropriate AC and DC fuses.

This instrument is an “Installation Category II” instrument, intended for operation from a normal single-phase supply.

CONNECTION TO THE POWER SUPPLY

An IEC-320 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket. The other end of the detachable power cord plugs into the local mains supply. Use only the cable supplied with the instrument. The mains supply must be earthed, and the cord used to connect the instrument to the mains supply must provide an earth connection. (The supplied cord does this.)

⚠ Warning: Failure to use a grounded outlet may result in injury or death due to electric shock. This product uses a power cord with a ground connection. It must be connected to a properly grounded outlet. The instrument chassis is connected to the ground wire in the power cord.

The table below describes the power cord that is normally supplied with this instrument, depending on the destination region:

Destination Region	Description	Option	Manufacturer	Part Number
United Kingdom, Hong Kong, Singapore, Malaysia	BS 1363, 230V, 50 Hz	-AC00	Qualtek	370001-E01
Australia, New Zealand	AS 3112:2000, 230-240V, 50 Hz	-AC01	Qualtek	374003-A01
Continental Europe, Korea, Indonesia, Russia	European CEE 7/7 “Schuko” 230V, 50 Hz	-AC02	Qualtek	364002-D01
North America, Taiwan	NEMA 5-15, 120V, 60 Hz	-AC03	Qualtek	312007-01
Switzerland	SEV 1011, 230V, 50 Hz	-AC06	Qualtek	378001-E01
South Africa, India	SABS 164-1, 220-250V, 50 Hz	-AC17	Volex	2131H 10 C3
Japan	JIS 8303, 100V, 50-60 Hz	-AC18	Qualtek	397002-01
Israel	SI 32, 220V, 50 Hz	-AC19	Qualtek	398001-01
China	GB 1002-1, 220V, 50 Hz	-AC22	Volex	2137H 10 C3

PROTECTION FROM ELECTRIC SHOCK

⚠ Operators of this instrument must be protected from electric shock at all times. The owner must ensure that operators are prevented access and/or are insulated from every connection point. In some cases, connections must be exposed to potential human contact. Operators must be trained to protect themselves from the risk of electric shock. This instrument is intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possibly injury. In particular, operators should:

1. Keep exposed high-voltage wiring to an absolute minimum.

2. Wherever possible, use shielded connectors and cabling.

3. Connect and disconnect loads and cables only when the instrument is turned off.

4. Keep in mind that all cables, connectors, oscilloscope probes, and loads must have an appropriate voltage rating.

5. Do not attempt any repairs on the instrument, beyond the fuse replacement procedures described in this manual. Contact Avtech technical support (see page 2 for contact information) if the instrument requires servicing. Service is to be performed solely by qualified service personnel.

ENVIRONMENTAL CONDITIONS

This instrument is intended for use under the following conditions:

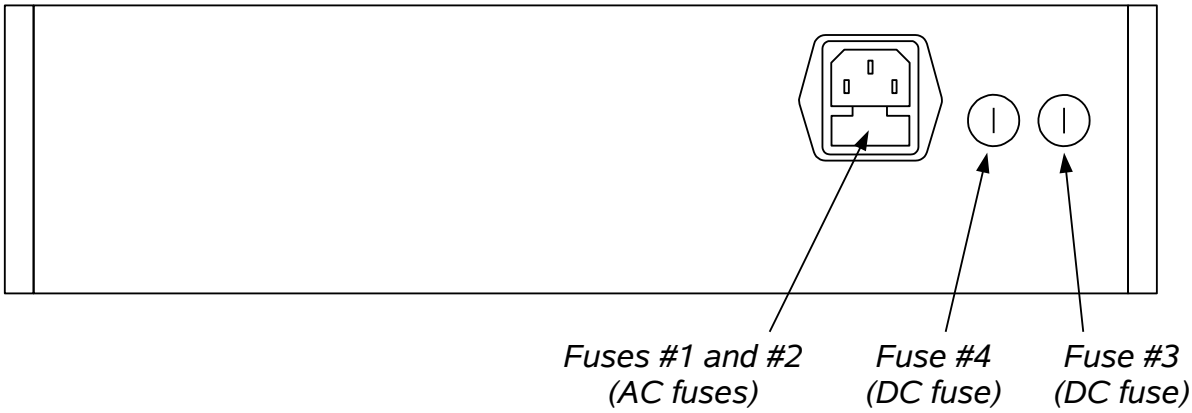
1. indoor use;
2. altitude up to 2 000 m;
3. temperature 5 °C to 40 °C;
4. maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
5. Mains supply voltage fluctuations up to ±10 % of the nominal voltage;
6. no pollution or only dry, non-conductive pollution.

LABVIEW DRIVERS

A LabVIEW driver for this instrument is available for download on the Avtech web site, at http://www.avtechpulse.com/labview. A copy is also available in National Instruments' Instrument Driver Library at http://www.natinst.com/.

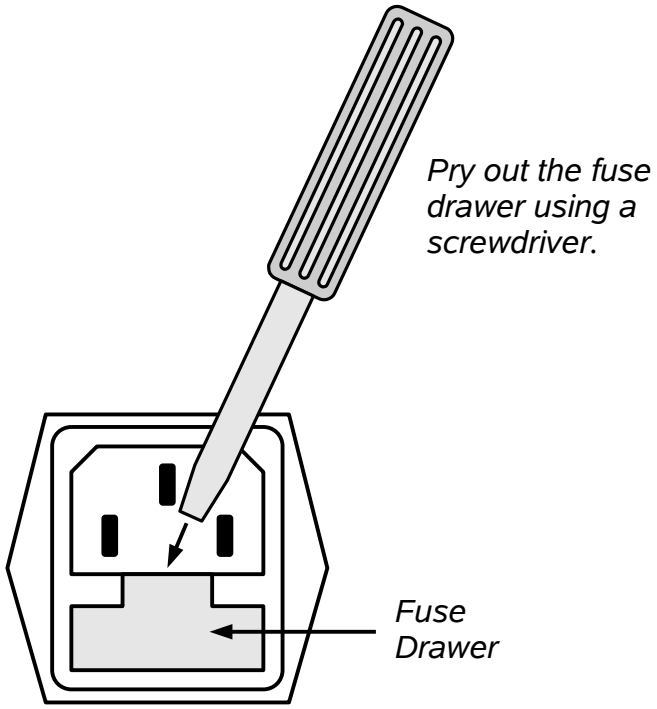
FUSES

This instrument contains four fuses. All are accessible from the rear-panel. Two protect the AC prime power input, and two protect the internal DC power supplies. The locations of the fuses on the rear panel are shown in the figure below:



AC FUSE REPLACEMENT

To physically access the AC fuses, the power cord must be detached from the rear panel of the instrument. The fuse drawer may then be extracted using a small flat-head screwdriver, as shown below:



DC FUSE REPLACEMENT

The DC fuses may be replaced by inserting the tip of a flat-head screwdriver into the fuse holder slot, and rotating the slot counter-clockwise. The fuse and its carrier will then pop out.

FUSE RATINGS

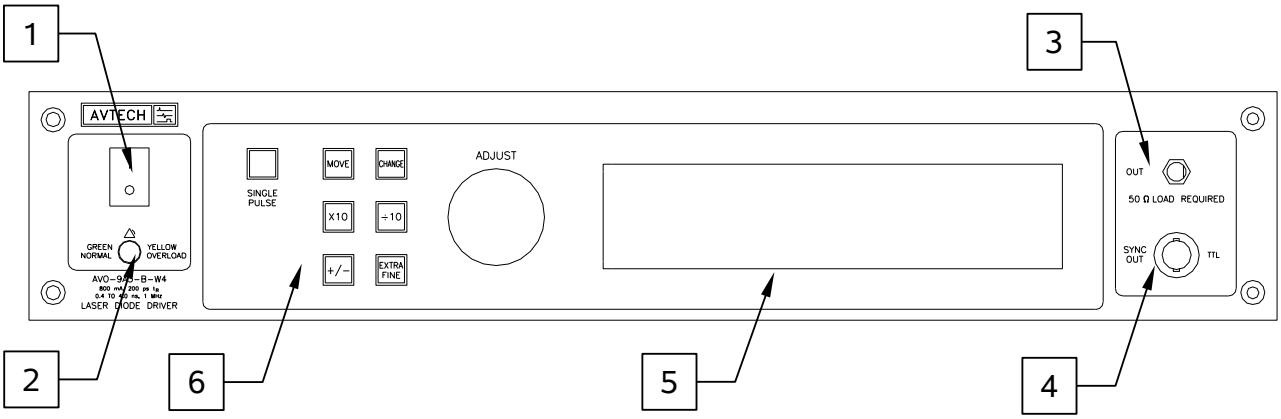
The following table lists the required fuses:

Fuses	Nominal Mains Voltage	Rating	Case Size	Recommended Replacement Part	
				Littelfuse Part Number	Digi-Key Stock Number
#1, #2 (AC)	100-240V	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND
#3 (DC)	N/A	1.0A, 250V, Time-Delay	5×20 mm	0218001.HXP	F2419-ND
#4 (DC)	N/A	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND

The recommended fuse manufacturer is Littelfuse (http://www.littelfuse.com).

Replacement fuses may be easily obtained from Digi-Key (http://www.digikey.com) and other distributors.

FRONT PANEL CONTROLS



1. POWER Switch. This is the main power switch. When turning the instrument on, there is normally a delay of 10 seconds before anything is shown on the main display, as the internal operating system boots up.

