

# 334 Selective Signaling Terminal (SST) System Description

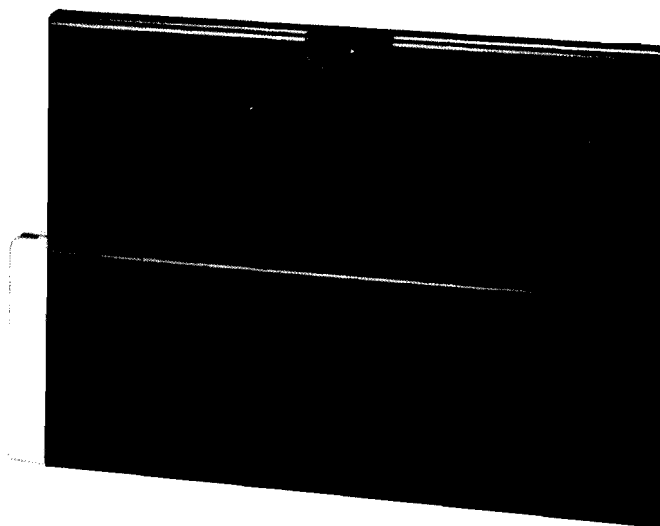


Figure 1. 334 SST System

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## 1. General Description

- 1.01 The Tellabs 334 Selective Signaling Terminal (SST) (Figure 1) is a user programmable, multistation communication System. The SST is designed to be compatible with SS-1 and SS-4 2600/2400Hz signaling or SS-3 DTMF signaling private-line networks that provide one-, two-, or three-digit dialing. Network conferencing is performed internally in a digital format to provide better voice quality and to allow a greater number of possible conference participants. Stations can also access an off-net feature to place calls outside of the selective-signaling network. The System is available in either a one- or two-shelf arrangement (depending on the number of stations used) that can be wall or rack-mounted. A single two-shelf 334 SST can accommodate up to 26 stations (telephones). The SST can be optionally expanded to support up to 52 stations by interconnecting two SST's in a master-slave System arrangement. The System is easily programmed via its front-panel controls and

indicators, and includes integral self-test diagnostic capabilities. Feature Package 2 (FP2) is the standard software included with the System, providing all selective-signaling operating functions. The System's selective-signaling functions can be enhanced by adding an FP3 or FP4 firmware subassembly to the 3401 SST Master Control Module to provide PBX-like local System functions. The 334 System with FP2 provides the following features:

- Three types of selective signaling: SS-1, SS-3, and SS-4.
- One-, two-, or three-digit dialing with up to 9, 81, or 729 possible dialing codes, respectively.
- Automatic-privacy, manual-privacy, or non-privacy network operating modes.
- Dial-controlled add-on conferencing.
- Privacy-override and intrusion options.
- 2wire and 4wire station interfaces.
- 2wire and 4wire trunk interfaces.
- Access by DTMF and rotary-dial telephones.
- Capacity of 26 stations, with expansion up to 52 stations in master-slave mode.
- Nonvolatile System memory that retains programmed information indefinitely, even during loss of System power.
- Automatic and manual self-test diagnostics.
- Voice-operated switch (VOX) that automatically resets System privacy.
- Loudspeaker control capability.
- Remote equipment-control capability via optional 3408A/B modules.
- Off-network access to PBX or central offices.
- Station-, System-, or network-status lamp indications.
- All-call and group-call features.

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

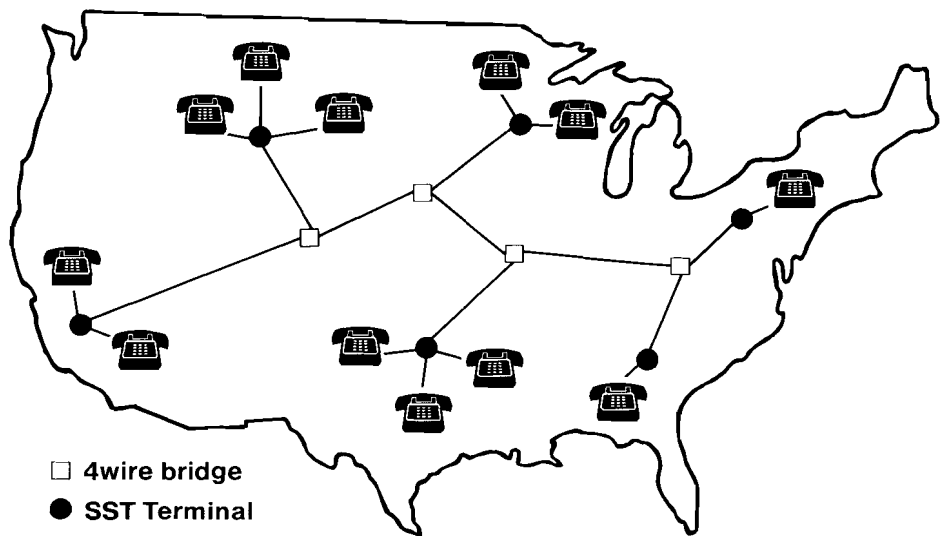
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## Applications

1.03 Services provided by the 334 System are normally used by individuals or businesses requiring frequent and private communication, e.g., government agencies, brokerages, utilities, airlines, trucking firms, etc. A number of 334 Systems can be interconnected to form a selective-signaling network. In the selective-signaling network (two or more SST's at different physical locations), each System interfaces a private 4wire network. Signaling and transmission between the stations of each System in the network are accomplished via this 4wire facility (see Figure 2). Conventional applications for selective-signaling networks are voice conferencing, low-speed data communication, and the regulation of remote equipment such as pumps or valves.

(General Description)

Figure 2. Typical Selective Signaling Network



<b>Available Codes</b>	1.04	The 334 System can be programmed for either one-, two-, or three-digit dialing. When the System is programmed for one-digit dialing, nine individual signaling codes (numbers) are available. The digit 1 is reserved to cancel previously dialed codes. Two-digit dialing expands the number of available codes to 81, and three-digit dialing allows 729 individual codes.
<b>All Call</b>	1.05	The all-call feature allows programming of up to 16 different all-call codes. When any one of the codes is dialed, it rings all stations that are not assigned for the transmission of data (see paragraph 2.16).
<b>Group Call</b>	1.06	The group-call feature allows the same code to be assigned to a group of selected stations, so that all stations in the group are rung when that code is dialed. By assigning the same code to different stations, an unlimited number of group calls can be formed.
<b>Operating Modes</b>	1.07	The 334 System offers a choice of three standard selective-signaling modes: non-privacy, manual privacy, and automatic privacy. Override and intrusion capabilities are provided in both the manual- and automatic-privacy modes. The operating mode selected depends upon network requirements.
<b>Privacy Operation</b>	1.08	In the non-privacy mode, any System user can access, dial, and converse on the network simply by going off-hook. The automatic and manual privacy features permit private conferences to be established among selected stations. In the automatic-privacy mode, only the System stations that are signaled are admitted into the conference. The manual-privacy feature is activated through the use of a privacy key, which prevents other stations from entering the conference. During privacy, stations can be admitted to an established conference only if they are dialed in by a party already in the conference. All privacy is released when the last party at the originating location goes on-hook.

(General Description)

<b>Privacy Override</b>	1.09	The privacy-override feature allows selected station users to enter the conference when the System is in the automatic- or manual-privacy mode. Privacy override allows a station user to release privacy by depressing a privacy-override key associated with the user's station set. When the key is depressed, a short burst of tone is applied to the connection to inform the conferring parties that privacy has been overridden. After the short burst of tone, privacy is released. At this time, the user enters the conference and can subsequently add other conference participants.
<b>Local Override</b>	1.10	The local-override, or <i>intrusion</i> , feature allows the station user to enter an established <b>private</b> connection only as long as a local-override key associated with the user's station is depressed. When this key is depressed, a short burst of tone is applied to the connection to inform the conferring parties that privacy has been violated. During local override, the intruding party cannot add other conference participants.
<b>Remote Equipment Control</b>	1.11	Remote equipment is controlled via code-activated relays on the 3408A/B module to remotely activate and deactivate external devices such as radios, lamps, relays, valves, etc. (see paragraphs 2.18 and 2.19).
<b>Off-Net Access</b>	1.12	The off-net-access feature allows SST stations to place calls outside of the selective-signaling network (i.e., into the public switched network). A network station can access a PBX line or trunk or a central-office line by dialing a user-programmed code. Also, parties outside of the selective-signaling network can dial directly into the network and access network stations; alternately, <i>unwanted</i> callers can be denied access to the network by assigning security codes to each incoming off-net trunk. When a party connects to the incoming SST off-net-access trunk, he or she must then dial the security code and receive another dial tone before being allowed access to a station.
<b>Off-Net-Access Circuits</b>	1.13	Three types of off-net-access circuits are available in the SST System: <ul style="list-style-type: none"><li>• 4Wire access via the 3409 SST 4Wire E&amp;M Off-Net-Access Module.</li><li>• 2Wire PBX-trunk or local 2wire-station access via the 3410A/B SST PBX Trunk Access Module.</li><li>• 2Wire PBX- or CO-line access via the 3411A/B SST PBX Line Interface Module.</li></ul>
<b>Off-Net Interfaces</b>	1.14	A 3409 module connects the SST's selective-signaling network to a 4wire E&M trunk. The 3410A connects the SST to a loaded-cable 2wire interface, while the 3410B interfaces a nonloaded-cable twisted pair to a standard 2wire station-set. A 3411A module connects the SST to a 2wire loaded PBX line, while the 3411B interfaces the SST to a 2wire nonloaded-cable CO line.
<b>SST Station-Sets</b>	1.15	The 334 System can be optioned and equipped for use with both DTMF and rotary-dial station sets at the same location. SST station circuitry is compatible with any standard 4wire or 2wire telephone set and also with standard 4wire key-type station sets.
<b>System Expansion</b>	1.16	While a single SST's maximum 26-station capacity is adequate for most locations, larger installations can benefit from the System's expansion capabilities. In such installations, two 26-station SSTs can be connected in a master-slave arrangement to extend service to as many as 52

stations at a single location. With such an arrangement, the two Systems both interface a single selective-signaling 4wire private line, thus economizing on monthly leased-line charges. When so connected, the SST connected to the 4wire selective-signaling line is designated the *master* System and the other is designated the *slave* System. For proper operation, the two SSTs should be located within 15 feet of each other.

## 2. System Components

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### Standard Equipment

2.01 A single 334 SST System consists of the following components:

#### Mounting and Power Equipment

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##### Wall-Mount Systems:

**334A** — One 334A SST System accommodates up to 10 stations and includes the following:

- One Type 16C (Tellabs Type 1922) Apparatus Case.
- One prewired Type 1012 Common Equipment Shelf.
- One 8050 Power and Ringing Supply.
- One 8034 DC-to-DC Converter.
- Two Type 66B terminal blocks.

**334B** — One 334B SST System accommodates up to 26 stations and includes the following:

- One Type 16C (Tellabs Type 1922) Apparatus Case.
- One prewired Type 1012 Common Equipment Shelf.
- One prewired Type 1012 Station Equipment Shelf.
- Two 8050 Power and Ringing Supplies.
- Two 8034 DC-to-DC Converters.
- Five Type 66B terminal blocks.

##### Rack-Mount Systems:

**334C** — One 334C System accommodates up to 10 stations and includes the following:

- One connectorized 334C Common Equipment Shelf.
- One 8034 DC-to-DC Converter.

**334D** — One 334D System, which must be used in conjunction with a 334C System and accommodates up to 16 additional stations (26 total), includes the following:

- One connectorized 334D Station Equipment Shelf.
- One 8034 DC-to-DC Converter.

