AVTECH ELECTROSYSTEMS LTD.

NANOSECOND WAVEFORM ELECTRONICS
SINCE 1975

P.O. BOX 265
OGDENSBURG, NY
U.S.A. 13669-0265

TEL: 888-670-8729 (USA & Canada) or +1-613-686-6675 (Intl)
FAX: 800-561-1970 (USA & Canada) or +1-613-686-6679 (Intl)

info@avtechpulse.com - http://www.avtechpulse.com/

BOX 5120, LCD MERIVALE
OTTAWA, ONTARIO
CANADA K2C 3H4

INSTRUCTIONS

MODEL AV-106B-B-P-IPGE

+5 TO 100 AMP, 0 TO +12.5 V, 1.5 us RISE TIME

LASER DIODE DRIVER

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

Phone: 888-670-8729 (USA & Canada) or +1-613-686-6675 (International)
Fax: 800-561-1970 (USA & Canada) or +1-613-686-6679 (International)

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

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Manual Reference: /fileserver1/officefiles/instructword/av-106/AV-106B-B-P-IPGE,ed1.odt.
Last modified February 29, 2024.

INTRODUCTION

The Model AV-106B-B-P-IPGE pulse generator is designed for pulsing laser diode and other low impedance loads with rectangular pulses as high as +100 Amperes into load voltages in the range of 0 to +12.5V, with rise and fall times of less than 1.5 us. The pulse repetition frequency can vary from 1 Hz to 10 kHz, and pulse widths can vary from < 5 to 100 us. The maximum average output current is 2A, subject to a maximum duty cycle limit of 20%.

The Model AV-106B-B-P-IPGE pulse generator is a current pulser. The current amplitude is largely independent of the load voltage. The load voltage must not exceed +12.5V for proper operation.

The loads can be connected to the pulse generator using the convenient AV-CLZ1-100 transmission line cable assembly, which has a 1Ω characteristic impedance (Z_0), and is terminated with a DB-37 male connector.

The AV-106B-B-P-IPGE can be controlled from the front panel, or via a computer connected to the IEEE 488.2-compliant GPIB port, or the RS-232 serial port.

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

SPECIFICATIONS

Model:	AV-106B-B-P-IPGE
Amplitude:	+5 to +100 Amperes
Load voltage range:	0 to +12.5 Volts
Pulse width (FWHM):	5 to 100 us
Rise & fall times (20%-80%):	≤ 1.5 us
PRF:	0 to 10 kHz
Maximum average current:	+2A
Duty cycle: (max)	20% at amplitudes below 10A. Limited by average current specification at higher amplitudes (for example, the maximum duty cycle at 50A is 4%, at 80A it is 2.5%, and at 100A it is 2%).
Output impedance:	≥ 50 Ohms
Output regulation:	≤ ±5% change in current for a load voltage change from 0 V to max. rated load voltage
GPIB & RS-232 control:	Standard on -B units.
LabView drivers:	Check http://www.avtechpulse.com/labview for availability and downloads
Settings resolution:	The resolution of the timing parameters (pulse width, delay, period) varies, but is always better than 0.15% of (|set value| + 20 ns). The amplitude resolution is < 0.1% of the maximum amplitude.
Settings accuracy:	Typically ± 3% of setting (plus ± 1% of maximum, for amplitude) after a 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.
Propagation delay (Jitter):	≤ 100 ns, (± 100 ps ± 0.03% of sync delay, Ext trig in to pulse out)
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:	Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).
Sync output:	+3 Volts, > 50 ns, will drive 50 Ohm loads
Gate input:	Sync or async, active high or low, switchable. Suppresses triggering when active.
Supplied output transmission line:	Detachable high-current transmission line cable assembly. See http://www.avtechpulse.com/transmission for details.
Part number, length, Z_0:	AV-CLZ1-100 (see http://www.avtechpulse.com/transmission/av-clz1). 1 Ω. 100 cm
Mainframe output connectors:	One standard DB37 connector (Pins 1-19 = signal, pins 20-37 = ground) suitable for mating to the included AV-CLZ1-100 cable, and one (non-standard) pair of female banana connectors. The two sets of connectors will be wired in parallel.
Supplied output adapter:	A modified version of the standard AV-CTLX-ENC adapter, suitable for mating to the included AV-CLZ1-100 cable. This adapter will be modified to provide a pair of female banana connectors, wired in parallel with the DB37 signals.
Connectors (other):	Trig, Sync, Gate, Monitor: BNC
Power requirements:	100 - 240 Volts, 50 - 60 Hz
Dimensions:	100 x 430 x 375 mm (3.9” x 17” x 14.8”)
Temperature range:	+5°C to +40°C

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 2004/108/EG for Electromagnetic Compatibility. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emission

EN 50082-1 Immunity

and that this pulse generator meets the intent of the Low Voltage Directive 2006/95/EC. Compliance pertains to the following specifications as listed in the official Journal of the European Communities:

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

DIRECTIVE 2011/65/EU (RoHS)

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

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

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

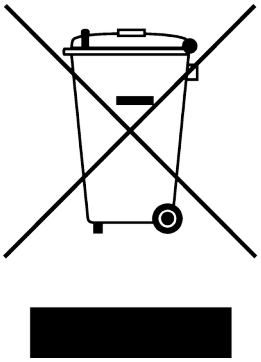
DIRECTIVE 2002/96/EC (WEEE)

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

Customers who have purchased Avtech equipment through local representatives should consult with the representative to determine who has responsibility for WEEE

compliance. Normally, such responsibilities with lie with the representative, unless other arrangements (under Article 9) have been made.

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



FIRMWARE LICENSING

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

Earlier firmware versions do not contain any open source software.

INSTALLATION

VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, liquid crystal displays (LCDs), and the handles. If the instrument has been damaged, file a claim immediately with the company that transported the instrument.

Confirm that the following items are present:

- The mainframe (i.e., the main instrument chassis)
- A power cord
- A GPIB cable
- An AV-CTLX-ENC-IPGE customized test adapter
- An AV-CLZ1-100 transmission line cable assembly
- Two instrumentation manuals (this manual and the “Programming Manual for -B Instruments”) are with the instrument.

POWER RATINGS

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

The maximum power consumption is 150 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:

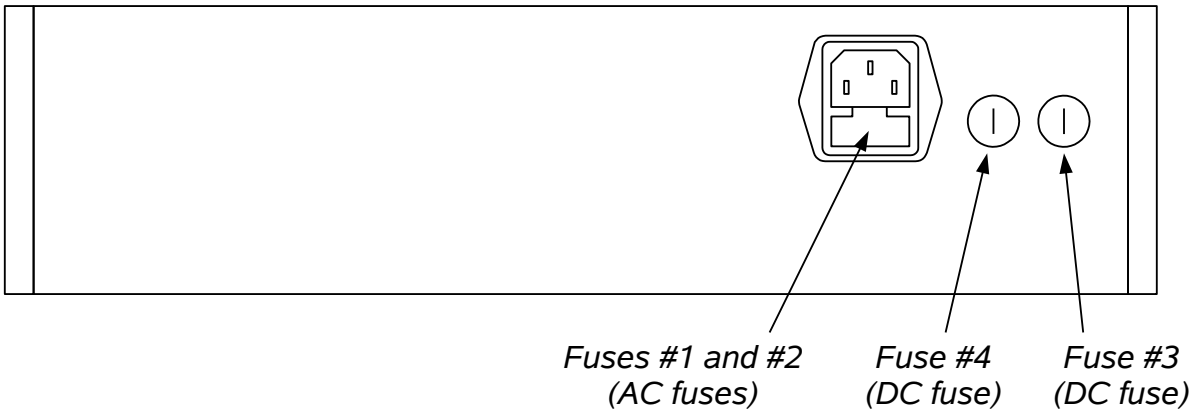
1. indoor use;
2. altitude up to 2 000 m;
3. temperature 5 °C to 40 °C;
4. maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
5. Mains supply voltage fluctuations up to ±10 % of the nominal voltage;
6. no pollution or only dry, non-conductive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

