AVTECH ELECTROSYSTEMS LTD.

NANOSECOND WAVEFORM ELECTRONICS
SINCE 1975

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OTTAWA, ONTARIO
CANADA K2C 3H5

INSTRUCTIONS

MODEL AVR-EBT1-B

STEP RECOVERY DIODE

TRANSITION TIME TEST

PULSE GENERATOR

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 (International)
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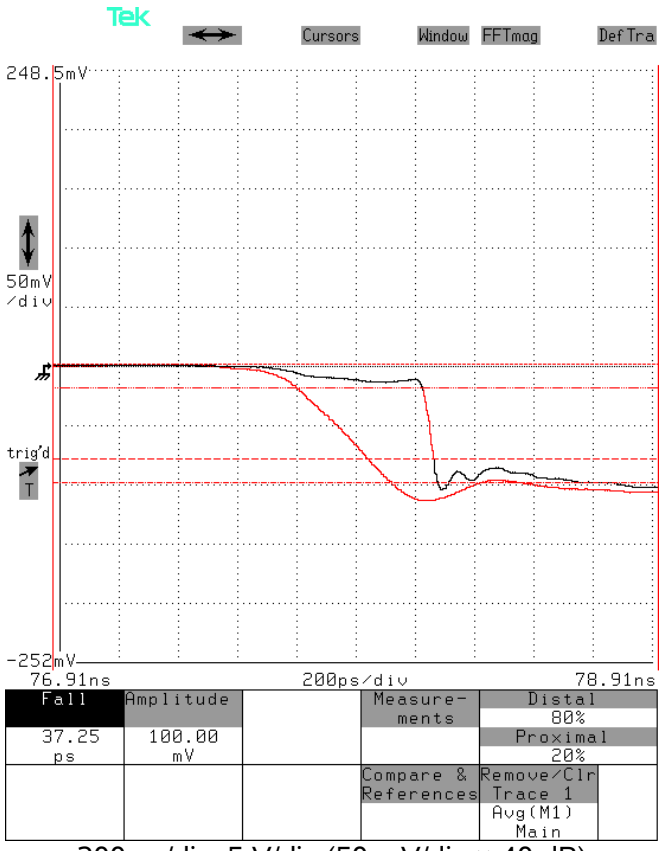
Last modified February 29, 2024.

INTRODUCTION

The AVR-EBT1-B is a high performance, GPIB and RS232-equipped pulse generator used for measuring the transition time of step recovery diodes (SRDs).

The AVR-EBT1-B generates a forward DC bias current of +1 to +20 mA. A 20 ns wide negative pulse of -1 to -10V is superimposed onto the DC bias. The rise time of this negative-going pulse is less than 300 ps (20%-80%).

The negative pulse is initially “shorted out” by the reverse conduction of the SRDs. The diode voltage suddenly rises once the reverse conduction ends. The speed of this sudden rise may be measured with a user-supplied high-bandwidth (> 15 GHz) sampling oscilloscope. Typical waveforms are shown below. The black waveform is the “sharpened” waveform generated with a high-speed SRD DUT. The red waveform is the “unsharpened” waveform with no DUT installed.



200 ps/div. 5 V/div (50 mV/div × 40 dB)

The AVR-EBT1-B may be provided with customer-specific test jigs to hold the DUT, or it may be used with user-supplied jigs.

The AVR-EBT1-B includes an internal trigger source, but it can also be triggered or gated by an external source. A front-panel pushbutton can also be used to trigger the instrument.

The AVR-EBT1-B 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 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.

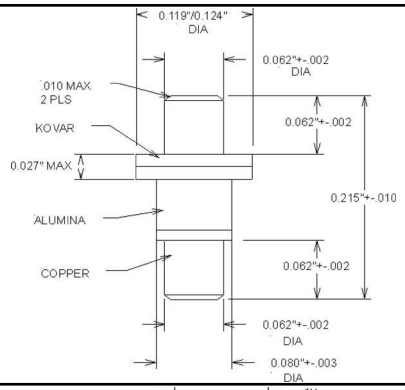
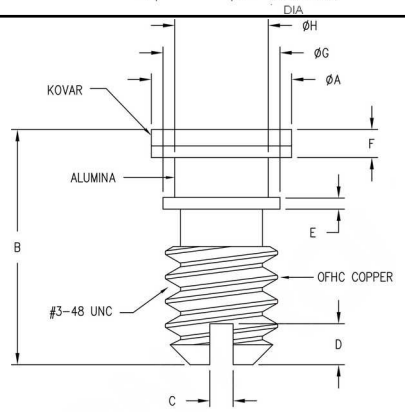
This instrument is intended for use in research, development, test and calibration laboratories by qualified personnel.

SPECIFICATIONS

Model[1]:	AVR-EBT1-B	
Intended application:	Step Recovery Diode Transition Time Tests	
Suitable DUT transition time range (20%-80%):	< 60 ps to > 200 ps	
Basic waveform:	Positive DC bias interrupted by a negative pulse	
Required measurement system:	The output signal is the voltage across the DUT. The output must be viewed on a user-supplied high-bandwidth (> 15 GHz) sampling oscilloscope.	
Waveform portion:	DC	-
Voltage output[2]:	+1V to +21V, applied to a 1 kΩ resistance in series with the DUT, permitting DC bias currents of up to +20 mA.	-1V to -10V, applied to the DUT through a length of coaxial cabling
Pulse width (FWHM):	DC	20 ns, nominally
Rise time (10%-90%):	< 300 ps	
Maximum PRF:	10 kHz	
Delay:	Fixed. Nominally 75 ns, SYNC to main OUT.	
Included test jig[3]:	See tables on next page. The users may also provide their own jigs.	
Connectors (OUT, jig):	SMA	
Connectors (Gate, Trig):	BNC	
GPIB & RS-232:	Standard on -B units. See http://www.avtechpulse.com/gpib for details.	
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 and offset resolution is typically 0.02% of the maximum amplitude.	
Settings accuracy[2]:	Typically ± 3% after 10 minute warmup, for timing parameters. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.	
Trigger required:	External trigger mode: + 5 Volts, 10 ns or wider (TTL)	
Gate input:	Active high or low, switchable. Suppresses triggering when active.	
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 and 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) The pulse amplitude settings should not be relied upon for any degree of accuracy, because the dynamics of the device under test can affect the actual generated waveforms. Pulse amplitude settings should always be verified by oscilloscope measurements.
3) Customized jigs available upon request.
4) Add the suffix -VXI to the model number to specify the Ethernet port.

SPECIFICATIONS – INCLUDED TEST JIGS

Option Code	Included Jig	Description	
-MS2	AVX-TT-30A	For Microsemi Type 30 packages	
	AVX-TT-42A	For Microsemi Type 42 packages	

NOTE: *All of the above jigs are suitable for light research and development use. Consult Avtech (info@avtechpulse.com) regarding the suitability of particular jigs for heavy production use.*

REGULATORY NOTES

FCC PART 18

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

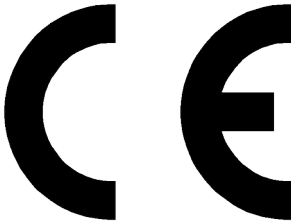
This instrument is enclosed in a rugged metal chassis and uses a filtered power entry module (where applicable). The main output signal is provided on a shielded connector that is intended to be used with shielded coaxial cabling and a shielded load. Under these conditions, the interference potential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

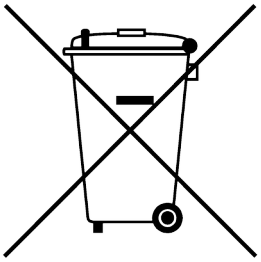
This instrument is exempt from Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment. Specifically, Avtech instruments are considered "Monitoring and control instruments" (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)

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 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.

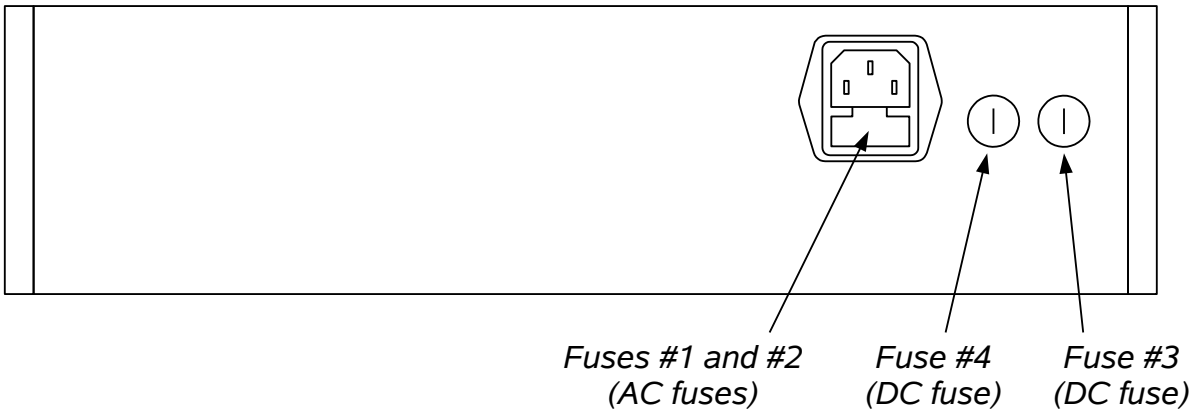
ENVIRONMENTAL CONDITIONS

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.

