

# 4409 Pickup Relay and Station Circuit Module

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## 1. description and application

1.01 The 4409 Pickup Relay and Station Circuit Module (figure 1) provides a 4wire telephone set with talk battery and access to a 4wire line. Modules of this type are frequently used in selective-signaling applications to interface station telephones (usually keysets) with terminal equipment of other than Tellabs' manufacture. While the 4409 can be used as a direct-replacement module in such applications, its *primary* application is to connect a 4wire station telephone and an associated loudspeaker to a voice-paging conference arrangement involving up to 20 such telephones and loudspeakers at one end of a 4wire private line.

1.02 In the event that this Practice section is reissued, the reason for reissue will be stated in this paragraph.

1.03 In a voice-paging conference arrangement of the type described above (see figure 2), a 4wire line amplifier (e.g., a Tellabs 4001) interfaces the 4wire private line with a Tellabs 4408 4Wire Line Termination module. Connected to the terminal (drop) side of the 4008 are up to twenty 4409 modules, each of which is, in turn, connected to a 4wire station telephone. Each 4409 is also connected to a voice-paging loudspeaker (e.g., a Tellabs 9791) except in cases where two stations are in close proximity and can share one loudspeaker. At the distant end of the 4wire private line is a 4wire station telephone (with an associated loudspeaker if two-way voice paging is required) or, more commonly, another voice-paging conference arrangement involving two or more 4wire station telephones and associated loudspeakers.

1.04 Going off-hook at any station in the circuit seizes the circuit for broadcasting a message through the loudspeakers at all other stations at both ends of the circuit. When a station goes off-hook in response to a received loudspeaker page, the 4409 module connects the station to the circuit, mutes its associated loudspeaker for as long as the station is off-hook, and supplies talk battery to the station handset. This type of circuit is commonly referred to as a hoot 'n' holler, yell-down, or junkyard circuit.

1.05 In applications where the station telephone is a push-to-talk set, the 4409 enables push-to-talk operation by providing cut-through of the transmit path when the station telephone's push-to-talk

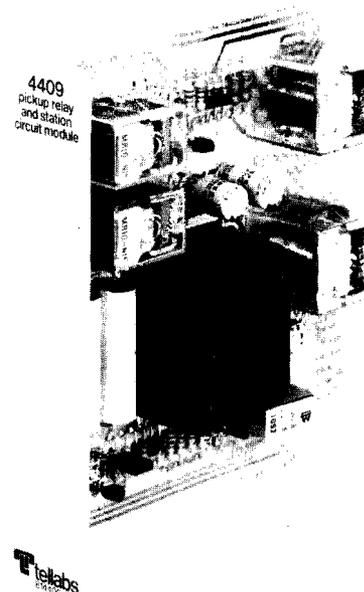


figure 1. 4409 Pickup Relay and Station Circuit Module

button is depressed. In applications where station dialing takes place (e.g., in non-Tellabs selective-signaling applications), the 4409 either repeats rotary-dial pulses or passes DTMF tones unchanged, depending upon the type of station telephone connected to the module. For such applications, several dialing-control switch options are available; these are covered in paragraph 2.05 and table 2.

1.06 While the 4409 can accommodate up to 600 ohms of station-loop resistance (including telephone-set resistance) for talk battery, the recommended range is 100 to 400 ohms. Insertion loss at 1000Hz (with a 600-ohm termination) is 1.0dB maximum in the module's transmit channel and 1.5dB maximum in the receive channel. Maximum resistance of each of the three relay leads from the 4409 to the station telephone — the ON (dial off-normal), PT (push-to-talk), and A leads — is 300 ohms, with a 300-ohm maximum resistance to ground at the station.

1.07 The 4409 module operates on -21 to -28Vdc filtered, ground-referenced input. Maximum current requirements (at -24Vdc) range from 7mA at idle to 175mA when active (not including current drain on FW lead, and with a short across drop-side transmit tip and ring). Surge protection is provided at all four ports. Reverse-battery protection is provided for the 4409's input power leads.

