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INSTRUCTIONS

MODEL AVMH-4-C

0 TO 100 VOLTS, 10 MHz

IMPULSE GENERATOR

WITH 1 ns PULSE WIDTH

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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World Wide Web: http://www.avtechpulse.com

TABLE OF CONTENTS

Manual Reference: /fileserver1/officefiles/instructword/avmh/AVMH-4-C,edE.sxw.
Last modified February 29, 2024.

INTRODUCTION

The AVMH-4-C is a high performance instrument capable of generating up to 100V into 50Ω loads at repetition rates up to 10 MHz. The output pulse width is 1 ns.

Instruments with the "-P" model suffix can generate 0 to +100V, whereas instruments with the "-N" model suffix can generate 0 to -100V.

Instruments with the "-P-PN" suffix generate 0 to +100V at the main output, and are supplied with an inverting transformer that can be installed on the output to generate a negative signal.

Instruments with the "-N-PN" suffix generate 0 to -100V at the main output, and are supplied with an inverting transformer that can be installed on the output to generate a positive signal.

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

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

AVAILABLE OPTIONS

The AVMH-3-C is available with several options:

-ECL Option: the input trigger levels are ECL, rather than TTL.

-M Option: a monitor output is provided.

-OS Option: an externally generated DC offset can be added to the output.

SPECIFICATIONS

Model[1]:	AVMH-4-C
Amplitude: (50 Ohm load)	0 to 100 Volts
Pulse width: (at 20% rise point):	1 ns
PRF, internal trigger: external trigger:	1 kHz to 10 MHz 0 to 10 MHz
Polarity[2]:	Positive
Propagation delay:	≤ 40 ns (Ext trig in to pulse out)
Jitter:	± 15 ps (Ext trig in to pulse out)
DC offset option[3]:	Apply required DC offset to back-panel solder terminals (+50 Volts, 250 mA max)
Trigger required: (ext trig mode)	TTL (low = 0V, high = +3V to +5V), 50 ns or wider
Sync output:	+3 V, 50 ns, will drive 50Ω
Sync delay:	Sync out to pulse out, -C units only: Variable 0 to 200 ns
Monitor output option[4]:	Provides a 20 dB attenuated coincident replica of main output
Connectors:	Out, Monitor: SMA, Trig: BNC
Power requirement:	100 - 240 Volts, 50 - 60 Hz
Dimensions (HxWxD):	100 mm x 215 mm x 375 mm (3.9" x 8.5" x 14.8")
Chassis material:	Anodized aluminum, with gray plastic trim.
Temperature range:	+5°C to +40°C

1) -C suffix indicates stand-alone lab instrument with internal clock and line powering. (See http://www.avtechpulse.com/formats for additional details of the basic instrument formats).
2) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative) or -P-PN or -N-PN for dual polarity option where the suffix preceding -PN indicates the polarity at the mainframe output port.
3) For DC offset option add suffix -OS.
4) For monitor option add suffix -M.

EC DECLARATION OF CONFORMITY

We

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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

INSTALLATION

VISUAL CHECK

After unpacking the instrument mainframe and the transformer module, examine to ensure that they have 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.) The table below describes the power cord that is supplied with this instrument, depending on the destination region:

Destination Region	Description	Volex (http://www.volex.com) Part Number	Newark (http://www.newark.com) Stock Number
Continental Europe	European CEE 7/7 “Schuko” 230V, 50Hz	17850-C3-326	44F1841
United Kingdom	BS 1363, 230V, 50Hz	17962-C3-10	84F1025
Switzerland	SEV 1011, 230V, 50Hz	2102H-C3-10	93F2452
Israel	SI 32, 220V, 50Hz	2115H-C3-10	04F1115
North America, and all other areas	NEMA 5-15, 120V, 60 Hz	17250-B1-10	36F1255

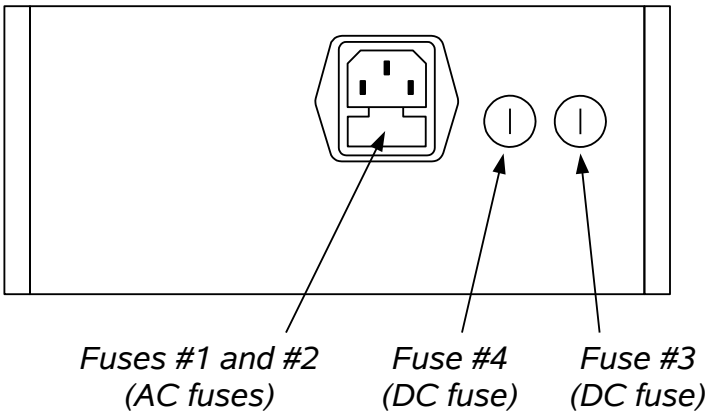
ENVIRONMENTAL CONDITIONS

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.

