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Genesis Aqua Series TXs UHF TRANSMITTER

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OPERATOR'S MANUAL

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5 APPENDIX

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C ... SAFETY PRECAUTIONS

- 1. INTRODUCTION
- 2. SAFETY OPERATIONS
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- 4. ABSTRACT OF APPENDIX "E" OF CEI EN 60215 SAFETY RULES



FOREWORD (how to consult the manual)

1. MANUAL ORGANIZATION

The manual is composed of the following sections:

- section 1 "Operator's Manual" including general information, installation guide, operating instructions, maintenance;
- section 2 "Technical Manual" dealing with units and sub-units which make up the equipment;

2. CIRCUIT DIAGRAMS (HOW TO CONSULT THEM)

2.1 Acronyms

CIRCUIT DIAGRAMS ARE IDENTIFIED BY ACRONYMS AFTER THE DRAWING NUMBER (I.E.: 6320636082**IC**). A LIST OF THE ACRONYMS USED IS GIVEN HERE BELOW:

acronym	explanation
IC	wiring diagram
ED	circuit diagram
CL	component layout
ML	Mechanical layout

2.2 Classification of wiring cables

Wiring cables (unipolar, multipolar, flat cables) are identified by an alphanumeric code on circuit diagrams; this code is composed of 4 digits as follows:

- 1st digit is 'W' (for wiring)
- 2nd digit identifies the type of wiring (e.g.: ac connections, dc connections, RF connections etc.) as follows:
 - 1 ... for AC connections;
 - 2 ... for DC connections;
 - 3 ... for **RF** connections; 4 ... for **LF** connections:
 - 4 ... Ior LF connections;
 - **5** for logic signals, alarms connections.
- 3rd and 4th digits indicate the progressive numbering for each type of wiring.



2.3 Connection of wiring cables

The wiring cables between two connectors, are always intended pin-to-pin unless otherwise specified. In the event the wiring is not pin-to-pin, it is shown on the drawing.

2.4 Symbols and identifications of connectors/terminal blocks

Connectors and terminal boards arranged inside an equipment, a unit or a board, are identified on the associated circuit diagram, by symbols as follows:

symbol	objetc
_	male connector identified by "Jx"
	female connector identified by "Jx"
000000	terminal block identified by "Kx"
- <u>O</u> -(coaxial cable identified by "Wx"

Both for connectors and terminal blocks, the numbering is progressive within each equipment, unit, or board; that is on a general wiring diagram two or more "J6" (or "K3") may exist because they are arranged inside different equipment, unit or board.

Male and female connectors are identified respectively by "J" and "P" in some circuit diagrams before the year 2000.

However a connector (or terminal block) will always have the same identification number both on the general wiring diagram of the unit and on the general wiring diagram of the equipment where the unit is arranged.



FOREWORD (how to consult the manual)

3. SAFETY INFORMATION

2.5 Introduction

The equipment fully complies with the requirements for the safety of personnel as specified in IEC 215 rules. The equipment, if operated per specification, is designed and manufactured to protect the operator from high voltage, heat, radiation and other dangers.

Warning labels are attached to enclosures and/or various assemblies to identify potentially dangerous conditions to the operator. These Warning labels must be adhered to.

2.6 Warning, Cautions and Notes

Throughout the manual *Warning* and *Cautions* notices are used to identify procedures, conditions and materials that could be potentially cause death, injury or damage to equipment.

 WARNING!
 Used to indicate a potential hazard that requires correct procedures or practises in order to prevent personal injury or damage to equipment.
 Used to indicate a potential hazard that requires in order to prevent equipment.

CAUTION! Used to indicate correct operation or maintenance in order to prevent damage to, or destruction of equipment or other property.

Used to highlight important information or

procedures.





Read the relevant Technical Manual

2.7 Hazard symbols

Throughout the manual *hazard symbols* are used to alert the operator of a potential hazard related to the operation to be carried out.



Warning



Danger of getting crushed when working with loads.



Danger when lifting heavy loads.



Danger of burns on contact with hot surfaces.

Shock hazard



Danger of falling off ladders while working



Danger of getting hands crushed when working.



2.8 Beryllia devices

Some units or parts of the equipment may contain beryllia devices. Normally these components can be handled without risk, but there is a toxic hazard if beryllia dust from a damaged component is inhaled or implanted in the skin.

Units or parts containing beryllia oxide are identified by the label shown on the left.

For handling and disposal of beryllia devices, refer to "Safety Precautions" section, para 3. – "SPECIFICATION ON HAN-DLING AND DISPOSAL OF BERYLLIA DEVICES".



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1.: GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 Manual Applicability

This Operator's Manual provides systemoriented information, procedures and data for operation and installation of the following transmitter belonging to the *Genesis Aqua line*:

• Genesis Aqua Series TXs 3KW UHF transmitter p/n. BE-TV-LUI

From here on for the sake of simplicitythroughout this manual, Genesis Aqua Series TXs 3KW UHF transmitter will be referred to as Genesis Aqua Tx.

The contents of the present manual are arranged in sections according to the following:

- 1.: General Information

- 2.: Installation
- 3.: Operations
- 4.: Maintenance

1.1.2 Physical description

The transmitter used, belonging to the *Genesis Aqua line*, is designed for *digital broadcasting* and operate in UHF (band IV/V) delivering output power of 3 KW_{avg}. The equipments fully comply with the requirements for the safety of personnel as specified in IEC 215 rules. Each unit is designed in order to be easily removed and individually checked.

The amplifier modules are hot–pluggable thanks to the use of isolated combiners, allowing safe removal and insertion without interrupting transmitter operation.

The *Genesis Aqua Tx* is arranged in 42HE-19" steel rack-frame, which guarantees an optimum mechanical rigidity.

Genesis Aqua Tx transmitter is made up by the following units available to the operator on cabinet-front panel (refer to Fig. 1.1):

- RF Monitor panel
- Central Control Unit
- Exciter
- RF Power Amplifier module

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

- UHF Splitter/Combiner system
- Output Directional Couplers

Genesis Aqua transmitter is air/liquid cooled: the liquid is used to cool HPAs (*High Power Amplifiers*) and unbalance loads of the output combiner; the air is used to cool both the exciter and the CCU by their own internal fans.

The cooling of the rack is obtained by the forced convection process of the warmed up air flow getting out of cabinet by means of a fan installed on the top cover.

The liquid cooling system is closed loop type. The circulator and the expansion vessel are arranged inside the cabinet on the bottom panel, the heat exchangers needed for this kind of cooling may be placed far away from the transmitter.



1.1.3 Units Description of the transmitter

RF MONITOR PANEL

The panel supports the connectors (BNC female) for monitoring transmitter RF output power (*fwd* and *rfl*) before and after filter (*if present*).



EXCITER

The unit uses OFDM (Orthogonal Frequency Division Multiplex) modulation, with a large number of sub-carriers delivering a robust signal. LDPC (Low Density Parity Check) coding combined with BCH (Bose-Chaudhuri-Hocquengham) coding offers excellent performance in the presence of high noise levels and interference, resulting in a very robust signal.

Several options are available in areas such as the number of carriers, guard interval sizes and pilot signals, so that the overheads can be minimised for any target transmission channel. The Rotated Constellations technique, provides significant additional robustness in difficult channels. Also, a mechanism is provided to separately adjust the robustness of each delivered service within a channel to meet the required reception conditions (e.g. in-door antenna/roof-top antenna). This same mechanism allows transmissions to be tailored such that a receiver can save power by decoding only a single programme rather than a whole multiplex of programmes.

DVB-T2 also specifies a transmitter diversity method, known as MISO (**M**ultiple Input – Multiple **O**utput), which improves coverage in smallscale single-frequency networks. Finally, DVB-T2 has defined a way that the standard can be compatibly enhanced in the future through the use of Future Extension Frames.

The modulator is able to modulate either an MPEG2 or T2–MI Transport Stream into a DVB– T2 fully compliant RF signal.

With its integrated RF up-converter option, the modulator outputs an RF signal that can be directly exploited for live broadcasting or testing purposes. It generates the exact signal needed for any DVB-T2 deployment, validation campaign, debug test, integration constraints simulation with a broadcast quality signal that is required by operators, and matches with terrestrial transmitting systems.



CENTRAL CONTROL UNIT

Central Control Unit (CCU) guarantees the complete and easy management of the entire equipment. The unit monitors in real time each module contained in the equipment. The CONTROL LOGIC unit carries out the interface between the transmitter and the operator or the software supervisory system, if it is required. All the information about the functioning state of the the amplifier modules, the cooling system and the general status of the transmitter are available on the Control Logic front panel display. Control Logic unit is also able to manage the dual-exciter configuration.

The unit housed on board of the reserve Tx is equipped with a different firmware version which allows the management of the (N+1) transmission systems in passive stand-by configuration (N \leq 9). If the output power of one of the on-air transmitters falls below 3dB with respect to the nominal power, the CCU manages the exchange between the faulty transmitter and the reserve transmitter. The operator can set priority levels between transmitters. The CCU ensures system management in a simple and complete way. The unit checks each transmitter in real time. The CCU also interfaces between the system and the operator or with a supervision system if required. All information on the system operating status and the general status of the transmitters is available on the CCU front panel display.



RF AMPLIFIER (qty 2)

The High Power Amplifier used is W6-232L. It is a full LDMOS wideband amplifier capable of delivering a nominal output power of 1600W_{ava}.

W6–232L is manufactured using high reliability, solid state components. The module is made up of a pre–driver stage, a driver stage and of a final stage. In turn the final stage is made up of six amplifier stages oprrating with *Doherty technology*.

Easy maintenance is ensured by a microprocessor which indicates in real time all faulty elements, thanks to a series of detectors. At the input of each module there is a phase and amplitude regulation control, which ensures that it can be coupled to other module of the same type. W6–232L has its own switch-mode power supply built-in and it is self protected against over-temperature, overcurrents, over-voltage, overdrive and high reflected power. The amplifier module is *hot-pluggable*.



MAINS DISTRIBUTION UNIT

Mains Distribution unit is the distributor of the power supply voltages for the units contained in the Transmitter cabinet. It delivers the power supply voltages to the exciter, to the control unit and to amplifiers modules. In addition, it delivers the power supply voltages to the Heat Exchanger.

Two AC/DC Converters are also included within Mains Distribution in order to deliver the service voltages (+24V_{DC} and +12 V_{DC}) supply to Master HPA Board.



UHF SPLITTER/COMBINER SYSTEM

This transmitters with 2 HPA uses a –3 dB hybrid splitter/combiner system. Both the input splitter and the output combiner are arranged in a single assembly.

The unbalance loads of the output combiner are liquid cooled. Each resistor is endowed with a directional coupler and an RF detector wich allow the measurement of the power dissipated.

OUTPUT DIRECTIONAL coupler (at the output of output combiner or at the output of the band pass filter, if it is present) picks-up the voltages proportional to forward (4 samples) and reflected power (2 samples). Two power samples (*fwd* and rfl) are routed to *CCU* unit for displayng the measurements, two other power samples (*fwd*) are routed to the exciter for the precorrection operations. The remaining power samples (*fwd* and *rfl*) are made available on transmitter front panel for monitoring purposes.

1.2 FUNCTIONAL DESCRIPTION OF THE EQUIPMENT

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

- Fig. 1.2 block diagram of Genesis Aqua Tx RF section;
- Fig. 1.3 block diagram of Genesis Aqua Tx Control section;
- Fig. 1.4 block diagram of Genesis Aqua Tx Power supply section;
- Fig. 1.5 Genesis Aqua Tx cooling system.

1.2.1 Genesis Aqua Tx RF section

The input signals enter the exciter whose output is sent to the amplification chain.

