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GAI-TRONICS®
A HUBBELL COMPANY

Model LE200-RM
Rack-Mount Page/Party® Line Extender

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Rack-Mount Page/Party® Line Extender

Confidentiality Notice

General Information

The Model LE200-RM Rack-Mount Page/Party® Line Extender is used in pairs to extend the operating distance of Page/Party®, SmartSeries or ICS Page/Party® systems. Two system cable segments are connected through the Line Extender using either a two-pair copper cable or fiber optic cable depending on the distance required. The local and remote cable segments are electrically isolated through the Line Extenders. Refer to Figure 1 for a typical block diagram.

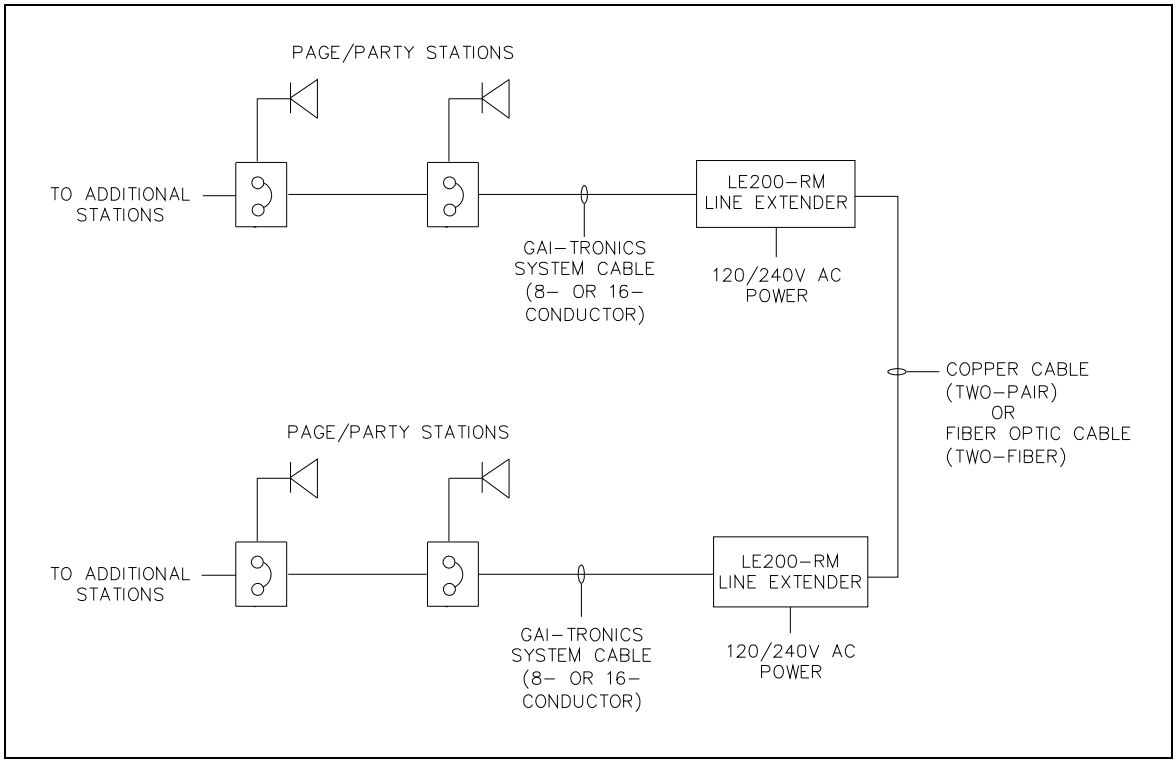

Figure 1. Typical System Block Diagram

Line Extender and Sub-Component Details

Refer to Figure 2 below for dimensional information and sub-component layout of the LE200-RM Line Extender.

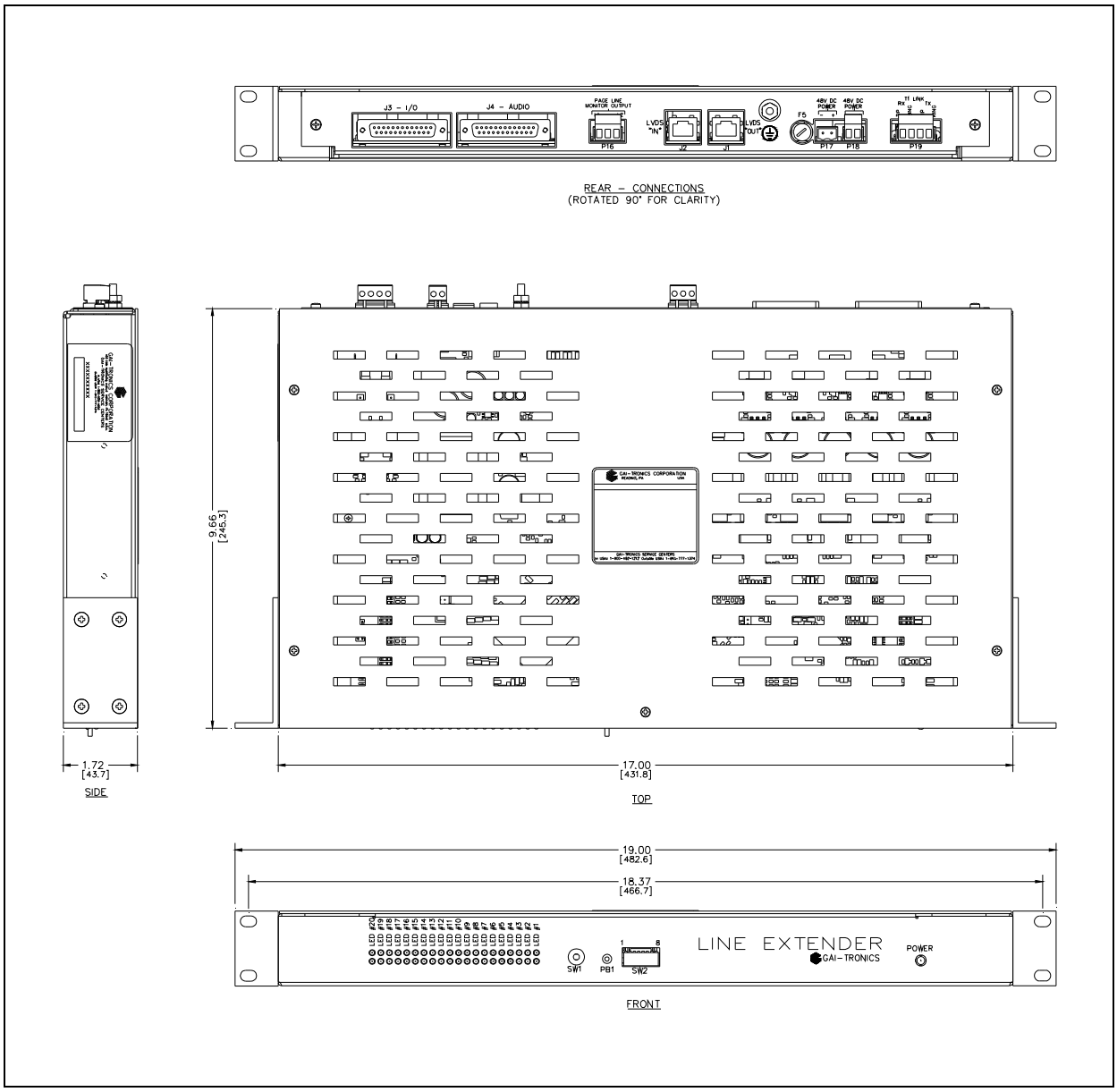

Figure 2. Model LE200-RM Line Extender Outline

PCBA Access

The Main PCBA can be easily accessed to set up switches and jumpers. Remove the two #6-32 screws from the rear of the unit. Slide the PCBA support plate and PCBA out of the unit. See Figure 3.

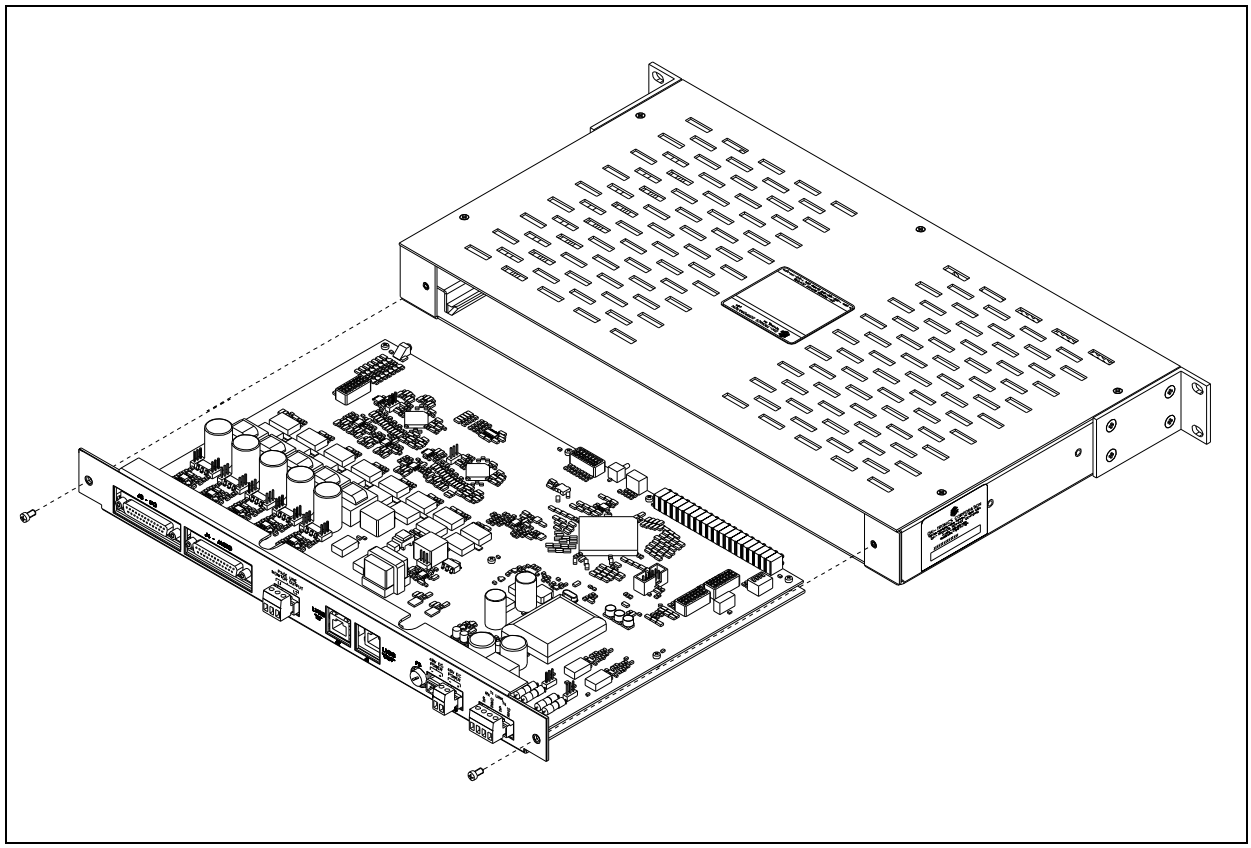

Figure 3. Access to the Model LE200-RM Line Extender's Main PCBA

Audio Termination Connection Module – Optional Model 12118-011 Kit

The GAI-Tronics Model 12118-011 Kit must be used if the LE200-RM is to be connected directly to a Page/Party® system. This kit consists of a ribbon cable for connection to the LE200-RM, an Audio Termination Connection Module for connection to the Page/Party® system and mounting hardware. The page line and party line 1–5 conductors of the Page/Party® system cable connect to the Audio Termination Connection Module. This module also can provide the 33-ohm line balance resistance needed for the audio lines. Audio line functions are described later in this manual.

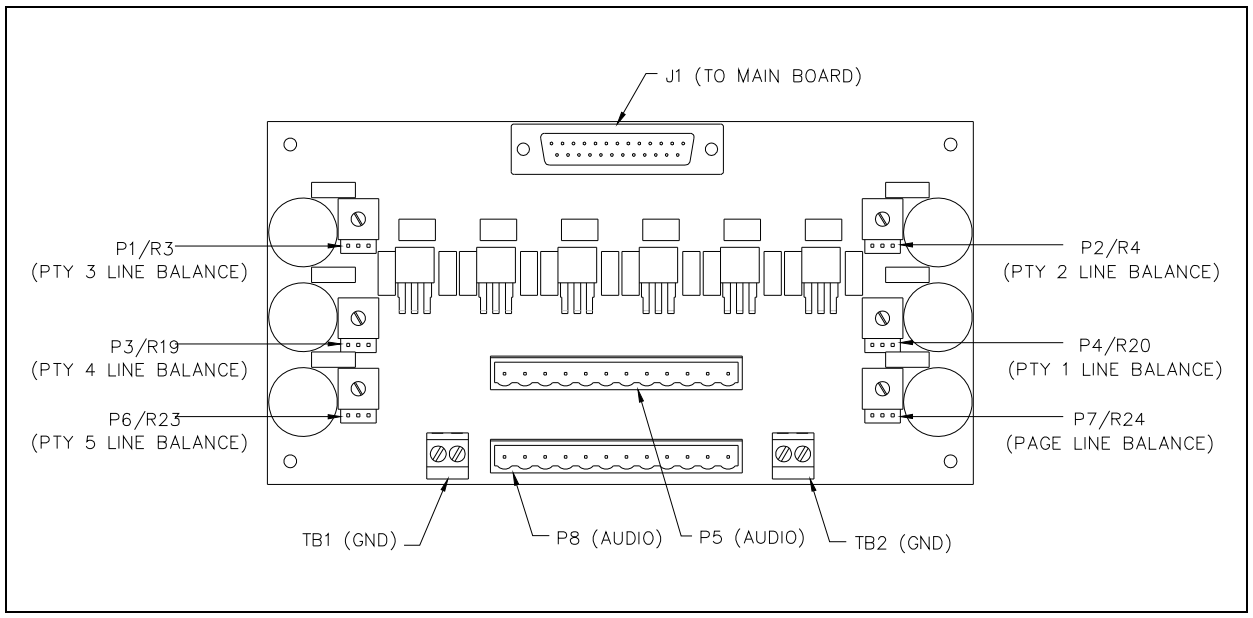

Figure 4. Audio Termination Connection Module

Input/Output (I/O) Termination Connection Module – Optional Model 12118-012 Kit

If the LE200-RM is to be connected directly to I/O wiring then the GAI-Tronics Model 12118-011 Kit is required. This kit consists of a ribbon cable for connection to the LE200-RM, an I/O Termination Connection Module and mounting hardware. The I/O Termination Connection Module is for connecting the control wiring needed to send contact closures across the Line Extenders. I/O features and functions are described later in this manual.

