AT&T 421-500-114, Issue 1
July 1996

DR 6/11-135A and 135EC 1×N Frequency Diversity Operation and Maintenance Operations

Contents

Figures

Tables

1 General

NOTE:
Manual switching operations can only be performed from the terminal stations, either locally or remotely [via the General Telemetry Processor (GTP) through the Transport Maintenance and Administration System (TMAS)].

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

a. How to perform manual protection switching operations at each end of a bidirectional switching section

b. What indications will light for each operation

c. A description of each operation

d. How to use the order-wire feature.

Manual protection switching operations are used to:

a. Reinforce an automatic switch during repair maintenance. (Refer to **SERVICE PROTECTION** tab to determine which manual switch is required.)

b. Transfer the regular channel payload to the protection channel during routine maintenance.

c. Lock out the protection channel or a regular channel to inhibit automatic switching.

d. Allow the protection channel to carry access service in a preemptible or nonpreemptible mode (optional).

e. 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 (Figure 1) is equipped with a Control and Service Channel Shelf (Figure 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 Figure 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 (Figure 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.

1.1 Safety Labels

Safety labels are strategically placed symbols and messages that will alert you to potential risks. There are three types of safety labels.

DANGER:
DANGER *indicates the presence of a hazard that* ***will*** *cause death or severe personal injury if the hazard is not avoided.*

WARNING:
WARNING *indicates the presence of a hazard that* ***can*** *cause death or severe personal injury if the hazard is not avoided.*

CAUTION:
CAUTION *indicates the presence of a hazard that* ***will*** *or* ***can*** *cause minor personal injury or property damage if the hazard is not avoided.*

Within the **CAUTION** safety label, the term "property damage" refers also to possible service interruption or impairment.

Please refer to the Safety Labels heading in the **START HERE** tab for additional information about, and examples of, safety labels.

