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Practice Section 104462B Rev A

4WIRE 2WAY CONFERENCE BRIDGE MODULE
MODEL 104462B

Contents:

1. GENERAL

1.01 This practice provides application, specification, circuit and mechanical description, maintenance, installation, and warranty information relating to Accurate Electronics' 4wire 2way Conference Bridge Module, Model 104462B.

1.02 The 104462B 4Wire 2Way Conference Bridge Module provides active bi-directional level control and impedance matching for two 4wire voice-frequency (VF) transmission facilities. When mounted in an Accurate 24X Mounting Assembly, multiple 104462B modules establish a multi-port 4wire voice conference bridge.

1.03 When the module is used in an Accurate 24X Mounting Assembly, incoming signals at the channel-1 receive in (RCV IN) port are cross-coupled to the channel-2 transmit out (XMT OUT) port, and those appearing at the channel-2 RCV IN port are cross-coupled to the channel-1 XMT OUT port. In addition, the VF signals appearing at the channel-1 and channel-2 receive ports are combined and coupled via the transmit right (TR) and transmit left (TL) pins of the 104462B to the voice conference bus of the 24X Assembly backplane. These conference buses transfer the combined VF signals to the receive right (RR) and receive left (RL) pins of the adjacent 104462B module

FIGURE 4. Front Panel Equalizer Switches.

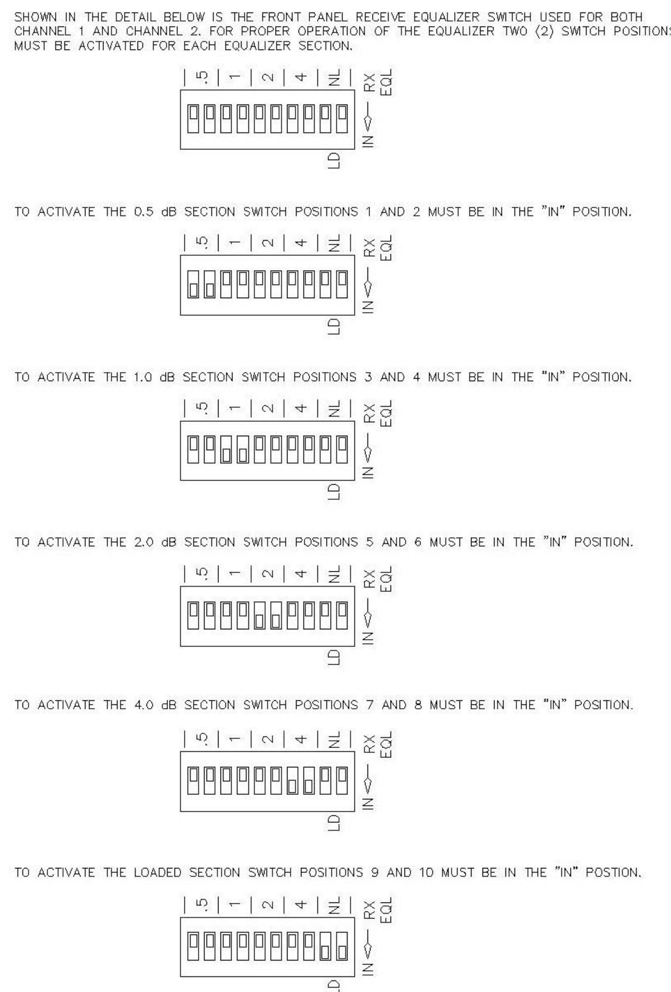
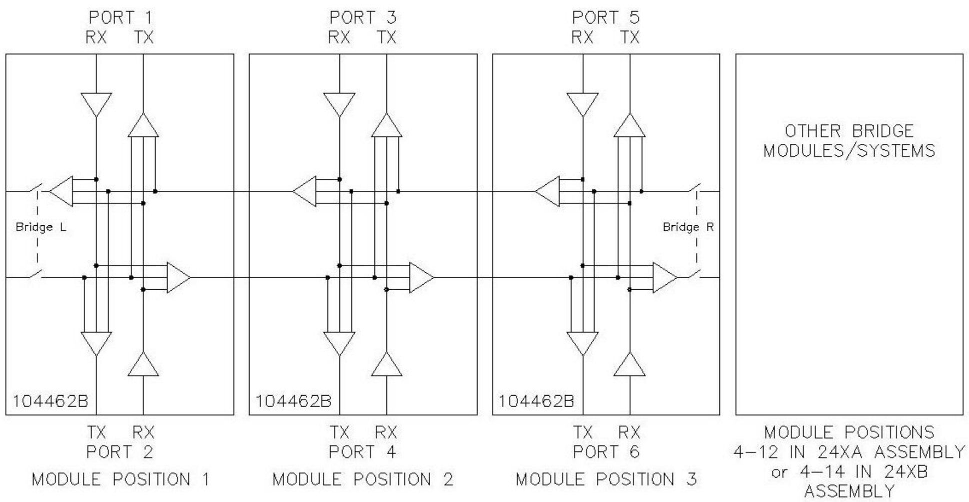


FIGURE 3. Typical 4wire 6way Conference Bridge Involving Three (3) 104462B modules in a 24X Mounting Assembly.



