

Linear Industries, Inc.

AT71-250 Owner's Manual



February 2013

User Notices and WARNINGS

USER NOTICES

IT IS VERY IMPORTANT TO READ THIS MANUAL PRIOR TO OPERATION OF THIS TRANSMITTER!

Notice 1

The transmitter main operating voltage setting is marked on the rear of the AT71-250 chassis.

Notice 2

The transmitter operating frequency is set from the factory.

Notice 3

For adjusting the RF output power setting a qualified technician should always employ the use of an RF Wattmeter and a calibrated dummy load.

Notice 4

Should accident or injury occur to the personnel engaged in the installation, operation, or service of the equipment, they should seek proper medical attention. It is advisable that such personnel have familiarity with first-aid practices.

Notice 5

For technical support please call the Linear technical support customer service line at 847/428-5793 ext. 105.

Notice 6

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WARNING!

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

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

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

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

WARNING!

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

WARNING!

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

Returns and Exchanges

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

Unpacking

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

AT71-250 General Description

1. INTRODUCTION

AT71-250 is a 250W UHF ATSC Digital Broadcast Transmitter. It uses state-of-the-art technology of transmission of the digital signal for TV broadcast. It carries an intelligent digital control using microcontrollers, which allows for remote supervision in real time of all transmitter functionality.

All operations of the AT71-250 is carried-out through a keypad and digital display, located on the front panel, including access to all the readings, alarms and configurations.

The RF amplification system constitutes one drawer of up to 300W rms comes with an independent power supply and supervision function. The FCC Mask filter is installed on the top of the cabinet (not shown on the pictures below).

