

Operation Manual

HITACHI
Inspire the Next

UHF Digital TV Transmitters

ATSC 3.0: 420 Watts RMS

ATSC 1.0: 500 Watts RMS

E-Compact Medium Power Series

EC702MP-BB3

EC704MP-BB3



Read before handling the equipment.

W A R N I N G

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Operation Manual
UHF Digital TV Transmitters
ATSC 3.0: 210 to 420 Watts RMS
ATSC 1.0: 250 to 500 Watts RMS
E-Compact Medium Power Series
EC704MP-BB3

Rev R04 – EN-US

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2. Abbreviations

1PPS	One Pulse per Second
A	Amperes
AC	Alternating Current
A-DPD	Adaptive Digital Pre-distortion
AF	After Filter
ALC	Automatic Level Control
ASI	Asynchronous Serial Interface
ASL	Above Sea Level
ATSC	Advanced Television System Committee
BF	Before filter
BISS	Basic Interoperable Scrambling System
BTS	Broadcast Transport Stream
BTU	British Thermal Unit
CAM	Conditional Access Module
dB	Decibel
DC	Direct current
DDP	Potential Difference
DPD	Digital Predistortion
DSP	Digital Signal Processing
DVB-S	Digital Video Broadcasting – Satellite
DVB-S2	Digital Video Broadcasting – Satellite – 2nd generation
FPGA	Field Programmable Gate Array
FWR	Forward
HKL	Hitachi Kokusai Linear
IP	Internet Protocol
ISDB-T	Integrated Services Digital Broadcasting Terrestrial (Brazil)
ISDB-Tb	Integrated Services Digital Broadcasting Terrestrial
LCD	Liquid Crystal Display
LPC	Linear Pre correction
MCCB	Molded Case Circuit Breakers
MER	Modulation Error Rate
MFN	Multiple Frequency Network
MSps	Million Sample per Seconds
N/A	Not Applicable
NLPC	Non-Linear Pre Correction
PA	Power Amplifier
PCMCIA	Personal Computer Memory Card International Association
PFC	Power Factor Correction
PID	Packet Identifier
PLL	Phase Locked Loop
PS	Power Supply
PSI	Program-specific information
PSU	Power Supply Unit
PW	Power
RPM	Rotations Per Minute

RTP	Real-Time Transport Protocol
RU	Rack Unit
SFN	Single Frequency Network
SI	Service Information
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
TMCC	Transmission and Multiplexing Configuration Control
TS	Transport Stream
TSoIP	Transport Stream over Internet Protocol
U	RU - Rack Unit
UDP	User Datagram Protocol
UHF	Ultra High Frequency
UPS	Uninterruptable Power Supply
V	Volts
VAC	Volts Alternating Current
VGA	Variable Gain Amplifier
VGS	Voltage Gate Source
VSWR	Voltage Standing Wave Ratio
WxDxH	Width x Depth x Height

3. About this Manual

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

EC702MP-BB3

210 W UHF ATSC 3.0 Transmitter (6-poles filter)

250 W UHF ATSC 1.0 Transmitter (6-poles filter)

EC704MP-BB3

420 W UHF ATSC 3.0 Transmitter (6-poles filter)

500 W UHF ATSC 1.0 Transmitter (6-poles filter)

Hitachi Kokusai Electric Comark LLC recommends that you carefully read this manual before installing or operating the equipment.



This manual is intended for use by qualified, trained installers.



Read this manual before working with the product. For personal and system safety, as well as for optimum product performance, one must be sure to thoroughly understand the contents before installing, operating, or maintaining this product.

4. Basic Knowledge Required

The mandatory knowledge and skills to operate the equipment are as follows:

- Knowledge of RF electronic circuits
- Knowledge of electricity and electrical systems
- Knowledge of digital electronics
- Experience conducting tests and Digital TV signal measurements in ATSC standards
- Knowledge of transmission antennas
- Experience operating radio frequency measurement equipment
- Practice in the management of radio frequency measuring equipment (spectrum Analyzer, RF power meter, Vector Network Analyzer, couplers, attenuators, etc)

5. Structure

This manual is comprised of seven sections, which provide the following information:

Section 1 - Care, Warranty, and Service

This section indicates the necessary care with the equipment, warranty, criteria, and technical assistance if needed.

Section 2 - Minimum Installation Requirements

This section comprises the minimum infrastructure requirements for installing these devices, such as AC power, protection against lightning, and air conditioning.

Section 3 –E-Compact BB3 High Power Series UHF Digital TV Transmitter

This section presents all equipment characteristics, such as description, models, functional description, and technical specifications of all the models of the E-Compact series of High-Power Transmitters.

Section 4 - Installation

This section provides procedures for physical and electrical installation.

Section 5 - Initial Activation

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

Section 6 – Preventive Maintenance

This section provides information for preventive maintenance.

Section 7 - Attachments

This section provides additional information for this document.

Section 1 - Care, Warranty, and Service

1. Care and Safety



Never open the device, as there is a risk of electric shock. If necessary, contact Hitachi Service.



Before Connecting the Machine to the AC Mains, one must ensure that the grid Voltage meets the equipment's settings.



Never expose the equipment to rain, moisture, or direct sunlight in order to avoid the risk of fire or electric shock.



Avoid risks of accidents with regards heights and electricity. Always install or maintain this equipment using qualified technicians.



Never turn on the equipment without connecting it to an Antenna or RF Load, as this may cause serious damage to the Equipment.



Never unplug any Power Amplifier Drawers while the Transmitter is on, as this may result in a risk of equipment damage.

2. Warranty

1. All equipment shall have warranty coverage by the supplier against manufacturing or assembly faults conducted by the supplier for the period of 12 months, beginning upon the issuing of the sales invoice. The period is irrevocable except in cases of extended warranty previously noted in the contract.
2. During warranty time, the supplier will repair, with no additional charge, the faulty products, providing adjustments, replacing or re-manufacturing 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 is 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 to have the supplier's technical personnel travel to the Purchaser's location, 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 hereinafter 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 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.

2.1.FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A Digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. The antenna(s) used for this transmitter must be fixed-mounted on the outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of §1.1307(b)(3).

2. Changes or modifications not expressly approved by Hitachi Kokusai Electric Comark LLC could void the user's authority to operate the equipment. 3. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

3. Technical Assistance

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

Therefore, in case of maintenance please contact:

Hitachi Kokusai Electric Comark LLC

Phone: (800) 345-9295 / Fax: (413) 998-1194 E-mail: support@comarktv.com

While submitting a request for assistance, please provide the following information: Customer 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 for the invoice.

Section 2 - Minimum Installation Requirements

W A R N I N G

Minimum infrastructure requirements for installation and operation of TV transmitters

1. Adequate Grounding
2. Proper Lightning protection system
3. Shelter with ventilation, footprint, and temperature in compliance with the transmitter's standards
4. Surge suppressors

Defects caused by improper installation or failure to comply with the minimum infrastructure requirements for installation and operation of the products will relieve Hitachi Comark of the contractual warranty.

1. Introduction

This section provides information on the minimum installation requirements for ATSC E-Compact Series transmitters with recommendations on shelter, tower, antennas, cables, grounding, mains, transient preventions, etc.

2. Minimum Requirements

2.1. AC Mains - Wire Gauge

The following details the consumption with the equipment running at its maximum power.

Current (A) on each wire:

	M110			M220			B220			T220			T380		
	110VAC $\pm 15\%$ Between Phase and Neutral			220VAC $\pm 15\%$ Between Phase B (Wild Leg) and Neutral			220VAC $\pm 15\%$ Between 2-Phases			220VAC $\pm 15\%$ Between 3-Phases.			380VAC $\pm 15\%$ Between 3 Phases 220VAC $\pm 15\%$ Between each Phases and Neutral		
MODEL	M110			M220 / B220			T220			T380					
	(A)	Wire Gauge		(A)	Wire Gauge		(A)	Wire Gauge		(A) Typical	Wire Gauge				
		mm ²	AWG		mm ²	AWG		mm ²	AWG		mm ²	AWG			
EC702MP-BB3	8.6	4.17	11	5.0	3.31	12									
EC704MP-BB3*	14.3	6.63	9	8.2	4.17	11									



Not available or uncommonly used

*EC704MP-BB3 operates on M110 electrical network using two PSUs.

The current values specified in the table are according to the load of each phase, which will determine the size of the conductors and protection.

Said gauge is the minimum recommended for the transmitter in question, if the cable length is longer, consider a voltage drop in the cable maximum of 5%.

The section of the neutral conductor should be the same as the phase.

The section of the ground conductor must be the same as the conductor's phase.

2.2. Grounding

The grounding system to which the Comark TV transmitter will be attached is suggested to be designed and implemented by a qualified professional. An improper grounding system may jeopardize the equipment as well as the lives-of the professionals working in the shelter. To be considered proper, the grounding is suggested have a resistance of no more than 5 Ohms.

It is recommended that all of the devices involved in the transmission system are that the same potential, so that there is no DDP, favoring the equilibrium of the flow of the atmospheric load.

It is important to state that if there is a need for chemical alteration of the soil, in order to provide the lowest impedance, it establishes a temporary condition for not being part of the natural chemistry of the place, thus being naturally absorbed. In this condition, preventive soil analyzes should be conducted as preventive maintenance procedure.

2.3. Stability

The voltages in each TV Transmitter phase should be stabilized. The use of voltage stabilizers or stabilized uninterruptible power systems (UPS's) is necessary since these devices can protect the TV transmitter from power surges. The voltage stabilizer or UPS design would be most effective if exclusively used with the Comark TV transmitter and is sized to operate at least 30% above the kVA consumption specified by the TV transmitter. For example, for the TV transmitter with maximum consumption of 38kVA, a voltage stabilizer, or 50kVA UPS should be used.

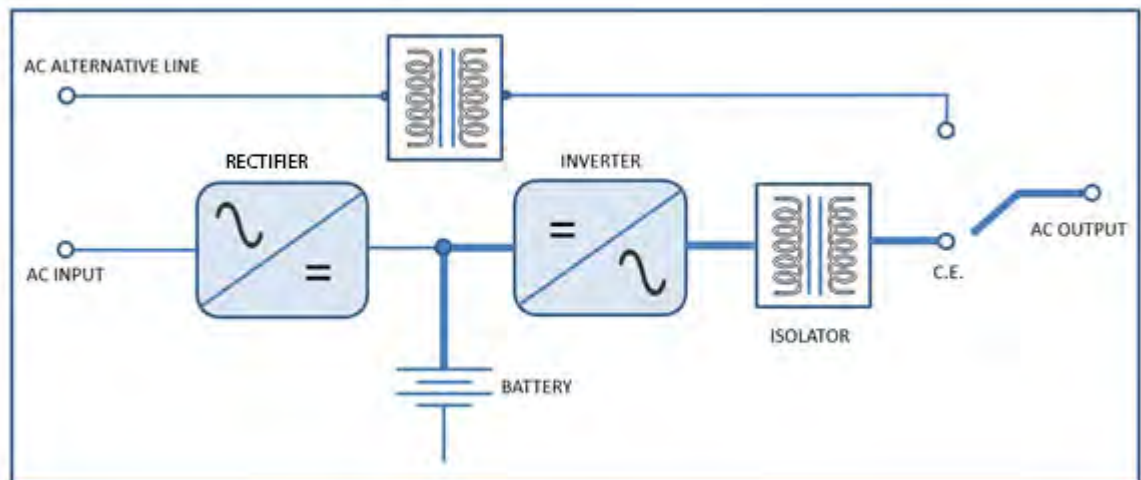
Input voltage variations above 15% of the rated values specified for the Comark TV transmitter may cause damage to the equipment and in this case will not be covered by the factory warranty. In addition, it is important to check the potential difference between the ground and neutral terminals (if any) that will be connected to the Comark TV transmitter. This potential difference should be at most 3V.

2.4. Insulation

It is recommended to have isolation between the energy stations of the shelter and the TV transmitter, which is achieved with the usage of isolator transformers. This guarantees that no AC Mains' transient coming from the shelter will be passed on to the TV transmitter or vice-versa. Besides, Comark's transmitters feature switching power supplies that require purely sinusoidal power inputs and voltage regulators / no-breaks without isolator transformers that have no assurance of a purely sinusoidal outputs. It is suggested that the isolator transformer should also be exclusive to the transmitter and its dimensioning should use the same standards employed in the dimensioning of the voltage regulators / no-break (ie, at least 30% higher than the specified consumption transmitter's (KVA)).

Recommendations

1. We recommend that the transmitter "never see" the power grid directly.
2. We recommend the use of online double-conversion UPS and / or Delta-conversion online UPS built with transformer insulation and with power factor correction (PFC).



No break example with Isolating Transformer

Benefits:

These types of UPS bring great protection and insulation to the transmitter due to its design.

The double conversion occurs because the AC network converts to DC and the DC voltage converts back to AC, which eliminates any disturbance in the AC mains when converted to DC, thus protecting the transmitter.

It is important to note that UPS's do 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.

The correction of the power factor (PFC) in the no break is necessary to reduce the cost of the electric energy, as it reduces the reactive power (VAr) and the total power (VA).

It is important to emphasize that it is not efficient to have a transmitter with power factor correction (PFC) powered by a no-break without PFC, as all the advantage achieved by the transmitter is lost in the UPS, resulting in no energy savings. When this type of connection made you actually have an excellent load (resistive behavior) for the no-break but your power grid will see the no-break input (without PFC, high consumption).

When we have a power factor correction (PFC) UPS, it performs well (low reactive power, low power consumption) within the network even if it is connected to a PFC-free transmitter, as it will correct the power factor of the entire system.

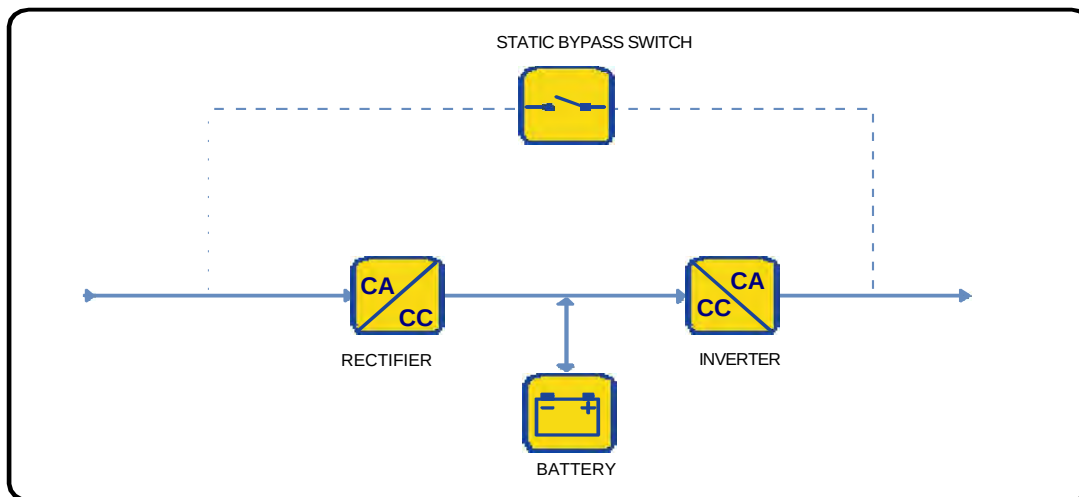
Nobreak capability

$$\text{Nobreak Power} = P_{TX} * (\cos \Phi * \eta_{(\text{nobreak})})$$

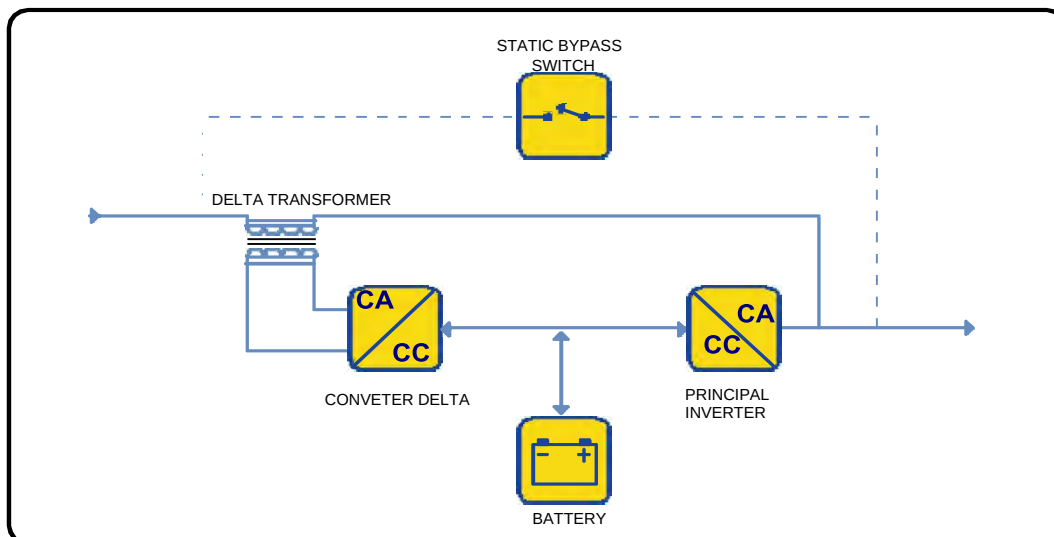
P_{TX} : Real Power [W]

$\cos \Phi$: Transmitter Power Factor Correction

$\eta_{(\text{nobreak})}$: Nobreak efficiency



Double Conversion Online Nobreak



Delta Conversion Online Nobreak

2.5. Atmospheric Discharge Protection System

2.5.1 Lightning rods

The Atmospheric Discharge Protection System consists of the lightning rods and their elements. The tower and shelter where the equipment will be installed must be protected against atmospheric discharges by means of lightning arresters.

It is important to determine that all ferrous parts and accessories that make up the Atmospheric Discharge Protection System should be galvanized.

In the path comprised of the lightning rod to the drainage well, no splicing is allowed, much less pathways with acute angles (angles of less than 90°).

2.5.2 Protectors

The use of coaxial protectors is advisable for cables connecting external devices (antennas, microwave heads, tower inverters) to the internal ones. These protectors are devices equipped with gas spark plugs, which shorten to earth any discharge occurring in the coaxial cable. They should be kept in the shelter near the equipment and with the ground wire connected to the ground of the equipment rack.

It is favorable to use Faraday's Ring or Cage on hilltops and areas of many transmission sources, which in turn isolates the transmitter from the electromagnetic fields avoiding interference caused by induction.

2.6 Air Conditioning

2.6.1 Temperature

For better performance and longer equipment life, it is important that, under the shelter, the temperature is controlled strictly by means of air conditioners. For the shelter's design, one should consider the thermal dissipation specified for the transmitter (reported in BTU / h), the dissipation of the other devices inside the shelter, the thermal load generated by the solar incident, and other thermal loads present in the shelter. In addition, it is recommended that the shelter's internal pressure be slightly positive to prevent the entry of contaminants. According to the transmission power, the internal temperature of the shelter should be:

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

If Comark equipment is damaged by the lack or inefficiency of the HVAC system, it will NOT be covered by the factory warranty.

2.6.2 Humidity

Relative air humidity inside the shelter is also considered a critical factor for improved performance and longer equipment life. Comark equipment should operate in dry environments, which can also be achieved using air conditioners. According to the transmission power, the relative humidity inside the shelter should be:

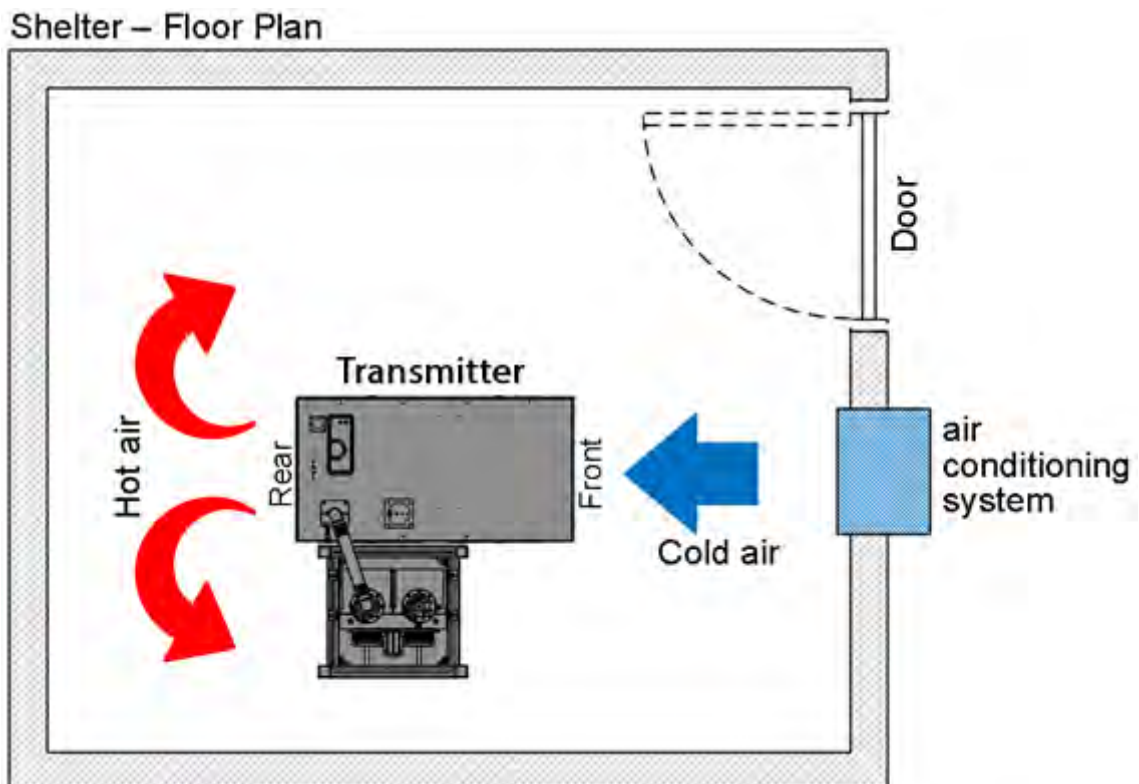
- E-COMPACT LOW POWER TV TRANSMITTERS: 0 to 90%
- E-COMPACT MEDIUM POWER AND HIGH-POWER TV TRANSMITTERS: 0 to 80%

There must never be condensation since water can damage the internal circuits of the transmitter.

2.6.3 Cooling

Cooling must be always in circulation, with the air conditioning lowering the temperature of the room, without external air intake. For better performance of the cooling system, the air conditioner must be installed in series with the transmitter cooling cycle, directing the output air conditioning flow to the front of the Comark transmitter.

The physical installation of the transmitter should protect a free area around it for better cooling efficiency and access to maintenance. See image below:



2.7 AC Load and Thermal Dissipation Information for Infrastructure Install

E-Compact High Power Broadband ATSC	AC Load for infrastructure Install (W)	Thermal Dissip. for infrastructure Install (BTU/h)
EC702MP-BB3	1092	2974
EC704MP-BB3	1812	4478

Section 3 – E-Compact BB3 Medium Power Series UHF Digital TV Transmitters

1. Overview

The E-Compact High-Power family of air-cooled Doherty solid-state transmitters from Comark was designed specifically for the repack marketplace. Its design is simple, rugged, reliable, and ultra-efficient. Advanced standard features are included to ensure:

- maximum transmitter efficiency using Doherty amplifiers
- maximum flexibility with broadband amplifier technology (470-608MHz)
- optimum signal performance in all operating modes
- maximum reliability for 100% power output
- ease of initial setup and operation
- ease of monitoring and diagnostics
- flexible solutions for all installations

The E-Compact Medium Power BB3 Family of solid-state DTV transmitters includes two models that provide transmitter power outputs (TPO) from 210 to 420 watts ATSC 3.0. Each power amplifier module has an excellent power density, with 2RU and 19", and features features high gain Broadband Doherty LDMOS configured for transmitting up to 510 Wrms (ATSC 3.0). Doherty Technology provides high efficiency and consumption cost reduction of up to 60% when compared to conventional transmitters. The transmitters are compliant with all FCC and ATSC requirements.

We recommend the use of the EXACT-V2 DTV driver with linearization circuits to compensate for linear and non-linear distortions for the E-Compact High-Power line transmitters. EXACT-V2 is software upgradeable for compatibility with ATSC 3.0.

The E-Compact family of solid-state TV transmitters includes a human-machine interface via an LCD display on the front panel and menus activated by programmable keys. Alarm indicators and normal controls, as well as power readouts, are available on the LCD.