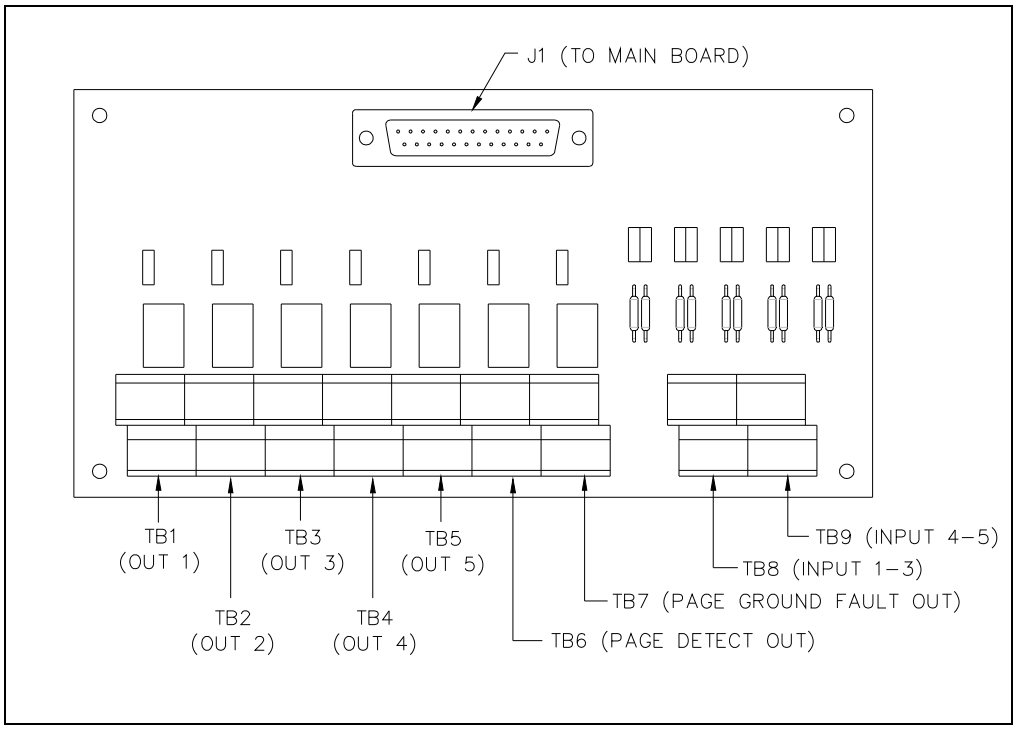

Figure 5. Input/Output (I/O) Connection Module

Main PCBA

The Main PCBA contains all the central processing and line driver circuitry for the Line Extender. The board contains numerous connectors, switches and jumpers for setting the Line Extender operating parameters. Figure 6 below identifies the various components on the Main PCBA. Features and functions of each are described later in this manual.

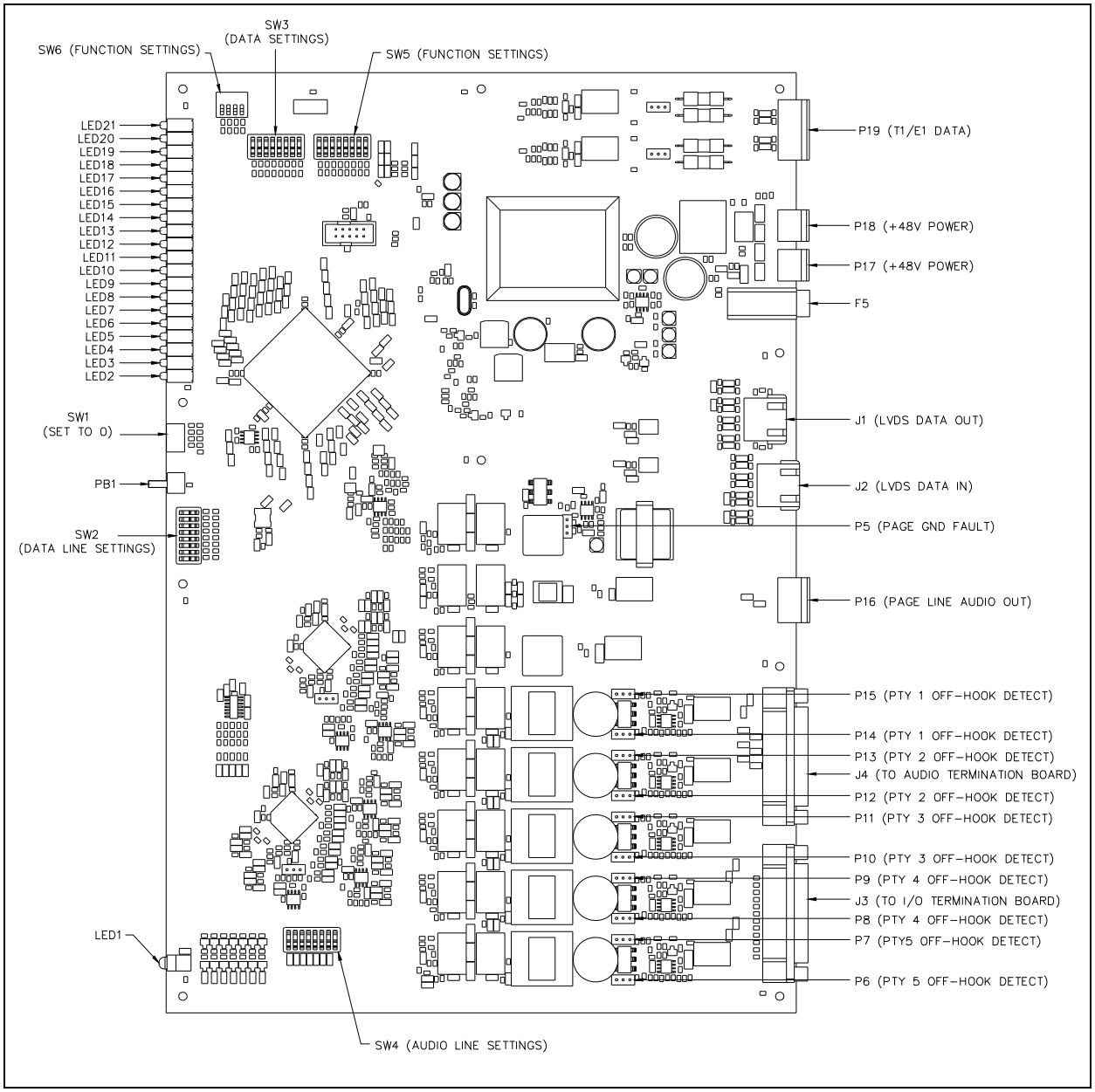

Figure 6. 69443-*xxx* Main PCBA

Features and Functions

The Model LE200-RM Page/Party® Line Extenders provide the following features between Page/Party® system cables.

Page Line Audio Transmission

A pair of Model LE200-RMs provides page line audio transmission between two Page/Party® system cables. This transmission is half-duplex operation.

When the Line Extender detects a peak audio level equal or above a **Peak Voltage Level Detection Threshold**, it immediately switches audio "on" in that direction for the **Transmission Direction Hold Time.** Audio from the other direction is muted and ignored during that time. Audio is not switched "off" until it is continuously below the Peak Voltage Level Detection Threshold for the Transmission Direction Hold Time. The DIP switch SW2 positions 5–7, located on the Main PCBA, selects Peak Voltage Level Detection Threshold and Transmission Direction Hold Time. Refer to Figure 6 for the location of switch SW2 on the Main PCBA and Table 1 and Table 2 below for setting options.

Table 1. Transmission Direction Hold Time Settings on Main PCBA

SW2-5	SW2-6	Transmission Direction Hold Time
Open*	Open *	1280 milliseconds
Closed	Open	640 milliseconds
Open	Closed	160 milliseconds
Closed	Closed	40 milliseconds

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Table 2. Peak Voltage Level Detection Threshold on Main PCBA

SW2-7	Peak Voltage Level Detection Threshold
Open*	−12 dB relative to nominal
Closed	−24 dB relative to nominal

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Page Line Audio Monitoring Output

The Model LE200-RM provides a balanced 600-ohm audio output for monitoring audio on both the local and remote page lines. LE200-RM mixes the local and remote page line audio and routes it to the 600-ohm audio output terminals. This audio can be sent to any external audio device (recorder, radio transmitter, amplifier, etc.) with an input impedance equal to or greater than 600 ohms. The audio output gain is adjustable using DIP switch SW3 positions 5–8 on the Main PCBA. Refer to Figure 6 for the location of switch SW3 on the Main PCBA and Table 3 below for setting options.

Table 3. Page Line Monitor Output Gain Setting on Main PCBA

SW3-5	SW3-6	SW3-7	SW3-8	Monitor Output Gain
Open*	Open*	Open*	Open*	0 dB
Closed	Open	Open	Open	−30 dB
Open	Closed	Open	Open	−27 dB
Closed	Closed	Open	Open	−24 dB
Open	Open	Closed	Open	−21 dB
Closed	Open	Closed	Open	−18 dB
Open	Closed	Closed	Open	−15 dB
Closed	Closed	Closed	Open	−12 dB
Open	Open	Open	Closed	−9 dB
Closed	Open	Open	Closed	−6 dB
Open	Closed	Open	Closed	−3 dB
Closed	Closed	Open	Closed	0 dB
Open	Open	Closed	Closed	+3 dB
Closed	Open	Closed	Closed	+6 dB
Open	Closed	Closed	Closed	+9 dB
Closed	Closed	Closed	Closed	+12 dB

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Page Line Audio Detect Output Contact

The Model LE200-RM provides a contact closure output that activates whenever audio is detected on the page line. The contact can be set to close when audio is detected at the local page line, the remote page line, or both. Typically this contact is used in conjunction with the Page Line Audio Monitoring Output to provide a control contact to external devices or systems when page line audio is present. The contact remains active for 1 second after the audio is no longer detected. DIP switch SW5 positions 6 and 7 enables or disables the output contact. Refer to Figure 6 for the location of switch SW5 on the Main PCBA and Table 4 below for setting options.

Table 4. Page Line Audio Detect Contact Main PCBA

SW5-6	SW5-7	Audio Detect Contact Operation
Closed	Closed	Disabled
Open	Closed	Local page line audio activates the contact
Closed	Open	Remote page line audio activates the contact
Open*	Open*	Both local and remote page line audio activates the contact

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Page Line FSK Data Transmission (SmartSeries Systems)

A pair of Model LE200-RM Line Extenders re-generates the FSK data transmission between two SmartSeries Page/Party® system cables. FSK data transmission occurs on the page line allowing SmartSeries Page/Party® stations to communicate with the system control cabinet. For proper operation, both Line Extenders must have this feature enabled by setting DIP switch SW5 position 1. Refer to Figure 6 for the location of switch SW5 on the Main PCBA and Table 5 below for setting options.

Table 5. Page Line FSK Transmission on Main PCBA

SW5-1	Page Line FSK Transmission
Open*	FSK data is disabled.
Closed	FSK data is enabled.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

NOTE: FSK operation and VLC operation (described below) cannot be enabled at the same time. FSK operation is only used with SmartSeries systems.
VLC operation is only used within NON-SmartSeries systems. If both VLC and FSK are enabled at the same time, neither feature will function correctly.

Page Line 50 kHz VLC Transmission

A pair of Model LE200-RM Line Extenders re-generates the 50 kHz VLC control signal between two Page/Party® system cables. 50 kHz VLC signaling occurs on the page line and is typically used to alter the speaker volume of Page/Party® stations equipped VLC receivers. VLC signals may also be used for other on/off control functions on some Page/Party® systems. For proper operation, both Line Extenders must have this feature enabled by setting DIP switch SW5 position 2. Refer to Refer to Figure 6 for the location of switch SW5 on the Main PCBA and Table 6 below for setting options.

Table 6. Page Line 50 kHz VLC Transmission Setting on Main PCBA

SW5-2	Page Line 50 kHz VLC Transmission
Open*	50 kHz VLC is disabled.
Closed	50 kHz VLC is enabled.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

NOTE: FSK operation and VLC operation (described above) cannot be enabled at the same time. FSK operation is only used with SmartSeries systems.
VLC operation is only used within NON-SmartSeries systems. If both VLC and FSK are enabled at the same time, neither feature will function correctly.

Page Line Ground Fault Detection

The Model LE200-RM Line Extenders provide page line ground fault detection on the local Page/Party® system cable. If multiple LE200-RMs are connected to the same Page/Party® system cable segment, only one page line ground fault detector may be enabled. A shorting clip setting at header P5 on the Main PCBA enables the page line ground fault detection. Refer to Figure 6 for the location of header P5 on the Main PCBA and Table 7 below for setting options:

Table 7. Page Line Ground Fault Detection Setting on Main PCBA

P5 Shorting Clip	Page Line Ground Fault Detection
Pins 1–2*	Page line ground fault detection is disabled.
Pins 2–3	Page line ground fault detection is enabled.
Removed	Page line ground fault detection is disabled.

NOTES:

1. If connecting an LE200-RM to the same system cable segment as an ADVANCE Page/Party® Interface (PPI) card, disable the LE200-RM page line ground fault detector. The PPI card contains the ground fault detector. If both ground fault circuits are enabled simultaneously, intermittent SmartSeries FSK data errors will occur between the PPI card and SmartSeries stations.
2. Changes to this parameter take effect without cycling power.
3. *Indicates default position.

Page Line Ground Fault Re-generation

When a ground fault is detected at a remote LE200-RM Line Extender, the ground fault can be duplicated on the local Page/Party® system cable. DIP switch SW5 position 3 enables regeneration of the ground fault. Refer to Figure 6 for the location of switch SW5 on the Main PCBA and Table 8 below for setting options.

Table 8. Page Line Ground Fault Regeneration Setting on Main PCBA

SW5-3	Page Line Ground Fault Regeneration
Open*	Disabled - Page line ground faults detected on the remote system cable are NOT regenerated on the local system cable.
Closed	Enabled - Page line ground faults detected on the remote system cable are regenerated on the local system cable.

NOTES:

1. The ground fault regeneration feature is used in SmartSeries systems to allow a ground fault on the remote cable segment to be detected by the system control cabinet. Disable this feature if the Line Extender is not installed in this type system.
2. Changes to this parameter take effect without cycling power.
3. *Indicates default position.

