

FlexAccess 9000 **8 POTS + 4 ADSL SUBSCRIBER TERMINAL**

MODEL 9400 L3 VAR1VT0FAA

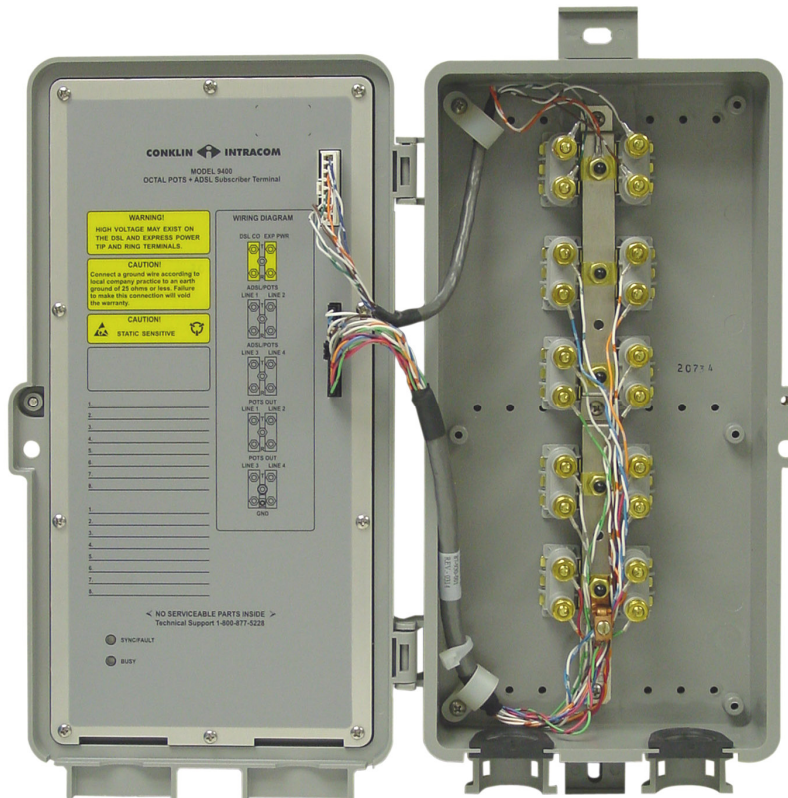


Figure 1 – FlexAccess Subscriber Terminal

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Introduction

The *FlexAccess 9000* system is a leading-edge technology platform providing voice and broadband services over a wide range of distances and loop impairments. The *FlexAccess* repeaters and subscriber terminals (STs) are used to deliver voice and data services in a 12-channel voice (784 kb/s), broadband (up to 2.048 Mb/s), or broadband and voice (1.536 or 2.048 Mb/s) G.shdsl TC-PAM transport mode.

The Model 9400 List 3 8 POTS + 4 ADSL ST matches the POTS+ADSL application module in the COT shelf and is installed at the end of the Digital Subscriber Line (DSL) transport cable pair. The ST works as a span-powered micro broadband DLC. It terminates 1.536 or 2.048 Mb/s G.shdsl transmission line and generates up to four ADSL+POTS and four additional POTS drops. A Model 9241 Quad POTS Add/Drop ST can also be installed on the DSL cable pair for a partially distributed system.

The unique feature of this system is the ability to transport both broadband data and multiple voice channels on one copper pair. This mixed ADSL+POTS service system is used for feeder and distribution relief applications (or range extension/pair gain), but can also be used to defer large DLC, remote DSLAM, and/or new cable deployment. It is also an ideal broadband-capable replacement for analog carriers.

The *FlexAccess* COT interfaces with the public switched telephone network (PSTN) and the packet-switched asynchronous transfer mode (ATM) network. It may be connected to an ATM switch, router, aggregation device, or DSLAM using up to four T1 digital transmission links. The POTS+ADSL application module receives the ATM traffic from the COT backplane, combines it with the POTS lines from the PSTN, and generates a 1.536 or 2.048 Mb/s G.shdsl transport link with the ST. The ST generates up to four POTS lines and four ADSL+POTS lines. The signals terminate at the customer premise, using splitters and/or in-line filters to separate voice and ADSL signals. The ADSL signal connects to the customer's ADSL modem/router.

The *FlexAccess* system has all the features of a DSLAM, including the ability to concentrate data traffic from ADSL loops first at the ST and again at the COT shelf.

The ST provides full-featured POTS service with CLASS and high speed analog modem capability, extended drop capability, and support for POTS line drop-side testing feature. Reverse Battery Answer Supervision is also supported. This feature reverses the polarity of the tip and ring on the POTS drop of any channel when the COT end of that channel receives a battery reversal. This enables the use of these STs for loop-start payphone service on lines that accept battery reversal as a coin-collect command.