2. Specifications

- ⇒ IP Input
- ⇒ Control Module present
- ⇒ Switcher Module present
- ⇒ Power amplifier drawer
- ⇒ High efficiency with Doherty technology
- ⇒ Air cooled
- ⇒ Automatic Fan Speed Control providing low noise levels, energy saving and increased lifespan
- ⇒ Power supplies featuring Power Factor Correction better than 0.95
- ⇒ Measures and alarms through front display and keypad or remotely
- ⇒ VSWR and Overdrive protection via hardware with power reduction
- ⇒ Software oriented overheating protection for internal modules
- ⇒ Adaptive 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
- ⇒ Isolated combiner, enabling Hot Swap
- ⇒ Main Control Software, WEB Server and SNMP
- ⇒ USB communication Drivers
- ⇒ Passive elements: Low-pass filter before and after filter probes

Optional:

- ⇒ Telemetry through GPRS interface
- ⇒ Exciter
- ⇒ GPS time base (exciter's internal module)

RF Performance

Modulation Standard	ATSC 3.0 A/300 ATSC 1.0 A/53		
Output Power (Before Filter)		EC702MP-BB3	EC704MP-BB3
ATSC 3.0		267 W	508 W
ATSC 1.0		321 W	610 W
Output Power (After Filter)		EC702MP-BB3	EC704MP-BB3
ATSC 3.0		210 W	420 W
ATSC 1.0		250 W	500 W
Minimum operating power		EC702MP-BB3	EC704MP-BB3
ATSC 3.0		21 W	42 W
ATSC 1.0		25 W	50 W
50Ω RF Output Connector	DIN 7/16" EIA 7/8" EIA 1-5/8"		
RF Output Regulation	≤± 0.1 dB		
UHF Operation Frequency	470MHz to 608MHz / Ch 14 to Ch 36 608MHz to 698MHz / Ch 37 to Ch 51		
Bandwidth	6 MHz		
RF Input Level	+6 dBm (typical)		
ATSC 3.0 MER Performance	≥33dB		
ATSC 1.0 MER Performance	≥35dB		
Harmonics/Spurious	better than -60dBc		

Electrical Features

Power Requirement ⁴ (specify configuration at equipment purchase order)	EC702MP-BB3 Single-Phase (M110) Single-Phase (M220) Biphasic (B220)	EC704MP-BB3 Single-Phase (M110) for two-PSU Single-Phase (M220) Biphasic (B220)
AC Power <i>For use one or two PSU, see Section 3, topic 3.2.2. PSU Redundancy, AC mains, RF Output Power (TPO)</i>	EC702MP-BB3 100~253VAC (one PSU)	EC704MP-BB3 100~253VAC (two PSU) 187~253VAC (two PSU)
AC mains Frequency	47 to 63Hz	
Power Factor Correction	0.97/230VAC at full load	
Typical Consumption ⁵ ATSC 3.0 ATSC 1.0	EC702MP-BB3 887 W 990W	EC704MP-BB3 1556 W 1750 W
Typical Thermal Dissipation ⁵ ATSC 3.0 ATSC 1.0	EC702MP-BB3 2309 BTU/h 2524 BTU/h	EC704MP-BB3 3874 BTU/h 4263 BTU/h

Interfaces

Monitor / Control Interface	Web GUI and SNMP: Ethernet ¹ via RJ-45
Communication Interfaces	Ethernet ¹ / SNMP
Format	Ethernet ¹ (IEEE 802.3u) 10Base-T/100Base-TX

Mechanical Features

Equipment Weight: Cabinet 19" 10U mounting	EC702MP-BB3 64 Kg (141.0 lb)	EC704MP-BB3 65 Kg (143.3 lb)
Dimensions (Cabinet 19" 10U mounting): Width: Length: Height:	600 mm (23.62 in) 900 mm (35.43 in) 550 mm (21.65 in)	

Environment Features

Operation altitude	up to 8200ft ² ASL ³
Environment temperature range	+32°F to +113°F (+77°F recommended) 0°C to +45°C (+25°C recommended)
Environment humidity range	0 to 95% (non-condensing)
Power Amplifier Cooling	Forced ambient air, front to back flow using integral high volume fans

3. Construction

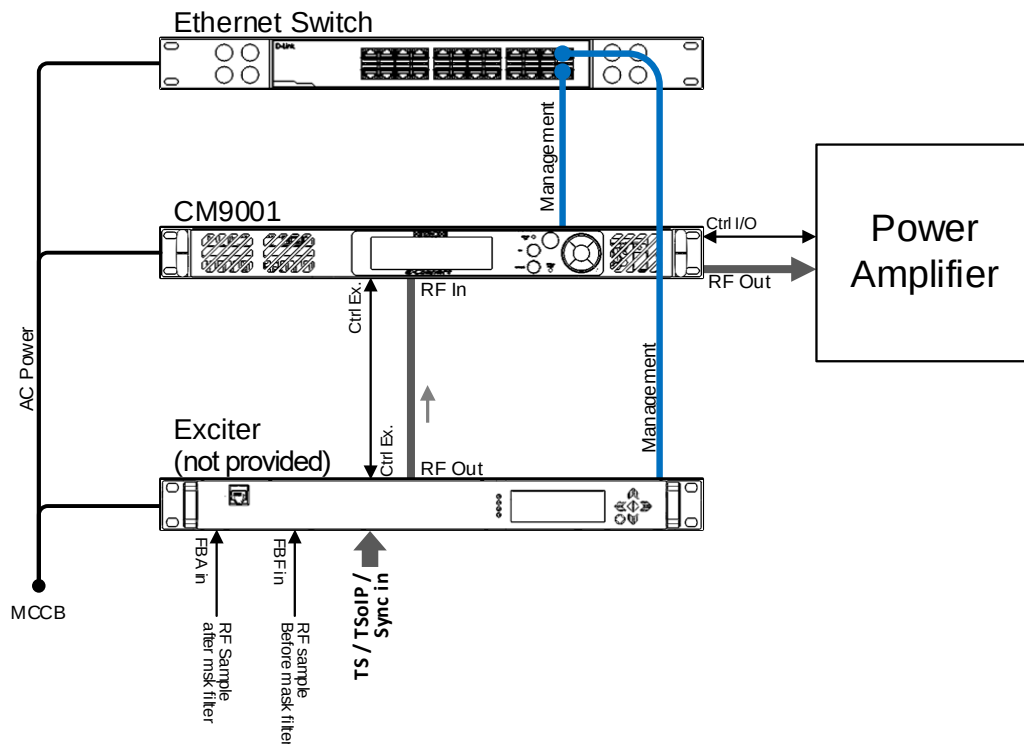
The E-Compact family of low power solid-state DTV transmitters provides maximum flexibility for site layout and installation. Transmitters are installed in custom designed 22" wide (19" panel opening) cabinets. Being available in several configurations depending on the output power, the redundancy option implemented, and the number of channels at a given site.

3.1. Single drive, Dual drive (optional) and touch screen display (optional)



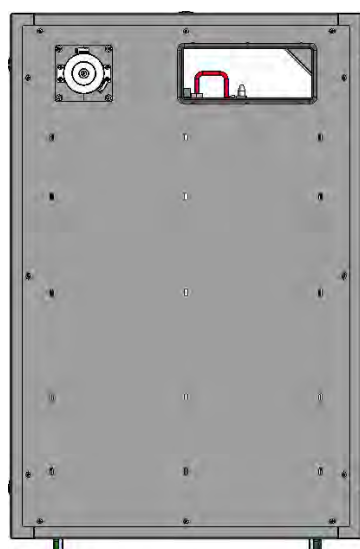
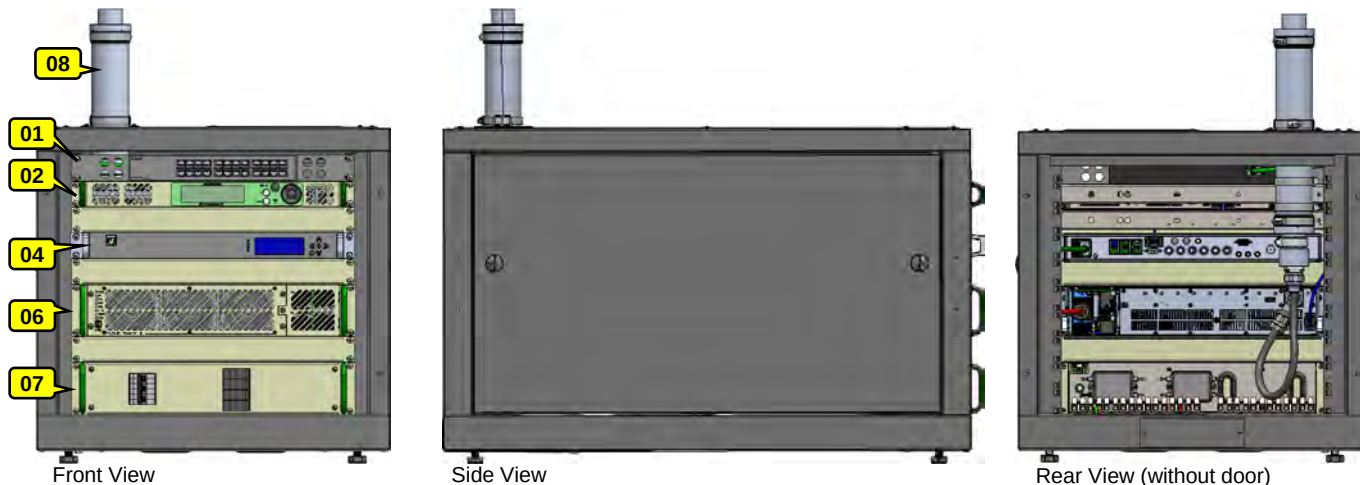
Single Drive

SINGLE DRIVE



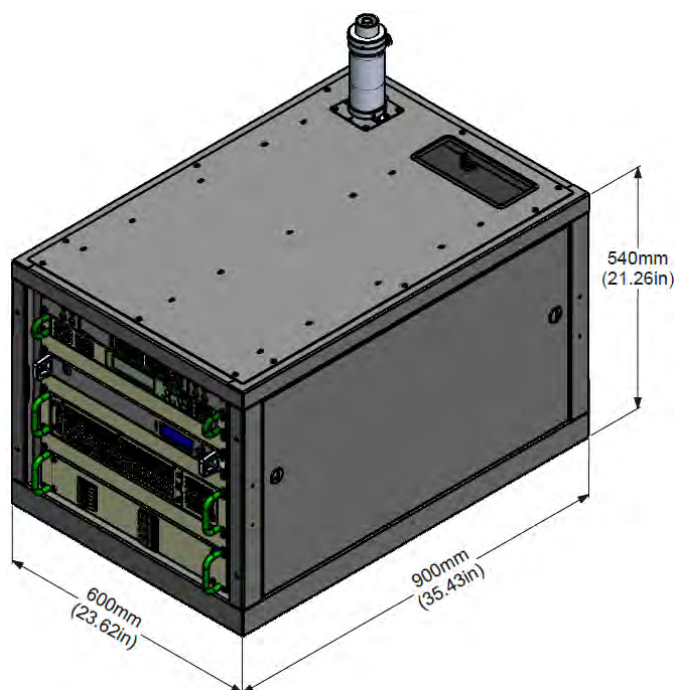
3.2. EC702MP-BB3 / EC704MP-BB3

The transmitter controller is contained in a 1RU chassis and the RF amplifier is contained in a separate 2RU chassis. The digital exciter is 1RU (not provided) for a total of 4RU or 7" of vertical panel space. An equipment rack cabinet (10RU) is supplied.



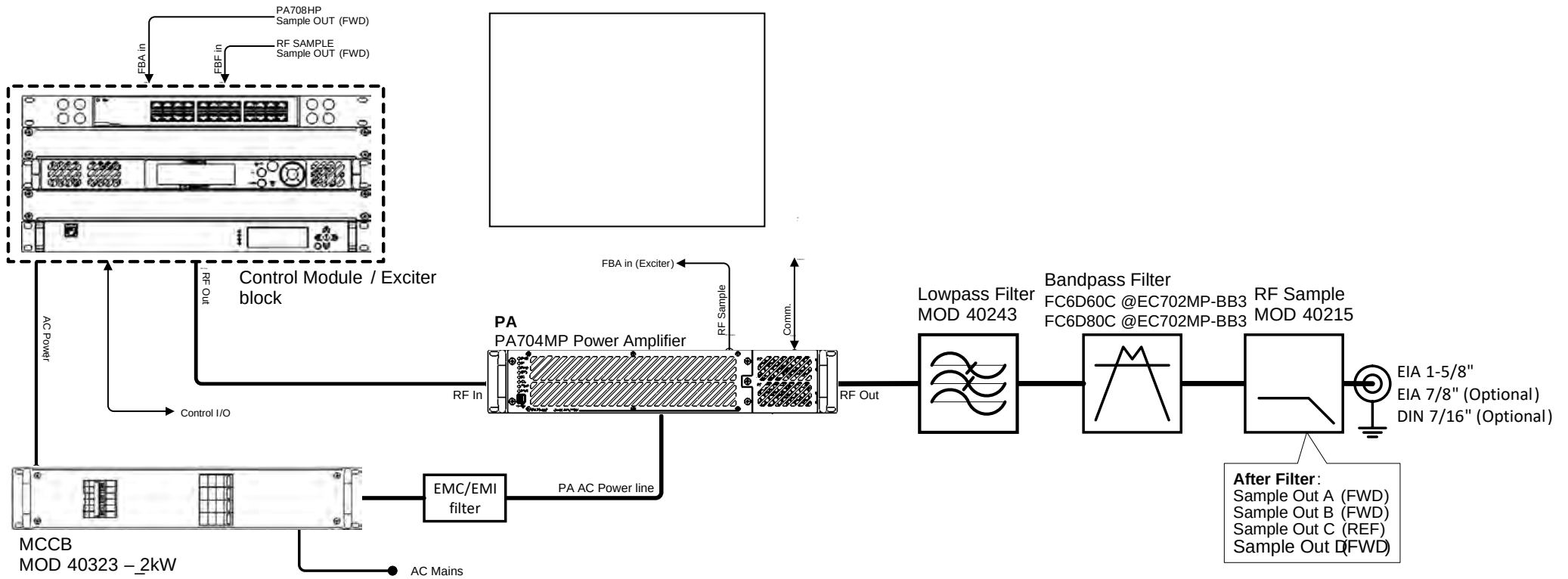
Top View

01	Ethernet Switch Module
02	Main Control Module CM9001
03	Backup Control Module CM9001 (optional)
04	Main Exciter (not provided)
05	Backup Exciter (not provided)
EC702MP-BB3:	
PA702MP – MOD GV 40335: CH14 to CH 36	
PA702MP – MOD GV 40336: CH37 to CH 51	
06	EC704MP-BB3:
PA704MP – MOD GV 40298: CH14 to CH 36	
PA704MP – MOD GV 40309: CH37 to CH 51	
07	MCCB AC Unit – MOD 40323
08	Low Pass Filter





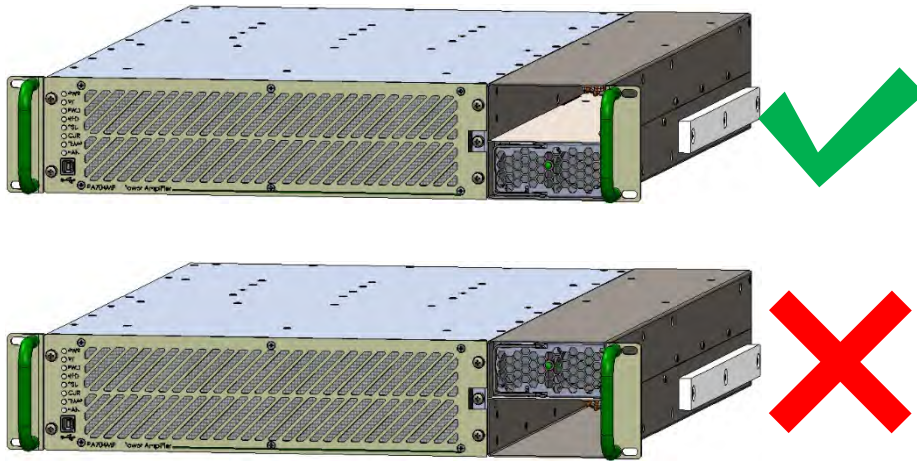
MP-BB3 BLOCK DIAGRAM



3.6.1. MP-BB3 1-PSU / AC Mains



For the 1-PSU configuration, connect the device to the PSU1 slot. Do not use the PSU2 slot:



3.6.2. PSU Redundancy, AC mains, RF Output Power (TPO)

For AC mains **M110** (mains less than 160VAC), the EC704MP-BB3 works with only **1 PSU** but with an output power of **50%**. The Control Module CM9001 will show the "REDUCTION POWER" alarm.

For AC mains **M220/B220** (187 ~ 253VAC), the EC704MP-BB3 works with only **1 PSU** but with an output power of **70%**. The Control Module CM9001 will show the "REDUCTION POWER" alarm.

EC704MP-BB3 - MAXIMUM PROGRAMMED POWER: **350W (ATSC 1.0)**

INPUT VOLTAGE	NUMBER OF PSU OPERATING	OUTPUT POWER
100 ~187 VAC	1	50%
100 ~187 VAC	2	100%
187 ~253 VAC	1	100%
187 ~253 VAC	2	100%

EC704MP-BB3 - MAXIMUM PROGRAMMED POWER: **500W (ATSC 1.0)**

INPUT VOLTAGE	NUMBER OF PSU OPERATING	OUTPUT POWER
100 ~187 VAC	1	50%
100 ~187 VAC	2	100%
187 ~253 VAC	1	70%
187 ~253 VAC	2	100%

EC702MP-BB3 - MAXIMUM PROGRAMMED POWER: **250W (ATSC 1.0)**

INPUT VOLTAGE	NUMBER OF PSU OPERATING	OUTPUT POWER
100 ~253 VAC	1	100%
100 ~253 VAC	2	100%

4. Main Modules

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

Drawers / Modules:

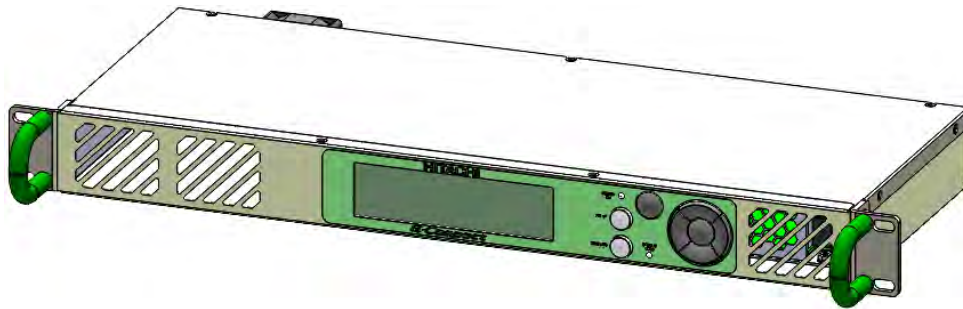
	Control Module CM9001	Power Amplifier PA704MP	MCCB Module
			
EC702MP-BB3	MOD GV 40288	MOD GV 40335/40336	MOD 40323
EC704MP-BB3	MOD GV 40288	MOD GV 40298/40309	MOD 40323

Passives Devices:

	RF Low Pass Filter	RF Out (50 Ω)	RF Output Sample	Mask Filter (Recommended)
EC702MP-BB3	MOD 40243	EIA 1-5/8"	MOD 40215	FC6D60C
EC704MP-BB3	MOD 40243	EIA 1-5/8"	MOD 40215	FC6D80C

N/A: NOT APPLY

4.1. Control Module CM9001 (MOD GV 40288)



The E-Compact series of transmitters utilize a dedicated 1RU controller chassis, CM9001. The controller chassis has several functions including:

- Access to exciter setup / monitoring
- AC mains power monitoring
- RF drive signal monitoring
- RF Exciter Level Control to RF Splitters
- RF power amplifier metrics
- RF output signal monitoring (FWD & RFL)
- Local user interface
- USB port for software diagnostics / updates
- External Web GUI status monitoring and control interface

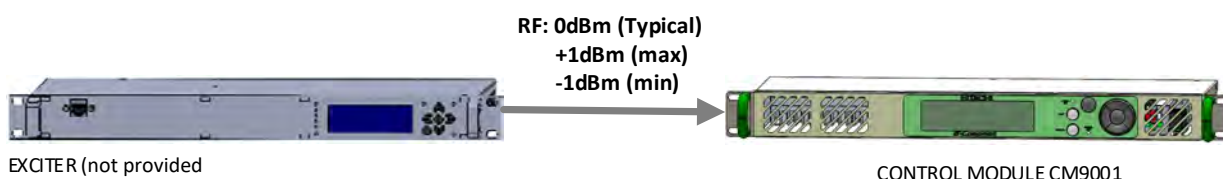
The CM9001 controller gathers the status monitoring of all the transmitter subassemblies to provide to the operator transmitter status information, either locally or remotely. The controller provides transmitter telemetry including RF power monitoring. A user-friendly interface on the transmitter controller chassis includes:

- A front panel LCD screen that provides transmitter status information
- A front-panel control interface for menu driven commands (up/down/right/left navigation, escape, and OK)
- LED status indicators

The CM9001 transmitter controller is paired with the TV exciter. For transmitter systems configured optionally with dual drive, the transmitter is equipped with two / redundant controllers, one for each exciter, eliminating single point failures for even higher system reliability.

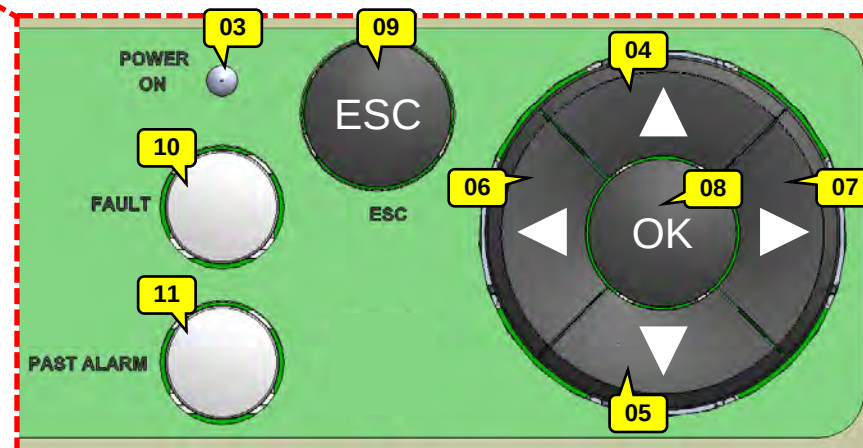
4.6.1. RF Input

The CM9001 Control Module redistributes the RF signal received from the exciter by controlling its level of distribution to the Power Amplifiers Drawers as a function of the transmitter's rated nominal power. For this the CM9001 is set at the factory to receive an RF signal level of **0dBm with minimum / maximum tolerances of -1dBm / + 1dBm**.

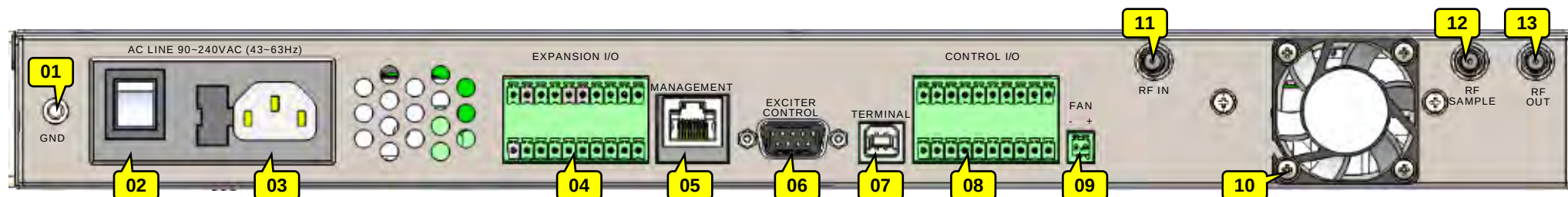


4.6.2. Interfaces

Front Panel

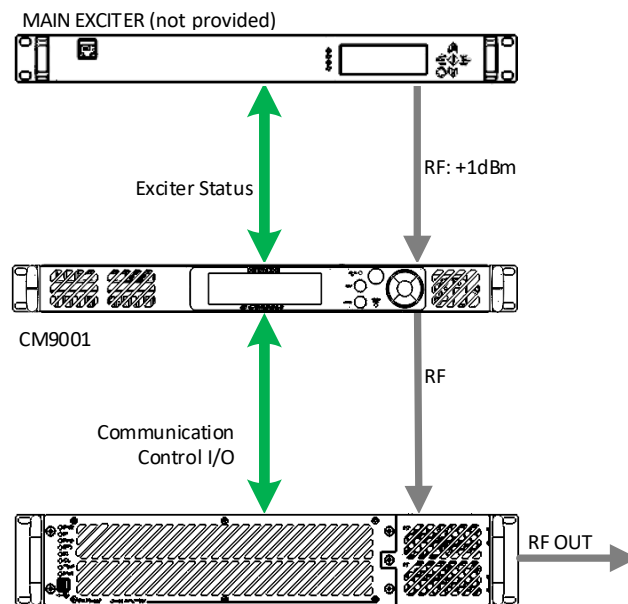


#	Description	Function
01	Air entrance	Air inlet for cooling
02	LCD Display	Navigation display
03	Leds Power On	Signals power on equipment
04	Up key (▲)	Display navigation keyboard.
05	Down key (▼)	
06	Left key (◀)	
07	Right key (▶)	
08	Enter/OK key (OK)	
09	Esc key (Esc)	
10	FAULT	On: Indicates the presence of an Alarm. (Alarm in progress) Pressing shows the list of active alarms on the display
11	PAST ALARM	On: Indicates that an alarm has occurred Pressing the display shows the alarm log list



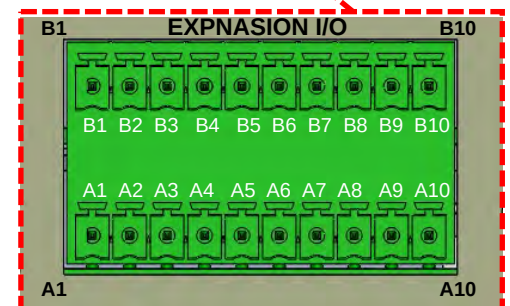
#	Description	Type	Function
01	GND	GND Screw	Chassis GND connector
02	ON/OFF	ON / OFF switch	ON/OFF equipment
03	AC LINE INPUT	Power Jack AC IEC	AC power input
04	EXPANSION I/O	10 pin terminal block	Expansion to Input / output management and control connector
05	MANAGEMENT	RJ45	Interface WEB access
06	EXCITER CONTROL	DB9 male	Exciter monitoring and control interface
07	TERMINAL	USB 2.0 Type B Jack	Access to devices Measurements
08	CONTROL I/O	10 pin terminal block	Input / output management and control connector
09	FAN	2 pin terminal block	Fan 24VDC power connector
10	COOLER (FAN)	--	40x40 DC fan AFB0424SHB
11	RF IN	SMA-Female / 50Ω	UHF TV Digital signal input 0 dBm (± 1 dB)
12	RF SAMPLE	SMA- Female / 50Ω	UHF TV Digital signal output sample -31dB
13	RF OUT	SMA- Female / 50Ω	UHF TV Digital signal output -20dBm to +23dBm

4.6.3. Communication



EXPANSION I/O - 10 pin terminal block

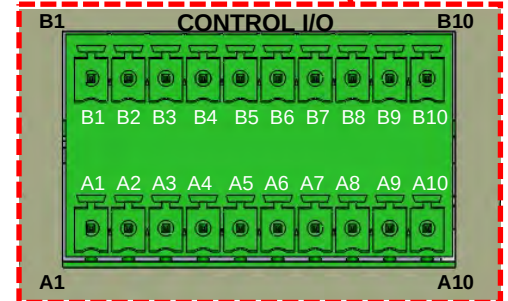
A1	+5VCC
A2	GND
A3	Analog general purpose Output 0
A4	Analog general purpose Output 1
A5	Analog general purpose input 0
A6	Analog general purpose input 1
A7	Digital general purpose input 0
A8	Digital general purpose input 1
A9	Digital general purpose input 2
A10	Digital general purpose input 3
B1	Relay 0 NO
B2	Relay 0 COM
B3	Relay 0 NC
B4	Relay 1 NO
B5	Relay 1 COM
B6	Relay 1 NC
B7	Digital general purpose output 0
B8	Digital general purpose output 1
B9	Digital general purpose output 2
B10	Digital general purpose output 3



