tellabs
technical manual
76-82242
rev C

practice section 82242

P/O

242 Distributive Data Bridge System

contents

Note: *This practice is written with specific reference to 242 Distributive Data Bridge Systems mounted in the* **Tellabs 24X Issue 2 Mounting Assembly** *(Tellabs part number 8224X). If your 242 System is to be mounted in a Tellabs* **24X Issue 1 Mounting Assembly** *(Tellabs part number 8124X), which is also known as the Tellabs 242 Mounting Assembly, please refer instead to the 242 System practice revision identified by section number 81242 and revision date 1 October 1978 for cabling information.*

1. general description

1.01 The 242 Distributive Data Bridge (DDB) Sys tem (figure 1) is a 4wire-common-port, 2wire-multiple-port active data bridge. Its primary use is in voice-frequency data networks where simultaneous bidirectional transmission at up to 300 baud takes place between a scanning-type central processor served by a 4wire facility and a number of remote data stations served by 2wire facilities. This type of data network is typically used in fire-alarm, intrusion-alarm, and other remote monitoring applications. Because it is modular, the 242 System can be arranged in a variety of ways to provide one or more individual bridge networks as desired. The 242 DDB follows a conventional *split* bridge format, i.e., the common port of a bridge network is interfaced with several multiple ports through separate *splitter* and *combiner* channels. In the splitter channel, the 4wire common input is divided a number of ways to provide outputs for the various 2wire multiple ports. In the combiner channel, inputs from the 2wire multiple ports are connected through the bridge to the 4wire common-port output. Splitter and combiner paths are derived via separate splitter and combiner amplifiers. Simultaneous bidirectional transmission is made possible, and isolation between the two channels is increased, through use of band-splitting filters that establish separate splitter and combiner frequencies through the bridge.

1.02 This practice section is revised to include information on the 4255S DDB Quad Termination module and to provide expanded and improved application and alignment information.

1.03 The 242 System comprises five components: the 4251 DDB Combiner Amplifier module, the 4252 DDB Splitter Amplifier module, the

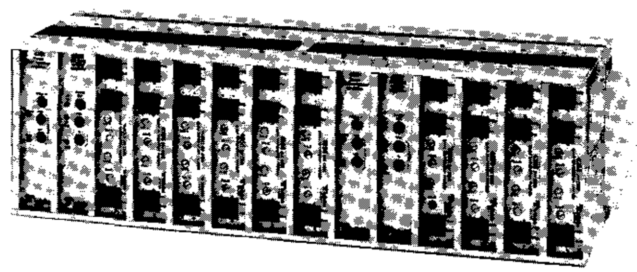


figure 1. 242 DDB System (typical configuration)

4255 and 4255S DDB Quad Termination modules, and the 24X Mounting Assembly (which houses the four types of modules). The 4251 and 4252 modules are the 4wire-common-port termination devices that derive the fully isolated combiner and splitter busses of a 242 Bridge network and provide active level control (amplification) for the network. The 4255 and 4255S modules each terminate four 2wire multiple ports of a 242 Bridge network, provide individual passive level control (attenuation) for each multiple port that they terminate, and provide 4wire-to-2wire conversion via integral resistive dividers. The 4255S, unlike the 4255, contains four integral 20mA sealing-current sources — one for each multiple-port facility that the 4255S interfaces. The active circuitry of the 4251 and 4252 modules permits a bridge network's multiple ports to be terminated and aligned by passive 4255 or 4255S modules rather than by more expensive active devices. Within a single 24X Mounting Assembly, the size of a 242 Bridge network can range from 2 to 48 multiple ports, i.e., one 4251 and one 4252 module can serve from one to twelve 4255 and/or 4255S modules.

1.04 The 24X Mounting Assembly that houses the 4251, 4252, 4255, and 4255S modules consists of a Tellabs 1012 or 1014 Mounting Shelf equipped with a connectorized printed-circuit backplane. The assembly is universally prewired to accommodate not only the four types of 242-System modules but also the modules of Tellabs' 244 (4wire) DDB System and 243 Low-Speed Data Signaling System. (For information on these systems, please consult the 243 and 244 System practices and related module practices.) Two versions of the 24X Assembly are available: the 24XA, which houses 12 modules and mounts in a 19-inch relay rack, and the 24XB, which houses 14 modules and mounts in a 23-inch relay rack.

1.05 The 24X Assembly is equipped with five 25-pair female cable connectors for all external connections except battery and ground. Battery and ground connections are made via a barrier-type terminal strip on the 24X Assembly's backplane. Also located on the backplane are several 6-pin wire-wrapping blocks used for extending a bridge network from one 24X Assembly to another and a 13-pin terminal used only for local or remote test access to 244 (4wire) DDB Systems.

1.06 As stated previously, the 24X Assembly is universally prewired to accommodate three different Tellabs systems. When used with the 242 System, the 24X Assembly may be equipped with as many common-port bridge modules (4251's and 4252's) and multiple-port bridge modules (4255's and/or 4255S's) as required. Module positions are nondedicated, i.e., either a 4251, 4252, or 4255/55S may be used in any position. However, in any bridge network within a 24X Assembly, modules must be arranged in a specific order (see paragraph 2.08). The assembly's printed-circuit backplane extends the splitter and combiner busses (derived in the 4252 and 4251 modules, respectively) through the bridge network as 4255/55S Quad Termination modules are added to the assembly. Option switches on the backplane allow unused module positions between modules in any bridge network in the assembly to be bypassed without wiring changes.

1.07 A 242 System can be arranged and rearranged for various bridge-network configurations within its overall capacity by adding, removing, or exchanging modules — without wiring changes to the 24X Assembly. For example, the number of multiple ports in an established bridge network may be changed simply by adding or removing 4255/55S Quad Termination modules as required. When a bridge is changed in this manner, the remaining multiple ports retain their integrity without rewiring or realignment. Levels are maintained within approximately ±1dB, and multiple-port positions from which modules have been removed need not be terminated. As a second example, a 242 System can be converted from one large bridge network (up to 48 multiple ports) in a 24X Assembly to several smaller networks simply by interchanging the appropriate 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 242 System is not installed in a CO). All external connections to the ports of the 242 Bridge itself are made via the cable connectors on the backplane of the 24X Assembly. These cable connections are made only once and need not be changed.

1.08 The remainder of section 1 contains a brief description of each 242-System module. For detailed information on these modules, please refer to their separate Tellabs practices.

4251 2Wire DDB Combiner Amplifier

1.09 In a 242 Bridge network, the 4251 2Wire DDB Combiner Amplifier module (figure 2) interfaces the transmit channel of the common-port facility, derives the bridge's combiner (multiple-port-to-common-port) bus, contributes active level control and amplitude equalization in the combiner path, and provides facility-side termination circuitry.

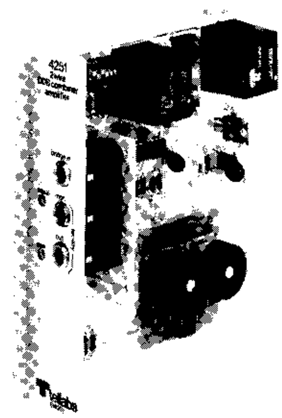


figure 2. 4251 2Wire DDB Combiner Amplifier module

1.10 The 4251's amplifier provides from −25 to +15dB of gain in four switch-selectable 10dB ranges. Throughout each range, levels are continuously adjustable to within ±0.1dB via a front-panel control. Maximum output level is +10dBm with less than 1 percent distortion.

1.11 The 4251 interfaces the common-port facility (transmit channel) via a transformer that can be switch-optioned for balanced 150, 600, 1200-ohm terminating impedance and that is center-tapped to derive a balanced simplex lead.

1.12 A slope equalizer in the 4251 can be used to pre-equalize the bridge's combiner output to the common transmit port. With this equalizer, which is intended primarily for use with nonloaded cable, combiner-channel frequency response can be adjusted from essentially flat to a nominal 4dB-per-octave slope.

1.13 The 4251 module accepts a Tellabs 9952X Low-Pass or High-Pass Band-Splitting Filter subassembly to provide combiner-channel transmission at a different frequency from splitter-channel transmission (see paragraphs 2.03 and 2.04). These subassemblies are available in several versions to accommodate the frequencies used by the various alarm and monitoring systems with which the 242 Bridge is used.

1.14 An internally regulated power supply in the 4251 permits operation on −22 to −56Vdc filtered input. Current requirements range from 20mA at idle to 30mA at maximum output level. Surge protection is provided for the module's facility port. Reverse-battery protection and transient-limiting circuitry are provided in the amplifier's internal power supply circuitry. Resistance-capacitance (RC) filtering and decoupling networks minimize cross-coupling and the effects of noise on the input power leads. Three front-panel test jacks facilitate alignment and maintenance.

4252 2Wire DDB Splitter Amplifier

1.15 In a 242 Bridge network, the 4252 2Wire DDB Splitter Amplifier module (figure 3) interfaces the receive channel of the common-port facility, derives the bridge's splitter (common-port-to-multiple-port) bus, contributes active level control and amplitude equalization in the splitter path, and provides facility-side termination circuitry.

1.16 The 4252's amplifier provides from −15 to +25dB of gain in four switch-selectable 10dB ranges. Throughout each range, levels are continuously adjustable to within ±0.1dB via a front-panel control. Maximum output level is approximately 3.1Vrms on the splitter bus with all 48 ports equipped and terminated. (This is equivalent to a +5dBm level at each multiple port.) Distortion at maximum output is less than 1 percent.

Note: *Actual maximum multiple-port capacity of one 4251-4252 module pair without significant degradation of System transmission characteristics is 60 multiple ports, i.e., fifteen 4255/55S modules. See paragraph 2.07 for details.*

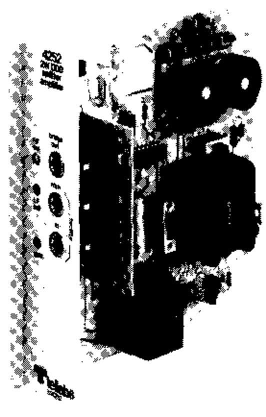


figure 3. 4252 2Wire DDB Splitter Amplifier module

1.17 The 4252 interfaces the common-port facility (receive channel) via a transformer that can be switch-optioned for balanced 150, 600, or 1200-ohm terminating impedance and that is center-tapped to derive a balanced simplex lead.

1.18 In the 4252, any of three modes of amplitude equalization can be selected via switch option to post-equalize the common input to the bridge's splitter channel. These modes are bypass (flat, no equalization), bump-type equalization for loaded cable or carrier, and slope equalization for nonloaded cable. In the bump equalization mode, a variety of high-frequency and low-frequency gain shapes can be achieved (as is typically required for loaded cable), or flat response with high-end and low-end roll-off can be provided (as is typically required for carrier facilities). In the nonloaded-cable slope equalization mode, frequency response is adjustable from essentially flat to a nominal 4dB-per-octave slope.

1.19 Like the 4251, the 4252 module accepts a Tellabs 9952X Low-Pass or High-Pass Band-Splitting Filter subassembly to provide splitter-channel transmission at a different frequency from combiner-channel transmission (see paragraphs 2.03 and 2.04).

1.20 The 4252 contains an internally regulated power supply that permits operation on −22 to −56Vdc filtered input. Current requirements range from 20mA when idle to 40mA at maximum output level. Surge protection is provided for the module's facility port. Reverse-battery protection and transient-limiting circuitry are provided in the amplifier's internal power supply circuitry. Resistance-capacitance (RC) filtering and decoupling networks minimize cross-coupling and the effects of noise on the input power leads. Three front-panel test jacks facilitate alignment and maintenance.

4255 and 4255S 2Wire DDB Quad Termination modules

1.21 The 4255 and 4255S 2Wire DDB Quad Termination modules (figure 4) each terminate and establish levels passively at four 2wire multiple ports of a 242 Bridge network. For each of the four multiple ports, a facility-side transformer provides fixed, balanced 600-ohm terminating impedance, and a front-panel attenuation control provides from 0 to 30dB of continuously adjustable (to within ±0.1dB) loss. (This does not include 0.5dB of insertion loss always present in the 4255 and 0.7dB of insertion loss always present in the 4255S.) Also, for each multiple-port path in the 4255 and 4255S, a resistive divider provides 2wire-to-4wire (facility-side-to-bridge-side) conversion. Twelve front-panel bantam-type jacks (three per multiple port) facilitate alignment and maintenance. The 4255 and 4255S differ solely through the presence of four integral, switch-selectable 20mA sealing-current sources, one for each multiple-port facility, on the 4255S.

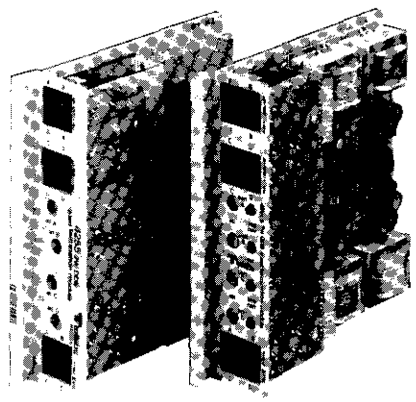


figure 4. 4255 and 4255S 2Wire DDB Quad Termination modules

2. application

2.01 The 242 Distributive Data Bridge (DDB) System interfaces a 4wire common port with a number of 2wire multiple ports to provide a bridge network normally used for transmission of voice-frequency data signals at rates up to 300 baud between a scanning-type central processor and a number of associated remote data stations. As such, the 242 DDB System is most commonly used in intrusion-alarm, fire-alarm, and other remote monitoring systems where a number of remote locations served by 2wire facilities are polled from a central location served by a 4wire facility. *(In such alarm systems, one central scanner constantly polls a number of remote data stations asking, in effect, "Is everything OK?" The remote locations each return a signal indicating one of two possible states—"yes" or "no," i.e., "OK" or "not OK." The central scanner responds to an "OK" indication by continuing to poll the remote locations as usual, and to a "not OK" indication by outputting an alarm signal. This signal may initiate a printout, sound an audible alarm, or provide additional types of alarm indications as required in a particular application. The 242 DDB System provides the necessary bridging arrangement for two-way data communication between the central scanner and the remote locations.)*

2.02 To perform its data bridging function, the 242 DDB System uses a *split* bridge design, i.e., the common port is interfaced with the multiple ports through separate *splitter* and *combiner* channels. In the splitter channel, input received from the 4wire common-port facility is split a number of ways to be transmitted out of all 2wire multiple ports. In the combiner channel, an input signal received from any 2wire multiple port is connected through the 242 Bridge and transmitted out of the 4wire common port.

2.03 As stated above, splitter and combiner channels in a 242 Bridge are separate. Two independent channels are required not only to accommodate 4wire transmission on the common-port side of the bridge but also to provide isolation between transmission in each direction. While many 242-System applications involve half-duplex operation (i.e., bidirectional transmission but only in one direction at a time), the System can also accommodate full-duplex operation (i.e., simultaneous bidirectional transmission) even though the transmission facilities on the multiple-port side of the bridge are 2wire. Full-duplex operation is made possible (and half-duplex operation is enhanced) through use of two band-splitting filters — one high-pass and one low-pass — that derive separate splitter and combiner frequencies. By means of these filters, higher-frequecy signals transmitted in one direction through the bridge are separated from lower-frequency signals transmitted in the opposite direction. In addition to allowing full-duplex operation, this arrangement helps to isolate the two channels by preventing splitter-channel signals from being reflected back into the combiner channel. This can occur, for example, at the multiple-port facility interfaces as a result of impedance mismatches between the 4255/55S modules and the mulitple-port facilities.

2.04 The high-pass and low-pass filters used in the 242 System are provided as Tellabs 9952X Band-Splitting Filter subassemblies, which plug onto the printed circuit boards of the 4251 Combiner Amp and 4252 Splitter Amp modules. Eight 9952X Filter subassemblies (four high-pass and four low-pass) are available to accommodate the supervisory frequencies used by the various alarm and monitoring systems that may be served by the 242 Bridge. Table 1 lists the type (high-pass or low-pass) and bandpass frequency of each of the eight 9952X Filter subassemblies as well as several typical alarm and monitoring systems with which they are used.

2.05 Physically, the 242 DDB System may be located in a central office or on the customer's premises. The 24X Assembly that houses the 242 System is available in two versions, both designed for relay-rack mounting. The 24XA Assembly provides mounting for up to twelve 242-System modules in a 19-inch rack, and the 24XB Assembly provides mounting for up to fourteen 242-System modules in a 23-inch rack. Both versions are universally wired and connectorized.

