PG-Flex*Plus*

PG-Flex*Plus* System Overview, Applications and Specifications

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ADC

Revision History of this Document

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02	April 13, 2001	Updated UAP application figures, corrected product specification errors. Removed references to PMX-743, added FRE-765 List 4A.
03	May 3, 2001	Correct cabling specifications for FRE-860 and FRE-865.
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1. Executive Summary

PG-Flex*Plus*™ is a subscriber carrier platform enabling the cost-effective deployment of multiple voice and data services using Digital Subscriber Line (DSL) transport technology over one or two unconditioned copper pairs. The PG-Flex*Plus* system is comprised of a Central Office Terminal Shelf (COTS) with line, multiplex, and management units; 4 or 6 line PG-Plus Network Interface Devices (NIDs); 24 to 96 line PG-Flex remote enclosures and an optional Universal Access Platform (UAP) GR-303 concentrator. This system is used in a variety of applications, creating more efficient utilization of network facilities including:

- Copper pair relief
- Plain Old Telephone Service (POTS) and data service extensions over unconditioned pairs
- Support for near-term growth includes High-bit-rate Digital Subscriber Line 2 (HDSL2) transport and Asymmetrical Digital Subscriber Line (ADSL) G.lite and G.shdsl service

The PG-Flex*Plus* Central Office (CO) equipment is designed with a digital (DS1) switch interface. The line units on the PG-Flex*Plus* access shelf are provisioned for TR-08 or D4/SF/ESF signaling for incumbent networks. This system offers a number of unique benefits:

- Control of capital budget
  - More economical than traditional solutions
    - Re-arrangements
    - Clearing defective pairs
    - Adding new copper in the distribution plant
  - Reduced new copper feeder placements
  - Reduced installation costs
- Reduced held orders
  - Rapid deployment
  - Deployment flexibility
- Low first-cost deployment
- Support for V.90 modems

Since the PG-Flex*Plus* CO equipment is environmentally hardened, it is deployed out in the network subtending DS1 tributaries from high-speed multiplexers or fiber based Next Generation Digital Loop Carrier (NGDLC) systems. As a result, pair relief can be achieved further into the network. With a digital interface into the switch, the need for expensive analog equipment in the CO becomes unnecessary. Additional wiring costs are reduced as a result of the elimination of the analog connections.

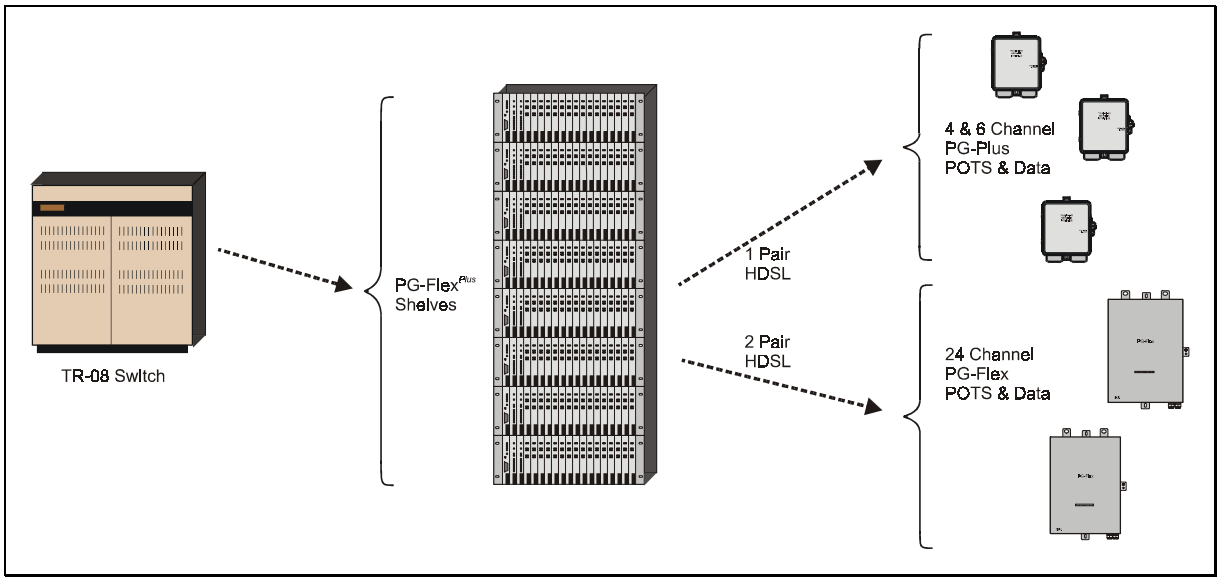


Figure 1
PG-Flex*Plus* Integrated System with TR-08 Interface

The optional UAP concentrator is used in conjunction with PG-Flex*Plus* access shelves for industry standard GR-303 connectivity, and is fully interoperable with Lucent 5E, Nortel DMS®, and Siemens EWSD® switch families. The UAP provides all the benefits associated with GR-303 such as dynamic bandwidth allocation and DS0 concentration.

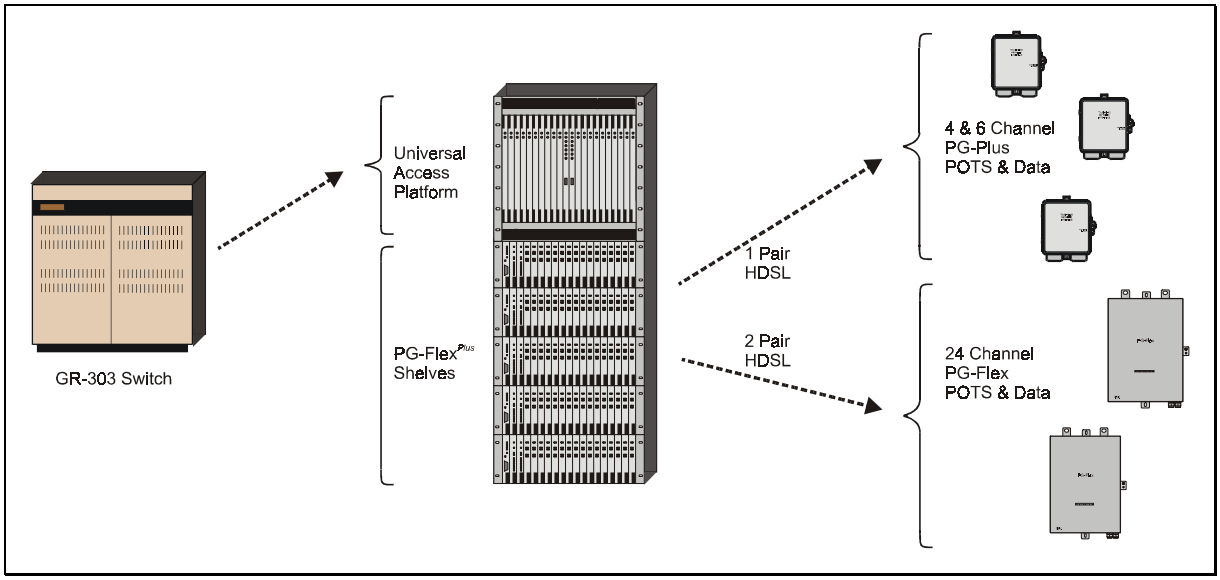


Figure 2
PG-Flex*Plus* Integrated System with GR-303 Interface

Table 1 summarizes the features and benefits of the PG-Flex*Plus* as a standalone system and when combined with the Universal Access Platform (UAP).

Table 1
PG-Flex*Plus* and UAP Features and Benefits

Feature	Benefit
Multiple Services over One or Two Pairs	Provides multiple services over one or two pairs, maximizing the utilization of the existing copper plant.
Network Management over a Local Area Network	Alarm reporting and provisioning can be centralized to a Network Operations Center (NOC) using TL1 over Telnet sessions. The PG-Flex*Plus* and UAP sites can be accessed over a Local Area Network (LAN) to obtain and evaluate alarms, T1 performance data, and other status information, providing high quality service at the lowest cost.
Modular Expansion	The system can be expanded gradually from Time Division Multiplex (TDM) technology to Asynchronous Transfer Mode (ATM) and Synchronous Optical Network (SONET) technologies as cards become available. It can be configured initially with a minimal card set, then new cards can be added as system requirements expand.
Redundancy	The PG-Flex*Plus* and UAP provide equipment redundancy on all critical elements that affect service on more than one DS1 of service.
GR-303 Concentration	GR-303 concentration minimizes port costs on the Class 5 switch and greatly reduces the recurring expenses of backhauling traffic between COs.
Full DS0 Cross Connection	Support for full DS0 cross connects allows the system to be feed with T1s carrying a mixture of voice and data services and eliminates the need for another cross connect. Voice can be assigned to the GR-303 interface and the data can be efficiently groomed onto non-303 trunks.
Growing Service Offerings	New data services and ATM interfaces are being developed. The flexibility of the architecture and supporting developments ensure that the PG-Flex*Plus*/UAP package will continue to grow more valuable and versatile – the design is future-safe.

2. Applications

This chapter describes various scenarios where PG-Flex*Plus* can be used to provide cable capacity relief in all segments of the outside plant. As shown in Figure 3, the operating company network is divided into three sections:

1. Feeder Plant: About 65% of the outside plant network between the CO and the first cross box is copper. This is usually the first section of the outside plant that experiences capacity problems and is an excellent candidate for cable capacity relief through the addition of new cable or deploying Digital Loop Carrier (DLC) systems.
2. Distribution Plant: The distribution plant, between the first cross box and the last cross box, or pedestal, is pure copper. While there is typically over-capacity within the first cross box, the distribution cables toward the subscriber are either out of capacity or under utilized.
3. Drop Cables: Like the distribution plant, the drop cables serving individual subscribers are copper and are typically two pair. As existing subscribers add new circuits, spare pairs in the drops quickly become depleted.

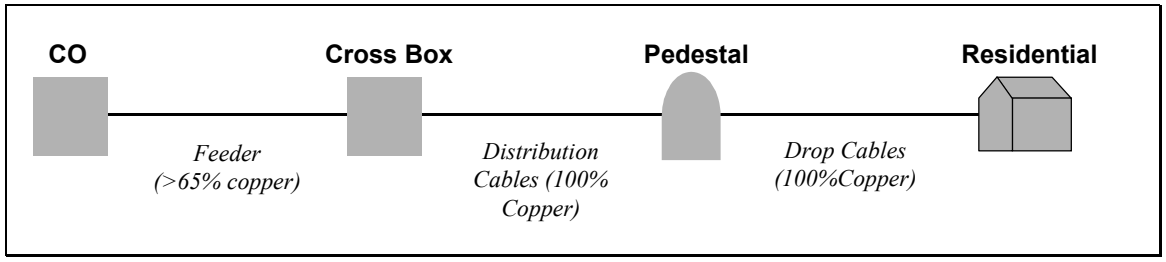


Figure 3
Network Segments

Operating companies have a variety of ways to address the growth of their network, as indicated in Table 2. Unfortunately, not every option is available and is heavily dependent on: whether the outside plant is primarily above ground or buried, the operating condition of the existing plant, whether there are any right-of-way issues associated with deploying new cable or fiber, and the growth rate for the area being served.

Table 2
Network Growth Options

	Low Growth Areas				High Growth Areas	
Network Segment	**Deploy PG-Flex*Plus***	**Re-arrange-ments**	**Clear Defective Pairs**	**Place New Cable**	**Deploy NGDLC**	**Place New Cable**
Feeder Plant	●	●	●	●	●	●
Distribution Plant	●	●	●	●	●	●
Drop Cables	●			●		

2.1 Feeder (F1) Relief

Twenty-four channel PG-Flex*Plus* systems are used to provide feeder relief by placing PG-Flex Remote Terminals (RTs) at the cross box (see Figure 4). The RTs can be mounted directly to the

cross box or installed in a cabinet adjacent to the cross box. DSL circuits between the PG-Flex^{Plus} COT shelf and PG-Flex RT also power the RT electronics.

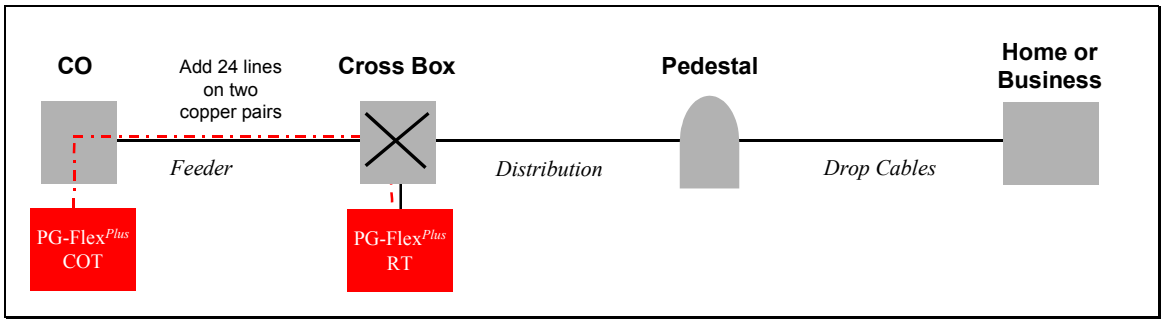


Figure 4
Feeder (F1) Relief – CO to Cross Box

2.2 Distribution (F2) Relief

Relief in the distribution plant can be achieved by placing the PG-Flex^{Plus} COT shelf in the central office or co-located with a NGDLC RT.

2.2.1 CO to Pedestal

Figure 5 shows the PG-Flex^{Plus} system providing cable capacity relief for the feeder and distribution plant by placing the PG-Flex RT or PG-Flex^{Plus} Network Interface Device (NID) at the far end of the distribution plant.

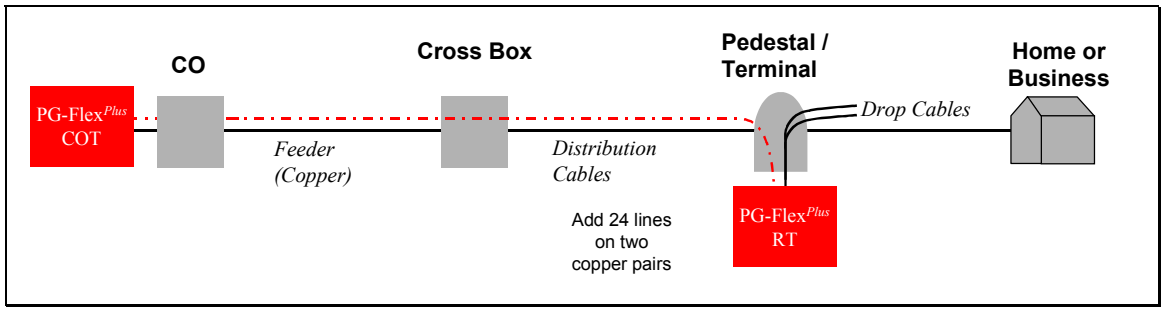


Figure 5
Distribution (F2) Relief – CO to Pedestal

2.2.2 NGDLC RT to Pedestal

Where the feeder plant is already fiber, the PG-Flex^{Plus} CO equipment is co-located with a NGDLC RT or in a cabinet adjacent to NGDLC RT. In this case, the PG-Flex^{Plus} CO equipment receives its power from the NGDLC RT; the RTs and NIDs are still line powered from the PG-Flex^{Plus} CO equipment (see Figure 6).

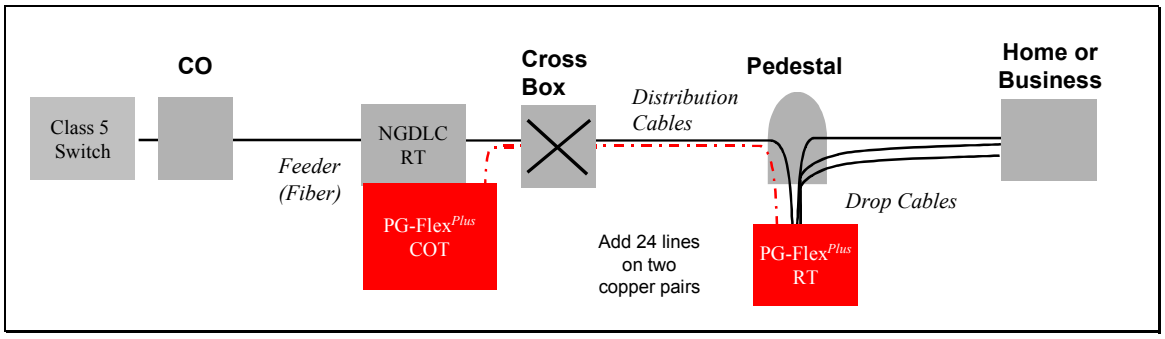


Figure 6
Distribution (F2) Relief – NGDLC RT to Pedestal

2.3 Subscriber Drop Relief

Pair relief to the subscriber is accomplished with a variety of PG-Flex^{Plus} deployment configurations.

2.3.1 CO to Subscriber

Figure 7 is the typical deployment strategy where there is copper from the CO to the subscriber and provides pair relief from the CO to the subscriber. The PG-Flex^{Plus} CO equipment is installed in the CO and the remote equipment is placed on the customer's premises.

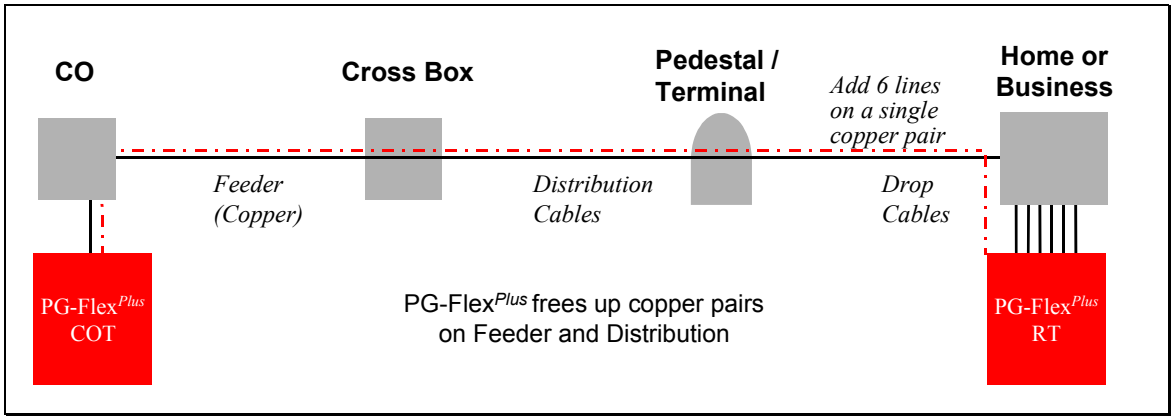


Figure 7
Drop Relief – CO to Subscriber

2.3.2 NGDLC RT to Subscriber

Where there is a fiber-based DLC system, the PG-Flex^{Plus} CO equipment can be placed in the DLC's RT enclosure and will provide pair relief from the NGDLC RT to the subscriber (see Figure 8).

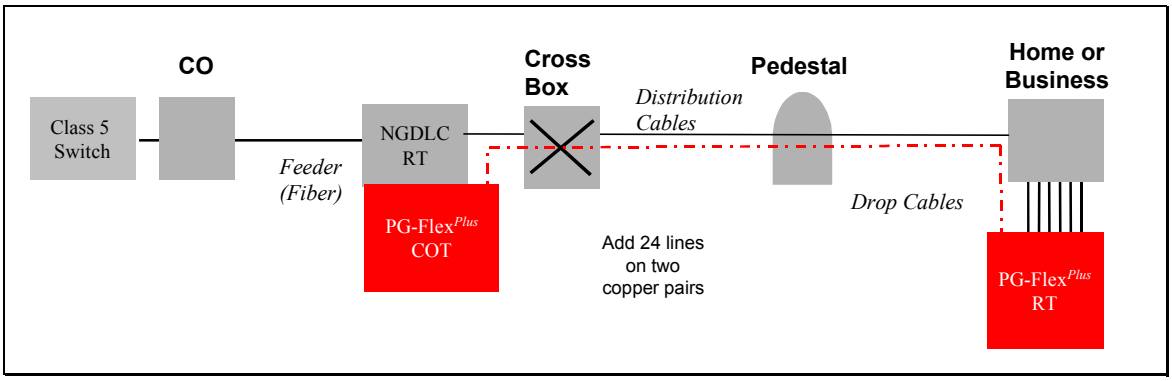


Figure 8
Drop Relief – NGDLC to Subscriber

3. System Architecture and Components

PG-Flex*Plus* is a subscriber carrier based system utilizing HDSL as the transport method between the CO and RT over one or two unconditioned copper pairs. The PG-Flex system uses HDSL 2B1Q technology to transport up to 24 DS0s of subscriber services between the CO and RT. The RT is line powered from the central office.

ADC combines the capabilities of the PG-Flex and PG-Plus Subscriber Carrier Systems in the PG-Flex*Plus*. The PG-Flex*Plus* provides POTS, Integrated Services Digital Network (ISDN), Universal Voice Grade (UVG), Loop-start/Ground-start (LS/GS), Digital Data Service (DDS), V.90 modem, and frame relay compatibility and in the future will offer G.lite, G.shdsl, ADSL and ATM from the same platform. Network Operation Centers monitor and manage PG-Flex*Plus* systems with up to 240 DS1 inputs by telnet.

The integrated system is comprised of line units in the CO and 4 or 6 channel NIDs or 24 to 96 channel RTs. Up to 32 integrated systems (192 DS0s) can be supported in a 23" COT shelf. An Alarm or Management unit, common to all systems installed in the COT shelf, provides an interface for alarm relays and testing of subscriber circuits. A multiplexer card takes the DS0s from the PG-Flex systems and converts them to a D4, ESF, or TR-8 (DSX-1) interface.

The remote end of the PG-Flex*Plus* system is housed in a RT enclosure. RT enclosures are designed for outdoor and indoor applications and may be pole or wall mounted. These enclosures support one, or more, systems. The benefits of using HDSL yield better range, quality and transmission performance. The design of the PG-Flex*Plus* also allows for fast and easy installation. PG-Flex*Plus* supports all Custom Local Area Signaling Services (CLASS), supports subscriber line testing and remote monitoring of system performance.

PG-Flex*Plus* can support up to 24 channels on two 24 AWG wire pairs up to a distance of 12 kft without doublers and up to 36 kft feet with doublers. Four channel service on one 24 AWG wire pair is supported up to a distance of 21 kft. Remote terminals are line powered from the COT. Powering remote terminals from the CO eliminates local powering costs.

Deploying PG-Flex*Plus* can alleviate the lack of acceptable copper pairs. The addition of PG-Flex*Plus* to a network can be a permanent solution as well as a temporary bridge to new facilities. PG-Flex*Plus* provides the ability to add capacity in the F1 (feeder), F2 (distribution), and drop.

3.1 System Architecture

The PG-Flex*Plus* can be deployed from CO or NGDLC remote cabinets using a TR-08 interface. As shown in Figure 9, the same PG-Flex*Plus* configuration can be used for either application; all POTS, UVG, ISDN, and DDS services are supported. When the PG-Flex*Plus* CO equipment is placed at the NGDLC RT, it can be installed in the RT when there is space available, or installed adjacent to the RT in adjunct cabinet.

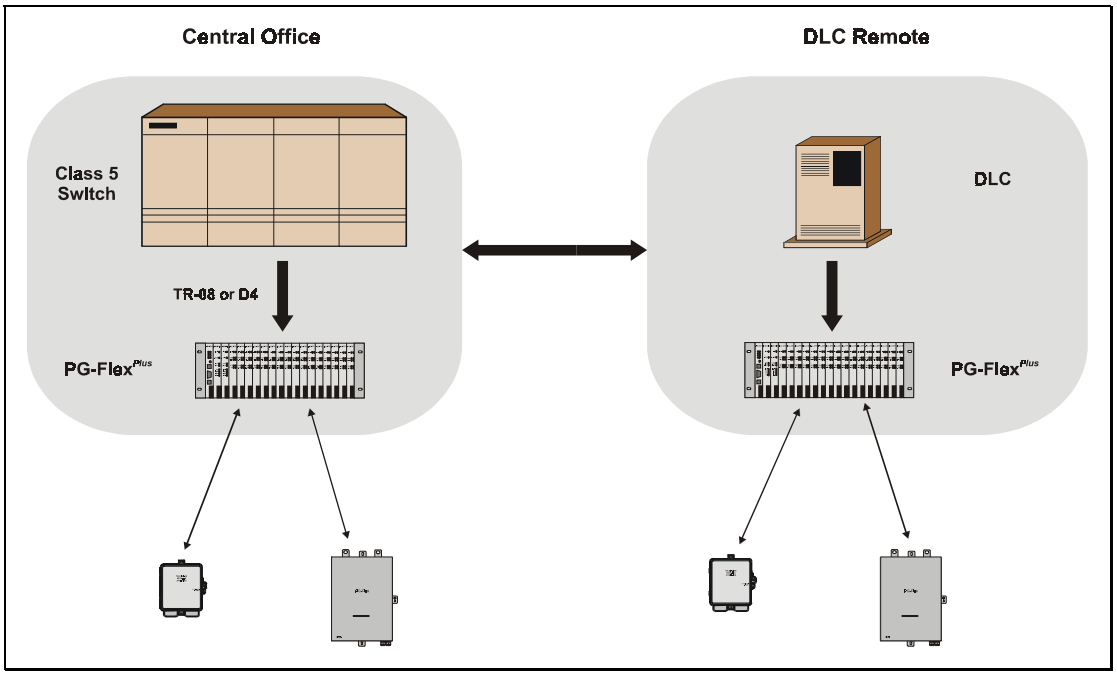


Figure 9
PG-Flex*Plus* Integrated System with TR-08 Interface

A GR-303 interface to the CO switch is supported through the UAP (see Figure 10). DS1 circuits from the UAP feed the PG-Flex*Plus* systems located in the CO or at remote locations.

