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INSTRUCTIONS

MODELS AVPP-2-B & AVPP-2A-B

20 VOLT, 100 kHz

HIGH PERFORMANCE PULSE GENERATOR

WITH IEEE 488.2 / RS-232 / ETHERNET CONTROL

SERIAL NUMBER: 14417

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)
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E-mail: info@avtechpulse.com
World Wide Web: http://www.avtechpulse.com

TABLE OF CONTENTS

WARRANTY.....2
TECHNICAL SUPPORT.....2
TABLE OF CONTENTS.....3
INTRODUCTION.....5
SPECIFICATIONS.....6
REGULATORY NOTES.....7
FCC PART 18.....7
EC DECLARATION OF CONFORMITY.....7
DIRECTIVE 2011/65/EU (RoHS).....8
DIRECTIVE 2002/96/EC (WEEE).....8
FIRMWARE LICENSING.....9
INSTALLATION.....10
VISUAL CHECK.....10
POWER RATINGS.....10
CONNECTION TO THE POWER SUPPLY.....10
PROTECTION FROM ELECTRIC SHOCK.....11
ENVIRONMENTAL CONDITIONS.....12
LABVIEW DRIVERS.....12
FUSES.....13
AC FUSE REPLACEMENT.....13
DC FUSE REPLACEMENT.....14
FUSE RATINGS.....14
FRONT PANEL CONTROLS.....15
REAR PANEL CONTROLS.....17
GENERAL INFORMATION.....19
BASIC PULSE CONTROL.....19
TRIGGER MODES.....20
GATING MODES.....21
OPERATION AT LOW AMPLITUDES.....21
OPTIONAL FEATURES.....22
RACK MOUNTING, "-R5" OPTION.....22
DC OFFSET, "-OS" OPTION.....22

DC OFFSET, "-OT" OPTION....22
MONITOR OUTPUT, "-M" OPTION....22
PROTECTING YOUR INSTRUMENT....23
TURN OFF INSTRUMENT WHEN NOT IN USE....23
DO NOT EXCEED 100 kHz....23
USE A 50 OHM LOAD....23
OPERATIONAL CHECK....24
PROGRAMMING YOUR PULSE GENERATOR....27
KEY PROGRAMMING COMMANDS....27
ALL PROGRAMMING COMMANDS....28
MECHANICAL INFORMATION....30
TOP COVER REMOVAL....30
RACK MOUNTING....30
ELECTROMAGNETIC INTERFERENCE....30
MAINTENANCE....31
REGULAR MAINTENANCE....31
CLEANING....31
TRIGGER DAMAGE....31
WIRING DIAGRAMS....32
WIRING OF AC POWER....32
WIRING OF DC POWER....33
PCB 158R7 - LOW VOLTAGE POWER SUPPLY....34
PCB 235D - HIGH VOLTAGE DC POWER SUPPLY....35
PCB 216F - PRF/PW TWEAKING PCB....36
PCB 231A - INTERNAL DC OFFSET FUNCTION....37
PCB 335C - TRIGGER MULTIPLEXER....38
PCB 104H - KEYPAD / DISPLAY BOARD....39
MAIN WIRING....40
PERFORMANCE CHECKSHEET....41

Manual Reference: /fileserver1/officefiles/instructword/avpp/AVPP-2-B, AVPP-2A-B, sn14417.odt.
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INTRODUCTION

The AVPP-2-B and AVPP-2A-B are high performance, GPIB/RS232/Ethernet-equipped instruments capable capable of generating 20V into 50Ω loads at repetition rates up to 100 kHz. The rise times (20%-80%) are less than 200 ps. The fall time is less than 500 ps for pulse widths less than 8 ns, and less than 200 ps for pulse widths below 8 ns (approximately).

The AVPP-2-B pulse width is adjustable from 0.5 ns to 100 ns, with a maximum duty cycle of 1%.

The AVPP-2A-B pulse width is adjustable from 0.5 ns to 1 us, with a maximum duty cycle of 5%.

Instruments with the "-P" model suffix can generate up to +20V, whereas instruments with the "-N" model suffix can generate up to -20V. Instruments with the "-PN" suffix can generate both polarities.

The AVPP-2-B and AVPP-2A-B are highly flexible instruments. 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 AVPP-2-B and AVPP-2A-B are feature 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]:	AVPP-2-B	AVPP-2A-B
Amplitude[2]: (50Ω load)	< 2 - 20 Volts	
Pulse width (FWHM):	0.5 ns - 100 ns	0.5 ns - 1 us
PRF:	1 Hz - 100 kHz	1 Hz - 100 kHz
Maximum duty cycle:	1%	5%
Rise times (20%-80%)[7]:	≤ 200 ps	
Fall times (80%-20%)[7]:	< 200ps, for > 8 ns PW < 500ps, for < 8 ns PW	
GPIB & RS-232 control[1]:	Standard on -B units	
Required load impedance:	50 Ohms[6]	
Polarity[3]:	Positive or negative or both (specify)	
LabView Drivers:	Check http://www.avtechpulse.com/labview for availability and downloads	
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Included. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.	
Calibration:	Not calibrated. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.	
DC offset:	Optional[4]. Apply required DC offset to back panel solder terminals(250 mA / ±50V maximum).	
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)	
Jitter:	± 35ps ± 0.015% of sync delay	
Trigger modes:	Internal trigger, external trigger (TTL level pulse, > 10 ns, 1 kΩ input impedance), front-panel “Single Pulse” pushbutton, or single pulse trigger via computer command	
Variable delay:	0 to 1.0 seconds, for all trigger modes (including external trigger)	
Sync output:	+3 Volts, > 50 ns, will drive 50 Ohm loads	
Monitor output option[5]:	Provides a 20 dB attenuated coincident replica of main output	
Connectors:	Out, Monitor: SMA female. Trig, Sync, Gate: BNC female.	
Optional accessory kit: (attenuators and terminators)	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.	
Optional accessory kit: (coaxial cables and adapters)	Add the suffix "-AK8" to the model number to include the recommended accessory kit. Consists of one 12-inch SMA-M/SMA-M PE-SR405FL coaxial cable, one 12-inch SMA-M/SMA-M RG-316 coaxial cable, one 36-inch SMA-M/SMA-M RG-316 coaxial cable, one 24-inch SMA-M/BNC-M RG-316 coaxial cable, one 36-inch BNC-M/BNC-M RG58C/U coaxial cable, one SMA-F to BNC-M adapter, one SMA-M to BNC-F adapter, one SMA-F to SMA-F adapter, and one SMA-F to solder cup adapter	
Power requirements:	100 - 240 Volts, 50 - 60 Hz	
Dimensions (H x W x D):	100 mm x 430 mm x 375 mm (3.9” x 17” x 14.8”)	
Chassis material:	cast aluminum frame & handles, blue vinyl on aluminum cover plates	
Temperature range:	+5°C to +40°C	

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (See http://www.avtechpulse.com/gpib/).
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.
3) Indicate the desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -PN for the dual polarity option.
4) The -OS option adds an internal bias tee circuit to the output, allowing an externally-generated DC offset (±50V/250mA max) to be added the output signal. The -OT option includes the -OS function, and adds the ability to generate a ±5V/100mA offset internally (controlled from the front panel, or by computer command on -B units).
5) Add -M to model number for monitor option.
6) A 50 Ohm load is required. Other loads may damage the instrument. Consult Avtech (info@avtechpulse.com) if you need to drive other load impedances.
7) 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

CE

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

declare that this pulse generator meets the intent of Directive 2014/30/EU 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 2014/35/EU. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 61010-1:2010+A1:2019, 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)
Bis(2-ethylhexyl) phthalate (DEHP)	< 1000 ppm (0.1% by mass)
Butyl benzyl phthalate (BBP)	< 1000 ppm (0.1% by mass)
Dibutyl phthalate (DBP)	< 1000 ppm (0.1% by mass)
Diisobutyl phthalate (DIBP)	< 1000 ppm (0.1% by mass)

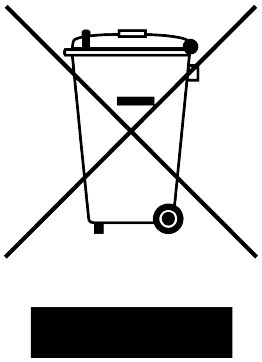
DIRECTIVE 2002/96/EC (WEEE)

