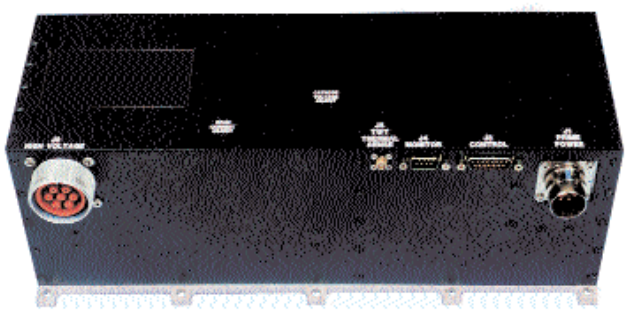
communications
Electron Devices

M755
TWT Power Supply

Features:

- **Compact and Lightweight**
- **Low Noise, High Performance**
- **High Reliability**
- **Operates a Wide Variety of TWTs**
- **1600 Watts of Output Power**



The M755 is a very lightweight, compact and high performance TWT power supply designed specifically for medium-power military radar applications.

It is capable of operating TWTs with up to 500 watts of average RF output power.

Although optimized for use with the 8kW, 5% duty X-band L5982 TWT, the M755 can be configured to operate in pulse or CW mode and is suitable for ECM, military communications, and other applications as well as radar.

State-Of-The-Art Power Electronics

- High frequency zero-current switching
- Independent mag-amp control of the filament supply
- A high speed and low noise floating-deck modulator
- A linear post-regulator for extremely low helix ripple voltage and low phase noise
- Modern, high performance components used throughout: high-speed power MOSFETs and high voltage diodes, lightweight high voltage capacitors, high frequency power magnetics, advanced power integrated circuits.

High-Reliability, Long-Life Design

- Component derating generally meets the requirements of U.S. government documents NAVMAT P-4855-1 and AS-4613.

Advanced Packaging Techniques

- Surface-Mount Technology (SMT)
- Hybrid Power Electronics
- Proprietary Potting Compounds
- Modular Design

Special Features

- Serial data link for transmission of status information with minimal wiring
- Rapid recovery to full power output after momentary loss of prime power
- Optional +12 VDC output available

DS7550904

Cleared by DoD/DFOISR for public release under 05-S-0093 on 10/25/04

L-3 Communications Electron Devices, Ph: 650-591-8411 Fax: 650-508-1956 E-mail: scl.marketing@L-3com.com

M755 Power Supply

Electrical Performance

Cathode Voltage . . . . . 13 to 16 kV, 2 kV adjustment range (Can be set to lower voltage ranges)

Collector Voltages . . . . Can be modified for different voltages or TWTs with single stage or three stage collectors

Collector 1 Voltage. . . . 70% of Cathode Voltage (typical)

Collector 2 Voltage. . . . 40% of Cathode Voltage (typical)

Heater. . . . . -6.3 VDC

3 amps max.

Warm-up Timer . . . . . 180 seconds maximum upon first applying prime power

In case of temporary loss of prime power, warm-up time reduced proportionately

Modulator . . . . . On-bias settable from +220 to +260
Off-Bias of -240 volts
Voltages are typical, other ranges available

Modulator Waveform . . 125 nsec acquisition time (max)
40 nsec voltage rise time (10 nsec typ. for RF)
Pulse width from 100 nsec to 50 µsec
PRF to 50 kHz

Input Prime Power . . . . 270 VDC or 3-phase, 200 V_{LL}, 400 Hz
Per MIL-STD-704E
1900 wattst, maximum
0.9 power factor

Output Power . . . . . 1400 watts to the TWT
+12 Volts, 0.5 amps optional

Controls, Indicators, and Monitors

The following interface signals are available on the M755. Typical applications use a subset of these signals and L-3 Electron Devices can configure the interface per customer requirements. The control and indicator signals are available as TTL or as differential line driver/receiver signals.

Controls

- Standby / Operate (HV On / Off)
- Pulse (Modulator On / Off)
- Fault Reset
- PRF Synchronization
- Pre-Trigger (Blanking)
- Battle Override

Indicators

- High Voltage On
- Operate
- Standby
- Warm-Up
- Fault
- Serial Link (see next page)

Monitors

Cathode Voltage	(1000:1)
Beam Current	(1 Volt/Amp)
Helix Current	(1 Volt/Amp)
Grid Voltage	(100:1)

Mechanical

Cooling . . . . . Conduction to mounting surface
Weight . . . . . 26 lbs
Dimensions . . . . . 14.25” long x 6” wide x 5” high 428 ci
(362mm x 153 mm x 127mm) 7034 cc