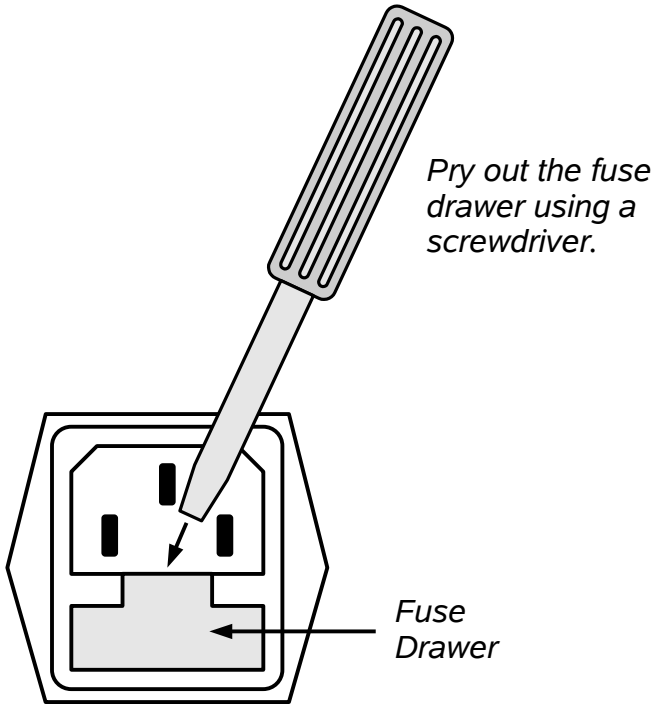
FUSES

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

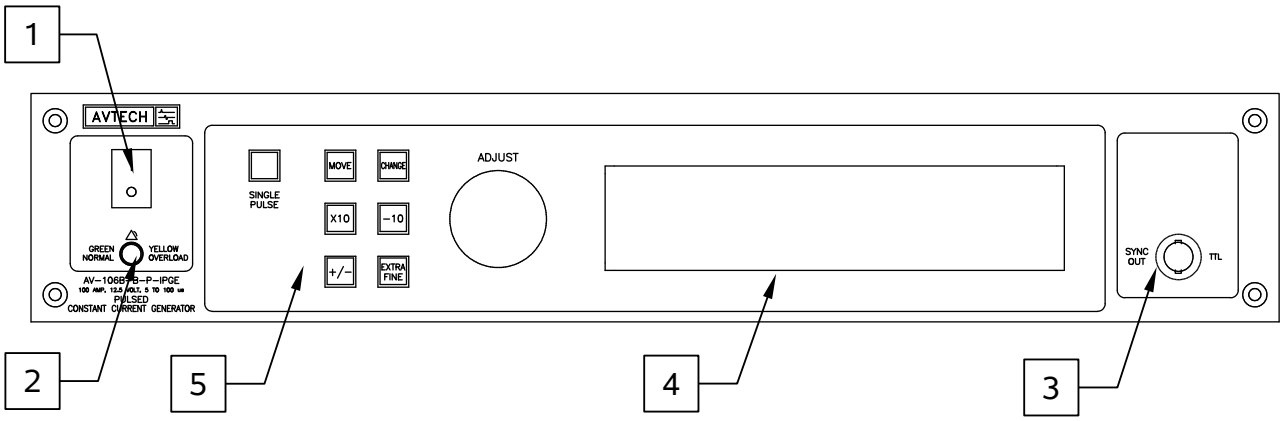
The following table lists the required fuses:

Fuses	Nominal Mains Voltage	Rating	Case Size	Recommended Replacement Part	
				Littelfuse Part Number	Digi-Key Stock Number
#1, #2 (AC)	115 V	1.6A, 250V, Time-Delay	5×20 mm	021801.6HXP	F2424-ND
	230 V	0.8A, 250V, Time-Delay	5×20 mm	0218.800HXP	F2418-ND
#3 (DC)	N/A	1.6A, 250V, Time-Delay	5×20 mm	021801.6HXP	F2424-ND
#4 (DC)	N/A	2.5A, 250V, Time-Delay	5×20 mm	021802.5HXP	F2427-ND

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

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

FRONT PANEL CONTROLS



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

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

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

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

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

3. 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.

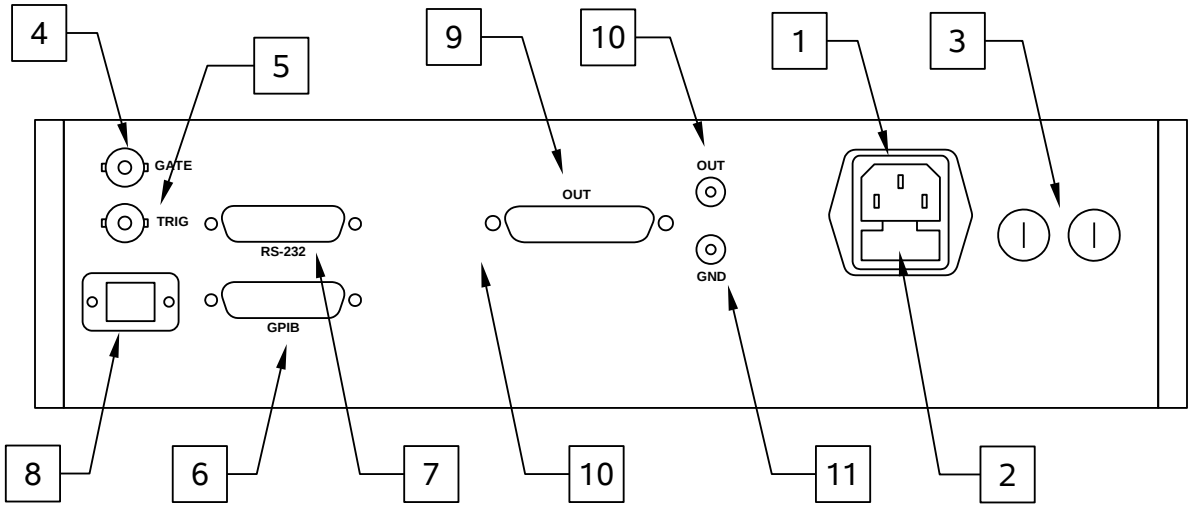
4. LIQUID CRYSTAL DISPLAY (LCD). This LCD is used in conjunction with the keypad to change the instrument settings. Normally, the main menu is displayed, which lists the key adjustable parameters and their current values. The “Programming Manual for -B Instruments” describes the menus and submenus in

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.)

When triggering externally, the instrument can be set such that the output pulse width tracks the pulse width on this input, or the output pulse width can be set independently.

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

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

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

9. OUT DB-37 Connector. This is the main output. The AV-CLZ1-100 transmission line plugs into this DB-37 female connector. Pins 1-19 (the upper row) are connected to the signal out, and pins 20-37 (the lower row) are connected to ground.

10. OUT Banana Connector. This supplementary output connector may be used as an alternative to the main output connector. This is wired in parallel with pins 1-19 of the OUT DB-37 connector.

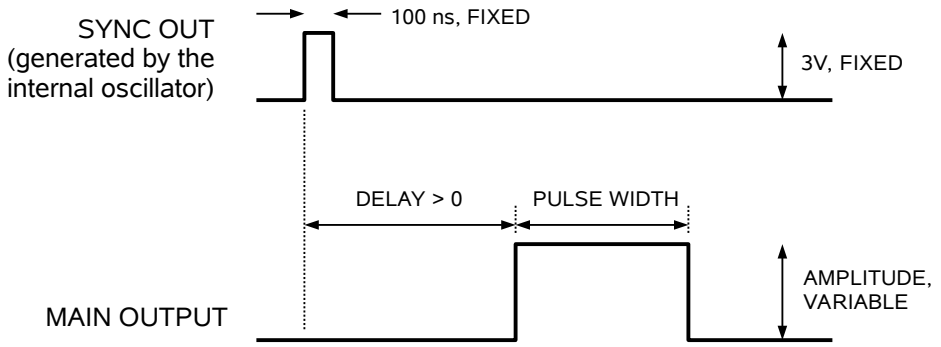
11. GND Banana Connector. This is a ground connector for use with the OUT banana connector. This is wired in parallel with pins 20-37 of the DB-37 connector.

