

TELLABS* 244B

DISTRIBUTIVE DATA BRIDGE SYSTEM

DESCRIPTION, INSTALLATION, AND TESTING

1. GENERAL

1.01 This section is a cover sheet for the Tellabs 244B Distributive Data Bridge (DDB) System instruction, Section 81244. PTEL (formerly GAEL) 1843 authorizes the use of this equipment in Pacific Company (PAC).

1.02 It is reissued to:

- Revise the section title
- Transmit the latest manufacturer's instruction
- Provide the standard format for a cover sheet

Note: Marginal arrows used to denote changes are omitted.

1.03 The Tellabs 244B DDB System provides a variety of active 4-wire-common-port or 4-wire-multiple-port bridging arrangements for application in multipoint voice frequency data networks.

1.04 The 244B system comprises prewired mounting shelves and plug-in printed circuit modules and are listed as follows:

- 1014 Mounting Shelf
- 4451 Distributive Data Bridge (DDB) Module
- 4455 Distributive Data Bridge Termination (DDBT) Module

Note: The Tellabs instruction includes the 244A DDB System and several modules which are *not* standardized for use in PAC. The Tellabs 242 DDB System is covered in Section 314-410-905PT.

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1.05 If corrections are required in the manufacturer's instruction, use Form E 3973-1PT as described in Section 000-010-901PT to process the correct information.

1.06 If equipment design and/or manufacturing problems should occur, refer to Section 010-700-011PT for procedures on how to file an Engineering Complaint For General Trade Products (GTPs).

1.07 When revised manufacturer's instructions reflect changes due to modification of equipment, retain the superseded information until equipment is modified.

Note: Equipment *shall not* be modified without the approval of the Equipment Maintenance Engineer.

2. MAINTENANCE

2.01 Field repairs that involve replacement of components within this unit are not recommended.

3. ORDERING PROCEDURES

3.01 Order Tellabs equipment direct from the manufacturer:

Tellabs, Incorporated
4951 Indiana Avenue
Lisle, IL 60532

3.02 When ordering Tellabs equipment, use Purchase Order Form GTP 2-FA as specified in System Instruction (SI) 70, Section 2. Enter contract

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

SECTION 314-410-904PT

No. 76-36 on all orders. Send the blue copy of the Purchase Order as follows:

- For Northern California and Nevada —

RPO
1129 B Street, Room 207
Hayward, CA 94541

- For Southern California —

RPO
2420 Yates Avenue, Room 246
Commerce, CA 90040

Note: Additional ordering information is contained in the GTP Catalog.

4. REPAIR/RETURN

4.01 Return defective units to the Plug-In Maintenance Pool for like-for-like exchange as specified in SI 60, Section 6, and Section 005-202-919PT. The Supplies Superintendent shall forward defective units to the manufacturer for repair and return.

4.02 Tellabs equipment has a warranty of 5 years.

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Attachment:

Tellabs Technical Manual, Practice Section 81244, 1 October 1978

244 Distributive Data Bridge System

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Note: This Practice is written with specific reference to the standard prewired 244 Distributive Data Bridge System Assembly. Modules of the 244 System may also be mounted in a Tellabs 242 Assembly. While all System functions except one (see paragraph 1.20) remain the same in either Assembly, cabling differs. When 244 modules are mounted in a 242 Assembly, a 242 Practice is required for cabling information.

1. general description

1.01 The Tellabs 244 Distributive Data Bridge (DDB) System (figure 1) provides a variety of active, 4wire-common-port, 4wire-multiple-port bridging arrangements intended for application in multi-point, voice-frequency data networks. The 244 DDB follows a conventional *split* bridge format, i.e., the common port of a bridge network is interfaced with several multiple ports through *splitter* and *combiner* channels. In the splitter channel, the common input is divided a number of ways to provide outputs for the various multiple ports. In the combiner channel, inputs from the multiple ports are connected through the bridge to the common output port.

1.02 The basic 244 System comprises one or more data bridge circuits in a prewired 244 DDB Assembly. The 244 Assembly consists of a 1012 or 1014 Mounting Shelf equipped with a printed circuit backplane that universally prewires the Shelf for a complement of six types of associated modules: the 4451 DDB module and the 4453, 4454, 4454A, 4455, and 4455A DDB Termination (DDBT) modules.

Note: Use of the 4454A and 4455A DDBT modules in the 244 DDB Assembly will be very infrequent. These modules provide a special remote test access feature that is enabled only when the modules are mounted in a Tellabs 242 DDB Assembly. Refer to paragraph 1.20 for additional information.

Two versions of the 244 DDB Assembly are available: the 244A and the 244B. The 244A is a 12-position Assembly designed for 19 inch relay rack installation, and the 244B is a 14-position Assembly designed for 23 inch relay rack installation. Both Assemblies are configured to accommodate one or more data bridge networks that each consist of one 4451 DDB module and two or more DDBT modules.

1.03 A 244 System can be arranged and rearranged for various bridge configurations within its over-

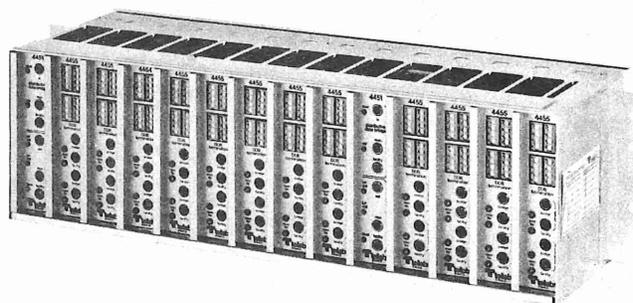


figure 1. Typical 244 DDB System

all capacity by adding, subtracting or exchanging modules — without wiring changes to the 244 Assembly. For example, the number of multiple ports in an established Bridge network may be changed simply by adding or subtracting Termination modules as required. The System may also be converted from one large bridge network (up to 13 multiple ports) to several smaller networks simply by interchanging plug-in modules. Wiring changes to implement rearrangement of the Bridge are required only at the intermediate distributing frame (IDF) or main distributing frame (MDF) of the serving central office (or at a local cross-connect frame if the 244 is not installed in a CO). All external connections to the ports of the 244 Bridge itself are made via cable connectors included as part of the 244 Assembly. These cable connections are made only once and need not be changed.

1.04 Of the six types of modules used in the 244 System, the 4451 DDB module is the *common-port* termination device that derives the fully isolated splitter and combiner busses. One 4453, 4454, 4454A, 4455 or 4455A DDBT module is used to terminate each *multiple port*. The 4451 can provide bridging for a maximum of 13 DDBT modules (i.e., 13 multiple ports).

1.05 Active (amplification) circuitry of the 244 DDB System resides in the 4451 DDB module. This normally permits a 244 Bridge network's multiple ports to be terminated and aligned by passive DDBT modules rather than by more expensive active devices.

