
SL-1

2-Mb/s Remote Peripheral Equipment

Maintenance and fault-clearing procedures

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Reason for issue

90 11 02

Standard, Group F (Phase 6) - New Generic X11 Supplementary Feature

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General

This Northern Telecom Publication (NTP) provides information for fault detection, fault isolation, and fault-clearing of the 2-Mb/s RPE required by Generic X11 Including Supplementary Features, Group F (Phase 6). Carrier is referred to only in general terms. The isolation and repair of faults within the carrier should be done using documentation provided by the carrier manufacturer.

Carrier systems for the span must be land-based links, which meet CCITT recommendation G703 for interface at 2.048 Mb/s.

Refer to NTP 553-2931-100 for feature and equipment descriptions as well as engineering guidelines. NTP 553-2931-200 outlines installation and acceptance tests for the RPE feature. Also refer to Appendix 1 to 553-2741-100/200/500 for RPE cabinets and shelves for the ST and SN machines.

The 2-Mb/s Remote Peripheral Equipment (RPE) increases the 50-foot (15 m) range of the multiplexed loop between the Common Equipment (CE) and the Peripheral Equipment (PE) shelves by using a 2.048 Mb/s carrier span (Figure 2-1). The increased range permits the PE to be located closer to the stations it serves, which in turn increases the serving range of the SL-1.

The 2-Mb/s carrier used to link the local and remote sites must conform to CCITT recommendation G703 for interface at 2.048 Mb/s. The SL-1 RPE and the carrier constitute a unified system. The first stage in fault-clearing is the isolation of the fault.

Before this publication is used to diagnose and to repair faults, 553-2931-100 should be read to gain familiarity with the feature, if required.

Related documentation

Maintenance. Diagnostic program descriptions and input/output references are provided in NTP 553-2301-511.

Data administration. Information and detailed procedures on feature and service implementation are provided in Appendix 1 to 553-2311-311.

Equipment description

Introduction

A remote loop can serve up to four PE shelves at the remote site.

Network circuit packs assigned to remote service are connected to the local RPE shelf using an NE-A18QA cable (Figure 2-2). The local site RPE shelf is connected to customer-supplied Line Terminating Units (LTUs) by two 75-ohm single-pair coaxial cables for each equipped loop. The LTU interface the SL-1 equipment with the digital carrier system.

At the remote site the carrier system is connected to the LTU, which are in turn connected to the RPE shelves by two 75-ohm single-pair coaxial cables for each loop. The remote RPE shelf is connected to the PE by NE-A18QA cables as shown in Figure 2-3. Refer to Figure 2-4 when a left-hand mount RPE shelf (QSD22) is provided.

Each RPE shelf can serve up to four remotely assigned loops. If the loop-sparing option is used the RPE shelf provides service to three loops. An attempt to switch the spare loop into service is made by the system when a serious fault or alarm condition is detected on an active loop.

