ACOM 1003

HF + 6 m
Linear Power Amplifier

User's Manual

Installation, Operation
and Maintenance

OUTSTANDING HF POWER PRODUCTS

June 2025

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Title of Documentation ACOM 1003 HF + 6 m Linear Amplifier
User's Manual
Installation, Operation and Maintenance

Type of Documentation User's Manual

Purpose of Documentation This manual explains Installation, Operation and Maintenance of the ACOM 1003 HF + 6 m Linear Amplifier.

Record of Revisions

Description	Release Date	Notes
ACOM 1003 User's Manual	17.12.2024	First edition, R01
ACOM 1003 User's Manual	20.06.2025	First edition, R02

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Note This manual has been printed on chlorine-free bleached paper.

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1. GENERAL INFORMATION

Congratulations on purchasing one of the finest HF + 6 m linear amplifiers in the world today.

ACOM is pleased that you have chosen one of our products, and we will endeavor to provide you with the information and support you need to enjoy your purchase for many years.

We urge you to read all of the following materials before you embark on operating your new amplifier.

1.1. Introduction and Description

This manual explains:

- Installation
- Operation and
- Maintenance

of the ACOM 1003 HF + 6 m linear amplifier.

ACOM 1003 is a self-contained, full-featured linear amplifier covering all amateur bands from 1.8 MHz to 54 MHz. It delivers 1000 W power output PEP or 900 W continuous carrier, with less than 80 W input power. A SWR up to 3 is allowed at 1000 W forward power to the antenna. Antenna matching is made simple by the True Resistance Indicator (TRI) which is a bar scale for accurate setting of the plate-load impedance real part. A front-panel button-controlled input attenuator allows for easy drive power reduction during tuning and restoration after that, without the need of transceiver re-adjustments. Peak power bar graph indicator, operational parameters and text messages are displayed during operation on a two-line OLED display. Switching RX/TX is fast and CW QSK compatible, using a silent HF reed relay.

1.2. To the Reader of this Manual

This document is written for the technically qualified users who will use the ACOM amplifier.

To ensure your safety in accordance with safety and security standards, read this manual carefully and follow the steps described in it.

Everyone who will use the amplifier must read this manual, and follow the instructions in it, and other accompanying ACOM documentation (see Section ***1.5 Additional Documentation***), and consider also the appropriate safety precautions.

Informational notes

Observe the informational notes provided in this manual to ensure reliable and efficient operation of the amplifier. In this manual, you will find the following informational notes:

The information symbol highlights operating procedures or practices that may improve equipment reliability and/or personnel performance, or to emphasize a concept.

*The book symbol represents a **cross reference** to external documentation, e.g., other ACOM manual.*

Symbols and fonts used for marking text

In this manual the following symbols and fonts are used for marking text:

Format	Meaning
Orange bold text	Identifies all internal links in the document between ***Sections***, ***Figures***, ***Tables***, etc. for your convenience.
BOLD TEXT IN CAPITAL LETTERS	Identifies the connectors, switches, and button names and labels.
TEXT IN CAPITAL LETTERS	Identifies the amplifier operating modes, menu names, messages, etc.

1.3. Distinctive Features

- Covers all amateur radio bands from 1.8 to 54 MHz;
- Uses a single ceramic/metal power triode 3CX800A7 in cathode driven, grounded grid configuration;
- Delivers 1000 W power output PEP or 900 W continuous carrier, with no limitation to the operating mode;
- Operator selectable class AB_2 mode for best linearity in SSB mode or class B for reduced plate dissipation in continuous digital modes;
- Operator selectable modes of full or 50% reduced power output with no efficiency deterioration;
- Auto controlled cooling air flow;
- Continuous monitoring of amplifier parameters and tube protection;
- Two-line OLED display with peak-reading forward-output power bar graph and 18 operator-selectable amplifier parameters on the display;
- Unique ACOM protection for the bands switch (BAND);
- Original ACOM HF arc protection at the output, or at the antenna;
- Original ACOM TRI prompt: bar scale for quick and accurate setting of the plate-load impedance real part while matching the antenna;
- No need of external antenna tuner (ATU) for antenna SWR up to 3;
- Three antenna outputs selected by a button on the front panel;
- Factory tuned input lowpass filters for best linearity and input SWR less than 1.3 in each amateur radio band;
- Drive power of 50 to 80 W from the transceiver for 1000 W output;
- Single phase mains power, 90-132 / 180-264 VAC at 50-60 Hz, power consumption at rated output – up to 2000 VA @ 240 VAC;
- HF antenna reed relay for a virtually silent, QSK compatible CW operation;
- Non-volatile memory with SIGNATURE records of the most recent 8 Serious (Hard Fault) Protection events.

1.4. Product History and Documentation Validity

The ACOM 1003 power amplifier serial production started in March 2025.

This manual refers to the ACOM 1003 amplifier and describes the operating possibilities of all amplifiers produced till the publishing date of this manual.

This manual is valid till a new manual is issued.

Production Version Release Date	Notes
03.2025	Basic design;

Table 1-1 | Production versions history

1.5. Additional Documentation

For further important information, please, refer to the following documentation:

- ***ACOM 1003 Brochure***;
- ***ACOM L-PROT 2000 User's Manual***.

The documentation is available for download at ***www.acom-bg.com***.

1.6. Product Identification

Every ACOM product features an ID (identification) label/plate. The ID label is usually on the rear side of the device. On this label, you can find data identifying the device. Which product identification data are important?

- Model designation - The model designation is the name of the device;
- Serial Number - Most products have their own serial number. The serial number is a consecutive number for unique identification of products with the same model designation. It serves to ensure traceability of a product after it has been put in circulation, e.g., to find the date of invoice that is required to determine guarantee and warranty periods. The term serial number is mostly abbreviated to SN or S/N.

Figure 1-1 | ID (identification) label/plate, example
(Note: The amp is shown with an optional fan installed)

1.7. Equipment Supplied

The ACOM 1003 amplifier is shipped as package, consisting of:

Nr.	PACKAGE CONTENTS	Pcs.
1	Amplifier ACOM 1003	1
2	Quality Inspection Certificate (hard copy)	1

Table 1-2 | Package contents

The User's Manual is available as PDF-file only.
The latest version of the User's Manual is available at www.acom-bg.com.

1.8. Optional Equipment

There are two individual purchase options available. They are:

Nr.	OPTIONAL EQUIPMENT
1	External fan for ACOM 1003
2	ACOM L-PROT 2000 | Lightning Protector

Table 1-3 | Optional equipment

Figure 1-2 | External fan

The external fan (see ***Figure 1-2*** above) is not necessary in SSB and CW mode or in continuous carrier modes (RTTY, SSTV, etc.) for a maximum time of continuous transmission up to 15 minutes followed by pause of at least 3 minutes.

For denser cycles such as continuous emissions or when the ambient temperature is high, it is recommended to install an external fan.

The auxiliary fan is a brushless type, 2 to 5 W, 24 VDC, 92x92x25 mm. It may be installed by your dealer or by the manufacturer upon request.

Figure 1-3 | ACOM L-PROT 2000 lightning protector

L-PROT 2000 (see ***Figure 1-3*** above) provides excellent protection against static electricity accumulation in the antenna and eliminates white noise in the receiver during wind, rain, or snow. It also prevents any DC current flow between the input and output. Besides, the two chokes DC short-circuit the ports and prevent charges from accumulating. The air spark gaps limit the back EMF.

Using the ACOM L-PROT 2000 lightning protector is highly recommended.

1.9. User Technical Support

If assistance is needed, you should contact your local dealer first. If necessary, your dealer will contact ACOM for additional guidance.

If you still have an issue you need to discuss with one of ACOM's specialists, the contact information is as follows:

ACOM Ltd.
Web-site: www.acom-bg.com -> **Support** page
E-mail: support@acom-bg.com

Bulgaria | Bozhurishte 2227
Sofia-Bozhurishte Industrial Park | 6 Valeri Petrov Str.
GPS coordinates: 42.748616° | 23.209801°

Including the ACOM equipment's model name, serial number, and a detailed problem description in your service assistance request is mandatory. Without this information, we cannot proceed with your request, or the proceeding will take longer.

1.10. Safety Considerations, Explicit Definitions

The ACOM 1003 HF + 6 m Linear Amplifier is a Safety Class I unit regarding protection against electric shock. For a safe operation the third grounding wire of the power cable (colored yellow with two green stripes) and the ground stud on the rear panel of the amplifier (marked **GND**, see ***Figure 1-4*** below) must be connected to the radio shack's grounding system.

Figure 1-4 | Rear panel - GND connection

The amplifier is designed to comply with international safety standards and complies with CE safety and electromagnetic compatibility requirements, as well as with FCC regulations.

This User's Manual contains information, warnings (signal words **Danger**, **Warning**, **Caution** and **Notice**) and instructions, related to hazards, that should be followed by the user in order to ensure safe operation and to keep the amplifier in a safe working condition at all times.

The safety instructions contained in this User's Manual feature specific signal words (**Danger**, **Warning**, **Caution** and **Notice**) and, where required, a safety alert symbol, in accordance with actual standards ISO 3864 or ANSI Z535.

The safety signs on the rear panel of ACOM amplifiers are in accordance with actual standards ISO 7010.

The EXPLICIT DEFINITIONS described below apply to this User's Manual:

⚠ DANGER

These notes call attention to a procedure or instructions which, if not correctly performed, ***will result in serious personal injuries and even death****.*

⚠ WARNING

These notes call attention to a procedure or instructions which, if not correctly performed, ***could result in serious personal injuries and even death****.*

⚠ CAUTION

These notes call attention to a procedure or instructions which, if not correctly performed, ***could result in minor or moderate personal injuries****.*

NOTICE

These notes call attention to a procedure or instructions which, if not correctly performed, ***could result in property damage or equipment damage not exclusively to the amplifier but also to connected equipment****.*

PRECAUTIONS:

⚠ DANGER

For safe operation, the amplifier's grounding stud on the rear panel (marked **GND**, see ***Figure 1-4 | Rear panel - GND connection*** above) should be connected according to the applicable standards and local regulations for electric safety, fire safety and lightning protection, in all cases when the radio station is equipped with outdoor antenna(s)!

⚠ DANGER

NEVER underestimate the danger of lightning!

To prevent accidents, connection/disconnection to the grounding and antennas should only be carried out in clear, quiet, and sunny weather when there is no danger of lightning and static discharges.

⚠ DANGER

The amplifier works with high voltages up to 3000 V, which are LETHAL!

For your safety, pull the amplifier power plug out of the mains wall outlet and WAIT AT LEAST 30 minutes EACH TIME BEFORE you remove the cover of the amplifier. Do not touch any part inside while the amplifier is open because some residual voltages may still be present.

⚠ DANGER

Never allow anyone, ESPECIALLY CHILDREN, to push or put anything into holes in the case - this will cause electric shock. NEVER TOUCH AN ANTENNA or antenna insulators during transmission or tuning - this may result in an electric shock or burn. NEVER EXPOSE the amplifier to rain, snow, or any liquids. AVOID placing the amplifier in excessively dusty environments or in direct sunlight. DO NOT OBSTRUCT AIR INTAKE (rear panel) and EXHAUST (top cover) areas of the amplifier. Keep a minimum clearance distance of 10 cm (4 inches) to the intake and 50 cm (20 inches) above the exhaust opening.

⚠ WARNING

To avoid damage (not covered under warranty) read the Section ***2 INSTALLATION*** of this User's Manual carefully. Installation of the equipment must comply with local and national electrical codes.

If you have any doubts about the installation, operation, or safety of the amplifier, please, consult your dealer.

⚠ WARNING

NEVER operate the equipment if you notice an abnormal odor, sound, or smoke. Immediately turn off the power and contact your dealer for assistance (see Section ***1.9 User Technical Support***).

⚠ WARNING

Do not undertake on your own repairs or changes in hardware or software of the amplifier in order not to endanger your or other's health and life and not to damage the amplifier and the equipment connected with it, not covered by warranty. The manufacturer is not liable for another's actions and responsibility shall be assumed by the doer.

⚠ WARNING

To be in compliance with the RF exposure requirements, please, read Section ***9.3.c) RF Exposure Information***.

2. INSTALLATION

2.1. Unpacking and Initial Inspection

Before you install your amplifier, thoroughly read this manual.

First, carefully inspect the cardboard carton and its contents for physical damage. ACOM ships amplifiers in highly protected containers, but it cannot assure that mistreatment by shippers will not occur. If damage is evident, notify your dealer immediately. Delay may void the carrier's warranty.

⚠ CAUTION

The packaged weight is about 25 kg (55.1 lbs.) and is recommended to be handled by two persons.

Keep all packing materials for possible future amplifier shipment (see Section ***9.4.4 Returning to the Service Provider***).

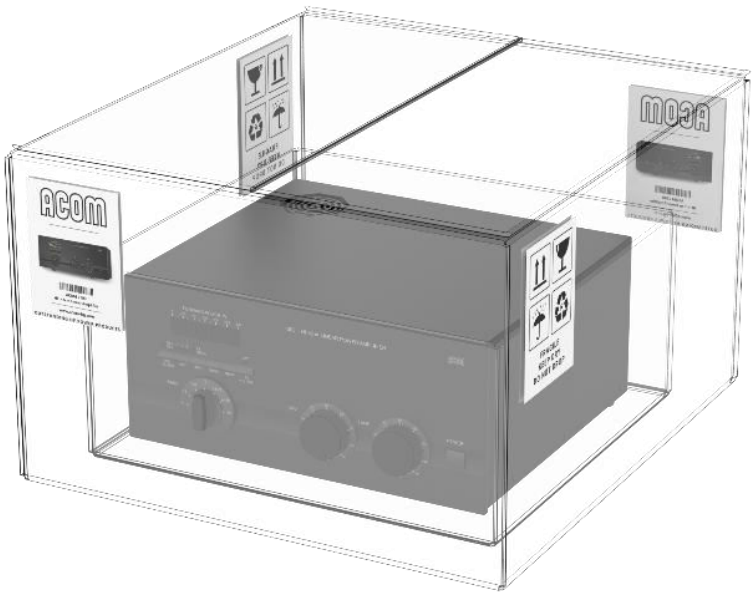


Figure 2-1 | Packaging carton (outside view)

See figures ***Figure 2-1*** above and ***Figure 2-2 | ACOM 1003 packaged in a cardboard box***) and unpack the amplifier as described below:

- Open the cardboard carton
  (see ***Figure 2-1*** and ***Figure 2-2***, Pos. 1);

- Take out the top secure element
  (see***Figure 2-2***, Pos. 2);
- Open the internal cardboard carton
  (see***Figure 2-2***, Pos. 3);
- Take out the amplifier using handles of the middle secure element
  (see ***Figure 2-2***, Pos. 4);
- Take out the amplifier
  (see ***Figure 2-2***, Pos. 8)
  from the middle secure element and remove top, bottom, and sides flat secure elements
  (see ***Figure 2-2***, Pos. 5, 6 and 7);
- Now, the amplifier is ready for installation.

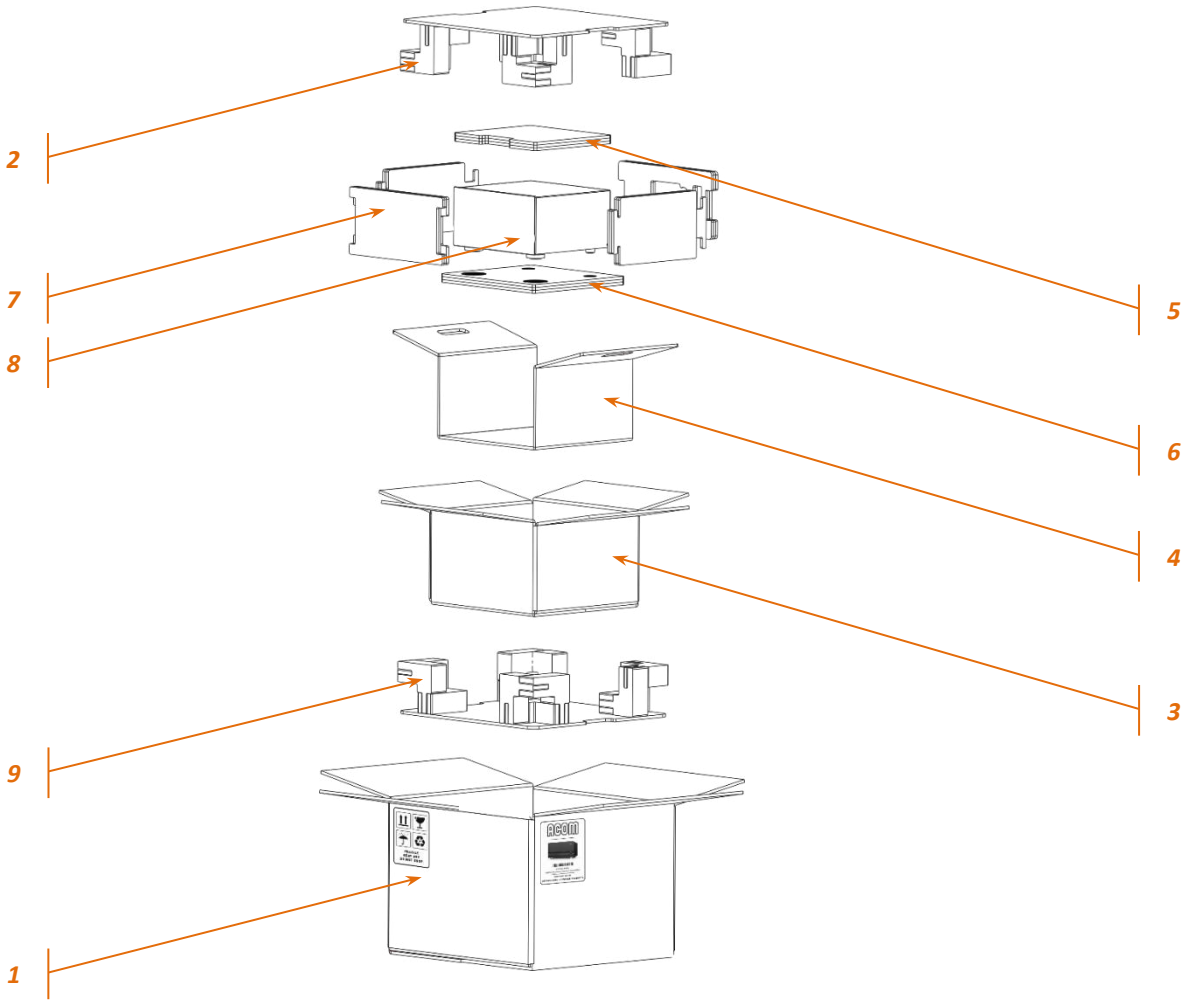


Figure 2-2 | ACOM 1003 packaged in a cardboard box

It is not necessary to take out the bottom secure element (See ***Figure 2-2***, Pos. 9).

