RITEC
BROADBAND RECEIVER
MODEL BR-640A

OPERATION MANUAL

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SECTION I
INTRODUCTION

The Model BR-640A Broadband receiver has been designed for general purpose use where a RF amplifier with a wide bandwidth, a low noise figure, and modest gain is required along with fast recovery from overload conditions. The frequency range for the unit is typically from 100 kHz to 50 MHz that are the typical –3dB points, along with switch selectable high pass and low pass filters. It is possible to change the frequency range for lower frequencies as an upgrade at the time of order. It has a maximum gain of 64 dB when operating into a 50 Ohm load on the receiver output. The receiver features a switch selectable input impedance of either 50 Ohms or an high impedance input of 100,000 Ohms shunted by a 25 pF capacitor. The receiver gain can be controlled over a 79 dB range from a minimum of -15dB to a maximum of +64 dB. This control is provided in 4 dB steps by a rotary switch on the front panel along with two switched attenuators of 1dB and 2dB, located in the upper right hand corner of the front panel. These attenuators are switched out (off) when the switches are in the down position. The maximum input signal before distortion is 8V peak-to-peak; this input voltage corresponds to an output of 1.42V peak-to-peak with the receiver gain set to –15dB. For an input signal of 625 microvolts peak-to-peak corresponds to an output of 1V peak-to-peak with the receiver gain set at the maximum of +64 dB. Because of the low noise figure of the receiver, further amplification can be applied to the output (as with an oscilloscope) to allow examination of extremely small signals. For example, when operating at full bandwidth, an input signal of approximately 48 microvolts peak-to-peak (20 microvolts RMS) will be equal to the equivalent noise input of the receiver.

Special attention has been paid to the recovery time in the BR-640A. It is protected against direct pulse inputs of up to 400 V peak with a duty cycle of 0.05%. Control of the receiver bandwidth is provided through three selectable high pass filters and three selectable low pass filters. The high pass filters make possible improved recovery time from overload conditions when the operating frequency permits their use. The low pass filters provide an improved signal-to-noise ratio (again, when the frequency of operation permits their use).

The one remaining control permits the user to select an impedance for the receiver input of either 50 Ohms or a high impedance (10 KOhm shunted by a 25 pF capacitor). This high impedance input. The latter is of value with low frequency high impedance transducers, typically up to a few megahertz before reflections in the cable start to become important and influence the performance.

A power accessory plug is provided to energize external accessories such as pre-amplifiers or diplexers. An external high impedance preamplifier is normally used with electromagnetic acoustic transducers (EMATs) where the pre-amplifier must be electrically and mechanically

close to the transducer.

The BR-640A has been designed specifically for use with transformer type diplexers and clamped output sources. The SP-801 square wave pulser meets this requirement because its output impedance is clamped during the off time to 4 to 5 Ohms. Ritec diplexers transfer almost all of the available pulser energy to the transducer and approximately 90% of the received signal level to receiver, when used with a SP-801 square wave pulser. The received signal level transferred to the BR-640A will be smaller when used with a gated amplifier where the output impedance during the off time is higher than the 4 to 5 Ohms observed with the SP-801. Besides providing excellent signal transfer, the diplexer also provides improved recovery time from overload conditions when operating in pulse/echo mode.

SECTION II
A BRIEF DESCRIPTION OF OPERATION

The BR-640A receiver contains four active gain stages. The first one acts as a low noise pre-amplifier and has a MOSFET with significant source degeneration. In its normal operating state (where the gain of the receiver is set above 8 dB) much of this degeneration is capacitively bypassed and a gain of 6 to 8 dB is obtained. When the gain of the receiver is set below 8 dB, (gain settings of +4, 0, -4, -8 and –12 dB on the front panel rotary control) the source capacitors are switched out. This results in a net loss of signal through this stage. Two trimmer resistors have been included in the source degeneration circuit. One of these has been adjusted so that the change in gain when the bypass capacitors are switched out of the circuit is exactly 16 dB. The other trimmer has been adjusted so that the gain through the entire receiver is exactly 0 dB when the rotary gain control switch is set to the 0 dB position and the 1dB and 2 dB attenuators are switched out (off), with the switches in the down position.

The second, third and fourth stages use high frequency operational amplifiers where the gain is established through the use of precision resistors. Excellent gain stability and reproducibility are achieved through this technique. Additional large gain steps are obtained by switching in and out of the system, the second and third gain stages which yields gain changes of 16 dB and 32 dB respectively. Because entire gain stages are switched out of the circuit for major reductions in gain, very good signal-to-noise ratios are retained down to the +4dB setting. However, there will be a change in the propagation time through the BR-640A as the gain stages are switched in and out; typically this is a small effect and is typically only noticeable in phase sensitive operating configurations.