Introduction, continued

Subscriber terminals can be installed on the DSL pair at any point up to a nominal 39 dB (42 dB maximum) of cable loss from the COT, a repeater, or another subscriber terminal. Repeaters are typically installed at 36 to 42 dB of cable loss to extend the range of the DSL signal. Single and dual repeater configurations are available. Multiple repeaters may be used on each DSL pair up to the span power limit of the system. Other *FlexAccess* STs are available to provide POTS-only and ADSL+POTS services.

The STs and repeaters are powered over a single cable pair from voltage supplied by the *FlexAccess* application module at the COT. With a second cable pair, the optional Express Power feature can be used to extend the range even further. Each repeater or add/drop ST passes span power voltage to any additional devices on the line. The maximum allowable length, the number of repeaters, and the number of channels depend on the cable gauge and the type of subscriber terminals being installed. The *FlexAccess* Design Aid Spreadsheet is used to determine the maximum operating range.

Each ST is a multi-environment unit in a rugged weatherproof enclosure similar to those widely used for customer Network Interface Devices (NIDs). They operate over an extended temperature range (-40 to +149°F, -40 to +65°C), and can be pole, stake, or pedestal mounted for use in aerial or buried cable installations.

What's Changed

This issue includes new information about the G.shdsl transport rates between the COT module and the ST (for all units with firmware 04.02.02 or higher).

Circuit Description

Figure 2 illustrates the basic operation of the 8 POTS + 4 ADSL ST.

The incoming signal from the CO (DSL CO) side of the unit is received in 1.536 or 2.048 Mb/s G.shdsl format and fed to the ADSL transceiver and POTS interface circuits. The CO side also receives the unit's operating power from the cable pair.

The four POTS lines and four ADSL+POTS lines are delivered to the customer, where the POTS service is routed to a voice line and the ADSL service is routed to a modem.

