

**OPERATION AND MAINTENANCE  
TERMINAL STATION  
1 X N FREQUENCY DIVERSITY  
SYSTEM OPERATIONS**

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This section describes the manual switching operations and the order-wire features of the DR 6/11-135 Digital Radio System, including the following:

- How to perform manual protection switching operations at each end of a bidirectional switching section
- What indications will light for each operation
- A description of each operation
- How to use the order-wire feature.

**MANUAL SWITCHING OPERATIONS**

Manual switching operations are used to:

- Reinforce an automatic switch during repair maintenance
- Transfer the regular channel payload to the protection channel during routine maintenance
- Lock out the protection channel or a regular channel to inhibit automatic switching
- Allow the protection channel to carry access service in a preemptible or nonpreemptible mode (optional)
- Establish a head-end bridge without a receiving-end switch.

The system provides a separate transmitting and receiving transmission path for each regular channel and the protection channel. Each initial bay in a terminal station (Fig. 1) is equipped with a control/service channel shelf (Fig. 2) that provides control functions for each direction of transmission. The shelf also provides a service channel that enables the control circuits at the two terminal stations to communicate with each other.

To determine if a control function is a transmitting or a receiving operation, the technician must know the direction of transmission of the channel to be switched. In Fig. 1, direction A is receiving for terminal station 1 and transmitting for terminal station 2. To switch a regular channel to protection in direction A (Fig. 1), the technician at terminal station 1 performs a receiving-end switch or the technician at station 2 performs a transmitting-end switch.

Except for the head-end bridges, the protection switches can be operated by telemetry from a centralized alarm center. Protection switches are end-to-end and include all terminal, radio, and regenerator equipment in the transmission path.

The manual switching operations are listed in Table A. The first column identifies the switch by its functional name (for example, line switch). This functional name will be referenced from other parts of this document. The second column identifies the operator location. To perform a manual operation, simultaneously press the appropriate pushbuttons on the units identified in the "TO OPERATE" column. The unit indications that will light locally and at the opposite end are listed in the "LOCAL INDICATIONS" and the "OPPOSITE END INDICATIONS" columns. To release a manual operation, simultaneously press the appropriate pushbuttons on the units identified in the "TO RESET" column.

Fig. 2 shows the location of the alarm cutoff control, the control/service channel shelf, and the protection and regular channels. Also shown are the control units, pushbuttons, and indications referenced in Table A.

The most frequently used switches are the line and span switches. Figures 3 and 4 show the signal flow for the normal path, line-switched path, and span-switched path on a 1x1 and 1xN system. The figures identify the terminal bay units that are bypassed by the line and span switches. These units can be replaced when the indicated switch is operated.

All manual switching is electrically initiated by the control circuits in the receiving-end terminal. All switches can be operated from the receiving-end terminal; some can be operated from the transmitting-end terminal.

## REGULAR CHANNEL LOCKOUT

**Caution: Service will be interrupted if a failure occurs on a regular channel that is locked out.**

A regular channel lockout will inhibit automatic switching and remote alarms for the affected channel. Any number of regular channels can be locked out. The regular channel lockout can only be operated from the receiving-end terminal.

## PROTECTION CHANNEL LOCKOUT

**Caution: Service will be interrupted if a failure occurs on a regular channel while the protection channel is locked out.**

A protection channel lockout will inhibit automatic switching and force regular channel 1 to carry the service channel. The protection channel lockout allows end-to-end maintenance of the protection channel transmission path. The protection digital terminal shelf and the growth shelf, if equipped, can be replaced if a protection channel lockout is operated in both

directions. The protection channel lockout can be operated from both the transmitting-end and receiving-end terminals.

### **LINE SWITCH**

This is the most frequently used switch. It provides a "hitless" switch and protects all equipment between the output of the FRAME GEN unit in a transmitting-end regular digital transmitter and the input of the LINE SW unit in a receiving-end regular digital receiver. The line switch can be operated from both the transmitting-end and the receiving-end terminals.

### **SPAN SWITCH**

*Caution: Operating a span switch will cause momentary misframes.*

This switch provides end-to-end protection of all equipment between the input of the B3ZS DCODR unit in a transmitting-end regular digital transmitter and the output of the VMR & CODER unit in a receiving-end regular digital receiver. A span switch is used when a line switch will not provide adequate protection. A regular digital terminal shelf can be removed if a span switch is operated in both directions. This switch can be operated from both the transmitting-end and receiving-end terminals.