   If the main menu does not appear after 30 seconds, turn off the instrument and leave it off for at least 60 seconds before applying power again.

2. OVERLOAD Indicator. When the instrument is powered, this indicator is normally green, indicating normal operation. If this indicator is yellow, an internal automatic overload protection circuit has been tripped. If the unit is overloaded (by operating at an exceedingly high duty cycle or by operating into a very low impedance), the protective circuit will disable the output of the instrument and turn the indicator light yellow. The light will stay yellow (i.e. output disabled) for about 5 seconds after which the instrument will attempt to re-enable the output (i.e. light green) for about 1 second. If the overload condition persists, the output will be disabled again (i.e. light yellow) for another 5 seconds. If the overload condition has been removed, the instrument will resume normal operation.

   This overload indicator may flash yellow briefly at start-up. This is not a cause for concern.

3. OUT CONNECTOR. This SMA connector is connected to the output module, when the output module is used to drive a diode load. If the output module is not used, this output will generate up to +43V into a load impedances of 50Ω. (NOTE: when the output module is not used, this output *requires* a 50Ω load to function properly).

4. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads (or lags) the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to R_L > 1kΩ with a pulse width of approximately 100 ns.

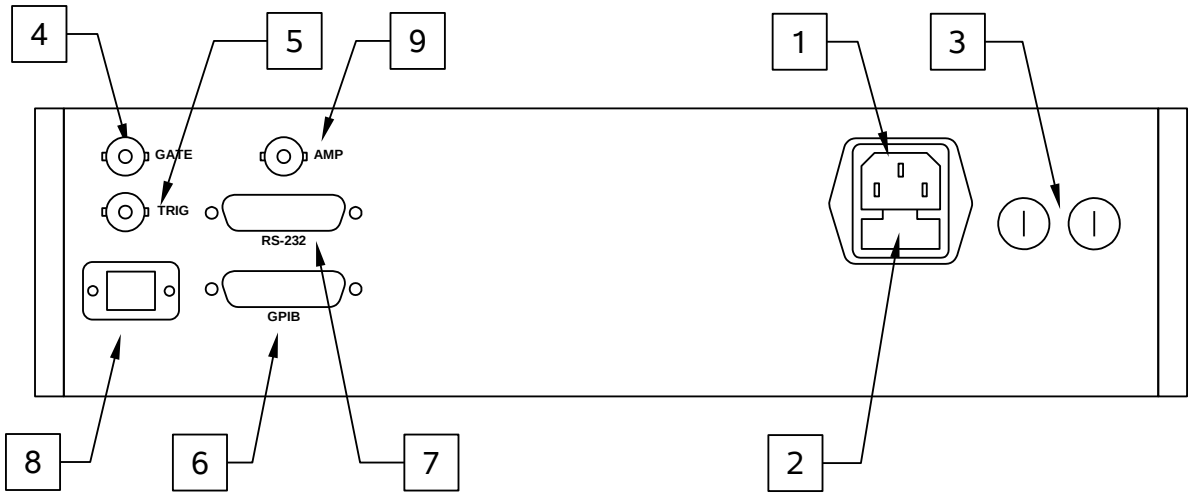
5. LIQUID CRYSTAL DISPLAY (LCD). This LCD is used in conjunction with the keypad to change the instrument settings. Normally, the main menu is displayed,

which lists the key adjustable parameters and their current values. The “Programming Manual for -B Instruments” describes the menus and submenus in detail.

6. KEYPAD.

Control Name	Function
MOVE	This moves the arrow pointer on the display.
CHANGE	This is used to enter the submenu, or to select the operating mode, pointed to by the arrow pointer.
×10	If one of the adjustable numeric parameters is displayed, this increases the setting by a factor of ten.
÷10	If one of the adjustable numeric parameters is displayed, this decreases the setting by a factor of ten.
+/-	If one of the adjustable numeric parameters is displayed, and this parameter can be both positive or negative, this changes the sign of the parameter.
EXTRA FINE	This changes the step size of the ADJUST knob. In the extra-fine mode, the step size is twenty times finer than in the normal mode. This button switches between the two step sizes.
ADJUST	This large knob adjusts the value of any displayed numeric adjustable values, such as frequency, pulse width, etc. The adjust step size is set by the "EXTRA FINE" button. When the main menu is displayed, this knob can be used to move the arrow pointer.

REAR PANEL CONTROLS



Note: some connectors may be in different positions than shown above, depending on the exact combination of options ordered.

1. AC POWER INPUT. An IEC-320 C14 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket.

2. AC FUSE DRAWER. The two fuses that protect the AC input are located in this drawer. Please see the “FUSES” section of this manual for more information.

3. DC FUSES. These two fuses protect the internal DC power supplies. Please see the “FUSES” sections of this manual for more information.

4. GATE. This TTL-level (0 and +5V) logic input can be used to gate the triggering of the instrument. This input can be either active high or active low, depending on the front panel settings or programming commands. (The instrument triggers normally when this input is unconnected). When set to active high mode, this input is pulled-down to ground by a 1 kΩ resistor. When set to active low mode, this input is pulled-up to +5V by a 1 kΩ resistor.

5. TRIG. This TTL-level (0 and +5V) logic input can be used to trigger the instrument, if the instrument is set to triggering externally. The instrument triggers on the rising edge of this input. The input impedance of this input is 1 kΩ. (Depending on the length of cable attached to this input, and the source driving it, it may be desirable to add a coaxial 50 Ohm terminator to this input to provide a proper transmission line termination. The Pasternack (www.pasternack.com) PE6008-50 BNC feed-thru 50 Ohm terminator is suggested for this purpose.)

6. GPIB Connector. A standard GPIB cable can be attached to this connector to allow the instrument to be computer-controlled. See the “Programming Manual for -B Instruments” for more details on GPIB control.

7. RS-232 Connector. A standard serial cable with a 25-pin male connector can be attached to this connector to allow the instrument to be computer-controlled. A user name (“admin”) and a password (“default”, as shipped from the factory) are required when logging into a serial terminal session. The internal controller attempts to auto-sense the parity setting. It may be necessary to send a few return characters before attempting a login in order to provide enough data to allow this auto-sensing to work. (A standard Linux “agetty” process is used to implement serial control internally.) See the “Programming Manual for -B Instruments” for more details on RS-232 control.

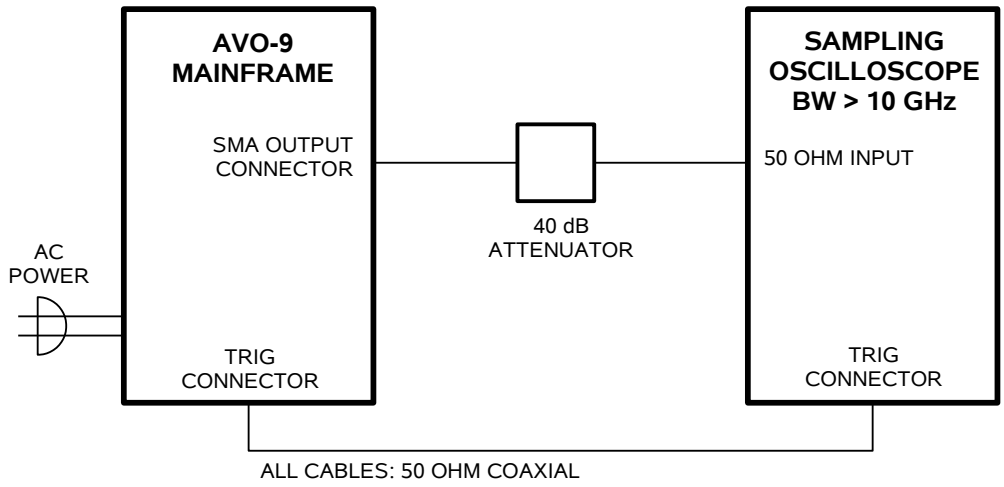
8. Network Connector. (Optional feature. Active on -VXI units only.) This Ethernet connector allows the instrument to be remotely controlled using the VXI-11.3, ssh (secure shell), telnet, and http (web) protocols. See the “Programming Manual for -B Instruments” for more details.

9. AMP Connector. (Optional feature. Present on -EA units only.) The output amplitude can be set to track the voltage on this input. Zero Volts in corresponds to zero amplitude output, and +10V in corresponds to maximum amplitude out. This mode is activated by selecting "Ext Control" on the front-panel amplitude menu, or with the "source:voltage external" command.

