GL-T8311,
GL-T8321,
GL-T8331,
GL-T8411,
GL-T8521,
GL-T8531,
and
GL-T8611 Transmitters

USER MANUAL

PN 9110.00166 **(old pn = 916-8B21-001)**

REV K

Specifications subject to change without notice

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Date: 8/30/99
Changes: added RF output measurement at output of PA or circulator in specifications

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1 GENERAL

1.1 Manual Scope

This manual provides information for the following transmitters:

- 325-watt, 280-MHz transmitter, model GL-T8521
- 325-watt, 320-MHz transmitter, model GL-T8531
- 125-watt, 280-MHz transmitter, model GL-T8321
- 125-watt, 320-MHz transmitter, model GL-T8331
- 450-watt, 150-MHz transmitter, model GL-T8611
- 225-watt, 150-MHz transmitter, model GL-T8411
- 125-watt, 150-MHz transmitter, model GL-T8311.

1.2 Applicable Documents

This manual is incomplete without additional manuals. See *Table 1-1, Applicable Documents*, for a listing and function of these manuals.

Table 1-1 Applicable Documents

Document	Part number	Note
GL-T8xx1 Transmitter System Manual	9110.00166	this manual
Assembled GL-T8411 manual	9100.00738	can provide a complete set of manuals for a transmitter
Assembled GL-T8611 manual	9100.00739	can provide a complete set of manuals for a transmitter
DSP VDT Manual	9110.00259	describes dSP exciter software installed in exciter
DSP exciter User Manual	9110.00172	describes DSP exciter hardware equipment in transmitter
GL-C2000 User Manual	9110.01167	describes GL-C2000, v. 330, controller hardware and software
GL-T8521/8531 PA User Manual	9110.00167	describes 325-watt PA, 280 and 300 MHz
GL-T8321/8331 PA User Manual	9110.00168	describes 125-watt PA, 280 and 300 MHz
GL-T8611 PA User Manual	9110.00255	describes 450-watt, 150-MHz PA
GL-T8411 PA User Manual	9110.00256	describes 225-watt, 150-MHz PA
GL-T8311 PA User Manual	9110.00247	describes 125-watt, 150-MHz PA
Dc Breaker / Fuse Panel User Manual	9110.00258	describes the dc control panel for all dc or external supplies
GL-T8311 w/I20 Upgrade	9110.00804	describes upgrade process for C2000 controller
GL-T8411 w/I20 Upgrade	9110.00271	describes upgrade process for C2000 controller
GL-T8611 w/I20 Upgrade	9110.00803	describes upgrade process for C2000 controller
Power Supply User Manual	9110.00257	describes ferroresonant ac-to-dc power supply
Power Supply User Manual	9130.00001	describes switching ac-to-dc power supply

1.3 About Glenayre

For an updated list of Glenayre locations, refer to **`www.glenayre.com/corporate/contacts/default.asp`** .

Questions regarding Glenayre equipment or this manual should be directed to:

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U.S.A.
Glenayre Customer Service - RF
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UNITED KINGDOM
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Block 5012 Ang Mo Kio Avenue 5
TechPlace II Unit 0503
Singapore 2056
Phone: (65) 481-1828
Fax: (65) 481-2838

1.3.1 Product Warranty Information

Glenayre warrants to the original purchaser that Glenayre products are free from defects in material or workmanship for a period of twenty-four months from the original invoice date, subject to the provisions herein. Glenayre will repair or replace at its option, FOB our factory, free of charge within one year from the date of shipment, any component, assembly or subassembly of our manufacture found to be defective under conditions of normal use. The unit, if repaired, will be returned to its original specifications. Failures caused by unauthorized modifications, *force majeure*, lightning, physical, environmental, or electrical damage including use with incompatible equipment are specifically excluded from this warranty. Glenayre disclaims any and all liability for loss or other damage whether direct, consequential or of any nature whatsoever, resulting from product failure.

This warranty is in lieu of all other warranties expressed or implied and covers only those items manufactured by Glenayre. Equipment supplied by, but not manufactured by Glenayre, is subject only to any warranty offered by the manufacturer of said equipment.

1.3.2 Service Warranty Information

Return of a defective item must be authorized by Glenayre prior to shipment. A Return Authorization number can be obtained from Glenayre Customer Service. When requesting a Return Authorization number, give the serial number of the unit. A description of the fault should accompany the unit on its return and the RA number must be shown on labels attached to the item(s). The cost of shipping to Glenayre is to be paid by the customer. Shipping from Glenayre will be prepaid by the customer, and shipped via surface mail. If express shipping is required, the unit will be shipped collect.

Any repair service performed by Glenayre under this limited warranty is warranted to be free from defects in material or workmanship for ninety days from the date of repair. All other terms of this limited warranty apply to the service warranty.

2 SPECIFICATIONS

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Transmitter specifications are subject to change without notice. See *Table 2-1, Specifications*, for various transmitter specifications. Listed specifications are applicable as of the manual printing date.

Also refer to the exciter, power supply, power amplifier, and other related manuals for more specifications. Test and measurement equipment is, where possible, calibrated in accordance with standards established by the National Institute of Standards and Technology (NIST).

Table 2-1 Specifications

characteristic	condition	specification
RF Characteristics		
RF output power	tx model: frequency range GL-T8521: 275 to 329 MHz GL-T8321: 275 to 329 MHz GL-T8331: 275 to 329 MHz GL-T8611: 138.0 to 175.0 MHz GL-T8411: 138.0 to 175.0 MHz GL-T8411EC 168.0 to 175.0 MHz GL-T8311: 138.0 to 175.0 MHz power measured directly at output of PA chassis, before any devices in the antenna network	RF output in watts 100 to 325 40 to 125 40 to 125 200 to 450 100 to 225 75 to 200 20 to 125
Physical Characteristics		
Chassis dimensions overall	standard EIA cabinet	H x W x D inches : (cm) 5.25 x 19 x 16.5 : (13.3 x 48.3 x 16.5)
Weights by transmitter model	PA chassis with exciter GL-T8521 GL-T8321 GL-T8331 GL-T8611 GL-T8411 GL-T8311	 32 lb (14.5 kg) 22 lb (10.0 kg) 22 lb (10.0 kg) 37 lb (16.8 kg) 16 lb (7.3 kg) 27 lb (12.3 kg)
Service Conditions		
Elevation	continuous operation at rated power	to 10,000 ft (3050 m) (see temperature derating factor)
Temperature	operating	-30 to +60 degrees C
	storage	-40 to +70 degrees C
Temperature derating factor	above 5000 ft (1525 m)	2 degrees C per 1000 ft (305 m)
Humidity	operating, noncondensing	0 to 95 percent

Table 2-1 Specifications (continued)

characteristic	condition	specification
Voltage Requirements and Power Consumption		
Dc input voltage	all models	28 V
Ripple on dc input	up to 120 Hz over 120 Hz	1.5Vp-p max 50 mVp-p max
Tx power consumption @ 28 Vdc	GL-T8521 GL-T8321 GL-T8331 GL-T8611 GL-T8411 GL-T8411EC GL-T8311	1200 W 900 W 900 W 1500 W 1000 W 1000 W 450 W
Performance Specifications		
Spurious output by model	 GL-T8311 GL-T8411 GL-T8611 GL-T8321 GL-T8331 GL-T8521	 -90 dBc (-80 dBc above 170 MHz) -90 dBc -90 dBc -80 dBc -80 dBc -80 dBc
Harmonic output by model	 GL-T8311 GL-T8411 GL-T8611 GL-T8321 GL-T8331 GL-T8521	 -90 dBc -90 dBc -90 dBc -80 dBc -80 dBc -80 dBc
RF output stability	all models	0.5 dB over temperature range
Intermodulation of PA w/ circ.	all models	-40 dB
Adjacent ch noise 4 level FSK	all models (25 kHz spacing)	-70 dB
Alternate ch noise 4 level FSK	25 kHz spacing GL-T8311 GL-T8411 GL-T8611 GL-T8321 GL-T8331 GL-T8521	 -90 dBc -100 dBc -100 dBc -100 dBc -100 dBc -100 dBc
Frequency stability	all models	0.005 parts per million
Cabinet radiation	all models	0.25 uW (maximum)
FM hum and noise	all models	-40 dB in 15 kHz bandwidth
Keyup / keydown time	all models	10 ms to +1.5 / -1.0 dB of rated power

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3 DESCRIPTION

3.1 Conceptual Description

The purpose of the paging transmitter is to provide a modulated, high-level RF signal, which sets off pagers within the coverage area of its associated antenna. The paging transmitter receives modulation and control information from the transmitter controller, which receives information from a control site. In a simulcasting environment, the control site may feed several paging sites at once. This transmitter is a computer controlled device. All user initiated operations are accomplished using the video display terminal connected through the exciter.

3.2 Physical Description

Refer to *Figure 3-1, Transmitter Chassis Isometric Front View*, which shows a front view of the PA chassis which is used in all models in this transmitter series. It is virtually impossible to identify the transmitter from the front view; refer to *Figure 3-2, Typical PA Top Views*. Positive identification can only be done by removing the PA top cover since each transmitter has a unique PA compartment.

3.2.1 Mounting Provisions

The transmitter chassis is mounted in the rack by screws which are inserted into the angle brackets on either side of the chassis. Access to the exciter and PA compartment is gained from the front; access to the metering board, fans, and I/O connections is gained from the rear.

3.2.1.1 PA and Exciter Assemblies

The transmitter chassis contains slide-out locations for the following:

- PA RF compartment (2 RU)
- exciter (1 RU)

Rear-mounted fans blow air across the PA heat sink and out the front.

The PA compartment and exciter are mounted on slides which allow them to be accessed or removed by loosening the knurled thumb fasteners on either side of the assembly. Most exciter maintenance operations can be performed with the exciter mounted in the rack. Most PA maintenance can be performed with the transmitter chassis mounted in the rack.

3.2.1.2 Power Supply

The power supply is contained in a separate chassis which is mounted separately from the transmitter chassis. The power supply may be an ac power supply, which converts 50/60-Hz mains power to dc voltage for the transmitter, or it may be a dc-to-dc converter. Refer to the power supply manual for details.

3.2.1.3 Video Display Terminal

A video display terminal (VDT) is not necessarily part of the racked-up equipment; instead, it is a piece of test equipment which the user brings to the site when setup, maintenance, or troubleshooting is necessary; or it is used as a monitoring device. Refer to the VDT manual for details, including cable requirements.