### **TRANSMIT LINE BRIDGE**

The transmit line bridge is similar to the line switch (Fig. 3 and 4) except the receiving-end terminal LINE SW unit does not operate. This bridge can be used to compare a marginal regular channel with a good protection channel from the output of the transmitting-end terminal FRAME GEN unit. (If the trouble in the regular channel shows up in the protection channel, the failure is ahead of or in the regular channel FRAME GEN unit. If the trouble does not show up in the protection channel, the failure is between the transmitting-end FRAME GEN unit and the receiving-end LINE SW unit.) This bridge will be preempted if a failure occurs on a regular channel requiring an automatic switch to protection. The transmit line bridge can only be operated from the receiving-end terminal.

### **TRANSMIT SPAN BRIDGE**

The transmit span bridge is similar to the span switch (Fig. 3 and 4) except the switch in the receiving-end terminal VMR & CODER unit does not operate. Like the transmit line bridge, the transmit span bridge can be used to compare a regular channel with the protection channel. The transmit line and span bridges can be used together to isolate trouble. This bridge will be preempted if a failure occurs on a regular channel requiring an automatic switch to protection. The transmit span bridge can only be operated from the receiving-end terminal.

### **ACCESS SWITCH AND PREEMPTIBLE ACCESS SWITCH**

*Caution: Service will be interrupted if a failure occurs on a regular channel while an access switch carries service.*

Access service is an option that allows the normally idle protection channel to carry additional DS3 signals (up to 3 rails). Access service is connected at the DS3 input jack(s) of the 3 x 45 Mb/s input (transmit interface) unit in the transmitting-end terminal and at the

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DS3 output jack(s) of the 3 x 45 Mb/s output (receive interface) unit in the receiving-end terminal. When the **access** switch is operated, the protection channel is not available to protect against a regular channel failure. When the **preemptible access** switch is operated, the protection channel will protect a failed regular channel, dropping the access service.

TABLE A MANUAL PROTECTION SWITCHING OPERATIONS							
MANUAL OPERATION		TO OPERATE		LOCAL INDICATIONS		OPPOSITE END INDICATIONS	
FUNCTION	OPERATOR LOCATION	UNIT	PUSHBUTTON	UNIT	INDICATOR	UNIT	INDICATOR
LINE SWITCH	RECEIVING END	MSTR ALARM } and simultaneously * CHAN STAT }	LINE MAN OPR	PROT STAT } * CHAN STAT } † LINE SW }	LINE SW, TRMT SW, MAN SW SW LINE SW	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††"
	TRANSMITTING END	TRMT STAT } MSTR ALARM } and simultaneously TRMT STAT }	Set CHANNEL SELECT to "††" then LINE MAN OPR	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††" MAN SW	PROT STAT } * CHAN STAT } † LINE SW }	LINE SW, TRMT SW, MAN SW SW LINE SW
SPAN SWITCH	RECEIVING END	MSTR ALARM } and simultaneously * CHAN STAT }	SPAN MAN OPR	PROT STAT } * CHAN STAT } †† VMR CODER }	SPAN SW, TRMT SW, MAN SW SW SPAN SWITCH	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††" SPAN SW
	TRANSMITTING END	TRMT STAT } MSTR ALARM } and simultaneously TRMT STAT }	Set CHANNEL SELECT to "††" then SPAN MAN OPR	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††" SPAN SW MAN SW	PROT STAT } * CHAN STAT } †† VMR CODER }	SPAN SW, TRMT SW, MAN SW SW SPAN SWITCH
REGULAR CHANNEL LOCKOUT	RECEIVING END ONLY	MSTR ALARM } and simultaneously * CHAN STAT }	LOCK OUT OPR	* CHAN STAT	LOCK OUT	NONE	MSTR ALARM } and simultaneously * CHAN STAT }

\* Odd or even channel half of unit associated with the regular channel switched or locked out.  
 † The LINE SW unit is located in the associated Regular Digital Terminal Shelf.  
 †† The VMR & CODER units on the Protection Digital Terminal Shelf AND the associated Regular Digital Terminal Shelf will indicate SPAN SWITCH.

