

SECTION 3 OPERATION

3.1 GENERAL

This section describes normal operation of the 6900K7, 8, 9 TWTA. The operating modes, the controls, the indicators, the meters, and the turn-on and turn-off procedures are discussed. All controls are located on the front or rear panel of the TWTA. Status and fault indicators display the status of the unit at all times. Helix current is displayed on the Front Panel.

Once the unit has been placed in operation, it is suggested that a logbook be kept in which to record current readings, approximate running time, approximate RF power output, and all maintenance activity performed on the unit.

The two basic operating modes are LOCAL and REMOTE via the GPIB; these are discussed separately in the following text.

3.2 LOCAL OPERATING MODE

A Front Panel Indicator (GPIB ENABLED) indicates when the TWTA power switch is turned-on. This indicates that prime power is applied to the 5 VDC power supply for the GPIB Interface Assembly. The initial state is LOCAL. If operating in REMOTE, the local control mode is selected by pressing the LOCAL Switch and is indicated when the LOCAL LED lights. The four operating modes for the TWT amplifier include: Filament Time Delay, Standby, Operate, and Fault.

3.2.1 Filament Time Delay

In this mode, which occurs immediately after prime power is turned on (FIL ON) and STANDBY is ordered, the power supply provides power to the TWT Filament (Heater).

Helix and collector voltages are inhibited for approximately three minutes following initial TWTA turn-on. After the TWT heater has reached its operating temperature, the inhibit circuits de-energize and high voltage may be applied to the TWT.

The Filament Time Delay circuitry provides proportional time delay if a prime power failure occurs. If the prime power is interrupted during normal operation, the Filament Time Delay circuits will automatically recycle. The circuits are designed so that a full, three-minute delay is not required if the outage period is short (up to 89 seconds) and the recycle period is proportional to the outage period. Longer outage periods (more than 90 seconds) produce a full three-minute delay. If the TWTA is in the STANDBY or OPERATE mode when a power outage occurs, it will automatically reset to the OFF mode when power is reapplied.

NOTE

The use of the Power ON switch to turn-on or to turn off the TWTA results in the same performance as that associated with prime power outages external to the TWTA.

3.2.2 Standby

Pressing the STANDBY switch applies power to the TWT filament and the low voltage power supplies. The STANDBY mode sequentially follows the Filament Time Delay and is indicated when the STANDBY LED lights. In this mode, filament voltage is applied to the TWT and high voltage is OFF. STANDBY is defined as no filament time delay, high voltage OFF, and no faults.

3.2.3 Operate

If there are no faults or Filament Time Delay (FTD), the OPERATE indicator lights whenever the OPERATE switch has been pressed. In this mode, Collector and Helix voltages are applied to the TWT. If ordered from POWER-OFF, the TWTA will cycle through FTD.

3.3.1 Front Panel Controls.

- A. PWR Switch.- Applies prime power to the TWT; when turned on, the LOCAL and GPIB ENABLED indicators are lighted.
- B. HV Switch.- This switch is not connected; it has no electrical function in this equipment.
- C. LOCAL.- This pushbutton switch permits temporary control by the other three pushbuttons on the front panel.
- D. RESET.- This pushbutton switch causes the PA to go into the reset state (which exists when the power to the tube is turned off, the high voltage is turned off, and the fan is turned off).
- E. STANDBY.- This pushbutton switch causes the PA to go into the standby mode.
- F. OPERATE.- This pushbutton switch causes the PA to go into the operate mode.

3.3.2 Front Panel Indicators (In window)

- A. FIL ON.- This indicator shows that the TWT filament is turned on.
- B. STANDBY.- This indicator shows that the PA is ready to operate (the filament time delay period is over).
- C. OPERATE.- This indicator shows that the PA has left the standby mode, is operating, and that high voltage is applied to the tube.

- D. SUM FAULT.- This indicator lights to show that a summary fault has occurred.
- E. HELIX FAULT.- This indicator lights to show that a helix fault has occurred.
- F. HELIX MA.- This bar array lights to show the relative amount of helix current being used.

3.3.3 Front Panel LEDs

- A. LOCAL.- This LED lights to show that the PA will accept commands from the front panel controls.
- B. GPIB ENABLED.- This LED lights to show that the GPIB bus is in control and that any valid command on the bus will be obeyed. Since this is always true when the power is turned on, this LED serves as a power-on indicator.

