VOICE AND DATA COMMUNICATIONS PRODUCTS

ACCURATE ELECTRONICS INC

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Practice Section 104445A Rev B

DUAL 5-WAY BALANCED ACTIVE DATA BRIDGE
MODEL 104445A

Contents:

1. GENERAL

1.01 This practice provides application, specification, circuit and mechanical description, maintenance, installation, and warranty information relating to Accurate Electronics' Dual 5 Way Balanced Active Data Bridge, Model 104445A.

1.02 The 104445A Dual 5-Way Balanced Active Data Bridge module (Figure 1) provides balanced termination and active level control for a single 4-Wire common port and up to four 4-Wire multiple ports. Independent splitter and combiner channels allow full-duplex (simultaneous bidirectional) data transmission.

1.03 The 104445A follows a conventional split bridge format, i.e., the common port interfaces the multiple ports through separate splitter and combiner channels. In the splitter channel, a single common input is divided through the bridge to provide outputs for the four multiple ports. In the combiner channel, inputs from the four multiple ports are connected through the bridge and to the single common output port. The common splitter input level can be attenuated by one of three switch-selectable settings of 0, -7, or –25dB, and the common combiner output by switch-selectable values of 0, -16, or –25dB.

1.04 The 104445A is an active bridge, that is, it includes integral amplification circuitry. Splitter gain and combiner gain at each multiple port are continuously adjustable over a –10 to +10dB range via independent splitter and combiner front-panel level controls.

1.05 All ports of the 104445A are transformer coupled, and the transformers at these ports are center-tapped to derive balanced simplex leads. The module's common port can be switch-optioned for 150, 600, or 1200-ohm terminating impedance, while the terminating impedance of each multiple port is fixed at 600 ohms. The 150-ohm option affords a small degree of amplitude equalization when the common-port facility consists of non-loaded cable.

1.06 Splitter and combiner bus extension leads on the module allow from two (2) to fourteen (14) 104445A's to be connected in tandem without performance degradation, yielding a bridge system with up to 56 multiple ports.

1.07 A complement of 10 front-panel bantam-type jacks facilitates alignment and maintenance of the 104445A. All ten (10) jacks are the opening type. The splitter in jack faces the common-port facility to permit measurement of the incoming signal level, while all other jacks face the module to allow measurement of the splitter and combiner levels at each port.

1.08 The 104445A contains an internally regulated power supply that permits operation on filtered, ground-referenced –22 to –56VDC input. With all amplifiers at their maximum output levels, the module draws a maximum current of 70mA.

1.09 A Type-10 module, the 104445A mounts in one position of Accurate Electronics' Type-10 Mounting Shelf, versions of which are available for relay-rack and apparatus-case installations. In relay-rack applications, up to 12 modules can be mounted across a 19-inch rack, while up to 14 modules can be mounted across a 23-inch rack. In either case, the shelves require 6 inches of vertical rack space.

2. APPLICATION

2.01 The 104445A Dual 5-Way Balanced Active Data Bridge is normally used to interconnect several 4-Wire data modems to a common data channel or link. Typically, the common data link is terminated at the distant end by a central processor unit (CPU) or computer that time-sequence-polls various remote data terminals. A 104445A is used to provide the central transmission bridge arrangement, or hubbing network, that extends data transmission to the outlying terminals.

2.02 All ports of the 104445A are transformer-coupled, and each transformer is center-tapped to derive a balanced simplex lead. Since these ports are transformer-coupled, modems with balanced and unbalanced terminations can be intermixed without affecting established transmission parameters. In addition, transformer coupling also prevents induced transients, or noise spikes, from degrading transmission quality on cable runs in excess of 1 kilofoot.

2.03 The modems used with the 104445A need not share common interface levels. The 104445A's active level-control circuitry can be adjusted to accommodate any modem's interface requirements (within the specified gain ranges) without affecting the settings of the other ports. Each multiple port is equipped with independent splitter and combiner gain controls that are adjustable over a –10 to +10dB range. These controls are non-interactive,

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allowing the level setting of any multiple ports to be varied without affecting the setting of the other multiple ports in the bridge system. The independent level controls at each multiple port also eliminate the need for separate pad modules to control signal levels, thus saving rack space as well as simplifying maintenance and alignment.

