

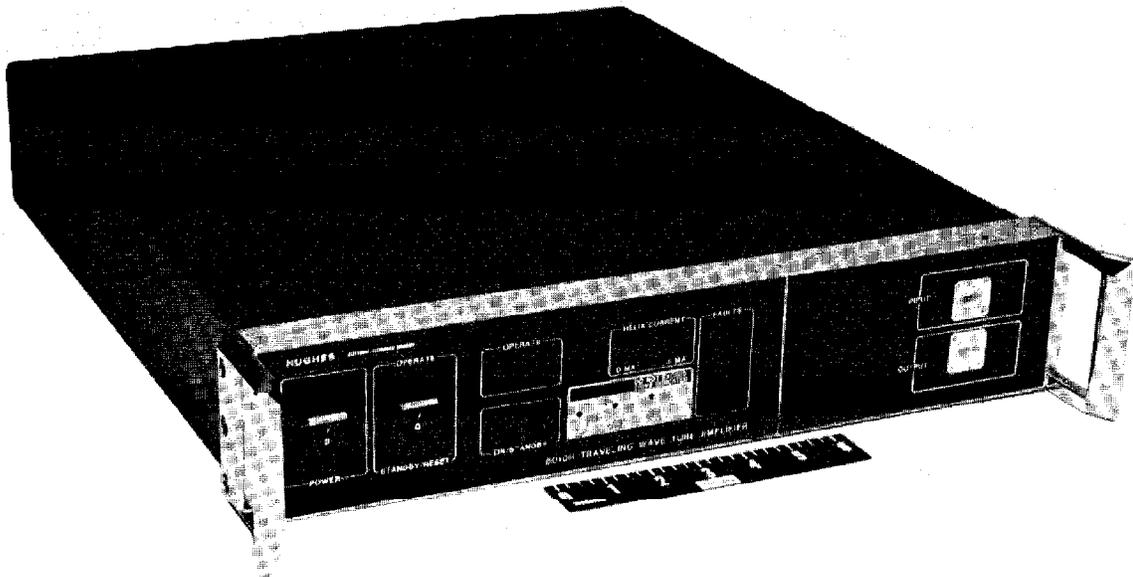


# 8000H SERIES

Instrumentation Amplifiers

1.0 to 18.0 GHz    10, 20, and 30 Watts

18.0 to 40.0 GHz    1 and 10 Watts



## FEATURES

- Hughes-Designed and -Built TWTs
- High Reliability
- High-Efficiency Switching Regulator and Converter
- Lightweight-Compact
- Low Spurious Modulation
- IEEE-488 Data-Bus Interface and Other Options Available
- Protective Features
- LED Fault Indicators
- Automatic Recycle
- Full One-Year Warranty — No Hour Limit

## DESCRIPTION

Hughes 8000H Series Instrumentation Traveling-Wave Tube Amplifiers are specifically designed for general-purpose system and component testing and laboratory experimentation and measurement. Customized units can be provided for communications and other specialized applications.

The 8000H Series offers power levels of 10, 20, and 30 watts in the 1.0- to 18.0-GHz range, along with 1- and 10-watt levels between 18.0 and 40.0 GHz. Higher power models, including many in the millimeter-wave 18.0- to 50.0-GHz range, are also available. (Reference their specific data sheets or consult the factory for details.)

The 8000H Series TWT amplifier is a compact

and lightweight, self-contained equipment case designed for bench top or rack mounting. The unit is comprised of a Hughes-designed and -manufactured TWT and fully filtered and regulated high-efficiency switching power supply. Integral cooling, automatic recycle, and protective features are included. In addition, a wide variety of options is available, including an IEEE-488 data-bus interface.

Hughes 8000H Series TWT Amplifiers offer superior performance and high reliability. Each 8000H TWT Amplifier described in this data sheet includes a full one-year warranty — no hour limit.

<b>1.0 TO 18.0 GHz MODELS</b>					
<b>TWTA POWER OUTPUT (WATTS/MIN.)</b>	<b>FREQUENCY</b>	<b>GAIN AT RATED POWER<sup>1,2</sup> (dB/MIN.)</b>	<b>TWTA MODEL NUMBER</b>	<b>RF CONNECTOR TYPE INPUT/OUTPUT</b>	<b>TWT MODEL NUMBER</b>
10	<b>STANDARD BANDS</b>				
	1.0 to 2.0	30	8010H09*000	N	417HD
	2.0 to 4.0	30	8010H01*000	N	564H
	4.0 to 8.0	30	8010H02*000	N	648HD
	8.0 to 12.4	30	8010H03*000	N	771HD
	12.4 to 18.0	30	8010H04*000	SMA	848HD
	<b>MULTIBANDS</b>				
	2.0 to 8.0 <sup>3</sup>	30	8010H19*000	N	8582H
	3.0 to 8.0	30	8010H13*000	N	646H
	3.9 to 11.7 <sup>4</sup>	30	8010H16*000	N	664H
	4.0 to 10.5 <sup>4</sup>	30	8010H06*000	N	648HDS
	6.5 to 13.5	30	8010H07*000	N	771HDS
	7.0 to 16.3	30	8010H17*000	SMA	785HD
	8.0 to 18.0	30	8010H15*000	SMA	846H
	20	<b>STANDARD BANDS</b>			
1.0 to 2.0		30	8020H09*000	N	418H
2.0 to 4.0		30	8020H01*000	N	568H
4.0 to 8.0		30	8020H02*000	N	640H
8.0 to 12.4		30	8020H03*000	N	783H
12.4 to 18.0		30	8020H04*000	SMA/UG419	856H
<b>MULTIBANDS</b>					
1.4 to 2.4		30	8020H10*000	N	419H
8.0 to 18.0		30	8020H15*000	SMA	889H
30		4.0 to 8.0	30	8030H02*000	N
<b>18.0 TO 26.5 AND 26.5 TO 40.0 GHz MODELS</b>					
(Higher power millimeter-wave TWT amplifiers available. Consult the factory.)					
1	18.0 to 26.5	30	8001H11*000	UG596 (WR42)	911H
	26.5 to 40.0	30	8001H12*000	UG600 (WR28)	912H
10	18.0 to 26.5	40	8010H11*000	UG596 (WR42)	991H
	26.5 to 40.0	40	8010H12*000	UG600 (WR28)	992H

