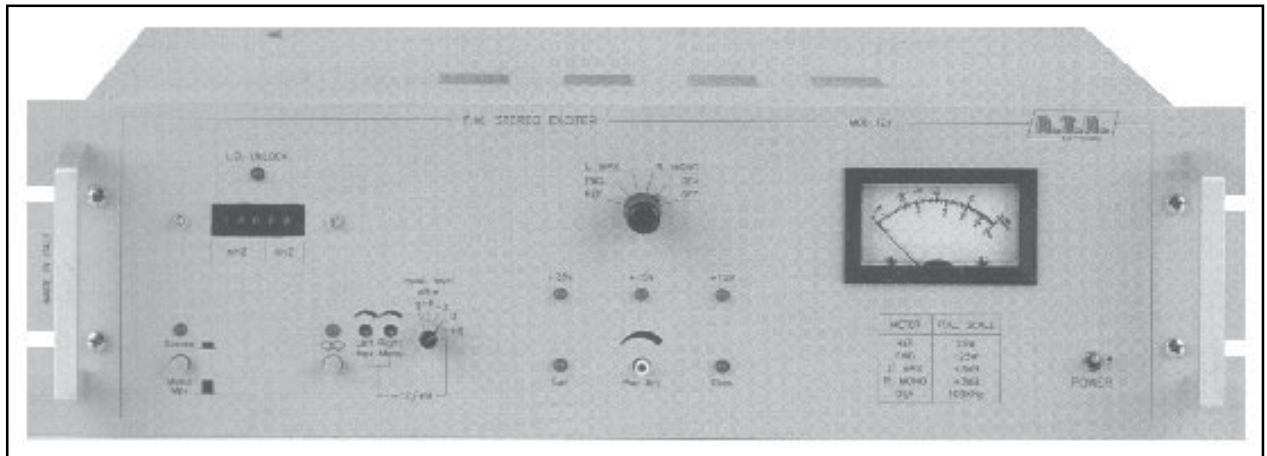

TEX100

TEX100/S



User Manual

Volume 1

Manufactured by



Italy



File Name: CAPITOLI_EN.p65

Version: 4.0

Date: 18/07/2003

Document History

Date	Version	Reason	Author
30/01/02	1.0	First electronic version	M. Morotti
01/07/03	4.0	New format in 2 volumes New Main card	D. Canazza

TEX100 - User Manual
Version 4.0

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Notification of intended purpose and limitations of product use

This product is a FM transmitter intended for FM audio broadcasting. It utilises operating frequencies not harmonised in the intended countries of use.

The user must obtain a license before using the product in intended country of use. Ensure respective country licensing requirements are complied with.

Limitations of use can apply in respect of operating frequency, transmitter power and/or channel spacing.

Declaration of Conformity

Hereby, R.V.R. Elettronica SpA, declares that this FM transmitter is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.



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1. Preliminary Instructions

This manual is designed to provide a general guide to skilled and qualified personnel, who are aware of the dangers that may arise when handling electric and electronic circuits.

It does not aim to provide a complete description of all the safety precautions that must be observed by people who use this or similar equipment.

The installation, operation, maintenance and use of this piece of equipment involve risks both for people and the equipment itself, which must be handled only by experienced technicians.

R.V.R. Elettronica SpA does not assume responsibility for injuries to persons or damage to items caused by improper use or incorrect usage procedures, whether the users are experienced or not.

Users should observe local regulations and fire-prevention rules while installing and using this equipment.



WARNING: always disconnect the power before opening covers or removing any part of the equipment.

Take appropriate earthing measures to discharge the condensers and high voltage points before doing any maintenance work.



WARNING: this equipment may radiate radio-frequency energy, and if it is not installed according to the instructions, may cause troublesome interference to radio communications.

Operating this equipment in a residential environment may give rise to radio disturbance; if so, the user may be asked to take appropriate counter measures.

R.V.R. Elettronica SpA reserves the right to make modifications to the design and technical specifications of the equipment, and to update this manual without notice.

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2. Warranty

The guarantee, which is for 12 (twelve) months, is valid for any R.V.R. Elettronica product.

On components such as tubes for final amplifiers, the manufacturer's guarantee applies.

R.V.R. Elettronica extends all transferable original guarantees to its own products. To ensure that servicing is carried out properly and as fast as possible, the work shall be handled by R.V.R. Elettronica; any claims should be sent directly to R.V.R. Elettronica, in accordance with the defined procedures.

The warranty does not include:

- 1 damage while the equipment is being shipped to R.V.R. for repairs;
- 2 any unauthorized modification or repair;
- 3 accidental damage, or damage not due to defects in the equipment;
- 4 nominal damage not accidental;
- 5 shipping the equipment and insuring it, and replacement of parts or units.

Any damage to the equipment caused during shipment must be reported to the transporters and notified in writing on the forwarding receipt.

Any difference or damage discovered after delivery must be reported to R.V.R. Elettronica within 5 (five) days from the delivery date.

To take advantage of the guarantee, adopt the following procedure:

- 1 Contact the retailer or dealer where you bought the equipment; describe the problem or fault to check if there is a simple solution.

Retailers and Distributors can provide full information on the problems that occur most frequently; they can normally repair the equipment much faster than the manufacturer

- 2 If your dealer cannot help you, contact R.V.R. Elettronica and describe the problem to them; if necessary, you will be sent authorization with the necessary instructions;
- 3 When you have received authorisation, return the equipment carriage paid to the address specified.

Pack it carefully, if possible in the original packing, and seal the package.



Do not return the machine without prior authorization, otherwise it may be returned to you

- 4 Quote the machine's type, model and serial number; attach a written technical diagnosis listing all the problems and faults encountered, and enclose a copy of the invoice.

Replacement of parts under guarantee or spare parts can be ordered from the following address:



R.V.R. Elettronica SpA
Via del Fonditore, 2/2c
40138 BOLOGNA
ITALY
Tel. +39 051 6010506

quoting type, model and serial number of the device.

3. First Aid

Personnel involved in the installation, use, and maintenance of the equipment must be familiar with the theory and practice of first aid.

3.1 Treating electric shocks

3.1.1 If the victim is unconscious

Follow the first aid principles described below.

- Lay the victim down on his back on a rigid surface
- Free the respiratory tracts by raising the neck and pushing the forehead back (Figure 1).
- If necessary, check the breathing of the victim opening his mouth.
- If the victim is not breathing, start artificial respiration immediately (Figure 2): incline the head, close the nostrils, apply your mouth to the victim's and make four fast respirations.

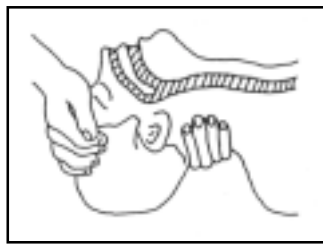


Figure 1



Figure 2

- Check the heart beat (Figure 3); if there is none, start a cardiac massage immediately (Figure 4) pressing the sternum approximately at the centre of the chest (Figure 5).



Figure 3

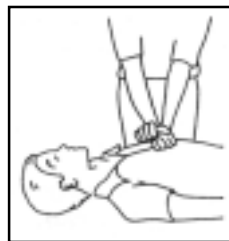


Figure 4

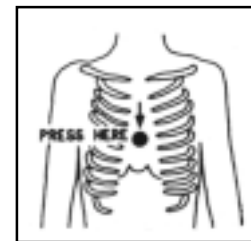


Figure 5

- If there is just one person providing first aid, he must adopt a rhythm of 15 compressions and 2 fast respirations alternately.
- If there are two persons, the rhythm must be 1 respiration and 5 compressions alternately

- Do not interrupt the cardiac massage during the artificial respiration.
- Call a doctor as soon as possible

3.1.2 If the victim is conscious

- Cover the victim with a blanket
- Keep him calm.
- Loosen the victim's clothes and keep him lying down
- Call a doctor as soon as possible

3.2 Treating electric burns

3.2.1 Large-scale burns and serious cuts

- Cover the area concerned with a sheet or a clean cloth.
- Do not break the blisters; remove any fabric and parts of clothing that may be attached to the skin; apply a suitable ointment.
- Treat the victim depending on the type of accident.
- Take the victim to hospital as soon as possible.
- If the arms and legs are injured, keep them raised.

If no medical help is available within an hour and the victim is conscious and has not retched, administer a liquid solution of salt and bicarbonate of soda: 1 teaspoonful of salt to every 250ml of water.

Get the victim to slowly drink half a glass of the solution, four times, over a period of 15 minutes.

Stop the treatment if the victim starts to retch.



Do not administer alcoholics!

3.2.2 Less serious burns

- Apply cold gauze compresses (not iced) using a clean cloth (i.e. as clean as possible).
- Do not break any blisters; remove any fabric and parts of clothing that may be attached to the skin; apply a suitable ointment.
- If necessary, dress the victim in clean dry clothes.
- Treat the victim depending on the type of accident.
- Take the victim to hospital as soon as possible.
- If the arms and legs are injured, keep them raised.

4. General Description

The TEX100 is an exciter working in the 87.5 to 108 MHz band, programmable in steps of 10KHz. Its power output is continuously adjustable from 5W to 100W into a 50 Ohm load and it's contained in a 19" rack mountable 3HE case.

The power output control, audio input level control and analog meter for the measurement of operating parameters, are all mounted on the front panel, beyond to the selector of the working frequency and to various LED.

The line power, audio input, RF output and telemetry connectors are mounted on the rear panel.

This device is present in two version: the mono (TEX100) and the stereo version (TEX100/S).

The TEX100 incorporates a stereo coder which guarantees excellent stereo separation together with low harmonic distortion (only for Stereo version). It also accepts two SCA signals. A front panel switch allows stereo operation (only for stereo version) or "mono/ mpx" operation which excludes the stereo encoder and uses the "right" input as the mono input and the "left" input as the wideband composite input (MPX).

The TEX100 (Mono/MPX version) can be used for monophonic transmission or, with an external coder stereo, for stereophonic transmission.

Both the versions include two subcarrier inputs, usable for RDS (Radio Data System) transmission or SCA.

The specification features low audio distortion and intermodulation figures (typically 0.03%) and a high signal-to-noise ratio (typically -80 dB).

