

**INSTRUCTION MANUALS**

An outline of the preliminary VHF high power booster radio system manual is included in this package (in draft form). Final manuals will be sent to the commission and/or telecommunication certification body (TCB) as soon as they become available. All of the descriptions and schematics in this filing are up to date and will be included in the instruction and/or service manuals.

**TUNE-UP PROCEDURE**

There is no field tune-up procedure. All adjustments are software controlled and are pre-set at the factory. Certain station operating parameters can be changed via radio service software (RSS) within predetermined limits. Examples include transmitter operating frequencies and power level.



**MOTOROLA**

Commercial Government and  
Industrial Solutions Sector

**QUANTAR**™

# Digital-Capable Station with High Power Booster

For Conventional and *ASTRO* Systems

VHF Range 2  
350 W Continuous Duty

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## MODEL AND OPTION SELECTION PROCEDURE (INCLUDES MODEL/OPTION COMPLEMENTS)

The following equipment ordering scenario is used by the sales representative to equip a *Quantar* station with the proper hardware and firmware for specific system types and customer-defined options and features. The scenario is described here to explain the process and to show the structure and contents of the various options and models.

**1**

The sales model is T5365A (as translated from C99ED/001C).

**NOTE:** *The Sales Model includes only a TRN7795A Base Station Nameplate. Equipping the station with the proper modules is accomplished by ordering additional options, as described in the following steps.*

**2**

A System Family Option must be selected as follows:

System Type	Family Option	VHF
Conventional Analog	X597	✓
Conventional <i>ASTRO</i> VSELP	X599	✓
Conventional <i>ASTRO</i> CAI	X806	✓

**3**

The External Power Booster Option must be ordered as follows:

External Power Booster	Option
Add 350W External Power Booster	CA00052

*(Continued)*

**4**

The Station Frequency/Power Option must be ordered as follows:

### VHF

Output Power	25W
Frequency Range	
VHF High Band Range 2 (150–174 MHz)	Option X330AA

**5**

A cabinet or open rack option must be ordered as follows:

Option	Description
<b>Cabinets</b>	
X308AG	46" Cabinet
X180AG	60" Cabinet
X36AF	70" Outdoor Cabinet
<b>Standard Open Racks</b>	
X832AF	7' Standard Open Rack
X882AF	7½' Standard Open Rack
X810AH	8' Standard Open Rack
<b>Modular Racks</b>	
X741AH	30" Modular Rack
X742AG	45" Modular Rack
X743AG	52" Modular Rack

**6**

If no other options are selected, Motorola's Order Processing appends the appropriate standard options (based on power and frequency band) to complete the station equipment list. The table on the next page shows the completed equipment lists for the available options. If additional options are desired, they must be added to the initial order form. Step 7 lists the available options and the impact each has on the standard equipment configuration.

