Operation Manual

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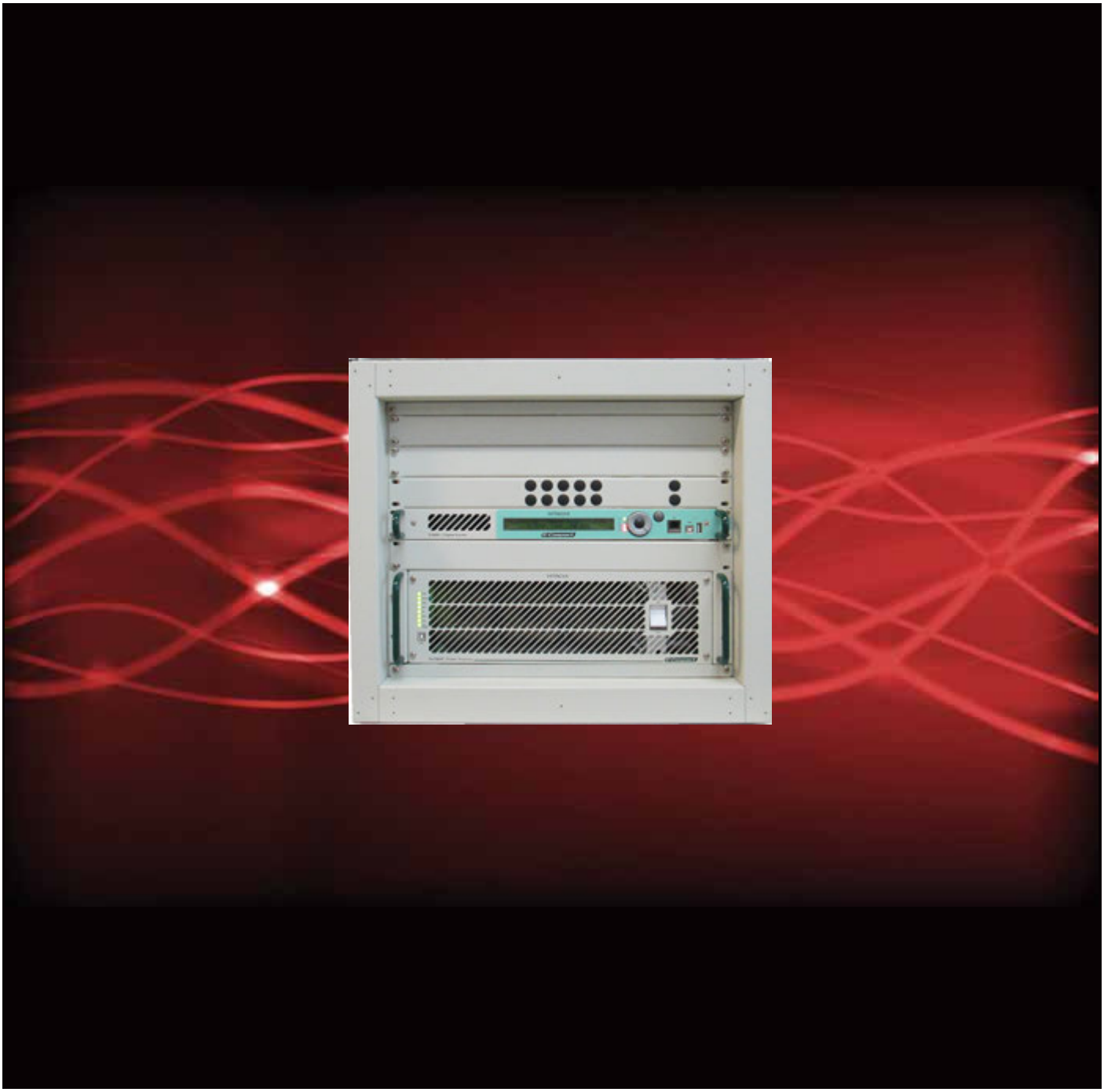
700W UHF 8VSB-ATSC Transmitter

EC701HP



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TECHNICAL ASSISTANCE

In our Quality Management System, since several devices are received without proper identification and explanations; we are now working with previous approval for maintenance devolution.

Therefore, in case of maintenance please contact:

Hitachi Kokusai Linear Equipamentos Eletrônicos S/A

Phone: (+35) 3473-3473 / Fax: (+35) 3473-3474 E-mail: manutencao@linear.com.br

And inform: **Client Name, Equipment Part Number, Serial Number and a brief explanation of the occurrence**.

With this intel we shall send the ARM number (Authorization for Return of Material), which is mandatory to appear in the invoice.

WARRANTY

1. All equipment shall have warranty coverage of the supplier against manufacturing or assembly faults conducted by the supplier, for the period of 12 months, counting from the issuing of the sales invoice. The period is irrevocable except in cases of extended warranty previously noted in contract.

2. During warranty time, the supplier will repair, with no additional charge, the faulty products, providing adjustments, replacing or re-manufacturing, of all the equipment or its modules and components that present unusual behavior;

2.1. The repaired/replaced products are covered for an additional period of 3 (three) months or up to the end of the original warranty time, taking into count the longer period;

2.2. If the additional 3 (three) months term, referred above, is higher than the original warranty term, the warranty will only extend to the repaired/replaced modules or components;

2.3. The warranty will become effective in the supplier's factory, therefore it's not a responsibility of the supplier: the shipment of any modules, components or any other equipment or accessory. These expenses will be, when due, a responsibility of the Purchaser.

2.4. The Purchaser may choose a visit of the supplier's technical personnel , instead of submitting the goods for factory repair, although the expenses relative to transportation, lodge and nourishment of the supplier's technicians will occur at sole expense of the Purchaser, upon budget approval.

3. The supplier is relieved of the warranty terms in the here in after situations:

3.1. Faults or defects caused by AC Mains variation, atmospheric phenomena or accidental;

3.2. Faults or defects caused by inadequate installation of the goods, not complying with the OPERATING MANUAL(S) or caused by negligence of the minimum infrastructure requirements in the installation site, which is referred in the ANNEX 1 herein attached.

3.3. Faults or defects caused by inadequate usage of the products, not complying with the OPERATING MANUAL(S) or by lack of proper preventive maintenance recommended in the product's manual.

3.4. In event of the goods and its accessories are submitted to 3rd Party maintenance, unauthorized by the supplier, as well as removal or violation of its serial number.

4. The supplier shall employ, during warranty term, original parts and components listed by the product's manufacturer.

5. The technical assistance must be held by the SUPPLIER or its accredited personnel or companies, failing which will result in warranty voidance.

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WARNING

MANDATORY CONDITIONS FOR TRANSMITTER INSTALATION, FOR VALIDATING THE WARRANTY TERMS

1. Proper grounding;
2. Proper lightning-rod;
3. Shelter with ventilation, foot-print, and temperature in compliance with the transmitter's standards.
4. Voltage regulator in compliance with transmitter's consumption.

Noncompliance with any of above-mentioned terms will automatically result in the suspension of the warranty terms.

ANNEX I

AC MAINS

GROUNDING

The grounding system, to which Hitachi Kokusai Linear' TV transmitter will be attached, must be designed and implemented by trained professionals. An improper grounding system may put at risk, not just the equipment but the life of the professionals working in the shelter. To be considered proper, the grounding must have a resistance of no more than 5 Ω.

STABILITY

It is important to have isolation between energy stations of the shelter and the TV transmitter, which is achieved with the usage of isolator transformers. Thus is guaranteed that no AC Mains' transient coming from the shelter will be passed on to the TV transmitter or vice-versa. Besides, Hitachi Kokusai Linear' TV transmitter features switching power supplies that require purely sinusoidal power input, and voltage regulators or no-breaks without isolator transformers have no assurance of a purely sinusoidal outputs. The isolator transformer must also be exclusive to the TV transmitter and its dimensioning must use the same standards employed in the dimensioning of the voltage regulator or no-break, ie, at least 30% higher than the TV transmitter's specified consumption (in KVA).

INSULATION

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WIRE GAUGE

			EC701HP		EC702HP		EC703HP		EC704HP		EC706HP		EC708HP	
			2.8 kVA		5.5kVA		8.3kVA		11kVA		16.5kVA		22kVA	
			Current	Gauge (mm2)	Current	Gauge (mm2)	Current	Gauge (mm2)	Current	Gauge (mm2)	Current	Gauge (mm2)	Current	Gauge (mm2)
M220	P+N+G	1 phase with neutral : 220Vac between phase and neutral	13	1.5	25	6	38	10	50	16	75	35	100	50
B220	2P+G	2 phases, without neutral: 220Vac between phases	13	1.5	25	6	38	10	50	16	75	35	100	50
T220	3P+G	3 phases, without neutral: 220Vac between phases	13	1.5	23	4	23	4	34	10	45	10	68	25
T380	3P+N+G	3 phases with neutral: 380Vac between phases, 220Vac between phase and neutral	13	1.5	13	1.5	13	1.5	26	6	26	6	39	10
					(*)				(*)				(*)	

(*) Due to the number of amplifiers not be multiple of 3, the current is not equal to the 3 phases (unbalanced system).
The current quoted in the table is more loaded phase to sizing effect of conductors and protection.
Said gauge is the minimum recommended for the transmitter in question, if the cable length is large, consider voltage drop in the cable maximum of 5%
The section of the neutral conductor should be the same phase.
The section of the ground conductor may be 10% of the phase conductors, not being less than 1mm2.
The settings on the green background with table are the recommended settings for each transmitter model.

ADPS

LIGHTNING ROD

The Atmospheric Discharge Protection System – ADPS is comprised by the lightning rod and its accessories. The tower and shelter must be protected against Atmospheric Discharges, through a FRANKLIN lightning rod, dimensioned and installed by the USER, following the criteria defined by NBR 5419 (in its latest version) and including all the station installations within the protection zone defined in the Level I electro-geometric model of rolling spheres.

PROTECTORS

The usage of coaxial protectors is advisable for cables which connect internal and external equipments (antennas, microwave heads, tower converters). These shields are devices featuring gas-sparklers that short-circuit to the ground, any surges discharged in the coaxial cables. Must be within the shelter, close to the equipment and with its ground wire bound in the equipment's rack ground.

CLIMATE CONTROL

TEMPERATURE

For best performance and longer lifetime of the equipment, it is important that the shelter features a strict climate control, through the installation of an air-conditioning system. For project purposes, consider the thermal dissipation specified to the transmitter (BTU/h), the thermal dissipation of the other devices in the shelter, the thermal charge cause by solar incidence and all other thermal charges within the shelter. It is recommended that the internal pressure of the shelter is slightly positive, avoiding the entrance of outside contaminants. According to the transmission power, the internal temperature of the shelter should be:

- LOW POWER E-COMPACT TV TRANSMITTERS: from 0 to 35ºC
- MEDIUM POWER E-COMPACT TV TRANSMITTERS: from 0 to 30ºC
- HIGH POWER E-COMPACT TV TRANSMITTERS: from 0 to 25ºC

In the event of damage caused by inefficient or improper Climate Control Systems within the shelter, will automatically result in the suspension of the warranty terms.

HUMIDITY

The relative humidity within the shelter is a solely important factor for best performance and longer lifetime of the equipment. Hitachi Kokusai Linear' devices must operate in dry environments; this is also achieved by proper Climate Control Systems. In accordance with transmission power, the relative humidity must be:

- LOW POWER E-COMPACT TV TRANSMITTERS: from 0 to 90%
- HIGH POWER AND MEDIUM POWER E-COMPACT TV TRANSMITTERS: from 0 to 80%

Should never be condensation, as water may damage internal circuitry of the transmitter.

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Section 1
Introduction

1

1.1 Purpose of this Manual

The purpose of this manual is to provide the technical information required for the installation and operation of transmitters in UHF TV signals (digital ATSC) in the E-Compact series.

Hitachi Kokusai Linear Electronic Equipment S/A recommends that you carefully read the sections of this manual before installing or operating this equipment.

1.2 Basic Knowledge Required

Follow the necessary knowledge and skills to operate the equipment under:

• Knowledge of electronic circuits of Radio Frequency;

• Knowledge of electricity and electrical systems;

• Knowledge of digital electronics;

• Conducting tests and Digital TV signals measures in ATSC standard;

• Knowledge of radiant systems;

• Conducting tests and measures of Radio Frequency;

• Practice in the management of radio frequency measures equipment (spectrum Analyzer, RF power meter, Vector Network Analyzer, couplers, attenuators, etc).

1.3 Structure

This manual is divided into six (6) sections, which provide the following information:

Section 1 - Introduction

This section provides general overview, models, functional description and technical specifications for all models of transmitters ATSC of the E-Compact series.

Section 2 - Installation Requirements

This section describes the criteria of the minimum requirements of the infrastructure for the equipment installation, such as: electrical power system, lightning protection and air conditioning.

Section 3 - Installation

This section provides the procedures for physical and electrical wiring of the TV transmitter.

Section 4 - Initial Activation

This section describes which steps to be performed in the initial activation of the equipment.

Section 5 – Operation of the Control System

Information of navigation and Operation using the front keypad as well as identifications and functions of all controls and indicators of the outer panel.

Section 6 – Preventive / Corrective Maintenance

Provides information for preventive / corrective maintenance.

1.4 General Description

This section contains a general description of the ATSC TV transmitters of the E-Compact series. Included in this section are the functional description of power drawers and digital exciter, block diagrams and technical specifications of the system.

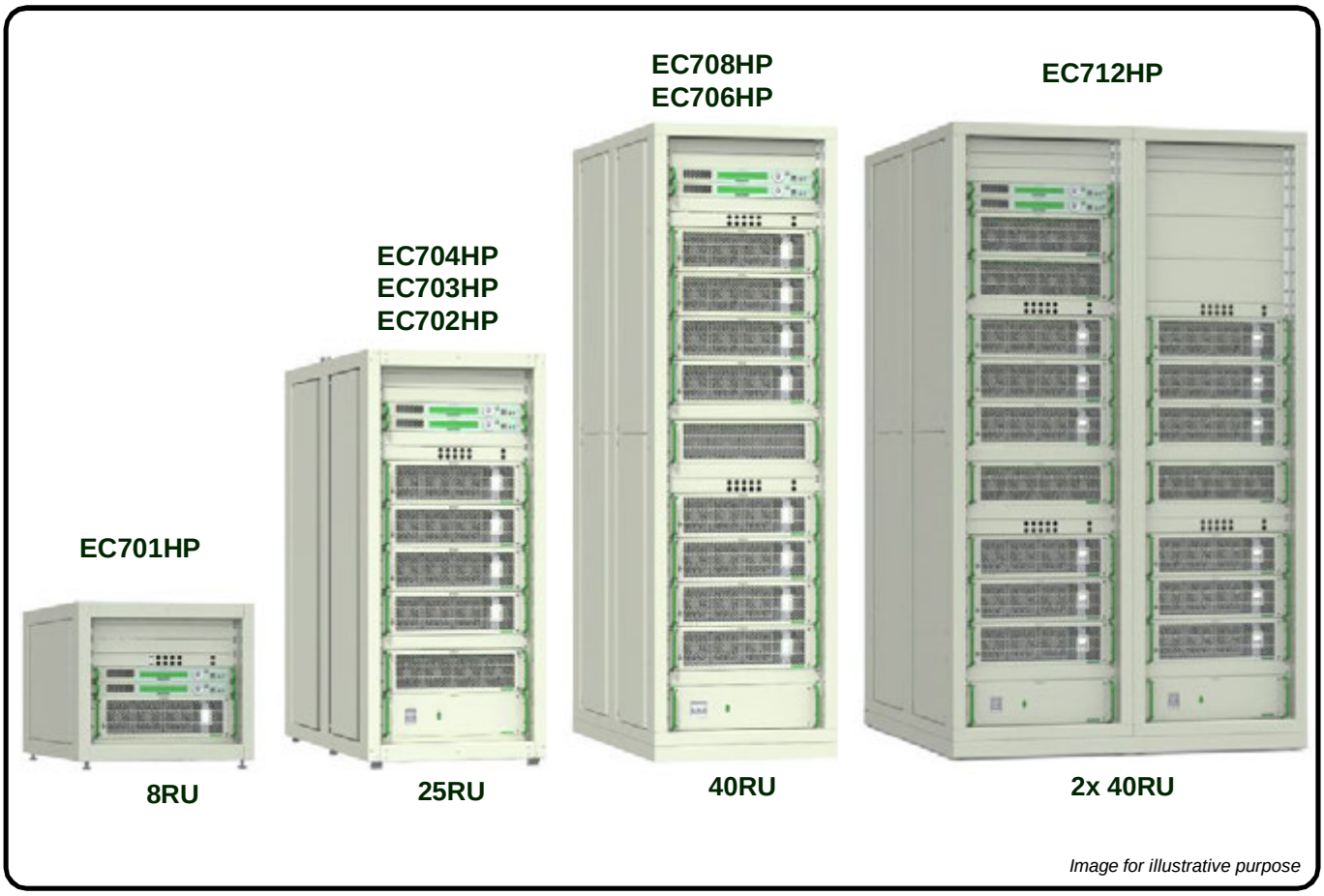


Figure 1-1 Front View ATSC Transmitters

HP transmitters Family (High Power) has high efficiency and high power density.

The high´s power line consists of refrigerated air transmitters with output powers of 700W up to 8.5kW (after filter) to ATSC standard.

The intelligent digital management system using microcontrollers, allows control and monitoring in real time of all transmitter functions. All operation is performed through keypad and digital display both located on the front panel, through which we have access to all readings, alarms and settings.

The RF amplification system is comprises by a splitter, power drawers in parallel, each with its own power supply and independent supervision and isolated combiner.

Main Features:

- Management of all equipment functions and power drawers across the front display.
- High Efficiency providing low power consumption.
- Doherty amplifier technology with LDMOS High Voltage transistors
- Compact Design.
- Amplifier with quick coupling connection (Hot Swap), facilitating installation and maintenance.
- Digital automatic Pre-correction automatic (linear and nonlinear)
- Control of the transmitter integrated to the exciter.
- User interface through display allows monitoring and configuration of the equipment.
- Software for measuring measures the main parameters of the transmitter without the need for expensive equipment and specific.
- WEB and SNMP interface for remote management.
- Option of automatic redundancy in excitation (optional).
- GPS receiver for internal time base (optional)
- Power supplies with power factor correction.
- Power protection reflected with gradual reduction of the direct power control (foldback).
- Start with Inrush.
- Combiners and isolated splitters, allowing removal and insertion of drawers with the connected equipment (provided that the drawer is turned off).

1.4.1 Transmitter's Control System

- **Control Architecture for Hitachi Kokusai Linear' Transmitters:**

Hitachi Kokusai Linear's transmitter control system allows control and monitoring, through front display, all parameters of the equipment.

This system is comprised by a control unit (exciter's integrated function) which through a RS485/ MODBUS network, gather and sends information to the power drawers.

Below the table of power drawers of addresses and exciters on MODBUS.

Table 1-1 Addresses of power drawers and Exciters - MODBUS

MODEL	MODULE	ADDRESS MODBUS (decimal)	Pinout configuration (MSB) A2 A1 A0 (LSB) (binary)
EC701HP	PA Drawer #1	003	000
EC702HP	PA Drawer #1	003	000
	PA Drawer #2	004	001
EC703HP	PA Drawer #1	003	000
	PA Drawer #2	004	001
	PA Drawer #3	005	010
EC704HP	PA Drawer #1	003	000
	PA Drawer #2	004	001
	PA Drawer #3	005	010
	PA Drawer #4	006	011
EC706HP	PA Drawer #1	003	000
	PA Drawer #2	004	001
	PA Drawer #3	005	010
	PA Drawer #4	006	011
	PA Drawer #5	007	100
	PA Drawer #6	008	101
EC708HP	PA Drawer #1	003	000
	PA Drawer #2	004	001
	PA Drawer #3	005	010
	PA Drawer #4	006	011
	PA Drawer #5	007	100
	PA Drawer #6	008	101
	PA Drawer #7	009	110
	PA Drawer #8	010	111
Comum	Exciter A	100	-
	Exciter B	101	-
	1+1 Control Unit	234	-

The Architecture of Control for Hitachi Kokusai Linear Transmitters is composed of subcontrol blocks characterized by Control / Exciter Drawers and by Power Drawer. This architecture allows the distribution of control functions.

The main control block represents the Control / Exciter Drawer and the sub-control blocks represent the Power Drawers and Telesupervision Drawer (Remote Control Drawer).

Each sub-block only reports monitoring information to the main control block, and in some situations the main control block can also transmit commands to the sub-blocks.

The Information reported to the control block is displayed on the primary display.

The control center of each block and sub-block consists of a microcontroller module of 16-bit and 32-bit, according to its functionality described below:

a)- Main Control Module:

The main control module receives information from the other modules, processes this information for displaying on the LCD and sends it to the system telesupervision. The main module is also responsible for checking abnormal conditions and generate alarms, control of transmitted power levels and general user interface. The main control module can also send commands to the sub-blocks in situations where it is necessary to enable specific protections for sub-blocks and also for the control of information sent and received by the remote supervision system.

b)- Power Drawer's Control Module

The control module sends information to the main module on request. This module has a protection system fully independent of the main control module. The control module is responsible for monitoring the power supplies, the readings of forward and reflected power, cooling system, control of quiescent current according to temperature variation.

▪Alphanumeric User Interface

The Control/Exciter drawer has a LCD display in it's front panel companied by a keyboard with six keys, which are: ENTER, ESC, LEFT, RIGHT, UP, DOWN. There is also close to these keys a set of indicative LEDs for Control/Exciter drawer alarms.

▪Communication between blocks and sub-blocks

The Control / Exciter Drawer uses a communication system called MODBUS. This is a serial communication network operated by the Main Control Module in which each node (sub-block) has its own address. This communication system works with the differential transmission avoiding interference noise.

1.4.2 E-Compact ATSC Transmitters Models

The E-Compact TV series consists of transmitters that have a rated power of 700Wrms to 8,500Wrms (digital). Following in Table 1-2, the available model are listed.

Table 1-2 E-Compact ATSC Transmitter Models (High Power)

TRANSMITTER MODEL	NUMBER OF POWER DRAWER	OUTPUT RATED POWER (Wrms)
EC701HP	1	700
EC702HP	2	1400
EC703HP	3	2100
EC704HP	4	2900
EC706HP	6	4200
EC708HP	8	5600
EC712HP	12	8500

Note: The power levels are given in average power for critical mask (50dB). The power is measured at the transmitter's output after the filter.

1.4.3 Composition

The general structure of an E-Compact transmitter series consists of the following stages:

- Exciter with frontal display
- Coaxial Relay (*1)
- Power Splitter (*2)
- Power Drawer(s)
- Power Combiner (*3)
- Reflectometer
- Filtering System
- Power System (*4)
- Ventilation System

Notas:

(*1) Used only in equipment setup dual exciters.

(*2) The splitter is on the equipment with more than one power drawer.

(*3) The combiner is present only on devices with more than one power drawer.

(*4) The components of the AC input (In-Rush, circuit breakers, etc.) of the transmitter are contained in a drawer called MCCB (except EC701HP model).

MCCB: Moulded Case Circuit Breaker.

1.4.4 Block Diagram of the System

Figure 1-2 contains the block diagram of the 700W transmitter, EC701HP model.

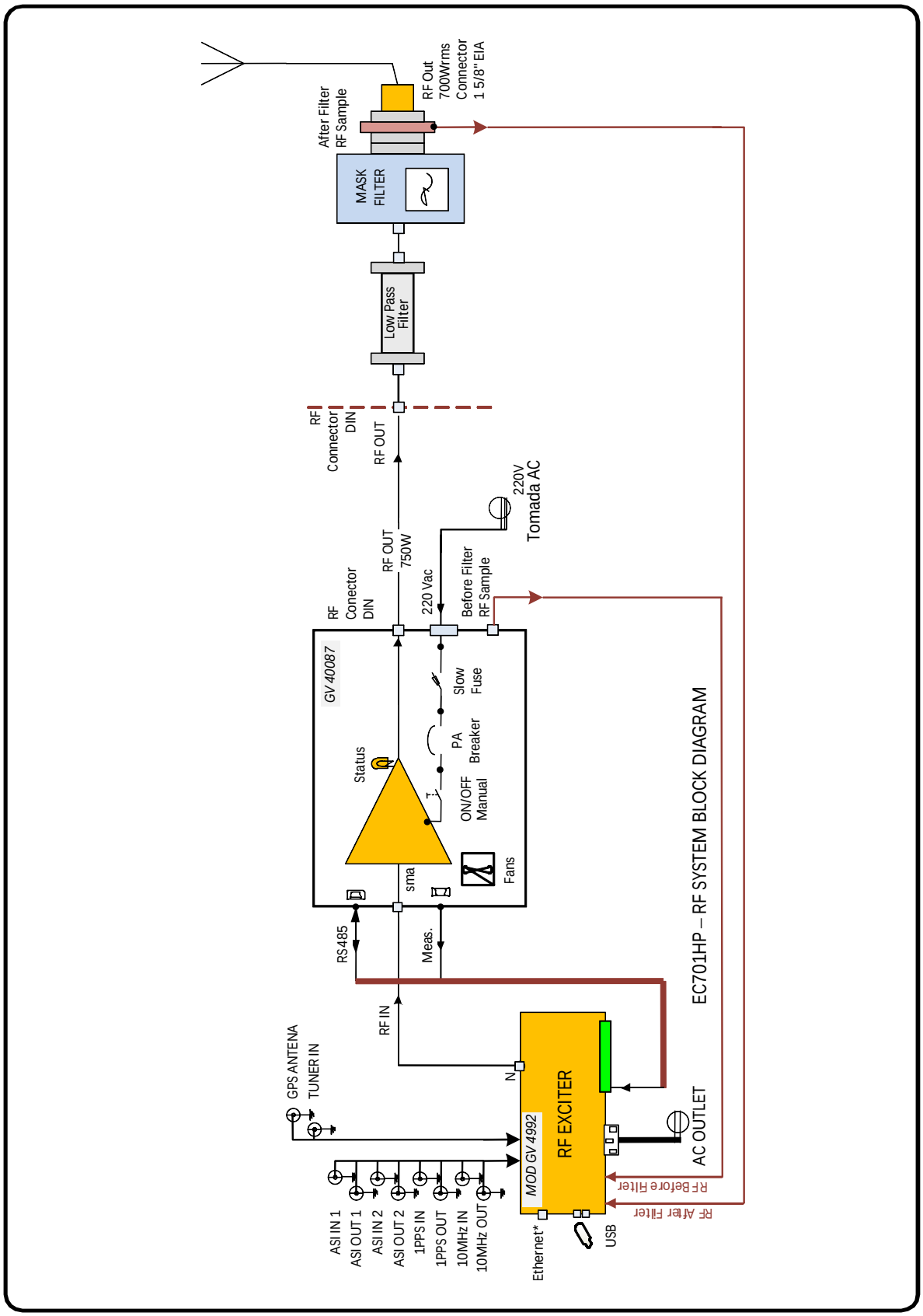


Figure 1-2
Block Diagram of the Transmitter model EC701HP

1.4.5 Functional Description of the System

1.4.5.1 ATSC Digital Exciter

The exciter is formed by the MOD GV 40153 module drawer more optional (internal GPS, and other software optional). This equipment is responsible for generating the digital TV signal and can perform, among other functions, for controlling the output power and the pre-correction of distortions caused by filtering and amplification stages of a transmitter.

Has the following main modules:

1. AC-DC Converter (MOD 4779 FTE 1RU +28V/80W);
2. Ethernet/USB-Host/Device interface board (MOD CIM 3744 DIGI and USB);
3. Keyboard (MOD CIM 3717 TECLADO 1U);
4. Display (MOD CIM 30165 LCD 2x40);
5. MOD VENP 40X40 24V 1U;
6. DC-DC Converter (MOD CIM 30143 PWR 8001 V4);
7. Output Amplifier (MOD 4803 PA 100mW 4001);
8. MOD 4854 EXC DIGI 8001 V4 (MOD 4854);
9. CIM 3832 GPS 8001 (Optional);
10. MOD VENP RADIAL 24V 1U.

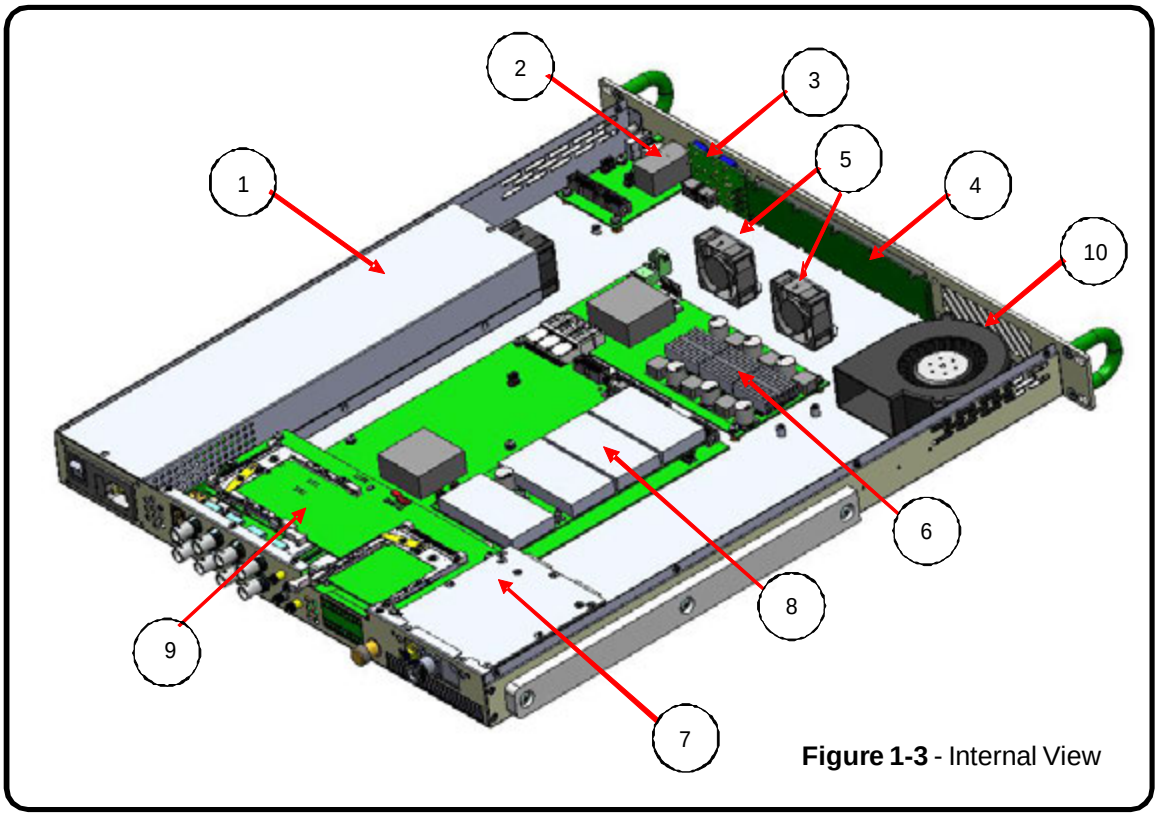


Figure 1-3 - Internal View

The Digital Exciter is responsible for providing an RF signal to excite the amplification stage of the equipment.

The exciter input is a BNC connector that may receive either an ASI or SMPTE310M transport stream. The modulation process follows ATSC A/53E recommendation, and is a complex modulation process generating identical phase-modulated orthogonal IF carriers, (I) and (Q) at frequency of 18.833916 MHz.

Both (I) and (Q) modulated carriers are routed into the IF/UHF up-converter. The local oscillator is a synthesized time-based PLL via an internal VOCXO (Voltage / Temperature Oven Controlled Crystal Oscillator). This oscillator can receive external reference one among 6 possibilities; (External 1PPS GPS, Internal 1PPS GPS, External 10MHz or Input Transport Stream).

The on-channel modulated signal is routed to the RF amplifier, a class A highly linear amplifier with enough head room to accommodate future signal amplitude expansion during the non-linear pre-correction process.

The exciter output delivers a 100mW max RF output level, (+20dBm) at the desired UHF channel, driving the RF power amplifiers line-up. The overall RF output power is kept over control via an internal power control loop ALC.

The power sensors for direct and reverse power are integrated also on this same PC Board; allow the power control feature for a several different types and models of transmitters. A sample of the of the RF signal delivery to the load is necessary to be present, so the external loop to control the RF power is closed. (External Power Control Loop).

The Master Control Unit (MCU) of the unit is embedded in the exciter. The MCU interacts with all functionality present within the equipment. It further interfaces externally via a keypad and an LCD display.

The MCU receives information proceeding from several modules, as the DTV modulator, Up-Converter, RF amplifiers, RF samples and the administration of passwords. Via keypad it is possible to read and program the power level delivered by the transmitter. Major changes on the transmitter configuration are possible with factory assistance.

The Digital Exciter interacts with the HITACHI proprietary software (GUI8001) that performs the implementation of linear and non-linear pre-correction as required; the software also conducts measurements on the demodulated signal, such as MER and power spectrum readings, among others.

Figure 1-4
Front view - Digital Exciter

ATTENTION: In the event of any changes being required in the settings of the equipment, the Service Department of Hitachi Kokusai Linear should be consulted for further information on the procedures to be adopted.

Block Diagram - Digital Exciter

Figure 1-5 contains the 1st part of the block diagram of the exciter 100mW.

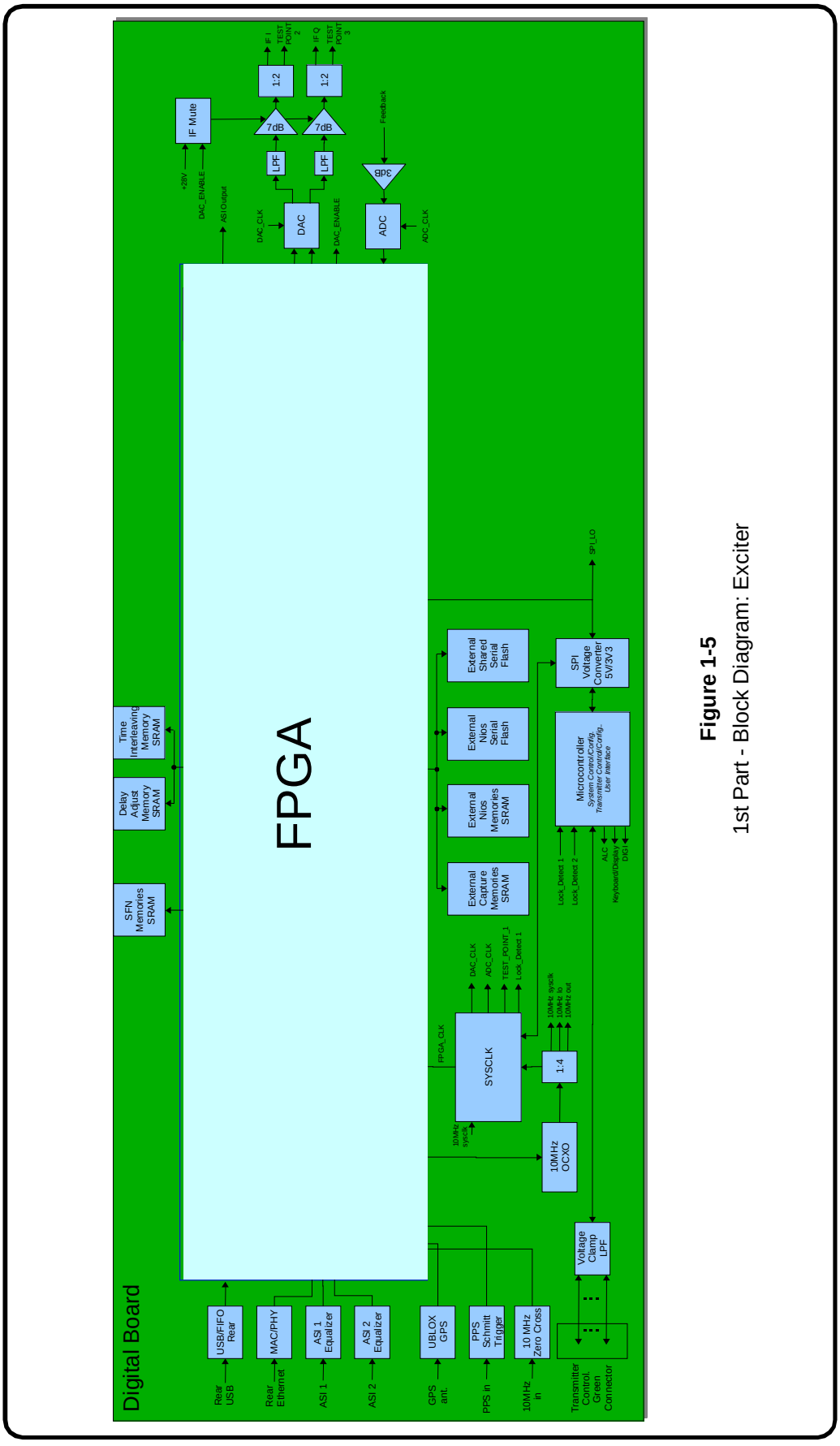


Figure 1-5
1st Part - Block Diagram: Exciter

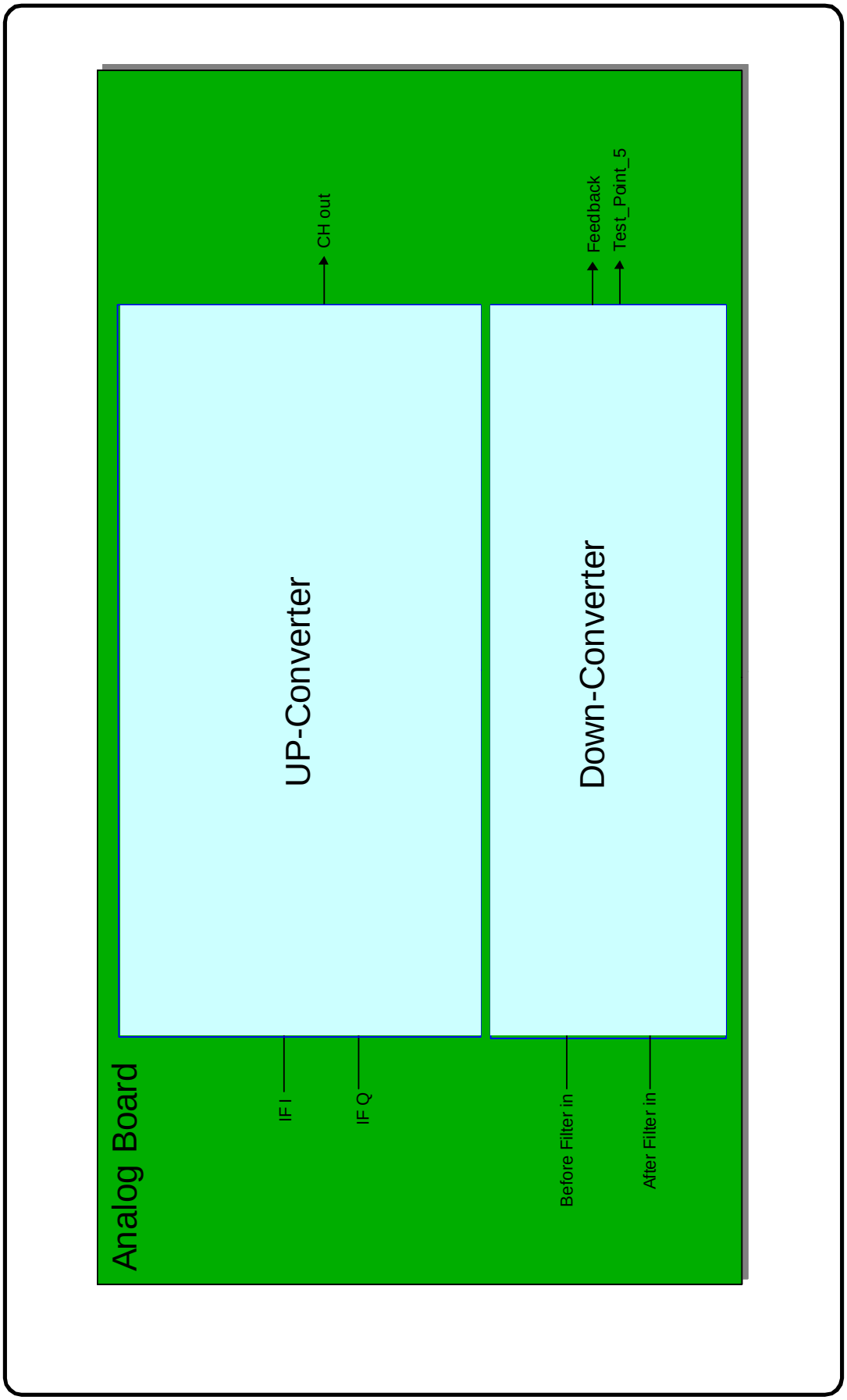


Figure 1-6
2nd Part - Block Diagram: Exciter

Description of main circuits:

Equalizer input circuit ASI 1 e 2

Equalize and convert DVB-ASI signal into a differential LVDS signal to the FPGA.