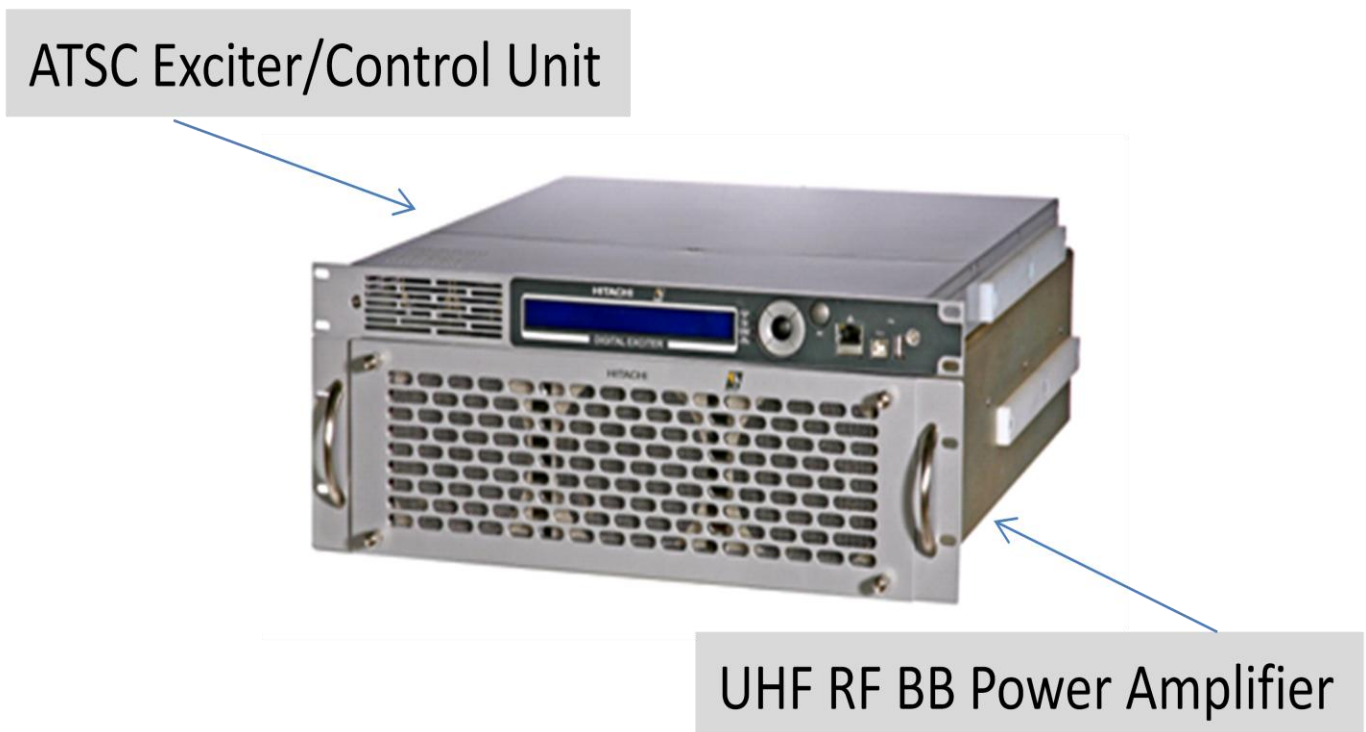


Figure 1: AT72-250 - Front View



Figure 2: AT72-250 - Rear View

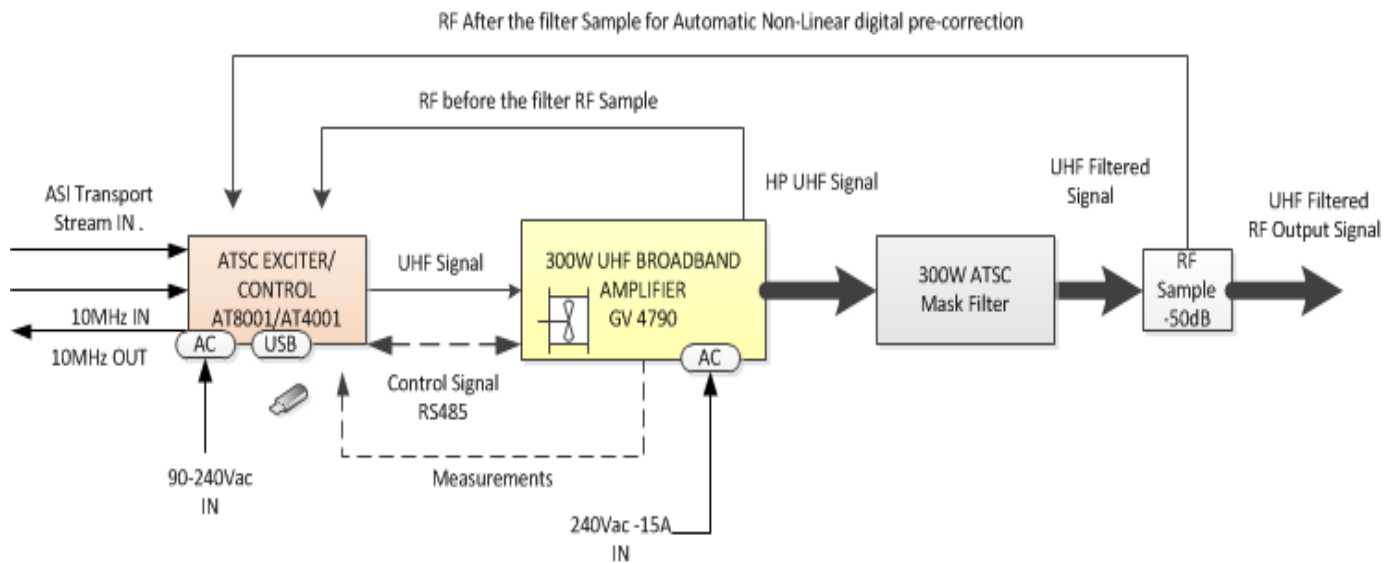


Figure 3 - AT71-250 - Block Diagram

2. Main Features

- Via the 4 lines x 40 columns display keypad located at the front panel it is possible to manage, configure all functions of the equipment and each one of the RF power drawer.
- Via the hyper-terminal it is also possible to manage, configure all of the functions of the transmitter.
- Digital Filter, type Finite Impulse Power (FIR) built-in at the 8VSB Modulator.
- Automatic non linear pre-correction.
- Automatic linear equalization.
- Built in oscillators synthesized via serial-PLL, locked at a 10MHz OCXO reference or external equivalent reference, e.g. GPS signal.
- The UHF RF power amplifier was implemented with LDMOS transistors, operating highly linearly at higher gain under high efficiency and absolute controlled thermal conditions.
- Automatic control over the quiescent operational electrical current value on the RF main power transistors, under temperature variations.
- Self-protection against over-current on the RF main power amplifiers.
- Each RF power module carries its own +50 volts full bridge type switching power supply.
- Automatic Level Control (ALC) control, which keeps the RF on-channel output level constant, even with a +3 dB overall system gain variation.
- System fault indication shown on the front panel, including current and past alarms log.
- Low noise, variable speed fans for the air cooling system.
- Modular design, built with SMD (Surface Mounted Devices), easing the maintenance and service.
- Outstanding overall field system performance.
- 19" rack cabinet.

3. AT71-250 stage-by-stage

1. 1 Digital Exciter
2. 1 RF power drawer
3. Output FCC mask filter
4. RF Sampler

4 General Description by stage

4.1 Digital Exciter, model AT8001.

The digital exciter unit is also the control and monitoring system for the entire transmitter.

- 8VSB Modulador
- IF/UHF Up Converter
- Power Supply
- RF Amplifier
- Master Control Unit

The AT8001 input is a single BNC connector that may receive either an ASI or SMPTE310M transport stream. The modulation process follows ATSC A/53E recommendation, and is a complex modulation process generating identical phase-modulated orthogonal IF carriers, (I) and (Q) at frequency of 18.833916 MHz.

Both (I) and (Q) modulated carriers are routed into the IF/UHF up-converter. The local oscillator is a synthesized time-based PLL via an internal OCXO (Oven Controlled Crystal Oscillator) at 10MHz reference, or an equivalent one external reference, e.g. a GPS signal. The on-channel modulated signal is routed to the RF amplifier, a class A highly linear amplifier with enough head room to accommodate future signal amplitude expansion during the non-linear pre-correction process.

The AT8001 output delivers a variable 100mW max RF output level, (+20dBm) at the desired UHF channel, driving the RF power amplifiers line-up.

The Master Control Unit (MCU) of the unit is embedded in the AT8001. The MCU interacts with all functionality present within the equipment. It further interfaces externally via a keypad and an LCD display.

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

The AT8001 is factory-set in one of four (4) optional versions. Depending upon the version it is possible set the operation with 2 types of non-linear pre-correction, mask filter equalization and/or ATSC set of 13 measurements on the RF signal demodulated.

4.2 300 watts RF power amplifier

The main power amplification system is built with 1 RF power drawer. The drawer carries a set of 3 fans, switching power supply, 3 RF pallets, an intermediate power amplifier, a removable (plug-in) control system based on microcontrollers and includes a hyper-terminal interface.

The use of the hyper-terminal interface allows the operator to adjust the quiescent RF transistor's current via software. It is also possible to retrieve data information regarding RF transistor current variations as a function of the temperature variation. Further, it is possible to collect valuable system information related with the RF drawer serial number, embedded software name and version, direct and reverse RF power readings, one-by-one RF transistor current readings, and detailed descriptions about current and past alarms.

4.3 RF Power Sensor. RF sample.

RF samples associated with the direct and reverse RF power are detected with this unit, and converted to proportional DC readings. These 2 DC levels are routed to the MCU located in the exciter where they are processed and displayed on the LCD screen. The processing of this analog information manages the RF power delivered by the transmitter, increasing or reducing it as part of the automatic level control (ALC) and is a part of the automatic linearization/equalization of the transmitter. The RF samples are available in two points in the RF path (line-up), BEFORE and AFTER the RF output filter. The second set of RF samples is the last element on the transmitter line-up, directly connected to the output transmission and antenna system.