2.04 Although a single 104445A provides four multiple ports, the number of modems hubbed to a single data channel can be increased beyond four through the use of the module's bus extension leads and additional 104445A's. For example, by connecting the combiner OUT of one 104445A to the bus extension IN of another 104445A and the splitter IN of this 104445A to the bus extension OUT of the first, the two modules function as a dual 9-Way data bridge. Connected in this manner (see Figure 2.), the 4-Wire data hubbing network can be expanded to include up to twelve (12) 104445A's in a 19-inch shelf, or up to fourteen (14) modules in a 23-inch shelf. The 12-module data bridge can thus provide up to forty-eight (48) multiple ports, and the 14-module system up to 56, the maximum number recommended without impairing the performance of the system.

3. SPECIFICATIONS

3.01 Electrical

Splitter-channel common-port attenuation: 0, -7, -25dB
(switch selectable)

Splitter-channel multiple-port gain: -10 to +10dB
usable range (continuously adjustable)

Combiner-channel common-port attenuation: 0, -16, -25dB
(switch selectable)

Combiner-channel multiple-port gain: -10 to +10dB
usable range (continuously adjustable)

Maximum output level (overload point): Splitter: +12dBm
Combiner: +12dBm

Combiner input port impedance: 600 ohms +5% (balanced)

Combiner Output Port Impedance:
600 or 1200 ohms +5% or 150 ohms +15%, balanced, switch selectable

Splitter Input Port Impedance:
600 or 1200 ohms +5% or 150ohms +15%, balanced, switch selectable

Splitter Output Port Impedance: 600 +5% ohms, balanced

Total Harmonic Distortion (each channel): less than 1% at +12dBm

Noise: 20dBrnC maximum

Frequency Response: +0.5dB re 1000Hz level, 300to 5000Hz

Delay Distortion: less than 75 microseconds, 400 to 3000Hz

Cross-port Coupling Loss (crosstalk):
greater than 70dB @ 0dB gain with output level +12dBm

Input Power Requirements:
Voltage: -22 to –56 VDC, filtered, ground referenced
Current: 70mA maximum at maximum output levels

3.02 Environmental

Operating Temperature: 20 - 130° F, (-7 To 54° C)

Humidity: up to 95% R.H. / no condensation

3.03 Physical

Dimensions: 1.420"W x 5.580"H x 5.960"D
3.610 cmW x 14.170 cmH x 15.140 cmD

Weight: 22 oz. / 622 g.

Mounting: One (1) shelf position, Type-10, AEI Mtg Shelf.

4. INSTALLATION

INSPECTION

4.01 The 104445A Dual 5-Way Balanced Active Data Bridge module should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

MOUNTING

4.02 The 104445A module mounts in one position of Accurate Electronics' Type-10 Mounting Shelf. The module plugs physically and electrically into a 56-pin edge connector at the rear of the shelf.

INSTALLER CONNECTIONS

4.03 Before making any connections to the mounting shelf, make sure that power is OFF and modules are REMOVED. Modules should be put into place only AFTER they are properly optioned and AFTER wiring is completed.

4.04 Table 1 lists external connections to the 104445A module. All connections are made via wire wrapping at the 56-pin edge connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector.

OPTIONS

4.05 The 104445A can be switch-optioned for 150-, 600-, or 1200-ohm facility-side terminating impedance in both the splitter and the combiner channels. These switch settings are listed in Table 2 and their locations are shown in Figure 3.

ALIGNMENT

4.06 At the common port, the splitter and combiner channels of the 104445A can be independently switch-optioned for any of three attenuator settings, each of which shifts the 20dB overall gain range of the multiple ports. For example, when splitter attenuator switches S2-3 and S2-4 are set to 0dB, the gain range of the splitter in ports is +10 to –10dB. When the splitter

TABLE 2. Splitter / Combiner Impedance Switch Settings.