2.06 Four modules are used in various combinations to accommodate all applications. They are the 4251 2Wire DDB Combiner Amplifier, the

alarm system	max. no. of 2w stations per 4w interface	tone frequencies (Hz) from master station	tone frequencies (Hz) to master station	Tellabs 9952X subassembly required	filter type high pass	filter type low pass	cutoff frequency (3dB down)
Larse		360		9952A*		X	400Hz
Corp.	63		1440, 1800	9952G**	X		1300Hz
Morse		1350		9952C*		X	1370Hz
Products	100		1750, 2100	9952D**	X		1650Hz
Esterline		2025, 2225		9952E*	X		1925Hz
Security Group	64		1070, 1270	9952B**		X	1300Hz
Wells		1070, 1270		9952J*		X	1460Hz
Fargo	127		2025, 2225	9952H**	X		1810Hz

*On 4252 Splitter Amp module. **On 4251 Combiner Amp module.

Note: *To the best of our knowledge, this table is valid as of the date of publication of this revision (January, 1984). However, changes to the various alarm systems by their manufacturers may invalidate part or all of the table at any time. Also, because the table is intended to list only typical examples of alarm systems, your particular alarm system may not be included. If, for these or other reasons, you are not certain as to which 9952X Filter subassemblies to use, please consult either the manufacturer of your alarm system or Tellabs Customer Service at your Tellabs Regional Office or at our U.S. or Canadian headquarters.*

table 1. Filter subassemblies (9952X) required with various alarm and monitoring systems

4252 2Wire DDB Splitter Amplifier and the 4255 and 4255S 2Wire DDB Quad Termination modules. A two-way (i.e., full- or half-duplex) application requires one 4251 Combiner Amp module and one 4252 Splitter Amp module for the entire bridge network, and one 4255 or 4255S Quad Termination module for every four multiple ports to be served. One-way (simplex) applications require only a 4251 Combiner Amp or a 4252 Splitter Amp, as appropriate for the direction of transmission, and sufficient 4255 or 4255S Quad Termination modules.

Note: *Because the majority of 242 System applications require both splitter and combiner channels, little detail is given here on one-way applications. If your application is one-way, simply disregard the information in this practice concerning the channel you are not using. Should you need additional information, please call Tellabs Customer Service at your Tellabs Regional Office (in Canada, at our Canadian headquarters).*

system capacity

2.07 Within a single 24XA (12-position) Mounting Assembly, the size of a 242 Bridge network (as served by one 4251 and one 4252 module) can range from 2 to 40 multiple ports (as provided by one to ten 4255/55S modules). Within a single 24XB (14-position) Mounting Assembly, the size of a 242 Bridge network can range from 2 to 48 multiple ports. If more than one 24X Assembly is available, however, one 4251-4252 module pair can serve up to 60 multiple ports, i.e., fifteen 4255/55S modules, with no significant degradation of 242-System transmission performance. If even larger bridge networks are required, tandem bridge arrangements can be used to greatly expand the number of multiple ports. See paragraphs 2.13 through 2.15 for information on expanding a 242 Bridge network to a second 24X Assembly. See paragraphs 2.16 through 2.18 for information on tandem bridge arrangements.

module arrangements

2.08 As stated earlier, module positions in the 24X Assembly are nondedicated: any of the four 242-System modules may be plugged into any slot in the assembly, so long as modules within a bridge network are in appropriate positons relative to each other. A 4251 Combiner Amp normally defines the beginning of a bridge network. A 4252 Splitter Amp is then inserted to the 4251's immediate right (as viewed from the front of the assembly). The 4255/55S Quad Termination modules are plugged into subsequent slots beginning at the immediate right of the 4252 (see figure 5). Up to twelve 4255/55S modules (providing 48 multiple ports) may be used in association with a 4251-4252 module pair in one 24X Assembly. Should you arrive at the assembly's rightmost module position while assigning 4255/55S modules, additional 4255/55S's can still be added to that bridge network in any of several ways, as described in paragraphs 2.12 through 2.15.

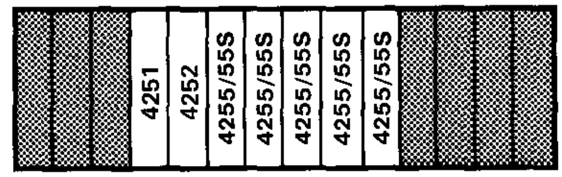


figure 5. Front view of 24X Assembly showing left-to-right module arrangement of bridge network

splitter and combiner busses and assembly bypass switches

2.09 Splitter and combiner busses are extended through a 242 Bridge network by both the associated modules and by the printed circuit backplane of the 24X Assembly. Paragraphs 2.10 and 2.11 explain where and how a 242 Bridge network continues from module to module and from module position to module position. These paragraphs also explain where and how a 242 Bridge network starts and stops (i.e., is not continued between the modules).

2.10 Both the 4251 Combiner Amp module and the 4252 Splitter Amp module interrupt the combiner and splitter busses at the point at which they are inserted into the 24X Assembly. On the other hand, 4255/55S Quad Termination modules extend the busses to the adjacent lefthand and righthand module positions. Interruption of the busses by the 4251 is necessary because the 4251 defines the beginning of a bridge network (that is, it breaks the circuit with the module position to its immediate left). The 4252 is designed to interrupt the busses only because of its possible use (without a 4251) in one-way bridge applications. In the more common two-way bridge applications, the busses must be extended through a module position containing a 4252. This is accomplished by means of a bypass switch on the 24X Assembly. Bypass switches are located at the rear of each module position in the 24X Assembly (see figure 6). They are used either to extend the bridge network through a 4252 position or through a vacant module position occurring between modules in a network.

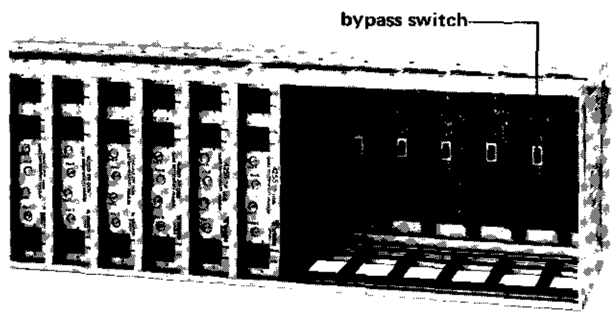
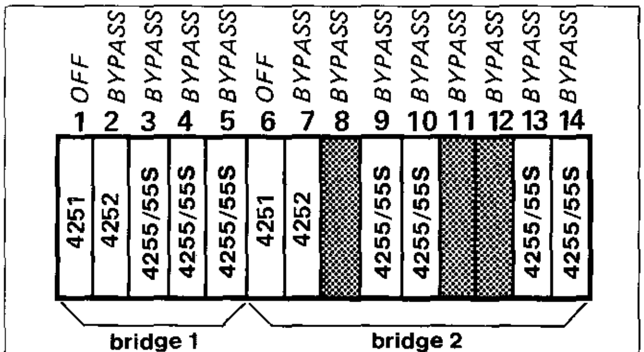


figure 6. View of 24X-Assembly bypass switches

Note: *The term "bypass" used to describe these switches may be somewhat misleading. When used to extend a bridge network through vacant module positions, the switch does, indeed, provide bypassing. However, when used at a 4252 module position as described above, the switch provides network continuity from the 4251 modules through the 4252* *module and on to the 4255/55S multiple-port termination modules. In this latter case, the switch does not actually bypass the 4252 position.*

2.11 The 24X Assembly's bypass switches have two settings: *BYPASS* and *OFF*. The switch at a module position housing a 4251 Combiner Amp is normally set to *OFF*, and the switch at a module position housing a 4252 Splitter Amp is normally set to *BYPASS* (unless the 4252 is used in a one-way application without an associated 4251, in which case the switch must be set to *OFF*). Bypass switches at module positions occupied by 4255/55S Quad Termination modules may be set either to *BYPASS* or to *OFF*, with no immediate effect on that particular bridge network at that particular time. However, Tellabs recommends that the switches of module positions occupied by 4255/55S's be set to *BYPASS* to provide circuit continuity in the event that a 4255/55S 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 24X Assembly, bypass switches are 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 7 for a visual example.)*



Note: *Switches at all positions housing 4251 modules must be set to* OFF. *Switches at all positions housing 4252 modules must be set to* BYPASS. *Switches at positions 8, 11 and 12 are set to* BYPASS *in order to extend splitter and combiner busses through these vacant positions, thus connecting all modules of the second bridge network. (Service provided by modules once occupying positions 8, 11 and 12 has been discontinued and the modules have been removed to be used elsewhere, but the remaining ports of the second bridge retain their integrity.) Switches at all positions housing 4255/55S modules may be set to* OFF *or* BYPASS, *but* BYPASS *is recommended to maintain continuity in the event that a module is later removed from service.*

figure 7. Use of bypass switches on a 24XB Assembly in a hypothetical arrangement of two individual bridge networks

expansion of existing bridge networks

2.12 If, while assigning 4255/55S modules to a 242 Bridge network, you arrive at the last available module position at the righthand end of the assembly, additional 4255/55S modules may still be added to that bridge network in several ways, as long as the maximum number of 4255/55S's per bridge network is not exceeded. For example, if one or more module positions beginning with position 1 at the lefthand end of the assembly are available, 4255/55S modules may simply be inserted into these positions as shown in figure 8a. This is because the splitter and combiner busses "wrap around" from the last module position to the first module position due to the design of the assembly's printed circuit backplane. Other hypothetical expansion arrangements with **two 242 Bridge networks mounted in the same assembly** are shown in figures 8b through 8e. Please note that, in figures 8b through 8e, some module positions must be left empty to avoid interconnecting the two bridge networks. Also, for certain module positions, the required assembly bypass switch settings *(OFF* or *BYPASS)* are shown. These are exceptions to the general bypass-switch rules in paragraph 2.11 and are necessary, in the expansion arrangements shown, to either extend or break splitter and combiner bus continuity between critical module positions. (Note, for example, that setting the bypass switch at a position housing a 4251 to *BYPASS* instead of to the normal *OFF* position extends the splitter and combiner busses to the left as well as to the right of the 4251-4252 pair. This allows expansion of a bridge network to the immediate left as well as to the right of the 4251 and 4252). For those module positions where assembly bypass switch settings are not shown, the bypass switches are set to their normal positions as described in paragraph 2.11 and also in paragraph 3.08.

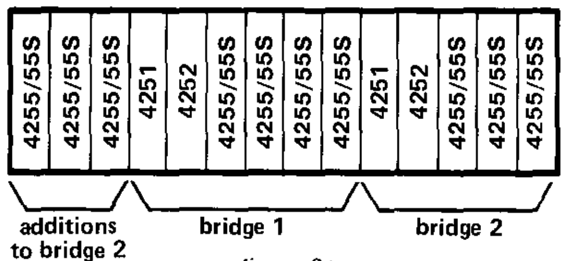


figure 8a.

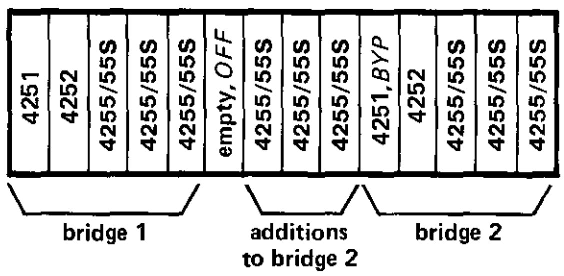


figure 8b.

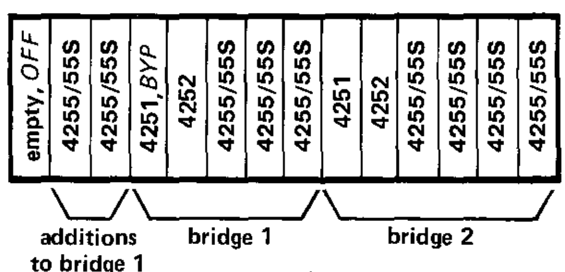


figure 8c.

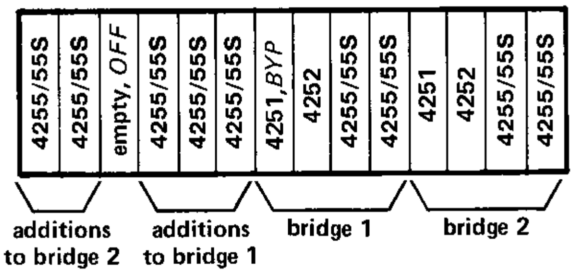


figure 8d.

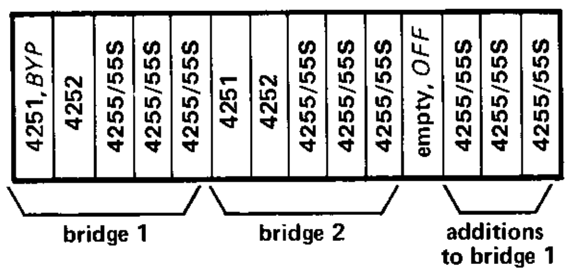


figure 8e.

figure 8. Hypothetical expansion arrangements with two bridge networks mounted in same Assembly

2.13 In applications where **more than two 242 Bridge networks are installed in the same assembly** and one or more of these networks are to be expanded to vacant module positions in the same assembly, jumper wiring may be required between specific six-pin wire-wrapping blocks on the assembly's backplane (see figure 9). Also, in applications where **a 242 Bridge network in one assembly is to be expanded to vacant module positions in a second assembly,** jumper wiring is always required between one or more specific six-pin blocks on the first assembly and one or more specific six-pin blocks on the second assembly. (The one exception to this is *tandem* bridge arrangements, where the required connections between bridge networks are made at the distributing frame. See paragraphs 2.16 through 2.18 and paragraphs 3.13 and 3.14 for details.) These six-pin blocks are provided specifically to facilitate bridge-network expansion by extending (via jumpers) the splitter and combiner busses of a bridge network to vacant module positions in the same or in a different assembly. On the 24XA (12-position) Assembly, 6-pin blocks are located behind module positions 3, 6, and 9. On the 24XB (14-position) Assembly, 6-pin blocks are located behind module positions 3, 6, 9, and 12. As a general rule, a group of 4255/55S

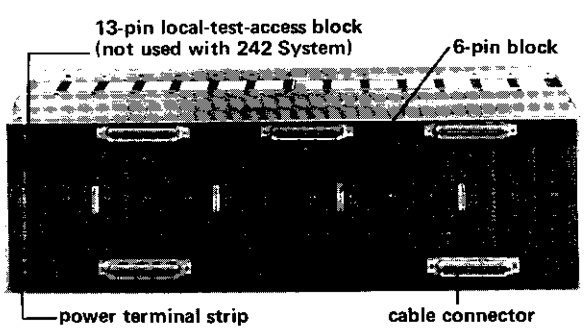


figure 9. Rear view of 24X Assembly

Quad Termination modules can be installed either to the left or to the right of the module position at which the jumpers are connected. In all cases, however, the following three guidelines hold true:

A. The six-pin block behind a particular module position accesses the bridge-side ports of a 4251-4252 module (adjacent) pair when either module of the pair is located in that position, and accesses the bridge-side ports of a 4255/55S module located in that position. (For the 4251 and 4252, these are the combiner bus input and splitter bus output ports, respectively; for the 4255/55S, these are the combiner bus output and splitter bus input ports.)

B. If (1) the module position behind which a six-pin block is located is empty and (2) the bypass switch for that position is set to *BYPASS*, the six-pin block accesses the bridge-side ports of a 4251-4252 module pair located in the *two preceding* module positions or the bridge-side ports of a 4255/55S module located in the *preceding* module position. If the preceding module position is also empty and its bypass switch is set to *BYPASS*, the six-pin block accesses the splitter and combiner bus appearances at the preceding module position.

C. If (1) the module position behind which a six-pin block is located is empty, (2) the bypass switch for that position is set to *OFF*, and (3) a 4255/55S module is located in the *following* module position, the six-pin block accesses the bridge-side ports of that 4255/55S module. If a 4251-4252 module pair is located in the following two module positions, access to their bridge-side ports is provided only if the bypass switches for their module positions are set to *BYPASS*.

2.14 For expanding 242 Bridge networks via jumpering (on the same assembly or between two assemblies), four jumpers (splitter tip, splitter ring, combiner tip, and combiner ring) are required. This means that only four of the six available pins on the assembly's wire-wrapping blocks need be used. Paragraph 3.12 provides details on installing these jumpers. Figures 10a through 10g show hypothetical expansion arrangements with more than two bridge networks mounted in the same assembly. Figures 11a through 11c show hypothetical bridge-network expansion arrangements from one assembly to another. In the diagrams where jumper wiring is shown, asterisks (*) indicate module positions behind which six-pin blocks are located. Also, as in figure 8, exceptions to the normal bypass switch settings are shown where appropriate.

Note 1: *In applications where* **two** *bridge networks are mounted in the same assembly and the recommended module arrangement is observed (i.e., 4252's to the immediate right of their associated 4251's), jumper wiring should never be necessary for expansion of the bridge networks to vacant module positions in the same assembly.*

Note 2: *For jumpering between two assemblies in applications where length of the jumpers will exceed*

15 feet, Tellabs recommends that shielded connecting cable be used and that the cable shield be grounded at one end only.