1.06 The 244 DDB Assembly is provided completely and universally prewired for any of its intended data bridge network applications. Each Assembly may be equipped with as many bridge modules (4451's) or multiple bridge ports (DDBT modules) as required. Module positions are non-dedicated (i.e., either a 4451 DDB module or a 445X DDBT module may be used in any position). However, in any given bridge network within a 244

Assembly, modules must be arranged in a specific order (see paragraphs 2.08 through 2.10). The Assembly's printed circuit backplane extends the splitter and combiner busses (derived in the 4451 module) through the bridge network as DDBT modules are added to the Assembly. The backplane may also be used to bypass unused module positions between modules in a given bridge network within the Assembly.

1.07 As stated above, the number of multiple ports in an established Bridge network may be changed by adding or subtracting DDBT modules. When a Bridge is changed, the remaining multiple ports retain their integrity without rewiring or realignment. Levels are maintained within ± 1.0 dB, and multiple-port positions from which modules have been removed need not be terminated.

1.08 The 244 System is provided with two 25-pair cable connectors for all external connections except battery and ground. Battery and ground connections are made via a barrier strip. Terminals are also provided to extend a bridge network from one 242 Assembly to another.

1.09 Much of the preceding description, which places primary emphasis on a 244 DDB System mounted in a 244 Assembly, also holds true when the 244 System modules are mounted in a 242 DDB Assembly. The 242 Assembly is similar to the 244 Assembly (i.e., it is also a prewired Type 10 Shelf with printed circuit backplane) but is designed to house the modules of Tellabs 242 DDB System as well as those of the 244 DDB System. For complete information on the 242 Assembly, refer to the 242 DDB System Practice.

1.10 The remainder of section 1 contains a brief description of the individual 244 System modules. For detailed information on these modules, refer to the individual Tellabs Practice on each.

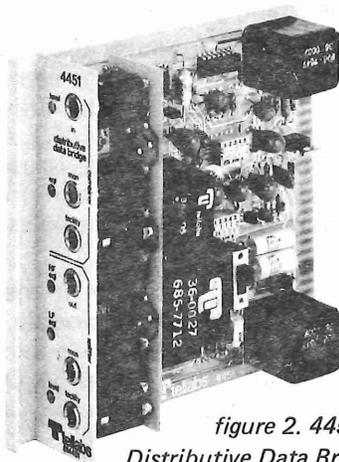


figure 2. 4451
Distributive Data Bridge module

4451 Distributive Data Bridge Module

1.11 The 4451 DDB module (figure 2) derives the Bridge's splitter and combiner busses and provides adjustable gain and amplitude equalization in both common-port paths of a 244 Bridge network. The 4451 module may be individually switch-optional to match 600 ohm or 1200 ohm facility-side impe-

dance in both splitter and combiner channels and is center-tapped to derive balanced simplex leads.

1.12 Both splitter and combiner amplifiers provide from -15 to $+25$ dB of gain in four switch-selectable 10dB ranges. Levels may be continuously adjusted to within ± 0.1 dB throughout each of these ranges. The maximum output level of either amplifier in the 4451 is $+8$ dBm with less than 1 percent distortion.

1.13 In the splitter channel, one of three modes of amplitude shaping may be switch-selected to post-equalize the common input to the module. These modes are flat (no equalization), high-low equalization for loaded cable, and slope equalization (nominal 4dB per octave) for nonloaded cable. In the high-low mode, a variety of high-frequency and low-frequency gain shapes may be effected, or flat response with high-end and low-end roll-off, which is typically required for carrier facilities, may be provided.

1.14 In the combiner channel, slope equalization adjustable from essentially flat to a nominal 4dB-per-octave slope may be introduced to pre-equalize the Bridge's output to the common port.

1.15 The 4451 incorporates an internally regulated power supply that permits operation on -22 to -56 Vdc input. Current requirements range from 20mA in the quiescent state to 60mA with both splitter and combiner outputs at maximum levels.

1.16 Surge protection is provided for the facility ports of the 4451. Reverse battery protection and transient-limiting circuitry are provided in the amplifier's internal power supply circuitry. RC filtering and decoupling networks minimize cross-coupling and the effects of noise on the input power leads.

1.17 The 4451, like the other 244-System modules described later in this Practice, conforms to the 244 System's universal wiring format. Front-panel gain and equalization controls, plus four module access jacks (one at each port) and two facility monitor jacks (one per channel), facilitate alignment and maintenance of the 4451.

4454, 4454A, 4455, and 4455A DDBT modules

1.18 The 4454 Distributive Data Bridge Termination (DDBT) module (figure 3) provides one multiple port of a 244 Bridge network with termination and passive level control. On the facility side, the 4454 provides balanced, switch-selectable 150, 600, or 1200 ohm impedance matching for the multiple port, allowing the 4454 to interface various types of transmission facilities (typically, short and intermediate loops of nonloaded cable and short loops of loaded cable). The 4454's impedance-matching transformers are center-tapped to derive simplex leads toward the multiple port. Level control is achieved via digital attenuation switches on the module's front panel and printed circuit board. From 0 to 32.5dB of loss may be introduced into both splitter (multiple-port output) and combiner (multiple-port input) channels in 0.1dB increments.

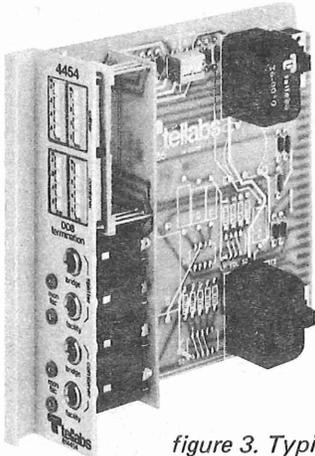


figure 3. Typical DDB Termination module

1.19 The 4455 is identical to the 4454 in all respects except one: it provides nominal high-frequency and low-frequency post-equalization in the combiner channel. The high-frequency equalizer introduces up to 3dB of "bump" equalization at 3400Hz, and the low-frequency equalizer provides gradually adjustable low-end roll-off (4dB per octave, 5dB maximum) beginning at about 600Hz. These equalizers are designed specifically for use with loaded cable. Channel response is flat when no equalization is selected. The 4455 is typically used to interface short and intermediate loops of loaded and nonloaded cable.

1.20 The 4454A and 4455A (figure 4) are identical to the 4454 and 4455, respectively, except for the inclusion of a transfer relay on the bridge side of each module. This relay disconnects the multiple port from the bridge network and connects it to a test bus for remote jack access. The transfer relay is functional **only** when the 4454A or 4455A (as part of a 244 Bridge network) is mounted in a Tellabs 242 DDB Assembly; it **cannot** be used when these modules are mounted in a 244 DDB Assembly.