**(Continued)**

# VHF

## Quantar Station with High Power Booster (VHF Range 2; 350W Transmitter) (X308 46" Cabinet Selected in Step 5)

Source	Option/ Kit	Description
Option from Initial Sales Order	<b>X597AA</b>	<b>Conventional System Family Option</b>
	<b>CA00052AB</b> CLD1291A CLN7516A CPN6087A	<b>Add External Power Amplifier Booster</b> High Power Booster PA Deck (VHF R2) Quantar Station w/High Power Booster Hardware High Power Booster Dual Power Supply Chassis
	<b>X330AA</b> TLD3110B TKN8699A TRN7480A TRN7708A CHN6100A	<b>VHF High Band Ranges 1 &amp; 2; 25W Transmitter</b> 25 W Power Amplifier Module (VHF R1 & R2) PA-to-Exciter RF Cable Station Interconnect Board (Backplane) PA Module Front Panel Anti-Vibration/EFI Screws (2)
	<b>X308AG</b> THN6691A CLN7516A TTN5040B	<b>46" Cabinet</b> 46" Cabinet Hardware Grommet Kit
Options/Kits Internally Added by Motorola Order Processing	<b>X131AB</b> CLD1280A CHN6100A	<b>Exciter Module (VHF High-Band Range 2)</b> Exciter Module (Board and Hardware) Anti-Vibration/EFI Screws (2)
	<b>X333AB</b> CLD1260A CLN7334A TRN7799A CHN6100A	<b>Receiver Module (VHF High-Band Range 2)</b> Receiver Module (Board, Preselector, Hardware) Receiver Module Front Panel VHF/UHF Tuning Kit Anti-Vibration/EFI Screws (2)
	<b>X43AV</b> CPN1049C CPN1070A CLN7261A CLN7618A CPN6086A TRN7998A CHN6100A	<b>Booster Dual Power Supply Option (w/o Batt Chrgr)</b> 265W Power Supply (AC input; w/o battery charger) 625W Power Supply (AC input; w/o batt chrg); Qty 2 Ferrite RFI Suppressor Dual Power Supply Chassis Hardware Front Panel, Dummy Charger Connector AC Adapter Hardware Anti-Vibration/EFI Screws (2)
	<b>X621AY</b> CLN1614A TRN7476A TKN8751A	<b>Station Control Module (SCM); Standard EPIC III</b> Station Control Module SCM Internal Speaker Internal Speaker Cable
	<b>X222AB</b> CGN6157A CHN6100A	<b>Front Panel (Station Control Module)</b> Station Control Module Front Panel Anti-Vibration/EFI Screws (2)
	<b>X216AA</b> CLN6955A TKN8731A CLN6816A	<b>Wireline Interface Module (WIM) (4-wire)</b> Wireline Interface Board WIM Cable RFI Suppressor
	<b>C831AA</b> TRN7479A	<b>Card Cage</b> Card Cage Assembly (12")
	<b>X142AA</b> TRN7494A	<b>Duplex Interface Assembly</b> Duplex Interface (includes ant. connector bracket)
	<b>X249DD</b> TKN8753A TKN9151A CKN6456A	<b>RF Cabling (High Power Booster)</b> Receiver mini-UHF to N-type coax cable (need detailed description of this cable) (need detailed description of this cable)
	<b>X187AA</b> TRN7663A	<b>Domestic Power Cable</b> AC Line Cord
	<b>X163AD</b> TRN7696A CHN6100A	<b>Blank Panels</b> Dual Slot Wide Blank Panel Anti-Vibration/EFI Screws (2)
	<b>X842AB</b> CLN6885A	<b>Ethernet Termination Kit</b> Ethernet Termination Hardware
	<b>X362AD</b> TBN6626A	<b>Packing</b> (no cabinet) Packing for 46" Cabinet
	<b>X436BA</b> 68P80801D55	<b>Instruction Manual</b> Quantar Station with Hi-Pwr Booster Functional Manual

(Continued)

# 7

The following lists available options that may be selected in addition to the standard model and options (described in Steps 1 thru 6).