A voltage selector on the transformer primary allows a variety of supply voltages to be used.

The operating parameters of the exciter can be monitored using the analog multimeter situated on the front panel. The parameter to be measured is selected by the rotary selector.

The frequency control allows frequencies to be selected in steps of 10KHz (note that the actual norms in some countries preview the obligation of transmission on channels with steps of 100 kHz; for this reason, the TEX100, comes supplied on demand with step of selection of frequency of 100 kHz) .

Three red alarm leds indicate PLL unlock , excess SWR on the output and the excess of temperature, and the shutdown condition, programmed by a remote command (interlock). Three green leds indicate the presence of +12V, +15V and +28V voltages which are used to power the various cards inside the exciter.

In the stereophonic version, are present two switch to that allows the selection between Mono/MPX and Stereo functions and to disabled the 19 KHz subcarrier from the coded signal.

For both the models, on the front panel is present a selector for the audio input level adjustment. These can be regulated on fixed values of -9, -6, -3, 0 o +6 dBm (for 75 kHz of deviation), or a position can be selected where the inputs can go from -12 to +9 dBm and the regulation for the correct level of the deviation comes made through two trimmer accessible from the panel.

The operating frequency is governed by a thermally-compensated, reference oscillator working within a phase-locked loop (PLL). The TEX100 reaches frequency lock within a maximum of 30 seconds.

The exciter contains the control circuitry for the following functions:

- automatic control of the output power (maintains the prefixed level on all the frequency range to varying of the work conditions, being based also on two signals of external feedbacks)
- protection of the final stage from excess of standing waves (internal or external), or from temperature excess.

The control circuits allow automatic control of output power (internal and external), maintaining the chosen power level across the entire operating band. Furthermore another circuit protects the final stage against excessive VSWR or short circuits and excessive temperature.

Then, there are other protection circuits that allow to limit the maximum output power and to protect the equipment against a power supply's overvoltage.

The RF amplifier is a wide-band design and guarantees an adjustable power output up to 100 watts across the entire FM band.

A low-pass filter enables the TEX100 to be used as a low power transmitter, connected directly to an antenna: the harmonic emissions are reduced under the levels allowed from the international norms, like CCIR or FCC.

The TEX100 is designed in a modular way: the different functionalities are performed by modules that are then interconnected either directly (the male connector of one module plugs in the the female connector of another one) or by means of connectors-ended cables. This design allows easy servicing and replacement of the single modules.

5. Installation and Use Quick Start

This chapter gives a concise view of the points that are necessary for the installation of the device. If any item is not completely clear, for example when you use the exciter for the first time, we strongly suggest to read throughly the manual.

5.1 Preparation

Unpack the exciter and before any other operation check the unit for any shipping damage and check that all the controls and connectors on the front and rear panels are in good conditions.

Check the mains voltage selector on the rear panel: the selected value is indicated by an arrow. If required, extract the selector block levering with a little screwdriver. Rotate the block until the correct printed value corresponds with the arrow, then reinsert it.

The current capacity of the fuses are are the follows:

- Power supply (in the mains voltage selector block):

230-240V	3.15A 5X20
100-120V	6.3A 5X20
- P.A. Fuse 8A 10X38
- Fuse 6A 10X38

Now ensure that the “PWR ADJ” control is rotated fully anti-clockwise, using a small screwdriver.



NOTE: The control is a ten-turn potentiometer so care should be taken to verify the minimum position.

Units are usually shipped with this control already at minimum.



NOTE: When the unit is switched on with the control at its minimum position, power output is about 5W.

Connect a dummy load with a power rating of at least 100 W continuous to the “N” type connector of the RF output, situated on the rear panel of the unit. It is advisable to connect a bypass wattmeter in series with this load in order to verify the accuracy of the unit's own internal wattmeter, as shown in the Figure 5.1.

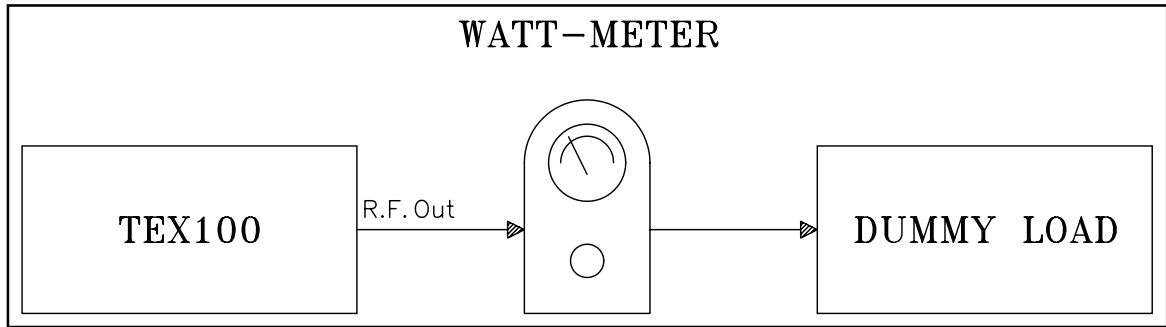


Figure 5.1

Connect a switch, via a cable, to the BNC connector (REMOTE 3) on the rear panel so that the switch is able to short the central conductor to its screen. Leave the switch in the short-circuit position. It is not indispensable to have a cable of this type, but it is comfortable when is wanted to able or to disable fastly the emission of power is wanted.

Verify that TEX100 is switch off.

Connect line power to the unit via the VDE socket.



NOTE: This device shall be correctly connected to ground. Correct grounding is essential both for safety and to reach the rated performances.

5.2 Use

Select the desired operating frequency using the corresponding selector. The frequency selector comprises five figures of which the three to the left of the decimal point represent (from left to right) hundreds of MHz, tens of MHz and MHz. Examples of right configurations are:

0 9 8 4 5

98.45 MHz

1 0 3 9 0

103.90 MHz

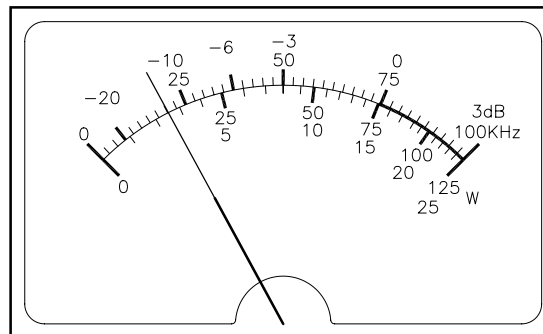
Furthermore, if a frequency is selected beyond the two limits of the 87.5-108 MHz band, the amplifier will continue to work even through the displayed frequency no longer corresponds to the operating frequency of the unit.



NOTE: Transmitting outside the legal band (87.5-108 MHz) is an offence and may lead to prosecution. For this reason, the TEX100 can be equipped on demand with a device that prevents the transmission on various frequencies from those concurred.

Switch On the TEX100 and check that the three green internal voltage led and the red UNLOCK led are all lit.

After having verified that the UNLOCK led is switched off (about 30 sec.) and that the unit is therefore locked to the selected working frequency, switch the switch connected to the REMOTE connector so as to remove the short circuit between the central conductor and ground. The RF output is now enabled and should correspond to a power level of about 5W. To check this reading, select FWD on the meter selector and read the power from the 120 W FSD scale:



Using a small screwdriver, rotate the PWR ADJ control clockwise; the power output should increase progressively to a maximum of 100W. Check the value with the bypass wattmeter which should be within $\pm 10\%$.

With the power output at 100W, select a new operating frequency well away from the current value: at the same time will happens time that the "UNLOCK" led be litted and that the output power goes completely to 0; only when the led turn off (new locked frequency) it will be returned to having output power.

The functionalities of the TEX100 are described in the continuation.

- Automatic power control check

It is advisable to start this procedure with the operating frequency set to 87.50 MHz. When locked to this frequency, the PWR ADJ control should be adjusted for an output power of 50 W.

Now, with no further adjustment of the PWR ADJ control, change the operating frequency in steps of 4-5 MHz, ensuring that the output power remains constant at 50 W.

- SWR alarm check

For this test, adjust the PWR ADJ control for a power output of 5W. Disconnect the output load and check that the S.W.R. led switches on.

Now check that the reflected power doesn't exceed 25% of the output power and that, once exceeded the alarm threshold, the output forward power decrease to avoid that the final stage can be damaged.

Re-connect the output load and check that REF falls to zero, the SWR led switches off and that PWR FWD jumps to 100 W.

- Deviation reading check

The maximum input sensitivity is determined by the position of the INPUT LEVEL control. In the -12/+9 position, the sensitivity will depend on the L/mpx and R/mono controls.

The following procedure is referred to a TEX100/S. For the Mono/MPX version, proceed in analogous way.

- Put the selector in the L/MPX position.
- Connect a low-distortion audio generator to the LEFT and RIGHT inputs..
- Put the INPUT LEVEL control in the 0dBm position.
- Inject a 400 Hz tone at a level of 0dBm ($775\text{mV}_{\text{RMS}} = 2.2\text{V}_{\text{pp}}$).
- Select stereo mode with the pilot tone enabled (the corresponding two leds will switch on).
- Check that the reading is 0dB, measured on the +3dB FSD scale.
- Repeat the operation for the Right.
- In these conditions, verify that the deviation measured on the instrument (position of selector on "DEV") is of 75 kHz.

5.3 Operation using the Internal Stereo Encoder (TEX100/S)

Inject the pilot tone checking that the corresponding led switches on, than select STEREO operation confirmed by the corresponding led.

Select the sensitivity of the audio LEFT/RIGHT inputs to match the signal level being supplied to the unit. Connect the signal source to the LEFT/RIGHT inputs (these are balanced inputs).

Check on the internal analog meter that the L/R signal levels are those expected, selecting the desired input with the corresponding control. The effective modulation level may be measured on the analog multimeter by selecting DEV with the corresponding selector.

5.4 Operation using an External Stereo Encoder

Connect the stereo source's output to the MPX input of the unit.