GENERAL INFORMATION - PULSE GENERATOR TIMING

BASIC PULSE CONTROL

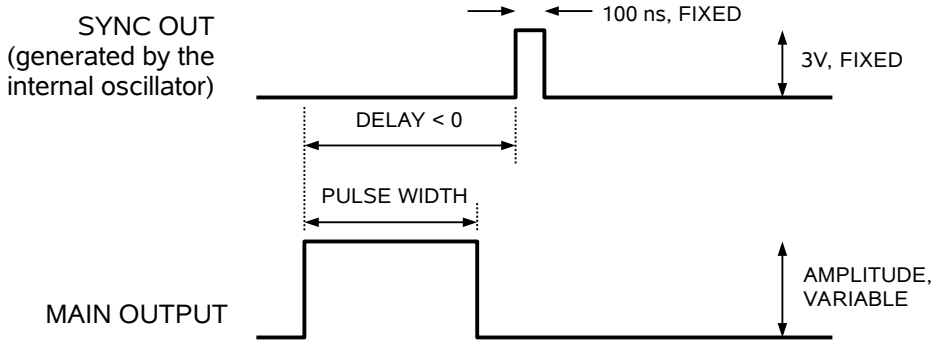
This instrument can be triggered by its own internal clock or by an external TTL trigger signal. In either case, two output channels respond to the trigger: OUT and SYNC. The OUT channel is the signal that is applied to the device under test. Its amplitude and pulse width are variable. The SYNC pulse 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.

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



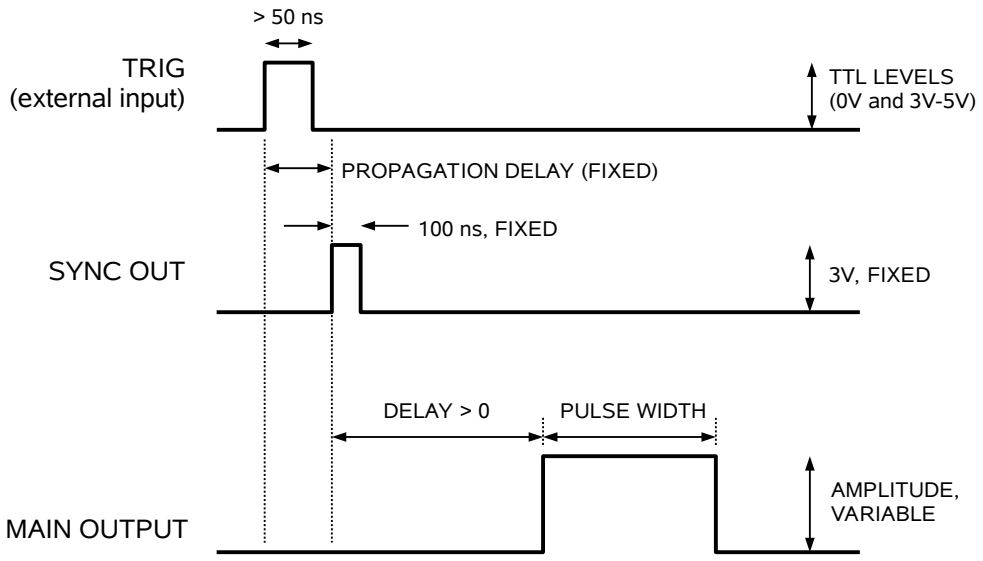
Basic Output Pulses for Delay > 0

The order of the output pulses is reversed for negative delays:



Basic Output Pulses for Delay < 0

When the triggering is set to external mode, a TTL-level pulse on the TRIG input will trigger the pulse generator, as shown below:



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

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. This input can also be set to act synchronously or asynchronously. When set to asynchronous mode, the GATE will disable the output immediately. Output pulses may be truncated. When set to

synchronous mode, the output will complete the full pulse width if the output is high, and then stop triggering. No pulses are truncated in this mode.

GENERAL INFORMATION - OPERATING INTO A LOAD

AMPLITUDE CONTROL

The AV-106B-B-P-IPGE is a pulsed constant current source. The output current is largely independent of the load voltage (as long as the load voltage remains within the specified 0 to +12.5V range).

The instrument will function properly into short circuits and diode loads. For optimal waveform shape, however, it may be beneficial to add a small resistance to the load (~0.1Ω), to reduce the L/R time constants in the cabling and load.

OUTPUT CONNECTIONS

The main output is provided on a rear-panel DB-37 female connector. Pins 1-19 of this connector (the upper row) are connected to the signal out, and pins 20-37 (the lower row) are connected to ground. These two signals are also provided on supplementary banana connectors close to the DB-37 connector.

An AV-CLZ1-100 transmission line is supplied with the instrument. One end plugs into the rear-panel connector. The other end is terminated with a DB-37 male connector. Pins 1-19 of this connector (the upper row) are connected to the signal out, and pins 20-37 (the lower row) are connected to ground. The cable is reversible - either end can be plugged into the rear panel. This cable can be ordered separately, as model AV-CLZ1-100. (Lengths longer than 100 cm are also available - see http://www.avtechpulse.com/transmission/av-clz1 for details.)

The user may connect a load to the end of the AV-CLZ1-100 transmission line using a load that has a DB-37 female connector. To construct your own connectorized load, consider using a Norcomp 172-037-201-001 DB-37 female connector with solder cup pins. This is readily available from Digi-Key (http://www.digikey.com, stock number 137F-ND). Care must be taken to construct the connectorized test load to conform to local safety standards. Pins 1-19 short be connected together to provide the signal output, and pins 20-37 should be connected together to provide the ground.

It may be simpler to modify the supplied test adapter. The supplied test adapter has this connector pre-installed, and a safety enclosure is provided. This test adapter is described in the next section.

USING THE SUPPLIED TEST ADAPTER (AV-CTLX-ENC-IPGE)

The supplied test adapter consists of a DB-37 female connector mounted on the lid of a small aluminum box chassis. Inside the chassis, an 8 mm by 50 mm circuit board is sandwiched between the two rows of solder cups on the rear of the connector. Pins 1-19 of this connector are connected to the signal out, and pins 20-37 are connected to

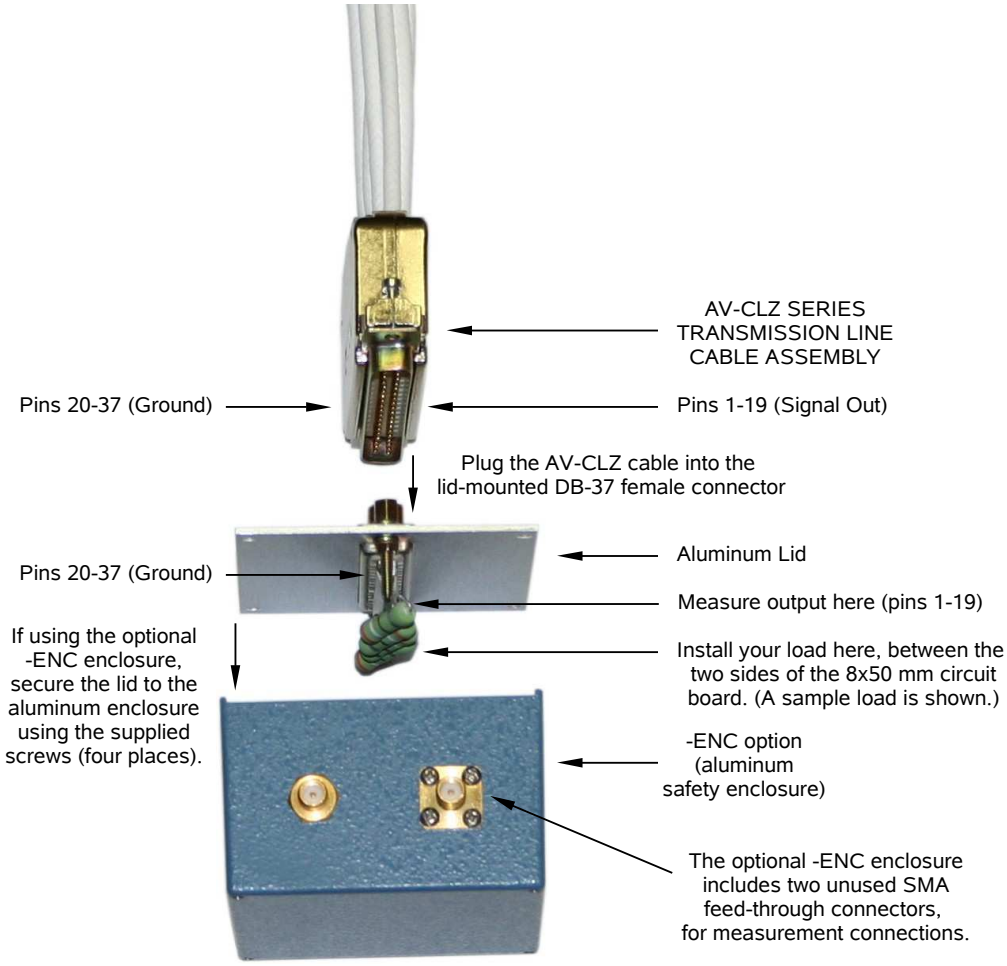
ground. These two signals are also provided on supplementary banana connectors close to the DB-37 connector.