Combiner Output Impedance (ohms)			
Switch #	150	600	1200
S1-1	ON	ON	OFF
S1-2	ON	OFF	OFF
Splitter Input Impedance (ohms)			
Switch #	150	600	1200
S2-1	ON	ON	OFF
S2-2	ON	OFF	OFF

TABLE 3. Splitter / Combiner Attenuator Switch Settings.

Common-port Splitter Attenuation (dB)	**Switch Settings**		**Resultant Splitter Gain range at Multiple ports (dB)**
	S2-3	**S2-4**	
0	OFF	OFF	-10 to +10
-7	ON	OFF	-17 to +3
-25	OFF	ON	-35 to -15
Common-port Combiner Attenuation (dB)	**S1-3**	**S1-4**	**Resultant Combiner Gain range at Multiple ports (dB)**
0	OFF	OFF	-10 to +10
-16	ON	OFF	-26 to -6
-25	OFF	ON	-35 to -15

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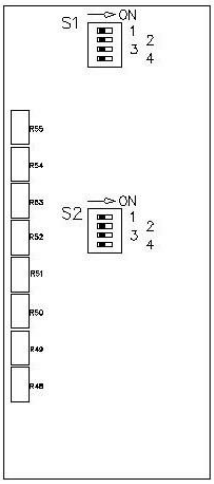
attenuator switches are set to -7dB, the gain range of the splitter in ports is +3 to –17dB. The splitter attenuator switches, then, should be set based on the incoming signal level at the splitter in port and on the input level(s) required by the modems connected to the multiple ports. Select the splitter attenuator switch setting that places the midpoint of the 20dB gain range at each of the splitter out ports nearest the input level required by the modems. This same principle applies to the combiner attenuator switch setting (S1-3 and S1-4), except that this setting is based on the OUTPUT level of the modems and the level required at the combiner out port. Splitter and combiner switch settings are listed in Table 3.

FIGURE 3. S1, S2 Locations.



4.07 To adjust the levels at the splitter output ports, first set S2-3 and S2-4 as described in paragraph 4.06 and then request that 1004hz test tone be sent from the distant end at the level specified on the CLR. With a 600-ohm terminated voltmeter connected to the split out 1 jack, adjust the split out level 1 control to the level required by the modem connected to port 1. Repeat this procedure for the remaining split out ports.

4.08 To adjust the levels in the combiner channel, first set S1-3 and S1-4 as described in paragraph 4.06. Then connect a voltmeter, terminated at the impedance of the comb out port, to the comb out jack. Next, insert 1004Hz test tone, at the transmit level of the modem, into the comb in 1 jack. Finally adjust the comb in level 1 control to the level specified on the CLR. Repeat this procedure for the remaining comb in ports.

5. CIRCUIT DESCRIPTION

5.01 See Figure 1.

5.02 This circuit description is intended to familiarize you with the 104445A Dual 5-Way Balanced Active Data Bridge for engineering and application purposes only. Attempts to troubleshoot the 104445A are not recommended and may void your warranty. Troubleshooting procedures should be limited to those described in Section 7 of this Practice. Please refer to Figure 1 as an aid in following the circuit description.

5.03 The combiner channel of the 104445A consists of four (4) transformer-coupled input ports and four (4) variable-gain operational amplifiers. The output of each of the four (4) op-amps is combined in a summing amplifier along with the bus extension input signal. The summing amplifier, which can be set to one of three (3) switch-selected gain ranges, applies its output to the power amplifier, impedance option switches, and finally to the balanced output transformer. Both input and output transformers provide balanced terminations, and their center taps, simplex leads.

5.04 The splitter channel includes a center-tapped balance transformer, switch-selectable impedance option, and a distribution amplifier whose gain range can be switch-set at any of three (3) levels. the output of the distribution amplifier is applied to four (4) variable-gain op-amps, which drive the splitter out-out ports, and to one fixed-gain buffer amplifier that drives the bus extension output line. The four (4) variable-gain amplifiers each apply their signals to the splitter output ports through individual power amplifiers and center-tapped balance transformers.

5.05 An integral regulated power supply permits operation with an external input between –22 and –56VDC. Reverse-battery protection is provided by a blocking diode, while a high-voltage zener diode protects against transients on the input line.