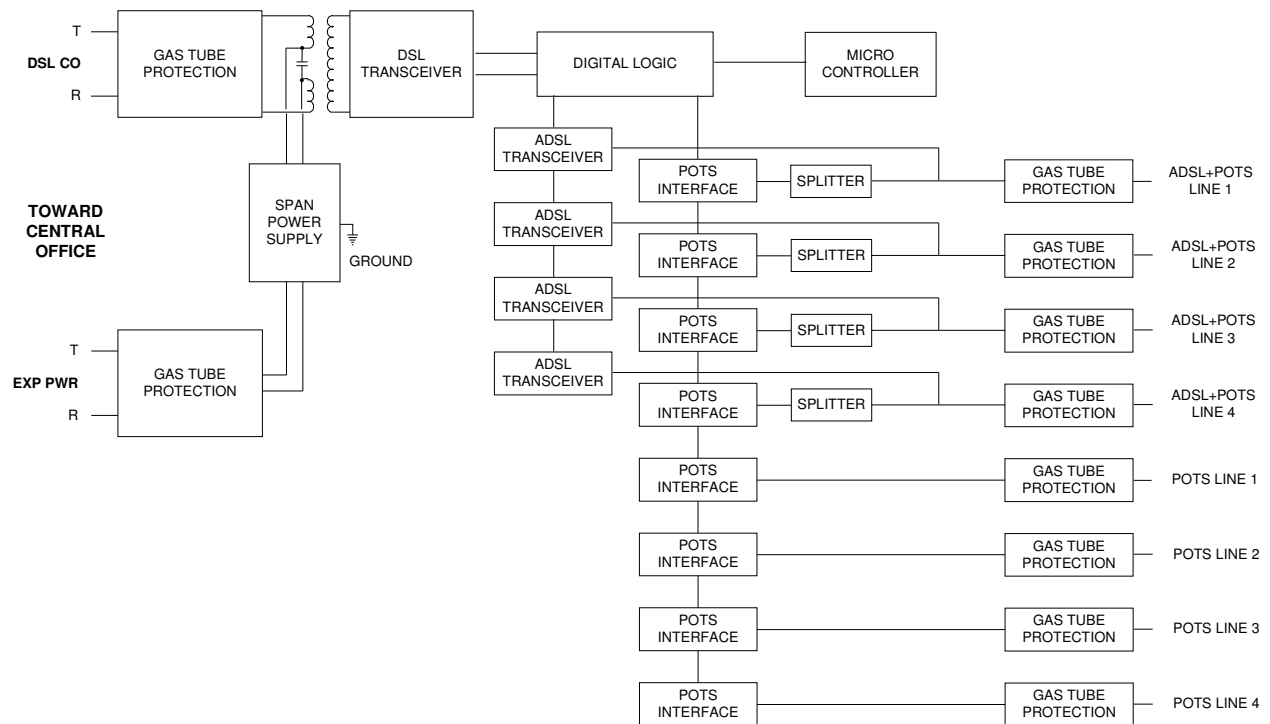


Figure 2 – Block Diagram

Circuit Description, continued

Span Power

Span power for the subscriber terminal is generated from the -48 Vdc central office battery by the *FlexAccess* COT. Loop current on the DSL cable pair will vary according to the number and type of span-powered devices, but will not normally exceed 160 mA. The span power supply has built-in ground fault protection and meets the safety requirements of Telcordia GR-1089-CORE. Local power solutions are also available.

Express Power

The Express Power option delivers span power to the subscriber terminal over a separate cable pair that carries no DSL signal. Span power received in this manner supplements the voltage received over the DSL pair. Express Power is an optional feature that should only be used when the *FlexAccess* Design Aid Spreadsheet requires it.

Installation

This section provides the information necessary to install, operate, and test the subscriber terminal.



CAUTION! These products contain static sensitive components. Follow proper electrostatic discharge procedures.

Subscriber terminals are span powered from the COT and do not normally require any source of external power. All system configurations must be designed using the ÔVÖQ *FlexAccess* Design Aid Spreadsheet.

The 8 POTS + 4 ADSL ST is a terminating (non-repeating) unit and must be located at the end of the cable pair.

A subscriber terminal may be mounted on a pole or pedestal. If the desired location results in a signal loss greater than 42 dB at 1.536 Mb/s or 38 dB at 2.046 Mb/s from the Central Office, one or more repeaters may be required. Table A shows the nominal 39 dB and 35 dB subscriber terminal 1.536 and 2.048 Mb/s design spacing from the CO or a repeater based on the signal loss for various cable gauges.

Table A. Nominal Subscriber Terminal Spacing

Operating Mode	Cable Gauge	Buried Cable Spacing
1.536 Mb/s Broadband (233 kHz) 39 dB	19 (0.9 mm)	22.8 kft (6.95 km)
	22 (0.6 mm)	16.6 kft (5.06 km)
	24 (0.5 mm)	12.9 kft (3.93 km)
	26 (0.4 mm)	9.5 kft (2.90 km)
Operating Mode	Cable Gauge	Buried Cable Spacing
2.048 Mb/s Broadband (343 kHz) 35 dB	19 (0.9 mm)	17.2 kft (5.25 km)
	22 (0.6 mm)	12.3 kft (3.75 km)
	24 (0.5 mm)	9.7 kft (2.95 km)
	26 (0.4 mm)	7.4 kft (2.25 km)

A Quad POTS Add/Drop ST can be installed on the cable pair between the Central Office and the 8 POTS + 4 ADSL ST in order to drop up to four POTS lines at that location. Channels that are enabled on the Quad POTS unit are automatically disabled on the 8 POTS + 4 ADSL unit.

Installation, continued

Mounting

For a pedestal-type installation, install a stake or post behind the pedestal to mount the subscriber terminal. Units may also be installed inside some pedestals. For an aerial cable installation, mount the unit directly to the pole. ÖVÖÖ recommends that STs be mounted at eye level, but local practices should prevail.

External mounting tabs at the top and bottom of the housing provide an easy way to secure the unit to the pole, stake, or other mounting surface (refer to Figure 3). The distance from the center of one mounting hole to the center of the other is approximately 14 inches (35.5 cm). Use appropriate fasteners (normally screws) to firmly secure the unit to the mounting surface. Do not open the housing cover while mounting the unit.

The subscriber terminal housing has a single-hinged, removable cover with connectorized wiring. The cover opens from the right side after the hex head screw is loosened with a can wrench. Open the cover to finish installing the unit. When the installation is complete, close the cover and tighten the hex head screw to secure it.