GENERAL INFORMATION

MINIMAL TEST ARRANGEMENT - WITHOUT OUTPUT MODULE

The AVO-9A3-B-P-P2D can be tested initially without the supplied output module. If the output module is not used, the mainframe output generates up to +43 Volts into a 50 Ohm load, as illustrated below:

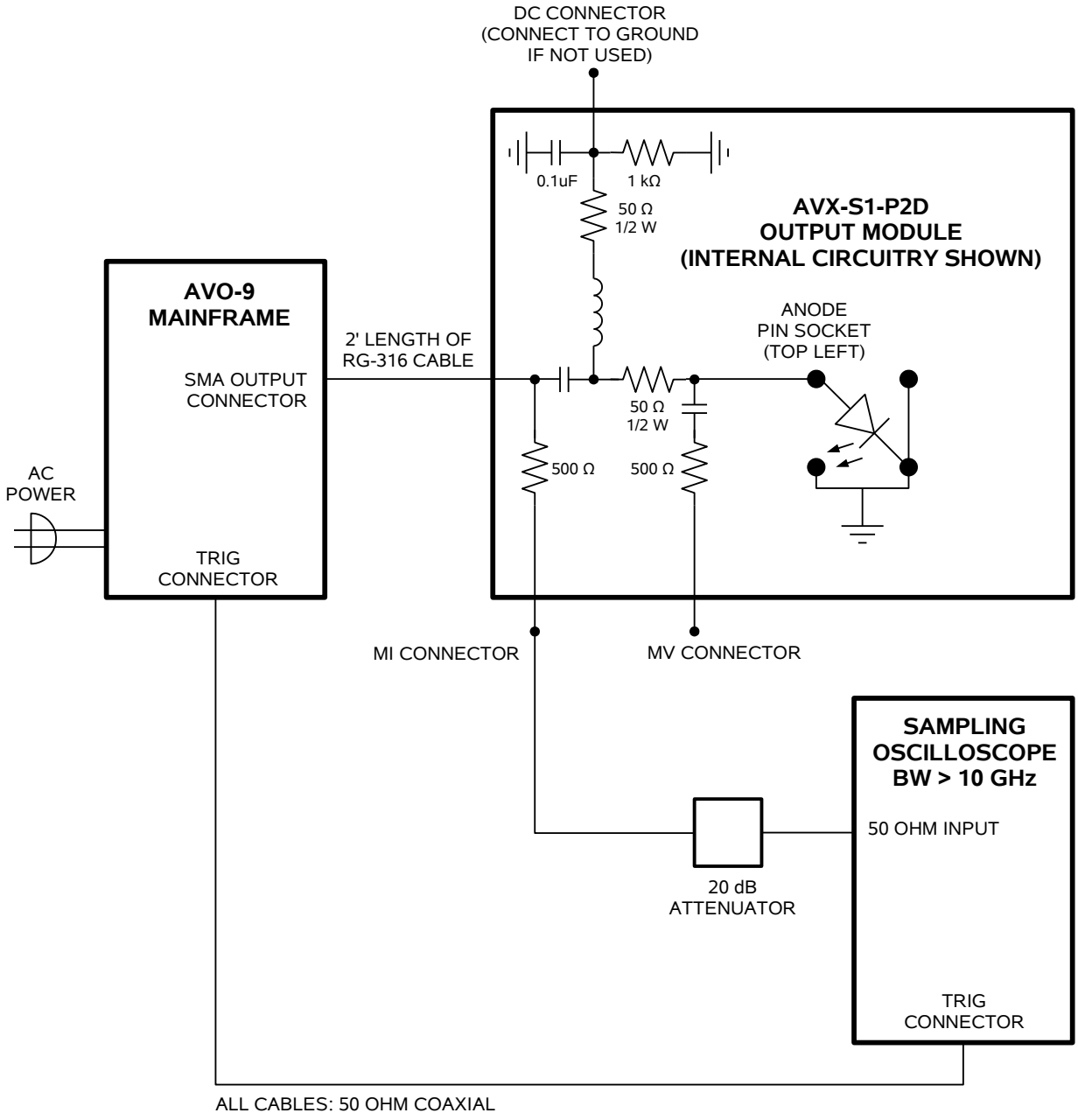


Since most sampling oscilloscopes have limited input amplitude ranges, attenuators are required. Select appropriate attenuators for your oscilloscope.

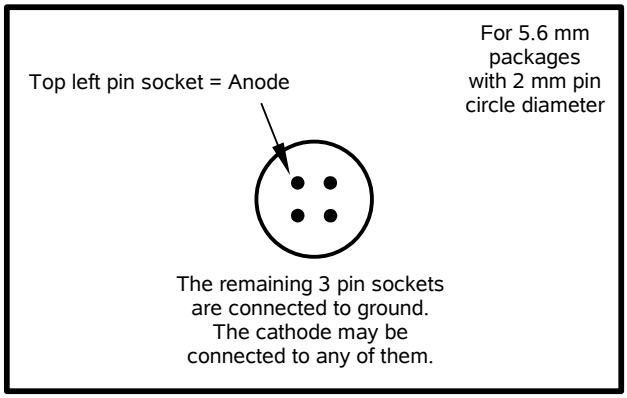
When the output module is not used, a 50 Ohm load impedance is *required* for proper test operation.

NORMAL TEST ARRANGEMENT

To fully test the instrument, and for normal operation, the output module must be connected as shown below:

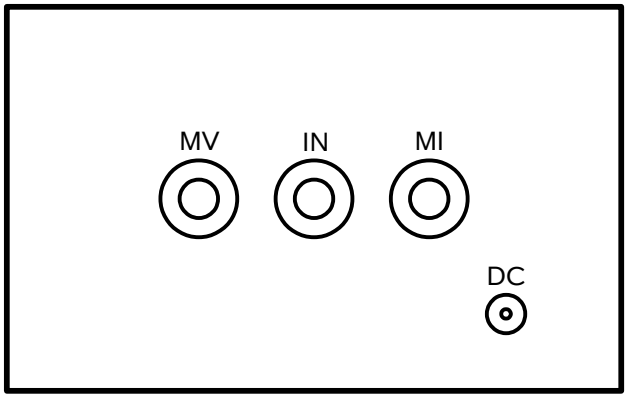


The diode load is inserted into the socket on the output module. The AVX-S1-P2D output module is designed to accommodate a 2, 3 or 4 pin 5.6 mm package with a 2 mm pin circle diameter. Four pin sockets are provided, which accept pins of 0.38-0.56 mm diameter (15-22 mils). A positive pulse signal is applied to one pin socket (for the anode). The other three pin sockets (one of which will be the cathode) are grounded. The diode should have a parasitic resistance (dV/dI at lasing) of < 5 Ohms for proper impedance matching.



AVX-S1-P2D OUTPUT MODULE, SOCKET VIEW

NOTE: Trim the diode leads to no longer than 1.0 cm in length. If the leads are longer than that, they may cause an internal short circuit in the output module, which may cause damage to the diode and the output module.



AVX-S1 OUTPUT MODULE, CONNECTOR VIEW

An oscilloscope may be used to monitor the MV and MI outputs, the locations of which are shown in the figure above. A forward DC bias may be applied to the laser diode by connecting a DC potential of 0 to +10 Volts to the DC solder terminal. The application of a small forward bias often yields a more ideal diode current waveform (as observed on the MI port).

AMPLITUDE CONTROL

When using the output module, the pulse current through the diode load is given by:

$$I_{DIODE} = (V_{SET} - V_{DIODE}) / (50\Omega + R_{DIODE})$$

where V_{SET} is the amplitude setting on the mainframe (up to +43V), V_{DIODE} is the forward voltage drop across the diode (typically 2-3V), and R_{DIODE} is the resistor internal to the laser diode (ideally 0Ω). The 50Ω resistance is built into the AVX-S1-P2D output module.

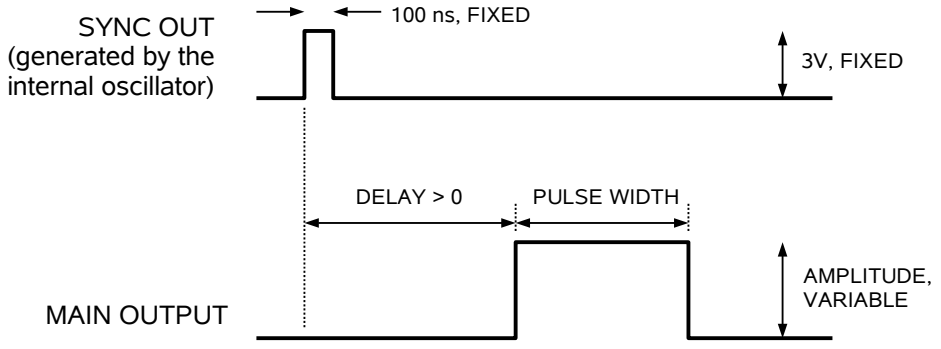
The AVO-9A3-B-P-P2D can deliver up to +43V into a total resistance (diode resistance + output module resistance) of 50 Ohms. This means that if your diode voltage is 3V, then you can obtain up to (43V - 3V) / 50 Ohms = 800 mA of current, approximately.

BASIC PULSE CONTROL

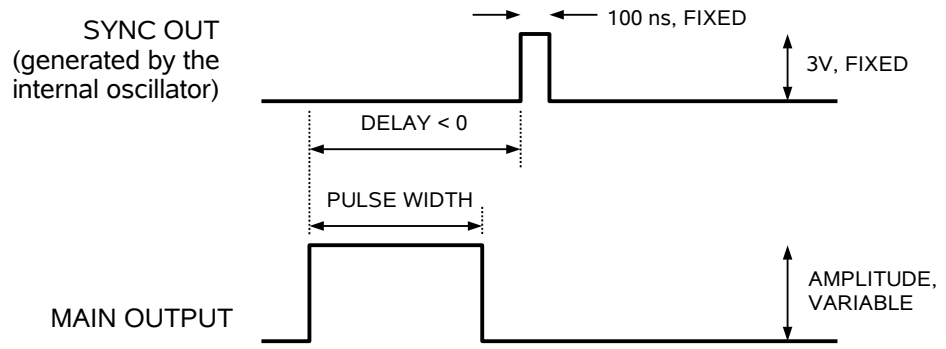
This instrument can be triggered by its own internal clock or by an external TTL trigger signal. In either case, two mainframe output channels respond to the trigger: OUT and SYNC.