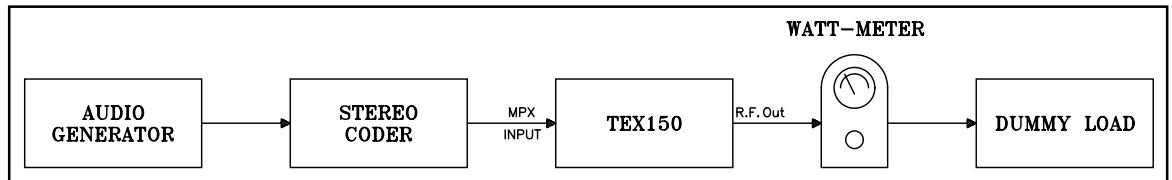


Figure 5.2

Adjust the stereo encoder to obtain just the 19 KHz subcarrier output and ensure the total absence of signals on the left and right inputs of the encoder.

Adjust the output level of the encoder to obtain the correct level as displayed on the analog meter of the TEX100, typically 7,5 KHz. Inject audio signals into the left and right inputs of the encoder and adjust the sensitivity of the input (with both channels enabled) to obtain a peak reading of MAX=75KHz.

5.5 Monophonic Transmission

Connect the signal source (audio mixer, receiver, compressor etc.) to the MONO input (this input is unbalanced), and select the desired INPUT LEVEL.

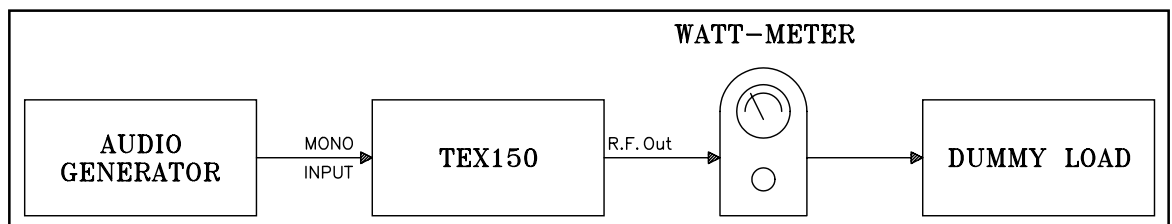


Figure 5.3

Adjust the signal level of the equipment connected to the TEX100 (with the audio signal present) for a peak reading of DEVIATION MAX 75 KHz.



NOTE: The international standards permit a maximum deviation of 75 KHz for radiophonic transmissions in Frequency Modulated. Exceeding this limit will only result in the degradation of signal quality and represents a violation of the laws and regulations in vigor.

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6. External Description

This chapter describes the elements of the front and rear panels of the TEX100.

6.1 Front Panel (TEX100/S stereo version)

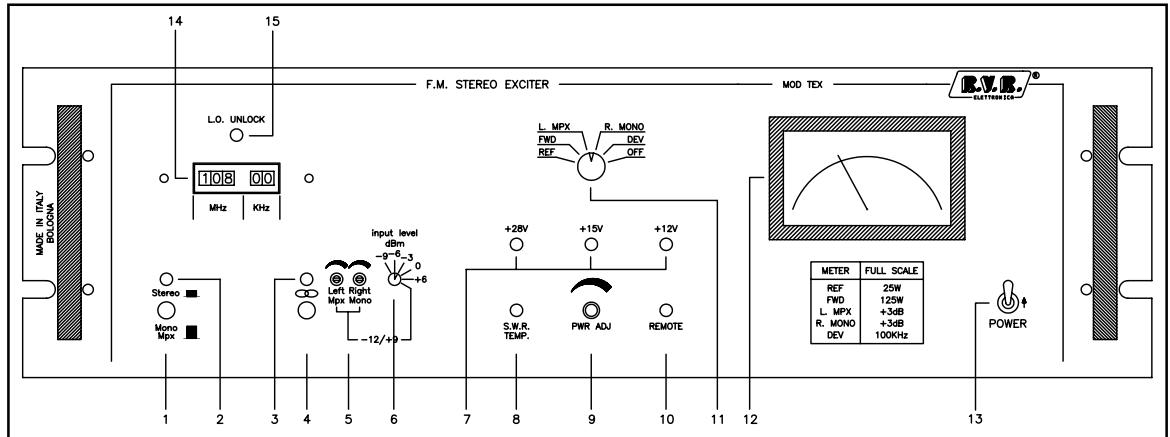


Figure 6.1

- | | |
|--------------------------|--|
| [1] STEREO/MONO | MPX Selects STEREO or MONO/MPX operation |
| [2] STEREO LED | When lit, indicates the operation of the stereo encoder |
| [3] 19KHz LED | When lit, indicates the 19KHz pilot tone presence |
| [4] MODE SELECTOR | Selects the enabled/disabled of the pilot tone inside the MPX signal |
| [5] L/MPX & R/MONO LEVEL | L/MPX and R/MONO input level adjustable from -12 to +9dBm; this is possible if the input level [6] switch is completely turned clockwise |
| [6] INPUT LEVEL | Input signal attenuator adjustable in 5 steps from -9 to +6 dBm, plus one position for continuous regulation |
| [7] SUPPLY LED | When lit, indicates the presence of internal operating voltages |
| [8] SWR + TEMP | Indicates that the reflected power exceeds 10W |
| [9] PWR ADJ | Multi-turn trimmer to regulate the power output of the exciter. AGC maintains constant the output level set by this control |
| [10] REMOTE | When lit, indicates that the exciter has been shutdown by remote control |
| [11] MEAS. SELECTOR | The measurement made by the meter corresponds to the position of this selector |
| [12] METER | Analog meter used to display the following operating parameters of the exciter: |
| | Direct power f.s. 125W |
| | Reflected power f.s. 25W |
| | Deviation f.s. 100KHz |
| | Right channel input level f.s. +3dB |
| | Left channel input level f.s. +3dB |
| [13] POWER | Switch ON/OFF selector |
| [14] MHz/KHz | Rotatory frequency selector |
| [15] L.O. UNLOCK | When lit, indicates that the VCO is not locked to the reference frequency. The output power will drop zero in this condition |

6.2 Front Panel (TEX100 mono version)

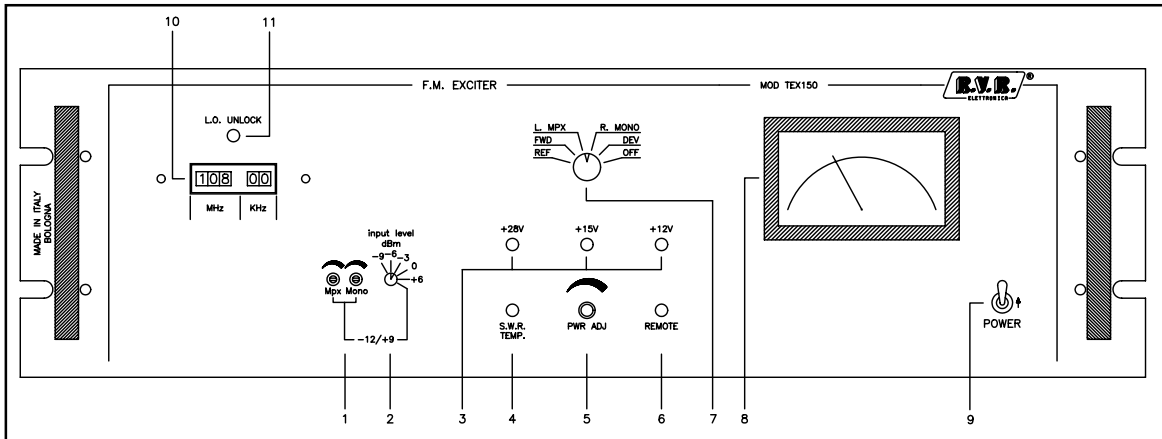


Figure 6.2

- [1] L/MPX & R/MONO LEVEL Trimmer for the inputs levels regulation L/MPX and R/MONO; when the inputs levels selector [2] is turned completely in clockwise sense, the inputs levels can be regulated with continuity between -12 and +9 dBm
- [2] INPUT LEVEL Input signal attenuator adjustable in 5 steps from -9 to +6 dBm, plus one position for continuous regulation
- [3] SUPPLY LED When lit, indicates the presence of internal operating voltages
- [4] SWR + TEMP Indicates that reflected power exceeds 10W
- [5] PWR ADJ Multi-turn trimmer to regulate the power output of the exciter.
- [6] REMOTE When lit, indicates that the exciter has been shutdown by remote control
- [7] MEAS. SELECTOR The measurement made by the meter corresponds to the position of this selector
- [8] METER Analog meter used to display the following operating parameters of the exciter:

Direct power	f.s. 125W
Reflected power	f.s. 25W
Deviation	f.s. 100KHz
Right channel input level	f.s. +3dB
Left channel input level	f.s. +3dB
- [9] POWER Switch ON/OFF selector
- [10] MHz/KHz Rotatory frequency selector
- [11] L.O. UNLOCK When lit, indicates that the VCO is not locked to the reference frequency. The output power will drop zero in this condition