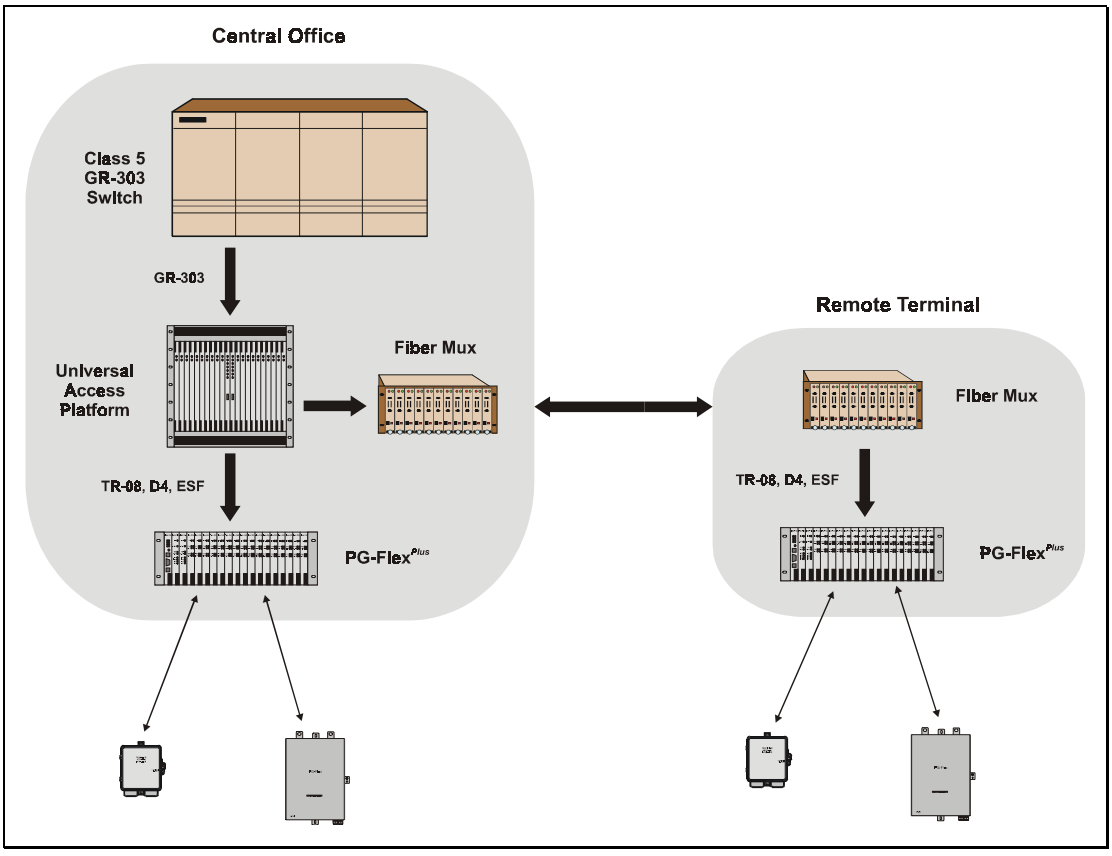


Figure 10
PG-Flex*Plus* Integrated System with TR-303 Interface

3.2 PG-Flex*Plus* – Central Office Equipment

PG-Flex*Plus* CO equipment consists of the PG-Flex*Plus* COT shelf, one PMU-712 management unit, one or two PMX-744 multiplex units, and up to 16 integrated CO line units. Figure 11 shows a fully-populated PG-Flex*Plus* COT shelf with 16 DICOLUs that support 32 4 or 6 channel NIDs.

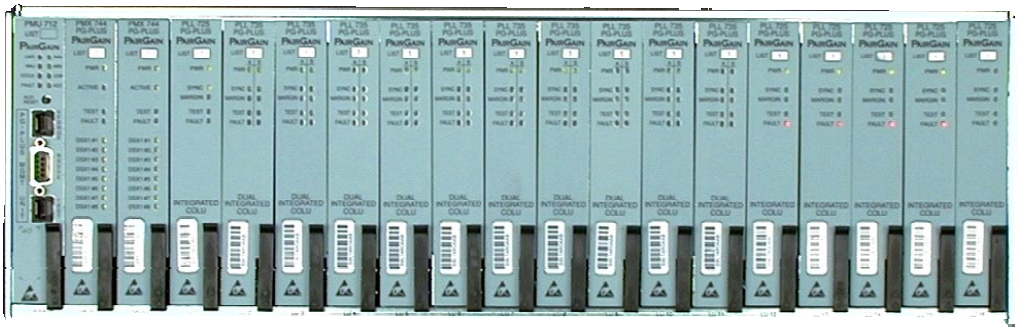


Figure 11
PG-Flex*Plus* Central Office Terminal Shelf

3.2.1 COT Shelf

The PCS-719 PG-Flex*Plus* COT shelf is equipped for front or rear mounting in a 23-inch equipment rack and accommodates one Management Unit, two Multiplex units (for redundancy), and 16 DICOLUs or eight FICOLUs. The shelf has screw terminations for dual CO battery feeds for redundant powering, a DB-25 for connecting to the network monitoring system, and a BNC for 10Base2 communications between PCS-719 COT shelves. DS1, HDSL, composite clock, and alarm terminations are on wire-wrap posts.

3.2.2 Management Unit

The PMU-712 management unit provides the user interface into the PG-Flex*Plus* CO shelf. The PMU supports provisioning, monitoring, and testing of multiplex and line units installed in the CO shelf.

The PMU-712 supports subscriber drop testing through the VT-100 craft interface and the TR-08 frame format DS1 interface. Results are pass/fail and conform to TA-909 requirements. The results are reported on the VT-100 craft terminal and as three-terminal resistive signatures that can be measured by the CO test system.

Two independent RS-232 serial ports, one on the front panel and another on the backplane support a VT-100 compatible terminal or modem interface for user provisioning, status queries, and autonomous alarm reporting. The PMU also supports a 10Base-2 connector on the backplane to manage multiple CO shelves through a single connection. Both a proprietary screen-based and a Telcordia compliant TL1 user interface are supported.

The PMU contains a non-volatile database that stores provisioning data for all PG-Flex*Plus* systems and the PMX units in the CO shelf. The PMU monitors the status of other system units, and provides audible and visual alarms classified as major, minor, and critical. Front panel indicators include power, alarm, and composite clock synchronization LEDs. An alarm cutoff (ACO) switch disables any existing audible alarms.

The PMU generates independent 64 k and 8 k system clock signals from a composite bipolar clock signal connected through the CO shelf backplane. These clock signals are used by the DDS cards and are distributed on the backplane. The clock signals also appear on the front panel as a 64 k bit and 8 k byte clock.

3.2.3 Multiplex Units

The PMX-744 multiplex unit provides a digital interface between the PG-Flex*Plus* COT shelf and the DS1 facilities. A non-blocking digital cross-connect within the PMX maps the DS0 channels from the DS1 lines to the PG-Flex*Plus* Central Office Line Units (COLUs). The PMX can multiplex voice, voice and data, or data services. Two PMX cards, active and standby, can be installed in the COT shelf for added system reliability. The PMX-744 supports eight DS1 facilities (192 DS0s) and allocates 12 or 24 DS0s per COT shelf slot, depending on the type of integrated central office line unit installed.

The PMX supports D4, Extended Super-frame (ESF), and TR-08 DS1 frame formats, and Alternate Mark Insertion (AMI) or Binary 8 Zero Suppression (B8ZS) DS1 line encoding. DS1 alarm monitoring for each of the DS1 facility interfaces and DS1 performance monitoring are provided, as well as in-band and craft initiated DS1 loopbacks.

PMXs provide extensive real-time, non-disruptive monitoring of DS1 transmission performance parameters. The PMX generates alarms for problem conditions on the DS1 transmission facilities. PG-Plus provides user-selectable threshold settings for these measurements. These alarms are activated at the designated threshold settings.

3.2.4 Line Units

The PG-Flex*Plus* system supports two Integrated Central Office Line Units (ICOLUs). For four and six DS0 applications, the PLL-735 Dual Integrated Central Office Line Unit (DICOLU) is used, where each PLL-735 supports two RTs. For 24 DS0 applications, the FLL-814 PG-Flex Integrated Central Office Line Unit (FICOLU) is used which supports one RT.

HDSL technology is used to transport the DS0s between the ICOLUs and the RTs. The PLL-735 uses one copper pair for each NID and the FLL-814 uses two copper pairs for each RT. The ICOLUs provide line powering of the RTs over the same HDSL pairs to eliminate dependence of local power at the RT sites.

To support the Integrated Digital Loop Carrier (IDLC) functions, a PMU must be installed in the PG-Flex*Plus* COTS. The ICOLUs communicates through the PMU for setup of the IDLC services. When operating in the IDLC mode, the system determines the type of service being supported based on the type of NID connected or the channel units installed in the RT.

The FLL-814 ICOLU can use up to two doublers to extend the distance between the FLL-814 and the RT. For each doubler installed in the circuit, two auxiliary power pairs are required between the FLL-814 and the RT (in addition to the HDSL pairs). Doublers cannot be used with the PLL-735.

3.3 PG-Flex*Plus* – Doublers

Doublers (repeaters) re-generate the HDSL signals between the CO and RT equipment to extend the operating distance between this equipment. Doublers are used with the 24 channel systems; they are not available for the four and six channel systems. See Table 32 on page 63 for a typical PG-Flex*Plus* system with doublers.

Up to two doublers can be used with a 24 channel system. Each doubler is powered over the HDSL transport pairs connected through the doublers. For each doubler installed in the circuit two additional power pairs, of the same equivalent wire gauge as the HDSL transport pairs must be installed between the PG-Flex*Plus* CO line unit and the PG-Flex RT line unit.

3.4 PG-Flex*Plus* – Remote Terminal Equipment

Remote terminal equipment provides a wide range of subscriber services, including POTS, and ISDN. They range in size from 4 and 6 channel NIDs to 96 channel enclosures and offer a variety of mounting, termination, and protection options.

3.4.1 4 and 6 Channel RT NIDs

The PRL-77x series of RT NIDs are used in conjunction with the PLL-735 CO line unit. These NIDs deliver four or six DS0s of various combinations of POTS, ISDN, and UVG services. The NIDs are designed for outdoor mounting, are available in several standard housings to simplify retrofitting of existing pure-copper NIDs, and include primary protection for the HDSL connection.

Figure 12
NID (external)

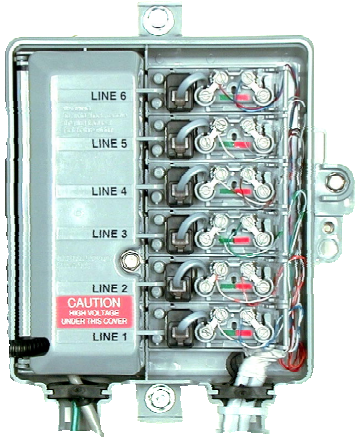


Figure 13
NID (internal - typical)

3.4.2 24, 48, and 96 Channel RT Enclosures

The 24 channel RT enclosures are available in environmentally hardened models for outdoor applications, and indoor models for equipment room mounting. These enclosures range in capacity from one to four systems, where each system is comprised of one 24 channel RT line unit and from one to three RT channel units.

3.4.2.1 Outdoor Enclosures

The FRE-860 series of outdoor enclosures provide solutions for pedestal applications when it is not possible to mount the RT enclosure on an existing structure. These enclosures house a single 24 channel system, utilize screw terminals or stub cables for all HDSL, auxiliary power and subscriber connections, and include 5-pin protector fields for primary protection of all circuits terminated in the enclosure.

Figure 14
FRE-860 – 24 Ch. RT Enclosure

For outdoor applications where the RT enclosures can be wall- or pole-mounted, the FRE-865 and FRE-867 provide cost-effective solutions. The FRE-865 enclosure houses one 24 channel system and the FRE-867 houses two 24 channel systems. Both enclosures are available with either gel-filled or air-filled cable stubs for all HDSL, auxiliary power and subscriber connections, and include 5-pin protector fields for primary protection of all circuits terminated in the enclosure.

Figure 15
FRE-865 – 24 Ch. RT Enclosure

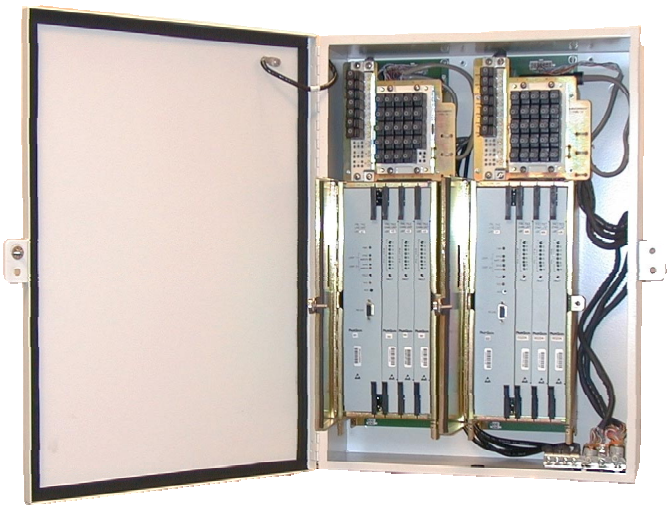


Figure 16
FRE-867 – 48 Ch. RT Enclosure

3.4.2.2 Indoor Enclosures

FRE-868 and FRE-869 RT enclosures are designed for indoor applications only. The FRE-868s are wall-mounted enclosures that support one or two 24 channel systems. HDSL and auxiliary power connections are on screw terminal blocks; subscriber terminations are on 25-pair male Amphenol connectors. These enclosures are offered with and without 5-pin protector fields for primary protection of the HDSL and auxiliary power connections.

Figure 17
FRE-868 – 24 Ch. RT Enclosure

Figure 18
FRE-868 – 48 Ch. RT Enclosure

Figure 19
FRE-869 – 96 Ch. RT Enclosure

The FRE-869 RT enclosures are for wall- or rack-mounting and house four 24 channel systems. All HDSL, auxiliary power, and subscriber terminations are through 25-pair male Amphenol connectors. There are no provisions for primary protection in these indoor RT enclosures.

3.4.3 24 Channel Remote Line Units

The FRL-842 24 channel remote line unit resides in any of the 24, 48, and 96 channel RT enclosures. This unit incorporates the HDSL transceivers, power supply, and common control for the RT channel units. LEDs on the front panel provide status indicators for system power, HDSL sync and margin, and alarm conditions. A VT-100 craft port is included for viewing system provisioning and monitoring system performance.

3.4.4 Remote Channel Units

Channel units are used in conjunction with the 24 channel line units to provide subscriber services. The FRC-753 provides eight LS/GS POTS circuits. The FRC-756 provides four ISDN 2B+D circuits.

3.4.4.1 POTS

The eight FRC-753 List 4C circuits are automatically, and individually, configured for loop-start or ground-start operation. This card supports CLASS services, line-side answer supervision, forward disconnect, and distinctive ringing.

3.4.4.2 ISDN

The FRC-756 maps the four ISDN circuits into 12 DS0s in a 3-DS0 format. It presents the LULT (line unit line termination) interface toward the subscriber's equipment. Each ISDN circuit can be provisioned for interim or segmented performance monitoring.

3.5 Field Shelf

The PCS-822 PG-Flex*Plus* Field Shelf (FS) extends the pair relief capabilities of the PG-Flex*Plus* into the F2 (distribution) plant using the same PG-Flex*Plus* central office plugs as used in the PCS-719 COTS (see Figure 20). Standard 200-mechanics T1 or HiGain HDSL and HDSL2 plugs provide the interface to the CO over copper pairs, through an NGDLC RT, or remote fiber

multiplex unit. The PCS-822 may be wall, post, or pedestal-mounted for outside plant applications.

Each PCS-822 accepts up to four DSX1, T1, HDSL, or HDSL2 interfaces and supports D4, ESF, or TR-08 frame formats. Four dual-slot FICOLUs, eight single-slot DICOLUs, or any combination of these units not exceeding eight slots, can be installed in the PCS-822. Battery power is derived from the –48 Vdc used by the serving equipment (NGDLC RT or local battery plant).

A PG-Flex*Plus* PMU-712 Management Unit and one PMX-744 Multiplex Unit (two for equipment redundancy) are required. Subscriber drop testing is accomplished through the PMU. When served through a TR-08 interface, test results are provided at the PCS-822 as TR-909 three-terminal resistive signals that can be measured by a remote test head in the NGDLC RT and reported back to the CO loop test system.

Figure 20
Field Shelf Enclosure

Primary protection is provided for all interfaces toward the CO (DSX1/T1/HDSL) and for the HDSL and auxiliary power feeds toward the PG-Flex RTs and PG-Flex*Plus* NIDs.

3.6 Universal Access Platform

The UAP is a next-generation access solution for service providers. Combining multiple network elements, technologies, and services in a single platform, the UAP maximizes existing infrastructure and reduces operational transport cost. The UAP can be connected both to a switch and to transmission equipment for dedicated services.

The UAP is designed for installation in a 23-inch standard equipment rack and conforms to NEBS Level 3 specifications. Up to three UAPs, a fuse/alarm panel, and three optional 1:8 DS1 protection switches can be mounted in a seven-foot rack, providing a total of 720 DS1 ports in the rack.

The UAP maximizes the flexibility of service offerings in business applications by deploying remote units in co-location or as close to subscribers as is economically possible. By bringing a digital signal close to the subscriber, increased service options and bandwidth are available to the

customer. When the shelf is loaded with DS1 cards only, each UAP supports up to 240 1.544 Mbps DS1 interfaces, for a maximum of 5760 DS0s.

Time slot and cross-connect functions in the UAP are equivalent to an electronic digital distribution frame (DDF). For non-GR-303 applications, the unit provides non-blocking cross-connection of up to 240 DS1 digital links, without the need for demultiplexing, allowing semi-permanent 64 kb/s transmission paths to be set up under software control. Any time slot on the exchange side can be cross-connected to any subscriber time slot on the system.

The UAP supports Telcordia GR-303 concentration to transport DS1 voice services from a CO voice switch to remote subscribers. It provides the interface between the distribution network and the GR-303 DS1s from the telephone exchange, performing the GR-303 functions internally. By implementing GR-303 concentration, the UAP greatly reduces the number of DS1 lines and associated facilities needed to backhaul these services from the point of presence to the CO switch. The UAP is capable of interfacing to the Lucent 5ESS® , Nortel DMS-100/500® or Siemens EWSD® digital switches, using the GR-303 digital interface as defined by the Telcordia GR-303 specification.

A single UAP supports multiple GR-303 Interface Groups (IGs), with each IG supporting up to 28 DS1 lines. Any data or special services can be cross-connected out before they reach the local digital switch.

With GR-303 signaling, the primary and secondary DS1 feeders carry both Embedded Operations Channel (EOC) and Time Slot Management Channel (TMC) channels on time slots 12 and 24 respectively, for messages between the switch and the UAP. Going towards the GR-303 switch, the same channels are carried on two different DS1s, therefore providing an integral 1:1 dynamic protection for the EOC and TMC channels. For the connection to the distribution network, the UAP can accept TR-08, D4 or ESF signaling. The DS1 interfaces are configured individually as either Customer Provided Equipment (CPE) lines or switch ports. The UAP converts D4 or ESF signaling from DS1 channel banks and/or DLCs to a GR-303 concentrated connection to the digital switch.

On the distribution side, the UAP supports concentration ratios from 1:1 to 20:1 for GR-303 applications, depending on customer traffic profiles. When equipped with DS1 cards only and using a 3:1 concentration ratio, the UAP supports up to 180 DS1s from subscribers and 60 ports for the switch side (without protection on the subscriber side).

By implementing GR-303 concentration, the UAP greatly reduces the number of T1 lines and associated facilities needed to backhaul services between central offices. The actual concentration selected depends on the traffic load and the grade of service offered to the subscribers.

GR-303 permits the concentration of a maximum of 2048 subscribers on the facility side into a minimum of two and up to a maximum of 28 T1 lines on the switch side. Each subscriber is assigned the same CRV (Call Reference Value) on the subscriber side and on the host digital switch. The 28 T1s on the LDS side have 672 (28 x 24) DS0s. Four of these DS0s are used for duplicated EOC and TMC channels. The remaining 668 channels carry voice and data traffic. Higher or lower concentrations are easily obtained by varying the number of T1s on the Local Digital Switch (LDS) side or the facility side.

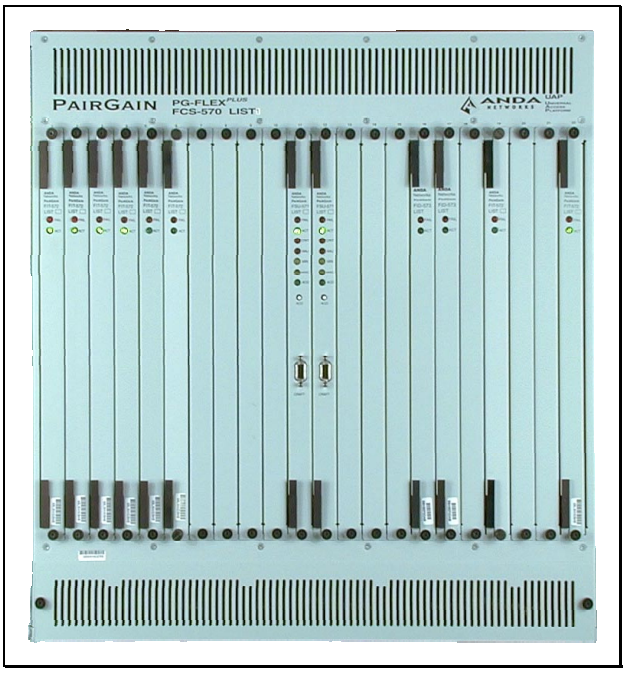


Figure 21
Universal Access Platform

3.6.1 COT Shelf

The FCS-570 22-slot UAP shelf is equipped for front or rear mounting in a 23-inch equipment rack and accommodates the CPU, DS1, and DS3 modules. Two slots are dedicated for two (redundant) CPU controller cards and 20 universal card slots are available for different types of line cards, including the DS1 and DS3 modules. The shelf has screw terminations for dual CO battery feeds for redundant powering. Ethernet connectors are included for connecting to a LAN. DS1 connections are through 25-pair male Amphenol connectors; DS3 connections are through BNC connectors.

3.6.2 CPU Module

The FSU-571 CPU module controls all dynamic (GR-303) and static (nailed up) DS0 cross connections between DS1 and DS3 line cards in the chassis; cross connects DS1s; polls for the operating status of each card; logs and stores alarms; and controls DS1 and DS3 protection schemes. One or two CPU modules can be installed in the UAP shelf. Redundant pairs increase reliability and reduce system downtime.

3.6.3 DS1 Module

FIT-572 DS1 modules supports 12 DS1s. Each DS1 module can be configured with both CO-side and network-side connections and support SF, ESF, and TR-08 frame formatting. Up to 20 DS1 modules can be installed in the UAP shelf.

The FIT-572 List 1 is used for SF and ESF connections; the FIT-572 List 3 is used for TR-08 connections.

3.6.4 DS3 Module

Each FID-573 DS3 module supports 1 DS3 carrier interface (28 DS1s). The DS3 module can be configured with either a line-side (CPE) or network-side connection. Up to 18 DS3 modules can be installed in the UAP shelf, with 1:1 redundancy recommended.

3.6.5 1:8 Protection Switch

The FTP-579 provides protection switching for eight DS1 modules. For each FTP-579 installed, a DS1 module must be dedicated for protection switching. For a system fully populated with 20 DS1 modules, three FTP-579 protection switches are required and three of the DS1 modules are dedicated to protection switching, leaving 17 DS1 modules for service.

Figure 22
1:8 Protection Switch

4. System Configuration Guide

PG-Flex*Plus* supports a variety of configurations. 4, 6, and 24 channel systems can be combined and managed in a single COT shelf. If GR-303 support is not required as part of the initial deployment, it can be added later without requiring any changes to the existing PG-Flex*Plus* equipment.

4.1 4 and 6 Channel Systems with TR-08/D4/ESF Interface

Figure 23 shows the typical configuration for a PG-Flex*Plus* system supporting 4 and 6 channel systems. While only one PMX-744 Multiplex Unit is required for operation, a second PMX-744 provides equipment protection. The PMU-712 Management Unit is required for system provisioning and alarm monitoring.

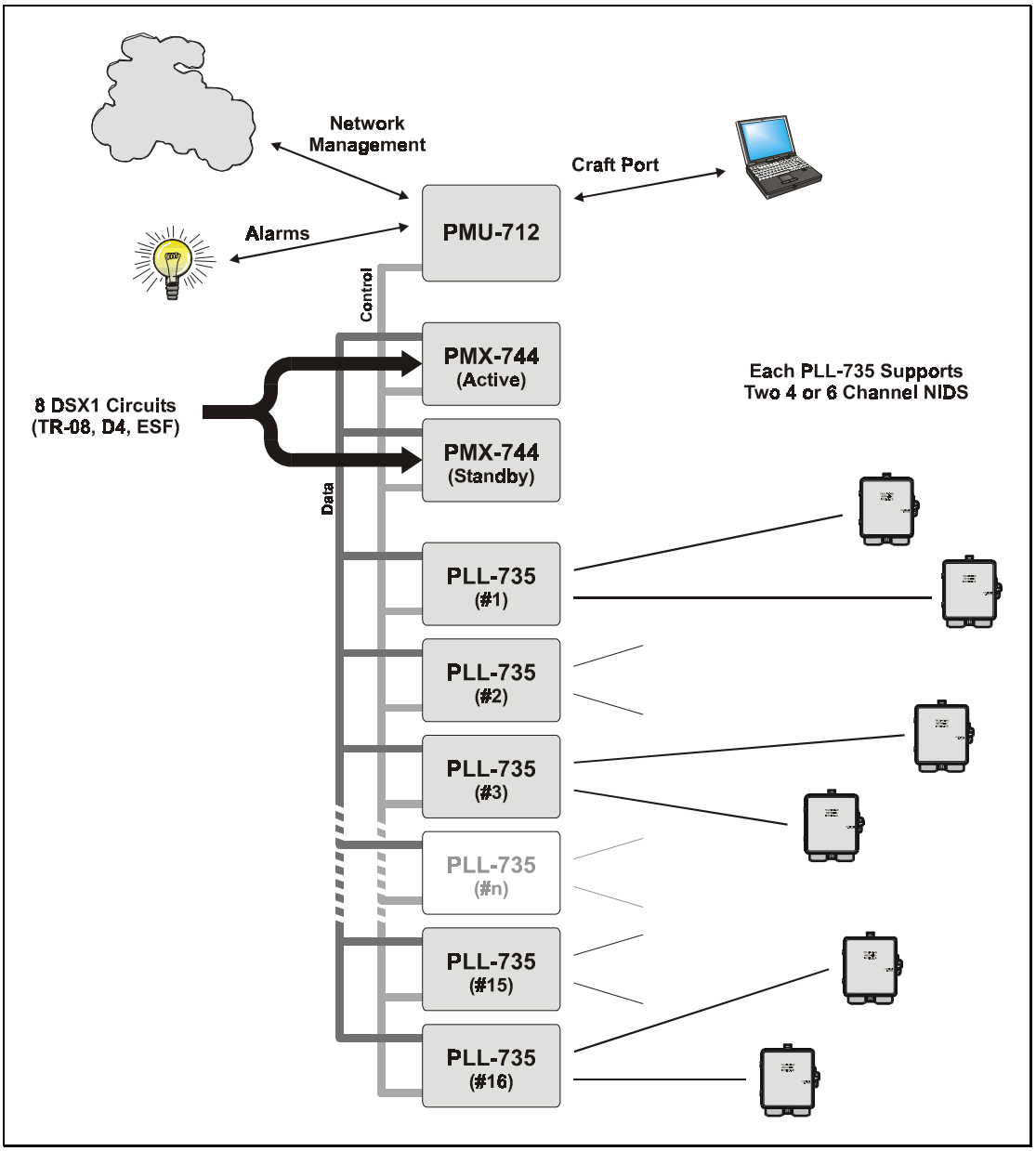


Figure 23
4 and 6 Channel Systems with TR-08/D4/ESF Interface

Table 3 identifies the subscriber services that can be provided by the integrated 4 and 6 channel PG-Flex*Plus* line units and NIDs. Regardless of the system capacity or type of subscriber service, the same COLU can be used for all applications.

Table 3
PG-Plus Service Offerings

System Capacity		Line Units		Subscriber Services		
Channels	**DS0s**	**COLU**	**NID**	**POTS**	**UVG**	**ISDN**
4	4	PLL-735	PRL-770	4	-	-
6	6	PLL-735	PRL-771	6	-	-
			PRL-772	3	-	1
			PRL-773	-	-	2
			PRL-779	-	6	-

The minimum and maximum component requirements for equiping a shelf of integrated 4 or 6 channel PG-Flex*Plus* system are provided in Table 4.