Smaller gain steps (4, 8 and 12 dB) are obtained through the use of 4 and 8 dB attenuators located at the input to the fourth gain stage. The output of the fourth stage is series terminated in 50 Ohms, thus providing a 50 Ohm source impedance for the output signal. This series termination helps to reduce reflections in situations where the output cable is not terminated in 50 Ohms. The output is also protected against inadvertent injection of a high power pulse. The output stage is designed to provide 1 V peak-to-peak into a 50 Ohm load. To obtain optimum flatness in the frequency response for the receiver, the output should be terminated in 50 Ohms.

The high pass filters are established with shunt inductors in the output circuitry of the first stage. This simple approach introduces essentially no ringing and is helpful in improving the overall recovery time of the receiver when it is subjected to overload conditions at the input such as operating in pulse/echo mode.

The linearity of the BR-640A is excellent. Linearity has been checked by using the 0.1dB stepped attenuators provided at the output of a high quality signal generator. No deviation from linearity can be discerned under these measurement conditions up to the maximum rated output level.

SECTION III
SPECIFICATIONS

Receiver

Bandwidth ..... 100 kHz to 50 MHz (-3dB points)
Gain Control Range.....79 dB
Gain Control steps (±0.2dB maximum) ..... 4 dB steps on the rotary control
..... 1 dB or 2 dB through the switched attenuators
Minimum Receiver Gain .....-15 dB (with 1 and 2 dB attenuators switched in)
Maximum Receiver Gain ..... +64 dB (with 1 and 2 dB attenuators switched out)
Linearity .....No observable nonlinearity up to the maximum rated output level
Noise figure.....approximately 6 dB
Input impedance..... switch selectable between 50 Ohms or 10,000 Ohms parallel by 25 pF
Maximum Output Level .....1V peak to peak into 50 Ohm load
High Pass Filter.....switch selectable between 100 kHz, 500 kHz, or 1MHz
Low Pass Filter .....switch selectable between 3, 12 or 50 MHz

Cabinet

Cabinet Style .....Bench-top.
Dimensions ..... 18.5" (47 cm) side, 4" (10.16 cm) high, 10.5" (26.67cm) deep
Shipping Weight ..... Approximately 21 pounds (10 kg)

Power Supply

AC Line Fuse ..... Bussman MDL-1, 1A 250V fuse for 100V and 120V
..... Bussman MDL-1/2, 1/2A 250V fuse for 220V and 240V
AC Power Requirements..... 100, 120, 220, or 240 Volts RMS, 50-60 Hz, ~30 VA
.....Voltage selectable on power entry module
Auxiliary Power Outputs (-15V @ 50mA max, -5V @ 25mA max,
+5V @ 400mA max, +15V @200mA max) 1

Specifications are subject to change without notice.

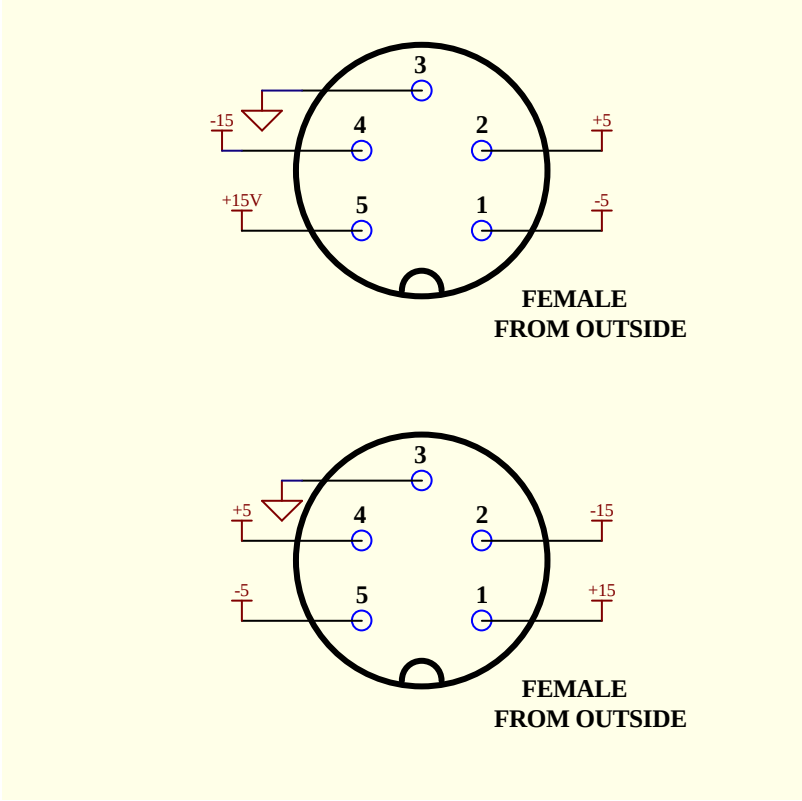
SECTION IV
PLACING THE UNIT IN OPERATION

Using the BR-640A receiver is very straightforward. Conventional three wire power with one line hot, one neutral and one ground is required. The correct power line voltage should be applied to the AC power entry module which is mounted on the rear of the unit.

