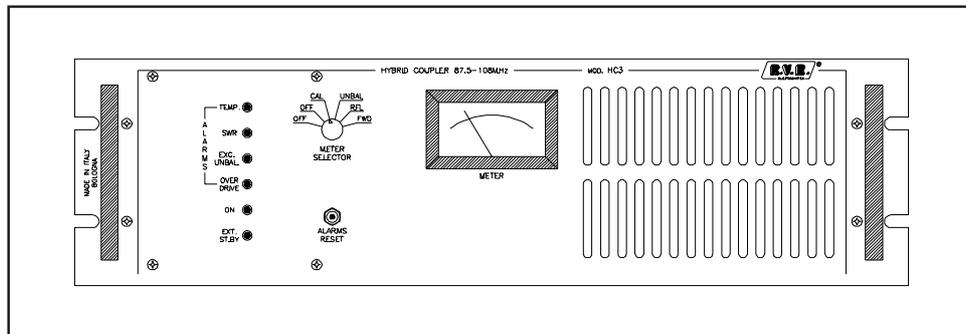

HC3



TECHNICAL AND MAINTENANCE MANUAL



Manufactured by R.V.R. Elettronica -
Italy

HC3

**3 KW 3-Way Hybrid
Splitter & Combiner**

Technical and Maintenance Manual

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PRELIMINARY INSTRUCTIONS AND WARRANTY INFORMATION

WARNING: This is a "CLASS A" equipment. In a resident place this equipment can cause hash. In this case can be requested to user to take the necessary measures.

Please observe safety precautions when handling this unit. This equipment contains dangerous currents and high voltages.

This manual is written as a general guide for those having previous knowledge and experience with this kind of equipment. It is not intended to contain a complete statement of all safety warnings which should be observed by personnel in using this or other electronic equipment.

R.V.R. doesn't assume responsibility for injury or damage resulting from improper procedures or practices by untrained/unqualified personnel in the handling of this unit.

Please observe all local codes and fire protection standards in the operations of this unit.

CAUTION: always disconnect power before opening covers or removing any part of this unit. Use appropriate grounding procedures to short out capacitors and high voltage points before servicing.

Any damage to the goods must be reported to the carrier in writing on the shipment receipt.

Any discrepancy or damage discovered subsequent to delivery, shall be reported to R.V.R. within five (5) days from its receipt.

R.V.R. extends to the original end-user purchaser all original manufacturers warranties which are transferable and all claims are to be made directly to R.V.R. per indicated procedures.

All manufacturers warranties will be supported by R.V.R. to ensure precise and speedy service where possible.

R.V.R. shall not be liable for any damage of whatsoever nature, arising out of or in connection with the product or its use thereof.

R.V.R.'s warranty shall not include:

- 1) Re-shipment of the unit to R.V.R. for repair purposes
- 2) Any unauthorized repair/modification
- 3) Incidental/consequential damages as a result of any defect
- 4) Nominal non-incident defects
- 5) Re-shipment costs or insurance of the unit or replacement units/parts

Warranty shall come into force from invoice date and for the period of the manufactures warranty.

The warranty for a period of 12 months is referred to any R.V.R. product, while for products as transistors, Mos-Fets and Tubes of the final stages is applied the manufacture's warranty of these devices.

To claim your rights under this warranty:

- a. Contact the dealer or distributor where you purchased the unit. Describe the problem and ask if he has an easy solution. Dealers and Distributors are supplied with all the information about problems that may occur and usually they can repair the unit quicker than what the manufacturer could do. Very often installing errors are discovered by dealers.
- b. If your dealer cannot help you, contact R.V.R. in Bologna and explain the problem. If it is decided to return the unit to the factory, R.V.R. will mail you a regular authorization with all the necessary instructions to send back the goods.
- c. When you receive the authorization, you can return the unit. Pack it carefully for the shipment, preferably using the original packing and seal the package perfectly. The customer always assumes the risks of loss (i.e., R.V.R. is never responsible for damage or loss), until the package reaches R.V.R. premises. For this reason, we suggest you to insure the goods for the whole value. Shipment must be effected C.I.F. (PREPAID) to the address specified by R.V.R.'s service manager on the authorization.

DO NOT RETURN UNITS WITHOUT OUR AUTHORIZATION AS THEY WILL BE REFUSED.

Be sure to enclose a written technical report where mention all the problems found and a copy of your original invoice establishing the starting date of the warranty.

Replacement and warranty parts may be order from the following address. Be sure to include the equipment model and serial number as well as part description and part number.

**R.V.R. Elettronica S.r.l. - Broadcasting Equipment -
Via del Fonditore, 2/2c
40138 Bologna - Italy**

R.V.R. reserves the right to modify the design and specifications of the equipment in this manual without previous notice.

WARNING!

The currents and voltages in this equipment are dangerous!
Personnel must at all times observe safety regulation!

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical and electronic circuits.

It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care.

R.V.R. ELETTRONICA s.r.l. shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed.

WARNING!

Always disconnect power before opening covers, doors, enclosures, gates, panels or shields.
Always use grounding sticks and short out high voltage points before servicing. never make internal adjustments, perform maintenance or service when alone or when fatigued.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields.

Keep away from live circuits, know your equipment and don't take chances.

WARNING!

In case of emergency ensure that power has been disconnected

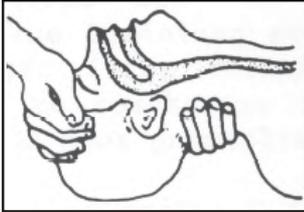
Treatment of electrical Shock

1) If victim is not responsive follow the A-B-C's of basic life support.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

A AIRWAY

IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK,
PUSH FOREHEAD BACK,
CLEAR OUT MOUTH IF NECESSARY,
OBSERVE FOR BREATHING.

B BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL
BREATHING



TILT HEAD,
PINCH NOSTRILS,
MAKE AIRTIGHT SEAL,
4 QUICK FULL BREATHS.
REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS
POSSIBLE.

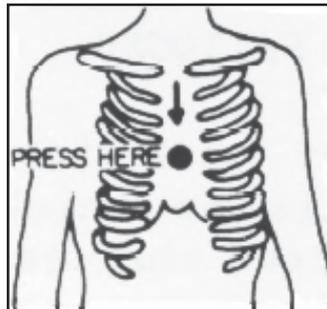
C CIRCULATION

CHECK CAROTID PULSE

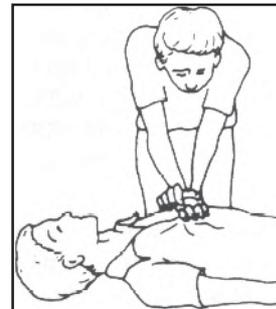


IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

DEPRESS STERNUM 1 1/2" TO 2"



APPROX. 80 SEC. : ONE RESCUER, 15 COMPRESSIONS,
2 QUICK BREATHS.



APPROX. 60 SEC. : TWO RESCUERS, 5 COMPRESSIONS,
1 BREATH

NOTE: DO NOT INTERRUPT RHYTHM OF COMPRES-
SIONS WHEN SECOND PERSON IS GIVING BREATH.

Call for medical assistance as soon as possible.

2) If victim is responsive.

- a. Keep them warm.
- b. Keep them as quiet as possible.

c. Loosen their clothing (a reclining position is recommended).

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be a complete first-aid procedure, it is brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

Treatment of electrical Burns

- 1) Extensive burned and broken skin.
 - a. Cover area with clean sheet or cloth.
(Cleanest available cloth article).
 - b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
 - c. Treat victim for shock as required.
 - d. Arrange transportation to a hospital as quickly as possible
 - e. If arms or legs are affected keep them elevated.

NOTE

If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold).

Allow victim to sip slowly about 4 ounces (half a glass) over a period of 15 minutes.

Discontinue fluid if vomiting occurs (Do not give alcohol).

- 2) Less severe burns - (1st & 2nd degree)
 - a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
 - b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
 - c. Apply clean dry dressing if necessary.
 - d. Treat victim for shock as required.
 - e. Arrange transportation to a hospital as quickly as possible.
 - f. If arms or legs are affected keep them elevated.

CHAPTER 1

GENERAL DESCRIPTION

1.1 EXTERNAL DESCRIPTION

The HC3 is housed in a 3U, 19" rack. On the front panel there are: four alarms leds (3-7-8-9 Fig.1), the button for the Alarms Reset (4 Fig.1), two signalling leds (1-2 Fig.1) for A.C. line presence and external Stand-By, the analog meter (5 Fig.1) and the relative selector of the parameters that can be measured (10 Fig.1). On the rear panel are mounted: the mains voltage selector and A.C. Line inlet (1-2 Fig.2), the R.F. output connector to antenna (14 Fig.2), the R.F. input connector from exciter (9 Fig.2), three R.F. output connectors for the driving of the three amplifiers (10-11-12 Fig.2), three R.F. input connectors from the the three amplifiers (16-17-18 Fig.2). There are also present an auxiliary out A.C. Line socket and relative protection fuse, one BNC Interlock connector (7 Fig.2), a D-type Telemetry connector (5 Fig.2), the R.F. Test Connector at -60 dB (15 Fig.2) and one BNC connector correlated to unbalanced power signal for "Fold-Back" utility regarding the exciter.

1.2 ELECTRICAL DESCRIPTION

The HC3 Hybrid Coupler, realized with "Suspended-Substrate-Strip-Lines" technology, allows to combine on the antenna the outputs of three power amplifiers (max. 1200 W) and to split their driver power coming from a single exciter.

The exciter and the HC3 are connected in cascade through the Alarms/Interlock connectors. This allows to shut down the exciter in the event of a fault on either amplifiers the system.

The exciter's AGC connection, if connected to HC3 Fold Back signal, allows the reduction of the unbalanced power transients and the absolute reduction of the exciter power output for the best system working. In the event that a failure occurs on two of the amplifiers and the user wishes to operate at the best power out, the exciter must be disconnected from the coupler and connected to the functionig amplifier that in the same way, must be connected directly to the antenna. If this connection isn't made, on the coupler's output can be obtained approximately an output power less of a 1/2 of the nominal value for one amplifier out of game) or less of 1/6 for two amplifier out of game, the lost power of the working amplifiers is dissipated as unbalanced power on the 500hm power reistors to the absorption outputs.

1.3 METERS AND INDICATORS

The operating parameters can be measured with the analog multimeter (9 Fig.1) situated on the front panel. The measurament being made by the analog multimeter selectable via the corresponding control (8 Fig.1).

Four alarm conditions leds provide indication of overtemperature (1 Fig.1), excess of V.S.W.R. (2 Fig.1), excess of unbalanced power (3 Fig.1)

and exciting power overdrive (4 Fig.1).

1.4 DEVICE SPECIFICATIONS

Refer to table A for electrical specifications of the HC3, and table B for dimensional and enviromental specifications.

TABLE A

ELECRICAL SPECIFICATIONS

A.C. Power	117 or 230V \pm 10% 50-60 Hz
Max. Rating power	3.6 KW - for HC3 version
Cooling	Forced ventilation
Operating Frequency	from 87.5 to 108 MHz

Power Splitter Section

Input Impedance	50 Ohm
Input Connector	"N-type" connector
Output Impedance	50 Ohm
Output Connector	"N-type" connector

Power Coupler Section

Input Impedance	50 Ohm
Input Connector	"N-type" connector
Output Impedance	50 Ohm
Output Connector	EIA 7/8" Flange for HC2/2 version

MECHANICAL SPECIFICATIONS

TABLE B

<i>Chassis dimensions</i>	<i>132.5 mm (5.2") H</i> <i>507.5 mm (19.98") D</i> <i>447 mm (17.6") W</i>
<i>Panel dimensions</i>	<i>483 mm (19") W</i> <i>132.5 mm (5.2") H</i>
<i>Ambient operating temp.</i>	<i>from -10°C to +50°C</i>
<i>Humidity</i>	<i>90% maximum, non-condensed</i>
<i>Weight</i>	<i>17.5 Kg</i>

CHAPTER 2

ELECTRICAL DESCRIPTION

2.1 INTRODUCTION

This section describes, in detail, the operating theory of the HC3. To aid understanding, the unit has been subdivided into blocks, each of which is fully described below. A block diagram is shown in Fig.4.

2.2 POWER SUPPLY

This equipment has only a transformer (32 VA) with a primary 100-120-220-240 V and a secondary 16-0-16 V, 1A to supply Alarms card, the Telemetry card and Remote card.

2.3 ALARMS CARD

This module is composed of a board mounted on the front panel, in left position, as shown in Fig.1.

On this board, the electronics detect any system anomaly such as excessive SWR, overtemperature, excessive unbalanced power, exciting power overdrive. This module will also, whenever possible, reset the system to its original conditions, after a fault has occurred.

2.4 TELEMETRY CARD

Thanks to this card mounted on the rear part of the Alarms Card, the essential parameters and alarms status are externally available for remote measurements purposes on a Telemetry Connector (D-Type 25-pin).