Table 4
4 and 6 Channel Systems with TR-08 Interface – System Configuration

		Quantity	
Component	**Model**	**Minimum**	**Maximum**
COT Shelf	PCS-719	1	1
Management Unit	PMU-712	1	1
Multiplex Unit	PMX-744	1	2
CO Line Unit	PLL-735	1	16
NID	PRL-770 PRL-771 PRL-772 PRL-773 PRL-779	1	32

4.2 24 Channel Systems with TR-08/D4/ESF Interface

The PG-Flex*Plus* COT shelf can support up to eight 24 channel systems, as shown in Figure 24.

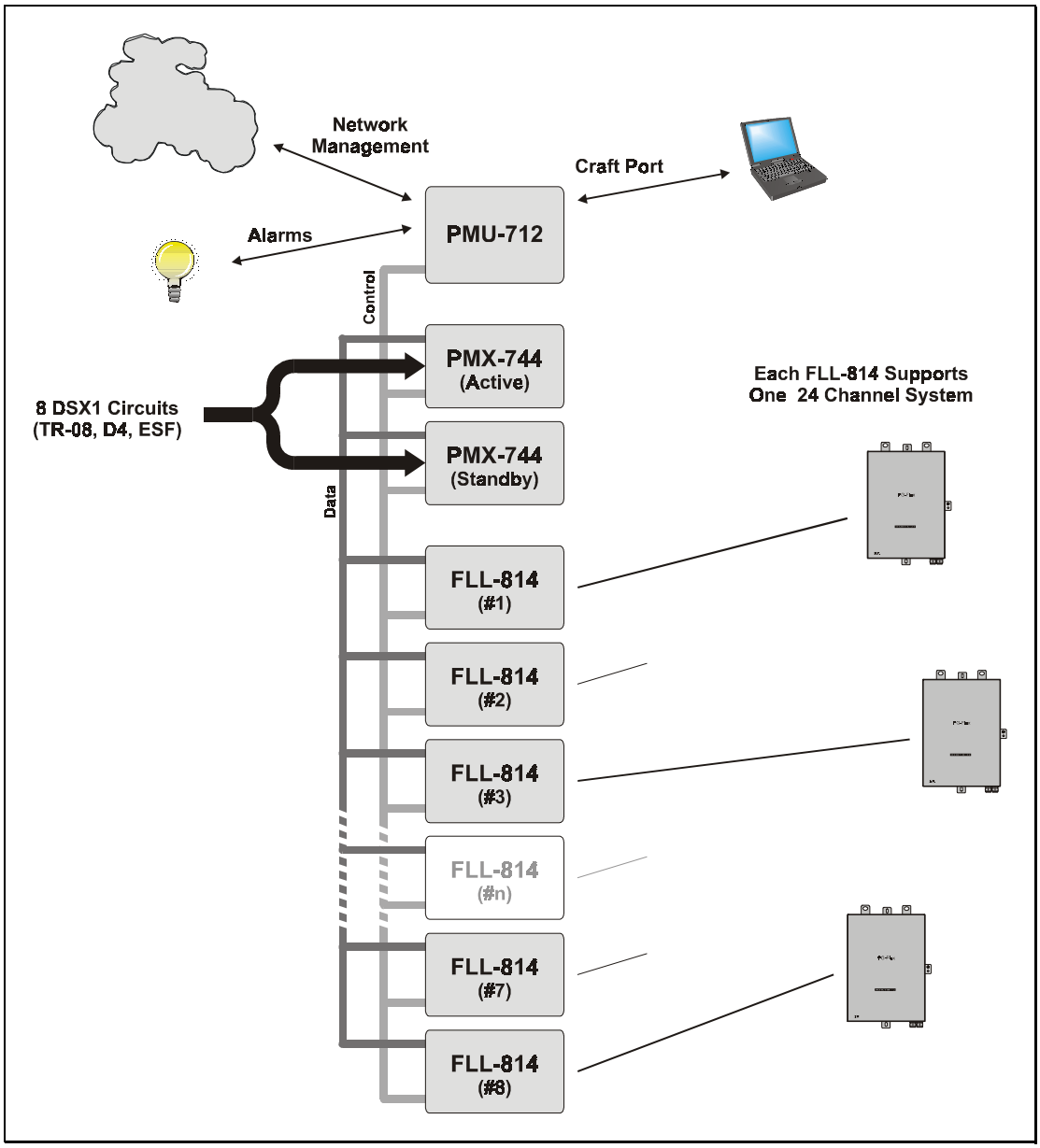


Figure 24
24 Channel Systems with TR-08/D4/ESF Interface

The equipment required to support 24 channel systems is shown in Table 5. Regardless of how many FLL-814 CO line units are installed in the COT shelf, one PMU-712 and at least one PMX-744 unit is required for provisioning and operation.

Table 5
24 Channel Systems with TR-08 Interface – CO System Configuration

		Quantity	
Component	**Model**	**Minimum**	**Maximum**
COT Shelf	PCS-719	1	1
Management Unit	PMU-712	1	1
Multiplex Unit	PMX-744	1	2
CO Line Unit	FLL-814	1	8

Each FLL-814 supports one PG-Flex remote terminal. As shown in Figure 25, each RT can have up to three channel units installed to provide POTS and ISDN service. A craft port is included with the FRL-842 RT line unit for system provisioning, performance monitoring, and maintenance.

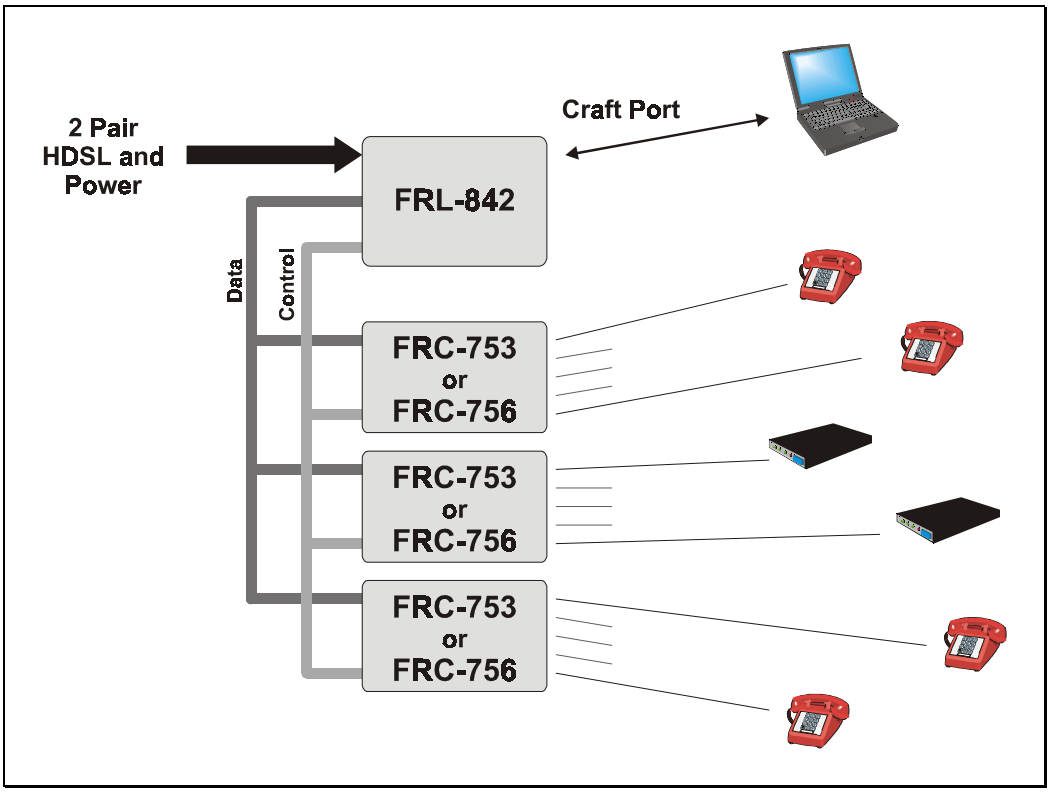


Figure 25
PG-Flex RT Configuration

Table 6 indicates the type of RT channel units required to support various configuration of subscriber services.

Table 6
PG-Flex Circuits Available Based on Channel Units Installed

Channel Units Installed		Subscriber Services	
POTS (FRC-753)	ISDN (FRC-756)	POTS	ISDN
3	0	24	0
2	1	16	1
		16	2
		15	3
		12	4
1	2	8	5
		6	6
		3	7
		0	8
0	2	0	8

Remote terminal enclosures are available in a variety of sizes and capacities – refer to Table 38 for additional information of these enclosures. Table 7 indicates the line units and channel units required to configure a PG-Flex remote terminal.

Table 7
24 Channel Systems with TR-08 Interface – RT System Configuration

		Quantity	
Component	**Model**	**Minimum**	**Maximum**
RT Enclosure	FRE-86x	1	1
RT Line Unit	FRL-842	1	1
RT Channel Unit	FRC-753 FRC-756	Refer to Table 6 on page 24	

4.3 4, 6, and 24 Channel Systems with TR-08/D4/ESF Interface

A PG-Flex*Plus* COT shelf may contain a combination of 4, 6, and 24 channel systems. There are two rules that must be followed under these conditions:

1. Whenever a 24 channel COLU is installed in a COT shelf, the PMX-744 must be used.
2. Each 4 or 6 channel COLU uses one (1) slot space in the COT shelf.
3. Each 24 channel COLU uses two (2) slot spaces in the COT shelf.
4. Each PCS-719 COT shelf has 16 slots available for COLUs. Therefore, the total number of slots required by any combination of 4, 6, and 24 channel COLUs must not exceed 16.

Valid combinations of FLL-814 and PLL-735 line units that can be installed in a single PCS-719 COT shelf are shown in Table 13.

Table 8
Valid Combinations of FLL-814 and PLL-735 COLUs in PCS-719 COT Shelf

FLL-814	PLL-735																
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
0	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
2	●	●	●	●	●	●	●	●	●	●	●	●	●				
3	●	●	●	●	●	●	●	●	●	●	●						
4	●	●	●	●	●	●	●	●	●								
5	●	●	●	●	●	●	●										
6	●	●	●	●	●												
7	●	●	●														
8	●																

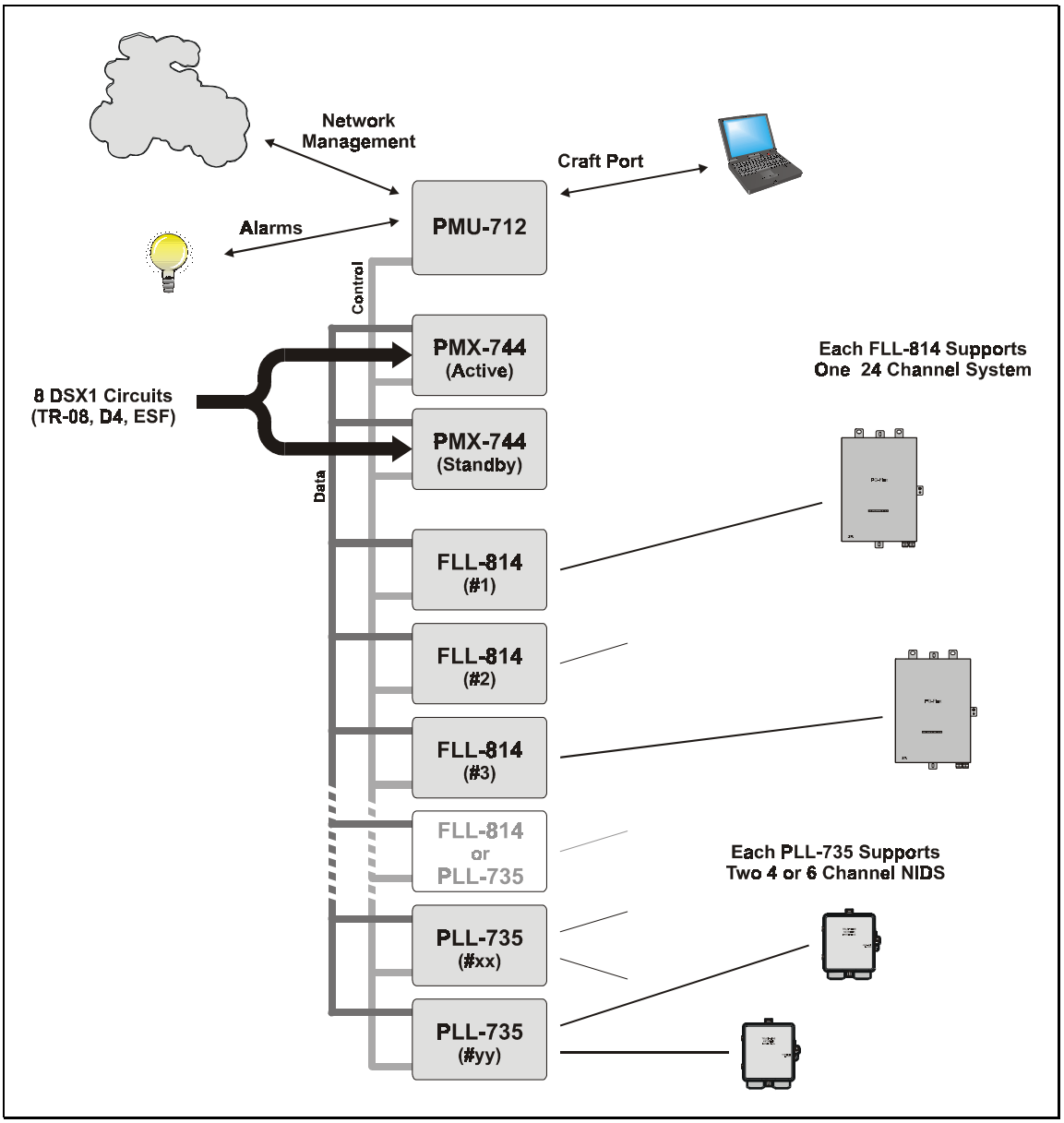


Figure 26
4, 6, and 24 Channel Systems with TR-08/D4/ESF Interface

4.4 GR-303 and TR-08 Interfaces with the UAP

The UAP can be added to any of the system configurations in the previous sections to provide a GR-303 interface between the PG-Flex*Plus* systems and the CO switch. Circuits between the switch and the UAP can be DS1 or DS3. DS1 circuits configured for TR-08, D4 or ESF signaling are used between the UAP and the PG-Flex*Plus* shelves.

Figure 27 shows a typical GR-303 configuration for the UAP with DS1 and DS3 circuits. DS1s on the facility side are brought into the UAP through FIT-572 DS1 Interface Units. On the network side, the TMC and EOC channels are protected through channel redundancy in the first two FIT-572s installed in the UAP COT shelf. The DS3 on the network side is brought into the UAP through two FID-573 DS3s to provide protection. Facility side protection of the DS1s is provided through the FTP-579 1:8 Protection Switches.

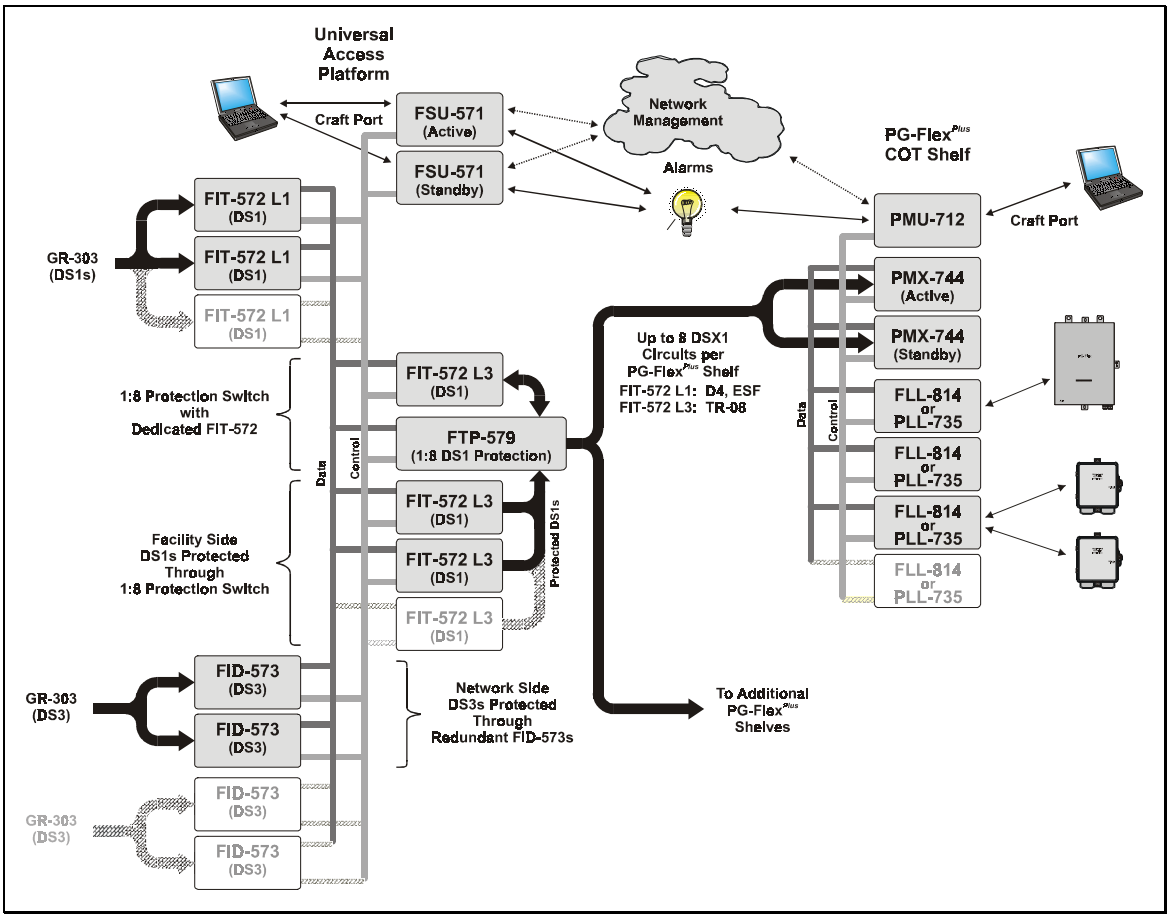


Figure 27
Universal Access Platform with PG-Flex*Plus* – GR-303 Interface

The UAP can also be used to groom TR-08 and D4/ESF circuits on the network side into TR-08 circuits on the facility side to drive the PG-Flex*Plus* COT shelf. An example of this application is combining voice on the TR-08 network circuits with ISDN network circuits derived from D4 channel banks into TR-08 circuits to drive PG-Flex*Plus*. FIT-572 List 1 DS1 Interface Units are used for the D4/ESF circuits and FIT-572 List 3 DS1 Interface Units are used for the TR-08 circuits. All network and facility circuits are protected through FTP-579 1:8 Protection Switches.

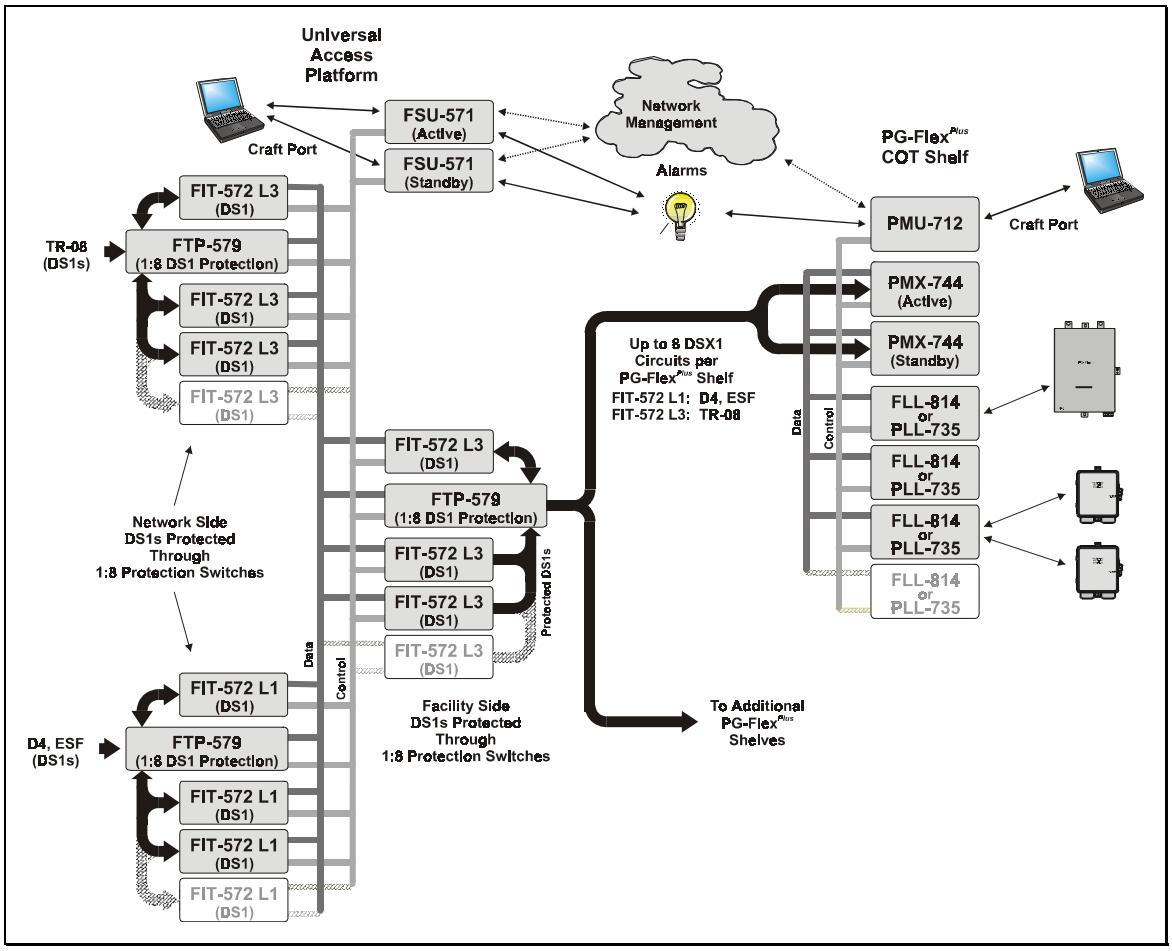


Figure 28
Universal Access Platform with PG-Flex^{Plus} – TR-08/D4/ESF Interfaces

UAP components required to provide a GR-303 interface are identified in Table 9. The following sections provide additional information on the number of DS1 and DS3 interface units required and is dependent on the total number of subscribers to be served, the type of CO switch interface, and whether protection circuits are included between the CO switch and the UAP.

Table 9
Universal Access Platform – CO System Configuration

		Quantity	
Component	**Model**	**Minimum**	**Maximum**
UAP COT Shelf	FCS-570	1	1
UAP CPU	FSU-571	1	2
UAP Interface	FIT-572 List 1 FIT-572 List 3 FID-573	Refer to Table 10 on page 29 and Table 11 on page 29	
UAP 1:8 Protection	FTP-579	0	4

GR-303 allows for a maximum of 2,048 CRVs within a single IG. Protection for the TMC and EOC channels is provided through a second DS1 or DS3 plug on the network side of the UAP. DS1 protection on the facility side is provided through FTP-579 1:8 Protection Switches.

Table 10 indicates the total number of subscribers that can be served by a single IG using DS1 interfaces to the switch (network side) and DS1 circuits to the PG-Flex*Plus* shelves (facility side). In this configuration, the UAP can support two IGs.

Table 10
Available Circuits Using DS1 Facility Interfaces – GR-303 Applications

FIT-572 Plugs		Protection		Network Circuits	CRVs	Concentration	PG-Flex*Plus* Shelves Supported
Network	Facility[1]	Network	Facility				
1	7 + 1	No	Yes	286	2,016	7.1 to 1	10
2	7 + 1	Yes	Yes	572	2,016	3.5 to 1	10
3	7	Yes	No	860	2,016	2.3 to 1	10
3	6 + 1	Yes	Yes	860	1,728	2.0 to 1	8
4	6	Yes	No	1,148	1,728	1.5 to 1	8
4	5 + 1	Yes	Yes	1,148	1,440	1.3 to 1	7

Table 11 indicates the total number of subscribers that can be served by a single IG using DS3 interfaces to the switch (network side) and DS1 circuits to the PG-Flex*Plus* shelves (facility side). In this configuration, the UAP can support two IGs.

Table 11
Available Circuits Using DS3 Facility Interfaces – GR-303 Applications

FID-573 Plugs	FIT-572 Plugs	Protection		Network Circuits	CRVs	Concentration	PG-Flex*Plus* Shelves Supported
Network	Facility[1]	Network	Facility				
1	7 + 1	No	Yes	670	2,016	3.0 to 1	10
2	7 + 1	Yes	Yes	1,340	2,016	1.5 to 1	10

The capacities provided in Table 10 and Table 11 do not take into account possible limitations due to local standards that may include traffic and capacity planning criteria, power consumption and heat dissipation, and other system design factors.

4.5 Field Shelf System

The Field Shelf system extends the functionality of the PG-Flex*Plus* CO equipment into remote locations. This system accepts up to four DSX1, HDSL, or T1 circuits and supports up to four FLL-814 or eight PLL-735 CO line units. The system also accepts alarm inputs, such as from doors and fans, and transports this information back on the DS1 channels.

[1] This is the number of FIT-572 plugs installed for the IG, where the "+ 1" indicates one FIT-572 is dedicated to protecting the facility circuits through a FTP-579 1:8 Protection Switch.

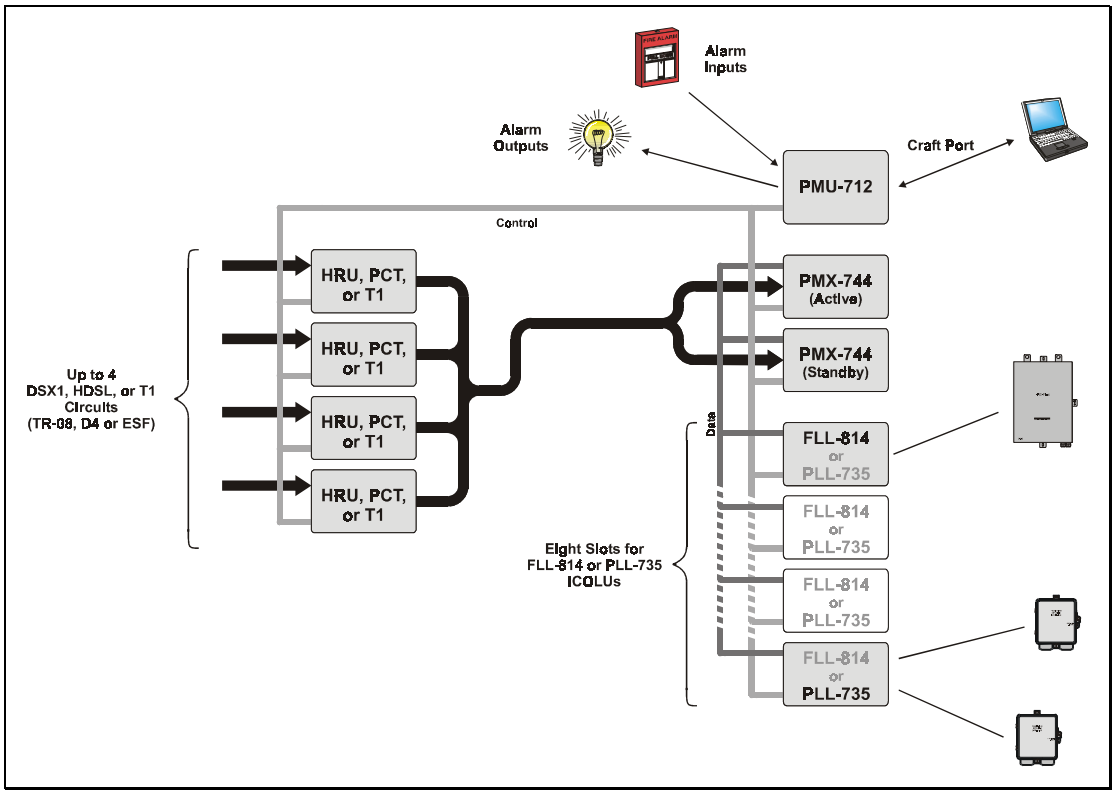


Figure 29
Field Shelf System

Equipment required to support the system is shown in Table 12. Up to four interface units may be installed in the shelf; this can be "mix-and-match", depending on the host system providing these signals. The multiplex units must be PMX-744s if there are FLL-814 line units installed in the shelf.