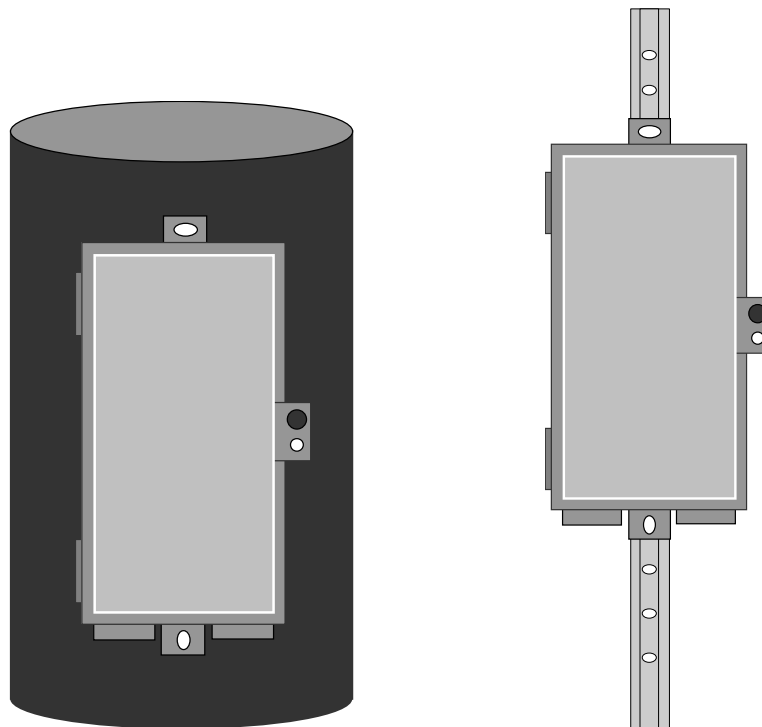
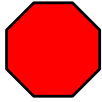


Figure 3 – Pole and Stake Mountings

Installation, continued

Wiring



WARNING! HIGH VOLTAGE MAY EXIST ON THE DSL AND EXPRESS POWER TIP AND RING TERMINALS.

Each subscriber terminal is a 2-wire full-duplex device that is installed at the end of the DSL transport cable pair. This means that the pair must be dead-ended in the splice case or pedestal. A separate pair of wires is also required for each outgoing POTS or ADSL+POTS line.

Subscriber terminals are supplied without any pre-wired cable stubs in order to allow for maximum flexibility in all installations. Follow local practices to determine what type of telco-supplied wiring should be used in each installation. Any type of 19 to 26 gauge outdoor telephone cable or wire is acceptable. A single cable can be used to make the DSL, Express Power, POTS, and ADSL+POTS connections; or, separate cables can be used. Measure the required length of cable to reach from the pedestal or splice case to the subscriber terminal.

DSL Wiring

Inside the subscriber terminal housing, a set of protector modules labeled DSL CO provides wiring terminals for the DSL transport cable pair from the Central Office.

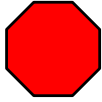
Use a screwdriver or knife to puncture a hole in the left-hand grommet on the bottom of the housing. Feed the DSL transport cable through the grommet and strip back approximately 1/2" of insulation from the wires.

Terminate the tip and ring wires on the DSL CO terminals shown in the wiring diagram (refer to Figure 4). It is good practice to maintain tip and ring continuity through the unit, although it is required only when Express Power is used. If a shielded cable was used, connect the cable shield to a ground terminal on the ST.

After completing the DSL transport wiring, press a red protective cap (included with the unit) onto each DSL CO terminal.

Installation, continued

Express Power Wiring (If Required)



WARNING! HIGH VOLTAGE WILL BE PRESENT ON THE EXPRESS POWER TERMINALS EVEN IF THIS FEATURE IS NOT BEING USED.

The EXP PWR terminals are used to connect to an Express Power cable pair or locally provided span power as required. Express Power can be used to deliver additional dc power to the subscriber terminal to extend the range of the system. Express Power is only used when required by the *FlexAccess Design Aid Spreadsheet*. **The polarity of the EXP PWR terminals must be the same as that of the DSL CO terminals. Either the tip or the ring terminal may be positive or negative, but both tips and both rings must be the same polarity.**

Terminate the EXP PWR tip and ring wires on the appropriate terminals in the same manner as the DSL wiring was completed. Tip and ring continuity must be maintained throughout the unit when Express Power is used.

After completing the Express Power wiring, press a red protective cap onto each EXP PWR terminal.

POTS Wiring

The terminals labeled POTS are for connection of the POTS lines being served from this unit. One set of terminals is provided for each line. The POTS lines occupy channels 5 through 8 in the system.

If a separate cable is being used for these lines, use a screwdriver or knife to puncture a hole in the right-hand grommet on the bottom of the housing. Feed the cable through the grommet.

Strip back approximately 1/2" of insulation from each of the wires. Terminate each POTS line tip and ring on the terminals shown in the wiring diagram (refer to Figure 4). If a shielded cable was used, connect the cable shield to a ground terminal on the ST.

ADSL+POTS Wiring

The terminals labeled ADSL/POTS are for connection of the ADSL+POTS lines being served from this unit. One set of terminals is provided for each line. The ADSL+POTS lines occupy channels 1 through 4 in the system.