1.08 A Type 10 module, the 4409 mounts in one position of a Tellabs Type 10 Mounting Shelf, versions of which are available for relay-rack and

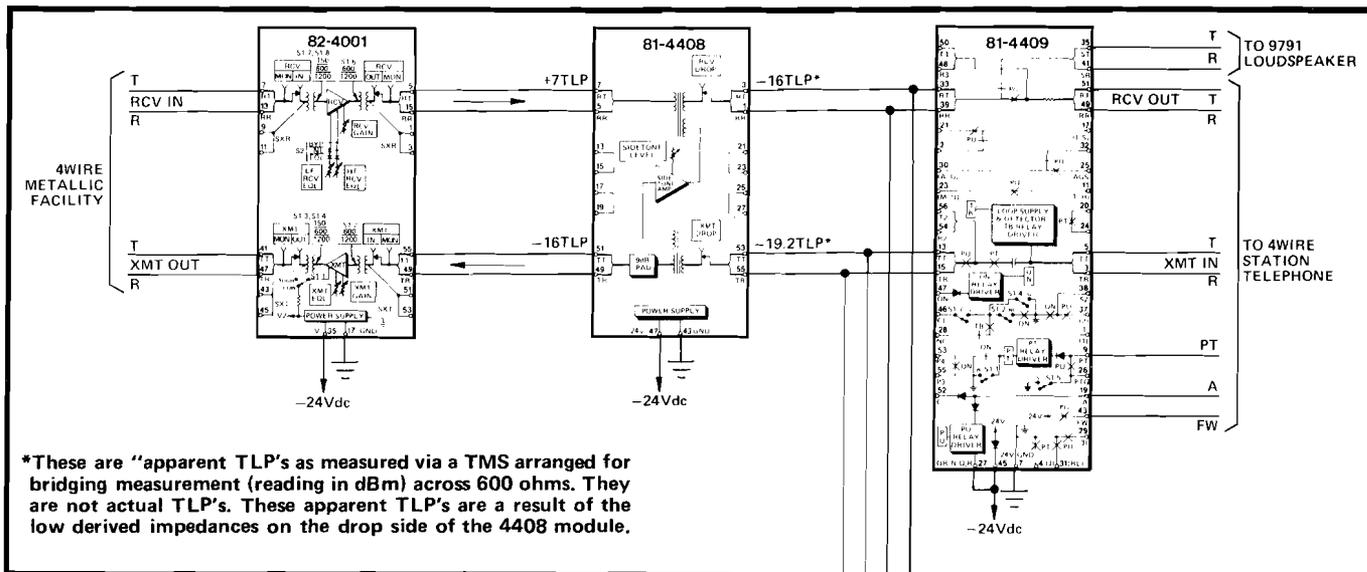


figure 2. Voice-paging conference arrangement of 4409

apparatus-case installation. In relay-rack applications, up to 12 modules can be mounted across a 19-inch rack, while up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical mounting space is used.

## 2. installation inspection

2.01 The 4409 Pickup Relay and Station Circuit Module should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

### mounting

2.02 The 4409 module mounts in one position of the Tellabs Type 10 Mounting Shelf, which is available in configurations for relay-rack and apparatus-case installation. The module plugs physically and electrically into a 56-pin connector at the rear of its module position in the Type 10 Shelf.

### installer connections

2.03 Before making any connections to the mounting shelf, make sure that power is **off** and modules are **removed**. Modules should be put into place only **after** they are properly optioned and **after** wiring is completed.

2.04 Table 1 lists external connections to the 4409 module. All connections are made via wire wrapping to the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector.

**Note:** Depending upon the type of station telephone interfacing the 4409 and the requirements of the particular application, not all connections listed in table 1 may be required. Paragraph 2.06 provides information on special wiring and switch optioning required when the station telephone is not a keyset and, therefore, no station-telephone A lead is present.

