High-Speed Voice and Data Link™ Central Office Terminal

CONTENTS PAGE

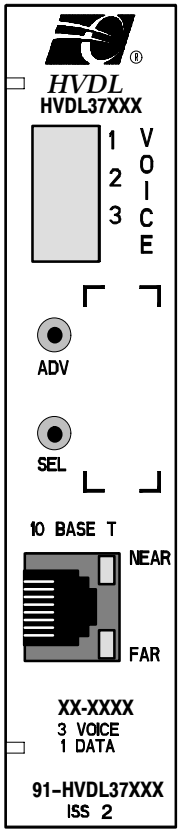


Figure 1. HVDL COT Line Unit

1. GENERAL

1.1 Document Purpose

This document provides a general, installation and troubleshooting information for the High-Speed Voice and Data Link (HVDL) Central Office Terminal (COT) line unit. This document covers the following model numbers:

Model #	Description	Safety	Signatures
HVDL37011	COT Line Unit	A2	none
HVDL37031	COT Line Unit	A2	4TEL
HVDL37131	COT Line Unit	A2	MLT
HVDL37231	COT Line Unit	A2	BSMLT
HVDL37331	COT Line Unit	A3	BSMLT
HVDL37431	COT Line Unit	A3	4TEL
HVDL37531	COT Line Unit	A3	MLT
HVDL37631	COT Line Unit	A2	none
HVDL37731	COT Line Unit—Raychem® shelf-compatible	A2	none

1.2 Document Status

This document is reprinted to add HVDL37731.

1.3 Equipment Purpose and Description

The HVDL system is a G.SHDSL-based multiplexing system that combines up to 3 voice lines and one 10 BaseT Ethernet line onto a single twisted-copper pair. This system consists of a central office terminal (COT), a remote terminal (RT) and an optional repeater. The COT multiplexes the voice lines and 10 BaseT Ethernet line. It also provides power to the RT, which demultiplexes the voice lines and 10 BaseT Ethernet lines, and to the repeater (if used) which extends the allowable distance between the COT and the RT.

HVDL components have been designed for use in all areas, regardless of environmental constraints.

The HVDL system is rate-selective. Data rates between 0 and 832 K can be configured at the COT. The data rate can be increased beyond 832 K by turning off unused POTS channels (see System Configuration on page 7). For each POTS channel that is turned off, 64 K is added to the system data rate. As the system data rate is decreased, DSL distance can be extended.

Note: HVDL systems with fewer than 3 POTS lines automatically assign the extra bandwidth to the data line (so with 1 voice line, 1 data line, the maximum data rate is 960 K)

1.3.1. EPREP Feature (non-repeater mode only)

The EPREP feature allows the HVDL RT to interact with the HVDL COT, providing easy circuit turn-up or turn-down without end-to-end coordination. The HVDL COT must be installed before the HVDL RT. When first installed, the HVDL COT will perform a metallic bypass around the COT electronics, connecting line 1 from the Central Office (CO) switch to the subscriber's line. This bypass condition can remain in effect indefinitely, keeping the customer in service. The COT continuously monitors the line (which will become the DSL) for the presence of a HVDL RT. When the RT is connected to the pair at the desired installation site, its unique signal will be detected by the COT. The COT will remove the bypass and cause the system to go into service, providing up to three voice lines (depending on the model) and a 10 BaseT Ethernet line digitally over the DSL pair.

1.3.2. Metallic Bypass (non-repeater mode only)

Metallic bypass enables line 1 on the COT to remain connected to line 1 of the central office (CO) switch. In the unlikely event of a system failure the COT connects line 1 from the switch onto the DSL span.

1.3.3. Fail-to-POTS Feature (non-repeater mode only)

The RT connects the DSL span to its line 1, thereby connecting line 1 of the switch to the customer premises equipment connected to RT line 1. This feature requires FTP-enabled RTs.

Note: This feature is not available in HPNA systems

1.3.4. Repeater Mode

Through the front panel of the COT, the system can be configured with repeaters (up to 3) between the COT and the RT, increasing the system range. In repeater mode, the COT applies DSL voltage (+/−130 VDC) to the DSL line immediately to begin synchronizing with the RT. The COT does not wait to detect the RT as in EPREP mode. In repeater mode, turning off unused POTS channels extends DSL range.

1.3.5. Rate Selection Feature

Use the rate selection feature to select the optimum data/DSL rate for a given application using the front panel controls on the COT.