2.2. Amplifier Location Selection

⚠ CAUTION

The unit's weight is about 21 kg (46.3 lbs.) and is recommended to be handled by two persons.

Position the amplifier near the place where it will be used. You will need an easy access to the front-panel command knobs and indicator's area, as well as to the rear panel cabling.

NOTICE

The ACOM 1003 is forced air cooled.

DO NOT OBSTRUCT AIR INTAKE (rear panel) and EXHAUST (top cover) areas of the amplifier. Keep a minimum clearance distance of 10 cm (4 inches) to the intake and 50 cm (20 inches) above the exhaust opening (see ***Figure 2-3*** below).

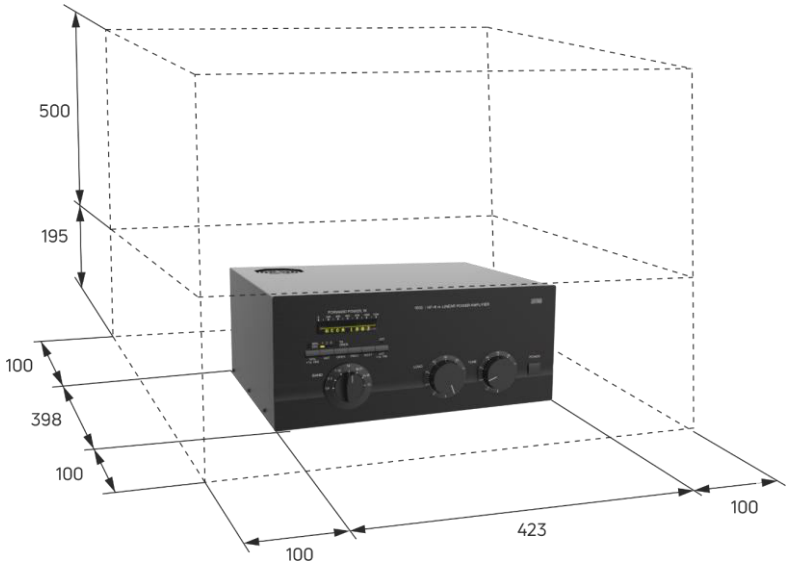


Figure 2-3 | Location space requirements
(Note: All dimensions are in millimeters, mm)

The exhaust air temperature can reach 65 °C (150 °F) and if the surrounding devices are sensitive to heating from outside or use forced air cooling themselves, increase the distances accordingly.

No temperature-sensitive devices should be located above the exhaust hot air area. This means that the amplifier should not be located under a shelf or other structure that could impede the free movement of air away from the amplifier.

NOTICE

Do not leave accidental paper, cloth, or other lightweight pieces around and under the amplifier. They may be drawn in by the cooling air stream and block the vents. This will lead to overheating and accelerated material aging, not covered by the warranty.

No magnetic-field sensitive devices (such as microphones) should be located next to the right side of the amplifier because its power transformer is located there. It is advisable to position the amplifier to the right of your transceiver.

2.3. Line Voltage Selection

NOTICE

In order to avoid any damage (not covered by the warranty), check carefully to be certain that the voltage for which the amplifier is set corresponds to your mains nominal voltage.

Normally, the amplifier is delivered with the voltage selector configured for mains voltage of 240 VAC and mains fuses of 10 A. Please, check this information in the Quality Inspection Certificate (see Section ***1.7 Equipment Supplied***).

If your mains voltage is not rated as 240 VAC, you must contact your dealer to reconfigure the voltage selector and eventually replace the mains fuses.

The amplifier power supply can be configured for 8 different nominal line voltages: 100, 110, 120, 200, 210, 220, 230, or 240 VAC, 50 or 60 Hz.

NOTICE

The two mains fuses in the amplifier (see ***Figure 2-4 | Rear panel - Connections***), Pos. (f)) should be rated for a current matching your rated mains voltage.

For correct fuse rating and voltage-specific instructions, see Section ***8.2 Fuse Replacement***.

2.4. Connections

Please, see ***Figure 2-4*** below.

Connecting to your radio shack must be accomplished in the order described below, before you apply mains voltage to the amplifier.

⚠ WARNING

Installation of the equipment must comply with local and national electrical codes.

The applicable standards and local regulations shall prevail if there is a difference in the requirements, and if they contain more or stricter requirements than the minimum for installation stated in our documentation.

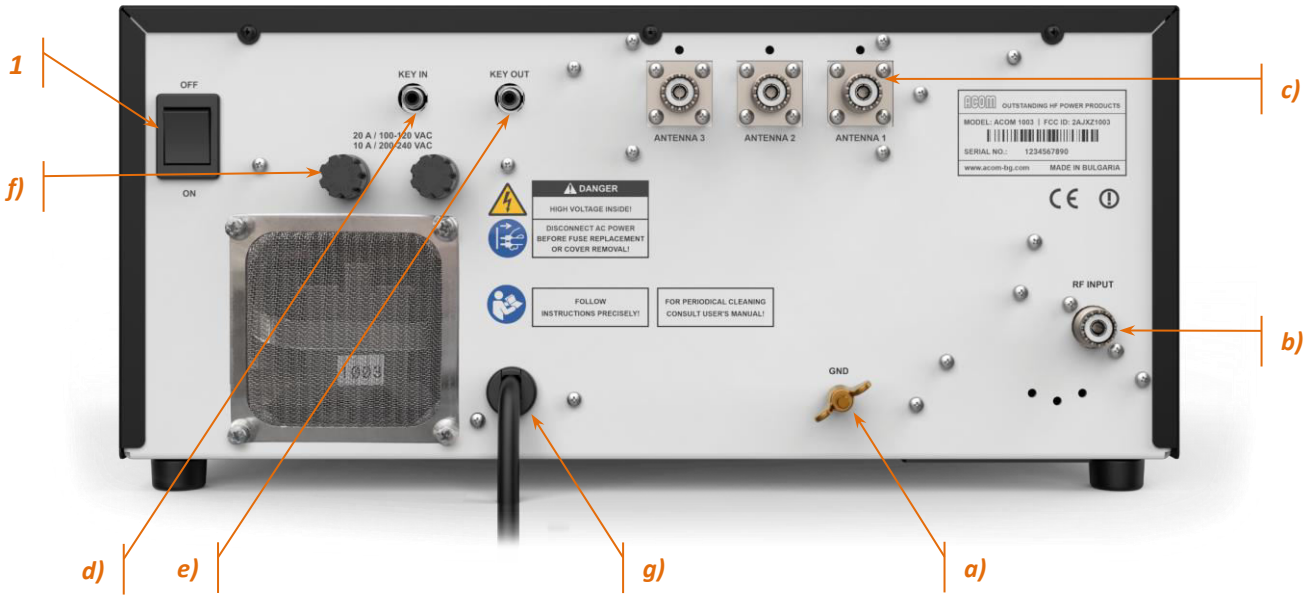


Figure 2-4 | Rear panel - Connections

a) **GND** stud for grounding

Before you connect the amplifier to external grounding, you should advise with a licensed electrician and confirm such kind of connection is allowed by your national standards and regulations for electric safety, fire safety, and lightning protection.

Simultaneous connection to the earth grounding and protective earth may be inadmissible or may fall under special requirements in some countries!

⚠ DANGER

Never use the gas installation for grounding. This can cause an EXPLOSION!

⚠ DANGER

Do not use the steam-heating or water-supply network for grounding! You may expose to dangerous voltage not only yourself but also other people using the same installation.

⚠ WARNING

This amplifier needs to be grounded.

When installing or replacing the unit, the ground connection must always be made first and disconnected last.

Note that the grounding system may have to withstand currents over 20 A with insignificant voltage drop on it. Therefore, it may be necessary to improve the grounding system considerably, i.e., to become less resistive, with heavier leads and lower-resistive ground path.

The grounding leads should be at least 8 mm² (AWG 8 or SWG 10).

If no other data is available, in order to avoid conduction of a lightning strike with all resulting consequences - death, injury, fire, equipment damage, destruction, etc., please, read and understand clearly:

- ***ACOM L-PROT 2000 User's Manual***;

Pay particular attention to Sections ***1.9.1. General Information about Lightning Protection*** in the downloaded manual.

The documentation is available for download at ***www.acom-bg.com***.

For details and recommendations on the grounding and RF counterpoise system concerning the electromagnetic compatibility see also Section ***3.4 Elimination of Electromagnetic Compatibility (EMC) Problems***.

First connect the amplifier ground terminal (See ***Figure 2-4 | Rear panel - Connections***, Pos. (a)) through a low HF-impedance connection with a cross section of no less than 8 mm² (AWG 8 or SWG 10), preferably flat-shaped solid band, rather than a flexible multistrand cable, to the grounding system of the radio station.

b) **RF INPUT** connector

Connect a suitable coaxial cable from the transceiver output to the amplifier **RF INPUT** SO-239A connector (see ***Figure 2-4***, Pos. (b)), using PL-259 plug.

NOTICE

In order to avoid a damage, turn off your transceiver's internal antenna tuner.

c) **ANTENNA 1**, **ANTENNA 2**, and **ANTENNA 3** connectors

NOTICE

If this is the first time you will use a power amplifier in your station, pay attention to the coaxial cable type from the amplifier's three outputs to the antennas. It must handle the increased power safely, particularly on the 10- and 6 meters bands. We recommend that you use RG213 cable or better. Check the same for the antenna switch and tuner, as well as the whole antenna system (especially multi-band trap antennas).

Connect a suitable coaxial cable with a PL-259 plug (with PTFE insulation) from the appropriate amplifier output (marked **ANTENNA 1**, **ANTENNA 2**, and **ANTENNA 3**, see ***Figure 2-4***, Pos. (c)) to the antenna for the respective frequency band.

d) **KEY IN** connector

This is the amplifier's input for receive/transmit control from the transceiver.

The transceiver switches the amplifier from receive mode into transmit mode (RX/TX) by grounding of the **KEY IN** input.

Run a shielded cable from the "ground on transmit" connector or terminal on your transceiver to the amplifier rear panel **KEY IN** connector (see ***Figure 2-4***, Pos. (d)). The **KEY IN** connector uses a standard RCA phono plug.

The switching voltage presented from amplifier **KEY IN** connector to the transceiver "ground on transmit" output does not exceed +13 V (positive to the ground). The short-circuit current is below 5,1 mA.

Your amplifier will NOT WORK if **KEY IN** input is not connected properly.

The transceiver producers give different names to this output and they are for instance TX-GND, SEND, T/R-LINE, PTT, etc. Some transceivers require that "ground on transmit" output is implemented via a software command, or by changing the setting of a switch on the rear panel, or interior of the transceiver.

Check your transceiver's manual and consult your dealer if you have any difficulties.

e) **KEY OUT** connector

This is a control output from the amplifier that could be used to enable or disable the transceiver's transmission.

The **KEY OUT** connector (see ***Figure 2-4***, Pos. (e), above) provides an extra control signal from the amplifier to a corresponding transceiver input, if available. It could be used to improve the switching safety from receive to transmit (RX/TX) and vice versa.

If your transceiver has a suitable input that disables transmission unless grounded externally, we recommend that you connect it with a shielded cable terminated in a Phono (RCA) connector to the **KEY OUT** connector of the amplifier.

The transceiver producers give different names to this input and they are for instance TX-INHIBIT, MUTE, LINEAR, etc. Check your transceiver's manual.

NOTICE

KEY OUT is a low-power open-drain output; make sure that the signal voltage coming from the respective transceiver connection does not exceed 50 VDC (open circuit) and the closed-circuit current to the ground is below 20 mA.

Using **KEY OUT** is not required for normal operation. ACOM 1003 will operate normally with **KEY OUT** unconnected if your transceiver has no such input.

f) Main fuses

Please, see ***Figure 2-4 | Rear panel - Connections***, Pos. (f).

NOTICE

Make sure you check whether the mains fuses installed in your amplifier correspond to your local mains nominal voltage:

- 20 A ("F" type) / 100-120 VAC;
- 10 A ("F" type) / 200-240 VAC.

Should the occasion require replacement of the mains fuses, replace them as described in Section ***8.2 Fuse Replacement***!

⚠ WARNING

If your amplifier is only fitted with one line (mains) fuse, it is suitable for European Community ONLY. Your dealer will check that your amplifier is correctly fused before it is shipped to you. Customers should check with a qualified electrician if the amplifier is to be used outside the country for which it was purchased.

g) Power cord

Please, see ***Figure 2-4 | Rear panel - Connections***, Pos. (g).

Due to the different standards in different countries, the mains plug for the amplifier power supply cable is supplied and mounted by the dealer. He connects to the mains cord end a standard mains supply plug which meets the Safety Class I unit standard in your country.

The ground lead of the amplifier's power cord is colored yellow with two green stripes and the blue and brown leads are active. When the amplifier is to be used with only one mains fuse, it is connected in series with the brown lead, which must be the active.

	Wire name	Description	Colors	
ACOM amplifier	N	Neutral	Blue	
	L	Line, Active, Live	Brown	
	G or PE or E	Ground (Protective Earthing conductor)	Yellow +	Green

Table 2-1 | Power cord connections

If you have any doubts about the correct way of connecting the wires, consult your dealer.

h) Preparation of power outlet for the amplifier

⚠ WARNING

Before connecting the amplifier to your mains supply using a licensed electrician, check that the supply is correctly wired, and is adequate for current drawn by the amplifier (up to 10 A from 200/240 VAC mains and up to 20 A from 100/120 VAC mains). Make certain that the grounding lead is connected properly and that it has a cross section not less than the cross section of the phase conductor in the wall outlet for the amplifier.

It is preferable that you use the wall outlet closest to the source. The installation leads should be at least 2.5 mm² (AWG 13 or SWG 15), (recommended values if there are no stricter requirements by your local standard).

Check that the voltage at the power outlet matches the voltage that the amplifier is set to (see Section ***2.3 Line Voltage Selection***).
Check that the panel fuse has a free capacity (10 A from 200-240 VAC or 20 A from 100-120 VAC) for the additional load from the amplifier as specified in Sections ***8.2 Fuse Replacement*** and ***9.1.i) Mains Power Consumption***.

If you connect the amplifier to a different mains outlet, be sure that you check it, too.

3. POWER ON, CONTROLS, AND INDICATORS

NOTICE

Do not turn the amplifier on for at least 2 hours after unpacking it in the room where it will be used. Pay particular attention when you move it from a very cold into a warm place - condensation is likely and this could result in damage to the high voltage circuits. In such a case, wait at least 4 hours. A similar effect can occur after a rapid warming of the operating room (for instance after switching on a powerful heater in a cold shack).

NOTICE

To avoid any damages (not covered by the warranty) make sure that the voltage selector in the amplifier is configured for the rated voltage of your mains power (see Section ***2.3 Line Voltage Selection***).

NOTICE

To avoid any damage (not covered by the warranty), never connect, or disconnect cables while power is applied at either end of the cable.

Hot-plugging is technically incorrect and is a bad practice to connect or disconnect any piece of equipment while it is powered on. Make sure the device is switched off before connecting or disconnecting any cable.

After following all instructions in Section ***2 INSTALLATION***, make sure that the rear panel mains rocker switch (marked **ON**/**OFF**) is turned **OFF** (see ***Figure 3-1*** below, Pos. (1)). Then insert amplifier's mains plug into the power outlet prepared for it. The amplifier remains powered off at this time.

Figure 3-1 | Rear panel - ON/OFF switch

Now you may turn **ON** the mains rocker switch marked **ON**/**OFF**. The red indicator above **POWER** button (see ***Figure 3-2***, Pos. (b), below) on the front panel must light up, and the Home Screen inscription

must appear on the display. Should this not occur turn **OFF** the mains rocker switch and investigate the cause before proceeding.

In this state (called OFFLINE mode hereafter), only the Control PCB is operational, while the amplifier itself is still turned off, and the tube is not powered at all.

Figure 3-2 | Front panel - POWER button and Home Screen

The amplifier control is structured in two main states - OFFLINE mode and ONLINE mode, each having several sub-menus, as shown in ***Figure 3-3 | Control Routines, Menu and Information Displays Tree*** below.

The mains power is to be supplied in both OFFLINE and ONLINE modes. These are two different operating modes of the already powered amplifier. The OFF and ON are here not for the mains supply, but they refer to the tube usage and longevity resource.