Table 12
Field Shelf System – System Configuration

		Quantity	
Component	**Model**	**Minimum**	**Maximum**
Field Shelf	PCS-822	1	1
Interface Units (200 mechanics)	HDSL HDSL2 T1 PCT-850	1	4
Management Unit	PMU-712	1	1
Multiplex Unit	PMX-744	1	2
Line Units	FLL-814 PLL-735	1 1	4 8

FLL-814 and PLL-735 line units may be mixed in a single PCS-822 Field Shelf using the following guidelines:

- Each PCS-822 has eight slots for line units.
- Each FLL-814 occupies two slots in the PCS-822.
- Each PLL-735 occupies one slot in the PCS-822.

Valid combinations of FLL-814 and PLL-735 line units that can be installed in a single PCS-822 Field Shelf are shown in Table 13.

Table 13
Valid Combinations of FLL-814 and PLL-735 COLUs in PCS-822 Field Shelf

FLL-814	PLL-735								
	0	1	2	3	4	5	6	7	8
0	●	●	●	●	●	●	●	●	●
1	●	●	●	●	●	●	●		
2	●	●	●	●	●				
3	●	●	●						
4	●								

5. Planning and Deployment Considerations

This section provides information on the CO and cable facility requirements that must be considered when deploying PG-Flex*Plus* systems.

5.1 Central Office Wiring

An overview of the CO wiring requirements is provided in Figure 30 when the system is configured for non-GR-303 applications. Figure 31 on page 34 provides an overview of the CO wiring requirements for GR-303 applications. Dotted lines indicate the connections between each of the elements that comprise the complete system. The 1:8 Protection Switch is optional; if it is not required, the UAP receives the DS1 circuits directly from the CO switch. Likewise, if a GR-303 interface or circuit grooming is not required, the UAP is not required and the PG-Flex*Plus* shelf derives its DS1 circuits directly from the CO switch.

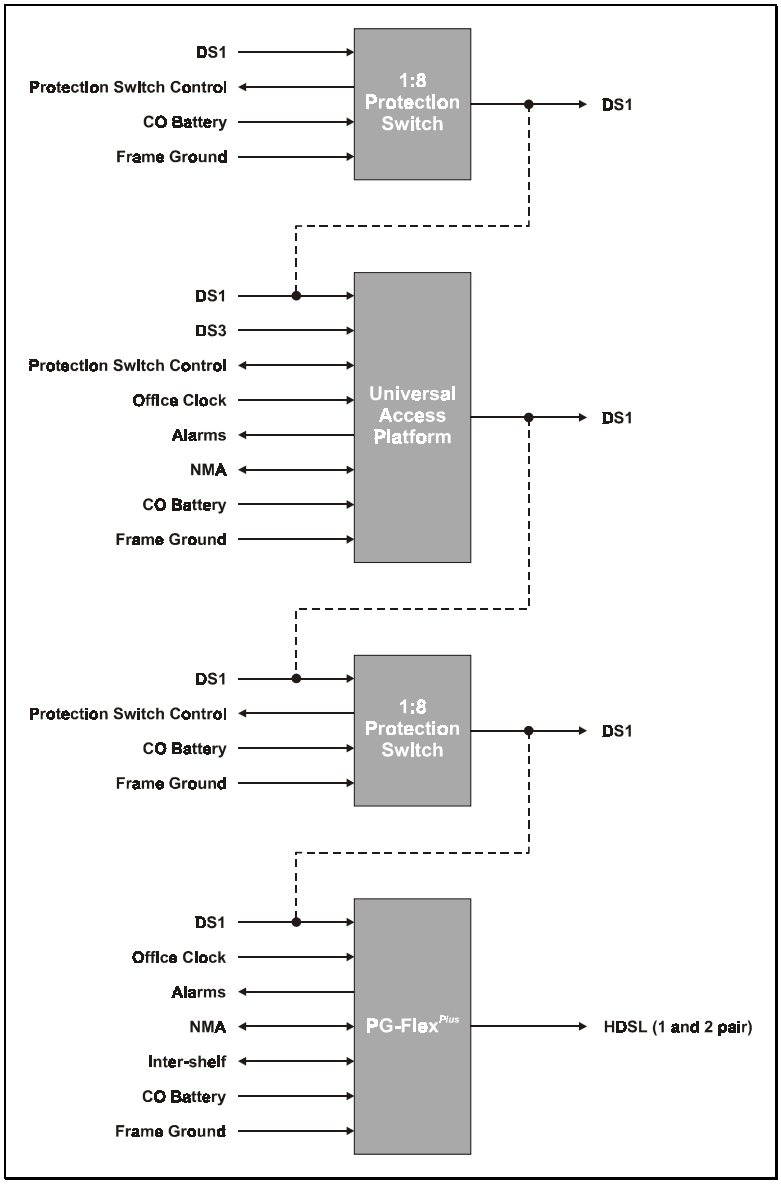


Figure 30
CO Wiring – Block Diagram for Non-GR-303 Applications

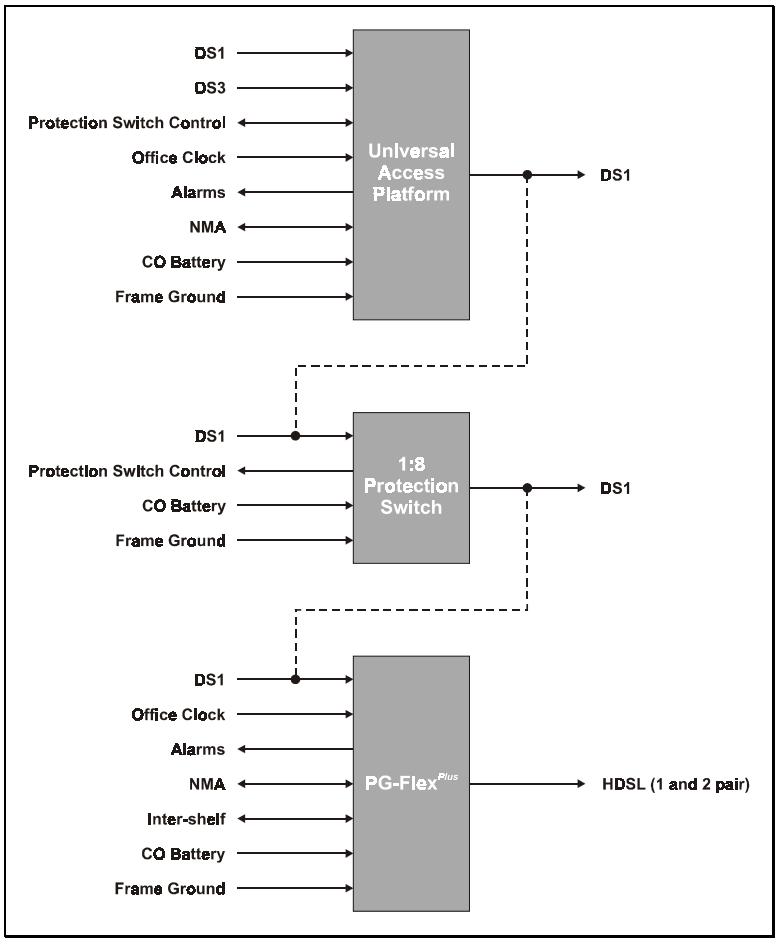


Figure 31
CO Wiring – Block Diagram for GR-303 Applications

Refer to section 6 (Specifications) of this document for information on the types of connectors used by each element of the PG-Flex*Plus* system.

5.1.1 PG-Flex*Plus*

Figure 32 shows the PCS-719 COT Shelf backplane connections. The following subsections provide detailed descriptions of these connections.

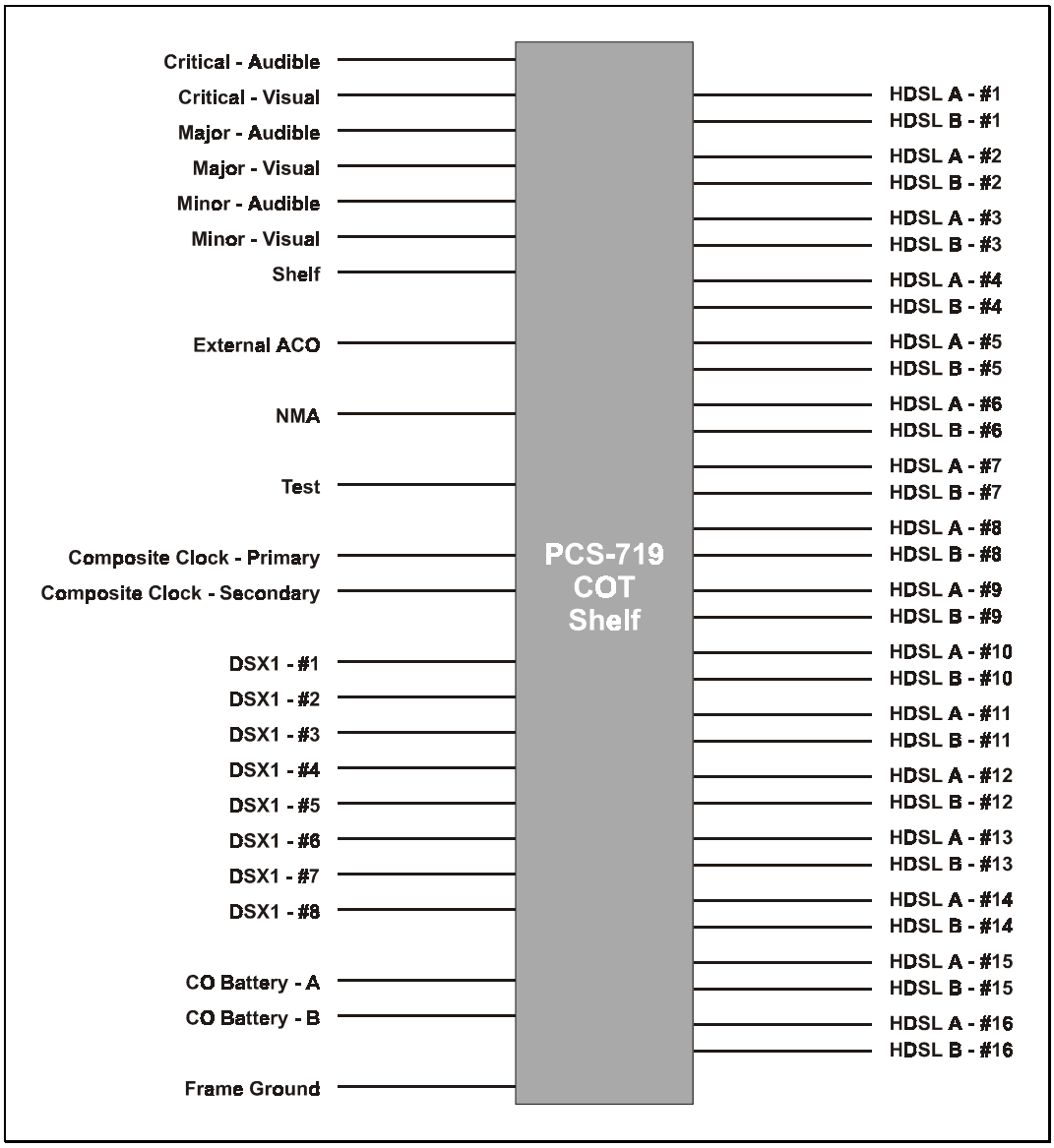


Figure 32
PCS-719 COT Shelf Wiring

5.1.1.1 Ground

A frame ground connection is required for secondary protection of all PG-Flex*Plus* circuits. The connection between the PG-Flex*Plus* shelf and the equipment frame ground wire should be of the same gauge as the equipment frame ground wire. A compression-type ground lug is provided on the PG-Flex*Plus* COTS backplane.

5.1.1.2 CO Battery

CO battery should be distributed from the equipment bay fuse panel to the PG-Flex*Plus* shelves using 12 AWG (minimum) wire. PG-Flex*Plus* shelves support both redundant and split powering. Redundant powering provides A and B battery feeds to all cards installed in the PG-Flex*Plus* shelf. Split powering provides A battery to COLU slots 1 through 8, B battery to COLU slots 9 through 16, and redundant (A and B battery) to the PMU and PMX slots. Refer to section 5.5.1 on page 43 for information on determining the equipment bay fuse panel requirements. All CO battery terminations are made to a screw terminal strip.

5.1.1.3 DS1s

Backplane wire-wrap terminations are provided for eight DS1 “in” and “out” connections on the PG-Flex*Plus* COTS backplane. Each of the “in” connections include 135 Ω termination resistors across the tip and ring of the DS1 circuit. There are no termination points for the shields of the DS1 pairs on the COTS backplane, as the shield should be grounded at one end only.

5.1.1.4 DSLs

All DSL connections appear as wire-wrap terminations on the PG-Flex*Plus* COTS backplane, with each COLU slot equipped with two pairs of terminations. With the PLL-735 DICOLU, each wire-wrap pair serves one PG-Plus NID. With the FLL-814 FICOLU, the two pairs associated with the even-numbered slot terminates the HDSL pairs to the PG-Flex RT and the two pairs associated with the odd-numbered slot terminates the auxiliary power pairs to the PG-Flex RT.

5.1.1.5 Composite Clock

Central office timing is derived from the DS1 connections to the host (CO switch or digital cross connect) equipment. Composite clock terminations are not required when the PG-Flex*Plus* is configured for integrated applications.

5.1.1.6 NMA

The PCS-719 shelf can be managed through the PMU-712 Management Unit. A VT-100 terminal or a modem (through a null-modem adapter) can be connected to the PMU-712 and the interface can be menu-driven or TL1-based. All provisioning, performance monitoring, and fault isolation functions can be performed through this interface.

5.1.1.7 Inter-shelf Communications

Inter-shelf communications is supported through a BNC connector located on the PG-Flex*Plus* shelf backplane. This is a 10Base-2 local area network using coax cable daisy-chained between PG-Flex*Plus* shelves. Each shelf must have a PMU installed, with one PMU being configured as the master unit.

5.1.1.8 Alarms

Discrete form C alarm relay contacts are provided on the PG-Flex*Plus* COTS backplane and provide the following indications:

- Critical Audible
- Critical Visual
- Major Audible
- Major Visual
- Minor Audible
- Minor Visual
- Shelf Visual
- Alarm Cutoff

Audible alarm cutoff can be accomplished using the Alarm Cut-Off (ACO) pushbutton on the front panel of the PMU-712 or with a remote switch connected to the ACO terminations on the COTS backplane. This does not disable any visual indications and any new alarms received by the PMU will re-activate the appropriate audible alarm.

When the PMU is connected to a network monitoring system, the PMU will generate autonomous TL1 alarm messages in addition to providing the appropriate discrete alarm relay contact closures.

5.1.1.9 Subscriber Drop Test Results

PG-Flex*Plus* supports subscriber drop test requests and can be initiated through a VT-100 connected to the craft port, through the TR-08 maintenance bits, or via TL1 commands. Test results are be reported through the craft port, TL1 responses, or three-terminal TR-909 resistive signatures.

5.1.2 Universal Access Platform

Figure 33 shows the FCS-570 Universal Access Platform connections. The following subsections provide detailed descriptions of these connections.

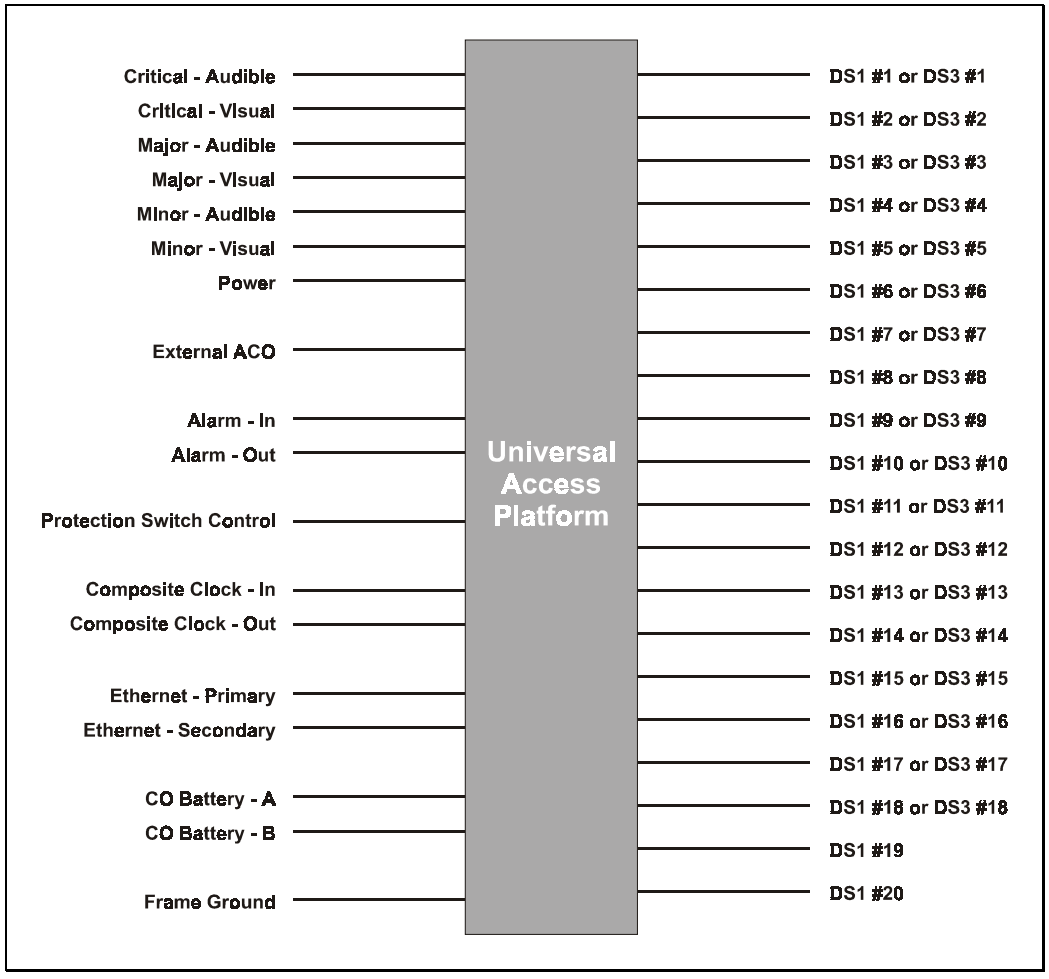


Figure 33
Universal Access Platform Wiring

5.1.2.1 Ground

A frame ground connection is required for secondary protection of all UAP circuits. The connection between the UAPshelf and the equipment frame ground wire should be of the same gauge as the equipment frame ground wire. A compression-type ground lug is provided on the UAP shelf backplane.

5.1.2.2 CO Battery

CO battery should be distributed from the equipment bay fuse panel to the UAP shelves using 12 AWG (minimum) wire. Redundant powering of the UAP shelf is provided. Refer to section 5.5.2 on page 45 for information on determining the equipment bay fuse panel requirements. All CO battery terminations are made to a screw terminal strip.

5.1.2.3 DS1s

50-pin male Amphenol connectors are provided for DS1 terminations on the UAP shelf backplane. Each connector terminates 12 DS1s from a single UAP DS1 module. ADC recommends that shielded cable be used when terminating DS1 circuits. Refer to Table 30 on page 62 for cable ordering information. The UAP shelf supports up to 20 DS1 modules. Each DS1 circuit in a DS1 module can be provisioned for connecting to the CO switch or PG-Flex*Plus* shelf

5.1.2.4 DS3s

BNC connectors are provided on the UAP shelf backplane for DS3 terminations. Follow local practice for selecting the appropriate coaxial cable and terminations. The UAP shelf supports up to 18 DS3 modules. Each DS3 circuit in a DS3 module is provisioned for connecting to the CO switch.

5.1.2.5 Protection Switch Control

A female DB-9 connector is provided for interfacing the UAP Central Processor Unit (CPU) modules to the DS1 Protection Switch. Refer to Table 30 on page 62 for cable ordering information. Up to four DS1 Protection Switches can be managed from a single UAP shelf.

5.1.2.6 NMA

The UAP system can be managed through a VT-100 terminal connected to the front panel of either CPU module installed in the UAP shelf or over TCP/IP through Ethernet connections on the UAP backplane. The front panel supports a menu-driven interface; the Ethernet connections support a HTML- based interface. All provisioning, performance monitoring, and fault isolation functions can be performed through this interface.

5.1.2.7 Alarms

Alarm reporting is provided through the GR-303 conduit and discrete alarm relay wire-wrap connections and provide the following alarm indications:

- Critical Audible
- Critical Visual
- Major Audible
- Major Visual
- Minor Audible
- Minor Visual
- Shelf Visual
- Alarm Cutoff

Audible alarm cutoff can be accomplished with a remote switch connected to the ACO terminations on the UAP backplane. This does not disable any visual indications and any new alarms received by the UAP will re-activate the appropriate audible alarm.

5.1.3 Protection Switch

Figure 34 shows the FTP-579 1:8 Protection Switch connections. The following subsections provide detailed descriptions of these connections.

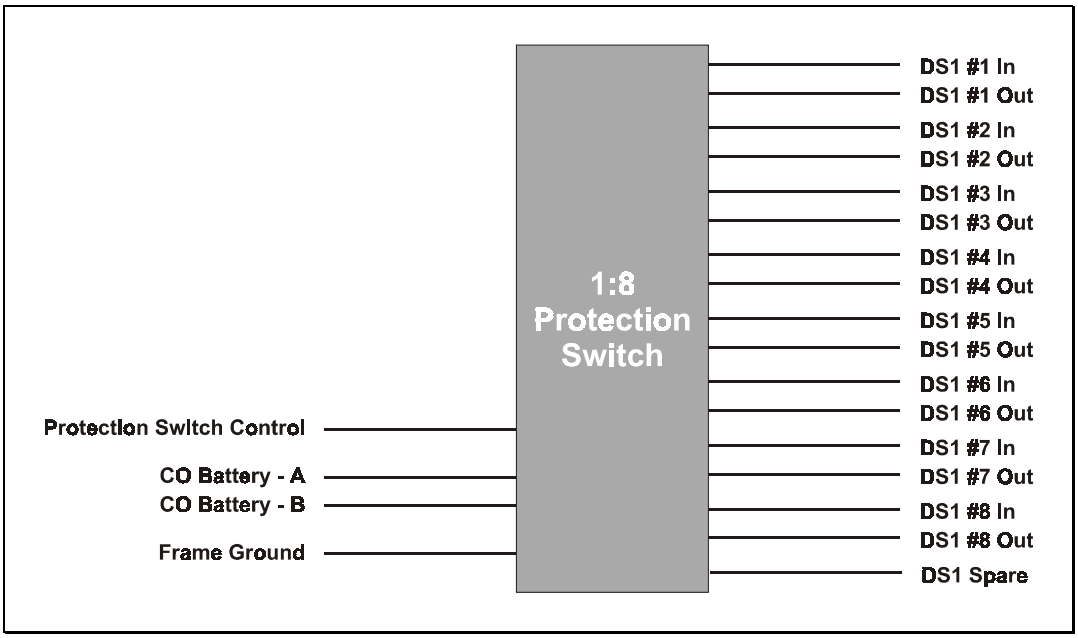


Figure 34
1:8 Protection Switch Wiring

5.1.3.1 Ground

A frame ground connection is required for secondary protection of all UAP circuits. The connection between the UAP shelf and the equipment frame ground wire should be of the same gauge as the equipment frame ground wire. A compression-type ground lug is provided on the UAP shelf backplane.

5.1.3.2 CO Battery

CO battery should be distributed from the equipment bay fuse panel to the Protection Switch using 12 AWG (minimum) wire. Redundant powering of the Protection Switch is provided. Refer to section 5.5.2 on page 45 for information on determining the equipment bay fuse panel requirements. All CO battery terminations are made to a screw terminal strip.

5.1.3.3 DS1s

50-pin male Amphenol connectors are provided for DS1 terminations on the Protection Switch. Each connector terminates 12 DS1s from a single UAP DS1 module. ADC recommends that shielded cable be used when terminating DS1 circuits. Refer to Table 30 on page 62 for cable ordering information. The 1:8 Protection Switch supports up to 8 DS1 modules and are designated for input (from the CO switch) and output (to the UAP).

5.1.3.4 Protection Switch Control

A female DB-9 connector is provided for interfacing the UAP CPU modules to the DS1 Protection Switch. Refer to Table 30 on page 62 for cable ordering information. Up to four DS1 Protection Switches can be managed from a single UAP shelf.

5.2 Field Shelf Wiring

Figure 35 shows the PCS-822 Field Shelf backplane connections. The following subsections provide detailed descriptions of these connections.

