

# 4458 DTMF Control Module

## contents

section 1 description and application	page 1
section 2 installation and use	page 2
section 3 circuit description	page 6
section 4 block diagram	page 7
section 5 specifications	page 6
section 6 testing and troubleshooting	page 7

## 1. description and application

1.01 The 4458 DTMF Control Module (figure 1) is designed specifically for remote testing of the Tellabs 244 Distributive Data Bridge (DDB) System and associated 4wire transmission facilities when the 244 System is installed in the Issue 2 Tellabs 24X or 24X L1 Mounting Assembly. Testing is initiated by transmitting a sequence of three DTMF tones to either the common (master) port of the bridge or to the input of the mounting assembly's integral test access bus (TAB). Upon receipt of these tones, the 4458, from its location in the assembly's rightmost module position, activates the transfer relay on a bridge module in one of the assembly's 11 leftmost module positions, as selected by a specific DTMF tone sequence. This causes one individual port of the bridge network—specifically, the selected bridge module and/or the facility (bridge leg) terminated on that module—to be isolated (disconnected from the bridge) for loop-back and other tests. The port is reconnected to the bridge, again by transmitting a sequence of three DTMF tones, when testing and any necessary maintenance or repairs are completed. As an alternative to isolating either the common port or one particular multiple (slave) port of a bridge individually, all multiple ports of a bridge can, if desired, be isolated simultaneously by transmitting the proper DTMF tone sequence.

1.02 In the event that this practice section is revised or reissued, the reason for revision or reissue will be stated in this paragraph.

1.03 The 4458 module operates only with those 244-System modules that contain a transfer relay. These modules can be identified by the presence of the letter "A" or "B" after the last digit of their module numbers. At the time of this writing, nine such modules are available: the 4451A, 4452A, and 4452B DDB modules, each of which, interfaces the common port of a 244 Bridge network, and the 4454A, 4455A, 4454B, 4455B, 4456A, and 4456B DDB Termination (DDBT) modules, each of which interfaces one multiple port of a 244 Bridge network. For complete information on these modules (and their counterparts without transfer relays), please refer to their respective Tellabs practices. For complete information on the 244 DDB System

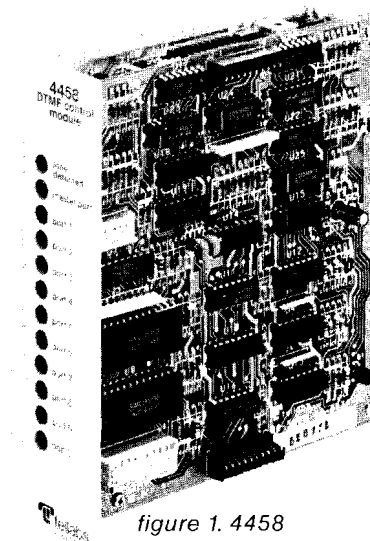


figure 1. 4458  
DTMF Control Module

when mounted in the Issue 2 24X or 24X L1 Mounting Assembly, please refer to the appropriate 244 DDB System practice.

1.04 The 4458 module is always installed in the rightmost module position (as viewed from the front) of the Issue 24X or 24X L1 Assembly that houses the 244 System. To use the 4458 module, a connectorized control/test cable (Tellabs part number 50-4006) must be connected between 25-pair female cable connector *P5* and 13-pin test connector *TL1* on the backplane of the 24X or 24X L1 Assembly. This cable is factory-installed on 24X L1 Mounting Assemblies and can be optionally field-installed on 24X Mounting Assemblies.

**Note:** The 24X-Assembly bypass switch setting at the rear of the 4458's module position may be set to either *BYPASS* or *OFF* without affecting operation of the 4458.

1.05 The 4458 can be optioned to function in a tandem (i.e., multiple-mounting-assembly) 244 Bridge network composed of up to 10 single-shelf 244 Bridges. In such a network, 2 to 10 single-shelf 244 Bridges are interconnected in a "hubbing" arrangement to provide an increased number of multiple ports (see the applicable 244 System practice for details). A 10-position *SHELF SELECT* DIP switch on the 4458's printed circuit board selects the desired address number (1 through 0, where 0 represents 10) for the 24X or 24X L1 Assembly in which the 4458 module resides. This address number is then used as part of the DTMF tone sequence that causes the 4458 to activate the transfer relays of the common-port DDB and multiple-port DDBT modules in the assembly. For example, the *SHELF SELECT* switch on the 4458

module in the first assembly in a tandem bridge arrangement is normally set for 1, the *SHELF SELECT* switch on the 4458 in the second assembly is normally set for 2, and so on, with each 4458, and thus each assembly, being assigned a different address number.

