

Operation Manual

HITACHI
Inspire the Next

UHF Digital TV Transmitters

ATSC 3.0: 930 to 3800 Watts RMS

ATSC 1.0: 1100 to 4400 Watts RMS

E-Compact High Power Series

EC701HP-BB3

EC702HP-BB3

EC703HP-BB3

EC704HP-BB3



Read before handling the equipment.

W A R N I N G

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Operation Manual
UHF Digital Transmitters
ATSC 3.0: 930 to 3800 Watts RMS
ATSC 1.0: 1100 to 4400 Watts RMS
E-Compact High Power Series
EC701HP-BB3 • EC702HP-BB3
EC703HP-BB3 • EC704HP-BB3

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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 Pre distortion
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
HKC	Hitachi Kokusa Electric Comark
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/Apply
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
TSolP	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 High-Power E-Compact series of UHF TV signal transmitters (digital ATSC).

EC701HP-BB3

930W UHF ATSC 3.0 Transmitter (6-poles filter)

1.1kW UHF ATSC 1.0 Transmitter (6-poles filter)

EC702HP-BB3

1.86kW UHF ATSC 3.0 Transmitter (6-poles filter)

2.2kW UHF ATSC 1.0 Transmitter (6-poles filter)

EC703HP-BB3

2.85kW UHF ATSC 3.0 Transmitter (6-poles filter)

3.3kW UHF ATSC 1.0 Transmitter (6-poles filter)

EC704HP-BB3

3.8kW UHF ATSC 3.0 Transmitter (6-poles filter)

4.4kW UHF ATSC 1.0 Transmitter (6-poles filter)

Hitachi Kokusai Electric Comark LLC recommends that you carefully read this manual before installing or operating this 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 follow:

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

5. Structure

This manual is comprised of seven (7) 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 is 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 Transmitter

This section presents all equipment characteristics, such as description, models, functional description, and technical specifications of all models of the E-Compact series 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 Comark customer 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 avoiding risk of fire or electric shock.



Avoid risks of accidents with regards to heights and electricity. Always install or maintain this equipment by 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 Drawer 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. Voltage stabilizer or UPS (with isolating transformer) according to the transmitter's consumption
5. Surge suppressors

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

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

AC load for infrastructure install (A) - E-Compact Series - ATSC												
MODEL	M110			M220 / B220			T220			T380		
	(A)	Wire mm²	Gauge AWG	(A)	Wire mm²	Gauge AWG	(A)	Wire mm²	Gauge AWG	(A) Typical	Wire mm²	Gauge AWG
EC701HP-BB3				18.1	8.36	8	10.4	5.26	10	6.0	3.31	12
EC702HP-BB3				34.6	16.77	5	20.0	10.55	7	11.5	5.26	10
EC703HP-BB3				51.6	26.67	3	29.8	13.3	6	17.2	8.36	8
EC704HP-BB3				72.4	33.63	2	41.8	21.15	4	24.1	10.55	7



Not available or uncommon use

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 large, consider 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.

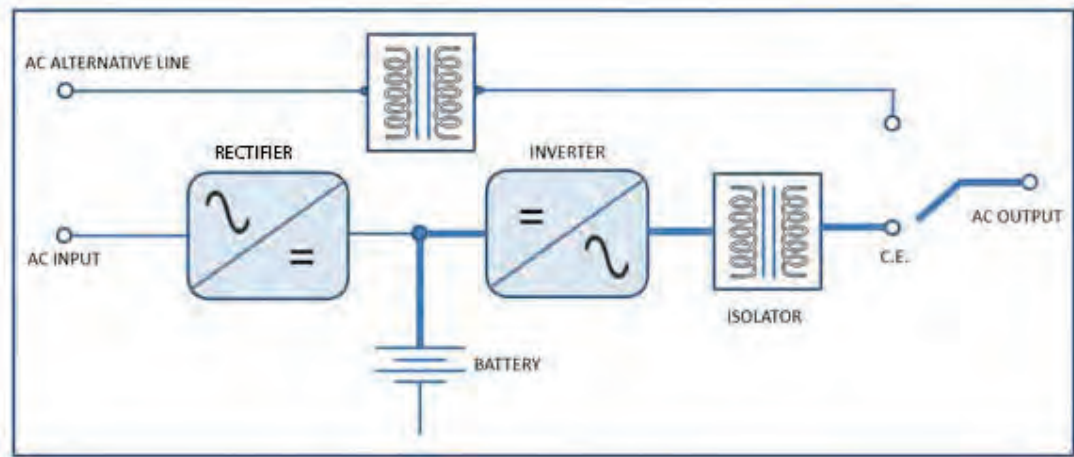
Input voltage variations above 15% of the rated values specified for the Comark TV transmitter may cause damage to the equipment and in this case will not be covered by the factory warranty. In addition, it is important to check the potential difference between the ground and neutral terminals (if any)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

2.4. Insulation

It is important 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.

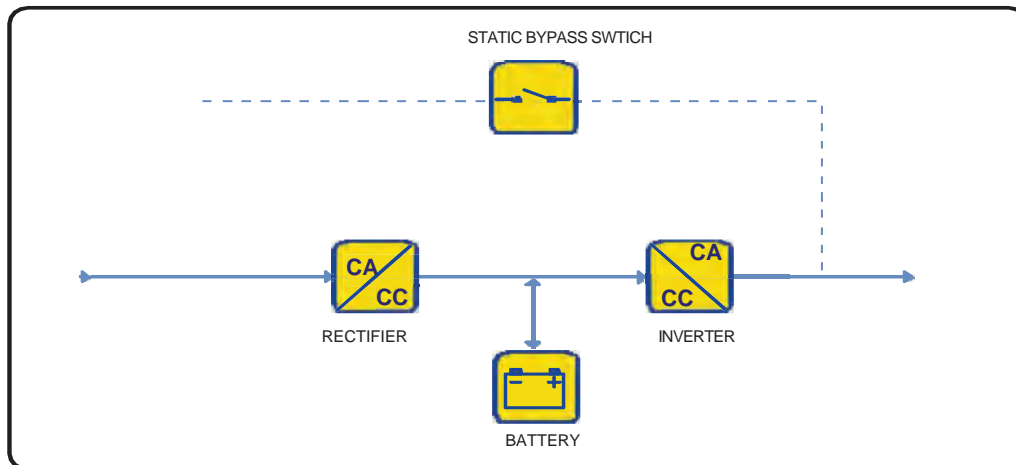
Nobreak capability

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

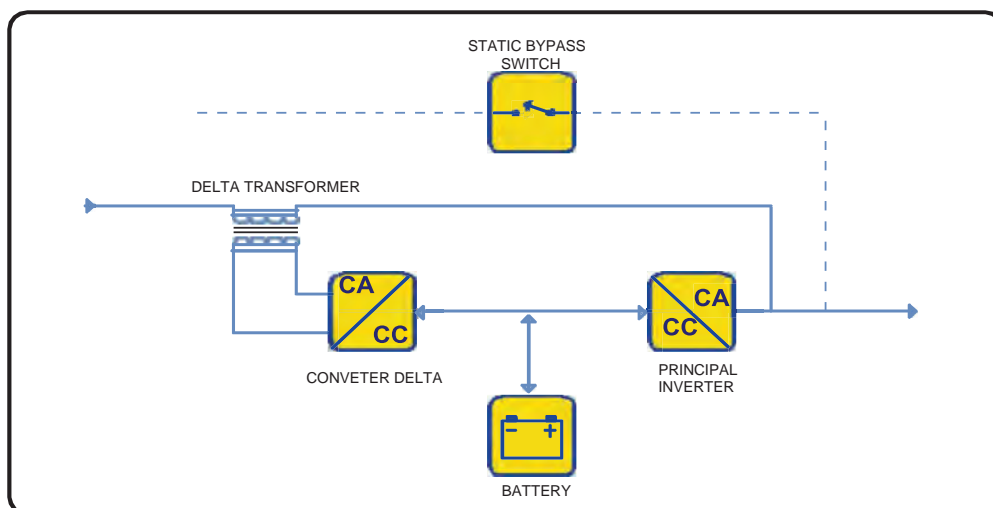
P_{TX} : Real Power [W]

$\cos \Phi$: 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:

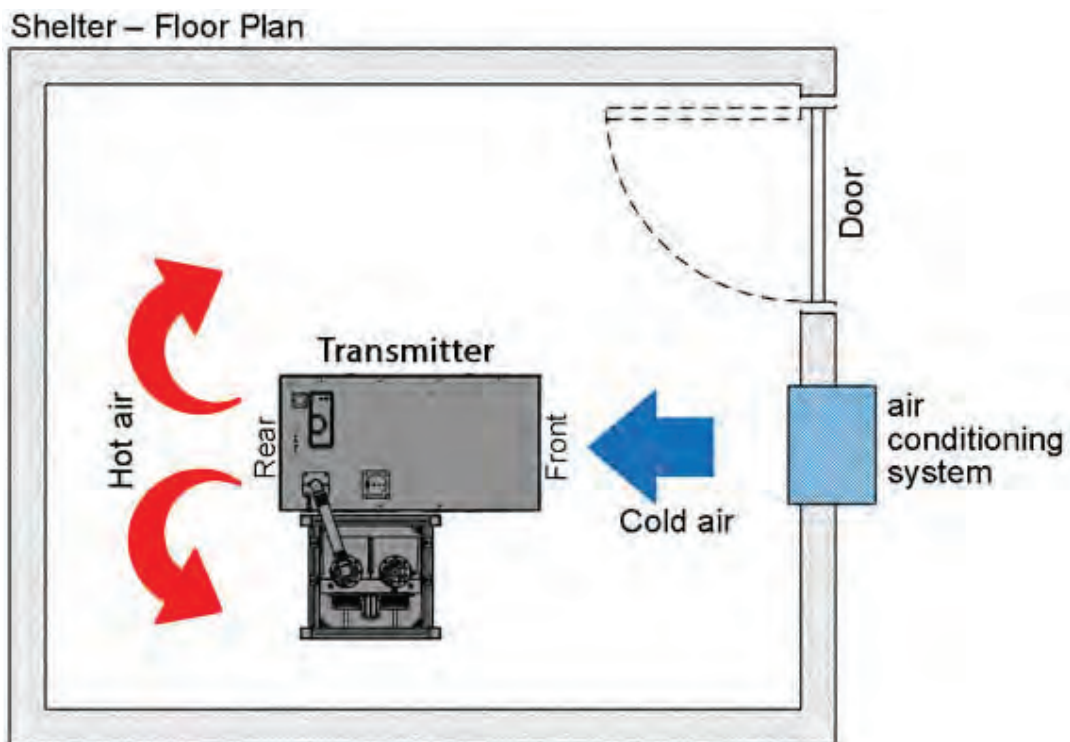
- E-COMPACT LOW POWER TV TRANSMITTERS: 0 to 90%
- E-COMPACT MEDIUM POWER AND HIGH-POWER TV TRANSMITTERS: 0 to 80%

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)
EC701HP-BB3	3976	9815
EC702HP-BB3	7609	18457
EC703HP-BB3	11356	27487
EC704HP-BB3	15930	39340

Section 3 – E-Compact BB3 High Power Series UHF Digital 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 / 608-701MHz)
- 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 High Power BB3 Family of solid-state DTV transmitters includes four models that provide transmitter power outputs (TPO) from 930 to 3800 watts ATSC 3.0. Each power amplifier module has an excellent power density, with 3RU and 19". Featuring high gain Broadband Doherty LDMOS configured for transmitting up to 1.1kWrms (ATSC 3.0). Doherty Technology provides high efficiency and consumption cost reduction of up to 60% when compared to conventional transmitters. The final power amplifier configuration that is in parallel depends on the required output power level. 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 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.

There are three basic E-Compact High Power transmitter equipment configurations available:

- 1) Single Drive = One exciter driving the amplifier chain (SD)
- 2) Dual Drive = Two exciters (main/standby selectable) driving the amplifier chain (DD)
- 3) 1+1 = Two SD transmitters operating in parallel with high level RF switching (Custom made)

2. Specifications

- ⇒ IP Input
- ⇒ Control Module present
- ⇒ Switcher Module present
- ⇒ Power amplifier drawers
- ⇒ 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:

- ⇒ Interface color LCD touch screen display
- ⇒ Telemetry through GPRS interface
- ⇒ Exciter
- ⇒ Exciter Redundancy
- ⇒ Control Module Redundancy
- ⇒ GPS time base (exciter's internal module)

More Features

Communication interfaces	USB / Ethernet / SNMP
Power factor	better than 0.95
Operation altitude	up to 8200ft ASL
Environment temperature range	+32°F to +113°F
Environment humidity range	0 to 95% (non-condensing)

Outputs

Operation frequency	470 to 608MHz (CH14 to 36) 608 to 701MHz (CH37 to 51)
Bandwidth	6 MHz
RF Output Regulation	≤± 0.1 dB
Impedance	50Ω
Minimum operation power (After Filter)	10% of nominal power with 10W steps
TV Standard	ATSC 1.0 and ATSC 3.0
Harmonics/Spurious	better than -60dBc
MER	better than 34dB

Technical Table:

Model:	EC701HP-BB3		EC702HP-BB3		EC703HP-BB3		EC704HP-BB3	
Output power (W) ³	B.F. ⁸	A.F. ⁸	B.F. ⁸	A.F. ⁸	B.F. ⁸	A.F. ⁸	B.F. ⁸	A.F. ⁸
ATSC 3.0	1100	930	2200	1860	3300	2850	4400	3800
ATSC 1.0	1300	1100	2600	2200	3800	3300	5000	4400
50Ω Output connector	EIA 1-5/8"							
Power modules	1 module		2 modules		3 modules		4 modules	
AC mains	Dual Phase 240Vac / Wye Three-Phase 208Vac / Delta Three-Phase 240Vac							
AC typical consumption (kW) ³								
ATSC 3.0	2.90		5.70		8.50		11.30	
ATSC 1.0	3.15		6.15		9.17		12.20	
Typical heat dissipation (BTU/h) ³								
ATSC 3.0	6620		12820		19220		25510	
ATSC 1.0	6790		13150		19740		26210	
Rack dimensions (RU)	10		20		24		28	

¹A.F.: After Filter

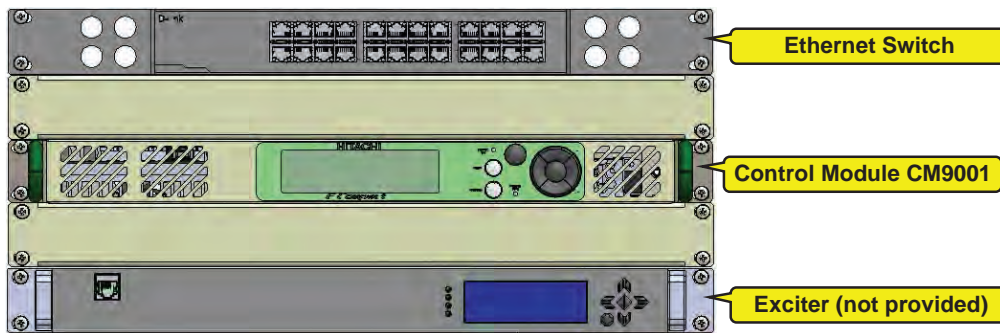
²B.F.: Before Filter

³May change depending on MER value, channel, and output power.

3. Construction

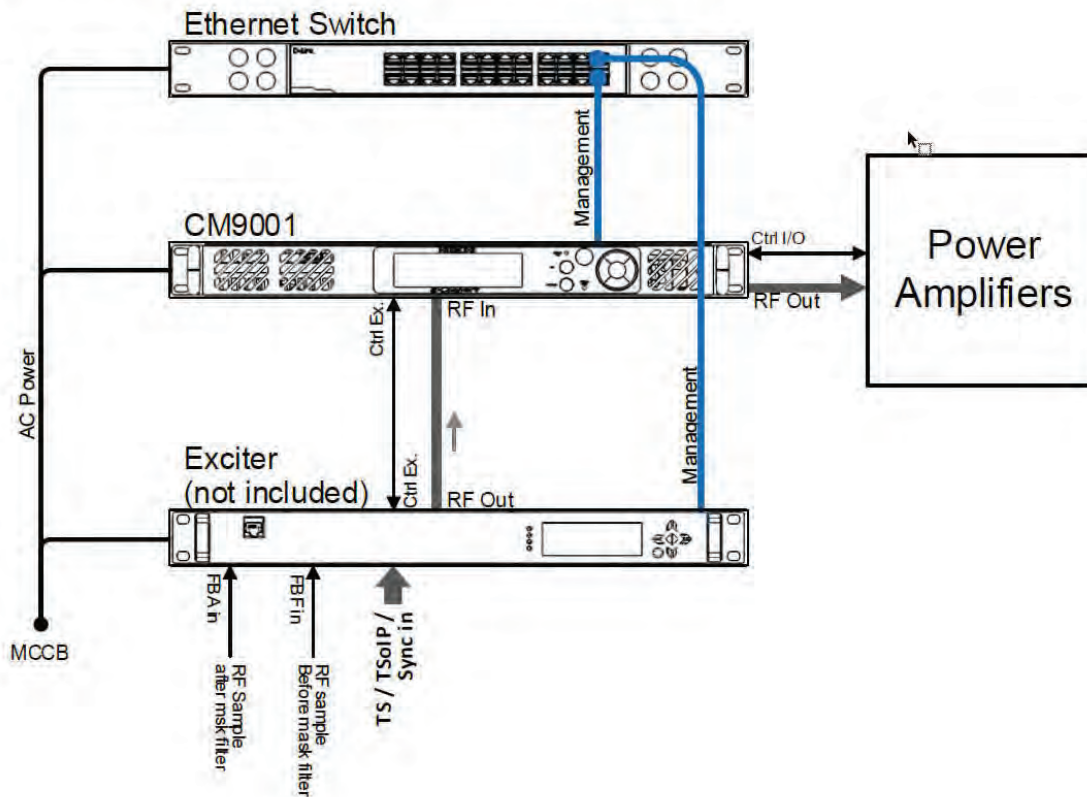
The E-Compact family of low high solid-state DTV transmitters provides maximum flexibility for site layout and installation. Transmitters are installed in custom designed 22" wide (19" panel opening) cabinets. Being available in several configurations depending on the output power, the redundancy option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

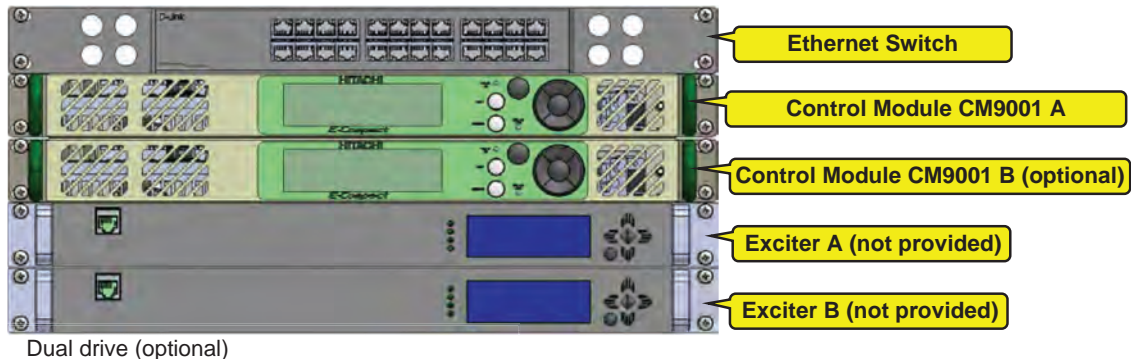
3.1. Single drive, Dual drive (optional), and touch screen display (optional)



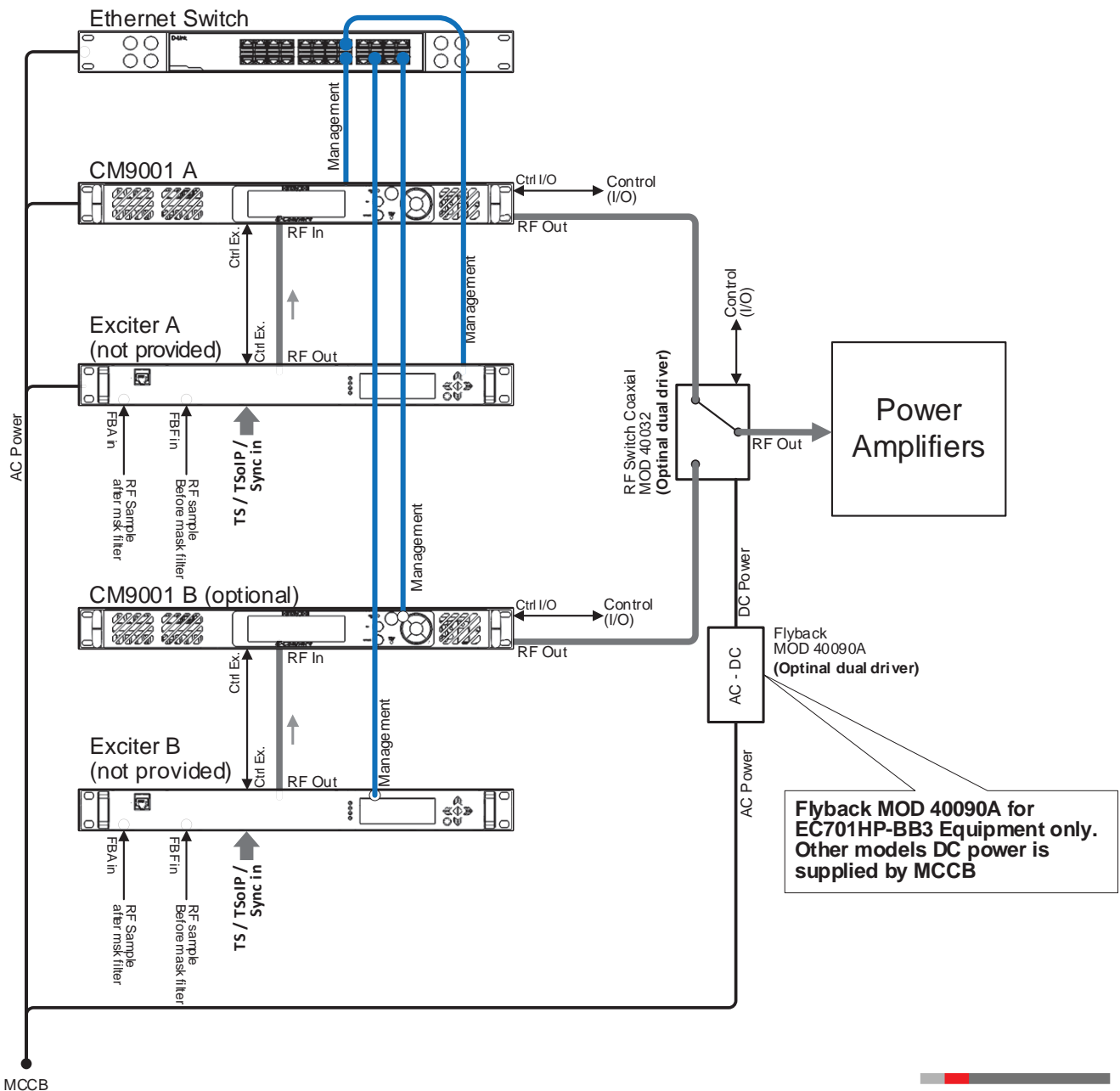
Single Drive

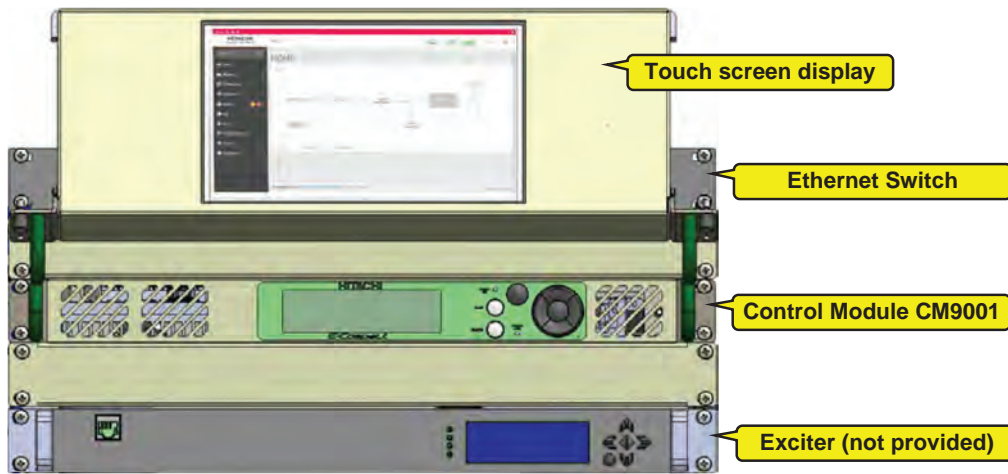
SINGLE DRIVE





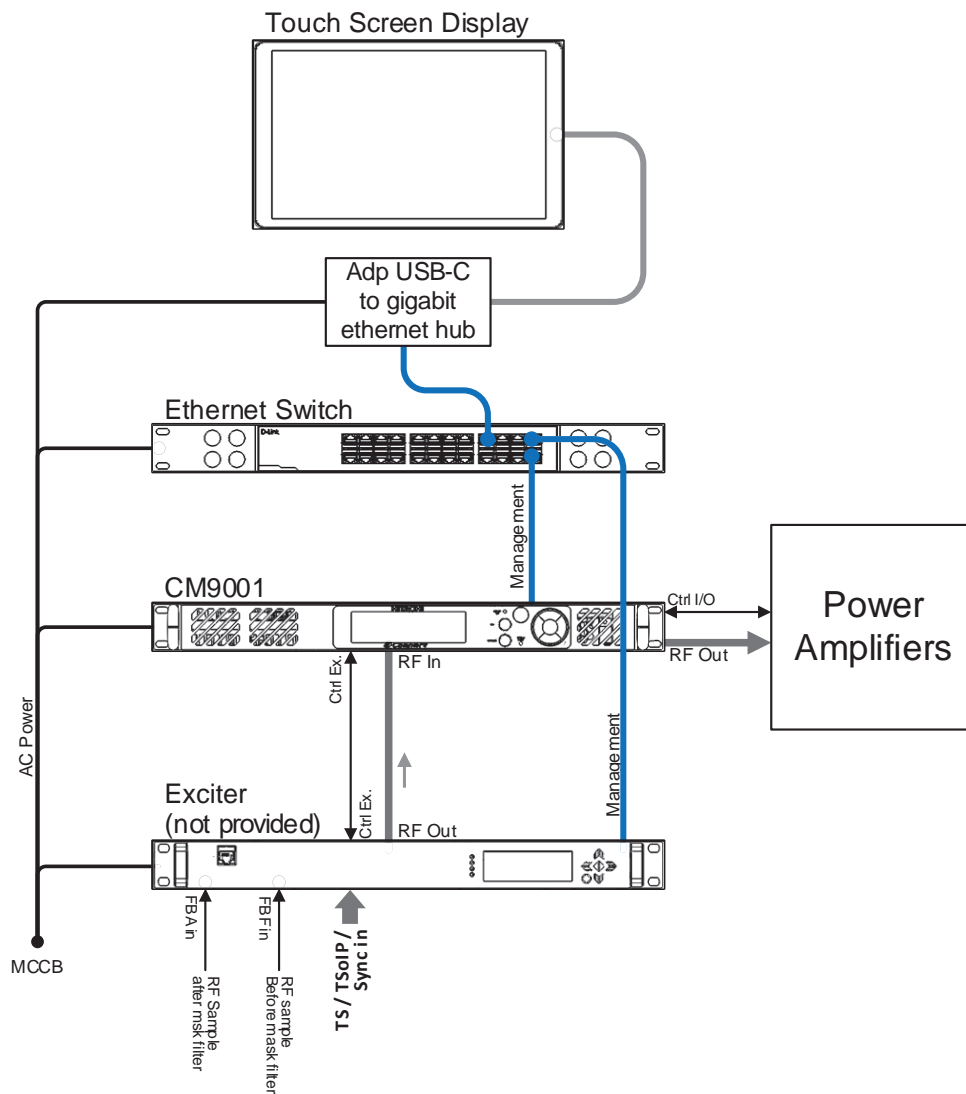
DUAL DRIVE (OPTIONAL)





