



# E&I UltraX-20

## Broadband Power Amplifier



HIGH RF VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.

Do not attempt to operate this unit prior to reading this manual.

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## Warranty

Electronics & Innovation Ltd., (hereafter E&I) warrants for the period of three year from the date of original delivery, each unit to be free of defects in materials and workmanship. For the period of 36 months E&I will, at its option, repair or replace defective parts so as to render the unit fully operational such that it performs according to the original specifications; free of charge to the original purchaser.

Should warranty service be required, the unit must be returned to E&I, freight cost to be borne by the owner. If, in our opinion, the unit has been damaged by use outside the limits prescribed in this manual or by accident, then the warranty shall not be honored. In such a case E&I will provide an estimate for repair, assuming repair is possible and provide a quote at standard service rates.

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## **Chapter 1 Introduction**

The UltraX-20 is a broadband solid state amplifier covering the frequency spectrum from 100 KHz to 2 MHz. It is rated at 20 watts of RF power with low harmonic and intermodulation distortion. Over 40 watts of saturated power can be produced with increased distortion products. A highly linear Class A design, the UltraX-20 will amplify inputs of AM, FM, SSB, pulse and any complex modulation signals. The amplifier has 43 dB gain it is unconditionally stable and will not oscillate even with combinations of mismatched source and load impedance. It is protected against failure due to output load mismatch.

An integral power supply permits operation from 115/230 single phase AC power.

### **1.2 INSTRUMENTATION IDENTIFICATION**

Each amplifier is identified by a serial number tag on the back panel of the unit. Both the model number and the serial number should be quoted to identify specific unit.

### **1.3 SPECIFICATIONS**

Physical and electrical specifications are listed in Table 1-1 below

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**Table 1-1. SPECIFICATIONS**

|                        |   |
|------------------------|---|
| FREQUENCY COVERAGE:    | 100 KHz to 2 MHz.   |
| GAIN:                  | 43 dB min, $\pm 1.5$ variation.   |
| CLASS A LINEAR OUTPUT: | Nominal 20 watts.   |
| HARMONIC DISTORTION:   | > -20 dBc at 20 watts output.   |
| INPUT IMPEDANCE        | 50 ohms, VSWR, 1.5:1 Maximum.   |
| OUTPUT IMPEDANCE:      | 50 ohms, VSWR, 2:1 Maximum  |
| STABILITY:             | Continuous operation into any load or source impedance.   |
| PROTECTION:            | Unit will withstand a + 13dBm input signal (1.0 Volts RMS max) into 50 ohms.<br>Unit will withstand +3dBm input for all load conditions |
| POWER REQUIREMENTS:    | 100 – 240 VAC 47-63 Hz.   |
| SIZE:                  | 13.5 X 12.0 X 3.25 inches 34.3 X 30.5 x 8.3 cm.   |
| WEIGHT:                | 8.5 pounds 3.9 kg   |
| CONNECTORS:            | BNC   |
| OPERATING TEMPERATURE: | 0 – 40 C  |

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## **Chapter 2 Operation**

### **2.1 INTRODUCTION**

The UltraX-20 RF amplifier is used to amplify the RF level of signal sources in the 100 KHz to 2 MHz range. No tuning or any other form of adjustment is required.

The UltraX-20 produces power output at its output connector, regardless of load impedance. Any power reflected due to output load mismatch is absorbed in the amplifier. Therefore, although the output impedance is 50 ohms (maximum VSWR: 2:1), the amplifier will work into any load impedance.

The maximum input applied should be less than +13 dBm (into 50ohm load), and +3dBm in any other load. Continuous operation above this level can cause degradation and failure.

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## **2.2 RACK INSTALLATION**

This unit is 2U high, 12" width. With it will fit into a standard rack.

### **2.2.1 Mains Voltage**

The unit accommodates AC line voltages from 100 TO 240 VAC 47 – 63 Hz

## **2.3 OPERATION**

A line cord is supplied to form a connection between the mains supply and the rear of the unit. Plug this into AC input at the rear of the unit and the AC mains outlet.

### **2.3.1 Proceed as follows:**

- (i) Ensure that there is at least 3" or 7.5 cm clearance at the rear of the unit for air flow.
- (ii) Switch on power and observe that the green led illuminates. (A brief flash of the fault led is normal at turn on).
- (iii) Ensure RF input voltage is not excessive
  - a. The 1 V rms indicated maximum input voltage is 5 times the level of the input signal required to achieve maximum output. Input voltages in excess of 2 volts peak may permanently damage the instrument.
- (iv) Connect the output via a 50 ohm coaxial lead and BNC plug to the load.
- (v) Connect the input signal via a 50 ohm coaxial lead and BNC plug to the input connector.