## AVAILABLE HARDWARE OPTIONS FOR QUANTAR STATION with HIGH POWER BOOSTER

Option Category	Option and Complement
<b>Power Supply</b>	<p align="center"><b>AC Input Supplies</b></p> <p><b>X30BM    Booster Dual Power Supply Option (with Batt Chrgr)</b>            CPN1050D 265W Power Supply (AC input; w/ battery charger)            CPN1071A 625W Power Supply (AC input; w/ batt chrg); Qty 2            CLN7261A Ferrite RFI Suppressor            CLN7619A Dual Power Supply Chassis Hardware            CPN6086A Front Panel, Dummy Charger Connector            CLN7499A Battery Control Board            TKN8786A Battery Temperature Sensor            TRN5155A 10' Extension Cable w/connectors and fuse block            CHN6100A Anti-Vibration/EFI Screws (2)</p>
<b>Wireline Interface Module</b>	<p><b>X84AA    Omit Standard Wireline Interface Module (WIM)</b></p> <p><b>X144AA    Add 8-Wire Wireline Interface Module (WIM)</b>            CLN6956A 8-Wire Wireline Interface Board (WIB)            TKN8731A WIM Cable Kit            CLN6816A RFI Suppressor</p>
<b>Antenna Relay</b>	<p><b>X371AA    Add Antenna Relay</b>            TRN7664A Antenna Relay, Cables, and Mounting Hardware</p>
<b>Modem</b>	<p><b>X437AA    Add ASTRO Modem</b>            TRN7668A ASTRO Modem Card</p>
<b>Circulator</b>	<p><b>X676AB    Add Triple Circulator (UHF, R1 and R2)</b>            TLE9120A Dual Circulator            TLN3391A 50 Ohm Load with Heat Sink            TLE9140A Low Pass Filter            TRN7796A Fan, Peripheral Tray</p>
<b>Low Pass Filter</b>	<p><b>X154AA    Add Triple Circulator (UHF, R1 and R2)</b>            TLE9120A Dual Circulator            TLN3391A 50 Ohm Load with Heat Sink            TLE9140A Low Pass Filter            TRN7796A Fan, Peripheral Tray</p>
<b>UHSO</b>	<p><b>X873AA    Add Internal Ultra High Stability Oscillator</b>            CLN7012A BNC Terminator            CHN6100A Anti-Vibration/EFI Screws (2)            CLN1477A UHSO Module            TTN5070C UHSO Board            TTN5071A UHSO Housing and Front Panel            TTN5072A UHSO 5 PPB Ovenized Element</p>
<b>Peripheral Tray</b>	<p><b>X696AA    Add Peripheral Tray</b>            TRN7751A Quantar Peripheral Shelf</p>
<b>Miscellaneous</b>	<p>HSN1000 External Speaker            TRN7738A External Speaker Hardware (bracket and cable)</p> <p>HMN1001A Microphone</p> <p><i>Note that the external speaker and microphone are not options and must be ordered as line items on the STIC-1 order form.</i></p>

**Need help with the Circulator and Low Pass Filter!!! Gonna talk to Mike V. while he's up here.**



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# FOREWORD

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## Product Maintenance Philosophy

Due to the high percentage of surface-mount components and multi-layer circuit boards, the maintenance philosophy for this product is one of Field Replaceable Unit (FRU) substitution. The station is comprised of self-contained modules (FRUs) which, when determined to be faulty, may be quickly and easily replaced with a known good module to bring the equipment back to normal operation. The faulty module must then be shipped to the Motorola System Support Center for further troubleshooting and repair to the component level.

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## Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. In keeping with the maintenance philosophy of Field Replaceable Units (FRU), this manual contains functional information sufficient to give service personnel an operational understanding of all FRU modules, allowing faulty FRU modules to be identified and replaced with known good FRU replacements.

The information in this manual is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMRs are added to the manuals as the engineering changes are incorporated into the equipment.

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## Service and Replacement Modules

*Motorola System Support Center  
1311 E. Algonquin Road  
Schaumburg, IL 60196*

*1-800-221-7144  
Int'l 1-847-576-7300  
FAX 1-847-576-2172*

For complete information on ordering FRU replacement modules, or instructions on how to return faulty modules for repair, contact the System Support Center (see sidebar).

The following FRU replacement modules are available:

### **Receiver Modules**

Receiver Module (VHF Range 2) . . . . . TLN3251A

### **Exciter Modules**

Exciter Module (VHF Range 2) . . . . . TLN3253A

### **Power Amplifier Modules**

Power Amplifier Module (VHF 25W, R1 & R2) . . . . . TLN3255A

High Power Booster PA Deck (VHF 350W, R2) . . . . . DLN1108A

### **Station Control Modules**

Station Control Module (Conventional/6809 EPIC III) CLN1621A

### **Wireline Interface Modules**

4-Wire Wireline Interface Module . . . . . CLN1295A

8-Wire Wireline Interface Module . . . . . CLN1296A

### **Power Supply Modules**

Power Supply Module (265W AC w/o Charger) . . . . . TLN3261A

Power Supply Module (265W AC w/Charger) . . . . . TLN3262A

Power Supply Module (600W AC w/o Charger; HPB) DLN1109A

Power Supply Module (600W AC w/Charger; HPB) . DLN1110A

### **Miscellaneous**

High Power Booster PA Deck Front Panel . . . . . DLN?????