SIGNAL	TELEMETRY	CONNECTOR	PIN	VOLTAGE	LEVEL
Not Used			1	/	
Calibration			2	2.0 V	full scale
Ground			3	0.0 V	
Reflected Power			4	2.0 V	full scale
Inhibit Tx			5	12.0 V	
Exc. Unbalancing			6	15.0 V	when fault
Ground			7	0.0 V	
Unlock			8	15.0 V	
Not Used			14	/	
Unbalancing Power			15	2.0 V	full scale
Forward Power			16	2.0 V	full scale
Exc. Temperature			17	15.0 V	when in faulty
Antenna S.W.R.			18	15.0 V	when in faulty
Overdrive			19	15.0 V	when in faulty
Lock			20	15.0 V	
Ground			21	0.0 V	

The other pins are not connected.

2.5 REMOTE CARD

This Card mounted on the right side of the equipment in rear position, allows to switch off the Auxiliary Out A.C. Line in case of any faulty of the equipment.

2.6 POWER SPLITTER

The Power Splitter circuit mounted on the rear part of the equipment on the right side, is used to split exciter's driving power to three amplifiers. The circuit is realized with strip plus coaxial cables and three specific circuits can adjust (equalize) phases on the three outputs that are used to drive the amplifiers.

Three resistive termination placed near to the output serves to absorb any unbalanced powers in case of faulty or performance differences of some amplifier to prevent excessive power driving on the well functioning (well loaded) outputs.

2.7 POWER COMBINER

The Power Combiner circuit mounted on the rear part of the equipment on the left side, is used to combine the output powers of the two amplifiers. The circuit is realized with suspended-substrate strip lines plus 50ohm coaxial cables and guarantee equal phases on the three input power ways that are combined to obtain the antenna output power.

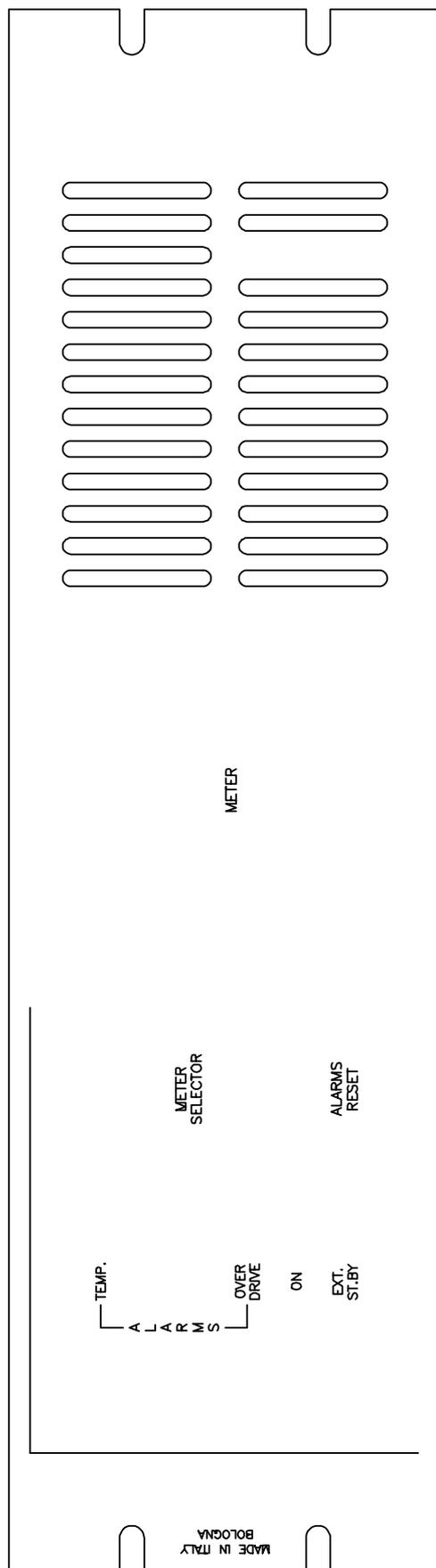
Three resistive terminations placed on the main cooler serve to absorb any unbalanced powers in case of faulty or performance differences of some amplifier.

2.8 UNBALANCING POWER CARD

This card, mounted on the rear part of the Alarms card, is used to calculate the voltage proportional to Unbalancing Power, coming from the unbalancing measuring section placed on the Power Coupler, to send it to Alarms card and then to the analog meter.

FRONT PANEL DESCRIPTION (FIG. 1)

- | | | |
|----|----------------|--|
| 1 | EXT. ST.BY | Led indicating an External Stand-By |
| 2 | ON | A.C. ON Power indicator |
| 3 | OVER DRIVE | Led indicating the OVER DRIVE Alarm Status |
| 4 | ALARMS RESET | Press-button to reset the Alarm Status |
| 5 | METER | Analog Meter used to monitor the operating parameters of the equipment |
| 6 | AIR FILTER | Air Filter of R.F. Amplifier Module |
| 7 | TEMP | Led indicating the OVER TEMPERATURE Alarm Status |
| 8 | SWR | Led indicating the S.W.R. Alarm Status |
| 9 | EXC. UNBAL. | Led indicating an Excessive Unbalancing of the two Amplifier's Output power |
| 10 | METER SELECTOR | Selector to monitor the operating parameters:
OFF Not Used
OFF Not Used
CAL. Calibration of the meter
UNBAL. PWR Unbalancing Power
RFL Reflected Power
FWD Forward Power |

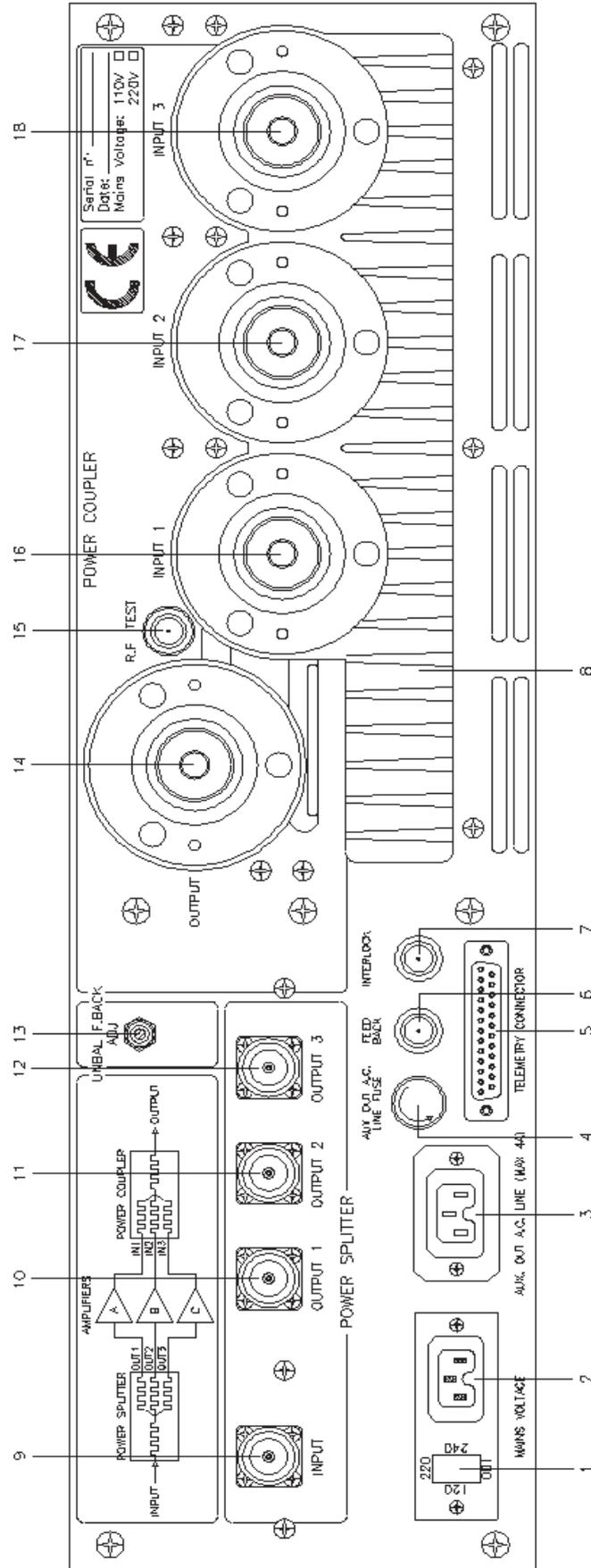


FRONT PANEL (FIG. 1)

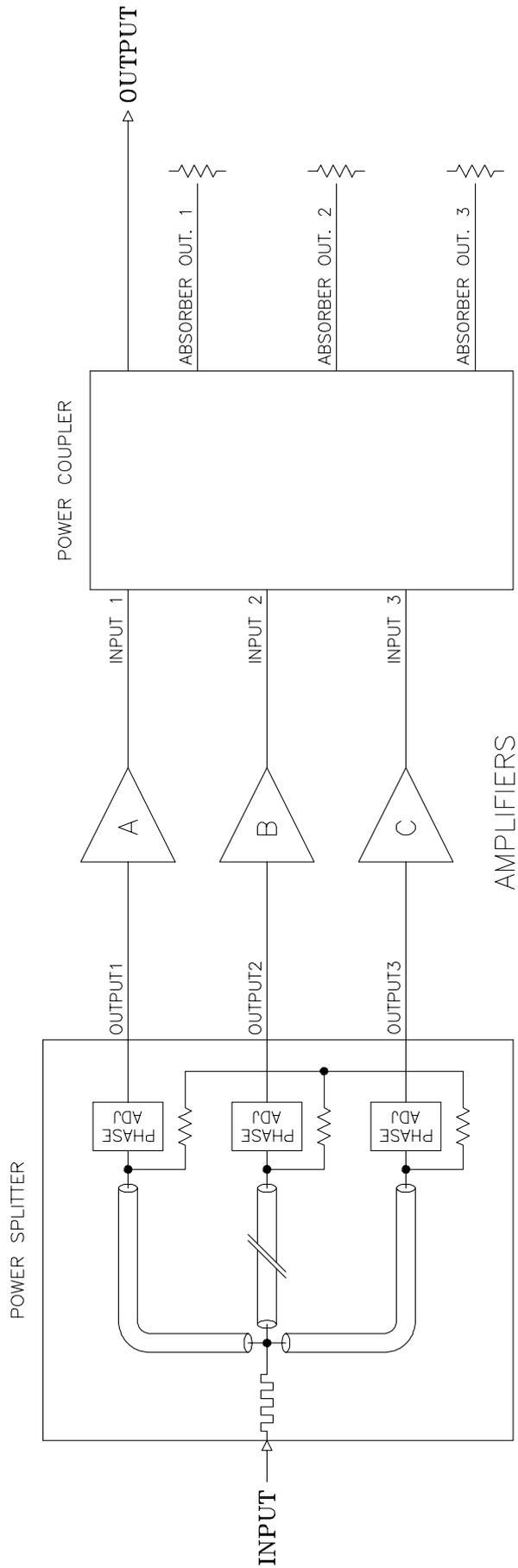
REAR PANEL DESCRIPTION

(FIG. 2)

- 1 VOLTAGE CHANGER & Fuse Block and Line Voltage Selector.
A.C. LINE FUSE Use a small screwdriver to change the fuse or
line voltage. Rotate the block and position it
for the desired voltage.
- 2 MAINS VOLTAGE A.C. Power Line for the combiner.
- 3 AUX. OUT A.C. LINE Auxiliary Out A.C. Power Line for external
equipment.
- 4 FUSE Protection Fuse (max. 4A) for Auxiliary Out
A.C. Power Line.
- 5 TELEMETRY CONNECTOR Connector for Remote measurement of operating
parameters.
- 6 FEED BACK BNC connector for the FEED BACK connection
- 7 INTERLOCK 1-2 BNC connector which permits the exciter to be
put in stand-by in case of one amplifier or
coupler fault or in case of EXT. ST.BY
- 8 HEAT SINK Heat Sink for the R.F. Output Combiner
- 9 INPUT Exciter's R.F. Input Connector (N-Type)
- 10 OUTPUT 1 Power Splitter's Output 1 (N-type connector)
to drive Power Ampl. A
- 11 OUTPUT 2 Power Splitter's Output 2 (N-type connector)
to drive Power Ampl. B
- 12 OUTPUT 3 Power Splitter's Output 2 (N-type connector)
to drive Power Ampl. B
- 13 UNBAL F.BACK ADJ Trimmer for UNBAL FOLD BACK adjustment
- 14 OUTPUT Power Combiner's Output (EIA 7/8" flange)
- 15 R.F. TEST R.F. Test Connector (BNC) at -60 dB
- 16 INPUT 1 Power Combiner's Input 1 (7/8" EIA Flange)
from the Power Ampl. A
- 17 INPUT 2 Power Combiner's Input 2 (7/8" EIA Flange)
from the Power Ampl. B
- 18 INPUT 3 Power Combiner's Input 3 (7/8" EIA Flange)
from the Power Ampl. C



REAR PANEL (FIG. 2)



BLOCK DIAGRAM (FIG. 3)

CHAPTER 3

INSTALLATION PROCEDURE

3.1 INTRODUCTION

This chapter contains the necessary information for preliminary checks and installation of the HC3.

3.2 UNPACKING

Unpack the coupler and before any other operation check that the equipment isn't damaged and all the controls on the front and rear panels are in good condition.

3.3 INSTALLATION

This equipment is just supplied with all connecting cables marked with the indication of the position in which must be connected. To install the HC3 coupler is necessary to execute the following operations:

1) This equipment is able to operate from 4 different supply voltages: 100, 120, 220 or 240 Vac, at 50-60 Hz.