1.06 The specific 244-System module or 4wire facility to be tested is selected by transmitting a sequence of three DTMF tones to the common port or to the TAB. A switch option on the 4458 allows common-port tone detection to be disabled, if desired, so that customer (end-user) access to bridge-testing functions is denied. (A front-panel *master port* LED indicates common-port tone detection.) In addition, the DTMF tone detection level can be switch-optional for -20, -12, or -4dBm to prevent false operation of the 4458. A front-panel *tone detected* LED indicates that tone is received above the threshold (activation) level. Ten additional front-panel LEDs indicate which multiple (slave) port is being tested.

1.07 Proper incoming DTMF tone sequences initiate a 0.25-second acknowledgement tone that is audible either at the TAB output only, or at both the TAB output **and** at the common-port combiner output, as selected via switch option. For *disconnect* operations (i.e., activation of the selected module's transfer relay to disconnect the module and/or the facility from the bridge), a 2200Hz tone is transmitted. For *connect* operations (i.e., deactivation of the transfer relay to reconnect the module and/or the facility to the bridge), a 350Hz tone is transmitted. If a complete sequence is not received within 10 seconds, the operator must redial.

1.08 Activating the transfer relay on a **445XA** common-port or multiple-port module **disconnects the module** from the bridge network's splitter and combiner busses and connects it to an independent test access bus (TAB) that, like the splitter and combiner busses, is present on the printed-circuit backplane of the Issue 2 24X or 24X L1 Assembly. Activating the transfer relay on a **445XB** common-port or multiple-port module, in contrast, **disconnects the associated facility** from the bridge and connects the facility to the TAB. In either case, with a module's transfer relay activated, 2713Hz loopback-activation tone may be transmitted to verify proper operation of appropriate equipment, e.g., a Tellabs data station termination (DST) module or system, at the distant end of the associated bridge leg. Figure 2 shows a typical application. After the remote DST unit is in loopback, various test-tone frequencies (i.e., 404, 1004, and 3004Hz) may be transmitted over the TAB to determine the transmission characteristics of the 4wire facility.

1.09 The 4458 module contains an internally regulated power supply that permits operation on filtered, ground-referenced -42 to -56Vdc input. Maximum current required is 40mA.

## 2. installation and use

2.01 The 4458 DTMF Control Module should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should be immediately filed with the carrier. If stored, the module should be visually inspected again prior to installation.

### mounting

2.02 The 4458 mounts in the rightmost module position of the Issue 2 24X or 24X L1 Mounting Assembly that contains the 244-System modules to be tested. In the 24XA or 24XA L1 Assembly, this is module position 12; in the 24XB or 24XB L1 Assembly, this is module position 14. No specific bypass switch setting is required at the assembly mounting position containing the 4458, i.e., the switch may be left in either the *BYPASS* or the *OFF* position with no effect upon the 4458's operation.

### installer connections

2.03 The 4458 module requires no external connections. This is because all external connections to all modules in a 24X or 24X L1 Assembly (except battery and ground connections, which are made to a separate terminal strip) are made to the 25-pair female cable connectors on the assembly's backplane. To enable testing, however, a Tellabs 50-4006 test cable must be connected between 25-pair female cable connector *P5* and 13-pin test-access connector *TL1* on the Issue 2 24X Assembly's backplane. This cable is standard on 24X L1 Assemblies and can be optionally installed on 24X Assemblies. In addition, connections to the test access bus (TAB) are required if the TAB is to be used to send or receive signals during testing. Signals are transmitted into the bridge via the TAB input (pins 24 and 49 of connector *P1* or pins 2 and 27 of connector *P3*) and out of the bridge via the TAB output (pins 25 and 50 of connector *P1* or pins 1 and 26 of connector *P3*).

