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INSTRUCTIONS

MODEL AVR-D2-B

MIL-PRF-19500 SWITCHING TIME TEST

PULSE GENERATOR

WITH IEEE 488.2 AND RS-232 CONTROL

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

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TABLE OF CONTENTS

Manual Reference: /fileserver1/officefiles/instructword/avr-d2/AVR-D2-B,edition7.odt.
Last modified February 29, 2024.

INTRODUCTION

Model AVR-D2-B is specifically designed to perform MIL-PRF-19500 switching time tests, but it is also useful as a high-speed medium-voltage general-purpose laboratory pulse generator.

The main output (channel 1) provides a ±6 to ±30 Volt (±40 Volts for units with the -SOA option) pulse. The pulse width is adjustable from 200 ns to 20 us. The 10%-90% rise time is ≤ 1.5 ns (≤ 1.0 ns for units with the -TRF option), and the fall time is ≤ 2 ns.

A second output (channel 2) provides a ±2 Volt, 15 ns wide pulse, with 1.5 ns rise times (10%-90%) and 2.5 ns fall times.

Both outputs require a 50Ω load. A variable DC offset of 0 to ± 15 Volts may be added to the outputs.

Only one channel is active at a time. There is a single main output connector. Internal relays connect the desired channel to the output connector.

The AVR-D2-B 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 AVR-D2-B features front panel keyboard and adjust knob control of the output pulse parameters along with a four line by 40 character back-lit 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.

AVAILABLE OPTIONS

-SOA Option: This option increases the maximum channel amplitude from ±30 Volts to ±40 Volts.

-TRF Option: This option decreases the specified rise time of the CH1 output from 1.5 ns to 1.0 ns (10%-90%).

The -SOA and -TRF options are mutually exclusive.

SPECIFICATIONS

Model:	AVR-D2-B[1]	
Output:	CH A	CH B
Amplitude: (into 50 Ohms)	6 to 30 V, adjustable[2] + or -, switchable	2 V, fixed + or -, switchable
DC offset:	-15V to +15V, adjustable	-1V to +1V, adjustable
Pulse width (FWHM):	200 ns to 20 us, adjustable	15 ns, fixed
Duty cycle:	1% maximum	N/A
Rise time of leading edge (10%-90%):	≤ 1.5 ns (≤ 1.0 ns optional[3])	≤ 1.5 ns
Fall time of trailing edge (90%-10%):	≤ 2.0 ns	≤ 2.5 ns
Pulse repetition frequency (PRF):	5 Hz - 50 kHz	
Source impedance:	50 Ohms	
Required load impedance:	50 Ohms	
GPIB and RS-232 control[2]:	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.	
Settings resolution:	The resolution of the timing parameters varies, but is always better than 0.15% of the set value. The amplitude resolution is typically 0.02% of the maximum amplitude.	
Settings accuracy:	Typically ± 3% (±1 ns or ± 2% of max. amplitude) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output with a calibrated oscilloscope.	
Jitter:	± 35 ps ± 0.015% of sync delay	
Trigger modes:	Internal trigger, external trigger (TTL level pulse, > 50 ns, 1 kΩ input impedance), front-panel “Single Pulse” pushbutton, or single pulse trigger via computer command.	
Sync delay:	Sync out to pulse out: Variable, 0 to ± 1 second	
Sync output:	+3 Volts, 100 ns, will drive 50 Ohm loads	
Monitor output:	Provides an attenuated (÷11) coincident replica of main output	
Connectors:	BNC	
Power required:	100-240 Volts, 50-60 Hz	
Dimensions, temperature range:	100 x 430 x 375 mm (3.9 x 17 x 14.8”), +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) The maximum amplitude may be increased from 30V to 40V by specifying the -SOA option.
3) Add the -TRF suffix to the model number to specify the ≤ 1.0 ns rise time option. Not available with the -SOA option.
4) Add the suffix -VXI to the model number to specify the Ethernet port.

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

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 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 72/23/EEC as amended by 93/68/EEC. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

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

DIRECTIVE 2002/95/EC (RoHS)

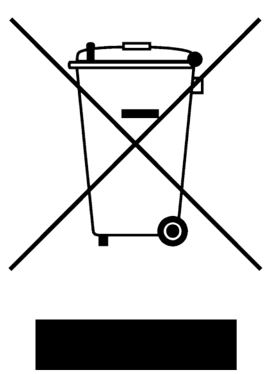
This instrument is exempt from Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment. Specifically, Avtech instruments are considered "Monitoring and control instruments"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

DIRECTIVE 2002/96/EC (WEEE)

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

Customers who have purchased Avtech equipment through local representatives should consult with the representative to determine who has responsibility for WEEE compliance. Normally, such responsibilities 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.



AC POWER SUPPLY REGULATORY NOTES

This instrument converts the AC input power to the +24V DC voltage that powers the internal circuitry of this instrument using a Tamura AAD130SD-60-A switching power supply. According to the manufacturer, the Tamura AAD130SD-60-A has the following certifications:

UL60950-1
IEC60950 -1
CSA C22.2 No. 60950- 1
EN60950 -1

and is compliant with:

EN61000-3-2
EN61000-4-2 Level 2
EN61000-4-2 Level 3 (Air Only)
EN61000-4-4 Level 3
EN61000-4-5 Level 3
EN61000-4-11
CISPR 11 and 22 FCC Part 15 Class B (conducted)

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, 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:

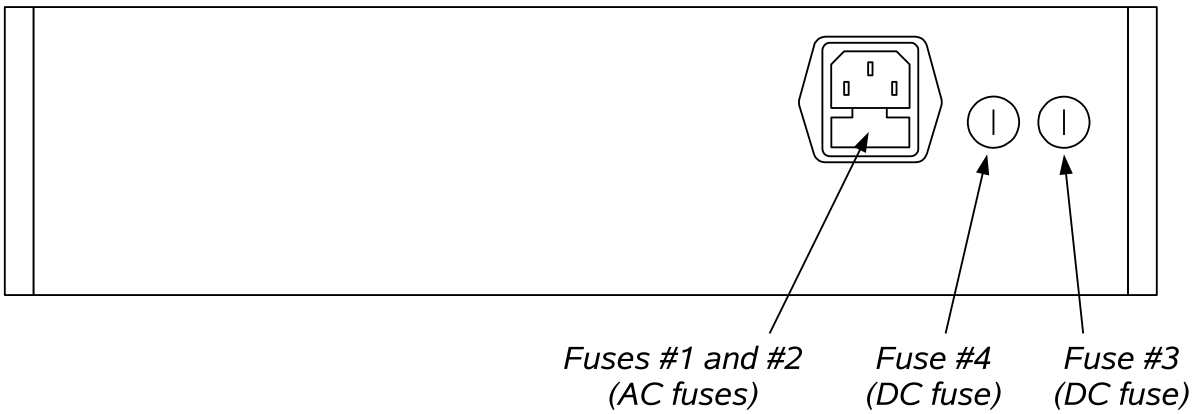
1. indoor use;
2. altitude up to 2 000 m;
3. temperature 5 °C to 40 °C;
4. maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
5. Mains supply voltage fluctuations up to ±10 % of the nominal voltage;
6. no pollution or only dry, non-conductive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

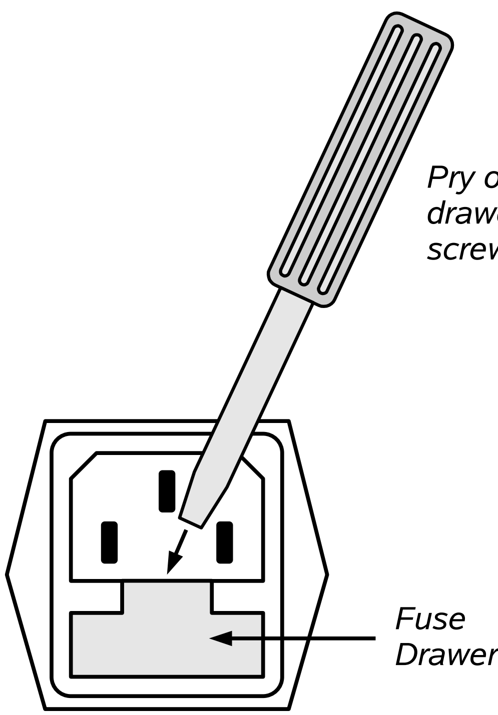
FUSES

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

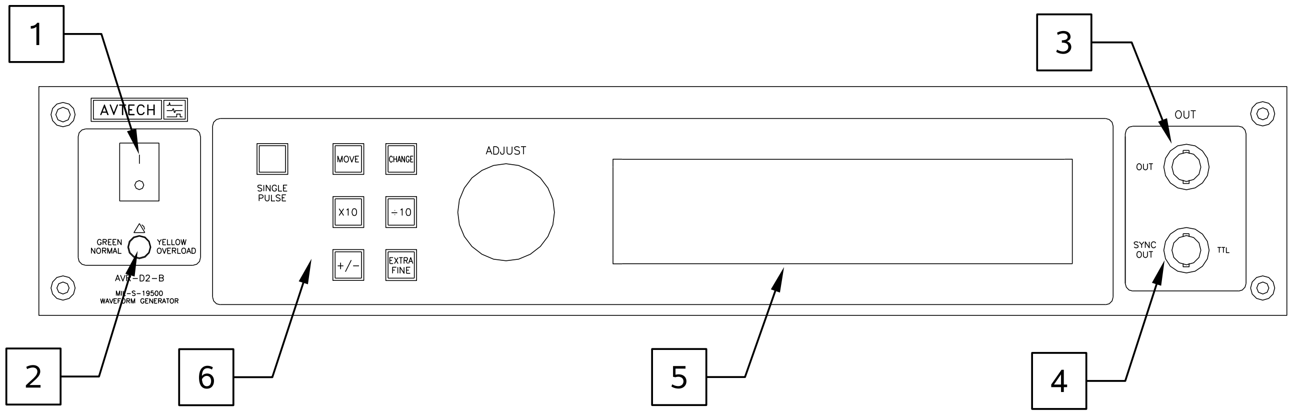
The following table lists the required fuses:

Fuses	Nominal Mains Voltage	Rating	Case Size	Recommended Replacement Part	
				Littelfuse Part Number	Digi-Key Stock Number
#1, #2 (AC)	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	0.8A, 250V, Time-Delay	5×20 mm	0218.800HXP	F2418-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 may be a delay of several seconds before the instrument appears to respond.