3.3.4 Rear Panel Controls and Indicators

- A. Address programming is accomplished by a Dual Inline Package (DIP) switch on the rear panel. It contains eight, two-position switches; from top to bottom, the first five switch positions address 2^0 , 2^1 , 2^2 , 2^3 , and 2^4 .
- B. For auto addressing, pick an unused bus address between 0 and 30, decimal. Convert the address to binary and place the code in the switches with the LSB in switch 1 and the MSB in switch 5 (1 is ON, 0 is OFF). The PA is set at the factory to address 20.
- C. Switch 6 is set the ON position to suppress the IRQ.

- D. Switches 7 and 8 are not used and must be set to 0 (the OFF position).
- E. The rear panel also contains an indicator that lights to show operation in the TALK mode (MTA) and another that lights to show operation in the LISTEN mode (MLA).

3.3.5 Pre-Operation Setup

Use a standard IEEE 488 Bus cable to connect the PA to the bus controller or to another bus-compatible instrument. This cable is available in various lengths from any of several suppliers.

3.3.6 Operation

Turn ON the PWR Switch; the GPIB ENABLED and the LOCAL indicators should light. If the GPIB ENABLED indicator blinks continuously, the GPIB Interface PWB has failed its self-test.

NOTE

Turning on the PA during a transaction may cause failure in the GPIB portion of the self-test. Temporarily suspend bus transactions and turn OFF the PWR Switch; turn ON the PWR Switch again to restart the cycle.

The bus controller should send the IFC command to reset the TWTA. Messages sent to the PA should be preceded by setting the PA to LISTEN. To avoid accidentally changing the output when data is transmitted over the bus, the controller should take the interface out of the listen mode after the PA is programmed. The listening indicator is ON while the PA is in the listen mode.

3.3.7 Amplifier Command Forms

When addressed as a listener, the PA accepts two forms of commands: Varian Simplified Language (VSL) and an Alternate Language (AL).

3.3.7.1 Varian Simplified Language

This is a simplified form of Computer Interface Instrument Language (CIIL). All of the command that is enclosed in brackets may be deleted. The SRQ is always enabled and alerted for syntax errors. Both serial and parallel polling are available. VSL commands can be made to look like the proposed MATE System Control Standard Number 2806763, Revision B, by including the portion of the command enclosed within the brackets.

Several non-approved noun modifiers have been added as required by the TWTA. It is a subset of VSL in that CIIL words may be put in the brackets of VSL Commands:

Standby FNC [SGC :CHO SET GAIN SET] VLST CR [LF]

If this command is received in reset condition, the filament will be turned-on and the filament time delay will start. If it is received when the high voltage is on, the high voltage will be turned-off and the unit will go to standby.

High Voltage FNC [SGC :CHO SET GAIN 50 SET] VLON CR [LF]

If this command is received when the PA is in the standby mode, the high voltage will be turned-on. If it is received at any other time, the high voltage will be turned-on when the time delay period is over.

On to Off / Fault Reset RST [SGC :CHO] CR [LF]

This command turns off the high voltage and turns off the filament power. It will also reset any latched faults.

Fault Status STA [SGC] CR [LF]

This command causes the PA to prepare a current status response. To actually get this message put on the bus, the PA must be addressed as the talker. Normal conditions such as reset, standby, and HV On generate a single ASCII space, carriage return, and line-feed. One of the following fault or diagnostic messages will be returned:

```
F07TWTWTA:SYNTAX ERROR CR LF
F07TWTWTA:THRM OVERLOAD CR LF
F07TWTWTA HELX OVERCURRENT CR LF
F07TWTWTA:INTERLOCK FAULT CR LF
F06TWTWTA:AMP TIMING CR LF
```

3.3.7.2 Alternate Language

The alternate language allows three commands which must be preceded by "GAL" and followed by "X". The following are Alternate Language Commands:

Command: D CR LF

Response: D n n (n represents a hexadecimal character in ASCII.)

Character	Bit	Definition
1	3 (MSB)	Heater Time Delay
	2	High Voltage ON
	1	Standby
	0 (LSB)	Mains Power ON
2	3	Interlock Fault
	2	Thermal Fault
	1	Helix Fault
	0	Summary Fault

When a bit is set in the response, it indicates that the status or fault exists.