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, and two instrumentation manuals (this manual and the “Programming Manual for -B Instruments”) 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 90 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 / 2099-1, 220V, 50 Hz	-AC22	Qualtek	399012-01

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:

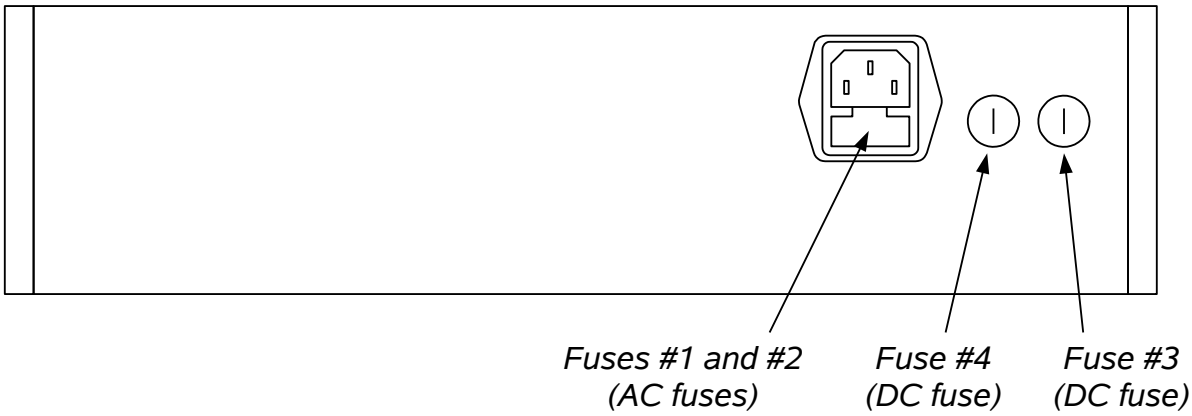
1. indoor use;
2. altitude up to 2 000 m;
3. temperature 5 °C to 40 °C;
4. maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
5. Mains supply voltage fluctuations up to ±10 % of the nominal voltage;
6. no pollution or only dry, non-conductive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

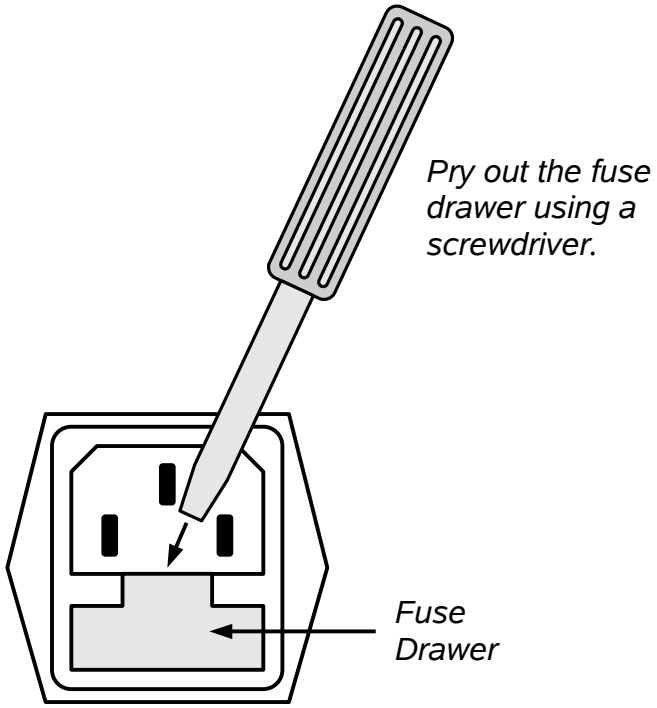
FUSES

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 for standard models:

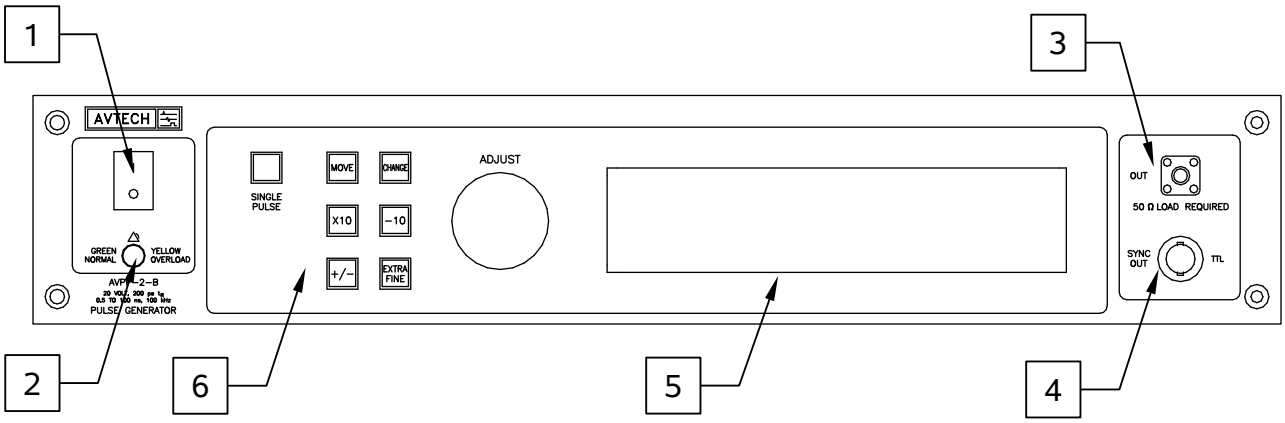
Fuses	Nominal Mains Voltage	Rating	Case Size	Recommended Replacement Part	
				Littelfuse Part Number	Digi-Key Stock Number
#1, #2 (AC)	115 V	0.8A, 250V, Time-Delay	5×20 mm	0218.800HXP	F2418-ND
	230 V	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND
#3 (DC)	N/A	2.5A, 250V, Time-Delay	5×20 mm	021802.5HXP	F2427-ND
#4 (DC)	N/A	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND

Certain combinations of features may require slightly different fuse ratings. The required fuse ratings will be clearly marked on the rear panel of the instrument.

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.

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 connector provides the main output signal, into load impedances of 50 Ohms. A 50 Ohm load is *required*.

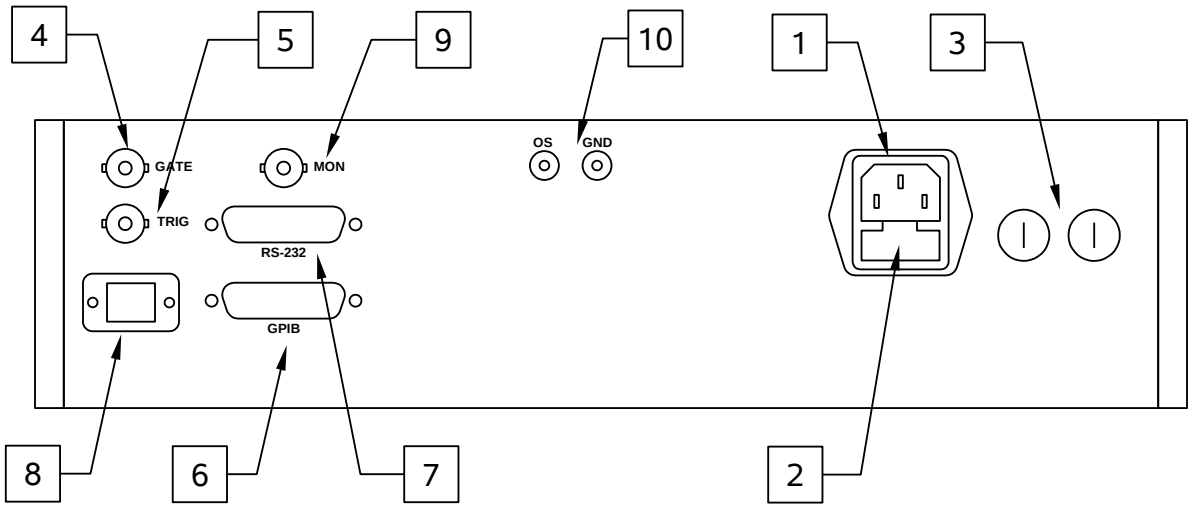
4. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads (or lags) the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to R_L > 1 kΩ with a pulse width of approximately 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. 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. M Connectors. (Optional feature. Present on "-M" units only.) The monitor output provides an attenuated replica (20 dB down) of the voltage on the main output (but excluding the effect of the internal range attenuator and DC offset functions).