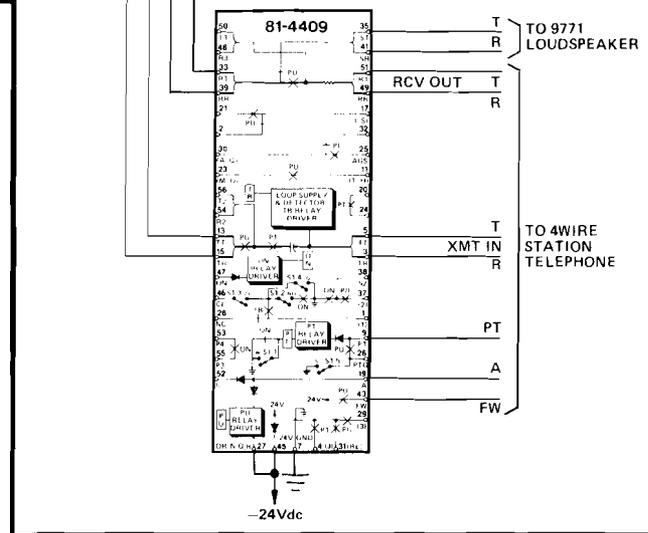


figure 3. 4409 option switch location

### optioning and alignment

2.05 The 4409 module has no user-adjustable controls and therefore requires no alignment. However, the five positions of DIP switch S1 must be properly set before the module is placed into service. Table 2 lists the required S1 switch-position settings for both voice-paging conference applications and non-Tellabs selective-signaling applications. Figure 3 shows the location of switch S1 on the 4409's printed circuit board.

### wiring and switch optioning for non-key telephone sets

2.06 In applications where the 4409's associated station telephone is not a keyset and therefore has no A lead, the 4409 can be wired and switch-optioned so that the PU relays and the PT relay are activated by the station's going off-hook. To do this, proceed as follows:

connect:	to pin:
TT1 (line transmit output tip)*	13
TR1 (line transmit output ring)*	15
RT1 (line receive input tip)*	33
RR1 (line receive input ring)*	39
TT (drop transmit input tip)*	5
TR (drop transmit input ring)*	3
RT (drop receive output tip)*	51
RR (drop receive output ring)*	49
A LEAD*	19
ST (loudspeaker tip)**	35
SR (loudspeaker ring)**	41
FW (four-wire lead for convertible 2wire/4wire station telephone set)†	43
PT (push-to-talk lead)†	9
PTG (push-to-talk ground lead)†	26
N, R, or Q OPTION LEAD (PU-relay energizing voltage)††	27
ON (dial off-normal lead)	47
AG (privacy intrusion key)	30
AGS (privacy intrusion key)	25
M or Q (privacy override key)	23
T or H (privacy override key)	11
1 LEAD	1
2 LEAD	37
3 LEAD	29
RL LEAD	31
R or ZC LEAD	21
I or S LEAD	17
NC LEAD	28
CL LEAD	46
J LEAD	4
P3 LEAD	55
P4 LEAD	53
C LEAD	52
S2 LEAD	38
T2 LEAD	56
R2 LEAD	54
T3 LEAD	50
R3 LEAD	48
N.C., PU2 (normally closed contacts, pickup relay 2)	2
N.O., PT (normally open contacts, push-to-talk relay)	20
N.O., PT (normally open contacts, push-to-talk relay)	24
N.C., PU2 (normally closed contacts, pickup relay 2)	32
-24Vdc (nominal -24Vdc filtered input)	45
GND (ground)	7

\* Mandatory connections to 4wire key telephone set in all applications. See paragraph 2.06 for information concerning non-key telephone sets.  
 \*\* Mandatory loudspeaker connections in voice-paging conference applications.  
 † May be required, depending upon type of tel set used.  
 †† Must be connected to input battery in most applications.

table 1. External connections to 4409

- A. Set switch S1-4 to G (on) and switch S1-5 to S (on).
- B. Connect a strap between the 4409's N, R, OR Q OPTION lead (pin 27) and -24Vdc (battery input) lead (pin 45).
- C. Connect a strap between the 4409's A lead (pin 19) and 1 lead (pin 1).

**3. circuit description**

3.01 This circuit description is intended to familiarize you with the 4409 Pickup Relay and Station

Circuit Module for engineering and application purposes only. Attempts to troubleshoot the 4409 internally are not recommended and may void your warranty. Troubleshooting procedures should be limited to those prescribed in section 6 of this Practice. Please refer to the associated functional block diagram, section 4 of this Practice, as an aid in understanding this circuit description.