Two unused SMA connectors are provided for making connections through the chassis wall, if desired. A 5/16" hole, plugged with a screw is also provided. The screw may be removed to provide an access hole to the interior of the chassis.

For safety reasons, the lid should be installed on the aluminum chassis so that users can not physically touch the load.

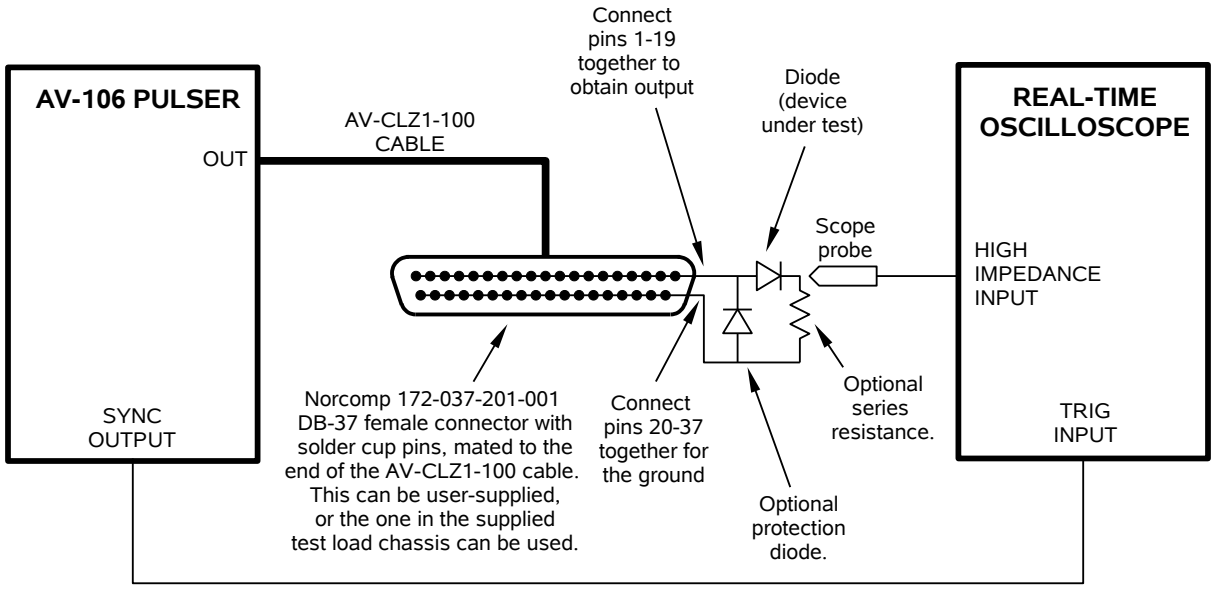
This test adapter can be ordered separately, as model AV-CTLX-ENC-IPGE.

The basic mechanical connection scheme for the AV-CTLX-ENC-IPGE is shown below:



TEST ARRANGEMENT

The basic test arrangement is shown below:



NOTE: BOTH DIODES ARE SHOWN ORIENTED FOR A POSITIVE OUTPUT.
REVERSE BOTH DIODES FOR NEGATIVE OPERATION.

There are several key points to note. As explained above, a resistance can optionally be added in series with the diode load, to provide transmission line matching. This resistance may also be used to monitor the current through the diode. If connected as shown above, the resistor voltage displayed on the oscilloscope is directly proportional to the diode current. It is essential the low-inductance resistors be used. Several non-inductive, medium power resistors should be used in parallel.

It is also recommended that a low-capacitance, high-voltage, ultra-fast Schottky rectifier diode be connected for reverse-bias protection, especially for sensitive or costly devices under test. The capacitance added by the protection diode may degrade the output rise time slightly.

LENZ'S LAW AND INDUCTIVE VOLTAGE SPIKES

This instrument is designed to pulse resistive and diode loads and will exhibit a large output spike when used to drive a load with significant inductance (as predicted by LENZ'S LAW). For this reason the load should be connected to the output using low inductance leads (as short as possible and as heavy a gauge as possible).

The voltage developed across an inductance L (in Henries), when the current is changing at a rate given by dI_{LOAD}/dt (in Amps/sec), is: $V_{SPIKE} = L \times dI_{LOAD}/dt$.

For this reason, the length of leads used to connect the load to the circuit board should be kept as short as possible.

CURRENT MEASUREMENT

Measuring current is more difficult than measuring voltage. There are four basic approaches to measuring pulsed current:

1) Rely on the accuracy of the amplitude setting (typically 5%), as displayed on the LCD display.

2) Use a high-performance current transformer, such as a Pearson 410. The output voltage of the transformer is proportional to the sensed current. Transformers are AC-coupled devices, so some droop is inevitable.

3) Use a DC-coupled current probe, such as a Tektronix TCP303 (and associated TCPA300 amplifier).

4) Use a low-resistance, low-inductance, current-sensing resistor connected in series with the load. To minimize inductance, it is usually wise to connect several resistors in parallel. Beware that wirewound resistors usually have far too much inductance to be useful as current-sensing resistors. A differential probe (discussed below) can be used to measure the voltage across the sensing resistance.

DIFFERENTIAL PROBING

Large currents (up to 100A) will be present on both the signal and ground return lines of the output. This may lead to voltage differentials between various points that are nominally at ground. For this reason, voltages across the actual load should be measured with a differential probe rather than the more common single-ended probe. Some factory tests are conducted using a Tektronix P5205 differential probe.

ALARMS

Several protective circuits are included in the AV-106B-B-P-IPGE.

If the output circuitry overheats, an audible alarm will sound, and the output will be turned off.

The average power consumption is also monitored. If it exceeds safe limits, the output be will turned off and the front-panel “Overload” indicator will glow amber, instead of green.

If these alarms trip during normal operation, turn off the instrument until it becomes clear why the problems are occurring. In particular, confirm that the output duty cycle has not exceeded the maximum limit of 20% or 2A of average current.

CALIBRATION ADJUSTMENTS - SOFTWARE PROCEDURES

ADJUSTING AMPLITUDE ACCURACY

The AV-106B-B-P-IPGE has two amplitude ranges: 0 to 27A, and 27A to 100A, approximately. The calibration of each range can be adjusted by a few percent if necessary.

If it is found that the output amplitude settings (as set by the front-panel controls or programming commands) do not agree exactly with measured values of amplitude (i.e., by examining the output on an oscilloscope) in one of these ranges, the amplitude calibration can be updated using software commands.