Typical 4wire 6way conference bridge involving three 104462B modules in a 24X Mounting Assembly

used in the conference bridge. An option switch (or switches) disables the transfer of their combined VF signals to the left, right, or both, allowing for more than one discrete bridge to coexist within the same 24X Assembly.

1.04 For each 4wire channel of the 104462B, receive and transmit levels can be adjusted while the module is in place and operating. RCV IN levels from –23 to +7dBm can be set by means of front-panel rcv level controls without the use of a transmission measuring set (TMS). This is made possible by two front-panel LEDs that serve as over-range and under-range indicators. XMT OUT levels from –20 to +8dBm (based on internal bus levels) are set by means of front panel xmt level controls and are verified at the XMT OUT port. Front-panel bantam-type opening jacks facilitate alignment and maintenance procedures. Both channel-1 and channel-2 receive and transmit facility-side ports maintain constant input and output levels regardless of the terminating impedances selected. Sidetone at a typical –14.5dB level (re:internal bus level) can be introduced via switch option into each channel independently.

1.05 Two types of amplitude equalization are available in the channel-1 and channel-2 receive paths for post-equalization of the incoming pairs. For loaded cable (LD), a compromise bump equalizer inserts a 3dB bump at 3200Hz (re:1004Hz) and provides 1.5dB of roll-off at 404Hz (re: 1004Hz). For nonloaded cable, an active prescription slope equalizer introduces from 0 to 7.5dB of gain at 2804Hz (re:1004Hz) in switch-selectable 0.5dB increments. Either or both equalizers can be inserted into a channel's receive signal path by means of front-panel switches. When both equalizers are used simultaneously, their effect upon the receive-path frequency response is additive. Because neither equalizer affects 1004Hz levels, equalization can be introduced not only before but also after levels are set, with no interference between level and equalization adjustments.

1.06 The transformer-coupled transmit and receive facility-side ports in the module's two 4wire channels can be switched-optioned for balanced 1200, 600 or 150-ohm terminating impedance. For each channel, the given impedance switch setting provides the same terminating impedance for both of that channel's facility-side ports. All four transformers on the module are center-tapped to derive balanced simplex (SX) leads. As an alternative to normal SX-lead derivation, the module can be switched-optioned to apply 20mA of internally generated sealing current at the channel-1 and channel-2 facility-side ports independently. An integral "ZAP" feature provides a momentarily higher initial level of sealing-current when the module is powered up. Front panel LEDs light when the internal sealing-current option is selected; these are the same LEDs used to indicate receive levels when the front-panel test switch is set to TEST1 or TEST2. All ports of the 104462B are surge-protected.

1.07 An internally regulated power supply allows the 104462B to operate on filtered, ground-referenced –22 to –56VDC input power except when internally generated sealing current is selected for one or both channels, in which case input voltage must be –42 to –56VDC. Maximum current consumption at –48VDC is 40mA at idle, 75mA maximum without sealing current, and 117mA maximum with sealing current selected for one or both channels. The power supply features reverse-battery protection and transient-limiting circuitry, while a filter network minimizes noise and ripple.

1.08 The 104462B mounts in one position of an Accurate 24X Mounting Assembly or in a Type 10 Mounting Shelf or apparatus case. The 24X Mounting Assembly is a pre-configured, connectorized printed circuit board (PCB) mounting shelf available in 19-inch and 23-inch versions. Type 10 shelves are available in several versions for relay rack and apparatus case installation. Up to 12 modules can be mounted across a 19-inch shelf or 24XA Assembly, while up to 14 modules can be mounted across a 23-inch shelf or 24XB Assembly. In either case, 6 inches of vertical rack space (e.g., 3.5 mounting space) is used.

2. APPLICATION

2.01 This module is designed for use on two 4wire VF transmission facilities, where it provides active bi-directional level control and impedance matching and establishes a common conference bridge arrangement when mounted in an Accurate 24X Assembly. In addition, the 104462B also provides receive-path post-equalization for both 4wire facilities (channel-1 and channel-2). Within a 104462B module, the receive port of one 4wire channel is connected to the transmit port of the adjacent 4wire channel of the same module while maintaining minimum cross-coupling to the transmit port of its own associated 4wire channel. Therefore, each individual module establishes a dual 4wire conference bridge.

2.02 Multiple 104462B modules can be installed in a 24X or other Type 10 Mounting Assembly to provide voice-conferencing arrangements. Figure 3 shows a typical 4wire 6way voice-conferencing bridge configuration using three 104462B modules.

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2.03 Levels at the receive and transmit ports of both 4wire channels are individually set via front-panel controls. The receive ports are arranged such that incoming VF signals, whose levels can range from –23 to +7dBm, are adjusted and transferred to the common conference buses at a predefined level. The transmit ports can be adjusted to provide transmission output levels of –20 to +8dBm. All ports are equipped with constant-power circuitry to ensure that input and output signal levels remain constant regardless of the selected terminating impedance. For example, levels that are set during alignment with 600 ohm module and test equipment settings will remain the same when the module's terminating impedance is changed to 150 or 200 ohms.