Touch screen display (optional)

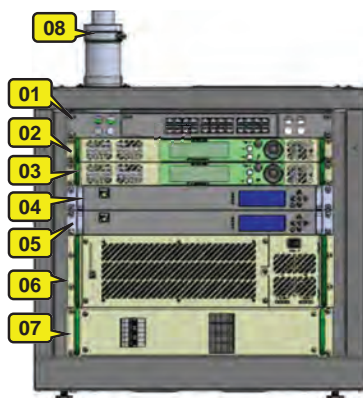
OPTIONAL INTERFACE TOUCH SCREEN DISPLAY



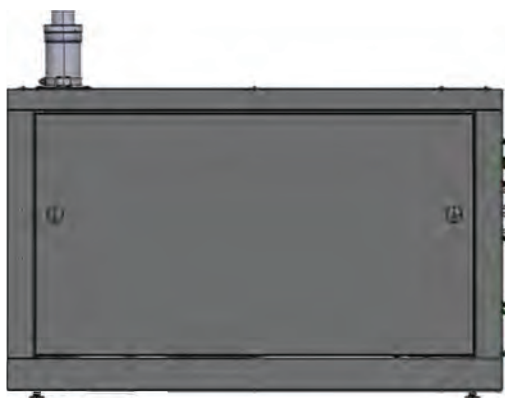
3.2. EC701HP-BB3

1100 Watts (Before Filter) UHF ATSC 3.0 output
1300 Watts (Before Filter) UHF ATSC 1.0 output

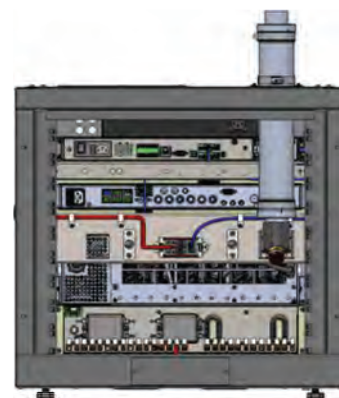
The transmitter controller is contained in a 1RU chassis and the RF amplifier is contained in a separate 3RU chassis. The digital exciter is 1RU (not provided) for a total of 5RU or 8.75" of vertical panel space. An equipment rack cabinet (10RU) is supplied.



Front View



Side View

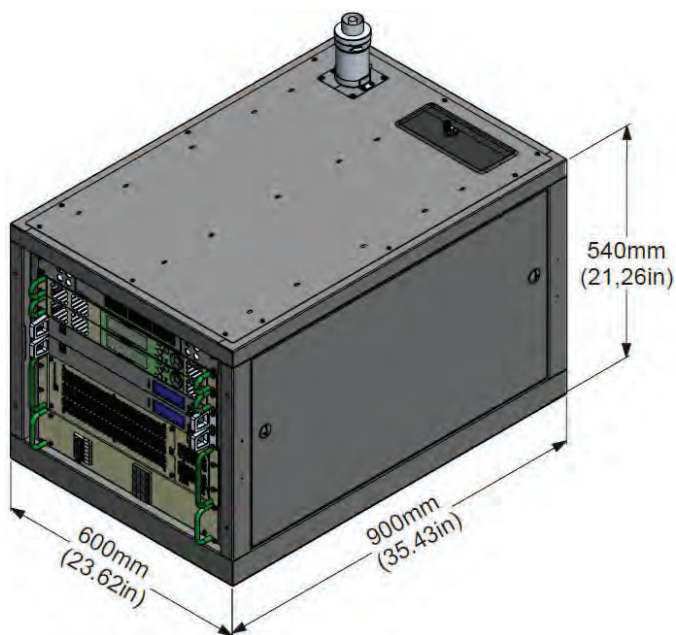


Rear View (without door)

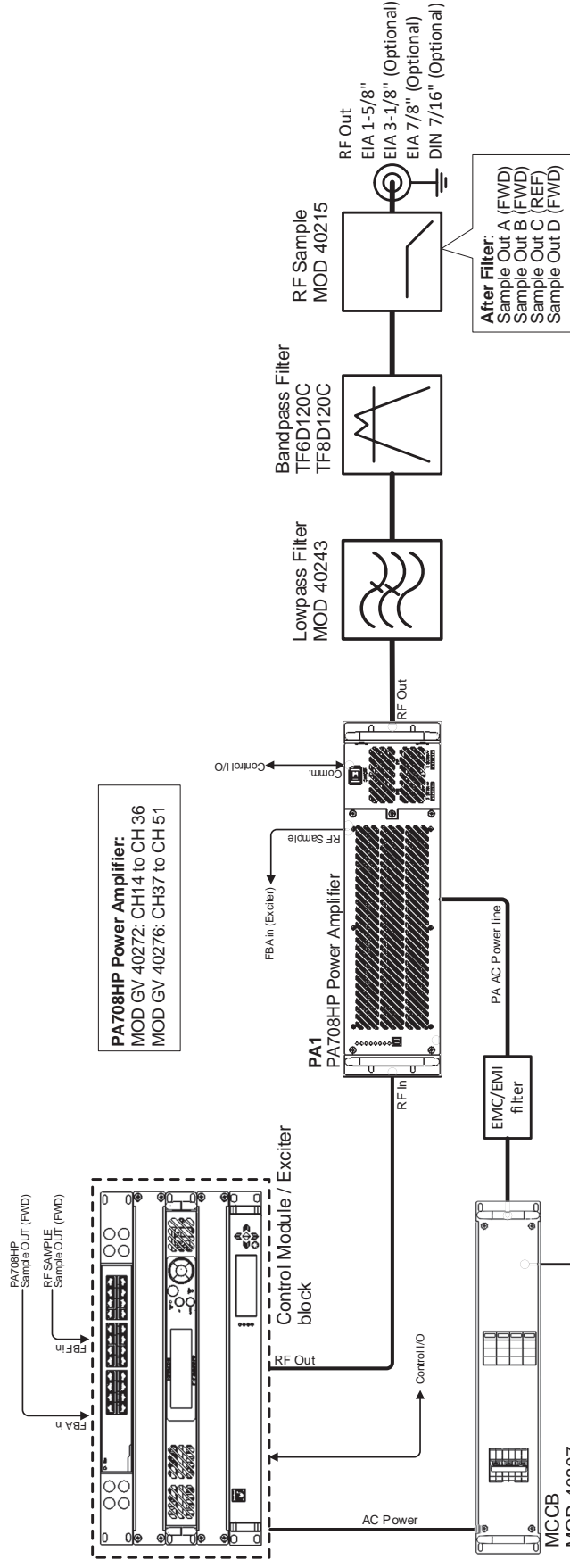


Top View

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)
06	PA708HP – MOD GV 40272: CH14 to CH 36
	PA708HP – MOD GV 40276: CH37 to CH 51
07	MCCB AC Unit
08	Low Pass Filter



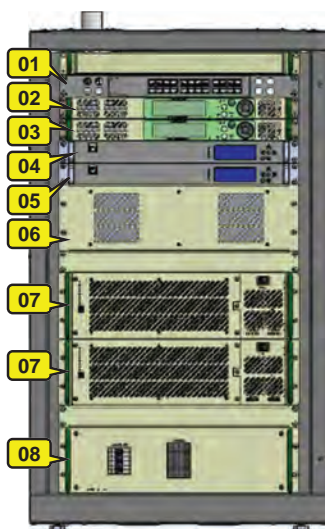
EC701HP-BB3 BLOCK DIAGRAM



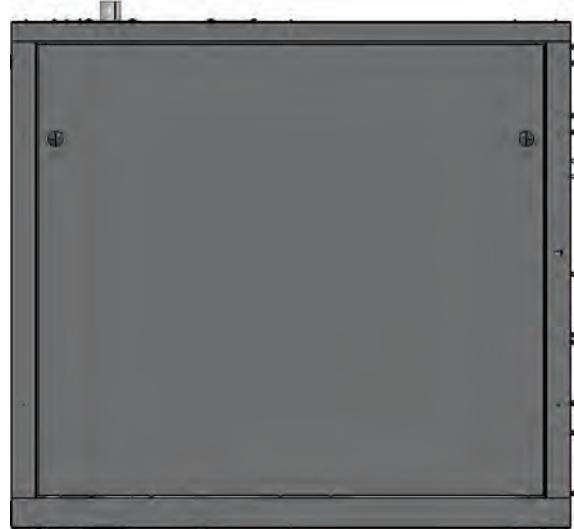
3.3. EC702HP-BB3

2200 Watts (Before Filter) UHF ATSC 3.0 output
2600 Watts (Before Filter) UHF ATSC 1.0 output

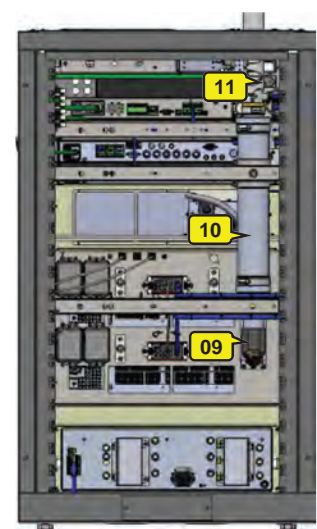
The transmitter controller is contained in a 1RU chassis and two amplifiers are contained in two separate 3RU chassis. The digital exciter is 1RU for a total of 8RU or 14" of vertical panel space. Additional rack units are used by the RF load (3RU) and AC power distribution (3RU). An equipment 20RU rack cabinet is supplied.



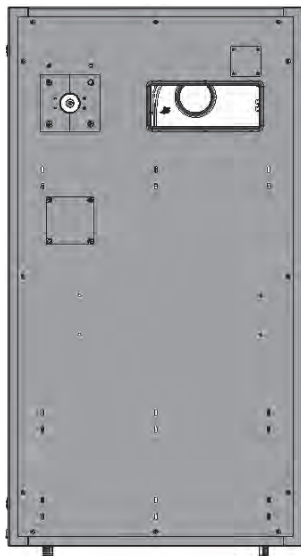
Front View



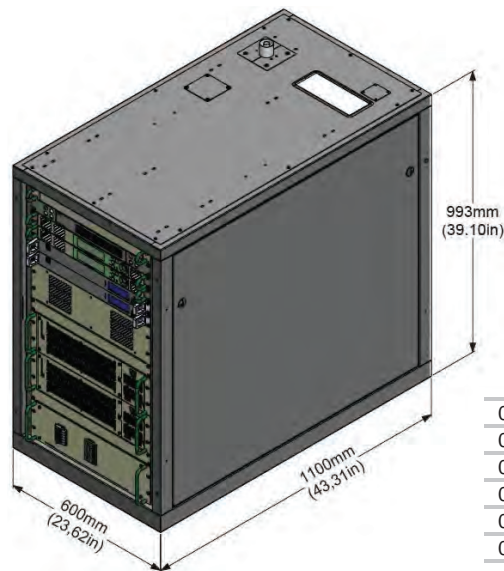
Side View



Rear View (without door)

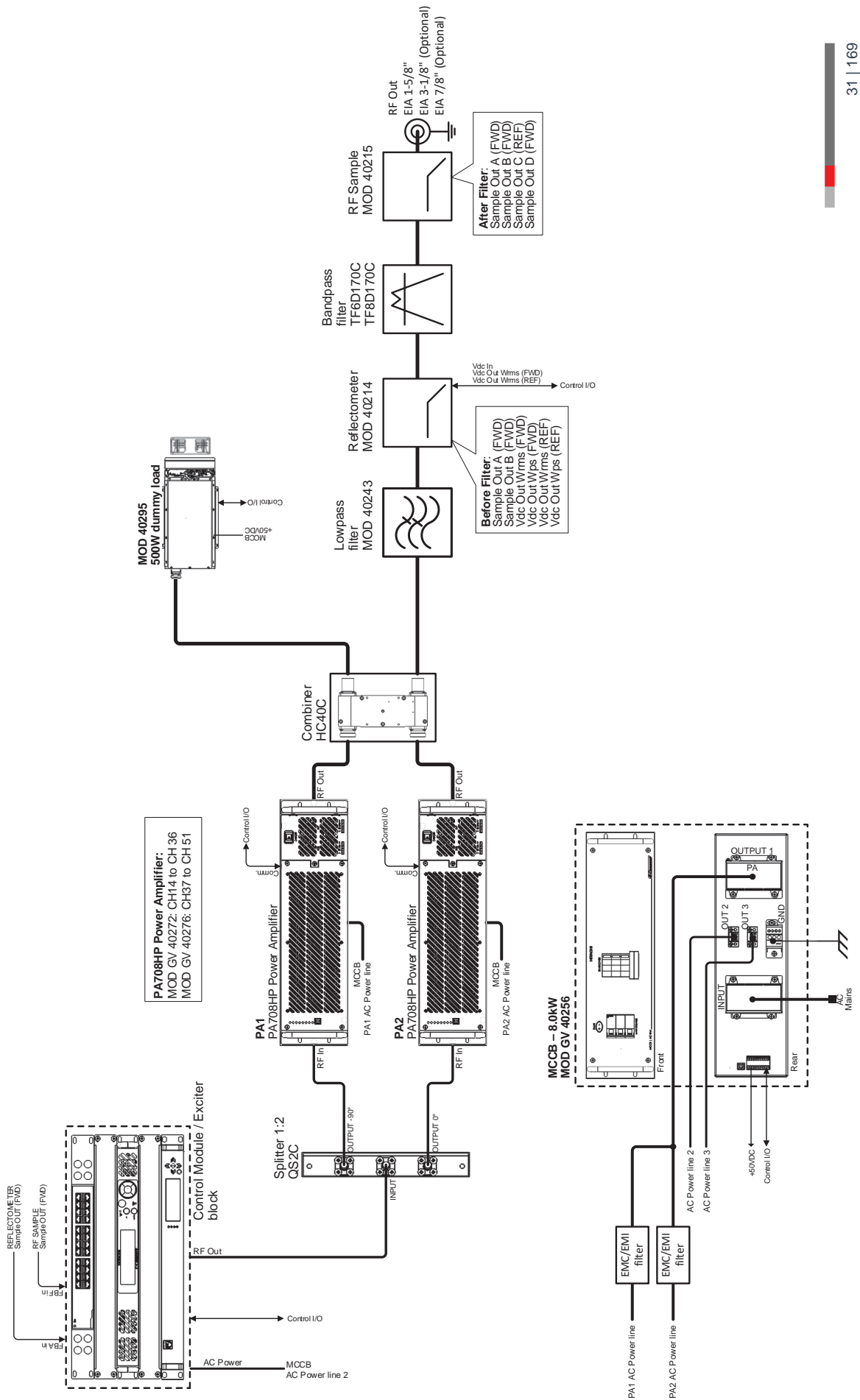


Top View



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)
06	Dummy Load Module MOD 40295 (500W)
07	PA708HP – MOD GV 40272: CH14 to CH 36 PA708HP – MOD GV 40276: CH37 to CH 51
08	MCCB AC Unit
09	Combiner HC40C (2:1)
10	Low Pass Filter
11	Sample probe - Reflectometer

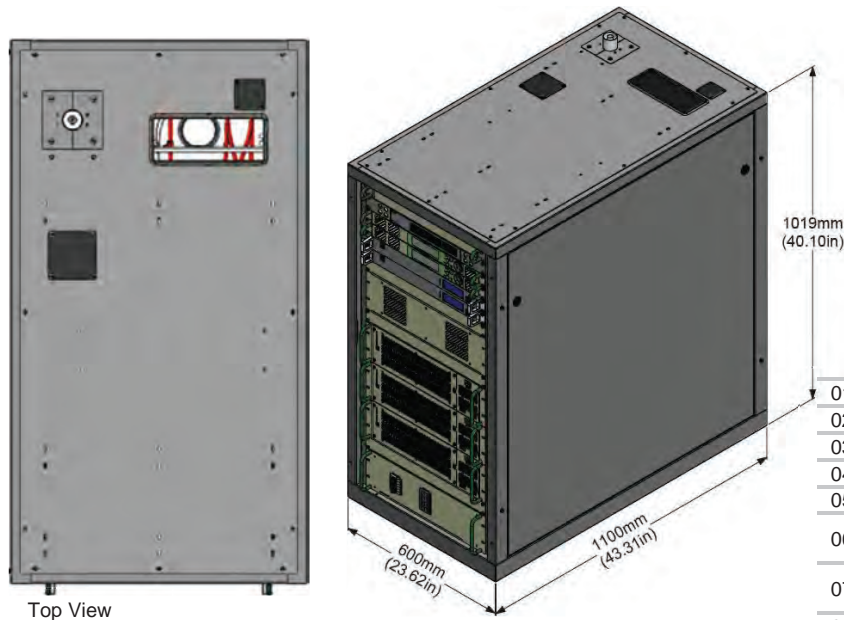
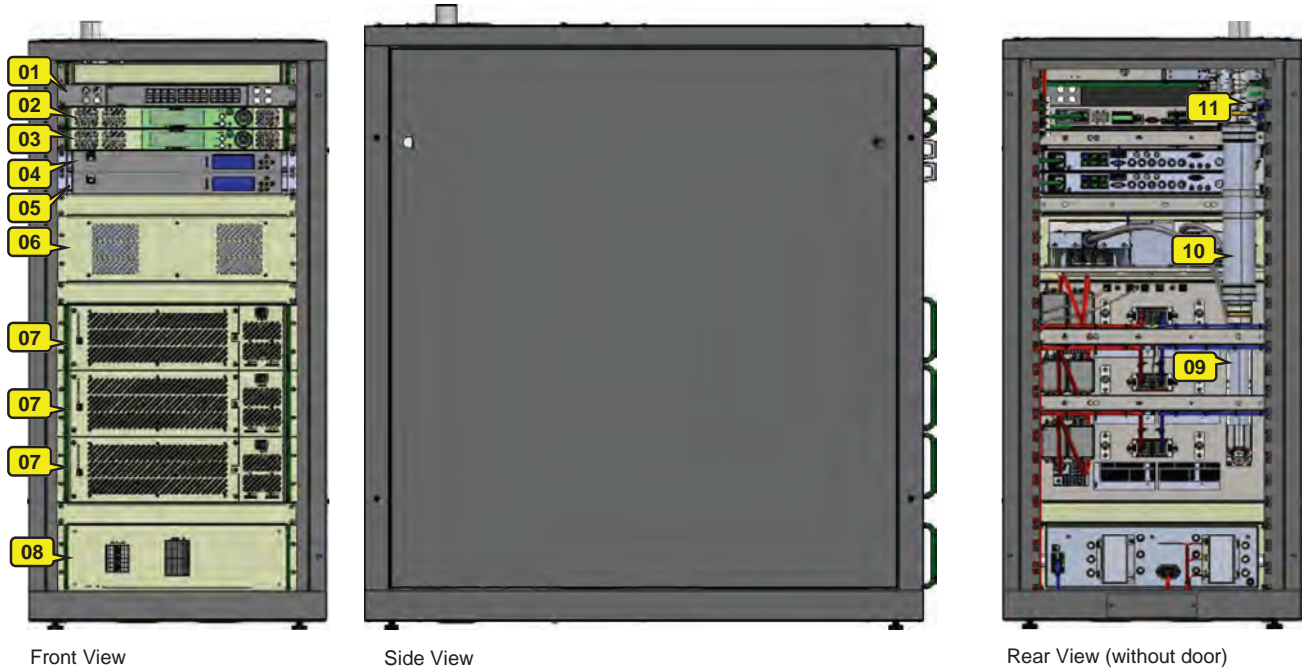
EC702HP-BB3 BLOCK DIAGRAM



3.4. EC703HP-BB3

3300 Watts (before Filter) UHF ATSC 3.0 output
3800 Watts (before Filter) UHF ATSC 1.0 output

The transmitter controller is contained in a 1RU chassis and three amplifiers are contained in three separate 3RU chassis. The digital exciter is 1RU for a total of 11RU or 19.25" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. An equipment 24RU rack cabinet is supplied.