First of all select the correct supply voltage using the selector situated on the rear panel; use a screwdriver to raise the cover (1 Fig.2) on which are written the various voltages, rotate it until the arrow points to the correct voltage and re-insert it.

Check that a fuse is fitted to the cover and that its value corresponds to the following:

<u>220-240 Vac</u>	<u>1 A</u>
<u>100-120 Vac</u>	<u>1 A</u>

2) Connect the cable of the exciter to the "N-type" Input connector of the Splitter Section.

3) Connect three cables from "N-type" Output connectors of the Splitter Section to the inputs of the three amplifiers.

4) Connect three cables from Output connectors of the three amplifiers to the Inputs of the Couplers Sections.

5) Connect the Output connector of the Coupler Section to the antenna.

6) Connect the three Interlock BNC Connector to the Interlock connector of the exciter (see as reference the diagram enclosed with each station).

7) Connect the Fee-Back connector to the "EXT. A.G.C." of the exciter.

8) Now, connect the A.C. Line to the equipment and switch ON all parts of the station.

9) Check on the front panel that all alarms leds are OFF.

10) Check with the analog meter placed on the front panel that all working parameters are rights.

PWR FWD = Max. Ooutput Power avalaible

PWR REF = less of the 10% of the Max. Output Power

PWR UNBAL. = less of 150W (about zero)

10) If there are some parameters that aren't right, follow the callibration procedures described in the Capitolo 5 of this manual.

A connection diagram in which are showed all connections will be enclosed in each station and depends from the equipment used to realize it.

A drawing indicates the block diagram of the equipment is serigraphed on the rear panel.

TABLE C

RECOMMENDED TEST EQUIPMENT

INSTRUMENT	MODEL	SPECIFICATION
Non-Inductive Dummy Load	Bird Mod. 8891-300 with BA-300-115	50 Ohm P = 5 KW
Non-Inductive Dummy Load	Bird Mod. 8166	50 Ohm P = 150 W continuous
Spectrum Analyzer	Advantest Mod. R4131D	10KHZ-3.5GHz
Digital multimeter	Mod. Metrix	
Bypass Wattmeter	Bird Mod. 43	50 Ohm
Attenuator	Bird Mod. 8325	30 dB, 500 W continuous

CHAPTER 4

MAINTENANCE PROCEDURES

4.1 INTRODUCTION

This chapter provides general maintenance procedures of the HC3 Combiner.

4.2 SAFETY CONSIDERATIONS

WARNING! WARNING! WARNING! WARNING! WARNING! WARNING! WARNING!

When the transmitter is working, removing the top panel will expose lethal voltages on the line voltage selector.

Ensure that the unit is disconnected from all sources of power before carrying out any inspection or maintenance work.

MAINTENANCE LEVEL 1

4.3 ROUTINE MAINTENANCE

The only routine maintenance required by the combiner is the periodic replacement of the cooling fan and the removal of accumulated dust. The period between such action will depend on ambient operating conditions such as temperature, air-borne dust levels and humidity.

It is advisable to check the unit every 6 months and to replace noisy or worn fans.

Fans should be replaced as a matter of course after no more than 18 months of operation.

MAINTENANCE LEVEL 2

CARD REPLACEMENT

WARNING: TO RE-INSTALL THE CARDS IS ENOUGH TO EXECUTE OPERATIONS SEQUENCE IN THE OPPOSITE WAY.

4.4 ALARMS CARD REPLACEMENT

- 1) Open the top and bottom covers of the unit.
- 2) Remove the Telemetry and Remote cards mounted on the Alarms card (see as reference the paragraphs of this chapter relative to these cards).
- 3) Remove the screws securing the board on the front panel.

- 4) Disconnect connectors CN1, CN3, M1 and M3.
- 5) Remove the knob of the meter selector loosening the screw inside the knob.
- 6) Dismount the screws of the meter selector switch and Alarms Reset push-button.
- 7) Slowly remove the card paying attention to signaling leds.

4.5 UNBALANCING CARD REPLACEMENT

- 1) Open the top and bottom covers of the unit.
- 2) Disconnect JP1, JP2, and JP4 on the Unbalancing card and M1 on the Alarms card.
- 3) Remove the fixing bolts of the card on the Alarms card.
- 4) Remove slowly the unbalancing card.

4.6 TELEMETRY CARD REPLACEMENT

- 1) Open the top and bottom covers of the unit.
- 2) Remove the fixing bolts of the card on the Alarms card.
- 3) Disconnect CN2 connector on the Telemetry card.
- 4) Remove the Telemetry card paying attention to disconnect slowly M2 strip.

4.7 REMOTE CARD REPLACEMENT

- 1) Open the top and bottom covers of the unit.
- 2) Disconnect CN1 and CN2 connectors on the Remote card.
- 3) Remove the fixing bolts of the card.
- 4) Remove slowly the Remote card.

CHAPTER 5

CALIBRATION PROCEDURES

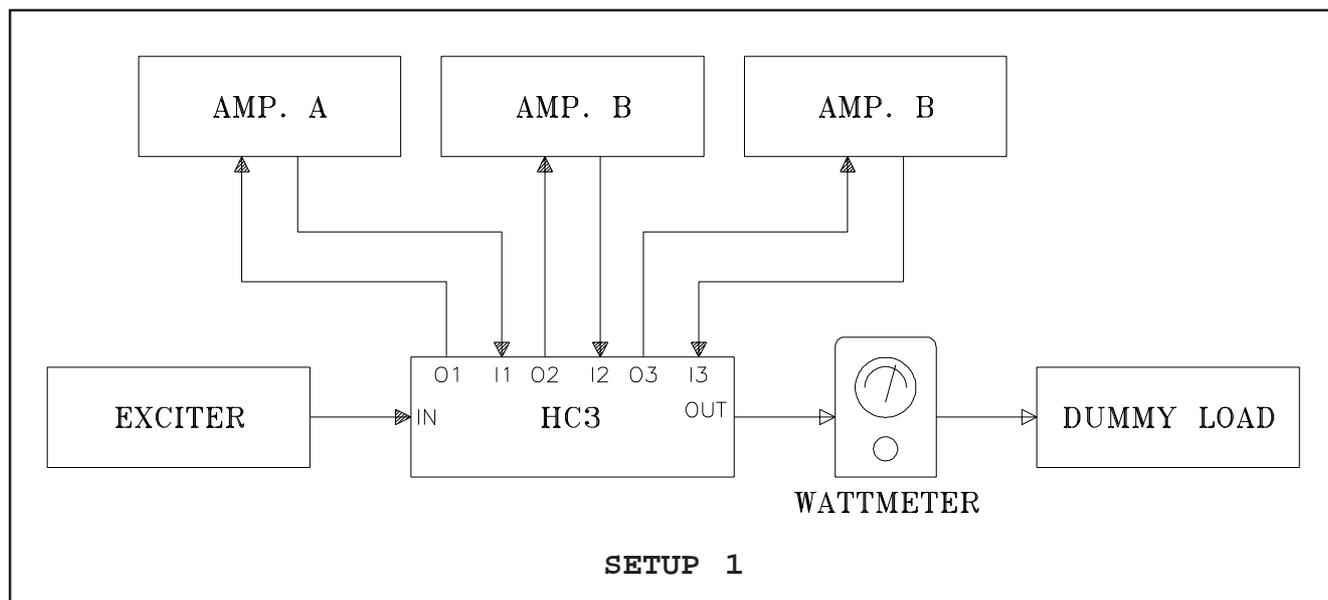
5.1 INTRODUCTION

This chapter describes the calibration procedures that are necessary to do when you have replaced some cards or some devices, or in case of a complete replacement of the equipment into of a transmitter station.
All calibrations must be executed switching on all equipment at the minimum power.

5.2 METER CALIBRATION

To realize this callibration execute the following operations:

- 1) Turn the Meter selector on the CALL position.
- 2) Adjust the trimmer R14 on the Alarms card for a full scale reading on the analog meter.



5.3 OVERDRIVE CALIBRATION

To realize this callibration execute the following operations:

- 1) Connect to RF output of the HC3, an external by-pass wattmeter in series to a dummy load with the necessary power to the system considered (see as reference SETUP 1).
- 2) Switch ON the system.
- 3) Increase driver power until to obtain an output power greater of 5% than nominal output power of the system.
- 4) Adjust trimmer R26 on the Alarms card until the overdrive Alarm led

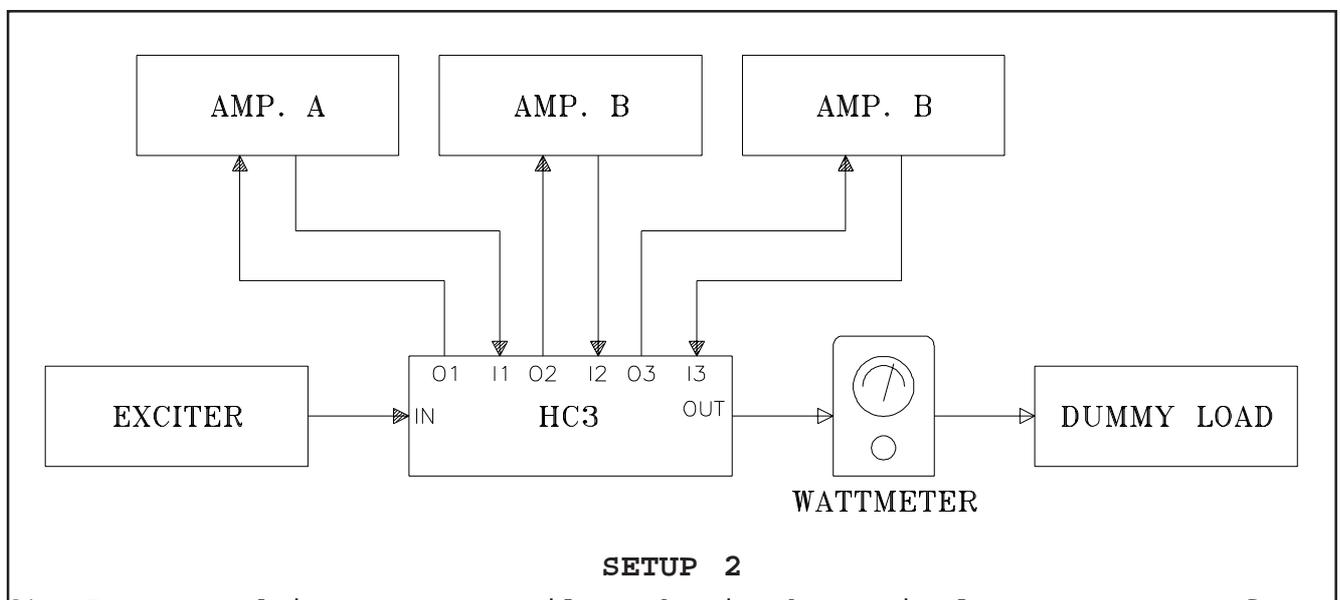
switch ON.

- 5) Decrease the power to the nominal level and check that the Overdrive Alarm led switch off and the system works again.

5.4 UNBALANCING POWER READING CALIBRATION

To realize this callibration execute the following operations:

- 1) Connect to RF output of the HC3, an external by-pass wattmeter in series to a dummy load with the necessary power for the system considered (see as reference SETUP 2).
- 2) Switch ON the system.



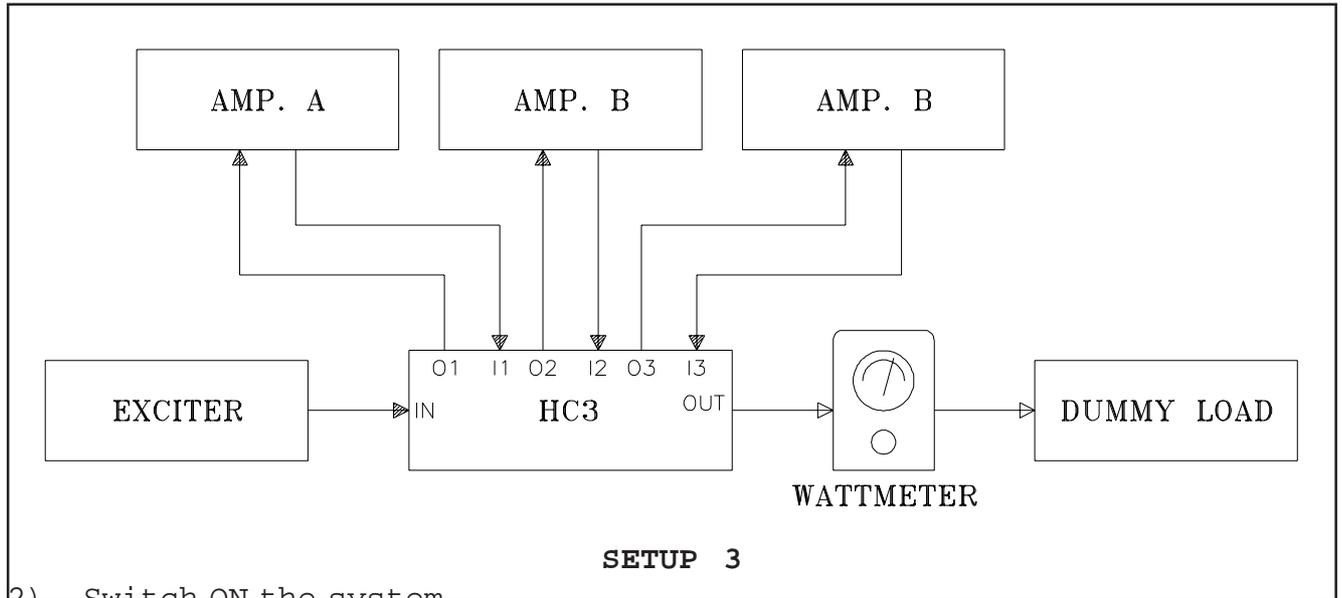
- 3) Increase driver power until to obtain the nominal output power of the system (set at 98MHz).