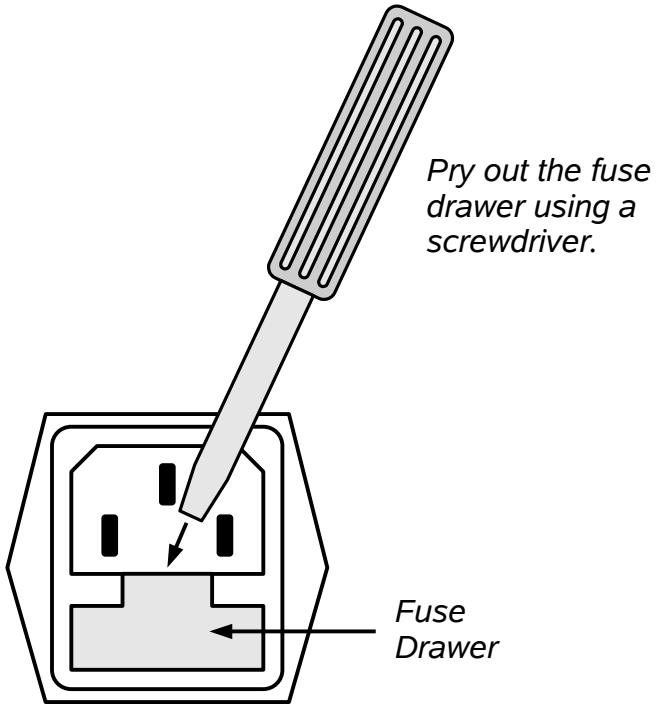
FUSES

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

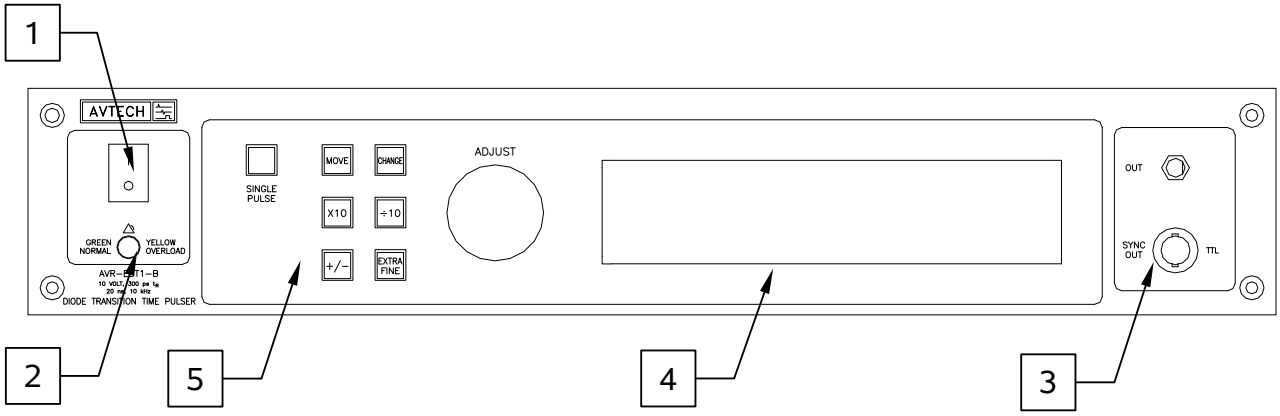
The following table lists the required fuses:

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	1.6A, 250V, Time-Delay	5×20 mm	021801.6HXP	F2424-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 abOUT1 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. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads the main output by 75 ns (approximately) and has an amplitude of +3 Volts (approximately) to $R_L > 50\Omega$ with a pulse width of approximately 100 ns.

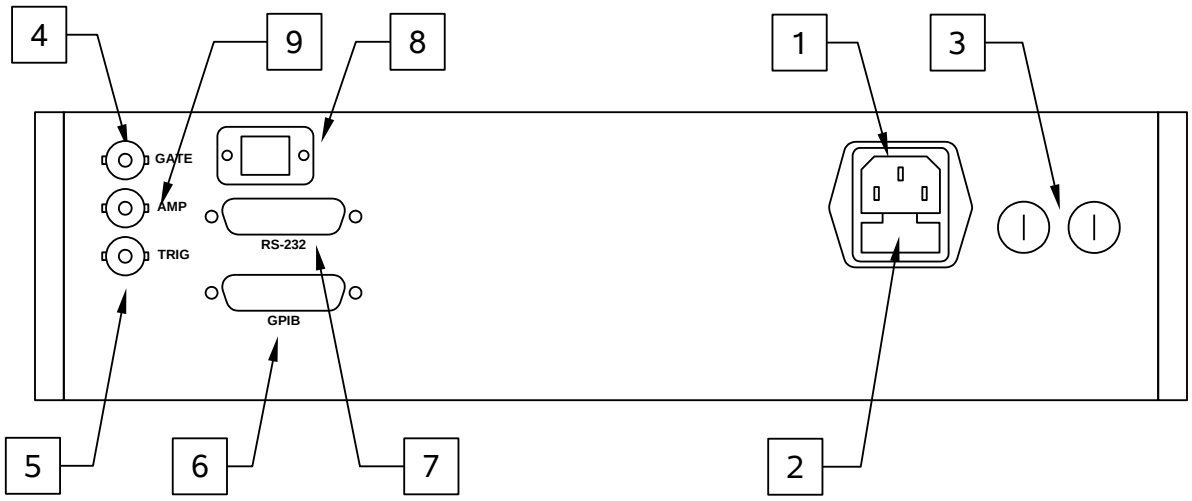
4. LIQUID CRYSTAL DISPLAY (LCD). This LCD is used in conjunction with the keypad to change the instrument settings. Normally, the main menu is displayed, which lists the key adjustable parameters and their current values. The “Programming Manual for -B Instruments” describes the menus and submenus in

detail.

5. 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.

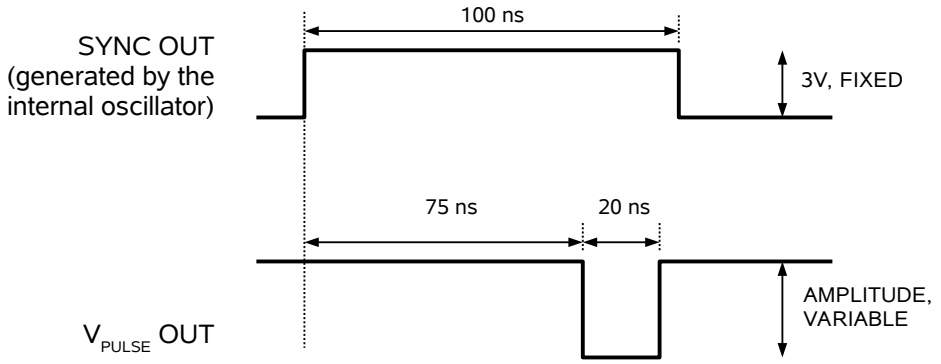
8. Network Connector. (Optional feature. Present on -VXI units only.) This Ethernet connector allows the instrument to be remotely controlled using the VXI-11.3, ssh (secure shell), telnet, and http (web) protocols. See the “Programming Manual for -B Instruments” for more details.

9. AMP Connector. Not used.

TIMING CONTROL

MAINFRAME PULSE OUTPUT

This instrument can be triggered by its own internal clock or by an external TTL trigger signal. In either case, two pulse signals respond to the trigger: V_{PULSE} (on the mainframe OUT connector) and SYNC. The amplitude of V_{PULSE} is adjustable up to -11V. The pulse width is fixed at 20 ns. The SYNC pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems. The SYNC pulse precedes the V_{PULSE} pulse by 75 ns, approximately. These pulses are illustrated below:



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.

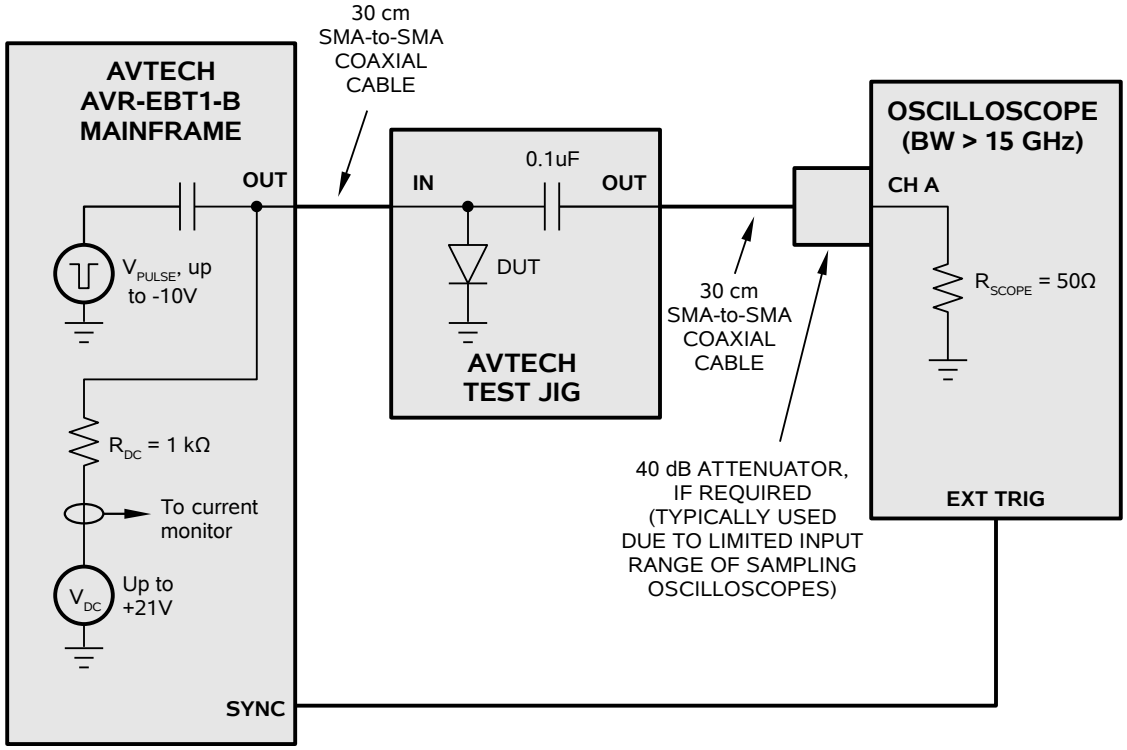
These modes can be selected using the front panel trigger menu, or by using the appropriate programming commands. (See the “Programming Manual for -B Instruments” for more details.)