The amplification chain is made up by an attenuator, a 2-way splitter, two amplifier modules and a 2-way combiner. The RF output signal from the combiner passes consecutively through a first directional coupler (before the band pass filter), the band pass filter, the second directional coupler (after the band pass filter) and finally is sent to the antenna. The directional couplers allow to to monitor the RF output power before and after the filter.

The forward (*fwd*) and reflected (*rfl*) power samples, picked up from output directional coupler are routed, via the boards of logic section, to *Central Control Unit* unit in order to be processed for displaying the relevant measurement.

Two other samples of *fwd* output power from picked up from the directional couplers are sent to the exciter to be processed for the precorrection operations.



1.2.2 Genesis Aqua Tx Control section

Control section consists of a *Central Control Unit*, two *CAN Bus Distributor*, a *Master HPA Borad*, a *PIB Parallel Interface* and six *PIB* boards.

A CAN bus allows interfacing the logic section of the transmitter with the other units and detectors.

CENTRAL CONTROL UNIT allows transmitter management and collects information on general functioning of the transmitter, on general status of its cooling system and on amplifier modules status. The information is displayed on the liquid crystal display.

CAN BUS DISTRIBUTOR boards act as concentrators and distributors of information from transmitter units.

MASTER HPA BOARD interfaces the amplifiers modules and the parts of the transmitter involved with them (cooling liquid flow of amplifiers and of unbalance loads; temperature of unbalance loads heatsink) with CCU. The interfacing is through CAN BUS DSITRIBUTOR 1 and 2. The board also allows manual control of the transmitter if CCU is under failure conditions or removed for servicing: through *Manual Control* assembly it is possible starting/stopping transmitter and setting "exciter A" or "exciter B" on air. *Manual Control* assembly is disabled under normal operating condition (CCU operating).

PIB BOARDs interface the different peripherals to CAN BUS DSITRIBUTOR 1.

ETHERNET SWICTH (optional) allows the remote control of the transmitter via web server.

When a P.I.B. is faulty *CCU* displays the number associated to this P.I.B.: the following Tab. 1.1 lists the number of P.I.B. boards (column 1), its arrangement within the transmitter cabinet (column 2), the reference on the associated circuit digaram (column 3) and the board part number (column 4).

Tab. 1.1 – P.I.B.s arrangement within TX				
PIB	arrangement	REFERENCE	ON TX WIRING DIAGRAM	p/n.
1	RF Combining Kit (GR5)	PIB	SC6	4010002313
4	Cooling Assembly	PIB	SC7	4010002315



1.2.3 Genesis Aqua Tx Power supply section

Power supply section includes the groups which distribute the power supply voltage to the different units which make up the transmitter, and to the liquid cooling system. The power supply section consists mainly of a *Mains Distribution* unit.

Two AC/DC Converters are also included within Mains Distribution in order to deliver $+24V_{DC}$ and $+12V_{DC}$ supply to Master HPA Board and service supply voltages ($+24V_{DC}$ and $+12V_{DC}$) for amplifier modules.



1.2.4 Genesis Aqua Tx Cooling system (ref. Fig. 1.5)

The liquid cooling system, consists mainly of the following parts:

- a cold plate inside each RF amplifier module;
- one circulator;
- an expansion vessel;
- one heat exchanger (placed far away from the transmitter cabinet);
- two sensors, one for the liquid temperature measurement and other used as flow-rate meter (both arranged at the liquid output manifold).

The liquid cooling system is based on a recirculating liquid loop. In fact the coolant is continuously circulating through the electronic equipment through a circuit where two manifolds distribute the liquid flow to the units of the transmitter. An inlet branch conduct splits equally the flow rate among module cold plates. The module cold–plates allows to dissipate the high thermal power produced by the amplifier stages.

The liquid flow is also conveyed towards the cold plate where the unbalance loads of the output combiner are assembled.

Changing the operating conditions, from the cold plate to the exchangers, there are high variations (increases/decreases) in pressure, volume and temperature.

An expansion vessel is used to contain these variations in pressure and volume which, otherwise, could compromise the safety and operation of the circuit. it is a metal container with an inner air chamber divided into two variable volume chambers, one containing the circuit fluid (the water, almost incompressible), the other containing air or gas (compressible) preloaded at a given pressure by means of a special valve. The division between the two chambers can take place thanks to a bag or an elastic membrane. This air chamber absorbs the variations in water volume, making the operation of the system much more stable and certainly safer.

The coolant is a mixture composed by liquid and antifreeze like glycol.

All the cooling system is managed by *Central Control Unit*. The start signal from *CCU* allows switching–on the circulator and the heat exchanger. The same unit collects all the alarm signals related to the liquid cooling system fault as excessive water temperature ("^oC MAX"), fluid flow rate out of working range ("LIQUID FLOW ALARM"), circulator fault ("circulator FAULT") and exchanger fault ("BLOWER 1" FAULT"). All of these signals belong to the set of *Cooling Control* unit alarms, and they can stop via *CAN bus* the transmitter already running. In this event a "Cooling Fault" alarm is displayed on *CCU*.





1.3 TECHNICAL SPECIFICATIONS (Genesis Aqua transmitter)

RF DATA		
Frequency range	470 to 700 Mhz (UHF band IV-V) Doherty mode	
RF Output power	3 KW _{avg}	
RF Output connector	1- ⁵ /8" EIA flanged	
Shoulder	> 38 dB	
MER	> 35 dB (DAB > 30 dB)	
Crest factor	8.5 to 9.5 dB	
Spurious Emissions	<–60 dBc (< –70 dBc with filter)	
Harmonic Emissions	<-60 dBc (< -70 dBc with filter)	
In band Spurious Emissions	<-70 dBc	
STANDARDS		
■ Digital TV		
Standards	DVB-T (fully compliant with EN 300 744, TS 101 191) DVB-T2 (EN 302 755, TS 102 773; TR101 290; TS 102 2831) ISDB-T/Tb (ARIB STB-B31, TR-B14) ATSC, ATSC Mobile DTV, ATSC 3.0	
Channel Bnadwidth		
• DVB-T	5/6/7/8 MHz	
• DVB-T2	1.7/5/6/7/8 MHz	
• ISDB-T/T _b	6/8 MHz	
AISC 3.0	6 MHZ, 7 MHZ, 8 MHZ	
 DVB-T/T2, ISDB-T/T_b, DTMB 	2 BNC 75 $\Omega,$ DVB ASI, TS 188/204 packets, continuous and burst mode, 2 RJ45 GbE	
ATSC, ATSC 3.0	2 SMPTE310M or 2 ASI, 75 Ω BNC, 2 RJ45	
MAINS SUPPLY VOLTAGE		
Ac supply	single phase 208V _{ac} – 240V _{ac}	
Frequency	50/60 Hz ± 4%	
Power factor	> 0.95	
Efficiency (COFDM) with heat exchangers	up to 41% Doherty mode	
Efficiency (COFDM) without heat exchanger	up to 42% Doherty mode	
THD	< 6%	
Safety	EN 60215/EN 60950	
EMC	EN 301489	
REMOTE INTERFACES		
Local control	Display(s), Keyboard(s), and USB ports	
Remote control	Ethernet for HTTP (Web Server)/SNMP/NTP/SSL, RS232, Parallel	
Test points	RF out monitor, RF amp output, RF exciter output	
SYNCHRONIZATION		
Reference frequency	Internal (OCXO or integrated GPS)/Internal locked to the External (BNC 50 Ω , 10 MHz)	
Reference pulse	1pps Internal (integrated GPS)/External (BNC 50 Ω , TTL)	
Internal reference Accuracy	±1 · 10 ⁻⁸ (0 to 70 °C) ±5 · 10 ⁻¹⁰ per day (after 30 day) ±1 · 10 ⁻⁷ per year	

METERING		
	 forward output power (before and afterf filter) reflected power (before and afterf filter) 	
COOLING		
HPAs and output combiner dummy load	liquid cooling	
Transmitter cabinet	air cooling by forced convection	
MECHANICAL		
RACK	19" - 42 HU/ steel	
DIMENSIONS (W x H x D, in mm)	600 x 2015 x 1100	
WEIGHTS (kg) (Transmitter Cabinet +dual exciter + 4 HPA)	400	
COLOUR		
Cabinets	black	
Units	light grey	
ENVIRONMENTAL		
Ambient temperature range	0 °C to +55 °C	
Storage temperature range	–30 °C to +70 °C	
Relative humidity (@ 40 °C)	95% without condensation	
Max. Operating altitude (asl)	Up to 3000 meters	
Safety rules	EN 60215 / EN 60950	
EMC	EN 301489	

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Fig. 2.10) – Filling the hydraulic circuit

2

INSTALLATION

INFORMATION FOR THE OPERATOR

Throughout the manual Warning and Caution notices are used along with hazard symbols.

Warning and *Caution* notices identify procedures, conditions and materials that could be potentially cause death, injury or damage to equipment.

Hazard symbols are used to alert the operator of a potential hazard related to the operation to be carried out.

Here below Warning, Caution notices and hazard symbols used, are shown.

WARNING

Used to indicate a potential hazard that requires correct procedures or practises in order to prevent personal injury or damage to equipment.

CAUTION!

Used to indicate correct operation or maintenance in order to prevent damage to, or destruction of equipment or other property.

NOTE!

Used to highlight important information or procedures.



Tips on how alert the operator faster or easier to complete a task



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

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

These regulations especially refer to the following:



2.: INSTALLATION

2.1 INTRODUCTION

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

2.1.1 Requirements for Installation

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

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

2.1.2 Transport

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

NOTE!

INSPECTION FOR DAMAGE DURING TRANSPORT

-

When the equipment arrives at destination, it should be inspected immediately for possible damage incurred during transport.

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

2.1.3 Unpacking

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

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

2.1.4 Storage

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

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

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

2.1.5 Repacking

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

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

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

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

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

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

2.2 PHYSICAL INSTALLATION

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

- 2.2.1 Racks set up (refer to Fig. 2.1)
 - POSITIONING AND LINING UP RACK Transmitter cabinet must be fitted, fixed in place and lined up (in horizontal) after it has been placed in the desired position. Four bolts on the front/rear bottom of the rack are used for this purpose. These bolts must be unscrewed until they touch the floor. In this way they block and allow lining up the racks.

2.2.2 Connection of the equipment to the ground system of the site (refer to Fig. 2.3)

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

2.2.3 Fitting units to the cabinets (refer to Fig. 2.4 and to the system wiring diagrams)

Due to their weight for safety reasons, some units of the system are packed separately, so it is necessary to fit them to the cabinets. The units that have to be fitted are:

- EXCITERS
- AMPLIFIERS MODULES
- FITTING EXCITER UNITS

The exciter unit must be inserted into the cabinet in its suitable housing in the space under the *CCU* unit.

Connection of the units must be carried out according to the wiring diagram included on divider no. 6 "*Wiring diagrams*".

• FITTING AMPLIFIERS MODULES

Amplifiers modules must be inserted into transmitter cabinet, in their suitable housings. To have the best performance of the equipment, insert the units according to the numbering shown on the side uprights of the cabinets. The number of each amplification unit is shown on a label on the top cover of the amplifier itself.

No operation is required to the operator for connection of the amplifiers modules since fitting them inside their frame both electrical and hydraulic connections are made.



2.2.4 Connecting the cabinets and heat exchanger to the mains supply *to Fig. 2.5 and to the system wiring diagrams)*

TX CABINET

Mains supply must be connected to K1 terminal block of the *Mains Distribution* unit. The terminal block is accessed by removing the *Mains Distribution* unit from the cabinet (unscrew the four screws on the front panel and slide the unit outwards).

