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# INSTRUCTIONS

MODEL AVP-AV-HV3-B-PN-UTXB

0 TO ±25 VOLTS, 0.4 to 2 ns, 5 kHz

BURSTED POLARITY

HIGH PERFORMANCE 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/avp/old/AVP-AV-HV3-B-PN-UTXB,edition1.sxw.
Last modified February 29, 2024.

# INTRODUCTION

The AVP-AV-HV3-B-PN-UTXB is a high performance, GPIB and RS232-equipped instrument capable of generating 25V into 50Ω loads at repetition rates up to 5 kHz. The output pulse width is variable from 0.4 to 2 ns, and the sync delay is variable up to ±500 ns. The rise times are fixed at less than 200 ps, and the fall times are less than 400 ps.

The polarity of the main output can set to positive or negative, or it can be set to alternate polarities every N pulses, where N is variable from 1 to 14. N can be set from the front panel or by computer command. If N is set to zero, all output pulses will be positive. If N is set to 15, all output pulses will be negative. A TTL-level polarity output (AMP output) is provided, which indicates the current output polarity. This output is useful for synchronizing other test equipment, such as oscilloscopes. A SYNC output is also provided, which generates one TTL-level pulse per main output pulse.

The amplitude and pulse width of the positive and negative pulses are separately adjustable.

The AVP-AV-HV3-B-PN-UTXB 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 AVP-AV-HV3-B-PN-UTXB features front panel keyboard and adjust knob control of the output pulse parameters along with a four line by 40-character backlit LCD display of the output amplitude, pulse width, pulse repetition frequency, and delay. The instrument includes memory to store up to four complete instrument setups. The operator may use the front panel or the computer interface to store a complete “snapshot” of all key instrument settings, and recall this setup at a later time.

This instrument is intended for use in research and development laboratories.

# SPECIFICATIONS

| | |
|---|---|
| Model: | AVP-AV-HV3-B-PN-UTXB[1] |
| Amplitude[2]: (50 Ohm load) | 0 to 25 Volts.<br>Two amplitude controls<br>are provided - one for positive pulses, and one for negative pulses. |
| Pulse width: (FWHM) | 0.4 - 2.0 ns<br>Two pulse width controls<br>are provided - one for positive pulses, and one for negative pulses. |
| PRF: external trigger mode:<br>internal trigger mode: | 0 Hz to 5 kHz<br>1 Hz to 5 kHz |
| Rise time (20%-80%)[7]: | ≤ 200 ps |
| Fall time (80%-20%)[7]: | ≤ 400 ps |
| Polarity: | N positive pulses will be followed by N negative pulses in a repeating cycle, where N is adjustable from 1 to 14. The amplitudes and pulse widths of the two polarities are independently adjustable. |
| GPIB and RS-232 control[2]: | Standard on -B units. Not available on -C units or modules. |
| Propagation delay:<br>(Ext trig in to pulse out) | ≤ 140 ns (Ext trig in to pulse out) |
| Jitter, Ext trig in to pulse out: | ± 35ps ± 0.015% of sync delay |
| Trigger required: | Ext trig mode: +5 Volt, 50 ns to 500 ns (TTL) |
| Sync delay: | Variable 0 to ±1second (sync out to pulse out) |
| Sync output: | +3 Volts, 100 ns, will drive 50Ω |
| Connectors: OUT:<br>TRIG:<br>SYNC:<br>GATE: | SMA<br>BNC<br>BNC<br>BNC |
| Power requirement: | 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: | Anodized aluminum, with blue plastic trim. |
| Mounting, Temperature range: | Any, +5°C to +40°C |

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude, pulse width, PRF and delay (See http://www.avtechpulse.com/gpib).
2) For operation at amplitudes of less than 20% of full-scale, best results will be obtained by setting the amplitude near full-scale and using external attenuators on the output.

# ORIGINAL QUOTATION

Date: Mon, 13 Dec 2004 12:54:59 -0500
From: Avtech Sales
To: XXXXX
Subject: Avtech bipolar pulse generator quote

XXXXX,

Following our telephone conversation today, I am pleased to re-quote (with a modified model number) as follows:

Quote number: 12400

Model number: AVP-AV-HV3-B-PN-UTXB

Description: Ultra High Speed Bipolar Pulse Generator

Amplitude: 0 to 25V into 50 Ohms, adjustable. Two amplitude controls are provided - one for positive pulses, and one for negative pulses.

Pulse width (FWHM): 0.4 to 2 ns, adjustable. Two pulse width controls are provided - one for positive pulses, and one for negative pulses.

Polarity: N positive pulses will be followed by N negative pulses in a repeating cycle, where N is adjustable from 1 to 9. The amplitudes and pulse widths of the two polarities are independently adjustable.

Rise time (20%-80%): < 200 ps

Fall time (80%-20%): < 400 ps

Maximum pulse repetition frequency: 5 kHz

-B option: includes GPIB and RS-232 ports. See http://www.avtechpulse.com/gpib/ for details.

Other: as per the standard AVP-AV-HV3 series, described at http://www.avtechpulse.com/speed/avp-av-hv3/

Price: $XXXXX US each, FOB destination (includes 5% academic discount).

Estimated delivery: 60-75 days after receipt of order (excluding export permit* delays).

*Export Permit: These instruments are very high performance pulse generators, which are considered to be "Nuclear-Related Dual-Use Goods" under government regulations. As such, an "End Use Statement" must be completed when ordering. The necessary form is attached (in Microsoft Word format). We will use the information in the completed form to apply for an export license from the Canadian government, which will take 1 to 6 weeks to obtain. We cannot ship your order without the license. Please return the completed form to us by fax.

Please call or email me if I can be of further assistance.

Regards,
Dr. Michael J. Chudobiak
Chief Engineer

--- Avtech Electrosystems Ltd. ---------- since 1975 ---

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Attachment: EndUse Statement generic1.doc

# EUROPEAN REGULATORY NOTES

## EC DECLARATION OF CONFORMITY

We

Avtech Electrosystems Ltd.
P.O. Box 5120, LCD Merivale
Ottawa, Ontario
Canada K2C 3H4

declare that this pulse generator meets the intent of Directive 89/336/EEC 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

CE

## 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.

# 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 | Manufacturer | Part Number |
|---|---|---|---|
| Continental Europe | European CEE 7/7 “Schuko” 230V, 50Hz | Volex (http://www.volex.com) | 17850-C3-326 |
| | | Qualtek (http://www.qualtekusa.com) | 319004-T01 |
| United Kingdom | BS 1363, 230V, 50Hz | Qualtek (http://www.qualtekusa.com) | 370001-E01 |
| Switzerland | SEV 1011, 2 30V, 50Hz | Volex (http://www.volex.com) | 2102H-C3-10 |
| Israel | SI 32, 220V, 50Hz | Volex (http://www.volex.com) | 2115H-C3-10 |
| North America, and all other areas | NEMA 5-15, 120V, 60 Hz | Qualtek (http://www.qualtekusa.com) | 312007-01 |

## PROTECTION FROM ELECTRIC SHOCK

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

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

2. Wherever possible, use shielded connectors and cabling.

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

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

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

## ENVIRONMENTAL CONDITIONS

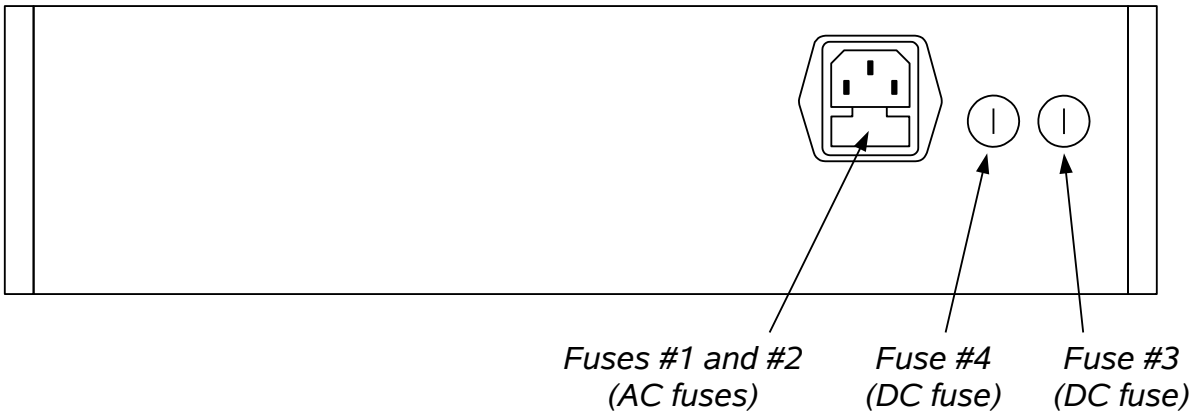
This instrument is intended for use under the following conditions:

1. indoor use;
2. altitude up to 2 000 m;
3. temperature 5 °C to 40 °C;

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

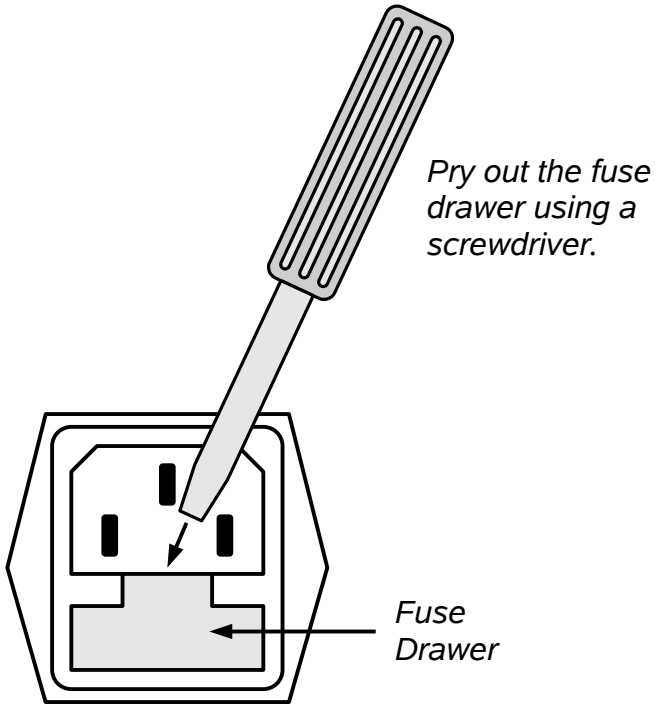
## FUSES

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

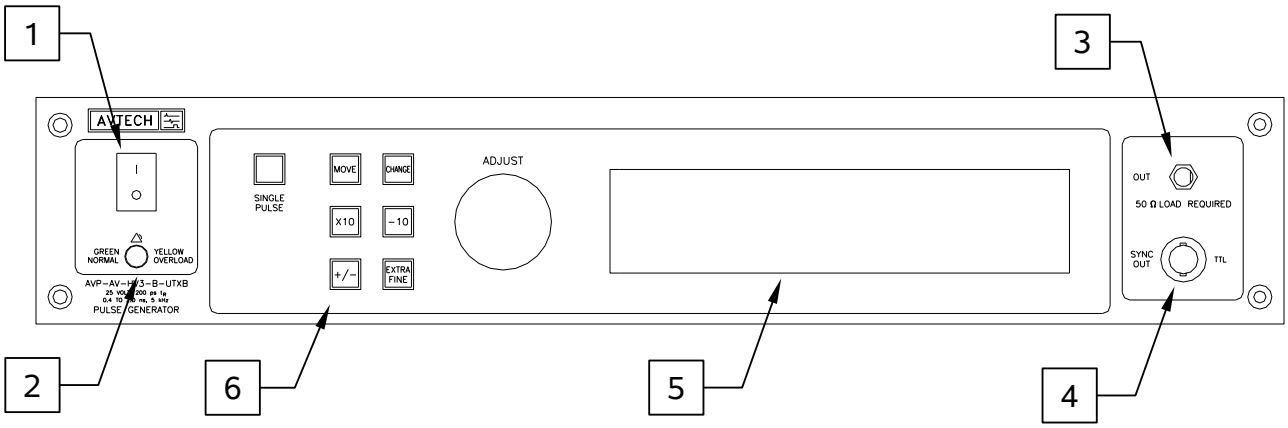
The following table lists the required fuses:

| Fuses | Nominal Mains Voltage | Rating | Case Size | Manufacturer's Part Number (Wickmann) | Distributor's Part Number (Digi-Key) |
|---|---|---|---|---|---|
| #1, #2 (AC) | 100-240V | 0.5A, 250V, Time-Delay | 5×20 mm | 1950500000 | WK5041-ND |
| #3 (DC) | N/A | 1.0A, 250V, Time-Delay | 5×20 mm | 1951100000 | WK5048-ND |
| #4 (DC) | N/A | 0.25A, 250V, Time-Delay | 5×20 mm | 1950250000 | WK5035-ND |

The fuse manufacturer is Wickmann (http://www.wickmann.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.

3. OUT CONNECTOR. This SMA connector provides the main output signal, into load impedances of 50Ω.

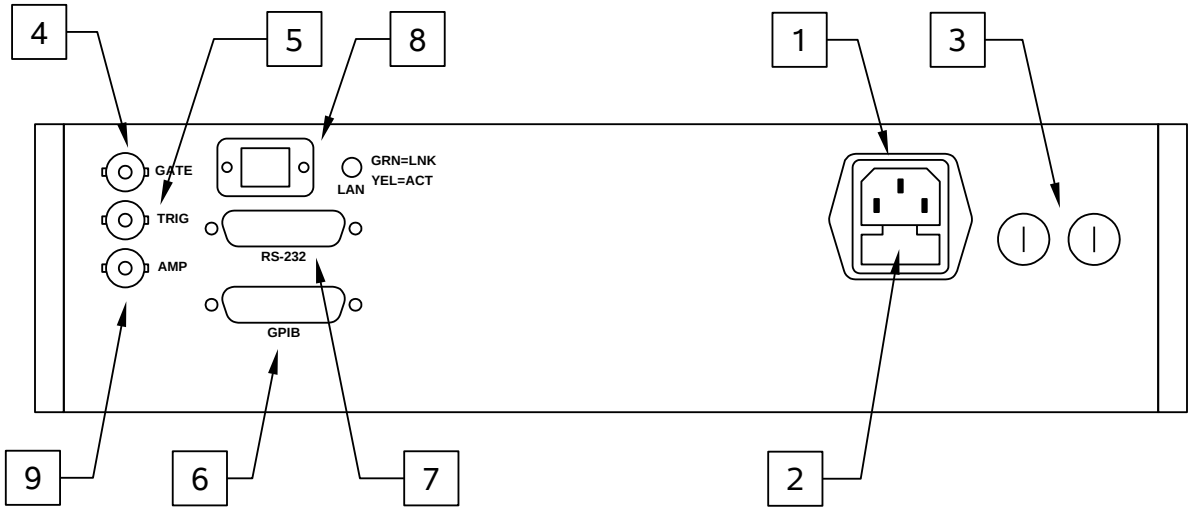
4. SYNC OUT. This connector supplies a SYNC output that can be used to trigger other equipment, particularly oscilloscopes. This signal leads (or lags) the main output by a duration set by the "DELAY" controls and has an approximate amplitude of +3 Volts to $R_L$ > 1kΩ with a pulse width of approximately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

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

6. KEYPAD.

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

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

8. LAN Connector and Indicator. (Optional feature. Present on -TNT units only.) The -TNT option "Internet-enables" Avtech pulse generators by adding this standard Ethernet port to the rear panel, in addition to the IEEE-488.2 GPIB and RS-232 ports normally found on "-B" units. Commands are sent using the standard Telnet protocol. The SCPI-compliant command set is the same as that used for GPIB and RS-232 control. The -TNT option uses the Dynamic Host Configuration Protocol (DHCP) to obtain its network address. A DHCP server must be present on the local network for the -TNT option to operate properly.

9. AMP Connector. This connector provides a TTL-level output (which will drive loads of 50 Ohms or higher) which is TTL-high (+2V to +5V) when the output polarity is positive, and is TTL-low (0 to +0.7V) when the output polarity is negative. This output can be used to trigger other equipment, particularly oscilloscopes. When this output changes state, it lags the last output pulse by approximately 30 ns.

# GENERAL INFORMATION

## BASIC PULSE CONTROL

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

- OUT. This is the main output.
- SYNC. The SYNC pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems. When the delay is set to a positive value the SYNC pulse precedes the OUT pulse. When the delay is set to a negative value the SYNC pulse follows the OUT pulse.
- AMP. This TTL-level signal is TTL-high (+2V to +5V) when the output polarity is positive, and is TTL-low (0 to +0.7V) when the output polarity is negative. This output can be used to trigger other equipment, particularly oscilloscopes. When this output changes state, it lags the last output pulse by approximately 30 ns.