GATING MODES

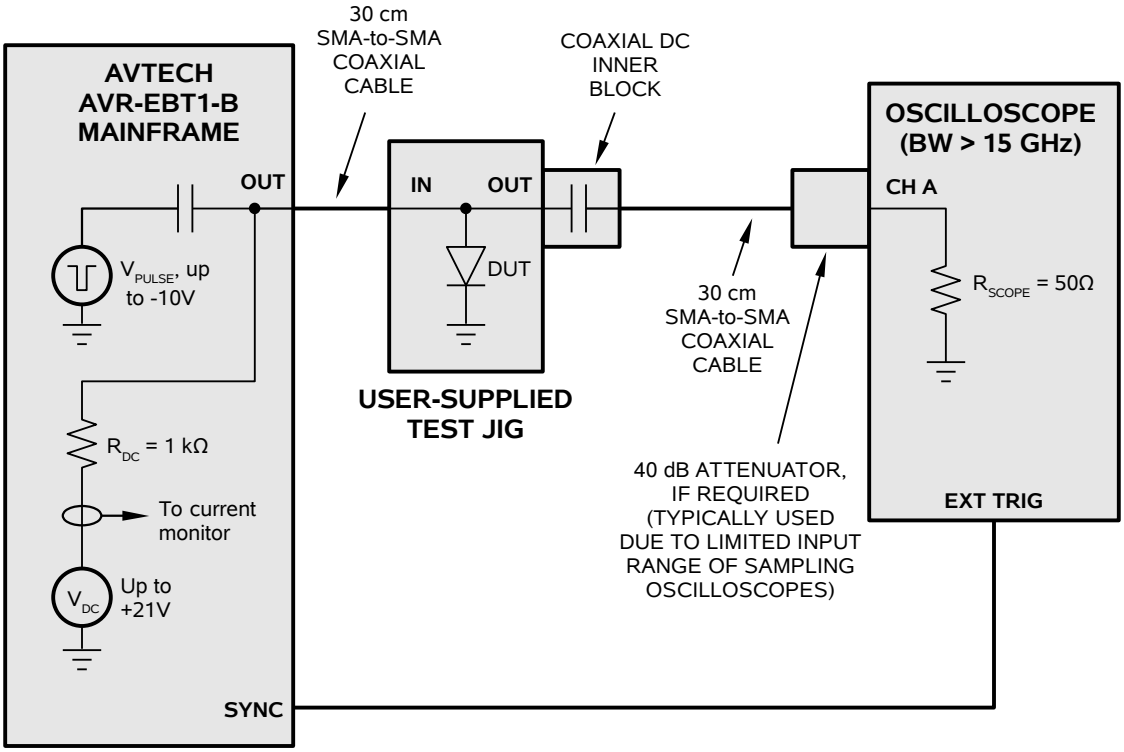
Triggering can be suppressed by a TTL-level signal on the rear-panel GATE connector. The instrument can be set to stop triggering when this input high or low, using the front-panel gate menu or the appropriate programming commands. When gated, the output will complete the full pulse width if the output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

BASIC AMPLITUDE CONTROL

The basic test arrangement for the AVR-EBT1-B is shown in the figure below. The OUT output on the instrument mainframe is connected to the IN input on the test jig (model AVX-TT-30A, AVX-TT-42A, or a customized variant) using the supplied coaxial cable.



The user may construct their own test jigs using high-bandwidth microstrip construction techniques. The 0.1uF capacitor must be included on the test jig, or a coaxial “DC inner block” may be used instead. The Pasternack PE8210 is an example of a suitable coaxial DC inner block. If the DC block is used, the setup would be modified slightly:



The OUT output on the test jig (or of the DC block, if used) must be connected to the 50 Ohm input of a high-bandwidth (> 15 GHz) user-supplied oscilloscope. The oscilloscope may be used to observe the transition time of the SRD voltage waveform.

SETTING THE AMPLITUDE LEVELS

The test jig contains a “bias tee” circuit to combine a DC forward bias with a reverse bias pulse.

An adjustable DC voltage of up to +21V is generated in the mainframe. This DC voltage is controlled by the front-panel OS menu, or by the “source:voltage:low” command. The DC voltage source has R_{DC} = 1 kΩ in series with it, inside the mainframe. The DC forward bias current through the DUT is then given by:

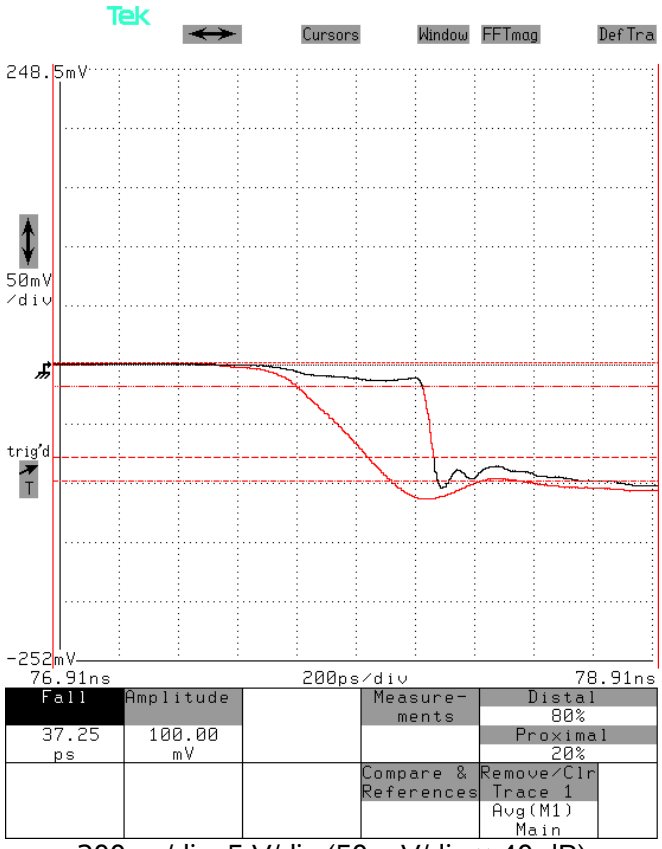
$$I_F = (V_{DC} - V_{DIODE}) / 1000\ \Omega$$

where V_{DIODE} is the diode forward voltage drop (typically 0.7V).

A current monitor circuit measures the actual DC current, and reports it on the front-panel (the output must be “on”). The DC current can also be remotely queried using the “measure:amplitude?” command.

The reverse bias voltage pulse is capacitively coupled “on top” of this DC bias current. The pulse generator has an adjustable amplitude of up to -10V, controlled by the front-

panel AMP menu, or by the “source:voltage” command. The negative pulse is initially “shorted out” by the reverse conduction of the SRDs. The diode voltage suddenly rises once the reverse conduction ends. Typical waveforms are shown below. The black waveform is the “sharpened” waveform generated with a high-speed SRD DUT. The red waveform is the “unsharpened” waveform with no DUT installed.



200 ps/div. 5 V/div (50 mV/div × 40 dB)

The pulser circuit is isolated from the “shorting out” of the SRD DUT during this brief interval by the length of coaxial cabling between the pulser circuit and the SRD DUT.

AMPLITUDE ACCURACY

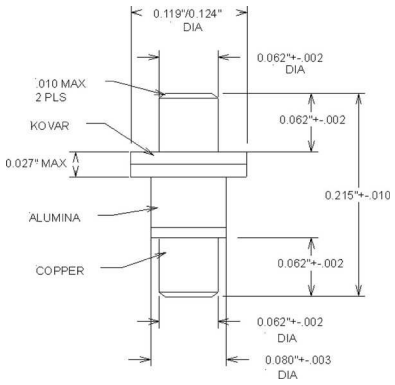
The amplitude settings *should not be relied upon for any degree of accuracy*, because the diode characteristics (forward voltage drop, reverse parasitic resistance) are not known accurately in advance. Instead the voltage at the OUT terminal on the test jig should be *measured* with a calibrated oscilloscope.

AVTECH-SUPPLIED TEST JIGS

This instrument is normally provided with one or more test jigs to meet customer-specific requirements.

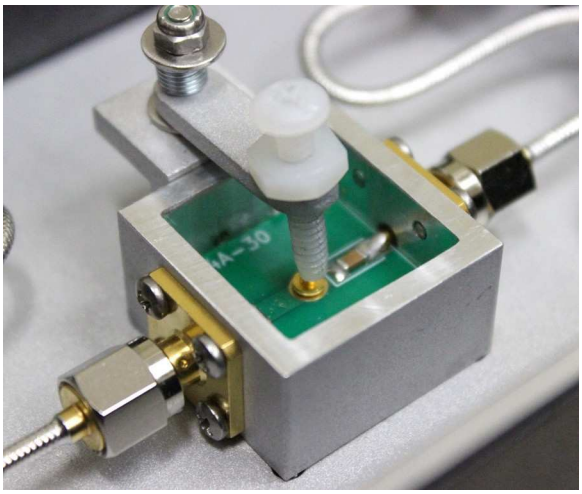
AVX-TT-30A TEST JIG

The AVX-TT-30A test jig will accept Microsemi Type 30 packages.



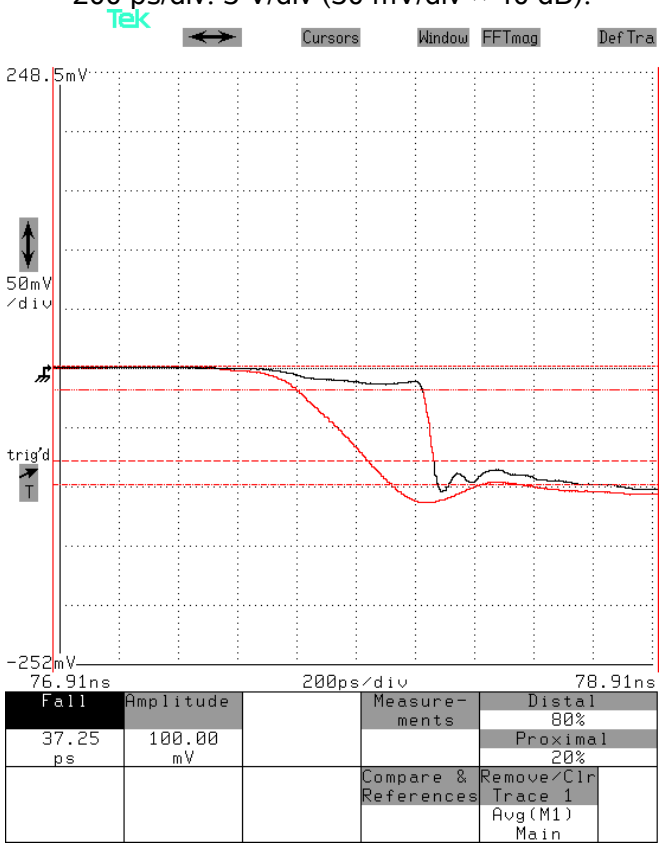
The green PCB in the center of the jig has a hole in its center, which is visible if the spring-loaded nylon arm is moved out of the way:

The cathode of the DUT is inserted into this hole. It will make contact with a flexible copper arm on the bottom (ground plane) side of the PCB. The copper arm should move slightly, and hold the cathode end secure. The nylon arm must then be positioned over top of the DUT anode, to apply downward pressure, ensuring that the anode contacts the gold ring around the hole:



Typical results with an M-Pulse Microwave MP4022 installed are shown below, for +10 mA bias and a -10V pulse amplitude:

200 ps/div. 5 V/div (50 mV/div × 40 dB).

