AVTECH ELECTROSYSTEMS LTD.

NANOSECOND WAVEFORM ELECTRONICS
SINCE 1975

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

INSTRUCTIONS

MODEL AVP-AV-1-C-PN-DP-OT-M-WHA

0 TO -5 VOLTS, 2 MHz, 0.6 TO 2 ns

HIGH SPEED PULSE DOUBLET GENERATOR

WITH 300 ps RISE AND FALL TIMES

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 +1-613-226-5772 (Intl)
Fax: 800-561-1970 (USA & Canada) or +1-613-226-2802 (Intl)

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

TABLE OF CONTENTS

Manual Reference: /fileserver1/officefiles/instructword/avp/old/AVP-AV-1-C-PN-DP-OT-M-WHA,ed1.odt.
Last modified February 29, 2024.

INTRODUCTION

The AVP-AV-1-C-PN-DP-OT-M-WHA is a high performance instrument capable of generating pulse doublets with amplitudes up to -5V into 50Ω loads at repetition rates up to 2 MHz. The rise and fall times are less than 300 ps. The pulse width is variable from 0.6 to 2 ns.

For each trigger event, a pulse doublet is generated. That is, two output pulses are generated, separated by a variable delay of 0 to 100 ns. The two pulses in each doublet have separately adjustable amplitudes and pulse widths.

Each output is designed to drive 50Ω loads. (A 50Ω 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-PN-DP-OT-M-WHA[1]
Amplitude: (50 Ohm load)	-1V to -5V, adjustable
Output waveform:	Double pulse, with separate amplitude and pulse width controls for the two pulses. The pulse separation is adjustable.
Pulse separation within doublet:	0 to 100 ns, adjustable. One-turn control.
Pulse width:	0.6 - 2.0 ns
PRF: external trigger: internal trigger:	0 Hz to 2 MHz 200 Hz to 2 MHz
Rise time (20%-80%):	≤ 300 ps
Fall time (80%-20%):	≤ 300 ps
Polarity:	negative
Propagation delay:	≤ 70 ns (Ext trig in to pulse out)
Jitter, Ext trig in to pulse out:	±15 ps
Internally generated DC offset:	Variable from -2V to +2V. One-turn control, and an on/off switch to enable/disable the offset feature.
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)
Sync output: (-B, -C only)	+3 Volts, 200 ns, will drive 50Ω
Monitor output:	Provides a 20 dB (x10) attenuated coincident replica of main output
Connectors: OUT TRIG SYNC MONITOR	 SMA BNC BNC SMA
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, Temp. range:	Any, +5° to +40° C

ORIGINAL QUOTATION

Date: Fri, 27 Apr 2007 10:59:32 -0400
From: Avtech Sales
To: XXXXX
Subject: Re: Updated Quotation 12751 for AVP-AV-1-C-PN-DP-OT-M-WHA

XXXXX,

Following your recent inquiry, I am pleased to quote on the following customized pulse generator:

Quote number: 13770

Model number: AVP-AV-1-C-PN-DP-OT-M-WHA

Description: Ultra High Speed Pulse Generator

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

Pulse width (FWHM): 0.6 to 2 ns, adjustable. Two one-turn controls.

Amplitude: -1V to -5V, adjustable. Two one-turn controls. (Lower output amplitudes can be obtained by adding external attenuators, if desired.)

Rise and fall times (20%-80%): < 300 ps

Pulse repetition frequency (PRF): 200 Hz to 2 MHz, adjustable using a four-position decade range switch and a one-turn fine control.

Pulse separation: 0 to 100 ns, adjustable. One-turn control.

DC offset: internally generated DC offset, variable from -2V to +2V. One-turn control, and an on/off switch to enable/disable the offset feature.

Monitor output: included

Supplied accessory: one AVX-2-T inverting transformer with bias tee circuit. This allows the output polarity to be inverted (and a DC offset added).

Note 1: To generate a TTL signal, the output amplitude should be set between -3V and -5V, and the AVX-2-T should be used to invert the amplitude to between +3V and +5V.

Note 2: To generate an ECL signal, the output amplitude should be set to -0.8V, and the AVX-2-T should be used to invert the pulse and add a -1.6V offset.

Other: Similar to the standard AVP-AV-1-C-PN-DP-OT-M, described at http://www.avtechpulse.com/speed/avp-av-1.

Price: $XXXXX US each, FOB destination (includes 5% academic discount).
GST: 6% extra

Estimated delivery: 60-75 days after receipt of order

No Export Permit is required since delivery will be within Canada.

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

Thank you for your interest in our products!

Regards,

Mary Budarick
Sales Manager

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

PO Box 265 ph: 888-670-8729 or 613-226-5772 Box 5120
Ogdensburg fax: 800-561-1970 or 613-226-2802 LCD Merivale
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USA 13669-0265 email: info@avtechpulse.com Canada K2C 3H4
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Pulse Generators - Laser Diode Drivers - HV Amplifiers
Monocycle Generators - Impulse Generators - Pulse Amplifiers
Current Pulsers - Function Generators - Frequency Dividers - and more!

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.

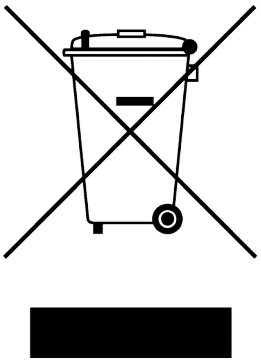
DIRECTIVE 2002/96/EC (WEEE)

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.