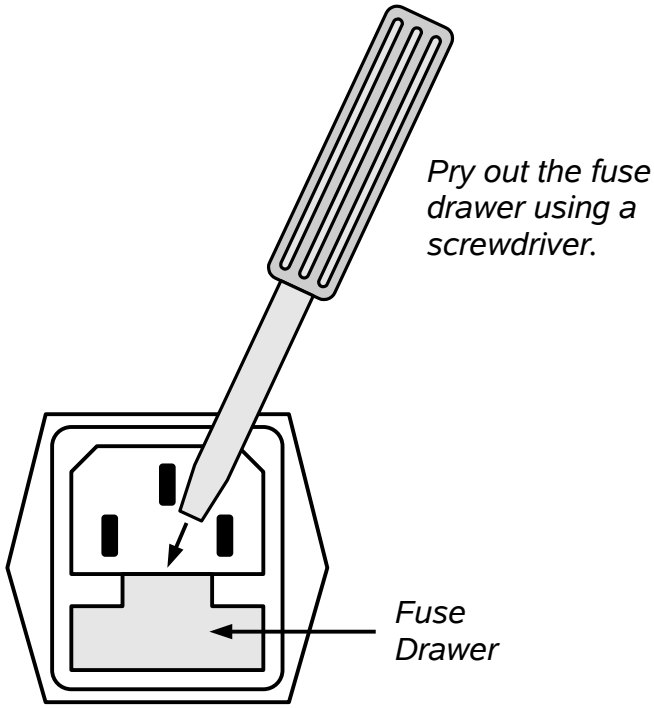
FUSES

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

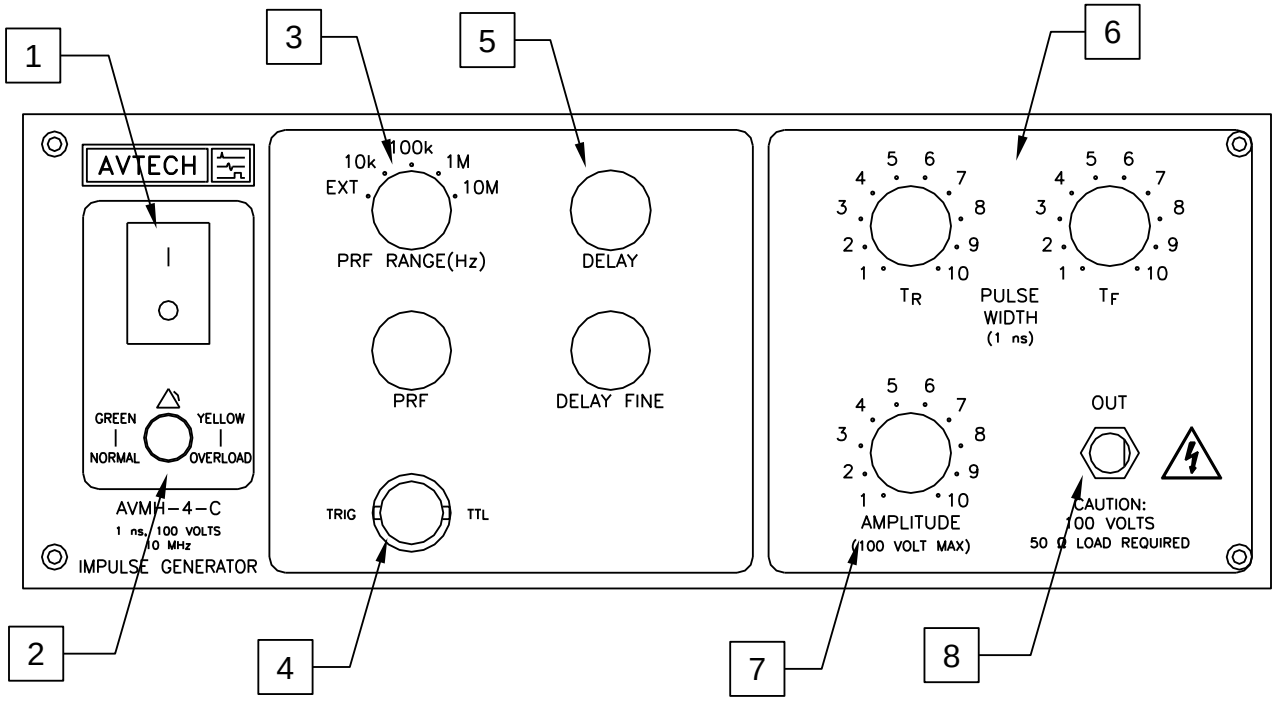
The following table lists the required fuses:

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	1.6A, 250V, Time-Delay	5×20 mm	1951160000	WK5053-ND
#4 (DC)	N/A	1.0A, 250V, Time-Delay	5×20 mm	1951100000	WK5048-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 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.

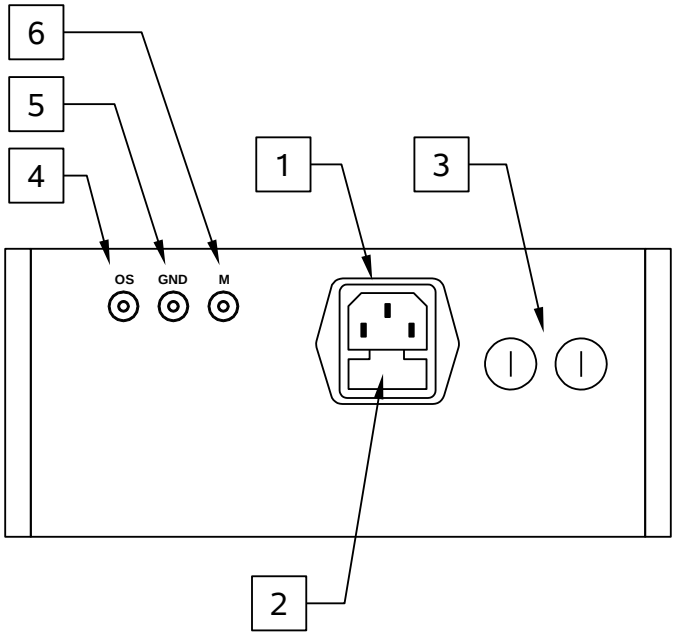
6. Pulse Width Controls. These two dials control the pulse width. The T_R dial determines the position of the impulse rising edge, and the T_F dial determines the position of the impulse falling edge. Used together, they control the pulse width. Clockwise rotation of the T_R control reduces the pulse width, while clockwise rotation of the T_F control increases the pulse width.

