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NANOSECOND WAVEFORM ELECTRONICS
SINCE 1975

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INSTRUCTIONS

MODEL AVP-AV-1-C-2CHPP-UBA
0 TO +10 VOLTS, 1 MHz, DUAL CHANNEL
HIGH SPEED PULSE GENERATOR
WITH 100 ps RISE TIME, 135 ps FALL TIME

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 disassembled, 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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Manual Reference: Z:\officefiles\instructword\avp\AVP-AV-1-C-2CHPP-UBA,ed1.odt.

Last modified October 20, 2005.

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INTRODUCTION

The AVP-AV-1-C-2CHPP-UBA is a high performance instrument capable of generating up to +10V into 50 Ω loads at repetition rates up to 1 MHz. The rise time is less than 100 ps, and the fall time is less than 135 ps. The pulse width is variable from 0.2 to 4 ns.

The AVP-AV-1-C-2CHPP-UBA provides two output channel, each with independently variable amplitude and pulse width. The two channels share a common trigger source. The relative delay between the two channels is adjustable over a ± 10 ns range.

Each output is designed to drive 50 Ω loads. (A 50 Ω load is required for proper operation.) Each output is AC-coupled.

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

SPECIFICATIONS

Model:	AVP-AV-1-C-2CHPP-UBA ¹
Amplitude ² : (50 Ohm load)	0 to 10 Volts
Output channels:	Two, with separate amplitude and pulse width controls for the two pulses. The pulse separation is adjustable over a ± 10 ns range.
Pulse width ³ :	0.2 - 4.0 ns
PRF: external trigger:	0 Hz to 1 MHz
internal trigger:	100 Hz to 1 MHz
Rise time (20%-80%) ⁷ :	≤ 100 ps
Fall time (80%-20%) ⁷ :	≤ 135 ps
Polarity:	positive
Propagation delay:	≤ 70 ns (Ext trig in to pulse out)
Jitter, Ext trig in to pulse out:	± 15 ps
DC offset or bias insertion:	Option available. Apply required DC offset or bias in the range of ± 50 Volts (250 mA max) to back panel solder terminal. See note 8.
Trigger required:	ext trig mode: +5 Volt, 50 ns to 500 ns (TTL)
Sync delay:	Variable 0 to 500 ns (sync out to pulse out, -B and -C units only)
Sync output: (-B, -C only)	+3 Volts, 200 ns, will drive 50 Ω
Monitor output option ⁹ :	Provides a 20 dB (x10) attenuated coincident replica of main output
Connectors:	
OUT	SMA
TRIG	BNC
SYNC	BNC
MONITOR ⁸	SMA
Power requirement:	100 - 240 Volts, 50-60 Hz
Dimensions (H x W x D):	dual-polarity -C units: 100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8") single-polarity -C units: 100 mm x 215 mm x 375 mm (3.9" x 8.5" x 14.8")
Chassis material:	anodized aluminum, with blue plastic trim
Mounting, Temp. range:	Any, +5° to +40° C

1. -C suffix indicates stand-alone lab instrument with internal clock and line powering.

2. For operation at amplitudes of less than 10% 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, 29 Aug 2005 13:19:22 -0400
From: Avtech Sales
Subject: Re: New Inquiry from XXXXX Mod. AVP-AV-1-P-2CHPP-UBA
To: K. Kitsukawa
Meisho Corporation
kitsukawa@78meisho.co.jp

Mr. Kitsukawa,

We have updated the model number slightly for this instrument, because we have recently added the "-2CHPP" to the datasheet as a new option. The correct model number is:

AVP-AV-1-C-2CHPP-UBA

I am pleased to quote as follows:

Quote number: 12727

Model number: AVP-AV-1-C-2CHPP-UBA

Description: Two-Channel Ultra-High-Speed Pulse Generator

Output waveform: Two separate outputs, with separate amplitude and pulse width controls for the two pulses. The pulse separation is adjustable.

Pulse width (FWHM): 0.2 to 4 ns, adjustable. Two one-turn controls.

Amplitude: 0 to +10V, adjustable. Two one-turn controls.

Rise times (20%-80%): < 100 ps

Fall times (80%-20%): < 135 ps

Pulse repetition frequency (PRF): 100 Hz to 1 MHz, adjustable using a four-position decade range switch and a one-turn fine control.

Pulse separation: 0 to 10 ns, adjustable. One-turn control which delays one output with respect to the other output.

Chassis size: 3.9" x 14.8" x 17"

Connectors: Out: SMA, Trig: BNC

Other: Similar to the standard AVP-AV-1-C-2CHPP, described at <http://www.avtechpulse.com/speed/avp-av-1>.

Price: \$XXXXXX US each, Ex-works, Ottawa, Canada. Before discount.

Estimated delivery: 45-60 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 PDF 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.

Thank you for your interest in our products!

Regards,
Dr. Michael J. Chudobiak
Chief Engineer

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

PO Box 265	ph: 1-800-265-6681 or 613-226-5772	Box 5120
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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



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 it to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, and handles. Confirm that a power cord and an instrumentation manual (this manual) 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

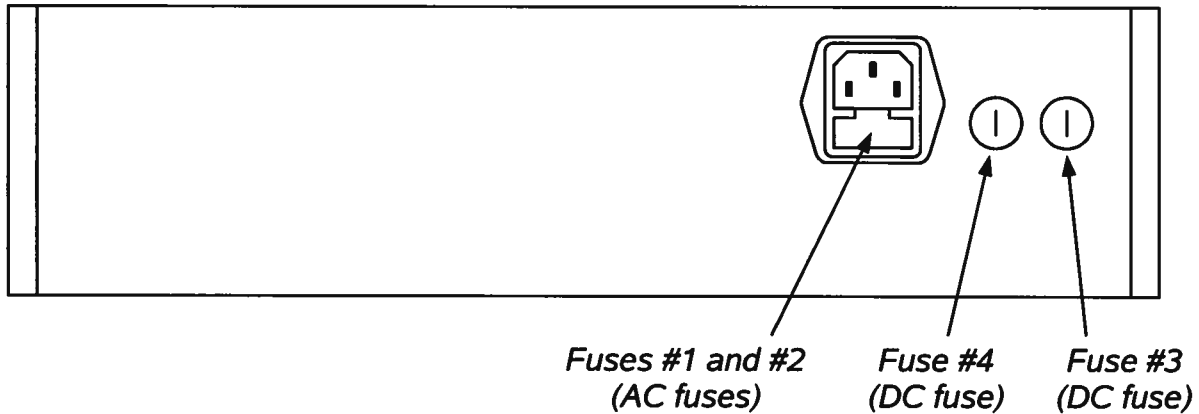
This instrument is intended for use under the following conditions:

- a) indoor use;
- b) altitude up to 2 000 m;
- c) temperature 5 °C to 40 °C;

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

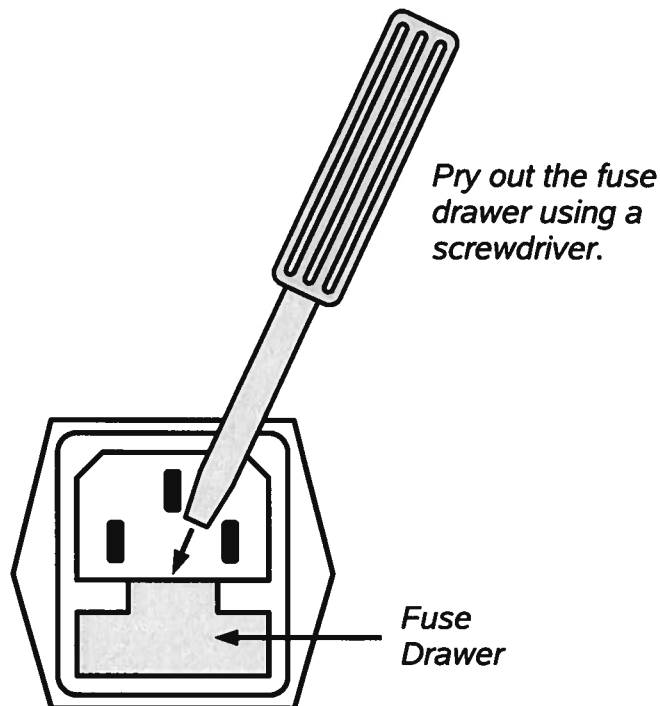
FUSES

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

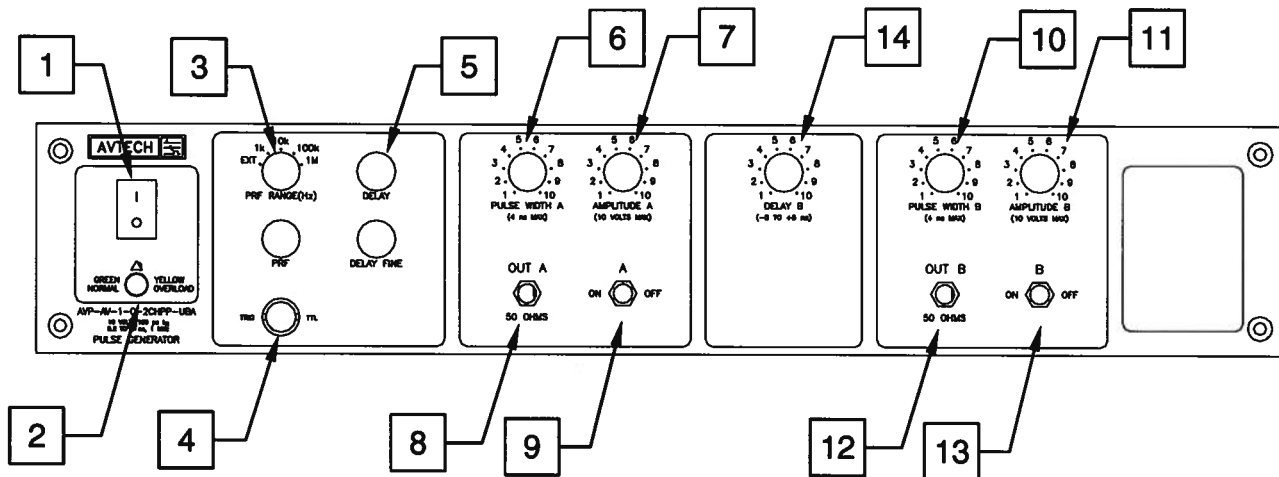
The following table lists the required fuses:

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	0.5A, 250V, Time-Delay	5×20 mm	1950500000	WK5041-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) **PRF Range Switch**. This switch sets the pulse repetition frequency (PRF) range of the internal oscillator. The marked value of each position is the upper limit of the 10:1 range, approximately. The vernier dial directly below the switch varies the PRF within the set range.

If this switch is set to the "EXT" position, the instrument is triggered by a signal applied to the TRIG connector, rather than by the internal oscillator.

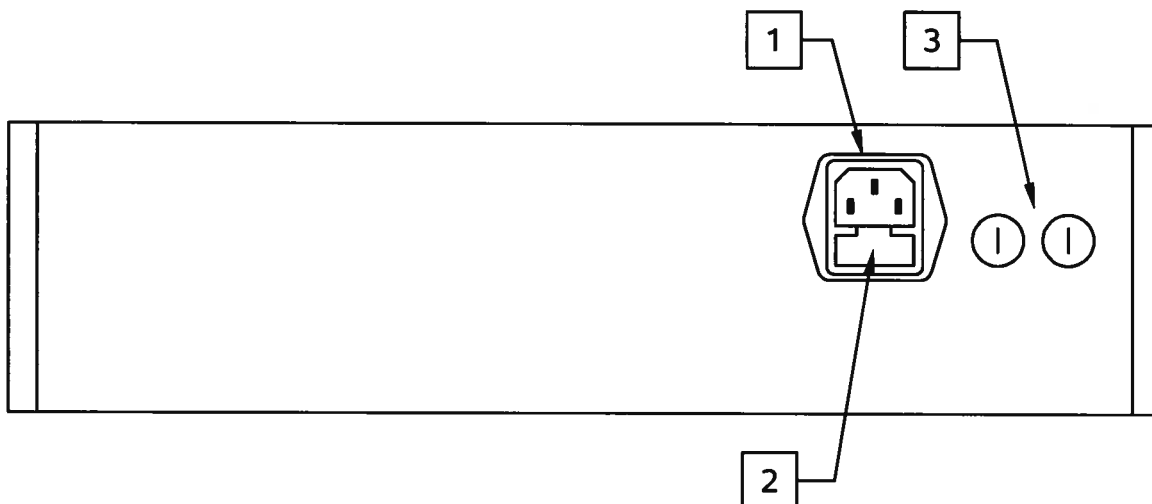
- 4) **TRIG Connector**. When the PRF Range Switch is set to "EXT", the instrument is triggered by a TTL pulse applied to this connector. The pulse must be at least 50 ns wide.

When the PRF Range Switch is set to one of the four internal oscillator ranges, this

connector is an output, which supplies a 2V, 200 ns wide pulse for each trigger event. This output may be used to trigger oscilloscopes or other equipment.