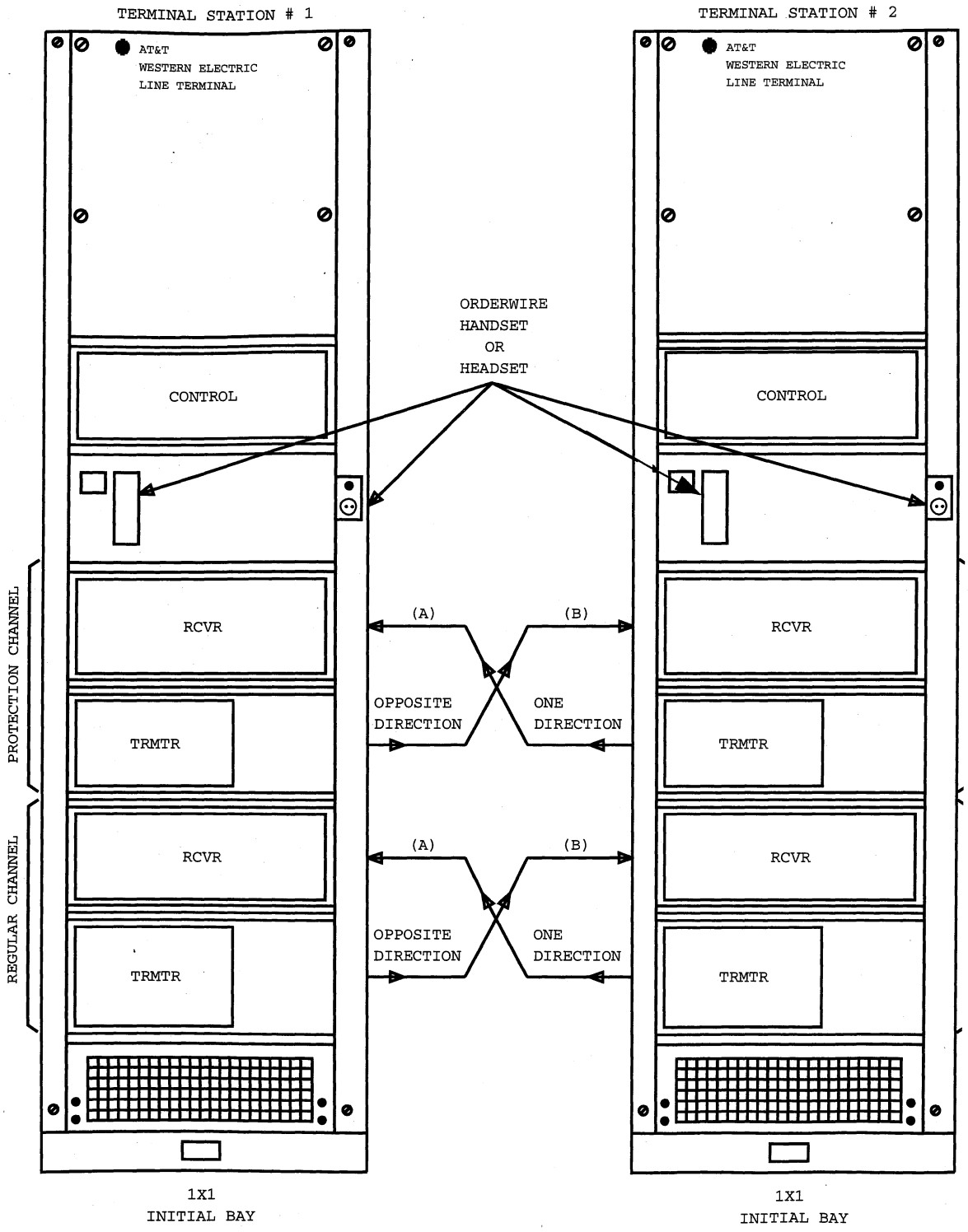

Figure 1. Typical End-to-End Transmission (Bidirectional)—Terminal

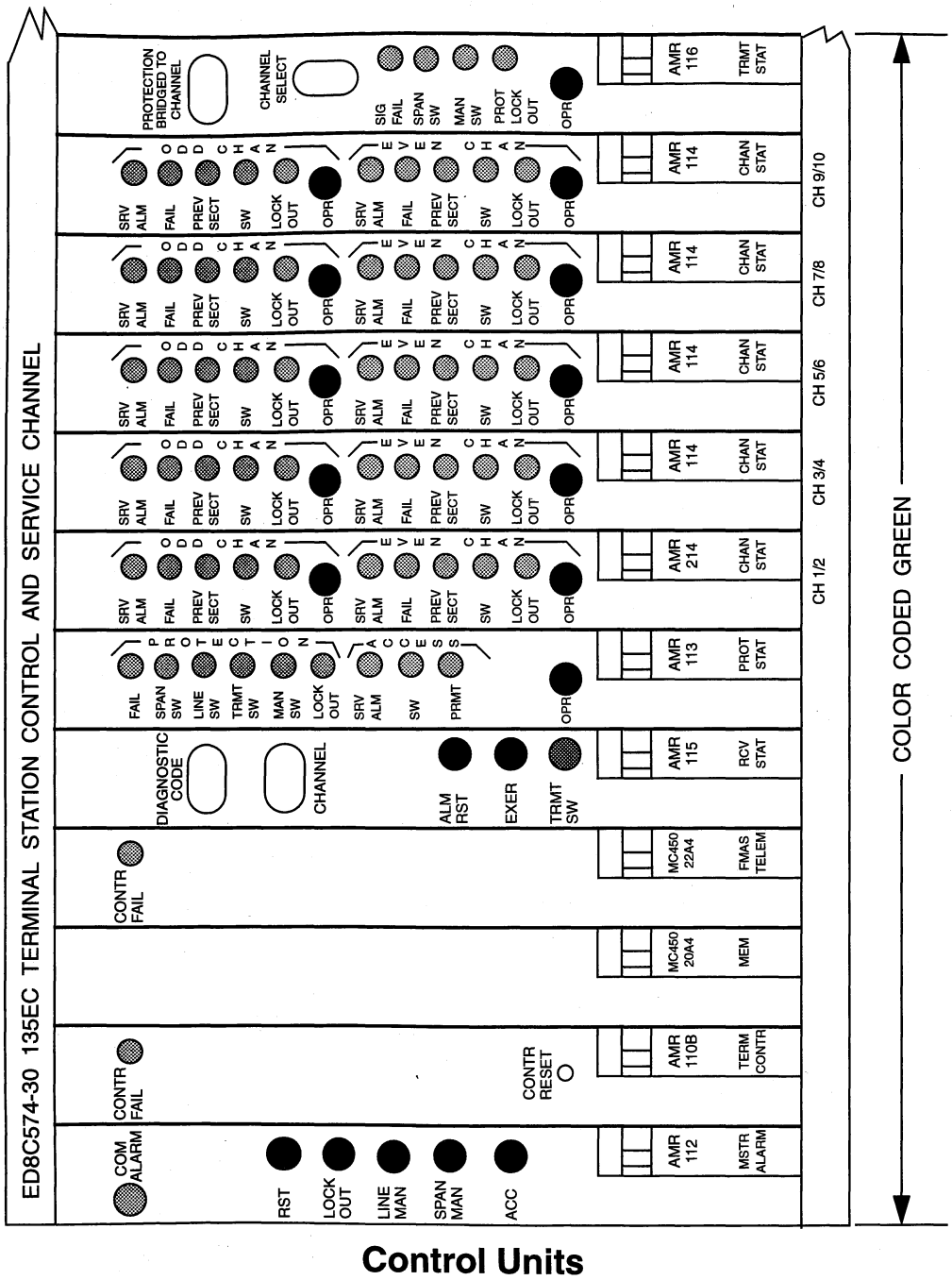

Figure 2. Terminal Station—Control and Service