TABLE A (Continued) MANUAL PROTECTION SWITCHING OPERATIONS							
MANUAL OPERATION		TO OPERATE		LOCAL INDICATIONS		OPPOSITE END INDICATIONS	
FUNCTION	OPERATOR LOCATION	UNIT	PUSHBUTTON	UNIT	INDICATOR	UNIT	INDICATOR
PROTECTION CHANNEL LOCKOUT	RECEIVING END	MSTR ALARM } and simultaneously PROT STAT }	LOCKOUT OPR	PROT STAT } SC MULDM }	LOCK OUT SRV CHAN SWITCHES -RCV-	SC MULDM	SRV CHAN SWITCHES -TRMT-
	TRANSMITTING END	TRMT STAT } MSTR ALARM } and simultaneously TRMT STAT }	Set CHANNEL SELECT TO "0" then LOCKOUT OPR	TRMT STAT } SC MULDM }	PROT LOCKOUT SRV CHAN SWITCHES -TRMT-	PROT STAT } SC MULDM }	LOCK OUT SRV CHAN SWITCHES -RCV-
TRANSMIT LINE BRIDGE	RECEIVING END ONLY	* CHAN STAT } and simultaneously RCV STAT }	OPR TRMT SW (TWICE)	RCV STAT } PROT STAT }	DIAGNOSTIC CODE displays "88" and CHANNEL "††" TRMT SW	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††"
TRANSMIT SPAN BRIDGE	RECEIVING END ONLY	* CHAN STAT } and simultaneously RCV STAT }	OPR TRMT SW	RCV STAT } PROT STAT }	DIAGNOSTIC CODE displays "89" and CHANNEL "††" TRMT SW	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "††" SPAN SW
ACCESS SWITCH	RECEIVING END ONLY	MSTR ALARM } and simultaneously PROT STAT }	ACC OPR	PROT STAT }	TRMT SW **VMR SPAN SWITCH CODER	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "P" SPAN SW
PREEMPTIBLE ACCESS SWITCH	RECEIVING END ONLY	PROT STAT } and simultaneously MSTR ALARM }	OPR ACC (TWICE)	PROT STAT } **VMR SPAN SWITCH CODER }	TRMT SW PRMT SPAN SW	TRMT STAT	PROTECTION BRIDGED TO CHANNEL displays "P" SPAN SW

"††" Selects or displays the appropriate regular channels 1 through 10.  
 "0" Selects the protection channel.  
 "P" Displays the protection units.  
 \*\* Only the VMR & Coder units on the Protection Digital Terminal Shelf will indicate SPAN SWITCH.