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.

   Note that the output stage will safely withstand a short-circuited load condition.

3. OUT CONNECTOR. This BNC connector provides the main output signal, into load impedances of 50Ω. This instrument has two channels internally (channels 1 and 2), but only one is supplied to the OUT connector at a time, depending on the front-panel settings, or computer commands.

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 > 50Ω with a pulse width of approximately 100 ns.

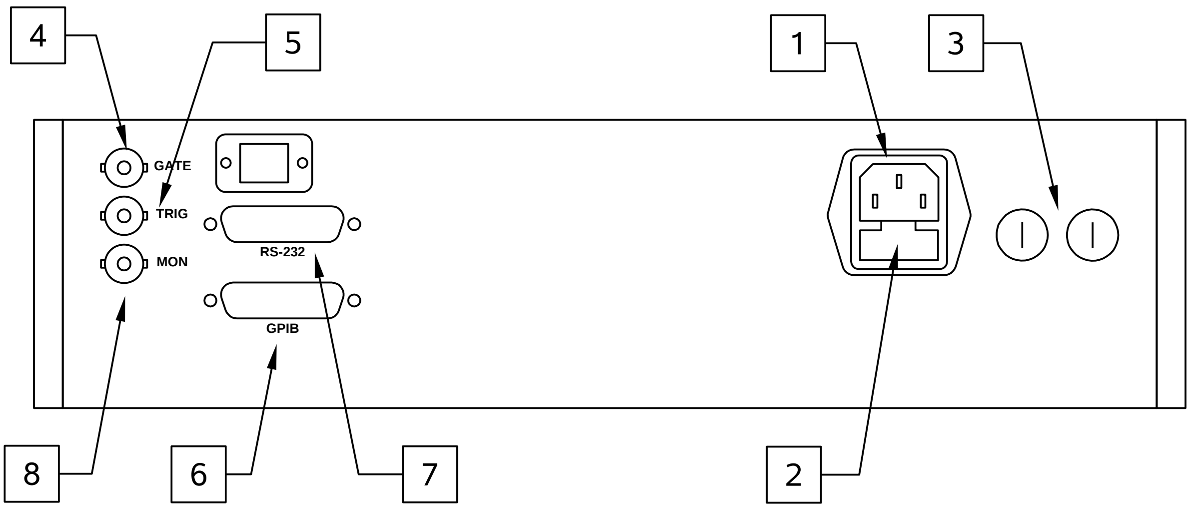
5. LIQUID CRYSTAL DISPLAY (LCD). This LCD is used in conjunction with the keypad to change the instrument settings. Normally, the main menu is displayed, which lists the key adjustable parameters and their current values. The “Programming Manual for -B Instruments” describes the menus and submenus in

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



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. See the “Programming Manual for -B Instruments” for more details on RS-232 control.

8. M Connector. The monitor output provides an attenuated replica (÷11) of the voltage on the output connector. The monitor output is designed to operate into a 50 Ohm load.

GENERAL INFORMATION

BASIC PULSE CONTROL

This instrument can generate two types of waveforms, designated Channel 1 and Channel 2, on the main output. These two channels share a common output connector, and only one is active at a time. The general characteristics of the two channels are as follows:

- Channel 1:
  Amplitude continuously variable from -30V to +30V (requires a 50Ω load)
  Pulse width continuously variable from 0.2 to 20 us

- Channel 2:
  Amplitude of either -2V or +2V (not continuously variable)
  Pulse width fixed at 15 ns

When Channel 1 is active, the main menu on the front panel LCD will display “Route: 1”.

When Channel 2 is active, the main menu on the front panel LCD will display “Route: 2”.

A DC offset of -15V to +15V may be added to the output in either mode.

Regardless of the channel used, this instrument can be triggered by its own internal clock or by an external TTL trigger signal. In either case, two signals respond to the trigger: OUT and SYNC.

- OUT. This is the main output. The Channel 1 or Channel 2 waveform is generated on this 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:

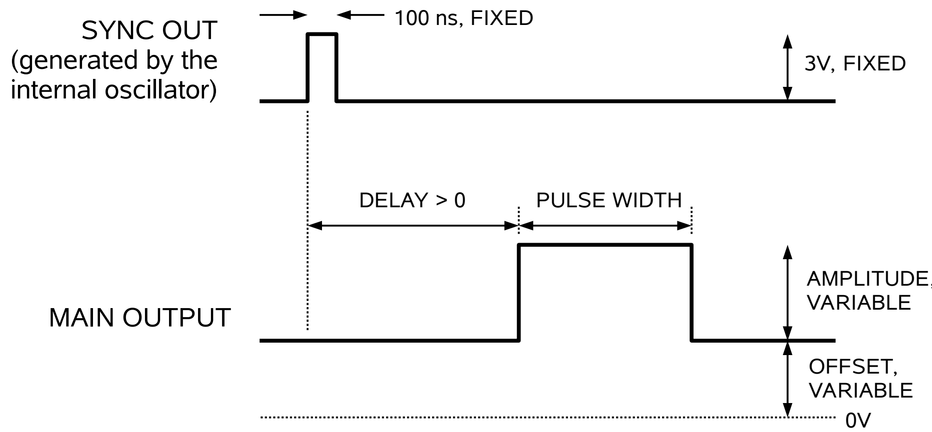


Figure A

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

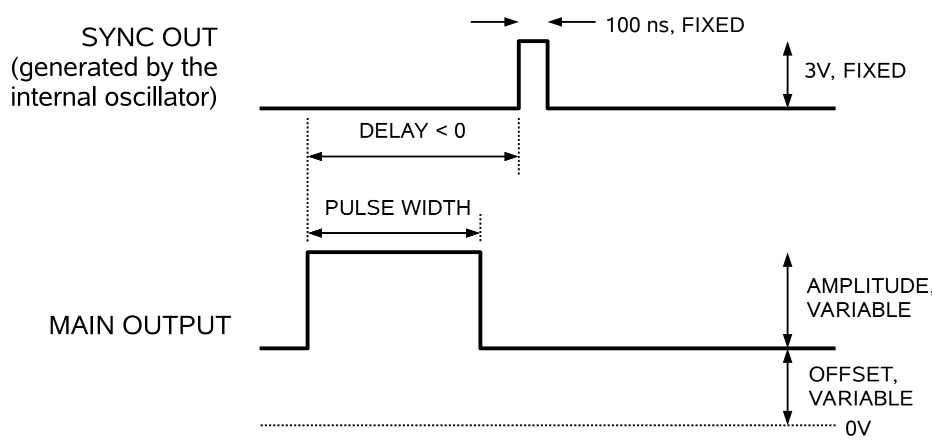


Figure B

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

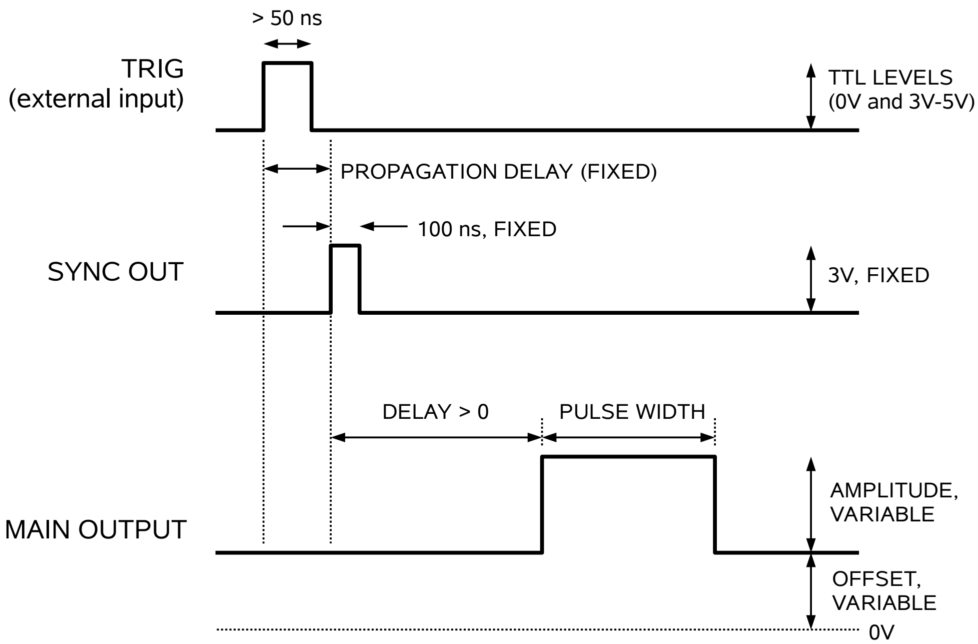


Figure C

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

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.

