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
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.

### 1.0 TO 18.0 GHz MODELS

<table>
<thead>
<tr>
<th>TWTA POWER OUTPUT (WATTS/MIN.)</th>
<th>FREQUENCY</th>
<th>GAIN AT RATED POWER&lt;sup&gt;1,2&lt;/sup&gt; (dB/MIN.)</th>
<th>TWTA MODEL NUMBER</th>
<th>RF CONNECTOR TYPE</th>
<th>TWT MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDARD BANDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 to 2.0</td>
<td>30</td>
<td>8010H09'000</td>
<td>N</td>
<td>417HD</td>
<td></td>
</tr>
<tr>
<td>2.0 to 4.0</td>
<td>30</td>
<td>8010H10'000</td>
<td>N</td>
<td>564H</td>
<td></td>
</tr>
<tr>
<td>4.0 to 8.0</td>
<td>30</td>
<td>8010H12'000</td>
<td>N</td>
<td>648H</td>
<td></td>
</tr>
<tr>
<td>8.0 to 12.4</td>
<td>30</td>
<td>8010H13'000</td>
<td>N</td>
<td>771HD</td>
<td></td>
</tr>
<tr>
<td>12.4 to 18.0</td>
<td>30</td>
<td>8010H15'000</td>
<td>SMA</td>
<td>848H</td>
<td></td>
</tr>
<tr>
<td><strong>MULTIBANDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 to 8.0</td>
<td>30</td>
<td>8010H19'000</td>
<td>N</td>
<td>8582H</td>
<td></td>
</tr>
<tr>
<td>3.0 to 8.0</td>
<td>30</td>
<td>8010H20'000</td>
<td>N</td>
<td>646H</td>
<td></td>
</tr>
<tr>
<td>3.9 to 11.7&lt;sup&gt;3&lt;/sup&gt;</td>
<td>30</td>
<td>8010H21'000</td>
<td>N</td>
<td>664H</td>
<td></td>
</tr>
<tr>
<td>4.0 to 10.5&lt;sup&gt;4&lt;/sup&gt;</td>
<td>30</td>
<td>8010H22'000</td>
<td>N</td>
<td>648HDS</td>
<td></td>
</tr>
<tr>
<td>6.5 to 13.5</td>
<td>30</td>
<td>8010H24'000</td>
<td>N</td>
<td>771HDS</td>
<td></td>
</tr>
<tr>
<td>7.0 to 16.3</td>
<td>30</td>
<td>8010H27'000</td>
<td>SMA</td>
<td>785H</td>
<td></td>
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<tr>
<td>8.0 to 18.0</td>
<td>30</td>
<td>8010H29'000</td>
<td>SMA</td>
<td>846H</td>
<td></td>
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<tr>
<td><strong>STANDARD BANDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 to 2.0</td>
<td>30</td>
<td>8020H03'000</td>
<td>N</td>
<td>418H</td>
<td></td>
</tr>
<tr>
<td>2.0 to 4.0</td>
<td>30</td>
<td>8020H04'000</td>
<td>N</td>
<td>568H</td>
<td></td>
</tr>
<tr>
<td>4.0 to 8.0</td>
<td>30</td>
<td>8020H05'000</td>
<td>N</td>
<td>640H</td>
<td></td>
</tr>
<tr>
<td>8.0 to 12.4</td>
<td>30</td>
<td>8020H07'000</td>
<td>N</td>
<td>783H</td>
<td></td>
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<tr>
<td>12.4 to 18.0</td>
<td>30</td>
<td>8020H09'000</td>
<td>SMA/UG419</td>
<td>856H</td>
<td></td>
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<tr>
<td><strong>MULTIBANDS</strong></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.4 to 2.4</td>
<td>30</td>
<td>8020H10'000</td>
<td>N</td>
<td>419H</td>
<td></td>
</tr>
<tr>
<td>8.0 to 18.0</td>
<td>30</td>
<td>8020H11'000</td>
<td>N</td>
<td>889H</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>4.0 to 8.0</td>
<td>8030H02'000</td>
<td>N</td>
<td>670H/1A-299</td>
<td></td>
</tr>
</tbody>
</table>

### 18.0 TO 26.5 AND 26.5 TO 40.0 GHz MODELS

(Higher power millimeter-wave TWT amplifiers available. Consult the factory.)

