

Technical Manual

(INSTALLATION & USE)

2 kW UHF TV RF AMPLIFIER ETL0550TAD



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Technical Manual

2 kW UHF B IV-V RF POWER AMPLIFIER ETL0550TAD

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Section A-GENERAL INFORMATION

I - AMENDMENT RECORD SHEET

When an amendment to this publication is incorporated, the record below is to be completed and initialed.

	Release	Language	DESCRIPTION	AUTHORITY	DATE

II - APPROVAL RECORD SHEET

When an approval to this publication is incorporated, the record below is to be completed.

	Release		Signature	AUTHORITY	DATE

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III - WARNINGS

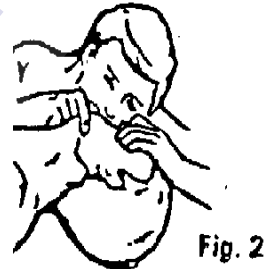
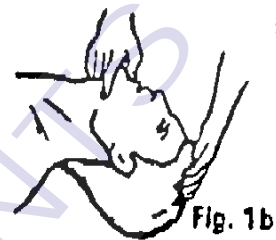
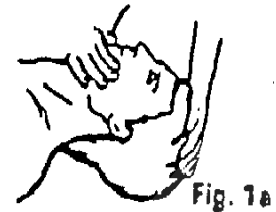
- Observe safety precautions when handling this unit. This equipment operates with dangerous voltages and currents.
- Always disconnect power before opening covers or removing any part or module of this unit.
- Prior to checking out or working on the switch mode supply, disconnect all the R.F. power amplifiers. Some of the R.F. power amplifier transistors are encased in Beryllium Oxide (BeO). This substance is harmless as is, but becomes very dangerous if ground to a powder. These devices, once failed, cannot be disposed of by normal means and special procedures of disposal must be observed.
- In any case, but especially when the RF Power Amplifier is operating, **do not attempt to remove and then re-insert the front panel coaxial interconnecting cables of the EXCITER.** Although suitable protection circuitry is in place, sudden loss and re-application of RF drive causes transients that may damage one or more RF amplification stages.
- In any case, but especially when the RF Power Amplifier is operating, **do not change position of the switch A.G.C. – m.g.c in the EXCITER.** Although suitable protection circuitry is in place, very high and sudden variations of RF drive cause transients that may damage one or more RF amplification stages.

1) FIRST AID IN CASE OF ELECTRIC SHOCK

DO NOT TOUCH THE VICTIM WITH YOUR BARE HANDS until the circuit is broken. SWITCH OFF. If this is not possible, PROTECT YOURSELF with DRY insulating material and pull the victim clear of the conductor. If breathing has stopped, indicated by unconsciousness, lack of respiratory movements and a 'blue' look to cheeks, lips, ears and nails, START RESUSCITATION AT ONCE.

2) EMERGENCY RESUSCITATION: EXPIRED AIR METHOD

- If possible, lie the victim on his back, with his head slightly higher than his feet. Clear the mouth and the throat of any obvious obstruction.
- Kneel on one side of the victim, level with his head. LIFT THE JAW AND TILT THE HEAD BACK AS FAR AS POSSIBLE. (Figures 1a and 1b).
- One of the following may now happen:
 - ⇒ Breathing may begin and consciousness return.
 - ⇒ Breathing may begin, but consciousness may NOT return. Turn the victim on his side and ensure that the airway is kept clear.
 - ⇒ Breathing may return, but be NOISY, which means that the airway is not fully clear. Try to clear the airway.
- IF THERE IS NO SIGN OF BREATHING
 - ⇒ Check that the head is still tilted back.
 - ⇒ Take a deep breath.
 - ⇒ Pinch the victim's nose and blow firmly into his mouth. As you do, his chest will RISE (figure 2).
 - ⇒ Turn your head away and take another breath, watching for the chest to FALL (figure 3).
- Start with four quick deep breaths and then continue with one breath every five seconds (i.e. 12 times a minute). This should be continued until the victim revives or a doctor certifies death.
- As consciousness returns, the victim will start to breathe on his own and a 'pink' color replaces the 'blue' look. This is the time to stop resuscitation. Continue to hold his chin up and so keep the airway clear.
- In the case of injuries to the mouth, it may be necessary to use mouth-to-nose resuscitation. Seal the victim's mouth with your cheek and blow firmly into his nose, proceeding as above.
- In any case it is ESSENTIAL to commence resuscitation WITHOUT DELAY and to send for medical assistance immediately.



3) TREATMENT FOR BURNS

If the victim is also suffering from burns, then, without hindrance to resuscitation, observe the following:

- **Do not attempt to remove clothing adhering to the burns.**
- If possible, alleviate the pain from the burn part by immersing in cold water.
- If help is available or as soon as resuscitation is no longer required, the wound should be covered with a DRY clean dressing.
- If help is available or as soon as resuscitation is no longer required, the wound should be covered with a DRY clean dressing.

Section B-PURPOSE AND PLANNING INFORMATION

I - INTRODUCTION

- The ETL0470 TV RF Amplifier provides linear, class "AB" amplification of composite Vision+Sound TV signals in the standard UHF bands IV & V (470 to 860 MHz). Rated RF output power is set to 500 W. Nominal input power is 2 W.
- This Amplifier has been expressly designed to be used with others 500 W Amplifiers. The four Amplifiers produce an output power of 2 kW, with a nominal input power of 8 W. This configuration of four ETL0470 RF Amplifiers is designated model ETL0550TAD, which comprises four RF Amplifiers, six 3 dB hybrids and a band-pass output filter with a power rating of 2 kW. All these components are housed in a standard 19" metal cabinet, which provides additional space for the Exciter and for ancillary equipment.
- A transmitter or a Transposer capable of a full 2 kW output can be built using an Exciter of the ETL0310 (TV Transmitter) family or of the ETL0290 (TV Transposer) family.
- A complete selection of options, together with ordering information, is given at the end of this Section B.

II - SCOPE

- The scope of this manual is to provide information on the use, operation and maintenance of:
- The 2 kW ETL0550TAD UHF TV RF Amplifier.

III - COMPOSITION OF RF AMPLIFIER ETL0550TAD, 2 kW UHF

- RF Amplifier ETL0550TAD comprises four ETL0470 RF Amplifiers, one input power divider, one output RF power summer, 50 Ohm balancing loads for the hybrids and one band-pass filter for the attenuation of harmonic and spurious products. All these parts are assembled into a standard 19" cabinet 2100 mm high (40 Units)¹, which also carries three large diameter fans for the extraction of hot air. The list of standard parts is as follows.

PARTS SUPPLIED IN THE STANDARD CONFIGURATION	QTY	MODEL
500 W RF Amplifiers	4	ETL0470
Input power divider gain and phase equalizer	1	ETL2142TA
Output power summer	3	ETL2153TA
50 Ohm high power balancing load	1	MODM300
Output directional coupler	1	ETL2154TA
Interconnection cables & accessories kit	1	CAV135
Output band pass filter	1	ETL2150TA
Air extraction fan	3	VEM4E315
Standard 40 unit rack cabinet	1	MECC000353/EURO

¹ This height is for the standard product. Other dimensions can be supplied on request.

IV - COMPOSITION OF RF AMPLIFIER ETL0470, 500 W UHF

- The ETL0470 TV R.F. Amplifier consists of one class "AB" driver stage, that feeds four class "AB" final RF amplifiers combined. Other parts of this Amplifier are: three identical switch mode power supply modules, a microprocessor controlled metering, alarm and protection module, a directional coupler and an output filter. All these parts are assembled into a standard 4 unit 19 inch rack chassis, including two forced air ventilation fans.
- The four R.F. amplifiers of the output stage are coupled together by means of three suspended substrate hybrid couplers.
- The R.F. amplifier modules are mounted on a massive heat sink in the upper part of the cabinet and the 3 switch mode power supplies are mounted at the bottom of the cabinet.
- The modules are:

PARTS SUPPLIED IN THE STANDARD CONFIGURATION	QTY	MODEL
Class "AB" UHF RF buffer Amplifier module	1	MOE140-C800
Class "AB" UHF RF Amplifier module (4 final Amplifiers)	4	MOE158-B
Switch Mode Power Supply Unit	3	MOE104ABD
Metering, alarm and protection module	1	MOE183