- 5) Delay Controls. When the PRF Range Switch is set to one of the four internal oscillator ranges, the main output is advanced or delayed relative to the TRIG output pulse (item 3). The delay is variable up to 200 ns, approximately, using the DELAY and DELAY FINE dials.
- 6) Pulse Width A Control. This dial controls the pulse width of OUT A.
- 7) Amplitude A Control. This dial controls the amplitude of OUT A.
- 8) OUT A Connector. This SMA connector provides the OUT A signal. This output *requires* a 50 Ω load to function properly.
- 9) A ON/OFF Switch. This switch enables or disables OUT A. If the output is not being used, this switch should be set to "OFF".
- 10) Pulse Width B Control. This dial controls the pulse width of OUT B.
- 11) Amplitude B Control. This dial controls the amplitude of OUT B.
- 12) OUT B Connector. This SMA connector provides the OUT B signal. This output *requires* a 50 Ω load to function properly.
- 13) B ON/OFF Switch. This switch enables or disables OUT B. If the output is not being used, this switch should be set to "OFF".
- 14) DELAY B Control. This dial varies the relative delay between the A and B outputs, over a range of -10 ns to +10 ns.

REAR PANEL CONTROLS

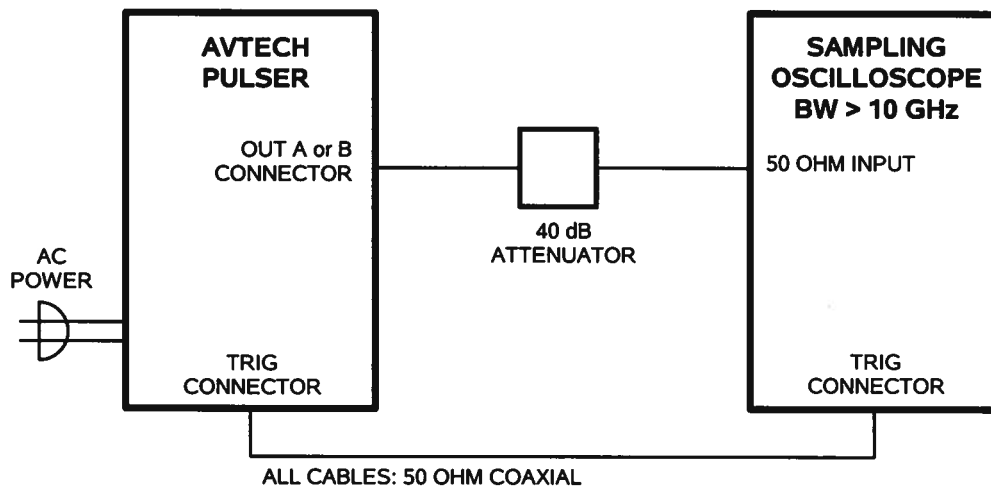


1. **AC POWER INPUT.** An IEC-320 C14 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket.
2. **AC FUSE DRAWER.** The two fuses that protect the AC 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.

GENERAL INFORMATION

BASIC TEST ARRANGEMENT

The AVP-AV-1-C-2CHPP-UBA should be tested with a sampling oscilloscope with a bandwidth of at least 10 GHz to properly observe the high-speed waveform. (The cables and attenuators must also have a bandwidth of at least 10 GHz.) A typical test arrangement is shown below:



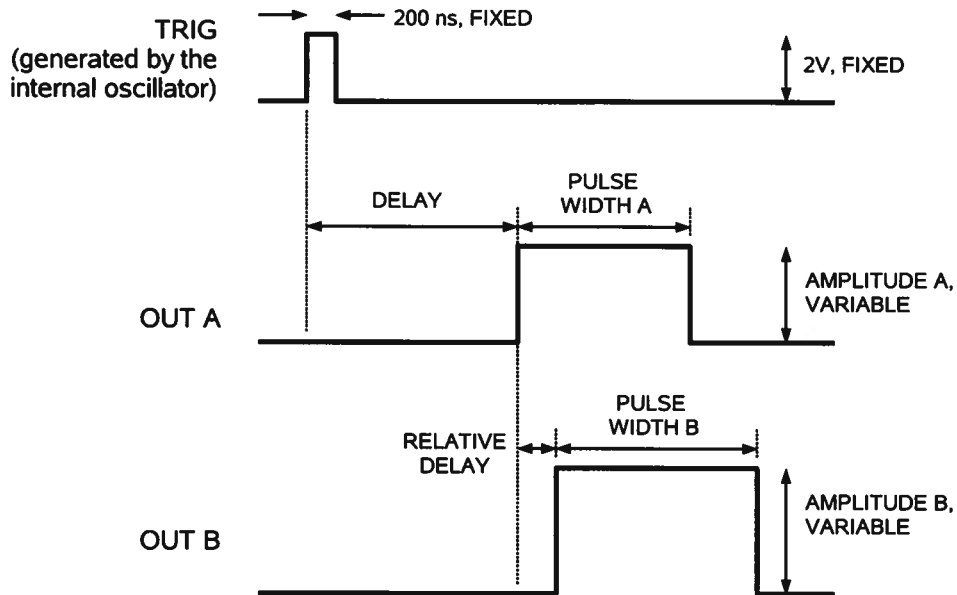
The attenuators are required to prevent damage to the sampling oscilloscope. A 40 dB attenuator with sufficient voltage rating should be used on the main output.

BASIC PULSE CONTROL

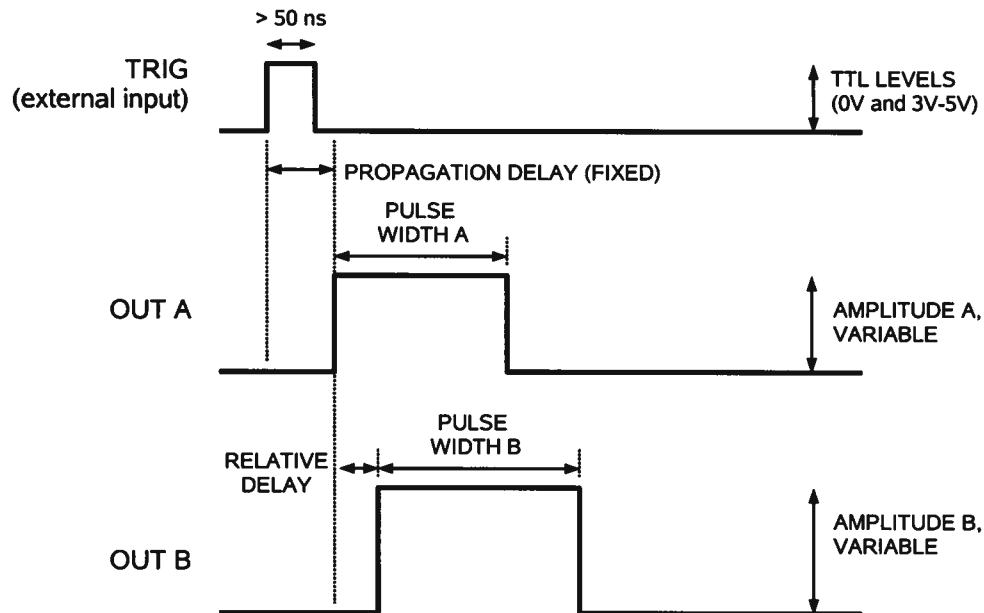
This instrument can be triggered by its own internal clock or by an external TTL trigger signal. When triggered internally, three mainframe output channels respond to the trigger: OUT A, OUT B, and TRIG.