Circuit Cable Driver of the outputs ASI 1 e 2

Converts the LVDS signal provided by the FPGA to DVB-ASI electrical standard. The two ASI outputs have the same content.

GPS Ublox (Optional)

GPS receiver module with input for active antenna (amplified) supplied with +5 V (via coaxial cable) and output PPS (Pulse Per Second) with LVTTL levels.

PPS Input and Output

Uses components schmitt trigger as interface, has high input impedance (> 1MΩ) and low output impedance (~ 35Ω). Compatible with TTL/ LVTTL level input and LVTTL output.

10MHz Input and output

The input circuit is a zero crossing detector with an impedance of 50Ω and AC coupling. Provides a signal of 10MHz square with LVTTL levels for the FPGA for input between 0 and +10 dBm.

The output with an impedance of 50Ω provides a sinusoidal signal with +8 dBm ~ 700mV DC level to a load 50Ω or 4Vpp and 1.5 V average for high impedance loads (> 1MΩ). The output signal is a sample of 10MHz from the OCXO, a temperature-controlled oscillator and a frequency range of approximately + / -1.5 ppm or + / - 15Hz.

SYSCLK – System's Clock

The sysclk circuit is basically composed of two main components, the first is the clock generator (CI HMC830LP6) that receives the reference of 10MHz and generates a signal of 1377.56643358 MHz (8xSYS_CLK) through the fractional PLL and integrated VCO.

The second component is the clock distributor (IC AD9510) which performs a frequency division of 8 and 16 for generating the signs of 172.195804197 MHz (FPGA_CLK, and DAC_CLK and test point SYSCLK) and 86.09790209 MHz (ADC_CLK) respectively.

This circuit is configured via SPI interface, by the microcontroller A512 during system startup. The Lock Detect output is used for verification of this circuit.

The frequency of the system clock for 6MHz BW is achieved through tithe $8192 * 10^6/63$.

Digital Modulator

The ASI reception blocks, remultiplexing, modulation and corrections are described through the languages VHDL and Verilog and synthesized using the Quartus II software. A SOC (System on a Chip) using Nios processor is also present for the execution of the functions of conFiguretion, control and communication of the system using functions described in ANSI C language.

The FPGA basically makes the treatment of the input transport stream and modulates this information according to the ATSC standard, generating a complex digital FI (I and Q signals of 16-bit signed complementing 2) with a sampling rate of 86.0979 MSPS. Also performs the linear and non-linear pre-correction, the capture and storage of internal signals and of feedback to implement the tasks of pre-correction and measures.

Digital-to-Analog Converter and Analog FI generation

Composed of the DA converter, reconstruction filter (low pass with fc ~ 50MHz) and FI amplifier.

The DA converter operates at 172.0195804 MSPS (interpolation factor equal to 2) and the output amplifier with gain of 7dB has a protection circuit that inhibits its operation during the transient power supply and system startup.

The FI signals I and Q (In-phase and Quadrature) are centered on 18,834MHz (obtained by tithe 1024 * 106/63), with an average power of -20 dBm +/- 0.5 dB and intermodulation lower than -55 dBc at +/-3.25.

Local Oscillator

The LO circuit is essentially composed of the CI (fractional PLL + VCO) receiving the 10MHz reference and generates a signal corresponding to twice the frequency of the local oscillator (used by the mixer complex of the up-converter to generate the LO signal with 0° and 90°) and also by CI HMC432 which is a frequency divider by 2 (LO signal for monitoring and downconvert).

The value of the frequency of the local oscillator can be obtained by the following equation 6MHz BW):

$LO(C) = (C-14)*6*10^6 + 473*10^6 + 1*10^6/7 + 1024*10^6/63$ [Hz]

In which C is the desired channel: 14..69

Eg: C=54. $LO = (54-14)*6*10^6 + 473*10^6 + 1*10^6/7 + 1024*10^6/63 = 729{,}396825$ MHz

This circuit is configured via SPI interface for A512 microcontroller during system startup. Lock Detect output is used to check this circuit.

Up-converter

The channel conversion is done by the CI ADL5385, a mixer complex (FI input in quadrature) and input 2xLO (internal generation of LO 0 ° and 90 °) where the main features are canceling the image frequency (top rate: LO + FI) and reduced leakage of the local oscillator.

The cancellation of the image frequency is optimized by adjusting the FI quadrature (amplitude and phase adjustment between I and Q signals).

The reduction of LO leakage is maximized by adding a voltage offset in order to compensate for the imbalance present in the DC ports of FI.

The minimum expected frequency image rejection is -50dBc and LO leakage is -40dBc.

The converted signal in frequency, lower rate (C = LO - FI), is then submitted to the selector circuit low pass filter of 2nd harmonic of four bands, VHF B1 (channels 2-6), VHF B3 (channels 7-13), UHF Low (14-42) and UHF High (43-69), automatically selected according to the channel by the microcontroller A512.

The next step is the Voltage-Controlled Variable Gain Amplifier (CI ADL5330) which applies a gain proportional to the ALC voltage (Gmin ~= -34 dB to ALC = 0V e Gmáx ~= +22 dB to ALC = 1,4V) applied to the pin 24 of the VGA (after resistive divider). The typical maximum output power is 0dBm for an intermodulation smaller than -50 dBc at +/- 3.25 MHz from the center of the channel.

Down-converter

The circuit “down-converter” performs the selection of one of the two feedback signals (Before and After Filter or Before and After Filter), performs the beating of this signal with 1xLO using a real passive mixer and gets a FI signal centered at 18.834 MHz.

The FI signal is then filtered and amplified, this feeds the output stage of AD conversion (Analog to Digital) and the AGC level detector (Automatic Gain Control), which operates in the Truss (Variable Voltage Controlled Attenuator) of the RF inputs (average power between 0 and +10dBm) in order to maintain the output of FI with an average power of -5dBm + / - 1dB.

This signal is available for monitoring via test point connector and is also applied to the drivebuffer that feeds the AD converter, which operates clocked at 86.09790209 MHz and 16 bits resolution.

1.4.5.2 Coaxial Relay (Optional Dual Excitation)

The UHF coaxial relay makes the selection of which exciter (A or B) will provide the signal to the passive splitter, which distributes the signal to the power drawers. This switch is controlled by a DC command from the exciter A.The software present on this unit makes the control and selection of which exciter will be transmitting. The exciter which is not selected will remain powered in standby, ready to take control of the equipment.

1.4.5.3 Power Splitter

This passive module is a UHF power splitter in quadrature, which is responsible for the clustering of power drawers in parallel configuration. Receives the signal from the exciter and promotes a division 1:N(*5), to excite the UHF amplifiers in the drawer power.

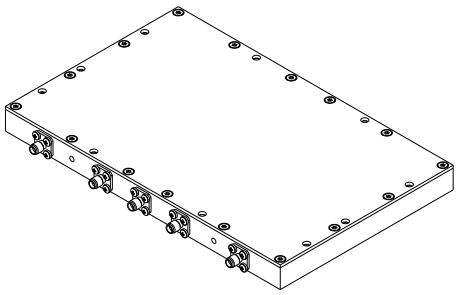


Figure 1-7 - Splitter
(UHF 4-Way Quadrature Hybrid Splitter - QS4C - used in the EC703HP transmitter)

1.4.5.4 UHF Power Amplification System

The amplification system comprises power drawers PA708HP model (MOD GV40001)(*6) combined to obtain the final output power. Each drawer provides 860W from 8 power amplifier in configuration Doherty power amplifier configuration, in this way one obtains a high efficiency amplifier. Power drawers are mounted in the rack via a quick release system which allows speed in maintenance operation.

The main features of the power drawer are:

- High efficiency
- Doherty Configuration
- Standing fans accessible from the front panel
- Removable power supply at the rear panel of the drawer
- 3U Power Drawer for 19" rack

(*5) N represents the number of drawers of the transmitter.
(*6) The EC701HP equipment uses the MOD GV 40087 drawer. What differs from the drawer MOD GV 40001 are the models of adders and back panel connectors.

- Power Amplifiers which cover the entire UHF band
- Power transistors LDMOS NXP BLF888A
- Automatic control of the quiescent currents of the power transistors depending on the temperature.
- Automatic control of rotation of the fan depending on the temperature of the power transistors.
- Protection against VSWR and Overdrive
- Power Factor Corrector (PFC) at power supply (PFC).
- Protection against over current in the power supply.
- Settings and measures via terminal.
- Automatic restart after alarm event.
- Matched sample of the output signal

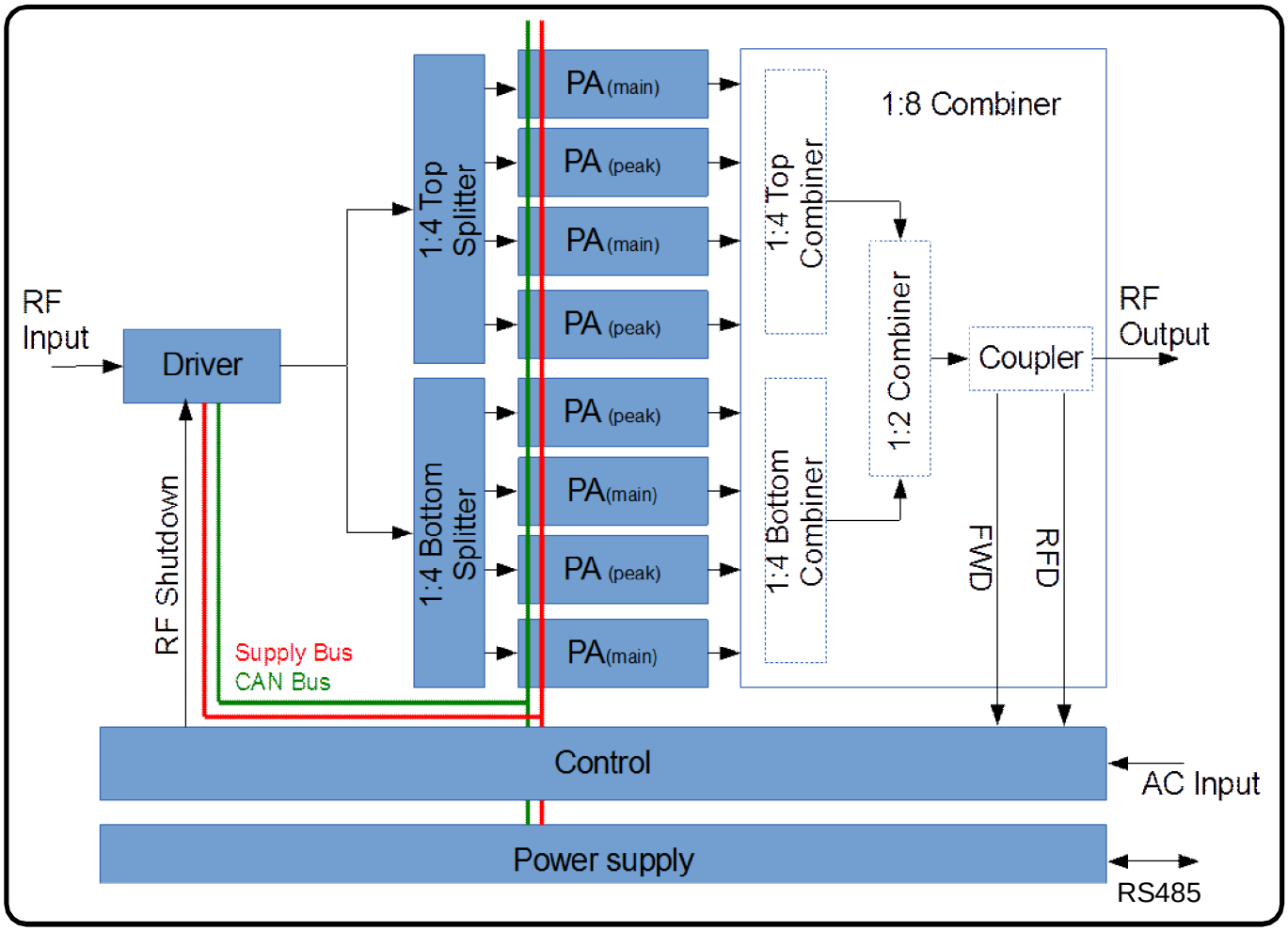


Figure 1-8 - Block diagram of the power drawer (MOD GV 40001)

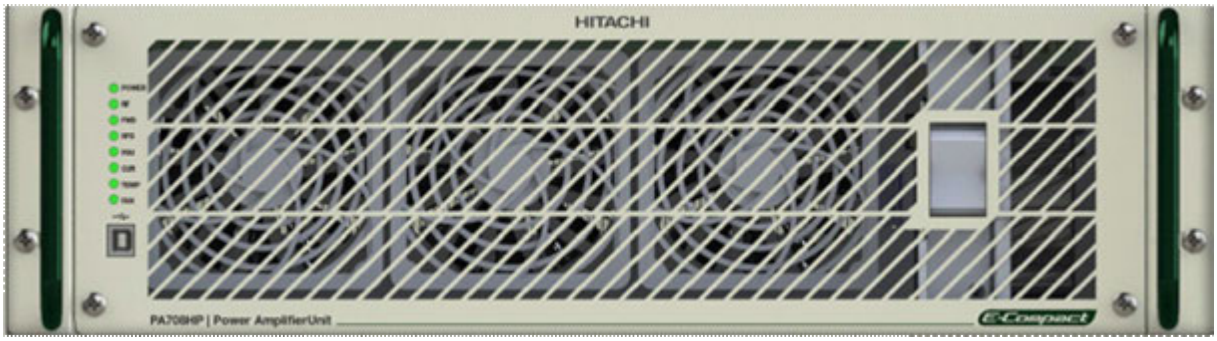


Figure 1-9 - Front view of the power drawer

Table 1-3 Power Drawer Technical Specification

CHARACTERISTIC	SPECIFICATION
Input Impedance	50 ohms
Loss of input return	Better than 19dB
RF Input connector	Plug-in
RF Input level	7.3dBm
Operation Frequency Range	470-782 MHz (divided into 14 subbands)
Output Power	860W rms
Power Gain	Ajusted 52dB
Gain adjustment range	6 dB
Phase adjustment range	30°
Automatic Fan Speed (rpm) Control	2100 to 7000 rpm
RF Output connector	7/8" without flange
Intermodulation (shoulder)	Better than -36dBc
Harmonic Attenuation	Better than -30dBc
AC Power Supply	220 VAC (180 to 240VAC)
Efficiency	> 33%
Power Factor	> 0,98
Cooling System	Air
DC Power Supply	+50V 3.5kW
Dimensions	Height: 3RU = 135 mm Width 19" = 483 mm Depht: 630 mm
Weight	32Kg

1.4.5.5 Power Combiner

This module is a passive RF combiner N doors constructed with hybrid couplers, which is a combination of N: 1[(*5)] from the output of the N power drawers, thus obtaining the final transmitter power.
This combiner has loads of unbalance, located in the loads drawer.

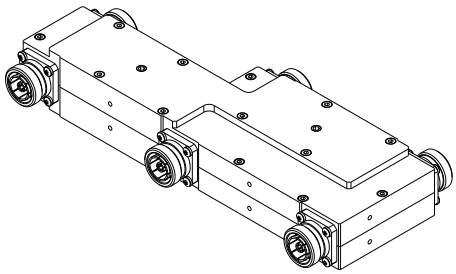


Figure 1-10 - Combiner
(UHF Hybrid Coupler - MC3Q40C model - used in the EC703HP transmitter)

1.4.5.6 Loads Bank

It is a drawer where loads of unbalance of the power combiner are packed, there are different models according to the number of loads.

There are five models of load bank of drawers:

- 056402 - MOD GV 40041 DL0K5W EC702HP
- 056395 - MOD GV 40040 DL1K0W EC703HP
- 055356 - MOD GV 40027 DL1K9W EC704HP
- 059323 - MOD GV 40082 DL4K3W EC706HP
- 056402 - MOD GV 40081 DL5K1W EC708HP

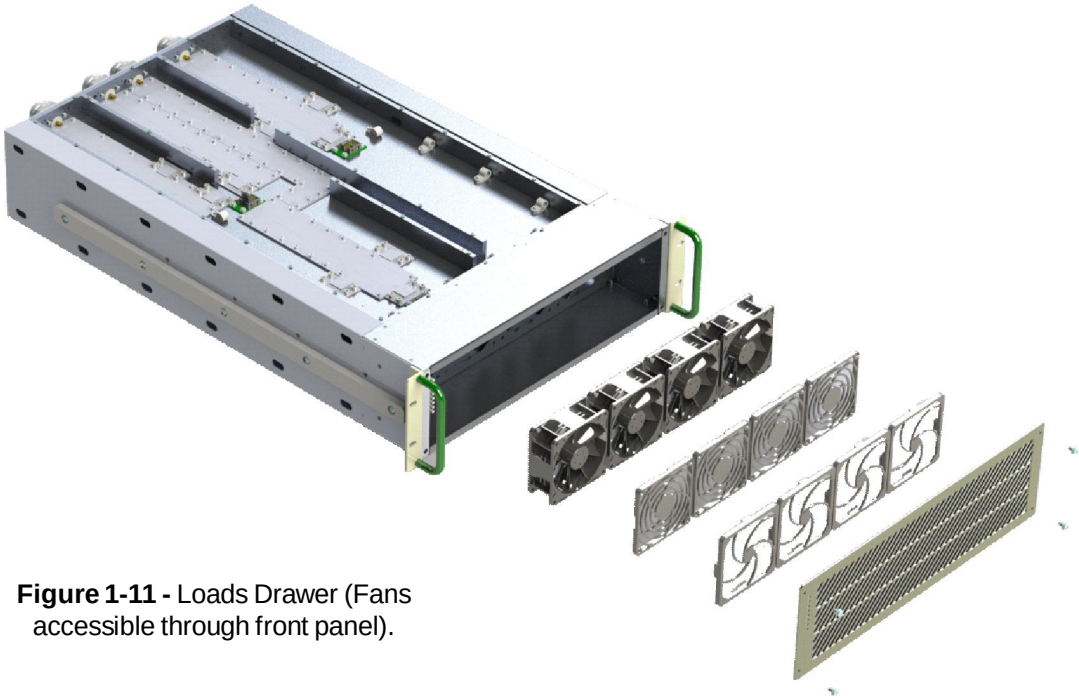


Figure 1-11 - Loads Drawer (Fans accessible through front panel).

(*5) Note: N represents the number of transmitter drawers.

1.4.5.7 Filtering System

The TV transmitter is endowed with a filtration system that ensures that the spectral conformity of the TV channel broadcast on UHF stay in accordance with the parameters set by international standards (FCC, ITU and Anatel).

The filtering system of the transmitter consists of two steps:

- Low-pass UHF filter
- Bandpass filter

The low-pass filter has the form of a rigid line, which aims to counter the harmonics of second and third order of the TV signal broadcasted on UHF.

(*6) Note: Each transmitter uses a given filter model bandpass filter and low-pass model.

1.4.5.8 RF Sampling Probe

Measured Module, we used to extract a signal sample to perform measurements with the transmitter installed and operating, without this being necessary to remove the operation transmitter. This module provides points of RF samples for RF measurements with spectrum analyzer, direct power measurement with Power Meter (reflectometer) and analysis of digital modulation ATSC.

It has three RF couplers (sample) matched with RF levels defined, and is also used to measure reflected power (reflectometer) by sampling probe set for this purpose.

1.4.5.9 Power Supplies

The power supplies used in the TV transmitters are all the switching type. These power supplies are controlled by the digital control units via the shutdown command. Also report, each in its respective control unit, the DC voltage supplied and the consumption required by UHF amplifiers' transistors.

In the transmitter, three models of power supplies are used:

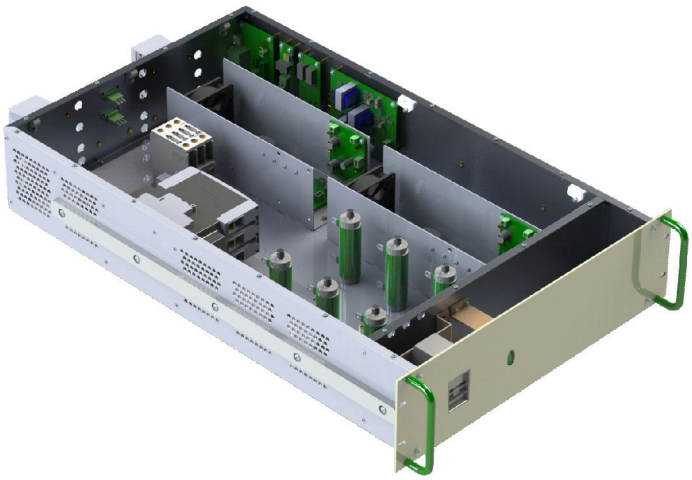
- Module 4779 - Exciter power supply
- Module 40008 - Power Drawer's Power Supply (MOD GV 40001 / MOD GV 40087)
- Module 40039 - AC Unit

1.4.5.10 Electrical Distribution Drawer (MCCB)

This drawer is responsible for the distribution and protection of AC power equipment, and has the following characteristics:

- Inrush current limitation of equipment (inrush).
- Equipment protection in the event of over-voltage or phase failure in the AC network.
- Provides + 50V for the load bank drawer.
- Provides + 8V for the reflectometer.
- Provides + 15V for the relay.

Figure 1-12 - MCCB



NOTA:

The MOD GV MCCB drawer has different power capacities according to the respective transmitter models, requiring the transmitter power specification.

Table 1-4 Models of electric distribution drawer (MCCB) as the transmitter model

TRANSMITTER MODEL	MCCB MODEL
EC701HP	NOT APPLICABLE
EC702HP	MOD GV 40031 MCCB
EC703HP	MOD GV 40030 MCCB
EC704HP	MOD GV 4993 MCCB
EC706HP	MOD GV 40061 MCCB
EC708HP	MOD GV 40062 MCCB

For more information on the electrical distribution drawer, see the Annex.

1.4.5.11 Cooling System

The transmitter's cooling is obtained by forced air ventilation through of the ventilation of the power drawers and excitation drawer. Within each power drawer there are fans modules that promote circulation of air within them and especially the in the fins of the power modules' heat sinks.

The rear and top covers with vents also aid in cooling the transmitter, providing the drawers' output with direct air power for the environment.

1.5 Technical Specification - E-Compact TV ATSC Transmitters

GENERAL FEATURES

- IP Input;
- Modular power amplifiers;
- High efficiency with Doherty Technology;
- Air Cooling;
- Automatic Fan Speed Control: low noise levels, energy saving and increased lifespan;
- Power Supply with Power Factor Correction ≥ 0.9;
- Measurements and Alarms through front display and keyboard or via web;
- VSWR and Overdrive protection via hardware with power reduction;
- Software oriented overheating protection for internal modules;
- Automatic Digital Pre-correction (Linear and Non-Linear);
- Telemetry: WEB Server/SNMP, for local or remote management;
- AGING transistor compensation via exciter's front panel;
- Automatic GM compensation with temperature;
- Gain and Phase adjustments per drawer;
- SFN Operation;
- Configurable BTS decompressor, compatible with other compression standards.
- Isolated combiner, enabling Hot Swap[4]

INCLUDED

- General Control Software, WEB Server and SNMP;
- USB communication Drivers;
- PT-BR, US-EN or ESP manuals (digital formats).
- Passive elements kit: Low-pass filter, before and after-filter probes

OPTIONALS[5]

- Telemetry through GPRS interface;
- Double Exciter;
- Instrumental embedded via software;
- GPS time base (exciter's internal module);
- Terrestrial reception for UHF retransmission (N-Female Connector);
- Satellite reception (DVB-S/S2) for UHF retransmission (N-Female Connector);
- Conditional Access Module with up to four simultaneous services, and display of up to eight services;
- Output Mask filter;
- Input 7-pole filter for UHF receiver.

Communication Interfaces	USB / Ethernet[2] / SNMP
Frequency Stability	±1Hz (internal GPS)
Oscillator	PLL synthesized
Power Factor	better than 0.9
Operation Altitude	up to 2,500m a.s.l[6]
Ambient operating temperature	25°C Recommended 35°C Maximum
Environmental Humidity range	from 0 to 95% (non-condensing)
BTS, TS or IP INPUTS	
Formats	DVB-ASI 188 / 204 bytes Ethernet[2] (IEEE 802.3u) 10Base-T/100Base-TX
Connectors	BNC-Female RJ45
Impedance	75Ω
OUTPUT	
Operation Frequency	470MHz to 806MHz (UHF)
Bandwidth	6 / 7 / 8 MHz
Power	up to 9.5kWrms before filter
Minimum Operation Power (after filter)	10% of nominal power (increased in steps of 10W)[7]
TV Standard	ISDB-T, ATSC and DVB-T2
Intermodulation	-50dB @ ±3.15MHz (BW=6MHz) -50dB @ ±4.2MHz (BW=8MHz)
Harmonics / spurious	better than -60dBc
MER	34dB to 38dB

TECHNICAL TABLE (typical values)

Model	EC701HP		EC702HP		EC703HP		EC704HP		EC706HP		EC708HP		EC712HP	
Output Power (W)[8]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]	B.F.[9]	A.F.[9]
ATSC	800	700	1,600	1,400	2,400	2,100	3,200	2,900	4,800	4,200	6,500	5,600	9,500	8,500
DVB-T2	750	600	1,500	1,300	2,200	1,900	3,000	2,600	4,500	3,900	6,000	5,200	8,800	7,700
ISDB-T	700	580	1,400	1,200	2,100	1,800	2,700	2,400	4,000	3,600	5,400	4,800	7,800	7,200
AC Mains (43 to 63Hz)	M220 B220		M220 B220 T220 T380		M220 B220 T220 T380		M220 B220 T220 T380		M220 B220 T220 T380		M220[10] B220[10] T220 T380		M220[10] B220[10] T220 T380	
Output Connector	EIA 1-5/8"		EIA 1-5/8"		EIA 1-5/8"		EIA 1-5/8"		EIA 3-1/8"		EIA 3-1/8"		EIA 3-1/8"	
PA Modules	1 module		2 module		3 module		4 module		6 module		8 module		12 module	
Typical AC Consumption(W)[8]														
ATSC	2,055		4,009		5,964		7,918		11,827		15,736		23,575	
DVB-T2	2,051		4,002		5,954		7,905		11,807		15,710		23,515	
ISDB-T	1,935		3,810		5,685		7,560		11,310		15,060		22,620	
Typical Heat Dissipation (BTU/h)[8]														
ATSC	4,539		8,551		12,656		16,618		25,111		33,600		50,983	
DVB-T2	4,857		9,058		13,320		17,647		26,773		35,584		53,206	
ISDB-T	4,595		8,688		12,840		17,052		25,921		34,060		51,840	
Rack dimensions (RU)	8		25		25		25		40		40		40	
Number of Racks	1		1		1		1		1		1		2	
Rack total width (mm)	570		570		570		570		570		570		1,140	
Rack total depth (mm)	900		1,100		1,100		1,100		1,100		1,100		1,100	
Transmitter weight (kg)	70		170		210		250		350		420		700	

Remarks / Notes

[1] Except EC712HP.

[2] Ethernet is a registered trademark of Xerox Corporation

[3] Except EC701HP.

[4] The PA modules can be removed / inserted with the transmitter in operation, although the PA being removed / inserted must be switched off.

[5] Contact Hitachi Kokusai Linear for optionals availability in each standard.

[6] Altitudes above 2,500m under consultation.
a.s.l: above sea level.

[7] Except for model EC701HP, nominal power of 580W, in which the minimum power is 50W.

[8] May change depending on MER value, channel and output power. For details, consult Hitachi Kokusai Linear.

[9] B.F.: Before Filter / A.F.: After Filter

[10] Under consultation.

Note: *All specifications are subject to change without notice.*

1.6 Photo - EC701HP Transmitter

Figure 1-13 - Front view of the EC701HP

E-Compact Series - Installation CheckList

(Use before turning the transmitter on for the first time)

Task	Description		
Grounding	Electrical. External Grounding from the AC panel.		
	Cabinet. Physical grounding to the Station grounding.		
Low power cables	Hyper-Terminal, ready for monitoring		
	Ethernet, ready for remote control		
	Internal Control Connection, back of the Exciter		
	RS485 connections - rear panel of the RF Power Amplifiers		
	AC Cable, 220Vac to the exciter rear panel, to the cabinet power outlet.		
Electrical 220Vac power cable	Ground. Into the cabinet.		
	Phase 1. Main Breaker, or rear bottom conection poles.		
	Phase 2. Main Breaker, or rear bottom connection poles.		
	Phase 3. Main Breaker, or rear bottom connection poles.(Three-phase transmitters).		
	Neutral: Rear bottom connection (380 VAC three-phase transmitters)		
	AC Connectors - Rear panel of RF PAs.		
	Individual RF Drawer - Cabinet AC Grounding cables. Rear Panel of PAs.		
	Individual Exciter-Cabinet AC Grounding cable. Rear Panel of Exciter		
	No-Breaks / voltage stabilizers.		
Coaxial low power cable	ASI IN.Transport Stream IN. Exciter to the top the cabinet.		
	RF SAMPLE Before Filter. Exciter to the External Dir. Coupler before the mask filter.		
	RF SAMPLE After Filter. Exciter to the External Dir. Coupler after the mask filter.		
	Exciter RF output to the Splitter. Inside the cabinet.		
	ASI OUT. Exciter to the top the cabinet..		
	GPS Antenna. Exciter to the top the cabinet. If applicable.		
	Tuner Antenna. Exciter to the top the cabinet. If applicable.		
High power RF passives	Connection of rigid line, coaxial cable and curves.		
Operating environment	Temperature. Under 25°C.		
	Cleaness. Few or no dusty stress.		

Section 2
Minimum Installation Requirements 2

2.1 Introduction

This section describes the minimum requirements for the E-Compact ATSC transmitters installation, including recommendations about shelter, tower, antennas, cables, grounding, electric network, transient prevention, etc.

2.2 Minimum Requirements

2.2.1 Electric Power

2.2.1.1 Grounding

The grounding system to which the Hitachi Kokusai Linear TV transmitter will be connected must be designed and installed by qualified professionals. A deficient grounding system could represent a danger not only for the equipment, but also for people working in the shelter. A satisfactory grounding system should have maximum 5Ω resistance between the grounding and neutral terminals.

An important aspect is that all the devices involved in a transmission system should have the same potential in order to avoid DDP and enable a balanced flow of eventual atmospheric discharges.

It must be borne in mind that, if it is necessary to change the chemical characteristics of the soil in order to lower the impedance, a temporary condition would be created (as it would not be the natural local chemistry), which will be naturally absorbed over time. In this case, periodic preventive checking should be made during maintenance activities.

2.2.1.2 Stability

The voltages delivered to each phase of the Hitachi Kokusai Linear TV transmitter must be purely sinusoidal and stabilized. For this reason, it is necessary to use voltage stabilizers or stabilized uninterrupted power systems (UPS), since such devices protect the TV transmitter from power surges. The voltage stabilizer or UPS must be dedicated to the Hitachi Kokusai Linear TV transmitter. The voltage stabilizer or UPS device must be designed for at least 30% above the consumption (in kVA) specified for the TV transmitter. Therefore, in the case of the TV transmitter, whose maximum consumption is 38 kVA, the voltage stabilizer or UPS device capacity must be 50 kVA. It must be kept in mind that input voltage variations more than 15% above the transmitter specification can damage the equipment, and such damages are not covered by the factory guarantee. Moreover, it must be checked the potential difference between the ground and neutral (if any) terminals to be connected to the Hitachi Kokusai Linear TV transmitter. Such potential difference must be maximum 3V.

2.2.1.3 Insulation

It is important to provide suitable electric insulation between the shelter's power points and the Hitachi Kokusai Linear TV transmitter, which can be achieved by means of insulating transformers. This will hinder the passage of any kind of transient from the electric network to the TV transmitter and vice versa. Moreover, the Hitachi Kokusai Linear TV transmitter is fitted with switching power supplies that require a purely sinusoidal input voltage, but output voltages are usually not **purely sinusoidal** if electronic stabilizers or UPS devices are used without an insulating transformer.The insulating transformer should be dedicated to the Hitachi Kokusai Linear TV transmitter and its capacity should be the same as that adopted for the voltage stabilizers or UPS devices, i.e. 30% above the specified TV transmitter consumption in kVA.

The Hitachi Kokusai Linear TV transmitter should not be installed within a radius of 10 meters from the 13kVA transformer, as it could cause interferences due to the electromagnetic field or sparking in the internal brushes.

Recommendations

1- We recommend that the transmitter "never sees" the electric power directly.

2- We recommend using UPSs online double conversion and / or UPSs online Delta-conversion built with isolation transformer and power factor correction (PFC).

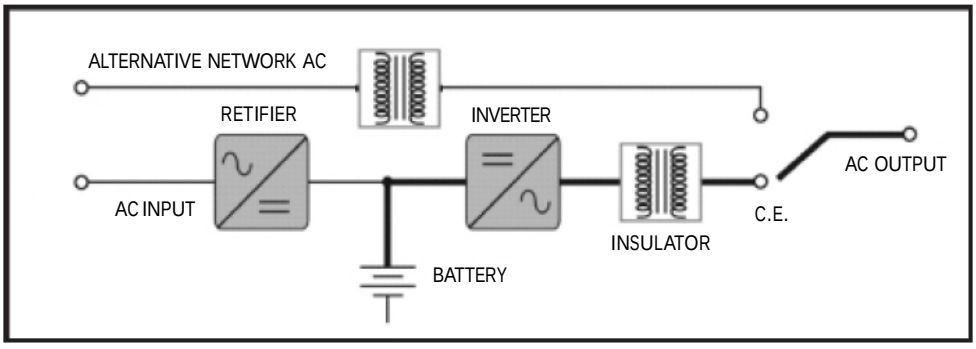


Figure 2-1 - *Example of UPS with isolating transformer*

Advantages:

- These types of UPSs bring great protection and insulation to the transmitter due to its mode of operation and design.

