



## **Marti Electronics**

### **Transmitter Combiner**

### **MODEL: HRC-10B**

597-0565  
Rev E  
February 24, 2012

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### **MODEL: HRC-10B**

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The terms of the foregoing warranty shall be null and void if the equipment has been altered or repaired without specific written authorization from BE, or if not installed according to BE's instruction manuals, including, but not limited to, the absence of proper grounding, surge (TVSS) protection on the AC circuit panel or proper lightning protection/grounding on all output circuits, or if equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the



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## IMPORTANT INFORMATION

### EQUIPMENT LOST OR DAMAGED IN TRANSIT -

When delivering the equipment to you, the truck driver or carriers' agent will present a receipt for your signature. Do not sign it until you have:

1) Inspected the containers for visible signs of damage and 2) Counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

### RF PRODUCT TECHNICAL ASSISTANCE, REPAIR SERVICE, PARTS -

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone or E-mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the RF Technical Services Department for a shipping container. Do not mail the equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the RF Technical Services Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non-emergency replacement parts may be ordered directly from the Broadcast Electronics stock room at the number shown below.

### RF TECHNICAL SERVICES -

Telephone: +1 (217) 224-9617

E-Mail: [rfservice@bdcast.com](mailto:rfservice@bdcast.com)

Fax: +1 (217) 224-6258

### FACILITY CONTACTS -

Broadcast Electronics, - Quincy Facility

4100 N. 24th St. P.O. BOX 3606

Quincy, Illinois 62305

Telephone: +1 (217) 224-9600

Fax: +1 (217) 224-6258

General E-Mail: [bdcast@bdcast.com](mailto:bdcast@bdcast.com)

Web Site: [www.bdcast.com](http://www.bdcast.com)

### PARTS -

Telephone: +1 (217) 224-9617

E-Mail: [parts@bdcast.com](mailto:parts@bdcast.com)



### **RETURN, REPAIR, AND EXCHANGES -**

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

### **MODIFICATIONS -**

Broadcast Electronics, reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

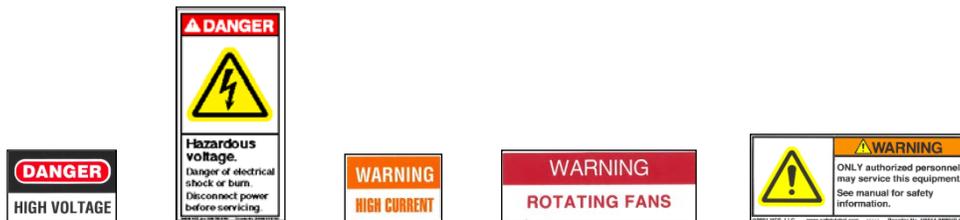




## SAFETY PRECAUTIONS

**PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS!!**

**ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT WHICH UTILIZES SUCH DEVICES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.**



### **DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TUBES AND POWER TRANSISTORS -**

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

- A. HIGH VOLTAGE** - Normal operating voltages can be deadly. Additional information follows.
- B. RF RADIATION** - Exposure to RF radiation may cause serious bodily injury possibly resulting in Blindness or death. Cardiac pacemakers may be affected. Additional information follows.
- C. HOT SURFACES** - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched. Additional information follows.
- D. RF BURNS** - Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

## **HIGH VOLTAGE –**

Many power circuits operate at voltages high enough to kill through electrocution. Personnel should always break the primary AC Power when accessing the inside of the transmitter.

## **RADIO FREQUENCY RADIATION -**

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to “high levels” of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to “low level” RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm<sup>2</sup> per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm<sup>2</sup> per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leak proof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF generating tube or circuit or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

## **HOT SURFACES –**

The power components in the transmitter are cooled by forced-air and natural convection. When handling any components of the transmitter after it has been in operation, caution must always be taken to ensure that the component is cool enough to handle without injury.



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# 1 Model HRC-10B Transmitter Combiner

## 1.1 APPLICATION

The Marti HRC-10B is a microstrip-hybrid designed to combine two 20 watt STL transmitters (with frequencies programmed independently as long as they fall within the HRC-10B allowable frequency range of 935-965MHz) to a single 50 ohm transmission line and antenna. The HRC-10B is capable of providing at least 20 dB isolation between transmitters, placing the IM products well below the FCC emission mask.

## 1.2 SPECIFICATIONS

Frequency range:	935-965 MHz.
Transmitter power (each):	20 watts max.
Dummy load rating:	40 watts
Impedance (all ports):	50 ohms
Isolation between transmitters:	<-20dB (typical; -24dB)
Return Loss:	<-15dB (typical; -24dB)
Insertion Loss:	>-4.3dB (typical -4.0dB)
Connectors:	UG-58
Dimensions:	4" x 4" x 1.5"
Weight:	12 oz.