#### Common Equipment

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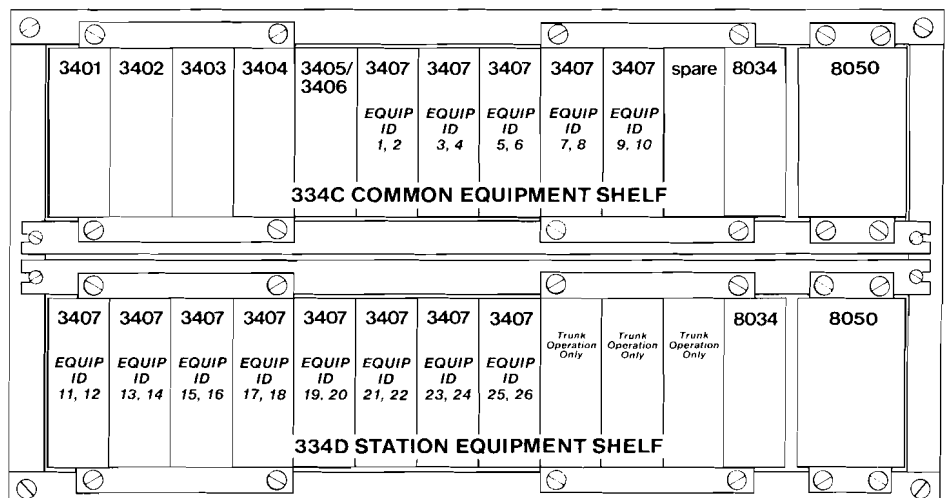
##### All Systems:

The Common Equipment complement, which must be ordered separately with each 334A, 334B, or 334C System (see List numbers in Tellabs Price List), includes the following modules:

(System Components)

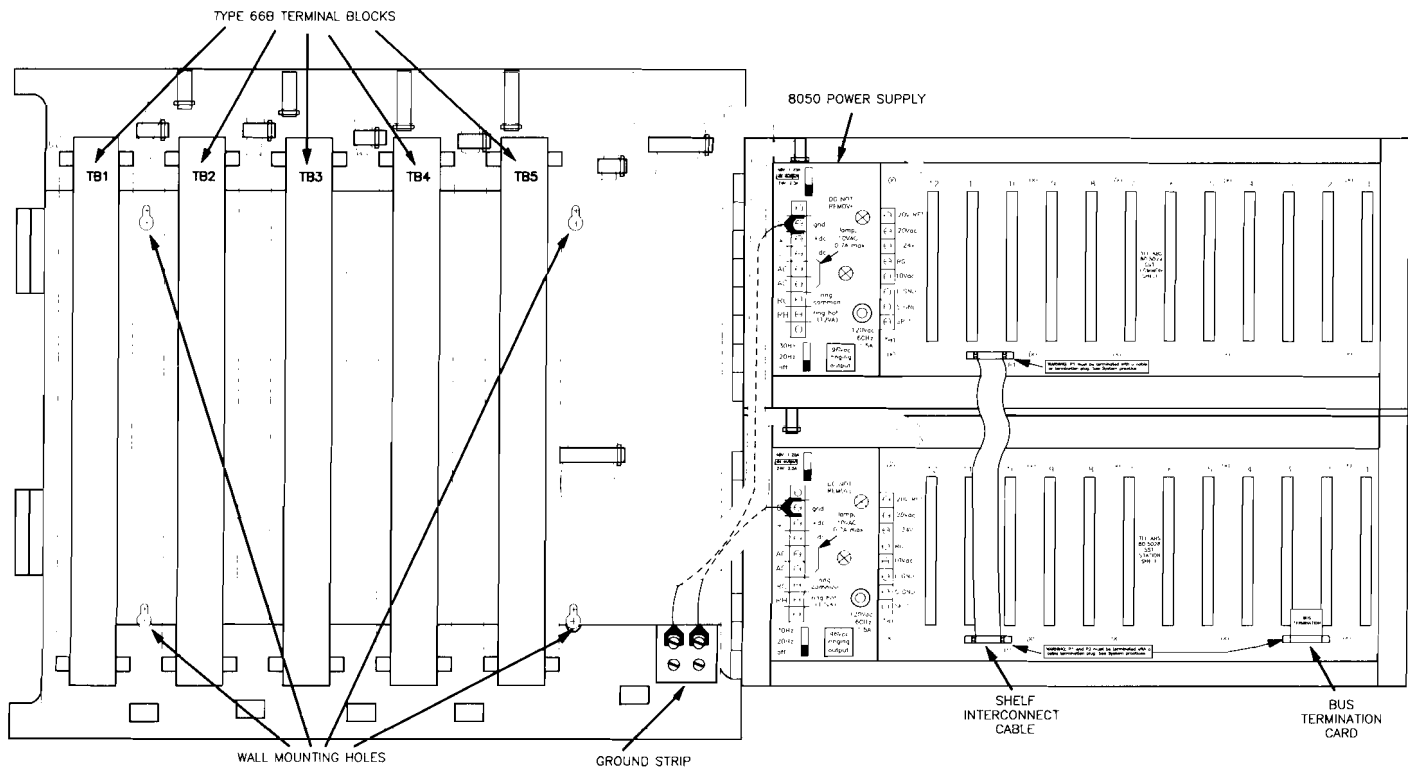
		<ul style="list-style-type: none"> <li>• One 3401 SST Master Control Module.</li> <li>• One 3402 SST System Clock Module.</li> <li>• One 3403 SST Time Slot Interchange Module.</li> <li>• One 3404 SST 4Wire Interface Module (accepts optional 9914 2713Hz Tone Detector Subassembly for tone-activated loopback).</li> <li>• <i>Either:</i> One 3405 SST Tone Generator Module (rotary only), <i>Or:</i> One 3406 SST Tone Generator and DTMF Transceiver Module (rotary or DTMF).</li> </ul>
<b>Optional Equipment</b>	2.02	<p>In addition to the 3407 4wire station module, the 334 SST System offers a choice of two external-control and five off-network-access modules. Each of these can be installed in any 3407 mounting position; however, each reduces by one the maximum number of 3407s that can be installed. The available modules are as follows:</p> <ul style="list-style-type: none"> <li>• One 3407 Dual Station Circuit for every two 4wire stations; up to 13 can be installed for a total of 26 stations.</li> <li>• 3408A and/or 3408B SST External Control Modules.</li> <li>• 3409 SST 4Wire E&amp;M Off-Network-Access Module.</li> <li>• 3410A and/or 3410B SST 2Wire PBX Trunk Access Modules.</li> <li>• 3411A and/or 3411B SST PBX/CO Line Access Modules.</li> </ul>
<b>Wall-Mounted System</b>	2.03	<p>The wall-mounted 334A and 334B assemblies include the necessary hardware to mount and interconnect the System modules. The assemblies are housed in a Type 16C (Tellabs Type 1922) Apparatus Case. All cabling between the SST and the on-premises equipment is accomplished at Type 66B terminal blocks located on the frame of the apparatus case (see Figures 3a and 3b).</p>
<b>334A and 334B Systems</b>	2.04	<p>The 334A provides mounting for the Common Equipment Shelf, all common equipment modules, and up to five station modules (10 stations), while the 334B includes the above plus a Station Equipment Shelf to increase System capacity to a maximum of 26 stations. Each 12-position Type 1012 Mounting Shelf has prewired mounting positions for up to 10 System modules plus power and ringing. These shelves are attached to a swing-out frame to permit access to the terminal blocks.</p>

Figure 3a. 334B SST System equipped for 26 stations



## (System Components)

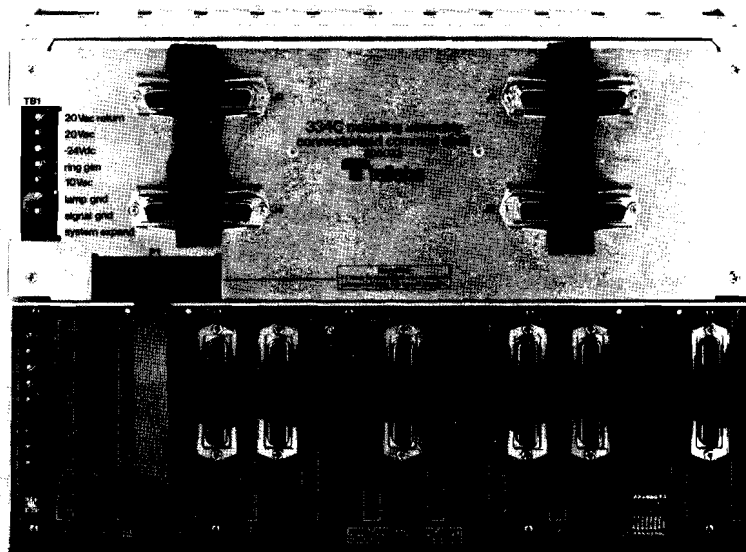
Figure 3b. Open apparatus case showing frame-mounted terminal blocks and swing-away 334B System shelves



## Rack-Mounted System

- 2.05 The SST System can also be rack-mounted by means of the 334C and 334D Mounting Assemblies. The 334C and 334D assemblies are both 12-position Type 1012 Mounting Shelves designed for mounting in 19-inch relay racks. The 334C Mounting Assembly is factory-wired to accommodate the SST's common equipment complement and up to five station, external control, or off-network-access modules. The 334D Mounting Assembly provides prewired mounting positions that accept up to 10 station, external control, or off-network access modules. Power and ringing connections are made at barrier-type terminal blocks on the shelves' backplanes, while all other connections are made via 25-pair connectorized cables to Amphenol-type connectors located on the 334C's metal backplate and on the 334D's printed circuit backplane (see Figure 3c).

Figure 3c. Interconnected 334C and 334D Assemblies, rear view



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## System Modules

2.06 The modules of the 334 SST can be grouped into five categories as follows:

- Common equipment modules.
- Station equipment modules.
- External control modules.
- Off-network-access modules.
- Power and ringing modules.

Each of the modules in each category are described in the paragraphs that follow.

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## Common Equipment Modules

### Common Equipment Module Complement

2.07 The common equipment modules provide the conference functions; control all station, external-control, and off-net-access modules; interface the 4wire private network; and provide the means to option the System. The common equipment modules are as follows:

- 3401 SST Master Control Module.
- 3402 SST System Clock Module.
- 3403 SST Time Slot Interchange Module.
- 3404 SST 4Wire Interface Module.
- 3405 SST Tone Generator Module.
- 3406 SST Tone Generator and DTMF Transmitter/Receiver Module.

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### 3401 SST Master Control Module

2.08 The 3401 SST Master Control Module is a software-controlled circuit that directs the signaling and control functions of the digital 334 System. Software contained in the 3401 controls all functions of the System modules and receives status information from them. The 3401 includes a nonvolatile memory that retains programmed information indefinitely, even during a loss of System power. Front-panel pushbuttons and LED displays (see Figure 4) provide the means to program station codes (numbers) and most System features. The 3401's software in the



(System Components)

feature-package subassembly includes self-test and diagnostic programs that allow diagnosis of System failures through the use of the module's front-panel pushbuttons and displays. The 3401's block diagram is shown in Figure 5.