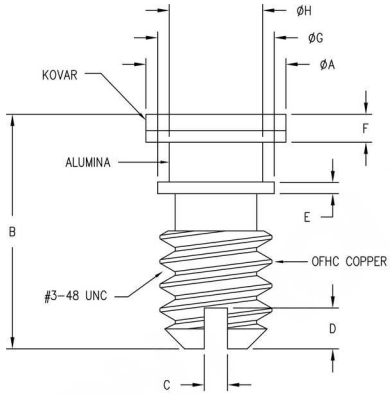


Black = with DUT installed,
Red = with DUT removed.

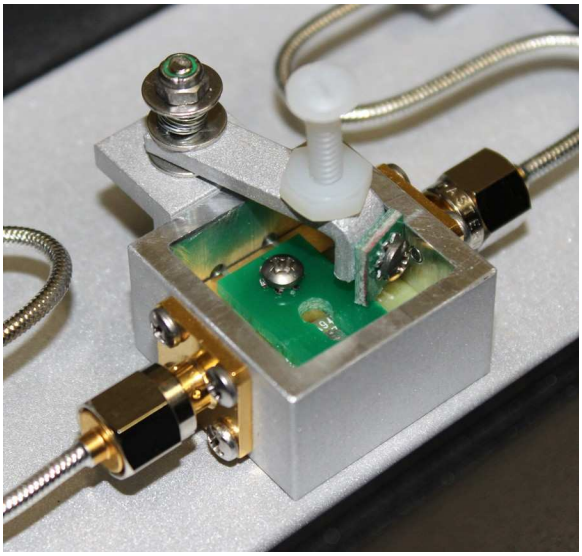
The measured transition time (20%-80%) is 37.25 ps.

AVX-TT-42A TEST JIG

The AVX-TT-42A test jig will accept Microsemi Type 42 packages.



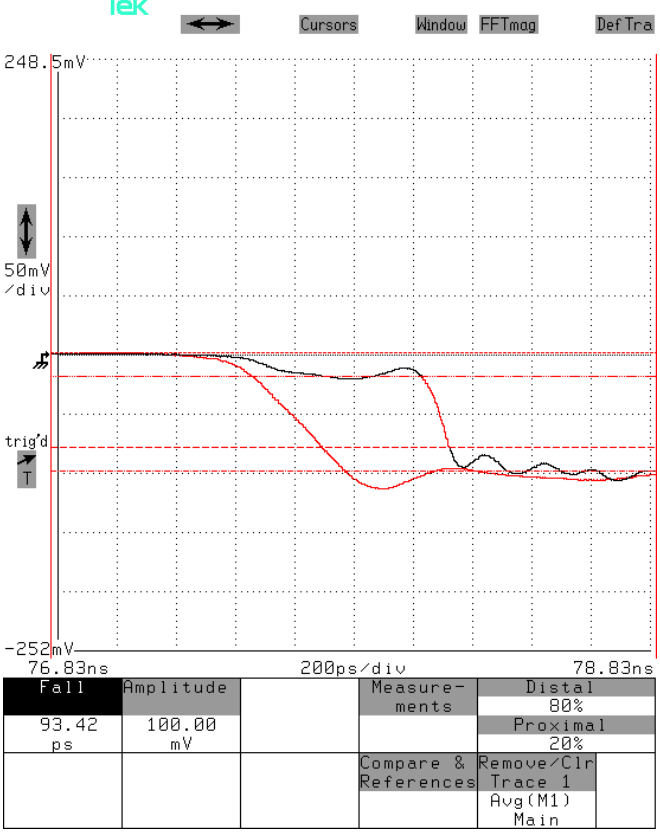
The green PCB in the center of the jig has a slot in its center, which is visible if the spring-loaded aluminum arm is moved out of the way:



The DUT is inserted into this slot. The anode fits in the wider section of the slot, and the cathode in the narrower section. The anode will contact a section of gold-plated microstrip line, and the cathode will contact a gold-plated ground plane. The aluminum arm must then be positioned over top of the DUT, to apply downward pressure, ensuring that both the anode and cathode contacts the gold areas of the PCB.

Typical results with an Microsemi 2520-42 installed are shown below, for +10 mA bias and a -10V pulse amplitude:

200 ps/div. 5 V/div (50 mV/div × 40 dB).



Black = with DUT installed,
Red = with DUT removed.

The measured transition time (20%-80%) is 93.42 ps.

USER-SUPPLIED TEST JIGS

The Avtech-supplied test jigs are suitable for light research and development use. For production use, or to accommodate different packages, the users may prefer to develop their own test jigs.

High-bandwidth microstrip construction techniques should be used. Two coaxial connectors must be provided, IN and OUT. The IN signal connects directly to the OUT signal through a 0.1uF DC blocking capacitor, with the DUT anode connected at any point between the IN point and the capacitor. The DUT cathode must be connected to ground.

As noted earlier sections, the capacitor can be replaced with an externally-attached coaxial DC inner block accessory.

It is challenging to design robust sockets with sufficient bandwidth to handle the ~30 ps switching times that the fastest SRDs are capable of. Avtech suggests Aries Electronics (http://www.arieselec.com/) as a source of high-bandwidth custom sockets.

TROUBLESHOOTING

If you obtain “strange” output waveforms, or unexpected values of t_{RR}, keep these points in mind:

1) The test jig output *must* be terminated with 50 Ohms. This is normally the input impedance of the oscilloscope, or the oscilloscope / attenuator combination.

2) An attenuator may be required on the oscilloscope to avoid overdriving the oscillscope input, especially for sampling oscilloscopes.

3) It may be necessary to re-seat the DUT, if it does not initially make good contact with the test jig.

For technical support, contact info@avtechpulse.com. Sample waveforms and digital photos of your setup are always helpful!

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)
volt:low +10V           (sets the DC voltage to +10V, and thus I_F ≈ +10 mA)
volt -10V               (sets the pulse voltage to -10V)
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)
output on               (turns on the output)
volt:low +10V           (sets the DC voltage to +10V, and thus I_F ≈ +10 mA)
volt -10V               (sets the pulse voltage to -10V)
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)
volt:low +10V           (sets the DC voltage to +10V, and thus I_F ≈ +10 mA)
volt -10V               (sets the pulse voltage to -10V)
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
MEASure:		
:AMPLitude?		[query only]
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	
[SOURce]:		
:PULSe		
:PERiod	<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 | 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

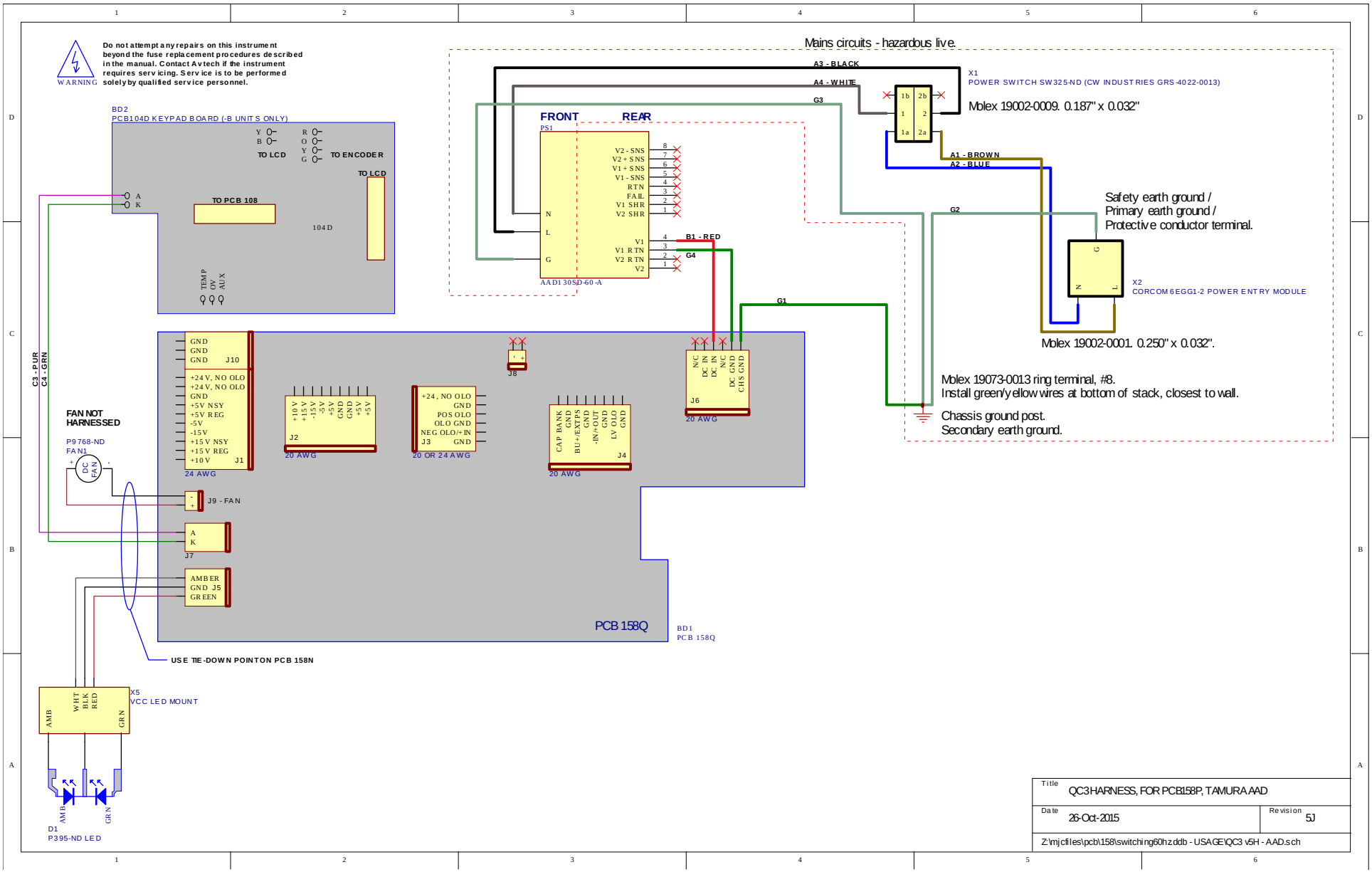
The rear-panel TRIG input, used in the external trigger mode, is protected by a diode clamping circuit. However, the protection circuit is not foolproof, and it is possible for a grossly excessive signal to damage the trigger circuitry on the main timing control board (the 4×10 inch board on the right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