- 4) Switch the meter selector over the UNBAL. position.
- 5) Switch off one of the three amplifiers.
- 6) Adjust trimmer RV1 of the Unbalancing Power card, to measure on the front panel the difference power equal Antenna Power minus (sum power of two functioning amplifiers).

5.5 UNBALANCING POWER THRESHOLD CALIBRATION

To realize this callibration execute the following operations:

- 1) Connect to RF output of the HC3, an external by-pass wattmeter in series to a dummy load with the necessary power to the system considered (see as reference SETUP 3).



- 2) ~~Switch ON the system.~~
- 3) Now, switch off one of three amplifier and increase the output power of the other one until this power is 10% greater than the nominal value.
- 4) Then, adjust Trimmer R40 on the Alarms card until to obtain that UNBAL. led light ON.
- 5) Reduce the output power until the nominal value and check that the UNBAL. led light off.

5.6 FORWARD POWER READING CALIBRATION

To realize this callibration execute the following operations:

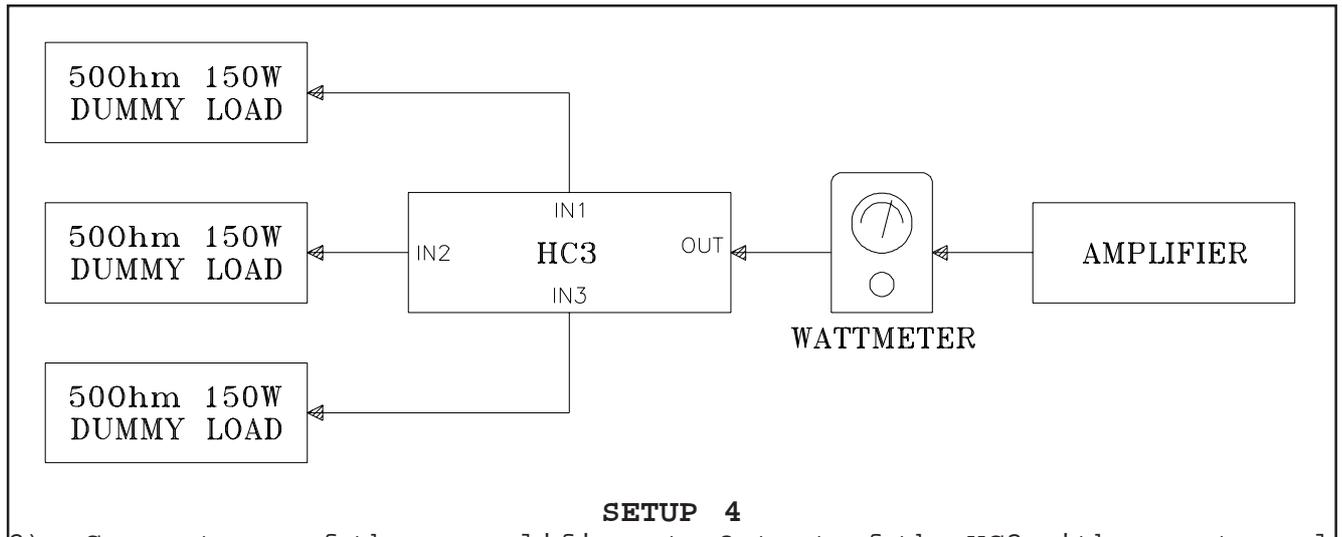
- 1) Connect to RF output of the HC3, an external by-pass wattmeter in series to a dummy load with the necessary power to the system considered (see as reference SETUP 3).
- 2) Switch ON the system.
- 3) Switch the meter selector on the FWD.PWR. position.
- 4) Increase the output power of the system for maximum nominal value reading on the external wattmeter.
- 5) Adjust trimmer R11 on the Alarms card to obtain the same reading on the analog meter of the HC3 and on the external wattmeter.

5.7 REFLECTED POWER READING CALIBRATION

To realize this callibration execute the following operations:

- 1) Connect to input 1,2 and input 3 of the HC3, two dummy loads with

adequate power to the system considered (see as reference SETUP 5).



~~2) Connect one of three amplifiers to Output of the HC3 with an external wattmeter in series.~~

- 3) Switch ON the system with the exciter at the minimum power.
- 4) Switch the meter selector over the RFL.PWR. position.
- 5) Increase the output power of the amplifier until 10% of the nominal value verifying the correct value on the external wattmeter.
- 6) Adjust R13 trimmer on the Alarms card to obtain the same value on the analog meter of the HC3.

NOTE: If with exciter at minimum power, the output power of the amplifier is greater than 10% necessary, insert an attenuator between the exciter output and the input of the amplifier.

5.8 ANTENNA S.W.R. THRESHOLD CALIBRATION

To realize this callibration execute the following operations:

- 1) Connect to input 1,2 and input 3 of the HC3, three dummy loads with adequate power to the system considered (see as reference SETUP 4).
- 2) Connect one of three amplifiers to Output of the HC3 with an external wattmeter in series.
- 3) Switch ON the system with the exciter at the minimum power.
- 4) Switch the meter selector over the RFL.PWR. position.
- 5) Increase the output power of the amplifier until 10% of the nominal value verifying the correct value on the external wattmeter.
- 6) Adjust R13 trimmer on the Alarms card to obtain the same value on

the analog meter of HC3.

- 7) Adjust R56 trimmer on the Alarms card until the ANT. SWR led light ON.
- 8) Reduce the output power and check that the ANT. SWR. led light off.

5.9 FOLD-BACK ADJUSTEMENT FOR THE EXCITER

- 1) The system must be connected in standard configuration and ready to work.
- 2) Switch on the system and adjust it for maximum power.
- 3) Switch off one of three amplifiers.
- 4) Switch on again the same amplifier; this could remain blocked because the protection is active and couldn't be able to supply the output power.
- 5) Adjust trimmer "UNBAL F. BACK ADJ" placed on the rear panel of HC3 to obtain an output power reduction when the system is unbalanced; this operation must allow the restart of the blocked amplifier.
- 6) Repeat point 3, 4, 5, switching off alternatively all amplifiers; the trimmer setting must always allow the restart of any amplifier.

APPENDIX A

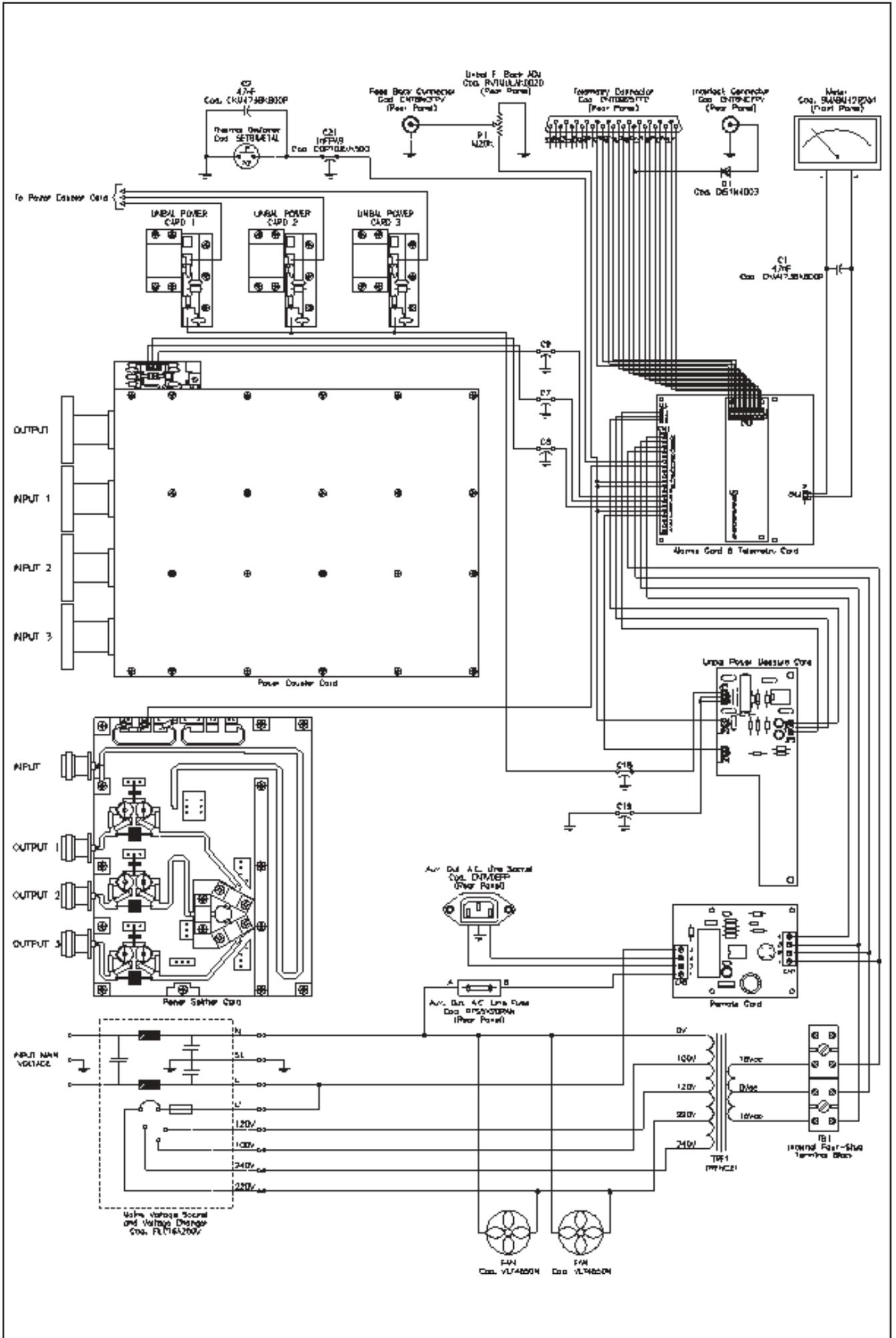
CIRCUIT DIAGRAMS, LAYOUTS AND BILLS OF MATERIAL

This section contains circuit diagrams, layouts and bills of material of the modules which composing the equipment. For more information about each module see as reference Section 2.