(ref.

Following the indications drawn on each terminal block, connect the cables (L1, L2, L3, N) of the three-phase mains and ground cable (PE) to K1.

HEAT EXCHANGER

The mains supply must be taken from K11 (W118 to blower 1) terminal blocks of the *Mains Distribution* unit.

Suitable through holes available on top panels of the cabinets allow the input/output of mains cables.

2.2.5 Program signals connection (ref. to Fig. 2.6 and to the system wiring diagrams)

The connectors for the program signals are available on the rear panel of "2+1 ASI Change– Over" unit. It is accessed from the rear side of the TXR cabinet removing the back panel.

Suitable through-holes on top panel of the cabinet allows the entry of the program signals cables; refer to wiring diagram included on divider no. 6 *"Wiring diagrams".*

2.2.6 Hydraulic connections (refer to Fig. 2.7, Fig. 2.8 and Fig. 2.9)

The hydraulic connections of the system cabinets to the heat exchangers must be carried out according to the indications shown in Fig. 2.7, Fig. 2.8 and Fig. 2.9.

- RECOMMENDED MATERIALS FOR PIPELINES
 - The pipelines of hydraulic circuit must be carried out with one of the following materials: $-\mbox{ C-PVC}$
 - EPDM rubber
 - stainless steel AISI 304

The use of C-PVC is advisable because of its easy handling

CAUTION!

if aluminium exchangers are used along with copper ducts, then a PVC pipe short length (at least 50cm) must be inserted between exchangers and copper ducts.

 MAXIMUM ALLOWED LENGTH OF HYDRAULIC CIRCUIT 40 meters is the maximum length allowed for pipelines of a TX's hydraulic circuit. This length is referred to pipelines of adequate section. Equivalent length of elbows and any other discontinuity, must be subtracted from 40 meters.

2.2.7 Filling the hydraulic circuit (refer to Fig. 2.10)

Once the hydraulic connections of the tarnsmitter cabinet to heat exchangers have been carried out (see previous para. 2.2.6 "Hydraulic connections" – Fig. 2.7, Fig. 2.8 and Fig. 2.9), it is necessary to fill the cooling circuit. The capacity of the huydraulic circuit depends on the characteristics of the installation site that determines the length of the connections.

Follow the directions given here below in order to operate safely and correctly.

CAUTION!

Carry out the operation with transmitter switched-off

Prepare the coolant by mixing water and glycol according to the thinning ratios shown in Tab. 2.1:

CAUTION!

30% is the minimum of glycol percentage for a good protection of cooling circuit. For low temperature the thinning ratio must be increased as listed on the following table.

Tab. 2.1 – Glycol thinning ratio				
EXT. TEMP. (^O C)	EXT. TEMP. (^o F)	GLYCOL (%)		
t≥ -15ºC	t≥ 5ºF	30%		
$-15^{\circ}C \ge t \ge -20^{\circ}C$	$5^{o}F \ge t \ge -4^{o}F$	40%		
$-20^{\circ}C \ge t \ge -35^{\circ}C$	$-4^{o}F \ge t \ge -31^{o}F$	50%		
$-35^{\circ}C \ge t \ge -45^{\circ}C$	$-31^{\circ}F \ge t \ge -41.8^{\circ}F$	60%		

CAUTION!

Coolant must be renewed every 5 years, unless glycol with longer life is used (see manufacturers' indications). ELECTROSYS recommends the following TEXACO type of glycol:

• Havoline Extended Life (ethylene type)

Lifetime of this glycol is 5 years.

WARNING!

<u>CIRCULATORS MUST BE NEVER OPERATED WITHOUT LIQUID IN</u> <u>THE CIRCUIT.</u>

At the first switching-on, cooling alarms may occur until the cooling circuit is not completely filled. In the meantime transmitter stops and starts again until the steady condition is reached.

WARNING

Disregarding the above rules will cause the warranty to expire and will release Electrosys from any responsibility!

Now follow the directions of Fig. 2.10.

Operator's Manual

manufacturer	type	web site
DOWCAL	Dowcal 100Dowcal 200	<i>www.dowcal.com</i> (follow indication of home page)
TEXACO	Extended Life Coolant	<i>www.havoline.com</i> (follow indication of home page)

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Fig. 2.3 - Connection of the equipment to the ground system of the site

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Genesis Aqua Series TXs: 2. Installation



To have the best performance of the equipment, insert the units according to the numbering shown on the side uprights of the cabinets. The number of each amplification unit is shown on a label on the top cover of the amplifier itself. After fitting the units to the cabinet, make sure that the cocks on the liquid manifold (inside the cabinet) are open. f ladders Danger of getting crushed when working with loads. Danger when lifting heavy loads. Danger of getting hands crushed when working. Danger of falling off while working NOTE TIP 🔆 AN N F

Fig. 2.4 - Fitting units to the cabinets

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with the coolant up to the MAX mark indicated on the tank

WARNING!

NING AVOID THE COOLANT GOES DOWN ON THE TANK.

CAUTION

keep the coolant level between the MIN and MAX and again during the functioning of the LP.

TIP	

P cover T tank during the whole filling operation.

to the drain open valve <mark>1</mark> as shown in the *side figure*. to the drain open valve <mark>2</mark> , as shown in the *side figure*, he LP tank.

_. ;

figure) and the heat exchanger (see Fig. 2.9) bleeder.

ltion (A) as shown in the *side figure,* leaving the other valo Chap. 1; General Info; Para. 1.2.4; Fig. 1.5).

nt to go in the hydraulic circuit.

in as the airless coolant comes out from the *emptying pipe* e tank.

: until its pressure amount to 1.7 bar (you always have to after close the drain valve 1 and turn off the LP immedi-

tion **B** as shown in the *side figure*.

nap. 3; Operations; Para. 3.5/step 1 of Tab. 3.7) flex unit then press the relevant "STOP" button. CU unit.

s the hydraulic circuit pressure stabilizes.

utton on the CCU) and check the hydraulic circuit pressure: *han 1.6 bar* fill the hydraulic circuit again; in order to do it, valve 1 immediately letting the coolant to go in as long as nally, close the drain valve 1 and turn off the LP immedi-

than 1.6 bar, move to the next step.

o times again.

neat exchanger bleeder (see Fig. 2.9).

pipe ${\sf M}$ from drain valve $oldsymbol{1}$ and the Emptying Pipe end

on again by pressing "LOCAL" button on its front panel.



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Fill up the Loading P ump (LP) tank (<i>ref. to side figure</i>).	DURING THE LP FUNCTION	THE MIN MARK INDICATED	It's strictly recommended to k marks filling up the tank again	It's suggested to remove the L	Connect the LP delivery pipe M	Connect one <i>emptying pipe</i> end R putting the other end pipe inside t	Close the drain valves 3 4 5	Open both the manifold (see side	Rotate the 3-way valve <mark>6</mark> to posives in the normal operation (ref. t	Turn on the LP letting the coolant	Close the drain valve <mark>2</mark> as soon end R previously put inside the t	Keep loading the hydraulic circuit check it by the pressure gauge); a ately.	Rotate the 3-way valve 6 to pos	Turn on the transmitter (ref. to Ch Press "LOCAL" button on the M Press "START" button on the Co 	Keep the transmitter on, as long a	Turn off the transmitter (" STOP " but • <i>if the pressure value is lower th</i> turn on the LP then open the drain v	the pressure amount to 1.7 bar; fin ately. <i>if the pressure value isn't lower</i>	Repeat steps 11., 12. and 13. two	Close both the manifold and the h	Disconnect both the LP delivery p from the drain valve 2.	Set MEX unit into remote operatic	
÷					N	ю.	4	Ċ.	9.	7.	α	.0	10.	÷	12.	13.		14. 14.	15.	16.	17.	

3.: OPERATIONS

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OPERATIONS

3.: OPERATIONS

3.1 INTRODUCTION

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

3.2 CALL OUT OF CONTROLS AND INDICATORS ON TRANSMITTER FRONT PANEL

The following tables refers to the figures showing the call out of the front panel of the units included in the equipment, which have controls and connectors available to the operator.

Each number of the tables marks and indicator, connector, test point etc. located on the panels. A simple description of the function carried out is given for each number.

This section is subdivided as follows:

3.2.1 Call out of the units on transmitter cabinet

- Tab. 3.1 refers to Fig. 3.1 which is the call out of "RF Monitor" front panel
- Tab. 3.2 refers to Fig. 3.2 which is the call out of "Central Control Unit" front panel
- Tab. 3.3 refers to Fig. 3.3 which is the call out of "MEX Exciter" front panel
- Tab. 3.4 refers to Fig. 3.4 which is the call out of "W6-232L" front panel
- Tab. 3.5 refers to Fig. 3.5 which is the call out of "Mains Distribution" front panel

3.2.1 Call out of the units on transmitter cabinet



	Tab. 3.1 – RF Monitor front panel call out (ref. Fig. 3.1)						
No.	LABEL	FUNCTION					
1	BEFORE FILTER	Monitor connector (BNC female); allows monitoring the RF output power (<i>FWD</i> and <i>RFL</i>) of the transmitter before the filter (signal level labelled beneath connector).					
2	AFTER FILTER	Monitor connector (BNC female); allows monitoring the RF output power (<i>FWD</i> and <i>RFL</i>) of the transmitter after the filter (signal level labelled beneath connector).					



	Tab. 3.2 – Central Control Unit front panel call out (ref. Fig. 3.2)					
NO.	LABEL	FUNCTION				
1		Liquid Crystal <i>toucl</i> on the functioning s	<i>h–screen</i> Display. It displays the information state of the equipment.			
2	TOUCH - SCREEN	Push-button; it ena disables the transm <i>touch-screen</i> contr	ables (the associated yellow led is lit) or hitter control via <i>touch-screen</i> . Disabling rol enables the keybord (#4).			
3		Control buttons:				
		START allows st <i>Central C</i> ted green	arting the equipment functioning when the <i>Control Unit</i> is set in local mode. The associa- n led is lit.			
		STOP allows st <i>Central C</i> ted <i>red</i> le	opping the equipment functioning when the <i>Control Unit</i> is set in local mode. The associa- ed is lit.			
	* v	LOCAL toggle bu ment. W "STOP" b and the a	atton; sets <i>local/remote</i> control of the equip- hen <i>local</i> mode is selected, "START" and puttons and navigation keyboard are enabled associated <i>yellow</i> led (arrow), lights up.			
		ESCAPE allows to	quit from current menu.			
4	STATUS	Indicator led (<i>multic</i> status, as follows:	<i>color</i>); According to the colour, it shows TX			
		SOLID BLUE	TX is delivering its nominal RF output power;			
		BLINKING BLUE/RED	when an alarm with <i>Warning level</i> has occurred (transmitter goes on).			
		SOLID RED	when an alarm with <i>Critical level</i> has occur- red (transmitter stops).			
	RF PRESENT	Indicator led (<i>solid</i>) (RF output power a	<i>green</i>); it indicates TX operates properly tt the rated value).			
	INFO	Indicator led (<i>solid</i> occurred since alar time	<i>yellow</i>); it indicates that an alarm condition m history has been displayed for the last			



	Tab. 3.3 – MEX Exciter front panel call out (ref. Fig. 3.3)					
No.	LABEL	FUNCTION				
1		USB connection Do not use for co	used only by <i>Itelco</i> for maintenance purposes. communication with DVB-T2 modulator.			
2	RF MONITOR	Monitor connector (SMB female); it allows monitoring the RF output signal of the unit.				
3		LCD display of the functioning of MI	ne unit; displays information and data relevant to the EX <i>II</i> (4 lines x 30characters).			
4	EXCITER	Led indicator (g colours, as follow	reen/red); indicates MEX status according to the ws:			
		BLUE	MEX is delivering its nominal RF output power;			
		BLUE (blinking)	warm up at the switching-on (approx. 30sec); within this time interval all alarms are inhibited;			
		BLUE/RED (blinkin	g)warning condition of MEX (MEX is still working);			
		RED	failure condition of MEX (no RF ouput power);			
		OFF	MEX is in STOP condition (EXCITER RF OFF).			
	TRANSMITTER	Led indicator (gre control logic of t colour, it shows	een/red); it is active only when MEX operates also as he transmitter where it is housed. According to the the transmitter status, as follows:			
		BLUE	the transmitter is delivering its nominal RF output power;			
		BLUE/RED (blinkin	<i>g) warning</i> condition of the transmitter (transmitter is still working);			
		RED	failure condition of the transmitter (no RF ouput power);			
		OFF	when the transmitter is in STOP condition.			
	ON AIR	Led indicator (gr	een); <i>NOT USED</i> .			