2-2 Equipment description

Figure 2-1
Typical 2-Mb/s RPE block diagram

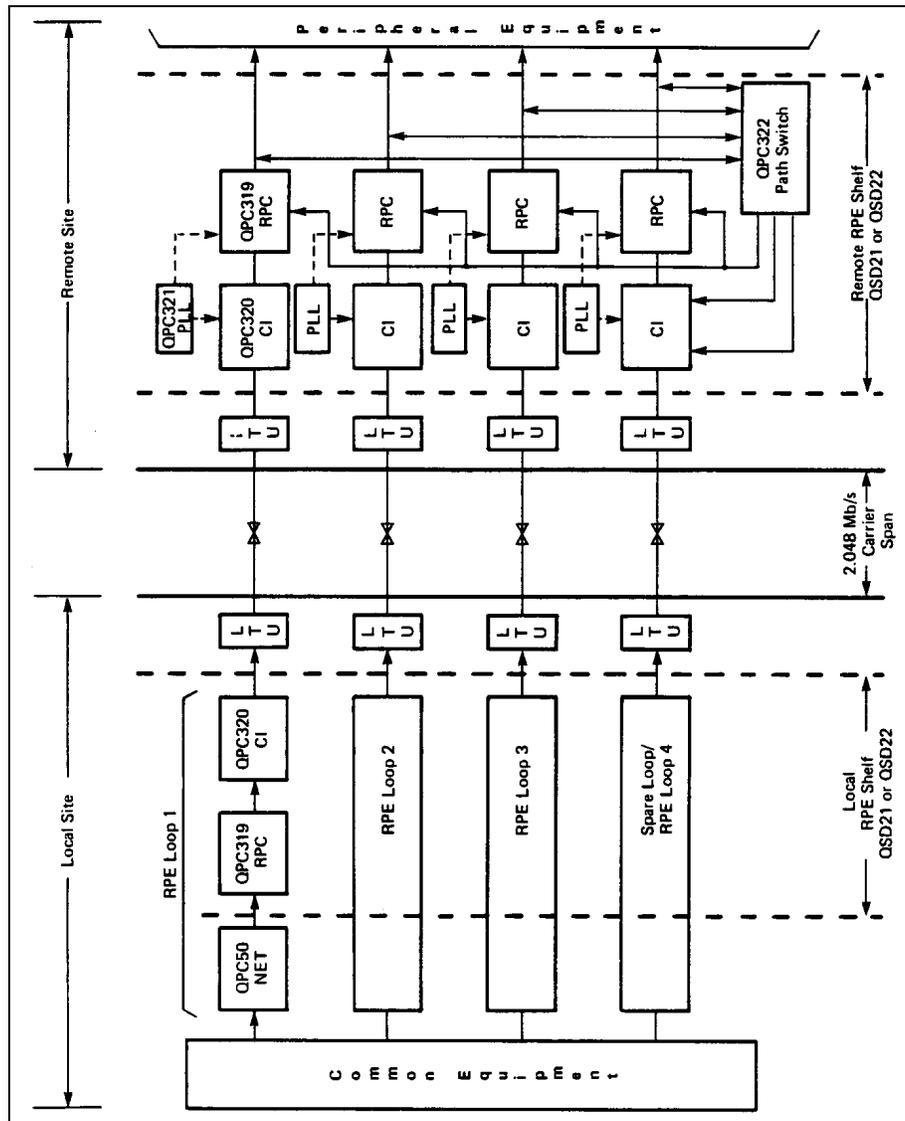


Figure 2-2
Local RPE cabling

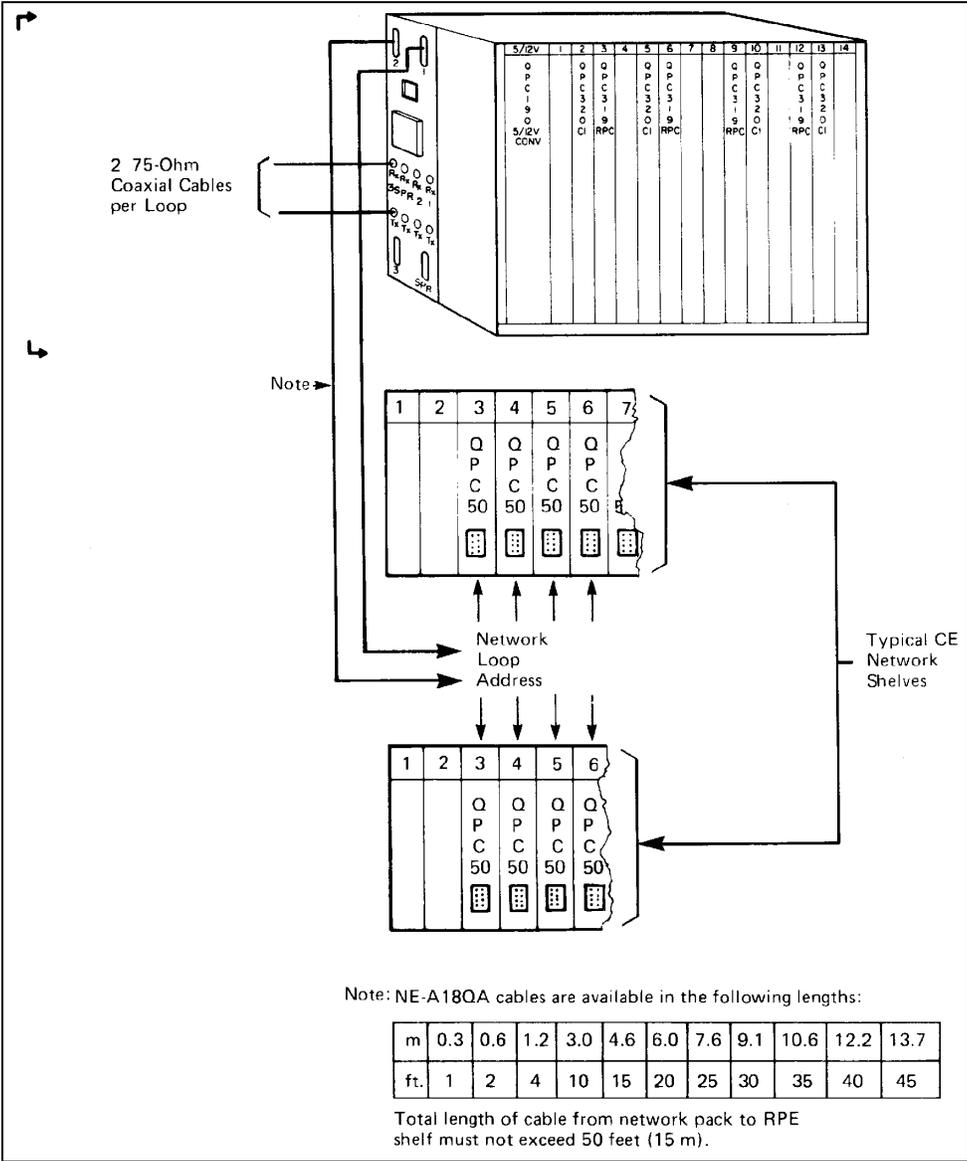
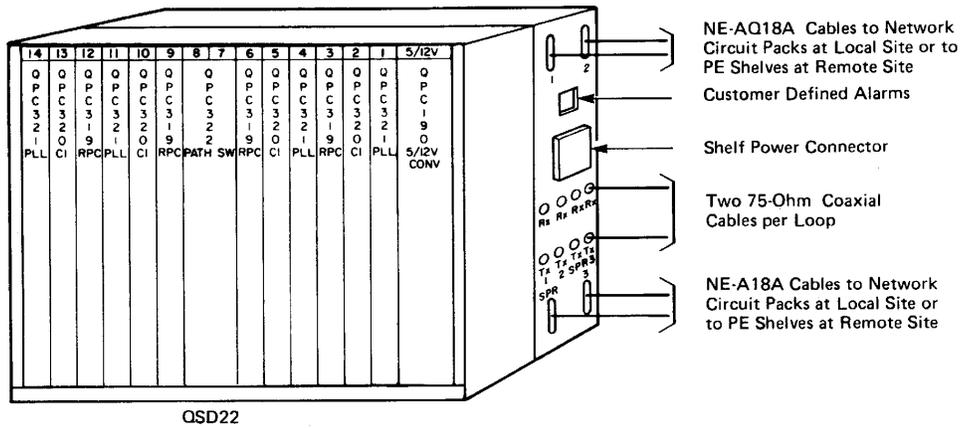


Figure 2-4
Typical layout of left-hand mount RPE shelf (QSD22)



Fault detection and isolation

The 2-Mb/s RPE design includes the following features to aid the technician in locating, isolating, and clearing faults:

- Resident RPE Alarm Handler Program
- RPE Diagnostic Overlay Program
- Fault and Status Light Emitting Diodes (LEDs) on circuit pack faceplates

Resident alarm handler program

The resident alarm handler program runs continuously, monitoring the RPE equipment. When the program detects a fault in the RPE an RPEXXX alarm message is printed at the maintenance terminal. When a serious fault condition is detected on a loop the program attempts to replace the faulty loop with the spare loop (if equipped).

Not all faults detected by the program are of a serious nature. The program does however print an alarm message for each fault detected. The alarm messages are in the form RPEXXX L, where L is the loop number that the fault is detected on. Any one of the following conditions can generate an alarm message:

- (a) Frame alignment error rate exceeded at the local/remote site on loop L.
- (b) PCM error rate exceeded at the local/remote site on loop L
- (c) Loss of frame alignment at local or remote site on loop L
- (d) Failure of remote RPC circuit pack of loop L
- (e) Loss of carrier clock at the local site on loop L

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- (f) Loss of outgoing or incoming messages at the local site on loop L
- (g) Local Remote Peripheral Controller (RPC) circuit pack initialization (failure) on loop L
- (h) Missing, faulty or disabled path switch circuit pack
- (i) Customer defined alarms

Threshold levels can be set for alarms (a), (b), (c), (d), and (g) using overlay program 52. Two types of thresholds may be specified:

- Counter Thresholds - number of alarm occurrences
- Timing Thresholds - duration of an alarm

Note: Timing thresholds do not apply to alarm (g). When any occurrence of alarm (g) is encountered sparing is immediately attempted

- (j) SSD in PE card failed to respond to a shift out message within the time limit.

When a threshold is exceeded on a loop an attempt is made to spare the loop. Table 3-A provides the RPE alarm message formats and indicates any action taken by the program. Refer to 553-2301-511 for further detail on RPEXXX messages.

Customer-defined alarms

Each RPE shelf can have up to three customer-defined alarm inputs assigned (Figure 3-1). Refer to 553-2931-100 for further detail about the customer-defined alarms.

Table 3-A
RPE alarm handler message format

Output message	Cause	Action taken
RPE0XX L	Alarm occurrence detected	Reports loop number on which the alarm is detected and the cause of the alarm
RPE1XX L	Counter threshold violation	Reports loop number and violation threshold that is exceeded. Sparing is attempted
RPE2XX L	Timing threshold violation	Reports loop number and violation threshold that is exceeded. Sparing is attempted
RPE3XX L	Sparing problems	During sparing attempt a problem is encountered. Sparing is aborted.
RPE4XX L	RPC initialization problems	Problems encountered during initialize of remote loops

Alarm handling

This feature enhances the existing alarm function for the 2-Mb/s RPE.

The alarm handling function checks for primary loop failure (several failures during a certain period or a single failure lasting too long). If any failure is detected, automatic switching (or sparing) to a spare loop is performed. This feature enhancement adds flexibility to how sparing is controlled. The Counter and Timer thresholds are changed from one set per PBX to one set per RPE group. The Error Counting and Counter Reset are changed from every 24 hours to every half hour. Two additional maintenance information fields are printed if automatic sparing has occurred.

Overlay programs

Program 53 should be included in the daily routines (see 553-2311-311 Appendix 1). This program when included in the daily routines tests the

3-4 Fault detection and isolation

RPE equipment once every 24 hours. The program can be loaded manually from the maintenance terminal to test, enable, or disable RPE equipment.

Program 45 (Background Signaling Test) is run continuously, testing signaling paths to all system PE including RPE.

Programs 53 and 45 may disable parts of the RPE that fail during a test. Program 45 may light LED on PE circuit packs. Faults are also indicated by output on a maintenance terminal or a code on the maintenance display. Program 53 can also be a background program to do automatic unsparing.

