SPECIFIED CONFIDENTIAL ATTACHMENT C

BellSouth Telecommunications, Inc.
FPSC Docket No. 001305-TP
Request for Confidential Classification
Page 1 of 1
10/29/01

REQUEST FOR CONFIDENTIAL CLASSIFICATION OF BELLSOUTH'S LATE FILED HEARING EXHIBITS 8 AND 17 FILED OCTOBER 8, 2001IN FLORIDA DOCKET NO. 001305-TP

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DECLASSIFIED 9.12.05
CONFIDENTIAL
appeal

This confidentiality request was filed by or for a "telco" for DN 13681-01. No ruling is required unless the material is subject to a request per 119.07, FS, or is admitted in the record per Rule 25-22.006(8)(b), FAC.
(x-ref. 12814-01)

BellSouth Telecommunications, Inc.
FPSC Docket No. 001305-TP
Late Filed Hearing Exhibit No. 8

PROPRIETARTY

REQUEST: In what ways is the Commercial Arbitration Award identified as OAR-3 inconsistent with FPSC rulings?

RESPONSE: In its June 5, 2001 Award, the Arbitration Tribunal found "that BellSouth is obligated to provide Supra nondiscriminatory direct access to BellSouth's OSS and orders that such access be provided by BellSouth to Supra no later than June 15, 2001." (Award of the Tribunal in Consolidated Arbitrations at p. 24) To the contrary, in its July 22, 1998 Order in Docket No 980119-TP, the Florida Public Service Commission found "that BellSouth is not required to provide Supra with the exact same interfaces that it uses for its retail operations." (Order No. PSC-98-1001-TP at pg. 23). In Docket No. 981834-TP, the FPSC established a third party test to evaluate the performance of the interfaces developed for ALECs to BellSouth's OSS. Such a test is inconsistent with a requirement for direct access to BellSouth's OSS.

RESPONSE PROVIDED BY: Cindy Cox

BellSouth Telecommunications, Inc.
FPSC Docket No. 001305-TP
Late-Filed Hearing Exhibit No. 17

Related Letters (RL) as Identified in Jerry Kephart's Late Filed Deposition Exhibit JK-2: Digital AML Deployment Directives.

PLEASE NOTE: **RL:00-12-002BT was never issued.**

PROPRIETARY

BELLSOUTH

file code: 205.0200 RL:98-09-003BT

subject: Deployment Directives for Digital AML Systems

type: Deployment Directive

date: September 25, 1998

distribution list: See Attachment

related letters: RL:98-08-021BT, RL:98-07-015BT, RL:98-09-002BT, RL:98-09-019BT

other: None

to: Network Vice Presidents
General Managers - Network

entities: BellSouth Telecommunications, Inc.

from: D. L. King, Network Vice President - Infrastructure Planning

description: Digital AML Deployment Directives

* * *

In an effort to provide alternative solutions necessary to meet continued increases in Additional Line demand, as well as to provide an additional facility relief alternative for slow growth areas, this letter transmits Deployment Directives for evolving Digital AML Multi-Line Carrier Systems. Also included are updates to prior directives regarding Standard and DLE Digital AML (two line) systems. These directives also supersede RL: 97-03-012BT, which provided direction on the deployment of Raychem Digital AML (2:1) devices.

BST has worked with Raychem to develop multi-line Digital AML devices capable of providing four (4) voice frequency lines over a single non-loaded copper cable pair. The Product Approval Letter (RL:98-08-021BT) for the 4:1 system is due for release in September, 1998, along with the associated M&Ps (RL: 98-09-002BT). Raychem is currently developing additional multi-line devices, including 6:1 Digital AML devices, and 4:1 Digital AML capable plug-ins for application in Next Generation Digital Loop Carrier (NGDLC) systems. As these products are developed, evaluated, and approved, directives will be issued providing recommendations for their deployment.

These new 4:1 Digital AML multi-line carrier systems consist of a Central Office (CO) line card, which can be installed in multiple system CO shelves, and a series of remote terminal alternatives. Remote terminal alternatives include: 1) a standalone Outside Network Interface (ONI) device; 2) a snap on door configuration for existing Siecor 6-pair ONIs; 3) a version suitable for indoor applications; 4) a pedestal mounted configuration; and 5) a pole/strand mounted version. These Raychem Miniplex[R] 4:1 multi-line carrier systems provide the following capabilities:

- Four POTS lines over a single, non-loaded, copper cable pair

- Modem speeds supported are dependent upon plant conditions and level of adherence to the loop qualification criteria
- CLASS Services including Caller ID, Caller ID Deluxe, etc.
- Transmission compatibility with T1, ISDN, and other POTS lines
- Standard Digital AML Mechanized Loop Test (MLT) capabilities
- Line Powering for the Remote Units
- Fail-to-POTS (FTP) functionality for single customer premise applications, i.e. the standalone ONI, the snap on ONI door, and the indoor remote unit configurations
- Non Fail-to-POTS (Non-FTP) functionality for multiple customer premise applications, i.e. the pole/strand and pedestal mounted remote unit configurations
- Drop side MLT capabilities for the non-FTP remote unit configurations

The 4:1 multi-line carrier systems, unlike the 2:1 Digital AML systems deployed in BellSouth today, cannot be administered through the service order process via Hands-off Assignment Logic (HAL) support. Structural restrictions within the LFACS source code preclude the virtual assignment of more than two telephone numbers to a given cable pair. Therefore, 4:1 systems will always require administration as small digital loop carrier systems and will always require an Engineering Work Order. Please refer to the M&Ps (RL:98-09-002BT) for full details.

Consequently, the deployment of 2:1 Digital AML (Standard or DLE) equipment in lieu of an Engineering Work Order (EWO) for additional facilities, to provide a **single** Additional Line (ADL) service at a customer location remains economically attractive (Section 3.1 and 3.2). However, the relatively high per line electronics costs for the 2:1 Digital AML, as well as the 4:1 multi-line systems, do restrict their widespread deployments. Yet, the attached directives do identify various scenarios where Digital AML solutions can be used to reduce our overall costs:

a) locations where extenuating circumstances, i.e. buried encapsulated plant, preclude us from performing low cost facility modifications (Section 4.0),
b) niche applications as a facility relief alternative in slow growth areas (Section 3.3),
c) strategic and competitive situations where high Additional Line losses to facility based competitors will offer opportunities to reuse Digital AML equipment at other demand locations (Section 6.0).

When used in a prudent fashion, Digital AML solutions, including traditional 2:1 systems, currently available 4:1 systems, and evolving 6:1 systems, offer attractive architecture alternatives to reduce costs in some situations. They also provide opportunities for us to evolve to a more variable cost structure, particularly in our increasingly competitive marketplace, by allowing us the flexibility to reuse equipment where needed.

For convenience, Subject Matter Experts for Digital AML solutions are identified, along with an overview of the directives, in the Summary of Digital AML Directives provided on the next page. Questions or comments from your staff regarding these directives should be directed to Jim Jackson at (205) 977-5032 or Sherry Woodruff at (770) 493-3741.

Original Signed by D. L. King

D. L. King
Network Vice President - Infrastructure Planning

Attachments

Summary of Digital AML Directives

Primary Application

Utilize Raychem Miniplex® 2:1 systems for single line ADL Service Orders in lieu of an EWO, and Raychem Miniplex® 4:1 systems at households or small businesses where 3-4 lines are required.

Deploy Digital AML where

a) Loop Capacity Management (Service Order Advocacy Group or Outside Plant Engineer), or HAL in a mechanized application, determines that all other possible Facility Modification service alternatives have been exhausted, i.e., Line and Station Transfers (LSTs), Wired Out of Limits (WOLs), Clear Defective Pairs (CDPs), Break Over-age Connect-Throughs (BCTs), and purging of invalid Quickserves and CTs.
b) No pending relief job authorization can be advanced, completed or coordinated with the ADL order to provide facilities in time to meet the expected service activation date.
c) The primary line to the service location meets the Loop Qualification Criteria set forth in Digital AML M&Ps (Section 4 of RL:98-07-015BT for 2:1 Systems or Section 9 of RL:98-09-002BT for 4:1 Systems).

Niche Applications

Raychem 4:1 Digital AML systems on a Bulk Basis as a Facility Relief Alternative is typically a last choice option due to the higher per line costs for this equipment as compared to other conventional alternatives. However, there are economically attractive niche applications under the following conditions:

Conditions

a) Loop Capacity Management (Service Order Advocacy Group, Outside Plant Planner or Engineer) has determined that all other traditional Facility Modification alternatives, i.e. LSTs, WOLs, BCTs, CDPs, as well as the purging of invalid Quickserves and CTs, will not be sufficient to defer facility relief authorizations and their associated capital expenditures by at least 1 year.
b) There are enough ADLs currently served by the crossbox, or in the Distribution Area, such that placement of 4:1 Digital AML single premise remote units, i.e. standalone ONI, DooRT, or indoor configurations, would facilitate "mining" of enough feeder and/or distribution pairs to meet the anticipated 3-5 year demand.
c) Enough existing line demand must be accumulated at given pole or pedestal locations to justify the placement of 4:1 Digital AML multiple customer premise units for cutover to facilitate the "mining" of feeder and/or distribution pairs to meet the anticipated 3-5 year demand.
d) The drops serving the individual living units beyond the 4:1 multiple customer premises remote units, i.e. pole/strand or pedestal mounted, must not exceed the length recommended in the M&Ps (RL:98-09-002BT).
e) The ultimate loops (F1 and F2) potentially served by 4:1 Digital AML systems, or the distribution loops (F2) in a DLE 2:1 Digital AML configuration, do not exceed the Loop Qualification Criteria defined in the Digital AML M&Ps (Section 4 of RL:98-07-015BT for 2:1 Systems or Section 9 of RL:98-09-002BT for 4:1 Systems).

Deploy	Where	and	Growth Rate
4:1 Digital AML Systems	Feeder and Distribution Relief Required		Any
4:1 Digital AML Systems	Feeder Relief req'd in slow growth area where DLC proposed in existing cabinet		<= 10 lines/year
4:1 Digital AML Systems	Feeder Relief req'd in slow growth area where DLC and new cabinet proposed		<= 22 lines/year
4:1 Digital AML Systems	Feeder Relief req'd in slow growth area where short section metallic cable placements proposed		<= 24 lines/year
4:1 Digital AML Systems	Distribution Relief req'd in slow growth area where metallic cable placement proposed		<= 8 lines/year
2:1 DLE Digital AML	Distribution Relief req'd in slow growth area where metallic cable placement proposed		<= 6 lines/year

Subject	Subject Matter Expert	Telephone Number
Deployment Strategy	Sherry Woodruff	1-770-493-3741
Outside Plant Engineering	Dennis Grau	1-615-214-4609
Installation & Maintenance	W. P. Beverly	1-205-977-2985
Procurement	Neil Shattles	1-404-420-6089
AFIG Inventory Issues	Rick Haggard	1-205-977-3251
AFIG Service Order Processing	Rhonda Hannon-Holland	1-615-214-4570

Digital AML Deployment Directives
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1.0 INTRODUCTION

This letter provides Deployment Directives for the Raychem Miniplex® Digital Added Main Line (Digital AML) system, either in the standard copper configuration, or in the Digital Loop Electronics (DLE) configuration via SLC-96, SLC-Series 5, or Reltec DISC*S, and the Raychem Miniplex® Multi-line (4:1) Carrier System. These directives supersede the previous Digital AML Deployment Directives issued in 1997 (RL:97-03-012BT). Since that time, in addition to the development of 4:1 units by Raychem, BellSouth continues to pursue enhancements to the Hands-off Assignment Logic (HAL) system which eliminate the manual handling previously required in the Address and Facility Inventory Group (AFIG) for 2:1 systems. Manual handling is still required in the AFIG and Recent Change Memory Administration Group (RCMAG) for those 2:1 Digital AML units not provisioned through HAL, i.e. when provisioned via Outside Plant Engineering (Service Order Advocacy Group) response to a PF'd ADL service order, or on a bulk basis for niche facility relief applications as described in Section 3.3. Due to structural restrictions within the LFACS source code, which preclude the assignment of more than two telephone numbers to a given cable pair, all 4:1 multi-line carrier systems will have to be administered as small digital loop carrier systems. Thus an Engineering Work Order will be required for all 4:1 system deployments (see RL:98-09-002BT for full details).

The Raychem Miniplex® Digital AML is a two-line digital subscriber carrier system that utilizes a single copper pair to provide two independent voice grade (POTS1) telephone service channels over non-loaded copper plant of various lengths, depending on gauge and bridged taps. The Raychem *UDC-CU96, MP-CU5,* and *CU-R Digital* AML Channel Units allow provisioning of additional line growth in areas served by SLC-96, SLC Series 5, and Reltec DISC*S digital loop carrier systems, respectively. The channel units plug directly into their respective remote terminal channel banks. All Raychem channel units multiplex two adjacent channels onto one copper distribution pair, while interfacing with standard POTS channel units at the COT in a universal configuration, or directly with the switch in an integrated configuration. Since DLE Digital AML channel units are plug-ins for SLC-96, SLC Series 5, or Reltec DISC*S DLC systems, there are no feeder relief opportunities associated with their deployment. However, the deployment of DLE Digital AML systems as a distribution relief alternative is addressed in Section 3.3.4. Methods and Procedures associated with Standard Digital AML and DLE Digital AML 2:1 systems are provided in RL:98-07-015BT. Table 1 provides a summary of installed 2:1 system deployments within BellSouth as of July, 1998.

State	DLE Wkg	Copper Wkg	Total Wkg	Partial Disconnects	Full Disconnects	Total In-Plant
Alabama	854	195	1049	36	26	1111
Florida	16346	7394	23740	3664	2436	29840
Georgia	4084	985	5069	412	442	5923
Kentucky	26	491	517	136	145	798
Louisiana	136	486	622	32	63	717
Mississippi	194	293	487	94	94	675
No. Carolina	2320	621	2941	106	143	3190
So. Carolina	2518	714	3232	287	176	3695
Tennessee	902	831	1733	202	323	2258
BellSouth	27380	12010	39390	4969	3848	48207

Table 1: Digital AML Deployments as of July, 1998

The new 4:1 Digital AML multi-line carrier systems consist of a Central Office (CO) line card, which can be installed in multiple system CO shelves, and a series of remote terminal alternatives. Remote terminal alternatives include: 1) a standalone Outside Network Interface (ONI) device; 2) a snap on door configuration for existing Siecor 6-pair ONIs; 3) a version suitable for indoor applications; 4) a pedestal mounted configuration; and 5) a pole/strand mounted version.

These Raychem Miniplex® 4:1 multi-line carrier systems provide the following capabilities:

- Four POTS lines over a single, non-loaded, copper cable pair
- Modem speeds supported are dependent upon plant conditions and level of adherence to the loop qualification criteria
- CLASS Services including Caller ID, Caller ID Deluxe, etc.
- Transmission compatibility with T1, ISDN, and other POTS lines
- Standard Digital AML Mechanized Loop Test (MLT) capabilities
- Line Powering for the Remote Units
- Fail-to-POTS (FTP) functionality for single customer premises applications, i.e. the standalone ONI, the snap on ONI door, and the indoor remote unit configurations
- Non Fail-to-POTS (Non-FTP) functionality for multiple customer premise applications, i.e. the pole/strand and pedestal mounted remote unit configurations
- Drop side MLT capabilities for the non-FTP remote unit configurations

By design, there are distinct differences in the technical attributes and capabilities associated with each remote terminal alternative. For example,

- Fail-to-POTS (FTP) functionality is provided only in those remote terminal configurations designed for single customer premises applications, i.e. the standalone ONI, the snap on ONI door, and the indoor remote unit. Hence, if the Digital AML electronics fail, at least the primary service to the customer premise will remain in tact.
- Non Fail-to-POTS (Non-FTP) functionality is provided only in those remote terminal configurations designed for multiple customer premise applications, i.e. the pole/strand and pedestal mounted remote unit configurations. In these configurations, if the Digital AML electronics fail, all premises served by the 4:1 device are without service. This arrangement is similar to other "digital loop carrier" systems in the network today, in that none of the customers served by the 4:1 system would have service in the event of a system outage.

Drop side MLT capabilities are provided for the non-FTP remote unit configurations. Drop side test capabilities are required in these applications to assist in the isolation of customer troubles which might occur in the customer drops beyond the 4:1 system remote unit.

