

**OPERATING & MAINTENANCE
INSTRUCTION MANUAL
MODEL 387
MAGNETIC REPRODUCE ELECTRONICS**



**INOVONICS
INCORPORATED**

USER'S RECORD

Model 387 - Serial No. _____

Date Purchased: _____

Warranty Card Sent _____

Purchased From: _____

INSTRUCTION MANUAL

MODEL 387

MAGNETIC REPRODUCE ELECTRONICS

August, 1984



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I. GENERAL INFORMATION

The Inovonics 387 is an audio reproduce-only electronics for playback of magnetic tape and film. It is modular in concept; a chassis with power supply accommodates from one to four plug-in channel amplifier modules.

Features of the 387 include:

Operation as mono, stereo, 3- or 4-channel reproduce amplifier. Additional chassis may be slaved for multi-track systems.

Wide range equalization with three sets of LEVEL, LOW FREQUENCY, HIGH FREQUENCY and GAP LOSS adjustments.

Front-panel or remote selection of level and EQ setups.

Multi-turn LEVEL control may be switched in when deviation from the calibrated gain is required.

Accommodates a wide range of head impedances.

II. SPECIFICATIONS

Performance of any magnetic reproducing system obviously depends to a major extent on the quality of the reproduce heads. The electronics rarely limit frequency response, and even signal-to-noise ratio is affected by a number of head efficiency parameters.

The one-quarter-inch, two track format used to obtain operating specifications indicates expected performance of a two- or multi-track tape system with 70-80 mil track width. The heads used were manufactured by Saki Magnetics, Culver City, CA, and are of ferrite construction.

Frequency Response (in Hz):

30ips	±1dB, 45 - 25k
15ips	±1dB, 25 - 22k
7-1/2ips	±1dB, 20 - 20k
3-3/4ips	±2dB, 20 - 16k

Signal-to-Noise Ratio (in dB, referred to a "peak" record level 6dB above 250nW/m; 20Hz - 20kHz):

30ips	79 unweighted	86 "A" weighted
15ips	75 "	84 "
7-1/2ips	75 "	84 "
3-3/4ips	72 "	80 "

Equalization: Accommodates NAB, IEC, AES or mixed characteristics for 3-3/4 through 30ips; 16 and 35mm SMPTE film.

Head Impedance Range: 3mH to 1H; 500mH optimum.

Line Output: "Electronically-balanced" May be adjusted for nominal line levels between 0 and +10dBm; clipping level +24dBm into 600-ohm load, +27dBmV into bridging inputs. LEVEL TRIM control affords -6, +12dB variation from calibrated gain.

Power Requirements: 105 - 130VAC (230V available), 50 / 60Hz; 10 watts (plus transport power requirement if transport derives AC power from the electronics.

Size and Shipping Weight (with four plug-in amplifier modules):
3-1/2" X 19" X 7"; 14 lbs.

Ordering Information:

- 387-00 Chassis with Power Supply only.
- 387-10 Plug-in Reproduce Module; single channel only.
- 387-20 Blanking Panel to cover unused module spaces in chassis.

III. INSTALLATION

Unpacking and Inspection

Upon receipt, promptly inspect the equipment for shipping damage. Should any be observed, notify the carrier; if not, proceed as outlined below. It is suggested that the original shipping carton and materials be retained for future reshipment if it should become necessary. In the event of return for repair under terms of the Warranty, damage sustained as a result of improper repacking may invalidate the Warranty.

It is essential that the Warranty Registration card found at the front of this manual be completed and returned. This assures coverage of the equipment under terms of the Warranty, and the user is automatically sent any specific servicing or modification information when issued.

Mounting

The 387 is packaged to mount in a standard 19-inch equipment rack or recorder overbridge with EIA mounting provision. Each chassis requires 3-1/2 inches of vertical rack space and about 8 inches of cabinet depth to accommodate back-panel connectors.

Connection

The 387 has a captive power cord which plugs directly into an AC receptacle. Alternately, the AC plug can be replaced with another connector which mates with a source of AC power provided by the transport.

