

# Operation Manual

**HITACHI**  
Inspire the Next

**UHF Digital TV Transmitters**  
**ATSC 3.0: 950 to 7600 Watts RMS**  
**ATSC 1.0: 1100 to 8800 Watts RMS**  
**E-Compact High-Power Series**



**Read before handling the equipment.**

## W A R N I N G

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Operation Manual  
UHF Digital TV Transmitters  
ATSC 3.0 • 950 to 7600 Watts RMS  
ATSC 1.0 • 1100 to 8800 Watts RMS  
E-Compact High-Power Series  
EC701HP-BB2 • EC702HP-BB2 • EC703HP-BB2  
EC704HP-BB2 • EC706HP-BB2 • EC708HP-BB2

Rev R04 – EN-US

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## 2. Abbreviations

1PPS	One Pulse per Second
A	Amperes
AC	Alternating Current
A-DPD	Adaptive Digital Pre-distortion
AF	After Filter
A.N.M.	Acima do Nível do Mar
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
HKL	Hitachi Kokusai Linear
IP	Internet Protocol
ISDB-T	Integrated Services Digital Broadcasting Terrestrial (Brazil)
ISDB-Tb	Integrated Services Digital Broadcasting Terrestrial
LCD	Liquid Crystal Display.
LPC	Linear Pre correction

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

MCCB	Molded Case Circuit Breakers
MER	Modulation Error Rate
MFN	Multiple Frequency Network



### 3. About this Manual

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

#### EC701HP-BB2

950W UHF ATSC 3.0 Transmitter (6-poles filter)

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

#### EC702HP-BB

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

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

#### EC703HP-BB2

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

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

#### EC704HP-BB2

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

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

#### EC706HP-BB2

5.7kW UHF ATSC 3.0 Transmitter (6-poles filter)

6.6kW UHF ATSC 1.0 Transmitter (6-poles filter)

#### EC708HP-BB2

7.6kW UHF ATSC 3.0 Transmitter (6-poles filter)

8.8kW UHF ATSC 1.0 Transmitter (6-poles filter)

Hitachi Kokusai Electric Comark LLC recommends that you carefully read the sections of 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

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

- Knowledge of electronic circuits of Radio Frequency
- Knowledge of electricity and electrical systems
- Knowledge of digital electronics
- 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

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This manual is comprised of seven (8) sections, which provide the following information:

### **Section 1 - Care, Warranty, and Service**

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

### **Section 2 - Minimum Installation Requirements**

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

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

Present all equipment characteristics, such as description, models, functional description and technical specifications of all models of 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 – WEB Interface**

This section describes how the transmitter can be controlled and monitored remotely, using a Web GUI interface.

### **Section 7 – Preventive Maintenance**

Provides information for preventive maintenance.

### **Section 8 - Attachments**

Additional information for this document.

# Section 1 - Care, Warranty, and Service

## 1. Care and Safety

---



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



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



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



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



Never turn on the equipment without connecting it to an Antenna or RF Load. May cause serious damage to the Equipment.



Never unplug any Power Amplifier Drawer while the Transmitter is on. 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, counting from the issuing of the sales invoice. The period is irrevocable except in cases of extended warranty previously noted in contract.
2. During warranty time, the supplier will repair, with no additional charge, the faulty products, providing adjustments, replacing or re-manufacturing, of all the equipment or its modules and components that present unusual behavior;
  - 2.1. The repaired/replaced products are covered for an additional period of 3 (three) months or up to the end of the original warranty time, taking into count the longer period;
  - 2.2. If the additional 3 (three) months term, referred above, is higher than the original warranty term, the warranty will only extend to the repaired/replaced modules or components;
  - 2.3. The warranty will become effective in the supplier's factory; therefore, it 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 a visit of the supplier's technical personnel, instead of submitting the goods for factory repair, although the expenses relative to transportation, lodge and nourishment of the supplier's technicians will occur at sole expense of the Purchaser, upon budget approval.
3. The supplier is relieved of the warranty terms in the 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

1. 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

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

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](mailto:support@comarktv.com)

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

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

## Section 2 - Minimum Installation Requirements

### W A R N I N G

#### **MANDATORY CONDITIONS FOR TRANSMITTER INSTALLATION, FOR VALIDATING THE WARRANTY TERMS**

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

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

## 1. Introduction

This section provides information on the minimum installation requirements for ISDB-Tb 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

Consumption with the equipment running at its maximum power.

Current (A) on each wire:



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

M208	B240	T208	T240	T380
208 Vac WILD LEG	SINGLE PHASE 240 VAC	WYE THREE PHASE 208 VAC	DELTA THREE PHASE 240 VAC	3 Phases Neutral Ground
208VAC Between Phase B (Wild Leg) and Neutral	240VAC Between 2-Phases	208VAC Between 3-Phases.	240VAC Between 3-Phases.	380VAC Between 3 Phases / 220VAC Between each Phases and Neutral

E-Compact Series - ATSC									
MODEL	M208 / B240			T208 / T240			T380		
	(A) Typical	Wire diameter		(A) Typical	Wire diameter		(A) Typical	Wire diameter	
		mm <sup>2</sup>	AWG		mm <sup>2</sup>	AWG		mm <sup>2</sup>	AWG
EC701HP-BB2	15,1	8,36	8	8,8	5,26	10	4,8	3,31	12
EC702HP-BB2	29,6	16,77	5	17,1	10,55	7	9,3	6,63	9
EC703HP-BB2	44,1	26,67	3	25,5	13,3	6	13,9	8,36	8
EC704HP-BB2	58,7	33,63	2	33,9	21,15	4	18,5	10,55	7
EC706HP-BB2	87,7	42,41	1	50,7	26,67	3	27,7	16,77	5
EC708HP-BB2				67,5	42,41	1	36,8	21,15	4



Not available or uncommon use

The current quoted in the table is more loaded phase to sizing effect of conductors and protection.

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

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

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

## 2.2. Grounding

The grounding system to which the Comark TV transmitter will be attached must 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 must have a resistance of no more than 5 Ohms.

It is important to establish that all 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 must be stabilized. Use voltage stabilizers or stabilized uninterruptible power systems (UPSs) is necessary since these devices can protect the TV transmitter from power surges. The voltage stabilizer or UPS design must be of exclusive use to the Comark transmitter and shall be 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 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 transmitter. This potential difference should be at most 3V.

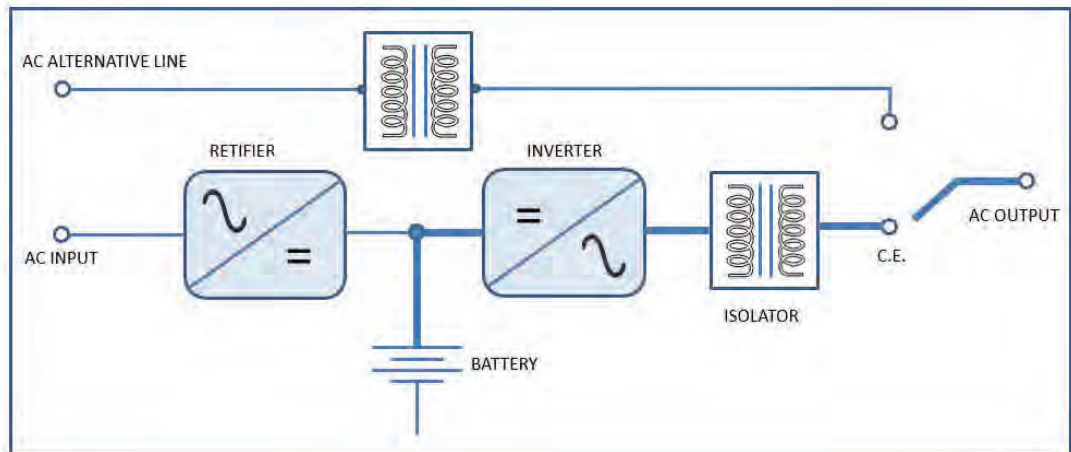
## 2.4. Insulation

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

The double conversion occurs because the AC network convert to DC and the DC voltage convert 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 as already explained.

The correction of the power factor (PFC) in the no break is necessary to reduce the energy costs, because it reduces the reactive power (VAr), reducing 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, because all the advantages achieved by the transmitter is lost in the UPS, resulting in no energy savings. When this type of connection is made you have an excellent load (resistive behavior) for the no-break but your power grid will see the entrance of the no break (without PFC, high consumption).

When we have a power factor correction (PFC) UPS, it will present an excellent behavior (low reactive power, low power consumption) to the network even if it is connected to a PFC-free transmitter, that is, it will correct the power factor of the entire system.

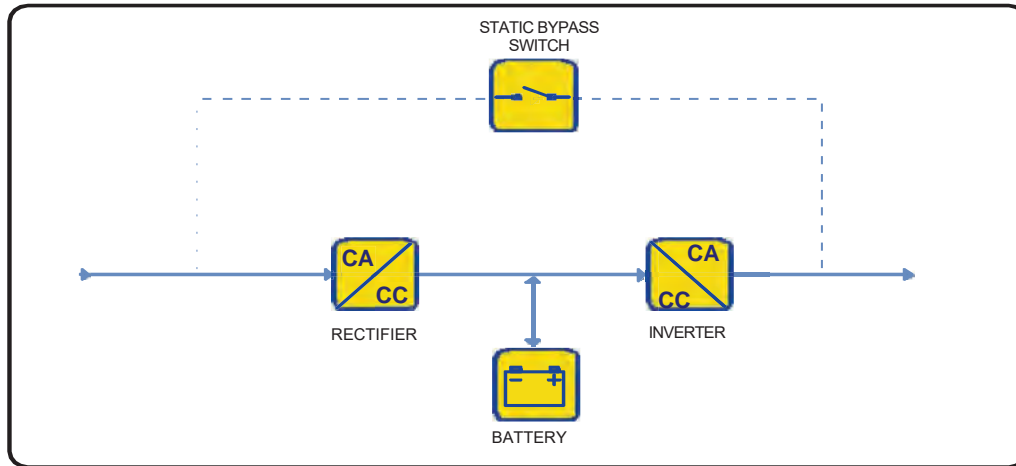
**Nobreak compatibility**

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

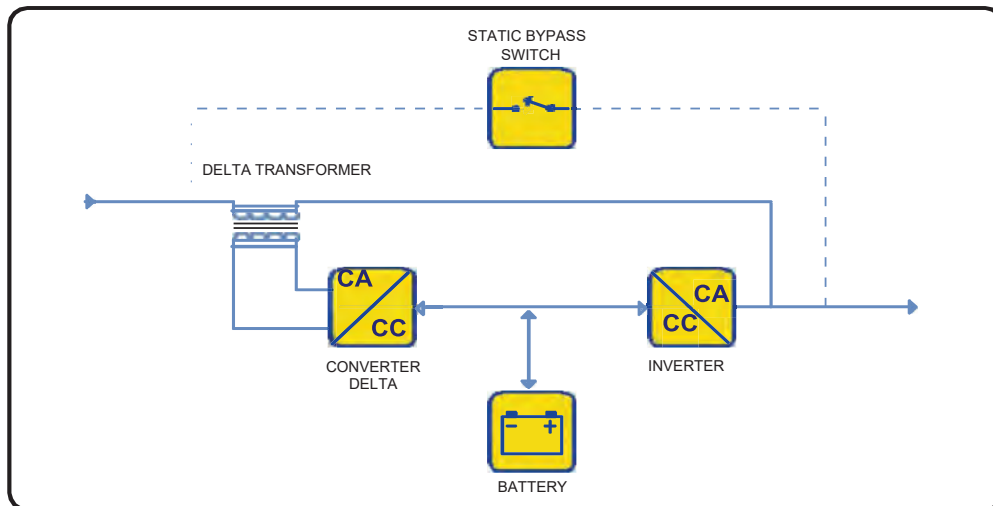
$P_{TX}$ : Real Power [ W ]

$\cos \Phi$ : 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's 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%

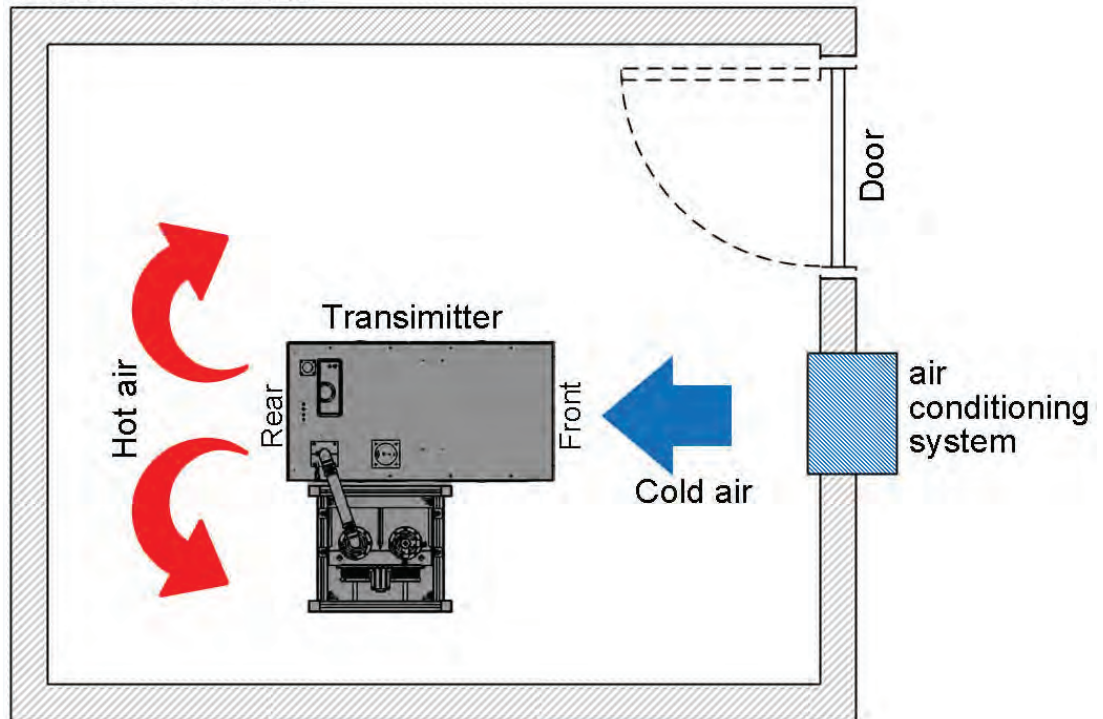
There must never be condensation since water can damage the internal circuits of the transmitter.

### 2.6.3 Cooling

Cooling must be always in circulating, 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:

Shelter – Floor Plan



# Section 3 – E-Compact High-Power Series

## UHF Digital TV Transmitters

### 1. Overview

---

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

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

The E-Compact High-Power Family of solid-state DTV transmitters includes four models that provide transmitter power outputs (TPO) from 950 to 3800 watts ATSC 3.0. Each power amplifier module has an excellent power density, with 3RU and 19", and features 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 in parallel depends on the output power level required. The transmitters are compliant with all FCC and ATSC requirements.

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

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

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:

- ⇒ 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	0°C (32°F) to 45°C (113°F)
Environment humidity range	0 to 95% (non-condensing)

**Outputs**

Operation frequency	470MHz to 608MHz (UHF)
Bandwidth	6 MHz
RF Output Regulation	$\leq \pm 0.1$ dB
Impedance	50 $\Omega$
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:**
**Technical Table – Equipment with 6-poles mask filter**

Model:	EC701HP-BB2		EC702HP-BB2		EC703HP-BB2		EC704HP-BB2		EC706HP-BB2		EC708HP-BB2	
	B.F. <sup>8</sup>	A.F. <sup>8</sup>	B.F. <sup>8</sup>	A.F. <sup>8</sup>	B.F. <sup>8</sup>	A.F. <sup>8</sup>	B.F. <sup>8</sup>	A.F. <sup>8</sup>	B.F. <sup>8</sup>	A.F. <sup>8</sup>	B.F. <sup>8</sup>	A.F. <sup>8</sup>
Output power (W) <sup>3</sup>												
ATSC 3.0	1100	930	2200	1860	3300	2850	4400	3800	6500	5700	8800	7600
ATSC 1.0	1300	1100	2600	2200	3800	3300	5000	4400	7500	6600	10000	8800
50Ω Output connector	EIA 1-5/8"						EIA 3-1/8"					
Power modules	1 module		2 modules		3 modules		4 modules		6 modules		8 modules	
AC mains	Single Phase 240Vac		Single Phase 240Vac / Wye Three-Phase 208Vac		Single Phase 240Vac / Wye Three-Phase 208Vac / Delta Three-Phase 240Vac		Single Phase 208Vac Wild Leg <sup>9</sup> / Wye Three-Phase 380Vac <sup>9</sup>					
AC typical consumption (kW) <sup>3</sup>												
ATSC 3.0	2.90		5.70		8.50		11.30		16.90		22.50	
ATSC 1.0	3.15		6.15		9.17		12.20		18.25		24.30	
Typical heat dissipation (BTU/h) <sup>3</sup>												
ATSC 3.0	6620		12820		19220		25510		37690		50140	

<sup>1</sup>A.F.: After Filter

<sup>2</sup>B.F.: Before Filter

<sup>3</sup>May change depending on MER value, channel and output power.



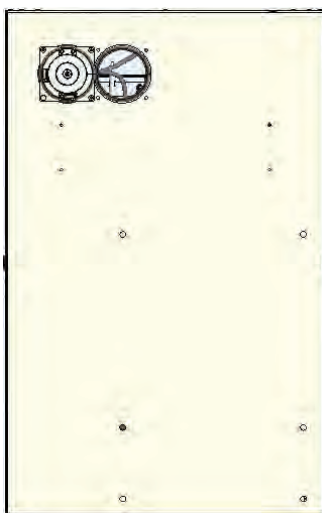
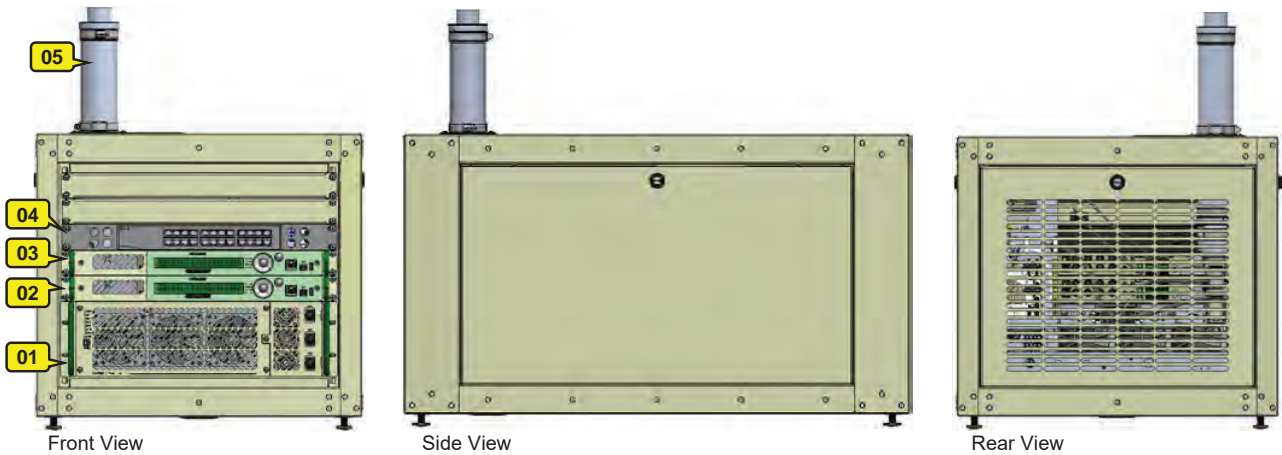
### 3. Construction

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

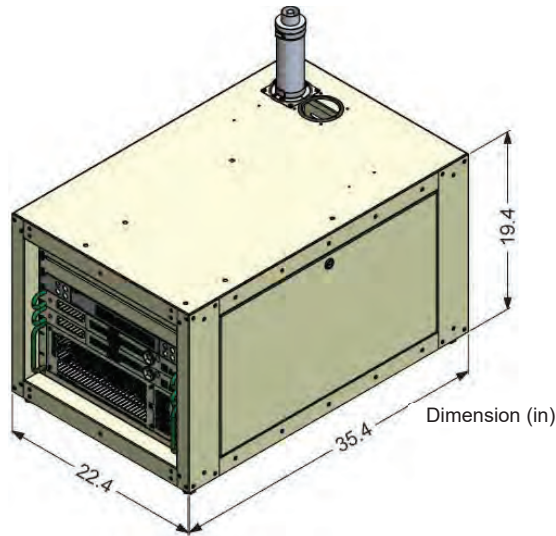
#### 3.1. EC701HP-BB2

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 (8RU) is supplied.