- The double conversion is due to be converted to AC power and DC to DC voltage is converted back to AC, which eliminates any disturbance in the electric power when converted to DC, thus protecting the transmitter.

Important to note that UPS does not necessarily need to have a battery bank, thus minimizing the cost of the final product. This solution is much better than a conventional **stabilizer** due to double conversion as explained earlier.

- The power factor correction (PFC) in the UPS is necessary to reduce the cost of electricity, it reduces the reactive power (VAr), dimunindo the total power (VA).

Importantly, it is not efficient to have a transmitter with power factor correction (PFC) powered by a UPS without PFC, because all the advantage achieved by the transmitter is lost on UPS, not resulting in energy savings. When making this type of connection, you actually had a great load (resistive behavior) to the UPS, but its electric power sees the input of the UPS (without PFC, high consumption).

When we have a UPS with power factor correction (PFC), this will present a network for optimal behavior (low reactive power, low consumption) even connected to a transmitter without PFC, ie, it will correct the power factor of all the system.

Sizing of the UPS

$PW\ UPS = PTX_{(real)} (COS\ \Phi * \eta_{(UPS)})$

PTX: Real Power (W)
Cosϕ: Power Factor Correction
η%: Efficiency of the UPS

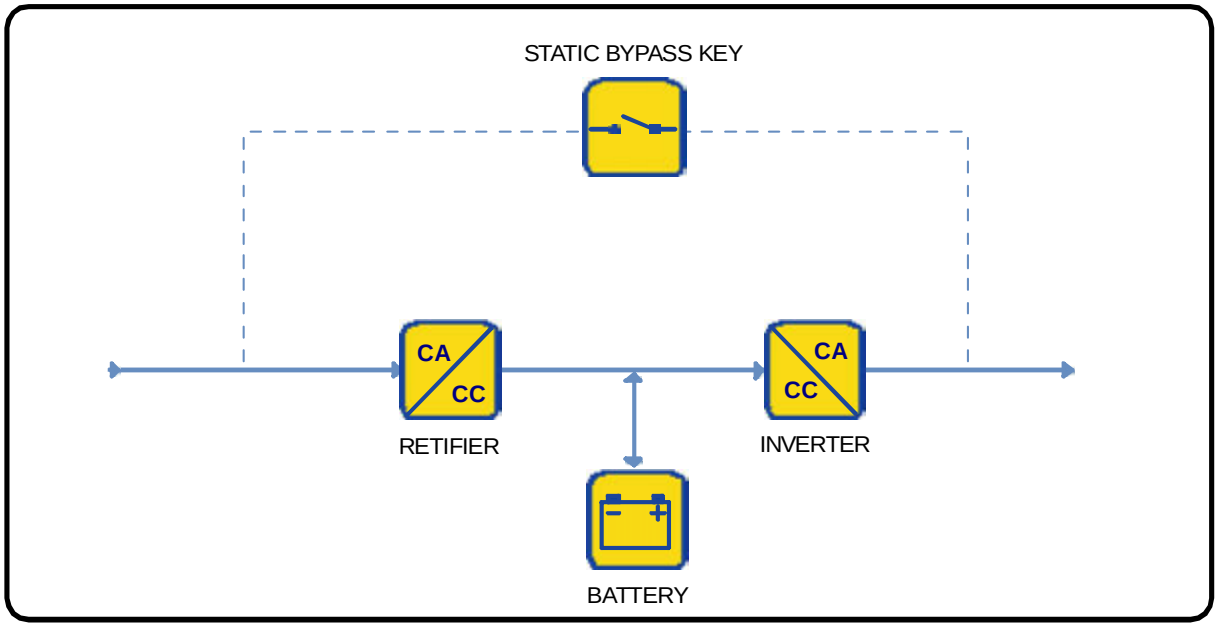


Figure 2-2 - UPS on-line Double Conversion

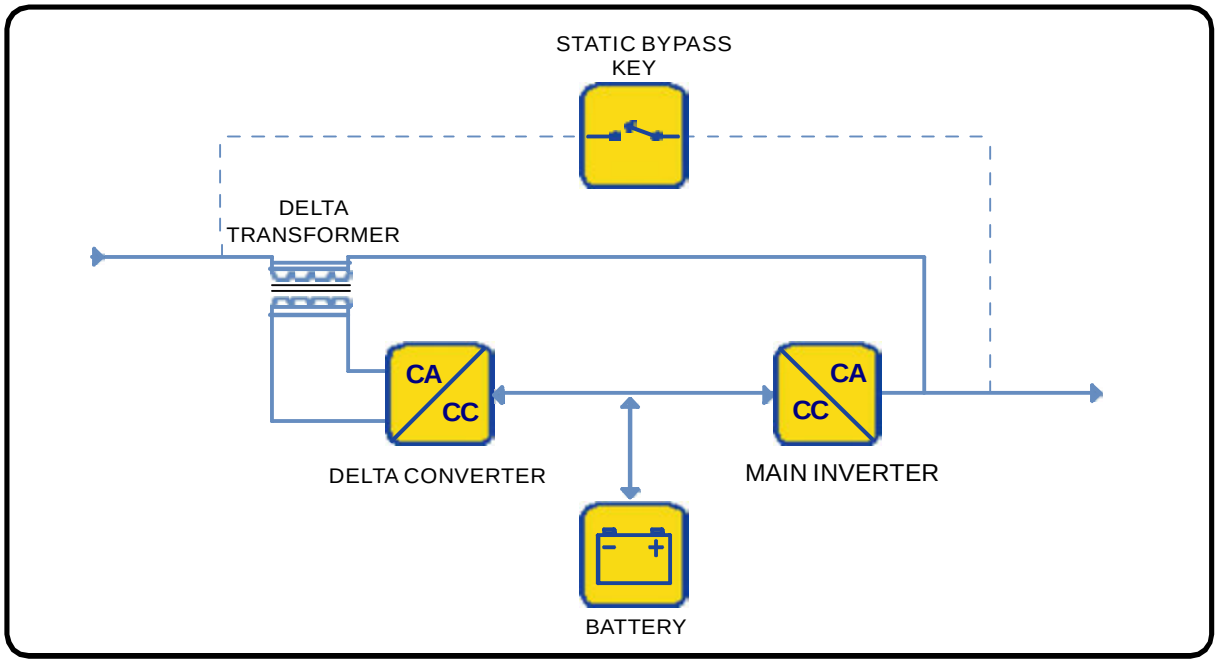


Figure 2-3 - *No-Break on-line Delta Conversion*

2.3 Atmospheric Discharge Protection System

2.3.1 Lightning Arresters

The Atmospheric Discharge Protection System comprises the lightning arresters and their elements. The tower and the shelter where the equipment is installed must be protected against atmospheric discharges by means of FRANKLIN-type lightning arresters, which must be designed and installed by the USER in accordance with the criteria set forth by standard NBR 5419 (in its latest version) and in such a way that the whole station is covered by the protection zone as defined by the electrogeometric model of rolling spheres Level I.

All the ferrous parts and accessories that make up the atmospheric discharge protection system must be hot galvanized or plated with a 254-mm coat of copper.

The cable length from the lightning arrester up to the flowing pit cannot have any splices and the cable path must be such so as to avoid angles smaller than 90º, which could create sparking points.

2.3.2 Cable Protectors

It is advisable to use coaxial protectors for the cables that interconnect outdoor equipment (antennas, microwave heads, tower converters) to indoor equipment. Such protectors are fitted with a gas-filled spark arrester that short-circuits to earth any surge discharged in the coaxial cable. They must be installed in a shelter next to the equipment and the grounding wire must be connected to the grounding connector of the equipment rack.

If located in hilltops or areas with many transmission sources, it is recommended to use a Faraday cage or ring to insulate the transmitter from electromagnetic fields and avoid induction interferences.

2.4 Air Conditioning

2.4.1 Temperature

For optimum equipment performance and longer life the shelter temperature must be rigorously controlled by means of air conditioning. Taking into consideration the heat dissipation (BTU/hour) specified for the equipment and the shelter's internal area, the cooling system must be designed in such a way that the incoming air volume is higher than the outgoing air volume in order to avoid negative pressure. The shelter temperature must be determined as a function of the transmission power, as follows:

• LOW POWER E-COMPACT TV TRANSMITTERS: from 0º to 35ºC
• MEDIUM POWER E-COMPACT TV TRANSMITTERS: from 0º to 30ºC
• HIGH POWER E-COMPACT TV TRANSMITTERS: from 0º to 25ºC

If a Hitachi Kokusai Linear equipment is damaged due to the lack or inefficiency of the air conditioning system, it shall **NOT** be covered by the guarantee.

2.4.2 Humidity

The relative air humidity inside the shelter is also a very important factor to improve the equipment performance and extend its life. Hitachi Kokusai Linear equipment must operate in a dry environment, which can be ensured by means of a suitable air conditioning system. Depending on the transmission power, the shelter's relative humidity should be as follows:

• LOW POWER E-COMPACT TV TRANSMITTERS: from 0 to 90%

• HIGH POWER AND MEDIUM POWER E-COMPACT: from 0 to 80%

Should never be condensation, as water may damage internal circuitry of the transmitter.

2.4.3 Cooling

The air conditioning system should always be operated in the "recirculation" mode, with the room temperature being reduced without outside air coming in. For improved cooling system performance, the air conditioner should be installed in series with the transmitter's cooling cycle. I.e., the air conditioner's outgoing flow must be directed to the front part of Hitachi Kokusai Linear TV transmitter.

The transmitter's installation layout should contemplate a free space around the transmitter for higher cooling efficiency and access for maintenance. Refer to the table below for details:

TRANSMITTER	FREE INTERNAL AREA
EC701HP	16.0m2
EC702HP	
EC703HP	
EC704HP	
EC706HP	
EC708HP	
EC712HP	

Note: If the transmitter is installed in a rack, the transmitter front and rear must be entirely unobstructed.

E-COMPACT UHF Transmitter
HITACHI E-COMPACT SERIES™ INSTALLATION GUIDE

INSTALLATION CONSIDERATIONS:

Thank you for selecting Hitachi LINEAR for your TV Broadcast needs.

The transmitter you are about to install was tested and approved by Hitachi LINEAR quality control. It is factory set on the requested channel and output power, and in accordance with ANATEL regulations. No setting changes are required for the transmitter to go on the air.

After unpacking the transmitter and before the broadcast transmission starts, a qualified Broadcast Engineer should perform the transmitter installation as suggested by this guide and to protect your warranty.

The installation should take approximately 1 hour for all tasks related with the transmitter. The installation can be completed successfully without the use of instruments, and does not require special tools. However for installation quality purposes, a performance check is recommended as in accordance with best-engineering-practices.

We are certain that with proper installation and in a properly prepared transmission facility that you and your station will benefit from your Hitachi LINEAR transmitter for many years to come.

For additional questions and/or issues regarding your installation, please contact us at:
HITACHI KOKUSAI LINEAR EQUIPAMENTOS ELETRÔNICOS S/A.

Technical Support Contact information:
linear@linear.com.br
Mobile: (+5535) 9103-1081
Fax: (+5535) 3473-3474
Phone: (+5535) 3473-3473

Thank you,
Your HITACHI Sales & Support Team –

HITACHI
Inspire the Next

WARNING!

THE VOLTAGES AND CURRENTS IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST, AT ALL TIMES, OBSERVE SAFETY WARNINGS, INSTRUCTIONS, AND ANY LOCAL REGULATIONS.

THIS OWNER'S MANUAL IS INTENDED AS A GENERAL GUIDE FOR TRAINED AND QUALIFIED PERSONNEL WHO ARE AWARE OF THE DANGERS THAT ARE INHERENT IN THE HANDLING AND OPERATION OF POTENTIALLY HAZARDOUS ELECTRICAL AND ELECTRONIC CIRCUITS. IT IS NOT THE INTENT OF THIS MANUAL TO PROVIDE A COMPLETE SET OF SAFETY INSTRUCTIONS OR PRECAUTIONS THAT SHOULD ALREADY BE UNDERSTOOD BY TRAINED OR EXPERIENCED PERSONNEL IN USING THIS OR OTHER TYPES AND FORMS OF ELECTRONIC EQUIPMENT.

THE INSTALLATION, OPERATION, AND MAINTENANCE OF THIS EQUIPMENT INVOLVE RISKS TO PERSONNEL AND ALSO TO THE EQUIPMENT. HITACHI KOKUSAI LINEAR SHALL NOT BE RESPONSIBLE FOR INJURY OR DAMAGE THAT IS THE RESULT OF IMPROPER PROCEDURES OR USE BY INDIVIDUALS IMPROPERLY TRAINED OR LACKING THE KNOWLEDGE TO PERFORM ASSOCIATED TASKS.

ALL LOCAL CODES FOR BUILDING, SAFETY, FIRE, OR RELATED STANDARDS MUST BE OBSERVED. CONSULT LOCAL AUTHORITIES FOR THE STANDARDS FOR THE AREA OR REGION WHERE THE EQUIPMENT WILL BE INSTALLED AND PUT IN USE.

WARNING!

AT ALL TIMES DISCONNECT AC/MAIN POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, PANELS, OR PROTECTIVE SHIELDS THAT EXPOSE LIVE CIRCUITS. NEVER PERFORM MAINTENANCE, MAKE ADJUSTMENTS, OR SERVICE THE EQUIPMENT WHEN ALONE OR FATIGUED.

WARNING!

IF ELECTROLYTIC OR OIL FILLED CAPACITORS ARE UTILIZED IN THE EQUIPMENT AND THE COMPONENT APPEARS LEAKY, OR IS BULGING, OR IF THE CASE OR COVERING OF THE COMPONENT APPEARS DAMAGED OR DISTRESSED, ALLOW SUFFICIENT TIME FOR THE UNIT TO COOL OR FULLY DISCHARGE BEFORE SERVICING. SERVICING HOT OR LEAKY CAPACITORS CAN CAUSE A RUPTURE OF THE CASE AND POSSIBLE INJURY.

Returns and Exchanges

Equipment (Damaged or undamaged) should not be returned unless written approval and a Merchandise Return Authorization (MRA Number) is received from your Linear Sales representative or Linear Customer Service. Special shipping instruction will be provided which will assure proper handling. The circumstances and reasons for the return must be included in the request for return. Equipment that is special or "custom" ordered may not be returnable. In situations where return or exchange is at the request of the customer a restocking fee may be charged. All returns must be sent freight prepaid and properly insured by customer. When communicating with Linear please refer to your Order or Invoice Number.

Unpacking

Use care when unpacking the equipment. First perform a visual inspection of the item(s) to determine if any damage occurred during shipment. Be sure to retain all the shipping materials (crates and boxes or cartons) until such time that it has been determined that the received equipment arrived undamaged. Find all PACKING LISTS and keep them to assist in locating and identifying any components or assemblies that may have been removed for shipping and might need to be reinstalled in the equipment. Make sure that all shipping straps, supports and packing materials are completely removed from the equipment prior to initialization and use.

Section 3
Installation

3

3.1 Introduction

This section provides general information for planning the installation of the EC701HP transmitter, such as recommendations regarding Shelter, Tower, Antennas, Cables, Grounding, Power Line, Prevention against Transients, etc.

3.2 Inspection

The package and the equipment must be inspected upon delivery in order to detect eventual visible damages. If there are signs of violation or physical damage (which points to transportation problems), the corresponding evidences should be described in the delivery documentation provided by the transport company. Such notice would be used to establish the responsibilities for the product integrity.

Hitachi Kokusai Linear carries out operating tests at the factory on every transmitter in order to ensure proper operation after delivery to the user. Nevertheless, if the equipment does not operate after the start-up and there is no evidence of transportation damage, it might be necessary to send the equipment back to the factory for repair or replacement. In such a case, please get in contact with Hitachi Kokusai Linear Equipamentos Eletrônicos S/A's Technical Support Department.

3.3 Installation Recommendations

3.3.1 Preventive Protection

Voltage transients with a duration of micro and nano-seconds are a constant challenge for the solid state circuits. The downtime and the equipment maintenance make the preventive protection the best warranty against these surges.This protection can be in many forms, from isolation transformers and no-breaks to the more efficient but more expensive AC Voltage Protectors. Since lightning is the most common cause of transients, AC Voltage Protectors are the best choice.

An efficient AC Voltage Protection must be able to dissipate the energy to a low voltage, sufficient to guarantee the protection of the eletronic components. The protection must be always placed transversely to the AC line, even during blackout periods.In addition, it must be immediately and automatically turned-on and ready in case of repeated transients.

3.3.2 Tower

For the installation of the TV transmission and reception system, the tower must be made with hot-dip galvanized steel. A lightning protection system should be installed in the tower as well as nocturnal beacons bulbs with red glass.

The following information about the tower must be obtained:

(a) It must be provided of special insulator supports for descent of cordage of lightning rod, with a space of 1,5m maximum between them.
(b) There must be a lightning signaling system in every 20m along the tower.
(c) It must be painted with orange and white stripes in every 2m with a special paint that complies with local regulations.
(d) It must endure winds of up to 150 Km/h.

In a retransmission station the tower is the highest and therefore, the most vulnerable device to be hit by lightning and because of it, the tower is used as a part of the protection system.The lightning protection device used in these cases is called lightning rod and has the function of guiding the electrical discharge safely, avoiding other parts of the system to be hit and damaged by it.

The use of a lightning rod is **MANDATORY**. The project and installation of grounding and lightning protection systems must be performed by specialized companies. Eventual damage to the equipment caused by missing or malfunctioning of the arrester is not covered by warranty.

3.3.3 Fastening of cables, antennas and connectors

Please observe the following items when installing antennas:

Direction of Antennas and Aperture Angles

Use a pocket compass when directing the antenna.Use a field strength meter for the fine adjustment of the recepton antenna.

Height

It mainly depends on the receiving signal and the transmission conditions (obstructions, attended area, etc). It's very important to verify how far the antenna is from the lightning protection device, since the antenna must stay inside its cone protection.

Distance between the Rx and Tx Antennas

They should be placed as far as possible from each other in order to isolate the transmitted signal from the received signal.

Polarization

It is very important to verify the polarization of the received signal, which can be vertical, horizontal or circular.

Phasing

When receiving a signal with vertical polarization, the system must be mounted vertically, otherwise the gain of the antenna will be drastically reduced, likewise in case of a signal with horizontal polarization.
To receive a signal with circular polarization with a non-circular antenna, the system can be mounted either vertically or horizontally.

Stacking antennas

When using this system, the distance between them depends on the kinds of antenna used and the kind of stacking used. This must be studied thoroughly in order to obtain the best solution for each case.

Cables and Connectors

All cables must be carefully installed in order not to be twisted during the installation process. When using 7/8" or 1/2" cables, please pay attention to their bending that must not be made in spaces smaller than 80cm. The cables can't force the connectors in the Input/Output of the equipment. The entry holes for the cables in the shelter must be done in a way to avoid the water that runs along them to get inside.

Follow the manufacturer 's instructions when assembling them. All splices done outside the shelter must be isolated with a special plastic tape and/or a plastic insulation material.

Avoid using silicon to coat the isolation made with auto-fusion tape. It has been verified that the silicon chemical characteristics may provoke the drying of the auto-fusion tape.

3.3.4 Equipment Installation Indoors

Small equipments must be placed on a table in a way to provide easy access from all sides and be at least one meter far from the walls.

Do not place anything on the top of the equipment in order not to compromise its natural ventilation.

The ventilation system equipments must be placed directly on the shelter's floor as long as it is flat and they must be placed at least one meter far from the walls.

Some of these air outlet must be connected to the outside of the shelter through PVC tubing.

The AC cable has two terminations to be used exclusively in the equipment.

3.3.5 Equipment Grounding

The grounding has to be made separately from the power supply, with a rig and a grounding terminal that come with the equipment.

Normally, the retransmission sites are located in the highest spot of the chosen location, what makes them more vulnerable to lightning strikes.

These discharges carry a great amount of electric energy, putting at risk not only the antenna and its structure but also the equipments in the shelters. In order to minimize this effect and guarantee their protection and continuous service during thunderstorms with lightning, the use of a reliable grounding system is paramount.

Lightning is a transient, high-current eletric discharge that happens between the ground and the clouds therefore the most important part of a lightning protection system are the parts that are on the ground.In order to maintain the low impedance of the technical grouding system, it must be carefully executed in a way that the electric field energy is drained away without affecting the equipment.In order to define a system, the characteristics of the soil resistivity must be taken into consideration.

To dertermine the behavior of the soil capacity to drain the currents, its resistivity has to be measured. For an adequate protectionm this value should not exceed 5 Ω, being zero Ω the ideal value.

Generally, the grounding method used for TV retransmitters is a system with a single vertical electrode made with copper measuring 2.5 meters or more.

In case the conditions and characteristics of the soil are of high resistivity or high incidence of lightning discharges, the grounding system must be thoroughly analyzed.

It is very important to notice that the grounding systems of the equipments and the lightning rod are independent and should never be connected to each other. A poorly elaborated grounding system can cause damages to the equipment that won't be covered by the warranty.

3.3.6 Electric Installation Grounding

The shelter installations receive power through an aerial power line. Moreover, because of it, the lightning discharges that might hit the power lines generate power surges that can reach the shelter and consequently the equipments.

To protect the equipments against eventual power surges, we recommend the use of gas filled surge protectors, after an isolation transformer with electrostatic shield.

When installing the grounding system, please observe the following items:

- Connect all equipment carcasses to the grounding system using the grounding rig that comes with them.
- Connect the gate and all the wires from the fence to the grounding system.
- Connect the neutral wire from the public power line to the grounding system.
- Connect the rig from the lightning rod to the grounding system with the shortest connection possible avoiding cable splices.
- The tower's structure must also be connected to the grounding system.
- Use porcelain isolators to insulate the lightning rod rig.

3.3.7 Power Supply

Before plugging the equipment to the power supply, verify the voltage in the outlet to make sure that is correct.If its variation is greater than 10%, it is necessary to use a power stabilizer to correct the voltage.

The power provided by the stabilizer must be at least 30% greater than the consumption of the equipment

3.4 Mechanical Drawings

This section shows the mechanical drawings relative to the external structure of the equipment, including location of drawers.

3.4.1 Front View

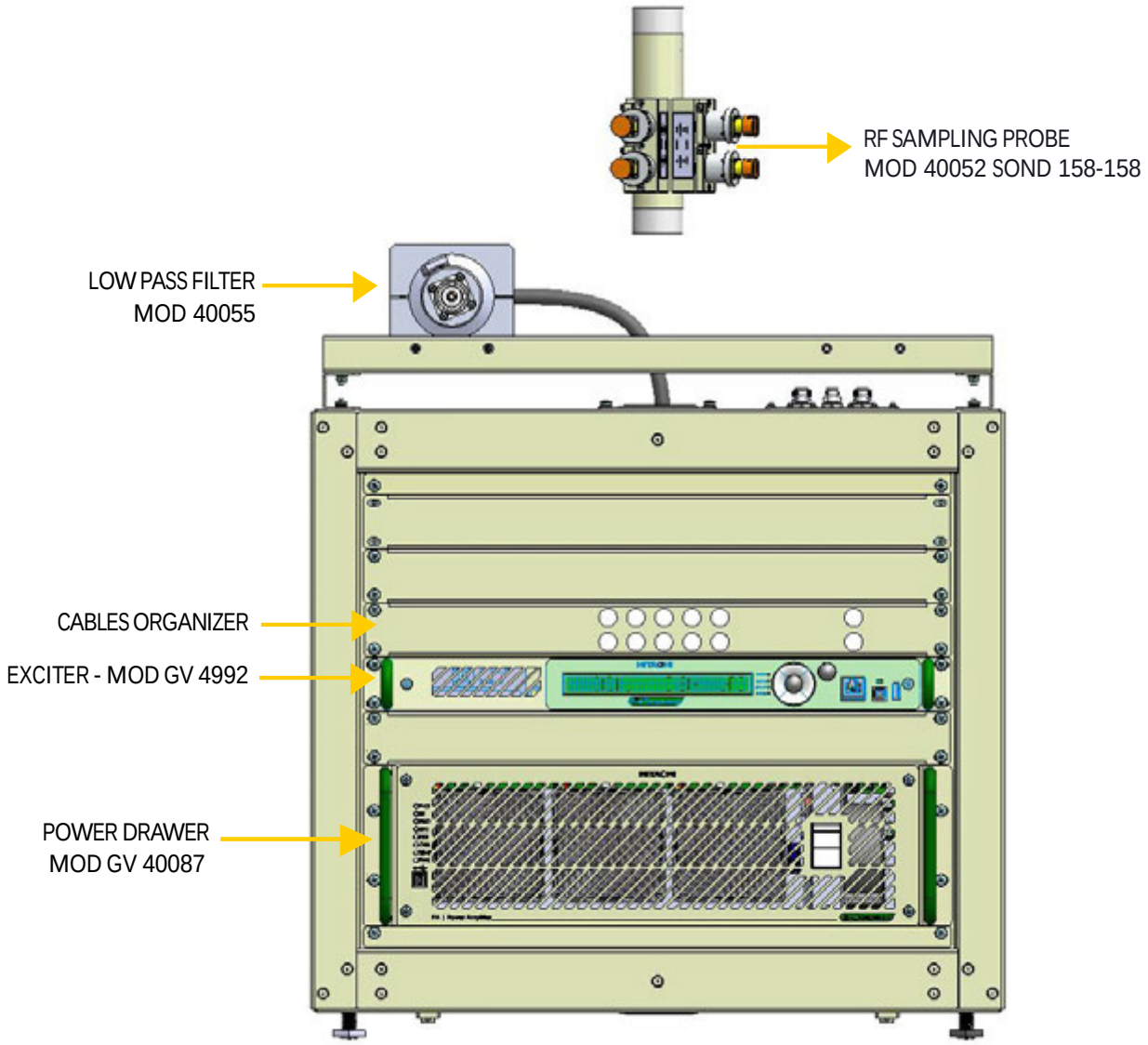


Figure 3-1

Front View EC701HP with double exciter

Note:

*

3.4.2 Rear View

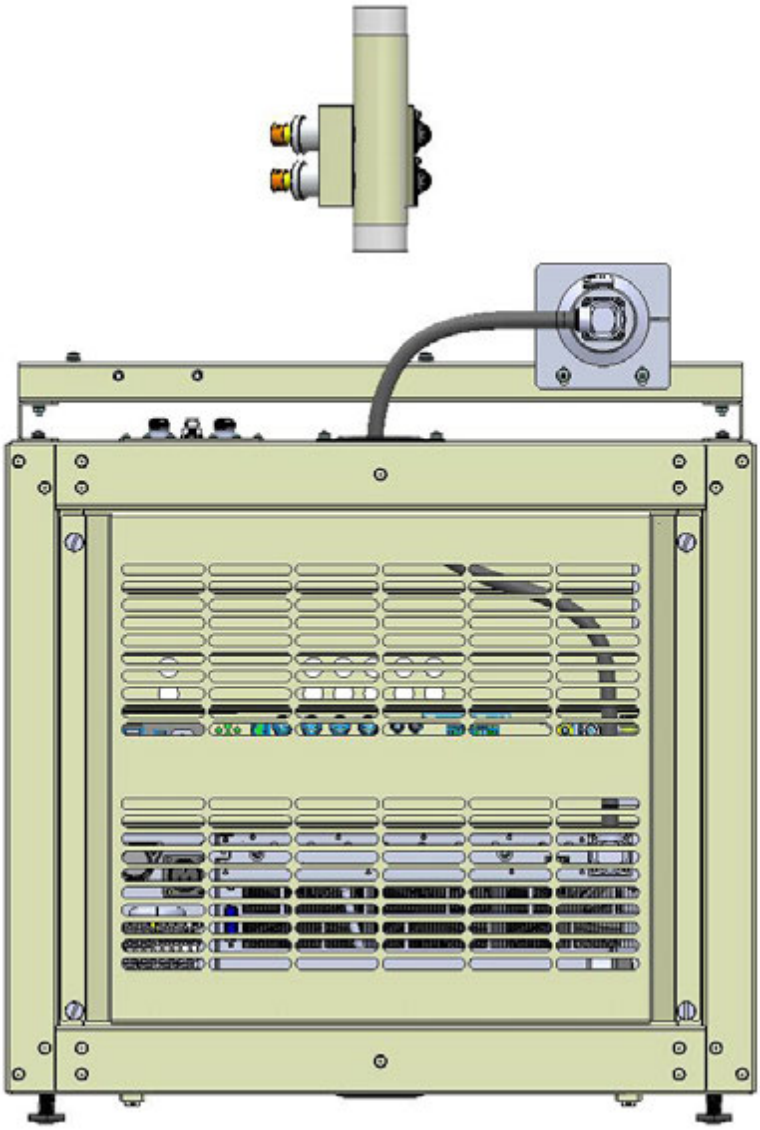


Figure 3-2

Rear wiew - Model EC701HP (rack of 8 units)

3.4.3 Isometric View

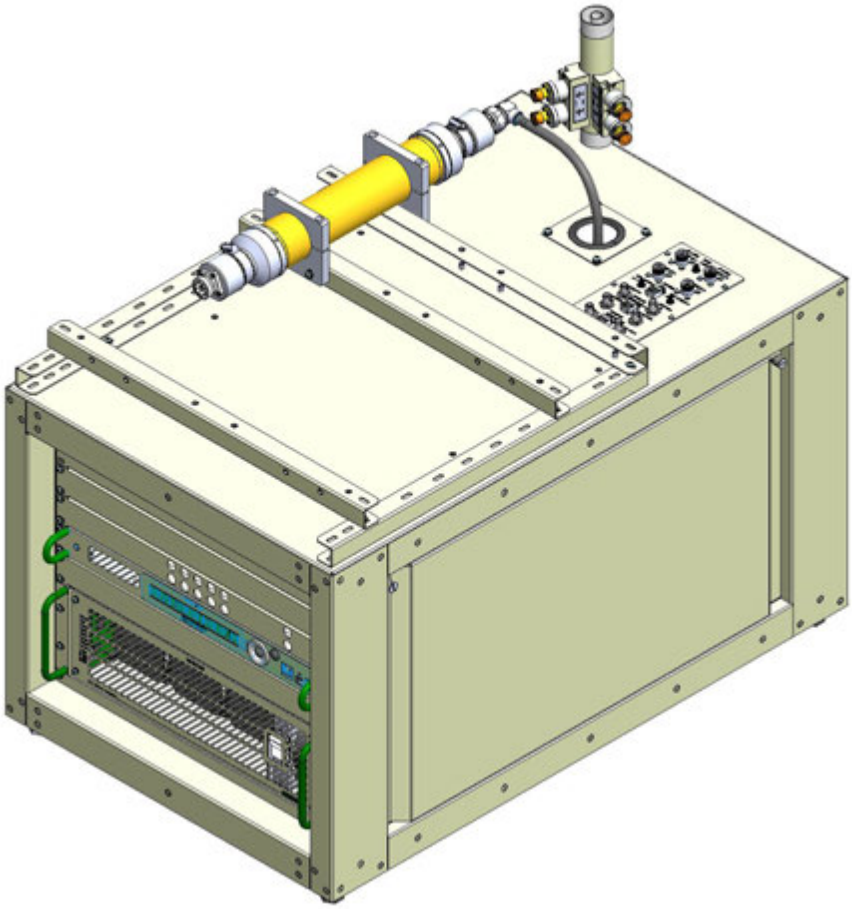


Figure 3-3

Isometric View - Model EC701HP

3.4.4 Dimensions (mm)

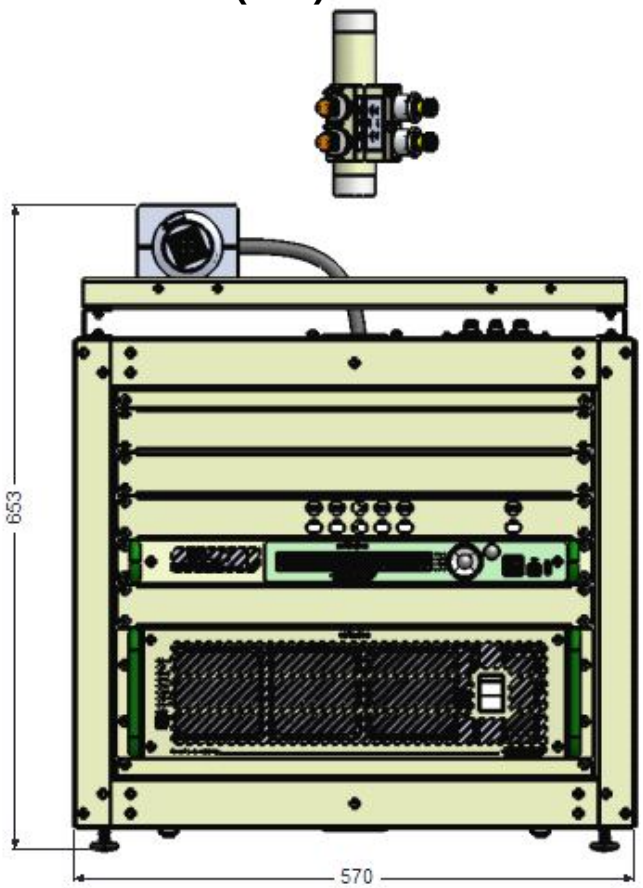


Figure 3-4 - Front view

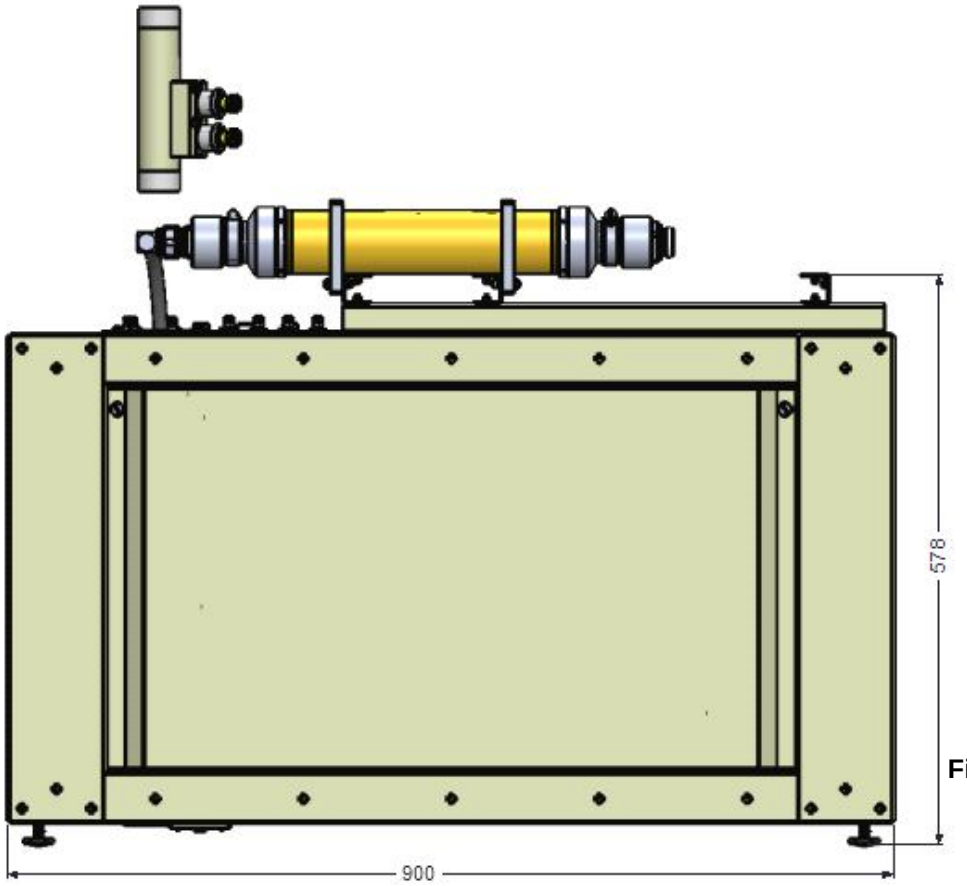


Figure 3-5: Side view

3.4.5 Top view

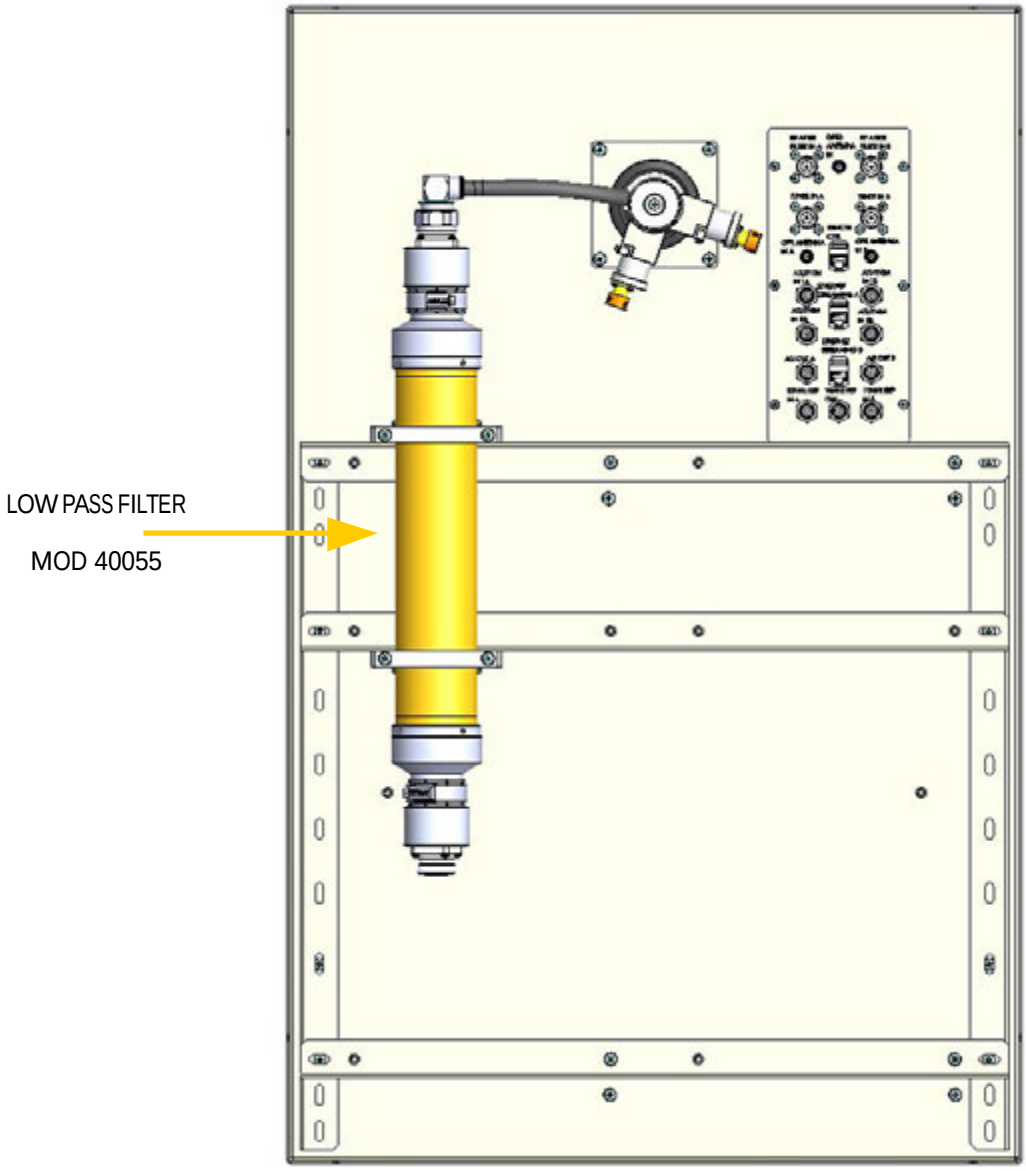


Figure 3-6

Top view of EC701HP

3.5 Front Panel

The transmitter's front panel provides access to the following drawers: Digital Exciter and Power Drawer.