Environmental

Temperature . . . . . -40 to +70°C
Altitude . . . . . 35,000 feet
Vibration . . . . . 6 g’s rms, 5 to 2000 Hz
Shock . . . . . 15 g’s, 11 msec
Humidity. . . . . Up to 100% including condensation

Electron Devices
960 Industrial Road, San Carlos, CA 94070
Ph: 650-591-8411 Fax: 650-508-1956
E-mail: scl.marketing@L-3com.com
Web Site: www.L-3com.com/edd

Serial Data Link Description

The following serial data is transmitted asynchronously at 9600 bits per second, continuously retransmitting 400 12-bit words. Only Words 1 through 4 contain information. All signals are active high.

Bit	Word 1	Word 2	Word 3	Word 4	Words 5–400
0	Low	Low	Low	Low	High
1	Low	Low	High	High	High
2	Low	High	Low	High	High
3	HV Off Indicator	HVPS Inverter Overcurrent Fault	Low	TWT Overtemperature	High
4	Warm-Up / Indicator	Cathode Over Voltage Fault	Low	Heater Under Current Fault	High
5	Summary Fault Indicator	Cathode Under Voltage Fault	Beam Peak Current Fault	High Voltage Interlock Fault	High
6	PRF Synchronization Fault	HVPS Thermal Fault	Beam Average Current Fault	Excess Duty Fault	High
7	Battle Override (Negative polarity)	HVPS Logic Over Voltage Fault	Helix Peak Current Fault	Prime Power Over/Under Voltage Fault	High
8	High	HVPS Logic Under Voltage Fault	Helix Average Current Fault	Safety Overtemperature Fault	High
9	Operate	Standby Indicator	High	High	High
10	High	High	High	High	High
11	High	High	High	High	High

Associated TWTs

The M755 is capable of operating a wide variety of TWTs. Some examples are listed below.

Model	Frequency	Power	Duty Cycle
L5827	0.7 - 2.0 GHz	1 kW	4%
L5873	2.5 - 8.0 GHz	1 kW	8%
L5737	7.5 - 18.0 GHz	1 kW	5%
L5850	8.5 - 10.5 GHz	2 kW	6%
L5982	9.0 - 10.0 GHz	8 kW	5%
L2119	2.5 - 8.0 GHz	125 Watts	CW
L5841	7.5 - 18.0 GHz	125 Watts	CW

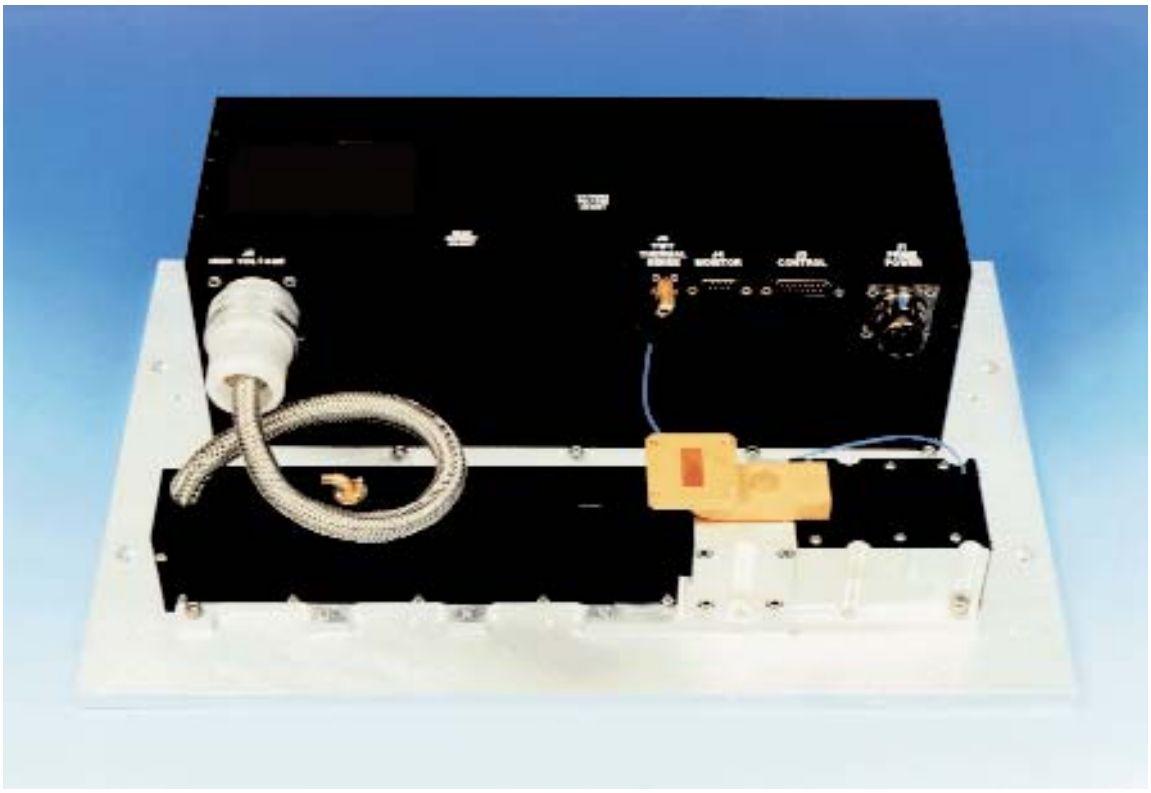
Electron Devices
960 Industrial Road, San Carlos, CA 94070
Ph: 650-591-8411 Fax: 650-508-1956
E-mail: scl.marketing@L-3com.com
Web Site: www.L-3com.com/edd