Figure 4. Front-panel pushbuttons and LED displays on 3401 SST Master Control Module

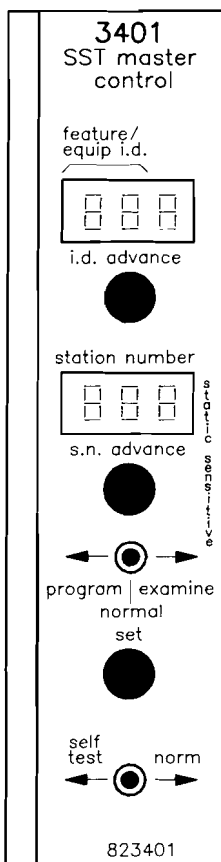
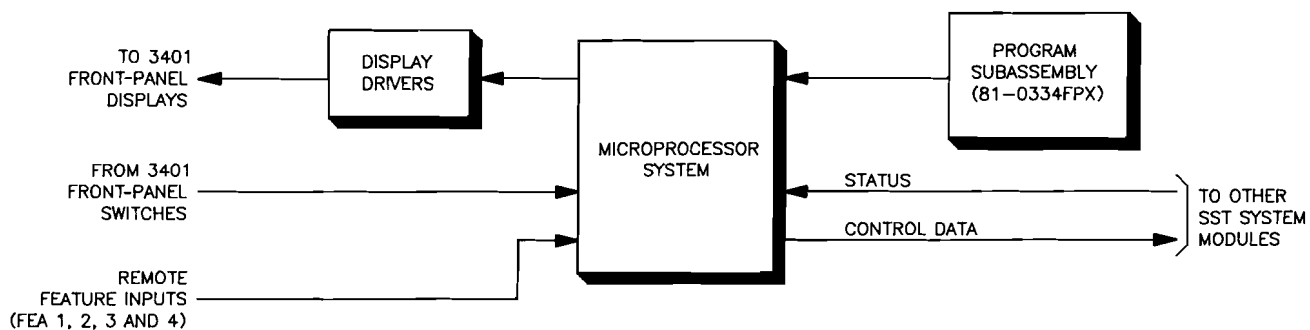


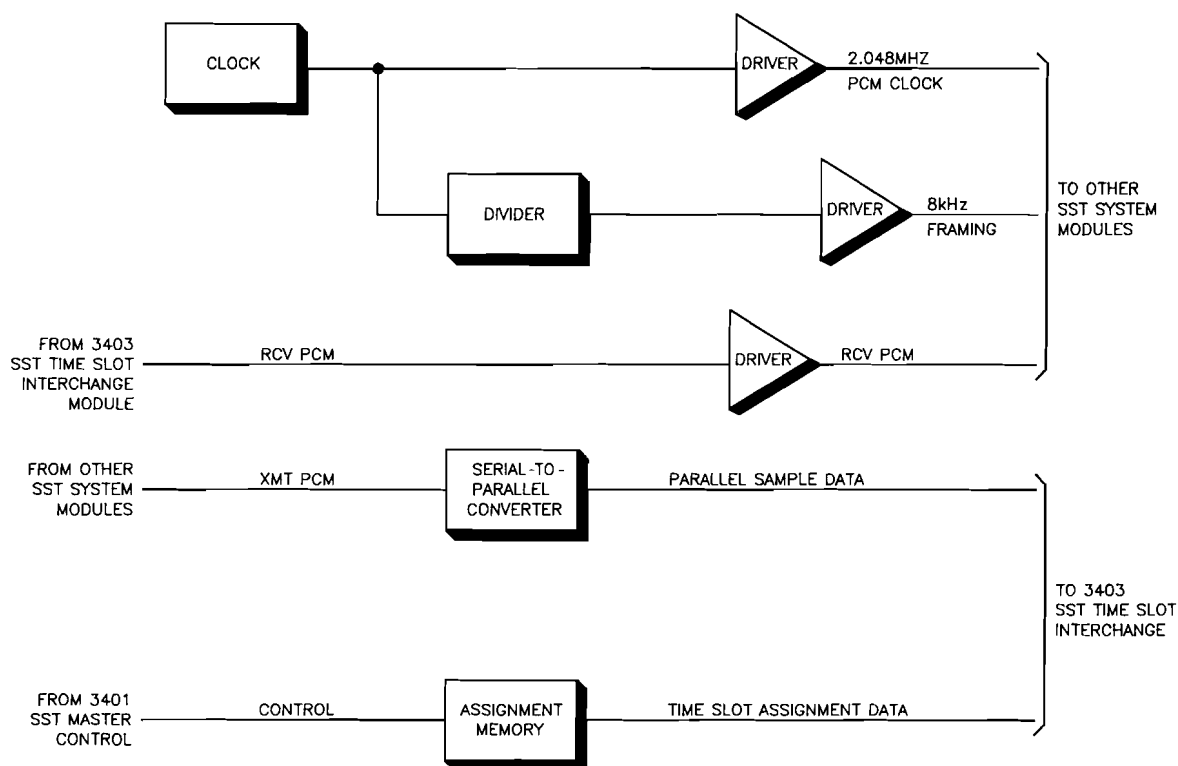
Figure 5. Block diagram of 3401 SST Master Control Module



**3402 SST System Clock Module**

2.09 The 3402 SST System Clock Module is designed to interact with the 3401 SST Master Control Module and the 3403 SST Time Slot Interchange Module to provide the System's conferencing functions. The 3402 module accepts conference assignments from the 3401 SST Master Control Module and supplies timing and control signals to the 3403 SST Time Slot Interchange Module. The 3402 module supplies crystal-controlled 2.048MHz clock signals and 8kHz framing signals to other System modules. The block diagram of the 3402 module is shown in Figure 6.

Figure 6. Block diagram of 3402 SST System Clock Module



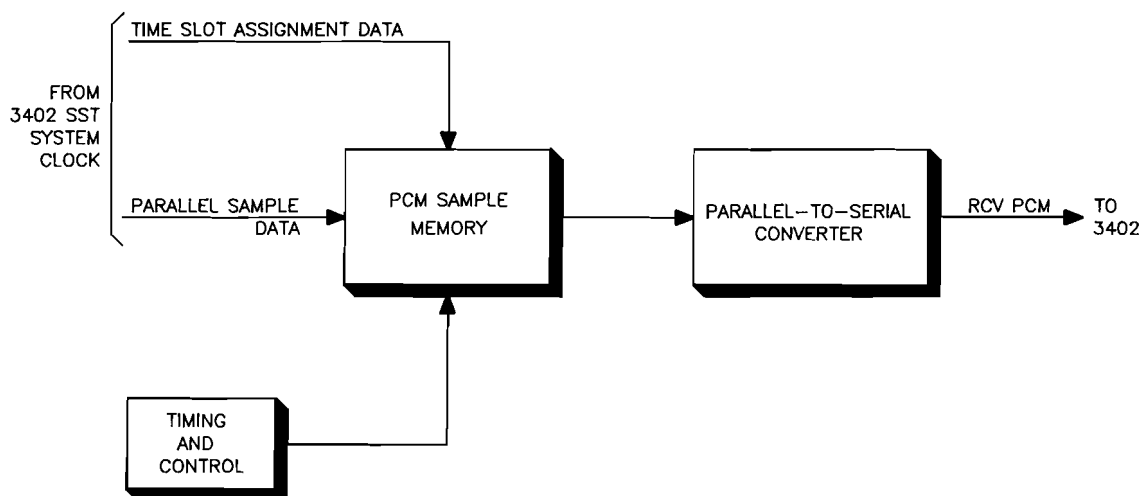
**3403 SST Time Slot Interchange Module**

2.10 The 3403 SST Time Slot Interchange Module, in conjunction with the 3402 SST System Clock Module, provides the conferencing capabilities for the System. The 3403 receives pulse code modulation (PCM) samples from other System modules and distributes them in precise timeslots that support the System's multiple voice-path connections and conference capabilities. The block diagram of the 3403 module is shown in Figure 7.

**3404 SST 4Wire Interface Module**

2.11 The 3404 SST 4Wire Interface Module, in conjunction with either the 3405 SST Tone Generator or the 3406 SST Tone Generator and DTMF Transmitter/Receiver Module, provides the transmission and signaling interface between the 4wire private line and other modules of the System. Adjustable gain is provided in the 3404's transmit and receive channels. The receive channel also provides a switch-selectable choice of

Figure 7. Block diagram of 3403 SST Time Slot Interchange Module



loaded-cable equalization, nonloaded-cable equalization, or no equalization. The 3404 module contains a 2600Hz single-frequency (SF) receiver and a 2400/2600Hz SF transmitter. The SF transmitter and receiver are used when the 334 System is configured for SS-1 or SS-4 operation. Six front-panel jacks provide access to the transmit and receive channels for measurement, testing, or troubleshooting. In addition, the 3404 also includes the following features:

- A voice-operated switch (VOX) in the 3404 module that can reset 334 System privacy 2 minutes after the termination of voice activity.
- A loudspeaker output capable of driving one 800-ohm external loudspeaker.
- Local loopback, standard dc-controlled loopback, or optional 2713Hz tone-activated loopback.

Loopback capabilities are described in the following paragraph, and the 3404 block diagram is shown in Figure 8. For detailed information on the 3404 module, refer to Tellabs practice section 8X3404.

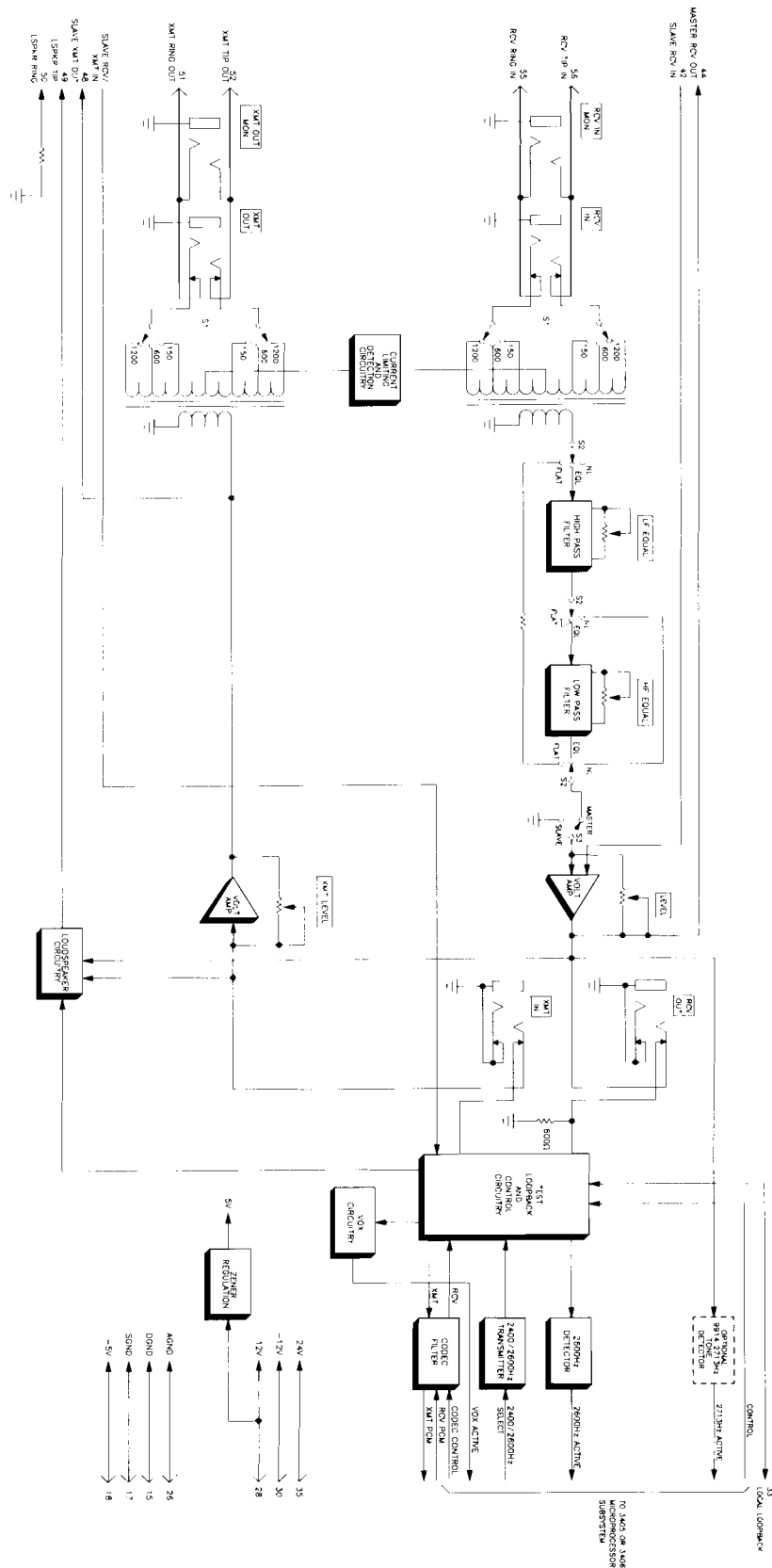
### 3404 Loopback Capabilities

2.12 The 3404 module provides three methods of activating loopback:

- Local loopback is activated when a ground is applied to the loopback lead to allow the receive input to be looped to the transmit output.
- Standard dc-controlled remote loopback is activated by applying dc current to the simplex leads at the local office.
- Tone-activated loopback is possible when the 3404 is equipped with the optional Tellabs 9914 2713Hz Tone Detector Subassembly. When the 9914 receives 2713Hz tone, the 3404 enters the loopback state wherein the module's receive input is looped to its transmit output. Tone-activated loopback also causes each local station to receive busy tone to indicate that the System is not available for operation. Loopback is released manually in response to a second 2713Hz tone or automatically after 2 minutes of inactivity on the facility.