Terminate the ADSL+POTS line tip and ring wires on the appropriate terminals in the same manner as the POTS wiring was completed.

Installation, continued

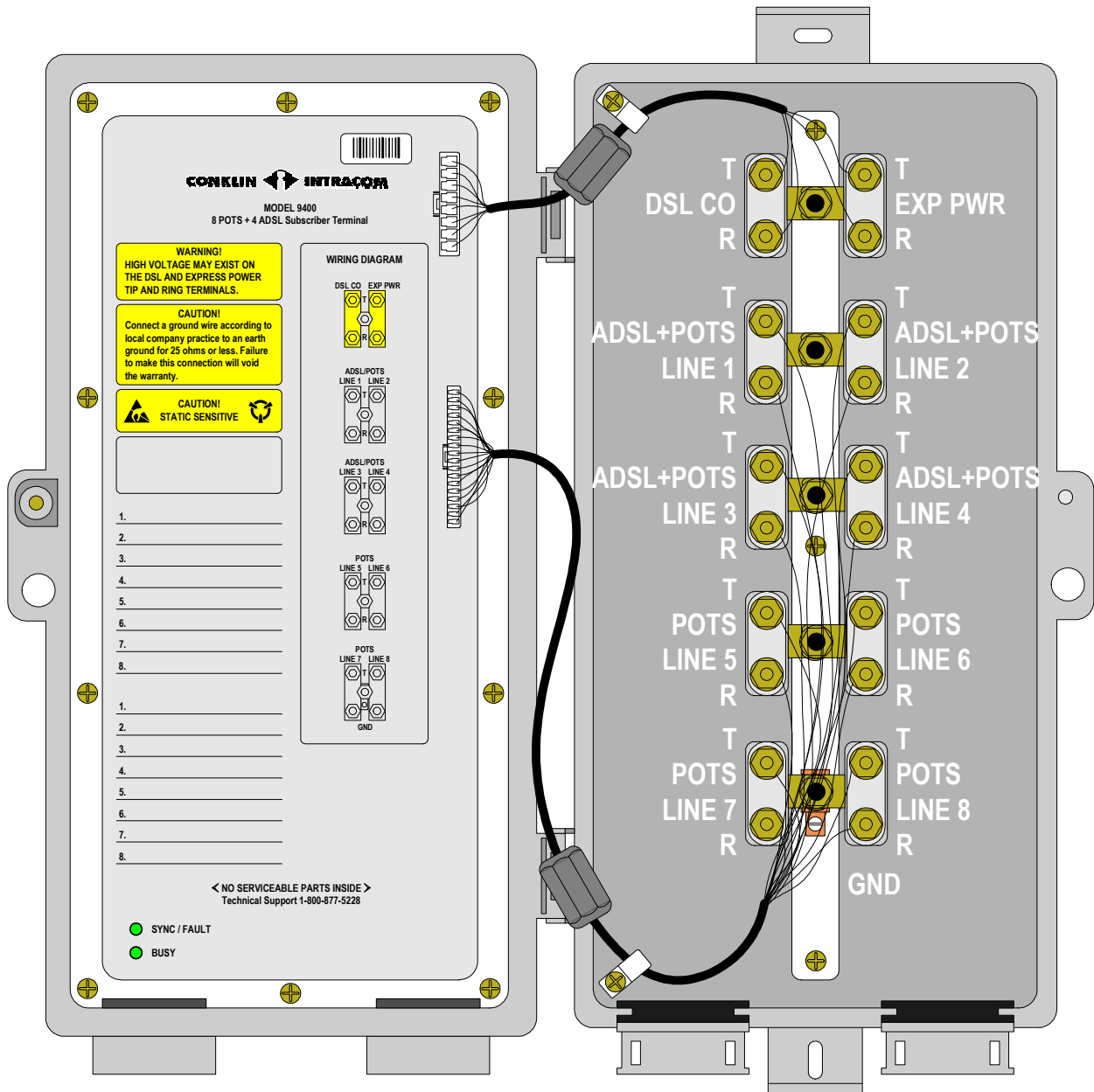


Figure 4 – Model 9400 List 3 Subscriber Terminal (Shown Open)

Installation, continued

Grounding



CAUTION! Provide a ground of 25 ohms or less according to local company practice at each ST location. Failure to provide a local ground connection will void the warranty.

Terminate a #6 ground wire inside the subscriber terminal on the stud labeled GND. Run the other end of the ground wire to the ground bus on the pedestal for buried plant, or to the pole's vertical ground for aerial plant. A ground rod must be installed at each ST site as shown in Figure 5 and Figure 6.