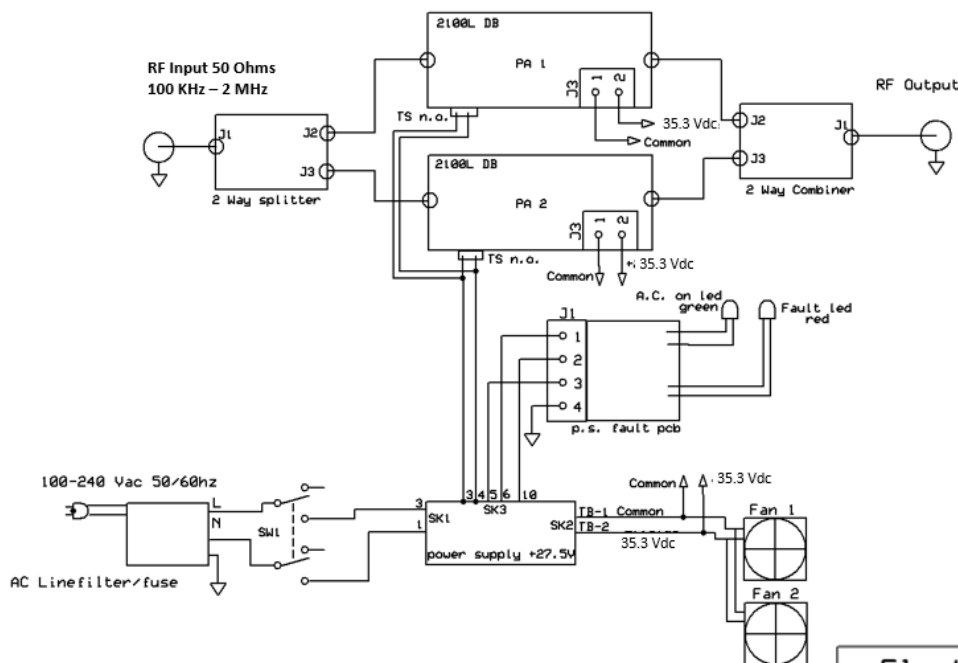
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## Chapter 3 Technical Description

### 3.1 GENERAL DESCRIPTION

The UltraX-20 is designed to amplify signals by 43 dB in the frequency band of 100 KHz to 2 MHz. The signal from the front panel BNC connector is fed via a length of 50 ohm coaxial cable into the input of the two way splitter. The signal is split into two and fed to the two power amplifiers that are in parallel with each other. Each power amplifier is a two stage unit, each stage comprising of a push-pull LDMOS Fet. The output of each stage is then combined and fed to the output of the unit.

The power supply unit provides a 35.3 VDC 5 ampere source. It is a switch mode power supply unit. The output feeds the PA The power supply also has a 5 VDC output which feeds the fault detection board.



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If the PA heat sink temperature exceeds 70C the unit will fault to prevent damage. This will be indicated by a Red LED on the front panel. The unit will not need to be power cycled to reset the fault condition.

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## **Chapter 4 Maintenance**

### **4.1 INTRODUCTION**

The UltraX-20 RF amplifier requires no periodic maintenance. The instrument is unconditionally stable and is fail-safe under all load conditions. Damage can only be externally caused by the incorrect selection of the AC supply voltage or by an input signal in excess of the specified 1 volt rms equivalent to a power level of +13dBm.

This chapter therefore, deals only with certain fundamental procedures for fault location.

Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless they are also quoted in the Specification Section 1.2.

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## 4.2 PERFORMANCE CHECKS

To determine the amplifier's performance, carry out the following procedure.

### 4.2.1 Initial Check

The following check can be made after repair and adjustments or whenever the condition of the unit is in question.

- a. Connect AC power supply. Switch on power and observe that the green led illuminates. A brief flash of the fault led is normal at turn on.
  - b. Connect a sweep generator (HP 8601 or similar) capable of sweeping the frequency range 50 KHz to 2 MHz, to the input connector.
  - c. Adjust the output level of the sweep generator so that a 50 ohm video detector connected at the output of the unit will not be damaged by excessive power output. (Reference section 4.4.1 for set up.)
  - d. Observe the gain versus frequency ripple on an oscilloscope calibrated in decibels. The gain variation must be not more than +/- 1.5 dB over the frequency range.
  - e. Connect a calorimetric power meter (HP434 or equivalent) through a 10dB 200-watt attenuator to the output connector. Adjust the input CW signal to any frequency between 100 kHz and 2 MHz for 20 watts output.
  - f. Observe the harmonic distortion of the output on a spectrum analyzer. The harmonic components contributed by the amplifier should be better than 20 dB down from the fundamental.
- (a) If the above items are found to be outside of the specification, check the spectral content of the input signal. If this is a pure signal then the unit needs to be returned to the factory for service.