### switch options

2.04 Three option switches must be set before the 4458 is placed into service. These switches and their functions are described in paragraphs 2.05 through 2.08. Locations of these switches on the module's printed circuit board are shown in figure 3.

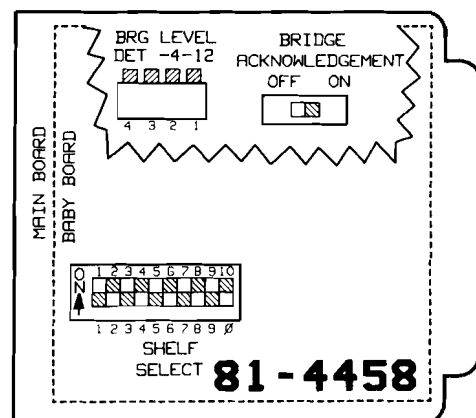


figure 3. 4458 option switch locations

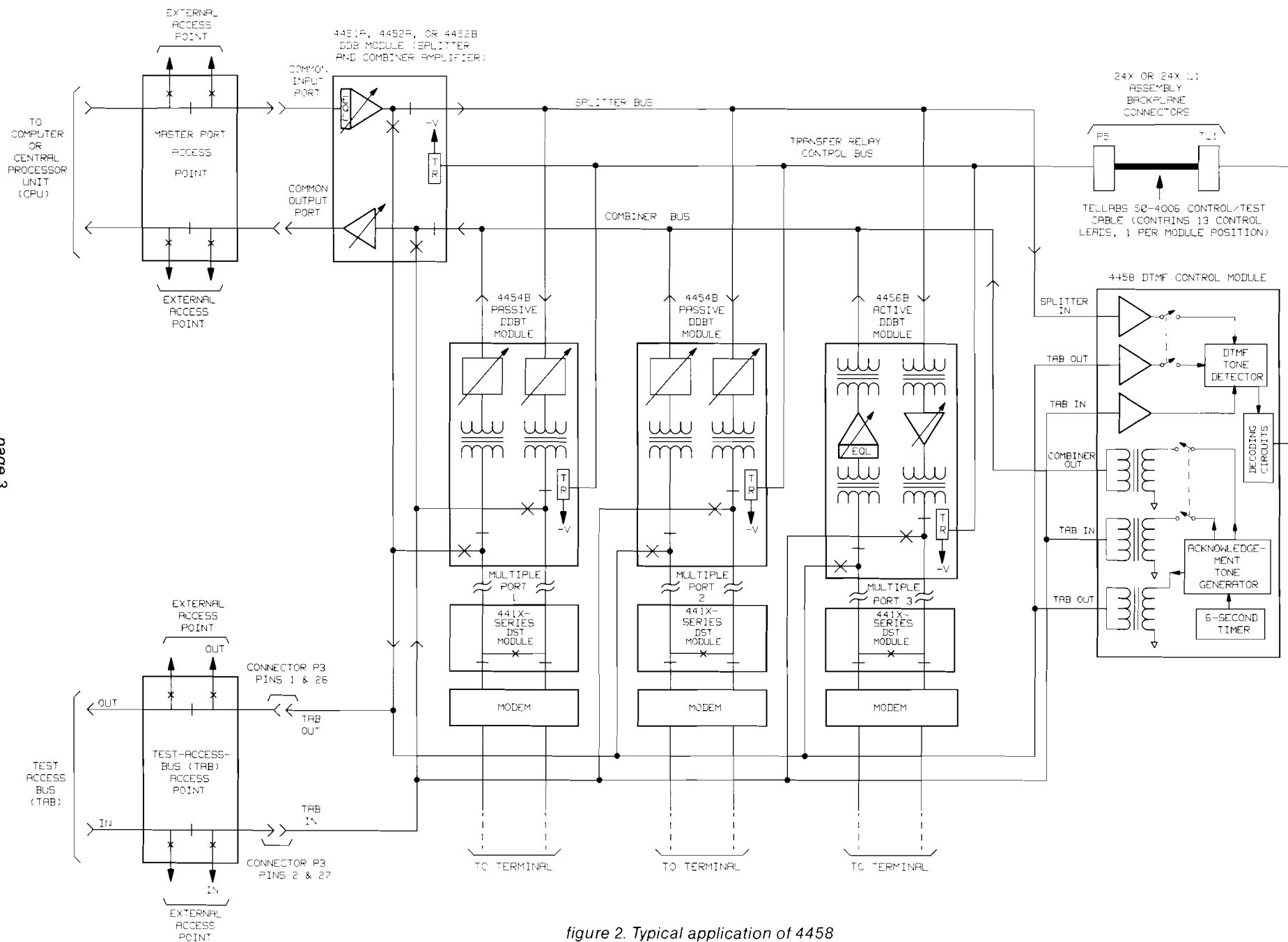


figure 2. Typical application of 4458

2.05 The 10-position *SHELF SELECT* DIP switch on the baby board selects the desired address number for the 24X or 24X L1 Assembly in which the 4458 module resides. This shelf address number is used as the first digit of the three-digit DTMF sequence that causes the 4458 module to activate the transfer relays of the common-port and multiple-port bridge modules in the assembly. Shelf address number assignment is arbitrary. For a single-assembly bridge network, any desired shelf address number from 1 through 0 (where 0 represents 10) can be selected, although 1 is ordinarily used. For a multiple-assembly (tandem) bridge network, the first assembly is normally assigned shelf address number 1, the second assembly is normally assigned shelf address number 2, and so on, with each assembly being assigned a different shelf address number via its own 4458 module. Because shelf address number assignment is arbitrary, however, a consecutive numbering pattern need not be followed if a different shelf addressing scheme is desired. To select a shelf address number, set to *ON* the one position of the *SHELF SELECT* DIP switch whose number (as indicated on the printed circuit board below the switch body) is the desired shelf address number. (Remember, 0 represents 10.) Then set to *OFF* the remaining nine positions of the *SHELF SELECT* DIP switch.