10. OS Connector. (Optional feature. Present on units with the -OS and -OT options only). This connector allows an externally generated DC offset to be added to the output. The desired DC offset is applied to this connector, which is connected to the output centre conductor through a high-quality RF inductor. Do not exceed ±50V, 250 mA. For units with the -OS option, this input is always active. For units with the -OT option, the DC offset is generated internally by default, unless the “volt:low ext” command is sent, or the external mode is selected from the front panel offset menu – in which case, the externally-generated DC bias is applied to this input.

GENERAL INFORMATION

BASIC PULSE CONTROL

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

- OUT. This is the main output.

- 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:

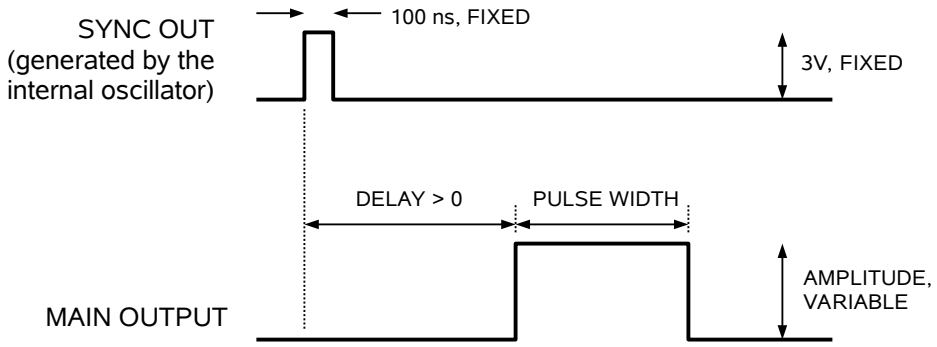


Figure A

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

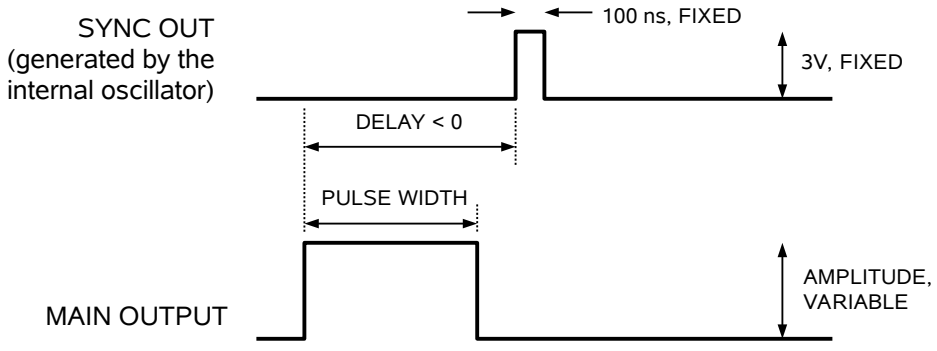


Figure B

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

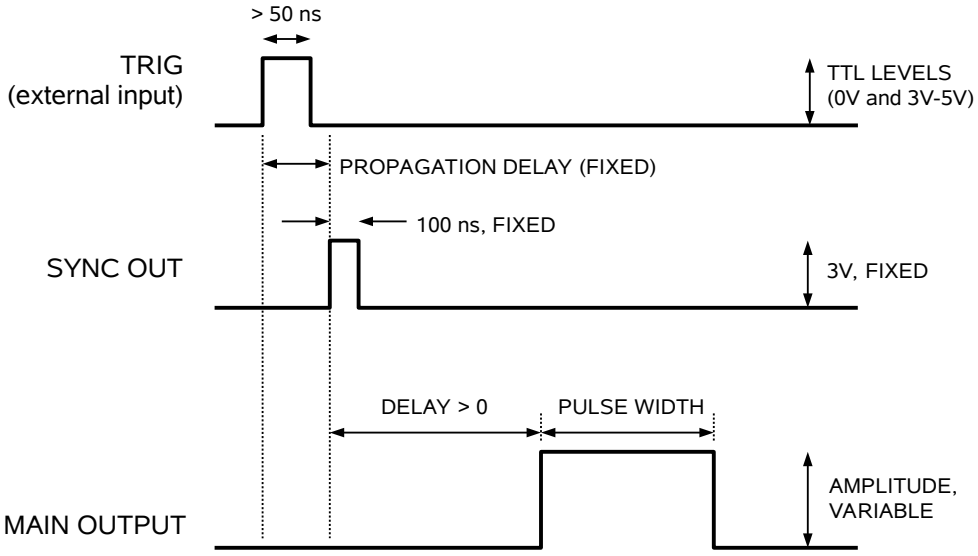


Figure C

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.)

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.

OPERATION AT LOW AMPLITUDES

This instrument will generate the best waveforms when operated near maximum amplitude. If amplitudes less than ~ 4% of the full-scale value are desired, better results will be obtained if the pulse generator is operated at a higher amplitude, and an attenuator is connected to the output.

Avtech recommends the BW-SxxW2+ series of 18 GHz coaxial attenuators from Mini-Circuits, http://www.minicircuits.com/. (The “xx” in the part number is replaced with the numeric attenuation value in dB).

OPTIONAL FEATURES

RACK MOUNTING, "-R5" OPTION

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.

DC OFFSET, "-OS" OPTION

This option adds a bias tee circuit on the output, with a rear-panel “OS” connector. This connector allows an externally generated DC offset to be added to the output. The desired DC offset is applied to this connector, which is connected to the output centre conductor through a high-quality RF inductor. Do not exceed ±50V, 250 mA.

DC OFFSET, "-OT" OPTION

This option adds a bias tee circuit on the output, and adds an internal 0 to ±5V DC bias source. The offset level can be set by the front-panel controls, or by computer commands. The internal DC source is active by default, unless the “volt:low ext” command is sent, or the external mode is selected from the front panel offset menu. In that case, the user must add the desired externally-generated DC offset to the rear-panel solder terminals (± 50 Volts / 250 mA maximum).

MONITOR OUTPUT, "-M" OPTION

The monitor output provides an attenuated replica (÷ 10) of the voltage on the main output. The monitor output is designed to operate into a 50 Ohm load. The monitor output does not include the effect of the internal 15 dB attenuator that is used to provide main output amplitudes of 3.4V or less.

PROTECTING YOUR INSTRUMENT

TURN OFF INSTRUMENT WHEN NOT IN USE

The lifetime of the switching elements in the pulse generator module is proportional to the running time of the instrument. For this reason the prime power to the instrument should be turned off when the instrument is not in use. In the case of failure, the switching elements are easily replaced following the procedure described in a following section.

DO NOT EXCEED 100 kHz

The output stage may be damaged if triggered by an external signal at a pulse repetition frequency greater than 100 kHz.

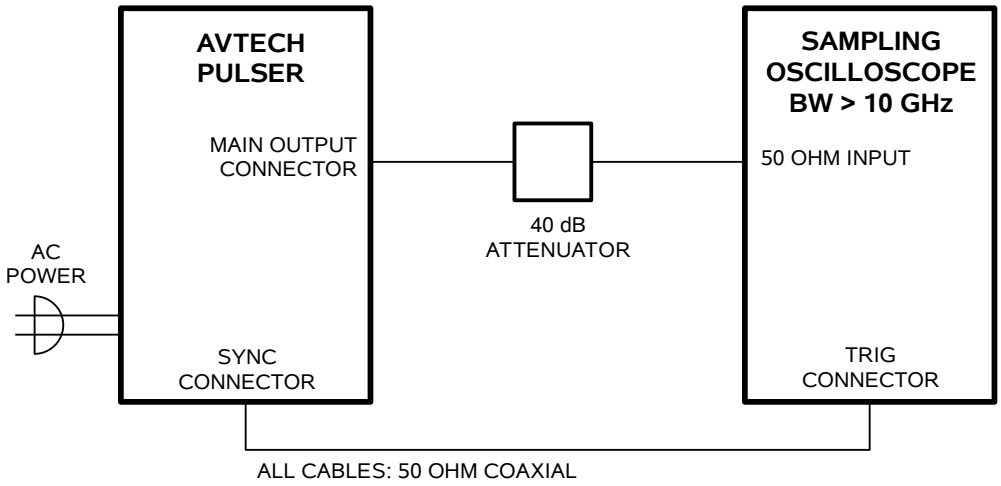
USE A 50 OHM LOAD

The output stage may be damaged if the output is not terminated into a 50Ω 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. Factory tests are conducted using Mini-Circuits model BW-S20W2+ attenuators.