The following procedure is suggested:

1. Connect a precision, high-power resistive load to the output. (As an example, suppose 1Ω is used.)

2. Connect the pulse generator to a computer using the GPIB or RS232 ports.

3. Turn on the pulse generator, and set the time controls (frequency, delay, pulse width) to typical values.

4. Turn on the outputs.

5. Set the output amplitude to 80% of the maximum current for that range. For instance, if the 0 to 100A range requires calibration, set the amplitude to 80A.

6. Observe the voltage across the load. (Using the 0.1Ω example, suppose that 7.6V is observed.) From this, calculate the measured current (76 A in this example).

7. Send the measured value to the instrument using the following command:

   diag:ampl:cal 76 A

   The internal software compares the supplied measured value to the programmed value, and adjusts the internal calibration data to null out any differences.

8. Observe the voltage across the load again. The amplitude setting should now agree with the measured value.

Information on more extensive timing and amplitude calibration procedures is available at http://www.avtechpulse.com/appnote/.

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 10 Hz	(sets the frequency to 10 Hz)
pulse:width 5 us	(sets the pulse width to 5 us)
pulse:delay 200 ns	(sets the delay to 200 ns)
output on	(turns on the output)
source:current 17 A	(sets the current amplitude to 17 amperes)

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

*rst	(resets the instrument)
trigger:source hold	(turns off all triggering)
pulse:width 5 us	(sets the pulse width to 5 us)
output on	(turns on the output)
source:current 17 A	(sets the current amplitude to 17 amperes)
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 5 us	(sets the pulse width to 5 us)
pulse:delay 200 ns	(sets the delay to 200 ns)
source:current 17 A	(sets the current amplitude to 17 amperes)
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
DIAGnostic:		
:AMPLitude		
:CALibration:	<numeric value>	[no query form]
OUTPut:		
:[STATe]	<boolean value>	
:PROTection		
:TRIPped?		[query only]
[SOURce]:		
:FREQuency		
[:CW | FIXed]	<numeric value>	
[SOURce]:		
:CURRent		
[:LEVel]		
[:IMMediate]		
[:AMPLitude]	<numeric value>	
:PROTection		
:TRIPped?		[query only]
[SOURce]:		
:PULSe		
:PERiod	<numeric value>	
:WIDTh	<numeric value>	
:DCYCle	<numeric value>	
:HOLD	WIDTh | DCYCle	
:DELay	<numeric value>	
:GATE		
:TYPE	ASYNC | SYNC	
:LEVel	HIgh | LOw	
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

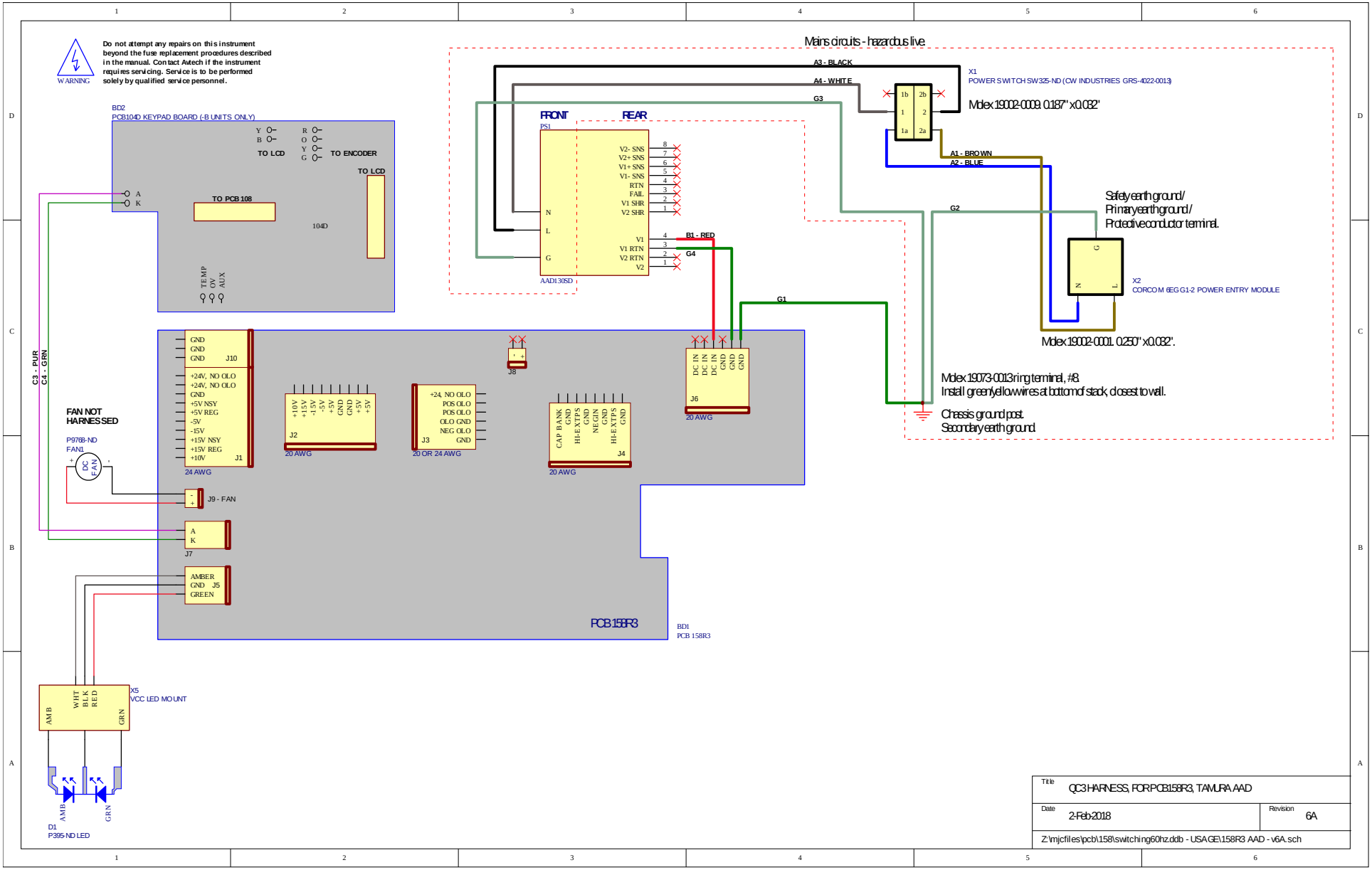
The rear-panel TRIG input, used in the external trigger mode, is protected by a diode clamping circuit. However, the protection circuit is not foolproof, and it is possible for a grossly excessive signal to damage the trigger circuitry on the main timing control board (the 4×10 inch board on the right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