After all the wiring has been completed, check each grommet opening for a tight seal. If the grommet doesn't seal around the cable(s), apply Sealant B or a similar silicone-type sealing compound around the grommet.

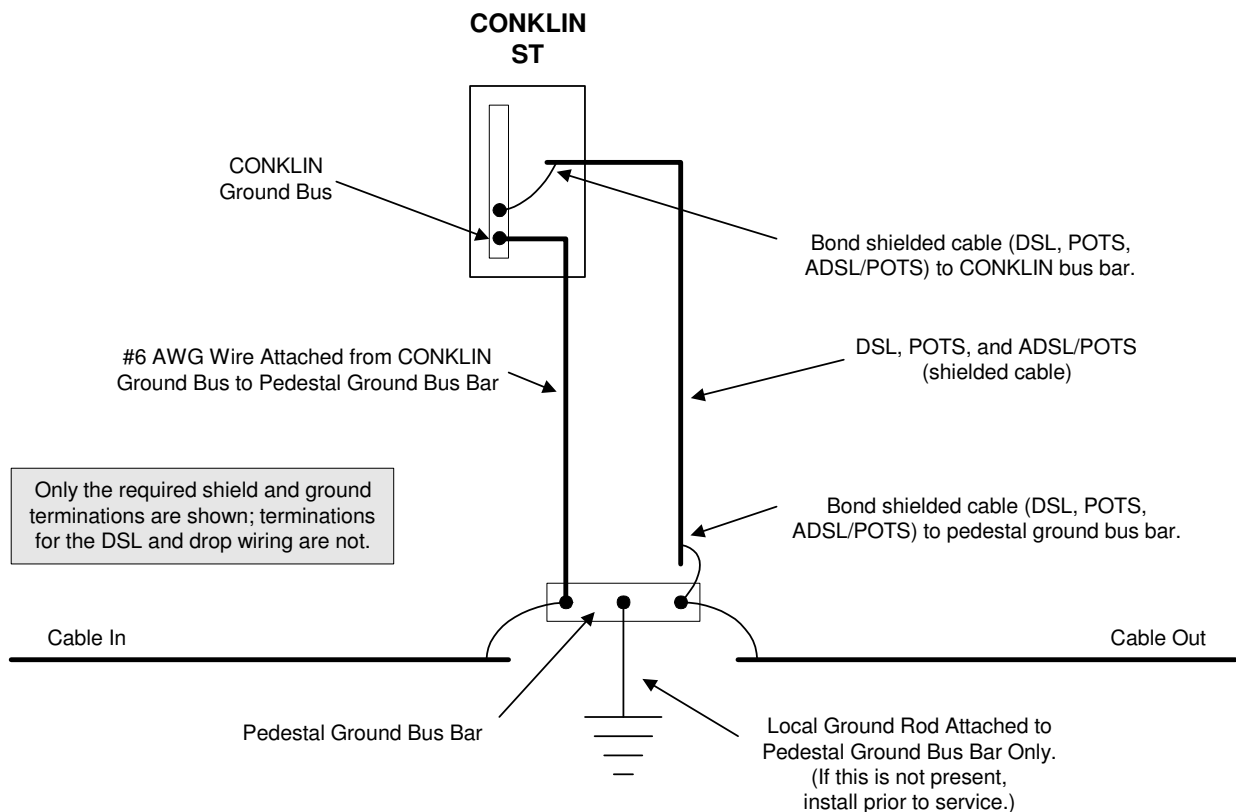


Figure 5 – Grounding Method for Buried Plant

Installation, continued

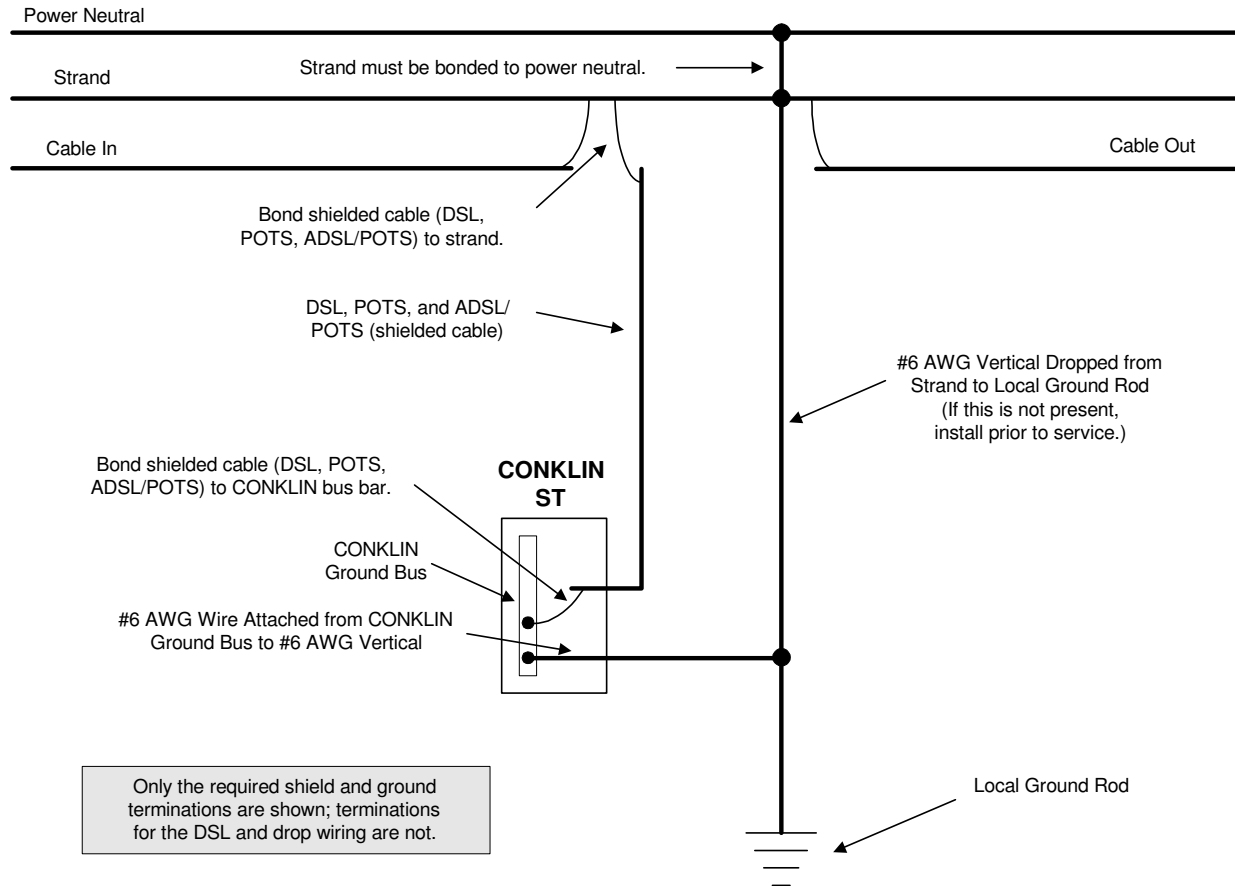


Figure 6 – Grounding Method for Joint-Use Aerial Plant

Operation

Power

Power for the subscriber terminal is provided by the application module at the COT. Illumination of the SYNC/FAULT LED (either green or red) indicates that span power voltage is present on the DSL CO terminals. The minimum operating voltage is 150 to 180 Vdc between tip and ring. If the minimum voltage is not present with all lines connected, then a power fault condition exists, insufficient voltage is being supplied by the COT, or too the loop is too long.

System Synchronization

NOTE: During the following synchronization process, it may be helpful to partially close the housing cover when viewing the LEDs in bright sunlight.

When all of the necessary connections to the subscriber terminal are complete, the unit will attempt to synchronize to the DSL CO signal. During the synchronization process, the SYNC/FAULT LED flashes green until the unit has acquired lock onto the CO signal (typically 45 to 60 seconds). When the SYNC LED stops flashing and illuminates steady, the unit has successfully synchronized.

If the SYNC/FAULT LED illuminates red, the unit has failed its self-test and should be replaced.

Operation, continued

Testing the Subscriber Terminal

The on-hook tip-to-ring voltage on the drop terminals for each POTS or POTS+ADSL line should be approximately 42 Vdc. If dial tone is not present, verify that the ST's BUSY LED illuminates green when going off-hook. If there is no dial tone and there is a click occurring every 2 or 3 seconds during the off-hook, then there is probably no CO switch connection for this line at the COT.

The subscriber terminal and its POTS connection to the COT may be tested on a per-channel basis by using the TEST button on the front of the COT application module. Each POTS line may be individually tested. A PASS/FAIL LED on the application module indicates the results of the test.

Drop-side Testing

All *FlexAccess* subscriber terminals that provide POTS service are equipped with built-in drop-side test capability. Drop-side testing of the POTS lines can be initiated from an MLT system or via the Command Line Interface (CLI). The drop facility and CPE test results are reported back to the MLT test desk or CLI screen. Drop-side tests are performed in the order listed below and will stop at the first failed test. A carrier circuit channel test is automatically performed before the drop-side test. The channel test must be successful for the drop test to be performed.