> **Special Note:** *On 4255 modules built after December, 1981, and on all 4255S modules, four strap options provide for greater efficiency of module arrangement when expanding a 242 Bridge network to a second 24X Assembly. Details follow in paragraph 2.15. If your 4455/55S modules have these straps (see paragraph 2.15), be certain to read all of that paragraph before proceeding with jumper installation.*

2.15 Four strap options, *ST1* through *ST4*, on the printed circuit boards of 4255 modules built after December, 1981, and on the printed circuit boards of all 4255S modules (see figure 12) provide increased efficiency of module arrangement when expanding a 242 Bridge network from one mounting assembly to another via jumpering between the wire-wrapping terminal blocks on the assemblies' backplanes. Previously, module positions to the left or right of one or more Quad Termination modules being added in a second assembly had to be left empty to prevent automatic connection of these modules to other bridge networks or bridge-network additions in the same assembly. By cutting or removing straps *ST1* through *ST4* on the 4255/55S, however, the splitter and combiner busses are opened within the module so that continuity of both busses to adjacent module positions in the assembly is controlled solely by the bypass switch at the rear of the module's mounting-assembly position (as viewed from the front of the assembly). Thus, groups of one or more 4255/55S modules equipped with these straps can be installed immediately adjacent to one another in the same assembly without unwanted interconnection of their independent bridge networks. To do this, the straps are cut on the **leftmost** (as viewed from the front) modules of each group, and the assembly bypass

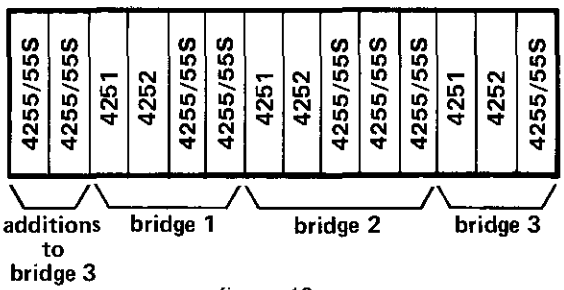


figure 10a.

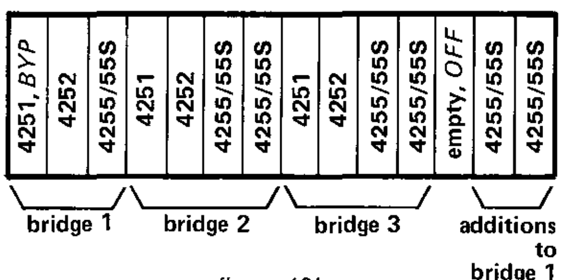


figure 10b.

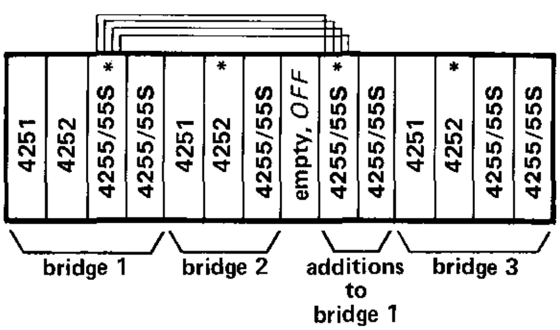


figure 10c.

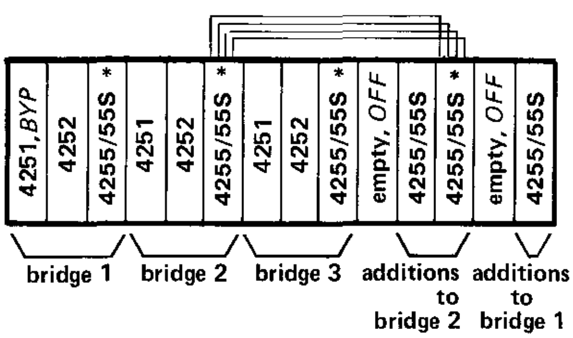


figure 10d.

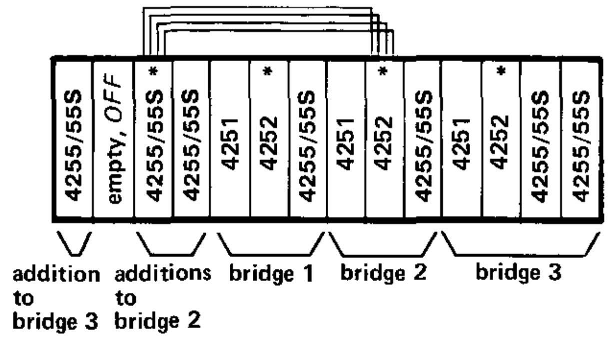


figure 10e.

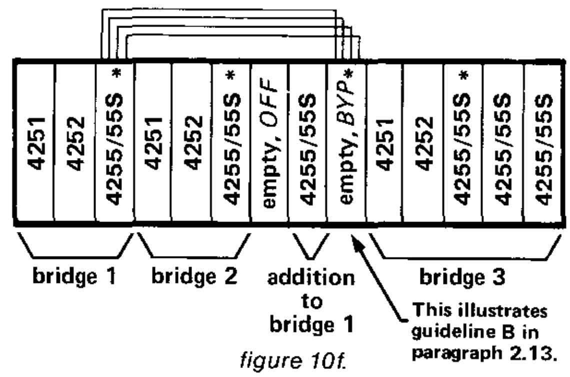


figure 10f.

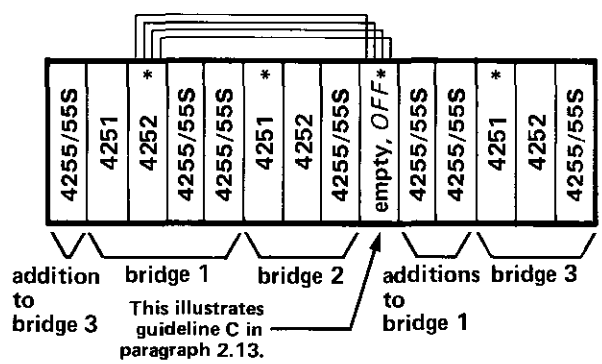


figure 10g.

figure 10. Hypothetical expansion arrangements with more than two bridge networks in same Assembly

switches at these modules' positions are set to *OFF.* Figure 13 shows how this is done for a hypothetical arrangement involving additions in a second assembly to three existing bridge networks.

Note: *If a 4255/55S module whose straps have been cut or removed is to be used in any module position other than the leftmost in its group (i.e., in a middle or rightmost position), its assembly bypass switch* **must** *be set to the* **BYPASS** *position to provide splitter and combiner bus continuity to the adjacent modules.*

tandem operation

2.16 For large bridge-network applications (i.e., more than 48 [or 60, depending upon mounting arrangements] multiple 2wire ports), 242 Bridges can be tandemed with Tellabs 244 (4wire) Bridges to provide a greatly increased number of 2wire ports. **In the most effective tandem arrangement** (see figure 14), a *244 Bridge network* consisting of one 4451 DDB common-port (splitter and combiner amplifier) module and two or more 445X DDB Termination (DDBT) modules interfaces the 4wire common port and derives a number of 4wire multiple ports (maximum is 13, i.e., thirteen 445X DDBT modules, in a 24X Assembly). Each 4wire multiple port becomes the common port of a *242 Bridge network* that derives a number of 2wire multiple ports (maximum for each 242 network is 48, i.e., twelve 4255/55S modules, in a 24X Assembly).

Note 1: *In a tandem arrangement of this type, all 4251 Combiner Amp modules in the 242 Bridge networks must be equipped with the same 9952X Filter subassembly. The same holds true for all 4252 Splitter Amp modules in the 242 Bridge networks.*

Note 2: *This tandem bridging arrangement, as well as others (such as that described in paragraph 2.17) where the common port of one bridge network serves as the common port of the entire tandem arrangement while the common ports of all*

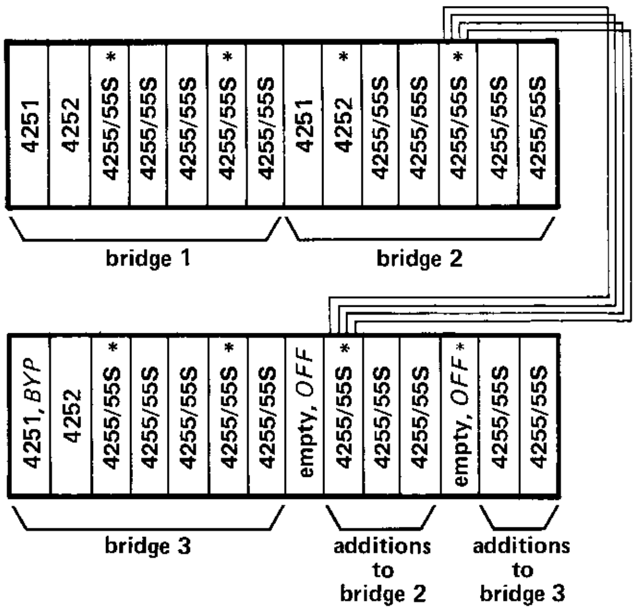


figure 11a.

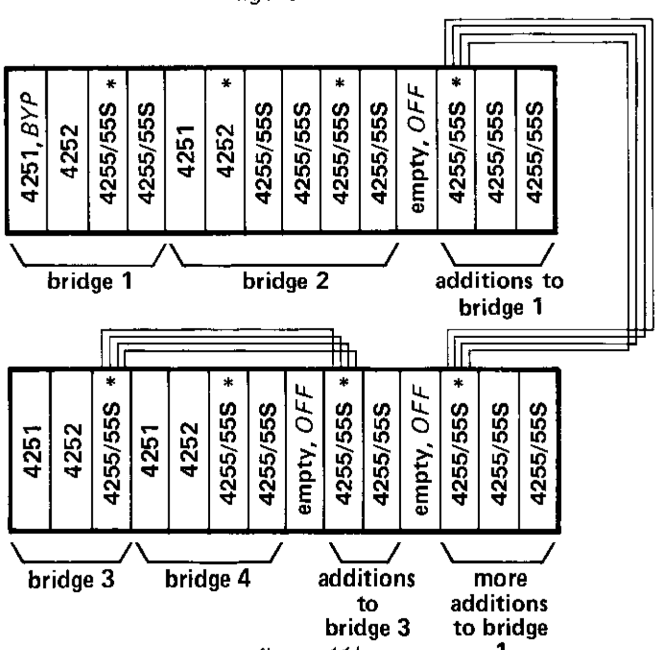


figure 11b.

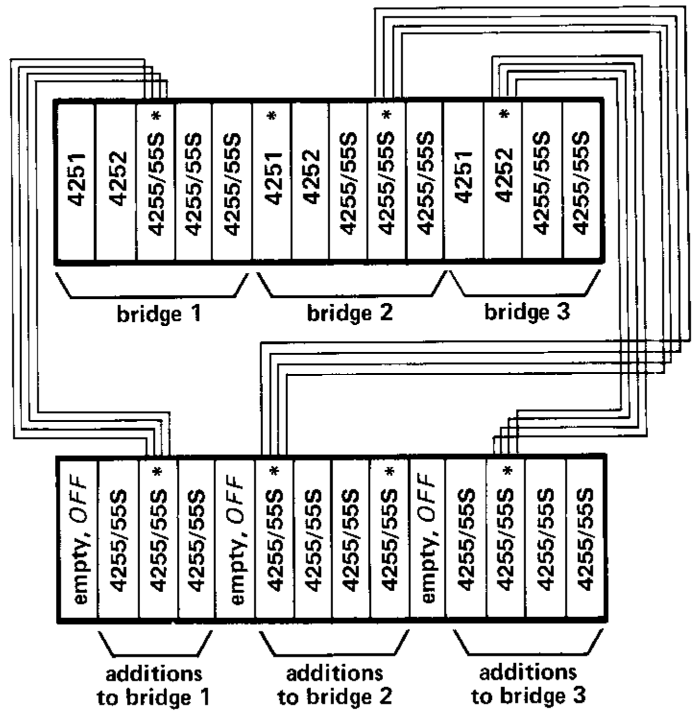


figure 11c.

figure 11. Hypothetical bridge network expansion arrangements from one Assembly to another

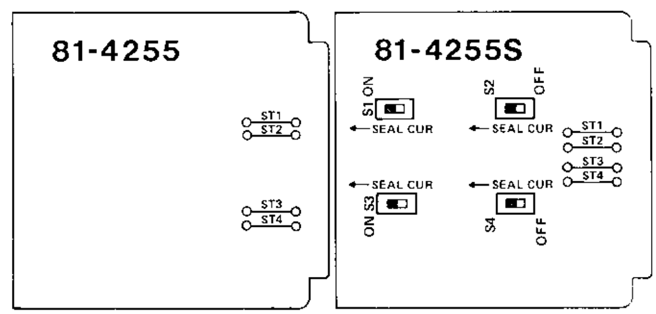


figure 12. 4255 and 4255S option switch and strap locations

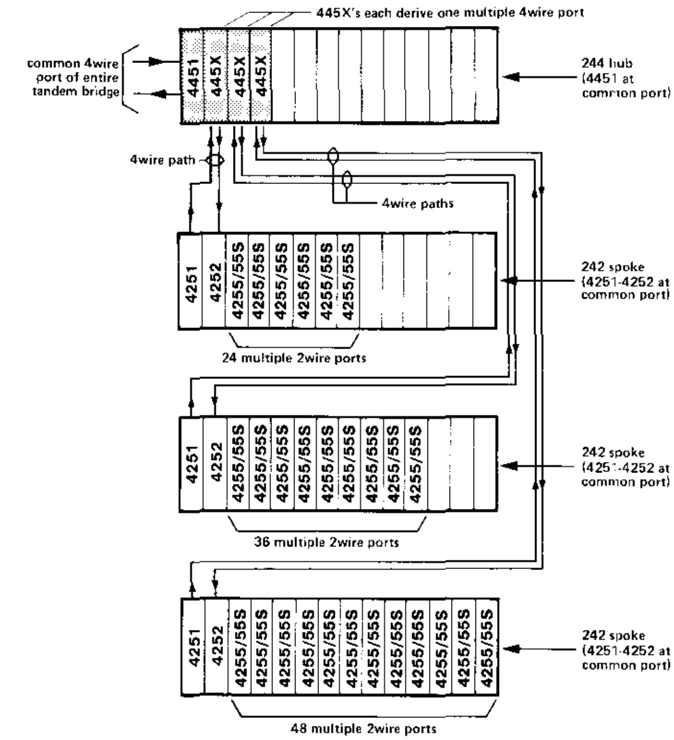
other bridge networks in the tandem arrangement interface the multiple ports of the first, is sometimes called a "hubbing" arrangement. The bridge network serving as the entire tandem arrangement's common port is the "hub," and the other bridge networks that provide the tandem arrangement's multiple ports are the "spokes."

Note 3: *If some or all of the spokes in a tandem arrangement are at different locations than the hub, 4wire voice-frequency transmission facilities are required between the various locations, and appropriate interconnections between the bridge networks' 24X Mounting Assemblies and the 4wire facilities must be made. Transmission levels between the hub and the spokes of any tandem arrangement will depend upon the individual circuit requirements of the particular application.*

Caution 1: *Please be aware that, in very large tandem arrangements, accumulative 2wire-port noise may adversely affect the bridge arrangement's signal-to-noise ratio.*

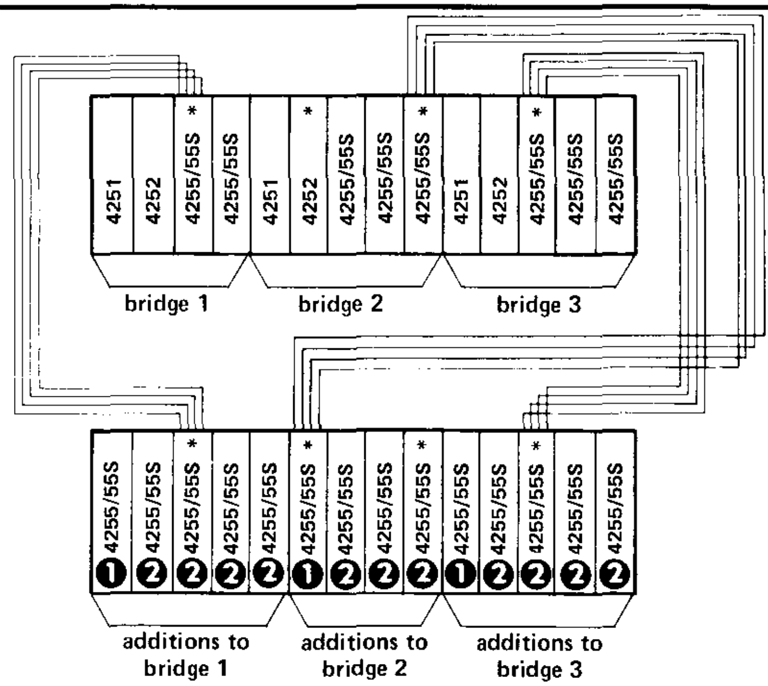
Caution 2: *In tandem arrangements involving both 242 and 244 Bridge networks where more than two networks are tandemed in series (i.e., where at least one spoke connected to the hub has additional spokes of its own), transmission parameters may be degraded somewhat from those specified in this practice. If a series tandem arrangement of more than two bridge networks is desired for a particular application, be certain that the resultant performance will be acceptable for that application. Consult Tellabs' Application Engineering Group at your Tellabs Regional Office (in Canada, at our Canadian headquarters) if you need additional information on tandem bridge applications.*

Caution 3: *In any tandem bridge arrangement, the splitter bus level of every bridge network in the arrangement should be the same. This is also true for the combiner bus level of every bridge network in the arrangement. Otherwise, excessive noise may result.*



Note: *This arrangement, as shown, provides 108 multiple 2wire ports. Theoretical maximum is 624, as provided by thirteen 445X's in hub and thirteen maximally configured (i.e., twelve 4255/55S's each) spokes (13 x 12 x 4 = 624).*

figure 14. Tandem bridging arrangement with 244 hub and 242 spokes (244-System modules are shaded)



❶ Cut or remove straps on these, the **leftmost** (as viewed from the front) 4255/55S modules of their groups, and set the assembly bypass switches at their module positions to *OFF*.