At start-up, the system will synchronize at the lowest data rate (0 K). Once this is accomplished, the COT will instruct the RT and repeater(s) (if used) to synchronize at either the factory-programmed data rate (512 K) or the data rate that was previously configured. If the system cannot synchronize at the configured data rate (usually because there is too much distance between the COT and the RT), it will start “stepping down” the rate until it finds a rate it can synchronize at (the highest possible rate below the requested rate). The COT LED displays “WAIT” momentarily for each step-down sequence. The system will operate in this mode, but the COT will send an alarm indicating “bad COT”. The COT’s LED display will flash the current data rate, indicating that the rate is lower than the requested rate.

1.4 Equipment Mounting

The COT mounts in an available slot in a Charles Industries DDL301, DDL305, HVDL311 or HVDL315 shelf.

1.5 Equipment Features

The HVDL COT provides the following features:

- 0−3 voice lines available with Lifeline and CLASS services (depending on model)
- Always On 10 BaseT Ethernet line ready to connect to other 10/100 BaseTx peripherals
- Craftsperson-selectable Ethernet data transport speed/DSL speed
- COT with enhanced lightning protection
- Repeater-ready for extra-long DSL loops
- EPREP feature for one-man turn up
- Last synchronization status display
- “Access Multiplexer” compatibility
- Functions with multiple repeaters (up to 3)

1.5.1. Optional features

- 4TEL or MLT signatures on voice lines
- A2 or A3 safety

2. INSPECTION

2.1 Inspect for Damages

Inspect the equipment thoroughly upon delivery. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company.

2.2 Equipment Identification

Charles Industries' equipment is identified by a model and issue number imprinted on the front panel or located elsewhere on the equipment. Each time a major engineering design change is made on the equipment, the issue number is advanced by 1 and imprinted on subsequent units manufactured. Therefore, be sure to include both the model number and its issue number when making inquiries about the equipment.

2.3 Static Concerns

Each module is shipped in static-protective packaging to prevent electrostatic charges from damaging static-sensitive devices. Use approved static-preventive measures, such as static-conductive wrist straps and a static-dissipative mat, when handling modules outside of their protective packaging. A module intended for future use should be tested as soon as possible and returned to its original protective packaging for storage.

STATIC-SENSITIVE

This equipment contains static-sensitive electronic devices. To prevent electrostatic charges from damaging static-sensitive units:

- **Use approved static preventive measures (such as a static-conductive wrist strap and a static-dissipative mat) at all times whenever touching units outside of their original, shipped static-protective packaging.**
- **Do not ship or store units near strong electrostatic, electromagnetic, or magnetic fields.**
- **Use static-protective packaging for shipping or storage.**

3. APPLICATION GUIDELINES

3.1 Typical Application

A typical application of the HVDL System consists of a 300-mechanics COT connected to a switch in the central office, and the wall-mounted RT connected to the subscriber line. Figure 2 illustrates typical applications.