Expansion I/O connector
Rear Panel

CONTROL I/O - 10 pin terminal block

A1	External measurement of +8V
A2	External measurement of +15V
A3	External measurement of +50V
A4	External measurement of Forward Power
A5	GND
A6	External measurement of Reflected Power
A7	External RF Power On/Off
A8	RS485A for HPA Communication
A9	GND
A10	RS485B for HPA Communication
B1	Not implemented
B2	External Address of Exciter A
B3	Double Exciter Output Status
B4	External AC Phase Alarm
B5	External RF Load Alarm
B6	General Analog Output
B7	External Modulator/Exciter Alarm Status
B8	General Digital Input
B9	External Double Exciter Input Status
B10	Relay Output Command

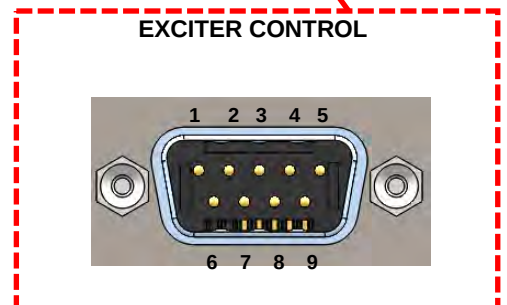


Control I/O connector
Rear panel



EXCITER CONTROL – DB9 male

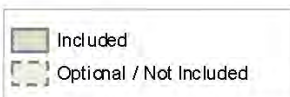
1	N/A
2	RS232 line data input from the Exciter
3	RS232 line data output to the Exciter
4	N/A
6	N/A
5	GND
7	N/A
8	N/A
9	N/A



DB9 male connector
Rear panel



CM9001 Communication Schematic for EC702MP-BB3 / EC704MP-BB3



Exciter A (not included)

- 4: Exciter Alarm Status
- 9: +5VDC

CM9001

- A1: External +15V measurement
- A2:
- A3: External +50V measurement
- A4: External Forward Power measurement
- A5: GND
- A6: External Reflected Power measurement
- A7: External RF Power On/Off
- A8: RS485A for HPA Communication
- A9: GND
- A10: RS485B for HPA Communication
- B1: Not Implemented
- B2: External Exciter A Address
- B3: Double Exciter Output Status
- B4: External AC Phase Alarm Output +8V
- B5: External RF Load Alarm
- B6: +5VDC
- B7: External Modulator/Exciter Alarm Status
- B8: General Digital Input
- B9: External Double Exciter Input Status
- B10: Relay Output Command

CONTROL I/O

PA702MP / PA704MP – COMM. PLUG IN

- 7: Reflected Power
- 5: GND
- 6: Forward Power
- 2: RS-485A
- 3: RS-485B

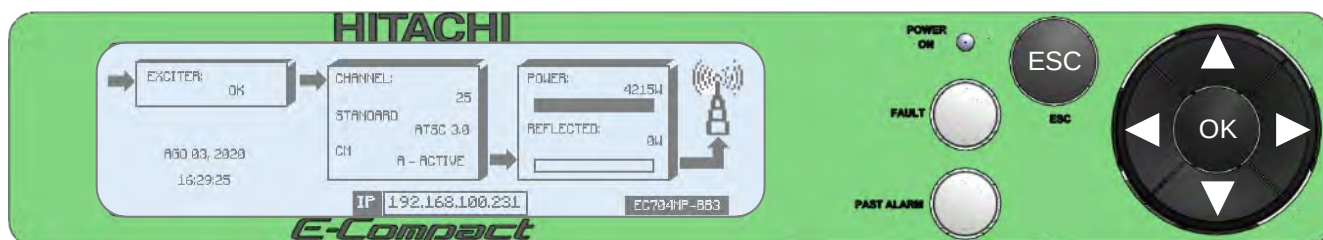
Communication
Interface (COMM)

4.6.4. Display interface

The Control Module CM9001 has a system of configuration, measurements, alarms, and remote management (TELESUPERVISION), that controls all of the transmitter modules.

The transmitter configuration can be done either by the front panel of the transmitter or the web interface using a browser of your choice or SNMP.

This section will show you how to navigate, operate, and configure certain device functions using the Keyboard and Display Interface. These interfaces allow interaction between system control and the user.



The Interface is composed of a Graphic LCD Display, two alarm management keys: “Fault” AND “Past Alarm”, two indication LED’s (“Power “On” and “Stream Loss”), and six Navigation keys.

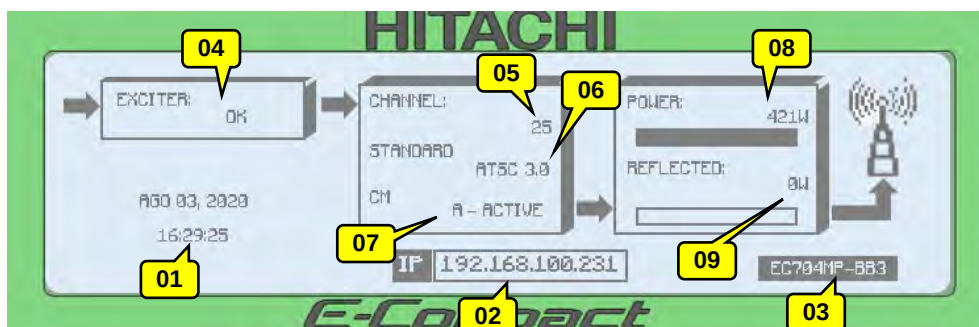
This set allows equipment operation. Through the display it is possible to visualize and change all of the parameters of the equipment.

The navigation consists of positioning the functions in the display according to the ►▲▼◀ where the “OK” key triggers the “Menu” or the “Function” selected and the “ESC” key either aborts the changes made or returns to the next ascending level of the Menu

When holding the “ESC” key for 3 seconds the equipment standby screen is accessed.

When holding the “ESC” key for more than 10 seconds the front panel is reset without affecting the operation of the transmitter.

Standby screen:



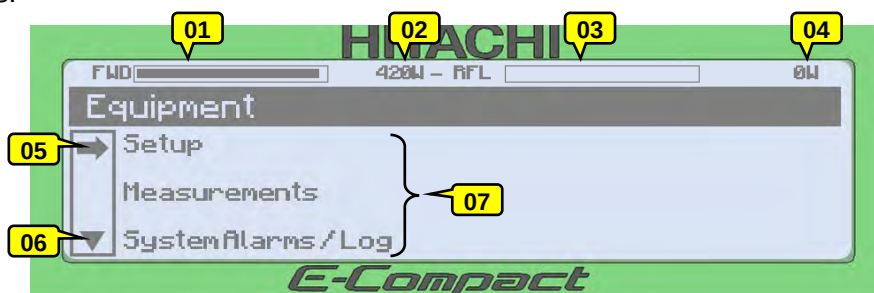
#	DESCRIPTION
01	Current date and time
02	CM9001 IP address for Remote Access (interface WEB)
03	Equipment model controlled by CM9001
04	Exciter status (OK / Fail)
05	Operation channel
06	Operation digital TV system (ATSC 1.0 / ATSC 3.0)
07	Status CM9001: Single Drive: ---- Dual Drive: (A-active / B-Standby), (A-standby / B-active)
08	Forward power after filter value (Watts)
09	Reflected power value (Watts)

Warning screen:



#	DESCRIPTION
01	Some Functions / Menus for security ask for your confirmation for access. Use the ◀▶ keys to toggle between “yes” or “no” and the “OK” key to select the option.

Access to menus:



#	DESCRIPTION
01	FWD after filter power graph bar
02	FWD after filter power value
03	Reflected power graph bar
04	Reflected power value
05	Menu accessed
06	Indicates that there are Submenus / Functions
07	Submenu list / Functions list



#	DESCRIPTION
08	Indicates the Submenu to be accessed OR Functions to access or that are changing in value
09	Select "on" / "off" with the "▶" and "◀" keys.
10	When the function is accessed, to change the value, increase the value with the "▶" key or decrease the value with the "◀" key.
11	* Indicates that the Function has been changed and not registered (Not active). When you press the "OK" key, the "*" disappears and the new record takes effect
12	Function Value Information

4.6.5. Equipment featurings

Remote access via Ethernet:

This equipment has a Web Page server accessed through the "MANAGEMENT" port located on the rear panel. All the functionalities of the keyboard and display interface are accessed through a graphical and interactive WEB page.

Power Change:

It is possible to change the transmitter's power via the front panel's keyboard and web interface.

Measurements:

Measures Power Amplifiers parameters such as output power, power supplies, drain currents, and power Amplifier Temperature.

Alarm management and protection system:

The E-Compact Line has an automatic protection system of high reliability that has fast response to any failures. The protection method consists of avoiding going off-air, which means reducing transmission power to guarantee the equipment's integrity, reducing the transmission power to guarantee the integrity of the equipment.



The reflectometer is a protective device for the equipment. It is not recommended that it be used as a measuring instrument for the radiating system. For this purpose a wattmeter or other dedicated instrument is more appropriate.

RF Power Protection:

The reflectometer has accuracy above 10% of the reflected power to react to the equipment reaching or exceeding 20%. Therefore, accuracy in measures of reflected below 10% relative to direct power are not guaranteed.

Protection against main voltage variations (Surge):

Each part of the equipment has its independent power supply and all feature the same protection characteristics.

Surge protection in the grid is carried out by inserting the varistors between the phases and between the phase and the ground, thereby absorbing the mains voltage peaks and not allowing them to damage the source.

4.6.6. ALARMS - Front Panel Signaling and Shortcut Keys**FAULT:**

When a fault occurs, the equipment automatically takes protective actions (turn off or reduce power) and trigger the visual alarm on the front panel ("FAULT" key lit in red). When pressing the FAULT key, the list of alarms currently occurring appears on the display.

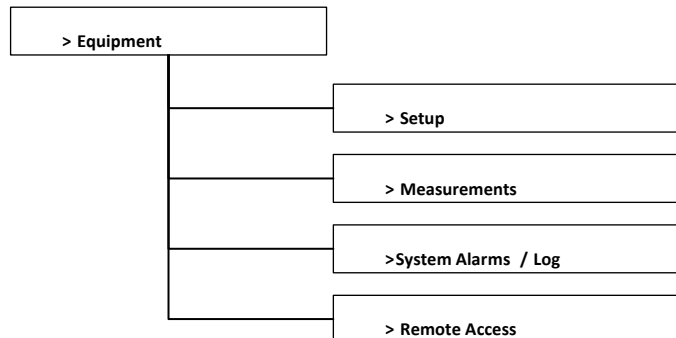
PAST ALARM:

When there has been a fault and it is not necessarily occurring, "PAST ALARM" will be lit in yellow. When you press it, it shows the list of alarms that have occurred.

The details of each alarm and where to view it in the display menu: "> Equipment > Alarms".

4.6.7. System Operation (Display interface)

The "Setup" menu allows you to access and change the functions of the equipment's parameter settings:



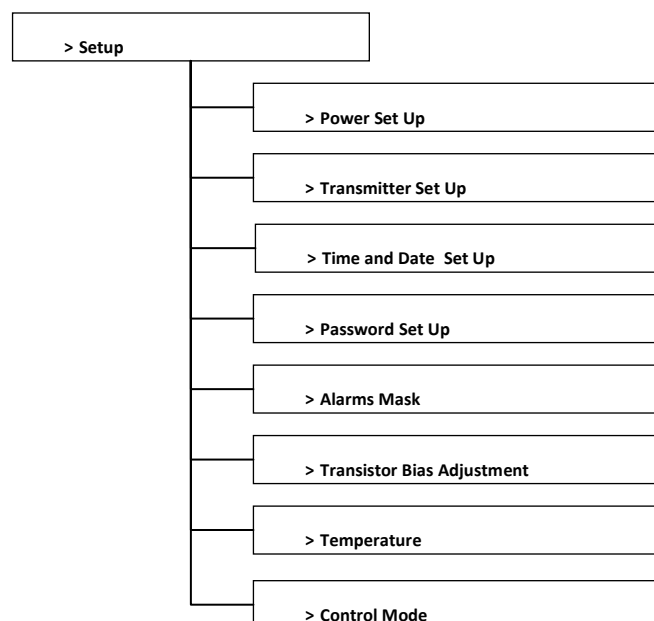
- > **Equipment > Setup:** Access to configure equipment parameters
- > **Equipment > Measurements:** Access to consult measurements of the equipment
- > **Equipment > System Alarms/Log:** Access to query alerts and history of Alarms
- > **Equipment > Remote Access:** Access to configure the equipment to operate on ethernet network

Main Menu > Setup

The "SETUP" menu allows access and alteration of the equipment's parameter settings.



The transmitter is delivered to the customer configured with the parameters that were provided in the purchase act, therefore, it is not necessary to change the settings of equipment.



> Main Menu > Setup > Power:

Control the Equipment Power:



MENU	PARAMETER	DESCRIPTION
> RF Mute	on / off	Mute RF power (on) Enable RF power (off)
> Program Output Power	Power (W)	Changes the output power of the Equipment. The maximum power changed in this parameter is defined in: Equipment>Setup>Transmitter>Operational Power
> Output Power	Power Status (W)	Demonstrates the direct output power of the equipment

> Main Menu > Setup > Transmitter Setup:

Changes Transmitter Parameters, such as turning the ALC ON or OFF, output power mute or not, and programs the operating power:



MENU	PARAMETER	DESCRIPTION
> Level Control	on / off	Enable (on) / Disable (off) the Automatic level control

> Main Menu > Setup > Time and Date Setup:

Sets the internal real time clock (RTC) of the equipment:



MENU	PARAMETER	DESCRIPTION
> Time (HH:MM:SS)	(HH:MM:SS)	Changes the current time
> Date (yyyy/MM/dd)	(yyyy/MM/dd)	Changes the current date

> Main Menu > Setup > Password Setup:

Set a 5-digit numeric password to access the setup menu by the front panel.



MENU	PARAMETER	DESCRIPTION
> Password	XXXXX	Stores the numeric value of the password
> Password ON/OFF	On / off	Enable or Disable the access password

> Main Menu > Setup > Alarms Mask:

Configures the alarm mask to show which alarm should be displayed when its related failure occurs.



MENU	PARAMETER	DESCRIPTION
> Reflected Power	Watts	Set the reflected power alarm threshold

> Main Menu > Setup > Transistor Bias Adjustment:

Setting a transistors DC operating voltage or current conditions to the correct level so that any RF input signal can be amplified correctly by the transistor.



MENU	PARAMETER	DESCRIPTION
> LDMOS Drain Voltage	Voltage (V)	LDMOS Drain Voltage - The values are pre-set at the factory
> Carrier Amp. Current	Current (A)	Carrier Amp. Current - The values are pre-set at the factory
> Peak Amp. Gate Voltage	Voltage (V)	Peak Amp. Gate Voltage - The values are pre-set at the factory
> Status HPA1	Ok Failure ---- (absence)	Power Amplifier 1 Status

> Main Menu > Setup > Temperature:

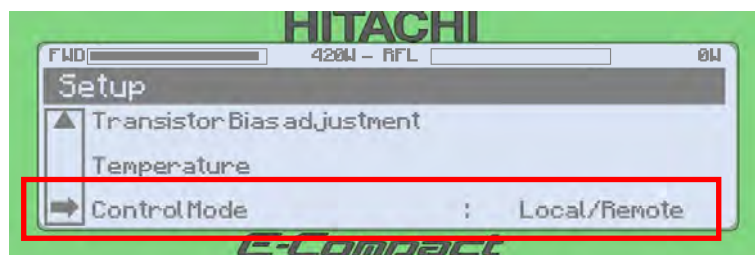
Allows for the setting of the operating temperature of the Powers Amplifiers.



MENU	PARAMETER	DESCRIPTION
> PA Temperature Control	40.0 to 60.0 °C	Set the operating temperature of the Powers Amplifiers
> Unit Temp	Celsius Farrenheit	Set the temperature unit

> Main Menu > Setup > Control Mode:

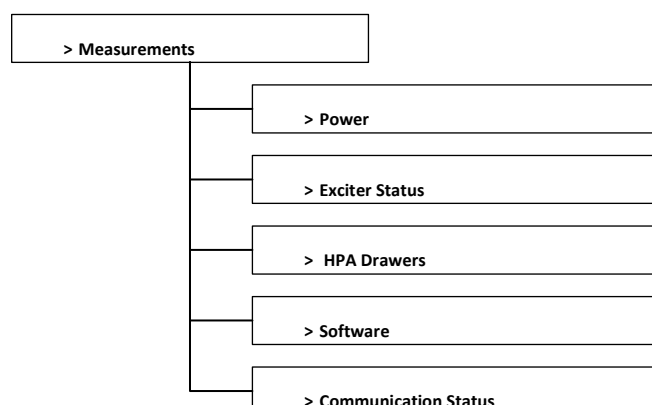
Set CM9001 operation ("local" or "local / remote"):



To change the settings (setup) via the WEB interface, the CM9001 must be configured in "Local / Remote".

Main Menu > Measurements

The “Measurements” menu allows access to the equipment's operating parameters (read only).



> Main Menu > Measurements > Power:

Reading of the equipment's power parameters, such as forward power and reflected power, among others:



MENU	PARAMETER	DESCRIPTION
> Program Power	Power (W)	Programmed operating power on the equipment
> Output Power	Power (W)	Transmitter forward output power
> Reflected	Power (W)	Transmitter reflected output power
> ALC Reference Voltage	Voltage (V)	Voltage that controls the VGA (Variable Gain Amplifier) and output power

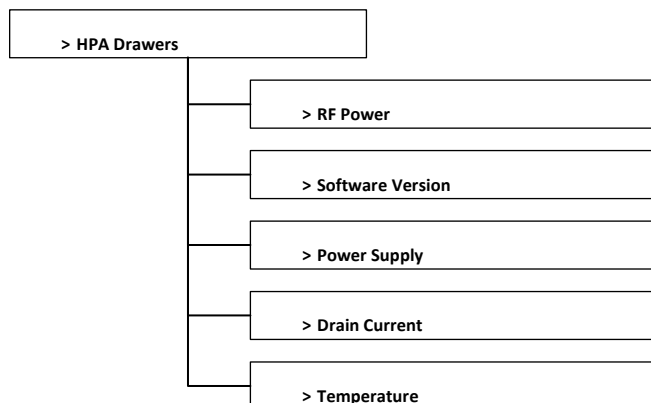
> Main Menu > Measurements > Exciter Status:

Shows the Exciter status: (Ok / Fail)

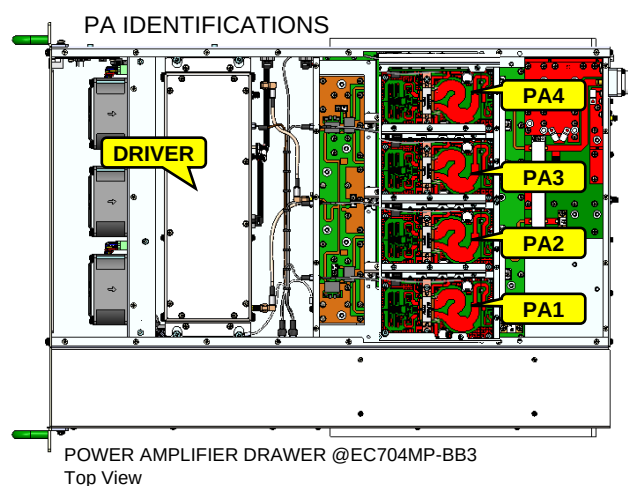
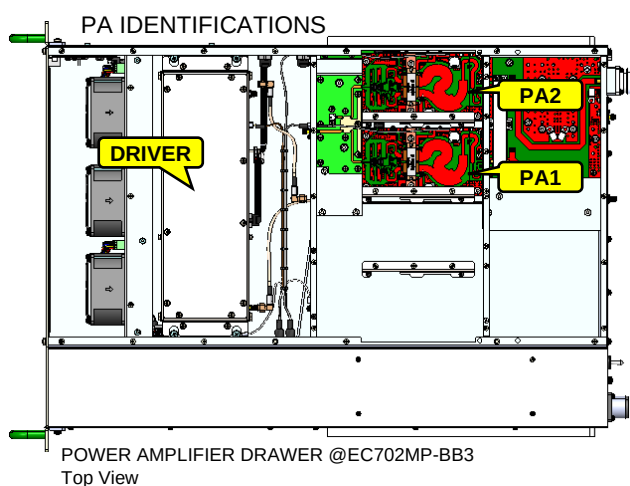
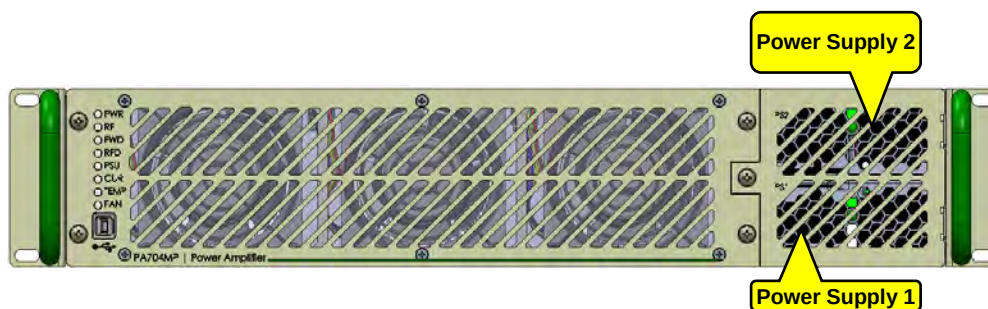


> Main Menu > Measurements > HPA Drawers:

View the main status of all Power Amplifiers Drawers:



Identifying HPA Drawers, Power Supplies, and Power Amplifiers (PA) in the menu:



> Main Menu > Measurements > HPA Drawers > RF Power:

View the main status of all Power Amplifiers Drawers:



MENU	PARAMETER	DESCRIPTION
> Forward Power	Power (W)	HPA forward output power
> Reflected Power	Power (W)	HPA reflected output power
> Driver RF In	Power (dBm)	RF signal input power of HPA Driver
> Driver RF OUT	Power (dBm)	RF signal output power of HPA Driver

> Main Menu > Measurements > HPA Drawers > Software Version:

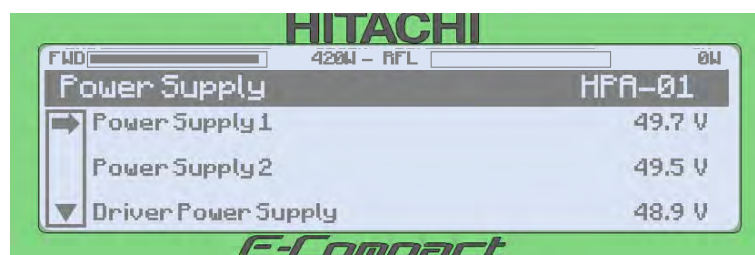
Shows all HPA Drawer software versions:



MENU	PARAMETER	DESCRIPTION
> Software Version	---	PAM40000v0.00
> PA1 Software	---	PAM30000v0.00
> PA2 Software	---	PAM30000v0.00
> PA3 Software	---	PAM30000v0.00
> PA4 Software	---	PAM30000v0.00
> Driver Software	---	PAM30000v0.00
> PSU1 Software	---	PAM30000v0.00
> PSU2 Software	---	PAM30000v0.00

> Main Menu > Measurements > HPA Drawers > Power Supply:

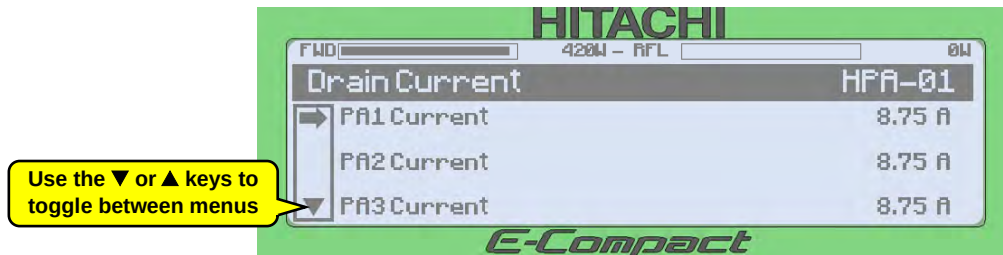
Shows all HPA Drawer Power Supplies statuses:



MENU	PARAMETER	DESCRIPTION
> Power Supply 1	Voltage (V)	Power supply voltage 1
> Power Supply 2	Voltage (V)	Power supply voltage 2
> Driver Power Supply	Voltage (V)	Power supply voltage Driver

> Main Menu > Measurements > HPA Drawers > Drain Current:

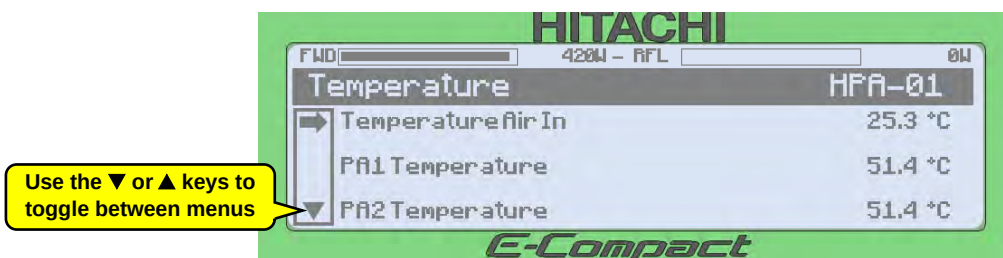
Shows all HPA Drawer drain Currents:



MENU	PARAMETER	DESCRIPTION
> PA1 Current	Current (A)	Drain current
> PA2 Current	Current (A)	
> PA3 Current	Current (A)	
> PA4 Current	Current (A)	
> Driver Current	Current (A)	

> Main Menu > Measurements > HPA Drawers > Temperature:

Shows all HPA Drawer temperatures:



MENU	PARAMETER	DESCRIPTION
> Temperature Air In	°C / F°	Ambient inlet air temperature at HPA
> PA1 Temperature	°C / F°	PAs temperature
> PA2 Temperature	°C / F°	
> PA3 Temperature	°C / F°	
> PA4 Temperature	°C / F°	
> Driver Temperature	°C / F°	Driver temperature
> PSU1 Temperature	°C / F°	Power Supplies temperature
> PSU2 Temperature	°C / F°	

> Main Menu > Measurements > Software:

Shows the Control Module software version:



MENU	PARAMETER	DESCRIPTION
> Software Control	---	Software Control version
> Software DIGI	---	Software DIGI version

> Main Menu > Measurements > Communication Status:

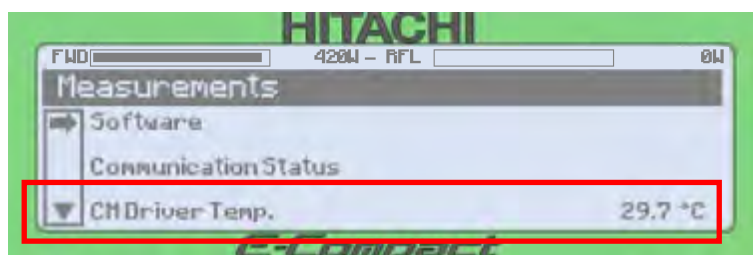
Shows the HPA communication status (ok / fail):



MENU	PARAMETER	DESCRIPTION
> Communication HPA1	Ok / Fail	Status of each HPA present in the equipment

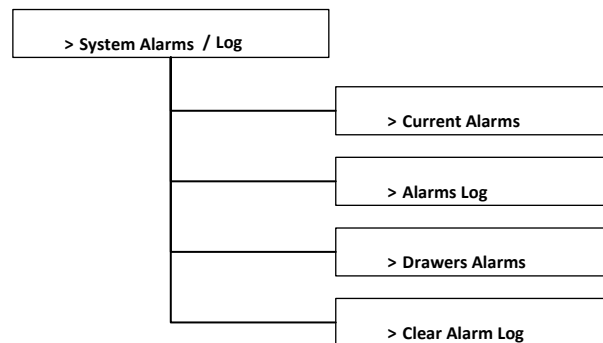
> Main Menu > Measurements > CM Driver Temp.:

Shows the temperature of Control module internal driver:



Main Menu > System Alarms/Log

This menu gives access to information on alarms that are occurring or have occurred in the past, providing a guide for necessary preventive or corrective maintenance.