1.21 Alignment and maintenance activities are facilitated by four front-panel module access jacks (one at each port) and facility monitor test points for both channels on all four modules above.

4453 DDBT module

1.22 Like the 4454, 4454A, 4455 and 4455A DDBT modules, the 4453 DDBT module terminates and establishes levels (passively) at one multiple port of 244 Bridge network. The 4453, however, differs from the other DDBT modules in that it is designed specifically for interface with carrier facilities. On the facility side, the 4453 provides fixed 600 ohm terminating impedance without transformer coupling. Level control is achieved via fixed 23dB attenuator pads (instead of adjustable attenuators) in both splitter and combiner channels. These pads may be switch-optional out of either or both channels, if desired, to provide zero loss.

1.23 The 4453's primary application (figure 5) is at a multiple port of a 244 Bridge System whose

common data bus with +7 splitter and -16 combiner transmission level points (TLP's) interfaces a carrier channel with -16 transmit and +7 receive TLP's. Because the 4453's 23dB attenuators can be switched out of either or both channels individually, the 4453 can also be used where the carrier TLP's are +7 transmit and -16 receive (the same as the corresponding data bus levels on the bridge side of the 4453 or even where the carrier transmit and receive TLP's are identical, i.e., +7 or -16 in both channels. Refer to the Tellabs Practice on the 4453 for details.

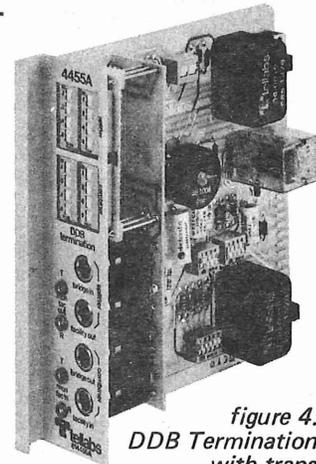


figure 4. Typical DDB Termination module with transfer relay

1.24 The 4453 incorporates four front-panel module access jacks (one per port) as well as facility monitor test points for both splitter and combiner channels.

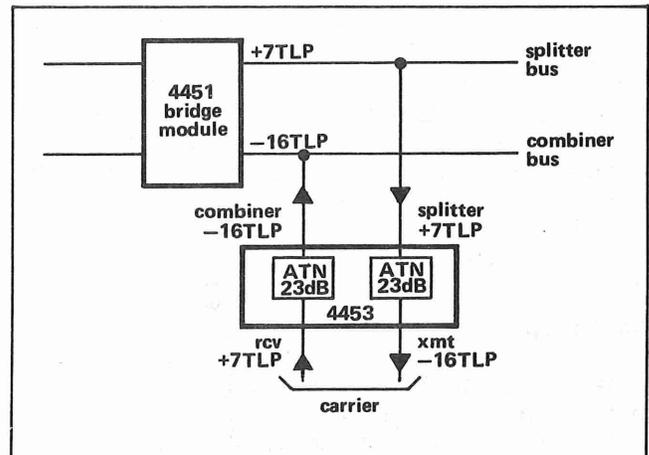


figure 5. Primary application of 4453

2. application

2.01 The 244 Distributive Data Bridge (DDB) System interfaces a common 4wire port with multiple 4wire ports to provide a bridge network normally used for the transmission of voice-frequency data signals. As such, the 244 DDB System may be used at a central office or at a remote location to provide a bridging network between, for example, a number of outstation data modems and a centralized computer. This arrangement is commonly found in department store credit card verification systems and in branch banking operations.

2.02 To implement its data bridging function, the 244 DDB System employs a *split* bridge design, i.e., the common port is interfaced with the multiple port through separate *splitter* and *combiner* channels. In the splitter channel, input received from the common facility is split a number of ways to be transmitted out at all multiple ports. In the combiner channel, an input signal received from any multiple port is connected through the Bridge and transmitted out of the common port.

2.03 As mentioned above, splitter and combiner channels are separate. Separation is required to accommodate transmission in the full-duplex mode that is characteristic of most applications of the 244 System.

2.04 Physically, the 244 DDB System may be located in a central office or on the customer's premises. The System is available in two basic configurations, both designed for relay rack mounting. The 244A Assembly provides mounting for up to twelve 244 System modules in a 19 inch rack, and the 244B Assembly provides mounting for up to fourteen 242 System modules in a 23 inch rack. Both Assemblies are universally wired and connectorized.

2.05 Six modules are used in various combinations to accommodate all applications. They are the 4451 DDB module and the 4453, 4454, 4454A, 4455, and 4455A DDBT modules. Each is described briefly in section 1 of this Practice.

Note: *The 4454A and 4455A DDBT modules alone provide a remote test access feature that is enabled only when these modules are mounted in a Tellabs 242 DDB Assembly. When mounted in a 244 DDB Assembly, the 4454A and 4455A function exactly as the 4454 and 4455, respectively.*

system capacity

2.06 Normally, the capacity of a single 244 Bridge network (as served by one 4451 DDB module) is 13 multiple ports (as provided by 13 DDBT modules). However, up to 15 DDBT modules (from more than one 244 Assembly) may be used in a single bridge network, with transmission parameters somewhat degraded from those specified in this Practice.

tandem operation

2.07 For very large bridged network applications, 244 Systems may be arranged in tandem — that is, a multiple port of one 244 System is wired to the common port of another 244 System. The number of multiple ports that can be established in a bridge network in this manner is greatly increased.

Caution: *When more than two 244 DDB Systems are tandemed in series, transmission parameters will be somewhat degraded from those specified in this Practice. If a series tandem arrangement of more than two 244 Systems is desired for a particular application, be certain that the resultant performance will be acceptable for that application. Consult Tellabs' Application Engineering Group for further information on tandem bridge applications.*

module arrangements

2.08 As stated earlier, module positions in the 244 Assembly are nondedicated — any of the six 244 System modules may be plugged into any slot in the Assembly, so long as modules within a bridge network are in appropriate positions relative to each other. A 4451 DDB module defines the beginning of a bridge network. The associated DDBT modules are plugged into subsequent slots beginning at the immediate right of the 4451 (see figure 6). Up to 13 DDBT modules, either of a single type or mixed as necessary, may be used in association with the 4451 DDB module.



figure 6. Front view of 244 Assembly showing left-to-right module arrangement of bridge network

2.09 If, while assigning DDBT modules, you arrive at the last available module position at the righthand end of the Assembly, additional DDBT modules may still be added to that bridge network by wiring jumpers from the 4-pin wire-wrap connector (figure 7) on the rear of the Assembly at the far righthand module position to another 4-pin connector associated with vacant module slots in the same Assembly (figure 8) or in an adjacent Assembly (figure 9). The 4-pin wire-wrap connectors extend the 2 pairs of the splitter and combiner busses.