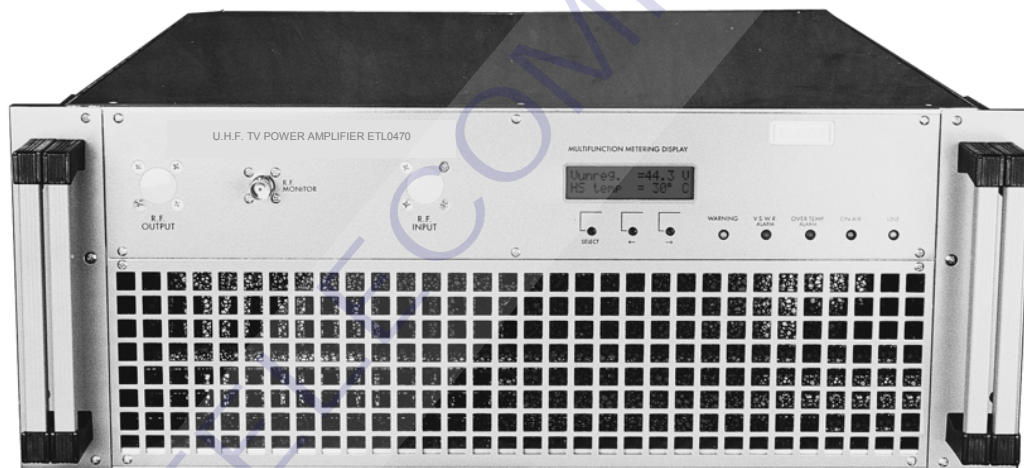


Figure 1: UHF TV 500 W RF Power Amplifier ETL0470

V - TECHNICAL SPECIFICATIONS

1) General

Primary power	380 V Tri-phase. +10% -15% 50 Hz, Consumption: 6000 W @ 50% A.P.L. at 2 kW vision carrier power.
Cooling	Forced air.
Operating temperature range	-5°C to +45°C.
Storage temperature range	-10 to +70°C.
Nominal UHF output power	2kW

2) Input Parameters

Input R.F. nominal level	4 W.
Input impedance	50 Ω , unbalanced.
Input return loss	> 18 dB.

3) Output Parameters

Output frequency range	BANDS IV-V: 470-860 MHz.
Power gain	> 25dB.
Gain flatness	< 1.5 dB.
Output impedance	50 Ω , unbalanced.
Permissible VSWR	< 1.5.
Standard Output power	500 W (1 kW).
Spurious suppression	> 60 dB.
Harmonic suppression	> 60 dB.
Rejection of out of band IMD products	> 60 dB.
I.M.D. Products Suppression (with driver series ETL0310 or ETL0290)	> 60 dB (-8, -10, -16 dB) @ rated output power, with pre-correction inserted, system B/G. > 60 dB (-6, -10, -17) @ rated output power, with pre-correction inserted, system I. > 60 dB (-6, -13, -17, -20) @ rated output power, with pre-correction inserted, system I with Nicam.

4) Transmission Quality

(with driver series ETL0310)

Vision weighted S/N ratio (CCIR 567)	> 60 dB.
Amplitude Frequency response	$\pm .5$ dB within the Vision band.
Group Delay deviations	± 30 ns within the Vision band.
2T K factor	< 1.5%.
Luminance non linearity	< 3%.
Differential Gain error	< 3%.
Differential Phase error	< 3°.
Sync pulse compression	< 3%.
Audio frequency S/N ratio	> 64 dB @ 50 KHz deviation.

5) Dimensions and Weight

Dimensions	Standard 19" frame, 40 unit. H=2100mm, P=800mm, L=565mm
Weight	350 kg.

VI - FUNCTIONAL DESCRIPTION

1) Theory of operation of 2 kW UHF RF Amplifier ETL0550TAD

- With reference to the general Blocks diagram, Figure 2, the output signal from the Exciter, at a nominal level of 4 W, reaches the Input low power divider, which splits the drive into 4 components of 1 W each. This system incorporates a step attenuator and a step phase shifter to adjust the slight differences of gain and phase of the four RF Amplifiers. The resultant signals drive the four ETL0470 RF Amplifiers to a nominal output of 500 W each. The Output power summer connected to the outputs of the four RF Amplifiers sums the output signals to a nominal level of 2 kW.

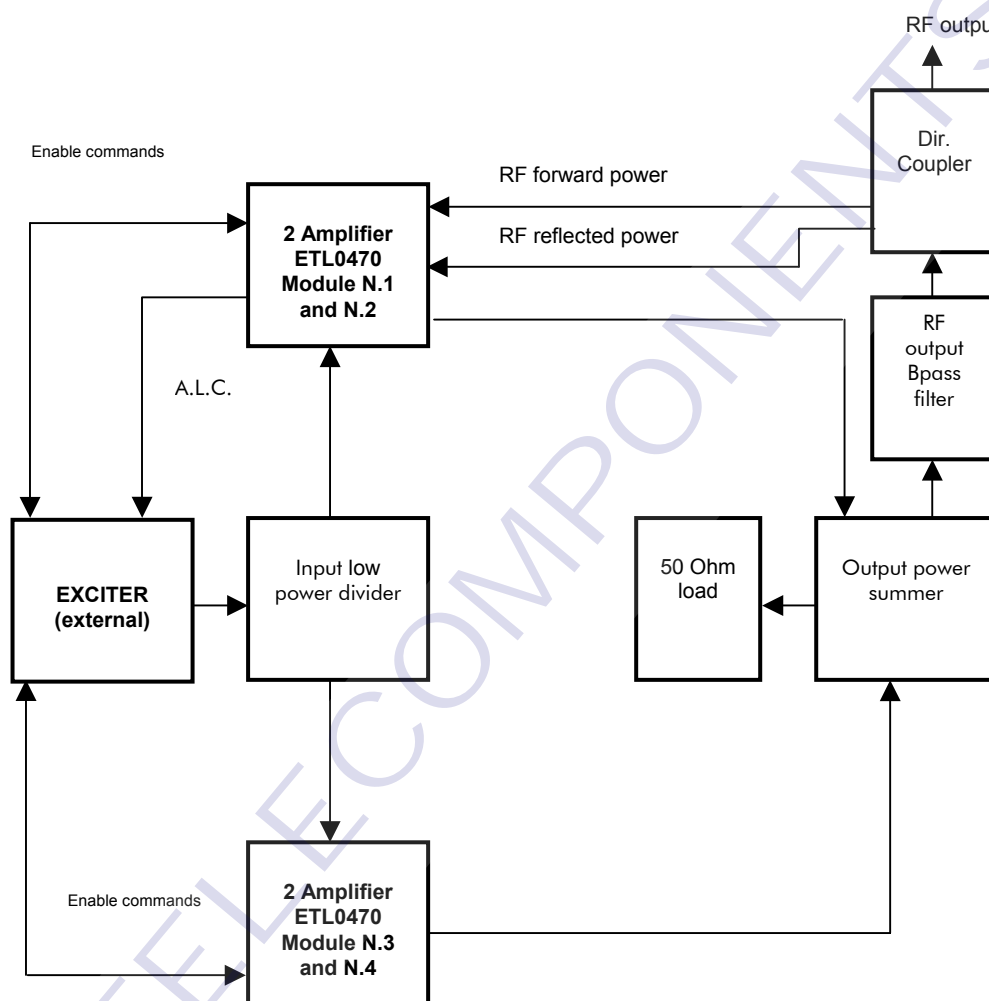


Figure 2: ETL0550TAD TV RF Amplifier blocks diagram

- At the output of the output band pass filter a directional coupler collects samples of forward & reflected output power, which are sent to the 4 ETL0470 RF Amplifiers. Here they are processed by their internal metering, alarm and protection modules.
- Even though the 4 tandem connected RF Amplifiers are perfectly symmetrical, by convention the RF Amplifier installed in the upper position in the cabinet is called **MAIN AMPLIFIER** (or Amplifier N°1) while the one in the lower position is called the Amplifier N.4.

- The Amplifier N.1 shows, on its multi-function display, in addition to all parameters previously mentioned, the **final (summed) RF forward power output** after the pass-band filter. The Amplifier N.2 shows the **final (summed) RF reflected power output** after the pass-band filter.
- With reference to the blocks diagram, the Enable and A.L.C. connections are made, and the system works, as previously described for the single ended ETL0470 RF Amplifier, with the following differences.
 - ⇒ During the turn-on phase, the Enable commands go from the **Exciter to both amplifier are connected through a serial bus**, which is called serial **E-LINK**. The serial E-LINK has also additional functions, as described below.
 - ⇒ The Exciter is driven by the A.L.C. voltage generated by the Main Amplifier only. Therefore the Exciter closes the loop by producing enough power to drive the Main Amplifier to the power pre-set by the operator (600 W nominal, in case of 1 kW output). The Slave Amplifier, which has a closely equalised gain, will "follow" the same drive, to produce an identical output power. This mode of operation is very simple and is made possible by the close gain & phase balance between the two Amplifiers, which is an essential design feature of these products. Any slight residual imbalance (gain and/or phase) can be compensated by adjustments in the drive hybrid.
 - ⇒ If any protection threshold is reached in only one RF Amplifier the second Amplifier will continue its work, but in case of excessive RF reflected output power both amplifiers are switched off. This function is obtained through the serial E-LINK interconnection.