(System Components)

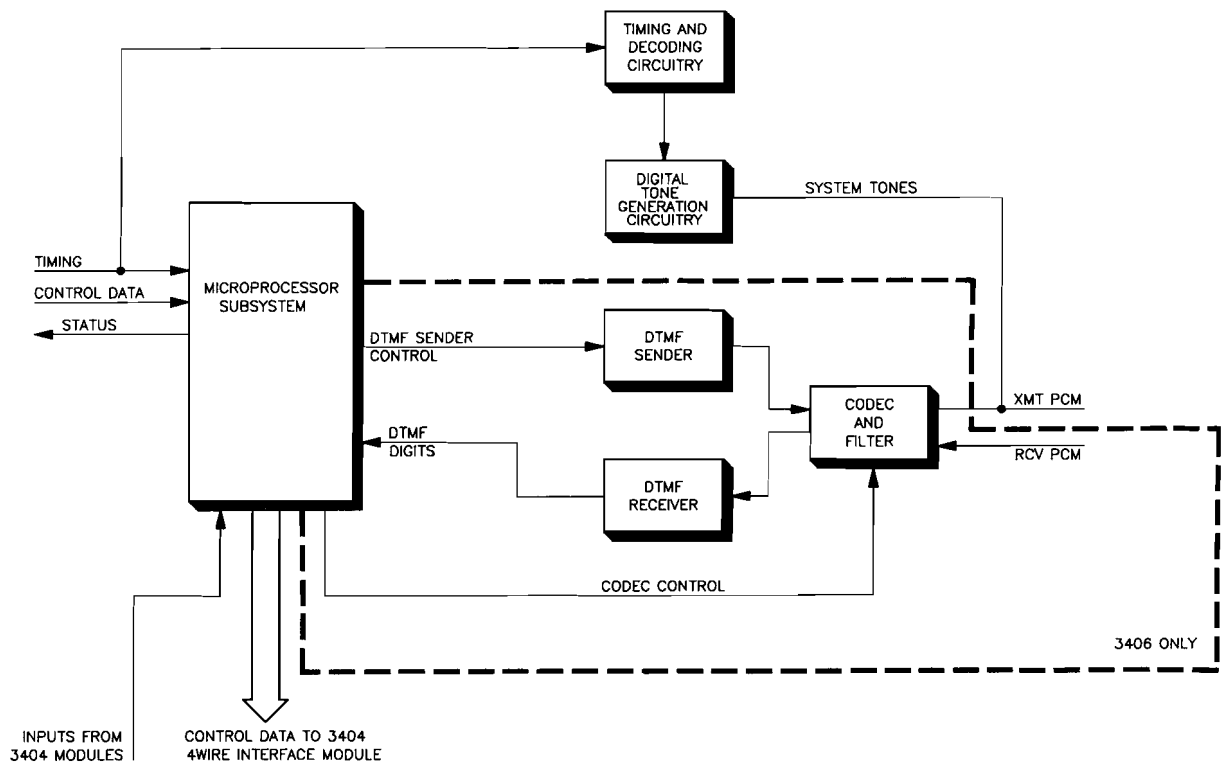
Figure 8. Block diagram of 3404 SST 4Wire Interface Module



(System Components)

<b>3405 SST Tone Generator Module</b>	2.13	The 3405 SST Tone Generator Module generates dial tone (440Hz+350Hz), intrusion tone (2183Hz), busy tone (480Hz+350Hz interrupted at 120ipm), and ringback tone (440Hz+480Hz interrupted at 30ipm), and is used in Systems where only <b>rotary-dial</b> station-sets are used. Its front-panel houses a red <i>fault</i> LED that lights during diagnostic self-testing to indicate that the module has failed.
<b>3406 SST Tone Generator and DTMF Transmitter/Receiver Module</b>	2.14	The 3406 SST Tone Generator and DTMF Transmitter/Receiver Module provides the same functions as the 3405 but adds a DTMF transmitter and receiver for use in Systems where only DTMF station-sets or a mixture of <b>DTMF and rotary-dial</b> station-sets are used. The transmitter converts rotary-dial pulses to DTMF signaling while the receiver accepts DTMF signaling from the DTMF stations and 4wire private facility during SS-3 selective signaling. For more detailed information on the 3405 and 3406 modules, refer to Tellabs practice section 8X3405/8X3406. The block diagram of both modules is shown in Figure 9.

Figure 9. Block diagram of 3405 SST Tone Generator Module and 3406 SST Tone Generator and DTMF Transmitter/Receiver Module



### Station Equipment Module

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|---|------|---|
| <b>3407 SST Dual<br/>4Wire Station<br/>Circuit Module</b> | 2.15 | The 3407 SST Dual 4Wire Station Circuit Module simultaneously controls two 4wire stations. Although these stations are normally key stations, any 4wire station with or without an A lead can be used. The 3407 module provides talk battery, sidetone, dial-pulse or DTMF station telephone access, and local hold for both stations, and it also passes ringing. In addition, the 3407 can be switch-optional for push-to-talk operation; local, system, or network lamp indications; and internal or external ringing. |
| <b>Channels<br/>A and B</b>                               | 2.16 | The 3407 module serves two local stations designated channel A and channel B. Channel A on each 3407 module provides a loudspeaker output that can be activated with or without ringing the associated station. Eight individual station numbers are provided for each station: the sixth and seventh numbers are used for loudspeaker activation, and the eighth number is reserved for the transmission of data (sidetone is automatically disabled on channel A only).   |
| <b>Key-Station<br/>Lamp Indications</b>                   | 2.17 | In the 334 System, normal key-station lamp indications are provided when the stations are ringing, off-hook, or on hold. Switch optioning of the 3407 module provides either local-System status indications or network-privacy status indications during idle. For more detailed information on the 3407 module, refer to Tellabs practice section 8X3407. The 3407 module block diagram is shown in to Figure 10.   |

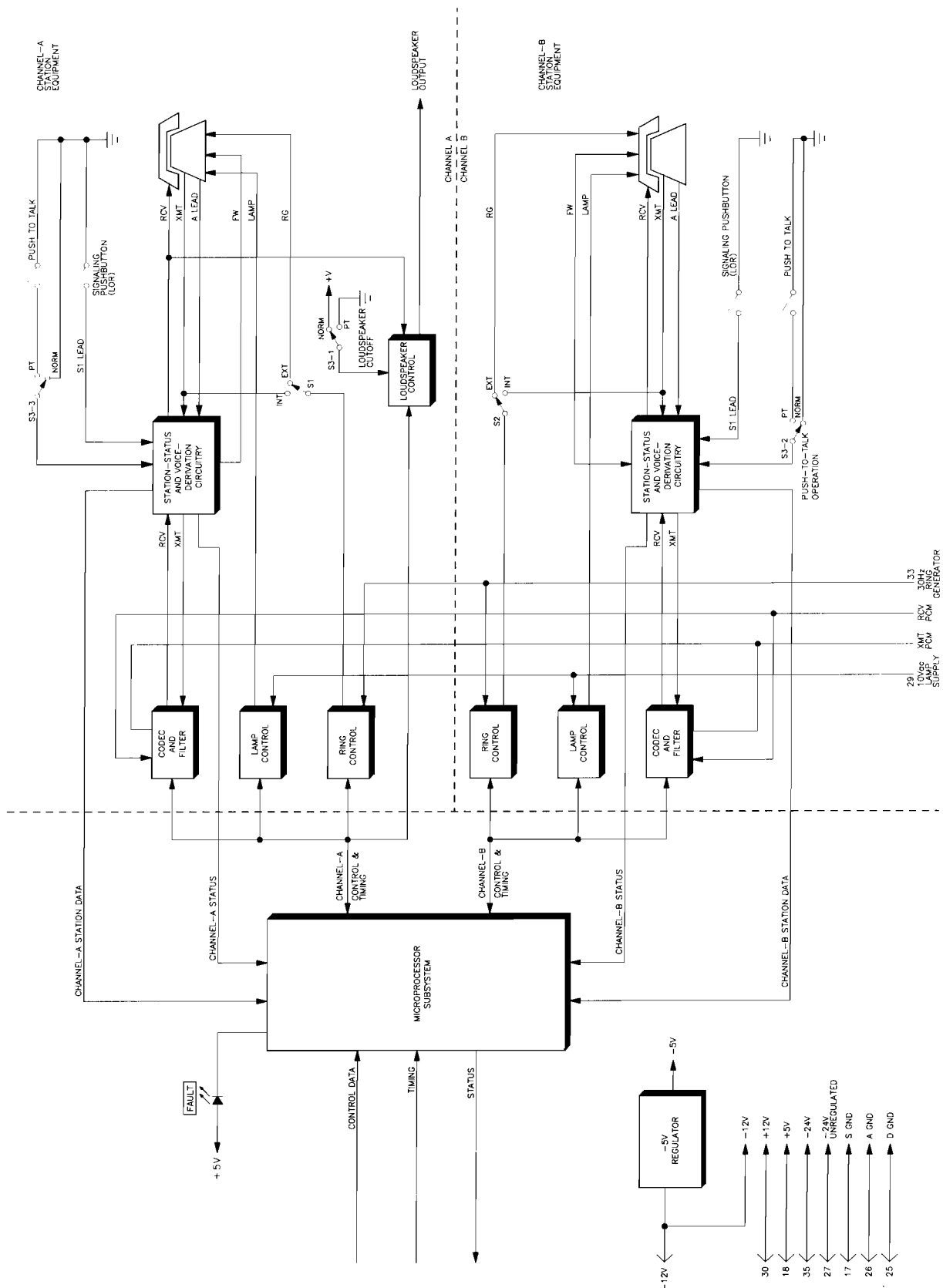
### External Control Modules

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|--|------|---|
| <b>3408A SST External<br/>Control Module</b> | 2.18 | The 3408A SST External Control Module provides six independent relays for use where remote activation and deactivation of external devices such as radios, lamps, relays, valves, etc., are required. The module can be switch-optional for either a pulsed, latched, or bypassed mode of operation. In the pulsed and latched modes, each relay is activated by dialing its user-programmed code. In the bypass mode, each relay is activated by placing a ground signal on its input lead.  |
| <b>3408B SST External<br/>Control Module</b> | 2.19 | The 3408B SST External Control Module contains six independent relays that can monitor the output of various devices. The module also provides the capability of automatically dialing a user-programmed number whenever a ground signal is applied to a particular input lead. The 3408B functions identically to the 3408A in all modes of operation with the addition of the auto-dial feature. Figure 11, along with Table 1, explains these modes of operation. For more detailed information on the 3408A and 3408B modules, refer to Tellabs practice section 8X3408A/ 8X3408B. The block diagram of both modules is shown in Figure 12. |

## (System Components)

Figure 10. Block diagram of 3407 SST Dual 4Wire Station Circuit Module



(System Components)

Figure 11. Simplified 3408A/B module circuit

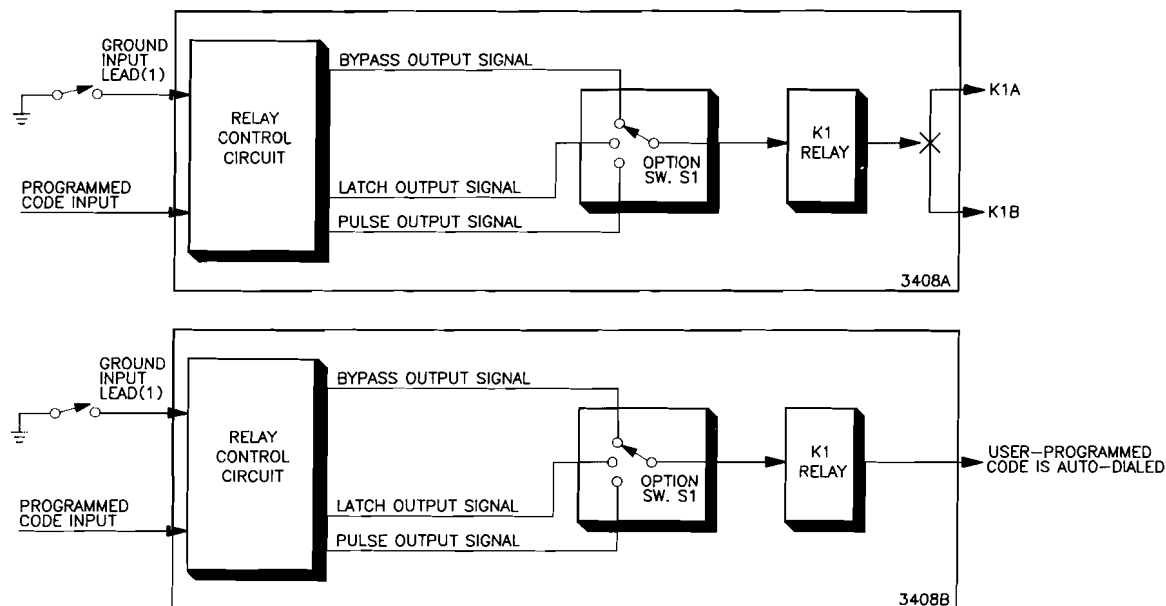


Table 1. 3408A/B operation in bypass, latch, and pulse modes

mode selected	external action (note 1)	3408A response	3408B response
Bypass	Apply ground to input lead (1)	Activates relay	Activates relay and auto-dials user-programmed code (note 2)
	Remove ground from input lead (1)	Deactivates relay	Deactivates relay
Latch	Dial user-programmed code	Activates relay	Activates relay
	Apply momentary ground to input lead (1) (note 3)	Deactivates relay	Deactivates relay and auto-dials user-programmed code (note 2)
Pulse	Dial user-programmed code	Pulses relay momentarily	Pulses relay momentarily
	Apply ground to input lead (1)	No action	Auto-dials user-programmed code (note 2)

**Note 1:** Dialing can be initiated either by the user or via 3408B auto-dial circuitry. Grounds can be supplied via manual or automatic switch or relay closures.