**pickup relay circuit**

3.02 The 4409's pickup-relay circuit consists of pickup relays 1 and 2 (PU1 and PU2) and their associated circuitry (e.g., ground detectors and relay drivers). Relays PU1 and PU2 operate when the associated station telephone set goes off-hook, grounding the A lead. When the PU relays operate, the following occurs:

- (A) The transmission leads of the 4409's station circuit are connected to the transmission leads of the associated 4408 4Wire Line Termination module.
- (B) The 4409's RL lead is grounded.
- (C) The 4409's FW lead goes to -24Vdc to operate the FW relay in a convertible 2wire/4wire station telephone.
- (D) Auxiliary PU relay contacts operate providing for various functions as required by the module's particular application.

3.03 When the associated station telephone is not a push-to-talk set (and, therefore, option switch S1-5 is set to S), the PT relay in the 4409's station circuit is slaved to the module's PU relays. Thus, when the station goes off-hook and the PU relays operate, ground is provided to the PT relay so that it also operates, completing the transmit transmission path. When the associated station telephone is a push-to-talk set (and, therefore, switch S1-5 is set to off), the PU relays operate when the station goes off-hook but the PT relay does not operate until the station's push-to-talk button is depressed.

3.04 When an associated loudspeaker is connected to the 4409's loudspeaker tip and ring leads, operation of the PU relays disconnects the loudspeaker from the receive side of the line to mute the loudspeaker when the station telephone is off-hook.

**station circuit**

3.05 The 4409's station circuit consists of the push-to-talk (PT) relay, the dial-off-normal (ON) relay, the talk-battery (TB) relay, and the circuitry associated with these relays. Thus, the station circuit provides the station telephone with talk battery and dialing control and enables push-to-talk operation when the station telephone is a push-to-talk set.

3.06 Talk battery is inductively fed to the associated station telephone via the drop-side transmit path. Four capacitors block talk battery from the line-side transmit path. The TB relay is energized by loop current when the station telephone is off-hook and is de-energized during the break portions of dial pulses. During dialing in SS-1A applications, the TB relay converts station dialing to 1-lead signals for the SS-1A terminal equipment.

switch	option	voice-paging conference applications	non-Tellabs selective-signaling applications
S1-1	W (on) or off	Set <i>S1-1</i> to <i>W</i> ; this makes PT relay independent of ON relay so that PT relay does not de-energize when ON relay energizes.	Where station telephone is a DTMF set, set <i>S1-1</i> to <i>W</i> to complete the transmission path during dialing. Otherwise, set <i>S1-1</i> to <i>off</i> to prevent dial-pulse transients from reaching the 4wire transmit path.
S1-2 (see note)	NO (on) or off	Setting of <i>S1-2</i> is immaterial.	Set <i>S1-2</i> to <i>NO</i> if it is desired that 1 lead be active only during dialing. In SS-1A applications, set <i>S1-2</i> to <i>off</i> .
S1-3 (see note)	CL (on) or off	Setting of <i>S1-3</i> is immaterial.	Set <i>S1-3</i> to <i>CL</i> to allow state of 1 lead to be externally controlled when TB relay is energized via CL lead. With <i>CL</i> option selected, 1 lead is at ground when station is off-hook and CL lead (pin 46) is at ground. In SS-1A applications, set <i>S1-3</i> to <i>off</i> .
S1-4 (see note)	G (on) or off	Set <i>S1-4</i> to <i>off</i> so that ground is not provided on 1 lead when station telephone is off-hook.	In SS-1A applications, set <i>S1-4</i> to <i>G</i> to provide ground on 1 lead (under control of TB relay) when station telephone is off-hook. With <i>G</i> option selected, 1 lead is momentarily open during dial pulses.
S1-5	S (on) or off	If station telephone is push-to-talk type, set <i>S1-5</i> to <i>off</i> so that PT relay energizes only when push-to-talk button is depressed. If station telephone is not push-to-talk type, set <i>S5-1</i> to <i>S</i> so that PT relay energizes when PU relays energize.	Same as for voice-paging conference applications.

**Note:** Option switches S1-2, S1-3, and S1-4 are all used to condition the 4409's 1-lead output. In selective-signaling applications, if one of these switches is to be set to its on position, the other two must be set to off.

table 2. 4409 switch options

3.07 The PT relay is energized when the module's PT lead (pin 9) is grounded. This occurs either when the module's pickup relays operate (switch *S1-5* set to *S*) or when the station telephone is a push-to-talk set and its handset button is depressed (switch *S1-5* set to *off*). When the PT relay is energized, the transmit path is terminated on contacts of pickup relay 2 (PU2), and because relay PU2 is operated, the drop-side transmit path is cut through to the line-side transmit path.