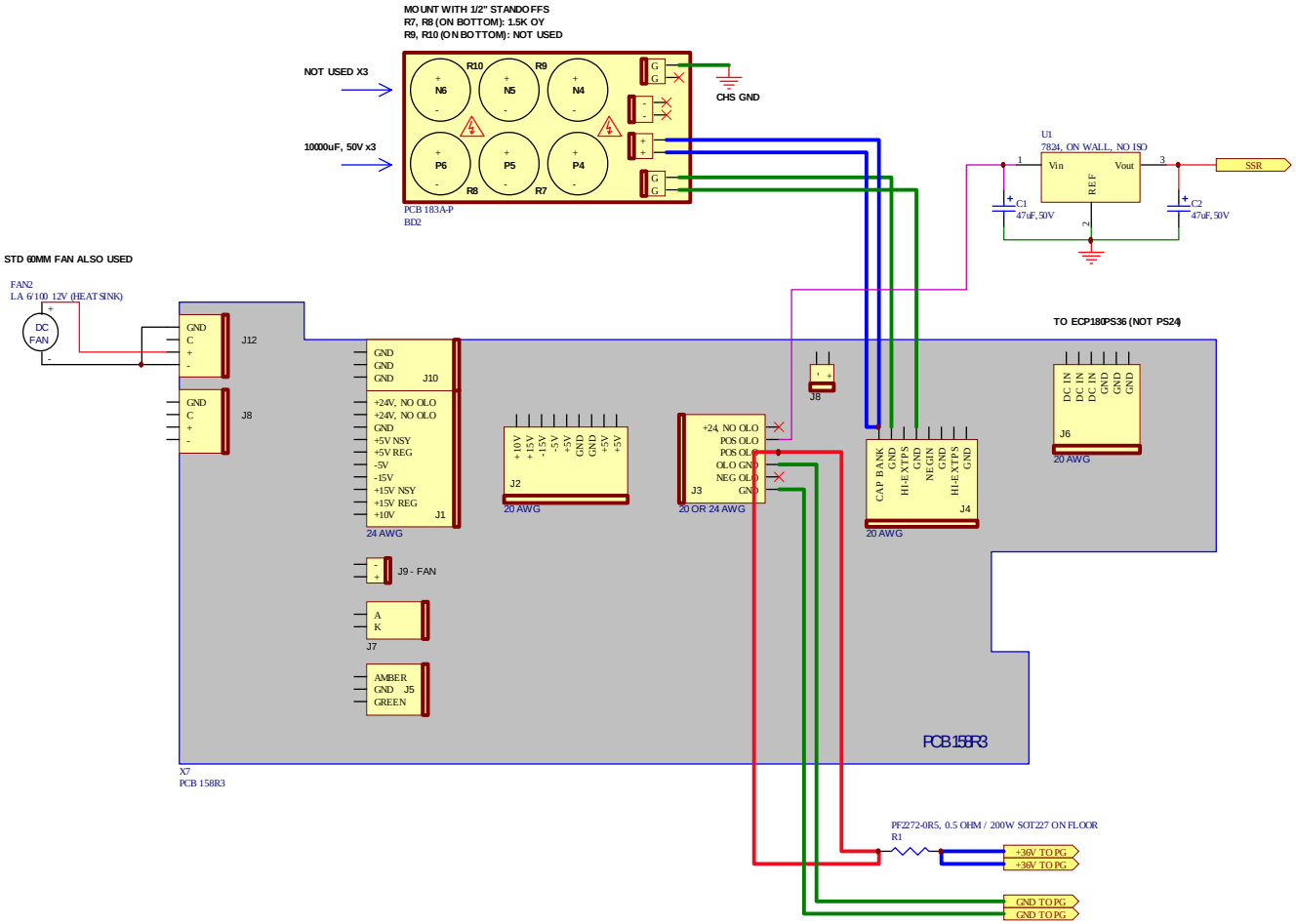
If you suspect that this IC has been damaged, turn off the power and replace this IC. It may be replaced by a 74F151, 74LS151, 74ALS151, or 74HCT151.

