



AVTECH ELECTROSYSTEMS LTD.

NANOSECOND WAVEFORM ELECTRONICS  
SINCE 1975

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CANADA K2C 3H4  
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## INSTRUCTIONS

MODEL AV-151E-C-R5-ARD-STA

26 VRMS, 6.00 kHz  
FUNCTION GENERATOR

SERIAL NUMBER: 9434

### 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

Phone: 613-226-5772 or 1-800-265-6681

Fax: 613-226-2802 or 1-800-561-1970

E-mail: [info@avtechpulse.com](mailto:info@avtechpulse.com)

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

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Manual Reference: /files/officefiles/instructword/av-151-153/AV-151E-C-R5-ARD-STA,edition2.sxw.  
Last modified February 29, 2024.  
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## INTRODUCTION

The Model AV-151E-C-R5-ARD function generator can produce square, sine, and triangle wave outputs at a frequency of  $6000 \text{ Hz} \pm 5 \text{ Hz}$ , with an amplitude of 26 VRMS. (The  $\pm 5 \text{ Hz}$  tolerance includes both initial accuracy and long-term drift errors.) The instrument can drive load impedances of 65 Ohms or larger. The load may be connected to either the front-panel or rear-panel connectors, which are wired to the same points internally.

The amplitude may be adjusted over a narrow range for calibration purposes.

The sine-wave total harmonic distortion (THD) is less than 1.5%.

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

ORIGINAL QUOTATIONS & SPECIFICATIONSQUOTATION #1 (ORIGINAL)

April 13, 2000

To: Don Longworth  
Atlantic Research Corp.  
ph. 703-754-5130  
longworth@arceng.com

Don,

Following our telephone conversation on Wednesday, I am pleased to re-quote as follows for a special-purpose function generator:

Quote Number: 9831

Model Number: AV-151E-C-R5-ARD

Amplitude: 74 Volts peak-to-peak (i.e., 26 Volts RMS for a sine wave), adjustable  $\pm 10\%$  with back-panel ten-turn locking dial.

Load Impedance:  $> 65$  Ohms

Frequency: 6000 Hz, adjustable  $\pm 10\%$  with back-panel ten-turn locking dial.

Output Waveform: Sine, Square, Triangle. Selectable via a front-panel switch.

DC offset: none

External Trigger mode: none

Output Connectors: Two sets of OUT and GROUND connectors. One set is on the front panel; the second is on the rear panel. The two sets are wired to the same connections internally.

OUT: female banana post.

GROUND: female banana post.

The OUT and GROUND posts are separated by 0.75".

Overload: An automatic overload protection feature protects the output against short circuits. The circuit resets automatically.

Dimensions: 3.9" x 17" x 14.8"

Rack mounting: "-R5" rack-mount kit included

Power requirements: 107-124 Volts AC, 50-60 Hz.

Other: See AV-151 series data sheet at  
<http://www.avtechpulse.com/function>

Price: \$5,140.00 US, FOB destination

Delivery: 60 days

Please contact me if you require any further information.

Regards,  
Dr. Michael J. Chudobiak  
VP, New Product Development

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

PO Box 265	ph: 1-800-265-6681 or 613-226-5772	Box 5120 Stn. F
Ogdensburg, NY	fax: 1-800-561-1970 or 613-226-2802	Ottawa, Ontario
USA 13669-0265	email: info@avtechpulse.com	Canada K2C 3H4
	http://www.avtechpulse.com/	

Nanosecond Waveform Generators  
for general purpose, R&D and OEM applications

Pulse Generators - Laser Diode Drivers - Pulse Amplifiers  
Impulse Generators - Delay Generators - Comb Generators - Splitters  
Function Generators - Monocycle Generators - Frequency Dividers + more!  
-----

## QUOTATION #2 (-STA UPGRADE)

To: Don Longworth  
Atlantic Research Corp.  
ph. 703-754-5130  
longworth@arceng.com

Don,

in response to our telephone conversation yesterday, I am pleased to quote on the following upgrade for your AV-151E-C-R5-ARD function generator:

Quote Number: 10136

Part Number: "-STA" option for the AV-151E-C-R5-ARD function generator

Description: upgrades the internal oscillator to a high-stability version

Output Frequency: 6000 Hz, +/- 5 Hz (including drift). Non-adjustable.

Output Total Harmonic Distortion: < 1.5% (sine-wave output)

Price: \$1198 for each unit upgraded, FOB destination.

Delivery: 3 weeks after receipt of order and the instrument for upgrade

As noted above, the output frequency would no longer have the +/- 10% adjustability. It would be fixed at 6000 +/- 5 Hz.

If you wish to proceed with this upgrade, please return the unit(s) via prepaid shipping to the following address:

Avtech Electrosystems Ltd.  
C/O Strader-Ferris International  
808 Commerce Park Drive  
Ogdensburg, NY 13669

Tel: (315)394-0051 (Strader-Ferris Intl)

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

Regards,  
Dr. Michael J. Chudobiak  
VP, New Product Development

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Ogdensburg, NY	fax: 1-800-561-1970 or 613-226-2802	Ottawa, Ontario
USA 13669-0265	email: info@avtechpulse.com	Canada K2C 3H4
	<a href="http://www.avtechpulse.com/">http://www.avtechpulse.com/</a>	

Nanosecond Waveform Generators  
for general purpose, R&D and OEM applications

Pulse Generators - Laser Diode Drivers - Pulse Amplifiers  
Impulse Generators - Delay Generators - Comb Generators - Splitters  
Function Generators - Monocycle Generators - Frequency Dividers + more!

---

### QUOTATION #3 (REPAIR AND POWER SUPPLY UPGRADE)

Brad Shafter  
United States Air Force HILL AFB  
Bldg A-15 Freeport Center  
Clearfield, Utah, 84016

Brad,

I have quoted below for performing a basic repair on the AV-151E-C-R5-ARD-STA, and for a more extensive upgrade which involves replacing the internal AC power supply. Our current AC power supply design is more efficient, rugged and flexible, and has a "universal" input range of 100-240V. In the past, a different unit with the same model number (AV-151E-C-R5-ARD-STA, S/N 9433) was returned to us because it was damaged by AC inputs outside of the specified 120/240 +/- 10% range. The wider input range of the new design would greatly reduce the



likelihood of damage from unusual AC input conditions.