2.0 DIGITAL AML COSTS

2.1 Equipment Costs

Digital AML alternatives, when deployed as recommended in these directives, provide a viable means of meeting Additional Line (ADL) demand while also avoiding excessive capital expenditures and/or delays in meeting service activation expectations. The deployment of Digital AML systems, particularly as a niche facility relief alternative, should be considered only after comparing the total costs of Digital AML deployments to the costs of currently acceptable methods of providing facility relief. The current in-plant equipment costs of standard 2:1 Digital AML systems is approximately $500 per line

gained, while the 2:1 DLE Digital AML SLC-96 and SLC-5 installed per line equipment cost is approximately $617 per line gained. BellSouth is currently evaluating another 2:1 DLE Digital AML channel unit, suitable for Reltec DISC*S DLC system applications, which has an installed per line equipment cost of approximately $695 per line gained. Standard (all copper) 2:1 Digital AML system cost is comprised of fully allocated in-plant equipment cost for the C.O. shelf, power supply, rack and test assembly, wiring, etc. (~$76), as well as the in-plant equipment cost of the 2:1 C.O. line card (~$182) and remote 2:1 Door RT unit (~$242). The 2:1 DLE Digital AML in-plant equipment costs are comprised solely of a 2:1 DLE channel unit (~$375 for SLC-96 and SLC-5 or ~$454 for Reltec DISC*S) and a remote 2:1 DooRT unit (~$242). These new in-plant equipment costs for the 2:1 system reflect decreased material prices received from Raychem upon approval of the 4:1 multi-line carrier system.

The current in-plant equipment costs of the new 4:1 Digital AML multi-line systems varies by type of remote configuration deployed. For each 4:1 multi-line system application, the total system cost is comprised of the fully allocated in-plant equipment cost for the C.O. shelf, power supply, rack and test assembly, wiring, etc. (~$76), as well as the in-plant equipment cost of the 4:1 C.O. line card (~$405) and the in-plant equipment cost of the specific remote configuration required. The approximate in-plant equipment costs of the various remote configurations are as follows:

- Standalone Outside Network Interface (ONI) device ~ $532
- Snap on door configuration (DooRT) for existing Siecor 6-pair ONIs ~ $490
- a version suitable for indoor applications ~ $490
- Pedestal mounted configuration ~ $605
- Pole/strand mounted configuration ~ $557

Hence, the total 4:1 multi-line carrier in-plant equipment costs range from a low of $971 for the Door and Indoor RT configurations, to a high of $1086 for the pedestal mounted configuration. On a per line basis, these totals equate to a range of $324 to $362 per line gained (4:1 systems utilize one line to provide 4 lines, thus a net gain of 3 lines per system).

2.2 Administrative Costs

When provisioned through the service order process via HAL, neither Standard nor DLE 2:1 Digital AML deployments add any significant work content to the Additional Line provisioning process. However, when provisioned by Outside Plant Engineering (Service Order Advocacy Group) response to a PF'd ADL service order, there are incremental manual handling requirements in the AFIG and RCMAG of approximately 67 and 6 minutes, respectively. For 2:1 Digital AML deployments on a bulk basis as a niche facility relief application (see Section 3.3), there are incremental manual handling requirements in the AFIG and RCMAG of approximately 30 and 3 minutes, respectively. Additionally, upon disconnect of an ADL on a 2:1 Digital AML system, regardless of how they were provisioned, manual handling of approximately 30 minutes is required. For analysis purposes, these manual handling requirements translate into a cost of approximately $35 per 2:1 Digital AML provisioned on a service order basis without the aide of the HAL system, and approximately $20 per 2:1 Digital AML system deployed on a bulk basis as a niche facility relief alternative. For ADL disconnects involving 2:1 Digital AML, regardless of how they were provisioned, the AFIG manual handling requirements translate to a cost of approximately $20 per 2:1 Digital AML.

The 4:1 multi-line carrier systems, unlike the 2:1 Digital AML systems, are required to be administered as small digital loop carrier systems. Thus an Engineering Work Order will

be required for **all** 4:1 system deployments. Please refer to the M&Ps (RL:98-09-002BT) for full details. For analysis purposes, the EWO will result in AFIG and RCMAG manual handling requirements which translate into a cost of approximately $50 per 4:1 Digital AML system deployed. This approximation is based on the estimated time required for administration in the AFIG and RCMAG. Hence, the total estimated costs of provisioning a 4:1 multi-line system, on a per line **gained** basis, ranges from $341 to $379 depending on the remote unit configuration deployed.

2.3 Total System Costs

Combining the total in-plant equipment costs (capital) detailed in Section 2.1 with the administrative costs (expense) detailed in Section 2.2 results in the following total (capital and expense) system costs, on a **per line gained** basis, for the various Digital AML configurations available to BellSouth:

- Standard 2:1 system with service order flow-thru via HAL ~ $500
- Standard 2:1 system with manual handling on a PF'd service order basis ~ $535
- Standard 2:1 system with manual handling on a bulk basis for niche relief ~ $520
- DLE 2:1 system (SLC-96 or SLC-5 plugs) with service order flow-thru via HAL ~ $617
- DLE 2:1 system (SLC-96 or SLC-5 plugs) with manual handling on a PF'd service order basis ~ $652
- DLE 2:1 system (SLC-96 or SLC-5 plugs) with manual handling on bulk basis for niche relief ~ $637
- DLE 2:1 system (Reltec DISC*S plugs) with service order flow-thru via HAL ~ $695
- DLE 2:1 system (Reltec DISC*S plugs) with manual handling on a PF'd service order basis ~ $730
- DLE 2:1 system (Reltec DISC*S plugs) with manual handling on bulk basis for niche relief ~ $715
- 4:1 system with standalone Outside Network Interface (ONI) device ~ $354
- 4:1 system with Snap on door (Door RT) for existing Siecor 6-pair ONIs ~ $341
- 4:1 system for indoor applications ~ $341
- 4:1 systems in pedestal mounted configurations ~ $379
- 4:1 systems in pole/strand mounted configurations ~ $363

These total costs, on a per line gained basis, are used to develop the following directives.

3.0 DIGITAL AML DEPLOYMENT DIRECTIVES

3.1 Residence Additional Line Applications

3.1.1 Miniplex^{R} 2:1 System Residence Additional Line Applications

The deployment of 2:1 Digital AML, in lieu of an Engineering Work Order (EWO), to provide **single** Additional Line service remains economically attractive. In fact, with the provisioning enhancements available through the HAL system, 2:1 Digital AML deployments offer greater potential savings than in the previous administrative environment where manual handling was required in the AFIG and RCMAG for all ADL orders involving Digital AML. There are still minor incremental administrative costs associated with ADL disconnects involving Digital AML devices (see Section 2.2), however, these eventual costs are far outweighed by the benefits of avoiding EWOs, not only from an overall cost perspective, but also from a service delay perspective.

Considering these cost and administrative impacts, 2:1 Digital AML provides BellSouth a viable **single** ADL service provisioning alternative where all of the following conditions have been met:

a) The Outside Plant Engineer, or HAL in a mechanized application, has determined that all other possible Facility Modification service alternatives have been exhausted, i.e., Line and Station Transfers (LSTs), Wired Out of Limits (WOLs), Clear Defective Pairs (CDPs), and Break Over-age Connect-Throughs (BCTs). On a weighted average basis, using 1997 Facility Mod data and accepted LATIS Cost Factors from the Outside Plant Engineering Support Staff, these alternatives cost approximately $42 per occurrence. Clearly, when compared to the $500, $617 or $695 cost of Standard 2:1 or DLE 2:1 Digital AML systems, each of these alternatives offer significant economic and administrative advantage over Digital AML deployments.
b) No pending relief job authorization can be advanced, completed or coordinated with the ADL order to provide facilities in time to meet the expected service activation date.
c) The primary line to the service location meets the Loop Qualification Criteria set forth in Section 4 of the Digital AML M&Ps (RL:98-07-015BT)

Note that Standard 2:1 Digital AML systems are generally not an economical feeder facility relief alternative, however, there are niche applications for facility relief via Digital AML (see Section 3.3). Obviously, since the DLE 2:1 Digital AML channel units are plug-ins for DLC systems, there are no feeder relief opportunities associated with their deployments. Hence, the use of DLE 2:1 Digital AML systems is restricted to the provisioning of ADL service orders requiring distribution facilities at residential or small business locations served by their own ONI. Regardless of the application, for either Standard or DLE two-line Digital AML systems, both the primary and additional lines must be assigned to the same address. Furthermore, to avoid the complexities of having multiple ONIs at a given address, not to mention the cost penalties of having multiple 2:1 ONIs as opposed to a 4:1 ONI, there should be no more than one 2:1 Digital AML remote unit deployed to a residential or small business location.

3.1.2 Miniplex® 4:1 Multi-line Carrier System Residence Additional Line Applications

The new 4:1 Digital AML multi-line carrier systems consist of a Central Office (CO) line card, installed in 23" rack mounted CO shelves, with various remote terminal configurations.

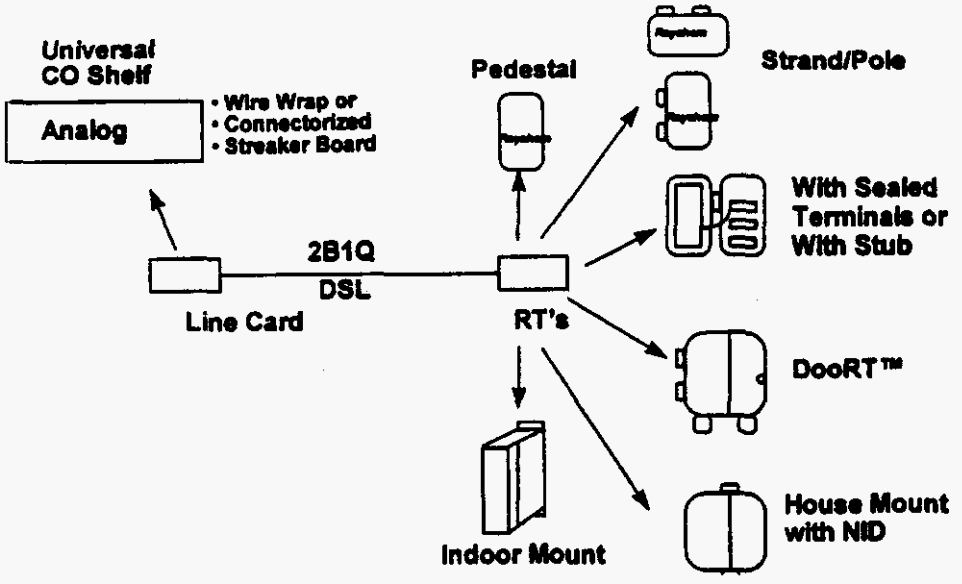

Figure 1: Raychem Miniplex 4N1 RT Packaging Options

Raychem's 4:1 CO equipment consists of shelves for housing Line Cards. In order to satisfy 4:1 system powering and fusing requirements, the 23" universal CO shelf used for Raychem's 2:1 DAML system, is required. **Previous versions of the COT shelf (CLEI SLMLT705MB and CLEI and SLMLT705MA) cannot be used for 4:1 systems.** Ten, non-baffled shelves for mixed (2:1, 4:1) applications plus four, non-baffled shelves dedicated to 4:1 applications can be used in a 7' bay. Ten baffled (heat deflector) shelves per 7' bay can be installed with no limitations on the number of 4:1 systems installed. **Dedicated shelves for the 4:1 are recommended, because of powering (10 Amps/shelf), administrative and derived pair wiring requirements.**

See Section 11 of the 4:1 System M&Ps (RL:98-09-002BT) for CO shelf layouts. CO shelf capacities are as follows:

Capacities (with fuse panels)	23" - 18 Slot Shelf
Shelves	*14 / 10#
Line Cards- 4 line Miniplex	252
VF Lines	1008

*Limited to 14 non-baffled shelves/bay = 10 (mixed 2:1, 4:1) + 4 (dedicated to 4:1)
Baffled (heat deflector) shelves - no limitations

As illustrated in Figure 1, remote terminal alternatives include:

1) a standalone Outside Network Interface (ONI) device (House mount w/ NID)
2) a snap on door (DooRT) configuration for existing Siecor 6-pair ONIs
3) a version suitable for indoor applications
4) a pedestal mounted configuration
5) a pole/strand mounted version.

The standalone ONI, the DooRT, and the indoor remote terminal configurations are all designed to serve Additional Line demand locations. By providing 4 voice grade circuits

over a single copper pair, they are ideal for residence locations requiring more than a single additional line. Obviously, due to the higher first cost of the 4:1 system relative to the Miniplex® 2:1 system, if the demand at a given residence location is only 2 lines, the lower cost 2:1 system should be deployed. However, in those locations where 3 – 4 lines are required, the 4:1 system is ideal. As of July, 1998, over 600,000 households within the BellSouth franchise area met those criteria. Obviously, the majority of those households have embedded facilities sufficient to meet the ADL demand, however, there appears to be significant opportunity to deploy the 4:1 system on a going forward basis. As with the Miniplex® 2:1 systems, the 4:1 system is a viable ADL service provisioning alternative only where all of the following conditions have been met:

a) The Outside Plant Engineer has determined that all other possible Facility Modification service resolution alternatives have been exhausted, i.e., Line and Station Transfers (LSTs), Wired Out of Limits (WOLs), Clear Defective Pairs (CDPs), and Break Over-age Connect-Throughs (BCTs). On a weighted average basis, using 1997 Facility Mod data and accepted LATIS Cost Factors from the Outside Plant Engineering Support Staff, these alternatives cost approximately $42 per occurrence. Clearly, when compared to the per line costs of Digital AML systems (see Section 2.3), each of these alternatives offer significant economic and administrative advantage over Digital AML deployments.
b) No pending relief job authorization can be advanced, completed or coordinated with the ADL order to provide facilities in time to meet the expected service activation date.
c) The primary line to the service location meets the Loop Qualification Criteria set forth in Section 9 of the Digital AML M&Ps (RL:98-09-002BT)

Recall that all 4:1 systems require an EWO. Therefore, they cannot be implemented via the service order assignment process. As such, any ADL service order assigned mechanically on a flow-through basis will be provisioned via 2:1 Digital AML equipment. However, the majority of ADL service orders are PF'd to Outside Plant Engineering for facility assignment. The Loop Capacity Manager should always use sound engineering judgment regarding the demand for multiple additional lines at a given location when evaluating which Digital AML alternative to recommend.

The pedestal mounted and pole/strand mounted remote unit versions of the 4:1 system are not designed for Additional Line applications. Instead, they are designed for niche facility relief applications. Additional details are provided in Section 3.3.

3.2 Business Back-Up® Line and Additional Business Line Applications

Back-Up® Line is a measured Additional Line service targeted at Small Business customers with peak calling periods. While Digital AML may appear to be an attractive alternative for Back-Up® Line service, the following issues should be considered prior to deploying Digital AML to a business location:

a) There are relatively few business locations served by their own ONI, thus restricting the opportunities to deploy either the Raychem DooRT (ONI door version) or standalone ONI version Digital AML devices. The 4:1 system, in an indoor remote unit configuration, would be applicable in some specific cases.
b) Business locations typically involve more volatile or unpredictable additional line growth patterns. Digital AML, even the 4:1 system, may not be the appropriate deployment vehicle, either economically or practically, for locations where significant additional line growth potential exists.
c) Since HAL processes a limited array business (1FB) orders, the manual handling requirements in the AFIG and RCMAG associated with Additional Business Lines

would be incurred with every 2:1 Digital AML deployed, and an EWO would be required for any 4:1 system deployments

d) All 2:1 Digital AML systems, and most 4:1 systems (i.e. standalone ONI, snap on door, or indoor remote unit configurations) must be assigned and deployed to the same exact address as the primary line, including suite or unit numbers typically prevalent in Small Business locations. For example, a Digital AML system assigned and deployed to the same general address as a primary line (i.e. 2800 Main St.), but to an incorrect suite or unit number, would create significant confusion in the AFIG office and in LFACS records. This confusion could ultimately lead to extended service maintenance and repair intervals.