   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 required 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 10 GHz.

   d) Set the oscilloscope to trigger externally with the vertical setting at 100 mV/div and the horizontal setting at 10 ns/div.

2. Turn on the AVPP-2-B. The main menu will appear on the LCD.

3. To set the AVPP-2-B 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 100 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 100 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 60 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 60 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 +20V (or -20V for "-N" models).

c) Observe the oscilloscope. You should see 60 ns wide, 20V 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 20V.

e) ("-PN" units only) Press the +/- button on the front panel. The amplitude as seen on the oscilloscope should flip polarity, to -20V.

f) Press CHANGE to return to the main menu.

9. To set the pulse width to 6 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 6 ns.

c) Observe the oscilloscope. You should see 6 ns wide, 20V 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. Note that this pulser has two internal pulse width ranges (of 0.5 - 8 ns and 8 - 100 ns, approximately), and the internal propagation delay is 20 ns smaller in the wider pulse range than in the narrower pulse range.

d) Press CHANGE to return to the main menu.

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 50 ns       (sets the pulse width to 50 ns)
pulse:delay 20 ns       (sets the delay to 20 ns)
volt:ampl 5             (sets the amplitude to +5 V)
                        ("-N" units should use "volt:ampl -5)
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 50 ns       (sets the pulse width to 50 ns)
output on               (turns on the output)
volt:ampl 5             (sets the amplitude to +5 V)
                        ("-N" units should use "volt:ampl -5)
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 50 ns       (sets the pulse width to 50 ns)
pulse:delay 1 us        (sets the delay to 1 us)
volt:ampl 5             (sets the amplitude to +5 V)
                        ("-N" units should use "volt:ampl -5)
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>	
[SOURce]:		
:PULSe		
:PERiod	<numeric value>	
:WIDTh	<numeric value>	
:DCYCle	<numeric value>	
:HOLD	WIDTh | DCYCle	
:DELay	<numeric value>	
:GATE		
:TYPE	ASYNC | SYNC	
:LEVel	HIgh | LOw	
[SOURce]:		
:VOLTage		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric value> | EXTernal	
: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

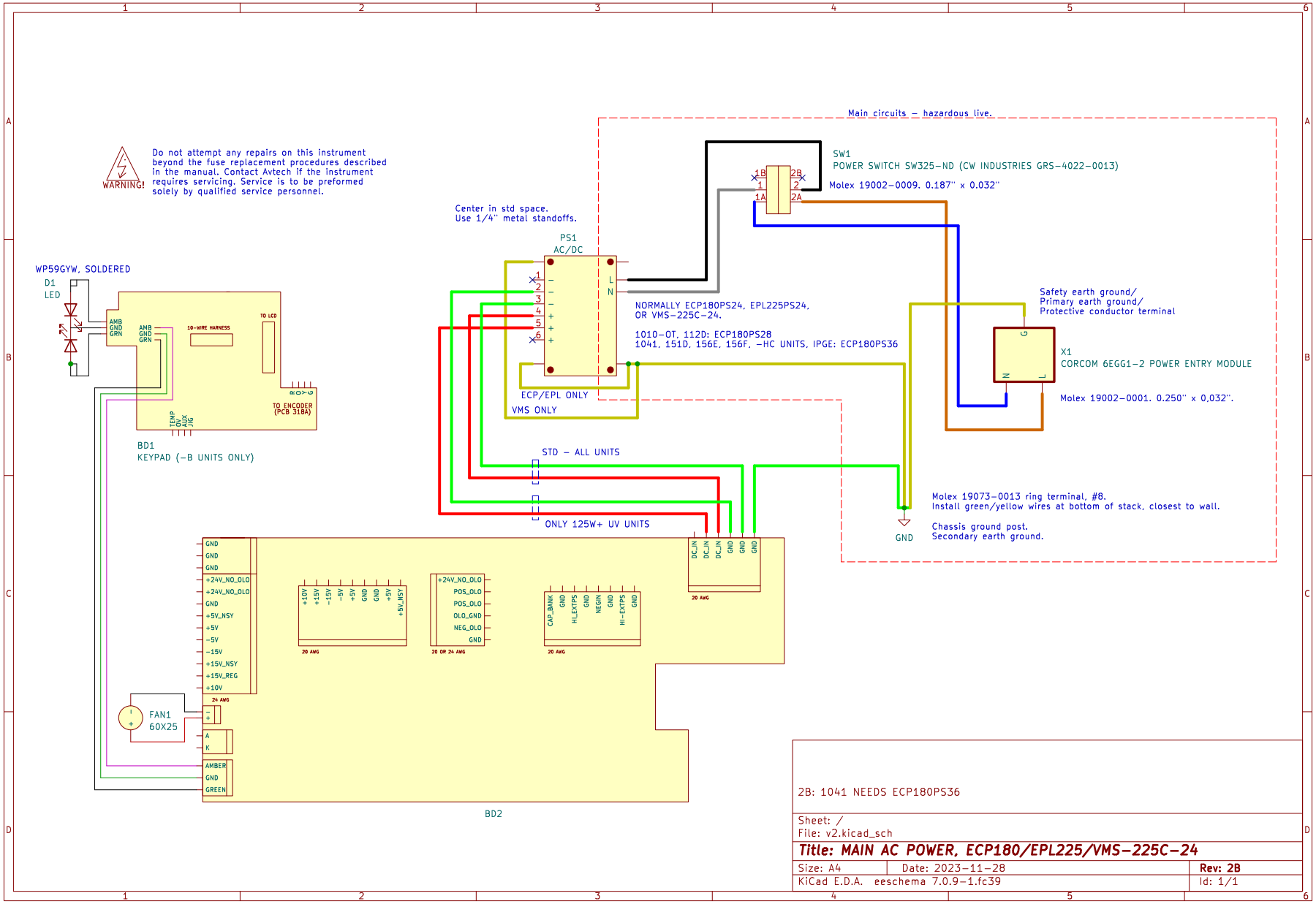
The rear-panel TRIG input, used in the external trigger mode, is protected by a diode clamping circuit. However, the protection circuit is not foolproof, and it is possible for a grossly excessive signal to damage the trigger circuitry on the main timing control board (the 4×10 inch board on the right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