I am pleased to quote as follows:

Quote number: 12503.01

Task: Evaluate and/or repair Model AV-151E-C-R5-ARD-STA (S/N 9434 MOD 1). Keep the existing internal AC power supply.

Price: \$698, Ex-works, Ottawa, Canada.

Time to repair: 1 week at the factory.

Quote number: 12503.02

Task: Evaluate and/or repair Model AV-151E-C-R5-ARD-STA (S/N 9434 MOD 1), and upgrade the AC power supply from the existing 120/240V linear-circuit design to the most recent 100-240V universal input switching power supply design.

Price: \$1298, Ex-works, Ottawa, Canada.

Time to repair: 1 week at the factory.

To proceed with repair, please return the instrument via prepaid shipping to the following address:

Avtech Electrosystems Ltd.  
C/O Strader-Ferris International  
808 Commerce Park Drive  
Ogdensburg, NY 13669

Tel: (315)394-0051 (Strader-Ferris Intl)

Please package the instrument very carefully! Please use the original packing box, if possible, as it is designed to minimize the possibility shipping damage. Damage incurred during shipping may increase the repair cost.

The RMA number is the same as the serial number, 9434 (MOD 1). The return shipment will be sent via FedEx. The shipping charges will be added to our invoice.

A purchase order, or credit card payment information, is required to process the repair. Please fax the purchase order to 800-561-1970, or provide the credit card details to Mary Budarick at 800-265-6681 (telephone).

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

Regards,  
 Dr. Michael J. Chudobiak  
 Chief Engineer

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PO Box 265	ph: 1-800-265-6681 or 613-226-5772	Box 5120,
Ogdensburg,	fax: 1-800-561-1970 or 613-226-2802	LCD Merivale
New York	email: info@avtechpulse.com	Ottawa, Ontario
USA 13669-0265	http://www.avtechpulse.com/	Canada K2C 3H4

Nanosecond Waveform Generators  
 for general purpose, R&D and OEM applications

Pulse Generators - Laser Diode Drivers - Pulse Amplifiers  
 Impulse Generators - Current Pulsers - Delay Generators - Splitters  
 Function Generators - Monocycle Generators - Frequency Dividers + more!

---

russell.shafter@hill.af.mil wrote:

```
> This RMA request has been submitted from the Avtech web site:
>
>
> Instrument Information
> -----
>     Model Number: AV-151E-C-R5-ARD-STA
>     Serial Number: 9434 (MOD 1)
>     Reason for Return: No output on PG module.  Needs repair.
>
> End-User Contact Information
> -----
>     Name: Brad Shafter
>     Phone: 801-774-2467
>     Fax: 801-525-9448
>     Email: russell.shafter@hill.af.mil
>
> Buyer Contact Information
> -----
>     Name: Brad Shafter
>     Phone: 801-774-2467
>     Fax: 801-525-9448
>     Email: russell.shafter@hill.af.mil
>
> Return Shipping Instructions
> -----
>     Carrier: FedEx
>     Account Number: Account number unavailable.
>     Other Instructions: Attach shipping costs to repair bill please.
>
> Return Shipping Address
> -----
>     Attn: Brad Shafter
>     Company: United States Air Force HILL AFB
>     Address: Bldg A-15 Freeport Center
>     City: Clearfield
```

> State/Province: Utah  
> Country: USA  
> Zip/Postal Code: 84016  
>

## INSTALLATION

### VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, and handles. Confirm that a power cord and a rack-mount kit 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 90 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 ( <a href="http://www.volex.com">http://www.volex.com</a> )	17850-C3-326
United Kingdom	BS 1363, 230V, 50Hz	Volex ( <a href="http://www.volex.com">http://www.volex.com</a> )	17962-C3-10
Switzerland	SEV 1011, 230V, 50Hz	Volex ( <a href="http://www.volex.com">http://www.volex.com</a> )	2102H-C3-10
Israel	SI 32, 220V, 50Hz	Volex ( <a href="http://www.volex.com">http://www.volex.com</a> )	2115H-C3-10
North America, and all other areas	NEMA 5-15, 120V, 60 Hz	Volex ( <a href="http://www.volex.com">http://www.volex.com</a> )	17250-B1-10
		Qualtek ( <a href="http://www.qualtekusa.com">http://www.qualtekusa.com</a> )	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

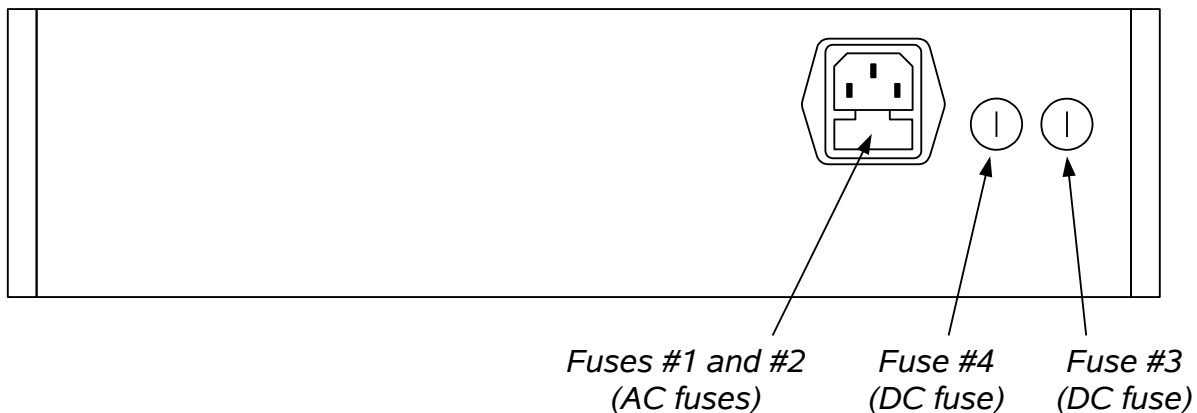
This instrument is intended for use under the following conditions:

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  $\pm 10$  % of the nominal voltage;

6. no pollution or only dry, non-conductive pollution.