The 6-pin "Jones" TRANSPORT connector on the rear panel can supply up to 5 amperes of switched AC power if the 1/2A fuse normally supplied with the 387 is replaced with one of higher value.

Line Output

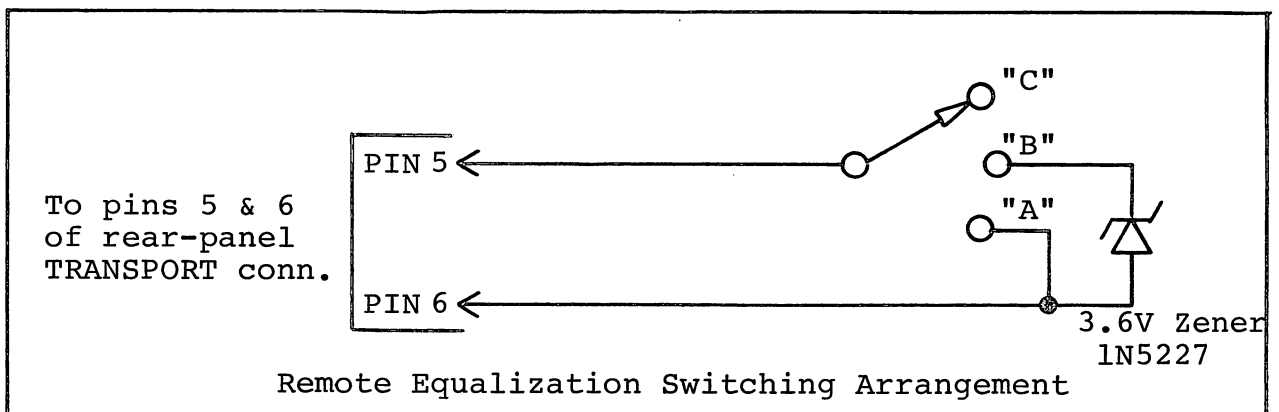
As delivered, the 387 is calibrated to operate at a +4dBm line level corresponding to "zero-VU." Operation at other line levels can be accommodated; see section IV, pages 7 through 8, for level setting procedure and adjustment of panel meter calibration.

The characteristic output impedance of the 387 is 200 ohms. This will feed both 600-ohm terminating loads and bridging inputs; nevertheless, the 387 should be connected to its intended load prior to final calibration.

When feeding unbalanced, single-ended inputs, use the "high" side of the output (pin 3) and ground (pin 1). Do not ground the unused, "low" side (pin 2).

Remote Equalization Selection

When an EQUALIZATION button is depressed slightly so that all three buttons are "out," equalization selection is transferred to the rear panel TRANSPORT connector. The required switching arrangement, diagrammed below, may be multiplied to other 387's for simultaneous, multi-channel remote EQ selection. The front panel EQUALIZATION selector overrides remote commands.



Reproduce Head Matching

The 387 accommodates reproduce heads from a nominal high impedance, typically 200mH to 1H, to low impedance with values between 3 and 10mH. The reproduce amplifier input characteristic is selected by a set of four circuit board terminals below the head connector. These are labeled A, B, C and D.

Without jumpers, the 387 accepts high output, high impedance heads as encountered in Ampex 350-series or Scully 280-series full-track tape machines. Some heads in the Hi-Z category may require additional amplifier gain. These heads may be two-track, have even a narrower track format, or merely have fewer windings. Need for more gain will quickly be determined during the Calibration Procedure (page 7) when it is found that the LEV calibrate pots cannot be turned up quite far

enough. The additional gain required by heads of lower output, but still of nominal high impedance, is obtained by installing a jumper between terminals A and B.

Many film recorder / reproducers utilize heads of "medium" impedance in the 20 - 80mH range. Depending on head efficiency, these are treated as either Hi-Z or Low-Z situations.

Low impedance heads, as found on the Ampex 440-series tape recorders and on film equipment, often employ an impedance-matching, step-up transformer. The 387 uses a transformerless approach for accommodating these heads, enabled by strapping circuit board terminals A, B and C. Again, should additional gain be required, the jumper may be extended to include A, B, C and D.