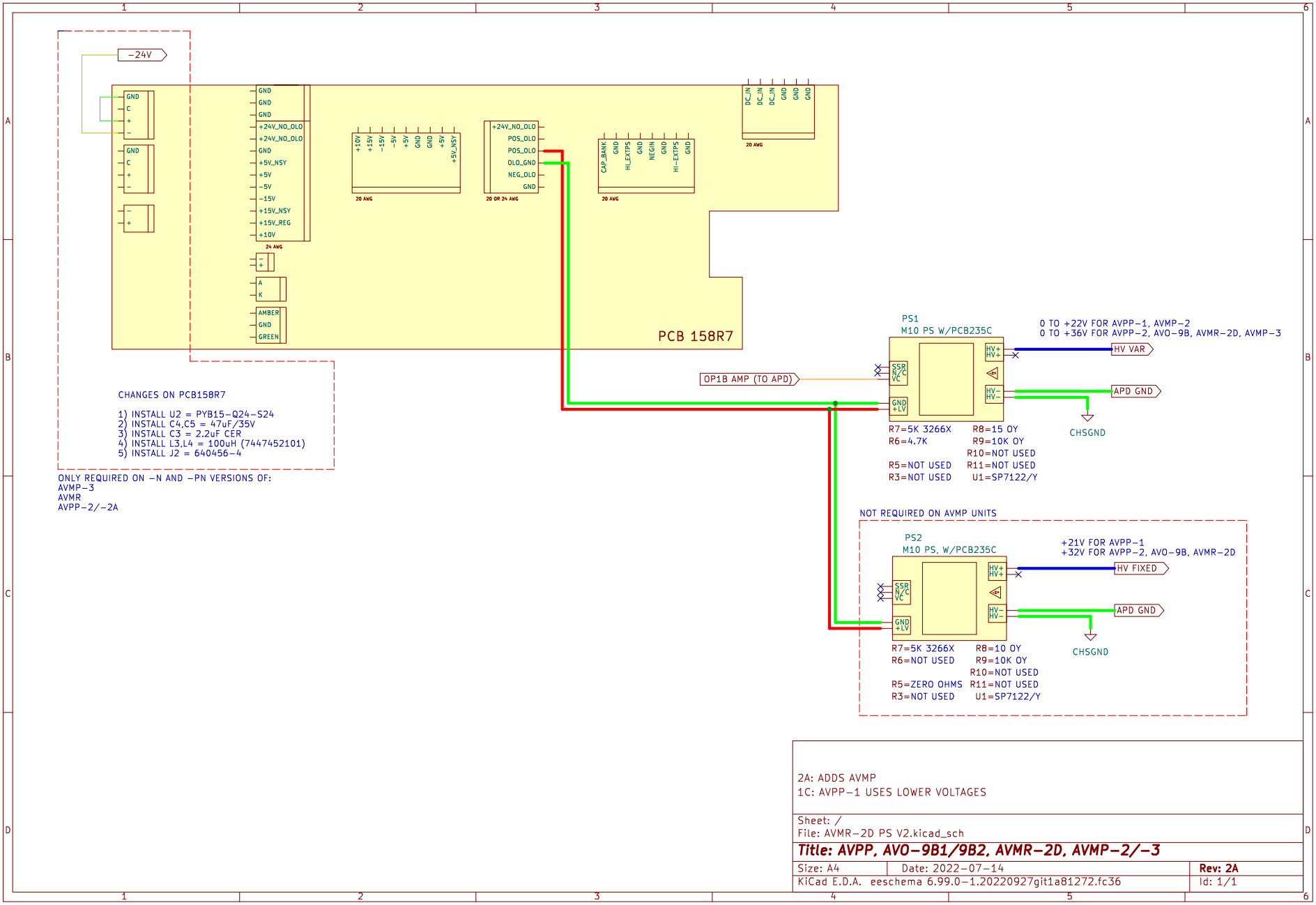
If you suspect that this IC has been damaged, turn off the power and replace this IC. It may be replaced by a 74F151, 74LS151, 74ALS151, or 74HCT151.