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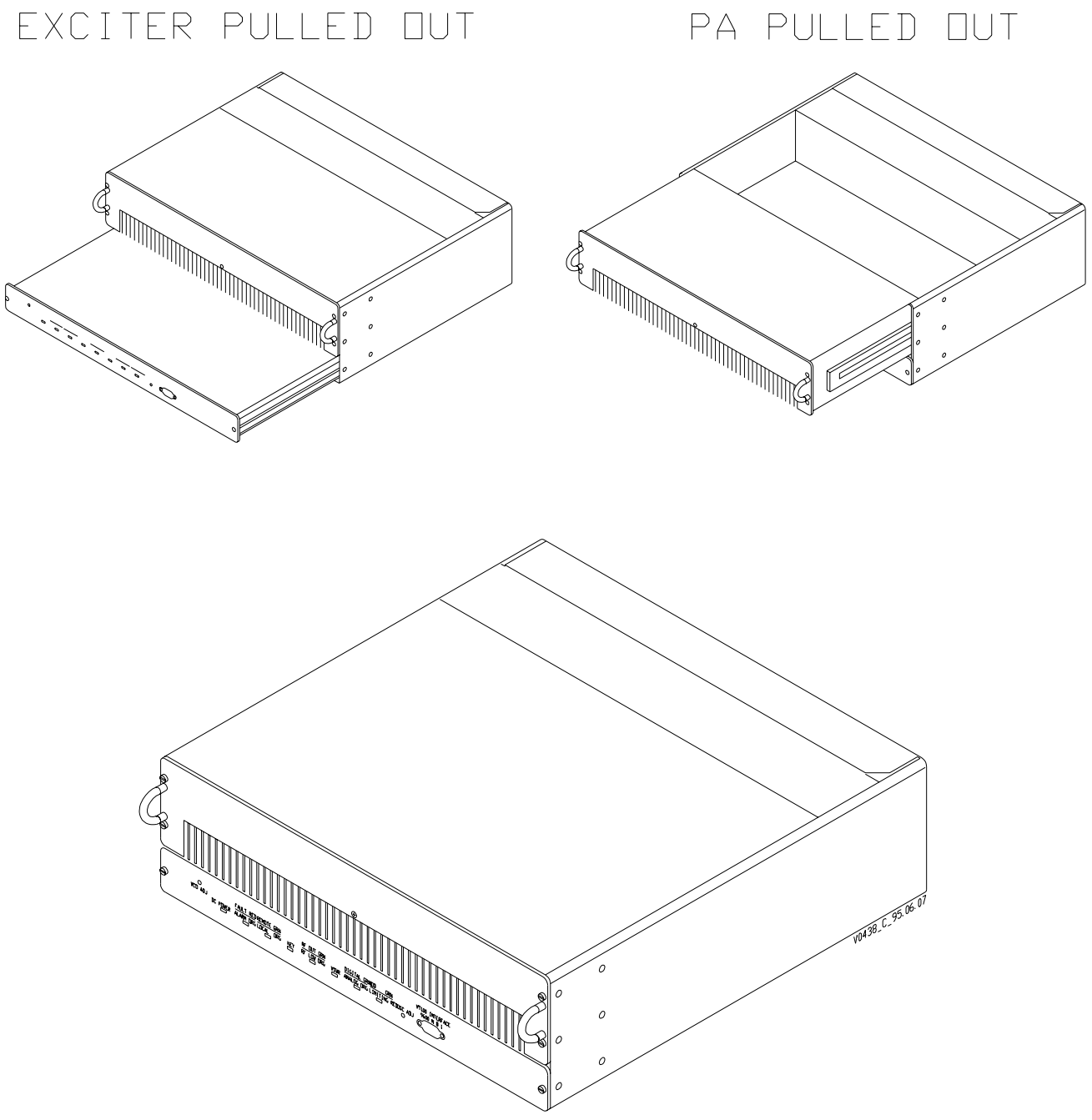

Figure 3-1 Transmitter Chassis Isometric Front View

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3.3 Simplified Paging-Site Functional Description

3.3.1 Paging Site

The following paragraphs provide a block diagram-level functional description of a typical paging site.

Refer to *Figure 3-3, Transmitter Functional Diagram*. This figure shows basic signal flows between the various paging site equipment pieces. The communications device which the transmitter uses in order to communicate with the control site is not shown and may vary from application to application.

3.3.2 Communications Equipment and Transmitter Controller

A link receiver, satellite receiver, microwave drop, telephone link, or other similar device is used for communication between the transmitter controller and the control site. The particular device depends on the application.

The transmitter controller is typically a GL-C2000 model. There are various ways of interfacing the transmitter controller to the I/O portions of the exciter. Refer to the transmitter controller manual and the exciter manual for details.

3.3.3 Paging Transmitter

The paging transmitter converts the signal from the transmitter controller into modulated and amplified RF. Depending on the type of transmitter controller-to-exciter interface which is used, the modulation information from the transmitter may be audio, modem signals (analog or digital), or a digitized representation of the original signal. In any case, all analog signals are ultimately converted to digital form at some point between the paging terminal and the DSP modulator in the exciter.

Operation is in response to commands from the transmitter controller via the DSP exciter. The transmitter monitors its functions and reports its status to the VDT via the exciter. The transmitter controller permits the transmitter to be controlled and monitored from a remote location. Local control and monitoring is performed through a VT-100 video display terminal (VDT).

3.3.3.1 DSP Exciter

The DSP exciter combines functions of an RF exciter and a PA controller. The exciter generates modulation using digital signal processing (DSP) to achieve accurate, stable modulation that does not vary with time or temperature. The PA-control section monitors transmitter status signals in the form of fault logic and voltage samples. The microprocessor in the exciter reports PA status to the transmitter controller, VDT, and the exciter front panel. If a malfunction occurs, the transmitter enters a reduced operating condition, depending on the seriousness of the fault. PA control and status monitoring are performed by the microprocessor, which consolidates control logic from the transmitter controller or the locally operated VDT. Both the exciter and transmitter controller receive continuous status reports from the microprocessor. The exciter is the control and status-monitoring interface between the transmitter and the user.

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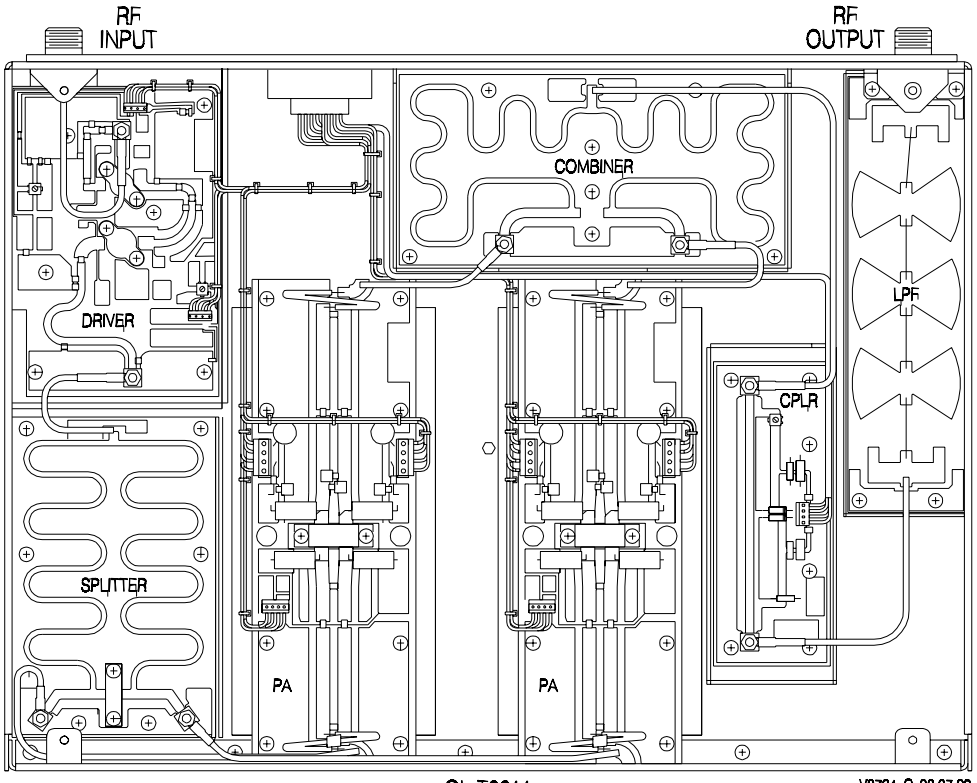
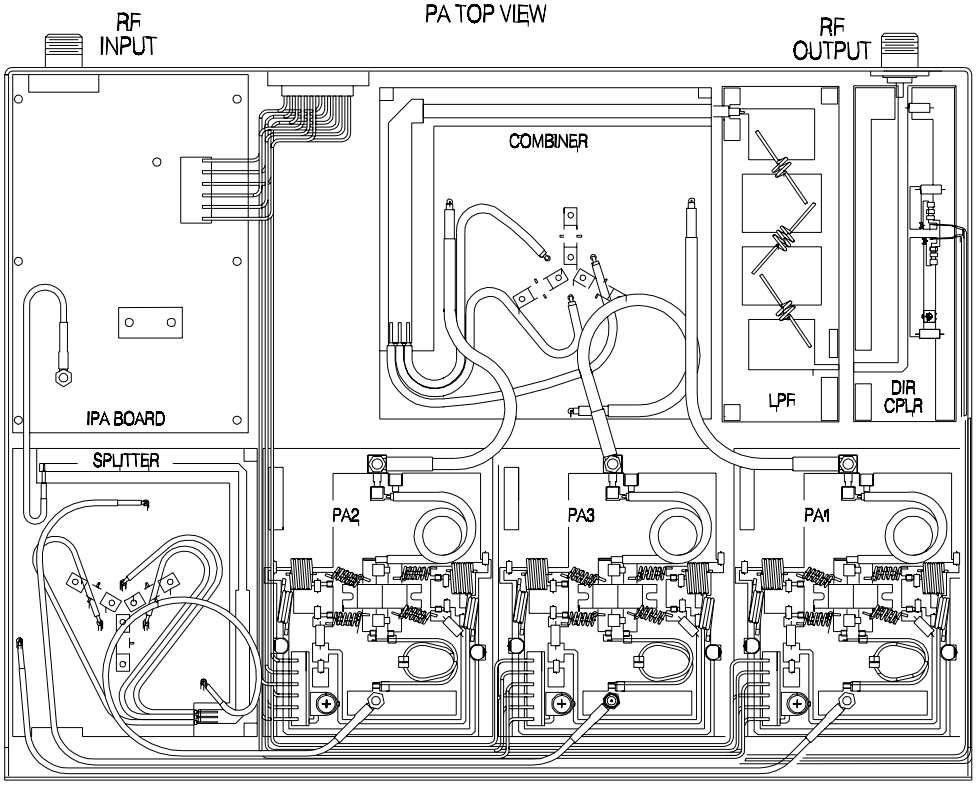


GL-T8611
PA TOP VIEW



GL-T8521/GL-T8531
PA TOP VIEW

Figure 3-2 Typical PA Top Views

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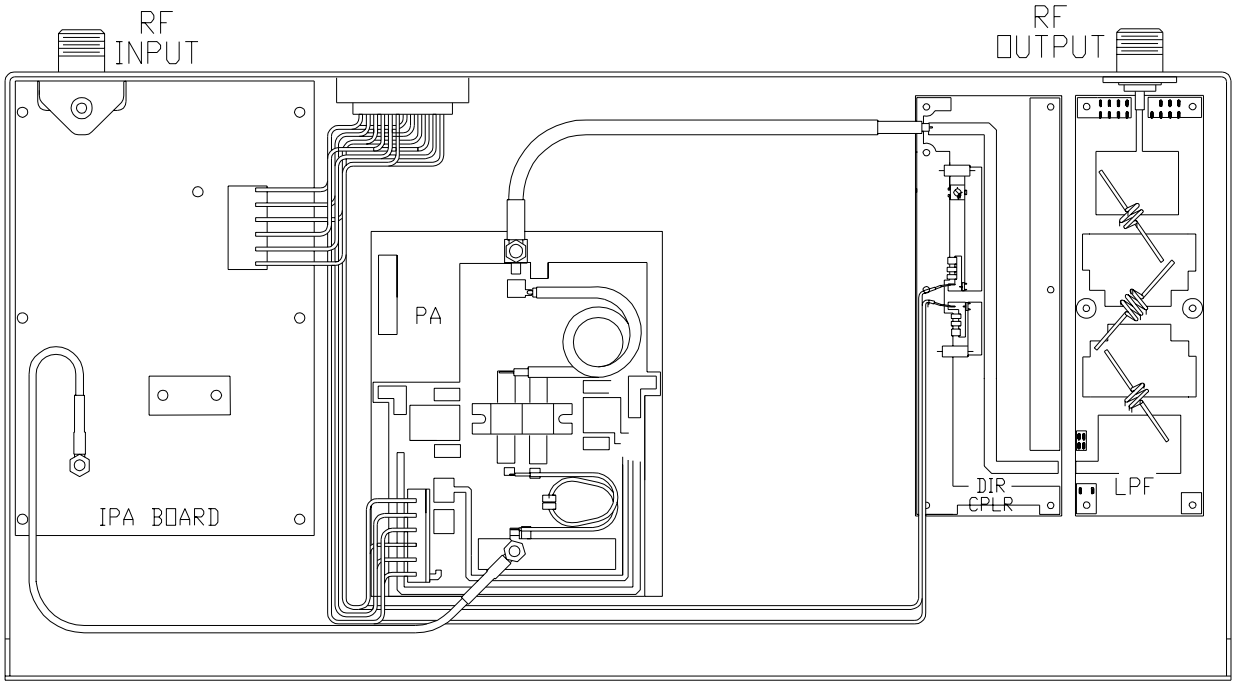
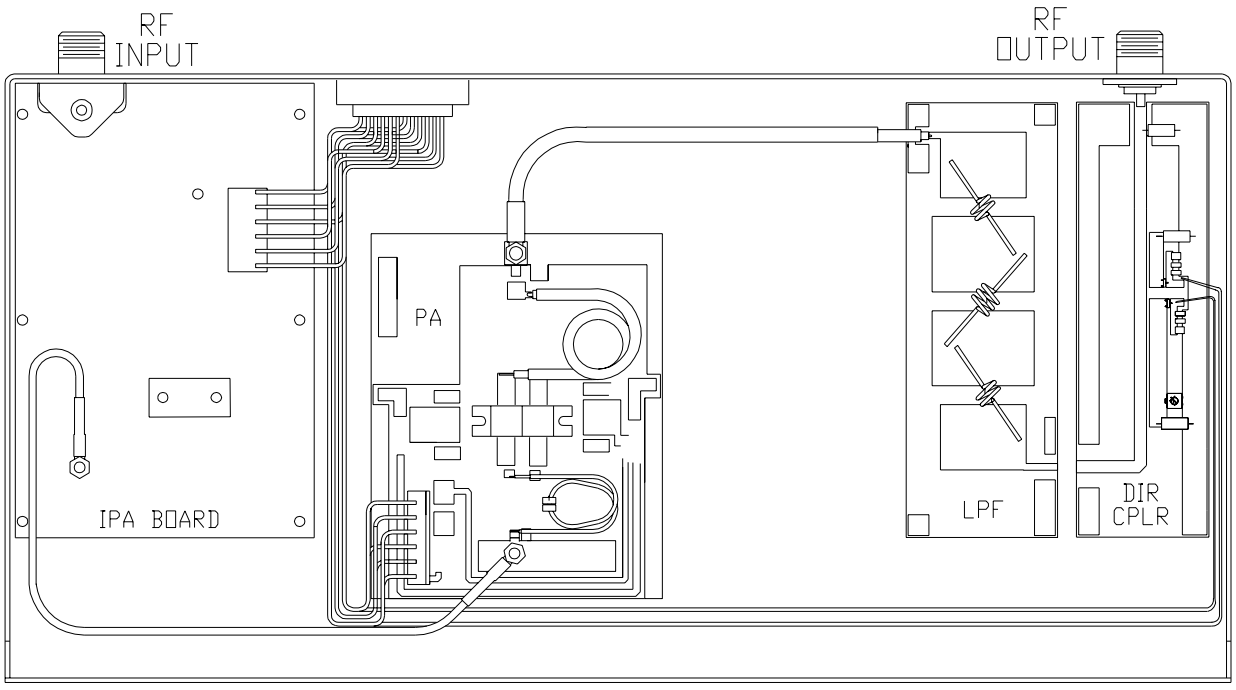