It should be noted that the noise specification of the 387 used with low impedance heads will be somewhat inferior to that obtained with heads of higher inductance, particularly with respect to pickup of stray AC hum fields. Heads in the 400 to 600mH range are recommended for new installations.

Recommended Reading

The Standard Tape Manual, By Robert K. Morrison, is a compilation of much data relevant to magnetic recording. This book includes numerical and graphic representation of the popular equalization curves, means of calculating head-related losses, and methods of test and measurement in recording systems.

The Standard Tape Manual is available from R.K. Morrison Illustrative Materials, 819 Coventry Road, Kensington, CA 94707.

IV. CALIBRATION

Equipment Required

Proper alignment of the 387 will require the following test gear:

Head Demagnetizer
Appropriate Reproducer Alignment Tapes / Test Films
AC Electronic Voltmeter

Calibration Procedure

1. Establish the nominal impedance of the reproduce head and jumper the appropriate terminals per instructions on pages 5 and 6.
2. With power off, clean and demagnetize the heads, moving very slowly while the demagnetizer is in contact with the head, and withdrawing it about two feet before turning it off.
3. Thread an alignment tape (or test film) appropriate for the equalization to which the 387 is switched.
4. With the front panel LEVEL TRIM control switched out (CALIB position), play the Operating Level tone on the alignment tape/film and adjust the appropriate LEV trim pot for the nominal line level as measured with the AC voltmeter connected across the 387 Line Output working into the intended load. If the adjustment is not within the range of this pot, refer to pages 5 and 6 for restrapping instructions.
5. While reproducing the highest frequency on the test tape/film, adjust the reproduce head azimuth for maximum output.
6. With high impedance reproduce heads, if the resonance of the head is near the top of the passband (as is usually the case for best signal-to-noise performance), a peak in response will be noted at the highest frequencies. The REPRO HEAD DAMPING POT, R2, adjusts the "Q" of this primary head resonance. To determine the proper setting, turn the appropriate GAP pot fully CCW and set playback for flat response at 4-6kHz with respect to the reference tone using the HF pot. Note response at the highest frequencies and adjust the HEAD DAMPING control for flattest high-end response. This procedure is best done at the highest speed that will be used, and is relevant to

high impedance heads only. When Low-Z heads are used, the HEAD DAMPING pot should be left fully CW.

7. With the HF and GAP pots, playback response can be set for flattest response from reference frequency to highest frequency. The GAP pot is used to trim the very highest frequencies, but it interacts with the HF adjustment to some extent at the mid-highs.
8. If the alignment tape/film has the same track width as the reproduce head track, set the appropriate LF pot for smoothest response from reference frequency to the lowest frequency. If this is not the case, as with full-track test tapes and two-track machines, an appropriate correction factor may be employed to compensate for "fringing." If the test tape does not come with a correction factor chart, tones in the 50 - 60Hz range can be set 2dB above the reference frequency level for first-order fringing correction.
9. Repeat steps 3, 4, 7 and, if applicable, 8 for the other speeds or formats. It is advisable to make the final reproduce head azimuth adjustment at the lowest speed to be used.
10. While reproducing an operating level tone and observing nominal output line level, the METER CAL control, R59, may be adjusted to bring the panel meter to zero-VU.

This completes calibration of the Inovonics 387 Reproduce-Only amplifier module.

V. CIRCUIT DESCRIPTION

Plug-in Reproduce Module (387-10); Schematic 174700

Q1 is a low-noise, matched pair of conventional NPN junction transistors. It is connected in an unequalized, feedback-pair configuration, and is the low level reproduce head pre-amplifier. Gain of this preamp is established by resistors R5, 6, 7 and 8, which may be jumpered for four gain settings; two for nominal Hi-Z heads and two for Low-Z heads.

Signal switching in the 387 is performed by quad, CMOS analog switch gates. These gates, referenced on the schematic as A1, 2, 3 and 4, are operated between the $\pm 7.5V$ supply rails in order to pass ground-referenced AC waveforms at levels up to about +10dBmV. Gates "open" with -7.5V applied to the control lead and "close" to pass the audio signal when +7.5V is applied. Terminology in this case is switch contact oriented.