2.04 Both the receive and transmit transmission levels, as well as the internal bus levels, can be quickly and easily adjusted with the 104462B module mounted in its normal operating position in the 24X Assembly or Type 10 Shelf. The only external test equipment required is a TMS at the distant end. The module's front-panel test switch, SC1 and SC2 LEDs and internal reference circuitry eliminate the need for local test equipment during level alignment. When the test switch is set to either the TEST1 or TEST2 position (for channel-1 or channel-2, respectively), the channel being aligned is removed from the bridge, and the SC1 LED becomes an over-range indicator and SC2 LED becomes the under-range indicator. The rcv level control is properly adjusted when both LEDs are off in channel-1 or channel-2 test mode. The transmit level is then adjusted to provide an appropriate level reading at the output port. After the levels for both channels are set, the test switch is reset to off, returning the module to normal service and reconfiguring the LEDs to serve their primary functions as sealing-current flow indicators.

AMPLITUDE EQUALIZATION

2.05 Two switch-selectable modes of amplitude equalization are available for the receive path of each of the 104462B module's two 4wire channels. These modes are active prescription slope-type equalization for nonloaded cable and compromise bump-type equalization for loaded cable. Both equalization modes are described in detail as follows.

Note: Because the transmit path is generally used to coordinate levels rather than to reduce facility loss, no transmit equalization is available. Transmit equalization (i.e., pre-equalization) tends to amplify high-frequency signals to a level conducive to crosstalk. Receive equalization (i.e., post-equalization) not only eliminates this problem, but also expedites the equalization procedure because the circuit is easier to equalize at the receive end.

2.06 With active prescription slope equalization for nonloaded cable selected in a channel (front-panel channel-1 or channel-2 RX EQL ld switch set to NL), from 0 to 7.5dB of gain at 2804Hz (re:1004Hz) can be introduced in switch-selectable 0.5dB increments. Typical flatness achievable with the slope equalizer is ±0.3dB from 404 to 3200Hz (re:1004Hz). Typical frequency response of each channel's slope equalizer is shown in Table 1.

2.07 With compromise bump equalization for loaded cable selected in a channel (front-panel channel-1 or channel-2 RX EQL ld switch set to LD), a 3dB bump is inserted at 3200Hz (re:1004Hz and 1.5dB of roll-off is provided at 404Hz (re:1004Hz). Typical frequency response of each channel's compromise bump equalizer is shown in tabular form in Table 2.

2.08 For each channel, the response curves of both the slope equalizer and the bump equalizer "pivot" at 1004Hz. Therefore, neither equalizer has any

TABLE 1. Typical 104462B Slope Equalization Frequency Response

Slope Equalizer Switch Setting (dB), LD Switch Out	Equalization Gain (in dB) Introduced at Various Frequencies									
	300Hz	**404Hz**	**500Hz**	**800Hz**	**1004Hz**	**1500Hz**	**1800Hz**	**2500Hz**	**2804Hz**	**3200Hz**
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	-0.2	-0.2	-0.1	-0.1	0.0	+0.2	+0.3	+0.4	+0.5	+0.5
1.0	-0.3	-0.3	-0.3	-0.1	0.0	+0.4	+0.5	+0.9	+1.0	+1.1
1.5	-0.5	-0.5	-0.4	-0.2	0.0	+0.5	+0.8	+1.3	+1.5	+1.6
2.0	-0.7	-0.6	-0.5	-0.2	0.0	+0.7	+1.1	+1.8	+2.0	+2.2
2.5	-0.9	-0.8	-0.7	-0.3	0.0	+0.9	+1.4	+2.2	+2.5	+2.7
3.0	-1.1	-0.9	-0.8	-0.3	0.0	+1.1	+1.6	+2.7	+3.0	+3.3
3.5	-1.2	-1.1	-0.9	-0.4	0.0	+1.3	+1.9	+3.1	+3.5	+3.9
4.0	-1.5	-1.3	-1.2	-0.5	0.0	+1.3	+2.0	+3.4	+3.9	+4.4
4.5	-1.6	-1.5	-1.3	-0.5	0.0	+1.5	+2.3	+3.9	+4.4	+5.0
5.0	-1.8	-1.6	-1.4	-0.6	0.0	+1.6	+2.5	+4.3	+4.9	+5.6
5.5	-2.0	-1.8	-1.5	-0.6	0.0	+1.8	+2.8	+4.8	+5.5	+6.2
6.0	-2.2	-2.0	-1.7	-0.7	0.0	+1.9	+3.0	+5.2	+6.0	+6.9
6.5	-2.4	-2.1	-1.8	-0.8	0.0	+2.1	+3.2	+5.6	+6.5	+7.5
7.0	-2.6	-2.3	-2.0	-0.8	0.0	+2.2	+3.4	+6.0	+7.0	+8.2
7.5	-2.7	-2.5	-2.1	-0.9	0.0	+2.3	+3.6	+6.4	+7.5	+8.9

TABLE 2. Typical 104462B Compromise Bump Equalization Frequency Response

Front-Panel ld Switch Setting	Equalization Gain (in dB) introduced at Various Frequencies									
	300Hz	**404Hz**	**500Hz**	**800Hz**	**1004Hz**	**1500Hz**	**1800Hz**	**2500Hz**	**2804Hz**	**3200Hz**
NL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD	-2.5	-1.5	-0.9	-0.2	0.0	+0.2	+0.3	+0.6	+1.1	+3.1

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effect on 1004Hz levels. As a result, equalization can be introduced not only before but also after receive levels are set, with no interference between level and equalization adjustments.