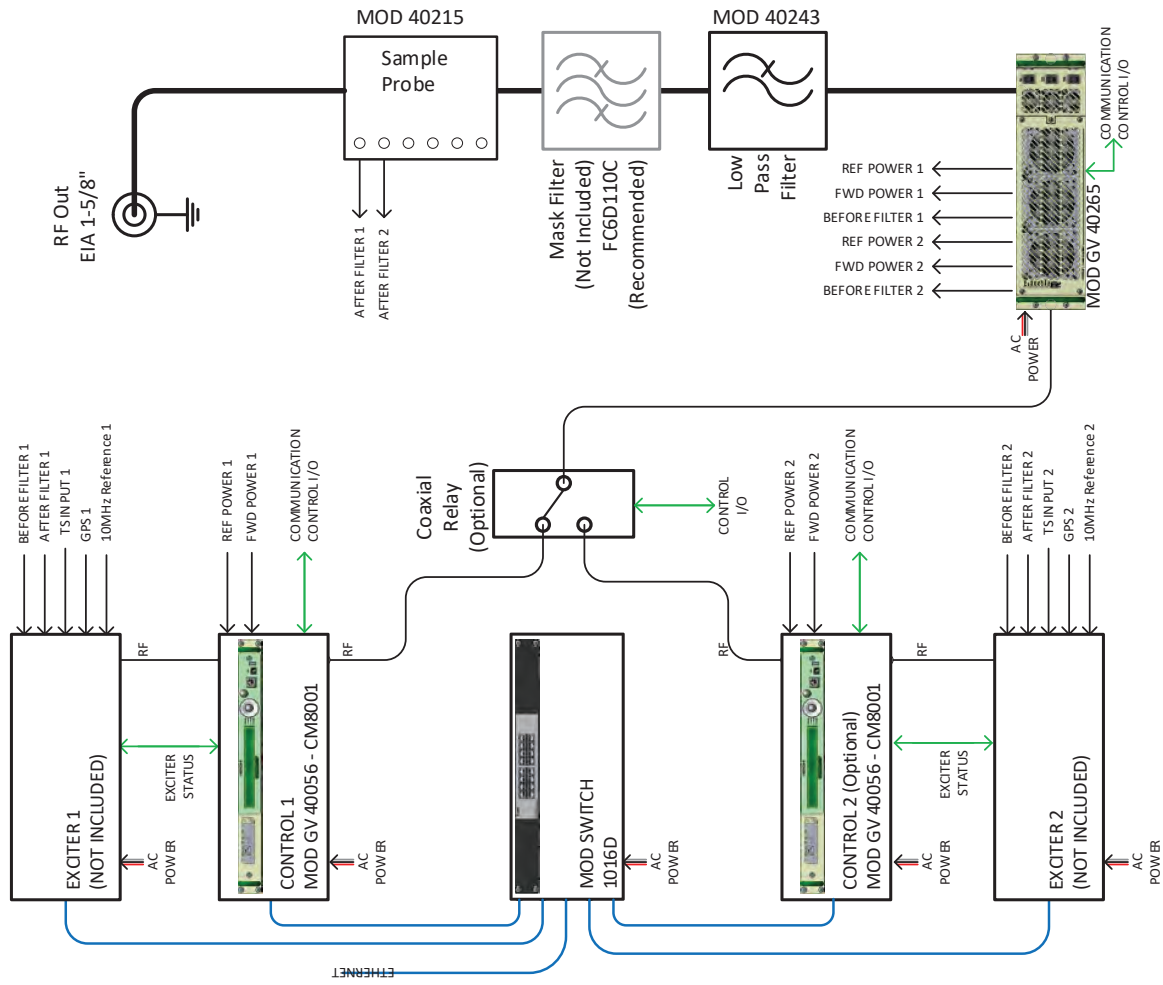
Top View



Dimension (in)

01	Power Module MOD GV 40265
02	Backup Control Module MOD GV 40056 (optional)
03	Main Control Module MOD GV 40056
04	Switch Module
05	Low Pass Filter

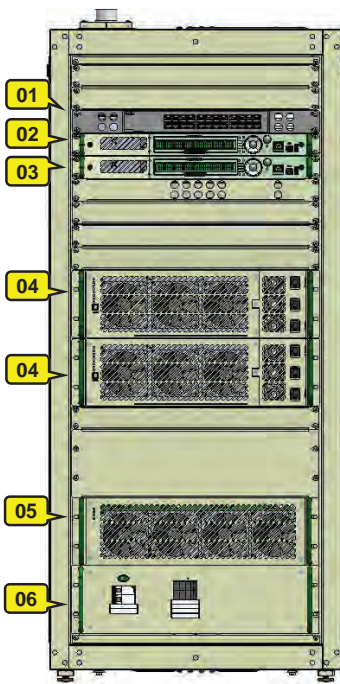
### EC701HP-BB2 - Block Diagram



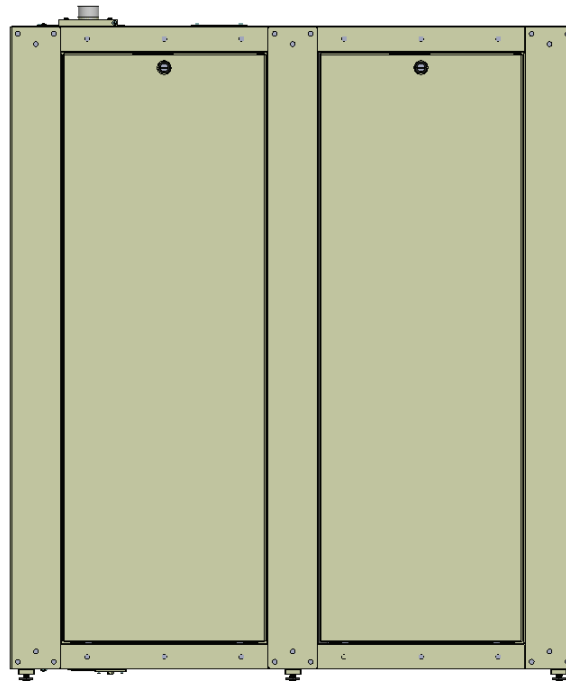
### 3.2. EC702HP-BB2

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

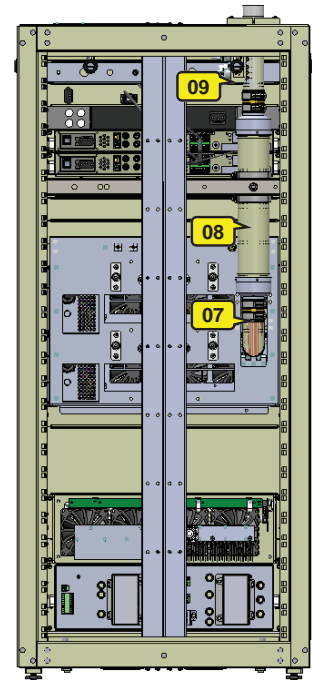
The transmitter controller is contained in a 1RU chassis and two amplifiers are contained in two separate 3RU chassis. The digital exciter is 1RU for a total of 8RU or 14" of vertical panel space. Additional rack units are used by the RF load (3RU) and AC power distribution (3RU). An equipment 25RU rack cabinet is supplied.



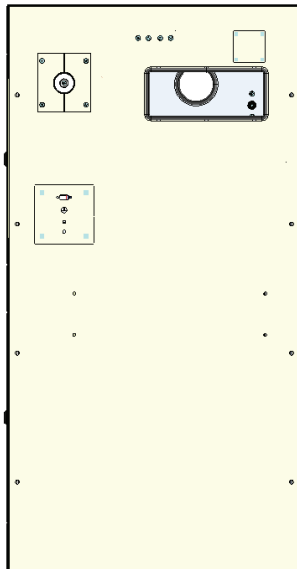
Front View



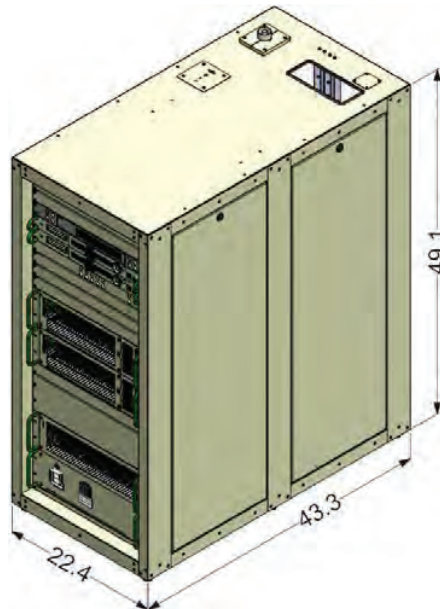
Side View



Rear View (Without door)



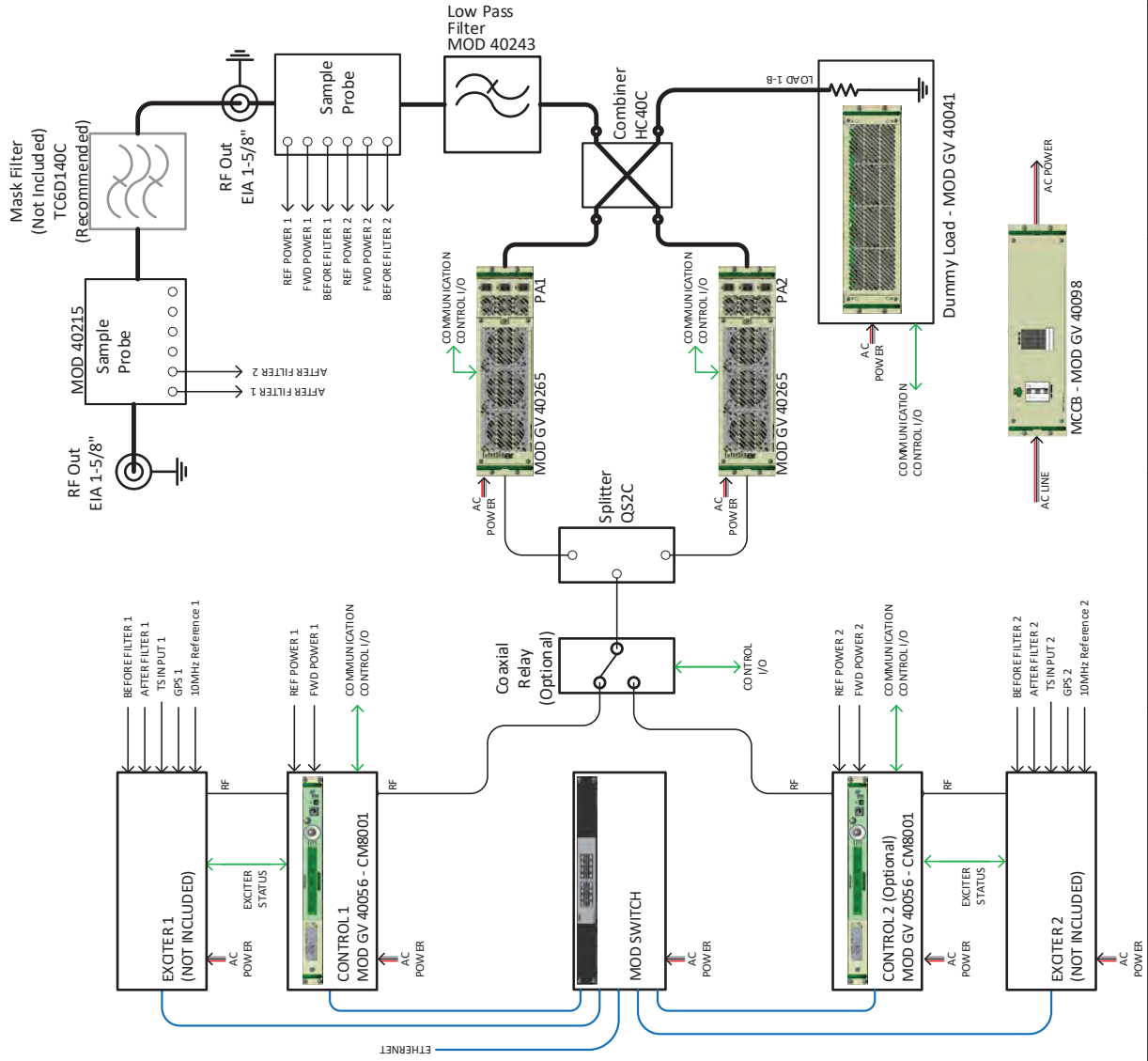
Top View



Dimension (in)

01	Switch Module
02	Main Control Module MOD GV 40056
03	Backup Control Module MOD GV 40056 (optional)
04	Power Module MOD GV 40265
05	Dummy Load Module MOD GV 40041
06	MCCB Module MOD GV 40098
07	Combiner HC40C (2:1)
08	Low Pass Filter
09	Sample probe

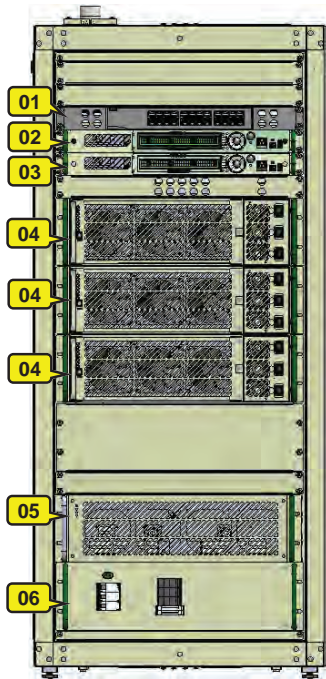
EC702HP-BB2 - Block Diagram



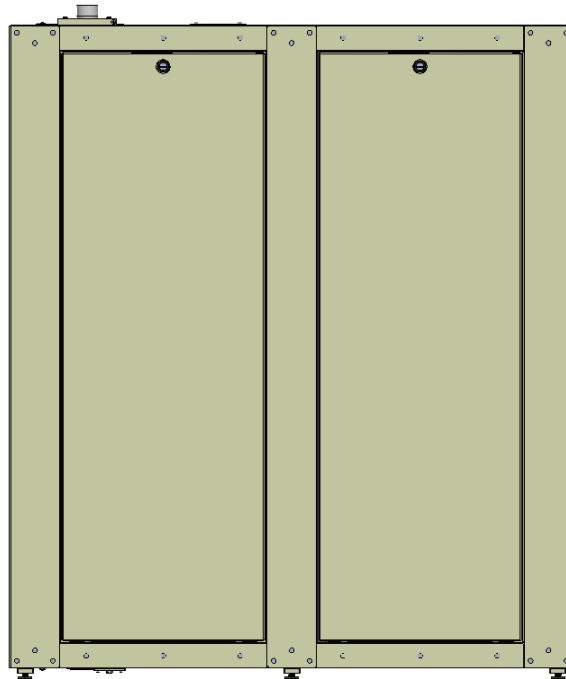
### 3.3. EC703HP-BB2

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

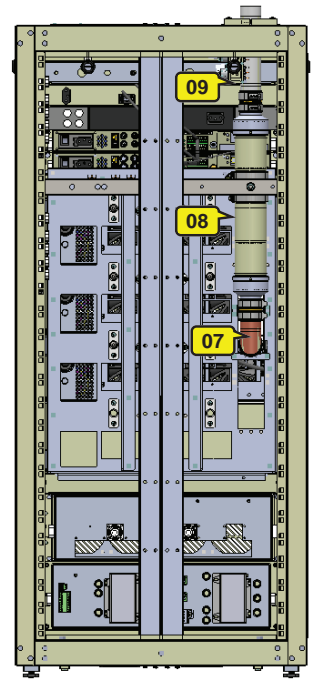
The transmitter controller is contained in a 1RU chassis and three amplifiers are contained in three separate 3RU chassis. The digital exciter is 1RU for a total of 11RU or 19.25" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. An equipment 25RU rack cabinet is supplied.



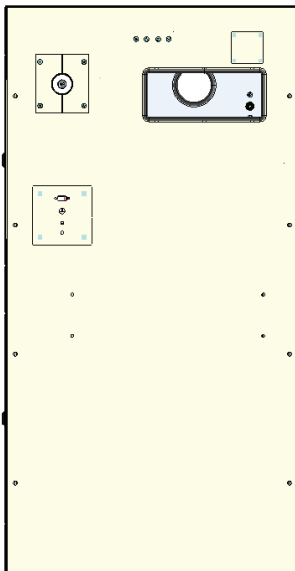
Front View



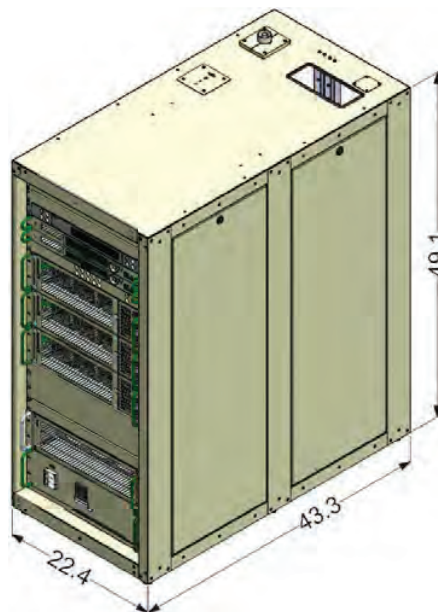
Side View



Rear View (Without door)



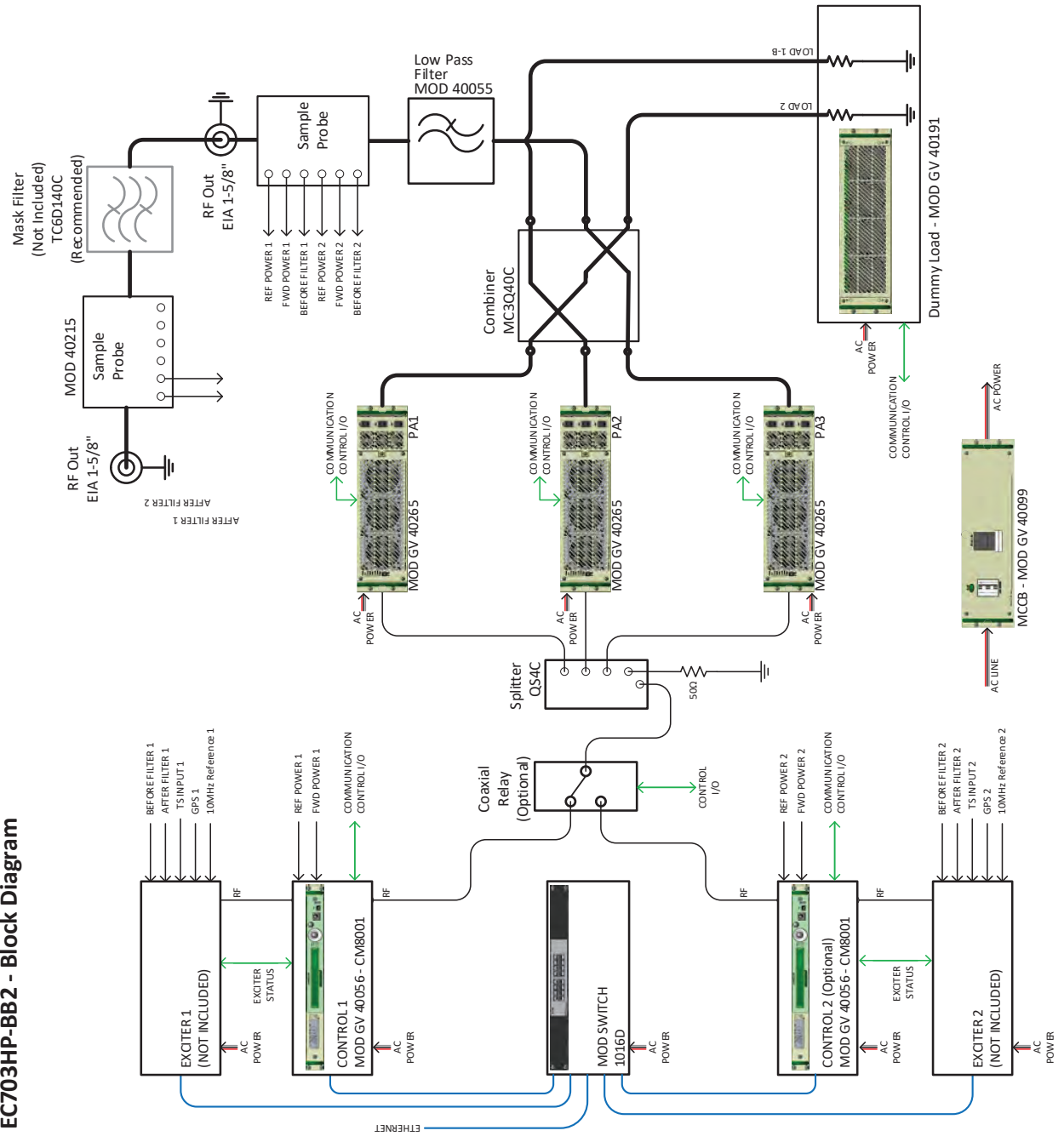
Top View



Dimension (in)

01	Switch Module
02	Main Control Module MOD GV 40056
03	Backup Control Module MOD GV 40056 (optional)
04	Power Module MOD GV 40265
05	Dummy Load Module MOD GV 40191
06	MCCB Module MOD GV 40099
07	Combiner MC3Q40C (3:1)
08	Low Pass Filter
09	Sample probe

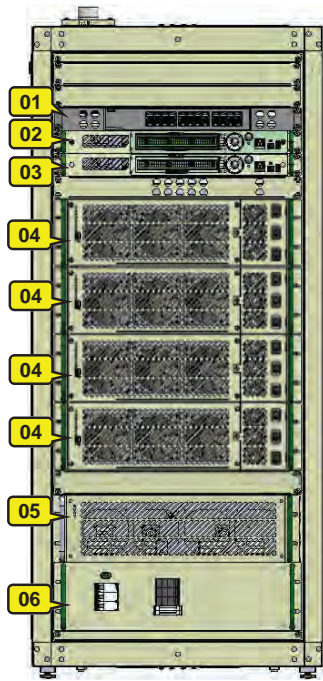
EC703HP-BB2 - Block Diagram



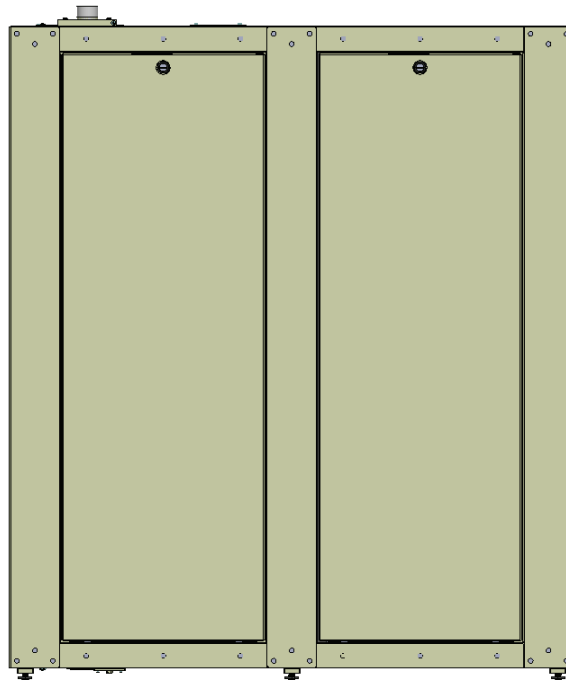
### 3.4. EC704HP-BB2

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

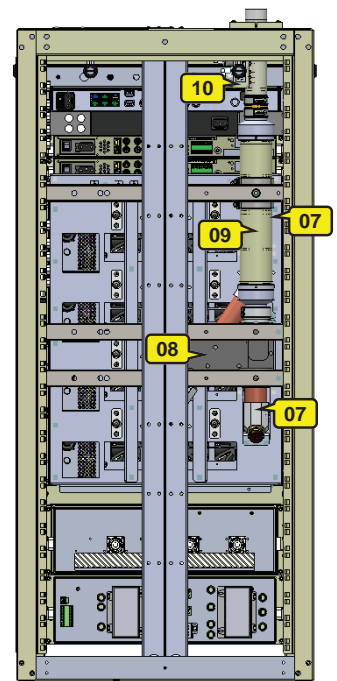
The transmitter controller is contained in a 1RU chassis and four amplifiers are contained in four separate 3RU chassis. The digital exciter is 1RU for a total of 14RU or 24.5" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. An equipment 25RU rack cabinet is supplied.