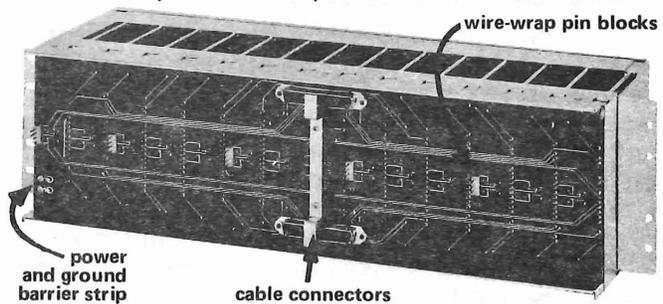


figure 7. Rear view of 244 Assembly

Note: *Not all module positions are equipped with jumper pins at the rear of the Assembly. Pins are located behind the rightmost module position on all 244 Assemblies (position 12 on the 244A, position 14 on the 244B). On the 244A, pins are also located behind positions 3, 6, and 9. On the 244B, pins are also located behind positions 3, 6, 9, and 12.*

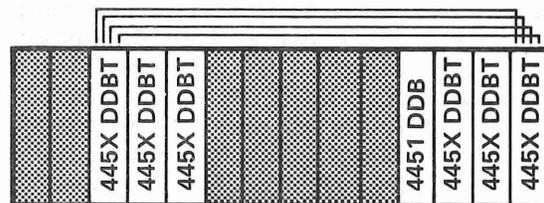


figure 8. Jumpers on rear of 244 Assembly extending bridge network from far righthand shelf position to additional DDBT modules in shelf positions 3, 4 and 5

2.10 A group of DDBT modules that are separated from their associated 4451 DDB module by

jumpers may be built either to the left or to the right of the module position at which the jumpers are connected (see figure 10). This is possible because the splitter and combiner busses are extended between all adjacent DDBT modules (see paragraphs 2.11 and 2.12).

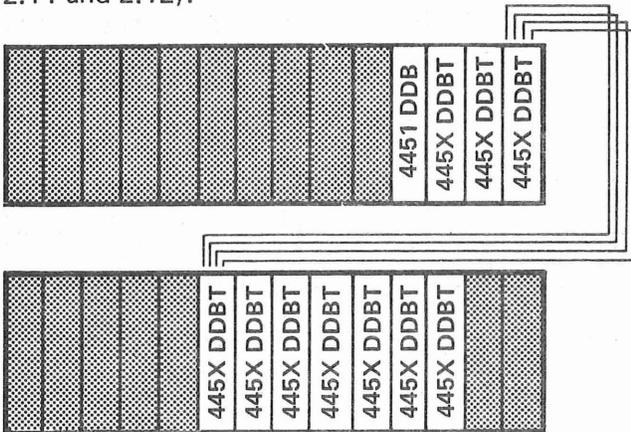


figure 9. Jumpers on rear of 244 Assembly extending bridge network from far righthand shelf position of upper Assembly to additional DDBT modules in lower Assembly

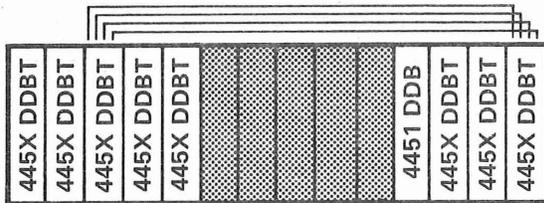


figure 10. A group of DDBT modules built to both left and right of module position to which jumpers are attached

splitter and combiner busses

2.11 Splitter and combiner busses are extended through a 244 Bridge network by both the associated modules and the printed circuit backplane of the 244 Assembly. Paragraphs 2.12 and 2.13 explain where and how a 244 Bridge network continues from module to module and from module position to module position. These paragraphs also explain where and how a 244 Bridge network starts and stops (i.e., is not continued between modules).

2.12 The 4451 DDB module interrupts the splitter and combiner busses at the point where the module is inserted into the 244 Assembly. On the other hand, the DDBT modules extend the busses to adjacent lefthand and righthand module positions. Interruption of the busses by the 4451 is necessary because the 4451 defines the beginning of a bridge network (that is, it breaks the circuit with the module position to its immediate left).

2.13 Bypass switches are located at the rear of each module position in the 244 Assembly (see figure 11). They may be used to extend a bridge network through a vacant module position occurring between modules in a network. The 244 Assembly bypass switches have two settings: *BYPASS* and *OFF*. The switch at a module position housing a 4451 DDB module is always set to *OFF* so that the circuit is broken to the immediate left of the 4451. This allows the 4451 to perform its

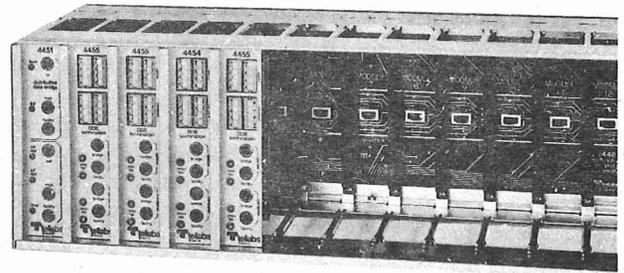


figure 11. Front view of 244 Assembly showing bypass switches at rear of each module position

function of establishing splitter and combiner busses for the single bridge network that it serves. Bypass switches at module positions occupied by DDBT modules may be set to either *BYPASS* or *OFF*, with no direct effect on that particular bridge network at that particular time. However, we do recommend that the switches of module positions occupied by DDBT modules be set to *BYPASS* in order to provide circuit continuity in the event that a DDBT module is later removed from the Assembly (leaving that module position vacant) when circuit requirements change. And, of course, if vacant module positions are originally designed into an individual network in the 244 Assembly, bypass switches may be used to extend splitter and combiner busses across those vacant module positions. (If we've managed to confuse you with the above explanation, see figure 12 for a diagrammatic representation of this discussion.)