	Tab. 3.3 – MEX Exciter front panel call out (ref. Fig. 3.3)							
No.	LABEL	FUNCTION						
5		Push-buttons; allow se START	 etting the operating conditions of the unit: Push-button; it is active only if <i>local</i> functioning mode has been set. Under this condition, it operates as follows: <i>if MEX operates only as exciter</i> starts the unit; <i>if MEX operates as TX CTRL LOGIC</i> starts TX. When pushed, the associated green led, lights up. 					
		STOP	Push-button; it is active only if <i>local</i> func- tioning mode has been set. Under this con- dition, it operates as follows:					
			 <i>if MEX operates only as exciter</i> switches– off the unit; <i>if MEX operates as TX CTRL LOGIC</i> switches–off TX. When pushed, the associated red led, lights up. 					
		ESCAPE	Push-button; it allows to quit from current menu.					
		LOCAL/REMOTE	Push-button which allows <i>local/remote</i> control of the equipment. When <i>local</i> mode is selected, "START" and "STOP" push-buttons and the keyboard are enabled. When <i>remote</i> mode is selected, "START" and "STOP" push-buttons and the keyboard are disabled.					
6		Controller keyboard. It hand side of the displa MEX. Accessing the menu ar - "▲" and "♥" arrows select the parameter parameters inside a - "∢" and "▶" arrows a - "OK" key is used to e ting carried out.	allows accessing the menu (listed on right- y) and setting the functioning parameters of nd setting of the parameter is as follows: select the menu; once accessed the menu, er to be changed; change the values of the menu. allow scrolling the pages of each menu. enter the selected menu and to confirm the set-					
7		Grid for the inlet of the	cooling air of the unit.					



	Tab. 3.4 –W6–232L front panel (ref. Fig. 3.4)							
No.	LABEL	FUNCTION						
1		Push-button; it allo	Push-button; it allows resetting logic section of the unit.					
2		Connector (SMB, female); it allows monitoring RF output of the amplifier module.						
3		Indicator led (multic	color); depending on the unit status it is lit:					
		SOLID GREEN	when the unit is AC supplied, but it does not deliver RF output power;					
		SOLID BLUE	when the unit is AC supplied and it delivers RF output power (normal operating condi- tions).					
		BLINKING BLUE/RED	when an alarm with <i>Warning level</i> has occurred (transmitter goes on).					
		SOLID RED	when an alarm with <i>Critical level</i> has occur- red (transmitter stops).					
4		USB connector; it is software installalle status.	s the connection for a PC (whith a dedicated ed) which allows monitoring the amplifier					



	Tab. 3.5 – Mains Distribution front panel (ref. Fig. 3.5)					
No.	LABEL	FUNCTION				
1	LOGIC	Breaker. It connects the power supply to CCU unit.				
2	EXC.	Breaker. It connects the power supply to exciter unit.				
3	AC/DC	Breaker. It connects the power supply to the internal AC/DC power supplies (+24 V_{DC} /GR1 and +12 V_{DC} /GR2).				
4	HPA1 1 to HPA 2	Set of breakers (<i>HPA3 and HPA4 are present only for 5KW tran-</i> <i>smitters</i>). They connect the AC power supply to the relevant amp- lifier module.				
5	MAINS INPUT	It is the general breaker of the transmitter.				
6	PUMP 1	Breaker; it routes the power supply voltage to pump 1.				
7	HEAT EXCHANGER	Breaker; it routes the power supply voltage to heat exchanger.				

3.3 SUMMARY TABLE OF INDICATOR LEDS ON TX FRONT PANEL

The following table refers to Fig. 3.6 which point out all the indicator LEDs available to the operator, on the front panels of the tarnsmitter's units. A simple description of the function carried out is given for each number.



Tab. 3.6 – Indicator LEDs on TX front panel (ref. Fig. 3.6)				
No.	LED	COLOR	INDICATION	
"CCU" Central Control Unit				
1	STATUS	MULTICOLOR	SOLID BLUE TX delivering its nominal RF output power BLINKING BLUE/RED alarm with Warning level occurred (TX goes on) SOLID RED alarm with Critical level occurred (TX stops)	
2	RF PRESENT	GREEN	TX operating (RF output pwr at the rated value)	
3	INFO	YELLOW	alarm condition occurred since alarm history has been displayed for the last time	
<i>"MEX"</i> exciter				
4	EXCITER	MULTICOLOR	Led indicator (green/red); indicates MEX status according to the colours, as follows:	
			RF output power;	
			BLUE (blinking) warm up at the switching-on (approx. 30sec); within this time interval all alarms are inhibited;	
			<i>BLUE/RED</i> (<i>blinking</i>) <i>warning</i> condition of MEX (MEX is still working);	
			<i>RED</i> failure condition of MEX (no RF ouput power);	
			OFF MEX is in STOP condition (EXCITER RF OFF).	
5	TRANSMITTER	MULTICOLOR	Led indicator (green/red); it is active only when MEX operates also as control logic of the trans- mitter where it is housed. According to the colour, it shows the transmitter status, as follows:	
			BLUE the transmitter is delivering its nominal RF output power;	
			BLUE/RED (blinking) warning condition of the tran- smitter (transmitter is still wor- king);	
			RED failure condition of the tran- smitter (no RF ouput power);	
			<i>OFF</i> when the transmitter is in <i>STOP</i> condition.	
6	ON AIR	GREEN	Led indicator (green); NOT USED.	
	4	<i>'NORTHIA"</i> High I	Power Amplifier	
7		MULTICOLOR	SOLID BLUE unit is AC supplied and delivering RF output power (normal conditions)	
			BLINKING BLUE/RED alarm with Warning level occurred (TX goes on)	
			<i>SOLID RED</i> alarm with <i>Critical level</i> occurred (<i>TX stops</i>)	
			SOLID GREEN mains voltage phases within allowed range	

3.4 INSTALLATION CHECKS

After each unit has been installed, as described in the previous chapter, a series of checks must be performed to verify that:

- neither equipment nor cables have been damaged during installation;
- the equipment operates regularly and is fully able to carry out the functions for which has been installed.

The check procedure consists of two steps:

- Cold checks;
- Hot checks.

3.4.1 Cold checks

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

- ▶ the place of installation complies with the stated requirements;
- ▶ sufficient space is available around the unit for maintenance requirements;
- ▶ the unit is easily accessible to the operator;
- ▶ the unit is grounded;
- connectors and cables attached to the unit are well tightened
- ▶ RF output of the transmitter is connected to antenna or to a suiatble dummy load

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

3.4.2 Hot checks

Upon completion of "cold" checks with the euipment switched off, switch it on (carry out steps 1 and 2 of Tab. 3.7) and verify that functioning is regular. It is advisable to check:

- all power supply voltages to the various units;
- regular functioning of equipment, on CCU display; regular functioning of the equipment may be also checked referring to Tab. 3.6 which lists the indicator LEDs on equipment front panels and their associted status (*alarm* or *regular*);
- air and liquid cooling system are efficient, making sure that the air can be felt from all nozzles.

3.5 SWITCHING-ON

The switching on procedure for the equipment is given on Tab. 3.7.

Tab. 3.7 – Switching on the equipment (local control procedure)				
Step	DESCRIPTION	EXPECTED RESULT		
1	 Close the breakers on Mains Distribution unit front panel of each cabinet <i>(see Tab. 3.5 and Fig. 3.5)</i> 	 These LEDs light up on front panels of the following units: <u>CCU:</u> <i>STATUS (blue)</i> blinks for about 30 s then remains lit; <i>LOCAL (yellow, on the relevant key)</i> <i>STOP (red, on the relevant key)</i> <i>STOP (red, on the relevant key)</i> <i>See note (1).</i> <u>MEX Exciter</u>: <i>EXCITER (blue)</i> blinks for about 30 s then goes off; <i>Display on unit front panel lights-up and the exciter starts the software loading ('loading' operation).</i> <u>RF Amp. modules</u> 		
2	- Press "START" button on CCU.	 (LED blinking green) modules supplied These LEDs light up on front panels of the following units: CCU: RF PRESENT (green). MEX Exciters: EXCITER (blue). RF Amp. modules (LED blue) modules deliever RF Pwr THE SYSTEM DELIVERS RF POWER 		

NOTE

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

- CCU units of TX1/2 were in <u>remote</u> mode and in <u>stop</u> condition (no RF power delivered).
- CCU units of TXR was in <u>local/manual</u> mode and in <u>stop</u> condition (no RF power delivered).
- Exciters were in <u>remote</u> mode and in <u>stop</u> condition (no RF power delivered).

3.6 SWITCHING-OFF

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

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

- ▶ push 'STOP' on *CCU*;
- ▶ open the mains breakers on *Mains Distribution* front panel.

3.7 REMOTE CONTROL

The remote control of the transmitter is allowed via web service.

Special connectors are available on rear panel of *CCU* and *MEX* units. The remote control is achieved entering the address (i.e.: 192.4.0.186) associated to each unit.

The IP address of *CCU* unit is read on "Options\TCP-IP" menu.

The IP address of *MEXII* unit is read on < TX IP > menu.

An "ETHERNET SWITCH" unit (available on request), can be housed inside TX cabinet

Further details about *ETHERNET* interfaces and connection protocols, are given in Appendix "A": *Ethernet Iterface Installation Guide.*



3.8 MANUAL CONTROL UNDER EMERGENCY CONDITIONS

Under emergency conditions (i.e.: failure of *CCU* or maintenance operations) the manual control of the transmitter (*TX start/stop*) is allowed through via "*MANUAL CONTROL*" group arranged on the left side wall of the cabinet (from the rear side).

Two buttons, ("START" and "STOP") allows *starting/stopping* the transmitter. Moreover two indicator LEDs (green) show the operative conditions of the transmitter:

- "INTERLOCK PRESENT" . . indicates the interlock chain is closed (normal operations);
- "LOGIC PRESENT" indicates *CCU* is operating normally (under failure conditions of *CCU* the LED is off.





3.9 REGULATION AND SETTINGS

3.9.1 Measurement and Regulation of a transmitter Output Power

A transmitter unit replacement could change the transmitter output power, that is factory set. So it could be necessary to check the RF output power and eventually adjust it again. The procedure must be performed on Exciter.

Refer to *MEX II* Technical Manual for information on how to perform the RF output power adjustment.

The test-bench set-up is shown in Fig. 3.8.



3.9.2 Changing the trasnmission channel

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

(section 2, Tech Manual; Cahp. 2 – paragraph 2.4.4 "Description of Menu"; Fig. 2.16 'Options/Configuration' menu)

MEX // EXCITER



(section 2, Tech Manual; see the relevant description)

NOTE!