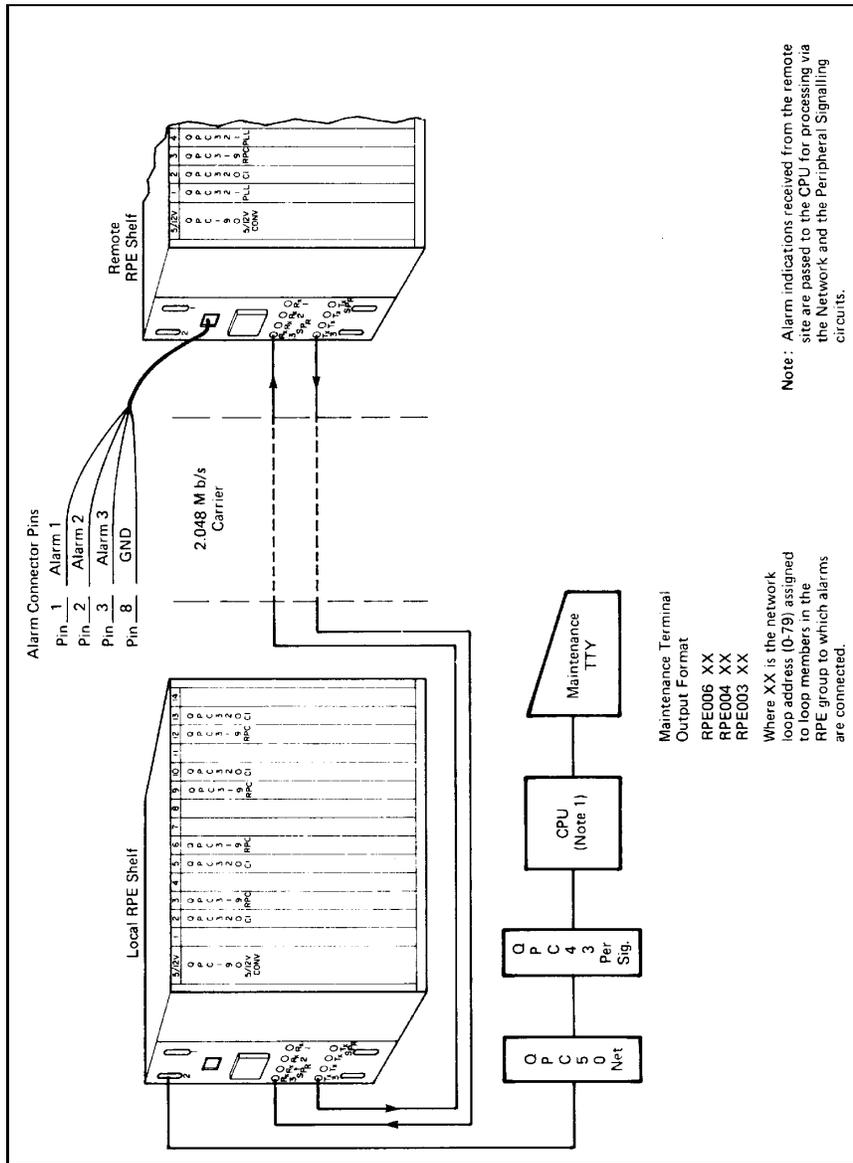
The command LCNT L available with program 53, prints the contents of alarm counters (number of alarm occurrences) for the requested loop. By examining the contents of the counters the technician can determine the type of problem that is causing the RPE fault. Table 3-B gives the alarm mnemonics and counters that are printed. It also provides an explanation of the condition that would cause the counter value to be increased as well as a probable fault location.

The meaning of terminal output codes is given in 553-2301-511. The first three characters of the output identify the program that generated the message. The last three characters provide the meaning of the output.

Loop member assignment and location requirements

The relationship between the network loop address and the assignment of the RPE group member number (program 52) is illustrated in Figure 3-7. It should be noted that the member number assignment refers to the physical location of RPE packs in the remote RPE shelf only.

Figure 3-1
Customer-defined alarms



Fault and status LEDs

Fault and status LEDs on the faceplate of RPE circuit packs are shown in Figure 3-2. Figure 3-3 gives the possible faults that could cause the LEDs to light and lists the equipment that would most likely be the cause of the fault. When fault LEDs are lit the technician should initiate tests using program 53 to isolate and identify the faulty equipment.

Loop-around test facility

The loop-around test facility in program.53 may be used by the technician to aid in fault location. By using a combination of local and remote loop-around tests the technician can determine whether the fault is in:

- the local site equipment
- the carrier equipment
- the remote site equipment

N In most cases the message received when a fault is encountered will indicate the faulty circuit pack.

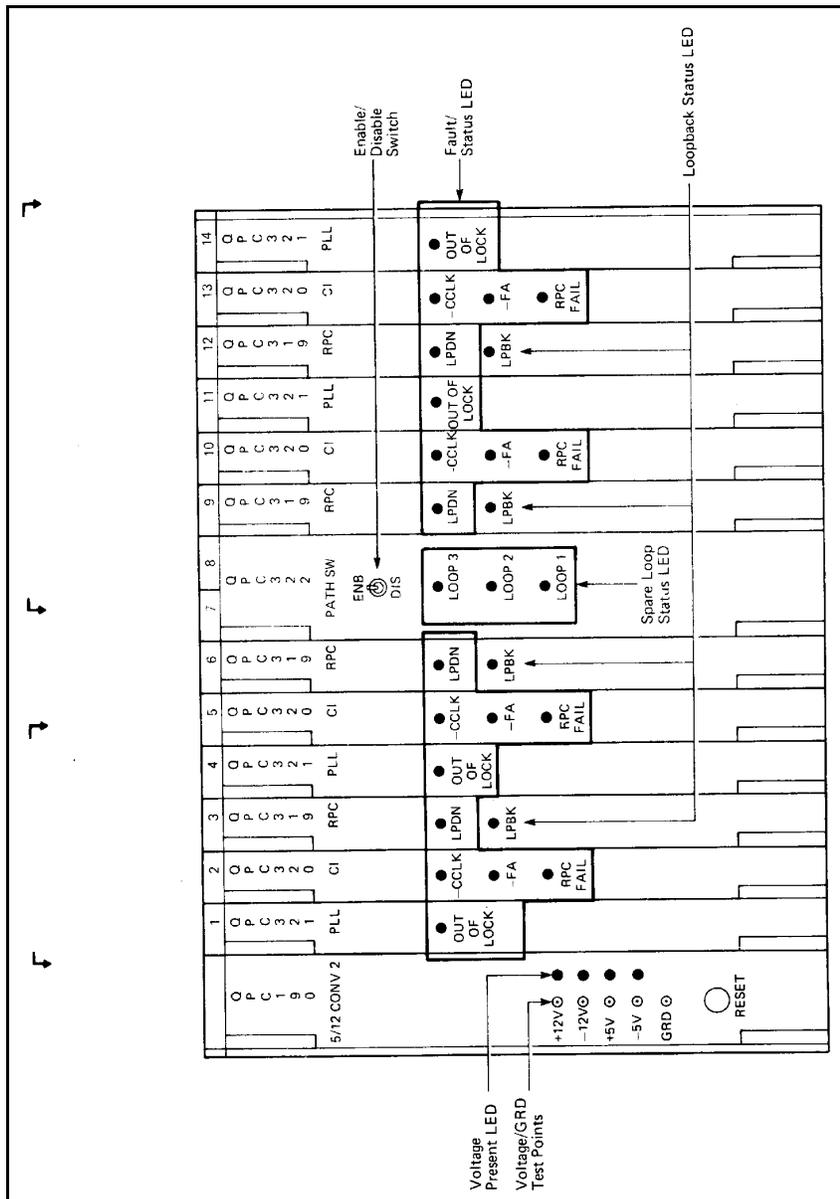
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Figure 3-4 shows the portions of an RPE loop that are tested when performing local and remote loop-around tests.