- Hazardous Voltage
- Foreign EMF
- Resistive Fault
- Receiver Off-hook
- Ringer Termination

Operation, continued

Changing the Front Cover

All of the subscriber terminal's electronics are contained inside the front cover of the unit. If the ST is defective, the front half of the unit can be replaced without disturbing the DSL, Express Power, POTS, and ADSL wiring. To remove the front cover, open the ST and unplug all the cables going to the cover. Pinch the latch on the side of the connector to release it. Figure 7 shows the location of the release latch.



CAUTION! Be sure to release the latch before attempting to unplug the connector. Pulling on the connector without releasing the latch may damage it. Do not pull the connector out by the cable.

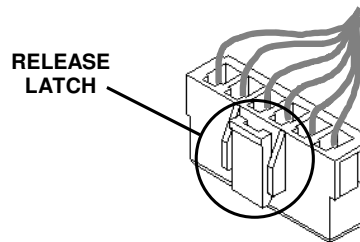


Figure 7 – Location of Release Latch on Connector

With the cables unplugged, open the cover as far as it will go without forcing it. Starting with the bottom hinge first, insert a flat screwdriver blade into the gap between the hinge and the right-hand half of the unit (refer to Figure 8). *Carefully* pry the cover hinge toward you with the screwdriver blade. The hinge should come apart easily. Hold onto the cover and repeat the process with the top hinge. The cover should now be disconnected from the rest of the unit.

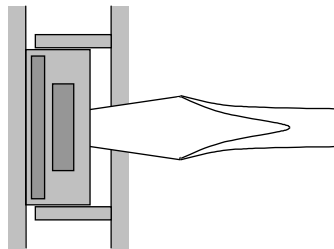


Figure 8 – Using a Screwdriver to Disengage the Hinge

To install the replacement cover, hold the two halves side-by-side in the open position with the hinge components overlapping. Close the unit firmly to engage the hinges. Open and close the unit to verify that both hinges are connected and working properly. Re-connect the cables to the appropriate connectors, making sure that each connector snaps into place without forcing it. The latch must be aligned properly (on the left-hand side) as the connector is inserted.

Specifications

Specifications are subject to change without notice.

Interface Characteristics

DIGITAL SUBSCRIBER LINE (DSL)

INTERFACE:

Signal: 1.536 or 2.048 Mb/s G.shdsl format.
Loop loss: Nominal 39 dB (max. 42 dB) at 233 kHz for 1.536 Mb/s. Nominal 35 dB (max. 38 dB) at 343 kHz for 2.048 Mb/s.
Nominal impedance: 135 Ω .

ADSL INTERFACE:

Complies with requirements of ITU G.992.1 (G.dmt) and ITU G.992.2 (G.Lite).
Built-in POTS splitters according to T1.413.
Data streams are isolated between customers.
Coexists with baseband voice.

POTS INTERFACE:

On-hook voltage: ≥ 42 Vdc.
Loop current: 23 mA.
Maximum loop: 1200 Ω including telephone set.
Dialing: Tone or pulse.
Idle channel noise: ≤ 20 dBmC.
Impedance: 900 Ω + 2.16 uf.
Maximum ringer load: 5 REN.
Ringing voltage: 20 Hz @ 45 Vrms nominal.
Reverse Battery Answer Supervision.

Protection

Contains gas tube and solid-state secondary protection for DSL, POTS, and ADSL+POTS interfaces.

Interface Connections

One set of terminals for the DSL (DSL CO), one set of terminals for Express Power (EXP PWR), one set of terminals for each POTS line (POTS), one set of terminals for each ADSL+POTS line (ADSL/POTS), and ground terminal(s).

Indicators

SYNC/FAULT:

Dual-color LED. *Steady green* indicates that synchronization has been achieved with the DSL signal coming from the Central Office. *Flashing green* indicates that the unit is in the synchronization process. *Steady red* indicates that the unit has failed self test. *Off* indicates that no power is being provided at the DSL terminals.

BUSY:

Green LED. *On* indicates an off-hook or ringing condition on at least one POTS channel on this unit.

Power

SOURCE - SPAN POWERED FROM CO:
 ± 190 Vdc tip- and ring-to-ground.

Dimensions

An Outside Network Interface (ONI) type plastic enclosure designed for pole, pedestal, or stake mounting. Approximately 15" high x 7.5" wide x 4.5" deep (38 cm x 19 cm x 11.5 cm).

Environment

TEMPERATURE:

-40 to +149°F, -40 to +65°C, operating.

HUMIDITY:

0 to 95% RH, non-condensing.