These pulses are illustrated below, assuming internal triggering, positive delay, and N=2 (burst count):

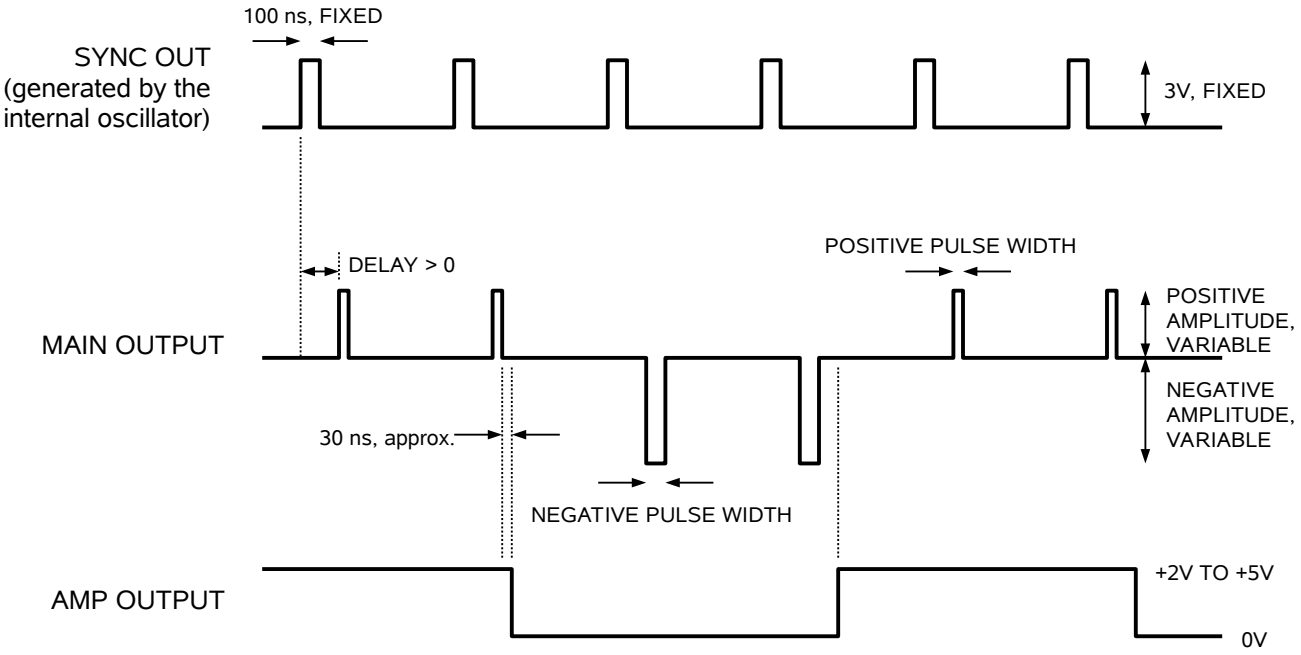



*Figure A*

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

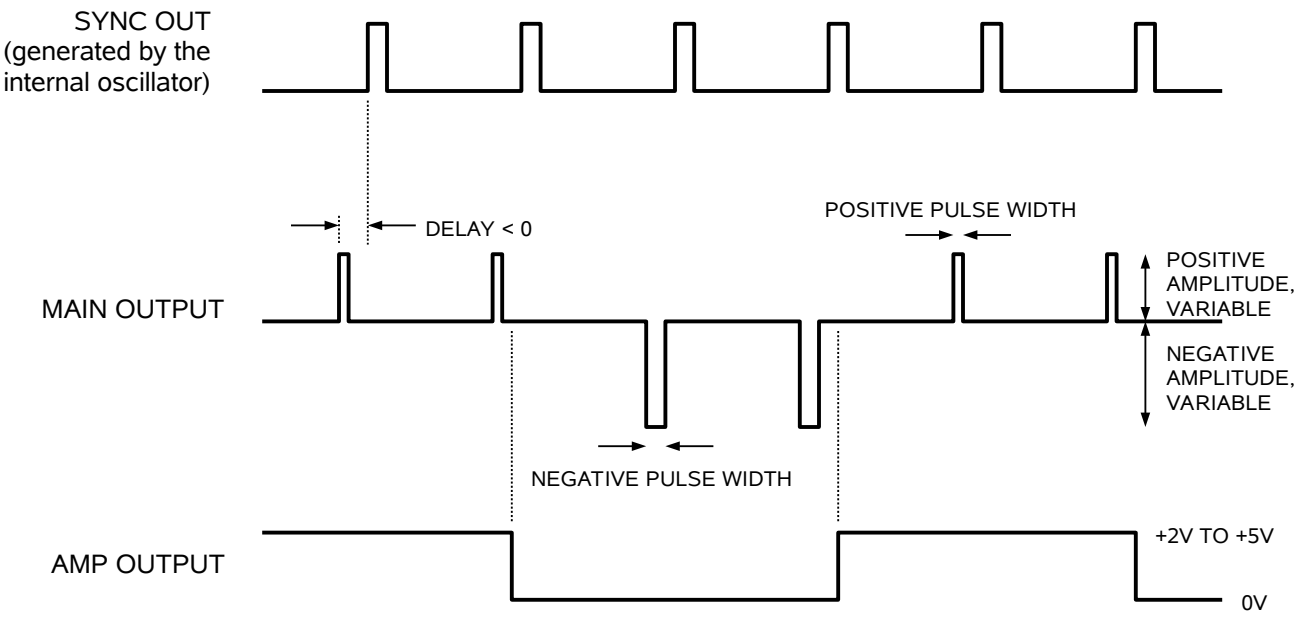



*Figure B*

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

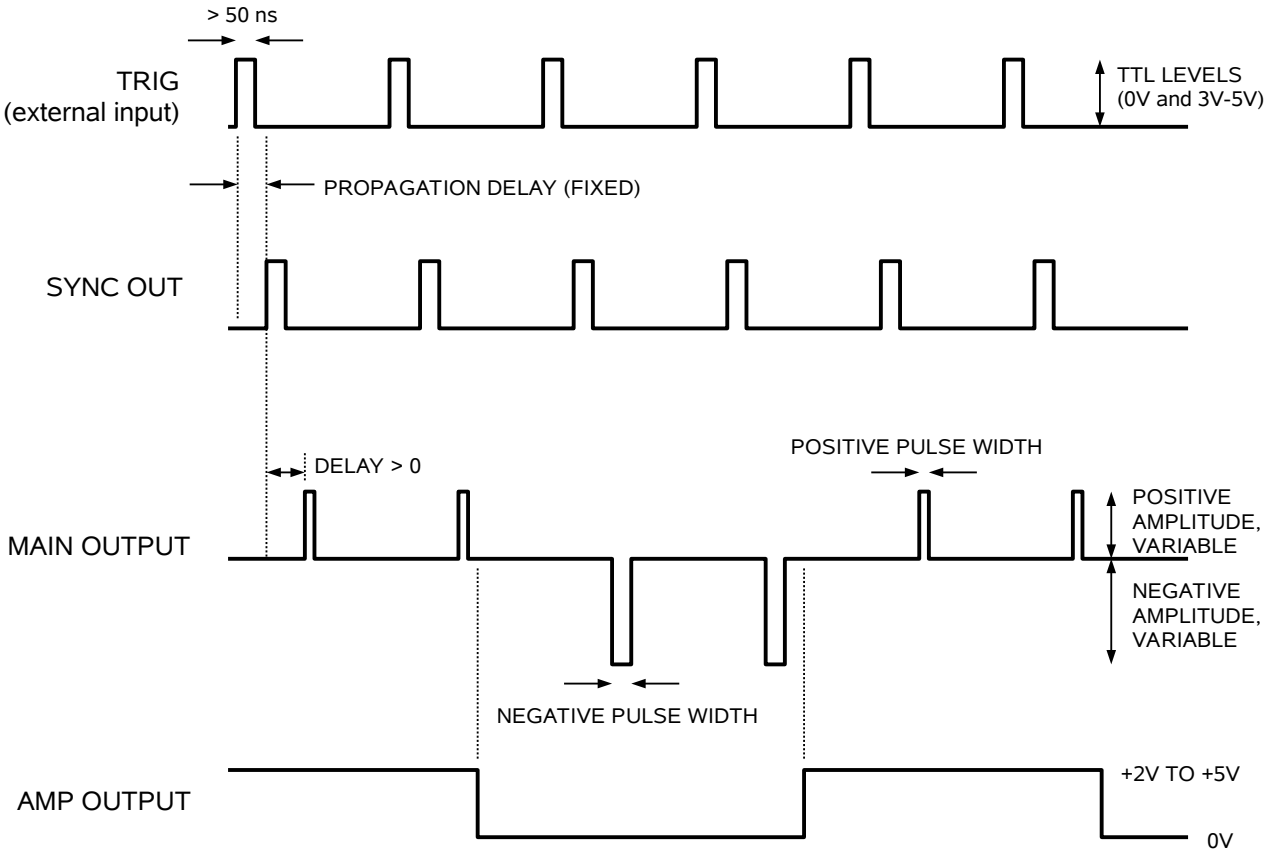



*Figure C*

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

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

## TRIGGER MODES

This instrument has four trigger modes:

- Internal Trigger: the instrument controls the trigger frequency, and generates the clock internally.
- External Trigger: the instrument is triggered by an external TTL-level clock on the back-panel TRIG connector.
- Manual Trigger: the instrument is triggered by the front-panel “SINGLE PULSE” pushbutton.