## 1.3 INSTALLATION

The STL transmitters should be installed in a standard rack cabinet with a minimum of one rack space (1  $\frac{3}{4}$  inches) between transmitters. Connect the upper transmitter output (J6) to transmitter 1 connector and the lower transmitter to transmitter 2 connector of the HRC-10B combiner using the special double-shielded RG-214/U cables provided. These cables have an effective length selected to minimize connector VSWR. Double-shielded cables are necessary to prevent coupling between cables, which lowers isolation between transmitters. Swing the HRC-10B over to the side of the cabinet and locate a mounting area which provides good air circulation while allowing the two cables to be separated as far as possible. The HRC-10B can be fastened to the side of the rack cabinet by drilling four 5/32 diameter holes on 3" centers to line up with the hole at each corner of the HRC-10B. Attach using machine screws and nuts (not provided). Using a third PG-1.7B/585-017 as a jumper cable, connect the ANTENNA connector to the STL transmitting coaxial cable.

## 1.4 OPERATION

In continuous operation, it is normal for the internal 50 ohm load to feel quite warm to the touch. With an antenna system having low VSWR (less than 0.3 watts reflected power), the HRC-10B should provide a level of isolation to prevent any interaction between transmitters when metering forward or reflected power.



## 1.5 ADJUSTMENT

The HRC-10B is tested and adjusted at the factory for operation into a 50 ohm resistive termination. When operating into an antenna system which presents a reactive load component to the HRC-10B, less than optimum isolation may result. Isolation can be determined by viewing the combined transmitter spectrum with a high resolution spectrum analyzer. A coaxial sampling device rated for 1 GHz may be used, or an antenna can be connected to the analyzer to monitor the radiated signal from the STL antenna. If the IM levels are less than 40 dB below carrier reference, the trimmers located on the side of the HRC-10B adjacent to the ANTENNA connector can be adjusted for minimum IM level. Use a **Johansen No. 8777 microwave trimmer tool** or equivalent for this adjustment.

For installation requiring more than 20 dB isolation, a more costly combiner utilizing a combination of hybrid coupler and ferrite isolators may be required.

## 2 BILL OF MATERIAL

This section provides parts lists for the AM Matching Network. The parts lists provide descriptions and part numbers of electrical components, assemblies and selected mechanical parts required for maintenance. Each parts list entry in this section is indexed by reference designators appearing on the applicable schematic diagrams.

This bill of material uses an indented structure to show relationships of parts into sub assemblies. Example; all BOM LEVEL 2 parts are contained in the BOM LEVEL 1 part immediately above it.

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
0	565-026WC	HRC-10B Combiner w/Cables (935-965MHz)		
..1	565-026	HRC-10B COMBINER (935-965MHz)	1	
....2	131-5027	RES,50 OHM,150W,PPT870-150-3(N) (NOTE)	1	
....2	290-524	Capacitor, variable trimmer .4 - 2.5 pf	6	
....2	350-159	HYBRID COUPLER, 3 DB, 90 DEGS, 500-1000 MHz	1	
....2	420-4104	SCREW,4-40X.250,S.S. PH	4	
....2	500-002-1	Hex Nut, #4-40 Regular Nickel Plated	5	
....2	500-055	Lockwasher, #4 internal tooth small pattern zinc plated	5	
....2	500-057	Lockwasher, #2 internal tooth zinc	2	
....2	500-062	Hex Nut, 2/56 zinc plated	2	
....2	500-121	Rivet, 3 x 8 F metric 101203081 M3X8	7	
....2	500-159	Screw, 2/56 x 1/2 Pan Head Slot zinc"	2	
....2	500-162	Screw, 4-40 x 7/16 phillips pan head MS zinc plated"	5	
....2	510-066	Equipment Label, 2.5 x .937" Brady #10C8600890"	1	
....2	513-026	STANDOFF,1/4HEX x 0.5"LONG,4-40"	4	
....2	550-037	CONNECTOR, UG-58A/U N PANEL RECEPTICLE	3	
....2	580-005	Buss Wire, #22AWG Solid Tinned Copper	0.25	
....2	597-0565	INSTRUCTION MANUAL, HRC 10B STL COMBINER	1	
.....3	594-9999	PAPER,COPIER 8 1/2 X 11,20LB HI-TEC	0.001	



BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	700-257-1	Plate, HRC-10B 1/8 aluminum"	1	
....2	700-257-2	Cover, HRC-10B .050 aluminum	1	
....2	700-257-3	Bracket, HRC-10B .025 Tin Coated Steel	3	
..1	585-017	Cable Assembly, PG1.7B HRC	2	
....2	550-013	Conn. UG-21D/U N Plug Amphenol 82-202-RFX Connex#172113	2	
....2	580-034	RG-214/U COAX	1.7	

### 3 RF TECHNICAL SERVICES CONTACT INFORMATION

RF Technical Services -

Telephone: **(217) 224-9617**

E-Mail: [rfservice@bdcast.com](mailto:rfservice@bdcast.com)

Fax: **(217) 224-6528**

web: [www.bdcast.com](http://www.bdcast.com)

### 4 SCHEMATIC