2.06 Positions 3 and 4 (the *DET* positions) of the four-position *BRG DET/LEVEL* DIP switch on the main board condition the 4458 to detect incoming DTMF tones both at the common-port splitter input **and** at the TAB input of the shelf containing the 4458, or at the shelf's TAB input only. Enabling tone detection at the common port allows end-user access to testing and control functions. Disabling common-port tone detection in favor of TAB-input-only tone detection denies test access and control to the end-user. Please be aware that with common-port tone detection enabled, tone detection is also automatically enabled at the TAB output of the shelf containing the 4458. This allows DTMF tones received at the common port to be detected even when the common-port module's transfer relay is activated (which would otherwise prevent incoming tones from reaching the 4458 module via the splitter bus). Please be aware also that in multishelf (tandem) bridges, a particular shelf's common port may or may not be the common port of the overall bridge network. Set the 4458's *BRG DET* switches as follows:

- To enable incoming DTMF tone detection both at the common port **and** at the TAB input and output of the shelf containing the 4458, set positions 3 and 4 of the *BRG DET/LEVEL* DIP switch to *ON*, i.e., upward, away from the main board. This allows end-user test access.
- To enable incoming DTMF tone detection only at the TAB input of the shelf containing the 4458 (and not at the shelf's common port and TAB output), set positions 3 and 4 of the *BRG DET/LEVEL* DIP switch to *OFF*, i.e., downward, toward the main board. This denies end-user test access.

2.07 Positions 1 and 2 (the *LEVEL* positions) of the four-position *BRG DET/LEVEL* DIP switch select either a -20, -12, or -4dBm detection threshold for incoming DTMF tones. Set the *BRG LEVEL* switches as follows:

desired detection threshold	BRG LEVEL switch setting	
	position 1	position 2
-20dBm	OFF*	OFF*
-12dBm	ON**	OFF*
-4dBm	OFF*	ON**
* OFF is downward, toward the main board. ** ON is upward, away from the main board.		