3.3 Niche Facility Relief Applications

As stated earlier, Digital AML systems are generally not an economical long-term facility relief alternative when compared to our currently available feeder and distribution relief alternatives (see RL:98-09-019BT, the 1998 Issue of the Loop Technology Deployment Directives to be released during 4Q98). However, there are niche applications where Digital AML deployed on a bulk basis should be considered. When deployed on a bulk basis, due to the per line equipment cost advantages of the 4:1 Digital AML systems relative to the 2:1 systems, the 4:1 system is the recommended Digital AML configuration for most niche facility relief applications. In considering these niche applications, the following conditions are all required:

a) Loop Capacity Management (Service Order Advocacy Group, Outside Plant Planner or Engineer) has determined that all other traditional Facility Modification alternatives, i.e. LSTs, WOLs, BCTs, CDPs, as well as the purging of invalid Quickserves and CTs, will not be sufficient to defer facility relief authorizations and their associated capital expenditures by at least 1 year.
b) There are enough ADLs currently served by the crossbox, or in the Distribution Area, such that placement of 4:1 Digital AML single premise remote units, i.e. standalone ONI, DooRT, or indoor configurations, would facilitate "mining" of enough feeder and/or distribution pairs to meet the anticipated 3-5 year demand.
c) Enough existing line demand must be accumulated at given pole or pedestal locations to justify the placement of 4:1 Digital AML multiple customer premise units for cutover to facilitate the "mining" of feeder and/or distribution pairs to meet the anticipated 3-5 year demand.
d) The drops serving the individual living units beyond the 4:1 multiple customer premise remote units, i.e. pole/strand or pedestal mounted, must not exceed the length recommended in the M&Ps (RL:98-09-002BT).
e) The ultimate loops (F1 and F2) potentially served by 4:1 Digital AML systems, or the distribution loops (F2) in a DLE 2:1 Digital AML configuration, do not exceed the Loop Qualification Criteria defined in the Digital AML M&Ps (Section 4 of RL:98-07-015BT for 2:1 Systems or Section 9 of RL:98-09-002BT for 4:1 systems).

3.3.1 Digital AML for Feeder and Distribution Facility Relief

As noted in Section 2.3, the total in-plant costs of 4:1 Digital AML systems range from $341 to $379 per line gained depending on the remote terminal configuration required. Hence, deployment of 4:1 Digital AML systems as a facility relief alternative, **where traditional feeder *and* distribution facility relief can be deferred**, is always economically attractive. There are no currently available feeder (NGDLC, Conventional DLC, Metallic Cable, etc.) or single family residential distribution (Metallic cable, Fiber Distribution, etc.) relief alternatives, which in **combination**, can be implemented on a per line basis for less than the per line cost of 4:1 Digital AML systems.

Additionally, the single premise applications of 4:1 Digital AML systems, i.e. the standalone ONI, DooRT, and indoor remote terminal configurations offer a variable cost incentive, in that the major cost components could be retrieved and redistributed upon ADL disconnect. The Outside Plant Engineering Staff is currently investigating Digital AML recovery procedures that would enhance the reuse potential of these components. The successful implementation of any recovery process could further reduce the per line cost of Digital AML by making components more readily available from reuse stock.

As noted earlier, since 2:1 DLE Digital AML channel units are plug-ins for SLC-96, SLC Series 5, or Reltec DISC*S systems, there are no feeder relief opportunities associated with their deployment. The deployment of 2:1 DLE Digital AML systems as a distribution relief alternative is addressed in Section 3.3.4 below.

3.3.2 Digital AML for Feeder Facility Relief

While Digital AML is not generally an economical feeder facility relief alternative, there are limited scenarios where its deployment can be economically attractive. Again, with each deployment of a 4:1 Digital AML system for facility relief comes a manual handling requirement in the AFIG and RCMAG. Therefore, their deployments should be carefully considered. At a fully allocated cost of approximately $341 to $379 per line gained, 4:1 Digital AML systems deployed for bulk recovery of feeder facilities is more expensive over the long run than our typical feeder facility relief alternatives (i.e. NGDLC, Conventional DLC, short sections of Metallic Cable reinforcement, etc.) Please refer to RL:98-09-019BT, the 1998 Issue of the Loop Technology Deployment Directives to be released during 4Q98, for appropriate feeder relief alternatives. However, for **slow growth areas** (as defined in the following sections), the deployment of 4:1 Digital AML systems for feeder facility relief can be more cost effective than incurring the higher first costs associated with other feeder facility relief alternatives.

Viable feeder facility relief alternatives for slow growth areas include conventional DLC systems, such as SLC-96 (least desirable), SLC Series 5, and FDLC, either in existing cabinets or via new small cabinet placements. Additionally, short cross-sections of metallic cable placement (not C.O. terminations) to make feeder pairs available to a crossbox in need is a viable feeder facility relief alternative in some situations. When DLC can be placed in an existing cabinet to provide feeder facility relief, 4:1 Digital AML systems are an economically viable relief alternative for **growth rates of up to 10 lines per year**. Where a cabinet is also required to house a new DLC system for feeder facility relief, the threshold growth rate for 4:1 Digital AML feeder relief **increases to 22 lines per year**. Similarly, when metallic cable placements are required for feeder facility relief, the use of 4:1 Digital AML systems can be economically justified at **growth rates of up to 24 lines per year**. In either case, conditions a) through e) set forth in Section 3.3 must be met in order to consider 4:1 Digital AML systems as a feeder facility relief alternative.

3.3.3 Digital AML for Distribution Facility Relief

Utilizing Digital AML, on a bulk basis via EWO, is also generally not an economically attractive distribution facility relief alternative when compared to placing short sections of metallic distribution relief cable. 4:1 Digital AML systems deployed for bulk recovery of distribution facilities is more expensive over the long run than our typical facility relief alternatives, **except in slow growth areas**. In analyzing the initial and subsequent costs for these alternatives, 4:1 Digital AML systems prove to be a viable economic alternative only when the growth rate is **not greater than 8 lines per year**. Again, before considering Digital AML as a distribution facility relief alternative, the conditions set forth in Section 3.3 must be met.

3.3.4 Digital Loop Electronics (DLE) 2:1 Digital AML for Distribution Facility Relief

The economics associated with utilizing 2:1 DLE Digital AML systems (i.e. UDC-CU96, MP-CU5, or CU-R channel units in SLC-96, SLC Series 5, or Reltec DISC*S systems, respectively, combined with a 2:1 Digital AML remote unit at the residence ADL location), for distribution facility relief are not as attractive as the economics for 4:1 Digital AML systems. As noted earlier, on a per line gained basis, the cost for 2:1 DLE Digital AML ($637 for SLC-96 and SLC-5 or $715 for Reltec DISC*S) is higher than the 4:1 Digital AML alternative. However, having channel units at the DLC Remote Terminal which constitute the "office end" of the DLE Digital AML loop, as opposed to the C.O. equipment (shelves, power supplies, fuse panels, line cards, etc.) required for the 4:1 Digital AML configuration, offers a time value of money benefits that offset some of the per line cost penalty. Additionally, there are opportunities for distribution relief that are beyond the non-loaded cable pair loop qualification criteria of the 4:1 system, that possibly could be addressed with the deployment of a 2:1 DLE Digital AML from an existing SLC-96, SLC-5, or Reltec DISC*S remote terminal out in the network.

Therefore, similar conclusions can be drawn for DLE 2:1 Digital AML that were drawn for the 4:1 Digital AML systems in the previous section. Utilizing DLE 2:1 Digital AML on a bulk basis via EWO is also generally not an economically attractive distribution facility relief alternative when compared to placing metallic distribution relief cables, **except in slow growth areas.** In analyzing the initial and subsequent costs of DLE 2:1 Digital AML versus metallic distribution facility relief, DLE 2:1 Digital AML proves to be a viable economic alternative only when the growth rate is **not greater than 6 lines per year.** Again, before considering DLE 2:1 Digital AML as a distribution facility relief alternative, the conditions set forth in Section 3.3 must be met.

Considering the relatively low utilization typically associated with our existing metallic distribution (F2) facilities, as well as the potential impact of local competition (particularly facility based competition as opposed to resale), there could be strategic advantages associated with deploying Digital AML facilities in lieu of distribution facility relief to meet ADL demand. Specifically, the opportunity to reuse Digital AML components following ADL disconnect provides a strategically attractive alternative to potentially stranded facilities that would have otherwise been placed to meet ADL demand. The Loop Capacity Manager should always use sound engineering judgment when evaluating these distribution relief alternatives.

4.0 SPECIAL CONSIDERATIONS

There are a number of other factors which may affect the Digital AML deployment decision. Among those factors would be the ability to effectively perform low cost facility modifications, i.e. LSTs, WOLs, CDPs, or BCTs. The costs associated with performing facility mods to make available the facilities required to meet an impending ADL service request and/or resolve an existing facility shortfall, are generally much less than the installed per line cost of a Digital AML system. For example, there could be opportunities to perform a facility mod at one distribution terminal to make facilities available in another distribution terminal from which the ADL service request may be served. HAL has been designed to perform logic of this nature, however, on ADL orders that are PF'd (Pending Facilities) to Loop Capacity Management (Service Order Advocacy Group or Outside Plant Engineer), care must be taken to examine these alternatives. In those situations where extenuating circumstances exist, i.e., buried encapsulated plant, any extraordinary costs associated with these types of facility mods may make the use of Digital AML an attractive alternative.

The costs associated with the development and implementation of an EWO to provide traditional facility relief will generally exceed the installed cost of a single 2:1 Digital AML system. In situations where an EWO would be required to support a small number of ADL service requests, the Digital AML deployment option is the preferred alternative. However, if the Loop Capacity Manager anticipates that a large number of ADL service requests will occur at a particular location, or along a particular route, traditional facility reinforcement methods may be more applicable. This scenario would theoretically appear more likely in the volatile additional business line environment. Regardless of the situation, the deployment of Digital AML should be done only after comparing its cost to the cost of other facility relief alternatives. Section 3.3 provides some niche applications for Digital AML as a facility relief mechanism, however the Loop Capacity Manager should always use sound engineering judgment when evaluating these alternatives.

5.0 RESTRICTIONS

5.1 Services Supported by Digital AML

All BellSouth approved Digital AML systems will support basic (POTS1) service, including all CLASS® services, FAX and modem lines, CALLER ID, Enhanced CALLER ID, MemoryCall®, and future Utility Telemetry Service. However, they will not support ISDN or WatchAlert® service. WatchAlert® service is presently only being offered in Florida.

5.2 Transmission Requirements

Digital AML systems, either in 2:1 or 4:1 configurations over metallic feeder and distribution facilities, or in DLE 2:1 configurations over metallic distribution facilities behind SLC-96, SLC Series 5, or Reltec DISC*S, are restricted to 2-wire 1300 ohm Resistance Design loops within the non-loaded range (total non-DLC loop length not to exceed 18 Kft). The loop includes all segments of cable and bridged taps connected to serve a customer premise, including segments in the C.O. and on the customer premise. Refer to the M&Ps (Section 4 of RL:98-07-015BT for 2:1 Systems or Section 9 of RL:98-09-002BT for 4:1 systems) for the Loop Qualification Criteria before deploying Digital AML.

5.3 Specific Restrictions for Various Digital AML Alternatives

The DLE 2:1 Digital AML channel units generally provide the same features as Standard (Copper Only) 2:1Digital AML devices. However, the following exceptions do apply:

a) DLE 2:1 Digital AML channel units do not have a Fail-to-POTS option. In the event of a failure of a Digital AML component in a Standard (Copper only) 2:1 Digital AML configuration, the Fail-to-POTS feature allows the residence primary line to remain intact. However, in a DLE 2:1 Digital AML configuration, where the primary and additional lines serve from the same channel unit, the Fail-to-POTS feature is not achievable.
b) The DLE Digital AML channel units use programmable signatures in the MLT system to achieve testability. Unique VER codes are returned to the tester to indicate a Digital AML system. Refer to RL:98-07-015BT for more details.

Additionally, by design, there are distinct differences in the technical attributes and capabilities associated with each remote terminal alternative. For example,

- Fail-to-POTS (FTP) functionality is provided only in those remote terminal configurations designed for single customer premises applications, i.e. the standalone ONI, the snap on ONI door, and the indoor remote unit. Hence, if the

Digital AML electronics fail, at least the primary service to the customer's premises will remain intact.

- Non Fail-to-POTS (Non-FTP) functionality is provided only in those remote terminal configurations designed for multiple customer premises applications, i.e. the pole/strand and pedestal mounted remote unit configurations. In these configurations, if the Digital AML electronics fail, all premises served by the 4:1 device are without service. This arrangement is similar to other "digital loop carrier" systems in the network today, in that none of the customers served by the 4:1 system would have service in the event of a system outage.

Furthermore, drop side MLT capabilities are provided for the non-FTP remote unit configurations. Drop side test capabilities are required in these applications to assist in the isolation of customer troubles which might occur in the customer drops beyond the 4:1 system remote unit.

6.0 STRATEGIC IMPLICATIONS

Generally, the deployment of Standard 2:1 or 4:1 Digital AML systems or DLE 2:1 Digital AML systems, either on an ADL service order basis or on a bulk basis via EWO, should be restricted to areas where distribution (F2) facilities have exhausted. Niche applications for Digital AML deployment as a distribution relief alternative are described in Sections 3.3.3 and 3.3.4. Similarly, while Standard Digital AML 2:1 and 4:1 systems are not generally an economical feeder facility relief alternative, there are niche applications that are justified (see Sections 3.3.1 and 3.3.2). Refer to RL:96-09-026 BT, the 1996 Issue of the Loop Technology Deployment Directives (RL:98-09-019BT, the 1998 issue of the LTDD is due out during 4Q98), for those facility relief alternatives that have been identified as strategically and economically beneficial for BST. For the purposes of this application, direct underground facilities to a service location (no F2 component) are considered distribution facilities.

Conversely, when considering the relatively low utilization of our existing metallic distribution (F2) facilities and the potential impact of local competition, particularly facility based competition as opposed to resale, there are strategic advantages associated with deploying Digital AML facilities for additional line demand. Specifically, the opportunity to reuse Digital AML components following ADL disconnect provides a strategically attractive alternative to potentially stranded facilities that would have otherwise been placed to meet ADL demand. The Outside Plant Engineering Staff is currently investigating Digital AML recovery procedures that would enhance the reuse potential of these components. The successful implementation of any recovery process could further reduce the per line cost of Digital AML by making components more readily available from reuse stock.

7.0 REFERENCES

1. RL:98-08-021BT, September, 1998, Product Approval Letter for Raychem Miniplex^{R} 4N1 High-Speed Digital Subscriber Loop Carrier System
2. RL: 98-09-002BT, September, 1998, Outside Plant Engineering Methods and Procedures for the Raychem Miniplex^{R} 4N1 Multiline carrier System
3. RL: 98-07-015BT, July 20, 1998, Outside Plant Engineering Methods and Procedures for Raychem Miniplex^{R} DAML Systems
4. RL: 97-01-012BT, January 10, 1997, Product Approval Letter for Raychem Digital AML Channel Unit for SLC Series 5 DLC System Remote Terminal

5. RL: 96-07-012BT, July, 1996. Product Approval Letter for Raychem Digital AML Channel Unit for SLC 96 DLC System Remote Terminal
6. UG-AFIG-001BT, Section II, Tab 19, Issue A, June, 1996, FACS Methods and Procedures Users Guide, "Pair Gain (PG) Digital Added Main Line (DAML) FACS Service Order Assignment Procedures."
7. RL:95-07-033BT, July 21, 1995, Product Approval Letter for the Raychem Miniplex® Digital AML Door RT unit.
8. RL:95-02-018BT, February 28, 1995, Digital AML Monitor Report User Guide.
9. RL:94-10-030BT, November 30, 1994, Product Approval for the Raychem Miniplex® Digital AML Systems.

RL:98-09-002BT

BELLSouth

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description: Provides the Methods and Procedures for the Deployment of the Raychem Miniplex ® 4N1 Multi-line Carrier System

The attachment to this Region Letter provides the Methods and Procedures for deployment of the Raychem Miniplex 4N1 multi-line carrier system, that was approved in RL: 98-08-021BT. The 4N1 system can provide up to four (4) voice frequency lines over a single, non-loaded, copper cable pair. It can be used to provide facilities for additional lines and for feeder and distribution relief, by use of Remote Terminals with Fail-to-POTS and Non-Fail-to-POTS features. *Traditional Digital Loop Carrier administrative methods and Engineering Work Orders are required for deploying 4N1 systems.*

The 4N1 system, can provide facilities for additional line (ADL) demand at households or small businesses where 3-4 lines are required, and on a bulk basis as a facility relief alternative for slow growth areas. In those locations where 3 to 4 ADL's are required, the 4N1 is cheaper on a per line gained basis than the 2N1 DAML system. As of July, 1998, there were over 500,000 households within the BellSouth franchise with 3 or more lines. The majority of these households have embedded facilities sufficient to meet ADL demand. The 4N1 also provides opportunities to improve BellSouth's variable cost structure, particularly in an increasingly competitive marketplace, by enabling reuse of the equipment where needed. Deployment Guidelines for the 4N1 are provided in RL: 98-09-003BT.