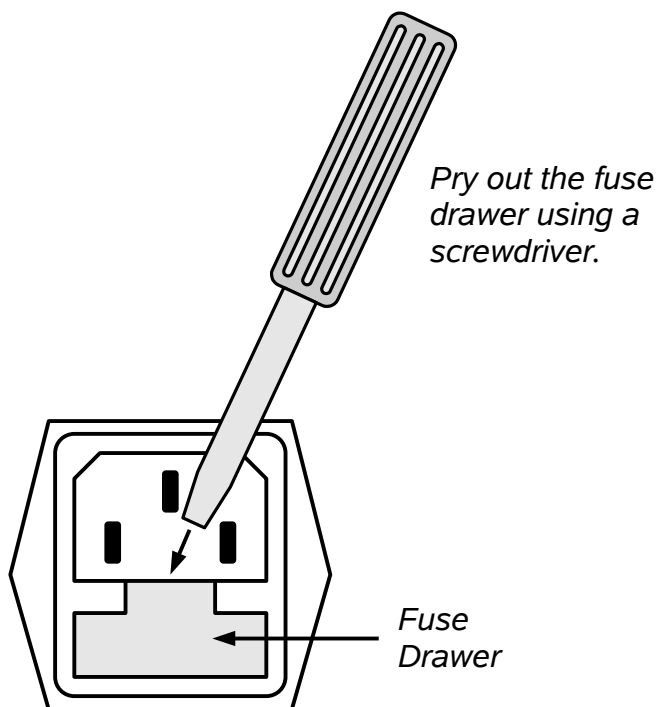
## FUSES

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:

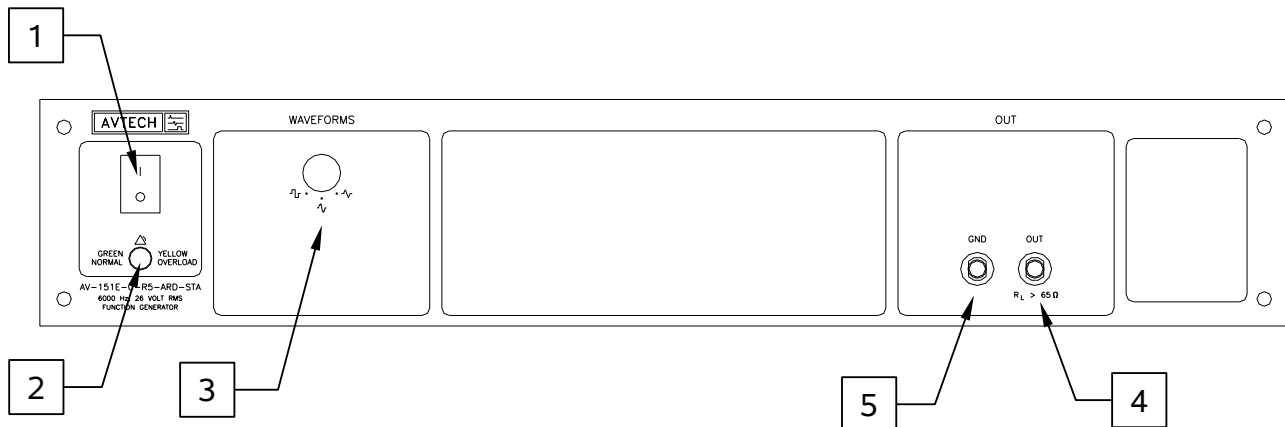
Fuses	Nominal Mains Voltage	Rating	Case Size	Manufacturer's Part Number (Wickmann)	Distributor's Part Number (Digi-Key)
#1, #2 (AC)	115 V	0.8A, 250V, Time-Delay	5×20 mm	1950800000	WK5046-ND
	230 V	0.5A, 250V, Time-Delay	5×20 mm	1950500000	WK5041-ND
#3 (DC)	N/A	2.0A, 250V, Time-Delay	5×20 mm	1951200000	WK5057-ND
#4 (DC)	N/A	1.6A, 250V, Time-Delay	5×20 mm	1951160000	WK5053-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



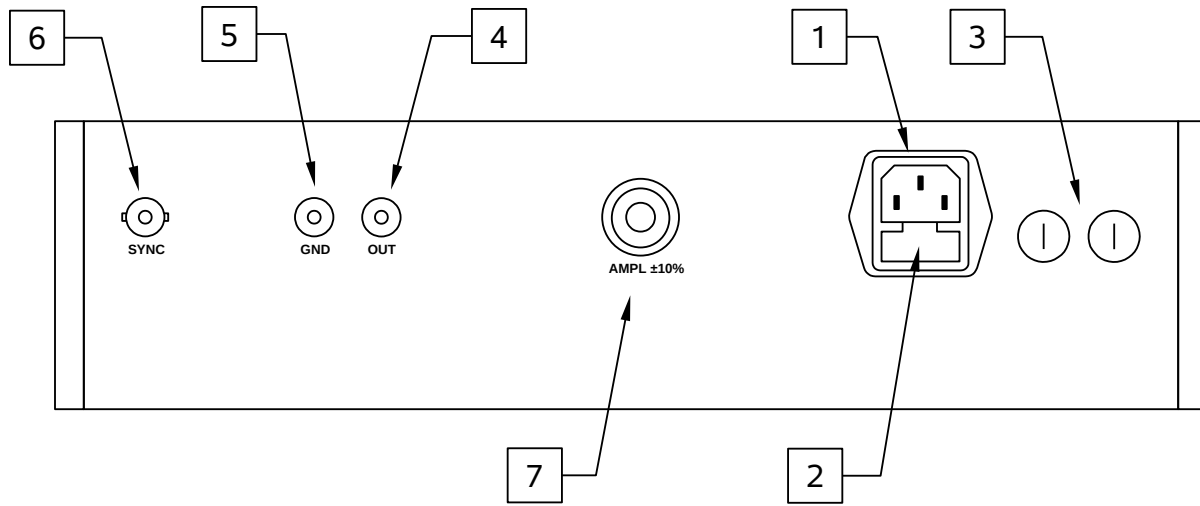
1. POWER Switch. This is the main power switch. When turning the instrument on, there may be a delay of several seconds before the instrument appears to respond.
2. OVERLOAD Indicator. When the instrument is powered, this indicator is normally green, indicating normal operation. If this indicator is 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.