6.3 Rear Panel

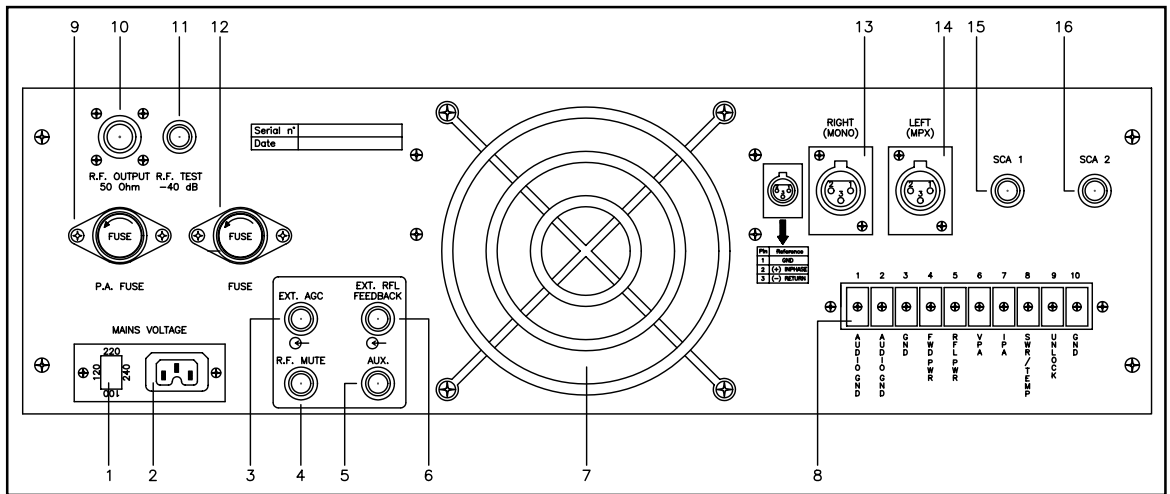


Figure 6.3

- | | |
|-------------------------|---|
| [1] FUSE BLOCK | Fuse block and line voltage selector. Use a small screwdriver to change the fuse or the line voltage. Rotate the block and position it so that the arrow corresponds to the working voltage wished |
| [2] PLUG | Line power connector |
| [3] REMOTE 1 | BNC connector, external AGC input |
| [4] REMOTE 2 | BNC connector, external reflected feedback input |
| [5] EXT REF 1KHz | External 1KHz reference (optional) |
| [6] REMOTE 3 | BNC connector. Connecting the central conductor to ground will cause the Rf output power level to drop to zero and to stay there until the short is removed. When used with an R.V.R. amplifier, this connector should be connected to the REMOTE output of the power amplifier |
| [7] FAN | Fan assisted cooling for the power stage and the power supply |
| [8] TELEMETRY TERMINALS | Telemetry terminals board |
| [9] P.A.. FUSE | Power amplifier protection fuse 8A |
| [10] R.F. OUTPUT | N type connector, 50Ohm |
| [11] R.F. TEST POINT | -40dB output referred to the output power level |
| [12] FUSE | Main protection fuse 6A |
| [13] RIGHT (MONO) | BNC connector for FCC unbalanced version; cannon XLR for CCIR version with balanced input |
| [14] LEFT (MPX) | BNC connector for FCC version; cannon XLR for CCIR version with balanced input |
| [15] SCA 1 | BNC connector, unbalanced SCA1 input |
| [16] SCA 2 | BNC connector, unbalanced SCA2 input or output (internally selectable) for pilot tone (i.e. for R.D.S. encoder) |

6.4 Descrizione Connettori

6.4.1 Sinistro (MONO) / Destro (MPX Bal)

Tipo: XLR femmina



- | | |
|---|----------|
| 1 | GND |
| 2 | Positivo |
| 3 | Negativo |

7. Technical Specifications

7.1 Mechanical Specifications

Panel size	483 mm (19") x 132.50 mm (5.20") (3 HE)
Depth	345 mm (13.7")
Weight	15 Kg
Temperature range	-10 °C , +50 °C

7.2 Electrical Specifications

General

A.C. Supply	117-230 V \pm 10%, 50-60 Hz single phase
Power consumption	approx.230W
Cooling	Forced ventilation
Frequency range	from 87.5 to 108MHz in steps of 10KHz
Output power Adjustable	Adjustable from 5 to 100W
Automatic output level control	Stabilizes the set RF output level, septate with internal or external reference
S.W.R. protection	The maximum output power comes diminished in proportional way in case the reflected power increase; this control acts with internal or external reference
Output Impedance	50Ohm
Output connector	Standard "N"-type
Temperature control	Intervene in case of temperature excess of the final stage reducing the output power
Harmonic suppression	> -70dB
Spurious signal suppression	> -80dB
Intermodulation distortion	0.05% or less, measured at 1KHz and 1.3KHz, ratio 1:1 at 100% modulation
Frequency stability	\pm 500Hz (typically \pm 300Hz) from 0° to 50° C
Modulation type	Direct frequency modulation of the RF oscillator at fundamental frequency
Frequency deviation	\pm 75KHz nominal
Harmonic distortion	< 0.05% (typically 0.01%)
FM signal/noise ratio	> 75dB mono, > 70dB stereo measured with 75KHz deviation in the 30Hz to 15KHz band RMS.
Residual AM (asynchronous)	approx. 0.05% = 65dB RMS
Residual AM (synchronous)	0.1% = 60dB
Pre-emphasis	50 μ s \pm 2% or 75 μ s \pm 2% internally selectable
Audio input impedance	10KOhm balanced or 50KOhm unbalanced (600Ohm on request)
Audio input level	Selectable from -9 to +6dBm in 5 steps, continuously from -12 to +9 dBm
Audio frequency range	30-15000Hz, MONO input 30-10000Hz, MPX input
Audio input filter	> 45dB at 19KHz (mono) > 40dB from 20KHz to 100KHz
Mono frequency response	\pm 0.3dB from 30Hz to 15KHz
MPX frequency response	\pm 0.5dB from 30Hz to 75KHz
Stereo Separation	> 45dB (typically 50dB)
Pilot tone frequency	19KHz \pm 1Hz

Pilot tone level	-20dBm adjustable
Number of SCA inputs	2
SCA input impedance	1KOhm unbalanced
SCA input level	0dBm per ± 7.5 KHz of deviation
SCA input response	± 0.5 dBm from 40KHz to 100KHz

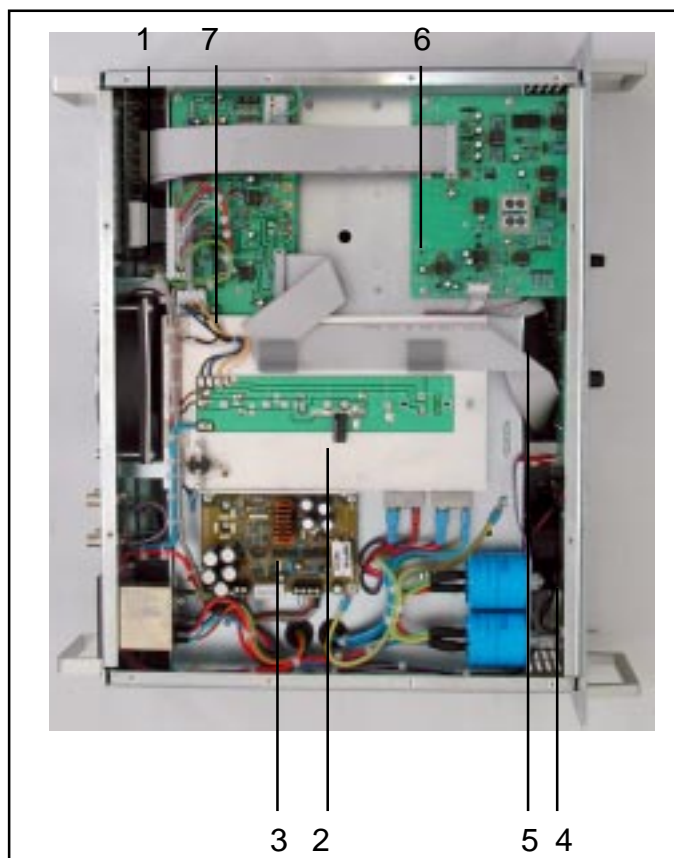
8. Identification and Access to the Modules

8.1 Modules Identification

The TEX100 is composed of different modules wired between them with connectors, allowing for easy servicing or module substitution.

8.1.1 Bottom view

The figure below shows the upper view of the device with the indication of the different components.



- [1] Audio input card
- [2] Power supply
- [3] Switch power supply
- [4] Analog meter
- [5] Meter card
- [6] Stereo coder card (for stereo version)
Scheda Mono/MPX (for mono version)
- [7] Alarms card

8.1.2 Upper view

The figure below shows the bottom view of the device with the indication of the different components.



- [1] Power amplifier card
- [2] Low pass filter
- [3] Audio input card
- [4] Main card
- [5] Frequency selector card
- [6] Meter card
- [7] Analog meter
- [8] Toroidal transformer
- [9] Directional coupler

8.2 Removal of the Modules



NOTE: When the exciter is operated with the cover removed, hazardous voltages and heavy current are accessible. Ensure all primary power is disconnected from the exciter before attempting equipment maintenance.

To reinstall the card is enough to execute operations sequence in the opposite way.

Remove all the screws that are located on the top and bottom covers of the machine. After that the covers have been removed, extract, with the help of the upper and bottom view, all exciter modules.

8.2.1 Stereo encoder card replacement

- Open the top and bottom covers of the unit.
- Disconnect connectors J1, J3 and J4.
- Unscrew the four nuts fixing the card on internal chassis.
- Unscrew the screw inside the INPUT LEVEL knob and slide it off.
- Raise the card from its supports, simultaneously sliding the switches and the INPUT LEVEL switch pivot from the panel.

8.2.2 RF power amplifier replacement

The power amplifier module is constituted from a preassembled block in which are integrated circuits, the power devices and the cooling fin.

In order to remove this module, identify with the help of the wiring diagrams the various cables connects to the module. Remove the power supply cable from the final stage module and unsolder other cables. To disconnect the cable of RF input.

At this point, remove the screws that fix the amplifier module block to the rear of the machine and the nuts that fixes it to the bottom and remove the module.

8.2.3 RF power amplifier transistor replacement

For this module it's only possible to replacement the transistors:

- Open the top cover of the unit.
- Unscrew the two fixing screws of the device (BGY33, MRF317 or SD1480).
- Remove the broken transistor.



NOTE: During replacement of broken devices it's necessary to pay attention to device's pin position and insertion, to check that the device's fixing screws aren't in short-circuit and to check that the soldering is good and without impurities.



NOTE: Interpose between devices and heat-sink an electronic silicone compound.

8.2.4 Main card replacement

- Open the top cover of the unit.
- Disconnects connector JP1, JP2 , JP4 and CN1
- Unscrew the fixing nuts of the main card on the internal chassis.
- Remove the card.

8.2.5 Audio input card replacement

- Open the bottom cover of the unit.
- Disconnects connectors CN1 and CN2.
- Unscrew the nuts of the two connectors BNC1 and BNC2 situated on the rear panel.
- Desolder the six wires (placed on EC1 and EC2) connecting the Audio Input Card to the two audio connectors, RIGHT (mono) and LEFT (MPX).
- Slide the card out.