CAUTION

Before using the local or remote loop-around test facility, the loop that is suspected to be faulty should be replaced by the spare loop

Figure 3-2
RPE circuit pack faceplate layout

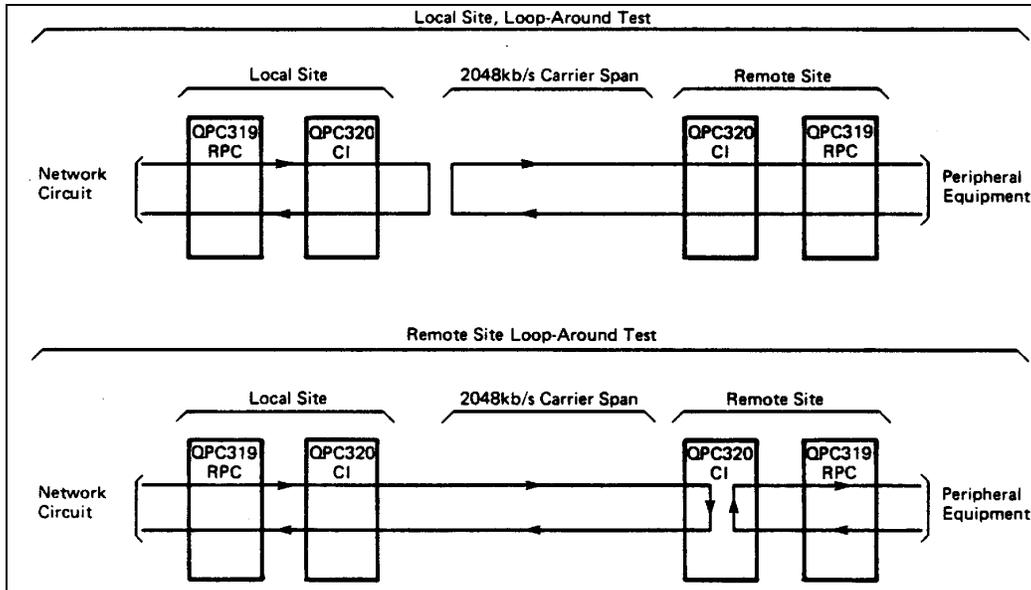


3-8 Fault detection and isolation

Figure 3-3
LED fault indicators

Circuit Pack Number (LED Lit = ● LED Dark = ○)												Comments			
Local Site						Remote Site									
QPC319		QPC320		QPC319		QPC320		QPC321	QPC322						
LPDN	LPBK	-CCLK	-FA	RPC Fail	LPDN	LPBK	-CCLK	-FA	RPC Fail	Out of Lock	Loop 1	Loop 2	Loop 3	Note: If spare loop option is equipped, when an active loop is replaced by the spare its corresponding LED is lit. Loss of link between network and RPE shelf. Possible faulty QPC320 at remote sets Loss of link between network and RPE shelf. Faulty QPC320 at local site Faulty QPC319 at local site Faulty QPC319 at remote site Loop is disabled and local loopback is active Loop is disabled and remote loopback is active Clock signal cannot be locked on possible faulty QPC321	
○	○	○	●	○	●	○	○	○	○	○	○	○	○		(See Note)
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Figure 3-4
Local and remote loop-around tests



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Table 3-B
Explanation of alarm counter mnemonics

Alarm mnemonic and counter	Explanation	Probable fault location
FAER xx	Frame alignment error rate (16 faulty frame alignment signals in 4 seconds) exceeded at remote site	Carrier
PCMR xx	PCM error rate (8 violations in 8 seconds) exceeded at remote site	Carrier
ALM3 xx	Customer-defined alarm number 3	Customer specified
ALM2 xx	Customer-defined alarm number 2	Customer specified
RPF xx	Remote RPC failure	Remote RPE controller
ALM1 xx	Customer-defined alarm number 1	Customer specified
CCLK xx	Loss of carrier clock at the local site	Carrier
PSWD xx	Path Switch disabled, missing or faulty	Path switch card
PSWF xx	Path switch attempted to switch two RPE loops to the same peripheral buffer. Attempt was blocked	Path switch card
LFAR xx	Loss of frame alignment at the remote site	Carrier interface card or carrier
LFAL xx	Loss of frame alignment at the local site	Remote carrier interface card or carrier

PCML xx	PCM error rate (8 violations in 8 seconds) exceeded at the local site	Carrier
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—continued—

3-12 Fault detection and isolation

Table 3-B (continued)
Explanation of alarm counter mnemonics

Alarm mnemonic and counter	Explanation	Probable fault location
FAEL xx	Frame alignment signal error rate (16 faulty frame alignment signals in 4 seconds) exceeded at local site	Carrier
LIMG xx	Incoming message buffer overflow on the local RPC (Remote Peripheral Controller)	Occasionally lost messages do not necessarily imply a fault
LOMG xx	Outgoing message buffer overflow on the local RPC	Occasionally lost messages do not necessarily imply a fault
LINT xx	Local RPC pack initialized	Repeated initializations imply the failure of the local RPC
SSDF xx	SSD circuit has failed on a PE card	Line card
BGTH xx	Current number of unsparing attempts made by background since last midnight	—

Automatic sparing on alarms

Some alarms cause an automatic sparing attempt and have threshold timer and/or counter values associated with them specifying when the sparing attempt will be made.

The timer value specifies the maximum time the alarm condition is allowed to exist before the sparing attempt takes place.

The counter value specifies how many times per day a temporary alarm condition is allowed to occur before a sparing attempt is made.

No threshold is specified for the CCLK alarm. Instead, the status register is read a second time, and if the alarm situation still exists, the sparing attempt is made immediately.

If more than one alarm arrives, the most serious (the one with the lowest timer value) will be timed.

The alarm time and threshold nominal values (assigned by default through the data administration service change) are shown in Table 3-C. Respond to the TASK prompt with THRS for thresholds. For lower and upper limits refer to overlay program 52.