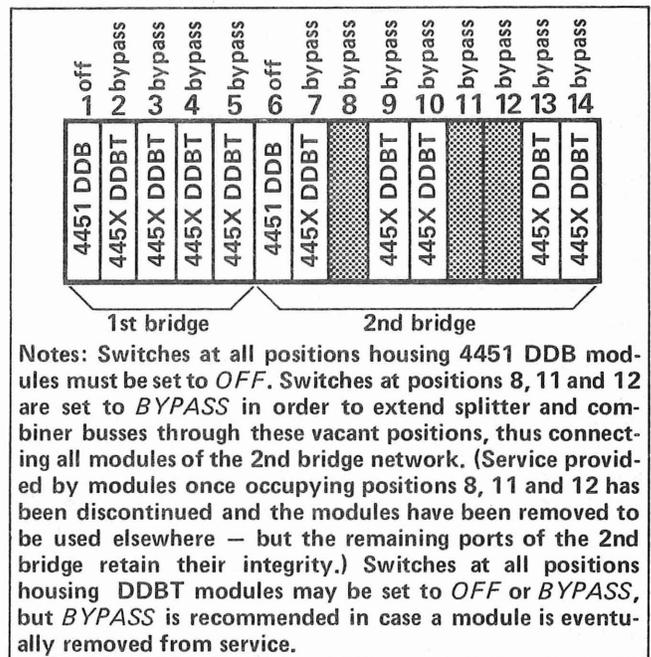


figure 12. Use of bypass switches on a 244B Assembly in a hypothetical arrangement of two individual bridge circuits

levels and alignment

2.14 All gain in a 244 Bridge is provided by the 4451 DDB module. The 4451 provides the same amount of gain for all paths in a given channel. Levels for both channels are, of course, individually adjustable. Levels for individual multiple ports

are established via attenuators on the DDBT modules. In basic theory, enough gain is introduced into the combiner and splitter channels by the 4451 DDB module to cover the worst common-port-to-multiple-port case. Then, via DDBT modules, loss is introduced in sufficient quantity at all other multiple ports to align the network. Once a 244 Bridge is aligned, multiple ports may subsequently be added or deleted without significantly affecting levels in any of the established ports. For specific information on level adjustment for each of the modules in the 244 System, refer to the individual Tellabs Practice on each.

3. installation

inspection

3.01 The 244 System and its component modules should be inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the equipment should be inspected again prior to installation.

installer connections*

3.02 External connections to the 244 System (except for power and ground) are made via the two 25-pair connectors (*P1* and *P2*) on the rear of the 244 Assembly. Connector *P1* is used for output and simplex (SX) transmit connections; connector *P2* is used for input and simplex (SX) receive connections. Table 1 lists the external lead assignments for the 244 System when its modules are installed in 244A and 244B Assemblies. Connector number and lead color are listed for each external lead. All on-site wiring (usually accomplished at the MDF or IDF or other type of local cross-connect frame) may be performed by referencing these tables. Further understanding may be gained by referencing the Wiring Diagram that comprises section 4 of this Practice.

Note: If 244 System modules are to be mounted in a Type 10 Shelf that is not prewired, Bridge interconnections and external connections must be made to the Shelf's module connectors. Refer to the Tellabs Practice on each module for pin assignments.

3.03 External leads are now connected by plugging the two 25-pair plug-ended cables into their receptacles, *P1* and *P2*, on the rear of the 244 Assembly. The reversible connector hold-down brackets on the 244 Assembly's backplane are designed for use with both high-profile and low-profile 25-pair cable connector hoods. Figure 13 shows how the reversible brackets are attached to the standoff posts with both kinds of hoods.

3.04 Once cables are in place, power connections to the 244 System are made via the 2-position barrier-type terminal block located at the lower left rear corner of the 244 Assembly. Make sure that the 1-ampere line fuse is in place in its receptacle above the terminal block. Connect -22 to -56Vdc battery to the negative (-) terminal and ground to the positive (+) terminal of the terminal block.

connector P2 input (rcv)		connector P1 output (xmt)		wire color	cable connector pin no.
244 Assy. position	lead	244 Assy. position	lead		
1	T	1	T	W-BL	26
1	R	1	R	BL-W	1
1	SX	2	SX	W-O	27
2	SX	1	SX	O-W	2
2	T	2	T	W-G	28
2	R	2	R	G-W	3
3	T	3	T	W-BR	29
3	R	3	R	BR-W	4
3	SX	4	SX	W-S	30
4	SX	3	SX	S-W	5
4	T	4	T	R-BL	31
4	R	4	R	BL-R	6
5	T	5	T	R-O	32
5	R	5	R	O-R	7
5	SX	6	SX	R-G	33
6	SX	5	SX	G-R	8
6	T	6	T	R-BR	34
6	R	6	R	BR-R	9
7	T	7	T	R-S	35
7	R	7	R	S-R	10
8	SX	7	SX	BK-BL	36
7	SX	8	SX	BL-BK	11
8	T	8	T	BK-O	37
8	R	8	R	O-BK	12
9	T	9	T	BK-G	38
9	R	9	R	G-BK	13
10	SX	9	SX	BK-BR	39
9	SX	10	SX	BR-BK	14
10	T	10	T	BK-S	40
10	R	10	R	S-BK	15
11	T	11	T	Y-BL	41
11	R	11	R	BL-Y	16
12	SX	11	SX	Y-O	42
11	SX	12	SX	O-Y	17
12	T	12	T	Y-G	43
12	R	12	R	G-Y	18
13*	T	13*	T	Y-BR	44
13*	R	13*	R	BR-Y	19
14*	SX	13*	SX	Y-S	45
13*	SX	14*	SX	S-Y	20
14*	T	14*	T	V-BL	46
14*	R	14*	R	BL-V	21

*Positions 13 and 14 apply to 244B Assembly only.

table 1. Cable assignments for 244 System mounted in 244A or 244B Assembly

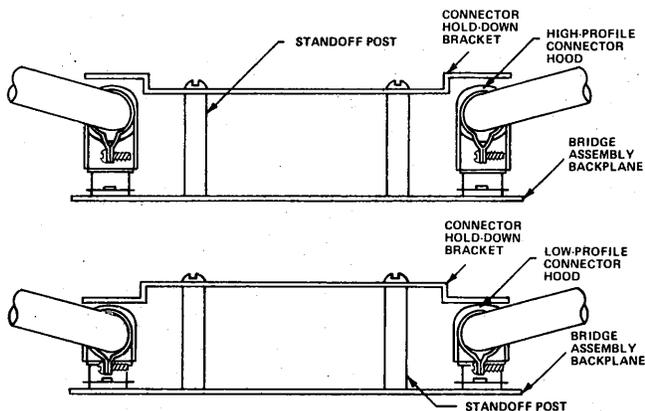


figure 13. Attachment of reversible hold-down brackets when used with high-profile cable connector hoods (upper illustration) and with low-profile hoods (lower illustration)

*When describing external connections, we talk of "inputs" and "outputs" to the 244 Assembly. Please note that an "input" connection accesses either the splitter channel of a 4451 DDB module or the combiner channel of a DDBT module. Conversely, "outputs" access the combiner channel of a 4451 DDB module or the splitter channel of a DDBT module.

module placement and bypass switches

3.05 Before plugging modules into a wired and powered 244 Assembly, bypass switches on that Assembly must be set. Module bypass switches (one per module position) are located on the 244 Assembly's printed circuit backplane and are accessible from the *front* of the Assembly when the modules are removed (see figure 11).

3.06 When 244 System modules are to be installed in a 244 Assembly, the bypass switch for a given module position should be set as follows:

- to *OFF* when a 4451 DDB module is placed in that position;
- to *BYPASS* when a 4453, 4454, 4454A, 4455, or 4455A DDBT module is placed in that position;
- to *BYPASS* if it is desired to continue the Bridge network through an empty module position;
- to *OFF* if it is desired **not** to continue a Bridge network through an empty module position.