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Methods And Procedures For The Raychem Miniplex® 4N1 Multi-line Carrier System

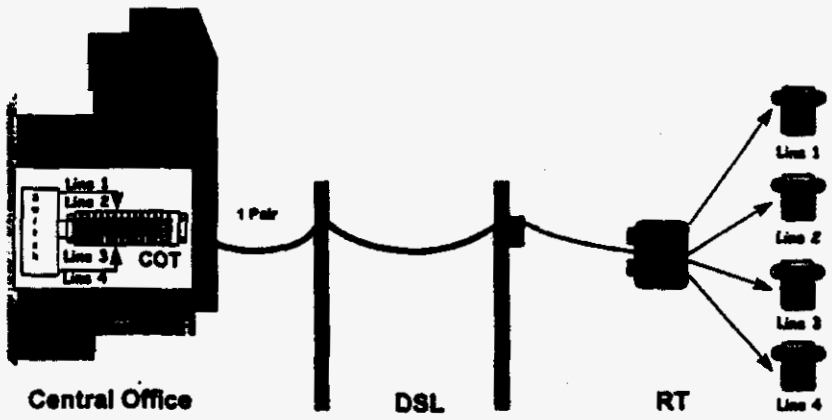
Methods And Procedures For The Raychem Miniplex® (4N1) Multi-line Carrier System

1.0 Introduction

This document provides Methods and Procedures (M&P's) for the design, administration, and installation and maintenance of Raychem's Miniplex® (4N1) Multi-line Carrier system, that was approved in RL: 98-06-021BT. Deployment guidelines are provided in RL: 98-09-003BT. Each system, defined herein as a 4N1 or Multi-line Carrier (MLC), consists of a Central Office (CO) Line Card (installed in multiple system shelves), Remote Terminal (RT), and copper transport facility. It can provide up to four (4) voice frequency lines (channels) over a single, non-loaded, copper cable pair that is defined as a *Digital Subscriber Line (DSL)*.

1.1 The 4N1 can be used to provide facilities for Additional Lines (ADL's) and for feeder and distribution facility relief. Traditional Digital Loop Carrier (DLC) administrative methods are required, since standard two line Digital Added Main *Line (DAML) procedures* cannot be used to support the automatic provisioning, assignment, and inventory of this, and other similar equipment. **An Engineering Work Order (EWO) is also required for provisioning 4N1 systems.**

Raychem 4N1 System



2.0 General Description

The 4N1 system uses 2B1Q line coding techniques to transmit four, 64 kb/s, independent, voice frequency circuits at 288 kb/s over a single cable pair. Since 2B1Q transmission is full duplex, simultaneous two-way transmission is possible. The DSL requires a non-loaded cable pair with no more than 6 Kft of total bridged tap. The maximum

length of the transmission line between the CO and RT is 1300 Ohms or - 49 dB @72 kHz. There are no voice frequency signals on this pair. Each system, comprised of a Central Office (CO) Line Card and an RT, provides four derived subscriber lines. **The maximum distribution loop resistance from the RT-NID is limited to 560 ohms, including 430 ohms for customer equipment.** The subscriber side of RT's should be connected to drop wire/customer facilities only.

3.0 Service Features and Benefits

3.1 The 4N1 has the following capabilities:

- Four POTS lines over a single cable pair
- Fail-To-POTS (FTP) RT-NID feature for single customer premises applications
- Non Fail-To-POTS (NFTP) RT-NID feature for multiple customer applications
- Compatible with Seicor six line Outside Network Interface (ONI)
- MLT test capabilities (drop side capabilities for NFTP RT [Network Interface Device - NID])
- Line powered RT
- Supports modems up to 33 kb/s, CLASS Services - Caller ID, Caller ID Deluxe, distinctive ringing, answering machine forward disconnect
- Ringer capacity - 10 Ringer Equivalence Numbers (REN's)/system, 5 REN's/line
- Compatible with T1, ISDN and ADSL lines
- Quick service turn-up via HDSL transmission
- Supports Unbundled Voice Loops (UVL's) to Competitive Local Exchange Carriers (CLEC's)

The 4N1 cannot be used to serve WatchAlert customers (Florida only).

4.0 Deployment Guidelines

4.1 The 4N1 system, can provide facilities for additional line (ADL) demand at households or small businesses where 3 to 4 lines are required, and on a bulk basis as a facility relief alternative for slow growth areas. It also provides opportunities to improve BellSouth's variable cost structure, particularly in an increasingly competitive marketplace, by enabling reuse of the equipment where needed. Deployment Guidelines for the 4N1 MLC are provided in RL:98-09-003BT. Details regarding fixed and variable cost structures are provided in RL: 97-06-014BT.

4.2 Due to inherent start-up costs, 4N1 CO shelf additions, and plug-in seed stocks must be managed very carefully. MBOS models developed by CCM can help control 4N1 hardwired costs. *Loop Capacity Managers (LCM's) are responsible for determining those CO's that are candidates for 4N1 deployment, as well as the number of initial shelf installations.* In order to ramp up for 4N1 deployment, CO Line Card and RT plug-in seed stock levels should be established by mutual agreement between CO, I&M, and OSPE personnel. PIPSO (Plug-in Provisioning On A Service Order) administration will be used to for all ongoing 4N1 requirements. See Sections 20 and 21 for more information.

4.3 In those locations where 3 to 4 ADL's are required, the 4N1 is cheaper on a per line gained basis than the 2N1 DAML system. As of July, 1998, there were over 500,000 households within the BellSouth franchise with 3 or more lines. The majority of these households have embedded facilities sufficient to meet the ADL demand. The 4N1 can be used for ADL demand on a going forward basis only when all of the following conditions have been met:

a) The Outside Plant Engineer (OSPE) has determined that all other possible service resolution alternatives have been exhausted, i.e., Line and Station Transfers (LST's), Wired Out of Limits (WOL, Clear Defective Pairs (CDP's), and Break Over-age Connect-Through (BCT's). On an average weighted basis, using 1997 Facility Mod data and accepted LATIS Cost Factors, these alternatives cost approximately $42 per occurrence. Clearly, when compared to the per line costs of the 4N1, each of these alternatives offer significant economic and administrative advantage over 4N1 deployments.

b) No pending relief job authorization can be advanced, completed or coordinated with the ADL order to provide facilities in time to meet the expected service activation date.

c) The primary line to the service location meets the Loop Qualification Criteria set forth in Section 9.

4.4 Since the 4N1 system requires an EWO, and must be administered as a small DLC system, it cannot be administered through the service order assignment process. As such, any ADL service order assigned mechanically on a flow-through basis will be provisioned via 2N1 DAML systems. **However, the majority of ADL service orders are PF'd to Outside Plant Engineering for facility assignment.** The Loop Capacity Manager (LCM) should always use sound engineering judgment regarding the demand for multiple additional lines at a given location when evaluating which system (2N1 or 4N1) alternative to recommend. Total estimated costs (including administrative and installation) for provisioning a 4N1 on a per line gained basis, ranges from $340 to $380, depending on the RT configuration.

5.0 Business Back-Up^R Line and Additional Business Line Applications

5.1 Back-Up^R Line is a measured ADL service targeted at small business customers with peak calling periods. While the 4N1 may appear to be an attractive alternative for Back-Up^R Line service, the following issues should be considered prior to deploying a 4N1 system to a business location:

a) There are relatively few business locations served by their own Outside Network Interface (ONI), thus restricting the opportunities to deploy either the DoorRT (ONI door version) or standalone RT. The 4N1 system, in an indoor RT configuration, would be applicable in some specific cases.

b) Business locations typically involve more volatile or unpredictable additional line growth patterns. The 4N1 system, may not be the appropriate deployment vehicle, either economically or practically, for locations where significant additional line growth potential exists.

c) An EWO is required for all 4N1 deployments

d) Most 4N1 systems used at a customer's premises (i.e. standalone RT, DoorRT, or indoor RT configurations) must be assigned and deployed to the same exact address as the primary line, including suite or unit numbers typically prevalent in small business locations. For example, a 4N1 system assigned and deployed to the same general address as a primary line (i.e. 2800 Main St.), but to an incorrect suite or unit number, would create significant confusion in the AFIG office and in LFACS records. This confusion could ultimately lead to extended service maintenance and repair intervals.

6.0 Niche Facility Relief Applications

6.1 The following conditions are required in order to deploy 4N1 systems on a bulk basis as a facility relief alternative:

Loop Capacity Management, Service Advocate Center (SAC), or OSPE has determined that all other traditional Facility Modification alternatives, i.e., LST's, WOL's, BCT's, CDP's, as well as the purging of invalid

QUICKserves and CT's, will not be sufficient to defer facility relief authorizations and their associated capital expenditures by at least 1 year.

a) There are enough ADL's currently served by the cross box, or in the Distribution Area, such that placement of 4N1 single premises RT's, DoorRT, or indoor RT's, would facilitate "mining" of enough feeder and/or distribution pairs to meet the anticipated 3-5 year demand.
b) Enough existing line demand must be accumulated at given pole or pedestal locations to justify the placement of 4N1 multiple customer premises RT's for cut over to facilitate the "mining" of feeder and/or distribution pairs to meet the anticipated 3-5 year demand.

c) The drops serving the individual living units beyond the 4N1 customer premises RT's must not exceed the length recommended in Section 9.

d) Type of Relief [Growth Rate - lines/year]:

- Feeder and Distribution Relief [Any]
- Feeder Relief in slow growth area - DLC proposed in existing cabinet [<= 10]
- Feeder Relief in slow growth area - DLC and new cabinet proposed [<= 22]
- Feeder Relief in slow growth area - metallic cable placements proposed [<= 24]
- Distribution Relief required in slow growth area - metallic cable placement proposed [<=8]

7.0 Physical Description, Power and Environmental Requirements

Raychem's 4N1 CO equipment consists of a 23" rack mounted shelf with a capacity for 18 CO Line Cards. Each 4N1 system is comprised of a CO Line Card plug-in, DSL, and RT. Customer premises, pole, and pedestal type RT's are available. This system complies with FCC Part 15, Class B, TR-TSY-000499, TR-TSY-000393, and TR-TSY-000057. The CO Line Cards require -48 Vdc. The RT's are line powered by the Line Card and do not require battery backup. The CO Line Card and RT's operate over temperature ranges of 32^0 F to 132^0 F and -40^0 F to 150^0 F, respectively.

8.0 Hardwired And Plug-in Equipment Descriptions

Universal CO Shelf (CLEI SLML1B05RD - Connectorized/w Heat Deflector)

8.1 **The universal, 18 slot, CO shelf, equipped with heat deflectors, is required for all 4N1 system installations.** CO shelves with CLEI's of SLML1B05RA (2N1), SLMLT705MB and SLMLT705MA, cannot be used for the 4N1. Male Amphenol connectors are mounted on the shelf backplane to provide connections to the DSL and derived (RPG) pairs for each 4N1 system. Five, 25 pair cables with female Amphenol connectors are used to connect the DSL and RPG pairs to frame termination points. The RPG cables must be terminated to match consecutive 4 pair RPG cable counts to the 4 channels of each system in a CO shelf slot. **Mixed (2N1, 4N1) system shelf/bay serving arrangements are not advised, because of powering (4N1 @10 amperes/shelf), heat deflector, administrative, and derived pair wiring requirements. Therefore, it is strongly recommended, that dedicated (separate) shelf/bays be used for 2N1 and 4N1 systems.**

8.2 In instances where there is limited floor/bay space availability, mixed bay arrangements may be required. **Mixed bays should be a last resort measure**, only after all attempts to obtain additional floor/bay space by the removal and retirement of obsolete/unused equipment have been exhausted. In those cases were mixed bays are necessary, the following guidelines should be followed:

1. First remember that 2N1 bays are fused at 60 Amps and 4N1 bays at 140 Amps.
2. Should you have existing 2N1 bays that will grow past seven shelves, a 4N1 bay should be placed.

3. In slow growth wire centers where 2N1 growth will not exceed seven shelves in the foreseeable future, a 4N1 shelf may be placed starting in the position where the eighth 2N1 would have been placed. All 2N1 growth would be in the lower half of the bay and 4N1 growth in the upper half. **(Seven 2N1 shelves would be fused at 21 Amps and five 4N1 shelves would be fused at 50 Amps for a total of 71 Amps. This exceeds the 60 Amp total for a 2N1 bay. Additional fusing would be required.)**
4. In reverse of number 3 above, should you have an existing 4N1 bay that will not exceed five shelves in the foreseeable future, 2N1 shelves may be placed starting in the position where the sixth 4N1 would be placed. All 4N1 growth would be in the lower half of the bay and all 2N1 growth would be in the upper half. **(Five 4N1 shelves would be fused at 50 Amps and Seven 2N1 would be fused at 21 Amps for a total of 71 Amps, which doesn't exceed the 140 Amp total for a 4N1 bay. No additional fusing is required.)**
5. All mixed bays should have the 2N1 and 4N1 bays grouped together.

CO shelf capacities are as follows:

Capacities (with fuse panels)	23" - 18 Slot Shelf Capacities
4N1 Heat Deflector Shelves	10 shelves/7' bay #
4N1 CO Line Cards	252 (4N1 systems)
VF Lines	1008

No 4N1 limitations, each shelf fused for 10 Amps, four 35 Amp power feeds

8.2 At the back of the CO shelf, there are connection points for major and minor alarms that allow the parallel connection of like alarms of as many shelves as desired for a central alarm. Alarms may be treated as individual connections if specific alarm locations need to be indicated. The alarm points are normally open contacts that will close in the event of an alarm condition. Daisy chaining of like alarms is recommended. Alarm Wiring Figures (AWF's) used in the BellSouth DLC Alarm Plan are not required for this shelf.

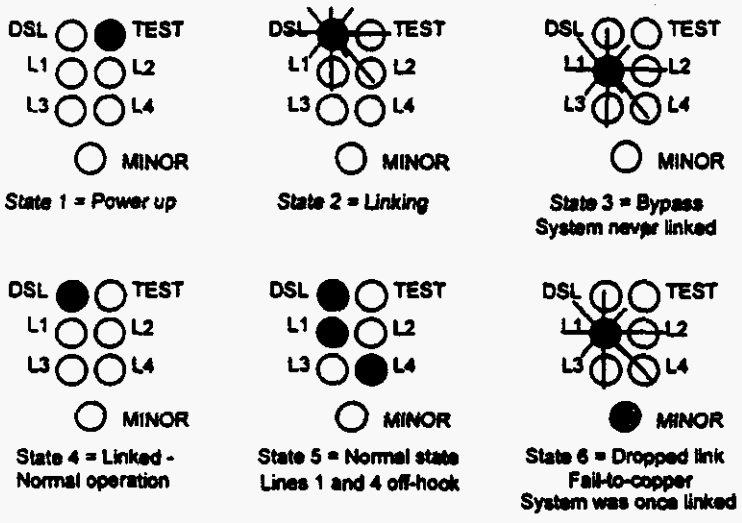
CO Line Card (CLEI SLLN3E02AA)

8.3 The CO Line Card (LC) plug-in comprises one of three elements that constitute the Line Set or "4N1 system". The RT and the DSL are the other two.

8.4 The LC's main function is to receive four voice frequency lines from the CO switch, digitize and multiplex them for transmission over the DSL to the RT. Since the 4N1 is a full duplex (simultaneous transmit and receive) system, the LC also receives the digital signal from the RT, de-multiplexes it, and converts the four channels into voice frequency lines for connection to the CO switch. The LC also converts -48 Vdc into ± 5 Vdc power supply and ± 100 Vdc DSL voltages. **A shelf power supply card is not required.**

8.5 The LC continuously monitors the DSL for excessive noise, bit error rates and proper linkage between it and the RT. Under any of these conditions, the LC will break the link and will automatically reestablish acceptable communications when the problem is cleared.

8.6 The LC is supplied with light indicators to display the status of the system as follows:



The front panel of the LC has a miniature push button switch that is used for Lamp Test functions. The LC also provides standard interface points for extending the alarms to the central alarm panel.