8.2.6 Main power supply's transistors replacement

- Open the top and bottom covers of the unit.
- Remove from flat cable clamp the flatwire fixed on heat-sink.
- Cut the tagliare le fascette che fissano il modulo di alimentazione al dissipatore.
- Remove the switching power supply with all its cooling fin.
- Unscrew the two fixing screws of the two rectifier bridges.
- Desolder the device's pins.
- Unscrew the fixing screws of the heat-sink and raise the top part of heat-sink paying attention to cabling.
- Carefully lift out the device.



NOTE: During replacement of broken devices it's necessary to pay attention to device's pin position and insertion, to check that the device's fixing screws aren't in short-circuit and to check that the soldering is good and without impurities.



NOTE: Interpose between devices and heat-sink a thin layer of thermoconductive paste.

8.2.7 Meter card replacement

- Open the top and bottom covers of the unit.
- Unscrew the four fixing screws of the front panel.
- Unscrew the nut inside the measurement selector situated on the front panel and the selector fixing nut.
- Disconnect connectors CN1, CN2, CN3, CN6 and CN7 situated on the meter card.

- Disconnect the faston CN4.
- Remove the card paying careful attention to the various leds and adjustments.

8.2.8 Frequency selector card replacement

- Open the top and bottom covers of the unit.
- Unscrew the four fixing screws of the front panel.
- Disconnect connector CN1 situated on the Contraves card.
- Unscrew the two card's fixing screws on the front panel.
- Remove the Contraves card.

8.2.9 Sostituzione della scheda Mono/MPX

- Open the top and bottom covers of the unit.
- Disconnect connectors JP1, JP2 and JP3.
- Unscrew the four nuts fixing the card on internal chassis.
- Unscrew the screw inside the INPUT LEVEL knob and slide it off.
- Raise the card from its supports, simultaneously sliding the switches and the INPUT LEVEL switch pivot from the panel.

8.2.10 Alarms card replacement

- Open the top and bottom covers of the unit.
- Disconnect connectors JP1 and JP2 of the Stereo Coder card (or Mono/MPX card) to ease the removal of the Alarms card.
- Disconnect connectors CN1, CN2, CN3 and CN4.
- Unscrew the fixing screws of the card on the internal chassis.
- Remove the card.

8.2.11 Switching power supply replacement

- Open the bottom cover of the unit.
- Disconnect JP1 and JP2 from the switching card.
- Unscrew the two fixing screws of the components D2 and U1 placed on the heat-sink.
- Unscrew the fixing screws of the switching card.
- Remove the card.

8.2.12 Directional coupler replacement

- Open the top and bottom covers of the unit.
- Disconnect input SMA connector.
- Desolder three wires connecting to the meter card.

- Unscrew the fixing screws of the two connectors on the rear panel.
- Remove the card.

8.2.13 Fan replacement

- Open the top and bottom covers of the unit.
- Unscrew the fixing screws of the rear panel to ease fan removal, paying attention to connecting wires.
- Unscrew the fixing screws of the R.F. Power Amplifier on the rear panel.
- Unscrews the fixed screws of the fan on the rear panel.
- Desolder the two supply wires of the fan from the main power supply module.
- Remove the fan.

8.2.14 Analog meter replacement

- Open the top and bottom covers of the unit.
- Unscrew the fixing screws of the front panel to ease Meter removal, paying attention to connecting wires.
- Disconnect connector CN3 on the meter card.
- Remove the analogic instrument.

9. Operations Theory

The figure shows the block diagrams of TEX100 (fig. 9.1) and the TEX100/S (fig. 9.2). The blocks are described in the following chapter:

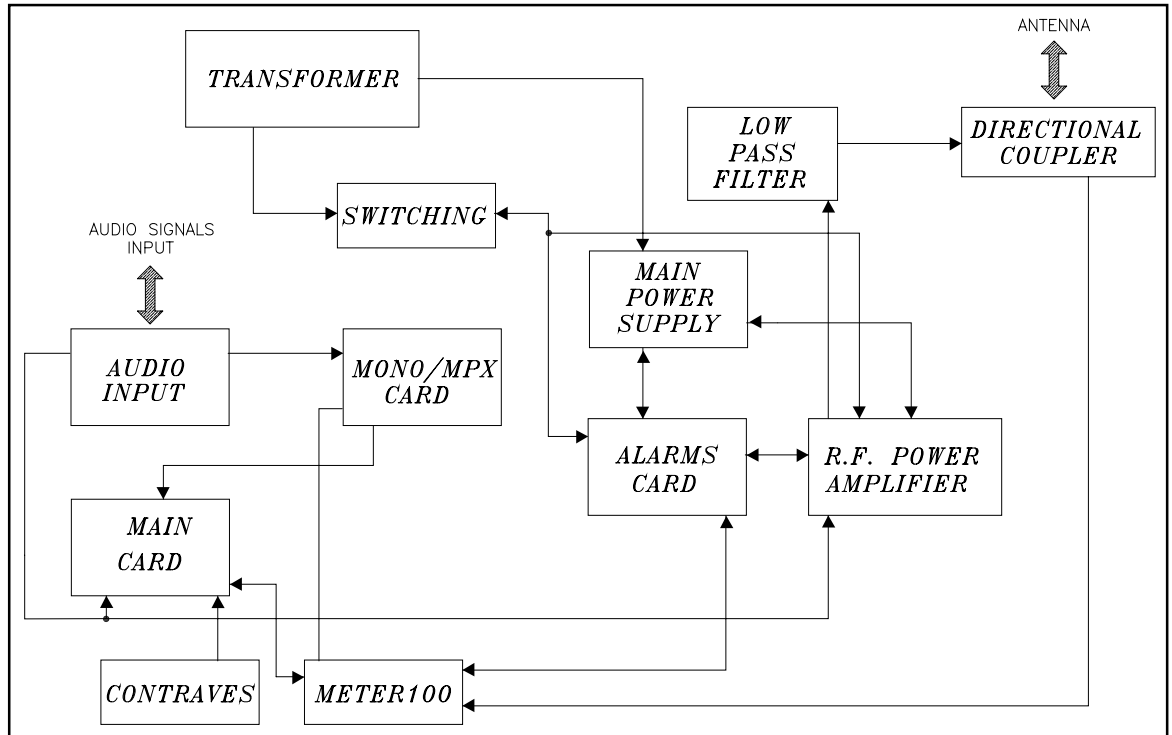


figure 9.1

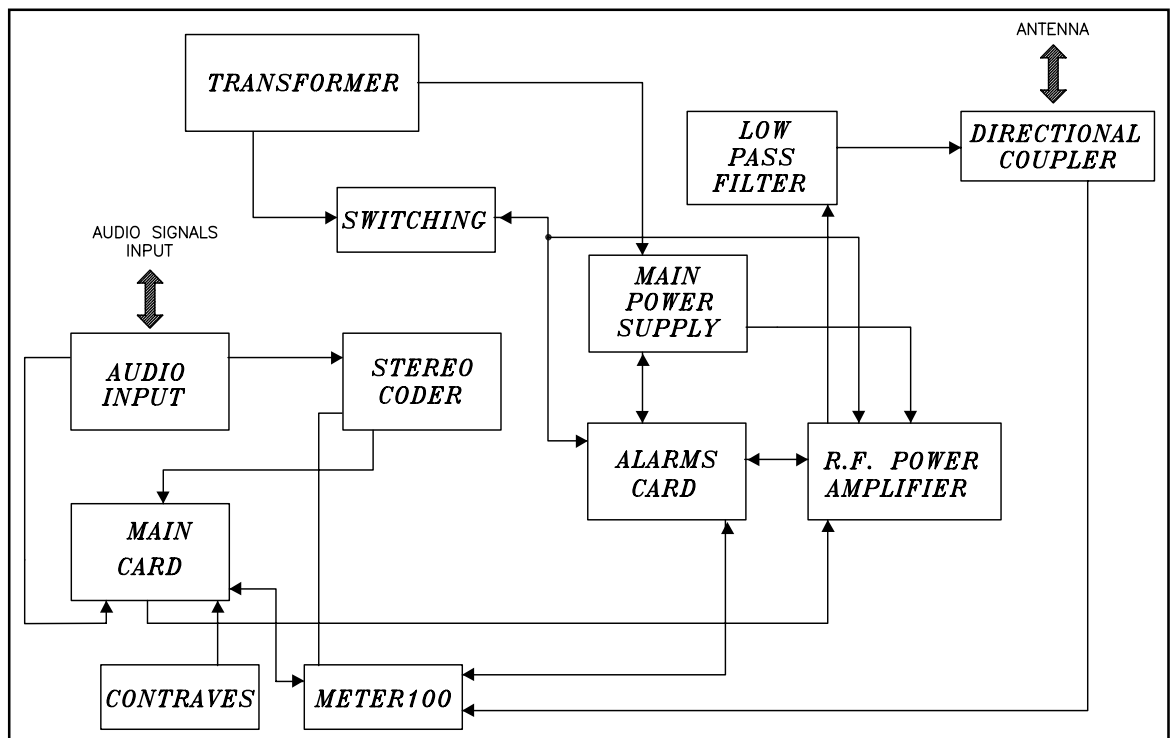


figure 9.2

9.1 Power Supply

This circuit comprises a board, mounted on a heat sink, which is fixed to the central part of the lower section of the unit.

The transformer has a selectable input from 110 V_{AC} to 240 V_{AC} and two outputs A +18V (6.3A) and B +32V (10A).

This power supply is composed of two main parts: after having undergone “EMI” filtering for mains-borne interference, the supply is transformed into four lower voltages, rectified, smoothed and stabilized to the following values: +12V, +15V and 10 to 28V variable to obtain the high efficiency (85-90%).

The +15V supplies the encoder mixer, the PLL card, the VCO card, the meter 100 card and the alarm card. The +12V supplies the input of RF power amplifier driver (BGY33) and the 10-28V variable supplies the output of RF power amplifier driver (BGY33) and the final power stage of the same module (two MRF317 or two SD1480).

The variable voltage of the final stage is controlled by the PWR ADJ control which determines the R.F. power output of the exciter. The automatic control of output power guarantees the power level set by the PWR ADJ control right across the frequency range and independantly of other variables such as temperature, load variations etc.

The system works by comparing the value set by the PWR ADJ control with the actual power output of the unit and compensating accordingly.