3.5.1 Digital Exciter

The Digital Exciter's front panel contains the display, the initialization LEDs and the keyboard.

IDENTIFICATION

1- Air vents.

2- Display - 2-line 40-column digital display through which it is possible to view the navigation menu of the Transmitter's management software.

3- ◀ → Displaces the cursor to the next left position.

4- ▼ → Displaces the cursor to the next lower position, and increases or decreases the number of digits.

5- ▶ → Displaces the cursor to the next right position and shows the options.

6- **ETHERNET*** – RJ45 input connector for monitoring and control via TCP-IP protocol.

7- **USB Port** – USB Device Port, used to GUI8001 communication with the software, allowing the user perform mesuares on to the transmitter and make corrections linear and non-linear.

8- USB Host Port, used for communication with storage devices (USB Drives FAT32 up to 4GB) allowing the user to import and export data to updade Firmware and Drawer Import Static Tables for Modux.

9- **ESC** → Returns to the previous menu.

10- ▲ → Displaces the cursor to the next upper position, and increases or decreases the number of digits.

11- ENTER key → Confirms the selection.

12- Initialization LEDs - The equipment is fitted with LEDs to indicate energized equipment, loss of input signal, and past and current alarms.

*Ethernet is a trademark of the Xerox Corporation.

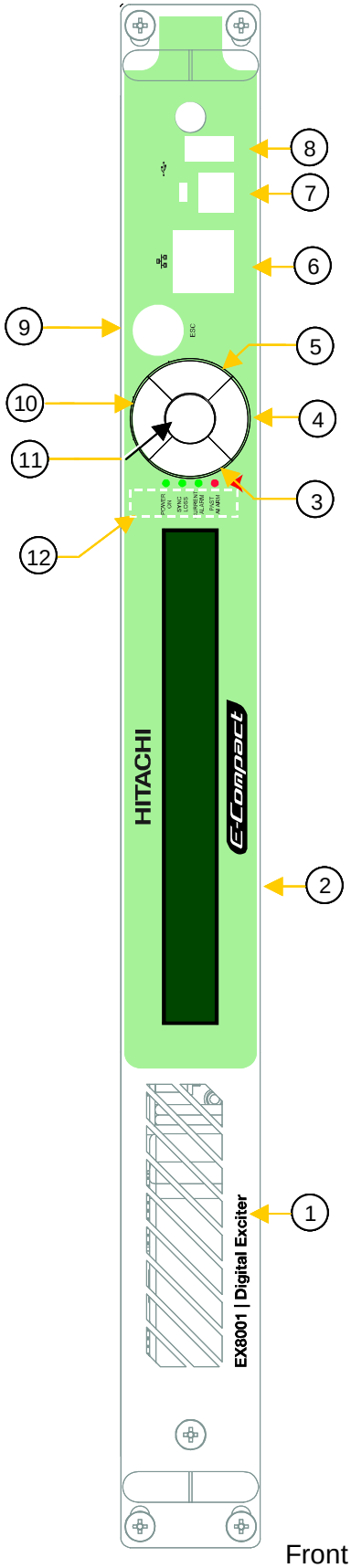


Figure 3-7

Front view of the Digital Exciter - MOD GV 4992

Rear Panel

The following elements are located in the digital exciter's rear panel:

1- On/Off switch

2- 3-pin AC feeding connector.

3/ 11- Air output.

4- **USB** Port - USB Device Port, used for GUI8001 communication with the software , allowing the relative measures the user to the transmitter and perform corrections linear and non-linear.

5- **ASI / 310M IN 2**–Electric interface DVB-ASI-C
Function: Transport Stream (TS) input
Type: BNC female
Impedance: 75Ω

6- **ASI OUT 2** – Electric interface DVB-ASI-C
Function: ASI signal sample from the modulator
Type: BNC female

7- **1PPS OUT**
Function: Monitoring or connection to other equipment
Type: BNC female

8- **10MHz OUT**
Function: 10MHz reference output
Type: BNC female

9- **GPS ANT.**
Function: Antenna input for the GPS module
Type: SMA Female

10- **BEFORE F.**

Function: Input of a FEEDBACK sample taken before output filter (used for non-linear pre-correction).

Type: SMA Female
Impedance:50Ω
Level: 0 ~ +10dBm

12- **CONTROL I/O** – General communication of the equipment.

13- **GND** – Drawer grounding screw.

14-Dissipater of the exciter's amplifier module.

15- **SAMPLE**
Function: RF signal sample output (-20dB)
Type: SMA female
Impedance: 50Ω

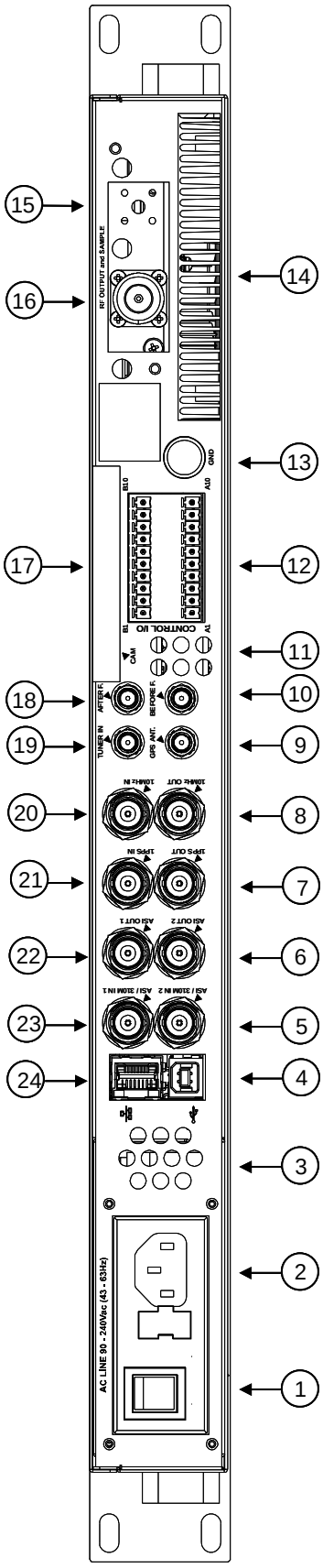


Figure 3-8

Rear view of Digital Exciter - MOD GV 4992

16- **RF OUTPUT**
Function: RF signal output
Type: N female
Impedance: 50Ω

17- **CAM**
Function: Conditional Access Module compatible with IRDETO cards and CONAX. Supports multiple services.
Type: PCMCIA

18- **AFTER F.**
Function: Input of a FEEDBACK sample taken after output filter (used for linear pre-correction).
Type: SMA female
Impedance: 50 Ω
Level: 0 ~ +10dBm

19- **TUNER IN**
Function: ISDB-Tb (UHF) Signal receiver or DVB-S/S2 (L Band).
Type: SMA Female

20- **10MHz IN**
Function: 10MHz reference input
Type: BNC female
Impedance: 50Ω

21- **1PPS IN**
Function: One pulse per second input used to synchronize the single frequency network (SFN).
Type: BNC female

22- **ASI OUT 1** – Electric Interface DVB-ASI-C
Function: ASI signal sample from the modulator
Type: BNC female

23- **ASI / 310M IN 1** - Electric Interface DVB-ASI-C
Function: Transport Stream (TS) input
Type: BNC female
Impedance: 75Ω

24- **ETHERNET***
Function: Input Transport Stream over IP. It supports multicast streams / Unicast the UDP / RTP protocols. Allows access by GUI8001 software via UDP protocol.
Type: RJ45

NOTE: About disconnection of the device front of the exciter.
After using the front USB (7) driver, not interrupt it by unplugging the USB cable, hold the disconnection by the software first. This will prevent the blocking of USB. To unlock, use one of the options below:

→ Shut the drawer;

→ Change the option through the Setup Menu Device Frontal to Device Rear and after, returns to Device Frontal.

*Ethernet is a trademark of the Xerox Corporation.

3.5.2 Power Drawer

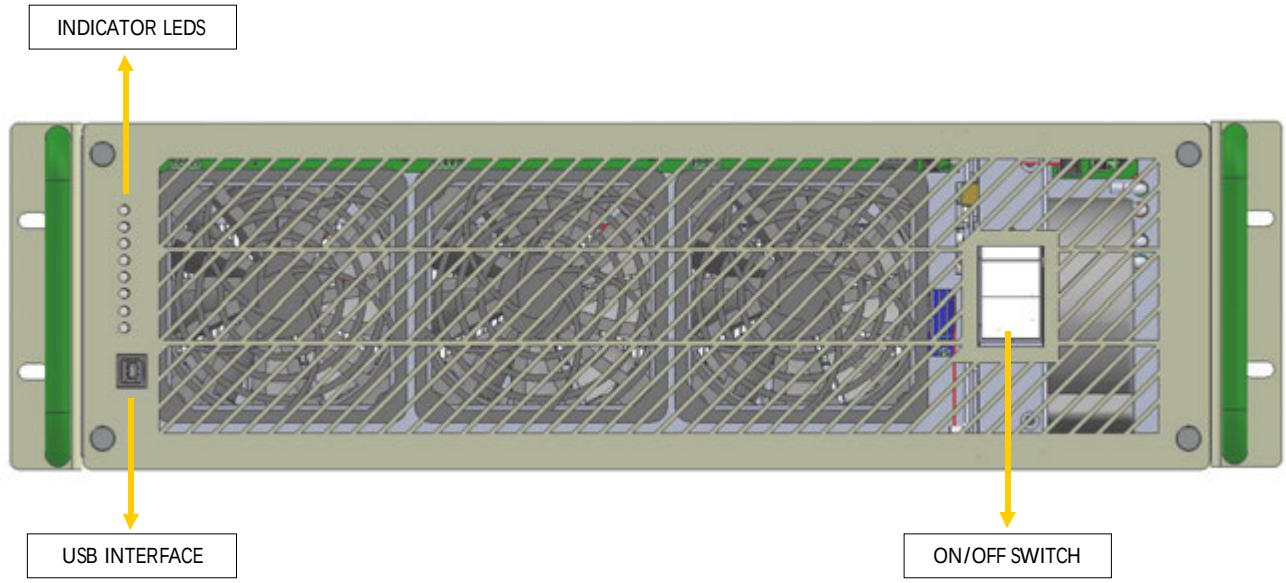


Figure 3-9

Front View of Power Drawer - Module MOD GV 40001 / 40087

Changing Functions of the LED's of the GV 40001 front panel

1) Status dos LEDs

- Green light indicates OK
- Orange light indicates that ocurred a failure
- Flashing Red light indicates that is ocurring a failure

LED's Functions - MOD GV 40001 HP.PA

LED	ALARM
PWR	This LED lights only GREEN indicating that is POWERED ON.
SHDN	Power Supply Shutdown
FWD	Over Forward Power
RFD	Re?ected Power
PA	PA Failure, High Current on PA, Low Current on PA, Current UNBAL on PA, Low Gain on PA, High Temperature on PA Communication Failure on PA.
DRV	High Current on Driver, Low Current on Driver, Low Current on Pre Driver, High Current on Pre Driver, Low Gain on Driver, High Temperature onDriver, Low Voltage on Driver, Communication Failure on Driver, High Input Signal, High Driver Output Level.
PSU	Low AC Line Voltage, High AC Line Voltage, Low PSU Voltage, High PSU Voltage, High PSU Current, High PFC Temperature, High DC/DC Temperature, PSU Communication Failure.
FAN / TEMP	Low Speed on FAN1, Low Speed on FAN2, Low Speed on FAN3, Low Speed on PSU FAN, FAN1 Failure, FAN2 Failure, FAN3 Failure, PSU FAN Failure, High power drawer input air temperature (greater than 35ºC).

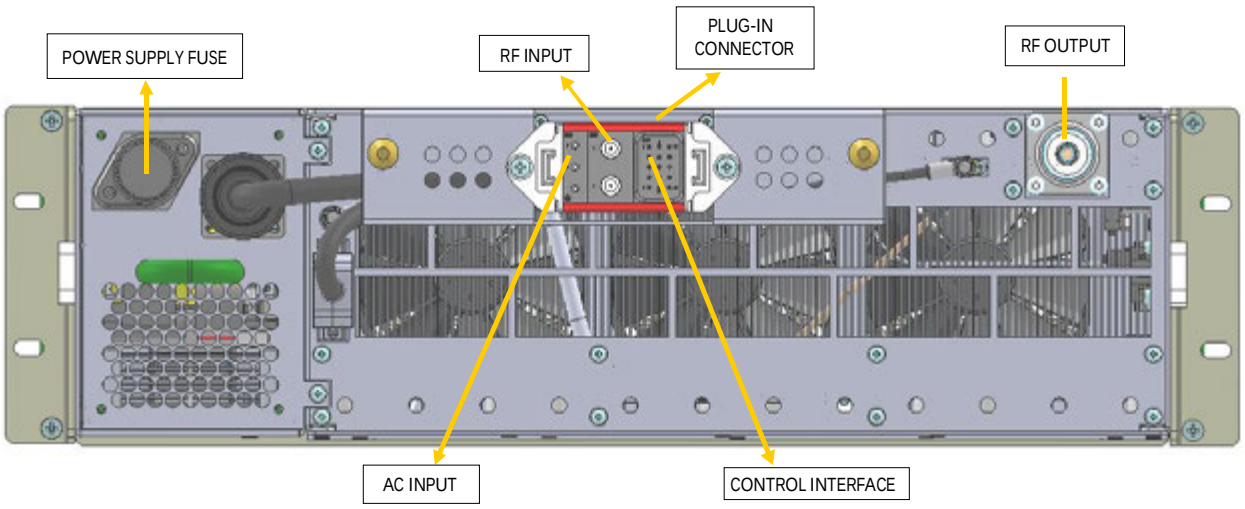


Figure 3-10

Rear view of the Power Drawer - Model MOD GV 40001

Identification:

The following elements are located in the power drawer's rear panel:

RF OUT - Unflanged 7/8" RF output connector (female) for the power module.

RF IN - SMA connector (female) for the RF input from the excitation drawer.

Function of the pins of PLUG-IN connector

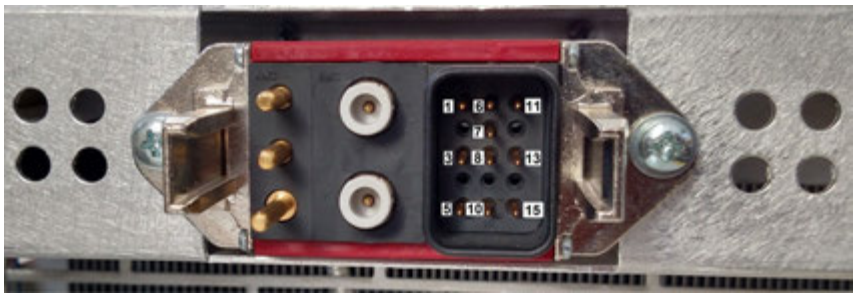


Figure 3-11

PLUG-IN Connector

Pin	Function
1	Address A2
3	RS-485A
5	-
6	Address A1
7	GND
8	GND
10	-
11	Address A0
13	RS-485B
15	-

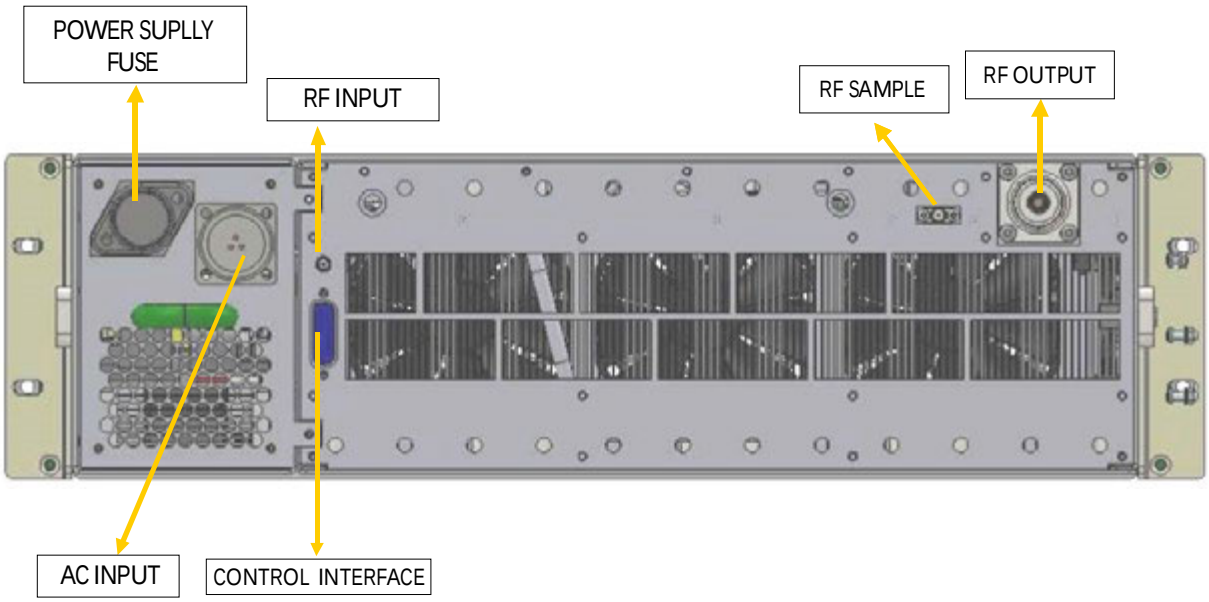


Figure 3-12

Power drawer's rear panel - MOD GV 40087 model

(Used only on the EC701HP transmitter)

Identification:

RF OUT - DIN 7-16 RF output connector (female) for the power module.

RF IN - SMA connector (female) for the RF input from the excitation drawer.

RF SAMPLE - SMA RF signal sample output connector (female) - Approximately +10dBm level.

AC IN - AC 220V power input connector.

COMM - DB15 connector (male), used for RS 485 standard serial communication, between power drawer and central control.

3.5.3 Top Panel

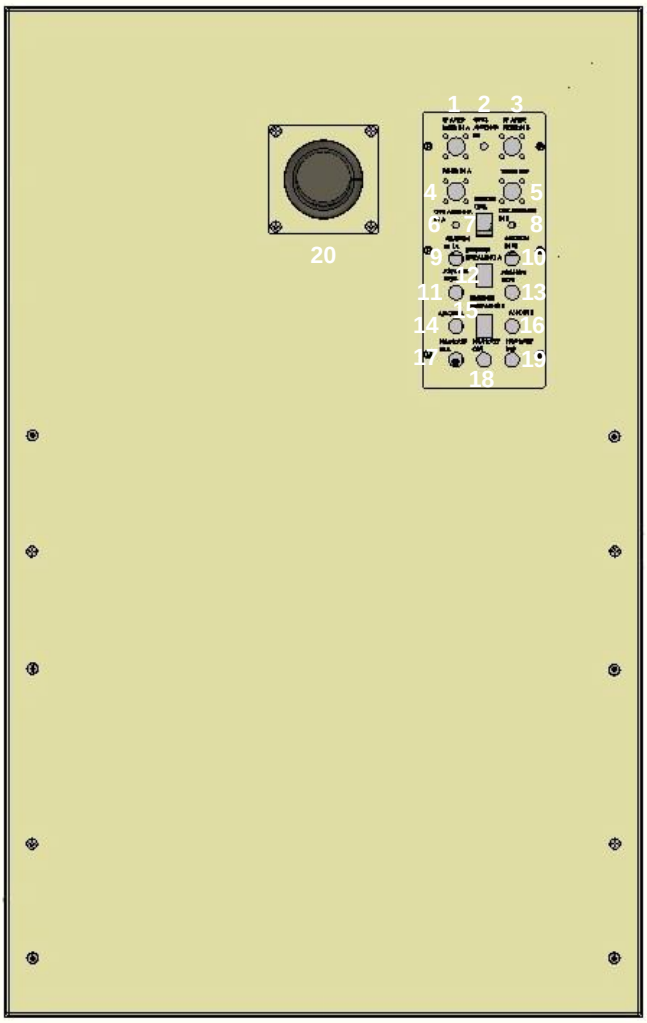


Figure 3-13

Top panel with identifications

Description:

The following connectors are located in the top panel:

1,3- RF AFTER FILTER IN A / RF AFTER FILTER IN B

- Function: Measurement point of the signal after the filter
- Type: N Female

2- GPRS ANTENNA IN (optional)

- Function: Antenna input for the GPRS module
- Type: SMA Female

4,5- TURN IN A / TURN IN B (optional)

- Function: RF Signal Input (VHF / UHF)
- Type: F Female

6,8- GPS ANTENNA IN A / GPS ANTENNA IN B (opt.)

- Function: Antenna input for the GPS module
- Type: SMA Female

7- CONTROL PORT

- Function: Equipament Managment
- Type: RJ45

9,11- ASI / 310M IN 1A / ASI / 310M IN 1B

- Function: Transport Stream input
- Type: BNC Female
- Impedance: 75 Ohms

10,15 - ETHERNET* STREAMING A / ETHERNET STREAMING B

- Function:Transport Stream over IP Interface
- Type: RJ45

12,13- ASI / 310M IN 2A / ASI / 310M IN 2B

- Function: Transport Stream input
- Type: BNC Female
- Impedance: 75 Ohms

14,16- ASI OUT A / ASI OUT B

- Function: Sample ASI signal modulator
- Type: BNC Female
- Impedance: 75 Ohms

18- 10MHz REF. OUT

- Function: Reference output 10MHz
- Type: BNC Female

17,19- 10MHz REF. IN A / 10MHz REF. IN B

- Function: Reference output 10MHz
- Type: BNC Female

20- RF OUT

- Function: Transmitter RF output before filter

NOTE:

The other connectors identified are not used on this equipment.

*Ethernet is a trademark of the Xerox Corporation.

3.6 Power Network Connections

3.6.1 Power Feeding Options

- **Single phase 208V =** 1(one) 208V phase + Neutral
- **Two-phase 208V =** 1(one) 120V phase + 1(one) 120V phase
- **Three-phase 208V =** Y: 3 (three) 120V phases + Neutral
  Δ : 3 (three) 120V phases
- **Three-phase 360V =** Y: 3 (three) 208V phases + Neutral

A grounding cable is required for all the above options.

ATTENTION

The electric network is set up at the factory according to the internal connections and it cannot be changed in the field.

If it is necessary to change the transmitter's electric network structure, please get in contact with Hitachi Kokusai Linear Equipamentos Eletrônicos S/A's Digital Support department for the corresponding instructions.

If the network structure is changed without previous notice, the transmitter guarantee shall be suspended.

NEVER change the transmitter's network structure without previous instruction from Hitachi Kokusai Linear Equipamentos Eletrônicos S/A's Digital Support department. Undue or mistaken changes could not only endanger the equipment, but also the people operating it.

3.6.2 AC Power Cable Connections

The rack bottom is provided with a hole for the inlet of AC power cables and grounding cable.

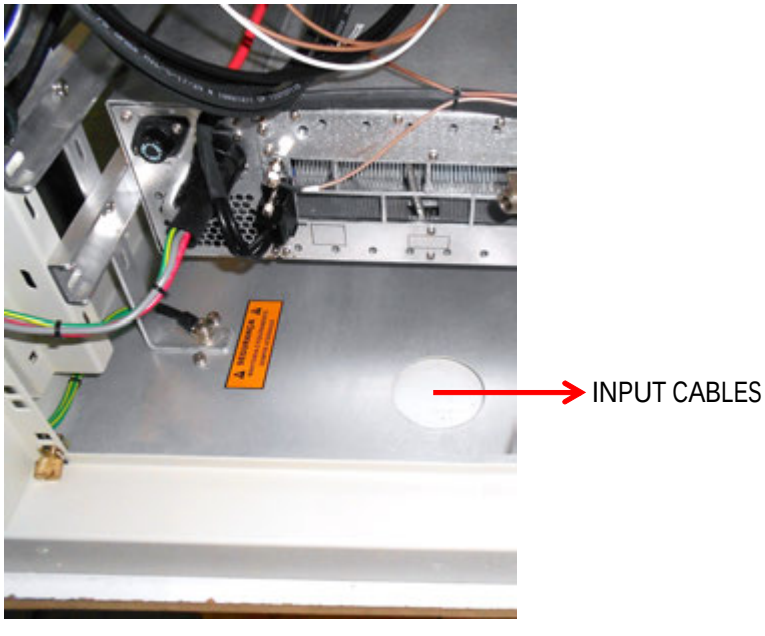


Figure 3-14

Rack bottom - Input cables

3.7 ON SITE PHYSICAL ASSEMBLY

NOTE: trained personnel ONLY should conduct the on-site physical assembly.

ATTENTION

The following precautions should be taken when positioning the transmitter at the installation site:

1) The air intake (front) and air outlet (back) should be completely clear.

2) The transmitter rack must be positioned in such a way so as to ensure easy access from any side. The gap between the transmitter and the shelter walls must be minimum 1.0 meter.

3) In case of installation on a site that contains other transmitters connected, do not position the transmitter in a location that can receive hot air from other transmitters.

3.7.1 Assembly Instructions

1- Unpacking the transmitter, power drawer and filter.

2- Position the rack where the equipment is installed in compliance with the following issues:

- Antenna cable
- AC Power Supply
- RF Cable
- *Transport Stream* (ASI) cables
- Grounding point

Visual Inspection:

a. Remove the lateral and rear panel of the transmitter and proceed to a visual inspection searching for any alteration that may have happened during the transportation of the equipment.

b. Pay special attention on the RF and signal cable connectors, ie. loose screws.

c. Check unit switches, make sure they are in the "ON" position.

Grounding:

For personal and equipment safety reasons, connect the ground of the of the transmitter room to the ground of equipment before proceeding to the next steps.

Figure: 3-15
AC Grounding
Site Grounding

3- Insert and fasten the power drawer in the rack.

4- Insert and fasten the digital exciter B.

5- Insert and fasten the digital exciter A.

6- Insert and fasten the Ethernet* switch

7- Check the presence and physical integrity of all the drawers' power feeding and communication points.

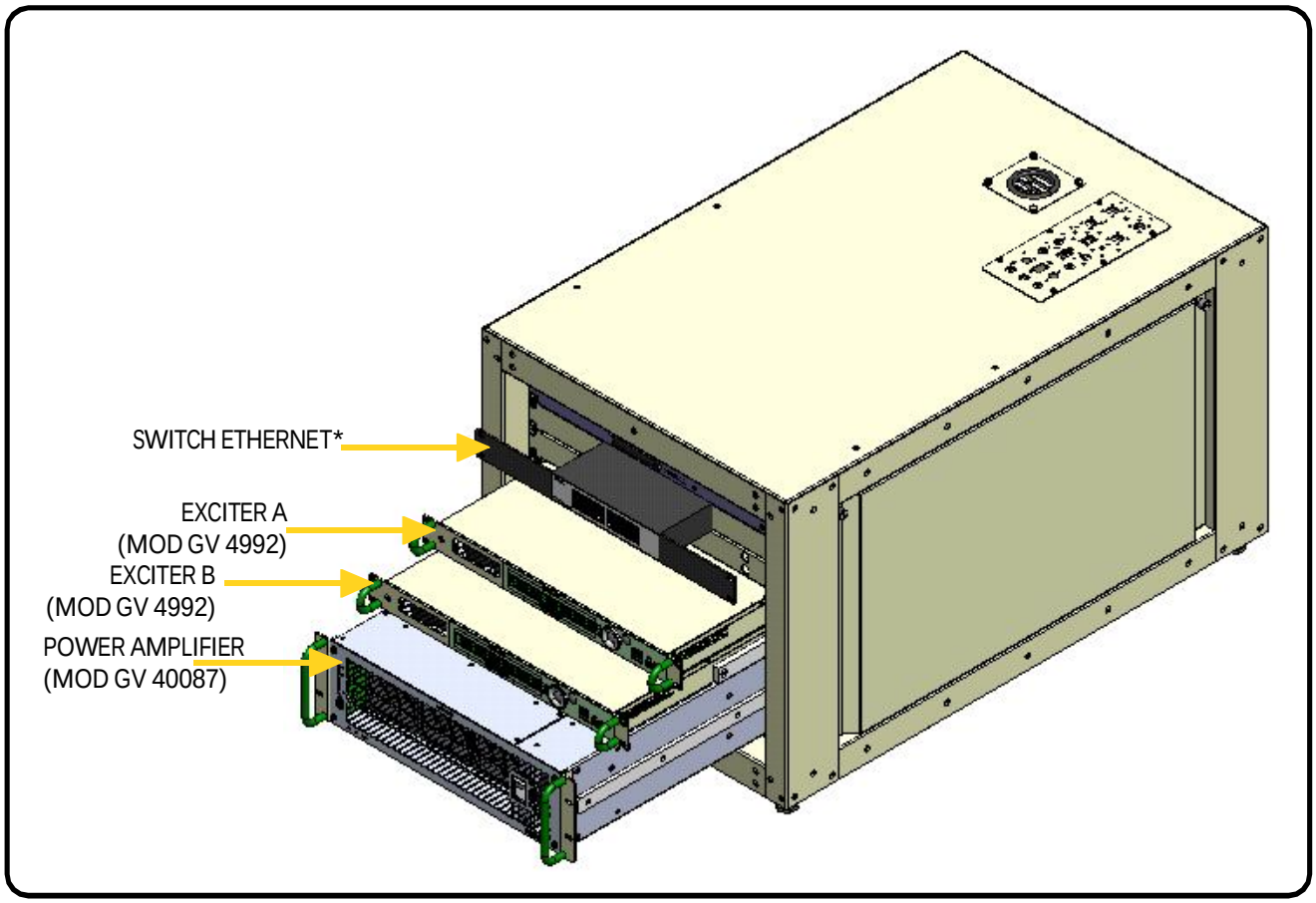


Figure 3-16
Positioning of the drawers

*Ethernet is a trademark of the Xerox Corporation.

3.7.2 Connections

3.7.2.1 Internal Connections

The following connections must be made:

- RF cables
- AC power cables and grounding of the exciter
- AC power cables and grounding of the power drawer
- Measuring cable and communication cable
- *Transport Stream* cables (ASI)
- Switch Ethernet*

NOTE: *Before making connections, remove all "Yellow cable ties" fixed cables.*

A- RF cables

These cables are used in the connections between the digital exciter and power drawer, and between equipment and filter.

- Make the connection between the output of the exciter identified as **RF OUTPUT** and **RF IN** of the power drawer.
- Cable type: Connector N(M) - Connector SMA (M) RG16 50 Ohms.

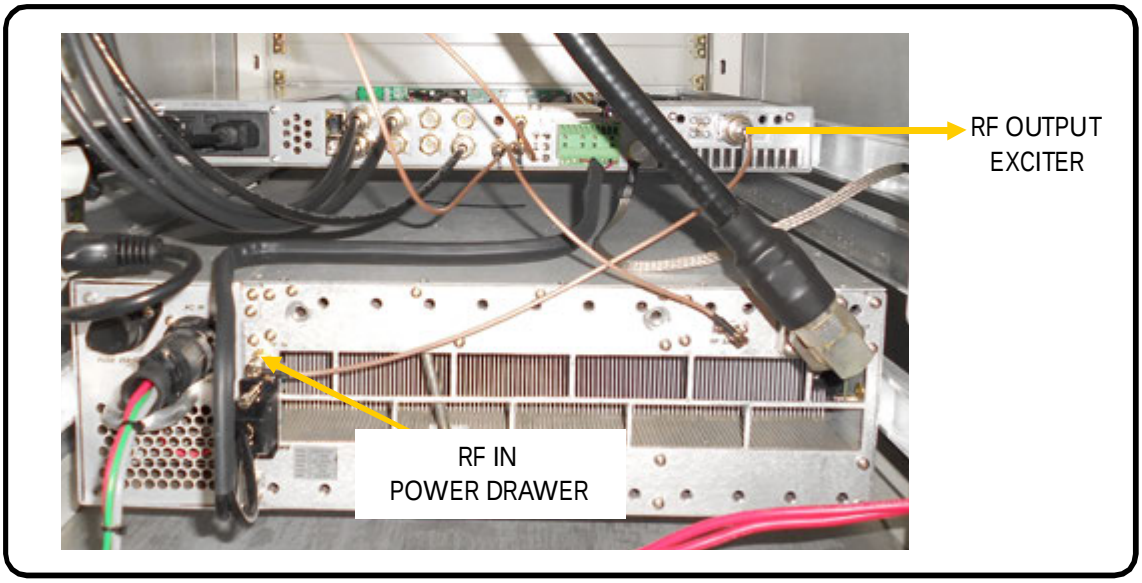


Figure 3-17

Connector RF OUTPUT (Exciter - MOD GV 4992) - > Connector RF IN (Power Drawer - MOD GV 40087)

*Ethernet is a trademark of the Xerox Corporation.

- Connect the AC feeding pigtail to the identified 3-pin connector located in the left side of the exciter drawer's rear panel.

Figure 3-18
ACInput cable, ON/OFFswitch and fusible - Module 4992

- Connect the grounding mesh in the GND screw on the rear panel of exciter.

Figure 3-19
Screwgrounding - Digital Exciter

GND: Ground - Connect this terminal to ground at the installation site.

****** Bandpass filter not included.

C- Power Drawer AC Power Cable

- Locate the power cable attached to the side of the rack.
- Connect the power cable to the power drawer.