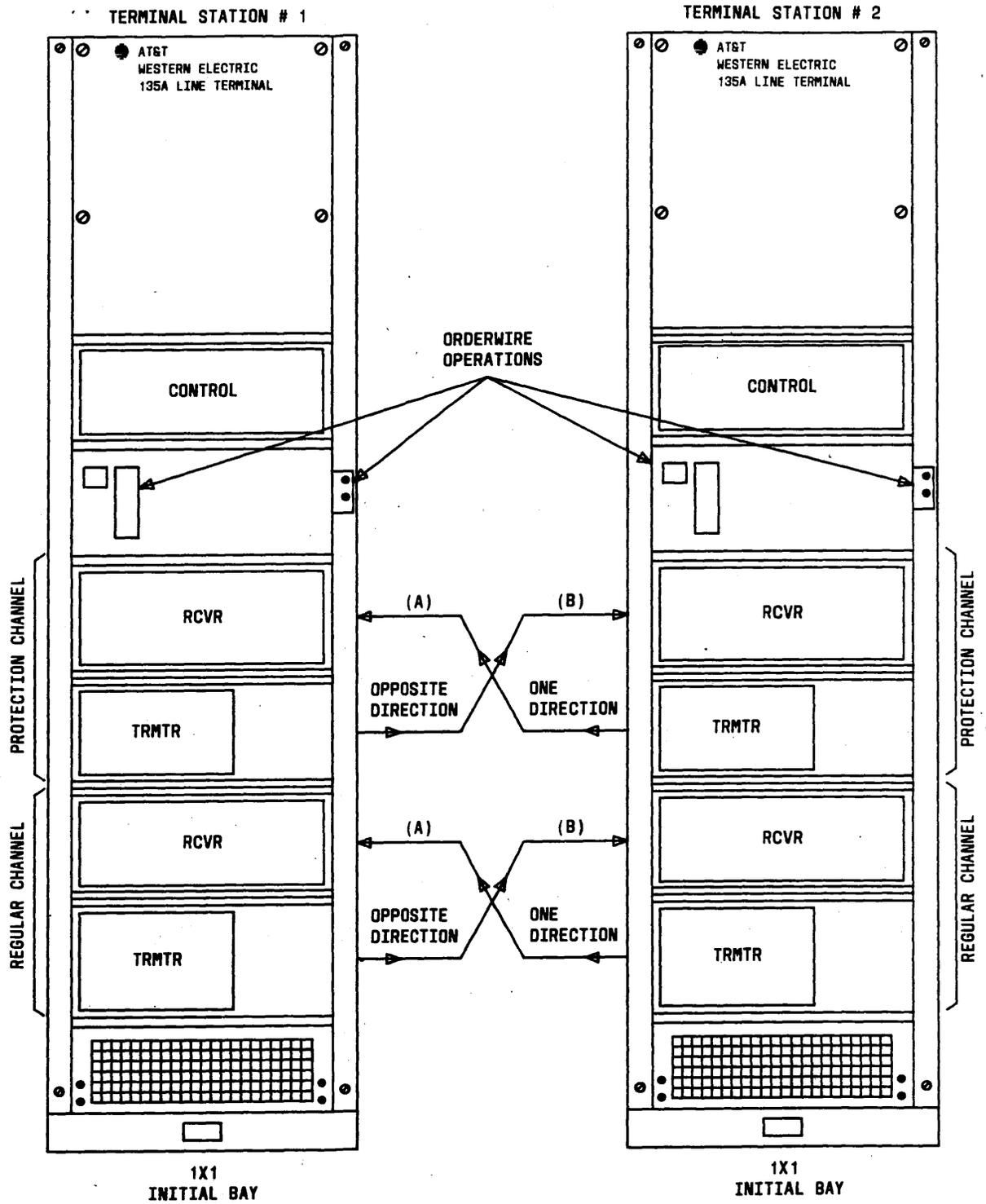


Fig. 1—Typical End-to-End Transmission (Bidirectional)