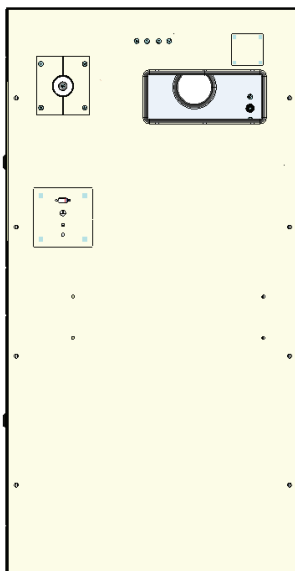
Front View



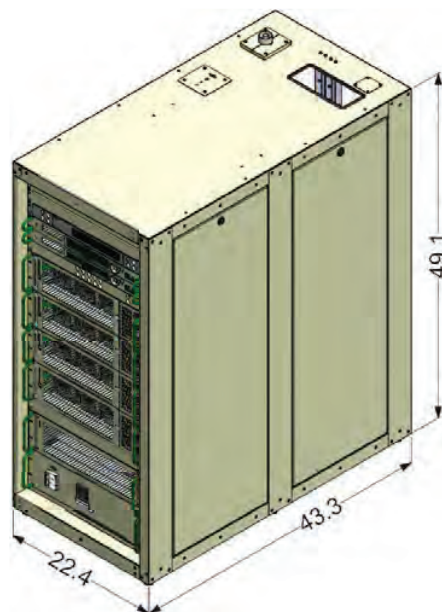
Side View



Rear View (Without door)



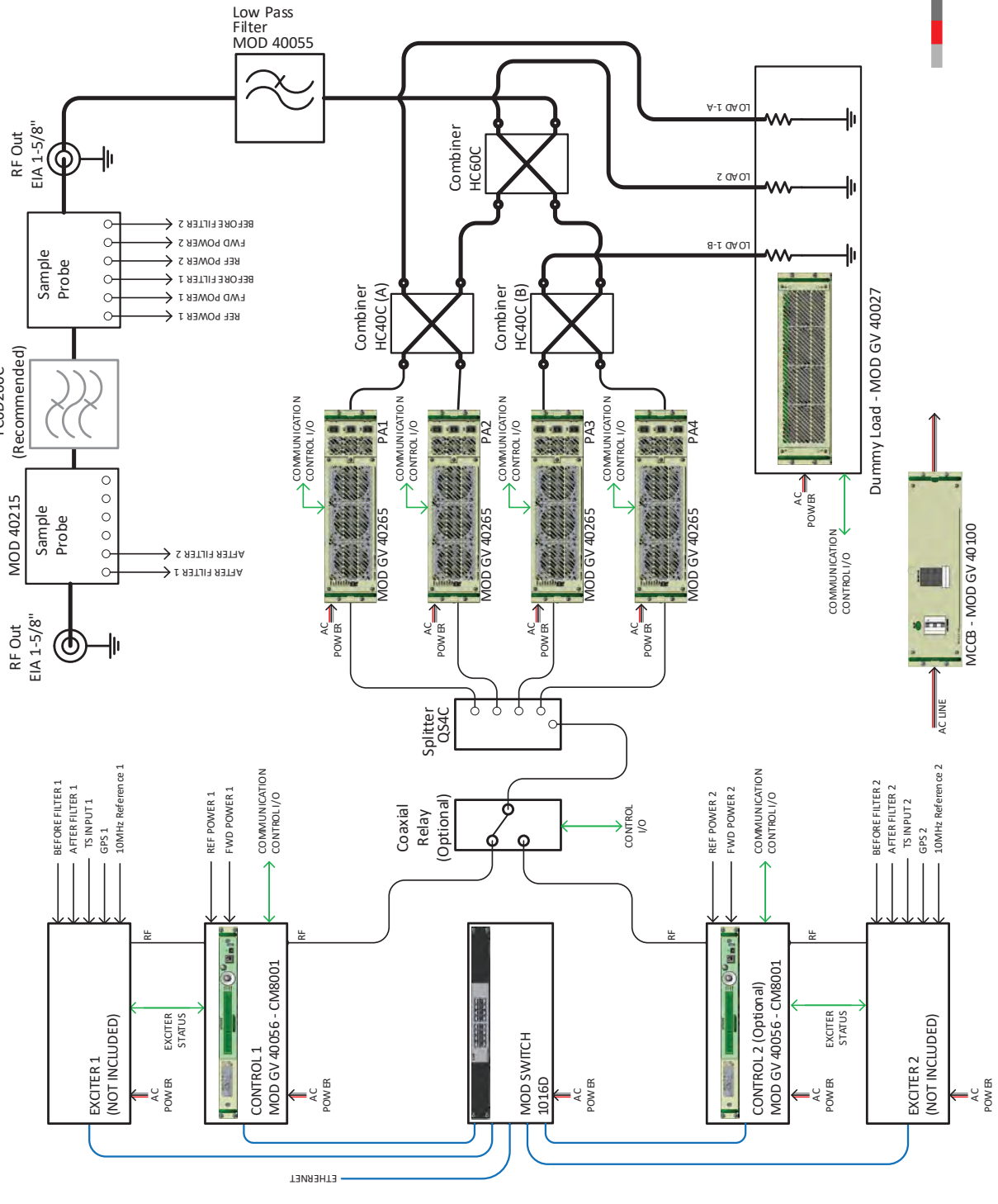
Top View



Dimension (in)

01	Switch Module
02	Main Control Module MOD GV 40056
03	Backup Control Module MOD GV 40056 (optional)
04	Power Module MOD GV 40265
05	Dummy Load Module MOD GV 40027
06	MCCB Module MOD GV 40100
07	Combiner HC40C (2:1)
08	Combiner HC60C (2:1)
09	Low Pass Filter
10	Sample probe

**EC704HP-BB2 - Block Diagram**

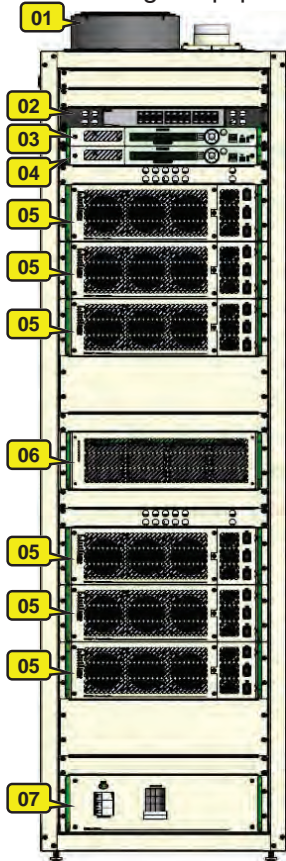




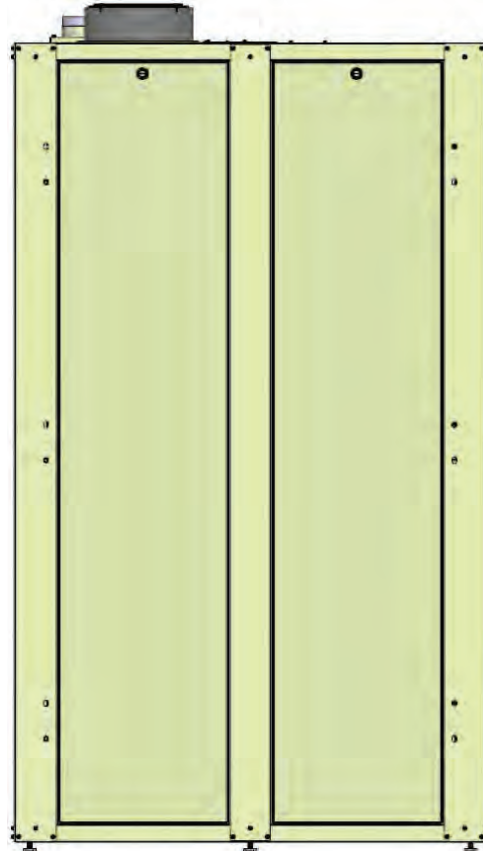
### 3.5. EC706HP-BB2

6500 Watts (Before Filter) UHF ATSC 3.0 output  
 7500 Watts (Before Filter) UHF ATSC 1.0 output.

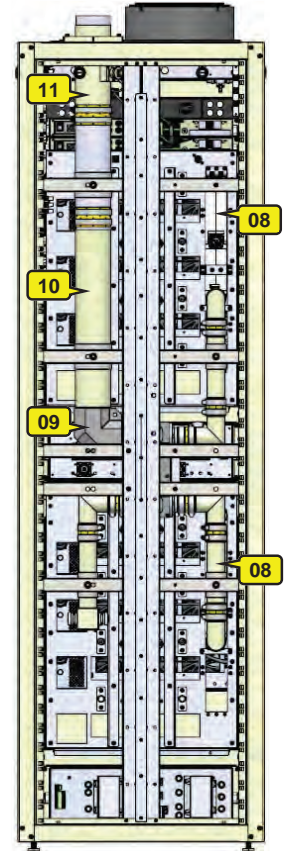
The transmitter controller is contained in a 1RU chassis and six amplifiers are contained in six separate 3RU chassis. The digital exciter is 1RU for a total of 20RU or 35" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. This transmitter uses a single equipment rack cabinet with 40RU.



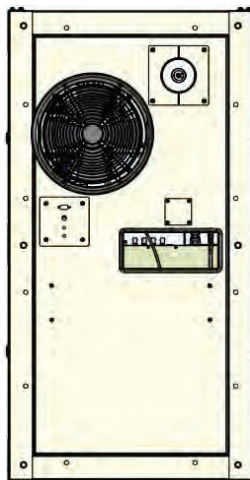
Front View



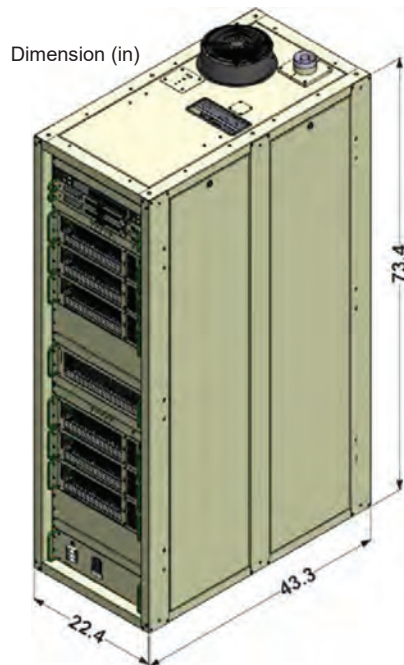
Side View



Rear View (Without door)



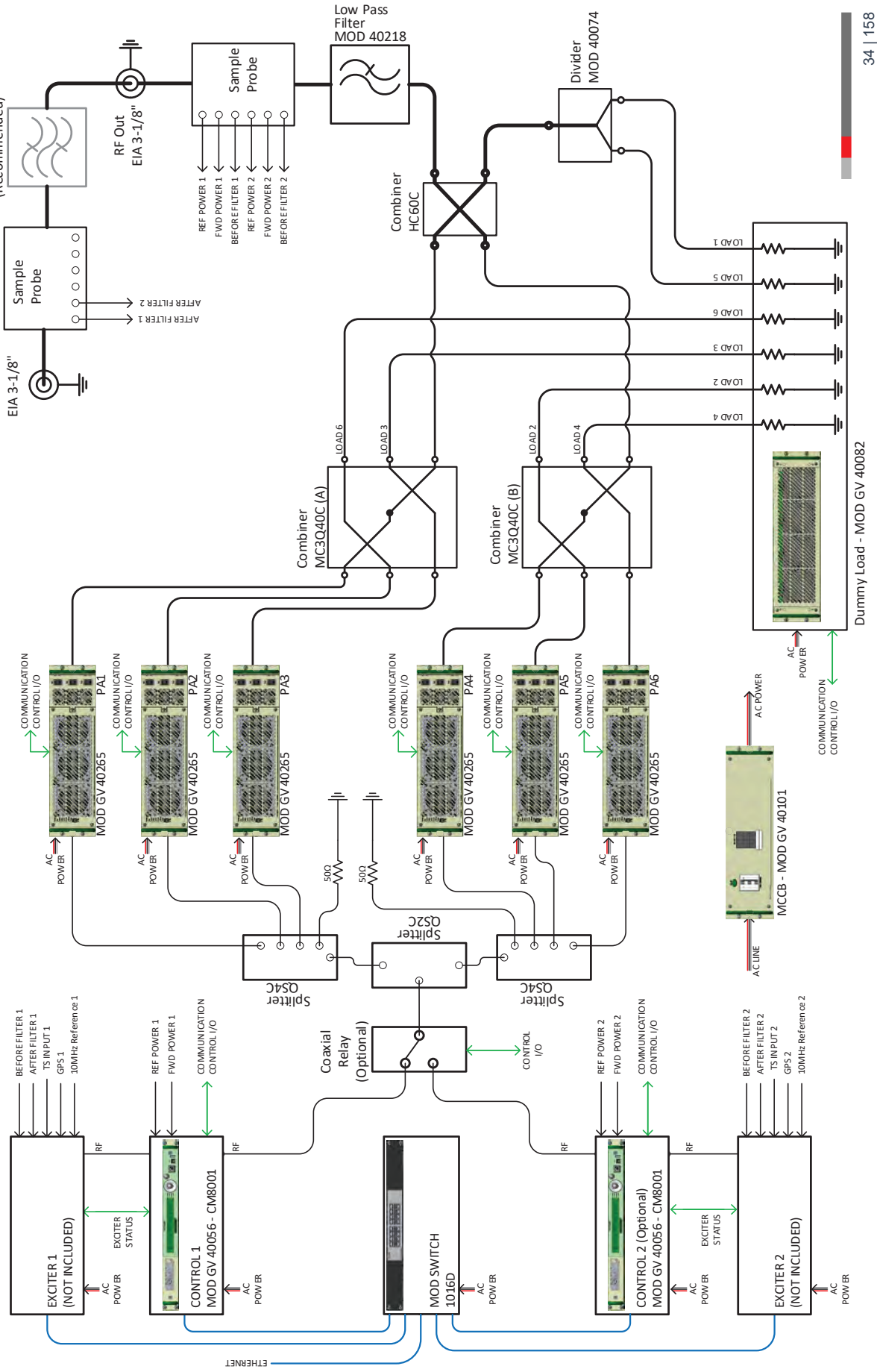
Top View



Dimension (in)

01	Fan
02	Switch Module
03	Main Control Module MOD GV 40056
04	Backup Control Module MOD GV 40056 (optional)
05	Power Module MOD GV 40265
06	Dummy Load Module MOD GV 40082
07	MCCB Module MOD GV 40101
08	Combiner MC3Q40C (3:1)
09	Combiner HC60C (2:1)
10	Low Pass Filter
11	Sample probe

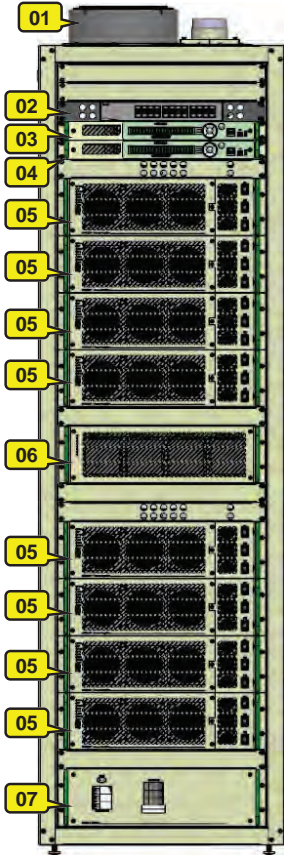
**EC706HP-BB2 - Block Diagram**



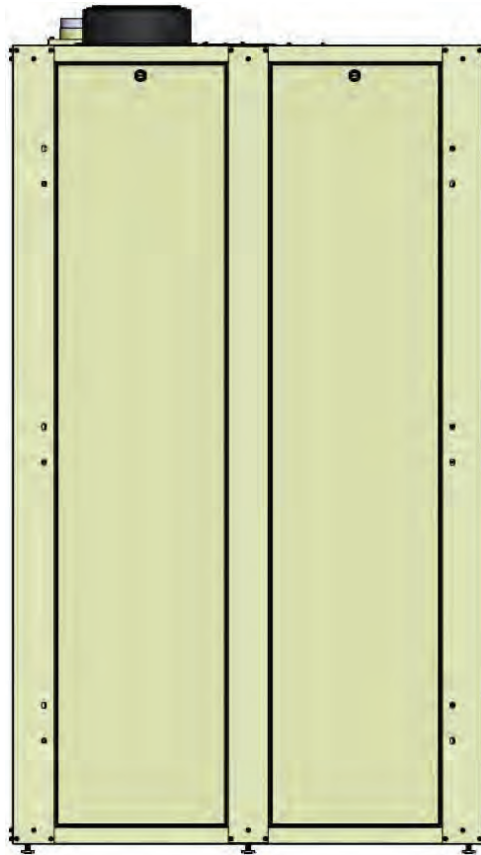
### 3.6. EC708HP-BB2

8800 Watts (Before Filter) UHF ATSC 3.0 output  
 10000 Watts (Before Filter) UHF ATSC 1.0 output

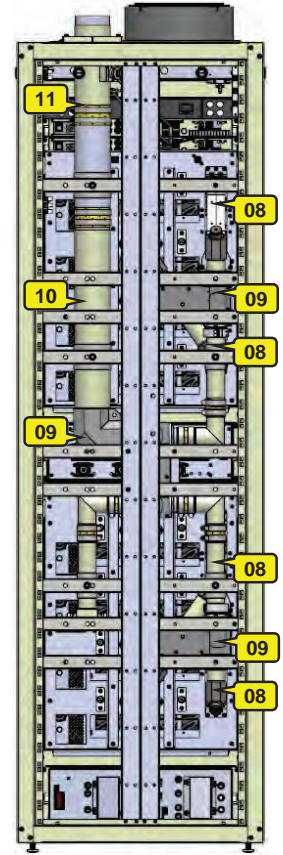
The transmitter controller is contained in a 1RU chassis and eight amplifiers are contained in eight separate 3RU chassis. The digital exciter is 1RU for a total of 26RU or 45.5" of vertical panel space. Additional rack units are used by the RF load and AC power distribution. This transmitter uses a single equipment rack cabinet with 40RU.



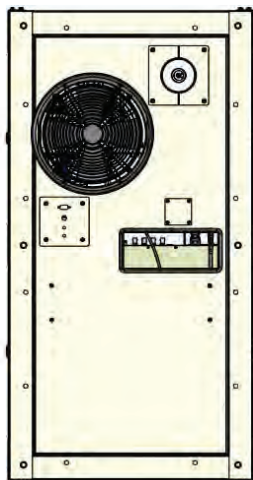
Front View



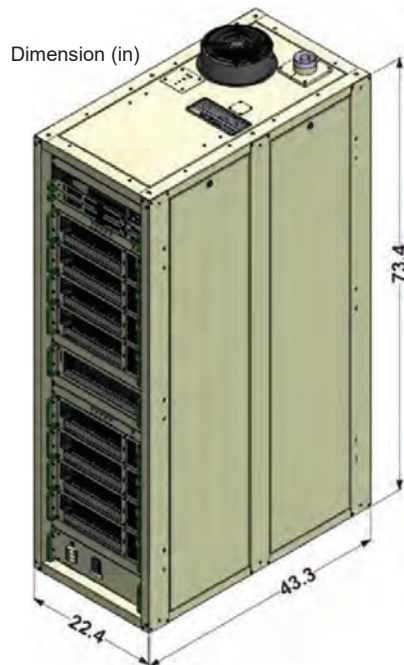
Side View



Rear View (without door)



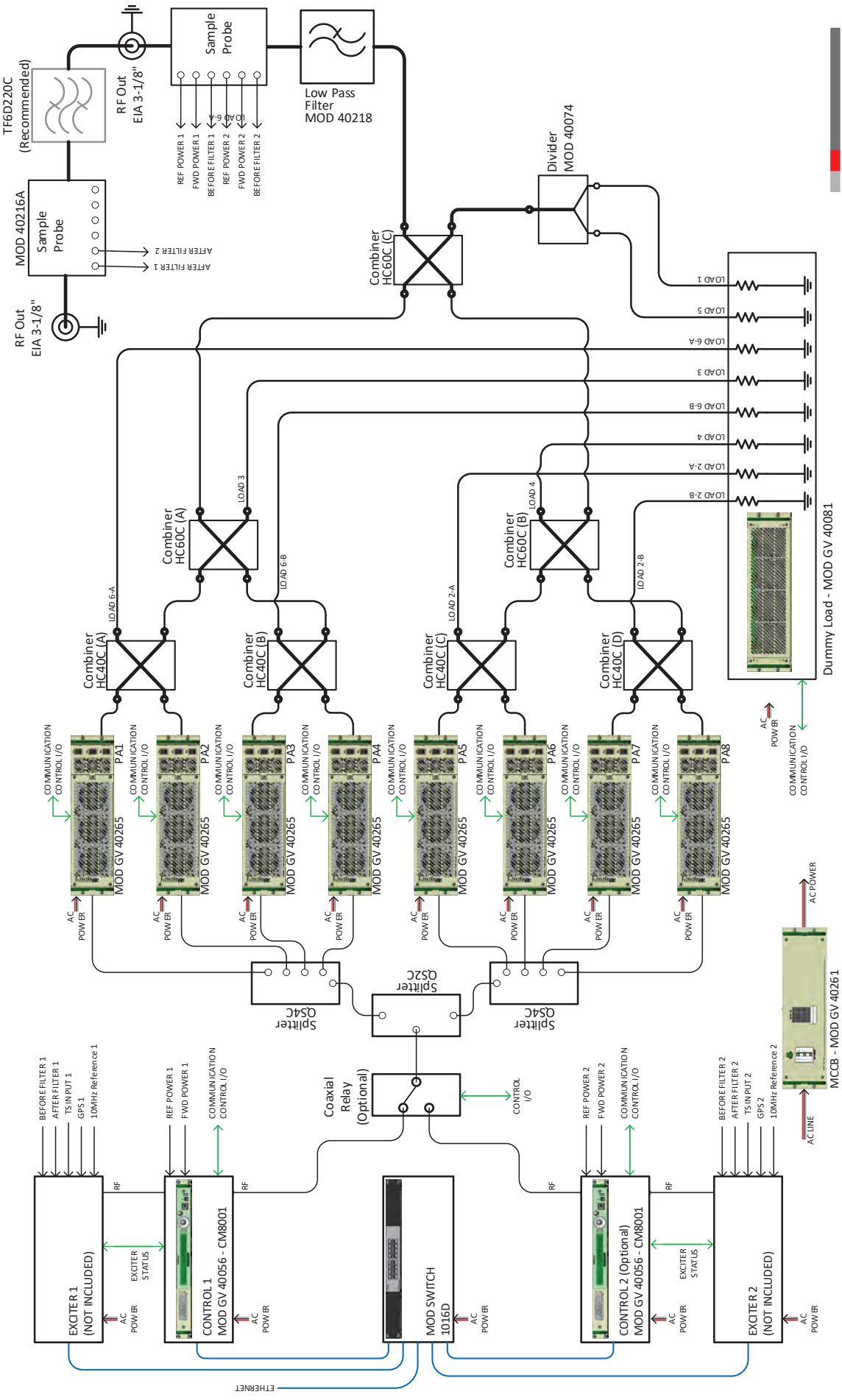
Top View



Dimension (in)

01	Fan
02	Switch Module
03	Main Control Module MOD GV 40056
04	Backup Control Module MOD GV 40056 (optional)
05	Power Module MOD GV 40265
06	Dummy Load Module MOD GV 40081
07	MCCB Module MOD GV 40261
08	Combiner HC40C (2:1)
09	Combiner HC60C (2:1)
10	Low Pass Filter
11	Sample probe





EC708HP-BB2 - Block Diagram



## 4. Main Modules

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

Drawers:

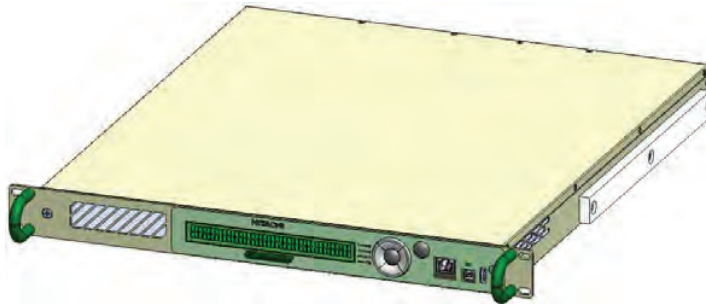
	Control Module  CM8001	Power Amplifier Module 	Dummy Load Module 	MCCB Module 
<b>EC701HP-BB2</b>	MOD GV 40056	MOD GV 40265	N/A	N/A
<b>EC702HP-BB2</b>	MOD GV 40056	MOD GV 40265 (x2)	MOD GV 40041	MOD GV 40098
<b>EC703HP-BB2</b>	MOD GV 40056	MOD GV 40265 (x3)	MOD GV 40191	MOD GV 40099
<b>EC704HP-BB2</b>	MOD GV 40056	MOD GV 40265 (x4)	MOD GV 40027	MOD GV 40100
<b>EC706HP-BB2</b>	MOD GV 40056	MOD GV 40265 (x6)	MOD GV 40082	MOD GV 40101
<b>EC708HP-BB2</b>	MOD GV 40056	MOD GV 40265 (x8)	MOD GV 40081	MOD GV 40261

Passives Devices:

	RF Splitters	Combiners	RF Low Pass Filter	RF Out (50 Ω)	RF Output Sample	Mask Filter (Recommended)
<b>EC701HP-BB2</b>	N/A	N/A	MOD 40243	EIA 1-5/8"	MOD 40215	FC6D110C
<b>EC702HP-BB2</b>	QS2C	HC40C	MOD 40243	EIA 1-5/8"	MOD 40215	TC6D140C
<b>EC703HP-BB2</b>	QS4C	MC3Q40C	MOD 40055	EIA 1-5/8"	MOD 40215	TC6D140C
<b>EC704HP-BB2</b>	QS4C	HC40C (2x) HC60C	MOD 40055	EIA 1-5/8"	MOD 40215	TC6D200C
<b>EC706HP-BB2</b>	QS4C (2X) QS2C	MC3Q40C (2x) HC60C	MOD 40218	EIA 3-1/8"	MOD 40216A	TF6D220C
<b>EC708HP-BB2</b>	QS4C (2X) QS2C	HC40C (4x) HC60C (3x)	MOD 40218	EIA 3-1/8"	MOD 40216A	TF6D220C

N/A: NOT APPLY

## 4.1. Control Module CM8001 (MOD GV 40056)



The E-Compact series of transmitters utilize a dedicated 1RU controller chassis, CM8001. 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

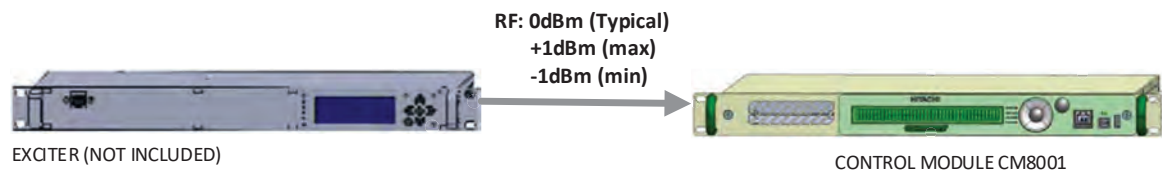
The CM8001 controller gathers the status monitoring of all the transmitter subassemblies to provide to the operator transmitter status information, either locally or remotely. The controller provides transmitter telemetry including RF power monitoring. A user-friendly interface on the transmitter controller 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, and OK buttons).
- LED status indicators

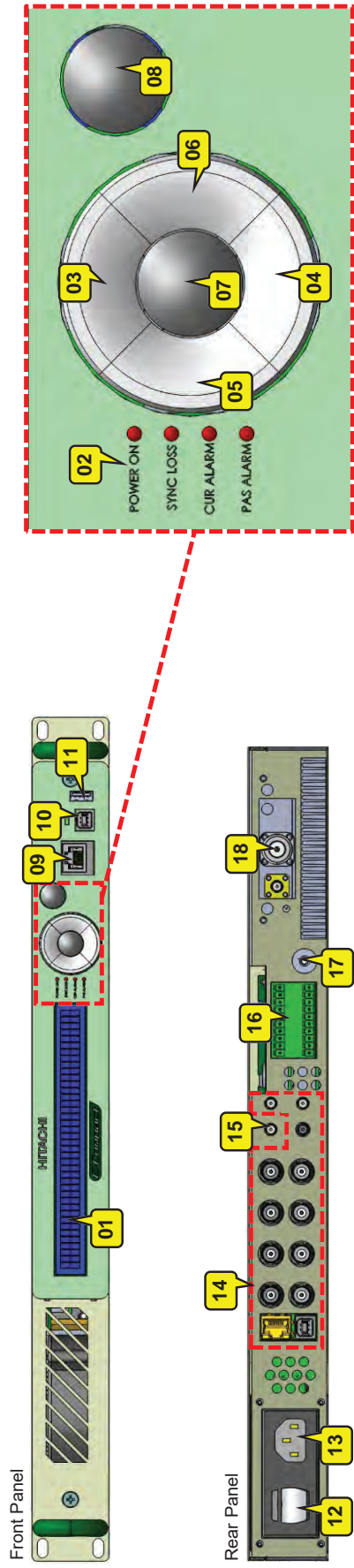
The CM8001 transmitter controller is paired with the TV exciter. For transmitter systems configured optionally with dual drive, the transmitter is equipped two / redundant controllers, one for each exciter eliminating single point failures for even higher system reliability.

### 4.1.1. RF Input

The CM8001 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 CM8001 is set at the factory to receive an RF signal level of **0dBm, with minimum / maximum tolerances of -1dBm / + 1dBm.**

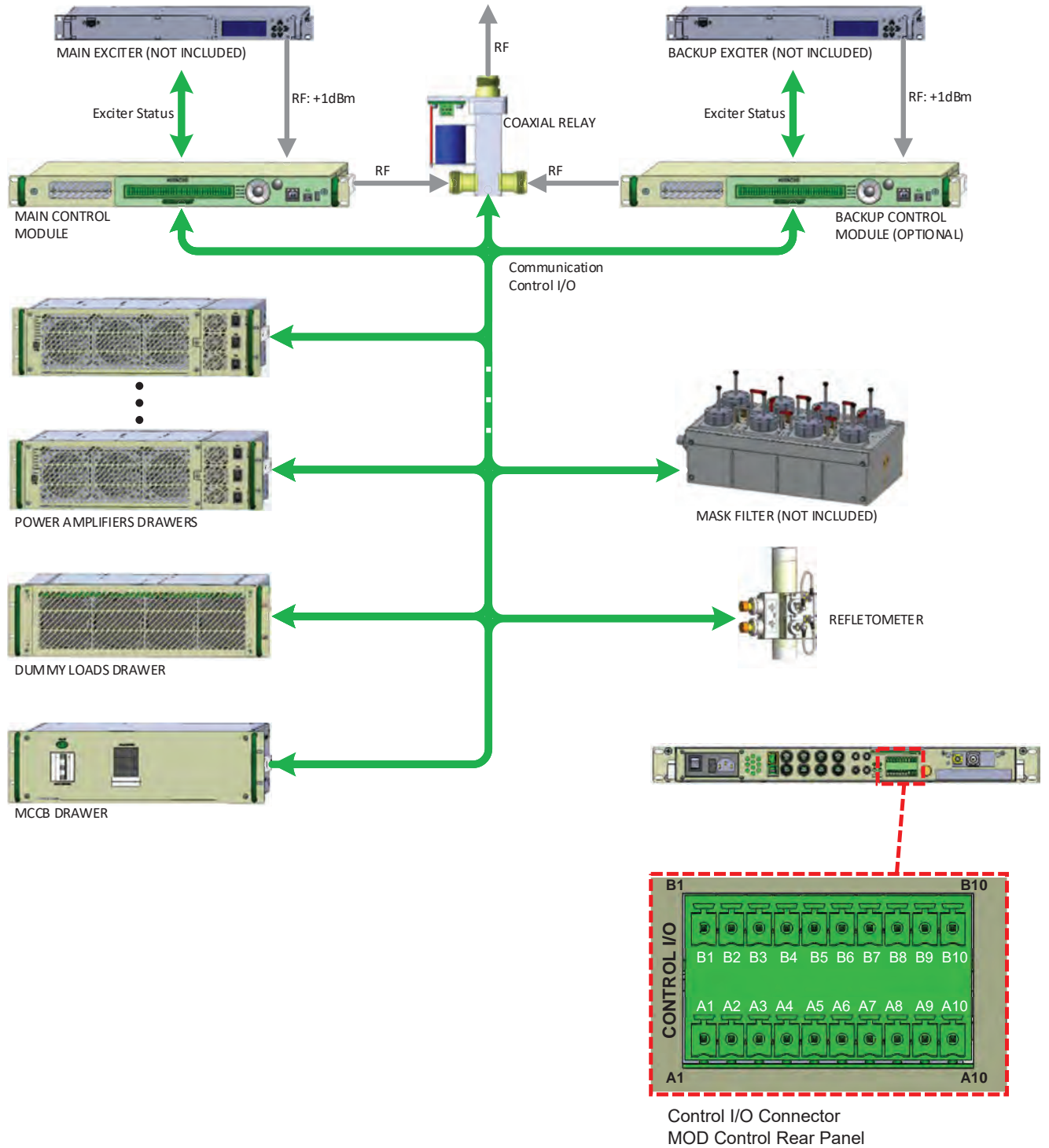


4.1.2. Interfaces



01	LCD Display (2 Lines x 40 Columns)	10	USB Port
02	Signaling LED's	11	USB Port
03	Up Key (▲)	12	Power ON Key
04	Down Key (▼)	13	AC Input
05	Left Key (◀)	14	NOT USED / NOT APPLY
06	Right Key (▶)	15	"Tuner IN" – RF Input From Exciter
07	Enter Key (Enter)	16	Interface Control I/O
08	Esc Key (Esc)	17	Grounding
09	Ethernet Port	18	RF Output

### 4.1.3. Control System Functional Description





A1	+8Vcc from MCCB
A2	+15VCC - MCCB Source Monitor
A3	+50VCC - MCCB Source Monitor
A4	Forward Output Power Measure - Analog signal, from 0 to 4.5v
A5	Remote Control Data In
A6	Reflected Output Power Measure - Analog signal, from 0 to 4.5v
A7	Power Amplifier On/Off (5V means normal operation)
A8	RS-485A Communication
A9	GND
A10	RS-485B Communication
B1	Mask Filter Alarm Temperature (5Vcc)
B2	+8Vcc (Main Control Address) – 0Vcc (Backup Control Address)
B3	Control I/O
B4	AC Phase Alarm - 5V means normal operation
B5	Dummy Load Drawer Fan Alarm - 5V means normal operation
B6	Remote Control Data Out
B7	Exciter Status - Digital signal - 5V means normal operation
B8	Remote Control Clock
B9	Control I/O
B10	Coaxial Relay Control

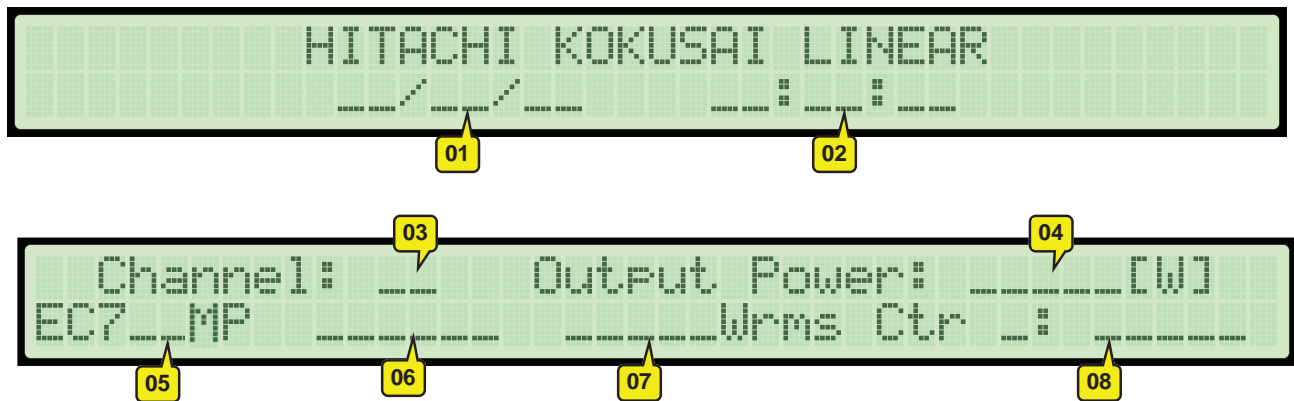
### 4.1.4. Control System Operation

#### 4.1.4.1. Navigation

The Control Module CM8001 has a system of configuration, measurements, alarms and remote management (TELESUPERVISION), that controls all the modules of the transmitter.

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

When the device is turned on, or when it enters in stand-by mode (idle for 5 minutes), the display switches between the following status screens:



01	Current date
02	Current time
03	Operation UHF channel number
04	Real Output Power Value (Watts)
05	Equipment Model:
	EC701HP-BB2      EC702HP-BB2
	EC703HP-BB2      EC704HP-BB2
	EC706HP-BB2      EC708HP-BB2

06	Transmission System:
	ATSC 1.0
	ATSC 3.0
07	Power Equipment Model
08	Double Exciter Status
	CM8001 Main "Ctr A":
	Active / Standby
	CM8001 Backup "Ctr B":
	Active / Standby

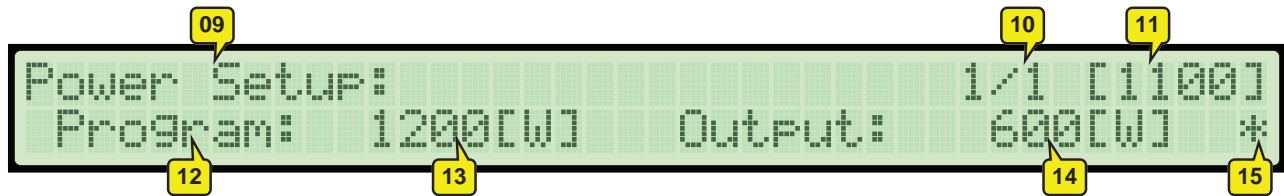
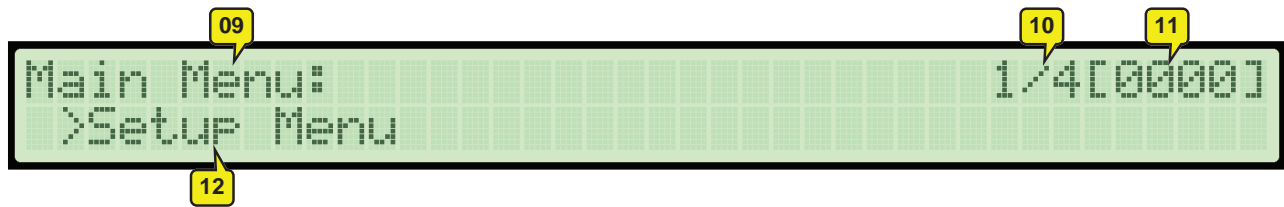
When navigating through the different functions (status and setup), take into consideration the keyboard symbols and the descriptions below (See 5.1.1 Interfaces):

- ▲ Moves the arrow UP to the next function shown on LCD screen
- ▶ Moves the arrow to the next RIGHT position
- ▼ Moves the arrow DOWN to the next function shown on LCD screen.
- ◀ Moves the arrow to the next LEFT position.

ENTER - Confirms the chosen selection.

ESC - Cancel the selection and return to the previous screen.

When browsing the LCD screen, you will have access to status reading or settings changes. In order to orient yourself in this interface, attention should be paid to the menu structure as follows:



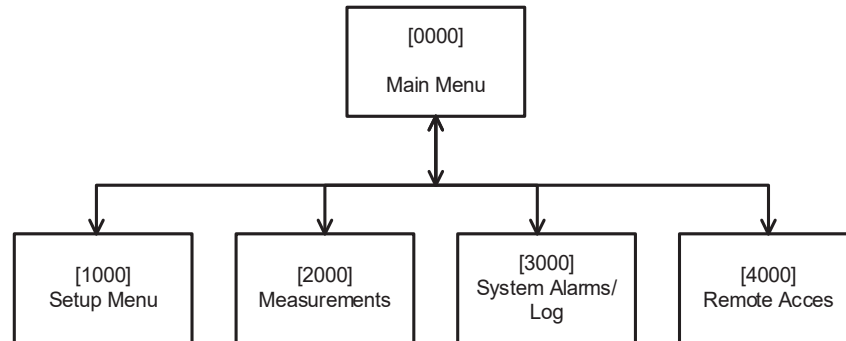
09	Parameter Menu or Parameter in the Screen.
10	Number of Parameter Menu or Parameter in the Screen / Total Number of Parameter or Menu.
11	4 digit numbers represents the screen position on the command menu

12	Current Menu or Current Parameter
13	Changing Parameter Value
14	Current Parameter Value
15	When show “ * “ indicates that the changes is not yet active. For this It' s necessary to press “ENTER” key

For change any parameter, used ◀ for decrease or ▶ to increase.

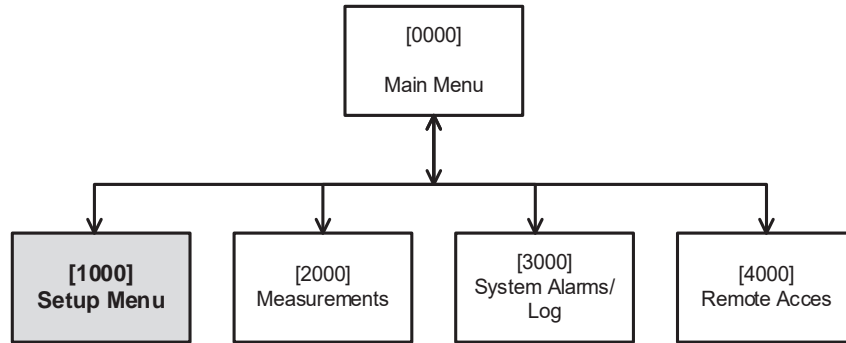
#### 4.1.4.2. System Structure

The system consists of the Root Menu "Main Menu" that gives access to four categories of Menu:



- ⇒ Main Menu ⇒ Setup Menu: Access to configure the equipment parameters
- ⇒ Main Menu ⇒ Measurements: Access to consult the parameters of the equipment
- ⇒ Main Menu ⇒ System Alarms/Log Alarms: Access to query alerts and history of Alarms
- ⇒ Main Menu ⇒ Remote Access: Access to configure the equipment to operate on ethernet network

[1000] - Main Menu ⇌ Setup Menu



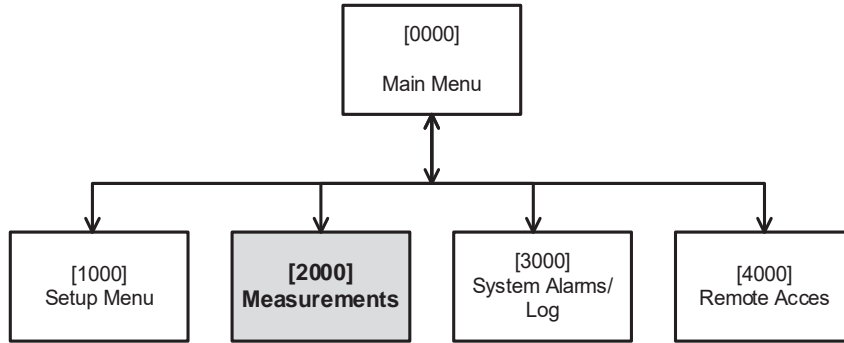
The "Setup Menu" allows access to alter machine's parameter setting functions.



**The Transmitter is delivered to the customer with the parameters that were provided at the time of purchase, so it is not necessary to change the settings of the Equipment.**

#	Parameter	Position	#	Description / Functionality
1/8	Power Setup	1100	1/1	Changes the output power of the Equipment.
2/8	Transmitter Setup	1200	1/2	Automatic Level Control: On / Off
			2/2	Ctrl Mode: Active / Standby
3/8	Time and Date Setup	1300	1/1	Change the date, time and date format (dd/mm/yy or mm/dd/yy)
4/8	Password Setup	1400	1/2	Enable / Choose new password
			2/2	Disable Password
5/8	Alarms Mask	1500	1/1	Reflected Power – Set de Alarm Mask for Reflected Power
6/8	USB Host Access	1600	1/1	System Upgrade – Used to system upgrade via USB card.
7/8	Transistor Bias Adjustment	1700	1/4	LDMOS Drain Voltage - The values are pre-set at the factory.
			2/4	Carrier Amp. Current - The values are pre-set at the factory.
			3/4	Peak Amp. Gate Voltage - The values are pre-set at the factory.
			4/4	Status: show the status exciter: (Active / Standby)
8/8	PA Temperature Control	1800	1/1	Allows to set the operating temperature of the Powers Amplifiers.

**[2000] - Main Menu ⇔ Measurements**

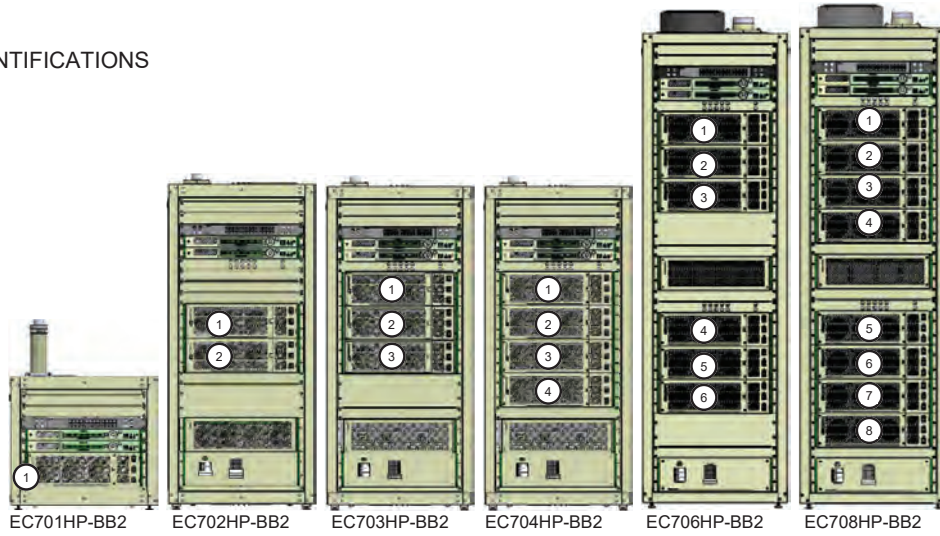


The "Measurements" menu allows access to read the operating parameters of the equipment (read only).