The final stage driver is composed of two separate parts, the input part is supplied with +12V voltage, and the output part is supplied by the switching power supply with 4-12V variable voltage obtained dividing the 10-28V variable voltage. A power limiting circuit intervenes in the event of excess SWR on the output, thus protecting the final stage.

9.2 Audio Input Card

This card is situated on the rear panel of the exciter.

In this card travel the audio signals coming from the outside that come preventively cleaned up from possible interferences due to radiofrequency signals and subsequently sends to the mixer coder card. An appropriate connector makes available outside the equipment the main electrical operation parameters of the exciter for possible remote controls.

9.3 Mixer board / stereo coder (TEX100/S version)

This card is situated in the lower part of the unit.

This card can work like stereo coder stereo or simple mixer of the various audio inputs; the operation way is selected through an appropriate control on the frontal panel.

In stereo encoder mode, the 19KHz pilot tone is derived from a quartz crystal reference oscillator. So too is the sampling frequency which allows the L and R signals to be separated from the multiplexed signal, plus the suppression of the 38KHz frequency.

The level of the left and right signals is set by the corresponding selector situated on the front panel. The signals are then filtered at 15KHz and pre-emphasized (50 μ S CCIR, 75 μ S FCC) before being sent to the multiplex circuit.

The audio signals from the two SCA inputs are mixed in to provide the output.

In mixer mode (Mono/MPX) the stereo encoder is bypassed, the right input accepts a mono signal (so filtered at 15 kHz) and the left input accepts a multiplex signal upto 100KHz. The SCA inputs remain unchanged.

Three rectifiers allow the peak levels of the two inputs "Left/MPX" and "right/mono" to be displayed on the analog meter, and provide the audio detector circuit with the deviation level.

9.4 Amplificatore di potenza RF

The final power stage is mounted on a cooling fin to dissipate waste heat and is enclosed in a totally screened, metal container, fixed to the upper-middle part of the central section of the unit.

The RF signal coming from the Stereo Decoder or Mono\MPX at a power level of about 300 mW (+25dBm), reaches the driver stage (BLF244) and is amplified to a variable level depending from the power regulated by the PWR ADJ control, before being further amplified by the final stage (1480) to a level of up to 100 W. The resultant signal is then filtered by a low-pass filter which removes any harmonic content.

A directional coupler allows the forward and reflected power levels to be measured and displayed on the analog multimeter and also feedback to the power supply for automatic control of the output power (see Power Supply description).

A BNC connector situated on the rear panel provides a power signal at -40 dB of the amplifier output power.

9.5 Meter Card

This card is situated centrally on the front panel.

The card receives forward and reflected power signals from the power supply which, in turn, come from the final power stage. The stereo encoder card supplies deviation and left and right signal levels. These signal levels are normalized then displayed on the analog meter according to the position of the rotary selector situated on the front panel.

9.6 Frequency Selector Card (Contraves)

This card is fixed to the left-hand side of the front panel.

The operating frequency selected by the frequency control is represented by a signal which is supplied to the frequency dividers that form part of the PLL circuits found on the PLL card.

9.7 Alarms Card

This card is fixed in the lower part of the unit.

This circuit contains an rotative selector that allows to adjust, through 7 trimmers, the threshold of the external and internal output level, internal and external SWR level, temperature and to preset the maximum value of the output power.

In case of fault there isn't an automatic reset, because the transmitter provides to decrease the output power to continue the transmission without stops, even if at minimum power.

9.8 Mono/MPX Coder Card (mono version)

This card is fixed in the lower part of the unit.

The Mono\MPX card is an Audio Mixer at four inputs, two balanced (Mono and MPX) and two unbalanced (SCA1 and SCA2).

Mono and MPX input level can be setted through relative switches placed on front panel, on 5 fixed positions and on a variable position from -12dBm to +9dBm (presetted at 0dBm).

It's possible to set the pre-emphasis value at 50 μ S, 75 μ S or linear. Then, it's possible to insert or remove a low pass filter at 15KHz.

9.9 Main Card

This card is placed in the upper-left part of the unit.

The functionalities of the card can be subdivided in three sections: Audio, PLL and VCO.

The Audio section takes the audio signal coming from mixer coder (for stereo version) that comes amplified and tried in order to compensate the distortions caused from the varicap diodes and therefore inject in VCo section to execute the modulation.

The digital section PLL includes a reference crystal oscillator (optionally can be used an external reference), a logic section that includes the frequency dividers and the comparator.

The reference crystal oscillator generates a 10MHz frequency that is divided to generate a 1KHz fixed signal.

This signal is sent to the comparator (LMX1501) and managed by the microcontroller (PIC16F877Q) that confront it with the signal produced by the VCO opportunely divided in base on the working frequency setted on the frequency selector.

The unlocked situation (difference of the signal dissimilar from 0) comes indicated from the appropriate pointer place on the front panel.

At the output of the comparator is present a signal (Rf PLL), which comes sent to the varicap placed on the VCO card.

La VCO section includes an audio input stage at low frequency, a Voltage Controlled Oscillator at low noise (VCO) and a drive stage.

The Voltage Controlled Oscillator (VCO) generated the signal on the working frequency impostated on the card by the rotative selector (Contraves).

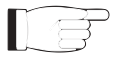
This signal is amplified to 300 mW level (25 dBm) to drive the final stage and to be sent to the PLL control section.

The VCO operating frequency, after opportune division, comes compared to a reference frequency obtained from a high stability generator and the error tension, subsequently filtered, comes used to guarantee the stability of the VCO frequency.

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10. Calibration Procedure

10.1 Internal Adjustment



Attenzione: Please note that this kind of operations should only be done by skilled technical people. Remember that this operation is not normally needed, if not in case of extraordinary maintenance operations. Opening the device may void your warranty.

10.1.1 Stereo coder adjustment

It will be necessary to check and recalibrate the following parameters after replacement of the Stereo Encoder card

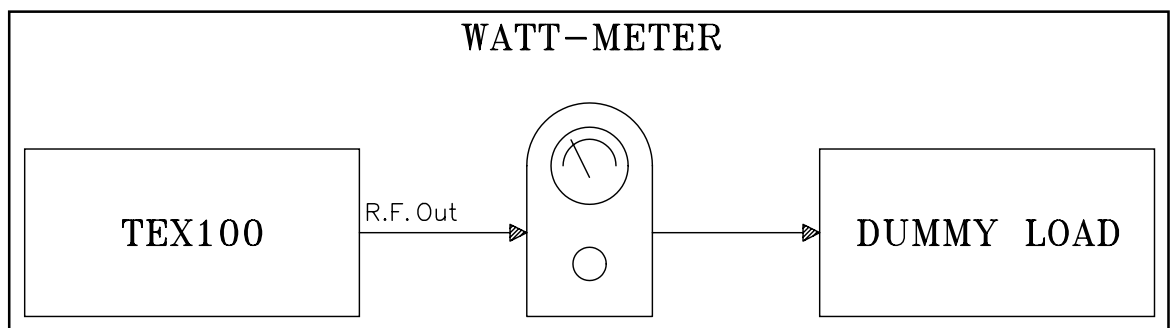


figura 10.1

- Select 0dBm on the INPUT LEVEL selector (encoder and pilot tone inserted).
- Connect a low distortion, sine-wave, audio generator to the left and right inputs.
- Connect a 50 Ohm 100 W load to the RF output of the TEX100/S.
- Connect the drawing of -40 dB (11 Fig.2) to the input of the own modulation analyzer.
- Connect a stereo MEAS-decoder to the rear FM-MPX output of the F.A.M.
- Switch on the TEX100 and wait for the PLL to lock.
- Adjust the audio output of the generator to 0dBm ($2.2V_{pp} = 775mV_{RMS}$ 400Hz).
- Check, using the modulation analyser regulated for peak measurement, that the deviation is 75 kHz; in couter case acts on the RV6 and RV7 trimmers on the actual TEX100 main card or on the trimmer RV1 of the VCO card in the previous version.
- Remove the audio signal from both channels, leaving the pilot tone inserted, and check that the deviation is between 6.5KHz and 8KHz (typically 7.5KHz). Adjust RV7 if necessary.
- Remove the audio signal from one channel, for example the right channel.



NOTA: Check that, removing a channel, the output is still at 0dBm.

Now measure the stereo separation with the Stereo Meas-Decoder, which, with a 400Hz signal, should be better than 45dB. Repeat the operation for the other channel. To maximized the stereo separation, is possible acts on the compensator C41 (pilot tone phase) and on RV6 (right channel separation) and RV7 (left channel separation) trimmers.

10.1.2 VCO card adjustment (old version)

After having replaced the VCO Card and relevant connectors, carry out the following procedure:

MONO VERSION

- Connect an audio generator to the Mono input or MPX.

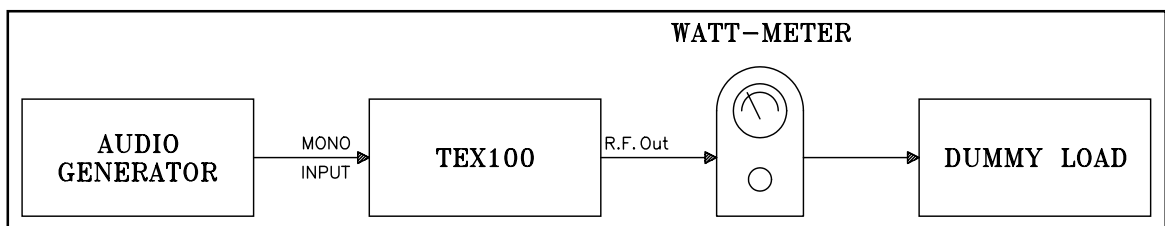


figure 10.2

- Switch on TEX100, select a frequency at 98MHz and select 0dBm on the INPUT LEVEL selector (pilot tone inserted).
- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Connect the drawing of -40 dB to the input of the own modulation analyzer.
- Inject a 400Hz, 0dBm (775mVrms = 2.2Vpp) tone into the Mono (or MPX) input.
- Configure the FAM to measure deviation with the 30Hz-200KHz/FM/P+ filters and check that it is 75KHz. If not, adjust trimmer R15 accordingly.
- Verify correct value on TEX100's analog meter.