- OUT. This is the main output. The maximum output voltage is +43V.
- SYNC. The SYNC pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems. When the delay is set to a positive value the SYNC pulse precedes the OUT pulse. When the delay is set to a negative value the SYNC pulse follows the OUT pulse.

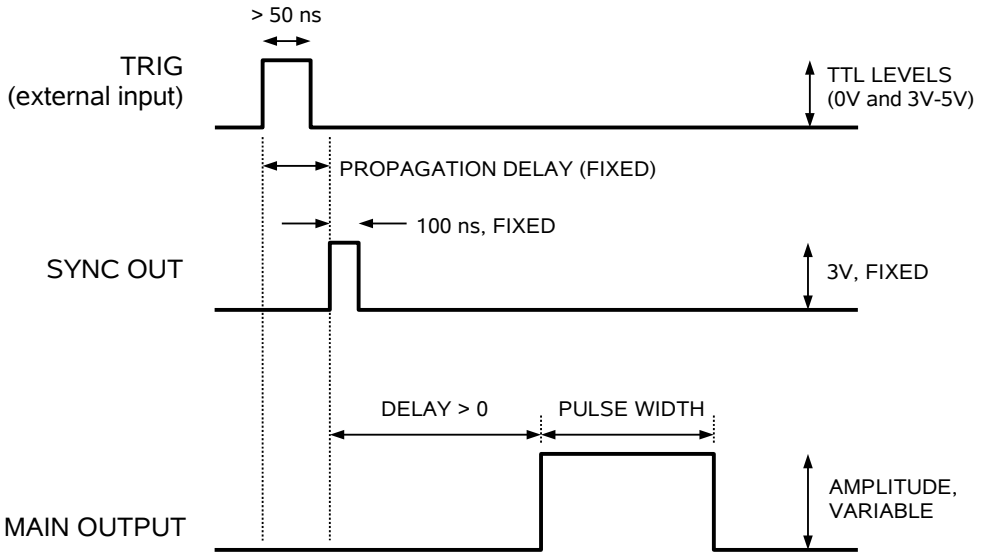
These pulses are illustrated below, assuming internal triggering and a positive delay:



If the delay is negative, the order of the SYNC and OUT pulses is reversed:



The next figure illustrates the relationship between the signal when an external TTL-level trigger is used:



As before, if the delay is negative, the order of the SYNC and OUT pulses is reversed.

In general, the delay, pulse width, and frequency (when in the internal mode), of the OUT pulse can be varied with front panel controls or via the GPIB or RS-232 computer interfaces.

TRIGGER MODES

This instrument has four trigger modes:

- Internal Trigger: the instrument controls the trigger frequency, and generates the clock internally.

- External Trigger: the instrument is triggered by an external TTL-level clock on the back-panel TRIG connector.

- Manual Trigger: the instrument is triggered by the front-panel “SINGLE PULSE” pushbutton.

- Hold Trigger: the instrument is set to not trigger at all.

These modes can be selected using the front panel trigger menu, or by using the appropriate programming commands. (See the “Programming Manual for -B Instruments” for more details.)

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

GATING MODES

Triggering can be suppressed by a TTL-level signal on the rear-panel GATE connector. The instrument can be set to stop triggering when this input high or low, using the front-panel gate menu or the appropriate programming commands. When gated, the output will complete the full pulse width if the output is high, and then stop triggering. Pulses are not truncated.

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.

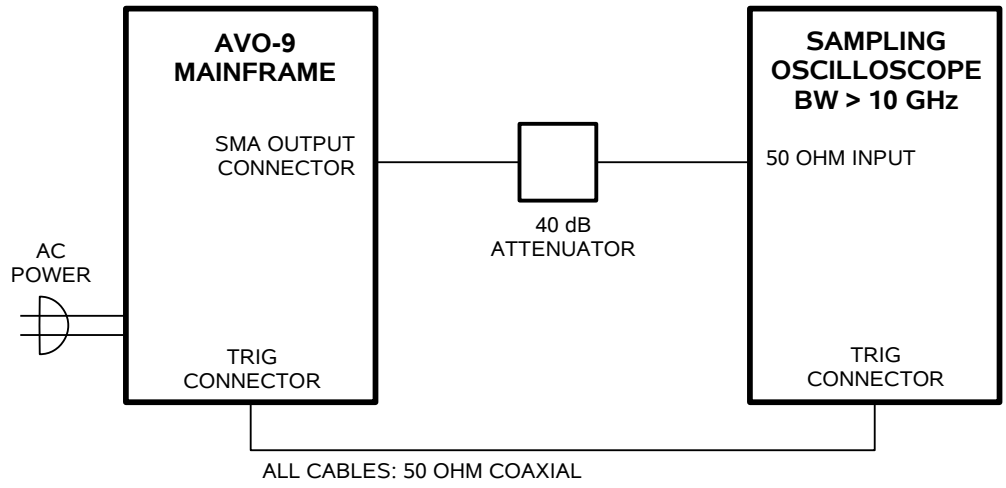
USE A 50Ω LOAD

The mainframe output stage may be damaged if the output is not terminated into the output module or a 50Ω dummy load.

OPERATIONAL CHECK

This section describes a sequence to confirm the basic operation of the instrument. It should be performed after receiving the instrument. It is a useful learning exercise as well.

Before proceeding with this procedure, finish reading this instruction manual thoroughly. Then read the “Local Control” section of the “Programming Manual for -B Instruments” thoroughly. The “Local Control” section describes the front panel controls used in this operational check - in particular, the MOVE, CHANGE, and ADJUST controls.



1. Connect the pulse generator to a sampling oscilloscope as shown above. Note that:

   a) The use of 40 dB attenuator at the sampling scope vertical input channel will ensure a peak input signal to the sampling scope of less than 1 Volt.

   b) The TRIG output channel provides TTL level signals (approximately 0 and +3V). To avoid overdriving the TRIG input channel of some scopes, a 20 dB attenuator may be needed at the input to the scope trigger channel.

   c) The bandwidth capability of components and instruments used to display the pulse generator output signal (attenuators, cables, connectors, etc.) should exceed 2 GHz.

   d) Set the oscilloscope to trigger externally with the vertical setting at 100 mV/div and the horizontal setting at 5 ns/div.

2. Turn on the AVO-9A3-B-P-P2D. The main menu will appear on the LCD.

3. To set the AVO-9A3-B-P-P2D to trigger from the internal clock at a PRF of 10 kHz:

    a) The arrow pointer should be pointing at the frequency menu item. If it is not, press the MOVE button until it is.

    b) Press the CHANGE button. The frequency submenu will appear. Rotate the ADJUST knob until the frequency is set at 10 kHz.

    c) The arrow pointer should be pointing at the “Internal” choice. If it is not, press MOVE until it is.

    d) Press CHANGE to return to the main menu.

4. To set the delay to 20 ns:

    a) Press the MOVE button until the arrow pointer is pointing at the delay menu item.

    b) Press the CHANGE button. The delay submenu will appear. Rotate the ADJUST knob until the delay is set at 20 ns.

    c) The arrow pointer should be pointing at the “Normal” choice. If it is not, press MOVE until it is.

    d) Press CHANGE to return to the main menu.

5. To set the pulse width to 2 ns:

    a) Press the MOVE button until the arrow pointer is pointing at the pulse width menu item.

    b) Press the CHANGE button. The pulse width submenu will appear. Rotate the ADJUST knob until the pulse width is set at 2 ns.

    c) The arrow pointer should be pointing at the “Normal” choice. If it is not, press MOVE until it is.

    d) Press CHANGE to return to the main menu.

6. At this point, nothing should appear on the oscilloscope.

7. To enable the output:

    a) Press the MOVE button until the arrow pointer is pointing at the output menu item.

    b) Press the CHANGE button. The output submenu will appear.

c) Press MOVE until the arrow pointer is pointing at the “ON” choice.

d) Press CHANGE to return to the main menu.

8. To change the output amplitude:

a) Press the MOVE button until the arrow pointer is pointing at the amplitude menu item.

b) Press the CHANGE button. The amplitude submenu will appear. Rotate the ADJUST knob until the amplitude is set at 40V.

c) Observe the oscilloscope. You should see 2 ns wide, 40V pulses. If you do not, you may need to adjust the delay setting to a value more compatible with your sampling oscilloscope. Repeat step 4 if required. You may also need to adjust the sampling scope controls.

d) Rotate the ADJUST knob. The amplitude as seen on the oscilloscope should vary. Return it to 40V.

e) Press CHANGE to return to the main menu.

9. Try varying the pulse width, by repeating step (5). As you rotate the ADJUST knob, the pulse width on the oscilloscope will change. It should agree with the displayed value.

10. Turn off the instrument, and connect the output module as shown in the earlier “NORMAL TEST ARRANGEMENT” sections, with an appropriate diode load into the output module socket. Repeat steps 2 to 9, and view the “MI” output on the sampling oscilloscope.

This completes the operational check.