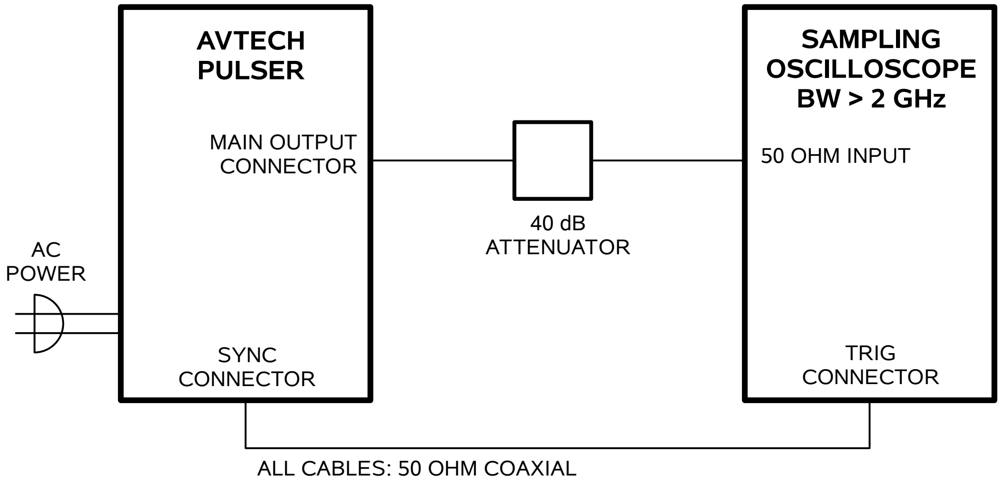
These modes can be selected using the front panel trigger menu, or by using the appropriate programming commands. (See the “Programming Manual for -B Instruments” for more details.)

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.

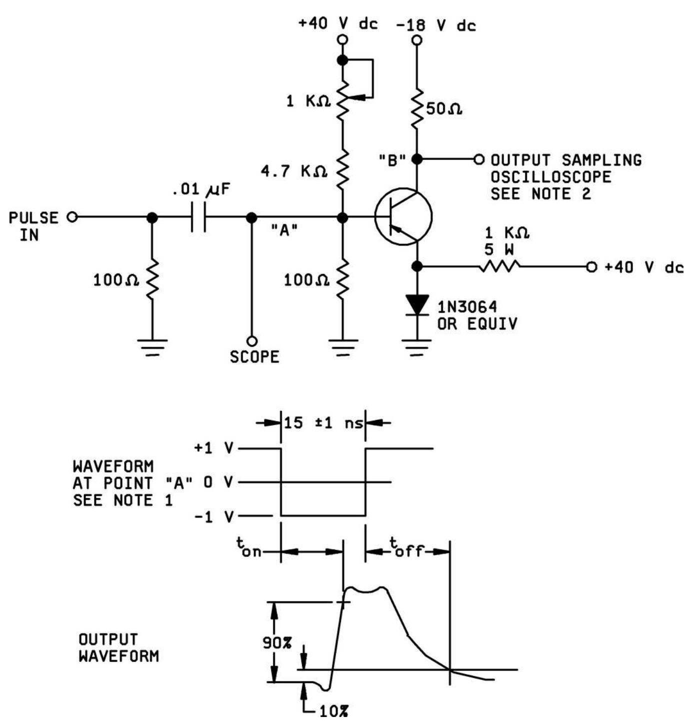
BASIC TEST ARRANGEMENT

The AVR-D2-B should be tested with a sampling oscilloscope with a bandwidth of at least 2 GHz to properly observe the high-speed waveform. A typical test arrangement is shown below:



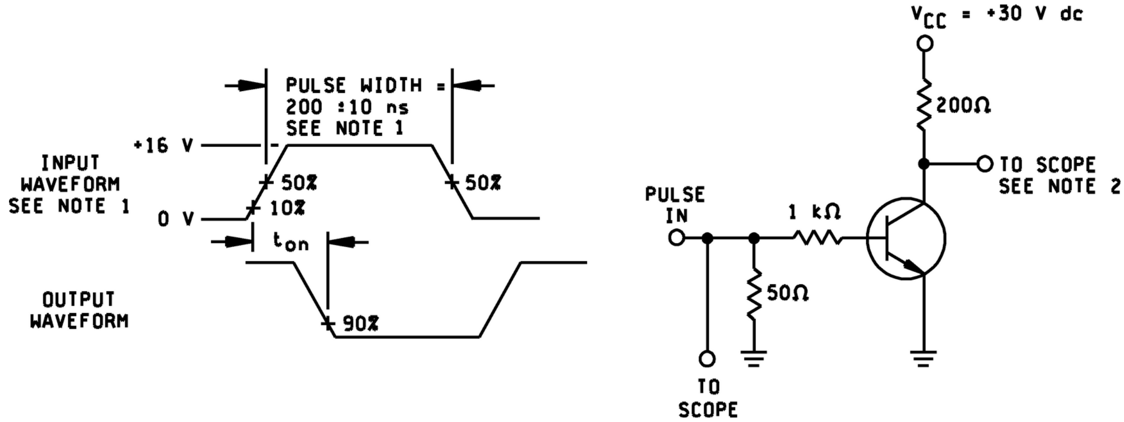
The attenuator is required to prevent damage to the sampling oscilloscope.

TYPICAL TEST SETUPS

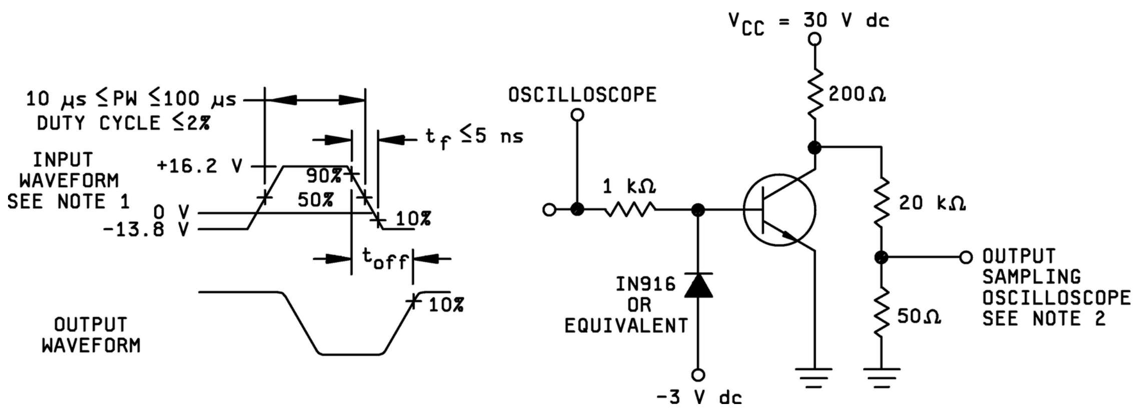


The figure above is taken from MIL-PRF-19500/177F, and is for testing the non-saturated switching time of PNP transistors.

The next figure is taken from MIL-PRF-19500/255V, and is for testing the saturated turn-on switching time of NPN transistors:



Both of the above circuits have 50 Ohm input impedance, so no additional shunt resistance is required. However, MIL-PRF-19500/255V also specifies a circuit for testing the saturated turn-off switching time of NPN transistors:



The input impedance of this circuit is 1 kilohm, so a 50 Ohm resistance (to ground) should be added at the input to this circuit, to avoid transmission line reflections.

Other circuits, specified in other MIL-PRF-19500 “slash sheets” can also be driven by the AVR-D2-B. The above circuits are only typical examples.

Avtech can provide test jigs (designed using proper high-speed construction techniques) to implement your required test circuitry. Contact Avtech (info@avtechpulse.com) with your test requirement!

MINIMIZING WAVEFORM DISTORTIONS

USE 50 OHM TRANSMISSION LINES

Connect the load to the pulse generator with 50Ω transmission lines (e.g. RG-58 or RG-174 cable). If possible, use a 50Ω load. If the actual device under test has a high impedance, consider adding a 50Ω termination in parallel with the load to properly terminate the transmission line.

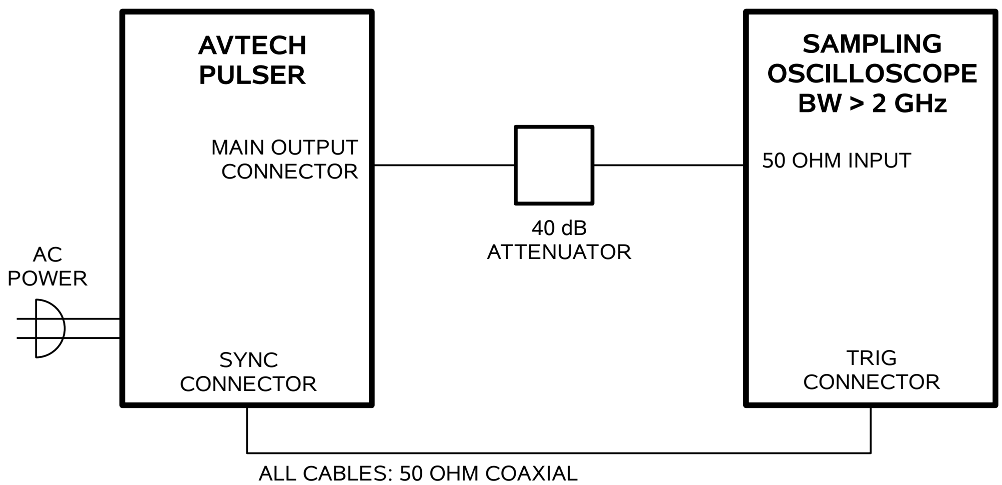
USE LOW-INDUCTANCE LOADS

Lenz's Law predicts that for an inductive voltage spike will be generated when the current through an inductance changes. Specifically, $V_{SPIKE} = L \times dI_{LOAD}/dt$, where L is the inductance, I_{LOAD} is the load current change, and t is time. For this reason, it is important to keep any parasitic in the load low. This means keeping wiring short, and using low inductance components. In particular, wire-wound resistors should be avoided.

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.

2. Turn on the AVR-D2-B. The main menu will appear on the LCD.

3. To set the AVR-D2-B to generate the Channel 1 waveform on the output connector:

    a) Press the MOVE button until the arrow pointer is pointing at the “Route” menu item.

    b) Press the CHANGE button. The active channel submenu will appear.

    c) Rotate the ADJUST knob until “1” is the actice channel.

    d) Press CHANGE to return to the main menu.

4. To set the AVR-D2-B to trigger from the internal clock at a PRF of 2 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 2 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.