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

3. WAVEFORM Switch. This 3-position switch selects between square, sine or triangular output at the main output.
4. OUT Connector. This red banana post connector provides the main output signal. The rear-panel OUT connector provides the same signal. The two connectors are wired to the same point internally.
5. GND Connector. This black banana post connector is connected to ground.

## REAR PANEL CONTROLS

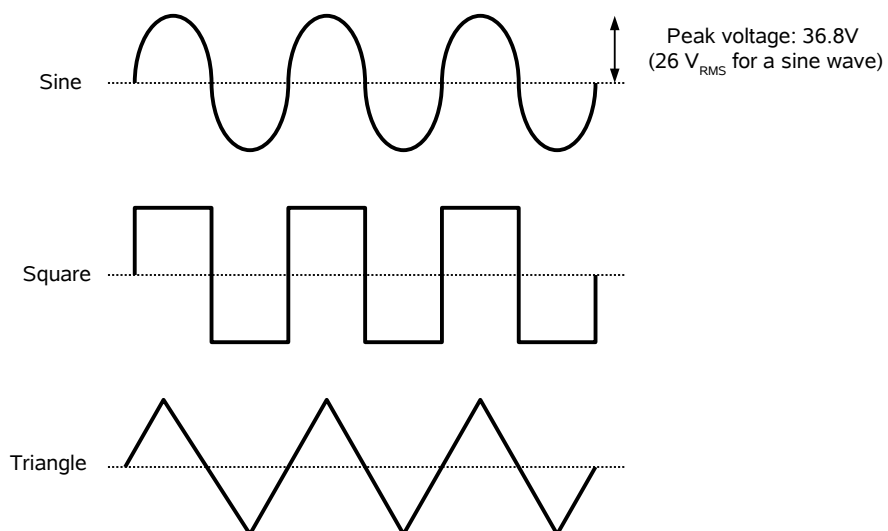


1. AC POWER INPUT. An IEC-320 C14 three-pronged recessed male socket is provided on the back panel for AC power connection to the instrument. One end of the detachable power cord that is supplied with the instrument plugs into this socket.
2. AC FUSE DRAWER. The two fuses that protect the AC input are 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. OUT Connector. This red banana post connector provides the main output signal. The front-panel OUT connector provides the same signal. The two connectors are wired to the same point internally.
5. GND Connector. This black banana post connector is connected to ground.
6. SYNC Connector. This connector provides a bipolar square wave signal, for triggering oscilloscopes or other test equipment. The output is (approximately)  $\pm 10\text{V}$ , with a  $470\Omega$  output impedance. When driving a  $50\Omega$  load, an amplitude of approximately  $\pm 1\text{V}$  can be expected. This output is short-circuit protected.
7. Amplitude Adjust. The output amplitude is nominally  $26\text{ V}_{\text{RMS}}$ . This ten-turn locking dial can be used to adjust the output amplitude within a  $\pm 10\%$  range, approximately, for calibration purposes.

## GENERAL INFORMATION

### BASIC PULSE CONTROL

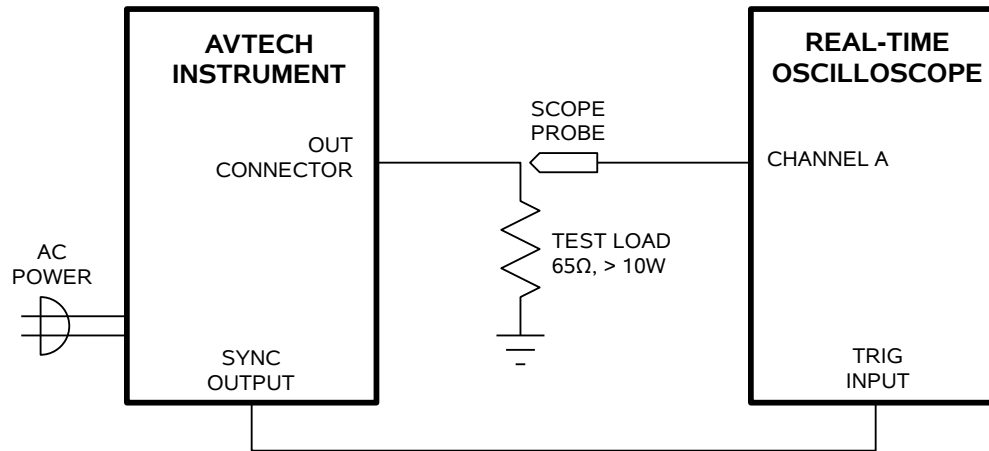
Instrument operation is straightforward. The output may be set to be a triangle, sine, or square wave, as illustrated below:



The minimum load resistance is 65 Ohms. The output signal may be obtained from the front or rear connectors, as desired.

## 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.



*Basic Test Arrangement*

1. Connect a 10W or greater, 65Ω test load between the OUT connector and ground.
2. Connect a cable from the SYNC OUT connector to the TRIG input of an oscilloscope. Set the oscilloscope to trigger externally.
3. Connect one oscilloscope probe (channel A) to the OUT load. On the oscilloscope, set the channel A vertical scale to 20 V/div, and the horizontal scale to 50 us/div.
4. Turn on the AV-151E-C-R5-ARD.
5. Set the waveform switch to the sine wave position.
6. Observe the oscilloscope. You should see a sine wave with a 166.7 us period, and 73.6V peak-to-peak amplitude.
7. Observe the waveform as you switch between the sine, triangle, and square wave modes using the waveform switch.

This completes the operational check.