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

X8
6-32 1/4" SS SCREW, 0604MPP188

X9
6-32 1/4" SS SCREW, 0604MPP188

X13
6-32 SS EXT TOOTH WASHER, 06WE188

X14
6-32 SS EXT TOOTH WASHER, 06WE188

X12
4-40 1/4" SS SCREW, 0404MPP188

X16
4-40 SS EXT TOOTH WASHER, 04WE188

X17
2-56 1/4" SS SCREW, 0204MPP188

X18
2-56 1/4" SS SCREW, 0204MPP188

X4
2-56 1/4" SS SCREW, 0204MPP188

X5
2-56 1/4" SS SCREW, 0204MPP188

X19
2-56 SS EXT TOOTH WASHER, 02WE188

X20
2-56 SS EXT TOOTH WASHER, 02WE188

X23
2-56 SS EXT TOOTH WASHER, 02WE188

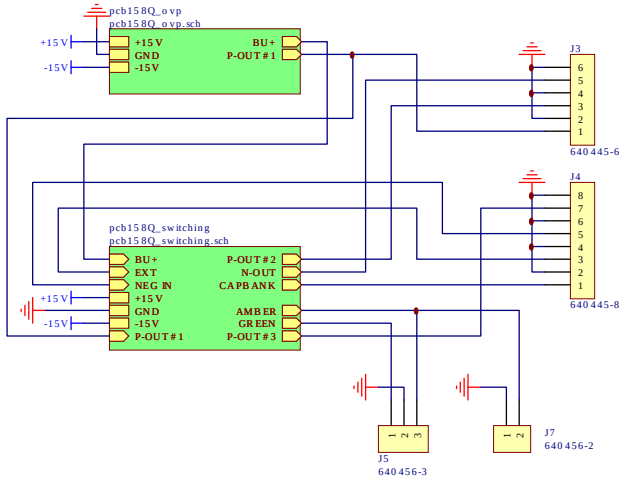
X24
2-56 SS EXT TOOTH WASHER, 02WE188

X25
#2 SS FLAT WASHER, 02WM188

X26
#2 SS FLAT WASHER, 02WM188

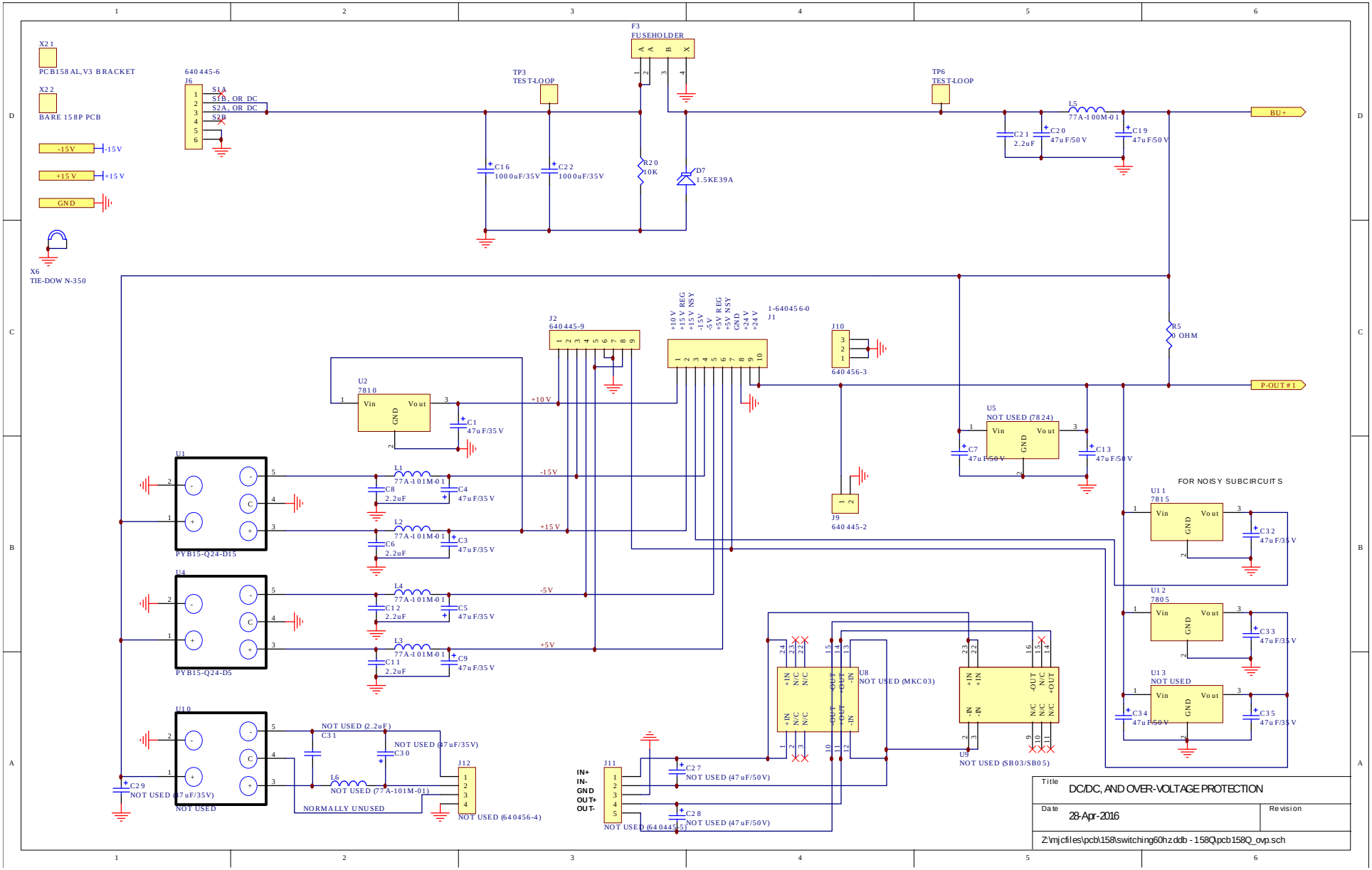
X27
#2 SS FLAT WASHER, 02WM188

X28
#2 SS FLAT WASHER, 02WM188

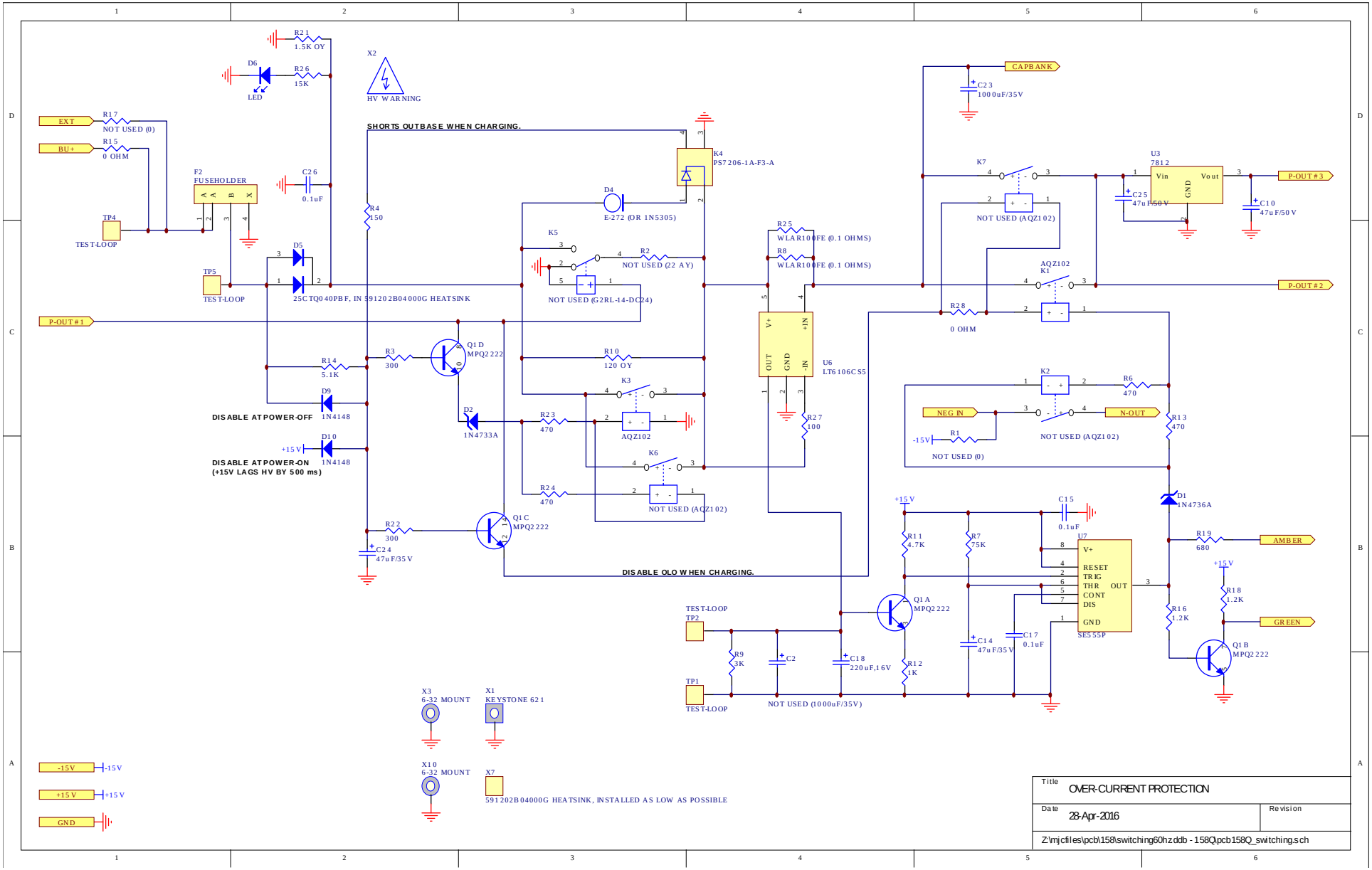


Title	LOW VOLTAGE DC/DC POWER SUPPLY
Date	28-Apr-2016
Revision	
Z:\mjcfiles\pcb\158\switching60hzddb - 158Q.pcb158Q.sch	

