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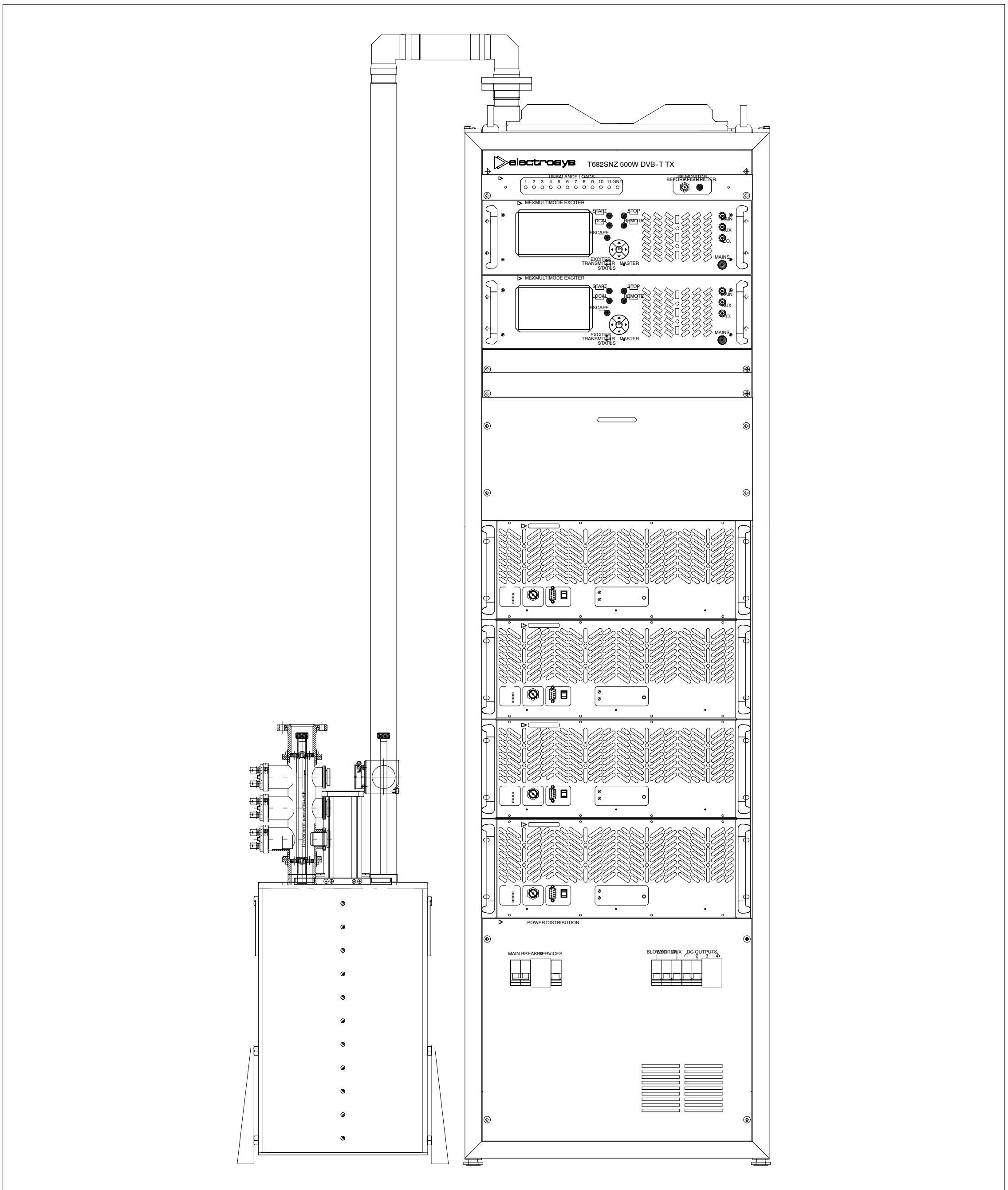

T333SVZ 2.2KW VHF DTV TRANSMITTER

OPERATOR'S MANUAL

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electrosys	A	23/07/08	6600621000	T333SVZ 2.2KW VHF DTV SOLID STATE AIR COOLED TX	1	4

CE 0051 ⓘ

Restrictions:

The use of this equipment is only under authority licence.

Note for countries submitted to 1999/05/EC directive:

This equipment can be operated in the following countries:

AT	DE	MT	GB
BE	GR	NL	IS
CY	HU	PL	LI
CZ	IE	PT	NO
DK	IT	SK	CH
EE	LV	SI	BG
FI	LT	ES	RO
FR	LU	SE	TR

As option the equipment may be provided with telemetering connectors for PTSN, ADSL, or GSM networks

T333SVZ 2.2KW VHF DTV SOLID STATE AIR COOLED TX

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SAFETY PRECAUTIONS

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1 INTRODUCTION

1.1 Application notes

The following rules apply to radio–transmitters, included every auxiliary equipment requested for their functioning, working under the responsibility of trained personnel. Antennas system and their supplying lines are excluded.

1.2 Purpose

The content of this section provides information concerning safety precautions which must be observed by the operating personnel. Para. **4** provides in addition, an abstract of the “*Appendix E of CEI EN 60215 Safety Rules*”.

The information given throughout this section concerns the safety operations (protection against electric shock, burns, dangerous radiations, sundry risks) and the specifications on handling and disposal of beryllia devices.

These directions do not ensure necessarily the safety of not–trained personnel operating with the equipment when it is not working in normal conditions.

1.3 General

Electrosys® equipments have been designed and manufactured taking into due consideration:

- personnel safety requirements as specified by IEC 215 Standard;
- Council recommendation of 12 july 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz) [1999/519/EC].

Depending upon the material to be highlighted, the following attention headings are used in the technical content.

> **WARNING!**
>
> An operating or maintenance procedure, practice, condition and statement which, if not strictly observed, could result in injury to or death personnel.

> **CAUTION!**
>
> An operating or maintenance procedure, practice, condition and statement which, if not strictly observed, could result in damage to or destruction of equipment or loss of mission effectiveness.

> **NOTE!**
>
> An essential operating or maintenance procedure, condition and statement which must be highlighted.

When a precaution is required which relates specifically to a part of the technical content, the information is given in the relevant part of the manual. WARNING and CAUTIONS precede applicable text.

2 SAFETY OPERATIONS

2.1 Introduction

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUIT

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustment, inside the equipment with the high voltage supply turned on.

Under certain conditions, dangerous potentials may exist when the power breaker is in the OFF position, also due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person initiate servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

2.2 Electric shock

Factors affecting electric shock consequence are:
- amount of current flown thru human body;
- current path thru human body;
- contact duration.

The following table gives probable effects of electric shock described by MIL–STD–454C specification.

CURRENT (mA) A.C. 50/60 HZ	CURRENT (mA) D.C.	EFFECT ON HUMAN BODY
0 to 1	0 to 4	SENSATION
1 to 4	4 to 15	SURPRISE
4 to 21	15 to 80	REFLECTED ACTION
21 to 40	80 to 160	MUSCLES INHIBITION
40 to 100	160 to 300	CHOCKING
> 100	> 300	FATAL

2.3 Rescue

In case of electric shock, shut off the high voltage at once and ground circuits. If the high voltage cannot be turned off without delay, free the victim from the contact with the live conductor as promptly as possible.

Avoid direct contact with either the live conductor or the victim's body. An axe with a dry wooden handle may be used to cut the high voltage wire. Use extreme caution to avoid the resulting electric flash.

2.4 Resuscitation

Personnel working with or near high voltage should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

2.5 Emergency First Aid instructions

WARNING!

VOLTAGES THAT ARE DANGEROUS TO LIFE ARE INVOLVED IN THE OPERATION OF THIS ELECTRONIC EQUIPMENT.

OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATION.

DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH THE VOLTAGES APPLIED.

DANGEROUS CONDITIONS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE ”OFF” POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC.

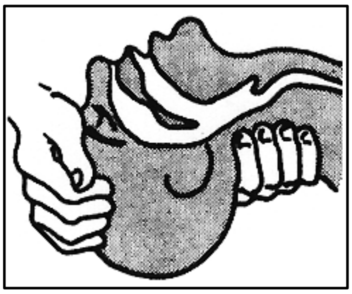
ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM TO AVOID PERSONAL INJURY OR LOSS OF LIFE.

Personnel engaged in the installation, operation, or maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

2.5.1 Rescue breathing

1. Find out if the person is breathing.

You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing, you can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.



2. If he is not, open the airway by tilting his head backward.

Lift up up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself. If it does not, begin rescue breathing.

3. If he is still not breathing begin rescue breathing:

Keep his head tilted backward.
Pinch his nose shut.
Put your mouth tightly over his mouth.
Blow into his mouth once every five seconds.
Do Not Stop Rescue Breathing Until Help Comes.

LOOSEN CLOTHING
KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him quiet as possible and from becoming chilled. Otherwise, treat him for shock.

2.5.2 Burns

SKIN REDDENED:

Apply ice cold water to burned area to prevent burn from going deeper into skin tissue.
Cover area with clean sheet or cloth to keep away air.
Consult a physician.

SKIN BLISTERED OR FLESH CHARRED:

Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with clean sheet or cloth to keep away air. treat the victim for shock and take to hospital.

EXTENSIVE BURN–SKIN BROKEN:

Cover area with clean sheet or cloth to keep away air. Treat the victim for shock and take to hospital.

3 SPECIFICATION ON HANDLING AND DISPOSAL OF BERYLLIA DEVICES

3.1 Handling

Normally the components can be handled without risk, but there is a toxic hazard if beryllia dust from a damaged component is inhaled or implanted in the skin. It is therefore necessary to follow the indications described below:

- cover cuts and abrasions with dressing;
- wear disposable gloves;
- do not eat, drink, smoke, make up;
- wash hands and face after the contact with these damaged components;
- if beryllia penetrates under the skins through cuts or abrasions, the wound has to be cleaned and treated by a qualified medical personnel.

3.2 Disposal

The disposal procedure is normally laid down by Operating Authority and must be strictly adhered to. However, in the absence of such instructions the following points will be of assistance.
The disposal procedure is divided into two categories:

- <u>Electrically faulty, but not mechanically damaged.</u>

The faulty component should be placed in a polythene bag which is to be sealed and placed in a Beryllia scrapbox *(1)*.

- <u>Mechanically damaged components.</u>

Using disposable gloves and tweezers, all visible parts are to be placed in a polythene bag which is to be sealed and placed in a Beryllia scrapbox (1).
Still wearing gloves, clean the area with a damp cloth then place the cloth and gloves into a polythene bag, seal the bag and place it in a Beryllia scrapbox.
The hands must be thoroughly washed after handling damaged components.

(1) Ideally the Beryllia scrapbox is a sealed metal container clearly marked with a warning.

4 ABSTRACT OF APPENDIX “E” OF CEI EN 60215 SAFETY RULES

E *Guide to safety precautions which must be observed by the personnel operating with radio–transmitters*

E.1 INTRODUCTION

For the safety of the staff working on radio–transmitters and associated equipment, a full evaluation of the several dangers which may occur is necessary.
The considered factors are:

- *the special precautions which have to be taken in presence of voltages over 1000V of peak;*
- *the special precautions which have to be taken when high radiofrequency voltages, often higher than the previous ones, are being used;*
- *the effects of electromagnetic fields, present by the antennas and their conductors, which may present dangers of fire for the surroundings, of electric shock and of burns for the staff;*
- *dangers of explosion in presence of inflammable gas;*
- *dangers of falls of the staff working on structures or buildings, which can get worse because of shakes caused by the accidental contact with conductors under voltage.*

E.4 A RADIO–TRANSMITTER’S FUNCTIONING

E.4.1 *The equipment has to be kept in such a way as to fulfil the safety rules.*

E.4.2 *A person, competent and certified by the responsible units, has to make sure, at regular intervals, of the good functioning of the equipment and of the protection and safety devices.*

Functioning tests have to be carried out on door block devices, on mechanical blocks, on line– and earth breakers, on parallel resistors, and on protection devices against overvoltages and overcurrents.

The above said tests have to be carried out as well when a protection or safety device works after a failure has occurred.

The safety devices have not either to be altered or disconnected, except for the substitution, nor to be modified without approval, in any case, of the responsible units.

E.4.3 *All the covers assuring protection against accidental contacts with parts under dangerous voltage must be kept in their position during the ordinary service. They can be taken off, for maintenance or repair operations, only under the responsibility of the charged staff.*

E.4.4 *All the covers and metal casings of the electric and electronic equipment have to be grounded with effective methods, and particular attention must be paid to the maintenance of these connections to the protection ground.*

E.4.5 *The rooms occupied by parts of equipment having open structure are considered as fences.*

E.4.6 *If a radio transmitter is put under voltage, the trained person in charge of it has to personally verify that: no other person is working on the transmitter or on the associated antenna; that each work carried out is sufficiently completed in order to allow the transmission; that no tool, test equipment or portable lamp remains inside or on the transmitter; and that all test or auxiliary equipment used for the tests has been disconnected.*

E.6 PROCEDURE TO VERIFY ABSENCE OF VOLTAGE

After the equipment has been sectioned, the absence of voltage has to be verified on the work place. This can be carried out by using voltage indicators, measuring instruments, neon lamps indicating radiofrequency voltages or any other convenient means.

E.7 WORK ON CIRCUITS UNDER VOLTAGE

Work on circuits under voltage with peak voltages over 72V, or in proximity of such circuits, has to be reduced to the lowest. Such a work can be performed only if the following conditions are fulfilled.

- *The work has to be carried out by an authorized person, qualified in electrical engineering, supervised at least by another person who has been trained and who can immediately interrupt the voltage, and furthermore who has been trained to administer first aid through artificial respiration and heart massage.*
- *No risk of ionizing or non–ionizing radiation has to exist.*
- *The work has to be carried out in such a way as not to run the risk of formation of arcs or currents through the body.*
- *For the safe execution of the work, adequate equipment, devices and test tools have to be employed.*
- *Adequate safety measures for the indication of the dangerous areas have to be taken.*
- *The work has to be carried out only for urgent reasons, e.g. if it is not possible to carry out the work or locate a failure in absence of voltage.*

NOTE In some Countries stricter rules and/or regulations may be applied.

E.8 OTHER DANGERS

E.8.1 DANGERS OF RADIOFREQUENCY RADIATIONS

a) The utmost power levels in the field of microwaves and/or lower radio frequencies electric or magnetic field, which the staff can be exposed to, have not to exceed the limits foreseen by the laws of the considered Country. For those Countries where a national law for the levels of non–ionizing radiation does not still exist, directions from the IEC 657 and World Health Organization Publication can be obtained: “Hygienic rules of the surrounding environment 16” (1981).

NOTE Limits given are applied to the radio transmitter, except for its antenna, in a frequency range from 30 MHz to 30 GHz. Under 30 MHz, higher limits can be appropriate.

b) During the transmission period the staff has never to look directly at a radiator, spotlight, waveguide or any other irradiating element which concentrates energy in a narrow, intense beam.