If additional assistance is required:

Tel: (613) 226-5772, Fax: (613) 226-2802  
Email: [info@avtechpulse.com](mailto:info@avtechpulse.com)


## 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

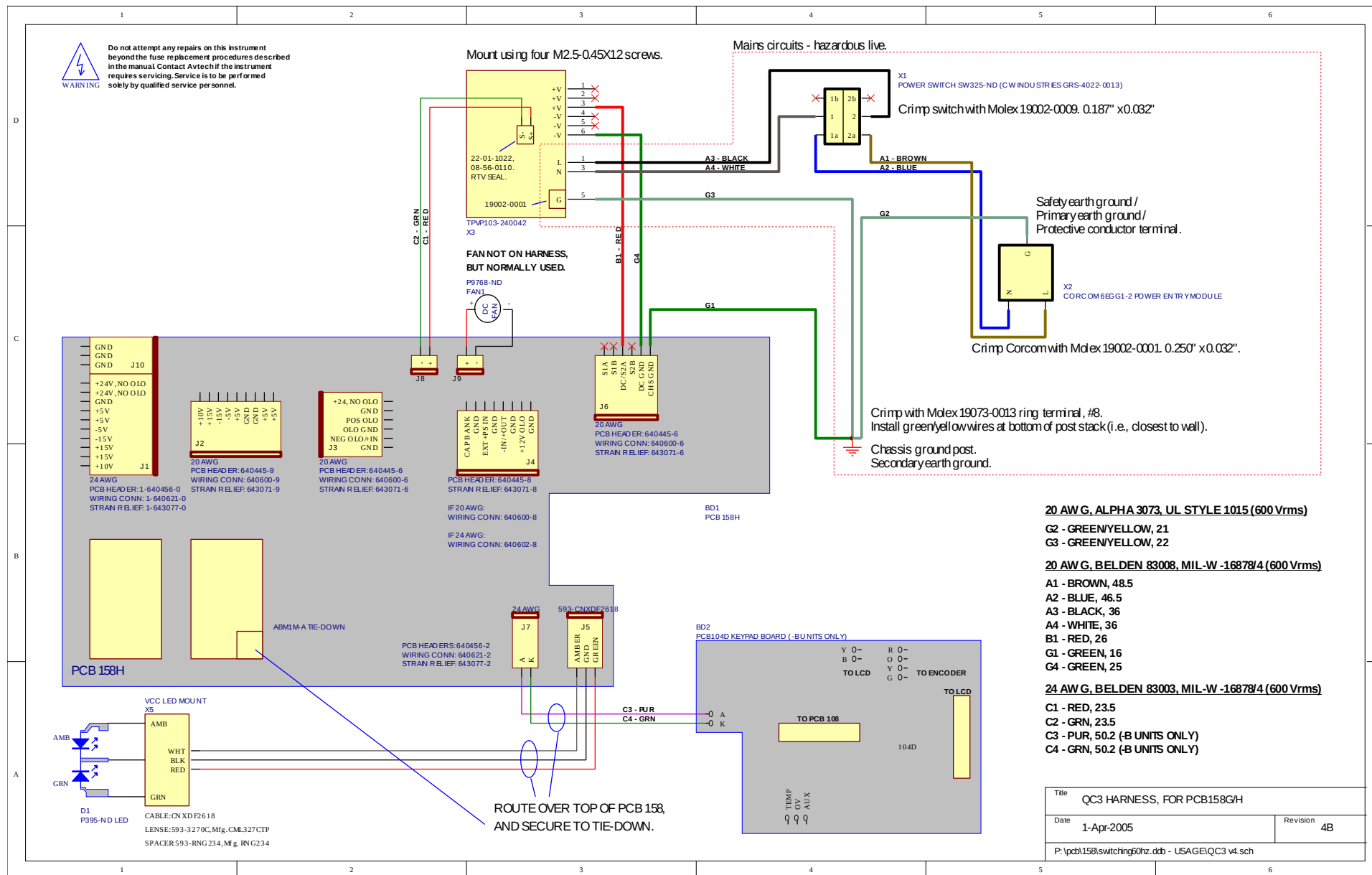
If desired, the interior of the instrument may be cleaned using compressed air to dislodge any accumulated dust. (See the “TOP COVER REMOVAL” section for instructions on accessing the interior.) No other cleaning is recommended.

### CALIBRATION

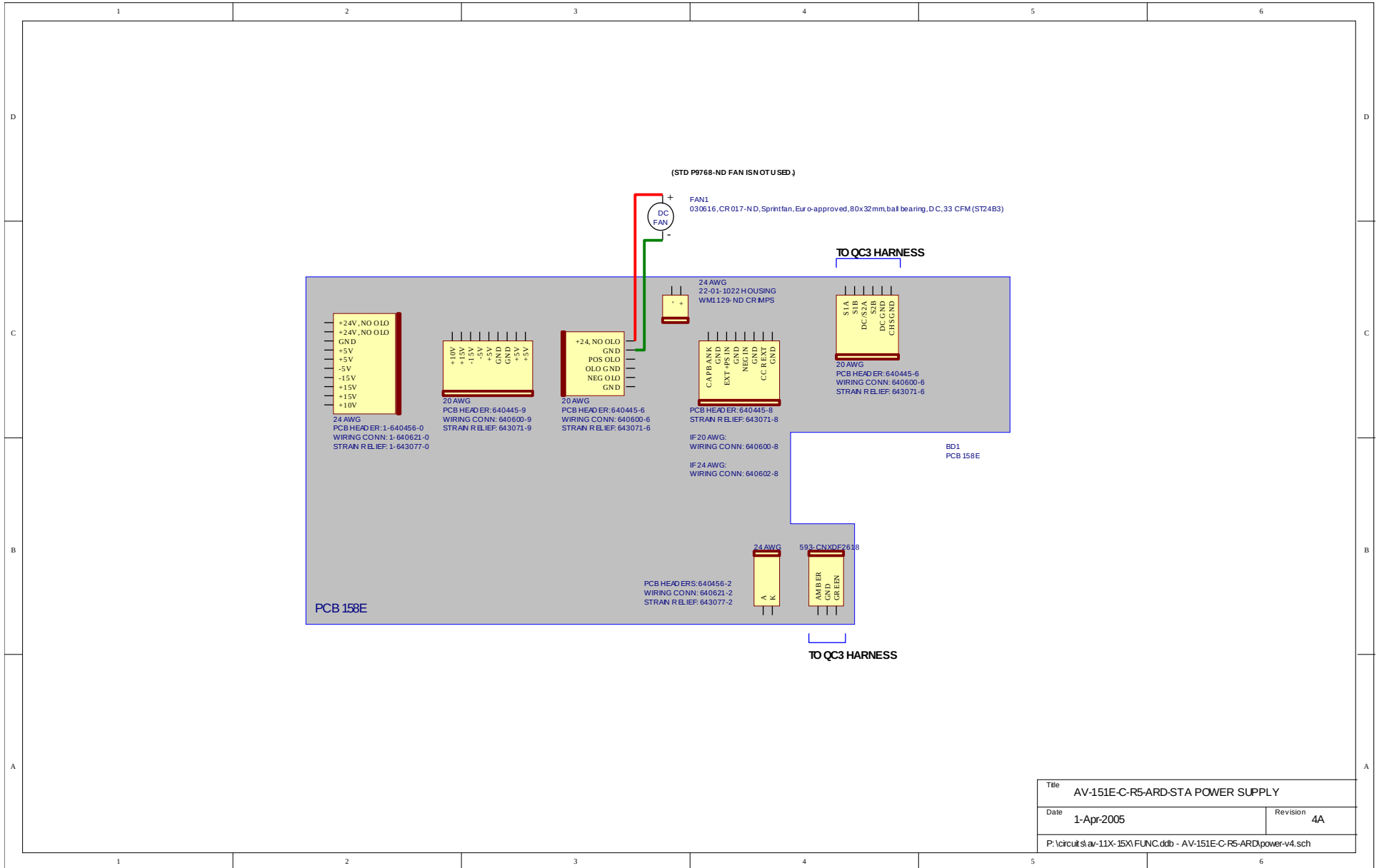
The output amplitude may be adjusted within a  $\pm 10\%$  range using the “AMPL  $\pm 10\%$ ” locking dial described in the “REAR PANEL CONTROLS” section. The output frequency is not adjustable.