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

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

## GATING MODES

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

## OPERATION AT LOW AMPLITUDES

This instrument will generate the best waveforms when operated near maximum amplitude. If amplitudes less than 1/3 of the full-scale value are desired, better results will be obtained if the pulse generator is operated at a higher amplitude, and an attenuator is connected to the output. Avtech recommends the ATT-0444-XX-SMA-02 series of 18 GHz coaxial attenuators from Midwest Microwave, http://www.midwestmicrowave.com/. (The “XX” in the part number is replaced with the numeric attenuation value in dB).

## BURST POLARITY OPERATION

The polarity of the main output can be set to alternate polarities every N pulses, where N is variable from 1 to 14. N can be set from the front panel or by computer command. If N is set to zero, all output pulses will be positive. If N is set to 15, all output pulses will be negative. A TTL-level polarity output (AMP output) is provided, which indicates the current output polarity. This output is useful for synchronizing other test equipment, such as oscilloscopes.

## OBTAINING A STABLE OSCILLOSCOPE DISPLAY IN BURST MODE

Some care must be taking when planning an experimental set-up to ensure that proper oscilloscope synchronization occurs for measurement purposes.

When the burst count (N) is set to 0 or 15, all of the output pulses will have the same polarity (positive for N=0, and negative for N=15). In this case, your oscilloscope should be externally triggered using the front-panel "SYNC" output on the pulse generator. This output provides a single 100 ns wide TTL-level pulse for each main output pulse. Under

these conditions, the AMP output will be constantly high (for N=0, positive) or constantly low (for N=15, negative), making it unsuitable for triggering oscilloscopes.

When the burst count is set to 1 - 14 inclusive, the output pulses will be alternating in polarity frequently. If the front-panel "SYNC" output is used to trigger an oscilloscope, an unstable display will result due to the alternating pulses. That is, there will be a 50% probability that the SYNC pulse that the oscilloscope triggers from is associated with a positive output pulse, and 50% probability that it will be associated with a negative output pulse. If the oscilloscope is operating in an averaging mode, the average output will be zero! Instead, the rear-panel "AMP" output should be used to trigger this oscilloscope. The rising edge of this output will always precede the beginning of a burst of positive pulses, and the falling edge of this output will always precede the beginning of a burst of negative pulses. This will result in a stable oscilloscope display. Most oscilloscopes allow triggering from both rising and falling edges, allowing convenient viewing of the positive and negative bursts, respectively.

# PROTECTING YOUR INSTRUMENT

## TURN OFF INSTRUMENT WHEN NOT IN USE

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

## DO NOT EXCEED 5 kHz

The output stage may be damaged if triggered by an external signal at a pulse repetition frequency greater than 5 kHz.

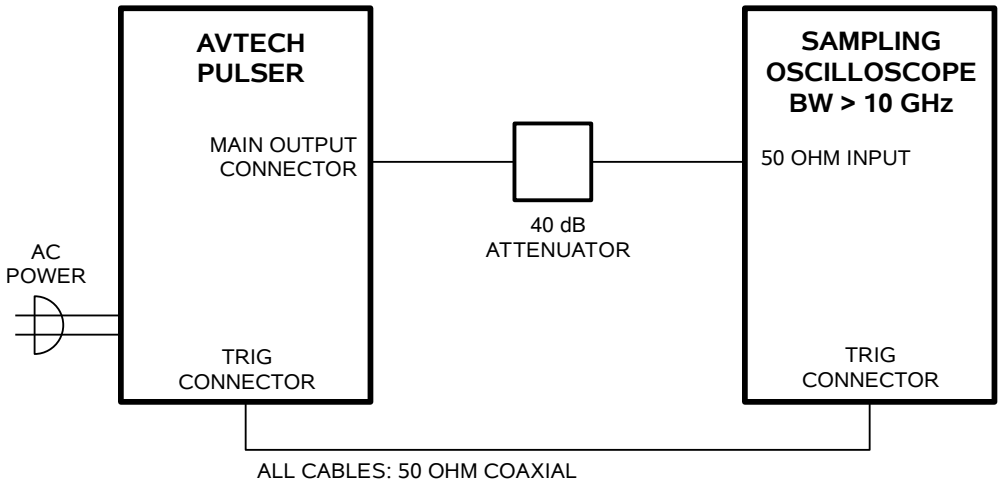
## USE A 50Ω LOAD

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

# OPERATIONAL CHECK

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

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




*BASIC TEST ARRANGEMENT*

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

   a) The use of 40 dB attenuator at the sampling scope vertical input channel will insure a peak input signal to the sampling scope of less than 1 Volt. Factory tests are conducted using Midwest Microwave model ATT-0444-20-SMA-02 attenuators.

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

   c) The bandwidth capability of components and instruments used to display the pulse generator output signal (attenuators, cables, connectors, etc.) should exceed 10 GHz.

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

2. Turn on the AVP-AV-HV3-B-PN-UTXB. The main menu will appear on the LCD.

3. To set the AVP-AV-HV3-B-PN-UTXB to trigger from the internal clock at a PRF of 5 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 5 kHz.

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

    d) Press CHANGE to return to the main menu.

4. To set the delay to 100 ns:

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

    b) Press the CHANGE button. The delay submenu will appear. Rotate the ADJUST knob until the delay is set at 100 ns.

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

    d) Press CHANGE to return to the main menu.

5. To set the pulse width to 2 ns:

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

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

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

    d) Press CHANGE to return to the main menu.

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

7. To enable the output:

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

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

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

d) Press CHANGE to return to the main menu.

8. To change the output amplitude:

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

b) Press the CHANGE button. The amplitude submenu will appear. Rotate the ADJUST knob until the amplitude is set at +25V.

c) Observe the oscilloscope. You should see 2 ns wide, 25V pulses. If you do not, you may need to adjust the delay setting to a value more compatible with your sampling oscilloscope. Repeat step 4 if required. You may also need to adjust the sampling scope controls.

d) Rotate the ADJUST knob. The amplitude as seen on the oscilloscope should vary. Return it to 25V.

e) Press CHANGE to return to the main menu.

This completes the operational check.

# PROGRAMMING YOUR PULSE GENERATOR

## KEY PROGRAMMING COMMANDS

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

```
*rst                        (resets the instrument)
trigger:source internal     (selects internal triggering)
frequency 1000 Hz           (sets the frequency to 1000 Hz)
pulse:width1 2 ns           (sets the positive pulse width to 2 ns)
pulse:width2 1.3 ns         (sets the positive pulse width to 1.3 ns)
pulse:delay 20 ns           (sets the delay to 20 ns)
volt1 +5                    (sets the positive amplitude to +5 V)
volt2 -25                   (sets the negative amplitude to -25 V)
pulse:count 3           (output polarity alternates after every 3 pulses)
output on                   (turns on the output)
```