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CHAPTER 1:
GENERAL INFORMATION

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LIST OF ILLUSTARTIONS

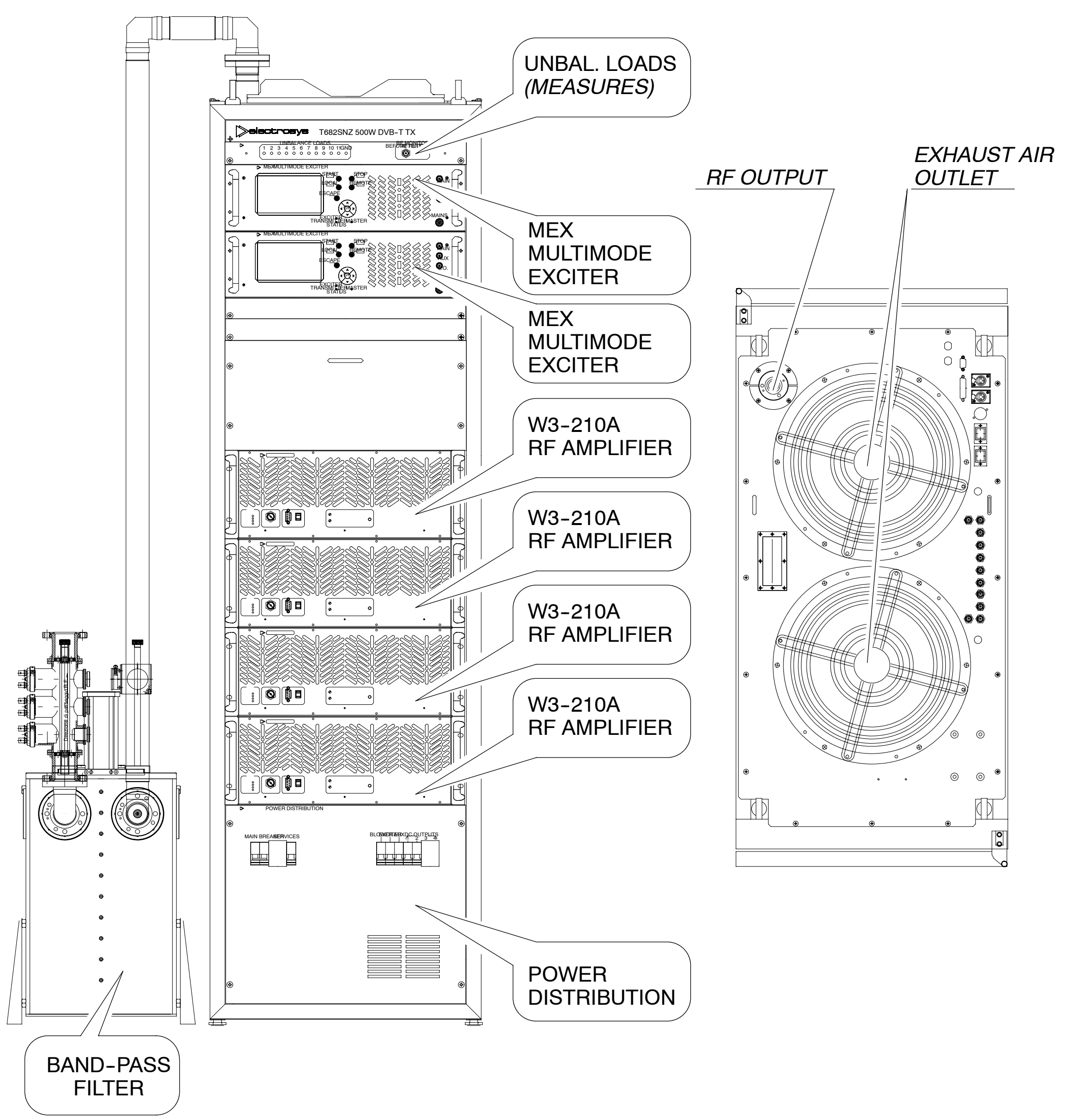


Fig. 1.1 – Transmitter overall views

CHAPTER 1: GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 Manual Applicability

This Operator's Manual provides system-oriented information, procedures and data for operation and installation of the following:

- T333SVZ 2.2KW VHF DTV Solid State Air Cooled transmitter . . . . p/n. 6600322200.

From here on for the sake of simplicity, throughout this manual T333SVZ 2.2KW VHF DTV Solid State Air Cooled transmitter will be referred to as T333SVZ.

- Chapter 1 : General Information
- Chapter 2 : Installation
- Chapter 3 : Operating Instructions
- Chapter 4 : Maintenance

1.1.2 Physical description

T333SVZ is an air cooled solid state equipment for DTV broadcasting in VHF band. T333SVZ is able to deliver a nominal output power of 2.2KWrms.

The equipment fully complies with the requirements for the safety of personnel as specified in IEC 215 rules. Each unit is designed in order to be easily removed and individually checked. The equipment is contained in a single 40HE-19" standard steel rack-frame, which guarantee an optimum mechanical rigidity. Fig. 1.1 shows typical overall view of the equipment.

The following units are arranged inside transmitter cabinet and their front panels are available to the operator by opening the front door:

- Unbalance Loads Monitor
- MEX Multimode Exciter (*qty 2 for Dual Drive configuration optional*)
- RF Power Amplifier modules (qty 4)
- Power Distribution

The following units are arranged within transmitter cabinet and they are available to the operator from the rear side of the cabinet by opening the rear door:

- 4-way VHF Combiner
- 4-way VHF Splitter
- MEX BB/RF Interface
- Unbalance Loads unit
- Band pass Filter
- output directional coupler

The cooling system is forced air and is performed by two extractor blowers located on top panel of the cabinet.

1.1.3 Units Description

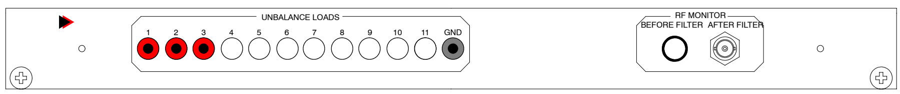
This paragraph gives some general information about the units of the transmitter, which are:

- Unbalance Loads Monitor
- MEX Multimode Exciter
- RF Power Amplifier module *available on cabinet front panel*
- Power Distribution

- 4-way VHF Combiner
- 4-way VHF Splitter
- MEX BB/RF Interface *available inside cabinet*
- Unbalance Loads unit
- Band pass Filter
- output directional coupler

UNBALANCE LOADS UNIT

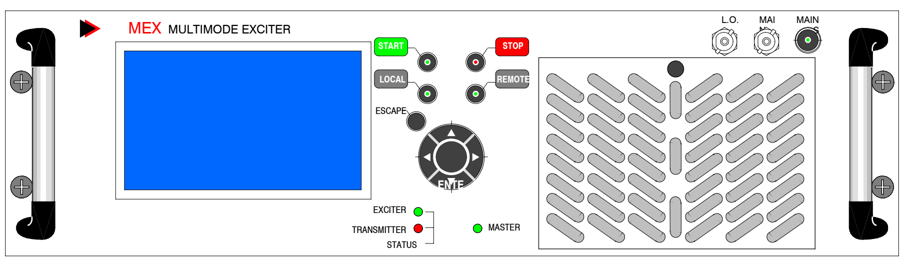
The unit supports on its front panel, the test points for moonitoring the unbalance power dissipated on the dummy load of the *VHF Hybrid Combiner* of the amplifiers modules. A BNC (female) connector is also available for monitoring the RF output power of the transmitter after the output filter.



MEX MULTIMODE EXCITER

Multimode is the State-of-Art Exciter capable of all modulation mode by means of fully digital signal processing. Changing only the modulator card MEX can implement analog TV (all standards), DTV, ATSC DTV.
The integration of the digital and RF stages in a single rack amplifies and improves the equipment. Signals and synchronisms are internally connected avoiding the use of external cables which can cause signal losses, emissions and susceptivity to external electromagnetic fields.
The equipment using a lower number of cards and components offers a high reliability higher MTBF, reduced costs for spare parts and lower power consumption. MEX unit is made up by the following functional area:

- *analog section* . . . . including Frequency Synth., Frequency Ref. and GPS Receiver;
- *digital modulator* including the digital modulator circuitry;
- *RF section* . . . . including the RF amplifiers final stages which are able to deliver up to 1Wrms DTV/5Wp.s. TV signal if the unit drives subsequent RF amplifiers; if the unit is in stand-alone configuration is able to deliver up to 2Wrms DTV/10Wp.s. TV signal.
- *pwr supp. section* . including two AC/DC converters which supply all the circuits and assemblies of the unit.
- *control section* . . . . which allows commands, configuration setting and paramenters monitoring of the unit. This section is located behind the front panel.



RF POWER AMPLIFIER MODULE

W3-210A RF Amplifier unit is manufactured using high reliability, solid state components. It is a wideband amplifier which is able to work in the frequency range from 470 to 860 MHz. Due to the intrinsic high linearity offered by this RF module, it allows the application in Dual Cast emission , that means in Analog TV or digital as well DTV and ATSC standards.

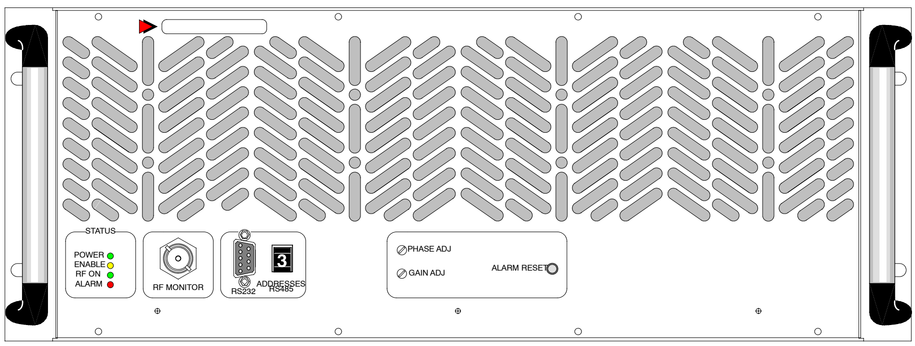
Its nominal output power is as follows:

- $300W_{rms}$ for DTV signal;
- $560W_{rms}$ for DTV signal;
- 1200W p.s. (combined ampl.)

The cooling system is built-in air forced, performed by two DC fans. The unit is arranged in a 19"-4HE mechanical frame.

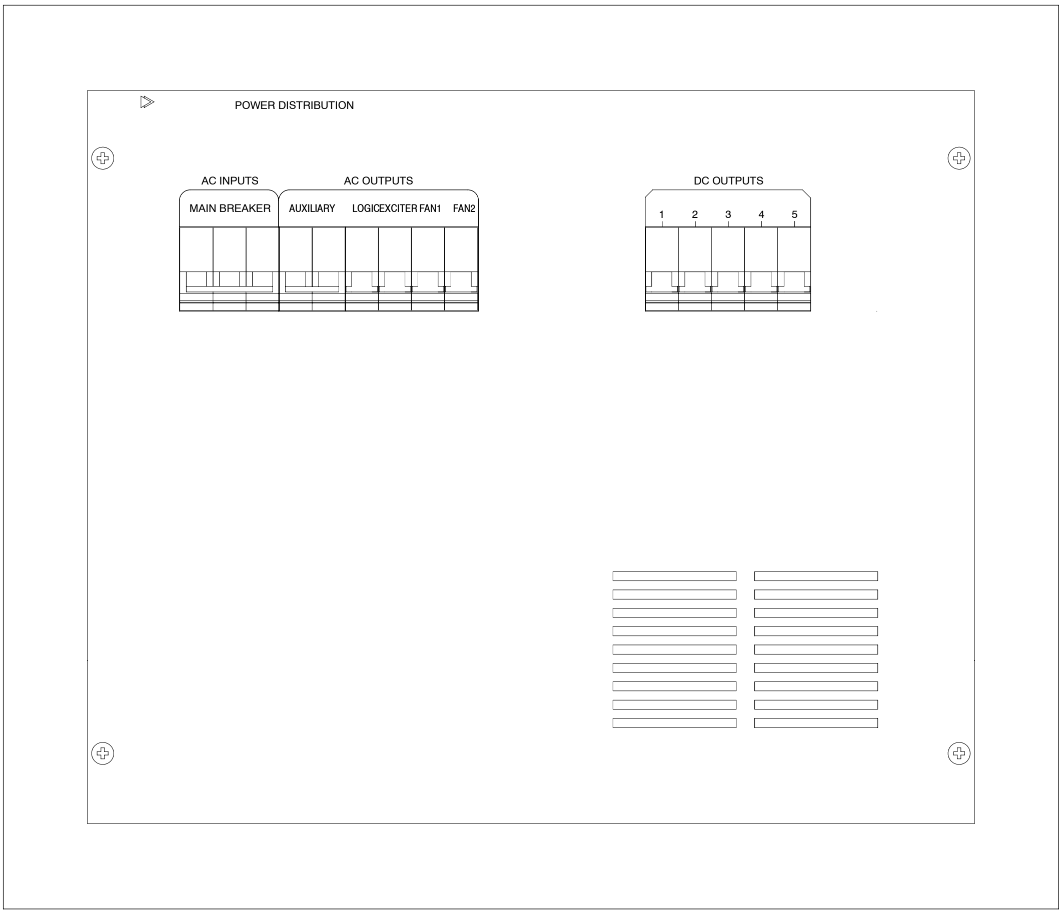
W3-210A amplifier final stages work in AB class to reach a good compromise between introduced distortion and dissipated power with low current consumption. Phase and gain of the module can be adjusted simply by opening the front panel, without need of module extraction.

W3-210A module is self-protected from overdrive of the RF input power, from incidental reflected power, from overvoltage of the amplifier power supply voltages and from driver and final stage abnormal absorption. The protections are performed through the module control section, which consists of a *CPU Module Board*, an *Interface Board* and an *Amplifiier Control Board.* The data acquired by the module control section are also transferred to the equipment control logic via RS485 and consequently the module status and functioning can be monitored on control logic monitor.



POWER DISTRIBUTION UNIT

The unit supplies the main power to the all subunits of the transmitter; it is located in the lower part of the cabinet. The power transformer is installed in the rear rack side. The AC/DC Power Distribution is configurable with different AC standard voltage, the set-up is allowed changing the transformer's taps.
The single phase mains (115 or 230 VAC) is applied , by the main breaker, to the internal distribution; the main power for the RF module amplifier is performed by a 140 VDC power supply unregulated, this one is feed by an insulation transformer for protection against the accidental line sparks.
The dual step switch-on is provided in order to limit the peak current during start process, this circuit is realised with the delayed relay and ballast resistors.
The exciter and auxiliary circuits are feed by another dedicated transformer for protection against the accidental line sparks.
The Power Distribution unit includes the overcurrent and overtemperature breakers for complete protection of the each electrical line.



4-WAY VHF COMBINER

The assembly allows combining four amplifiers modules and is made up by three hybrid couplers carried out with air-suspended strip-lines. This technique guarantees optimum isolating values, very low insertion loss and good matching on any RF port. Since the unit is completely passive it does not need any supply. The unbalance loads are arranged in a separate assembly (air cooled by a their own fan) located in the rear side of the cabinet on lower right-hand side.

4-WAY VHF SPLITTER

The assembly splits the RF output signal from the exciter into four signals which drive the same number of amplifiers modules. It is carried out with strip-lines technique on PCB and arranged in a metal box including the unbalance load.

MEX BB/RF INTERFACE

The board splits the input signals and routes them to both exciters; it also performs the change-over of the RF output signal of the operative exciter towards the amplifier section. The board is able to manage both analog and digital signals.