3.08 When the dial of the associated station telephone is moved off-normal, the 4409's ON relay is energized, providing a 2-lead ground corresponding to the dial-off-normal condition. When switch *S1-2* is set to *NO*, operation of the ON relay provides cut-through for the 1-lead output. When switch *S1-4* is set to *G*, the 1 lead is grounded while the station is off-hook.

## 5. specifications

### transmit insertion loss

1dB maximum at 1000Hz with 600-ohm terminations

### receive insertion loss

1.5dB maximum at 1000Hz with 600-ohm terminations

### station-side (drop-side) limit for talk battery

recommended: 100 to 400 ohms (including station resistance)

maximum: 600 ohms (including station resistance)

### relay contact ratings

PU1, PU2, PT, and ON relays: 1 ampere maximum

TB relay: 0.25 ampere maximum

### relay operating requirements (grounds must be common)

300 ohms maximum resistance in relay leads to station;

300 ohms maximum resistance to ground at station

### dial pulse distortion

negligible

### input voltage

-21 to -28Vdc, filtered, ground referenced

### input current

7mA at idle; 175mA maximum, not including current drain on FW lead (pin 43) and with a short across drop-side transmit tip and ring

### operating environment

20° to 130° F (-70° to +54°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

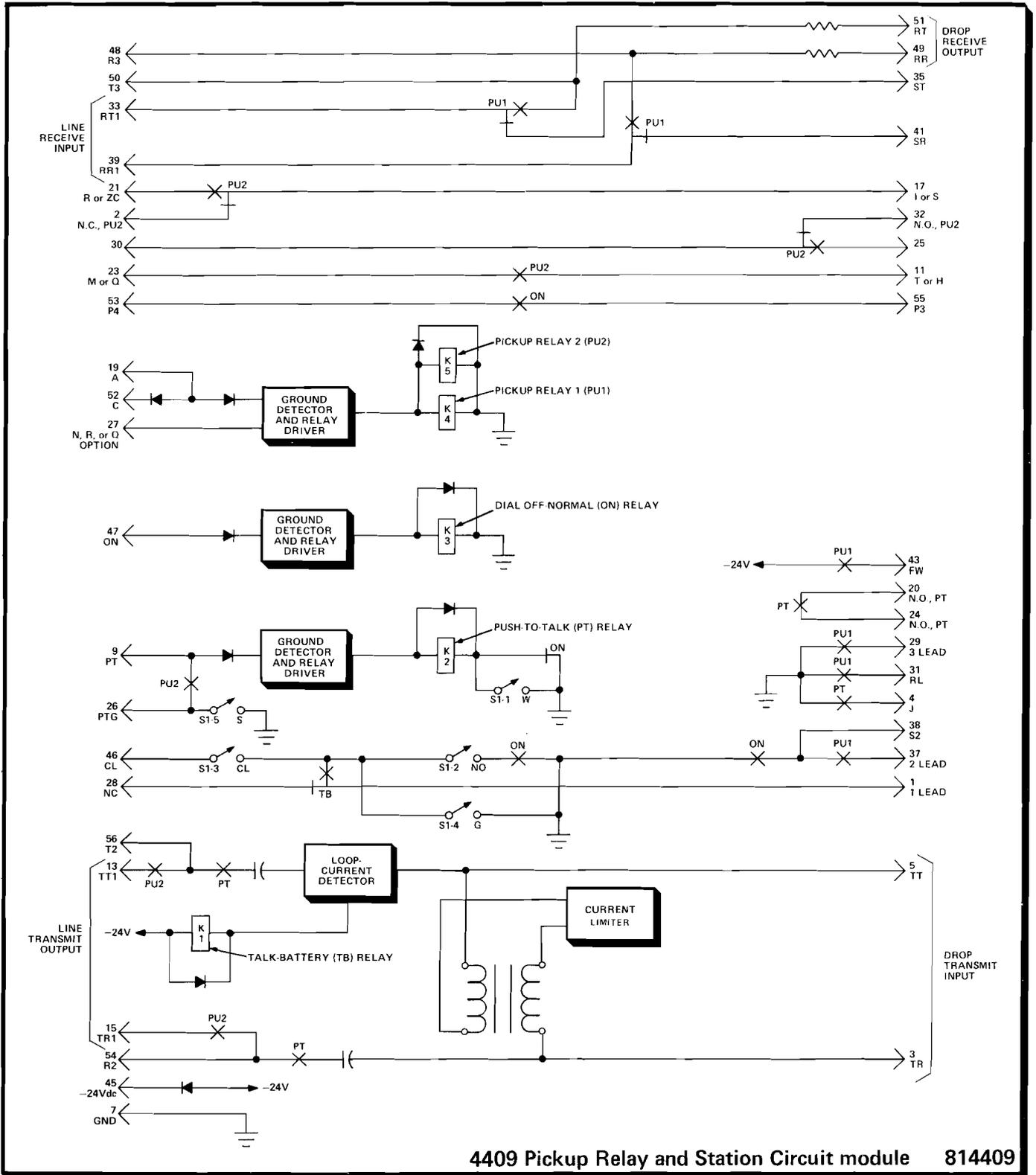
### weight

18 ounces (510 grams)

### mounting

relay rack or apparatus case via one position of Tellabs

Type 10 Mounting Shelf



4409 Pickup Relay and Station Circuit module 814409

4. block diagram

6. testing and troubleshooting

6.01 The Testing Guide Checklist in this section may be used to assist in the installation, testing, or troubleshooting of the 4409 Pickup Relay and Station Circuit Module. The Checklist is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective,

a new one should be substituted and the test conducted again. If the substitute module operates correctly, the original module 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 the 4409 module. Unauthorized testing or repairs may void the module's warranty.

**Note:** *Warranty service does not include removal of permanent customer markings on the front panels of 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 Checklist, contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle, Illinois, or Mississauga, Ontario, Headquarters. Telephone numbers are as follows:

US central region: (312) 969-8800  