2) Theory of operation of 500 W UHF RF Amplifier ETL0470

- The ETL0470 UHF TV RF Amplifier blocks diagram is shown in figure 3.
- The nominal RF input of 1 W, coming from the external Exciter, is amplified by the driver module MOE140C800, to a nominal level of 40 W.
A directional coupler monitors forward input power to the final stage. D.C. samples of these quantities are sent to the metering, alarm and protection module.
A four way hybrid divider splits the drive power into four components, that feed four modules MOE158B, each rated at 200 W (nominal) output. RF output from each module is summed by a four way hybrid combiner.
The output directional coupler, which is equipped with built-in high sensitivity detectors for forward and reflected RF power, outputs D.C. samples to the Metering and Protection module.
- The metering, alarm and protection module monitors: the peak and average RF output power, the peak reflected power and the temperature of the heat sinks. When any one of the pre-set values is exceeded, the module enters into a warning or into an alarm condition and reduces or disables the output of the power supplies. When in a disabled alarm condition, the amplifier is automatically recycled to continuously check the operating status. Once the warning or the alarm condition is removed, the metering, alarm and protection module returns the power supplies to the normal operating status.
- The metering outputs of the metering, alarm and protection module feed an alphanumeric display, located on the front panel. This display provides all the significant electrical parameters: RF power, temperature, supply voltages and currents and other important information.
- The D.C. supply is distributed in such a way that, if one of the power supplies fails, the driver Amplifier and 3 of the output stages are still supplied. In this condition, the surviving supplies will sustain an output current increase of several Amperes and the amplifier output will drop to approximately 25% rated power, but service will not be disrupted.
- Should a transistor of one of the RF output stages fail in short circuit, one supply will be shorted out (the supply will not fail in this condition) and the amplifier output, while dropping, will still be at an useful level of approximately 25% rated power.

- Should a transistor of the RF driver stage fail in short circuit, one of the fuses in the driver module will open, and the amplifier output will drop to approximately 50% rated power.
- The yellow LINE LED, when lit, shows presence of A.C. power mains.
- The green ON AIR LED is on when the Amplifier is operating under normal conditions. When the RF power output drops below approximately half power (- 3 dB threshold), this LED is extinguished. This led blinks if the amplifier is enable and ready.
- The red ALARM LED is normally dark. It turns on to indicate that one alarm has occurred. In this condition the Metering, alarm and Protection module immediately disables the amplifier.
- The red V.S.W.R. ALARM LED is normally dark. It turns on to indicate that the reflected output power has risen above a pre-set, critical threshold. In this condition the Metering and Protection module immediately disables the amplifier.
- The yellow WARNING LED is normally dark. It turns on to indicate that one or more operating parameters have risen above the normal limiting values. This LED blinks if some past warnings and alarms are stored in the EEPROM non volatile memory of the microprocessor. This LED turns off only if the memory has been cleared.

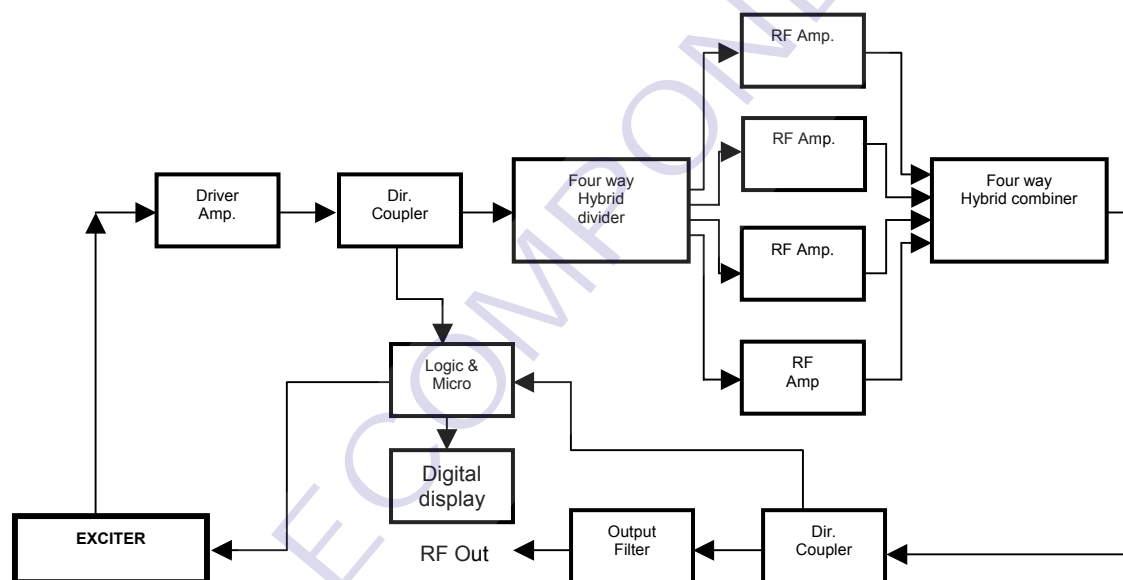


Figure 3: ETL0470 RF Amplifier blocks diagram

A.L.C.

VII - RF AMPLIFIER CONFIGURATIONS & ORDERING INFORMATION

The model numbers of all EuroTel RF Amplifiers are based on a 15-position code as follows:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
E	T	L	0	5	5	0	T	A	See text	See text	See text	See text	Spare	Spare

- Positions **1** to **3** are fixed and never change.
- Positions **4** to **7** specify power output and operating class of RF Power Amplifier.
- Positions **8**, **9** and **10** specify RF band of operation. **TA** is for UHF, Bands IV & V. **TAV** is for VHF, Band III. In UHF, position 10 is not used.
- When the Amplifier is part of a complete Transmitter or Transposer, position 10 in UHF, or 11 in VHF are used for a separation mark : " - ", followed, in positions **11 & 12**, or **12 & 13** by **TX** or **TP**.
- Positions **14** and **15** are spare.

EXAMPLES:

Description	Code
Single UHF RF Amplifier, 500 W, class "AB"	ETL0470TA
Single VHF, Band III RF Amplifier, 800 W, class "AB"	ETL0470TAV
Complete TV Transposer, Input UHF, output 2 k W UHF (ETL0290TCS+ETL0550TAD)	ETL0550TAD-TP
Complete TV Transposer, Input VHF, output 500 W UHF (ETL0290TFS+ETL0470TA)	ETL0470TA-TP
Complete TV Transmitter, output 2 kW UHF (ETL0310TCS+ETL0550TAD)	ETL0550TAD-TX

Section C-OPERATING INFORMATION

I - INSTALLATION

1) ETL0550TAD R. F. Amplifier: mounting procedure

- Due to the weight of the components, the 2 kW UHF Amplifier ETL0550TAD is normally shipped in 6 packages, as follows.
 - ⇒ QTY 1 wooden crate, or heavy cardboard container, housing the metal cabinet, which is fully wired and with all ancillaries, such as 3 dB hybrids, loads, filter, etc. already mounted. This package has the following approximate dimensions and weight: 2200 x 690 x 940 mm. and 240 kg.
 - ⇒ QTY 4 heavy cardboard boxes, housing the ETL0470 RF Amplifiers. Each box has a weight of approximately 32 kg and dimensions: 680 x 620 x 320 mm.
 - ⇒ QTY 1 heavy cardboard boxes, housing the Exciter, with the following approximate dimensions and weight: 610 x 570 x 230 mm. and 25 kg.
- Identify, by means of marking stickers on the RF Amplifiers, the **Main Amplifier** (marked N°1) and the **Amplifiers** marked N°2, N 3 and N 4. For the meaning of these denominations, please see this manual, Section B, "Functional description". Install N°1 in the **upper space** in the cabinet and N°4 in the **lower space**. These spaces are also marked with corresponding stickers pasted on the inside wall of the cabinet.
- Install the Exciter, in the space near the bottom of the cabinet.
- Connect all cables supplied and already wired in the cabinet. In order to simplify this operation, every cable has stickers at each end. As an additional help, here below is a complete list of all connections.
 - ⇒ QTY 1 "N" to "N" coaxial cable from Exciter, RF OUTPUT socket to low Input power divider gain and phase equalizer.
 - ⇒ QTY 4 "N" to "N" coaxial cables from low Input power divider gain and phase equalizer to ETL0470 RF Amplifiers, RF DRIVE IN sockets.
 - ⇒ QTY 4 coaxial cables with 7-16 to 7-16 connectors from ETL0470 RF Amplifiers, RF OUTPUT sockets, to 3 dB high power hybrid.
 - ⇒ QTY 2 "N" to "N" coaxial cable, and QTY 1 "7-16"- "N" coaxial cable from balancing output of high power 3 dB hybrid, to 50 Ω high power load.
 - ⇒ QTY 1 BNC to BNC coaxial cable from socket P203 on the rear panel of the Exciter to the A.L.C. OUT socket of the N°1 RF Amplifier ETL0470
 - ⇒ QTY 1 "ENABLE" five way cable from the "ENABLE" socket at the back of the Exciter and the "ENABLE IN/OUT" of **all** Amplifiers ETL0470.
 - ⇒ QTY 2 interconnection cable between the E-LINK sockets of the two RF Amplifiers ETL0470 (Amplifiers 1-2 and amplifiers 3-4).
 - ⇒ QTY 1 coaxial cable (SMA on directional coupler and BNC on Amplifier side) between FORWARD RF OUT of the directional coupler and the FINAL FWD/REFL.INPUT socket of RF Amplifier N°1.