Page Line Ground Fault Output Contact

The Model LE200-RM provides a relay contact that activates whenever a ground fault is detected on the local page line, remote page line or both the page lines. The ground fault detection feature (described above) must be enabled. The contact output can be used to activate an external device or system which annunciates the fault condition. The DIP switch SW5 positions 4 and 5 configure which page line ground faults activate this contact. Refer to Figure 6 for the location of switch SW5 on the Main PCBA and Table 9 below for setting options.

Table 9. Page Line Ground Fault Contact Setting on Main PCBA

SW5-4	SW5-5	Page Line Ground Fault Contact
Closed	Closed	Disabled
Closed	Open	Remote page line ground fault activates the contact.
Open	Closed	Local page line ground fault activates the contact.
Open*	Open*	Both Local and Remote page line ground faults activate the contact.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Party Line Audio Transmission

A pair of Model LE200-RM Line Extenders provides full duplex party line audio between two Page/Party® system cables, for party lines 1–5. During on-hook conditions of the party lines (meaning no handset stations are in use), the LE200-RM will mute the local party line analog circuits. If it is necessary to have party line audio enabled even when no stations are off-hook, DIP switch SW6-3 may be closed to disable this muting feature. This switch affects the on-hook muting function of all five party lines simultaneously. Refer to Figure 6 for the location of switch SW6 on the Main PCBA and Table 10 below for setting options.

Table 10. Party Line On-Hook Muting Setting on Main PCBA

SW6-3	Party Line On-Hook Muting
Open*	Enabled – local party lines are muted when no handset stations are in-use.
Closed	Disabled – party line audio is never muted.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Party Line Off-Hook Regeneration

When an off-hook handset station is detected, the LE200-RM can transmit the off-hook condition to remote Line Extenders so that it is duplicated on the remote Page/Party® system cable. Typically this feature is used in systems that contain a telephone interface device so that the caller is transferred to the party line when a handset station answers the call. DIP switch SW6 position 2 is used to enable this feature. This switch affects the off-hook regeneration function of all five party lines. Refer to Figure 6 for the location SW6 on the Main PCBA and the Table 11 below for setting options.

Table 11. Off-Hook Regeneration on Main PCBA

SW6-2	Off-Hook Regeneration Setting
Open*	Enabled – an off hook condition on the local party line is regenerated at the remote Line Extender.
Closed	Disabled

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Party Line Off-Hook Detection

The Model LE200-RM Line Extenders provide off-hook detection on the local Page/Party® system cable for party lines 1 through 5. An off-hook condition means a handset station is in use. If multiple Line Extenders are connected to the same Page/Party® system cable segment, only one off-hook detector can be enabled. If connecting an LE200-RM to the same system cable segment as an ADVANCE Page/Party Interface (PPI) card, disable the LE200-RM off-hook detection for party lines 1 and 2. The PPI card contains off-hook detection for party lines 1 and 2.

Several shorting clips (P6–P15) are used to enable the off-hook detection feature on party line 1 through 5. Two shorting clips are associated with each party line and must be set to the same position for proper operation. The party lines 1–5 are configured independently. Refer to Figure 6 for the location of P6–P15 on the Main PCBA and Table 12 below for setting options.

Table 12. Party Line Off-Hook Detection Setting on Main PCBA

Party Line	Headers	Shorting Clip	Off-Hook Detection
Party Line 1	P15, P14	Pins 1–2*	Disabled
		Pins 2–3	Enabled
		Removed	Disabled
Party Line 2	P13, P12	Pins 1–2*	Disabled
		Pins 2–3	Enabled
		Removed	Disabled
Party Line 3	P11, P10	Pins 1–2*	Disabled
		Pins 2–3	Enabled
		Removed	Disabled
Party Line 4	P9, P8	Pins 1–2*	Disabled
		Pins 2–3	Enabled
		Removed	Disabled
Party Line 5	P7, P6	Pins 1–2*	Disabled
		Pins 2–3	Enabled
		Removed	Disabled

NOTES:

1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Audio Line Connection Relays

The Model LE200-RM has relays that disconnect the page, party lines 1–5 and the page monitoring output connections from the Main PCBA. The disconnect feature is used for special applications such as connection of a single party line system or other scenarios in which a particular audio line is not physically connected to the Line Extender. DIP switch SW4 is used to control the audio line disconnect feature. Refer to Figure 6 for the location of SW4 on the Main PCBA and Table 13 below for setting options.

Table 13. Audio Line Connection Relay Settings on Main PCBA

Audio Line	Switch SW4	Setting	Field Wiring
Party line 5	SW4-1	Open	Disconnected
		Closed*	Connected
Party line 4	SW4-2	Open	Disconnected
		Closed*	Connected
Party line 3	SW4-3	Open	Disconnected
		Closed*	Connected
Party line 2	SW4-4	Open	Disconnected
		Closed*	Connected
Party line 1	SW4-5	Open	Disconnected
		Closed*	Connected
Page line	SW4-6	Open	Disconnected
		Closed*	Connected
Page monitor	SW4-7	Open	Disconnected
		Closed*	Connected
N/A	SW4-8	Open	Not used
		Closed*	

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Audio Line Muting

In some system configurations, the Page/Party® system cable is not connected to the Line Extender. In this case, all audio lines (page and party lines 1–5) should be muted since they are not physically connected. DIP switch SW6 position 4 on the Main PCBA enables this feature. If this feature is enabled, it is unnecessary to disconnect the audio lines using the audio line relays (mentioned above). Refer to Figure 6 for the location of SW6 on the Main PCBA and Table 14 below for setting options.

Table 14. Audio Line Mute Setting on Main PCBA

SW6-4	Mute Analog Lines Setting
Open*	Disabled - Party lines 1–5 and page line are operational.
Closed	Enabled - Party lines 1–5 and page line are muted.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

Page/Party® Line Balance

For proper system operation, the page line and party lines 1–5 must be terminated with a resistance of approximately 33 ohms. The Model LE200-RM provides potentiometers to set the line balance resistance on the page line and five party lines. The line balance resistors are located on the Audio Termination Connection Module (part of Model 12118-011 Kit) next to the page and party line terminal blocks. The line balance resistors are adjustable or can be disabled using shorting clips P1–P7.

If connecting an LE200-RM to the same system cable segment as an ADVANCE Page/Party Interface (PPI) card, disable the line balance for party lines 1, 2 and the page line. The PPI card provides the line balance resistors for these audio lines. Refer to Figure 4 for the location of the jumpers and potentiometers on the Audio Termination Connection Module and the Table 15 for setting details.

Table 15. Page/Party® Line Balance Settings on Audio Termination Connection Module

Audio Line	Header	Shorting Clip	Line Balance	Adjustment Potentiometer
Party line 5	P6	Pins 1–2*	Disabled	R23
		Pins 2–3	Enabled	
		Removed	Disabled	
Party line 4	P3	Pins 1–2*	Disabled	R19
		Pins 2–3	Enabled	
		Removed	Disabled	
Party line 3	P1	Pins 1–2*	Disabled	R3
		Pins 2–3	Enabled	
		Removed	Disabled	
Party line 2	P2	Pins 1–2*	Disabled	R4
		Pins 2–3	Enabled	
		Removed	Disabled	
Party line 1	P4	Pins 1–2*	Disabled	R20
		Pins 2–3	Enabled	
		Removed	Disabled	
Page line	P7	Pins 1–2*	Disabled	R24
		Pins 2–3	Enabled	
		Removed	Disabled	

NOTES: *Indicates default position.

Contact Closure Inputs & Relay Outputs (I/0)

Five independent contact closures can be transmitted across a pair of Line Extenders meaning that an active input contact on the local Line Extender results in the corresponding output relay contact energizing on the remote Line Extender. Contact closures are bi-directional.

Example: Closing a switch contact across input #1 of the local Line Extender results in relay output #1 activating on the remote Line Extender and vice versa. When the input contact is removed the corresponding output relay de-activates. No switch or jumper setting is required on the Main PCBA for configuring the I/O feature.

NOTE: Any active output contacts will deactivate if the data link is broken between the Line Extenders.

Echo Cancellation

Line echo (also known as electric or hybrid echo) is created by the electrical circuitry connected to a two-wire (full duplex) audio system. Echo is inherent in all full-duplex audio systems and is affected by the audio line length and line impedance mismatches. The presence of audible echoes results in undesirable audio quality. This kind of quality degradation is inherent in network equipment and end-user phone devices.

To minimize echo, the Model LE200-RM performs an echo cancellation sequence on party lines 1 through 5. The echo cancellation process takes approximately 15 seconds and is performed automatically one minute after power is applied to the LE200-RM. This delay allows all power levels to stabilize prior to performing echo cancellation.

NOTE: Signal impulses are transmitted onto the party lines during the echo cancellation process. Handset stations that are in use on a party line will hear the signals in the handset receiver. For troubleshooting purposes, the 1-minute delay may be disabled by closing DIP switch SW6 position 1. Refer to Figure 6 for the location of SW6 on the Main PCBA and Table 16 below for setting details.

Table 16. Echo Cancellation Power-On Delay Setting on Main PCBA

SW6-1	Echo Cancellation Power-On Delay
Open*	1 minute
Closed	No delay

NOTES: 1. Changes to this parameter take effect when cycling power.
2. *Indicates default position.

Manual Initiation of Echo Canceling

Echo cancellation can be manually initiated as described below.

Press and release push button PB1 on the Main PCBA three times. The push button must be pressed for at least 0.25 second and no more than 2 seconds each time. The timing requirement is meant to prevent accidental requests. If an error is made with the push-button timing, the sequence must be repeated from the beginning.

The LEDs on the Main PCBA will indicate the progress of the echo canceling sequence. One column of LEDs turns on after each push button press release until the sequence is started. Once the sequence is started, those LEDs remain on, and a countdown timer is displayed on the remaining LEDs. The LEDs turn OFF after the echo cancellation training sequence is complete.

Data Links between Line Extenders

The LE200-RM is equipped with two different data link types for connecting to another Line Extender. The two data types are T1/E1 and Low Voltage Differential Signaling (LVDS). The type of data connection(s) required is determined by the system architecture. It is possible to use both types at the same time to achieve complex system architectures. Each data type, the intended use, and the applicable switch settings are described below.

T1/E1 Data Link

The T1/E1 data link connection is the most common and is used when one pair of Model LE300 Line Extenders are connected in point to point system architecture over a long distance. The T1/E1 carrier technology uses dedicated copper cable or fiber optic cable when equipped with a T1/E1 fiber optic modem. The distance between Line Extenders determines the type of connection needed. Copper wire connections between the Line Extenders require a two-pair cable and will operate at a distance of up to 6000 feet using No. 22 AWG wire. For distances greater than 6000 feet, a T1/E1 fiber optic transceiver and fiber optic cable must be used.

NOTE: The Model LE200-RM is NOT designed for use with the public switched telephone network.

Low Voltage Differential Signaling (LVDS) Data Link

The LVDS data link connection is used to connect two or more LE200-RM Line Extenders in a "daisy chain" fashion when the Line Extenders are located within 10 meters of each other. The LVDS data link requires a straight-through CAT5e cable between Line Extenders. Each Line Extender contains an LVDS data "in" port and an LVDS data "out" port. The "out" port of the first Line Extender connects to the "in" port of the next Line Extender. This connection scheme can be used to link up to a maximum of eight Line Extenders and is typically used when multiple Line Extenders are installed in a central location.

Configuring the Data Links

The T1/E1 and LVDS data link parameters between Line Extenders must be configured using multiple DIP switch settings on the Main PCBA. The following sections describe each parameter and the switch settings.

T1/E1 Data Format Selection

The LE200-RM supports both T1 and E1data line connections between units. T1 is a digital circuit that uses the DS-1 (Digital Signaling level 1) signaling format to transmit voice/data at 1.544 Mbps. T1 can carry up to 24 digital channels for voice or data. E1 is the European equivalent of the T1, except E1 carries information at the rate of 2.048 Mbps. E1 is used to transmit 30 digital channels for voice or data plus one channel for signaling, and one channel for framing and maintenance.

DIP switch SW5 position 8 on the Main PCBA selects the data link format for the digital audio transmission between Line Extenders. Both Line Extenders must be set to the same format. Refer to Figure 6 for the location of SW5 on the Main PCBA and Table 17 below for setting details.

Table 17. Data Format Setting on Main PCBA

SW5-8	Format
Open*	T1 Mode (1.544 Mbps, 24-channel)
Closed	E1 Mode (2.048 Mbps, 32-channel)

NOTES: 1. Changes to this parameter take effect *after cycling power*.
2. *Indicates default position.

T1 Line Build-out Settings

This option allows the user to control the wave shape being output by the transmitter. This helps to correct problems related to long copper cables. Improperly setting this switch will cause signal degradation. The proper setting refers to the cable distance between two LE200-RM Line Extenders. If connecting to a fiber optic transceiver, it refers to the copper cable distance between the LE300-RM Main PCBA and the fiber optic transceiver and should be set to 0–133 feet (default setting). DIP switches SW2 positions 1–3 on the Main PCBA selects line-build out parameters. Refer to Figure 6 for the location of SW2 on the Main PCBA and Table 18 below for setting details.

Table 18. T1 Line Length Setting on Main PCBA

SW2-1	SW2-2	SW2-3	T1 Line Length
Open (up)*	Open (up)*	Open (up)*	0 to 133 feet
Closed (down)	Open (up)	Open (up)	133 to 266 feet
Open (up)	Closed (down)	Open (up)	266 to 399 feet
Closed (down)	Closed (down)	Open (up)	399 to 533 feet
Open (up)	Open (up)	Closed (down)	533 to 655 feet

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.
3. These switches have no effect in E1 mode.

T1/E1 Receiver Equalization Gain Limit

This option allows the user to compensate for diminishing signal intensity over the data line by adjusting the sensitivity of the receiver. By setting the Receive Equalizer Gain Limit, very long copper lines can be utilized. DIP switch SW2 position 4 on the Main PCBA selects the parameter. Refer to Figure 6 for the location of SW2 on the Main PCBA and Table 19 below for setting details.

Table 19. Receive Equalizer Gain Limit Setting on Main PCBA

SW2-4	Receive Equalization Gain Limit	
	T1 Mode	E1 Mode
Open (up)*	−36 dB (long haul)	−12 dB (short haul)
Closed (down)	−15 dB (limited long haul)	−43 dB (long haul)

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

T1/E1 Clock Source

For each pair of Line Extenders, one Line Extender must be the master clock source. The other unit must be the slave. The slave unit receives the clock from the master. DIP switch SW3 positions 1 and 2 on the Main PCBA selects T1/E1 clock parameters. Refer to Figure 6 for the location of SW3 on the Main PCBA and Table 20 below for setting details.