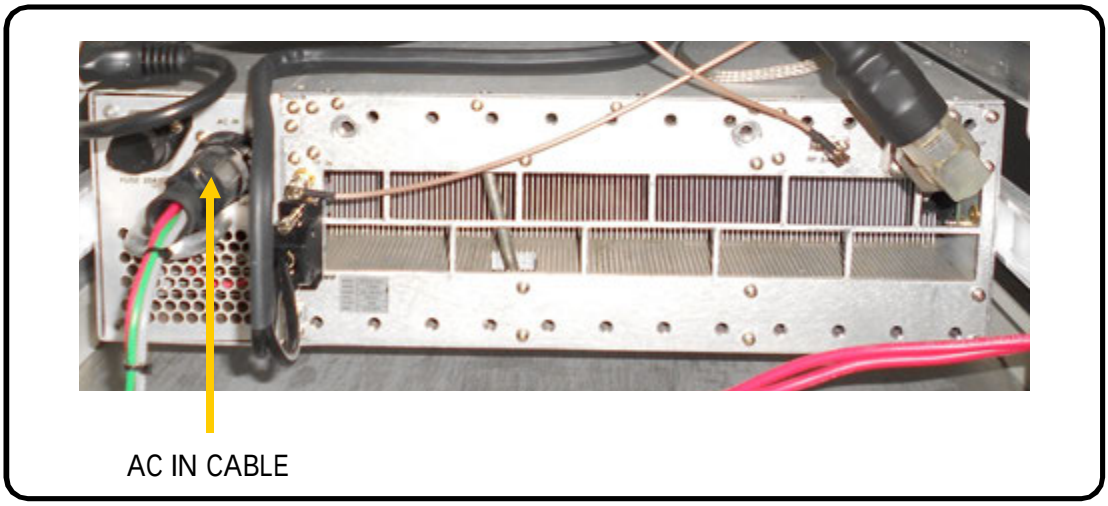
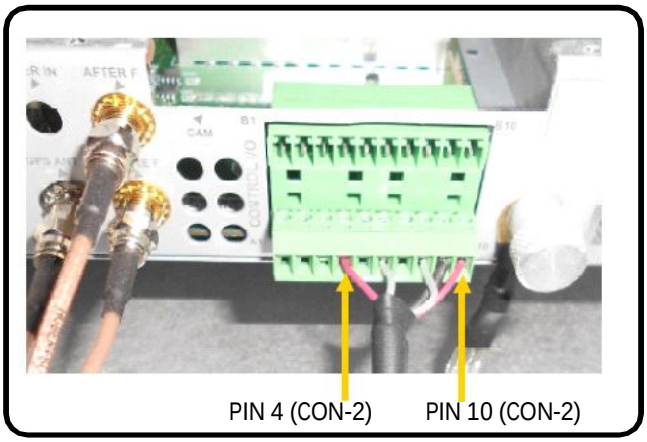


Figure 3-20

AC IN cable - Power drawer (MOD GV 40087)

D- Measurement Reading Cable and Communication Cable

Using the measuring cable (cable having a green connector on one end), make the connection between the connector labeled CONTROL I / O on the exciter and the connector labeled RS485 in the power drawer. Observe the connections in the photo below:



EQUIPMENT CONTROL PINS		
PIN	**COLOR**	**FUNCTION**
A4	Red	Direct Power Reading
A6	White	Re?ected Power Reading
A8	White	RS485 A
A9	Mesh	GND
A10	Red	RS485 B

Figure 3-21

I/O CONTROL connector - MOD GV 4992

E- Transport Stream ASI Cables

▪ Connect the cables from the top panel of the transmitter to the respective connectors on the rear panel of the exciter (MOD GV 4992).

Figure 3-22

ASI cables input - MOD GV 4992

▪ Connect the other points of the exciter according to the tables below:

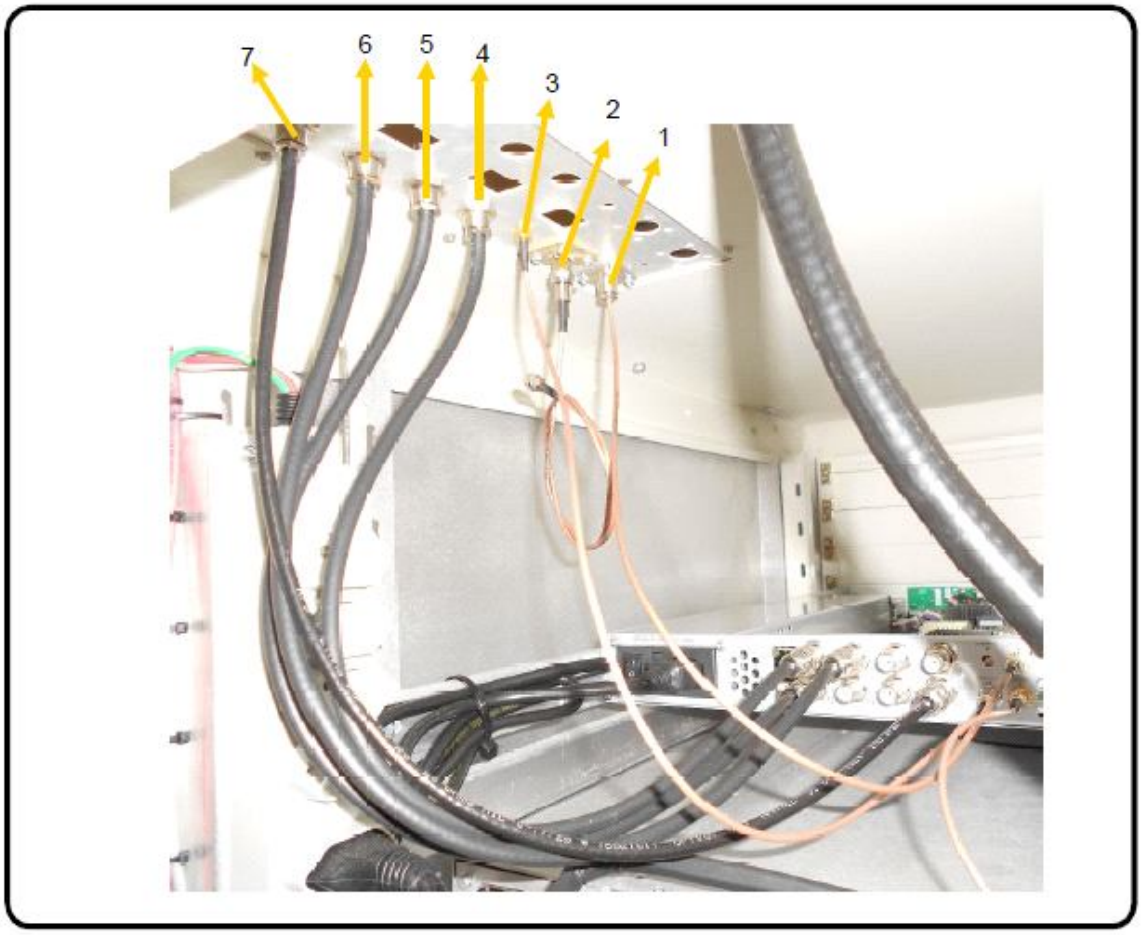


Figure 3-23

Top panel connections

ORIGIN – TRANSMITTER TOP COVER		FROM	Connector Description	CABLE TYPE
CABLE	Connector Description			
1	RF AFTER FILTER IN A	Exciter	AFTER F.	N(F) –SMA(M) RG316 50 Ohms
2	TURN IN A	Exciter	TURN IN	F(F) –SMA(M) RG316 50 Ohms
3	GPS ANTENNA IN A	Exciter	GPS ANT.	SMA(F) –SMA(M) RG316 50 Ohms
4	ASI / 310M IN 1A	Exciter	ASI 310M / ASI IN 1	BNC(F) –BNC(M) RG59 75 Ohms
5	ASI / 310M IN 2A	Exciter	ASI 310M / ASI IN 2	BNC(F) –BNC(M) RG59 75 Ohms
6	ASI OUT A	Exciter	ASI OUT 1	BNC(F) –BNC(M) RG59 75 Ohms
7	10MHz REF. IN A	Exciter	10MHz IN	BNC(F) –BNC(M) RG58 50 Ohms

F- Ethernet* Switch Cables (MOD SWT DES-1024D D-LINK)

- Make the connection between the switch module and **CONTROL PORT** connector of the transmitter top panel.
- Make the connection between the switch module and the front port ethernet* of the exciter A.
- Make the connection between the switch module and the front port ethernet of the exciter B (optional).
- Connect the AC pigtail.

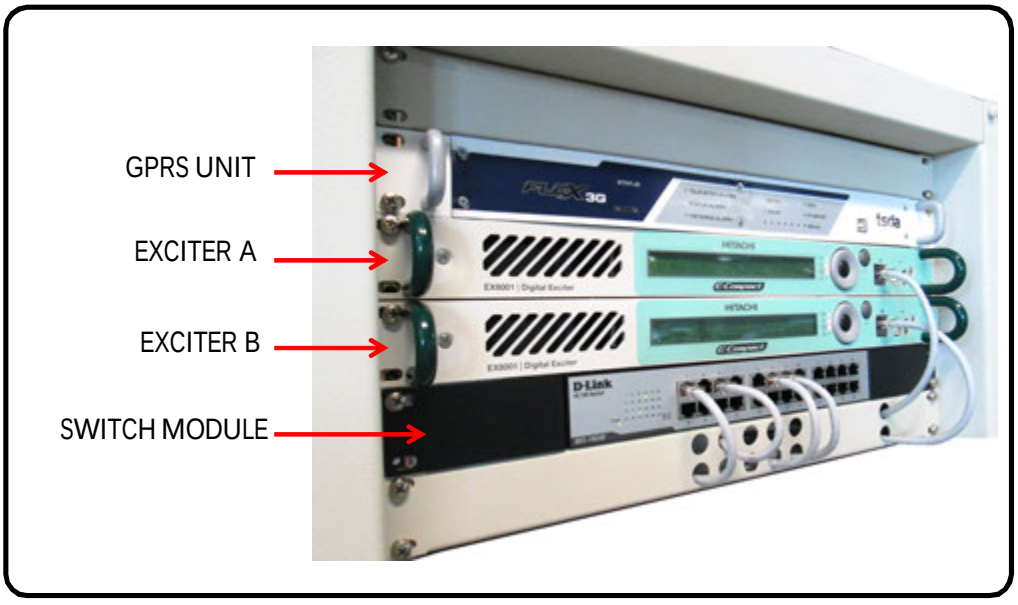


Figure 3-24
Switch module connections

*Ethernet is a trademark of the Xerox Corporation.

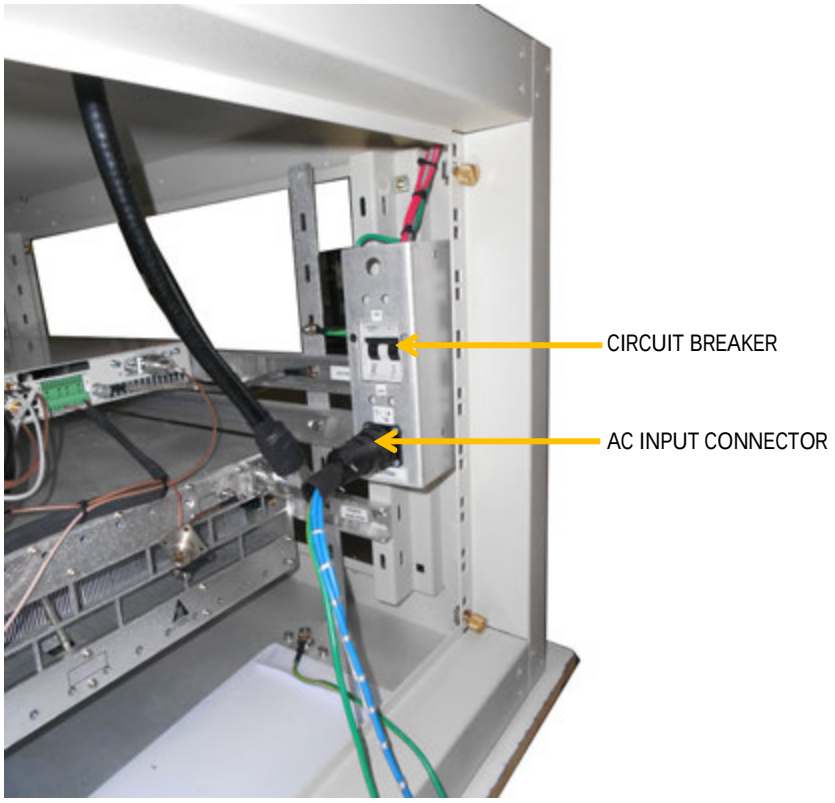
3.7.2.2 External Connections

The following external connections must be made:

- AC power feeding
- Grounding
- Rigid line / Filter / Antenna
- Transport Stream IN

A- AC Power Feeding

- Pass the AC power feeding cables through the hole at the rack bottom and connect them to the AC input connector.



Identification of pins:

A - Phase (GY)
B - GND (GR / YL)
C - Phase / Neutral (RD)

AC input connector - Rack

Figure 3-25
Equipment AC Power Cable

B- Grounding

- Insert the ground cable through the hole and connect it to the screw at the bottom of the rack.

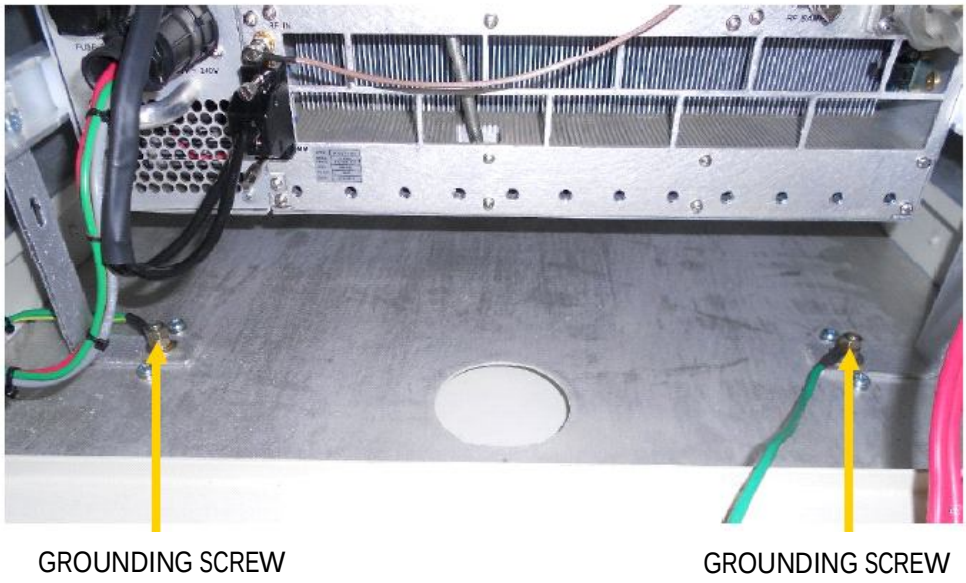


Figure 3-26
Grounding screws - Bottom of the rack

ATTENTION

Before energizing the transmitter, ensure that the localized circuit breaker on the right rear side of the transmitter rack is off.

C- Rigid line / Filter / Antenna

- Connect the rigid lines as required to interconnect the equipment to the filter and the filter to the antenna.

D- Programming

a. The transmitter is ready to receive ASI transport streams as programming source.

b. Programming BNC connector is located on the top panel of the transmitter.

c. Connect the applicable signal cables on the top cover of the rack.

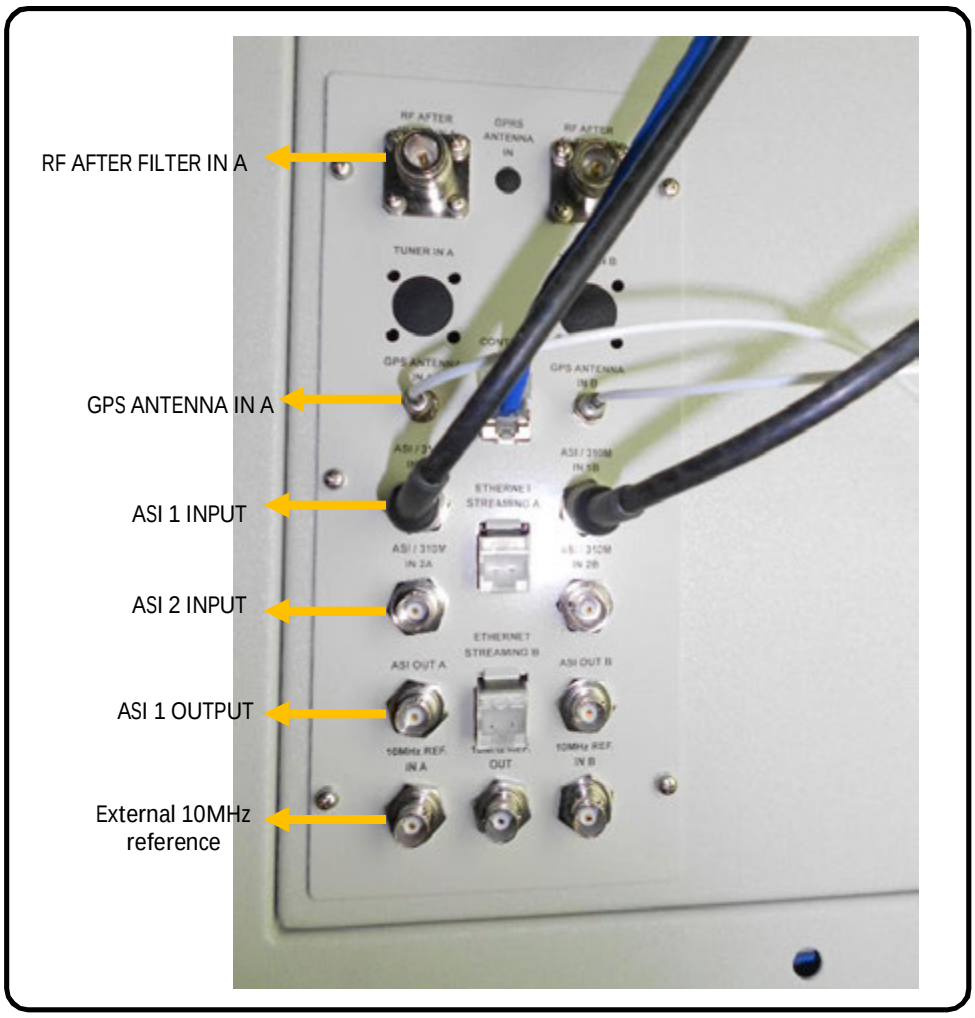


Figure 3-27

Connections Panel - Transmitter

Section 4

Initial Activation

4

4.1 Introduction

After finishing the installation, the equipment is ready to be activated. It is important to observe that the transmitter is configured at the factory with the parameters that were supplied by the customer at the time he made the purchase, such as the channel output, power, MER, etc.

One should check the functionality and performance of the RF power, DC currents, temperature, alarms and communication.

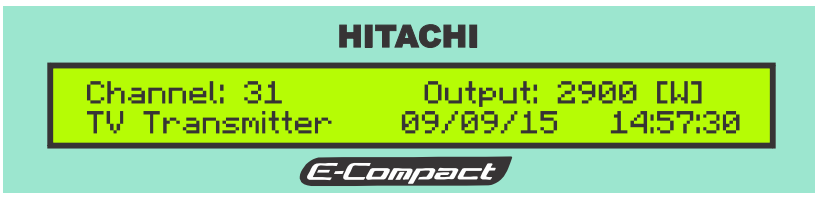
A- Initial Precautions

- Firstly you must ensure that the general circuit breaker is off.
- Ensure that the POWER ON / OFF button is off, should be in the OFF position.
- Check with multimeter, the AC input voltage of the transmitter and verify that it is within specifications.

ATTENTION

To avoid damaging the equipment, never turn on without having it connected to the antenna or a supporting a load.

- Trigger the circuit breaker on the lower front panel of the transmitter.
- Connect the Exciter Drawer and check if it works properly. Press ESC for 5 seconds and the splash screen appears. Verify the channel, time and date.



Setting the output power to 0 watts

For security purposes, access the power programming screen (POWER SETUP [1100]) of the exciter by Menu navigation software, no display digital and set the transmitter's power to zero watts.

Below the sequence to access:

Select **Setup Menu**, press ENTER.

Select **Power Setup**, press ENTER. Screen [1000].

Set the power to 0 W, press ENTER. Screen [1100].

B- Activation Sequence

Verify:

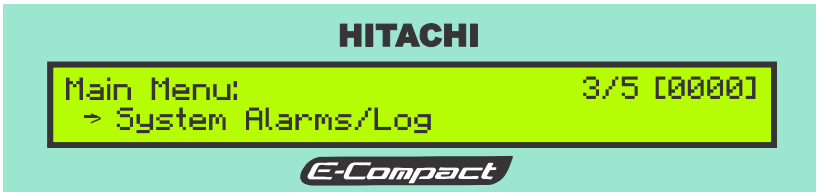
- Alignment of the transmission antenna
- Insertion loss in the transmission cable
- General conditions of the radiating system (connectors, cables, etc.)
- Connections of the Digital Exciter's output to the input (RF IN) of the power drawer
- Connections of the power drawer's output to the band pass filter's output
- Connectionof the cable to the transmitter's antenna
- Connection of the measurement Reading cable
- Proper grounding
- Power source connection (observe power supply T220, T380, etc.)
- Check that the AC connections are fixed properly.

  - Trigger the POWER ON / OFF button of the transmitter's front panel.
  - Check the status of current alarms.

> ***NOTE:*** *Only the SYNC LOSS TS 1 and SYNC LOSS TS 2 Fail alarms are acceptable.*

If the input signal (TS) is present, just the led PAST ALARM shall remain lit.

Resetting the status of older alarms (PAST ALARM)



Select **System Alarms/Log** in the Main Menu [0000] and press ENTER.

Select **Clear Alarm Log** [3000]. Press ENTER.

Deleted alarms, LED PAST ALARM deleted.

Verification of the communication Status between Power drawer and the Exciter

In the **Main Menu** screen, select **Measurements** and press ENTER.

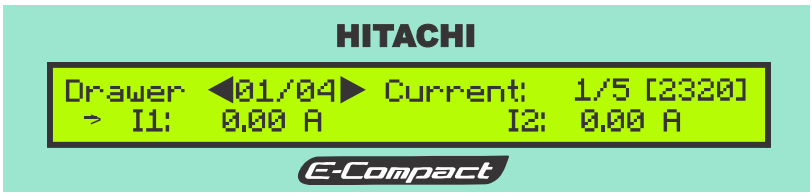
Select **Communication Satus** and press ENTER.

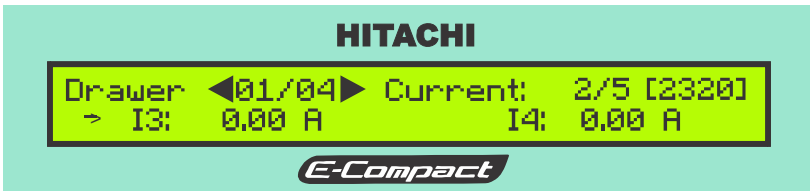
In the [2500] screen will be shown the communication Status RS485 with the power drawer.

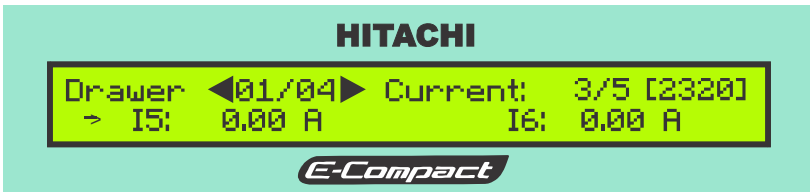
Verification of current (Standby) on the main RF transistors of power drawers

Select **Drawers** in the screen **Measurements** [2000]. Press ENTER.

Select **Current** in the screen **Drawer Measurements** [2300]. Press ENTER.







Readings sequence of power drawer's currents, screen [2320].

Are shown the readings related to the quiescent current of the transistors which can be displayed in three sequences of the [2320]screen to the power drawer 01. Use the key ▼ to view the current modules and the keys ◀ or ▶ to select the drawer.

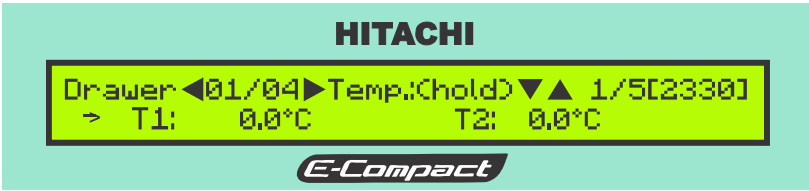
The current of the Driver ID shall be about 1,2 A.

The currents I1, I3, I5 and I7, shall be about 1,0 A.

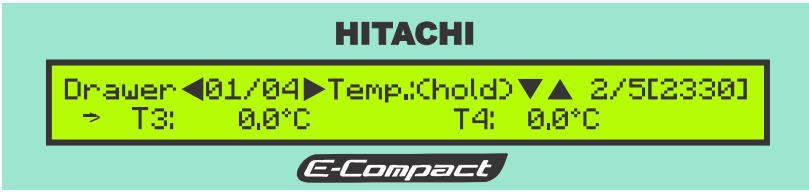
The currents I2, I4, I6 and I8, shall be about 0 A.

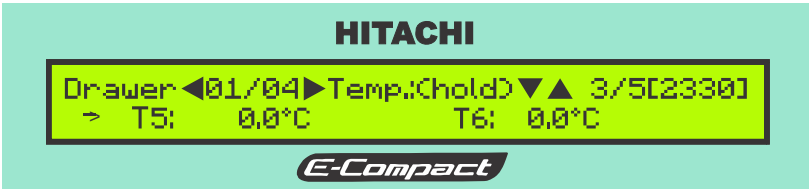
Verification of the temperatures of the modules in each power drawer

In the screen **Drawer Measurements** [2300], select Temperature. Press ENTER.



Use the "▼" button to display the remaining items on this menu.





To select the drawer use the button ◀ or ▶.

To change the temperature from º C to º F, press and hold ▼ and ▲.

Programming the Power to 10% of rated output

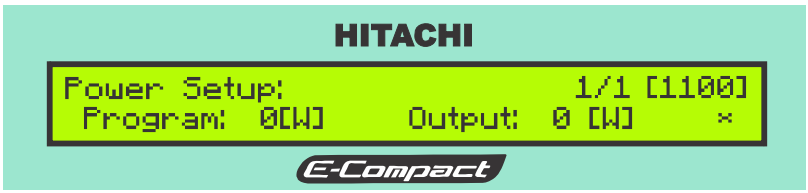
Gradually increase the output power of the transmitter to 10% of the rated output.

In the screen **Main Menu** [0000], select **Setup Menu**. Press ENTER.

Select **Power Setup** and press ENTER.

Program the value of 10% of rated output.

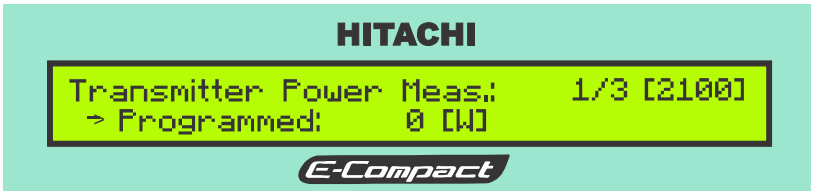
Use the right button on your keyboard to increase the RF power. Confirm the selected value by pressing the ENTER key (center key on the keyboard).



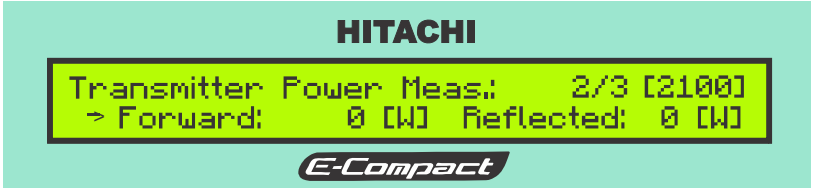
* Indicates that the configuration has not been confirmed.

Measuring the power

Select **Power** in the screen **Measurements** [2000]. Press ENTER.



- Use "▼" button to display the remaining items on this menu.



Screen [2100]. The ALC voltage is directly proportional to the RF power at the transmitter output.

NOTE: *If an alarm occurs during the power increase, it is advisable to reset the output power of the transmitter to seek the solution. If necessary contact the Service Department of Hitachi Kokusai Linear Electronic Equipments S / A.*

- Check if there is any abnormal or differential heating, in the connection joints between the transmitter, filter, antenna and adder's imbalance load. If there is any abnormal warming in an isolated way, this may indicate some flaw or imperfection in that connection. This must be checked before continuing on increasing the transmitter power.

NOTE: *When operating under normal conditions, the modules located at the transmitter's rear may reach up to 55°C. This is due to the fan speed control, which is responsible for keeping the transistor's temperature at 65°C, as well as the presence of aluminum heatsinks and high thermal dissipation pallets. All passive devices are located at the rear panel and operate within' the temperature ranges recommended by the manufacturer.*

- Check the current reading and the drawer module temperature, observing whether there is any abnormality present. If there is any, check the connections of RF and if the problem persists, contact the Hitachi Kokusai Linear Customer Service.
- Repeat the previous steps for programming 25%, 50%, 75% and 100% of the rated power. Between steps, consider a minimum of fifteen (15) minutes.

NOTE: *For EC704HP transmitter module, you must repeat the previous steps to 730W programming, 1450W, 2180W and 2900W.*

Enable / disable the automatic shutdown of the equipment by the absence of ASI signal.

Sequence 3 screens to enable automatic reconnection of the equipment by the absence / presence of the ASI signal.

Select **Transmitter Setup** in the screen **Setup Menu** [1000]. Press ENTER.

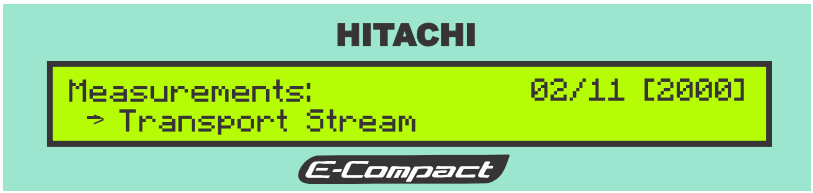
Access **Automatic Level Control** and select **On.**

Use the "▼" key to display the next screen option.

Set the Mute on TS Loss: Off

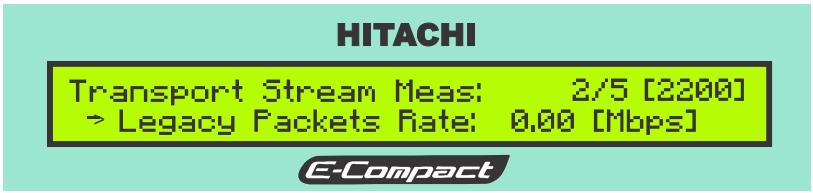
Verification of measures relating to the Input Flow (BTS - Broadcast Transport Stream)

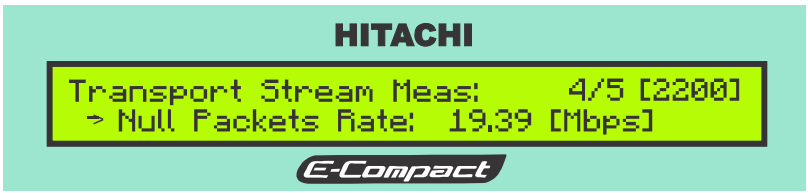
To access the screen of BTS flow measure, one should follow the following sequence of screens, starting from the Measurements menu:



In the screen **Measurements** [2000], select **Transport Stream**. Press ENTER.

Use the "▼" key to display the remaining items on this menu.





4.2 Connections and Final Checks

Connect Transport Stream (TS) cable at the transmitter's upper panel. At this time the LED SYNC. LOSS and the LED of the CURRENT ALARM will extinguish and the LED PAST ALARM will light. Access the menu of the digital exciter and erase the alarm log. After this, only the LED will remain lit named POWER ON.

Main Menu – System Alarms / Log – Clear Alarm Log.

4.3 Possible operations with the Transmitter in Operation

A- Power Changing – POWER SETUP ([1100])

The alteration of the transmitter power is something possible and accessible to the customer through the screen POWER SETUP ([1100]) by software navigation Menu, in the digital display, according to instructions given in the section 5.

It is noteworthy that after the change of the output power of the transmitter, the intermodulation levels will change.

B- Transmitter's Pre-Correction

The linear and non-linear pre-corrections are previously applied to the transmitter in the factory.

C- Enable and disable the linearization

Non-Linear Pre-Correction - You can enable or disable the non-linear pre-correction by the front panel.

Linear Pre-Correction - You can enable or disable the linear pre-correction by the front panel.

4.3.1 Communication

A- Via Ethernet

This equipment has a Web Page server accessed by the Ethernet port located on the front panel of the digital exciter, which has all the functionality of the keyboard interface + display. Eg, settings, measurements, alarms, etc.This interface can be used for remote management.

B- Via USB with the Digital Exciter

The communication of the digital exciter via USB port, is only possible with the use of the software GUI8001 (optional).

4.3.2 Serial terminal Emulators

The Power Drawer can be configured using the serial terminal emulators.

4.3.3 Forbidden operations

There are transmitter parameters which are configured at the factory, parameters defined on the purchase of the transmitter, which are not available to change.

- Canal

- Equipment model

There are other parameters that are configured in the factory, but allow changes in their values by using a password. The careful use of the password is to prevent unauthorized access that can cause the appearance of a reflected power at the transmitter and consecutively decreasing the value of the output power of the transmitter due to the protective action of the same.

- L.O. Null
- Frequency image adjustment

4.3.4 Safeguards

A – Reflected Power

If the incidence of reflected power at the transmitter due to any external or internal factor occurs, this can be viewed on the measurement screen (MEASUREMENTS [2000]) by the software's navigation Menu, in the digital display, according to instructions given in the Operation Section of the Digital Control System.

If the value of the reflected power exceeds the value of 5%* of rated power, the control will immediately signal this fact by lighting the LED current alarm on the front panel of the digital exciter, will provide, on the current alarm screen, and this will trigger the routine protection against reflected power. This will gradually decrease the value of the forward power until the amount of power reflected returns to less than 5% of rated output. At this time, the software returns to gradually increase the value of forward power, foreseeing the possible disappearance of the reflected power. Thus, the equipment will be oscillating between increase and decrease of the direct power around the power value that provides a reflected power of 5% of rated power, always seeking the return to the rated power of equipment.

B - Over-excitation

If an excessive increase in the value of the excitation signal level occurs, the control, through the ALC, will interact with the excitement, to maintain a constant output power in it's rated value.

** Approximately*

C – Variations in the network

Each piece of equipment has its own independent power supply, all of which have equal protection features.

- Protection against short circuit
- Surge Protection

Basically, the surge protection on the network is performed by inserting the varistors between phases and between phase and earth, thus absorbing peak voltage, not allowing them to damage the power source. Protection against short-circuit is carried out by monitoring the current in the output of the power source. If the current exceeds a pre-set reference value, it will understand that the source output is shorted and should be disabled through the shutdown pin.

4.3.5 Transistor Temperature Setting.

The default temperature value of the transistor is 60 ° (140 ° F), factory set, the hottest transistor will be the reference. The temperature can be set between 50 and 60 ° in Setup "PA Temperature Control" menu (Setup Menu [1M00]). This setting can be changed according to ambient temperature and transmitter efficiency. You can change this following procedure:

- With the transmitter in the operating power for at least 30 minutes, access the web page of the transmitter or the USB interface of the power drawer and check the fans. Fan rotation should be between 2000rpm and 7000rpm.

- After checking all fans of all drawers and if the highest rotation is below 5500rpm, the control temperature can be reduced, it is advisable to reduce in steps of 2 degrees.

- Set the temperature of the transistor in the Setup Menu "PA Temperature Control", once you have set the fan speed, you should wait a few minutes until the temperature of the transistor to stabilize at the configured value, and then check the fan rotation again, the operating rotation will be between 5500rpm and 6000rpm.

4.4 Automatic Power reduction Table

In case of any defect or failure to communicate in one or more Power Drawers, the equipment will continue running, but on condition of power reduction. The reduction table of each equipment of the E-Compact series is calculated according to the following formula:

$$Max.Out.Power = \left(\frac{Number\ of\ operating\ drawers}{Number\ of\ Total\ drawer} \right)^2 \times Eqp´s\ Rated\ Power$$

In this condition, the equipment will operate with a power reduction alarm and with other alarms that identifiy which of the drawers are not operating and the reason of it.

The EC701HP transmitter uses reduction table for modules. Below the formula for calculating table:

$$Max.Out.Power = \left(\frac{Number\ of\ PAs^*\ carriers\ x\ 9 + Number\ of\ PAs\ peak}{40} \right)^2 \times Eqp´s\ Rated\ Power$$

**PAs - Power Amplifiers*

Section 5

5

System Operation Manual

E-Compact ATSC Transmiitters

5.1 Introduction

The E-Compact ATSC transmitters provision:

(a) Measurements,

(b) Configurations,

(c) Alarms, and

(d) Remote control via microcontrollers.

Below is a detailed description about the operational software (configuration and operation) system installed in the ATSC transmitters, located within of the exciter.

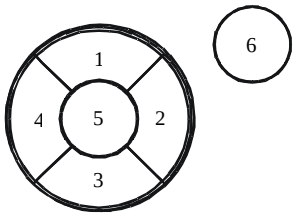
5.1.1 Front Panel

Figure 5-1 Exciter´s front view

On the front panel of the Exciter there is a LCD Display with 2 lines and 40 columns. Also a circular keypad with a set of 4 command keys in gray color, and one centered, termed ENTER on black color. An escape key, ESC, complete the set of 6 keys that allows an easy operator-transmitter interaction.

Checking the LCD display is always possible to gather the operation status of many parameters, and also, promote changes on some of these parameters using the 5 keys keypad.

5.2 Digital Exciter - The Master Control Unit



5.2.1 Keypad

When navigating through the different functions (status and setup), take into consideration the keyboard symbols and the descriptions below:

▲ (1) → Moves the arrow UP to the next function shown on LCD screen

▶ (2) → Moves the arrow to the next RIGHT position

▼ (3) → Moves the arrow DOWN to the next function shown on LCD screen.