3.07 Before inserting the appropriate complement of modules, ensure that each module is properly optioned. Each module used in the 244 Assembly must be conditioned for the intended application. All options are implemented via slide switches or DIP switches located on the printed circuit board of each module. Refer to the appropriate module Practices for specific optioning information.

3.08 After all options are selected and external connections, power, and ground are verified, insert the modules into the 244 Assembly. Modules must be inserted in their proper slots, as determined by cabling assignment at the distributing frame. The installer should have specific information regarding which module to insert into which slot. (Bridge network engineering and the assignment of module slots are discussed in paragraphs 2.08 through 2.10.)

expansion of established bridge networks

3.09 If the number of multiple ports of an established bridge network in a 244 Assembly must be increased and no additional room is available in the Assembly, the bridge network may be expanded to a second 244 Assembly by either of two methods. In the tandem method, a bridge network in one Assembly is multiplied to another bridge network in a second Assembly by interconnecting certain leads accessed in the Assemblies' 25-pair connectorized cables. Connections between the two Assemblies are normally made at the distributing frame rather than between the Assemblies themselves (see paragraph 2.07 for a relevant *Caution* and paragraph 3.10 for procedure). In the second method of expansion to a second Assembly, the splitter and combiner busses of one Assembly are connected directly to those of another Assembly via the four-pin wire-wrap terminals located on the backs of the Assemblies (see figure 7 for locations and paragraph 3.11 for procedure). The method to be used will depend upon local requirements.

3.10 If a bridge network in one Assembly is to be multiplied to another bridge network in a second

Assembly in a *tandem* configuration, proceed as follows:

A. Determine the module positions in the second Assembly that will contain the additional bridge network. Remember that, in this method, the last multiple port of the bridge network in the first Assembly will be connected to the common port of the tandem bridge network in the second Assembly. Thus, the last multiple port (DDBT module) of the bridge network in the first Assembly will not be available for connection to station equipment, and the first module position of the second bridge network will be occupied by a 4451 DDB module.

B. At the MDF or other cross-connect field, strap the input tip and ring lead appearances of the last multiple-port (DDBT) module of the bridge network in the first Assembly to the output tip and ring lead appearances of the common-port (4451 DDB) module of the tandem bridge network in the second Assembly. Then strap the output tip and ring lead appearances of the last DDBT module of the bridge network in the first Assembly to the input tip and ring lead appearances of the 4451 DDB module of the tandem bridge network in the second Assembly. Refer to table 1 for the 244 System cable assignments.

3.11 If the splitter and combiner busses of one 244 Assembly are to be multiplied to those of a second 244 Assembly, connections between the Assemblies are made directly via the four-pin wire-wrap blocks on the rear of the Assemblies. Several blocks are provided at conveniently spaced intervals between module positions on the Assemblies (see paragraphs 2.09 and 2.10). Make the connections between the two Assemblies as follows:

A. Determine the wire-wrap pin block to be used on the first 242 Assembly. This will normally be the **first** block to the **left** of the common-port (4451 DDB) module of the bridge network to be expanded, as viewed from the **rear** of the Assembly.

B. Determine the wire-wrap pin block to be used on the second 244 Assembly. This is done as follows: Leave at least one blank module position to the right (as viewed from the front) of any existing bridge network in the second Assembly to avoid unwanted interconnection of bridge networks. (Set the bypass switch in that position to *OFF*.) The pin block to be used will be the **first** block to the **left** of the blank module position, as viewed from the **rear** of the Assembly.

C. Wire the respective pins of the two blocks together (i.e., topmost pin to topmost pin, etc.). These pins are, top to bottom, splitter tip, splitter ring, combiner tip, and combiner ring.

D. Insert the required DDBT modules in the designated module positions (those to the

right of the blank position left in step B). (Ensure that a module is placed in the position to which the wire-wrap connections have been made, or that bypass switches in empty positions between the connection point and the first module are set to *BYPASS*. No additional common-port modules (4451's) are required in the second Assembly when a bridge network is extended by this method.

E. If a new bridge network is to be located to the right of the bridge network extension just installed, the new bridge network's common-port module (4451) may be installed in the module position to the immediate right of the last DDBT module of the extension.

F. If an extension of another bridge network is to be located to the right of the bridge network extension just installed, the module position to the immediate right of the last DDBT module of the first extension must be left vacant and that position's bypass switch set to *OFF*.

alignment

3.12 Gain in both splitter and combiner channels of a 244 Bridge System is provided by the 4451 DDB module, which provides enough gain to compensate for the worst-case multiple port in each channel. Levels are then coordinated at all other multiple ports in each channel via attenuators on the DDBT modules. The following two paragraphs outline the technique for aligning a 244 System. The Practice on each individual module contains specific information regarding how to adjust levels in that particular module.

Note: *The following procedure is generalized to cover "typical" applications of the 244 System. Local requirements in a particular application may necessitate an alignment procedure that differs somewhat from that provided here.*

244 combiner channel alignment

3.13 Determine the Bridge's multiple-channel input facility with the most loss between the station (data modem) and the station-side port of the associated DDBT module. Set the *combiner* attenuator on the DDBT module associated with that multiple port for zero loss. Next, set all other multiple port levels, via the *combiner* attenuators on the respective DDBT modules, to provide the same input to the 4451 (i.e., combiner bus level) as that multiple with the most loss. Then set the *combiner level* control on the 4451 module for the gain or loss required to adjust the multiple-port input signal level (now the same from all multiple ports) to the proper common-port transmission output level (as specified in the circuit records).

244 splitter channel alignment

3.14 Determine the Bridge's multiple-channel output facility with the most loss between the station-side port of the associated DDBT module and the station (data modem). Set the *splitter* attenuator on that DDBT module to provide zero loss. Next, set the *splitter level* control on the

associated 4451 DDB module to provide the appropriate output level (i.e., splitter bus level) for that multiple port. Then set the *splitter* attenuators on the remaining DDBT modules in the bridge network to provide the proper output levels (as specified in the circuit records) for each of the remaining multiple ports.

4. wiring diagram

4.01 For ease of use, the 244 Distributive Data Bridge System wiring diagram is presented as a fold-out at the end of this Practice (pages 10 through 12).