EARLY GL-T8321
PA TOP VIEW



GL-T8331/LATE GL-T8321
PA TOP VIEW

Figure 3-2, Typical PA Top Views, (continued)

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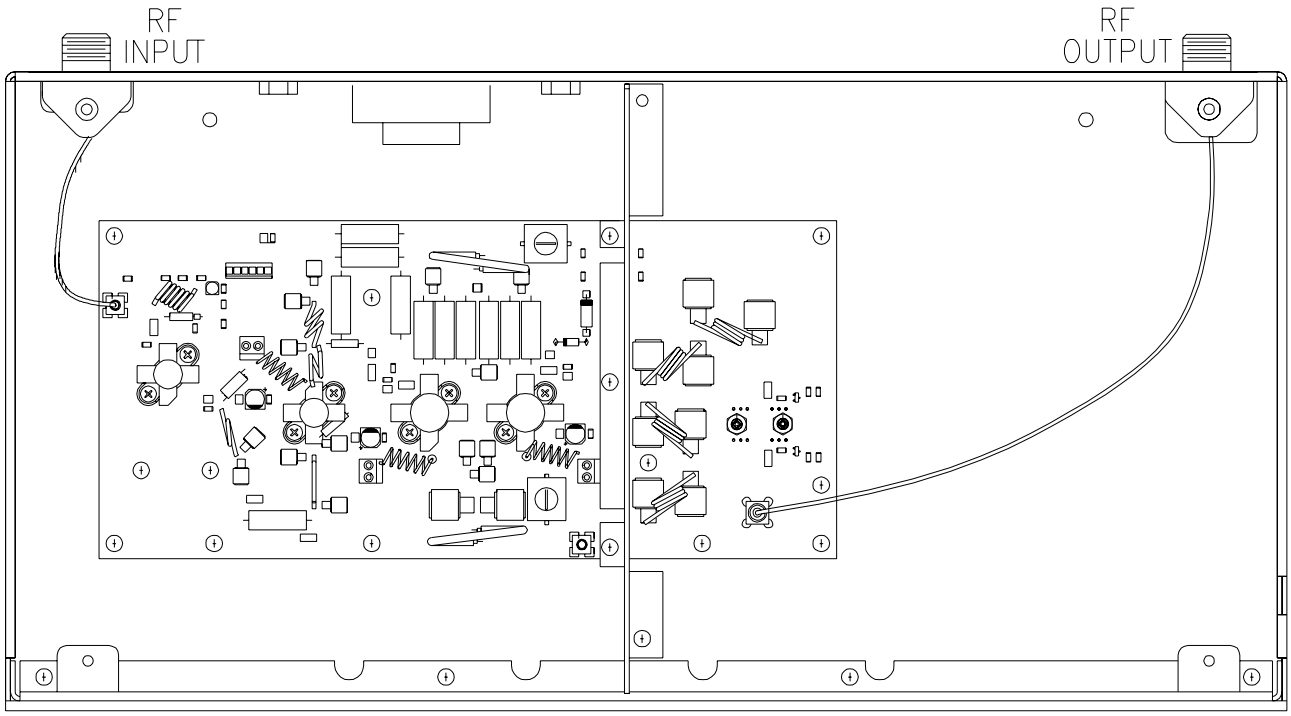
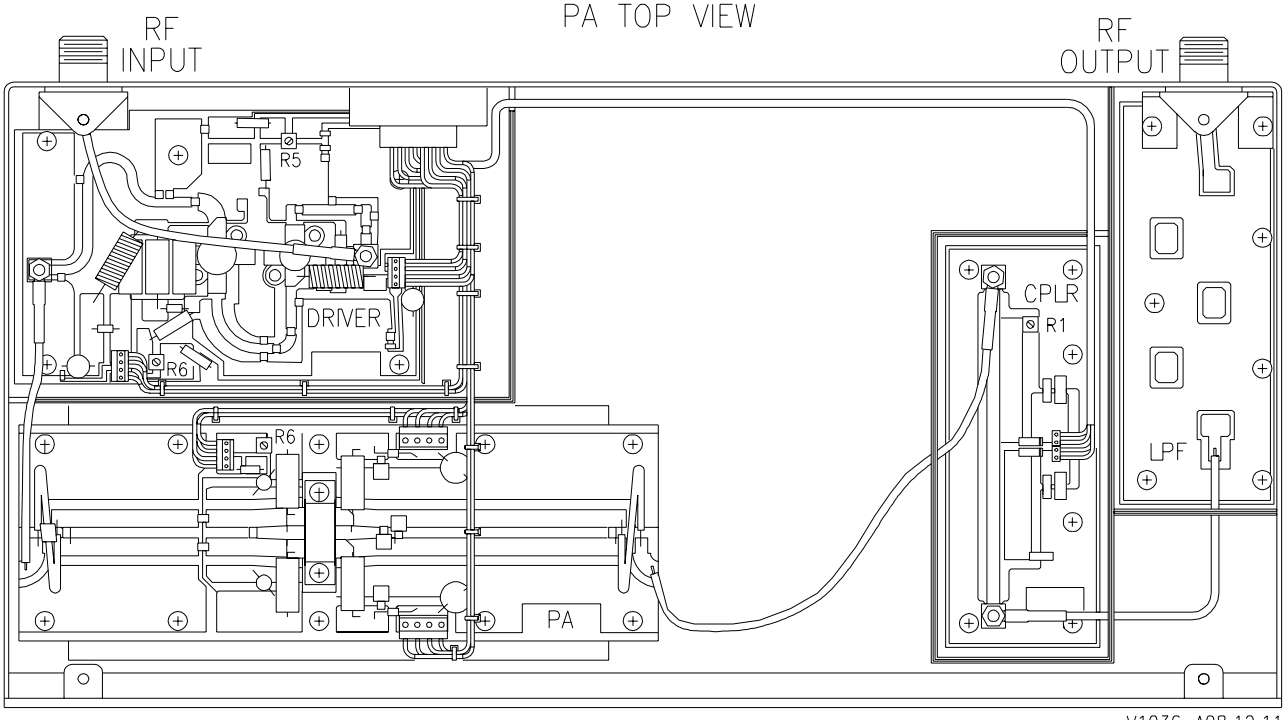


GL–T8311
PA TOP VIEW



GL–T8411
PA TOP VIEW

Figure 3-2, Typical PA Top Views, (continued)

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The exciter provides up to 0.5 watt of RF drive to the PA. A power-reference signal from the PA is fed back to the exciter, via the metering board, to allow control and monitoring of output power.

3.3.3.2 Power Amplifier RF Compartment

The PA performs amplification of the RF signal generated by the exciter. The PA amplifies a nominal 0.5-watt signal to rated power for application to the antenna system. Monitoring circuitry is on the metering board in the rear compartment of the PA chassis.

3.3.3.3 Metering Board

The metering board provides a rectified dc sample of the PA output to the exciter; the exciter, in turn, generates a power-control voltage which maintains PA power at the desired level.

The metering board also returns operational parameters of the PA, which information can be read by the transmitter controller and the VDT.

The metering board also serves as a distribution point for dc power for other assemblies within the transmitter chassis.

3.3.3.4 Power Supply

Because different power supplies can be used, refer to the appropriate power supply manual for details.

3.3.3.4.1 Ac-Powered Sites

The standard ac power supply takes ac input, converts it, rectifies and filters it, and supplies dc output to all racked equipment. Each dc circuit is individually fused on the front of the supply. A circuit breaker on the front of the supply doubles as a transmitter power on/off switch.

3.3.3.4.2 Dc-Powered Sites

Dc-only sites typically have a dc breaker / fuse panel mounted for power control. An external dc source should meet all pertinent specifications. A racked dc-to-dc converter needs to have adequate cooling provisions so as not to overheat other racked equipment.

3.3.4 Video Display Terminal

The VDT, though not part of the transmitter, is required for setup, local control, and local monitoring of the transmitter. The VDT can be any laptop or desktop terminal with a VT-100 type program. The VDT interfaces the transmitter through the connector on the front of the exciter. The VDT software is menu-driven.

3.4 Site Signal Flows

3.4.1 Site RF-Signal Flow

The on-frequency carrier is created by the VCO circuitry in the DSP exciter. It is then modulated with paging information, amplified, and sent to the PA via connector J3 on the back of the DSP exciter. Through coaxial cable, the carrier goes to the back of the PA, where it is further amplified to a preset level under control of a microprocessor within the exciter. The amplified carrier is cabled from the PA output to the antenna system. Note that some installations have a ten-MHz reference signal cabled from the transmitter controller to connector J8 on the back of the DSP exciter.

3.4.2 Site Audio-Signal Flow

Modulation information arrives at the site either through a link receiver or by wireline. The signal can be either analog or digital and is first routed through the transmitter controller, which checks for and responds to appropriate embedded commands. Paging information is supplied to the exciter. The exciter modulates this signal using digital signal processing, then up-converts this modulated signal to final output frequency. This modulated RF from the exciter is supplied to the PA, which amplifies the signal to the RF output level. This modulated, amplified RF from the PA is supplied to an antenna network for transmission. An audio-monitoring speaker is available on the Glenayre RL-XX3-series receiver.

3.4.3 Site Control-Signal Flow

Transmitter paging-site control is done two ways: remotely (normal operation), and locally. In either case, the paging transmitter is keyed when the transmitter controller commands it, via the DSP exciter, to key.

Control functions are shared by the transmitter controller and the DSP exciter, which controls the power amplifier. The DSP exciter also controls the power amplifier locally by responding to commands from the VDT.

Control signals enter and exit the paging site via the transmitter controller, which has overall control of the paging site. The transmitter controller is part of the larger paging control system even though it is racked with paging-site equipment. The transmitter controller has control functions which include those listed below.