WIRING DIAGRAM

1 *Wiring Diagram*

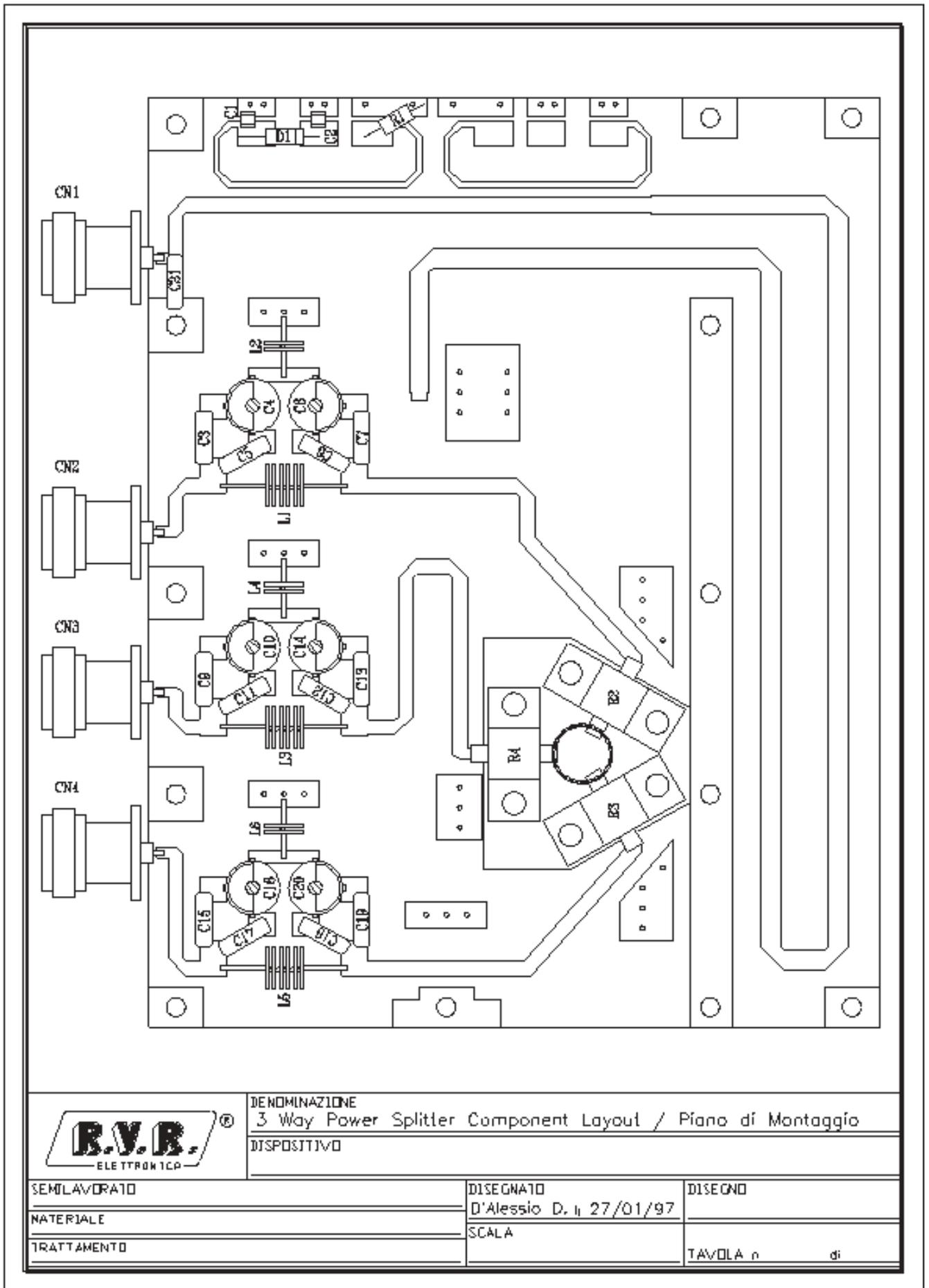
Pag. 33



POWER SPLITTER

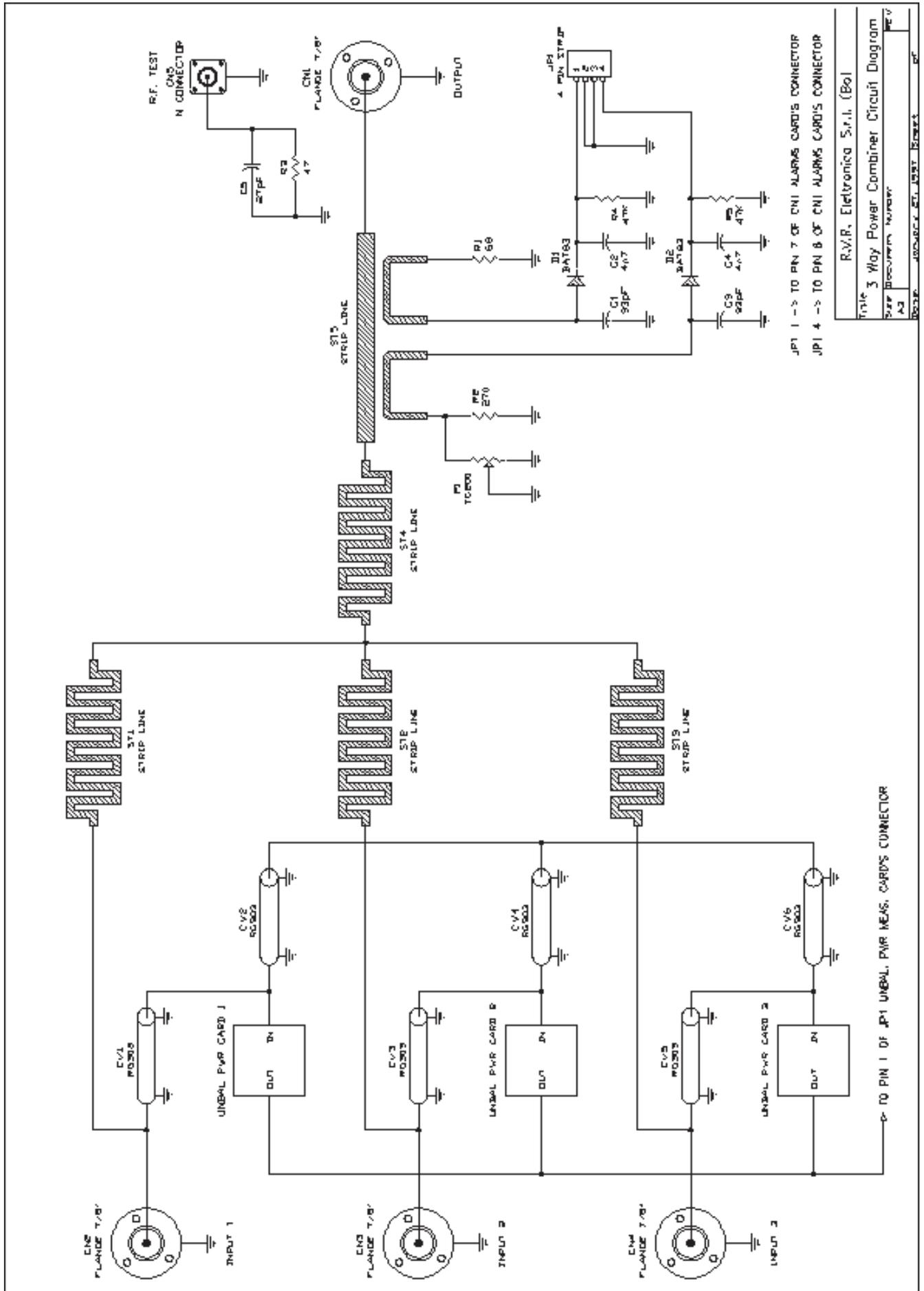
1	<i>Circuit Diagram</i>	<i>Pag. 35</i>
2	<i>Bill of Materials</i>	<i>Pag. 36</i>
3	<i>Layouts</i>	<i>Pag. 37</i>

Power Splitter		Bill Of Materials/Lista Componenti			Page 1
Item	Quantity	Reference Part	Description	Part Order Code	
1	3	R2,R3,R4 50 KDI	RES. DI TERM. (KDI)	RDT250H0050	
2	1	R1 100	RESISTOR 1/4W 5%	RSC1/4JH0100	
3	1	C21 3p3MA	SILVER MICA CAPACITOR	CSM3,3XK351	
4	6	C4,C8,C10, C14,C16,C20	T10/80PF TRIMMER CAPACITOR		
5	6	C5,C6,C11, C12,C17,C18	15pFMA SILVER MICA CAPACITOR	CSM150XK351	
6	6	C3,C7,C9, C13,C15,C19	39pFMA SILVER MICA CAPACITOR	CSM390XK351	
7	1	C1 33pF	CERAMIC CAPACITOR NP0	CKM330BJ600C	
8	1	C2 4n7	CERAMIC CAPACITOR	CKM472BK600P	
9	3	L2,L4,L6 L26RVR1	2 SP DIA 7 R.A. 1.0mm	BFS10000206	
10	3	L1,L3,L5 L67RVR1	6 SP DIA 7 R.A. 1.0mm	BFS10000607	
11	3	CAV1,CAV2, CAV3	RG179-75 CAOX CABLE RG179 75Ohm	CAVRG17975	
12	4	CN1,CN2, CN3,CN4	N CONNECTOR CONN. N A TELAIO	CNTNFPFL	
13	1	D1 BAT83	HOT CARRIER DIODE	DHCBAT83	
14	5	ST1,ST2, ST3,ST4,ST5	STRIP LINE		



POWER COUPLER

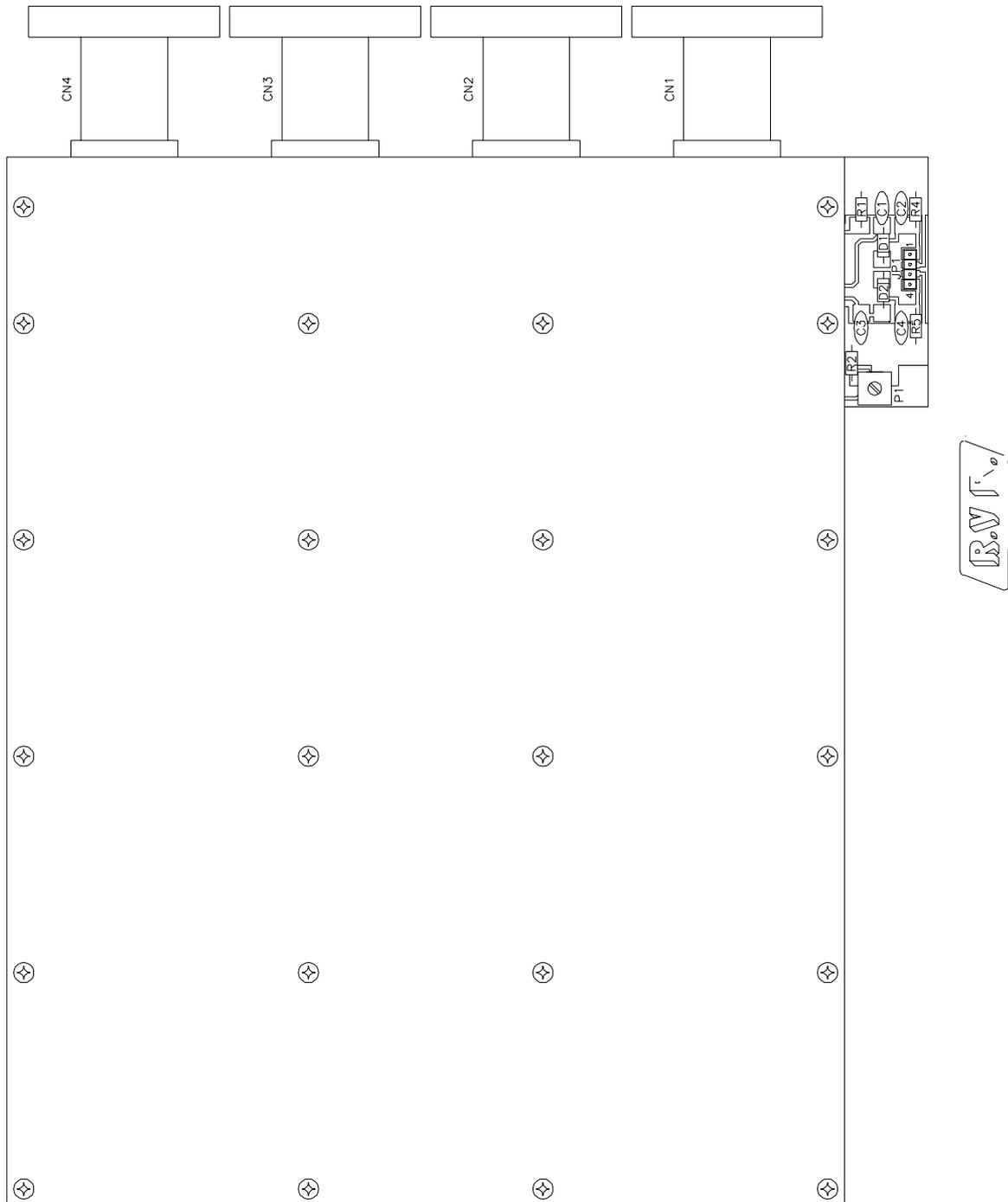
1	<i>Circuit Diagram</i>	<i>Pag. 39</i>
2	<i>Bill of Materials</i>	<i>Pag. 40</i>
3	<i>Layouts</i>	<i>Pag. 41</i>



JP1 1 -> TO PIN 7 OF CNI ALARMS CARD'S CONNECTOR
 JP1 4 -> TO PIN 8 OF CNI ALARMS CARD'S CONNECTOR

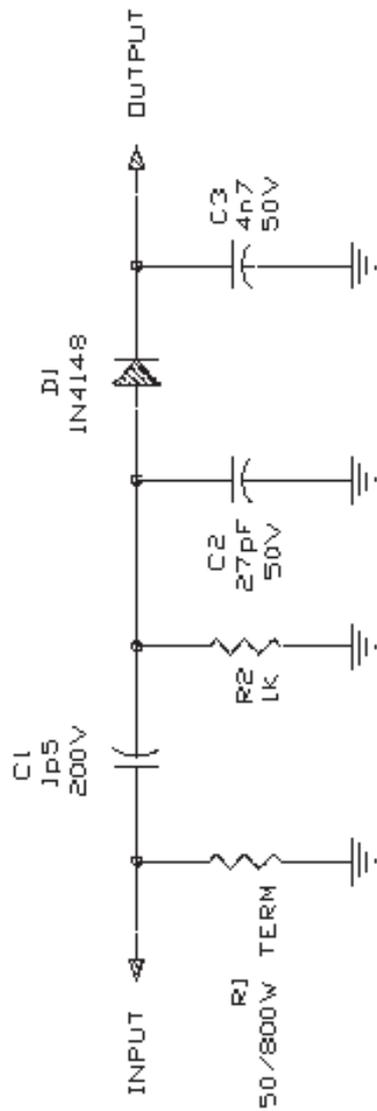
R.V.R. Elettronica S.r.l. (Bo)	
Title 3 Way Power Combiner Circuit Diagram	
Drawn	Document Number
As	REV
DATE	APPROVED BY