Remote Terminals /CLEI

- **DoorRT/SLCIHLZBAA - FTP**
- ***Outdoor/SLMSEDD3RA - FTP***
- **Indoor/SLML6L65RA - FTP**
- **Strand & Pole/SLMSFDE3RA - NFTP**
- **Pedestal Mount/SLMSFDE3RA - NFTP**

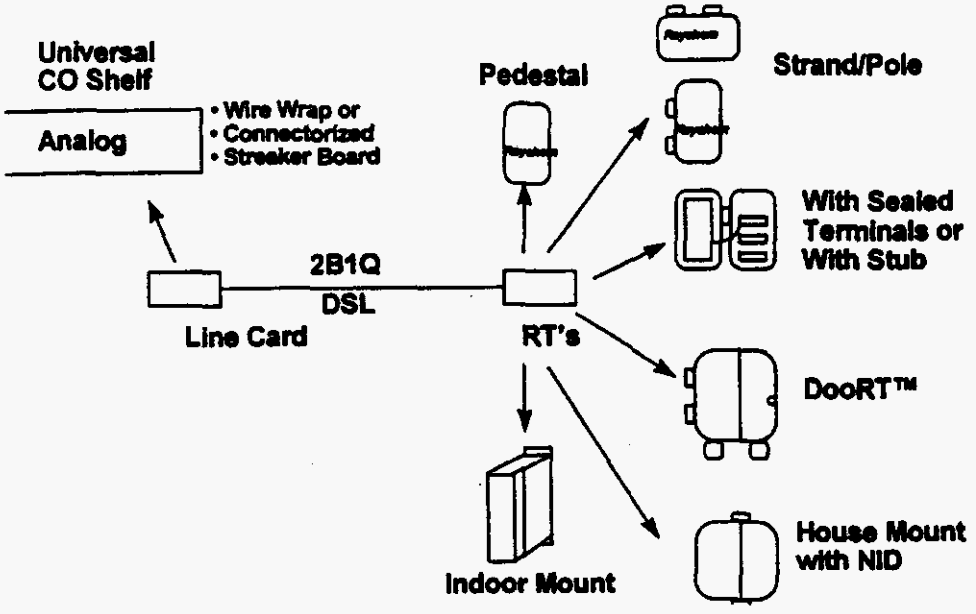
8.7 The RT comprises one of three elements that constitute the Line Set or "4N1 system". The CO LC and the DSL are the other two. It receives digital signals sent by CO LC, de-multiplexes them, and performs digital to analog conversion of the four voice frequency lines. The RT also receives the four voice frequency lines from the subscriber(s), performs an analog to digital conversion, and multiplexes them for transmission to the CO LC via the DSL. The RT receives power from the CO LC, via the DSL, and includes a power supply that generates circuit pack and ringing generator voltages and circuitry for communication of system conditions to the CO LC.

8.8 ***RT's with Fail-To-POTS (FTP) and Non-Fail-To-POTS (NFTP) features are available*** for customer premises, pole, strand, and pedestal mounted applications. Also available for customers premises use, is an RT, that replaces the existing door on the standard, 6 line Seicor Outside Network Interface (ONI) or NID. *The subscriber side of RT's should be connected to drop wire/customer facilities only.* In the event of electronics failure, RT's with the FTP feature revert to metallic bypass (copper) operation for line 1, whereas RT's with the NFTP feature interrupt service to all customers. The following RT's are available:

- DoorRT - FTP

- House (Standalone) Mount & Indoor - FTP
- Pedestal - NFTP
- Strand/Pole - NFTP

Raychem 4N1 RT Packaging Options



9.0 Loop Qualification Criteria

9.1 The Raychem 4N1 has simple loop qualification design rules. Transceivers located in the COT and RT are designed to operate over copper loops with losses up to a maximum of -49 dB @ 72 Khz. If one or more 4N1 DSL's occupy the same binder group as ISDN and/or HDSL lines, it is recommended, that the maximum loss be reduced by 3dB, in order to ensure adequate noise margin performance. **Copper pairs used for the DSL must comply with the following guidelines:**

- Non-loaded (no load coils) cable only
- No build-out capacitors, bridge lifters or air pressure transducers
- Maximum 1300 ohms cable loop resistance
- Maximum cumulative length of all bridged taps cannot exceed 6.0 kft
- Bridged taps near the RT should be removed
- Cable gauge changes allowed
- Maximum distribution cable/drop loop resistance from the RT-NID 560 ohms, including 430 ohms for customer equipment is 560 ohms, including 430 ohms for customer equipment.

The following table provides approximate maximum transmission limits for the 4N1:

Cable Gauge	Ohms/Kft @ 68°F	dB/Kft Loss @72 kHz	Maximum Loop Length (Kft) @ 49 dB*
26	83.3	3.2	15.5

24	51.9	2.2	22
22	32.8	1.5	31

*** If ISDN and/or HDSL in same binder group, reduce by 3dB**

10.0 Engineering Work Orders (EWO's) For System Activation

10.1 It is intended, that 4N1 systems be "activated" in response to ADL (mostly PF'd) service orders, business line, or facility relief requirements as dictated by the Deployment Guidelines summarized in Section 4. To simplify OSPE and AFIG work content, a simplified EWO format has been developed to enable installation of 4N1 systems and conditioning of the LFACS, COSMOS, and LMOS databases. The EWO must provide: 4N1 system numbers, CO relay rack/shelf/slot information, DSL cable pairs, Raychem Pair Gain (RPG) cable counts, Line Terminal Statuses (LTS'), DSL pair usage codes, cutover information, associated terminal addresses, CO and RT CLLI codes, and GLC's (Geographic Location Codes) or Area Numbers. See Exhibit A for an example of a Raychem 4N1 EWO and Exhibit B for corresponding LFACS inventory transactions. Wiring limits also need to be changed, and noted on the EWO, to show the new 4N1 RT terminal as the primary serving terminal (the 4N1 RT/NID also provides a terminal). Associated (or original) serving terminal information should also be included on the EWO, so that when all 4N1 lines are working), a serving terminal will be available from which to provide additional facilities. Taper codes are not required for the 4N1. When the EWO is complete, the AFIG must be provided a closing notification when the job closes in OSPCM. The AFIG will then complete the Job in LFACS per any changes from the *As-Built* OPEDS Design in the AS-BUILT Workbasket, if AFIG was included in the Resource Select pick list prior to routing the Job to the OPEDS Post Reconcile Workflow.

10.2 In most cases, a customer's primary line will be used as the DSL support pair to activate a 4N1 system for **single** customer premises applications. Then, all lines (primary + additional) are cut over to channels 1-4. In the event of system failure, the FTP feature allows the customer's primary line (line 1) to remain in service (on the DSL line), while lines 2, 3 and 4 are out of service. It is expected, that most of these installations will be service order driven.

10.2 Installation & Maintenance should install and cut over 4N1 systems placed at **single** customer's premises.

10.3 In order to activate a 4N1 system for **multiple** customer applications, either any customer's line or spare copper pair can be used as the DSL support pair. All lines should then be cut over to the 4N1 system. The NFTP feature denies service to all customer's (lines 1, 2, 3, and 4) in the event of system failure. It is expected, that most of these installations will be facility relief driven.

10.4 In most cases, the Digital Loop Carrier Work Group (DLCWG) will install and cut over 4N1 systems placed at pole and pedestal locations to serve **multiple** customers.

10.5 When planning service cutover to the 4N1, a customer's use of their existing copper facilities for modems must be considered. They may use a modem, or are planning to do so. Since modem rates are limited to approximately 33 kb/s, a decrease in modem speed will more than likely be experienced when their facilities are cutover to the 4N1. Even though BellSouth officially supports modem transmission rates of 9.6 kb/s throughout our network, much higher rates are possible, particularly over all copper loops. Therefore, customers who experienced higher rates prior to cutover to the 4N1, may become very dissatisfied with their modem performance. In order to maintain customer satisfaction, copper pairs may have to be retained for modem usage. The 4N1 cannot be used for Integrated Services *Digital Network (ISDN) and Asymmetrical Digital Subscriber Line (ADSL) service. A separate facility is required for these services.*

11.0 Administration

System Naming Conventions, Line Terminal Statuses and Account Code

11.1 The 4N1 system is designated as system type **"MX4P"** in LFACS and LMOS. The Line Terminal Status (LTS) for the derived pairs for PIPSO administration is **ES**; non-PIPSO slots should use status **"NE"**. The pair usage code for the DSL support pair is **PGH**. The 4N1 derived pairs are designated as Raychem Pair Gain **(RPG)**. The use of *RPG* distinguishes the *4N1 from the large platform DLC systems. The 4N1 supports* POTS1, POTS1B, POTS5, SS1L, SS2L, SS6, and SSPL Service Categories, with most services being POTS1.

11.2 **Each Raychem 4N1 system is classified in its entirety to the central office asset account [Subsidiary Record Category (SRC)] 2232.1200 and Field Reporting Code (FRC) 257C as non-exempt material, i.e., a retirement unit.**

11.3 **Since *Part 32 of the FCC's regulations require that costs associated with central office assets be identified and maintained by specific location, a discrete Common Language Location Identification (CLLI) and Geographic Location Code (GLC) is required for each 4N1 RT location.*** These assets are maintained in the Detailed Continuing Property Records (DCPR) database. **If multiple RT's are placed at the same physical location, they can share the same GLC and CLLI.** RT's that share the same GLC and CLLI have to be easily located and identified for auditing purposes. OSPE is responsible for obtaining the CLLI codes and GLC's for RT's from the *LOC CLLI system.* ***CO CLLI codes and GLC's should be used for the CO Line Cards.***

System Numbering

11.4 Each 4N1 system is associated with a CO Line Card as one of the (18) eighteen, 4 channel systems in the CO shelf. The 4N1 systems should be numbered consecutively, starting with nnnn = 0001, in a left to right, bottom to top *shelf/bay sequence.* ***One 25 pair cable, per shelf, is used to terminate 18 DSL (control) pairs for 18 4N1 systems. DSL cables should be designated as: 4X, 1-18, 26-43, 51-68, 76-93, etc. Four 25 pair cables are used to terminate the derived pairs/channels.*** Eighteen (18) pairs in each cable are used; the last 7 pairs are not terminated. The derived pair cables are: **Cable #2 = Channel 1/Systems 1-18, Cable #3 = Channel 2/Systems 1-18, Cable #4 = Channel 3/Systems 1-18, Cable #5 = Channel 4/Systems 1-18.** The derived pair cables should be terminated to match consecutive 4 pair cable counts to the 4 channels of each system in a CO shelf slot. This termination method will facilitate 4N1 system wiring by Frame Attendants from COSMOS. Derived pair cables for should be designated as: **RPG nnnn, 1-72, 101-172, 201-272, etc. See Section 20 for 4N1 wiring and stenciling recommendations and a diagram of a fully equipped 4N1 CO bay.**

Monitoring Of CO Shelves

11.5 The number of initial shelves and the annual monitoring of system utilization by use of the LEIS program "util.dlc" (see RL:95-08-023BT), can help in establishing a baseline from which to develop forecasts for annual COT shelf installations. Utilization reports can be obtained from LUVM, since the 4N1 is administered as a DLC system using system type "MX4P". More frequent monitoring may be required in high growth wire centers. 4N1 shelves should be sized for one year's growth and should be ready for service 30 days prior to the earliest system installation.

12.0 Identification of 4N1 Systems in Outside Plant

12.1 **Once the Raychem 4N1 is deployed, OSPE must be constantly alert for the presence of DSL lines in cable relief activities.** Rearrangements of cable pairs that include pairs used for 4N1 systems require coordination amongst Outside Plant Engineering, AFIG, Central Office, Construction and I&M, to ensure that transmission limits are not exceeded. **Bridged tap restrictions for 4N1 systems may not permit cable**

pairs to be half-tapped in all situations. 4N1 systems are incompatible with DLC and cannot be cut over to DLC without providing additional physical feeder and/or distribution pairs from the DLC RT to customer's premises. In other words, if an area is completely cut over to carrier, all existing 4N1's must be removed and additional physical pairs must be provided to each existing 4N1 serving terminal location. The *"util.dlc" program, available in* LEIS (Loop Engineering Inventory System), can be used to identify lines served by MLC systems.

12.2 The 4N1 channel units can be tracked by their LTS. FACS will retain the "ES" LTS for the four pairs associated with the plug-in for each disconnect.

13.0 Recovery/Re-use of 4N1 Systems - COT Line Cards and RT's

13.1 Outside Plant Engineering is responsible for determining when to recover idle 4N1 systems. They should obtain the necessary reports (see Section 12) and determine if sufficient quantities of plugs are available for *recovery. For 4N1 removals involving single customer premises,* I&M and CO personnel will be responsible for cut over, removal of the RT and C.O. Line Cards, and returning them to PICS. Rewiring and reconfiguring the NID at single customer's premises may be required. For removal of 4N1 systems involving multiple customers, Construction will be responsible for cut over, removal of the RT and C.O. Line Cards, and returning them to PICS. In all cases, distributing frame and Originating Equipment (OE) cross-connect wiring should be removed. The EWO must indicate the CLLI and Area Numbers of the CO and RT locations for units returned to PICS, in order to maintain accurate records in the DCPR database.

13.2 The 4N1 systems (1 COT Line Cards and RT/system) should be recovered on a bulk basis, only when all four channels have been disconnected (CT'd or CF'd) and sufficient time(>180 days recommended) has elapsed to indicate that a particular system will not be reused. Since all channels should be disconnected for at least 180 days, the reuse potential of the 4N1 systems is expected to be low, until sufficient deployment has occurred.

13.3 When a disconnect is processed, for either the primary or derived lines, they will CT or CF. LFACS will show the loop facilities in LFACS with the plug Line Terminal Statuses (LTS') as "ES". If a service request is issued for this address, the CT/CF'd facilities will be available for the reconnect in FACS. The "util.dlc" program in LEAD described in RL: 95-08-023BT can be used to monitor utilization of 4N1 systems.

14.0 LEIM

14.1 ***Raychem 4N1 systems, COT shelves, and the RT's will not be inventoried in LEIM.*** CO shelf inventories are maintained by Raychem, Circuit Capacity Management, PICS, and DCPR (Detailed Continuing Property Records) databases. These sources are deemed sufficient for obtaining detailed investment information. See paragraph 11.5 for monitoring of CO shelves.

15.0 Alarms

15.1 The 4N1 has minimal alarm capabilities. The CO Line Card provides standard interface points for extending the Alarms to the Central Alarm Panel At the back of the CO shelf are connection points for major and minor alarms. The alarm points are Normally Open contacts that will close in the event of an alarm condition. Daisy chaining of like alarms is recommended. A Minor Alarm (amber LED) indicates loss of link on an individual DSL line. Alarm Wiring Figures (AWF's) used in the BellSouth DLC Alarm Plan are not required for this shelf.

16.0 Central Office Methods and Procedures

16.1 The Raychem Miniplex 4N1 Central Office Line Cards (LC's) will be ordered and provisioned as PIPSO channel units. When a new support pair is installed, a Line Card (LC) must be placed in the DAML relay rack. Section 21 provides a detailed plug-in description.

16.2 The Central Office Technician (ET or FA) will be responsible for placing and verifying the existence of a 4N1 LC in the appropriate 4N1 shelf and slot as indicated on the frame output of COSMOS for inward type service orde's.

16.3 The normal relay rack installation will consist of 180 support terminations and 720 derived (RPG) cable pairs. The support pair will be wired to the Toll Main Distribution Frame (TMDF) or the Combined Main Distributing Frame (CMDF). The terminals will count from 1 through 180. Pair one (1) is associated with RPG pair 1-4, pair two (2) is associated with RPG pair 5 –8, pair three (3) is associated with RPG pair 9–12. This format will continue to the end of the count at pair 180, which is associated with RPG pair 717 –720. Cross-connects will be wired from the control or support pair to the copper cable and pair.

16.4 Derived cable pairs will be wired as RPG cable and pairs on distribution frames to obtain consecutive derived pair count. Cross-connects are made from the derived pairs to Originating Equipment terminating blocks.

16.5 The Central Office Line Card will not be removed on outward or disconnect service orders activity. Recovery of 4N1 unit procedures are covered in Section 13.