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	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

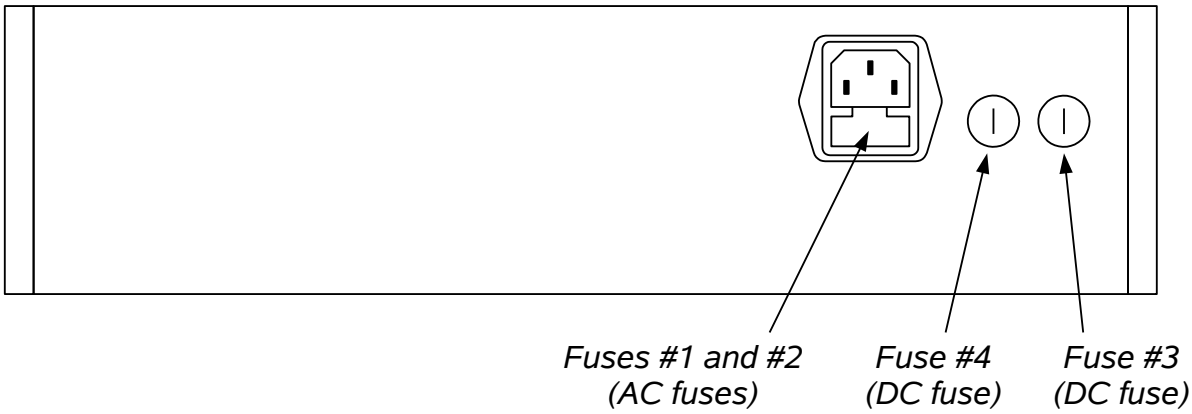
This instrument is intended for use under the following conditions:

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.

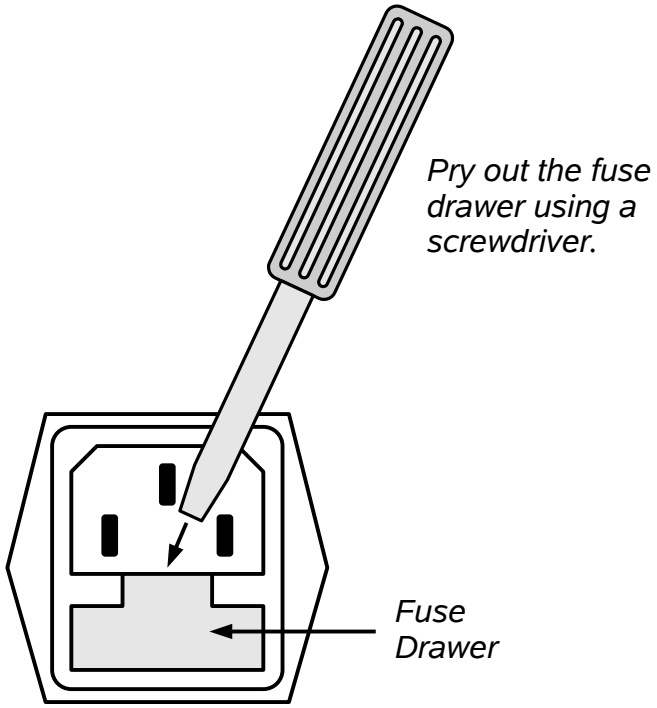
FUSES

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

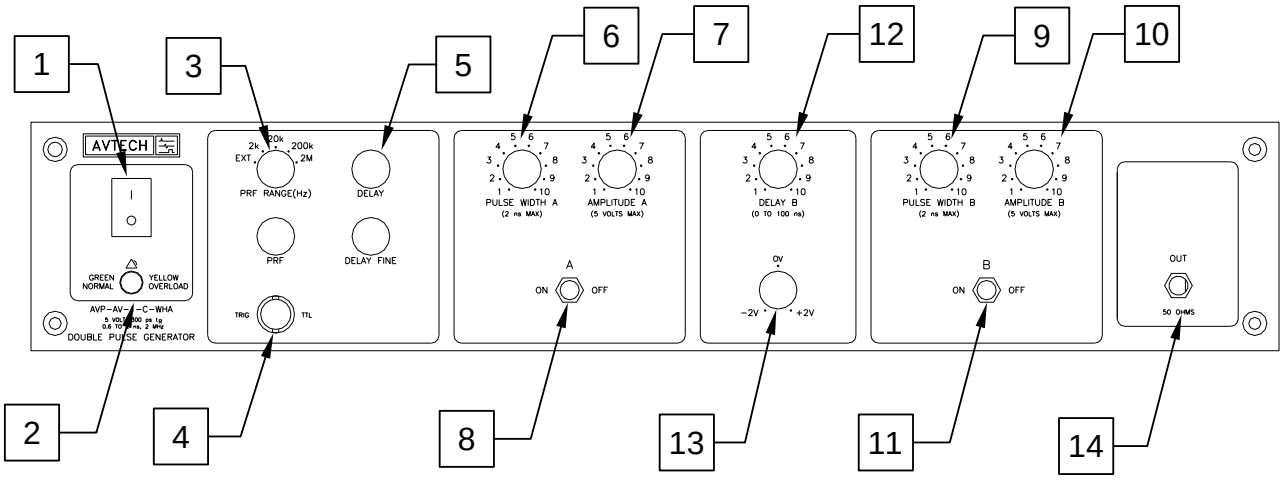
The following table lists the required fuses:

Fuses	Nominal Mains Voltage	Rating	Case Size	Recommended Replacement Part	
				Littelfuse Part Number	Digi-Key Stock Number
#1, #2 (AC)	100-240V	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND
#3 (DC)	N/A	1.0A, 250V, Time-Delay	5×20 mm	0218001.HXP	F2419-ND
#4 (DC)	N/A	0.5A, 250V, Time-Delay	5×20 mm	0218.500HXP	F2416-ND

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

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

FRONT PANEL CONTROLS



1) POWER Switch. This is the main power switch. When turning the instrument on, there 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 switched 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 the leading pulse of the pulse doublet.

7) Amplitude A Control. This dial controls the amplitude of the leading pulse of the pulse doublet.

8) A ON/OFF Switch. This switch enables or disables the leading pulse of the pulse doublet.

9) Pulse Width B Control. This dial controls the pulse width of the trailing pulse of the pulse doublet.

10) Amplitude B Control. This dial controls the amplitude of the trailing pulse of the pulse doublet.