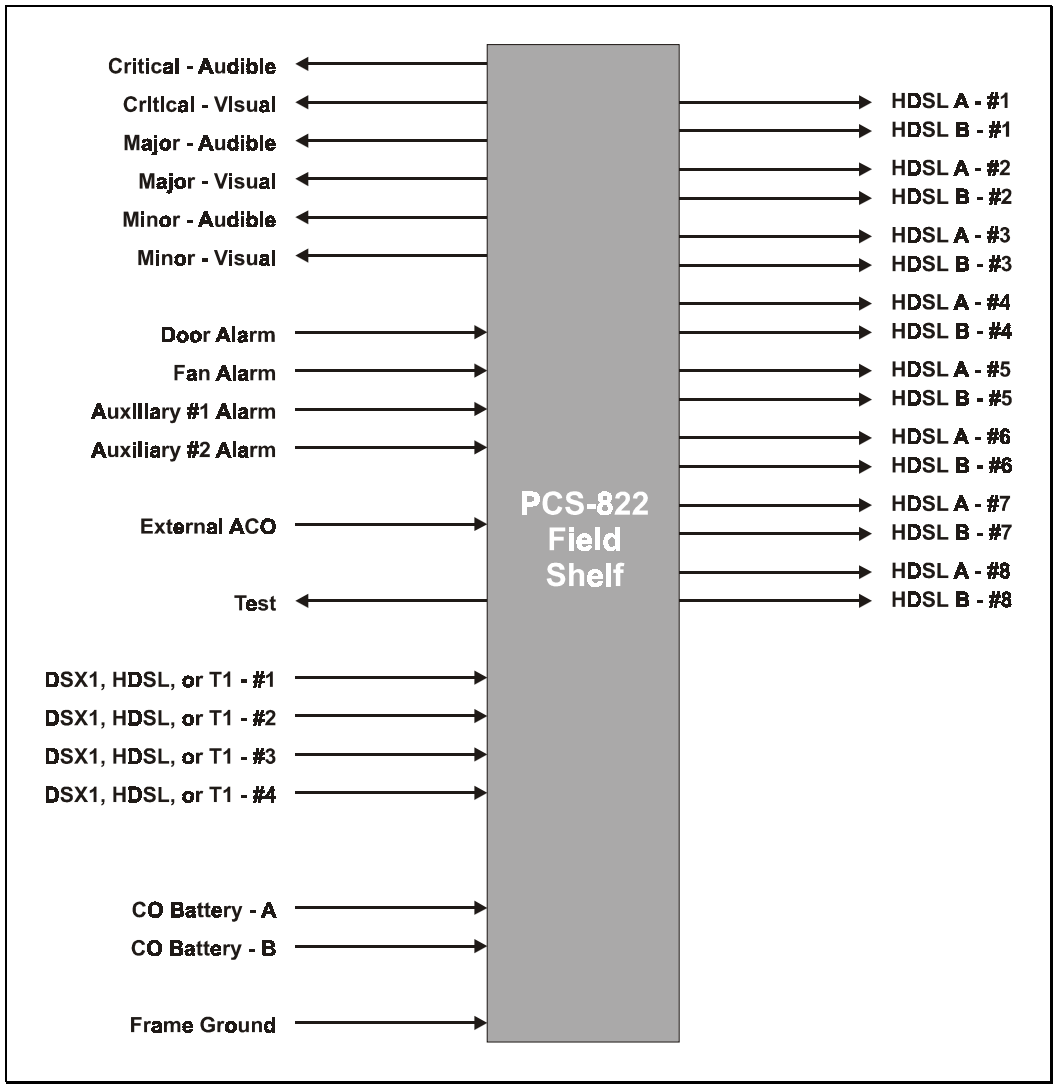


Figure 35
Field Shelf Wiring

5.2.1 Ground

A frame ground connection is required for primary and secondary protection of all PG-Flex*Plus* circuits. The connection between the Field Shelf and the ground termination point is made using the 6' ground wire provided with the Field Shelf.

5.2.2 CO Battery

CO battery should be distributed from the NGDLC Remote Terminal fuse panel to the Field Shelf through the power cable provided with the Field Shelf. The Field Shelf supports both redundant powering.. Refer to section 5.5.2 on page 45 for information on determining the equipment bay fuse panel requirements.

5.2.3 DS1, HDSL, or T1 Inputs

All DS1/HDSL/T1 connections are through the 35' shielded "T" cable provided with the Field Shelf. Each of the "in" connections include 135 Ω termination resistors across the tip and ring of the circuit.

5.2.4 DSLs

All DSL connections are through the 35' cable provided with the Field Shelf, with each COLU slot equipped with two pairs of terminations. With the PLL-735 Dual ICOLU, each pair serves one PG-Plus NID. With the FLL-814 FICOLU, the two pairs associated with the even-numbered slot terminates the HDSL pairs to the PG-Flex RT and the two pairs associated with the odd-numbered slot terminates the auxiliary power pairs to the PG-Flex RT.

5.2.5 Composite Clock

Central office timing is derived from the DS1 connections to the host (CO switch or digital cross connect) equipment. Composite clock terminations are not required with the Field Shelf.

5.2.6 Alarms

Alarm reporting is provided through the TR-08 conduit and discrete alarm relay wire-wrap connections on the Field Shelf and provide the following indications:

- Critical Audible
- Critical Visual
- Major Audible
- Major Visual
- Minor Audible
- Minor Visual
- Shelf Visual
- Alarm Cutoff

Four discrete alarm inputs are supported by the Field Shelf through the backplane NMA connector and requires a PMU-712 List 2 Management Unit installed in the Field Shelf:

- Remote Integrated COTS Door
- Remote Integrated COTS Fan
- Auxiliary #1
- Auxiliary #2

Auxiliary #1 and #2 alarm inputs can be connected to any normally open switch contacts and can be provisioned as critical, major, minor, or information alarms. These discrete alarms are carried over the TR-08 overhead.

5.2.7 Test

The Field Shelf system supports subscriber drop test requests and can be initiated through a VT-100 connected to the craft port, through the TR-08 maintenance bits, or via TL1 commands. Test results are reported through the craft port, TL1 responses, or three-terminal TR-909 resistive signatures. The Test tip and ring connections on the Field Shelf can be connected to the test bus of the NGDLC Remote Terminal and transported back to the CO through the NGDLC.

5.3 Management

The PG-Flex*Plus* and UAP support system management functions through a VT-100 terminal or PC with VT-100 terminal emulation software connected to front panel or rear access craft ports, and through a TCP/IP Ethernet connection.

5.3.1 PG-Flex*Plus*

PG-Flex*Plus* system management is provided through the PMU-712 Management Unit. The PMU includes a craft interface on the front panel and an NMA interface on the COTS backplane. Although the PG-Flex*Plus* system will function normally without a PMU-712 Management Unit installed; it cannot be provisioned, performance cannot be monitored, and alarms will not be reported unless the PMU-712 is installed in the PCS-719 COT shelf.

5.3.1.1 Craft Port

The front panel DB-9 craft port on the PMU can be configured to support a menu-driven VT-100 terminal interface or a command-driven TL1 interface. The technician can switch between either interface. A modem can also be connected to the craft port through a null-modem adapter. The craft port is also used for downloading new software into the PMU management unit, PMX multiplex units, PLL CO line units, FRL remote line units, or PRL NIDs.

5.3.1.2 NMA

The PG-Flex*Plus* COT shelf backplane DB-25 port can be configured to support a menu-driven VT-100 terminal interface or a command-driven TL1 interface. A modem can be connected directly to this port or a terminal can be connected through a null-modem adapter.

5.3.1.3 Inter-shelf Communications

Through the BNC connector on the PG-Flex*Plus* backplane, the PMU provides a common interface between the host network monitoring system and other PG-Flex*Plus* shelves mounted in the same, or adjacent, equipment bays.

5.3.2 Universal Access Platform

The UAP provides female DB-9 connectors on the front panels of the CPUs and on the UAP shelf backplane, and two RJ-45 Ethernet connections on the UAP shelf backplane. The DB-9 connections support a VT-100 screen-based interface; the Ethernet connections support a TCP/IP-based interface.

5.3.2.1 Craft Ports

The craft port on the front panel of the CPU modules are used for provisioning, performance monitoring, fault isolation, and software downloading. A VT-100 terminal provides a realtime menu-driven interface to the UAP. A PC connected to the craft port supports an HTML-based interface with Web browsers such as Netscape's Communicator™ and Microsoft's Internet Explorer™.

5.3.2.2 Ethernet

The RJ-45 Ethernet connections allow the UAP shelf to be connected to a local area network for provisioning, performance monitoring, fault isolation, and software downloading. If the default IP information must be changed, this must be done through a VT-100 terminal connected to the craft port on the CPU module or UAP backplane.

5.3.3 Protection Switch

The DS1 protection switches are managed through the UAP and do not support any direct management functions.

5.4 Integrated Interface

A variety of integrated interfaces are available with the PG-Flex*Plus* system, ranging from basic D4/ESF protocols using DS1 circuits, to concentrated GR-303 protocols using DS1 and/or DS3 circuits.

5.4.1 PG-Flex*Plus*

The PG-Flex*Plus* system can be provisioned to support D4, ESF, or TR-08 protocols on DS1 circuits using the same PMX-744 multiplex units.

5.4.2 Universal Access Platform

Combining the PG-Flex*Plus* shelf with the UAP provides a highly concentrated GR-303 interface using DS1 or DS3 circuits between the UAP and the CO switch and DS1 or DS3 circuits between the UAP and the PG-Flex*Plus* shelf.

5.5 Current Consumption and Heat Dissipation for Integrated Systems

This section provides information on PG-Flex*Plus* and UAP current consumption and heat dissipaton necessary for engineering equipment bays.

5.5.1 PG-Flex*Plus*

Table 14 defines the current consumption and heat dissipation for PG-Flex*Plus* individual plugs and systems.

Table 14
PG-Flex*Plus* Unit Current Consumption and Heat Dissipation for Integrated Systems

Service	Models	CO Current Consumption	CO Heat Dissipation
Management Unit	PMU-712	0.08 A	4 W
8 DS1 Multiplex Unit	PMX-744	0.15 A	7 W
4 POTS (dual)	PLL-735 PRL-770	0.53 A	6 W
6 POTS (dual)	PLL-735 PRL-771	0.67 A	7 W
3 POTS, 1 ISDN (dual)	PLL-735 PRL-772	0.51 A	7 W
2 ISDN (dual)	PLL-735 PRL-773	0.40 A	6 W
6 UVG (dual)	PLL-735 PRL-779	0.81 A	10 W
24 POTS[2] (No Doublers)	FLL-814 FRL-842	1.52 A	15 W
24 POTS[2] (1 Doubler)	FLL-814 FRL-842	1.67 A	16 W
24 POTS[2] (2 Doublers)	FLL-814 FRL-842	1.88 A	18 W
24 POTS[3] (No Doublers)	FLL-814 FRL-842	1.06 A	11 W
24 POTS[3] (1 Doubler)	FLL-814 FRL-842	1.21 A	14 W
24 POTS[3] (2 Doublers)	FLL-814 FRL-842	1.33 A	14 W

Table 15 summarizes the average shelf powering requirements and heat dissipation for the PG-Flex*Plus* FCS-719 23" COT shelf, where the entire shelf is populated with the same ICOLU. The following conditions apply to the systems:

- All line units support the same type of service
- One PMU and two PMX cards are installed
- All POTS circuits are off-hook
- All HDSL lines spans are at their maximum design length
- -48 Vdc CO battery

[2] POTS RT Channel Unit subscriber drops provisioned for "Long Loop".

[3] POTS RT Channel Unit subscriber drops provisioned for "Short Loop".

Table 15
PCS-719 Shelf Current Consumption and Heat Dissipation for Integrated Systems

Service	Models	Split Powering		Single or Redundant Powering		CO Heat Dissipation
		CO Input Current	Shelf Fuse[4]	CO Input Current	Shelf Fuse[4]	
4 POTS (dual)	PLL-735 PRL-770	4.54 A	7.50 A	8.74 A	12.00 A	120 W
6 POTS (dual)	PLL-735 PRL-771	5.66 A	7.50 A	10.98 A	15.00 A	135 W
3 POTS, 1 ISDN (dual)	PLL-735 PRL-772	4.39 A	7.50 A	8.43 A	12.00 A	123 W
2 ISDN (dual)	PLL-735 PRL-773	3.56 A	5.00 A	6.79 A	10.00 A	118 W
6 UVG (dual)	PLL-735 PRL-779	6.79 A	7.50 A	13.24 A	20.00 A	171 W
24 POTS[5] (No Doublers)	FLL-814 FRL-842	6.42 A	10.00 A	12.51 A	20.00 A	136 W
24 POTS[5] (1 Doubler)	FLL-814 FRL-842	7.01 A	10.00 A	13.67 A	20.00 A	144 W
24 POTS[5] (2 Doublers)	FLL-814 FRL-842	7.87 A	10.00 A	15.41 A	20.00 A	159 W
24 POTS[6] (No Doublers)	FLL-814 FRL-842	4.63 A	7.50 A	8.88 A	12.00 A	106 W
24 POTS[6] (1 Doubler)	FLL-814 FRL-842	5.22 A	7.50 A	10.04 A	15.00 A	130 W
24 POTS[6] (2 Doublers)	FLL-814 FRL-842	5.70 A	10.00 A	11.04 A	15.00 A	130 W

5.5.2 Universal Access Platform

Table 16 defines the current consumption and heat dissipation for UAP plugs. The UAP COT shelf includes the fan tray.

Table 16
UAP Current Consumption and Heat Dissipation

Service	Models	CO Current Consumption	CO Heat Dissipation
23" UAP COT Shelf[7]	FCS-570	0.20 A	10 W
4 DS3 Interface Unit	FID-573	0.30 A	15 W
12 DS1 Interface Unit	FIT-572	0.20 A	10 W
Central Processor Unit	FSU-570	0.31 A	15 W
1:8 Protection Switch	FTP-579	0.13 A	6 W

[4] The recommended fuse rating assumes a minimum 15% margin over the CO battery input current.

[5] POTS RT Channel Unit subscriber drops provisioned for "Long Loop".

[6] POTS RT Channel Unit subscriber drops provisioned for "Short Loop".

[7] The FCS-570 UAP COT Shelf power consumption and heat dissipation includes the fan tray.

Table 17 provides current consumption and heat dissipation information for basic UAP configurations. Use the detailed information provided in Table 17 to calculate this information for other configurations.

Table 17
UAP Current Consumption and Heat Dissipation

Service	Models	CO Input Current[7]	Shelf Fuse[8]	CO Heat Dissipation[7]
23" UAP COT Shelf with 2) CPU	FCS-570 FSU-571	0.82 A	1.0 A	40 W
23" UAP COT Shelf with 2) CPU Plugs 20) DS1 Plugs 3) 1:8 Protection	FCS-570 FSU-571 FIT-572 FTP-579	5.21 A	7.5 A	258 W
23" UAP COT Shelf with 2) CPU Plugs 18) DS3 Plugs	FCS-570 FSU-571 FID-573	6.22 A	7.5 A	340 W

5.5.3 Network Equipment-Building System Compliance

There is a limitation imposed by NEBS (GR-63-CORE) on the amount of heat dissipated in the frame installed in the CO. The requirements for non forced-air cooled equipment (as applicable to PG-Flex type of equipment) are defined below:

Individual Frame: 134.7 W/ft^2 ($H_{individual}$)

Multi-frame: 99.9 W/ft^2 (H_{multi})

There are two applicable types of CO equipment frame floor plans described in GR-63-CORE and are shown in Table 18:

Table 18
GR-63-CORE CO Equipment Frame Floor Plans

Aisle Type	GR-63-CORE Figure	Aisle Lineup	Equipment Rows	Frame Depth	Side-to Side	Front Aisle	Rear Aisle	Floor Area
Narrow	2-2	6	5	12"	2' 2"	2' 6"	2' 0"	7.04 ft^2
Wide	2-3	4	3	18"	2' 2"	4' 6"	2' 6"	10.83 ft^2

The formula for computing floor area when calculating heat dissipation is:

$$\text{Floor Area} = \left(\text{Frame Depth} + \left(\frac{\text{Front Aisle} + \text{Rear Aisle}}{2} \right) \right) \times \text{Side To Side}$$

The floor area for narrow aisles is 7.04 ft^2:

[8] The recommended fuse rating assumes a minimum 15% margin over the CO battery input current.

$$\textbf{Floor Area} = \left(\textbf{12"} + \left(\frac{\textbf{2' 6"} + \textbf{2' 0"}}{\textbf{2}}\right)\right) \textbf{x 2' 2"}$$

$$\textbf{Floor Area} = \textbf{7.04 ft}^{\textbf{2}}$$

The floor area for wide aisles is 10.83 ft^2:

$$\textbf{Floor Area} = \left(\textbf{18"} + \left(\frac{\textbf{4' 6"} + \textbf{2' 6"}}{\textbf{2}}\right)\right) \textbf{x 2' 2"}$$

$$\textbf{Floor Area} = \textbf{10.83 ft}^{\textbf{2}}$$

The equations used to compute shelf heat dissipation per square foot and the number of shelves per frame are:

$$\textbf{Shelf Heat Dissipation} = \left(\frac{\textbf{Heat Dissipation per Shelf}}{\textbf{Floor Area}}\right)$$

$$\textbf{Watts per Bay} = (\textbf{Floor Area}) \textbf{ x } (\textbf{Heat Dissipation Allowed})$$

$$\text{Shelves per Frame} = \left(\frac{\text{Heat Dissipation Allowed}}{\text{Shelf Heat Dissipation}}\right) = \left(\frac{\text{Heat Dissipation Allowed}}{\left(\frac{\text{Heat Dissipation per Shelf}}{\text{Floor Area}}\right)}\right)$$

5.6 PG-Flex*Plus* HDSL Span Distance Tables

The DSL span distance information provided in this section assumes a cable temperature of 68º F (20º C). Cable temperature affects the resistance and attenuation of the cable. An increase in temperature will increase both the resistance and the dB loss of cable. The net result is that the effective length of the cable decreases as the temperature increases. The affect temperature has on resistance is independent of wire gauge and cable type. The affect temperature has on dB attenuation is dependent of wire gauge and cable type.

Pulp cable has a significantly higher loss than PIC cable. Although pulp cable hasn't been deployed in the outside plant for many years, there is still a considerable amount of this cable in service. It is important to know the type of cable being used to transport DSL signals when calculating span losses.

The span distance is related to the number of DS0s being transported by the system (4, 6, or 24) – the fewer DS0s being transported, the greater the distance between the central office and remote terminal equipment.

To simplify circuit loss calculations for different wire gauges and cable temperatures, ADC has developed a Microsoft® Windows®-based Cable Calc program. This program supports multiple cable gauges, cable types, spans, and temperatures. It also computes the losses for bridged taps and cable gauge changes. This program can be obtained by contacting ADC Technical Support or from the local ADC account manager.

5.6.1 4 Channel Systems

Four channel systems require one copper pair for operation and provide the greatest distance between the central office and subscriber.

Maximum Circuit Design Loss[9]: 45.9 dB @ 65 kHz
Center Frequency: 65 kHz
Symbol Rate: 130.6 ks/s
Bit Rate: 261.3 kb/s

Table 19
HDSL Span Distance – 4 Channel Systems

Gauge		HDSL Loss[10]		Cable Resistance		Span Length			Loop Resistance
AWG	Metric	dB/kft	dB/km	Ω/kft	Ω/km	kft	Miles	km	
26	0.40 mm	3.06 dB	10.04 dB	83.3 Ω	273.3 Ω	15.00	2.84	4.60	1250 Ω
24	0.51 mm	2.11 dB	6.92 dB	51.9 Ω	170.3 Ω	21.70	4.12	6.60	1125 Ω
22	0.61 mm	1.47 dB	4.82 dB	32.4 Ω	106.3 Ω	31.20	5.91	9.50	1010 Ω
19	0.91 mm	0.92 dB	3.02 dB	16.1 Ω	52.8 Ω	49.89	9.45	15.20	800 Ω

Note: Information is based on a cable temperature of 68º F (20º C).

5.6.2 6 Channel Systems

Six channel systems require one copper pair for operation.

Maximum Circuit Design Loss[9]: 45.9 dB @ 98 kHz
Center Frequency: 98 kHz
Symbol Rate: 196.0 ks/s
Bit Rate: 392.0 kb/s

Table 20
HDSL Span Distance – 6 Channel Systems

Gauge		HDSL Loss[10]		Cable Resistance		Span Length			Loop Resistance
AWG	Metric	dB/kft	dB/km	Ω/kft	Ω/km	kft	Miles	km	
26	0.40 mm	3.32 dB	10.89 dB	83.3 Ω	273.3 Ω	12.53	2.37	3.80	1044 Ω
24	0.51 mm	2.30 dB	7.55 dB	51.9 Ω	170.3 Ω	18.09	3.43	5.50	939 Ω
22	0.61 mm	1.65 dB	5.41 dB	32.4 Ω	106.3 Ω	25.21	4.76	7.70	817 Ω
19	0.91 mm	1.10 dB	3.61 dB	16.1 Ω	52.8 Ω	37.82	7.16	11.50	609 Ω

Note: Information is based on a cable temperature of 68º F (20º C).

[9] Includes 6 dB margin for approximately 10^{-10} bit error rate.

[10] The HDSL Loss is calculated at the center frequency for the specific system capacity.

5.6.3 24 Channel Systems

The 24 channel system requires two copper pairs for HDSL transport and carries 12 DS0s on each pair. For each doubler used to extend the operating distance of 24 channel systems, two additional power pairs of the same gauge as the HDSL pairs are required between the COT shelf and the RT enclosure.

Maximum Circuit Design Loss[9]: 35.0 dB @ 196 kHz
Center Frequency: 196 kHz
Symbol Rate: 392 ks/s
Bit Rate: 784 kb/s

Table 21
HDSL Span Distance – 24 Channel Systems

Gauge		HDSL Loss[10]		Cable Resistance		Span Length			Loop Resistance
AWG	Metric	dB/kft	dB/km	Ω/kft	Ω/km	kft	Miles	km	
26	0.40 mm	3.88 dB	12.73 dB	83.3 Ω	273.3 Ω	9.02	1.71	2.75	752 Ω
24	0.51 mm	2.84 dB	9.32 dB	51.9 Ω	170.3 Ω	12.32	2.33	3.76	639 Ω
22	0.61 mm	2.18 dB	7.14 dB	32.4 Ω	106.3 Ω	16.07	3.04	4.90	521 Ω
19	0.91 mm	1.54 dB	5.04 dB	16.1 Ω	52.8 Ω	22.80	4.32	6.95	367 Ω

Note: Information is based on a cable temperature of 68º F (20º C).

5.7 Span Distance and Cable Temperature

It is important to remember that the information provided in the tables in section 5.6 are based on a cable temperature of 68° F. As the cable temperature increases, the dB/kft loss increases and the span length decreases. It is not unusual for cable temperatures on aerial spans to reach 140° F, or higher, during summer months. A general rule of thumb is the HDSL loss increases about 1.6% for each 10° F temperature increase. For example, the HDSL span for a 24 channel PG-Flex system with a cable temperature of 68° F is 12.3 kft. If this cable temperature were to rise to 120° F, the HDSL span would decrease to about 11.5 kft. The converse is true as cable temperature decreases. However, be aware that maximizing the HDSL span during the colder months may cause the system to fail as the temperature of the cable increases during the warmer months. Always design HDSL spans using the maximum anticipated cable temperatures.

5.8 HDSL Pair Requirements

Table 22 identifies the number of copper pairs required between the CO and remote terminal equipment for HDSL transport and powering the RT. For each doubler used with the 24 channel system, two additional copper pairs are required between the CO and RT (they must not pass through the doubler).

Table 22
HDSL Pair Requirements

System	CO Line Unit	RT NID or Line Unit	Pairs
4 Channel	PLL-735	PRL-770	1
6 Channel	PLL-735	PRL-771 PRL-772 PRL-773 PRL-779	1
24 Channel	FLL-814	FRL-842	2

Note that the same PLL-735 COLU can be used for both 4 and 6 channel applications.

5.9 24 Channel Doublers and Auxiliary Power Pair Requirements

Up to two doublers can be used with the 24 channel PG-Flex*Plus* system to extend the distance between the CO and RT equipment. With one doubler in the circuit, the distance is doubled; two doublers will triple the distance. When doublers are used, each span must meet the criteria described in sections 5.6 and 5.10 of this document.

For each doubler used in the circuit, two auxiliary power pairs (in addition to the HDSL pairs) are required between the CO and RT equipment to ensure the RT has sufficient power for normal operation (see Figure 36). These pairs do not pass through the doubler, but should be of the same quality and gauge as the HDSL pairs.

Doublers can be used only on 24 channel systems, four and six channel systems do not utilize doublers.

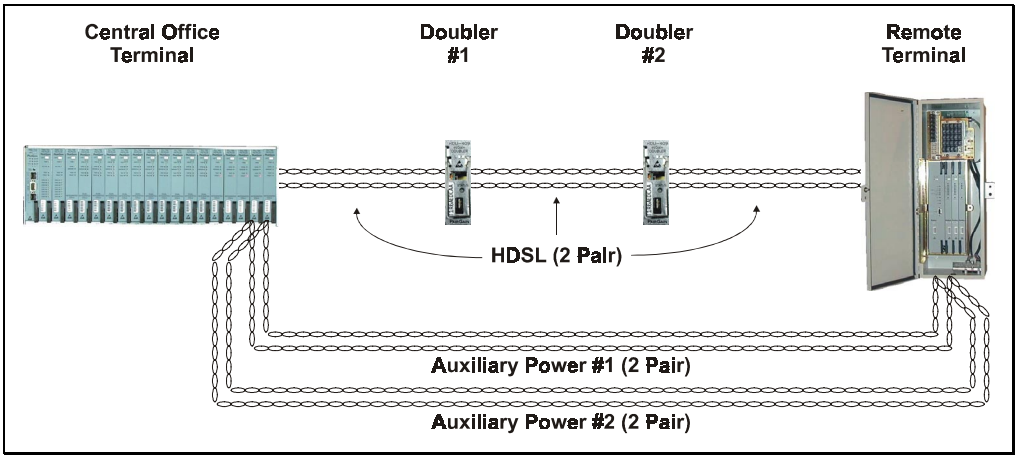


Figure 36
24 Channel PG-Flex*Plus* System with Doublers

5.10 Qualifying the Loop Plant for DSL Services

As xDSL technology is pushed to its limits, the more susceptible these circuits are to physical cable impairments and noise. Bridged taps, multiple gauge changes, and the overall condition of the outside plant will affect the quality of the digital service. The first step in qualifying copper pairs for digital service is to look at these pairs like they were POTS circuits. After all, a digital pair is nothing more than a POTS pair with an attitude.

Qualifying a loop prior to DSL deployment will reduce the repeat report rate and kickbacks while improving operating company efficiency and customer satisfaction. Qualifying a loop is a two-step process:

- Ensure the loop meets the CSA (Carrier Serving Area) requirements for DSL service. Basic POTS circuit test procedures will determine whether the cable is too long, or if ac or dc faults are present that may significantly impair service.

- Confirm that the loop meets DSL performance requirements. BERT (Bit Error Rate Testing) emulates the DSL signaling and provides the best prediction of the circuit's service performance after installation.

5.10.1 Voltage

Even when a cable has been bonded and grounded in accordance with local practices, there may still be a certain amount of voltage present on the cable pairs and it may not be possible to find any pairs that are "dry" (0 volts on the conductors). When qualifying pairs for DSL service, try to locate pairs that have less than about 3 Vdc on the conductor; this will not have any significant adverse affects on the DSL signals.

A voltage greater than about 10 Vac on dry conductors is usually an indication of water in the cable, a bonding and/or grounding problem with the cable, or a problem with the cable sheath or pair. These pairs should not be used for DSL circuits as the foreign voltage may induce excessive noise on the circuit that will result in high bit error rates, or adversely affect the ground fault protection circuitry in the PG-Flex CO line units.

5.10.2 Resistance

Resistance between the tip and ring of an DSL circuit will attenuate the DSL signal level; the lower the resistance, the shorter the allowable length of the DSL span. Tip-ground and ring-ground resistance will have a similar impact on span length. A tip-ground and/or ring-ground resistance will affect circuit balance and introduce noise onto the DSL circuit that can result in excessive bit error rates.

A tip-ground and/or ring-ground resistance less than about 200 kΩ may activate the ground fault detection circuitry in the PG-Flex CO line unit and cause its power supply to shut down until the ground fault is cleared. While the CO line unit power supply is shut down, all subscribers on the PG-Flex system will be out of service.