PROGRAMMING YOUR PULSE GENERATOR

KEY PROGRAMMING COMMANDS

The “Programming Manual for -B Instruments” describes in detail how to connect the pulse generator to your computer, and the programming commands themselves. A large number of commands are available; however, normally you will only need a few of these. Here is a basic sample sequence of commands that might be sent to the instrument after power-up:

*rst	(resets the instrument)
trigger:source internal	(selects internal triggering)
frequency 1000 Hz	(sets the frequency to 1000 Hz)
pulse:width 1 ns	(sets the pulse width to 1 ns)
pulse:delay 20 ns	(sets the delay to 20 ns)
volt:ampl 10	(sets the amplitude to 10 V)
output on	(turns on the output)

For triggering a single event, this sequence would be more appropriate:

*rst	(resets the instrument)
trigger:source hold	(turns off all triggering)
pulse:width 1 ns	(sets the pulse width to 1 ns)
output on	(turns on the output)
volt:ampl 10	(sets the amplitude to 10 V)
trigger:source immediate	(generates a single non-repetitive trigger event)
trigger:source hold	(turns off all triggering)
output off	(turns off the output)

To set the instrument to trigger from an external TTL signal applied to the rear-panel TRIG connector, use:

*rst	(resets the instrument)
trigger:source external	(selects internal triggering)
pulse:width 1 ns	(sets the pulse width to 1 ns)
pulse:delay 100 ns	(sets the delay to 100 ns)
volt:ampl 10	(sets the amplitude to 10 V)
output on	(turns on the output)

These commands will satisfy 90% of your programming needs.

ALL PROGRAMMING COMMANDS

For more advanced programmers, a complete list of the available commands is given below. These commands are described in detail in the “Programming Manual for -B Instruments”. (Note: this manual also includes some commands that are not implemented in this instrument. They can be ignored.)

Keyword	Parameter	Notes
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	
:PULSe		
:PERiod	<numeric value>	
:WIDTh	<numeric value>	
:DCYCle	<numeric value>	
:HOLD	WIDTh | DCYCle	
:DELay	<numeric value>	
:GATE		
:TYPE	ASYNC | SYNC	
:LEVel	HIgh | LOw	
:TRANsition		
:[LEADing]	<numeric value>	
:VOLTage		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric value>	
:PROTection		
:TRIPped?		[query only]
STATUS:		
:OPERation		
:[EVENt]?		[query only, always returns "0"]
:CONDition?		[query only, always returns "0"]
:ENABle	<numeric value>	[implemented but not useful]
:QUEStionable		
:[EVENt]?		[query only, always returns "0"]
:CONDition?		[query only, always returns "0"]
:ENABle	<numeric value>	[implemented but not useful]
SYSTem:		
:COMMunicate		
:GPIB		
:ADDRess	<numeric value>	
:SERial		
:CONTrol		
:RTS	ON | IBFull | RFR	
:[RECeive]		
:BAUD	1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200	
:ERRor		
:[NEXT]?		[query only]
:COUNT?		[query only]
:VERSion?		[query only]
TRIGger:		

:SOURce	INTernal | EXTernal | MANual | HOLD | IMMediate	
*CLS		[no query form]
*ESE	<numeric value>	
*ESR?		[query only]
*IDN?		[query only]
*OPC		
*SAV	0 | 1 | 2 | 3	[no query form]
*RCL	0 | 1 | 2 | 3	[no query form]
*RST		[no query form]
*SRE	<numeric value>	
*STB?		[query only]
*TST?		[query only]
*WAI		[no query form]

MECHANICAL INFORMATION

TOP COVER REMOVAL

If necessary, the interior of the instrument may be accessed by removing the four Phillips screws on the top panel. With the four screws removed, the top cover may be slid back (and off).

⚠ Always disconnect the power cord and allow the instrument to sit unpowered for 10 minutes before opening the instrument. This will allow any internal stored charge to discharge.

There are no user-adjustable internal circuits. For repairs other than fuse replacement, please contact Avtech (info@avtechpulse.com) to arrange for the instrument to be returned to the factory for repair. Service is to be performed solely by qualified service personnel.

⚠ Caution: High voltages are present inside the instrument during normal operation. Do not operate the instrument with the cover removed.

RACK MOUNTING

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

ELECTROMAGNETIC INTERFERENCE

To prevent electromagnetic interference with other equipment, all used outputs should be connected to shielded loads using shielded coaxial cables. Unused outputs should be terminated with shielded coaxial terminators or with shielded coaxial dust caps, to prevent unintentional electromagnetic radiation. All cords and cables should be less than 3m in length.

MAINTENANCE

REGULAR MAINTENANCE

This instrument does not require any regular maintenance.

On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the “FUSES” section for details.

CLEANING

If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the “TOP COVER REMOVAL” section for instructions on accessing the interior.) No other cleaning is recommended.

TRIGGER DAMAGE

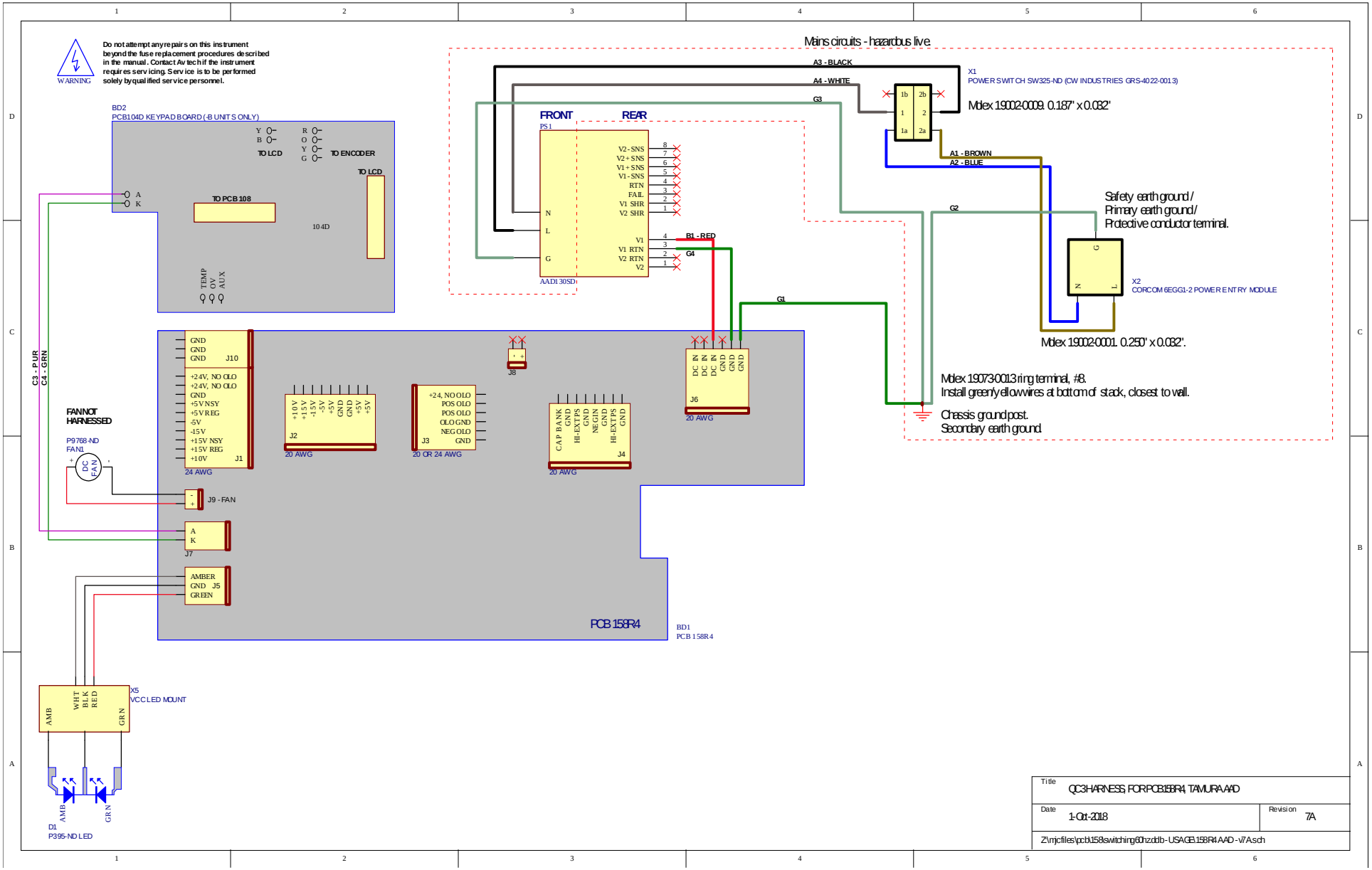
The rear-panel TRIG input, used in the external trigger mode, is protected by a diode clamping circuit. However, the protection circuit is not foolproof, and it is possible for a grossly excessive signal to damage the trigger circuitry on the main timing control board (the 4×10 inch board on the right side of the instrument).

The IC that is most likely to fail under these conditions is installed in a socket. It is a standard TTL IC in a 16-pin plastic DIP package, model 74F151 or equivalent.