4.4 Output Mask Filter

The UHF RF channel output filter is a tunable band-pass six pole elliptical synthesis type filter. This filter reduces the unwanted spurious and harmonics signals inherent in the RF amplification process. The filter bandwidth and attenuation specifications are two important components that help the transmitter to meet the FCC an ATSC A/53E specification recommendation.

4.5 Power Supplies

All power transmitter supplies are full bridge switching power supplies. Each drawer includes a total of two power supplies, each with its own individual shut-down commands. These power supplies are in constant communication with its respective drawer control unit. The communication collects and distributes the voltage value (+50V nominal) and the electrical instantaneous current values in Ampere. The normal mains value for all power supplies is 208Vac. The three different models present on this transmitter are:

5. AT71-250 - 250W UHF ATSC/8VSB Transmitter - Technical Specifications

Electrical	
Main	120 VAC, bi phase, 50-60 Hz.
Consumption	1080 W
Power Factor Correction, FPC.	Included
Signal Input	
Transport Stream Input	ATSC/MPEG2, compliant to SMPTE310M or ASI
Input Data Rate	19.39 Mbps (SMPTE / 310M) / 270Mbps (ASI)
External Reference Signal	10MHz. (0 to +10 dBm).
Input Connector	75Ω (BNC),
Reference Input Connector	50Ω (BNC),
RF	
Modulation Mode	8VSB.
IF	18.833916 MHz.
Channel Bandwidth	6MHz.
Test Signal	PRBS
Frequency Range	UHF. C14 to Ch59, (4 bands).
Frequency Step	1 Hz. ± 220kHz
Symbol Rate	10.76 MSymbol/sec.
Digital/Analog Converter	16 bit
Both Linear and Non-Linear Pre-Correction at factory	Included
Pilot frequency stability overall	±0.3 ppm
Peak to peak frequency response	≤ 0.2 dB
Peak to peak group delay response	≤ 20 ns.
Phase noise	≲ -104 dBc/Hz @ 20kHz offset.
Conducted spurious and harmonics	< -60 dBc, FCC 47 Part 74.
Radiated spurious and harmonics	< -80 dBc, FCC 47 Part 74.
MER (Modulation Error Rate)	≥ 33 dB (transmitter output) typical.
RF output connector	N
Output sample connector	N
Communication	
Hyper-terminal	RS232 (DB-9)
Mechanical	
Dimensions	7.13" (H) X 12" (W) X 9" (D)
Weight	NET: 100 lbs

Annex A – AT71-250 Operational Software

1. Introduction

The DTV transmitter AT71-250 provisions: (a) measurements, (b) configurations, (c) alarms, and (d) remote control via microcontrollers.

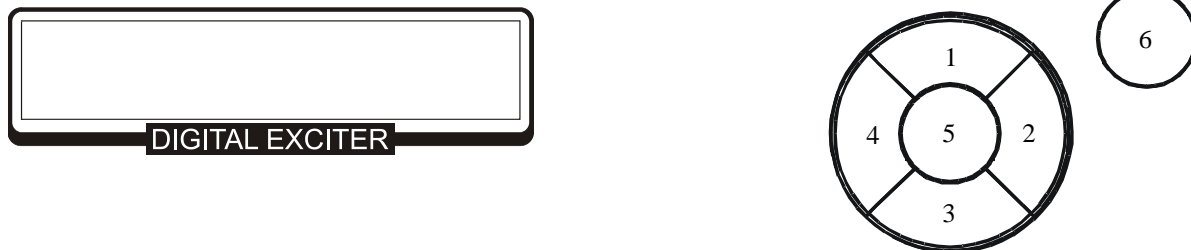
Below is a detailed description about the operational software (configuration and operation) system installed in the AT71-250, located within the AT8001 exciter.



Figure 4 AT8001

AT8001 Exciter – Front Panel.

2. Digital Exciter – The Master Control Unit



2.1 Keypad

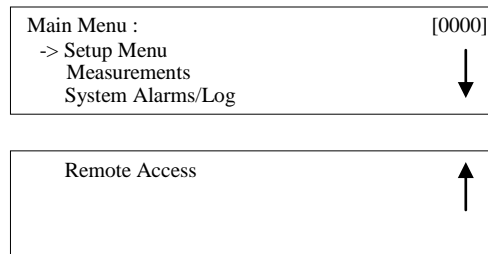
- (1) □ Moves the arrow UP to the next function shown on LCD screen
- (2) □ Moves the arrow to the next RIGHT position
- (3) □ Moves the arrow DOWN to the next function shown on LCD screen
- (4) □ Moves the arrow to the next LEFT position
- (5) □ ENTER – Confirms the chosen selection

(6) ESC – Cancel the selection and return to the previous screen.

2.2. LCD Display

To browse over the LCD screen follow the instructions below:

- Move the arrow Up or Down to the item listed by pressing the (1) or (3) buttons.



- Hit ENTER.

Remarks:

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

2.3. Signaling

Besides the LCD screen and the command keypad, the front panel of AT8001 also shows a set of 4 LED's. These LED's when ON indicate:

POWER ON – Energy is present.

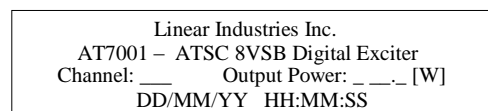
SYNC. LOSS – The INPUT transport stream is not present.

CURRENT ALARM – One or more alarm situations are occurring.

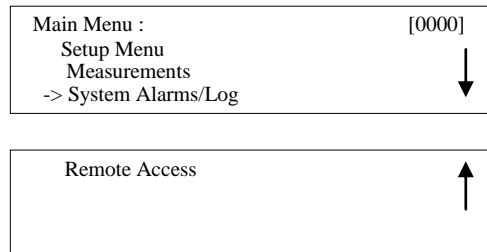
PAST ALARM – Alarm log screen.

3. Initialization:

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



After pressing any key on the keypad, the next screen that appears is:



(It is always possible to return to the initial LCD screen by pressing the ESC key)

After 5 minutes the initial LCD screen is shown.