#	Parameter	Position	#	Description / Functionality
1/7	Power	2100	1/3	Programmed: Show the Programmed power measurement.
			2/3	Forward: Show the value of Forward Output Power (Watts). Reflected: Show the value of Reflected Output Power (Watts).
			3/3	ALC Reference Voltage: Show the value (Volts).
2/7	Exciter Status	-	-	Active / Fail
3/7	Drawers	2300	1/3	Drawers Measurements

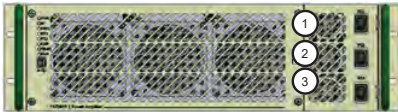
The [2300] Drawers Measurements parameter allows to view the main status of all Power Amplifier Drawers:

DRAWERS IDENTIFICATIONS

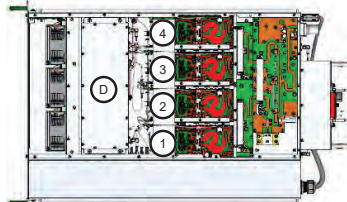


PA IDENTIFICATIONS

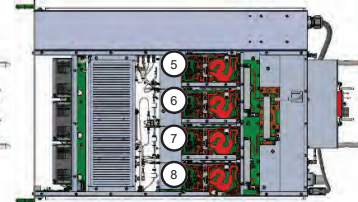
PSU IDENTIFICATIONS



POWER AMPLIFIER DRAWER  
Front View



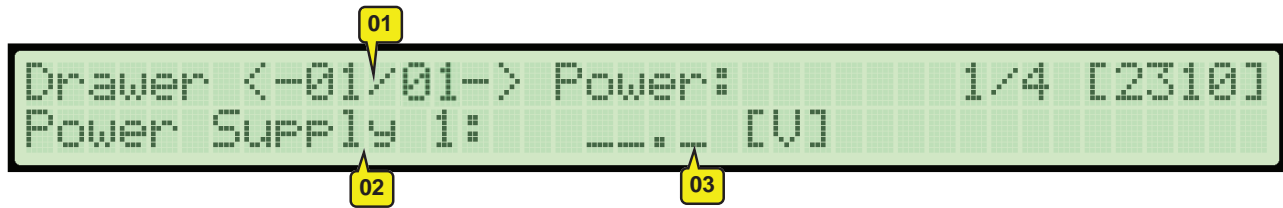
POWER AMPLIFIER DRAWER  
Top View



POWER AMPLIFIER DRAWER  
Bottom View

**1/3 Power Supply:** Voltage measure of all Power Amplifier Drawers Sources

Position	#	Description / Functionality
2310	1/4	Power Supply 1: [V]
	2/4	Power Supply 2: [V]
	3/4	Power Supply 3: [V]
	4/4	Driver Power Supply: [V]

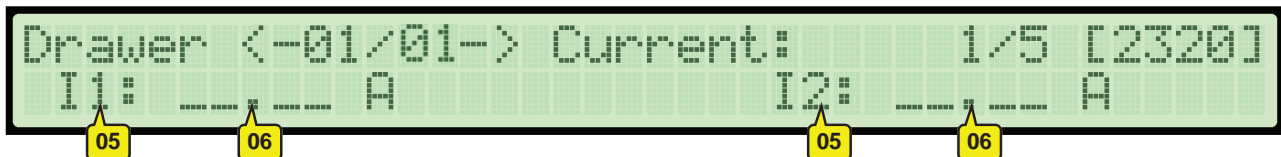


01	(◀ or ▶) Selects the Power Amplifier Drawer: EC701HP-BB: 1 Drawer, EC702HP-BB: 2 Drawers, EC703HP-BB: 3 Drawers, EC704HP-BB: 4 Drawers, EC706HP-BB: 6 Drawers, EC708HP-BB: 8 Drawers
02	(▲ or ▼) Selects the Power source of each Power Amplifier Drawer: Power Supply 1, Power Supply 2, Power Supply 3 and Driver Power Supply
03	Measured value (Volts) in each Power Supply



**2/3 Current:** Current measure (Amper) in all Power Amplifier Drawers Transistors and Drive (Eight Power Transistors and one Drive per Power Amplifier Drawer):

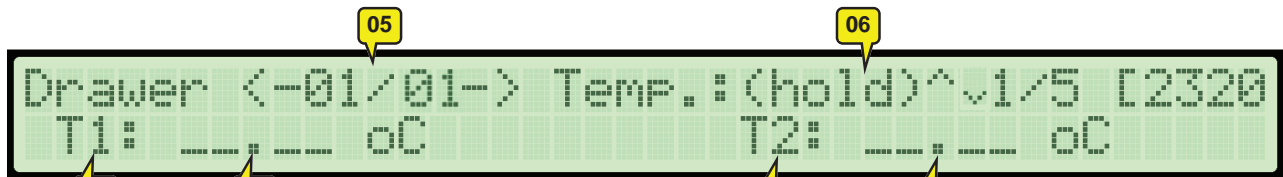
Position	#	Description / Functionality
2320	1/5	I1: [A] I2: [A] - Transistor 1 and Transistor 2 Current
	2/5	I3: [A] I4: [A] - Transistor 3 and Transistor 4 Current
	3/5	I5: [A] I6: [A] - Transistor 5 and Transistor 6 Current
	4/5	I7: [A] I8: [A] - Transistor 7 and Transistor 8 Current
	5/5	ID: [A] - Driver Current



04	(◀ or ▶) Selects the Power Amplifier Drawer: EC701HP-BB: 1 Drawer, EC702HP-BB: 2 Drawers, EC703HP-BB: 3 Drawers, EC704HP-BB: 4 Drawers, EC706HP-BB: 6 Drawers, EC708HP-BB: 8 Drawers.
05	(▲ or ▼) Selects the Power Transistors or Driver of each Power Amplifier Drawer
06	Measured value (Amper) in each Power Transistor

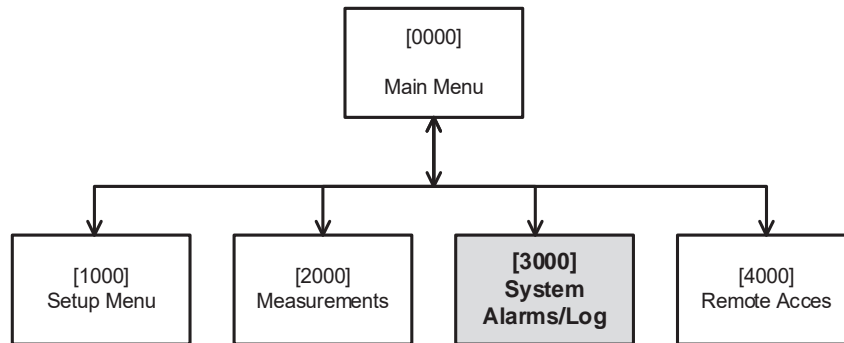
**3/3 Temperature:** Temperature measure (°C or °F) in all Power Amplifier Drawers Transistors and Drive (Eight Power Transistors and one Drive per Power Amplifier Drawer):

Position	#	Description / Functionality
2330	1/5	T1: [°C or °F] T2: [°C or °F] - Transistor 1 / Transistor 2
	2/5	T3: [°C or °F] T4: [°C or °F] - Transistor 3 / Transistor 4
	3/5	T5: [°C or °F] T6: [°C or °F] - Transistor 5 / Transistor 6
	4/5	T7: [°C or °F] T8: [°C or °F] - Transistor 7 / Transistor 8
	5/5	TD: [°C or °F] TAir: [°C or °F] - Drive Temperature / air Temperature



05	(◀ or ▶) Selects the Power Amplifier Drawer: EC701HP-BB: 1 Drawer, EC702HP-BB: 2 Drawers, EC703HP-BB: 3 Drawers, EC704HP-BB: 4 Drawers, EC706HP-BB: 6 Drawers, EC708HP-BB: 8 Drawers
06	Hold ▲ or ▼ to change between °C and °F
07	(▲ or ▼) Selects the Power Transistors or Driver of each Power Amplifier Drawer
08	Measured value (°C or °F) in each Power Transistor

#	Parameter	Position	#	Description / Functionality
4/7	Control Module Power Supply	2400	1/2	+3,3V : OK - Check de +3,3Vcc Ctrl Module Power Supply +15V : OK - Check de +15Vcc Ctrl Module Power Supply
			2/2	+5V : OK - Check de +5Vcc Ctrl Module Power Supply +28V : OK - Check de +28Vcc Ctrl Module Power Supply
5/7	Communication Status	2500	1/3	Drawers Communication Status (OK / Fail / -- "not present") P01 / P02 / P03 / P04 – Power Drawer 1 / 2 / 3 / 4
			2/3	Drawers Communication Status (OK / Fail / -- "not present") P05 / P06 / P07 / P08 – Power Drawer 5 / 6 / 7 / 8
			3/3	Control Module Communication Status (OK / Fail / -- "not present")
6/7	Software/Hardware Version	2600	1/4	Control: Control Module Version
			2/4	Drawers Version. (◀ or ▶) Selects the Power Drawer
			3/4	Digi: Ethernet Module Version
			4/4	CIP Version / CIM Version
7/7	Eqp. Power Supply	2700	1/1	Eqp. Power Supply Measurements (OK / Fail) 15V / 8V 50V

**[3000] - Main Menu ⇒ System Alarms/Log**

This menu provides information on current and past alarms for preventive/corrective maintenance purposes.

Before detailing access to the submenus of this item, it is important to know what the alarms are and their possible solutions.

There are two alarm lists; "Equipment Alarms", which refers to faults in the equipment as a whole and "Drawers Alarms", which refers to faults in power amplifier drawers and thus impact the transmitter's operation reflected in the operation of the equipment.

**EQUIPMENT ALARMS**

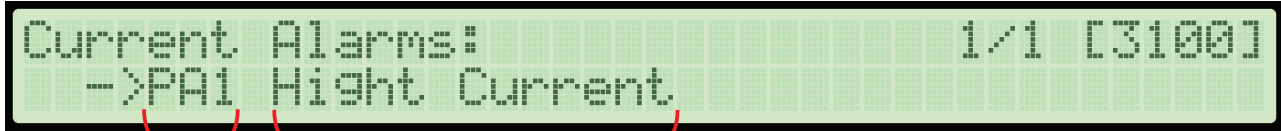
ALARM	DESCRIPTION
+15V Control Module Failure	
+3.3V Control Module Failure	
+28V Control Module Failure	<p>Indicates failure in any of the Control Module Sources (+15V, +3,3V, +28V +5V).</p> <p>The sources that are inside the Control Module.</p>
+5V Control Module Failure	
+15V Equipment Failure	
+50V Equipment Failure	<p>Indicates failure in any of the Equipment Sources (+15V, +50V, +8V).</p> <p>The sources that are at the rack bottom.</p>
+8V Equipment Failure	

ALARM	ALARM DESCRIPTION
AC Failure	Indicates a power surge or other irregularity.
Drawer Comm. Failure	Indicates that there is no communication between the power drawers. Check the RS485 cable connections in the rear panel of the excitation drawer and power drawers. Check the internal interconnections of connectors. Get in contact with Comark's customer support. Check the power drawers for proper operation using the HyperTerminal.
Drawers Alarms	Indicates failure in any of the Power Drawers.
Equipment Info Error	Indicates lack of information for the selected ID and thus impact the transmitter's operation 1PPS or 10MHz reference OR Wrong EQP ID.
Exciter Failure	Indicates transmitter exciter failure and prompts excitation exchange between Main and Backup (if was available).
Other Control Module Failure	Indicates failure in the communication between Control Modules A and B (if was available).
Output High Power	Indicates that the Output Power Transmitter outstripped 10% of the maximum power limit.
Output Power Zero	Indicates that the Transmitter has the programmed power, but without power reading at the output.
Power Amp. OFF	Indicates that the ON/OFF switch in the front panel is off.
Reduced Power	Indicates that the Transmitter is not operating at rated power. May occur due to power loss in one or more Power Amplifier Drawers.
Reflected Power	Indicates presence of reflected power at the transmitter's output at the output of transmitter. Check the current alarm list to list other possible alarms that could help better assess the situation of the equipment as a whole. Check the connections of the equipment to filter and filter the antenna. Get in contact with Comark's customer support.
Remote Ctrl Failure	Indicates communication failure in the Remote Control Drawer.
Remote Mute	Indicates that the equipment output power was remotely reduced to zero. No measure needs to be taken, as this alarm is intentionally caused by the system operator.
RF Load FAN Failure	Occurs when the Dummy Load Module Drawer fan fails and the internal temperature exceeds 90°C (194°F).
Too Few Drawers	Indicates that the Transmitter does not have the minimum number of Drawers to operate under reduced power condition.

**POWER AMPLIFIERS DRAWERS ALARMS**

This list is directly related to the alarms that occur in the Power Drawers. When there is an alarm LED lit (see item 5.2.6 - Signaling LED's - Power Amplifier Module) the alarm detail is displayed when accessing the "System Alarms / Log" of the Control Module CM8001. Alarms can be a **Notification** (irregular operation that generates no fault containment action) or a **Critical** alarm (shutdown the device or reduces its operational capability).

Usually when the alarm occurs it indicates which the device the alarm is triggering from:

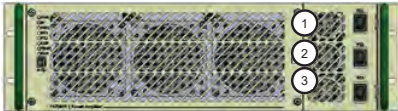


Device Identification

Alarm

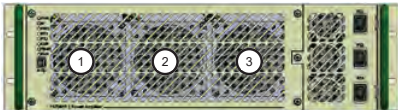
Devices Identification:

PSU IDENTIFICATIONS



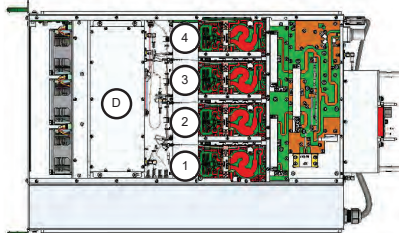
POWER AMPLIFIER DRAWER  
Front View

FAN IDENTIFICATIONS

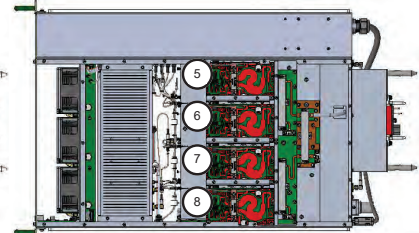


POWER AMPLIFIER DRAWER  
Front View

PA IDENTIFICATIONS



POWER AMPLIFIER DRAWER  
Top View



POWER AMPLIFIER DRAWER  
Bottom View

“D” – Driver / Pre-driver

Alarms List:

ALARM	ALARM DESCRIPTION
Critical High Forward Power	Power Amplifier Drawer forward output power is greater than 1300Watts. Default system action: <b>Shutdown</b>
Critical High Reflected Power	Drawer reflected output power is greater than 184Watts. Default system action: <b>Shutdown</b>
Critical High Input Air Temperature	Ambient air temperature used in the reflow of the equipment is greater than 48°C (118.4°F). Default system action: <b>Shutdown</b>
High Input Air Temperature	Ambient air temperature used in the reflow of the equipment is greater than 35°C (95°F). Default system action: <b>Notification</b>
Low RF Input Level	RF Input Level is less than -8dBm Default system action: <b>Notification</b>
High RF Input Level	RF Input Level is greater than 10dBm Default system action: <b>Notification</b>
PA__ High Current	Current at the indicated PA is greater than 10A. Default system action: <b>Notification</b>
PA__ Critical High Current	Current at the indicated PA is greater than 10A. Default system action: <b>Shutdown</b>
PA__ Low Current	Current at the indicated PA is less than 0.2A. Default system action: <b>Shutdown</b>
PA__ Unbalance Current	Current in the indicated PA is 2.5A is higher or lower than the others. Default system action: <b>Notification</b>
PA__ High Temperature	Temperature at the indicated PA is greater than 75°C (167°F). Default system action: <b>Notification</b>
PA__ Critical High Temperature	Temperature at the indicated PA is greater than 80°C (176°F). Default system action: <b>Shutdown</b>
PA__ Low Gain	Indicated PA Gain is Less than 49dB. Default system action: <b>Notification</b>

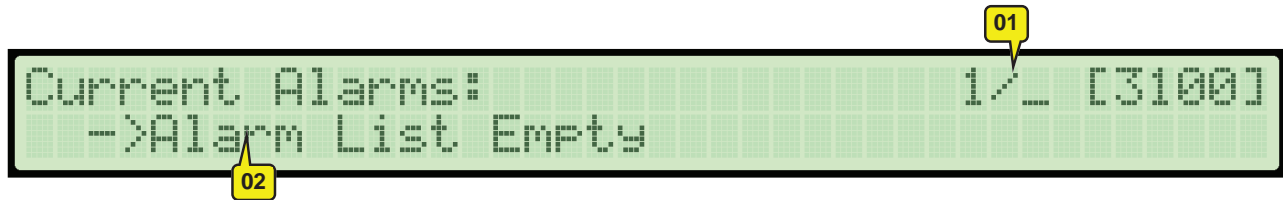


ALARM	ALARM DESCRIPTION
PA__ Failure	VGS (Voltage Gate Source) of the indicated PA is less than 2/3 of the programmed VGS. Default system action: <b>Shutdown</b>
PA__ Comm Failure	No communication with the indicated PA.
Driver Low Gain	Gain in the driver is less than 30dB. Default system action: <b>Notification</b>
Driver Low Voltage	Voltage in the driver is less than 5.0V of programmed. Default system action: <b>Notification</b>
Driver Critical High Current	Consumption current in the driver is greater than 4.9A. Default system action: <b>Shutdown</b>
Driver High Current	Consumption current in the driver is between 4.5A and 4.9A. Default system action: <b>Notification</b>
Driver Low Current	Consumption current in the driver is less than 0.4A. Default system action: <b>Notification</b>
Driver High Temperature	Temperature Driver is greater than 75°C (167°F). Default system action: <b>Notification</b>
Driver High Output Power	Output Power Driver is greater than 46dBm. Default system action: <b>Notification</b>
Driver Comm Failure	No communication with the Driver.
Pre-Driver Low Current	Consumption current in the pre-driver is less than 0.1A. Default system action: <b>Notification</b>
Pre-Driver High Current	Consumption current in the pre-driver is greater than 0.35A. Default system action: <b>Notification</b>
PSU __ High AC Line Voltage	AC Voltage at PSU is greater than 240VAC Default system action: <b>Notification</b>
PSU __ Critical High AC Line Voltage	AC Voltage at PSU is greater than 250VAC Default system action: <b>Shutdown</b>

ALARM	ALARM DESCRIPTION
PSU __ Critical Low AC Line Voltage	AC Voltage at PSU is less than 170VAC Default system action: <b>Shutdown</b>
PSU __ Critical High Current	Power at PSU indicate exceeds 1300Watts Default system action: <b>Shutdown</b>
PSU __ High Temperature	Temperature at PSU is greater than 60°C (140°F). Default system action: <b>Notification</b>
PSU __ Critical High Temperature	Temperature at PSU is greater than 63°C (145.4°F). Default system action: <b>Shutdown</b>
PSU __ High Current	Current at PSU is greater than 24A. Default system action: <b>Notification</b>
PSU __ Low Voltage	DC Output Voltage at PSU is less than 3V of the programmed. Default system action: <b>Shutdown</b>
PSU __ High Voltage	DC Output Voltage at PSU is greater than 3V of the programmed. Default system action: <b>Shutdown</b>
PSU __ Low AC Line Voltage	AC Voltage at PSU is less than 180VAC Default system action: <b>Notification</b>
PSU __ Shutdown	The PSU is Shutdown.
FAN __ Warning	Fan rotation reaches ±1000RPM in relation to software programmed value. Default system action: <b>Notification</b>
FAN __ Failure	Fan rotation reaches ±2000RPM in relation to software programmed value. Default system action: <b>Notification</b>

**BROWSER ALARMS STATUS**

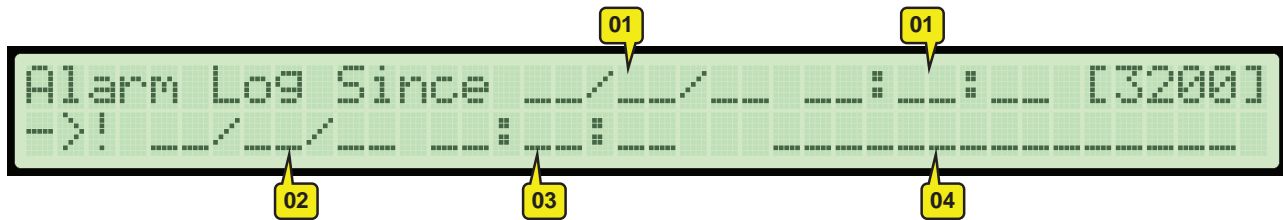
#	Parameter	Position	#	Description / Functionality
1/4	Current Alarms	3100	---	Show the list of currents Alarms in the Equipment.



01	Number of Alarm of Total Alarms
02	▲ or ▼ to view the Alarms List

When there is no alarm, it will display: "Alarm List Empty"

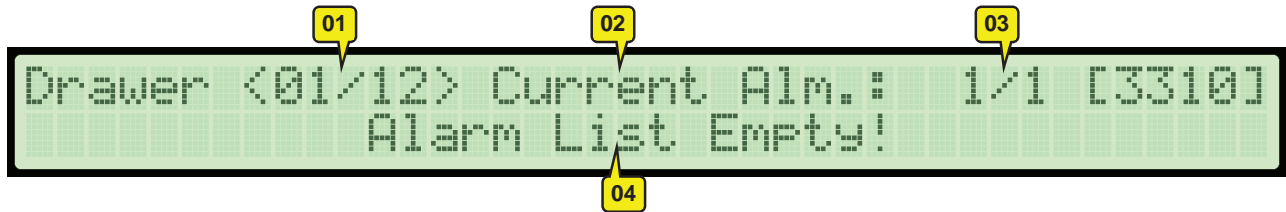
#	Parameter	Position	#	Description / Functionality
2/4	Alarm Log	3200	---	Show the list of past Alarms in the Equipment.



01	Date and time the first alarm occurred
02	Date of the alarm occurred
03	Time of the alarm occurred
04	Alarm List

Press ▲ or ▼ to browse in the Alarm List.

#	Parameter	Position	#	Description / Functionality
3/4	Drawers Alarms	3300	1/2	Current Drawers Alarms [3310]
			2/2	Past Drawers Alarms [3320]



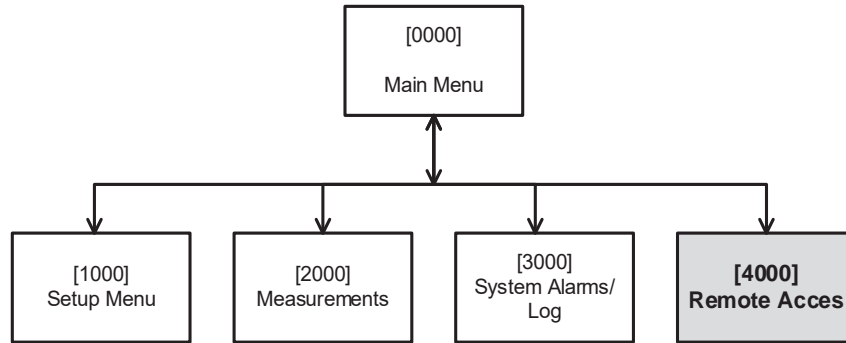
01	Indicates which Drawer/Module indication
02	Indicates "Current Alarms [3310] or "past Alarms [3320]
03	Number of Alarm of Total Alarms
04	Alarm List

Press ▲ or ▼ to browse in the Alarm List.

#	Parameter	Position	#	Description / Functionality
4/4	Clear Alarm Log	---	---	Show the list of past Alarms

Select this option to clear all alarm logs.

[4000] - Main Menu ⇌ Remote Access



This menu allows the configuration of the Ethernet network parameters so that you have remote access via a network connection. All equipment parameters such as transmit power, source measurements, alarms check, and all possible functional selections can be accessed remotely through a PC Browser or any Smartphone Browser by connecting to the embedded WEB page server of the Equipment.

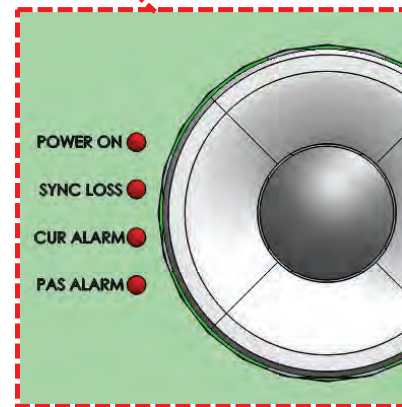
#	Parameter	Position	#	Description / Functionality
1/3	IP Address	---	---	Set the IP Address
2/3	Subnetwork Mask	---	---	Set the Subnetwork Mask
3/3	Gateway	---	---	Set the gateway

4.1.5. Front Led Alarms



**CURRENT ALARM:** When a fault occurs, the equipment will automatically take containment and protection actions (Power Off or Power Reduce) and signal by the "CURRENT ALARM" led on the front panel.

These may be checked via the display in the menu: [3000] System Alarms / Log.



**PAST ALARM:** When signaling, indicates that there have been malfunctions in the past. These alarms may be checked via the display in the menu: [3000] System Alarms / Log.

## 4.2. Power Amplifier Module (MOD GV 40265)



This is an air-cooled UHF power amplifier drawer composed of an RF block with eight (08) power transistors that utilize Doherty's high efficiency technology. Each Drawer can provide up to 1000 Watts RMS (ATSC 1.0) or up to 900 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.