Most operating companies consider a circuit is good if there is greater than 3.5 MΩ of resistance between tip and ring, tip and ground, and ring and ground. When these measurements drop below 1 MΩ, this is an excellent indication that the circuit is (or has been) exposed to water, the cable sheath is damaged, or there is some other circuit impairment that may seriously degrade the performance of the DSL circuit.

Wherever possible, try to find circuit pairs where resistance measurements are greater than 3.5 MΩ. If the necessary pairs cannot be found that meet this criteria, use the available pairs with the highest resistance measurements in the cable.

5.10.3 Loss and Margin Objectives

Designing DSL spans with losses not exceeding the maximum circuit design loss (see section 5.6 on page 47) will ensure that the DSL circuit will continue to provide satisfactory service as span conditions change due to noise, temperature, and other extraneous influences.

5.10.4 Typical Impairments to DSL

With few exceptions, it is difficult to quantify the exact dB of loss any impairment will have on the DSL signal; it is important to remember, however, that any impairments on the span will degrade the quality of the DSL signal and may result in higher bit error rates on the DSL payload than expected. As such, all reasonable efforts should be made to remove as many of these impairments as possible before placing DSL service on the copper pairs.

5.10.4.1 Bridged Taps and Splices

Bridged taps and splices cause echoes and noise in the DSL signals, some of which can be filtered out by the echo cancellers in the DSL transceivers. However, if the bridged tap is too long or too close to the transceivers, the echo cancellers may not be able to reliably differentiate between the actual signal and the reflections. Figure 37 shows the echoes and noise caused by splices and bridged taps in an DSL span.

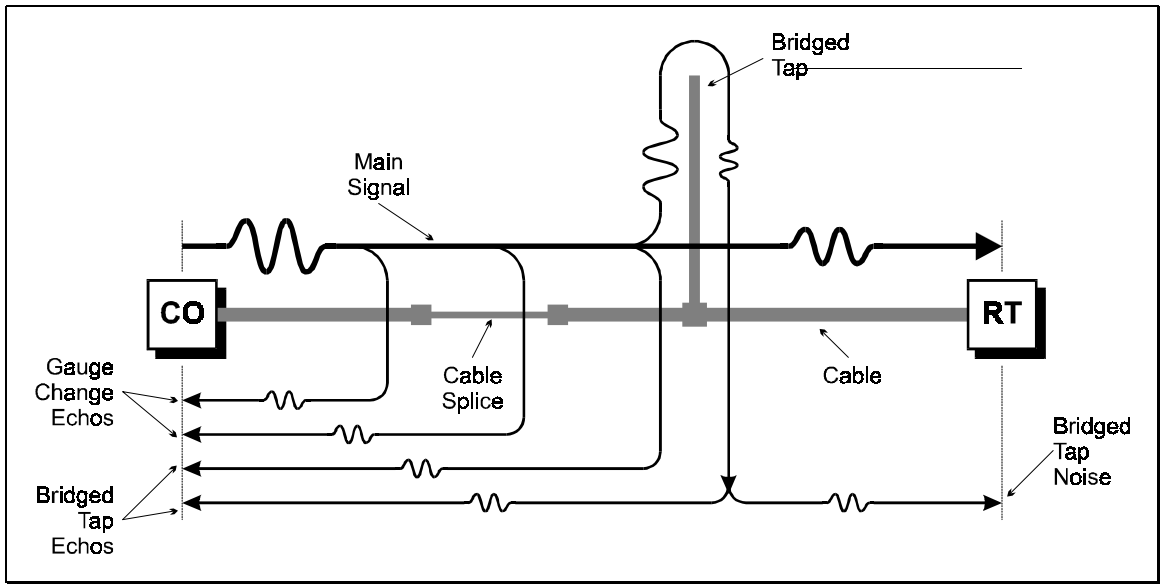


Figure 37
Bridged Taps and Splices

Bridged taps are considered the most significant structural impairment to DSL in the subscriber loop environment and are any non-essential portion of the cable pair that is not part of the dc loop. This includes not only bridged taps that occur on the span, but also any runs that extend beyond the ends of the DSL circuit. There are several rules to follow with bridged taps:

1. The total length of all bridged taps in the span must be less than 2.5 kft.

2. No single bridged tap can be greater than 2.0 kft in length.

3. When calculating span losses, 3 dB should be included for each bridged tap in the span, regardless of the length of each bridged tap.

4. Any bridged tap within 1 kft from an HDSL transceiver (COLU, RTLU, or mid-span doubler) should be removed. The closer a bridged tap is to an DSL transceiver, the greater the impact it can have on degrading the DSL signal. A short bridged tap located close to an HDSL transceiver may create more havoc on the DSL signal than a long bridged tap located in the middle of an DSL span.

Each splice in a circuit results in echoes that add noise to the HDSL signal and makes it more difficult for the DSL transceivers to accurately recover the data payload. Figure 37 shows the echoes generated when the DSL signal encounters cable splices.

When calculating span losses, 1 dB should be included for each splice in the span. For example, if there was a span of 26 AWG cable that had a section of 24 AWG spliced in the middle, 2 dB should be included in the span loss calculation (1 dB for each end of the spliced section).

5.10.4.2 Load Coils

Load coils are inductors used to reduce the attenuation and distortion of telephone circuits over the voice-frequency band (typically 300 Hz to 3.4 kHz) by counteracting the affects of cable capacitance when these circuits extend beyond the normal carrier serving area. Loaded telephone circuits will allow modems to run at 28.8 kb/s and caller ID to work.

Load coils present a “brick wall” to DSL signals and must be removed from any cable pairs used to transport DSL signals. With few exceptions, load coils are only found on extremely long cable pairs. In many cases, however, it is these long cable pairs that are being readied for digital services such as DSL.

5.10.4.3 Build-out Capacitors

Build-out capacitors are placed across the cable pair to simulate a longer cable pair. While not commonly used on POTS circuits, they are sometimes used on data circuits (including POTS circuits used for modems or provisioned for Caller ID) where the digital receivers expect a higher signal loss than the copper plant is providing (this is usually due to relatively short loop lengths).

Build-out capacitors present a short to DSL signals and must be removed from any spans used to transport DSL signals.

5.10.4.4 Noise Mitigation Inductors

Noise mitigation inductors are typically used in subscriber drops to eliminate the affects of a local radio transmitter such as an AM or FM radio station or taxi dispatch transmitter. Like load coils, these inductors are the equivalent of a “brick wall” to DSL signals and must be removed from any spans used to transport DSL signals. These inductors can, however, still be used on subscriber drops between the remote terminal and the subscriber station equipment.

5.11 Subscriber Drop Testing

PG-Flex*Plus* eliminates dependence on a metallic bypass pair for subscriber drop testing by implementing TR-909 compliant testing of the drop. The condition of the drop is reported using three-terminal resistive signatures (see Table 23) that can be measured by the local test system, or on a VT-100 terminal connected to the craft port.

Table 23
TR-909 DC Signatures

Indication	Signature Resistors (1%)		
	T-R	T-G	R-G
RT Equipment Failure	17.8 kΩ	90.9 kΩ	90.9 kΩ
Foreign Voltage Test Failure	27.8 kΩ	90.9 kΩ	90.9 kΩ
All Tests Pass	38.3 kΩ	90.9 kΩ	90.9 kΩ
Drop Termination Test Failure	48.3 kΩ	90.9 kΩ	90.9 kΩ
Resistive Fault Test Failure	58.0 kΩ	90.9 kΩ	90.9 kΩ
Receiver Off-Hook Test Failure	68.0 kΩ	90.9 kΩ	90.9 kΩ
Hazardous Potential Test Failure	78.5 kΩ	90.9 kΩ	90.9 kΩ
HDSL Facility Failure	≥ 1000 kΩ	90.9 kΩ	90.9 kΩ

Figure 38 shows the test result screen for a PG-Plus system. PG-Plus performs the testins in the order shown on the screen. In the event of a test failing, PG-Plus will indicate the test that failed and terminate the test sequence.

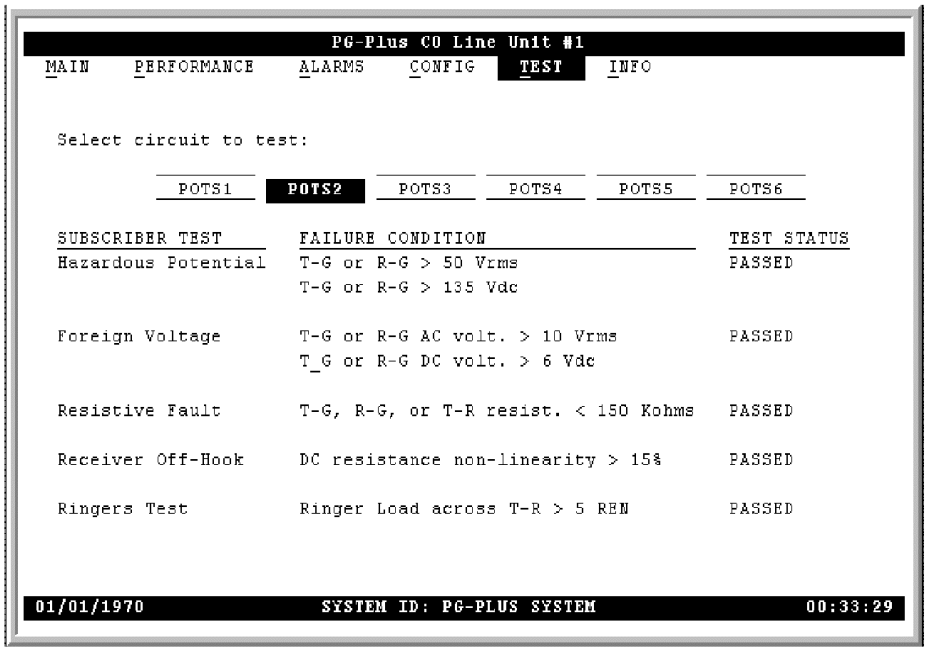


Figure 38
PG-Flex*Plus* Subscriber Drop Test Result Screen

5.12 Concentration

This section identifies the number of digital transmission facilities required to support various levels of concentration and acceptable levels of call blocking.

5.12.1 Determining System Concentration

The proper concentration level is determined by the acceptable probability of blocking a call and by Engset (similar to Erlang) traffic equations. The following factors enter into the equation:

- Number of subscriber lines
- Number of DS1 trunks in the GR-303 Interface Group (IG)
- Assumed Call Traffic load
- Acceptable probability of blocking a call during that planned traffic level

For a given probability of blocking, the statistics allow higher concentration levels for larger GR-303 interface groups as shown in Table 24 for a traffic level of 0.3 Erlang on each line (where 0.3 Erlang equates to 30% utilization).

Table 24
Concentration vs. Line Size and Probability of Blocking

Probability of Blocking	Number of Subscriber Lines			
	500	1,000	1,500	2,000
10^{-3}	3.5	3.8	3.9	3.9
10^{-4}	3.4	3.6	3.7	3.8
10^{-5}	3.2	3.5	3.6	3.7

As Table 24 shows, the concentration would need to be ≤ 3.5 for 500 lines to have a probability of blocking of 1 in 1,000 (10^{-3}) calls. However, for a blocking probability of 10^{-3} for 2,000 lines, the concentration could be up to 3.9. The reason for this is that larger interface groups allow higher levels of concentration.

5.12.2 GR-303 Concentration

T1 lines can be grouped in GR-303 groups that depend on the selected concentration ratio. GR-303 defines the digital interface between a LDS (Local Digital Switch) and a RDT (Remote Digital Terminal) such as the UAP. The GR-303 interface includes the following characteristics:

- A GR-303 Interface Group can support up to 2048 subscribers, with concentration.
- The concentration depends on the number of DTFs (Digital Transmission Facilities) provided between the RDT and the switch, which can range from a minimum of two to a maximum of 28 DS1s per GR-303 Interface Group.

The concentration determines which upper limit will be reached first, as shown in Table 25.

Table 25
Minimum DTFs as a Function of Subscribers to DS0 Channels and Concentration

Concentration	Number of Subscriber Lines				
	500	1,000	1,500	2,000	2,048
1	21	–	–	–	–
2	11	21	–	–	–
3	7	14	21	28	–
4	6	11	16	21	22
5	5	9	13	17	18
6	4	7	11	14	15
7	3	6	9	12	13

For a blocking probability level of 10^{-3} for 2,000 subscribers, Table 25 indicates that there must be at least 21 DS1s provisioned as DTFs in the GR-303 interface.

5.13 System Administration

System administration functions, such as alarm checking and clearing, configuration changes, performance monitoring, and testing is accomplished through a VT-100 terminal connected to either the PMU-712 front panel connector, or through the backplane RS-232 connector. The following sections describe how to connect modems and terminals to the front and backplane craft ports.

5.13.1 Front Panel RS-232 Craft Port

The front panel (craft port) RS-232 connector is a DB-9 female connector wired as a Data Communication Equipment (DCE) interface. The signals and pin assignments for this connector are listed in Table 26. Connections between the RS-232 craft port and a VT-100 terminal are shown in Figure 39 for both DB-9 and DB-25 connectors. Although a cable can be used that connects only the Transmit Data (TD), Receive Data (RD), and Ground (GND) signals, the craft port will not automatically log off when the terminal is unplugged. Using a cable that also connects the Data Terminal Ready (DTR) signal will ensure automatic log off when the terminal is unplugged.

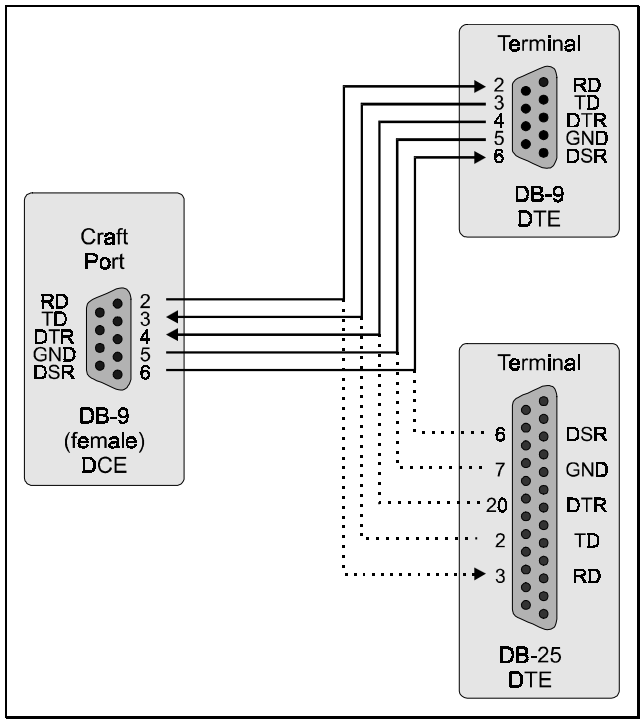


Figure 39
Front Panel Craft Port to Terminal Connections

The pinouts for the front panel PMU craft port are provided in Table 26.

Table 26
DB-9 Connector Pinouts

DB-9 Pin	Signal
2	Received Data
3	Transmitted Data
4	Data Terminal Ready
5	Signal Common
6	Data Set Ready

When connecting the RS-232 port to a modem, a null modem cable should be used. The wiring for this cable is shown in Figure 40. Ensure that the modem's Carrier Detect (CD) and Data Terminal Ready (DTR) functions are enabled. This will allow the modem connection to terminate properly when the PMU drops Data Set Ready (DSR) and the unit will log off when the modem drops Carrier Detect.

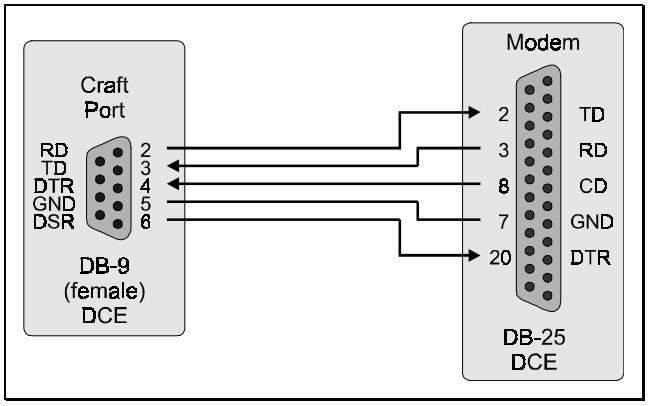


Figure 40
Front Panel Craft Port to Modem Connections using a Null Modem Cable

The craft port supports a VT-100 terminal interface, rather than an American National Standards Institute (ANSI) terminal. The VT-100 interface allows "real time" updating of information displayed on the screen, rather than requiring the technician to press the ENTER key to refresh the screen. The VT-100 should be configured as shown in Table 27.

Table 27
VT-100 Terminal Configuration

Parameter	Setting
Data	
Bits	8
Stop Bits	1
Parity	None
Baud Rate	
Autobaud	1.2 kb/s
	2.4 kb/s
	4.8 kb/s
	9.6 kb/s
	14.4 kb/s
	19.2 kb/s
	28.8 kb/s
	38.4 kb/s
	57.6 kb/s
Software Flow Control (XON/XOFF)	Enabled

5.13.2 Backplane Craft Port

The rear backplane DB-25 is a female connector wired as a Data Terminal Equipment (DTE) interface. The signals and pin assignments for this connector are listed in Table 28. This connector is for communication with a modem or terminal. Figure 41 shows the cable connections between the backplane connector and a DCE DB-25 connector.

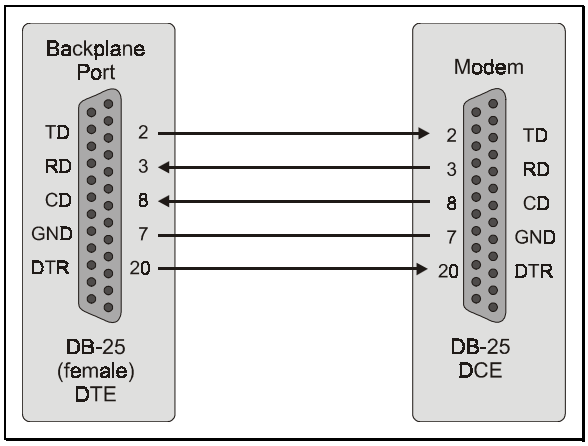


Figure 41
Backplane Craft Port to Modem Connections

Pinouts for the backplane craft port are shown in Table 28.

Table 28
DB-25 Connector Pinouts

DB-25 Pin	Signal
2	Transmitted Data
3	Received Data
8	Carrier Detect
7	Signal Common
20	Data Terminal Ready

To connect to a DTE device from the backplane connector, a null modem cable is required. Figure 42 shows the wiring for the required null modem cable to a DB-9 and DB-25 connector.

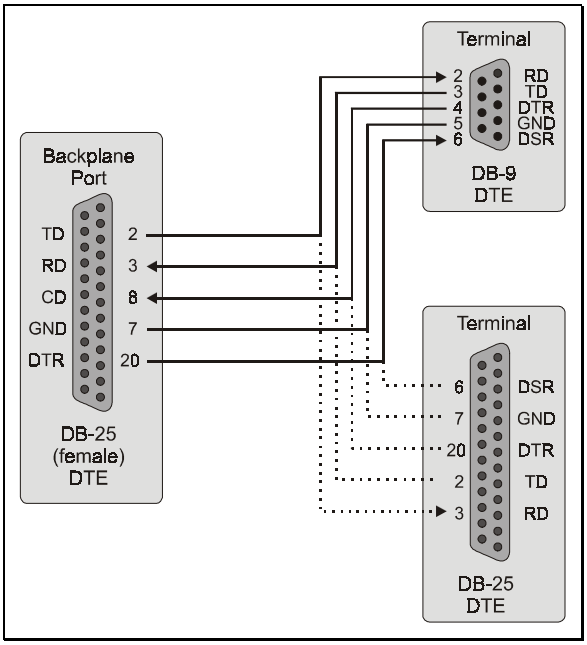


Figure 42
Backplane Craft Port to Terminal Connections using a Null Modem Cable

6. Specifications

This section identifies the equipment described in this document and key product specifications. Additional information can be found in the practices associated with each product.

6.1 Equipment Identification

Equipment is grouped by its by location in the network. The model number, part number, CLEI code, and product description are provided. Where applicable, the page number where additional information can be found for each product in this document is also provided.

6.1.1 Universal Access Platform Central Office Equipment

Products associated with the UAP are listed in Table 29. This equipment is required when the PG-Flex*Plus* is connected to the local digital switch through a GR-303 interface and typically resides in the serving CO.

Table 29
Universal Access Platform Equipment

Model No.	Part No.	CLEI Code	Description	Page
FCS-570 List 2	1161405	SBMAPK0E~~	23" UAP COT Shelf	68
FID-573 List 1	150-2373-01	SBHSEF0D~~	1 DS3 Interface Unit	69
FIT-572 List 1	150-2372-01	SBLSW60B~~	12 DS1 Interface Unit (SF, ESF)	70
FIT-572 List 3	1161402	SBLSW80B~~	12 DS1 Interface Unit (TR-08)	70
FSU-571 List 2	1161404	SBPQAA9E~~	Central Processor Unit (ATM/TR-08)	81
FTP-579 List 1	150-2379-01	SBMMJ20D~~	1:8 Protection Switch	82

Table 30 lists the cables used to interconnect the UAP to the central office switching and cross-connect equipment and to the PG-Flex*Plus* COT shelf.

Table 30
Universal Access Platform Interconnect Cables

Part No.	End #1	End #2	Length	Description
150-2377-04	50-pin Amphenol (male – right angle reversed)	Stub	30’	2 x 12 pair shielded cable. Connects one UAP DS1 input to the DSX jack panel. 1 cable is required for each DS1 connection between the UAP and the DSX jack panel.
150-2377-05	50-pin Amphenol (male – right angle reversed)	50-pin Amphenol (male – low profile)	10’	2 x 12 pair shielded cable. Connects one UAP DS1 input to a DS1 output on one Protection Switch. 1 cable is required for each DS1 connection between the UAP and the Protection Switch.
150-2377-06	50-pin Amphenol (male – low profile)	Stub	30’	2 x 12 pair shielded cable. Connects one DS1 input on one Protection Switch to the DSX jack panel. 1 cable is required for each DS1 connection between the Protection Switch and the DSX jack panel.
150-2378-01	DB-9 (male)	DB-9 (male)	6’	Straight-through data cable. Connects the UAP protection switch control to the Protection Switch. Also used to daisy-chain Protection Switches. 1 cable is required for each Protection Switch.
150-2378-02	DB-9 (male)	DB-9 (female)	6’	Straight-through data cable. Connects the UAP alarm output connector to the UAP alarm output relay box. 1 cable is required for each UAP.

6.1.2 PG-Flex*Plus* Central Office Equipment

The equipment listed in Table 31 is installed in the PG-Flex*Plus* COT shelf, and is dependent on the services being deployed from the PG-Flex*Plus* COT shelf.

Table 31
Central Office Equipment

Model No.	Part No.	CLEI Code	Description	Page
FLL-814 List 1A	1174460	VACHD7NG~~	24 Channel CO Line Unit	71
PCS-719 List 1A	150-1619-11	S9MTCB0A~~	23” PG-Flex*Plus* COT Shelf	86
PLL-735 List 1	150-1635-01	S9L1AR0A~~	Dual 4/6 Channel CO Line Unit	88
PMU-712 List 2	150-1612-02	S9C3CCDA~~	Management Unit	89
PMX-744 List 1A	150-1644-11	VAPHCC0C~~	8 DS1 Multiplex Unit	90

6.1.3 PG-Flex*Plus* Doublers

The doublers listed in Table 32 are used with the 24-channel PG-Flex*Plus* systems. While they are all functionally identical, the mechanics of the doubler housing will determine which doubler(s) to deploy. Only those doublers listed in Table 32 are compatible with the 24-channel PG-Flex*Plus* systems; other HDSL doublers should not be used.

Table 32
Doublers

Model No.	Part No.	CLEI Code	Description	Page
HDU-404 List 2	150-1558-02	T1R6AFDC~~	24 Channel Universal Doubler (200 Mechanics)	83
HDU-407 List 2	150-1576-02	T1R6AH0C~~	24 Channel Universal Doubler (DDS/ISDN Mechanics)	84
HDU-409 List 2	150-1572-02	T1R6AERC~~	24 Channel Universal Doubler (239 Mechanics)	85

6.1.4 PG-Flex*Plus* 4 and 6 Channel Remote Terminal NIDs

The PG-Flex*Plus* 4 and 6 channel NIDs listed in Table 33 are used in conjunction with the PLL-735 Dual 4/6 Channel CO Line Units and determine the type of service supported by each 4/6 channel system.

Table 33
4 and 6 Channel Remote Terminal Equipment

Model No.	Part No.	CLEI Code	Description	Page
PRL-770 List 2B	150-1670-22	S9MSBA0A~~	4 POTS NID (Outdoor/Indoor)	91
PRL-771 List 1B	150-1671-21	S9MSBB0A~~	6 POTS NID (Outdoor/Indoor)	92
PRL-772 List 1B	150-1672-21	S9MSBD0A~~	3 POTS, 1 ISDN NID (Outdoor/Indoor)	93
PRL-773 List 1B	150-1673-21	S9MSBC0A~~	2 ISDN NID (Outdoor/Indoor)	94
PRL-779 List 1C	150-1679-31	S9MSCHAA~~	6 UVG NID (Outdoor/Indoor)	95
PRL-779 List 1E	150-1679-51	S9MAEH0A~~	6 UVG NID (Indoor)	95

Table 34 summarizes the significant features, including service offerings and mounting configurations for each of the PG-Flex*Plus* NIDs listed in Table 33.

Table 34
PRL-77x NID Feature Matrix

Feature		PRL-770		PRL-771	PRL-772	PRL-773	PRL-779	
		L2B	L2E	L1B	L1B	L1B	L1C	L1E
Mounting	Indoor	●	●	●	●	●	●	●
	Outdoor	●		●	●	●	●	
	Wall	●		●	●	●	●	
	Pole	●		●	●	●	●	
	Desk		●					●
Subscriber Lines	POTS	4	4	6	3			
	ISDN				1	2		
	UVG						6	6
Subscriber Terminations	Line Module	●		●	●	●	●	
	Insulation Displacement		●					●
HDSL Terminations	Binding Post	●		●	●	●	●	
	Insulation Displacement		●					●
Subscriber Protection	Gas Tube	●		●	●	●		
	None		●				●	●
HDSL Protection	Gas Tube	●		●	●	●	●	
	None		●					●
Enclosure	Siecor 7600	●		●	●	●	●	
	Custom		●					●

6.1.5 PG-Flex*Plus* 24 Channel Remote Terminal Enclosures, Line and Channel Units

Table 35 identifies the line and channel units used with the 24 channel system. Note that the channel units determine the type of services offered through the 24 channel system.

Table 35
24 Channel Remote Terminal Line and Channel Units

Model No.	Part No.	CLEI Code	Description	Page
FRC-753 List 4C	150-1353-43	VARHCK1C~~	8 Channel Loop-start/Ground-start RT Channel Unit	72
FRC-756 List 1A	150-1356-11	VARHEJJC~~	4 Channel ISDN RT Channel Unit	73
FRL-842 List 1A	1174462	VARHZTPG~~	24 Channel RT Line Unit	80

Outdoor and Indoor remote terminal enclosures used with the 24 channel PG-Flex*Plus* system are listed in Table 36.