**Note 2:** If user-programmed codes are not assigned, the 3408B operates exactly like the 3408A.

**Note 3:** In the latched mode, a permanent ground on the input lead prevents reactivation of the relay.

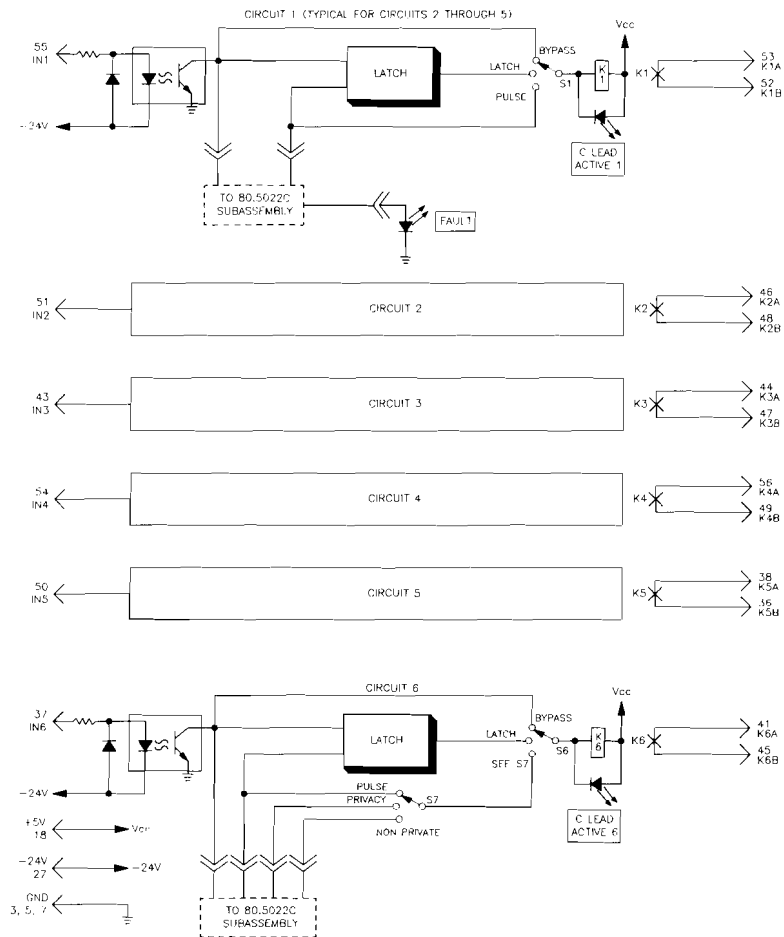
**Note 4:** In addition to the bypassed, latched, and pulsed modes, the sixth relay on the 3408A/B can be optioned to follow network privacy. When so optioned, the sixth relay can be further optioned for either of the following states:

A. Closed when privacy (manual or automatic) is established for the network, and open when privacy is terminated.

B. Open when privacy is established, and closed when privacy is terminated.



Figure 12. Block diagram of 3408A and 3408B SST External Control Modules



## Off-Net-Access Modules

### Available Mounting Positions

- 2.20 The 334 System can support a maximum of 26 stations, 13 off-net-access modules, or a combination of both. Each off-net module derives a single circuit and replaces one 3407 SST Dual 4Wire Station Circuit Module. The off-net modules can be installed in any mounting position used for 3407 modules, with the following exceptions:
- No station equipment or off-net modules optioned for station operation (3407, 3409, or 3410A/B) can be used in positions 9 and 10 of the **station shelf**.
  - If station equipment (or an off-net module optioned for station operation) is used in position 7 of the **station shelf**, trunk equipment cannot be used in position 10.
  - If station equipment (or an off-net module optioned for station operation) is used in position 8 of the **station shelf**, trunk equipment cannot be used in position 9.
  - There are no restrictions on the use of 3408A/B modules.

<b>3409 SST 4Wire E&amp;M Off-Net-Access Module</b>	2.21	<p>The 3409 4Wire E&amp;M Off-Net-Access Module allows the 334 System stations to access a network or PBX tie trunk external to the 334 SST and allows off-net stations to access the SST network. The 3409 module can be optioned for Type I or Type II E&amp;M signaling and for A-side or B-side E&amp;M signaling. A security code can be assigned via the 3401 module so that, on incoming calls, that code must be dialed to gain access to the SST network. When DTMF dialing is used by SST stations but the off-network equipment cannot accept DTMF dialing, the 3409 can be optioned (via the 3401 module) for DTMF-to-dial-pulse conversion. For detailed information on the 3409 module, refer to Tellabs practice section 8X3409. The 3409 module block diagram is shown in Figure 13.</p> <p><b>Note:</b> <i>The 3409 module should only be used in privacy operation.</i></p>
<b>3410A and 3410B SST 2Wire PBX Trunk Access Modules</b>	2.22	<p>The 3410A and 3410B SST 2Wire PBX Trunk Access Modules each provide an interface to a 2wire PBX trunk (loop-start or ground-start) or to a 2wire station set. Both modules provide loop current, send ring generator, and detect off-hook conditions to support a PBX trunk or a 2wire station set. The modules are identical in all respects except the factory-installed precision balance network (PBN) on each. The 3410A's PBN is designed for use with loaded cable or in a switched network containing a mixture of loaded and nonloaded cable, while the PBN used with the 3410B is designed for use with either nonloaded cable or short loops and tel sets. The 3410A and 3410B can be programmed for security-code operation to restrict incoming off-net access. For more detailed information on the 3410A and 3410B modules, refer to Tellabs practice section 8X3410A/8X3410B. The block diagram of both modules is shown in Figure 14.</p>
<b>3411A and 3411B SST PBX Line Access Modules</b>	2.23	<p>The 3411A and 3411B SST PBX Access Modules interface a loop-start or ground-start 2wire PBX line or CO line. Both modules detect ringing and present the appearance of a 2wire station set. The modules are identical in all respects except the factory-installed precision balance network (PBN) on each. The PBN on the 3411A is designed for use with loaded cable, while the PBN on the 3411B is designed for use with nonloaded cable. For more detailed information on these modules, refer to Tellabs practice section 8X3411A/8X3411B. The block diagram of both modules is shown in Figure 15.</p>

(System Components)

Figure 13. Block diagram of 3409 SST 4Wire E&M Off-Net-Access Module

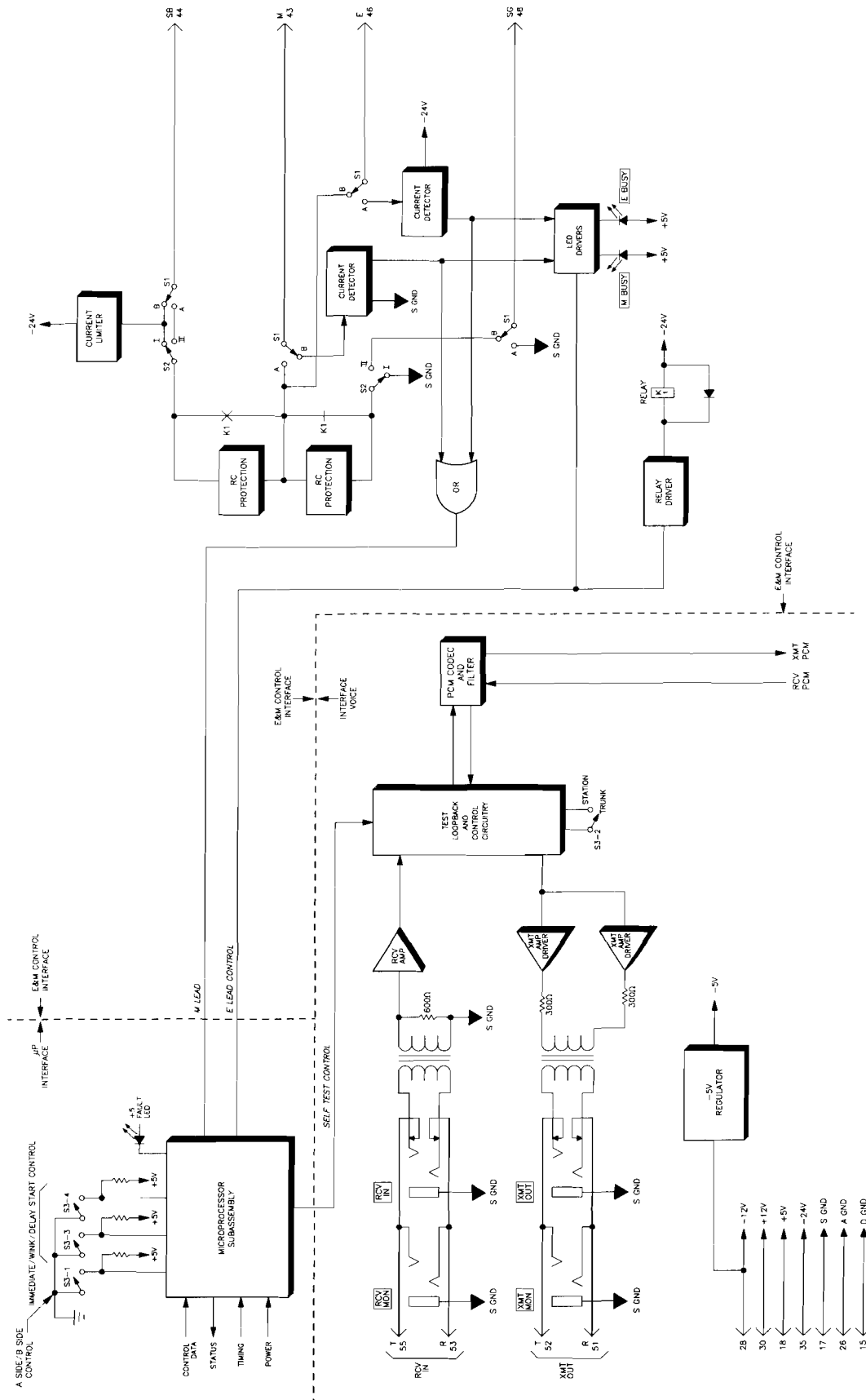
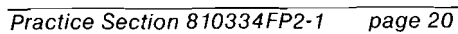


Figure 14. Block diagram of 3410A and 3410B SST 2Wire PBX Trunk Access Modules



(System Components)

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**8050 Power and Ringing Supply Module**

- 2.24 The 8050 Power and Ringing Supply Module derives power and ringing from a standard 117Vac, 60Hz source. A portion of the power provided by the 8050 is used by the 8034 DC-to-DC Converter Module for logic voltages used elsewhere in the System. The 8050 module also supplies lamp voltage to the System's key stations. The 8050 module block diagram is shown in Figure 16.