- ⇒ QTY 1 coaxial cable (SMA on directional coupler and BNC on Amplifier side) between REFLECTED RF OUT of the directional coupler and the FINAL FWD/REFL.INPUT socket of RF Amplifier N°2.
- ⇒ Qty 1 coaxial cable with BNC-BNC connectors and Qty. 1 BNC "T" adapter between the FINAL FWD/REFL. INPUT of Amplifier N°2 and FINAL FWD/REFL. INPUT of amplifier N 4.
- ⇒ A.C. mains cables to the various units coming from the Mains Distribution Module installed on the bottom of the cabinet.
- ⇒ The Prime Power line connection is preset for a three phase 380V nominal prime power line.

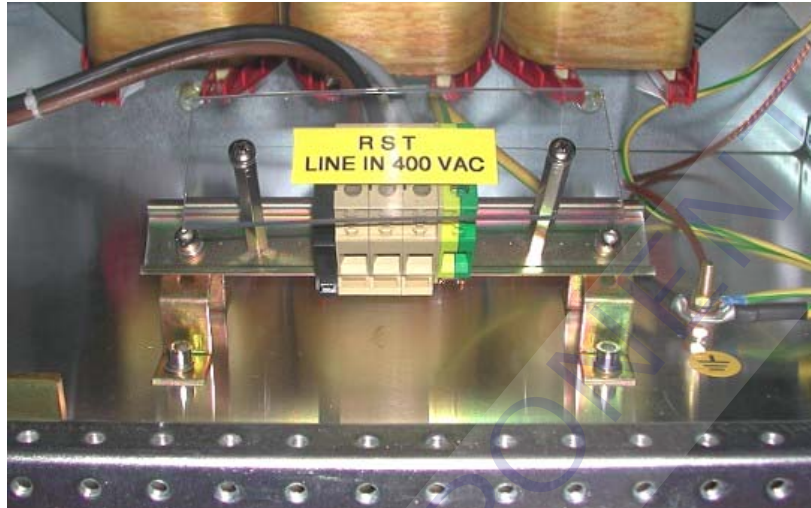


Figure 4 A.C. Mains distribution module – rear panel

- Prime power line connection:
Connect the ground rod terminal to ground and the R,S and T terminal to the three phases.
- Check that the two coaxial cables coming from the sockets mounted on the front auxiliary panel and marked FORWARD RF MONITOR and REFLECTED RF MONITOR are connected (SMA connectors) to the output directional coupler.
- Again check that the antenna coaxial cable is connected to the output socket of the directional coupler by means of a 7-16 connector.
- The ETL550TAD RF Amplifier is cooled by forced air stream entering from each front panel opening of the RF ETL0470 amplifier. The air is sucked in by the two blower installed in the rear of the rack cabinet. The hot exhaust air is again sucked by another blower installed on the top of the rack cabinet.
- If it is not possible to discharge the hot air into the Transmitters' bay, the air can be ducted externally by means of flexible, lightweight tubing, with a diameter of 350 mm. The maximum allowable ducting length is 5 meters. With longer runs, a suitable depression must be created by means of an external fan.

2) Other connections

- Both the ETL0470 make available external alarm connections by means of hard wired and insulated relay contacts. Additionally, all significant operating parameters are provided on a standard RS-232 and RS-485 interface.
- To wire the relay contacts to external circuits, see sub-chapter 10 following and use the ALARMS OUT socket. Note that contacts are rated 48 V D.C. @ 0.1A maximum.

3) ETL0470: front panel controls, displays & connectors

The front panel of the ETL0470 TV RF AMPLIFIER is shown in figure 5.

FRONT PANEL	ITEM	DESCRIPTION
SIGNALS & CONNECTIONS	RF INPUT	RF Input, type N socket. A plug replaces this socket when the rear input is used.
	RF OUTPUT	RF output, type 7-16 socket. A plug replaces this socket when the rear output is used.
	RF MONITOR	BNC socket. Provides a monitoring sample of the RF output.
	SERIAL PORT RS232	Type "D", 9-pin socket. Makes RF Amplifier parameter data available for display on an external PC or monitoring system. (RS-232 format)
SWITCHES	I/O	Mains switch. Turns the AC mains on (I) or off (O).
PUSHBUTTONS	SELECT	Controls the menu levels and is menu driven, as explained in detail in the "MENU DESCRIPTION" following.
	~	Normally controls the lower row of the display and is menu driven.
	~	Normally controls the upper row of the display and is menu driven.
	PREV.	Controls the menu levels and is menu driven, as explained in detail in the "MENU DESCRIPTION" following.
DISPLAYS and LED's	MULTIFUNCTION METERING DISPLAY	Two row, 16-character alphanumeric display. Shows levels of: RF output power, supply voltage, supply current and heats-sink temperature. It also shows warning conditions, alarm conditions and other information.
	LINE LED (YELLOW)	Shows presence of mains voltage.
	ON AIR LED (GREEN)	Indicates that the RF Amplifier is operating normally and RF output is within limits specified.
	ALARM LED (RED)	When lit, this LED indicates that one alarm has occurred. In this condition the Metering, alarm and Protection module immediately disables the amplifier.
	V.S.W.R. ALARM LED (RED)	As soon as it turns on, the power supply is disabled. This indicator shows that the reflected RF power alarm has been triggered.
	WARNING LED (YELLOW)	Indicates one or more warning conditions in act, if blinking indicates alarm or warning stored in the EEPROM non-volatile memory.