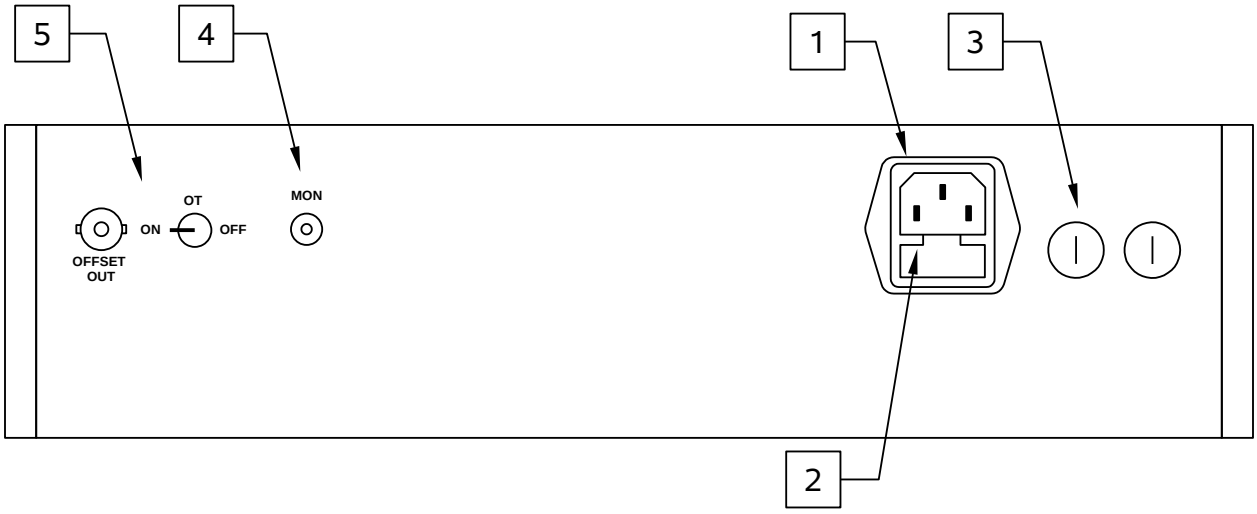
11) B ON/OFF Switch. This switch enables or disables the trailing pulse of the pulse doublet.

12) DELAY B Control. This dial varies the relative delay between the A and B portions of the pulse doublet, over a range of 0 to 100 ns.

13) OFFSET Control. This dial varies the internally-generated DC offset over the range of -2V to +2V. The rear panel OT ON/OFF switch must be set to “ON” to enable this function.

14) OUT Connector. This SMA connector provides the output signal. This output *requires* a 50Ω load to function properly.

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. MON OUTPUT CONNECTOR. This SMA connector output provides a 20 dB attenuated coincident replica of main output, for monitoring purposes.

5. OFFSET ON/OFF SWITCH & OUTPUT. This switch enables the internally-generated offset feature when it is set to “ON”. When it is set to “OFF”, no offset is added to the output.

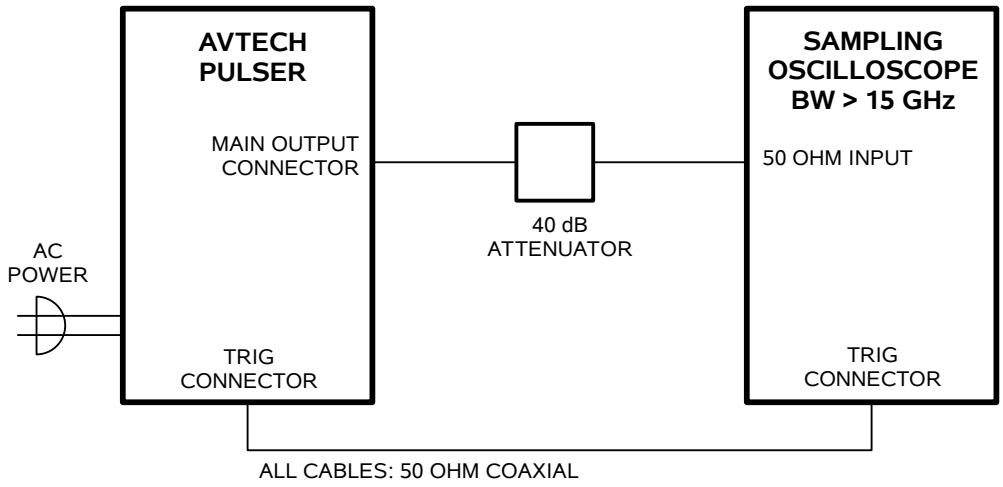
   The internally generated offset is available at the “OFFSET OUT” BNC connector, for monitoring purposes.

   To add an offset to inverted pulses when using an accessory inverting transformer, connect this terminal to the DC terminal of the inverting transformer (see the “POLARITY INVERSION” sections in this manual for further details).

GENERAL INFORMATION

BASIC TEST ARRANGEMENT

The AVP-AV-1-C-PN-DP-OT-M-WHA 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:



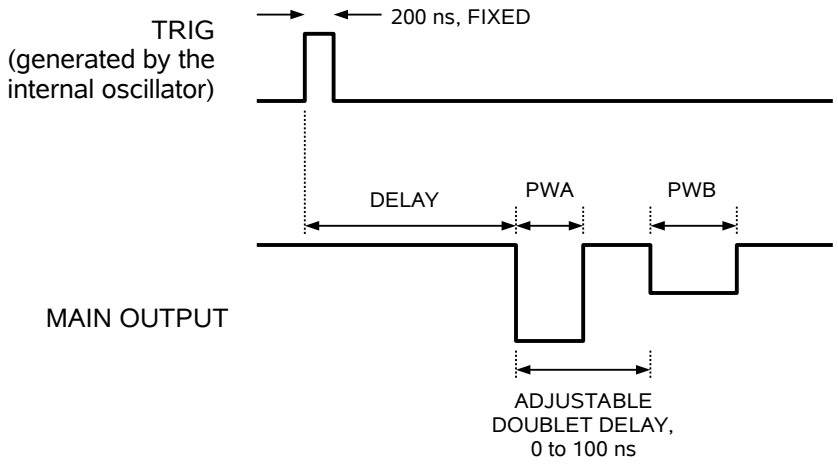
The attenuators are required to prevent damage to the sampling oscilloscope. A 40 dB attenuator with sufficient voltage rating should be used on the main output.