During the OFFLINE mode, the tube is not powered at all, and all tube currents are zero. This is just a Control PCB information mode that does not use the tube resource. Time in OFFLINE mode is not included in the tube operating (working) hours count, as the tube is off.

Unlike OFFLINE, the ONLINE mode is the real amplifier operating mode "On The Air", which inevitably uses the tube resource. The tube operating (working) hours clock is ticking during ONLINE mode only because during this period the tube-heater voltage is "ON" continuously (see Section ***3.3.8) Eighth pressing the NEXT button***).

At this point you can proceed in one of two directions:

a) You can press the **POWER** button (see ***Figure 3-2 | Front panel - POWER button and Home Screen***, Pos. (a)) and start the cathode warm-up period. After 3.5 minutes you may tune-up and begin operating the amplifier in the ONLINE mode as described in Section ***4 ONLINE MODE*** below.

b) You can continue in the present OFFLINE mode as described in Section ***3.2 OFFLINE MODE*** below).

We recommend that, for the time being, you examine the functions in the OFFLINE mode and thus acquaint yourself with the basic control ideas.

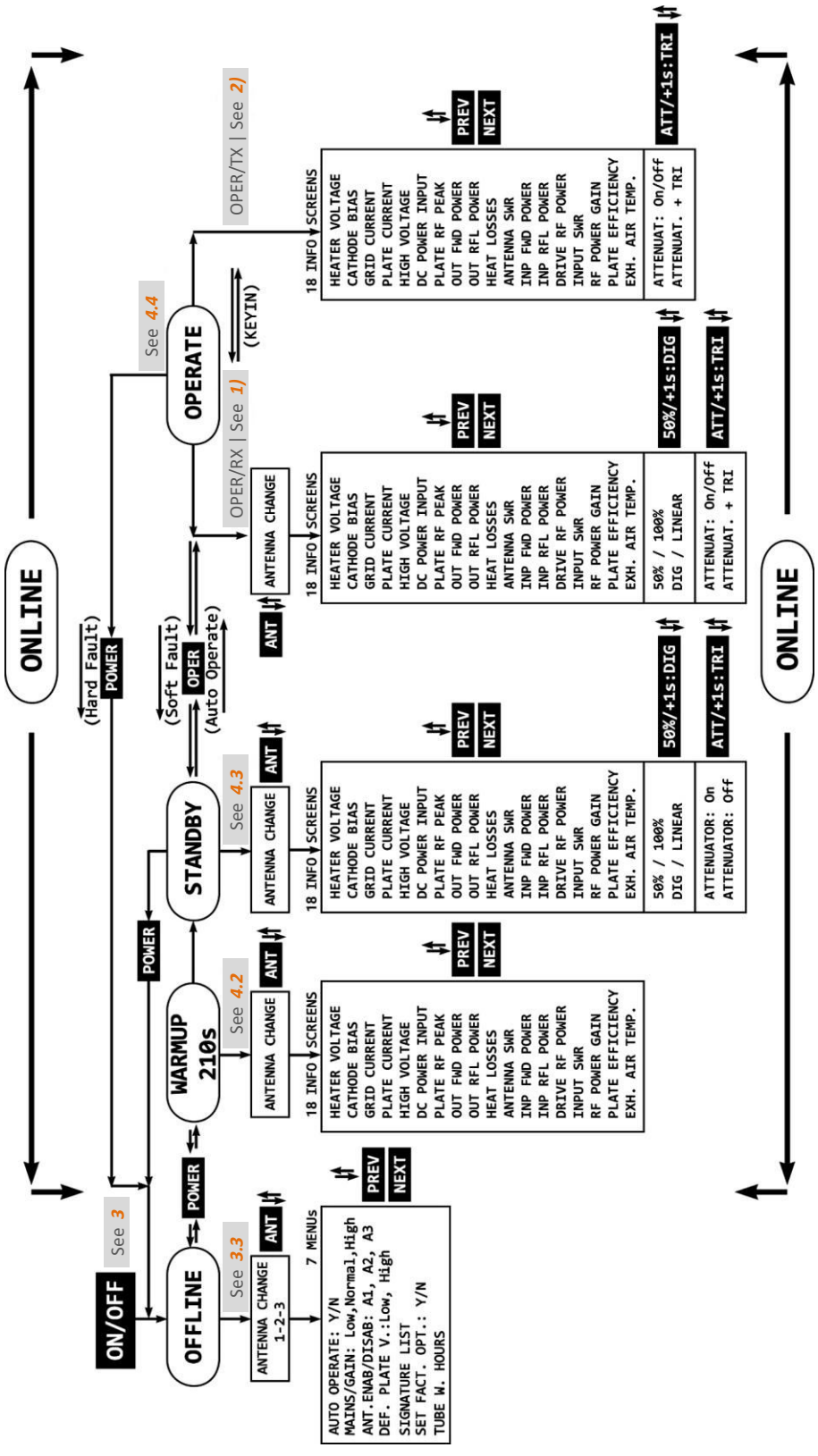


Figure 3-3 | Control Routines, Menu and Information Displays Tree

3.1. Automatic Power-On Test

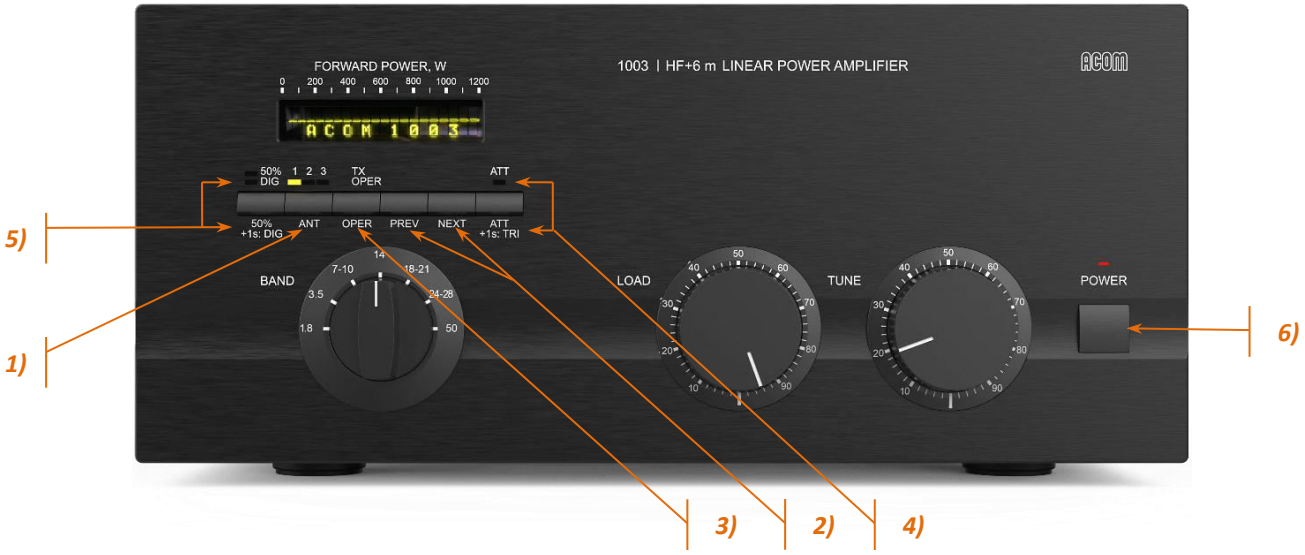


Figure 3-4 | Front panel - Display, buttons and Indicator lights

On every power-on cycle the Control PCB checks the basic amplifier signals. Normally the automatic power-on test will pass successfully and you can perform the following actions in OFFLINE mode:

1) **ANT** button
The **ANT** button (see ***Figure 3-4***, Pos. (1)) can be used to change the three antennas - 1, 2 and 3, without the optional restrictions described in Section ***3.3.3)***; the three indicators above the **ANT** button show the connected antenna number;

NOTICE

If RF power is applied to the antenna at the moment when you press the **ANT** button, the three indicators will flash together simultaneously - the antenna will not be changed and a message

will be shown on the display for 2 seconds.

2) **PREV** and/or **NEXT** buttons
Shortly pressing **PREV** and/or **NEXT** buttons (see ***Figure 3-4***, Pos. (2)) you can cycle through seven options menus and also you are able to read the SIGNATURE records in the events list (see Section ***3.3.6)***);

3) **OPER** button
Operator options are accessible by shortly pressing the **OPER** button (see ***Figure 3-4***, Pos. (3)); the main use of this button will be in the ONLINE mode (see Section ***4 ONLINE MODE***);

4) **ATT/+1s:TRI** button
Shortly pressing the **ATT/+1s:TRI** button (see ***Figure 3-4***, Pos. (4)) returns the state to one level upwards (in the case you will exit the menu); pressing it successively you will return up to the Home Screen (see ***Figure 3-4***); if any selection was changed in the meantime, it will be written to the memory with the message:

Pressing the **ATT/+1s:TRI** button longer than 1 second will display the amplifier firmware version and date, for instance:

The regular screen will reappear after 20 seconds or when the **ATT/+1s:TRI** button is pressed.

5) **50%/+1s:DIG** button
The **50%/+1s:DIG** button (see ***Figure 3-4***, Pos. (5)) has no function in the OFFLINE mode;

6) **POWER** button
Pressing and holding the **POWER** button for 1 second (see ***Figure 3-4***, Pos. (7)) will start the 210 seconds tube cathode warm-up countdown to begin operation in the main ONLINE mode (see Section ***4 ONLINE MODE***);

In the other modes of the amplifier the buttons functions could differ from the ones described here; a description will be provided for every mode.

NOTICE

If a Serious Fault is detected while testing the basic amplifier signals after mains power has been supplied, a relevant signature record will be stored in the non-volatile memory of the amplifier (see Section ***8.7 Troubleshooting | Serious-Fault Protection Codes and Signatures***) and then you will get a protection code at the display bottom line for the next 20 seconds, for instance:

The regular screen will reappear after 20 seconds or earlier if the **ATT/+1s:TRI** button is pressed shortly. If you press the the **ATT/+1s:TRI** button longer than 1 second at this moment, you will enter the SIGNATURES LIST immediately. See Sections ***3.3.6)*** and ***8.7 Troubleshooting | Serious-Fault Protection Codes and Signatures*** for protection codes and signature records reading and decoding.

While there is an active protection code the amplifier could not be turned in ONLINE mode. On pressing the **POWER** button (see ***Figure 3-4***, Pos. (7)) the display would show the active protection code for another 20 seconds or until the **ATT/+1s:TRI** button is pressed again. In this state you cannot use the amplifier - except for changing antennas, transmission, and reception with the transceiver, or running and changing operator options in the 8 menus in OFFLINE mode (see Sections ***3.2*** and ***3.3*** below).

3.2. OFFLINE MODE

OFFLINE Mode Preview:

- In OFFLINE mode only the Control PCB is powered and the display is in operation;
- The tube heater and high voltage are turned off, and maximum cut-off bias is applied to the cathode;
- The basic amplifier signals will undergo an automatic test;
- Antenna 1 will be automatically selected and indicator **1** above the **ANT** button will light up (see ***Figure 3-5*** below);
- On the display top line, there is always (in ONLINE mode as well) a peak bar graph indicator for the output power; the scale range is from 0 to 1200 W - each box represents 60 W, and each vertical bar in a box represents 10 W;
- The transceiver can either receive or transmit; transceiver power is not amplified while transmitting however it is browsed on the bar graph indicator (levels below 20 W may be undetectable).

Figure 3-5 | Front panel - ANT and PREV/NEXT buttons

3.3. Operator Options in OFFLINE Mode

1) **NEXT** button
First pressing of the **NEXT** button (see ***Figure 3-5***, Pos. (1)) after the Home Screen (see ***Figure 3-5***) grants access to the first menu. You can select the **AUTO OPERATE N [Y]** operator option here:

The factory setting of the option is **[Y]**. It can only be changed from this menu. The **OPER** button toggles the position of the square brackets on **[Y]** or **[N]** in this menu.

When **[Y]** is selected **AUTO OPERATE** option implies automatic return to OPERATE mode, 4 seconds after triggering a Common Issues Protection (see Section ***7.2 Second Level of Protection - Common Issues Protection***).

When **[N]** is selected the OPERATE and STANDBY modes will never be changed automatically during ONLINE. Instead, you will have to use the **OPER** button to toggle between OPERATE and STANDBY modes (see Sections ***4.3 STANDBY Mode*** and ***4.4 OPERATE Mode*** below).

On selecting a next menu by **PREV**, **NEXT** buttons (see ***Figure 3-5***, Pos. (1)) or **ATT/+1s:TRI** - one level up, or by starting the cathode warm-up countdown by the **POWER** button the most recent **AUTO OPERATE** option selection is saved. If you do not press any button for 20 seconds the current selection will be saved and you will exit the menus.

2) Second pressing the **NEXT** button
On second pressing the **NEXT** button after the Home Screen the MAINS/GAIN menu is selected - **[Normal]**, **[High]**, or **[Low]**.

The bottom line of the display shows the current operator selection:

The selection can be made cyclically with the **OPER** button in this menu.

The **MAINS/GAIN** operator option is used to correct the default TRI-prompt center (see Section ***5.2 True Resistance Indicator (TRI Prompt) and Input Attenuator Control***). The aim is to compensate for the dominant mains voltage fluctuations by correcting the tube plate load resistance.

This same option allows you to change the default gain of the amplifier, for example when the exciter power is insufficient. The factory setting of this option is **[Normal]**. It cannot be changed during operation. It can only be changed in this menu in the way described below.

When **[High]** is selected, the TRI prompt center will shift toward the higher plate load resistance by approximately 17%. Adjusting the amplifier in the center of the TRI will increase the gain by about 0.7 dB, but at the expense of the maximum achievable undistorted output power (it will decrease by almost the same amount), and a grid-current protection may begin tripping. This choice is good to alleviate the tube temperature regime at frequent mains line overvoltages or when the exciter power is insufficient.

When **[Low]** is selected, the TRI indicator center will shift toward the lower plate load resistance by approximately 15%. Adjusting the amplifier in the center of the TRI will reduce the gain by about 0.7 dB, but this way the maximum achievable undistorted output power will increase by almost the same amount under low mains conditions, provided the exciter has sufficient drive power. However, in this way plate-current protection may begin tripping.

As shown above, the current selection made by the operator - **[Normal]**, **[High]**, or **[Low]** is indicated on the display bottom line. It can be toggled by the **OPER** button. The most recent selected state will be saved on selecting a next menu by the **PREV**, **NEXT** buttons or the **ATT/+1s:TRI** (one level up) or by starting the cathode warm-up countdown by the **POWER** button (see Section ***4.2 Cathode Warm-up Time***). If you do not press any button for 20 seconds the current state will be saved and exits the menus.

3) Third pressing the **NEXT** button
   On third pressing the **NEXT** button after the Home Screen (see ***Figure 3-5*** above), will be selected the third menu - to disable the unused antenna outputs:

In this menu you can state which of the three antenna outputs are actually connected to antennas (or other loads), regardless of which one is assigned to which bands. However, it is necessary to have at least one of the outputs connected. Otherwise, the default setting is output number 1.

If there is no antenna or load connected to any of the outputs, it is recommended to have that output disabled. So that during operation, using the **ANT** button the operator will select only antenna-connected outputs and the amplifier will be protected from potential damage of no-load transmission.

The factory setting of this option is that all three antenna outputs are enabled. The setting cannot be changed during operation. It can only be changed in this menu in the way described below.

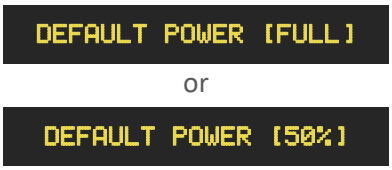
Enabling (**-En**, short for **Enable**) and disabling (**-Ds**, short for **Disable**) the antenna output currently in brackets is toggled by pressing the **OPER** button.

To enable or disable another antenna output the brackets should be moved to its number by short pressing the **ANT** button. The current selection **-En** / **-Ds** is toggled by the **OPER** button.
The cycle can be completed at any moment, when at least one out of the three available outputs is enabled. If an attempt is made to disable all 3 outputs, then there will be a 2s-warning message displayed at the bottom line of the display:

The combination of enabled and disabled antenna outputs is saved when you select a next menu by the **PREV**, **NEXT** buttons or the **ATT/+1s:TRI** (one level up) or by starting the cathode warm-up countdown by the **POWER** button.

If no buttons are pressed within 20 seconds the current selection will be saved. If there is no output selected, antenna 1 will be saved by default and the menu exits.

4) Fourth pressing the **NEXT** button
The fourth menu pressing the **NEXT** button after the Home Screen (see ***Figure 3-5*** above), is an operator option to choose full or reduced output power by default at amplifier start-up. The bottom line of the display shows the current selection:



The factory setting of the option is **[FULL]**. The selection of **[FULL]** or **[50%]** can be toggled by short pressing the **OPER** button.

When **[50%]** is selected the "50%" indication lights above the button **50%/+1s:DIG** and in OPERATE mode the tube will operate at a decreased plate voltage (by approx. 25% lower than rated). Thus, the temperature conditions for the tube will be greatly relieved without efficiency loss in lower-power operation.

If **[FULL]** is selected the "50%" indication light remains off and the tube will work at full power and at rated plate voltage in OPERATE mode.

The most recent selected state is saved on selecting a next menu by the **PREV**, **NEXT** buttons, the **ATT/+1s:TRI** (one level up) or by starting cathode warm-up period by the **POWER** button. If you do not press any button for 20 seconds the current state will be saved and exits the menus.