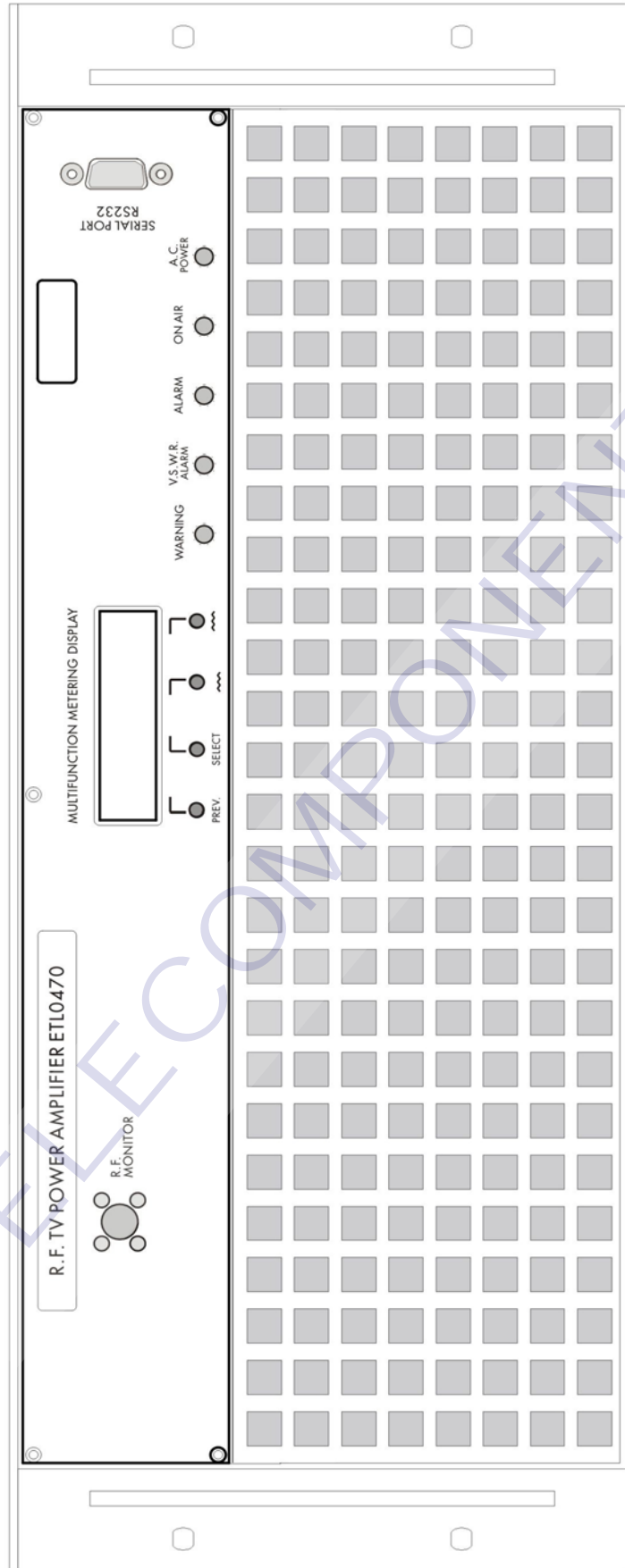


Figure 5: Front panel of ETL0470 TV RF Amplifier

4) ETL0470: rear panel connectors

The connectors on the rear panel are as follows:

REAR PANEL	ITEM	DESCRIPTION
SIGNALS AND EXTERNAL CONNECTIONS	RF INPUT	RF input, type N socket. A plug replaces this socket when the front panel input is used.
	RF OUTPUT	RF output, type 7-16 socket. A plug replaces this socket when the front panel output is used.
	ENABLE IN/OUT	DIN type socket. Receives the ENABLE voltage from the Exciter and sends a READY signal to the Exciter.
	ALARMS OUT	Type "D", 25-pin socket. Provides contacts from the "Low RF output power" alarm relay and the "Reflected RF power alarm" relay.
	E-LINK SERIAL NETWORK	Type "D", 9-pin socket, to be connected to the second amplifier working in tandem configuration
	SERIAL DATA RS-485	Type "D", 9-pin socket. Makes RF Amplifier parameter data available for display on an external PC or monitoring system. (RS-485 format)
	SERIAL DATA COM	Type "D", 9-pin socket. Makes RF Amplifier parameter data available for display on an external PC or monitoring system. (RS-232 format)
	FINAL FWD/REFL. INPUT	BNC socket. Auxiliary input to monitor final direct or reflected power when two twins amplifier work coupled.
	A.L.C. OUT	BNC socket for connection of the A.L.C. voltage to the Exciter.
	A.C. POWER INPUT	LINE INPUT	A.C. mains socket.
FUSES		A.C. mains fuses.

5) Enable IN/OUT DIN socket

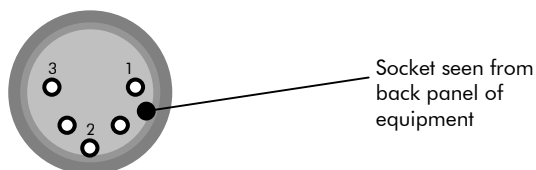


Figure 6: Enable socket and connector

This socket is used:

- To enable the Amplifier with an external command.
- To co-ordinate the operation of the RF Amplifier with an external Exciter, by means of an inter-connection cable.
- **PIN 1:** +15 V enable to RF Amplifier from external Exciter.
- **PIN 2:** Ground.
- **PIN 3:** +10 V (nominal) enable output ("READY") signal to external Exciter.

6) ALARMS OUT socket

This is a 25 pin DIN type socket, which may be used to make external connections as shown in following Table.

Table 1: Connections to ALARMS OUT socket

PIN	25 PIN DIN SOCKET
1	Low power alarm. Contact closed in alarm condition.
2	Low power alarm. Common contact.
3	Low power alarm. Contact open in alarm condition.
4-5-6-7-8-9-10-11-12-13	Not connected.
14	Reflected power alarm. Contact closed in alarm condition.
15	Reflected power alarm. Common contact.
16	Reflected power alarm. Contact open in alarm condition.
17-18-19-20-21-22-23-24-25	Not connected.

Figure 7: ALARMS OUT socket



7) SERIAL DATA RS-485 socket

Table 2: Connections to SERIAL DATA RS485 socket

PIN	DESCRIPTION
1	TX Data +
2	TX Data -
3	RX Data -
4	RX Data +
5	Ground.
6	Not connected.
7	Not connected.
8	Not connected.
9	Not connected

Figure 8: Serial DataRS485 in-out socket



8) SERIAL DATA COM (RS-232) socket

Table 3: Connections to SERIAL DATA RS232 socket

PIN	DESCRIPTION
1	Not connected.
2	TX out
3	RX in
4	RX c.er
5	Ground.
6	Not connected.
7	Not connected.
8	TX c.er
9	Not connected.

Figure 9: Serial Data Com in-out socket



9) E-LINK SERIAL NETWORK socket

Table 4: Connections to E-LINK SERIAL NETWORK socket

PIN	DESCRIPTION
1	Not connected.
2	CAN low
3	GND
4	Not connected.
5	Shield
6	Not connected.
7	CAN high
8	Not connected.
9	Not connected.

Figure 10: E-LINK SERIAL NETWORK in-out socket



II - OPERATING PROCEDURES

1) First time operation of ETL0550TAD

- Locate the switches on the front panel of the A.C. Mains Distribution module, near the bottom of the cabinet. Switch on to distribute mains to the Exciter, RF Amplifiers and extraction fan. Noise from the fan should be heard and the green lamps on the switches should turn on.
- Check that the Multi-function Metering Display is configured as follows.
- **Amplifier N°1:**
 - ⇒ FINAL F/R (upper row): shows the total **RF FORWARD** output power.
 - ⇒ FWD peak (lower row): shows the total RF FORWARD output of **this Amplifier**.
- **Amplifier N°2:**
 - ⇒ FINAL F/R (upper row): shows the total **RF REFLECTED** output power.
 - ⇒ FWD peak (lower row): shows the total RF FORWARD output of **this Amplifier**.
- **Amplifier N°3:**
 - ⇒ FWD peak (lower row): shows the total RF FORWARD output of **this Amplifier**.
 - ⇒ RFL peak (lower row): shows the total RF REFLECTED output of **this Amplifier**.
- **Amplifier N°4:**
 - ⇒ FWD peak (lower row): shows the total RF FORWARD output of **this Amplifier**.
 - ⇒ RFL peak (lower row): shows the total RF REFLECTED output of **this Amplifier**.

The following procedure must be followed to make sure that the RF cable connections are properly done:

- ⇒ Decrease the output power of the exciter by fully rotating counter clock wise the multi-turn potentiometer (about 15 turns) labelled "Power" on the front panel of the A.G.C. – A.L.C. Controller plug-in module.
- ⇒ Turn on the exciter with video modulation signal applied.
- ⇒ Increase the exciter output power by clock wise rotating the multi-turn potentiometer labelled "Power" on the front panel of the A.G.C. – A.L.C. Controller plug in module until reaching about 100W output power on each one of the amplifier modules.
- ⇒ Check simultaneously that the total forward output power level "" is about 400W and the total reflected power "FINAL F/R on Amplifier 2" is about 0W.
- ⇒ If the above values are correct slowly increase the power until reaching 2000W of total output power, and readjust till reading on Amplifier N.1 an A.L.C. value comprised between -5.0% end +5.0% (The A.L.C. control is done on Amplifier N.1).
- If the output RF power is too low to allow control (in this case the green LED "ON AIR" will be off), the A.L.C. will not start the control.
- The A.L.C. is always best positioned at mid range. To align the A.L.C. voltage, **wait at least for half an hour at full power, to allow the system to reach thermal equilibrium** and then locate the "POWER" screwdriver control on the front panel of the Exciter (A.G.C.-A.L.C. CONTROLLER plug-in). Insert a small screwdriver and slowly adjust, while looking at the Multi-function Display on the Amplifier 1: the optimum value is around 0.0%.

- Remove the vision signal from the Exciter and check that the RF output power drops to 50% or lower reading. In this condition the LED ON AIR will turn off..