16.6 The Central Office Line Card functions are detailed in vendor documentation provided with each card.

16.7 Customer Trouble Report close-outs for lines involving 4N1 electronics are as follows:

(a) **Trouble caused by 4N1 RT electronics should be closed to the disposition code 0465.**

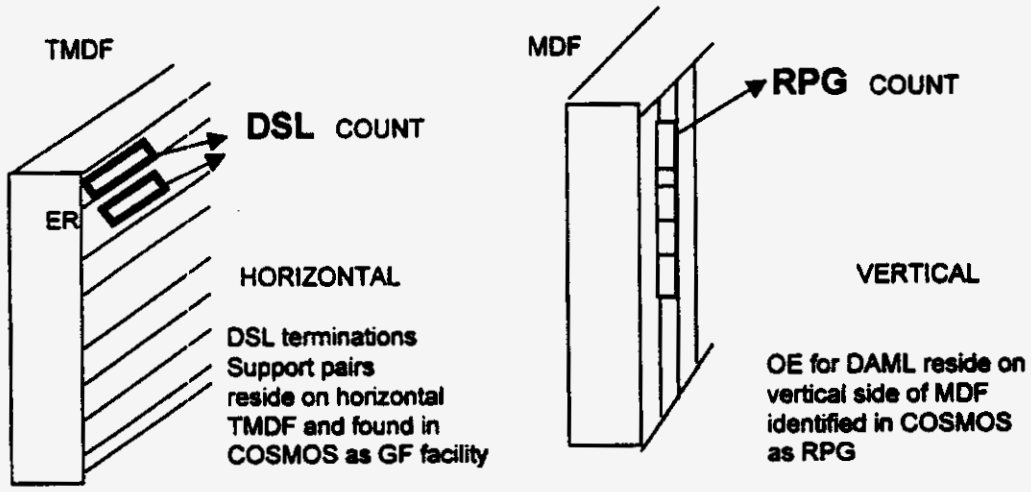
(b) **Troubles caused by 4N1 Central Office LC electronics should be closed to the disposition code 0561.**

17.0 Central Office Frame Procedures

17.1 This section provides methods and procedures for wiring of the 4N1 system on all types of distributing frames. The 4N1 can be used to provide Additional Lines (ADL's) for single subscriber customers or feeder and distribution facility relief for multiple customers. An Engineering Work Order is required in all cases, and Line and Station (LST) procedure should be applied for feeder relief.

17.2 **FOR SINGLE SUBSCRIBER USE:** The addition of a 4N1 MINIPLEX unit will require that the existing OE to cable pair cross-connect be removed, and the unit wired in the path. The existing customer cable pair (CP) must be rewired to the support pair and the OE rewired to the RPG cable pair of the 4N1 unit. On COSMIC and Modular ESS frames this will require wiring the original cable pair to a tie pair that connects to the TMDF. The associated tie pairs on the TMDF are then wired to the support pair of the 4N1 unit. Conventional frames require rewiring of the CP to the 4N1 support pair and the OE rewired to the RPG cable pair on the vertical side of the frame.

17.3 The support pairs (DSL) will be hard wired over to the vertical side of the MDF. The existing Originating Equipment (OE) is wired to the RPG count on the vertical side of the MDF. The existing OE should be the first pair assigned to that count. The re-wiring of the OE and CP will be accomplished via a Change order, see attached example of COSMOS service order. On COSMIC or Modular frames COSMOS will assign tie pairs. The diagram below shows the placement for cross connects.



17.4 The OEs will be wired to lines 1, 2, 3, and 4 (derived side) of the 4N1 DAML RPG count on the vertical side of the MDF. These lines will be assigned as per COSMOS, which is associated with the EWO. COSMOS will issue a change order with assignments for the support pair and the RPG cable pair. Additional lines added to the unit will only need wiring from the OE to the RPG as regular orders are wired.

Example of COSMOS Service Order Inquiry

```
[ZY]IC% SOI
H ORD 4N1DAMLLS.0003

                SERVICE ORDER ASSIGNMENT INQUIRY
```

```
ORD 4N1DAMLLS.0003          OT(CH)    ST(AC- )
   DD(06-05-99)  FDD(06-05-99)  EST(06-03:14)  SG(P)
   MDF WORK REQ(YES)  MDF COMPL(NO)  LAC COMPL(NO)  RCP(NO)
TN  404-298-1377
    ST WK          DATE 07-22-92     TYPE X
CP  1-0012      <---------- EXISTING CP TO BECOME SUPPORT PR
    ST WK  PD PC  FS SF      SBS A  DATE 07-22-92      RZ 13
    LOC BF14001
OE  001-301-602
    ST WK          DATE 07-22-92     CS RES        US 1FR       FEA TNNL
    LCC 1FR
    LOC WF14002
CP  RPG310-0005    <---------- DERIVED PAIR
    ST SF  PC      FS WK   DATE 04-27-99
    RMKP RR0120.01.01        RZ 13   REMARKS SHOW THE LOCATION OF THE DAML RR
    LOC PF14001


ORD 4N1DAMLLS.0003          OT(CH)    ST(AC- )
   DD(06-05-99)  FDD(06-05-99)  EST(06-03:14)  SG(P)
   MDF WORK REQ(YES)  MDF COMPL(NO)  LAC COMPL(NO)
CP  1-0012
    ST WK  PD PC  FS WK      SBS A  DATE 07-22-92      RZ 13
    LOC BF14001
TP  TM03-0320
    ST SF  PC      FS WK   DATE 02-24-99
    LOC  F14001
    LOC  F20001
GF  DML4012001-01-002  <---- DML4-THE FIRST 4 CHARATERS IDENTIFY THE DAML
    ST SF  PC      FS WK   DPA 999   EQUIP, 0120 IDENTIFY THE RR,01 IDENTIFIES
    LOC  F20001                      THE BAY, The second 01 IDENTIFIES THE
PL  CKTDLC.RPG310.012001-01-05       SHELF, AND THE 002 THE LAST THREE
    ST SF  PC      FS WK             DIGITS IDENTIFIES THE SLOT OR POSITION
    ADSR NO
** SOI COMPLETED
```

Example of Inquiry for Support Pair

```
INQ
H CP 1-12      <---------- DAML CONTROL PAIR

TP  TM03-0320
    ST  WK          DATE 06-04-99
    LOC  F14001    LOIS F14-01-01L03-1-20
    LOC  F20001    LOIS F20-01
    FROM FAC CP  1-0012     TO FAC GF  DML4012001-01-002
GF  DML4012001-01-002  <---- 4N1 MINIPLEX INFORMATION (See details above)
    ST  WK          DATE 06-04-99    DPA 999
    LOC  F20001    LOIS F20-01
PL  CKTDLC.RPG310.012001-01-05
    ST  WK          ADSR NO
CP  1-0012
    ST  WK          SBS A    DATE 06-04-99     RZ 13
    LOC WF14001    LOIS F14-00-02U10-1-12    PF   1-1-12


** INQ COMPLETED 06-04-99  10:02
```

```
[ZY]IC% INQ
H TN 298-1377
_.

TN  404-298-1377
    ST  WK          DATE 07-22-92    TYPE X
OE  001-301-602
    ST  WK          DATE 07-22-92    CS RES       US 1FR      FEA TNNL
    LCC 1FR
    LOC WF14002   LOIS F14-01-03L10-4-11
CP  RPG310-0005                  DERIVED PAIR WIRED TO OE
    ST  WK          DATE 06-04-99
    RMKP RR0120.01.01      PG YES     RZ 13
    LOC WF14001
                                 RELAY RACK FOR 4N1 MINIPLEX
** INQ COMPLETED 06-04-99  10:028
[ZY]IC%
```

17.5 The wiring of line 1 into the 4N1 will not require coordination with the Service Technician in the field because the 4N1 will remain in a cut through mode (not activated) until the Service Technician activates the 4N1 unit. However, **this wiring step will interrupt service**, so it is important to keep this outage to a minimum.

17.6 **FOR FEEDER RELIEF (MULTIPLE SUBSCRIBER) USE:** The wiring for a 4N1 **multiple** customer application will use the same steps as the above Single Subscriber, however, the DSL can be an existing CP or a spare copper pair. The **multiple** application requires that the CP and all OE lines be pre-wired to the 4N1 terminals at both locations, (the support and derived on the frames). Since the 4N1 unit requires an EWO, and must be administered as a small DLC system, existing cable throw procedures are applied. Therefore a go-ahead will be necessary before OEs are cut into the 4N1 unit. In the event of electronic failure the 4N1unit, when serving **multiple** subscribers, is equipped with the Non Fail to Pot (NFTP) feature, the NFTP feature interrupts service to all customer served by the unit.

18.0 RT Installation, Acceptance, And Test Procedures

General Description

18.1 The RT, along with the CO Line Card (LC), constitute a line set, containing the circuitry to multiplex/de-multiplex four-POTS line services onto a single twisted-copper pair.

18.2 This installation practice is applicable to all Miniplex 4N1 Universal Digital Channel (UDC) RT's. Consult the *instruction printed on the inside of the unit's door for style-specific instructions.*

18.3 Miniplex 4N1 UDC RT's are compatible only with Miniplex 4N1 UDC LC's. The RT's are available in either the fail-to-copper (FTC) or non-fail-to copper (NFTC) versions.

18.4 System specification - Based in OSP cable resistance-design parameters:

Reach:

- Maximum loop length is 15.5 kft (26 gauge)
- Maximum bridged tap 6 kft
- 49dB at 72 kHz
- Non-loaded cable

Drops: Station wiring: 560 ohms (includes 430-ohm CPE)

Compatibility: Voice, fax, modems, and CLASS services, including on-hook transmission.

Testability: Provides resistive signatures, which indicate fault conditions and sectionalization of such faults to standard MLT equipment.

CAUTION!!!!

18.5 Use caution when installing or modifying telephone lines. Never touch non-insulated wires or terminals unless the telephone line has been disconnected at the network.

18.6 ***Risk of electrical shock. Voltages up to ± 100 Vdc are present on the Digital Subscriber Line (DSL) copper pair. Proceed with caution when handling the DSL.***

Remote Terminal Installation and Acceptance

18.7 This Miniplex RT is identified by "4N1" on the installation instructions printed on the inside of the door.

18.8 System can be in one of two modes:

- **Bypass or fail-to-copper mode.** System never linked or has lost link. Dial tone on Line 1, which is the DSL pair (-48V on ring, ground on tip).
- **Carrier mode.** Carrier (data-type signal on DSL) (±100V on tip and ring).

Note: The digital subscriber line (DSL) is the cable pair.

STEP 1: Verify with CO that CO frame wiring is completed per service order document.

STEP 2: Test cable pair.

- ANI to determine Line 1 and telephone number.
- Verify cable pair meets standard test OK criteria.
- Verify ring (-48V) and tip (ground).

STEP 3: Mount RT.

Install RT using provided hardware. If the RT consists of only a network interface door (Miniplex DoorRT), remove the existing door and place Miniplex DoorRT in its place.

STEP 4: Ground RT.

- RT must be grounded when installed outside, at, or before the customer's station protector.
- Use #10 gauge copper ground wire using company-approved grounding practices.

When installed indoors -- after the customer's protector -- the RT does not have to be grounded.

STEP 5: Wire the RT.

- Connect the cable pair to the DSL connector.
- Verify Line 1 dial tone using DSL connector test points.

STEP 6: Activate the DSL carrier.

- System can be manually activated by grounding the ring side of the DSL for up to 15 seconds.
- CO line card will detect a good RT connected to the DSL cable pair, then the line card completes the circuit and the system converts to the carrier mode.

STEP 7: Test DSL carrier activation.

Test for carrier signal on DSL:

- Use butt-in set in monitor mode to verify carrier signal or voltmeter to verify tip and ring ± 100V to ground.
- If dial tone is present on the cable pair (DSL), activation is incomplete. Retry using Step 6 procedure.
- Carrier signal present on DSL:
- Test Lines 1, 2, 3, and 4 for dial tone using company-approved testing method.
- Connect customer station wiring to Line 1, 2, 3, and 4 connectors.

STEP 8: Conditions that can affect or prevent carrier signal activation.

- Loaded cable pair (there will be no activation)
- Loop length exceeding 1300 ohms or 49dB at 72kHz
- High resistance open
- Unbalanced cable pair
- Excessive bridge tap > 6 kft
  These conditions can cause noise, clicking on line, or intermittent loss of dial tone.

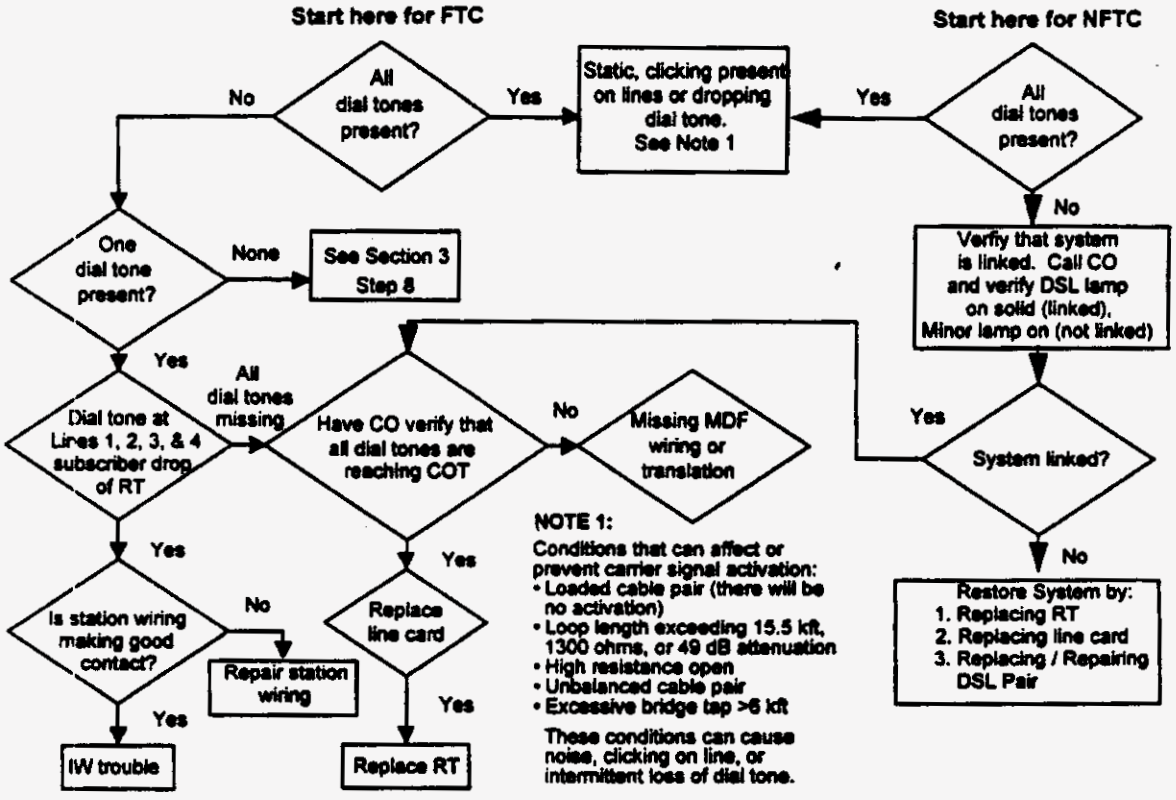
Test and Repair Procedure

18.9 System equipped with FTC can be in one of two modes: bypass or fail-to-copper.

- **Bypass or fail-to-copper mode.** System never linked or has lost link. Dial tone on Line 1, which is the DSL pair (-48V on ring, ground on tip).
- **Carrier mode.** Carrier signal (±100V on ring, ground on tip) on DSL

18.10 System equipped with NFTC can be in one of two modes: bypass or carrier mode.

- **Bypass.** System never linked. Dial tone on Line 1, which is the DSL pair (-48V on the ring, ground on tip).
- **Carrier mode.** Carrier signal (±100V on ring, ground on tip) on DSL.