❷ Straps need not be cut on these 4255/55S modules. If the straps on these modules are cut, the assembly bypass switches at their module positions must be set to *BYPASS*.

*Denotes locations of wire-wrapping terminal blocks on assembly backplanes.

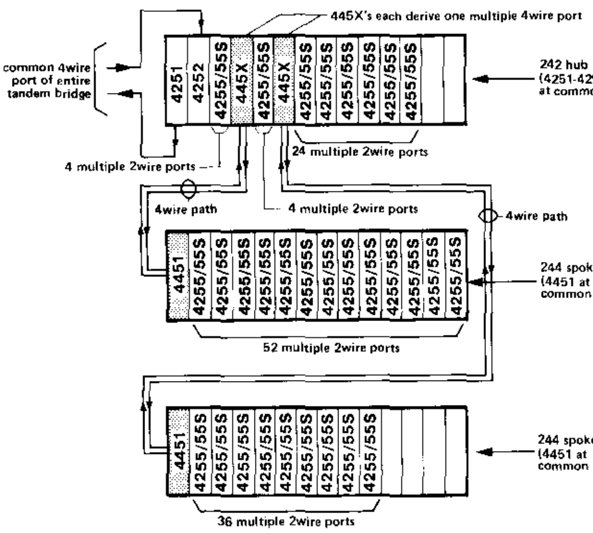
figure 13. Expansion of existing bridge networks through additional 4255/55S modules in second 24X Assembly

2.17 In another possible tandem arrangement (see figure 15), a 242 Bridge network (the hub) interfaces the common 4wire port and derives both 2wire and 4wire multiple ports (the former via 4255/55S modules, the later via 244-System 445X 4wire DDBT modules). Each multiple 4wire port interfaces the common port of a 244 Bridge network (the spokes). These spokes are considered 244 Bridge networks because their common ports are served by 4451 (4wire) DDB modules; their multiple ports, however, are 2wire ports derived via 4255/55S modules. The 9952X Band-Splitting Filter subassemblies in the hub serve both the hub and the spokes. In this arrangement, the total number of termination modules in the hub (4255/55S's and 445X's) should not exceed 12, and the number of termination modules in each spoke (4255/55S's) should not exceed 13.

2.18 The tandem arrangements described in paragraph 2.16 and 2.17 represent only two common tandeming methods out of many different possibilities. Once again, should you require specific information not included in this practice about a particular tandem arrangement, please contact Tellabs' Application Engineering Group at your Tellabs Regional Office (in Canada, at our Canadian headquarters).

levels and alignment

2.19 All gain in a 242 Bridge is provided by the 4251 DDB Combiner Amplifier and 4252 DDB Splitter Amplifier modules. Each module provides the same amount of gain for all paths in its respective channel. Levels for individual multiple ports are established by attenuators on the 4255/55S DDB Quad Termination modules. In basic theory, gain is introduced into the combiner and splitter channels by the 4251 and 4252 modules' amplifiers to coordinate bus levels with common-port facility levels, and loss is introduced via the 4255/55S modules' attenuators to coordinate bus levels with multiple-port facility levels. Once a 242 Bridge is aligned, multiple ports can subsequently be added or deleted without significantly affecting levels at any of the established ports. For the overall 242-System alignment procedure, refer to paragraphs 3.15 through 3.19 of this practice. For specific information on level and equalization adjustment for each of the modules in the 242 System, refer to their individual Tellabs practices.



Note: *This arrangement, as shown, provides 120 multiple 2wire ports. Theoretical maximum is 624, as provided by twelve 445X's in hub and twelve maximally configured (i.e., thirteen 4255/55S's each) spokes (12 x 13 x 4 = 624).*

figure 15. Tandem bridging arrangement with 242 hub and 244 spokes (244-System modules are shaded)

3. installation

inspection

3.01 The modules and mounting assembly(s) that comprise the 242 DDB System 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.

mounting

3.02 The 24XA (12-position) Mounting Assembly mounts in a standard 19-inch relay rack, while the 24XB (14-position) Assembly mounts in a standard 23-inch relay rack. Each version of the 24X Assembly occupies 6 inches of vertical rack space.

installer connections

3.03 All external connections to the 24X Assembly except power and ground are made via the five 25-pair female cable connectors, *P1* through *P5*, on the assembly's backplane. The 24X Issue 2 Assembly is truly universal in that the same assembly can simultaneously house a 242 (2wire) DDB System, a 244 (4wire) DDB System, and a 243 Low-Speed Data Signaling System. Table 2 lists the specific connectors that are used when the 242,

25-pair cable connector 24X (Issue 2) Assembly backplane					Tellabs Systems that can be accommodated through use of indicated cable connectors
P1	P2	P3	P4	P5	
	X		X		1) 244 Bridge networks only, without capability of remote/local testing via 4459 Loopback/Facility Test Module
	X		X	X	1) 244 Bridge networks only, with remote/local test capability via 4459 module 2) 242 Bridge networks only (for which this is the most economical cabling arrangement) 3) Independent 242 and 244 Bridge networks in same Assembly, without remote/local test capability for 244 networks via 4459 module 4) Tandem bridge arrangements with 242- and 244-System modules intermixed within bridge networks
X	X	X	X		1) 243 Systems only 2) Independent 242 networks, 244 networks, and/or 243 Systems in same Assembly, without remote/local test access for 244 networks via 4459 module 3) Independent tandem bridge arrangements and 243 Systems in same Assembly 4) Tandem bridge arrangements as described above (for which this is a less economical cabling arrangement than that of preceding table entry) 5) 242 Bridge networks only (for which this is a less economical cabling arrangement than that of preceding table entry) 6) 244 Bridge networks only, without remote/local test capability via 4459 module unless special wiring is done at MDF to access 4459 via connectors P1 and P3 (See System wiring diagram in 244 Practice). (Again, this arrangement is less economical than those of first and second table entries.)
X	X	X	X	X	1) Same as items 1 through 6 in preceding table entry, but with remote/local test access via 4459 module for any 244 networks in Assembly

table 2. Use of cable connectors on 24X Issue 2 Assembly backplane

243, and 244 Systems (and combinations thereof) are used in a single 24X Assembly.

3.04 As indicated in table 2, connectors *P1* through *P4* are normally used in all 242-System applications. If it is absolutely certain, however, that only 242 Bridge networks will always be used in a 24X Issue 2 Assembly and the need to include 244-System modules in a 242 network for tandeming purposes will never arise, a more economical wiring arrangement that requires only *three* cable connectors instead of four may be used. In this arrangement, all connections normally made via connectors *P1* and *P3* are made instead via connector *P5*. Tables 3 and 4 list, for cable connectors *P2* and *P4*, respectively, the module-connector and cable-conector pin numbers and lead colors applicable to 242-System modules for every 24X-Assembly module position. Table 5 provides similar information for cable connectors *P1* and *P3*, and also for the optional arrangement that uses connector *P5* instead of *P1* and *P3*. (Please note that the format of table 5 differs slightly from that of tables 3 and 4. This is because lead assignments for cable connectors *P1* and *P3*, or *P5*, involve only the Quad Termination modules (the 4255 and 4255S). Tables 6a and 6b list, for reference purposes, all pin numbers and lead colors for connectors *P1* through *P5* on the 24X Assembly. All on-site wiring (usually done at the MDF, IDF, or similar local cross-connect frame) may be performed by referring to these tables. The System Wiring Diagram, section 4 of this practice, may also be helpful during the wiring procedure.

242-System modules — connector P2

24XA/ 24XB (Issue 2) module position	56-pin module connector pin no.	25-pair cable connector pin no.	lead color	connector P2 lead designations for each module when used in listed module positions: 4251 DDB Combiner module	4252 DDB Splitter module	4255/55S DDB Quad Termination module
1	43	1	BL-W	out SX	–	line-C R
	9	26	W-BL	–	in SX	line-C T
	13	2	O-W	–	in R	line-A R
	7	27	W-O	–	in T	line-A T
	47	3	G-W	out R	–	line-B R
	41	28	W-G	out T	–	line-B T
2	43	4	BR-W	out SX	–	line-C R
	9	29	W-BR	–	in SX	line-C T
	13	5	S-W	–	in R	line-A R
	7	30	W-S	–	in T	line-A T
	47	6	BL-R	out R	–	line-B R
	41	31	R-BL	out T	–	line-B T
3	43	7	O-R	out SX	–	line-C R
	9	32	R-O	–	in SX	line-C T
	13	8	G-R	–	in R	line-A R
	7	33	R-G	–	in T	line-A T
	47	9	BR-R	out R	–	line-B R
	41	34	R-BR	out T	–	line-B T
4	43	10	S-R	out SX	–	line-C R
	9	35	R-S	–	in SX	line-C T
	13	11	BL-BK	–	in R	line-A R
	7	36	BK-BL	–	in T	line-A T
	47	12	O-BK	out R	–	line-B R
	41	37	BK-O	out T	–	line-B T
5	43	13	G-BK	out SX	–	line-C R
	9	38	BK-G	–	in SX	line-C T
	13	14	BR-BK	–	in R	line-A R
	7	39	BK-BR	–	in T	line-A T
	47	15	S-BK	out R	–	line-B R
	41	40	BK-S	out T	–	line-B T
6	43	16	BL-Y	out SX	–	line-C R
	9	41	Y-BL	–	in SX	line-C T
	13	17	O-Y	–	in R	line-A R
	7	42	Y-O	–	in T	line-A T
	47	18	G-Y	out R	–	line-B R
	41	43	Y-G	out T	–	line-B T
7	43	19	BR-Y	out SX	–	line-C R
	9	44	Y-BR	–	in SX	line-C T
	13	20	S-Y	–	in R	line-A R
	7	45	Y-S	–	in T	line-A T
	47	21	BL-V	out R	–	line-B R
	41	46	V-BL	out T	–	line-B T

table 3. Cable connector P2 lead assignments for 242-System modules in 24X Issue 2 Assembly

242-System modules — connector P4

24XA/ 24XB (Issue 2) module position	56-pin module connector pin no.	25-pair cable connector pin no.	lead color	connector P4 lead designations for each module when used in listed module positions: 4251 DDB Combiner module	4252 DDB Splitter module	4255/55S DDB Quad Termination module
8	43	50	V-S	out SX	–	line-C R
	9	25	S-V	–	in SX	line-C T
	13	49	V-BR	–	in R	line-A R
	7	24	BR-V	–	in T	line-A T
	47	48	V-G	out R	–	line-B R
	41	23	G-V	out T	–	line-B T
9	43	47	V-O	out SX	–	line-C R
	9	22	O-V	–	in SX	line-C T
	13	46	V-BL	–	in R	line-A R
	7	21	BL-V	–	in T	line-A T
	47	45	Y-S	out R	–	line-B R
	41	20	S-Y	out T	–	line-B T
10	43	44	Y-BR	out SX	–	line-C R
	9	19	BR-Y	–	in SX	line-C T
	13	43	Y-G	–	in R	line-A R
	7	18	G-Y	–	in T	line-A T
	47	42	Y-O	out R	–	line-B R
	41	17	O-Y	out T	–	line-B T
11	43	41	Y-BL	out SX	–	line-C R
	9	16	BL-Y	–	in SX	line-C T
	13	40	BK-S	–	in R	line-A R
	7	15	S-BK	–	in T	line-A T
	47	39	BK-BR	out R	–	line-B R
	41	14	BR-BK	out T	–	line-B T
12	43	38	BK-G	out SX	–	line-C R
	9	13	G-BK	–	in SX	line-C T
	13	37	BK-O	–	in R	line-A R
	7	12	O-BK	–	in T	line-A T
	47	36	BK-BL	out R	–	line-B R
	41	11	BL-BK	out T	–	line-B T
13*	43	35	R-S	out SX	–	line-C R
	9	10	S-R	–	in SX	line-C T
	13	34	R-BR	–	in R	line-A R
	7	9	BR-R	–	in T	line-A T
	47	33	R-G	out R	–	line-B R
	41	8	G-R	out T	–	line-B T
14*	43	32	R-O	out SX	–	line-C R
	9	7	O-R	–	in SX	line-C T
	13	31	R-BL	–	in R	line-A R
	7	6	BL-R	–	in T	line-A T
	47	30	W-S	out R	–	line-B R
	41	5	S-W	out T	–	line-B T

*24XB (14-position) Assembly only.

table 4. Cable connector P4 lead assignments for 242-System modules in 24X Issue 2 Assembly

242-System modules — connectors P1 and P3, or P5

module position in 24X Issue 2 Assembly	56-pin module connector pin	4255/55S DDB Quad Termination module lead designation	connector P1 and P3 pin numbers and lead colors for 4255/55S module used in listed module positions: connector P1 pin	connector P1 lead color	connector P3 pin	connector P3 lead color	alternative to connector P1 and P3 connections: connector P5 pin numbers and lead colors for 4255/55S module used in listed module positions*: connector P5 pin	connector P5 lead color
1	49	line-D R	1	BL-W	–	–	50	V-S
	45	T	26	W-BL	–	–	25	S-V
2	49	line-D R	4	BR-W	–	–	49	V-BR
	45	T	29	W-BR		–	24	BR-V
3	49	line-D R	7	O-R	–		48	V-G
	45	T	32	R-O		–	23	G-V
4	49	line-D R	10	S-R	–	–	47	V-O
	45	T	35	R-S	–	–	22	O-V
5	49	line-D R	13	G-BK		–	46	V-BL
	45	T	38	BK-G	–		21	BL-V
6	49	line-D R	16	BL-Y	–	–	45	Y-S
	45	T	41	Y-BL		–	20	S-Y
7	49	line-D R	19	BR-Y	–	–	44	Y-BR
	45	T	44	Y-BR	–	–	19	BR-Y
8	49	line-D R		–	50	V-S	43	Y-G
	45	T	–	–	25	S-V	18	G-Y
9	49	line-D R	–	–	47	V-O	42	Y-O
	45	T		–	22	O-V	17	O-Y
10	49	line-D R	–	–	44	Y-BR	41	Y-BL
	45	T	–	–	19	BR-Y	16	BL-Y
11	49	line-D R	–	–	41	Y-BL	40	BK-S
	45	T		–	16	BL-Y	15	S-BK
12	49	line-D R	–	–	38	BK-G	39	BK-BR
	45	T	–		13	G-BK	14	BR-BK
13**	49	line-D R		–	35	R-S	38	BK-G
	45	T	–	–	10	S-R	13	G-BK
14**	49	line-D R	–	–	32	R-O	37	BK-O
	45	T	–	–	7	O-R	12	O-BK

*Use connector *P5* as an alternative to connectors *P1* and *P3* only in accordance with the limitation stated in paragraph 3.03 and table 2.

**24XB (14-position) Assembly only.

table 5. Cable connector P1 and P3, or P5, lead assignments for 242-System modules (4255/55S only) in 24X Issue 2 Assembly

3.05 External leads are now connected by plugging the 25-pair plug-ended cables into their receptacles on the rear of the 24X Assembly. The reversible connector hold-down brackets on the 24X Assembly's backplane are designed for use with both high-profile and low-profile 25-pair cable connector hoods. Figure 16 shows how the reversible brackets are attached to the standoff posts with both kinds of hoods. In addition, the 24X Issue 2 Assembly's cable connectors also accommodate the newer self-locking plastic cable-connector housings that do not require hold-down brackets.