BASIC PULSE CONTROL

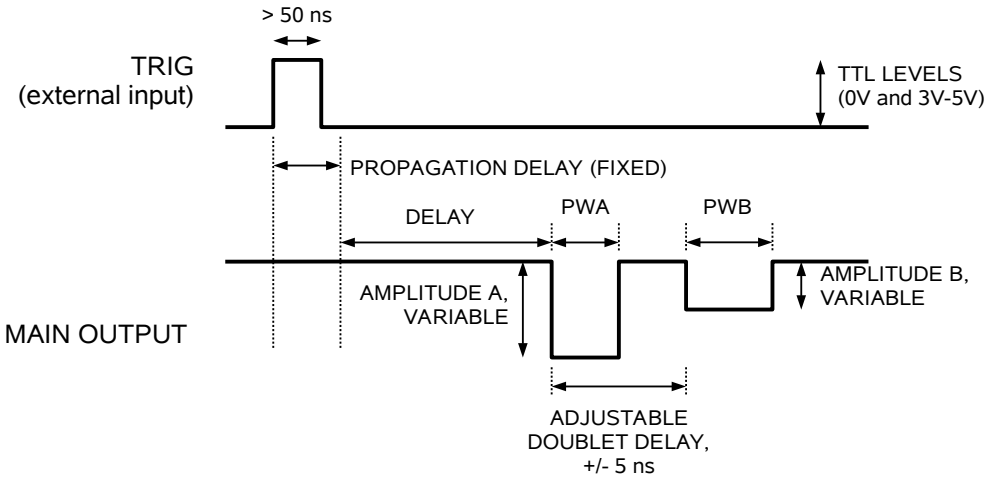
This instrument can be triggered by its own internal clock or by an external TTL trigger signal. When triggered internally, two mainframe output channels respond to the trigger: OUT and SYNC.

- OUT. This is the main output.
- 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 output. 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.

POLARITY INVERSION

The main output of the AVP-AV-1-C-PN-DP-OT-M-WHA generates negative amplitude pulses.

An AVX-2-T inverting transformer / bias tee is supplied for situations when the user wishes to generate positive output pulses. To invert the output polarity, connect the

supplied AVX-2-T inverting transformer to the OUT port. An inverted pulse is then obtained at the OUT port of the AVX-2-T unit.

To add an offset to the inverted pulse, connect a lead from the rear-panel “OFFSET OUT” BNC connector to the DC terminal of the AVX-2-T unit. The DC offset at the output of the AVX-2-T unit is then controlled by the front-panel OFFSET control.

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, $V_{SPIKE} = L \times dI_{LOAD}/dt$, where L is the inductance, I_{LOAD} is the load current change, and t is time. For this reason, it is important to keep any parasitic in the load low. This means keeping wiring short, and using low inductance components. In particular, wire-wound resistors should be avoided.

PREVENTING DAMAGE

The AVP-AV-1-C-PN-DP-OT-M-WHA may fail if triggered at a PRF greater than 2 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.

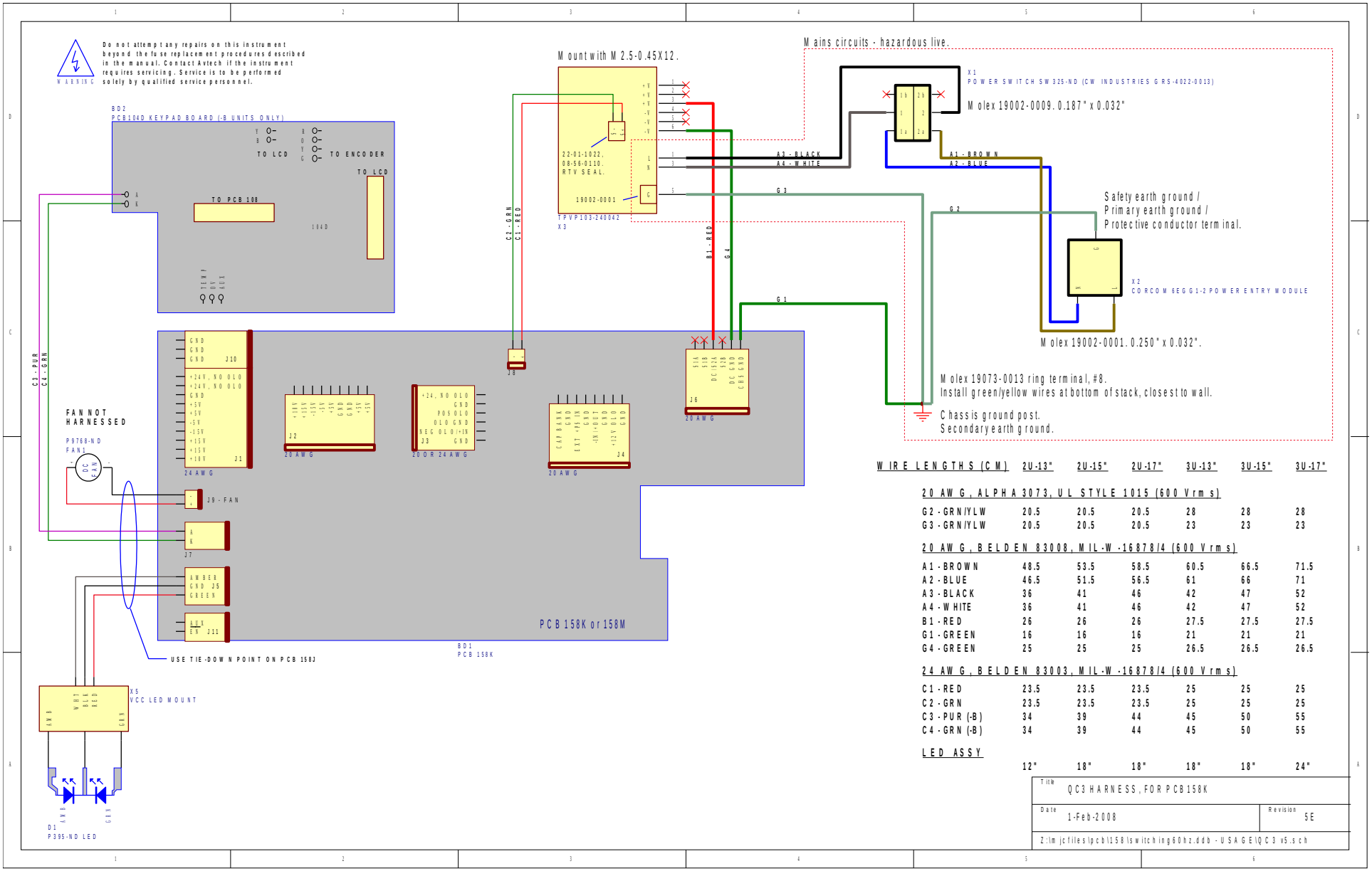
On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the “FUSES” section for details.