Current Alarms: Shows the list of alarms currently occurring

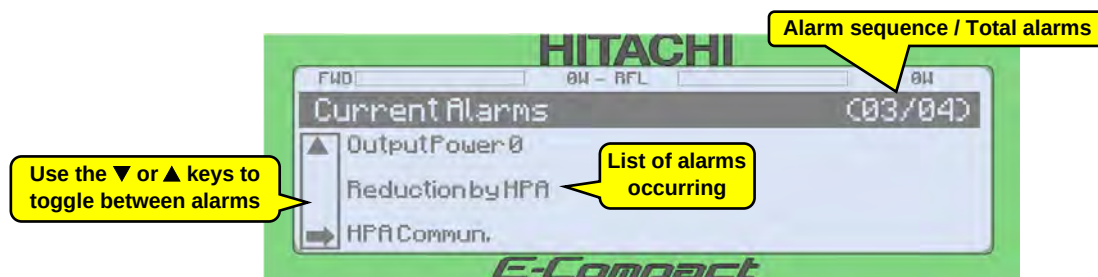
Alarms Log: It shows a detailed list with all alarms, with their respective start/end date and time

Drawers Alarms: It shows all alarms active or occurred in the HPA's (Current Alarms / Past Alarms)

Clear Alarm Log: Reset alarm log list

> Main Menu > System Alarms/Log > Current Alarms:

Shows the list of alarms currently occurring. This function can also be accessed through the "FAULT" key, located on the front panel:



See page 49 for the alarms list and their respective meanings.

In the absence of alarms, the display will show the following message:



> Main Menu > System Alarms/Log > Alarms/Log:

Shows the Log alarms list. This function can also be accessed through the “PAST ALARM” key, located on the front panel:



The Log Menu has the following structure:



REF	DESC.
01	Amount of existing Logs
02	Log number pointed in order of occurrence
03	! - Indicates that the log refers to the start of the alarm
04	# - Indicates that the log refers to the end of the alarm
05	Indicates that the date that alarm was occurred
06	Indicates that the time that alarm was occurred
07	Alarm name recorded in the Log

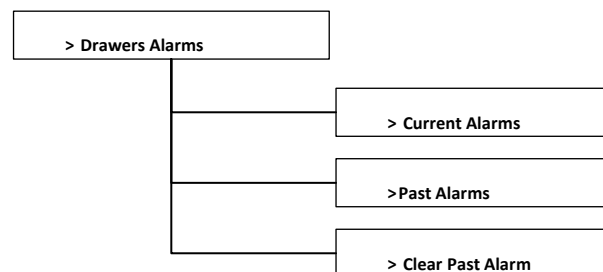
See page 49 for the alarms list and their respective meanings.

In the absence of alarms, the display will show the following message:



> Main Menu > System Alarms/Log > Drawers Alarms:

Shows the list of alarms currently occurring. This function can also be accessed through the “FAULT” key located on the front panel:



Current Alarms: Shows the list of drawer alarms currently occurring

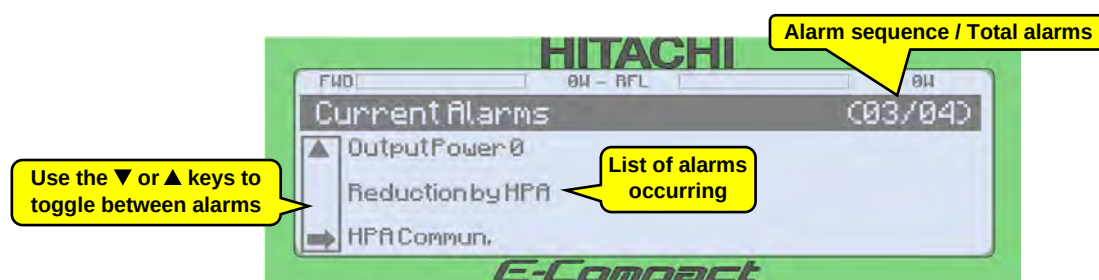
Alarms Log: Shows a detailed list with all drawers alarms with their respective start/end date and time

Clear Alarm Log: Resets drawer alarm log list



> Main Menu > System Alarms/Log > Drawers Alarms > Current Alarms:

Shows the list of drawer alarms currently occurring.



See page 49 for the alarms list and their respective meanings.

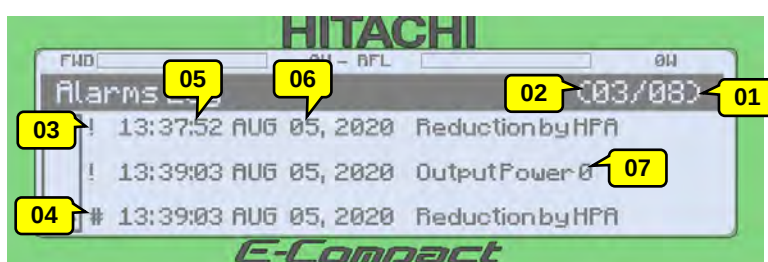
In the absence of alarms, the display will show the following message:



> Main Menu > System Alarms/Log > Drawers Alarms > Past Alarms:

Shows the Log alarms list.

The Log Menu has the following structure:



REF	DESC.
01	Amount of existing Logs
02	Log number pointed in order of occurrence
03	! - Indicates that the log refers to the start of the alarm
04	# - Indicates that the log refers to the end of the alarm
05	Indicates that the date that alarm was occurred
06	Indicates that the time that alarm was occurred
07	Alarm name recorded in the Log

See page 49 for the alarms list and their respective meanings.

In the absence of alarms the display shows the following message:



> Main Menu > System Alarms/Log > Drawers Alarms > Clear Past Alarm:

Reset the drawer alarm list.



Select "On" to reset the Past Alarms list.

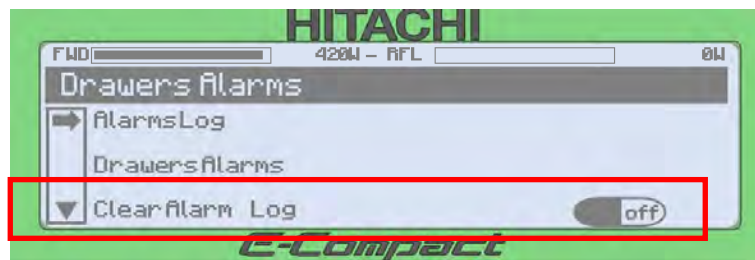
Power Amplifiers Drawers (HPA) Alarms List

DRAWER ALARM	ALARM DESCRIPTION	THRESHOLD	SYSTEM ACTION
PA High Current	Indicated PA Current is greater than threshold	9 A	Notification
PA Critical High Current	Indicated PA Current is greater than threshold	10 A	Shutdown
PA Unbalanced Current	Indicated PA Current is higher or lower than the others	2.5 A	Notification
PA Low Current	Indicated PA Current is lower than threshold.	0.2 A	Reduces 3dB
PA High Temperature	Indicated PA Temperature is greater than threshold.	80 °C (176 °F)	Notification
PA Critical High Temp	Indicated PA Temperature is greater than threshold	85 °C (185 °F)	Reduces 3dB
PA Failure	VGS (Voltage Gate Source) of the indicated PA is less than 2/3 of the programmed VGS.	2/3	Shutdown
PSU High AC Voltage	PSU AC Voltage is greater than threshold	265 VAC	Notification
PSU Critical High AC Line Voltage	PSU AC Voltage is greater than threshold	270 VAC	Shutdown
PSU Low AC Voltage	PSU AC Voltage is lower than threshold	100 VAC	Notification
PSU Critical Low AC Voltage	PSU AC Voltage is lower than threshold	90 VAC	Shutdown
PSU High Current	PSU Current is greater than threshold	31A @PA702MP 32A @PA704MP	Notification
PSU Critical PSU High Current	PSU Current is greater than threshold	33 A	Shutdown
PSU High Temperature	PSU temperature is greater than Threshold	65 °C (149 °F)	Notification
PSU Critical High Temperature	PSU temperature is greater than threshold	68 °C (154.4 °F)	Shutdown
PSU High Voltage	PSU voltage exceeds 2V of programmed PSU voltage	52 V	Shutdown
PSU Low Voltage	PSU voltage is lower than 3V of programmed PSU voltage	47 V	Shutdown
Driver High Current	Driver Current is greater than threshold	4.0 A	Notification
Driver Critical High Current	Driver Current is greater than threshold	4.5 A	Shutdown
Driver Low Current	Driver Current is lower than threshold.	0.4 A	Notification
Pre-Driver High Current	Pre-Driver Current is greater than threshold	0.35 A	Notification
Pre-Driver Low Current	Pre-Driver Current is lower than threshold.	0.1 A	Notification
Driver High Voltage	Driver Voltage is greater than threshold	52 V	Notification
Driver Low Voltage	Driver voltage is lower than 5v of programmed PSU voltage	5 V	Notification
Driver Low Gain	Driver Gain is lower than threshold.	30 dB	Notification

DRAWER ALARM	ALARM DESCRIPTION	THRESHOLD	SYSTEM ACTION
Driver Low RF Input Level	Driver RF Input is lower than threshold.	-8 dBm	Notification
Driver High Temperature	Driver Temperature is greater than threshold.	75 °C (167 °F)	Notification
Critical High Forward Power	HPA Forward Power is greater than threshold.	330W @PA702MP ATSC3.0 380W @PA702MP ATSC1.0 650W @PA704MP ATSC3.0 750W @PA704MP ATSC1.0	Shutdown
Critical High Reflected Power	HPA Reflected Power is greater than threshold.	45W @PA702MP ATSC3.0 50W @PA702MP ATSC1.0 90W @PA704MP ATSC3.0 100W @PA704MP ATSC1.0	Shutdown
High Input Air Temperature	Ambient air temperature used in the reflow of the equipment is greater than threshold.	40 °C (104 °F).	Notification
Critical High Input Air Temperature	Ambient air temperature used in the reflow of the equipment is greater than threshold.	48 °C (118.4 °F)	Notification
Fan warning	Fan rotation reaches ±1000RPM in relation to software programmed value.	1000 RPM	Notification
Fan Failure	Fan rotation reaches ±2000RPM in relation to software programmed value.	2000 RPM	Notification

> Main Menu > System Alarms/Log > Clear Alarm Log:

Resets the main alarm list.



Select "On" to reset the Alarms Log list.

Control Module Main Alarm List

MAIN ALARM	ALARM DESCRIPTION
High Power Amplifier Communication	Control Module cannot communicate with Power Amplifiers
High Power Amplifier Active Alarm	Current alarm on one or more Power Amplifiers
Exciter Fail	Control Module cannot communicate with Exciter
ALC Max	Automatic Level Control set to maximum and not able to drive the output power required
uC Communication Fail	Web Server cannot communicate with microcontroller
Interlock Failure	Interlock protection disabled
RF Mute	RF Output muted by itself or by an external command
Over Power	Output Power exceeded allowed limit
Reflected Power	Reflected Power exceeded the minimum allowed!
Output Power Zero	Output power not detected by Directional Coupler
Reduction Power by Reflected	Power reduced to comply with reflected power limit
Reduction Power by High Power Amplifier	Power reduced to comply with maximum power provided by each power amplifier
Reduction Power by HPA High Temperature	When the HPA reaches 87 °C (188.6 °F), it reduces the power by 3dB. Returns the rated power when the temperature is restored to 80 °C (176 °F).

Main Menu > Remote Access

In this menu the Ethernet network parameters are configured to have remote access via a network connection.

All equipment parameters, such as transmit power, source measurements, alarms check, and all possible functional selections can be accessed remotely by a PC Browser or any Smartphone Browser by connecting to the embedded WEB page server inside of the equipment.



MENU	PARAMETER	DESCRIPTION
> IP Address	000.000.000.000	IP address of Ethernet Control Port v4 (32-bit)
> Subnetwork Mask	000.000.000.000	Ethernet Control Port Sub Network Mask
> Gateway	000.000.000.000	Ethernet Control Port Default Gateway

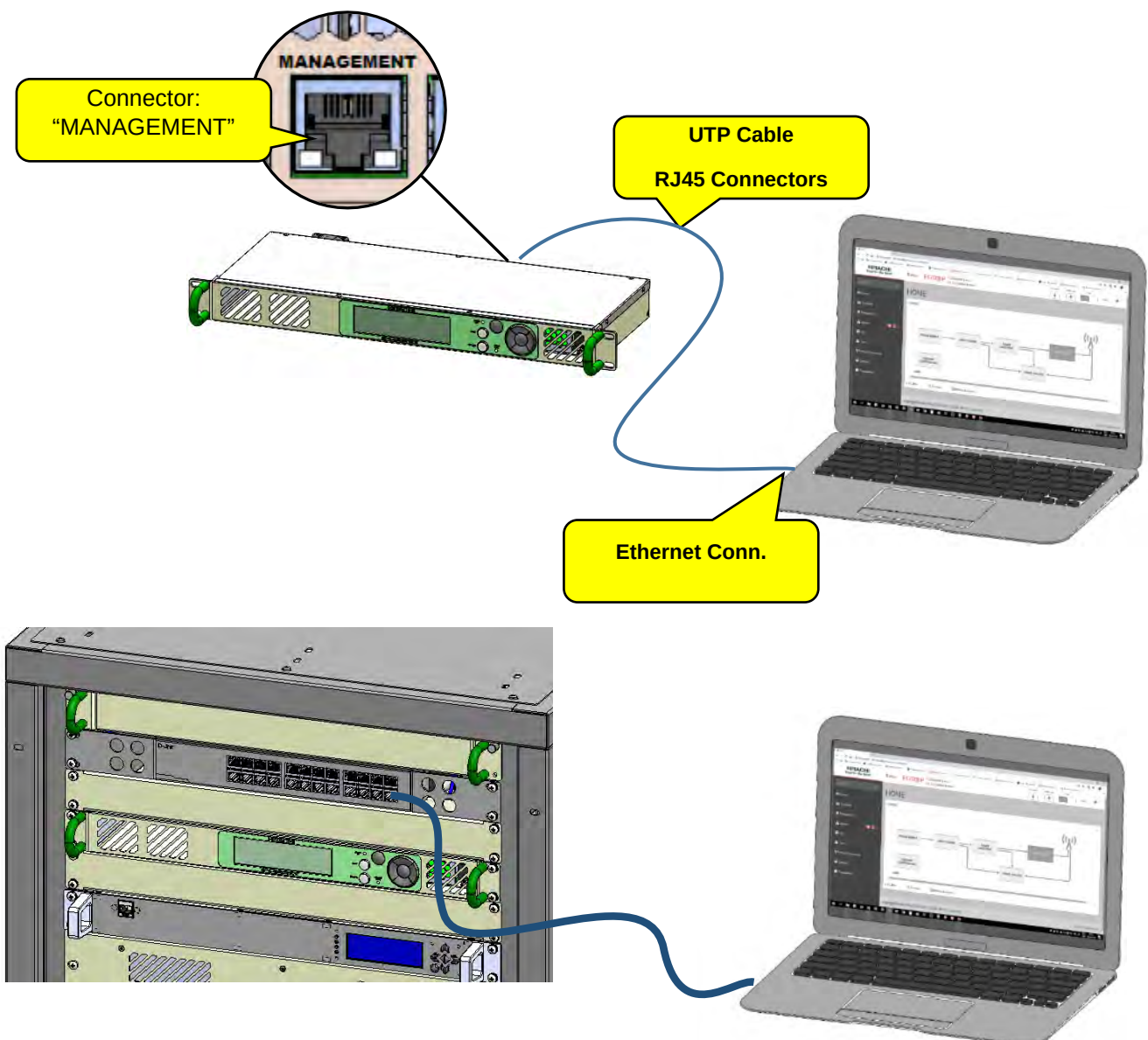
4.6.8. WEB Interface – Remote Access

Introduction

The entire device management and configuration system can be remotely accessed via a browser on any personal computer, tablet, or smartphone.

The device embeds an internet server with a dedicated page that allows you to navigate its parameters in an easy way and also make it possible to change its settings in a more friendly graphical environment. This interface enables remote interaction between the user and the transmitter.

To access the interface, it is necessary that the transmitter is connected to a local network through a cable (CAT5 UTP with RJ45 connectors conforming to EIA / TIA-568-B standard).





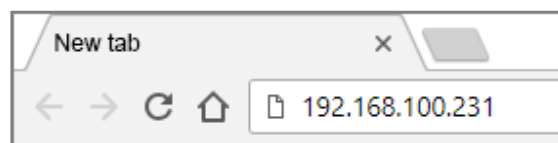
For ethernet connections, only use static IP settings.



For navigation, use a fully updated internet browser. To control the device through the web interface, we recommend Chrome, Firefox Mozilla, and Opera browsers.

The equipment can be connected directly to a computer, switcher, or router through the MANAGEMENT port located on its rear panel. The equipment's IP address is fixed and is configured by accessing the keyboard-display interface via Menu >Equipment > Remote Access > Management.

Once the configuration is set, open a browser and enter the IP address:



This IP address is a simple example.
View the settings on the device before
accessing the Web Interface.

When initially login in, use the factory password:

Login: **user**

Password: **linear**



For security reasons, we recommend that once the first login is made, change the factory password to a personal password.

Homepage features

The screenshot shows the Hitachi EC704MP-BB3 web interface. At the top, the Hitachi logo and slogan 'Inspire the Next' are on the left. The main header area displays the model 'EC704MP-BB3', the transmitter name 'HKL Transmitter CH 35', and real-time power monitoring for Forward (420 W) and Reflected (5 W) power. There is also an RF Mute toggle set to OFF, a user selection dropdown, and a logout button. Below the header, a 'No Alarms' status bar is shown. A left sidebar contains navigation links: Alarms, Log Alarms, Setup, Measurements, Drawers, Remote, User, and Software Update. On the right, there are expandable sub-menus for Setup (Power Setup, Transmitter Setup, PA Temperature Control, Time and Date Setup, Alarm Mask, Exciter, Import/Export) and Measurements (Software Version, Power, Communication Status, Transistor Bias, Exciter Status). The Drawers sub-menu is expanded, showing options like Power Supply, Driver, Power Amplifier, General Measurements, Drawer Current Alarms, and Drawer Past Alarms. A NETWORK/SNMP section is also visible. Numbered callouts 01 through 14 identify specific UI elements as detailed in the table below.

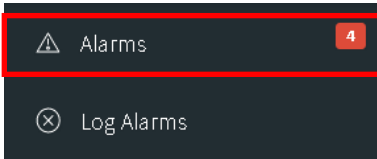
#	DESCRIPTION
01	Hides / Displays Side Menu Bar
02	Model Transmitter
03	Equipment name / Channel transmission
04	Forward Power - Direct Power Monitor in real time
05	Reflected Power - Reflected Power Monitor in real time
06	On / Off Power
07	Section user
08	Exits the WEB Interface
09	Vertical Bar Menu
10	RED: Qty of Current Alarms present ORANGE: Qty of past alarms
11	Setup Sub-Men
12	Measurements Sub-Menu
13	Drawers Sub-Menu
14	Remote Sub-Menu



When changing any setting, it will only take effect when you click "SAVE" in the upper left corner of the screen.

SAVE

Alarms



Shows the list of alarms currently occurring. In the event of alarms, the number of active alarms (Current Alarms) will appear in the sidebar in red.

Alarms

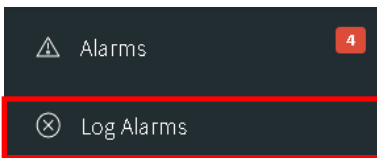
List of alarms occurring

TYPE	DESCRIPTION	HELP
Current Alarms	Output Power Zero	?
Current Alarms	Reduction Power By High Power Amplifier	?
Current Alarms	High Power Amplifier Communication	?
Current Alarms	Exciter Fail	?

Alarm help

Output power not detected by Directional Coupler!

Log Alarms



Shows the list of alarms currently occurring. In the event of alarms, the number of active alarms (Current Alarms) will appear in the sidebar in red.

Log Alarms

04 CLEAR 05 DOWNLOAD

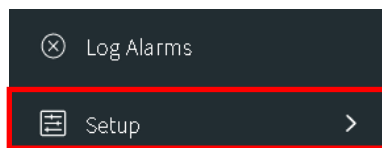
01 TYPE	02 DESCRIPTION	03 DATETIME	HELP
Current Alarms		2020/08/05 16:18	?
Past Alarms		2020/08/05 16:18	?
Current Alarms		2020/08/05 15:21	?
Past Alarms		2020/08/05 15:21	?
Past Alarms	Reduction Power By High Power Amplifier	2020/08/05 13:37	?
Past Alarms	High Power Amplifier Communication	2020/08/05 13:37	?
Past Alarms	Output Power Zero	2020/08/05 13:37	?
Past Alarms	Exciter Fail	2020/08/05 13:37	?

06

07 < 1 >

#	DESCRIPTION
01	Type alarm (Current / Past alarm)
02	Alarm Description
03	Date / time alarm
04	Clear the entire list. Upon confirming this action, it will no longer be possible to recover the deleted list
05	Download the alarm list to the file named "LogAlarms.csv" in the "Download" folder on your computer
06	Alarm help
07	Indication of the current page and command to switch between the previous or subsequent pages

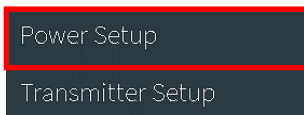
Setup



The "SETUP" menu allows for the accessing and changing of the equipment's parameter settings.

Power Setup
Transmitter Setup
PA Temperature Control
Time and Date Setup
Alarm Mask
Exciter
Import/Export

Power Setup



Control the Equipment Power:

Setup Power

Programmed Power [W]

420 — +

Operational Power [W]

420

Transmitter Setup

Power Setup

Transmitter Setup

Changes Transmitter Parameters, such as turning the ALC ON or OFF and setting the transmitter name.

Transmitter

Automatic Level Control
OFF

Transmitter Name
HKL Transmitter

PA Temperature Control

Transmitter Setup

PA Temperature Control

Allows to set the operating temperature of the power amplifiers and set the temperature unit (°C / °F).

Pa Temperature

CELSIUS FAHRENHEIT

Pa Temperature °C

52 - +

Time and Date Setup

PA Temperature Control

Time and Date Setup

Sets the internal real time clock (RTC) of the equipment:

Time And Date

Date
05/08/20:

Time
17:11:31

Alarm Mask

Time and Date Setup

Alarm Mask

Sets the reflected power alarm threshold.

The interface is titled "Alarm Mask". It contains a sub-section titled "Reflected Power [W]". Below this title is a slider control with the value "110" displayed in the center, flanked by minus and plus signs.

Exciter

Alarm Mask

Exciter

Opens the external exciter control and management web. Enter the external exciter IP address and press connect.

The interface is titled "External Exciter". It features an input field labeled "IP Address" containing the text "0.0.0.0". To the right of the input field is a red button labeled "CONNECT".

Import/Export

Exciter

Import/Export

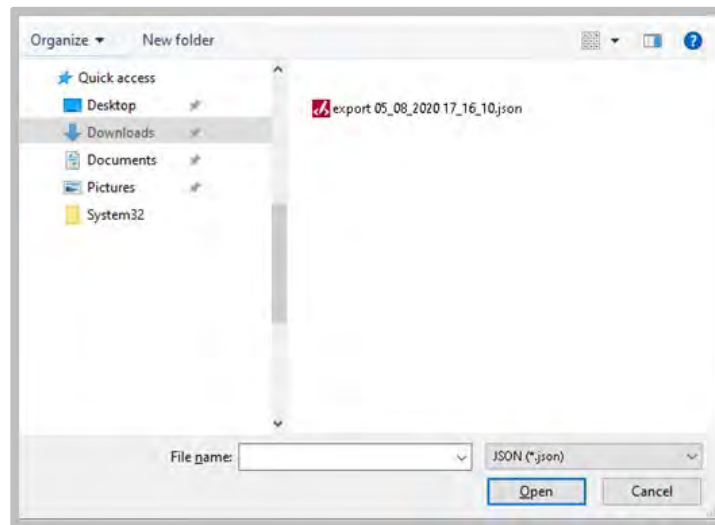
Import / Export Control Module settings.