- transmitter alarm gathering
- transmitter alarm dispatching
- simulcast parameter implementation
- remote transmitter operation interface.

Remote control of the paging site is done through commands being sent to the transmitter controller from the external paging control system.

Control commands originating from a remote site are supplied to the exciter through the controlling device. Control and setup commands may be applied to the exciter locally through the VDT. A microprocessor within the exciter interprets each command and responds by performing the appropriate function.

3.4.4 Status-Signal Flow

The exciter monitors transmitter status signal in the form of fault logic and voltage samples. The microprocessor within the exciter reports transmitter status to the controlling device, VDT, and the exciter front panel. If a transmitter malfunction occurs, a reduced operating condition is entered, depending on the seriousness of the fault.

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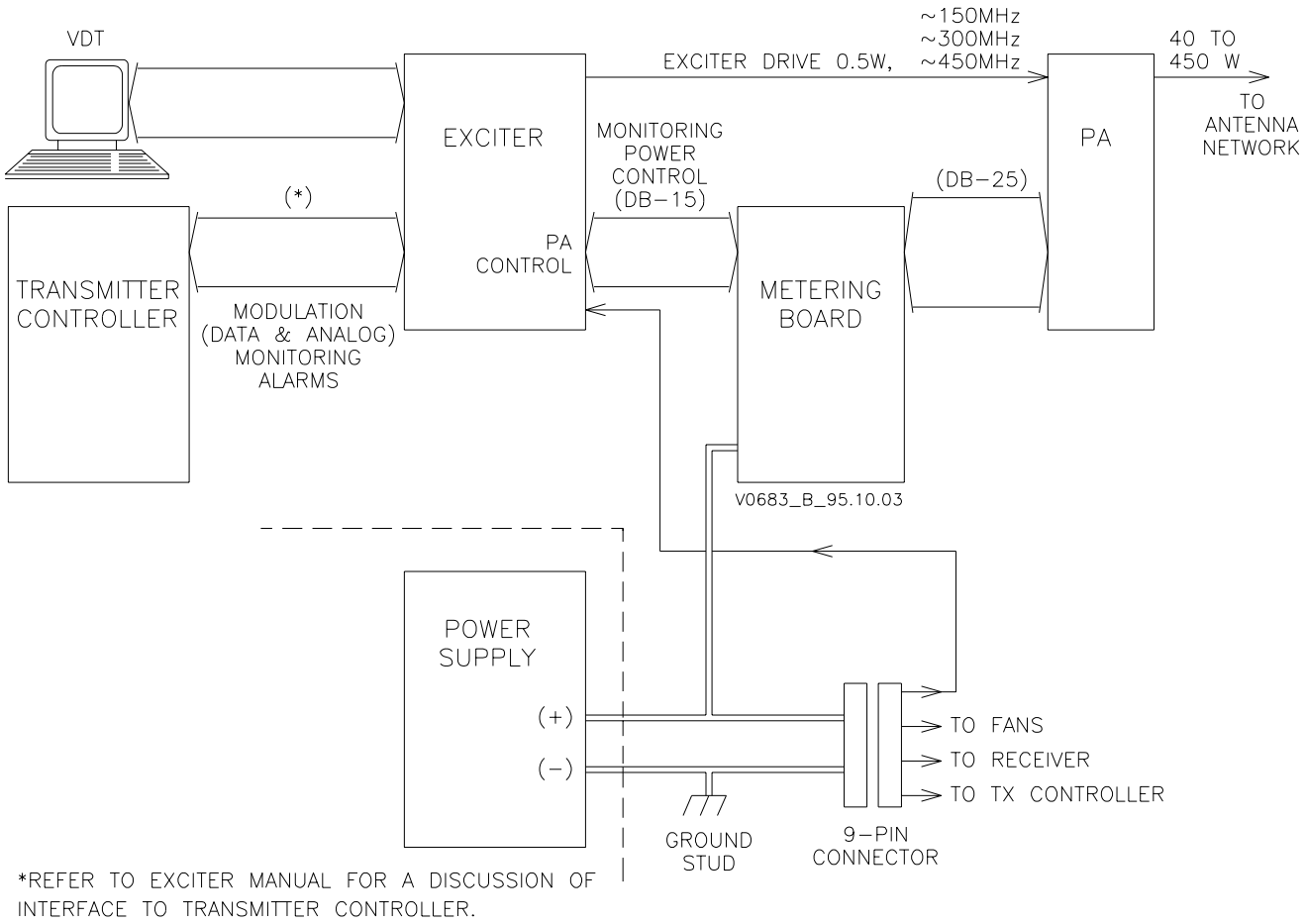

Figure 3-3 Transmitter Functional Diagram

4 INSTALLATION AND SETUP

4.1 Inspection

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Inspect the equipment to be certain that the equipment rack is complete. Compare items received to the packing list. Report shipping loss or damage to carrier within 15 days of receipt. Remove any packing material from the rack and check each assembly. Pay particular attention to the power supply; check it closely and remove any foreign material in the chassis. Be certain to disconnect primary power from the power supply before removing any equipment covers.

4.2 Installation

4.2.1 Tools and Equipment Required

Refer to *Table 4-1, Tools and Equipment*. Equipment listed by brand name may be substituted with equivalent. For installation, only common hand tools are necessary if at all, since installation is usually completed at the factory.

Table 4-1 Tools and Equipment

Device	Description
nut driver	5/16 inch
screwdriver	# 2 flat blade
screwdriver	# 2 Phillips
RF power meter	Bird model 4421 or equivalent
dummy load	Bird model 8327 or equivalent
barrel connector	type-N
RF cable	type-N ends, 1m long max
voltmeter	Fluke 77 DVM or equivalent

4.2.2 Rack Positioning

Cooling and cabling restraints require that equipment pieces be racked so that there is adequate ventilation for exhaust air. The top and front of the rack should have at least ten inches of free space. The cabinet should be placed as close as possible to the transmitting antenna, and to the primary power source as a secondary consideration. To gain reasonable access to the back, 30 inches of free space should be allowed.

Caution

Never place rack where moisture, steam, condensation, or standing water can come in contact with it. The host room may need to be air conditioned or additionally ventilated to remove excess heat generated by this equipment.

4.2.3 Rack Grounding

The rack cabinet must be connected to a reliable earth ground. Connect the earth ground point to the ground stud provided in the bottom of the cabinet; use four-gauge or larger copper conductor.

4.2.4 Positioning within the Rack

When it is used in a normal, one-transmitter-per-cabinet rackup, the transmitter chassis should be placed just above the power supply.

The transmitter is normally shipped already installed in a cabinet. To remove or reinstall the transmitter chassis, refer to Section 9.

4.2.5 Primary Power Requirements

The primary power source must be capable of delivering adequate power to the equipment. Racked power supplies operate with 60-Hz ac unless the power supply has the 50-Hz option or is dc-only. Refer to Section 2 of this manual and to the power supply manual for current and voltage specifications. Electrical connections made to this equipment must be made in accordance with local electrical codes.

DANGER

Rotating fan blades are a hazard to maintenance personnel who access equipment from the rear.

Caution

The rear door must be closed and the fans must be operating before the PA is keyed to ensure that the PA receives adequate ventilation.

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4.2.5.1 Special Considerations

Various options for the power supply permit operation at different line frequencies and voltages. The supplied connector allows for these variations. If the supplied connector is not used, be certain that the correct combination of line frequency and voltage is applied.

The power supply causes a large inrush of current when first turned on. The ac supply breaker must be able to handle this brief surge.

4.2.6 Equipment Cabling

Refer to *Figure 4-1, Transmitter Rear View with Door Open* and *Figure 4-2, Transmitter Chassis Pictorialized Schematic* for details.

4.2.6.1 Ac Connections

Generally, all ac connections internal to the rack are made at the factory and should not need to be modified. Refer to the power supply manual for additional details.

4.2.6.2 Dc Connections

If cable is being originally installed or replaced, be sure connections are sufficiently tight. Refer to the power supply and related manuals for details.

4.2.6.3 Dc-Only Sites

Some installation do not use ac input power. If the transmitter is not racked and wired at the factory, be sure to connect as shown in the documentation supplied with the retrofit option.

Note

For locations operating from a direct 28 Vdc source or an external power supply, the dc supply cable must not exceed three meters (3 m) in length. This restriction is critical to comply with the emission and immunity requirements

4.2.7 PA Chassis Connections

Refer to *Table 4-2, PA Chassis Connectors*. As viewed from the back, RF input is on the right; RF output is on the left; the power/IO connector is in the middle.

Table 4-2 PA Chassis Connectors

Connector	Description /Function
PA RF INPUT	type-N, quick-connect/ RF from exciter to PA unit
PA RF OUTPUT	type-N, quick-connect/ RF from PA to antenna
POWER/IO J1	DB-25, quick-connect/ power for... and I/O to and from, PA boards

4.2.8 Metering Board Connections

Refer to *Table 4-2, PA Chassis Connectors*. As viewed from the back, the + dc lug is on the right; the - dc lug is on the left; the control/ IO connector is in the middle.

Table 4-3 Metering Board Connectors

Connector	Description /Function
+ dc lug	1/4 -20 post, part of metering bd assembly/ main dc supply input
- dc lug	1/4 -20 post, part of metering bd assembly/ dc supply ground
control/IO J2	DB-15, part of metering bd assembly/ control and IO

Table 4-4, Exciter J6-to-Metering Board DB-15 J6 Pin Functions, shows the functional pinout of the connection between the metering board and the DSP exciter.*Table 4-7, Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment*, shows the functional pinout of the connection between the metering board and the PA compartment. Note that the connection is made whenever the PA compartment is positioned normally within the transmitter compartment, as the connector on the metering board becomes effectively, part of the chassis.

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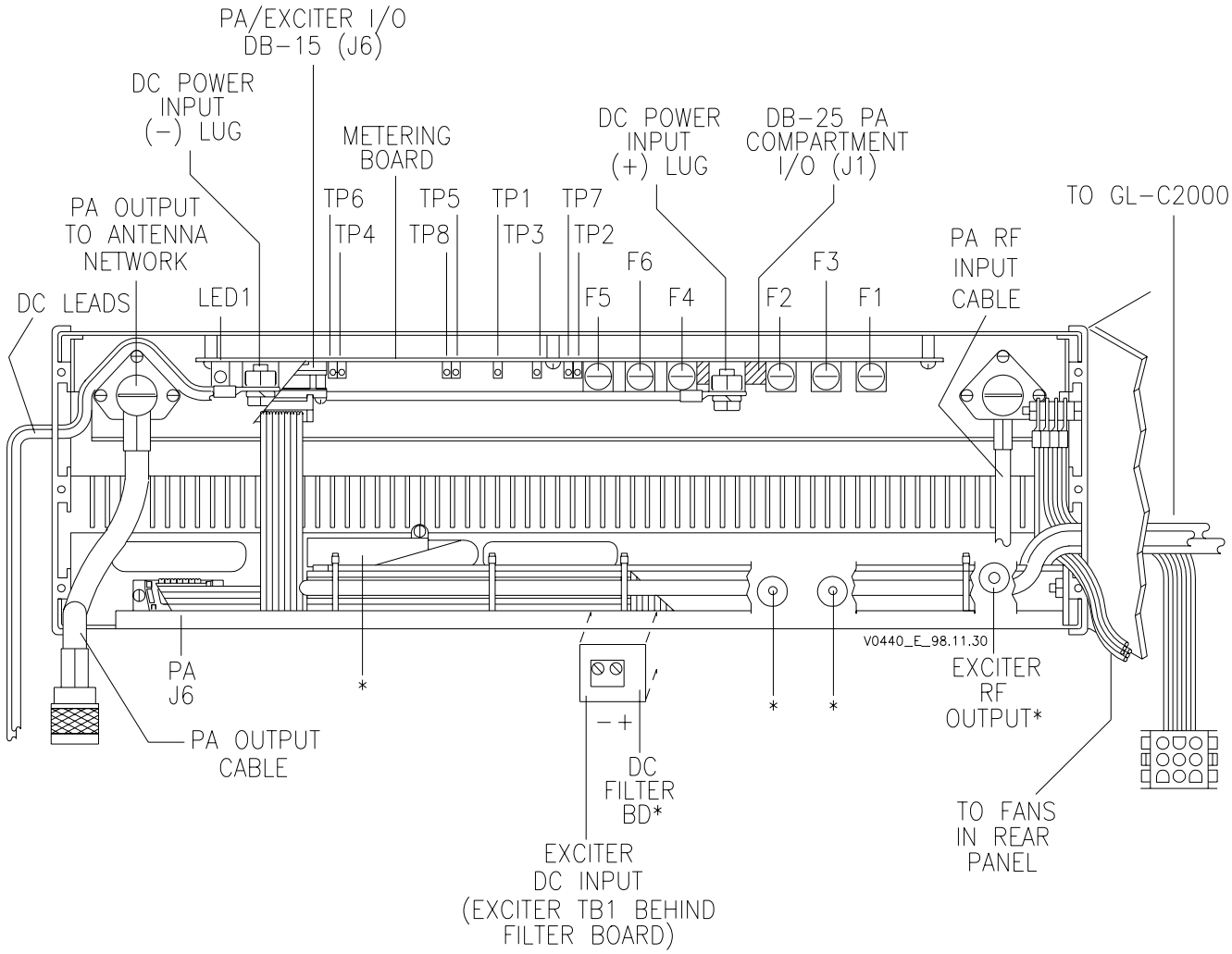