Table 20. Master Clock Setting on Main PCBA

SW3-1	SW3-2	Clock Source
Open*	Open*	LE200-RM is the T1/E1 Master (generates the T1/E1 clock).
Closed	Closed	LE200-RM is the T1/E1 Slave (receives the T1/E1 clock from master).

NOTES: 1. Changes to this parameter take effect *after cycling power*.
2. *Indicates default position.

T1/E1 Data Line Grounding

T1/E1 data line can be floating or grounded. When floating, neither conductor of the data line cable pair is connected to ground. Headers P20 and P21 control the grounding of the T1/E1 lines. Grounding the T1/E1 lines may reduce emissions if it becomes an installation concern. Refer to Figure 6 for the location of P20 and P21 on the Main PCBA and Table 21 below for setting details.

Table 21. T1/E1 Data Line Grounding setting on Main PCBA

Header	Shorting Clip	Grounding Condition
P20	1–2*	T1/E1 Rx line - floating
	2–3	T1/E1 Rx line - grounded
	Removed	T1/E1 Rx line - floating
P21	1–2*	T1/E1 Tx line - floating
	2–3	T1/E1 Tx line - grounded
	Removed	T1/E1 Tx line - floating

*Indicates default position.

⚠ **NOTE** ⚠ Do not ground the T1/E1 lines at both ends. Doing so will create a ground loop.

LVDS Data Link Settings

The LVDS "in" port is disabled unless it is receiving a signal from LVDS "out" from another Line Extender. Switch SW3 position 3 enables the LVDS "in" port. Refer to Figure 6 for the location of SW3 on the Main PCBA and Table 22 below for setting details.

Table 22. LVDS "IN" Setting on Main PCBA

SW3-3	Enable/Disable LVDS "IN" Port
Open*	The LVDS "in" port is disabled (no cable connection from another LE200-RM.)
Closed	The LVDS "in" port is enabled (cable is connected to LVDS "out" cable connection from anther to LVDS.

NOTES: 1. Changes to this parameter take effect *after cycling power*.
2. *Indicates default position.

The LVDS "out" port is disabled unless the Line Extender is transmitting an LVDS signal to another Line Extender's LVDS "in" port. Switch SW3 position 4 enables the LVDS "out" port. Refer to Figure 6 for the location of SW3 on the Main PCBA and Table 23 below for setting details.

Table 23. LVDS "OUT" Setting on Main PCBA

SW3-4	Enable/Disable LVDS "OUT" Port
Open*	LVDS "out" is disabled.
Closed	LVDS "out" is enabled.

NOTES: 1. Changes to this parameter take effect without cycling power.
2. *Indicates default position.

⚠ **NOTE** ⚠ Do not connect LVDS "in" to LVDS "out" on the same Model LE200-RM. Doing so creates a feedback path that usually results in (extremely loud) oscillations on the page line, all party lines, and possibly the contact outputs.

LVDS Port Indicators

Each LVDS port has two LEDs. The green LED is ON when the LE200-RM detects a signal connection from the other LE200-RM connected to that port. The yellow/orange LED is ON when the LE200-RM detects page line data (SmartSeries FSK or 50 kHz VLC) on the LVDS port.

Typical Data Link Settings

The following section shows the most common Line Extender connection schemes and the expected T1/E1 and LVDS data line parameters for each. Consult the applicable tables above to determine the correct switch settings. Consult GAI-Tronics for technical support of connection schemes not shown in this manual.

Point-to-Point Page/Party® System Connection

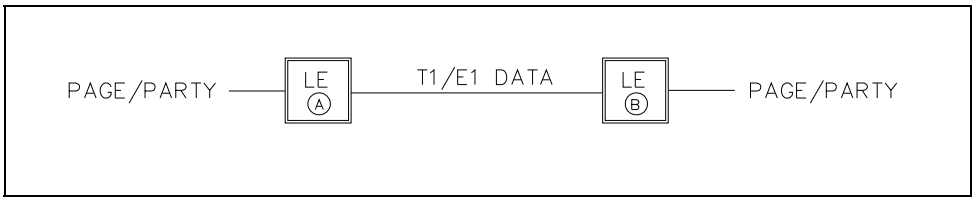

Figure 7. Point-to-Point Page/Party® System Connection

Table 24. Point-to-Point Page/Party® System Connection Table

Parameter	Switch	Configuration Description
T1 Line Length	SW2	Determined by installation distance between LE200-RMs.
T1/E1 Clock Source	SW3-1 SW3-2	• Unit A is the master clock source: SW3-1 (open) SW3-2 (open) • Unit B is the slave and uses the T1/E1 clock from Unit A: SW3-1 (closed) SW3-2 (closed)
LVDS Clock Source	SW3-3 SW3-4	Not used - disable both LVDS “in” and “LVDS out”: SW3-3 (open) SW3-4 (open)

Point to Multi-point Page/Party® System Connection

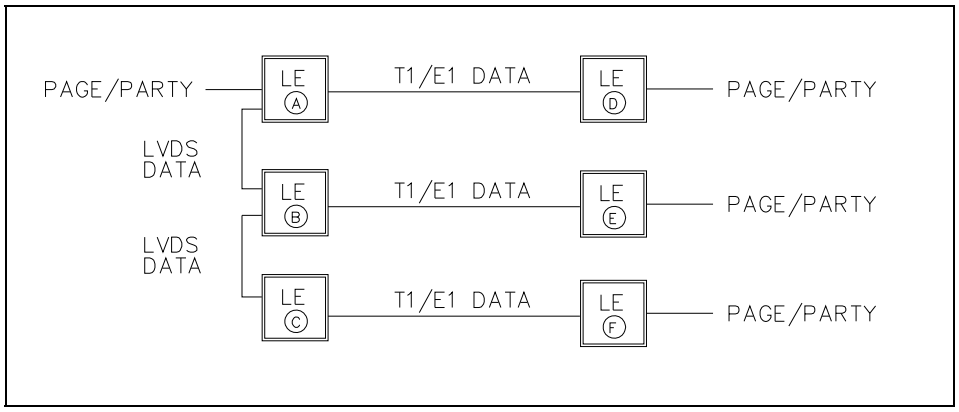

Figure 8. Point to Multi-point Page/Party® System Connection

Table 25. Point to Multi-point Page/Party® System Connection Table

Parameter	Switch	Configuration Description
T1 Line Length	SW2	Determined by installation distance between each pair of Line Extenders: • A to D • B to E • C to F
T1/E1 Clock Source	SW3-1 SW3-2	• Units A, B, and C are the master T1/E1 clock sources: SW3-1 (open) SW3-2 (open) • Unit D is a slave and uses the T1/E1 clock from Unit A: SW3-1 (closed) SW3-2 (closed) • Unit E is a slave and uses the T1/E1 clock from Unit B: SW3-1 (closed) SW3-2 (closed) • Unit F is a slave and uses the T1/E1 clock from Unit C: SW3-1 (closed) SW3-2 (closed)
LVDS Data Line	SW3-3 SW3-4	LVDS data link is used between units A, B and C. • Unit A - "LVDS in" disabled, "LVDS out" enabled: SW3-3 (open) SW3-4 (closed) • Unit B - "LVDS in" enabled, "LVDS out" enabled: SW3-3 (closed) SW3-4 (closed) • Unit C - "LVDS in " enabled, "LVDS out" disabled: SW3-3 (closed) SW3-4 (open)
Mute Analog Lines	SW6-4	Units B and C are muted since there is not a Page/Party® cable connected: SW6-4 (closed)

Series Connection of Page/Party® System

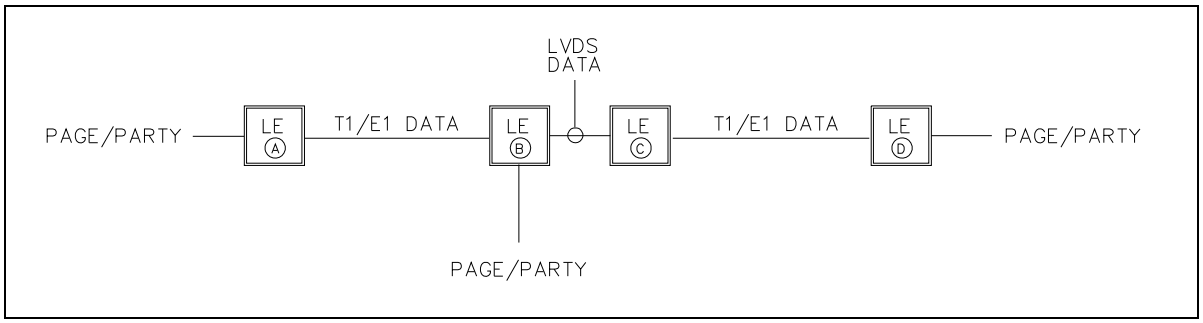

Figure 9. Series Connection of Page/Party® System

Table 26. Series Connection of Page/Party® System Table

Parameter	Switch	Configuration Description
T1 Line Length	SW2	Determined by installation distance between each pair of Line Extenders: • A to B • C to D
T1/E1 Clock Source	SW3-1 SW3-2	• Units A and C are the master T1/E1 clock sources: SW3-1 (open) SW3-2 (open) • Unit B is the slave and uses the T1/E1 clock from Unit A: SW3-1 (closed) SW3-2 (closed) • Unit D is the slave and uses the T1/E1 clock from Unit C: SW3-1 (closed) SW3-2 (closed)
LVDS Clock Source	SW3-3 SW3-4	LVDS clock is used between units B and C: • Unit B - "in" disabled, "out" enabled: SW3-3 (open) SW3-4 (closed) • Unit C - "in" enabled, "out" disabled: SW3-3 (closed) SW3-4 (open)
Mute Analog Lines	SW6-4	Unit C is muted since there is not a Page/Party® cable connected: SW6-4 (closed)

Rules for Interconnecting More than Two Model LE200-RMs

When connecting more than two Model LE200-RMs together, these rules must be followed.

- A maximum of two Model LE200-RM pairs can be connected in series when the series connections are made using Page/Party® cable as shown below.

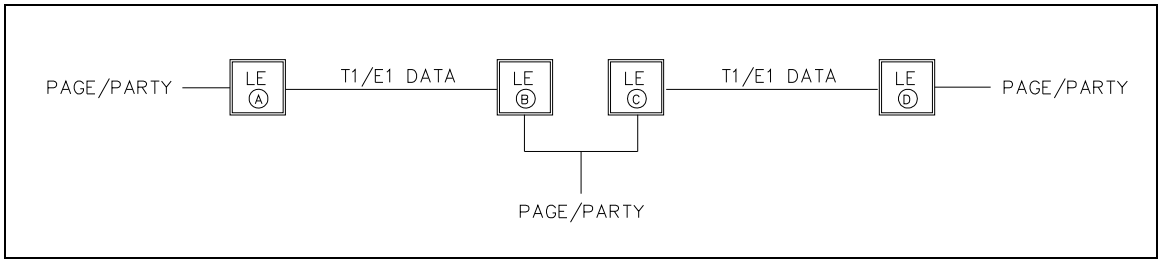

Figure 10. Maximum Series Connections

When the Model LE200-RMs are connected in series, a problem can arise when training the echo cancellation. If more than one Model LE200-RM is training echo cancellation on a signal line at the same time, then none of them will train echo cancellation properly. To prevent this, power each Line Extender one at a time. Wait for the echo cancellation to complete on the first Line Extender before powering the second.

- A maximum of <u>eight</u> pairs of Model LE200-RMs can be connected in parallel. Parallel connections must be made using the LVDS link and the T1/E1 link as shown below.

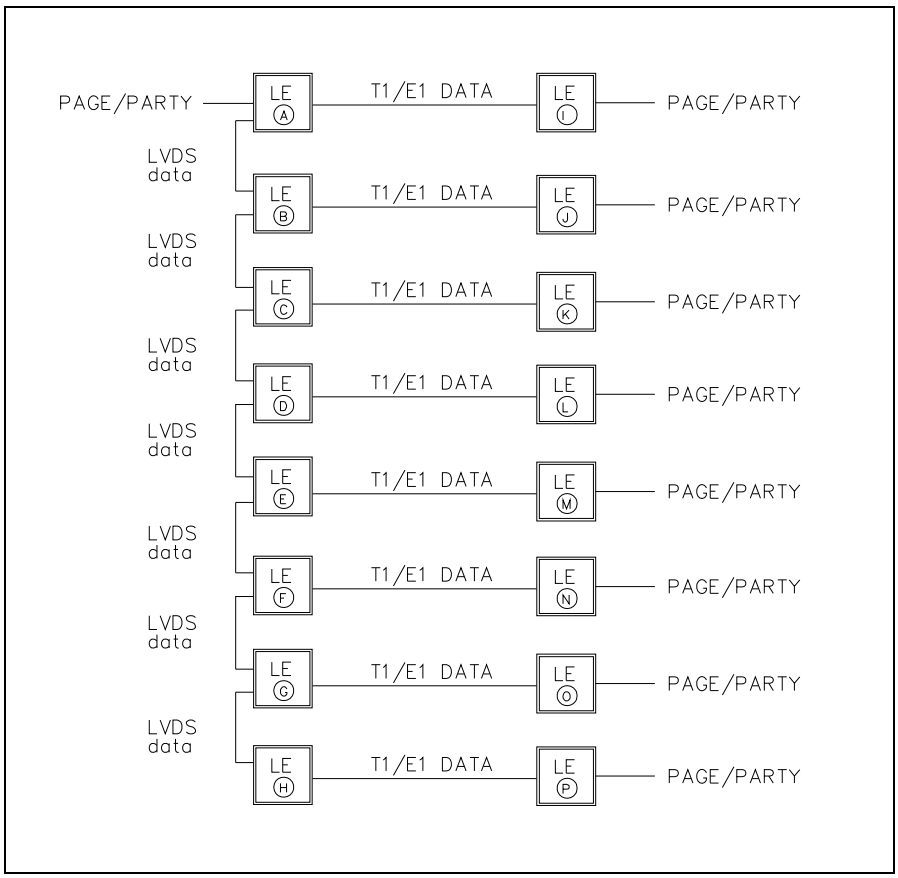

Figure 11. Maximum Parallel Connections

- A maximum of 16 Model LE200-RMs can be connected within a single zone or Page/Party® subsystem.
- Avoid having more than one Model LE200-RM connected to a particular Page/Party® cable. Instead, use the LVDS link whenever possible.
- Line extenders can NOT be wired in a loop architecture for redundant connections as shown below:

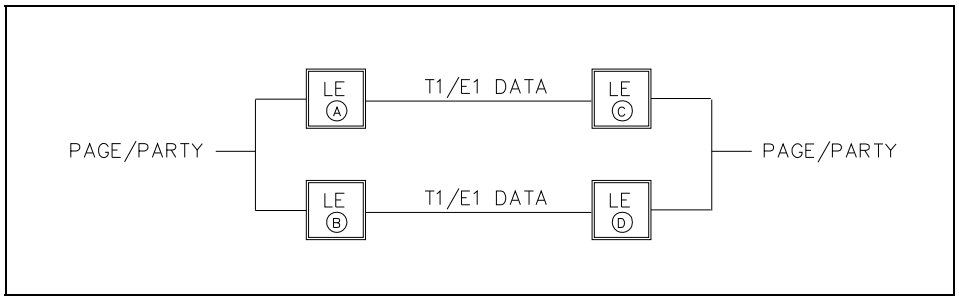

Figure 12. Invalid Loop Connection of Page/Party® Systems

- All contact input states are ORed together to determine a contact output state.
- All remote page line audio detected states are ORed together to determine the state of the page line audio detected relay contact output.
- All remote page line ground fault states are ORed together to determine the state of the page line ground fault relay contact output.
- When enabled, 50 kHz VLC signal on any page line is transmitted to all page lines.
- SmartSeries FSK data on any page line is transmitted to all page lines.
- Manual retraining of echo cancellation at one Model LE200-RM also requests it at all digitally interconnected Model LE200-RMs.