2.09 It is possible to introduce both modes of equalization into a channel simultaneously. If this is done, the resulting equalized gain at any frequency is the sum of the gain introduced by each equalizer at that frequency, as listed in Table 1 and Table 2. For example, if both equalizers are used and the slope equalizer is set for 3.5dB of gain at 2804Hz (re:1004Hz), the total amount of equalized gain at 800Hz is –0.6dB, which is the sum of –0.4dB (from Table 1) and –0.2dB (from Table 2). As a second example, with the same slope equalizer setting, the amount of equalized gain introduced by both equalizers at 1800Hz is +2.2dB, which is the sum of +1.9dB (from Table 1) and +0.3dB (from Table 2). Please note that even if both equalizers are used, there is no effect upon 1004Hz levels, as explained in paragraph 2.8).

Note: Accurate recommends that if both equalizers in a channel are used simultaneously, only a small amount of slope equalization be introduced. Large amounts may cause instability in the form of ringing or oscillation.

IMPEDANCE MATCHING

2.10 The impedance-matching transformers at the facility-side receive and transmit ports of both 4wire channels of the 104462B can be switch-optioned for balanced 1200, 600, or 150 ohm terminating impedance. For each channel, this impedance selection is separate and independent. A given impedance setting, however, affects both facility-side ports of a channel. The 1200 ohm option is used for interface with loaded cable; the 600 ohm option for interface with nonloaded cable or carrier; and the 150 ohm option, to provide a small amount of slope equalization for long sections of nonloaded cable through the deliberate impedance mismatch. In addition, each of the four impedance-matching transformers is center-tapped to derive a balanced SX-lead.

SEALING CURRENT

2.11 Option switches on the 104462B select either internally-generated sealing current or normal SX-lead derivation independently for each channel's facility-side ports. When internal sealing current is selected for a channel, 20mA of sealing current flows from that channel's XMT OUT ports and returns via the channel's RCV IN ports. A ZAP feature integral to the 104462B's sealing current supply provides a momentarily higher level of current to eliminate existing oxidation or corrosion when the sealing current option is initially activated. Front-panel LEDs function as sealing current flow indicators (SC1 and SC2; the same used in the level-alignment procedure).

SIDETONE

2.12 Sidetone at a typical –14.5dB level (re:internal bus level) can be independently selected for each 4wire channel via switch option, if required.

3. INSTALLATION

INSPECTION

3.01 Visually inspect the 104462B module upon its arrival to detect any possible damage incurred during shipment. If damage is noted, immediately file a claim with the carrier. If the module is stored, reinspect both the module(s) and the mounting assembly prior to installation.

MOUNTING

3.02 The 104462B mounts in one position of an Accurate 24X Mounting Assembly or in one position of a Type 10 Mounting Shelf or apparatus case. When a 24X Assembly is used, the bypass switch on the assembly backplane must be set to OFF at each module position containing a 104462B. A switch option on the 104462B enables or disables extension of the common conference bridge to the module positions to the left and right of the 104462B's own position in the 24X Assembly.

INSTALLER CONNECTIONS

3.03 If the 104462B module is to be installed in a 24X Assembly, no intermodule connections to the module need to be made because the assembly is internally prewired to accommodate multiple 104462B modules without adding wiring. All external connections to the assembly itself are made quickly and easily via 25-pair male cables. Refer to the Accurate 24X Mounting Assembly practice for details.

Note: At each 24X Assembly module position that houses a 104462B, the bypass switch at the rear of the module position must be set to OFF.

3.04 If the 104462B is to be installed in an unwired Type 10 Shelf, all required connections to the module must be made. Before doing so, ensure that power is off and modules are removed. The module should be put into place only after it is properly optioned and after wiring is completed.

3.05 Table 3 lists external connections to the 104462B. If the module is to be installed in a Type 10 Shelf, all connections are made via wire-wrapping to the 56-pin connector at the rear of the module's shelf position. Pin numbers are found on the body of the connector.

TABLE 3. External Connections to 104462B

CONNECT	TO PIN:
CH1 RCV Tip	7
CH1 RCV Ring	13
CH1 RCV SX	44
CH1 XMT Tip	41
CH1 XMT Ring	47
CH1 XMT SX	48
CH2 RCV Tip	9
CH2 RCV Ring	43
CH2 RCV SX	8
CH2 XMT Tip	45
CH2 XMT Ring	49
CH2 XMT SX	14
TR (Conference Bus XMT Right)	19
RR (Conference Bus RCV Right)	31
TL (Conference Bus XMT Left)	27
RL (Conference Bus RCV Left)	23
-BATT (-22 to –56VDC Without Sealing Current, -42 to	35
GND (Ground)	17