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## 4.4.2 Measurement of Harmonics

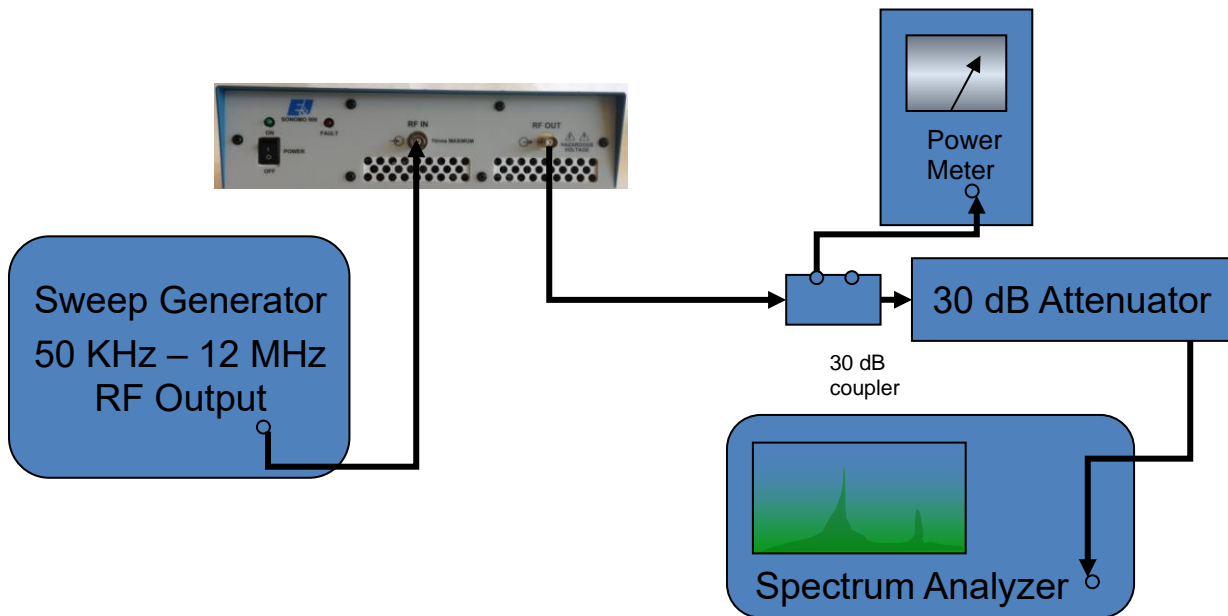


Figure 4-2.

### 1.) Equipment Required:

- a) Sweep/Signal Generator
- b) Calorimetric Power Meter HP434A
- c) Spectrum Analyzer.
- d) Attenuator (20dB)
- e) Attenuator (30dB)
- f) Coupler (30 dB)

### 2.) Connect the Equipment as shown in Figure 4-2, then proceed as follows:

- a) Adjust the signal generator to a CW center frequency of 1 MHz, for an indicated output of 20 watts on the power meter.
- b) Using the spectrum analyzer, check that the level of the carrier harmonics is less than -20 dB with respect to the carrier while manually scanning the frequency band of 100 KHz to 2 MHz. An indicated power output of 20W should be maintained during this operation.

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## 4.5 PACKAGING FOR RESHIPMENT

In the event of the equipment being returned for servicing it should be packed in the original shipping carton and packing material. If this is not available, wrap the instrument in heavy paper or plastic and place in a rigid outer box of wood, fiberboard or very strong corrugated cardboard. Use ample soft packing to prevent movement. Provide additional support for projecting parts to relieve these of unnecessary shock. Close the carton securely and seal with durable tape. Mark the shipping container FRAGILE to ensure careful handling.

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### **Chapter 5 Safety:**

Do not attempt to operate this unit with the cover removed. High AC and DC voltages are present. The cover prevents against electrical shock due to AC line voltages, high DC and RF fields. Further the cover provides part of the cooling system design. Components, specifically on the RF driver board are prone to over-heat and eventual failure if the unit is operated without the cover in place.

Ensure that the load is connected to the output prior to connecting the RF input to the unit. This will prevent high voltages being present and exposed at the output connector.

Only use the AC cord provided or equivalent.

Ensure that the mains outlet is properly grounded.

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