Note: *If 242-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 56-pin module connectors. See the Tellabs Practices on the 24X Assembly and on the three 242-System modules for pin assignments.*

3.06 After all cables are in place, power connections to the 242 System are made via the two-position barrier-type terminal strip located at the lower left rear corner of the 24X Assembly. Connect −22 to −56Vdc filtered battery (or −42 to −56Vdc filtered battery if 4255S modules or 244-System modules requiring nominal −48Vdc input are used in the assembly) to the negative (−) terminal and ground to the positive (+) terminal of the terminal strip.

module placement and bypass switches

3.07 Before plugging modules into a wired and powered 24X Assembly, bypass switches on the Assembly must be set. Module bypass switches (one per module position) are located on the 24X Assembly's printed circuit backplane and are accessible from the front of the assembly when the modules are removed (see figure 6).

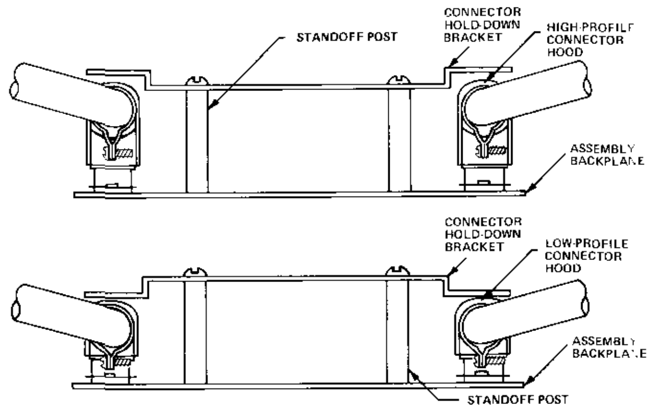


figure 16. Attachment of reversible hold-down brackets when used with high-profile cable connector hoods (upper illustration) and with low-profile hoods (lower)

24X-Assembly input/output connector assignments

24X Issue 2 Assembly module position	connector P1			connector P2			connector P5		
	56-pin module conn. pin	25-pair cable conn. pin	lead color	56-pin module conn. pin	25-pair cable conn. pin	lead color	56-pin module conn. pin	25-pair cable conn. pin	lead color
1	49	1	BL-W	43	1	BL-W	49	50	V-S
	45	26	W-BL	9	26	W-BL	45	25	S-V
	14	2	O-W	13	2	O-W	–	–	–
	8	27	W-O	7	27	W-O			–
	48	3	G-W	47	3	G-W	–	–	–
	44	28	W-G	41	28	W-G	-	-	-
2	49	4	BR-W	43	4	BR-W	49	49	V BR
	45	29	W-BR	9	29	W-BR	45	24	BR-V
	14	5	S-W	13	5	S-W	–	–	–
	8	30	W-S	7	30	W-S	–	–	–
	48	6	BL-R	47	6	BL-R	–	–	-
	44	31	R-BL	41	31	R-BL	–	–	–
3	49	7	O-R	43	7	O-R	49	48	V-G
	45	32	R-O	9	32	R-O	45	23	G-V
	14	8	G-R	13	8	G-R	-	–	–
	8	33	R-G	7	33	R-G	–	–	–
	48	9	BR-R	47	9	BR-R	–	–	
	44	34	R-BR	41	34	R-BR	–	–	–
4	49	10	S-R	43	10	S-R	49	47	V-O
	45	35	R-S	9	35	R-S	45	22	O-V
	14	11	BL-BK	13	11	BL-BK	–	–	–
	8	36	BK-BL	7	36	BK-BL	-		
	48	12	O-BK	47	12	O-BK	–	–	–
	44	37	BK-O	41	37	BK-O	–	–	–
5	49	13	G-BK	43	13	G-BK	49	46	V-BL
	45	38	BK-G	9	38	BK-G	45	21	BL V
	14	14	BR-BK	13	14	BR-BK	–	–	–
	8	39	BK-BR	7	39	BK-BR	–	–	–
	48	15	S-BK	47	15	S-BK	–	–	–
	44	40	BK-S	41	40	BK-S	–	–	
6	49	16	BL-Y	43	16	BL-Y	49	45	Y-S
	45	41	Y-BL	9	41	Y-BL	45	20	S-Y
	14	17	O-Y	13	17	O-Y	–	–	–
	8	42	Y-O	7	42	Y-O	–		
	48	18	G-Y	47	18	G-Y	–	–	–
	44	43	Y-G	41	43	Y-G	–	–	–
7	49	19	BR-Y	43	19	BR-Y	49	44	Y-BR
	45	44	Y-BR	9	44	Y-BR	45	19	BR-Y
	14	20	S-Y	13	20	S-Y	–	–	–
	8	45	Y-S	7	45	Y-S	–	–	–
	48	21	BL-V	47	21	BL-V	–	–	–
	44	46	V-BL	41	46	V-BL	–	–	–
1 through 7	42	24	BR-V	–	–	–	42	30	W-S
	50	49	V-BR	–	–	–	50	5	S-W
	5	25	S-V	–	–	–	5	29	W-BR
	12	50	V-S	–	-	–	12	4	BR-W
	37	23	G-V	–	–	–	37	33	R-G
	39	48	V-G	–	–	–	39	8	G-R

Note: There are no connector-P3 or connector-P4 assignments for module positions 1 through 7.

table 6a. Input/output connector assignments for 24X Assembly, module positions 1 through 7

24X Issue 2 Assembly module position	connector P3			connector P4			connector P5		
	56-pin module conn. pin	25-pair cable conn. pin	lead color	56-pin module conn. pin	25-pair cable conn. pin	lead color	56-pin module conn. pin	25-pair cable conn. pin	lead color
8	49	50	V-S	43	50	V-S	49	43	Y-G
	45	25	S-V	9	25	S-V	45	18	G-Y
	14	49	V-BR	13	49	V-BR	–	–	–
	8	24	BR-V	7	24	BR-V	–	–	–
	48	48	V-G	47	48	V-G	–	–	–
	44	23	G-V	41	23	G-V	–	–	–
9	49	47	V-O	43	47	V-O	49	42	Y-O
	45	22	O-V	9	22	O-V	45	17	O-Y
	14	46	V-BL	13	46	V-BL	–	–	–
	8	21	BL-V	7	21	BL-V	–	–	–
	48	45	Y-S	47	45	Y-S	–	–	–
	44	20	S-Y	41	20	S-Y	–	–	–
10	49	44	Y-BR	43	44	Y-BR	49	41	Y-BL
	45	19	BR-Y	9	19	BR-Y	45	16	BL-Y
	14	43	Y-G	13	43	Y-G	–	–	–
	8	18	G-Y	7	18	G-Y	–	–	–
	48	42	Y-O	47	42	Y-O	–	–	–
	44	17	O-Y	41	17	O-Y	–	–	–
11	49	41	Y-BL	43	41	Y-BL	49	40	BK-S
	45	16	BL-Y	9	16	BL-Y	45	15	S-BK
	14	40	BK-S	13	40	BK-S	–	–	–
	8	15	S-BK	7	15	S-BK	–	–	–
	48	39	BK-BR	47	39	BK-BR	–	–	–
	44	14	BR-BK	41	14	BR-BK	–	–	–
12	49	38	BK-G	43	38	BK-G	49	39	BK-BR
	45	13	G-BK	9	13	G-BK	45	14	BR-BK
	14	37	BK-O	13	37	BK-O	–	–	–
	8	12	O-BK	7	12	O-BK	–	–	–
	48	36	BK-BL	47	36	BK-BL	–	–	–
	44	11	BL-BK	41	11	BL-BK	–	–	–
13*	49	35	R-S	43	35	R-S	49	38	BK-G
	45	10	S-R	9	10	S-R	45	13	G-BK
	14	34	R-BR	13	34	R-BR	–	–	–
	8	9	BR-R	7	9	BR-R	–	–	–
	48	33	R-G	47	33	R-G	–	–	–
	44	8	G-R	41	8	G-R	–	–	–
14	49	32	R-O	43	32	R-O	49	37	BK-O
	45	7	O-R	9	7	O-R	45	12	O-BK
	14	31	R-BL	13	31	R-BL	–	–	–
	8	6	BL-R	7	6	BL-R	–	–	–
	48	30	W-S	47	30	W-S	–	–	–
	44	5	S-W	41	5	S-W	–	–	–
8 through 14*	42	27	W-O	–	–	–	42	27	W-O
	50	2	O-W	–	–	–	50	2	O-W
	5	26	W-BL	–	–	–	5	26	W-BL
	12	1	BL-W	–	–	–	12	1	BL-W
	37	28	W-G	–	–	-	37	32	R-O
	39	3	G-W	–	–	–	39	7	O-R

Note: There are no connector-P1 or connector-P2 assignments for module positions 8 through 14.
*Module positions 13 and 14 on 24XB Assembly only.

table 6b. Input/output connector assignments for 24X Assembly, module positions 8 through 14

Note: *On the 24X Issue 2 Assembly, the bypass switches are oriented vertically:* OFF *is the "down" position, while* BYPASS *is the "up" position.*

3.08 When 242 System modules are to be installed in a 24X Assembly, the bypass switch for each module position should be set as follows:

- to *OFF* when a 4251 DDB Combiner Amplifier module is placed in that position.
- to BYPASS when a 4252 DDB Splitter Amplifier module is placed in that position.
- to *BYPASS* when a 4255 or 4255S DDB Quad Termination module is placed in that position.
- to *BYPASS* if it is desired to continue a bridge network through an empty module position.
- to *OFF* if it is desired **not** to continue a bridge network through an empty module position.

Note: *When you are expanding bridge networks to vacant module positions in the same or in a different assembly, exceptions to these rules may sometimes be necessary. See paragraphs 2.12 through 2.15 for details.*

3.09 Before inserting the appropriate complement of modules, ensure that each module is properly optioned for its intended application. All options are selected 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.

3.10 After all options are selected and external circuit connections, power, and ground are verified, insert the modules into the 24X Assembly. Modules must be inserted in their proper slots, as determined by cabling assignment. The installer should have specific information regarding which module to insert in which slot. A discussion of the engineering of a bridge network and the assignment of module slots is presented in paragraphs 2.08 through 2.11. Unless expansion of existing bridge networks is required (see paragraphs 3.11 through 3.14), proceed to **alignment**, paragraph 3.15.

expansion of established bridge networks

3.11 If the number of multiple ports of an established 242 Bridge network in a 24X Assembly must be increased and not enough room is available for the required number of 4255/55S modules to the right of that bridge network (either because the last module position in the assembly has been reached or because another bridge network is occupying the module positions to the immediate right of that bridge network), the bridge network can still be expanded in any of three ways, depending upon the total number of multiple ports required. If 48 or fewer multiple ports (i.e., 12 or fewer 4255/55S modules) are required and if vacant module positions are available elsewhere in the same assembly (i.e., separated by one or more other bridge networks from the bridge network to be expanded), the bridge network can often be expanded to the vacant positions without the need for rearrangement of existing modules. Depending upon the arrangement of the existing modules, jumpering between two 6-pin wire-wrapping blocks on the assembly's backplane to extend the bridge network's splitter and combiner busses to the vacant module positions may or may not be required, as described in paragraphs 2.12 through 2.15. If 60 or fewer multiple ports are required and no additional room is available in the assembly, the bridge network can be expanded to a second 24X Assembly via jumpering between a 6-pin block on the first assembly and another 6-pin block on the second assembly. If more than 60 multiple ports (the maximum for one 242 Bridge network) are required, tandem expansion involving additional bridge networks will be necessary. Paragraphs 3.12 through 3.14 contain instructions for expansion via these three methods.

expansion to vacant module positions in the same or in a second assembly

3.12 If an existing 242 Bridge network is to be expanded to vacant module positions in the same assembly, determine whether jumper wiring between six-pin wire-wrapping blocks is required (see paragraphs 2.12 through 2.15). If it is not, simply insert the required 4255/55S modules in the designated empty module positions (reference to figures 8 and 10 may be helpful in this procedure). If jumper wiring between two six-pin blocks on the same assembly is required, or if a 242 Bridge network is to be expanded to a second assembly (in which case jumper wiring is required between a six-pin block on the first assembly and a six-pin block on the second), make the connections between the six-pin blocks as follows (reference to paragraphs 2.13 and 2.14 and to figures 10 and 11 will definitely be helpful in this procedure):

A. Determine the six-pin wire-wrapping block that will be used for jumper connections at the **existing** bridge network. This will normally be the **first** block to the **left** of the 4252 Splitter Amp module of the bridge network to be expanded, as viewed from the **rear** of the assembly.

B. Determine the six-pin wire-wrapping block to be used for jumper connections to the **additional** 4255/55S module(s) that will be located elsewhere in the same assembly or in a second assembly. This is normally done as follows: Leave at least one empty module position to the **right** (as viewed from the **front**) of any existing bridge network (or bridge network extension) adjacent to the vacant module positions to be used. Set that module position's bypass switch to *OFF* to prevent unwanted interconnection of bridge networks. The six-pin block to be used will be the **first** block to the **left** of the empty module position, as viewed from the **rear** of the assembly.

C. Wire the **four lowest pins** of the two blocks together as follows: bottommost pin to bottommost pin, second pin from bottom to second pin from bottom, etc. These four pins are (bottom to top) splitter tip, splitter ring, combiner tip, and combiner ring. The two uppermost pins, which are not used in this procedure, are spares reserved for future system enhancements.

Note: *For jumpering between two assemblies in applications where jumper length will exceed 15 feet, use shielded connecting cable and ground the cable shield at one end only.*

D. Insert the required 4255/55S multiple-port termination modules in the designated module positions (those to the right of the empty position left in step B). Note that these positions can be both to the right and to the left of the position at which the jumper connections are made. Ensure that a 4255/55S module is placed in the position to which the jumper connections have been made, or that bypass switches of empty positions between the connection point and the first module are set to *BYPASS.* No additional common-port modules (4251's or 4252's) are required in the second assembly when a bridge network is expanded 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 network's common-port modules (4251 and 4252) may be installed in the module positions to the immediate right of the last 4255/55S module of the extension (with the 4251 position's bypass switch set to *OFF*).

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 4255/55S module of the first extension must be left empty and that position's bypass switch set to *OFF.*

expansion via tandem arrangements

3.13 If a 242 Bridge network is to be arranged in tandem with one or more additional 242 or 244 Bridge networks to form a large network with more than 48 multiple 2wire ports (or more than 60 multiple 2wire ports if two assemblies are being used), interconnections between bridge networks are made at the distributing or cross-connect frame rather than between six-pin wire-wrapping blocks on the assemblies themselves. (For the sake of simplicity, we are asssuming here that each bridge network is to be installed in its own 24X Assembly and that all assemblies are located on the same premises.) Specifically, these interconnections are made via leads of the assemblies' 25-pair cables rather than via direct jumpering between the 6-pin blocks on the assemblies' backplanes.

3.14 There are many different ways by which to expand a 242 Bridge network through tandem arrangement. Common tandem arrangements are covered in paragraphs 2.15 and 2.16. If you are not already familiar with the engineering of tandem bridge arrangements, contact Tellabs Customer Service at your Tellabs Regional Office or at our U.S. or Canadian headquarters for advice, consultation, and application drawings.

alignment

3.15 Gain in a 242 Bridge network is provided by the 4251 Combiner Amplifier module in the combiner channel and by the 4252 Splitter Amplifier module in the spliltter channel. Each module provides the same amount of gain for all paths in its respective channel. Levels at the multiple ports are set individually via attenuators on the 4255 and/or 4255S Quad Termination modules. Basically, gain provided by the 4251 and 4252 modules coordinates bridge-network bus levels with common-port facility levels, and loss provided by the 4255/55S modules coordinates bridge-network bus levels with multiple-port facility levels. This is explained more thoroughly in paragraphs 3.16 through 3.19, which contain step-by-step instructions for aligning a 242 Bridge network by two different methods: a "basic" method and a method for establishing predetermined bus levels. Specific information on adjusting level and equalization controls on the individual 242-System modules is provided in the separate Tellabs practices on these modules.

Note 1: *The alignment procedures that follow are based upon the following assumptions: (1) alignment is being performed locally, (2) all pre-alignment optioning (e.g., impedance matching) is completed, and (3) equalization at the 4wire common port is either completed as described in the 4251 and 4252 module practices or else is not required.*

Note 2: *Either channel of a 242 Bridge network may be aligned first —* **as long as the 4255/55S-module attenuator settings established during alignment of the first channel are not changed during alignment of the other channel.** *In the alignment procedures that follow, the splitter channel will be aligned first and the combiner channel second.*

Important Note: *In any 242 Bridge network, the algebraic sum of the splitter and combiner bus levels must equal the algebraic sum of the remote-station transmit and receive levels. Please note that transmit and receive levels do not have to be the same for every remote station on a circuit (although they normally are); it is the* **algebraic sum** *of the transmit and receive levels that must be the same for every remote station. For example, in figure 18 later in this practice, the splitter and combiner bus levels are −4dBm and −8.5dBm, respectively. The algebraic sum of these levels, i.e., −4 added to −8.5, is −12.5dBm. The remote-station input and output levels are −12.5dBm and 0dBm, respectively. The algebraic sum of these levels, i.e., −12.5 added to 0, is −12.5dBm, the same as the algebraic sum of the bus levels. (Incidentally, this "rule" also holds true for the facility-side 2wire ports of each 4255/55S.)*

basic alignment procedure

3.16 In the basic alignment procedure (when aligning the splitter channel first), the multiple port with the lowest input level from the remote station (i.e., with the greatest amount of facility loss) is determined, and the 4255/55S-module attenuator for this worst-case multiple port is set for zero loss.