UNBALANCE LOADS

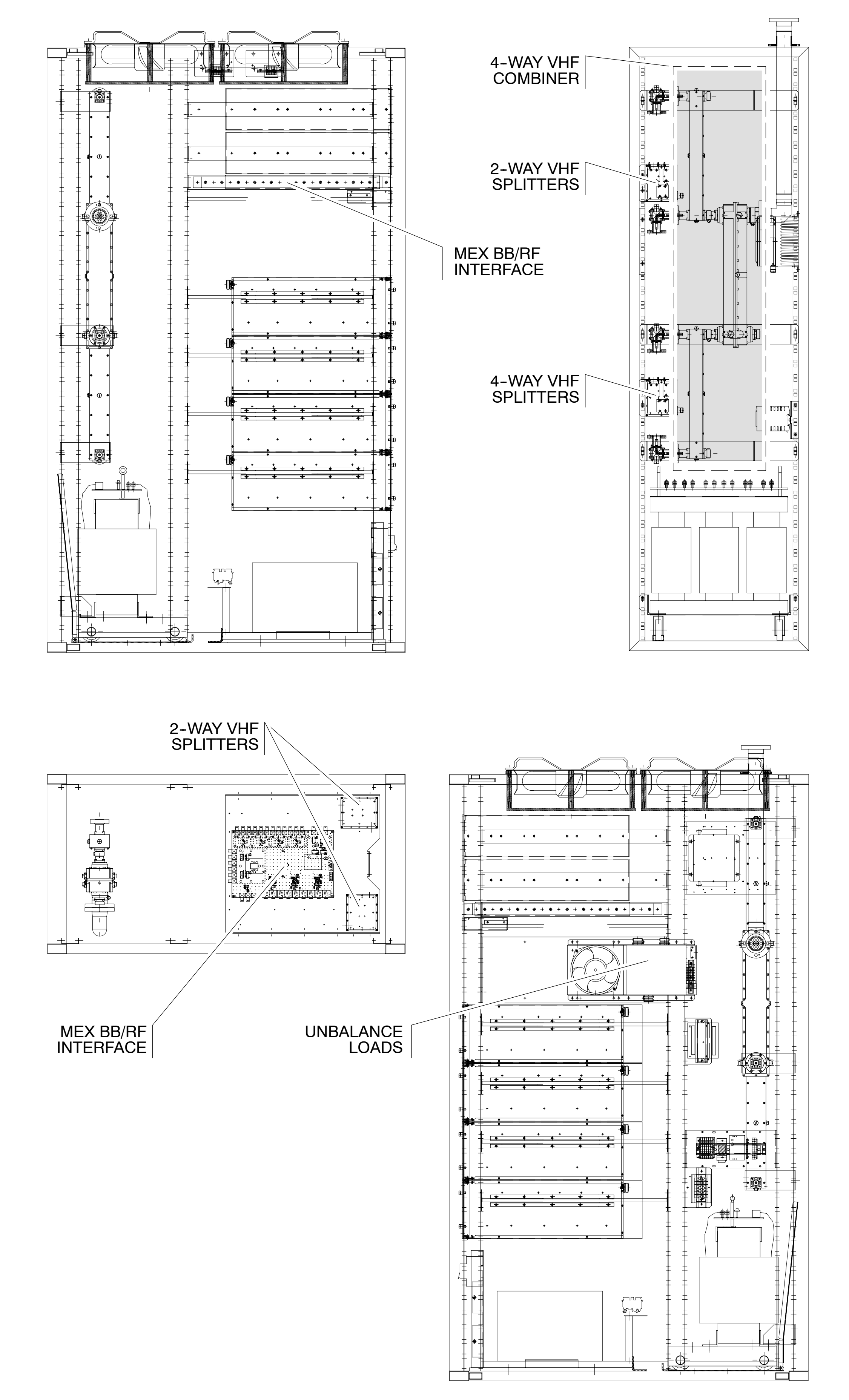
The unbalance load of VHF Output Combiner is arranged on a heatsink which is air cooled by an its own fan.
The heatsink is endowed with thermal switches enabling the fan ($t \geq 60^oC$) or stopping the transmitter ($t \geq 80^oC$).

BAND PASS NOTCH FILTER

Band Pass Filter is used to limit the undesirable emission from transmitter. More specifically, it is necessary to limit the harmonic content of the transmitter to prevent interference at higher frequencies with other services. In addition, it is necessary to limit the intrusion of other RF signals into the final stage of transmitter as a result of antenna coupling. The band-pass filter consists of resonant cavities, coupled.

OUTPUT DIRECTIONAL COUPLER

The output directional coupler picks-up the voltages proportional to forward (2 samples) and reflected power for monitoring purposes. The power samples are routed to TX *Control Unit*.



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1.2 FUNCTIONAL DESCRIPTION OF THE EQUIPMENT

This paragraph provides a functional description of the transmitter; the description below refers to the following figures:

- Fig. 1.2 block diagram of transmitter RF section;
- Fig. 1.3 block diagram of transmitter Power supply section;
- Fig. 1.4 block diagram of transmitter Control section;
- Fig. 1.5 block diagram of transmitter air cooling system.

1.2.1 RF section

The input *ransport streams* (ASI or SMPTE) or *audio* and *video* signals enter *MEX BB/RF Interface* board. *SUBC*, *MPX* and *10MHz* signals (for analog broadcasting) enter both exciters.

MEX BB/RF Interface splits the input *ransport streams* by two and send them to exciter “A” and “B”. The RF outputs of the exciters are connected to *MEX BB/RF Interface* board which routes the RF output of the operative exciter to the amplification chain (the RF output of the stand-by exciter is terminated on dummy load).

The RF output of the operative exciter is split into four signals driving the same number of power amplifiers; the RF output of the power amplifiers are summed up by a 4-way combiner. The RF output signal from the combiner passes throgh two directional couplers, a band-pass filter and it is made available for the antenna.

The forward (*fwd*) and rfelected (*rfl*) power samples, picked up from output directional coupler, are routed to two 2-way splitters. The output signals of the splitters enter the *logic section* of MEX exciters in order to be processed for displaying the relevant measurement (the processing is performed only by *master* exciter).

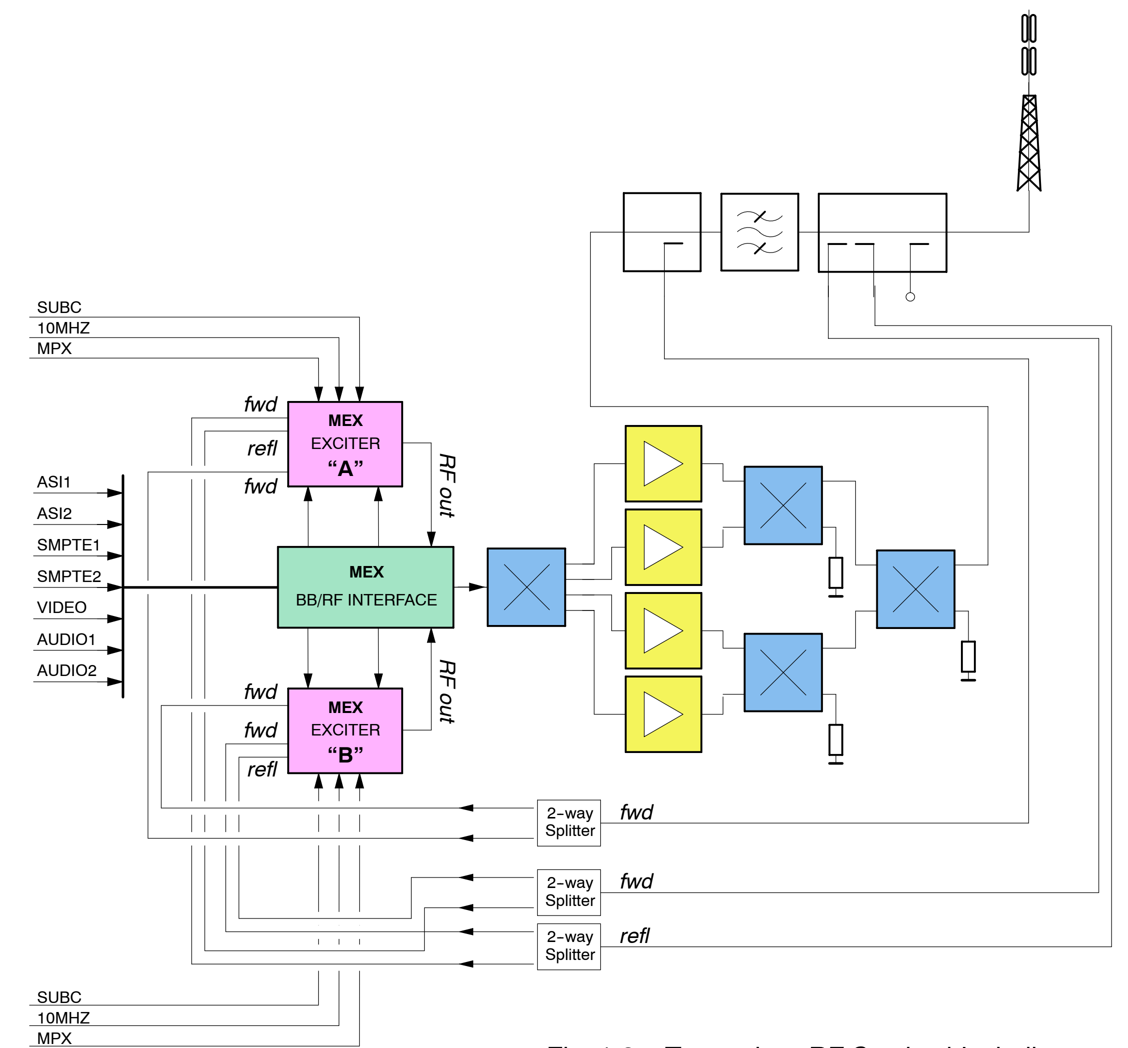

Fig. 1.2 - Transmitter *RF Section* block diagram

1.2.2 Power supply section

The power supply section includes *Power Distribution* unit which routes the power supply voltages to the different units and parts which make up the transmitter.

The three-phase mains (208/240 V_{AC}) is applied, through the main breaker, to the internal distribution (K1 terminal block) ; the main power for the RF module amplifier is delivered by a 140V_{DC} power supply unregulated, this one is feed by an insulation transformer for protection against the accidental line sparks.

A dual step switching-on is provided by a suitable circuit, in order to limit the peak current during start process, this circuit is made up by delayed relay and ballast resistors.

Exciter and blower are supplied by another dedicated transformer for protection against the accidental line sparks.

Power Distribution unit also delivers the mains supply to an *AC/DC Power Supply* board which, in turn, delivers +12VDC to “MEX/BB RF Interface” board.

Overcurrent and overtemperature breakers ensure a complete protection of each electrical line.

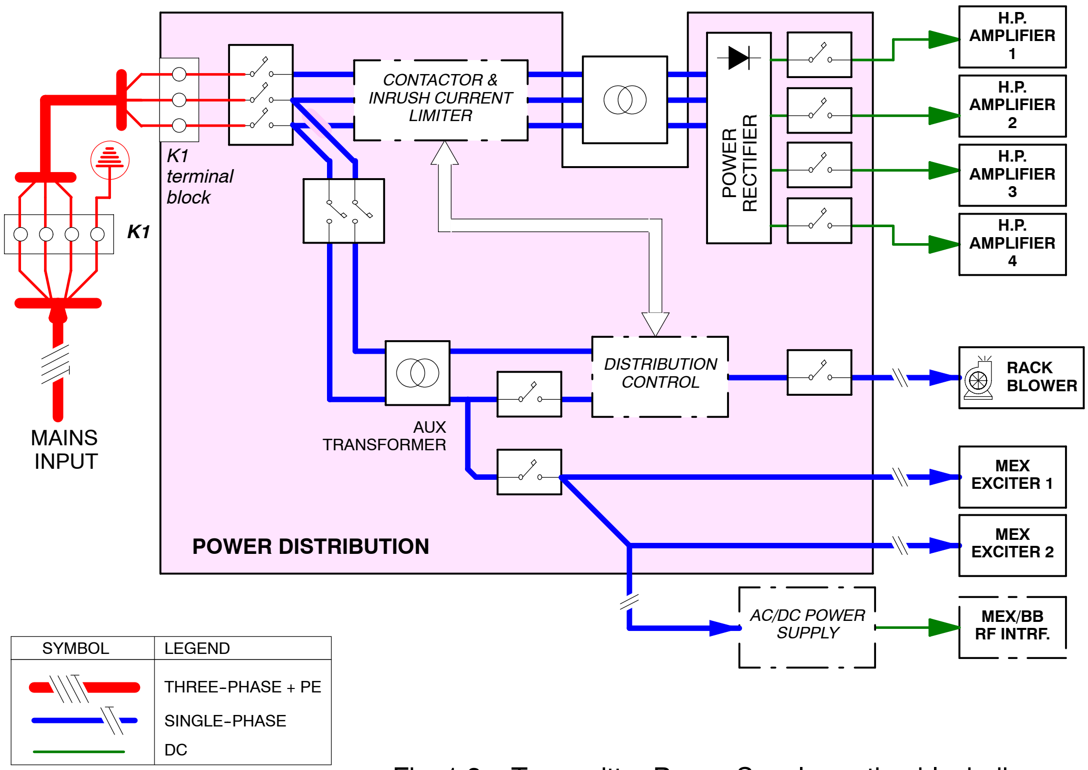

Fig. 1.3 - Transmitter Power Supply section block diagram

1.2.3 Control section

The control section consists of *MEX Exciter* units, *Interface Conn.37D\Terminal Board* and *Mains Distribution* unit.

MEX EXCITER unit is able to operate as *control logic* of the transmitter managing and displaying all information on the general functioning of the transmitter, the general status of its cooling system and the status of the amplifier modules. The information are displayed on the liquid crystal display and are accessed through a menu system by a keybord on the front panel.

INTERFACE CONN.37D\TERMINAL BOARD interfaces the unit of the logic section with the other ones to be controlled. It collects infromation from unbalance loads detector and amplifiers modules and interfaces them with MEX Exciter. The board is connected to MEX also via an *RS485* serial line.

MAINS DISTRIBUTION interfaces, through *Distribution Control* board, the cooling system to MEX unit. The commands from MEX are used to start the blower and also for sending the *enable* signal to the amplifiers modules (via *Interface Conn.37D\Terminal Board*).

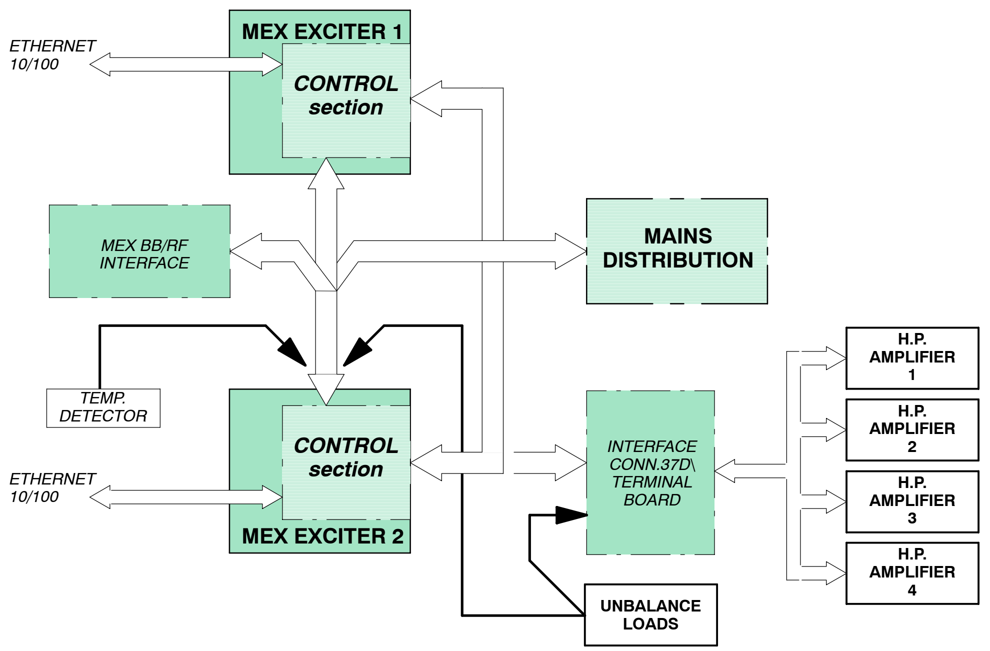

Fig. 1.4 – Transmitter Control section block diagram

1.2.4 Air Cooling system

An air forced system is used to cool the transmitter cabinet. This kind of cooling allows compact size and is also recommended for simplicity and efficiency whenever moderate quantities of heat have to be dissipated in low and medium power transmitters. The use of low velocity blowers, that means low noise, guarantees easy operation and maintenance to the operator.

From a structural point of view the air cooling system consists of two extractor blowers for the cabinet and of a fan for each unit: the air is exhausted from the top of the cabinet by the blowers and dispersed to the ambient or ducted outside the building. The transmitter is also endowed with dust protection filters.