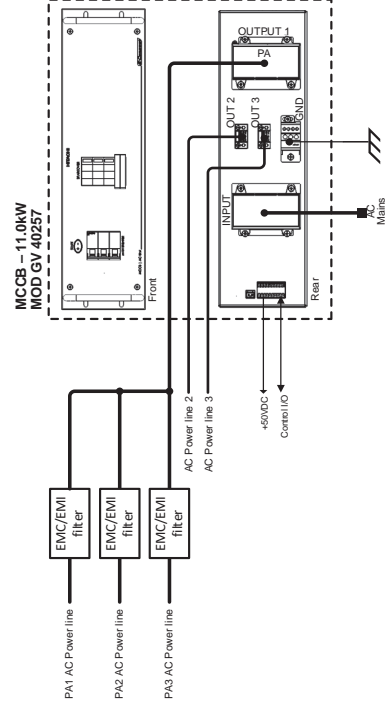
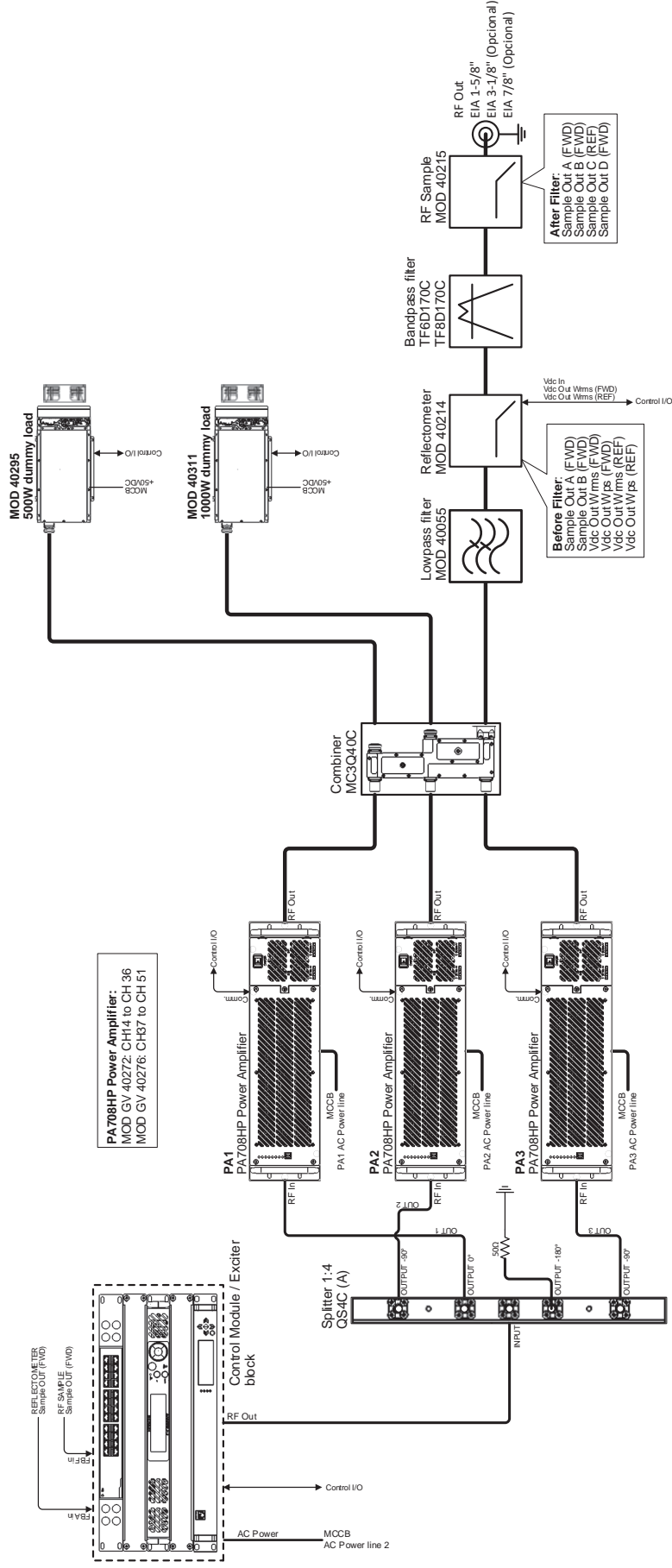
01	Ethernet Switch Module
02	Main Control Module CM9001
03	Backup Control Module CM9001 (optional)
04	Main Exciter (not provided)
05	Backup Exciter (not provided)
06	Dummy Load Module MOD 40295 (500W) Dummy Load Module MOD 40311 (1000W)
07	PA708HP – MOD GV 40272: CH14 to CH 36 PA708HP – MOD GV 40276: CH37 to CH 51
08	MCCB AC Unit
09	Combiner MC3Q40C (3:1)
10	Low Pass Filter
11	Sample probe - Reflectometer



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E-Compact HP-BB3 Series

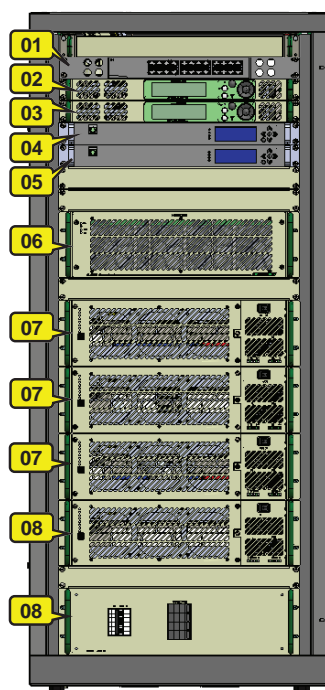
EC703HP-BB3 BLOCK DIAGRAM



3.5. EC704HP-BB3

4400 Watts (before Filter) UHF ATSC 3.0 output
5000 Watts (before Filter) UHF ATSC 1.0 output

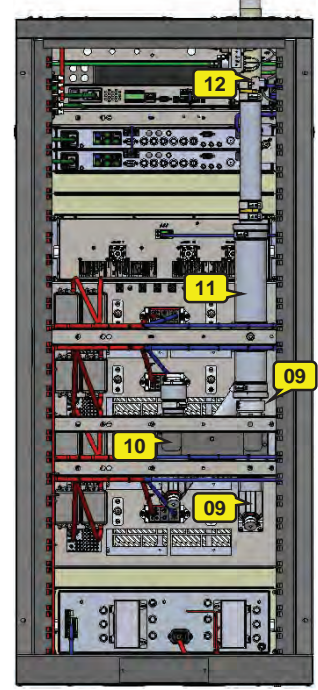
The transmitter controller is contained in a 1RU chassis and four amplifiers are contained in four separate 3RU chassis. The digital exciter is 1RU for a total of 14RU or 24.5" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. An equipment 28RU rack cabinet is supplied.



Front View



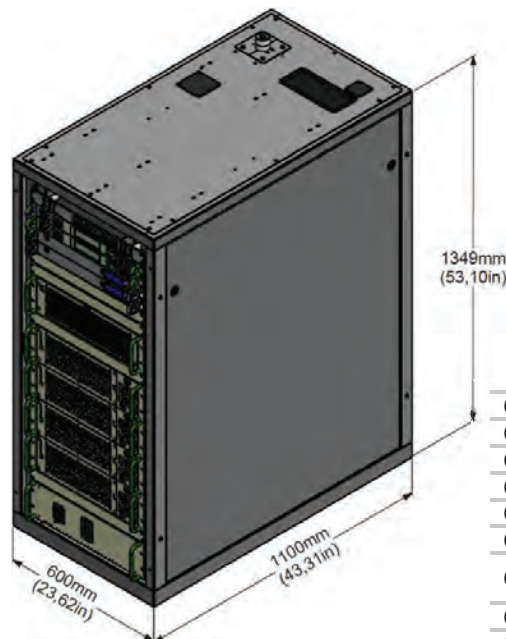
Side View



Rear View (Without door)



Top View



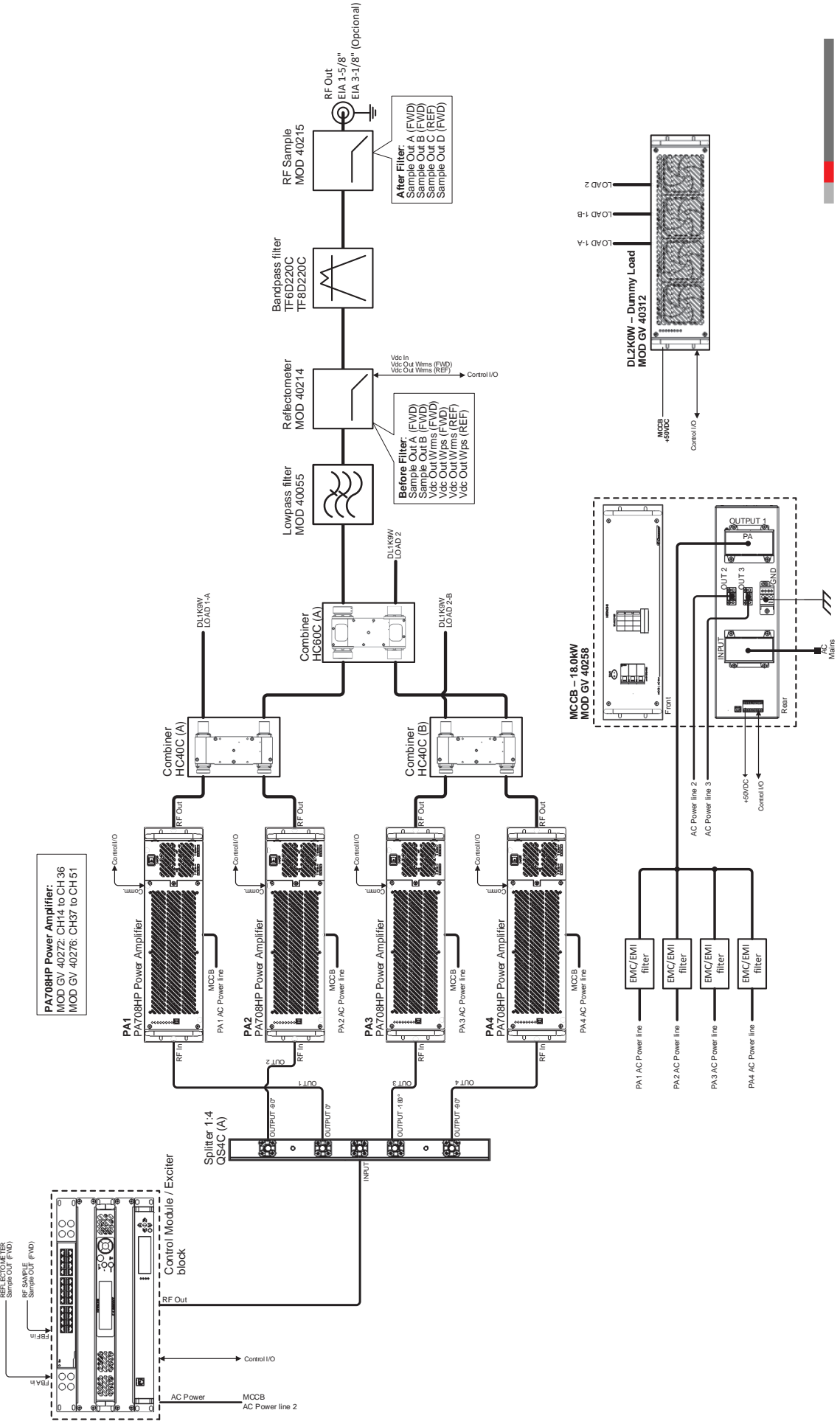
01	Ethernet Switch Module
02	Main Control Module CM9001
03	Backup Control Module CM9001 (optional)
04	Main Exciter (not provided)
05	Backup Exciter (not provided)
06	Dummy Load Module MOD GV 40312
07	PA708HP – MOD GV 40272: CH14 to CH 36 PA708HP – MOD GV 40276: CH37 to CH 51
08	MCCB AC Unit
09	Combiner HC40C (2:1)
10	Combiner HC60C (2:1)
11	Low Pass Filter
12	Sample probe - Reflectometer



Hitachi Kokusai Electric Comark LLC

E-Compact HP-BB3 Series





EC704HP-BB3 BLOCK DIAGRAM



4. Main Modules

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

Drawers / Modules:

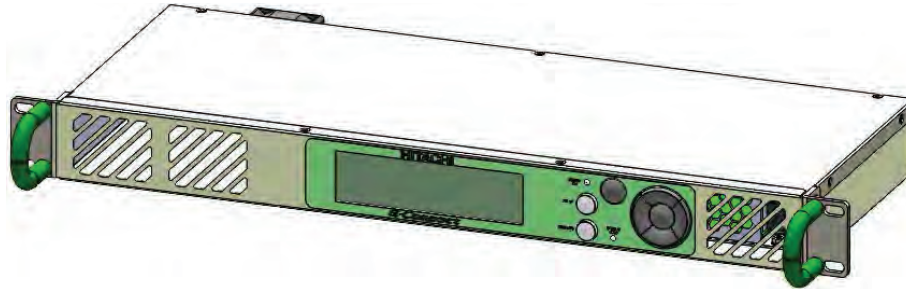
	Control Module CM9001 	Power Amplifier PA708HP 	Dummy Load Module 	MCCB Module 
EC701HP-BB3	MOD GV 40288	MOD GV 40272/40276	N/A	MOD 40307
EC702HP-BB3	MOD GV 40288	MOD GV 40272/40276 (x2)	MOD 40295	MOD GV 40256
EC703HP-BB3	MOD GV 40288	MOD GV 40272/40276 (x3)	MOD 40295-MOD 40311	MOD GV 40257
EC704HP-BB3	MOD GV 40288	MOD GV 40272/40276 (x4)	MOD GV 40312	MOD GV 40258

Passives Devices:

	RF Splitters	Combiners	RF Low Pass Filter	RF Out (50 Ω)	RF Output Sample	Mask Filter (Recommended)
EC701HP-BB3	N/A	N/A	MOD 40243	EIA 1-5/8"	MOD 40215	TF6D120C
EC702HP-BB3	QS2C	HC40C	MOD 40243	EIA 1-5/8"	MOD 40215	TF6D170C
EC703HP-BB3	QS4C	MC3Q40C	MOD 40055	EIA 1-5/8"	MOD 40215	TF6D170C With Heat Sink
EC704HP-BB3	QS4C	HC40C (2x) HC60C	MOD 40055	EIA 1-5/8"	MOD 40215	TF6D220C With Heat Sink

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

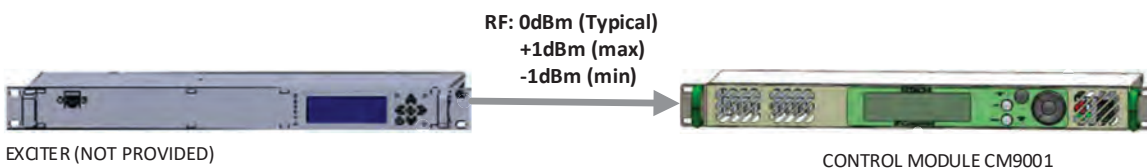
The CM9001 controller gathers the status monitoring of all the transmitter subassemblies to provide to the operator transmitter status information, either locally or remotely. The controller provides transmitter telemetry including RF power monitoring. A user-friendly interface on the transmitter controller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

- A front panel LCD screen provides transmitter status information
- A front-panel control interface for menu driven commands (up/down/right/left navigation, escape, & OK buttons)
- 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.

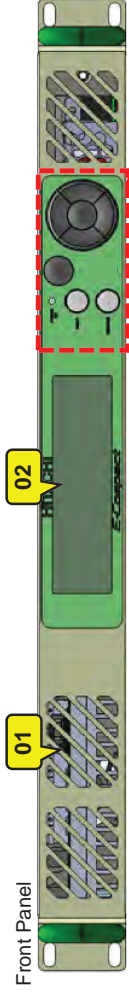
4.1.1. RF Input

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.**

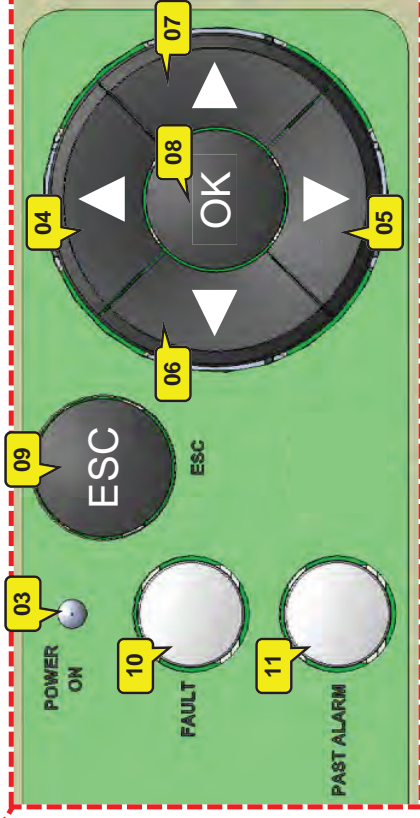


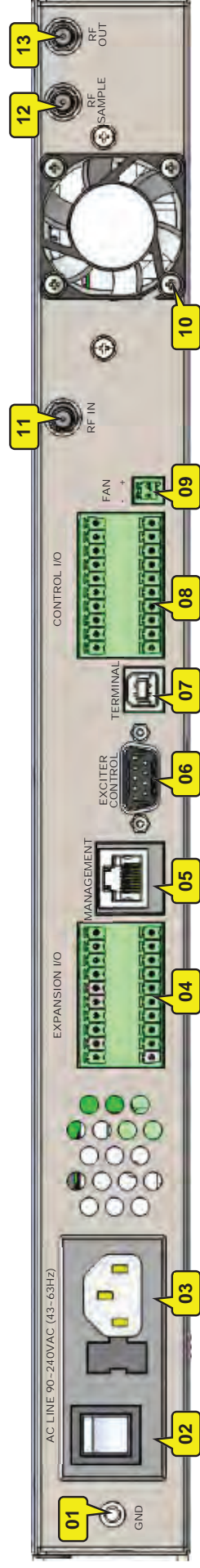


4.1.2. Interfaces



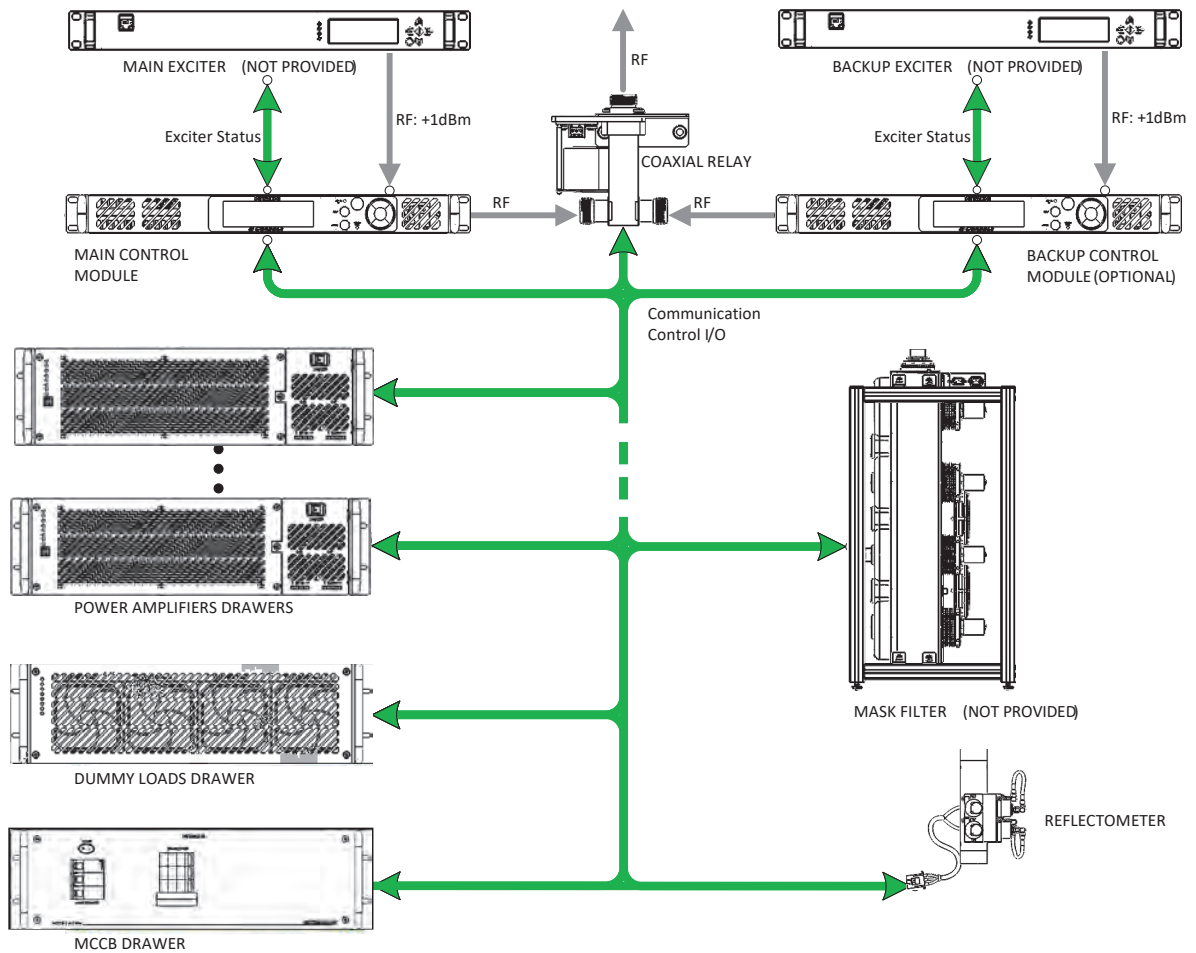
#	Description	Function
01	Air entrance	Air inlet for cooling
02	LCD Display	Navigation display
03	Leds Power On	Signals power on equipment
04	Up key (▲)	Display navigation keyboard
05	Down key (▼)	
06	Left key (◀)	
07	Right key (▶)	
08	Enter/OK key (OK)	
09	Esc key (Esc)	On: Indicates the presence of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





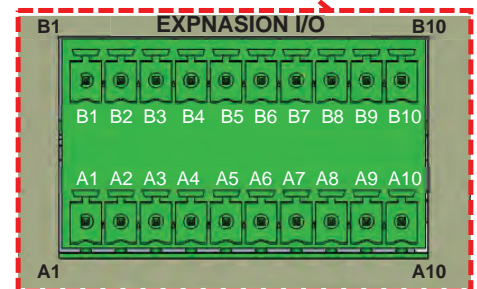
#	Description	Type	Function
01	GND	GND Screw	Chassis GND connector
02	ON/OFF	ON / OFF switch	ON/OFF equipment
03	AC LINE INPUT	Power Jack AC IEC	AC power input
04	EXPANSION I/O	10 pin terminal block	Expansion to Input / output management and control connector
05	MANAGEMENT	RJ45	Interface WEB access
06	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 (±1dB)
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

4.1.3. Communication



EXPANSION I/O - 10 pin terminal block

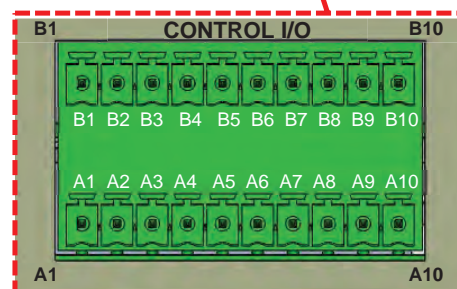
A1	+5VCC
A2	GND
A3	Analog general purpose Output 0
A4	Analog general purpose Output 1
A5	Analog general purpose input 0
A6	Analog general purpose input 1
A7	Digital general purpose input 0
A8	Digital general purpose input 1
A9	Digital general purpose input 2
A10	Digital general purpose input 3
B1	Relay 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

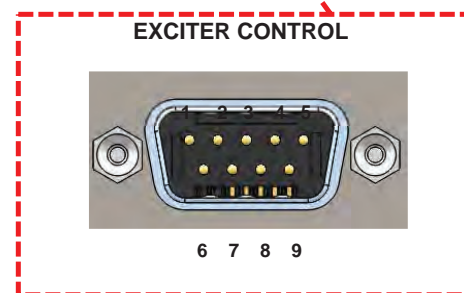
A1	External +15VDC measurement @EC701HP-BB3 External +8VDC measurement @EC702 / 703 / 704HP-BB3
A2	Not used for EC701HP-BB3 External +15VDC measurement @EC702 / 703 / 704HP-BB3
A3	External +50VDC measurement
A4	External measurement of Forward Power
A5	GND
A6	External measurement of Reflected Power
A7	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	Not used for EC702 / 703 / 704HP-BB3 +5VDC @EC701HP-BB3
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

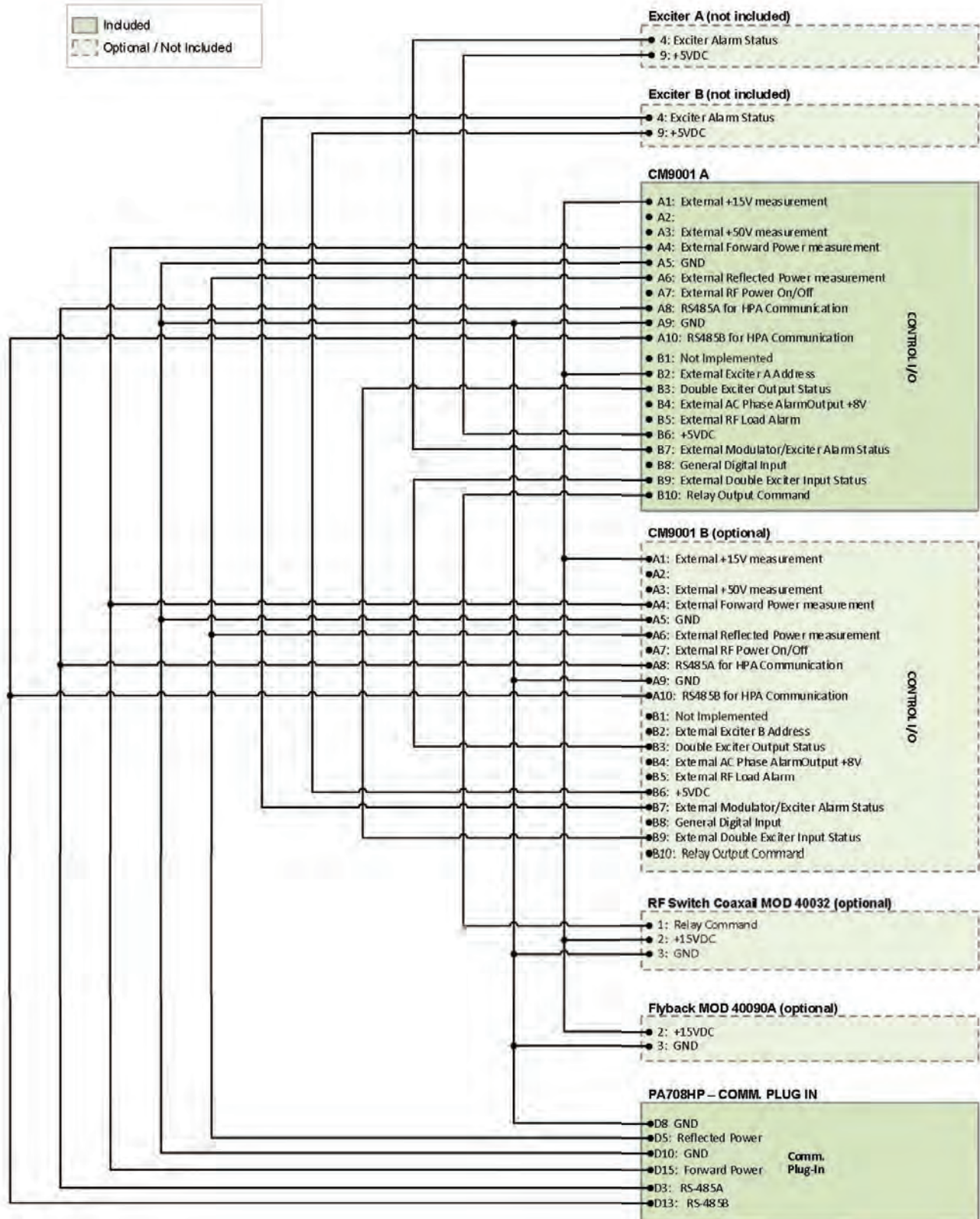
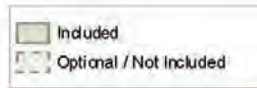
EXCITER CONTROL – DB9 male