The output power level can be changed during operation, too. It can be toggled by short pressing of the **50%/+1s:DIG** button during 210 seconds cathode warm-up countdown or in STANDBY mode. The current selection is indicated by the 50% indicator. However, in OPERATE mode this button is unavailable and in order to change the output power level to **[FULL]** or **[50%]** you need to temporarily switch to STANDBY mode.

Selecting **[FULL]**, **[50%]** in the **DEFAULT POWER** menu sets only the default power value to be restored at each power-up and is not dependent on the **50%/+1s:DIG** button changes while in operation. The changes made by the button during OPERATE mode do not affect the default selection. Even after a temporary change by the **50%/+1s:DIG** button while in operation, power is set again to the selected default option (see Section ***3.3.4)*** above) and this is indicated by "50%" at each start-up.

The **DEFAULT POWER [FULL]**, **[50%]** option reminds the **50%/+1s:DIG** button action which performs the same change but while in OPERATE mode. Do not confuse or mix both of them with the **MAINS/GAIN - [Normal]**, **[High]**, **[Low]** option - it was described in Section ***3.3.2)***, but controls the tube load resistance in the TRI prompt center.

5) Firth pressing the **NEXT** button
The fifth menu after the Home Screen (see ***Figure 3-5 | Front panel - ANT and PREV/NEXT buttons***) is used to choose between linear or digital operation mode of the tube by default at start-up.

This choice changes the tube's idling current (with no signal) by changing the cathode bias voltage. The bottom line of the display shows the current selection:

or

Setting **[LINEAR]** or **[DIGITAL]** is toggled by the **OPER** button.

If the **[LINEAR]** option is selected, the "DIG" indicator will go dark and while in OPERATE mode the tube will operate in linear mode, suitable for amplifying single sideband signals - SSB.

When the **[DIGITAL]** option is selected, "DIG" indication lights above the the **50%/+1s:DIG** button and in OPERATE mode the tube will operate with zero idling current. This increases power efficiency and the temperature conditions for the amplifier significantly improve in prolonged operation in digital modes.

The factory setting of this option is **[LINEAR]** ("DIG" indication is dark) - for linear tube operation, suitable to amplify for instance single sideband signals - SSB.

The most recent selected state is saved upon selecting a next menu by the **PREV**, **NEXT** buttons, the **ATT/+1s:TRI** (one level up) or by starting cathode warm-up period by the **POWER** button. If you do not press any button for 20 seconds the current selection will be saved and you will leave the menus.

Besides this menu, **[LINEAR]** or **[DIGITAL]** tube mode can be changed also during the 210 seconds cathode warm-up countdown or while in STANDBY mode, by pressing the **50%/+1s:DIG** button for 1 second or longer. The current selection is indicated by the "DIG" indicator. However, in OPERATE mode this button is unavailable and to change the "DIG" indication, you need to temporarily shift to STANDBY mode.

The selection of **[LINEAR]** or **[DIGITAL]** option in the **DEF. MODE** menu only sets the default operating mode, which will be restored at every start-up of the amplifier. The saved default selection can only be changed in the **DEF. MODE** menu and is not dependent on changes with the **50%/+1s:DIG** button during ONLINE mode.

Even after being changed while in operation by the **50%/+1s:DIG** button the mode will be setup as saved in the described menu and will be indicated by DIG at every powering on of the amplifier. The **50%/+1s:DIG** button does not change your default choice.

To avoid harsh non-linear IMD splatters, the "DIG" indicator should be dark when operating in SSB mode!

6) Sixth pressing the **NEXT** button
The sixth menu provides reading the SIGNATURES LIST.

For each one of the 8 most recently triggered Serious Fault Protection trips (also known as a Hard Fault), when the amplifier has performed an emergency stop, a recording will be made to the controller non-volatile memory. The data stored is called a SIGNATURE. It can be read from non-volatile memory at any time later. Starting from the Home Screen (see ***Figure 3-5 | Front panel - ANT and PREV/NEXT buttons***), six pressings of the **NEXT** button in succession will display:

If there are no records in the list, the text

is immediately displayed. You can exit by pressing the **ATT/+1s:TRI** button shortly. Press once more again to exit the menu.

If the list is not empty, please see Section ***8.7.2 Reading and Interpreting Serious-Fault Protection Signatures*** for details about signatures and how to read, decode and interpret the stored records.

7) Seventh pressing the **NEXT** button
The seventh menu is intended for setting all operator options in the "factory" state (like in a new amplifier). Starting from the Home Screen (see ***Figure 3-5*** above), seven pressings of the **NEXT** button in succession will display.

The **OPER** button toggles the selection by moving the square brackets over **[Y]** or **[N]** however the selection is not immediately executed. Pressing the **PREV** or **NEXT** button will execute the selection and will open respectively the previous or the next options menu after that.

When exiting the menu with **[N]** selected or when starting the cathode warm-up period using the **POWER** button with **[N]** selected, or if the buttons are not pressed for more than 20 seconds (any letter in brackets), implies **[N]** selected. Accordingly, the operator options are not reset to the "factory" state, and you will exit the options menus.

The operator options are returned to the "factory " state only when selecting **[Y]** with the **OPER** button and exiting the menu immediately, or when starting the cathode warm-up period with the **POWER** button right after having selected **[Y]**, but before 20 seconds have elapsed since a last button touch.

In this case, the screen will display for 1 second:

The operator options are then being set in their factory-default state as follows:

AUTO OPERATE [Y]
MAINS/GAIN [Normal]
Ant: 1,2,3 (all three outputs enabled)
DEFAULT POWER [FULL]
DEF. MODE [LINEAR]

8) Eighth pressing the **NEXT** button
The final 8th menu indicates the tube working hours. The screen displays the currently-accumulated number of hours the tube has been operated in ONLINE mode, for instance:

The count only includes the time in amplifier ONLINE mode, as the tube heater is only "ON" during that time. Time in OFFLINE mode is not included, as all tube currents are zero in this mode.

You can leave the menu by pressing any of the **ATT/+1s:TRI** button, the **PREV**, **NEXT** buttons or automatically when no button was pressed in 20 seconds, or by starting the cathode warm-up period by the **POWER** button.

3.4. Elimination of Electromagnetic Compatibility (EMC) Problems

If you use an amplifier for the first time in your shack, you may need to make some improvements in the configuration. It is possible you might experience tingling from metallic objects due to the stronger radiated RF field. It could affect the operation of your station or systems outside, if they are too sensitive - typical examples are the microphone, CW keyer, computer keyboard or mouse, as well as TV receivers, Hi-Fi devices, intercom or telephone setups and others.

For instance, induction of RF currents into the microphone, CW keyer or computer keyboard, may lead to distortion in the modulation peaks or relaxation oscillation in SSB mode, "sticking" or breaking off the dots or dashes from a Morse keyer, or garbling computer screen images.

For the elimination of such problems, we recommend that you take the following general measures:

- Minimize the radiation from the antenna feed lines by reducing the common mode currents in them, improve the balance of antennas and feedlines;
- In case you use asymmetric antennas (GP and similar) install as many radials as practical (use a well-developed counterpoise system);
- Add current chokes on the coaxial feeders;

- Place the radiating elements of antennas as far away as possible (also by height) from the premises, where the affected devices are located; in this sense, asymmetrical antennas without an intended feeder (like Long Wire, Windom, and similar) may cause more interference because their radiating element begins immediately from the shack (part of it is the feeder itself);
- If the use of asymmetrical directly fed "wire" antennas is inevitable, use mainly half wave or half wave multiple lengths: they have a high input impedance, operate respectively with a small current at the feed point, and in the grounding of the shack; thus you can reduce the strength of the disturbing RF fields more than 10 times (at the same radiated power) compared to the case with quarter-wave and odd-multiple to quarter-wave antennas of same class - you should avoid them because they have a low input impedance and operate with a high RF current in the grounding system and in the power supply network respectively, i.e. they create stronger disturbances (RFI);
- Improve the RF grounding system: use the shortest and widest practical metal strips for the connections to ground and between the different gear in the shack; connect one or more counterpoises (sized for the problematic band) to the feeder shield at the point, where it enters the building, and the same point - with the possibly shortest and widest connections - to the grounding system: this is a very efficient measure, in particular if the shack is located on a high floor far from the real earth ground;
- To reduce the RF impedance of the grounding connections, sheet-metal stripes are to be preferred to the multistranded flexible braids;
- Thread ferrite beads (rings) or snap-in ferrites with medium permeability (800-4000) over the power cord, over coaxial feeder, and the signal cables leading to the affected devices (TV, etc.); besides the size, consider the frequency range in which the offered materials are effective - normally they are optimized for suppression of interferences on HF (with larger permeability), with medium permeability for HF-VHF or with low permeability - only the VHF range; the latter are ineffective for HF;
- Whenever possible use shielded cables and ground their shields at both ends;
- The addition of even quite simple low pass L/C or R/C filters directly to the disturbed inputs or outputs of the devices is very effective, provided it is practically applicable.

Last but not least, bear in mind that the benefit of the above measures is two-fold. Firstly - they reduce the interferences from your transmissions to the ambient environment and secondly - they reduce the background noise floor for your reception.

Practically, with no great efforts, implementing the above measures, you can reduce the receive background noise floor with one or more S-units across the different bands. This will allow you not to miss weaker stations, which will hear you because of your increased transmission power using the amplifier. And third, but very important: the EMI environment at your station will become safer for you and those close to you.

4. ONLINE MODE

4.1. Entering ONLINE Mode

You can switch the amplifier from OFFLINE (see Sections ***3.2*** and ***3.3***) to ONLINE mode by pressing and holding for 1 second the **POWER** button on the front panel (see ***Figure 3-4 | Front panel - Display, buttons and Indicator lights***, Pos. (6)).

Initially the tube-cooling blower starts at a higher speed (for a reliable startup) and in 1 second slows down to the rated speed. Then begins a period of 210 seconds tube cathode warm-up countdown and the time to readiness for operation is displayed.

The tube heater is powered by a DC/DC converter. Startup current is limited to 2 A in the beginning and then decreases towards the rated value in less than a minute. During this initial warm-up period, the heater voltage gradually increases and stops, reaching the nominal value of 13.5 ± 0.6 V, where it stabilizes.

Thereafter the heater voltage is not affected by the usual mains voltage fluctuations during operation, nor by toggling receive/transmit mode even though the mains supply might appear "soft". Together with the soft start, precisely regulated heater voltage extends the expected service life of the tube filament and activating cathode coating.

4.2. Cathode Warm-up Time

During the 210 seconds countdown period the amplifier can be operated as follows:

- Using the **PREV** and **NEXT** buttons 18 information screens can be toggled on the display (see Section ***6 INFORMATION SCREENS***); for example, you can monitor the process of gradual increase in the heater voltage, the exhaust cooling-air flow temperature, time left to readiness for operation, etc.
- You can change enabled antennas (see Section ***3.3.3)***) pressing the **ANT** button shortly; the selected antenna number is indicated by 1, 2 or 3 lights above the button; if at **ANT** button press a request to transmit is present at **KEY IN** input or there is HF power at the output the three indicator lights 1, 2 and 3 above the button flash 3 times and the change is rejected;
- Transceiver receiving and transmitting continue with the antenna selected in OFFLINE mode;
- A short press of **50%/+1s:DIG** button toggles the operator option of reduced or full power operation; the current state is indicated by the "50%" light above the button and the effect will take place after switching to the OPERATE mode;
- A long press of the same **50%/+1s:DIG** button toggles DIG operator option of digital or linear modes of operation; the current state is monitored by "DIG" light above the button and the effect will take place after switching to the OPERATE mode;
- The **OPER** button has no function during countdown.

If during the cathode warm-up period a "Serious Fault Protection" is triggered, the warm-up process is interrupted and the amplifier returns to the OFFLINE mode in an emergency with a protection code displayed as described in Section ***7.3 Third Level of Protection - Serious Fault Protection***; if the **ATT/+1s:TRI** button is now pressed and held for more than 1 second, the stored signature can be read immediately; if the **ATT/+1s:TRI** button is pressed shortly instead, the protection code clears and the OFFLINE mode Home Screen is displayed (see ***Figure 3-5 | Front panel - ANT and PREV/NEXT buttons***).

The signature records of the 8 most recently triggered Serious Fault Protection trips can be read always later in the OFFLINE mode as described in Section ***3.3.6)***.

4.3. STANDBY Mode

After normal completion of the 210 seconds warm-up countdown the tube cathode is ready for operation. The display shows:

and the amplifier enters STANDBY mode, or right after that continues in OPERATE mode if AUTO OPERATE operator option has been enabled as described in Section ***3.3.1***).

When the AUTO OPERATE option is disabled the amplifier enters and stays in STANDBY mode after cathode warm-up period has been completed. In this case the indicator above the **OPER** button does not light and the amplifier can be operated as follows:

- Using the **PREV** and **NEXT** buttons the 18 information screens can be displayed (see Section ***6 INFORMATION SCREENS***);
- A short **50%/+1s:DIG** button press toggles the operator option "50%" of reduced power operation; the state is monitored by the "50%" light above the button; this applies after switching to OPERATE mode;
- A long press of the same button toggles DIG operator option of DIGITAL or LINEAR modes of operation; the state is monitored by "DIG" light above the button, which goes on for digital modes and off for linear modes; this applies after switching to OPERATE mode;
- A short **ANT** button press changes antennas enabled in OFFLINE mode (see Section ***3.3.3)***); the number of the selected antenna is indicated by 1, 2 or 3 lights above the button; if at **ANT** button press a request to transmit is present at **KEY IN** input, or if there is HF power at the output, the three antenna indicator lights 1, 2 and 3 above the button flash 3 times and the change is rejected;
- Transceiver receive and transmit may continue with the selected antenna in OFFLINE mode;
- Using the **ATT/+1s:TRI** button the input controllable attenuator 6 dB can be toggled in and out without changing the screen - **ATT** indicator goes on, or off above the button; in this way the operator can get the amplifier ready for OPERATE mode - with or without the attenuator;
- The **OPER** button toggles between OPERATE and STANDBY modes; in OPERATE mode the indicator above the button is on and in STANDBY mode it is off.

When the Auto Operate option is enabled the amplifier goes in OPERATE mode and the indicator above the **OPER** button lights on right after completing the cathode warm-up period.

4.4. OPERATE Mode

1) When the TX indicator above the **OPER** button is dark, and both the PTT switch and CW key are open (Key Up), the amplifier is in the receive state (OPERATE/RX). During OPERATE/RX state the amplifier can be operated as follows:

   - A short **ANT** button press changes antennas enabled in OFFLINE mode (see Section ***3.3.3)***); the selected antenna number is indicated by lights 1, 2 and 3 above the button; if at an **ANT** button press a transmit request is present at the **KEY IN** input, or if there is HF power at the output, the three antenna indicator lights 1, 2 and 3 above the button flash 3 times and the antenna change is rejected;
   - The transceiver can receive with the selected antenna; on pressing the CW key or a PTT switch closure the amplifier goes active and switches to transmit (TX) mode - the TX indicator above the OPER button lights up (see Section ***4.4.2)*** below);
   - Using the **PREV** and/or **NEXT** buttons the 18 information screens can be changed (see Section ***6 INFORMATION SCREENS***);
   - A short **ATT/+1s:TRI** button press toggles the input controllable attenuator 6 dB in and out without changing the screen; the state is monitored by ATT light above the button;
   - Pressing the **ATT/+1s:TRI** button for longer than 1 second switches the input controllable attenuator 6 dB in, ATT indication lights on, and invokes the TRI prompt screen (see Section ***5.2 True Resistance Indicator (TRI Prompt) and Input Attenuator Control***); pressing the button again does not change anything;
   - A short **OPER** button press switches manually from OPERATE mode to STANDBY mode; the light above the **OPER** button goes off and AUTO OPERATE function is temporarily suppressed, and the amplifier stays in STANDBY mode; To return to the OPERATE mode you should press the **OPER** button again; then the AUTO OPERATE function is restored if it had been previously enabled;
   - The **50%/+1s:DIG** button has no function in OPERATE mode; if pressed (briefly or for longer than 1 second) a message is displayed:

2) When you either close the PTT switch or press the CW key (Key Down) during the OPERATE mode, the amplifier goes into transmit state (OPERATE/TX) and the TX indicator above the **OPER** button lights up. During the OPERATE/TX state the amplifier can be operated as follows:

   - Using the **PREV** and/or **NEXT** buttons the 18 information screens can be displayed and toggled (see Section ***6 INFORMATION SCREENS***);
   - You can switch in the input controllable attenuator 6 dB by pressing the **ATT/+1s:TRI** button longer than 1 second; in this case the "ATT" indication lights on and the TRI prompt is displayed (see Section ***5.2 True Resistance Indicator (TRI Prompt) and Input Attenuator Control***); repeated button press does not change anything;
   - The **ANT** button is unavailable in transmit state (OPERATE/TX); should you press it, the indicator lights 1, 2 and 3 above the button flash 3 times and the change is rejected;

- The **OPER** button is unavailable during transmit (OPERATE/TX), too; should you press it, the indicator light above the button flashes 3 times and the action is rejected; to switch the amplifier back to STANDBY mode you have to first release both the CW key and PTT switch in order to shift to receive state and then to press the **OPER** button;
- The **50%/+1s:DIG** button has no function in transmit state (OPERATE/TX); if **50%/+1s:DIG** button is pressed a message is displayed:

5. TUNE-UP PROCEDURE

5.1. Pre-tuning Information

Tune-up can be performed in OPERATE mode only.

If the AUTO OPERATE option has not been previously enabled in Section ***3.3.1)***, press the **OPER** button to see the light go on above it.

Tuning up the amplifier is a procedure of matching the transformation of the complex impedance of the antenna currently in use to the optimal plate load resistance.