# WIRING DIAGRAMS

## WIRING OF AC POWER 1/2



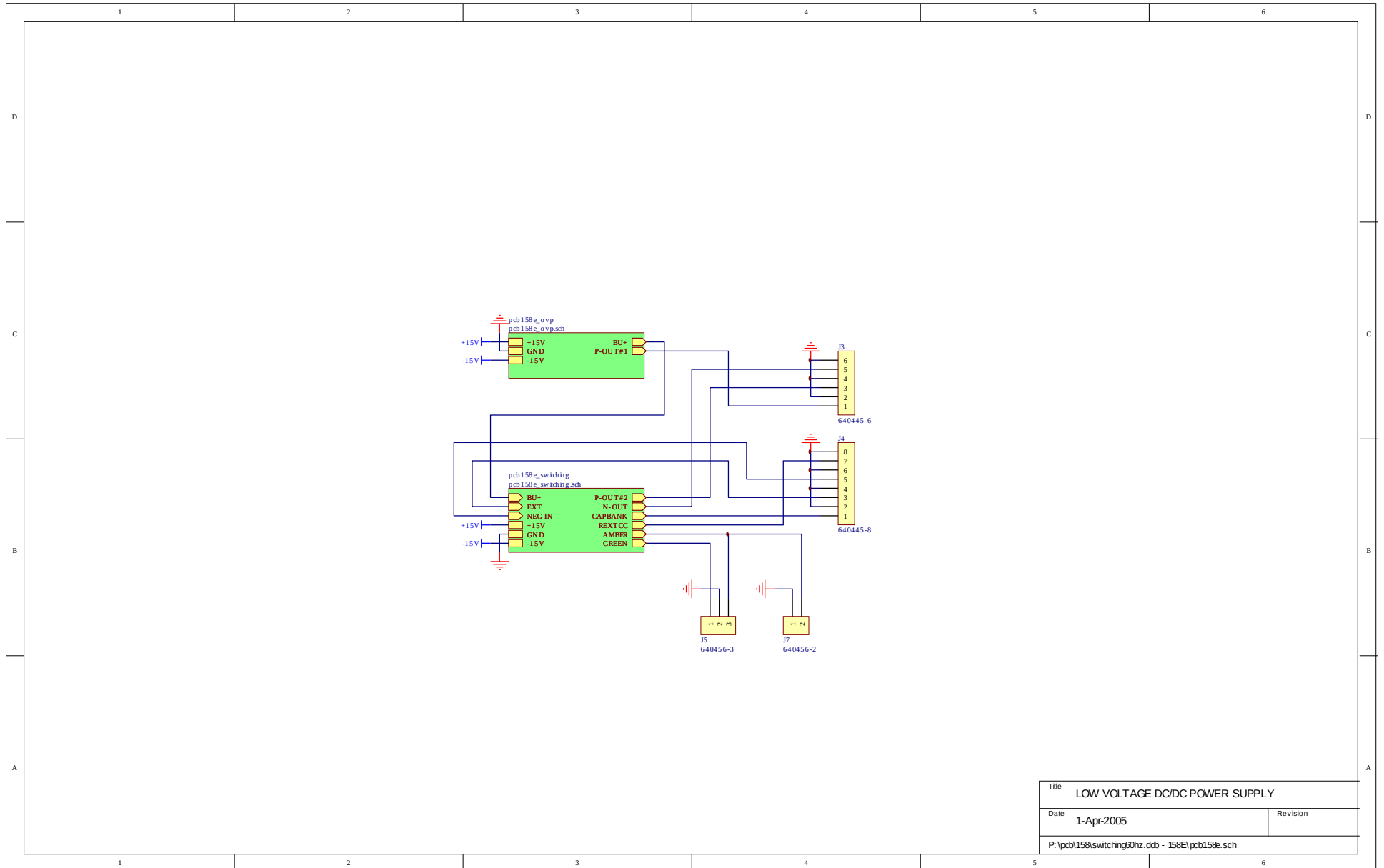
# WIRING OF AC POWER 2/2



Title AV-151E-C-R5-ARD-STA POWER SUPPLY	
Date 1-Apr-2005	Revision 4A
P:\circuit\st-av-11X-15X\FUNC.dtb - AV-151E-C-R5-ARD\power-v4.sch	