7. Amplitude Control. This dial controls the pulse amplitude.

8. OUT Connector. This is the main output. (This output *requires* a 50Ω load to function properly).

   ⚠ Caution: Voltages as high as ±100V may be present on the center conductor of this output connector. Avoid touching this conductor. Connect to this connector using standard coaxial cable, to ensure that the center conductor is not exposed.

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. OS INPUT CONNECTOR. (Present on units with -OS option only.) A DC offset in the range of ±50V (250 mA max) may be applied to this solder terminal. The DC offset will appear on the output. When this feature is not used, the OS input should be connected to ground (using the adjacent GND connector). This is especially important when driving loads containing a diode.

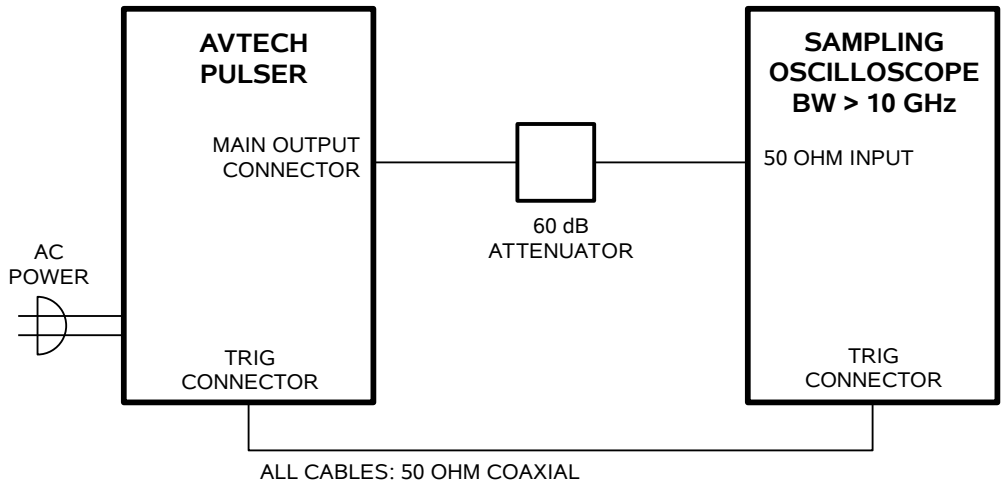
5. GND CONNECTOR. This solder terminal is connected to ground. It may be used to ground the OS input connector.

6. M OUTPUT CONNECTOR. (Present on units with -M option only.) This SMA connector output provides a 20 dB attenuated coincident replica of main output, for monitoring purposes.

GENERAL INFORMATION

BASIC TEST ARRANGEMENT

The AVMH-4-C should be tested with a sampling oscilloscope with a bandwidth of at least 10 GHz to properly observe the high-speed waveform. A typical test arrangement is shown below:



The attenuators are required to prevent damage to the sampling oscilloscope. A 60 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 TRIG.

- 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.

These pulses are illustrated below:

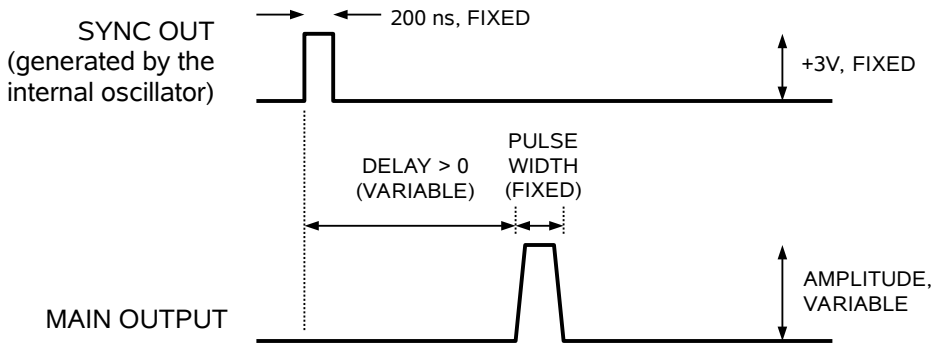


Figure A

The AVMH-4-C can also be triggered by a TTL-level pulse applied to the TRIG input.

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, $V_{SPIKE} = L \times dI_{LOAD}/dt$, 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 AVMH-4-C may fail if triggered at a PRF greater than 10 MHz.

To prolong instrument lifetime, avoiding operating near 10 MHz as much as possible. The internal thermal stresses are at their highest when operating near the maximum rated PRF of 10 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 before opening the instrument.

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.