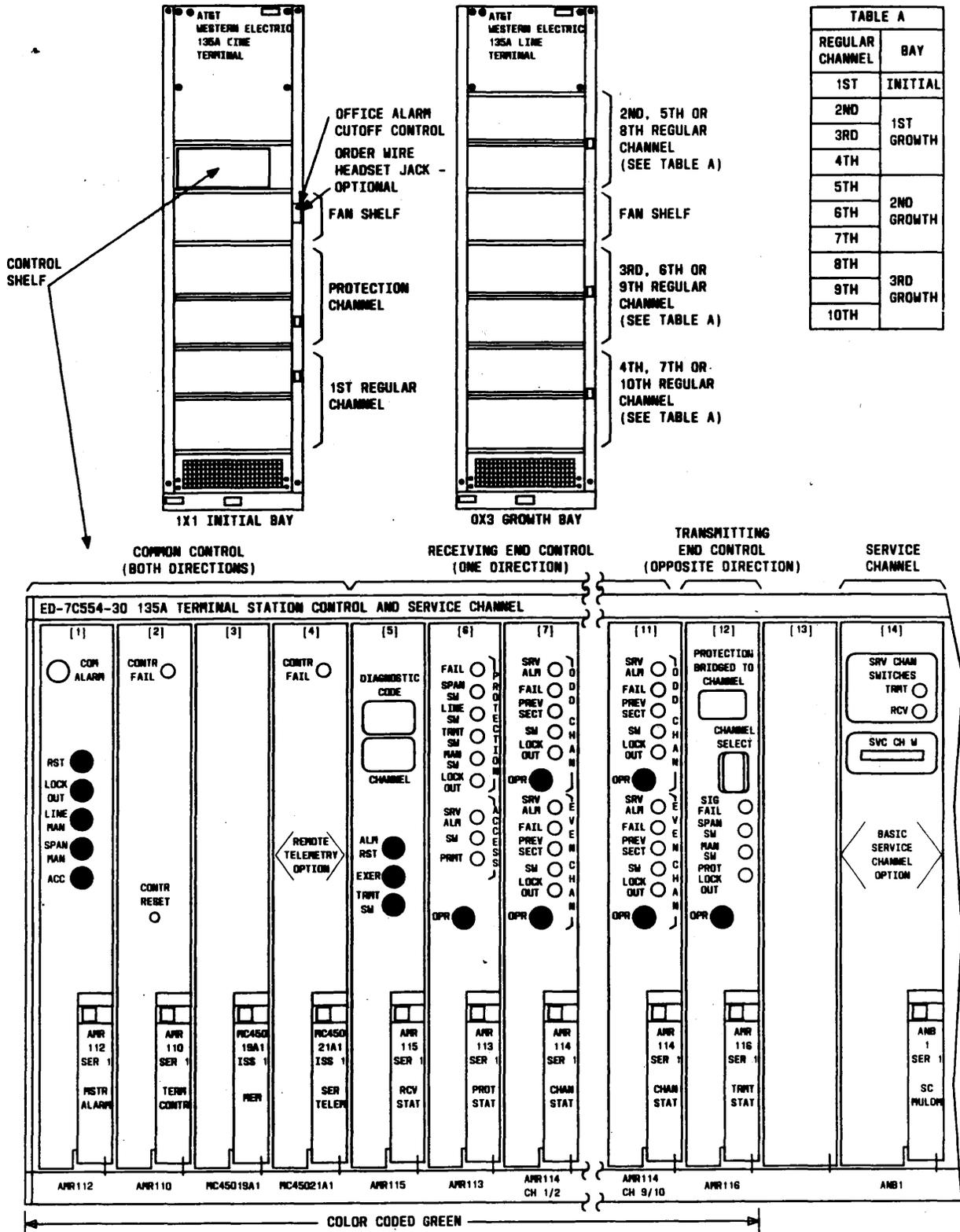


Fig. 2—Terminal Station Control Units