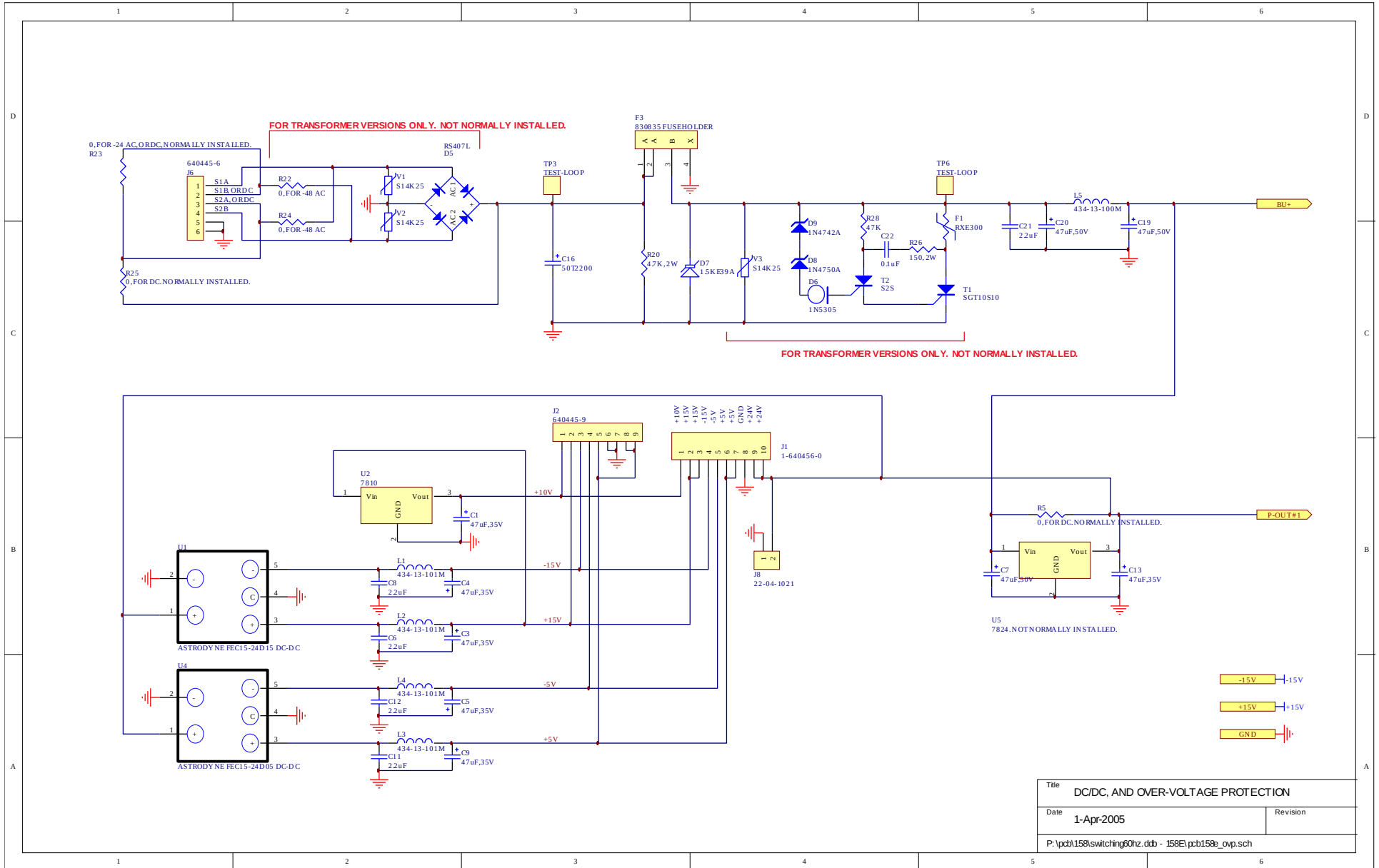


# PCB 158E - LOW VOLTAGE POWER SUPPLY, 1/3

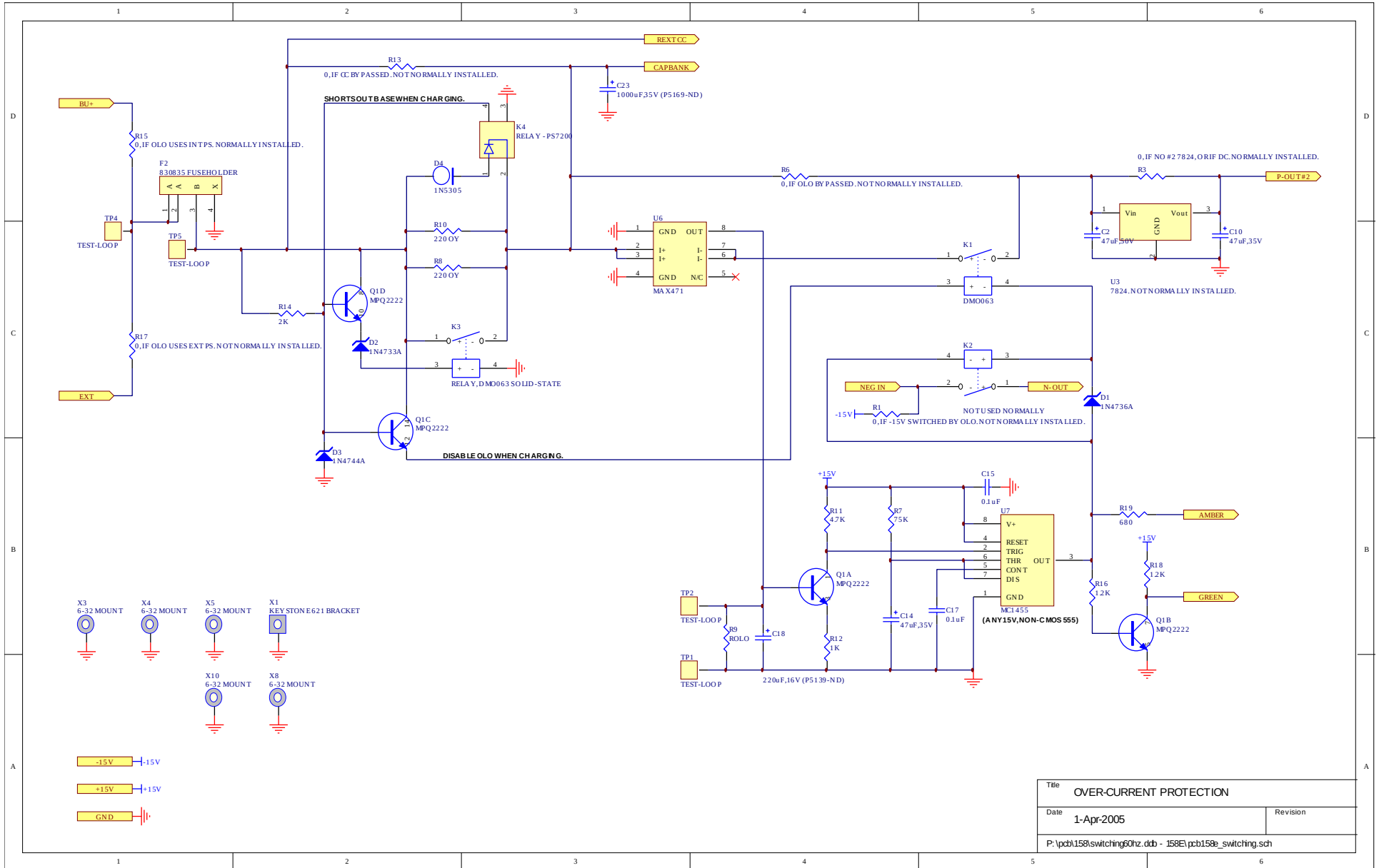


Title		LOW VOLTAGE DC/DC POWER SUPPLY
Date	1-Apr-2005	Revision
P:\pcb\158\switching60hz.ddb - 158E.pcb158e.sch		

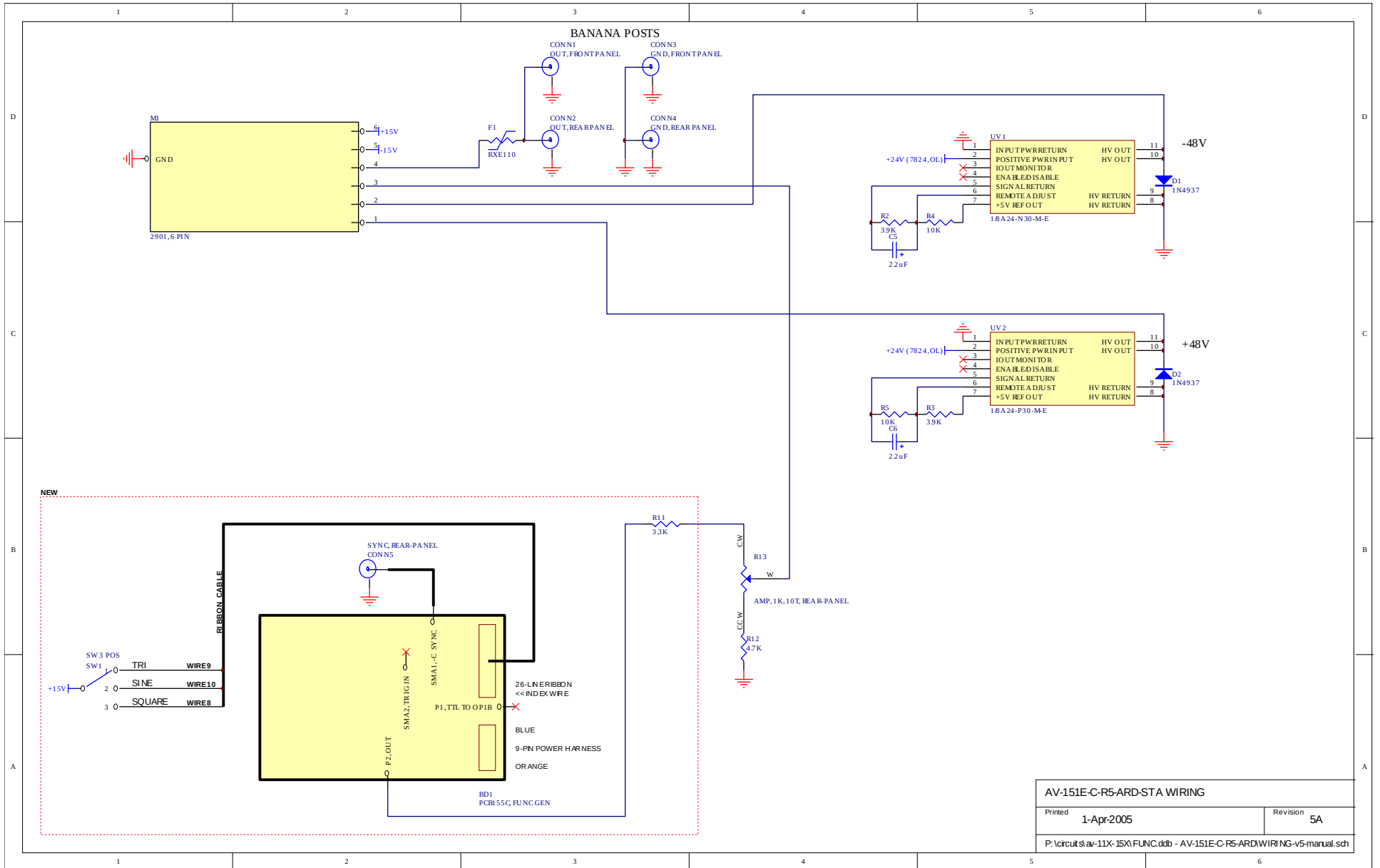
# PCB 158E - LOW VOLTAGE POWER SUPPLY, 2/3



# PCB 158E - LOW VOLTAGE POWER SUPPLY, 3/3



# MAIN WIRING



AV-151E-C-R5-ARD-STA WIRING	
Printed 1-Apr-2005	Revision 5A
P:\circuit\st\av-11x-15x\FUNC.cdb - AV-151E-C-R5-ARD\WIRING-v5-manual.sch	

PERFORMANCE CHECK SHEET