4. Measurement System Table

Measurements Menu Indications	Measurements Sub-Set Indications	Description	
POWER	Forward	Measure the Direct Power	
	Reflected	Measure the Reversa Power	
	Voltage ALC	Measure the ALC control voltage	
TRANSPORT STREAM	Transport Stream	Shows the INPUT transport stream protocol, or none.	
	Data Packets Rate	Measure the input Data Rate: 0 ~ 19,39Mbps	
	Null Packets Rate	Measure Nulls packages: 0 ~ 19,39Mbps	
	FIFO Occupation (%)	0 ~ 100%	
RF AMPLIFIERS DRAWER	POWER	+50V Power Supply for the RF power drawer.	
		RF Forward Power per each drawer.	
	CURRENT	Measure the electrical current at the drawer	
	TEMPERATURE	Ttemperature measurements	
EXCITER POWER SUPPLY	Voltage	+15V	+15V voltage power supply measurement
		+8V	+8V voltage power supply measurement
		+3V	+3V voltage power supply measurement
		+27V	+27V voltage power supply measurement
COMMUNICATION STATUS	COMMUNICATION	Indicate the communication status among the RF drawer and the MASTER Control Unit.	
POWER SUPPLY MEASUREMENTS	15V	+15V voltage power supply measurement	
	8V	+ 8V voltage power supply measurement	
	Battery	+15V voltage battery measurement	

To access the menu above, see item 4.1 below:

4.1. Transmitter Power Measurements

Main Menu : Setup Menu -> Measurements System Alarms/Log	[0000] ↓
---	-------------

Remote Access	↑
---------------	---

Access **Measurements**

Measurements : -> Power Transport Stream Drawer	[2000] ↓
--	-------------

Exciter Power Supply Communication Status Power Supply	↑
--	---

Access **Power** and hit ENTER

- Hit key "3" to view the other screens that are part of this menu.

Transmitter Power Measurements : Programmed: Forward: ____ [W] Reflected: ____ [W] ALC Reference Voltage : __.____ [V]	[2100]
--	--------

Hit ESC key to return to the prior screen.

4.2. Transport Stream related measurements

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

Main Menu : Setup Menu -> Measurements System Alarms/Log	[0000] ↓
---	-------------

Remote Access	↑
---------------	---

Access Measurements

Measurements : Power -> Transport Stream Drawer	[2000] ↓
--	-------------

Exciter Power Supply Communication Status Power Supply	↑
--	---

Select **Transport Stream** and hit ENTER

Transport Stream Measurements: Transport Stream : Data Packets Rate : Null Packets Rate :	[2200] ↓
--	-------------

FIFO Occupation (%) :	↑
-----------------------	---

Hit ESC key to return to the prior screen.

4.3. RF Power Drawer Measurements

For each RF Power Module it is possible to measure: (a) electrical current, (b) RF delivery power, (c) temperature. Hit the ESC key to return to the measurements screen menu, or return to the main menu screen and select measurements.

Measurements :	[2000]
Power	
Transport Stream	
-> Drawer	↓

Exciter Power Supply	
Communication Status	
Power Supply	↑

Select **Drawer** and presses ENTER.

Drawer Measurements :	[2300]
-> Power	
Current	
Temperature	

Select **Power** and presses ENTER

Drawer Power Measurements :	[2310]
Drawer : <_/_>	
32V Power Supply: ___.[V]	
Forward Power: ___.[W]	

To select a specific drawer, press the keys “2” or “4”.

Drawer Measurements :	[2300]
Power	
-> Current	
Temperature	

Select **Current** and press ENTER.

Drawer Current Measurements :	[2320]
Drawer : <_/_>	^More Modules^
-> Mod. 1 I1: ___ A	Mod. 1 I2: ___ A
Mod. 2 I1: ___ A	Mod. 2 I2: ___ A

Mod. 3 I1: ___ A	Mod. 3 I2: ___ A
Mod. 4 I1: ___ A	Mod. 4 I2: ___ A
Excit. I1: ___ A	Excit. I2: ___ A

Press ESC to return to the **Drawer Measurements** screen.

```
Drawer Measurements :           [2300]
Power
Current
-> Temperature
```

Select **Temperature** and press ENTER

```
Drawer Temperature Measurements : [2330]
Drawer : <_/_> Exciter: 0.0 °C ^°F^
Mod.1: 0.0 °C Mod.3: 0.0 °C
Mod.2: 0.0 °C Mod.4: 0.0 °C
```

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

```
Measurements :                   [2000]
Power
Transport Stream
Drawer
```

```
-> Exciter Power Supply
Communication Status
Power Supply
```

Select **Exciter Power Supply** and press ENTER

```
Exciter Power Supply :           [2300]
-> +15V : OK
+8V : Fail
+3V : OK
```

```
+27V : Fail
```

- Use the Up and Down keys, 1 and 3, to check the voltage status on the DTV exciter.
- To return to the Main Menu press ESC key.

4.4 Communication among RF drawer

From the LCD screen it is possible to conduct and view a diagnostic check of the communication link between the master control unit and each one of the RF power amplifier drawer.

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

Measurements :	[2000]
Power	↓
Transport Stream	
Drawer	

Exciter Power Supply	↑
-> Communication Status	
Power Supply	

Select **Communication Status** and press ENTER.

Communication Status :	[2500]
P01: OK P02: OK P03 OK P04: OK	

Press the ESC key to return to the Main Menu.

4.5 Voltages from the Power Supplies

To check the status of the value and presence of the power supplies, start from the Main Menu and select the Measurement [2000] screen.

Measurements :	[2000]
Power	↓
Transport Stream	
Drawer	

Exciter Power Supply	↑
Communication Status	
-> Power Supply	

Select **Power Supply** and press ENTER

Power Supply Measurements :
15V : OK
8V : OK
Battery: 12.5 [V]

Press the ESC key as many times as necessary to return to the main menu.