5. specifications

Note: *For specifications of modules used in the 244 System, see respective Practices on these modules.*

combiner channel (multiple ports to common port)

combiner channel level variation (from minimum to maximum number of ports)

1dB maximum variation (at same combiner-channel level setting), 1 to 14-port loading

delay distortion

less than 200 microseconds, 400 to 3000Hz

frequency response

±0.5dB re 1kHz level, 300 to 4000Hz

splitter channel (common port to multiple ports)

splitter channel level variation (from minimum to maximum number of ports)

1dB maximum variation (at same splitter-channel level setting), 1 to 14-port loading

delay distortion

less than 200 microseconds, 400 to 3000Hz

frequency response

±0.5dB re 1kHz level, 300 to 4000Hz

power requirements

input voltage

-22 to -56Vdc, ground referenced

input current

dependent upon number of 4451 DDB modules in 244 Assembly (normal maximum is four). Each 4451 requires 60mA maximum, 20mA quiescent; therefore, System current requirement is 240mA maximum, 80mA quiescent, when System is configured with four 4451's.

fusing

line fuse, 1.5 amperes

physical

operating environment

20° to 130°F (-7° to 54°C), humidity to 95% (no condensation)

dimensions

height: 5.91 inches (15.04cm)

depth: 7.31 inches (18.57cm)

width: 244A: 17.50 inches (44.45cm)

244B: 20.40 inches (51.82cm)

weight (without modules)

244A: 8 pounds (3.63kg)

244B: 9 pounds 1 ounce (4.11kg)

mounting

244A (12 module positions): mounts in 19 inch relay rack (6 inches vertical rack space)

244B (14 module positions): mounts in 23 inch relay rack (6 inches vertical rack space)

6. testing and troubleshooting

6.01 This Testing Guide may be used to assist in the installation, testing, or troubleshooting of the 244 Distributive Data Bridge System. The following *testing guide checklist* identifies the most common types of general trouble conditions with suggestions as to the probable cause. For specific signaling or transmission difficulties, consult the relevant module practice. Detailed testing information and a sequence diagram for each module installed in the 244 Assembly will be found in the practice for the module. In general, the most expeditious method of isolating trouble is the substitution of known good modules for suspected defective modules while referencing the modules' *testing guide* to determine proper operation.

6.02 It is strongly recommended that no internal (component level) testing or repairs be attempted on the 244 System or associated modules. Unauthorized testing or repairs may void your Tellabs warranty.

6.03 If a situation arises that is not covered in the Testing Guide, contact Tellabs Customer Service at (312) 969-8800 for further assistance.

6.04 If a 244 Assembly or an associated module is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is the more expedient method, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

6.05 If a defective device is encountered, notify Tellabs via telephone [(312) 969-8800], letter [see below], or twx [910-695-3530]. Notification should include all relevant information, including the 8XXXXX part number (from which we can determine the issue of the device in question). Upon notification, we shall ship a replacement to you. If the warranty period of the defective Assembly or module has not elapsed, the replacement will be shipped at no charge. Package the defective device in the replacement's carton; sign the packing list included with the replacement and enclose it with the defective device (this is your return authorization); affix the preaddressed label provided with the replacement to the carton being returned; and ship the equipment prepaid to Tellabs.

repair and return

6.06 Return the defective equipment, shipment prepaid, to: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: repair and return dept.

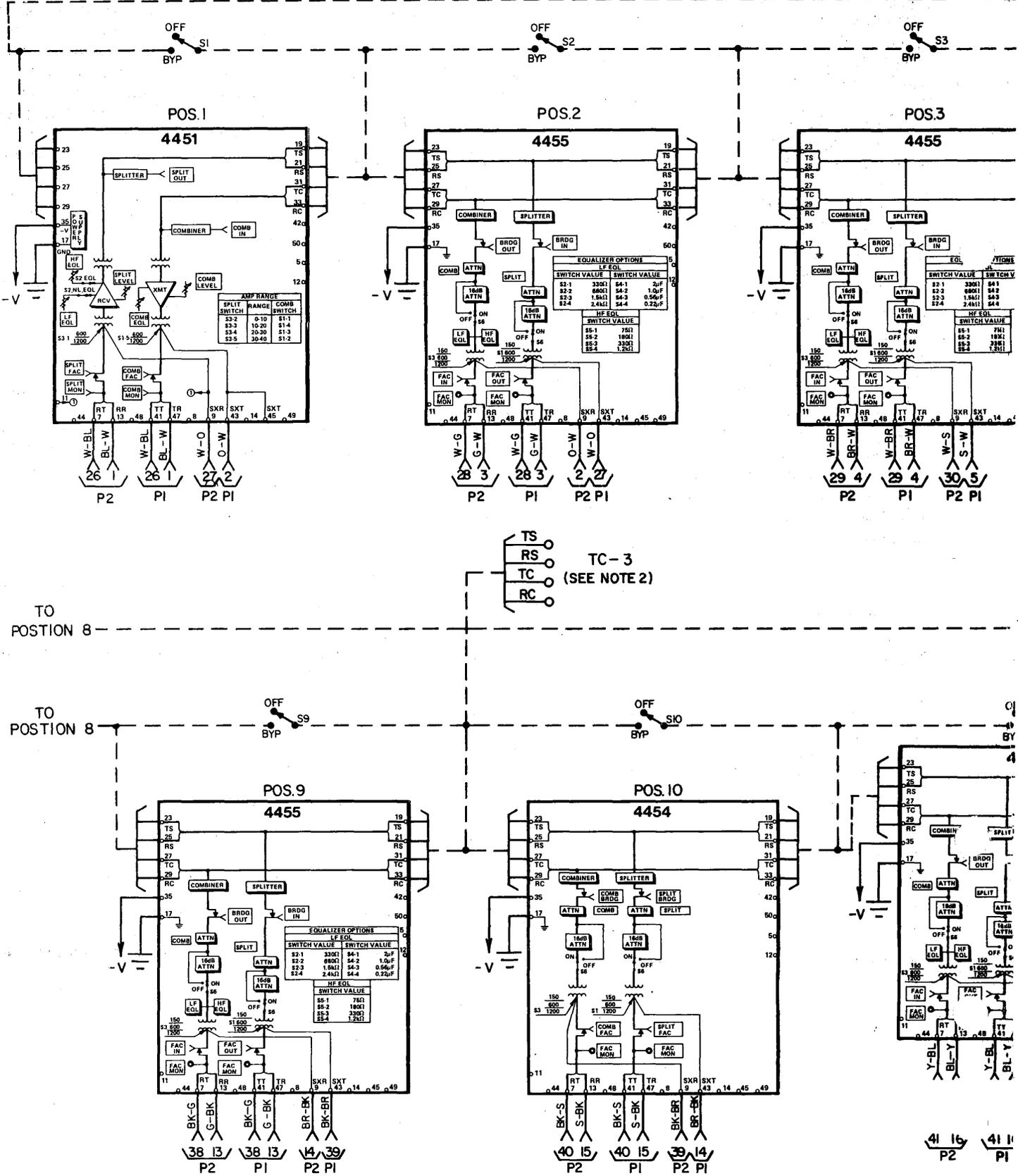
Enclose an explanation of the malfunction. Follow your company's standard procedure with respect to administrative paperwork. Tellabs will repair the equipment and ship it back to you. If the equipment is in warranty, no invoice will be issued.