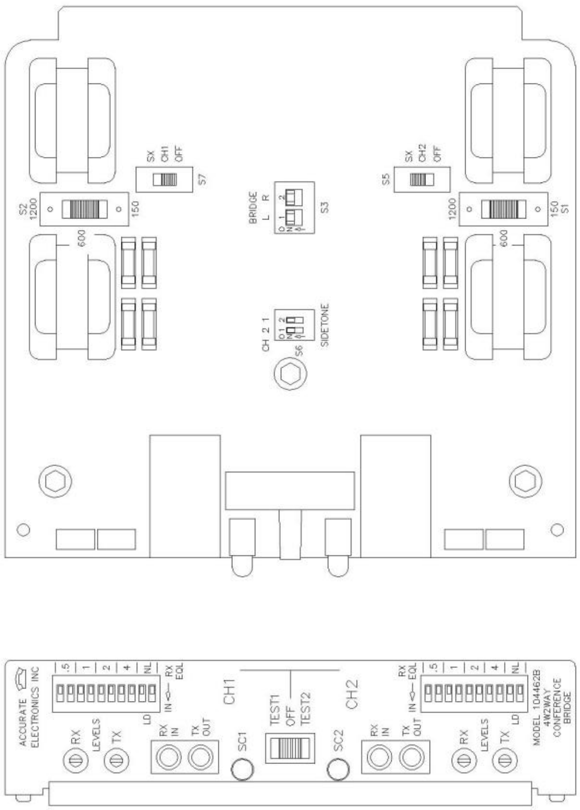
OPTIONING AND ALIGNMENT

3.06 Optioning and alignment of the 104462B is comprised of the following for each of the module's two 4wire channels:

- Selecting the terminating impedance at the facility-side receive and transmit ports
- Adjusting the receive and transmit levels
- Enabling or disabling sidetone
- Selecting sealing current or SX leads
- Setting the bridge-expansion switch
- Adjusting the receive-channel equalization

3.07 Instructions for optioning and aligning the module are provided below. Locations of the option and alignment switches on the module are shown in Figure 2.

FIGURE 2. Option Switch Locations and Front Panel Switches and Controls.



TERMINATING IMPEDANCES

3.08 Terminating impedances at the 104462B's channel-1 and channel-2 facility-side ports are selected via switches S2 and S1, respectively. While a choice of 1200, 600, or 150 ohms is available in channels 1 and 2 independently, the single impedance switch for each channel selects the same impedance at both facility-side ports (receive and transmit) in that channel. Set switches S2 (channel-1) and S1 (channel-2) as follows:

- For 1200 ohms, as is normally required for interface with loaded cable, set S2 and/or S1 to 1200.
- For 600 ohms, as is normally required for interface with nonloaded cable or carrier, set S2 and/or S1 to 600.
- For 150 ohms, which provides a small amount of slope equalization for nonloaded cable through the deliberate impedance mismatch, set S2 and/or S1 to 150.

SIDETONE

3.09 Provision of sidetone is controlled by two-position DIP switch S6. Set this switch as follows:

- For sidetone in channel-1, set position 2 of S6 to ON. If sidetone is not required in channel-1, set S6-2 to OFF.
- For sidetone in channel-2, set position 1 of S6 to ON. If sidetone is not required in channel-2, set S6-1 to OFF.

BRIDGE EXPANSION

3.10 Although each 104462B by itself establishes a dual 4wire conference bridge, the bridge size in a 24X Assembly can be expanded as required to a maximum of all 104462B modules in the assembly. Bridge size is controlled by the two-position Bridge DIP switch, S3, on each 104462B in the assembly. Switch S3-1 determines whether or not the 104462B interfaces the module located directly to its left in the shelf (as viewed from the front). Setting the switch to ON enables the interface; OFF disables it. Switch S3-2 performs the same function but affects the module to the right. Thus, any number of the modules (up to 12 in a 19-inch assembly and up to 14 in a 23-inch assembly) can be used to form an expanded bridge. In addition, switch S3 allows a number of separate and independent conference bridges to coexist within the same 24X Assembly. For example, the 4wire 6way conference bridge shown in Figure 3 is arranged by using three 104462B modules with their Bridges switches arranged as follows:

- Module position 1: S3-1 OFF, S3-2 ON for interface to the right only
- Module position 2: S3-1 ON, S3-2 ON for interface to both the left and the right
- Module position 3: S3-1 ON, S3-2 OFF for interface to the left only

3.11 In your particular application, option each 104462B module as required for its position as part of a bridge in the 24X Assembly.

SEALING CURRENT/SX LEADS

3.12 Switches S5 and S7 select, for channels 2 and 1 respectively, either SX leads or sealing current on the 104462B's facility side. Set these switches as follows:

- For 20mA of internally generated sealing current on the facility side of channel-1, set switch S7 to the SX position. For access to channel-1's facility-side SX leads, or if sealing current is not required for channel-1, set S7 to OFF.
- For 20mA of internally generated sealing current on the facility side of channel-2, set switch S5 to the SX position. For access to channel-2's facility-side SX leads, or if sealing current is not required for channel-2, set S5 to OFF.

ALIGNMENT: LEVEL ADJUSTMENT

3.13 The receive ports of the 104462B can accept transmission input levels from –23 to +7dBm, and the transmit ports can provide transmission output levels from –20 to +8dBm. After ensuring that the module is properly optioned, install it in its mounting position, apply power, and adjust the receive and transmit levels as directed below. Although the following procedure covers only channel-1 alignment, it is equally applicable to channel-2 alignment.