The interface is titled "Import/Export". It is divided into two main sections. The left section is titled "Settings Export" and contains a button labeled "Download". The right section is titled "Settings Import" and contains a button labeled "Upload".

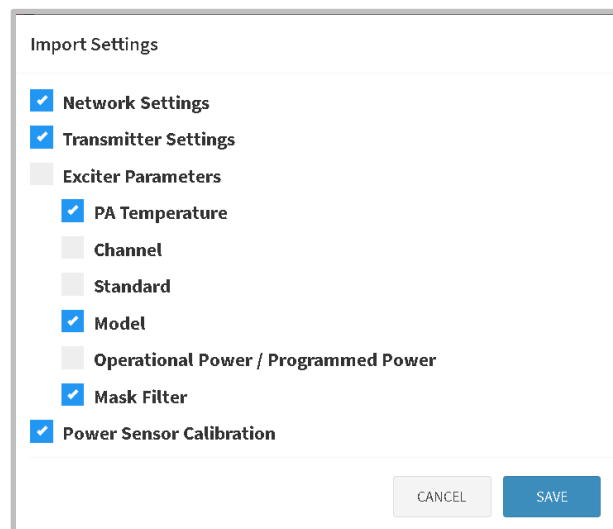
Press "Download" to save the file "export xx_xx_xx xx_xx_xx.json" in the PC downloads folder.

Upload a file settings:

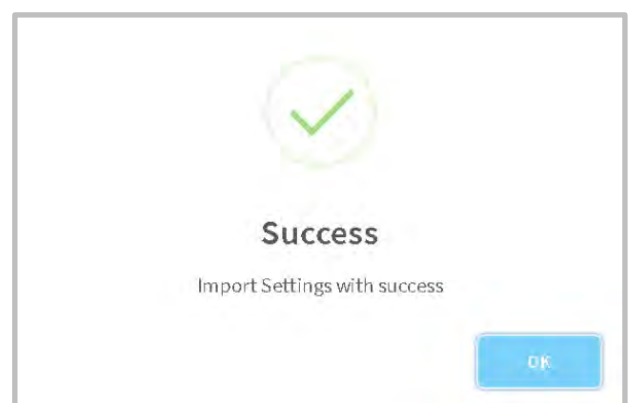
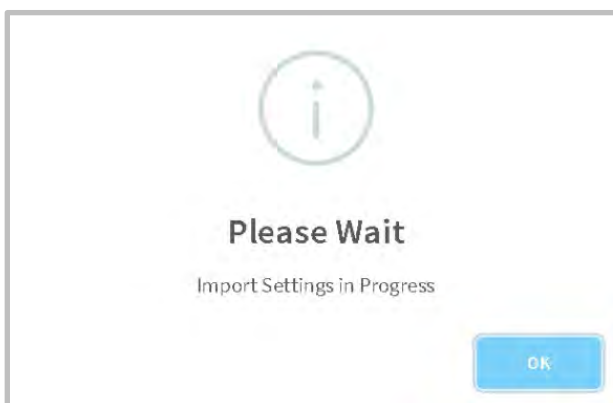
- Press “Upload”
- Select the .json file:



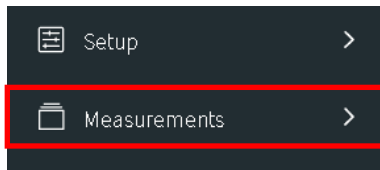
- Select the features to import and press save:



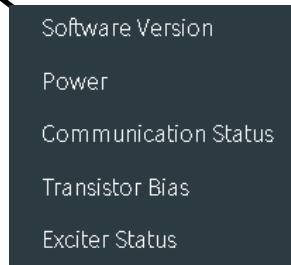
- Press “OK” when the process is done



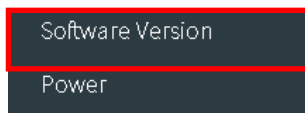
Measurements



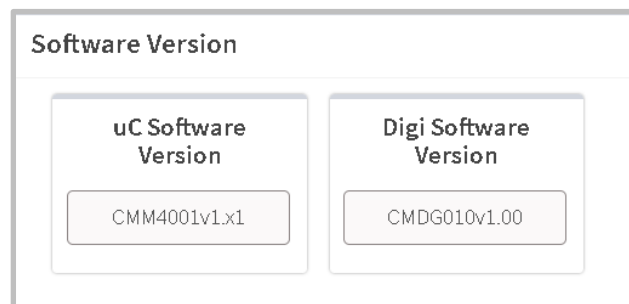
The “Measurements” menu allows the user to access the equipment's operating parameters (read only).



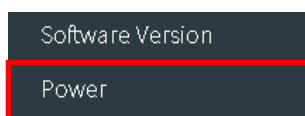
Software Version



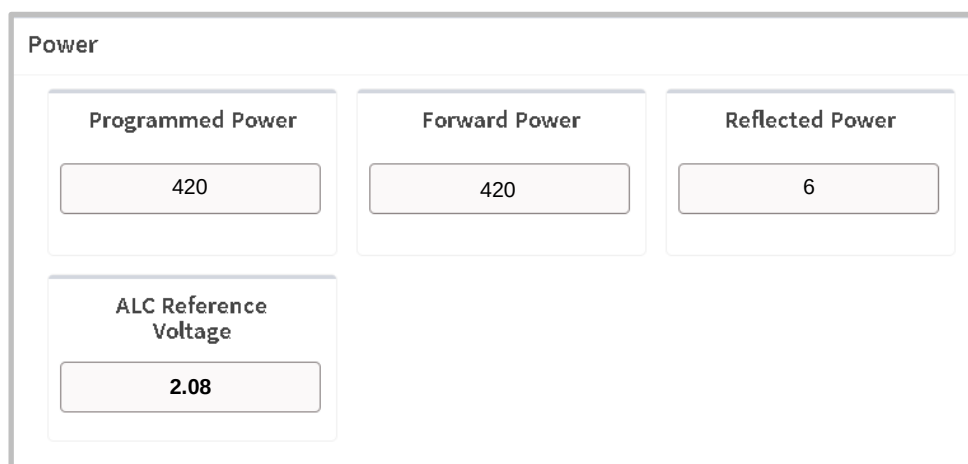
Shows the Control Module's software version.



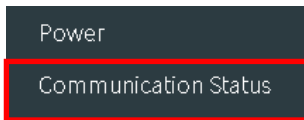
Power



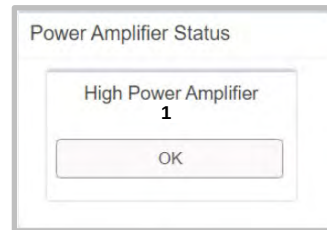
Shows the reading of the equipment's power parameters, such as forward power and reflected power, among others.



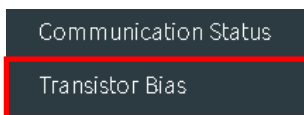
Communication Status



Shows the HPA's communication status.



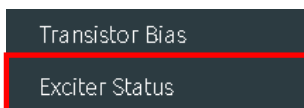
Transistor Bias



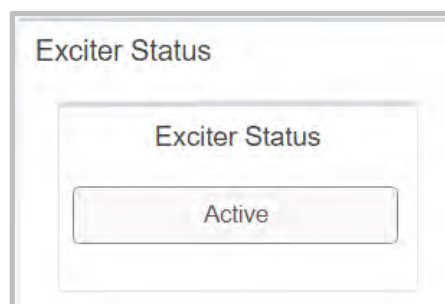
Shows the transistor DC's operating voltage or current conditions so that any RF input signal can be amplified correctly by the transistor.

Transistor Bias		
LDMOS Drain Voltage [V]	Carrier Amp. Current [A]	Peak Amp. Gate Voltage [V]
50.00	0.70	0.60

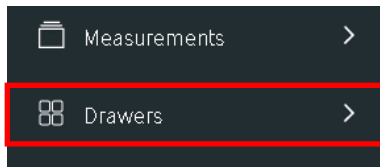
Exciter Status



Shows the Exciter's communication status.



Drawers



View the main status of all Power Amplifiers Drawers (HPA):



Power Supply

Driver

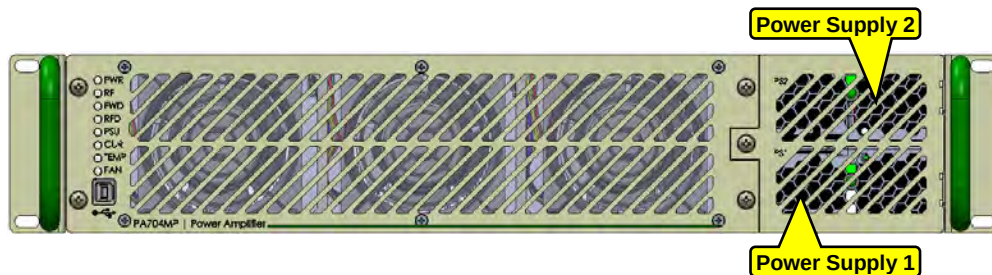
Power Amplifier

General Measurements

Drawer Current Alarms

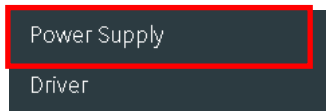
Drawer Past Alarms

Drawer Identification:



Individual status of each Drawer (HPA):

Power Supply



Shows the HPA Power Supply's status.

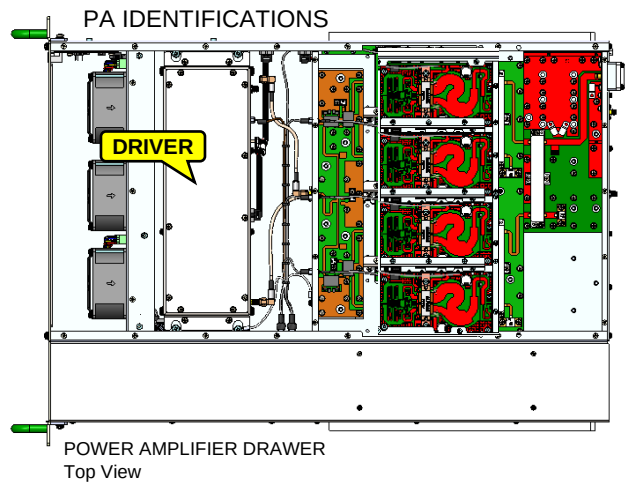
Drawer 1 Power Supply Measurements				
PSU 1 Input Voltage [VAC]	PSU 1 Output Voltage [V]	PSU 1 Temperature [°F]	PSU 1 Output Current [A]	PSU 1 Software Version
221.00	50.00	111.56	13.12	PAM30002v1.03
PSU 2 Input Voltage [VAC]	PSU 2 Output Voltage [V]	PSU 2 Temperature [°F]	PSU 2 Output Current [A]	PSU 2 Software Version
218.50	50.00	110.3	13.25	PAM30002v1.03

Driver

Power Supply

Driver

Shows the HPA Driver's status.



Drawer 1 Driver Measurements

Input Voltage
[V]

49.50

Pre Driver
Current [A]

0.21

Temperature
[°F]

119

Driver Current
[A]

2.35

Software
Version

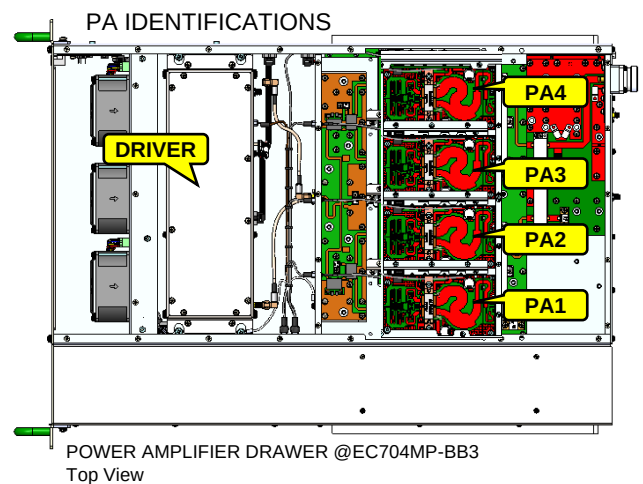
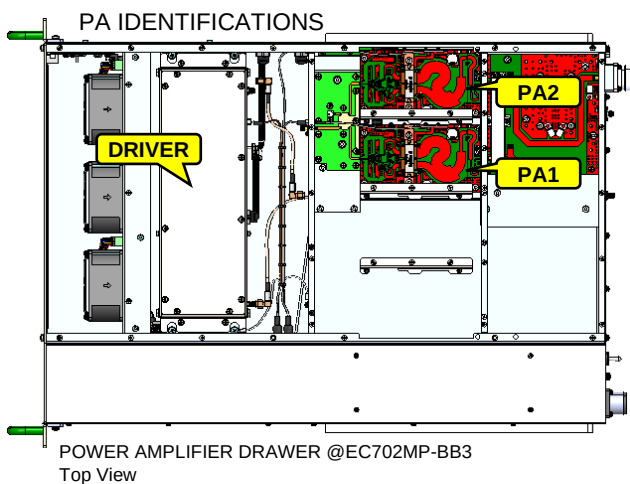
PAM30002v1.03

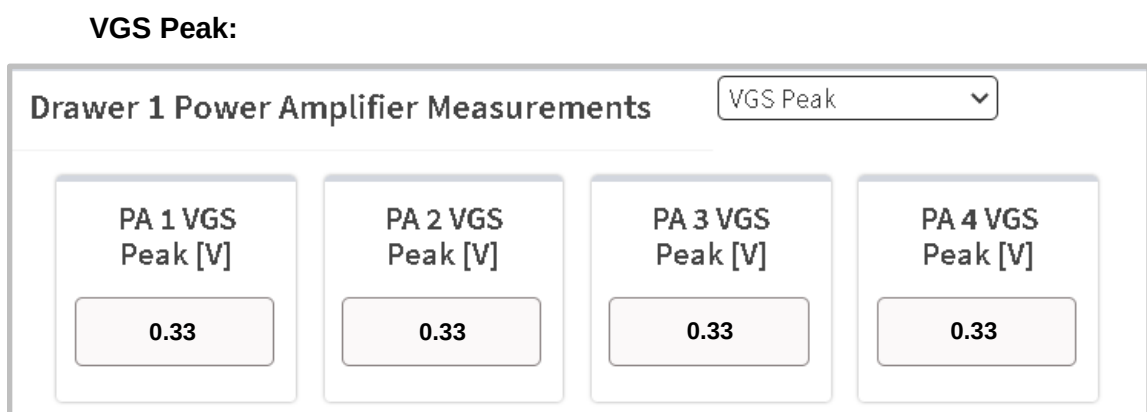
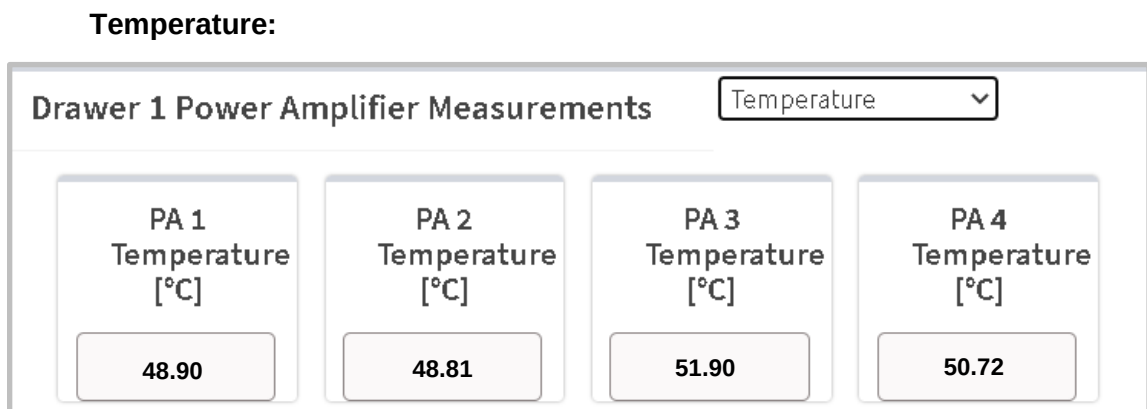
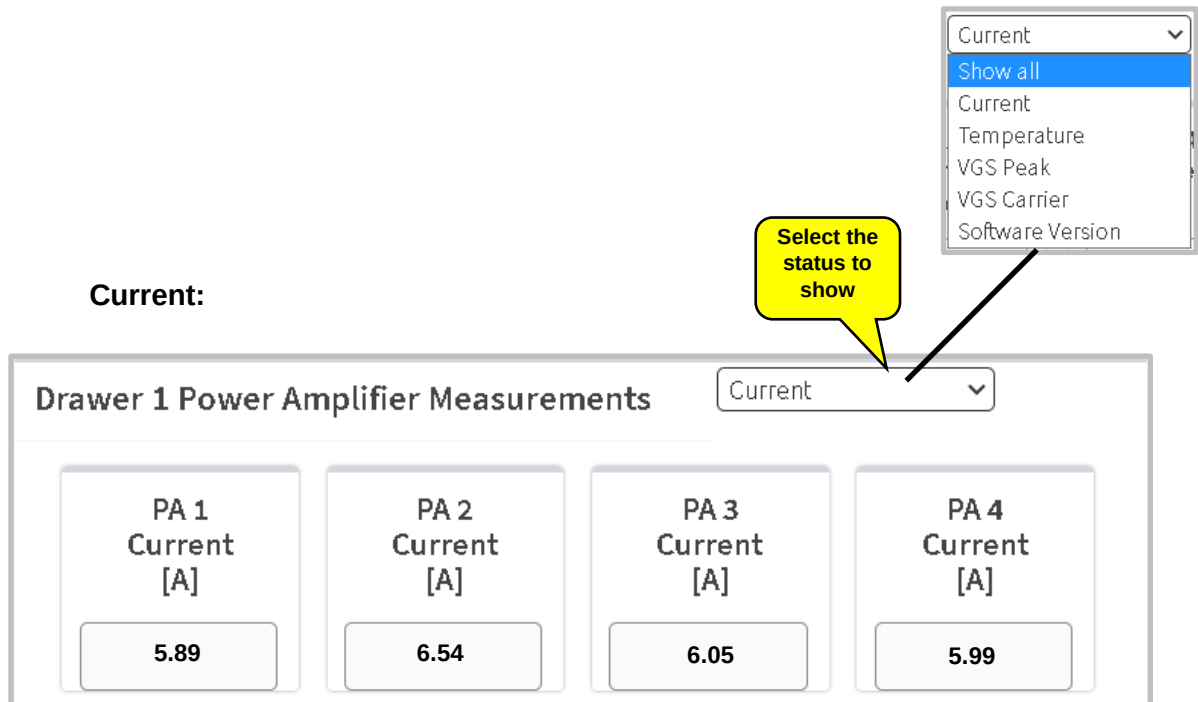
Power Amplifier

Driver

Power Amplifier

Shows the HPA Power Amplifier's status.





VGS Carrier:

Drawer 1 Power Amplifier Measurements
VGS Carrier

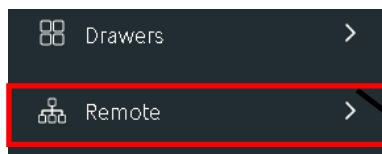
PA 1 VGS Carrier [V]	PA 2 VGS Carrier [V]	PA 3 VGS Carrier [V]	PA 4 VGS Carrier [V]
1.75	1.70	1.71	1.78

Software Version:

Drawer 1 Power Amplifier Measurements
Software Version

PA 1 Software Version	PA 2 Software Version	PA 3 Software Version	PA 4 Software Version
PAM30002v0	PAM30002v0	PAM30002v0	PAM30002v0

Remote



Configures the SNMP and Ethernet network parameters to have remote access via a network connection.

SNMP
NETWORK

SNMP



Configures SNMP and download MIB table.

SNMP

SAVE

Read Only Community: public

Read-Write Community: private

SNMP Version: v2c

Download MIB: Download

Trap Destination: 192.168.100.80

Enable Traps: OFF

SNMP Status

Download the MIB table (file CMLinearMIB.zip) in PC download folder

SNMP Traps config

NETWORK



Configures the Ethernet connection.

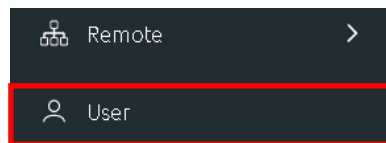
Network

IP Address: 192.168.100.18

Netmask: 255.255.255.0

Gateway: 192.168.100.1

User

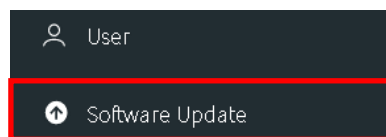


Change the password.

User Setup

Current Password 	New Password 	Confirm Password
---	---	---

Software Update



Update Software Control Modle via *.bin file.

Software Update

Upload Software

Escolher arquivo

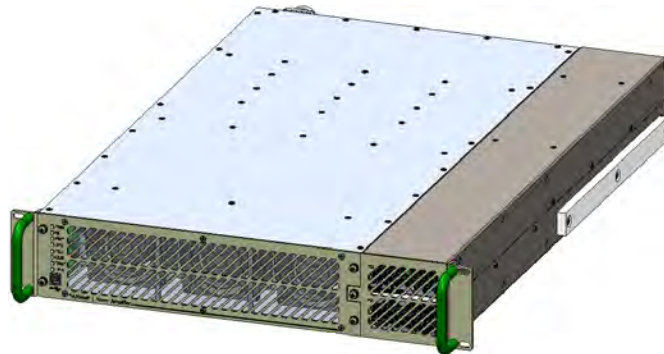
Nenh...ado

UPLOAD

4.2. Power Amplifier Module

PA 702MP (MOD GV 40335 / MOD GV 40336)

PA 704MP (MOD GV 40298 / MOD GV 40309)



This is an air-cooled UHF power amplifier drawer composed of an RF block with two (2) or four (4) power transistors that utilize Doherty's high efficiency technology with efficiency between 34% and 41%, depending on the operating channel.

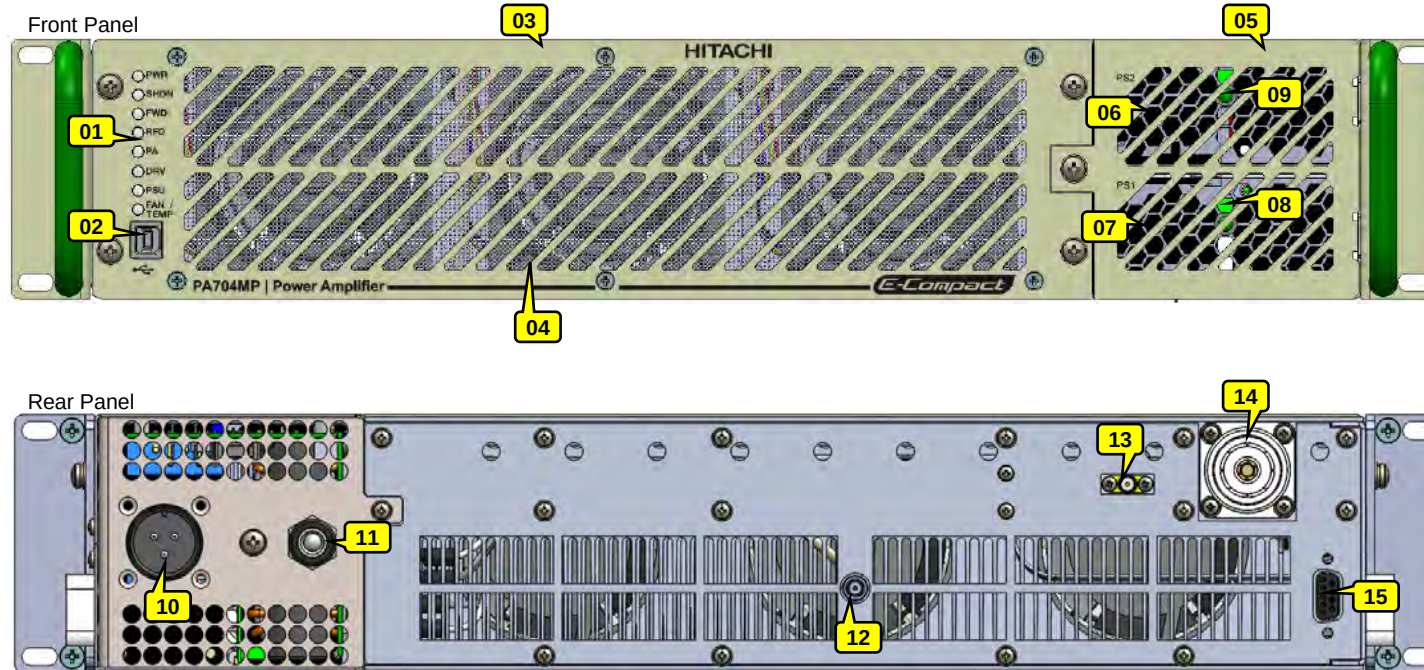
Main features:

- ⇒ High efficiency
- ⇒ Power Supply redundancy - 2 Power Supplies (RPC-1600-48)
- ⇒ Doherty Configuration
- ⇒ Standing fans accessible from the front panel
- ⇒ Removable power supply at the front panel of the drawer
- ⇒ 2U Power Drawer for 19" rack
- ⇒ Broadband power amplifiers
- ⇒ Power transistors LDMOS Ampleon BLF-888E
- ⇒ Automatic control of the quiescent currents of the power transistors depending on the temperature
- ⇒ Automatic fan speed control according to power transistor's temperature
- ⇒ 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
- ⇒ Integrated MOD bus Control



Never unplug any Power Amplifier Drawer while the Transmitter is on due to the risk of damaging the equipment.