Table 36
Remote Terminal Enclosures

Model No.	Part No.	CLEI Code	Description	Page
FRE-765 List 4A	150-1365-41	VAMRBN0A~~	24 Channel Wall or Pole Mount RT Enclosure, Amp Quiet Front Terminations	74
FRE-860 List 1	150-2360-01	VAMRMS0A~~	24 Channel Outdoor RT Enclosure, Pedestal Mount, Screw Terminations	75
FRE-865 List 1	150-2365-01	VAMRNS0A~~	24 Channel Wall or Pole Mount RT Enclosure, Gel-filled Cable Stubs	76
FRE-865 List 1B	150-2365-12	VAMRNS0A~~	24 Channel Wall or Pole Mount RT Enclosure, Non-filled Cable Stubs	76
FRE-867 List 1	150-2367-01	VAMRP40A~~	48 Channel Wall or Pole Mount RT Enclosure, Gel-filled Cable Stubs	77
FRE-867 List 1B	150-2367-12	VAMRP40A~~	48 Channel Wall or Pole Mount RT Enclosure, Non-filled Cable Stubs	77
FRE-868 List 1	150-2368-01	VAMRT40A~~	48 Channel Indoor Wall Mount RT Enclosure, No HDSL Protectors	78
FRE-868 List 2	150-2368-02	VAMRTS0A~~	24 Channel Indoor Wall Mount RT Enclosure, No HDSL Protectors	78
FRE-868 List 3	150-2368-03	VAMRS40A~~	48 Channel Indoor Wall Mount RT Enclosure, 5-pin HDSL Protector Sockets	78
FRE-868 List 4	150-2368-04	VAMRSS0A~~	24 Channel Indoor Wall Mount RT Enclosure, 5-pin HDSL Protector Sockets	78
FRE-869 List 1	150-2369-01	VAMRT60A~~	96 Channel Indoor Rack Mount RT Enclosure, No HDSL Protection	79
FRE-869 List 2	150-2369-02	VAMRX60A~~	96 Channel Indoor Wall Mount RT Enclosure, No HDSL Protection	79
PCS-822 List 1	150-2322-01	S9MSDM0B~~	Remote Field Shelf	87

Table 37 lists the RT mounting hardware that is used with the RT enclosures listed in Table 36.

Table 37
Remote Terminal Enclosure Mounting Hardware

Part No.	Description
150-2397-01	RT Pole Mounting Kit for the FRE-765, FRE-865, and FRE-867 RT Enclosures (Galvanized Steel)
150-2397-11	FRE-860 Pedestal Mounting Kit for the Magnum 14" pedestal
150-2397-21	FRE-865 Pedestal Mounting Kit for the Magnum 14" pedestal

Features that differentiate the various models of the FRE-86x RT enclosures are identified in Table 38.

Table 38
FRE-765 and FRE-86x RT Enclosure Feature Matrix

Feature		FRE-765	FRE-860	FRE-865		FRE-867		FRE-868				FRE-869	
		L4A	L1	L1	L1B	L1	L1B	L1	L2	L3	L4	L1	L2
Mounting	Indoor							●	●	●	●	●	●
	Outdoor	●	●	●	●	●	●						
	Wall	●		●	●	●	●	●	●	●	●	●	
	Pole	●		●	●	●	●						
	Pedestal		●										
	Rack												●
Subscriber Lines	24 (1 System)	●	●	●	●				●		●		
	48 (2 Systems)					●	●	●		●			
	96 (4 Systems)											●	●
Subscriber Terminations	35’ Gel-filled Stub			●		●							
	35’ Non-filled Stub				●		●						
	Amp Quiet Front	●											
	Amphenol (male)							●	●	●	●	●	●
	Marconi A-Line		●										
HDSL, Bypass, Auxiliary Power Terminations	35’ Gel-filled Stub			●		●							
	35’ Non-filled Stub				●		●						
	Amp Quiet Front	●											
	Amphenol (male)											●	●
	Marconi A-Line		●										
	Screw Terminal							●	●	●	●		
Subscriber Protection	5-pin Sockets	●	●	●	●	●	●						
	None							●	●	●	●	●	●
HDSL, Bypass, Auxiliary Power Protection	5-pin Sockets		●	●	●	●	●			●	●		
	Amp Quiet Front	●											
	None							●	●			●	●

6.2 General Specifications

The following specifications apply to all equipment described in this section, unless otherwise noted.

Environment	Operating Elevation	-200 ft. to 13,000 ft. (-60 m to 4,000 m)
	Operating Temperature	-40° F to 150° F (-40° C to +65° C)
	Operating Humidity	5% to 95% (non-condensing)
Compliance	NEBS	SR-3580 for Level 3
	Human Safety	UL-1950 for Restricted Access
	Emissions Radiation and Immunity	GR-1089-CORE for Class A Equipment (central office equipment)
		GR-1089-CORE for Class B Equipment (outside plant equipment)

6.3 Product Specifications

Key product specifications are provided in the following sections and are listed in alphabetical order, based on product model number. Refer to the product documentation for additional information, including installation, provisioning, operating, and maintenance procedures.

6.3.1 FCS-570 List 2 – UAP 23” COT Shelf

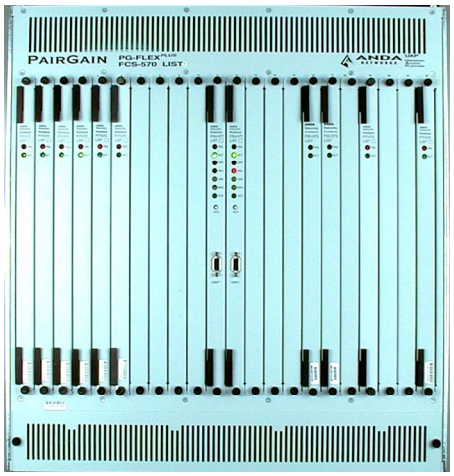
Description and Ordering Information

Part No: 1161405

CLEI Code: SBMAPK0E~~

Description: The FCS-570 Universal Access Platform (UAP) COT shelf fits in a 23” equipment bay and provides mounting for DS1, DS3, and CPU plugs. It includes a fan module for equipment cooling.

Features:
- ❏ 20 slots for DS1 or DS3 plugs
- ❏ 2 slots for redundant CPUs
- ❏ Fans for equipment cooling



Specifications

Connectors	CO Battery:	Screw terminals
	Frame Ground:	Screw terminals
	DS1 Circuits:	25-pr. Amphenol (female)
	DS3 Circuits:	BNC
	Alarm Relays:	Wire-wrap
	Network Clock:	DB-9 (female)
	Craft Port:	DB-9 (female)
	Protection Switch:	DB-9 (female)
	Ethernet:	RJ-45 (primary and secondary)
Physical Characteristics	Height:	22.75 in. (57.8 cm)
	Width:	23.00 in. (58.4 cm)
	Depth:	10.00 in. (25.4 cm)
	Weight:	70.0 lbs. (31.5 kg)
Environment	Operating Temperature:	32° F to 113° F (0° C to +45° C)
	Operating Humidity:	5% to 85% (non-condensing)
	Cooling:	Forced air (removable fan tray)

6.3.2 FID-573 List 1 – UAP DS3 Interface Unit

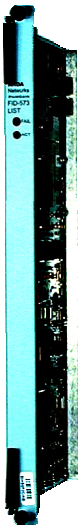
Description and Ordering Information

Part No: 150-2373-01

CLEI Code: SBHSEF0D~~

Description: The FID-573 DS1 Interface Unit provides one DS3 interface to the UAP system. The UAP can cross-connect individual DS0s in the DS3 circuit to other DS3 or DS1 circuits in the UAP. DS3 redundancy can be provided by installing a second FID-573.

Features:
- ❏ 1 DS3 per module
- ❏ Local and remote loopbacks
- ❏ Circuit status indicators



Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc	
	CO Input Power:	15 Watts (nominal)	
	CO Heat Dissipation:	15 Watts (nominal)	
Signaling Characteristics	Line Interface:	DS3 (with line build out)	
	Line Rate:	44.736 Mb/s per CCITT G.703	
	Input Impedance:	75 Ω (coax – RJ-59)	
	Signaling/Framing:	DS3	
	Line Coding:	B3ZS	
	Frame Format:	M13, C-bit	
Physical Characteristics	Height:	15.60 in.	(39.5 cm.)
	Width:	0.80 in.	(2.0 cm.)
	Depth:	9.60 in.	(24.5 cm.)
	Weight:	0.6 lb.	(0.3 kg.)

6.3.3 FIT-572 Series – UAP DS1 Interface Unit

Description and Ordering Information

Part No:	150-2372-01	(List 1)	(D4, ESF, GR-303)
	1161402	(List 3)	(TR-08)
CLEI Code:	SBLSW60B~~	(List 1)	(D4, ESF, GR-303)
	SBLSW80B~~	(List 3)	(TR-08)

Description: Each FIT-572 DS1 Interface Unit supports 12 DS1 circuits. The UAP provides full cross-connect capabilities at the DS0 level. DS1 circuits may be protected by installing the FTP-579 1:8 Protection Switch.

Features:

- ❏ 12 DS1s per module
- ❏ Local and remote loopbacks
- ❏ Circuit status indicators
- ❏ SF, ESF frame formatting (List 1)
  TR-08 frame formatting (List 3)

Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc	
	CO Input Power:	10 Watts (nominal)	
	CO Heat Dissipation:	10 Watts (nominal)	
Signaling Characteristics	Line Interface:	DSX1 with line build out provisioning	
	Line Rate:	1.544 Mb/s per CCITT G.703	
	Input Impedance:	100 Ω (twisted pair)	
	Signaling/Framing:	D4/SF, ESF	
	Line Coding:	AMI, B8ZS	
Physical Characteristics	Height:	15.60 in.	(39.5 cm.)
	Width:	0.80 in.	(2.0 cm.)
	Depth:	9.60 in.	(24.5 cm.)
	Weight:	0.6 lb.	(0.3 kg.)

6.3.4 FLL-814 List 1A – 24 Channel CO Line Unit

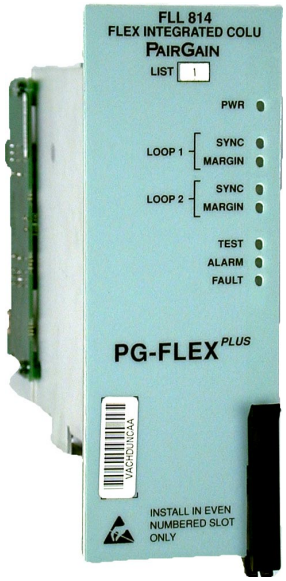
Description and Ordering Information

Part No: 1174460

CLEI Code: VACHD7NG~~

Description: The FLL-814 is a 24-channel Integrated Central Office Line Unit (ICOLU) placed in a PG-Flex*Plus* Central Office Terminal (COT) Shelf. The FLL-814 used in conjunction with the FRL-842 Remote Terminal Line Unit (RTLU) and PG-Flex Remote Terminal Channel Units (RTCUs).

Features:
- ❏ HDSL line transceivers and power supply
- ❏ Front panel status indicators
- ❏ Downloadable firmware
- ❏ Mechanized Loop Test (MLT)/Test Bus Control Unit (TBCU) compatibility
- ❏ 4TEL loop test compatibility



Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc	
	CO Input Current[11]:	0.10 A (minimum) 1.06 A/1.52 A with no Doublers (maximum) 1.21 A/1.67 A with 1 Doubler (maximum) 1.33 A/1.88 A with 2 Doublers (maximum)	
	CO Input Power[11]:	5 Watts (minimum) 51 Watts/73 Watts with no Doublers (maximum) 58 Watts/80 Watts with 1 Doubler (maximum) 64 Watts/90 Watts with 2 Doublers (maximum) Cooled by natural convection	
	CO Heat Dissipation[11]:	5 Watts (minimum) 11 Watts/15 Watts with no Doublers (maximum) 14 Watts/16 Watts with 1 Doubler (maximum) 14 Watts/18 Watts with 2 Doublers (maximum)	
	COLU Output Voltage:	±140 Vdc (maximum)	
	COLU Output Power[11]:	0 Watts (minimum) 40 Watts/58 Watts with no Doublers (maximum) 44 Watts/64 Watts with 1 Doubler (maximum) 50 Watts/73 Watts with 2 Doublers (maximum)	
	COLU Output Protection:	Short-circuit, over-voltage, over-current	
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format	
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*	
Physical Characteristics	Height:	5.50 in.	(14.0 cm)
	Width:	2.20 in.	(5.6 cm)
	Depth:	10.25 in.	(26.0 cm)
	Weight:	1.2 lbs.	(0.5 kg)

[11] Where two values are provided, the first value assumes the subscriber drop loop length provisioning option for the FRC-753 List 4C RTCU is configured for short lengths and the second number is for subscriber drop loop lengths provisioned for long lengths. All 24 subscriber circuits are off-hook.

6.3.5 FRC-753 List 4C – 8 Channel Loop Start/Ground Start RT Channel Unit

Description and Ordering Information

Part No: 150-1353-43

CLEI Code: VARHCK1C~~

Description: The FRC-753 List 4C Loop Start/Ground Start Remote Terminal Channel Unit (RTCU) provides eight loop start or ground start (LS/GS) channel interfaces for POTS services between a PG-Flex RT and subscribers. Each of the eight circuits is automatically provisioned for either loop start or ground start services. Subscriber drop testing conforms to TR-909.

Features:

- ❑ 8 LS/GS POTS circuits
- ❑ Front-panel status indicators
- ❑ Supports CLASS services
- ❑ Supports MLT drop testing
- ❑ Line-side answer supervision

Specifications

POTS Characteristics	Analog Impedance:	600 Ω	
	Subscriber Drop:	960 Ω (includes 430 Ω for station equipment)	
	DC Loop Voltage:	-48 Vdc (open loop)	
	DC Loop Current:	23 mA (minimum)	
	Ringer Output:	40 V_{RMS} + DC loop voltage 5 REN per circuit 15 REN per system	
	End-to-End Loss:	-2.5 dB ± 1.0 dB	
	Output Protection:	Primary and secondary protection	
Physical Characteristics	Height:	12.00 in	(30.5 cm)
	Depth:	04.50 in	(11.4 cm)
	Width:	01.00 in	(2.5 cm)
	Weight:	0.6 lb.	(0.3 kg.)

6.3.6 FRC-756 List 1A – 4 Channel ISDN RT Channel Unit

Description and Ordering Information

Part No: 150-1356-01

CLEI Code: VARHEJJC~~

Description: The FRC-756 List 1 ISDN RT Channel Unit provides an interface to the North American ISDN Basic Access services through a PG-Flex RT. The FRC-756 accommodates four ISDN channels and provides the ISDN Line Unit Line Termination (LULT) at the RT.

Features:
- ❏ Mechanized Loop Testing (MLT) compatible and metallic test access
- ❏ mp/pp-eoc slave mode in 3DS0 format
- ❏ software provisioning
- ❏ sealing current

Specifications

ISDN Characteristics	Code:	2B1Q at 160 kbps	
	Network Interface:	3DS0 format	
	Basic Rate Interface:	2B+D (2 B channels at 64 kbps, 1 D channel at 16 kbps)	
	Distance (to NT1):	Up to 18 kft or 1300 Ω	
	dc Test Signature:	30 kΩ	
	Maximum Line Loss:	42 dB @ 40 kHz	
	Sealing Current::	4.8 mA (nominal)	
	Facility Impedance:	135 Ω	
Physical Characteristics	Height:	12.00 in	(30.5 cm)
	Depth:	04.50 in	(11.4 cm)
	Width:	01.00 in	(2.5 cm)
	Weight:	0.6 lb.	(0.3 kg)

6.3.7 FRE-765 List 4A – 24 Channel Outdoor RT Enclosure

Description and Ordering Information

Part No: 150-1365-41

CLEI Code: VAMRBN0A~~

Description: The FRE-765 RT Outdoor Enclosure can be wall or pole mounted and supports one 24-channel system. The RT Enclosure provides Amp Quiet Front termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The system gets its power from the COT Shelf.

Features:

- ❑ Outdoor wall or pole mounting
- ❑ Supports one 24-channel system
- ❑ Amp Quiet Front terminations
- ❑ 5-pin protector sockets

Specifications

Terminations and Protection	Terminations:	HDSL:	Amp Quiet Front terminations
		Subscriber:	Amp Quiet Front terminations
	Protection:	HDSL:	Included with HDSL terminations
		Subscriber:	5-pin protector sockets
Physical Characteristics	Height:	19.25 in.	(48.9 cm.)
	Width:	24.25 in.	(36.2 cm.)
	Depth:	5.93 in.	(15.0 cm.)
	Weight (w/cables):	26.3 lb.	(11.9 kg.)
Mounting Hardware	Pole bracket:	Order the 150-2397-01 RT Pole Mounting Bracket when mounting the FRE-865 on a pole.	

6.3.8 FRE-860 Series – 24 Channel Outdoor RT Enclosures (Pedestal Mount)

Description and Ordering Information

Part No: 150-2360-01

CLEI Code: VAMRMS0A~~

Description: The FRE-860 Outdoor Pedestal Mount Enclosure mounts in a pedestal and supports one 24-channel system. The RT Enclosure provides termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The system gets its power from the COT Shelf.

Features:

- ❏ Outdoor pedestal mounting
- ❏ Compatible with the Marconi UP 10-900 and Coil Pedlock Magnum 14" pedestals
- ❏ Supports one 24-channel system
- ❏ 5 pin protector sockets for all terminations
- ❏ Screw terminations for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs

Specifications

Terminations and Protection	Terminations:	HDSL:	Screw terminals
		Subscriber:	Screw terminals
	Protection:	HDSL:	5-pin protector sockets
		Subscriber:	5-pin protector sockets
Physical Characteristics	Height:	23.60 in.	(59.9 cm.)
	Width:	7.70 in.	(19.5 cm.)
	Depth:	6.80 in.	(17.2 cm.)
	Weight:	30.0 lb.	(11.1 kg.)
Mounting Hardware	Pedestal bracket:	Order the 150-2397-11 Pedestal Mounting Bracket when installing the FRE-860 in the Marconi UP 10-900 pedestal.	

6.3.9 FRE-865 Series – 24 Channel Outdoor RT Enclosures

Description and Ordering Information

Part No: 150-2365-01 (List 1) (Gel-filled)
150-2365-12 (List 1B) (Non-filled)

CLEI Code: VAMRNS0A~~ (List 1) (Gel-filled)
VAMRNS0A~~ (List 1B) (Non-filled)

Description: The FRE-865 RT Outdoor Enclosure can be wall or pole mounted and supports one 24-channel system. The RT Enclosure provides termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The system gets its power from the COT Shelf.

Features:

- ❏ Outdoor wall or pole mounting
- ❏ Compatible with the Marconi UP 10-900 and Coil Pedlock Magnum 14" pedestals
- ❏ Supports one 24-channel system
- ❏ 5 pin protector sockets for all terminations
- ❏ 35' cable stubs

Specifications

Terminations and Protection	Terminations:	HDSL:	35' Gel-filled or non-filled cable stub
		Subscriber:	35' Gel-filled or non-filled cable stub
	Protection:	HDSL:	5-pin protector sockets
		Subscriber:	5-pin protector sockets
Physical Characteristics	Height:	23.60 in.	(59.9 cm.)
	Width:	8.70 in.	(22.0 cm.)
	Depth:	6.80 in.	(17.2 cm.)
	Weight (w/cables):	30.0 lb.	(12.6 kg)
Mounting Hardware	Pedestal bracket:	Order the 150-2397-21 Pedestal Mounting Bracket when installing the FRE-865 in the Magnum 14" pedestal.	
	Pole bracket:	Order the 150-2397-01 RT Pole Mounting Bracket when mounting the FRE-865 on a pole.	

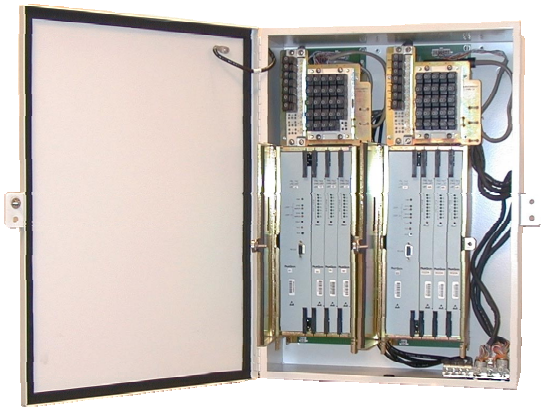
6.3.10 FRE-867 Series – 48 Channel Outdoor RT Enclosures

Description and Ordering Information

Part No: 150-2367-01 (List 1) (Gel-filled)
150-2367-12 (List 1B) (Non-filled)

CLEI Code: VAMRP40A~~ (List 1) (Gel-filled)
VAMRP40A~~ (List 1B) (Non-filled)

Description: The FRE-867 RT Outdoor Enclosure can be wall or pole mounted and supports two 24-channel systems. The RT Enclosure provides termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The systems get their power from the COT shelf.



Features:

- ❏ Outdoor wall or pole mounting
- ❏ Supports two 24-channel systems
- ❏ 5 pin protector sockets for all terminations
- ❏ 35’ cable stubs

Specifications

Terminations and Protection	Terminations:	HDSL:	35’ Gel-filled or non-filled cable stub
		Subscriber:	35’ Gel-filled or non-filled cable stub
	Protection:	HDSL:	5-pin protector sockets
		Subscriber:	5-pin protector sockets
Physical Characteristics	Height:	23.60 in.	(59.9 cm.)
	Width:	8.75 in.	(22.0 cm.)
	Depth:	6.80 in.	(17.2 cm.)
	Weight (w/cables):	56.0 lb.	(20.9 kg.)
Mounting Hardware	Pole bracket:	Order the 150-2397-01 RT Pole Mounting Bracket when mounting the FRE-867 on a pole.	

6.3.11 FRE-868 Series – 24 and 48 Channel Indoor Wall-mount RT Enclosures

Description and Ordering Information

Part No:

150-2368-01	(List 1)	(48 Ch., no protectors)
150-2368-02	(List 2)	(24 Ch., no protectors)
150-2368-03	(List 3)	(48 Ch., protectors)
150-2368-04	(List 4)	(24 Ch., protectors)

CLEI Code:

VAMRT40A~~	(List 1)	(48 Ch., no protectors)
VAMRTS0A~~	(List 2)	(24 Ch., no protectors)
VAMRS40A~~	(List 3)	(48 Ch., protectors)
VAMRSS0A~~	(List 4)	(24 Ch., protectors)

Description: The FRE-868 RT Indoor Enclosure can be wall mount and supports one or two 24-channel systems. The RT Enclosure provide termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The systems get their power from the COT shelf

Features:

- ❑ Indoor wall mounting
- ❑ Supports one or two 24-channel systems
- ❑ 5 pin protector sockets for CO terminations
- ❑ Amphenol subscriber terminations
- ❑ Indoor wall mount

List 1, 3

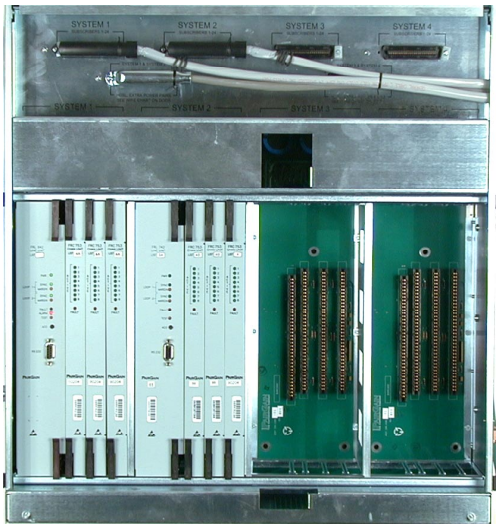
List 2, 4

Specifications

Termination and Protection	Terminations:	HDSL:	Screw terminals
		Subscriber:	25-pr. Amphenol
	Protection:	HDSL:	5-pin protector sockets (List 3 & 4 only)
		Subscriber:	None
Physical Characteristics	List 1, 3:		
	Height:	22.75 in.	(57.8 cm.)
	Width:	11.25 in.	(28.6 cm.)
	Depth:	7.25 in.	(18.4 cm.)
	Weight:	24.0 lb.	(10.8 kg.)
	List 2, 4:		
	Height:	22.75 in.	(57.8 cm.)
	Width:	6.00 in.	(15.2 cm.)
	Depth:	7.25 in.	(18.4 cm.)
	Weight:	15.0 lb.	(6.8 kg.)

6.3.12 FRE-869 Series – 96 Channel Indoor Wall and Rack-mount RT Enclosures

Description and Ordering Information



Part No: 150-2369-01 (List 1) (Wall Mount)
150-2369-02 (List 2) (Rack Mount)

CLEI Code: VAMRT60A~~ (List 1) (Wall Mount)
VAMRX60A~~ (List 2) (Rack Mount)

Description: The FRE-869 RT Indoor Enclosure can be wall or rack mounted and supports four 24-channel systems. The RT Enclosure provides termination points for subscriber circuits, HDSL, auxiliary power, and metallic bypass pairs. The systems get their power from the COT shelf.

Features:
- ❏ Indoor rack or wall mounting
- ❏ Supports four 24-channel systems
- ❏ Amphenol connectors for all terminations

Specifications

Terminations and Protection	Terminations:	HDSL:	25-pr. Amphenol (male)
		Subscriber:	25-pr. Amphenol (male)
	Protection:	HDSL:	None
		Subscriber:	None
Physical Characteristics	Height:	22.75 in.	(57.8 cm.)
	Width:	23.00 in.	(58.4 cm.)
	Depth:	7.13 in.	(18.1 cm.)
	Weight:	46.0 lbs.	(20.9 kg.)

6.3.13 FRL-842 List 1A – 24 Channel RT Line Unit

Description and Ordering Information

Part No: 1174462

CLEI Code: VARHZTPG~~

Description: The FRL-842 is a 24-channel Remote Terminal Line Unit (RTLU) that is placed in a PG-Flex RT Enclosure and is used in conjunction with the FLL-814 ICOLU. The FRL-842 supports up to three PG-Flex RTCUs.

Features:

- ❑ HDSL line transceivers and power supply
- ❑ Front panel status indicators
- ❑ Downloadable firmware
- ❑ Mechanized Loop Test (MLT)/Test Bus Control Unit (TBCU) compatibility
- ❑ 4TEL loop test compatibility

Specifications

Power Consumption and Heat Dissipation	RTLU Input Voltage:	-65 to -130 Vdc (Line 1) +65 to +130 Vdc (Line 2)	
	RTLU Input Power[12]:	14 Watts (minimum) 45 Watts/39 Watts with no Doublers (maximum) 41 Watts/35 Watts with 1 Doubler (maximum) 35 Watts/31 Watts with 2 Doublers (maximum)	
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format	
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*	
Physical Characteristics	Height:	12.00 in.	(30.5 cm)
	Width:	2.20 in.	(5.7 cm)
	Depth:	4.50 in.	(11.4 cm)
	Weight:	1.4 lb.	(0.6 kg)

[12] Where two values are provided, the first value assumes the subscriber drop loop length provisioning option for the FRC-753 List 4C RTCU is configured for short lengths and the second number is for subscriber drop loop lengths provisioned for long lengths. All 24 subscriber circuits are off-hook.