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



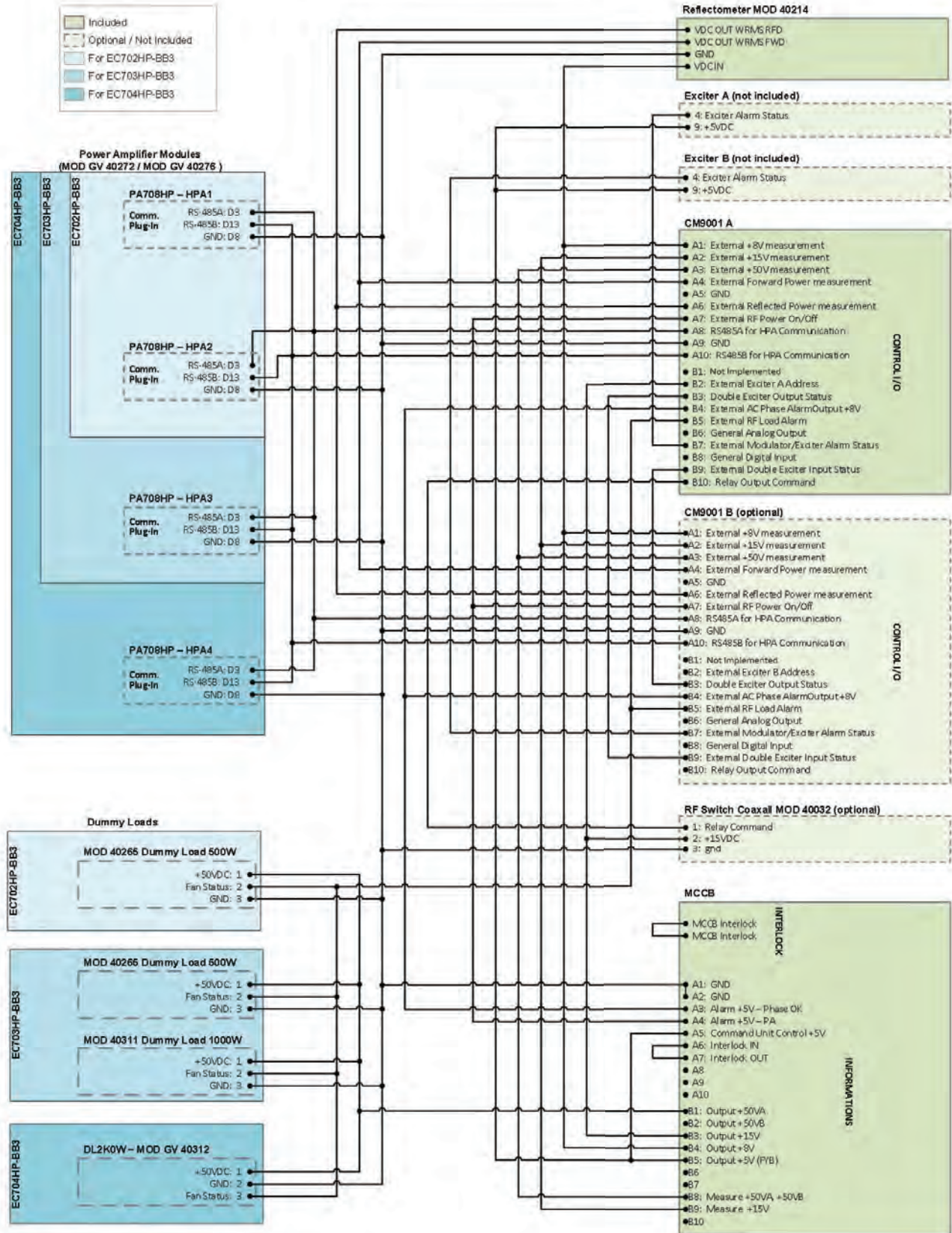
DB9 male connector
Rear panel

CM9001 Communication Schematic for EC701HP-BB3



CM9001 Communication Schematic for EC702HP-BB3, EC703HP-BB3 and EC704HP-BB3

- Included
- Optional / Not Included
- For EC702HP-BB3
- For EC703HP-BB3
- For EC704HP-BB3

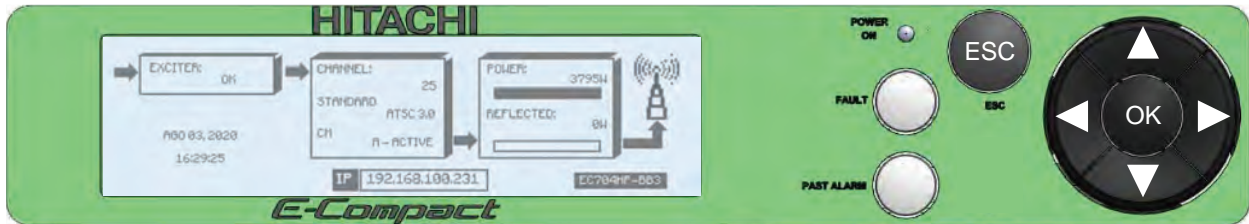


3.1.5. Display interface

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.

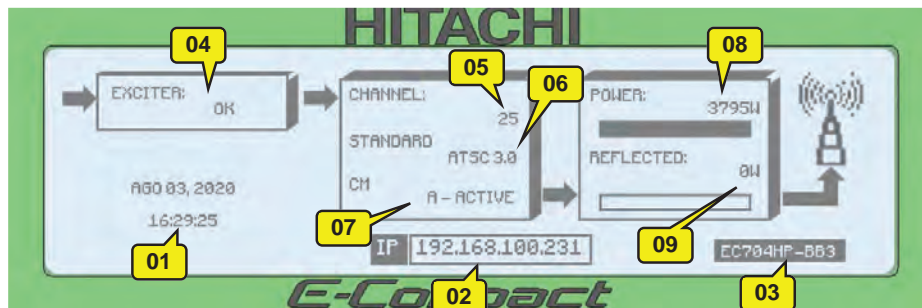
This set allows equipment operation. Through the display it is possible to visualize and change all of the parameters of the equipment.

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.

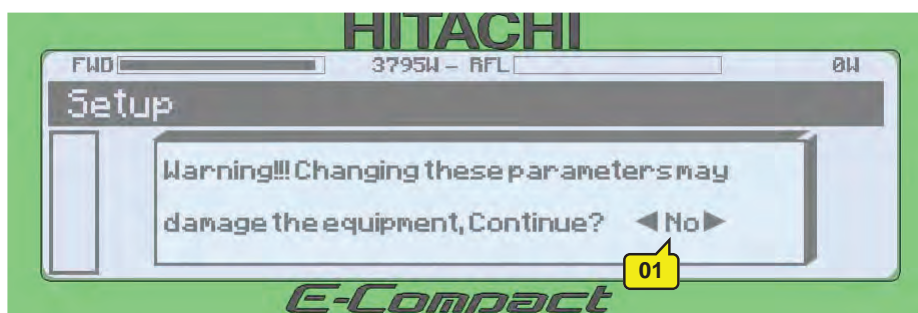
When holding the “ESC” key for more than 10 seconds the front panel is reset without affecting the operation of the transmitter.

Standby screen:



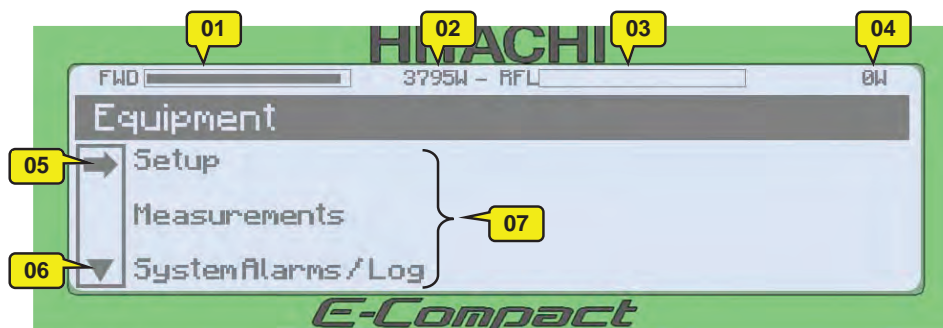
#	DESCRIPTION
01	Current date and time
02	CM9001 IP address for Remote Access (interface WEB)
03	Equipment model controlled by CM9001
04	Exciter status (OK / Fail)
05	Operation channel
06	Operation digital TV system (ATSC 1.0 / ATSC 3.0)
07	Status CM9001: Single Drive: ---- Dual Drive: (A-active / B-Standby), (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 will 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 "*" will disappear and the new record will take effect
12	Function Value Information

3.1.6. 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 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 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 power grid 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.

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

When a fault occurs, the equipment will automatically take protection 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 will appear on the display.

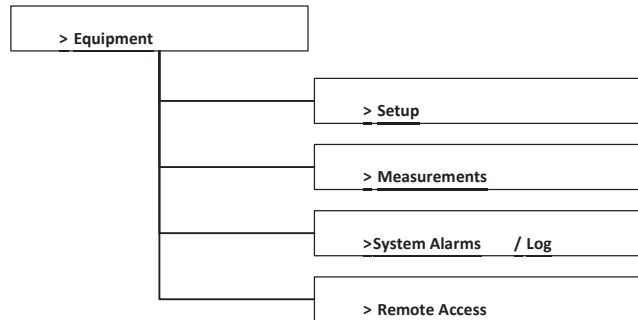
PAST ALARM:

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

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

3.1.8. System Operation (Display interface)

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



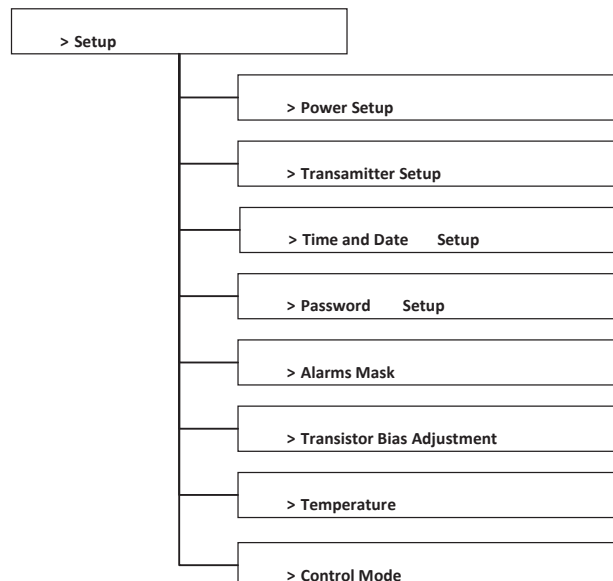
- > **Equipment > Setup:** Access to configure equipment parameters
- > **Equipment > Measurements:** Access to consult measurements of the equipment
- > **Equipment > System Alarms/Log:** Access to query alerts and history of Alarms
- > **Equipment > Remote Access:** Access to configure the equipment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

Main Menu > Setup

The "SETUP" menu allows to access and change 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 program 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 real time clock (RTC) internal 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 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 Fail ---- (absense)	Power Amplifier 1 Status
> Status HPA2		Power Amplifier 2 Status
> Status HPA3		Power Amplifier 3 Status
> Status HPA4		Power Amplifier 4 Status

The amount of HPA in the menu depends on the transmitter model configured:

EC701HHP-BB3: 01 HPA

EC702HHP-BB3: 02 HPA

EC703HHP-BB3: 03 HPA

EC704HHP-BB3: 04 HPA

> Main Menu > Setup > Temperature:

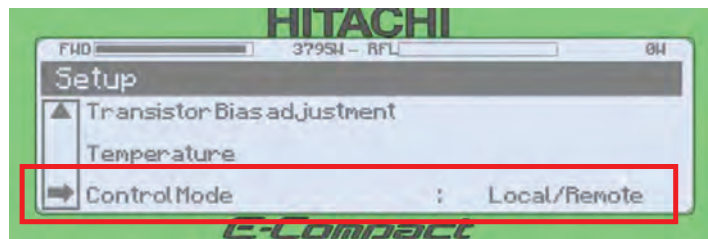
Allows to set the operating temperature of the Powers Amplifiers.



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

> Main Menu > Setup > Control Mode:

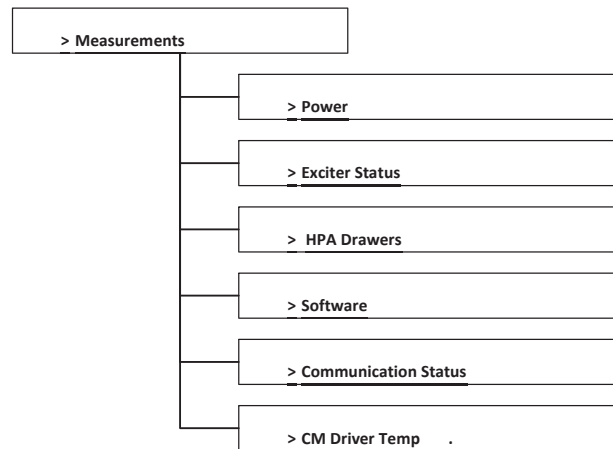
Set CM9001 operation ("local" or "local / remote"):



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 read 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

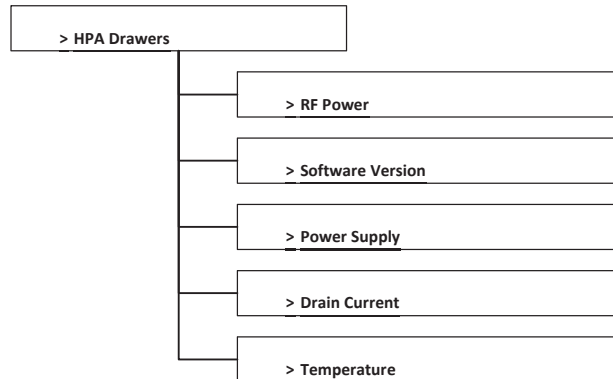
> Main Menu > Measurements > Exciter Status:

Shows the Exciter status: (Ok / Fail)

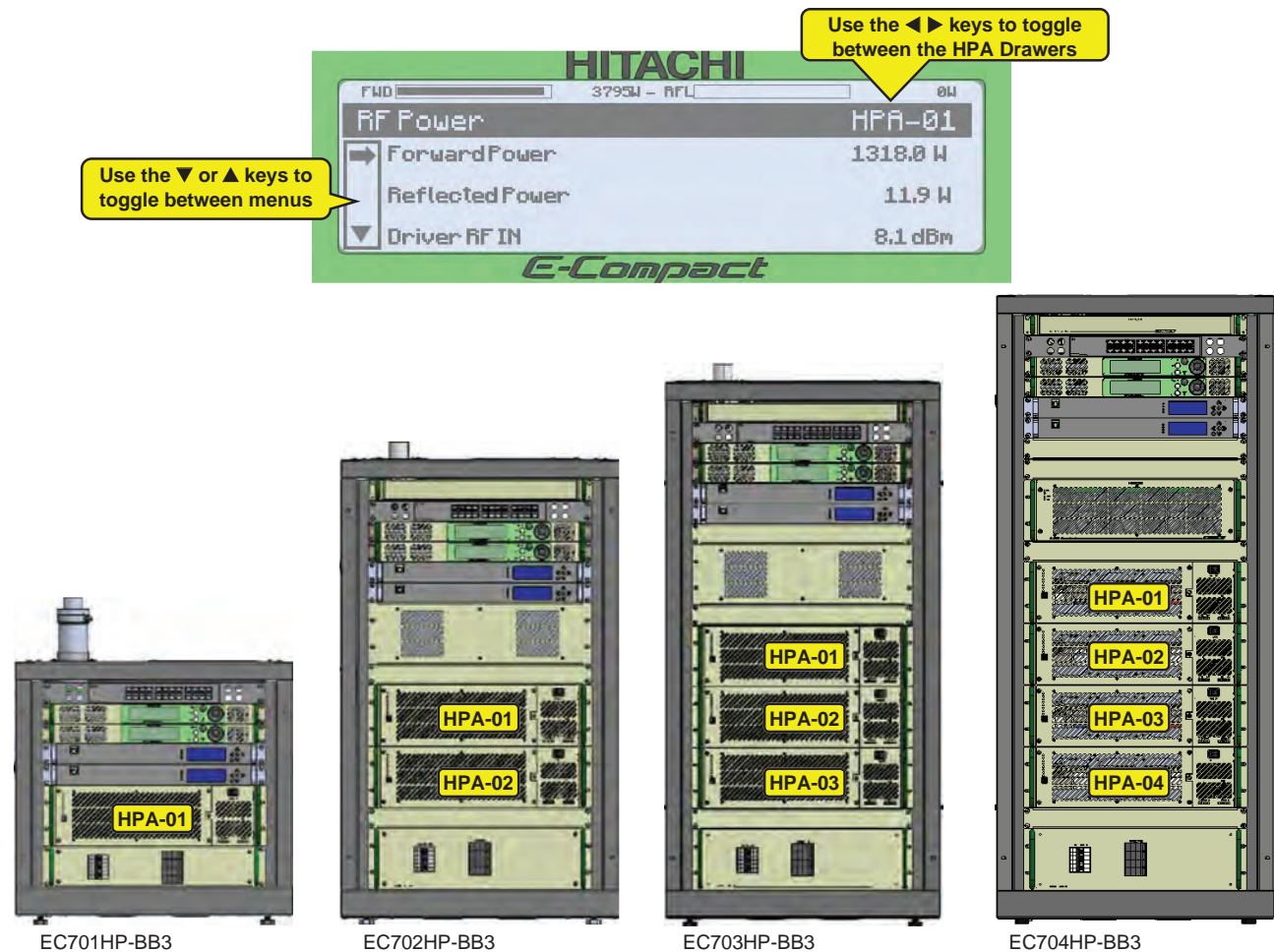


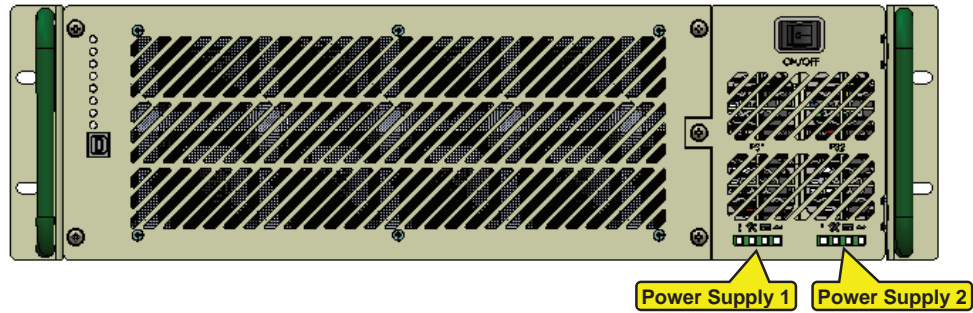
> Main Menu > Measurements > HPA Drawers:

View the main status of all Power Amplifiers Drawers:

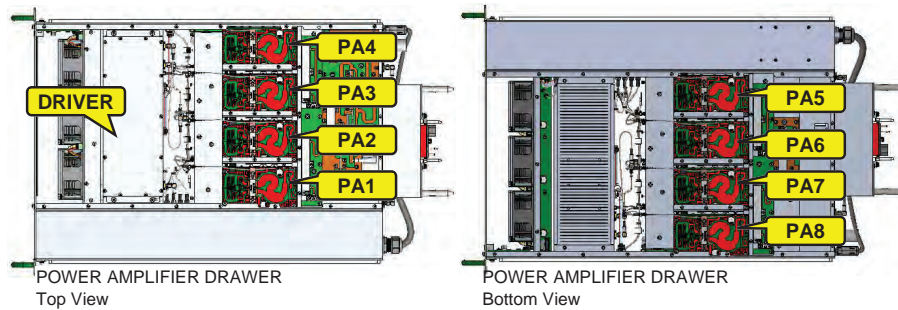


Identifying HPA Drawers, Power Supplies na Power Amplifiers (PA) in the menu:





PA IDENTIFICATIONS



> 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:

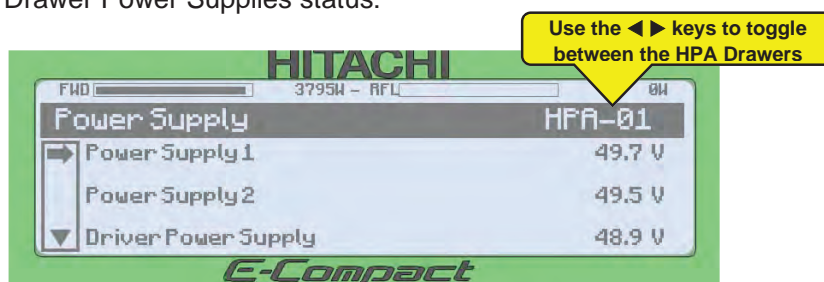
Shows all HPA Drawer software versions:



MENU	PARAMETER	DESCRIPTION
> Software Version	---	PAM40000v0.00
> PA1 Software	---	PAM30000v0.00
> PA2 Software	---	PAM30000v0.00
> PA3 Software	---	PAM30000v0.00
> PA4 Software	---	PAM30000v0.00
> PA5 Software	---	PAM30000v0.00
> PA6 Software	---	PAM30000v0.00
> PA7 Software	---	PAM30000v0.00

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

Shows all HPA Drawer Power Supplies status:



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 Current:



MENU	PARAMETER	DESCRIPTION
> PA1 Current	Current (A)	Drain current
> PA2 Current	Current (A)	
> PA3 Current	Current (A)	
> PA4 Current	Current (A)	
> PA5 Current	Current (A)	
> PA6 Current	Current (A)	
> PA7 Current	Current (A)	
> PA8 Current	Current (A)	
> Driver Current	Current (A)	

> Main Menu > Measurements > HPA Drawers > Temperature:

Shows all HPA Drawer temperature:



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°	
> PA5 Temperature	°C / F°	
> PA6 Temperature	°C / F°	
> PA7 Temperature	°C / F°	
> PA8 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
> Communication HPA2		
> Communication HPA3		
> Communication HPA4		

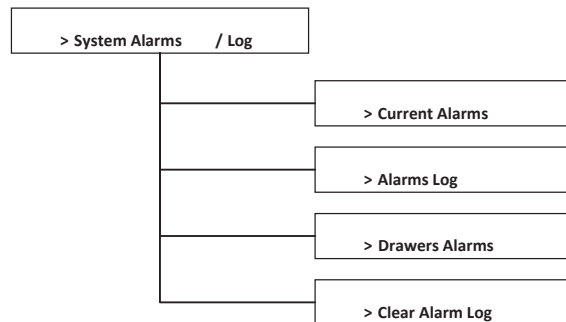
> Main Menu > Measurements > CM Driver Temp.:

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 that have occurred in the past, providing a guide for necessary preventive or corrective maintenance.



Current Alarms: Shows the list of alarms currently occurring

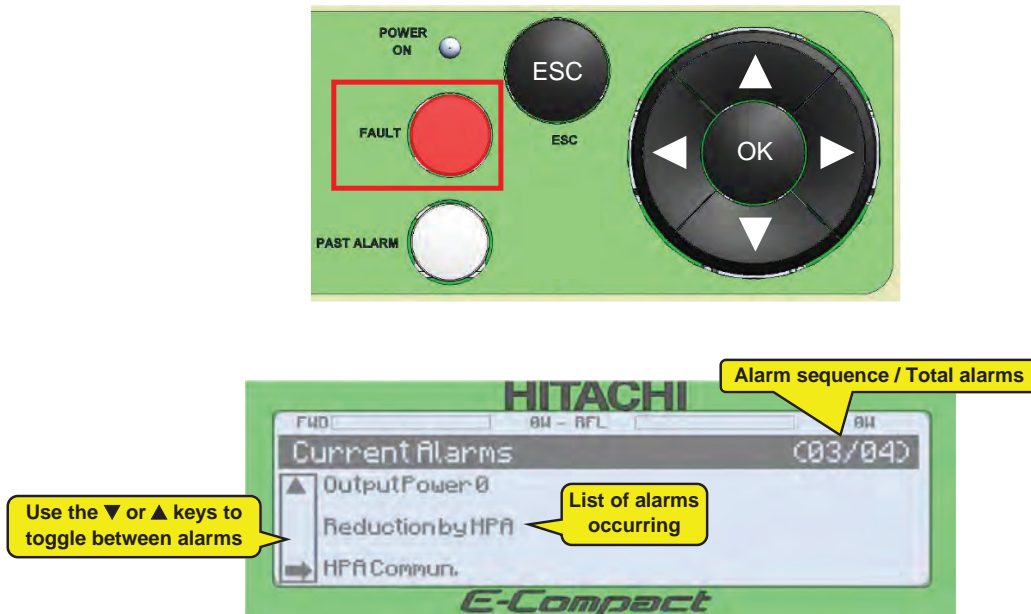
Alarms Log: It shows a detailed list with all alarms, with their respective start/end date and time

Drawers Alarms: It shows all alarms active or occurred in the HPAs (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 in the next section for the alarms list and their respective meanings.