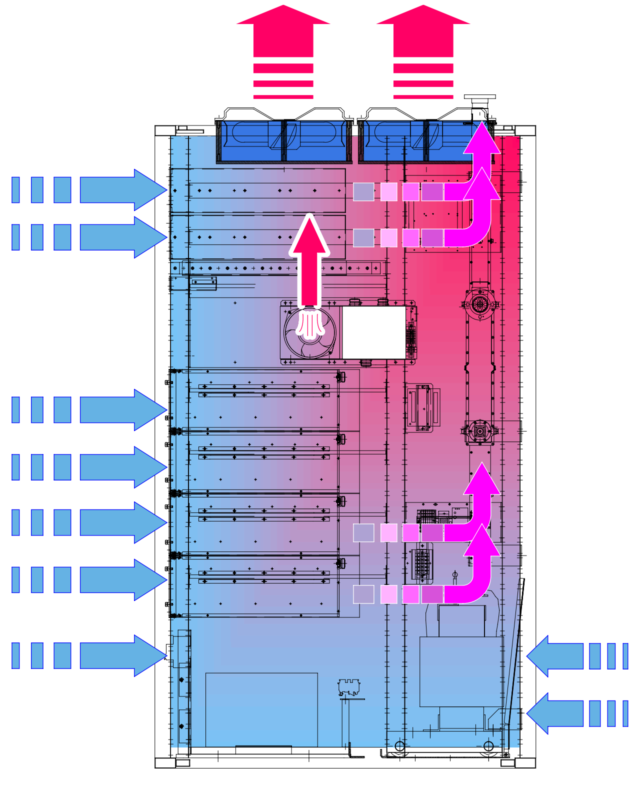

Fig. 1.5 – Air Cooling system

1.3 TECHNICAL SPECIFICATIONS

GENERAL DATA

ENVIRNOMENTAL CONDITIONS	
Operation temperature range	0°C to +45°C
Storage temperature range	-30°C to +70°C
Relative humidity (at 40°C)	90%
Altitude a.s.l.	up to 3000 m
Cooling system:	forced air
AC REQUIREMENTS	
AC supply	3 x 2080/240V_{ac} (-15, +10%) three phase + N + PE
Frequency	50/60Hz
Power factor	>0.9
Power consumption	*see 'Test Report'*
METERING	
	- forward output power
	- reflected power
PROTECTION CIRCUITS	
	- excessive reflected power
	- excessive cooling air temperature
	- cooling air flow lack
DIMENSIONS and WEIGHT	
Rack:	stainless steel; 19"-40HE
Dimensions (wxhxd) (mm):	546x1860+70x1190
Weight (kg):	295

TRANSMISSION CHARACTERISTISC

TRANSMISSION PARAMETERS	
Frequency range	170MHz to 240MHz
Output power	2.2Wrms
Modulation	8VSB
Standard	ATSC according to Doc. A53/1995
Input Data format	ASI (188/204 bytes packet) SMPTE 310M (188 bytes packet)
Input Bit Rate	ASI: Bit rate adaptation and PCR restamping SMPTE: 19.392638 Mbit/s
Code rate (trellis)	2/3
EVM	< 2.0% (typical 1.5%)
Linear precorrection, non-linear precorrection	digital processing
TRANSMISSION SPECIFICATIONS	
Intermodulation products	≤ -38dB (after filter)
Frequency Steps	1Hz
External reference	10MHz
External reference input level	7dBm/50Ω

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CHAPTER 2: INSTALLATION

LIST OF ILLUSTARTIONS

CHAPTER 2: INSTALLATION

2.1 INTRODUCTION

This chapter provides drawings and information concerning installation of T333SVZ transmitter. This paragraph deals with the actions normally performed when the equipment has to be moved. More in detail *paragraph 2.2* gives information and installation drawings, to mount and interconnect the equipment.

2.1.1 Requirements for Installation

The definition of the site where the equipment has to be installed is determined by the careful analysis of its standard dimensions (see Fig. 2.1). There are no specific constraints in the installation of the equipment, however the site must be defined in order to satisfy the following requirements and ensure the best utilization of the equipment:

- Each unit must be installed in such a way to provide optimum performance as long as it is possible.
- The room in which the equipment is housed must to be provided with controls of the environmental conditions.
- The ambient temperature must be kept in a range from 0°C to +45°C. Outside this temperature range, regular functioning of the equipment is not guaranteed.
- The relative humidity can reach 90% maximum, without condensation. Higher humidity encourages corrosion and deterioration of the equipment structures and in a short time could damage the insulation among the electrical parts which are subject to high voltage.
- It also encourages *CONDENSATION* on the internal and external surfaces causing therefore severe damage especially to the electrical parts of the equipment subject to high voltage.
- In the room where the equipment is housed, filters must be present at all air inlets and louvres at all air outlets. No sources of dust, even potential, ought to be present; in fact the dust may cause the clogging of the cooling system.
- The space around the unit must be sufficient to permit installation and maintenance. The amount of clearance from walls or other equipments must include the space necessary to open the doors.
- Sufficient space for cable connectors must also be available. In light of the above, any solution which limits the accessibility must be considered inacceptable.

2.1.2 Transport

The cabinet and the equipment units have been carefully packed for transport; the equipment cabinet may travel both in vertical and in horizontal position. Four eye-bolts placed on the upper part of the cabinet are used to lift it.

> NOTE
>
> *INSPECTION FOR DAMAGE DURING TRANSPORT*
>
> *When the equipment arrives at destination, it should be inspected immediately for possible damage incurred during transport.*

If any damage is found, both the insurance company and the shipping agent must be informed immediately. If the name of the insurance company is unknown, a Lloyd's inspector should be called in.

2.1.3 Unpacking

No particular procedures are necessary to unpack the crate. However, it is suggested to carry out this operation as close as possible to the final installation site.

Avoid damage to the crate and to the packing material inside them, so they can be re-utilized in case the equipment should be moved to another installation site.

2.1.4 Storage

After the material contained in the crate has been inspected and it has been verified for damages, the unit shall be stored in its original packing until the time of installation. The storage deposit must be well protected and free from humidity.

Avoid keeping the units in storage for a long time, scheduling the delivery date precisely. Long time storage may cause frequency failures during the initial period of utilization.

If the equipment should be kept in storage for a long time, it is advisable to insert hygroscopic substances (such as silicon gel salts) in the crates.

2.1.5 Repacking

The packing methods may be different according to: the transportation means, the environment, the expected period of inactivity and the storage.

The following suggestions are referred to a typical package able to withstand by land, by sea or by air transportation.

The cabinet must be inserted in a proper wooden box lined internally with polistyrene foam tailored to the cabinet dimensions. When the cabinet has been introduced, a packet of dehydrant must be added and the box must be closed with a polistyrene foam cover first and then with a wooden cover provided with hinges on one side and locking devices on the other side.

Finally the box must be properly wrapped with iron or plastic straps which can withstand very hard handling causing the box to be opened.

Each unit must be packed, wrapped with barrier paper and sealed with adhesive tape. The unit packaged must be introduced in a box internally lined with gummed horse hair.

The boxes must be closed with adhesive tape, wrapped with iron or plastic straps and then the identification tags must be applied.

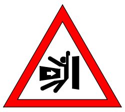
INFORMATION FOR THE OPERATOR

Hereafter a list of symbols that will be used in the present manual:

Index finger : ***this index finger indicates important details***

In setting up racks observe the relevant regulations for the prevention of accidents.

These regulations especially refer to the following:

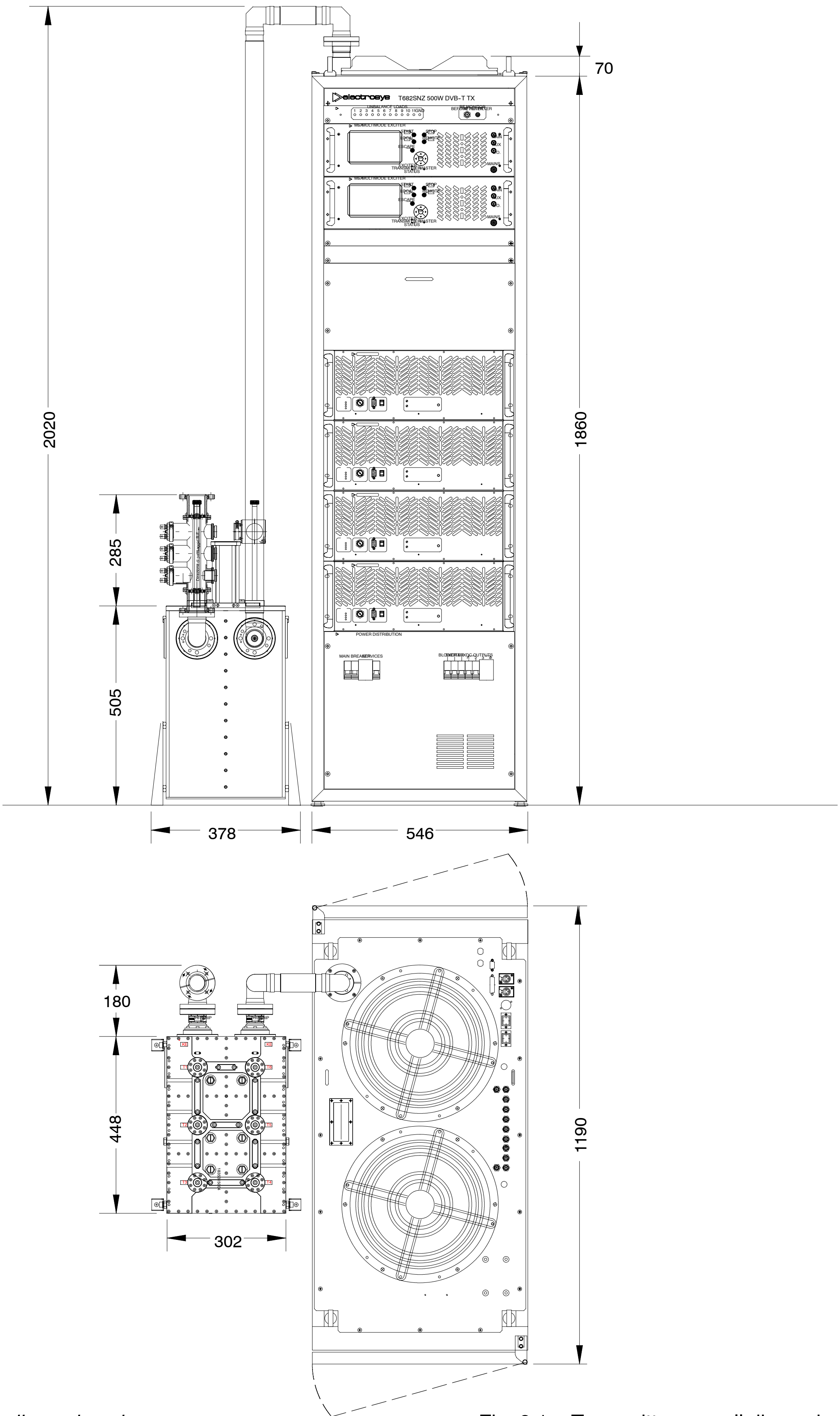


Danger of getting crushed when working with loads.

Danger of falling off ladders while working

Danger when lifting heavy loads.

All electrical installation and connections are to be carried out only by qualified personnel.



dimensions in mm

Fig. 2.1 – Transmitter overall dimensions

2.2 PHYSICAL INSTALLATION

The installation procedure consists of the steps described in the following paragraphs:

2.2.1 Rack set-up *(refer to Fig. 2.2)*

- *Fitting doors hinges*
  Fit hinges of rear doors according to relevant detail and then fit the doors to the rack.
- *Positioning and lining up rack*
  Transmitter rack must be fitted, fixed in place and lined up (in horizontal) after it has been placed in the desired position. Two bolts on the front bottom of the rack are used for this purpose. These bolts must be unscrewed until they touch the floor. In this way they block and allow lining up the rack.

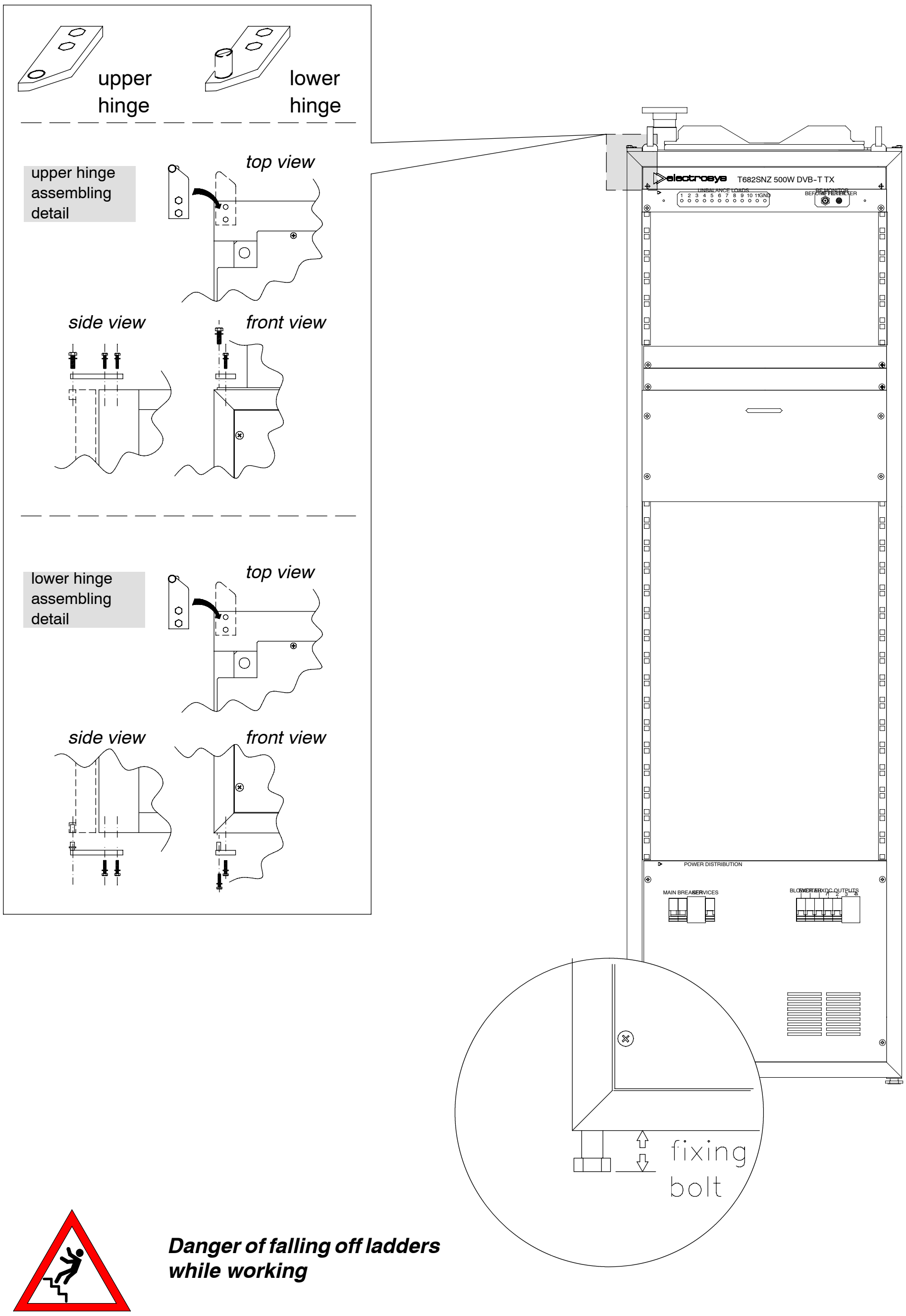
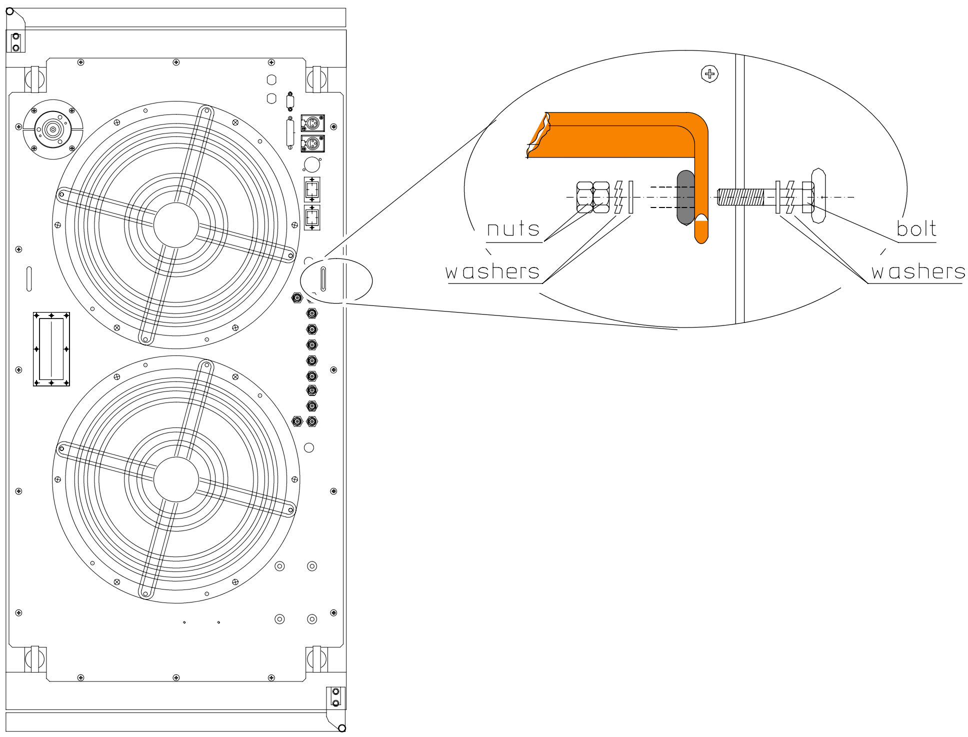


Fig. 2.2 - Rack setup

2.2.2 Ground connection *(refer to Fig. 2.3)*

- Grounding is made using the special termination found on top panel of the rack and pointed out by the label . It should be kept in mind that good ground contact is not always achieved merely by locking through bolts. Defective grounding not only may represent a danger to personnel, but can also increase possibilities of interferences or abnormal functioning. To prevent or reduce interference between the transmitter and other telecommunication equipments all external shields must be connected to the ground terminal board. This connection also serves to prevent formation of static loads on the unit.