Channel Shelf (Sheet 1 of 2)

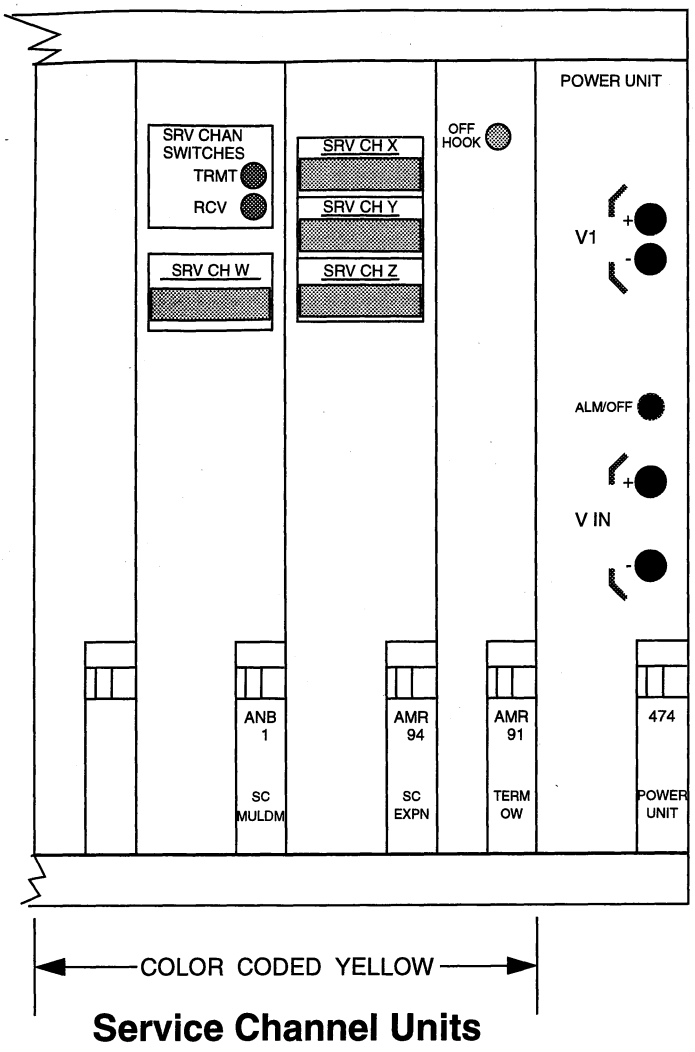

Figure 2. Terminal Station—Control and Service Channel Shelf (Sheet 2 of 2)

This page has been intentionally left blank.