5. The alarm system

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

At the Main Menu screen, access the System Alarm/Log.

```
Main Menu : [0000]
  Setup Menu
  Measurements
  -> System Alarms/Log ↓
```

```
Remote Access ↑
```

Access System Alarms/Log

```
System Alarm/Log [3000]
  -> Current Alarms
  Alarm Log
  Drawer Alarms ↓
```

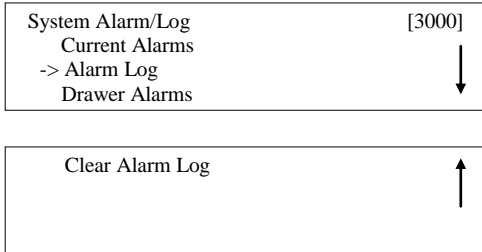
```
Clear Alarm Log ↑
```

Select **Current Alarms** and press ENTER

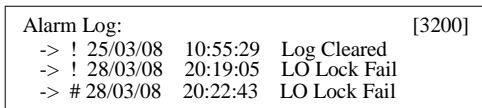
```
Current Alarms: [3100]
  Alarm List Empty!
```

- The “Alarm List Empty!” means the alarm is no longer present.

- Press ESC to return to the System Alarms/ Log menu



Access the Alarm Log and press ENTER screen to find out if all existing alarms, current alarms, and also the past alarms.



The symbol '!' is an indication that the alarm is current, (LED ON for alarms) with date and time of its occurrence. The symbol '#' is an indication that any alarms are no longer present, (LED ON for past alarm, LED OFF for current alarms), and the date and time mark when it ceased to occur. The alarm log keeps up to 100 registers.

The **Clear Alarm Log** if selected, erases the alarm log registers and then registers on the date and time when the registers were erased.

On the table below is shown all possible alarms, generated on the Digital Exciter and the associated suggested action to cease its occurrence.

Alarm Message	Alarm Description	Action Required	After Alarm Ceases
Sync Loss!	Sync loss on the transport stream	Alarm LED ON	Alarm LED OFF Past alarm LED ON
LO Lock Fail!	Up-Converter LO PLL unlocked	Shut down RF Re-program the PLL	Returns to the last RF level
Clock Lock Fail!	Clock at Modulator unlocked	Alarm LED ON	-----
Fifo Overflow!	Overflow on FIFO at the modulator	Alarm LED ON	-----
+15V Fail!	Lack of +15V.	Alarm LED ON	-----
+8V Fail!	Lack of +8V.	Alarm LED ON	-----
+3V Fail!	Lack of +3V.	Alarm LED ON	-----
+27V Fail!	Lack of +27V.	Alarm LED ON	-----

5.1 Drawer Alarms

On the **System Alarm/Log** screen it is possible to check and review all alarms, current and past, on each one of RF power drawer. From the Main Menu screen select system alarm/log, screen [3000].

```

Main Menu : [0000]
  Setup Menu
  Measurements
  -> System Alarms/Log
  
```

```

Remote Access
  
```

Select **System Alarms/Log** and ENTER

```

System Alarm/Log [3000]
  Current Alarms
  Alarm Log
  -> Drawer Alarms
  
```

```

Clear Alarm Log
  
```

Select **Drawer Alarms** and press ENTER.

```

Drawer Alarms: [3300]
-> Current Alarms
    Past Alarms
    
```

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

```

Drawer : <_/_> Current Alarms: [3310]
    Alarm List Empty!
    
```

Use the keys (4) ◀ or (2) ▶ to select one among many RF power drawer.

Press key ESC to return to the previous screen, **Drawer Alarms**. On the screen [3320], press the keys (4) ◀ or (2) ▶ to select the drawer.

```

Drawer : <_/_> Past Alarms: [3320]
    Alarm List Empty!
    
```

6. Setup

The SETUP screens allow the selection and changes on the configuration parameters, and also operational parameters. See below all possible operations under the SETUP menu.

Items on the SETUP menu	Description
Power Setup	Program the RF output power level
Frequency Setup	Program the RF UHF Channel of the transmitter
Image Frequency Suppression	TX Balance, eliminated the image frequencies band
LO Leakage Suppression	Reduces the LO undesirable spurious
Pre-Correction	Enable and Disable the pre-correction circuitry
Pilot Level	Adjust the pilot level [-2.048 ~ +511]
Time and Date Setup	Set time and date
Password Setup	Password configuration

6.1 Output Power Setup

Starting from the Main Menu

```
Main Menu : [0000]
-> Setup Menu
   Measurements
   System Alarms/Log
```

```
Remote Access
```

Select **Setup Menu** and press ENTER

```
Setup Menu : [250]
-> Power Setup
   Frequency Setup
   Image Frequency Suppression
```

```
LO Leakage Suppression
Pre-Correction
Modulation Settings
Time and Date Setup
```

```
Password Setup
Transmitter Setup
```

Select **Power Setup** and press ENTER

```
Power Setup :
   Output: 1300 [W]
   Program: 1300 [W]
```

To reach the desirable output power level, press the key (2)▶, to increase the power or (4)◀ to decrease the power. Once the desirable power level is adjusted, press ENTER for software acknowledgement, otherwise the change will not become effective.

6.2 Channel Frequency Setup

The channel frequency change is illustrated here, but it is a parameter that cannot be changed by the operator in the field. It is factory adjusted only. Starting at the setup menu screen [250]:

Setup Menu :	[250]
Power Setup	
-> Frequency Setup	↓
Image Frequency Suppression	

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	↓
Time and Date Setup	

Password Setup	↑
Transmitter Setup	

Select **Frequency Setup** and press ENTER

Frequency Setup :	[1200]
-> Channel :	
Offset	
Model	

Select **Channel** and press ENTER

Channel Setup :	[1210]
Channel : ____	Offset: + __.____ kHz
Center Frequency: ____ . ____ MHz	
Pilot Frequency : ____ . ____ MHz	

Press ESC to return to **Frequency Setup**.

Frequency Setup :	[1200]
Channel :	
-> Offset	
Model	

Select **Offset** and press ENTER

Frequency Offset Adjustment:	[1220]
Frequency Offset: +__ . ____ kHz	

The offset can be configured within 1Hz steps, in a ± 65536 Hz scale.