2.08 The two-position *BRIDGE ACKNOWLEDGEMENT* miniature slide switch on the main board conditions the 4458, upon receipt of a valid DTMF tone sequence, to return acknowledgement tone in either of two ways: via both the common-port combiner output **and** the TAB output of the shelf containing the 4458, or via the shelf's TAB output only. Normally, the former option is selected when end-user test access is provided (common-port DTMF tone detection enabled), and the latter option is selected when end-user test access is denied (common-port DTMF tone detection disabled). Please be aware that with the former option selected, acknowledgement tones are automatically returned via the TAB input as well as via the common port and TAB output. Returning acknowledgement tones via the TAB input ensures that these tones are present at the common port even when the common-port module's transfer relay is activated (which would otherwise prevent acknowledgement tones from reaching the common-port combiner output). Also, again please note that in multishelf (tandem) bridges, a particular shelf's common port may or may not be the common port of the entire bridge network. Set the 4458's *BRIDGE ACKNOWLEDGEMENT* switch as follows:

- For return of acknowledgement tones both via the common port and via the TAB output and input of the shelf containing the 4458, set the *BRIDGE ACKNOWLEDGEMENT* switch to *ON*. This is normally done when end-user test access is allowed.
- For return of acknowledgement tones via only the TAB output of the shelf containing the 4458 (and not via the shelf's common port and TAB input), set the *BRIDGE ACKNOWLEDGEMENT* switch to *OFF*. This is normally done when end-user test access is denied.

#### instructions for testing the 244 System via the 4458

2.09 To test a selected 244 DDB network, first ensure that all 4458 modules in the network are properly optioned as directed in paragraphs 2.05 through 2.08. Also ensure that a 4458 module is installed in the rightmost slot of each 24X or 24X L1 Assembly in the network. Finally, be sure that a 50-4006 test cable is properly installed between connectors *P5* and *TL1* of each 24X Assembly.

2.10 DTMF tones may be transmitted to the bridge either via the common-port input or via the TAB input (pins 24 and 49 of connector *P1* or pins 2 and 27 of connector *P3*). Please refer to the 244 System practice for a description of the 244 Bridge and associated facility connections.

2.11 The 4458 recognizes a sequence of three DTMF tones, each of which must be at least 50ms in duration. All three tones must be received within 6 seconds, and the tones must be separated by pauses of at least 50ms. Table 1 summarizes the DTMF tone sequence and describes the functions of each digit.

2.12 The first DTMF tone is interpreted as the shelf address number. This number may be a 1, 2, 3, 4, 5, 6, 7, 8, 9, or 0, with 0 representing 10. Thus, if the first tone is a 5, the 4458 whose *SHELF SELECT* switch is set for 5 is enabled and awaits the next two tones. Normally, this would be the 4458 in the fifth 24X or 24X L1 Assembly of a tandem (i.e., multiple-assembly) bridge network.

2.13 The second DTMF tone is interpreted as the module slot number within the selected 24X or 24X L1 Assembly. This number identifies the specific module and/or associated facility (bridge leg) to be tested and may be a \*, #, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 0. A # corresponds to the assembly's leftmost module position (slot 1) and can be used to identify the assembly's master (common) port if the common-port DDB module is installed in its usual leftmost position. A 1 corresponds to the next module position (slot 2, normally the first multiple slave port). Similarly, a 0 is used to designate the tenth multiple port and thus the eleventh module position of the assembly. If the second DTMF tone is a \*, all 10 multiple-port module positions (slots 2 through 11) in the assembly are selected (enabled).

2.14 The third (final) DTMF tone is either a #, which disconnects the selected port from the bridge, or a \*, which reconnects the selected port to the bridge. This is done as follows: A *disconnect* (#) command energizes the transfer relay on the selected module (or modules if the second DTMF tone was a \*). A *connect* (\*) command de-energizes the transfer relay on the selected module(s). No changes in the transfer-relay state occur if a *disconnect* command is received for an already-disconnected module or if a *connect* command is received for an already-connected module. However, an acknowledgement tone is still transmitted (see paragraph 2.15).

**Note:** *If any multiple ports are already disconnected from the bridge when an attempt is made to disconnect the common port from the bridge, the common port will be disconnected and the already-disconnected multiple ports will be reconnected. See paragraph 2.15 and the note that follows it for additional information.*

2.15 In response to received DTMF tones, 0.25-second acknowledgement tones are transmitted either via the common-port combiner output **and** the TAB, or via the TAB output only, as selected via switch option. A proper *disconnect* sequence generates a 2200Hz acknowledgement tone. A proper *connect* sequence generates a 350Hz acknowledgement tone. If an invalid sequence is dialed or if the sequence is not completed within 6 seconds, the operator must wait 10 seconds and then redial.