Battery Control Board . . . . . DLN1111A

ASTRO Modem Card . . . . . TLN3265A

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# GENERAL SAFETY INFORMATION

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. The safety precautions listed below represent warnings of certain dangers of which we are aware. You should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

## General Safety Precautions

- ▶ Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing or operating the equipment. Retain these safety instructions for future reference. Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgement must be used by personnel.
- ▶ Refer to appropriate section of the product service manual for additional pertinent safety information.
- ▶ Because of danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.
- ▶ Identify maintenance actions that require two people to perform the repair. Two people are required when:
  - A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.  
**Note** Use the National Institute of Occupational Safety and Health (NIOSH) lifting equation to determine whether a one or two person lift is required when a system component must be removed and replaced in its rack.
- ▶ If troubleshooting the equipment while power is applied, be aware of the live circuits.
- ▶ DO NOT operate the transmitter of any radio unless all RF connectors are secure and all connectors are properly terminated.
- ▶ All equipment must be properly grounded in accordance with Motorola Standards and Guideline for Communications Sites “R56” 68P81089E50 and specified installation instructions for safe operation.
- ▶ Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these slots and openings must not be blocked or covered.
- ▶ Only a qualified technician familiar with similar electronic equipment should service equipment.
- ▶ Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.

## Human Exposure Compliance

This equipment is designed to generate and radiate radio frequency (RF) energy by means of an external antenna. When terminated into a non-radiating RF load, the base station equipment is certified to comply with Federal Communications Commission (FCC) regulations pertaining to human exposure to RF radiation in accordance with the FCC Rules Part 1 section 1.1310 as published in title 47 code of federal regulations and procedures established in TIA/EIA TSB92, Report On EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines. Compliance to FCC regulations of the final installation should be assessed and take into account site specific characteristics

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such as type and location of antennas, as well as site accessibility of occupational personnel (controlled environment) and the general public (uncontrolled environment). This equipment should only be installed and maintained by trained technicians. Licensees of the FCC using this equipment are responsible for insuring that its installation and operation comply with FCC regulations Part 1 section 1.1310 as published in title 47 code of federal regulations.

Whether a given installation meets FCC limits for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the “environments” being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly, the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee’s equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

FCC OET Bulletin 65 provides materials to assist in making determinations if a given facility is compliant with the human exposure to RF radiation limits. Determining the compliance of transmitter sites of various complexities may be accomplished by means of computational methods. For more complex sites direct measurement of the power density may be more expedient. Additional information on the topic of electromagnetic exposure is contained in the Motorola Standards and Guideline for Communications Sites publication. Persons responsible for installation of this equipment are urged to consult the listed reference material to assist in determining whether a given installation complies with the applicable limits.

In general the following guidelines should be observed when working in or around radio transmitter sites:

- ▶ All personnel should have electromagnetic energy awareness training
- ▶ All personnel entering the site must be authorized
- ▶ Obey all posted signs
- ▶ Assume all antennas are active
- ▶ Before working on antennas, notify owners and disable appropriate transmitters
- ▶ Maintain minimum 3 feet clearance from all antennas
- ▶ Do not stop in front of antennas
- ▶ Use personal RF monitors while working near antennas
- ▶ Never operate transmitters without shields during normal operation
- ▶ Do not operate base station antennas in equipment rooms

For installations outside of the U.S., consult with the applicable governing body and standards for RF energy human exposure requirements and take the necessary steps for compliance with local regulations.