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

```
*rst                        (resets the instrument)
trigger:source hold         (turns off all triggering)
pulse:width1 2 ns           (sets the positive pulse width to 2 ns)
pulse:width2 1.3 ns         (sets the positive pulse width to 1.3 ns)
output on                   (turns on the output)
volt1 +5                    (sets the positive amplitude to +5 V)
volt2 -25                   (sets the negative amplitude to -25 V)
pulse:count 3           (output polarity alternates after every 3 pulses)
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:width1 2 ns           (sets the positive pulse width to 2 ns)
pulse:width2 1.3 ns         (sets the positive pulse width to 1.3 ns)
pulse:delay 1 us            (sets the delay to 1 us)
volt1 +5                    (sets the positive amplitude to +5 V)
volt2 -25                   (sets the negative amplitude to -25 V)
```

pulse:count 3 (output polarity alternates after every 3 pulses)
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 |
|---|---|---|
| LOCAL | | |
| OUTPut: | | |
| :[STATe] | <boolean value> | |
| :PROTection | | |
| :TRIPped? | | [query only] |
| REMOTE | | |
| [SOURce]: | | |
| :FREQuency | | |
| [:CW \| FIXed] | <numeric value> | |
| [SOURce]: | | |
| :PULSe | | |
| :PERiod | <numeric value> | |
| :WIDTh | <numeric value> | |
| :DCYCle | <numeric value> | |
| :HOLD | WIDTh \| DCYCle | |
| :DELay | <numeric value> | |
| :GATE | | |
| :TYPE | ASYNC \| SYNC | |
| :LEVel | HIgh \| LOw | |
| :COUNt | <numeric value> | [units with burst mode option only] |
| [SOURce]: | | |
| :VOLTage | | |
| [:LEVel] | | |
| [:IMMediate] | | |
| [:AMPLitude] | <numeric value> \| EXTernal | |
| :PROTection | | |
| :TRIPped? | | [query only] |
| STATUS: | | |
| :OPERation | | |
| :[EVENt]? | | [query only, always returns "0"] |
| :CONDition? | | [query only, always returns "0"] |
| :ENABle | <numeric value> | [implemented but not useful] |
| :QUEStionable | | |
| :[EVENt]? | | [query only, always returns "0"] |
| :CONDition? | | [query only, always returns "0"] |
| :ENABle | <numeric value> | [implemented but not useful] |
| SYSTem: | | |
| :COMMunicate | | |
| :GPIB | | |
| :ADDRess | <numeric value> | |

```
        :SERial
            :CONTrol
                :RTS            ON | IBFull | RFR
            :[RECeive]
                :BAUD           1200 | 2400 | 4800 | 9600
                :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]
```

# 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.

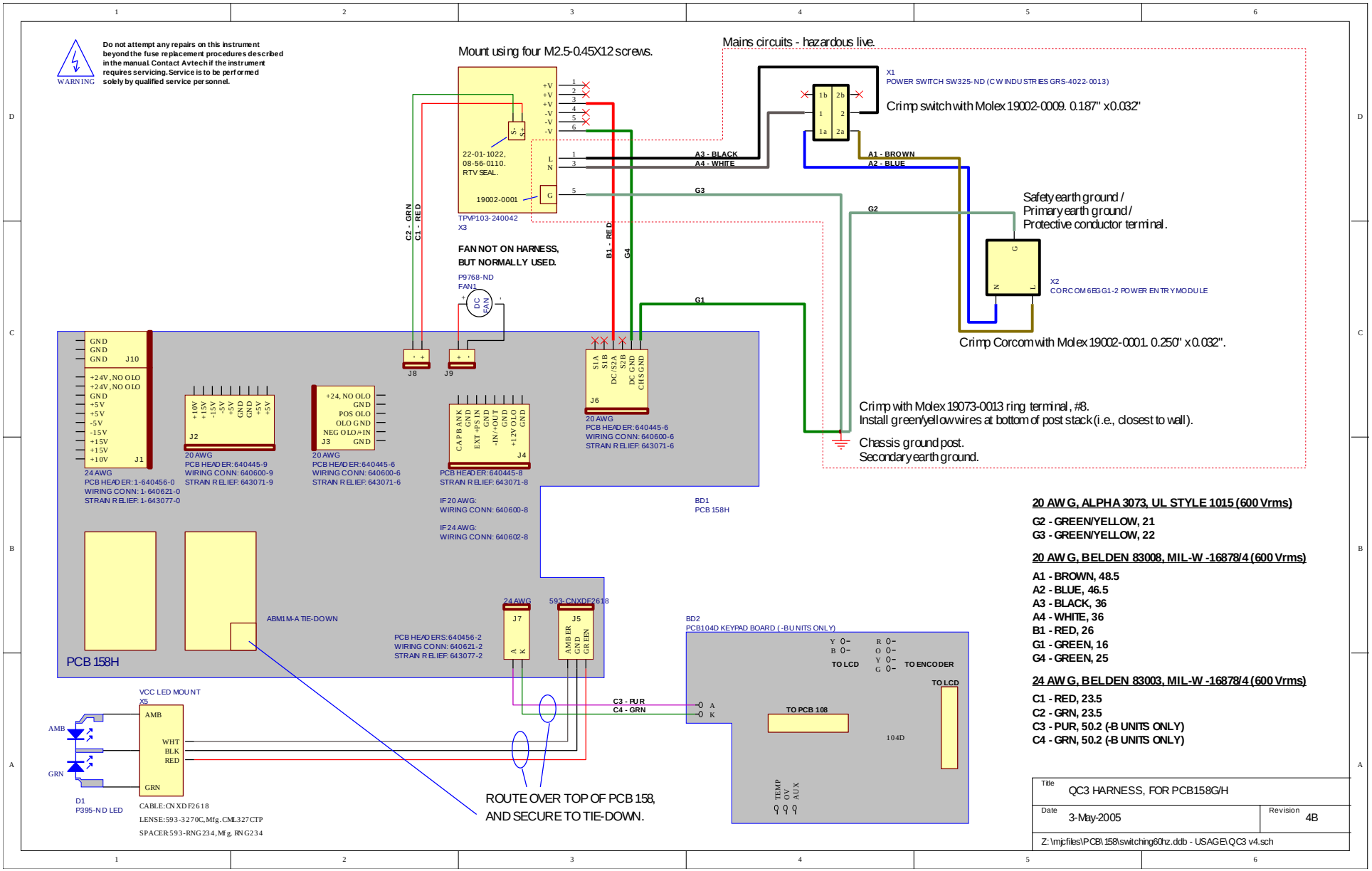
On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the “FUSES” section for details.

## CLEANING

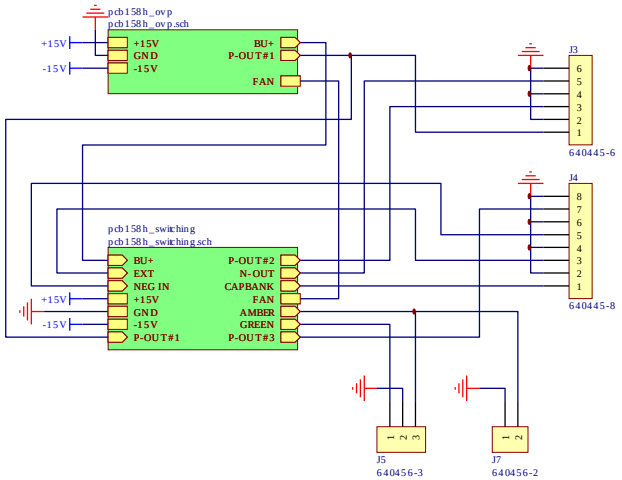
If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the “TOP COVER REMOVAL” section for instructions on accessing the interior.) No other cleaning is recommended.