Power Coupler		Bill Of Materials/Lista Componenti		Page	1
Item	Quantity	Reference Part	Description	Part Order Code	
1	1 R3	47	RESISTOR 1/4W 5%	RSC1/4JH0047	
2	1 R1	68	RESISTOR 1/4W 5%	RSC1/4JH0068	
3	1 R2	270	RESISTOR 1/4W 5%	RSC1/4JH0270	
4	2 R4,R5	47K	RESISTOR 1/4W 5%	RSC1/4JK0047	
5	1 P1	TC200	TRIM. REG. VERT. CERMET	RVTTCERVH0200	
6	1 C5	27pF	CERAMIC CAPACITOR NP0	CKM270BJ600C	
7	2 C1,C3	33pF	CERAMIC CAPACITOR NP0	CKM330BJ600C	
8	2 C2,C4	4n7	CERAMIC CAPACITOR	CKM472BK600P	
9	1 JP1	4 PIN STRIP	STRIP M P 2.54 4 PIN	CNTSTRIPMCS	
10	6 CV1,CV2, CV3,CV4, CV5,CV6	RG303	COAX CABLE RG303	CAVRG303V	
11	1 CN5	N CONNECTOR	CONN. N A TELAIO	CNTNFPFL	
12	4 CN1,CN2, CN3,CN4	FLANGE 7/8"	FLANGE 7/8"	CNTFL7/8	
13	2 D1,D2	BAT83	HOT CARRIER DIODE	DHCBAT83	
14	5 ST1,ST2, ST3,ST4,ST5	STRIP LINE	STRIP LINE		



UNBAL POWER CARD

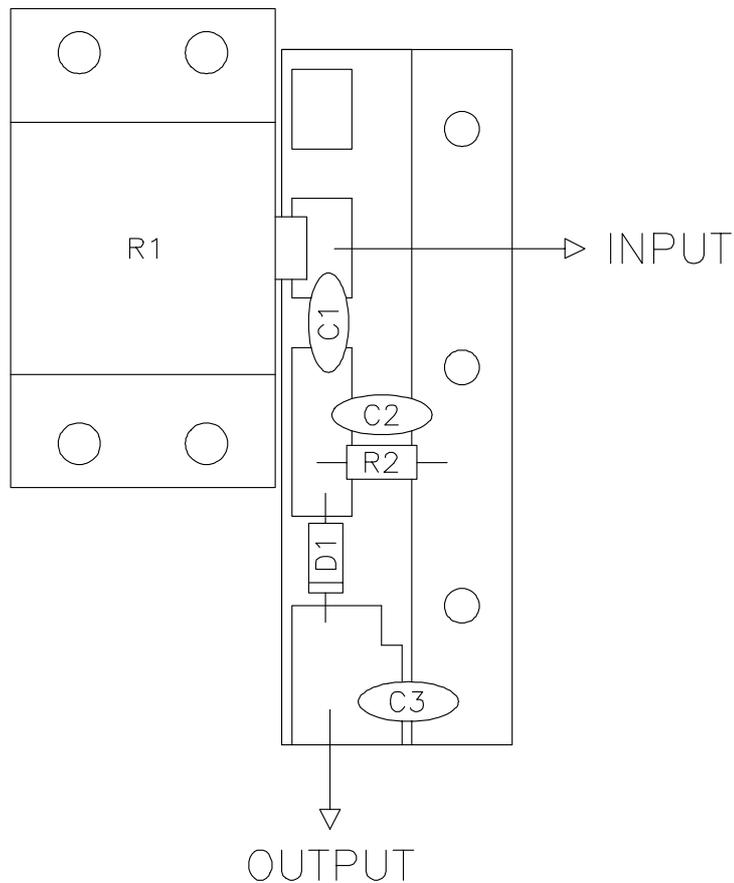
1	<i>Circuit Diagram</i>	<i>Pag. 43</i>
2	<i>Bill of Materials</i>	<i>Pag. 44</i>
3	<i>Layouts</i>	<i>Pag. 45</i>



Title		R.V.R. Elettronica S.r.l. (Bo)
Size		Unibal Power Card Circuit Diagram
Document Number		REV
Date:	January 27, 1997	Sheet 1 of 1

Item	Quantity	Reference Part	Description	Part Order Code
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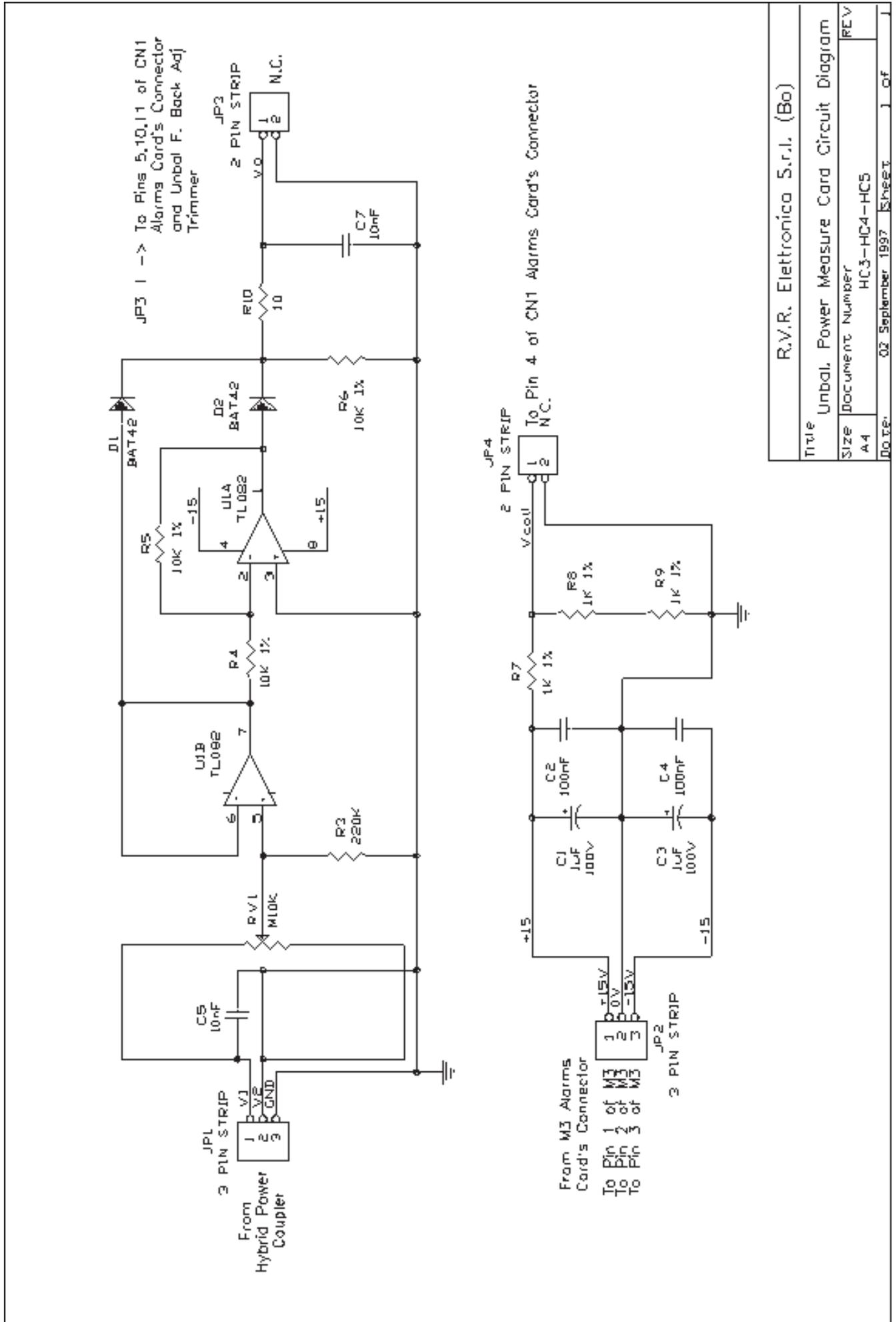
1	1	R1	50/800W TER	RES. TERMINAZIONE 800W	RDT800H0050
2	1	R2	1K	RESISTOR 1/4W 5%	RSC1/4JK0001
3	1	C1	1p5	CERAMIC CAPACITOR NP0	CKM1,5BJ600C
4	1	C2	27pF	CERAMIC CAPACITOR NP0	CKM270BJ600C
5	1	C3	4n7	CERAMIC CAPACITOR	CKM472BK600P
6	1	D1	1N4148	SILICON DIODE	DIS1N4148



	DENOMINAZIONE Unbal Power Card Component Layout / Piano di Montaggio	
	DISPOSITIVO	
SEMILAVORATO	DISEGNATO D'Alessio D. li 27/01/97	DISEGNO
MATERIALE	SCALA	TAVOLA n di
TRATTAMENTO		

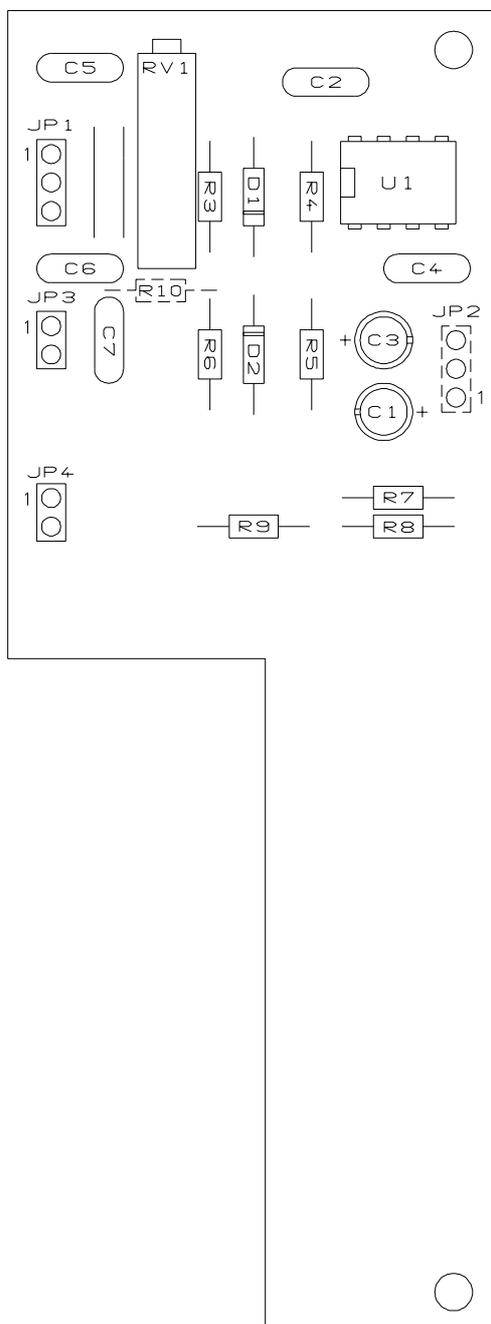
UNBALANCING POWER MEASURE CARD

1	<i>Circuit Diagram</i>	<i>Pag. 47</i>
2	<i>Bill of Materials</i>	<i>Pag. 48</i>
3	<i>Layouts</i>	<i>Pag. 49</i>



R.V.R. Elettronica S.r.l. (Bo)	
Title	Unbal. Power Measure Card Circuit Diagram
Size	Document Number
A4	HC3-HC4-HC5
REV	
Date:	02 September 1997
Sheet	1 of 1

Item	Quantity	Reference Part	Description	Part Order Code
1	1	R10 10	RESISTOR 1/4W 5%	RSC1/4JH0010
2	3	R7,R8,R9 1K 1%	RESISTOR 1/4W 1%	RSM1/4FK0001
3	3	R4,R5,R6 10K 1%	RESISTOR 1/4W 1%	RSM1/4FK0010
4	1	R3 220K	RESISTOR 1/4W 5%	RSC1/4JK0220
5	1	RV1 M10K	TRIMMER MULTIGIRI	RVTMULAK0010
6	2	C5,C7 10nF	CERAMIC CAPACITOR	CKM103BK600P
7	2	C2,C4 100nF	CERAMIC CAPACITOR	CKM104BK600P
8	2	C1,C3 1µF	ELECTROLYTIC CAPACITOR	CEA105AM630
9	2	JP3,JP4 2 PIN STRIP	STRIP M P 2.54 2 PIN	CNTSTRIPMCS
10	2	JP1,JP2 3 PIN STRIP	STRIP M P 2.54 3 PIN	CNTSTRIPMCS
11	2	D1,D2 BAT42	HOT CARRIER DIODE	DHCBAT42
12	1	U1 TL082	DOUBLE OP. AMP.	CILTTL082



	DENOMINAZIONE	
	Unbal. Power Measure Card Component Layout / Piano di Montaggio	
	DISPOSITIVO	
SEMILAVORATO	DISEGNATO	DISEGNO
MATERIALE	D'Alessio D. U	
TRATTAMENTO	SCALA	TAVOLA n di