Preamplified signals from Q1 are routed through the selected LEV calibration pot to an equalizing amplifier comprised of IC1A. With C7 in the primary AC feedback path, IC1A is an integrating amplifier with a 6dB/octave falling characteristic. HF pots R28-30 put a "shelf" in the integrating characteristic for control over high frequency equalization. LF pots R25-27 shunt C7 to shelve integration at low frequencies per selected equalization. Also in the feedback loop is the "bridged-T" network made up of R20 and 21 with C8 and 9. Alone in the feedback path, this network would cause IC1A to oscillate at about 22kHz. GAP pots R22-24 spoil the "Q" of the network, however, giving a controllable "peak" at the resonant frequency to compensate for short wavelength reproduce head gap loss.

The output of the equalizing amplifier is routed either through the front-panel LEVEL control or a fixed loss network to the output line-drive amplifier, IC2A and B. A second-order, low-pass filter (R39 and 41 with C10 and 11) attenuates frequencies above 25kHz to eliminate bias and RF noise from the output. A4/10-11 is a "power-on reset" circuit which shunts preamplified signals to ground for about 5 seconds after the 387 is first turned on.

IC2A and B are connected in a differential, "active-balanced" output amplifier configuration. Each section is buffered by a discrete, complementary emitter-follower pair to deliver the required current to the output load.

SPEED (equalization) logic is received from the chassis and decoded by IC4 to switch the appropriate CMOS switch gates.

IC3 and associated components comprise a conventional op-amp "precision rectifier" to drive the front panel "simulated VU" meter. The meter movement has 1mA full-scale deflection sensitivity with no internal rectification. R59 sets the gain of the rectifier so that the meter may be calibrated to the nominal line level, and CR7, R61 and 62 provide scale linearization and movement damping for traditional "VU" performance.

Each individual plug-in module performs its own power supply filtering and regulation for the ± 7.5 and ± 15 volt supplies using "three terminal" integrated circuit regulators, IC5-8.