Command: @ CR LF

Response: PROM VARIAN-P, P/N 112424 REV 0, 08/10/87 CR LF

Command: Serial Poll (the syntax depends upon the bus controller)

Response: 8-Bit character on the Bus data line. The bit assignments are listed below. When a bit is set in the serial poll response, it indicates that the status or fault is true.

Data Line	Information
DIO 1	Heater Time Delay
DIO 2	Standby
DIO 3	High Voltage ON
DIO 4	Zero
DIO 5	Syntax Error
DIO 6	Summary Fault
DIO 7	RSV (Set if syntax error)
DIO 8	Zero

Note 1: A serial Poll is required to clear an SRQ.

Note 2: The blanks shown in the bus commands illustrated above are put in the examples for clarity and should not generally be included in the command message.

3.4 METERS, CONTROLS AND INDICATORS

Figures 3-1 and 3-2 show the Front and Rear Panels of the TWTA.

3.5 INITIAL TURN-ON

Certain precautions must be taken to protect the PA against damage from unknown conditions when the PA is first turned-on after installation at the user site. Once proper overall operation is verified in the final installation, normal turn-on and turn-off may be performed as described in subsequent sections.

```
*****
*
*                               *****
*                               CAUTION
*                               *****
*
*   Before proceeding with initial turn-on, all of
*   the procedures defined in Section 2 should
*   be complete and verified.
*
*                               *****
*
*****
```

3.5.1 Pre-Power Check

Before applying prime power to the system, verify that the following conditions are met:

- A. The available prime power voltage must be within the ratings of the amplifier.
- B. The output must be terminated in a load capable of dissipating at least twice the rated output power at the intended operating frequency.
- C. The load VSWR must be less than 1.5 : 1.