Danger of falling off ladders while working

Fig. 2.3 – Ground connection

2.2.3 Fitting exciters and amplifiers units to the rack *(refer to Fig. 2.4 and Fig. 2.5)*

Due to their weight for safety reasons, some units of the transmitter are packed separately, so it is necessary to fit them to transmitter cabinet.

- FITTING EXCITER(s) UNITS
  Exciter(s) units are packed separately and must be inserted into transmitter cabinet, in their suitable housing. The slideways of the unit(s), are also disassembled from the frame(s) and they must be fitted again to the frame(s) before putting MEX unit(s) into the transmitter cabinet (see Fig. 2.4).
  In case of dual-drive configuration, exciter "A" has to be fitted on the upper position.
  Connection of the unit(s) has to be carried out according to the general wiring diagram of *T333SVZ 2.2KW VHF DTV transmitter* dwg. no. 6600322200ID.
- FITTINGAMPLIFIERS MODULES
  Amplifiers modules must be inserted into transmitter cabinet, in their suitabl housing. They may be inserted inside the rack, in whatever position (see Fig. 2.5).
  Connection of the unit(s) has to be carried out according to the general wiring diagram of *T333SVZ 2.2KW VHF DTV transmitter* dwg. no. 6600322200ID.

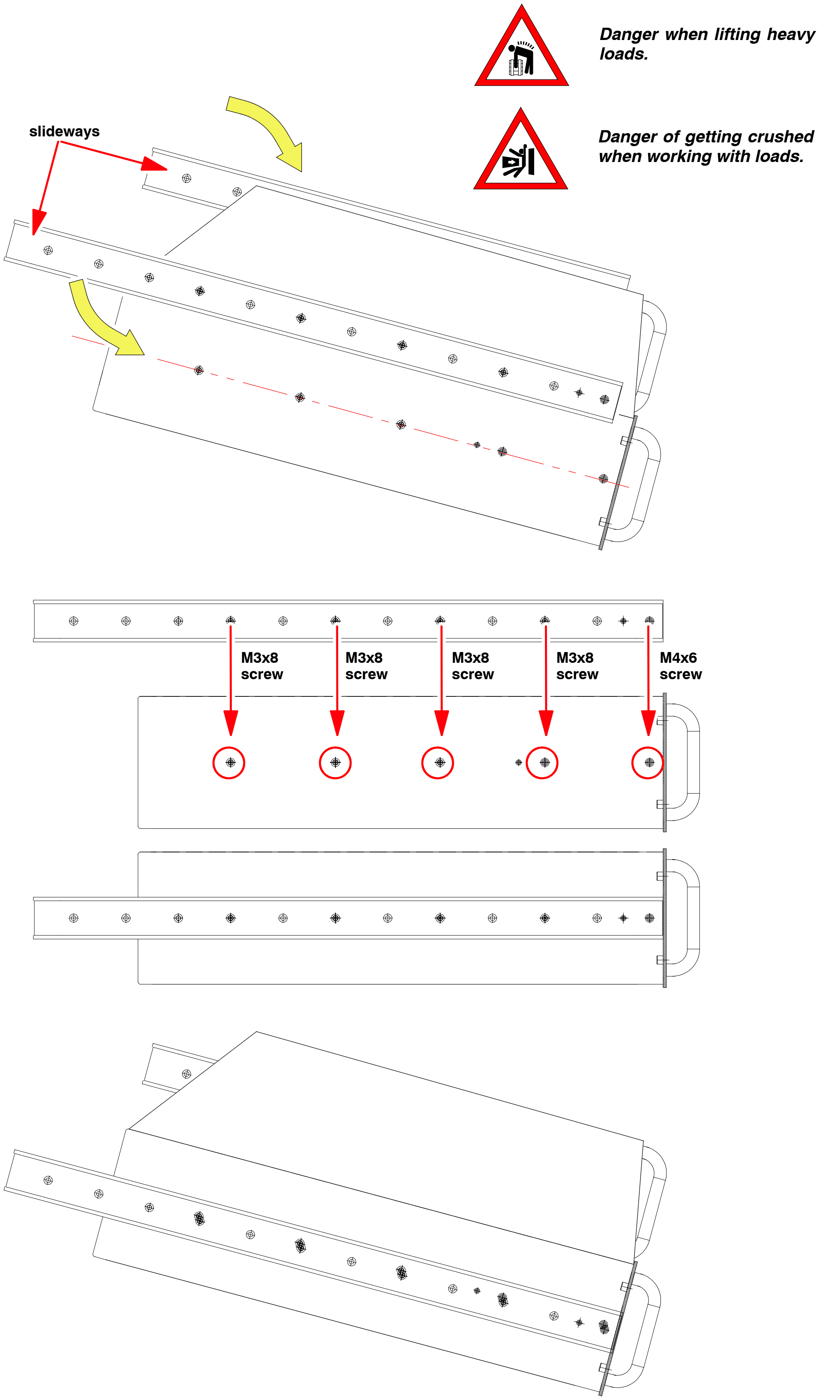
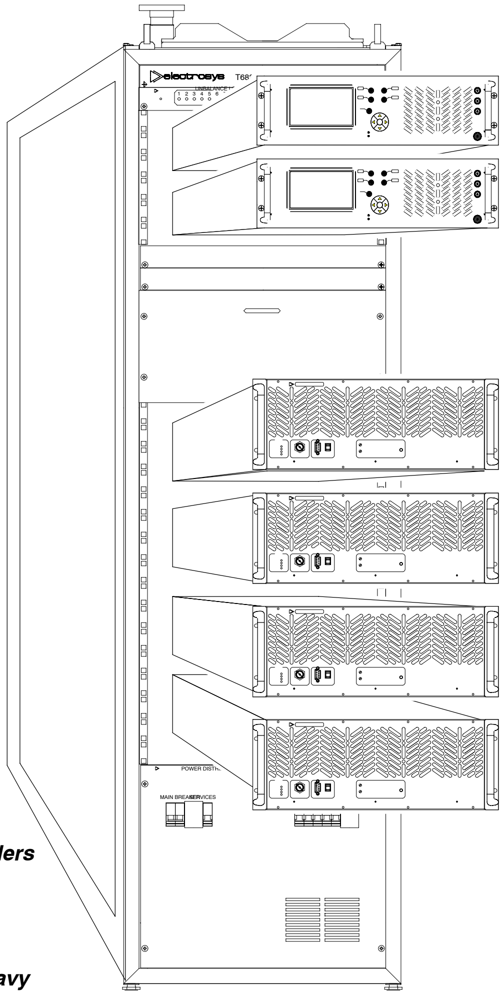


Fig. 2.4 – Fitting the slideways to exciter frame



Danger of falling off ladders while working

Danger when lifting heavy loads.

Danger of getting crushed when working with loads.

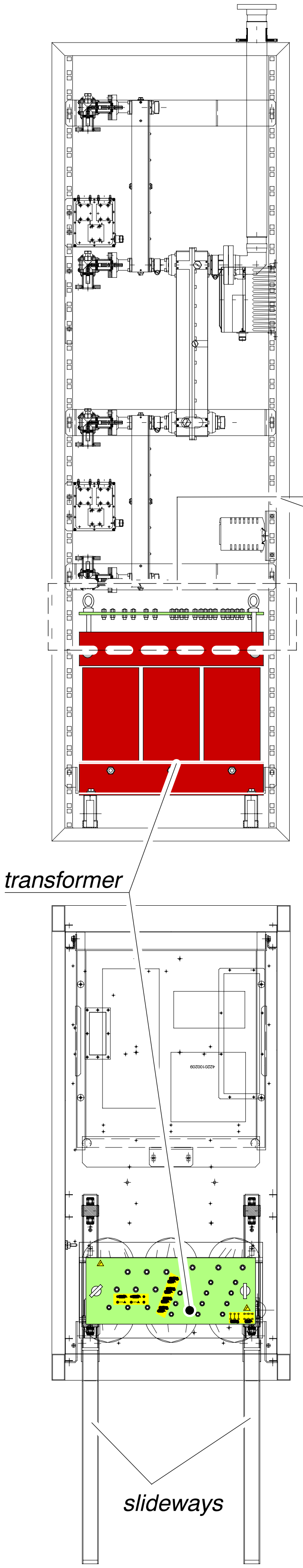
Fig. 2.5 – Fitting exciters and amp. modules to transmitter cabinet

2.2.4 Fitting transformer to transmitter cabinet *(refer to Fig. 2.6)*

Due to its weight and for safety reasons, the transformer is packed separately; so it has to be fitted inside the trannsmitter cabinet on its bottom panel on the rear side. Follow the directions listed here below:

- put down the slideways in order to insert the transformer and remove the locking bracket;
- push the transformer trolley onto the slideways and insert it inside the rack;
- fix in place the transformer trolley by means of the suitable locking brackets (on both sides of the trolley).
- lift slideways up and stop them fixing the suitable metal plate to the rack.

Carry out connections referring to the general wiring diagram of the transmitter included in section 6 “Circuit diagrams”: *T333SVZ 2.2KW VHF DTV transmitter* dwg. no. 6600322200ID.

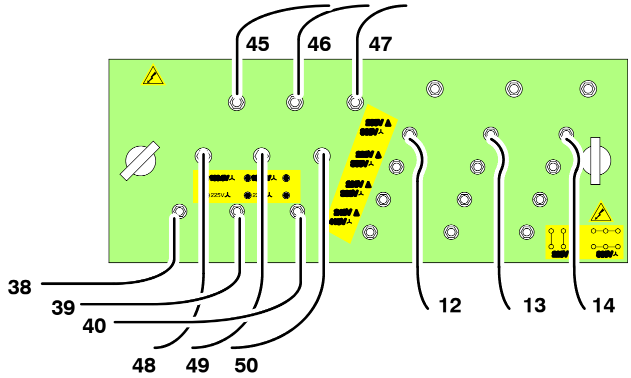


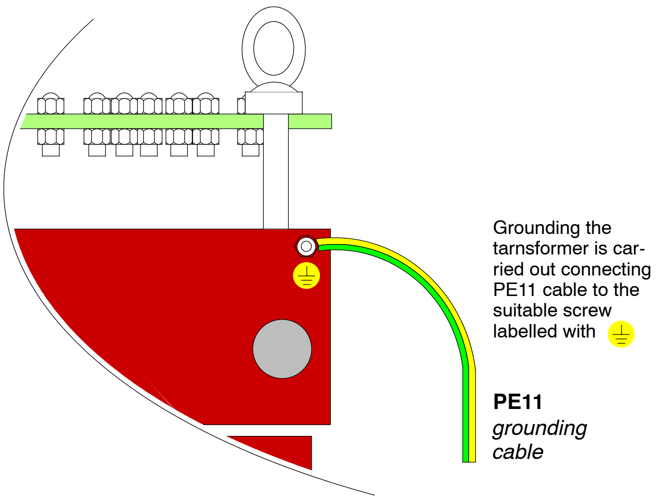
TRANSFORMERSCONNECTION

Carry out the connection of the transformer primary windings (cables 12-13-14 and 38-39-40) and of secondary windings (cables 45-46-47 and 48-49-50).

Keep in mind that the connections to the primary winding of the transformer, must be carried out according to mains voltage available; for the purpose follow the indciations labbelled close to terminals.

The following example, refers to a 208/240V_{AC} three-phase mains volatge.





Danger when lifting heavy loads.

Danger of getting crushed when working with loads.

Fig. 2.6 - Fitting the transformer to transmitter cabinet

2.2.5 Connection of the Band Pass Filter *(refer to Fig. 2.7)*

Refer to Fig. 2.7 and to the general wiring diagrams of the transmitter for carrying out the connection of the Band pass Filter. It has to be connected to transmitter cabinet by W320 rigid line. Carry out also the connection of the directional couplers on the filter to the cabinet.

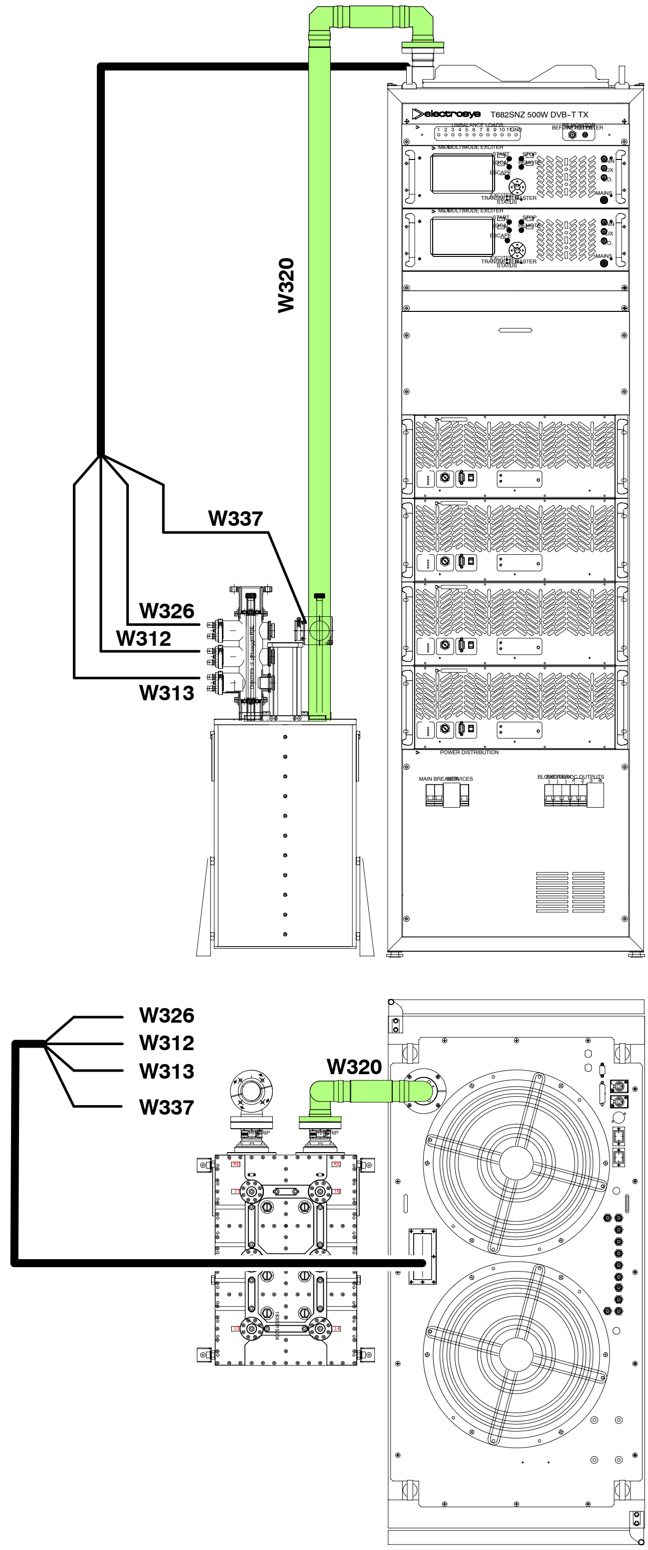


Fig. 2.7 - Connection of Band Pass Filter

2.2.6 Mains connections *(refer to Fig. 2.8)*

Refer to Fig. 2.8 and to the general wiring diagrams of the transmitter for carrying out the mains connections. Following the indications drawn on each terminal board, connect the cables (L1, L2, L3, N) of the three-phase mains and ground cable (PE) to K1 terminal board inside transmitter cabinet. This terminal board is accessible by opening the back door of the cabinet.