Chassis Assembly (387-00); Schematic 174800

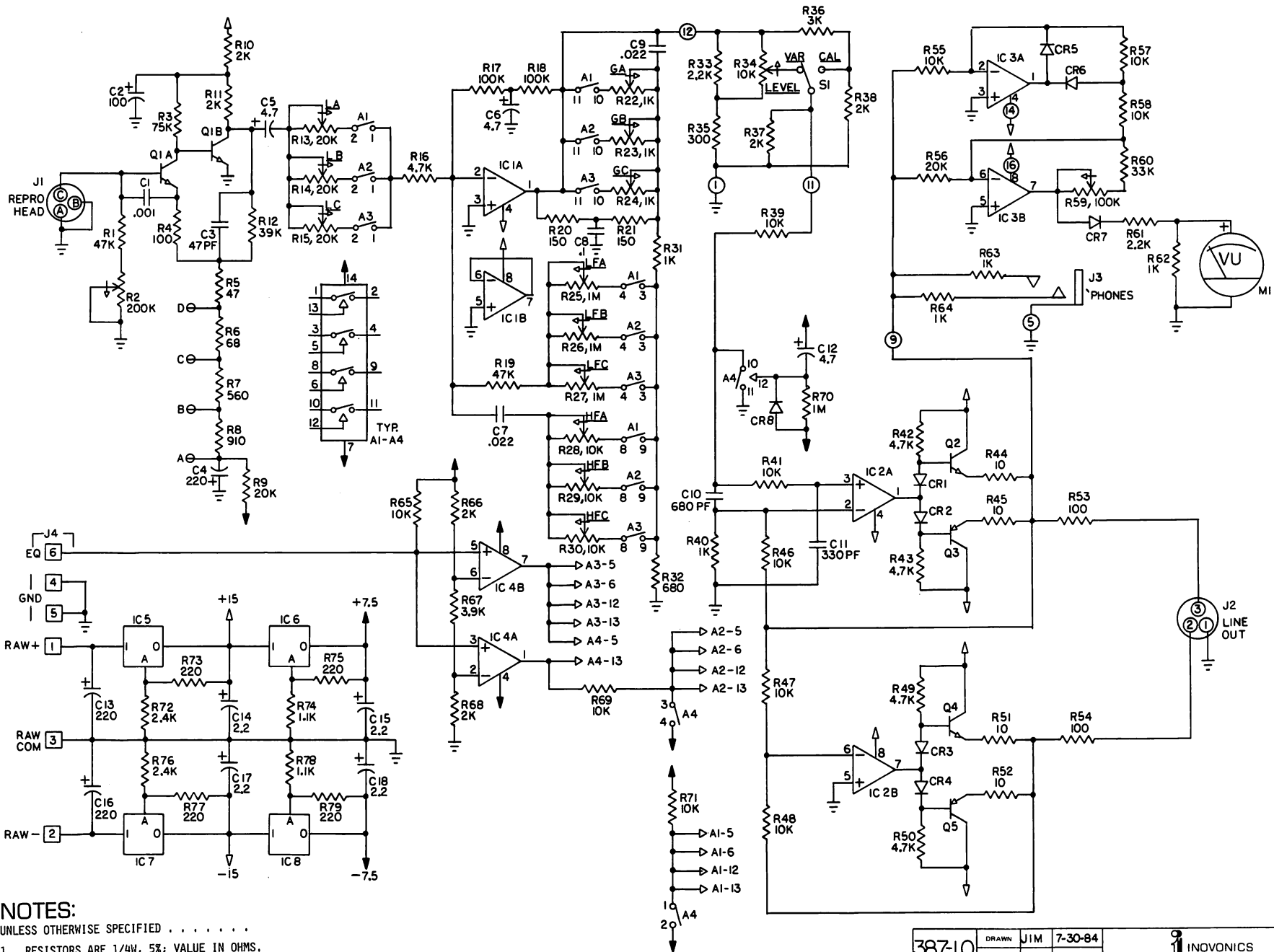
The 38700 chassis contains only the power transformer and power supply rectifiers. Filtering and regulation are handled in each plug-in module.

EQUALIZATION switching, whether by the front panel switch or by remote control, presents an open circuit, a short circuit or a 3.6V zener diode to the module EQ line. This command is decoded by each module for equalization selection.

VI. APPENDIX

SCHEMATIC DESIGNATION	INOVONICS PART NO.	GENERIC PART DESCRIPTION AND / OR MANUFACTURER'S ID & PART NO.
<u>PLUG-IN AMPLIFIER MODULE - 387-10, Schematic 174700</u>		
A1-4	1335	CMOS Analog Switch Gate - Type 4066 (RCA, National, Motorola)
C1	0930	Capacitor, Mylar; .001uF, 63V
C2	0920	" Electrolytic; 100uF, 25V radial
C3	0806	" Mica; 47pF, DM 15
C4	0927	" Electrolytic; 220uF, 6V radial
C5,6,12	1054	" Tantalum; 4.7uF, 25V
C7,9	0931	" Mylar; .022uF, 63V
C8	0932	" " .1uF, 63V
C10	1057	" " 680pF, 100V
C11	0816	" Mica; 330pF, DM 15
C13,16	0933	" Electrolytic; 220uF, 50V radial
C14,15,17, 18	1053	" Tantalum; 2.2uF, 25V
CR1-8	1100	Diode, silicon signal; 1N4151 or equivalent (Motorola)
IC1	1375	Integrated Circuit, dual FET-input op-amp; LM353N (National)
IC2	1314	" " dual op-amp; NE5532N (Signetics)
IC3,4	1313	" " " " RC4558NB (Raytheon)
IC5,6	1383	" " positive voltage reg.; LM317LZ (National)
IC7,8	1382	" " negative " " LM337LZ "
J1	1603	Connector, 3-pin "MS" male; Amphenol MS3102A10SL-3P
J2	1609	" 3-pin "XLR" male; Switchcraft D3M
J3	1628	" TRS "Phone Jack"; " RN112BPC
M1	2813	Meter, "Simulated VU" with 1mA DC movement (O.E.M./Modutec)
Q1	1237	Transistor, low noise monolithic dual; LM394BH (National)
Q2,4	1204	" NPN general purpose; PN3567-5 (National) or equiv.
Q3,5	1205	" PNP " " PN3645-5 " " "