\*Denotes RF Connector Location: F-front panel, R-rear panel. Specify at time of order placement.

<sup>1</sup>Small-Signal gain typically 5 dB higher.

<sup>2</sup>Higher gain available, consult the factory for details.

<sup>3</sup>Under development at time of publication.

<sup>4</sup>Power and gain slightly lower at band edges.

## OPERATIONAL FEATURES

### Controls (front panel)

- Prime Power On/Off
- RF Operate/Standby (Reset)
- Variable RF Input Attenuator (optional)

### Operational Status Indicators (front panel)

- Prime Power On/Standby
- RF Operate
- Remote/Local (optional)
- Fault
  - Helix Current Overload
  - TWT or Power Supply Overtemperature
  - Low Line Voltage
  - Safety Interlock Open

### Metering (front panel)

- Helix Current
- RF Power Output (optional)

### Protection

- Prime Power Fuse (rear panel)
- TWT Warm-up Delay

- Automatic Sequencing of High Voltage and Beam Current
- Unattended Protection (extended standby shutdown)
- Helix Current Overload
- High TWT or Power Supply Temperature
- Low Line Voltage
- High Line Voltage
- Safety Interlocks

### Automatic Recycle

This feature automatically recycles the TWTA from ready to "RF on" in the event of a momentary fault condition, such as a power outage of less than 3 seconds, low line voltage, overtemperature, or helix current overload. In the event of two consecutive helix current overload faults, the TWTA will revert to the "off" mode and require manual reset (either locally or via the remote interface) or recycling the prime power.

## SPECIFICATIONS<sup>1</sup>

### RF Performance

Frequency .....	see table to left
Power Output .....	see table to left
Gain at Rated Power Output .....	see table to left
Duty .....	CW
Noise Figure .....	35 dB maximum
Spurious Modulation .....	-50 dBc
Load VSWR .....	2.5:1 maximum
Gain Stability .....	0.25 dB/24 hours <sup>2</sup>

### Electrical

Input Voltage .....	99 to 132 VAC, 47 to 63 Hz	
Power Consumption .....	8001H .....	115 watts <sup>3</sup>
.....	8010H .....	250 watts <sup>3</sup>
.....	8020H .....	280 watts <sup>3</sup>
.....	8030H .....	350 watts <sup>3</sup>

### Mechanical

Size/Configuration .....	see drawing
Weight .....	20 pounds (9.1 kg) maximum
Cooling (integral blower) .....	forced air
RF Connector Type .....	see table to left

### Environmental

Temperature (operating) .....	0 to +50°C
Relative Humidity (without condensation) .....	95% maximum
Altitude .....	10,000 feet maximum <sup>4</sup>
Shock and Vibration .....	as normally encountered in commercial shipping and handling

### Warranty

One full year — no hour limit

<sup>1</sup>Specifications subject to change without notice.

<sup>2</sup>At constant drive and temperature after warm-up period.

<sup>3</sup>Indicates maximum power consumption of any model in that power range. For information on specific models, consult the factory.

<sup>4</sup>40°C maximum operating temperature above 6,000 feet.