*FILTER BD NOT USED ON MOST MODELS

*SEE EXCITER MANUAL FOR DETAILS

Figure 4-1 Transmitter Rear View with Door Open

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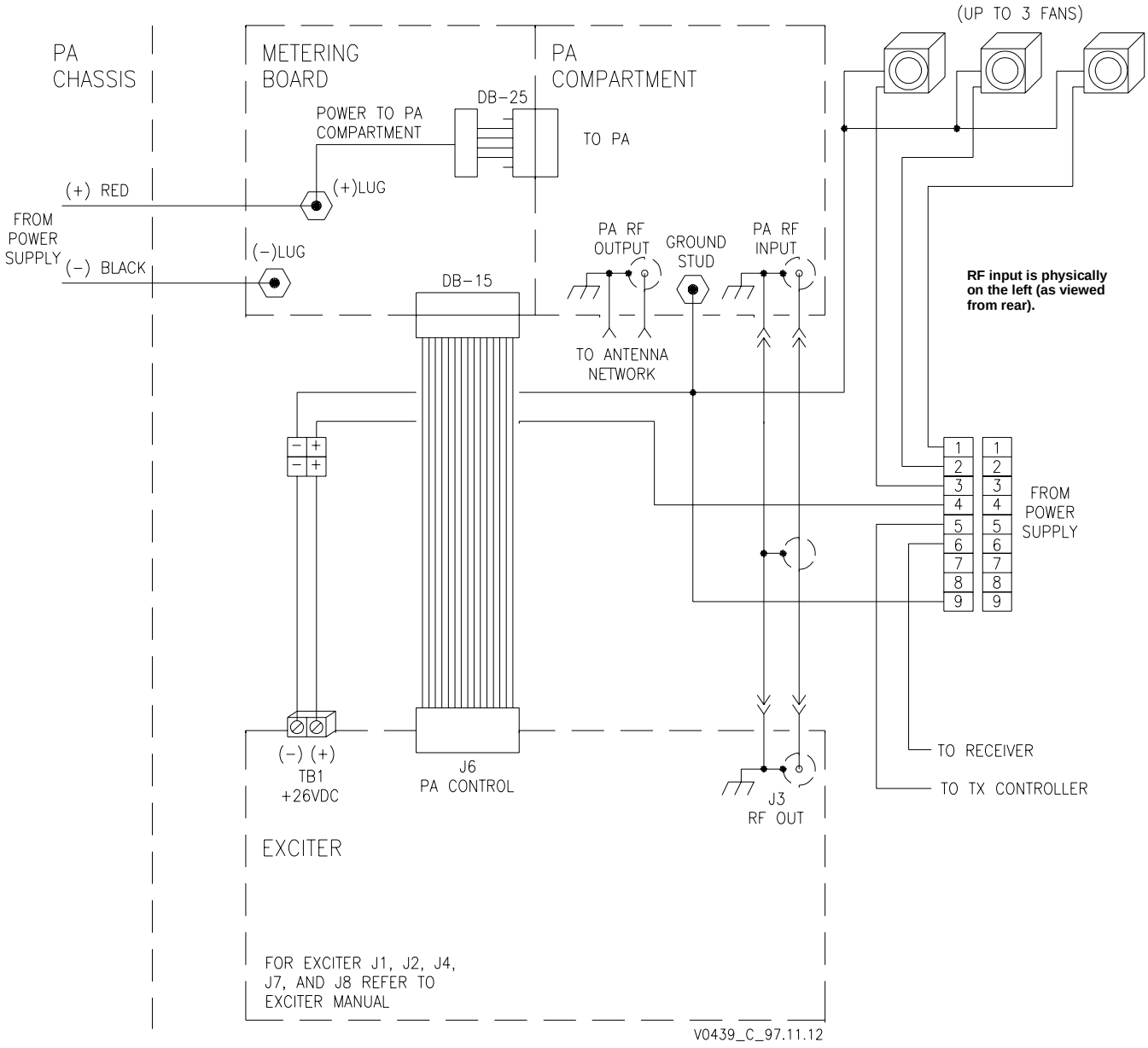

Figure 4-2 Transmitter Chassis Pictorialized Schematic

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Table 4-4 Exciter J6-to-Metering Board DB-15 J6 Pin Functions

DSP J6-	Exciter Function	Metering Board J6-	Metering Board Function
1	multiplex analog input from PA No. 1 multiplexer	1	A/D1
2	multiplex analog input from PA No. 3 multiplexer	2	A/D3, fixed LO
3	AGC reference voltage output to PA, 1-12 Vdc	3	AGC ref
4	no connection	4	ground
5	no connection	5	ground
6	1 of 4 select outputs to PA multiplexers, LO=2^1	6	input sel 2
7	one of four select outputs to PA multiplexers, not used	7	PA key input, enables AGC and preamplifier stage
		8	ref sample
9	multiplex analog input from PA No. 2 multiplexer	9	A/D2
10	multiplexed analog input from PA No. 4 multiplexer	10	A/D4, fixed LO
11	PA fault input, LO=fault		fixed LO (active logic in some versions)
12	no connection		ground
13	one of four select outputs to PA multiplexers, LO=2^0 digit enabled for mux input decoder	13	input sel 1
14	one of four select outputs to PA multiplexers, LO=2^2 digit enabled for mux input decoder	14	input sel 3
15	latch-enable output to PA multiplexers, LO=mux input decoder reads the three select inputs	15	spare

4.2.9 System Connectors

Refer to the transmitter controller manual for additional system connections at the paging-transmitter site.

4.2.10 I20 Control

GL-C2000 controllers (265-0090-002) manufactured prior to October, 1994, must have the universal exciter ASM board (265-0090-008) and v2.3 or later software installed. Units built after the October 1994 date support the I20 interface and have an assembly rev of A2 or greater (e.g., A2, B1, C1, etc.)

4.3 Setup

Refer to *Table 4-6* and *Table 4-6* for jumper setups for various transmitters.

Table 4-5 Metering Board Jumper Table for Transmitter Setups (w/ assembly 2000.00116)

	JW1	JW2	JW3	JW4	JW5	JW6
GL-T8331 GL-T8321 GL-T8521	A	A	B	B	B	A
GL-T8531	A	A	B	B	B	B

Table 4-6 Metering Board Jumper Table for Transmitter Setups (w/ assembly 2000.00513)

	JW1	JW2	JW3	JW4	JW5	JW6
GL-T8311	B	A	A	A	B	A
GL-T8411 GL-T8611	B A	B B	A A	A A	B B	B B

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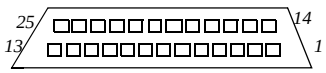
Table 4-7 Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment

8521/8531 PA RF compartment function	8321/8331 PA RF compartment function	m b function	J1 - X	m b fuse	8311/ 8411 PA RF compartment function	8611 PA RF compartment function
A2P1-5, PA (nearest to IPA) current	A2P1-5, PA current	PA2-A, PA2, PA	1	F4		PA2-J1 supply current
A2P1-6, PA (nearest to IPA) current	A2P1-6, PA current	PA2-A, PA2, PA	2	F4		PA2-J1 supply current
		PA2-B	3	F6		PA2-J2 supply current
		PA2-B	4	F6		PA2-J2 supply current
A5 REF, sample reflected dc relative output	A3 REF, sample reflected dc relative output	REF PWR, dc sample of reflected power	5		P6-1, reflected power sample from directional coupler board (red wire)	P6-1, reflected power sample from directional coupler board (red wire)
A5 FWD, sample forward dc relative output	A3 FWD, sample forward dc relative output	FWD PWR, dc sample of forward power	6		P6-4, forward power sample from directional coupler (black wire)	P6-4, forward power sample from directional coupler (black wire)
A1P1-2, key signal for first IPA stage	A1AP3-2, key signal for first IPA stage	PREAMP KEY	7		P1-1, preamp key bus	P1-1, preamp key bus
A1P1-6, temperature sensor on IPA board	A1AP3-6, temperature sensor on IPA board	TEMP SENSOR	8		P1-4, temp sensor on driver board	P1-4, temp sensor on driver board
		DRIVER+	9	F1	P1-3, +supply to driver	P1-3, +supply to driver
A4P1-5, PA (farthest from IPA) current		PA1-A, PA1	10	F2	P4-1, +supply to PA board	P4-1, +supply to PA board
A4P1-6, PA (farthest from IPA) current		PA1-A, PA1	11	F2	P4-2, +supply to PA board	P4-2, +supply to PA board
A3P1-, PA (center) current		PA1-B, PA3	12	F3	P5-8, +supply to PA board	P5-8, +supply to PA board
A3P1-6, PA (center) current		PA1-B, PA3	13	F3	P5-2, +supply to PA board	P5-2, +supply to PA board
A2P1-7, PA (nearest to IPA) current	A2P1-7, PA current	PA2-A, PA2	14	F4		PA2-J1 supply current
A2P1-8, PA (nearest to IPA) current	A2P1-8, PA current	PA2-A, PA2	15	F4		PA2-J1 supply current
		PA2-B	16	F6		PA2-J2 supply current
		PA2-B	17	F6		PA2-J2 supply current

Table 4-7 Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment (continued)

8521/8531 PA RF compartment function	8321/8331 PA RF compartment function	m b function	J1 - X	m b fuse	8311/ 8411 PA RF compartment function	8611 PA RF compartment function
A4P1-1, (daisy-chained to A3P1-1, A2P1-1, A1P1-3) -15-Vdc bias current for 3 PAs	A2P1-1, (daisy-chained to A1A3P1-3), -15-Vdc bias current for IPA and PA	-15V	18		P3-1, -15 Vdc to PA board (daisy-chained to P2-4 on driver board)	P3-1, -15 Vdc to PA board (daisy-chained to P2-4 on driver board)
A4P1-3 (daisy-chained to A3P1-3, A2P1-3), AGC voltage	A2P1-3, AGC voltage	AGC	19		P3-4, AGC to PA board	P3-4, AGC to PA board
A1P1-1, IPA current	A1AP3-1, IPA current	DRIVER+	20	F1	PRE KEY BUS	PRE KEY BUS
A1P1-4, IPA current	A1AP3-4, IPA current	DRIVER+	21	F1	PREAMP	PREAMP
A4P1-7, PA (farthest from IPA) current		PA1-A, PA1	22	F2	P4-3, +supply to PA board	P4-3, +supply to PA board
A4P1-8, PA (farthest from IPA) current		PA1-A, PA1	23	F2	P4-4, +supply to PA board	P4-4, +supply to PA board
A3P1-7, PA (center) current		PA1-B, PA3	24	F3	P5-3, +supply to PA board	P5-3, +supply to PA board
A3P1-8, PA (center) current		PA1-B, PA3	25	F3	P5-4, +supply to PA board	P5-4, +supply to PA board
DB-25 connector, as viewed from front (inside of PA compartment) 						

4.4 Ultimate Disposition

Caution

This equipment may contain hazardous materials. Check with the local EPA or other environmental authority before disposing of this equipment.

5 OPERATION

5.1 Controls and Indicators

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These assemblies within the transmitter chassis have controls and indicators:

- PA compartment - see PA manual
- exciter - see exciter manual
- metering boards - (*Figure 5-1*, and *Figure 5-2*).