Keep in mind that the set-up relevant the two types of modulators (DVB-T and DVB-T2) are completely independent.

So changing the transmission channel on a modulator type, the other ones keeps its pre-existing set-up.

- BAND PASS FILTER (*if presernt*)
 - Tuning the filter cavities (refer to test report which comes with the equipment)

3.9.3 Changing the *dual-cast* modulator

The steps to be carried out to change the modulator operation from *analog* to *digital* and vice versa, concern the units listed here below; for each of them is also given *(between parentheses)* the reference to the technical manual where the topic has dealt with.

(section 2, Tech Manual; Cahp. 2 – paragraph 2.4.4 "Description of Menu"; Fig. 2.16 'Options/Configuration' menu)

MEX // EXCITER



(section 2, Tech Manual; see the relevant description)



3.10 EXTRACTION OF THE MODULE FROM THE CABINET

The module is hot-pluggable thanks to the use of an isolated combiner, allowing safe removal and insertion without interrupting transmitter operation. The extraction is obtained with a release device operating from the amplifier front panel, operating only from the front of the transmitter. When the amplifier module is released, all power supply circuit inside the rack related to the amplifier itself mains supply are disabled. The following Fig. 3.9 shows the location of the release device.



3.10.1 Extraction of the module with the release device (steel wire) broken

In case of breakage of the release device of the module (steel wire), this last may be extracted from the rack, removing the latch mounted on the rear of the frame of the modules. To do this remove the rear panel of the cabinet and operate as shown in Fig. 3.10.



S.
4.: MAINTENANCE

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4

4.: MAINTENANCE

4.1 INTRODUCTION

4.1.1 Introduction to Maintenance

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

- PREVENTIVE MAINTENANCE
- CORRECTIVE MAINTENANCE

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

4.1.2 Maintenance tools

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

4.1.3 Test Instruments

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

4.2 PREVENTIVE MAINTENANCE

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

4.2.1 General Instruction

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

1 Cabinets

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

2 Air Filters

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



3 Connections Cables

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

4 Terminal Blocks

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

5 Mechanical Inspection

According to the environmental conditions, periodically check and lubricate the following mechanical parts:

- hinges of front doors;
- hinges of rear doors.

4.2.2 Preventive maintenance Table

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

Tab. 4.1 – Summary of periodic checks				
REF.	PERIODICITY	TYPE OF SERVICING	REFERENCE FOR THE EXECUTION	ESTIMATED EXECUTION TIME
1	Monthly	Checking the hydraulic circuit pressure	On CCU display (<i>Transmitter/</i> <i>Cooling menu</i>) See relevant TECH. MAN.	1 min.
2	Monthly	Checking of the voltage power supply of amplifier modules.	On CCU display (<i>HPA/Sum- mary menu</i>). See relevant TECH. MAN.	1 min.
3	Monthly	Checking of the current absorption of amplifier modules.	On CCU display (<i>HPA/Sum- mary menu</i>). See relevant TECH. MAN.	1 min.
4	Monthly	Cleaning of the air filters	Chap. 4; para. 4.2.1 of this OPERATOR'S MANUAL	1 min.
5	Six-Monthly	Checking of the mains terminal blocks tightening	Chapt. 2; para.2.2.4 (Fig. 2.5), of this OPERATOR'S MANUAL	5 min.
6	Six-Monthly	Cleaning of Y filter	Chapt.4; para.4.2.5 (Fig. 4.3), of this OPERATOR'S MANUAL	5 min.
7	Yearly	Cleaning of the heat exchangers	Chap. 4; para. 4.2.4 of this OPERATOR'S MANUAL	30 min.
8	Five-Yearly	Changing the cooling liq- uid	Chapt. 4; para. 4.2.3 of this OPERATOR'S MANUAL	3 hours

4.2.3 Changing the coolant

The changing of the cooling liquid consists of two operations:

- Emptying the hydraulic circuit
- Filling the hydraulic circuit

WARNING!

CARRY OUT THE PROCEDURE WITH TRANSMITTER SWITCHED-OFF

4.2.3.1 Emptying the hydraulic circuit

- 1. Close the ball valves of the inlet/outlet coolant pipes to the heat exchanger; after that disconnect pipe ends from the heat exchanger and place them on the same level of the transmitter base. Finally, open the ball valves to allow the emptying of the pipes (*ref. to Fig. 2.9*).
- 2. Open the drain valves of the heat exchanger to empty it (ref. to Fig. 2.9).
- 3. Keep the position of the 3-way valves unchanged as shown in the Fig. 4.1 (normal operation *ref. to Chapt.1.: General Info; Fig. 1.5*).
- 4. Open the drain valves of:
 - the cooling assembly;
 - the inlet/outlet coolant manifolds.



4.2.3.2 Filling the hydraulic circuit

Follow the procedure given in Chap 2.: Installaltion; para. 2.2.7.

4.2.4 Cleaning the heat exchanger

Dependant on each specific application attention must be paid to external material surfaces.

AIR FINS CLEANING: this operation can be carried out using controlled compressed air or low pressure water jetting. Care must be taken not to directly impinge onto the fin corrugations to prevent fin deflection damage.

4.2.5 Cleaning of the Y filter

The frequency in carrying out the Y filter maintenance increases much more the impurities in the coolant grow.

At least, It's recommended to clean the filter once a year to limit the impurities level in order not to both damage the cartridge filter and reduce consistently the coolant flow rate. To carry out the cleaning of the Y Filter follow the procedure shown below:



1. Arrange the 3-way valves in the bypassing filter position (ref. to Fig. 4.2).

- Fig. 4.2 3-way valves bypassing arrangement
- 2. Unscrew the screw plug and pull out the cartridge filter as shown below; clean it using running water and, if it's necessary, a non-metallic brush too (*ref. to Fig. 4.3*).



WARNIN GI

IF THE CARTRIDGE FILTER GETS DAMAGED OR CLOGGED PLEASE REPLACE IT

CAUTION!

Starting from the first filling of the hydraulic circuit, it's recommended to clean the cartridge filter after a week of operating

- 3. Insert the clean cartridge filter in the Y filter screwing the screw plug later.
- 4. Arrange the 3-way valves in the normal operation position (ref. to Chapt.1.: General Info; para. 1.2.4; Fig. 1.5).
- 5. Checking the pressure of the hydraulic circuit by the pressure gauge: if the pressure value is lower than 1.7 bar fill the hydraulic circuit (*ref. to Chapt. 2.: Installation; para. 2.2.7*).

4.3 CORRECTIVE MAINTENANCE

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

- Out of tolerance conditions of standard levels, waveforms and timings, detected during preventive maintenance;
- Failure conditions shown either by displays and/or LEDs.
- Failure conditions detected by operative personnel.

Restoring the unit to operation in a short time also depends on the availability of spare parts and components. Futher details on how to carry out maintenance procedures of the units are shown in the relevant technical manuals.

4.3.1 Identification and replacement of "CAN Bus Communication" boards

When a P.I.B. is faulty *CCU* displays the number associated to this P.I.B.: the following Tab. 4.2 lists the number of P.I.B. boards (column 1), its arrangement within the transmitter cabinet (column 2), the reference on the associated circuit digaram (column 3) and the board part number (column 4).

Tab. 4.2 – P.I.B.s arrangement within TX					
PIB	arrangement	REFERENCE ON	I TX WIRING DIAGRAM	p/n.	
1	RF Combining Kit (GR5)	PIB	SC6	4010002313	
4	Cooling Assembly	PIB	SC7	4010002315	



APPENDICES

A... "ETHERNET INTERFACE" INSTALLATION GUIDE

B... CIRCULATOR (EVOPLUS CIRCULATOR_{SMALL} V2.0)

 $\boldsymbol{C} \dots \boldsymbol{\mathsf{SAFETY}} \text{ PRECAUTION}$

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ETHERNET INTERFACE USER'S GUIDE

1.1 INTRODUCTION

The Ethernet Interface has inside three Internet Protocol Suite protocols:

- HTTP
- Telnet
- SNMP

1.2 TELNET PROTOCOL

The manufacturer has developed Telnet server as a tools for changing basic parameters remotely. For connection to Telnet server a Telnet client is needed.

1.3 OPENING A TELNET SESSSION

If you are connecting for the first time, these are the steps to follow:

1. Open the command prompt window, type "telnet <IP>" (in Fig. 2.1, the IP address is 10.0.12.248) and then push 'enter'. If the server does not answer, you have to wait a few seconds and try again. The hardware that handles the Ethernet protocol needs a while to initialize itself. If after some attempts the connection is impossible, you can reset the system.

C:\Windows\system32\cmd.exe		×
Microsoft Windows [Versione 6.1.7601] Copyright (c) 2009 Microsoft Corporation. Tutti i diritti riservati.		-
C:\Users\Simula> C:\Users\Simula> C:\Users\Simula>telnet 10.0.12.248	Fig. 2.	1

2. For logging in, type "admin" and "system" as password. Now you are logged in (Fig. 2.2).

C:\Windows\system32\cmd.exe	
itelco MEX-II, Telnet Server v.2.1.0	
login: admin Password: ***** Welcome	
Enter 'help' for a list of built-in commands.	Fig. 2.2

1.4 HELP

Typing "Help", the server will give a view of all command, of the syntax and a brief description of each command (Fig. 2.3):

Telnet 10.0.12	248		
help	Help	help <cmd></cmd>	^
SruSetCfg	Config the server	SrvSetCfg -i <ip> -s<subnet> -g<gateway></gateway></subnet></ip>	#
SruGetCfg	Get the server config	SrvGetCfg	
iface	Interface data	iface	
SnmpSetCfg	Config the SNMP agent	SnmpSetCfg -p <port> -t<trapport></trapport></port>	
SnmpGetCfg	Get the SNMP agent config	SnmpGetCfg	
SnmpSetPwd	Set the SNMP passwords	SnmpSetPwd -r <read> -s<set> -t<trap></trap></set></read>	
AddTrapDest	Adds a Trap target	AddTrapDest <ip address=""></ip>	
RemTrapDest	Removes a Trap target	RemTrapDest <ip address=""></ip>	
UserList	Get the list of users	UserList	
UserAdd	Add a new user	UserAdd <username> <level>{0-3></level></username>	
UserModPwd	Modify user password	UserModPwd <username></username>	
UserModLev	Modify user level	UserModLev <username> <new level=""></new></username>	
UserDelete	Delete user	UserDelete <username></username>	
UserShowLevs	Shows user level map	UserShowLevs	
Logout	Close terminal session	Logout	-
Exit	Logout command alias	Exit	
Quit	Logout command alias	Quit Fig. 2.3	

1.5 COMMANDS

The server parameters and privilege tables are stored in a no-volatile memory. The commands make it possible to set the basic server parameters. These are:

- IP address
- Subnet
- Gateway

1.5.1 Changing the server IP address, Subnet and Gateway

When the connection is established, using the default parameters you can change the server ip address, subnet and gateway, with the following commands:

- "SrvSetCfg -i<new IP>"
 - type the new address here
- "SrvSetCfg -s<new subnet>"
 type the new subnet here"
- "SrvSetCfg -g<new gateway>"
 type the new gateway here

You can change several parameters simultaneously typing the relevant commands, i.e:

■ "SrvSetCfg -i<new IP>" -s<new subnet>"

Take note the new server IP address, because this will be the new IP address that you will have to use for server connections.

Example: (Fig. 2.4) We want change the server ip address. The new ip address that we want set is 10.0.12.249.





1.5.2 Getting the server configuration

Typing "SrvGetCfg", you get information on server configuration (Fig. 2.5).