- OUT A. This is one of the main outputs. The maximum output voltage is 10V.
- OUT B. This is the other main output. The maximum output voltage is 10V.
- TRIG. The TRIG pulse is a fixed-width TTL-level reference pulse used to trigger oscilloscopes or other measurement systems.

The TRIG output precedes the main outputs. These pulses are illustrated below:



When triggered externally, the TRIG connector acts as an input. The delay controls do not function in this mode. This illustrated below:



AMPLITUDE INTERACTION

Some properties of the output pulse may change as a function of the amplitude setting. For some demanding applications, it may be desirable to use a combination of external attenuators and the amplitude pot to achieve the desired output amplitude.

MINIMIZING WAVEFORM DISTORTIONS

USE 50Ω TRANSMISSION LINES AND LOADS

Connect the load to the pulse generator with 50Ω transmission lines (e.g. RG-58 or RG-174 cable).

This instrument requires a 50Ω load for proper operation. It will not properly drive a high-impedance load. The output stage will be damaged if it is operated into an open circuit (or any other high impedance). Failures due to improper output loading are not covered by the warranty.

USE LOW-INDUCTANCE LOADS

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

PREVENTING DAMAGE

The AVP-AV-1-C-2CHPP-UBA may fail if triggered at a PRF greater than 1 MHz.


This unit is designed to operate into a load impedance of 50 Ohms and the output stage will be damaged if it is operated into an open circuit (or any other high impedance). Failures due to improper output loading are not covered by the warranty.

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.

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.

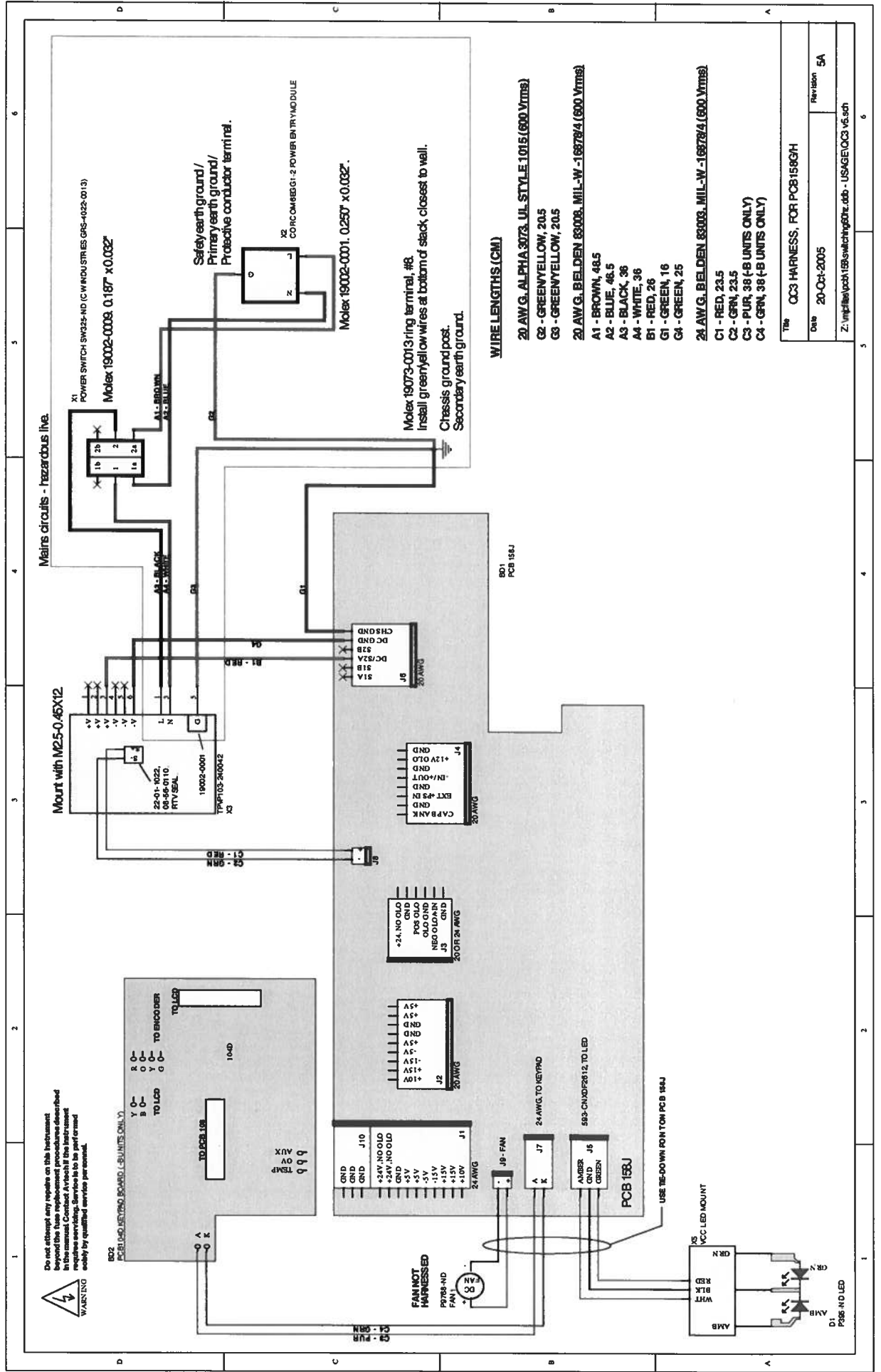
On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the "FUSES" section for details.