2 Manual Protection Switching Operations

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 customer information product (CIP). The second column identifies the operator location. To perform a manual operation, simultaneously press the appropriate push buttons on the units identified in the "To Operate" column. The unit indicators 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 push buttons on the units identified in the "To Reset" column.

Figure 2 shows the control units, push buttons, and indications of the Control and Service Channel shelf referenced in Table A.

The most frequently used switches are the line and span switches. Figure 3 shows the signal flow for the normal path, line-switched path, and span-switched path on a 1xN system. Figure 3 also identifies the terminal bay units that are bypassed by the line and span switches.

All manual switching is 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. All manual switching (except for Transmit Line and Transmit Span) can be performed remotely by the Transport Servicing Center (TSC) via TMAS.

2.1 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.

NOTE:
If the TSC indicates DS3 hits (via TMAS and VPM) while making a manual line switch, do the following:

1. Operate the Exerciser. (This performs static alignment.)
2. Repeat the line switch to ensure no DS3 hits occur.
3. If DS3 hits occurred, contact TSG for assistance.

2.2 Span Switch

CAUTION:
To prevent service interruptions, operate a span switch only when absolutely necessary. Operating a span switch will cause momentary out-of-frames.

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.

2.3 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 the service alarm indicator 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.

2.4 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.

2.5 Transmit Line Bridge

The transmit line bridge is similar to the line switch (Figure 3) 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.

2.6 Transmit Span Bridge

The transmit span bridge is similar to the span switch (Figure 3) 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.

2.7 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). 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 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	To Reset
Function	**Operator Location**	**Unit— Push Button**	**Unit— Indicator**	**Unit— Indicator**	**Unit— Push Button**
Line Switch	Receiving End	MSTR ALARM — LINE MAN and simultaneously * CHAN STAT — OPR	PROT STAT — LINE SW, TRMT SW, MAN SW * CHAN STAT — SW † LINE SW — LINE SW	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡"	MSTR ALARM — RST and simultaneously * CHAN STAT — OPR
	Transmitting End	TRMT STAT — Set CHANNEL SELECT to "‡‡" then MSTR ALARM — LINE MAN and simultaneously TRMT STAT — OPR	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡", MAN SW	PROT STAT — LINE SW, TRMT SW, MAN SW * CHAN STAT — SW † LINE SW — LINE SW	TRMT STAT — Set CHANNEL SELECT to "‡‡" then MSTR ALARM — RST and simultaneously TRMT STAT — OPR
Span Switch	Receiving End	MSTR ALARM — SPAN MAN and simultaneously * CHAN STAT — OPR	PROT STAT — SPAN SW, TRMT SW, MAN SW * CHAN STAT — SW ††VMR CODER — SPAN SWITCH	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡", SPAN SW	MSTR ALARM — RST and simultaneously * CHAN STAT — OPR
	Transmitting End	TRMT STAT — Set CHANNEL SELECT to "‡‡" then MSTR ALARM — SPAN MAN and simultaneously TRMT STAT — OPR	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡", SPAN SW, MAN SW	PROT STAT — SPAN SW, TRMT SW, MAN SW * CHAN STAT — SW ††VMR CODER — SPAN SWITCH	TRMT STAT — Set CHANNEL SELECT to "‡‡" then MSTR ALARM — RST and simultaneously TRMT STAT — OPR
Regular Channel Lockout	Receiving End Only	MSTR ALARM — LOCK OUT and simultaneously * CHAN STAT — OPR	* CHAN STAT — LOCK OUT	NONE	MSTR ALARM — RST and simultaneously * CHAN STAT — OPR

* 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. Manual Protection Switching Operations (Contd)