Telnet 10.0.12.248	
> >SruGetCfg Server Configuration: Server IP: 10.0.12.248 Subnet IP: 255.255.25.0	Fig. 2.5

1.5.3 About server parameters commands

The privilege management is completely achieved for all protocols (HTTP, SNMP, Telnet) through two tables.

The first one contains all users and the relevant passwords of the system.

Each user has only one level (from 0 to 3) showing the privilege of the user in the system management.

"Level 3" user (*System Administrator*) can access any possible operation on the equipment, that is:

- *Telnet session* for changing or updating the transmitter parameters and the users parameters.
- *FTP* for firmware upgrading.
- HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- SNMP. The SNMP access is managed with the community table. Then this table will have a description.

"Level 2" user (Supervisor R/W can access:

- *FTP* for firmware upgrading.
- HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- SNMP. The SNMP access is managed with the community table. Then this table will have a description.

"Level 1" user (Device Administrator) can access:

- HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- *SNMP*. The SNMP access is managed with the community table. Then this table will have a description.

"Level 0" user (Read Only) can access:

- HTTP page (R) for reading information about the equipment (supervisory system).
- *SNMP*. The SNMP access is managed with the community table. Then this table will have a description.

1.5.4 Getting the interface data

Typing "iface", you get information on interface data (Fig. 2.6).



1.5.5 Snmp agent

Typing "SnmpGetCfg", you get information on snmp agent configuration (Fig. 2.7).



1.5.6 The SNMP community management

The SNMP protocol has a privilege management that we can consider disconnected to the management for HTTP and Telnet. In particular the management is made through the community table. There are 3 community and the related passwords that to default are:

Community	Password	Related level	Description
Read only	public	0	Read Only
Read/Write	private	1	Read and Write commands
Trap Receiver	trap	2	Receive Alarms

Changing the password requires to be a user of level 3 and to have the possibility to access to Telnet and to use the command:

"SnmpSetPwd -r<read> -s<set> -t<trap>"

type the new pwd of read only community here

type the new pwd of trap receiver community here

type the new pwd of read/write community here

1.5.7 Adding/Removing a trap destination

A *trap destination* is an IP address (max 5) to which the system sends notifications of events occurred.

Typing "AddTrapDest", allows you adding a trap destination (Fig. 2.8).



Typing "RemTrapDest", allows you removing a trap destination (Fig. 2.9).



1.5.8 User List

Typing "UserList", you have the list of the users (Fig. 2.10).

Telnet 10.0.12.248	
> >UserList User: admin - Password: system - Level: 3 >_	Fig. 2.10

1.5.9 Adding/Deleting a User

In order to insert a new user type the command "UserAdd" (Fig. 2.11).

The user name or the password is a word up to 10 characters and not shorter of 4, consisting of numbers or letters. The level is a number in the range (0 - 3).

```
"UserAdd <userName> <level><0-3>" type the level here
```

If the user name you want insert already exists, the server will send you an error message. In the example of Fig. 2.11, the new user added is "operator" with level "3".



In order to delete a user type the command "UserDelete" (Fig. 2.12). In the example here below the user "operator" has been deleted.

Telnet 10.0.12.248	
>UserDelete operator User deleted. >	Fig. 2.12 🔶

Note that a user of level 3 can erase or update any user.

Default user of the unit is a level 3 user with user name "*admin*" and password "*system*". Adding a new user of level 3, overwrites the "*admin*" user.



Erasing the last user of level 3, restores "admin" user with its pwd:

- "system" if it has not been changed;
- last pwd set if "system" has been changed.

WARNING!

The passwords cannot be recovered! If the only administrator user forgets its password, it is no more possible to open a telnet session.

1.5.10 Modifying the User Password and/or level

In order to modify the user, type the command (Fig. 2.13):

"UserModPwd <userName>"

type the user name you want to modify the pwd

You have to type the old password and then the new one.

Gm Telnet 10.0.12.249	
>usermodpwd admin insert old password:****** Insert new password:******	
Password modified.	Fig. 2.13

The same operation leads to the modification of the user level (Fig. 2.14). Now the command is:

"UserModLev <username> <ner< th=""><th>v level>"</th></ner<></username>	v level>"
type user name here	type the new level here
Telnet 10.0.12.248	
> >usermodlev operator 1 User level modified.	Fig. 2.14

1.5.11 User Level Map (Level of security offered to protect against unauthorised control access to remote transmitter when connected over the corporate LAN/WAN system)

Typing "UsersShowLevs", you get a map of the users with the associated levels (Fig. 2.15). For further details refer to para. 1.5.3 "About server parameters commands".

GG Telnet 10.0.12.249	
> >usershowlev Level: 0: Read Only Level: 1: Supervisor R/W	* (m)
Level: 3: Telnet Access	Fig. 2.15

The application related to the Ethernet Interface of the Tx and N+1 Changeover CCU, the Exciters and the IEC devices implements control over IP.

No encryption is provided (no SSL ecc.).

The application uses a 4 level privileges defined by a user-id and a password :

"Level 3" user (System Administrator) can access any possible operation on the equipment, that is:

- _ Telnet session for changing or updating the transmitter parameters and the users privileges parameters.
- _ FTP for firmware upgrading.
- HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- _ SNMP. The SNMP access is managed with the community table.

"Level 2" user (Supervisor) R/W can access:

- _ FTP for firmware upgrading.
- HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- _ SNMP. The SNMP access is managed with the community table.

"Level 1" user (Device Administrator) can access:

- _ HTTP page (R/W) for reading information and sending commands to the equipment (supervisory system).
- _ SNMP. The SNMP access is managed with the community table.

"Level 0" user (Read Only) can access:

- _ HTTP page (R) for reading information about the equipment (supervisory system).
- _ SNMP. The SNMP access is managed with the community table.

The SNMP Agent offers protection by the use of one community for Read–Only GET queries and one community for the Read–Write SET commands.

Only the System Administrator can set and change the community table.

1.5.12 Closing terminal session

Typing "Logout", the connection is closed. The system will be reset and will be ready (after few seconds) to accept a new connection.

NOTE!

If you do not press any key for 120 seconds, the session is terminated due to timeout.

APPENDIX

B... CIRCULATOR (EVOPLUS CIRCULATOR_{SMALL} V2.0)



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ISTRUZIONI PER L'INSTALLAZIONE E LA MANUTENZIONE INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE INSTRUCCIONES PARA LA INSTALACIÓN Y EL MANTENIMIENTO INSTALLATIONS - OCH UNDERHÅLLSANVISNING INSTRUCTIONS POUR L'INSTALLATION ET LA MAINTENANCE INSTRUCTIES VOOR INGEBRUIKNAME EN ONDERHOUD INSTRUCTIONI DE INSTALARE SI INTRETINERE INSTALLATIONSANWEISUNG UND WARTUNG INSTRUKCJA MONTAŻU I KONSERWACJI ΟΔΗΓΙΕΣ ΓΙΑ ΤΗΝ ΕΓΚΑΤΑΣΤΑΣΗ ΚΑΙ ΤΗ ΣΥΝΤΗΡΗΣΗ NÁVOD NA POUŽITÍ A ÚDRŽBU NÁVOD NA INŠTALÁCIU A ÚDRŽBU MONTAJ VE BAKIM IÇIN BILGILER UZSTĀDĪŠANAS UN TEHNISKĀS APKOPES ROKASGRĀMATA MONTAVIMO IR TECHNINĖS PRIEŽIŪROS INSTRUKCIJOS INSTRUÇÕES PARA A INSTALAÇÃO РУКОВОДСТВО ПО МОНТАЖУ И ТЕХНИЧЕСКОМУ ОБСЛУЖИВАНИЮ ASENNUS- JA HUOLTO-OHJEET NAVODILA ZA VGRADNJO IN UPORABO ИНСТРУКЦИЯ ЗА ИНСТАЛИРАНЕ И ОБСЛУЖВАНЕ HASZNÁLATI ÚTMUTATÓ A BEÁLI ÍTÁSHOZ ÉS KARBANTARTÁSHOZ



40/180 M 60/180 M 80/180 M 110/180 M	40/180 SAN M 60/180 SAN M 80/180 SAN M 110/180 SAN M	
40/180 XM 60/180 XM 80/180 XM 110/180 XM		
B 40/220.32 M	B 40/220.32 SAN M	D 40/220.32 M
B 60/220.32 M	B 60/220.32 SAN M	D 60/220.32 M
B 80/220.32 M	B 80/220.32 SAN M	D 80/220.32 M
B 110/220.32 M	B 110/220.32 SAN M	D 110/220.32 M
B 40/250.40 M	B 40/250.40 SAN M	D 40/250.40 M
B 60/250.40 M	B 60/250.40 SAN M	D 60/250.40 M
B 80/250.40 M	B 80/250.40 SAN M	D 80/250.40 M
B 110/250.40 M	B 110/250.40 SAN M	D 110/250.40 M

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1. KEY

The frontispiece shows the version of this document in the form Vn.x. This version indicates that the document is valid for all software versions of the device n.y. For example: V3.0 is valid for all Sw: 3.y

In this document the following symbols will be used to avoid situations of ranger:



Situation of general danger. Failure to respect the instructions that follow may cause harm to persons and property.



Situation of **electric shock hazard**. Failure to respect the instructions that follow may cause a situation of grave risk for personal safety.

2. GENERAL



Read this documentation carefully before installation.

Installation, electrical connection and commissioning must be carried out by specialised personnel, in compliance with the general and local safety regulations in force in the country in which the product is installed. Failure to respect these instructions not only causes risk to personal safety and damage to the equipment, but invalidates every right to assistance under guarantee.

The appliance is not intended to be used by persons (including children) with reduced physical, sensory or mental capacities, or who lack experience or knowledge, unless, through the mediation of a person responsible for their safety, they have had the benefit of supervision or of instructions on the use of the appliance. Children must be supervised to ensure that they do not play with the appliance.



Ensure that the product has not suffered any damage during transport or storage. Check that the outer casing is unbroken and in excellent conditions.

2.1 Safety

Use is allowed only if the electric system is in possession of safety precautions in accordance with the regulations in force in the country where the product is installed.

2.2 Responsibility

The Manufacturer does not vouch for correct operation of the machine or answer for any damage that it may cause if it has been tampered with, modified and/or run outside the recommended work range or in contrast with other indications given in this manual.

2.3 Particular warnings



Always switch off the mains power supply before working on the electrical or mechanical part of the system. Wait for the warning lights on the control panel to go out before opening the appliance. The capacitor of the direct current intermediate circuit remains charged with dangerously high voltage even after the mains power has been turned off.

Only firmly cabled mains connections are admissible. The appliance must be earthed (IEC 536 class 1, NEC and other applicable standards).



Mains terminals and motor terminals may still have dangerous voltage when the motor is stopped.



If the power cable is damaged, it must be replaced by the technical assistance service or by qualified personnel, so as to avoid any risk. GB ENGLISH

3. PUMPED LIQUIDS

The machine has been designed and made for pumping water, free from explosive substances and solid particles or fibres, with a density of 1000 Kg/m³, a kinematic viscosity of 1mm²/s and non chemically aggressive liquids. It is possible to use ethylene glycol in a percentage of no more than 30%.

4. APPLICATIONS

EVOPLUS SMALL series circulators allow integrated adjustment of the differential pressure which enables the circulator performance to be adapted to the actual requirements of the system. This determines considerable energy saving, a greater possibility of control of the system, and reduced noise.

EVOPLUS SMALL circulators are designed for the circulation of:

- water in heating and conditioning systems.
- water in industrial water circuits.
- domestic water only for the versions with bronze pump body.