 US northeast region: (412) 787-7860  
 US southeast region: (305) 645-5888  
 US western region: (213) 595-7071  
 Lisle Headquarters: (312) 969-8800  
 Mississauga Headquarters: (416) 624-0052

6.03 If a 4409 is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is more expedient, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

**replacement**

6.04 To obtain a replacement 4409 module, notify Tellabs via letter (see addresses below), telephone (see numbers above), or twx (910-695-3530

in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X4409 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 4409 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 4409 module, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated  
 4951 Indiana Avenue  
 Lisle, Illinois 60532

in Canada: Tellabs Communications Canada, Ltd.  
 1200 Aerowood Drive, Unit 11  
 Mississauga, Ontario, Canada L4W 2S7

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.

**testing guide checklist**

test	test procedure	normal result	if normal conditions are not met, verify:
relays de-energized	Remove ground from pins 19, 47, and 9. Set switch <i>S1-1</i> to <i>W</i> (on). Use VOM (50Vdc scale) to measure voltage between battery and pins 29, 4, and 38.	VOM indicates 0 ohms in all three cases <input type="checkbox"/> .	Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Test setup <input type="checkbox"/> . Replace 4409 and retest <input type="checkbox"/> .
relays energized	Apply ground to pins 19, 47, and 9. Apply battery to pin 27. Set switch <i>S1-1</i> to <i>W</i> (on). Use VOM (50Vdc scale) to measure voltage between battery and pins 29, 4, and 38.	VOM indicates input battery voltage (-24Vdc nominal) in all three cases <input type="checkbox"/> .	Same as above <input type="checkbox"/> .
transmit level	Apply ground to pin 19 and battery to pin 27. Set switch <i>S1-5</i> to <i>S</i> (on). Arrange transmit portion of a transmission measuring set (TMS) to output 1000Hz tone at -10dBm. Connect this signal to pins 5 and 3. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to pins 13 and 15.	TMS indicates approximately -10 to -11dBm <input type="checkbox"/> .	Same as above <input type="checkbox"/> .
receive level	Apply ground to pin 19 and battery to pin 27. Leave TMS arranged as in preceding test. Connect transmit portion to pins 33 and 39. Connect receive portion to pins 51 and 49.	TMS indicates approximately -10.5 to -11.5dBm <input type="checkbox"/> .	Same as above <input type="checkbox"/> .