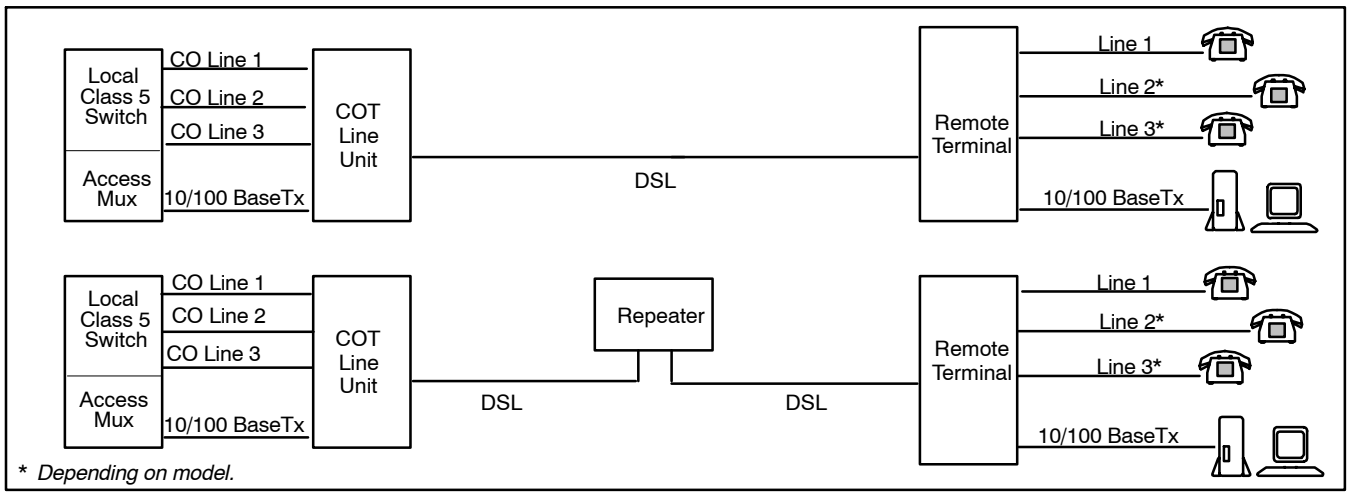


Figure 2. Typical HVDL Applications, with and without a Repeater

4. INSTALLING THE SYSTEM

A few elements need to be considered before you begin installing the HVDL system

4.1 Repeater

Decide whether or not a repeater will be used. Use a repeater under any one of the following conditions:

- The distance between the COT and RT exceeds the maximum non-repeater distance.

- Cable loss is high.
- Excess noise on the cable pair limits distance.

If you are installing with a repeater, install the RT and the repeater prior to installing the COT. If you are installing without a repeater, install the COT prior to installing the RT. Refer to the HVDL repeater documentation for HVDL repeater types and applications.

Note: Metallic bypass is not available in repeatered mode. EPREP and FTP will not work.

4.2 Choosing the Proper Location for the Repeater and the RT

HVDL operation distance is significantly longer with a repeater. Distance of operation is directly related to wire gauge and above/below ground routing. Software is available to help you calculate the distance of operation and verify your configuration: order part number SM-CSHVDL3.1T.

4.3 Bridge Taps

Bridge tap loss depends on the length and location of the bridge tap. For best results, remove all bridge taps.

4.4 Load Coils

All load coils must be removed.

4.5 Ground Faults

Many failures are caused by ground faults on the DSL copper pair. Ground faults occur when more than 5 milliamps (A2) or 10 milliamps (A3) leaks from the DSL copper pair into the earth, especially in wet conditions. Good cable techniques, including solid, dry connections and cable that is in good repair will eliminate this problem.

A good cable tester is the Sidekick™ 7B by Tempo.

5. INSTALLING THE COT

The data system can be thought of as a data bridge—the system does not require IP or MAC addresses. Simply connect the data system through the HVDL system as if it were transparent.

5.1 Mounting the COT

A HVDL COT mounts in one position in any of the shelves shown in Table 1.

Table 1. Units per Shelf

Mounting Shelf Model Number	Shelf Size (inches)	Slots Available	Maximum COT Line Unit(s)	Maximum Alarm Unit(s) (optional)
DDL301	23	19	18	1
DDL305	19	16	15	1
HVDL311	23	19	17	1*
HVDL315	19	16	14	1*
* Alarm unit or 91-HVDL381 Access Multiplexer				

IMPORTANT NOTE

For equipment protection, the equipment rack must be grounded to a suitable earth ground.

5.1.1. Subscriber Cable Selection

In most applications, a straight cable is all that is needed to make the data connection; however, in some cases you will need to use a crossover cable (shown in Figure 3) to connect properly. Situations in which a crossover cable is needed may include the following:

- Non-standard PC card.

- Connecting the PC to another PC.
- Connecting a PC to a hub
- Connecting 2 COTs on an individual network.

See the *Troubleshooting* section of this document for more information.