4.6.1. Interfaces



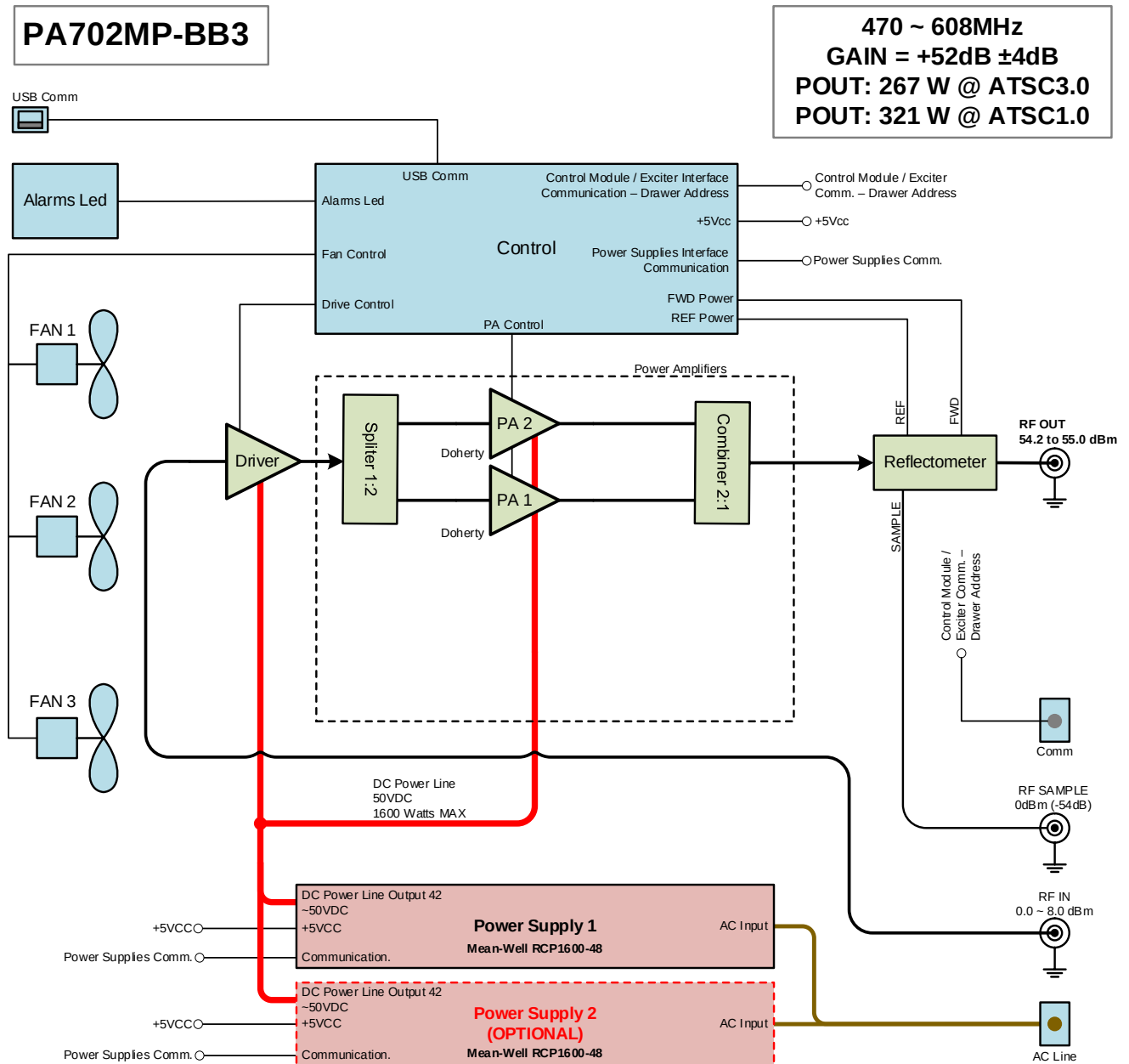
01	Signaling LED's
02	USB Interface
03	Removable front panel
04	Fan Air Filter
05	Removable Power Supplies front panel
06	Power Source 1 (PS1)
07	Power Source 2 (PS2)
08	LED status PS1
09	LED status PS2

10	AC power input
11	Power Amplifier On/Off
12	RF Input (SMA 50Ω)
13	RF Sample (SMA 50Ω)
14	RF Output Power (DIN 7/16" 50Ω)
15	COMM – DB9 communication

4.6.2. Specifications

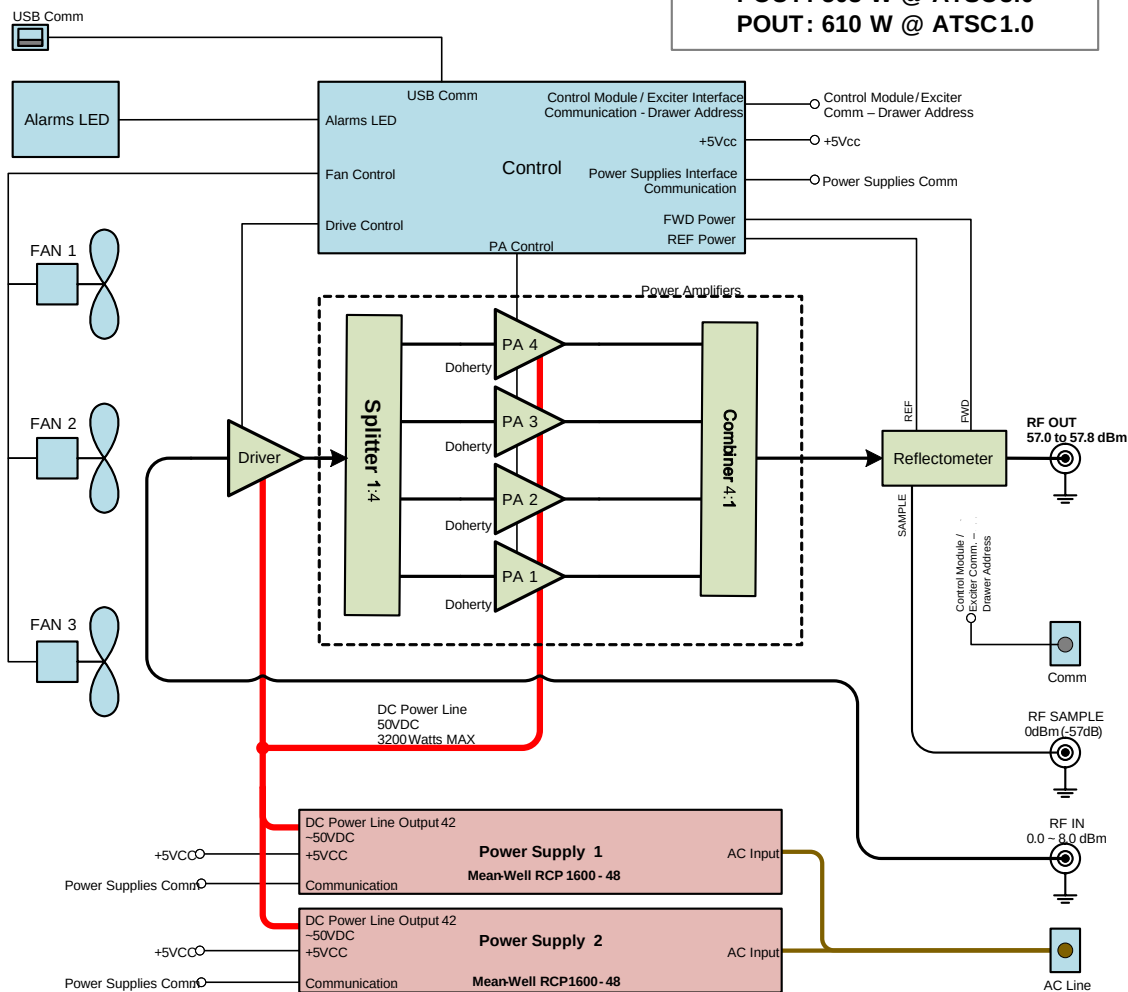
	Characteristic	Specification
Input	Frequency Range	PA702MP: 470 to 608MHz (CH14 to 36) @ MOD GV 40335 608 to 701MHz (CH37 to 51) @ MOD GV 40336 PA704MP: 470 to 608MHz (CH14 to 36) @ MOD GV 40298 608 to 701MHz (CH37 to 51) @ MOD GV 40309
	Level	+8.4dBm (± 0.2 dB) for 508 Wrms Output (ATSC 3.0) +9.2dBm (± 0.2 dB) for 610 Wrms Output (ATSC 1.0)
	Connector / Impedance	SMA female / 50 Ohms
	Return Loss	-20dB typical (-18dB Max)
Output	Frequency Range	PA702MP: 470 to 608MHz (CH14 to 36) @ MOD GV 40335 608 to 701MHz (CH37 to 51) @ MOD GV 40336 PA704MP: 470 to 608MHz (CH14 to 36) @ MOD GV 40298 608 to 701MHz (CH37 to 51) @ MOD GV 40309
	Output Power	PA702MP: 267 Wrms (ATSC 3.0) 321 Wrms (ATSC 1.0) PA704MP: 508 Wrms (ATSC 3.0) 610 Wrms (ATSC 1.0)
	Connector / Impedance	DIN 7/16" / 50 Ohms
	Return Loss	-20dB typical (-18dB Max) - measured with the drawer off
	Harmonics / Spurious	>-16dBc
	Average MER	PA704MP: Better than 36dB: Pout= 267 Wrms @ ATSC 1.0 Better than 33dB: Pout = 321 Wrms @ ATSC 3.0 PA704MP: Better than 36dB: Pout= 508 Wrms @ ATSC 1.0 Better than 33dB: Pout = 610 Wrms @ ATSC 3.0
General	Communication Interface	USB / RS-485
	AC Mains <i>For use one or two PSU, see Section 3, topic 3.2.2. PSU Redundancy, AC mains, RF Output Power (TPO)</i>	PA702MP: 100Vac to 253VAC / 43 to 63Hz (One –PSU / Two-PSU Optional) PA704MP: 100Vac to 253VAC / 43 to 63Hz (Two –PSU) 187Vac to 253VAC / 43 to 63Hz (Two –PSU)
	Power Factor	> 0.92
	Gain	52dB (± 0.2 dB)
	Average Efficiency	40% typical @ ATSC 1.0 38% typical @ ATSC 3.0

4.6.3. Power Amplifier Drawer Functional Description

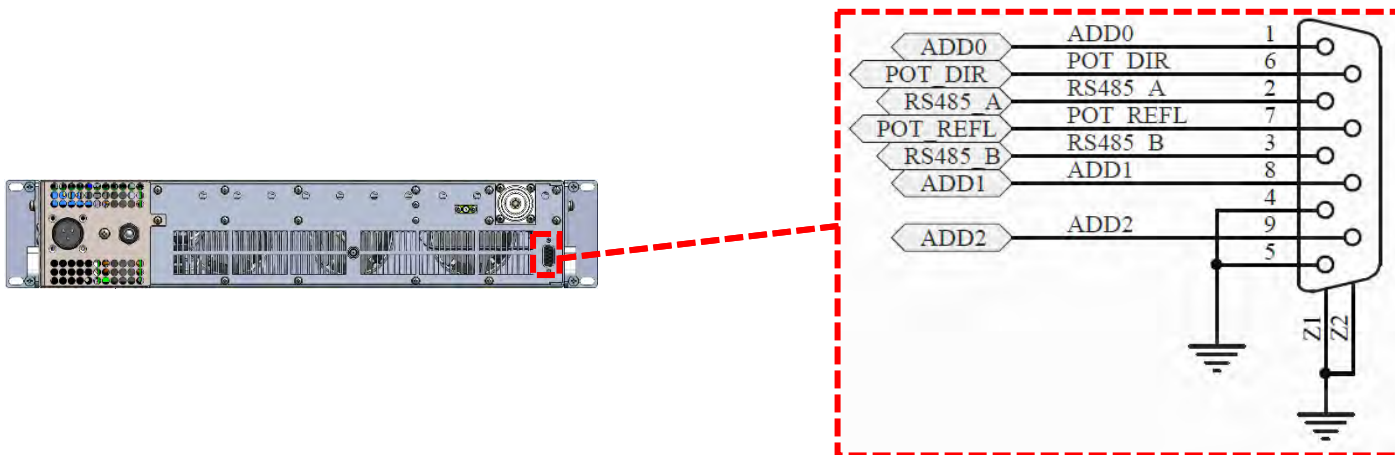


PA704MP-BB3

470 ~ 608MHz @ MOD GV 40298
608 ~ 701MHz @ MOD GV 40309
GAIN = +52dB
POUT : 508 W @ ATSC3.0
POUT : 610 W @ ATSC1.0



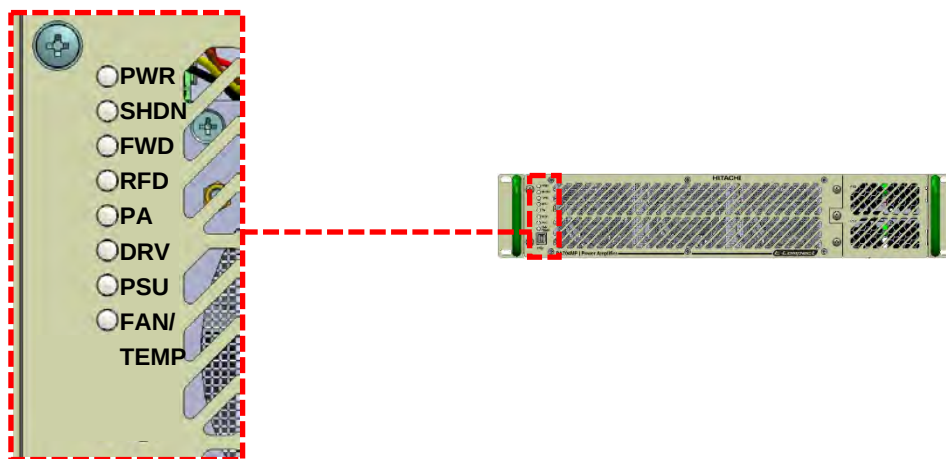
4.6.4. Communication Interface (COMM)



4.6.5. Power Amplifier Signaling LED's

Each Power Amplifier Drawer Features an LED bank that indicates its operation status according to the colors as shown below:

Green	Normal operation
Orange	Orange light indicates that a failure has <u>occurred</u>
Red	Flashing Red light indicates an <u>ongoing</u> failure

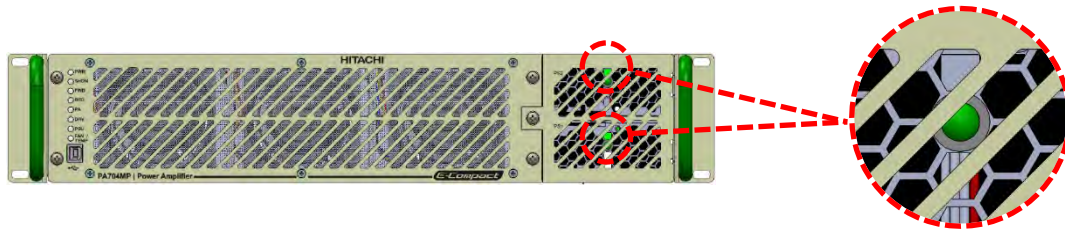


LED	ALARM
PWR	N/A - This LED lights only GREEN indicating that is POWERED ON
SHDN	Power Supply Shutdown
FWD	Over Forward Power (Overdrive)
RFD	Reflected Power
PA	PA Failure, High Current on PA, Low Current on PA, Current UNBAL on PA, Low Gain on PA, High Temperature on PA, Communication Failure on PA
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 on Driver, 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	When detecting a slow speed of rotation or complete failure in any of the fans. High temperature input air of the power drawer (greater than 35°C).

Alarm details are displayed by accessing the keyboard-display interface of the Control Module CM9001 in the menus:

> Main Menu > System Alarms/Log > Drawers Alarms

4.6.6. Power Supplies Signaling LED's

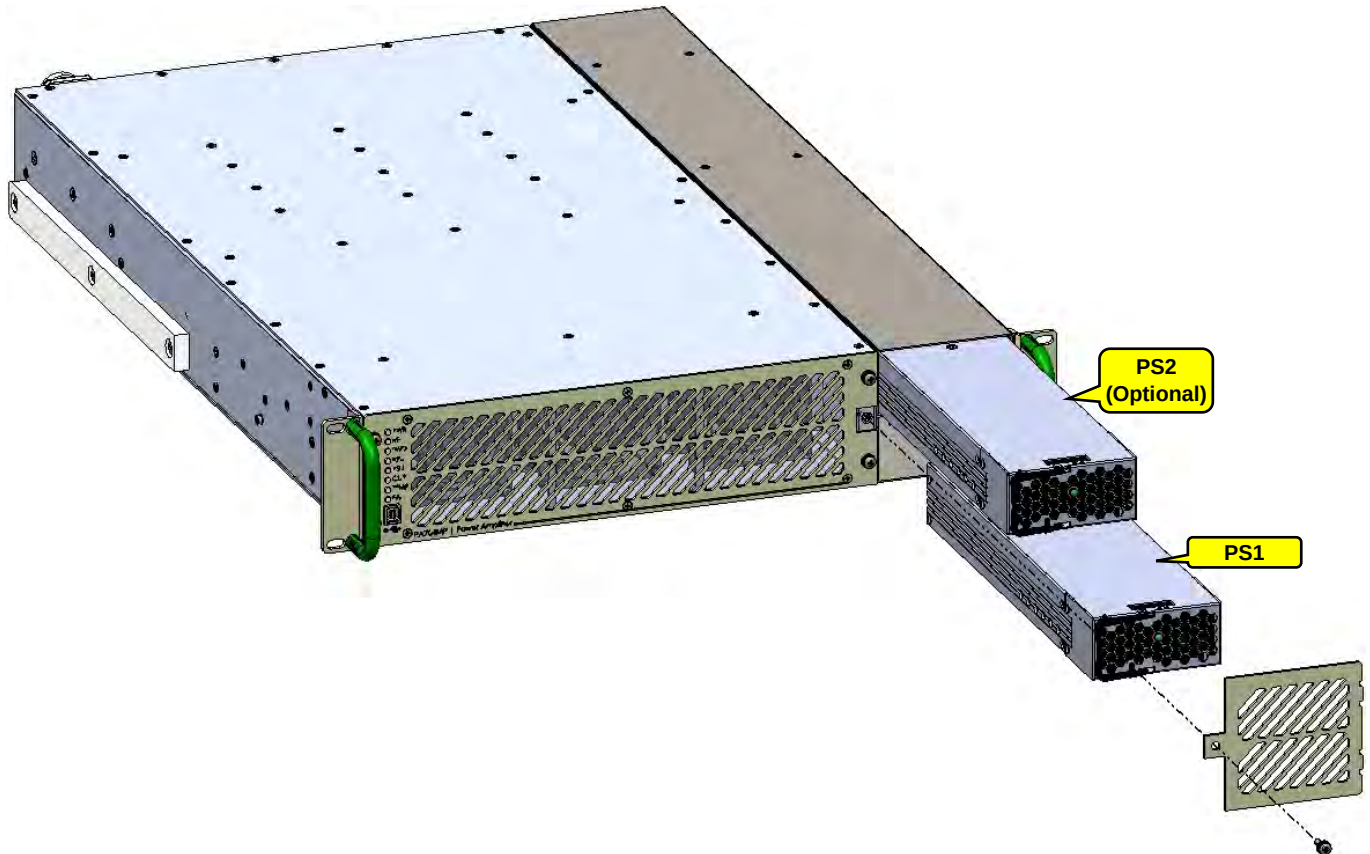


LED	Description
Green	The power supply functions normally.
Red	The LED will present a constant red light when the abnormal status (OTP, OLP, fan fail and charging timeout) arises.
Red (Flashing)	The LED will flash with the red light when the internal temperature reaches 60°C; under this condition, the unit still operates normally without entering OTP. (In the meantime, an alarm signal will be sent out through the PMBus interface.)

4.6.7. RPC-1600-48 - 1600 Watts Powers Supplies

Use MW model RPC-1600-48, 1600W AC-DC Power Supply

The Power Amplifiers Drawers use two 1600 Watt plug-in power supplies. Each one converts 180-240VAC single-phase line voltage to 40-50VDC and feature a quick-connect system that allows the unit to be easily removed through the front of the power amplifier chassis.



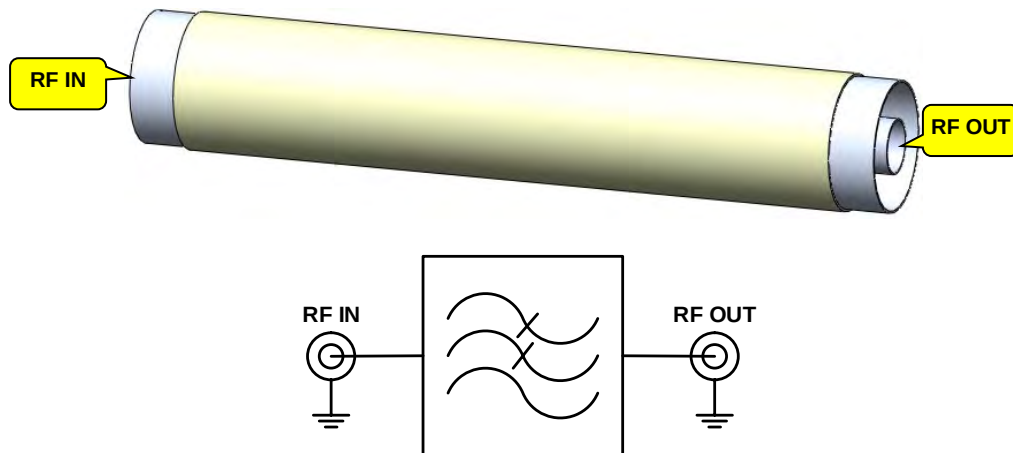
4.6.8. Power Supply Redundancy Operation / Power Reduction

The power supplies use a quick-connect system that allows the unit to be easily removed from the front of the power amplifier chassis. The power supply includes power factory correction, built-in I-rush protection, as well as overload protection (over-temperature, voltage, and current). The configuration of 2 PS's per power amplifier provides a soft-fail mode. In the EC704MP-BB3, if one PS is removed, the output power is reduced to 50% (see table above) of the nominal output power.

Power Supply redundancy operation – ATSC 1.0 – PS Mean-Well RCP1600-48:

Transmitter	Input Voltage	Number of PS operating	Output Power
EC702MP-BB3	100 ~ 253 VAC	1	100%
		2	100%
EC704MP-BB3	100 ~ 180 VAC	1	50%
		2	100%
	180 ~ 264 VAC	1	70%
		2	100%

4.3. EIA Low Pass Filter

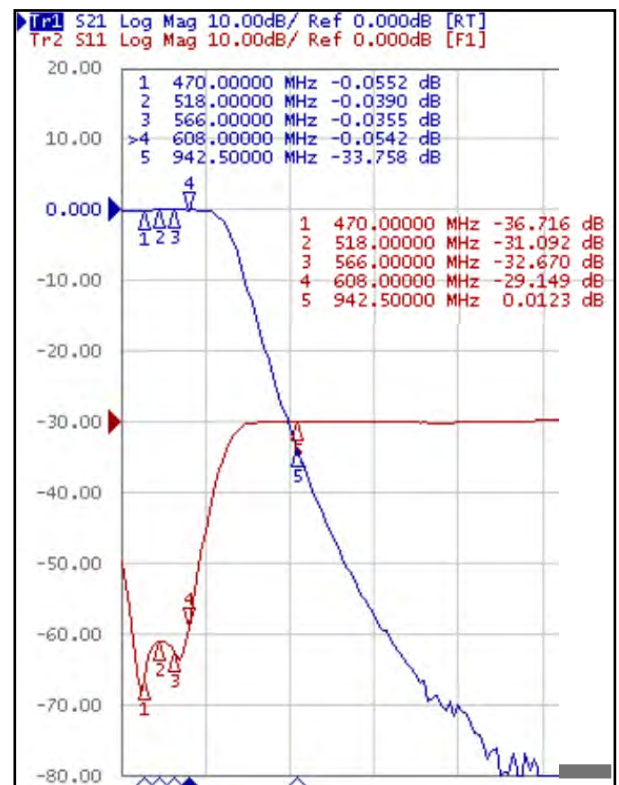


The Low Pass Filter is installed between the Power Amplifier Drawer RF Output and the Mask Filter, attenuating unwanted harmonic products so that they do not return as a reflected wave to the PA.

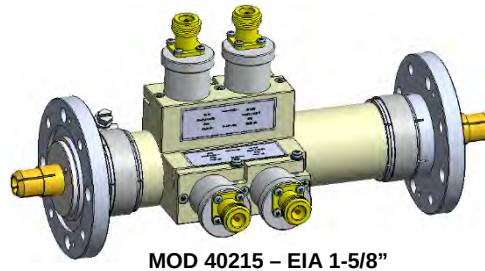
Low Pass Filter	EIA	Equipment
MOD 40243	1 – 5/8"	EC704MP-BB3

4.6.1. Features

Low Pass Filter Model	MOD 40243	
Use to	EC704MP-BB3	
Operation Frequency	470 to 608MHz - CH14 to CH36	
Connector / Impedance	1-5/8" EIA / 50 Ω	3-1/8" EIA / 50 Ω
Max Power	3300 Watts	5500 Watt
Return Loss	-26dB (min) -30dB (typical)	
Insertion Loss	-0.06dB (max) -0.05dB (typical)	
Second Harmonic Attenuation	Better than -30dB	



4.4. EIA RF Output Line with Sample Probe

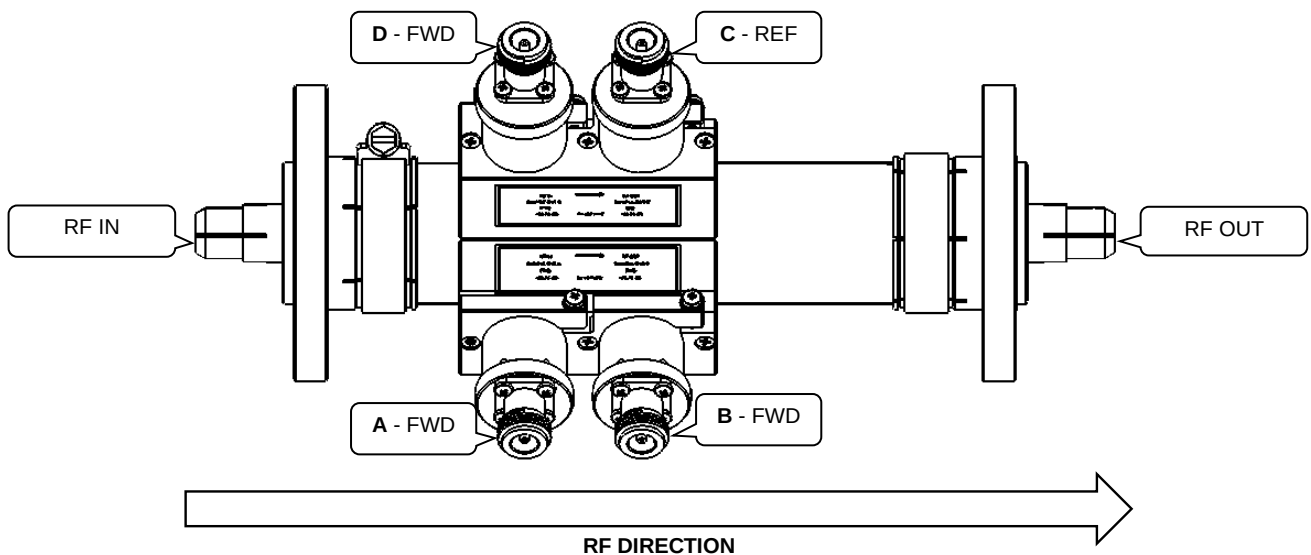


The EIA RF Output Line with Sample Probe is a passive coaxial RF sample installed in the Mask Filter RF output and has four independent RF outputs samples.