CLEANING

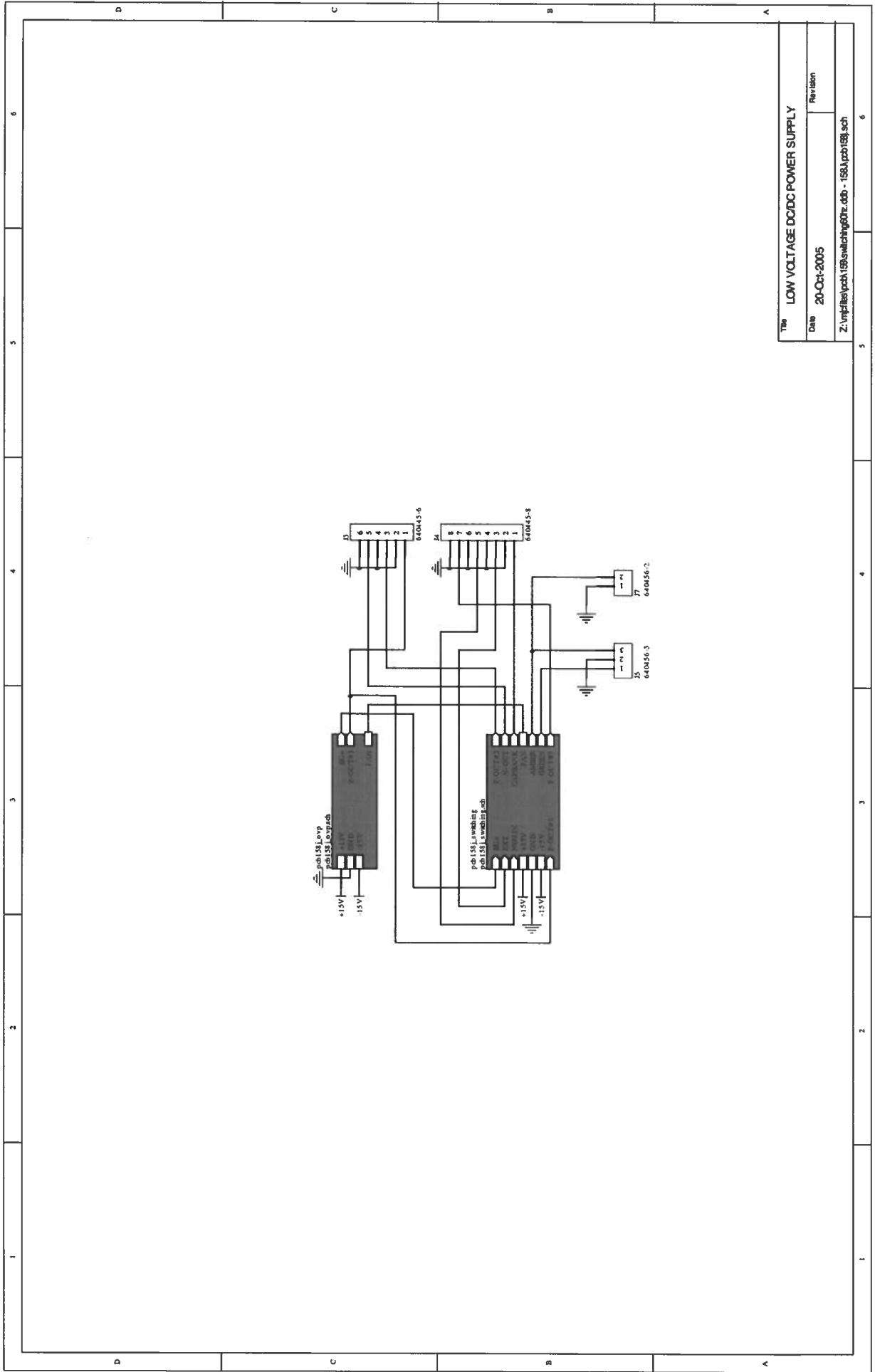
If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the "TOP COVER REMOVAL" section for instructions on accessing the interior.) No other cleaning is recommended.