⚠ Caution: High voltages are present inside the instrument during normal operation. Do not operate the instrument with the cover removed.

ELECTROMAGNETIC INTERFERENCE

To prevent electromagnetic interference with other equipment, all used outputs should be connected to shielded 50Ω loads using shielded 50Ω coaxial cables. Unused outputs should be terminated with shielded 50Ω 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.

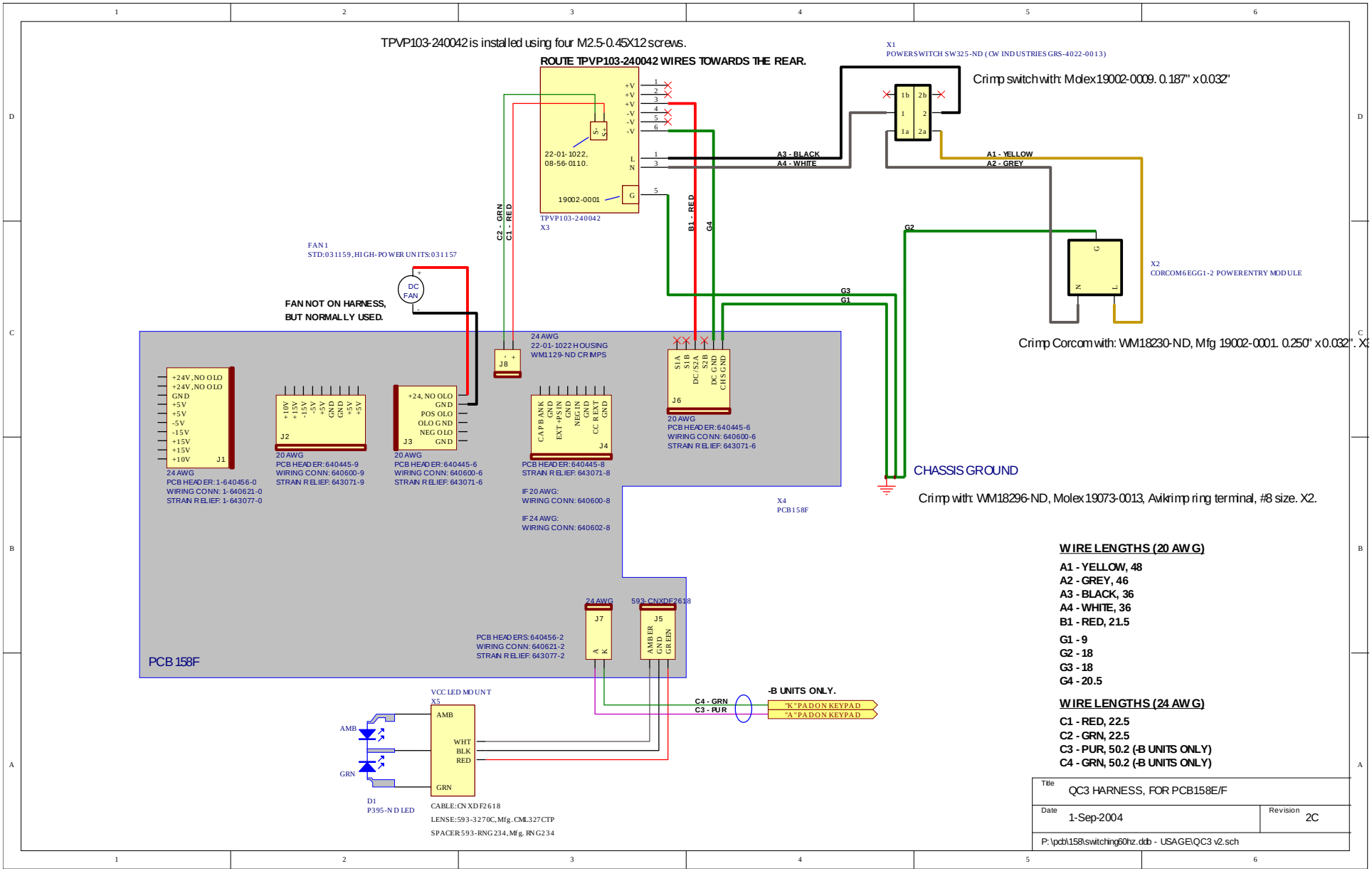
On occasion, one or more of the four rear-panel fuses may require replacement. All fuses can be accessed from the rear panel. See the “FUSES” section for details.

CLEANING

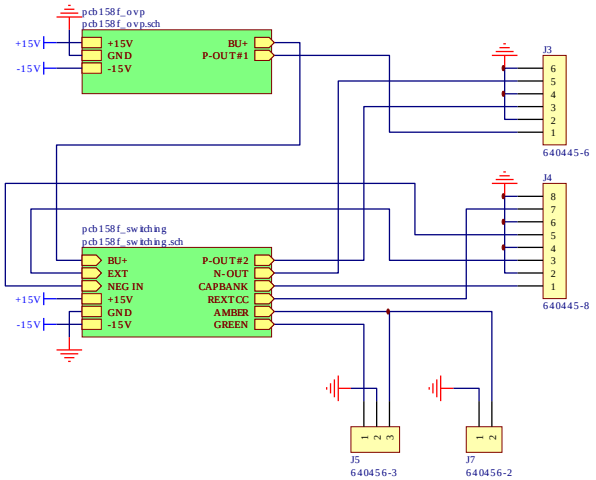
If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the “TOP COVER REMOVAL” section for instructions on accessing the interior.) No other cleaning is recommended.