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

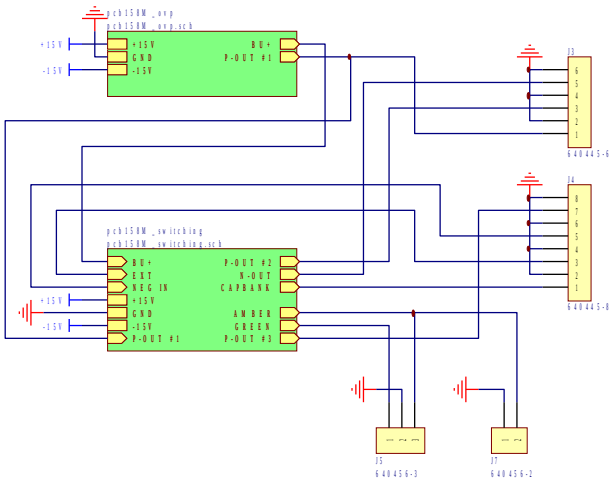
WIRING OF AC POWER



WIRE LENGTHS (CM)	2U-13"	2U-15"	2U-17"	3U-13"	3U-15"	3U-17"
20 AWG, ALPHA 3073, UL STYLE 1015 (600 Vrms)						
G2 - GRN/YLW	20.5	20.5	20.5	28	28	28
G3 - GRN/YLW	20.5	20.5	20.5	23	23	23
20 AWG, BELDEN 83008, MIL-W-16878/4 (600 Vrms)						
A1 - BROWN	48.5	53.5	58.5	60.5	66.5	71.5
A2 - BLUE	46.5	51.5	56.5	61	66	71
A3 - BLACK	36	41	46	42	47	52
A4 - WHITE	36	41	46	42	47	52
B1 - RED	26	26	26	27.5	27.5	27.5
G1 - GREEN	16	16	16	21	21	21
G4 - GREEN	25	25	25	26.5	26.5	26.5
24 AWG, BELDEN 83003, MIL-W-16878/4 (600 Vrms)						
C1 - RED	23.5	23.5	23.5	25	25	25
C2 - GRN	23.5	23.5	23.5	25	25	25
C3 - PUR (-B)	34	39	44	45	50	55
C4 - GRN (-B)	34	39	44	45	50	55
LED ASSY	12"	18"	18"	18"	18"	24"

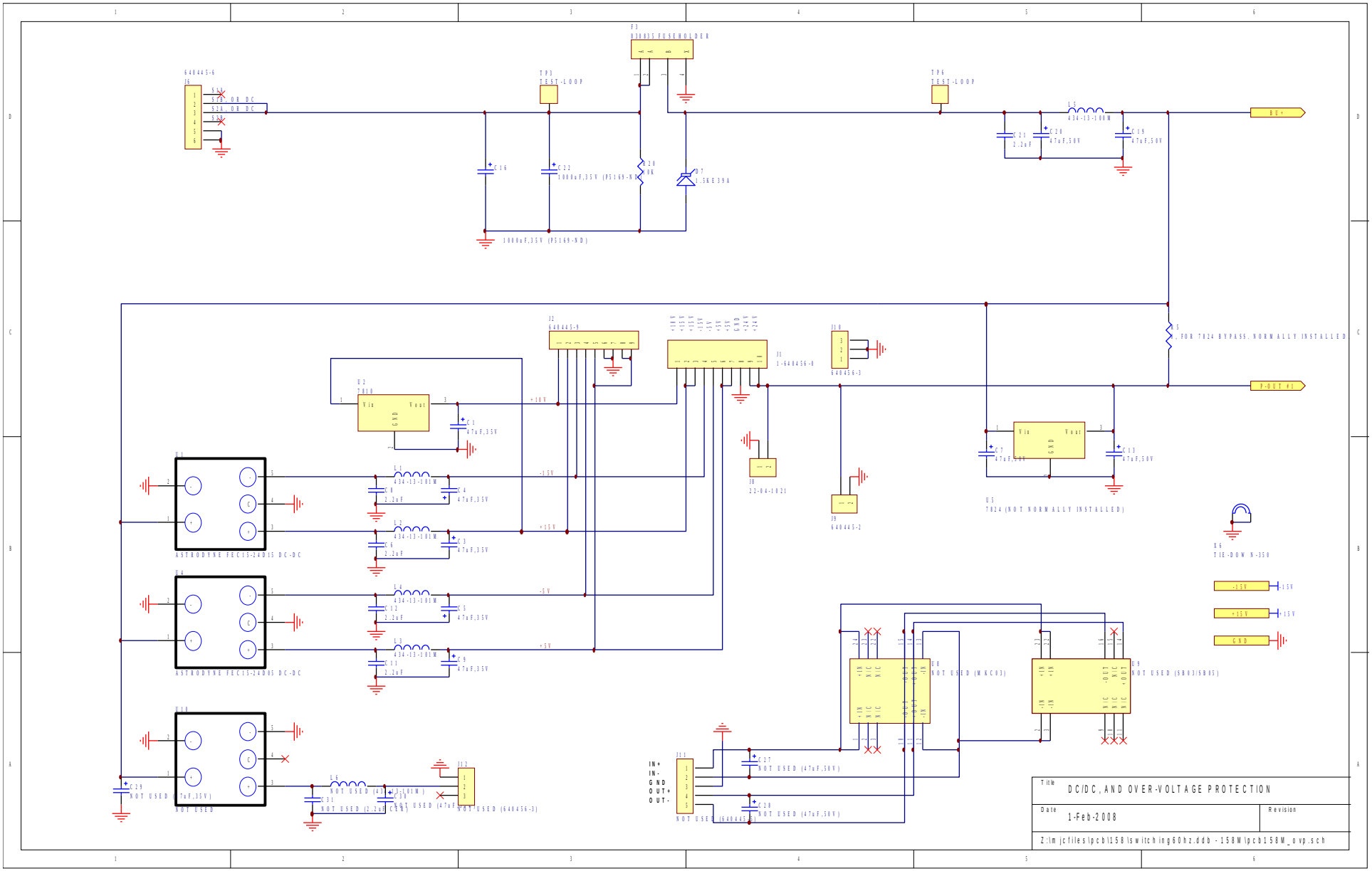
Title	QC3 HARNESS, FOR PCB 158K
Date	1-Feb-2008
Revision	5E
Z:\lmjc\files\pcb\158\switching60hz.ddb - USAGE\QC3 v5.sch	