► **Caution:** *The 8050 Power and Ringing Supply Module must be optioned for -24Vdc. Otherwise, the System may be damaged.*

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**8034 DC-to-DC Converter Module**

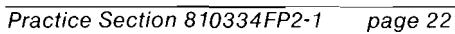
- 2.25 The 8034 DC-to-DC Converter Module is a switching-type converter that accepts a -24Vdc input from the 8050 Power and Ringing Supply Module and converts it into the various logic-level voltages used by the System modules. The 8034 module block diagram is shown in Figure 17.

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**System Expansion**

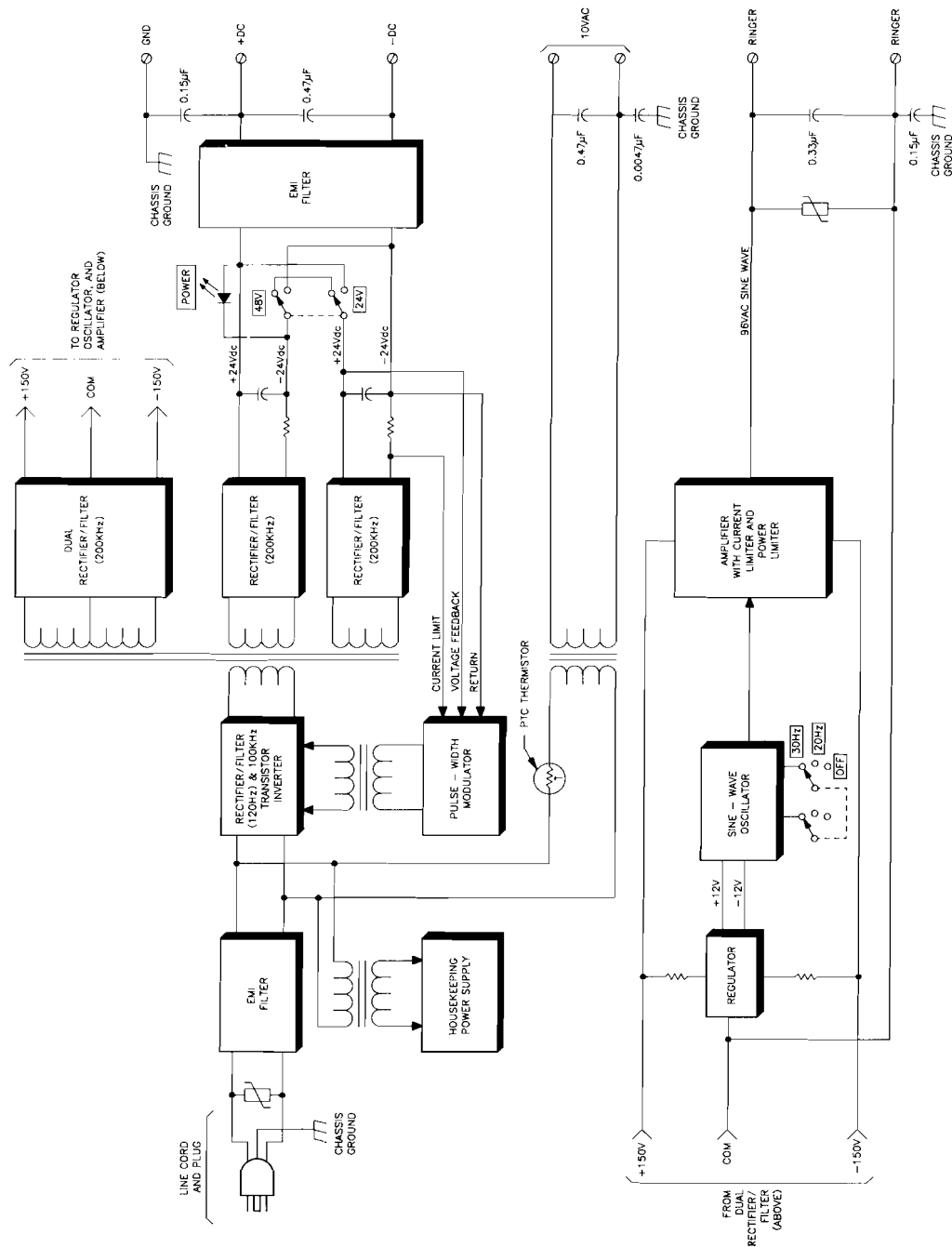
- 2.26 Two 334 SST Systems can be interconnected in a master-slave arrangement to extend service to as many as 52 stations at the same location via a single trunk connected to the master System. Key-station lamp indications for each System are entirely independent; no lamp-control information is passed between the two interconnected Systems.

Figure 15. Block diagram of 3411A and 3411B SST PBX Line Access Modules



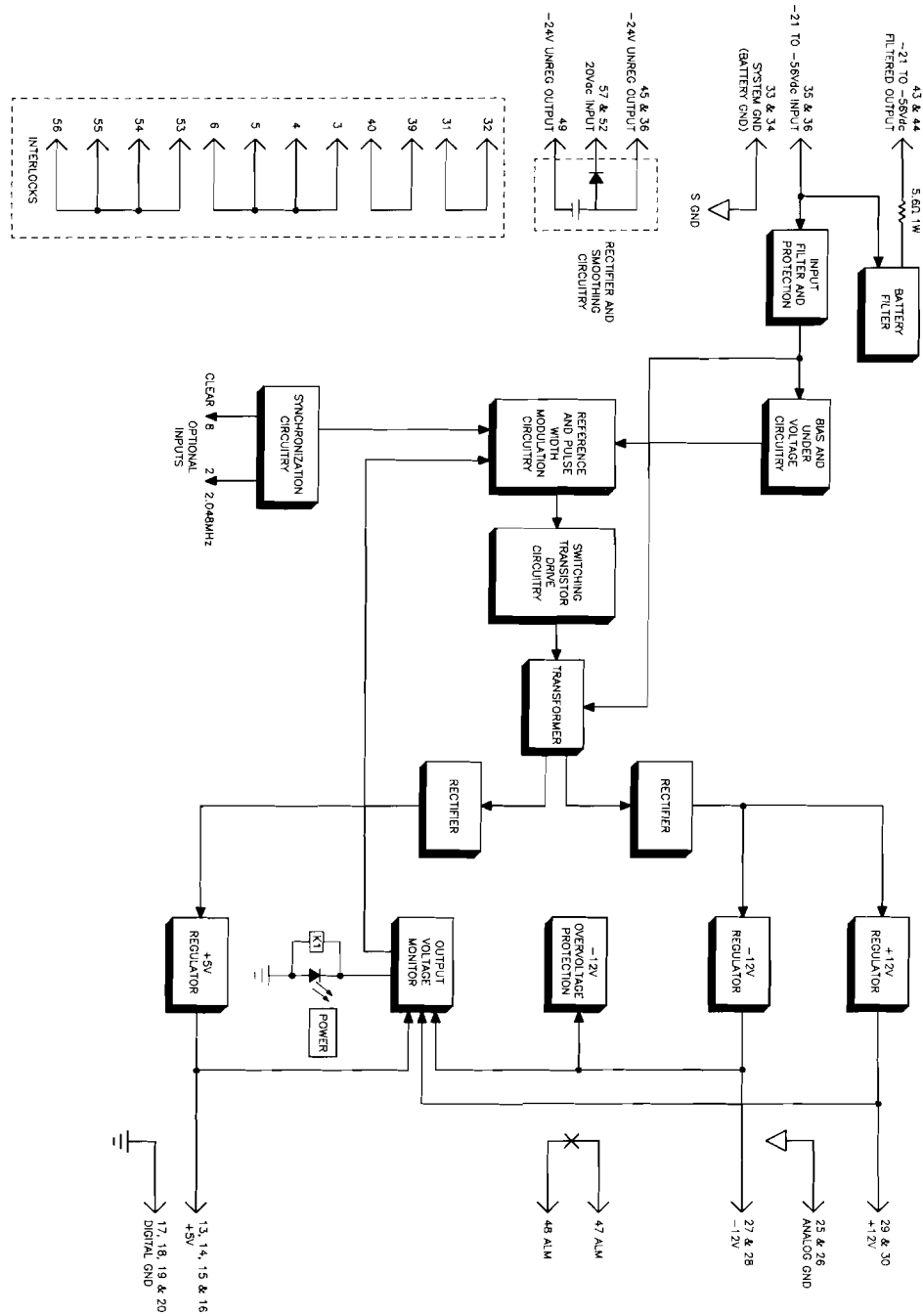
(System Components)

Figure 16. Block diagram of 8050 Power and Ringing Supply Module



(System Components)

Figure 17. Block diagram of 8034 DC-to-DC Converter Module





### 3. System Operation

Introduction	3.01	The 334 SST System is compatible with SS-1, SS-3, and SS-4 private-line networks that support privacy options and one-, two-, or three-digit dialing. The 334 System allows stations in a 4wire private network to establish multistation conferences. All System features are determined by the type of private-line network used. The remainder of Section 3 details System operation.
Selective-Signaling Operation	3.02	During selective-signaling operation, the network can be optioned for either privacy or non-privacy modes. The SST is optioned via front-panel switches and LEDs on the 3401 SST Master Control Module. System functions and network interactions are detailed in the following paragraphs, which begin with an SST station originating a call in a System arranged for two-digit dialing and non-privacy operation.
Non-Private Operation		
Initiating a Call	3.03	When the SST is optioned for SS-1 or SS-4 operation, a station goes off-hook and immediately accesses the 4wire private line. If signaling or conversation is taking place on the 4wire line, it will be heard. In SS-1 or SS-4 operation, digits are transmitted in the standard 2600Hz/2400Hz SF format.
Dialing Lockout	3.04	<p>When optioned for SS-3 operation, call initiation is processed in the same manner as for SS-1 and SS-4 with the exception of the dialing lockout feature. The dialing lockout feature (SS-1 and SS-4) prevents any other station from dialing after the originating station begins to dial. Any station that goes off-hook during the dialing period, or any station that was off-hook before dialing began, receives busy tone until dialing is completed. There is no dialing lockout feature for DTMF operation (SS-3). DTMF tones are transmitted in the standard format.</p> <p><b>Note:</b> <i>Even if the dialing lockout feature is not activated, dialing is still disregarded during the dialing period. Without activation of the dialing-lockout feature, busy tone is not heard.</i></p>
Dialing Timeout	3.05	<p>An interdigital timer is activated as soon as the first digit is dialed. For DTMF operation, the timer is set for 3 seconds, while for rotary-dial operation, the timer is set for 6 seconds. If the second digit is not dialed within the timeout period, the SST disregards the previously dialed digit, releases station lockout, and removes busy tone. In a two-digit System, if the second digit is dialed within the allotted time period, busy tone is removed from the locked-out local stations. All stations that are off-hook when lockout is released enter the conference.</p> <p><b>Note:</b> <i>If the System is optioned for single-digit operation, the interdigital timer is not activated. If the System is optioned for three-digit operation, lockout is extended for an additional time period after receipt of the second digit. As in all selective-signaling systems, dialing the digit 1 automatically releases station lockout and cancels any previously dialed digits.</i></p>

(System Operation)

<b>Ringback Tone in Non-Privacy Operation</b>	3.06	After dialing is completed, the dialed station is rung. If the network is optioned for ringback tone, the selective-signaling equipment at the ringing station provides ringback tone (440 + 480Hz interrupted at a 2-second-on/4-second-off interval) to all off-hook stations in the network.
<b>Ringing Timeout</b>	3.07	Ringing is applied until the station answers or until the conclusion of the preset ringing-timer interval, which can be set for up to 10 minutes. If more than one station at a location is being rung and the ringback-tone option is selected, ringback tone is applied until the first station goes off-hook or until the ringing-timer interval elapses (depending upon programming).