**Note:** *If the common port is already disconnected from the bridge and an attempt is made to disconnect a multiple port from the bridge, the attempt will be rejected and no acknowledgement tone will be transmitted.*

digit sequence	function	valid DTMF digits	comments
1st digit	shelf address number: selects bridge mounting shelf that houses System module associated with bridge leg(s) to be tested	1 through 0	assignment of shelf address numbers is arbitrary, but in multishelf (tandem) bridge networks, shelf address numbers are normally assigned in consecutive order (i.e., 1 for shelf 1, 2 for shelf 2, etc., with 0 representing shelf 10)
2nd digit	module diagnostic point: selects specific module that terminates bridge leg to be tested	1 through 0	selects individual multiple-port (slave) bridge leg: 1 selects first DDBT module in shelf (slot 2), 2 selects second DDBT module (slot 3), etc., with 0 selecting tenth (last) DDBT module in shelf (slot 11)
		*	selects <b>all</b> multiple-port (slave) bridge legs
		#	selects common-port (master) bridge leg only
3rd digit	connect/disconnect status: either connects selected module to or disconnects it from test access but (TAB)	#	disconnects selected module from bridge (connects to TAB)
		*	reconnects selected module to bridge (disconnects from TAB)

table 1. DTMF tone sequence and functions

2.16 The 4458 module represents one multiple-port termination of a 244 Bridge. Because one 4458 is required for every 11 shelf slots, and because a single 4451X or 4452X common-port DDB module can accommodate up to 26 multiple ports, a maximum of 23 multiple ports can be accommodated by one 4451X or 4452X common-port module when 4458 DTMF Control Modules are used in a two- or three-shelf non-tandem bridge.

### 3. circuit description

3.01 This circuit description is intended to familiarize you with the 4458 DTMF Control Module for engineering and application purposes only. Attempts to troubleshoot the module internally are not recommended. Troubleshooting procedures should be limited to those prescribed in section 6 of this practice. Refer to the 4458 block diagram, section 4 of this practice, as an aid in following the circuit description.

#### power supply

3.02 The 4458's *power supply* is a series voltage regulator that uses a zener diode as a reference source. A series diode in the negative input lead protects the circuit against reversed input power connections, and a surge arrestor between input battery and ground limits high-level supply transients to a safe level.

#### DTMF tone detection

3.03 Three high-impedance *differential amplifiers* monitor the common-port splitter input, the TAB input, and the TAB output for DTMF tones. A switch option selects DTMF tone monitoring at the TAB input only, or at both the common port **and** the TAB input. With the latter option in effect, the TAB output is also automatically monitored. This allows DTMF tones received at the common port to be detected even when the common-port module's transfer relay is activated (which would otherwise prevent DTMF tones from reaching the 4458 module via the splitter bus). Additional switch options afford a choice of three DTMF tone-detection thresholds (−20, −12, or −4dBm) so that low-level DTMF tones are not detected and thus do not interrupt bridge operation.

#### DTMF decoding

3.04 The 4458's *DTMF decoder and counter* consist of a crystal-referenced DTMF tone decoder and integrated-circuit logic gates. A *6-second timer* starts upon receipt of the first DTMF digit of a sequence and resets if a valid three-digit sequence is not received within 6 seconds.

3.05 Also associated with the 4458's *DTMF decoder and counter* are a *10-second timer* and a *count-to-three digit counter*. The *digit counter* resets the module (to receive a new DTMF tone sequence) after every three received DTMF tones. The *10-second timer*, which (like the *6-second timer*) starts upon receipt of the first DTMF digit of a sequence, resets the *digit counter* every 10 seconds. This

ensures that invalid DTMF tone sequences (less than three digits) do not inhibit module operation. The *10-second timer* and *digit counter* also ensure that module-slot-number tones do not falsely enable 4458 modules in other mounting assemblies of a multisshelf (tandem) bridge network.