TABLE 1. External Connections.

PORT 1	COMBINER INPUT TIP	31
PORT 1	COMBINER INPUT RING	29
PORT 1	COMBINER INPUT SX (Simplex)	56
PORT 1	SPLITTER OUTPUT TIP	21
PORT 1	SPLITTER OUTPUT RING	25
PORT 1	SPLITTER OUTPUT SX (Simplex)	22
PORT 2	COMBINER INPUT TIP	37
PORT 2	COMBINER INPUT RING	55
PORT 2	COMBINER INPUT SX (Simplex)	54
PORT 2	SPLITTER OUTPUT TIP	19
PORT 2	SPLITTER OUTPUT RING	23
PORT 2	SPLITTER OUTPUT SX (Simplex)	20
PORT 3	COMBINER INPUT TIP	39
PORT 3	COMBINER INPUT RING	53
PORT 3	COMBINER INPUT SX (Simplex)	52
PORT 3	SPLITTER OUTPUT TIP	15
PORT 3	SPLITTER OUTPUT RING	1
PORT 3	SPLITTER OUTPUT SX (Simplex)	16
PORT 4	COMBINER INPUT TIP	49
PORT 4	COMBINER INPUT RING	51
PORT 4	COMBINER INPUT SX (Simplex)	50
PORT 4	SPLITTER OUTPUT TIP	5
PORT 4	SPLITTER OUTPUT RING	3
PORT 4	SPLITTER OUTPUT SX (Simplex)	4
BUS EXTENTION INPUT TIP		28
BUS EXTENTION INPUT RING		26
BUS EXTENTION OUTPUT TIP		8
BUS EXTENTION OUTPUT RING		10
COMMON SPLITTER INPUT TIP		7
COMMON SPLITTER INPUT RING		13
COMMON SPLITTER INPUT SX (Simplex)		9 or 11
COMMON COMBINER OUTPUT TIP		41
COMMON COMBINER OUTPUT RING		47
COMMON COMBINER SPLITTER OUTPUT SX(Simplex)		43 or 45
-BATT (-22 TO -56 VDC Filtered Input)		35
GND (ground)		17

6. MECHANICAL OUTLINE

6.01 See Figure 2.

7. TESTING AND TROUBLESHOOTING

7.01 The Testing Guide Checklist (see Table 4.) may be used to assist in the installation, testing or troubleshooting of the product. The checklist is intended as an aid in the localization of trouble to a specific product. If a product is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute product operates correctly, the original product should be considered defective and returned to Accurate for repair or replacement as directed below. We strongly recommend that no

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internal (component-level) testing or repairs be attempted on the product. Unauthorized testing or repairs may void the product's warranty. Also, if the product is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

TECHNICAL ASSISTANCE

7.02 Contact Accurate Electronics, Inc. 503.641.0118, FAX: 503.646.3903; Mail: PO Box 1654, Beaverton OR 97075-1654.

RETURN PROCEDURE (FOR REPAIR)

7.03 To return equipment for repair, first contact Accurate Electronics, Inc. Enclose an explanation of the malfunction, your company's name and address, the name of a person to contact for further information, and the purchase order number for the transaction. Accurate Electronics will inspect, repair, and retest the equipment so that it meets its original performance specifications and then ship the equipment back to you. If the equipment is in warranty, no invoice will be issued.

8. MAINTENANCE

8.01 No preventive maintenance is required. General care is recommended.

9. WARRANTY

9.01 All Accurate Electronics Inc. products carry a full FIVE (5) YEAR warranty on materials and workmanship. See WARRANTY in front of catalog.

Note: Warranty service does not include removal of permanent customer markings on the front panels of Accurate Electronics' products, although an attempt will be made to do so. If a product must be marked defective, we recommend that it be done on a piece of tape or on a removable stick-on label.

9.02 If a situation arises that is not covered in the checklist, contact Accurate Customer Service as follows (telephone number are given below):

Contact Accurate Electronic Customer Service

9.03 If a product is diagnosed a defective, follow the replacement procedure in paragraph 9.04 when a critical service outage exists (e.g., when a system of a critical circuit is down and no spares are available). If the situation is not critical, follow the repair and return procedure in paragraph 9.05.