Manual Operation		To Operate	Local Indications	Opposite End Indications	To Reset
Function	**Operator Location**	**Unit— Push Button**	**Unit— Indicator**	**Unit— Indicator**	**Unit— Push Button**
Protection Channel Lockout	Receiving End	MSTR ALARM — LOCKOUT and simultaneously PROT STAT — OPR	PROT STAT — LOCK OUT SC MULDM — SRV CHAN SWITCHES —RCV—	SC MULDM — SRV CHAN SWITCHES —TRMT—	MSTR ALARM — RST and simultaneously PROT STAT — OPR
	Transmitting End	TRMT STAT — SET CHANNEL SELECT to "0" MSTR ALARM — then LOCKOUT and simultaneously TRMT STAT — OPR	TRMT STAT — PROT LOCKOUT SC MULDM — SRV CHAN SWITCHES —TRMT—	PROT STAT — LOCK OUT SC MULDM — SRV CHAN SWITCHES —RCV—	TRMT STAT — Set CHANNEL SELECT to "0" MSTR ALARM — then RST and simultaneously TRMT STAT — OPR
Transmit Line Bridge	Receiving End Only	* CHAN STAT — OPR and simultaneously RCV STAT — TRMT SW (TWICE)	RCV STAT — DIAGNOSTIC CODE displays "88" and CHANNEL "‡‡" PROT STAT — TRMT SW	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡"	MSTR ALARM — RST and simultaneously * CHAN STAT — OPR
Transmit Span Bridge	Receiving End Only	* CHAN STAT — OPR and simultaneously RCV STAT — TRMT SW	RCV STAT — DIAGNOSTIC CODE displays "89" and CHANNEL "‡‡" PROT STAT — TRMT SW	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "‡‡", SPAN SW	MSTR ALARM — RST and simultaneously * CHAN STAT — OPR
Access Switch	Receiving End Only	MSTR ALARM — ACC and simultaneously PROT STAT — OPR	PROT STAT — TRMT SW SW **VMR CODER — SPAN SWITCH	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "P", SPAN SW	MSTR ALARM — RST and simultaneously PROT STAT — OPR
Preemptible Access Switch	Receiving End Only	PROT STAT — OPR and simultaneously MSTR ALARM — ACC (TWICE)	PROT STAT — TRMT SW SW PRMT **VMR CODER — SPAN SWITCH	TRMT STAT — PROTECTION BRIDGED TO CHANNEL displays "P", SPAN SW	MSTR ALARM — RST and simultaneously PROT STAT — OPR