#### acknowledgement tones

3.06 A *2200Hz oscillator* and a *350Hz oscillator*, each with its own *0.25-second timer*, are controlled by the *DTMF decoder and counter*. A valid *disconnect* tone sequence causes the 4458 to transmit a 0.25-second 2200Hz acknowledgement tone, and a valid *connect* sequence causes the 4458 to transmit a 0.25-second 350Hz acknowledgement tone. A switch option allows acknowledgement tones to be transmitted via the TAB output only, or via both the TAB output **and** the common-port combiner output. With the latter option in effect, acknowledgement tones are also automatically transmitted via the TAB input. This ensures that acknowledgement tones are present at the bridge's common port even when the common-port module's transfer relay is activated (which would otherwise prevent acknowledgement tones from reaching the common-port combiner output).

3.07 Acknowledgement tones are coupled to the TAB output and, if the 4458 is so optioned, to the TAB input via contacts of the 4458's *tone-control relays*. Because these contacts are closed only during the 0.25-second intervals when acknowledgement tones are transmitted, the two *oscillators* and associated circuitry remain totally isolated from the TAB at all other times. As a result, the 1200, 600, or 150-ohm (switchable) impedance match between the selected bridge module and its associated facility remains undisturbed except during the brief periods of acknowledgement tone transmission.

## 5. specifications

#### input voltage requirements

−42 to −56Vdc, filtered, ground-referenced

#### input current requirements

40mA maximum

#### operating environment

23° to 130°F (0° to 57°C), humidity to 95% (no condensation)