Metering board assembly 2000.00116 is used in GL-T8321, 8331, 8521, and 8531 transmitter models. Assembly 2000.00513 is used is GL-T8311, 8411, and 8611 transmitter models.

Also see *Table 5-1* for more information.

5.2 Operation

The transmitter normally operates within the paging system in an unattended manner. Local control is not intended for operation, but for setup, checkout, or maintenance. On the metering board, LED1 lights when 28 Vdc is applied to it. No controls are available.

5.2.1 Turn PA On and Off

The PA does not contain an on/off switch, but turns on and off whenever the primary power equipment is turned on and off. When the PA is on, it remains in a standby condition until keyed. Turning off primary power (ac or dc) always turns off the transmitter (PA and exciter).

5.2.2 Fan(s) Control

The fan(s) are thermostatically-controlled. Fan speed can vary depending on PA loading. The fan(s) do not contain an on/off switch, but turn on and off whenever the primary power equipment is turned on and off. The fan(s) run continuously whenever primary power is on. Jumper JW5 on the metering board is used to enable or disable variable fan speed control. When it is set to position B, fan speed control is disabled and the fans run full speed at all temperatures. When it is set to position A, fan speed control is enabled.

DANGER

Rotating fan blades are a hazard to maintenance personnel who access equipment from the rear.

Caution

The rear door must be closed and the fans must be operating before the PA is keyed in order to ensure that the PA receives adequate ventilation.

Table 5-1 Metering Board Fuses, Indicators, and Test Points

Control/ Indicator	Function		Control/ Indicator	Function
F1*	driver fuse	The function of fuses varies, depending on the PA used. To match a fuse with the affected PA function, refer to *Table 4-7*.	TP1 (black)	**GROUND**, ground
F2*	PA1-A, PA1 fuse		TP2 (white)	**REF**, indication of reflected power
F3*	PA1-B, PA3 fuse		TP3 (blue)	+34 Vdc
F4*	PA2-A, PA2 fuse		TP4 (blue)	+5 Vdc
F5*	metering-board circuitry fuse		TP5 (yellow)	-15 Vdc
F6*	PA2-B fuse		TP6 (green)	+7.5 Vdc
			TP7 (red)	**FWD**, indication of forward power
LED1 (green)	**POWER**, indicates +26-Vdc input power applied		TP8 (brown)	**AGC**, sample of AGC voltage to PA compartment (controlled by forward-power and AGC ref, subject to shutdown circuit)

*Replace fuses with fuses of the same current rating. F1 through F4 and F6 are 20 A; F5 is 1 A.

5.2.3 Key and Unkey PA

The PA does not contain a key switch, but is keyed and unkeyed by the exciter. The exciter must be keyed and unkeyed remotely through transmitter controller or locally through a video display terminal (VDT). Refer to the controller manual for remote key and unkey instructions or to the VDT manual for local key and unkey instructions.

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See *Table 4-6* for jumpers.

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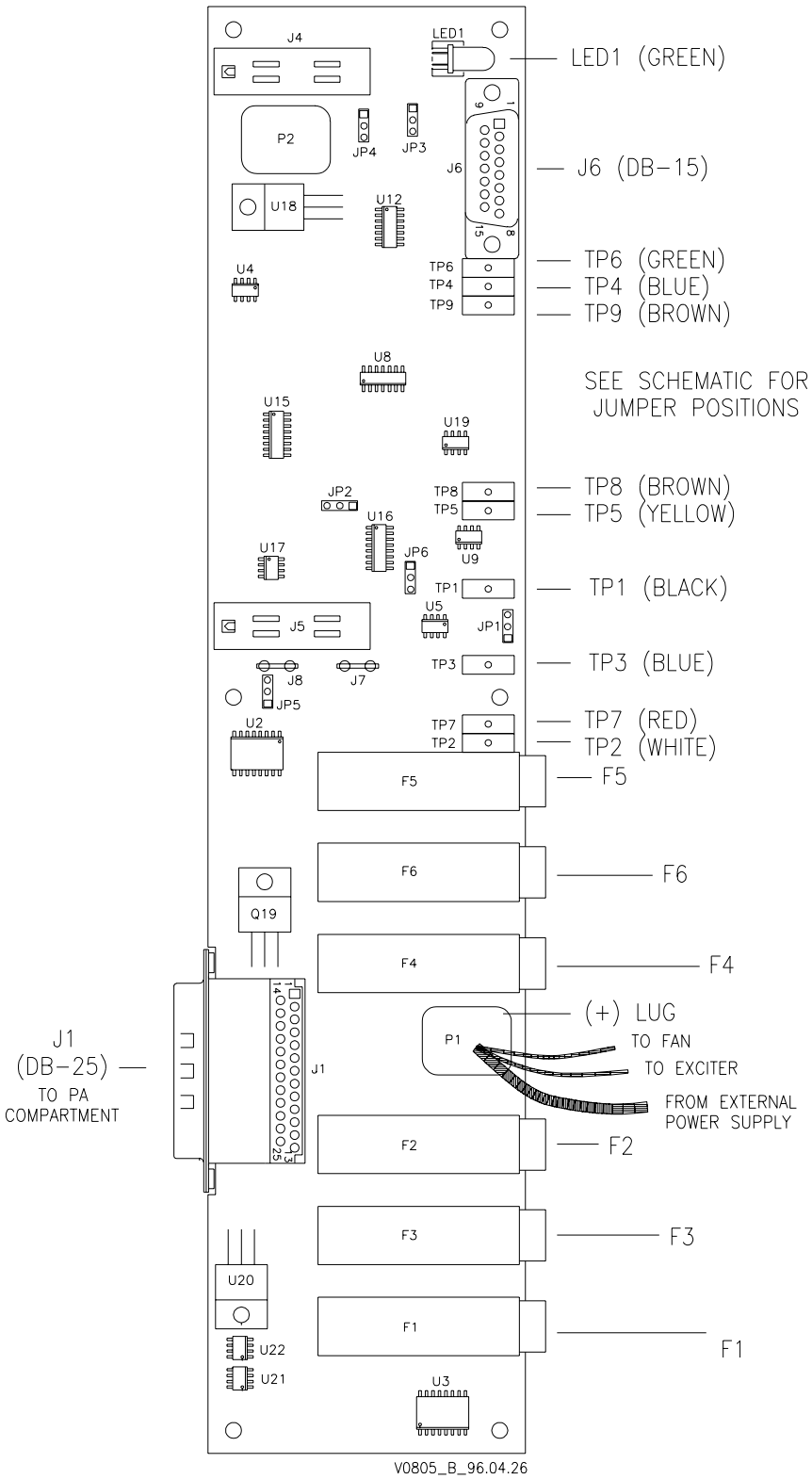

Figure 5-1 Metering Board Assembly 2000.00116

See *Table 4-6* for jumpers.

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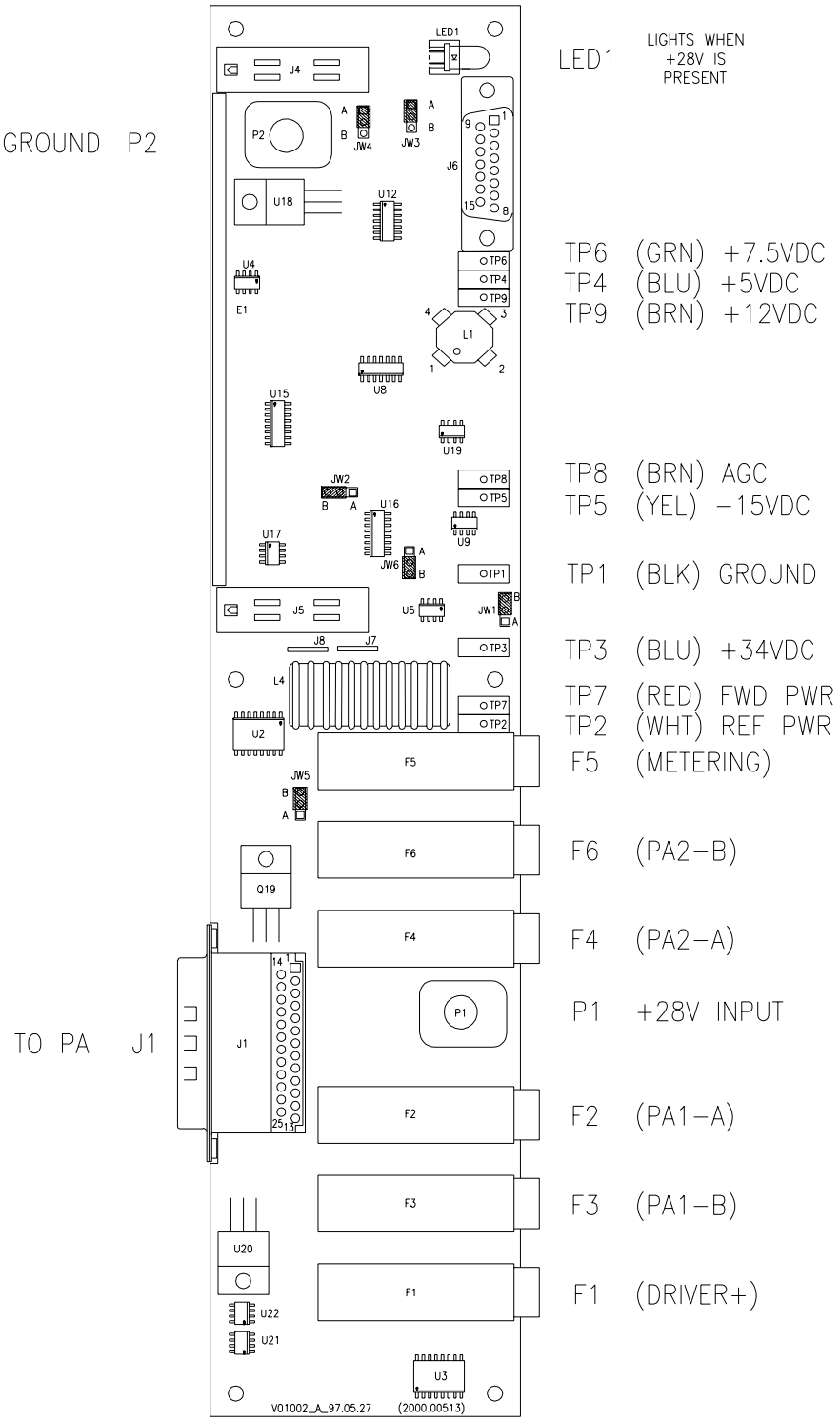

Figure 5-2 Metering Board Assembly 2000.00513

6 THEORY OF OPERATION

6.1 Metering Board

Refer to *Figure 6-1* and *Figure 6-2* for detailed circuit information.

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6.1.1 Dc-Power Distribution

The +lug on the metering board is the main distribution point for dc power within the transmitter chassis. The following connections terminate at the +lug:

- dc power from main power supply
- dc power to rear-mounted fans
- dc power to exciter
- dc power to PA compartment (through pc traces on board)

There are several current sources for stages within the PA compartment. Each separate circuit contains a fuse, metering resistor, and associated circuitry for measuring and reporting circuit currents. *Table 5-1, Metering Board Fuses, Indicators, and Test Points*, shows the circuits which are protected by the various fuses. Note that some transmitters do not use every fused circuit. *Table 4-7, Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment*, shows the functions of the connections between the metering board and the PA compartment.*Table 4-4, Exciter J6-to-Metering Board DB-15 J6 Pin Functions*, shows detail of the connections between the metering board and the exciter.

6.1.2 Control-Signal Distribution

6.1.2.1 Transmitter Keying

The transmitter may be keyed remotely by the transmitter controller or locally by the VDT. The exciter receives the key signal and activates internal circuitry which causes its RF output to become active. The exciter also sends a key signal to the PA RF compartment. The exciter signal is wired to metering-board J6-7. Metering-board circuitry relays the signal to the PA RF compartment and the IPA second amplifier stage via J1-7. The AGC reference signal from the exciter is passed to metering-board circuitry when the key signal is active.