The procedure adjusts the impedance transformation of the amplifier output circuit, which is connected between the antenna and the tube plate. Procedure aim is to load the tube with an optimal resistance that provides a favorable energy mode of tube operation with acceptable nonlinear distortions (IMD).

Antenna matching is greatly simplified by the True Resistance Indicator (TRI) for precise adjustment of the plate-load impedance real part. It is a powerful tuning aid, that helps the operator to quickly and precisely match the antenna impedance to the optimum tube load resistance (see Section ***5.2 True Resistance Indicator (TRI Prompt) and Input Attenuator Control*** below).

The presence of reflected antenna power and the SWR indication - OUT RFL POWER and ANTENNA SWR - depend on the antenna impedance, and not on the amplifier tune-up quality.

If the antenna impedance is other than purely active 50 Ω the readout of OUT RFL POWER information screen will always show a reflected power presence even at a perfect amplifier tune-up. Although reflected power is present however, a good tune-up will provide a safe tube operation at maximum output power and minimum distortion.

The bar graph indicator of peak FORWARD POWER (in the top line of the display) shows the **incident** power to the antenna - OUT FWD POWER. This is **the sum** of the effective OUTPUT POWER **plus** the power reflected from the antenna - OUT RFL POWER:

OUT FWD POWER = OUTPUT POWER + OUT RFL POWER

For above reason the full-scale range of the FORWARD POWER bar graph indicator in the top line of the display is 1200 W even though the amplifier rated output power is 1000 W. The effective power is what the bars show, less the reflected power that does not reach the antenna. If the antenna SWR is high, this difference can also be noted by the information screens (see Section ***6 INFORMATION SCREENS***):

OUTPUT POWER = OUT FWD POWER - OUT RFL POWER.

For example, when the bars show 1100 W and reflected power is OUT RFL POWER = 240 W (at antenna SWR of 2.75) the useful power in the antenna is equal to their difference:

OUTPUT POWER = 1100 W – 240 W = 860 W.

At proper TRI tuning (centered), the amplifier operates fine and the tube is in its optimal regime while this condition is true:

OUT RFL POWER < 250 W

If the reflected power goes over 250 W (at a high antenna SWR) a warning message

starts flashing on the display but the amplifier is in OPERATE mode and continues to operate. However, at a reflected power over 300 W, the Common Issues Protection is triggered (see Section ***7.2 Second Level of Protection - Common Issues Protection***) displaying a message:

and the amplifier returns to the STANDBY mode. In order to continue transmitting the operator should reduce the drive power or better - to improve the antenna SWR when possible.

NOTICE

At an extremely high SWR (major mismatch or missing antenna) the forward and the reflected power become almost same and the output power (their difference) is virtually zero. That is an extremely dangerous regime for the amplifier that should not be allowed.

NOTICE

The amplifier's output tank provides matching of antennas with SWR up to 3.
However, the maximum reflected power should never exceed 300 W at that.

Matching could be achieved for some antennas and frequencies for SWR even higher than 3 but this is not warranted. Whenever such a tuning is possible the drive power should be reduced in order to avoid triggering Common Issues Protection (see Section ***7.2***) at a reflected power over 300 W, as well as to prevent damage of the amplifier output circuit.

NOTICE

ACOM does not recommend using a coaxial cable at SWR above 3 in HF, especially in the 10- and 6-meter bands. At these high SWR values there is a risk of a permanent damage in the coaxial cable or in the antenna switch due to increased HF voltages and currents.

When changing frequency bands or moving between CW and SSB segments even in the same band you have to tune-up the amplifier again. You have to tune-up at each antenna change even in the same band, as well as at regular intervals even when the band or antenna have not been changed lately. Major changes in the antenna environment - such as rain, snow, ice, added or moved large metal objects, wires near the antenna, etc. - may change the antenna impedance and significantly change its tuning.

If using multiple antennas per band you have to select the appropriate antenna BEFORE the next tuning process. You have to tune-up after selecting a different antenna in the same band because their impedances may be much different (unless both have a perfect SWR, e.g. below 1.2).

NOTICE

Never turn the **BAND** knob (see ***Figure 5-1*** below) during amplifier transmissions!

A "hot switch" like that can permanently damage the amplifier output-tank band switch (not covered by the warranty!).

NOTICE

When tuning up do not apply drive power for more than 3 minutes continuously. Alternate the adjustment periods with 1–2-minute breaks when cooling down the tube is needed.

Figure 5-1 | Front panel - Knobs and buttons

5.2. True Resistance Indicator (TRI Prompt) and Input Attenuator Control

The True Resistance Indicator, TRI (see ***Figure 5-2*** below) is used to quickly and accurately match the antenna complex impedance to the optimum tube load resistance. There is a scale for the real part of the tube plate-load impedance, as well as a pointer showing the load resistance achieved during adjustment compared to the optimum one.

1) You can invoke the TRI prompt screen in two ways:
   - As one of the 18 information screens (see Section ***6 INFORMATION SCREENS***) by pressing the **PREV** and/or the **NEXT** button successively in any amplifier mode:

Figure 5-2 | TRI (True Resistance Indicator) prompt screen

   - During receive (RX) state in OPERATE/RX mode, by pressing the **ATT/+1s:TRI** button for longer than 1 second; Please note that this second way not only you invoke the TRI prompt screen but you also switch in the input controllable attenuator 6 dB of the amplifier so the ATT indicator above the button lights up; a short or a long next button press (even repeatedly) does not change anything in this mode.

NOTICE

Before starting a new tune-up procedure, you should reduce transceiver power to not more than 20 W continuous carrier; otherwise, a protection can be triggered unless the input controllable attenuator 6 dB is in, or when you are very close to the correct tuning.

To avoid unnecessary operations of reducing the drive power before tuning and then increasing it for operation, you can temporarily switch in and out the amplifier input controllable attenuator 6 dB. At full power, only fine touchup of a finished tuning is allowed.

2) During receive (RX) state in OPERATE/RX mode, the input controllable attenuator 6 dB can be toggled in and out by a short press of the **ATT/+1s:TRI** button; the in/out state is shown on the ATT light above the button. This way the display does not change and the TRI prompt indicator is not invoked automatically.

3) During transmit (TX) state in OPERATE/TX mode, a long **ATT/+1s:TRI** button press displays the prompt indicator but the state of the input controllable attenuator 6 dB does not change; a short or a repeated long button press does not change anything while transmitting.

5.3. Step by Step Tune-up Instructions

ACOM's original TRI-prompt tuning method (see Section ***5.2*** above) estimates the plate-load resistance based on RF linear measurands, independently of tube regime during tuning. The method is therefore not based on tracking grid dc-current while gradually increasing drive, like many of older grounded-grid amplifiers were tuned. The TRI benefit is that once tuned up at the center according to the instructions, you cannot go wrong when increasing or reducing the drive power later on - the capacitor settings would not need re-adjustment.

The Control PCB continuously monitors the tube grid and plate dc currents both during setup and during operation after that. Follow the tune-up instructions and do not worry - the appropriate protection will trip in an event of a grid or plate overload.

Tune-up can be performed in OPERATE mode only.

If the AUTO OPERATE option has not been previously enabled in Section ***3.3.1)***, press the **OPER** button to see the light go on above it.

Tuning the amplifier output circuit is to be completed as follows:

1) First stop transmitting and enter the Receive (RX) mode.

2) Select the correct antenna number 1...3 and set the **BAND** switch (see ***Figure 5-1*** above) if needed for the desired band position 1 to 7.

NOTICE

Never turn the **BAND** knob during amplifier transmissions!

A "hot switch" like that can permanently damage the amplifier output-tank band switch (not covered by the warranty!).

3) Refer to ***Table 5-1 | Approximate tuning presets for a 50 Ω load*** below and set the two capacitors **TUNE** and **LOAD** (see ***Figure 5-1 | Front panel - Knobs and buttons*** above) to the specified preset dial positions for an approximate tuning:

BAND Knob Position	Band, MHz	TUNE Knob Dial	LOAD Knob Dial
1	1.800 - 2.000	58 - 23	86 - 44
2	3.500 - 4.000	68 - 36	75 - 41
	5.250 - 5.450	13 - 7	18 - 13
3	7.000 - 7.200	37 - 29	70 - 54
	10.100 - 10.150	2 - 2	29 - 23
4	14.000 - 14.350	54 - 38	33 - 25
5	18.000 - 18.168	75 - 59	69 - 57
	21.000 - 21.450	29 - 19	48 - 38
6	24.890 - 24.990	83 - 67	59 - 49
	28.000 - 29.700	43 - 22	47 - 34
7	50.000 - 54.000	29 - 9	24 - 16

Table 5-1 | Approximate tuning presets for a 50 Ω load

4) Switch the input controllable attenuator 6 dB in (see ***Figure 5-1***, Pos. (ATT)), or decrease transceiver power below 20 W (see Section ***5.2.2)*** above).

5) Before transmitting listen and choose an unused (free) frequency near the center of the desired band on which you will tune the amplifier.

6) Apply continuous carrier drive power (CW key down, RTTY or FM mode) on the frequency and follow the next six steps:
   - Observing the FORWARD POWER bar graph indicator in the top line of the display gently turn the **TUNE** capacitor to achieve maximum output power;
   - Observing the prompt indicator for TRI setup (Load Cap) in the bottom line of the display gently turn the **LOAD** capacitor to move and center the triangle mark "▼" on the "!" sign;
   - If the input controllable attenuator 6 dB is in, switch temporarily to receive (RX) then switch the input controllable attenuator 6 dB out by a short **ATT/+1s:TRI** button press;
   - Apply drive again and increase the power slowly until you reach the rated output power by FORWARD POWER indicator;
   - Try to touchup the two **TUNE** and **LOAD** capacitors in fine steps following the rules above but at rated power now;
   - Always complete adjustments by fine-tuning the **TUNE** capacitor to the FORWARD POWER indicator maximum.

We suggest you log the TUNE and LOAD dials in a table, similar to ***Table 5-1***, for the used antenna.

NOTICE

If at any time the amplifier does not operate as described, stop transmission immediately and eliminate the cause of the problem before to continue.

An arrow sign displayed at either edge of the TRI prompt indicator means that currently the **LOAD** capacitor is too far from the correct position. Turn it to the pointed direction until the known triangle mark appears in the indicator area. Follow its movement.

No marker▼: Use TUNE knob for max. P to get any marker on the bottom scale.

Marker▼ is a far left: Turn LOAD knob to right until marker inside the bottom scale.

Marker▼ is a far right: Turn LOAD knob to left until marker inside the bottom scale.

Marker▼ inside: Turn LOAD knob slightly left to center the marker over the "!" mark.

LOAD is tuned: Turn fine TUNE knob to peak the Forward Power on the top scale.

Figure 5-3 | Using the TRI prompt (True Resistance Indicator) for tuning

The triangle mark "▼" might not appear until the transceiver drives at least 5 W excitation power or until at least 20 W output power appears.

If the tuning is unsuccessful check the **BAND** switch position, check if the correct antenna output is selected (1 ... 3), check if the correct antenna is connected there. Then return to the STANDBY mode and verify that the SWR of the connected load is below 3 at the same frequency using low power only. The reflected power should be less than 1/4 of the forward power for SWR below 3.

NOTICE

If the load SWR is good at low power, but it creeps or jumps when increasing power, check the output RF connector, coaxial cable, antenna switch, transmission line and the antenna itself, especially if it uses a balun transformer or tuned circuits. Do not continue tuning under these conditions, as such instability can cause serious damage on high modulation peaks during operation, and not only in the amplifier. Select another antenna or change the frequency band.

5.4. Optional Information and Tuning Hints

Thanks to ACOM's original system of TRI prompt, adjusting the **TUNE** capacitor practically does not change the **LOAD** setting. This greatly reduces the number of iterations between the two knobs and makes the tune-up procedure easier and shorter.

The **TUNE** capacitor tunes the plate output tank in resonance (to maximum output power). This capacitor virtually has no influence (or it is insignificant) on the coupling between the plate and antenna circuits, thus also on the TRI indicator i.e. the **TUNE** adjustment practically does not affect the **LOAD** tuning.

The **LOAD** capacitor controls the coupling between the plate tank and the antenna. It adjusts the antenna-resistance part introduced into the plate output circuit, and thus - its working (loaded) Q-factor. In this way, the LOAD capacitor adjusts the tube plate load resonant resistance.

However, the **LOAD** capacitor adjustment changes the plate tank resonance frequency. To restore the resonance frequency, it is always needed to fine tune the **TUNE** capacitor to maximum output power after adjusting the **LOAD** capacitor. The antenna-resistance part introduced into the plate tank does not change with **TUNE** fine adjustment, therefore the **LOAD** capacitor setting remains unchanged and there is no need to adjust it after **TUNE** touchup.

The tube plate-load resistance is visually monitored on the display bottom line by the TRI prompt indicator (Load Cap) during the **LOAD** capacitor adjustment (see ***Figure 5-3 | Using the TRI prompt (True Resistance Indicator) for tuning***).

The tube load resistance increases to the right and decreases to the left of the indicator center. Higher load resistance increases gain but limits output power - the grid current jumps abruptly. Lower load resistance does just the opposite: It decreases gain and allows for a higher output power (however, at the expense of higher plate current and heat as well as more drive power).

The TRI scale center presents the recommended optimal tube load resistance. It generally provides an optimal efficiency, gain by design and rated amplifier output power at the allowed IMD (intermodulation distortion). In most real-life cases, it is optimal to adjust the **LOAD** capacitor in the center of the TRI scale.

If the tuning marker is set to the right of the TRI center, gain will be higher but the achievable undistorted power will be lower and the permissible grid current might be easily exceeded.

Setting an offset to the right of the TRI center could be useful if there is not enough drive power available from the transceiver or to improve efficiency at either lower output power or higher mains voltage.

The goal might be less heat dissipation in high temperature conditions in digital operation modes, e.g. RTTY, FT8, etc. This setting offers a double benefit: the dissipated heat is decreased not only in the amplifier but in the transceiver as well because of the lower drive power.

Tuning the marker to the left of the TRI center will result in less power gain and higher output power might be achievable.

Of course, higher output power will demand higher drive power and more heat in transceiver as well. There will be higher plate current and more heat resulting in shorter tube life because of exhausting its cathode.

You could use off-center tuning to compensate for moderate variations in the mains voltage. To maintain decent efficiency and tube regime at higher mains voltage tune the amplifier to the right of TRI center, or tune to the left when the mains voltage is lower than what is set by the voltage selector.

NOTICE

For frequent mains voltage variations above ±5% please see Section ***2.3 Line Voltage Selection*** and contact your dealer to change the Mains Voltage Selector setting inside the amplifier.

6. INFORMATION SCREENS

In ONLINE mode, 18 information screens are available for selection on the amplifier display. Beside the countdown during cathode warm-up period (see Section ***4.2 Cathode Warm-up Time***) and the TRI prompt for amplifier tune-up (see Section ***5.2 True Resistance Indicator (TRI Prompt) and Input Attenuator Control***), the main technical parameters and operational status of the amplifier can be monitored by 18 more information screens as shown below.

Information screens can be toggled in a closed loop sequence by the **PREV** and **NEXT** buttons while the amplifier is warming up, while operated in STANDBY or in OPERATE mode, or being switched from receive (OPERATE/RX) to transmit (OPERATE/TX) states and vice versa, with no influence on amplifier operation by the measurement process.

Table 6-1 below shows 18 amplifier measurands available for digital indication on the display:

Amplifier measurands	
HEATER VOLTAGE	CATHODE BIAS
GRID CURRENT	PLATE CURRENT
HIGH VOLTAGE	DC POWER INPUT
PLATE RF PEAK	OUT FWD POWER
OUT RFL POWER	HEAT LOSSES
ANTENNA SWR	INP FWD POWER
INP RFL POWER	DRIVE RF POWER
INPUT SWR	RF POWER GAIN
PLATE EFFICIENCY	EXH. AIR

Table 6-1 | Digitally displayed amplifier measurands

Selection is made by the **PREV** and **NEXT** buttons. You may change the information screens in a closed loop, while the amplifier is used and controlled in OPERATE and STANDBY modes, changes transmit and receive, without any influence by the measurement process.

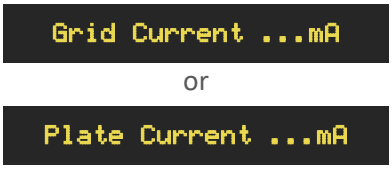
7. AUTO-PROTECTION SYSTEM

Whenever abnormal conditions are detected during operation, the amplifier will assess the risk and may apply three different levels of protection according to the nature of the problem. These are:

- OPER Light Flashing,
- Common Issues Protection trip, also called "Soft Faults", and
- Serious Fault Protection trip, also known as "Hard Fault".

7.1. First Level of Protection - OPER Light Flashing

The first, lowest level of protection is flashing light above the **OPER** button along with a warning text message (Notice) on the display - for example:



and similar.

Table 7-1 below shows the measurands thresholds while in OPERATE mode triggering the first level of protection - flashing light above the **OPER** button:

Measurand:	Warning threshold:
Plate Current	> 592 mA
Grid Current	> 55 mA
Reflected Power	> 250 W
Drive Power	> 90 W
RF Power Gain	< 9 dB

Table 7-1 | OPER Light Flashing Thresholds

Generally, a blinking OPER indicator does not interrupt the transmission, but the indicated measurand is close to the trip threshold of a next higher protection level. Therefore, it is recommended to correct the regime in good time, for example, slightly reduce the drive power, fine-tune the amplifier (see Section ***5.3 Step by Step Tune-up Instructions***), use a better-SWR antenna, etc.