WIRING DIAGRAMS

WIRING OF AC POWER



WIRING OF DC POWER



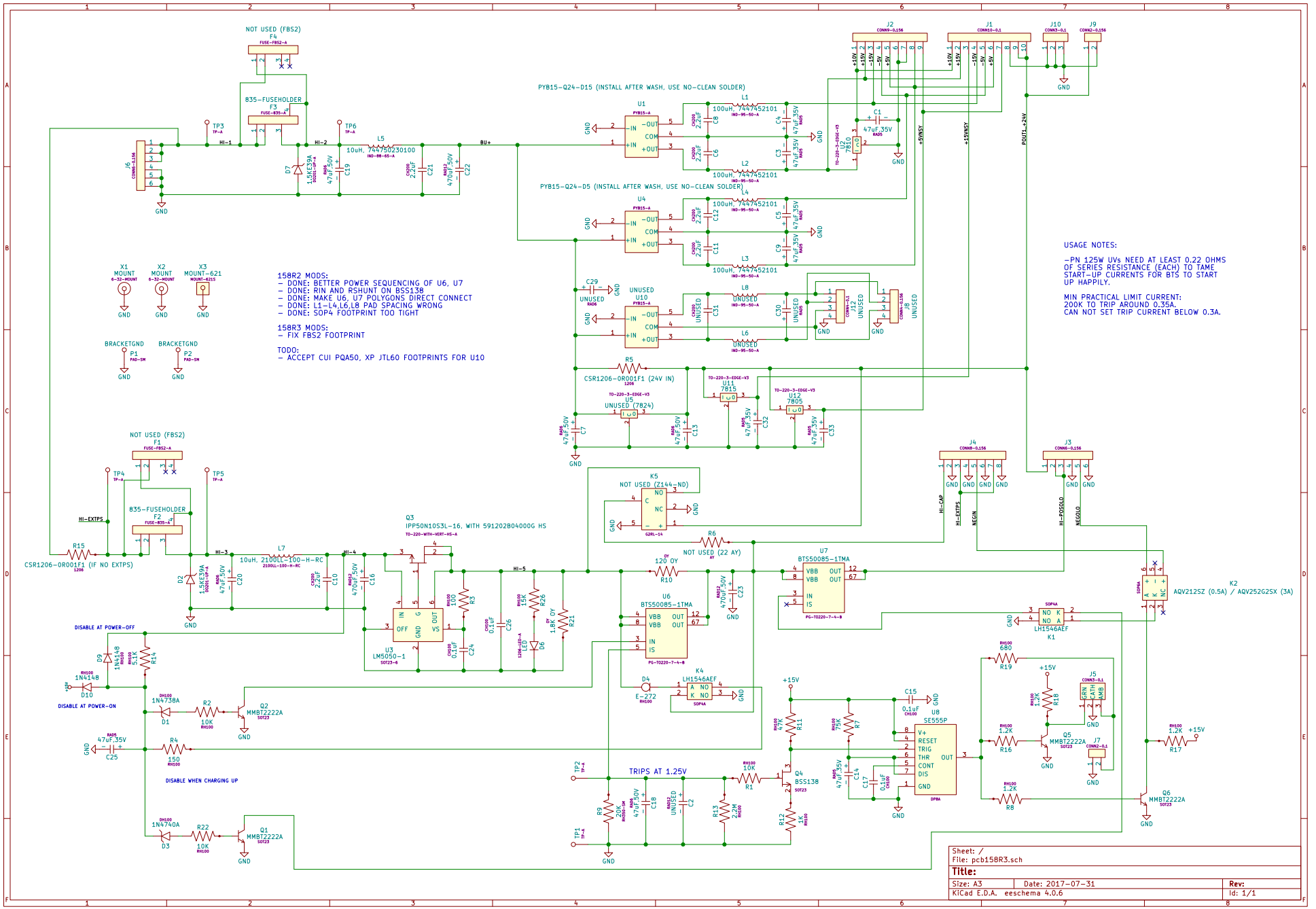
CHANGES REQUIRED ON PCB 158R3

1) REMOVE F5 (TO ENABLE U5)
2) ADD U5 (7824).
3) INSTALL R6, 22 AY. STRAIGHTEN THE LEADS.
4) INSTALL K5 = G2RL-14-DC24

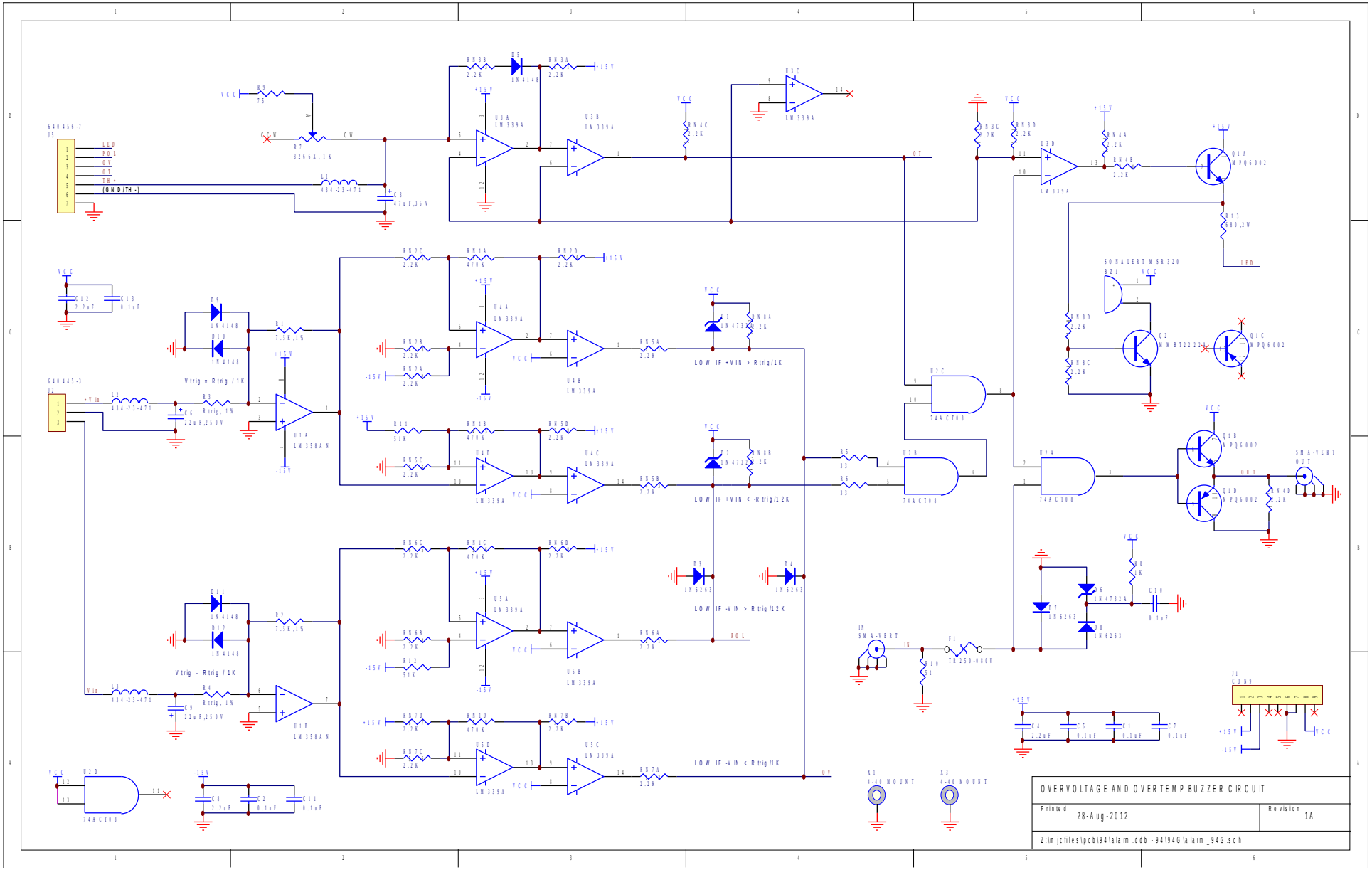
5) INSTALL U10 = PYB15-Q24-S12
6) INSTALL C29 = 47UF, 50V
7) INSTALL C30 = 47UF, 35V
8) INSTALL C31 = 2.2UF
9) INSTALL L6, L8 = 744745210 1 (100 UH)
10) INSTALL J12

AV-106B-B-P-IPGE POWER SUPPLY	
Printed: 2-Feb-2018	Revision: 1C
Z:\mjcfiles\circuits\AV-106\av-106.Ddb - AV-106B-B-P-IPGE\IPGE P.S V1.sch	