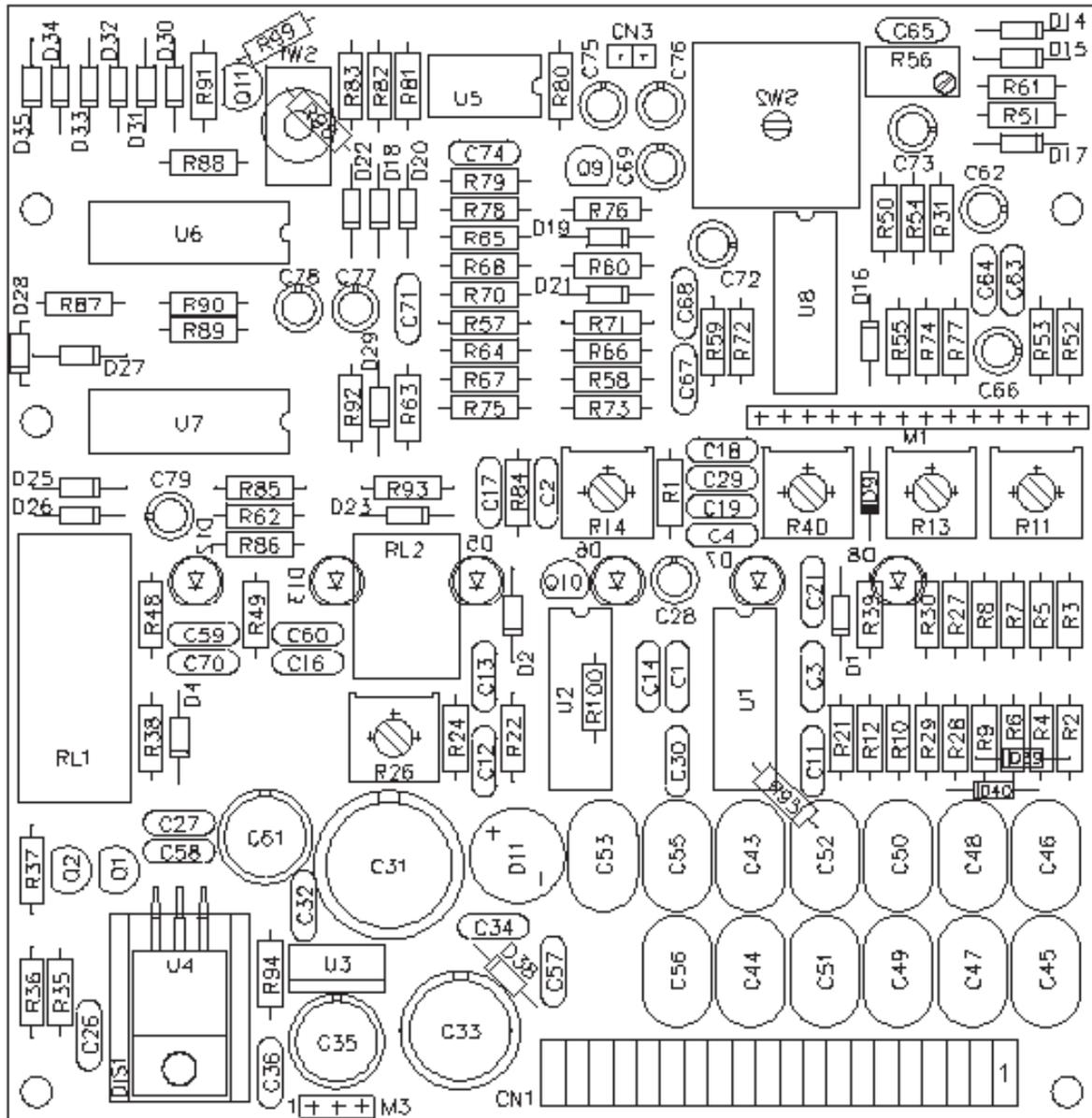
ALARMS CARD

1	<i>Circuit Diagram</i>	<i>Pag. 51</i>
2	<i>Bill of Materials</i>	<i>Pag. 53</i>
3	<i>Layouts</i>	<i>Pag. 55</i>

Alarms Card		Bill Of Materials/Lista Componenti			Page 1
Item	Quantity	Reference Part	Description	Part Order Code	
1	1	R35 330	RESISTOR 1/4W 5%	RSC1/4JH0330	
2	1	R39 470	RESISTOR 1/4W 5%	RSC1/4JH0470	
3	1	R51 680*	RESISTOR 1/2W 5%	RSC1/2JH0680	
4	1	R1 1K 1%	RESISTOR 1/4W 1%	RSM1/4FK0001	
5	8	R37,R48, 1K R49,R60,R67, R72,R77,R95	RESISTOR 1/4W 5%	RSC1/4JK0001	
6	2	R75,R93 2K2	RESISTOR 1/4W 5%	RSC1/4JK02,2	
7	2	R3,R5 4K16 1%	RESISTOR 1/4W 1%	RSM1/4FK4,16	
8	4	R54,R57, 4K7 R65,R99	RESISTOR 1/4W 5%	RSC1/4JK04,7	
9	1	R12 5K6	RESISTOR 1/4W 5%	RSC1/4JK05,6	
10	1	R30 10K 1%	RESISTOR 1/4W 1%	RSM1/4FK0010	
11	13	R10,R62, 10K R76,R80,R82, R83,R84,R88, R89,R90,R91, R94,R98	RESISTOR 1/4W 5%	RSC1/4JK0010	
12	2	R36,R38 15K	RESISTOR 1/4W 5%	RSC1/4JK0015	
13	8	R52,R59, 22K R63,R68,R70, R73,R78,R92	RESISTOR 1/4W 5%	RSC1/4JK0022	
14	1	R7 25K 1%	RESISTOR 1/4W 1%	RSM1/4FK0025	
15	5	R71,R81, 47K R85,R86,R87	RESISTOR 1/4W 5%	RSC1/4JK0047	
16	1	R8 47K3 1%	RESISTOR 1/4W 1%	RSM1/4FK47.3	
17	2	R53,R64 82K	RESISTOR 1/4W 5%	RSC1/4JK0082	
18	5	R2,R4,R6, 100K 1% R9,R29	RESISTOR 1/4W 1%	RSM1/4FH0100	
19	9	R21,R22, 100K R24,R31,R50, R55,R58,R61, R66	RESISTOR 1/4W 5%	RSC1/4JK0100	
20	2	R74,R79 220K	RESISTOR 1/4W 5%	RSC1/4JK0220	
21	2	R96,R100 330K	RESISTOR 1/4W 5%	RSC1/4JK0330	
22	1	R14 TC1K	TRIM. REG. VER. CERMET	RVTCERVK0001	

Alarms Card		Bill Of Materials/Lista Componenti		Page 2
Item	Quantity	Reference Part	Description	Part Order Code
23	1	R40 TC10K	TRIM. REG. VERT. CERMET	RVTCERVK0010
24	2	R11,R13 TC22K	TRIM. REG. VERT. CERMET	RVTCERVK0022
25	1	R26 TC100K	TRIM. REG. VERT. CERMET	RVTCERVK0100
26	1	R56 TM220K	TRIMM. MULT. REG. VERT.	RVTMULVK0220
27	8	C17,C18, 1nF C19,C21,C26, C27,C59,C60	CERAMIC CAPACITOR	CKM102BK600P
28	8	C11,C12, 10nF C64,C67,C68, C70,C71,C74	CERAMIC CAPACITOR	CKM103BK600P
29	14	C1,C3,C13, 0.1µF C14,C29,C30, C32,C34,C36, C57,C58A, C58,C63,C65	CERAMIC CAPACITOR	CKM104BK600P
30	1	C75 0.47µFT	TANTALIUM CAPACITOR	CET474AM350
31	3	C66,C69,C72 1µFT	TANTALIUM CAPACITOR	CET105AM350
32	7	C28,C62, 10µFT C73,C76,C77, C78,C79	TANTALIUM CAPACITOR	CET106AM350
33	1	C35 100µF	ELECTROLYTIC CAPACITOR	CEA107BM350
34	1	C61 220µF	ELECTROLYTIC CAPACITOR	CEA227BM350
35	1	C33 470µF	ELECTROLYTIC CAPACITOR	CEA477BM350
36	1	C31 1000µF	ELECTROLYTIC CAPACITOR	CEA108SCM350
37	1	M1 ST 250UA	STRUMENTO 250uA	SMABM42RQ251
38	1	CN3 2 PIN STRIP	STRIP M P 2.54 2 PIN	CNTSTRIPMCS
39	1	M3 3 PIN STRIP	STRIP M P 2.54 3 PIN	CNTSTRIPMCS
40	1	M1 14 P STRIP	STRIP M P 2.54 14 PIN	CNTSTRIPMCS
41	1	CN4 2 P F STRIP	STRIP F P 2.54 2 PIN	CNTSTRIPFCS
42	1	CN1 20 P CN.CS.	CON.STRIP 20P M. CS P.	CNTSRMCS20PO
43	12	C43,C45, FEMI C46,C47,C48, C49,C50,C51, C52,C53,C55, C56	FILTRO EMI MURATA	FEAY5S223500
44	1	RL2 RLY 1V 12V	RELAY 1 VIA 12V	RLD112

Item	Quantity	Reference Part	Description	Part Order Code
45	1	RL1	RELAY S/R RELAY SET / RESET 12V	RLDMZP-R2
46	1	SW1	P1V 2P PULSANTE 1 VIA 2 POS	PLS1V11M03CS
47	1	SW2	SW2V6P COMM. 2 VIE 6 POS FEME	COMR2V6PCS
48	2	D39,D40	1N4148 SILICON DIODE	DIS1N4148
49	22	D1,D2,D4, 1N914 D14,D16,D17, D18,D19,D20, D21,D22,D25, D26,D27,D28, D29,D30,D31, D32,D33,D34, D35	SILICON DIODE	DIS1N914
50	1	D23	1N4001 SILICON DIODE 50V	DIS1N4001
51	1	D38	1N4003 SILICON DIODE 200V	DIS1N4003
52	1	D11	WL04 DIODE BRIDGE 1.5A	PNRWL04
53	5	D5,D6,D7, LED-R5 D8,D12	RED LED DIODE	LEDRO05
54	1	D13	LED-G5 GREEN LED DIODE	LEDVE05
55	1	D15	Z3V9 ZENER DIODE 3.9V 0.4W	DIZ3V90W4
56	1	D9	Z9V1 ZENER DIODE 9.1V 0.4W	DIZ9V10W4
57	1	U4	7815 POS. STABILIZER 1A	CIL7815P
58	1	U3	7915 NEG. STABILIZER 1A	CIL7915P
59	2	Q9,Q11	BC237 NPN TRANSISTOR	TRNBC237
60	3	Q1,Q2,Q10	BC557 PNP TRANSISTOR	TRNBC557
61	2	U1,U2	TL084 QUAD OP. AMP.	CILTTL084
62	1	U5	NE555 TIMER	CIL555
63	2	U6,U7	4040 CMOS DIVIDER	CID4040
64	1	U8	LM3900 NORTON QUAD AMP.	CILLM3900

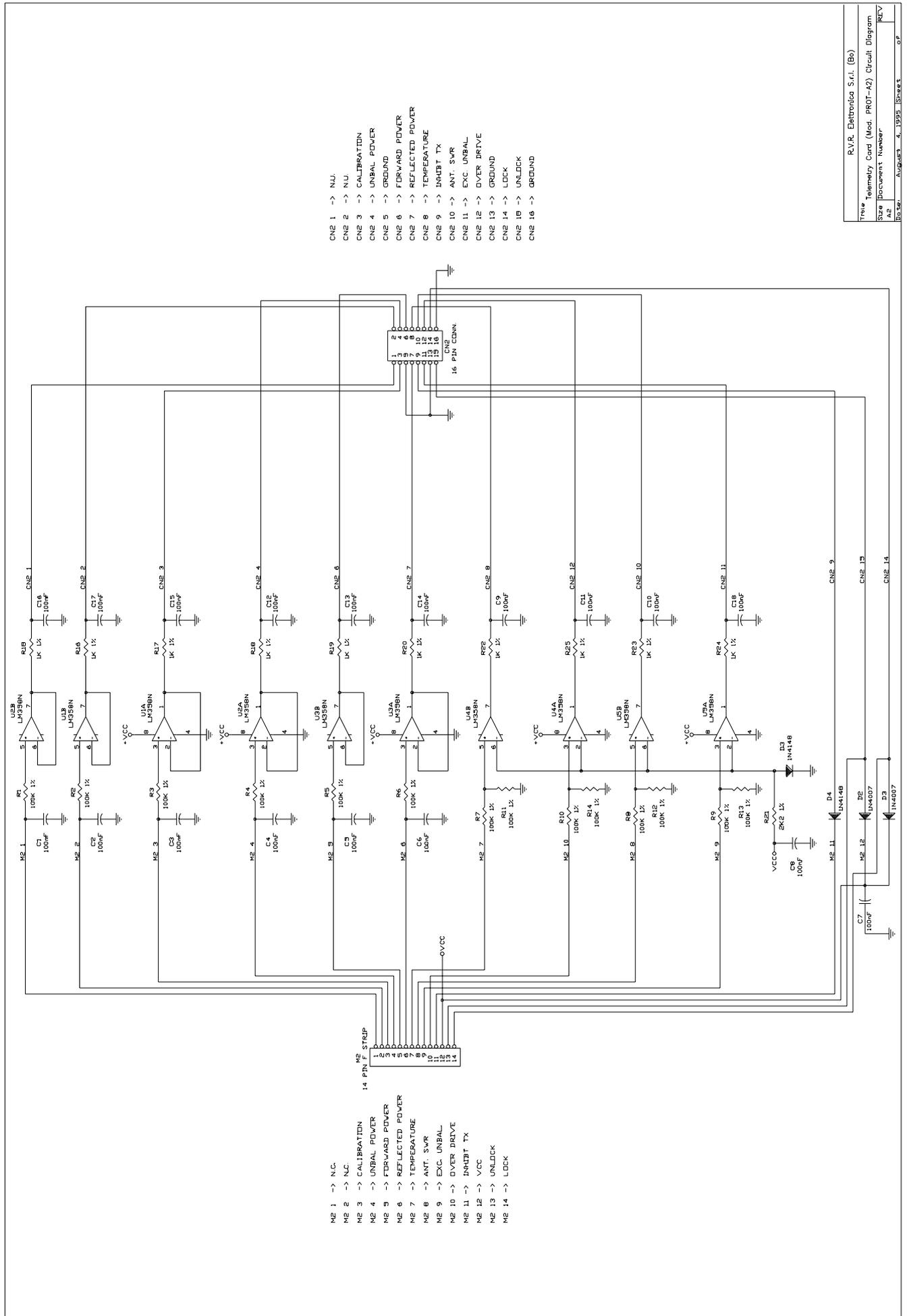


- R11 -> FWD PWR (meter reading)
- R13 -> RFL PWR (meter reading)
- R14 -> Full Scale Reading
- R26 -> OVER DRIVE Threshold
- R40 -> EXC. UNBAL. Threshold
- R56 -> ANT. SWR Threshold