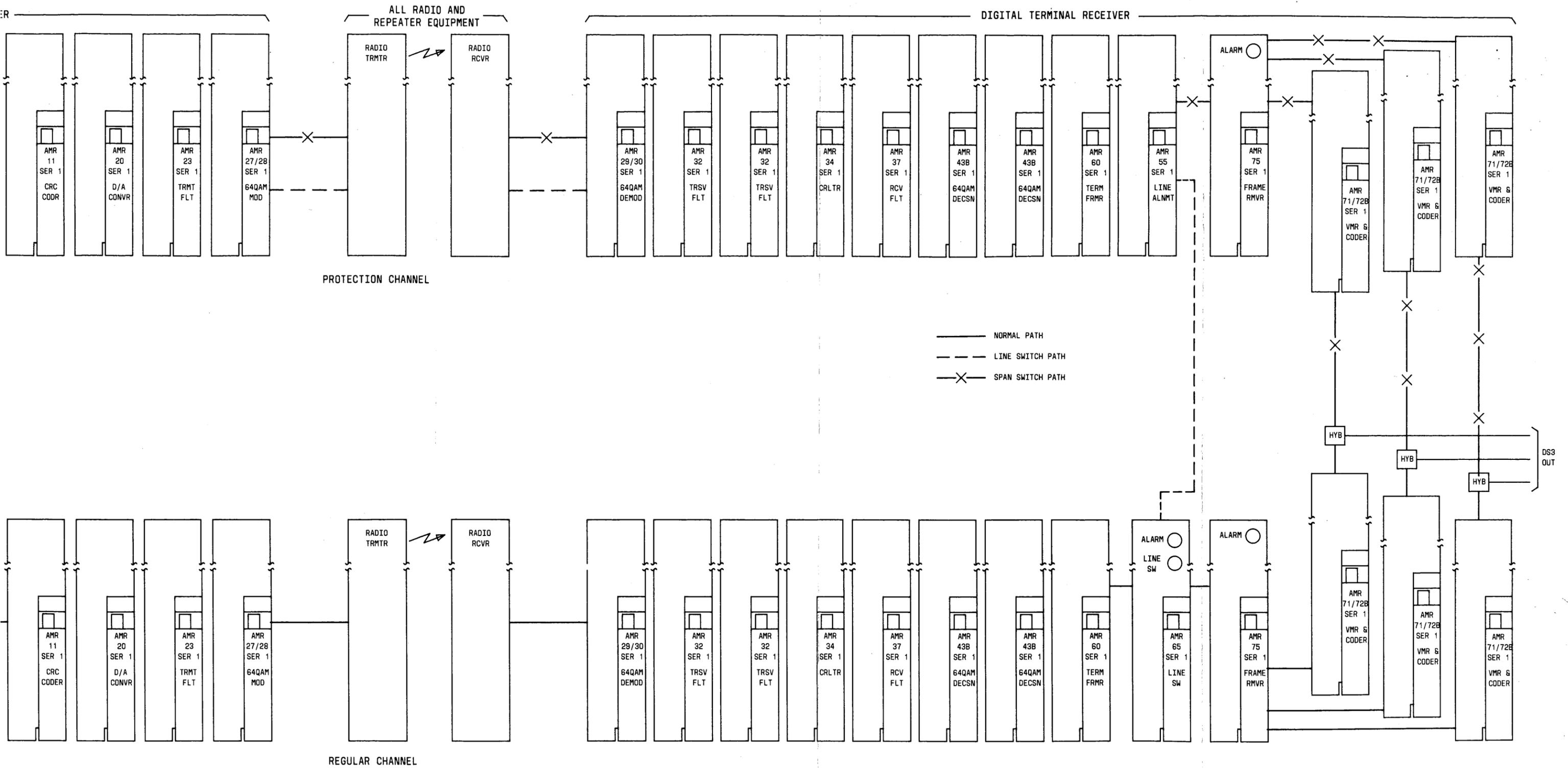
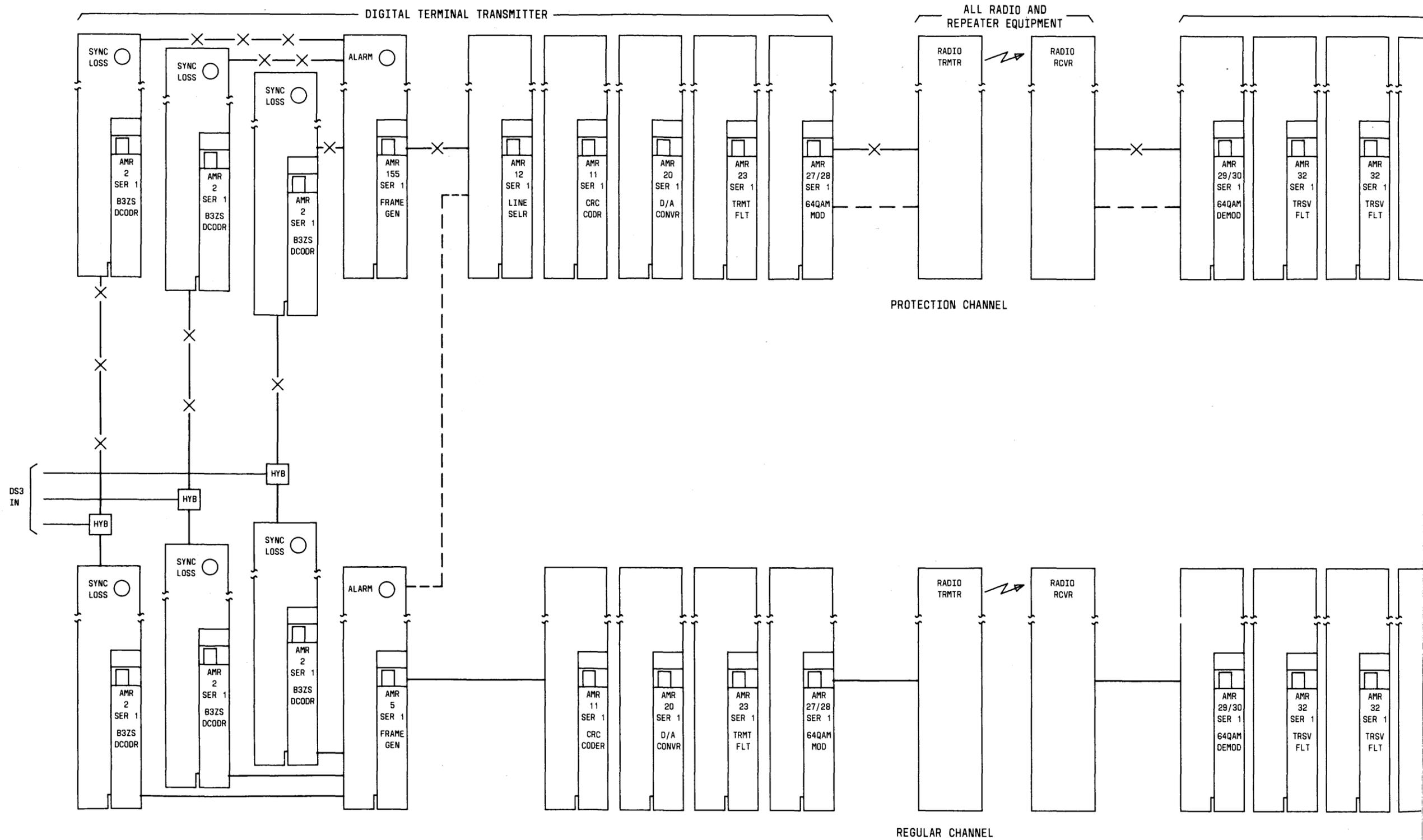