Installation

⚠ ATTENTION ⚠ Installation should be performed by qualified service personnel only in accordance with the National Electrical Code or applicable local codes.

Mounting

The Model LE200-RM Rack-Mount Line Extender can be placed on a table or desk, or it can be mounted in a standard EIA 19-inch electronic equipment rack. The LE200-RM unit requires 1U (1.75 inches) in a standard 19-inch rack. If the LE200-RM is installed in an electronic equipment rack, complete the following steps:

1. Install the mounted brackets with the eight 8-32 × 3/8-inch screws provided.

2. Mount the LE200-RM into the rack using the four 10-32 × 3/4-inch screws provided.

Tabletop Mounting

If the Model LE200-RM is to be placed on a table or desk, install the five stabilizing feet.

Wiring

Pressure-type terminal blocks are provided on the optional Model 12118-011 and 12118-012 Connection Module Kits for connecting the incoming field wiring. The terminal blocks can support a wire size of No. 24 AWG to 12 AWG. It is recommended that the installer crimp ferrules on the end of each wire before inserting the wire into the terminal block to ensure a reliable termination. Wiring connections to the connection modules are described below.

Power Connections

Connect input power of 48 V dc to P17 on the rear panel of the LE200-RM. Common must be connected to earth ground at the power supply.

Page/Party® System Cable Connection

Connect the audio conductors (page line and party line 1–5) of the Page/Party® system cable to either P5 or P8 on the Audio Termination Connection Module of the Model 12118-011 Kit. Each connection point is labeled next to the terminal block as shown below.

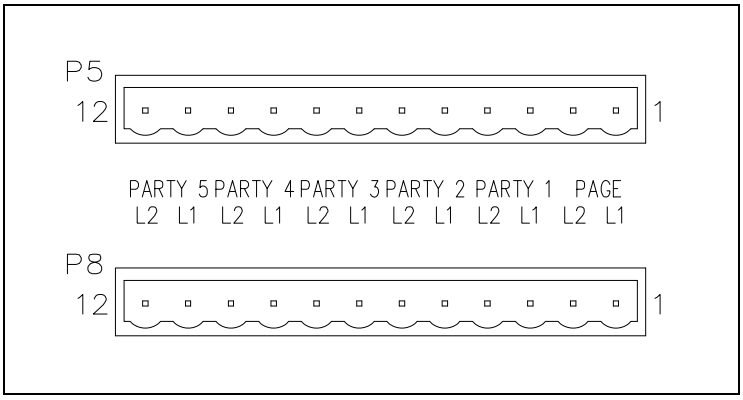

Figure 13. Page/Party® Cable Terminals

When using GAI-Tronics 60029 Series system cable, follow the wiring color code as shown in Table 27 below:

Table 27. Color Codes for GAI-Tronics 60029 Series System Cable

Terminal	Designator	GTC System Cable Color Code	Description
P5-1/P8-1	PAGE - L1	Red/blue	Page line audio
P5-2/P8-2	PAGE - L2	Blue/red	
P5-3/P8-3	PARTY 1 - L1	Red	Party line 1 audio
P5-4/P8-4	PARTY 1 - L2	Tan/red	
P5-5/P8-5	PARTY 2 - L1	Violet	Party line 2 audio
P5-6/P8-6	PARTY 2 - L2	Tan/violet	
P5-7/P8-7	PARTY 3 - L1	Blue	Party line 3 audio
P5-8/P8-8	PARTY 3 - L2	Tan/blue	
P5-9/P8-9	PARTY 4 - L1	Brown	Party line 4 audio
P5-10/P8-10	PARTY 4 - L2	Tan/brown	
P5-11/P8-11	PARTY 5 - L1	Yellow	Party line 5 audio
P5-12/P8-12	PARTY 5 - L2	Tan/yellow	

T1/E1 Data Connections

A two-pair cable is required for the T1/E1 data line connection between Line Extenders. Connect the T1/E1 data cable to P19 on the Main PCBA. The transmit (TX) and receive (RX) pairs between Line Extenders must be wired in a cross-over fashion such that the TX terminals of Line Extender #1 are connected to the RX terminals of Line Extender #2 and vice-versa. Each data cable connection point is labeled next to the terminal block P19 as shown below.

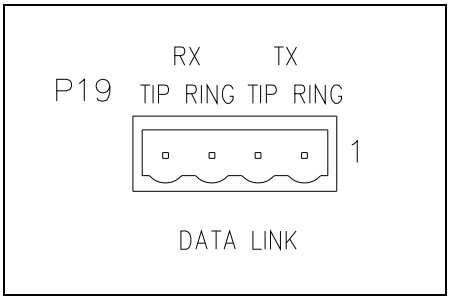

Figure 14. Data Line Terminals

Table 28. Terminal Block P19

Terminal	Designator	Description
P19-1	TX Ring	Data TRANSMIT wire pair
P19-2	TX Tip	
P19-3	RX Ring	Data RECEIVE wire pair
P19-4	RX Tip	

⚠ NOTE ⚠ Do NOT connect the TX (transmit) signal to the RX (receive) signal on the same Model LE200-RM Line Extender. Doing so creates a feedback path that usually results in extremely loud oscillations on the page line and the party lines. The contact outputs may also activate.

Contact Closure Input Connections

Contact inputs are typically connected to switches or mechanical relay contacts. Five inputs are available on Model 12118-012 Kit with each input requiring two conductors. Connect the normally open contact across the top and bottom. If using a solid state switch as the input device, observe polarity of the connection (−) on bottom, (+) on top. Each input cable connection point is labeled next to the terminal block TB8 and 9 as shown in Figure 15 below.

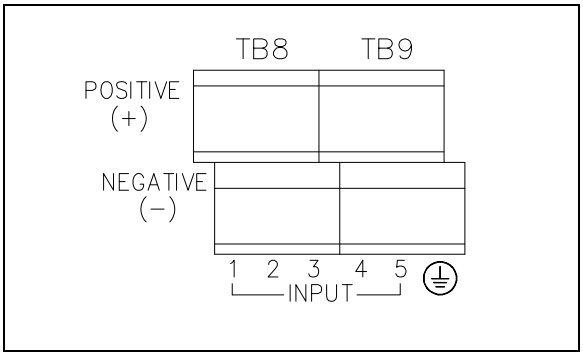

Figure 15. Input Contact Terminals

Table 29. TB8 and TB9

Terminal	Designator	Description
TB8	Input 1 (+)	Input contact 1
TB8	Input 1 (−)	
TB8	Input 2 (+)	Input contact 2
TB8	Input 2 (−)	
TB8	Input 3 (+)	Input contact 3
TB8	Input 3 (−)	
TB9	Input 4 (+)	Input contact 4
TB9	Input 4 (−)	
TB9	Input 5 (+)	Input contact 5
TB9	Input 5 (−)	

Contact Closure Output Connections

Seven relay outputs are provided. Each relay output provides two contact sets and each contact set consists of normally open (NO), common (C) and normally closed (NC) contacts. Outputs 1–5 are activated by inputs 1–5 on the remote Line Extender. Output 6 is activated when page line audio is detected and output 7 is activated when a page line ground fault is detected. Terminals are provided on the Model 12118-012 Kit for each relay contact and are labeled with the relay contact description next to the terminal block TB1-7 as shown below.

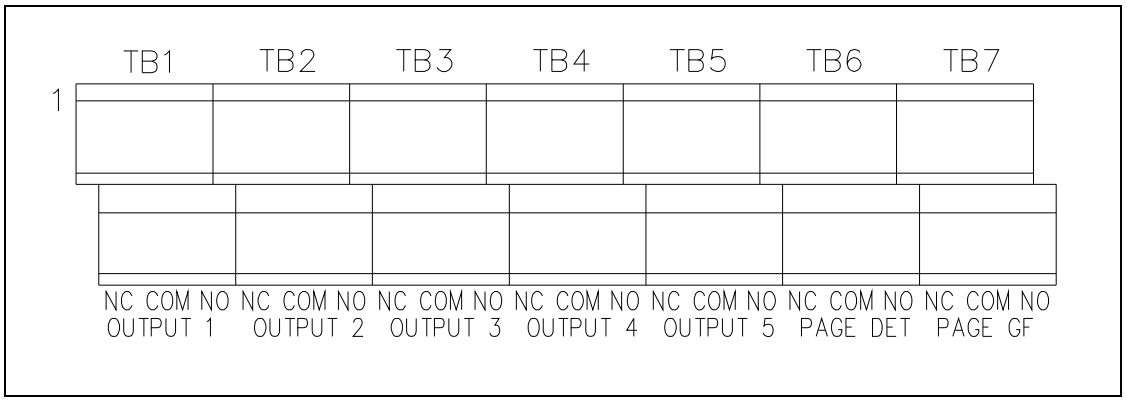

Figure 16. Relay Output Terminals

Table 30. Contact Closure Output Connections

Terminal	Designator	Description
TB1 (Top)	N.C.	Output 1 – contact #1
	COM	
	N.O.	
TB1 (Bottom)	N.C.	Output 1 – contact #2
	COM	
	N.O.	
TB2 (Top)	N.C.	Output 2 – contact #1
	COM	
	N.O.	
TB2 (Bottom)	N.C.	Output 2 – contact #2
	COM	
	N.O.	
TB3 (Top)	N.C.	Output 3 – contact #1
	COM	
	N.O.	
TB3 (Bottom)	N.C.	Output 3 – contact #2
	COM	
	N.O.	
TB4 (Top)	N.C.	Output 4 – contact #1
	COM	
	N.O.	
TB4 (Bottom)	N.C.	Output 4 – contact #2
	COM	
	N.O.	
TB5 (Top)	N.C.	Output 5 – contact #1
	COM	
	N.O.	

Terminal	Designator	Description
TB5 (Bottom)	N.C.	Output 5 – contact #2
	COM	
	N.O.	
TB6 (Top)	N.C.	Page line audio – contact #1
	COM	
	N.O.	
TB6 (Bottom)	N.C.	Page line audio – contact #2
	COM	
	N.O.	
TB7 (Top)	N.C.	Page line ground fault – contact #1
	COM	
	N.O.	
TB7 (Bottom)	N.C.	Page line ground fault – contact #2
	COM	
	N.O.	

Page Line Audio Monitoring Connections

The Model LE200-RM provides a balanced 600-ohm audio output for monitoring audio on both the local and remote page lines. Connect any external audio input device (audio recorder, radio transmitter, amplifier, etc.) to the audio line monitoring terminals using a twisted pair cable. The input impedance of the audio device should be 600 ohms or greater. Terminals are located at connector P16 on the Main PCBA and are labeled as shown below.

Table 31.

Terminal	Designator	Description
P16-1	PG MON L2	Page line monitor audio output (L2)
P16-2	–	No connection
P16-3	PG MON L1	Page line monitor audio output (L1)

Verifying the Proper Line Balance Resistance

For proper Line Extender operation, the line balance resistance, for both page and party lines, should be set close to 33 ohms. This can be done by enabling and adjusting the line balance potentiometers on the 69441-xxx terminal board using an ohmmeter.

When the line balance potentiometer is enabled, it is possible to measure the selected dc resistance directly. One side of the ohmmeter should connect to the exposed header pin on the header used to enable or disable the line balance potentiometer. The other side of the ohmmeter should connect to the side of the associated 15-ohm series resistor closest to the edge of the printed circuit board. Ensure the 15-ohm resistor is part of the measurement before adjusting the potentiometer for the correct resistance. All six circuits are symmetric and their signals have minimal overlap. If the incorrect series resistor is chosen, then the ohmmeter should read an open circuit.

Distributing Line Balance Resistance

As an increasing length of cable is added from the Line Extender the effects of cable resistance should be taken into consideration. The farther a Page/Party® station is connected to the system cable from the line balance resistance the greater the chance deficiencies in system behavior may occur. The station farthest away from the line balance will exhibit increased sidetone audio in the handset earpiece and will place higher than nominal levels of audio onto the system cable. Stations receiving this audio nearby will have louder than expected outputs. These same stations receiving audio from other stations near the line balance resistance will have lower than expected outputs due to the line loss of the cable resistance. A system showing these characteristics should have distributed line balancing.

For reference, if a line balance is installed at both ends of one mile of 18 gauge cable, then both line balances should be set to nominally 46.7 ohms. The one mile of cable provides approximately 33 ohms of resistance in each leg; the resulting series-parallel combination will result in the devices installed at both ends seeing a line impedance of approximately 33 ohms.

SmartSeries systems utilize FSK for communication on the page line between the stations and the Line Extender. Since FSK frequencies range between 31 kHz and 33 kHz instead of audio frequencies, the effects of longer cable lengths will present itself sooner. The higher frequency will lend to a greater probability that standing waves of the FSK signal will be present. The cable length, in addition to the number of cable branches present, will combine to determine the severity of these standing waves. Severe standing waves present on the line can cause a portion of the system devices to be unable to properly communicate with the Line Extender giving the need for distributing the line balance resistance.