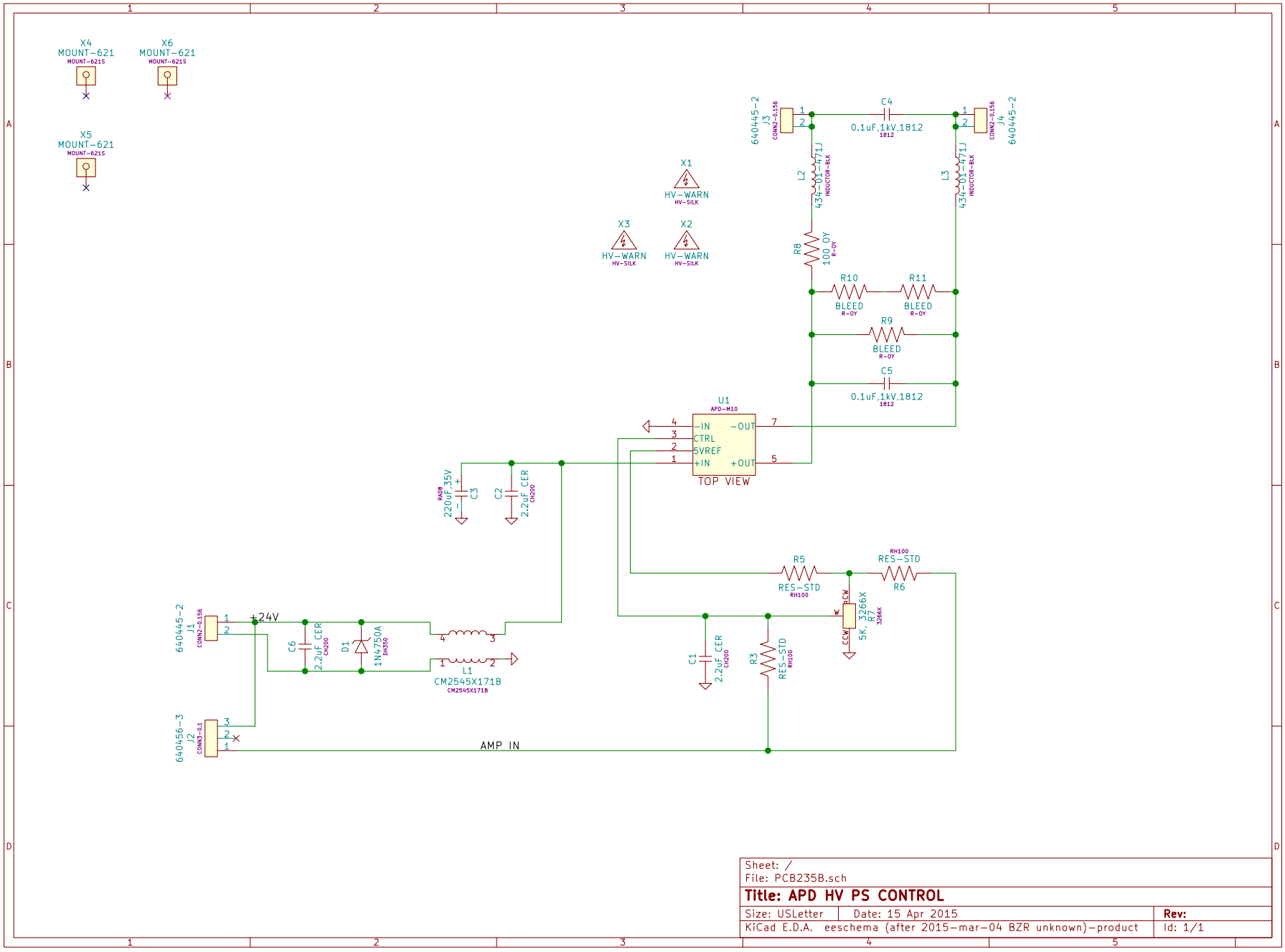
PCB 158Q - LOW VOLTAGE POWER SUPPLY, 2/3



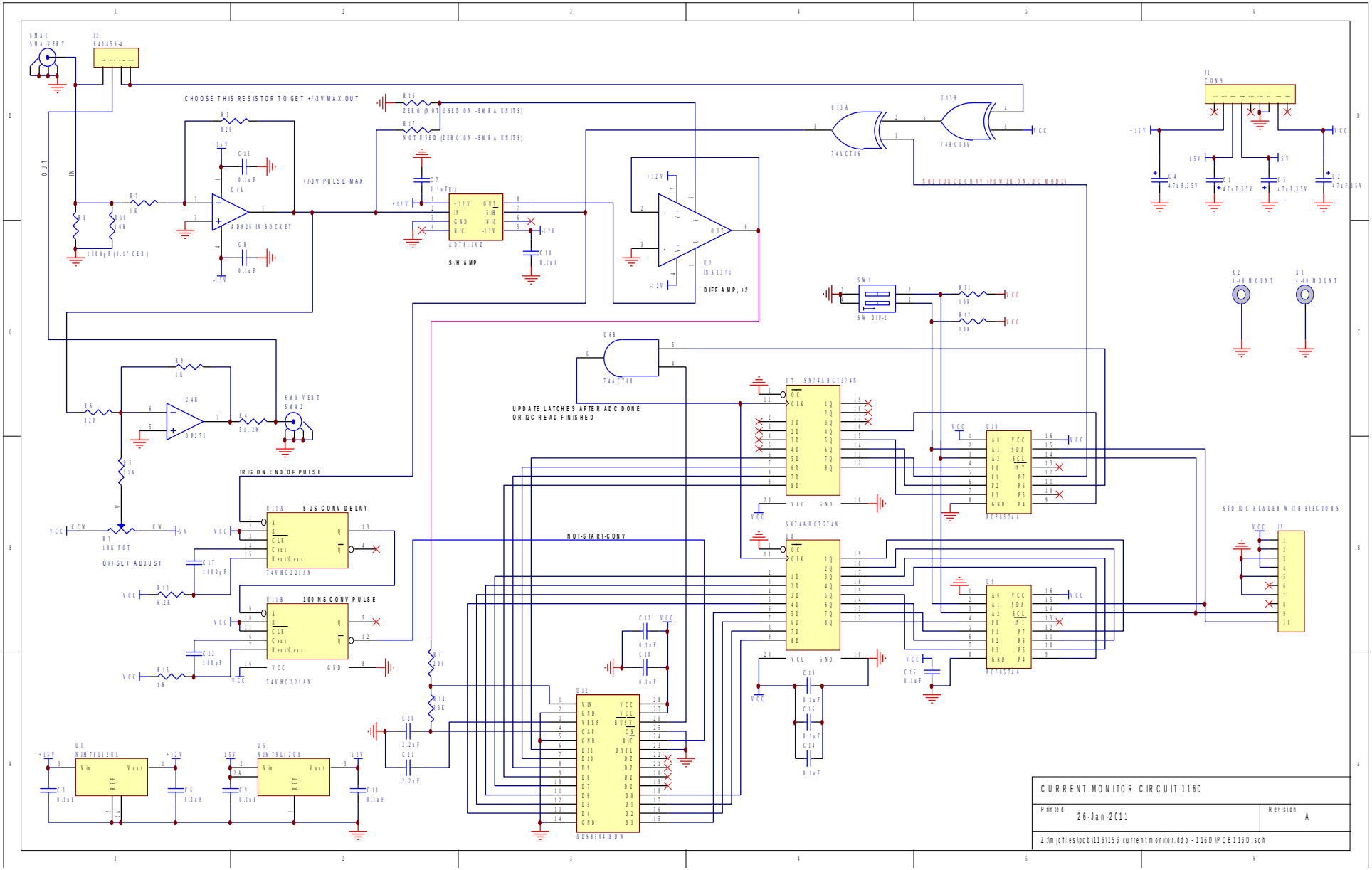
PCB 158Q - LOW VOLTAGE POWER SUPPLY, 3/3