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

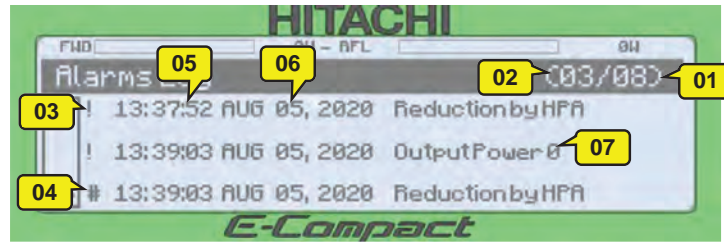


> Main Menu > System Alarms/Log > Alarms/Log:

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

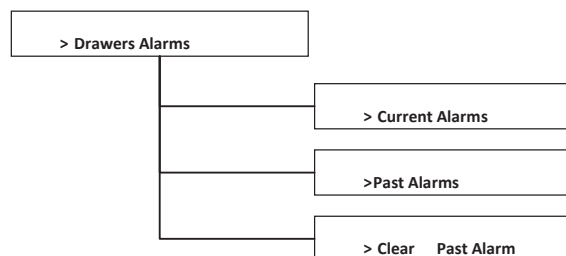
See the next section for the alarms list and their respective meanings.

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



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

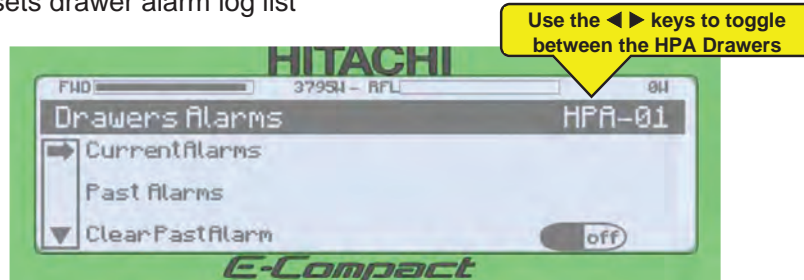
Shows the list of alarms currently occurring. This function can also be accessed through the “FAULT” key, located on the front panel:



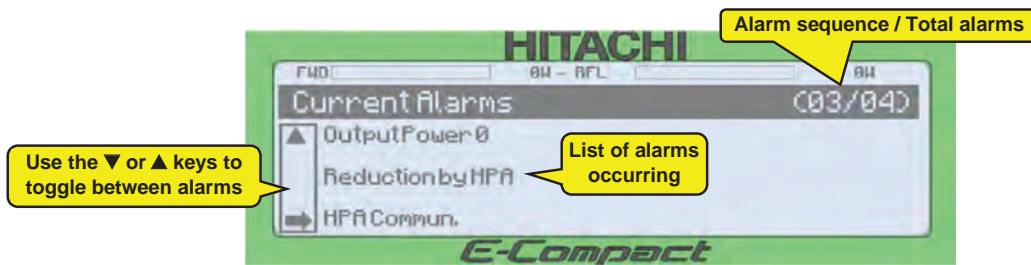
Current Alarms: Shows the list of drawer alarms currently occurring

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.



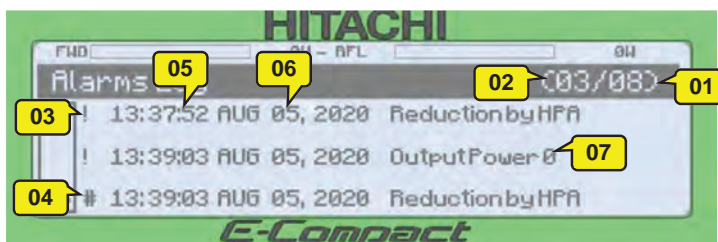
See the next section for the alarms list and their respective meanings.

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 the section 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 > Clear Past Alarm:
Resets the drawer alarm list.



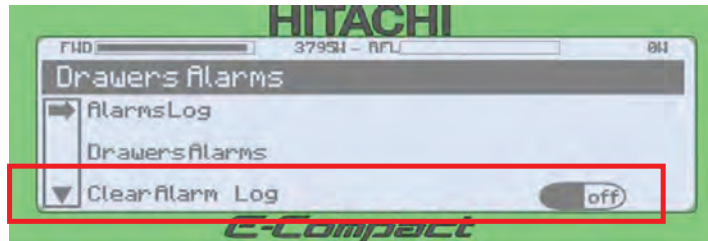
Select "On" to reset the Past Alarms list.

Power Amplifiers Drawers (HPA) Alarms List

DRAWER ALARM	ALARM DESCRIPTION	THRESHOLD	SYSTEM ACTION
PA High Current	Indicated PA Current is greater than threshold	10 A	Notification
PA Critical High Current	Indicated PA Current is greater than threshold	11 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	Shutdown
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)	Shutdown
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	175 VAC	Notification
PSU Critical Low AC Voltage	PSU AC Voltage is lower than threshold	165 VAC	Shutdown
PSU High Current	PSU Current is greater than threshold	37 A	Notification
PSU Critical PSU High Current	PSU Current is greater than threshold	39 A	Shutdown
PSU High Temperature	PSU temperature is greater than Threshold	75 °C (167 °F)	Notification
PSU Critical High Temperature	PSU temperature is greater than threshold	80 °C (176 °F)	Shutdown
PSU High Voltage	PSU voltage exceeds 3v of programmed PSU voltage	3 V	Shutdown
PSU Low Voltage	PSU voltage is lower than 3v of programmed PSU voltage	3 V	Shutdown
Driver High Current	Driver Current is greater than threshold	4.5 A	Notification
Driver Critical High Current	Driver Current is greater than threshold	4.9 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	53 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
Driver Low RF Input Level	Driver RF Input is lower than threshold	-8 dBm	Notification
Driver High RF Input Level	Driver RF Input is greater than threshold	+12 dBm	Notification
Driver High RF Output Power	Driver RF Output Power is greater than threshold	+48 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	1600 W	Shutdown
Critical High Reflected Power	HPA Reflected Power is greater than threshold	184 W	Shutdown
PA Low Gain	HPA Gain is lower than threshold	49 dB	Notification
High Input Air Temperature	Ambient air temperature used in the reflow of the equipment is greater than threshold	35 °C (95 °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)	Shutdown
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:

Reset the main alarm list.



Select "On" to reset the Alarms Log list.

Control Module Main Alarm List

MAIN ALARM	ALARM DESCRIPTION
8V Equipment Fail	Control Module cannot read 8V from equipment
Load Fan Fail	Control Module cannot read status from Load Fan
High Temperature Load	High temperature detected on Load
AC Fail	Control Module cannot detect AC mains from equipment
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
Other Control Module Fail	Control Module cannot communicate with its redundant unit
Power Amplifier OFF	Control Module cannot get Power Amplifier status
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
Too Few Drawers	Minimum amount of drawers required not activated
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
50V Equipment Fail	Control Module cannot read 50V from equipment
15V Equipment Fail	Control Module cannot read 15V from equipment

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, alarm checks, 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

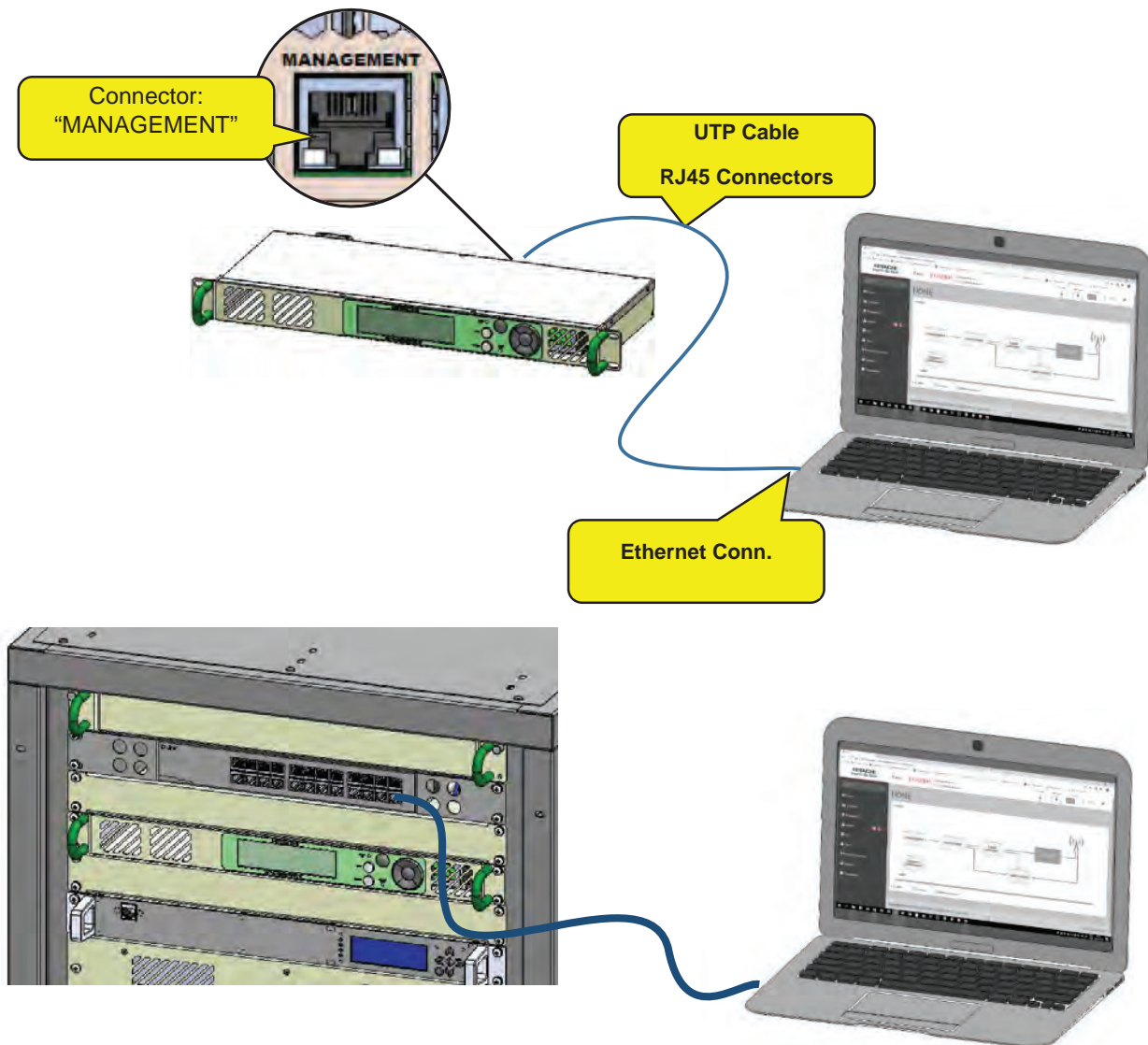
3.1.9. WEB Interface – Remote Access

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, with access to its statuses and also makes 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).





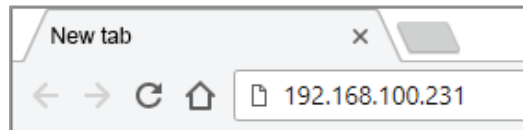
For ethernet connections, use only static IP settings.



For navigation, you must use a recent internet browser, updated in its latest version. 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 in the menu >Equipment > Remote Access > Management.

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

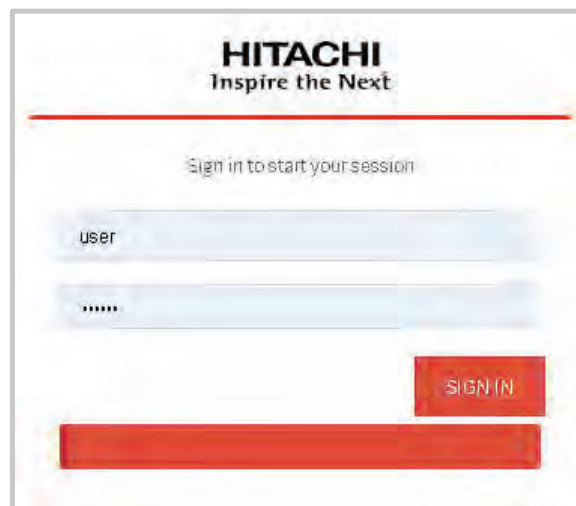


This IP address is a simple example.
View the settings on the device before
accessing the Web Interface.

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 EC704HP-BB3 web interface. The top header includes the Hitachi logo, the slogan 'Inspire the Next', the model name 'EC704HP-BB3', and the equipment name 'HKL Transmitter CH 35'. The main display area shows 'Forward' and 'Reflected' power meters, an 'RF Mute' button, and a 'user' dropdown menu. A left sidebar contains a vertical menu with items like 'Alarms', 'Log Alarms', 'Setup', 'Measurements', 'Drawers', 'Remote', 'User', and 'Software Update'. A central 'Alarms' section shows 'No Alarms'. Below the main display, there are three sub-menus: 'Drawer 1' (containing Power Supply, Driver, Power Amplifier, General Measurements, Drawer Current Alarms, and Drawer Past Alarms), 'Power' (containing Software Version, Power, Communication Status, Transistor Bias, and Exciter Status), and 'Setup' (containing Power Setup, Transmitter Setup, PA Temperature Control, Time and Date Setup, Alarm Mask, Exciter, and Import/Export). A 'SNMP NETWORK' section is also visible. Numbered callouts (01-14) point to specific features: 01 (Side Menu Bar), 02 (Model Transmitter), 03 (Equipment name / Channel transmission), 04 (Forward Power monitor), 05 (Reflected Power monitor), 06 (RF Mute button), 07 (User dropdown), 08 (Exit button), 09 (Vertical Bar Menu), 10 (Alarms status), 11 (Setup Sub-Menus), 12 (Measurements Sub-Menus), 13 (Drawers Sub-Menus), and 14 (Remote Sub-Menus).

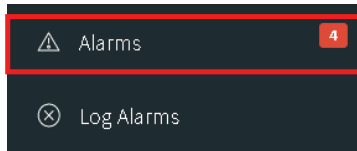
#	DESCRIPTION
01	Hides / Displays Side Menu Bar
02	Model Transmitter
03	Equipment name / Channel transmission
04	Forward Power - Direct Power Monitor in real time
05	Reflected Power - Reflected Power Monitor in real time
06	On / Off Power
07	Section user
08	Exits the WEB Interface
09	Vertical Bar Menu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



When changing any setting, it will only take effect when you click the "SAVE" button 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

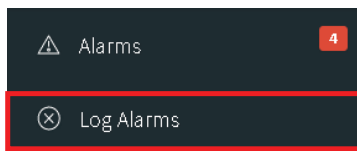
List of alarms occurring

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

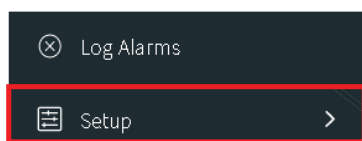
01 TYPE	02 DESCRIPTION	03 DATETIME	HELP
Current Alarms		2020/08/05 16:18	?
Past Alarms		2020/08/05 16:18	?
Current Alarms		2020/08/05 15:21	?
Past Alarms		2020/08/05 15:21	?
Past Alarms	Reduction Power By High Power Amplifier	2020/08/05 13:37	?
Past Alarms	High Power Amplifier Communication	2020/08/05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

06

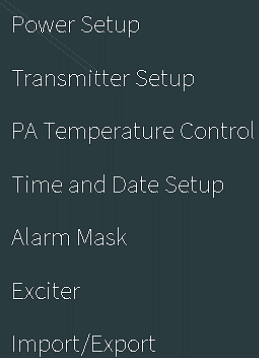
07

#	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

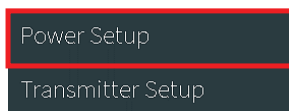


The "SETUP" menu allows for the accessing and changing of the equipment's parameter settings.



- 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]
4400 — +

Operational Power [W]
4400

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

Time And Date

Date

05/08/20: 📅

Time


17:11:31 ⌚

Alarm Mask

Time and Date Setup

Alarm Mask

Set the reflected power alarm threshold.



Alarm Mask

Reflected Power [W]

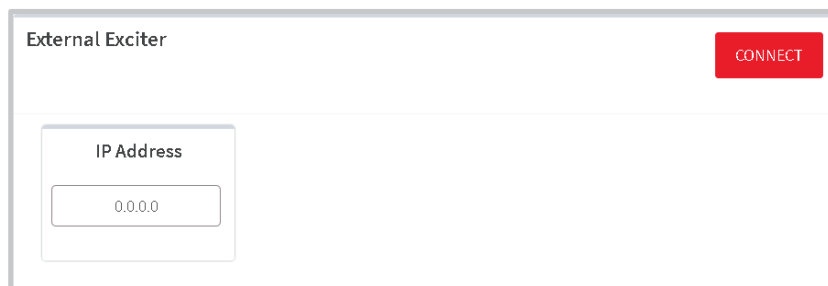
110 - +

Exciter

Alarm Mask

Exciter

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



External Exciter

CONNECT

IP Address

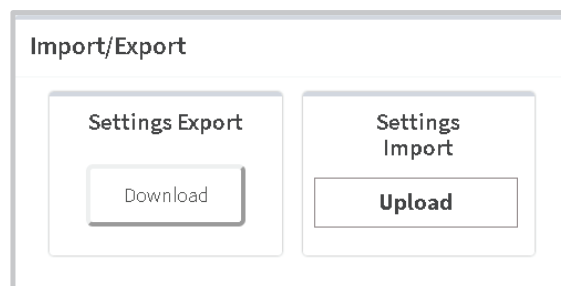
0.0.0.0

Import/Export

Exciter

Import/Export

Import / Export Control Module settings.



Import/Export

Settings Export

Download

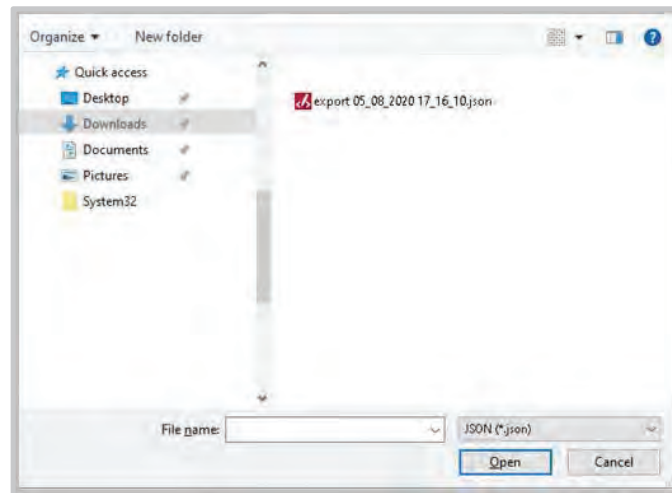
Settings Import

Upload

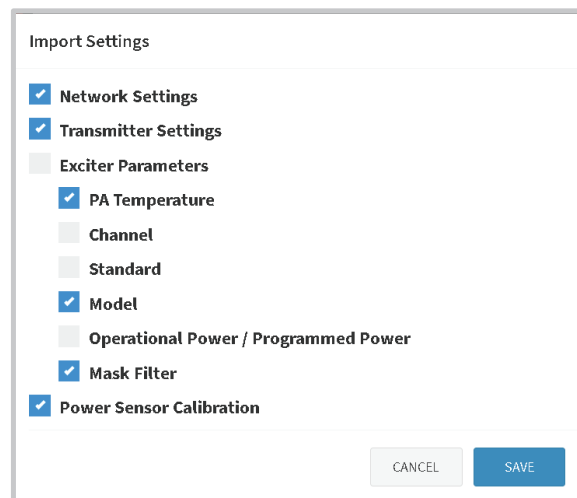
Press “Download” to save the file “export xx_xx_xx xx_xx_xx.json” in the PC downloads folder.

Upload file settings:

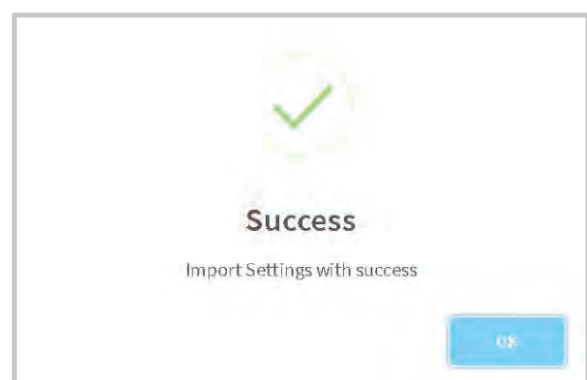
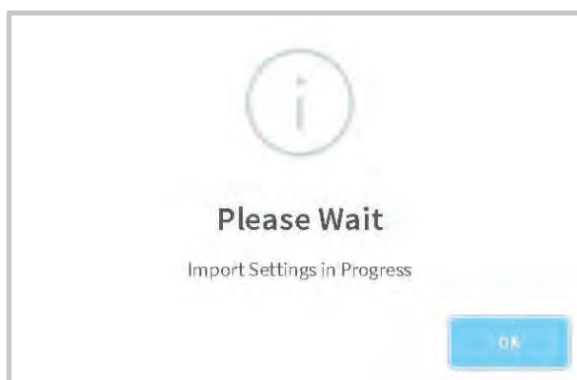
- Press “Upload”
- Select the .json file:



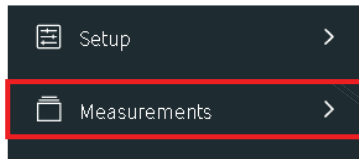
- Select the features to import and press save:



- Press “OK” when the process is done.



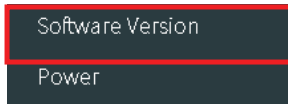
Measurements



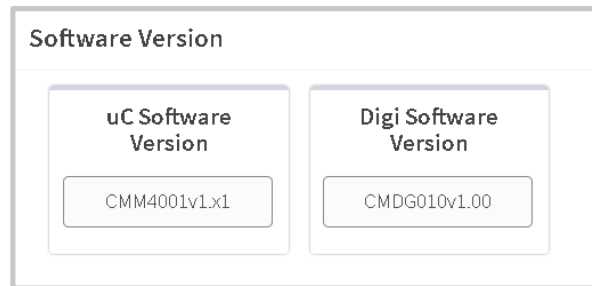
The “Measurements” menu allows the user to access the equipment's operating parameters (read only) .

Software Version
Power
Communication Status
Transistor Bias
Exciter Status

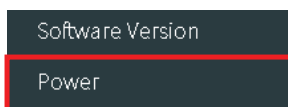
Software Version



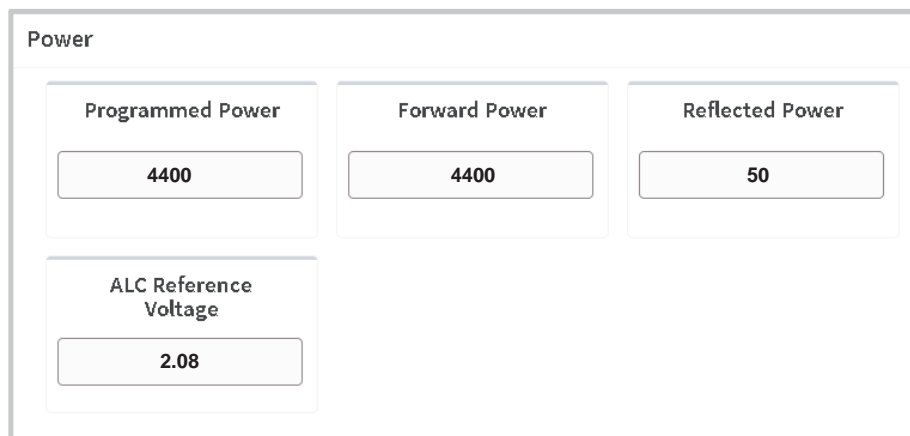
Shows the Control Module software version.



Power



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

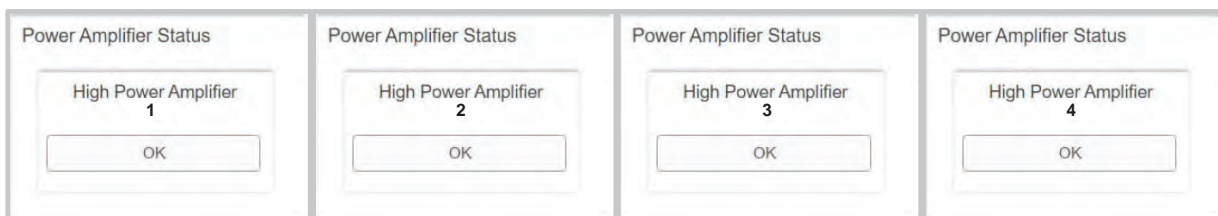


Communication Status

Power

Communication Status

Shows the HPA communication status.