WIRING DIAGRAMS

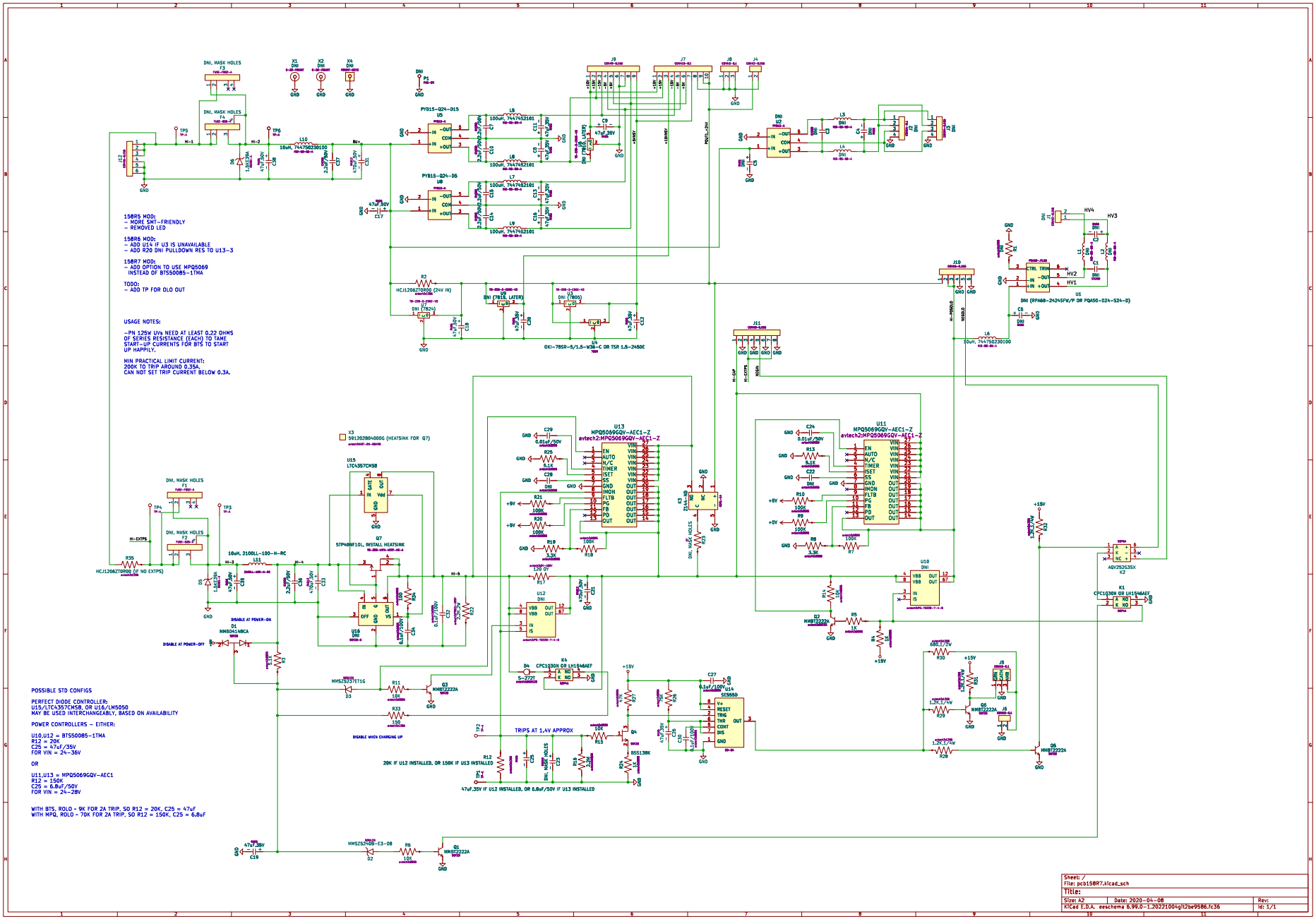
WIRING OF AC POWER



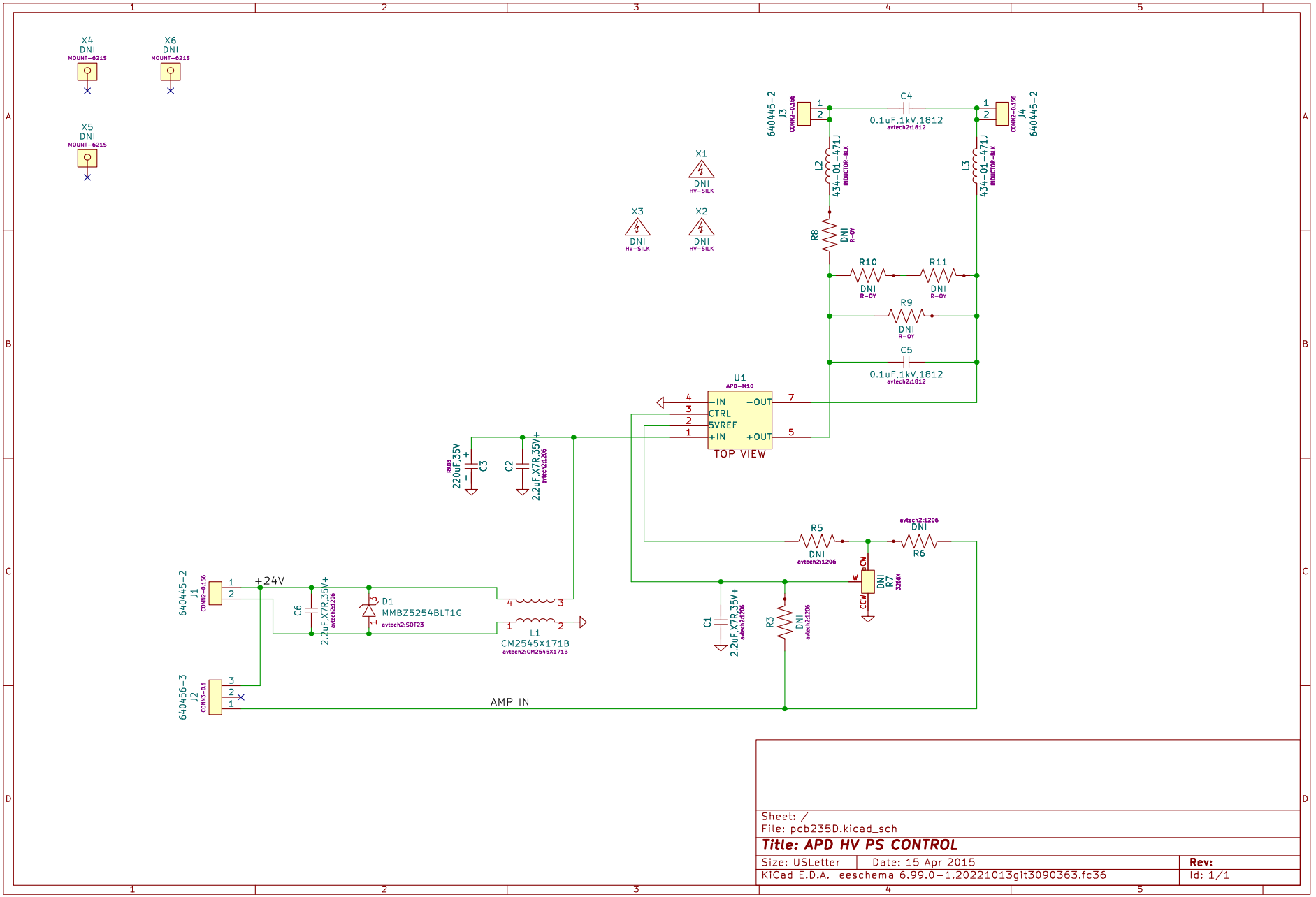
WIRING OF DC POWER



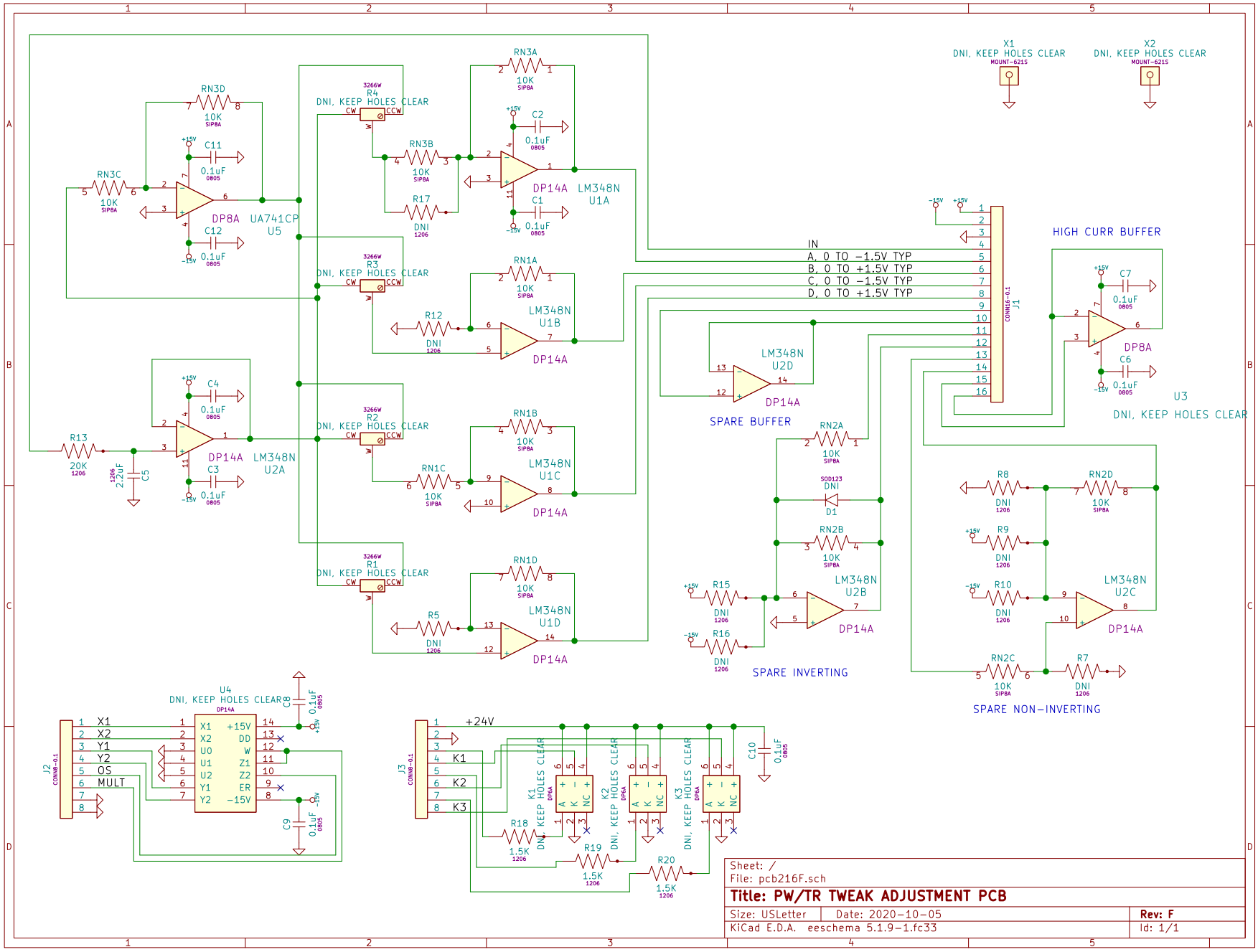
PCB 158R7 - LOW VOLTAGE POWER SUPPLY



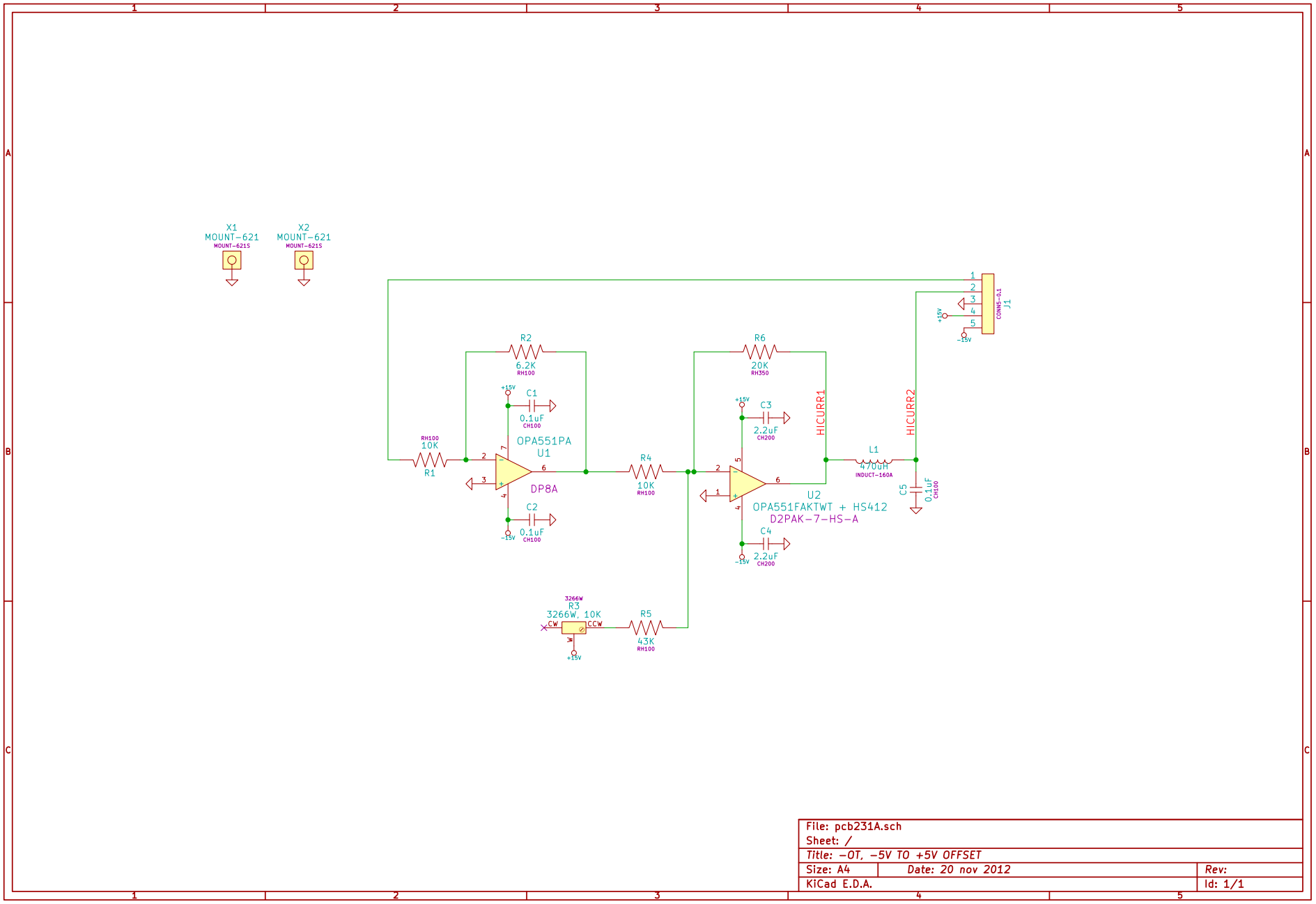
PCB 235D - HIGH VOLTAGE DC POWER SUPPLY