	DENOMINAZIONE	
	Alarms Card Component Layout / Piano di Montaggio	
	DISPOSITIVO	
SEMILAVORATO	DISEGNATO	DISEGNO
MATERIALE	11/29/04/97	
TRATTAMENTO	SCALA	TAVOLA n. di

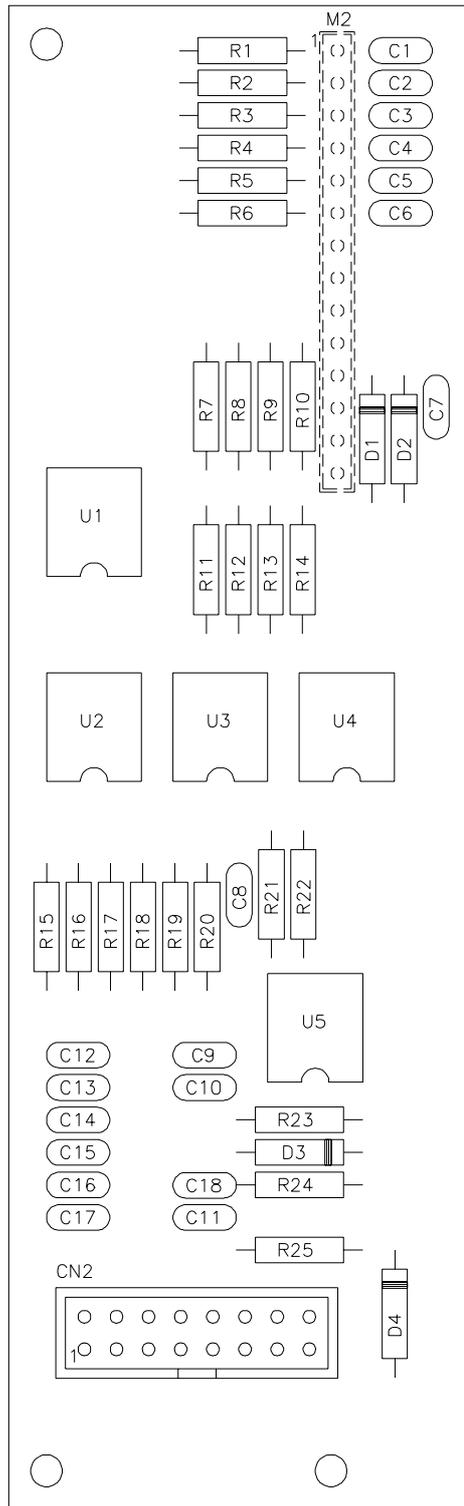
TELEMETRY CARD

1	<i>Circuit Diagram</i>	<i>Pag. 57</i>
2	<i>Bill of Materials</i>	<i>Pag. 58</i>
3	<i>Layouts</i>	<i>Pag. 59</i>



File	R.V.R. Elettronica S.r.l. (Bo)
Size	Telemetry Card (Mod. PROT-42) Circuit Diagram
Rev	A2
Bo. Ser.	August 4, 1995 Sheet 3 of 3

Telemetry Card		Bill Of Materials/Lista Componenti		Page	1
Item	Quantity	Reference Part	Description	Part Order Code	
1	9	R15,R16, 1K 1% R17,R19, R20,R22, R23,R24,R25	RESISTOR 1/4W 1%	RSM1/4FK0001	
2	1	R18 1K	RESISTOR 1/4W 5%	RSC1/4JK0001	
3	1	R21 2K2 1%	RESISTOR 1/4W 1%	RSC1/4FK02,2	
4	14	R1,R2,R3, 100K 1% R4,R5,R6, R7,R8,R9, R10,R11, R12,R13,R14	RESISTOR 1/4W 1%	RSM1/4FH0100	
5	18	C1,C2,C3, 100nF C4,C5,C6, C7,C8,C9, C10,C11,C12, C13,C14,C15, C16,C17,C18	CERAMIC CAPACITOR	CKM104BK600P	
6	1	M2 14 PF STRIP	STRIP F P 2.54 14 PIN	CNTSTRIPFCS	
7	1	CN2 16 P CONN.	CONN. M 2*8 P 2.54	CNTMCSFC16P	
8	2	D3,D4 1N4148	SILICON DIODE	DIS1N4148	
9	2	D2,D3 1N4007	SILICON DIODE 1000V	DIS1N4007	
10	5	U1,U2,U3, LM358N U4,U5	DOUBLE OP. AMP.	CILLM358N	



DENOMINAZIONE
Telemetry Card (Mod. PROT-A2) Component Layout / Piano di Montaggio

DISPOSITIVO

SEMILAVORATO

DISEGNATO

DISEGNO

MATERIALE

D'Alessio D. U

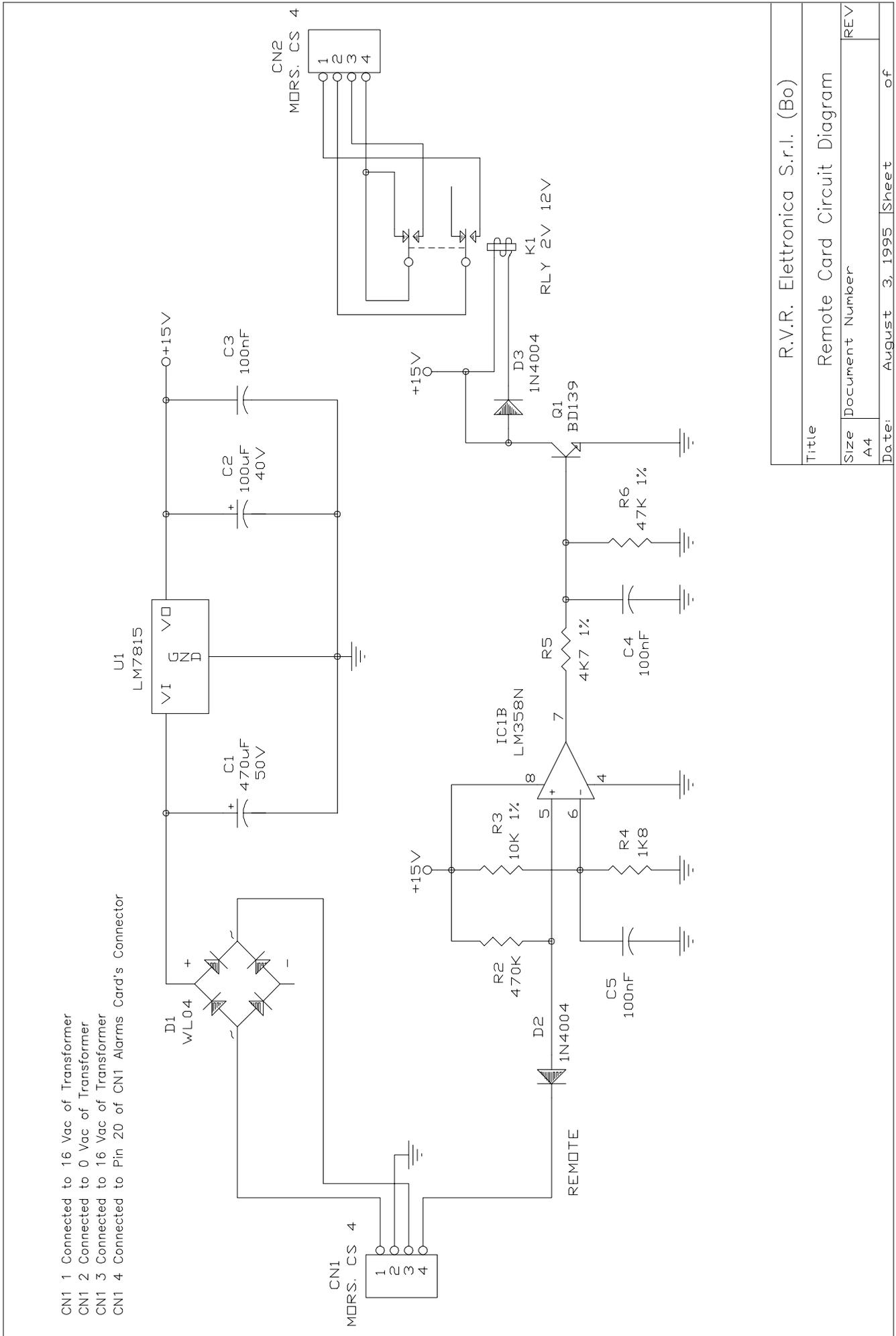
TRATTAMENTO

SCALA

TAVOLA n di

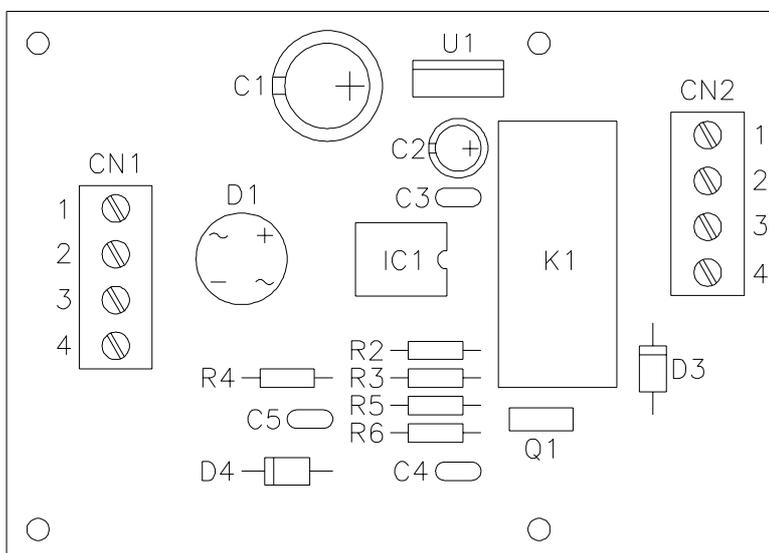
REMOTE CARD

1	<i>Circuit Diagram</i>	<i>Pag. 61</i>
2	<i>Bill of Materials</i>	<i>Pag. 62</i>
3	<i>Layouts</i>	<i>Pag. 63</i>



Title		R.V.R. Elettronica S.r.l. (Bo)	
Size		Remote Card Circuit Diagram	
Document Number	REV		
A4			
Date:	August 3, 1995	Sheet	of

Remote Card		Bill Of Materials/Lista Componenti		Page	1
Item	Quantity	Reference Part	Description	Part Order Code	
1	1 R4	1K8	RESISTOR 1/4W 5%	RSC1/4JK01,8	
2	1 R5	4K7 1%	RESISTOR 1/4W 1%	RSM1/4FK04,7	
3	1 R3	10K 1%	RESISTOR 1/4W 1%	RSM1/4FK0010	
4	1 R6	47K 1%	RESISTOR 1/4W 1%	RSM1/4FK0047	
5	1 R2	470K	RESISTOR 1/4W 5%	RSC1/4JK0470	
6	3 C3,C4,C5	100nF	CERAMIC CAPACITOR	CKM104BK600P	
7	1 C2	100uF	ELECTROLYTIC CAPACITOR	CEA107BM350	
8	1 C1	470uF	ELECTROLYTIC CAPACITOR	CEA477BM350	
9	2 CN1,CN2	MORS.CS 4 MORSETT. C.S. 4 CONT.		MORSKB04PPO	
10	1 K1	RLY 2V 12V	RELAY 2 VIE 12V	RLDLFHA00212	
11	2 D2,D3	1N4004	SILICON DIODE 400V DIS1N4004		
12	1 D1	WL04	DIODE BRIDGE 1.5A	PNRWL04	
13	1 U1	LM7815	POS. STABILIZER	CILLM7815	
14	1 Q1	BD139	NPN TRANSISTOR	TRNBD139	
15	1 IC1	LM358N	DOUBLE OP. AMP.	CILLM358N	



DENOMINAZIONE
Remote Card Component Layout / Piano di Montaggio
DISPOSITIVO

SEMILAVORATO

DISEGNATO
D'Alessio D.ti

DISEGNO

MATERIALE

SCALA

TRATTAMENTO

TAVOLA n di

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