Transistor Bias

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]

50.00

Carrier Amp.
Current [A]

0.70

Peak Amp. Gate
Voltage [V]

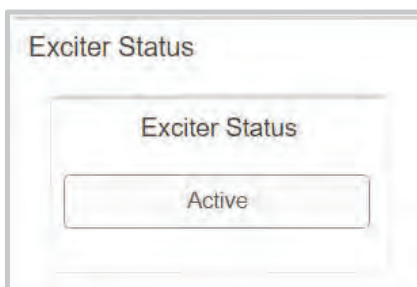
0.60

Exciter Status

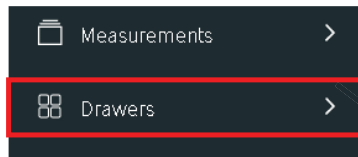
Transistor Bias

Exciter Status

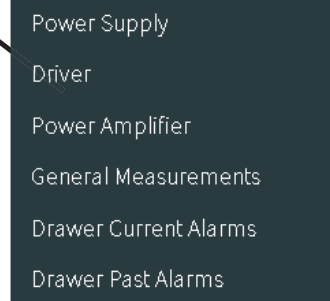
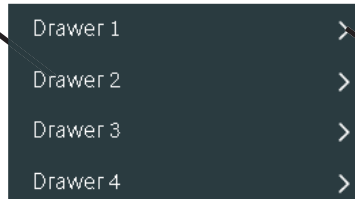
Shows the Exciter's communication status.



Drawers



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



The Drawers number (HPA) varies depending on the equipment model:

EC701HP-BB3: Only Drawer 1

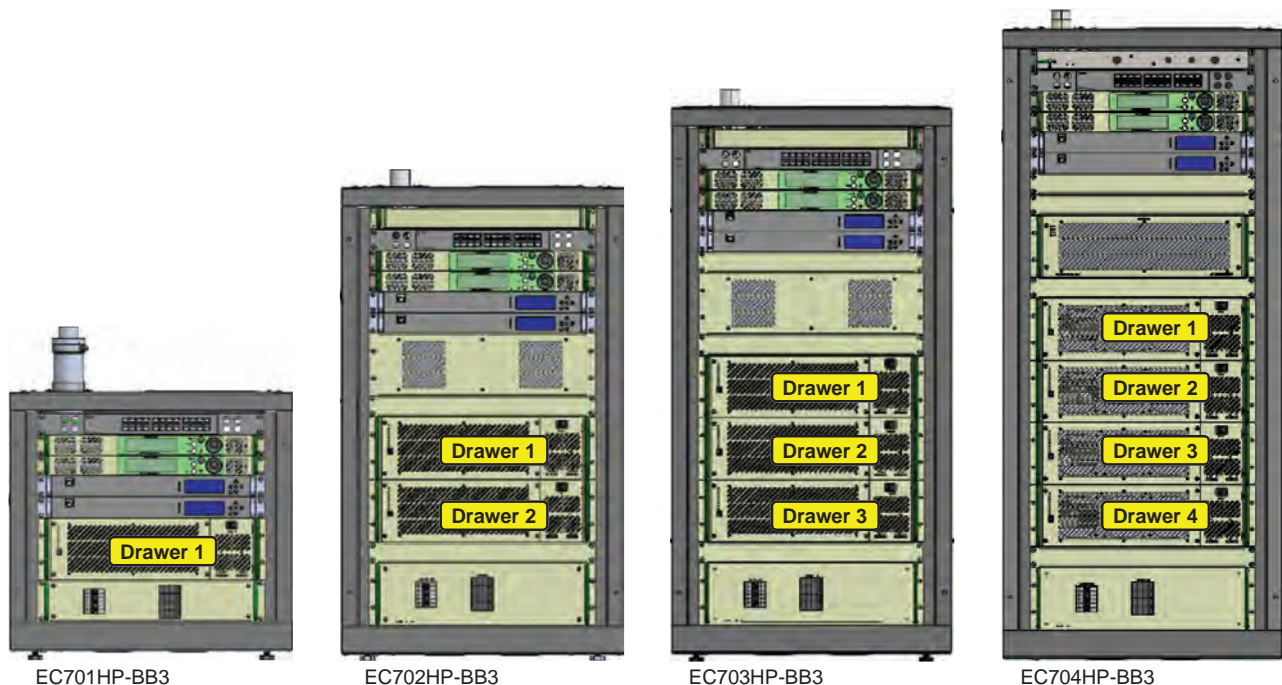
EC702HP-BB3: Drawer 1 and Drawer 2

EC703HP-BB3: Drawer 1 to Drawer 3

EC704HP-BB3: Drawer 1 to Drawer 4

Through the submenu access the individual status of each Drawer (HPA).

Drawer Identification:



EC701HP-BB3

EC702HP-BB3

EC703HP-BB3

EC704HP-BB3

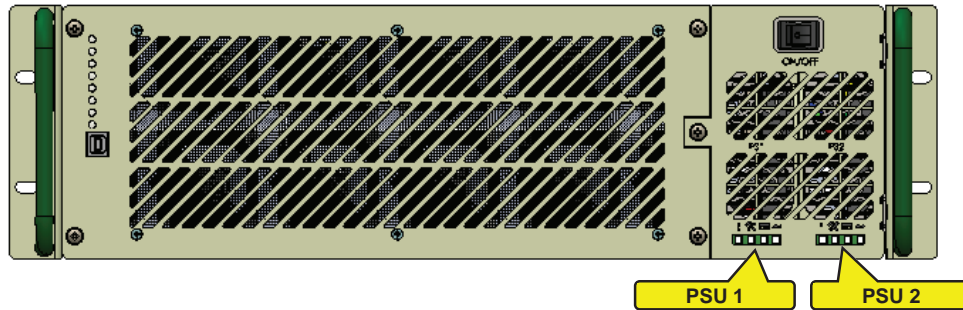
Individual status of each Drawer (HPA):

Power Supply

Power Supply

Driver

Shows the HPA Power Supplies status.



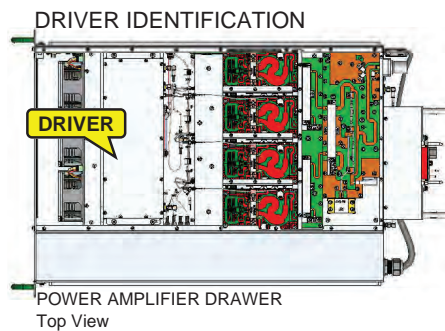
Drawer 1 Power Supply Measurements				
PSU 1 Input Voltage [VAC]	PSU 1 Output Voltage [V]	PSU 1 Temperature [°F]	PSU 1 Output Current [A]	PSU 1 Software Version
221.00	50.00	111.56	13.12	PAM30002v1.03
PSU 2 Input Voltage [VAC]	PSU 2 Output Voltage [V]	PSU 2 Temperature [°F]	PSU 2 Output Current [A]	PSU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

Driver

Power Supply

Driver

Shows the HPA Driver status.



Drawer 1 Driver Measurements				
Input Voltage [V]	Pre Driver Current [A]	Temperature [°F]	Driver Current [A]	Software Version
49.50	0.21	119	2.35	PAM30002v1.03

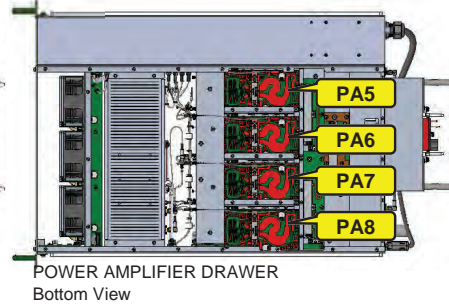
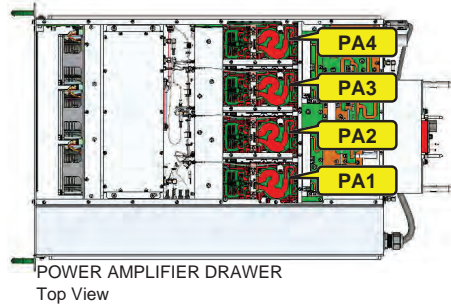
Power Amplifier

Driver

Power Amplifier

Shows the HPA Power Amplifier's status.

PA IDENTIFICATIONS



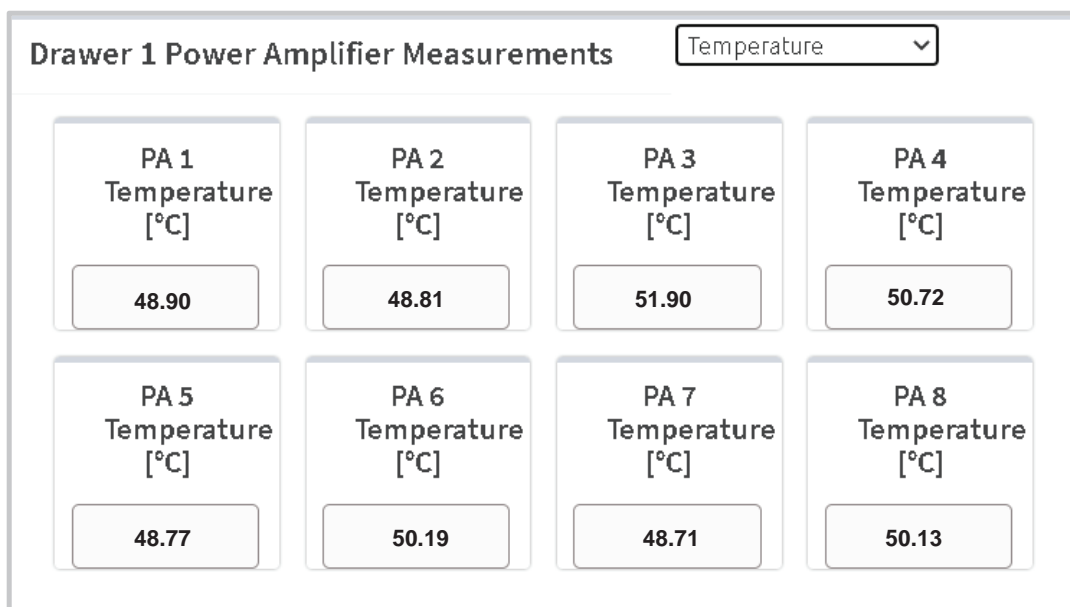
Current:

Select the
status to
show

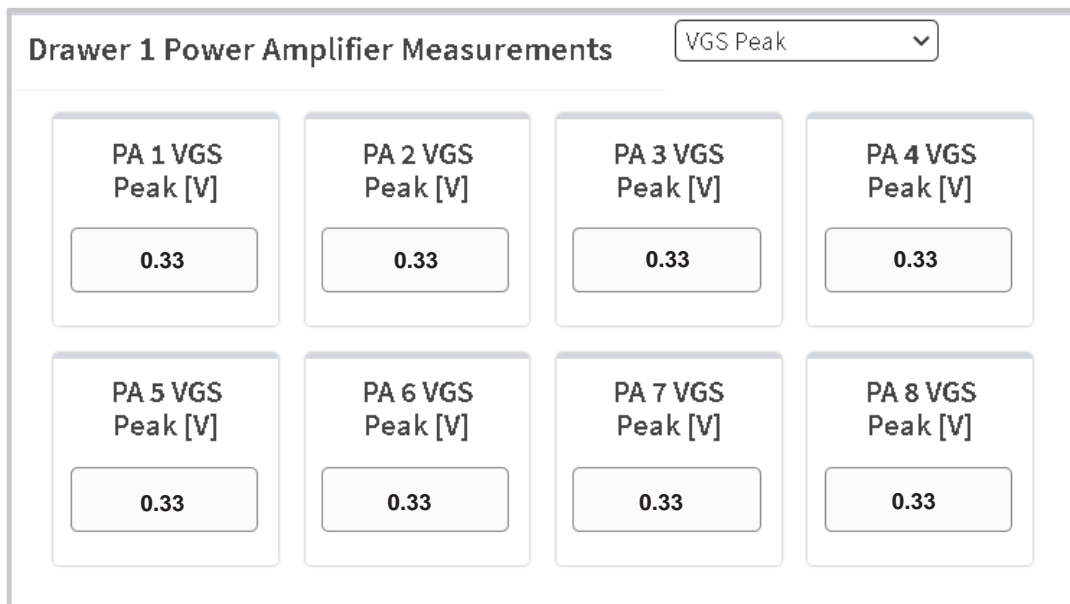
- Current
- Show all
- Current
- Temperature
- VGS Peak
- VGS Carrier
- Software Version

Drawer 1 Power Amplifier Measurements				Current
PA 1 Current [A]	PA 2 Current [A]	PA 3 Current [A]	PA 4 Current [A]	
5.89	6.54	6.05	5.99	
PA 5 Current [A]	PA 6 Current [A]	PA 7 Current [A]	PA 8 Current [A]	
5.91	6.21	6.3	5.99	

Temperature:



VGS Peak:



VGS Carrier:

Drawer 1 Power Amplifier Measurements

VGS Carrier

PA 1 VGS Carrier [V] <div>1.75</div>	PA 2 VGS Carrier [V] <div>1.70</div>	PA 3 VGS Carrier [V] <div>1.71</div>	PA 4 VGS Carrier [V] <div>1.78</div>
PA 5 VGS Carrier [V] <div>1.69</div>	PA 6 VGS Carrier [V] <div>1.67</div>	PA 7 VGS Carrier [V] <div>1.73</div>	PA 8 VGS Carrier [V] <div>1.75</div>

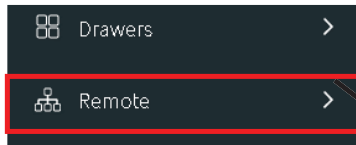
Software Version:

Drawer 1 Power Amplifier Measurements

Software Version

PA 1 Software Version <div>PAM30002v0</div>	PA 2 Software Version <div>PAM30002v0</div>	PA 3 Software Version <div>PAM30002v0</div>	PA 4 Software Version <div>PAM30002v0</div>
PA 5 Software Version <div>PAM30002v0</div>	PA 6 Software Version <div>PAM30002v0</div>	PA 7 Software Version <div>PAM30002v0</div>	PA 8 Software Version <div>PAM30002v0</div>

Remote



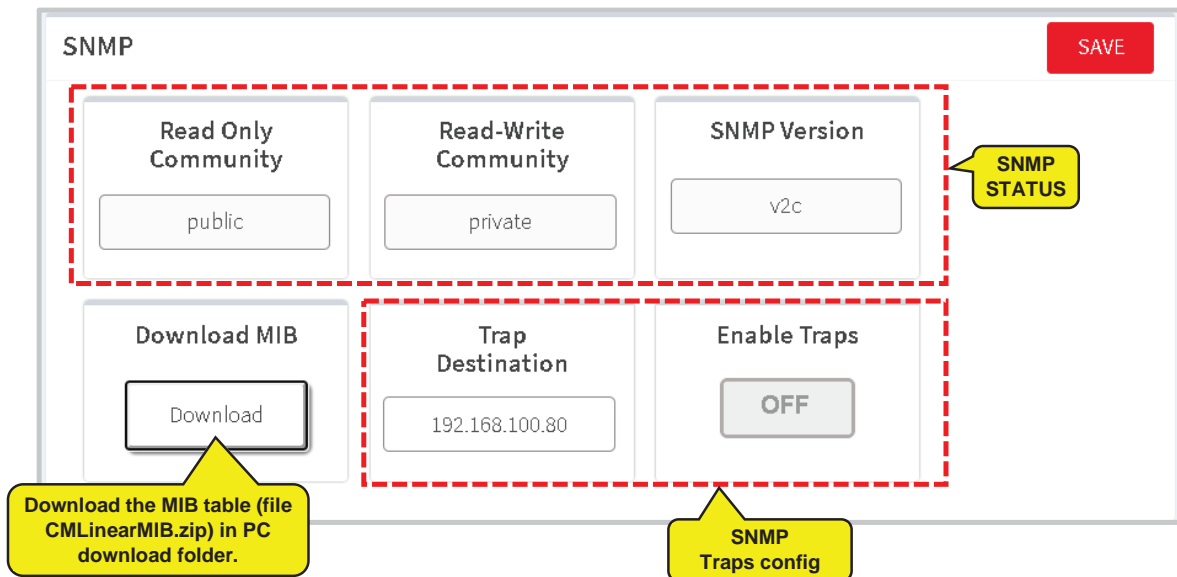
Configures the SNMP and Ethernet network parameters to have remote access via a network connection.



SNMP



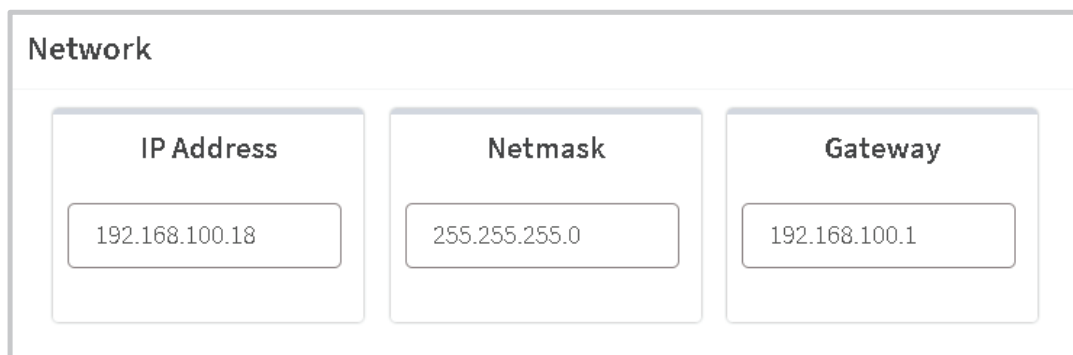
Configures SNMP and download MIB table.



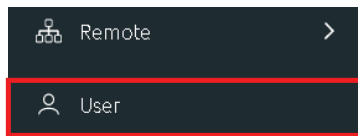
NETWORK



Configures the Ethernet connection.



User



Change the password.

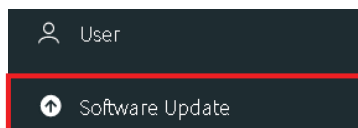
User Setup

Current Password

New Password

Confirm Password

Software Update



Update Software Control Modle via *.bin file.

Software Update

Upload Software

Escolher arquivo

Nenh...ado

UPLOAD

3.2. PA708HP - Power Amplifier Module (MOD GV 40272 / MOD GV 40276)



This is an air-cooled UHF power amplifier drawer composed of an RF block with eight (8) power transistors that utilize Doherty's high efficiency technology. Each Drawer can provide up to 1100 Watts RMS (ATSC 1.0) or up to 930 Watts RMS (ATSC 3.0) with efficiency between 34% and 41%, depending on the operating channel.

The Power Drawers are mounted in the rack by a quick release system that allows them to be connected to the Racks without the need to plug cables or connectors into the rear.

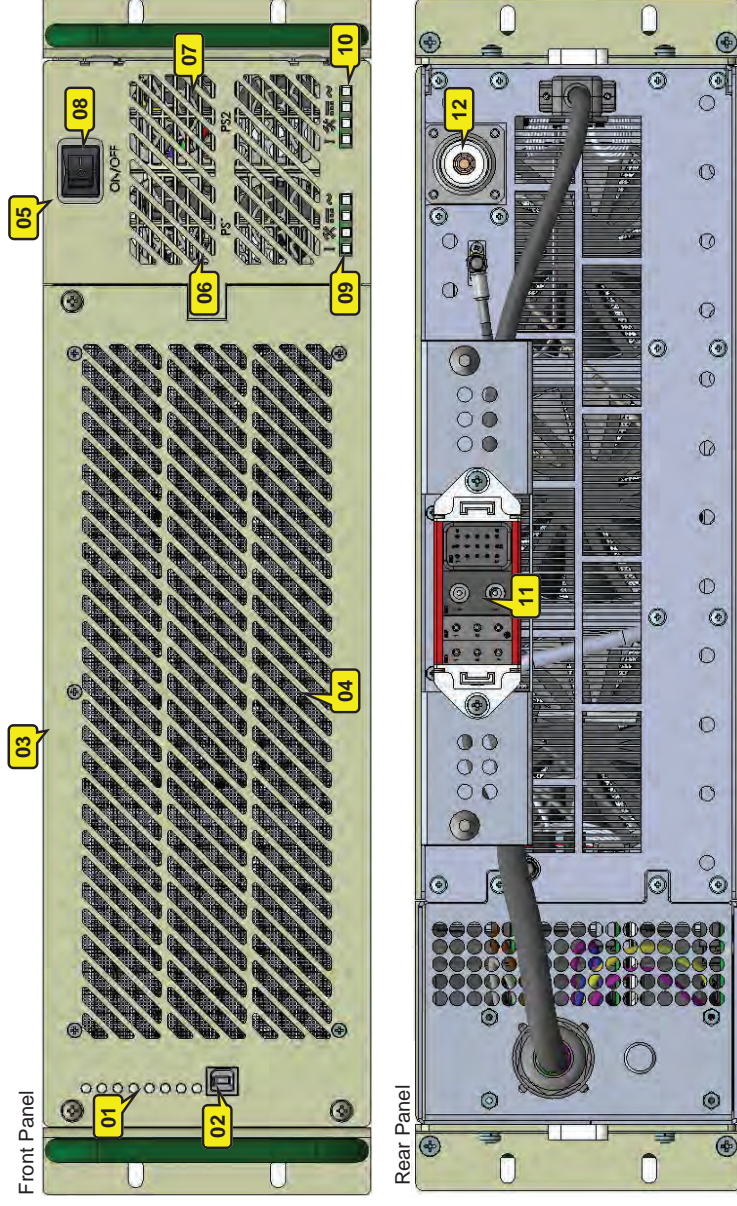
Main features:

- ⇒ High efficiency
- ⇒ Power Supply redundancy - 2 Power Supplies
- ⇒ Doherty Configuration
- ⇒ Standing fans accessible from the front panel
- ⇒ Removable power supply at the front panel of the drawer
- ⇒ 3U 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.

3.2.1. 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	On/Off PA708HP
09	LED status PS1
10	LED status PS2
11	A/C Power, RF Input and Communication Plug-In (quick release system)
12	RF Out Plug-In (quick release system)

3.2.2. Specifications

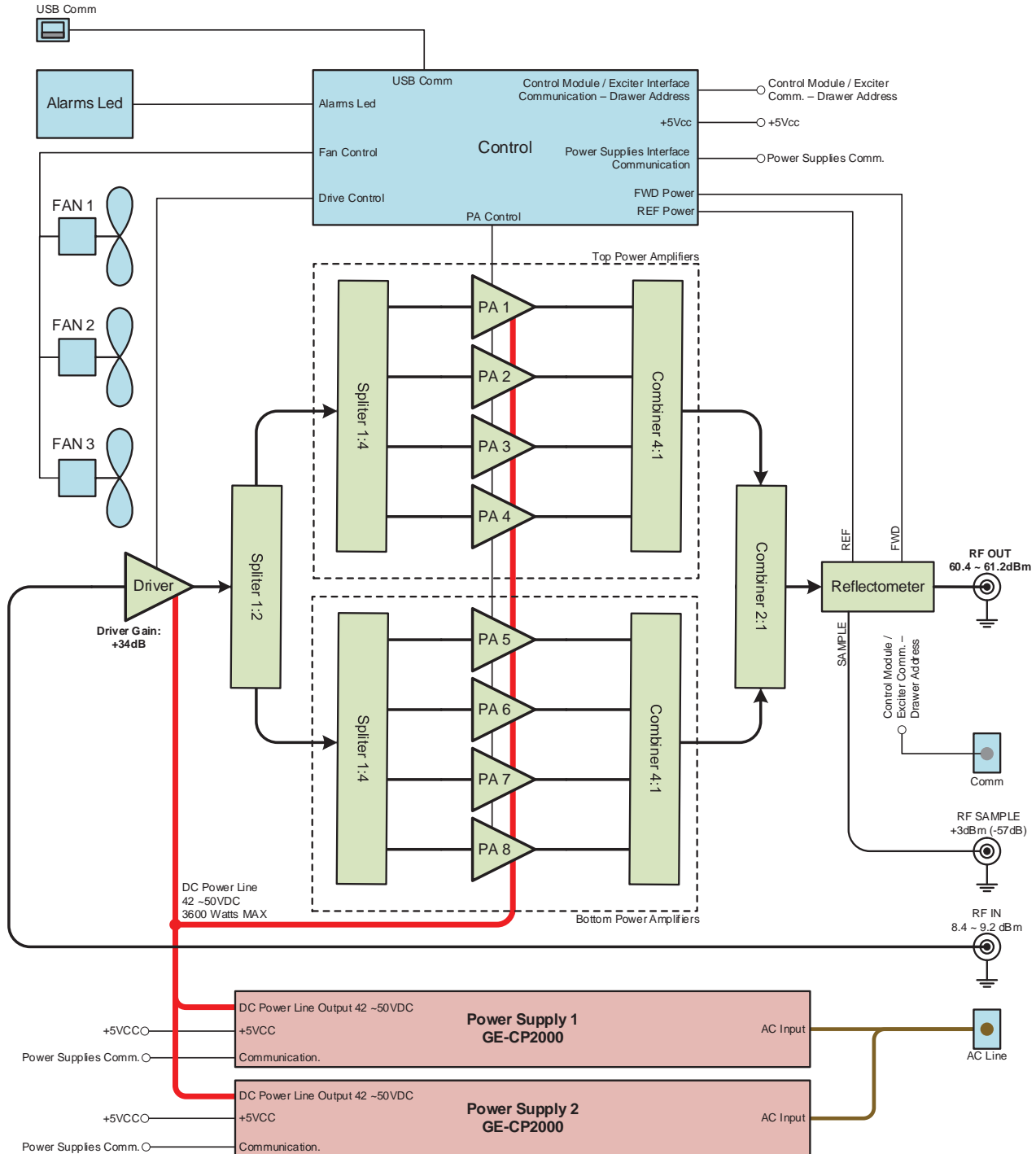
7	Characteristic	Specification
Input	Frequency Range	470 to 608MHz (CH14 to 36) @ MOD GV 40272 608 to 701MHz (CH37 to 51) @ MOD GV 40276
	Level	+8.4dBm (± 0.2 dB) for 1100Wrms Output (ATSC 3.0) +9.2dBm (± 0.2 dB) for 1300Wrms Output (ATSC 1.0)
	Connector / Impedance	SMA female / 50 Ohms
	Return Loss	-20dB typical (-18dB Max)
Output	Frequency Range	470 to 608MHz (CH14 to 36) @ MOD GV 40272 608 to 701MHz (CH37 to 51) @ MOD GV 40276
	Output Power	1100Wrms (ATSC 3.0) 1300Wrms (ATSC 1.0)
	Connector / Impedance	7/8 Fast Socket / 50 Ohms
	Return Loss	-20dB typical (-18dB Max) - measured with the drawer off
	Harmonics / Spurious	-25dBc
	Average MER	Better than 36dB: Pout=1300W @ ATSC 1.0 Better than 33dB: Pout = 1100Wrms @ ATSC 3.0
General	Communication Interface	USB / RS-485
	AC Mains	180Vac to 250Vac / 43 to 63Hz
	Power Factor	> 0.92
	Gain	52dB (± 0.2 dB)
	Average Efficiency	40% typical @ ATSC 1.0 40% typical @ ATSC 3.0

3.2.3. Power Amplifier Drawer Functional Description

MOD GV 40272: 470 to 608 MHz (ch14 to ch36)

MOD GV 40276: 608 to 701 MHz (ch37 to ch51)

GAIN: +52 dB



The Power Amplifier Drawer MOD GV 40272/40276 uses eight RF amplifier pallets operating in parallel. The chassis is configured with four pallets per side (top & bottom). Each pallet incorporates the Ampleon BLF-888E Broadband Doherty LDMOS device. Doherty amplifiers significantly improve efficiency by passing the signal peaks in the class C device while using the class AB device to handle average power.