PCB 216F - PRF/PW TWEAKING PCB

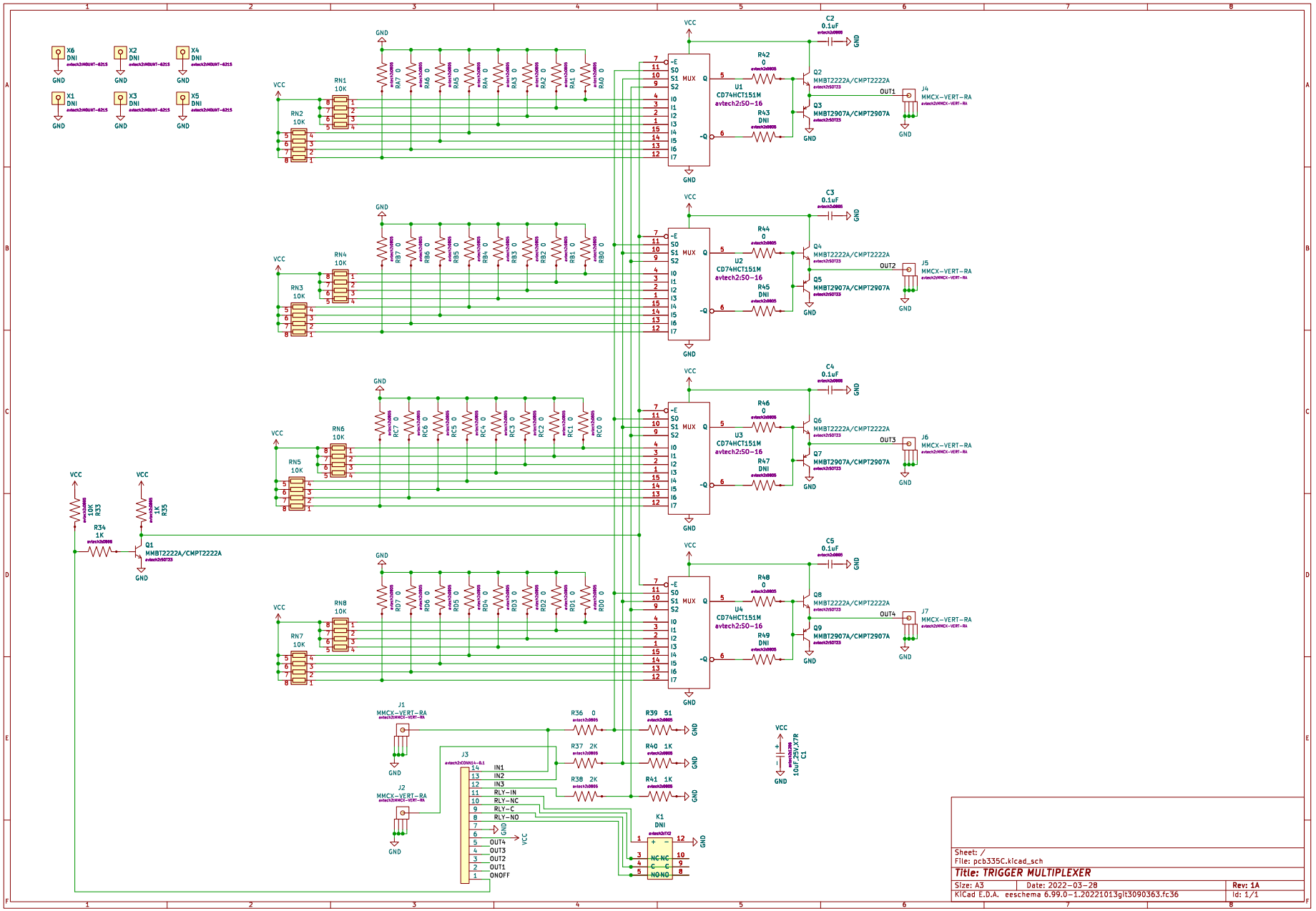


PCB 231A - INTERNAL DC OFFSET FUNCTION

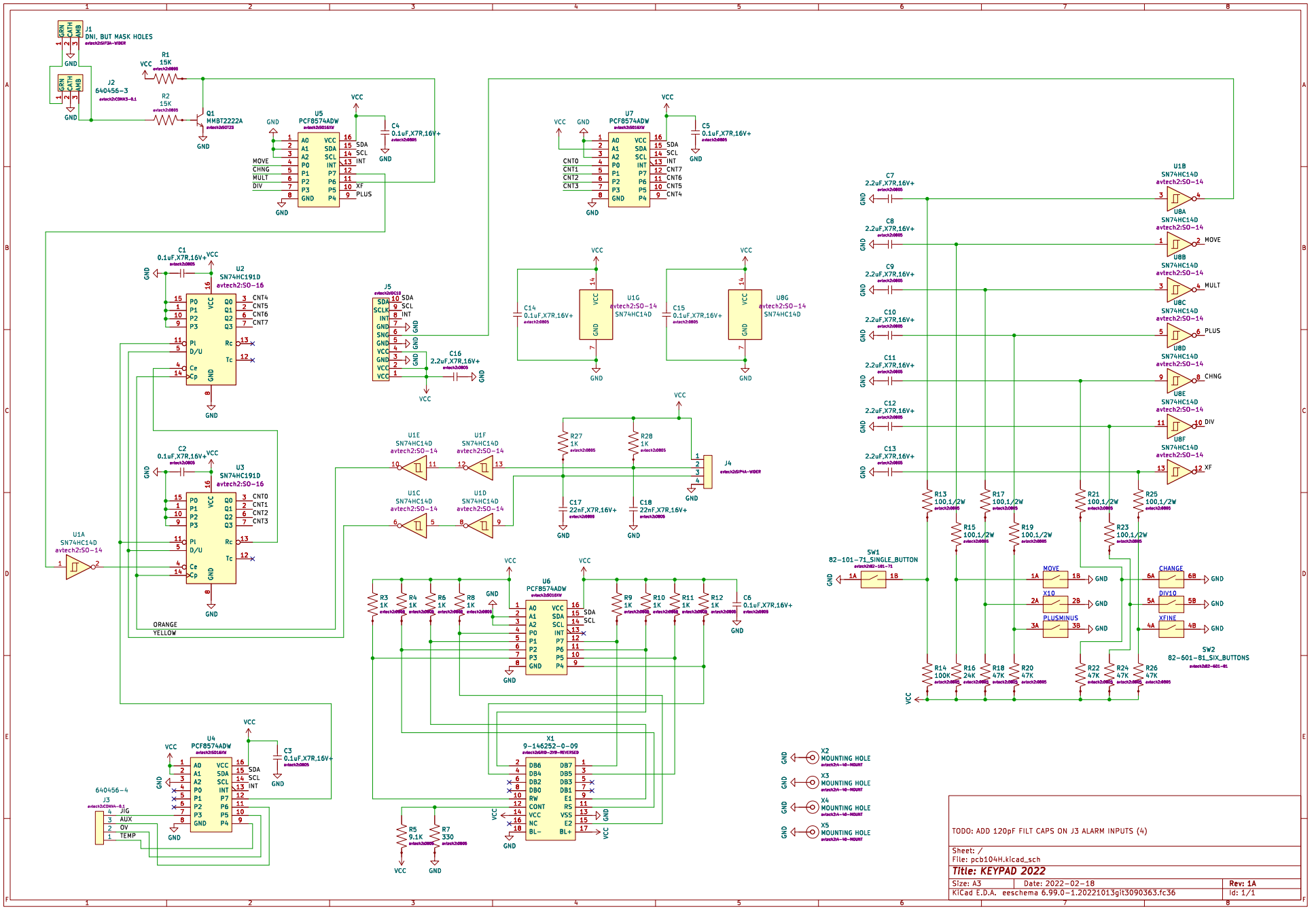


File: pcb231A.sch		
Sheet: /		
Title: -OT, -5V TO +5V OFFSET		
Size: A4	Date: 20 nov 2012	Rev:
KiCad E.D.A.		Id: 1/1