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

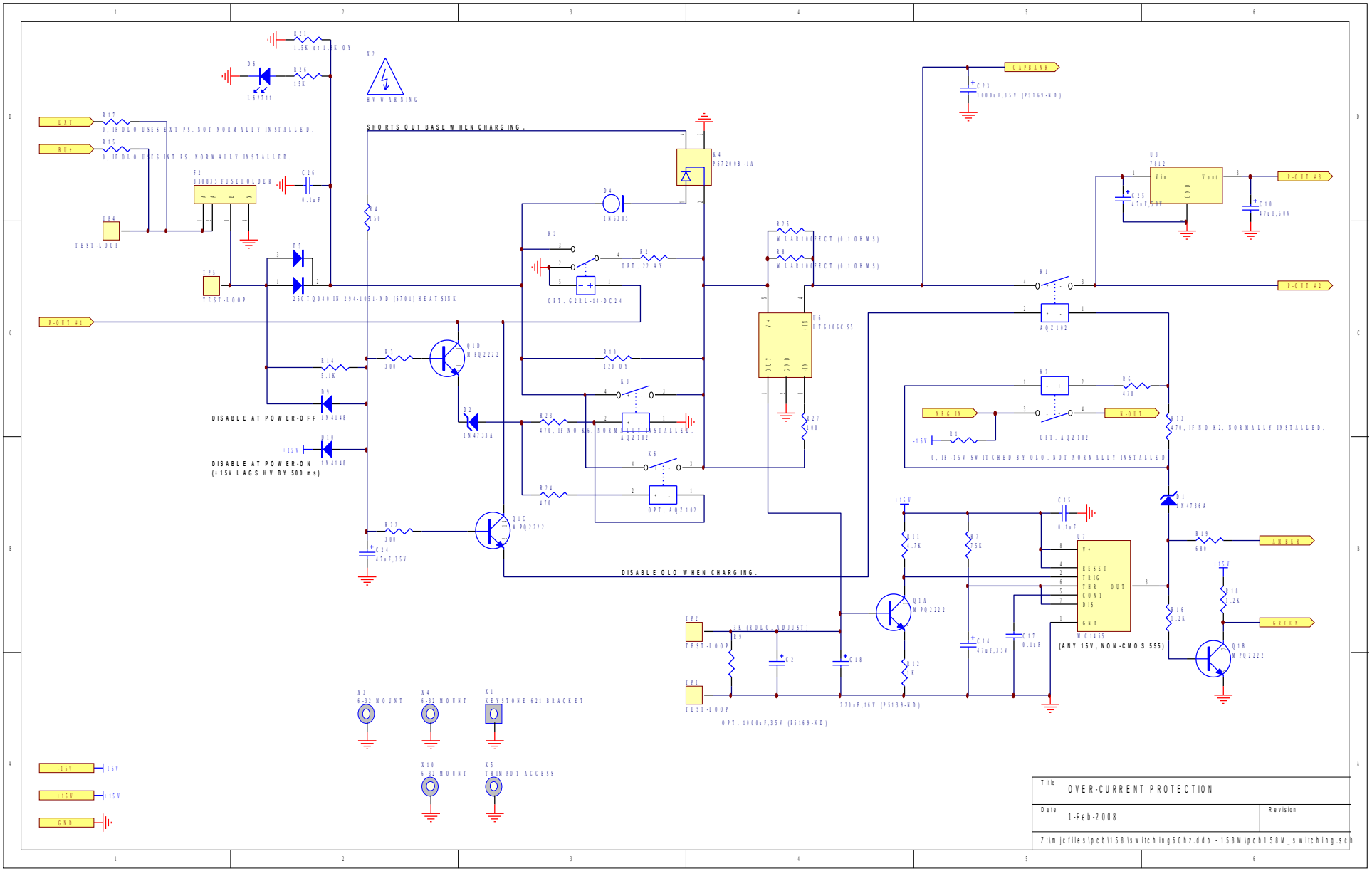


Title	LOW VOLTAGE DC/DC POWER SUPPLY
Date	1-Feb-2008
Revision	
Z:\mjcfiles\pcb\158\lswitching60hz.ddb - 158M\pcb158M.sch	