Press ESC to return to the **Frequency Setup** screen.

```

Frequency Setup : [1200]
Channel :
Offset
-> Model
    
```

Select **Model** and press ENTER

```

Transmitter Model Selection: [1230]
Transmitter Model: AT7xxx
    
```

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

```

Setup Menu : [250]
Power Setup
Frequency Setup
-> Image Frequency Suppression
    
```

```

LO Leakage Suppression
Pre-Correction
Modulation Settings
Time and Date Setup
    
```

```

Password Setup
Transmitter Setup
    
```

Select **Image Frequency Suppression** and press ENTER.

6.3 Image Frequency Suppression

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

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

```

Image Frequency Suppression: [1300]
-> I Amplitude : [dB]
Q Amplitude: [dB]
I Phase : °
    
```

```

Q Phase : °
    
```

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

Setup Menu :	[250]
Power Setup	↓
Frequency Setup	
Image Frequency Suppression	
-> LO Leakage Suppression	
Pre-Correction	↓
Modulation Settings	
Time and Date Setup	
Password Setup	
Transmitter Setup	↑

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

7.4 LO Leakage Suppression

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

LO Leakage Suppression:	[1300]
-> I Offset :	[mV]
Q Offset:	[mV]

Using the keys, it's possible to activate or deactivate the linear and non-linear pre-correction.

ON: Activate Pre-correction

OFF: Deactivate Pre-correction

7.5 Pre-correction adjustment

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

Setup Menu :	[250]
Power Setup	↓
Channel Setup	
Image Frequency Suppression	
LO Leakage Suppression	
-> Pre-Correction	↑
Pilot Level	
Time and Date Setup	

Select **Pre-Correction** and press ENTER

```
Pre-Correction Setup:          [250]
-> Linear
   Non-Linear
```

Select **Linear** and press ENTER

```
Linear Pre-Correction:        [1510]
Linear Pre-correction: on/off
```

Press ESC to return to **Pre-correction Setup**.

```
Pre-Correction Setup:        [250]
  Linear
-> Non-Linear
```

Select **Non-Linear** and press ENTER

```
Non-Linear Pre-Correction:    [1520]
-> Non-Linear Pre-correction: on/off
   Scale: -300 ~ +300
```

The scale listed on the screen above, is related with how intense the pre-correction will act over the ATSC signal on the modulator.

7.6 Modulation Settings

On this screen option is possible to turn on and off the modulation process. It is also possible adjust the pilot level rating from -2048 to +511. Press ESC up to the **SETUP MENU** screen.

```
Setup Menu :                  [250]
  Power Setup
  Frequency Setup
  Image Frequency Suppression ↓
```

```
LO Leakage Suppression
Pre-Correction
-> Modulation Settings      ↓
  Time and Date Setup
```

```
Password Setup
Transmitter Setup          ↑
```

Select **Modulation Settings** and press ENTER.

Modulation Settings :	[1600]
Modulation : on/off	
Pilot Level offset : +0000	
(-2.048 to 511)	

7.7 Time and date configuration

Press ESC up to Setup Menu screen.

Setup Menu :	[250]
Power Setup	
Frequency Setup	↓
Image Frequency Suppression	↓

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	↓
-> Time and Date Setup	↓

Password Setup	↑
Transmitter Setup	↑

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

Time and Date Setup:	[1700]
Time: HH:MM Date: 25/02/11	DD/MM/YY

To program the date and time, use keys 2 and 4. To change between the parameters, use keys 1 and 3.

7.8 Password Setup

A valid password is composed by 4 number, that will than become the standard password for the equipment.

The keys 1 e 3, set the arrow heard underwriting on each one of the 4 password position. The 1 and 3 keys increase or decrease the numerical value of the chosen position. Once you reach this screen, it is just possible to leave it after the password be choose. Please follow the sequence below for a complete understanding of the password setup process.

Press ESC key up to activate the **SETUP MENU** screen:

Setup Menu :	[250]
Power Setup	
Frequency Setup	
Image Frequency Suppression	↓

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	
Time and Date Setup	↓

-> Password Setup	
Transmitter Setup	↑

Access to the **Password Setup**

Password Setup:	[1800]
-> Enable / choose new password	
Disable password	

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

New Password:	[1810]
0 0 0 0	
Write new password	

8. Remote system supervision (Tele-supervision)

All the parameters associated with the transmitter such us:

RF Power Level
Power Supply voltage readings
Alarms, and
Other functional parameters

Can be monitored on two possible ways:

- Via Front Panel – Local access via LCD screen and keypad, as shown on this section, it is possible configure, change functions and monitor performances.

- Using a PC local or remote access via Ethernet.

8.1 IP Configuration

Start from the Main Menu

Main Menu :	[0000]
Setup Menu	↓
Measurements	
System Alarms/Log	

-> Remote Access	↑
------------------	---

Select **Remote Access** and press ENTER

Remote Access:	[3000]
-> IP Address	
Subnetwork Mask	
Gateway	

Select **IP Address** and press ENTER.

IP Address:	[4100]
192.168.100.018	

Configure the IP using the keys 1 or 3 and 2 or 4.

8.2 Mask Configuration

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

Remote Access:	[3000]
IP Address	
-> Subnetwork Mask	
Gateway	

Select **Subnetwork Mask** and press ENTER

Subnetwork Mask:	[4200]
192.168.100.018	

Configure the Mask using the keys 1 or 3 and 2 or 4.

8.3 Gateway Configuration

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

```
Remote Access:                [3000]
  IP Address
  Subnetwork Mask
  -> Gateway
```

Access **Gateway** and press ENTER

```
Gateway:                       [4300]
      192.168.100.018
```

Configure the gateway address using 1 or 3 and 2 or 4.