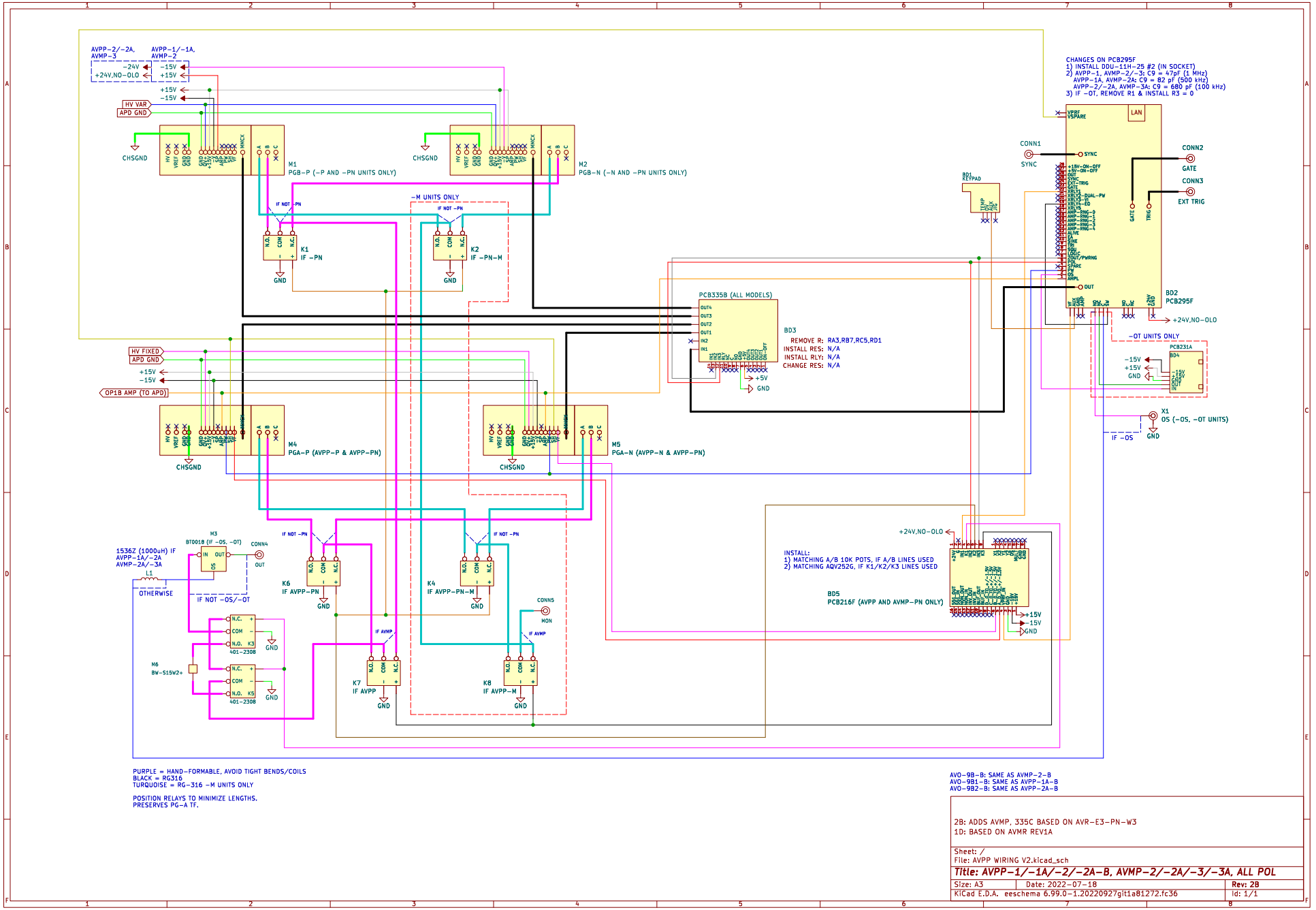
PCB 335C - TRIGGER MULTIPLEXER



PCB 104H - KEYPAD / DISPLAY BOARD



MAIN WIRING


AVPP-2/-2A, AVMP-3
AVPP-1/-1A, AVMP-2
-24V
+24V,NO-OLO
-15V
+15V
HV VAR
APD GND
CHSGND
M1
PGB-P (-P AND -PN UNITS ONLY)
M2
PGB-N (-N AND -PN UNITS ONLY)
IF NOT -PN
K1
IF -PN
-M UNITS ONLY
K2
IF -PN-M
GND
CHANGES ON PCB295F
1) INSTALL DDU-11H-25 #2 (IN SOCKET)
2) AVPP-1, AVMP-2/-3: C9 = 47pF (1 MHz)
AVPP-1A, AVMP-2A: C9 = 82 pF (500 kHz)
AVPP-2/-2A, AVMP-3A: C9 = 680 pF (100 kHz)
3) IF -OT, REMOVE R1 & INSTALL R3 = 0
CONN1
SYNC
CONN2
GATE
CONN3
EXT TRIG
LAN
BD1
KEYPAD
BD2
PCB295F
PCB335B (ALL MODELS)
BD3
REMOVE R: RA3,RB7,RC5,RD1
INSTALL RES: N/A
INSTALL RLY: N/A
CHANGE RES: N/A
+5V
-OT UNITS ONLY
PCB231A
BD4
HV FIXED
APD GND
OP1B AMP (TO APD)
M4
PGA-P (AVPP-P & AVPP-PN)
M5
PGA-N (AVPP-N & AVPP-PN)
X1
OS (-OS, -OT UNITS)
IF -OS
M3
BT001B (IF -OS, -OT)
CONN4
15336 (1000uH) IF
AVPP-1A/-2A
AVMP-2A/-3A
L1
OTHERWISE
IF NOT -OS/-OT
K6
IF AVPP-PN
K4
IF AVPP-PN-M
CONN5
MON
IF AVMP
K7
IF AVPP
K8
IF AVPP-M
M6
BW-S15W2+
401-2308
INSTALL:
1) MATCHING A/B 10K POTS, IF A/B LINES USED
2) MATCHING AQV252G, IF K1/K2/K3 LINES USED
BD5
PCB216F (AVPP AND AVMP-PN ONLY)
PURPLE = HAND-FORMABLE, AVOID TIGHT BENDS/COILS
BLACK = RG316
TURQUOISE = RG-316 -M UNITS ONLY
POSITION RELAYS TO MINIMIZE LENGTHS.
PRESERVES PG-A TF.
AVO-9B-B: SAME AS AVMP-2-B
AVO-9B1-B: SAME AS AVPP-1A-B
AVO-9B2-B: SAME AS AVPP-2A-B
2B: ADDS AVMP, 335C BASED ON AVR-E3-PN-W3
1D: BASED ON AVMR REV1A
Sheet: /
File: AVPP WIRING V2.kicad_sch
Title: AVPP-1/-1A/-2/-2A-B, AVMP-2/-2A/-3/-3A, ALL POL
Size: A3
Date: 2022-07-18
Rev: 2B
KiCad E.D.A. eeschema 6.99.0-1.20220927git1a81272.fc36
Id: 1/1

PERFORMANCE CHECKSHEET