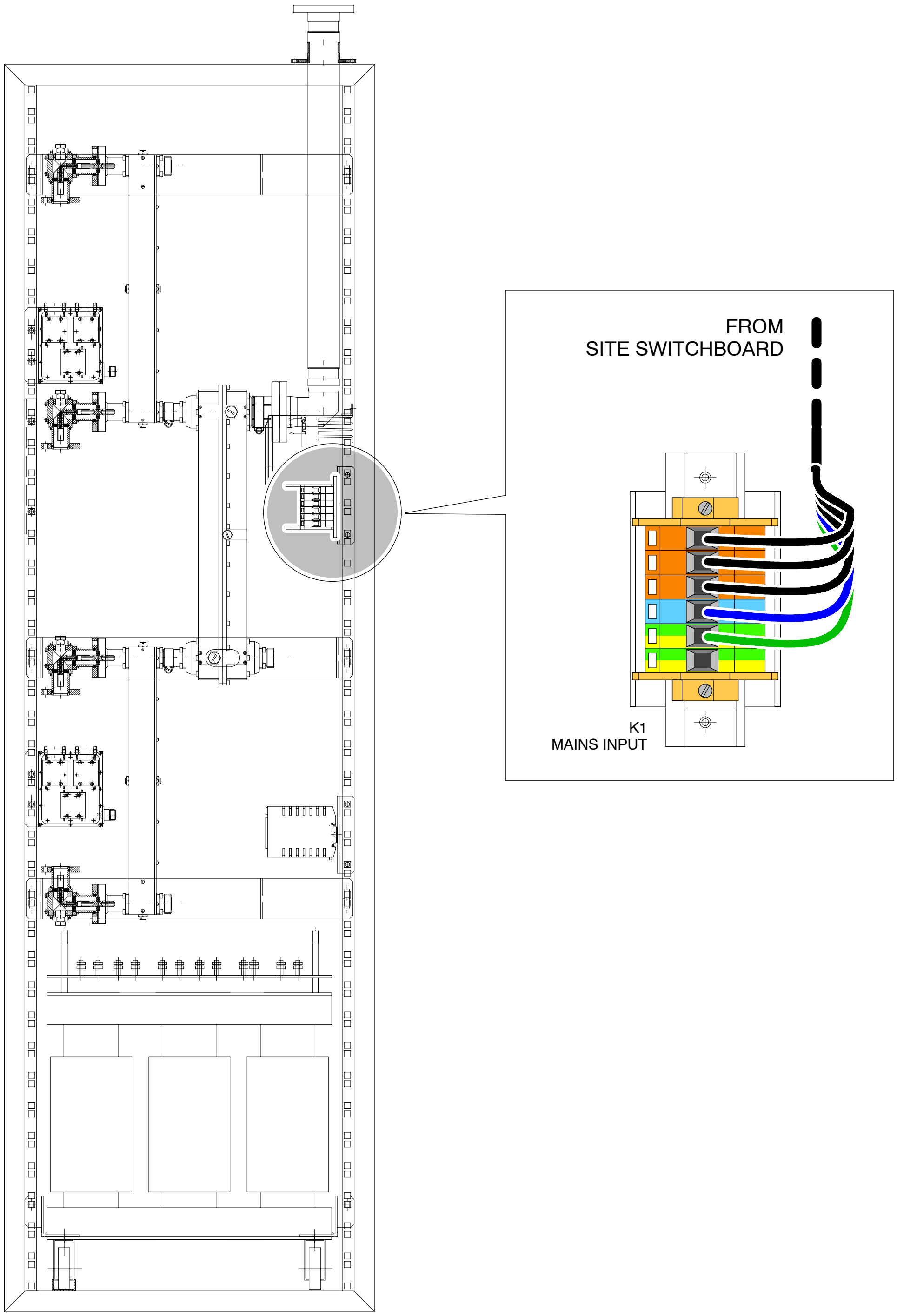


Fig. 2.8 - Mains connections

2.2.7 Program signals connection *(refer to Fig. 2.9)*

The connectors for the program signals are arranged on top panle of the cabinet; refer to Fig. 2.9 for the connection.

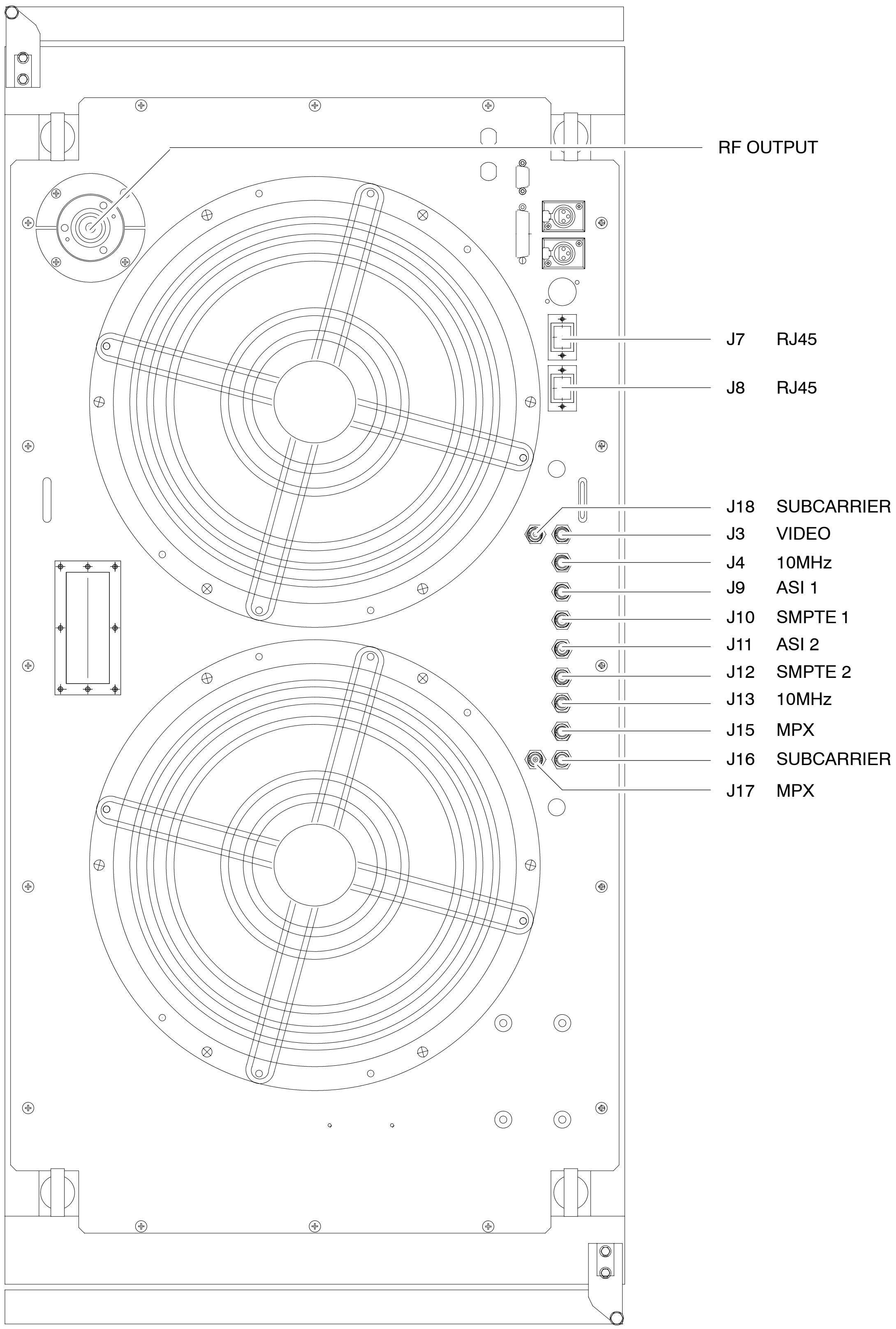


Fig. 2.9 – Program signals connection

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CHAPTER 3: OPERATING INSTRUCTIONS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER 3: OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The present chapter contains the operating instructions, the information and procedures necessary to enable the operating personnel to efficiently and effectively use the equipment.

3.2 INTSTALLATION CHECKS

After each unit has been installed, as described in the previous chapter, a series of checks must be performed to verify that:
- neither equipment nor cables have been damaged during installation;
- the equipment operates regularly and is fully able to carry out the functions for which has been installed.

The check procedure consists of two steps:
- Cold checks;
- Hot checks.

3.2.1 Cold checks

Check that each unit has been installed in accordance with the instructions given in the previous chapter. Particularly verify that:

- ▶ the place of installation complies with the stated requirements;
- ▶ sufficient space is available around the unit for maintenance requirements;
- ▶ the unit is easily accessible to the operator;
- ▶ the unit is grounded;
- ▶ connectors and cables attached to the unit are well tightened

Then check that the unit has been connected in accordance with the indications given in the interconnection diagrams, and check the ohmic continuity of all conductors.

3.2.2 Hot checks

Upon completion of ”cold” checks with the unit switched off, supply power and verify that functioning is regular. It is advisable to check:

- ▶ all power supply voltages to the various units;
- ▶ regular functioning of equipment, on Control Logic Unit display of the transmitter;
- ▶ air and liquid cooling system are efficient, making sure that the air can be felt from all nozzles.

3.3 SWITCHING ON

The switching on procedure for the equipment is given in the following Tab. 3.1.

Tab. 3.1 – Switching-on the equipment *(local control procedure)*

Step	DESCRIPTION	EXPECTED RESULT
1	– Close the breakers and press (for closing) the restorable fuses located on **Power Distribution-** front panel *(see Appendix A)*.	The following leds light up: • *POWER (green)* on **RF Amp. modules**
2	– Press (for closing) the power switch located on front panels of the following units *(see Appendix A)*: • MAINS . . . . on **MEX** Multimode exciters;	The following leds light up on **MEX "A"** (*master*): • *MAINS (green)* on relevant push button; • *LOCAL (yellow)* on relevant push button. *See note (1).* • *STOP (red)* on relevant push button. *See note (1).* • *MASTER (green)*. *See note (1).* The following leds light up on **MEX "B"**: • *MAINS (green)* on relevant push button; • *REMOTE (green)* on relevant push button. *See note (1).* • *STOP (red)* on relevant push button. *See note (1).* The displays on **MEXs** light-up and the exciters start the software loading ('*loading...*' operation).
3	– Press START button on **MEX "A"** (*master*).	The following leds must be lit on **MEX "A"** (*master*): • *START (green)* on relevant push button (LED 'STOP' goes off). • *EXCITER (green)*. • *TRANSMITTER (green)*. The following leds must be lit on **MEX "B"**: • *STOP (red)* on relevant push button. • *REMOTE (green)* on relevant push button. The following leds must be lit on **RF Amp. modules**: • *POWER (green)*; • *ENABLE (yellow)*; • *RF ON (green)*. **TRANSMITTER DELIVERS RF POWER**

NOTE

(1) The exciters at the switching-on, are under the operative conditions they had before the switching-off. In this table it is stated that:

- *MEX "A" (master) was in <u>local</u> functioning and in <u>stop</u> condition (no RF power delivered); otherwise <u>remote</u> and <u>start</u> LEDs should be lit (MEX delivers RF power).*
- *MEX "B" was in <u>remote</u> functioning and in <u>stop</u> condition (no RF power delivered); otherwise <u>local</u> and <u>start</u> LEDs should be lit.*

3.4 SWITCHING OFF

The equipment can be switched off locally only if it is working under this condition; if it is working in remote control, the switching-off must be carried out sending the relevant command from the remote control unit.

The switching off in '*local*' functioning is achieved carrying out the following operations:

- push 'STOP' on MEX exciter (see *note (1)*);
- open the mains breakers on *Power Distribution* front panel.

3.5 REMOTE CONTROL

Remote control of the transmitter is allowed via the suitable "*ETHERNET*" connectors (RJ45) available to the operator on cabinet top panel (see *Chap. 2; para. 2.2.6*).

3.6 REGULATIONS AND SETTINGS

3.6.1 Measurement and Regulation of the transmitter Output Power

A transmitter unit replacement may change the transmitter output power, that is factory set. So it could be necessary to check the RF output power and eventually adjust it again. The following procedure must be performed on MEX exciter. Set-up the test bench of Fig. 3.1 and operate as follows.

1 Starting from main menu of MEX, execute: `[▼] EXC. RF OUT>[ENTER]>[ENTER]` *(a blinking cursor will be displayed under a digit of* `POWER SET`*)*

2 Shift the cursor under the digit to be changed, using "◀" or "▶" arrow.

3 Increase ("▲" arrow) or decrease ("▼" arrow) the digit to the wanted value. Carry out the operation on each digit to be changed.

4 Press "ENTER" key. Confirm the setting by pressing the "▲" arrows (YES). If "▼" arrow is pressed (NO) the setting is not carried out. If no key is pressed within about 10 sec., no operation will be carried out.

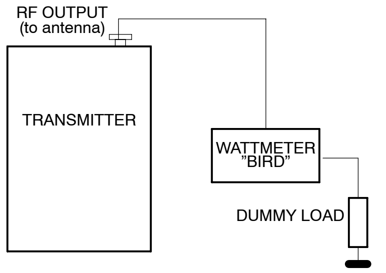


Fig. 3.1 - Test Bench set-up for the transmitter output power check

The RF output power adjustment may be performed both with "EXCITER RF" set on ON and on "OFF". In the first case the RF output power of the exciter will be displayed by the percentage bar and by the numerical value in Watt. In the second case the RF output power of the exciter will not be displayed while it is increasing or decreasing, but as soon as "EXCITER RF" is set on "ON", the RF output power of the exciter will rise at the new value set.

3.6.2 Check and regulation of the RF output signal precorrection

The precorrection procedure of the RF output signal has to be carried out on MEX Exciter. Further details about precorrection procedure are available on MEX *Technical Manual* (see Chapter 2,para. 2.14 - *Setting precorrection tables of the precorrector*).

3.6.3 Replacing an amplifier module

The replacement of one or more amplifier modules with spare one(s) may cause an unbalance of the power dissipated on unbalance loads (inside the cabinet) of the 4-way output coupler. In turn this may effect the output power of the transmitter (even though little variation), so it is advisable checking the power dissipated on the unbalance load relevant to the amplifier module replaced.

For the purpose use the test points available on transmitter cabinet front panel (refer to Fig. 3.2), for measuring the power dissipated on the relevant dummy load (i.e.: test point "1" for amp. mod. 1 and so on). The power dissipated should be "0" or as much as possible close to it. The measurement may be carried out by an analog or digital multimeter, the measurement ratio is approx. 100W/1V.

In case the unbalance power is not "0", adjust gain of the amplifier module replaced in such a way to zero the power. It is advisable firstly to check the forward RF power of the other modules and then adjust the gain of the module replaced. The checking of the forward RF power of a moduoe may be carried out on the dispaly of the MEX exciter '*master*'.