5. To set the delay to 50 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 50 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. To set the Channel 1 pulse width to 500 ns:

   a) Press the MOVE button until the arrow pointer is pointing at the PW1 menu item.

   b) Press the CHANGE button. The pulse width submenu will appear. Rotate the ADJUST knob until the pulse width is set at 500 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.

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

8. To change the output amplitude:

   a) Press the MOVE button until the arrow pointer is pointing at the AMP1 menu item.

   b) Press the CHANGE button. The amplitude submenu will appear. Rotate the ADJUST knob until the amplitude is set at +20V.

c) Observe the oscilloscope. You should see 500 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 5 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) 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. Try varying the pulse width, by repeating step (6). As you rotate the ADJUST knob, the pulse width on the oscilloscope will change. It should agree with the displayed value.

10. To set the AVR-D2-B to generate the Channel 2 waveform on the output connector:

a) Press the MOVE button until the arrow pointer is pointing at the “Route” menu item.

b) Press the CHANGE button. The active channel submenu will appear.

c) Rotate the ADJUST knob until “2” is the actice channel.

d) Press CHANGE to return to the main menu.

e) Observe the oscilloscope. You should see 15 ns wide, -2V pulses. If you do not, you may need to adjust the delay setting to a value more compatible with your sampling oscilloscope. Repeat step 5 if required. You may also need to adjust the sampling scope controls.

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, using the internal trigger source:

*rst	(resets the instrument)
trigger:source internal	(selects internal triggering)
route:close (@1)	(selects the Channel 1 output waveform)
frequency 1000 Hz	(sets the frequency to 1000 Hz)
pulse:width 500 ns	(sets the channel 1 pulse width to 500 ns)
pulse:delay 20 ns	(sets the delay to 20 ns)
volt:ampl -20	(sets the channel 1 amplitude to -20 V)
volt:low -2V	(sets the channel 1 offset to -2 V)
volt:ampl2 -2V	(sets the channel 2 amplitude to -2 V)
(….perform your tests using the channel 1 output….)	
route:close (@2)	(selects the Channel 2 output waveform)
(….perform your tests using the channel 2 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
LOCAL		
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
REMOTE		
ROUTe:		
:CLOSe	<channel list>	
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	

```
[SOURce]:
    :PULSe
        :PERiod                     <numeric value>
        :WIDTh                      <numeric value> | IN
        :DCYCle                     <numeric value>
        :HOLD                       WIDTh | DCYCle
        :DELay                      <numeric value>
        :GATE
            :LEVel                  HIgh | LOw
[SOURce]:
    :VOLTage
        [:LEVel]
            [:IMMediate]
                [:AMPLitude]        <numeric value>
                :LOW                <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
                :BITS               7 | 8
                :ECHO               <boolean value>
                :PARity
                    :[TYPE]         EVEN | ODD | NONE
                :SBITS              1 | 2
    :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]
```

OTHER INFORMATION

APPLICATION NOTES

Application notes are available on the Avtech web site, at http://www.avtechpulse.com/appnote.

MANUAL FEEDBACK

Please report any errors or omissions in this manual, or suggestions for improvement, to info@avtechpulse.com. Thanks!

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

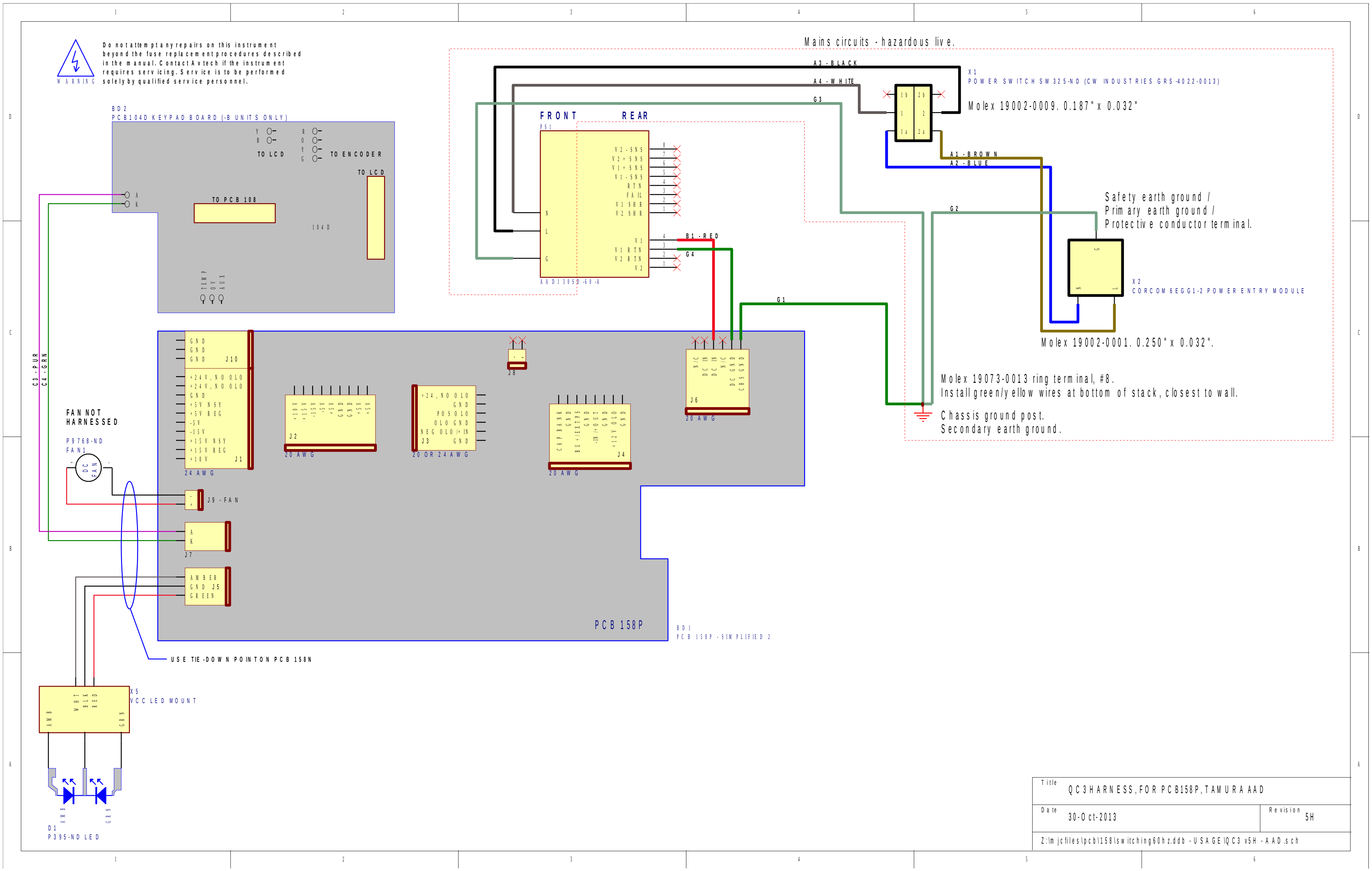
The rear-panel TRIG input, used in the external trigger mode, is protected by a diode clamping circuit. However, the protection circuit is not foolproof, and it is possible for a grossly excessive signal to damage the trigger circuitry on the main timing control board (the 4×10 inch board on the right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

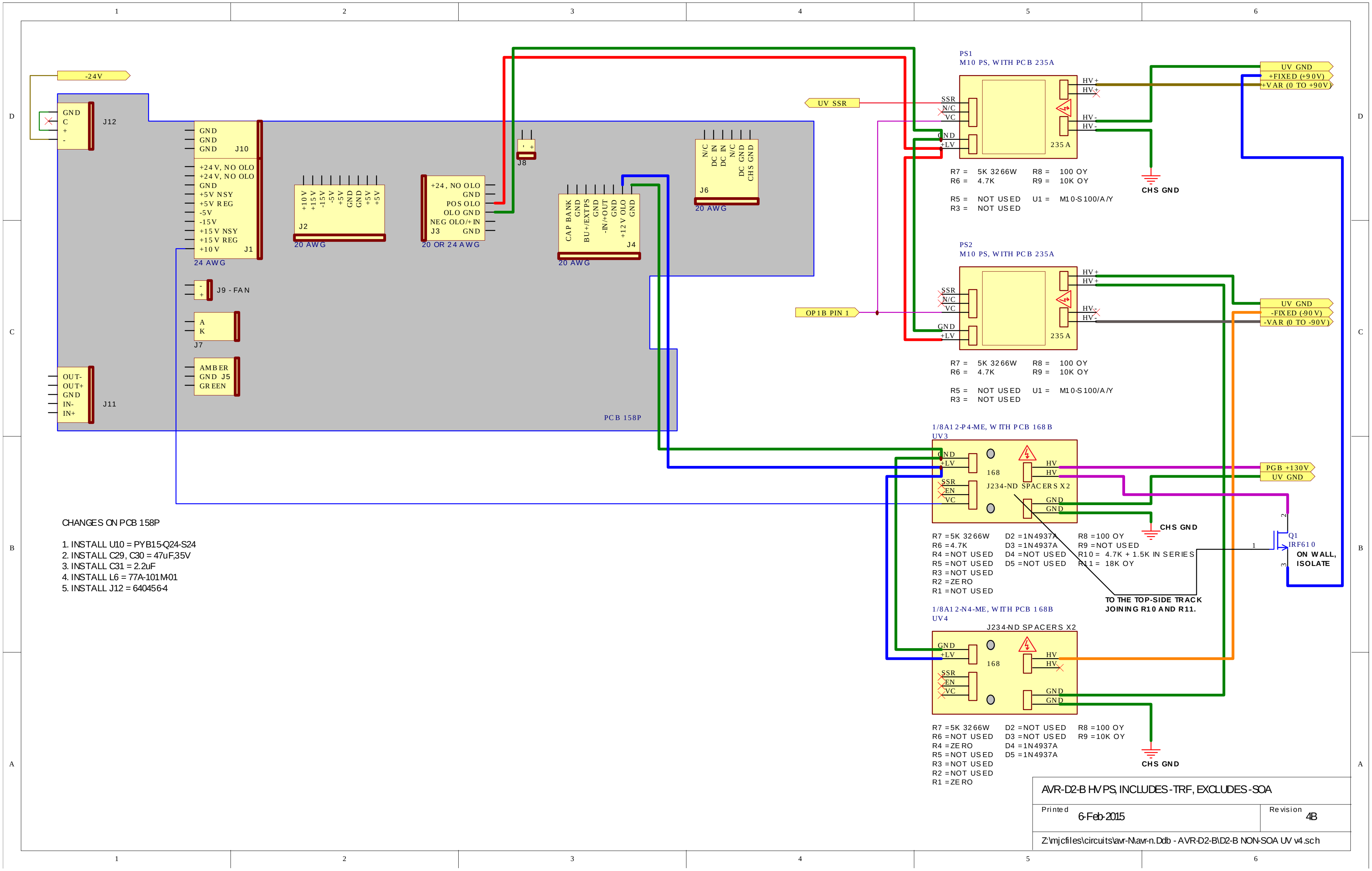
If you suspect that this IC has been damaged, turn off the power and replace this IC. It may be replaced by a 74F151, 74LS151, 74ALS151, or 74HCT151.