Fault Protection Matrix

Fault Condition	RF Off	HV Off	Auto Reset, Latches After 3 Tries	Auto Reset After Fault Clears	External Reset	Cycles Back To Warm-Up
TWT Arc	X	X	X		X	
Excess Peak Helix Current	X	X	X		X	
Excess Average Helix Current	X	X	X		X	
Excess Peak Beam Current	X	X	X		X	
Excess Average Beam Current	X	X	X		X	
Cathode Over-Voltage	X	X	X		X	
Cathode Under-Voltage	X			X		
Heater Under-Current	X	X		X		X
Prime Power Over-Voltage	X	X		X		
Prime Power Under-Voltage	X	X		X		
Prime Power Over-Current	X	X	X		X	
TWT Over-Temperature	X	X		X		
Power Supply Over-Temperature	X	X		X		
HV Connector Interlock	X	X			X	X
Internal Power Supply Voltage	X	X		X		
Excess Duty Cycle	X			X		
Excess Pulse Width*	X			X		

* TWTA remains operational, pulses truncated.

Electron Devices
960 Industrial Road, San Carlos, CA 94070
Ph: 650-591-8411 Fax: 650-508-1956
E-mail: scl.marketing@L-3com.com
Web Site: www.L-3com.com/edd

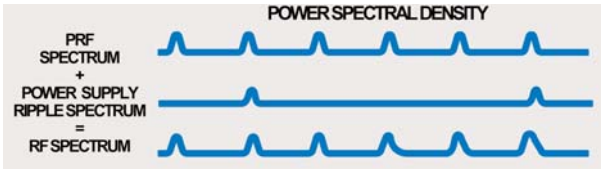


The M755 is shown above with the L5982 TWT, forming a compact 8kW, 5% duty X-band TWTA.

Phase Noise

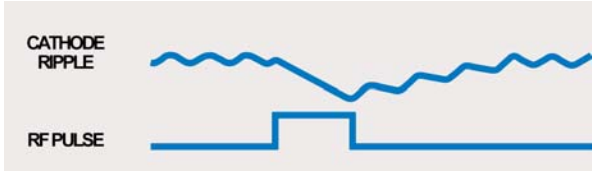
The M755 has been optimized for modern radar systems which require a low phase noise TWTA. The primary contributor to phase noise in TWTAs is ripple voltage on the TWT cathode and grid. In addition to very accurate regulation and significant filtering, the M755 has two phase noise reduction techniques which can be utilized to achieve ultra-low noise: PRF synchronization and blanking (pre-trigger). Depending on the TWT and the phase noise reduction technique employed, the M755 can achieve noise levels of -105 dBc/Hz with a maximum spur of -70 dBc at 2400 Hz (six times the line frequency).

PRF Synchronization



With PRF synchronization the ripple voltage is not reduced, rather it is controlled in frequency such that the phase noise effects of the ripple are effectively eliminated. This technique requires an input signal with a frequency of 380 ± 10 kHz and an integer multiple of the pulse frequency (PRF). This signal is used to synchronize the power supply switching frequency, and hence the output ripple frequency, of the M-755. As can be seen by the pictorial example above, the phase noise spectrum generated by the ripple voltage is masked by the spectrum generated by the output pulse.