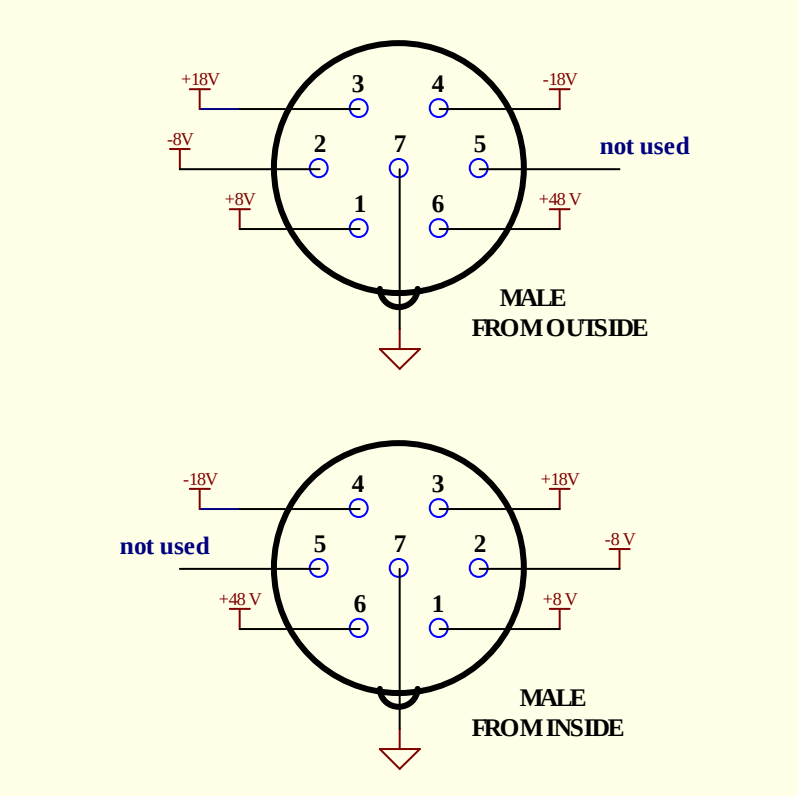
The output of the receiver should be coupled to a 50 Ohm oscilloscope input (usually set to 0.5V per division) through a BNC type coaxial cable. Under these conditions, the gain control settings will be correct within ±0.3 dB except at the high and low frequency roll-off points. The receiver input should be coupled to the source of the signal; normally an ultrasonic transducer or the output of a preamplifier placed at or close to the transducer. If operating in "pulse/echo" mode, it is possible to greatly improve the recovery time from overload conditions through the use of a diplexer. Additional information on the function and use of diplexers appears in the Model SP-801 square wave pulser manual, and the RDX-2 diplexer. If the BR-640A is to be used with a gated amplifier such as the GA-2500 or the GA-10000, more information is available in the manual for either the RDX-6 diplexer or the RCDX-2A clamped diplexer.

Appendix P
External Power Output Connectors

There is an auxiliary power connector located on the front panel of the BR-640A receiver to power peripherals such as a preamplifier. For safety reasons, the connector on the instrument is a female polarity, typically 5 pins. With a powered peripheral, we will supply a 7-pin connector with a male end and a 5-to-7 pin adapter cable. The preamplifiers and clamped diplexers have both a male and female 7-pin connectors so that more than one peripheral can be powered at once. The female connector on the front panel is connected as shown in the figure shown below:



The male connectors on the end of the power cable and the preamplifiers and clamped diplexers are shown as follows:



CHANGING POWER ENTRY MODULE VOLTAGE SETTING

The correct power line voltage should be supplied to the AC power entry module, which is mounted on the rear of the unit. Different line voltages can be accepted by properly setting a small circuit board mounted in the module. Access to this board is provided by removing the plastic cover plate on the module by gently prying out one edge with a small screwdriver. (Access to the power line fuse is achieved in this same manner.) A small projection on the card protrudes through one of the four holes on the cover plate to indicate at which line voltage the unit has been set. If the unit has been previously operated at a different line voltage, the board should be removed and carefully re-set so that the projection appears through the correct hole to match the available line voltage.

APPENDIX W

WARRANTY

All RITEC instruments are warranted against defects in material and workmanship for a period of one year after date of shipment. RITEC agrees to repair or replace any assembly or component found to be defective under normal use during this period. RITEC's obligation under this warranty is limited solely to repairing any such instrument that, in RITEC's sole opinion, proves to be defective within the scope of the warranty when returned to the factory. Transportation to the factory is to be prepaid by the purchaser. Shipment should not be made without prior authorization by RITEC.

This warranty does not apply to any products repaired or altered by persons not authorized by RITEC, or not in accordance with instructions furnished by RITEC. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

RITEC assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. RITEC assumes no liability for secondary charges or consequential damages and, in any event, RITEC's liability for breach of warranty under any contract or otherwise shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.
Any recommendations made by RITEC for use of its products are based upon tests believed to be reliable, but RITEC makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for RITEC any liability in connection with the sale of our products other than set forth herein.