## OPTIONAL REMOTE-CONTROL INTERFACE DEFINITION

OPTION F — REMOTE CONTROL INTERFACE (RELAY CONTACT) (CANNON DBMA-25S OR EQUIVALENT)		
Pin Number	Nomenclature	Characteristics
<b>Commands</b>		
1	Power On	Form "A" contact to ground 150 mA maximum
2	Operate	Form "A" contact to ground 65 mA maximum
13	Command Enable +15 VDC	+15 VDC $\pm 0.5$ @ 215 mA maximum user supplied
25	Beam Off (optional)	Form "A" contact to ground 65 mA maximum
<b>Status</b>		
3	Power On	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
5	Operate	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
22	Remote Indicator	Form "A" contact to ground 100 mA maximum
<b>Faults</b>		
4	Summary Fault	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
6	Line Under Voltage	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
7	Interlock	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
8	Thermal	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
9	Helix Current	Open-collector Darlington output (emitter grounded) +15 V maximum standoff
14	Summary Fault (optional)	Low-Fault ( $< 1$ V), $Z_{out} = 1$ K $\Omega$ , High=Norm ( $\approx 14$ V)
15	Low RF (optional)	High=Fault ( $\approx 14$ V), Low=Norm ( $< 1$ V), $Z_{out} = 1$ K $\Omega$
<b>Analog</b>		
10	Helix Current	0 to 5 V full scale, $Z_{out} = 1$ K $\Omega$
11	RF Power (optional)	0 to 5 V full scale, $Z_{out} = 1$ K $\Omega$
17	Ground	Chassis

OPTION H — REMOTE-CONTROL INTERFACE (TTL) (CANNON DBMA-25S OR EQUIVALENT)		
Pin Number	Nomenclature	Characteristics
<b>Commands</b>		
1	Power On	1 TTL load, 0.1 $\mu$ F input, Low=True
2	Operate	1 TTL load, 0.1 $\mu$ F input, Low=True
25	Reset	1 TTL load, Low=True
<b>Status</b>		
3	Power On	Open-collector Darlington output (emitter grounded) +50 V maximum standoff
5	Operate	Open-collector Darlington output (emitter grounded) +50 V maximum standoff
14	Fault	Open-collector Darlington output (emitter grounded) +50 V maximum standoff
16	Power On	TTL output, Fanout=2
17	Ground	Chassis
19	Ready	TTL output, Fanout=2
20	Ready	Open-collector Darlington output (emitter grounded) +50 V maximum standoff
23	Operate	TTL output, Fanout=2
24	Fault	TTL output, Fanout=2

### OPTION P — REMOTE-CONTROL INTERFACE (IEEE-488 DATA BUS)

Consult the factory for detailed description.

## **OPTIONS LIST**

### **Option A — 198 to 264 VAC Input Voltage**

This option provides for 198 to 264 VAC, 47 to 63 Hz operation.

### **Option E — Rackmount**

This option allows the unit to be mounted in a standard EIA 19-inch cabinet.

### **Option F — Remote-Control Interface (Relay Contact)**

This option provides remote control, status indication, and metering via a relay contact, open-collector Darlington output and proportional voltage interface. This remote interface is recommended for use in noisy environments. The distance between the TWTA and remote panel can be up to 150 meters.

### **Option G — 400 Hz**

This option provides for 380 to 420 Hz AC frequency operation.

### **Option H — Remote-Control Interface (TTL)**

This option consists of computer-compatible, transistor-transistor logic (TTL) command and control circuitry that provides turn-on, turn-off, and reset functions, as well as full status indication. The prime power for these control circuits is normally supplied internally.

### **Option I — 28 Vdc Input Voltage**

This option allows the unit to operate from either a negative or a positive 28 ( $\pm 3$ ) Vdc bus.

### **Option J — Output Isolator/Circulator**

This option protects the traveling-wave tube from varying load VSWR conditions. All isolators are mounted within the amplifier. Due to the insertion loss of the isolator, the output power will be slightly lower (0.5 dB typically) than the level normally available from these units.

### **Option K — High Gain**

This option adds a solid-state preamplifier at the input to the traveling-wave tube to provide higher overall TWTA gain when minimal drive is available. In addition to this option, selected higher-gain tubes are available.

### **Option M — 48 Vdc Input Voltage**

This option allows the amplifier to be operated from either a negative or a positive 48 (-4, 18) Vdc bus.

### **Option N — Variable Input Attenuator**

This option allows the amplifier gain to be continuously adjusted 0 to 20 dB for applications that can provide excessive drive power to the input of the TWTA, or require RF gain adjustment.

### **Option P — Remote-Control Interface (IEEE 488 Data Bus)**

This option provides a parallel digital interface that conforms to "IEEE STD. 488 - 1978." The option allows monitoring of all TWTA conditions and, when in remote, allows control of the TWTA from a computer. Monitored lines consist of TWTA mode status, fault status, RF power out,\* and helix current telemetry. This option is entirely contained within the TWTA chassis, has a user-selectable address, and is operational any time line voltage is applied.

### **Option Q — Input Isolator**

This option optimizes the TWTA input match for system applications where low input VSWR is required. Consult the factory for specifications.

### **Option R — RF Signal Sample Port**

This option provides a port to sample RF output. Consult the factory for specifications.

### **Option S — Output Harmonic Filter**

This option adds a harmonic (lowpass) filter after the output of the traveling-wave tube. Consult the factory for specifications.

### **Option T — RF Metering**

This option provides a relative indication of RF output power. An LED bar graph display is provided on the TWTA front panel. RF output power indication is also provided at the TWTA remote-control interface, if used in conjunction with Options F or P.

\*Requires Option T — RF Metering

**OTHER OPTIONS ARE AVAILABLE UPON REQUEST.**

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**ELECTRON DYNAMICS DIVISION**  
 Industrial Electronics Group