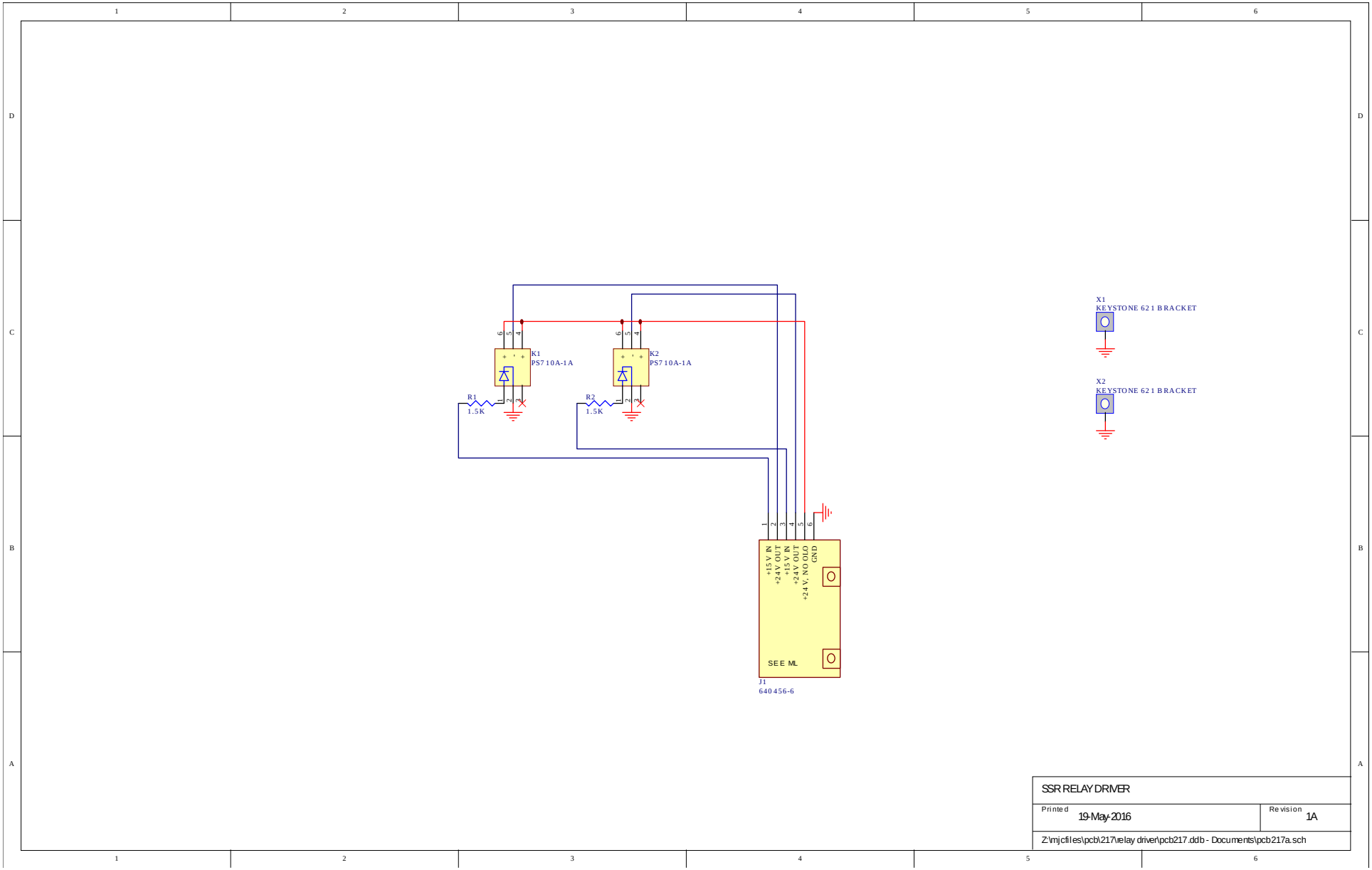
PCB 235B - HIGH VOLTAGE DC POWER SUPPLY



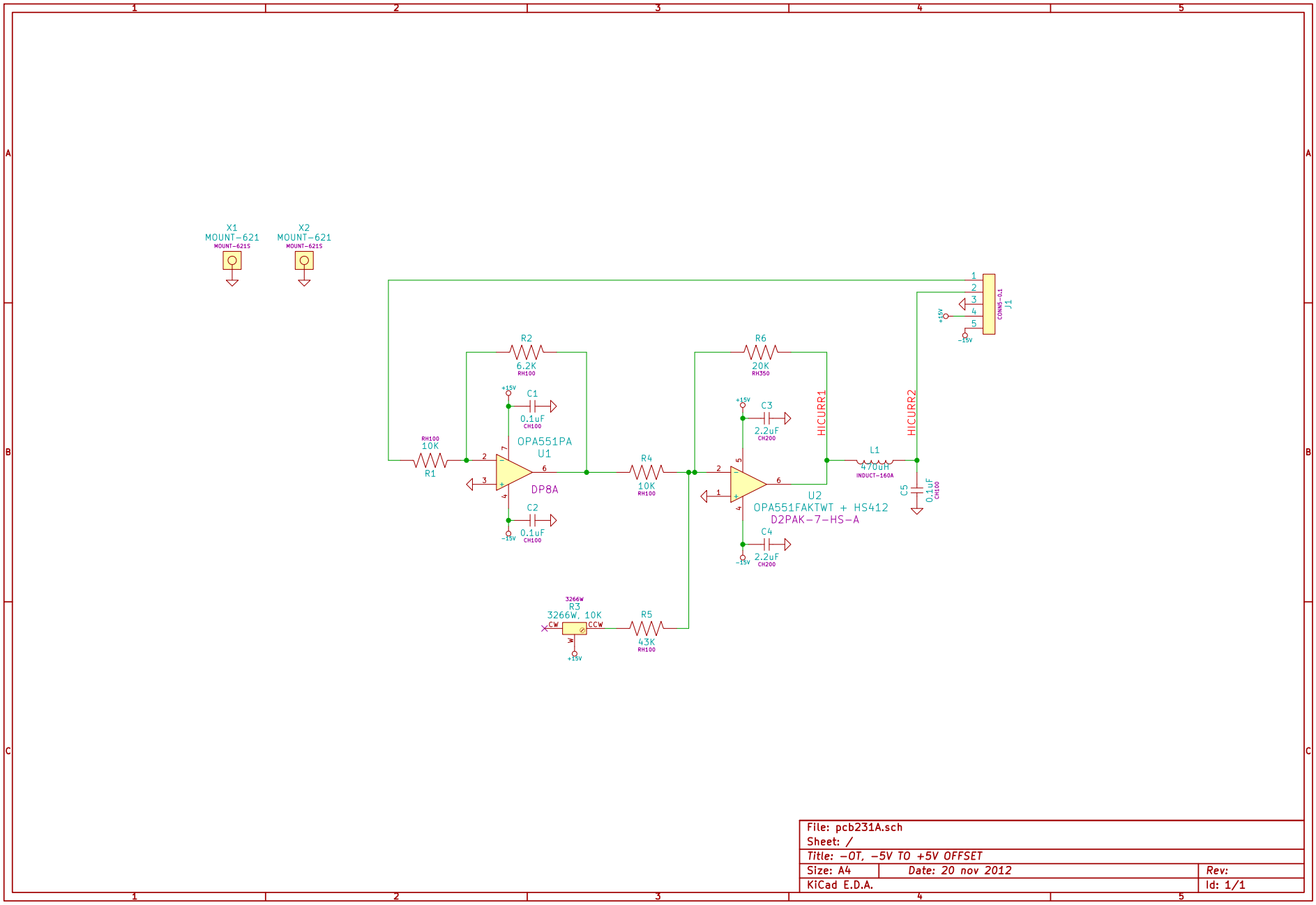
PCB 116D - CURRENT MONITOR



PCB 217A - RELAY DRIVER

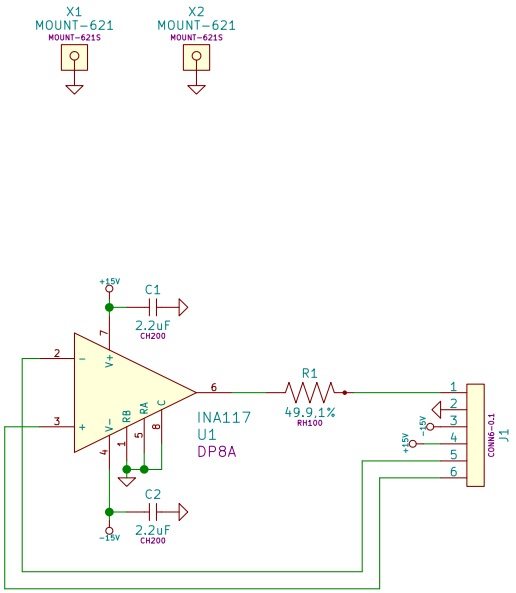


PCB 231A - DC BIAS



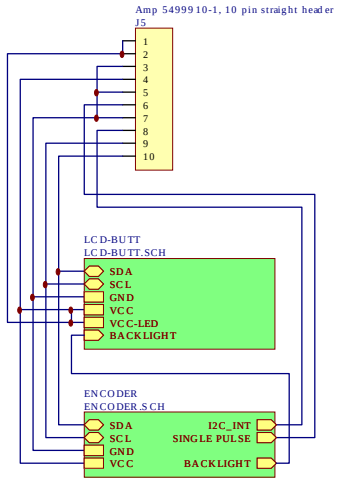
File: pcb231A.sch		
Sheet: /		
Title: -OT, -5V TO +5V OFFSET		
Size: A4	Date: 20 nov 2012	Rev:
KiCad E.D.A.		Id: 1/1

PCB 249A - CURRENT SENSOR



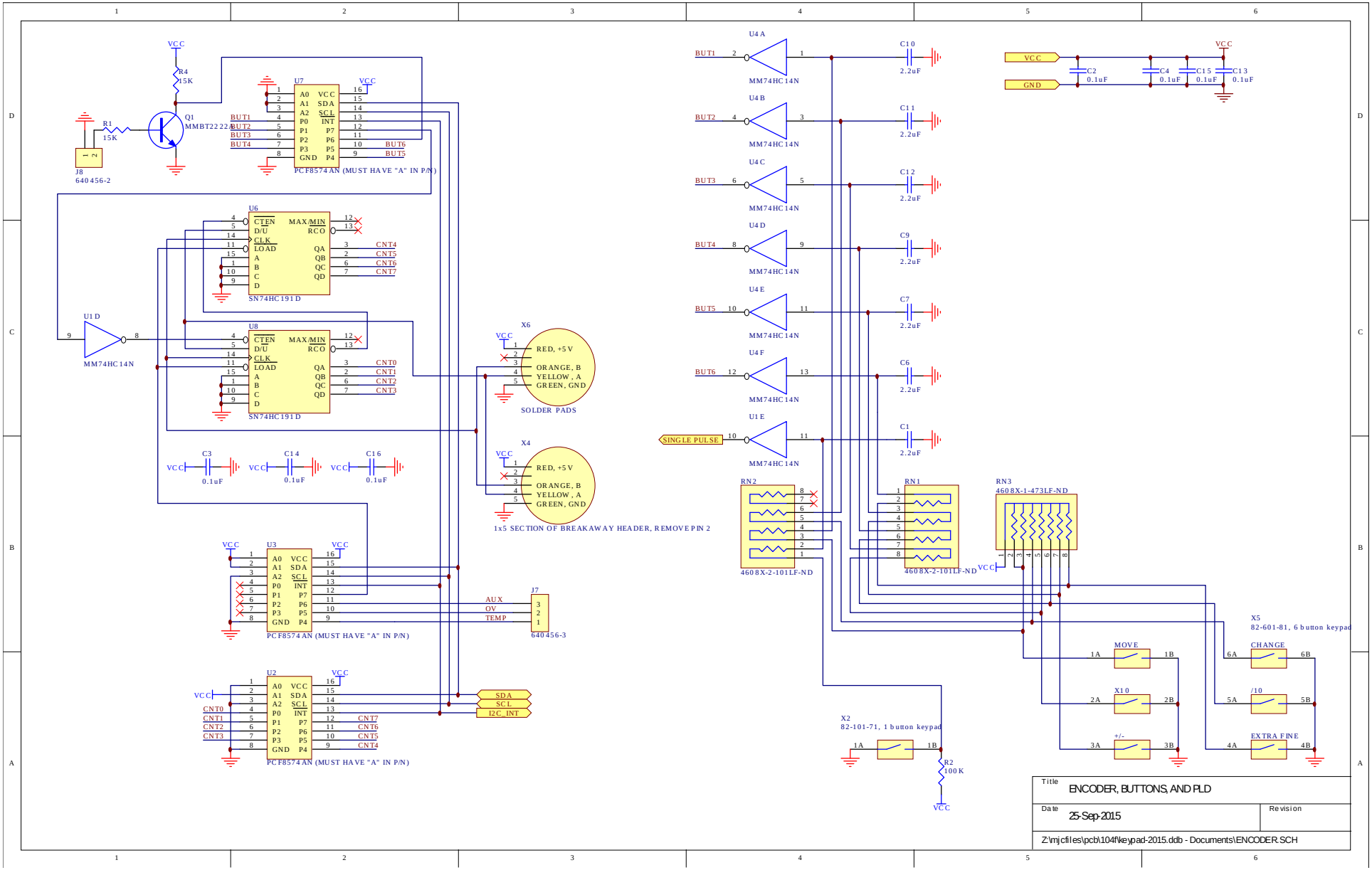
Sheet: / File: pcb249A.sch		
Title:		
Size: USLetter	Date: 17 oct 2013	**Rev:**
KiCad E.D.A. eeschema 4.0.2-1.fc23-product		Id: 1/1