Replacement

9.04 To obtain a replacement product, notify Accurate Electronics. Be sure to provide all relevant information, including the 104445A part number that indicates the issue of the product in question. Upon notification, we shall ship a replacement product to you. If the product in question is in warranty, the replacement will be shipped at no charge. Pack the defective product in the replacement product's carton, sign the packing slip included with the replacement, and enclose it with the defective product (this is your return authorization). Affix the preaddressed label provided with the replacement product to the carton being returned, and ship the product prepaid to Accurate Electronics.

Repair and Return

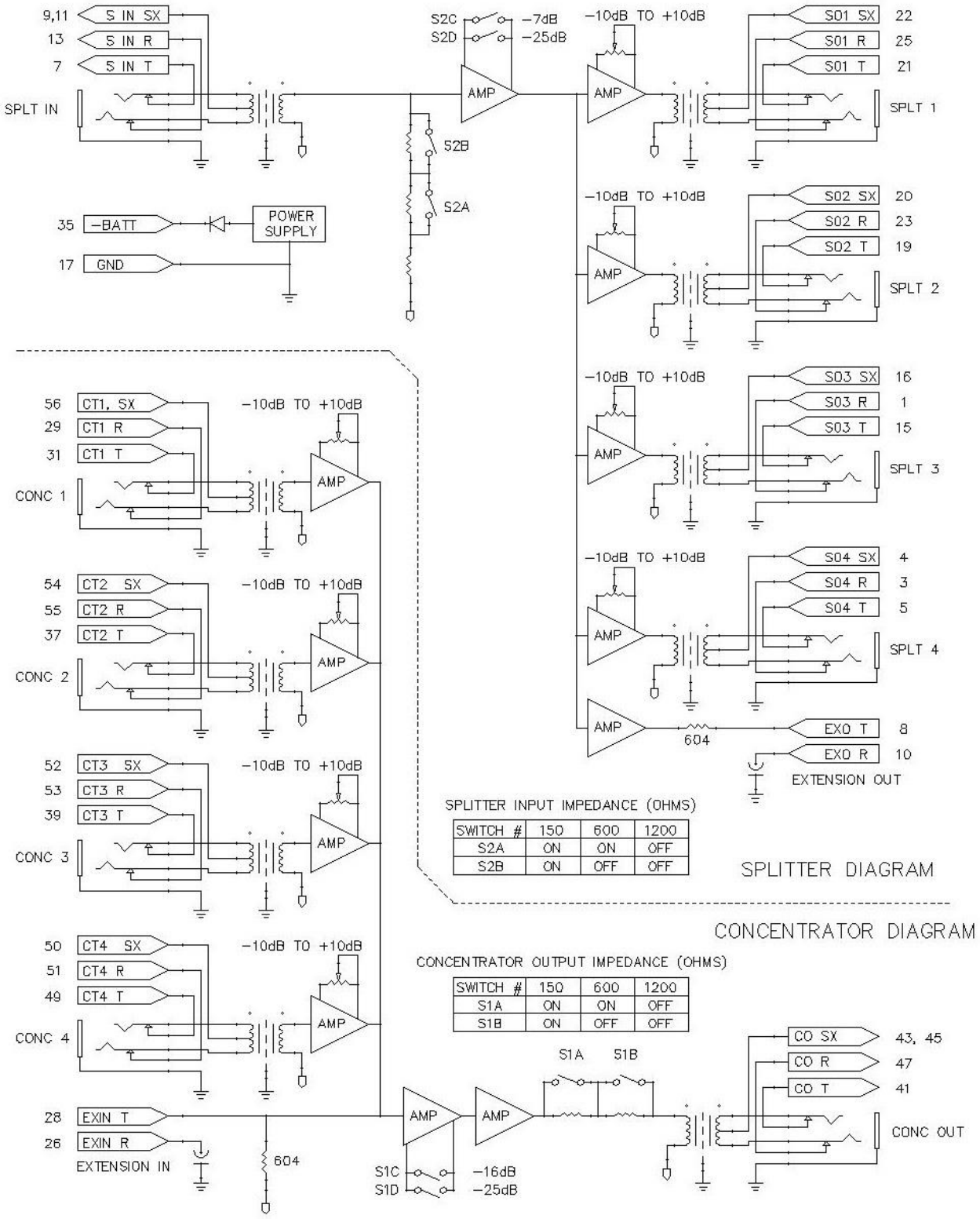
9.05 Return the defective product, shipment prepaid, to Accurate Electronics Inc. :