Fig. 3—Line Terminal Switching Block Diagram—1x1 System



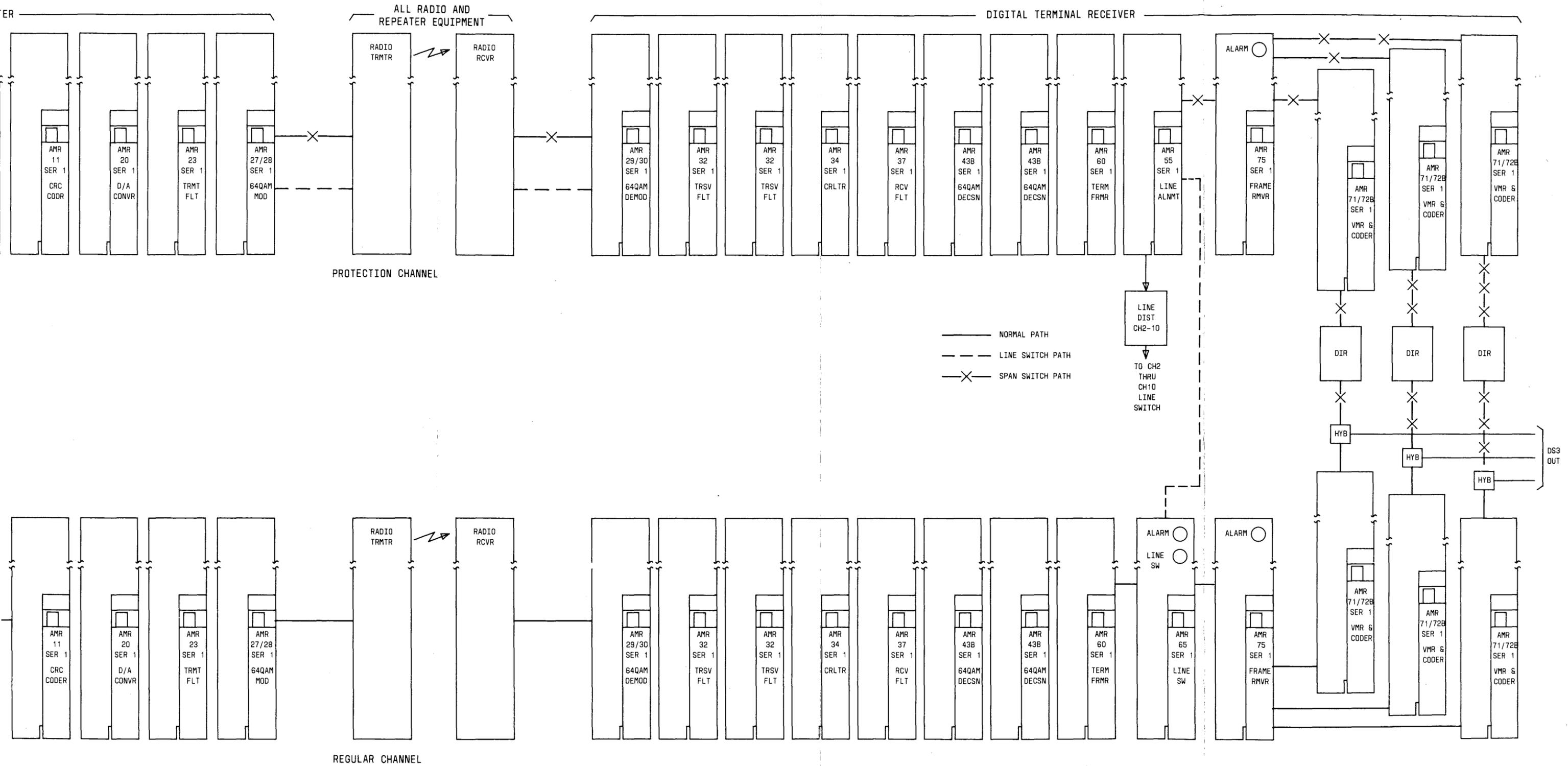
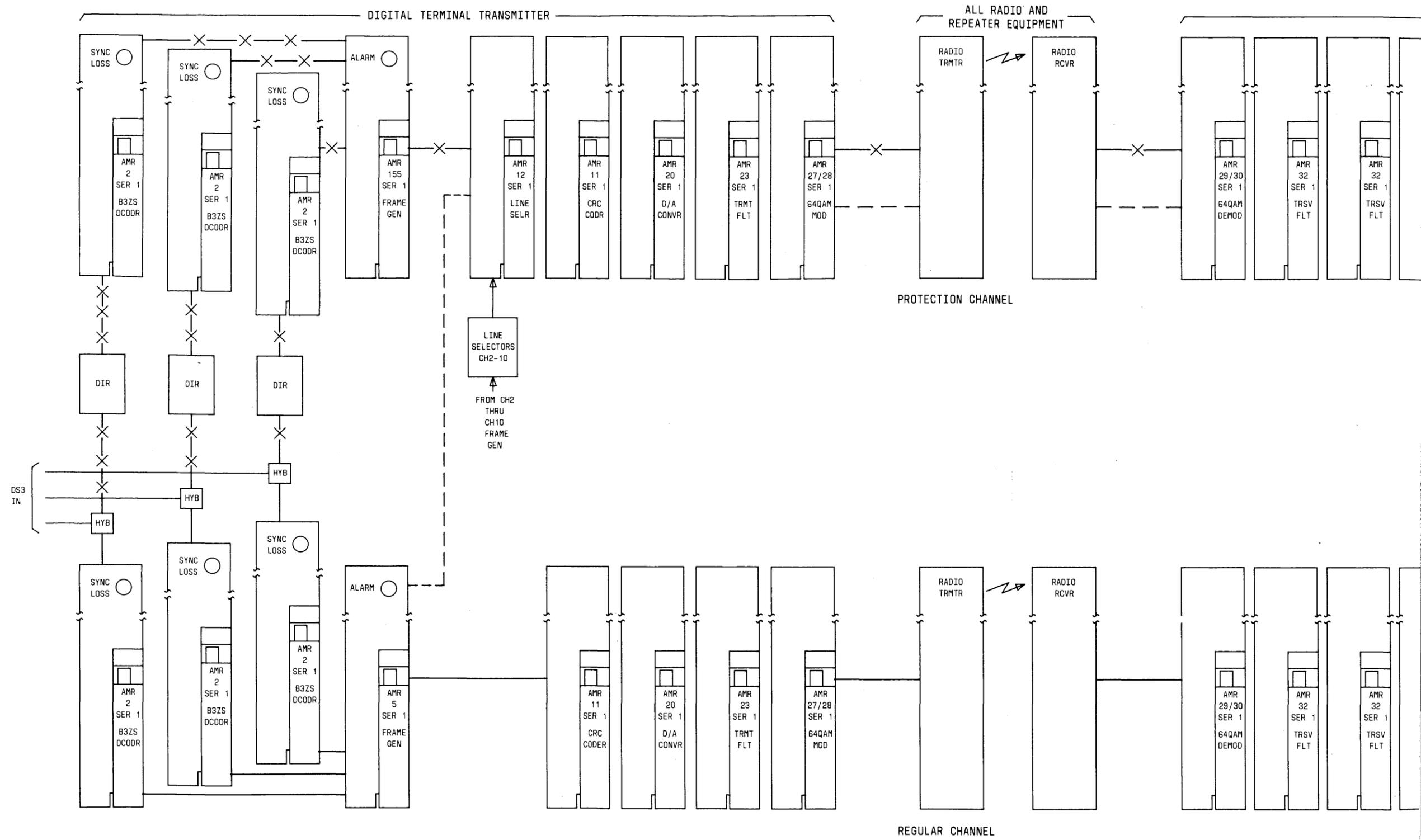