STEREO VERSION

- Connect an audio generator to the Left and Right inputs (together)
- Switch on TEX100, select a frequency at 98MHz and select 0dBm on the INPUT LEVEL selector (pilot tone inserted).
- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Connect the drawing of -40 dB to the input of the own modulation analyzer.
- Inject a 400Hz, 0dBm (775Vrms=2.2Vpp) tone into Left and Right.
- Configure the F.A.M. to measure deviation with the 30Hz-200KHz/FM/P+ filters and check that it is 75KHz. If not, adjust trimmer R15 accordingly.
- Verify correct value on TEX100's analog meter.



NOTE: The audio generator used in these tests must have a distortion figure better than 0.01%. Perform this test at the operating frequency of the exciter.

10.1.3 RF power amplifier module adjustment

No calibration is required after the replacement of this card.

10.1.4 Power supply adjustment

No calibration is required after the replacement of these two cards (Main power supply and switching power supply).

10.1.5 Audio input card adjustment

No calibration is required after the replacement of this card.

10.1.6 Meter card adjustment

All meter readings should be calibrated after the replacement of any card:

- Inject a 400 Hz, 0dBm pilot tone into the Left or Right inputS
- Connect a bypass wattmeter between the RF output and a 50 Ohm, 100W dummy load.
- Adjust the power output to 100W.
- With the selector, select the following measurements and make adjustments according to the table below:

MEASUREMENT	VALUE	FSD	TRIMMER	NOTE
R(MONO)	0dB	+3dB	R6	
L(MPX)	0dB	+3dB	R5	
FWD PWR	150W	125W	R8	
REF PWR	10W	50W	R7	1
DEV	VAR	100KHz	R4	
SWR LED	---	---	R23	



NOTA: 1 - Disconnect the load for this measurement only and adjust PWR ADJ for 50W of direct output power.

10.1.7 Frequency selector card adjustment

No calibration is required after the replacement of this card.

10.1.8 PLL card adjustment (old version)

After having replaced the PLL card, carry out the following procedure (see the setup below):

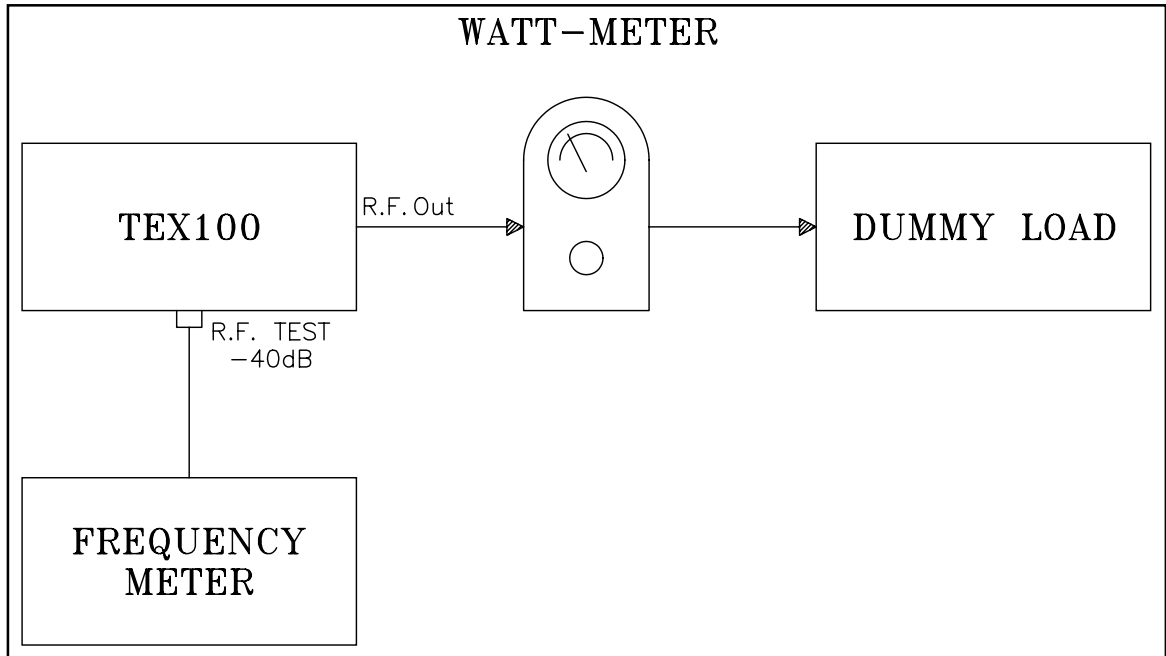


figurE10.4

- Switch on the equipment and select the frequency of 98MHz.
- Wait 10 minutes to have thermal stabilization of the equipment.
- Unscrew the fixing screws of PLL's metal box and open the cover near to VCO metal box.
- Check with frequency meter if the frequency setted is right. If the frequency read on frequency meter is different from frequency setted on the contraves , adjust the compensator placed on the TCXO accesible trthrough a little hole on the PLL card box.

10.1.9 Alarms card adjustment

After having replaced the alarms card, carry out the following procedure:

Internal AGC Adjustment

- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Adjust output power at minimum turning PWR ADJ trimmer completely anticlockwise and then switch on the equipment.
- Turn trimmer R2, placed on Alarms card, completely clockwise.
- Increase output power until maximum through PWR ADJ trimmer (clockwise).

- Adjust variable capacitor C2 on Directional Coupler to read, through a voltmeter between Directional Coupler's REF contact and GND (see as reference Directional Coupler Layout), minimum voltage value.
- Adjust R2 to obtain a reading of 100W on external wattmeter.
- Select with Meter Selector the FWD position.
- Adjust trimmer R8 on METER card to read 100W on TEX100's analog meter.

Internal VSWR Adjustment

- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Adjust output power at minimum turning PWR ADJ trimmer completely anticlockwise and then switch on the equipment.
- Turn trimmer R7, placed on Alarms card, completely clockwise.
- Disconnect external dummy load, increase output power until 150W turning PWR ADJ trimmer clockwise.

Output power must increase slowly because the protection is working. (If this doesn't happen, suspend all operation e contact the seller)

- Adjust R7 to obtain a reading of 10W on external wattmeter.
- Select with Meter Selector the REF position.
- Adjust trimmer R7 on METER card to read 10W on TEX100's analog meter.

External AGC Adjustment

- Perform the setups below (fig. 10.5 and 10.6).

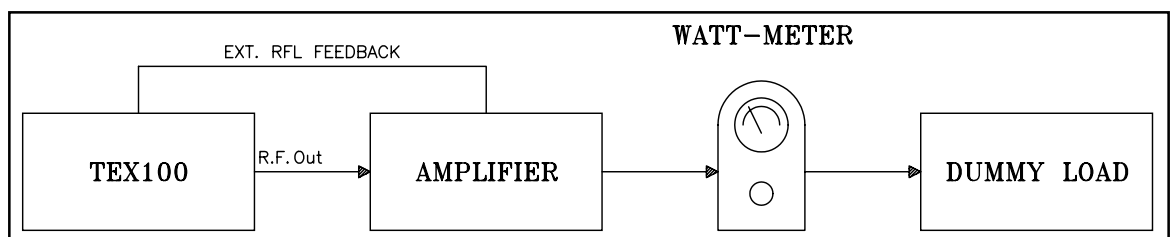


figure 10.5

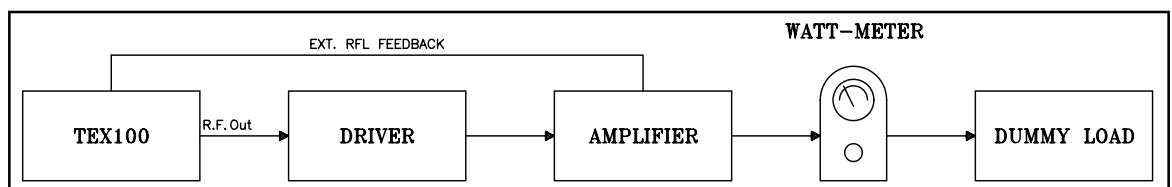


figure 10.6

- Adjust output power at minimum turning PWR ADJ trimmer completely anticlockwise and then switch on the equipment.
- This adjustment it's necessary when TEX100 is connected as exciter or driver for a power amplifier. Therefore, it's necessary to have on last amplifier of the system an output voltage proportional with antenna output forward power and connect this signal to REMOTE1.

Increase TEX100's output power with PWR ADJ to have the necessary output power to drive the next stage of the system (e.g. for a 1KW amplifier, read 1050W on external wattmeter).

- Turn trimmer R16, until to have maximum output power of the power amplifier on external wattmeter (e.g. 1000W). In these conditions is possible to control output power into the range of 50W presetted, protecting the equipmment against voltage variations).