WIRING DIAGRAMS

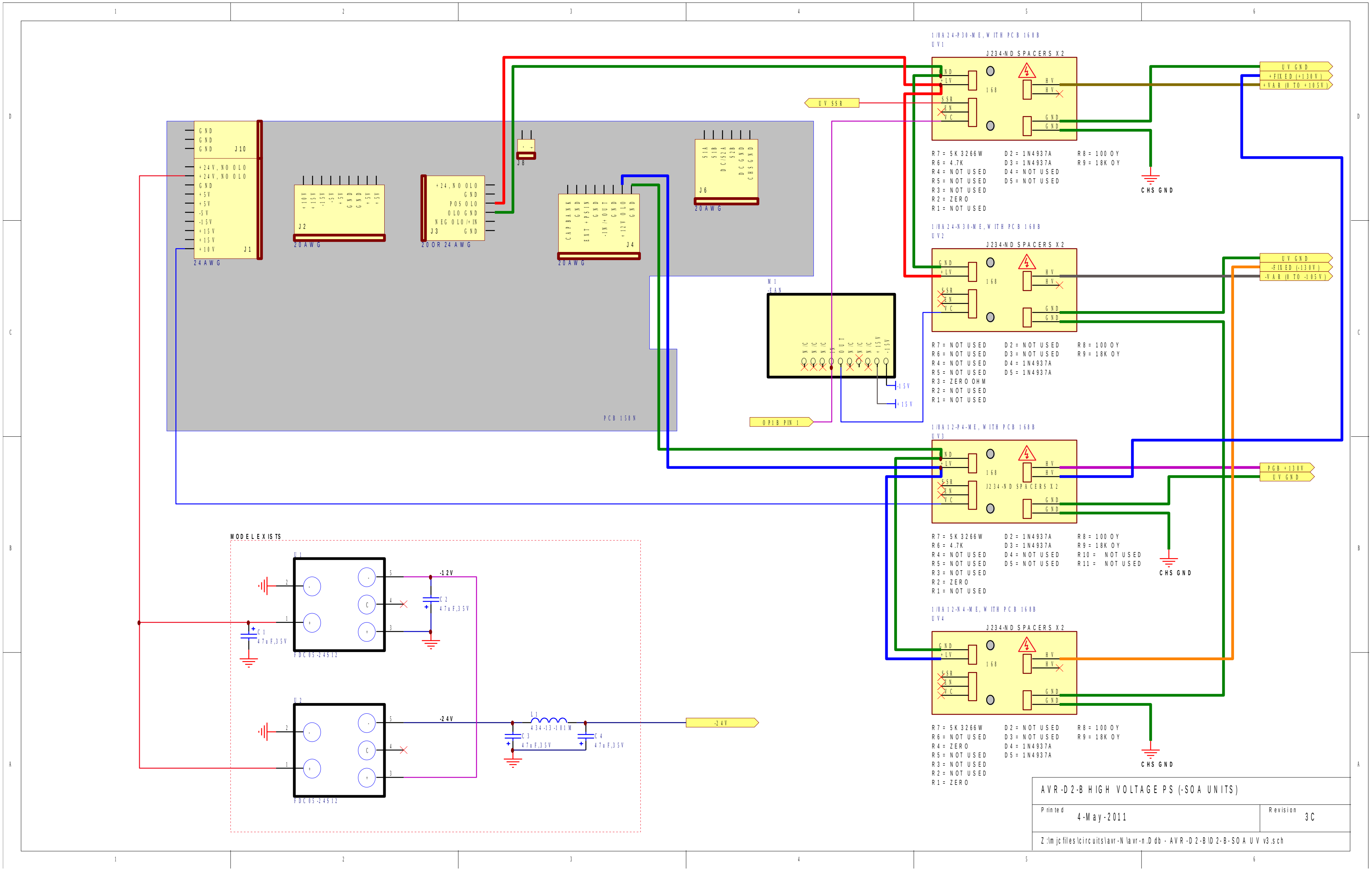
WIRING OF AC POWER



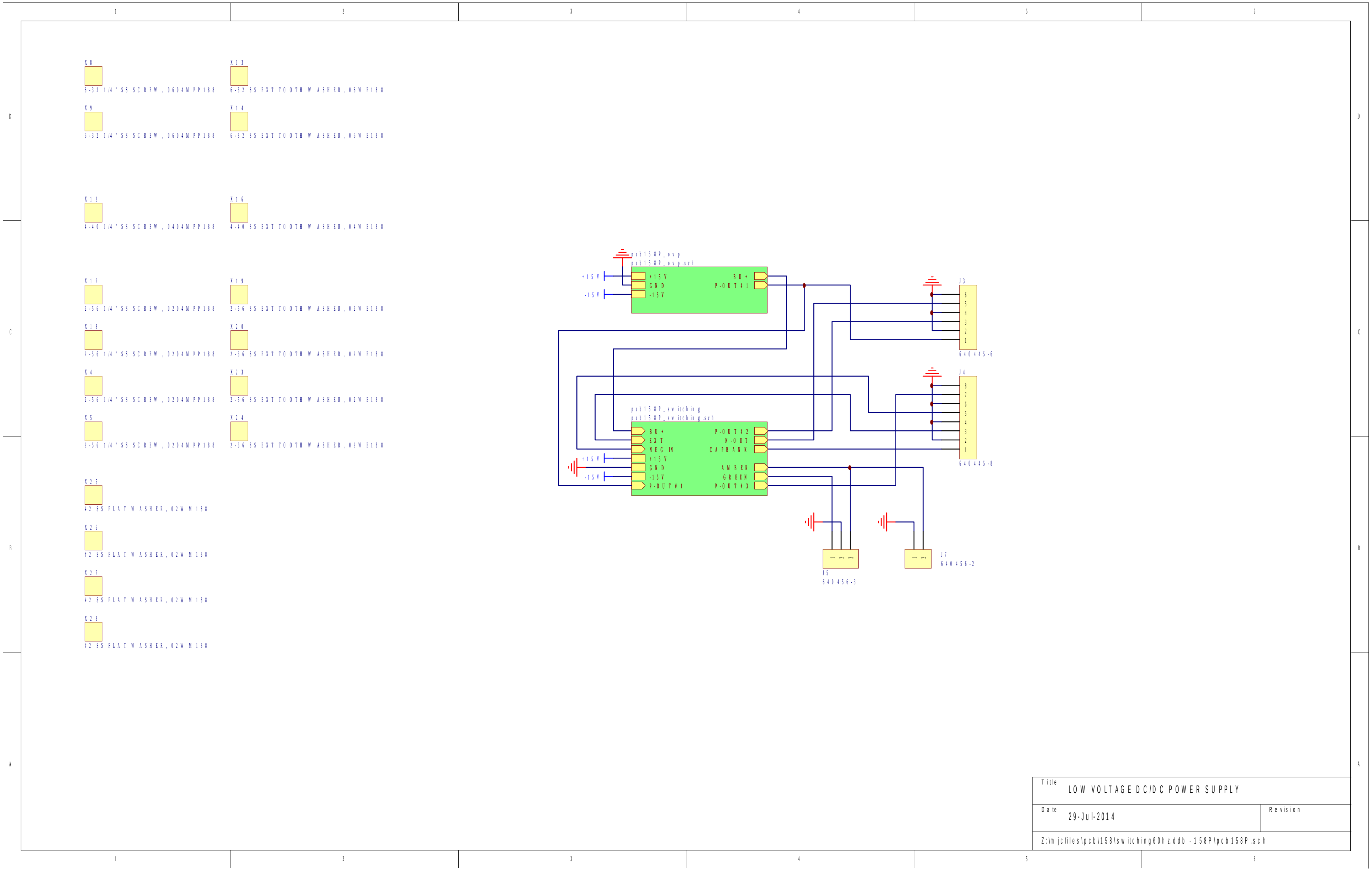
WIRING OF HIGH-VOLTAGE DC POWER SUPPLIES (STANDARD MODELS)