## References

TIA/EIA TSB92 “Report On EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines,” Global Engineering Documents: <http://global.ihs.com/>

FCC OET Bulletin 65 “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”: <http://www.fcc.gov/oet/rfsafety/>.

Motorola Standards and Guideline for Communications Sites, Motorola manual 68P81089E50.

IEEE Recommended Practice for the Measure of Potentially Hazardous Electromagnetic Fields – RF and Microwave, IEEE Std C95.3–1991, Publication Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855–1331

IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, IEEE C95.1 – 1991, Publication Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855–1331.

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# PERFORMANCE SPECIFICATIONS

## **General**

TX Sub-Band Range	<b>VHF</b> 150–174 MHz (R2)
RX Sub-Band Range	<b>VHF</b> 150–174 MHz (R2)
Number of Channels	16
Channel Spacing	VHF: 30, 25, 12.5 kHz
Frequency Generation	Synthesized
Power Supply Type	Switching
Power Supply Input Voltage	90–280 V ac
Power Supply Input Frequency	47–63 Hz
Battery Revert	12 V
T/R Separation (with duplexer option)	VHF: $\geq 1.5$ MHz
Temperature Range (ambient)	–30° C to +60° C

## PERFORMANCE SPECIFICATIONS (Cont'd)

### Receiver

I-F Frequencies	<b>VHF</b> 21.45 MHz (1st) 450 kHz (2nd)
Preselector Bandwidth	VHF/UHF: 4 MHz
Sensitivity (12 dB SINAD)	VHF: 0.25 $\mu$ V
Sensitivity (20 dB Quieting)	VHF: 0.35 $\mu$ V
Adjacent Channel Rejection	<b>VHF</b> 90 dB (25/30 kHz) 80 dB (23.5 kHz)
Intermodulation Rejection	<b>VHF</b> 85 dB (25/30 kHz) 80 dB (30 kHz)
Spurious and Image Rejection	100 dB
Wireline Output	-20 dBm to 0 dBm @ 60% Rated System Deviation, 1 kHz
Audio Response (Analog Mode)	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line input
Audio Distortion	Less than 3% @ 1000 Hz
FM Hum and Noise (300 to 3000 kHz bandwidth)	<b>VHF</b> 50 dB (25/30 kHz) 45 dB (12.5 kHz)
Frequency Stability	1 ppm
RF Input Impedance	50 $\Omega$
FCC Designation (FCC Rule Part 15)	VHF: ABZ89FR3776

# PERFORMANCE SPECIFICATIONS (Cont'd)

## ***Transmitter***

***(Station Level, includes both Power Amplifiers)***

Power Output	<b>VHF</b> 175–350 W
Electronic Bandwidth	Full sub–band
Intermodulation Attenuation	<b>VHF:</b> 20 dB (single circulator; standard on all PAs) 65 dB (triple circulator – requires triple circulator option)
Spurious and Harmonic Emissions Attenuation	90 dB
Deviation	<b>VHF,</b> ±5 kHz (25 kHz) ±2.5 kHz (12.5 kHz)
Audio Sensitivity	–35 dBm to 0 dBm (variable)
Audio Response (Analog Mode)	+1, –3 dB from 6 dB per octave pre–emphasis; 300–3000 Hz referenced to 1000 Hz at line input
Audio Distortion	Less than 2% @ 1000 Hz @ 60% rated system deviation
FM Hum and Noise (300 to 3000 Hz bandwidth)	45 dB nominal (12.5 kHz) 50 dB nominal (25/30 kHz)
Frequency Stability	1 ppm
RF Output Impedance	50 Ω
FCC Designation (FCC Rule Parts 22, 74, 80, 90)	<b>VHF</b> 25W Internal PA: ABZ89FC3774 350W High Power PA Deck: ABZ89FC3788

*Measurement Methods per TIA/EIA–603  
Specifications subject to change without notice*