6.1.2.2 Power-Output Control

A reference signal from the exciter determines the nominal output power. Depending on the exciter interface, the level may be remotely adjustable. The REF PWR dc reference signal (J1-5 and J6-8) is also routed to the exciter for use in determining acceptable output power and for generating alarms.

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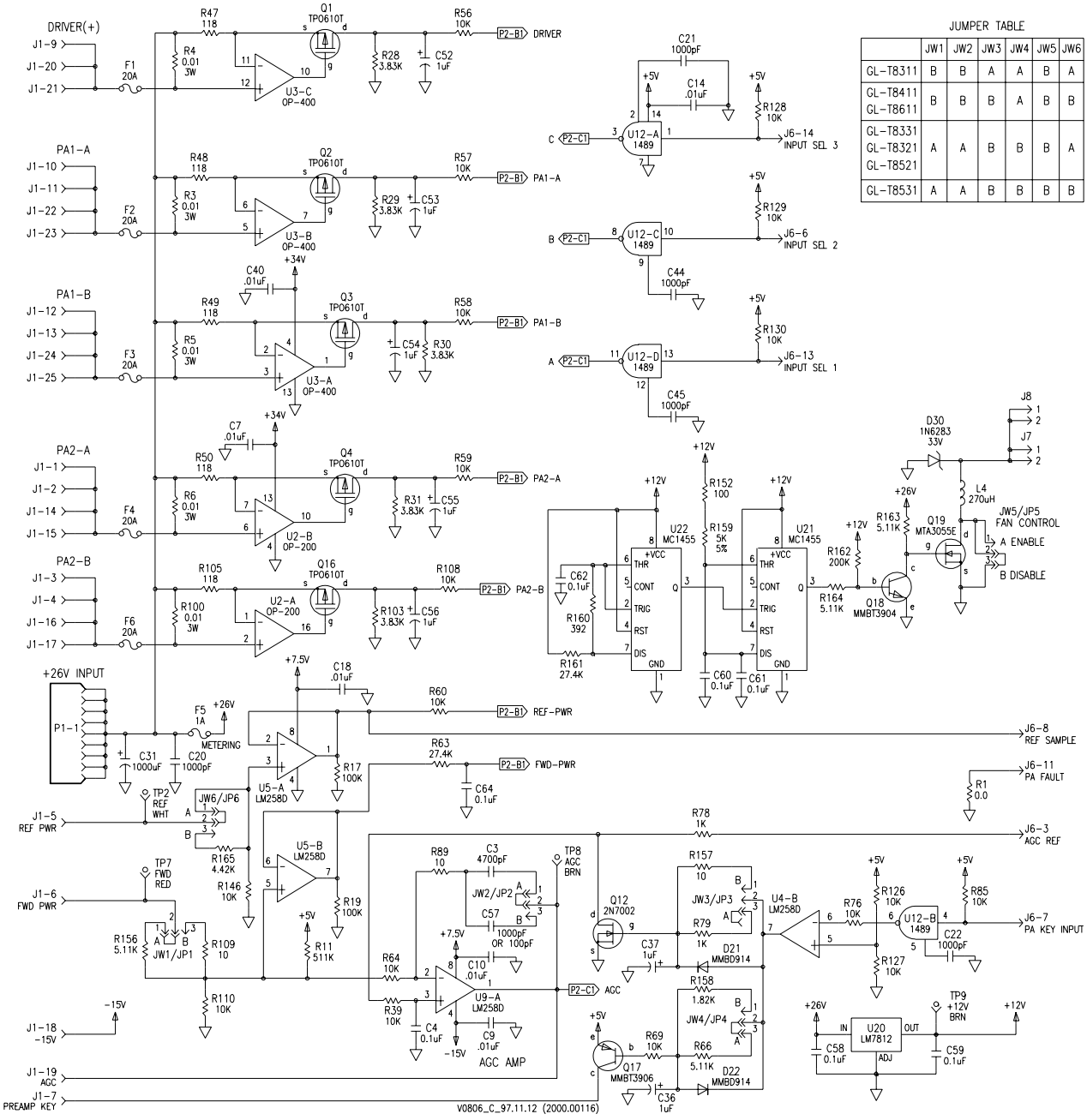

Figure 6-1 Metering Board 2000.00116 Functional Diagram

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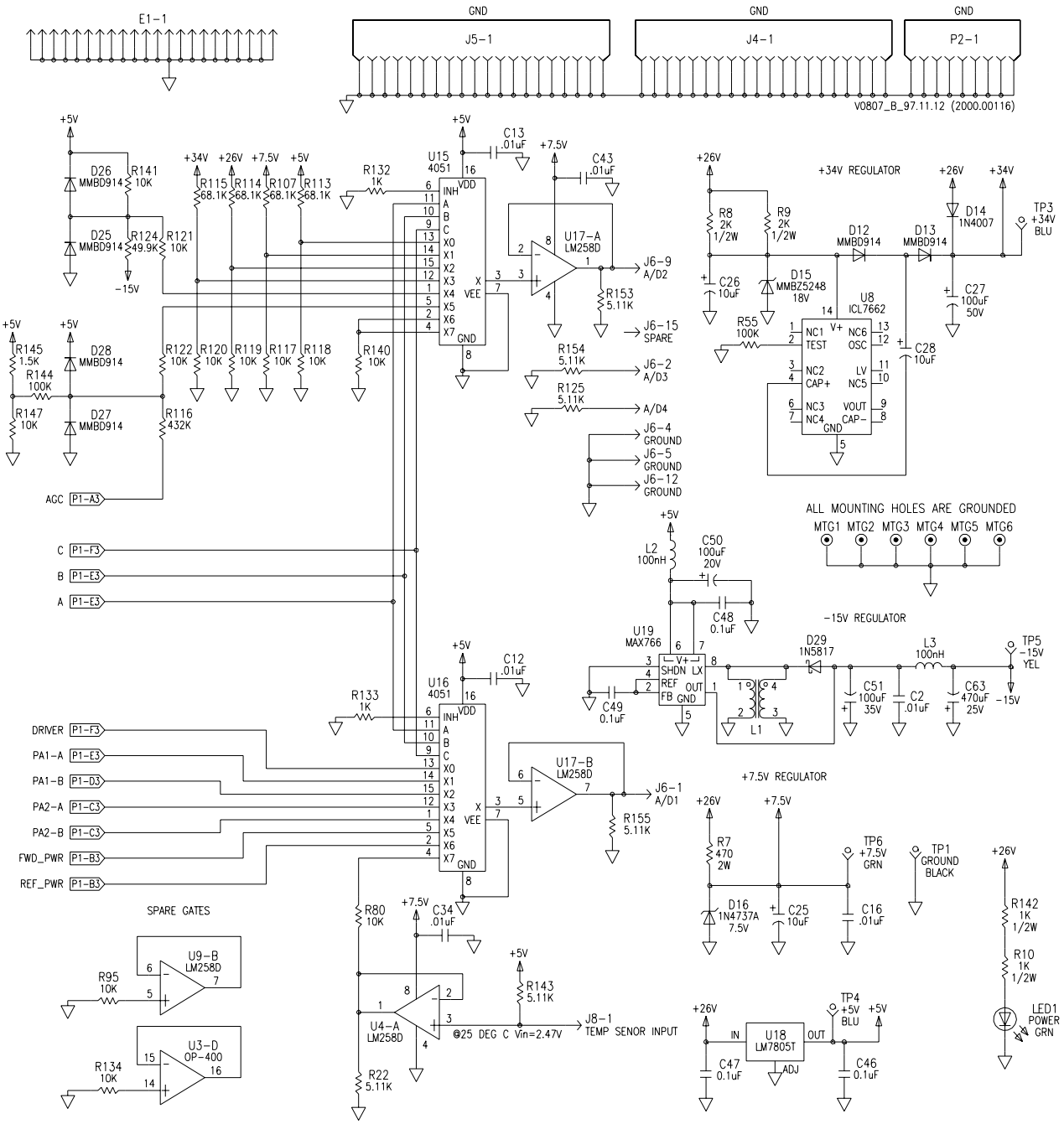

Figure 6-1, Metering Board Functional Diagram (continued)