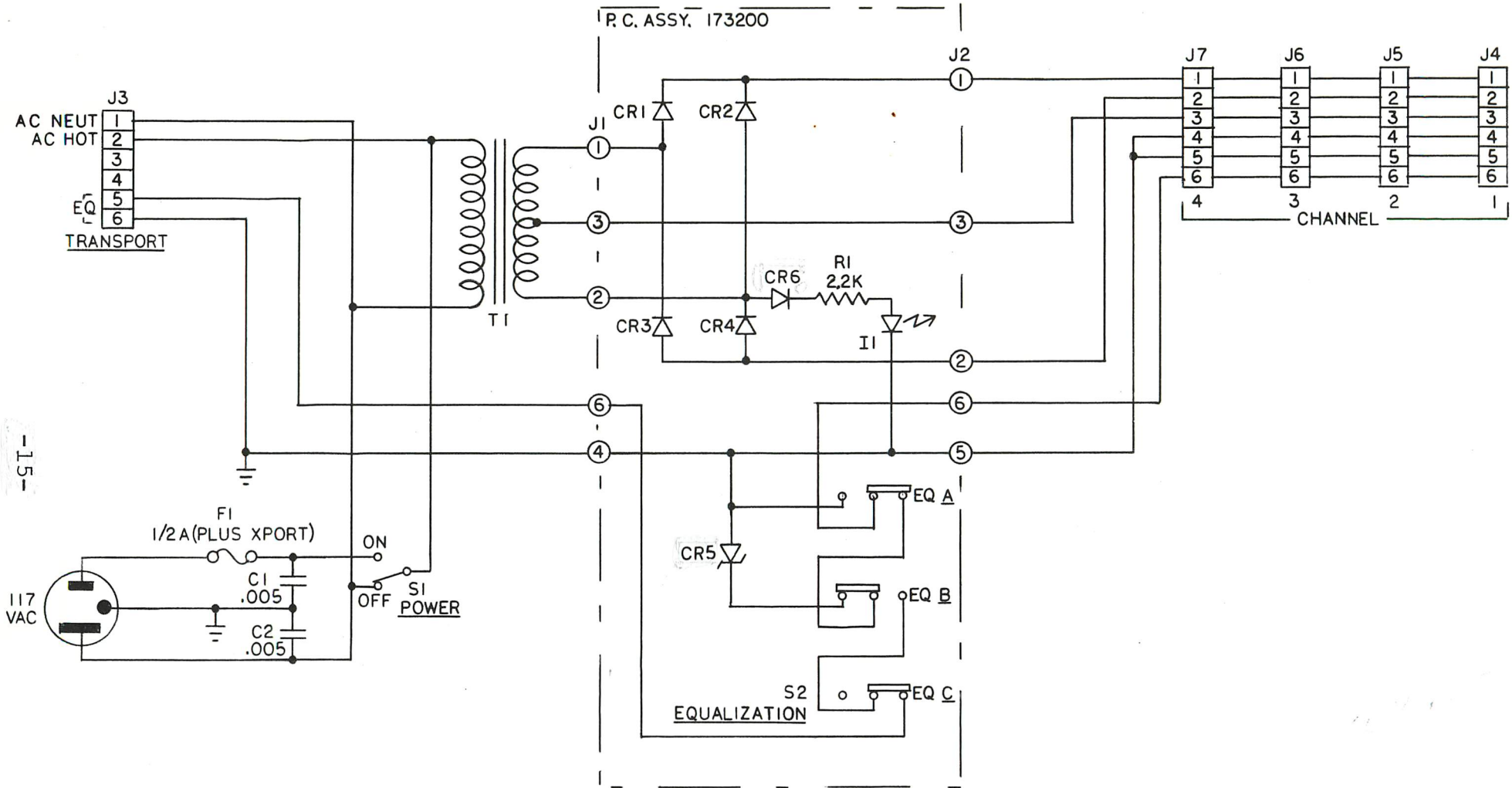
SCHEMATIC DESIGNATION	INOVONICS PART NO.	GENERIC PART DESCRIPTION AND / OR MANUFACTURER'S ID & PART NO.
R2 R13-15, 22-30,34 S1	0564 (various) 1855	NOTE: Unless otherwise specified, all fixed resistors are carbon film type, value and wattage per schematic. Resistor, variable; 200k single-turn; (Beckman 91AR200K) " " multi-turn, Spectrol 43P, Bourns 3006P or Beckman 89PR series; value per schem. Switch, SPDT miniature toggle; (C&K 7105-Y9A0)
<u>CHASSIS ASSEMBLY</u> - 387-00, Schematic 174800		
C1,2 CR1-4 CR5 CR6 F1 I1 J3 S1 T1	1064 1125 1111 1100 2702 2019 1644 1830 1505	Capacitor, ceramic; .005uF, 1kV Diode, silicon rectifier; 1N4005 (Motorola) or equiv. " zener, 3.6V; 1N5227 (Motorola) " silicon signal; 1N4151 (Motorola) or equiv. Fuse; 3AG, 1/2A (or as required for transport power) L.E.D., red; (Stanley SPR5731) or equivalent Connector, 6-pin "Jones" female; (Cinch S-306 AB) Switch, DPDT "Rocker"; (Arrow-Hart 1602-12E) Transformer, power; (Signal 241-4-36)