EVOPLUS SMALL circulators are self-protected against:

- Overloads
- Lack of phase
- Excess temperature
- Over-voltage and under-voltage

5. TECHNICAL DATA

Supply voltage	1x220-240 V (+/-10%), 50/60 Hz		
Absorbed power	See electrical data plate		
Maximum current	See electrical data plate		
Grade of protection	IP44		
Protection class	F		
TF Class	TF 110		
Motor protector	No external motor protector is needed		
Maximum environment temperature	40 °C		
Liquid temperature	-10 °C ÷ 110 °C		
Flow rate	See Table 1		
Head	See Table 1		
Maximum working pressure	1.6 MPa		
Minimum working pressure	0.1 MPa		
Lpa [dB(A)]	<= 33		

EVOPLUS SMALL	Hmax [m]	Qmax [m3/h]	EVOPLUS SMALL	Hmax [m]	Qmax [m3/h]
40/180 M - 40/180 SAN M*	4,0	6,0			
60/180 M - 60/180 SAN M*	6,0	7,0			
80/180 M - 80/180 SAN M*	8,0	8,0			
110/180 M - 110/180 SAN M*	11,0	9,0			
40/180 XM	4,0	6,0			
60/180 XM	6,0	7,2			
80/180 XM	8,0	8,2			
110/180 XM	11,0	10,0			
B 40/220.32 M - B 40/220.32 SAN M*	4,0	7,4	D 40/220.32 M	4,0	7,0
B 60/220.32 M - B 60/220.32 SAN M*	6,0	9,0	D 60/220.32 M	6,0	8,0
B 80/220.32 M - B 80/220.32 SAN M*	8,0	10,0	D 80/220.32 M	8,0	9,0
B 110/220.32 M - B 110/220.32 SAN M*	11,0	11,0	D 110/220.32 M	11,0	10,0
B 40/250.40 M - B 40/250.40 SAN M*	4,0	8,4	D 40/250.40 M	4,0	8,0
B 60/250.40 M - B 60/250.40 SAN M*	6,0	9,8	D 60/250.40 M	6,0	9,0
B 80/250.40 M - B 80/250.40 SAN M*	8,0	10,8	D 80/250.40 M	8,0	10,0
B 110/250.40 M - B 110/250.40 SAN M*	11,0	12,0	D 110/250.40 M	11,0	11,2

*This circulator is suitable for drinking water only.

Table 1: Maximum head (Hmax) and maximum flow rate (Qmax) of EVOPLUS SMALL circulators

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GB ENGLISH

5.1 Electromagnetic Compatibility (EMC)

EVOPLUS SMALL circulators respect standard EN 61800-3, in the C2 category, for electromagnetic compatibility.

- Electromagnetic emissions Industrial environment (in some cases restrictive measures may be requested).
- Conducted emissions Industrial environment (in some cases restrictive measures may be requested).

6. MANAGEMENT

6.1 Storage

All the circulators must be stored in a dry covered place, with possibly constant air humidity, free from vibrations and dust. They are supplied in their original pack in which they must remain until the time of installation. If this is not the case, accurately close the suction and delivery mouth.

6.2 Transport

Avoid subjecting the products to needless impacts and collisions. To lift and transport the circulator use lifting devices with the aid of the pallet supplied with it (if contemplated).

6.3 Weight

The adhesive plate on the packaging indicates the total weight of the circulator.

7. INSTALLATION

Carefully follow the advice in this chapter to carry out correct electrical, hydraulic and mechanical installation.



Always switch off the mains power supply before working on the electrical or mechanical part of the system. Wait for the warning lights on the control panel to go out before opening the appliance. The capacitor of the direct current intermediate circuit remains charged with dangerously high voltage even after the mains power has been turned off.

Only firmly cabled mains connections are admissible. The appliance must be earthed (IEC 536 class 1, NEC and other applicable standards).



Ensure that the voltage and frequency on the data plate of the EVOPLUS SMALL circulator are the same as those of the power mains.

7.1 Circular Installation and Maintenance



Always install the EVOPLUS SMALL circulator with the motor shaft in a horizontal position. Install the electronic control device in a vertical position (see Figure 1)







Figure 1: Assembly position

 The circulator may be installed in heating and conditioning systems on either the delivery pipe or the return pipe; the arrow marked on the pump body indicates the direction of flow.

- Install the circulator as far as possible above the minimum boiler level and as far as possible from bends, elbows and junction boxes.
- To facilitate control and maintenance operations, install an interception valve both on the suction pipe and on the delivery pipe.
- Before installing the circulator, accurately flush the system with only water at 80°C. Then drain the system completely to eliminate any harmful substance that may have got into circulation.
- Assemble in such a way as to avoid dripping on the motor and on the electronic control device during both installation and maintenance.
- Avoid mixing additives derived from hydrocarbons and aromatic products with the circulating water. It is recommended that the addition of antifreeze, where necessary, should not exceed 30%.
- In the event of heat insulation use the special kit (if provided) and ensure that the condensate draining holes in the motor casing are not closed or partly blocked.
- To guarantee maximum efficiency of the system and long life of the circulator it is recommended to use magnetic sludge-removing filters to separate and collect any impurities present in the system (particles of sand, particles of iron and sludge).
- In the case of maintenance, always use a set of new gaskets.



Never insulate the electronic control device.

7.2 Rotation of the Motor Heads

If the circulator is installed on pipes in a horizontal position, it will be necessary to rotate the motor with the respective electronic device through 90 degrees in order to maintain the grade of IP protection and to allow the user a more convenient interaction with the graphic interface (see Figure 2).



Before rotating the circulator, ensure that it has been completely

To rotate the EVOPLUS SMALL circulator, proceed as follows:

- Remove the 4 fixing screws of the circulator head. 1.
- 2 Rotate the motor casing with the electronic control device through 90 degrees clockwise or counterclockwise, as necessary.
- 3 Reassemble and tighten the 4 screws that fix the circulator head.





7.3 Non-return valve

If the system is equipped with a non-return valve, ensure that the minimum pressure of the circulator is always higher than the valve closing pressure.

8. ELECTRICAL CONNECTIONS

The electrical connections must be made by expert, gualified personnel.



ATTENTION! ALWAYS RESPECT THE LOCAL SAFETY REGULA-

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Always switch off the mains power supply before working on the electrical or mechanical part of the system. Wait for the warning lights on the control panel to go out before opening the appliance. The capacitor of the direct current intermediate circuit remains charged with dangerously high voltage even after the mains power has been turned off.

Only firmly cabled mains connections are admissible. The appliance must be earthed (IEC 536 class 1, NEC and other applicable standards).

THE SYSTEM MUST BE CORRECTLY AND SAFELY EARTHED!

It is recommended to install a differential switch to protect the system, which must have correct dimensions, such as: Class A with adjustable leakage current, selective, protected against sudden tripping.

The automatic differential switch must be marked with the following two symbols:



- -The circulator does not require any external motor protection.
- -Ensure that the supply voltage and frequency are the same as the values indicated on the electrical data plate of the circulator.

8.1 Power supply connection

After having wired the power supply cable as shown in Figure 3, connect it to the board as shown in Figure 4.

Before supplying power to the circulator, ensure that the cover of the EVOPLUS SMALL control panel is perfectly closed!





Figure 4: Power supply connector connection



9. START



All the starting operations must be performed with the cover of the EVOPLUS SMALL control panel closed!

Start the system only when all the electrical and hydraulic connections have been completed.

Avoid running the circulator when there is no water in the system.



As well as being at a high temperature and pressure, the fluid in the system may also be in the form of steam. DANGER OF SCALDING!

It is dangerous to touch the circulator. DANGER OF SCALDING!

Once all the electrical and hydraulic connections have been made, fill the system with water and if necessary with glycol (for the maximum glycol percentage see par. 3) and feed the system.

Once the system has been started it is possible to modify the operating modes to adapt better to the plant requirements (see par.12).

10. FUNCTIONS

10.1 Regulating Modes

EVOPLUS SMALL circulators allow the following regulating modes depending on plant requirements:

- Proportional differential pressure regulation depending on the flow present in the plant.
- Constant differential pressure regulation.
- Regulation with constant curve.

The regulating mode may be set through the EVOPLUS SMALL control panel (see par. 12 Page 2.0).

10.1.1 Regulation with Proportional Differential Pressure



In this regulating mode the differential pressure is reduced or increased as the demand for water decreases or increases.

The Hs set point may be set from the display.

Q Regulation indicated for:

- Heating and conditioning plants with high load losses.
- Two-pipe systems with thermostatic valves and head ≥ 4 m.
- Plants with secondary differential pressure regulator.
- Primary circuits with high load losses.
- Domestic water recirculating systems with thermostatic valves on the rising columns.

10.1.2 Regulation with Constant Differential Pressure



In this regulating mode the differential pressure is kept constant, irrespective of the demand for water, The Hs set point may be set from the display.

→ Q Regulation indicated for:

- Heating and conditioning plants with low load losses.
- Two-pipe systems with thermostatic valves and head ≤ 2 m.
- Single-pipe systems with thermostatic valves.
- Plants with natural circulation.
- Primary circuits with low load losses.
- Domestic water recirculating systems with thermostatic valves on the rising columns.

10.1.3 Regulation with constant curve



In this regulating mode the circulator works on characteristic maximum limit curves at a constant speed. The operating curve is selected

by setting the rotation speed through a percentage factor. The value 100% indicates the maximum limit curve. The actual rotation speed may depend on the power and differ-

ential pressure limits of your circulator model.

The rotation speed may be set from the display.

Regulation indicated for heating and conditioning plants with constant flow.

10.2 Expansion Modules

EVOPLUS SMALL circulators may be equipped with some expansion modules that allow their functions to be increased.

For details on the procedures for installation, configuration and use of the expansion modules, see the specific manual.
11. CONTROL PANEL

The functions of EVOPLUS SMALL circulators can be modified by means of the control panel on the cover of the electronic control device.

On the panel there are: a graphic display, 4 navigation keys and 3 LED warning lights (see Figure 5).



11.1 Graphic Display

Using the graphic display it will be possible to navigate in an easy and intuitive menu which will enable you to check and modify the system operating mode and the working set-point. It will also be possible to view the system status and the log of any alarms memorised by the system.

11.2 Navigation Buttons

4 buttons are provided for navigating in the menu: 3 buttons under the display and 1 at the side. The buttons under the display are called active buttons and the one at the side is called hidden button.

Each page of the menu is made in such a way as to indicate the function associated with the 3 active buttons (the ones under the display).

11.3 Warning Lights

Yellow light: System live signal.

If lit, it means that the system is live.



Never remove the cover if the yellow light is lit.

Red light: Warning of an **alarm/malfunction present** in the system. If the light is blinking it is a non-blocking alarm and the pump can still be controlled. If the light is fixed it is a blocking alarm and the pump cannot be controlled.

Green light: Pump ON/OFF signal.

if lit, the pump is running. If off, the pump is stopped.

12. MENUS

EVOPLUS SMALL circulators offer a user menu accessible from the Home Page by pressing and releasing the central "Menu" button.

Below are shown the user menu pages with which it is possible to check the system status and modify its settings.

If the menu pages show a key at bottom left it means that it is not possible to change the settings. To unblock the menus go to the Home Page and press the hidden button and the button under the key at the same time until the key disappears.

If no button is pressed for 60 minutes, the settings are automatically blocked and the display switches off. When any button is pressed the display lights up again and the "Home Page" appears.

To navigate in the menus, press the central button.

To return to the previous page, hold down the hidden button, then press and release the central button.

To modify the settings use the left and right buttons.