It has two signal samples for use in the non-linear adjustment, a sample for the reflected power monitoring and a direct power monitoring sample.

RF Output Line with Sample Probe	EIA	Equipment
MOD 40215	1 – 5/8"	EC704MP-BB3 @ ATSC

4.6.1. Features

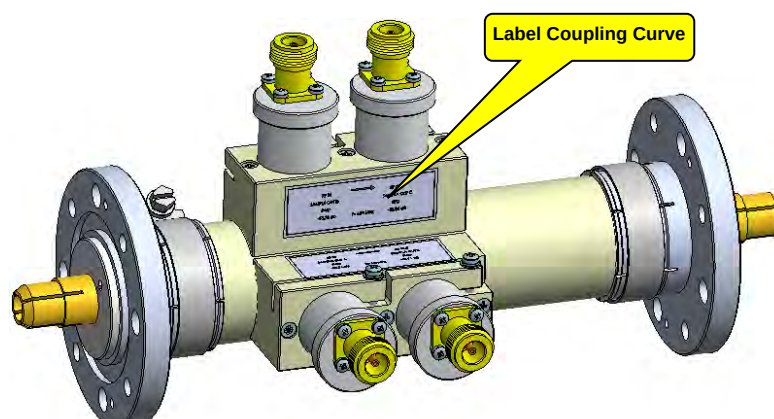


MODEL	MOD 40215
Operation Frequency	470 to 608MHz CH14 to CH36
Max Power	5500 Watts
Insertion Loss (RF IN – RF OUT)	-0.13dB (MAX); -0.10dB (MIN)
RF OUT	Connection: 1-5/8" EIA Flange Return Loss: -36dB (TYPICAL); -31dB (MIN) Impedance: 50Ω
RF IN	Connection: 1-5/8" EIA Flange Return Loss: -36dB (TYPICAL); -31dB (MIN) Impedance: 50Ω

MOD 40215 - GENERAL FEATURES

A – FWD Sample	Use for Non-Linear Correction Forward Power Sample Connection: N Coupling: -52dB (MAX); -61dB (MIN) Impedance: 50Ω
B – FWD Sample	
C – REF Sample	To monitor Reflected Power Output. Reflected Power Sample Connection: N Coupling: -52dB (MAX); -61dB (MIN) Impedance: 50Ω
D – FWD Sample	To monitor Forward Power Output. Forward Power Sample Connection: N Coupling: -52dB (MAX); -61dB (MIN) Impedance: 50Ω
Samples Return Loss	-28dB (TYPICAL); -27dB (MIN)
Insulation between RF OUT And FWD Samples A, B and D	-30dB (TYPICAL); -27dB (MIN)
Insulation between RF IN And REF Sample C	-30dB (TYPICAL); -27dB (MIN)

Check on the Sample output connector labels on the coupling curve for the corresponding frequency of the equipment.



4.5. Mask Filter

We recommend using Com-Tech RF Mask Filters:

Recommended bandpass filter for ATSC 1.0

Transmitter	Number of Poles	Model	Brand	Note
EC702MP-BB3	6	FC6D60C	COM-TECH	With Heat Sink
EC704MP-BB3	6	FC6D80C	COM-TECH	With Heat Sink

Recommended bandpass filter for ATSC 3.0

Transmitter	Number of Poles	Model	Brand	Note
EC702MP-BB3	6	FC6D60C	COM-TECH	With Heat Sink
EC704MP-BB3	6	FC6D80C	COM-TECH	With Heat Sink

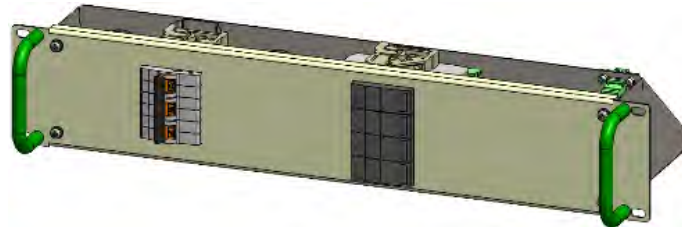
4.6. MCCB (Molded Case Circuit Breaker)

The MCCB (Molded Case Circuit Breaker) Drawer is responsible for the AC Power distribution and Equipment AC Power protection. Provides information to the Control Module regarding power supply conditions and protects the transmitter from power line problems.

MCCB has different power capacities according to the respective transmitter models:

Equipment	MCCB Model	Power
EC702MP-BB3	MOD 40323	2.0kW
EC704MP-BB3		

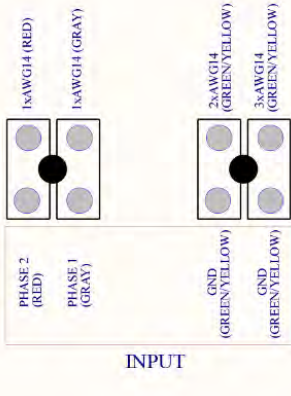
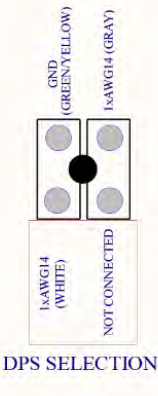
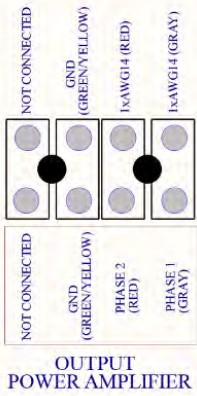
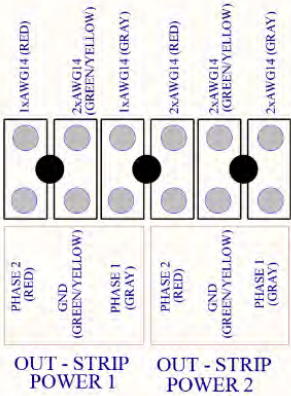
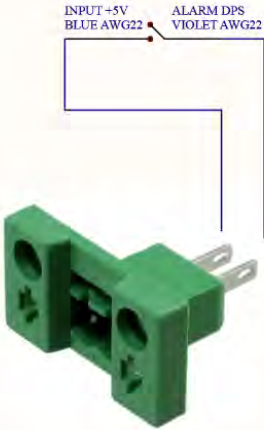
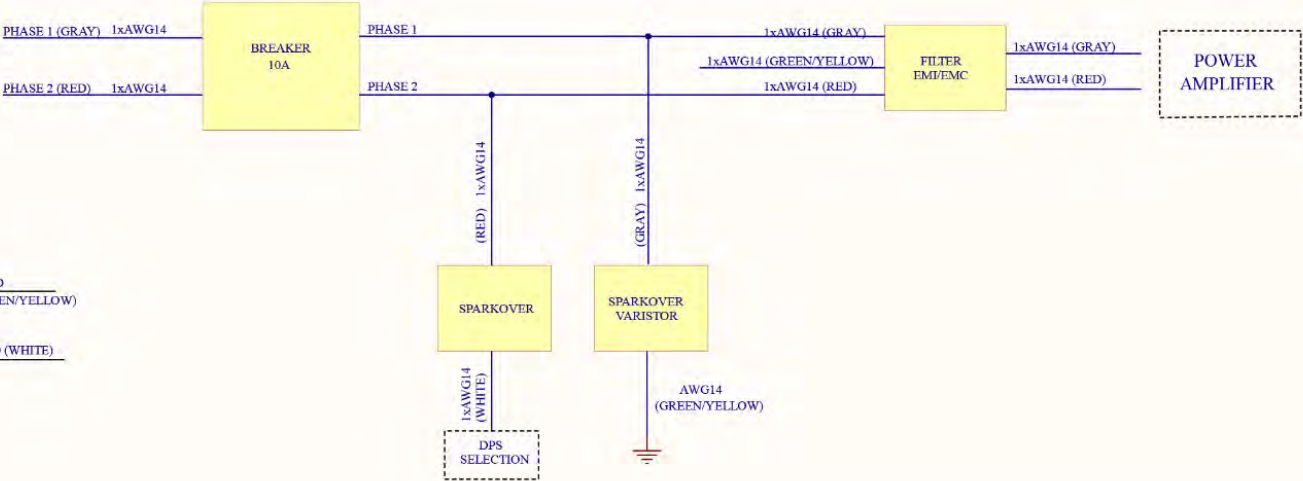
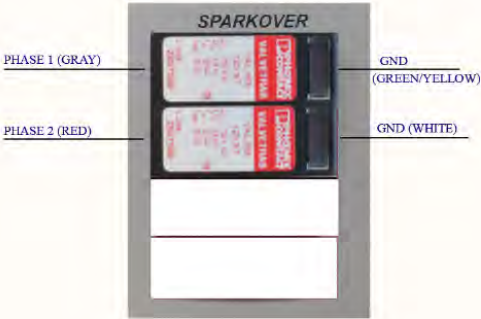
4.6.1. 2.0kW MCCB (MOD 40323)



Characteristics:

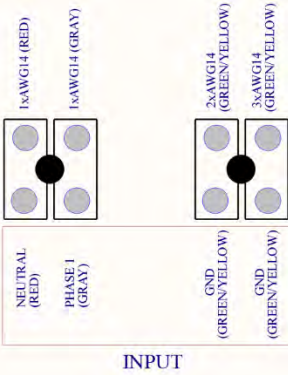
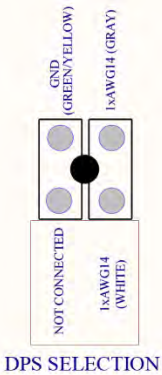
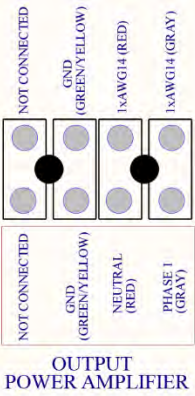
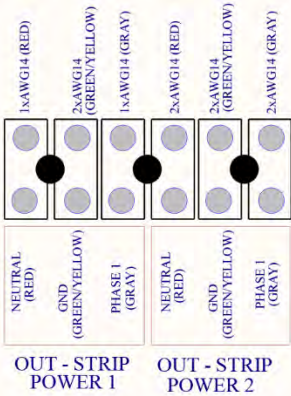
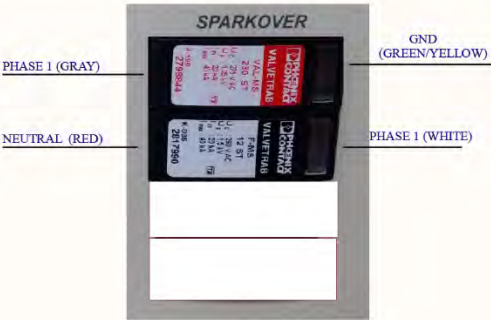
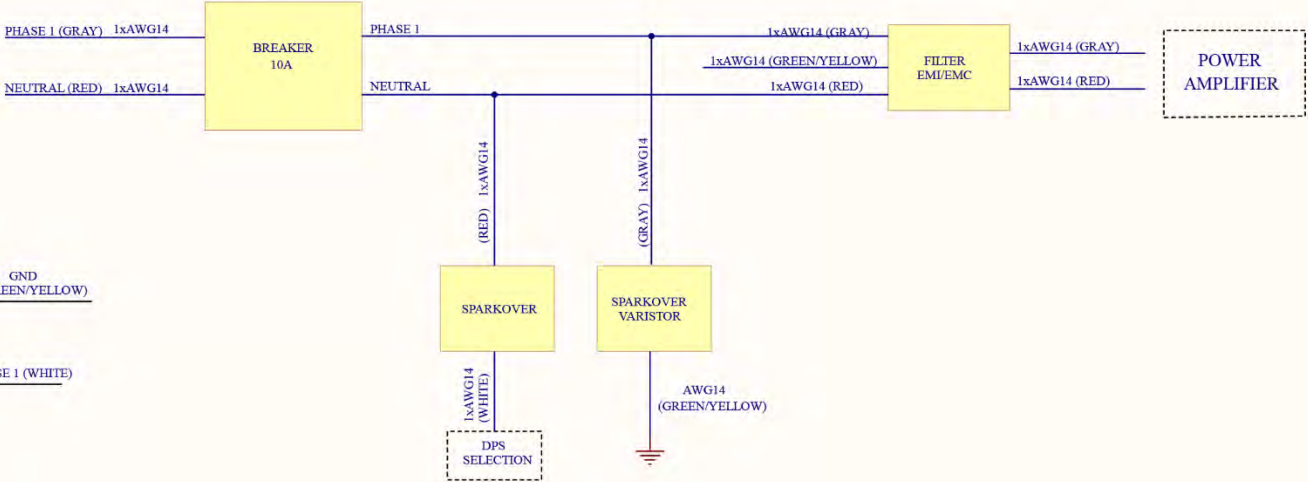
- For EC704MP-BB3 (AC 2.0kW)
- Surge Protection Device (SPD)
- Circuit Breaker
- Overvoltage Protection (>300VAC)
- EMC / EMI filter
- Available on Single-Phase (M220) and Biphasic (B220)

BIPHASIC 220VAC
2 PHASE (110VAC) + GND



HITACHI KOKUSAI LINEAR EQUIPAMENTOS ELETRONICOS SA			
Title: EQPEC704MP-BB3			
Size: A3	Number: MCCB 40323	Revision	CIP
Date: 24/07/2020		Drawn By: LEONARDO	
Approved By: Mauro Ariele		Sheet: 1 of 2	

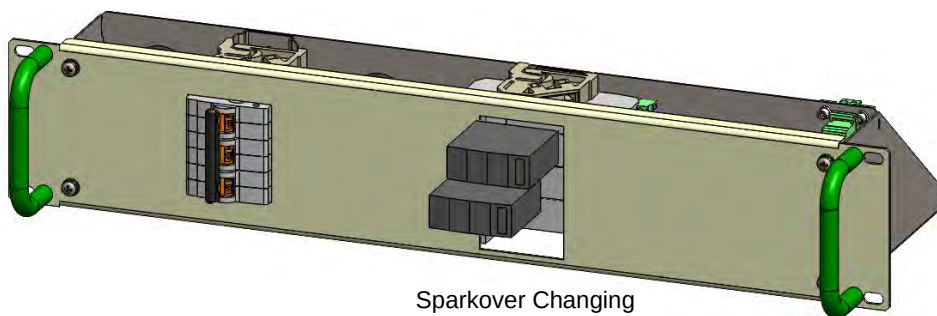
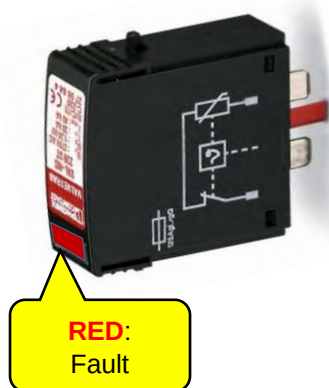
SINGLEPHASE 220VAC
1 PHASE + NEUTRAL + GND



HITACHI KOKUSAI LINEAR EQUIPAMENTOS ELETRONICOS SA			
Title: EQPEC704MP-BB3			
Size: A3	Number: MCCB 40323	Revision	CIP
Date: 24/07/2020		Drawn By: LEONARDO	
Approved By: Mauro Arriel		Sheet: 2 of 2	

4.6.2. Sparkover - Phase Surge Protection Device (SPD)

It is a device that limits overvoltages in the mains by diverting the current line to the ground in order to limit the amplitude of this overvoltage to a value that is not dangerous to the equipment. It is connected in parallel between the line and the ground and has high impedance. Once the transient overvoltage appears in the system the impedance of the device decreases and directs the current to earth, protecting the equipment. When this occurs the device signals a red flag, calling for replacement:

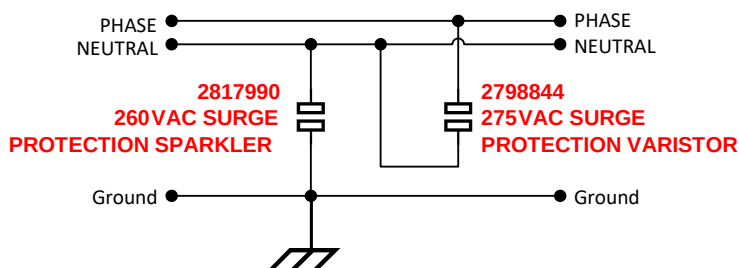


Sparkovers types:

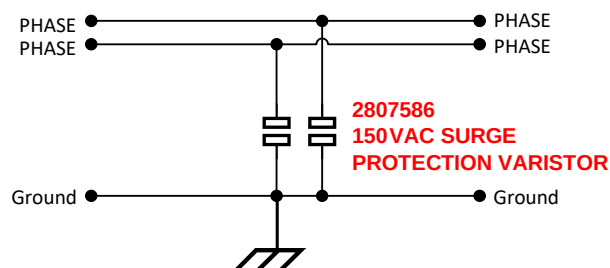
2798844 – 275VAC SURGE PROTECTION VARISTOR
2817990 – 260VAC SURGE PROTECTION SPARKLER
2807586 – 150VAC SURGE PROTECTION VARISTOR

About AC MAINS TYPE, see Section 8 – Attachments, USA AC Mains Types for E-

M208



B240



Never open the device: as there is a risk of electric shock. If necessary, contact Comark customer support.



Before Connecting the Machine to the AC Mains, one must ensure that the grid Voltage meets the equipment's settings.



Never expose the equipment to rain, moisture, or direct sunlight in order to avoiding risk of fire or electric shock.

Section 4 – Installation

1. Overview.

This section provides general information for planning the installation of the E-Compact High Power Line Transmitters, such as recommendations regarding Shelter, Tower, Antennas, Cables, Grounding, Power Line, Prevention against transients, etc.

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 details 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.

Comark 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 Electric Comark LLC's customer support.

3. Installation Recommendations.

3.1. Preventive Protection

Voltage transients with a duration of micro and nano-seconds are a constant challenge for 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 electronic components. The protection must always be 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.

3.2. Tower

For the installation of the 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 features a special insulator support for descent of cordage of the lightning rod with a maximum space of 1.5m between them.
- b) There must be lightning signaling system every 20m along the tower.
- c) It must be painted with orange and white stripes every 2m with 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. Because of this the tower is used as a part of the protection system. The lightning protection device used in these cases is called a lightning rod and has the function of guiding the electrical discharge safely, avoiding other parts of the system that could 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 arresters are not covered by warranty.

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 and a field strength meter for the fine adjustment of the reception 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 from entering them.

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.

3.4. Indoors Equipment Installation

Small equipment 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 compromise the equipment's air flow by placing objects on its top panel, which is its natural ventilation.

The equipment 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 to avoid obstruction of its ventilation system.

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.

3.5. Equipment Grounding

Assemble the grounding separately from the power supply, with a rig and a grounding terminal that comes with the equipment.

Normally, the retransmission sites are located in the highest spot of the chosen location, making 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 equipment 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 mandatory.

Lightning is a transient, high-current electric 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 grounding 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 determine the behavior of the soil capacity to drain the currents, its resistivity has to be measured. For an adequate protection this value should not exceed 5, with zero being 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 equipment 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.

3.6. 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 equipment.

To protect the equipment 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.

3.7. Power Supply

Before plugging the equipment to the power supply, verify the voltage in the outlet to make sure that it 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.

4. Equipment Assembly



Only trained personnel should conduct physical assembly on site.



Observe the requirements described in this manual in Sections 1 (Care, Warranty and Service) and Section 2 (Minimum Installation Requirements).

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

- (1) The air intake (front) and the air outlet (rear) must be completely unobstructed.
- (2) The transmitter rack should be positioned to ensure easy access from either side. The distance between the transmitter and the walls of the shed must be at least 1.0 meter.
- (3) In case of installation on a site containing other connected transmitters, do not position the transmitter in a location that can receive hot air from other transmitters.

4.1. Assembly

- (1) Unpacking the transmitter and drawers.
- (2) Position the rack where the equipment is installed in compliance with the following equipment:

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

- (3) Visual Inspection:

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.

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

Check the power switches located on the left of the rear panel of the units, make sure they are in the "ON" position.

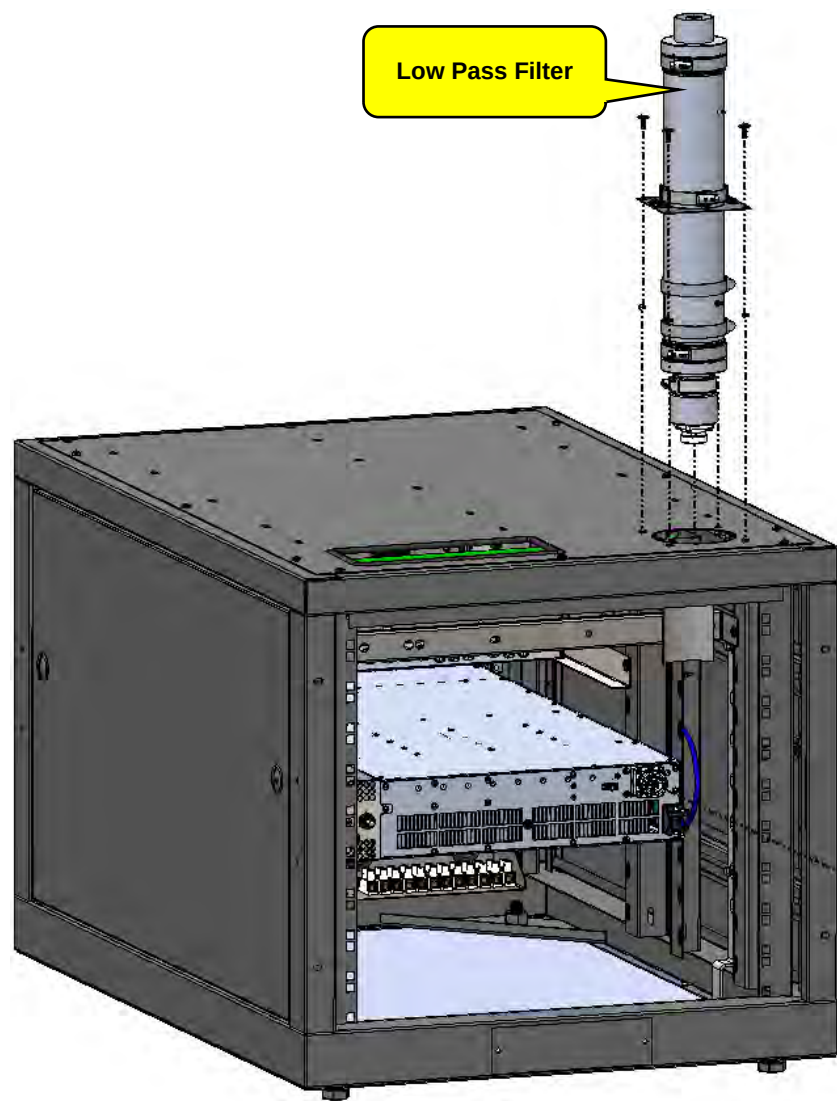
- (4) Grounding:

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.



- (5) Remove the cabinet rear and side housings to facilitate equipment mount.