19.0 Mechanized Loop Testing (MLT)

19.1 The Raychem 4N1 is compatible with MLT. It has the capability to isolate and report the location of a trouble to MLT equipment using resistive signatures applied at the line card. Signatures enable the testing desk to confirm that the system is normal, or that the line card is bad, or that the trouble is outside. Raychem 4N1 MLT signatures and a troubleshooting guide are as follows:

FTP System MLT Response Matrix

Condition	Line 1 T-R	Line 1 T-G	Line 1 R-G	Lines 1,2,3,4 T-R	Lines 1,2,3,4 T-G	Lines 1,2,3,4 R-G	LED Indication & Alarm Contact
System OK	3500	80	80	3500	80	80	DSL on
Bad LC (Bypass)	Physical	Physical	Physical	3500	160	160	Minor on

Bad DSL Bypass)	Physical	Physical	Physical	160	80	80	Minor on
DSL Short (Bypass)	Physical	Physical	Physical	160	160	160	Minor on
Bad RT	3500	80	160	3500	80	160	Minor on

NFTP System MLT Response Matrix

Condition	Lines 1, 2, 3, 4 T-R	T-G	R-G	LED Indication & Alarm Contact
System OK	130	75.9	75.9	DSL on
Bad LC	1000	75.9	75.9	Minor on
Bad DSL	28.0	75.9	75.9	Minor on
Bad RT	17.8	75.9	75.9	Minor on
Resistive Drop Fault	63.4	75.9	75.9	Minor on
CPE Not Present	80.6	75.9	75.9	Minor on
Receiver Off Hook	102	75.9	75.9	Minor on

Values are resistance in ohms (k = 1000), as would be reported by MLT

4N1 System Troubleshooting Guide

System equipped with FTC can be in one of three modes: bypass, FTP, or carrier mode.
- Bypass or Fail-to-POTS mode. System never linked or has lost link. Dial tone on Line 1 which is the DSL pair (–48V on ring, ground on tip).
- Carrier mode. Carrier signal (±100V on tip and ring) on DSL.

Note: Failure of either the CO line card or the RT electronics, Line 1 dial tone will be restored on the DSL cable pair.

System equipped with NFTP can be in one of two modes: bypass or carrier mode.
- Bypass. System never linked. Dial tone on Line 1 which is the DSL pair. (–48V on ring, ground on tip).
- Carrier mode. Carrier signal (±100V on ring, ground on tip) on DSL.

20.0 CO Shelf Ordering Information

20.1 Raychem universal CO shelves used for both 4N1 and 2N1 systems, are installed via Equipment Requests from OSPE to Circuit Capacity Management (CCM) or authorized contractor, based on anticipated need. Due to the inherent start-up costs, 4N1 shelf additions must be managed very carefully. MBOS models have been developed by CCM, to help control these costs. *Loop Capacity Managers (LCM's) are responsible for determining the CO's that are candidates for 4N1 deployment, as well as the number of initial shelf installations.*

20.2 All 4N1, as well as 2N1 requirements, should be included on the same OSPE annual CO installation equipment request to CCM. Shelves are ordered by either CCM or authorized contractor for installation by a turf vendor via a Telephone Equipment Order (TEO). **Since the 4N1 is administered as a DLC system, TEO's must also include DSL, 4N1 system number, and RPG cable stenciling information. Mixed (2N1, 4N1) system shelf/bay serving arrangements are not advised, because of powering (4N1@10 amps/shelf), heat deflector (4N1 only), administrative, and derived pair wiring requirements. Therefore, it is strongly recommended, that dedicated shelf/bays be used for 2N1 and 4N1 systems.** In instances where there is limited floor/bay space availability, mixed bay arrangements may be required. Mixed bays should be a last resort, only after all attempts to obtain additional floor/bay space by the removal and retirement of obsolete/unused equipment have been exhausted. Special engineering by Circuit Capacity Management is required for mixed bay installations.

4N1 Universal CO Shelf

Description	CLEI
Shelf 23" Connectorized - Miniplex 4N1 e/w heat deflector	SLML1B05RD
Capacities (with fuse panels)	23" - 18 Slot Shelf Capacities
4N1 Heat Deflector Shelves	10 shelves/7' bay #
4N1 CO Line Cards	252
VF Lines	1008

No 4N1 limitations, each shelf fused for 10 Amps, four 35 Amp power feeds

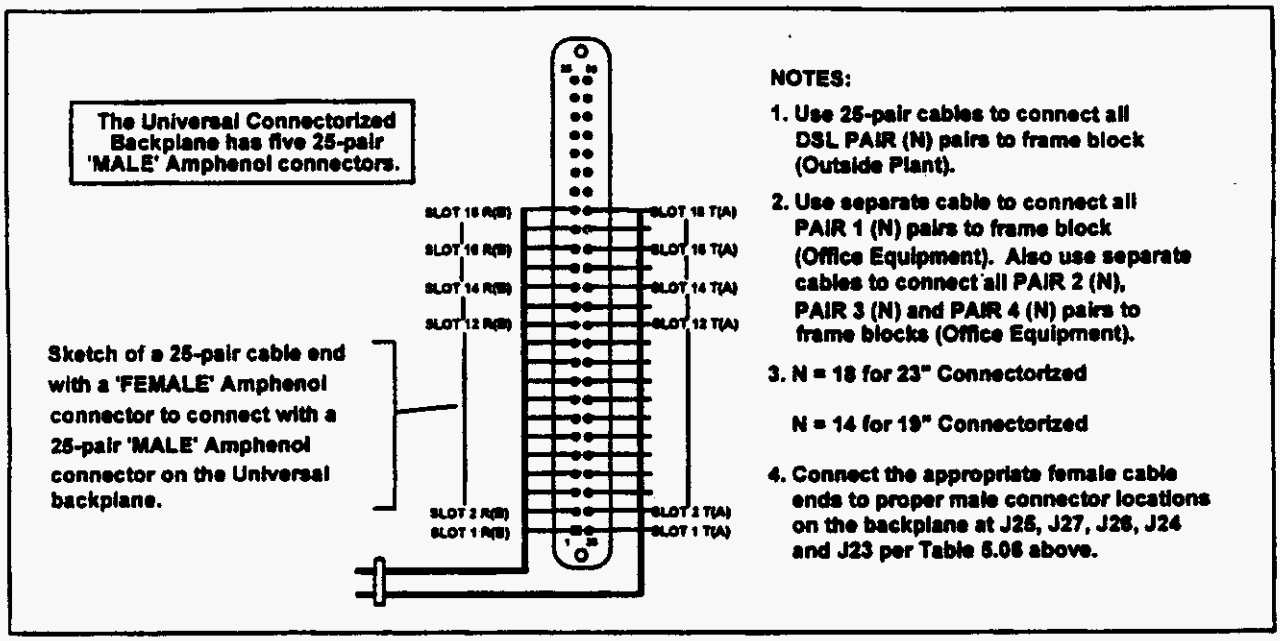
20.1 **The Raychem 4N1 system (CO shelf, CO Line Card and all RT versions) is classified to central office asset account [Subsidiary Record Category (SRC)] 2232.1200 and Field Reporting Code (FRC) 257C as non-exempt material, i.e., a retirement unit.**

20.2 The COSMOS form used by CCM or authorized contractor for transmitting 2N1 shelf installation to the COSMOS Database Administrator is not applicable for the 4N1. Instead, the standardized COSMOS Facility Input Form for the 4N1 shelf must be prepared by OSPE, and sent to the COSMOS Database Administrator.

Installation Vendor Guidelines

20.3 Male Amphenol connectors are mounted on the shelf backplane to provide connections to the DSL and derived (RPG) pairs for each 4N1 system. Five, 25 pair cables with female Amphenol connectors are used to connect the DSL and RPG pairs to frame termination points. **The RPG cables must be terminated to match consecutive 4 pair RPG cable counts to the 4 channels of each system in a CO shelf slot.** The last 7 pairs in each 25 pair cable are not terminated. Wiring designations are shown in the below table.

MINIPLEX SYSTEM TYPE	# 25-Pair Cables/ Shelf	Cable #1 DSL Pair (1B)	Cable #2 Derived Pair 1 (1B)	Cable #3 Derived Pair 2 (1B)	Cable #4 Derived Pair 3 (1B)	Cable #5 Derived Pair 4 (1B)
4N1	5	DSL	Line 1	Line 2	Line 3	Line 4
Connectorized Shelf Connector ID	------	J25	J27	J26	J24	J23



20.4 One 25 pair cable, per shelf, is used to terminate the DSL pairs for 18 4N1 systems. DSL cables should be terminated consecutively, according to color code, on horizontal connecting blocks for conventional frames, and on the TMDF for COSMIC frames. For termination purposes, **DSL cables(one/shelf) should be designated as: 4X, 1-18, 26-43, 51-68, 76-93, 101-118, etc.** The last 7 pairs in each cable are not terminated. Therefore, the last 28 termination points on a 100 pair connecting block will be vacant. Each DSL connecting block should be stenciled or labeled by the installation vendor per TEO instructions, e.g., 4X, 1-18, 26-43, 51-68, 76-93, 101-118, etc.

20.5 Four derived pair cables **(Cable #2 for channel 1 [systems 1-18], Cable #3 for channel 2[systems 1-18], Cable #4 for channel 3[systems 1-18], and Cable #5 = channel 4[systems 1-18])** from each shelf should be terminated on the vertical side of conventional frames and on COSMIC frames by use of PACE/MELD runs. The last 7 pairs in each cable are not terminated. Therefore, the last 28 termination points on a 100 pair connecting block will be vacant. **Derived pair cables should be terminated to match consecutive 4 pair cable counts to each 4 channel system in a CO shelf slot. For example:**

Derived Pair Cables	Derived Pairs	RPG Cable, Pair Range	CO Shelf Slot
2,3,4,5	1,1,1,1	400, 1-4	1
2,3,4,5	2,2,2,2	400, 5-8	2
2,3,4,5	3,3,3,3	400, 9-12	3
2,3,4,5	4,4,4,4	400, 13-16	4
2,3,4,5	18,18,18,18	400, 69-72	18

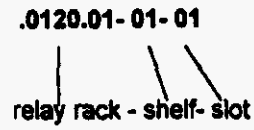
Comments for PACE/MELD runs on the TEO should specify, for example: "Add 4 shelves on PACE/MELD run and distribute RPG pairs in groups of 72". RPG cables should be stenciled or labeled at their termination points by the installation vendor per TEO instructions, e.g., RPG400, 1-72, 101-172, 201-272, etc. System numbers, DSL, and RPG cable information also be stenciled or labeled on the left hand side of each CO shelf relay rack. See the below example for CO shelf layouts and the derived pair termination method.

Raychem 4N1 CO Shelf 7' Bay - 10 Shelf Layout Example

SYS 163-180	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
4X, 226-243	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
RPG400, 649-720 0120.01-10	649	653	657	661	665	669	673	677	681	685	689	693	697	701	705	709	713	717
	650	654	658	662	666	670	674	678	682	686	690	694	698	702	706	710	714	718
	651	655	659	663	667	671	675	679	683	687	691	695	699	703	707	711	715	719
	652	656	660	664	668	672	676	680	684	688	692	696	700	704	708	712	716	720
SYS 146-162	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162
4X, 201-218	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218
RPG400, 577-648 .0120.01-09	577	581	585	589	593	597	601	605	609	613	617	621	625	629	633	637	641	645
	578	582	586	590	594	598	602	606	610	614	618	622	626	630	634	638	642	646
	579	583	587	591	595	599	603	607	611	615	619	623	627	631	635	639	643	647
	580	584	588	592	596	600	604	608	612	616	620	624	628	632	636	640	644	648
SYS127-144	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144
4X, 176-193	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193
RPG400, 505-576 .0120.01-08	505	509	513	517	521	525	529	533	537	541	545	549	553	557	561	565	569	573
	506	510	514	518	522	526	530	534	538	542	546	550	554	558	562	566	570	574
	507	511	515	519	523	527	531	535	539	543	547	551	555	559	563	567	571	575
	508	512	516	520	524	528	532	536	540	544	548	552	556	560	564	568	572	576
SYS 109-126	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
4X, 51-158	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168
RPG400, 433-504 .0120.01-07	433	437	441	445	449	453	457	461	465	469	473	477	481	485	489	493	497	501
	434	438	442	446	450	454	458	462	466	470	474	478	482	486	490	494	498	502
	435	439	443	447	451	455	459	463	467	471	475	479	483	487	491	495	499	503
	436	440	444	448	452	456	460	464	468	472	476	480	484	488	492	496	500	504
SYS 91-108	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
4X, 126-143	126	127	128	129	130	131	132	133	134	135	136	137	137	139	140	141	142	143
RPG400, 361-432 .0120.01-06	361	365	369	373	377	381	385	389	393	397	401	405	409	413	417	421	425	429
	362	366	370	374	378	382	386	390	394	398	402	406	410	414	418	422	426	430
	363	367	371	375	379	383	387	391	395	399	403	407	411	415	419	423	427	431
	364	368	372	376	380	384	388	392	396	400	404	408	412	416	420	424	428	432
SYS 73- 90	73	74	104	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
4X, 101-118	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
RPG400, 289-360 .0120.01-05	289	293	297	301	305	309	313	317	321	325	329	333	337	341	345	349	353	357
	290	294	298	302	306	310	314	318	322	326	330	334	338	342	346	350	354	358
	291	295	299	303	307	311	315	319	323	327	331	335	339	343	347	351	355	359
	292	296	300	304	308	312	316	320	324	328	332	336	340	344	348	352	356	360
SYS 55-72	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
4X, 76-93	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
RPG400, 217-288 .0120.01-04	217	221	225	229	233	237	241	245	249	253	257	261	265	269	273	277	281	285
	218	222	226	230	234	238	242	246	250	254	258	262	266	270	274	278	282	286
	219	223	227	231	235	239	243	247	251	255	259	263	267	271	275	279	283	287
	220	224	228	232	236	240	244	248	252	256	260	264	268	272	276	280	284	288
SYS 37-54	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
4X, 51-68	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
RPG400, 145-216 .0120.01-03	145	149	153	157	161	165	169	173	177	181	185	189	193	197	201	205	209	213
	146	150	154	158	162	166	170	174	178	182	186	190	194	198	202	206	210	214
	147	151	155	159	163	167	171	175	179	183	187	191	195	199	203	207	211	215
	148	152	156	160	164	168	172	176	180	184	188	192	196	200	204	208	212	216
SYS 19-36	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
4X, 26-43	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
RPG400, 73-144 .0120.01-02	73	77	81	85	89	93	97	101	105	109	113	117	121	125	129	133	137	141
	74	78	82	86	90	94	98	102	106	110	114	118	122	126	130	134	138	142
	75	79	83	87	91	95	99	103	107	111	115	119	123	127	131	135	139	143
	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140	144
SYS 1-18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4X, 1-18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
RPG400, 1-72 .0120.01-01	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
	2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
	3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
	slot 1	slot 2	slot 3	slot 4	slot 5	slot 6	slot 7	slot 8	slot 9	slot 10	slot 11	slot 12	slot 13	slot 14	slot 15	slot 16	slot 17	slot 18

Relay Rack Information

20.6 Relay rack information must be provided on the EWO by OSPE. This will enable a 4N1 system to be built by the AFIG and wired by Frame Attendants using service order information from COSMOS. Each 4N1 system will be identified by relay rack, shelf and slot. A slot containing a 4N1 Line Card in constitutes each 4N1 system. An example of this information is as follows:



21.0 Plug-In Ordering Information And Administration

21.1 In order to handle initial 4N1 service order/maintenance requirements, CO Line Card and RT seed stocks should be established by Network Operations and ordered from PICS by OSPE via FASTLite. ***PIPSO (Plug-in Provisioning On A Service Order) administration will be used to for all ongoing 4N1 requirements.*** To minimize start up costs, ramp up for 4N1 deployment must be done carefully. Initial seed stock levels for the CO and field should be established by mutual agreement between CO, I&M, and OSPE personnel. During ramp up, RT stock can be maintained in a work center for use by Service Technicians (ST's) and DLCWG. As 4N1 demand increases, designated ST's could be equipped with RT's. There is no economic justification for equipping every ST with RT's, especially during early 4N1 deployment. Subsequent adjustments in plug-in levels will be required, depending upon 4N1 service order activity. Beyond initial deployment, plug ins should be obtained from PICS by the CO and I&M work groups via the PIPSO process. *When Raychem 4N1 systems are used for niche facility relief requirements, CO Line Cards and RT's required for cut over activities should be ordered by OSPE from PICS via FASTLite.*

4N1 Plug Ins

Part Number	Description	CLEI	Net Price $
138527-000	Line Card 4N1	SLL2T5KF2AA	328
972043-000	DooRT- swap out door, Siecor 7600, Fail-to-POTS	SLCIHLZBAA	390
551285-000	Remote Terminal- outdoor use, Siecor 7600, Fail-to-POTS	SLMSEDD3RA	425
859591-000	Indoor RT, Fail-to-POTS	SLML6L65RA	393
726781-000	Strand and Pole Mount RT (Raychem SuperRT, Non-Fail-to-POTS	SLMSKDE3RA	455
479651-000	Pedestal Mount RT, 4-line POTS, Non-Fail-to-POTS	SLML5U05RA	495

Note: The Raychem 4N1 DoorRT will snap on to an existing Seicor 6 Line ONI by simply removing the existing cover of the 6 Line ONI and replacing it with the DoorRT. information regarding the Seicor ONI is available in RL:92 03 026BT.