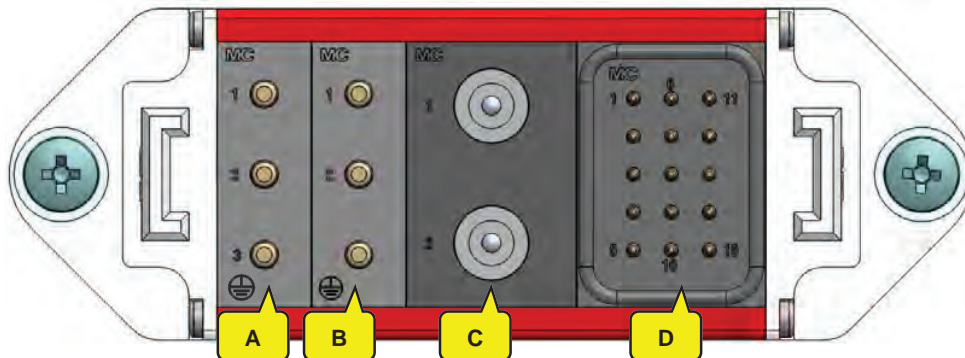
The 888E device internally has two parallel transistors in a Doherty configuration; one half of the device is operating in class AB and the other in class C. Furthermore, the 888E device is designed to be an asymmetric Doherty amplifier, with higher peak power capability on the Class C for better linear performance and higher peak power capability.

Amplifier pallets are housed in a 3RU rack mounted chassis. The chassis is self-contained and includes RF pallets, removable AC to 50VDC power supply, control and monitoring logic, low level RF splitting, high level RF combiner, as well as the cooling fans. The pallets are mounted to oversized extruded aluminum heat sinks for cool operation in the harshest conditions.

The Power Amplifier Drawer is controlled by the CM9001 Control Module. The CM8001 monitors, manages and controls all the drawer parameters via the RS485 interface called MODBUS.

Each final power amplifier module has protection systems for high temperature and over-current. The final power amplifier assembly has a protection system for excessive VSWR conditions. The amplifier chassis provides at a glance front panel indicators. LED's to indicate the status of the PS voltage and current, pallets, temperature status, as well as a general amp status indicator. All of the amplifier status information is collected via an amplifier interface board. The interface board provides its status back to the transmitter controller for system level control and monitoring.

3.2.4. A/C Power, RF Input and Communication Plug-In



A1	AC POWER PHASE 1 – PS1
A2	AC POWER PHASE 2 – PS2
A3	GND
B1	AC POWER PHASE 2 – PS2
B2	AC POWER PHASE 2 – PS1
B3	GND
C1	RF INPUT
C2	RF SAMPLE

D1	Pinout Configuration – Address A2
D2	Pinout Configuration – Address A3
D3	RS485A
D4	N/A
D5	Reflected Power
D6	Pinout Configuration – Address A1
D7	GND
D8	GND
D9	N/A
D10	GND
D11	Pinout Configuration – Address A0
D12	N/A
D13	RS485B
D14	N/A
D15	Forward Power

3.2.5. Power Amplifier Drawer Address Configuration - MODBUS

Each drawer position has an address. The address is assigned to the drawer when it is attached to a certain position in the rack. The assignment of this address occurs on pins D1, D2, D6, and D11 of the Plug-In connector. The addressing of the positions of the drawers follows the table below:

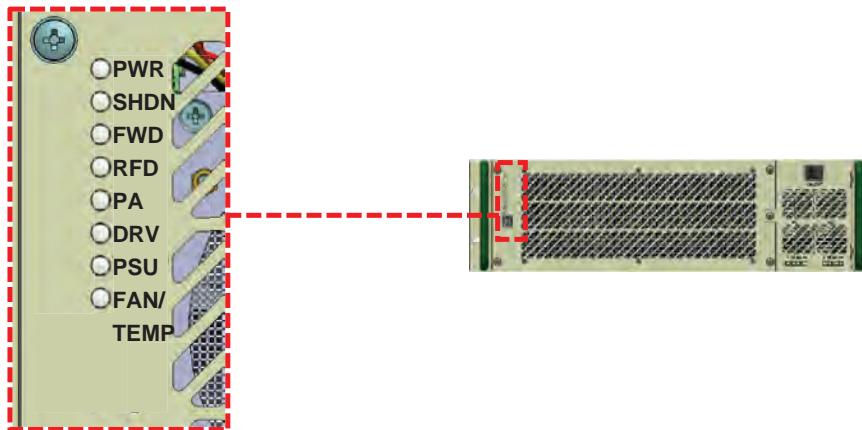
Equipment	Drawer Position	Decimal MODBUS Address	Binary Pinout Configuration			
			A3	A2	A1	A0
EC701HP-BB3	1	003	1	0	0	0
EC702HP-BB3	1	003	1	0	0	0
	2	004	1	0	0	1
EC703HP-BB3	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
EC704HP-BB3	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
	4	006	1	0	1	1

Binary Pinout Configuration: 0 (0Vcc); 1 (3.3Vcc)

3.2.6. Power Amplifier Signaling LED's

Each Power Amplifier Drawer Features an LED bank that indicates its operation 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

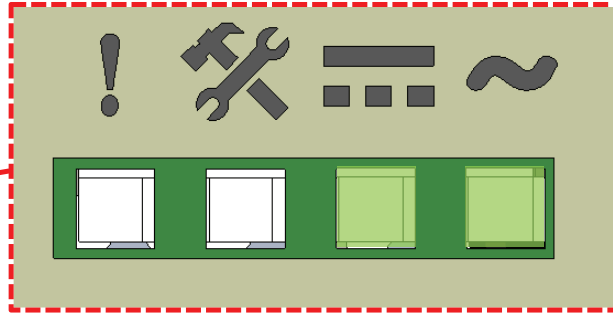
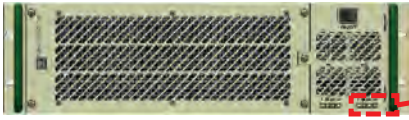


LED	ALARM
PWR	N/A - This LED lights only GREEN indicating that is POWERED ON
SHDN	Power Supply Shutdown
FWD	Over Forward Power (Overdrive)
RFD	Reflected Power
PA	PA Failure, High Current on PA, Low Current on PA, Current UNBAL on PA, Low Gain on PA, High Temperature on PA, Communication Failure on PA
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 detected 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

3.2.7. Power Supplies Signaling LED's

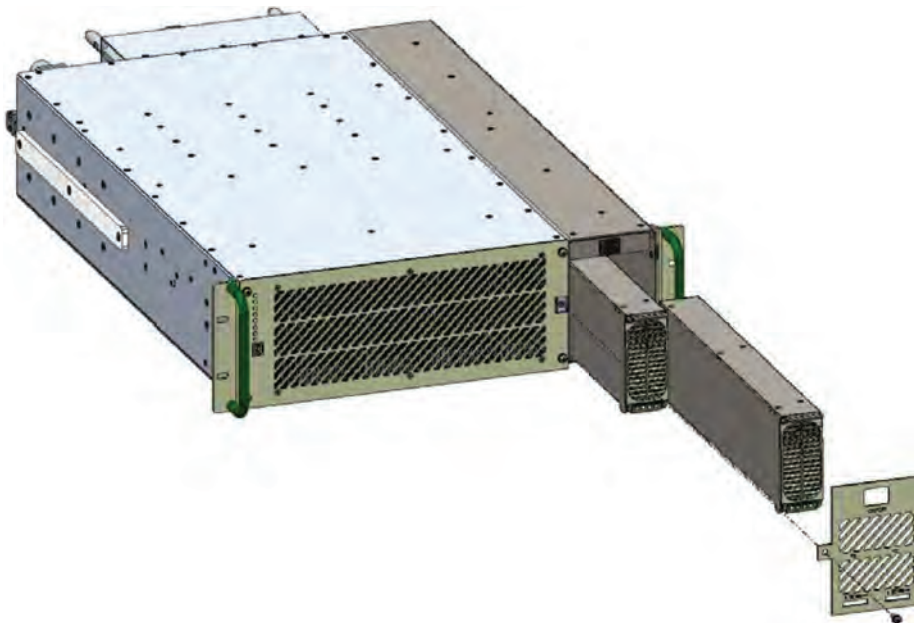


LED	STATUS
!	ON: Fault BLINKING: Not Communicating
	ON: Over-temperature warning BLINKING: Overload
	ON: Output OK BLINKING: Service
~	ON: Input OK BLINKING: Input out of limits

3.2.8. CP2000 - 2000 Watts Powers Supplies

Use GE model CP2000AC54TEZ, 2000W AC-DC Power Supply

The Power Amplifiers Drawers use two 2000 Watts plug-in power supplies. Each one converts 180-240VAC single-phase line voltage to 40-50VDC and features a quick-connect system that allows the unit to be easily removed through the front of the power amplifier chassis.



Never unplug any Power Supplies while the transmitter is on as this can result in equipment damage.

In the EC701HP-BB3, EC702HP-BB3 and EC703HP-BB3, which uses one, two and three Power Amplifiers, if one PS is removed the output power of the PA is reduced to 40% of the nominal power of the PA. From the EC704HP-BB3 up to EC712HP-BB3, which uses four or more amplifier, if one PS is removed the PA is shut off and the transmitter output power results follows the equations below.

3.2.9. Power Supply Redundancy Operation / Power Reduction

See below the description of the power supply redundancy operation of the transmitters EC701HP-BB3 to the EC712HP-BB3:

EC701HP-BB3

The EC701HP-BB3 is composed by one Power Amplifier with the combination of eight pallets with the Doherty technology.

Only in this model there is the possibility to operate with one of the two power supplies and with one or more RF transistors damaged.

The Output power reduction by PSU fail follows the table below:

Output Power reduction by PSU fail		
PS1	PS2	Output Power
OK	OK	100%
FAIL	OK	40%
OK	FAIL	40%

The Output Power Reduction by RF transistor fail follows the equation below:

$$P_{out} = \left(\frac{T_{ok}}{T_{total}} \right)^2 * P_n * k$$

Where:

P_{out} = Output Power Results

T_{ok} = Number of transistors working properly

T_t = Total number of transistors = 8

P_n = Nominal Output Power after the filter.

k = Reduction factor by dummy loads = 0.75

EC702HP-BB3

The Output Power Reduction by PSU fail follows the equation below:

$$P_{out} = \left(\frac{N1 + N2 * 0.73}{N} \right)^2 * Pn * k * y$$

Where:

Pout = Output Power Results

N1 = Number of Power Amplifiers working properly

N2 = Number of Power Amplifiers with one PSU failed

N = Total Number of Power Amplifiers = 2

Pn = Nominal Output Power after the filter

k = Reduction factor by dummy loads = 0.75

y = Reduction factor by PSU = 0.713

Obs: The output of the Power Amplifier is reduced to 40% in the case of one PSU fail

EC703HP-BB3

The Output Power Reduction by PSU fail follows the equation below:

$$P_{out} = \left(\frac{N1 + N2 * 0.73}{N} \right)^2 * Pn * k * y$$

Where:

Pout = Output Power Results

N1 = Number of Power Amplifiers working properly

N2 = Number of Power Amplifiers with one PSU failed

N = Total Number of Power Amplifiers = 3

Pn = Nominal Output Power after the filter

k = Reduction factor by dummy loads = 0.75

y = Reduction factor by PSU = 0.645

Obs: The output of the Power Amplifier is reduced to 40% in the case of one PSU fail

EC704HP-BB3 to EC712HP-BB3

The Output Power Reduction by PSU fail follows the equation below:

$$P_{out} = \left(\frac{N1}{N} \right)^2 * Pn * k$$

Where:

Pout = Output Power Results

N1 = Number of Power Amplifiers working properly

N = Total Number of Power Amplifiers (4 to 12 depending on the model)

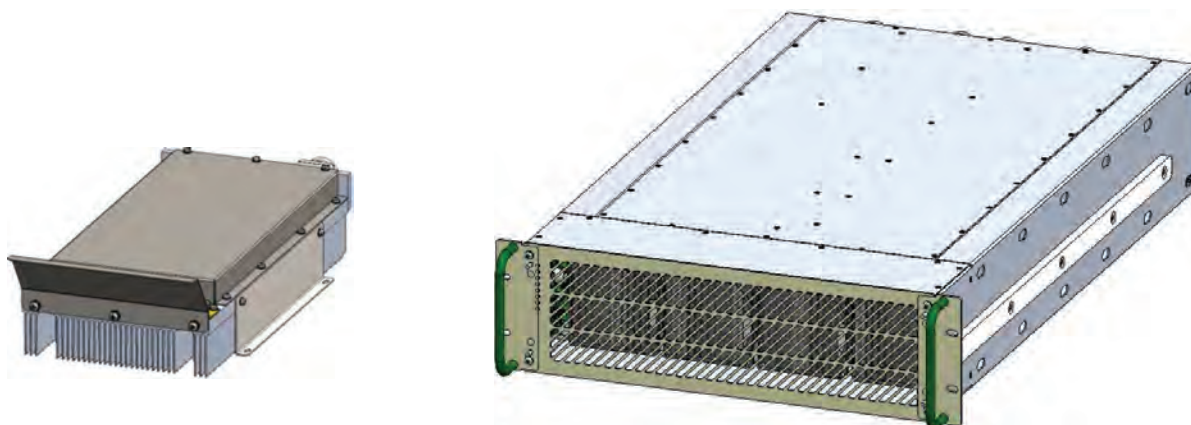
Pn = Nominal Output Power after the filter

k = Reduction factor by dummy loads = 0.75

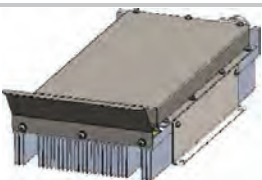


Obs1: The Power Amplifier switch off in the case of one PSU fail

Obs2: The Power Amplifier in the models EC704HP-BB3 to EC712HP-BB3 switch off in the case of one or more transistors fail

3.3. Dummy Loads Module

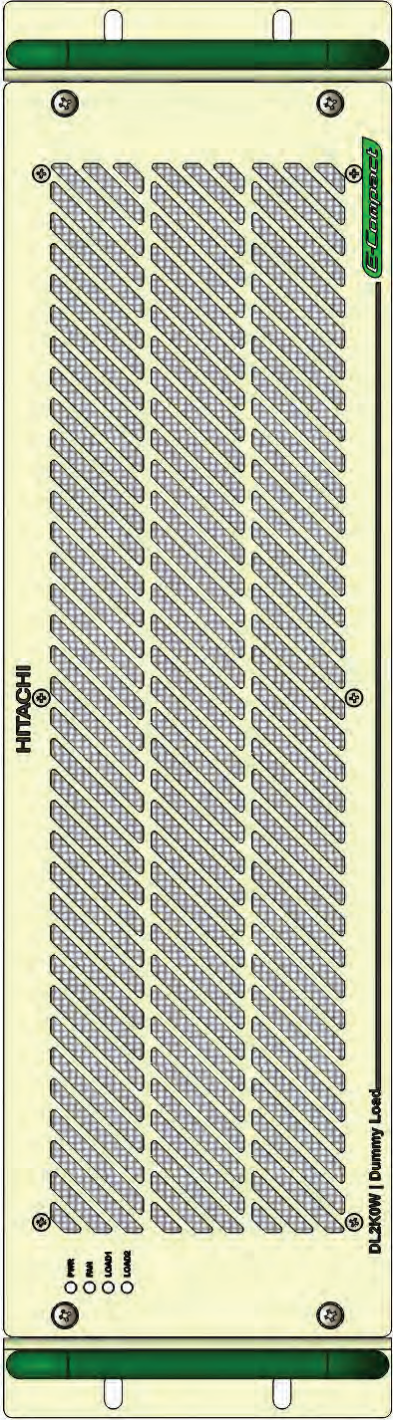


It is a drawer that absorbs the imbalances that occur in the power combiner. The model of the drawer varies according to the quantity of loads defined by the equipment model:

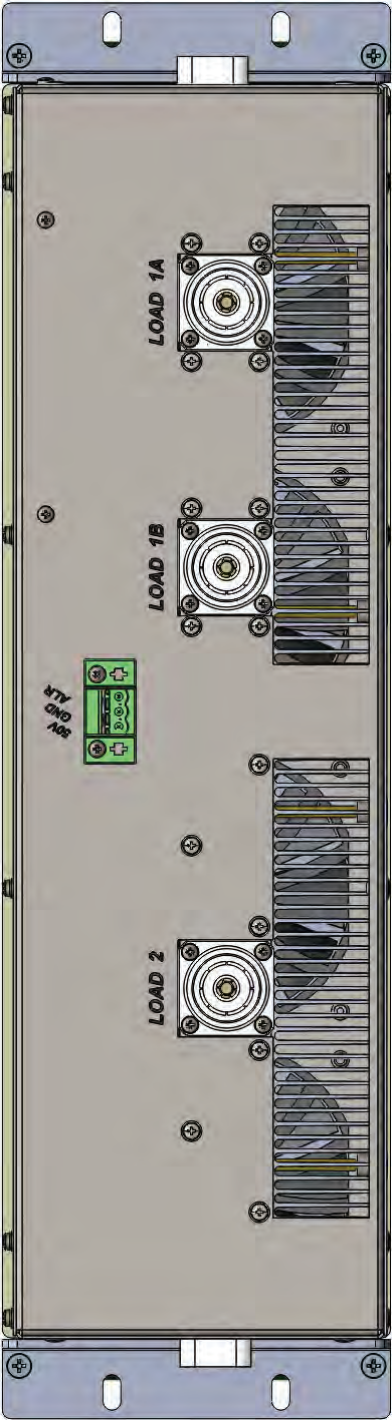
Dummy Load Module	Rear View	Loads Qty	Equipment
N/A	N/A	0	EC701HP-BB3
MOD 40295 500 Watts		1	EC702HP-BB3
MOD 40295 500 Watts MOD 40311 1000 Watts		2	EC703HP-BB3
MOD GV 40312 DL2K0W		3	EC704HP-BB3



3.3.1. DL2K0W - Interfaces



Front Panel



Rear Panel

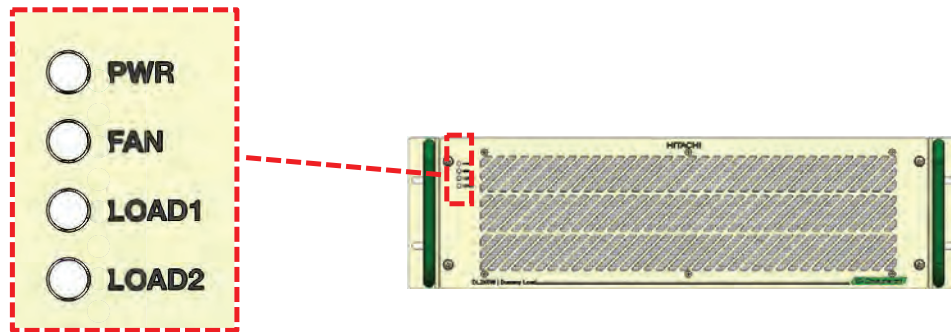
DL2K0W (MOD 40027)

LOAD	CONN.	LOAD SIDE	IMPEDANCE 470~608MHz	POWER
LOAD 1A	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 1B	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 2	DIN 7/6"	TOP	50Ω	1000 Watts

3.3.2. DL2K0W - Signaling LED's

Each Power Amplifier Drawer has a bank of LED's that indicates the situation of its operation according to the color of its illumination:

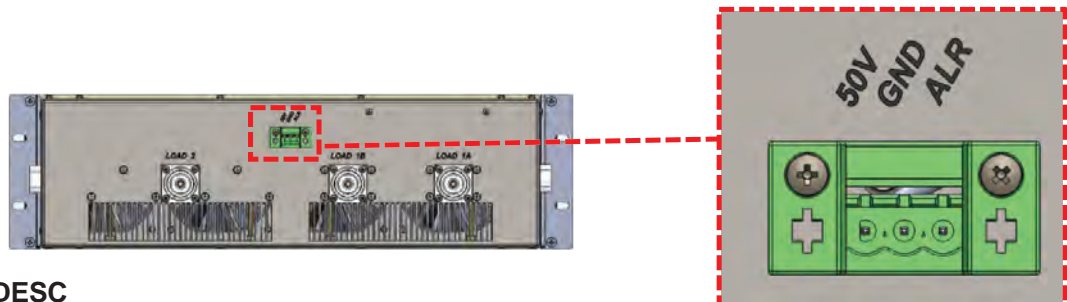
● Green	Normal operation
● Orange	There is power on the rejection loads (temperature is rising)
● Red	A failure is <u>occurring</u>



LED	COLOR	ALARM
PWR	● Green	N/A - This LED lights only GREEN indicating that is POWERED ON
ALR	● Red	Fan failure or high temperature loads
LOAD_*	● Orange	Temperature rise due to RF
	● Red	High temperature on Load