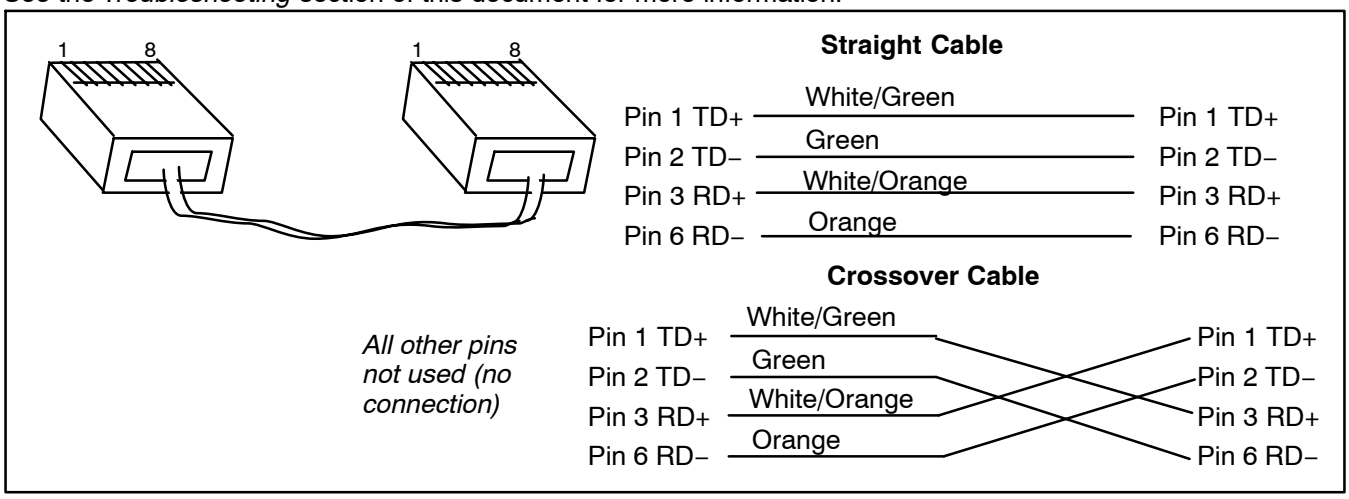


Figure 3. Straight and Crossover Cable Illustrated

5.2 Installing the COT in Non-Repeatered Mode

Use the following steps to install the COT line unit:

Step	Action
1.	Put on a static-conductive wrist strap and make sure you are grounded.
2.	Insert and seat the COT line unit into the shelf. *Note: If this is the first power-up, the system may require configuration. See below.* Unit will perform a self test. The LED display on the front of the unit reads **SELF TEST OK**. The COT searches for the RT. During this time, voice line 1 is bypassed around the COT and is available for use (FTP mode ONLY). BYP will be displayed at the COT. The COT can stay in this state indefinitely. Once the COT has detected an RT, the COT powers the DSL and attempts to establish a data connection with the RT. The COT displays **EPR** with a rotating arrow. The RT's SYNC and QUAL LEDs double-flash. After the COT powers up the RT and recognizes that the RT has powered up, the COT displays the current data rate with a rotating arrow. The COT and RT always start up at the lowest data rate (0 K). After the COT and RT establish a connection, the COT instructs the RT to change data rates to the data rate configured at the COT. At this point the COT and RT attempt to re-synchronize at this data rate. The COT display shows the new data rate and a rotating arrow while re-synchronizing Once the high-speed connection has been established, the COT displays the current status of the voice line. The RT's SYNC LED remains ON. The system is now ready to pass multiple voice and data traffic.

5.3 Installing the COT in Repeatered Mode

Use the following steps to install the COT line unit:

Step	Action
1.	If not already installed, install the RT line unit. We recommend installing the RT and repeater prior to installing the COT.
2.	Put on a static-conductive wrist strap and make sure you are grounded. *Note: If this is the first power-up, the system may require configuration. See below.*
3.	Insert and seat the COT line unit into the shelf. Unit will perform a self test. The LED display on the front of the unit reads **SELF TEST OK**.
4.	The COT immediately powers up the DSL and attempts to establish high-speed data communication with the RT through the repeater The COT displays **RPT** with a rotating arrow. The RTs SYNC and QUAL LEDs double-flash. After the COT powers up and recognizes that the repeater has powered up, the COT displays the current data rate with a rotating arrow. The COT, repeater and RT always start up at the lowest data rate (0 K). After the COT, repeater and RT establish a low rate connection, the COT instructs the RT and repeater to change data rates to the data rate configured at the COT. Then the units attempt re-synchronization at this data rate. The COT display shows the new data rate and a rotating arrow while re-synchronizing. Once the high-speed connection has been established, the COT displays the current status of the voice line. The RT's SYNC LED remains ON. The system is now ready to pass multiple voice and data traffic.

5.4 System Configuration at COT Power-Up

The system requires some configuration at the COT at first power-up. Once the COT is powered up, it will follow the steps outlined above; then at start-up, configure the system as described below. Once configured, the COT will remember the configuration for future power-ups. The configuration may be changed at any time using the same procedure. You can check which options are set by pressing the ADV button to move through current/default selections. Current settings are lit more brightly than the other options.