2) RF Amplifier ETL0470: in case of difficulty

- Absence of RF power from the Amplifier often indicates that the unit is not enabled : in this case there is no reading at V supply 1 & 2.
- Absence of RF power can also be caused by a defective Exciter. Check Exciter's output by using its own RF output meter.
- If, after turn on, the V.S.W.R. ALARM LED turns on, there is a defective antenna cable or defective antenna and this problem must be investigated first.
- If after some time the yellow WARNING LED turns on, this normally indicates that the temperature of the internal heat sinks is getting too high. Check temperature on the Multi-function Display. Also check ambient temperature. Remember that at high altitude air density is lower and hence internal operating temperature is higher. Check for dirty air filters and for defective fans.
- If, during normal operation, the drive power is removed, with A.L.C. operation enabled, the A.L.C. loop "freezes" at whatever level it was and operation immediately resumes as soon as RF drive is re-applied.
- As soon as the Microprocessor and Protection module detects an alarm condition, as explained in section B, two items are immediately acted upon : e RF drive is turned off by the inhibit command, and at the same time the power supplies are turned off, by removing the Enable command to the Exciter. Then the Amplifier is recycled periodically, to check if the condition causing the alarm has been removed. As soon as this happens, the RF power output is automatically brought back to normal.

III - ETL0470 - MULTI-FUNCTION METERING DISPLAY

1) Alphanumeric LCD display description

Below we list the parameters displayed in an order that is logical and may not correspond to the actual sequence. The two rows of the alphanumeric LCD display can be **indifferently** configured to show one of the following quantities.

Push the right button ~ Sets the quantity to be shown in the **upper row**, or row #1.

Push the left button ~ Sets the quantity to be shown in the **lower row**, or row #2.

NOTE : It is advisable to leave the upper row configured to show **FORWARD** peak RF power and the lower row configured to show **REFLECTED** peak RF power.

Vsupply 1 =	32.0 V	Shows the regulated output voltage of the power supply.
Vsupply 2 =	32.0 V	Shows the regulated output voltage of the power supply.
Vsupply 3 =	32.0 V	Shows the regulated output voltage of the power supply.
Isupply 1 =	.... A	Shows the output current of the power supply. ~1A idling.
Isupply 2 =	....A	Shows the output current of the power supply. ~1A idling.
Isupply 3 =	....A	Shows the output current of the power supply. ~3A idling.

Vunreg. =	....V	Shows the rectified, raw voltage D.C. input to the switch mode supply. From 33 V to 55 V, depending on Mains voltage.
Failed PS =	....N	Shows if there are failed power supply.
Vunreg =	....V	Displays the rectified raw D.C. input to the switch mode supply. From 35 to 55 V, depending on mains voltage.
HS left =	....°C	Shows the temperature of the left side heat sink.
HS right =	....°C	Shows the temperature of the right side heat sink.
FWD drive =	....W	Shows the RF drive level in Watts to the final Amplifier stages.
A.L.C. level =	....%	Shows the A.L.C. adjustment range from -24% to +24%. This display works only if the A.L.C. loop is enabled, as shown in "Menu descriptions", below. If the A.L.C. is disabled, this display shows : "A.L.C. contr. off". For more information see "first time operation".
FWD peak =	....W	Shows the forward peak output power of the Vision carrier.
FWD avrg =	....W	Shows the forward average output power of the Vision carrier.
RFL peak =	....W	shows the reflected peak output power of the Vision carrier
RFL avrg =	....W	Shows the reflected average output power of the Vision carrier.
FINAL F/R=	....W	Shows the forward RF final output power on N°1 Amplifier and reflected final output power on N°2 Amplifier (only for ETL0480TAD).

2) Menu Description

To set any particular menu, repeatedly push the SELECT button, until the required menu title appears. Then the required action or parameter is selected by pushing one of the two buttons marked with an arrow. Finally the selected action is stored by pushing SELECT a second time. Pushing SELECT a third time brings up the next menu and so on. A list of menus is given in the table in the next page.

NOTE: To illustrate the operation of the pushbuttons and the alphanumeric display, two detailed examples are given in the following pages. We suggest to photocopy these pages and to keep them near the Amplifier for immediate reference at all times.

Table 5: Menus available on the LCD display

MENU	DESCRIPTION
Display contrast	Changes the alphanumeric LCD display contrast.
Set	Stores the new contrast value.
-	Decreases the display contrast.
+	Increases the display contrast.
View Warning Log	Shows the last warning conditions which have been stored in "Last in-first out" order. Repeatedly pushing the buttons, the last 8 warnings are shown, with numbers 0 to 7. "0" is the most recent warning and "7" is the oldest warning stored.
Clear	Clears the non-volatile RAM memory. Displays **Cleared** when actuated.
-	Shows the previous warning condition.

+	Shows the next warning condition.
View Alarms Log	Shows the last alarm conditions which have been stored in "Last in-first out" order. Repeatedly pushing the buttons, the last 8 alarms are shown, with numbers 0 to 7. "0" is the most recent alarm and "7" is the oldest alarm stored.
Clear	Clears the non-volatile RAM memory. Displays **Cleared** when actuated. Note that the yellow WARNING LED also turns off when this memory is cleared.
-	Shows the previous alarm condition.
+	Shows the next alarm condition.
View Work Timer	Shows the working time of the amplifier in hours
TX enable config	
Extern Enabled	Amplifier externally enabled. An external signal coming from the Exciter is needed for turn-on.
Always Enabled	Amplifier always enabled. The Amplifier switches on as soon as A.C. power is switched on and the automatic test has been carried out by the internal microprocessor.
ALC ref. power	Changes the reference power of the A.L.C. loop and is used to set the RF power output.
Store	Stores the new reference power level.
-	Decreases the reference power level.
+	Increases the reference power level.
TX A.L.C. config	Enables o disables the A.L.C. loop. When the loop is disabled, the display shows: "A.L.C. contr. off".
ALC Disabled	The A.L.C. control loop is disabled.
ALC Enabled	The A.L.C. control loop is enabled.
ALC on AUX input	The A.L.C. control loop is enabled, the reference power is referred to the power read on external aux. Input.
Store LCD View	The measures on the two rows of the display now, will be displayed at power on of the amplifier.

Second level menu

MENU	DESCRIPTION
Vision Frequency	Set approximately the frequency of the Vision carrier at witch the amplifier is working, in order to provide course correction of the frequency amplitude response of the directional couplers.
Store	Set the new working Vision Frequency.
-	Decreases the working Vision Frequency.
+	Increases the working Vision Frequency.

3) Example 1: Set the Amplifier in "Internal enable" mode

The following example shows how to permanently enable the Amplifier.

In the beginning the display is set at the recommended quantities:

Upper row	FWD peak = 200 W
Lower row	RFL peak = 2 W

Push SELECT once again, to enter the menu: the display shows:

Upper row	Display Contrast
Lower row	< > enter
Push-buttons	PREV SELECT ~ ~

Now push SELECT again a few times, until the display shows:

Upper row	Tx enable config			
Lower row	<	>	enter	
Push-buttons	PREV	SELECT	~	~

Push right button: ~ to enter this menu:

The display now shows the previously entered ENABLE condition:

Upper row	External enable			
Lower row	X	stored	-	+
Push-buttons	PREV	SELECT	~	~

Push right button: ~ to select the "Always" (permanent) enable condition. The Amplifier will now be permanently enabled.

The display shows :

Upper row	Always enable			
Lower row	X	stored	-	+
Push-buttons	PREV	SELECT	~	~

Now push: SELECT to store the new Tx enable configuration into the memory.

The display shows :

Upper row	Always enable			
Lower row	**	Stored	**	

After several seconds the display will automatically return to the quantities it had been originally programmed to show:

Upper row	FWD peak	=	200 W
Lower row	RFL peak	=	2 W

4) Example 2: Changing the power output of the RF Amplifier

- Press the pushbutton SELECT to enter the menu, then push SELECT again several times, until you reach the menu: **A.L.C. Reference Power**.
- Set the new reference power by means of the push buttons "+" and "-", store the new value and wait until the display automatically exits the menu.
- Check the new amount of A.L.C. control and carefully adjust drive power on the Exciter to get an A.L.C. reading at or near 0%.
- The following step by step example shows how to change the reference output power from 600 to 500 W.

Set the display to show the following quantities:

Upper row	FWD peak	=	200 W
Lower row	ALC level	=	3 %

Repeatedly push SELECT, until the display shows:

Upper row	ALC ref. Power			
Lower row	<	>	enter	
Push-buttons	PREV	SELECT	~	~

Push right button: ~ to enter this menu. The display shows :

Upper row	ALC ref. P = 200W			
Lower row	X	stored	-	+
Push-buttons	PREV	SELECT	~	~

Use the push buttons "+" and "-" to bring the new reference value to 150 W, then push SELECT:

Upper row	ALC ref. P = 150W			
Lower row	X	stored	-	+
Push-buttons	PREV	SELECT	~	~

Wait for a few seconds, until the display automatically reverts to the initial condition:

Upper row	FWD peak	=	150 W
Lower row	ALC level	=	-10 %

Check the new A.L.C. reading (in this example: **-10%**) and rotate the screwdriver front panel control **POWER** in the Exciter, to obtain a reading of 0.0%, or near this value.