# WIRING DIAGRAMS

## WIRING OF AC POWER

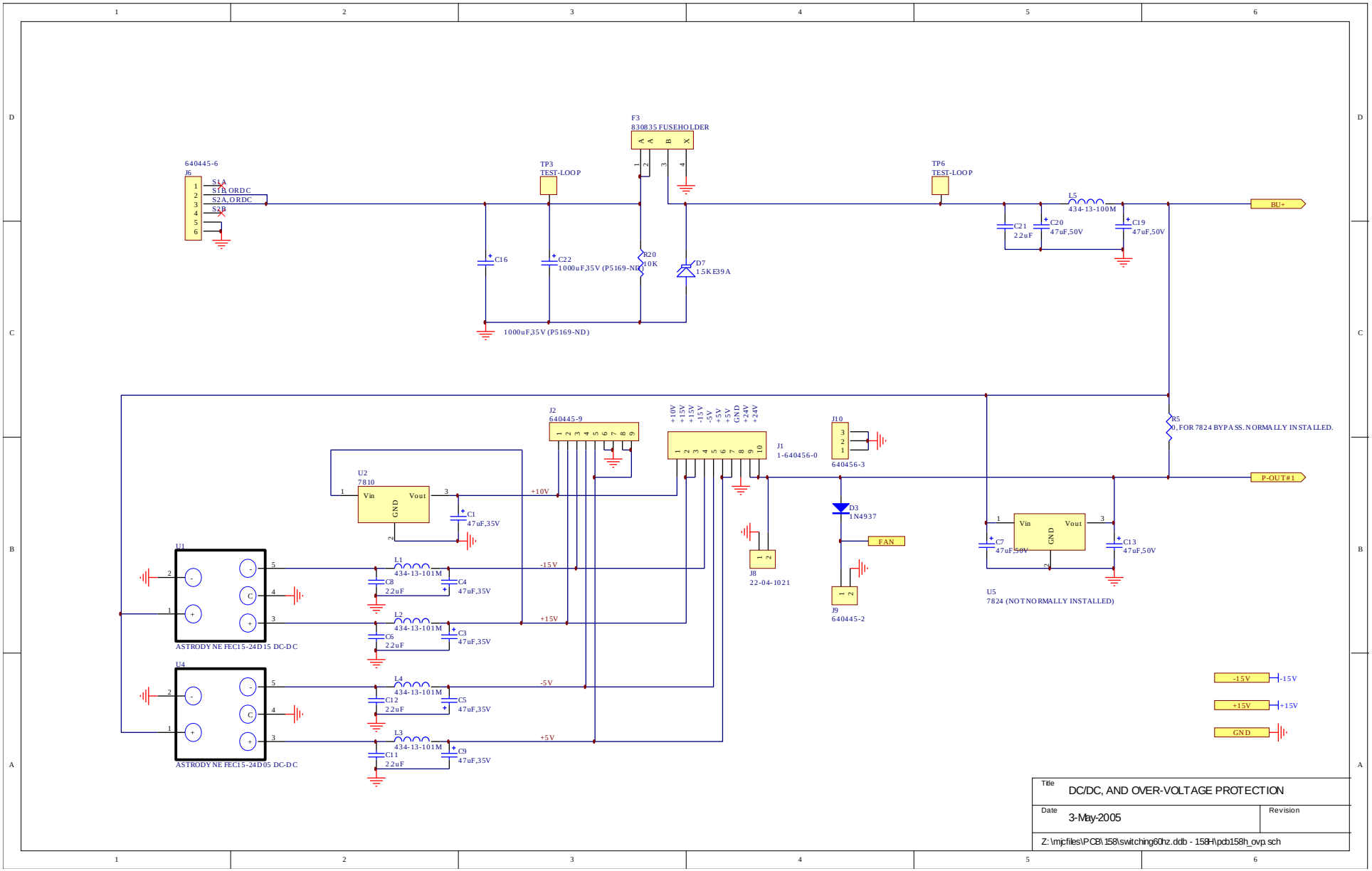


# PCB 158H - LOW VOLTAGE DC POWER SUPPLY, 1/3

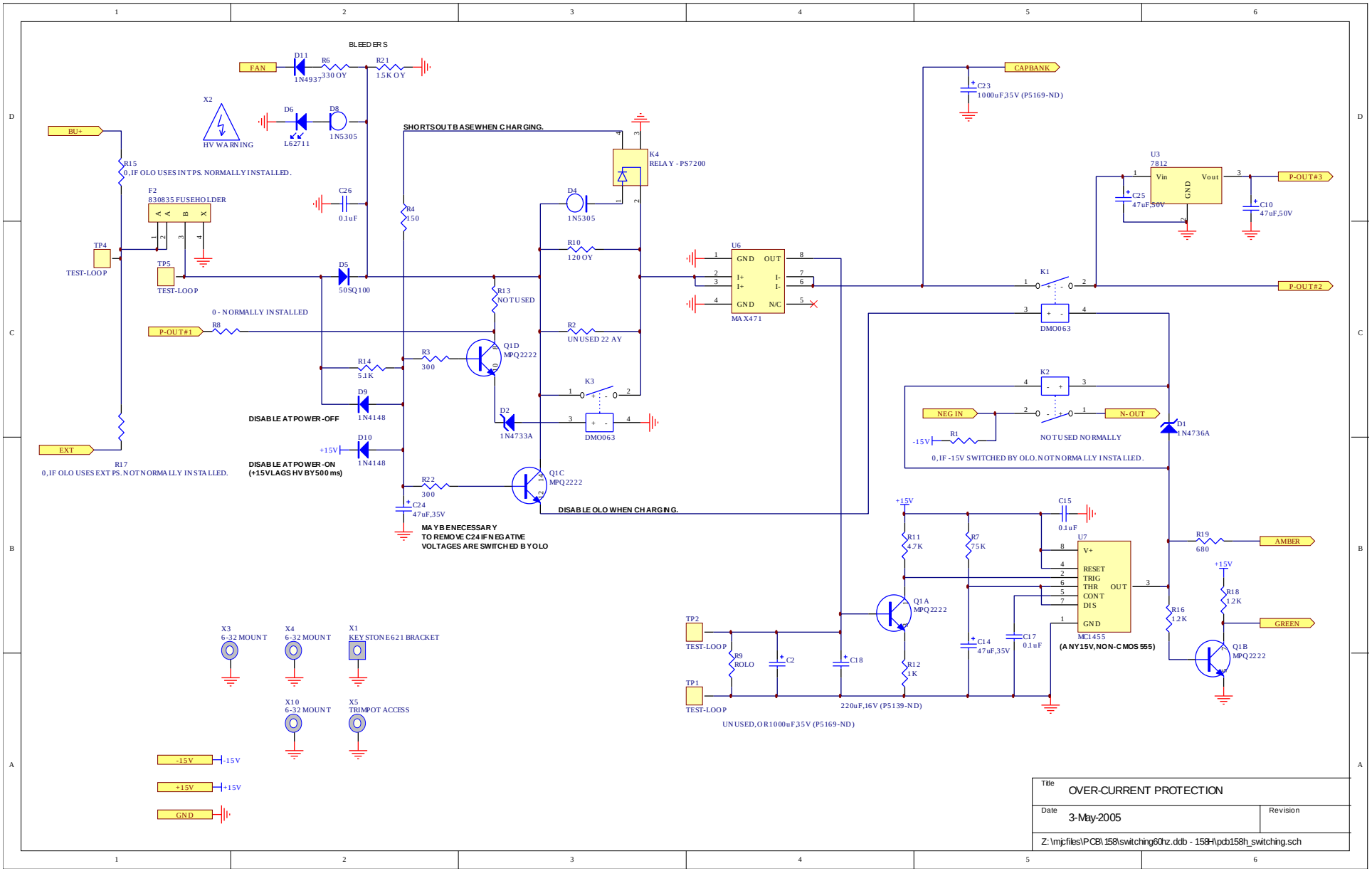



| | |
|---|---|
| Title | LOW VOLTAGE DC/DC POWER SUPPLY |
| Date | 3-May-2005 |
| Revision | |
| Z:\mjc files\PCB\158\switching60hz.ddb - 158H\pcb158h.sch | |

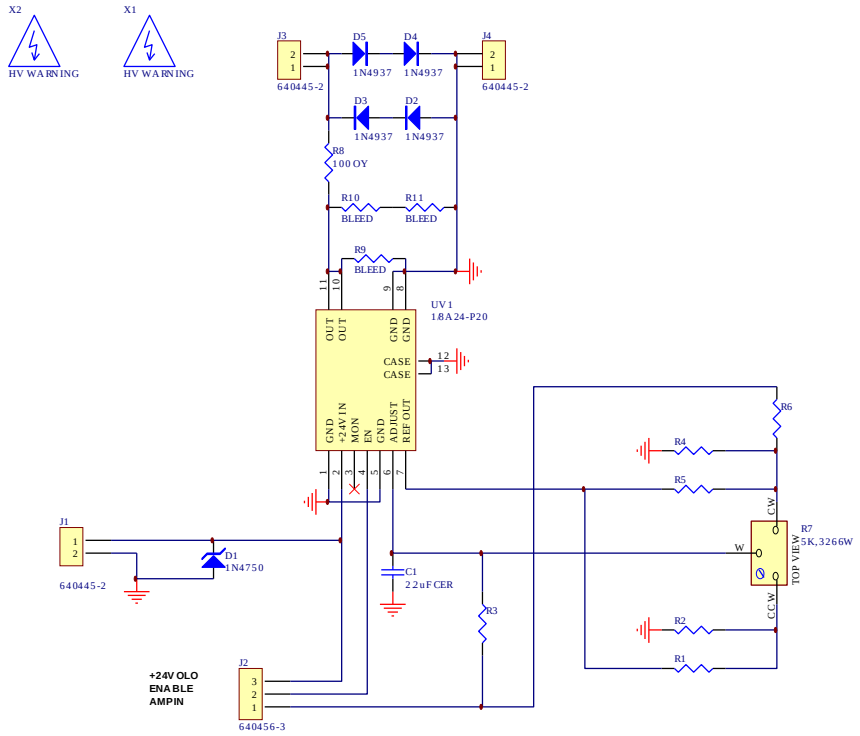
# PCB 158H - LOW VOLTAGE DC POWER SUPPLY, 2/3