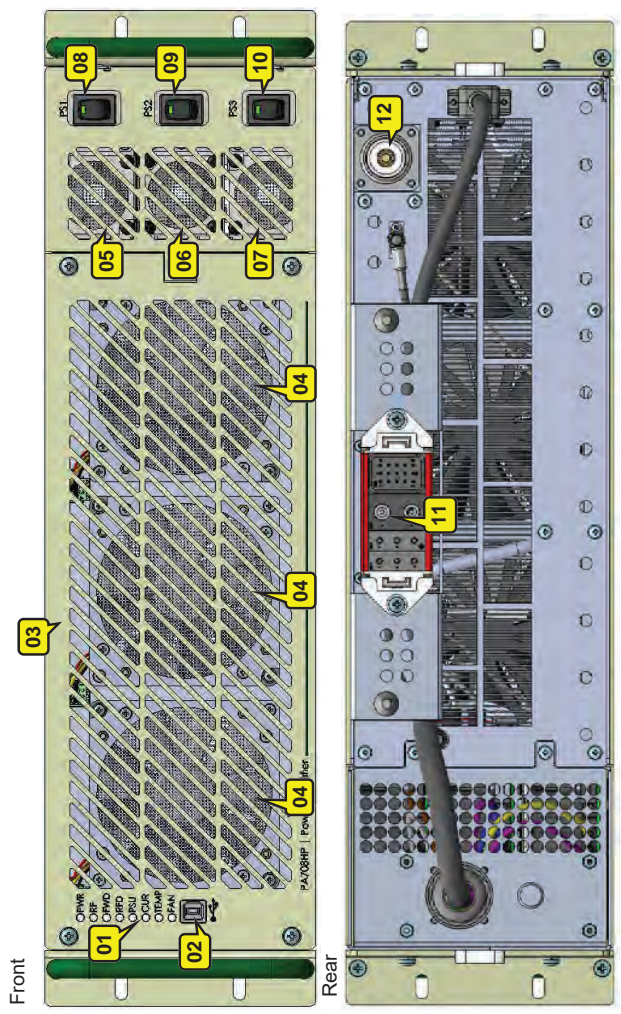
Main features:

- ⇒ High efficiency
- ⇒ Power Supply redundancy - 3 Power Supplies
- ⇒ Three-phase balanced drawer
- ⇒ 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. Risk of equipment damage.**

4.2.1. Interfaces



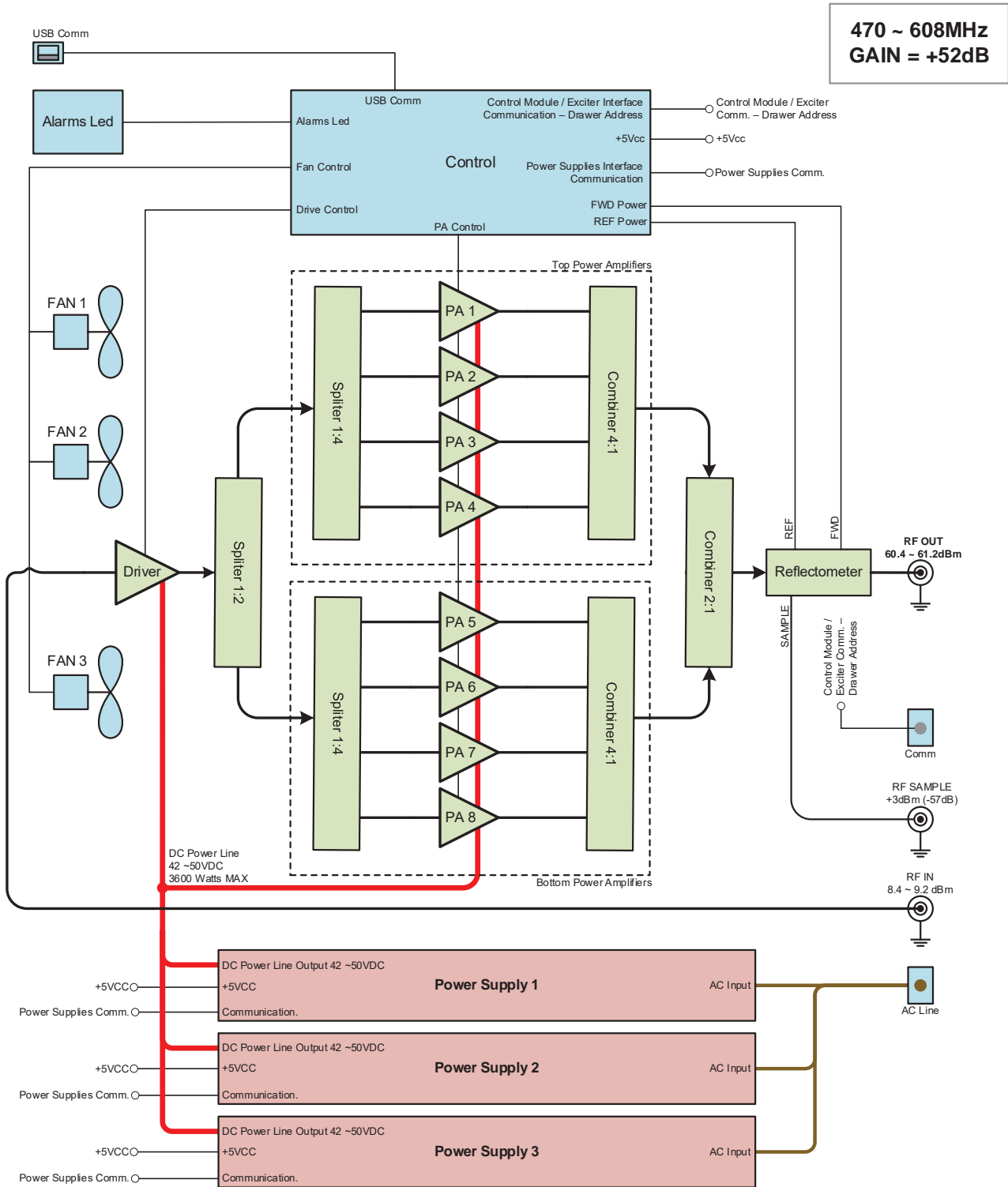
01	Signaling LEDs	
02	USB Interface	
03	Removable front panel	
04	Fan Air Filter	
05	Power Source 1 (PS1)	
06	Power Source 2 (PS2)	
07	Power Source 3 (PS3)	
08	On/Off Power Source 1 (PS1)	
09	On/Off Power Source 2 (PS2)	
10	On/Off Power Source 3 (PS3)	
11	A/C Power, RF Input and Communication Plug-In (quick release system)	
12	RF Out Plug-In (quick release system)	

**4.2.2. Specifications**

	<b>Characteristic</b>	<b>Specification</b>
Input	Frequency Range	470 to 608MHz
	Level	+8.4dBm ( $\pm 0.2$ dB) for 1100Wrms Output (ATSC 3.0) +9.2dBm ( $\pm 0.2$ 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
	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 ( $\pm 0.2$ dB)
	Average Efficiency	40% typical @ ATSC 1.0 40% typical @ ATSC 3.0



### 4.2.3. Power Amplifier Drawer Functional Description



The Power Amplifier Drawer MOD GV 40159 uses 8 RF amplifier pallets operating in parallel. The chassis is configured with 4 pallets per side (top and 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.

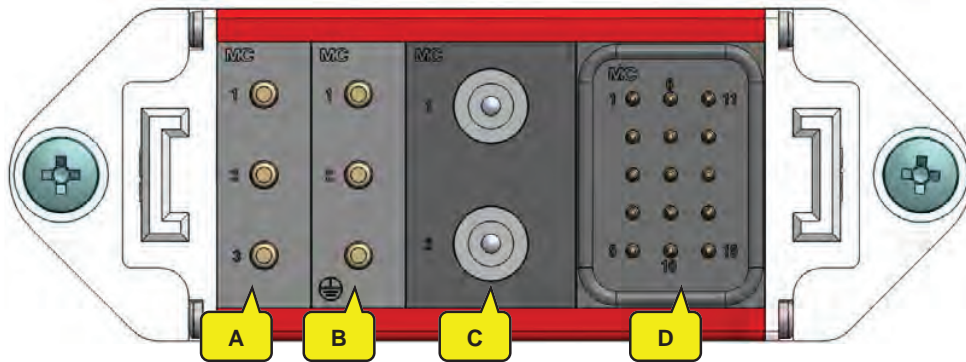
The 888E device internally has two parallel transistors in a Doherty configuration; one half of the device is operating in class AB and the other in class C. Further, the 888E device is designed to be an asymmetric Doherty amplifier with higher peak power capability on the Class C for better linear performance 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 combining 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 CM8001 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 a view of the front panel indicators at a glance and is comprised of 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.

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



A1	AC POWER PHASE 1 – PS1
A2	AC POWER PHASE 2 – PS2
A3	AC POWER PHASE 1 – PS2 / PS3
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

**4.2.5. 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 shown in Item 5.2.4. The addressing of the positions of the drawers follows the table below:

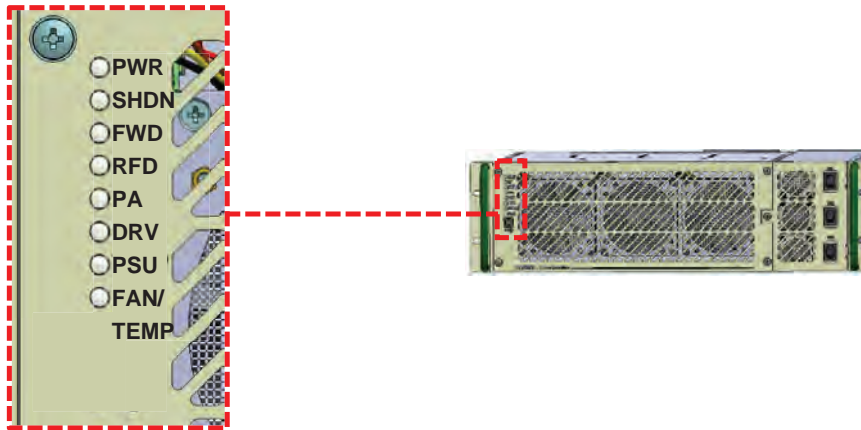
Equipment	Drawer Position	Decimal MODBUS Address	Binary Pinout Configuration			
			A3	A2	A1	A0
EC701HP-BB2	1	003	1	0	0	0
EC702HP-BB2	1	003	1	0	0	0
	2	004	1	0	0	1
EC703HP-BB2	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
EC704HP-BB2	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
	4	006	1	0	1	1
EC706HP-BB	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
	4	006	1	0	1	1
	5	007	1	1	0	0
	6	008	1	1	0	1
EC708HP-BB	1	003	1	0	0	0
	2	004	1	0	0	1
	3	005	1	0	1	0
	4	006	1	0	1	1
	5	007	1	1	0	0
	6	008	1	1	0	1
	7	009	1	1	1	0
	8	010	1	1	1	1

Binary Pinout Configuration: 0 (0Vcc); 1 (3,3Vcc)

### 4.2.6. Signaling LEDs

Each Power Amplifier Drawer Features a LED bank that indicates the situation of its operation according to the color as shown below:

	Green	Green light indicates normal operation.
	Orange	Orange light indicates that a failure has <b>occurred</b> .
	Red	Flashing Red light indicates an <b>ongoing</b> 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)

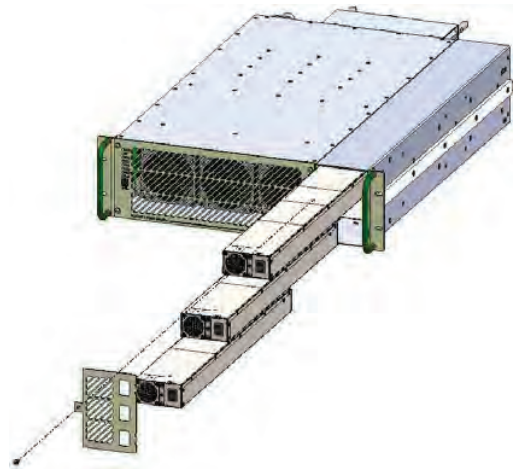
Alarm details are displayed by accessing the keyboard-display interface of the Control Module CM8001 in the menus:

⇒ Main Menu ⇒ System Alarms/Log [3000] ⇒ Drawers Alarms ⇒ Current Drawers Alarms [3310]

⇒ Main Menu ⇒ System Alarms/Log [3000] ⇒ Drawers Alarms ⇒ Past Drawers Alarms [3320]

#### 4.2.7. 1200 Watts Powers Supplies – Redundancy Operation / Power Reduction

The Power Amplifiers Drawers use three 1200 Watts plug-in power supplies. Each of the power supplies in the power amplifier converts 180-240VAC single-phase line voltage to 40-50VDC to power the RF pallets.



**Never unplug any Power Supplies while the Transmitter is on. Risk of equipment damage.**

The power supplies feature a quick-connect system that allows the unit to be easily removed through the front of the power amplifier chassis. The power supply includes power factor correction, built-in I-rush protection as well as overload protection (over-temperature, voltage, and current). The configuration of 3 PS per power amplifier provides a soft-fail mode. In the EC701HP-BB, which uses one power amplifier, if one PS is removed there is no reduction in the output power and if two PS are removed the output power is reduced by 40%. From the EC702HP-BB up to EC712HP-BB, which uses two or more power amplifiers, if one PS is removed from any or all power amplifiers there is no reduction in the output power and if two PS are removed from the same power amplifier this power amplifier is shut off and the transmitter apply the following equation to reduce the output power.

Table for the Power Supply redundancy operation – ATSC 1.0

Transmitter	Number of PS operating per PA	Output Power
EC701HP-BB2	3	100%
	2	70%
	1	30%
EC702HP-BB2 /EC703HP-BB2	3	100%
EC704HP-BB2 /EC706HP-BB2	2	Refer to Equation Reduction
EC708HP-BB2	1	Refer to Equation Reduction*

\* If PA operating with only one power supply, PA Pout=0W

Table for the Power Supply redundancy operation – ATSC 3.0

Transmitter	Number of PS operating per PA	Output Power
EC701HP-BB2	3	100%
	2	100%
	1	40%
EC702HP-BB2 /EC703HP-BB2	3	100%
EC704HP-BB2 /EC706HP-BB2	2	100%
EC708HP-BB2	1	Refer to Equation Reduction*

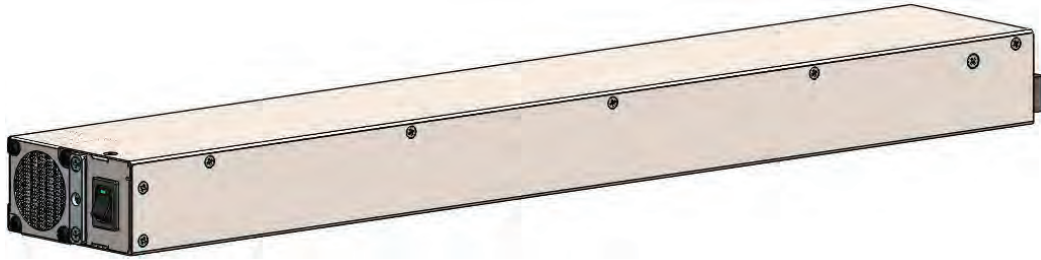
\* If PA operating with only one power supply, PA Pout=0W

For the EC702...12HP-BB2 the output power reduction for ATSC 1.0 and ATSC 3.0 is calculated according to the **Equation Reduction**:

$$P_{out} = \left( \frac{N1+N2*\sqrt{0.7}}{N} \right)^2 * P_n * k$$

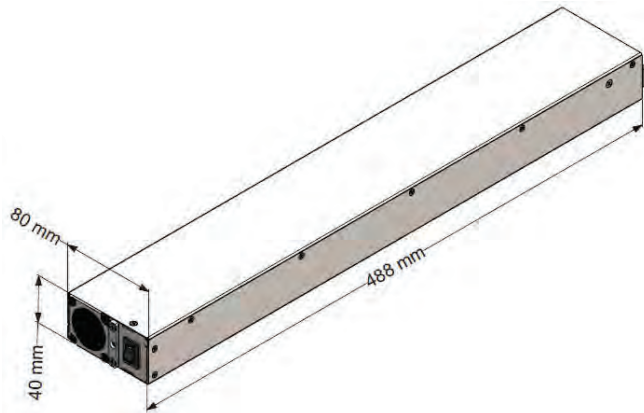
- N = Total Number of Transmitter Amplifiers
- N1 = Number of amplifiers working correctly
- N2 = Number of amplifiers with 1 PS burned
- Pn = Rated Output Power After Filter
- K= 0.9
- Pout = rated output power

**4.2.8. Power Supply 1200Watts – MOD 40241:**



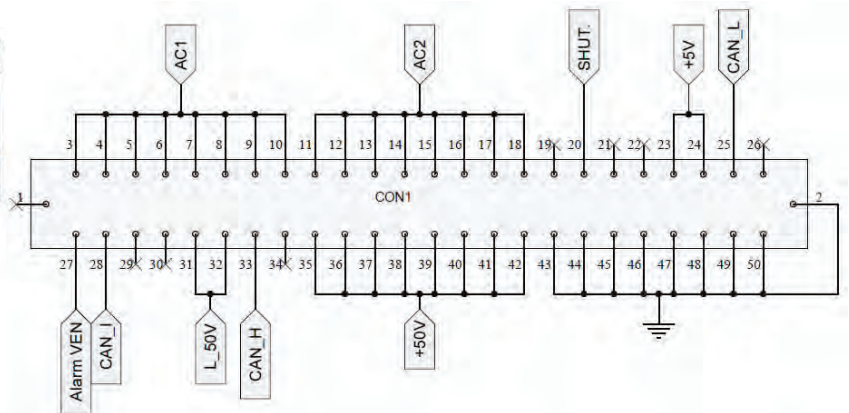
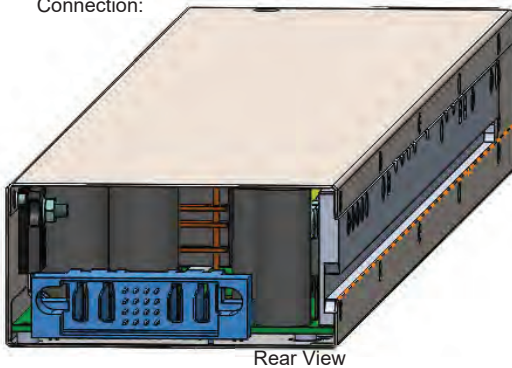
AC/DC Converter - PFC	
AC Mains Input	180 ~ 254 VAC
AC Mains Frequency	50 ~ 60Hz
Switching Frequency	100kHz
DC Output	375VDC
Power DC Output	1.32kW
Power Factor	> 0.92%

DC/DC Converter	
DC Input	350 ~ 400vdc
Switching Frequency	50kHz
DC Output	40 ~ 50vdc Adjustable
Power DC Output	1.2kW
Max Current	24A
Ripple	<400mVpp



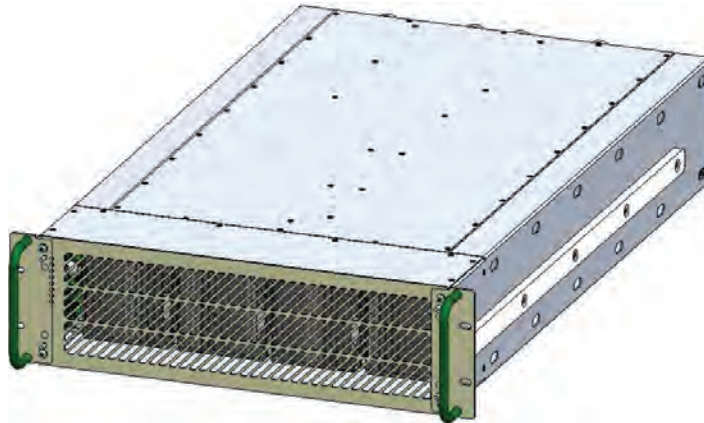
Flyback	
AC Mains Input	180 ~ 254 VAC
AC Mains Frequency	50 ~ 60Hz
Switching Frequency	65kHz
DC Output	+5VDC
Power DC Output	18W

Connection:




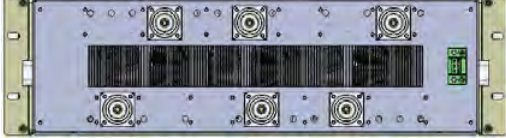
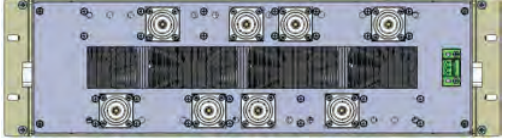




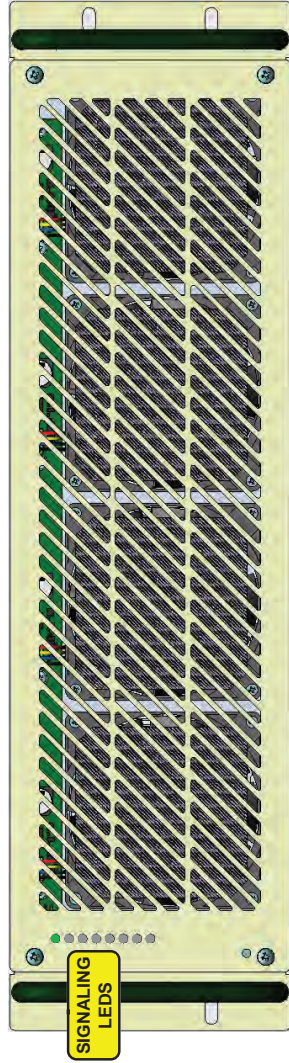
### 4.3. Dummy Loads Module



It is a drawer where unbalanced loads from the power combiner are packed. 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-BB2
MOD GV 40041 <b>DL0K5W</b>		1	EC702HP-BB2
MOD GV 40191 <b>DL1K4W</b>		2	EC703HP-BB2
MOD GV 40027 <b>DL1K9W</b>		3	EC704HP-BB2
MOD GV 40082 <b>DL4K3W</b>		6	EC706HP-BB2
MOD GV 40081		8	EC708HP-BB2

4.3.1. Interfaces



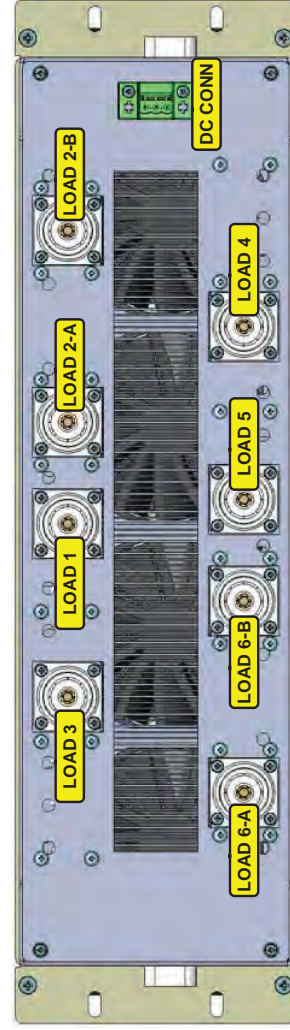
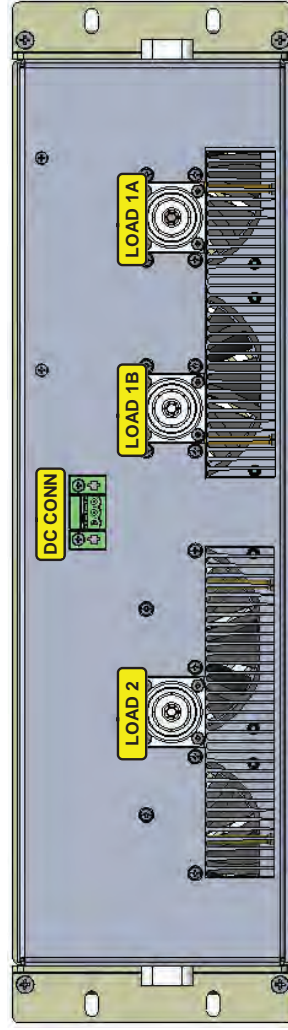
LOAD	CONN.	LOAD SIDE	IMPEDANCE 470-608MHZ	POWER
DL0K5W (MOD 40041)				
DL1K4W (MOD 40191)				
DL1K9W (MOD 40027)				
LOAD 1A	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 1B	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 2	DIN 7/6"	TOP	50Ω	900 Watts