Use the following steps to configure the system. Refer to Table 2 for a summary of the options. Refer to Figure 4 for a flow chart describing the process.

Note: The system will leave configuration mode if no key is pressed within the 5-second timeout.

Step	Action	System Response
1.	Once the COT has completed its self-test (SELF TEST OK), press ADV.	The LED display on the front of the unit will show **CFG?**.
2.	Press ADV.	Displays the current EPRP/RPTR setting.
3.	If you need to change the current EPRP/RPTR selection, press SEL to enter editing mode. Press ADV to change the mode (select RPTR if you are using a repeater, otherwise EPREP mode), and press SEL to select the proper mode. Otherwise, leave the display at the current setting and press ADV.	The LED display goes back to **CFG?**. You will need to press ADV 2 times to get to the FTP/AUTO (if your system is configured for EPREP) or data rate menu. If the unit is configured for EPREP, displays AUTO or FTP. Otherwise, displays the current data rate.

Step	Action	System Response
4.	If your system is not configured for EPREP, go to step 5. If your system is configured for EPREP, select whether you are using FTP or AUTO-START. If you need to change to FTP or AUTO, press SEL to enter editing mode. Press ADV to change the mode, and press SEL to select the proper mode. Otherwise, leave the display at the current setting and press ADV.	 The LED display goes back to **CFG?**. You will need to press ADV 3 times to get to the data rate menu. Displays the current data rate.
5.	If you need to change the data rate, press SEL to enter editing mode; then press ADV to move through the available data rates. When you have decided which rate you want to use, press SEL. *Note: If you have changed the data rate and the system is connected, it will momentarily disconnect and then re-synchronize at the new data rate once you have exited configuration mode.* Otherwise, continue with step 6.	The LED display goes back to **CFG?**. You will need to press ADV 5 times (4 if the system is configured for a repeater) to enter the menu to select fixed or dynamic bandwidth.
6.	Press ADV or wait.	Displays the current data rate as fixed or dynamic.
7.	If you need to change the data rate from fixed to dynamic or vice versa, press SEL to enter editing mode; then press ADV to change the setting. When the setting is correct, press SEL. Otherwise, continue with step 8.	The LED display goes back to **CFG?**. You will need to press ADV 6 times (5 if the system is configured for a repeater) to enter the menu to turn voice line 1 ON or OFF
8.	Press ADV or wait.	Displays voice line 1 ON or OFF.
9.	If you need to turn voice line 1 ON or OFF, press SEL to enter editing mode; then press ADV to change the setting. When the setting is correct, press SEL. Otherwise, continue with step 10.	The LED display goes back to **CFG?**. You will need to press ADV 7 times (6 if the system is configured for a repeater) to enter the menu to turn voice line 2 ON or OFF.
10.	Press ADV or wait.	Displays voice line 2 ON or OFF
If you are using a model with 1 voice line only, proceed to step NO TAG		
11.	If you need to turn voice line 2 ON or OFF, press SEL to enter editing mode; then press ADV to change the setting. When the setting is correct, press SEL. Otherwise, continue with step 12.	The LED display goes back to **CFG?**. You will need to press ADV 8 times (7 if the system is configured for a repeater)to enter the menu to turn voice line 3 ON or OFF.
12.	Press ADV or wait.	Displays voice line 3 ON or OFF.
13.	If you need to turn voice line 3 ON or OFF, press SEL to enter editing mode; then press ADV to change the setting. When the setting is correct, press SEL. Otherwise, continue with step 14.	The LED display goes back to **CFG?**. You will need to press ADV 9 times (8 if the system is configured for a repeater) to enter the menu to turn DSL high voltage ON or OFF.
14.	Press ADV.	Displays DONE.
15.	**If you have changed the RPTR/EPREP or the FIX/DYN setting**, you MUST remove and re-seat the COT for the change to take effect. Data rate and voice line changes take effect immediately.	