Regolazione VSWR Esterno

- Perform the setup below:

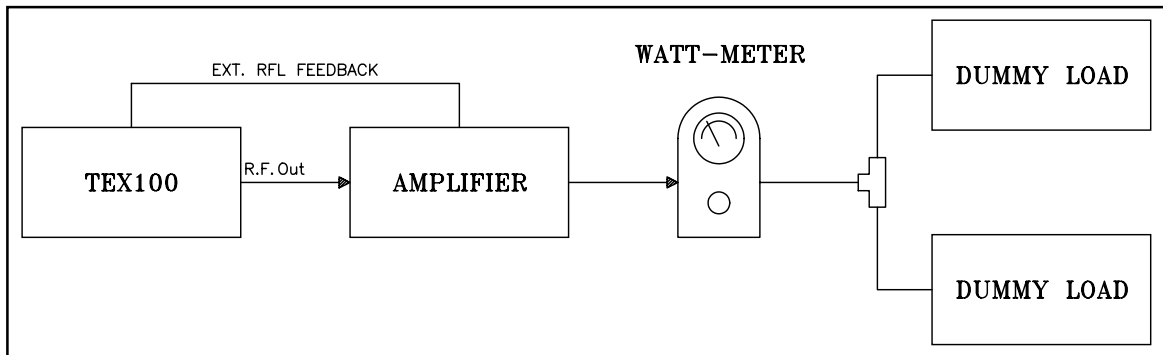


figure 10.7

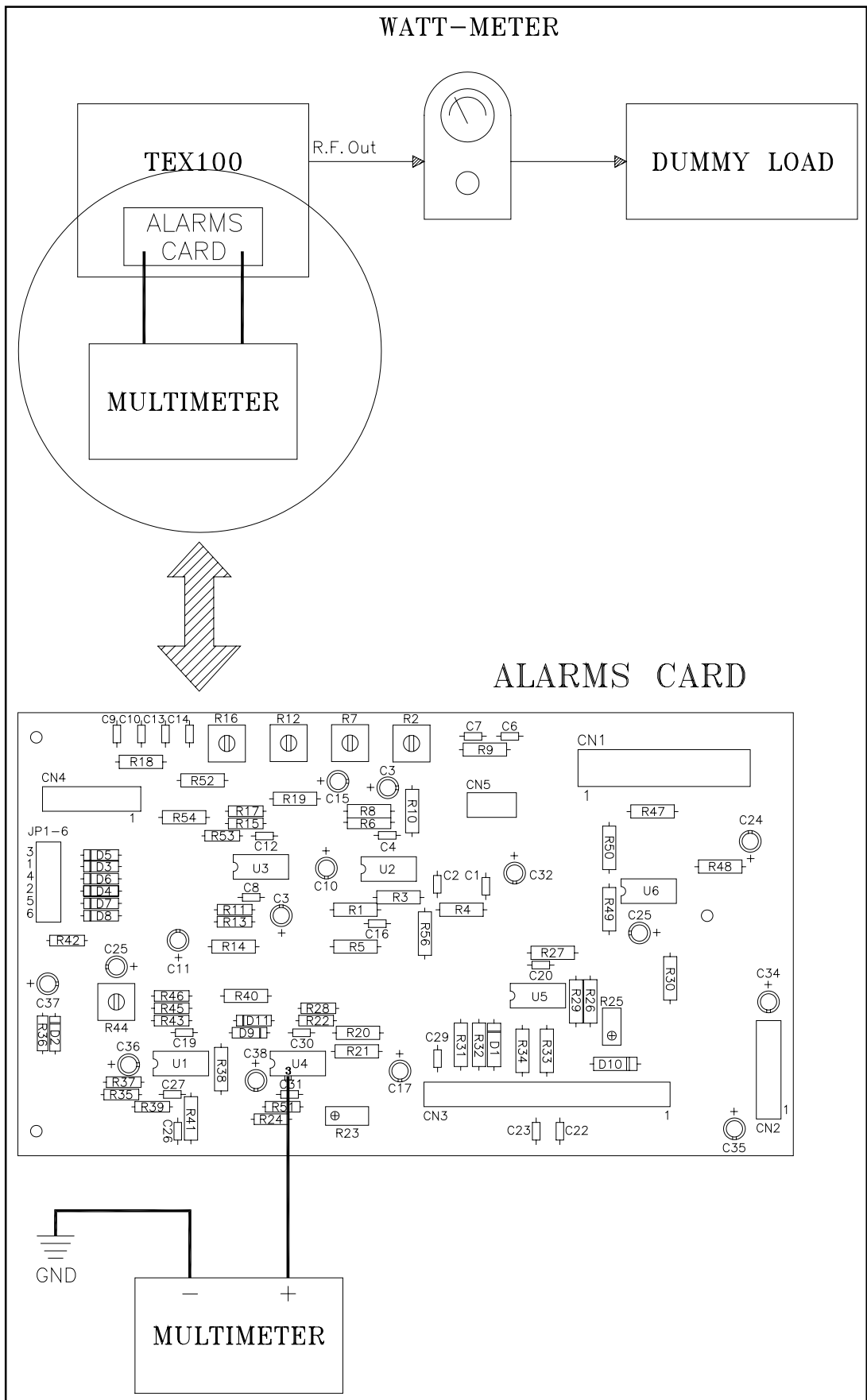
- Adjust output power at minimum turning PWR ADJ trimmer completely counter-clockwise and then switch on the equipment.
- This adjustment it's necessary when the TEX100 is connected as exciter or driver for a power amplifier. Therefore, it's necessary to have on last amplifier of the system an output voltage proportional with antenna output reflected power and connect this signal to REMOTE2.

Increase TEX100's output power with PWR ADJ to have the necessary output power to drive the next stage of the system (e.g. for a 1KW amplifier, read 1050W on external wattmeter).

- Turn trimmer R12, until to have an output power of the power amplifier on external wattmeter (e.g. 900W, -10%). In these conditions is possible to control output power into the range of $\pm 10\%$ presetted, protecting the equipmment against VSWR variations).

Temperature Alarm Adjustment

- Perform the setup below:



- Adjust output power at minimum turning PWR ADJ trimmer completely counterclockwise and then switch on the equipment.
- Increase output power until 100W, turning PWR ADJ trimmer clockwise.

- Tare R23 trime until the output power begin to decrease.
- Tare R25 trime until the LED “SWR/TEMP” begin to flash.
- Turn trimmer R23, until to have on pin 3 of U4 a voltage included between 265 and 275 mV. In these conditions temperature protection starts at 70°C.

Maximum Output Power Adjustment

Can be necessary to set maximum output power at maximum value included between 5 and 100W.

- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Adjust output power at minimum turning PWR ADJ trimmer completely anticlockwise and then switch on the equipment.
- Increase output power until 100W turning PWR ADJ trimmer clockwise.
- Turn trimmer R44, until to have maximum output power presetted on external wattmeter.
- Then, adjust output power turning PWR ADJ trimmer and note that output power can be increased over presetted value.



NOTE: The jumpers shown in table , disable all protections (all enabled from firm). A no-correct use of these jumpers can cause seroius damage to the unit and will automatically make the warranty void.

ALARMS CARD TRIMMERS AND JUMPERS

REF. DESCRIPTION

R2	<i>Internal AGC Adjustment</i>
R7	<i>Max Power Output Adjustment (VSWR INFINITE)</i>
R12	<i>External VSWR Threshold Adjustment</i>
R16	<i>External AGC Adjustment</i>
R23	<i>Temperature Threshold Adjustment</i>
R25	<i>Temperature Led Lighting Adjustment</i>
R44	<i>Max Power Output Adjustment</i>
JP1	<i>Internal AGC Insertion (DON'T REMOVE)</i>
JP2	<i>Internal AGC Insertion (DON'T REMOVE)</i>
JP3	<i>External VSWR Insertion</i>
JP4	<i>External AGC Insertion</i>
JP5	<i>Temperature Threshold Insertion</i>
JP6	<i>Maximum Output Power Threshold Insertion</i>

10.1.9 Main card adjustment

To tare the TEX100 main card must adjust the three trimmers present on the card.

Like in the previous version of VCO card, is present a trimmer for the deviation regulation (**RV7**), one for the distortion regulation (**RV6**) and one for the polarization regulation of the varicap in order to obtain the minimum refuse in the entire frequency range (**RV9**).

MONO VERSION

- To connect an audio generator to Mono or MPX input.

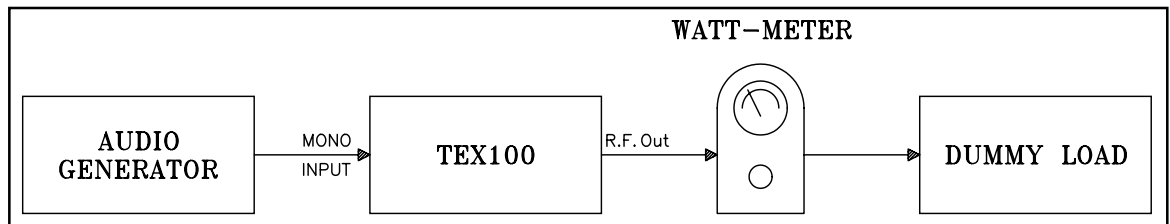


figure 10.2

- Switch on TEX100, select a frequency at 98MHz and select 0dBm on the INPUT LEVEL selector (pilot tone inserted).
- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Connect the drawing of -40 dB to the input of the own modulation analyzer.
- Inject a 400Hz, 0dBm (775mVrms = 2.2Vpp) tone into the Mono (or MPX) input.
- Configure the FAM to measure deviation with the 30Hz-200KHz/FM/P+ filters and check that it is 75KHz. If not, adjust trimmer R15 accordingly.
- Verify correct value on TEX100's analog meter.

STEREO VERSION

- Connect an audio generator to the Left and Right inputs (together)
- Switch on TEX100, select a frequency at 98MHz and select 0dBm on the INPUT LEVEL selector (pilot tone inserted).
- Connect a 50 Ohm, 100 W dummy load to the RF output.
- Connect the drawing of -40 dB to the input of the own modulation analyzer.
- Inject a 400Hz, 0dBm (775Vrms=2.2Vpp) tone into Left and Right.
- Configure the F.A.M. to measure deviation with the 30Hz-200KHz/FM/P+ filters and check that it is 75KHz. If not, adjust trimmer R15 accordingly.
- Verify correct value on TEX100's analog meter.



NOTE: The deviation can lightly vary with the working frequency, suggests to execute this measure to the exciter operation frequency, in order to obtain the minimum refuse point is necessary adjust RV9 and obtain 4.1V on TP18 test point.

In the case was necessary control or modify the positions of SW5 Dip-switch, for example after the substitution of the card, make reference to the table shown in continuation:

Function	1	2	3	4	5	6	7	8
External reference at 10MHz	-	-	-	-	-	-	-	-
External reference at 10MHz	x	-	-	-	-	-	-	-
External reference at 1 MHz	-	x	-	-	-	-	-	-
External reference at 500KHz	x	x	-	-	-	-	-	-
External reference at 100KHz	-	-	x	-	-	-	-	-
External reference at 19KHz	x	-	x	-	-	-	-	-
External reference at 10KHz	-	x	x	-	-	-	-	-
External reference at 5KHz	x	x	x	-	-	-	-	-
None Customer	-	-	-	-	-	-	-	-
NOA Customer (160MHz with 1250Hz)	-	-	-	x	-	-	-	-
Italia Customer (Limits 87.6 - 107.9)	-	-	-	-	x	-	-	-
Single dip switch NOA Customer (SW 4)	-	-	-	x	x	-	-	-