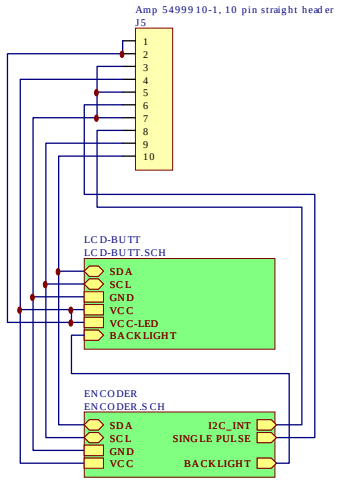
PCB 158R3 - LOW VOLTAGE POWER SUPPLY



PCB 94G - ALARM BOARD

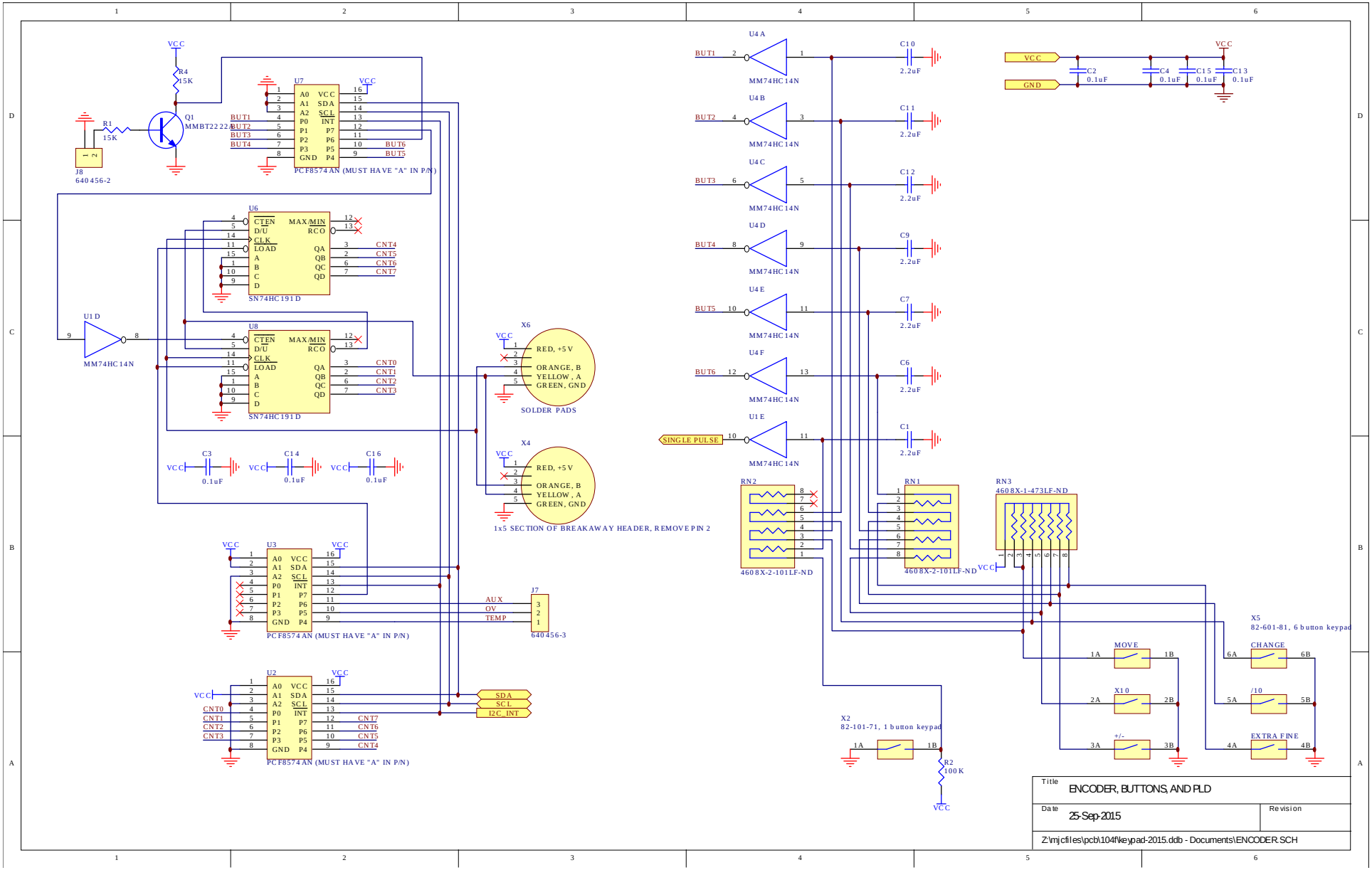


PCB 104F - KEYPAD / DISPLAY BOARD, 1/3

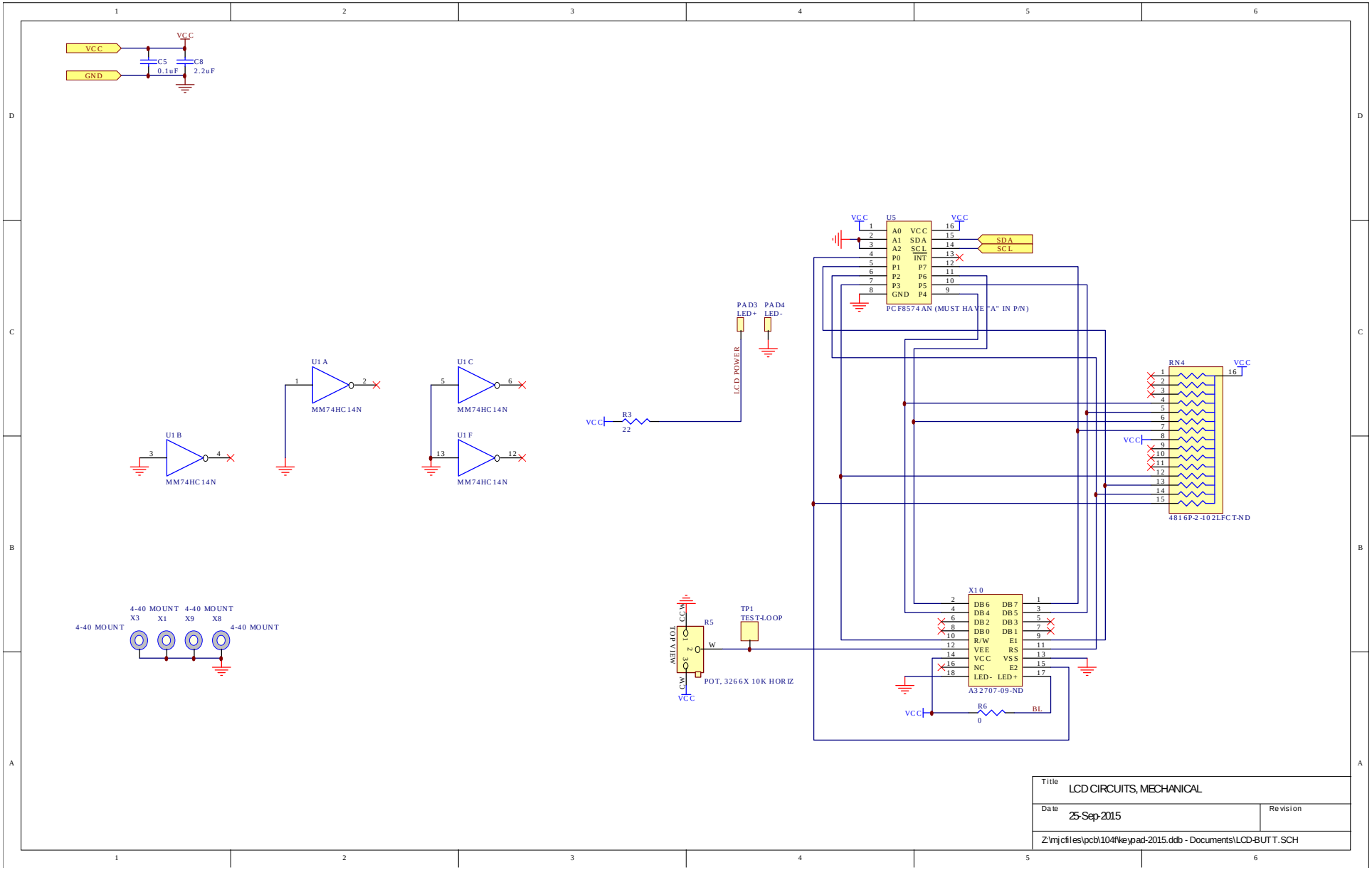


Title	PANEL TOP-LEVEL SCHEMATIC
Date: 25-Sep-2015	Revision:
Z:\mjcfiles\pcb\104f\keypad-2015.ddb - Documents\Panelbrd.prj	

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

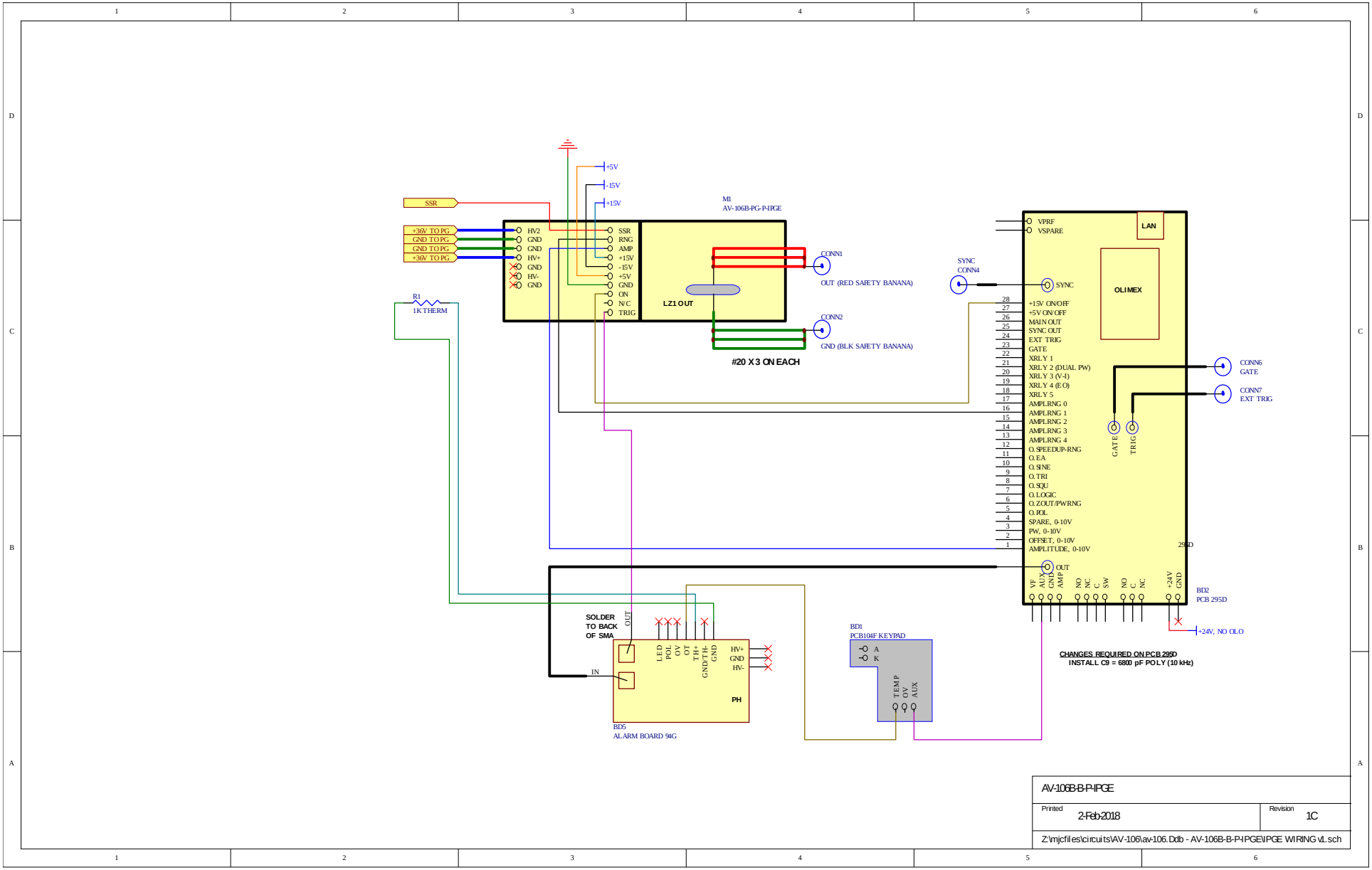


PCB 104F - KEYPAD / DISPLAY BOARD, 3/3



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

MAIN WIRING – POSITIVE UNITS (-P)



PERFORMANCE CHECK SHEET