7.2. Second Level of Protection - Common Issues Protection

When any measurand goes outside the permissible limits the second (higher) level of protection is activated - Common Issues Protection (also called “Soft Faults”). The amplifier automatically breaks transmission and returns to STANDBY mode. A message is displayed about the measurand which triggered the protection.

The cause of Common Issues Protection (Soft Fault) is most often outside the amplifier, and the operator can fix it immediately, without a long interruption in operation.

Messages for triggered Common Issues Protection are marked by a pair of asterisks at both line edges, for example:

or

The message stays on the display until the operator presses any key or until the AUTO OPERATE function automatically returns the amplifier to OPERATE mode. While the Auto Operate function is active, Common Issues Protection may enter an activation loop again and again until the cause of triggering is removed.

Table 7-2 below shows the measurands emergency thresholds while in OPERATE mode that will trigger the second level - Common Issues (Soft Fault) Protection:

Measurand:	Protection threshold:
** Plate Current **	> 648 mA
** Plate Current **	> 600 mA for 2 s
** Grid Current **	> 63 mA
** Grid Current **	> 60 mA for 2 s
** Overheating **	> 140 °C
** Reflected Power **	> 300 W
** Drive Power **	> 100 W

Table 7-2 | Common Issues (Soft Fault) Protection Thresholds

To continue operation after the Common Issues Protection (Soft Fault) has triggered, it is usually enough to correct the regime without stopping operation. E.g. slightly decreasing drive power, fine tuning the amplifier, or using an antenna with a better SWR. If necessary, the operator may correct the mains voltage, remove any obstacle for the cooling air, etc.

The operator is advised to get used to timely respond to the first protection level - warning flashing of the OPER indicator - in order to avoid triggering this or the next and highest, third level of protection.

7.3. Third Level of Protection - Serious Fault Protection

The third, most harsh and severe level is the Serious Fault Protection (also known as Hard Fault). This is an automatic turn-off of the tube power supply and return to the OFFLINE mode in order to limit possible damage to the amplifier or associated equipment. Then a protection code is shown on the display (see section ***8.7.1 Serious-Fault Protection Codes***).

Table 7-3 below shows the emergency thresholds of the controller measurands and variables that will trigger a Serious Faults Protection in various amplifier operation states and cases:

Measurand:	Protection threshold:
Plate Current	If Ip > 800 mA at any time
Plate Current	If Ip > 20 mA during STANDBY
Grid Current	If Ig > 63 mA during OPERATE
Grid Current	If Ig > 1.25 mA during STANDBY
Output Rel Open	If relay is open during TX
Output Rel Closed	If relay is closed during RX
Arc Fault	When RF arc is detected
Driving RF	When RF detected on Cath. During RX
Cathode Bias	If Vb < 17.3 V during STANDBY or RX
HV	If HV < 2208 V at full pwr selected
HV	If HV < 1648 V at 50% pwr selected
HV	If HV > 3424 V at any time
Heater Voltage	If Vhtr < 12.8 V
Heater Voltage	If Vhtr > 14.24 V
Exhaust Air Temp.	If Temp > 140 °C
Band Sw. Danger	When bad position detected
Plate RF Peak	If RF Voltage > 2540 Vpk
Low Air Flow	If Blower is not running
Forward Power	If > FWD RF > 200 W during STANDBY
Reflected Power	If RLF RF > 200 W during STANDBY

Table 7-3 | Serious Fault Protection Thresholds

If it is not clear why a Serious Fault Protection has been triggered you may try to restart the amplifier in order to check whether it is not an accidental condition. If the problem is persistent, refer to Section ***8.7 Troubleshooting | Serious-Fault Protection Codes and Signatures***.

If assistance is needed, you should contact your local dealer first (see Section ***1.9 User Technical Support***).

8. MAINTENANCE

⚠ DANGER

Both the mains voltage and the plate voltage (up to 3000 V) inside the amplifier are LETHAL!

For your safety, pull the amplifier power plug out of the mains wall outlet and WAIT AT LEAST 30 minutes EACH TIME BEFORE you remove the cover of the amplifier. Do not touch any part inside while the amplifier is open because some residual voltages may still be present.

If no indicator glows upon switching the amplifier ON, the mains fuse(s) may have blown (see Section ***8.2 Fuse Replacement***).

8.1. Periodic Maintenance

8.1.1. Periodic Checks

Periodically (but at least once per year) check the contact cleanliness and the tightening of all external connectors, in particular the coaxial ones.

Check the cables integrity, in particular when they are laid on the floor. Check also if the cables are secured well in the area where they come out of the connector body.

Pay particular attention to the mains plug and the wall outlet where the amplifier is powered from (see Sections ***2.4.g) Power cord*** and ***2.4.h) Preparation of power outlet***). If you have any doubts consult with a qualified electrician.

Periodically check the antenna feed lines and if their SWR changes over time. Problems could occur more often in poor weather conditions - rain, snow, strong wind etc.

8.1.2. Amplifier Cleaning

⚠ CAUTION

Do not use any solvents for cleaning. They may be dangerous to you and can damage amplifier surfaces, paint, and plastic components.

Do not open the amplifier. Cleaning of the amplifier outer surface can be done with a piece of soft cotton cloth lightly moistened with clean water.
Also, clean (as much as possible from the outside, without opening the amplifier) all ventilation apertures on the cover and the chassis, including the ones on the bottom.

⚠ DANGER

Never push or put anything into holes in the case - this will cause electric shock.

8.1.3. Air Filter Cleaning

Periodically (more often in a dusty environment, but at least once per year) clean the air filter without opening the amplifier (see ***Figure 8-1*** below).

⚠ CAUTION

The air filter may be too dusty - be careful how you clean it so that you DO NOT INHALE (BREATHE IN) neither spill the dust over! Wrap it, for instance, in a wet cloth before removing from the amplifier. Clean the filter in running water!

Figure 8-1 | Rear panel - Air Filter

8.2. Fuse Replacement

⚠ DANGER

If replacement of fuses is necessary, first pull out the amplifier mains plug from the mains outlet and wait for at least 30 minutes!

NOTICE

For replacement, only use standard fuses from the types recommended below.

Besides specific national standards, the principal fuses standard applied worldwide is IEC 60127.

The two Primary Mains Fuses of the amplifier are located on the rear panel (see ***Figure 8-2*** below). They are fuses of the "F" type (fast-acting / quick-acting / fast blow / quick blow), size 6.3 x 32 mm (1/4x1-1/4 inch), ceramic or glass body cartridge.

The fuses must be rated for a current corresponding to your mains nominal voltage:

- 10 A / 250 V for operation from 200-240 VAC;
- 20 A / 250 V for operation from 100-120 VAC.

Figure 8-2 | Rear panel - Fuses

Suitable replacement types are:

- For 200-240 VAC mains nominal voltage, e.g.:
  - EATON Bussmann, PN: BK/ABC-10-R (ceramic body cartridge);
  - Littelfuse, PN: 0312010 (glass body cartridge).

- For 100-120 VAC mains nominal voltage, e.g.:
  - EATON Bussmann, PN: BK/ABC-20-R (ceramic body cartridge);
  - SIBA, PN: 70-059-60/20A (glass body cartridge).

If, after Primary Mains Fuses replacement, the device does not operate normally, we recommend repair, performed only by a trained service technician.

Contact your ACOM dealer for assistance (see Section ***1.9 User Technical Support***).

Besides the primary fuses, on the MAINS PCB (inside the amplifier) there are three fuses**.**

⚠ WARNING

Do not replace fuses located inside the amplifier.

Blown internal fuses can be a symptom of a more serious problem, which should be resolved beforehand. A fault of this type will not occur under normal operating circumstances.

Replacing internal fuses is a complex and potentially dangerous operation. For this reason, we recommend this work be carried out only by a trained service technician.

Contact your ACOM dealer for assistance (see Section ***1.9 User Technical Support***).

Unauthorized replacement of inside fuses infringes the warranty conditions!

They are fuses of the "T" type (time-lag / slow-blow / time delay), European size 5 x 20 mm, ceramic (or glass) body cartridge, as follow:

- 1 x 1.25 A, 250 V - in the 40 W Aux Supply PCB;
- 2 x 2 A, 250 V - in the high-voltage Step Start circuit (time-lag / slow-blow / time delay).

Suitable types are:

- 1.25 A, 250 V, e.g.:
  - ESKA, PN: 522.518 (glass body cartridge);
  - SCHURTER, PN: 0034.3118 (glass body cartridge);
- 2 A, 250 V, e.g.:
  - EATON Bussmann, PN: S505-2-R (ceramic body cartridge, slow-blow / time delay);
  - Littelfuse, PN: 0218002 (glass body cartridge, time-lag).

8.3. Amplifier Cooling

The tube 3CX800A7 operates with forced air cooling. This is achieved by a centrifugal blower (see ***Figure 8-3*** below) mounted in close proximity to the tube deck, plus an External Fan, which is an option (see Section ***1.8 Optional Equipment***) and is mounted on the amplifier rear panel (see ***Figure 8-4*** below).

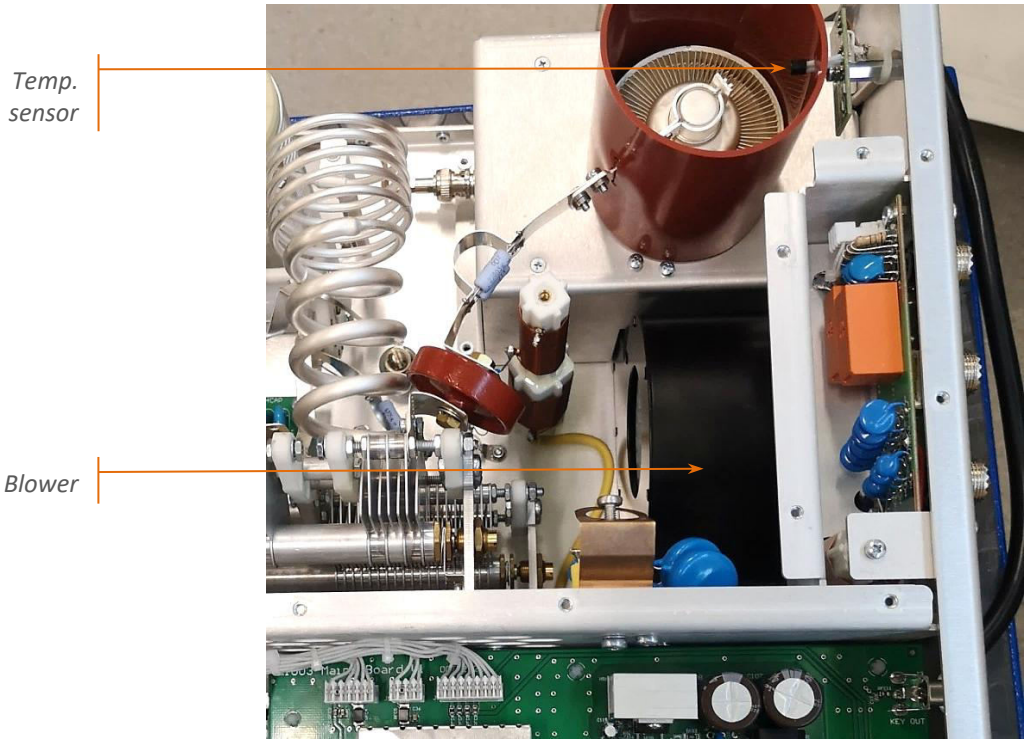


Figure 8-3 | Cooling blower and Temperature sensor

Figure 8-4 | Optional external fan

The tube-cooling air flow blows around most main components of the amplifier, thereby cooling also them. These components include:

- The heavy power transformer;
- The Mains PS board;
- The HV rectifier and HV filter;
- All high-power components of the RF output tank;
- The input RF filters, as well as
- Many components inside the tube deck.

This way, the Blower and the External Fan are fully utilized.

The cooling in the ACOM 1003 has two speed rates:

- The nominal speed, and
- The high speed.

They are automatically controlled by a temperature sensor that monitors the tube anode exhaust air. The sensor is installed just above the tube anode (see ***Figure 8-3*** above).

The optional external fan is recommended for high ambient temperatures and/or long transmissions with insufficient cooling breaks. The external fan is turned off at nominal blower speed and turns on only at high cooling speed.

The Control PCB regulates the cooling air speed by monitoring the temperature of the exhaust air:

- IN OFFLINE mode
  - If the exhaust air temperature exceeds 100 °C when the main **ON**/**OFF** power switch is turned on (see ***Figure 8-4*** above), or after an emergency shutdown, the cooling will turn on and will operate at high speed until the temperature drops below 100 °C;
  - When the temperature drops below 100 °C, the cooling is turned off; this is the normal state in OFFLINE mode.

- In ONLINE / STANDBY mode
  - The Control PCB does not allow warming up if trying to start it on while the tube is hot; If after the first second the temperature exceeds 100 °C, the Serious fault protection

    ER PN02 flg=11

    is triggered and the system switches to OFFLINE mode automatically;
  - When warming-up is started normally, it forcibly switches on cooling first at high speed for 1 second (for a reliable startup) and then returns to the nominal speed after 1 second;
  - The nominal speed is never turned off in ONLINE mode;
  - If the temperature is above 100 °C, the high speed is switched on;
  - At a temperature below 70 °C the speed is reduced to nominal;

- If in ONLINE/STANDBY mode the temperature exceeds 150 °C, the protection against serious failure

  is triggered and the control switches to OFFLINE mode (where cooling does not stop until the temperature drops below 100 °C);
- If the temperature exceeds 60 °C when the **POWER** button is pressed in order to turn off, or during an emergency power off,

  is displayed and cooling continues until the temperature drops below 60 °C; only then does it return to OFFLINE mode.

- In ONLINE / OPERATE mode
  - The nominal speed is on and is never switched off in ONLINE mode;
  - At temperatures above 100 °C, high speed is switched on;
  - When the temperature drops below 70 °C, the speed is reduced to nominal;
  - If the temperature exceeds 130 °C, the current temperature is displayed as a warning message until the temperature decreases or the operator presses the **NEXT** or **PREV** button;
  - If the temperature exceeds 140 °C, the display shows the message

    for two seconds, the Common Issues Protection (Soft Fault) is triggered and the amplifier goes back into STANDBY mode.

8.4. Tube Replacement

The amplifier uses one powerful ceramic/metal triode 3CX800A7.

⚠ DANGER

Tube replacement is a complex and potentially dangerous operation and is Life-threatening! Also, it is required to set up the idling current of the new tube after a tube replacement.

For this reason, we recommend this work be carried out only by a trained service technician.

Contact your ACOM dealer for assistance (see Section ***1.9 User Technical Support***)

Unauthorized replacement of the tube infringes the warranty conditions!

8.5. Simplified Schematic Diagram

The ceramic/metal (cermet) tube 3CX800A7 is an air-cooled, high-mu (high-μ) power triode. It is intended for operation in cathode-driven RF amplifiers in linear class AB_2, as well as in high efficiency class B. Despite its compact size, the plate can dissipate up to 800 W heat through forced air cooling.

The grid is connected directly to the chassis for stable cathode-driven operation in HF and UHF band. The low grid interception and high amplification allow for lower drive power with no sacrifice of low amplifier distortions (IMD).

Please, see ***Figure 8-5 | Simplified schematic diagram*** below.

From the SO-239 RF INPUT connector of the amplifier, the input RF signal is fed to the cathode of the tube V1 (pins 1, 2, 3, 8, 9, and 10), passing through:

- The Input Wattmeter;
- The Input Relay when in TX position;
- A fixed Input Attenuator 3 dB;
- A set of 7 lowpass input-matching filters; they are factory tuned and are selected synchronously with the **BAND** switch for each amateur band from 160 through 6 m.

The seven filters are located in the Tube Deck. They suppress cathode current harmonics that could otherwise degrade exciter (transceiver) performance. In addition, the filters transform the tube input impedance to nearly 50 Ω, thereby lowering the amplifier's input SWR.

The tube operates in classes AB_2 and B with a conduction angle of nearly 180 degrees (i.e. a cutoff angle of about 90 degrees). This is, the plate- and cathode currents are a cutoff (truncated) sinusoid thus the cathode input impedance is strongly non-linear. During almost half the HF period there is no current passing through the cathode. For this reason, the filters are located right next to the tube socket.

Still another and very important function of the input filters is to store a sufficient amount of HF reactive energy. It increases the tube efficiency and reduces the IMD while strictly maintaining the conduction angle (and cutoff angle) of the plate current and linearizes the tube input in the HF-period part when the tube is to be cut off.

The fixed input 3 db attenuator reduces the input HF power from the exciter (transceiver) to the tube by a factor of 2, and the power reflected from the lowpass-filter input towards the transceiver by a factor of 4. This attenuator additionally reduces the amplifier input SWR and also decreases the chance of an unintentional RF Overdrive of the tube at modulation peaks with some powerful transceivers.

The input relay RX/TX switches the transceiver antenna port: once - towards the selected antenna A1, A2 or A3 during reception, and then - towards the input filters and the tube cathode during transmission.

The tube grid is grounded directly - both for RF and DC. Thanks to the special low-inductive grid design of 3CX800A7, no grid inductance neutralization is required to avoid VHF self-excitation.