WIRING DIAGRAMS

WIRING OF AC POWER



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



Title	LOW VOLTAGE DC/DC POWER SUPPLY
Date	15-Sep-2004
Revision	
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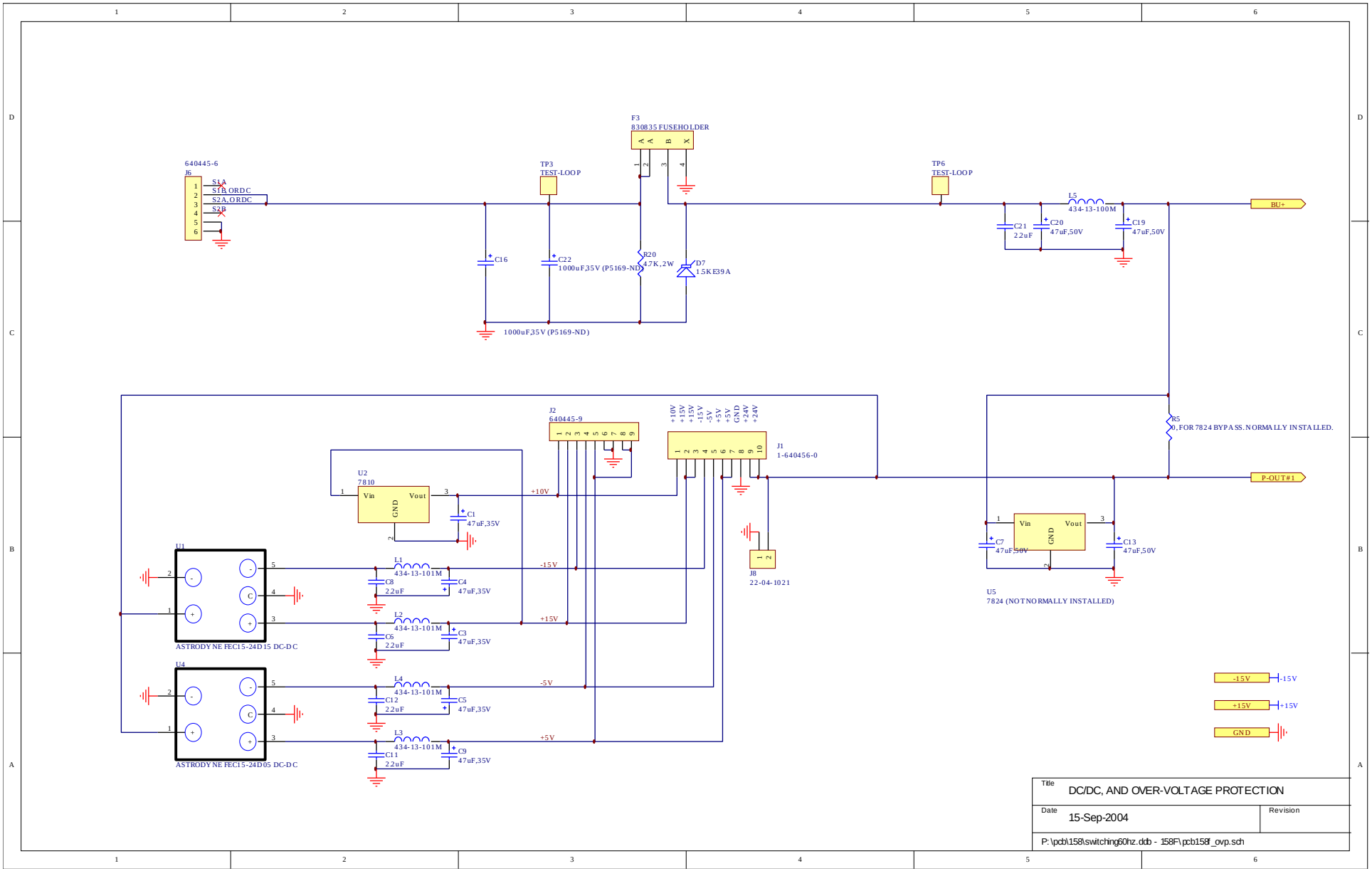
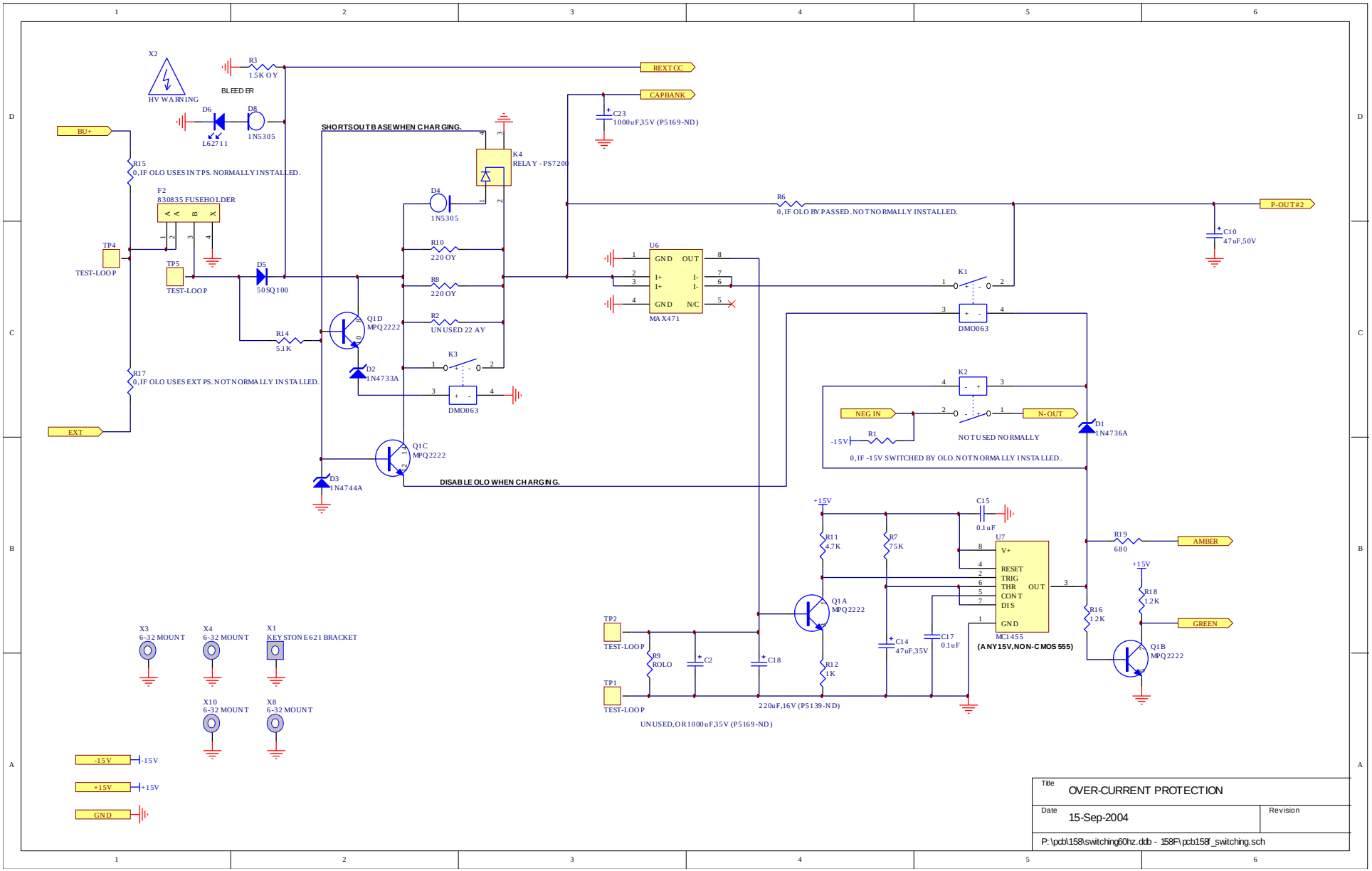
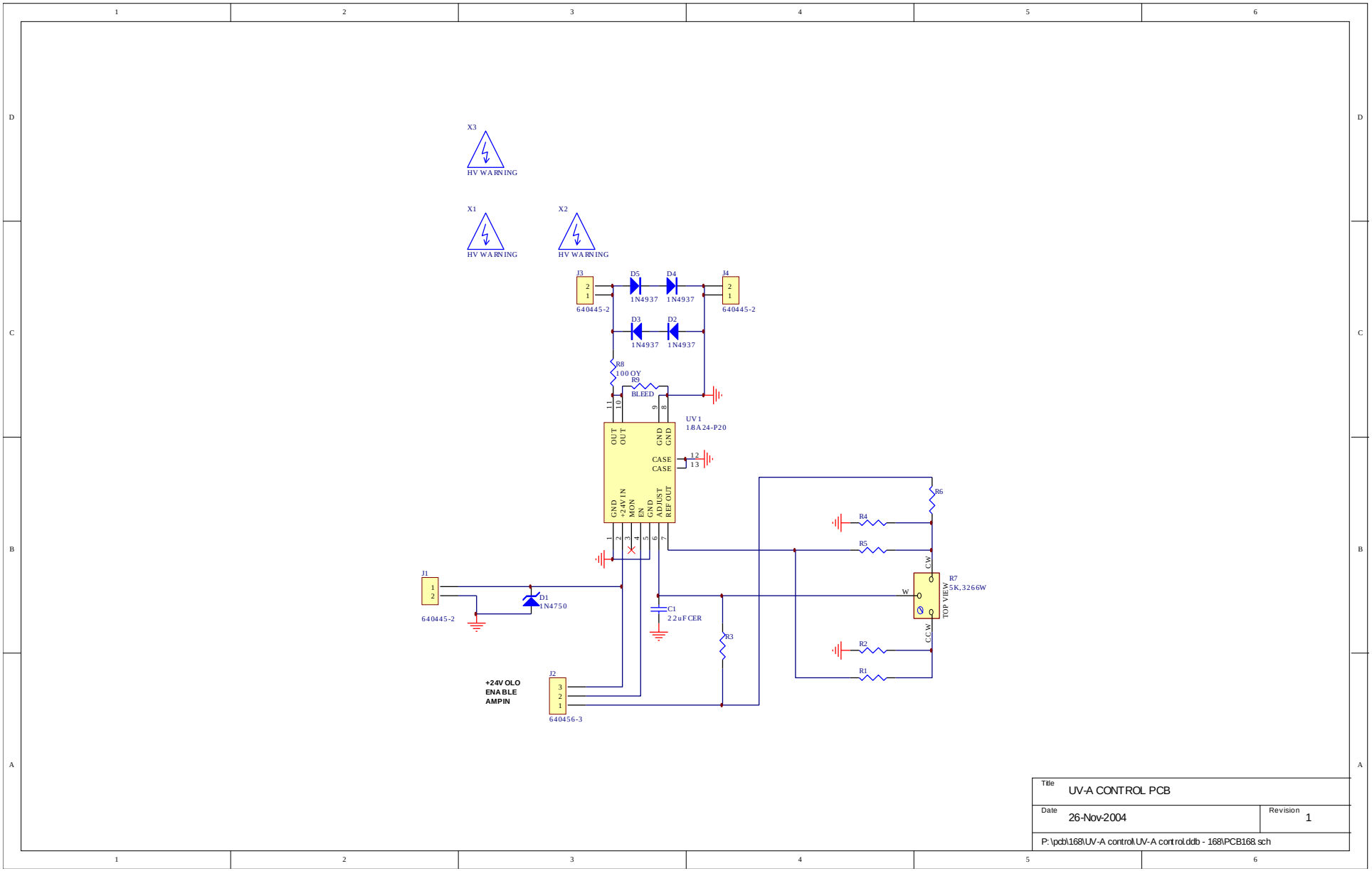
PCB 158F - LOW VOLTAGE POWER SUPPLY, 2/3