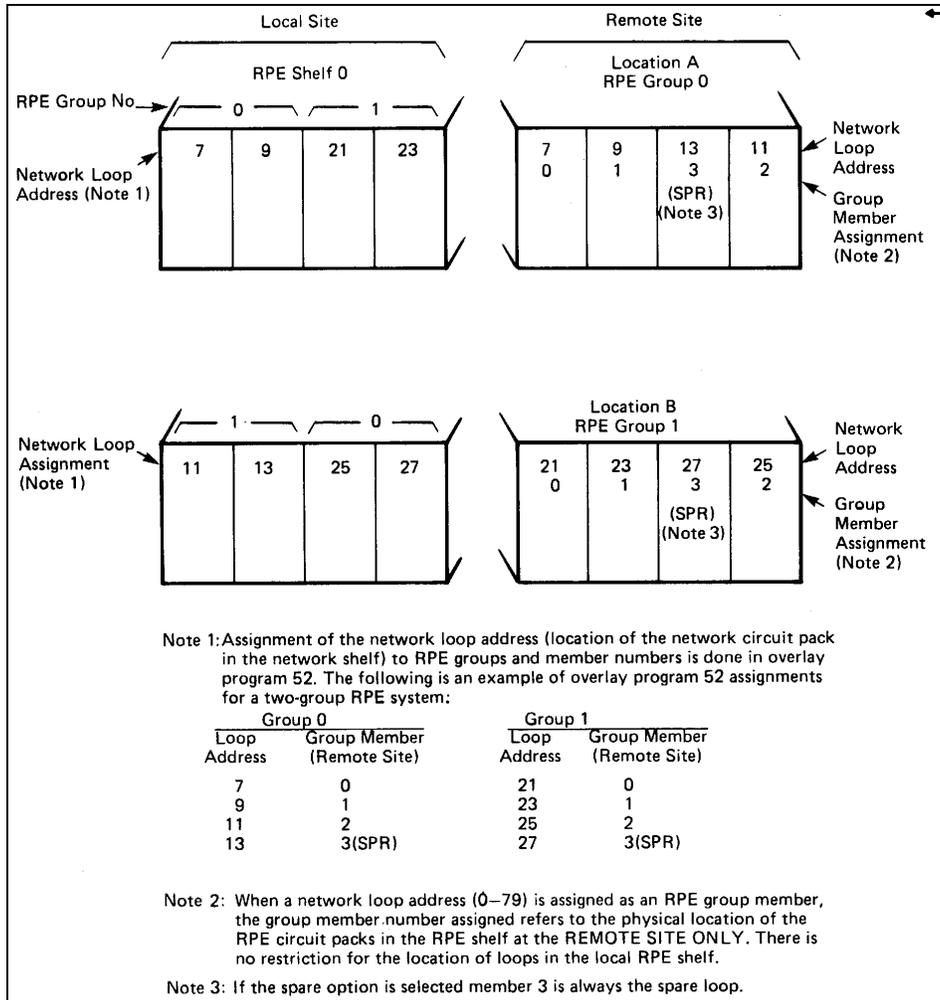
Table 3-C
Alarm time and counter thresholds

The time values are in seconds

Prompt	Response	Comment
LFAL	10	5
FAEL	600	20
PCML	600	20
LFAR	10	5
FAER	10	20
PCMR	600	20
RPF	1024	3
LINT	—	2

3-14 Fault detection and isolation

Figure 3-5
Typical layout for 2-group 2-location RPE system



Fault-clearing

Fault-clearing for the 2-Mb/s RPE equipment are shown in the flowchart of Figure 4-3. The steps in the flowchart are designed to isolate the fault (local/carrier/remote) with the use of the 2-Mb/s RPE diagnostic program and then clear the fault. When the fault is cleared, a complete test of the loop must be performed prior to returning the loop to service.

Precautions

Circuit packs in the RPE system should not be replaced without first disabling the loop in which the pack is located. Before disabling the loop an attempt should be made to replace the faulty loop with the spare loop. Procedure 4-1 should be followed when replacing suspected faulty RPE components. When a suspected faulty pack has been replaced and the fault is not cleared, the original pack should be returned to the shelf. Refer to Figures 4-1 and 4-2 for current pack location.

Power

RPE Shelves are powered from the QBL14 power distribution box. Refer to 553-2931-200 for connections and wiring. The QBL14 unit contains circuitry (input switch) that provides low voltage disconnect (-42 V). The box also provides individual fusing (3 A fuses) for each RPE shelf. If the power fault does not lie in the QBL14 unit refer to 553-YYY1-510.

Each RPE shelf requires a power converter circuit pack to convert the -48 V cabinet power into voltages required by the RPE circuit packs. If power faults are encountered refer to 553-YYY1-510 for power fault-clearing procedures.

4-2 Fault clearing

Figure 4-1
Local RPE shelf circuit pack location

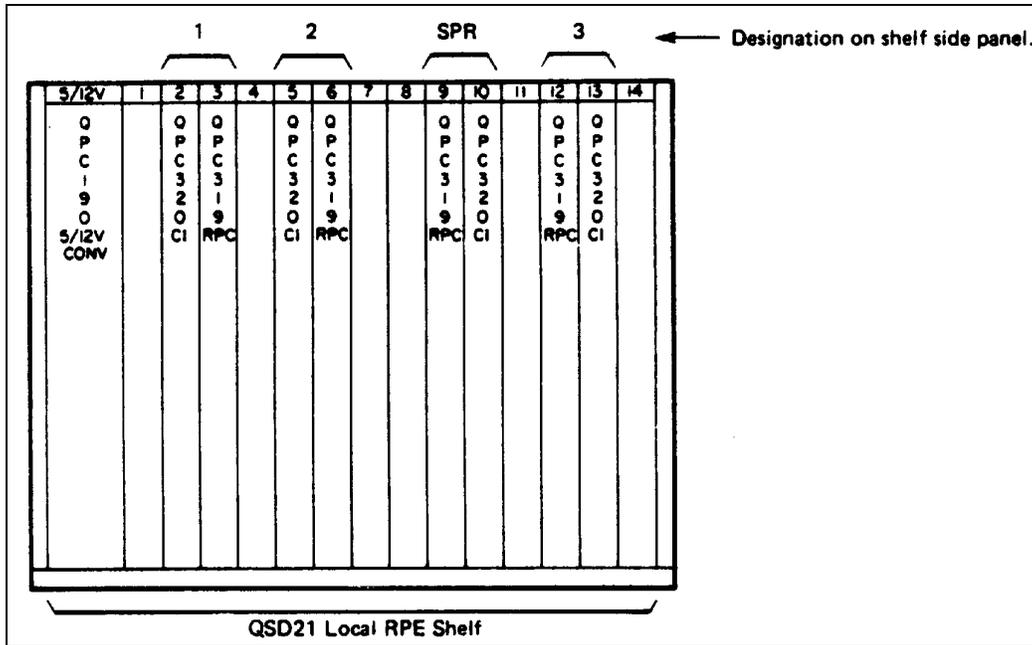
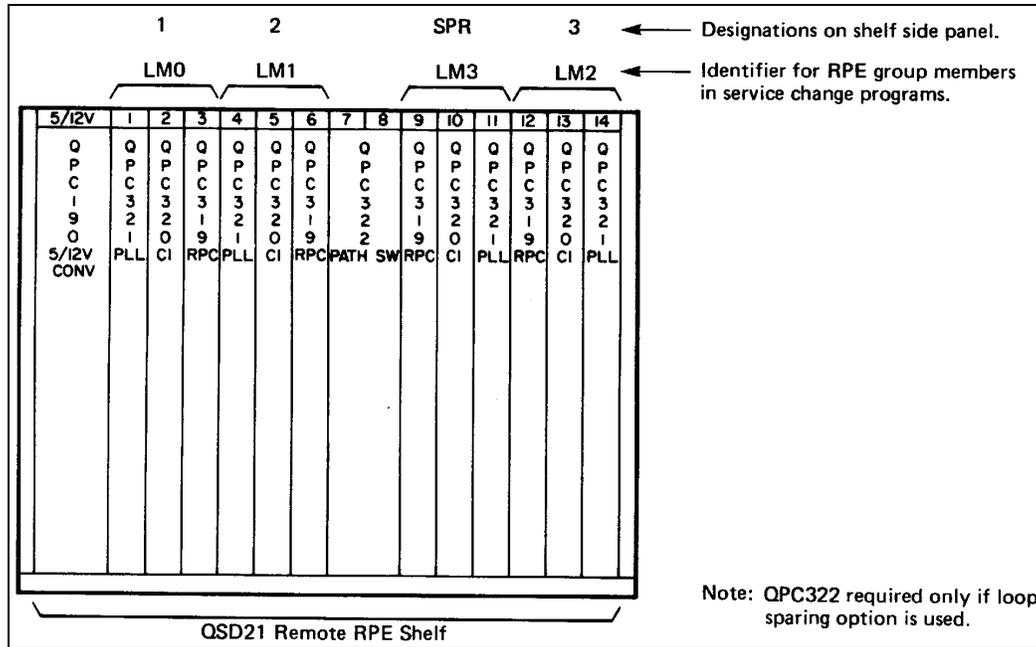


Figure 4-2
Remote RPE shelf circuit pack location



4-4 Fault clearing

Procedure 4-1 RPE equipment replacement

1. Load overlay program 53.
2. Enter command SWSP L to replace the suspected faulty loop with the spare loop (if equipped).
3. Replace the suspected faulty pack with a known good pack.
4. Completely test the loop using the following commands from overlay 53:
 - LOOP L
 - TSTL L
 - TSTR L
 - REML L
5. Request the status of the group by entering STAT RPG X.
6. Enable the repaired loop by entering ENLL L. If the shelf is disabled, also enter ENLS L S.
7. Disable the spare loop (if equipped) by entering DISL L.
8. Activate the previously faulty loop by entering UNSP X.
9. Enable the spare loop by entering ENLL L. (If the shelf is disabled, also enter ENLS L S).