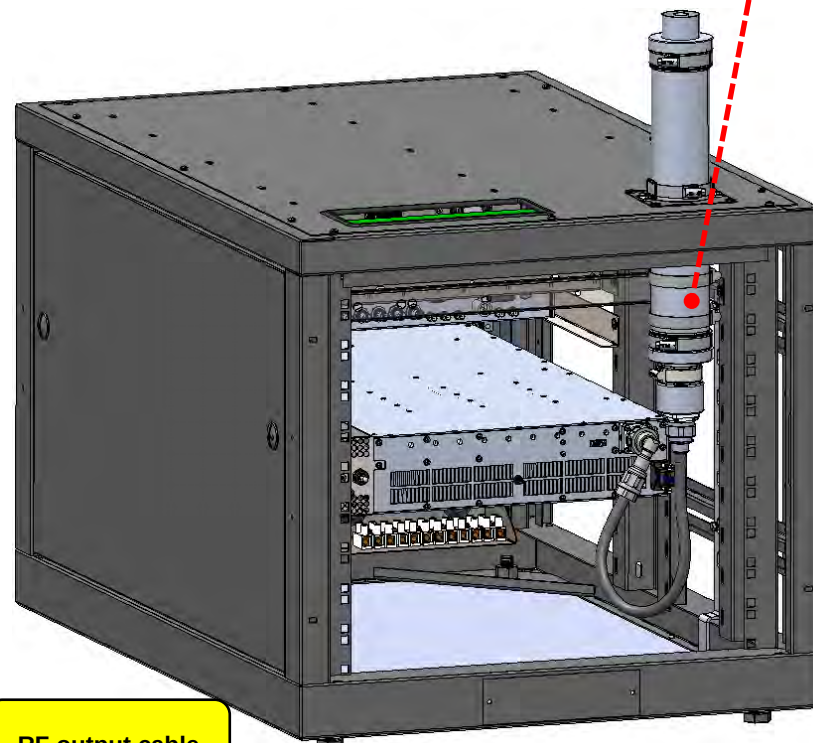
(6) Assembly:



EC704MP-BB3 (rer view)

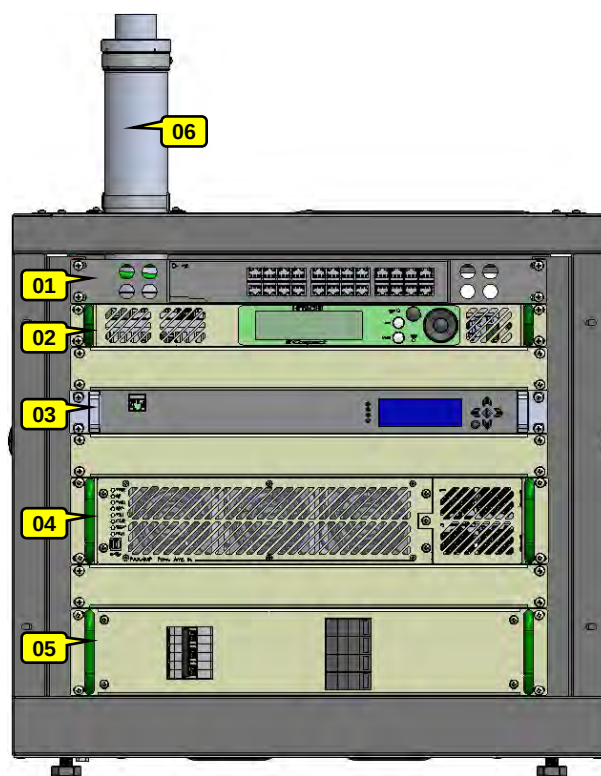


RF output cable

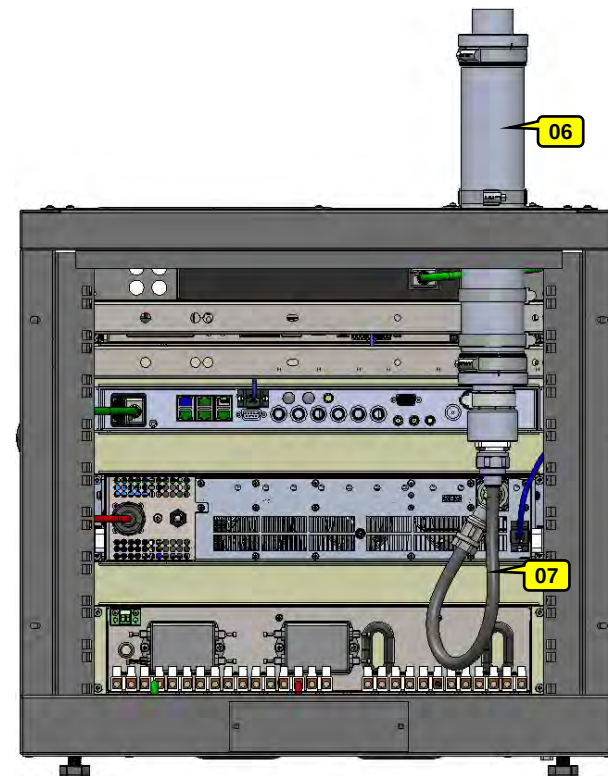


EC704MP-BB3 (rer view)

Ref	Drawer
01	Switch
02	Control Module CM9001
03	Exciter
04	Power Amplifier PA704MP
05	MCCB MOD 40323 2kW
06	RF Low Pass Filter MOD 40243
07	RF Output cable



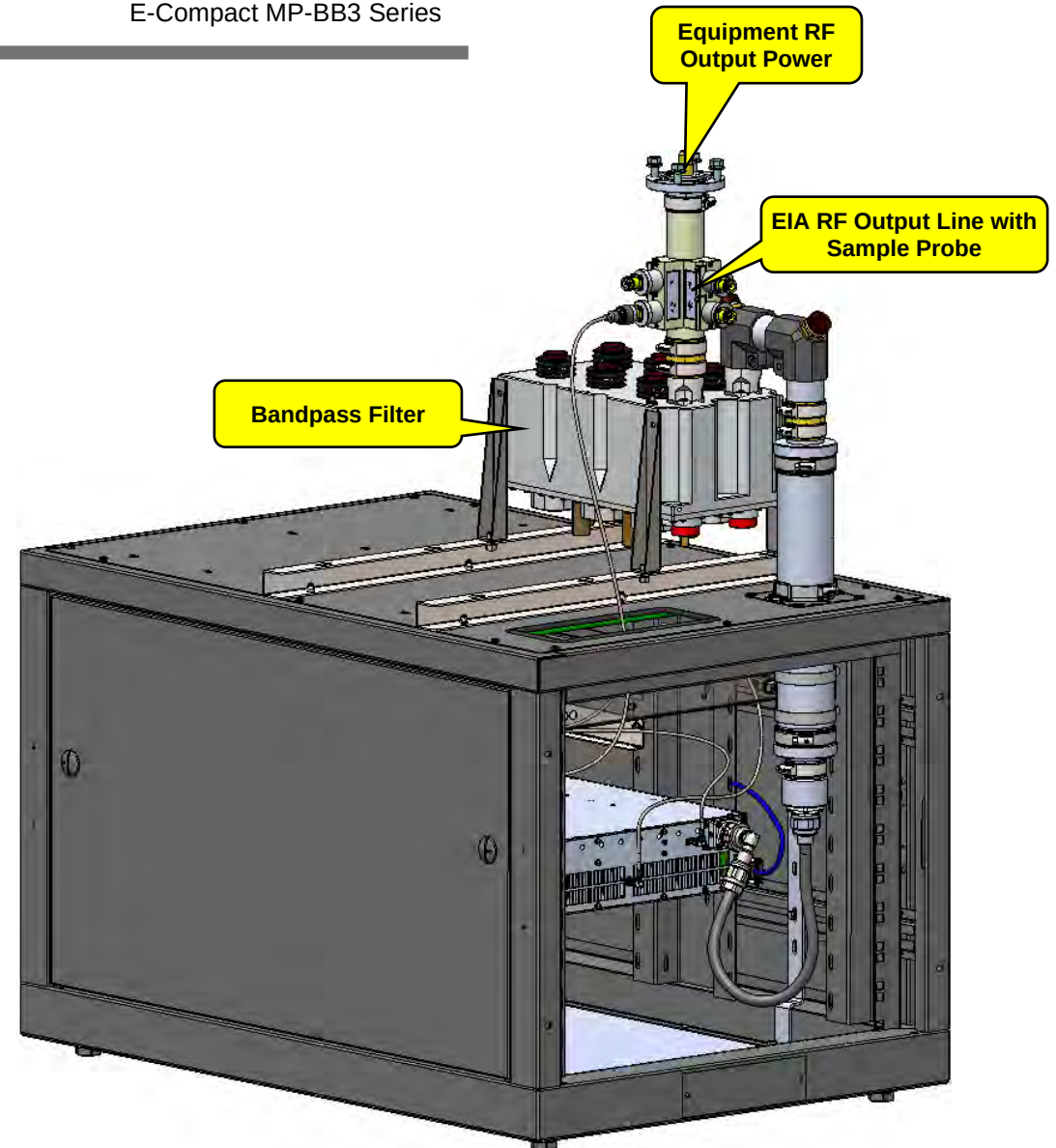
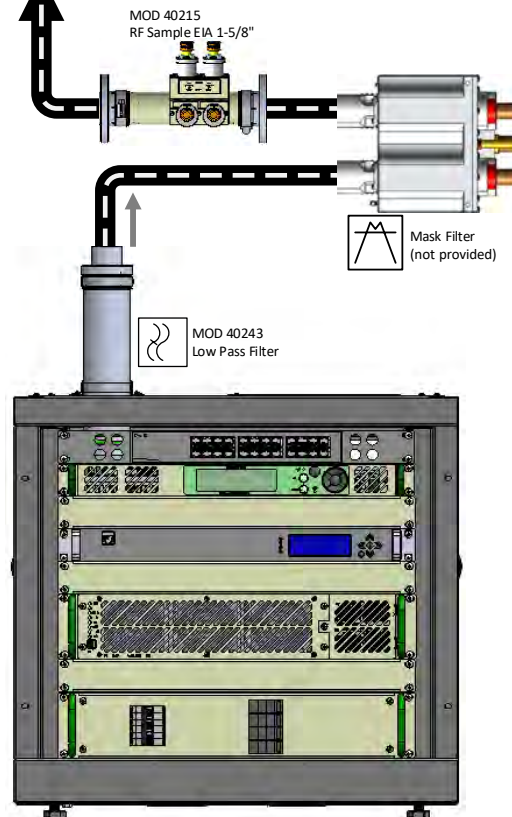
EC704MP-BB3 (front view)



EC704MP-BB3 (rer view)

BANDPASS FILTER INSTALL

ANTENNA



4.2. Internal Connections

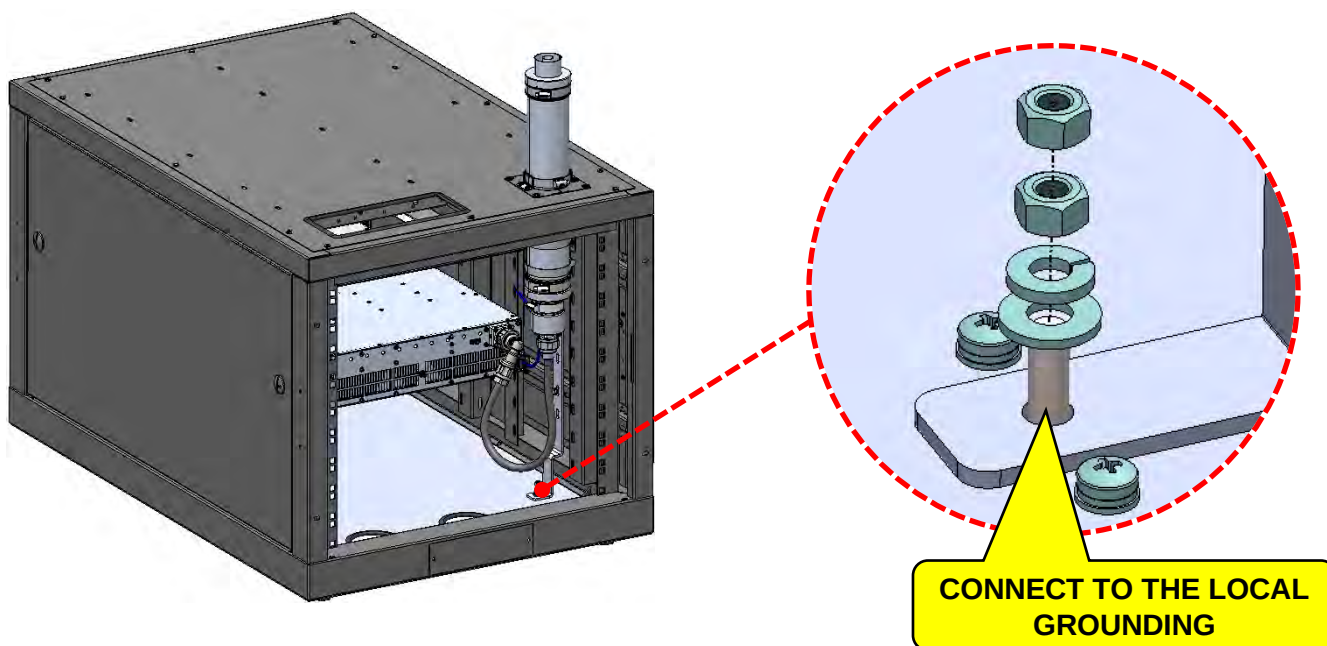
The following connections must be made:

- RF cables
- AC power cables and grounding
- Control Modules cables
- Rejection loads drawer cables
- Ethernet Switch
- Transport Stream cables (ASI)

(7) Loosen all the fixed cables inside the rack by removing yellow clamp ties:



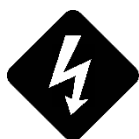
4.3. GND Connection



4.4. AC Electrical Line Connection



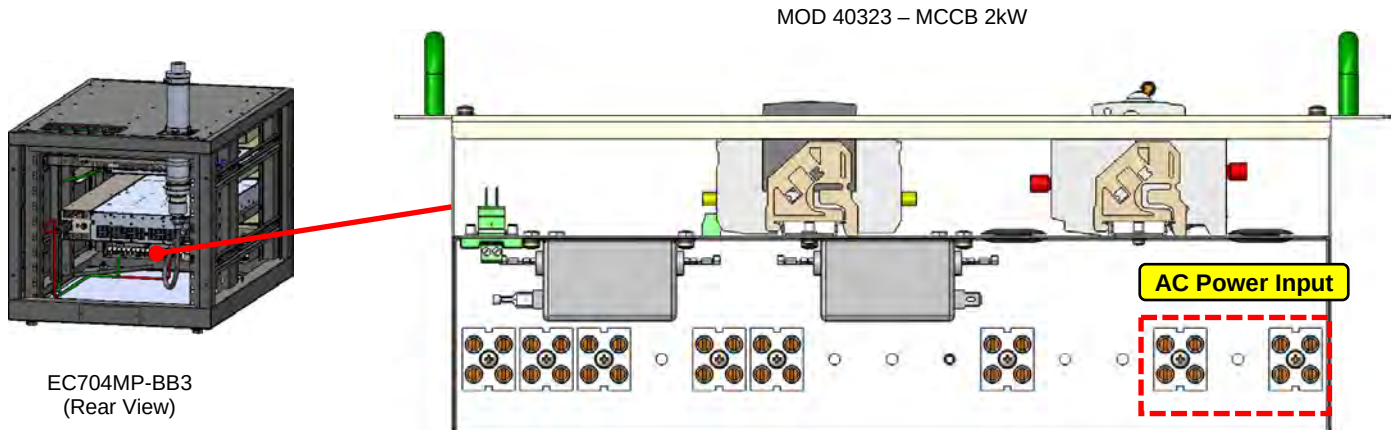
Prior to energizing the transmitter, one must make sure that the circuit breaker and the power switch (ON / OFF) are switched off or disabled.



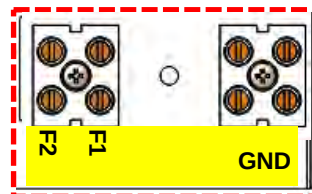
Before Connecting the transmitter to the AC Mains, one must ensure that the grid Voltage meets the equipment settings. Any questions, please refer to **Section 4 item 6.2. "Sparkover - Phase Surge Protection Device (SPD)"** of this manual.



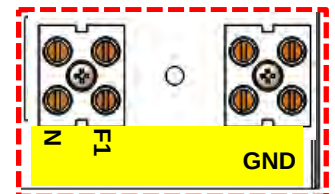
Connection modes according to the Grid Voltage:



**BIFASIC 220V
2-PAHSE (110V) +
GND**



**SINGLE-PHASE 220V
1-PAHSE (208V) +
NEUTRAL+GND**



Legend

F1	Phase 1 Input
F2	Phase 2 Input
N	Neutral
GND	Ground



Never invert the Neutral with the Phases.



The screws must be properly tightened in order to avoid sparks.

Section 5 - Initial Activation

1. Overview

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.



Never turn on the equipment without connecting it to an Antenna or RF Load, as this may cause serious damage to the Equipment.



You must ensure that the general circuit breaker is off. Then, ensure that the all POWER ON / OFF settings are set to the OFF position in all Drawers.



Make sure that the Channel is configured and the Exciter is the same as the Mask Filter and the antenna.



Check if the Antenna VSWR for the operating channel is better than -23dB of Return Loss.



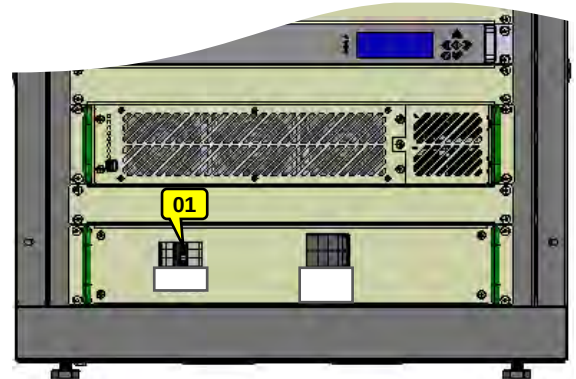
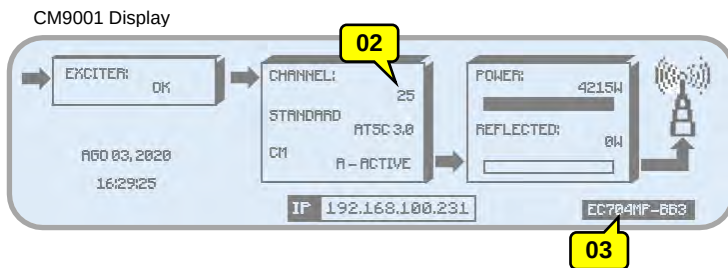
Using a voltmeter, check that the AC Mains of the equipment is within its characteristics.

2. Activation



The steps of this activation must be followed to avoid damage to the equipment.

1 st	Before Turn-On, Check if all on/off key Drawers are " off "
2 nd	Trigger the circuit breaker on (01)
3 rd	Power On (Rear Panel) The Exciters and the CM9001 Module Control



4 th	Check if both the Exciter (Main and Backup) are configured for the correct channel, the same as the Mask Filter and the Antenna
5 th	Check if both the Module Control CM9001 (Main and Backup): Channel is the same of the Exciter (02) The description of the Equipment is correct (03)
6 th	Check if the Main Exciter and Main Module Control CM9001 are active
7 th	Check if the Programmed Power in Main Module Control CM9001 is 0 (ZERO) Watts: Display Interface >Measurements > Power > Programmed Power [1/3]

8 th	In the Power Amplifier Drawer 1 Switch On the Power Amplifier (04)
9 th	Check the Drawer Communication Status. In the Main Module Control Display Interface: >Measurements > Communications Status HPA01 = OK
10 th	Check the ALL Power Supply and Current when 0 (Zero) Watts Transmitter FWD Power: In the Main Module Control Display Interface: >Measurements > Drawers > Power Supply Power Supply $\approx$ 50.0V >Measurements > Drawers > Current $I \approx$ 0.30A (for each PA)



PA704MP – REAR

11 th	Set the Programmed Power in Main Module Control CM9001 to <u>10%</u> of the total power of the equipment Display Interface >Measurements > Power > Programmed Power
12 th	Check: - Alarms Occurrences: >System Alarms/Log > Current Alarms No alarms - Reflected Power: >Measurements > Power > Reflected The REF power must be less than 2% of FWD Power. - Check the ALL Power Supplies, Current and Temperature in the Power Amplifiers Drawers >Measurements > Drawers] > Power Supply Power Supply ≈ 50.0V (all) >Measurements > Drawers > Current All must be of the same current value >Measurements > Drawers > Temperature Below 131°F (55 °C)
13 th	Set the Programmed Power in Main Module Control CM9001 to <u>25%</u> of the total power of the equipment. Display Interface >Measurements > Power > Programmed Power Repeat the check from 12th step.
14 th	Set the Programmed Power in Main Module Control CM9001 to <u>50%</u> of the total power of the equipment. Display Interface >Measurements > Power > Programmed Power Repeat the check from 12th step.
15 th	Set the Programmed Power in Main Module Control CM9001 to <u>75%</u> of the total power of the equipment. Display Interface >Measurements > Power > Programmed Power Repeat the check from 12th step.
16 th	Set the Programmed Power in Main Module Control CM9001 to <u>100%</u> of the total power of the equipment. Display Interface >Measurements > Power > Programmed Power Repeat the check from 12th step.



If there is an alarm during the power startup, it is advisable to zero the output power of the transmitter to determine the solution and then contact Comark's customer support.



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 further increasing the transmitter's power.



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 60°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.

3. Main Operations.

3.1. Power Changing

The alteration of the transmitter power is something possible and accessible to the customer through the screen POWER SETUP by software navigation Menu in the digital display.

3.2. Communication

Ethernet Communication:

This equipment has a Web Page server accessed by the Ethernet port located on the front panel of the Module Control CM9001. Once the Control Module is connected to the Switch, this graphical interface can be accessed by connecting to one of the Switch ports.

USB Communication:

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

4. Forbidden operations

There are transmitter parameters which are configured at the factory, parameters defined on the purchase of the transmitter. There are parameters that are set at the factory - and as previously noted, were provided at the purchase – which cannot then be changed.

- Channel
- Equipment Model

There are other parameters that are configured in the factory but might be reconfigured 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.

5. Protections

5.1. Reflected Power

If the incidence of reflected power at the transmitter due to any external or internal factor occurs, refer to the measurement screen (MEASUREMENTS) by browsing the software's navigation Menu, according to instructions given in the Operation Section of the Digital Control System.

If the value of the reflected power exceeds the value of 2% of rated power, the control immediately signals through the Current Alarm LED and this triggers the routine protection against reflected power. This gradually decreases the value of the forward power until the amount of power reflected returns to less than 2% of rated output. At this time, the software returns to gradually increase the value of forward power, foreseeing the possible absence 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 2% of rated power, always seeking the return to the rated power of equipment.

The 2% value to generate the reflected power alarm is fixed, ie. the alarm always occurs when the reflected power is 2% of the nominal power of the EQP. Already the reflected value that makes the EQP reduce direct power to a configurable 2 to 5%. To change this value, go to Setup Menu-> Alarms Mask-> Reflected and change as needed.

5.2. Over-excitation

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

5.3. AC Mains Line Protection

Each piece of equipment has it's 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 the phase and ground, thus absorbing peak voltage and not allowing it to damage the power supply. Protection against the short-circuit is carried out by monitoring the current in the output of the power supply. 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.

5.4. Transmitter Operating Temperature Configuration

The transmitter's operating temperature is measured on the power modules' transistors and is configurable between 50°C (122 °F) and 60°C (140 °F).

Configuration is done through the front panel Menu: Setup Menu "PA Temperature Control".

This configuration varies according to room temperature and the transmitter's efficiency and is necessary to optimize the operating temperature and equipment's lifespan.

This configuration shall be made when the equipment is activated following the procedure below:

1. With the transmitter running at operational power for at least 30 minutes, access the web or the PA USB interface to verify fan rotation.
2. Check fan rotation for all fans in all of the PA's.
3. Temperature adjustment must be done in order to obtain fan rotations between 5500 rpm and 6000 rpm.
4. If the highest rotation is below 5500 rpm, the temperature control has to be lowered. If it is above 6000 rpm, temperature control shall be raised.
5. Configure temperature at Setup Menu "PA Temperature Control". Lower or raise the temperature according to description in step 4 above. It is recommended that the procedure starts in steps of 4 °C.
6. Once configured, wait 5 minutes until transistor temperature stabilizes.
7. Repeat steps 3 through 6 until fan rotation is within range (5500 rpm to 6000 rpm).

Section 7 – Preventive Maintenance

1. Overview

This section is dedicated to the necessary procedures for proper preventive, periodic, and corrective maintenance in order to guarantee a TV transmitter that works properly and for a longer period of time.



Only trained and authorized people should be allowed to open the transmitter. The non-compliance of this item might result in the loss of warranty.

IMPORTANT:

- ⇒ The life expectancy of the equipment depends on its working conditions.
- ⇒ Environments with controlled temperatures increase the life span of the components.
- ⇒ In the semester inspections, if there is a noise or an abnormal vibration in the fan located inside the equipment, it should be replaced. This same procedure should be followed for the frontal panel fans in the power drawers or the exciter module.

2. Preventive Maintenance

2.1. Cleaning

Initial steps

- ⇒ Unplug the equipment from the power outlet.
- ⇒ Remove the side and top covers.
- ⇒ Disconnect all RF cables from the rear panel.

Procedure:

1. With an air blower, remove all the accumulated dust from the inside of the equipment, in the front and rear panels, sides, top, and bottom covers.
2. Clean the panels and the measurement instruments with a dry and soft cloth.
3. Remove the dust from the input of the air filters located in the bottom panel, side, and rear covers.



Do not allow any kind of particles or dust to get into the filter cavities.

4. If you can't use an air blower, use a brush with soft bristles to avoid scratching the equipment.
5. When you are done cleaning the equipment, put the side covers back in place, redo all RF and power connections, and turn the equipment on. Follow the activation procedure.

2.2. Visual Inspection

Remove the side covers.

1. Verify if all the connections in the modules, as well as the RF connections in the equipment and the irradiant system are correct.
2. Verify if rain water is coming through the RF cables or water dripping from the shelter's ceiling.
3. Verify all the air inputs and outputs of the equipment to make sure that they are not blocked.
4. When you finish the visual inspection, put the side covers back.

2.3. Reading Verification

Make all the possible measurements through the instruments and take notes of the results. Compare the obtained results with the quality control sheets, which come with the equipment. The monthly verification of these measurements helps to prevent any abnormality that may occur.

2.4. Power Transistors Ageing Adjust

We recommend that the first polarization adjustment of the power drawer's transistors occurs after the 6th month of operation and then annually from then on. This review will compensate for the variation in performance due to the aging of the device.

Perform the adjustment on the VGS voltage periodically. The transistor gain at its operating point on the saturation curve does not change, it maintains the nominal power with the same original ALC voltage and also maintains the original MER without the need to perform pre-correction.



This parameter is configured at the factory and should only be handled by a qualified technician and equipped with the appropriate test and measurement equipment. Improper modification can cause serious damage to the Equipment.

Access the "22/24 [1M00] Setup Menu / Transistor Aging Adjustment:"

```
Setup Menu: 22/24 [1000]
-> Transistor Aging Adjustment
```

Press <ENTER>.

The following warning appears:

```
WARNING!!! Changing this settings will
reduce power to zero. Continue? ◀ Yes ▶
```

Select "YES" and press <ENTER>.

The Bias values adjusts automatically and the equipment power reduces to 0 (zero).



When updating the transistors Bias values, the equipment reduces the power to ZERO. It only returns to the operating power manually, that is, when it is necessary to reprogram the operating power value in the item "Program" of the menu: "Setup Menu / Power Setup".

Access the "01/24 [1100] Setup Menu / Power Setup" and program the transmitter to the rated power.

```
Power Setup: 1/1 [100]
Program: 1000[W] Output: 1000[W]
```

Power value

Section 8 - Attachments

1. POWER AMPLIFIER DRAWER: Fan Filter Access for Cleaning / Fan Replacement