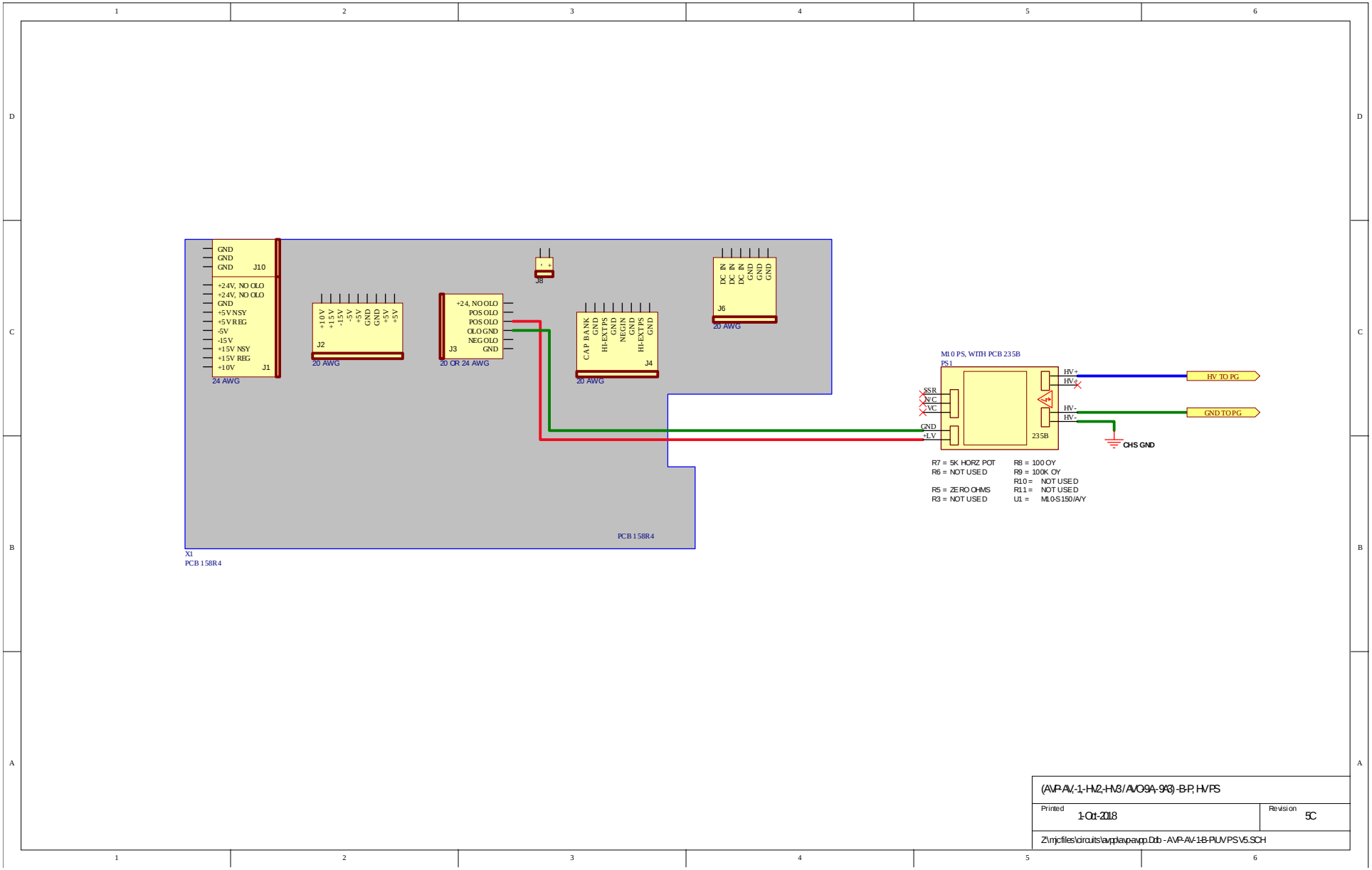
If you suspect that this IC has been damaged, turn off the power and replace this IC. It may be replaced by a 74F151, 74LS151, 74ALS151, or 74HCT151.