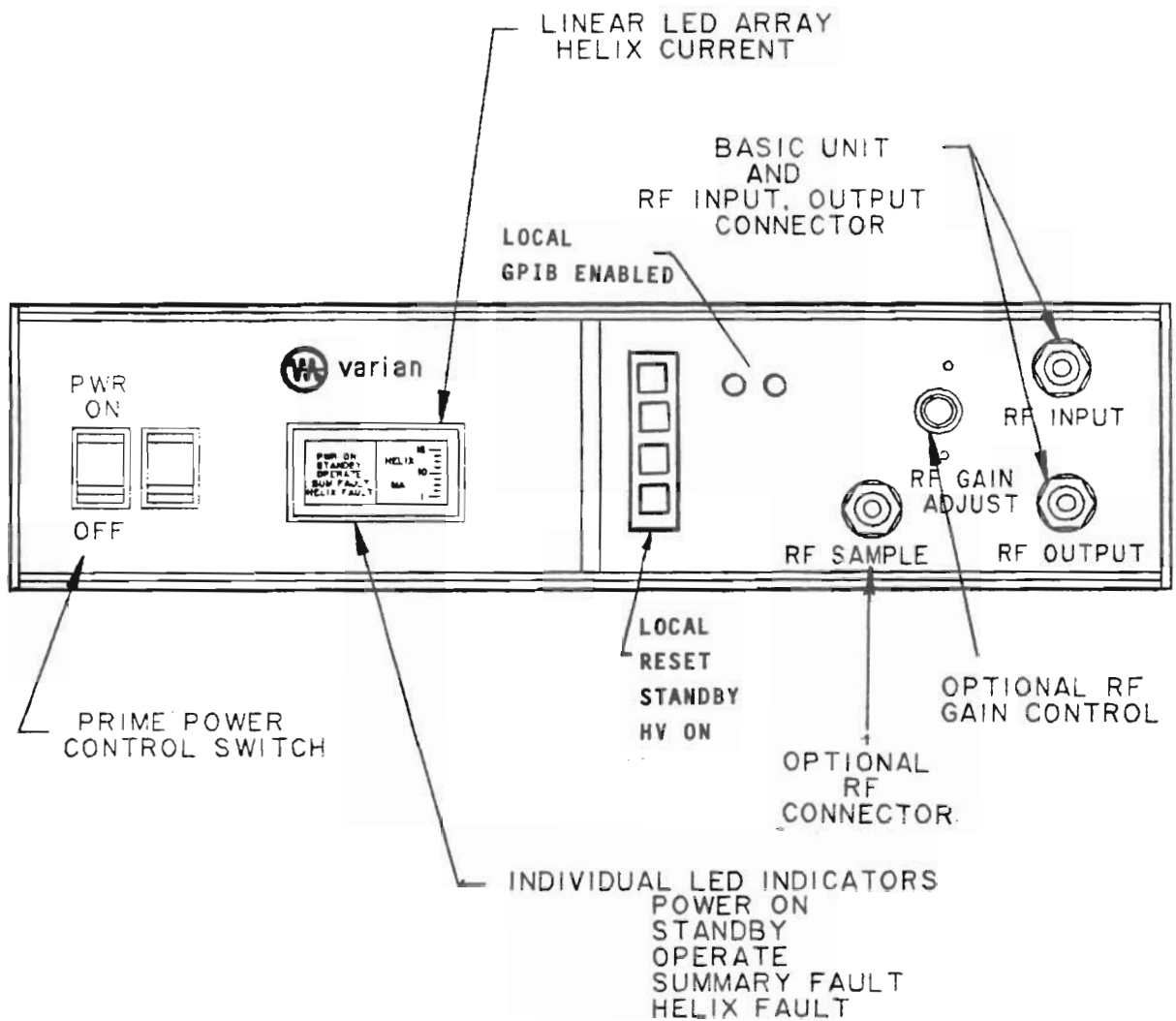


FIGURE 3-1

TWTA FRONT PANEL

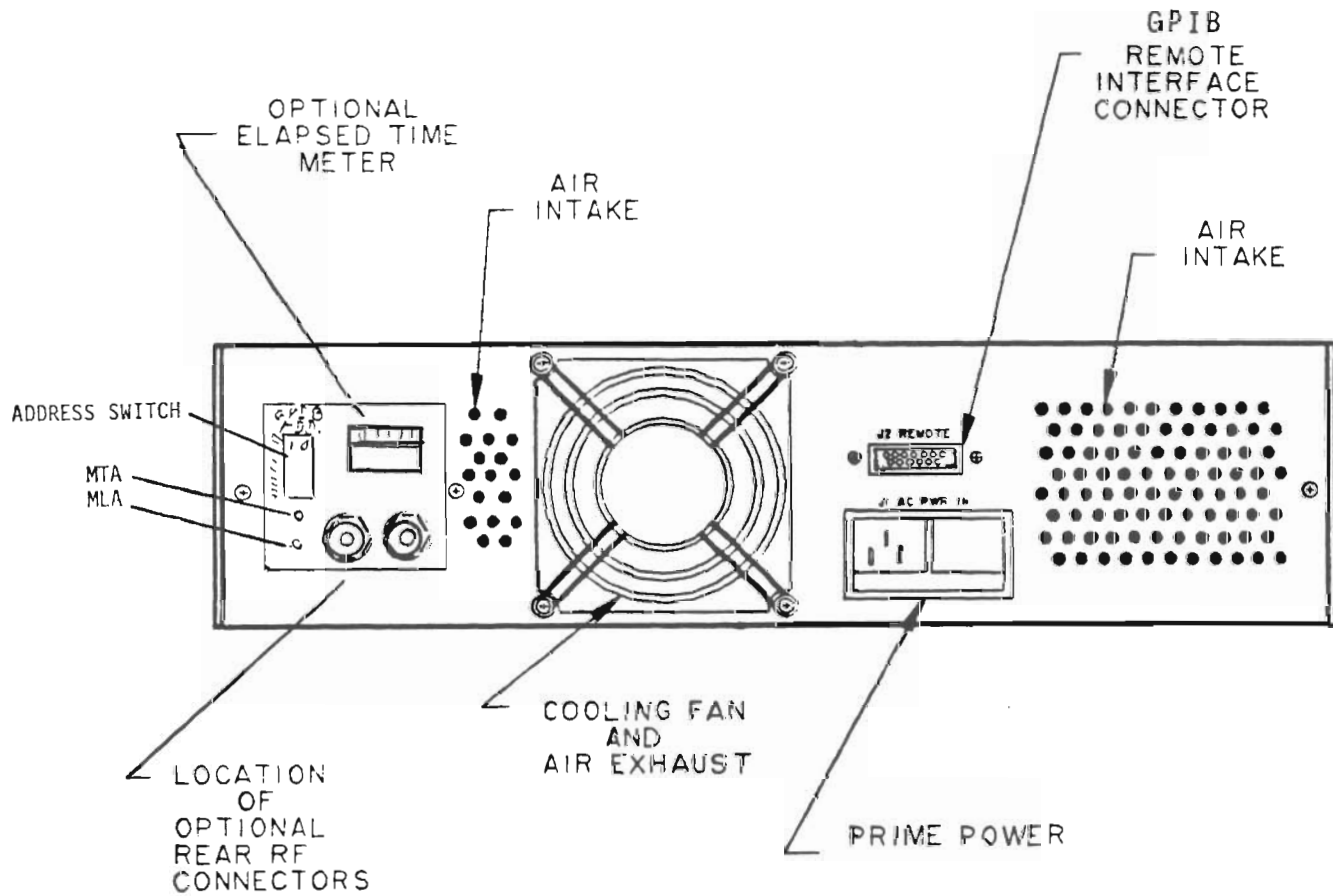


FIGURE 3-2

TWA REAR PANEL

- D. An RF drive source must be set to the correct frequency and preset for minimum output (Do not operate the TWTA without either a drive source or an input termination).
- E. The rear air exhaust and intake ports and the side air intakes of the TWT Assembly must not be blocked.

Failure to observe any of the above conditions can cause catastrophic damage to the unit and will void the warranty.

NOTE

The unit was adjusted and tested at the factory before shipment and no further adjustments should be required.

3.5.2 Turn-On Sequence

- A. If an RF drive source is connected to the TWTA, rotate the GAIN control of this source to the minimum output power level setting.
- B. Turn ON the Power Switch. Verify that the GPIB ENABLED indicator lights. No readings should be obtained on the HELIX CURRENT meter at this time.
- C. The LOCAL indicator may also light. If not, press the LOCAL switch to obtain local control capability.
- D. Press the STANDBY switch. The FIL ON indicator should light. After approximately three minutes, the STANDBY indicator should light.
- E. Press the OPERATE switch. Verify that the STANDBY indicator turns-off and the OPERATE indicator lights. Verify that a helix current reading is obtained on the display. Verify that this reading is consistent with the tube data sheet supplied.

- F. Slowly increase the RF drive and verify on the external power meter that RF is being amplified.

NOTE

If the optional Gain Control is included in your TWTA and no reading is obtained on the external power meter, rotate the GAIN control clockwise until the desired output is obtained.

```
*****
**                                     **
**          *****                   **
**          CAUTION                   **
**          *****                   **
**          Do not exceed the limits  **
**          specified in the          **
**          TWTA Data Sheets.        **
**          *****                   **
**                                     **
*****
```