testing guide checklist

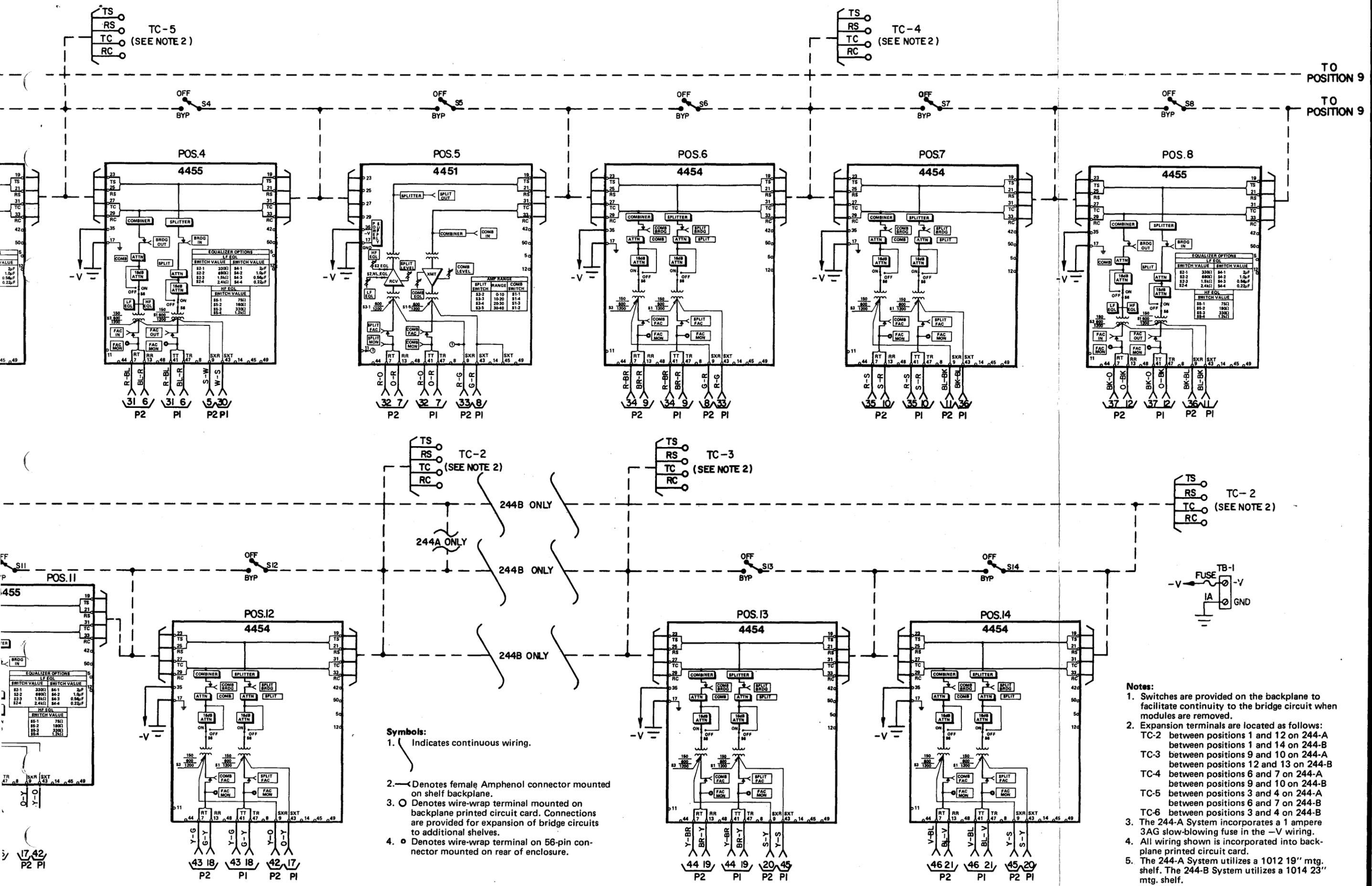
trouble condition	possible cause (in order of likelihood)
system inoperative (transmission not occurring)	1) Power connection faulty or fuse open <input type="checkbox"/> . Verify power output (-22 to -56Vdc) by measuring voltage between negative (-) and positive (+) terminals on connector at rear of 244 Assembly (see paragraph 3.03) <input type="checkbox"/> . 2) Bypass switches incorrectly set <input type="checkbox"/> . 3) External wiring incorrect <input type="checkbox"/> .
excessive noise in transmission path	1) Improper grounding, especially existence of ground loops <input type="checkbox"/> . 2) Amplifier levels in 4451 misaligned <input type="checkbox"/> . 3) Unbalanced facility terminations <input type="checkbox"/> . 4) Defective 4451 module. Substitute new module and retest <input type="checkbox"/> .
inability to derive proper transmission levels	1) Improper impedance optioning of DDBT module(s) <input type="checkbox"/> . 2) Signal levels exceeding overload limits of 4451 <input type="checkbox"/> . 3) Defective 4451 module. Substitute new module and retest <input type="checkbox"/> .
trouble at multiple port served by one DDBT module	1) See Practice on DDBT module for troubleshooting instructions <input type="checkbox"/> .

Tellabs Incorporated
4951 Indiana Avenue, Lisle, Illinois 60532
telephone (312) 969-8800 twx 910-695-3530

Module arrangement in this wiring diagram should be considered typical and is intended for example only. Modules in an actual System may be arranged as desired, consistent with the guidelines presented in this Practice.



4. wiring diagram



TO POSITION 9
TO POSITION 9

- Symbols:**
- Indicates continuous wiring.
 - ⊖ Denotes female Amphenol connector mounted on shelf backplane.
 - Denotes wire-wrap terminal mounted on backplane printed circuit card. Connections are provided for expansion of bridge circuits to additional shelves.
 - Denotes wire-wrap terminal on 56-pin connector mounted on rear of enclosure.

- Notes:**
- Switches are provided on the backplane to facilitate continuity to the bridge circuit when modules are removed.
 - Expansion terminals are located as follows:
 TC-2 between positions 1 and 12 on 244-A
 between positions 1 and 14 on 244-B
 TC-3 between positions 9 and 10 on 244-A
 between positions 12 and 13 on 244-B
 TC-4 between positions 6 and 7 on 244-A
 between positions 9 and 10 on 244-B
 TC-5 between positions 3 and 4 on 244-A
 between positions 6 and 7 on 244-B
 TC-6 between positions 3 and 4 on 244-B
 - The 244-A System incorporates a 1 ampere 3AG slow-blowing fuse in the -V wiring.
 - All wiring shown is incorporated into backplane printed circuit card.
 - The 244-A System utilizes a 1012 19" mtg. shelf. The 244-B System utilizes a 1014 23" mtg. shelf.