# PCB 158H - LOW VOLTAGE DC POWER SUPPLY, 3/3

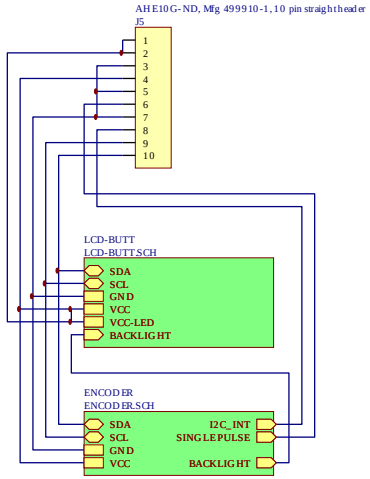


# PCB 168B - HIGH VOLTAGE DC POWER SUPPLY



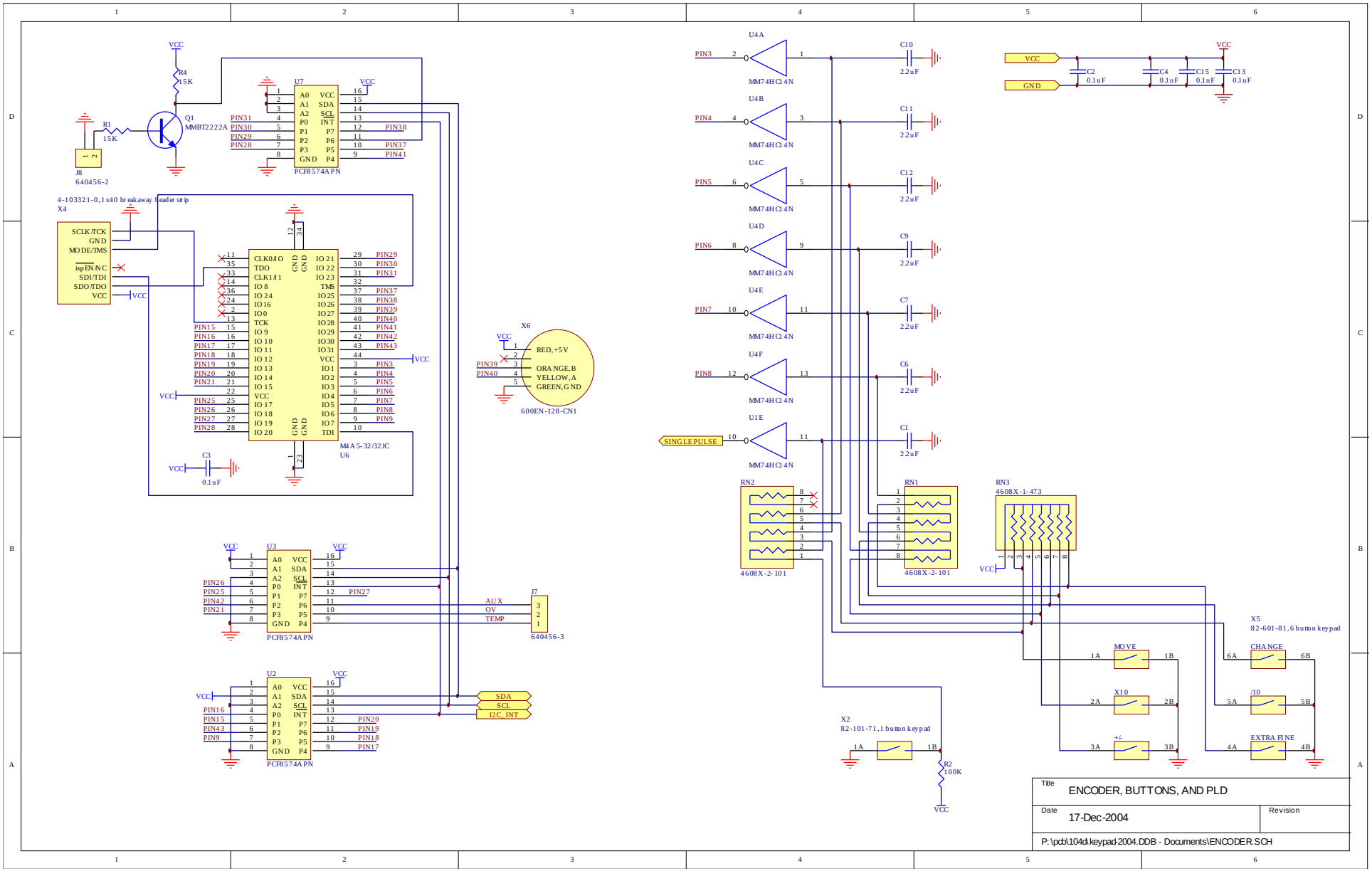

| | |
|---|---|
| Title | UV-A CONTROL PCB |
| Date | 3-May-2005 |
| Revision | 1 |
| Z:\mjcfiles\pcb\168\UV-A control\UV-A control.ddb - 168B\PCB168B.sch | |

# PCB 104D - KEYPAD / DISPLAY BOARD, 1/3

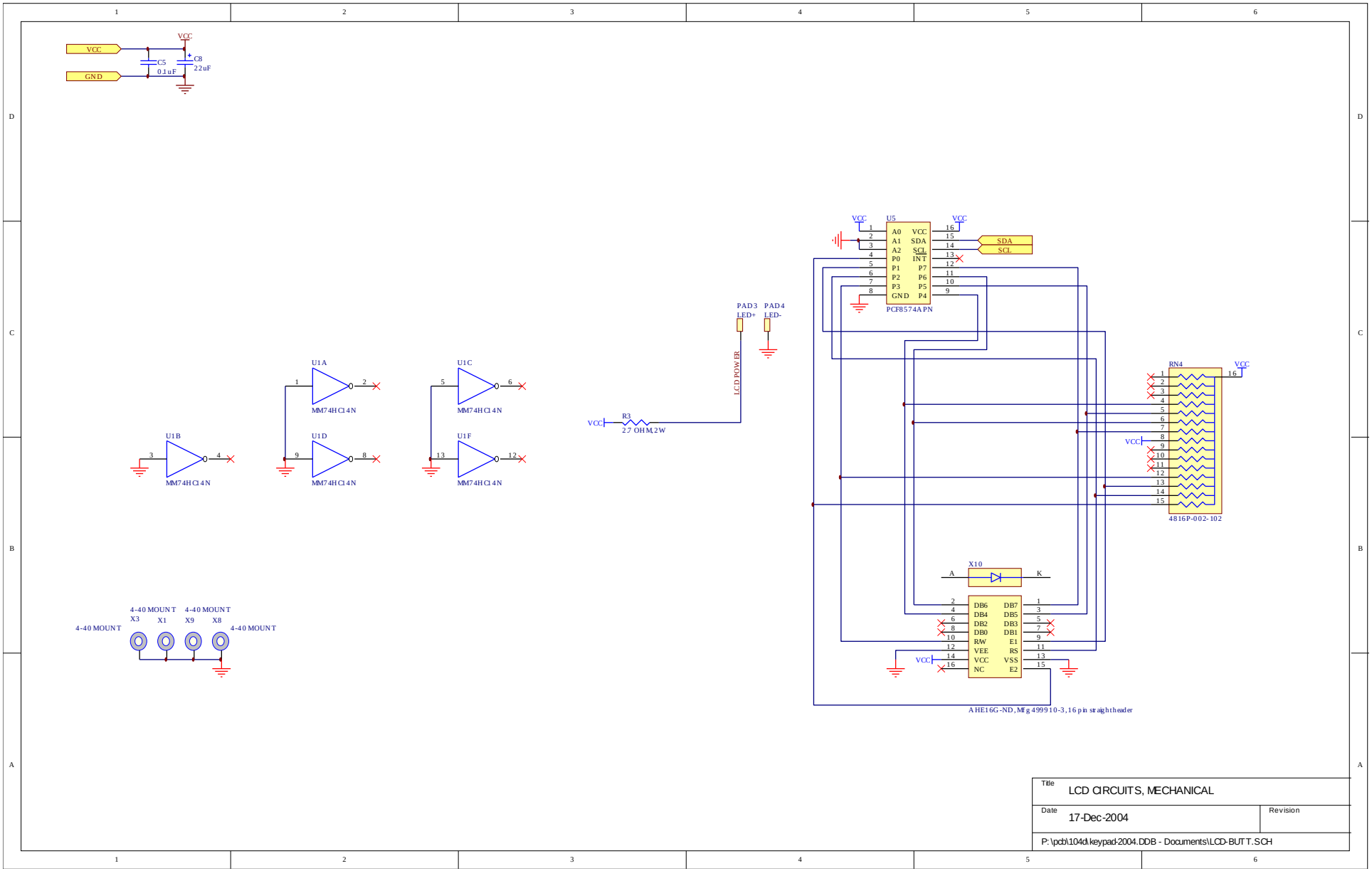



| | |
|---|---|
| Title | PANEL TOP-LEVEL SCHEMATIC |
| Date | 17-Dec-2004 |
| Revision | |
| P:\pcb\104d\keypad-2004.DDB - Documents\Panelbrd.prj | |