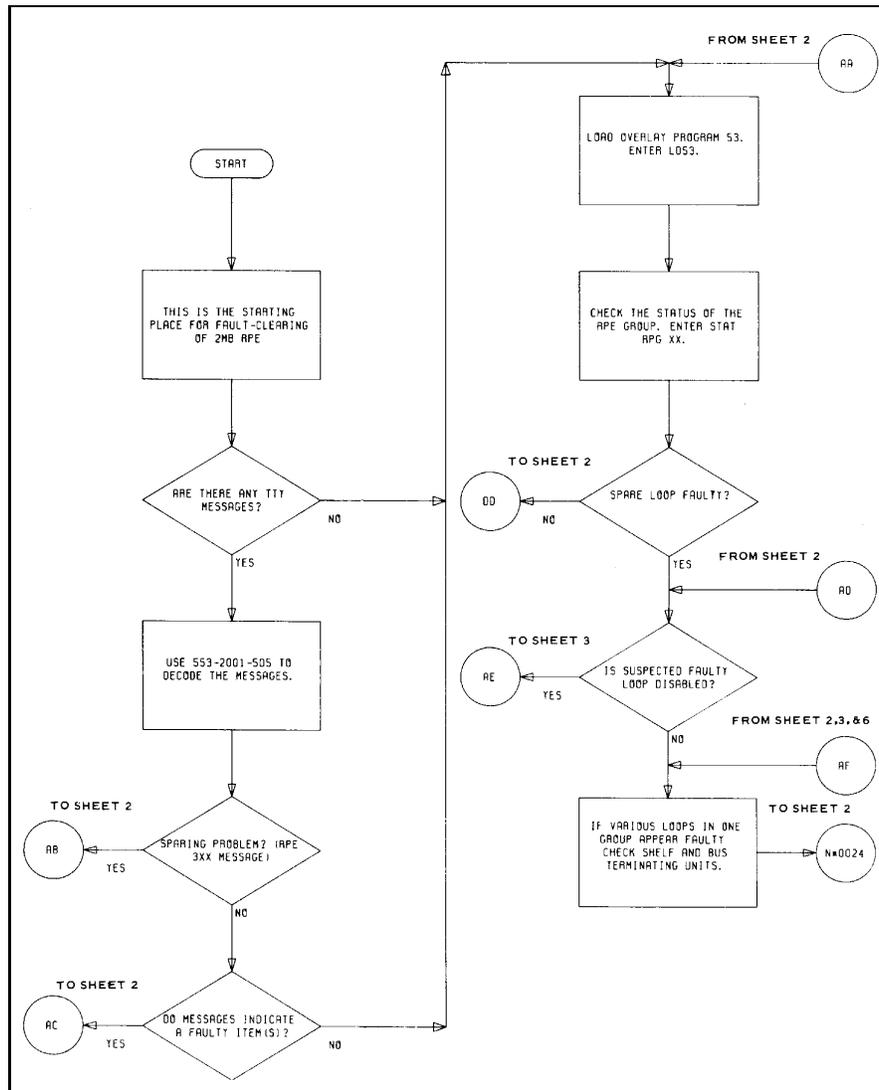
N Other precautions listed in 553-2301-511 should be followed when replacing faulty apparatus.

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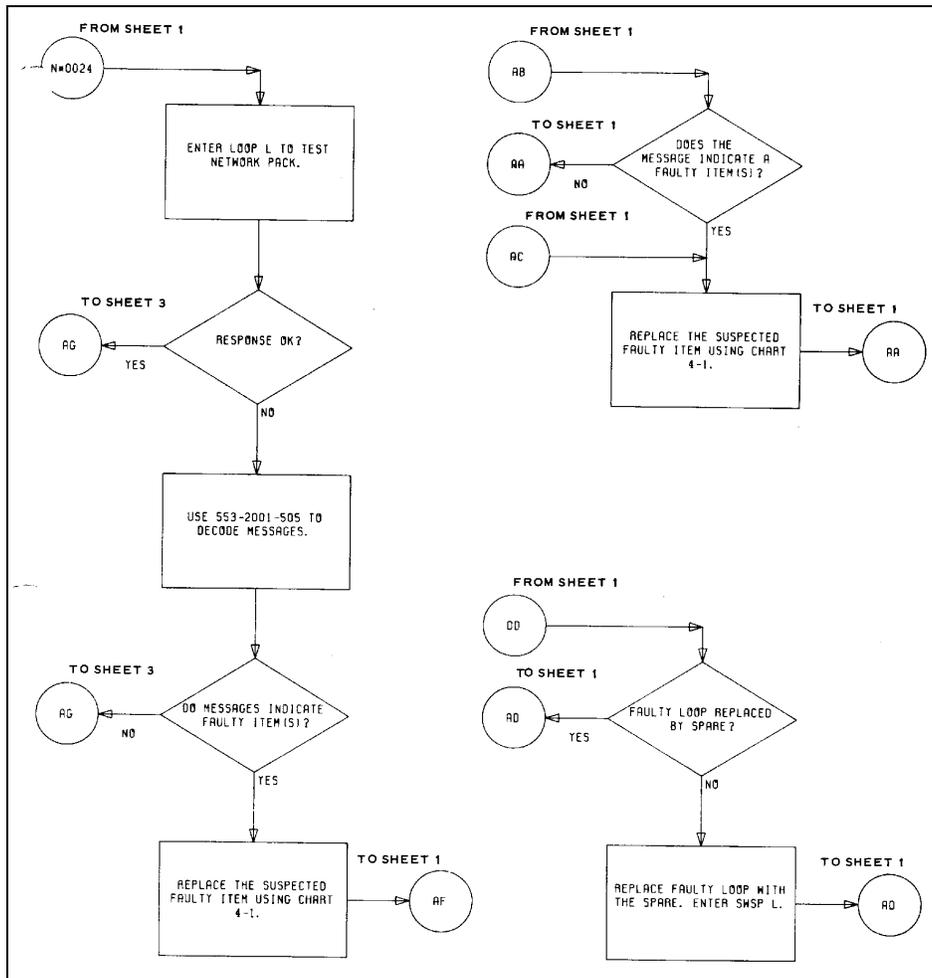
Figure 4-3
RPE fault-clearing



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4-6 Fault clearing

Figure 4-3 (continued)
RPE fault-clearing



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Figure 4-3 (continued)
RPE fault-clearing