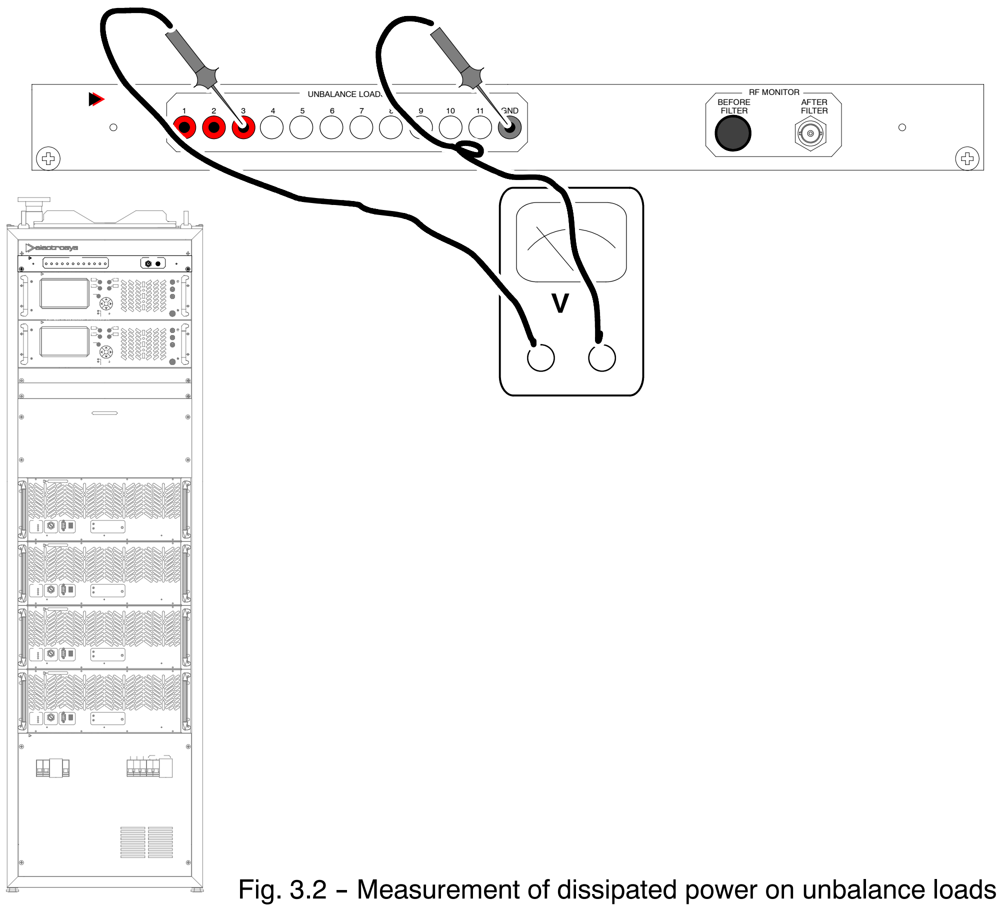


Fig. 3.2 – Measurement of dissipated power on unbalance loads

3.7 CHANGING THE TRANSMISSION CHANNEL

The steps to be carried out to tune the transmitter to the transmission channel concern the units listed here below; for each of them is also given *(between parentheses)* the reference to the technical manual where the topic has dealt with.

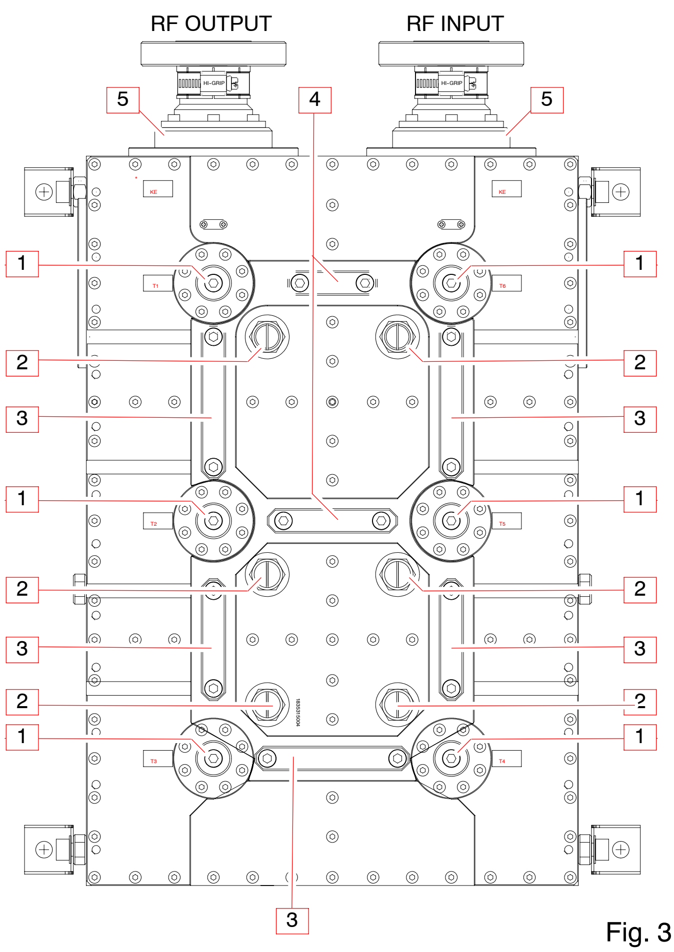
❑ MEX MULTIMODE EXCITER
(section 2, Technical Manual; see the relevant description)
Changing the transmission channel (frequency) is allowed by "SYNTHESIZER" menu. Execute:

☞ [▼] SYNTHESIZER>[ENTER]>[▼] CHANNEL>[ENTER]>[▲▼] (*set new channel*)>[ENTER]>[▲]

As alternative execute:

☞ [▼] SYNTHESIZER>[ENTER]>[▼] FREQ.>[ENTER]>[▲▼ and ▶ ◀] (*set new freq.*)> [ENTER]>[▲]

❑ BAND PASS FILTER
(see following Fig. 3.3)
- Tuning the filter cavities (refer to test report which comes with the equipment)



LEGEND	
1	TUNING
2	FINE TUNING
3	COUPLING
4	NOTCH TUNING
5	IN/OUT MATCHING

Fig. 3.3 – Band Pass filter controls

❑ OUTPUT DIRECTIONAL COUPLER
(see following paragraph)

The information necessary to correctly adjust the output Directional Coupler, when the transmission channel frequency changes, is given in the following paragraphs. Follow the procedure described below to check and eventually adjust the return loss and the directivity of the directional coupler at the new transmission frequency.

3.7.1 Directional Couplers adjustment

In order to adjust the Direct. Couplers, it is necessary to disconnect it from the other groups of the transmitter. For the measurements which need to be re-adjusted operate as follows:

In order to adjust the Direct. Couplers, it is necessary to disconnect it from the other groups of the transmitter. For the measurements which need to be re-adjusted operate as follows:

- ❑ <u>RETURN LOSS MEASUREMENT</u>
  set-up test bench as in fig. Fig. 3.4. For this measurement both test bench 1 and test bench 2 may be used.
- ❑ <u>ISOLATION AND DIRECTIVITY MEASUREMENT</u>
  set-up test bench as in fig. Fig. 3.5. Connect 50Ω dummy load onto connector $\boxed{1}$ used to pick up the power signal and connect the other connector $\boxed{2}$ to the network analyzer input. The isolation value is displayed; the directivity value is the difference between isolation value and coupling coefficient value.
- ❑ <u>COUPLING COEFFICIENT MEASUREMENT</u>
  set-up test bench as in fig. Fig. 3.6. The input of the network analyzer has to be connected to the BNC connector $\boxed{2}$ used to pick up the power signal. The other BNC connector must be closed on its own 50Ω dummy load $\boxed{1}$.

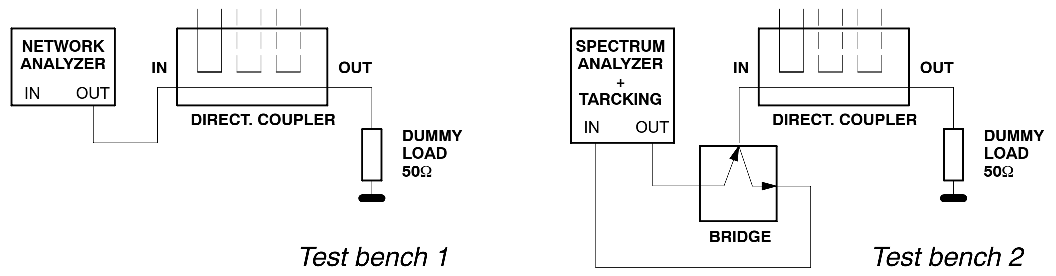


Fig. 3.4 – Return Loss Measurement

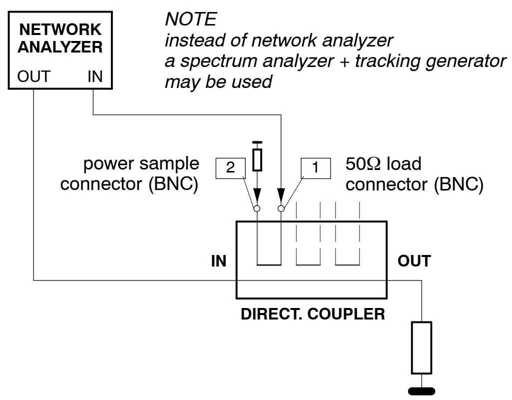


Fig. 3.5 – Directivity measurement

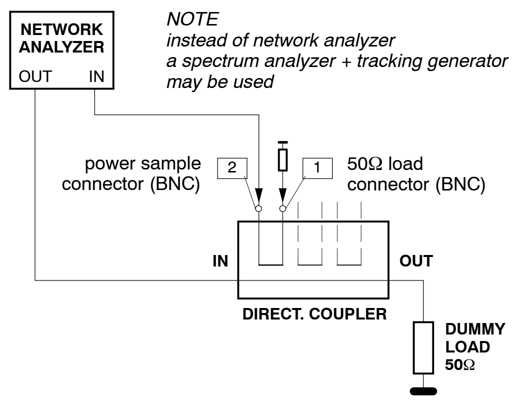


Fig. 3.6 – Coupling coefficient measurement

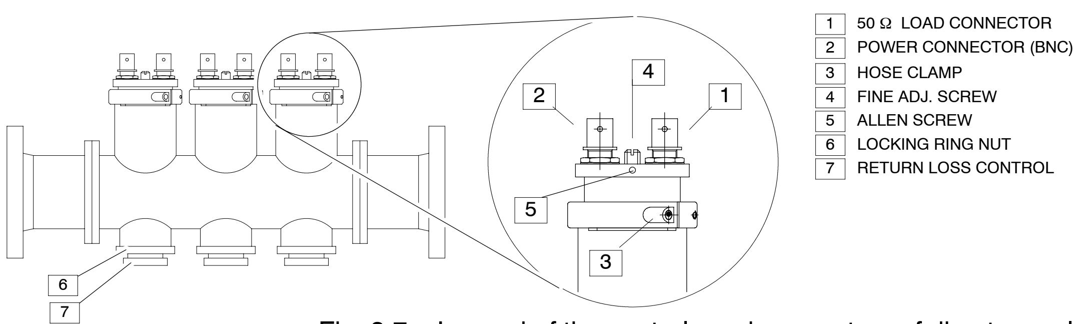


Fig. 3.7 – Legend of the controls and connectors of direct. coupler

❑ RETURN LOSS MEASUREMENT

1. The return loss level is factory set to be < –30dB in both band IV and V. Check it on the measuring instrument according to the test bench used. If its value is > –30dB, unscrew the ring nuts 6 (see figure Fig. 3.7) and turn slowly the return loss control screws 7 till to reach the correct level.
2. Repeat the previous steps for each directional coupler probe.

❑ ISOLATION AND DIRECTIVITY MEASUREMENT

1. Loosen the hose clamp 3 (see figure Fig. 3.7) enough to release the probe. Turn slowly it (corse adjustment), until the maximum directivity is reached (it has to be > |36|dB). If it is not possible to achieve a directivity greater than |36|dB, unscrew the locking Allen screw 5 and turn slowly the fine adjustment screw 4, until the maximum directivity is reached. After each adjustment screw again the relevant fastening screw.

❑ COUPLING COEFFICIENT MEASUREMENT

1. Check that the power level corresponds to the value indicated on the probe label. If the power level differs from this value, loosen the hose clamp 3 (see figure Fig. 3.7) and lift or lower the probe (without turning it) until the correct value is reached. After the adjustment screw again the relevant fastening screw.
2. Connect again the input cable of the measuring instrument to the probe connector (BNC) for the 50Ω load 1 and repeat step 1. for the directivity adjustment. Then connect again the input cable of the measuring instrument to the probe connector (BNC) to pick up the power samples 2 and the 50Ω load to the relevant connector 1 and repeat step 1. for the coupling coefficient adjustment.
3. Repeat step 2. until directivity and coupling coefficient have the correct values.
4. Repeat the above steps 1. and 2. and the directivity adjustment procedure, for each directional coupler probe.
5. Check again the return loss level by following the directional coupler return loss adjustment procedure mentioned above.

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CHAPTER 4: MAINTENANCE

LIST OF TABLES

CHAPTER 4: MAINTENANCE

4.1 INTRODUCTION

4.1.1 Introduction to Maintenance

The purpose of this section is to assist the maintenance personnel in keeping the equipment at best operational status. Maintenance can be subdivided into the following actions:

- PREVENTIVE MAINTENANCE
- CORRECTIVE MAINTENANCE

Preventive maintenance refers to maintenance procedures which have to be carried out periodically so as to prevent malfunctions. Corrective maintenance includes a series of tables representing a troubleshooting guide used to locate the most likely area where a malfunction has occurred or reference to the equipment manuals.

4.1.2 Maintenance tools

Maintenance tools include *Commercial*, *Standard* and *Special Tools* used for the 1st and 2nd levels of Maintenance. *Commercial Tools* include the tools normally used for the maintenance activities (screwdrivers, pliers,soldering irons, etc.) and are normally available on the local market. *Standards Tools* include those materials considered as standard for maintenance activities (coax cables of standard length, coax adapters, etc.) and are available on the local market and/or from the manufacturer of the Equipment. *Special Tools* include tools prepared by the manufacturer for maintenance requirements and are available only from the manufacturer of the Equipment for which they are designed.

4.1.3 Test Instruments

The Test Instruments required on-site in order to carry out the maintenance activities are listed in the technical manual pertinent to aech unit. Please note that all the listed Test Instruments are of commercial type and may be substituted by equivalents available on the local market.

4.2 PREVENTIVE MAINTENANCE

This chapter deals with the suggested preventive maintenance operations to guarantee continued performance of the equipment. The preventive maintenance operations are grouped in a table according to their periodicity. The following paragraphs describe those operations which cannot be considered procedures but which have to be carried out for the correct operation of the Equipment. These operations are also listed in the preventive maintenance table.

4.2.1 General Instruction

All Equipment parts shall be examined to check for dust or dirt, overheating, loose screws and foreign bodies. Dust, for example, may cause current discharges or leakages.

1 *Cabinets*
Cabinets, through which the ventilation air flows, need to be internally cleaned from dust. Cleaning can be carried out using a vacuum cleaner for the accessible parts or a clean, dry cloth or bristle brush.

2 *Air Filters*
Cabinet air filters shall be disassembled and cleaned to eliminate the dust accumulated during Equipment operation. The cleaning intervals depend on the number of Equipment operational hours and on the amount of dust present in the room where the Equipment operates. However, generally filters should be cleaned on monthly basis. If the dust layer is thin, it can be removed using a pressurized water spray; then dried by means of compressed air. If the dust layer is hard, dip the filter in hot water for approximately 20 minutes. Then clean the filter by means of a pressurized water spray, dry using compressed air; when perfectly dry, reassemble inside the cabinet.

3 *Printed Circuit Boards* (PCB)
PCBs shall not be removed unless dust is noted on their surface. In this case, the PCBs shall be removed one at a time. Use only moderately compressed air or a soft bristle brush to remove the dust. Clean the lance contacts of the connectors on the PCB using a bristle brush soaked in pure alcohol.

4 *Power Supply Modules and Converters*
Removal of the dust accumulated on the housing and components is normally sufficient to clean power supply modules. To clean the PCBs extract them from the Module, then carefully clean the connector pins using a bristle brush soaked in pure alcohol.

5 *Indicator Lamps*
Lamps must be well inserted in their socket. Remove any trace of corrosion, oxidation or dirt by the use of a cloth soacked in carbon tetrachloride.