<table>
<thead>
<tr>
<th>TWTA POWER OUTPUT (WATTS/MIN.)</th>
<th>FREQUENCY</th>
<th>GAIN AT RATED POWER&lt;sup&gt;1,2&lt;/sup&gt; (dB/MIN.)</th>
<th>TWTA MODEL NUMBER</th>
<th>RF CONNECTOR TYPE</th>
<th>TWT MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0 to 26.5</td>
<td>30</td>
<td>8010H11'000</td>
<td>UG596 (WR42)</td>
<td>911H</td>
<td></td>
</tr>
<tr>
<td>26.5 to 40.0</td>
<td>30</td>
<td>8010H12'000</td>
<td>UG600 (WR28)</td>
<td>912H</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0 to 26.5</td>
<td>40</td>
<td>8010H11'000</td>
<td>UG596 (WR42)</td>
<td>991H</td>
<td></td>
</tr>
<tr>
<td>26.5 to 40.0</td>
<td>40</td>
<td>8010H12'000</td>
<td>UG600 (WR28)</td>
<td>992H</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>Denotes RF Connector Location: F-front panel, R-rear panel. Specify at time of order placement.

<sup>2</sup>Small-Signal gain typically 5 dB higher.

<sup>3</sup>Higher gain available; consult the factory for details.

<sup>4</sup>Under development at time of publication.

<sup>3</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.

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**SPECIFICATIONS**

**RF Performance**
- Frequency
- Power Output
- Gain at Rated Power Output
- Duty
- Noise Figure
- Spurious Modulation
- Load VSWR
- Gain Stability

**Electrical**
- Input Voltage
- Power Consumption

**Mechanical**
- Size/Configuration
- Weight
- Cooling (integral blower)
- RF Connector Type

**Environmental**
- Temperature (operating)
- Relative Humidity (without condensation)
- Altitude
- Shock and Vibration

**Warranty**
One full year — no hour limit

1 Specifications subject to change without notice.
2 At constant drive and temperature after warm-up period.
3 Indicates maximum power consumption of any model in that power range. For information on specific models, consult the factory.
4 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)

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Nomenclature</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power On</td>
<td>Form &quot;A&quot; contact to ground 150 mA maximum</td>
</tr>
<tr>
<td>2</td>
<td>Operate</td>
<td>Form &quot;A&quot; contact to ground 65 mA maximum</td>
</tr>
<tr>
<td>13</td>
<td>Command Enable</td>
<td>+15 VDC ±0.5 @ 215 mA maximum user supplied</td>
</tr>
<tr>
<td>25</td>
<td>Beam On (optional)</td>
<td>Form &quot;A&quot; contact to ground 85 mA maximum</td>
</tr>
</tbody>
</table>

#### Commands

- **1** Power On
- **2** Operate
- **13** Command Enable
- **25** Beam On (optional)

#### Status

- **3** Power On
- **5** Operate
- **22** Remote Indicator

#### Faults

- **4** Summary Fault
- **6** Line Under Voltage
- **7** Interlock
- **8** Thermal
- **9** Helix Current
- **14** Summary Fault (optional)
- **15** Low RF (optional)

#### Analog

- **10** Helix Current
- **11** RF Power (optional)
- **17** Ground

**OPTION H — REMOTE CONTROL INTERFACE (TTL)**
(CANNON DBMA-25S OR EQUIVALENT)

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Nomenclature</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power On</td>
<td>1 TTL load, 0.1 μF input, Low=True</td>
</tr>
<tr>
<td>2</td>
<td>Operate</td>
<td>1 TTL load, 0.1 μF input, Low=True</td>
</tr>
<tr>
<td>25</td>
<td>Reset</td>
<td>1 TTL load, Low=True</td>
</tr>
</tbody>
</table>

#### Commands

- **1** Power On
- **2** Operate
- **25** Reset

#### Status

- **3** Power On
- **5** Operate
- **14** Fault
- **16** Power On
- **17** Ground
- **19** Ready
- **20** Ready
- **23** Operate
- **24** Fault

#### Faults

- **4** Summary Fault
- **6** Line Under Voltage
- **7** Interlock
- **8** Thermal
- **9** Helix Current
- **15** Summary Fault (optional)
- **16** Low RF (optional)

#### Analog

- **10** Helix Current
- **11** RF Power (optional)
- **17** Ground

**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 (±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 L — 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 M — 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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Hughes Aircraft Company, Electron Dynamics Division
3100 West Lomita Boulevard, P.O. Box 2999, Torrance, CA 90509-2999. Tel (213) 517-0000