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

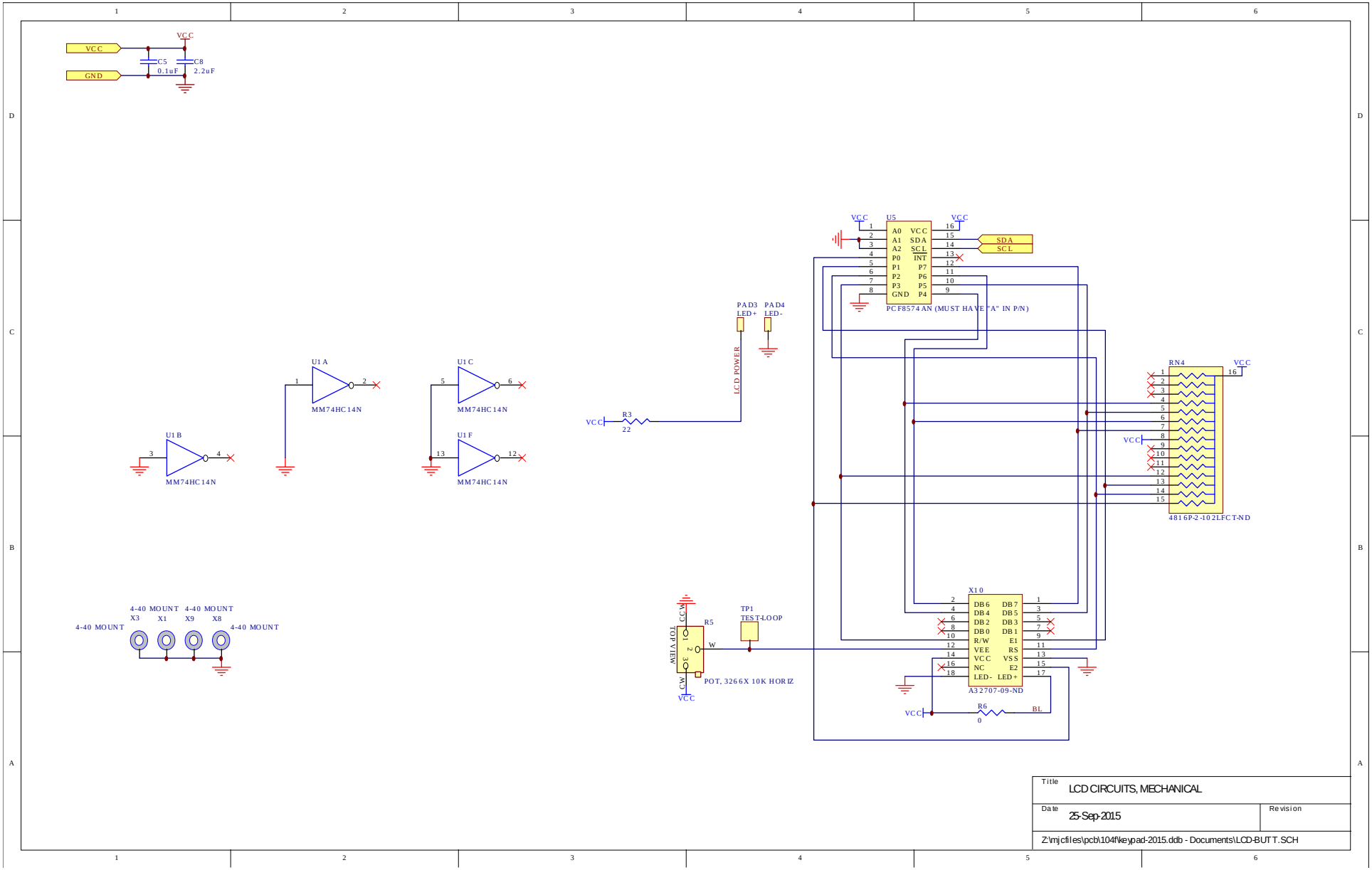


Title	PANEL TOP-LEVEL SCHEMATIC
Date: 25-Sep-2015	Revision
Z:\mjcfiles\pcb\104f\keypad-2015.ddb - Documents\Panelbrd.prj	

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

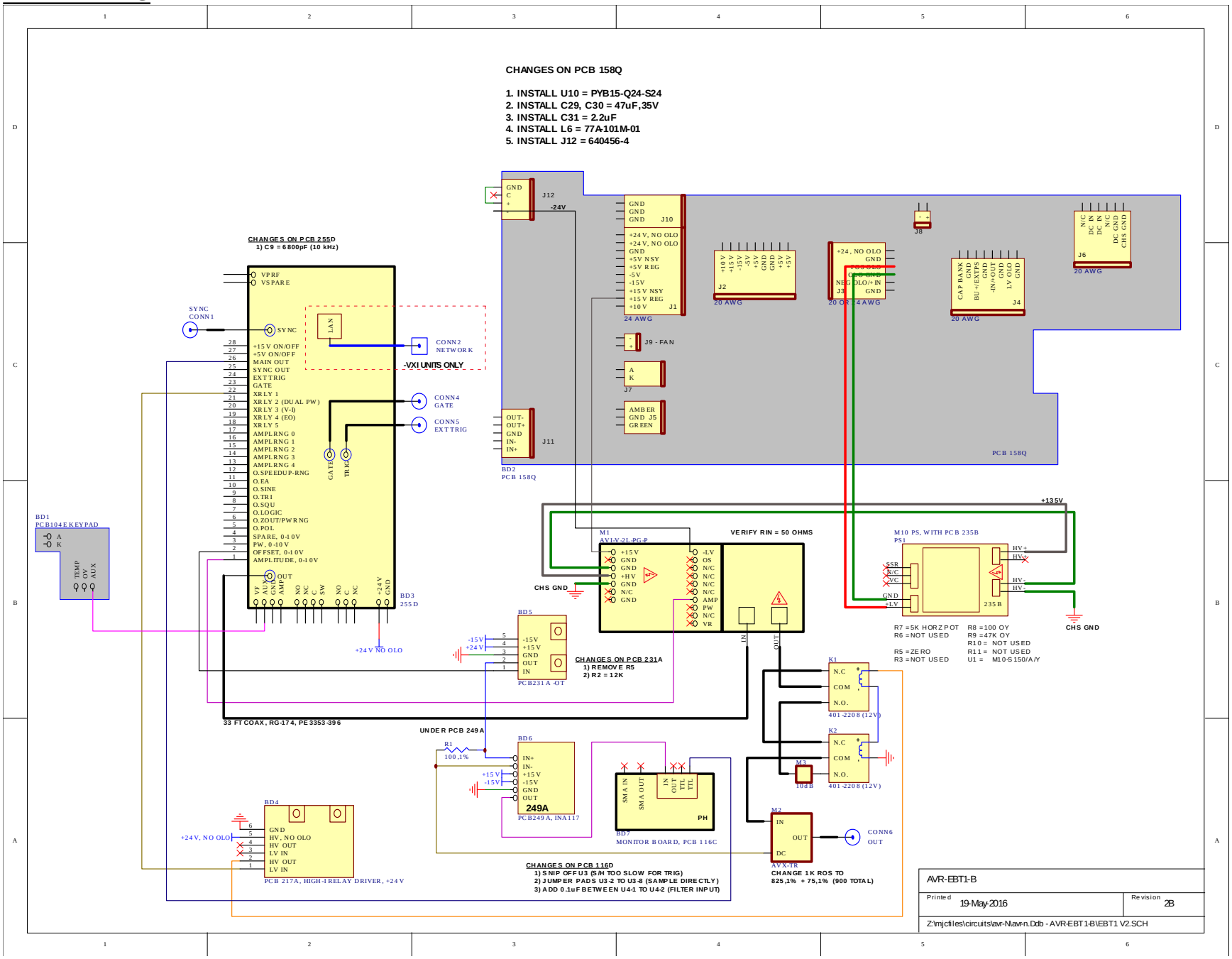


PCB 104F - KEYPAD / DISPLAY BOARD, 3/3



Title	LCD CIRCUITS, MECHANICAL
Date	25-Sep-2015
Revision	
Z:\mjcfiles\pcb\104f\keypad-2015.ddb - Documents\LCD-BUTT.SCH	

MAIN WIRING


CHANGES ON PCB 158Q
1. INSTALL U10 = PYB15-Q24-S24
2. INSTALL C29, C30 = 47uF,35V
3. INSTALL C31 = 2.2uF
4. INSTALL L6 = 77A-101M-01
5. INSTALL J12 = 640456-4
CHANGES ON PCB 255D
1) C9 = 6800pF (10 kHz)
-VXI UNITS ONLY
PCB 158Q
BD2
PCB 158Q
BD1
PCB104EKEYPAD
BD3
255D
BD4
PCB 217A, HIGH-I RELAY DRIVER, +24 V
BD5
PCB231A-OT
CHANGES ON PCB 231A
1) REMOVE R5
2) R2 = 12K
BD6
PCB249A, INA117
BD7
MONITOR BOARD, PCB 116C
M1
AVLV-2L-PG-P
VERIFY RIN = 50 OHMS
M10 PS, WITH PCB 235B
PS1
235B
+135V
CHS GND
R7 =5K HORZ POT
R6 =NOT USED
R5 =ZERO
R3 =NOT USED
R8 =100 OY
R9 =47K OY
R10 = NOT USED
R11 = NOT USED
U1 = M10-S150/A/Y
33 FT COAX, RG-174, PE3353-396
UNDER PCB 249A
CHANGES ON PCB 116D
1) SNIP OFF U3 (S/H TOO SLOW FOR TRIG)
2) JUMPER PADS U3-2 TO U3-8 (SAMPLE DIRECTLY)
3) ADD 0.1uF BETWEEN U4-1 TO U4-2 (FILTER INPUT)
CHANGE 1K ROS TO
825,1% + 75,1% (900 TOTAL)
AVX-TR
CONN6
OUT
CONN2
NETWORK
CONN4
GATE
CONN5
EXT TRIG
SYNC
CONN1
J1
J2
J3
J4
J6
J7
J8
J9 - FAN
J10
J11
J12
K1
K2
M2
M3
10dB
401-2208 (12V)
AMBER
GND J5
GREEN
AVR-EBT1-B
Printed
19-May-2016
Revision
2B
Z:\mjcfiles\circuits\avr-N\avr-n.Ddb - AVR-EBT1-B\EBT1 V2.SCH

PERFORMANCE CHECK SHEET