◀ (4) → Moves the arrow to the next LEFT position.

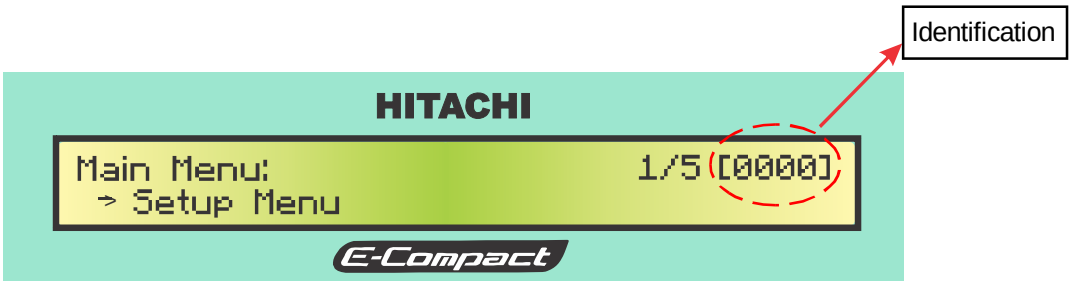
Tecla (5) → ENTER - Confirms the chosen selection.

Tecla (6) → ESC - Cancel the selection and return to the previous screen.

5.2.2 Display

To browse over the LCD screen follow the instructions below:

- Using the key ▼or ▲ position the cursor (represented by an arrow) next to the item to be accessed.



- Press ENTER.

Remark:

Please note that all screens are assigned a 4 digit number on the top-right of the LCD screen. These numbers, represents the screen position on the command menu.

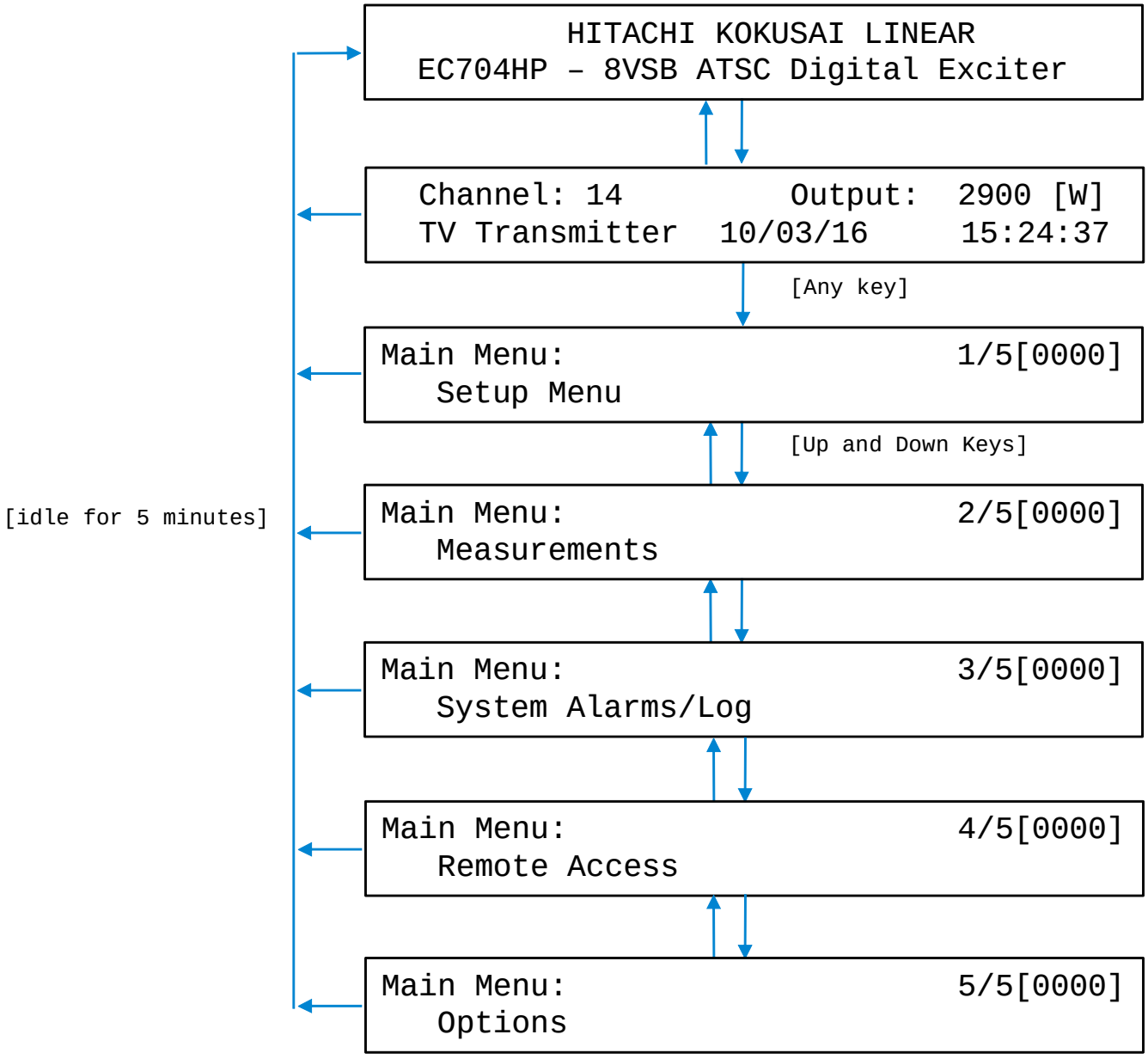
5.2.3 Signaling

Besides the LCD screen and the command keypad, the front panel of exciter also shows a set of 4 LED's. These LED's when ON indicate:

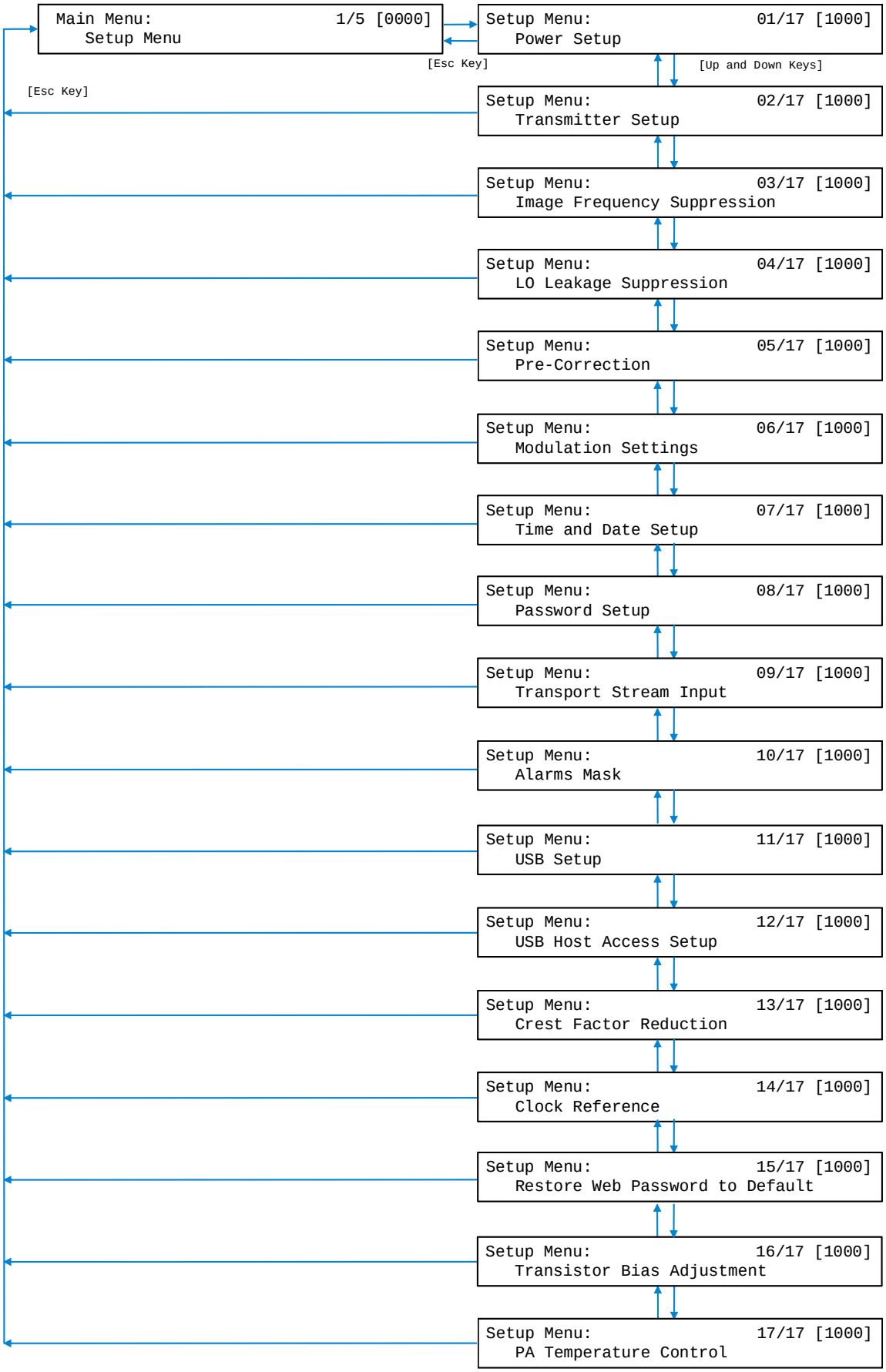
POWER ON – External AC line voltage is present.
SYNC. LOSS – The INPUT transport stream is not present.
CURRENT ALARM – One or more alarm situations are occurring.
PAST ALARM – Alarm log screen.

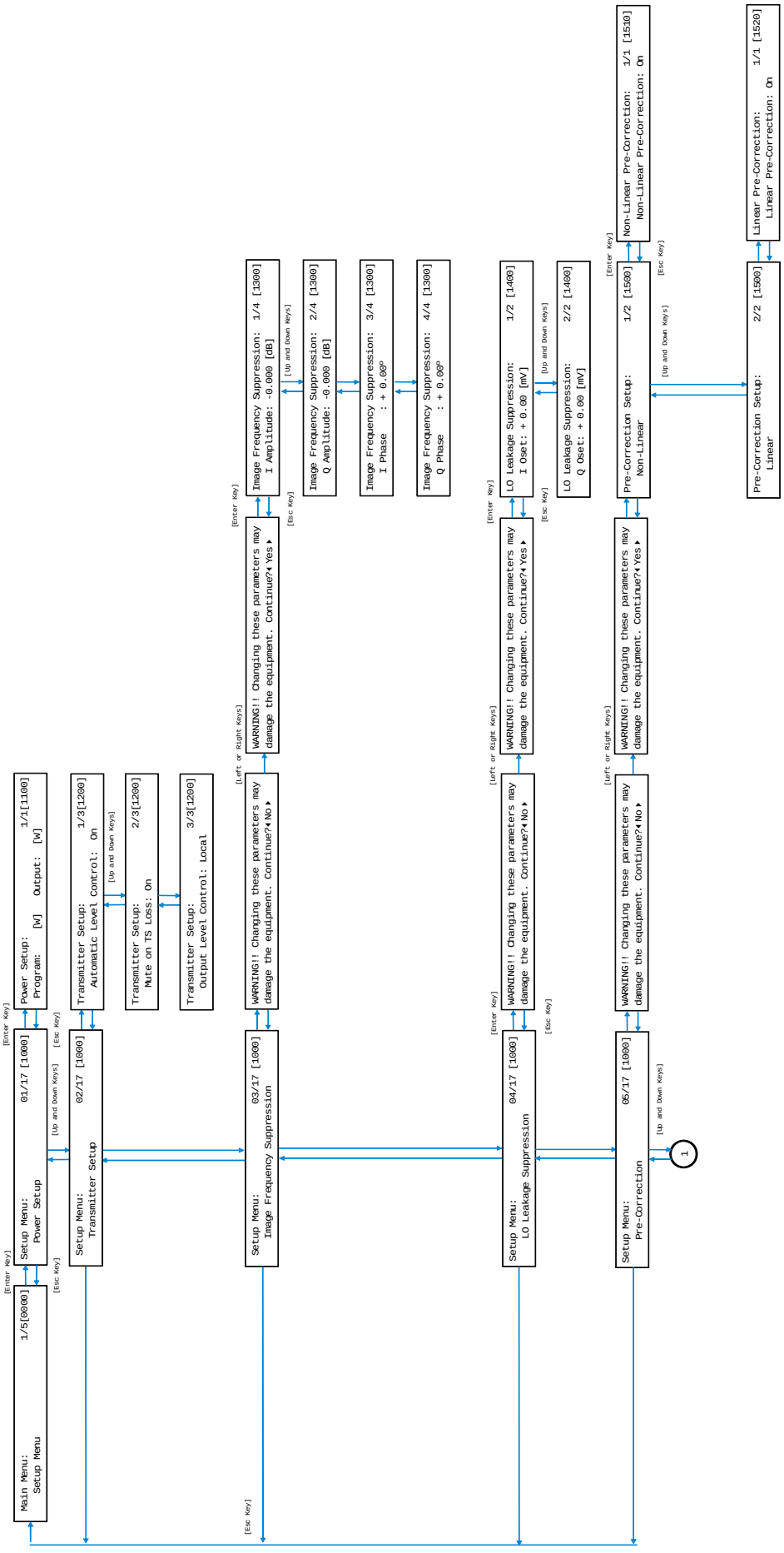
5.3 Flowchart Screens

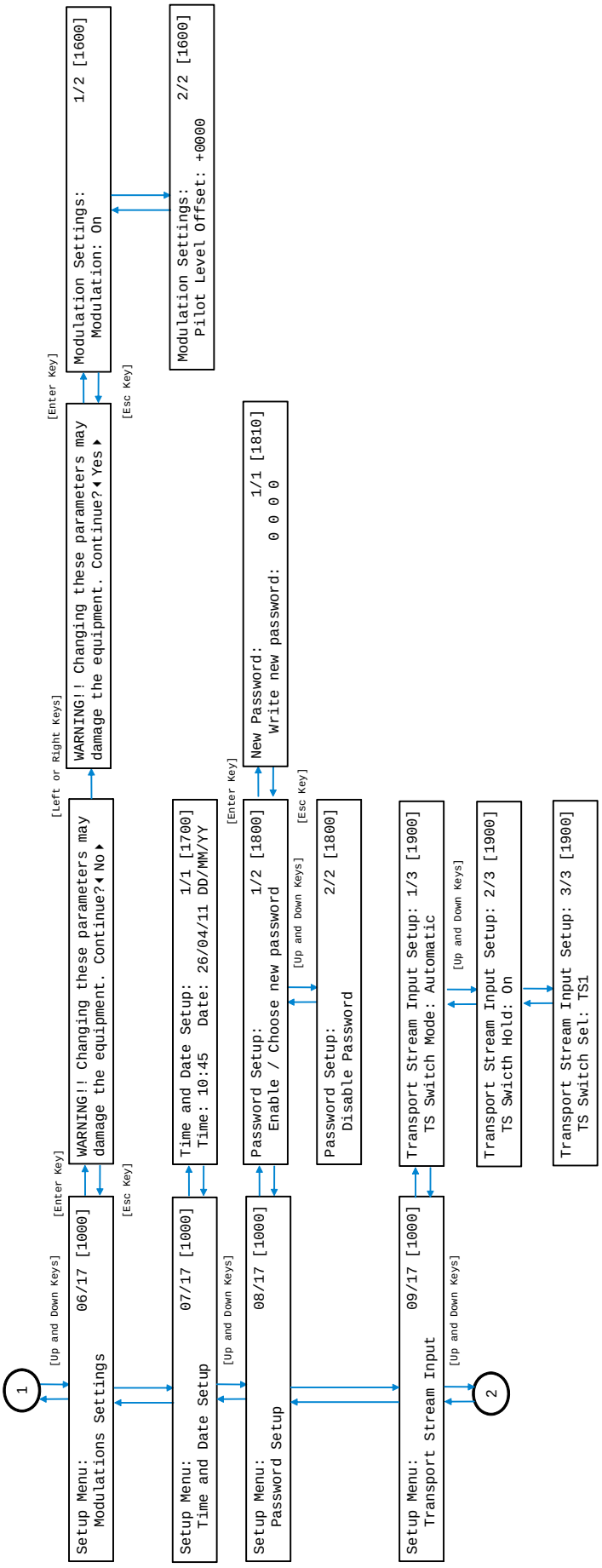
5.3.1 Presentation and Main Options

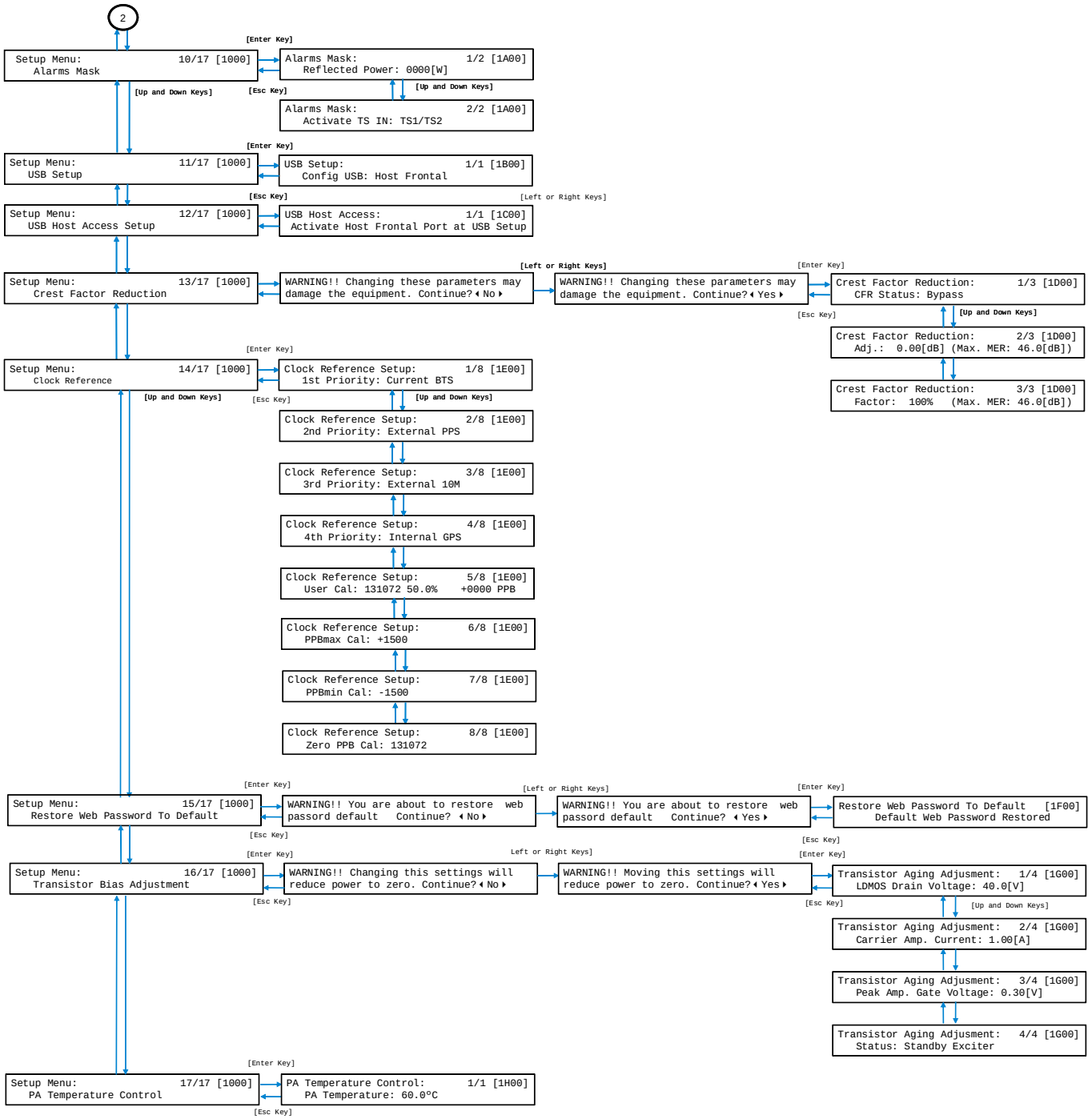


5.3.2 Setup Menu

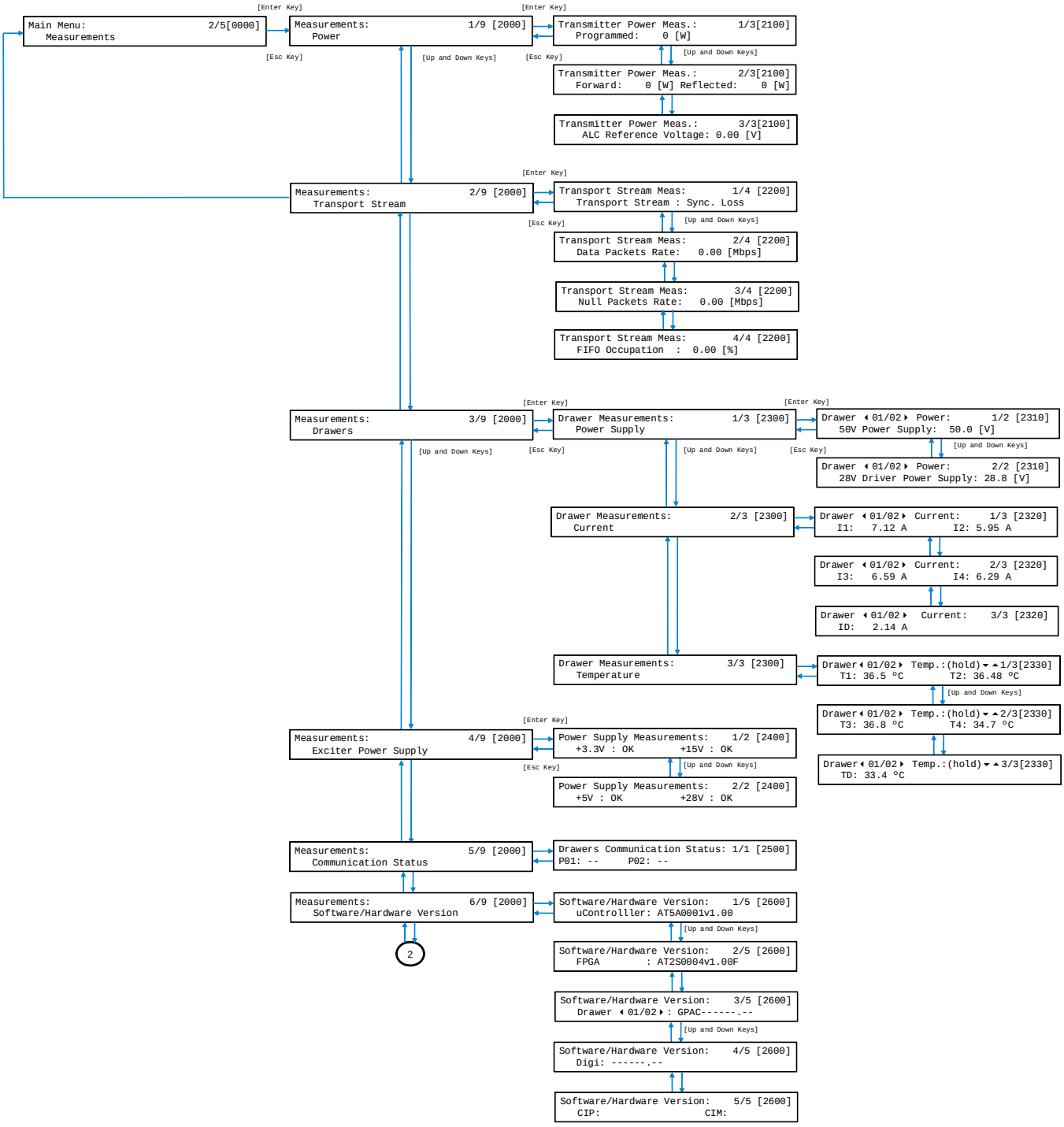


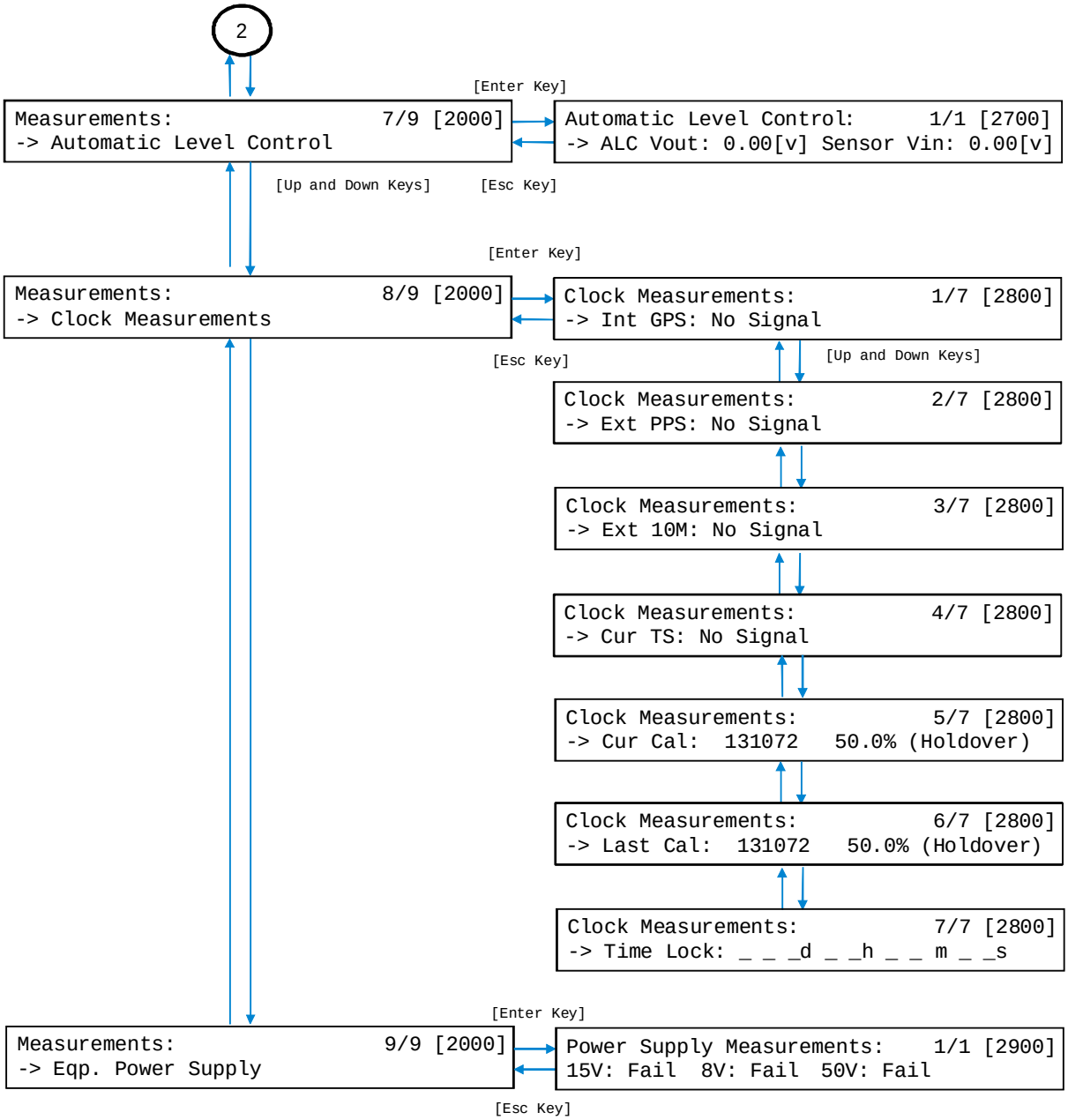

Main Menu:
Setup Menu
1/5[0000]
[Enter Key]
[Esc Key]
Setup Menu:
Power Setup
01/17 [1000]
Power Setup:
Program: [W] Output: [W]
1/1[1100]
Setup Menu:
Transmitter Setup
02/17 [1000]
Transmitter Setup:
Automatic Level Control: On
1/3[1200]
Transmitter Setup:
Mute on TS Loss: On
2/3[1200]
Transmitter Setup:
Output Level Control: Local
3/3[1200]
Setup Menu:
Image Frequency Suppression
03/17 [1000]
WARNING!! Changing these parameters may damage the equipment. Continue?◂No ▸
WARNING!! Changing these parameters may damage the equipment. Continue?◂Yes ▸
Image Frequency Suppression: 1/4 [1300]
I Amplitude: -0.000 [dB]
Image Frequency Suppression: 2/4 [1300]
Q Amplitude: -0.000 [dB]
Image Frequency Suppression: 3/4 [1300]
I Phase : + 0.00°
Image Frequency Suppression: 4/4 [1300]
Q Phase : + 0.00°
Setup Menu:
LO Leakage Suppression
04/17 [1000]
WARNING!! Changing these parameters may damage the equipment. Continue?◂No ▸
WARNING!! Changing these parameters may damage the equipment. Continue?◂Yes ▸
LO Leakage Suppression: 1/2 [1400]
I Oset: + 0.00 [mV]
LO Leakage Suppression: 2/2 [1400]
Q Oset: + 0.00 [mV]
Setup Menu:
Pre-Correction
05/17 [1000]
WARNING!! Changing these parameters may damage the equipment. Continue?◂No ▸
WARNING!! Changing these parameters may damage the equipment. Continue?◂Yes ▸
Pre-Correction Setup: 1/2 [1500]
Non-Linear
Non-Linear Pre-Correction: 1/1 [1510]
Non-Linear Pre-Correction: On
Pre-Correction Setup: 2/2 [1500]
Linear
Linear Pre-Correction: 1/1 [1520]
Linear Pre-Correction: On
[Up and Down Keys]
[Left or Right Keys]
1


1
Setup Menu:
Modulations Settings
06/17 [1000]
[Up and Down Keys]
[Enter Key]
WARNING!! Changing these parameters may
damage the equipment. Continue? ◂ No ▸
[Left or Right Keys]
[Esc Key]
WARNING!! Changing these parameters may
damage the equipment. Continue? ◂ Yes ▸
[Enter Key]
[Esc Key]
Modulation Settings: 1/2 [1600]
Modulation: On
Modulation Settings: 2/2 [1600]
Pilot Level Offset: +0000
Setup Menu:
Time and Date Setup
07/17 [1000]
[Up and Down Keys]
Time and Date Setup: 1/1 [1700]
Time: 10:45 Date: 26/04/11 DD/MM/YY
[Enter Key]
Setup Menu:
Password Setup
08/17 [1000]
[Up and Down Keys]
Password Setup: 1/2 [1800]
Enable / Choose new password
[Esc Key]
New Password: 1/1 [1810]
Write new password: 0 0 0 0
Password Setup: 2/2 [1800]
Disable Password
Setup Menu:
Transport Stream Input
09/17 [1000]
[Up and Down Keys]
Transport Stream Input Setup: 1/3 [1900]
TS Switch Mode: Automatic
[Up and Down Keys]
Transport Stream Input Setup: 2/3 [1900]
TS Switch Hold: On
Transport Stream Input Setup: 3/3 [1900]
TS Switch Sel: TS1
2

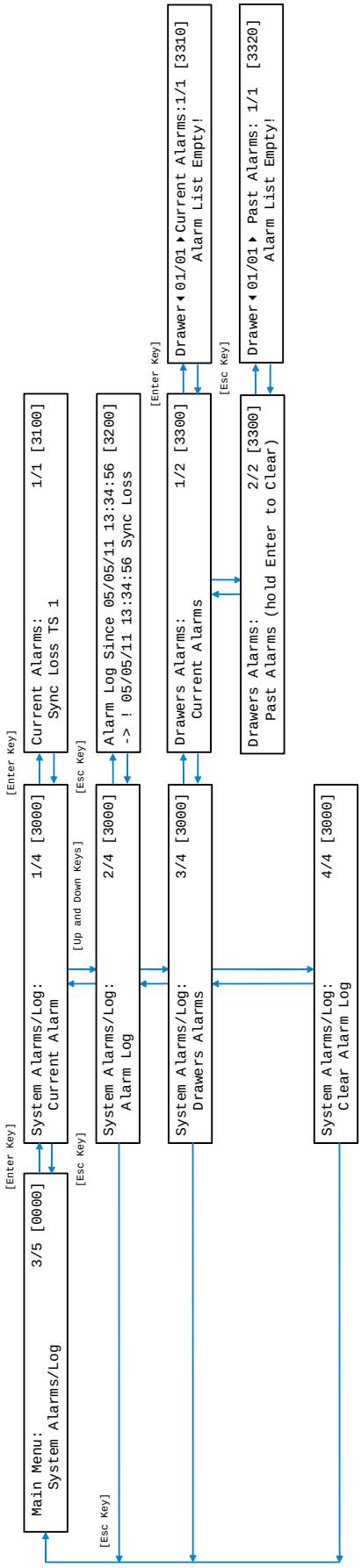

2
Setup Menu: 10/17 [1000]
Alarms Mask
[Enter Key]
Alarms Mask: 1/2 [1A00]
Reflected Power: 0000[W]
[Up and Down Keys]
[Esc Key]
[Up and Down Keys]
Alarms Mask: 2/2 [1A00]
Activate TS IN: TS1/TS2
Setup Menu: 11/17 [1000]
USB Setup
[Enter Key]
USB Setup: 1/1 [1B00]
Config USB: Host Frontal
[Esc Key]
[Left or Right Keys]
Setup Menu: 12/17 [1000]
USB Host Access Setup
USB Host Access: 1/1 [1C00]
Activate Host Frontal Port at USB Setup
Setup Menu: 13/17 [1000]
Crest Factor Reduction
[Left or Right Keys]
WARNING!! Changing these parameters may damage the equipment. Continue? No
WARNING!! Changing these parameters may damage the equipment. Continue? Yes
[Enter Key]
Crest Factor Reduction: 1/3 [1D00]
CFR Status: Bypass
[Esc Key]
[Up and Down Keys]
Crest Factor Reduction: 2/3 [1D00]
Adj.: 0.00[dB] (Max. MER: 46.0[dB])
Crest Factor Reduction: 3/3 [1D00]
Factor: 100% (Max. MER: 46.0[dB])
Setup Menu: 14/17 [1000]
Clock Reference
[Enter Key]
Clock Reference Setup: 1/8 [1E00]
1st Priority: Current BTS
[Up and Down Keys]
[Esc Key]
[Up and Down Keys]
Clock Reference Setup: 2/8 [1E00]
2nd Priority: External PPS
Clock Reference Setup: 3/8 [1E00]
3rd Priority: External 10M
Clock Reference Setup: 4/8 [1E00]
4th Priority: Internal GPS
Clock Reference Setup: 5/8 [1E00]
User Cal: 131072 50.0% +0000 PPB
Clock Reference Setup: 6/8 [1E00]
PPBmax Cal: +1500
Clock Reference Setup: 7/8 [1E00]
PPBmin Cal: -1500
Clock Reference Setup: 8/8 [1E00]
Zero PPB Cal: 131072
Setup Menu: 15/17 [1000]
Restore Web Password To Default
[Enter Key]
WARNING!! You are about to restore web passord default Continue? No
[Left or Right Keys]
WARNING!! You are about to restore web passord default Continue? Yes
[Enter Key]
Restore Web Password To Default [1F00]
Default Web Password Restored
[Esc Key]
[Esc Key]
Setup Menu: 16/17 [1000]
Transistor Bias Adjustment
[Enter Key]
WARNING!! Changing this settings will reduce power to zero. Continue? No
Left or Right Keys]
WARNING!! Moving this settings will reduce power to zero. Continue? Yes
[Enter Key]
Transistor Aging Adjusment: 1/4 [1G00]
LDMOS Drain Voltage: 40.0[V]
[Esc Key]
[Esc Key]
[Up and Down Keys]
Transistor Aging Adjusment: 2/4 [1G00]
Carrier Amp. Current: 1.00[A]
Transistor Aging Adjusment: 3/4 [1G00]
Peak Amp. Gate Voltage: 0.30[V]
Transistor Aging Adjusment: 4/4 [1G00]
Status: Standby Exciter
Setup Menu: 17/17 [1000]
PA Temperature Control
[Enter Key]
PA Temperature Control: 1/1 [1H00]
PA Temperature: 60.0°C
[Esc Key]