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

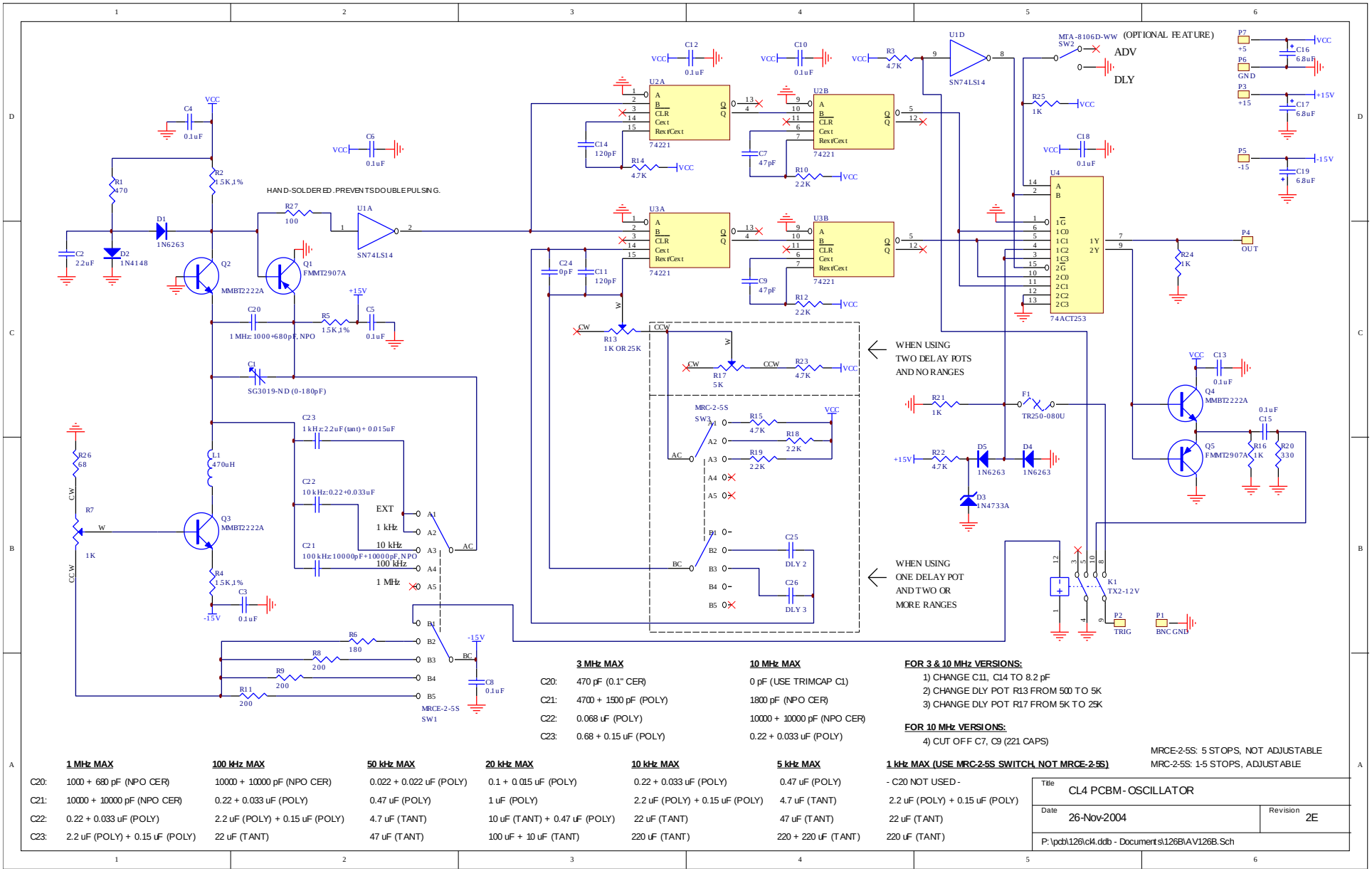


PCB 168 - HIGH-VOLTAGE POWER SUPPLY



Title	UV-A CONTROL PCB
Date	26-Nov-2004
Revision	1
P:\pcb\168\UV-A control\UV-A control.ddb - 168\PCB168.sch	