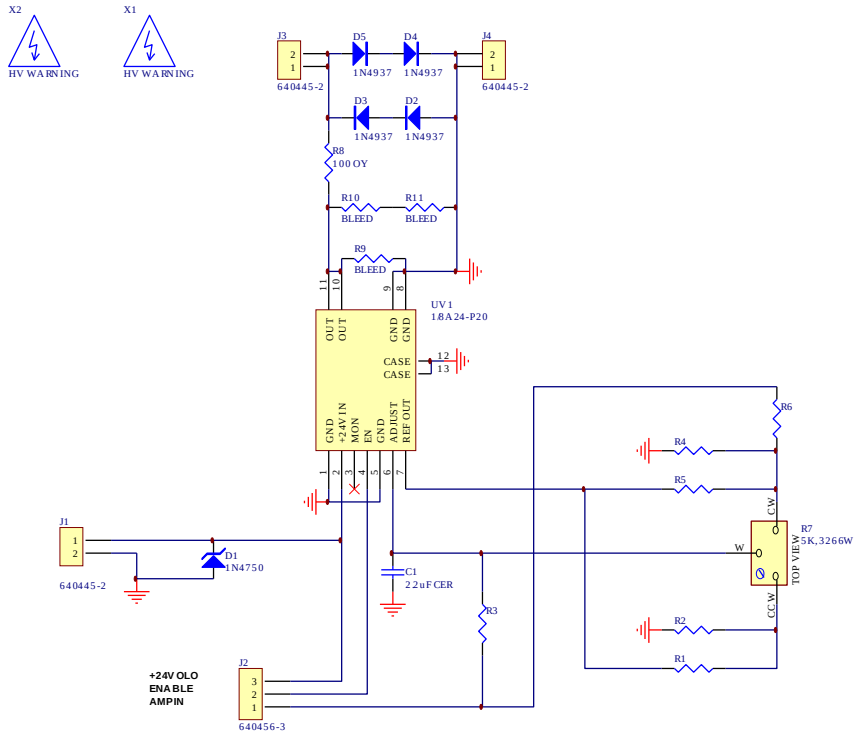
PCB 158M - LOW VOLTAGE POWER SUPPLY, 2/3



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

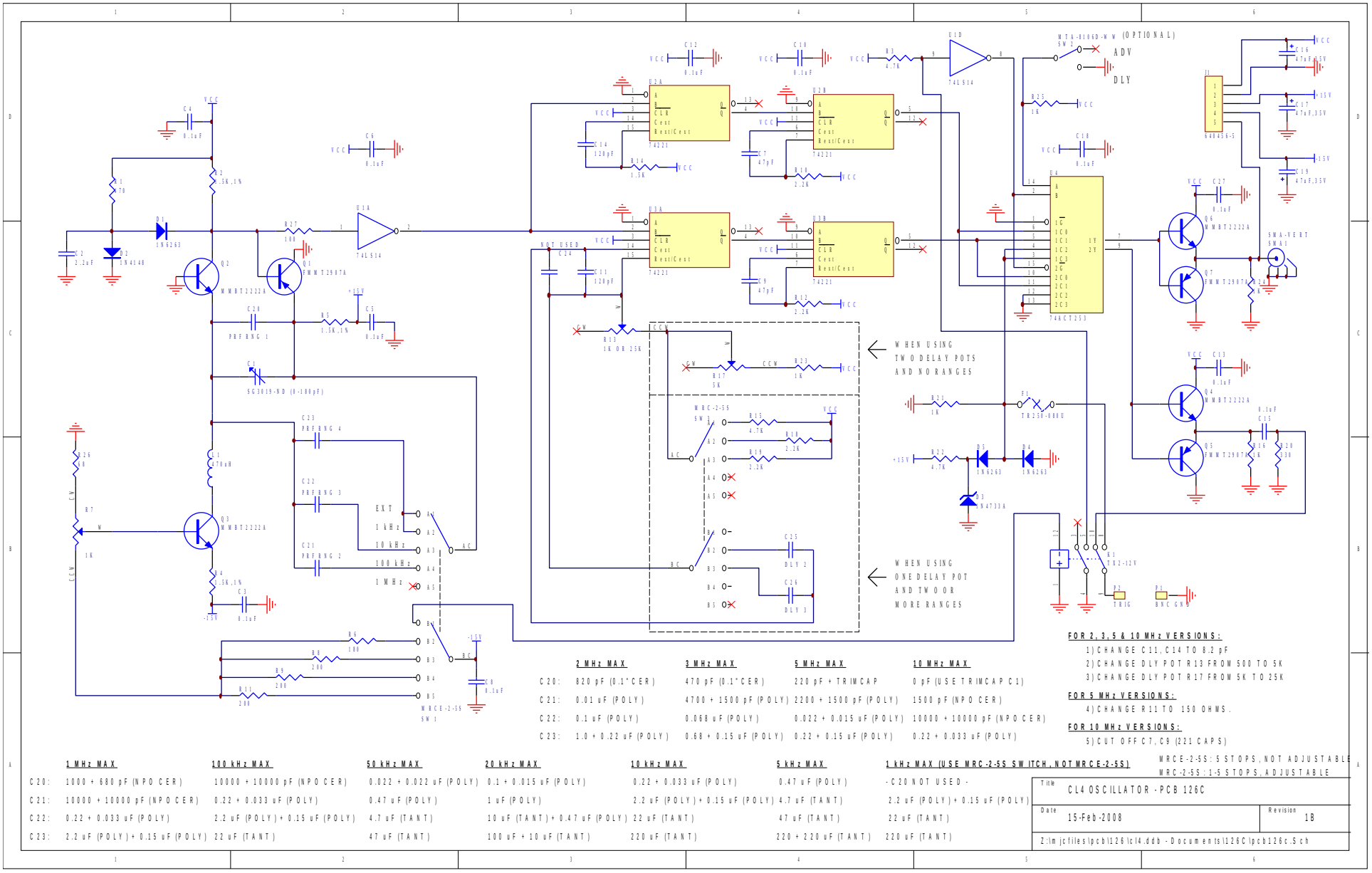


PCB 168B - HIGH VOLTAGE DC POWER SUPPLY



Title	UV-A CONTROL PCB
Date	12-May-2005
Revision	1
Z:\mjcfiles\pcb\168\UV-A control\UV-A control.ddb - 168B\PCB168B.sch	

PCB 126C - OSCILLATOR AND TRIGGER CIRCUIT



	2 MHz MAX	3 MHz MAX	5 MHz MAX	10 MHz MAX
C20:	820 pF (0.1" CER)	470 pF (0.1" CER)	220 pF + TRIMCAP	0 pF (USE TRIMCAP C1)
C21:	0.01 uF (POLY)	4700 + 1500 pF (POLY)	2200 + 1500 pF (POLY)	1500 pF (NPO CER)
C22:	0.1 uF (POLY)	0.068 uF (POLY)	0.022 + 0.015 uF (POLY)	10000 + 10000 pF (NPO CER)
C23:	1.0 + 0.22 uF (POLY)	0.68 + 0.15 uF (POLY)	0.22 + 0.15 uF (POLY)	0.22 + 0.033 uF (POLY)

FOR 2, 3, 5 & 10 MHz VERSIONS:

1) CHANGE C11, C14 TO 8.2 pF
2) CHANGE DLY POT R13 FROM 500 TO 5K
3) CHANGE DLY POT R17 FROM 5K TO 25K

FOR 5 MHz VERSIONS:

4) CHANGE R11 TO 150 OHMS.