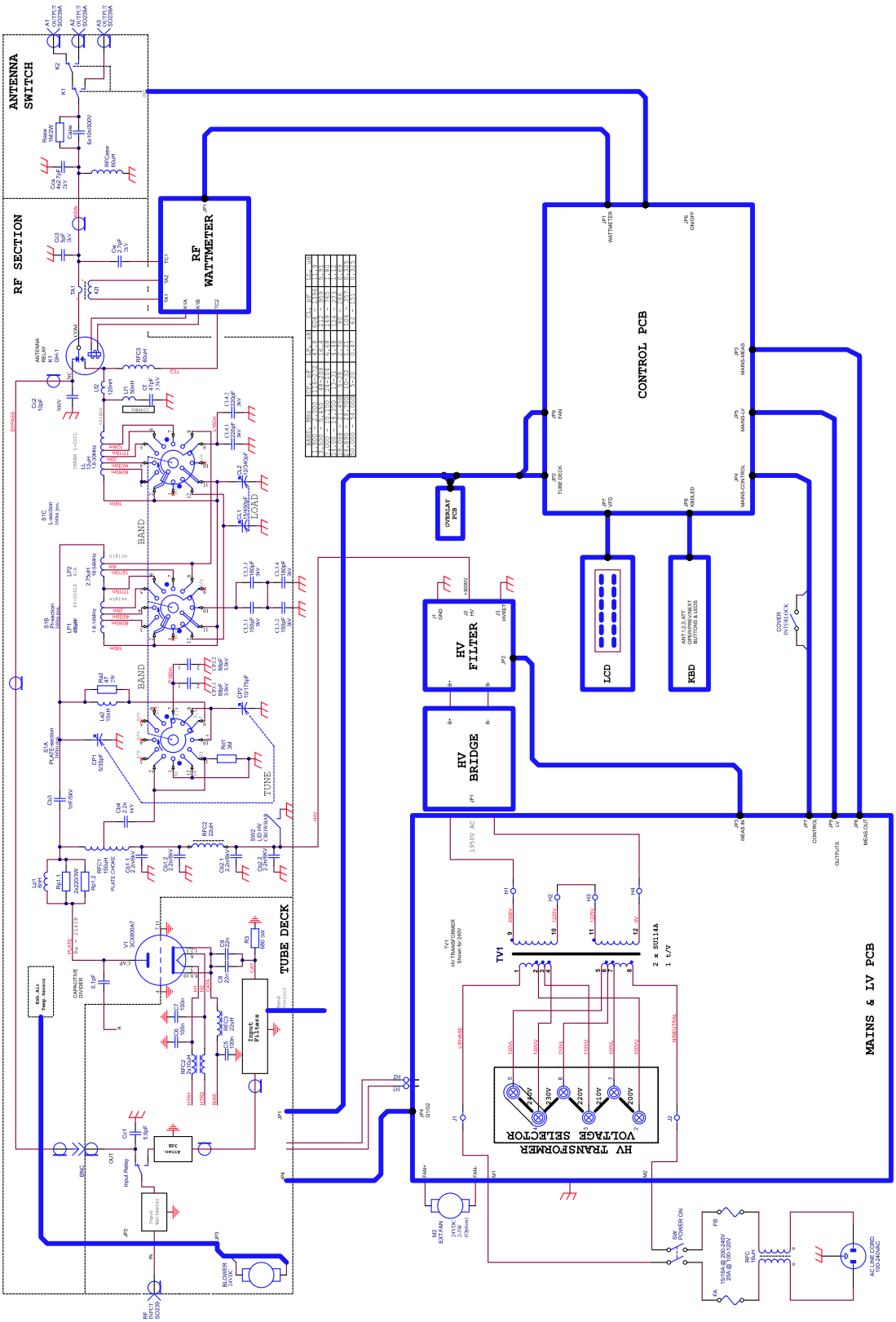


Figure 8-5 | Simplified schematic diagram

The Capacitive Divider 0.1 pF uses a very small part of the plate RF voltage and applies the rectified signal aavd/aavi to the Control PCB. Together with the two signals "fwdi" and "rfli" (output and reflected power from the Output Wattmeter), the three signals will be used by the Control PCB in order to estimate the real part of the plate load admittance. This generates and defines the exact position of the True Resistance Indicator - TRI tuning aid on the scale.

The parallel combination Lp1/Rp1 in the plate circuit is a VHF/UHF parasitic suppressor "trap".

The high DC voltage +HV is applied to the tube plate through the RFC1 and RFC2 chokes, while the blocking capacitor Cb3 separates it from the plate RF tank and from the amplifier antenna output.

The output RF circuit is comprised of the fixed inductors LP1, LP2, and LL, as well as the air variable capacitors CP1-CP2 and CL1-CL2. Together with the supplemental fixed capacitors CP3 and CL3 they form a classic Pi-L filter for harmonic-frequency parasitic suppression. Using the TRI tuning aid, and the two air variable capacitors, the output RF circuit is tuned to transform the antenna complex impedance to the optimum plate-load resistance of the tube.

The output tank is switched over the bands by the 3-section rotary switch S1A-S1C. The antenna matching circuit can be adjusted on all amateur bands from 160 to 6 m by the variable capacitors CP1,2 TUNE and CL1,2 LOAD to match any complex antenna impedance having an SWR up to 3.

The output-power RF signal is forwarded to the antenna switch through an additional VHF low-pass filter comprising Lf1, Lf2, and Cf, which further reduces harmonic emissions for frequencies above 55 MHz.

The filtered RF output power passes through the antenna relay receive-transmit K1 and the current winding of the transformer TA1 in the output wattmeter to reach the three-way antenna switch A1 - A2 - A3.

The antenna switch contains a high-pass filter with a cut-off frequency of 100 kHz (comprising the parallel choke RFCasw and the serial capacitor Casw), and two antenna relays K1 and K2. The relays select one of the three amplifier antenna outputs: A1, A2 or A3.

Two RF chokes RFC3 and RFCasw monitor the output relay TX contact closure (**com** to **no**) and, together with the capacitor Casw, prevent the appearance of DC voltage at the antenna output.

The RF choke RFCasw shunts the DC voltage to ground should the decoupling capacitor Cb3 break down. The resistor Rasw provides a constant DC leak path to the ground for any antenna static charges so that they flow down to the ground timely. This way the Casw capacitor will not accumulate large amounts of electrostatic charges and the antenna will not generate dangerous static voltages.

The electrical schematic diagrams are available from ACOM or your dealer on request.
In any case, ACOM is not obliged to provide this information, since it contains design and production know-how.

8.6. Block Diagram

The block diagram excludes the tube and the RF output circuit described in the previous Section ***8.5 Simplified Schematic Diagram***.

Please, see ***Figure 8-6 | Block diagram*** below.

All DC low voltages (+5 V, +24 V, and +48 V) are supplied by DC/DC Converters in the MAINS PCB, and the high plate voltage - by HV BRIDGE and HV FILTER PCBs. The tube is heated by a regulated converter Heater DC/DC, specially designed for this purpose, which is installed in the TUBE DECK and powered by +24 V. Its operation is controlled and monitored by the Control PCB.

The Mains PCB also generates the controllable cathode BIAS voltage, the High-Voltage measurement signal - hvmi, as well as monitoring signals for the tube plate- and grid currents - monia and monig. They are fed to be monitored by the Control PCB, too.

Besides the heater DC/DC converter, in the TUBE DECK are located also: the previously described in Section ***8.5 Simplified Schematic Diagram*** - Input Wattmeter with the fixed 3 dB attenuator, a 6 dB controllable attenuator, the tube's socket with a set of input filters right next to it, and the Band Decoder & Relay Driver PCB.

Right next to the Tube Deck side opening is attached the cooling Blower M1 mouth. Also, just above the anode heat sink, through a protective round metal grid, is visible the temperature sensor of the exhaust air flow (see ***Figure 8-3 | Cooling blower and Temperature sensor***).

The band switch optical sensor is a disk mask which is installed on the band switch shaft, right behind the front panel. It provides digital data in Gray code to the Control PCB about the current switch position - signals AG0, AG1, and AG2, or BSE (Band Switch Error) signal in the case of a possible inaccurate positioning.

The Control-, Keyboard- and LCD-Display PCBs are installed inside the front panel cavity. The Control PCB monitors all 11 analogue measurands and 17 digital input signals from the amplifier, and provides amplifier control through three registers for 24 more digital outputs.

The amplifier's tube, its input RF circuits, input filters, and the output RF tank comprising the Pi-L filter, have been described in Section ***8.5 Simplified Schematic Diagram*** thus they are not shown in ***Figure 8-6 | Block diagram***.

As it was mentioned in Section ***8.5 Simplified Schematic Diagram***, the output wattmeter, output relay, and the antenna switch are connected between the Pi-L filter output and the three antenna outputs of the amplifier A1, A2 and A3.

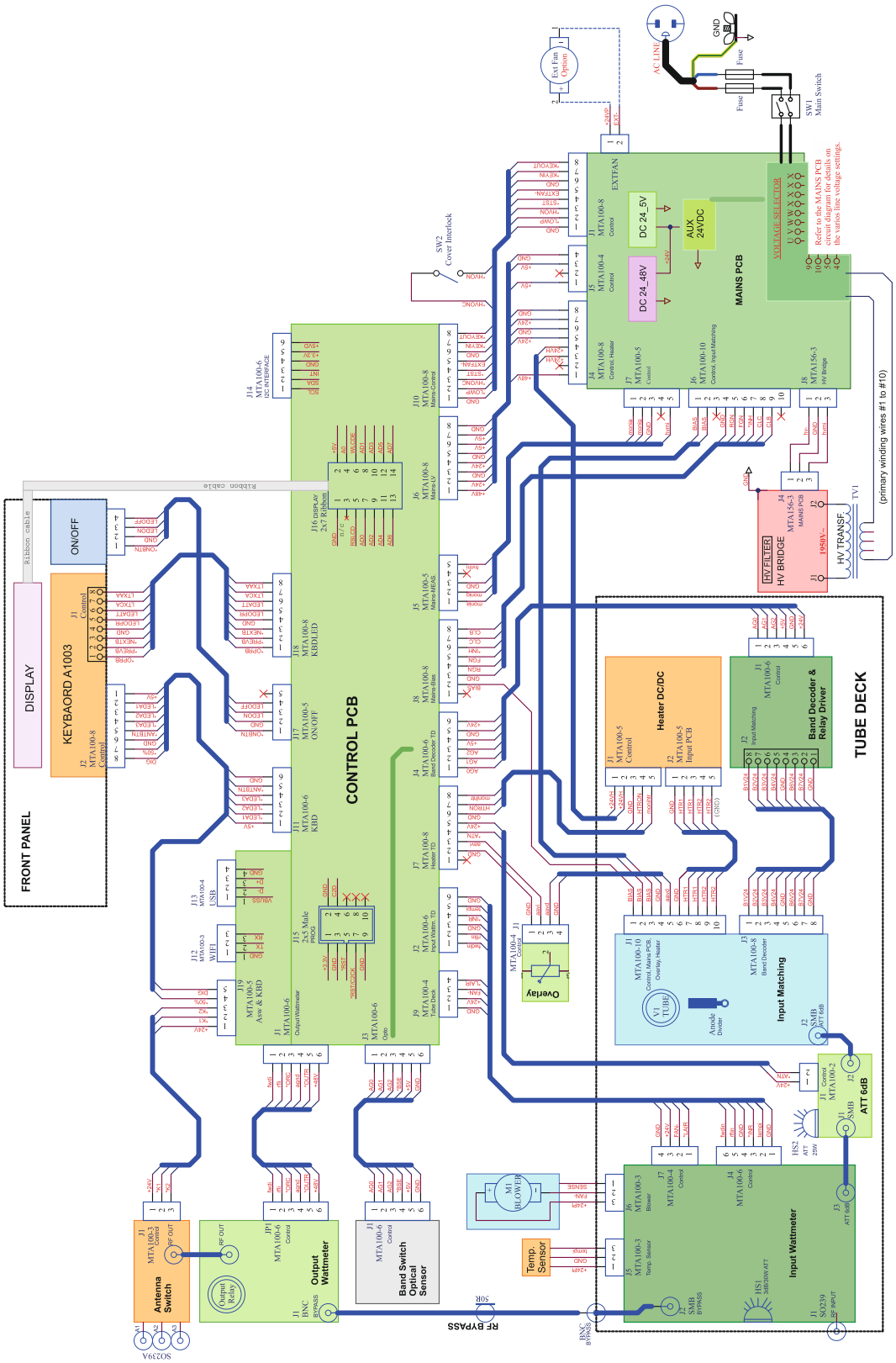


Figure 8-6 | Block diagram

8.7. Troubleshooting | Serious-Fault Protection Codes and Signatures

In case of a highest-protection level trip - a Serious Fault Protection (known as Hard Fault - see Section ***7.3 Third Level of Protection - Serious Fault Protection***), the controller first cuts off the tube by applying maximum cathode-bias voltage, removing RF drive, and disconnecting both the high voltage +HV, and the heater voltage.

Once the tube is ensured safe, the controller returns the amplifier control to the safe OFFLINE mode and records the corresponding signature in its non-volatile memory (see Section ***8.7.2*** below). Finally, an Error Code identifying the protection triggered appears on the display bottom line, for example:

The Error Code remains on the display for 20 seconds or until (any) button on the front panel is pressed, after which the Home Screen inscription (see ***Figure 3-2 | Front panel - POWER button and Home Screen***) returns on the display.

8.7.1. Serious-Fault Protection Codes

The protection identification code (error code) consists of two parts:

- Error code: ER PNxx, ER PRxx, ER SBxx or ER TRxx;
  Here **xx** is the conditional number of the mode in which the amplifier was operating at the moment the protection was triggered, for example:
  01, 02, 03, …;
- A conditioned number of the signal that was outside the normal range and triggered the protection, for example:
  flg01 ... 23, 53.

The protection identification codes (error codes) list is shown in ***Table 8-1*** below. The codes indicate the operating mode and sub-mode of the amplifier, as well as which measurand activated the protection.

For example, **PR25** means "Blower failure during operation", and **flg16** means that the protection has been triggered by the *LAR (Low Air; low level active) signal so the blower needs to be tested.

More detailed information about the error and the amplifier status can be obtained by reading the whole signature stored in the non-volatile memory of the controller concerning the event (see Sections ***3.3.6)*** and ***8.7.2***).

ER Code	Failing	Sig. Name	ER PN (Power ON):
Tests at Power On & during OFFLINE:			
ER PN01	flg02	**BIAS/16**	Bias voltage divided by 16
ER PN01	flg03	**HTR/8**	Heater voltage divided by 8
ER PN01	flg07	**PAAV**	Peak Anode Alternate Voltage
ER PN01	flg08	**IGM**	Grid current measure
ER PN01	flg09	**IPM**	Plate current measure
ER PN01	flg10	**HVM**	High Voltage measure
ER PN01	flg11	**TEMP**	Exhaust air temperature
ER PN01	flg15	***BSWE**	Band Switch Error (active low)
ER PN01	flg21	**ORC**	Output Relay Closed
ER PN01	flg22	***CATRF**	Cathode RF drive present (active low)
ER PN01	flg23	***ARCF**	RF Arc Fault present (active low)
Tests at Power On, before Warmup Started:			
ER PN02	flg02	**BIAS/16**	Bias voltage divided by 16
ER PN02	flg03	**HTR/8**	Heater voltage divided by 8
ER PN02	flg07	**PAAV**	Peak Anode Alternate Voltage
ER PN02	flg08	**IGM**	Grid current measure
ER PN02	flg09	**IPM**	Plate current measure
ER PN02	flg10	**HVM**	High Voltage measure
ER PN02	flg11	**TEMP**	Exhaust air temperature
ER PN02	flg15	***BSWE**	Band Switch Error (active low)
ER PN02	flg16	***LAR**	Low Air - check blower
ER PN02	flg20	**KEYIN**	CW Key or PTT
ER PN02	flg21	**ORC**	Output Relay Closed
ER PN02	flg22	***CATRF**	Cathode RF drive present (active low)
ER PN02	flg23	***ARCF**	RF Arc Fault present (active low)
Tests after Power On, during Warmup:			
ER PN03	flg03	**HTR/8**	Heater voltage divided by 8

Continued

ER Code	Failing	Sig. Name	ER PR (OPERATE):
Tests while entering OPER:			
ER PR00	flg02	**BIAS/16**	Bias voltage divided by 16
Tests at HV On, before STST:			
ER PR01	flg10	**HVM**	High Voltage measure
ER PR02	flg09	**IPM**	Plate current measure
Tests during Operate, after STST:			
ER PR03	flg10	**HVM**	High Voltage measure
ER PR04	flg10	**HVM**	High Voltage measure
ER PR05	flg09	**IPM**	Plate current measure
Tests during OPER / RX:			
ER PROB	flg09	**IPM**	Plate current measure
ER PR0C	flg06	***CATRF**	Cathode RF drive present (active low)
Tests during OPER / TX:			
ER PR12	flg21	**ORC**	Output Relay Closed
ER PR13	flg09	**IPM**	Plate current measure
ER PR14	flg08	**IGM**	Grid current measure
ER PR15	flg23	***ARCF**	RF Arc Fault present (active low)
HV too Low during OPER:			
ER PR1B	flg10	**HVM**	High Voltage measure
HV too Low during OPER:			
ER PR1C	flg10	**HVM**	High Voltage measure
HV too High during OPER:			
ER PR1D	flg10	**HVM**	High Voltage measure
Heater voltage too Low during OPER:			
ER PR1E	flg3	**HTR/8**	Heater voltage divided by 8