DL4K3W (MOD 40082)

LOAD	CONN.	LOAD SIDE	IMPEDANCE 470-608MHZ	POWER
LOAD 3	DIN 7/6"	TOP	50Ω	900 Watts
LOAD 1	DIN 7/6"	TOP	50Ω	900 Watts
LOAD 2	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 4	DIN 7/6"	BOTTOM	50Ω	900 Watts
LOAD 5	DIN 7/6"	BOTTOM	50Ω	900 Watts




DL5K1W (MOD 40081)

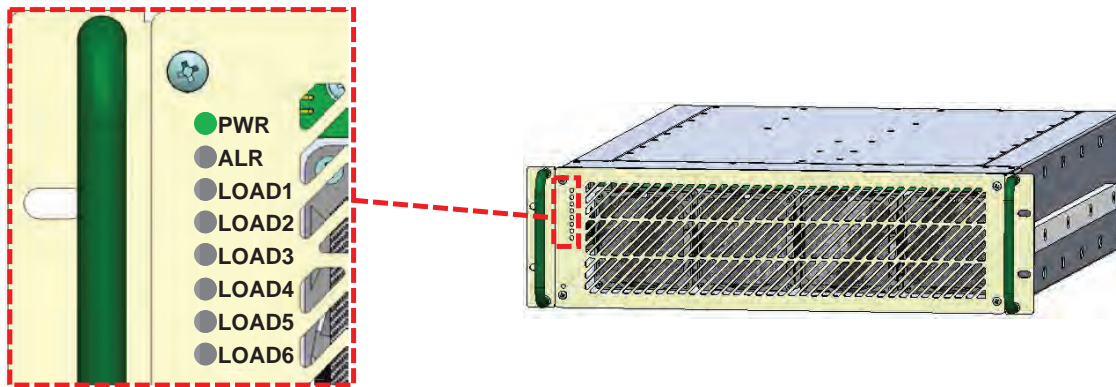
LOAD	CONN.	LOAD SIDE	IMPEDANCE 470-608MHZ	POWER
LOAD 3	DIN 7/6"	TOP	50Ω	900 Watts
LOAD 1	DIN 7/6"	TOP	50Ω	900 Watts
LOAD 2-A	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 2-B	DIN 7/6"	TOP	50Ω	500 Watts
LOAD 4	DIN 7/6"	BOTTOM	50Ω	900 Watts
LOAD 5	DIN 7/6"	BOTTOM	50Ω	900 Watts
LOAD 6-B	DIN 7/6"	BOTTOM	50Ω	500 Watts







### 4.3.2. Signaling LEDs

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

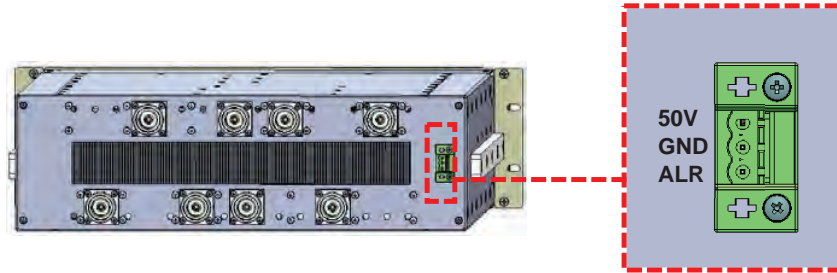
	Green	Indicates normal operation.
	Orange	Indicates that there is power on the rejection loads (temperature rise).
	Red	Indicates that a failure is <b><u>occurring</u></b> .



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

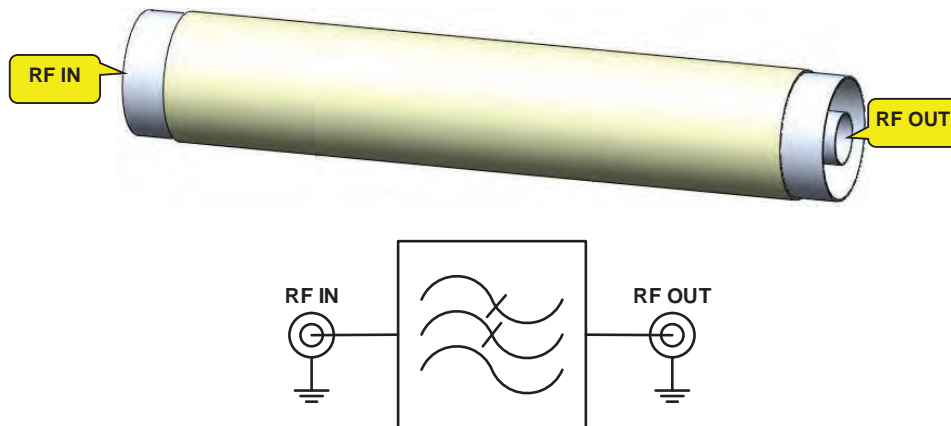
\*Load Number - amount of loads depends on the equipment model

### 4.3.3. Rear Connection



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

### 4.4. EIA Low Pass Filter

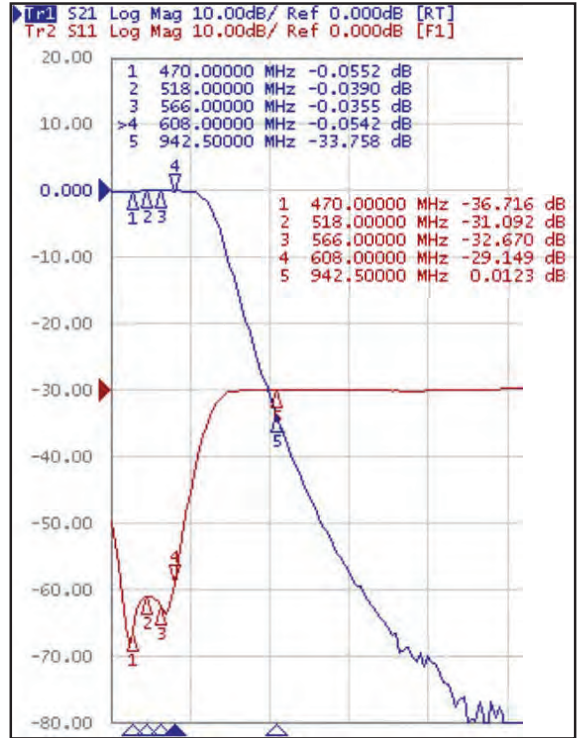


The Low Pass Filter is installed between the Power Amplifier Drawer RF Output and the Mask Filter attenuating unwanted harmonic products so that they do not return as reflected wave to the PA.

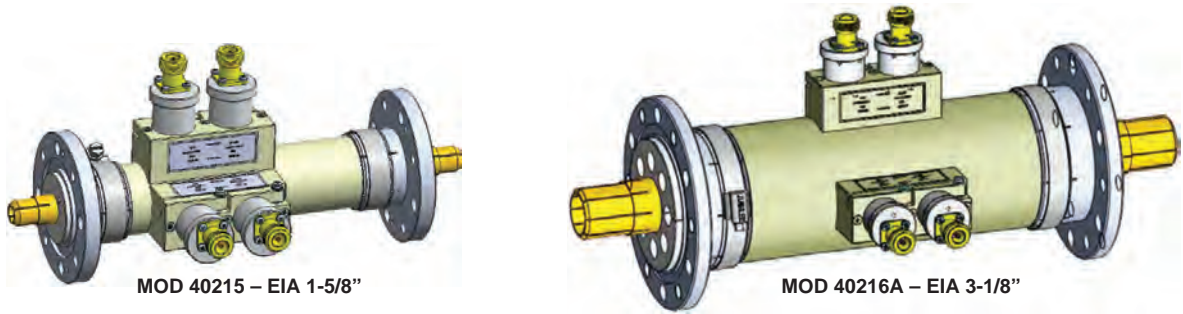
Low Pass Filter	EIA	Equipment
MOD 40243	1 – 5/8"	EC701HP-BB2
MOD 40243	1 – 5/8"	EC702HP-BB2
MOD 40055	1 – 5/8"	EC703HP-BB2

4.4.1. Features

Low Pass Filter Model	MOD 40243	MOD 40055	MOD 40218
Use to	EC701HP-BB2 EC702HP-BB2	EC703HP-BB2 EC704HP-BB2	EC706HP-BB2 EC708HP-BB2
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	14000 Watts
Return Loss	-26dB (min) -30dB (typical)	-23dB (min) -26dB (typical)	
Insertion Loss	-0,06dB (max) -0,05dB (typical)		
Second Harmonic Attenuation	Better than -30dB		



### 4.5. EIA RF Output Line with Sample Probe

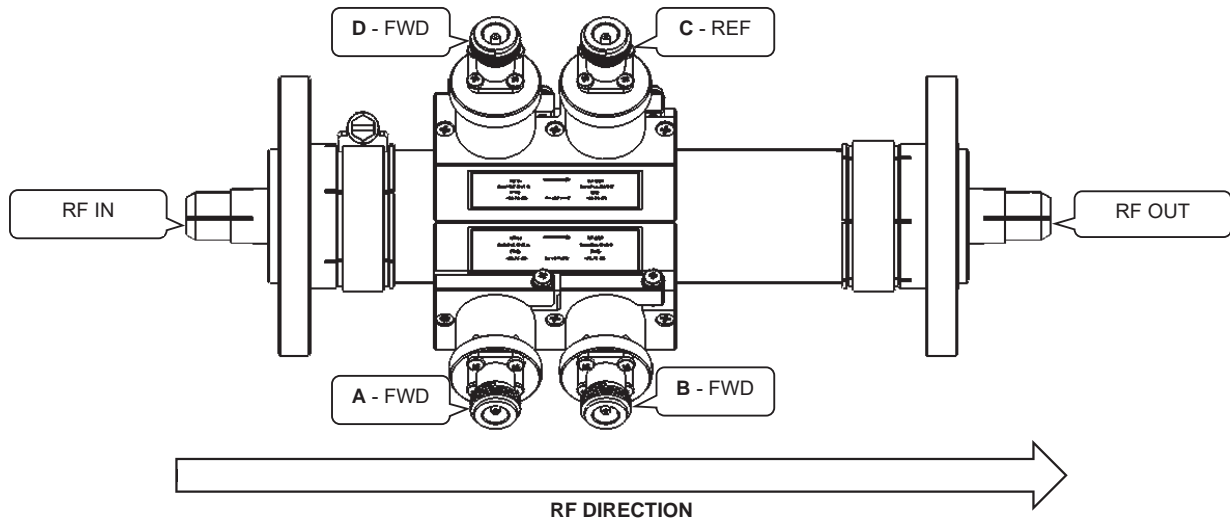


The EIA RF Output Line with Sample Probe is a passive coaxial RF sample installed in the Mask Filter RF output and has four independent RF outputs samples.

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-BB2 @ ATSC
		EC702HP-BB2 @ ATSC
		EC703HP-BB2 @ ATSC
		EC704HP-BB2 @ ATSC
MOD 40216A	3 - 1/8"	EC706HP-BB2 @ ATSC
		EC708HP-BB2 @ ATSC

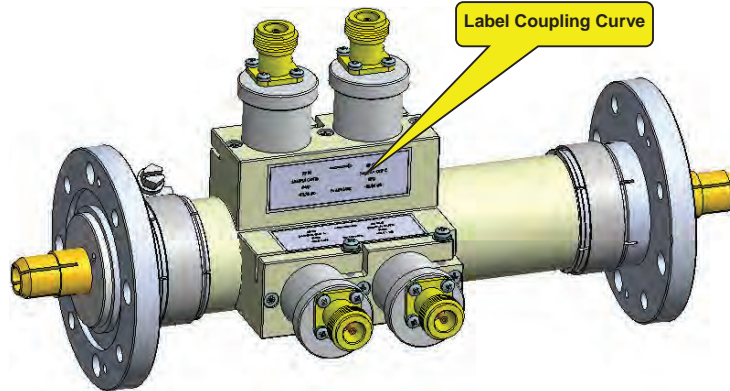
4.5.1. Features



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.



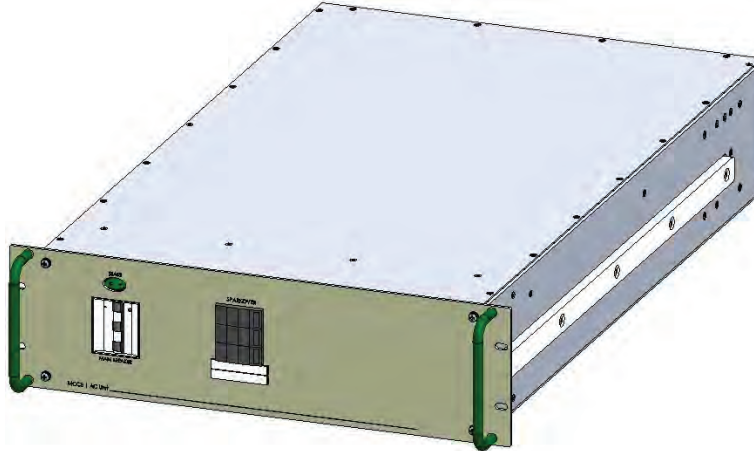
#### 4.6. Mask Filter

We recommend using Com-Tech RF Mask Filters:

EC701HP-BB2	Com-Tech 6-Pole RF Mask Filter FC6D110C with Heat Sinks
EC702HP-BB2	Com-Tech 6-Pole RF Mask Filter TC6D140C with Heat Sinks
EC703HP-BB2	Com-Tech 6-Pole RF Mask Filter TC6D140C with Forced Air Cooling
EC704HP-BB2	Com-Tech 6-Pole RF Mask Filter TC6D200C
EC706HP-BB2	Com-Tech 6-Pole RF Mask Filter TF6D220C with Heat Sinks
EC708HP-BB2	Com-Tech 6-Pole RF Mask Filter TF6D220C Forced Air Cooling



### 4.7. 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.

Characteristics:

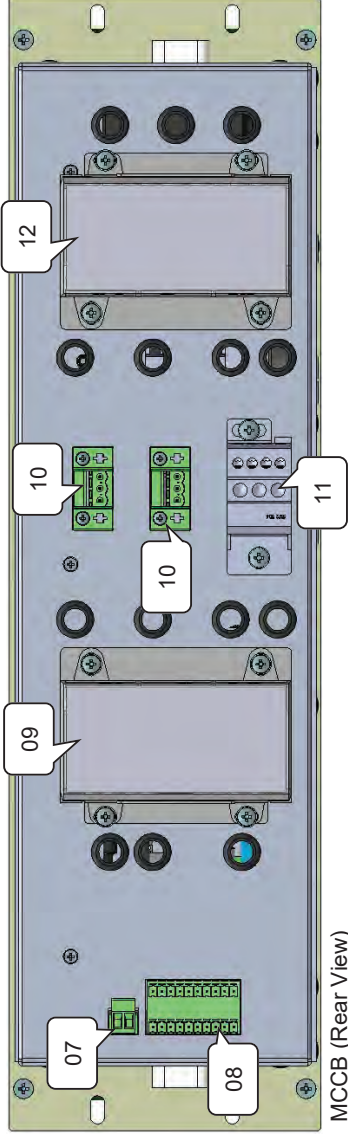
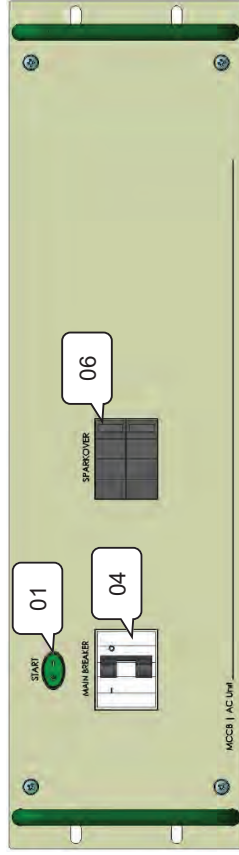
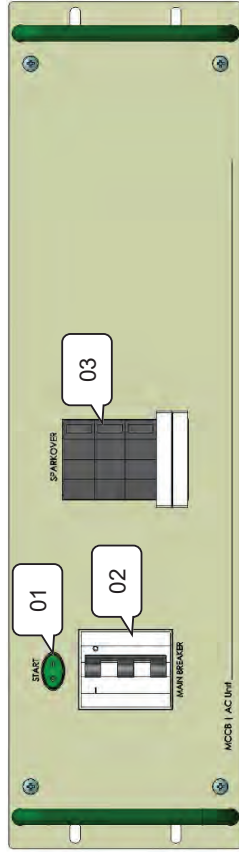
- ⇒ Starting current protection (inrush)
- ⇒ Equipment protection in the event of over-voltage or phase failure in the AC network
- ⇒ Surge Protection Device (SPD)
- ⇒ Circuit Breaker
- ⇒ Phase loss protection
- ⇒ Overvoltage Protection (>300VAC)
- ⇒ Undervoltage Protection (<180VAC)
- ⇒ Provides + 50V for the load bank drawer
- ⇒ Provides + 8V for the reflectometer
- ⇒ Provides + 15V for the relay

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

Equipment	MCCB Model	Capacity
EC701HP-BB2	Not applicable	Not applicable
EC702HP-BB2	MOD GV 40098	8.0kW
EC703HP-BB2	MOD GV 40099	11.0kW
EC704HP-BB2	MOD GV 40100	18.0Kw
EC706HP-BB2	MOD GV 40101	23.0Kw
EC708HP-BB2	MOD GV 40261	30.0Kw

### 4.7.1. Interfaces

In addition to differentiating themselves regarding the load capacity (for each type of equipment), the MCCB also differ by the type of AC power:



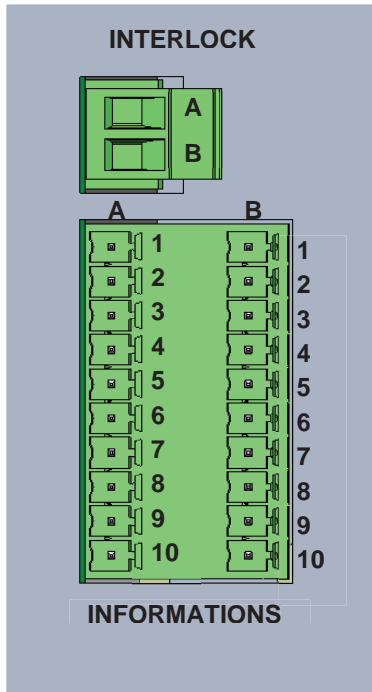
**AC MAINS TYPE**

<b>M208</b>	<b>208 VAC WILD LEG</b> 208VAC Between Phase B (Wild Leg) and Neutral
<b>B240</b>	<b>SINGLE PHASE 240 VAC</b> 240VAC Between 2-Phases
<b>T208</b>	<b>WYE THREE PHASE 208 VAC</b> 208VAC Between 3-Phases
<b>T240</b>	<b>DELTA THREE PHASE 240 VAC</b> 240VAC Between 3-Phases
<b>T380</b>	<b>WYE THREE PHASE 380 VAC</b> 380VAC Between 3 Phases / 220VAC Between each Phases and Neutral

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

<b>01</b>	Start Button
<b>02</b>	3-Phase Circuit Breaker
<b>03</b>	3-Phase Surge Protection Device (SPD)
<b>04</b>	2-Phase Circuit Breaker
<b>06</b>	2-Phase Surge Protection Device (SPD)
<b>07</b>	Interlock
<b>08</b>	Communication Interface
<b>09</b>	AC Input Connector (See variations on AC mains type)
<b>10</b>	AC output for Exciter, Control Module and other devices (See variations on AC mains type)
<b>11</b>	Ground (GND) Connector
<b>12</b>	AC output for Power Amplifiers Drawers (See variations on AC mains type)

4.7.1.1. Interlock Connection / Information Connection



**INFORMATIONS**

A	B
1- GND	1- Output +50VA
2- GND	2- Output +50VB
3- Alarm +5V - Phase OK	3- Output +15V
4- Alarm +5V - PA	4- Output +8V
5- Command Unit Control +5V	5- Output +5V
6- Interlock IN	
7- Interlock OUT	
	8- Measure +50VA, +50VB
	9- Measure +15V
	10- Measure +8V

INTERLOCK

A-B Short Circuited	MCCB ACTIVE
A-B Opened	MCCB DISABLE



Model EC701HP-BB2 do not have the MCCB Module.



The Equipment AC mains is configured at the factory according to the internal connections and can not be changed by the customer. If it is necessary to change the structure of the transmitter's AC mains, contact the Comark customer support for the corresponding instructions.

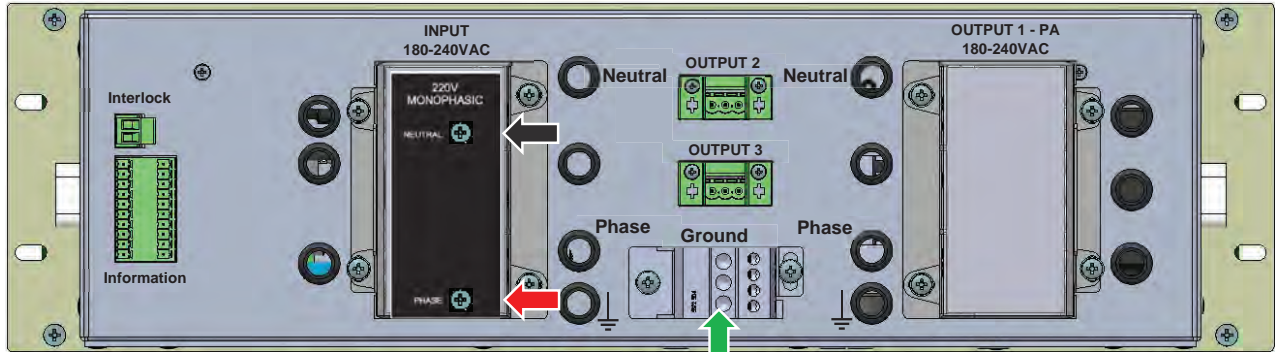


NEVER change the network structure of the transmitter without prior instruction from the Comark customer support. Undue or mixed changes may not only endanger the equipment but also the people who operate it.