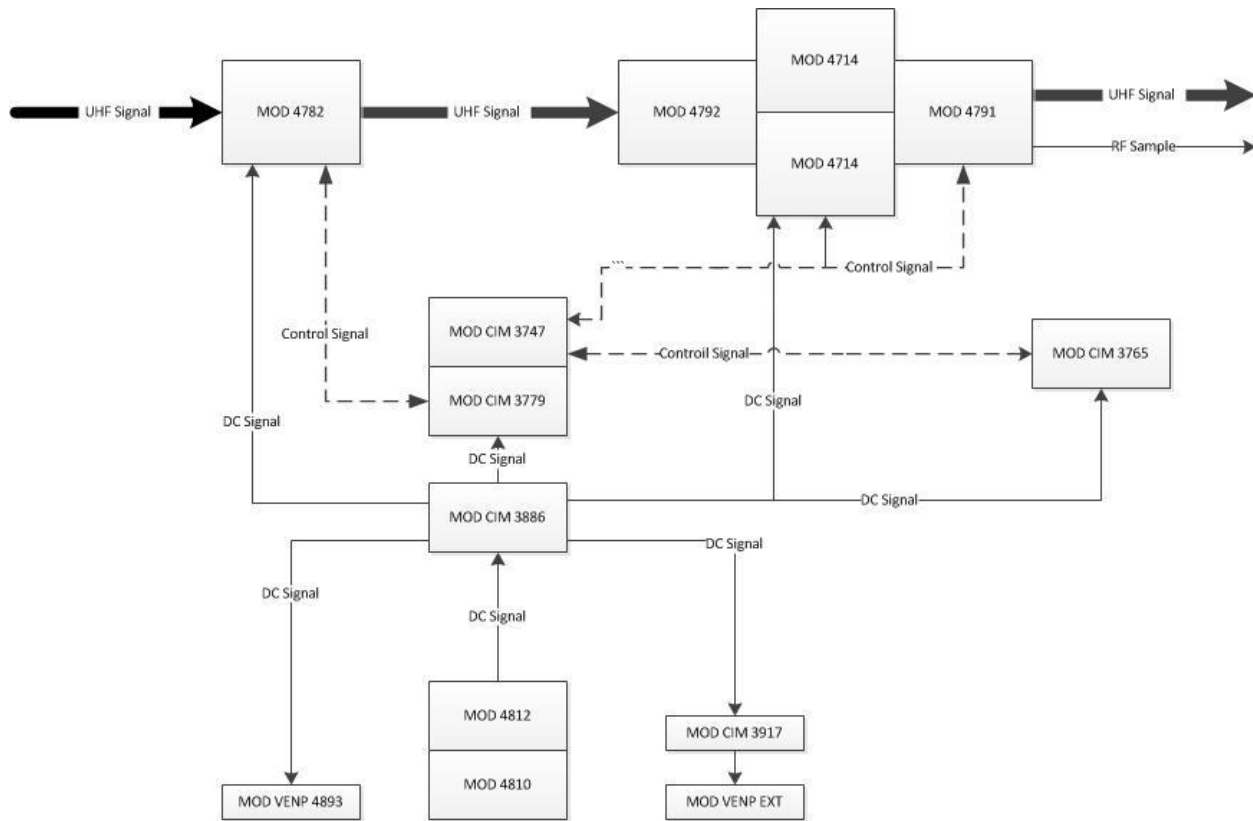
300W UHF ATSC Power Amplifier Drawer Model GV4790

Functional Description



The drawer GV 4790 is a UHF broadband power amplifier unit, air-cooled, designed to provide up to 300 Wrms ATSC.

Below is the block diagram of the drawer.



MOD 4782: RF Driver, +24Vdc.

The RF Driver is a UHF broadband amplifier. (See the technical specs below). It is assembled in an aluminum basis that is silver finishing and firmly attached to the air cooled heat sink. The RF driver printed circuit board and the mechanical base of the transistors are welded on the same aluminum base plate. This arrangement insures the excellent heat transfer performance and RF grounding at the same time.

The set of assembled components constitutes the kit CIM 3754. This set is composed by 2 stages of amplifiers on the UHF band. The first stage is composed by two transistors named PD57006, connect on quadrature topology. The second stage is also composed by two transistors named MRFE6S9060N also connected in quadrature.

This module has built in a circuit for reading the temperature. The reading is sent to the control circuitry via software.

MOD 4782 - Technical specifications:

Parameter	Specification
Input Impedance	50 Ohms
Frequency Range	470 to 806 MHz
Input Connector	SMA-F
Input Return Loss	>20dB
Gain	24dB to 30dB
Phase	70° to 120° at 570MHz
Output Power	Up to 50W (ATSC)
Output Impedance	50 Ohms
Output Return Loss	>20dB
Output Connector	SMA-F
Power Supply	+24V

MOD 4792: UHF divider 1:2

This module is a broadband passive design. No adjustment is required. Its divide equally the incoming RF signal in 2.

MOD 4714: RF Amplifier, +50Vdc, main device MRF6VP3450H.

This module has the final stage of solid stage RF amplifier is set under the push-pull circuit topology. At its RF output it is able to delivery up to 170Wrms ATSC. It is a single stage, and the main solid state device is the transistor named MRF6VP3450H.

This module has a highly linear RF transfer characteristic. The module has 2 sets of assembled components, the kit named CIM 3753 and the polarization circuitry kit named CIP 8592, and the CIM 3759 and CIP 8619 for also polarization and for temperature readings.

MOD 4714 Technical specifications:

Parameter	Specification
Input Impedance	50 Ohms
Frequency Range	470 to 806 MHz
Input Return Loss	2 to 4dB (push pull)
Gain	19dB to 20dB
Phase	29° at 570MHz
Output Power	Up to 170W (ATSC)
Output Impedance	50 Ohms
Power Supply	+50V

MOD 4791: 2:1 UHF Combiner

The UHF 2:1 combiner is a module operates over the all UHF band from 470 to 806 MHz, without adjustments.

Moreover, it has an internal low pass filter mainly designed to reduce the 3rd harmonic components generated by the amplification chain. It also has a power level detector circuit, reading the values of direct (FWD) and reverse power (REF).