- G. Press the STANDBY switch. Verify that the OPERATE indicator turns-off and the STANDBY indicator lights.
- H. Press the RESET switch and verify that all indicators turn off and that the fan stops (confirming that AC power is turned off).

The power amplifier system is now in normal operation and may be turned-on or turned-off as described below.

3.6 NORMAL TURN-ON

Once the steps defined in Section 3.5 have been completed, normal turn-on can be accomplished very simply, unless there is reason to suspect that a significant change in operating conditions has occurred during the "off-time". The following steps may be performed if the normal turn-off procedure has been followed:

- A. Turn ON the power switch and verify that the GPIB ENABLED indicator lights.

- B. Select the LOCAL mode if desired or operate in the REMOTE (priority) mode.
- C. Select either the STANDBY or the OPERATE mode. Verify that the FIL ON indicator lights.
- D. When the filament time delay is complete (after approximately three minutes), verify that the STANDBY or OPERATE indicator lights. If STANDBY was selected, press the OPERATE switch. The OPERATE indicator should light and there should be normal current meter reading and normal output RF level.

3.7 TURN-OFF

If the PA is to be turned off for less than two hours, it should be placed in STANDBY by pressing the STANDBY switch or by selecting the STANDBY mode through the GPIB. This permits the fan to run and minimizes thermal and electrical shock to the tube. If the "off-time" is to be extended, the unit should be turned off completely to save heater life and prime power.

- A. Select the STANDBY mode.
- B. Let the system run in the STANDBY mode for five minutes in order to cool the TWT and all other components.
- C. Select the RESET mode to remove all power from the unit (except from the GPIB power supply). The TWTA may be left in this mode to allow for later control via the GPIB.
- D. To completely remove the unit from service and to remove all prime power, turn OFF the Power Switch.