5.3.3 Measurements

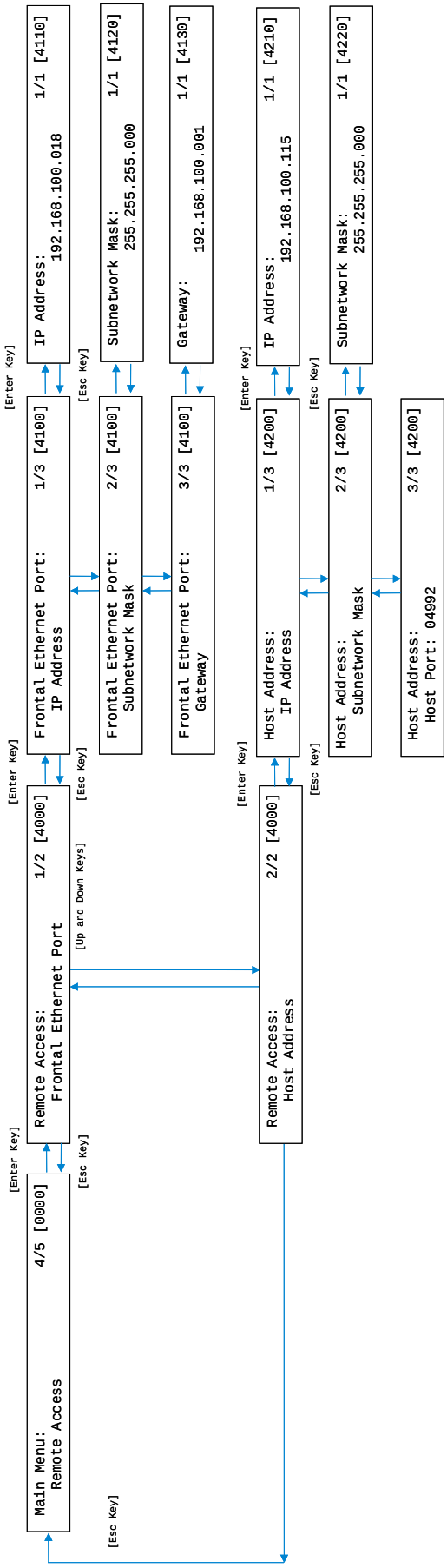



2
[Enter Key]
Measurements: 7/9 [2000]
-> Automatic Level Control
Automatic Level Control: 1/1 [2700]
-> ALC Vout: 0.00[v] Sensor Vin: 0.00[v]
[Up and Down Keys]
[Esc Key]
[Enter Key]
Measurements: 8/9 [2000]
-> Clock Measurements
Clock Measurements: 1/7 [2800]
-> Int GPS: No Signal
[Esc Key]
[Up and Down Keys]
Clock Measurements: 2/7 [2800]
-> Ext PPS: No Signal
Clock Measurements: 3/7 [2800]
-> Ext 10M: No Signal
Clock Measurements: 4/7 [2800]
-> Cur TS: No Signal
Clock Measurements: 5/7 [2800]
-> Cur Cal: 131072 50.0% (Holdover)
Clock Measurements: 6/7 [2800]
-> Last Cal: 131072 50.0% (Holdover)
Clock Measurements: 7/7 [2800]
-> Time Lock: _ _ _d _ _h _ _ m _ _s
[Enter Key]
Measurements: 9/9 [2000]
-> Eqp. Power Supply
Power Supply Measurements: 1/1 [2900]
15V: Fail 8V: Fail 50V: Fail
[Esc Key]

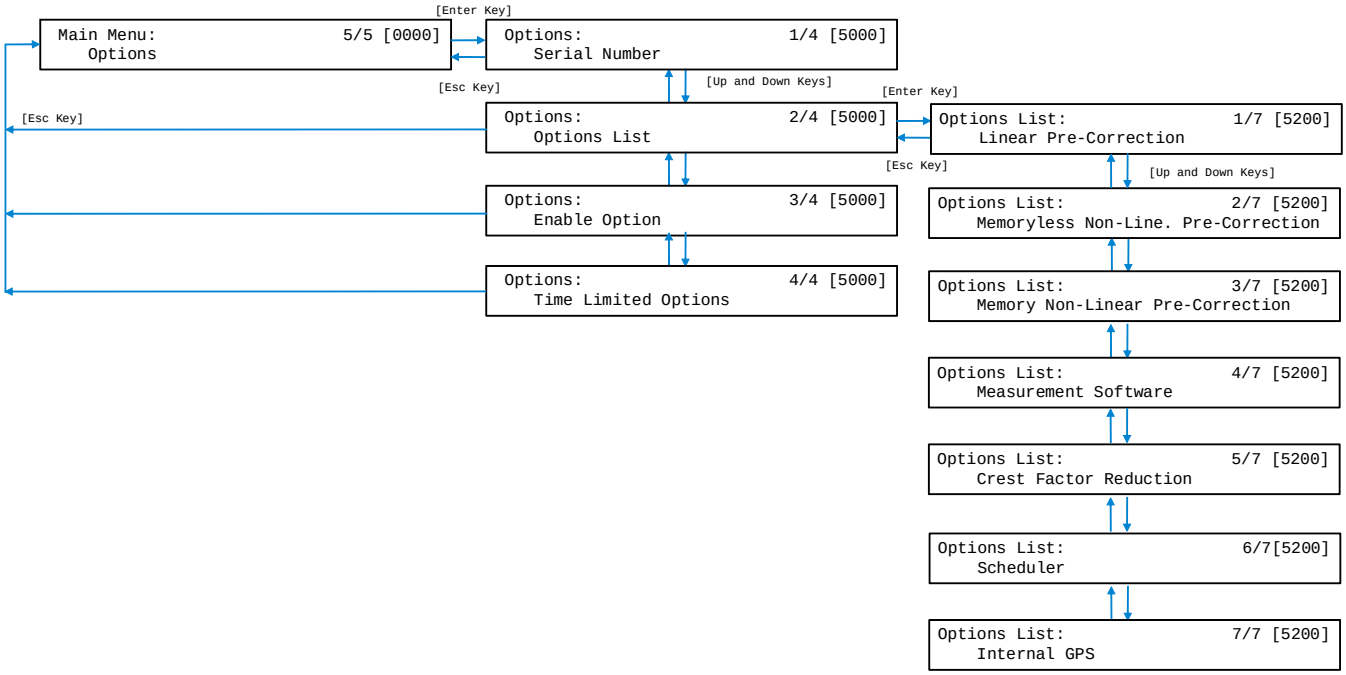
5.3.4 System Alarms / Log



5.3.5 Remote Access



5.3.6 Options


[Enter Key]
Main Menu: 5/5 [0000]
Options
Options: 1/4 [5000]
Serial Number
[Esc Key]
[Up and Down Keys]
[Enter Key]
[Esc Key]
Options: 2/4 [5000]
Options List
Options List: 1/7 [5200]
Linear Pre-Correction
[Esc Key]
[Up and Down Keys]
Options: 3/4 [5000]
Enable Option
Options List: 2/7 [5200]
Memoryless Non-Line. Pre-Correction
Options: 4/4 [5000]
Time Limited Options
Options List: 3/7 [5200]
Memory Non-Linear Pre-Correction
Options List: 4/7 [5200]
Measurement Software
Options List: 5/7 [5200]
Crest Factor Reduction
Options List: 6/7[5200]
Scheduler
Options List: 7/7 [5200]
Internal GPS

5.4 Start up

The first screen that appears when powering ON the transmitter is:

(example display of 2900W Tx)

The First Presentation Screen shows the time of the manufactures and the model of the transmitter, and the system it was set for. For the sample screen above:

Model: EC701HP - EC708HP
System: 8VSB ATSC

While no other key is pressed, these 2 presentation screens will be succeeding each other on the LCD.

After pressing any key on the keypad, the Main Menu screen appears:

Notes:
It is always possible to return to the previous LCD screen by pressing the ESC key.
After 5 minutes the initial LCD screen menu is displayed.

By the Main Menu, it's possible to access all transmitter information, divided in five sections: Setup, Measurements, System Alarms, Remote Access and Options.

5.5 Setup Menu

The SETUP screens permit the selection and changes on the configuration and operational parameters.

The menu on the table follow profiles the possible operations under SETUP.

Items on the SETUP menu	Description
Power Setup	Program the RF output power level
Transmitter Setup	Turn ON and turn OFF the ALC (Automatic Level Control)
	Mute the or not the RF power output on the event of absence of Transport Stream
	Select local or remote the transmitter output level control.
Image Frequency Suppression	TX Balance, eliminated the image frequencies band
LO Leakage Suppression	Reduces the LO undesirable spurious
Pre-Correction	Enable and Disable the pre-correction circuitry
Modulation Settings	Turn ON and turn OFF the modulation
	ATSC pilot level configuration (pilot level programming between 2.048 ~ +511)
Time and Date Setup	Set time and date
Password Setup	Password configuration
Transport Stream Input	Configure three parameters with respect to the 2 TS inputs: - TS input: Selects with one is preferable - Mode: Automatic (automatically switches in the case one fails) / Manual (does not switch even if it fails) - Hold: On (hold the last input even if the preferable input stopped failing) / Off (go back to the preferable input if has stopped failing)
Alarms Mask	Enable or disable conditions to generate alarms.
USB Setup	Selects one of three USB ports available on the 8001: - Device Rear / Device Frontal: PC software GUI8001 - Host Frontal: USB flash drive for software upgrade
USB Host Access Setup	With USB Host Frontal selected use this menu and follow further instructions to make a software upgrade
Crest Factor Reduction	Configure Crest Factor parameters to reduce the Peak to Average Power Ratio in order to improve intermodulation on PA output at the expense of MER degradation
Clock Reference	Set the priority list for exciter time base reference: - User cal (free running): internal OCXO without a reference (+/- 50ppb) - Internal GPS*: plug the antenna cable at the rear panel - External 10 MHz - External 1PPS - Incoming TS: this mode is useful for M/H since pre-processor and post-processor must be in the same time base.
Restore Web Password to Default	Reset web page user name and password to default values. User: user Password: linear
Transistor Aging Adjustment	Allows you to send the current settings for the power amplifiers. The values are pre-set at the factory.
PA Temperature Control	It allows you to set the operating temperature of the power amplifiers drawer.

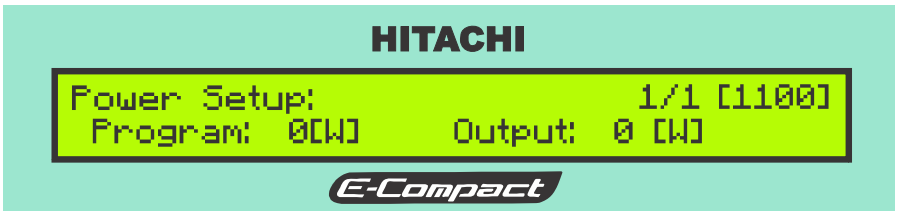
5.5.1 Power Setup

Commands the software to set the transmission power of the equipment.

Starting from the Main Menu:

Select **Setup** and press ENTER.

Select **Power Setup** and press ENTER.



To reach the desirable output power level, press the key (2)▶, to increase the power or (4) ◀ to decrease the power.

Once the desirable power level is adjusted, press ENTER for software acknowledgement, otherwise the change will not become effective.

5.5.2 Transmitter Setup

Under this menu, it is possible to turn ON and OFF the ALC (Automatic Level Control), mute or do not mute the RF power output on the absence of Transport Stream, and also select being local or remote the transmitter output level control.

Select **Transmitter Setup** and press ENTER.

Use the keys ◀ or ▶ to enable or disable the ALC. Hit key "▼" to view the next screen.

Use the keys ◀ or ▶ to enable or disable the Mute. Hit key "▼" to view the next screen.

Press key ESC to return to **Setup Menu**.

5.5.3 Image Frequency Suppression

This software feature adjusts numerical values related with the amplitude and phase optimized for maximum image frequency suppression on the superior side band spectrum region. An RF sample for monitoring purposes must be taken before the output mask filter.

The amplitude values are shown in dB, and the phase related values ar shown in degress.

Starting at the setup menu screen [1000], select **Image Frequency Suppression** and press ENTER.

The screen below will appear.

ATTENTION

When accessing this screen, by selecting option "YES", the operator will be responsible for the changes done on this parameter, as well as the effects that these changes may cause in the equipment if not using the appropriate instruments and test point.

To access the screen **Image Frequency Suppression**, select YES using the keys ◀ or ▶. Selecting NO, the software goes to the previous screen.

To program the values, use keys ◀ and ▶. Enter To change between the parameters, use keys ▲ or ▼.

To program the values, use keys ◀ and ▶.

To program the values, use keys ◀ and ▶.

To program the values, use keys ◀ and ▶.

Press ESC to return to the **Setup Menu**.

Starting from Setup Menu screen [1000]:

Select **LO Leakage Suppression** and press ENTER.

The screen below will appear.

To access the **LO Leakage Suppression** screen, select “Yes” by using the keys ◀or ▶. Selecting NO, the software goes to the previous screen.

ATTENTION

When accessing this screen, by selecting option “YES”, the operator will be responsible for the changes done on this parameter, as well as the effects that these changes may cause in the equipment if not using the appropriate instruments and test point.

5.5.4 LO Adjustment (LO Leakage Suppression)

An RF sample for monitoring purposes must be taken before the output mask filter. An ideal voltage in the range of -60 [mV] and +60 [mV] should be sought, and will cancel the LO leakage for the main RF amplifiers.

Utilizar a tecla “▼” para visualização da tela seguinte.

5.5.5 Active / De-active Pre-Correction

After the linear and non-linear pre-correction process by **Hitachi Kokusai Linear** staff, through these screens it is possible to activate or de-activate the non-linear pre-correction.

ON: activate the pre-correction.

OFF: de-activate the pre-correction.

Starting from the Setup Menu screen [1000].

Select **Pre-Correction** and press ENTER.

The screen below will appear.

ATTENTION

When accessing this screen, by selecting option “YES”, the operator will be responsible for the changes done on this parameter, as well as the effects that these changes may cause in the equipment if not using the appropriate instruments and test point.

To access the **Pre-Correction** screen, select “Yes” by using the keys ◄ or ►. Selecting NO, the software goes to the previous screen.

Select **Non-Linear** and press ENTER.

Use the keys ◄ or ► to enable or disable the pre-correction.

Press key ESC to return to Pre-Correction Setup.

Select **Linear** and press ENTER.

Use the keys ◄ or ► to enable or disable the pre-correction.

Press key ESC to return to **Setup Menu**.

5.5.6 Modulation Settings

On this screen option, it's possible to turn the modulation process on and off. It is also possible to adjust the pilot level.

Starting from Setup Menu screen [1000]:

Select **Modulation Settings** and press ENTER.

The screen below will appear.

ATTENTION

When accessing this screen, by selecting option "YES", the operator will be responsible for the changes done on this parameter, as well as the effects that these changes may cause in the equipment if not using the appropriate instruments and test point.

To access the **Modulation Settings**, select "Yes" by using the keys ◄or ►. Selecting NO, the software goes to the previous screen.

Use the keys ◄ or ► to enable or disable the modulation.

Hit key " ▼ " to view the next screen.

Use the keys ◄or ► to adjust the pilot level. Its range goes from -2048 to +511.

Press key ESC to return to **Setup Menu**.

5.5.7 Time and date configuration

Select **Time and Date Setup** and press ENTER.

To program the date and time, use keys ▲ or ▼ . To change between the parameters, press the ◀ and ▶.

Press key ESC to return to **Setup Menu**.

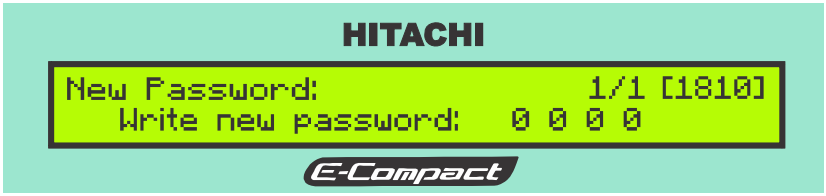
5.5.8 Password

Once a password is composed (by four numbers) it will become the set password for the equipment. Please be certain to capture and store your password in a safe place.

To access the password configuration screen, the operator must follow the sequences below, starting from the **Setup Menu** [1000].

Select **Password Setup** and press Enter.

To enable the password or set a new one, select **Enable / Choose new password**.



To set the password, use the keys ◀ and ▶ keys to move the arrow head under each one of the 4 password positions. The ▲ and ▼ keys increase or decrease the numerical value of the each position. Select the password and press ENTER.

Once the the password is confirmed, the software goes back to the **Password Setup**.

Hit key " ▼ " to view the next screen.

If the option **Disable password** is selected, it dispenses the use of password.

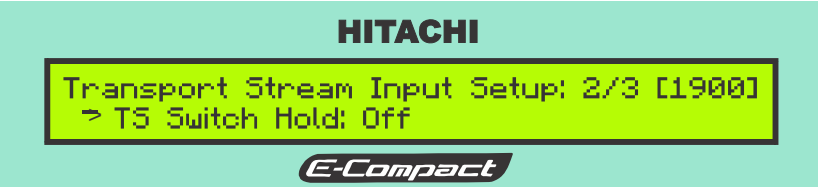
Press key ESC to return to **Setup Menu**.

5.5.9 Transport Stream Input

Select **Transport Stream Input** and press ENTER.

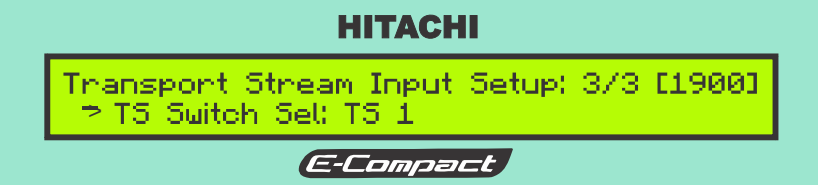
Use the keys ◀ and ▶ to configure automatic or manual.

Hit key " ▼ " to view the next screen.



Use the keys ◀ and ▶ to select On or Off.

Hit key " ▼ " to view the next screen.



Use the keys ◀ or ▶ to select TS 1 or TS 2.

Press key ESC to return to **Setup Menu** and hit key " ▼ " to view the next screen.

5.5.10 Alarms Mask

Select **Alarms Mask** and press ENTER.

Use the keys ◀ or ▶ to select TS1, TS2 or TS1 / TS2.

Press key ESC to return to **Setup Menu** and hit key " ▼ " to view the next screen.

5.5.11 USB Setup

Select **USB Setup** and press ENTER.

Use the keys ◀ or ▶ to configure USB.

Press key ESC to return to **Setup Menu** and hit key "▼" to view the next screen.

5.5.12 USB Host Access Setup

Select **USB Host Access Setup** and press ENTER.

Press key ESC to return to **Setup Menu** and hit key "▼" to view the next screen.

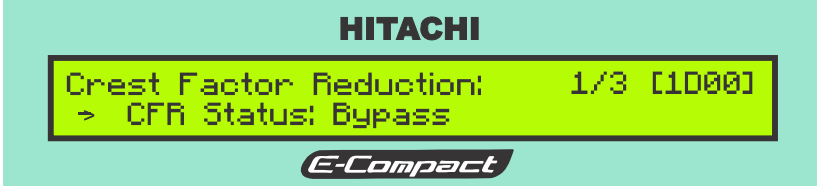
5.5.13 Crest Factor Reduction

The screen below will appear.

ATTENTION

When accessing this screen, by selecting option "YES", the operator will be responsible for the changes done on this parameter, as well as the effects that these changes may cause in the equipment if not using the appropriate instruments and test point.

To access the **Crest Factor Reduction** screen, select "Yes" by using the keys ◄ or ►.



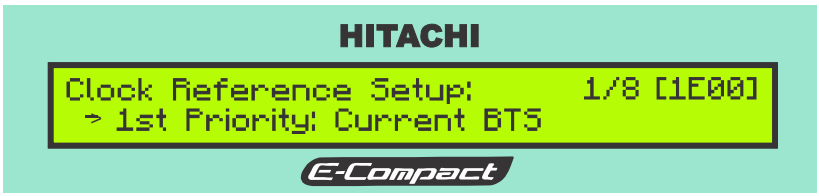
Use the keys ◀ or ▶ to configure the option and hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to adjust the value and hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to adjust the value.

5.5.14 Clock Reference

Select **Clock Reference** and press ENTER.



Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to program the value.

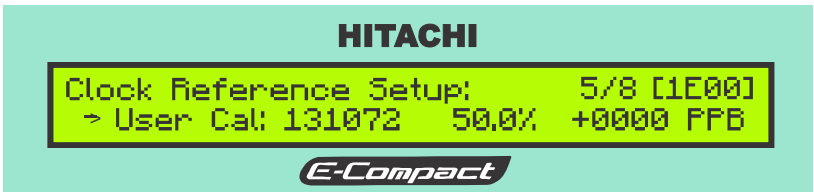
Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.



Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ to program the value.

Hit key " ▼ " to view the next screen.

Use the keys ◀ or ▶ and ▲ or ▼ to program the value.

Press key ESC to return to Main Menu.

5.5.15 Restore Web Password to Default

Select Restore Web Password to default and press ENTER.

The screen below will appear.

To access the **Restore Web Password to default** screen, select “Yes” by using the keys ◀ or ▶.

Press key ESC to return to **Setup Menu** and hit key “ ▼ ” to view the next screen.

5.5.16 Transistor bias readjustment

Note:

These values can be modified in the factory’s menu, although the readjustment command may be implemented through the user menu. After each modification in the parameters, it is mandatory to re-do the non-linear precorrection.

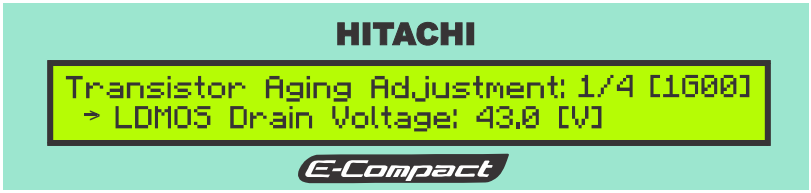
It is recommended in periodic maintenance to carry out the adjustment of the polarization of the RF transistors of the power drawers to compensate for variations occurring as a function of aging.

The configuration is done through the following screens that are accessed at:
Main Menu -> Setup Menu -> Transistor Bias Adjustment.

Select **Transistor Bias Adjustment** and press ENTER.
The following screen will be displayed:

ATTENTION:

When applying the "Transistor Bias Adjustment" function, the power will be zeroed. After adjusting the currents, you must reprogram the output power through the Setup Menu (Power Setup Screen 1/1 [1100]).



Use the key ▼ or ▲ to view the values.

5.5.17 PA Temperature Control

Through this screen you can configure the operating temperature of the power amplifiers drawer.

Select **PA Temperature Control** and press ENTER.

The following screen will be displayed:

Use the key ◀ or ▶ to set up. Confirm the selection by pressing ENTER.

The temperature amplifier (PA) can be adjusted from 50ºC to 60ºC.

Note:

For details on setting the temperature, see the Activation section.

5.6 Measurements Menu

The measurements screens allows the measurements on the exciter's parameters. The menu below profiles the possible measurements.

Measurements Menu Indications	Measurements Sub-Set Indications		Description
Power	Programmed		Measure the Programmed Power
	Forward		Measure the Reflected Power
	Reflected		Measure the Direct Power
	ALC Reference Voltage		Measure the ALC control voltage
Transport Stream	Transport Stream		Shows the INPUT transport stream protocol, or none.
	Data Packets Rate		Measure the input Data Rate: 0 ~ 19,39 Mbps
	Null Packets Rate		Measure Nulls packages: 0 ~ 19,39 Mbps
	FIFO Occupation (%)		0 ~ 100%
Drawers	Power Supply		Main Power Supply: drawer input power supply measurement
			Driver Power Supply: driver input power supply measurement
	Current		Measure the electrical current of the drawer modules
	Temperature		Temperature measurements of the drawers
Exciter Power Supply	Voltage	+3.3V	+3.3V voltage power supply measurement
		+15V	+15V voltage power supply measurement
		+5V	+5V voltage power supply measurement
		+28V	+28V voltage power supply measurement
Communication Status	Drawers Communication Status		Indicate the communication status among the RF drawers and the MASTER Control Unit.
Software / Hardware Version	µController		Microcontroller Software Version
	FPGA		FPGA Software Version
	Drawer		Drawer Power Software Version
	Digi		Digi Software
	CIP: 8753 CIM: 3930		Digital exciter board version
Automatic Level Control	ALC Volt		The voltage at the variable gain amplifier which controls the output power.
	Sensor Vin		The voltage at the average power detector output used to close the Automatic Level Control (ALC) loop.

Measurements Menu Indications	Measurements Sub-Set Indications	Description
Clock Measurements	Int GPS	This field displays NO SIGNAL or UNKOWN SIGNAL in the absence of a proper input signal. When validated, shows the PPS phase and frequency difference between this reference and the current PPS obtained with the internal control system of the OCXO (delivered on PPS output connector). When this input is identified as current reference a message identifies if the OCXO is in the frequency or phase locking process.
	Ext PPS	This field displays NO SIGNAL or UNKOWN SIGNAL in the absence of a proper input signal. When validated, shows the PPS phase and frequency difference between this reference and the current PPS obtained with the internal control system of the OCXO (delivered on PPS output connector). When this input is configured as current reference a message identifies if the OCXO is in the frequency or phase locking process.
	Ext 10M	This fi eld displays NO SIGNAL or UNKOWN SIGNAL in the absence of a proper input signal. When validated, shows the frequency difference between a PPS generated with this reference and the current PPS obtained with the internal control system of the OCXO (delivered on PPS output connector). When this input is configured as current reference a message identifies if the OCXO is in the frequency or phase locking process and the phase difference is also available.
	Cur TS	This field displays NO SIGNAL or UNKOWN SIGNAL in the absence of a proper input signal. When validated, shows the frequency difference between a PPS generated with this reference and the current PPS obtained with the internal control system of the OCXO (delivered on PPS output connector). When this input is configured as current reference a message identifies if the OCXO is in the frequency or phase locking process and the phase difference is also available.
	Cur Cal	Current value of the frequency control of the OCXO, range comprehended between 0 (0%, order of magnitude -1500ppb) and 262143 (100%, order of magnitude +1500ppb)
	Last Cal	Last calibrated value (zero frequency difference and less then 100ns phase difference) of the frequency control of the OCXO, range comprehended between 0 (0%, order of magnitude -1500ppb) and 262143 (100%, order of magnitude +1500ppb)
	Time Lock	Time counter since achieved lock
Eqp. Power Supply	15V	Status of power supply of 15V
	8V	Status of power supply of 8V
	50V	Status of power supply of 50V

5.6.1 Power

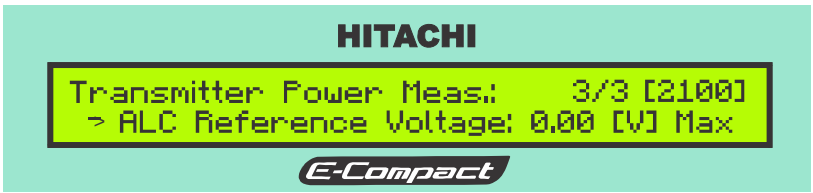
Shows the programmed and direct, reflected power measurements in the equipment output, ALC Reference Voltage.

To access the **Power** screen, the sequence of screens below must be followed, starting from the initial menu:

Access **Measurements**

Access **Power** and hit ENTER

Hit key "▼" to view the other screens that are part of this menu.



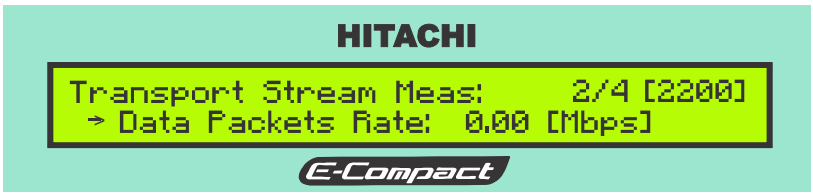
5.6.2 Transport Stream

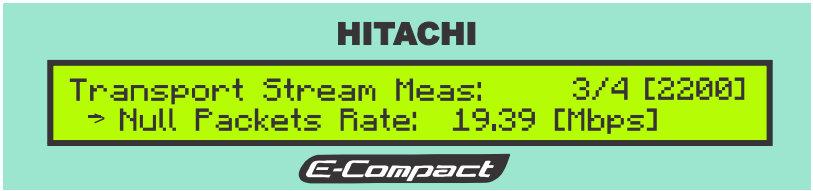
To gather information about the status of the incoming transport stream, follow the instructions below, starting on the main menu screen:

Access **Measurements** and hit ENTER

Select **Transport Stream** and hit ENTER.

Hit key " ▼ " to view the following screens





Hit ESC key to return to the **Measurements screen**.

5.6.3 RF Power Drawer Measurements

For RF Power Module it is possible to measure: (a) Power Supply Voltage (50V Power Supply and 28V Driver Power Supply), (b) electrical current ('I1', 'I2', 'I3', 'I4', 'I5', 'I6', 'I7', 'I8'and 'ID'), (c) temperature ('T1', 'T2', 'T3', 'T4', 'T5', 'T6', 'T7', 'T8' and 'TD'). Hit the ESC key to return to the measurements screen menu, or return to the main menu screen and select measurements.

Select **Drawers** and hit ENTER.

Select **Power Supply** and hit ENTER.

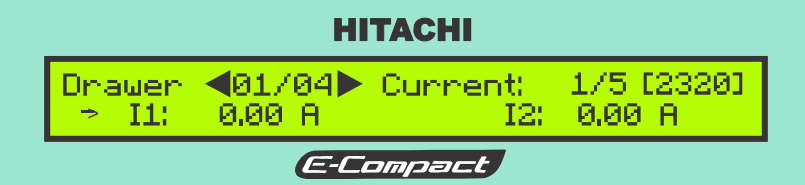
Hit key "▼" to view the other screens that are part of this menu.

For select the drawer use the key ◀ or ▶.

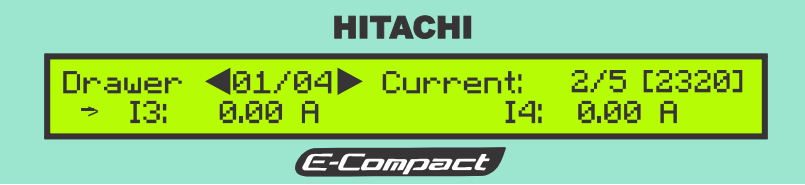
Check the displayed data.

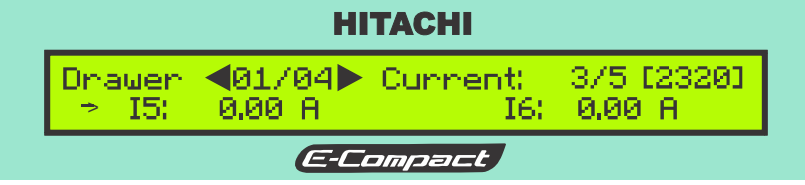
Press ESC to return to the menu Drawer Measurements.

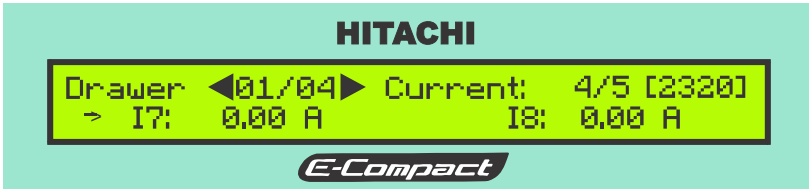
Select **Current** and press ENTER.

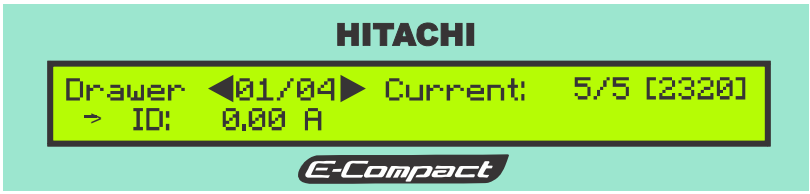


Press the key "▼" to view the next screen.





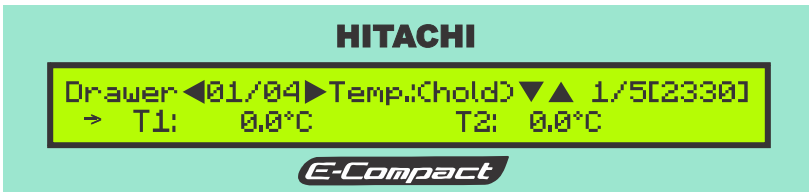




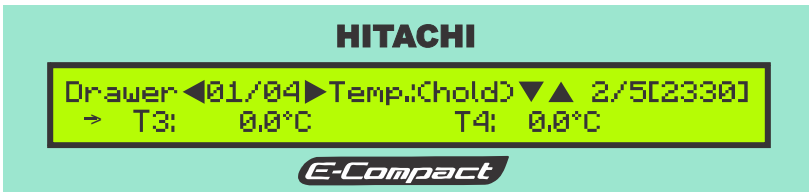
Check the displayed data.

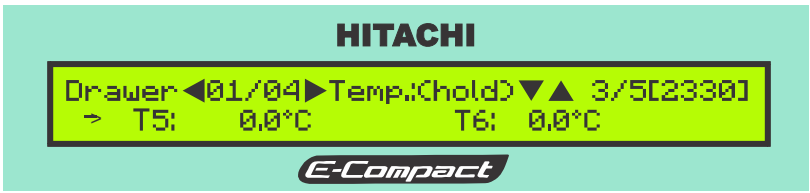
Press ESC to return to the menu Drawer Measurements.

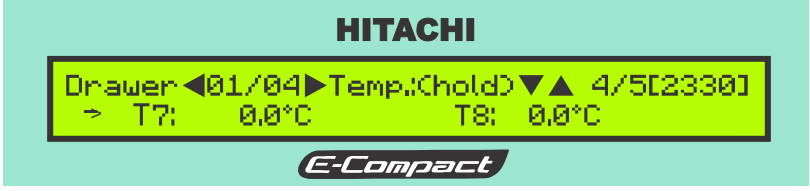
Select **Temperature** and press ENTER.

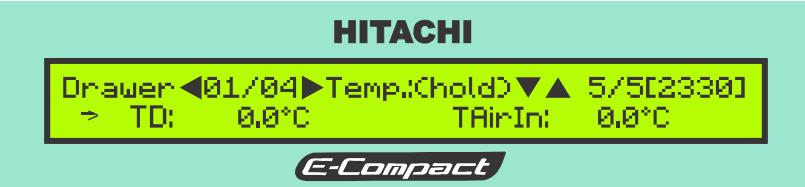


Hit key "▼" to view the other screens that are part of this menu.







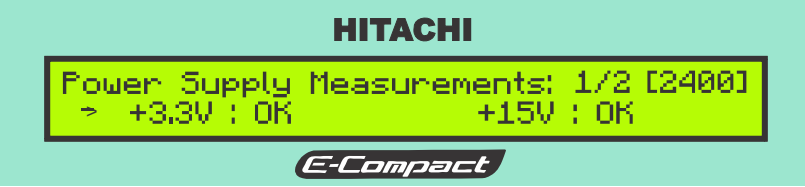


5.6.4 Exciter Power Supply

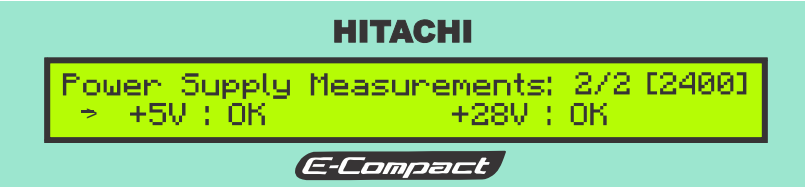
This screen shows the power supply status, indicating 'OK' or 'Fail'. The measured voltages are +3.3V, +15V, +5V and +28V.

Starting from the **Measurements Menu** [2000]:

Select **Exciter Power Supply** and hit Enter



Use the Up and Down keys, ▲ and ▼ , to check the following voltage measurements.



Hit ESC key to return to the **Measurements screen**.

5.6.5 Communication among RF drawers

From the LCD screen it is possible to conduct and view a diagnostic check f the communication link between the exciter unit and the RF power amplifier drawer ('P01).

Press ESC, to the Main Menu screen, and then to the screen [2000] is reached, as below:

Select **Communication Status** and press ENTER.

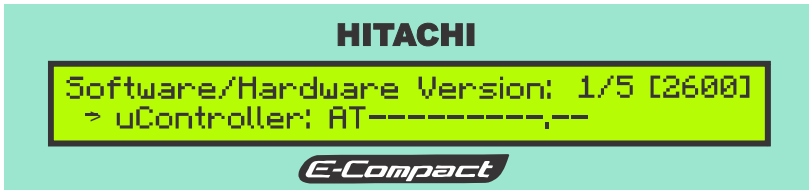
Press the ESC key to return to the Main Menu.

5.6.6 Software/Hardware Version

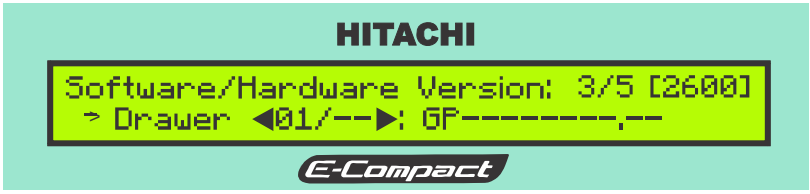
This screen indicates the software name and version recorded in the modulator FPGA, digital exciter's microcontrollers and power drawers. Such name and version must be reported to the factory in case of maintenance and checking of occurrences. It shows also the digital exciter's hardware version. The figures below show how to access the version screens from the Measurements menu:

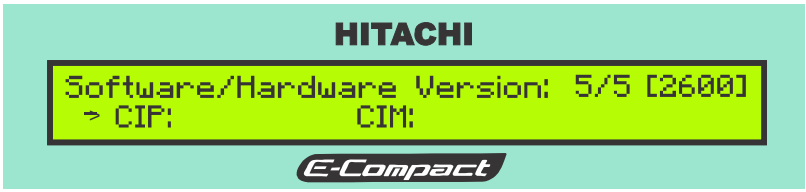
The sequence below indicates how to access the software version screen, starting from the **Measurements Menu** [2000]:

Select **Software Version** and hit ENTER



Hit key " ▼ " to view the next screen



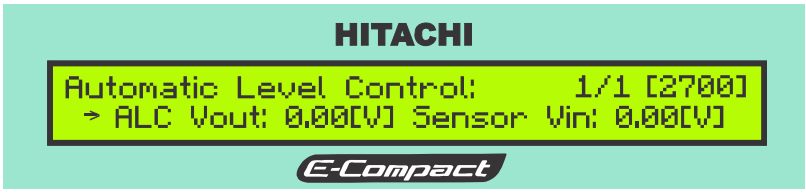


To return to the Measurements press ESC key.