A directional coupler built in on the same hardware structure It also has a directional coupler circuit responsible for providing a sample of the signal after the amplification before the output mask filter. The RF signal out from this sample is intended to be used as a RF sample for the non-linear pre-correction system.

MOD 4812: DC/DC 2kW Power Supply

The 4812 module is a DC / DC converter with +370 Vdc input and +50Vdc output. Its function is to lower the voltage delivered by the AC / DC converter with PFC (Phase Correction Factor) and perform insulation.

The circuit topology chosen for this circuitry is the topology named full-bridge, with synchronism performed on the secondary, set up with 4 powers MOSFET's on the primary of the transformer. The control circuit is assemble on a separate printed circuit board named; CIP 8696. This printed circuit board has a TPO that is used to precisely adjust the nominal voltage of the power supply.

The complete module 4812 is composed by the following boards:

- Power PCB (DC/DC): CIM 3918 and CIP 8708.
- Control PCB: (DC/DC): CIM 3855 and CIP8696.

MOD 4812 - Technical Specifications:

Parameter	Specification
Input Voltage	370Vdc
Switching Frequency	27KHz
Nominal Output Voltage	50Vdc
Nominal Power	3kW
Max Current	60A

MOD 4810: 2kW PFC Power Supply

The 4810 module is an AC / DC converter having power factor correction (PFC) with input of 180VAC to 240VAC and 370VDC output referenced to AC mains ground (not isolated).

The configuration used by this converter topology is named Boost Regulator. This configuration uses one MOSFET, one diode, one coil operation under a 100 KHz switching frequency.

This circuit also includes an in rush starting section composed by one relay and thermistors, the function of this circuit is to reduce the start rush current. The in rush circuit control is assemble in a separate printed circuit board, CIP 8673.

The module consists of the following boards:

- Power Plate (PFC): CIM 3869 and CIP 8709
- Control Board (PFC): CIM 3825 and CIP 8673

MOD 4810 Technical Specifications:

Parameter	Specification
Input Voltage	180Vac to 240Vac
Switching Frequency	100 KHz
Nominal Output Voltage	370 Vdc
Nominal Power	2kW
Max Current	5.5A

MOD CIM 3747 and MOD CIM 3779: Control Board and Inter-connections Board

The main digital control unit board is named CIP 8609. This board digitally manages the control functions of the drawer GV 4790. When used as a Digital-On-Channel-Repeater (Gap-filler) or as a simple repeater, the GV 4790 will be programmed via the RS485 protocol between the control-exciter unit and the drawer itself. The end user can produce set of configurations (program) into the drawer also using the USB port connected to a PC with Hyperterminal.

The modules that execute the digital controls are;

MOD CIM 3779: dedicated to connections

MOD CIM 3747: the control itself.

Together they perform the following functions:

- a. Communication with the external control unit module via RS-485.
- b. Hyper-terminal measurements and configurations via USB port.
- c. Digital and Analog measurements readings.
- d. Adjustments for the idle currents over the RF power transistors.
- e. Automatic stabilization of the idle currents on the RF power transistors.
- f. Automatic fan speed control.
- g. Checking alarms.

Technical Specifications:

Parameter	Specification
Supply Voltage	+15V
Consumption	60mA
Analog Inputs	22
Digital Outputs	24
Analog Outputs	0
Digital Inputs	6

MOD CIM 3765: Interface USB

The USB interface board is located on the rear panel of the drawer. It is a USB connection between the control board digital power drawer and a computer. On this board is also mounted bi-color LED signaling drawer power.

The front panel LED lights orange during the activation cycle of the power drawer. If no alarms signal were detected this same LED turns lights green. If otherwise, and some alarms signal is present, it starts to blinking in red.

CIM 3886 MOD: +24V Power Supply and V & I readings

The module 3886 is a circuit CIM which has functions of performing readings of current, voltage. It converts the voltage of +50 V to +24 VDC and also filter the +50 V that is used to power the fans, this +50V DC line is fuse protected.

The conversion from +50V to +24V uses an independent circuit (MOD CIM 3906) using the buck regulator topology. This circuit uses 2 power MOSFETs and one coils, operating at the 125kHz switching frequency.

This board also has the function of protecting the DC / DC converter (MOD 4812) in case of an over-current event. This protection is performed by voltage comparison. When one branch of the sensor network suffers a increase of the current value, the circuit turn its stage and the proction acts immediately.

The MOD CIM 3886 is composed of the following boards:

- Card readings: CIM 3869 and CIP 8722
- Board DC / DC converter: CIM 3906 and CIP 8680

MOD 3886 - Technical Specifications:

Parameter	Specification
Supply Voltage	+50V
Switching Frequency	125kHz
Nominal Output Voltage	+50Vdc and +24Vdc

MOD CIM 3917: Power Supply for the auxiliary bank of fans

This module is a DC / DC converter of +50 Vdc to +24 Vdc, which feeds the bank of auxiliary fans of the drawer GV 4790. It can provide up to 3A. Furthermore, has a PWM circuit that regulates the output voltage at seven different steps, resulting in seven operations speeds available for the bank of fans. This PWM circuit is controlled by software that monitors the junction temperature of the transistor and chooses the best rotation of the fan at that temperature.

MOD VENP 4893: Front side bank of fans.

This module is the bank of fans located on the front side of the drawer. It is comprised of four fans 120mm x 120mm/+24 V, which operate in seven different speeds, depending on the junction temperature of the transistor.

MOD VENP EXT GV 4790: Auxiliary Bank of Fans.

Bank of fans helping fans composed of 2 x (80mm x 80mm)/ +24 V, operating in 7 different speeds, depending on the junction temperature of the transistor.

Cooling System

The transmitter refrigeration is obtained by forced air ventilation via fans located inside the drawer GV 4790. The cooling system promotes circulation of air inside thereof.

The front and back panels with ventilation holes also aid in refrigerating the transmitter, allowing direct exit of air from the device to the environment.