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

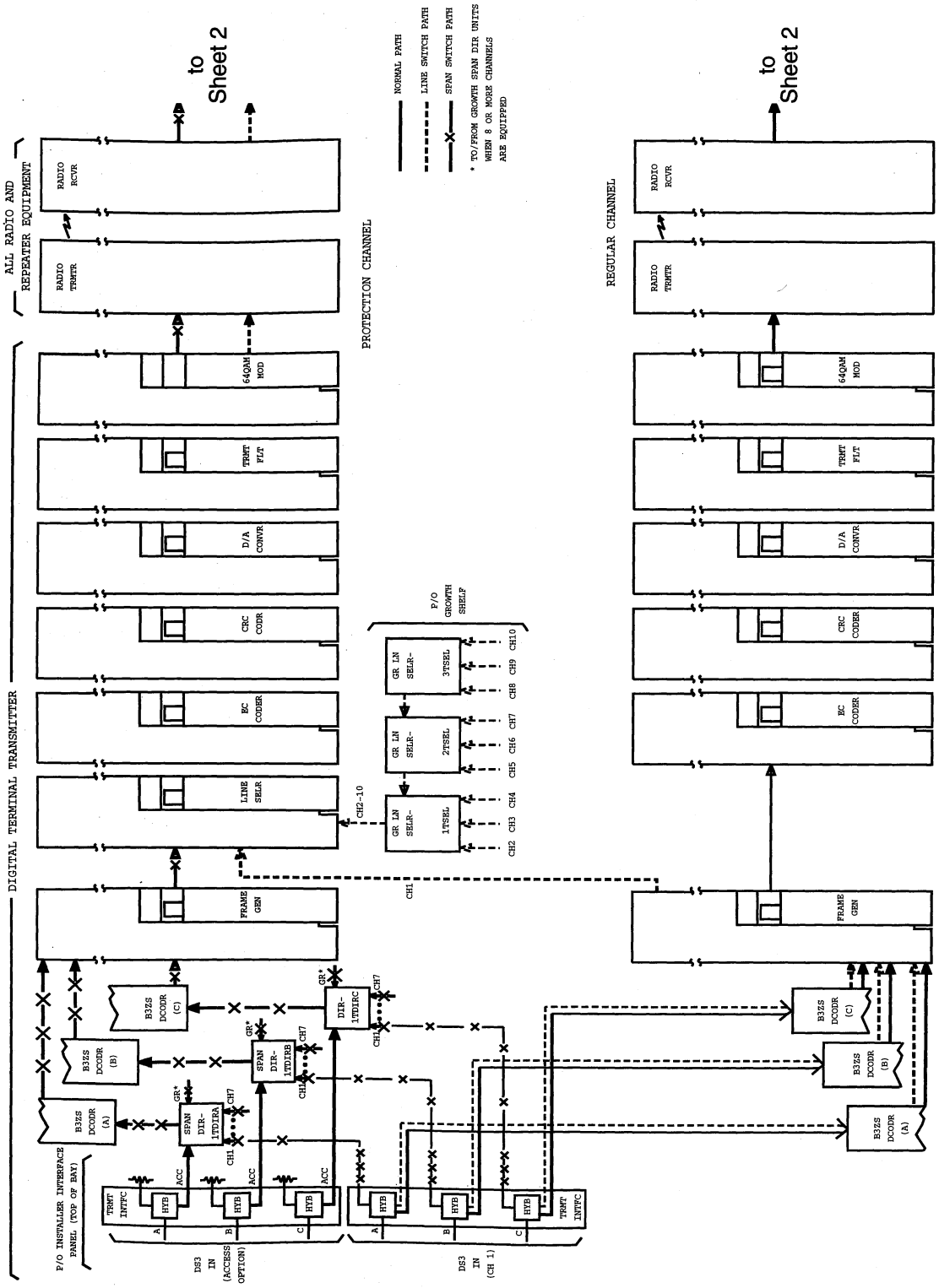

Figure 3. Line Terminal Switching Block Diagram—1xN System (Sheet 1 of 2)