Continued

Heater voltage too High during OPER:			
ER PR1F	flg3	**HTR/8**	Heater voltage divided by 8
BAND Switch Danger during OPER:			
ER PR20	flg15	***BSWE**	Band Switch Error (active low)
Grid Current too High during OPER:			
ER PR21	flg08	**IGM**	Grid current measure
Plate RF Peak too High during OPER:			
ER PR22	flg07	**PAAV**	Peak Anode Alternate Voltage
Arc Fault during OPER:			
ER PR23	flg23	***ARCF**	RF Arc Fault present (active low)
Plate Heat Dissipation Too High during OPER:			
ER PR24	flg53	**formula**	Plate Heat Dissipation
Blower Fail during OPER:			
ER PR25	flg16	***LAR**	Low Air, check blower
ER Code	**Failing**	**Sig. Name**	**ER SB (Stand By):**
Tests while Entering STBY:			
ER SB01	flg02	**BIAS/16**	Bias voltage divided by 16
ER SB01	flg07	**PAAV**	Peak Anode Alternate Voltage
ER SB01	flg08	**IGM**	Grid current measure
ER SB01	flg09	**IPM**	Plate current measure
ER SB02	flg19	***PANT**	RF Power in Antenna (active low)
ER SB03	flg21	**ORC**	Output Relay Closed
Tests during STBY:			
ER SB04	flg02	**BIAS/16**	Bias voltage divided by 16
ER SB04	flg03	**HTR/8**	Heater voltage divided by 8
ER SB04	flg07	**PAAV**	Peak Anode Alternate Voltage
ER SB04	flg08	**IGM**	Grid current measure

Continued

ER SB04	flg09	**IPM**	Plate current measure
ER SB04	flg10	**HVM**	High Voltage measure
ER SB04	flg11	**TEMP**	Exhaust air temperature
ER SB05	flg04	**PFWD**	Peak Forward Power
ER SB05	flg05	**RFL**	Reflected Power
ER SB06	flg16	***LAR**	Low Air, check blower
ER SB06	flg21	**ORC**	Output Relay Closed
ER SB06	flg22	***CATRF**	Cathode RF drive present (active low)
ER SB06	flg23	***ARCF**	RF Arc Fault present (active low)
ER Code	**Failing**	**Sig. Name**	**ER TR (Transmit / Receive):**
Tests at Key Down, before switching relay to TX:			
ER TR01	flg19	***PANT**	RF Power in Antenna (active low)
Tests at switching relay to TX:			
ER TR02	flg21	**ORC**	Output Relay Closed
Tests at Key Up, before switching relay to RX:			
ER TR04	flg22	***CATRF**	Cathode RF drive present (active low)
ER TR05	flg19	***PANT**	RF Power in Antenna (active low)
Tests at switching relay to RX:			
ER TR06	flg21	**ORC**	Output Relay Closed

Table 8-1 | Serious Fault (Hard Fault) Protection Codes List

8.7.2. Reading and Interpreting Serious-Fault Protection Signatures

As it was described in Sections ***3.3.6)*** earlier, starting from the Home Screen (see ***Figure 8-7*** below),

Figure 8-7 | Front panel - OPER, PREV/NEXT and ATT buttons

six pressings of the **NEXT** button in succession will display:

If there are no active records in the list, the text

is immediately displayed.

You can exit the menu by pressing the **ATT/+1s:TRI** button shortly. Press once more again to exit the Signature List.

If the signature list is not empty, please read the following information on details about signatures and how to read, decode and interpret the data.

Signatures are emergency data records that the Control PCB stores when a Serious Fault Protection is triggered. The Control PCB stores data into its own non-volatile memory before to turn OFF the tube power supply.

There is room for 8 records of Protection-trip Signatures in the non-volatile memory (or Signatures for short). If one more protection is activated, but the memory is already full, the new signature will be stored at number **1**. All older records will be shifted to a next position, and the oldest signature record with ex-number **8** will drop out and will be lost from the list.

The Signatures contain coded information about:

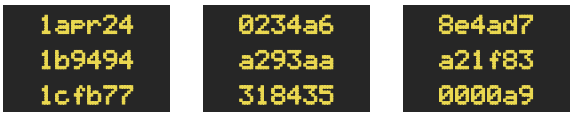
- The amplifier operating mode and sub-mode;
- The issue's nature;
- The values of all 11 analogue measurands;
- The registers state of all 17 input logic signals;
- The registers state of all 24 output logic signals;
- The operating antenna number, and
- The current number of operating hours as logged by the Control PCB.

The data characterizes the amplifier's operating regime at the time of activation for each one of the last 8 protection trips, thus helping the problem analyze and diagnose.

Each signature record contains 3 lines of numerical data. Lines are displayed one by one on the display bottom line when the **OPER** button (see ***Figure 8-7*** above) is pressed 3 times successively.

Each one of the three lines contains 18 characters, organized into 3 groups of 6 characters each with pauses between them for ease of reading. When the **OPER** button is pressed for the first time, the first 18 characters of the protection signature triggered last, appear on the display bottom line - for example (the values are illustrative only):

The next two presses of the **OPER** button show two more screens with the remaining two lines of 18 characters each from the same signature record. You can arrange the three lines comprising the first signature record to look like this (the values are illustrative only):



Each one of the three lines is numbered at the front with a number 1...8 and a letter a, b, c. The first digit in the row (from 1 to 8) is the successive number of the signature record, where number "**1**" is the most recent (last) and "**8**" is the oldest event. The letters "**a**", "**b**", or "**c**" after the first number indicate the first, second, and third lines for the specified event.

Continuing in the same way, using the **OPER** button a new 3 lines of 18 characters each are displayed for the penultimate signature record (starting with "**2a**", "**2b**" and "**2c**"). If there is more data, the same button takes you to three more lines of all next, to the oldest - the eighth signature record, stored in the non-volatile memory of the amplifier - under the numbers "**8a**", "**8b**" and "**8c**" respectively.

If no more events have been recorded, the text

is displayed.
You can exit the menu by pressing the **ATT/+1s:TRI** button shortly.

The signatures list can be read and photographed from the amplifier display in OFFLINE mode in order to be sent to a workshop for a diagnose. This could be done right after the emergency power off or at any time later, even if the amplifier had not been powered for a long time or when it could not be started in ONLINE mode after an emergency.

See Section ***1.9 User Technical Support***.

9. SPECIFICATIONS

9.1. Parameters

a) Standard Frequency Coverage: All amateur bands in the 1.8-54 MHz frequency range

1.800 - 2.000 MHz	(160 m band)
3.500 - 4.000 MHz	(80 m band)
5.250 - 5.450 MHz	(60 m band) *
7.000 - 7.300 MHz	(40 m band)
10.100 - 10.150 MHz	(30 m band)
14.000 - 14.350 MHz	(20 m band)
18.068 - 18.168 MHz	(17 m band)
21.000 - 21.450 MHz	(15 m band)
24.890 - 24.990 MHz	(12 m band)
28.000 - 29.700 MHz	(10 m band)
50.000 - 54.000 MHz	(6 m band) *

* Please, refer the applicable regional band plans and laws for specific allocations and limitations.

b) Power Output Power

- 1000 W PEP or 900 W continuous carrier, with no limitation to the operating mode;

NOTICE

In continuous carrier modes (RTTY etc.) for transmissions longer than 5 minutes, the external auxiliary fan must be mounted (see section ***1.8 Optional Equipment***).

c) Intermodulation Distortion at rated power

- Better than 34 dB IMD_3 with regard to one of the two tones (40 dB below PEP);

d) Hum and noise

- Not more than 4,5% (-27 dB) AM depth at rated power;

e) Harmonic Emissions Output Suppression

- 1.8-29.7 MHz – better than 50 dB below rated power;
- 50-54 MHz – better than 70 dB below rated power;

f) Input and Output Impedances

- Nominal impedance: 50 Ω unbalanced, UHF / PTFE coaxial connectors (SO-239A);
- Input circuit: factory tuned low-pass filters for best linearity and input SWR not more than 1.3 in every amateur band from 160 m to 6 m;
- Bypass path SWR: not more than 1.1 continuously from 1.8 to 54 MHz;
- Minimum range of impedance matching capability at the output: all loads with SWR up to 3 at any phase angle;

NOTICE

The drive power must be reduced at SWR above 3 in order to keep the Reflected Power under 250 W.

g) HF Power Gain

- 12 dB ±1 dB (50 W - 80 W at the input for rated output power);

h) Mains Power Supply Voltage

90-132 VAC / 180-264 VAC (taps for 8 nominal voltages: 100, 110, 120, 200, 210, 220, 230 & 240 VAC), ±10% tolerance), 50-60 Hz, Single phase;

i) Mains Power Consumption

- 2000 VA @ 240 VAC for rated output;

j) Safety and Electromagnetic Compatibility

- Complies with CE safety and EMC requirements, as well as with the US Federal Communications Commission (FCC) regulations;

k) Size & Weight (operating, excluding connected cables)

- WxDxH: 423x398x195 mm, 21.0 kg (16.7x15.7x7.7 inches, 46.35 lbs.);

l) Operating environments

- Temperature range: 0 to +50 degrees Celsius (32 °F to 122 °F);
- Relative air humidity: up to 95% @ +35 degrees Celsius (95 °F);
- Height above sea level: up to 3050 m (10000 ft) without output deterioration.

9.2. Functions

a) Antenna Impedance Matching Method
   - ACOM's original True Resistance Indicator (TRI) prompt;

b) Tube operation mode, operator selectable
   - Class AB_2 for best linearity in SSB mode (**DIG** indicator dark);
   - Class B for less plate heat in digital modes, e.g. RTTY, FT8, etc. (**DIG** indicator lighted).;

c) Operator selectable 50% reduction of output power with no deterioration in efficiency (**50%** indicator lighted);

d) Automatically controlled cooling air flow;

e) Antenna Outputs
   - Three antenna outputs selectable by a button on the front panel;

f) Receive/transmit switching: fast, QSK compatible, using silent RF reed-switching relay;

g) OLED display with detailed text messages and a peak bar graph indicator for output forward (incident) power and TRI tuning aid;

h) Eighteen operator selectable information screens for digital readout of the amplifier operating parameters;

i) Protections
   - Cover interlock for operator's safety;
   - Startup mains current at "power on" is limited to the rated current value;
   - Continuous monitoring of all tube protection parameters by the controller: plate voltage, grid current, plate current, power gain, and cathode bias;
   - The tube heater voltage is regulated within the producer technical specifications;
   - The startup heater current is limited to 2 A in order to extend the cathode expected life;
   - Anode exhaust air maximum temperature;
   - Unique ACOM protection for BAND switch;
   - Original ACOM protection for RF break down or RF arcs at the output, including the antenna system;
   - Punctual antenna relay transmit/receive sequence control and time synchronization with transceiver;
   - Antenna relay contacts are protected against hot switching, including RF power induced by a nearby transmitter;
   - Maximum HF power reflected from the antenna;
   - Maximum drive power (Overdrive).

j) Non-volatile memory with SIGNATURE records of the 8 most-recent Serious (Hard Fault) Protection events. It is a digital log of all analogue and digital CPU signals, frequency range, antenna number, and operating hours at the moment of a protection trip;

k) Tube

- The amplifier uses a single ceramic/metal (cermet) triode 3CX800A7.

9.3. Regulatory Requirements

a) European conformity

CE

CE mark (Conformitè Europëenne)

This symbol explains that "CE" marked ACOM product meets the essential requirements of the Radio Equipment Directive, 2014/53/EU, and the restriction of the use of certain hazardous substances in electrical and electronic equipment Directive, 2011/65/EU.

b) US Federal Communications Commission (FCC) regulations

FCC ID: **2AJXZ1003**

FCC ID number

The FCC ID number explains that market ACOM product complies with the US Federal Communications Commission (FCC) regulations.

The FCC ID number can be checked at ***www.fcc.gov/oet/ea/fccid***.

FCC ID numbers consist of two elements:

- A grantee code (for example **2AJXZ**), and
- An equipment product code (for example **1003**).

c) RF Exposure Information

⚠ WARNING

Using the ACOM 1003 amplifier, antennas must be operated at certain minimum distance between the radiator and any person's body.

This unit (ACOM 1003 amplifier) complies with the FCC RF Exposure limits for an uncontrolled environment.

To comply with CFR Title 47 Part 97.13(C) and the Guidelines and Limits for Human Exposure to RF electromagnetic fields adopted by the FCC, you should evaluate your Radio Station Facilities as described in OET BULLETIN 65 plus SUPPLEMENT B - Additional Information for Amateur Radio Stations.

OET BULLETIN 65 plus SUPPLEMENT B can be found at:

- ***https://www.fcc.gov/bureaus/oet/info/documents/bulletins/oet65/oet65.pdf***;
- ***https://www.fcc.gov/bureaus/oet/info/documents/bulletins/oet65/oet65b.pdf***.

In addition to the above guidelines, please, see Section ***3.4 Elimination of Electromagnetic Compatibility (EMC) Problems***.

9.4. Storage and Shipment

9.4.1. Storage Environment

The amplifier may be kept packed in a dry, ventilated, and unheated location (with no chemically active substances such as acids or alkalis) within the following environment ranges:

- Temperature range: -40 to +70 degrees Celsius (-40 °F to 158 °F);
- Humidity: up to 75% @ +35 degrees Celsius (95 °F).

9.4.2. Shipping Size and Weight

- WxDxH: Approx. 632x583x413 mm, 25.0 kg (24.9x23.0x16.3 inches, 55.1 lbs.);

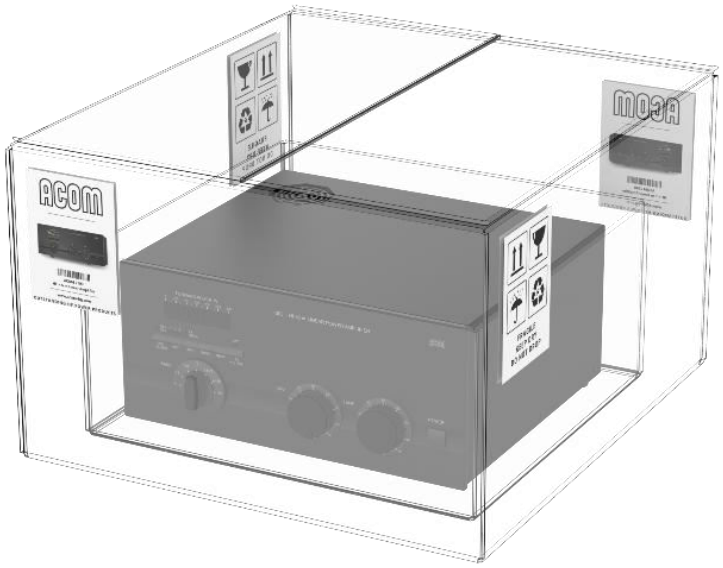


Figure 9-1 | Packaging cardboard box

9.4.3. Transportation

All types of transportation may be used, including storage in an aircraft baggage compartment at up to 12000 meters (40000 ft) above sea level.

9.4.4. Returning to the Service Provider

This document section contains the general information on packing and shipping an amplifier for diagnostics and repair.

NOTICE

Should it be necessary to ship the amplifier, use the original packing as described below.

NOTICE

Before shipping the amplifier, you should contact your local dealer first.

Your dealer can have a specific shipment requirement, e.g., a different shipping address. It is the sole customer's responsibility to ensure the commutator and all accessories are properly packaged to avoid any shipping damage.

If transporting for diagnostics and repair, you may not need to ship some cables or accessories. Please, consult with your dealer first.

Prepare the amplifier for shipping as described below:

- Switch off the amplifier via Main Power Rocker Switch (see ***Figure 2-4 | Rear panel - Connections***, Pos. 1); Make sure the Main Power Rocker Switch is in OFF position;
- Pull the amplifier's line (mains) plug out of the outlet;
- Do not disconnect **GND** connection;
- Disconnect all cables (except **GND** connection) from the rear panel of the amplifier;

⚠ DANGER

Remove the **GND** connection last (see ***Figure 2-4 | Rear panel - Connections***, Pos. (a)) and wait 30 minutes for safety.

- Pack the amplifier in its original cardboard carton. Please, follow the instructions in Section ***2.1 Unpacking and Initial Inspection*** but in reverse order;
- Seal the amplifier carton with heavy-duty, at least 2-inch-wide self-adhesive tape;
- Finally, the external strapping needs to be added over the amplifier carton. Either plastic or metal bands can be used;
- Now, the amplifier is ready for shipment.

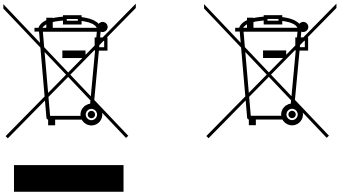
Basic shipping insurance is provided by the customer when sending in an amplifier - you can verify the amount covered by the shipping company by looking on their website. If you are shipping the amplifier, full/upgraded coverage is available as a suggested option.

For alternative shipping instructions, please, contact your local dealer.

9.5. Information on Disposing and Recycling of Old Electrical and Electronic Equipment

The information in this section is applicable for countries that have adopted separate waste collection systems.

ACOM products cannot be disposed as household waste.



Waste electricals

This symbol (crossed-out wheeled bin) explains that you should not place the electrical item in the general waste.

Waste electricals

This symbol (three green arrows going in a triangle with electrical plug in the center) means that according to local laws and regulations this product should be sent for recycling.

Old electrical and electronic equipment and batteries should be recycled at a facility capable of handling these items and their waste byproducts.

Contact your local authority for details in locating a recycle facility nearest to you.

Proper recycling and waste disposal will help conserve resources whilst preventing detrimental effects on our health and the environment.

Ultimate disposal of this product should be handled according to all national laws and regulations.

NOTES

This manual is for electronic distribution mainly.
If you have it on paper and you no longer need it, please, recycle it!

The latest versions of our User's Manuals are available at
www.acom-bg.com

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Sofia-Bozhurishte Industrial Park | 6 Valeri Petrov Str.
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