Determining the cable resistance with any accuracy in installed systems is too difficult. Fortunately, the resistance values to be installed can be determined without using the cable resistance in the calculation, as precise accuracy is not necessary to achieve acceptable system functionality. The resistance values installed should always calculate to a nominal parallel resistance of 33 ohms. One of the line balance resistances can be the resistance included on the 69441-xxx terminal board, but it is not a requirement. It will provide a resistance up to 115 ohms determined by the position of the potentiometer. Examples of line balance resistances that could be installed are 51 ‖ 100 ohms, 68 ‖ 68 ohms or 100 ‖ 100 ‖ 100 ohms. It is best to install the line balance resistors as far apart from one another in cable distance as possible.

Fiber Optic Cable Connections

Model LE200-RM can be used with an optional fiber optic interface. This consists of a chassis (GTRFP6972-102) and either a multimode fiber transceiver (GTRFP6972-201) or a single mode fiber transceiver (GTRFP6972-202), as shown below in Figure 17.

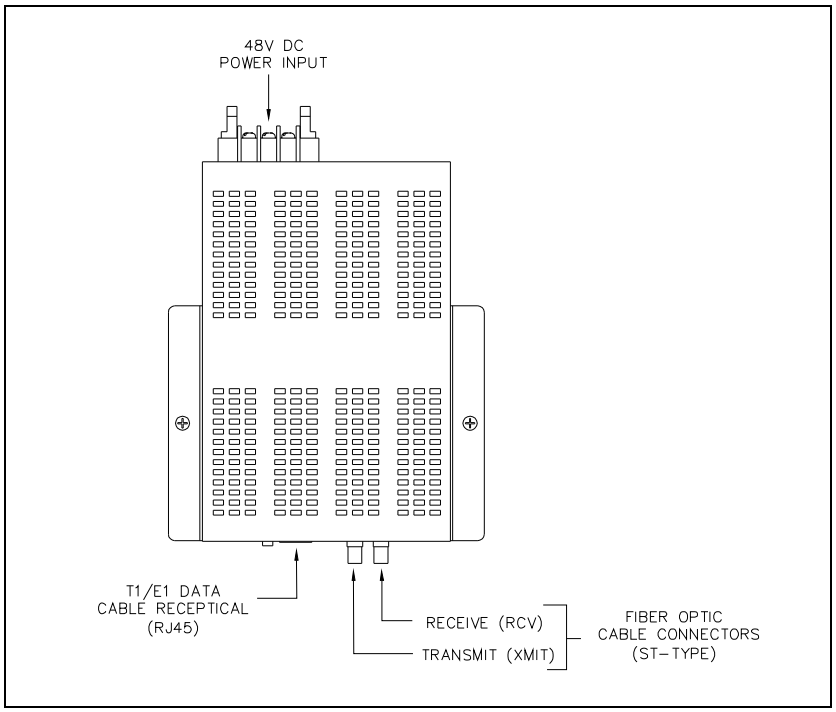

Figure 17. T1/E1 Fiber Optic Transceiver (top view)

Transceiver GTRFP6972-201 requires multi-mode fiber optic cable and Transceiver GTRFP6972-202 requires single-mode fiber optic cable. With either model, the fibers must be terminated with ST-type connectors. The fiber optic cables between Line Extenders must be connected in a "cross-over" fashion meaning the Transmit (XMIT) port of Line Extender #1 connects to the Receive (RCV) port of Line Extender #2 and vice-versa as shown below.

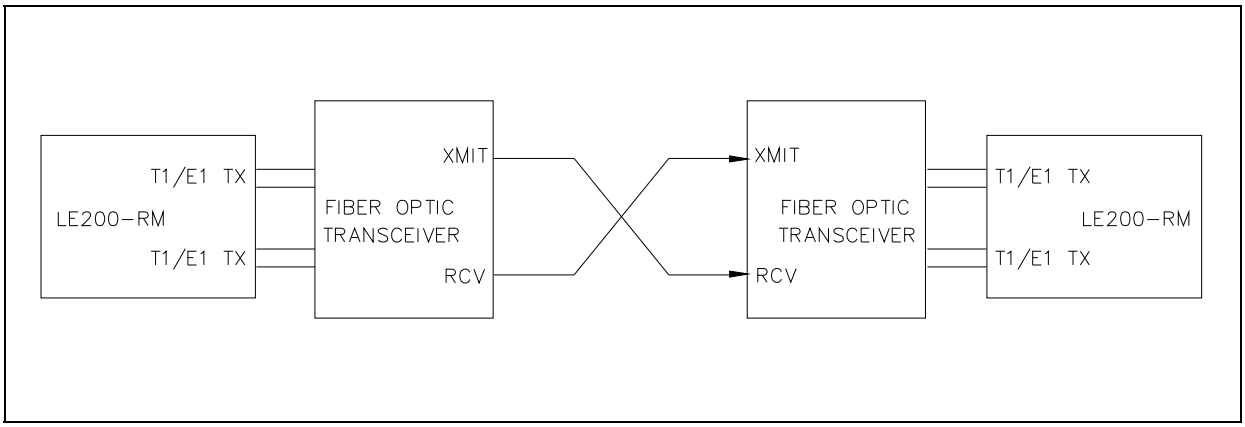

Figure 18. Fiber Optic Cable Connection

Fiber Optic Transceiver Set-Up

The Fiber Optic Transceiver contains two DIP switches as shown below. To access the switches, the module must be removed from the chassis. Loosen the screw and pull out the transceiver module.

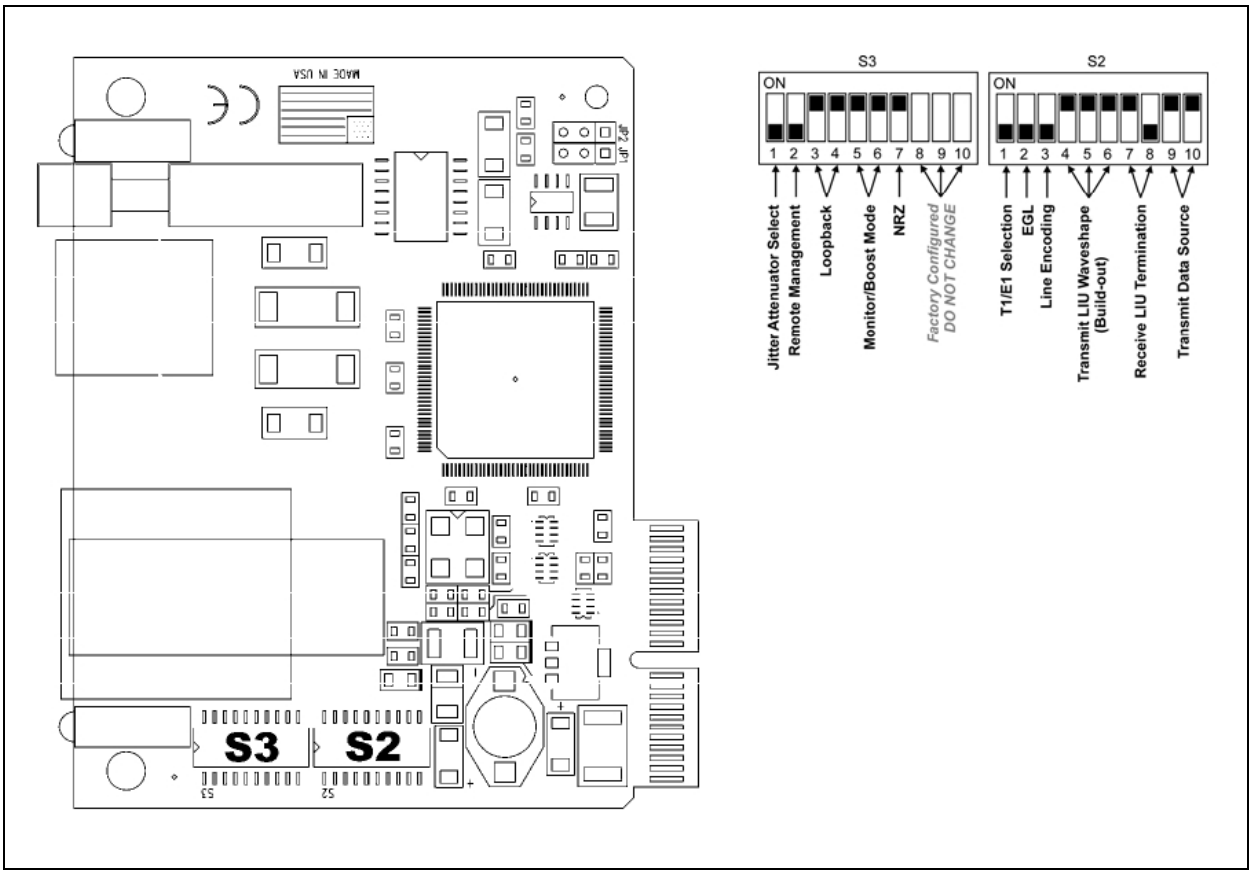

Figure 19. DIP Switches on Fiber Optic Transceiver

These switches are factory set according to Table 32 below. It is recommended that the default configuration (passive mode) is used for most typical applications. Passive mode allows the fiber segment to pass data unchanged between the T1/E1 segments independent of the actual line coding (AMI, B8ZS, or HDB3). All errors and fault conditions from one T1/E1 end will pass through the fiber to the other end as if there were one long T1/E1 connection. Use these settings to insure proper operation of the Model LE200-RM Line Extender.

Table 32. Factory Settings for the Fiber Optic Transceiver

Function	Factory Setting
T1/E1 mode	T1
Receive Equalizer Gain Limit (EGL)	−30 dB (Limited Long Haul)
Line encoding	AMI (passive mode)
Transmit LIU wave shape (Build-out)	DSX-1 (0 to 133 feet) 0 dB CSU
Receive LIU termination	Receive side 100 ohms enabled
Transmit data source	Standard data
Jitter attenuator	Place jitter attenuator on TX side
Select remote management	Remote management disabled
Loopback selection	No loopback
Monitor/boost mode	No boost
NRZ selection	Disable NRZ (passive mode)

Table 33 below outlines the functions settings for DIP switch S2:

Table 33. Function Settings for DIP Switch S2

Function	Setting			
T1/E1 Selection	S2-1: OFF; T1 mode selected *(default setting)* S2-1: ON; E1 mode selected			
Receive Equalizer Gain Limit	**E1** S2-2: ON; −12 dB Short Haul S2-2: OFF; −43 dB Long Haul **T1** S2-2: ON; −36 dB Long Haul S2-2: OFF; −30 dB Limited Long Haul *(default setting)*			
Line Encoding	S2-3: ON; B8ZS or T1 or HDB3 for E1 S2-3: OFF; AMI *(default setting)*			
Transmit LIU Wave Shape (Build-out)	E1			
	S2-4	S2-5	S2-6	
	ON	ON	ON	75 ohms
	OFF	ON	ON	125 ohms
	ON	ON	OFF	75 S ohms with High Return Loss
	OFF	ON	OFF	125 S ohms with High Return Loss
	T1			
	S2-4	S2-5	S2-6	
	ON	ON	ON	DSX-1 (0 to 133 feet) 0 dB CSU *(default setting)*
	OFF	ON	ON	DSX-1 (133 to 266 feet)
	ON	OFF	ON	DSX-1 (266 to 399 feet)
	OFF	OFF	ON	DSX-1 (399 to 533 feet)
	ON	ON	OFF	DSX-1 (533 to 655 feet)
	OFF	ON	OFF	−7.5 dB CSU
	ON	OFF	OFF	−15 dB CSU
	OFF	OFF	OFF	−22.5 dB CSU
Receive LIU Termination	S2-7: ON; S2-8: ON; Receive side termination disabled S2-7: OFF; S2-8: ON; Receive side 120 ohms enabled S2-7: ON; S2-8: OFF; Receive side 100 ohms enabled *(default setting)* S2-7: OFF; S2-8: OFF; Receive side 75 ohms enabled			
Transmit Data Source	S2-9: ON; S2-10: ON; Standard data *(default setting)* S2-9: OFF; S2-10: ON; Transmit pseudo-random bit sequence (PRBS) S2-9: ON; S2-10: OFF; Transmit alternating ones and zeros S2-9: OFF; S2-10: OFF; Transmit unframed all ones			

Table 34 outlines the function settings for DIP switch S3:

Table 34. Function Settings for DIP Switch S3

Function	Setting
Jitter Attenuator Select	S3-1: ON; Place jitter attenuator on RCV side S3-1: OFF; Place jitter attenuator on XMT side *(default setting)*
Remote Management	S3-2: ON; Remote management enabled (only at the REMOTE end) S3-2: OFF; Remote management disabled (only at the LOCAL end) *(default setting)*
Loopback Selection	S3-3: ON; S3-4: ON; None *(default setting)* S3-3: OFF; S3-4: ON; Local loopback S3-3: ON; S3-4: OFF; Analog loopback S3-3: OFF; S3-4: OFF; Remote loopback
Monitor/Boost Mode	S3-5: ON; S3-6: ON; Normal operation (No boost) *(default setting)* S3-5: OFF; S3-6 ON; 20 dB S3-5: ON; S3-6 OFF; 26 dB S3-5: OFF; S3-6 OFF; 32 dB
NRZ Selection	S3-7: ON; Disable NRZ (Required for Passive Mode) *(default setting)* S3-7: OFF; Enable NRZ (Line Terminating Mode)
Fiber Type	S3-8: Factory configured; DO NOT CHANGE S3-9: Factory configured; DO NOT CHANGE S3-10: Factory configured; DO NOT CHANGE

Verification of Proper Operation

This section describes the LEDs and their functions. The fiber port LED RM is the only LED that should be lit on the modules under normal operating conditions.

Table 35. Copper Port Indicators

Indicator	Function
LPBK	Glows green when the module is set to one of the loopback modes.
NO LNK	Glows green when a link is NOT established.
PBEO	Only used when the Transmit Data Source option is set to PRBS. This LED will glow amber when the module receives errors and will stay dark when the converter receives a PRBS without errors.

Table 36. Fiber Optic Port Indicators

Indicator	Function
NRZ	Glows green when the NRZ mode is enabled.
RM	Glows green on the remote unit when remote management is enabled. Glows green on the local unit when it has discovered a remote unit with remote management enabled.
NO LNK	Glows green when a fiber link has NOT been established.
SYM	Glows amber when a 4-bit to 5-bit (4b/5b) symbol encoding error in the fiber line is detected.