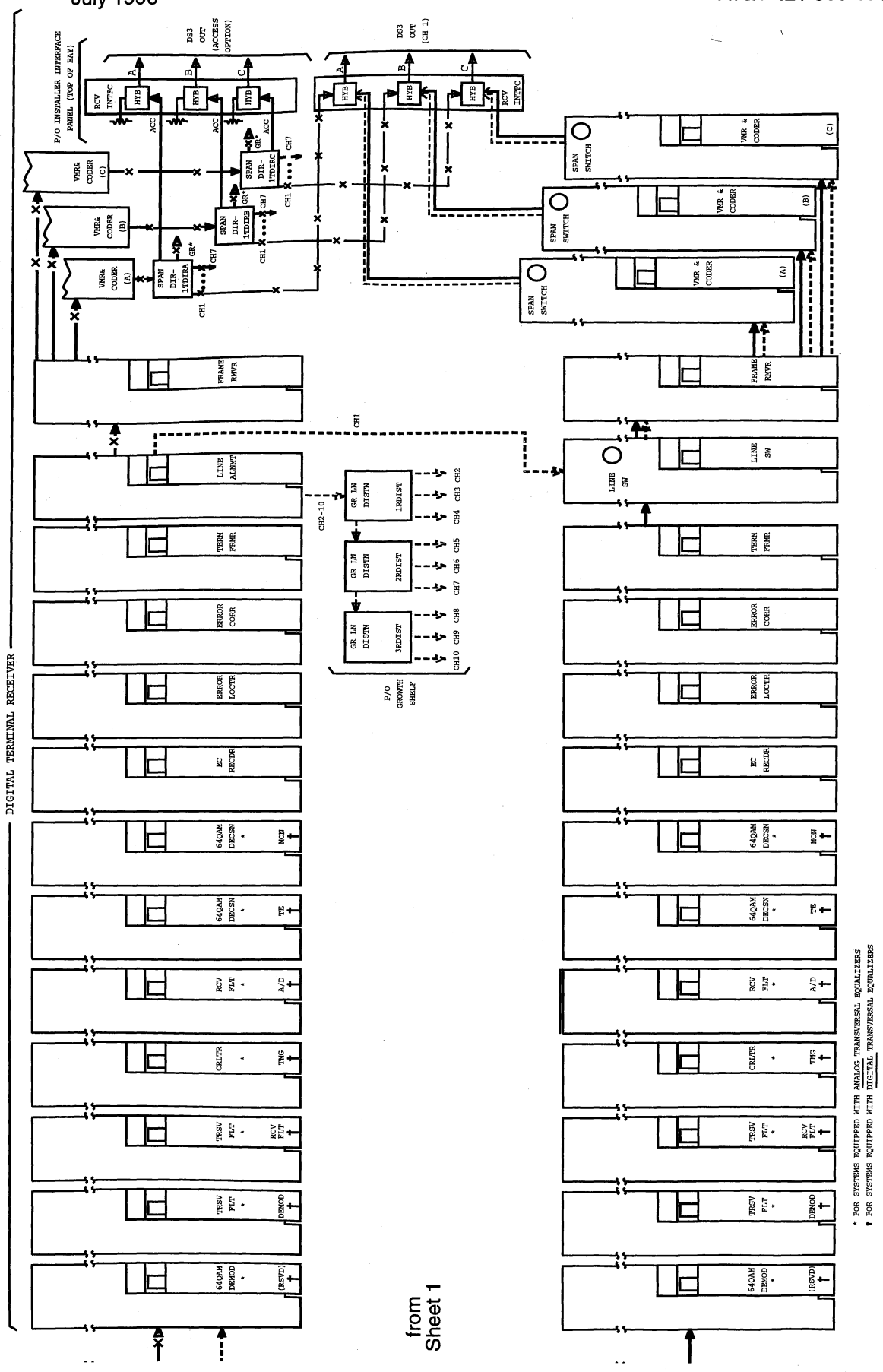

Figure 3. Line Terminal Switching Block Diagram—1xN System (Sheet 2 of 2)

3 Order-Wire Operations

The order-wire (OW) 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 direct distance dialing (DDD) 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 DDD service through the DDD interface at the 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 push-button 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
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 (TERM or REGEN) OW unit will light and an audible dial tone will be heard. — The dial tone will last for approximately 20 seconds or until any telephone handset digit is dialed. — 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.
2	For local-station to single-station calls, go to Step 3. For local-station to all-stations calls, go to Step 4. For DDD calls, go to Step 5.

Local-Station to Single-Station Calls

3 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.

Comment: *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

4 On telephone handset,

depress the # push button 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 at that station 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

5 On the telephone handset,

depress the "9" push button.

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

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

If central office dial tone is received, go to Step 6.

6 On the telephone handset,

depress the push buttons for the desired telephone number. Use DDD access (1) and/or area code, if required.

7 To terminate the DDD call, just hang up.

*Comment: 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 * push button on the telephone handset. This will cause the DDD interface to be disconnected but leave you connected to the OW circuit. To make another DDD call, repeat procedure from Step 5.*

End of Procedure

4 Status and Control Operations

Status and control operations are additional features of the DR 6/11 radio system. These features are executable from the Control and Service Channel shelf of the line terminal bay.

4.1 Installed Firmware

The latest firmware release as of the issue date of this CIP is designated 40B (H4). The following procedure allows you to check if it is installed in the terminal bay.