WIRING DIAGRAMS

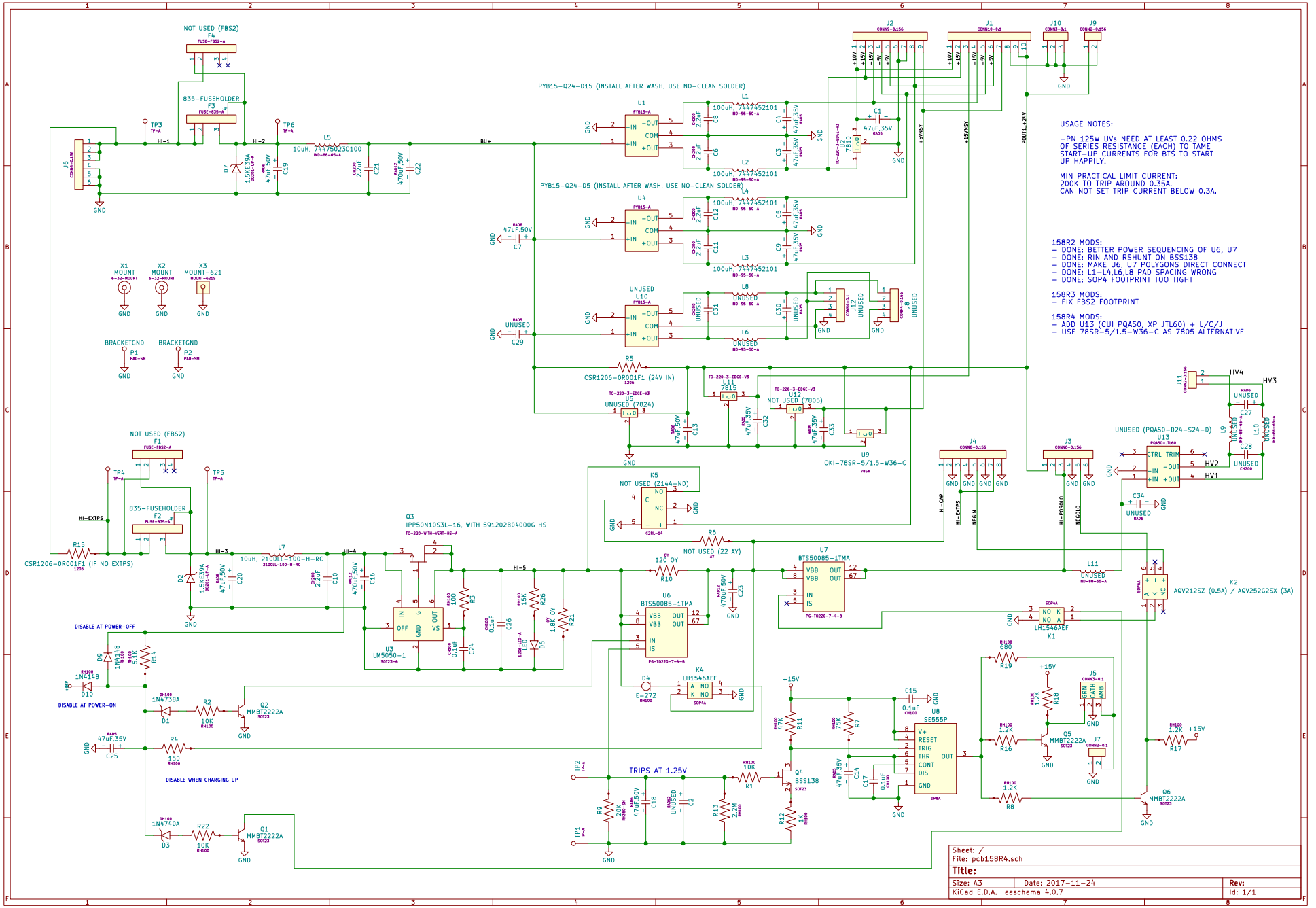
WIRING OF AC POWER



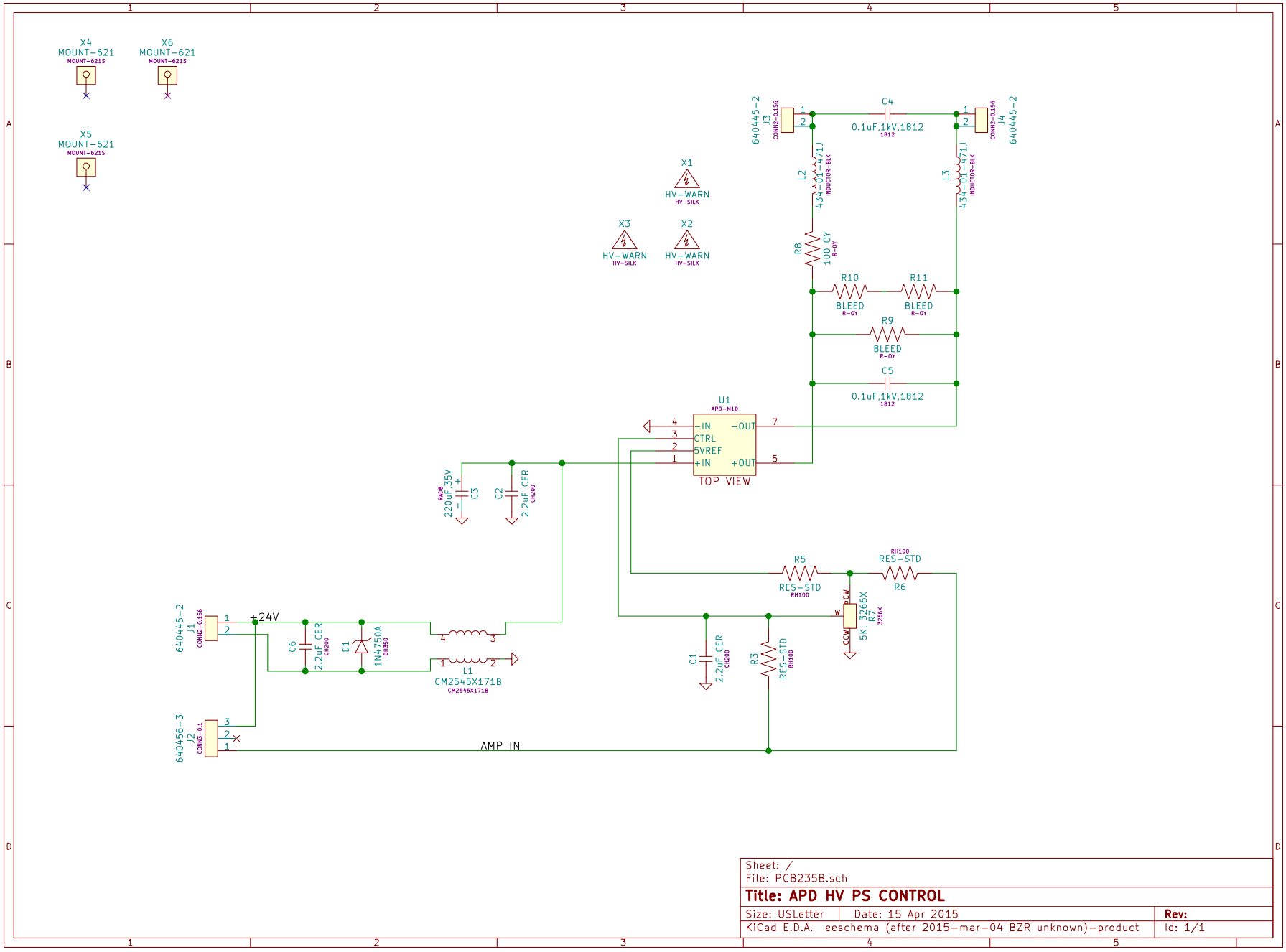
WIRING OF DC POWER



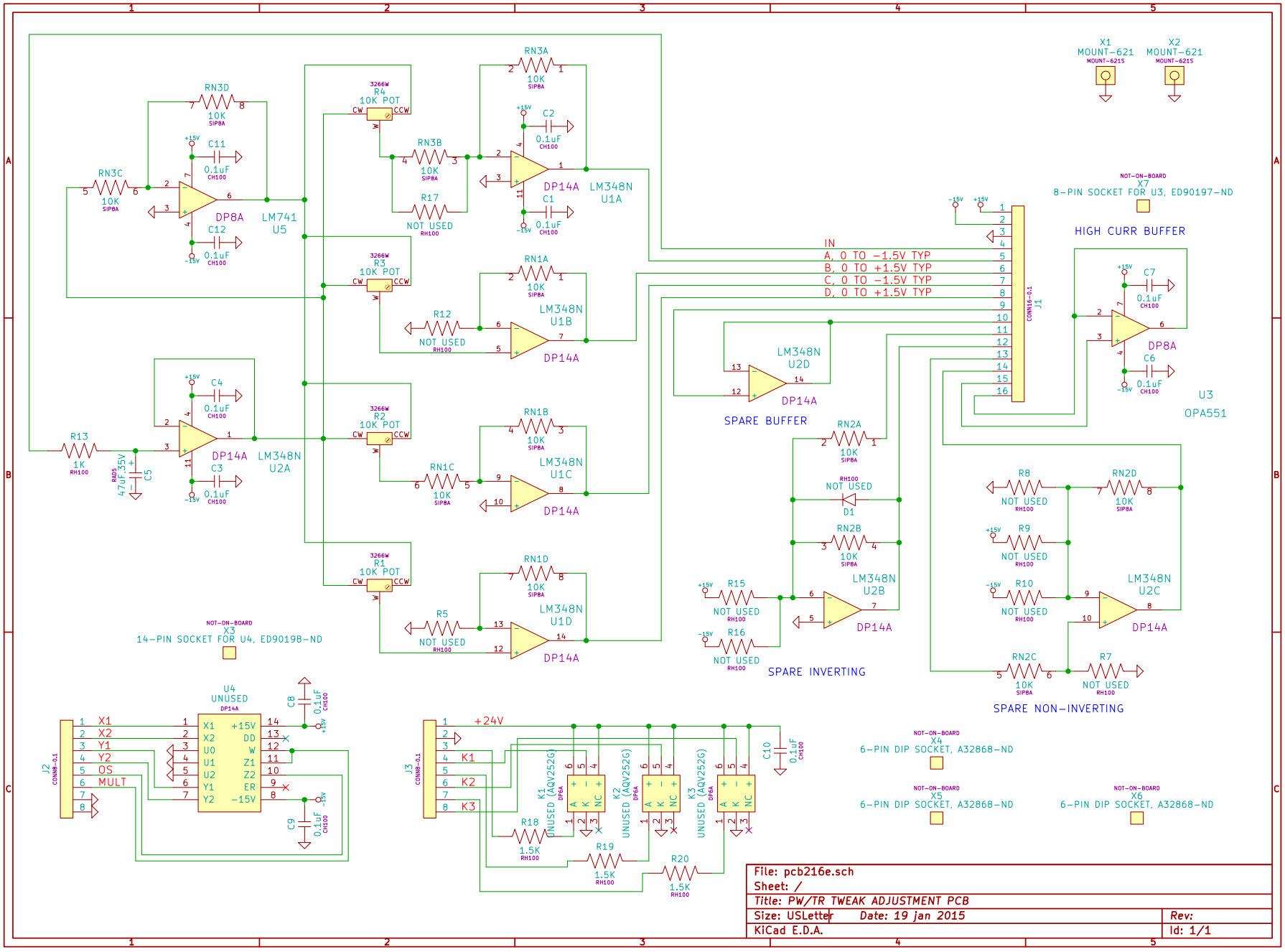
PCB 158R4 - LOW VOLTAGE POWER SUPPLY



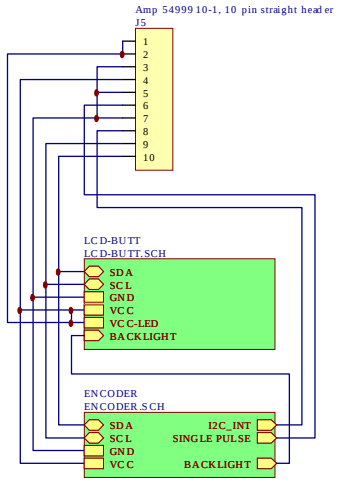
PCB 235B - HIGH VOLTAGE DC POWER SUPPLY



PCB 216E - PRF/PW TWEAKING PCB



PCB 104F - KEYPAD / DISPLAY BOARD, 1/3



Title	PANEL TOP-LEVEL SCHEMATIC
Date: 25-Sep-2015	Revision:
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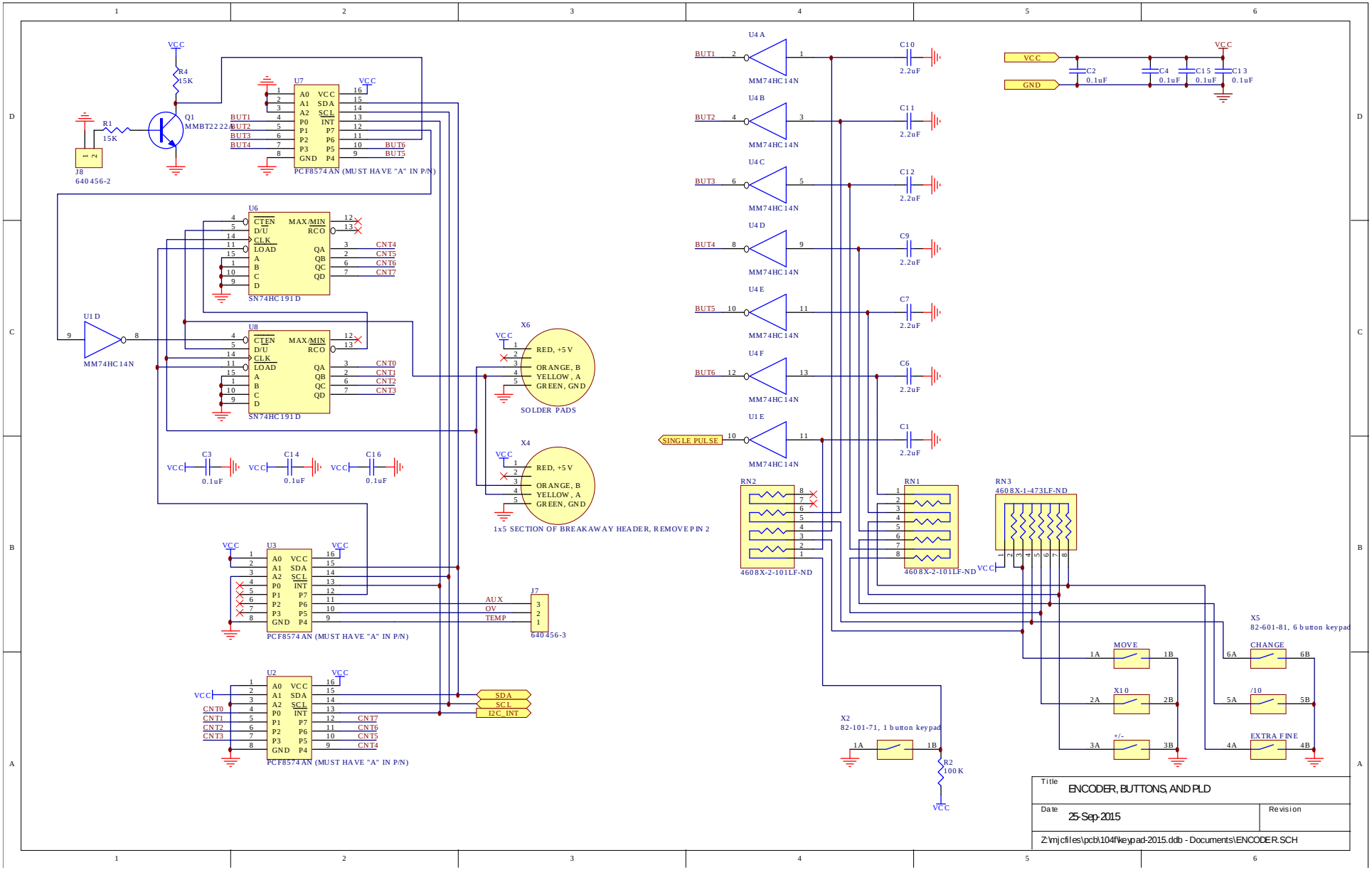
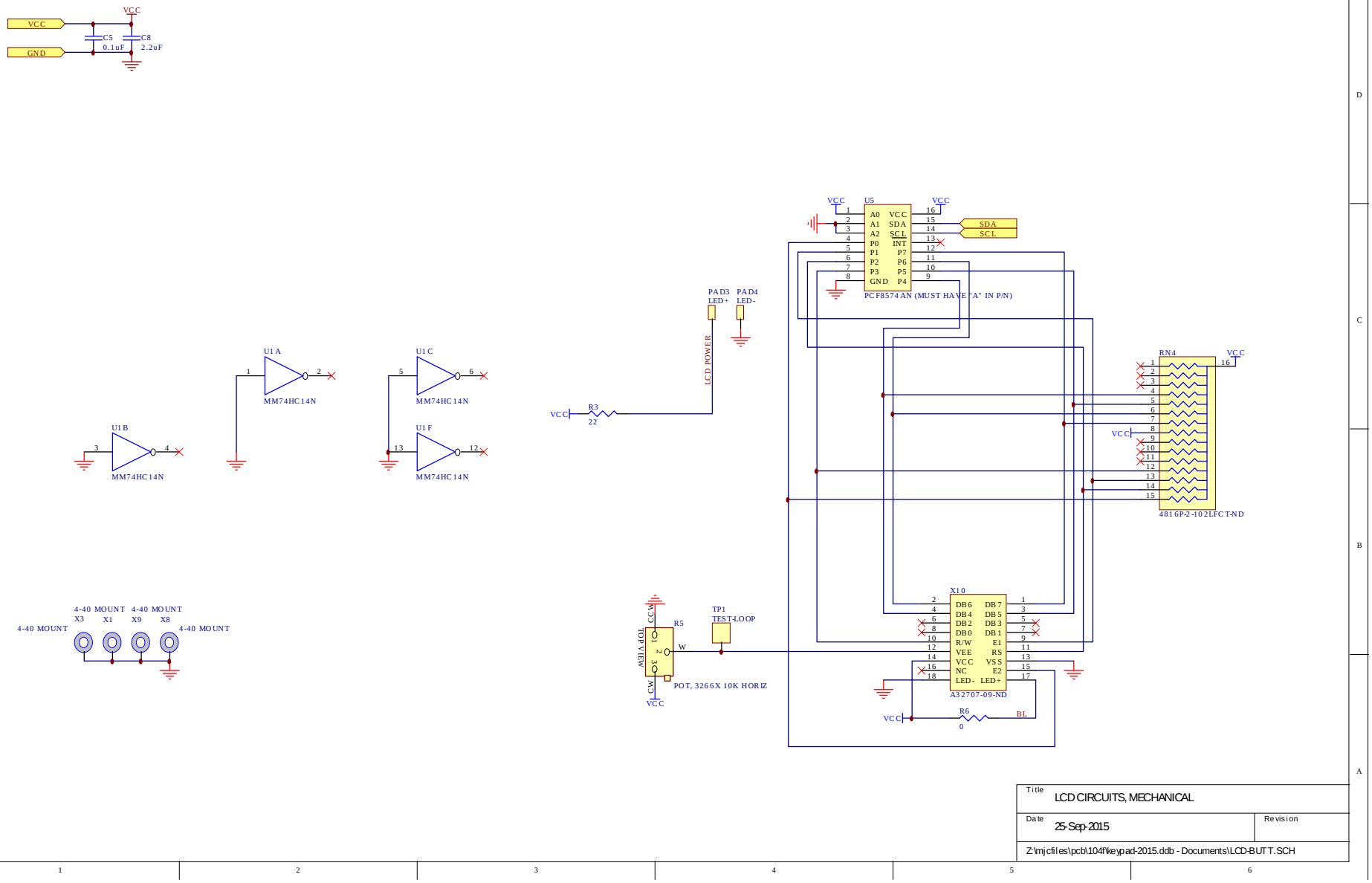
PCB 104F - KEYPAD / DISPLAY BOARD, 2/3



PCB 104F - KEYPAD / DISPLAY BOARD, 3/3



Title	LCD CIRCUITS, MECHANICAL
Date	25-Sep-2015
Revision	
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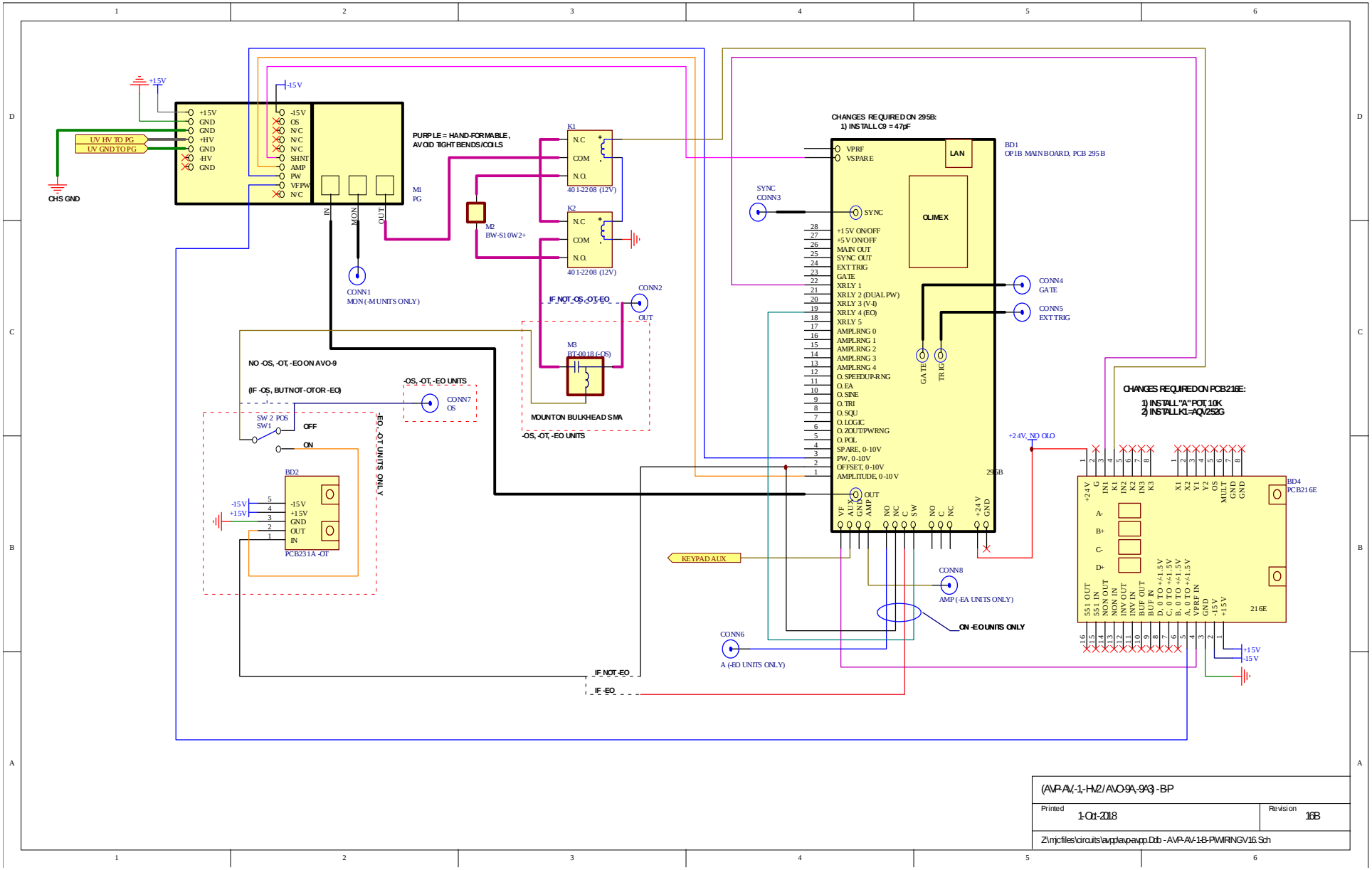
MAIN WIRING



(AVP-AV,-1,-HV,2 / AVO-9A,-9AG) - BP	
Printed: 1-Oct-2018	Revision: 16B
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PERFORMANCE CHECKSHEET