Summary of PC Board Connections and Settings

Table 37. Audio Line Termination Connection Module

Designator	Type	Function
J1	DB-25 connector	Connect to J4 on Main PCBA via ribbon cable.
P1	Jumper clip	Party line #3 line balance resistor (enabled/disabled)
P2	Jumper clip	Party line #2 line balance resistor (enabled/disabled)
P3	Jumper clip	Party line #4 line balance resistor (enabled/disabled)
P4	Jumper clip	Party line #1 line balance resistor (enabled/disabled)
P6	Jumper clip	Party line #5 line balance resistor (enabled/disabled
P7	Jumper clip	Page line balance resistor (enabled/disabled)
P5 & P8	Terminal block	Page line - Terminals 1 and 2 Party line 1 - Terminals 3 and 4 Party line 2 - Terminals 5 and 6 Party line 3 - Terminals 7 and 8 Party line 4 - Terminals 9 and 10 Party line 5 - Terminals 11 and 12
R3	Potentiometer	Party line #3 line balance resistance
R4	Potentiometer	Party line #2 line balance resistance
R19	Potentiometer	Party line #4 line balance resistance
R20	Potentiometer	Party line #1 line balance resistance
R23	Potentiometer	Party line #5 line balance resistance
R24	Potentiometer	Page line, line balance resistance
TB1	Terminal block	Chassis ground - Terminals 1 and 2
TB2	Terminal block	Chassis ground - Terminals 1 and 2

Table 38. Input/Output Termination Connection Module

Designator	Type	Function
J1	DB-25 connector	Connect to J3 on Main PCBA via ribbon cable
TB1	Terminal block	Field connections for contact output #1 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB2	Terminal block	Field connections for contact output #2 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB3	Terminal block	Field connections for contact output #3 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB4	Terminal block	Field connections for contact output #4 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB5	Terminal block	Field connections for contact output #5 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB6	Terminal block	Field connections for page audio detected contact output The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB7	Terminal block	Field connections for page ground fault contact output The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB8	Terminal block	Field connections for contact inputs #1, #2, and #3 The board's silkscreen indicates the connections; the pin numbers are not labeled.
TB9	Terminal block	Field connections for contact inputs #4 and #5 Field connections for chassis ground The board's silkscreen indicates the connections; the pin numbers are not labeled.

Table 39. Main PCBA

Designator	Type	Function
J1	RJ45 receptacle	LVDS data “out”
J2	RJ45 receptacle	LVDS data “in”
J3	DB-25 connector	Connect to J1 on Termination Connection Module via 25-pin ribbon cable.
J4	DB-25 connector	Connect to J1 on Page/Party® Termination Connection Module via 25-pin ribbon cable.
P1	N/A	Not installed
P2	Post header	No connection - used during production testing of PCBA
P3	N/A	Not installed
P4	Post header	No connection - used during production testing of PCBA
P5	Jumper clip	Page line ground fault detector (enabled/disabled)
P6, P7	Jumper clip	Party line #5 off-hook detector (enabled/disabled)
P8, P9	Jumper clip	Party line #4 off-hook detector (enabled/disabled)
P10, P11	Jumper clip	Party line #3 off-hook detector (enabled/disabled)
P12, P13	Jumper clip	Party line #2 off-hook detector (enabled/disabled)
P14, P15	Jumper clip	Party line #1 off-hook detector (enabled/disabled)
P16	Terminal block	Page line monitor output - Terminals 1 and 3 No connection - Terminal 2
P17, P18	Terminal block	Power 48 V dc (+) - Terminal 1 Power 48 V dc (−) - Terminal 2
P19	Terminal block	T1/E1 Data TX (ring) - Terminal 1 T1/E1 Data TX (tip) - Terminal 2 T1/E1 Data RX (ring) - Terminal 3 T1/E1 Data RX (tip) - Terminal 4
P20	Jumper clip	T1/E1 receive transformer center tap floating/grounded.
P21	Jumper clip	T1/E1 transmit transformer center tap floating/grounded.
PB1	Push-button switch	Used to retrain the echo cancellation circuit.
SW1	Rotary HEX switch	Used for diagnostic purposes. Set to 0 during normal operation.

Designator	Type	Function
SW2	Eight-position DIP switch	Position 1 - T1 line build out bit 0 Position 2 - T1 line build out bit 1 Position 3 - T1 line build out bit 2 Position 4 - T1/E1 receive equalizer gain limit Position 5 - Page audio hold time (bit 1) Test waveform select (bit 1) Position 6 - Page audio hold time (bit 2) Test waveform select (bit 2) Position 7 - Page audio detect threshold Test waveform select (bit 2) Position 8 - Test waveform enable
SW3	Eight-position DIP switch	Position 1 - T1/E1 clock source (master/slave) Position 2 - T1/E1 clock source (master/slave) Position 3 - LVDS “in” (enabled/disabled) Position 4 - LVDS “out” (enabled/disabled) Position 5 - 600-ohm audio monitor volume (bit 1) Position 6 - 600-ohm audio monitor volume (bit 2) Position 7 - 600-ohm audio monitor volume (bit 3) Position 8 - 600-ohm audio monitor volume (bit 4)
SW4	8-position DIP switch	Position 1 - Party line 5 (connect/disconnect) Position 2 - Party line 4(connect/disconnect) Position 3 - Party line 3 (connect/disconnect) Position 4 - Party line 2 (connect/disconnect) Position 5 - Party line 1 (connect/disconnect) Position 6 - Page line (connect/disconnect) Position 7 - Page line monitor output (connect/disconnect) Position 8 - Not used
SW5	Eight-position DIP switch	Position 1 - SmartSeries page line FSK data (enable/disable) Position 2 - 50 kHz page line VLC signal (enable/disable) Position 3 - Regenerate page line ground fault (enable/disable) Position 4 - GND fault contact activates on local page line fault. Position 5 - GND fault contact activates on remote page line fault. Position 6 - Page audio contact activates on local page line audio. Position 7 - Page audio contact activates on remote page line audio. Position 8 - T1 or E1 mode selection
SW6	Four-position DIP switch	Position 1 - One minute startup delay of echo cancellation training (enable/disable) Position 2 - Local party line off-hook regeneration (enable/disable) Position 3 - On-hook party line muting (enable/disable) Position 4 - Mute all audio lines (enable/disable)

Recording the Settings

The following tables have been included to document the "as installed" LE200-RM settings for future reference.

Table 40. Line Balance Resistor Enable on Audio Line Termination Connection Module

Header	Setting	Note
P1		Party line #3
P2		Party line #2
P3		Party line #4
P4		Party line #1
P6		Party line #5
P7		Page line

Table 41. Line Balance Resistance on Audio Line Termination Connection Module

Potentiometer	Setting	Note
R3		Party line #3
R4		Party line #2
R19		Party line #4
R20		Party line #1
R23		Party line #5
R24		Page line

Table 42. Off-hook and Ground Fault Detection on Main PCBA

Header	Setting	Note
P5		Page line ground fault detector
P6, P7		Party line #5 off-hook detector
P8, P9		Party line #4 off-hook detector
P10, P11		Party line #3 off-hook detector
P12, P13		Party line #2 off-hook detector
P14, P15		Party line #1 off-hook detector

Rotary Switch SW1 on Main PCBA

Set to "0" during normal operation.

Table 43. DIP Switch SW2 on Main PCBA

Switch	Setting	Function
SW2-1		T1 line length
SW2-2		
SW2-3		
SW2-4		T1/E1 receive equalizer gain limit
SW2-5		Page line transmission direction hold time
SW2-6		
SW2-7		Page line peak voltage level detection threshold
SW2-8	Open (Up)	Used during testing only.

Table 44. DIP Switch SW3 on Main PCBA

Switch	Setting	Function
SW3-1		T1/E1 master/slave
SW3-2		
SW3-3		Enable LVDS “in”
SW3-4		Enable LVDS “out”
SW3-5		Monitor volume
SW3-6		
SW3-7		
SW3-8		

Table 45. DIP Switch SW4 on Main PCBA

	Switch	Setting	Note
	SW4-1		Party line #5 connection to terminal board
	SW4-2		Party line #4 connection to terminal board
	SW4-3		Party line #3 connection to terminal board
	SW4-4		Party line #2 connection to terminal board
	SW4-5		Party line #1 connection to terminal board
	SW4-6		Page line connection to terminal board
	SW4-7		Monitor output connection to terminal block
	SW4-8	N/A	Not used

Table 46. DIP Switch SW5 on Main PCBA

	Switch	Setting	Note
	SW5-1		Enable FSK data for SmartSeries systems
	SW5-2		Enable 50 kHz VLC
	SW5-3		Regenerate page line ground fault
	SW5-4		Local ground fault activates output contact
	SW5-5		Remote ground fault activates output contact
	SW5-6		Local page audio activates output contact
	SW5-7		Remote page audio activates output contact
	SW5-8		Select T1 mode or E1 mode

Table 47. DIP Switch SW6 on Main PCBA

	Switch	Setting	Note
	SW6-1		Startup delay of echo cancellation training
	SW6-2		Local party line off-hook regeneration
	SW6-3		On-hook party line muting
	SW6-4		Mute analog circuits

Table 48. T1/E1 Line Grounding on Main PCBA

	Header	Setting	Note
	P20		T1/E1 Line receive
	P21		T1/E1 Line transmit

Testing and Troubleshooting

Generating Audio Test Signals

The Model LE200-RM is capable of generating several testing waveforms onto the audio lines of the page/party system to aid in system testing and troubleshooting. Rotary switch SW1 on the Main PCBA determines which Page/Party® audio line will receive the test waveform. DIP switch SW2 determines which testing waveform is generated. Closing DIP switch SW2-8 enables the test waveform. Switches SW2-5 through SW2-7 select a test waveform. Note that the frequency selections are different on the selected audio party line. Refer to tables below for valid switch settings.

Table 49.

SW1	Selected Page/Party® Line
1	Party line #1
6	Page line

Selected Tone	SW2-5	SW2-6	SW2-7	SW2-8
7 kHz (sine wave)	Open	Open	Open	Closed
4 kHz (sine wave)	Closed	Open	Open	Closed
2 kHz (sine wave)	Open	Closed	Open	Closed
1 kHz (sine wave)	Closed	Closed	Open	Closed
500 Hz (sine wave)	Open	Open	Closed	Closed
125 Hz (sine wave)	Closed	Open	Closed	Closed
1 kHz (saw tooth wave)	Open	Closed	Closed	Closed
31 Hz pulses	Closed	Closed	Closed	Closed

SW1	Selected Page/Party® Line
2	Party line #2
3	Party line #3
4	Party line #4
5	Party line #5

Selected Tone	SW2-5	SW2-6	SW2-7	SW2-8
3.5 kHz (sine wave)	Open	Open	Open	Closed
2.0 kHz (sine wave)	Closed	Open	Open	Closed
1.0 kHz (sine wave)	Open	Closed	Open	Closed
500 Hz (sine wave)	Closed	Closed	Open	Closed
250 Hz (sine wave)	Open	Open	Closed	Closed
125 Hz (sine wave)	Closed	Open	Closed	Closed
1 kHz (saw tooth wave)	Open	Closed	Closed	Closed
31 Hz Pulses	Closed	Closed	Closed	Closed

NOTE: Remember to restore SW1 to "0" and SW2 to its initial setting when no longer generating test signals.

Function Testing

The Model LE200-RM can manually activate some of the system "control" functions to aid in system trouble-shooting or commissioning. Functions include relay contact outputs, party line off-hook generation, page line ground fault generation, and the LVDS connector LEDs. Similar to the audio test generation, rotary switch SW1 and DIP switch SW2 are used to activate the various functions. Refer to the tables below for valid switch settings.

Table 50. Generated Data Signaling on Page Line

SW1	Selected Data Signal	SW2-5	SW2-6	SW2-7	SW2-8
B	50.087 kHz sine wave (VLC tone)	Closed	Open	Open	Closed
	30.720 kHz sine wave (SmartSeries data 0)	Open	Closed	Open	Closed
	32.941 kHz sine wave (SmartSeries data 1)	Closed	Closed	Open	Closed
	SmartSeries data 1/0 pattern	Open	Open	Closed	Closed
	Random waveform containing all signals above.	Closed	Open	Closed	Closed

NOTE: Remember to restore SW1 to "0" and SW2 to its initial setting when no longer generating test signals.

Table 51. Activate Contact Closure Outputs

SW1	Selected Function	SW2	SW2-8
7	Activate contact output #1	SW2-1 Closed	Closed
	Activate contact output #2	SW2-2 Closed	Closed
	Activate contact output #3	SW2-3 Closed	Closed
	Activate contact output #4	SW2-4 Closed	Closed
	Activate contact output #5	SW2-5 Closed	Closed
	Activate page audio detect contact	SW2-6 Closed	Closed
	Activate page ground fault detect contact	SW2-7 Closed	Closed

NOTE: Remember to restore SW1 to "0" and SW2 to its initial setting when no longer generating test signals.

Table 52. Generate Off-Hook & Ground Fault Conditions

SW1	Selected Function	SW2	SW2-8
7	Party line #1 off-hook	SW2-1 Closed	Closed
	Party line #2 off-hook	SW2-2 Closed	Closed
	Party line #3 off-hook	SW2-3 Closed	Closed
	Party line #4 off-hook	SW2-4 Closed	Closed
	Party line #5 off-hook	SW2-5 Closed	Closed
	Page line ground fault	SW2-6 Closed	Closed

NOTE: Remember to restore SW1 to "0" and SW2 to its initial setting when no longer generating test signals.

Specifications

Electrical

Supply Voltage

Input voltage ..... 48 volts dc, ±5%
Input power consumption ..... 12 watts (nominal)
48 watts (maximum)
DC operating current..... 250 mA (idle, nominal)
1000 mA (maximum)

T1 Parameters

NOTE: The LE200-RM is not compatible with the public switched telephone network.

Encoding ..... (Bipolar with 8 Zero Substitution) B8ZS
Framing..... (Extended Superframe) ESF

E1 Parameters

NOTE: The LE200-RM is not compatible with the public switched telephone network.