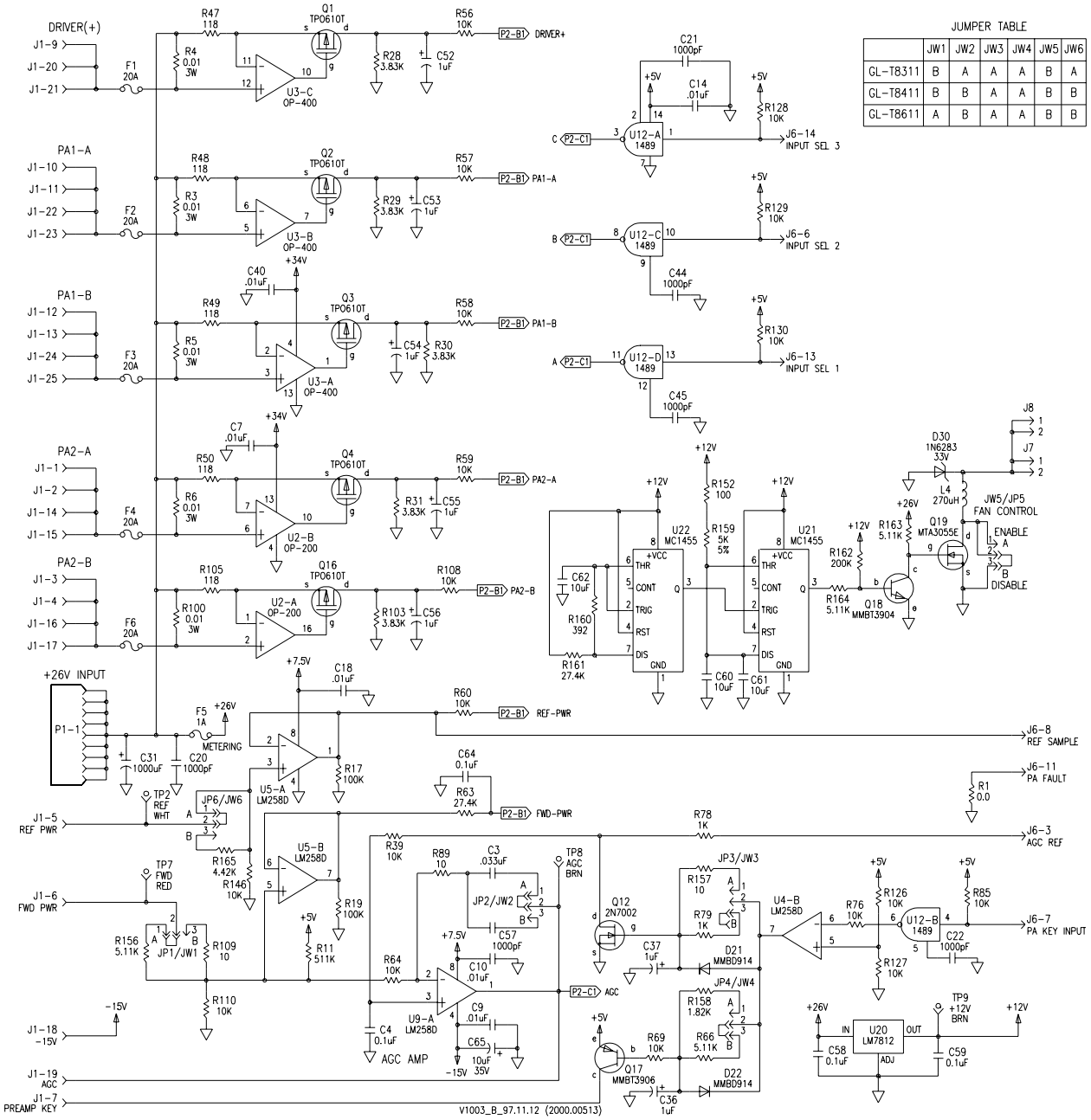

Figure 6-2 Metering Board 2000.00513 Functional Diagram

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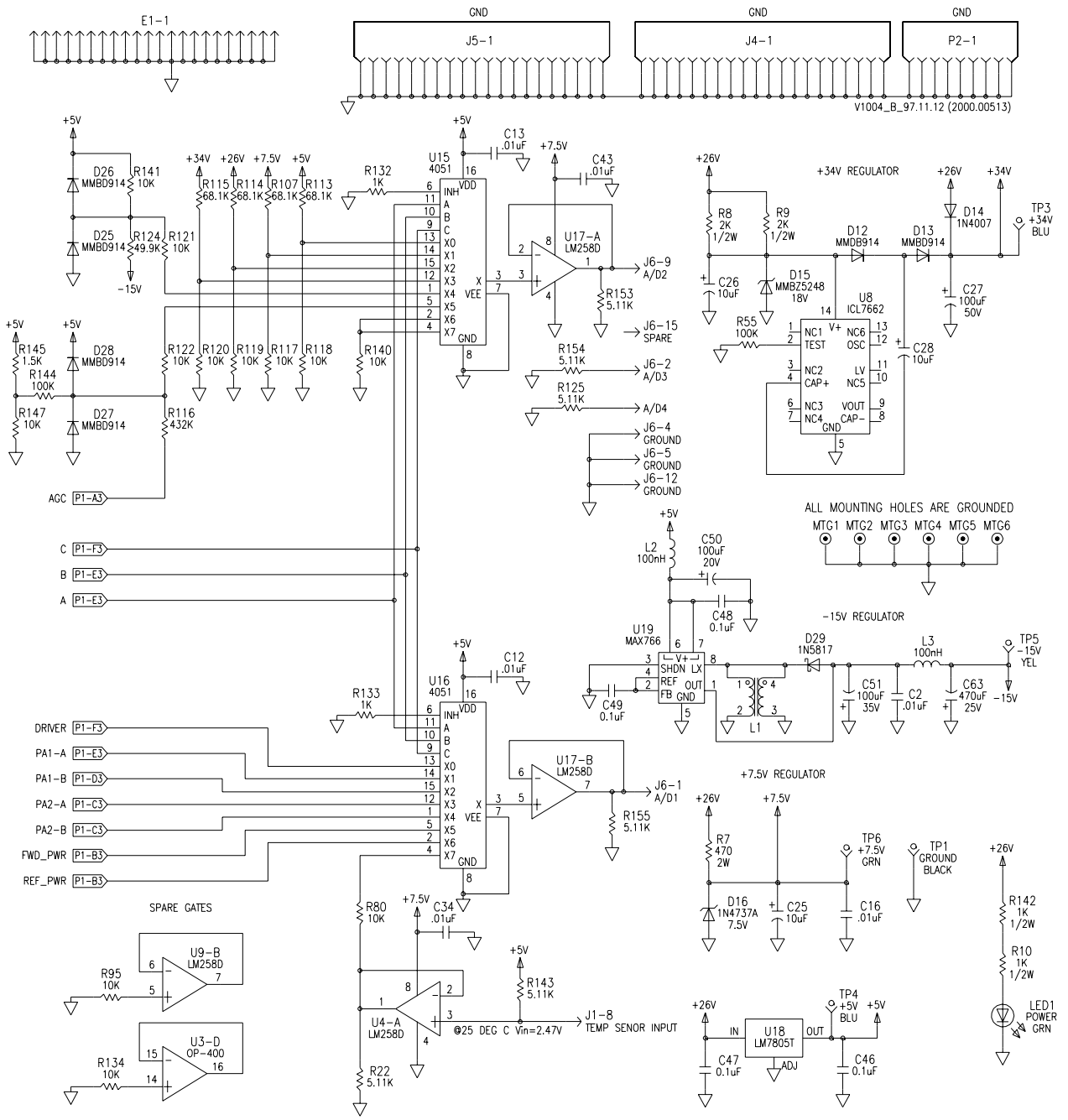

Figure 6-2 Metering Board 2000.00513 Functional Diagram (continued)

The metering board compares the AGC REF signal (J6-3) from the exciter and the FWD PWR dc reference signal (J1-6) from the PA RF compartment. The metering board attempts to hold power constant by using these signals to generate the AGC voltage (J1-19) which it sends to the PA RF compartment. All stages, except the first IPA stage, are under the influence of the AGC signal.

6.1.2.3 Signal Measurement and Alarm Gathering

Refer to *Table 4-7, Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment*. Each PA board and IPA board have separate, fused supplies, whose currents are measured by A/D converters which are multiplexed to the A/D1 line (J6-1) and A/D2 line (J6-9) to the exciter. The exciter has three input-select lines which determine the circuit to be measured. Refer to *Table 6-1, Input-Select Metering Lines from Exciter*.

Several metering points may not be used depending on the metering board assembly and the transmitter it is in. The labels of the measured parameters appear on the VDT screen when it is used to measure operating parameters. Refer to the VDT manual for details.

6.1.2.4 PA Fault

On nearly all versions of the metering board, no hardware circuit for PA-fault detection is installed, and PA faults are determined by software, as power supply voltage, PA currents, and RF power output can be read by the software.

On a few versions of the metering board, there is a hardware fault-detection circuit. If any of the PAs experiences a fuse-blowing fault, the PA FAULT line (J6-11) becomes active (HI).

Table 6-1 Input-Select Metering Lines from Exciter

input-select line	J6-x pin
1	13
2	6
3	14

7 MAINTENANCE

7.1 General

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Little or no maintenance is required on a regular schedule. The following, however, are important to ensure long term trouble free operation.

Maintenance procedures in this section are listed below:

- PA-current check
- Dc-ripple check.

7.2 PA-Current Check

Occasionally, the power amplifier device currents should be compared to the levels listed on the data sheet that accompanied the transmitter. Be sure that the operating RF output is the same as listed on the data sheet. The labelling of PA currents on the VDT's screen may be confusing. To relate the VDT indication to a particular pc assembly in the PA RF compartment, refer to the 'metering board function' column of *Table 4-7, Detail of J1 Connections (DB-25) between Metering Board and PA RF Compartment*. Also refer to the PA manual for the model of transmitter you are using.

1. Put transmitter in local mode.
2. Key transmitter.
3. Monitor power amplifier currents on VDT.
4. Make comparison between data sheet and monitor.

Monitored currents should not vary more than ten percent from data sheet levels. An exception is when original components or modules have been replaced or modified; in this case, a new benchmark should be noted for future reference.

7.3 Dc-Ripple Check

This procedure assumes that an ac power supply is part of the configuration. Occasionally the ac supply should be checked for excessive ripple. Maximum allowable ripple is given in section two of this manual. The supply should be under normal operating load for this procedure.

1. Put transmitter in local mode.
2. Key transmitter.
3. Connect oscilloscope between ground and supply output.
4. Set oscilloscope to read ripple.

The observed ripple level should be less than the ripple specification given in *Table 2-1, Specifications*.

8 CHECKOUT

8.1 General

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Checkout procedures can be performed at any time to verify that the transmitter and related paging site equipment is functioning properly. After checkout procedures are successfully completed, the site can be returned to normal service. Refer to the VDT user manual for details on checkout procedures.

8.2 Checkout Procedures

8.2.1 Dc-Voltage Verification

Once powered, verify that the equipment is powered and refer to list below.

1. On GL exciter front panel, the DC POWER indicator is on.
2. On the transmitter controller, the POWER indicator is on.
3. On receiver, the POWER indicator is on

8.2.2 VDT Power-up Verification

Once powered, verify that the VDT is powered; continue with the checklist below.

1. The VDT should have a cursor displayed and blinking; or,
2. the VDT should have an instructional prompt displayed; or,
3. the VDT should have an auto-loaded program running.

8.2.3 Cooling-Fans Check

Once the transmitter is powered, verify that the fans are operating; they should operate whenever the transmitter is powered.

9 REMOVAL AND REINSTALLATION

The following paragraphs discuss removing and reinstalling the various assemblies which make up the transmitter.

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Caution

Remove all input power to the cabinet before performing a removal or reinstallation procedure.

Note

The user may choose to remove the PA and exciter before removing the transmitter chassis in order to lighten the chassis for handling.

9.1 Transmitter Chassis

The transmitter chassis is held in the equipment rack by screws which are accessible from the front.

Removal

1. Turn thumbscrew to unlock rear door, and open rear compartment.
2. Remove large black wire from - lug on metering board.
3. Remove large red wire from + lug on metering board.
4. Mark and remove I/O connections between transmitter controller and exciter.
5. Mark and remove coax connection to antenna network.
6. Remove screws from front of rack and pull out transmitter chassis.

Reinstallation

7. Replace chassis in rack; secure with same hardware that was removed.
8. Carefully reinsert exciter and PA units in chassis.
9. Reconnect coax, power leads, and I/O as before.
10. Return transmitter to service.

9.2 Power Supply

Refer to the power supply manual for information.

9.3 PA RF Compartment

Note

Before removing the PA RF compartment, be certain that the fault is on an assembly within it. The exciter, metering board, and interconnecting wiring are essential to proper operation of the power amplifier.

Removal

1. From front of chassis, turn fasteners ccw so that front panel is loose, and pull PA RF compartment forward and out of transmitter chassis.

Reinstallation

2. Slide replacement PA RF compartment into location in top of transmitter chassis. Note that RF connectors slide into receptacles in rear of transmitter chassis.
3. Refasten front-panel fasteners.

Refer to the VDT manual to check out the replacement PA.

9.4 Exciter Removal and Reinstallation

The exciter is installed on slides in the lower third of the chassis. The local reference oscillator, if used, can be adjusted while the unit is mounted in the rack.

Removal

1. From rear or transmitter chassis, label and remove signal connectors on rear of exciter. Note that some DB-style connectors require loosening screws which hold mating receptacles in contact with one another.
2. Remove red (+) and black (-) wire from dc filter board by loosening retaining screws. Tape exposed end of red wire so that it does not come in contact with chassis.
3. Unfasten BNC RF output plug on right side of chassis.
4. Label and remove any other connections to exciter.
5. On chassis front, turn thumb fasteners ccw approximately one quarter turn to loosen; pull exciter chassis forward and out of transmitter chassis.

Reinstallation

When replacing the exciter, be certain that all variable subassemblies in the replacement exciter are correct for system requirements. Subassemblies which must be matched include those included in the list below.

- VCO/RF amplifier (must be for the correct frequency band)
- firmware chips (must be of the correct revision and type)
- controller interface (must be of the proper type and revision for interfacing with transmitter controller).

Refer to the exciter manual for additional information.

1. If necessary, attach dc filter board to dc input of replacement exciter before installing exciter into transmitter chassis.
2. Slide replacement exciter into location in lower third of transmitter chassis.
3. Refasten front-panel thumb fasteners.
4. Reattach and resecure connectors removed during removal process.

Refer to exciter manual and VDT manual to check out and realign replacement exciter.

9.5 Metering Board Removal and Reinstallation

The fuses on the metering board can be replaced without the need to remove the pc board from the chassis. In the event that replacing the metering board becomes necessary, use the following procedures.

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Caution

Use static-handling precautions on metering board.

Removal

1. Mark and remove wires attached to +lug: main dc input, exciter power, fan power.
2. Disconnect DB-15 ribbon cable from exciter.
3. Mounting hardware must be removed from pc board. Use L-shaped Phillips screwdriver or stubby screwdriver to gain access to screw heads. Alternately, remove entire metal mounting panel. Remove all screws holding metering board to top of transmitter chassis.
4. Once screws are removed, remove pc board from chassis by carefully pulling it toward rear, carefully breaking DB-25 connection to PA RF compartment.

Reinstallation

1. Plug replacement metering-board DB-25 connector into PA RF compartment chassis receptacle.
2. Reinstall screws removed during removal process. Do not tighten yet.
3. Once all screws are installed, tighten screws.
4. As a test, pull out and replace PA RF compartment shelf to verify that PA RF compartment DB-25 chassis receptacle easily docks with metering board.
5. Reconnect DB-15 ribbon cable from exciter.
6. Reconnect power wires to +lug.

The replacement metering board should not require realignment.

9.6 Fan Removal and Reinstallation

Heed all cautions at the beginning of this section.

Removal

Before replacing a fan suspected to be defective, determine that it has operating voltage supplied to it. Remove power to cabinet before beginning procedure.

1. Mark and remove power wires to fan.
2. Remove hardware which holds fan to rear panel.
3. Keep hardware for reinstallation.

Reinstallation

Check fan orientation before installing.

1. Mount fan to panel using removed hardware.
2. Reconnect power connector to fan connector.
3. Secure hardware.

Note

Overtightening of screws may cause fan failure.

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