5.6.7 Automatic Level Control

This screen indicates the voltage levels related to the Automatic Level Control (ALC) loop. Starting from the **Measurements Menu** [2000]:

Select **Automatic Level Control** and hit ENTER**.**



Hit ESC key to return to the **Measurements screen**.

5.6.8 Clock Measurements

This screen allows checking the clock measurements. The figures below show how to access the Clock screen from the Measurements menu:

Select **Clock Measurements** and hit ENTER**.**

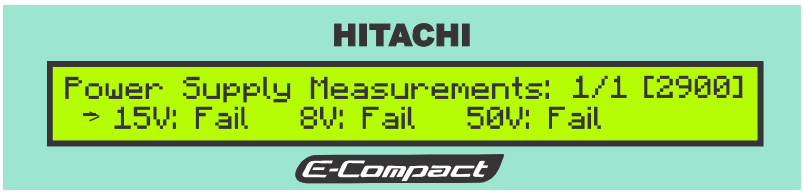
Hit key "▼" to view the other screens that are part of this menu.

5.6.9 Power Supply Voltages

Displays the status of the power supply voltages (located at the bottom of the equipment rack).

To verify these tensions in Measurements:

Select **Eqp. Power Supply** and press ENTER.



NOTE:

Function available for equipments with more than one drawer power.

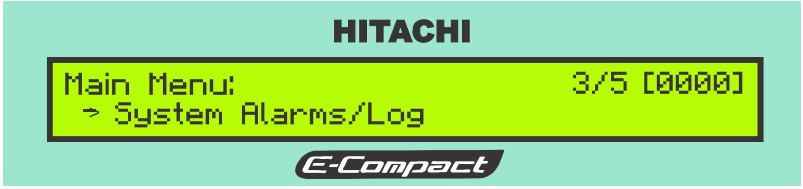
5.7 Alarm System

An alarm is indicated by one of the 3 red LEDs located on the front panel of the digital exciter. The first LED alarm is for transport stream (TS) absence (SYNC. LOSS). The next LED alarm is for a current malfunction present on the equipment, and requires investigation, (see CURRENT ALARM). The third LED indicates a past alarm (see PAST ALARM). This situation indicates that an alarm is no longer present. On normal operation, just a green LED is ON, which confirms that the AC input power is present. Once a CURRENT ALARM LED is ON, the origin of the alarm should be investigated.

5.7.1 Current Alarms

If there is an alarm occurrence, this screen shows the current alarms.

Starting from the Main Menu screen:



Select **System Alarms/Log** and press Enter.

Select **Current Alarms** and press Enter.

The second digit indicates the quantity of current alarms.

If there are more than one alarm, Hit key "▼" to view the other current alarms.
The "Alarm List Empty!" means the alarm is no longer present and there are no current alarms.

Press ESC to return to the **System Alarms/Log** menu.

5.7.2 Alarm Log

Select **Alarm Log** and press ENTER to view all the existing alarms, i.e. current and past alarms.

The symbol '!' before the log indicates that the alarm date and time have been recorded. The symbol '#' before the log indicates that the date and time in which the alarm stopped have been recorded.

Example:

When an alarm stops the corresponding time is stored in the log and the "PAST ALARM" LED will light.
If there is more than one log in the record, just press the key "▼" to roll the log.

5.7.3 Drawers Alarms

While in the **System Alarms/Log** screen it is possible to check and review all alarms, current and past, on the RF power drawer. From the System Alarms/log, screen [3000].

Starting from the **System Alarms** Menu [3000]:

Select **Drawers Alarms** and hit ENTER.

Select **Current Alarms** and press ENTER to check current alarms.

Use the keys ◀ or ▶ to select one among many RF power drawers.

Press key ESC to return to the previous screen, **Drawers Alarms.**

Select **Past Alarms** and press ENTER to check past alarms.

Use the keys ◀ or ▶ to select one among many RF power drawers.

5.7.4 Clear Past Alarms

Under this menu, it's possible to erase the past alarms occurrence.

Starting from the **System Alarms** Menu [3000]:

Select **Clear Past Alarms** and hit ENTER to erase past alarms occurrences.

The tables below show all the possible alarms and the respective measures to be taken when an alarm occurs.

Exciter Alarms:

The table below profiles all possible alarms generated on the Digital Exciter and the associated troubleshooting actions to take.

Digital Alarms Exciter:

ALARM MESSAGE	ALARM DESCRIPTION	ACTION THAT FOLLOWS
Sync loss TS 1!	Lack of sync with the input transport stream.	→ Check for the presence of TS 1 on the rear BNC connector of the Exciter. → Further action if necessary check inside the exciter for malfunction.
Sync loss TS 2!	Lack of sync with the input transport stream.	→ Check for the presence of TS 2 on the rear BNC connector of the Exciter. → Further action if necessary check inside the exciter for malfunction.
LO Lock Fail!	Lack of LOCK (UP Converter)	→ Check for mal-function on the UP Converter. → Substitute the module.
Clock Lock Fail!	Lack of LOCK (Clock modulator)	→ Check for eventual cabling bad contact. → Full analysis of the circuitry will be necessary. → Get in contact with Hitachi Kokusai
Fifo Overflow!	FIFO Overflow (modulator)	→ Full analysis of the circuitry will be necessary. → Get in contact with Hitachi Kokusai Linear's technical support service.
+15V, +3.3V, +2 8V, +5V	PS failure; +15V, +3.3V, 28V or +5V	→ Follow the basic procedure with voltmeter looking for some clear evidence of malfunction. Replace the module if necessary.
FPGA Comm. Fail!	No communication with the FPGA.	→ Full analysis of the circuitry will be necessary. → Get in contact with Hitachi Kokusai Linear's technical support service.
FIFO Underflow!	Self-explanatory	→ No local action.
Clock / CXO Fail!	Self-explanatory	→ No local action.
Remote Mute!	The transmitter output power was reduced to 0W via remote action.	→ No local action.

System Alarms

ALARM MESSAGE	ALARM DESCRIPTION	ACTION THAT FOLLOWS
Drawer Comm. !	At least one drawer is not communicating with the Exciter	→ Check the physical connection on the RS485 cabling. These connections are located on the Exciter rear panel, green connector. On the other end, at the rear panel of the RF Power Drawers, DB-15 connector. → Using the Hyper-Terminal, check the parameters on the RF Power Module. → Get in contact with Hitachi Kokusai Linear's technical support service.
Too Few Drawers!	Indication that the transmitter does not have enough RF Power Drawers to operate at the minimum reduction power level.	→ Check the presence of 208Vac on each RF Power Drawer. → Check the IRUSH circuit and/or the interlock. → Check the physical connection on the RS485 connector (DB-15). These connections are located on the RF Power Drawer rear panel. The cables connect the RF Power Drawer to the Exciter. → Get in contact with Hitachi Kokusai Linear's technical support service.
Reduced Power !	Indication that the transmitter is not operating at the nominal power. At least one RF Power Drawer is not contribuiting .	→ Check the physical connection on the RS485 cabling. These connections are located on the Exciter read panel, green connector. → Get in contact with Hitachi Kokusai Linear's technical support service.
Reflected Power !	Reflected power is present at the RF output of the transmitter.	→ Check other alarms status that can help for a better diagnostic. → Check the RF Power passives connections, looking for overheating on potential bad contacts on the transmission line. → Get in contact with Hitachi Kokusai Linear's technical support service.
RF Load Fan F ail	It indicates failure of one or more fans loads drawer or the temperature of the drawer is greater than 90°C	→ Check the mains power connection of the tail fan module. This is located at the rear of the loads drawer. Switch fan module or if appropriate only the damaged fan. → Check the temperature of the drawer. → **Note**: The equipment may work temporarily in the presence of this alarm, noting that it is responsible for cooling the load unbalance.
Power Amp. OFF!	The POWER ON/OFF switch is set on the OFF position. Green Switch locates on the bottom part of the front panel of the transmitter cabinet.	→ Check if the Green Switch (POWER ON/OFF Switch) is OFF. → Check interlock. → Get in contact with Hitachi Kokusai Linear's technical support service.
Other Exciter Fail!	Indicates failure in the communication between exciters A an d B.	→ Check the communication between the exciters in the CONTROL I/O connector in the exciters' rear panel.

System Alarms

ALARM MESSAGE	ALARM DESCRIPTION	ACTION THAT FOLLOWS
Phase Loss!	Main Breaker is disconnected.	→ Check Main Breaker OFF. → Get in contact with Hitachi Kokusai Linear's technical support service.
Output Power Zero!	Indication that the transmitter is programmed, but there is no output power	→ Check the Power Meter Dir. Coupler → Check the power reading at the PC controls.
+15V Eqp. Fail!	Failure on the +15V equipment power supply.	→ Check AC unit.
+8V Eqp. Fail!	Failure on the +8V equipment power supply.	→ Check AC unit.
+50V Eqp. Fail!	Failure on the +50V equipment power supply.	→ Check AC unit.
Drawers Alarms!	Failure on the RF Power Drawer	→ Via LCD check which RF Power Drawer listed is as the failure one. Access: Main Menu - System Alarms/Log – Drawers Alarms.
All PA Fail!	Indication that the all PA´s of the power drawer are damaged. This alarm there is only in the EC701HP.	→ Get in contact with Hitachi Kokusai Linear's technical support service.
Driver PA Fail!	Indication that the driver of the power drawer are damaged. This alarm there is only in the EC701HP.	→ Get in contact with Hitachi Kokusai Linear's technical support service.
Remote Ctrl Fail!	Communication failure between exciter and Remote Control drawer.	→ Check the physical connection between exciter and Remote Control. These connections are located on the exciter rear panel (green connector), on the other end, at the rear panel of the Remote Control (DB-9 connector).

5.8 Remote Management System (Tele-supervision)

All of the equipment parameters such as: transmission power level, power supply measurements, alarm verification and all the possible functional selections may be accessed two different ways.

- Frontal Panel – Through the frontal panel all of the equipment measurements and configurations may be accessed, as shown in the operation section.
- Local or remote PC virtual.

It is possible to change and/or monitor all of the parameters and measurements as is done at the frontal panel through the WEB server.

To accomplish this it is necessary to configure the IP / Mask / Gateway.

5.8.1 IP Configuration

Start from the Main Menu.

Select **Remote Access** and press ENTER.

Select **Frontal Ethernet Port** and press ENTER.

Select **IP Address** and press ENTER.

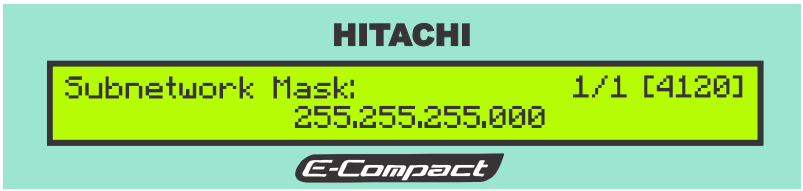
Configure the desired IP by using the keys ◄ or ► and ▲ or ▼.

Press ESC to the **Remote Access** screen .

Hit key "▼" to view the next screen.

5.8.2 Mask Configuration

Select **Sub-network Mask** and press ENTER.



Configure the desired IP by using the keys ◀ or ▶ and ▲ or ▼.

Press ESC to the **Remote Access** screen .

Hit key "▼" to view the next screen.

5.8.3 Gateway Configuration

Access the **Gateway** and press ENTER.

Configure the gateway address by using the keys ◀ or ▶ and ▲ or ▼.

5.8.4 Host Address Configuration

Select **Host Address** and press ENTER.

IP Address

Select **IP Address** and press ENTER.

Configure the IP Address by using the keys ◄ or ► and ▲ or ▼.

Subnetwork Mask

Access the **Subnetwork Mask** and press ENTER.

Configure the Subnetwork Mask by using the keys ◄ or ► and ▲ or ▼.

Press ESC to the **Host Address** screen.

Access the **Host Port** and press ENTER.

Host Port

Configure the Subnetwork Mask by using the keys ◄ or ► and ▲ or ▼.

5.9 Options

Select **Options** and press ENTER.

Hit key "▼" to view the next screen.

Select **Option List** and press ENTER.

Hit key "▼" to view the other screens that are part of this menu.

Press ESC to return the **Options** screen.

Hit key "▼" to view the next screen.

Select **Enable Option** and press ENTER.

Select time **Limited Options** and press ENTER.

Hit key "▼" to view the next screen.

Section 6
Preventive / Corrective Maintenance

6

6.1 Introduction

This section addresses the procedures to be adopted for Preventive, Periodic, Corrective Maintenance routines in order to ensure the life of the TV Transmitter.

The Transmitter must only be opened by authorized service personnel who have received adequate training to perform maintenance on this type of equipment. Failure to comply with what has been mentioned above may result in loss of warranty.

IMPORTANT:

1. The life expectancy depends on the operating conditions of the equipment.

2. Temperature controlled environments increase the life expectancy of components.

3. On semiannual inspections, if there is abnormal noise or vibration of the 3-fan module located on the front of the power drawer, it is recommended to replace it.

6.2 Preventive Maintenance

Below is a table containing the guidelines for preventive maintenance of E-Compact transmitter series.

Title:	Transmitter Maintenance	Frequency:	Semester		
Model:		Date:			
Item number	Task	Description	OK	repair	not applicable
1.	Cleanning	Initial Conditions: - Disconnect device from Main; - Remove/Detatch Front and side Door plates.			
		(1.1) Using an air jet (compressed air), remove any dust accumulated inside the equipment, the front and rear panels, the side covers and the upper and lower covers.			
		(1.2) Wipe dry and soft cloth on the panels, as well as on the digital driver display.			
		(1.3) Remove accumulated dust from the air inlet ?lters located on the bottom of the panel and on the side and rear covers.			
		(1.4) If it is not possible to use the air jet, provide a brush of very soft bristles, avoiding to scratch the paint of equipment.			
		(1.5) Clean fan air ?lters in power drawers (medium-power transmitters only). Verify how cleaning is done in Corrective Maintenance.			
		(1.6) Replace the fan air ?lters in the power drawers (high power transmitters only). Check how replace-ment is done in Corrective Maintenance.			
		(1.7) After cleaning, place the side panels and connect the device to the mains, putting it into operation according to the procedure for initial activation.			

Title:	Transmitters Maintenance	Frequency:	Semester		
Model:		**Date:**			
Item number	**Task**	**Description**	**OK**	**repair**	**not applicable**
2.	Visual Inspection	Initial Conditions: - Remove side plates.			
		(2.1) Check that the module connectors are correctly attached, as well as the RF connections to the equipment and the radiating system.			
		(2.2) Check if rainwater is not getting through the RF cables or there are gutters in the shelter.			
		(2.3) Check that the equipment's air inlets and outlets are not obstructed.			
		(2.4) At the end of the visual inspection, ?t the side covers.			
3.	Measurements veri?cation	Read all possible measurements through the display on the equipment panel and write down the values in a control sheet. Compare the values obtained with the values of the test report made in the factory, taking into account the tolerance of each measurement. The monthly periodic veri?cation of the measurements makes it possible to predict any abnormalities that may occur.			
		(3.1) Verify forward and re?ected powers through the exciter display (**Measurements - Power**).			
		(3.2) Check the voltages of the digital driver sources and equipment via the driver display **(Measurements – Exciter Power Supply / Eqp Power Suppy).**			
		(3.3) Check the voltages of the sources, currents and temperatures of the power drawers through the **Measurements - Drawers.**			
4.	Alarm veri?cation	Verify the transmitter's alarm log and in case of recurring alarms, contact Hitachi Kokusai Linear technical support.			

Title:	**Transmitters Maintenance**		**Frequency:**	**Semester**		
Model:			**Date:**			
Item number	**Task**	**Description**	**OK**	**repair**	**not applicable**
5.	General Inspection	**(5.1)** Check if there is heating in the connections of the splitter, adder, RF OUT / power cables / connectors of the power drawers, unbalance loads, ?lter, RF lines and antenna output cable connector. Obs.: It is normal for the temperature of the equipment's internal passive to be between 45ºC and 50ºC.			
		(5.2) Check the room temperature of the transmitter.			
		(5.3) Check the RF cable air pressurizer.			
		(5.4) Check the connections and AC cables of the power distribution board, circuit breaker and transmitter cables (AC current and temperature).			
6.	Adjusting Quiescent Currents	Adjust the quiescent currents of the transistors through the driver display (Screen: Setup Menu -> **Transistor Aging Adjustment**). Note: When performing this operation, the programmed power will change to 0W. After adjusting the currents, set the output power to the same value that was programmed (Display: Setup Menu -> **Power Setup**).			

Responsible: Date:

6.2.1 Quiescent currents Automatic adjustment procedure

Due to natural variations of LDMOS devices as they operate over time, it is recommended to re-do the setting of the quiescent current of the amplifier modules' transistors. This "re-tuning" procedure has been automated and is done by accessing the Transistor Aging Adjustment screen (21/21) in the Setup menu of the digital driver and it will take only a few seconds. Here is the recommended frequency to perform this procedure:

- Once after 3 months of operation
- Once every 6 months

NOTE: For Further details regarding the Quiescent Currents Automatic adjustment, refer to section 5 of the device's manual.

6.3 Corrective Maintenance

6.3.1 Visual identification of alarms (leds)

STEP 1 Check the driver's front panel for the status of each led.

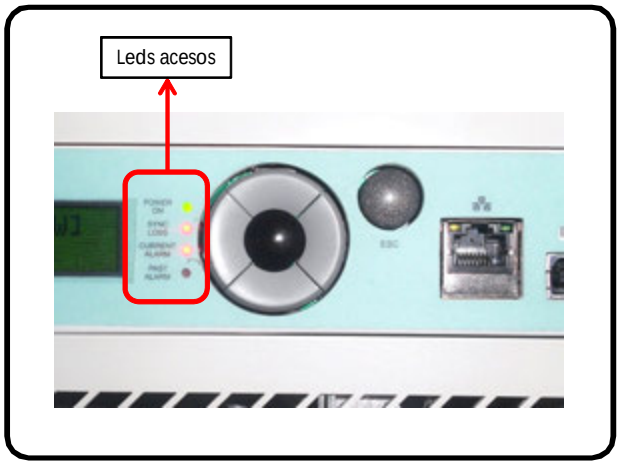


Figure 1 - Front partial view of the driver

The front panel LED indicates when lit:

POWER ON – Device is on
SYNC. LOSS – Input Signal Loss.
CURRENT ALARM – An alarm is occurring.
PAST ALARM – Existence of an old alarm in the "Alarm Log".

STEP 2 If the Sync Loss led is on, check the signal cables on the top panel of the equipment and the connections on the rear panel of the exciter.

STEP 3 If the Current Alarms LED is lit, access the alarm menu (**Main Menu → System Alarm/Log → Power Setup**) and check the existing alarms.

6.3.2 Measurement readings

6.3.2.1 Power Drawer

STEP 1 Check the voltage, current and temperature measurements of the power drawer modules.
Access on the exciter front panel: **Main Menu → Measurements → Drawers** and compare with the equipment measurements report. If there is any abnormality, contact the Hitachi Kokusai Linear Service Department.

6.3.2.2 AC Unit (MCCB) - Only high power transmitters – HP Series

STEP 1 Check the voltage measurements of the AC unit (MCCB) source located at the bottom of the equipment.
Access on the exciter front panel: **Main Menu → Measurements → Eqp.Power Supply** and compare with the equipment measurements report. If there is any abnormality, contact the Hitachi Kokusai Linear Service Department.

6.3.3 Power Drawer Air Filter

6.3.3.1 Replacement

Replacing the air filter is recommended only in the power drawers (MOD GV 40001) of the E-Compact high-power transmitters.

For replacement, see the steps below.:

STEP 1 Remove the four screws from the front panel of the drawer.

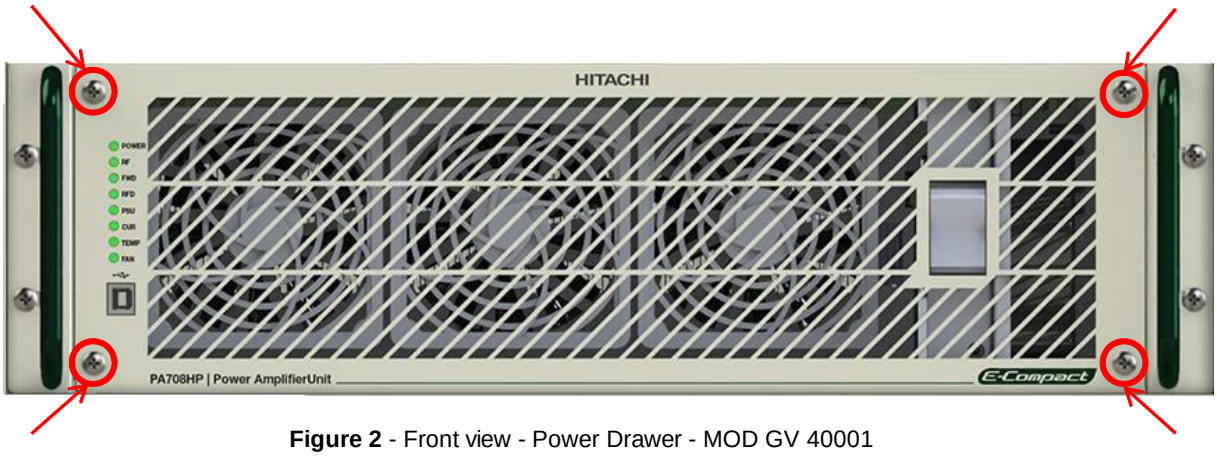


Figure 2 - Front view - Power Drawer - MOD GV 40001

STEP 2 Detatch the front panel.

STEP 3 Disconnect and remove a first degree of protection from the air filter.

STEP 4 Remove the air filter.

STEP 5 Remove the last grid of the air filter.

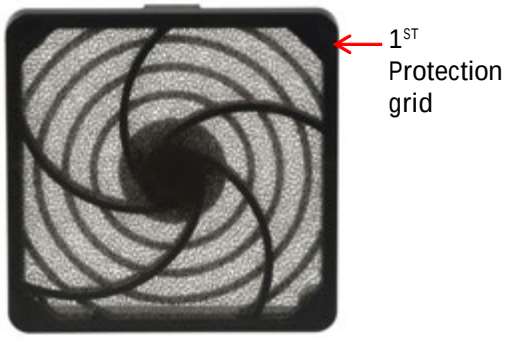


Figure 3 - Fan with air filter

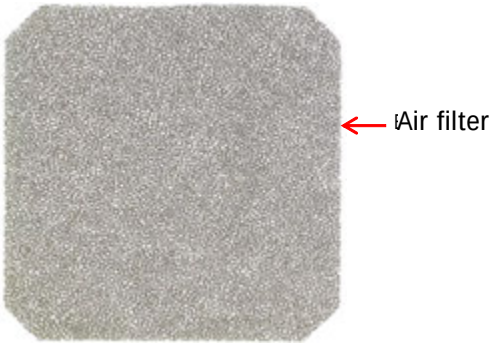


Figure 4 - Foam air filter

STEP 6 Replace each fan air filter and reinstall it by reversing the order of steps above.

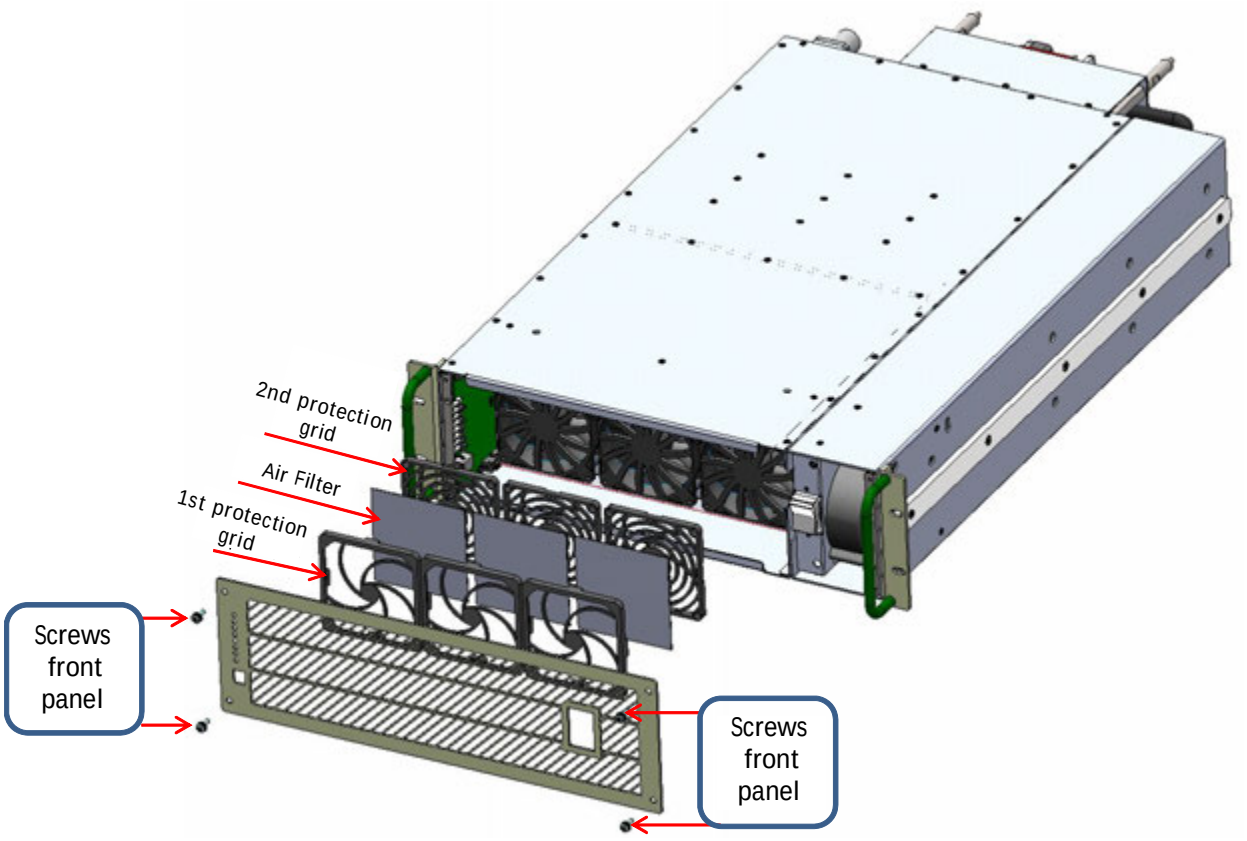


Figure 5 - Power Drawer - MOD GV 40001

Order Information:

ITEM	DESCRIPTION	HITACHI CODE	REFERENCE
1	FIL VEN 109-1001M13	HKL1000263	AIR FILTER

Note:
For a correct fitting of the 1st protection grid in the 2nd protection grid, the design of the 1st grid must match the design of the 2nd grid.

6.3.3.2 Cleaning

The power drawer air filters (MOD GV 40010) of the medium power transmitters are washable and can be removed by the front panel of the drawer.

Below is the sequence for removing the air filter.

STEP 1 Remove the screws from the front panel of the drawer.

STEP 2 Remove the front panel of the drawer.

STEP 3 Remove air filter bolts.

STEP 4 Clean with compressed air, wash with detergent / water, or replace if necessary

STEP 5 Reinstall the air filters by reversing the order of steps above.

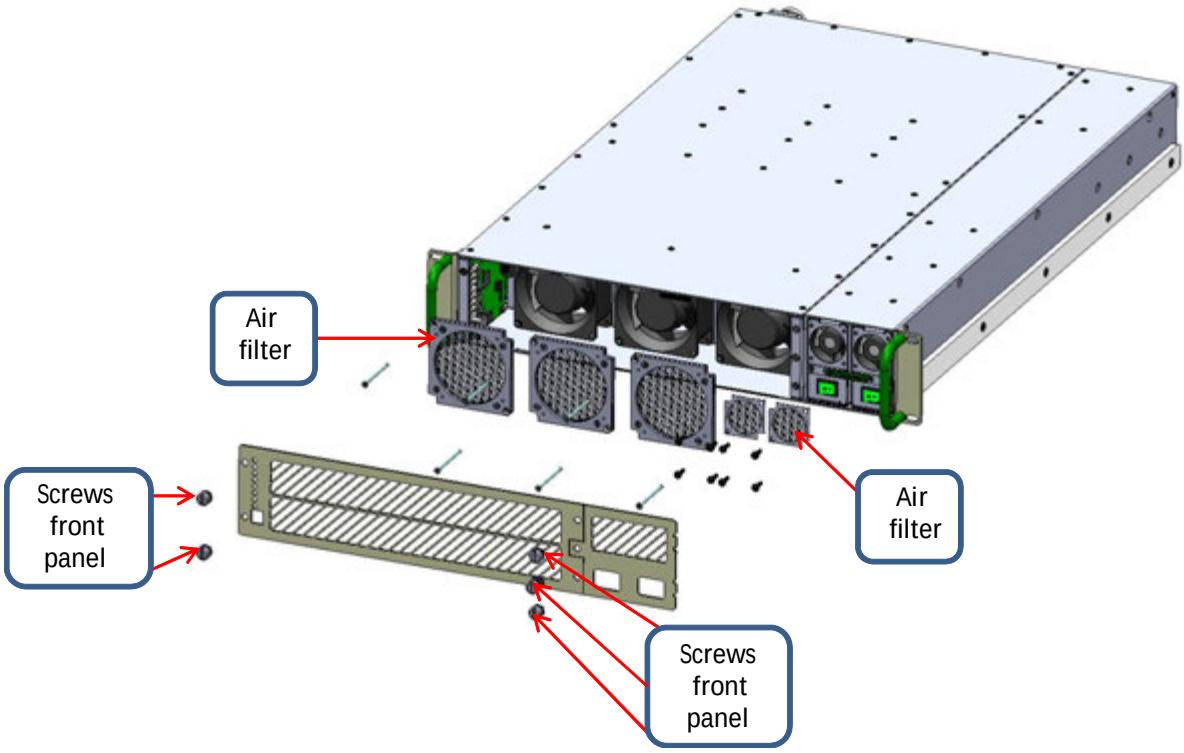


Figure 6 - Power Drawer - MOD GV 40010/40033

CAUTION:
It is recommended, periodically to clean the air filter, avoid blocking the air passage and, consequently, the heating of the transmitter.
If you need to change the air filter, contact the Hitachi Kokusai Linear.

6.3.4 Power Drawer Fan Replacement

Power Drawer MOD GV 40001 (High Power)

For replacement, see the steps below:

STEP 1 Remove the four screws from the front panel of the drawer.

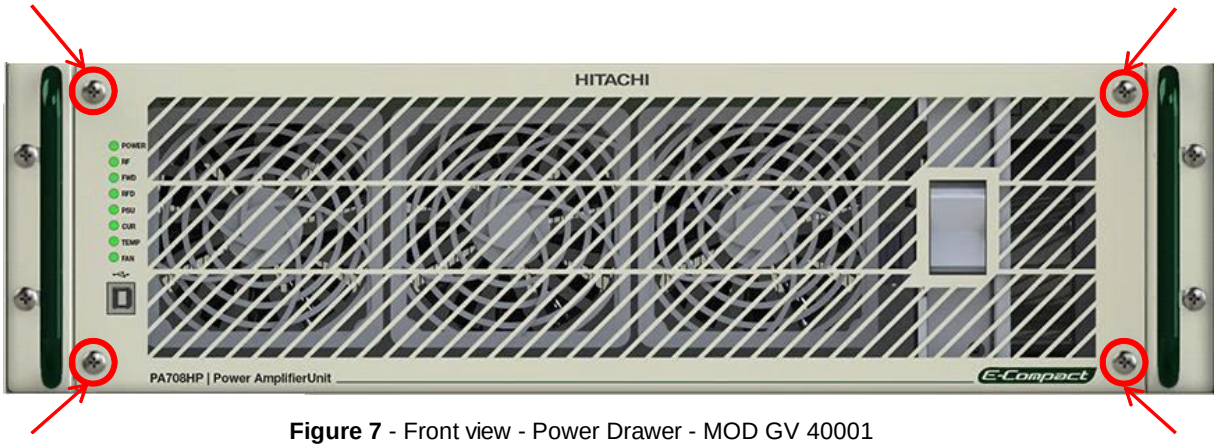


Figure 7 - Front view - Power Drawer - MOD GV 40001

STEP 2 Detatch drawer's front panel.

STEP 3 Carefully detach and remove the first filter screen from the air filter.

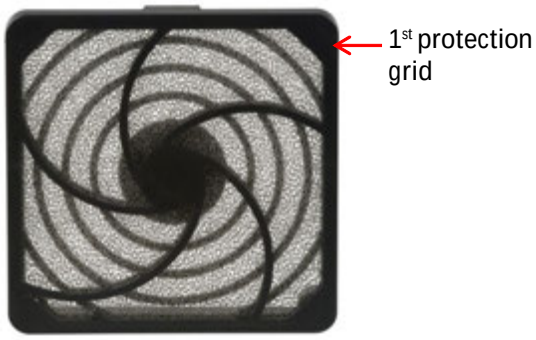


Figure 8 - Air filter's 1st protection grid

STEP 4 Remove the last filter grid from the air filter and the fan.

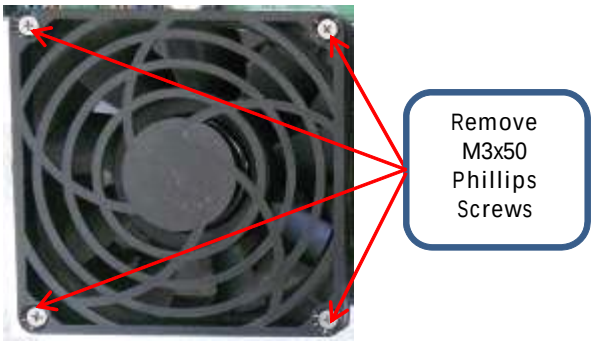


Figure 9 - Fan

STEP 5 Disconnect the plug cables from the fan bus board (CIP 8861).

Figure 10 - Fan connection

STEP 6 Replace the three fans.

STEP 7 Reinstall the fans by reversing the order of the above steps

Power Drawer MOD GV 40010 / 40033 (Medium Power)

To replace the fans, follow the steps below.:

STEP 1 Remove the screws from the front panel of the drawer.

STEP 2 Remove the front panel of the drawer.

STEP 3 Remove air filter screws.

STEP 4 Clean with compressed air, wash with detergent / water, or replace if necessary.

STEP 5 Remove the screws from each fan.

STEP 6 Disconnect the plug cables from the fan bus board (CIM 30260).

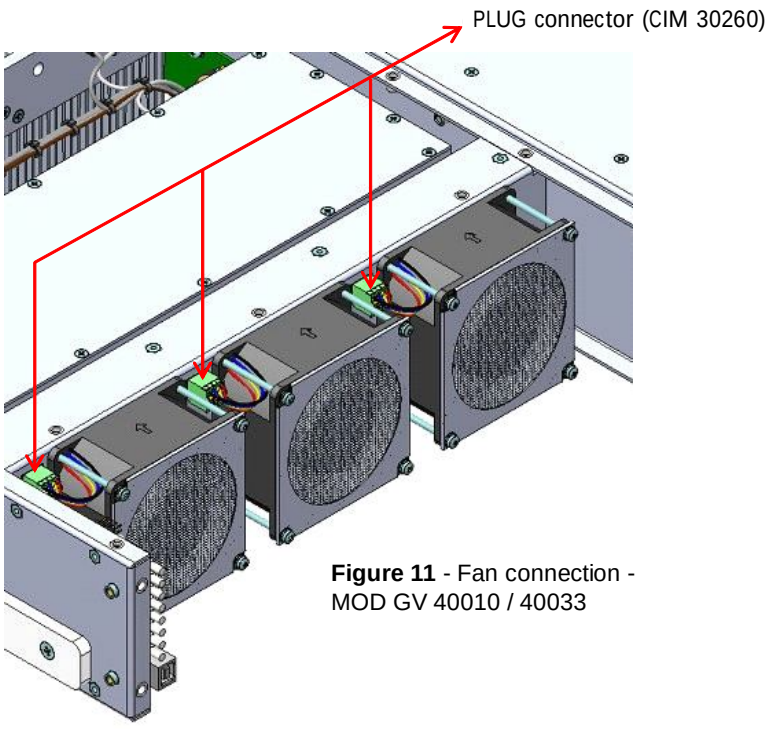


Figure 11 - Fan connection - MOD GV 40010 / 40033