**Privacy Operation**

<b>General</b>	3.08	If the privacy mode of operation is selected, the System can be further optioned for either automatic or manual privacy via the 3401 SST Master Control Module. System operation in these modes is detailed in the following paragraphs.
<b>Setting Manual Privacy: SS-1 and SS-4</b>	3.09	If the SST is optioned for SS-1 or SS-4 operation and the local System and network are optioned for manual privacy, any station equipped with a manual-privacy key can establish privacy for the System. These manual-privacy keys are active only while the local station is off-hook. In both SS-1 and SS-4 operation, privacy is established via transmission of a 400ms burst of 2600Hz tone over the 4wire private line when the manual-privacy key is activated.
<b>Setting Manual Privacy: SS-3</b>	3.10	If the SST is optioned for SS-3 operation (DTMF), activation of the manual-privacy key establishes privacy by transmitting a 100ms #-key tone-burst (1477 + 941Hz) over the 4wire private-line. In both manual- and automatic-privacy modes, the * and # keys on DTMF telephones can be used to control privacy. Depressing the # key establishes manual privacy, and depressing the * key releases privacy.
<b>Setting Automatic Privacy: SS-1 and SS-4</b>	3.11	When the SST is optioned for SS-1 or SS-4, local privacy is established as soon as a local station goes off-hook to originate a call. (Going off-hook generates <i>local privacy</i> only.) At this time, busy tone is applied to lock out all other local stations, and any dialing by these stations is disallowed by the System. (Remote selective-signaling stations are still able to access the network.) After the local station dials its first digit, network privacy is established. In both SS-1 and SS-4 operation, privacy is established via the transmission of a 400ms burst of 2600Hz SF tone generated by the 3404 SST 4Wire Interface Module. As soon as the first station-code is transmitted, the signaled station (or stations) is rung, all other local stations are locked out, and privacy is extended to all stations in the selective-signaling network.
<b>Setting Automatic Privacy: SS-3</b>	3.12	When the SST is optioned for SS-3 operation, privacy is established for the entire selective-signaling network at the time the originating station goes off-hook to dial. With SS-3 operation, the local SST establishes privacy by transmitting a 100ms #-key DTMF tone-burst (1477 + 941Hz). (Any off-hook station generates a 100ms # tone originating from the 3406 SST Tone Generator and DTMF Transmitter/Receiver Module and extended to the <i>entire system</i> via the 3404 SST 4Wire Interface Module.)

(System Operation)

<b>Termination of Privacy: SS-1 and SS-4</b>	3.13	Manual or automatic privacy is terminated when the last station at the originating location goes on-hook. If the System is optioned for SS-1 or SS-4 operation, a 1-second burst of 2600Hz tone is transmitted over the 4wire private-line to release privacy.
<b>Termination of Privacy: SS-3</b>	3.14	If the System is optioned for SS-3 operation, a 100ms burst of * key DTMF tone (1209 + 941Hz) is transmitted to release privacy. After privacy is released, any off-hook stations can continue to converse, but without privacy. After all stations at that location are on-hook, privacy can be reestablished by going off-hook and dialing. Any stations that are off-hook when privacy is reestablished are automatically included in the conference.
<b>Privacy-Override and Intrusion</b>	3.15	Automatic and manual privacy can also be released through the use of the privacy-override or local-override features described in paragraphs 3.18 and 3.19.
<b>Adding to a Conference</b>	3.16	<p>In all modes of operation (SS-1, SS-3, or SS-4), after privacy is set, the local originating station can dial other stations into the conference. As local stations are dialed into the conference, they, in turn, can dial additional stations into the conference.</p> <p><b>Note:</b> <i>In SS-1 and SS-4 operation only, a remote station can be dialed into a conference by a local station, but remote stations are prohibited from dialing-in other stations to avoid conflicts in the transmission of dialed digits over the 4wire private line.</i></p>
<b>Privacy Override</b>	3.17	Both manual- and automatic-privacy modes can be overridden through use of the privacy-override (sometimes called <i>System-override</i> ) or local-override (sometimes called <i>intrusion</i> ) features. These features are described in the following paragraphs.
<b>Privacy Override (System Override)</b>	3.18	The privacy-override feature permits a station user to release privacy on the network through use of a privacy-override key, which releases privacy for the entire network. Upon activation of this key, a 700ms burst of 2813Hz tone is applied to the conference to inform all parties that privacy is about to be released. After privacy is overridden, the conference is in the non-private mode.
<b>Local Override (Intrusion)</b>	3.19	<p>The local-override feature provides a second method by which privacy can be overridden. This feature allows the overriding party to enter a private conference only as long as the local-override key is depressed. When this key is depressed, low-level 2813Hz intrusion tone is applied to inform conferees that privacy is overridden. Intrusion tone can be applied either as long as the override key is depressed or as a 700ms burst when the override key is initially depressed.</p> <p><b>Note:</b> <i>Privacy is not released by using the local override key; therefore, no other parties can be added to the conference.</i></p>

(System Operation)

<b>Key-Station Status-Lamp Indications</b>	3.20	Standard key-station lamp indications are provided when stations are ringing, off-hook, or on hold. System optioning and switch-optioning of the 3407 module provide other lamp-indication options: local System-status indications or network-privacy-status indications during idle. Standard key-station lamp indications are as follows: <ul style="list-style-type: none"><li>● Station ringing—lamp flash at a 0.5-second-on/0.5-second-off rate.</li><li>● Station on-hold—lamp wink at a 470ms-on/30ms-off rate.</li><li>● Station off-hook—lamp lights steadily.</li></ul>
<b>Local System Status</b>	3.21	To provide local System-status indications, the 3407 module is optioned for System-status indications and the local System is programmed via the 3401 module for local lamp indications. The following lamp indications are displayed: <ul style="list-style-type: none"><li>● Location busy—lamp lights steadily when any station at that location is off-hook.</li><li>● Location ringing—lamp flashes at a 0.5-second-on/0.5-second-off rate when any station at that location is being rung.</li></ul>
<b>Network Status</b>	3.22	To provide network-privacy-status indications, the 3407 module is optioned for System-status indications and the local System is programmed via the 3401 module for manual- or automatic-privacy operation. The following lamp indications are displayed: <ul style="list-style-type: none"><li>● Network private—lamp lights steadily.</li><li>● Network idle—lamp remains unlighted.</li></ul>

**Off-Net-Access Operation**

<b>General</b>	3.23	In addition to selective-signaling operation, the System includes off-net-access modules for a variety of incoming and outgoing off-net functions. The 3409, 3410A and 3410B modules can be switch-optioned for station or trunk operation, while the 3411A and 3411B modules can be switch-optioned for PBX-line or CO-line operation. The operation of these modules is described in the paragraphs that follow.
<b>Station and Trunk Operation: 3409</b>	3.24	The 3409 can be optioned for station or trunk operation. When the module interfaces a remote 4wire telephone set, it is optioned for station operation. The 3409's E&M leads control station ringing and detect on-hook, off-hook, and dialing. When optioned for 4wire trunk operation, the 3409 is compatible with Type I or Type II E&M interfaces, supports A- or B-side signaling, and can be used with immediate-start, wink-start, or delay-dial trunks.
<b>Station and Trunk Operation: 3410A and 3410B</b>	3.25	The 3410A and 3410B each support a single local 2wire telephone set, when optioned for station operation. This option allows the module to be used with tel sets with or without an A lead, and also supplies lamp-lead output if required. Either key or non-key 2wire telephones can be used. When optioned for trunk operation, either module can interface a single 2wire PBX trunk, and each supports loop-start or ground-start operation.

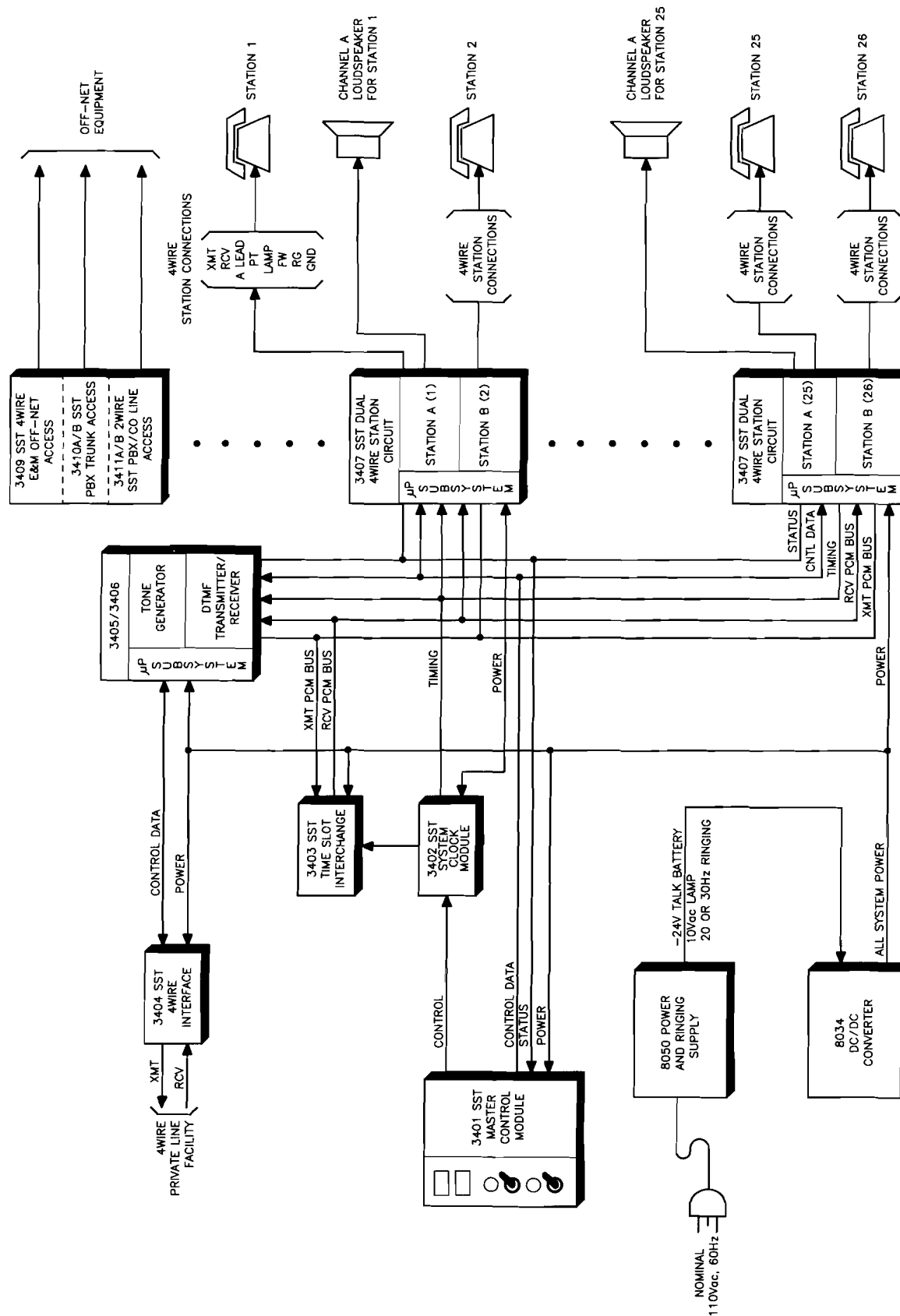
*(System Operation)*

<b>PBX-Line and CO-Trunk Operation: 3411A and 3411B</b>	3.26	The 3411A and 3411B modules each interface a single 2wire PBX line or CO trunk. When any of the off-net modules are used to interface a trunk circuit, one-way incoming, one-way outgoing, or two-way incoming and outgoing operation can be selected via the local SST's 3401 Master Control Module. DTMF-to-dial-pulse conversion and security codes are also optioned via the 3401 module.
<b>Off-Network Trunk Operation</b>	3.27	When optioned for trunk operation, each of the off-net modules can be arranged for one-way operation (either outgoing or incoming) or two-way operation via the 3401 SST Master Control Module. This optioning is described in the following paragraphs.
<b>One-Way Outgoing Operation</b>	3.28	When the System is optioned for one-way outgoing trunk operation, any station in the selective signaling network can access 3409, 3410A or 3410B modules to place calls outside of the network by dialing a user-programmed code. During this mode of operation, incoming calls to the trunk are rejected. A <b>way-station lockout</b> feature is also activated; this disables dial decoders to prevent off-network dialing information from being transmitted to all network locations via the 4wire facility. The trunk access code must be designated as a way-station lockout code at all locations. If other parties are to participate in the off-net call, the conference must be established before the trunk code is dialed.
<b>Outgoing DTMF-to-Dial-Pulse Conversion</b>	3.29	When optioned for trunk operation, the 3409, 3411A and 3411B modules can be arranged, via the local SST's 3401 Master Control Module, to provide outgoing DTMF-to-dial-pulse conversion.
<b>Incoming Trunk Access</b>	3.30	When optioned for one-way incoming operation, calls outside of the SST network are accepted through the trunk circuit into the network, but stations within the network are prohibited from accessing the trunk. Incoming access to the SST can take place during either non-privacy or privacy operation. During non-privacy, the off-net trunk can be programmed for immediate access to the selective signaling network, unless a security code is assigned (refer to paragraph 3.34). When the incoming call originates, the off-net trunk is admitted into the conference circuit and dial tone is applied to all off-hook stations in the network. After dial tone is applied, the originating party can dial network stations or perform control functions. If dialing does not commence within 12 seconds, dial tone is removed, although dialing is still permitted.