Check the new A.L.C. loop reading (in this example: **-10%**) and rotate screwdriver front panel control **POWER** on the Exciter, to obtain a reading of **0.0%, or near to this value.**

5) Alarm and Warning Thresholds

Forward peak power	800 W
--------------------	-------

if the peak output power of the Vision carrier exceeds this threshold, the power supplies are turned off and the **alarm condition** is stored in the EEPROM (non-volatile memory).

Forward average power	600 W
-----------------------	-------

if the average output power of the Vision carrier exceeds this threshold, the power supplies are turned off and the **alarm condition** is stored in the EEPROM.

Reflected peak power	30 W
----------------------	------

if the reflected peak power of the Vision carrier exceeds this threshold, the power supplies are turned off and the **alarm condition** is stored in the EEPROM.

Input overpower	50 W
-----------------	------

if the peak power of the Vision carrier at the input of the output stage exceeds this threshold, the power supplies are turned off and the **alarm condition** is stored in the EEPROM (non volatile memory).

Heat-Sink Warning Temperature	63 °C
----------------------------------	-------

if one of the heat-sinks exceeds this threshold, the power supply voltages are lowered and the **warning condition** is stored in the EEPROM.

Heat-Sink Alarm Temperature	70 °C
--------------------------------	-------

if one of the heat-sinks exceeds this threshold, the power supplies are turned off and the **alarm condition** is stored in the EEPROM.

NOTE: When a temperature alarm occurs, TWO conditions are naturally always stored in the EEPROM, one is for the temperature warning (temperature reaches 63 °C), that was stored while the temperature was rising and the other is the temperature alarm itself (temperature reaches 70 °C).

6) Displayed Alarms and Warnings

When one alarm or warning is triggered, the lower row of the display shows the following messages:

When an alarm or warning condition is detected, the **lower row of the display** shows the following:

DISPLAY	ALARM and WARNING DESCRIPTION
V.S.W.R alarm	The output reflected power exceeded the alarm threshold (the V.S.W.R. alarm LED is lit).
peak overpw. alrm	The peak output power exceeded the alarm threshold.
avrg. overpw. alrm	The average output power exceeded the alarm threshold.
heat sink warning	The temperature of one or both heat sinks exceeds the warning threshold and voltage has been automatically shifted down.
heat sink temp hi	The temperature of one or both heat sinks exceeds the alarm threshold, the ALARM LED is lit and the power supplies have been switched off.

7) Warning LED

The yellow WARNING LED is normally dark. It turns on to indicate that one or more operating parameters have risen above the normal limiting values. This LED blinks if some past warnings and alarms are stored in the EEPROM non volatile memory of the microprocessor.

To clear this LED the alarm and warning memories have to be cleared. This can be done only during normal operation and when no warning or alarm conditions exist. To clear the memories, proceed as follows.

- Repeatedly push the SELECT button, until "View warning log." appears.
- Push button → to enter this menu.
- Push CLR. The display will show: "*** Cleared ***".
- Then repeatedly push the SELECT button, until "View alarms log." appears.
- Push button → to enter this menu.
- Push CLR. The display will show "*** Cleared ***". At this point the yellow WARNING LED will go off.

8) Data Communication

- A serial CAN port E-LINK network interconnection among power amplifiers.
- A serial port is available as output interface in RS-232 standard.
- A serial port is available as output interface in RS-485 standard.
- The Technical information manual for the installation and operation of the interface is available from EuroTel to EuroTel Customers on request.

IV - ALIGNMENT & MAINTENANCE INSTRUCTIONS

1) ETL0470 - Changing the channel of operation, simplified procedure

To change the channel of operation, two procedures must be followed.

- The output filter (if installed) must be re-aligned on the new frequency. A detailed procedure is available in section D, technical information.
- The calibration of the internal power sampling directional couplers must be changed, as outlined below.

When changing the channel of operation of the ETL0470, it is necessary to change the calibration of the internal power sampling directional couplers. Calibration data is stored in 10 MHz intervals in the memory of the resident Microprocessor and is changed by following this step by step procedure.

- ⇒ Set upper and lower positions of the front panel meter to **Vunreg**.
- ⇒ Push "**SELECT**" several times, until "**Video Frequency**" appears.
- ⇒ Push "**Enter**", to enter this menu. You will see the frequency band at which the Amplifier had previously been set up.
- ⇒ On the "+" and "-" push-buttons, the entire UHF band is available, in steps of 10 MHz.
- ⇒ Now using "+" or "-" set the frequency nearest to the new operating channel which must be used.
- ⇒ Now push: "**Set**", to store the new setting. The word "**Stored**" will appear on the display.
- ⇒ After a few seconds the system will automatically revert to normal operating status.

WARNING: If the Amplifier is operated at a different channel without executing this calibration procedure, all the internal RF power readings will be out of calibration and therefore the front panel wattmeter readings, the alarm thresholds and the protection thresholds will be out of calibration.

2) ETL0550TAD – 2 kW – Replacing one RF Amplifier, simplified procedures

Due to the reliability of the basic ETL0470, partial failures in one RF Amplifier are very rare and total failures, due to the 4X architecture, extremely unlikely. When a partial failure in one 500 W RF Amplifier is detected, there are two possible courses of conduct.

- **Remove the defective Amplifier for repairs and run the Transmitter with three Amplifiers only.** In this case:
 - ⇒ Remove the defective amplifier.
 - ⇒ Install the optional Dummy Amplifier/Load in place of the amplifier removed.
 - ⇒ Connect the R.F. output and input coaxial cables to the optional Dummy Amplifier/Load.
- **Remove the defective Amplifier for repairs and install a spare Amplifier.** In this case:
 - ⇒ Make sure the spare ETL0470 RF Amplifier is set at the wanted operating band. When in doubt, follow the procedure for calibrating the internal RF samplers, as shown in the previous page.
 - ⇒ Install the spare RF Amplifier and make all connections. Installation procedure shown in Chapter I, "INSTALLATION", above may be of help, when in doubt.
 - ⇒ **CALIBRATION OF FINAL RF POWER READINGS:** In the ETL0550TAD the final readings of Forward and Reflected RF power at 1 kW level are performed by the RF Amplifiers. If one RF Amplifier is replaced, then the calibration factor of that Amplifier must be set, to take into account the calibration of the external RF coupler.

⇒ In the performance data booklet delivered with each Amplifier, in section PQ: "Final performance data" we give a screen showing all calibration settings of the Amplifier, as shown in figure 13. Under the heading: "Coupler Adjust", read: **FWD out=xx%** and note number **xx**, which is the coupler calibration factor. If the booklet is not available, you can obtain the calibration factor from the Amplifier that has been replaced, or from the Amplifier still in operation, as explained in the "Detailed procedures" below.

- ▲ Set **upper and lower** positions of the front panel meter of the **replacement Amplifier** to: **Vunreg**.
- ▲ Now push **SELECT** several times until you reach: **Aux. coupler adj**. Push **Enter**. You will now see on the meter: **Aux=ddd W. Adj xx**. Where the number "**ddd**" is the RF power output reading and "**xx**" is the calibration factor. Number **xx** can have any value between **-50** and **+50 [%]**.
- ▲ Disregard "**ddd**". Now push buttons "**+**" or "**-**" to insert the same value of the calibration factor **xx**.
- ▲ Now push **Set**. The meter in the **F/R** position of Amplifier #2 is now calibrated and normal operation can be resumed.

```
ETL0470TAD Amp   S/N 100113088 Date           -1 Center Frequency= 760
N.  Type          Value      Low  Warn.  Alarm
0] FWD peak=      95W    400.0  0.0   850.0
1] FWD avrg=      93W     0.0   0.0   550.0
2] RFL peak=       0W     0.0   0.0   40.0
3] RFL avrg=       0W     0.0   0.0   30.0
4] FWD driv=       4W     0.0   0.0   61.0
5] HS left =    35.6β   56.0  64.0   70.0
6] HS right=    32.8β   56.0  64.0   70.0
7] FinalF/R=    151W     0.0   0.0  2000.0
8] Vsupply1=    32.2V    20.0   0.0   40.0
9] Isupply1=     8.4A     0.0   0.0   45.0
10] Vsupply2=   32.1V    20.0   0.0   40.0
11] Isupply2=    7.1A     0.0   0.0   45.0
12] Vsupply3=   32.0V    20.0   0.0   40.0
13] Isupply3=    7.2A     0.0   0.0   45.0
16] Vunreg1 =    49.6V    30.0   0.0   70.0
17] Vunreg2 =    49.6V     0.0   0.0   70.0
18] I Tot.Ck=    22.6A     0.0   0.0  135.0
19] FailedPS=     0N     0.0   1.0    2.0
20] A.L.C. =    -70%     0.0   0.0   50.0

FWD adj= 3.0% RFL adj= 3.0% FWD drv=24.0% AUX adj=-24.0% ALC ref= 600W
Option (d) to exit>
```