6 *Fuses*
Fuse tips are subject to oxidation and must be periodically removed from their holders to check for any presence of oxidation. The oxidation or dust increases the resistance of the electrical circuit. Fuse tips shall be cleaned using a cloth soaked in carbon tetrachloride.

NOTE

FUSES SHALL BE REMOVED ONE AT A TIME IN ORDER TO AVOID INSERTING THEM INTO A WRONG HOLDER.

THE VALUE PRINTED ON THE FUSES SHALL CORRESPOND TO THAT PRINTED ON THEIR OWN HOLDERS.

7 *Connections Cables*
Connection cables shall be periodically examined to ensure that breaks in the external insulating coating are not present to cause possible short-circuits. Cover the parts showing deterioration of the insulating coating. Coaxial cables shall be carefully examined since they can be easily damaged by crushing or sharp bends. Connectors shall be checked to ascertain that corrosion is not present on their metallic contacts. Cables showing damages must be protected and eventually replaced.

8 *Terminal Boards*
Terminal boards shall be examined to ascertain that there are no traces of dirt, loose wires or excess solder on the terminals, which could cause undue contacts with the adjacent terminals. Fixing screws or mounting brackets shall be tightened. Terminal boards shall be cleaned using a dry cloth or bristle brush.

9 *Resistors*
Resistors shall be checked for evidence of cracks, discoloration or ”cooking”. Discoloration indicates that the resistor is subject to overload which could be caused by an incorrect operation of the circuit. Examine resistor leads for dust, dirt or loose connections.

10 *Transformers and Coils*
Examine transformers and coil leads for any trace of dust, dirt or humidity. Check that they are secured in their seats; tighten fixing screws and mounting brackets. Housings, terminals and insulators supporting transformers and coils should be free from foreign objects. Use a dry cloth or, if necessary, moisten the cloth with a suitable solvent. Should the wiring be corroded, tag each wire, disconnect and clean the contact surface using emery paper with a fine grain and then clean the surfaces using a clean cloth. Reconnect the wires.

11 *Mechanical Inspection*
According to the environmental conditions, periodically check and lubricate the following mechanical parts:
- hinges of front doors;
- hinges of rear doors.

4.2.2 Preventive maintenance Table

The preventive maintenance actions have been grouped according to periodicity; Tab. 4.1 gives the summary of periodical checks. The table is divided into four columns. The first column indicates the periodicity of the preventive maintenance. The second describes the function to be checked or the operation to be carried out. The third column contains applicable notes and/or references. The fourth column shows the time needed to carry out the maintenance procedure to allow planning of preventive maintenance for the whole Equipment.

Tab. 4.1 - Summary of periodic checks

REF.	PERIODICITY	TYPE OF SERVICING	REFERENCE FOR THE EXECUTION	ESTIMATED EXECUTION TIME
1	Two-Monthly	Checking of the mains terminal blocks tightening	Chapt. 2; para. 2.2.6, of this OPERATOR'S MANUAL	5 min.
2	Six-Monthly	Cleaning of the air filters	Chapt. 4; para. 4.2.1 step 2, of this OPERATOR'S MANUAL	20 min.
3	Six-Monthly	Checking of the voltage power supply of amplifier modules.	On W3-210A RF Amplifiers. See relevant TECH. MAN (Chapt. 2; para. 2.6).	5 min.
4	Six-Monthly	Checking of the current absorption of amplifier modules.	On W3-210A RF Amplifiers. See relevant TECH. MAN (Chapt. 2; para. 2.6).	5 min.

4.3 CORRECTIVE MAINTENANCE

Causes which give rise to a corrective maintenance action can derive from:

- Out of tolerance conditions of standard levels, waveforms and timings, detected during preventive maintenance;
- Failure conditions shown either by indicator lamps, displays, LEDs located on PCB (if any), TTY (teletypewriter) diagnostic print outs.
- Failure conditions detected by operative personnel.

Restoring the equipment to operation in a short time depends on the correct execution of suitable procedures and on the availability of spare parts and components. For further details on maintenance procedures of the units, refer to the pertinent technical manual of the unit involved.

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FRONT PANELS LEGEND
OF THE TRANSMITTER UNITS

LIST OF ILLUSTARTIONS AND TABLES

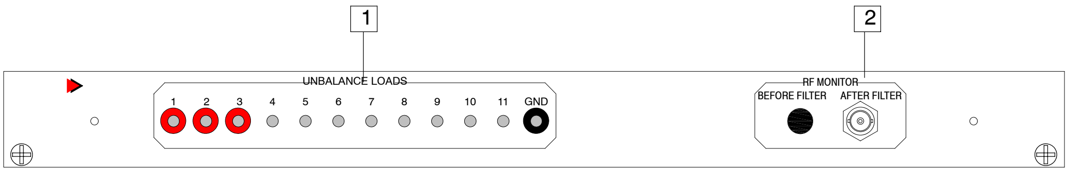


Figure 1. – Unbalance Loads front panel

Tab. 1 – Unbalance Loads front panel legend (ref. 1.)		
No.	LABEL	FUNCTION
1	UNBALANCE LOADS	Test points; allow the measurement of the unbalance RF power dissipated on the dummy load of the output combiner (mesure ratio 100W/1V).
2	RF MONITOR AFTER FILTER	Monitor connector (BNC female); allows monitoring the RF output power of the transmitter.

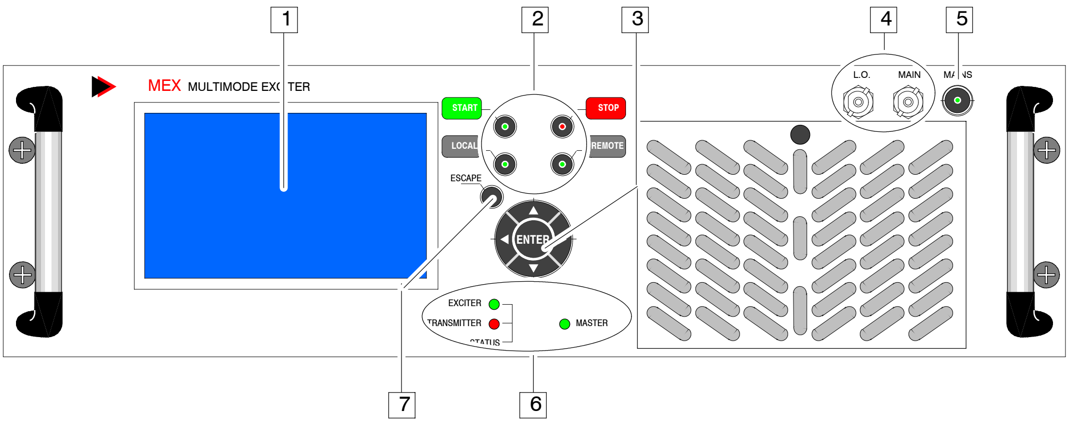
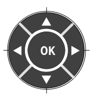


Figure 2. - MEX Multimode Exciter front panel

Tab. 2 - MEX Multimode Exciter front panel legend (ref. 2.)		
No.	LABEL	FUNCTION
1		LCD display of the unit; displays information and data relevant to the functioning of MEX.
2	START	Push-button; it is active only if *local* functioning mode has been set. Under this condition, it operates as follows: • *if MEX operates only as exciter* starts the unit; • *if MEX operates as TX CTRL LOGIC* starts TX. When it has been pushed, the associated green led, lights up.
	STOP	Push-button; it is active only if *local* functioning mode has been set. Under this condition, it operates as follows: • *if MEX operates only as exciter* switches-off the unit; • *if MEX operates as TX CTRL LOGIC* switches-off TX. When it has been pushed, the associated red led, lights up.
	LOCAL	Push-button which allows *local* control of the equipment. When this mode is selected, "START" and "STOP" push-buttons and the keyboard are enabled. When it has been pushed, the associated yellow led, lights up.
	REMOTE	Push-button which allows *remote* control of the equipment. When this mode is selected, "START" and "STOP" push-buttons and the keyboard are disabled. When it has been pushed, the associated green led, lights up.
3		Controller keyboard. It allows accessing the menu (listed on right-hand side of the display) and setting the functioning parameters of MEX. Accessing the menu and setting of the parameter is as follows: - "▲" and "▼" arrows select the menu; once accessed the menu, select the parameter to be changed; change the values of the parameters inside a menu. - "◀" and "▶" arrows allow scrolling the pages of each menu. - "*ENTER*" key is used to enter the selected menu and to confirm the setting carried out.
4	L.O.	Monitor connector (BNC female); it allows monitoring the local oscillator output signal.
	MAIN	Monitor connector (BNC female); it allows monitoring the RF output signal of the unit when it is working as DVB-T exciter or TV exciter in combined amplification.
5	MAINS	Push-button; it is the power switch of the unit. The associated green led is lit when the unit is switched-on.

Tab. 2 - MEX Multimode Exciter front panel legend (ref. 2.)		
No.	LABEL	FUNCTION
6	EXCITER	Led indicator (green/red/yellow); indicates MEX status according to the colours, as follows: *GREEN* indicates MEX is delivering its nominal RF output power; *RED* indicates a failure condition of MEX (no RF ouput power); *YELLOW* indicates a *warning* condition of MEX (MEX is still working); *OFF* when MEX is in *STOP* condition (*EXCITER RF OFF*).
	TRANSMITTER	Led indicator (green/red/yellow); it is active only when MEX operates also as control logic of the transmitter where it is housed (*MASTER* led is lit). According to the colour, it shows the transmitter status, as follows: *GREEN* indicates the transmitter is delivering its nominal RF output power; *RED* indicates a failure condition of the transmitter (no RF ouput power); *YELLOW* indicates a *warning* condition of the transmitter (transmitter is still working); *OFF* when the transmitter is in *STOP* condition or when MEX does not operate as transmitter control logic (*MASTER* led is *'off'*).
	MASTER	Led indicator (green); indicates MEX is operating also as control logic of the transmitter where it is housed. ☞ *The led blinks during the warm-up period (approx. 30sec.; at MEX swicthing-on); within this time interval all alarms are inhibited.*
7	ESCAPE	Push-button; it allows to quit from the current menu.

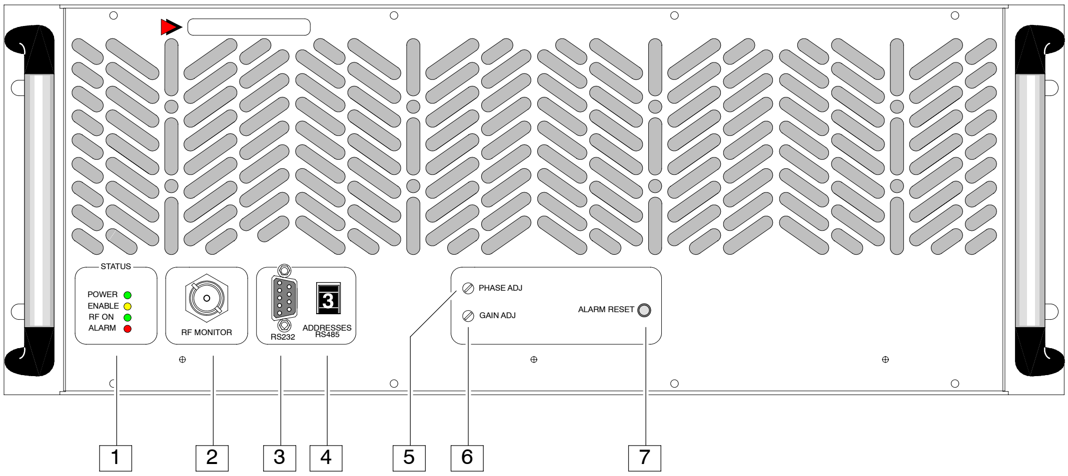


Figure 3. – W3–210A Amplifier front panel

Tab. 3 - W3-210A Amplifier front panel (ref. fig. 3.)		
NO.	**LABEL**	**FUNCTION**
1	STATUS	Set of four LED indicators: – POWER LED indicator (green); it indicates the presence of the external power supply voltage; – ENABLE LED indicator (yellow); it indicates the presence of the*enable* command from equipment *control logic unit*; – RF ON LED indicator (green); it indicates the RF output power is at its nominal value. – ALARM LED indicator (red); it indicates whatever alarm condition.
2	RF MONITOR	Connector (BNC, female); it allows monitoring the RF output signal of the amplifier (8dBm to 12dBm).
3	RS232	Connector (”D” 9–pins female); RS232 serial line. It allows moni-toring directly the amplifier status.
4		Digit switch; allows the module addresing for transmitter *Control Unit*.
5	PHASE ADJ	Trimmer; allows adjusting in/out phase (range from –35° to +35°).
6	GAIN ADJ	Trimmer; allows adjusting power gain (range from –2dB to +2dB).
7	ALARM RESET	Push–button; allows resetting the stored alarms (9 Alarms cycle) in order to re–start the amplifier.

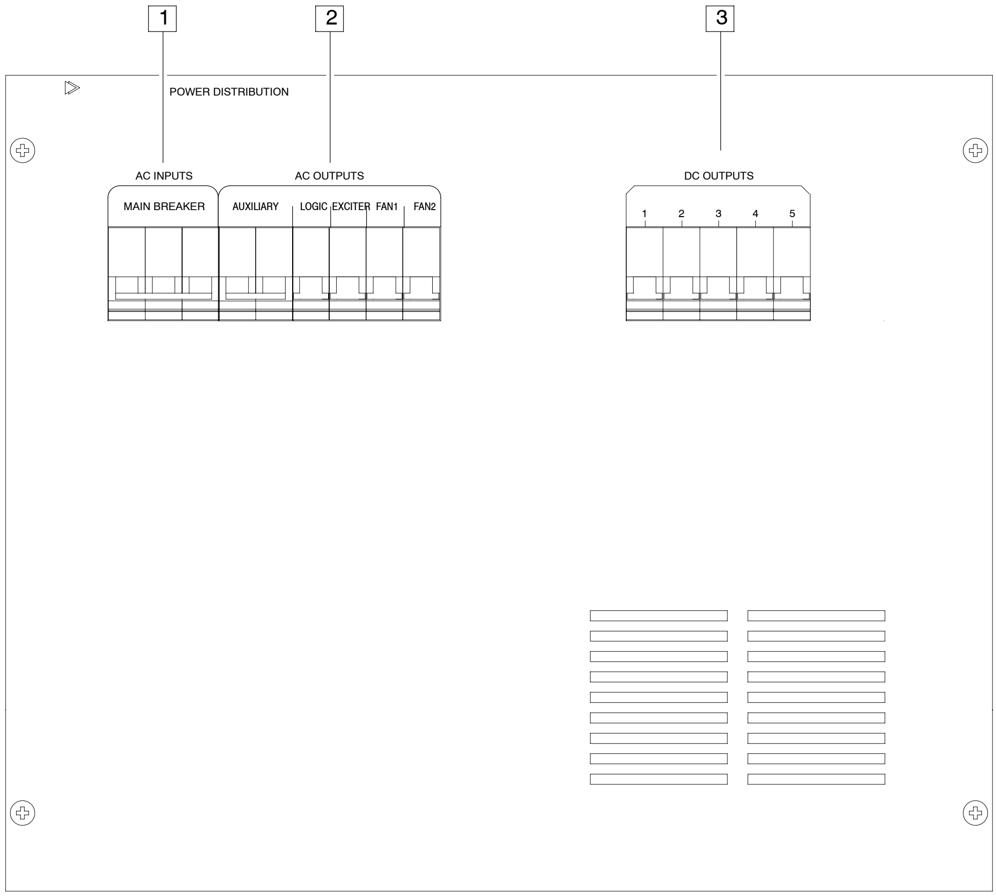


Figure 4. – Power Distribution front panel

Tab. 4 – Power Distribution front panel (ref. fig. 4.)

NO.	LABEL	FUNCTION
1	AC INPUTS	General breaker of the unit; it connects tarnsmitter cabinet to the mains suppy voltage.
2	AC OUTPUTS	Set of five breakers; they route the mains supply voltage to the relevant units.
3	DC OUTPUTS	Set of five breakers; they route the DC supply voltage to the amplifiers modules.