Note: When aligning channel-2, the front-panel test switch must be set to the ch2 test position in Step 2.

1. Set all five positions of the channel-1 rcv eql DIP switch to out for no equalization at this time.
2. Set the front panel test switch to the TEST1 position.
3. Adjust the front-panel channel-1 rcv level and xmt level controls fully counterclockwise (CCW). The SC2 LED should now be on.
4. Request personnel at the distant end of the channel-1 facility to send 1004Hz test tone at the output level specified on the circuit layout record (CLR) for that end. As an alternate method, the module's front-panel rcv in and xmt out jacks can be used in conjunction with local test equipment to insert tone and measure levels.
5. Adjust the rcv level control clockwise (CW until the SC2 LED goes off, but not far enough CW to cause the SC1 LED to go on. The incoming signal is now properly adjusted to the predefined bus level.
6. Now adjust the xmt level control until the level of the signal returned to the distant end equals the CLR-specified input level for that end.

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ALIGNMENT: EQUALIZATION ADJUSTMENT

3.14 To adjust the receive path equalization on the 104462B, proceed as directed below. Although the following procedure covers only channel-1 alignment, it is equally applicable to channel-2 alignment.

Note: When aligning channel-2, the front panel test switch must be set to the ch2 test position.

LOADED-CABLE EQUALIZATION

1. If the channel-1 facility consists of loaded cable and compromise bump equalization is desired, set the ld position of the front panel channel-1 rcv eql DIP switch to LD. This provides the frequency response curve indicated in Table 2. If desired, this curve can be altered by setting one or more of the dB-value positions of the channel-1 rcv eql DIP switch to in. If no equalization is desired, set all five positions of the channel-1 rcv eql DIP switch to out.

NONLOADED-CABLE EQUALIZATION

2. If the channel-1 facility consists of nonloaded cable, set the ld position of the front panel channel-1 rcv eql DIP switch to NL (away from LD).
3. Arrange the receive portion of a TMS for 600 ohm terminated measurement and connect it to the module's front-panel channel-1 rcv in jack.
4. Request personnel at the distant end of the channel-1 facility to send 1004Hz tone and 2804Hz tone, both at the CLR specified output level for that end. Measure and record the level at which each tone is received.
5. Subtract the 2804Hz level measure in Step 4 from the 1004Hz level (also measured in Step 4).
6. If the difference calculated in Step 5 is 0.3dB or greater, set to in the proper combination of channel-1 rcv eql dB-value DIP switch positions that most closely approximates this difference, as directed in Table 4. If no equalization is required, set all five positions of the channel-1 rcv eql DIP switch to out.

TABLE 4. Receive Equalization Setting from Cable Loss Data

1004Hz-2804Hz Difference	Amount of Equalized Gain Required
0.0 to 0.2dB	0.0dB
0.3 to 0.7dB	0.5dB
0.8 to 1.2dB	1.0dB
1.3 to 1.7dB	1.5dB
1.8 to 2.2dB	2.0dB
2.3 to 2.7dB	2.5dB
2.8 to 3.2dB	3.0dB
3.3 to 3.7dB	3.5dB
3.8 to 4.2dB	4.0dB
4.3 to 4.7dB	4.5dB
4.8 to 5.2dB	5.0dB
5.3 to 5.7dB	5.5dB
5.8 to 6.2dB	6.0dB
6.3 to 6.7dB	6.5dB
6.8 to 7.2dB	7.0dB
7.3 to 7.7dB	7.5dB

4. CIRCUIT DESCRIPTION

4.01 This circuit description is intended to familiarize you with this module for engineering and application purposes only. Attempts to test or troubleshoot the 104462B internally are not recommended and may void your Accurate warranty. Procedures for recommended testing in the field are limited to those described in Section 8. To help you follow this circuit description, refer to the block diagram in section 5.

OVERVIEW

4.02 The 104462B contains circuitry to interface two 4wire VF facilities (channel-1 and channel-2). Level control and impedance matching are provided for the receive and transmit ports of each 4wire VF channel. Receive path post-equalization is available for loaded or nonloaded cable. The 104462B also contains test and level-detection circuitry, sidetone circuitry, summing and buffer amplifiers for busing, an internal sealing current source, and power supply. Each of these is described throughout the remainder of this section.

POWER SUPPLY

4.03 The power supply in the 104462B 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 power connections, and transorb between input battery and ground limits high-level supply transients to a safe level.

SEALING CURRENT AND SX LEADS

4.04 Switch S7 selects either internally-generated sealing current or balanced SX-lead derivation for channel-1. Switch S5 does the same for channel-2. When the internal sealing current supply is selected for a channel, current at 20mA (nominal) is fed to the external 4wire facility via the XMT OUT port and returns to the module via the RCV IN port. A ZAP feature provides a greater level of sealing current (34 to 51mA) for approximately 1 second when power is initially applied to the module. Sealing-current flow is indicated by two front-panel LEDs (one for each channel).