The external coupler calibration factor **xx.x%** is available in this window

Figure 11: Screen of threshold values and calibration data of RF Amplifier ETL0470

3) ETL0550TAD – 2 kW – Replacing one RF Amplifier, detailed procedure

- ⇒ Make sure the spare ETL0470 RF Amplifier is set at the wanted operating band. When in doubt, follow the procedure for calibrating the internal RF samplers, above.
 - ⇒ Install the spare RF Amplifier and make all connections. Installation procedure shown in Chapter I, "INSTALLATION", above may be of help, when in doubt.
 - ⇒ Identify the 3 dB hybrid & gain+phase equaliser, MOE177. This device is the 3 dB splitter of the RF drive from the Exciter to the two RF Amplifiers. Remove the screws holding the cover lid in place.
 - ⇒ Each output of the internal 3 dB hybrid is equipped with 4 attenuators in series and with 4 phase shifting lines in series. Attenuators are in values 1-2-4-8, starting with 0.125 dB. Phase shifting lines are also in values 1-2-4-8, starting with a nominal phase value of 2.5°.
 - ⇒ Attenuators and lines can be inserted or removed from the circuit by soldering in or out special chip type shorts: these shorts look like chip resistors, but they are imprinted with "000".
- NOTE: The procedure that follows must be executed with a reduced, non-modulated vision carrier only. With Equipment turned off, witch sound carrier off. Remove video modulation and turn scredriver control "POWER" on the A.G.C.-A.L.C. Controller front panel fully counterclockwise.**
- ⇒ **POWER BALANCING:** Turn equipment on and slowly turn POWER screwdriver control to read approx. 200 W RF output on each RF Amplifier meter (lower scale). You will note that one Amplifier will give slightly more power then the other. Calculate the difference in power in dB and then adjust then increase the value of the attenuator of this Amplifier, or decrease the value of the other Amplifier of the same value.
 - ⇒ **EXAMPLE:** After having replaced one amplifier, the reading on Amplifier #1 is 195 W and the reading on Amplifier #2 is 215 W. The difference is 20 W, or approx. 0.4 dB. Supposing that no attenuation is inserted on Amplifier #1, insert the 0.25 dB and the 0.125 dB attenuators (total 0.375 dB) on the drive of Amplifier # 2. You will now have a reading of 195 W on Amplifier #1 and 200 W on Amplifier #2, with a difference of 5 W or less.
 - ⇒ **PHASE BALANCING:** Switch equipment off. **Locate the 50 Ohm output balancing load**, connected to the balance port of the output 3 dB coupler. Insert a Thruline (or equivalent) wattmeter between the 3 dB coupler and the load. Turn equipment on and note reading on wattmeter. If reading is 2% or less of output power (e.g. up to 4 W in the previous example), no action should be undertaken.
 - ⇒ The power flowing into the balancing load is due to phase imbalance and can be reduced to near zero by adjusting the phase. **To see which Amplifier has the more phase shift, slowly and carefully, PARTIALLY unscrew one of the two "N" connectors of the cable from the drive hybrid (MOE177) in order to achieve a longer path, BUT WITHOUT INTERRUPTING THE CONTACT.** If the power into the balance load increases, less phase shift is needed on this side, or more in the other side.
 - ⇒ Once the side that needs more phase shift is found, tighten the "N" connector and insert more phase shift on that side, in nominal steps of 2.5°, until an imbalance of 2% or less of the output power, as read in the F/R position of Amplifier #1, is reached. Remove the wattmeter reading the imbalance power.
 - ⇒ **CALIBRATION OF FINAL RF POWER READINGS:** In the ETL0480TAD the final readings of Forward and Reflected RF power at 1 kW level are performed by the RF Amplifiers. If one RF Amplifier is replaced, then the calibration factor of that Amplifier must be set.

- ⇒ Insert a reference wattmeter between main output of Transmitter and antenna (or dummy load). Turn Transmitter on, again with **a reduced, non-modulated vision carrier only**, to read an output of approx. 500 W on the external reference wattmeter.
- ⇒ **If Amplifier #1 has to be replaced.**
- ▶ Set **upper and lower** positions of the front panel meter of the **replacement Amplifier** to: **Vunreg**.
 - ▶ Now push SELECT several times until you reach: **Aux. coupler adj.** Push **Enter**. You will now see on the meter: **Aux=ddd W. Adj xx**. Where the number "ddd" is the RF power output reading and "xx" is the calibration factor. Number xx can have any value between -50 and +50 [%].
 - ▶ Disregard "ddd". Now push buttons "+" or "-" to insert the same value of the calibration factor xx.
 - ▶ Now push Set. The meter in the F/R position of Amplifier #2 is now calibrated and normal operation can be resumed.
- ⇒ **If Amplifier #2 has to be replaced.**
- ▶ The original calibration factor can be obtained from the performance data booklet delivered with each Amplifier. **If the booklet is not available**, the calibration factor can be recovered from the **failed Amplifier or from the Amplifier still operational**, using the procedure that follows.
 - ▶ set **upper and lower** positions of the front panel meter of the Amplifier to: **Vunreg**.
 - ▶ Now push SELECT of the Amplifier several times until you reach: **Aux. coupler adj.** Push **Enter**. You will now see on the meter: **Aux=ddd W. Adj xx**. Where the number "ddd" is the RF power output reading and "xx" is the calibration factor.
 - ▶ Write down the value of this calibration factor xx, which can be a number between -50 and +50 [%].
 - ▶ Now push SELECT of **replacement Amplifier**, several times until you reach: **Aux. coupler adj.** Push **Enter**. You will now see on the meter: **Aux=ddd W. Adj xx**. Where the number "ddd" is the RF power output reading and "xx" is the calibration factor.
 - ▶ Disregard "ddd". Now push buttons "+" or "-" to insert the same value of the calibration factor xx, as read on Amplifier #1.
 - ▶ Now push Set. The meter in the F/R position of Amplifier #2 is now calibrated.
- ⇒ Follow the first time operation procedure, as described in Chapter I, "INSTALLATION", to properly set up the A.L.C. circuitry.

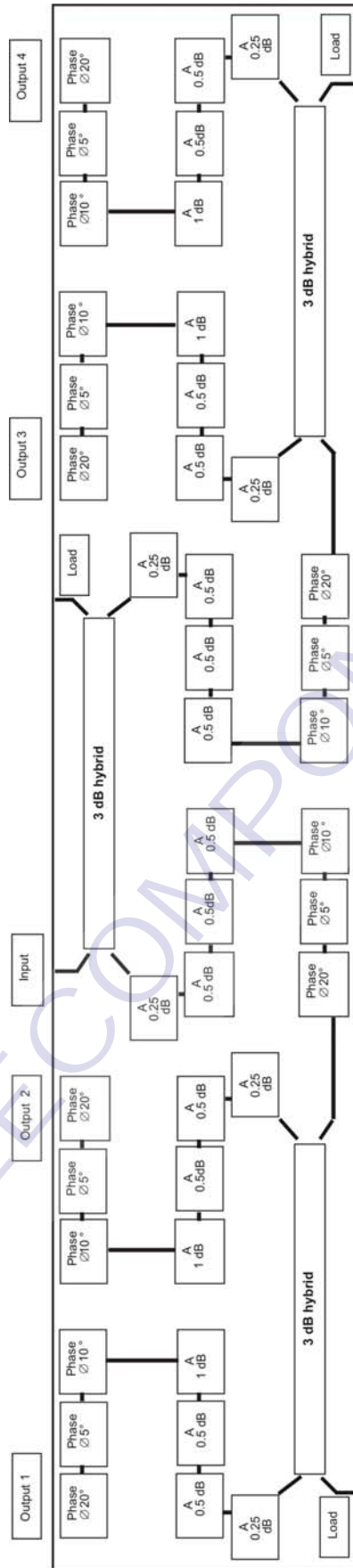


Figure 12: 3 dB hybrid & gain+ phase equaliser MOE177