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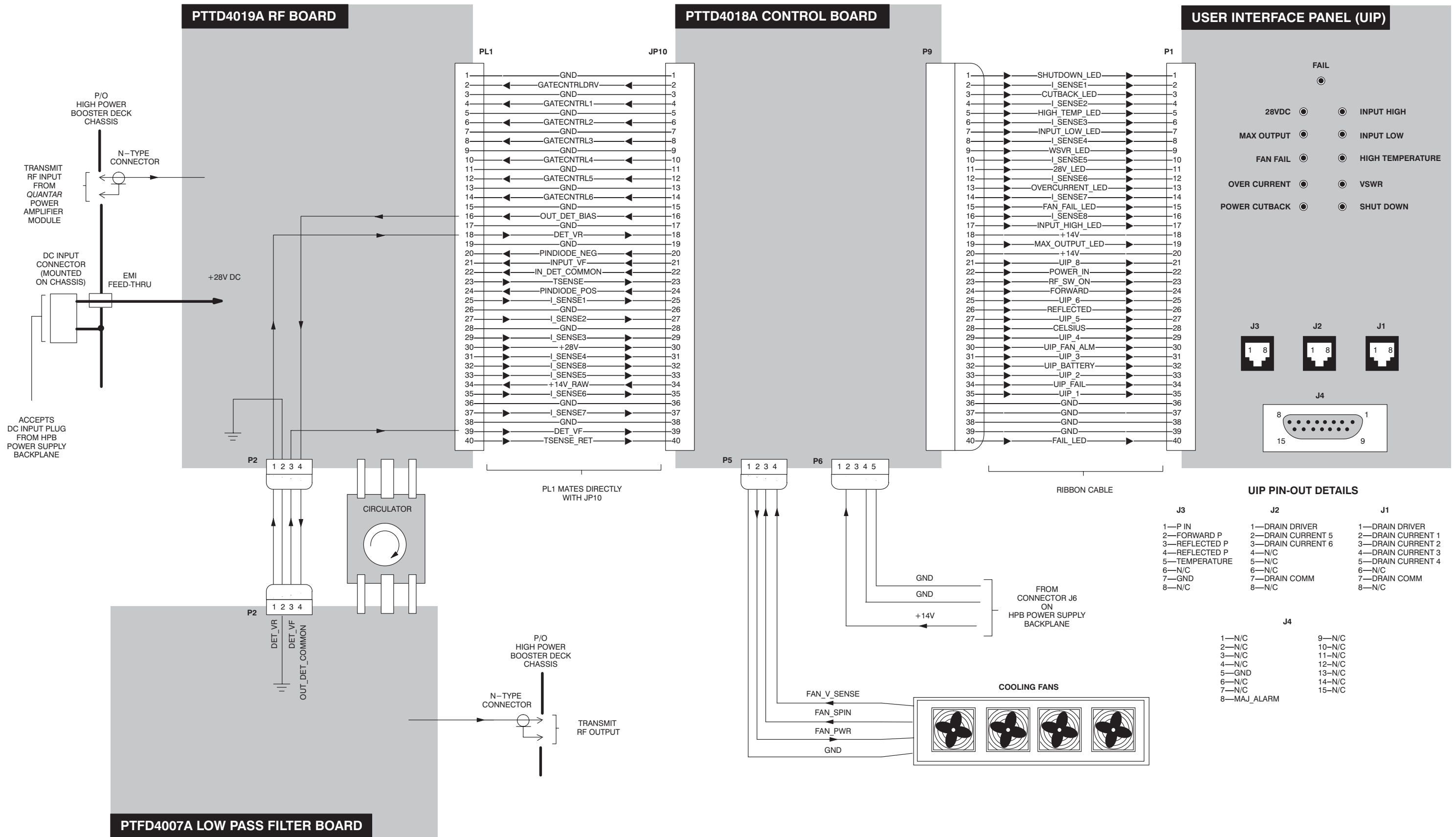


Figure 1. CLD1291A High Power Booster Deck Interconnect Diagram