WIRING DIAGRAMS

WIRING OF AC POWER

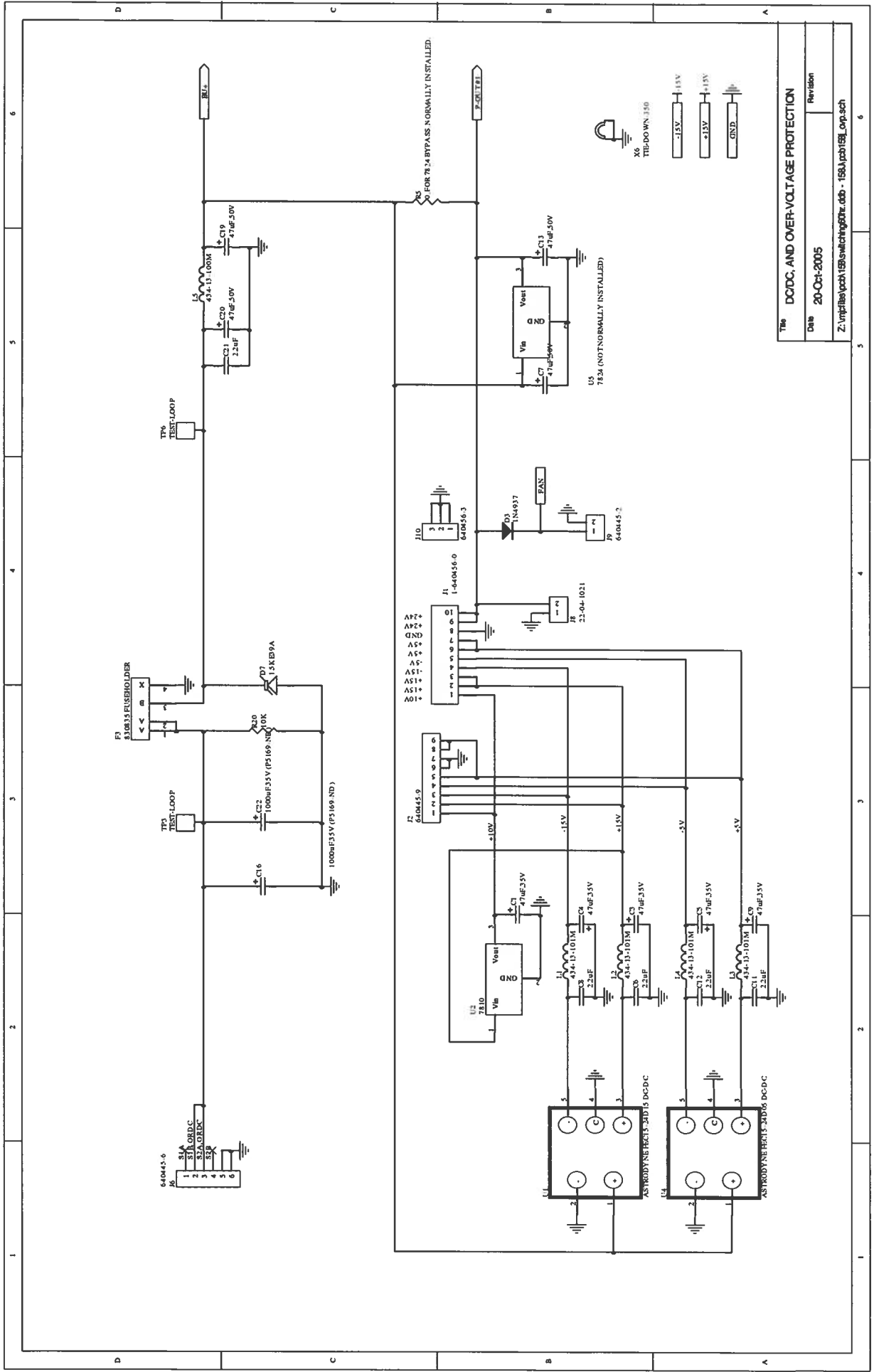


PCB 158J - LOW VOLTAGE DC POWER SUPPLY, 1/3



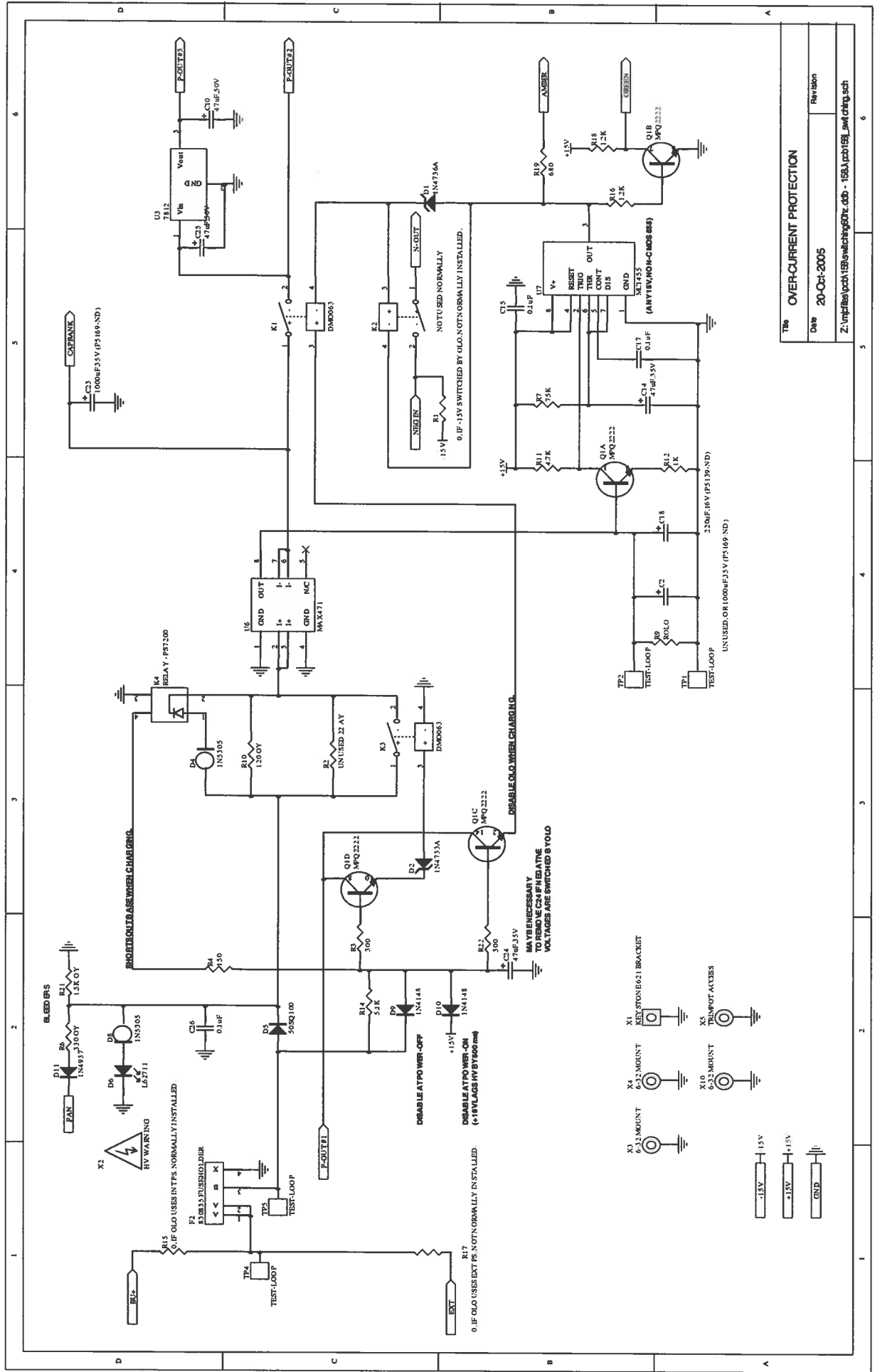
Title		LOW VOLTAGE DC/DC POWER SUPPLY
Date	20-Oct-2005	Revision
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PCB 158J - LOW VOLTAGE DC POWER SUPPLY, 2/3