ACCURATE ELECTRONICS INC.
ATTN: REPAIR AND RETURN
8687 SW HALL BLVD. #100
BEAVERTON, OREGON 97008 USA

TABLE 4. Test Guide Checklist.

TEST:	*TEST PROCEDURE:*	*NORMAL RESULTS:*	*IF NORMAL RESULTS ARE NOT MET, VERIFY:*
Combiner gain: Multiple port (+10 to -10dBm)	Open S1-3 and S1-4. Connect VOM or TMS (terminated at 600 ohms) to COMB OUT jack. Inject 1000Hz test tone (0dBm) into COMB IN 1 jack. Adjust COMB LEVEL 1 potentiometer to maximum and minimum level. Repeat for COMB IN 2, 3 and 4.	Signal is at least -10 dBm at minimum, and at least +10 dBm at high level.	Check power connection? Check double termination? S1 properly set?
Combiner gain: Common port (0, -16, and -25dBm)	Open S1-3 and S1-4. Connect VOM or TMS (terminated at 600 ohms) to COMB OUT jack. Inject 1000Hz test tone (0dBm) into COMB IN 1 jack. Adjust COMB LEVEL 1 potentiometer to 0dBm level.	S1-3 and S1-4 open, level is 0dBm. S1-3 closed and S1-4 open, level is –16dBm. S1-3 open and S1-4 closed, level is -25dBm.	Check power connection? Check double termination?
Combiner Channel Noise	Short all inputs to combiner and bus extension in. Measure noise at COMB OUT jack.	Noise level under 20dBrnC at all gain settings.	Inputs to combiner shorted? Noise test set at proper terminating impedance? High RF environment affecting test set?
Splitter gain: Multiple port (+10 to -10dBm)	Open S2-3 and S2-4. Connect VOM or TMS (terminated at 600ohms) to SPLITTER OUT 1 jack. Request 1000Hz test tone at CLR level from distant end. Adjust SPLIT LEVEL 1 potentiometer to maximum and minimum levels. Repeat for SPLIT OUT 2, 3 and 4.	Signal is at least –10dBm at minimum, and at least +10dBm at maximum.	Check power connection? Check double termination? S2 properly set?
Splitter gain: (0, -7, and -25dBm)	Open S2-3 and S2-4. Connect VOM or TMS (terminated at 600 ohms) to SPLIT OUT 1. Request 1000Hz test tone at CLR LEVEL from distant end. Adjust SPLIT LEVEL 1 potentiometer to 0dBm level.	S2-3 and s2-4 open, level is 0dBm. S2-3 closed and S2-4 open, level is –7dBm. S2-3 open and S2-4 closed, level is -25dBm.	Check power connection? Check double termination?
Splitter Channel Noise	Short splitter input. Measure noise at one SPLITTER OUT jack.	Noise level less than 20dBrnC at all gain settings.	Input to splitter shorted? Noise test set at proper terminating impedance? High RF environment affecting test set?

FIGURE 1. CIRCUIT DESCRIPTION.



SPLITTER INPUT IMPEDANCE (OHMS)

SWITCH #	150	600	1200
S2A	ON	ON	OFF
S2B	ON	OFF	OFF

SPLITTER DIAGRAM

CONCENTRATOR DIAGRAM

CONCENTRATOR OUTPUT IMPEDANCE (OHMS)

SWITCH #	150	600	1200
S1A	ON	ON	OFF
S1B	ON	OFF	OFF

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FIGURE 2. MECHANICAL OUTLINE.