PCB 126B - OSCILLATOR AND TRIGGER CIRCUIT



	3 MHz MAX	10 MHz MAX
C20:	470 pF (0.1" CER)	0 pF (USE TRIMCAP C1)
C21:	4700 + 1500 pF (POLY)	1800 pF (NPO CER)
C22:	0.068 uF (POLY)	10000 + 10000 pF (NPO CER)
C23:	0.68 + 0.15 uF (POLY)	0.22 + 0.033 uF (POLY)

FOR 3 & 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 10 MHz VERSIONS:

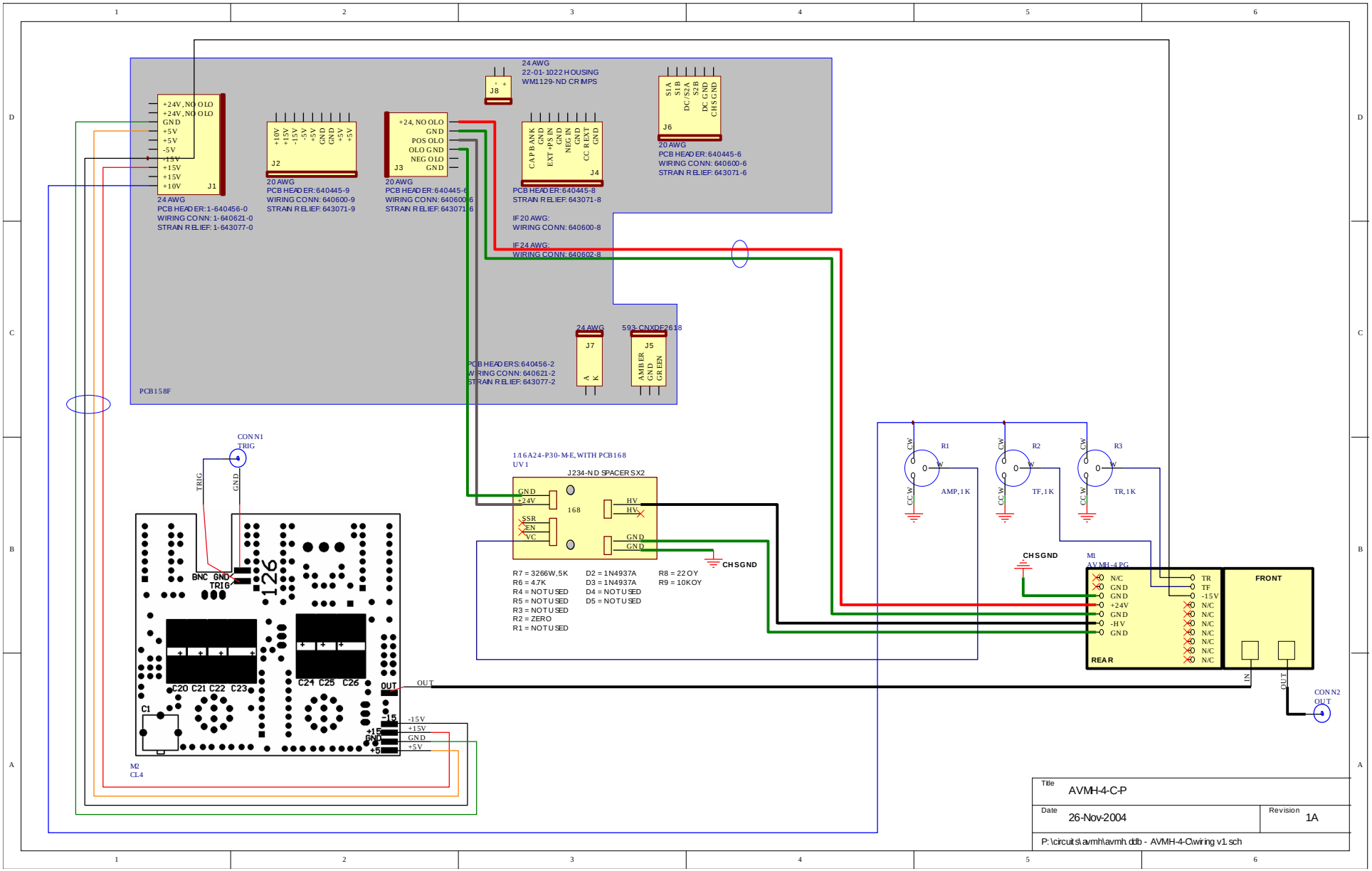
4) CUT OFF C7, C9 (221 CAPS)

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

	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)

Title	CL4 PCBM - OSCILLATOR
Date	26-Nov-2004
Revision	2E
	P: \pcb\126\cl4.ddb - Documents\126B\AV126B.Sch

MAIN WIRING - POSITIVE UNITS (-P)



PERFORMANCE CHECK SHEET