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- NOTES:**
 UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE 1/4W, 5%, VALUE IN OHMS.
 2. CAPACITOR VALUES IN μ F; TYPE, VOLTAGE AND TOLERANCE PER PARTS LISTING.
 3. ALL IC'S AND OTHER SEMICONDUCTORS PER PARTS LISTING.

387-10	DRAWN	JIM	7-30-84	 503 S. Vandell Way, Campbell, CA 95008 Phone 374-8300
	CHECKED			
APPROVED				TITLE
TOLERANCES				SCHEMATIC, PLUG-IN REPRO. MODULE
MATERIAL / FINISH				
2PL . 01	PAGE	OWG NO	ISSUE	
3PL . 006	OF	174700	A	
ANGLES : 1'				



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NOTES:

- UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE 1/4W, 5%; VALUE IN OHMS.
 2. CAPACITOR VALUES IN μ F; TYPE, VOLTAGE AND TOLERANCE PER PARTS LISTING.
 3. ALL IC'S AND OTHER SEMICONDUCTORS PER PARTS LISTING.

387 -00	DRAWN	JIM	8-1-84	 503 - B Vandell Way Campbell, CA 95008 Phone 374-8300 TITLE SCHEMATIC, REPRODUCE CHASSIS		
	CHECKED					
	APPROVED					
TOLERANCES	MATERIAL / FINISH			PAGE	DWG NO	ISSUE
2PL \pm .01 3PL \pm .005 ANGLES \pm 1'				1 OF 1	174800	A

INOVONICS WARRANTY

Inovonics, Inc. products are warranted to be free from defects in material and workmanship. Any discrepancies noted within 90 days of the date of purchase will be repaired free of charge. Additionally, parts for repairs required between 90 days and one year from the date of purchase will be supplied free of charge, with installation billed at normal rates. It will be the responsibility of the purchaser to return equipment for warranty service to the dealer from whom it was originally purchased unless prior arrangement is made with the dealer to inspect or repair at the user's location.

This warranty is subject to the following conditions:

1. Warranty card supplied with the equipment must be completed and returned to the factory within 10 days of purchase.
2. Warranty is void if unauthorized attempts at repair or modification have been made, or if serial identification has been defaced, removed, or altered.
3. Warranty does not apply to damage caused by misuse, abuse, or accident.
4. Warranty valid only to original purchaser.

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