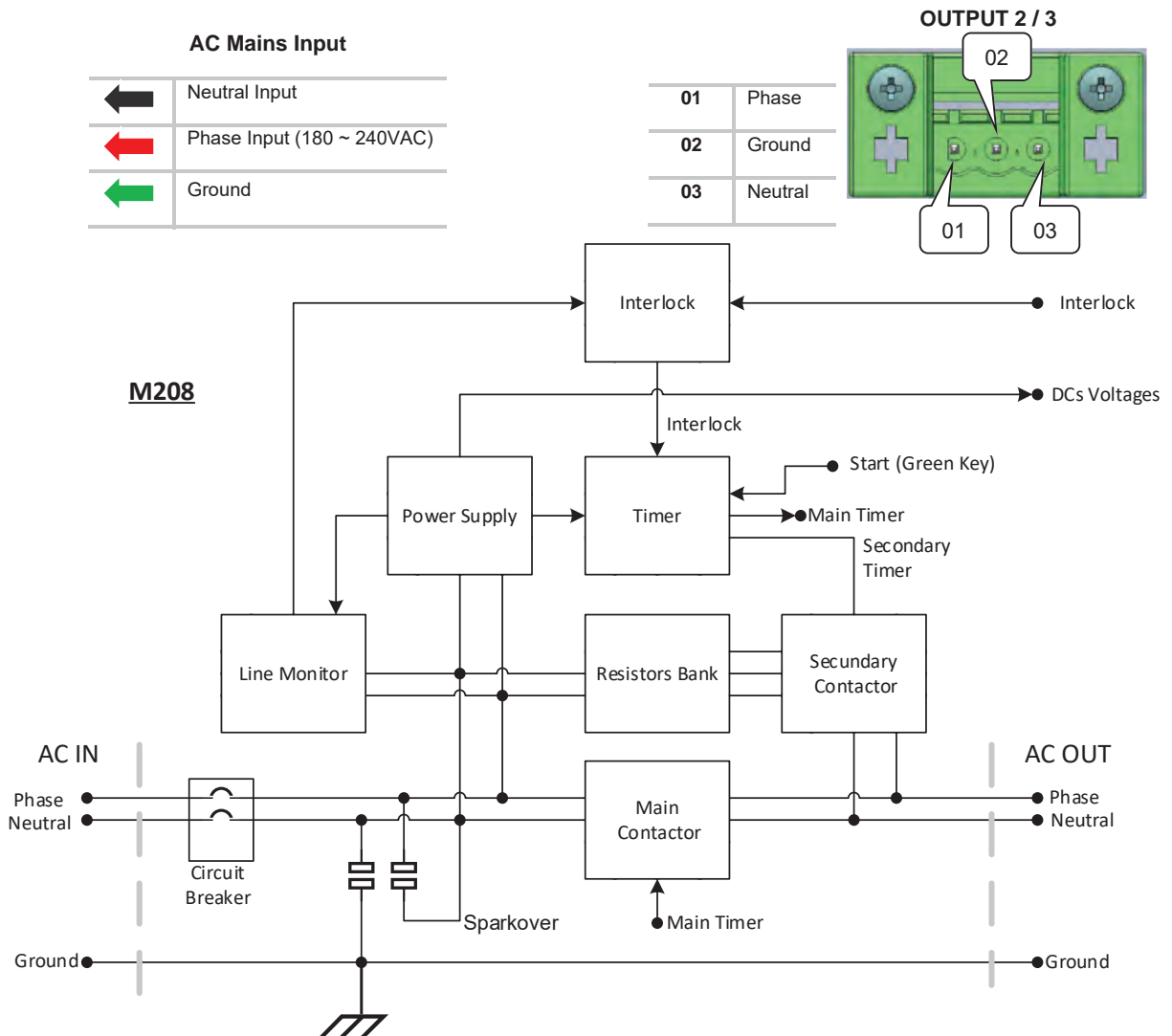
4.7.1.2. Variations on AC mains types

**M208 – 208VAC WILD LEG**

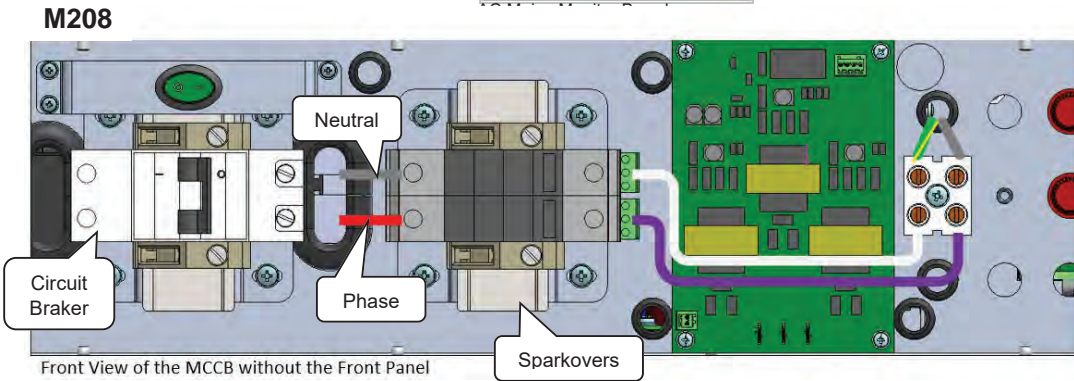
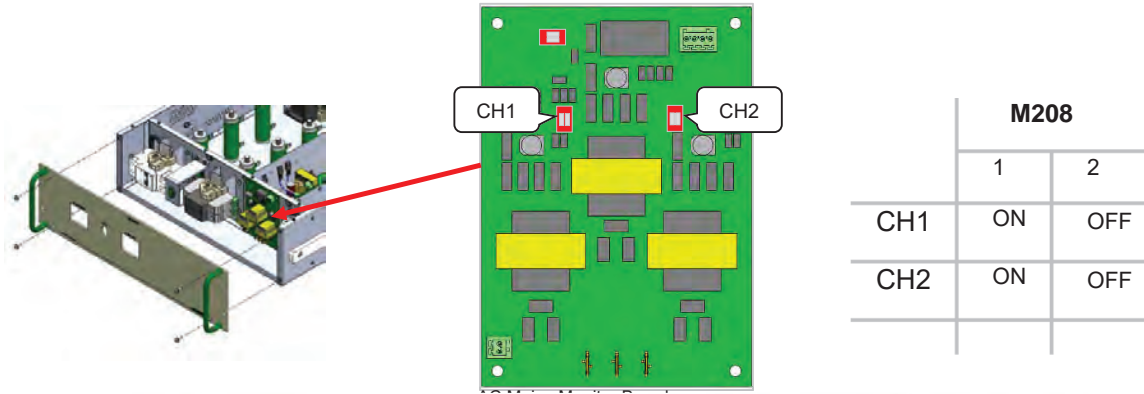
1-phase 208 (1 phases + neutral + GND): 180 to 240V



MCCB AC Mains M208 (Rear View)

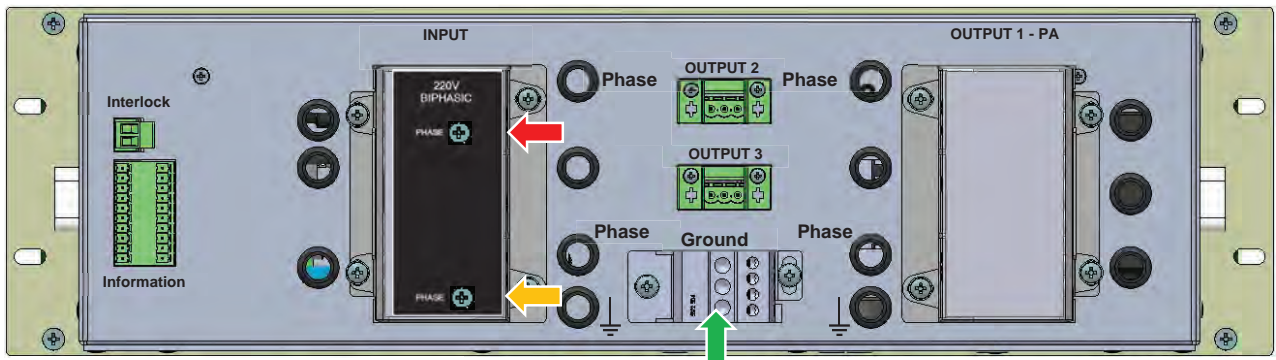


Internal Configuration for M208:



**B240 – SINGLE PHASE 240VAC**

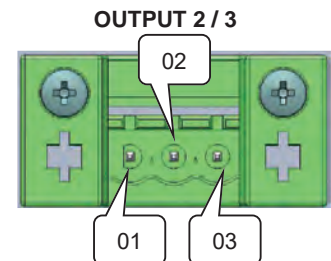
2-phase 240 (2 phases + GND): 180 to 240V (potential difference between phases)

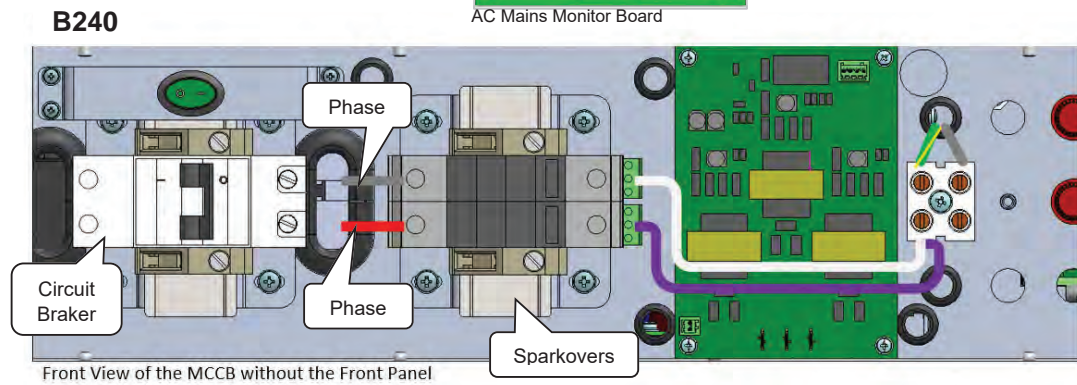
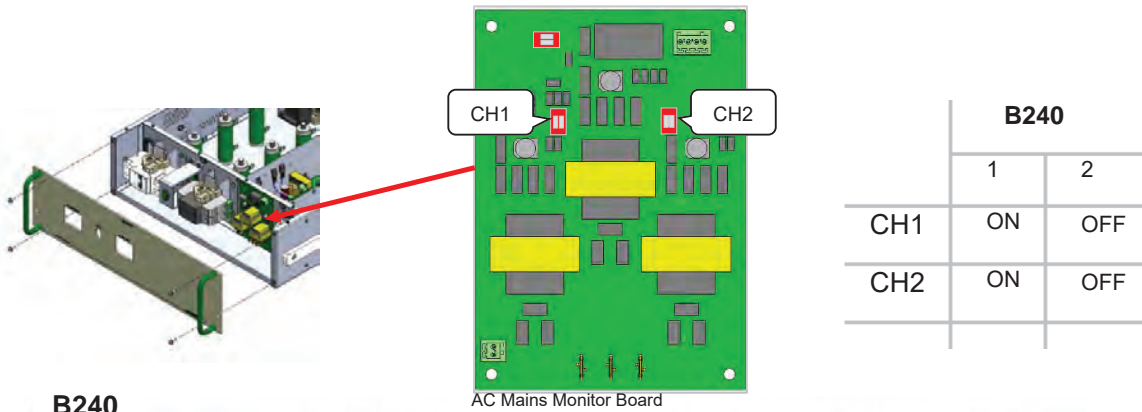
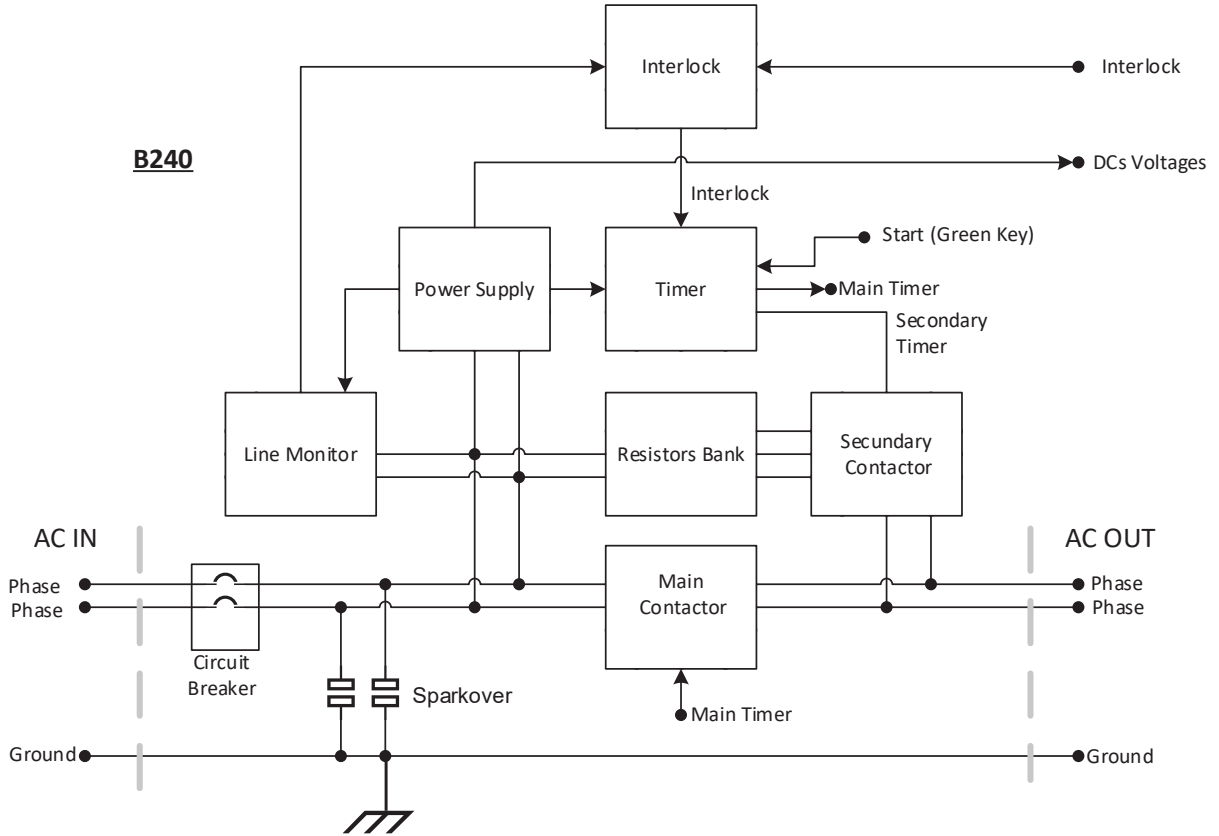


**AC Mains Input**

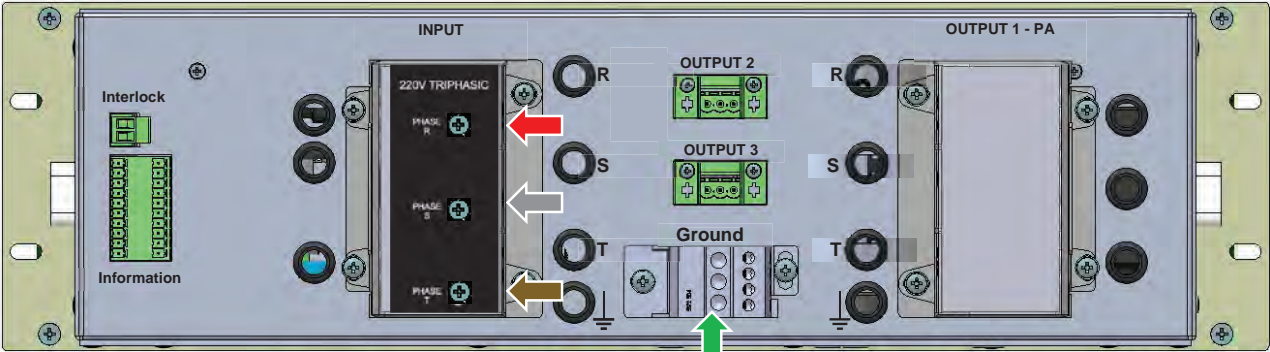
	Phase A Input
	Phase B Input
	Ground

01	Phase
02	Ground
03	Phase



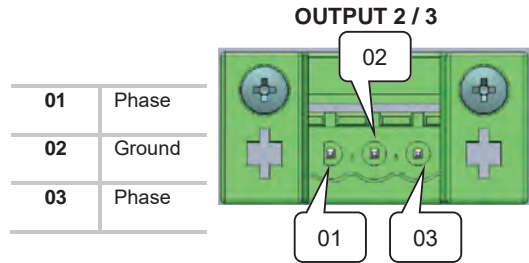


**T208 / T240 WYE THREE PHASE 208VAC / DELTA THREE PHASE 240VAC**  
**3-phase 208~240 (3 phases + GND): 180 to 240V (potential difference between phases) / 100 to 140V (potential difference between phases-ground)**

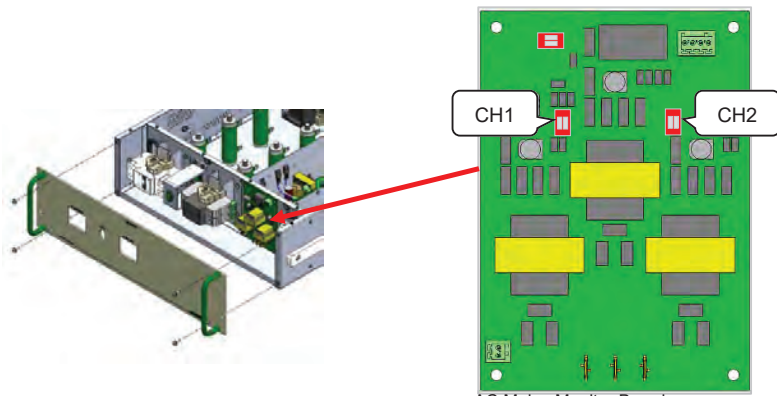
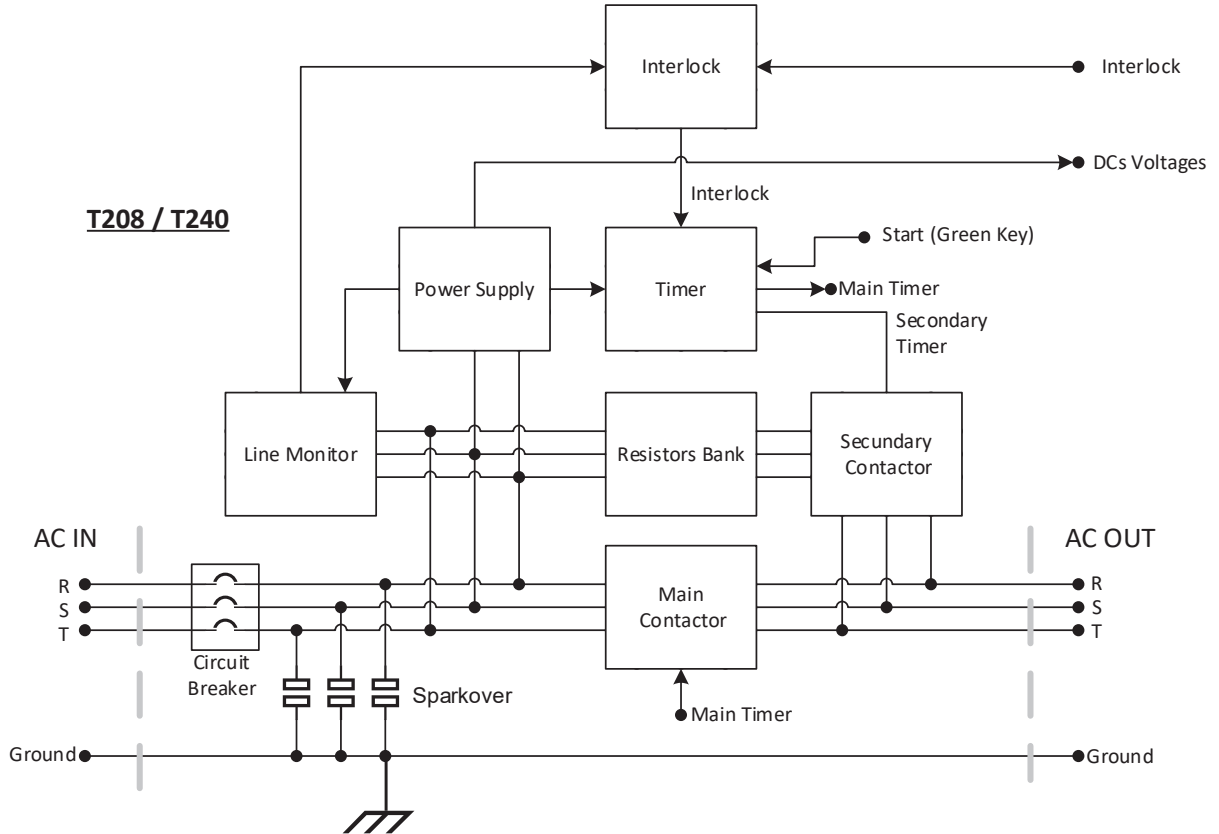


MCCB AC Mains T208 / T240 (Rear View)

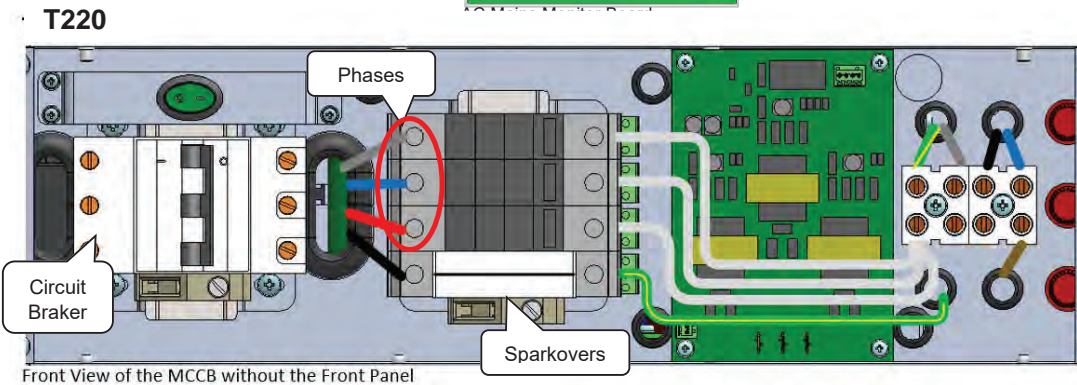
AC Mains Input	
	B Phase Input (R)
	A Phase Input (S)
	C Phase Input (T)
	Ground





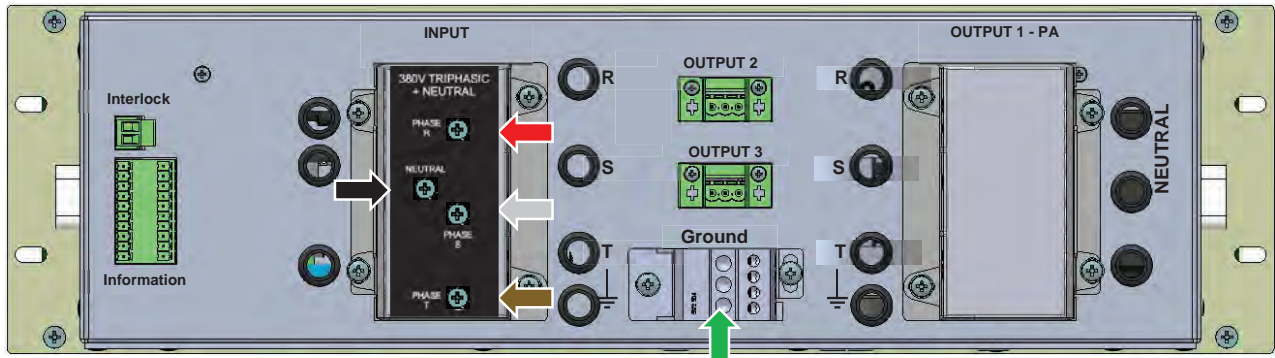


		T228 / T240	
		1	2
CH1		ON	OFF
CH2		ON	OFF



**T380**

3-phase 380 (3 phases + neutral+ GND): 380 to 415V (potential difference between phases) / 180 to 240V (potential difference between phases-Neutral)



MCCB AC Mains T380 (Rear View)  
AC Mains Input

	A Phase Input (R)
	B Phase Input (R)
	C Phase Input (T)
	Neutral
	Ground