Fig. 4—Line Terminal Switching Block Diagram—1xN System



## ORDER-WIRE OPERATIONS

The OW (order-wire) operations require that a 2- or 3-digit station code be enabled in the OW signaling equipment at each station. The code is determined by wire straps on terminal strip TS1 on the right side of the control shelf. If DDD (direct distance dialing) service is required, one terminal station on the OW circuit must be directly wired to the subscriber line. All stations on the OW circuit access the DDD interface through the one selected terminal station.

Station-to-station signaling on the OW circuit is accomplished by using a touch-tone telephone set mounted on the fan shelf or a headset equipped with a pushbutton keypad. An additional touch-tone telephone may be wired directly to the frame terminal strip and used on the OW circuit. The normal hang-up will terminate the call.

The procedure below is used to originate and terminate the following calls:

- Local-station to single-station
- Local-station to all-stations
- DDD.

STEP	PROCEDURE
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- |    |   |
|----|---|
| 1. | Pick up the telephone handset on the fan shelf. If a telephone headset is used, connect it to the OW jack on the right side of the frame. |
|----|---|

**Requirement:** The OFF-HOOK indicator on the OW unit will light and an audible dial tone will be heard.

**Note 1:** The dial tone will last for approximately 20 seconds or until any telephone handset digit is dialed.

**Note 2:** Absence of a dial tone indicates that another station on the OW circuit is also off-hook. In this case you will hear a short triple beep.

For local-station to single-station calls, go to Step 2.

For local-station to all-stations calls, go to Step 3.

For DDD calls, go to Step 4.

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**STEP**

**PROCEDURE**

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**Local-Station to Single-Station Calls**

2. On telephone handset, depress buttons for the 2- or 3-digit code of the desired station on the OW circuit.

**Requirement:** Dial tone will stop and the station signaling tone will sound at the station being called. The signaling tone will sound for approximately 3 minutes or until the station answers. When the called station answers (goes off-hook), a triple beep will be heard.

**Note:** This triple beep is generated by any station going off-hook as well as by an incoming call on a DDD line.

If no answer is received and you want to terminate the call, hang up. If a telephone headset is used, pull the plug from the OW jack.

**Local-Station to All-Stations Calls**

3. On telephone handset, depress the # pushbutton three times.

**Requirement:** Dial tone will stop and the station signaling tone will sound at all stations. The signaling tone will sound for approximately 3 minutes. If any station answers, the signaling tone will stop.

If all stations do not answer and all are required to answer, repeat this step until all stations answer.

If no answer is received and you want to terminate the call, hang up. If a telephone headset is used, pull the plug from the OW jack.

**DDD Calls**

4. On the telephone handset, depress the "9" pushbutton.

**Requirement:** The OW dial tone will stop and the central office dial tone will sound.

If central office dial tone is not obtained, repeat this step.

If central office dial tone is obtained, go to Step 5.

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STEP	PROCEDURE
5.	On the telephone handset, depress the pushbuttons for the desired telephone number. Use DDD access and area codes, if required.
6.	To terminate the DDD call, just hang up.

**Note:** If you wish to make another DDD call at the end of this call or continue a conversation on the party line OW circuit without hanging up, depress the \* pushbutton on the telephone handset. This will cause you to be disconnected from the DDD network but leave you connected to the OW circuit. To make another DDD call, repeat procedure from Step 4.

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