Next, the splitter amplifier (4252 module) is adjusted to provide the proper output level toward the station at the worst-case multiple port. All other 4255/55S-module multiple-port attenuators are then adjusted to provide the various output levels required at the remaining multiple ports. Because the 4255/55S modules' attenuators provide the same amount of loss in both directions of data transmission, the various multiple-port input levels will all be attenuated to the same level: that of the worst-case multiple port. Thus, the worst-case multiple-port input level automatically becomes the combiner bus level. Finally, the combiner amplifier (4251 module) is adjusted to provide the proper level at the common-facility output port.

Note: *A slight variation of the basic alignment method can be advantageous in applications where future bridge-network expansion is anticipated. In this variation, the bridge network is aligned to accommodate the greatest* **anticipated** *(rather than actual) multiple-port facility loss. This eliminates the need for bridge-network realignment if a multiple port with an input level lower than that of any existing multiple port is added. To better understand this alignment variation, read steps A through F of the splitter-channel alignment procedure; then read the note following step F.*

3.17 To align a 242 Bridge network by this basic method, proceed as directed below. Reference the bold circled numbers in the procedure to their counterparts in the basic-method procedural diagram, figure 17. Figure 18 shows a 242 Bridge network aligned via this method. **Please be aware that levels indicated in figure 18 are data levels and are strictly hypothetical; those in your bridge network(s) will probably be different.**

Note 1: *On 4255 modules built before February, 1983, the four front-panel attenuator controls are labeled* **line A** *through* **line D**. *On 4255 modules built after February, 1983, and on all 4255S modules, these controls are relabeled* **att A** *through* **att D** *to more accurately reflect their functions.*

Note 2: *On 4255 modules built before February, 1983, the four front-panel facility-side opening jacks are labeled* **line A** *through* **line D** *and the four front-panel facility-side monitoring jacks are labeled* **mon A** *through* **mon D**. *On 4255 modules built after February, 1983, and on all 4255S modules, the opening jacks are relabeled* **fac A** *through* **fac D** *and the monitoring jacks are relabeled* **fac mon A** *through* **fac mon D**. *(The labeling of the four bridge-side opening jacks on all 4255 and 4255S modules remains unchanged:* **brdg A** *through* **brdg D**.*) The changes in jack nomenclature on these modules provide consistency with jack nomenclature on other 242-System modules and also on 244-System modules (with which 242-System modules are sometimes used in tandem).*

Note 3: *It is assumed in the following procedure that the transmit and receive sections of the transmission measuring set (TMS) being used can be independently optioned for impedance.*

Note 4: *If a 4251 or 4252 module is optioned for 150-ohm impedance and the TMS being used has a 135-ohm termination setting instead of 150 ohms, use the 135-ohm setting; the slight impedance mismatch will not affect level measurements appreciably. This is not true, however, when a module is optioned for 1200 ohms and the TMS for 900 or 900 ohms.* **To avoid setting levels erroneously in such cases, please be certain to observe the following:** *In applications where a module must be optioned for 1200 ohms to achieve a proper impedance match and the TMS has no 1200-ohm termination setting, option both the module and the TMS for 600 ohms during alignment. Then adjust levels as necessary, keeping in mind that actual levels will be* **3dB higher** *than those indicated on the TMS when the module is reoptioned for 1200 ohms after alignment.*

Important Note: *If the 4251 and 4252 modules in your 242 Bridge network are to be equipped with 9952X Band-Splitting Filter subassemblies, Tellabs recommends that the bridge network be aligned with the subassemblies in place on the modules and optioned into the circuit (i.e., not bypassed). This necessitates the selection of appropriate alignment frequencies (within the bandwidths of the filters) for the splitter and combiner channels, as designated in table 7. If adjustment of the equalizers on the 4251 and 4252 is necessary and has not yet been performed, do not option the filter subassemblies into the circuit and begin bridge-network alignment until equalization adjustments are completed as directed in the 4251 and 4252 practices.*

Tellabs 9952X subassembly	filter type		cutoff frequency (3dB down)	recommended alignment frequency for channel in which 9952X subassembly is used
	high pass	low pass		
9952A		X	400Hz	300Hz
9952B		X	1300Hz	500Hz
9952C		X	1370Hz	500Hz
9952D	X		1650Hz	2500Hz
9952E	X		1925Hz	2500Hz
9952G	X		1300Hz	2500Hz
9952H		X	1460Hz	500Hz
9952J	X		1810Hz	2500Hz

table 7. Recommended alignment frequencies for 242 Bridge networks in which 9952X Filter subassemblies are used on 4251 and 4252 modules

splitter channel:

A. Adjust all front-panel multiple-port *att* controls on all 4255/55S modules 1 fully **counter-clockwise** for maximum attenuation, including those *att* controls associated with unused multiple ports.

B. Arrange the transmit portion of a transmission measuring set (TMS) for tone output at 1000Hz if a 9952X Filter subassembly is not being used on the 4252, or at the appropriate frequency

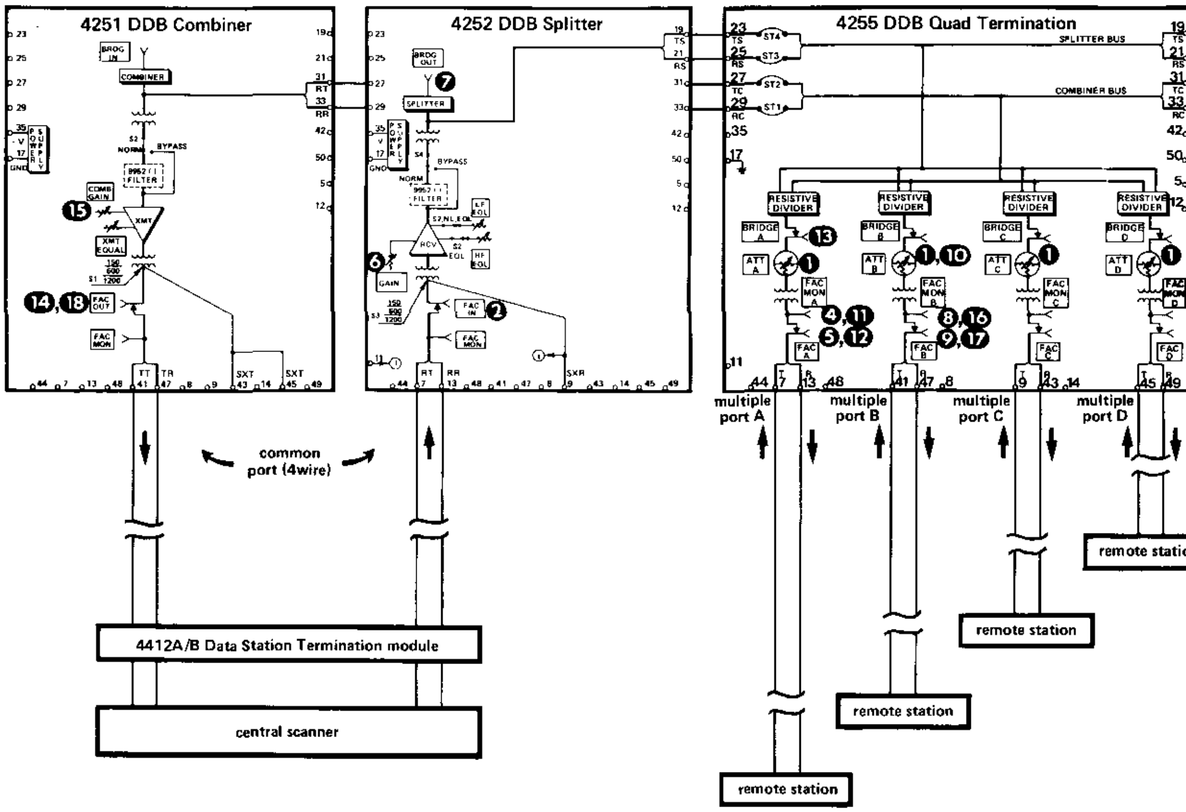


figure 17. 242 Bridge alignment procedure diagram for basic method (see paragraphs 3.16 and 3.17)

Caution: *Levels in this diagram are hypothetical and for purposes of illustration only. Levels required in your 242 Bridge(s) may be different. Therefore, align your bridge(s) as directed in the text rather than in accordance with this diagram.*

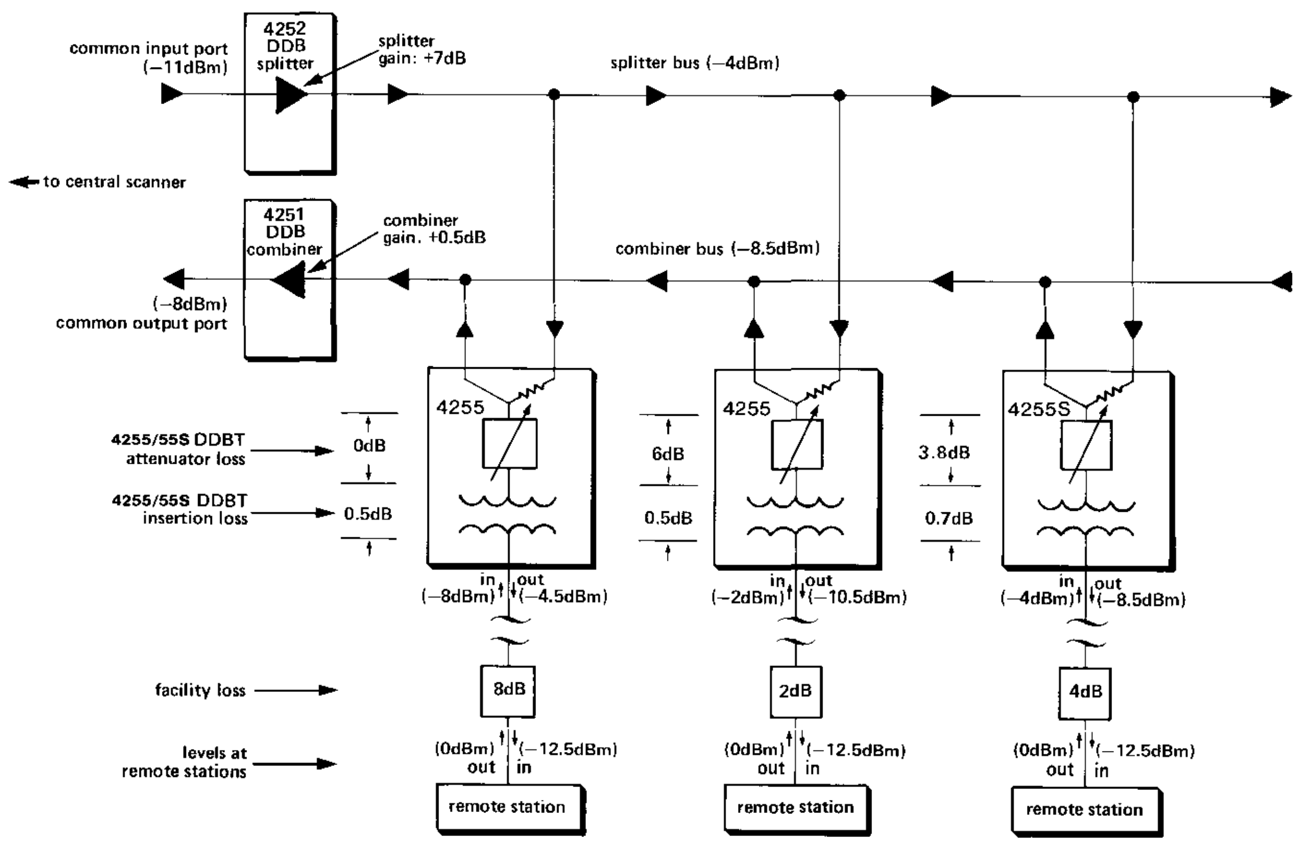


figure 18. Hypothetical 242 Bridge network aligned by basic method (see paragraphs 3.16 and 3.17)

from table 7 if a 9952X is being used on the 4252. Set the TMS output level to equal the common-port input level specified on the circuit layout record (CLR). If the transmit portion of the TMS has a separate impedance setting, select the impedance for which the 4252's common (facility-side) port is optioned. Connect the TMS-transmit signal to the 4252's *facility in* jack ❷ .

C. Determine the worst-case multiple port, i.e., the multiple port with the lowest input level (due to the greatest amount of facility loss). In this procedure, we'll assume that this worst-case multiple port is port A ❸ . Adjust its 4255/55S *att* control fully **clockwise** for **minimum** (zero) attenuation.

D. Arrange the receive portion of the TMS for 600-ohm terminated measurement, and connect it to the 4255/55S facility-monitor jack associated with the worst-case multiple port. In this procedure, this is the *fac mon A* jack ❹ .

E. Insert an opening plug into the 4255/55S facility jack associated with the worst-case multiple port. In this procedure, this is the *fac A* jack ❺ .

F. Adjust the 4252's *gain* control ❻ until the TMS reading at the 4255/55S facility-monitor jack equals the CLR-specified output level toward the station for that particular multiple port. Please note that the 4255/55S attenuator for this worst-case multiple port was not adjusted from its minimum (zero) attenuation setting in this step, nor will it be adjusted during the remainder of this procedure.

Note: *As an alternative to aligning for the greatest* **actual** *multiple-port facility loss in applications where future expansion of the bridge network is expected, determine the greatest* **anticipated** *multiple-port facility loss and assume that, for this hypothetical worst-case multiple port, an associated 4255/55S attenuator is set for zero loss. Then set the splitter bus level to provide what would be the proper output level at this hypothetical multiple port, and set all 4255/55S multiple-port attenuators in the existing bridge network to establish appropriate (CLR-specified) output levels at all actual multiple ports. This alignment method is advantageous in that it prevents the need for bridge-network realignment if a multiple port with greater facility loss than any existing multiple port is added after a bridge network is already installed and aligned.*

G. Connect the receive portion of the TMS, still arranged for 600-ohm terminated measurement, to the *bridge out* jack on the 4252 ❼ . Record the level measured here; this is the splitter bus level, which must be known when and if expansion of the bridge network takes place.

H. Connect the receive portion of the TMS, still arranged for 600-ohm terminated measurement, to the 4255/55S facility-monitor jack of any of the remaining multiple ports. In this procedure, we'll choose port B and, therefore, the *fac mon B* jack ❽ .

I. Remove the opening plug from the 4255/55S facility jack of the previous multiple port (port A) and insert it into the 4255/55S facility jack of the multiple port selected in step H. In this procedure, this is the *fac B* jack ❾ .

J. Adjust the 4255/55S *att* control for the multiple port selected in step H until the output level toward the station equals that specified on the CLR. In this procedure, this is the *att B* control ❿.

K. Repeat steps H through J for all other 4255/55S multiple ports that are being used at this time. If any multiple ports are to remain unused, i.e., unterminated, ensure that their attenuators are adjusted fully **counterclockwise** for maximum attenuation. This completes alignment of the splitter path. Remove all plugs and test cords.

combiner channel:

L. Arrange the transmit portion of the TMS for tone output at 1000Hz if a 9952X Filter subassembly is not being used on the 4251, or at the appropriate frequency from table 7 if a 9952X is being used on the 4251. Set the TMS output level to equal the lowest multiple-port input level (this should be specified on the CLR). If the transmit portion of the TMS has a separate impedance setting, select 600 ohms. Connect the TMS-transmit signal to the 4255/55S facility-monitor jack of the multiple port with the lowest input level. In this procedure, this is port A and, therefore, the *fac mon A* jack ⓫ .

M. Insert an opening plug into the 4255/55S facility jack associated with the worst-case multiple port. In this procedure, this is the *fac A* jack ⓬ .

N. Arrange the receive portion of the TMS for 600-ohm terminated measurement, and connect it to the 4255/55S bridge jack associated with the worst-case multiple port. In this procedure, this is the *brdg A* jack ⓭ . Record the level measured here; this is the combiner bus level, which must be known if and when expansion of the bridge network takes place.

O. Disconnect the receive portion of the TMS from the 4255/55S *brdg A* jack, set its impedance to equal that selected for the 4251 module's common port, and connect it to the 4251's *facility out* jack ⓮.