FOR 10 MHz VERSIONS:

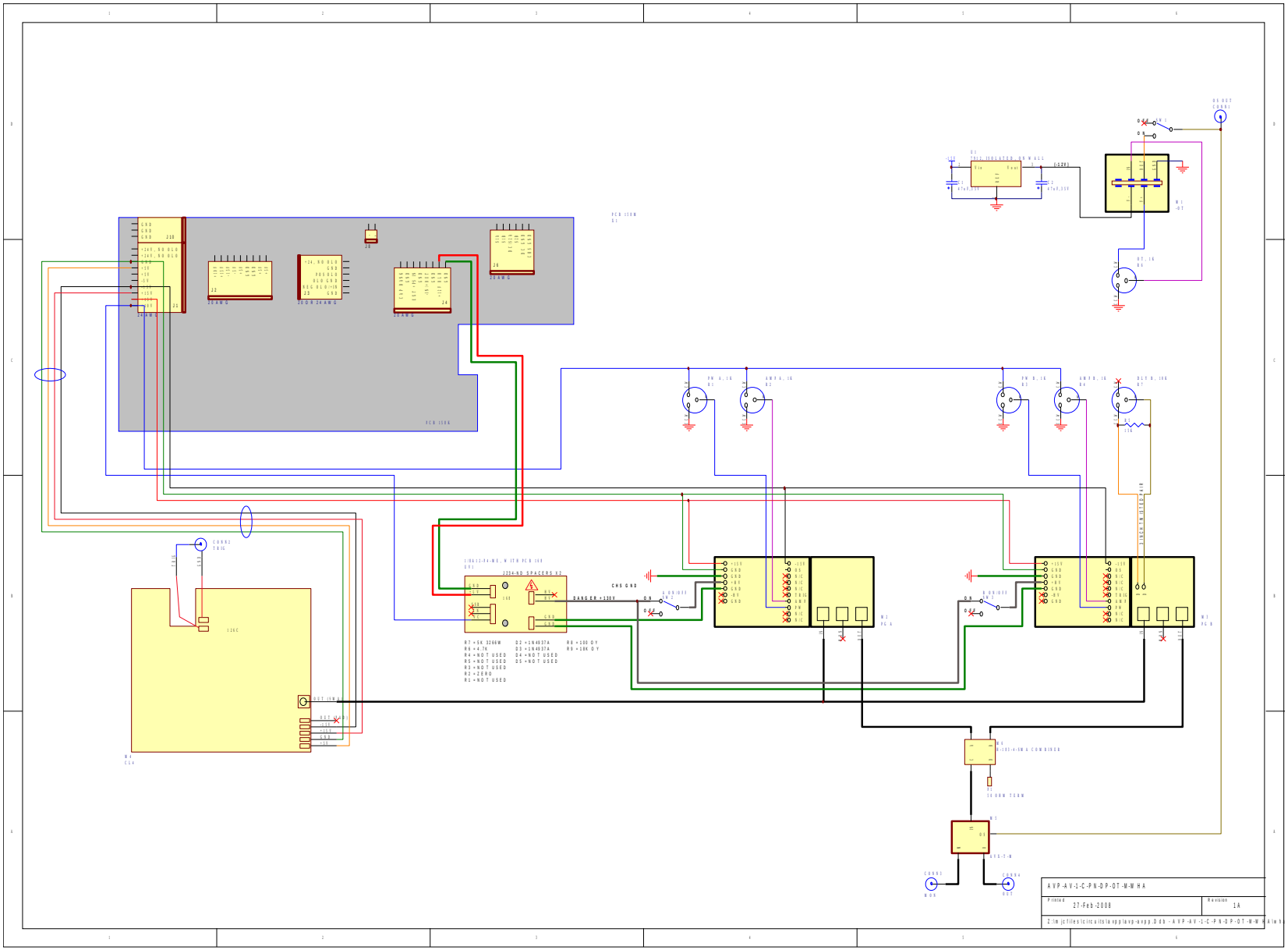
5) CUT OFF C7, C9 (221 CAPS)

	1 MHz MAX	100 kHz MAX	50 kHz MAX	20 kHz MAX	10 kHz MAX	5 kHz MAX	1 kHz MAX (USE MRC-2-5S SWITCH, NOT MRCE-2-5S)
C20:	1000 + 680 pF (NPO CER)	10000 + 10000 pF (NPO CER)	0.022 + 0.022 uF (POLY)	0.1 + 0.015 uF (POLY)	0.22 + 0.033 uF (POLY)	0.47 uF (POLY)	- C20 NOT USED -
C21:	10000 + 10000 pF (NPO CER)	0.22 + 0.033 uF (POLY)	0.47 uF (POLY)	1 uF (POLY)	2.2 uF (POLY) + 0.15 uF (POLY)	4.7 uF (TANT)	2.2 uF (POLY) + 0.15 uF (POLY)
C22:	0.22 + 0.033 uF (POLY)	2.2 uF (POLY) + 0.15 uF (POLY)	4.7 uF (TANT)	10 uF (TANT) + 0.47 uF (POLY)	22 uF (TANT)	47 uF (TANT)	22 uF (TANT)
C23:	2.2 uF (POLY) + 0.15 uF (POLY)	22 uF (TANT)	47 uF (TANT)	100 uF + 10 uF (TANT)	220 uF (TANT)	220 + 220 uF (TANT)	220 uF (TANT)

MRCE-2-5S: 5 STOPS, NOT ADJUSTABLE
MRC-2-5S: 1-5 STOPS, ADJUSTABLE

Title	CL4 OSCILLATOR - PCB 126C
Date	15-Feb-2008
Revision	18
	Z:\mjcfiles\pcb\126\cl4.ddb - Documents\126C\pcb126c.Sch

MAIN WIRING



PERFORMANCE CHECK SHEET