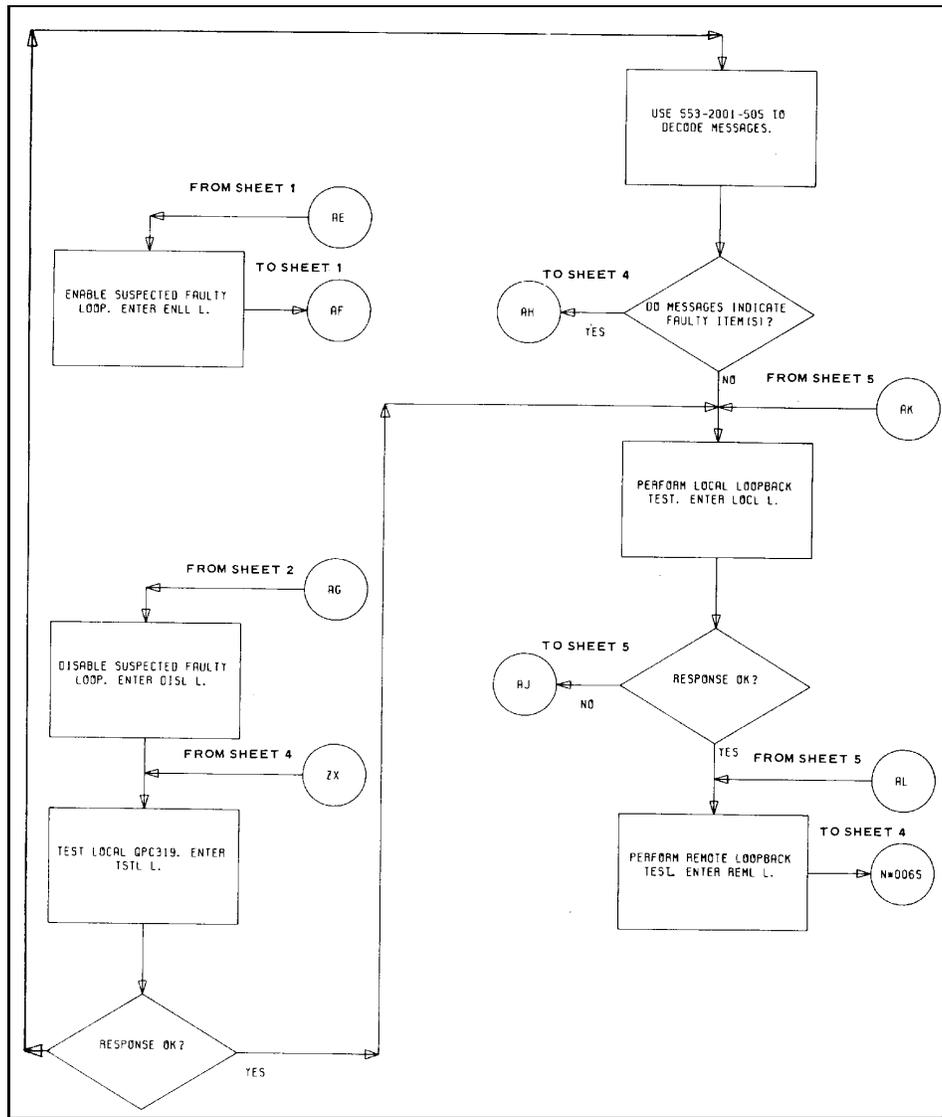
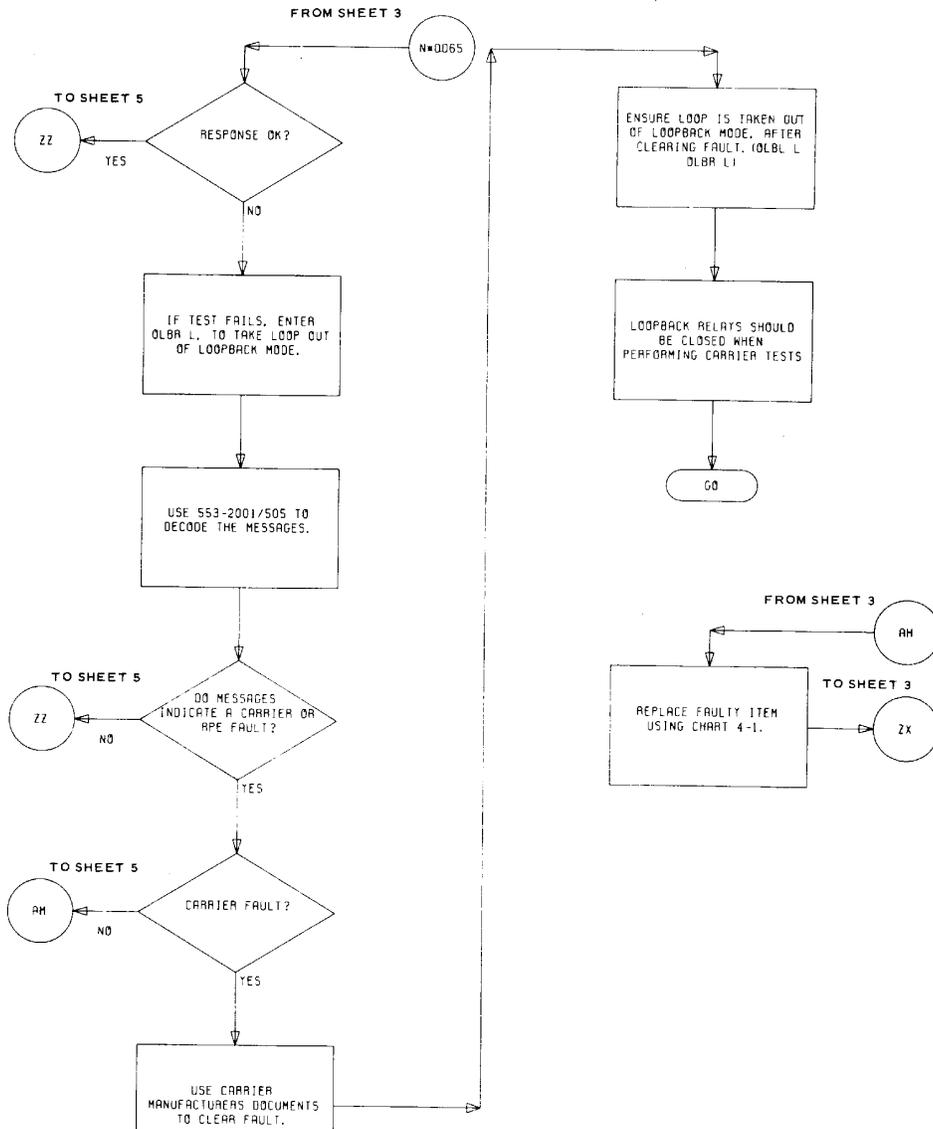