P. Adjust the 4251's *gain* control ⓯ until the CLR-specified common-port output level is achieved.

Q. Disconnect the TMS-transmit signal from the 4255/55S facility-monitor jack of the mulitple port with the lowest input level (in this procedure, the *fac mon A* jack). Also remove the opening plug from that port's 4255/55S facility jack (in this procedure, the *fac A* jack). Select another 4255/55S multiple port for testing (any other in-service multiple port will do). Arrange the transmit portion of the TMS to output tone at the appropriate frequency (see step B) and at the CLR-specified input level for the selected multiple port. If the transmit portion of the TMS has a separate impedance setting, select 600 ohms. Connect the TMS-transmit signal to the selected multiple port's 4255/55S facility-monitor jack, and insert an opening plug into that multiple port's 4255/55S facility jack. In this procedure, we'll select port B, so connect the signal to the *fac mon B* jack **16** and insert the opening plug into the *fac B* jack **17**.

R. Leave the receive portion of the TMS connected to the 4251's *facility out* jack **18** as described in step O. Verify that the measured output level is essentially unchanged from (i.e., within ±0.2dB of) that which was set in step P.

S. Repeat steps Q and R for all other 4255/55S multiple ports that are being used at this time. This completes alignment of the combiner path and, therefore, of the entire 242 Bridge network via the basic method. Remove all plugs and test cords. If any impedance-switch settings on the 4251 and 4252 modules were changed prior to alignment for compatibility with test-equipment impedances, reset the 4251 and 4252 impedance switches to their proper settings.

alignment procedure to establish predetermined bus levels

3.18 When aligning to establish predetermined bus levels (splitter channel first), the splitter bus level is set as specified by means of the splitter amplifier (4252 module). The output level of each multiple port is then adjusted via its 4255/55S-module attenuator to provide the proper output level toward each station. Because the 4255/55S-module attenuators provide the same amount of loss in both directions of data transmission, the various multiple-port input levels will all be attenuated to the same level. This level automatically becomes the proper combiner bus level. Finally, the combiner amplifier on the 4251 is adjusted to provide the proper common-port output level.

3.19 To align a 242 Bridge network for predetermined bus levels, proceed as directed below. Reference the bold circled numbers in the procedure to their counterparts in the procedural diagram for predetermined-bus-level alignment, figure 19. Figure 20 shows a 242 Bridge network aligned via this method to establish 0 and −16dBm data levels on the splitter bus and combiner bus, respectively. Figure 21, included for reference, shows a related alignment scheme where coordinated levels at the 2wire ports are established by level-control devices at the station end of each 2wire leg. **Once again, please be aware that levels indicated in these figures are data levels and are strictly hypothetical; those in your bridge network(s) will probably be different.**

Note 1: *On 4255 modules built before February, 1983, the four front-panel attenuator controls are labeled* **line A** *through* **line D**. *On 4255 modules built after February, 1983, and on all 4255S modules, these controls are relabeled* **att A** *through* **att D** *to more accurately reflect their functions.*

Note 2: *On 4255 modules built before February, 1983, the four front-panel facility-side opening jacks are labeled* **line A** *through* **line D** *and the four front-panel facility-side monitoring jacks are labeled* **mon A** *through* **mon D**. *On 4255 modules built after February, 1983, and on all 4255S modules, the opening jacks are relabeled* **fac A** *through* **fac D** *and the monitoring jacks are relabeled* **fac mon A** *through fac mon D. (The labeling of the four bridge-side opening jacks on all 4255 and 4255S modules remains unchanged:* **brdg A** *through* **brdg D**.*) The changes in jack nomenclature on these modules provide consistency with jack nomenclature on other 242-System modules and also on 244-System modules (with which 242-System modules are sometimes used in tandem).*

Note 3: *It is assumed in the following procedure that the transmit and receive sections of the transmission measuring set (TMS) being used can be independently optioned for impedance.*

Note 4: *If a 4251 or 4252 module is optioned for 150-ohm impedance and the TMS being used has a 135-ohm termination setting instead of 150 ohms, use the 135-ohm setting; the slight impedance mismatch will not affect level measurements appreciably. This is not true, however, when a module is optioned for 1200 ohms and the TMS for 900 or 600 ohms.* **To avoid setting levels erroneously in such cases, please be certain to observe the following:** *In applications where a module must be optioned for 1200 ohms to achieve a proper impedance match and the TMS has no 1200-ohm termination setting, option both the module and the TMS for 600 ohms during alignment. Then adjust levels as necessary, keeping in mind that actual levels will be* **3dB higher** *than those indicated on the TMS when the module is reoptioned for 1200 ohms after alignment.*

Important Note: *If the 4251 and 4252 modules in your 242 Bridge network are to be equipped with 9952X Band-Splitting Filter subassemblies, Tellabs recommends that the bridge network be aligned with the subassemblies in place on the modules and optioned into the circuit (i.e., not bypassed). This necessitates the selection of appropriate alignment frequencies (within the bandwidths of the filters) for the splitter and combiner channels, as designated in table 7 earlier in this practice. If adjustment of the equalizers on the 4251 and 4252 is necessary and has not yet been performed, do not option the filter subassemblies into the circuit and begin bridge-system alignment until equalization adjustments are completed as directed in the 4251 and 4252 practices.*

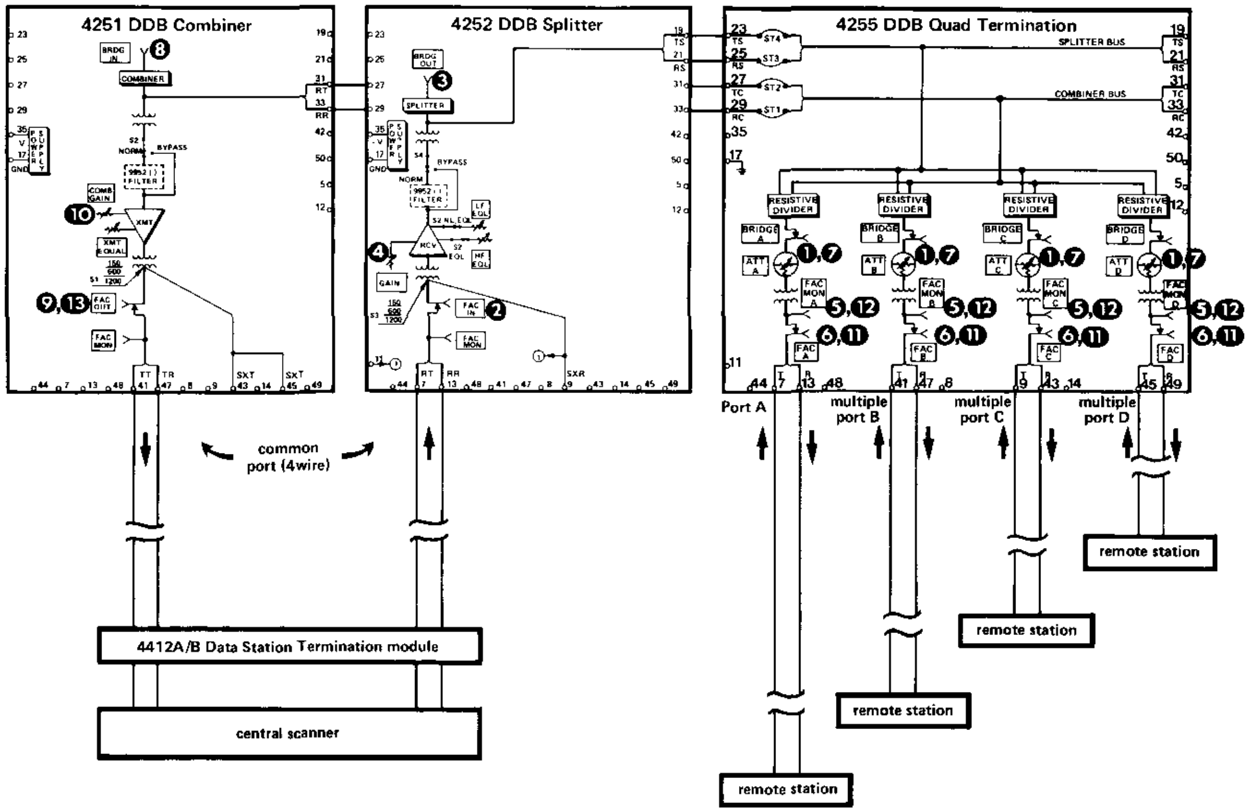


figure 19. 242 Bridge alignment procedure diagram for establishing predetermined bus levels (see paragraphs 3.18 and 3.19)

Caution: *Levels in this diagram are hypothetical and for purposes of illustration only. Levels required in your 242 Bridge(s) may be different. Therefore, align your bridge(s) as directed in the text rather than in accordance with this diagram.*

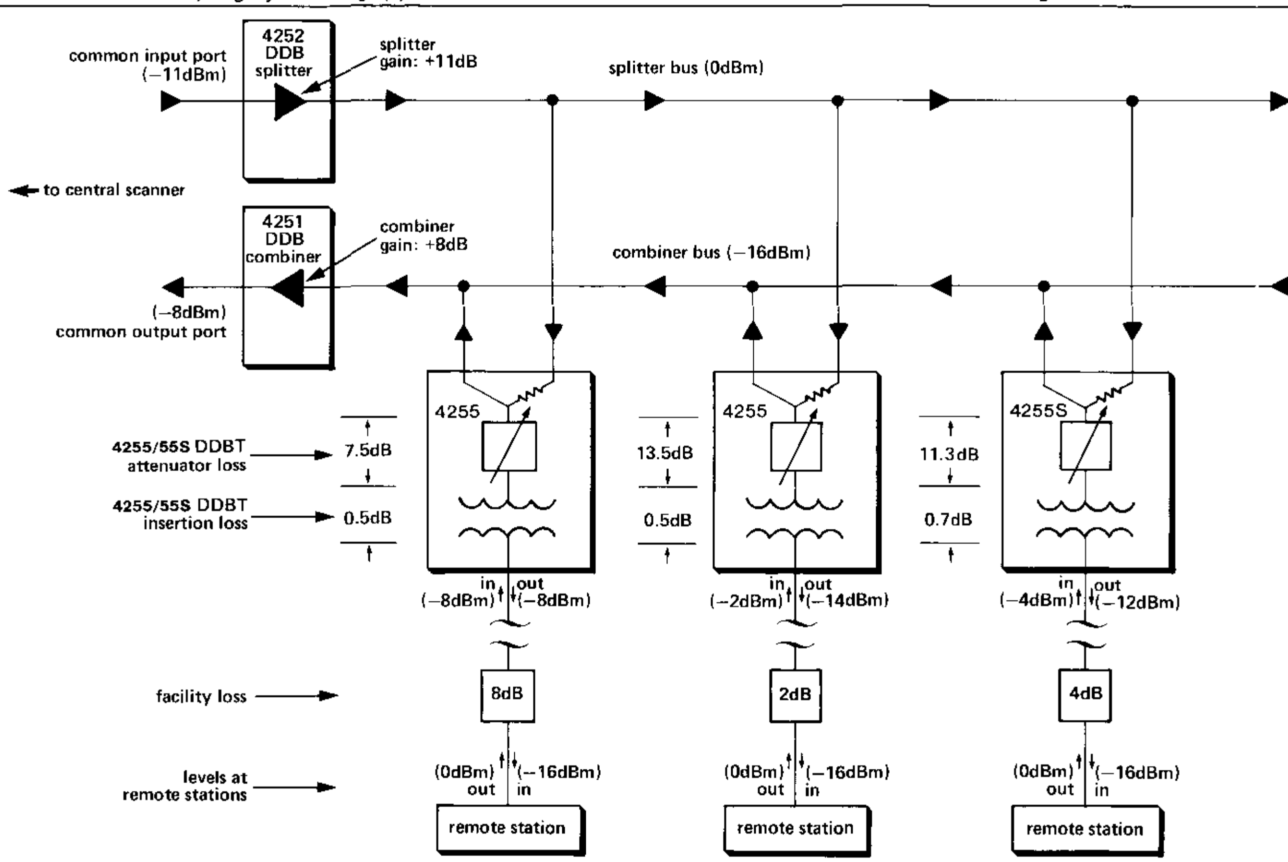


figure 20. Hypothetical 242 Bridge network aligned to establish 0 and −16dBm data levels on splitter and combiner busses, respectively (see paragraphs 3.18 and 3.19)

Caution: *Levels in this diagram are hypothetical and for purposes of illustration only. Levels required in your 242 Bridge(s) may be different. Therefore, align your bridge(s) as directed in the text rather than in accordance with this diagram.*

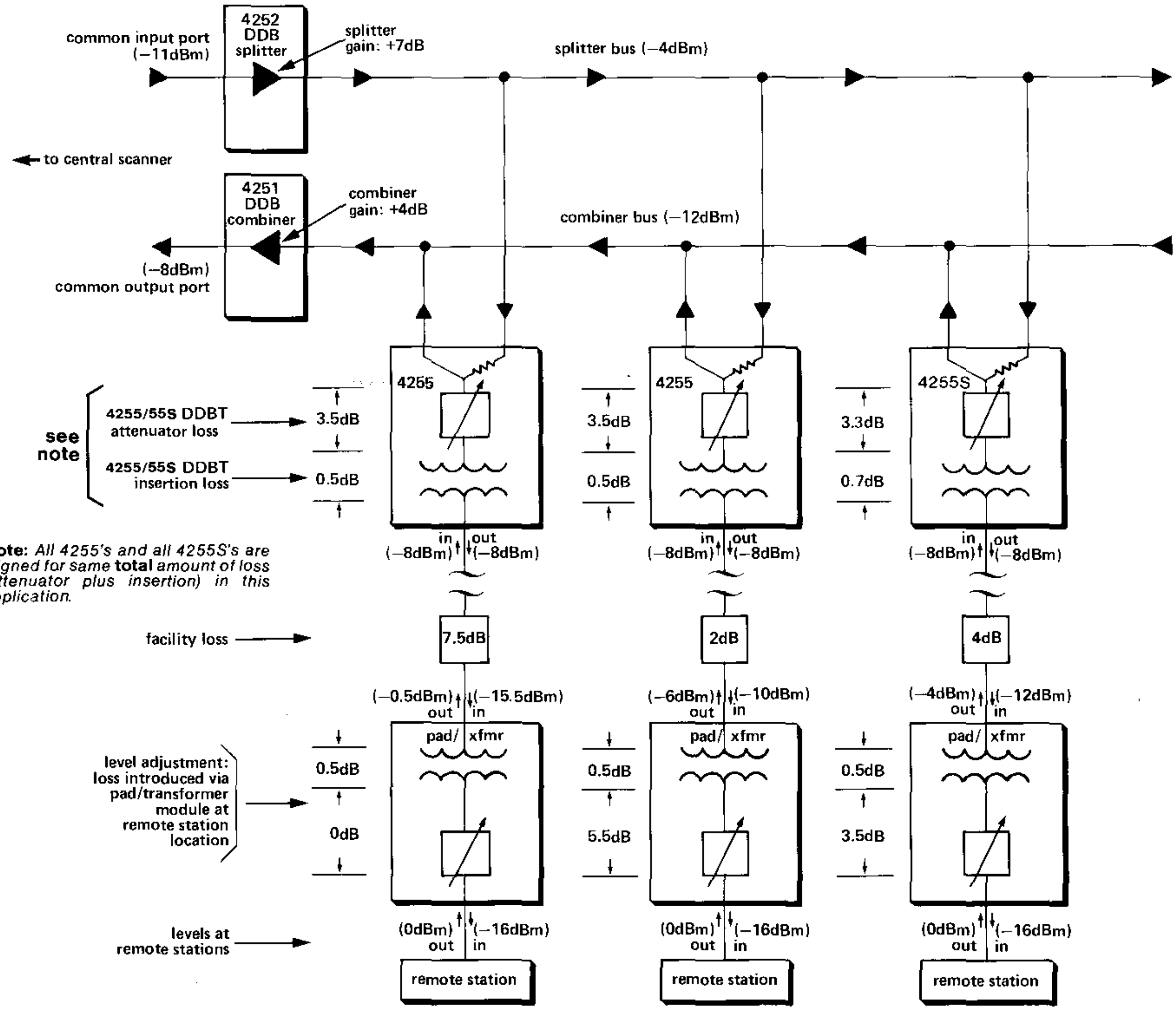


figure 21. Hypothetical 242 Bridge network where coordination levels at 2wire ports are established by level-control devices at station end of each 2wire facility

splitter channel:

A. If any multiple ports in the bridge network are to remain unused, adjust their 4255/55S front-panel *att* controls ❶ fully **counterclockwise** for maximum attenuation. In this procedure, the initial settings of the remainder of the 4255/55S *att* controls are immaterial. (Please note that the number ❶ in this step merely points out the 4255/55S attenuator controls; it does not indicate which multiple ports, if any, are unused.)

B. Arrange the transmit portion of a transmission measuring set (TMS) for tone output at 1000Hz if a 9952X Filter subassembly is not being used on the 4252, or at the appropriate frequency from table 7 if a 9952X is being used on the 4252. Set the TMS output level for the common-port input level specified on the circuit layout record (CLR). If the transmit portion of the TMS has a separate impedance setting, select the impedance for which the 4252's common-port facility interface is optioned. Connect the TMS-transmit signal to the 4252's *facility in* jack ❷.

C. Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the 4252's *bridge out* jack ❸.

D. Adjust the 4252's *gain* control ❹ until the CLR-specified splitter bus level is achieved.

E. Connect the receive portion of the TMS, still arranged for 600-ohm terminated measurement, to the 4255/55S facility-monitor *(fac mon)* jack ❺ of any active multiple port.

F. Insert an opening plug into that multiple port's 4255/55S facility *(fac)* jack ❻.

G. Adjust that multiple port's 4255/55S *att* control ❼ for the CLR-specified output level.

H. Repeat steps E through G for all remaining multiple ports that are being used at this time. This completes alignment of the splitter channel. Remove all plugs and test cords.

combiner channel:

I. Arrange the transmit portion of the TMS for tone output at 1000Hz if a 9952X Filter subassembly is not being used on the 4251, or for the appropriate frequency from table 7 if a 9952X is being used on the 4251. Set the TMS output level to equal the CLR-specified combiner bus level. If the transmit portion of the TMS has a separate impedance setting, select 600 ohms. Connect the transmit portion of the TMS to the 4251 module's *bridge in* jack 8.

J. Set the impedance of the receive portion of the TMS to equal that selected for the 4251's common port, and connect it to the 4251's *facility out* jack 9.

K. Adjust the 4251's *gain* control 10 until the CLR-specified output level is achieved.

L. Disconnect the TMS-transmit signal from the 4251's *bridge in* jack. Select a 4255/55S multiple port for testing (any in-service multiple port will do). Insert an opening plug into that port's 4255/55S facility *(fac)* jack 11. Arrange the transmit portion of the TMS to output tone at the appropriate frequency (see step I) and at the CLR-specified input level for the selected multiple port. If the transmit portion of the TMS has a separate impedance setting, select 600 ohms. Connect the TMS-transmit signal to the selected multiple port's 4255/55S facility-monitor *(fac mon)* jack 12.

M. Leave the receive portion of the TMS connected to the 4251's *facility out* jack 13 as described in step J. Verify that the measured output level is essentially unchanged from (i.e., within ±0.2dB of) that which was set in step K.

N. Repeat steps L and M for all other 4255/55S multiple ports that are being used at this time. This completes alignment of the combiner path and, therefore, of the entire 242 Bridge network via the method for establishing predetermined bus levels. Remove all plugs and test cords. If any impedance-switch settings on the 4251 and 4252 modules were changed prior to alignment for compatibility with test-equipment impedances, reset the 4251 and 4252 impedance switches to their proper settings.

4. system wiring diagram

4.01 For ease of use, the 242 Distributive Data Bridge System wiring diagram is presented as a foldout on the last three pages of this practice.

5. specifications

Note: *For specifications of the 4251, 4252, 4255, and 4255S modules used in the 242 System, see the respective practices on these modules.*

common system specifications

insertion loss, either direction
0.5dB nominal through 4255
0.7dB nominal through 4255S

input voltage
−22 to −56Vdc, filtered, ground referenced unless one or more 4255S sealing-current sources are to be used, in which case filtered, ground-referenced −42 to −56Vdc input is required

input current
dependent upon number of 4251, 4252, and 4255S modules in 24X Assembly. Each 4251 requires 20mA at idle and 30mA maximum. Each 4252 requires 20mA idle and 40mA maximum. Each sealing-current source on a 4255S draws 22mA when activated, for a maximum per 4255S of 88mA. (The 4255 module is passive; thus, it draws no current.)

combiner channel (multiple ports to common port)

combiner-channel level variation (from minimum to maximum number of multiple ports in one 24X Assembly)
1dB maximum variation (at same combiner-channel level setting), 4 to 48 multiple ports

delay distortion
less than 200μs, 400 to 3000Hz (without filters)
less than 1500μs, within pass band of filters

frequency response
±2.0dB re 1kHz level, within pass band of filters

splitter channel (common port to multiple ports)

splitter-channel level variation (from minimum to maximum number of multiple ports in one 24X Assembly)
2dB maximum variation (at same splitter-channel level setting), 4 to 48 multiple ports

delay distortion
less than 200μs, 400 to 3000Hz (without filters)
less than 1500μs, within pass band of filters

frequency response
±2.0dB re 1kHz level, within pass band of filters

physical

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

dimensions
height: 5.92 inches (15.04cm)
depth: 7.31 inches (18.57cm)
width (less mounting ears):
24XA, 17.50 inches (44.45cm)
24XB, 20.40 inches (51.82cm)

weight (without modules)
24XA: 5.5 pounds (2.5kg)
24XB: 6 pounds (2.7kg)

mounting
24XA (12 module positions): mounts in 19-inch relay rack, occupies 6 inches of vertical rack space
24XB (14 module positions): mounts in 23-inch relay rack, occupies 6 inches of vertical rack space

6. testing and troubleshooting

6.01 The *troubleshooting checklist* in this section may be used to assist in the installation, testing, or troubleshooting of the 242 Distributive Data Bridge System. The checklist identifies the most common types of general trouble conditions, with suggestions as to the probable causes. For specific signaling or transmission difficulties, consult the appropriate individual module practices. A detailed testing guide checklist and a functional block diagram for each 242-System module are included in these practices. If a module, a subassembly thereon, or a 24X Mounting Assembly is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on any Tellabs 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 Fules and Regulations.

Note: *Warranty service does not include removal of permanent customer markings on the front of Tellabs 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.*

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

USA customers: Contact Tellabs Customer Service at your Tellabs Regional Office.

Canadian customers: Contact Tellabs Customer Service at our Canadian headquarters in Mississauga, Ontario.

International customers: Contact your Tellabs distributor.

US central region: (312) 969-8800
US northeast region: (412) 787-7860
US southeast region: (305) 645-5888
US western region: (702) 827-3400
Canada: (416) 624-0052

6.03 If a 242-System module or subassembly or a 24X Assembly is diagnosed as defective, follow the *replacement* procedure in paragraph 6.04 when a critical service outage exists (e.g., when a system or a critical circuit is down and no spares are available). If the situation is not critical, follow the *repair and return* procedure in paragraph 6.05.

replacement

6.04 To obtain a replacement 242-System module, subassembly, or mounting assembly, notify Tellabs via letter or telephone (see addresses and numbers below), or via TWX (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X425X(X), 8X9952X, or 8X24X part number that indicates the issue of the item in question. Upon notification, we shall ship a replacement to you. If the item in question is in warranty, the replacement will be shipped at no charge. Pack the defective item in the replacement's carton, sign the packing slip included with the replacement, and enclose it with the defective item (this is your return authorization). Affix the preaddressed label provided with the replacement to the carton being returned, and ship the item prepaid to Tellabs.

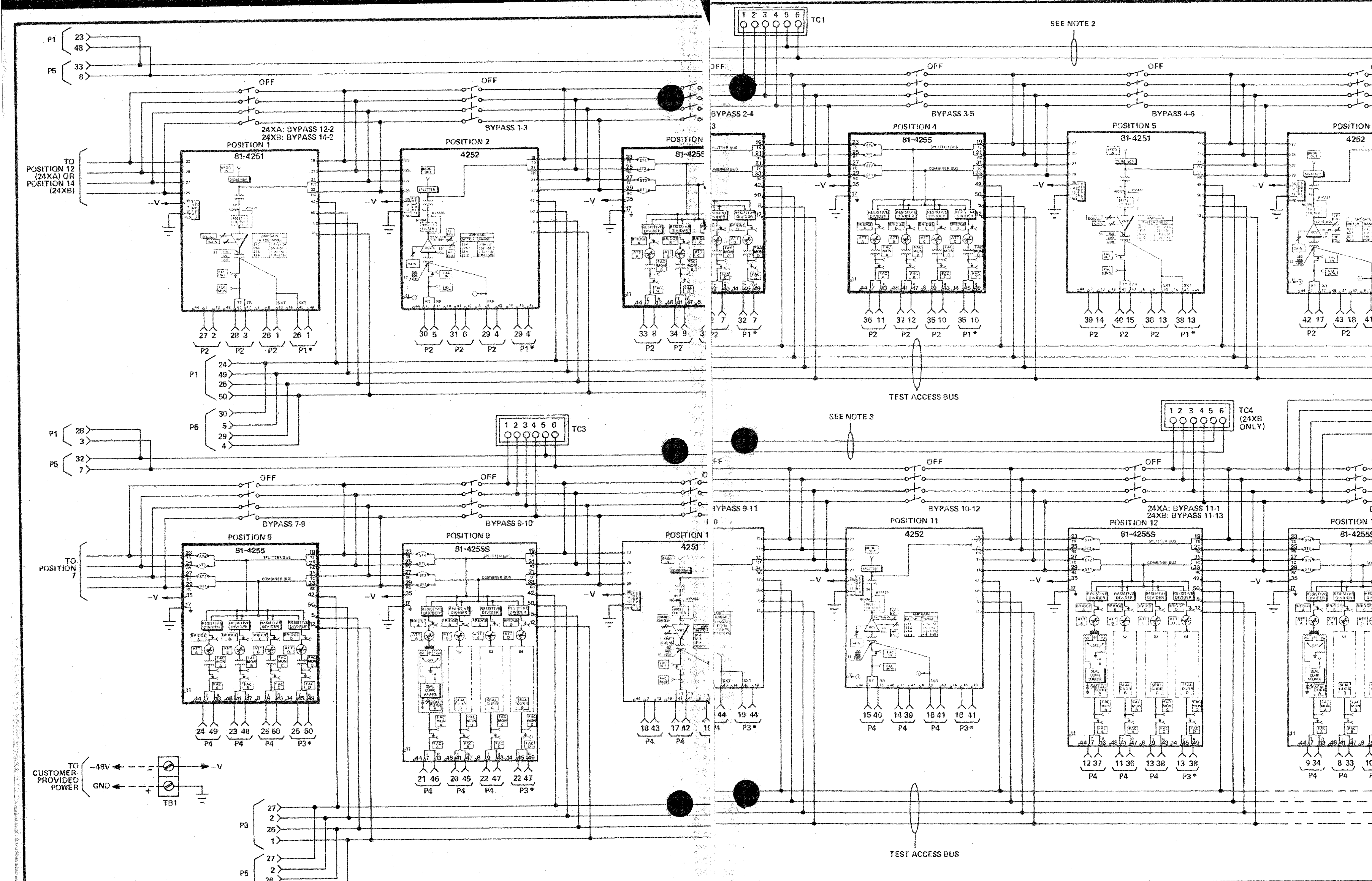
repair and return

6.05 Return the defective 242-System module, subassembly, or mounting assembly, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
telephone (312) 969-8800

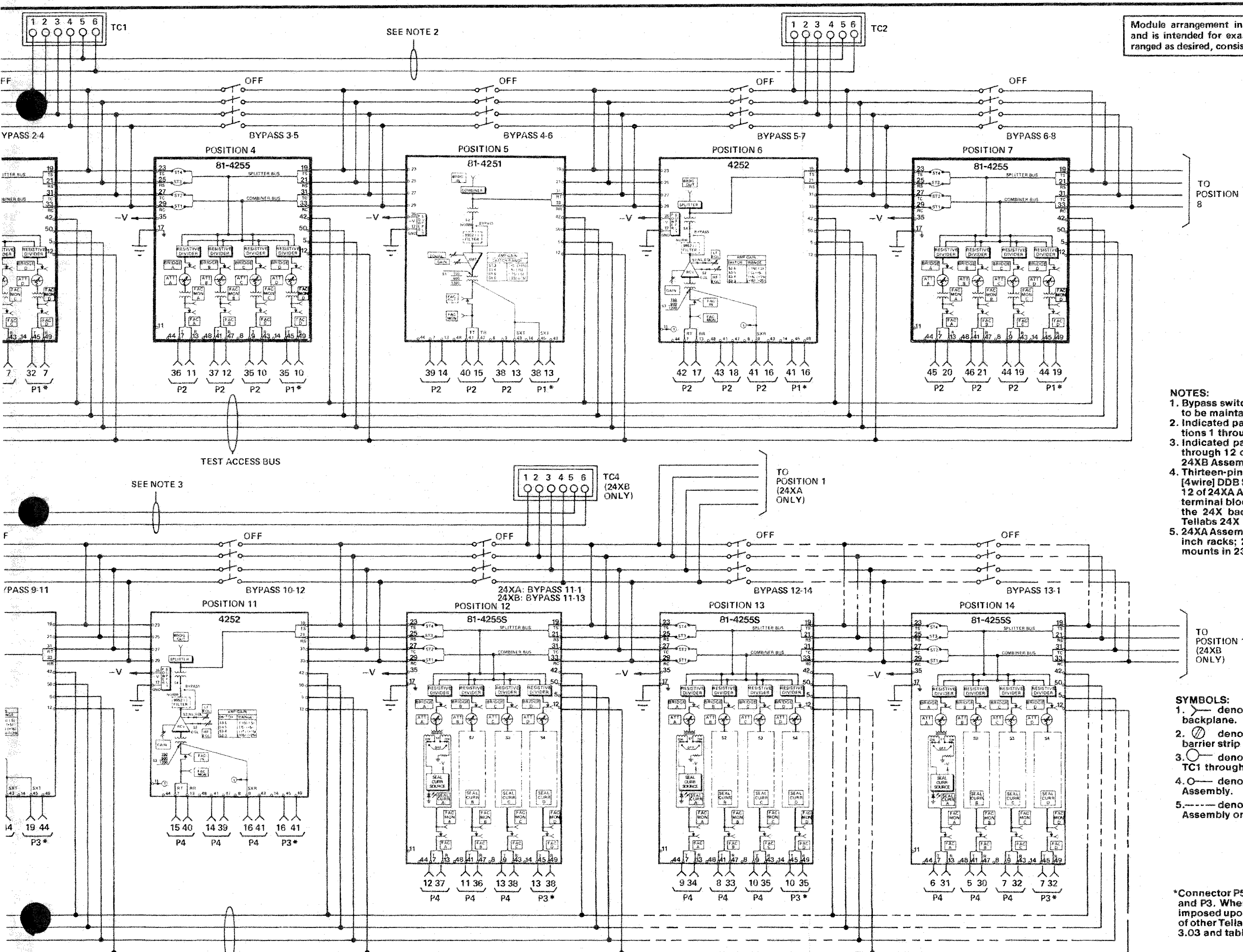
in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7
telephone (416) 624-0052

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



4. system wiring diagram

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.



NOTES:
1. Bypass switches on 24X backplane allow circuit continuity to be maintained through vacant module positions.
2. Indicated pair connects to pins 37 and 39 of module positions 1 through 7 for future applications.
3. Indicated pair connects to pins 37 and 39 of positions 8 through 12 of 24XA Assembly or positions 8 through 14 of 24XB Assembly for future applications.
4. Thirteen-pin local-test-access block TL1 (used with 244 [4wire] DDB System only) is located behind module position 12 of 24XA Assembly or position 14 of 24XB Assembly. This terminal block is not shown in this diagram but is shown in the 24X backplane schematic included in the separate Tellabs 24X Mounting Assembly Practice (section 8X24X).
5. 24XA Assembly has 12 module positions and mounts in 19-inch racks; 24XB Assembly has 14 module positions and mounts in 23-inch racks.

SYMBOLS:
1. ≻— denotes female cable connector on 24X Assembly backplane.
2. ⊘ denotes screw terminal on two-position power barrier strip on 24X backplane.
3. ◯— denotes wire-wrapping terminal of six-pin blocks TC1 through TC4 on 24X backplane.
4. ○— denotes pin of 56-pin module connectors in 24X Assembly.
5. ----- denotes wiring that appears on 24XB (14-position) Assembly only.

*Connector P5 can be used as an alternative to connectors P1 and P3. When this is done, however, certain limitations are imposed upon future tandem bridging arrangements and use of other Tellabs systems in the 24X Assembly. See paragraph 3.03 and tables 1 and 5 for details.

troubleshooting checklist

trouble condition	possible cause (in order of likelihood)
system inoperative (transmission not occurring)	1) ☐ Power connection faulty. Verify power output (−22 to −56Vdc or, if bridge network contains 4255S module[s], −42 to −56Vdc) by measuring voltage between negative (−) and positive (+) terminals on connector at rear of 24X Assembly (see paragraph 3.05). 2) ☐ Assembly bypass switches incorrectly set. 3) ☐ External wiring incorrect.
excessive noise in transmission path	1) ☐ Improper grounding, especially existence of ground loops. 2) ☐ Amplifier levels in 4251 and/or 4252 misaligned. 3) ☐ Unbalanced facility terminations. 4) ☐ Defective 4251 or 4252 Amplifier. Substitute new module and retest.
inability to derive proper transmission levels	1) ☐ Signal levels exceeding overload limits of 4251 and/or 4252. 2) ☐ Defective 4251 or 4252 Amplifier. Substitute new module(s) and retest.
trouble at multiple port or port group served by one 4255 or 4255S module	1) ☐ Faulty 4255 or 4255S module. See 4255/4255S practice for troubleshooting instructions.

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