(System Operation)

<b>Access During Privacy: System Idle</b>	3.31	During automatic-privacy operation, incoming off-net access is allowed only when the network is idle. When an incoming call originates (after accessing the network), the incoming caller receives dial tone. Dialing must commence within 12 seconds or dial tone is removed, although dialing is still permitted. The incoming caller can now dial network stations, access off-net ports at remote locations, or perform control functions. The 334 SST does not initiate a disconnect at the conclusion of the call. Therefore, a forward disconnect must be supplied by the distant end of the off-net circuit to idle the call.
<b>Access During Privacy: System Busy</b>	3.32	If an incoming off-net call tries to access the network when privacy is set, the call is rejected. If the off-net module is a 3409, 3410A, or 3410B, the SST answers and applies busy tone for several seconds. If the off-net module is a 3411A or 3411B, the SST does not answer the call, thus preventing the incoming caller from incurring DDD charges. During manual-privacy operation, incoming off-net access takes place identically to that described in paragraph 3.31. Privacy can be set manually after the off-net trunk initiates a conference.
<b>Two-Way Operation</b>	3.33	When optioned for two-way outgoing and incoming operation, stations in the network can access an off-net trunk to place calls outside of the network and outside callers can also access the trunks to become a part of the network.
<b>Security Codes</b>	3.34	A security code can be assigned to each incoming off-net trunk to restrict incoming access to the 334 SST during both privacy or non-privacy operation. If privacy is not established on the network, the incoming off-net caller receives dial tone immediately upon origination unless dialing is already taking place within the network. If privacy is established on the network, the incoming trunk receives busy tone. The off-net caller must begin dialing the security code within 12 seconds of receiving dial tone, or access to the network is denied. If denied, the off-net caller then receives busy tone for several seconds. If the security code is dialed correctly, the trunk is admitted into the conference circuit and dial tone is applied. Any off-hook stations in the network also receive dial tone. After dial tone is applied, the originating party can dial network stations, access off-net modules at remote locations, or perform control functions.
<b>Uncompleted Security-Code Dialing String</b>	3.35	In SSTs that are part of SS-1 and SS-4 networks, an incoming off-net caller who has not yet <i>completed</i> dialing the security code can be denied access by a network-station user who accesses the network first. If this occurs, the incoming caller receives busy tone for several seconds before the call is disconnected. The use of security codes during manual- or automatic-privacy operation is identical to that described in the preceding paragraph.

## 4. System Block Diagram



## 5. Specifications

### General Specifications

system compatibility	compatible with SS-1, SS-3, and SS-4 Systems
possible signaling codes (FP2)	<ul style="list-style-type: none"><li>● 9 one-digit codes</li><li>● 81 two-digit codes</li><li>● 729 three-digit codes</li></ul>
possible signaling codes (FP3)	<ul style="list-style-type: none"><li>● 81 two-digit codes</li><li>● 729 three-digit codes</li></ul>
maximum station capacity	26 stations per System, 52 stations per location (2 Systems)
data transmission rate	2400 baud maximum
input power requirements	117 $\pm$ 6Vac, 60 $\pm$ 3Hz
internal operating voltages (derived from 8050 Power and Ringing Supply)	–24Vdc, +12Vdc, –12Vdc, +5Vdc, and 10Vac; also 105Vac, 20 or 30Hz ringing voltage (switch-selectable)
internal operating voltages (derived from 8034 DC-to-DC Converter)	+12Vdc, –12Vdc, +5Vdc
operating environment	30° to 120°F (–1° to 49°C), humidity to 95%, no condensation
exterior dimensions (Type 16C Apparatus Case)	16.5 inches (41.9cm) high 25.25 inches (64cm) wide 11 inches (27.9cm) deep
weight	10-station System (Common Equipment Shelf only): 50lbs (22.68kg) 26-station System (Common Equipment and Station Equipment Shelves): 70lbs (31.75kg)

### SS-1 and SS-4 Interface

input-level sensitivity range	<b>SF Tone Detection</b> –24dBm0 to +3dBm0
detection bandwidth	2600 $\pm$ 37Hz
signal-to-noise ratio	10 $\pm$ 2dB
attack and hangover delay	7 $\pm$ 5ms
privacy-set detection time (for 2600Hz)	130ms, minimum 600ms, maximum
privacy-release detection time	610ms, minimum
2600Hz dial-pulse-break detection time	30ms minimum, 120ms maximum
SF tone transmission frequency	<b>SF Tone Transmission</b> nominal 2600Hz: 2599 $\pm$ 2Hz nominal 2400Hz: 2404 $\pm$ 4Hz
SF tone transmission output level	–8dBm0 $\pm$ 1dB
digit transmission ratio	2600Hz: 60 $\pm$ 5ms break, first pulse extended to 100 $\pm$ 5ms 2400Hz: 40 $\pm$ 5ms make
privacy-set transmission time (2600Hz)	400 $\pm$ 10ms
privacy-release transmission time (2400Hz)	1000 $\pm$ 5ms minimum signal duration



(Specifications)

**SS-3 Interface**

<i>DTMF-tone input frequencies accepted</i>	<b>DTMF Tone Detection</b> low group: 679Hz, 770Hz, 852Hz, and 941Hz high group: 1209Hz, 1336Hz, 1477Hz, and 1633Hz
<i>DTMF-tone frequency tolerance</i>	must-accept bandwidth: $\pm 1.5\%$ +2Hz must-reject bandwidth: $\pm 3.0\%$
<i>input-signal level range</i>	−24dBm to +6dBm
<i>minimum signal duration</i>	40ms
<i>minimum interdigital interval</i>	40ms
<i>privacy-set detection tone</i>	1477 + 941Hz (# tone)
<i>privacy-release transmission time (2400Hz)</i>	100 $\pm$ 5ms minimum signal duration
<i>output frequencies</i>	<b>DTMF Tone Transmission</b> low group: 697Hz, 770Hz, 852Hz, and 941Hz high group: 1209Hz, 1336Hz, 1477Hz, and 1633Hz
<i>output-frequency tolerance</i>	$\pm 0.75\%$
<i>output-level range</i>	high group frequencies: −8dBm0 minimum low group frequencies: −10dBm0 minimum
<i>duration of transmitted digit</i>	100ms minimum
<i>transmit interdigital interval</i>	100ms minimum
<i>privacy-set transmission tone</i>	1477 + 941Hz (# tone)
<i>privacy-release transmission tone</i>	1209 + 941Hz (* tone)

**4Wire Private Line Interface**

<i>receive-level range</i>	<b>Receive</b> −10dB to +20dB, to a maximum output level of +3dBm
<i>receive equalization (1kHz reference level)</i>	in <i>FLT</i> (bypass) mode: nominal flat response in <i>NL</i> (nonloaded) mode: nominal 4dB-per-octave slope in <i>LOAD</i> (high-low equalization) mode: <ul style="list-style-type: none"><li>● maximum HF equalization; +10dB minimum at 3400 <math>\pm</math> 100Hz relative to 1000Hz level</li><li>● minimum HF equalization; −1dB at 3400 <math>\pm</math> 100Hz relative to 1000Hz level</li><li>● maximum LF equalization; +8dB minimum at 300 <math>\pm</math> 20Hz relative to 1000Hz level</li><li>● minimum LF equalization; −6dB at 300 <math>\pm</math> 20Hz relative to 1000Hz level</li></ul>
<i>receive input impedance</i>	150 ohms $\pm 15\%$ or 600 or 1200 ohms $\pm 10\%$ , balanced, switch-selectable
<i>transmit level range</i>	<b>Transmit</b> −20 to +10dB gain, to a maximum output level of +3dBm
<i>transmit output impedance</i>	150 ohms $\pm 15\%$ or 600 or 1200 ohms $\pm 10\%$ , balanced, switch-selectable
<i>system interface level</i>	0dBm TLP

**Common Specifications**

<i>frequency response</i>	$\pm 3$ dB re 1000Hz level, 100 to 3500Hz, with equalizer switch set to <i>FLT</i> position (no equalization)
<i>simplex (SX) current</i>	120mA maximum with 5mA maximum unbalance
<i>loudspeaker output impedance (LST to LSR)</i>	800 ohms $\pm 5\%$
<i>total harmonic distortion</i>	2% maximum
<i>tone loopback frequency (optional 9914 Subassembly)</i>	2713Hz center frequency, $\pm 0.2\%$ stability, 75Hz maximum bandwidth
<i>tone loopback signal-to-guard ratio</i>	3dB minimum
<i>tone loopback threshold sensitivity</i>	+6 to −24dBm0 at 0TLP
<i>operating times, tone loopback</i>	initiate: 20ms minimum, loopback after removal of 1.4-second (minimum) tone release: 800ms maximum, release during tone (two-tone-burst operation)

### (Specifications)

<i>dc loopback</i>	<ul style="list-style-type: none"><li>● local loopback: ground applied to pin 33 (local loopback) to activate</li><li>● 254mA standard remote dc loopback: battery applied to SXR and SXT leads with negative battery on SXT lead activates loopback</li></ul>
<i>loopback time</i>	duration of applied dc, 20ms maximum operate and release times
<i>VOX detection level</i>	-22dBm0, 300 to 3200Hz
<i>VOX release time</i>	privacy is released within 2 minutes of cessation of activity at transmit output port

### **4Wire Station Interface**

<i>battery-feed current into 200-ohm transmitter</i>	27mA at -24Vdc, nominal sidetone level: $-16 \pm 1$ dB transmit TLP: 0dB
<i>transmit level accepted, no clipping</i>	0dBm maximum
<i>transmit level TLP</i>	-16dBm (re 600-ohm termination at RT and RR)
<i>maximum station-loop length</i>	450 ohms (includes tel-set resistance)
<i>total harmonic distortion</i>	less than 1%, 300 to 3400Hz
<i>receive output impedance</i>	600 ohms $\pm 5\%$
<i>transmit input impedance</i>	600 ohms $\pm 1\%$
<i>loudspeaker output impedance</i>	800 ohms $\pm 5\%$
<i>4wire (FW) output</i>	-24 $\pm 6$ Vdc supplied with A-lead active
<i>lamp control</i>	on-hold wink: 470ms on/30ms off, typical ringing flash: 500ms on/500ms off, typical
<i>lamp relay contacts</i>	ac or dc (10Vac nominal) 500mA, maximum
<i>ring generator output</i>	nominal 105Vac interrupted at rate of 1.5 seconds on/4.5 seconds off
<i>ring generator input</i>	nominal 105Vac continuous at 30Hz
<i>ringing generator capacity</i>	maximum of two typical ringing loads per station
<i>A-lead input</i>	active ground during off-hook, open during idle
<i>S-lead input</i>	active ground, open during idle
<i>push-to-talk input</i>	active ground, open during idle

### **System Power Requirements**

<i>nominal ac input</i>	110Vac at 60Hz; 1A typical
<i>System-derived power (per shelf)</i>	talk battery and relay supply: $-24 \pm 1$ Vdc, 2A lamp supply: 10Vac or 10 to 15Vdc, 400mA ringing supply: 100 to 118Vac at 30Hz, 50mA