22.0 Vendor Information and Documentation

Documentation:

Miniplex Universal COT Installation Practice
Miniplex 4N1 Universal Digital Channel Product System Description
Miniplex 4N1 UDC Line Card Installation Practice
Miniplex 4N1 UDC Remote Terminal Installation Practice

Ordering Information:

BellSouth orders through EDI to Raychem *(Contract #* PR8389A). Orders that are not sent over EDI may be mailed or Faxed to:

Raychem
2625 Cumberland Parkway
Suite 275
Atlanta, GA 30339

Tel: 770-805-0052
Fax: 770-805-9522

Technical Support:

Tel: 800-227-8816 Ext. 5792 or 650-361-5792

Training:

Raychem provides suitcase training programs tailored to the local area and group needs. Raychem will supply training to the extent that it is required at no charge to BellSouth. An instructional videotape is available from Raychem at no charge. Contact Raychem at 770-805-0052 for additional information.

23.0 Acronyms

ADL	Additional Line
ADSL	Asymmetrical Digital Subscriber Line
AFIG	Address and Facility Inventory Group
BCT	Broken Connect Through
CO	Central Office
CDP	Clear Defective Pair
COSMOS	Computer System for Main Frame Operations
DLC	Digital Loop Carrier
FTP	Fail to POTS
ISDN	Integrated Services Digital Network
LCM	Loop Capacity Manager
LFACS	Loop Facilities Assignment and Control System
LMOS	Loop Maintenance Operations System
LTS	Line Terminal Status
LST	Line Station Transfer
LUVM	Loop Utilization View Module
NFTP	Non Fail to POTS
NID	Network Interface Device
NISC	Network Infrastructure Support Center
OE	Originating Equipment
ONI	Outside Network Interface
OSPCM	Outside Plant Construction Management
OSPE	Outside Plant Engineering
PG	F1 Pair Gain [Traditional DLC fiber or copper feeder]
RPG	Raychem Pair Gain
RT	Remote Terminal
SAC	Service Advocate Center
T1	T1 Carrier Signal @1.544mb/s
WOL	Wired Out of Limits

Raychem 4N1 Engineering Work Order

Exhibit A

							Page	of	
Prepared By→	I.M. Engineer		I&M Supervisor→		I.M. Supervisor		Job # ↓		
Tel #→	615-214-1111		Tel #→		615-214-2222		9802283612		
***** **LFACS** *****									
Central Office→	Main		C.O. CLLI/AREA #→		NSVLTNMA/82112		NNX→	615320	
RT CLLI/Area #	NSVLTNXXXXX/82333								
4N1 RT Address→	5238 University Drive						RT Type→	DoorRT FTP	
4N1 Wiring Limits→	5238 University Drive								
4N1 System #→	1	RPG Cable →	PG400		Pair Range→	1 - 4			
PGS Type→	MX4P	DSL Cable →	4x		Pair →	1			
Cut over Info:	Existing Phone # ↓	Existing Cable ↓	Existing Pair ↓				Relay Rack↓	Shelf ↓	Slot ↓
Existing Line→	320-1111	13	1015				0120.01	01	01
	Phone #(s) ↓	PG Cable ↓	Pair ↓	LTS ↓					
	320-1111	400	1	ES					
	320-2222	400	2	ES					
	320-3333	400	3	ES			↓ Customer Type ↓		
	320-4444	400	4	ES			Single	Multiple	
							X		
1/27/99	N9FY9B23A	N90DYR84B	N977L8K0A						
Due Date(s) →	2/11/99	2/11/99	2/11/99						
Note: Copper cable(s) and pair(s) to be used as the Support Pair(s)									
Support Cable(s) →	13								
Support Pair(s) →	1015								
Equipment Type→	(1) C.O. Line Card = SLLN3E02AA (1) RT = SLCIHLZBAA (DoorRT FTP)								
Notes→									
	Run jumper from cable 13 pair 1015 to DSL cable 4x pair 1 on frame								
	Main line # 320-1111 working on 13, 1015. Cut over to PG 400, 1								
	Assign 320-2222 from S.O. # N9FY9B23A on PG 400, 2								
	Assign 320-3333 from S.O. # N90DYR84B on PG 400, 3								
	Assign 320-4444 from S.O. # N977L8K0A on PG 400, 4								
	Change WL for address to show new MX4P terminal at 5238 University Drive								
	and make new terminal the primary terminal. Original serving terminal at P20 University Drive.								
***** **LMOS** *****									
PREPARED BY→	I. M. Engineer		TEL #→	615 214 XXXX	Job # →	9802283612			
NPA →	615	WC→	320	TEA→	RCM4X 5238 University Drive				
System Information									
PGSTYPE→	RCM4X	IDENTIFIER→	1		INTEGRATED? →	NO			
RTLOC→	5238 University Drive								
PGCABLE→	400	LOPR→	1		HIPR→	4	LLT→		
System pair Information									
CAB TY→	F1	CA→	13		PR→	1015	PRU→	PGH	
PRS→	OK	CNR→	T/R		COLR→		BP→		
Note: No additional support information required.									
micform.doc									

Raychem 4N1 Engineering Work Order

								Page	of
Prepared By→			I&M Supervisor→			Job # ↓			
Tel #→			Tel #→						
***** LFACS *****									
Central Office→	Main		C.O. CLLI/AREA #→			NNX→			
RT CLLI/Area #									
4N1 RT Address→						RT Type→			
4N1 Wiring Limits→									
4N1 System #→			RPG Cable→			Pair Range→			
PGS Type→	MX4P		DSL Cable →			Pair →			
Cut over info:	Existing Phone # ↓		Existing Cable ↓	Existing Pair ↓			Relay Rack ↓	Shelf↓	Slot ↓
Existing Line→									
	Phone #(s) ↓		PG Cable ↓	Pair ↓		LTS ↓			
						ES			
						ES			
						ES	↓ Customer Type ↓		
						ES	Single	Multiple	
Due Date(s) →									
Note: Copper cable(s) and pair(s) to be used as the SUPPORT PAIR(s)									
Support Cable(s) →									
Support Pair(s) →									
Equipment Type→	(1) C.O. Line Card = SLLN3E02AA (1) RT =								
Notes→									
	Change WL for address to show new MX4P terminal at:								
	and make the new terminal primary terminal. Original serving terminal at:								
***** LMOS *****									
PREPARED BY→			TEL #→			Job # →			
NPA →		WC→		TEA→					
System Information									
PGSTYPE→		IDENTIFIER→				INTEGRATED? →			
RTLOC→									
PGCABLE→		LOPR→				HIPR→		LLT→	
System pair Information									
CAB TY→		CA→		PR→			PRU→	PGH	
PRS→	OK	CNR→	T/R	COLR→			BP→		
Note: No additional support information required.									
mlcform.doc									

LFACS INVENTORY TRANSACTIONS

EXHIBIT B

** ADD FEEDER CABLE ** wc GIC priority D
emp RH page 1L

ca RPG310 rmk

	— pr —			— lts —						(N)
type	lo	hi	tsi	bz	co	fld	pgs#	rla#	sdp	tsb	dle
MX4P	**9**	**12**			**ES**	**ES**	**0003**	**1**			

next 2 (1) more cable counts (2) rla (M) (P) (Q) (E)

REMOTE TERMINAL ADDRESS wc GIC

page 2L

ca PG310

rla# 1	rla	**5238 UNIVERSITY DRIVE**
	rlc	**NSVLTNXXXXX**
	rmk	
rla#	rla	
	rlc	
	rmk	
rla#	rla	
	rlc	
	rmk	
rla#	rla	
	rlc	
	rmk	
rla#	rla	
	rlc	
	rmk	

next E
(E)

(1) more rla (M) (P)

```
** ADD TERMINAL **                          wc GIC      priority D
                                              emp RH        page 1L
tea 5238 UNIVERSITY DRIVE
    primary tea                                        (N)
    type FIXED ind IN  rt 5135 rz   cz   csa Y tpr 513577 prq? Y  dle
    rmk                                  tec
    rst: asgm                xcon                tsi  dbps
  ra only: phy cap      admin cap      pic type   table #
         assign bp?   first assign bp     bp seq  (O,E,B)
  rloe       rloa
                              rloc          loti    rvw rma
                  in-count
    ca            lo   hi  lsp/bp  pc
    RPG310        9    12

                                  metal out-count
                                ca        lo   hi   lsp/bp


next E   (1)more counts (2)tea data (3) other out-counts    (M) (P) (Q) (E)
       (4)asg bp data (6E)term (7E)prep term (8E)add cq/cd
```

```
** CHANGE TERMINAL **                          wc GIC      priority D
                                      emp RH       page 1L
tea F 887 INDIAN CREEK DR
    primary tea 5238 UNIVERSITY DRIVE
    type FIXED ind UNK  rt 1104  rz 13 cz   csa Y tpr 110403 prq? Y  dle
    rmk                                        tec
    rst: asgm                xcon                tsi  dbps
  ra only: phy cap      admin cap      pic type   table #
        assign bp?   first asgn bp     bp seq   (O,E,B)
  rloe        rloa
                           rloc           loti    rvw rma
               in-count
    ca         lo     hi   lsp/bp   pc
    935NIC     817    825  1
    DD3                    10
                                metal out-count
                                ca        lo   hi   lsp/bp


next E    (1)more counts (2)tea data (3)other out-cnts (4)abp data(M)(P)(Q)(E)
(6E)chg term: tea                                        (7E)cq/cd
```

```
** CHANGE FACILITY ADDRESS **          type STD    wc GIC      priority D
                                    emp RH        page 1L
 addr:no 887        st N INDIAN CREEK DR
    loc UNIT        FLR         BLDG          new st N
    com CLKSTN                  state
#csw 3    serv tea F 887 INDIAN CREEK DR
rst               rmk
```

<WKG LOOPS ASSOC>

```
next     (1E)chg fa:                    (M) (P) (Q) (E)
 no           st
 loc UNIT        FLR        BLDG
```

```
** CHANGE FACILITY ADDRESS **          type STD    wc GIC      priority D
                                       emp RH       page 1L
 addr:no 887        st N INDIAN CREEK DR
    loc UNIT        FLR         BLDG          new st N
    com CLKSTN                  state
#csw 3    serv tea 5238 UNIVERSITY DRIVE
rst               rmk
```

<WKG LOOPS ASSOC>

```
next E    (1E)chg fa:                    (M) (P) (Q) (E)
 no          st
 loc UNIT        FLR        BLDG
```

```
** EWO BULK INPUT **                          wc GIC      priority D
                    remove all items?    emp RH        page 1L
ewo 9802283612  tr LS.0001 dd 02-07-99 type: lst Y line move   recon   other
   associated tr                          establish in cof? Y
from ca 935NIC    to ca: f1 RPG310     f2          f3
                  f4          f5          f6
   to pairs:                        complete all items?  or select:
frpr f1   f2   f3   f4   f5   f6     wol    tea   addr     bct/s# x
817  9                                 A
```

```
tea code (A) 5238 UNIVERSITY DRIVE
tea code (B)
tea code (C)
tea code (D)
next E    (1) more bulk input (2) more tea codes (3) addresses   (M)(P)(Q)(E)
```

***Note: EBI must be completed in LFACS before copper support loop can be built in LFACS.**

```
** COF INPUT SCREEN **                    pwd
transaction CTS  wc  IC      prid        pri   emp  RLH
H ORD 9802283612:LS.0001


***** response *****

                CABLE THROW SUMMARY
                ___________________

     FEB 07, 1999    5:15:01  PM    WC: IC         PAGE:  1

ORD: 9802283612:LS.0001     FDD:         DD: 02-07-99   NUMBER OF TRANSFERS:
1
CKT-ID                                        T
  OE                                        O T R  T
  USOC        ST  WSC TYPE FROM_CP   ST       TO_CP    ST   A P E  A
-------------------------------------------------------------------

next        file              (2)edit (3)delete (4)append
                               (M)move (P)print (Q)quit
       MORE        MORE        MORE

** COF INPUT SCREEN **                    pwd
transaction CTS  wc  IC      prid        pri   emp  RLH
h ord 9802283612:LS.0001


***** response *****
404-320-1111
  013-300-011
  1FR          AC  NBT LST     13-1015 WK       RPG310-9 SF  X     N


**TRANSACTION COMPLETED



next        file              (2)edit (3)delete (4)append
                               (M)move (P)print (Q)quit
********** END ********** END ********** END **********
```

***Reminder: EBI must be completed in LFACS before copper support loop can be built in LFACS.**

```
** ADD TERMINAL **                          wc GIC      priority D
                                        emp RH        page 1L
tea RLA 5238 UNIVERSITY DRIVE
   primary tea                                          (N)
   type FIXED ind IN   rt 5135 rz    cz    csa Y tpr 513577 prq? Y  dle
   rmk                                        tec
   rst: asgm                  xcon                  tsi   dbps
 ra only: phy cap      admin cap      pic type    table #
      assign bp?   first assign bp     bp seq   (O,E,B)
 rloe       rloa
                              rloc           loti     rvw rma
            in-count
   ca       lo    hi   lsp/bp   pc
   935NIC  817

                                    metal out-count
                                  ca        lo    hi   lsp/bp


next E   (1)more counts (2)tea data (3) other out-counts     (M) (P) (Q) (E)
      (4)asg bp data (6E)term (7E)prep term (8E)add cq/cd
```

```
** ADD FALP **              addr:type STD        wc GIC     priority
                                        emp RH      page
 addr:no 5238        st UNIVERSITY DRIVE
    loc UNIT RLA      FLR         BLDG          new st N
    com                         state       mkseg     acct
#csw       serv tea RLA 5238 UNIVERSITY DRIVE
rst                rmk

ckid CKT DLC.RPG310.0003.1                tid
ckid(2)
ckid(3)
au 95DLC                          lp stat WKG  date
adl  tsp   ssp Y ssm Y esl  adsr Y subl  sus   fid brdg   ssc   rc/tr
owc   wol  dist tea
csw:ex Y trm Y   ww              pos      jack      dist bp
 f1 ca 13       pr 1015         commit stat
  rmk
 f2 ca 935NIC  pr 817           commit stat
  rmk
 f3 ca          pr              commit stat
  rmk                                    same oec? Y
next     (1)seg (2)ptp (3E)falp (4E)prep lp (5E)prep falp       (M,P,Q,E)
```

** ADD OEC **

wc GIC
page 2L

LNP ndicators: invu rtnn pout exk

OEC

manual intervention (y or n)	N	category (v,n,w,d,p,i,m,s,t)	W
grade (1,2,4, or 8-party)	1	co termination (s,b,c,x,n,m)	
class (r,b,c)	B	quality (o,l)	
# of wires (1,2,4,6,8, or u)	2	signaling (l,b,g,r,o)	
locally switched? (y or n)	N	metal requirements (y or n)	Y
pair gain indicator (p,l,h,v,t,u,n)		digital data rate (l,h,e,o,b,m)	E
		laty	
		loop qualification type	
		despecialization code	

next E

(M) (P) (Q) (E)

```
** CHANGE PAIR ATTRIBUTES **                    wc GIC      priority D
  ewo          tr                        emp RH        page 1L

ca 935NIC   pr 817                 type METAL          pgs#
                        stat: co      field      sdp   notice flag

rst                  rmk

   telemetry       transmission equip                  multiplicity 1
   load type       #pnts      unigauge     conditioning       loop stat WKG
   pair usage PGH                                  commit stat

defect: type     date        ctt
      defect rmk

co side (connect from): ca          pr      exj?

fld side (connect to):  ca 13      pr 1015 exj? Y
   ca          pr      ca          pr      ca          pr
   ca          pr      ca          pr      ca          pr

next E      (1E)chg pr: ca          pr              (M) (P) (Q) (E)
```

```
** COF INPUT SCREEN **                          pwd
transaction CIE  wc  IC      prid          pri    emp  RLH
H ORD 9802283612LS.0001/DD 02-07-99/OT NC/ADSR Y
I CKID CKT DLC.RPG310.0120.01-01-001
I CP 13-1015/STP DP/GF 4X0120.01-01-001

next        file              (2)edit (3)delete (4)append
                               (M)move (P)print (Q)quit
```