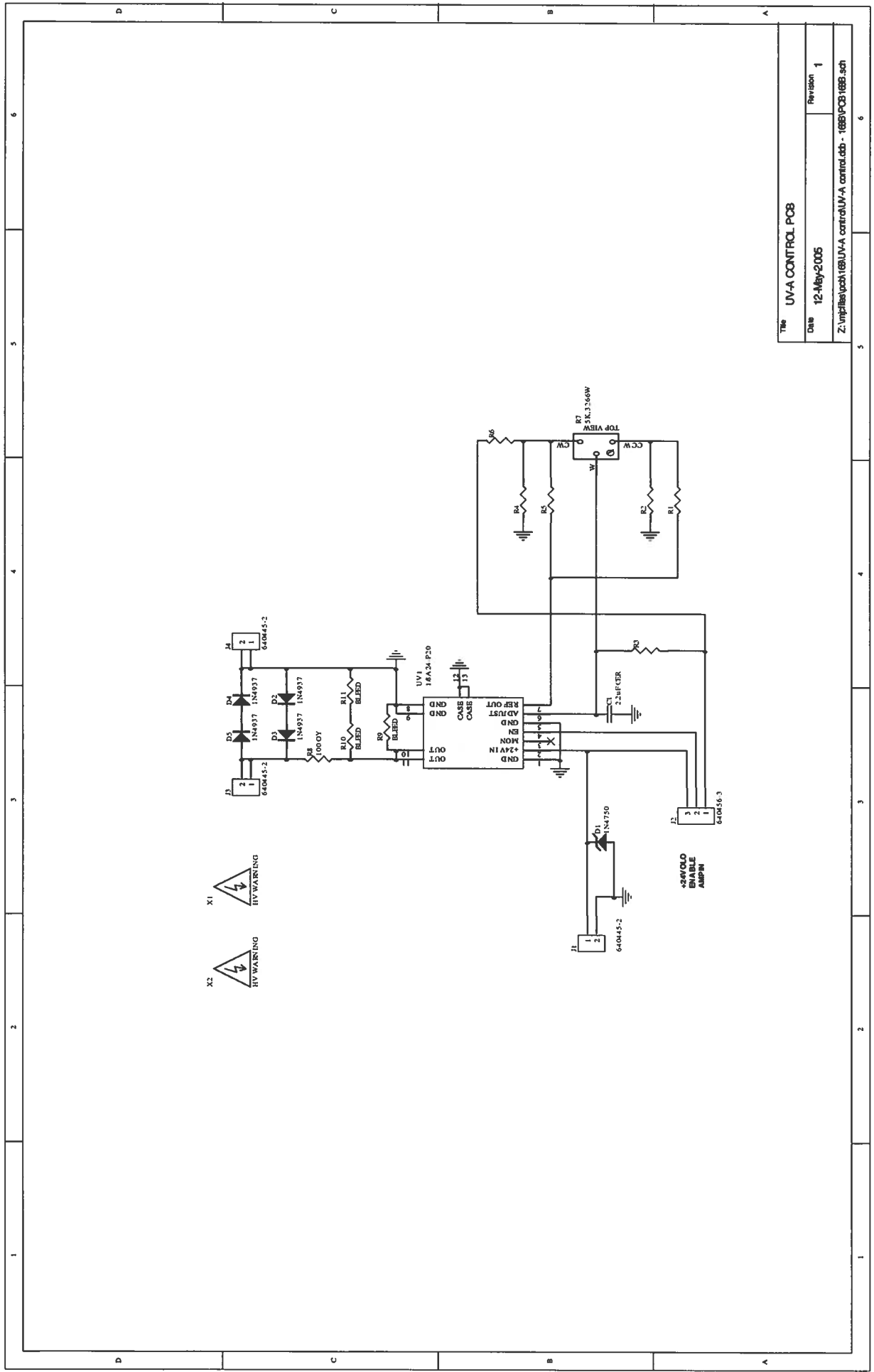
Title	
DC/DC, AND OVER-VOLTAGE PROTECTION	Revision
Date	20-Oct-2005
Z:\npf\lib\pcb\158\switching6tr.cdb - 158j.pcb158j_top.sch	

PCB 158J - LOW VOLTAGE DC POWER SUPPLY. 3/3



Title OVER-CURRENT PROTECTION
Date 20-Oct-2005
Revision Revision
 Z:\mp158j\pcb158j\switching05r.doc - 158j.pcb158j_swm.ctb sch

PCB 168B - HIGH VOLTAGE DC POWER SUPPLY



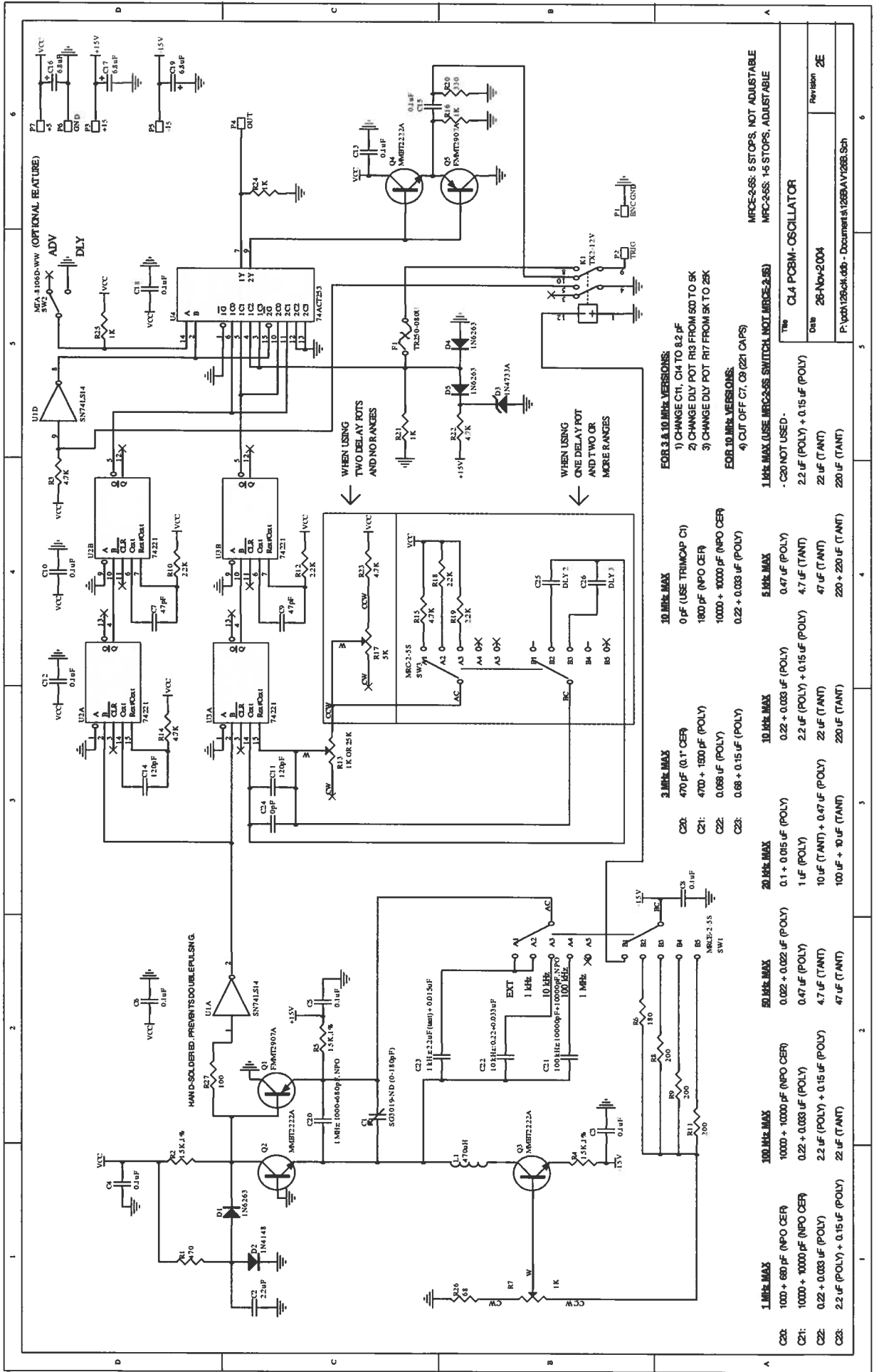
The UVA CONTROL PCB

Date 12-May-2005

Revision 1

Z:\mpf\files\pcb\168\UVA control\UVA control.ddb - 168B\PCB 168B.sch

PCB 126B - OSCILLATOR AND TRIGGER CIRCUIT



FOR 3.0 Mhz VERSIONS:
 1) CHANGE C1, C4 TO R2 pF
 2) CHANGE DLY POT R18 FROM 50 TO 5K
 3) CHANGE DLY POT R17 FROM 5K TO 25K
 4) CUT OFF C7, C9 (21 CAPS)