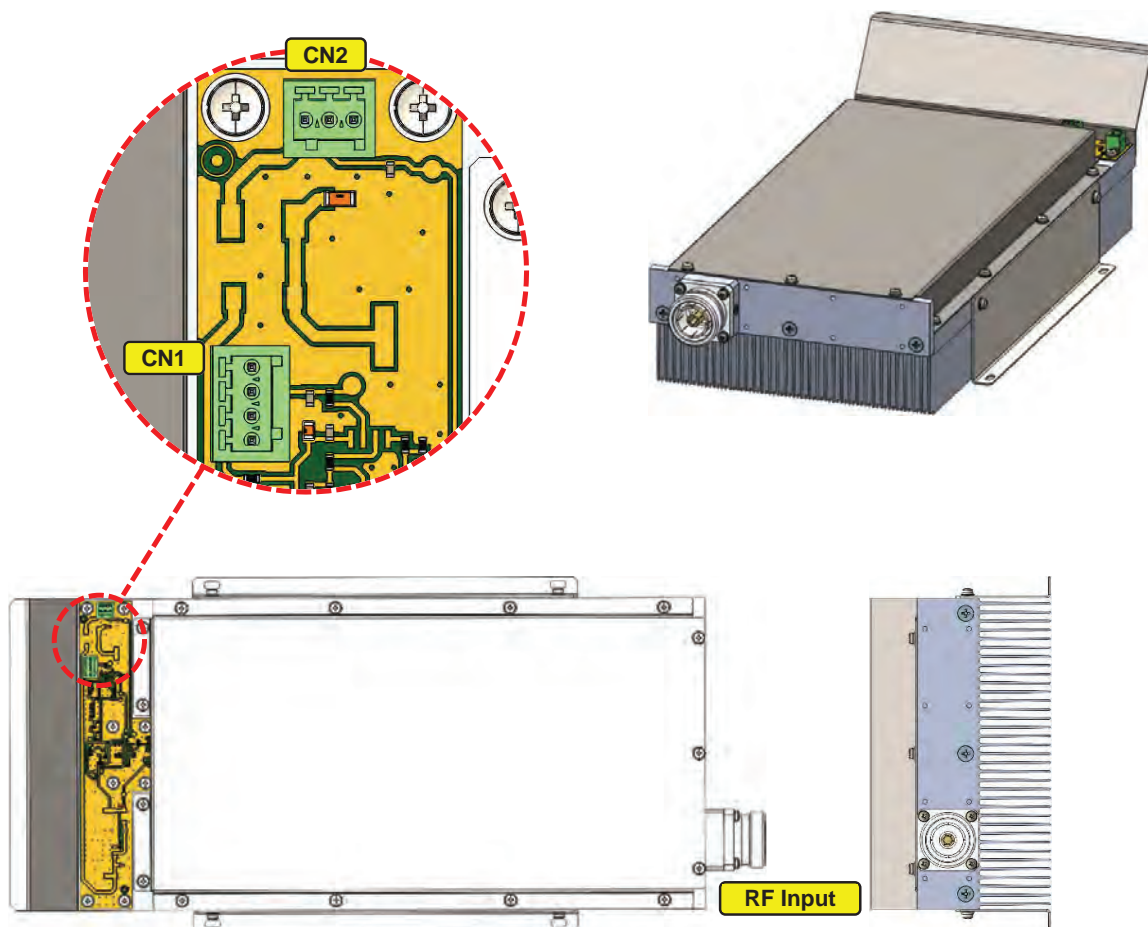
*Load Number - amount of loads depends on the equipment model

3.3.3. DL2K0W - Rear Connection



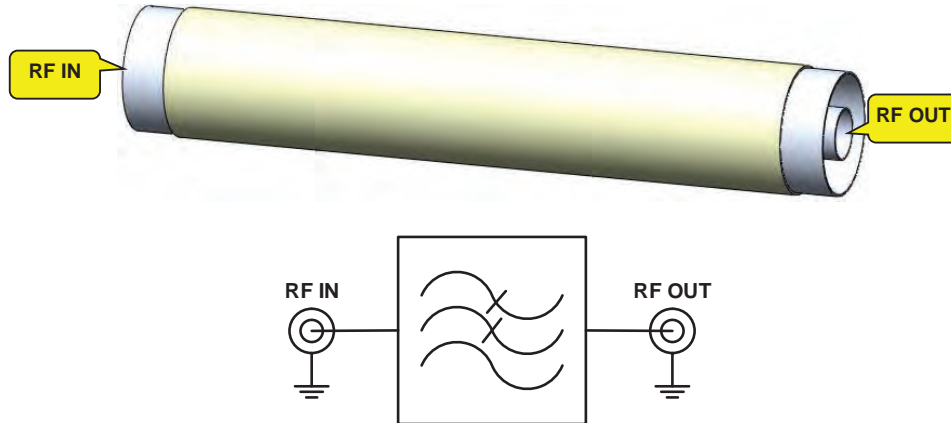
PIN	DESC
50V	50Vdc Input – From MCCB
GND	GND
ALR	Alarm Signaling

3.3.4. MOD 40295 / MOD 40311 - Interfaces



CONNECTOR	PIN	DESC
CN1 (Fan conn.)	1	GND
	2	FAN ROTATION
	3	FAN PWM
	4	+50 VDC
CN2 (Module Power)	1	+50 VDC
	2	ALARM_FAN/TEMP
	3	GND
RF Input 50Ω	---	MAX 500W @ MOD 40295 MAX 1kW @ MOD 40295

3.4. EIA Low Pass Filter

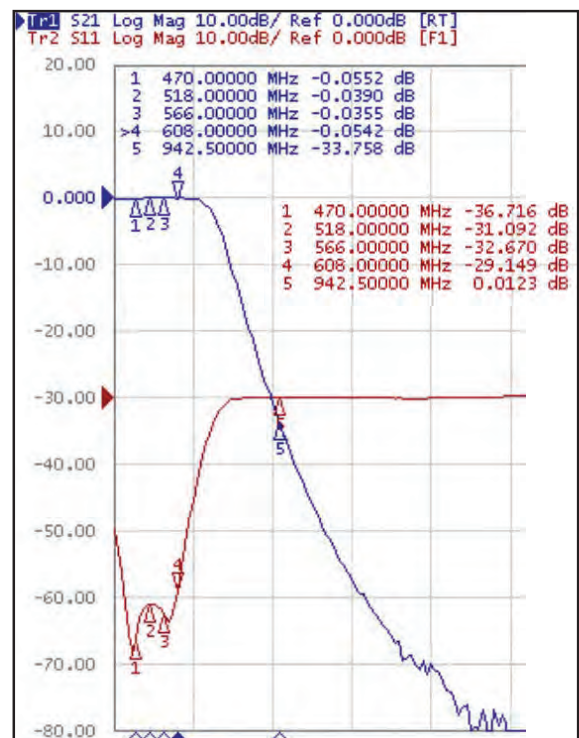


The Low Pass Filter is installed between the Power Amplifier Drawer RF Output and the Mask Filter, attenuating unwanted harmonic products so that they do not return as reflected wave to the PA.

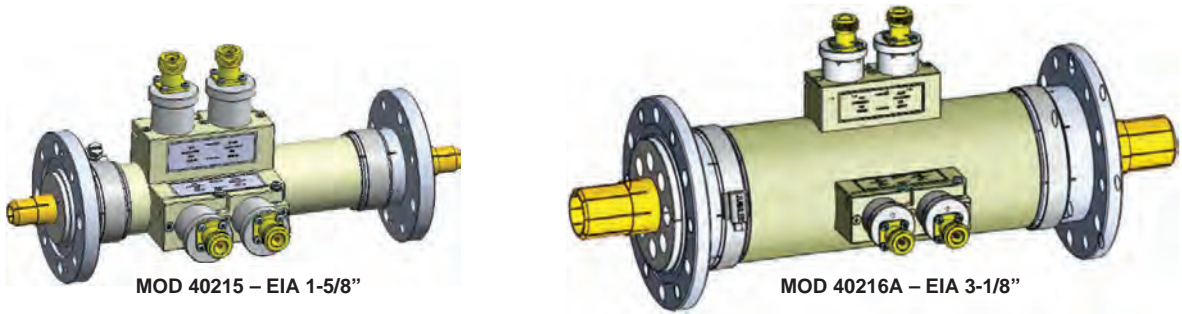
Low Pass Filter	EIA	Equipment
MOD 40243	1 – 5/8"	EC701HP-BB3
MOD 40243	1 – 5/8"	EC702HP-BB3
MOD 40055	1 – 5/8"	EC703HP-BB3

3.4.1. Features

Low Pass Filter Model	MOD 40243	MOD 40055
Use to	EC701HP-BB3 EC702HP-BB3	EC703HP-BB3 EC704HP-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	



3.5. EIA RF Output Line with Sample Probe

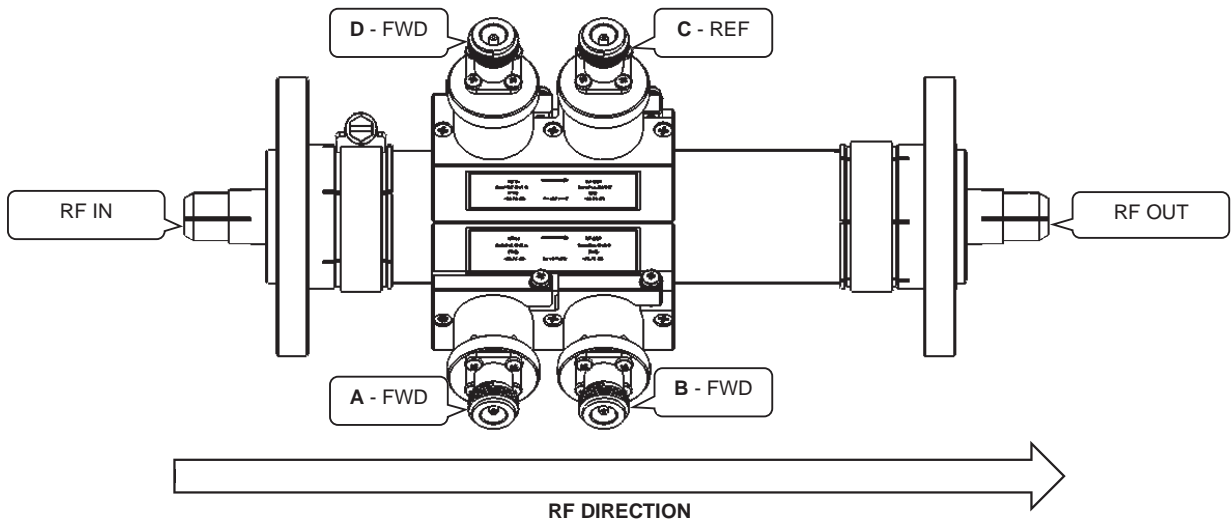


The EIA RF Output Line with Sample Probe is a passive coaxial RF sample installed in the Mask Filter RF output and has four independent RF outputs samples.

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"	EC701HP-BB3 @ ATSC
		EC702HP-BB3 @ ATSC
		EC703HP-BB3 @ ATSC
		EC704HP-BB3 @ ATSC

3.5.1. Features

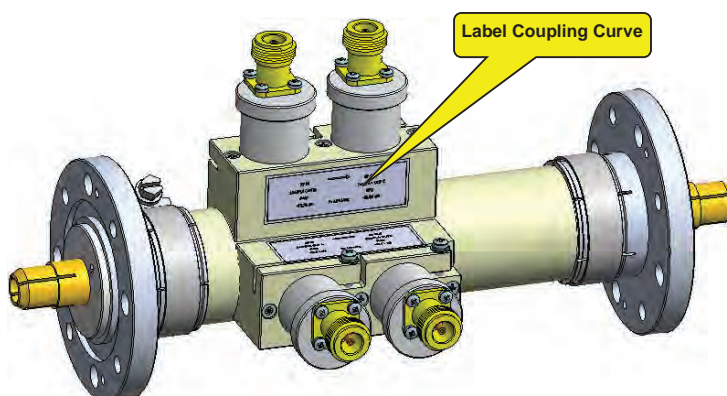


MODEL	MOD 40215	MOD 40216A
Operation Frequency	470 to 608MHz CH14 to CH36	470 to 608MHz CH14 to CH36
Max Power	5500 Watts	14000 Watts
Insertion Loss (RF IN – RF OUT)	-0.13dB (MAX); -0.10dB (MIN)	-0.13dB (MAX); -0.10dB (MIN)
RF OUT	Connection: 1-5/8" EIA Flange Return Loss: -36dB (TYPICAL); -31dB (MIN) Impedance: 50Ω	Connection: 3-1/8" 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	Connection: 3-1/8" EIA Flange Return Loss: -36dB (TYPICAL); -31dB (MIN) Impedance: 50Ω

MOD 40215 / MOD 40216A - 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 connectors labels the coupling curve for the corresponding frequency of the equipment.



3.6. Mask Filter

We recommend using Com-Tech RF Mask Filters:

Recommended bandpass filter for ATSC 1.0

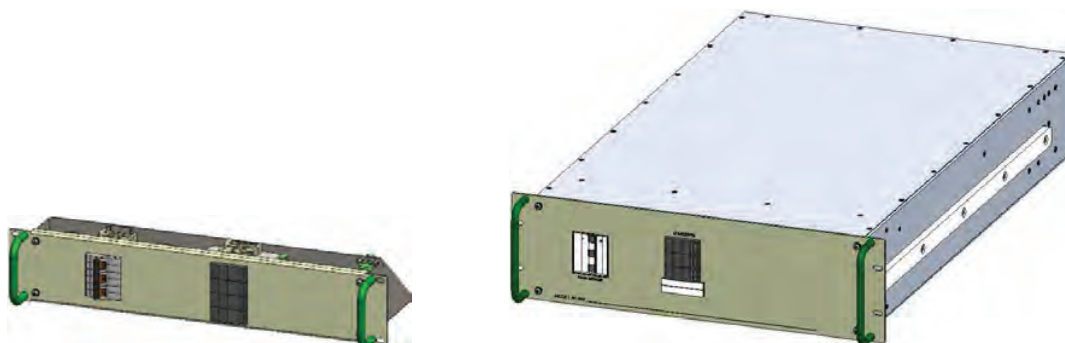
Transmitter	Number of Poles	Model	Brand	Note
EC701HP-BB3	6	TF6D120C	COM-TECH	With Heat Sink
EC702HP-BB3	6	TF6D170C	COM-TECH	Default
EC703HP-BB3	6	TF6D170C	COM-TECH	With Forced Air Cooling
EC704HP-BB3	6	TF6D220C	COM-TECH	With Heat Sink

Recommended bandpass filter for ATSC 3.0

Transmitter	Number of Poles	Model	Brand	Note
EC701HP-BB3	6	TF6D120C	COM-TECH	Default
EC702HP-BB3	6	TF6D170C	COM-TECH	Default
EC703HP-BB3	6	TF6D170C	COM-TECH	With Heat Sink
EC704HP-BB3	6	TF6D220C	COM-TECH	With Heat Sink

Transmitter	Number of Poles	Model	Brand	Note
EC701HP-BB3	8	TF8D120C	COM-TECH	Default
EC702HP-BB3	8	TF8D170C	COM-TECH	Default
EC703HP-BB3	8	TF8D170C	COM-TECH	With Heat Sink
EC704HP-BB3	8	TF8D220C	COM-TECH	With Heat Sink

3.7. MCCB (Molded Case Circuit Breaker)

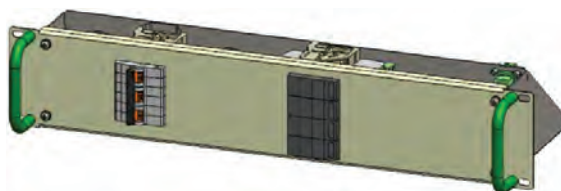


The MCCB (Molded Case Circuit Breaker) Drawer is responsible for the AC Power distribution and Equipment AC Power protection. Provides information to the Control Module regarding power supply conditions and protects the transmitter from power line problems.

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

Equipment	MCCB Model	Capacity
EC701HP-BB3	MOD 40307	4.0kW
EC702HP-BB3	MOD GV 40256	8.0kW
EC703HP-BB3	MOD GV 40257	11.0kW
EC704HP-BB3	MOD GV 40258	18.0KW

3.7.1. 4.0kW MCCB (MOD 40307)

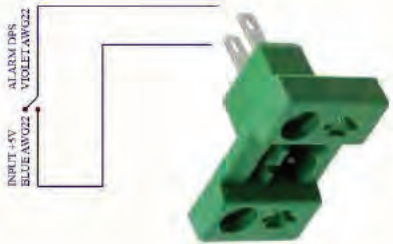
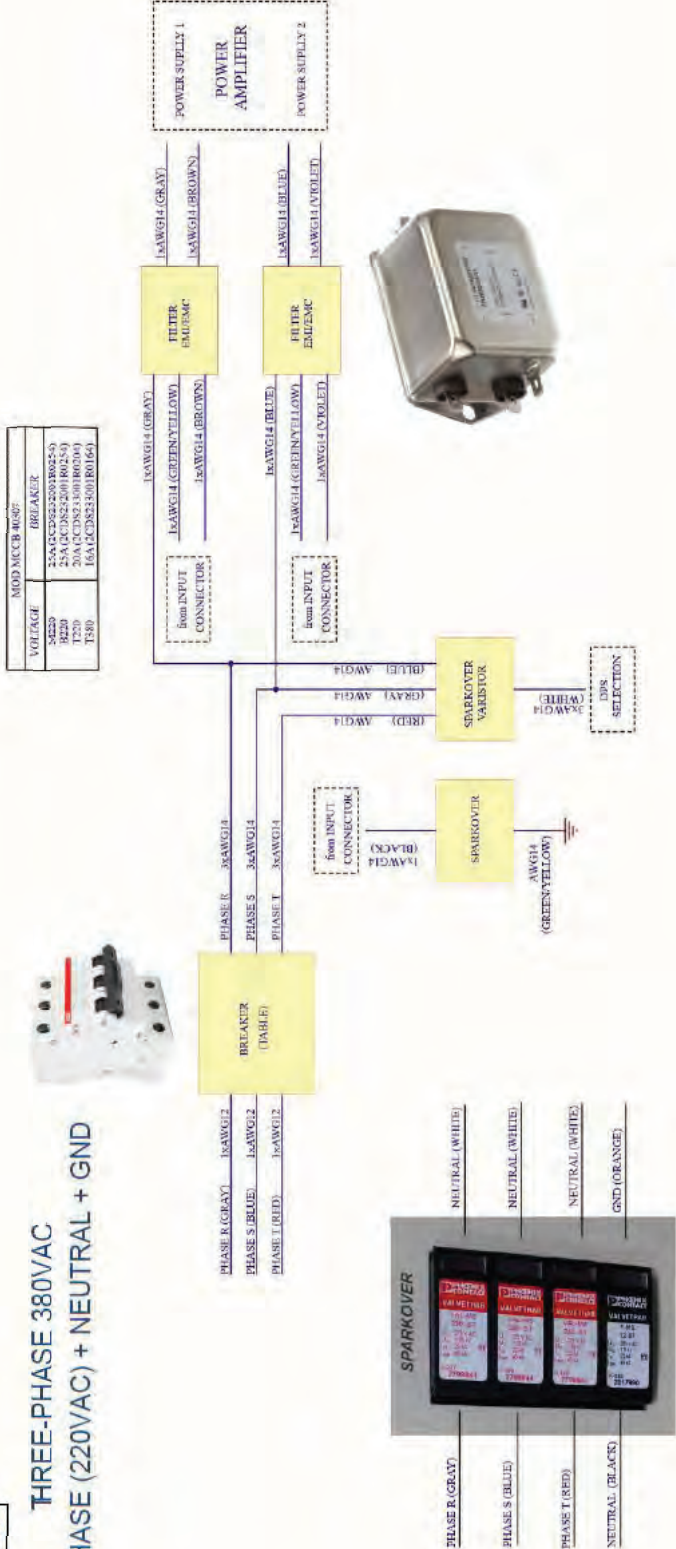


Characteristics:

- For EC701HP-BB3 (AC 4.0kW)
- Surge Protection Device (SPD)
- Circuit Breaker
- Overvoltage Protection (>300VAC)
- EMC / EMI filter

T380

THREE-PHASE 380VAC
3 PHASE (220VAC) + NEUTRAL + GND



OUT - STRIP POWER 1				OUT - STRIP POWER 2				OUTPUT POWER AMPLIFIER				DPS SELECTION			
PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)
NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)
GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)
PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)
NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)
GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)

NEUTRAL

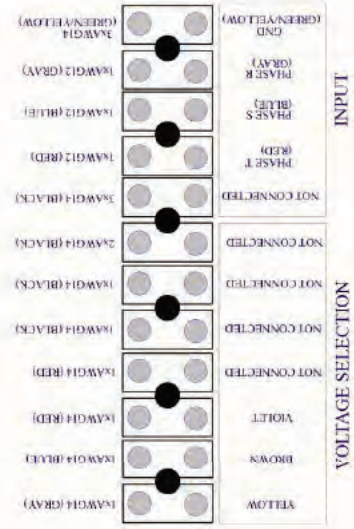
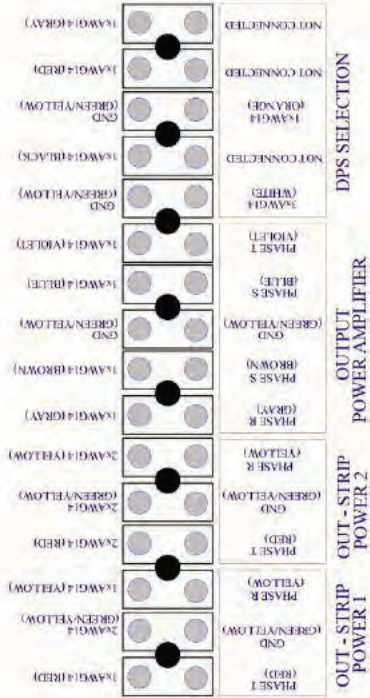
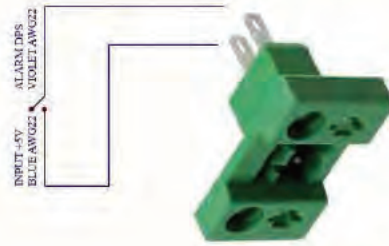
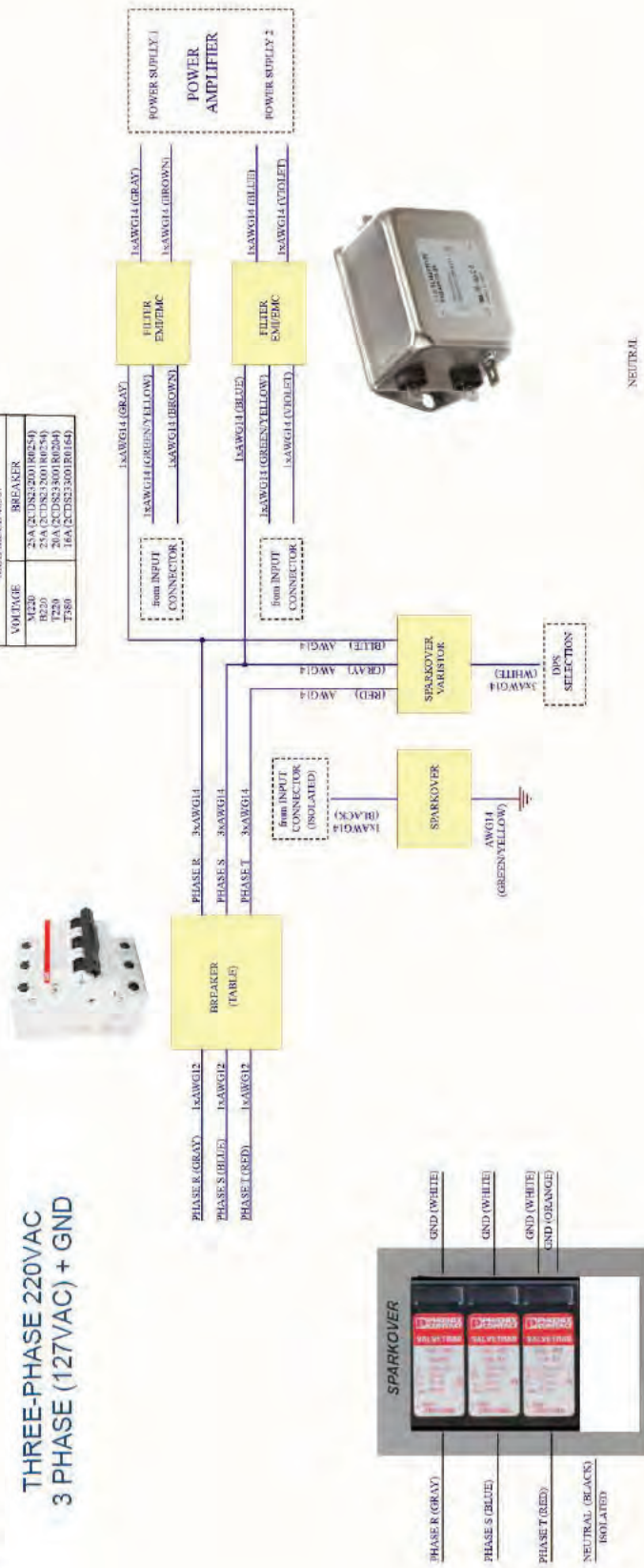
VOLTAGE SELECTION				INPUT			
PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)
NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)
GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)
PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)	PHASE T (RED)	1xAWG14 (RED)	2xAWG14 (RED)	2xAWG14 (RED)
NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)	NEUTRAL (YELLOW)	1xAWG14 (YELLOW)	2xAWG14 (YELLOW)	2xAWG14 (YELLOW)
GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	GND (GREEN/YELLOW)	1xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)	2xAWG14 (GREEN/YELLOW)

HTACHI KOKUSAI LINEAR EQUIPAMENTOS ELETRONICOS SA			
Title: EQPLC701HP-BH3	Revision	CIP	
Size: A3	Number: MCB-40307	Drawn By: LEONARDO	
Date: 23/07/2020	Approved By: Mauro Azeite	Sheet: 1	of 7

T220

THREE-PHASE 220VAC
3 PHASE (127VAC) + GND

MOD MCB 40/50	
VOLTAGE	BREAKER
M220	25A (2CD823200) R0254
B220	25A (2CD823200) R0254
T220	20A (2CD823300) R0204
T380	16A (2CD823300) R0164



HITACHI KOKUSAI LINEAR EQUIPAMENTOS ELETRONICOS SA

Title: EQP/EC701HP-PB3		Number: MCCB-0307	Revision	CIP
Date: 23/07/2020		Drawn By: LEONARDO		
Approved By: Mauro Ariel		Sheet 2 of 7		