RECEIVE PORTS AND FACILITY-SIDE IMPEDANCE MATCHING

4.05 The 104462B interfaces the 4wire facilities via channel-1 and channel-2 constant impedance transformers, each of which is center-tapped to derive a balanced SX-lead. A silicon transient suppressor is provided on the secondary of each transformer. Both facility-side transformers in each channel can be switch-optioned for balanced 1200, 600 or 150 ohm terminating impedance.

RECEIVE LEVEL CONTROL

4.06 Operational amplifier integrated circuits (op-amp ICs) provide voltage gain at the receive ports. Each channel's voltage-gain stage (volt amp) uses negative feedback to enhance amplifier stability and setability, and gain is adjusted by varying the negative feedback. This approach to gain control provides, in addition to optimum gain setability, optimum output signal-to –noise performance. Gain in each channel is adjusted via a front-panel control over a 30dB (-23 to +7dB) range. Either or both channels' receive paths can be optioned to provide sidetone at a typical –14.5dB level (re:internal bus level).

RECEIVE AMPLITUDE EQUALIZATION

4.07 On the 104462B module, the secondary windings at each receive port feed a series-connected equalization amplifier that offers switch-selectable compromise bump-type and/or active prescription slope-type amplitude equalization.

TRANSMIT PORTS

4.08 Like the receive ports, each of the 104462B's transmit ports uses a constant-power output transformer to interface the external facilities and to derive SX-leads.

TRANSMIT LEVEL CONTROL

4.09 A voltage-gain amplifier (volt amp) similar to that at the receive ports is used to give each transmit port a 30dB output level range. This amplifier

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then drives a push-pull output stage that provides the increase in current required by the output transformer.

SUMMING AND BUFFER AMPLIFIERS

4.10 Summing amplifiers (sum amps) are also provided on the 104462B. Signals from the receive ports are brought into these amplifiers and are passed to the conference buses and to the opposite channel transmit port. Signals from the conference buses also enter these amplifiers and are passed to the transmit ports. The summing amplifiers are op-amp ICs with the amplifier loop gain set to unity. The summing amplifiers, along with two buffer amplifiers (buffer amps), isolate the transmit-port and receive-port voltage-gain amplifiers (volt amps) from the conference buses.

TEST AND LEVEL-DETECTION CIRCUITRY

4.11 Level-detection circuitry (over/under level detector) is provided on the 104462B as an aid in circuit alignment and to maintain a constant conference bus level. When the front-panel test switch is set to either the TEST1 or TEST2 position, the level-detection circuit is active. This switch also isolates the selected channel from the conference and connects its receive and transmit ports to allow setting of gain and equalization. The same switch also conditions the sealing-current LEDs (seal curr 1 and 2) to function as part of the level-detection circuitry.

4.12 Two sections of a quad op-amp IC are used for the level-detection circuit. These amplifiers serve as voltage comparators with a window approximately 0.5dB wide at –13.dBm. Each voltage comparator drives one of the sealing-current LEDs to give an over-range (SC1) or under-range (SC2) indication.

TEST JACKS

4.13 Bantam-type opening jacks are provided at the facility-side ports (RCV IN and XMT OUT) of both 4wire channels. To facilitate testing and alignment, each of these jacks isolates the module from the facility when a plug is inserted into the jack.

5. MECHANICAL OUTLINE

5.01 See FIGURE 2.

6. SPECIFICATIONS

6.01 Electrical

Receive Port, Channel-1 and Channel-2:

Input Impedance: 1200 ohms ± 10%, 600 ohms ± 10%, or 150 ohms ± 15%,switch-selectable

SX Current (Sink): 120Ma maximum, 5mA maximum unbalanced

Input Signal Range: -23 to +7dBm

Sidetone Level: Typical –14.5dB re: internal bus level, switch-selectable for either or both channels

Frequency Response (No Equalization): +0.5dB, 300, to 4000Hz (re: 1004Hz)

Receive Equalization:

Prescription slope-type - 0.0 to 7.5dB of gain (in switch-selectable 0.5dB increments) at 2804Hz re: 1004Hz

Compromise bump-type - 3.0dB bump at 3400Hz re: 1004hz and 1.5dB loss at 404Hz re: 1004Hz

Additive mode -

If both equalizers are used simultaneously, the results are additive: at a given frequency, the amount of equalization provided is the sum of the amounts listed in Table 1 and Table 2.

Transmit Port, Channel-1 and Channel-2:

Output Impedance: 1200 ohms ± 10%, 600 ohms ± 10%, or 150 ohms ± 15%, switch-selectable

SX Current (Sink): 120mA maximum, 5mA maximum unbalanced

Output Signal Range: -20 to +8dBm (with internal bus aligned)

Frequency Response: ±0.5db, 300 to 4000Hz (re: 1004Hz)

Noise: 20dBrnC maximum

Total Harmonic Distortion: less than 1% at +8dBm level

Crosstalk Loss Between Receive and Transmit Ports of Same 4Wire Channel: Greater than 50dB at 3000hz Greater than 57dB at 1000Hz

Common

Internal Sealing Current Source:

20± 6mA for loop resistances of 0 to 2500 ohms when module is powered by –48VDC, switch-selectable for either or both channels; integral ZAP feature provides momentarily higher current upon initial sealing-current activation.