Step	Procedure
1	Go to the Control and Service Channel shelf of the line terminal bay.
2	On the RCV STAT unit, press and release the EXER push button. A 30 code (exerciser running) will be displayed in the DIAGNOSTIC CODE window. The next step needs to be performed while the exerciser is running.
3	On the PROT STAT unit, press and hold the OPR push button.
4	On the RCV STAT unit, observe the CHANNEL window. ***Requirement:*** H4 displayed
5	On the PROT STAT unit, release the OPR push button.

End of Procedure

4.2 Current Regular Channel Bridged to Protection

The DS3 signals fed to the protection are supplied from one of the regular channel's DS3 inputs or from the access DS3 inputs if an access is up. During a line or span switch, the DS3 inputs of the switched regular channel are bridged to protection (transmitting). For a nonswitched condition, regular channel 1 normally feeds protection unless another regular channel had recently released protection from a switch. There is an interval during which the last regular channel that was switched to protection will remain with its DS3 inputs bridged to protection (transmitting). The following procedure allows you to check which regular channel DS3 inputs are currently feeding the protection channel.

Step	Procedure
1	Go to the Control and Service Channel shelf of the line terminal bay.
2	Simultaneously press and hold the following push buttons: ■ On the RCV STAT unit—TRMT SW ■ On the PROT STAT unit—OPR.
3	On the RCV STAT unit: a. Verify 50 code appears in DIAGNOSTIC CODE window. b. The regular channel currently bridged to protection will appear in the CHANNEL window.
4	Release the push buttons.

End of Procedure

4.3 Static Alignment Time Display

The system updates and stores the alignment data needed for an errorless line switch each time the exerciser is run. The AMR56B line alignment plug-in unit has a range of 128 symbols. At a system baud rate of 22.5 M baud, each symbol period is about 44 ns. We can display the static alignment setting for a regular channel using the following procedure.

Step	Procedure
1	Go to the Control and Service Channel shelf of the line terminal bay.
2	Activate a line or span transmit bridge for the regular channel. Reference: Table A (this tab).
3	On the RCV STAT unit, verify 88 or 89 code appears in DIAGNOSTIC CODE window.
4	On the PROT STAT unit, press and hold the OPR push button.
5	On the RCV STAT unit, note the value displayed in the CHANNEL window.
6	On the PROT STAT unit, release the OPR push button.
7	Multiply the value displayed in Step 5 by two. The result is the number of symbol periods used in the static alignment for the indicated channel.

End of Procedure

4.4 Automatic TERM CONTR Reset

Some of the DR 6/11 systems have experienced the following problem in the past.

The system locks up with all channels indicating a receive span switch and service is failed on all channels.

The only way to clear the problem is to reboot the terminal by operating the CONTR RESET on the TERM CONTR unit. This cannot be done remotely, usually someone had to be dispatched to the station to perform this task. A fix was developed and installed which initiated an automatic reboot if this condition was detected.

The fix consists of:

- Replacing the AMR114 unit for channels 1 and 2 with an AMR214 unit
- Wiring additions from the AMR214 slot to the TERM CONTR unit slot.

When channels 1 and 2 both indicated a span switch the system is automatically rebooted. The following procedure checks for this feature and verifies its operation.

Step	Procedure
1	Go to the Control and Service Channel shelf of the line terminal bay.
2	Verify that the CHAN STAT plug-in unit for channels 1 and 2 is an AMR214.
3	Verify that the system is normal—nothing operated.

CAUTION:
A service interruption may occur with a reboot if something is operated. A reboot will drop any switches or lockouts.

4	On the AMR214 CHAN STAT unit for channels 1 and 2, simultaneously press and release both OPR push buttons.
5	Verify that a reboot occurs. Comment: During reboot: a. Most indicators on the PROT STAT unit and CHAN STAT units will flash. b. The bar graphs on all CHAN CONTR units will flash. c. The exerciser will run (30—DIAGNOSTIC CODE).

End of Procedure