Encoding ..... (High Density Bipolar 3) HDB3
Framing..... (Cyclic Redundancy Check 4) CRC4
Signaling ..... (Common Channel Signaling) CCS

Copper Cabling

Type ..... Twisted pair data cable (i.e., CAT5), shielding recommended
Cable characteristic impedance, T1/E1..... 100 Ω/120 Ω (nominal)
Maximum cable length ..... 6,000 feet/1.8 km (No. 22 AWG)
Maximum attenuation ..... 24 dB

Fiber Cabling (using optional transceiver)

GTRFP6972-102 chassis with GTRFP6972-201 transceiver ..... Multi-mode 62/125 µm
GTRFP6972-102 chassis with GTRFP6972-202 transceiver ..... Single mode 9/125 µm

LVDS Cabling

Type ..... Straight-through Shielded CAT 5e Ethernet
Cable characteristic impedance..... 100 Ω (nominal)
Maximum cable length ..... 10 meters

Line Balance Characteristics

Coupling..... AC coupled
Adjustment range..... Disabled, 15 to 115 Ω adjustable (nominal)

Page Line or Party Line Maximum Peak Working Voltage

L1 to L2 ..... ±30 V dc nominal
L1 or L2 to ground ..... ±120 V dc nominal

Page Line Data

VLC frequency ..... 50,087 Hz nominal
FSK high frequency (start bit) ..... 32,914 Hz nominal
FSK low frequency (stop bit) ..... 30,720 Hz nominal
FSK baud rate ..... 2400 bits per second
Page line data voltage transmit level ..... 707 mVrms ±3 dB @ 33 Ω impedance
Output type ..... Current source with 3.3 kΩ impedance, transformer coupled (nominal)
VLC frequency capture range ..... (within) inside 43,886 ≤ frequency ≤ 57,600 Hz nominal
VLC frequency release range ..... (beyond) outside 40,070 ≤ frequency ≤ 65,829 Hz nominal
FSK high frequency capture range ..... (within) inside 32,914 ≤ frequency ≤ 34,133 Hz nominal
FSK high frequency release range ..... (beyond) outside 31,779 ≤ frequency ≤ 36,864 Hz nominal
FSK low frequency capture range ..... (within) inside 29,729 ≤ frequency ≤ 31,779 Hz nominal
FSK low frequency release range ..... (beyond) outside 27,106 ≤ frequency ≤ 31,779 Hz nominal
Page line data voltage detected range ..... ≥100 mVrms
Page line data voltage not detected range ..... ≤4.0 mVrms

Page Line Monitor Audio from Either Page Line

Frequency response ..... 300 Hz to 7.0 kHz ±0.5 dB @ −10 dB
Reference voltage level ..... 775 mVrms @ 600 Ω impedance (nominal)
Output type ..... Voltage source with 600 Ω impedance, transformer coupled (nominal)
Gain error ..... ±3 dB @ 1,020 Hz sine wave
0 dB ref. 775 mVrms @ 600 Ω impedance
Distortion + noise ..... THD < 1.0% @ 1,020 Hz sine wave
0 dB ref. 775 mVrms @ 600 Ω impedance
Sampling rate ..... 16,000 samples per second ±32 ppm
Encoding ..... Linear
Direction ..... Output only
Gain adjustment range ..... −30 to +12 dB in 3-dB steps (nominal)

Maximum Peak Working Voltage L1 to L2 ..... ±15 V dc nominal

Page Line Audio between Two LE200-RMs

Frequency response..... 300 Hz to 7.0 kHz ±0.5 dB @ −10 dB
Reference voltage level..... 1.5 Vrms @ 33 Ω impedance (nominal)
Output type..... Current source with 3.3 kΩ impedance, transformer coupled (nominal)
Gain error..... ±3 dB @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Distortion + noise..... THD <1.0% @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Sampling rate ..... 16,000 samples per second ± 32 ppm
Encoding ..... Linear
Direction ..... Half duplex

NOTE: Refer to text for considerations when connecting LE200-RMs in series.

Party Line #1 Audio between Two LE200-RMs

Frequency response..... 300 Hz to 7.0 kHz ±0.5 dB @ −10 dB
Reference voltage level..... 1.5 Vrms @ 33 Ω impedance (nominal)
Output type..... Current source with 3.3 kΩ impedance, transformer coupled (nominal)
Gain error..... ±3 dB @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Distortion + noise..... THD <1.0% @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Sampling rate ..... 16,000 samples per second ±32 ppm
Encoding ..... Linear
Direction ..... Full duplex

NOTE: Refer to text for considerations when connecting LE200-RMs in series.

Party Line #2 to #5 Audio between Two LE200-RMs

Frequency response..... 300 Hz to 3.5 kHz ±0.5 dB @ −10 dB
Reference voltage level..... 1.5 Vrms @ 33 Ω impedance (nominal)
Output type..... Current source with 3.3 kΩ impedance, transformer coupled (nominal)
Gain error..... ±3 dB @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Distortion + noise..... THD <1.0% @ 1,020 Hz sine wave
0 dB ref. 1.5 Vrms @ 33 Ω impedance both ends
Sampling rate ..... 8,000 samples per second ±32 ppm
Encoding ..... Linear
Direction ..... Full duplex

NOTE: Refer to text for considerations when connecting LE200-RMs in series.

Page Line Audio Detection

Detection peak voltage threshold selections ..... −12 or −24 dB ref. nominal
Detection hold time selections ..... 40, 160, 640, 1280 milliseconds (nominal)
Hold time on audio detected relay output ..... 1 second (nominal)

Page Line Ground Fault Detection

DC resistance from either L1 or L2 to ground for fault ..... ≤5,000 Ω
DC resistance from either L1 or L2 to ground for no fault ..... ≥8,000 Ω
Minimum ground fault duration for detection ..... 10 seconds (nominal)
Minimum no ground fault duration for detection ..... 10 seconds (nominal)
No ground fault to ground fault propagation delay..... ≤20 seconds includes detection time
Ground fault to no ground fault propagation delay..... ≤20 seconds includes detection time

NOTE: Rapidly changing ground fault conditions may or may not be detected.

Page Line Ground Fault Generation

Resistance when generating ground fault ..... 3.3 kΩ (nominal)
Resistance when not generating ground fault ..... ≥1 MΩ

NOTE: The resistance is from the center tap of the page line coupling transformer to ground.

Party Line Off-hook detection

DC resistance between L1 and L2 for off-hook..... ≤300 Ω
DC resistance between L1 and L2 for on-hook ..... ≥30,000 Ω
Minimum off-hook duration for detection..... 50 milliseconds (nominal)
Minimum on-hook duration for detection..... 5 seconds (nominal)
On-hook to off-hook propagation delay..... ≤0.5 second includes detection time
Off-hook to on-hook propagation delay..... ≤10 seconds includes detection time

NOTE: Rapidly changing off-hook or on-hook conditions may or may not be detected.

Contact Outputs (using optional I/O kit)

Contact output type ..... DPDT miniature signal relay
Switching power ..... ≤30 W dc (resistive load)
≤62.5 VA ac (resistive load)
Switching voltage..... ≤110 V dc
≤125 V ac
Switching current ..... ≤1.0 A
Minimum switching capacity..... 10 μA, 10 mV dc (nominal)

NOTE: When neither the T1/E1 Link nor the LVDS link is detected, the contact outputs are de-energized.

Contact Inputs (using optional I/O kit)

Dry contact input open resistance ..... ≥20,000 Ω
Dry contact input closed resistance..... ≤200 Ω
Wet contact input open voltage..... 2.6 ≤ voltage ≤ +3.6 volts dc
Wet contact input closed voltage ..... 0.0 ≤ voltage ≤ 0.23 volts dc
Contact input allowed voltage ..... 0.0 ≤ voltage ≤ +3.6 volts dc
Contact input sink current..... ≤1.0 mA dc
Contact input state duration ..... ≥50 ms
Contact input to contact output delay ..... ≤50 ms
Contact input to contact output jitter..... ±10 ms
Contact input to contact output pulse width tolerance..... ±10 ms

NOTES:

1. Rapidly changing contact inputs may or may not be detected.
2. Contact input to contact output specifications does not include the effects of relay bounce.
3. The contact input's negative terminal is tied directly to the LE200-RM's signal ground.
4. Wet contact input voltages are measured at the input terminals on the I/O Connection Module.
5. The "wet contact input closed voltage" may be difficult to achieve when connecting a bipolar open collector output to a contact input.
6. A driving high wet contact input will source current to the LE200-RM when the LE200-RM is not powered. This current may or may not prevent the LE200-RM from powering up properly.
7. Be aware of the ground loop(s) formed when using wet contact inputs.

Fiber Optic Transceiver (using optional transceiver)

Nominal Voltage..... 48 V dc
Maximum Current..... 500 mA
Optical Port Type..... ST
Wavelength
GTRFP6972-102 chassis with GTRFP6972-201 transceiver ..... 1310 nm
GTRFP6972-102 chassis with GTRFP6972-202 transceiver ..... 1310 nm

Range dB (km)

NOTE: The maximum data transmission distance archived over a fiber optic link depends on many factors, such as Transmit Power, Receiver Sensitivity / Saturation, the number of fiber connectors, splices and cable type. Prior to designing or installing a fiber optic system, a loss budget analysis is recommended to make certain the system will work over the proposed link. Both the passive and active components of the circuit have to be included in the budget loss calculation. Passive loss is made up of fiber loss, connector loss, and splice loss. Don't forget any couplers or splitters in the link. Active components are system gain, wavelength, transmitter power, receiver sensitivity, and dynamic range. Prior to system turn up, test the circuit with a source and FO power meter to ensure that it is within the loss budget. The following distance information is approximate and based on an overall power loss budget.

GTRFP6972-102 chassis with GTRFP6972-201 transceiver (62/125 µm cable) 12 dB power budget (5 km)
GTRFP6972-102 chassis with GTRFP6972-201 transceiver (9/125 µm cable) 31 dB power budget (80 km)

Mechanical

Enclosure material ..... Steel
Mounting..... Rack-mount, IU Standard, 19-inch
Unit dimensions ..... 1.72 H × 17 W × 9.66 D inches (431 × 245 × 44 mm) nominal
Unit weight..... 9.5 lbs.

Environmental

Temperature range ..... 0° to +50° C (+32° to +122° F)
Relative humidity..... 10–85% non-condensing

Replacement Parts

Part Number	Description
51809-008	Fuse, 2 A
69443-002	Line Extender Main PCBA

Frequently Asked Questions

Q: Why does it take so long for the propagation of off-hook to on-hook transitions?

A: The line balance ac coupling capacitors take some time to charge. Also, the delay helps to prevent audio from looking like an on-hook condition.

Q: Why does it take so long for the propagation of the page line ground fault transitions?

A: If the delay was not there, then page line audio might appear to be a ground fault.

Q: Why is shielded cable specified for the LVDS cable?

A: To improve the link's noise immunity. Most likely, the clock signal that controls one of the LE200-RM s passes over the LVDS cable.

Q: Is the LE200-RM compatible with the public switched telephone network?

A: No.

Q: Does the LE200-RM have on-board primary protection for the T1/E1 cable?

A: No.

Q: Why is the LE200-RM not compatible with the public switched telephone network?

A: (1) It is not approved for such use. (2) At a minimum, it does not support the facility data link transmission required for such use.

Q: Can I connect a Model LE300 to an LE200-RM?

A. Yes, these units are electrically compatible, only mechanical changes were made between the LE200 and LE300.

Q: Can I connect a Model LE300-MM or a Model LE300-SM to a LE200-RM

A. Yes. However an optional fiber optic transceiver will be required.

Q: Can I connect a Model LE200-RM to an LE100?

A: No, the T1 connection cannot be used to connect an LE200-RM to an LE100. However, an analog connection can be used, i.e., an LE200-RM and an LE100 can both connect to the same system cable.

Q: Can I have Model LE300, LE200 and LE100 Line Extenders in the same system?

A.: Yes, but the LE100s must be connected only to other LE100s and the LE300s and L200s must be connected together. Remember that the LE200 & LE300 fiber optic versions are NOT compatible

Q: What happens if the line balance is not installed?

A: A loud oscillation is heard on the audio line.

Warranty

Equipment. GAI-Tronics warrants for a period of one (1) year from the date of shipment, that any GAI-Tronics equipment supplied hereunder shall be free of defects in material and workmanship, shall comply with the then-current product specifications and product literature, and if applicable, shall be fit for the purpose specified in the agreed-upon quotation or proposal document. If (a) Seller's goods prove to be defective in workmanship and/or material under normal and proper usage, or unfit for the purpose specified and agreed upon, and (b) Buyer's claim is made within the warranty period set forth above, Buyer may return such goods to GAI-Tronics' nearest depot repair facility, freight prepaid, at which time they will be repaired or replaced, at Seller's option, without charge to Buyer. Repair or replacement shall be Buyer's sole and exclusive remedy. The warranty period on any repaired or replacement equipment shall be the greater of the ninety (90) day repair warranty or one (1) year from the date the original equipment was shipped. In no event shall GAI-Tronics warranty obligations with respect to equipment exceed 100% of the total cost of the equipment supplied hereunder. Buyer may also be entitled to the manufacturer's warranty on any third-party goods supplied by GAI-Tronics hereunder. The applicability of any such third-party warranty will be determined by GAI-Tronics.

Services. Any services GAI-Tronics provides hereunder, whether directly or through subcontractors, shall be performed in accordance with the standard of care with which such services are normally provided in the industry. If the services fail to meet the applicable industry standard, GAI-Tronics will re-perform such services at no cost to buyer to correct said deficiency to Company's satisfaction provided any and all issues are identified prior to the demobilization of the Contractor's personnel from the work site. Re-performance of services shall be Buyer's sole and exclusive remedy, and in no event shall GAI-Tronics warranty obligations with respect to services exceed 100% of the total cost of the services provided hereunder.

Warranty Periods. Every claim by Buyer alleging a defect in the goods and/or services provided hereunder shall be deemed waived unless such claim is made in writing within the applicable warranty periods as set forth above. Provided, however, that if the defect complained of is latent and not discoverable within the above warranty periods, every claim arising on account of such latent defect shall be deemed waived unless it is made in writing within a reasonable time after such latent defect is or should have been discovered by Buyer.

Limitations / Exclusions. The warranties herein shall not apply to, and GAI-Tronics shall not be responsible for, any damage to the goods or failure of the services supplied hereunder, to the extent caused by Buyer's neglect, failure to follow operational and maintenance procedures provided with the equipment, or the use of technicians not specifically authorized by GAI-Tronics to maintain or service the equipment. THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES AND REMEDIES, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Return Policy

If the equipment requires service, contact your Regional Service Center for a return authorization number (RA#). Equipment should be shipped prepaid to GAI-Tronics with a return authorization number and a purchase order number. If the equipment is under warranty, repairs or a replacement will be made in accordance with the warranty policy set forth above. Please include a written explanation of all defects to assist our technicians in their troubleshooting efforts.

Call 800-492-1212 (inside the USA) or 610-777-1374 (outside the USA) for help identifying the Regional Service Center closest to you.