Input Voltage: without internal sealing-current option activated: -22 to –56VDC, filtered, ground referenced

Maximum Input Current (at –48VDC):

40mA at idle, 75mA at maximum input and output levels (both channels active), with an additional 42mA required with sealing current flowing in both 4wire facilities

6.02 Environmental

Operating Environment: +32° to +122° F (0° to +50° C)

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

6.03 Physical

Dimensions 5.58” H x 1.42”W x 5.96” D (14.17cmH x 3.61cmW x 15.14cmD)

Weight: 14 ounces (397 grams)

Mounting:

relay rack via one position of an Accurate 24X Mounting Assembly or one position of an Accurate Type-10 Mounting Shelf

7. TESTING AND TROUBLESHOOTING

7.01 The Testing Guide Checklist may be used to assist in the installation, testing or troubleshooting of the product. The checklist is intended as an aid in the localization of trouble to a specific product. If a product is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute product operates correctly, the original product should be considered defective and returned to Accurate for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the product. Unauthorized testing or repairs may void the product’s warranty. Also, if the product is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

TECHNICAL ASSISTANCE

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

RETURN PROCEDURE (FOR REPAIR)

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

8. MAINTENANCE

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

9. WARRANTY

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

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

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

Contact Accurate Electronic Customer Service

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

Replacement

9.04 To obtain a replacement product, notify Accurate Electronics. Be sure to provide all relevant information, including the 104462B part number that indicates the issue of the product in question. Upon notification, we shall ship a replacement product to you. If the product in question is in warranty, the replacement will be shipped at no charge. Pack the defective product in the replacement product's carton, sign the packing slip included with the replacement, and enclose it with the defective product (this is your return authorization). Affix the preaddressed label provided with the replacement product to the carton being returned, and ship the product prepaid to Accurate Electronics.

Repair and Return

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

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

10. ACRONYMS

CLR	Circuit Layout Record
CCW	Counter Clockwise
CW	Clockwise
HZ	Hertz
IC	Integrated Circuit
LD	Loaded Cable
LED	Light-emitting Diode
PCB	Printed Circuit Board
RCV	Receive
RL	Receive Left
RR	Receive Right
SX	Simplex (Lead)
TL	Transmit Left
TMS	Transmission Measuring Set
TR	Transmit Right
VF	Voice Frequency
VOM	Volt-Ohm Meter
XMT	Transmit

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TABLE 5. Test Guide Checklist

TEST	PROCEDURE	NORMAL RESULTS	IF NORMAL CONDITIONS ARE NOT MET, VERIFY:
Receive Path (Bus Level Adjustment)	Set test switch to ch1 test or ch2 test for channel being tested. Arrange xmt portion of TMS for 1004Hz tone output at –10dBm and at facility-side port impedance selected on module. Connect this signal to rcv in jack of channel under test. Adjust rcv level control of channel under test until both seal curr LEDs are off.	-As rcv level control is adjusted, both seal curr LEDs go off.	-Power -Wiring -Test switch properly set -Terminating impedance correct
Transmit Path Level Adjustment	Set test switch to ch1 test or ch2 test for channel being tested. Leave xmt portion of TMS arranged and connected as above. Arrange rcv portion of TMS for terminated measurement at facility-side port impedance selected on module, and connect it to xmt out jack of channel under test. Adjust xmt level control of channel under test fully CW and CCW. Observe TMS level readings at both control settings.	-With xmt level control fully CW, xmt output level is greater than + 10dBm. With xmt level control fully CCW, xmt output level is below –20dBm.	-Power -Wiring -Test switch properly set -Terminating impedance correct - rcv level control set as directed above
Receive Path Equalization, Bump-Type for Loaded Cable	Maintain all TMS connection as above. Set all rcv eql dB-value switches of channel under test to out. Set rcv eql ld switch of channel under test to in (toward ld). Arrange xmt portion of TMS for tone output of 404, 1004 and 2804Hz, all at 0dBm. Observe TMS level reading at all three frequencies.	TMS level readings should be as follows: - Approx. –1.5dBm at 404Hz - Approx. 0dBm at 1004Hz - Approx. +1.1dBm at 2804Hz	- Power - Wiring -Terminating impedances correct -Slide rcv eql dB-value and ld switches back and forth to clean contact surfaces -Impedance options correctly set -Input signal level (from TMS) constant over test range - Output level not exceeding +8dBm overload point
Receive Path Equalization, Prescription Slope for Non-loaded Cable	Maintain all TMS connections as above. Set all rcv eql dB-value switches of channel under test to out. Set rcv eql ld switch of channel under test to out (away from ld). Arrange xmt portion of TMS for tone output of 404, 1004 and 2804Hz, all at 0dBm. Observe TMS level reading at all three frequencies.	TMS level readings should be as follows: -Approx. –2.7dBm at 404Hz -Approx. 0dBm at 1004Hz -Approx. +7.3dBm at 2804Hz	-Same as above
Sealing Current	Set front panel test switch to off. Arrange Volt-Ohm Meter (VOM) to measure up to 50mA. With channel under test optioned for sealing current, connect VOM between that channel's xmt out and rcv in jacks.	VOM indicates approximately 20mA	- Switch S5 (channel-1) or S7 (Channel-2) set to SX CURR - Test switch set to off - Replace module and retest

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FIGURE 1. Circuit Description.