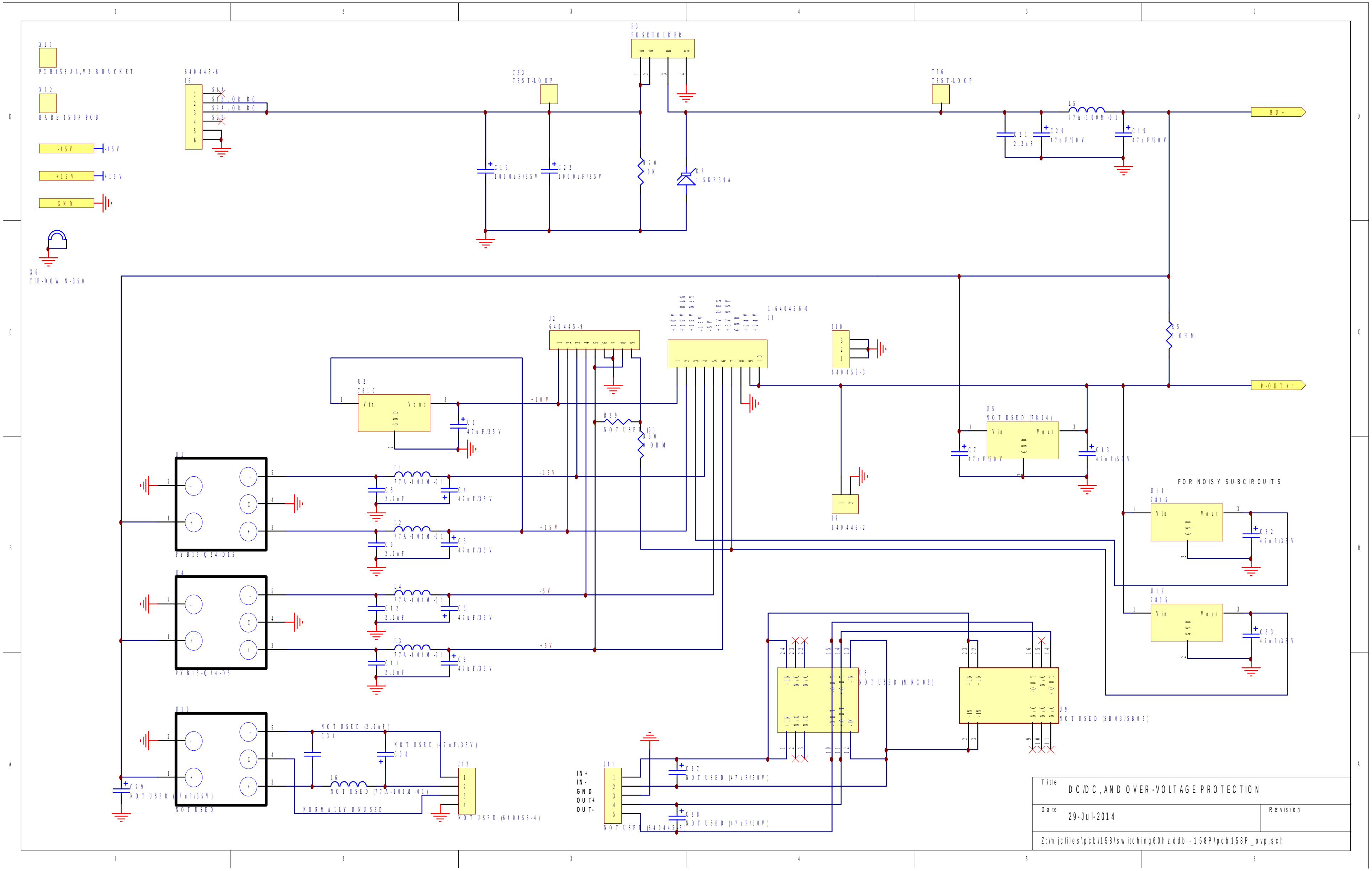
WIRING OF HIGH-VOLTAGE DC POWER SUPPLIES (UNITS WITH -SOA OPTION)



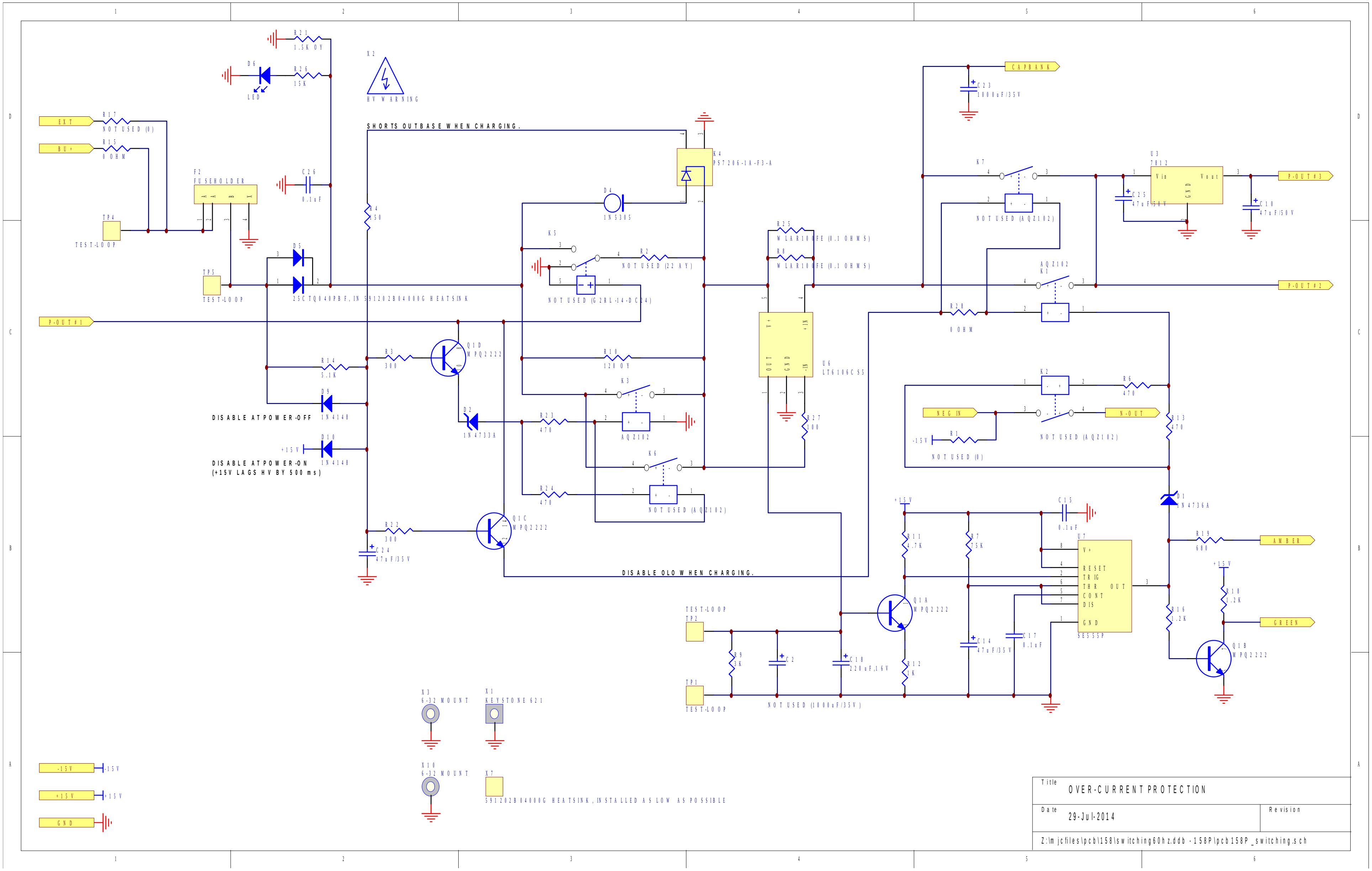
PCB 158P - LOW VOLTAGE POWER SUPPLY, 1/3



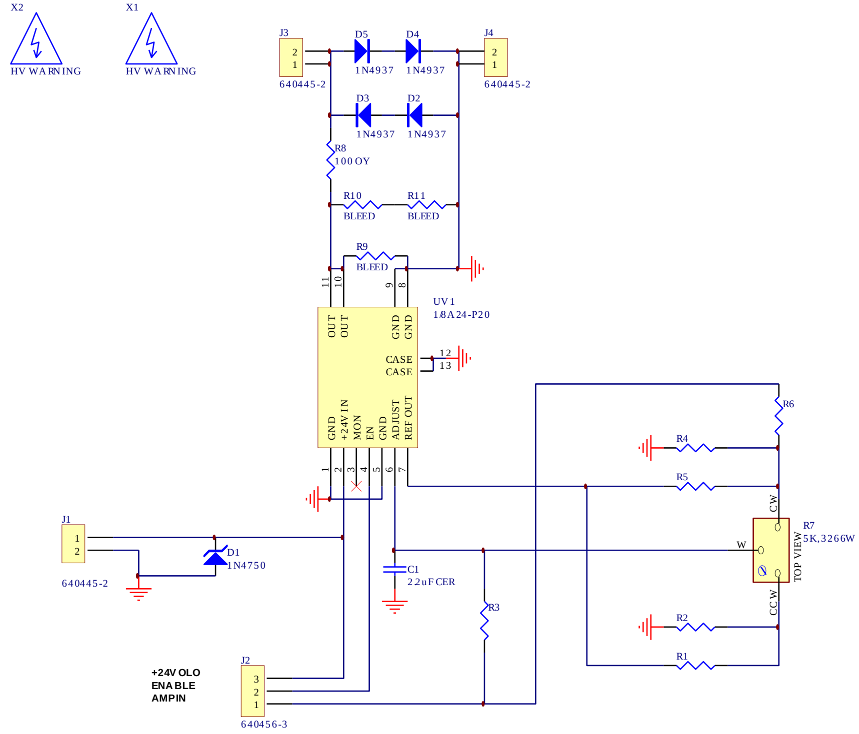
PCB 158P - LOW VOLTAGE POWER SUPPLY, 2/3