#### dimensions

5.58 inches (14.17cm) high

1.42 inches (3.61cm) wide

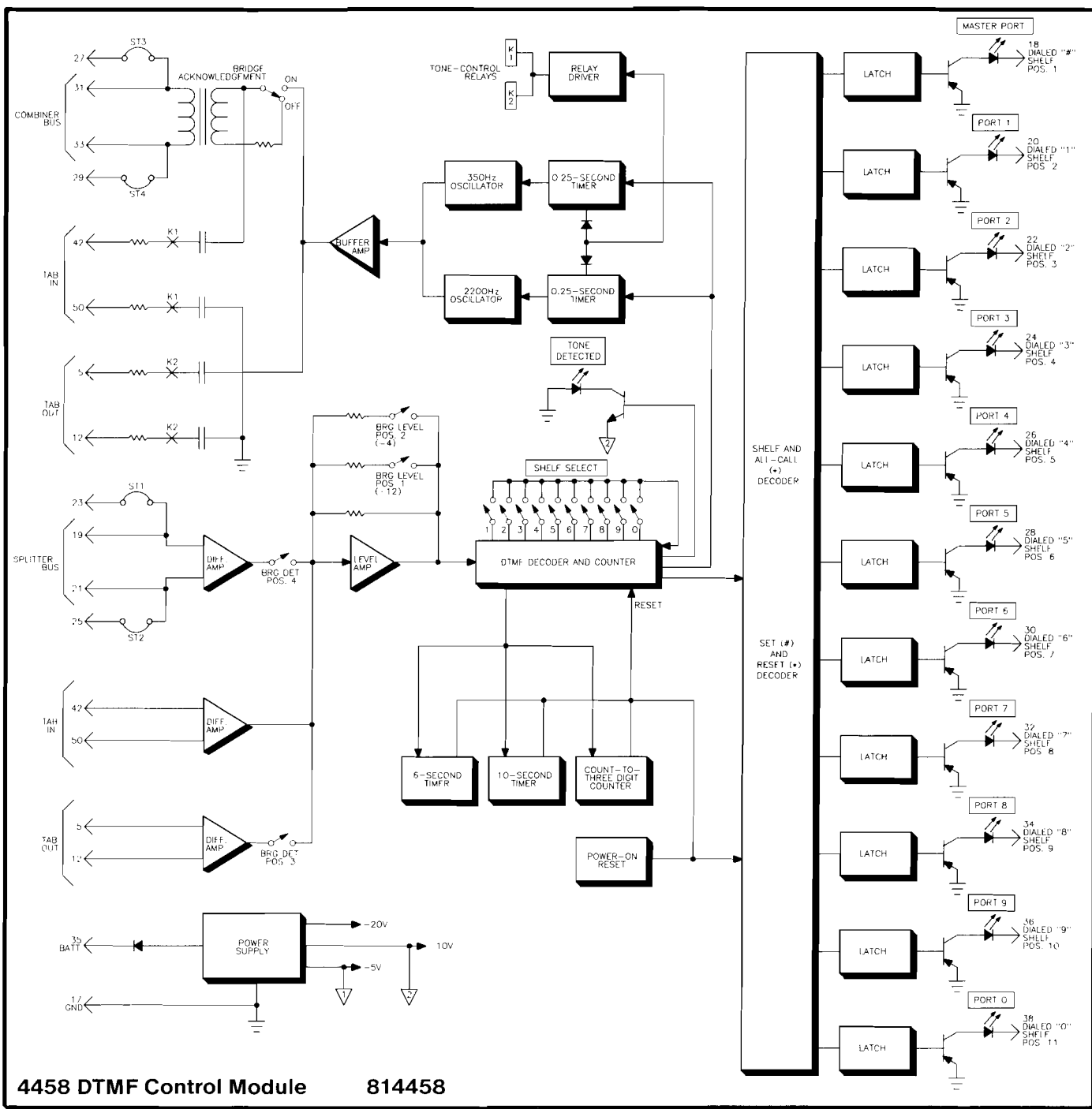
5.96 inches (15.14cm) deep

#### weight

9.5 ounces (269 grams)

#### mounting

relay rack via module position 12 of a Tellabs 24XA or 24XA L1 Mounting Assembly (Issue 2) or via module position 14 of a Tellabs 24XB or 24XB L1 Mounting Assembly (Issue 2). Please note that a Tellabs 50-4006 plug-on test cable must be ordered separately and field-installed on a 24XA or 24XB Assembly in which the 4458 is to be used. This cable is factory-installed on the 24XA L1 and 24XB L1 Assemblies.



4458 DTMF Control Module 814458

#### 4. block diagram

#### 6. testing and troubleshooting

6.01 The *troubleshooting guide* in this section may be used to assist in the installation, testing, or troubleshooting of the 4458 DTMF Control Module. Intended as an aid in localization of trouble to a single module, the *troubleshooting guide* lists a variety of trouble conditions along with possible causes of each. If a 4458 module is not performing properly, look up the problem in the troubleshooting guide and check all the possible causes listed opposite the problem. If this does not correct the problem, substitute a new module, if possible, and observe its operation. If the substitute module

operates correctly, the original module should be considered defective and returned to Tellabs for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 4458 module. Unauthorized testing or repairs may void the module's warranty. Also, if the module is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

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

*although an attempt will be made to do so. If a module 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 *troubleshooting guide*, 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 atlantic region: (203) 798-0506

US capital region: (703) 478-0468

US central region: (312) 357-7400

US southeast region: (305) 645-5888

US southwest region: (214) 869-4114

US western region: (714) 850-1300

Canada: (416) 624-0052

6.03 If a module 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 module, 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 8X4458 part number that indicates the issue of the module in question. Upon notification, we shall ship a replacement module to you. If the module in question is in warranty, the replacement will be shipped at no charge. Pack the defective module in the replacement module's carton, sign the packing slip included with the replacement, and enclose it with the defective module (this is your return authorization). Affix the preaddressed label provided with the replacement module to the carton being returned, and ship the module prepaid to Tellabs.

#### **repair and return**

6.05 Return the defective module, shipment prepaid, to Tellabs (attn: repair and return).

in the USA:

Tellabs, Inc.

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

### **troubleshooting guide**

<b>trouble condition</b>	<b>possible causes (check before assuming module is defective)</b>
module completely nonfunctional (no tone output and/or no transfer relay activation)	<ol style="list-style-type: none"> <li>1) No input power to module.</li> <li>2) Incorrect or faulty external wiring (including 50-4006 test cable).</li> <li>3) One or more option switches on 4458 improperly set.</li> <li>4) 4458 module installed in rightmost slot (as viewed from front) of 24X or 24X L1 Assembly and securely plugged into its connector.</li> </ol>
wrong transfer relay activated	<ol style="list-style-type: none"> <li>1) One or more option switches on 4458 improperly set.</li> <li>2) Incorrect shelf slot assignment for one or more bridge modules.</li> </ol>
acknowledgement tones inaudible	<ol style="list-style-type: none"> <li>1) One or more option switches on 4458 improperly set.</li> <li>2) Incorrect shelf slot assignment for one or more bridge modules.</li> </ol>