To confirm the change of a setting, hold down the central button "OK" for 3 seconds. Confirmation will be indicated by the following icon:

ENGLISH GB

Home Page , auto 10/20 H: 12.0 m Menul ON	The main settings of the system are graphically summed up on the Home Page. The icon at top left indicates the type of regulation selected. The icon at centre top indicates the operating mode selected (auto or economy). The icon at top right indicates the presence of a single \textcircled or twin inverter $\textcircled{O}/\textcircled$. The rotation of the icon \textcircled or \textcircled indicates which circulation pump is operating. At the centre of the Home Page is a read-only parameter which can be chosen from a small set of parameters on Page 9.0 of the menu. From the Home Page it is possible to access the page for regulating the contrast of the display: hold down the hidden button, then press and release the right button. EVOPLUS SMALL circulators offer a user menu accessible from the Home Page by pressing and releasing the central "Menu" button.		
Page 1.0	The factory settings are set from Page 1.0 by holding down the left and right buttons at the same time for 3 seconds. The resetting of the factory settings will be notified by the appearance of the symbol \mathbf{M} next to the word "Default".		
	 The regulating mode is set from Page 2.0. You can choose between the following modes: 1 ¹∠ = Proportional differential pressure regulation. 2 ¹⊂ = Regulation with constant differential pressure. 3 ¹⊂ = Regulation with constant curve with rotation speed set from the display. Page 2.0 displays 3 icons which represent: central icon = setting currently selected; right icon = next setting; left icon = previous setting. 		F
Page 3.0 Hs: 12.0 m − ▼IOK +	The regulating set-point can be modified from Page 3.0. Depending on the type of regulation chosen on the previous page, the set-point to be set will be a head or, in the case of a Constant Curve, a percentage of the rotation speed.]	

Page 9.0 ⊞©SETPhT1 H: 12.0 m ₩ ₩ΟΚ ₩	On page 9.0 it is possible to choose the parameter to be dis- played on the Home Page: H: Measured head expressed in metres Q: Estimated flow rate expressed in m3/h S: Rotation speed expressed in revs per minute (rpm) E: Not present P: Power distributed expressed in W h: Operating hours T: Not present T1: Not present
	On page 10.0 you can choose the language in which to display the messages.
Page 11.0	On page 11.0 you can display the alarms log by pressing the right button.
Alarms Log	If the system finds any faults it records them permanently in the alarms log (up to a maximum of 15 alarms). For each recorded alarm a page composed of 3 parts is displayed: an alphanumeric code that identifies the type of fault, a symbol that illustrates the fault in graphic mode, and a message in the language selected on Page 10.0, giving a brief description of the fault. By pressing the right button you can scroll through all the pag- es of the log. 2 questions appear at the end of the log: 1. "Reset Alarms?" Pressing OK (left button) resets any alarms still present in the system. 2. "Delete Alarms Log" Pressing OK (left button) deletes the alarms memorised in the log.

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Page 13.0	
DN OFF EXT → ▼ OK	On page 13.0 you can set the system status in ON or OFF. If ON is selected the pump is always on. If OFF is selected the pump is always off.

13. FACTORY SETTINGS

Parameter	Value	
Regulating mode	└, = Proportional differential pressure regulation	
Twin operating mode	⑦/① = Alternate every 24h	
Pump start control	ON	

Table 2: Factory settings

14. TYPES OF ALARM

Alarm Code	Alarm Symbol	Alarm Description
e0 - e16; e21	⊶	Internal Error
e17 - e19	⊕⊶⊶⊝	Short Circuit
e20	$\bigcirc \bigcirc_{\max}$	Voltage Error
e22 - e31	⊶	Internal Error
e32 - e35		Electronic system excess temperature
e37	\bigcirc min \bigcirc	Low voltage
e38	• OOmax	High voltage
e39 - e40	R A A A A A A A A A A A A A A A A A A A	Pump blocked
e46		Pump Disconnected
e42	ŧ,	Dry operation
e56	٢	Motor excess temperature (motor protector trips)



Table 3: List of alarms

15. DISPOSAL

This product or any part of it must be disposed of correctly:

- 1. Use public or private local systems for waste collection.
- 2. If that is not possible, contact Dab Pumps or the nearest authorised service workshop.

INFORMATION

Frequently asked questions (faq) on the ecodesign directive 2009/125/ ec establishing a framework for the setting of ecodesign requirements for energy-related products and its implementing regulations:

http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/guidance/files/20110429_faq_en.pdf

Guidelines accompanying commission regulations implementing the ecodesign directive:

http://ec.europa.eu/energy/efficiency/ecodesign/legislation_en.htm - see "circulators.

16. ERROR CONDITION AND RESET

Display indication		Description	Reset
e0 – e16	⊶æ	Internal error	 Switch off system power. Wait for the warning lights on the control panel to go off, then power the system again. If the error persists, change the circu- lator.

ENGLISH GB

e37	<u>O min</u> O	Low mains voltage (LP)	 Switch off system power. Wait for the warning lights on the control panel to go off, then power the system again. Check that the mains voltage is correct, if necessary reset it at the plate values. 	e57 ; e
e38	⊙ ⊖ _{max}	High mains voltage (HP)	 Switch off system power. Wait for the warning lights on the control panel to go off, then power the system again. Check that the mains voltage is correct, if necessary reset it at the plate values. 	EVOF EVOF EVOF EVOF
e32-e35		Critical over- heating of electronic parts	 Switch off system power. Wait for the warning lights on the control panel to go off. Check that the system ventilation ducts are not blocked and that the environ- ment temperature of the premises is correct. 	EVOF EVOF EVOF EVOF EVOF
e39-e40	Ŕ	Protection against overcurrent	 Check that the circulator turns freely. Check that any antifreeze added does not exceed the maximum percentage of 30%. 	EVOF
e21-e30	⊙⊖ _{max}	Voltage Error	 Switch off system power. Wait for the warning lights on the control panel to go off, then power the system again. Check that the mains voltage is correct, if necessary reset it at the plate values. 	EVOF EVOF EVOF EVOF
e31	⊶	Twin communication absent	 Check that the twin communication cable is intact. Check that both circulators are powered. 	EVOF EVOF EVOF
e42	- Fi	Dry operation	- Put the system under pressure.	
e56	٢	Motor excess temperature	- Switch off system power. - Wait for the motor to cool down - Power the system again	The ben

e57 ; e58	⊶	f < 100 Hz f > 5 kHz	Check that the PWM external signal is operating and connected as specified.

Energy Efficiency Index - EEI				
EVOPLUS 40/180 M	0,23			
EVOPLUS 60/180 M	0,22			
EVOPLUS 80/180 M	0,22			
EVOPLUS 110/180 M	0,22			
EVOPLUS 40/180 XM	0,21			
EVOPLUS 60/180 XM	0,21			
EVOPLUS 80/180 XM	0,21			
EVOPLUS 110/180 XM	0,21			
EVOPLUS B 40/220.32 M	0,22			
EVOPLUS B 60/220.32 M	0,22			
EVOPLUS B 80/220.32 M	0,22			
EVOPLUS B 110/220.32 M	0,22			
EVOPLUS B 40/250.40 M	0,21			
EVOPLUS B 60/250.40 M	0,21			
EVOPLUS B 80/250.40 M	0,21			
EVOPLUS B 110/250.40 M	0,21			
EVOPLUS D 40/220.32 M	0,23			
EVOPLUS D 60/220.32 M	0,23			
EVOPLUS D 80/220.32 M	0,23			
EVOPLUS D 110/220.32 M	0,23			
EVOPLUS D 40/250.40 M	0,22			
EVOPLUS D 60/250.40 M	0,22			
EVOPLUS D 80/250.40 M	0,22			
EVOPLUS D 110/250.40 M	0,22			

The benchmark for the most efficient circulators is $EEI \leq 0,20$.

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SAFETY PRECAUTIONS

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Guide to safety precautions which must be observed by the personnel operating with radio-transmitters

1 INTRODUCTION

1.1 Application notes

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

1.2 Purpose

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

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

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

1.3 General

Broadcast Electronics equipment have been designed and manufactured taking into due consider-ation:

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

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

WARNING!

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

CAUTION!

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

NOTE!

An essential operating or maintenance procedure, condition and statement which must be highlighted.

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

2 SAFETY OPERATIONS

2.1 Introduction

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

KEEP AWAY FROM LIVE CIRCUIT

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

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

DO NOT SERVICE OR ADJUST ALONE

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

2.2 Electric shock

Factors affecting electric shock consequence are:

- amount of current flown thru human body;
- current path thru human body;
- contact duration.

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

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

2.3 Rescue

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

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

2.4 Resuscitation

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

2.5 Emergency First Aid instructions

WARNING!

VOLTAGES THAT ARE DANGEROUS TO LIFE ARE INVOLVED IN THE OPERATION OF THIS ELECTRONIC EQUIPMENT. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE

OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATION.

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

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

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

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

2.5.1 Rescue breathing



1. Find out if the person is breathing.

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



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

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



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

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

LOOSEN CLOTHING KEEP WARM

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

2.5.2 Burns

SKIN REDDENED:

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

SKIN BLISTERED OR FLESH CHARRED:

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

EXTENSIVE BURN-SKIN BROKEN:

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

3 SPECIFICATION ON HANDLING AND DISPOSAL OF BERYLLIA DEVICES

3.1 Handling

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

- cover cuts and abrasions with dressing;
- wear disposable gloves;
- do not eat, drink, smoke, make up;
- wash hands and face after the contact with these damaged components;

• if beryllia penetrates under the skins through cuts or abrasions, the wound has to be cleaned and treated by a qualified medical personnel.

3.2 Disposal

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

The disposal procedure is divided into two categories:

• Electrically faulty, but not mechanically damaged.

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

• Mechanically damaged components.

Using disposable gloves and tweezers, all visible parts are to be placed in a polythene bag which is to be sealed and placed in a Beryllia scrapbox ⁽¹⁾.

Still wearing gloves, clean the area with a damp cloth then place the cloth and gloves into a polythene bag, seal the bag and place it in a Beryllia scrapbox.

The hands must be thoroughly washed after handling damaged components.

4 ABSTRACT OF APPENDIX "E" OF CEI EN 60215 SAFETY RULES

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

E.1 INTRODUCTION

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

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

E.4 A RADIO-TRANSMITTER'S FUNCTIONING

- *E.4.1* The equipment has to be kept in such a way as to fulfil the safety rules.
- **E.4.2** A person, competent and certified by the responsible units, has to make sure, at regular intervals, of the good functioning of the equipment and of the protection and safety devices.

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

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

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

- **E.4.3** All the covers assuring protection against accidental contacts with parts under dangerous voltage must be kept in their position during the ordinary service. They can be taken off, for maintenance or repair operations, only under the responsibility of the charged staff.
- **E.4.4** All the covers and metal casings of the electric and electronic equipment have to be grounded with effective methods, and particular attention must be paid to the maintenance of these connections to the protection ground.
- **E.4.5** The rooms occupied by parts of equipment having open structure are considered as fences.
- **E.4.6** If a radio transmitter is put under voltage, the trained person in charge of it has to personally verify that: no other person is working on the transmitter or on the associated antenna; that each work carried out is sufficiently completed in order to allow the transmission; that no tool, test equipment or portable lamp remains inside or on the transmitter; and that all test or auxiliary equipment used for the tests has been disconnected.

E.6 PROCEDURE TO VERIFY ABSENCE OF VOLTAGE

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

E.7 WORK ON CIRCUITS UNDER VOLTAGE

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

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

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

E.8 OTHER DANGERS

E.8.1 DANGERS OF RADIOFREQUENCY RADIATIONS

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

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

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

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Operator's Manual