PCB 158P - LOW VOLTAGE POWER SUPPLY, 3/3



PCB 168B - HIGH VOLTAGE DC POWER SUPPLY



Title UV-A CONTROL PCB	
Date 1-Apr-2005	Revision 1
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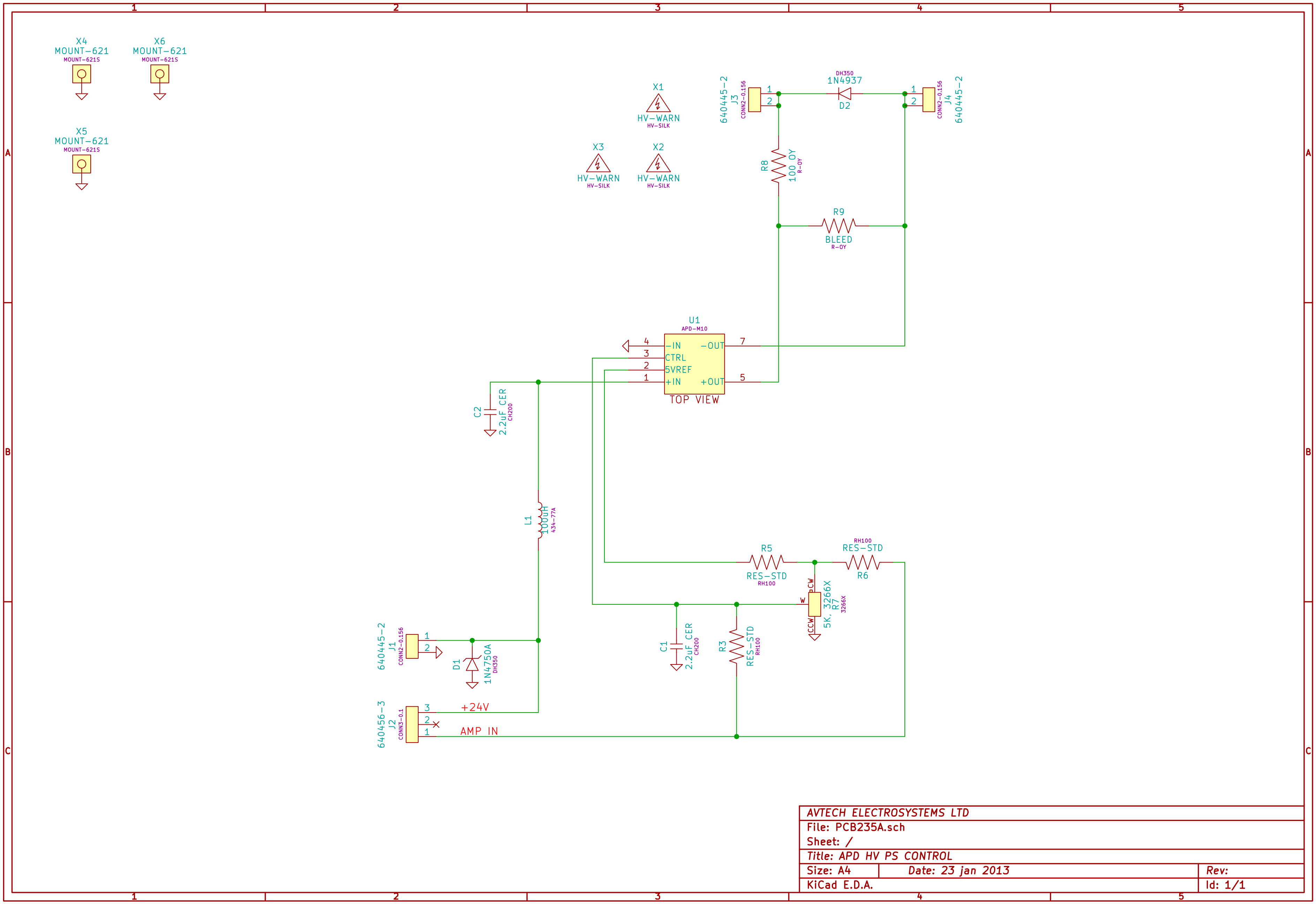
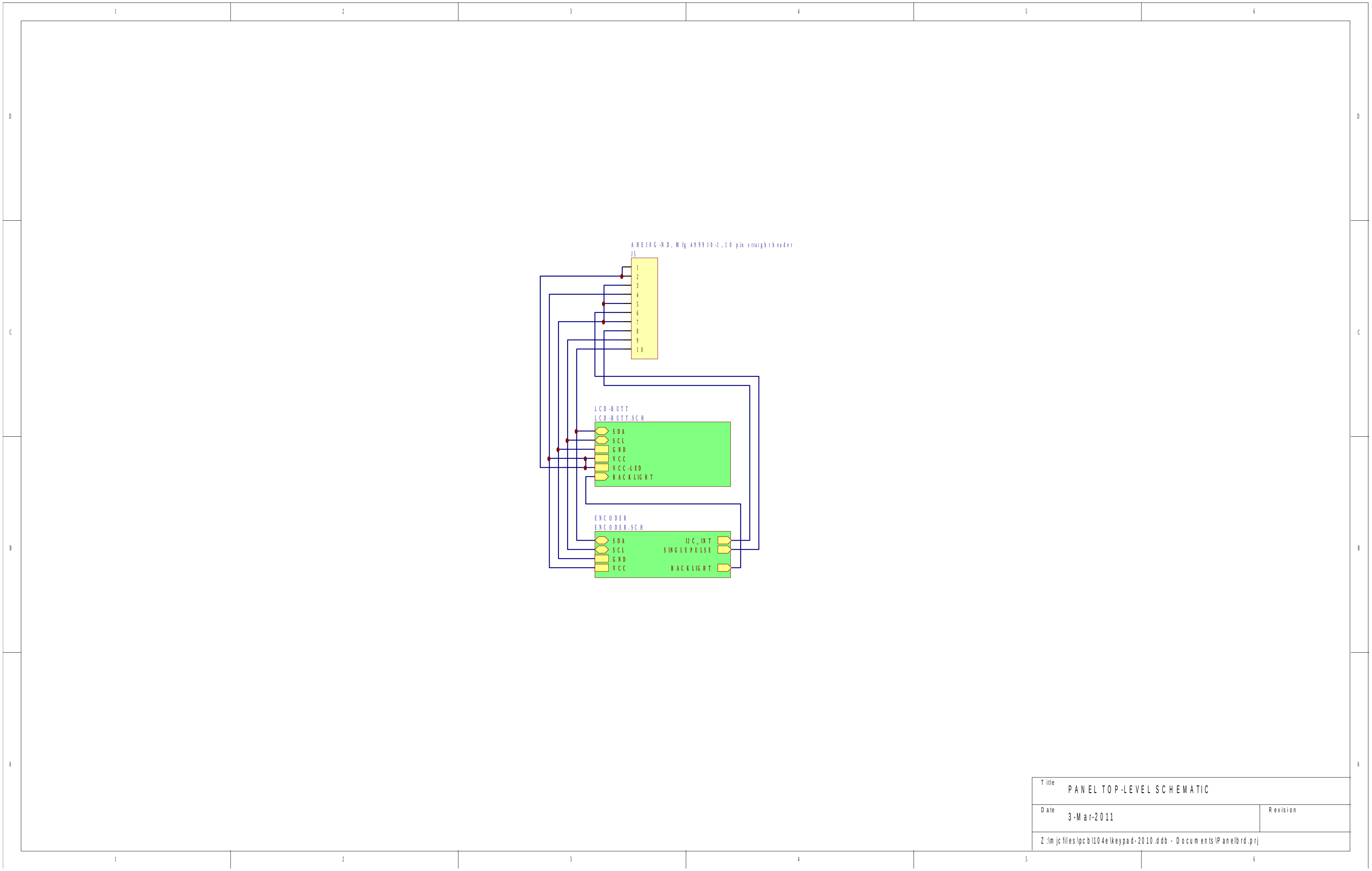
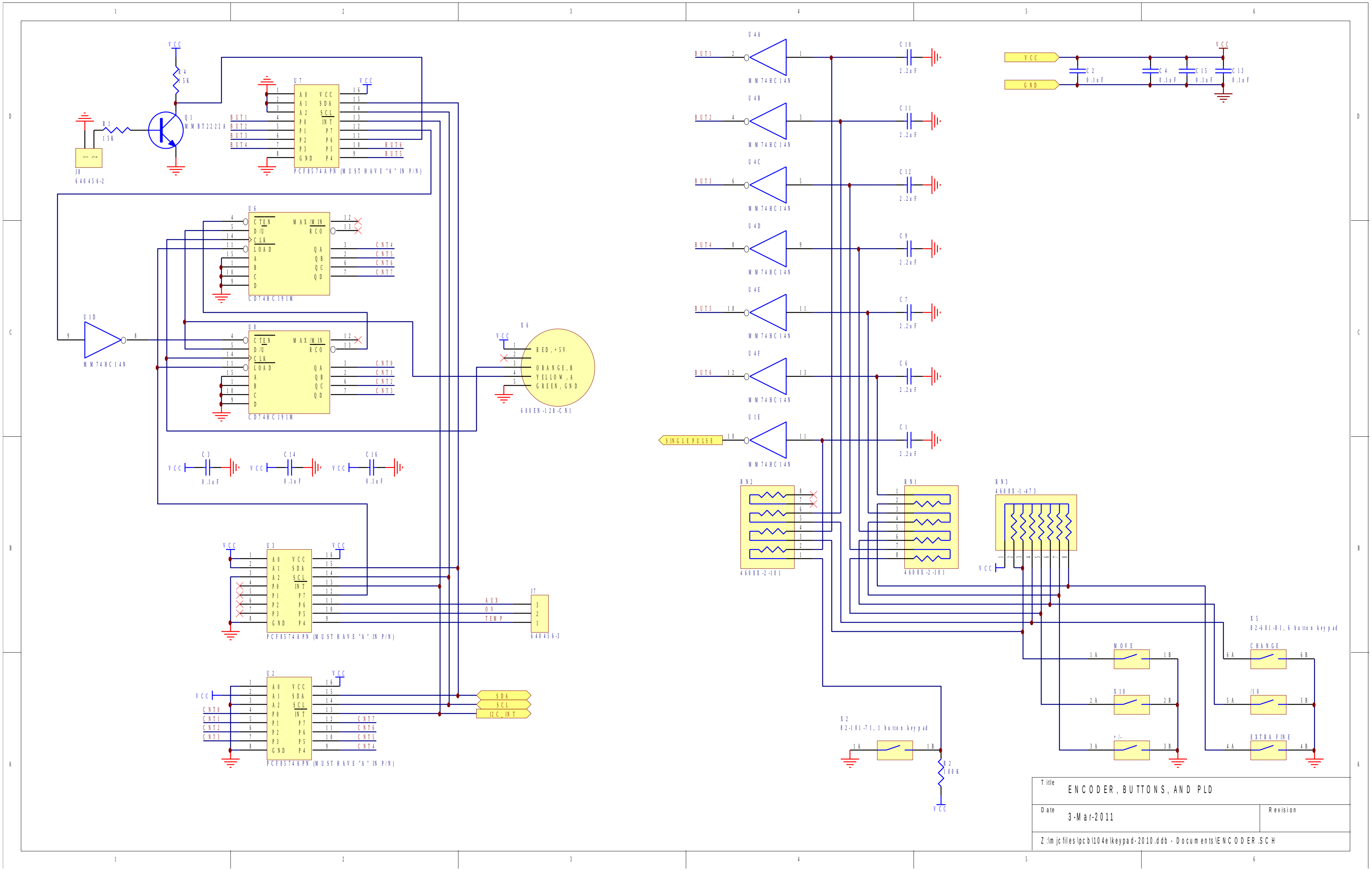
PCB 235A - HIGH VOLTAGE DC POWER SUPPLY