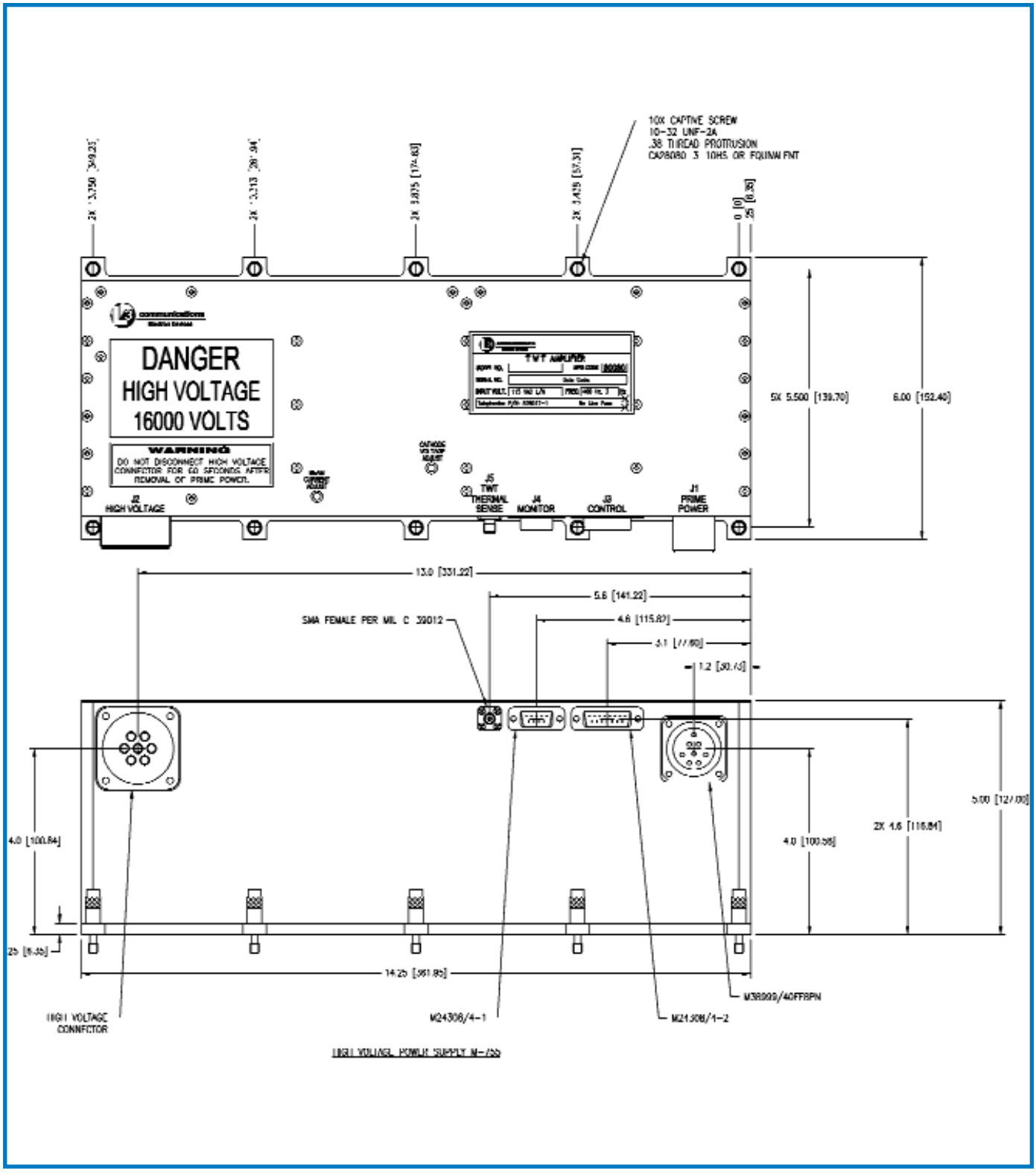
Blanking (Pre-Trigger)



The blanking technique eliminates ripple voltage during the pulse by turning the high voltage power processing circuits off during the pulse. This is best achieved with a pre-trigger input which turns the power supply off slightly before the application of the pulse, but for wide pulse width applications this input may be omitted. The high voltage outputs are supported by high voltage capacitors during the pulse. This technique, illustrated above, works best with relatively long pulse widths and low pulse frequencies.

Electron Devices
960 Industrial Road, San Carlos, CA 94070
Ph: 650-591-8411 Fax: 650-508-1956
E-mail: scl.marketing@L-3com.com
Web Site: www.L-3com.com/edd

M755 Outline Drawing



Electron Devices
960 Industrial Road, San Carlos, CA 94070
Ph: 650-591-8411 Fax: 650-508-1956
E-mail: scl.marketing@L-3com.com
Web Site: www.L-3com.com/edd