FOR 10 Mhz VERSIONS:
 1 Mhz MAX (USE MRC2-SS SWITCH NOT MRC2-SS)
 - C20 NOT USED -
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)

FOR 3.0 Mhz VERSIONS:
 1) CHANGE C1, C4 TO R2 pF
 2) CHANGE DLY POT R18 FROM 50 TO 5K
 3) CHANGE DLY POT R17 FROM 5K TO 25K
 4) CUT OFF C7, C9 (21 CAPS)

FOR 10 Mhz VERSIONS:
 1 Mhz MAX (USE MRC2-SS SWITCH NOT MRC2-SS)
 - C20 NOT USED -
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)

FOR 3.0 Mhz VERSIONS:
 1) CHANGE C1, C4 TO R2 pF
 2) CHANGE DLY POT R18 FROM 50 TO 5K
 3) CHANGE DLY POT R17 FROM 5K TO 25K
 4) CUT OFF C7, C9 (21 CAPS)

FOR 10 Mhz VERSIONS:
 1 Mhz MAX (USE MRC2-SS SWITCH NOT MRC2-SS)
 - C20 NOT USED -
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)

FOR 3.0 Mhz VERSIONS:
 1) CHANGE C1, C4 TO R2 pF
 2) CHANGE DLY POT R18 FROM 50 TO 5K
 3) CHANGE DLY POT R17 FROM 5K TO 25K
 4) CUT OFF C7, C9 (21 CAPS)

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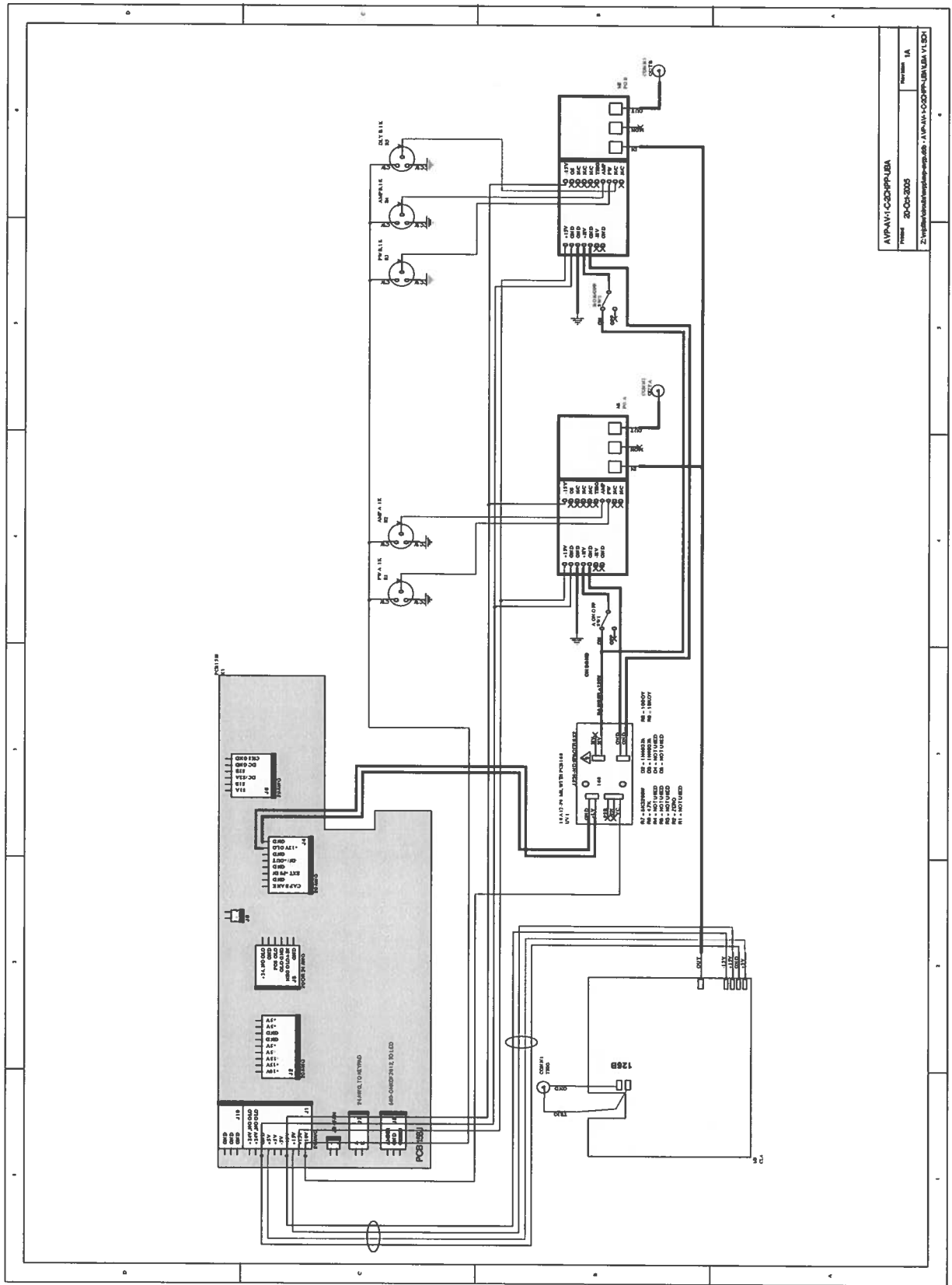
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FOR 10 Mhz VERSIONS:
 1 Mhz MAX (USE MRC2-SS SWITCH NOT MRC2-SS)
 - C20 NOT USED -
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)
 2.2 uF (POLY) + 0.15 uF (POLY)

MFC2-SS: 5 STOPS, NOT ADJUSTABLE
 MFC2-SS: 15 STOPS, ADJUSTABLE

The CL4 PC8M-OSCILLATOR
 Date 28-Nov-2004
 Revision 2E
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MAIN WIRING



AVPAW1-C000PPUBA
 20-04-2005
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Oct 20/05