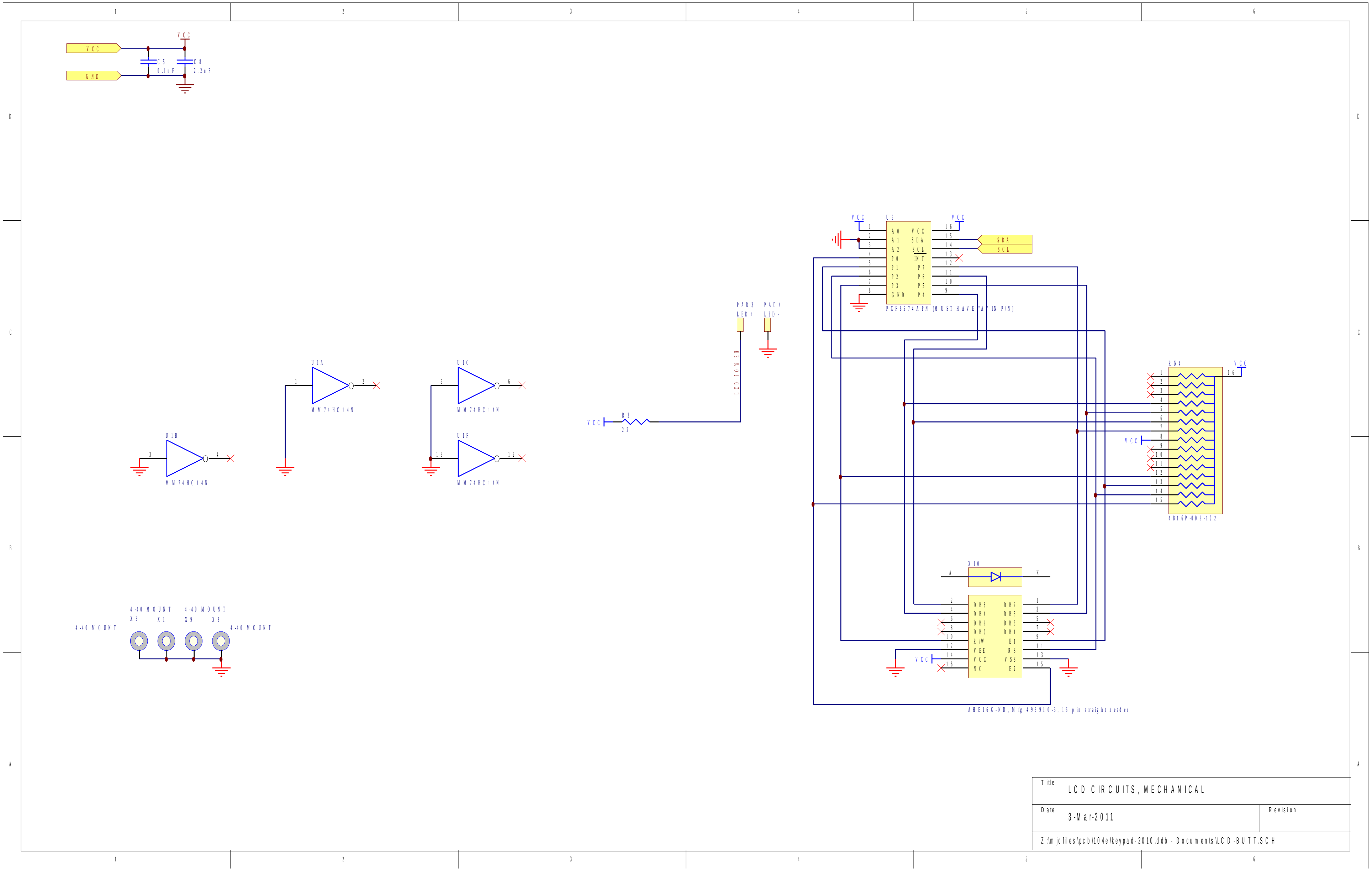
PCB 104E - KEYPAD / DISPLAY BOARD, 1/3



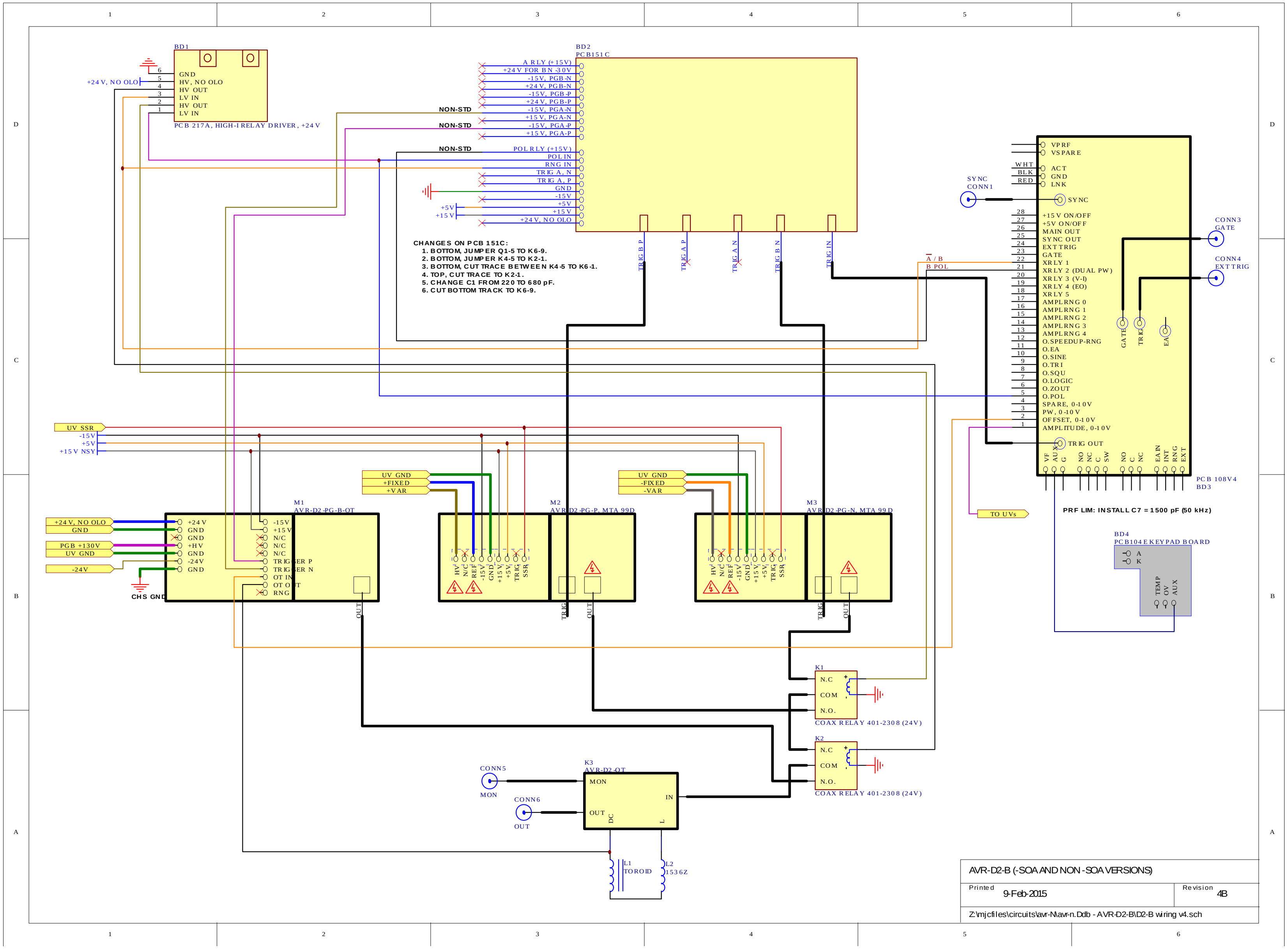
PCB 104E - KEYPAD / DISPLAY BOARD, 2/3



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



MAIN WIRING



CHANGES ON PCB 151C:
1. BOTTOM, JUMPER Q1-5 TO K6-9.
2. BOTTOM, JUMPER K4-5 TO K2-1.
3. BOTTOM, CUT TRACE BETWEEN K4-5 TO K6-1.
4. TOP, CUT TRACE TO K2-1.
5. CHANGE C1 FROM 220 TO 680 pF.
6. CUT BOTTOM TRACK TO K6-9.
PRF LIM: INSTALL C7 = 1500 pF (50 kHz)
AVR-D2-B (-SOA AND NON-SOA VERSIONS)
Printed 9-Feb-2015
Revision 4B
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PERFORMANCE CHECK SHEET