# PCB 104D - KEYPAD / DISPLAY BOARD, 2/3

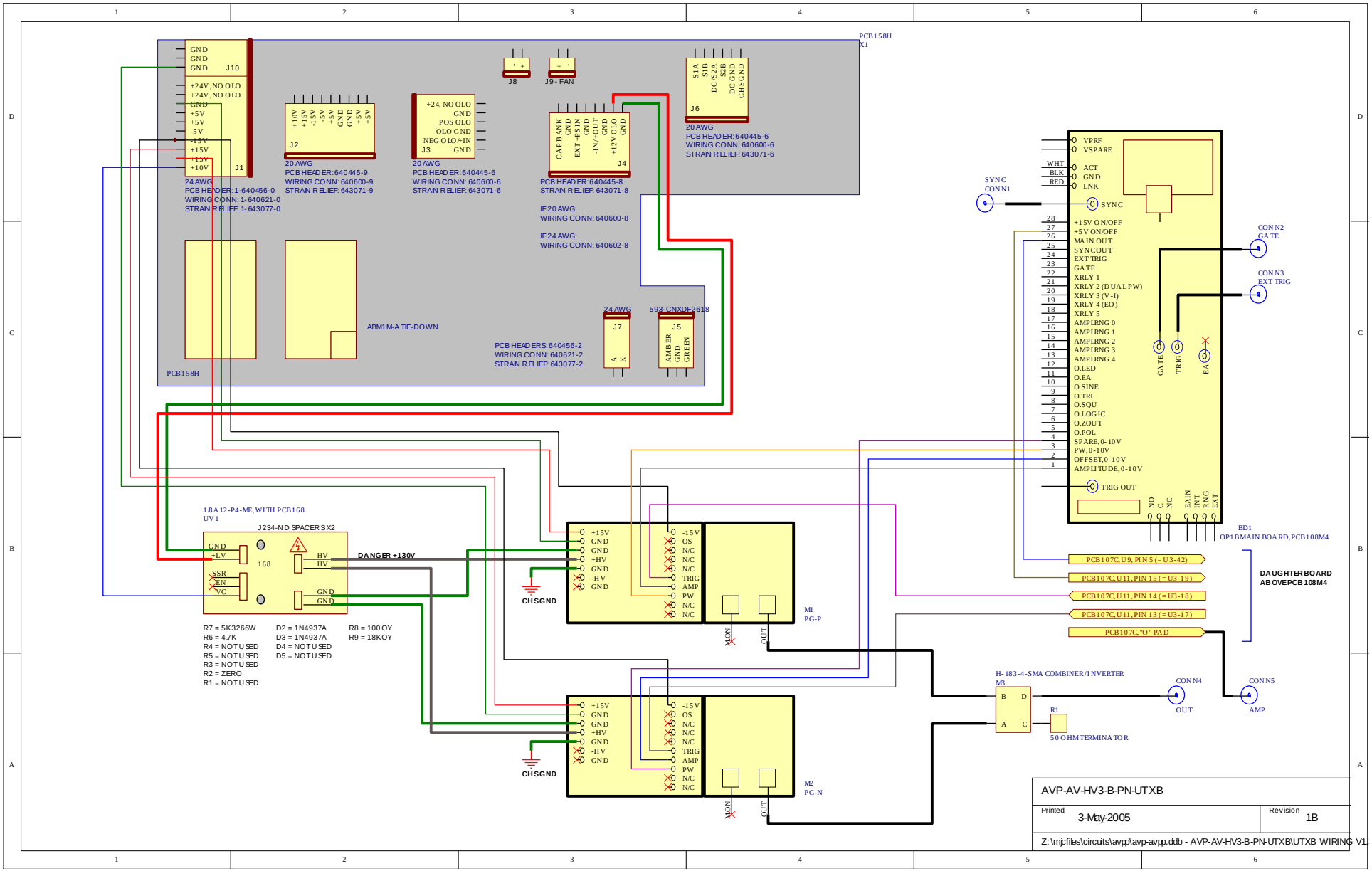


# PCB 104D - KEYPAD / DISPLAY BOARD, 3/3




| | |
|---|---|
| Title | LCD CIRCUITS, MECHANICAL |
| Date | 17-Dec-2004 |
| Revision | |
| P:\pcb\104d\keypad-2004.DDB - Documents\LCD-BUTT.SCH | |

# MAIN WIRING


PCB158H
X1
GND
GND
GND J10
+24V,NO OLO
+24V,NO OLO
GND
+5V
+5V
-5V
+15V
+15V
+15V
+10V J1
24 AWG
PCB HEADER: 1-640456-0
WIRING CONN: 1-640621-0
STRAIN RELIEF: 1-643077-0
+10V
+15V
-15V
+5V
GND
GND
+5V
+5V
J2
20 AWG
PCB HEADER: 640445-9
WIRING CONN: 640600-9
STRAIN RELIEF: 643071-9
+24, NO OLO
GND
POS OLO
OLO GND
NEG OLO/+IN
GND
J3
20 AWG
PCB HEADER: 640445-6
WIRING CONN: 640600-6
STRAIN RELIEF: 643071-6
J8
J9 - FAN
CAP BANK
GND
EXT +PS IN
GND
-IN/+OUT
GND
+12V OLO
GND
J4
PCB HEADER: 640445-8
STRAIN RELIEF: 643071-8
IF 20 AWG:
WIRING CONN: 640600-8
IF 24 AWG:
WIRING CONN: 640602-8
S1A
S1B
DC/S2A
S2B
DC GND
CHSGND
J6
20 AWG
PCB HEADER: 640445-6
WIRING CONN: 640600-6
STRAIN RELIEF: 643071-6
ABM1M-A TIE-DOWN
PCB158H
PCB HEADERS: 640456-2
WIRING CONN: 640621-2
STRAIN RELIEF: 643077-2
24 AWG
J7
A
K
593-CNXDF2618
J5
AMBER
GND
GREEN
SYNC CONN1
VPRF
VSPARE
WHT
BLK
RED
ACT
GND
LNK
SYNC
+15V ON/OFF
+5V ON/OFF
MAIN OUT
SYNC OUT
EXT TRIG
GATE
XRLY 1
XRLY 2 (DUAL PW)
XRLY 3 (V-I)
XRLY 4 (EO)
XRLY 5
AMPLRNG 0
AMPLRNG 1
AMPLRNG 2
AMPLRNG 3
AMPLRNG 4
O.LED
O.EA
O.SINE
O.TRI
O.SQU
O.LOGIC
O.ZOUT
O.POL
SPARE, 0-10V
PW, 0-10V
OFFSET, 0-10V
AMPLITUDE, 0-10V
TRIG OUT
CONN2
GATE
CONN3
EXT TRIG
GATE
TRIG
EA
NO
C
NC
EAIN
INT
RNG
EXT
BD1
OP1BMAIN BOARD, PCB108M4
DAUGHTERBOARD
ABOVEPCB108M4
PCB107C, U9, PIN 5 (=U3-42)
PCB107C, U11, PIN 15 (=U3-19)
PCB107C, U11, PIN 14 (=U3-18)
PCB107C, U11, PIN 13 (=U3-17)
PCB107C, "O" PAD
18A12-P4-ME, WITH PCB168
UV1
J234-ND SPACERS X2
GND
+LV
168
SSR
EN
VC
HV
HV
DANGER +130V
GND
GND
R7 = 5K3266W
R6 = 4.7K
R4 = NOT USED
R5 = NOT USED
R3 = NOT USED
R2 = ZERO
R1 = NOT USED
D2 = 1N4937A
D3 = 1N4937A
D4 = NOT USED
D5 = NOT USED
R8 = 100 OY
R9 = 18KOY
+15V
GND
GND
+HV
GND
-HV
GND
-15V
OS
N/C
N/C
N/C
TRIG
AMP
PW
N/C
N/C
CHSGND
MON
OUT
M1
PG-P
M2
PG-N
H-183-4-SMA COMBINER/INVERTER
M3
B
D
A
C
R1
50 OHM TERMINATOR
CONN4
OUT
CONN5
AMP
AVP-AV-HV3-B-PN-UTXB
Printed
3-May-2005
Revision
1B
Z:\mjcfiles\circuits\avpp\avp-avpp.ddb - AVP-AV-HV3-B-PN-UTXB\UTXB WIRING V1

# PERFORMANCE CHECKSHEET