6.3.14 FSU-571 List 2 – UAP Central Processor Unit

Description and Ordering Information

Part No: 1161404

CLEI Code: SBPQAA9E~~

Description: The FSU-571 UAP CPU module controls all DS0 cross connections between DS1 and DS3 line cards in the chassis; cross connects DS1s and polls for the operating status of each card; logs and stores alarms also controls DS1 and DS3 protection schemes. A second CPU module can be installed for system redundancy.

Features:

- ❏ Downloadable software for easy system upgrades
- ❏ Two modules may be installed in a UAP shelf for system redundancy
- ❏ Front panel craft port for system provisioning.

Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc	
	CO Input Power:	15 Watts (nominal)	
	CO Heat Dissipation:	15 Watts (nominal)	
Physical Characteristics	Height:	15.60 in.	(39.5 cm.)
	Width:	0.80 in.	(2.0 cm.)
	Depth:	9.60 in.	(24.5 cm.)
	Weight:	0.6 lb.	(0.3 kg.)

6.3.15 FTP-579 List 1 – UAP 1:8 Protection Switch

Description and Ordering Information

Part No: 150-2379-01

CLEI Code: SBMMJ20D~~

Description: The FTP-579 UUAP 1:8 Protection Switch provides DS1 protection for up to eight FIT-572 DS1 interface units. Each FTP-579 requires a dedicated FIT-572 DS1 interface unit installed in the UAP shelf.

Features:

- ❑ 1:8 DS1 protection
- ❑ Latching relays for maximum reliability, low power.
- ❑ Up to four FTP-579s can be controlled from a single UAP.

Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc
	CO Input Power:	6 Watts (nominal)
	CO Heat Dissipation:	6 Watts (nominal)
Terminations	Circuit Interfaces:	T1 -- Amphenol (Female) DS3 -- BNC
	Ethernet:	RJ-45
	Network Clock:	DB9 (Female)
	RS-232:	DB9 (Female)
	Protection Switch:	DB9 (Female)
Physical Characteristics	Height:	1.75 in. (4.4 cm.)
	Width:	23.00 in. (58.4 cm.)
	Depth:	9.90 in. (25.1 cm.)
	Weight:	9.7 lbs. (4.4 kg.)
Environment	Operating Temperature:	32° F to 113° F (0° C to +45° C)
	Operating Humidity:	5% to 85% (non-condensing)

6.3.16 HDU-404 List 2 – 24 Channel Universal Doubler

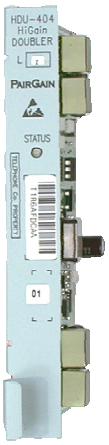
Description and Ordering Information

Part No: 150-1558-02

CLEI Code: T1R6AFDC~~

Description: The HDU-404 List 2 Doubler is a low-power micro doubler unit that extends the range of a 24-channel PG-Flex*Plus* system. The doubler is powered over the HDSL pairs that pass through the doubler. It can be installed in any doubler housing that supports 200 mechanics.

Features:
- ❑ Low latency
- ❑ Extremely low power dissipation
- ❑ Occupies one 200 Mechanics slot
- ❑ Front panel status display



Specifications

Power Consumption and Heat Dissipation	CO Input Current:	0.06 A (nominal) 0.07 A (maximum)
	CO Heat Dissipation:	3.1 Watts (nominal) 3.3 Watts (maximum)
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*
	Output:	+13 dBm
	Line Impedance	135 Ω
	Resistive Signature:	
	Input/Output:	25 Ω (maximum)
	Start-up Time (per span):	15 seconds (typical) 30 seconds(maximum)
Physical Characteristics	Mechanics:	200-type Mechanics
	Height: Width: Depth:	5.60 inch (14.2 cm) 0.70 inch (1.7 cm) 5.60 inch (14.2 cm)
	Weight:	1.1 lbs. (0.5 kg)
Mounting	Standard 400 Mechanics	
Electrical Protection	Secondary surge and power cross protection on all HDSL ports	
Line Clock Rate	Internal Stratum 4 clock	

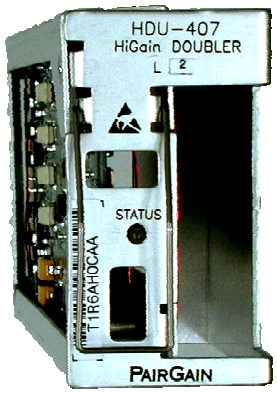
6.3.17 HDU-407 List 2 – 24 Channel Universal Doubler

Description and Ordering Information

Part No: 150-1576-02

CLEI Code: T1R6AH0C~~

Description: The HDU-407 List 2 Doubler is a low-power micro doubler unit that extends the range of a 24-channel PG-Flex^{Plus} system. The doubler is powered over the HDSL pairs that pass through the doubler. It can be installed in any doubler housing that supports DDS/ISDN mechanics.



Features:
- ❑ Low latency
- ❑ Extremely low power dissipation
- ❑ Occupies one standard DDS or ISDN Mechanics slot
- ❑ Front panel status display

Specifications

Power Consumption and Heat Dissipation	CO Input Current:	0.06 A (nominal) 0.07 A (maximum)
	CO Heat Dissipation:	3.0 Watts (nominal) 3.2 Watts (maximum)
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*
	Output:	+13 dBm
	Line Impedance	135 Ω
	Resistive Signature:	
	Input/Output:	25 Ω (maximum)
	Start-up Time (per span):	15 seconds (typical) 30 seconds(maximum)
	Electrical Protection:	Secondary surge and power cross protection on all HDSL ports
	Line Clock Rate:	Internal Stratum 4 clock
Physical Characteristics	Mechanics:	DDS/ISDN Mechanics
	Height:	5.60 in. (14.2 cm.)
	Width:	0.70 in. (1.7 cm.)
	Depth:	5.60 in. (14.2 cm.)
	Weight:	1.1 lb. (0.5 kg.)

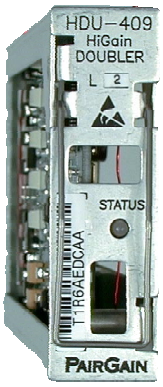
6.3.18 HDU-409 List 2 – 24 Channel Universal Doubler

Description and Ordering Information

Part No: 150-1572-02

CLEI Code: T1R6AERC~~

Description: The HDU-409 List 2 Doubler is a low-power micro doubler unit that extends the range of a 24-channel PG-Flex^{Plus} system. The doubler is powered over the HDSL pairs that pass through the doubler. It can be installed in any doubler housing that supports 239 mechanics.



Features:
- ❏ Extremely low latency
- ❏ Extremely low power dissipation
- ❏ Occupies one 239 mechanics slot
- ❏ Front panel status display

Specifications

Power Consumption and Heat Dissipation	CO Input Current:	0.06 A (nominal) 0.07 A (maximum)
	CO Heat Dissipation:	3.0 Watts (nominal) 3.2 Watts (maximum)
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*
	Output:	+13 dBm
	Line Impedance:	135 Ω
	Resistive Signature:	
	Input/Output:	25 Ω (maximum)
	Start-up Time (per span):	15 seconds (typical) 30 seconds(maximum)
	Electrical Protection:	Secondary surge and power cross protection on all HDSL ports
	Line Clock Rate:	Internal Stratum 4 clock
Physical Characteristics	Mechanics:	Single-slot 239 T1
	Height: Width : Depth: Weight:	2.60 in. (6.6 cm.) 0.75 in. (1.9 cm.) 6.50 in. (16.5 cm.) 0.8 lbs. (0.4 kg.)

6.3.19 PCS-719 List 1A – 23" PG-Flex*Plus* COT Shelf

Description and Ordering Information

Part No: 150-1619-11

CLEI Code: S9MTCB0A~~

Description: The PCS-719 23-inch COT shelf, supports a common management or alarm unit, two multiplexer units and up to sixteen PG-Flex*Plus* 4/6 Channel DICOLUs or up to eight 24-channel FICOLUs.

Features:

- ❑ 23", 5U, mounting
- ❑ One PAU or PMU can be installed
- ❑ 16 4/6-channel or 8 24-channel ICOLUs can be installed
- ❑ One or two PMXs can be installed

Specifications

Connectors	CO Battery:	Screw terminals	
	Frame Ground:	Screw terminal	
	HDSL, Auxiliary Power:	Wire-wrap	
	Subscriber:	2-wire – 25 pr. Amphenol (male) 4-wire – 32 pr. Amphenol (male)	
	Alarm Relays:	Wire-wrap	
	Composite Clock:	Wire-wrap	
	NMA:	DB-25	
	LAN:	BNC	
Slots	COLU:	16	
	PMU:	1	
	PMX:	2	
Physical Characteristics	Height:	8.75 in.	(22.5 cm.)
	Width:	23.00 in.	(58.4 cm.)
	Depth:	11.75 in.	(29.9 cm.)
	Weight:	18.5 lbs.	(8.4 kg.)

6.3.20 PCS-822 List 1 – Field Shelf

Description and Ordering Information

Part No: 150-2322-01

CLEI Code: S9MSFM0B~~

Description: The PCS-822 outdoor Field Shelf mounts in a pedestal and supports up to eight PG-Plus DICOLUs or four PG-Flex ICOLUs with HDSL, DS1, or T1 inputs. The shelf gets its power from a local, external, battery plant.

Features:

- ❏ Outdoor pedestal, pole, or wall mounting
- ❏ Power derived from local, external, battery plant.
- ❏ Supports up to eight DICOLUs or four ICOLUs.
- ❏ HDSL, DS1, or T1 interface to PMX multiplex units
- ❏ 5 pin protectors for all terminations toward PG-Flex RT Enclosures or PG-Plus NIDS.

Specifications

Terminations and Protection	Frame Ground:	Screw terminal	
	Terminations:	Circuits to RTs:	35' Gel-filled cable stub
		Circuits from CO:	35' Gel-filled cable stub
		CO Battery:	35' Gel-filled cable stub
	Protection:	Circuits to RTs:	5-pin protector sockets
		Circuits from CO:	5-pin protector sockets
Slots	COLU:	8	
	PMU:	1	
	PMX	2	
	HDSL/T1	5 (200 mechanics)	
Physical Characteristics	Height:	33.00 in.	(83.8 cm.)
	Width:	12.50 in.	(32.0 cm.)
	Depth:	15.00 in.	(38.1 cm.)
	Weight:	60.0 lbs.	(27.2 kg.)

6.3.21 PLL-735 List 1 – Dual Integrated Central Office Line Unit

Description and Ordering Information

Part No: 150-1635-01

CLEI Code: S9L1ADBA~~

Description: The PLL-735DICOLU supports two 4- or 6-channel PG-Plus NIDs. In a 23" COT shelf fully populated with PLL-735s, 32 NIDs (192 DS0s) can be served. It provides automatic HDSL rate adaptation, line powering of the NIDs, and performance monitoring of the HDSL circuit. Each of the NIDs connected to the PLL-735 can have different channel capacities and support different subscriber functions.

Features:
- ❏ Supports two 4- or 6-channel NIDs
- ❏ Automatic rate adaptation
- ❏ Performance monitoring
- ❏ NIDs are line powered from DICOLUs.

Specifications

Power Consumption and Heat Dissipation	COLU Input Voltage:	-42.5 Vdc to -56.5 Vdc
	CO Input Current:	0.08 A (minimum – no NID connected) 0.53 A (maximum – two PRL-770 NIDs connected) 0.67 A (maximum – two PRL-771 NIDs connected) 0.51 A (maximum – two PRL-772 NIDs connected) 0.40 A (maximum – two PRL-773 NIDs connected) 0.81 A (maximum – two PRL-779 NIDs connected)
	COLU Input Power:	4 W (minimum – no NID connected) 25 W (maximum – two PRL-770 NIDs connected) 32 W (maximum – two PRL-771 NIDs connected) 24 W (maximum – two PRL-772 NIDs connected) 19 W (maximum – two PRL-773 NIDs connected) 26 W (maximum – two PRL-779 NIDs connected) Cooled by natural convection
	COLU Output Voltage:	±140 Vdc (maximum)
	COLU Output Power:	9 W (maximum – per PRL-770 NID connected) 12 W (maximum – per PRL-771 NID connected) 9 W (maximum – per PRL-772 NID connected) 6 W (maximum – per PRL-773 NID connected) 9 W (maximum – per PRL-779 NID connected)
	COLU Heat Dissipation:	4 W (minimum – no NID connected) 6 W (maximum – two PRL-770 NIDs connected) 7 W (maximum – two PRL-771 NIDs connected) 7 W (maximum – two PRL-772 NIDs connected) 6 W (maximum – two PRL-773 NIDs connected) 10 W (maximum – two PRL-779 NIDs connected)
	COLU Output Protection:	Short-circuit, over-voltage, over-current
HDSL	Line Interface:	Two-pair, 784-kbps, full-duplex, 2B1Q transmission format
	Signal Characteristics:	Comply with TR-NWT-001210, *"Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems"*
Physical Characteristics	Height:	5.50 in. (14.0 cm.)
	Width:	1.10 in. (2.8 cm.)
	Depth:	10.25 in. (26.0 cm.)
	Weight:	1.0 lb. (0.5 kg.)

6.3.22 PMU-712 List 2 – Management Unit

Description and Ordering Information

Part No: 150-1612-02

CLEI Code: S9C3CCDA~~

Description: The PMU-712 Management unit provides the user interface into ADC PG-Flex*Plus* COT Shelf. The PMU allows for provisioning, monitoring, and testing of Central Office Line Units (COLUs) installed in the COTS.

Features:

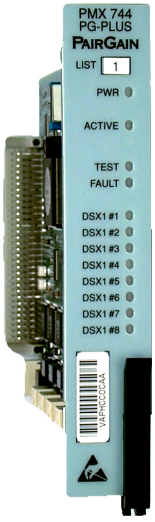
- ❏ VT-100 interface
- ❏ Telcordia compliant TL-1 user interface
- ❏ Nonvolatile database
- ❏ MLT and 4TEL support with three-terminal signature resistors indicating drop condition.
- ❏ 10 base 2 Ethernet port for connecting PMUs of multiple COTs
- ❏ TCP/IP Ethernet port for network management

Specifications

Power Consumption and Heat Dissipation	CO Input Voltage:	-42.5 Vdc to -56.5 Vdc
	CO Input Current:	0.08 A (nominal)
	CO Heat Dissipation:	4 Watts (nominal)
	Input Protection:	"A" and "B" battery feeds each fused through two 1.0 A fuses
Composite Clock	Terminations:	Primary and secondary office clock.
	Impedance:	135 Ω
External Alarm Signals	Relay contacts:	Critical, Major, Minor (audible and visual), Shelf (visual) (COT shelf backplane)
Alarm Cutoff (ACO)	Function:	Disables only the currently active audible alarms.
Connectors	Craft::	DB9 (female – DCE)
	NMA:	DB25 (female – DTE, COT shelf backplane)
	Monitor (VF DROP):	RJ-11
	Clock Sync (TEST):	RJ-11Front RS-232 Compliant with EIA-RS-232
Physical Characteristics	Height:	5.50 in. (14.0 cm.)
	Width:	1.10 in. (2.8 cm.)
	Depth:	10.25 in. (26.0 cm.)
	Weight:	1.0 lb. (0.5 kg.)

6.3.23 PMX-744 List 1A – 8 DS1 Multiplex Unit

Description and Ordering Information



Part No: 150-1644-11

CLEI Code: VAPHCCOC~~

Description: The PMX-744 is a 8 DS1 PG-Flex*Plus* Multiplexer Unit. Up to 8 DS1 lines can be terminated on the PMX, allowing up to 192 DS0 channels to be cross connected to any ICOLU installed in the same COT shelf.

Features:

- ❑ SF, ESF and TR-08 DS1 frame formats
- ❑ DS1 alarm monitoring for each of four DS1 facility interfaces
- ❑ DS1 performance monitoring
- ❑ In-band and craft initiated DS1 loopbacks
- ❑ Non-blocking cross connect matrix
- ❑ Used with the PLL-735 4/6 Channel Dual Integrated COLU and FLL-814 24 Channel Integrated COLU
- ❑ Two PMX units can be installed in the COT shelf for equipment protection

Specifications

Power Consumption and Heat Dissipation	CO Input Current:	0.15 A (nominal)	
	CO Heat Dissipation:	7 Watts (nominal)	
DS1 Line Characteristics	Output Voltage:	3 Vdc (maximum)	
	Line Code:	AMI or B8ZS	
	Frame Formats:	TR-08, SF, ESF	
Physical Characteristics	Height:	5.50 in.	(14.0 cm.)
	Width:	1.10 in.	(2.8 cm.)
	Depth:	10.25 in.	(26.0 cm.)
	Weight:	1.0 lb.	(0.5 kg).

6.3.24 PRL-770 Series – 4 POTS NID

Description and Ordering Information

Part No: 150-1670-22 (List 2B) (Outdoor)

CLEI Code: S9MSBA0A~~ (List 2B) (Outdoor)

Description: The PRL-770 4 POTS NID supports four POTS circuits. It is used in conjunction with, and derives its power from, the PLL-735 DICOLU.

Features:

- ❑ 4 POTS circuits
- ❑ Seicor 7600 enclosure (List 2B)
- ❑ Gas tube protection on HDSL and POTS circuits
- ❑ Metallic fall back to POTS
- ❑ MLT and 4Tel compatible

List 2B

List 2E

Specifications

POTS Interface	Analog Impedance	600 Ω	
	Supervisory Range	100 Ω plus 430 Ω for handset	
	Detection of Loop Open	≥ 10 kΩ	
	Idle State Voltage	-48V (minimum)	
	Loop Current	23 mA (minimum)	
	Ring Generator		
Terminations and Protection	Terminations:	HDSL:	Binding Post
		Subscriber:	Line Module
	Protection:	HDSL:	Gas Tube
		Subscriber:	Gas Tube
Physical Characteristics	Height:	10.25"	(26.0 cm.)
	Width:	8.50"	(21.6 cm.)
	Depth:	4.75"	(12.1 cm.)
	Weight:	4.6 lbs.	(2.1 kg.)

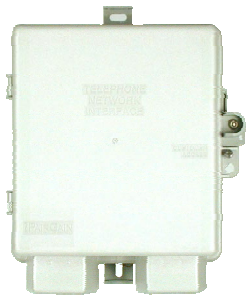
6.3.25 PRL-771 List 1B – 6 POTS NID

Description

Part No: 150-1671-21

CLEI Code: S9MSBB0A~~

Description: The PRL-771 6 POTS NID supports six POTS circuits. It is used in conjunction with, and derives its power from, the PLL-735 DICOLU.



Features:

- ❑ 6 POTS circuits
- ❑ Seicor 7600 enclosure
- ❑ Gas tube protection on HDSL and POTS circuits
- ❑ Metallic fall back to POTS
- ❑ MLT and 4Tel compatible

Specifications

POTS Interface	Analog Impedance	600 Ω	
	Supervisory Range	100 Ω plus 430 Ω for handset	
	Detection of Loop Open	≥ 10 kΩ	
	Idle State Voltage	-48V (minimum)	
	Loop Current	23 mA (minimum)	
	Ring Generator		
Terminations and Protection	Terminations:	HDSL:	Binding Post
		Subscriber:	Line Module
	Protection:	HDSL:	Gas Tube
		Subscriber:	Gas Tube
Physical Characteristics	Height:	10.25"	(26.0 cm.)
	Width:	8.50"	(21.6 cm.)
	Depth:	4.75"	(12.1 cm.)
	Weight:	4.6 lbs.	(2.1 kg.)

6.3.26 PRL-772 List 1B – 3 POTS, 1 ISDN NID

Description

Part No: 150-1672-21

CLEI Code: S9MSBD0A~~

Description: The PRL-772 NID supports one ISDN and three POTS circuits. It is used in conjunction with, and derives its power from, the PLL-735 DICOLU.

Features:

- ❑ 3 POTS circuits, 1 ISDN circuit
- ❑ Seicor 7600 enclosure
- ❑ Gas tube protection on HDSL and POTS circuits
- ❑ Metallic fall back to POTS

Specifications

POTS Interface	Analog Impedance	600 Ω	
	Supervisory Range	100 Ω plus 430 Ω for handset	
	Detection of Loop Open	≥ 10 kΩ	
	Idle State Voltage	-48V (minimum)	
	Loop Current	23 mA (minimum)	
	Ring Generator		
ISDN Interface	Interface	U Interface/2B1Q	
	Analog Impedance	135 Ω	
	Loop Length	18 kft, conforms to ANSI T1-601 loops	
	Performance Monitoring	Interim Path	
	Provisional EOC	Multipoint EOC mp-eoc; transparent	
	Idle State Voltage	-48V (minimum)	
	Provisional Sealing Current	9 mA (minimum)	
Terminations and Protection	Terminations:	HDSL:	Binding Post
		Subscriber:	Line Module
	Protection:	HDSL:	Gas Tube
		Subscriber:	Gas Tube
Physical Characteristics	Height:	10.25"	(26.0 cm.)
	Width:	8.50"	(21.6 cm.)
	Depth:	4.75"	(12.1 cm.)
	Weight:	3.6 lbs.	(1.6 kg.)

6.3.27 PRL-773 List 1B – 2 ISDN NID

Description

Part No: 150-1673-21

CLEI Code: S9MSBC0A~~

Description: The PRL-773 NID supports two ISDN circuits. It is used in conjunction with, and derives its power from, the PLL-735 DICOLU.

Features:
- ❑ Seicor 7600 enclosure
- ❑ Gas tube protection on HDSL and ISDN circuits

Specifications

ISDN Interface	Interface	U Interface/2B1Q	
	Analog Impedance	135 Ω	
	Loop Length	18 kft, conforms to ANSI T1-601 loops	
	Performance Monitoring	Interim Path	
	Provisional EOC	Multipoint EOC mp-eoc; transparent	
	Idle State Voltage	-48V (minimum)	
	Provisional Sealing Current	9 mA (minimum)	
Terminations and Protection	Terminations:	HDSL:	Binding Post
		Subscriber:	Line Module
	Protection:	HDSL:	Gas Tube
		Subscriber:	Gas Tube
Physical Characteristics	Height:	10.25"	(26.0 cm.)
	Width:	8.50"	(21.6 cm.)
	Depth:	4.75"	(12.1 cm.)
	Weight:	3.6 lbs.	(1.6 kg.)

6.3.28 PRL-779 Series – 6 UVG NID

Description

Part No: 150-1679-31 (List 1C) (Outdoor)
150-1679-51 (List 1E) (Indoor)

CLEI Code: S9MSCHAA~~ (List 1C) (Outdoor)
S9MSEH0A~~ (List 1E) (Indoor)

Description: The PRL-779 NID supports six UVG circuits. It is used in conjunction with, and derives its power from, the PLL-735 DICOLU.

Features:

- ❑ 6 UVG circuits
- ❑ Seicor 7600 enclosure (List 1C), Indoor enclosure (List 1E)
- ❑ Gas tube protection on HDSL circuits (List 1C only)
- ❑ Metallic fall back to POTS
- ❑ MLT and 4Tel compatible

List 1C

List 1E

Specifications

POTS Interface	Analog Impedance	600 Ω	
	Supervisory Range	100 Ω plus 430 Ω for handset	
	Detection of Loop Open	≥ 10 kΩ	
	Idle State Voltage	-48V (minimum)	
	Loop Current	23 mA (minimum)	
	Ring Generator		
Terminations and Protection	List 1C:		
	Terminations:	HDSL:	Binding Post
		Subscriber:	Line Module
	Protection:	HDSL:	Gas Tube
		Subscriber:	None
	List 1E:		
	Terminations:	HDSL:	Insulation Displacement
		Subscriber:	Insulation Displacement
	Protection:	HDSL:	None
		Subscriber:	None
Physical Characteristics	List 1C:		
	Height:	10.25"	(26.0 cm.)
	Width:	8.50"	(21.6 cm.)
	Depth:	4.75"	(12.1 cm.)
	Weight:	4.6 lbs.	(2.1 kg.)
	List 1E:		
	Height:	9.00"	(22.9 cm.)
	Width:	6.00"	(15.2 cm.)
	Depth:	1.75"	(4.6 cm.)
	Weight:	2.1 lbs.	(1.0 kg.)

7. Abbreviations and Glossary

2B1Q	Two-Binary, One-Quaternary.
ACO	Alarm Cutoff
ADSL	Asymmetrical Digital Subscriber Line
AMI	Alternate Mark Insertion
ANSI	American National Standards Institute
ATM	Asynchronous Transfer Mode
AWG	American Wire Gauge
B8ZS	Binary 8 Zero Suppression
BERT	Bit Error Rate Test
CD	Carrier Detect
CLASS	Custom Local Area Signaling Services
CLEI	Common Language Equipment Identifier
CO	Central Office
COLU	Central Office Line Unit
COT	Central Office Terminal
COTS	Central Office Terminal Shelf
CPE	Customer Provided Equipment
CPU	Central Processor Unit
CRV	Call Reference Value
CSA	Carrier Serving Area
CTS	Clear to Send
CU	Channel Unit
DCE	Data Communications Equipment
DDS	Digital Data Service
DICOLU	Dual Integrated Central Office Line Unit
DLC	Digital Loop Carrier
DS0	Digital Signal 0
DS1	Digital Signal 1
DS3	Digital Signal 3
DSL	Digital Subscriber Line
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTF	Digital Transmission Facilities
DTR	Data Terminal Ready
EIA	Electronic Industry Association
EOC	Embedded Operations Channel
ESD	Electrostatic Discharge
ESF	Extended Super Frame
FICOLU	PG-Flex Integrated Central Office Line Unit
FLL	PG-Flex Central Office Line Unit
FRC	PG-Flex Remote Channel Unit
FRE	PG-Flex Remote Terminal Enclosure
FRL	PG-Flex Remote Line Unit
FS	Field Shelf
GND	Ground
HDSL	High-bit-rate Digital Subscriber Line
HDU	HiGain Doubler Unit
ICOLU	Integrated Central Office Line Unit
IDLC	Integrated Digital Loop Carrier
IG	Interface Group
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LDS	Local Digital Switch
LED	Light-emitting Diode
LS/GS	Loop-start/Ground-start
LU	Line Unit
LULT	Line Unit Line Termination
LUNT	Line Unit Network Termination
LS/GS	Loop Start/Ground Start
MLT	Mechanized Loop Test
NEBS	Network Equipment – Building System
NGDLC	Next Generation Digital Loop Carrier System
NID	Network Interface Device
PAU	PG-Plus Alarm Unit
PCS	PG-Plus Central Office Shelf
PLL	PG-Plus Line Unit
PMU	PG-Plus Management Unit
PMX	PG-Plus Multiplexer Unit
POTS	Plain Old Telephone Service
PRL	PG-Plus Remote Line Unit
RD	Receive Data
RDT	Remote Digital Terminal
REN	Ringer Equivalence Number
RLU	Remote Line Unit
RT	Remote Terminal
RTLU	Remote Terminal Line Unit
RTS	Ready to Send
SDT	Subscriber Drop Test
SF	Super Frame
SONET	Synchronous Optical Network
TBCU	Test Bus Control Unit
TCP/IP	Transmission Control Protocol/Internet Program
TD	Transmit Data
TDM	Time Division Multiplex
TL1	Transaction Language 1
TMC	Time Slot Management Channel
UAP	Universal Access Platform
UL	Underwriter's Laboratories
UVG	Universal Voice Grade
WAN	Wide Area Network

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