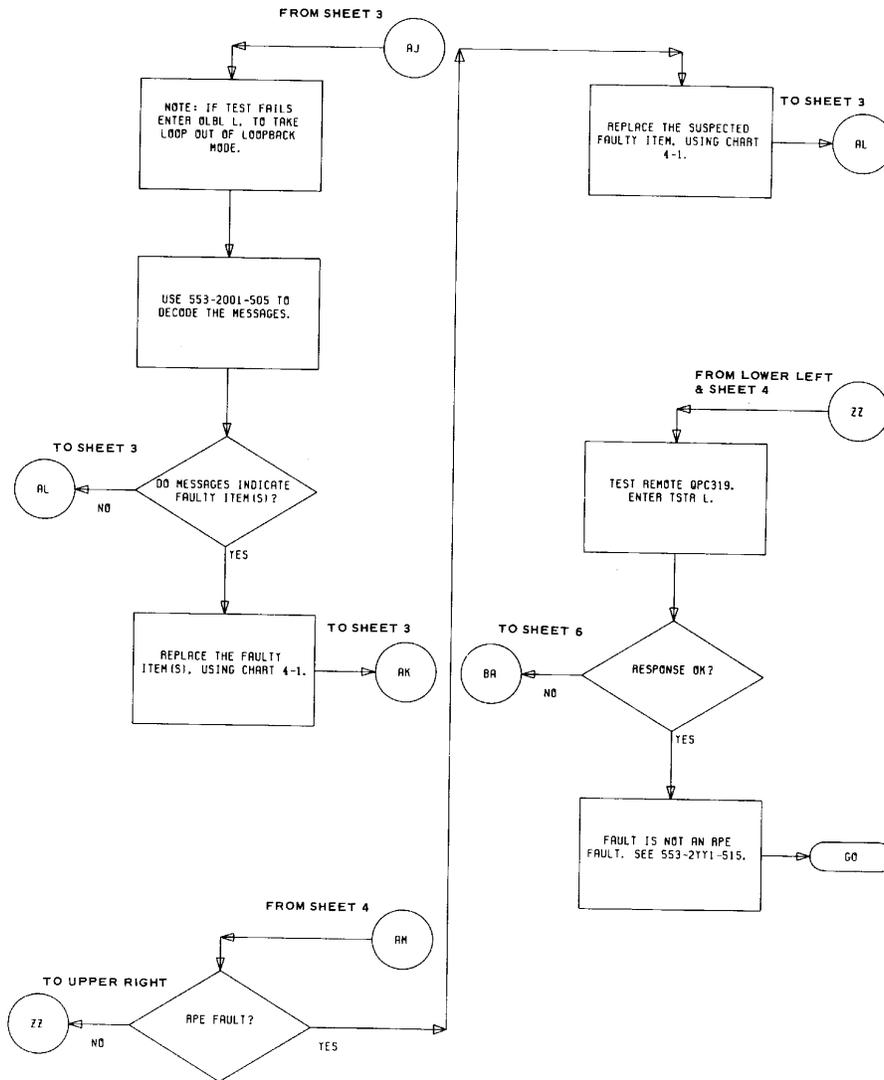
Figure 4-3 (continued)
RPE fault-clearing



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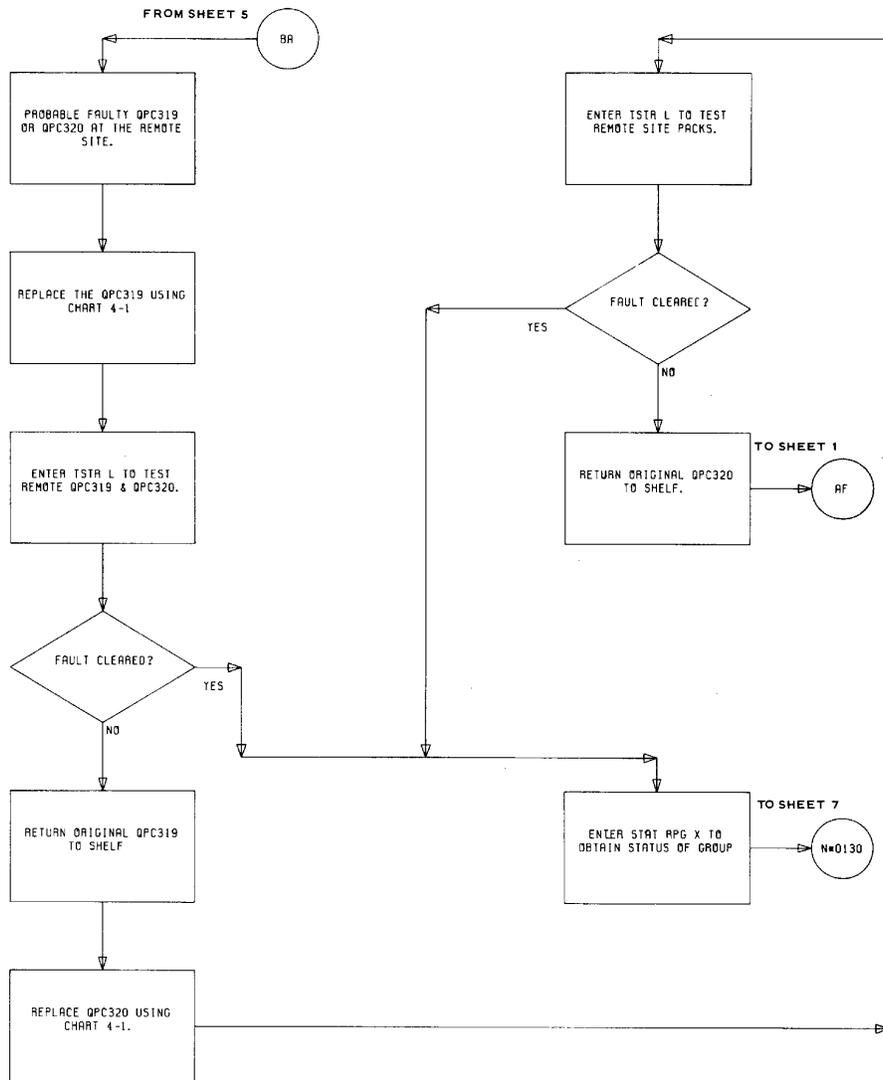
4-10 Fault clearing

Figure 4-3 (continued)
RPE fault-clearing



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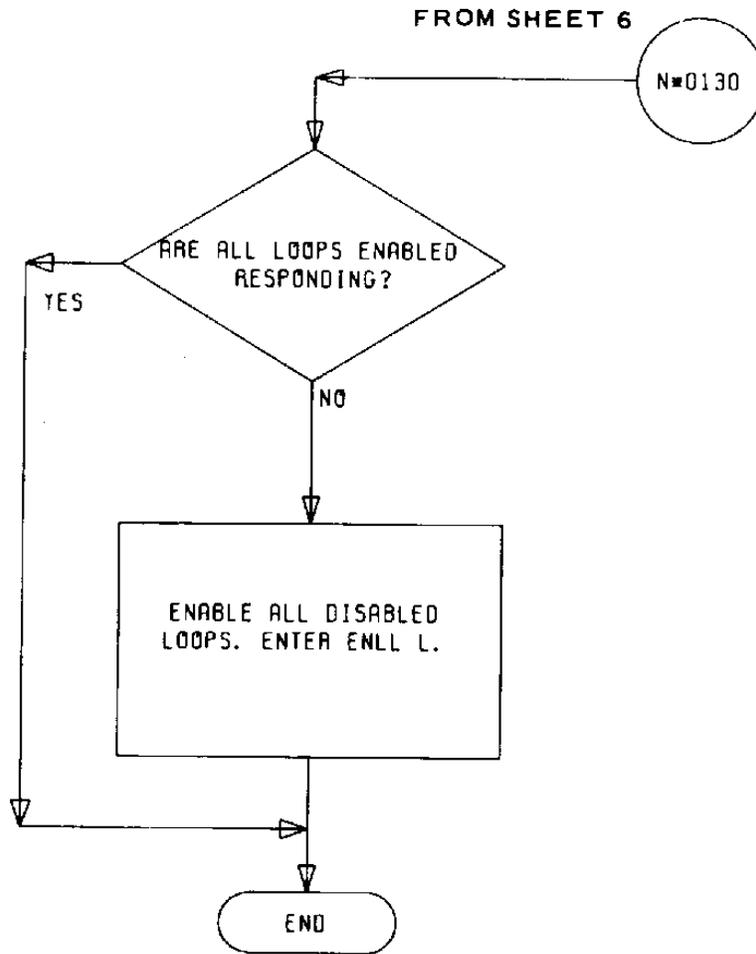
Figure 4-3 (continued)
RPE fault-clearing



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4-12 Fault clearing

Figure 4-3 (continued)
RPE fault-clearing



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2-Mb/s Remote Peripheral Equipment

Maintenance and fault-clearing procedures

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