The changes you make are stored in non-volatile memory. If the system should go down or be unplugged, the COT will not need to be re-configured

Table 2. System Configuration Options

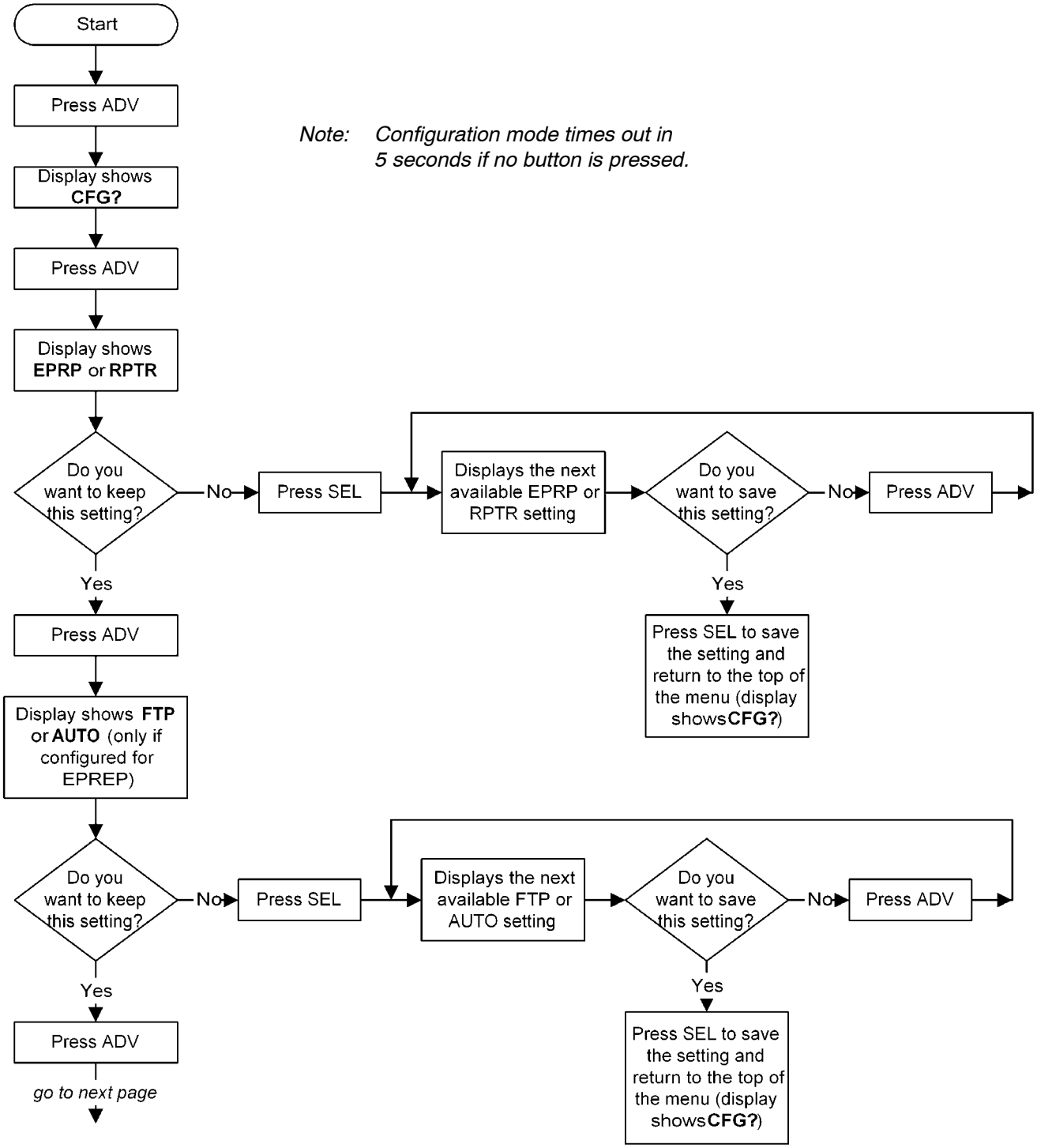
Feature	System Displays	Default	Description
EPREP or Repeater mode	EPRP (Eprep)	✓	Configures the system for EPREP mode. The COT waits for the RT's unique signal to begin training.
	RPTR (Repeater)		Configures the system for a repeater. The COT applies power immediately to begin training with a repeater and an RT.
Auto Start or Fail-to-POTS mode	AUTO (AutoStart)		The COT applies –48V to the DSL to "listen" for an RT signal. This setting works only in EPREP mode. Metallic bypass is not available.
	FTP (Fail-to-POTS)	✓	The COT performs a metallic bypass connecting line 1 to the DSL. When connected to an RT with the FTP feature, this allows line 1 to remain in service even when the system is not in sync. This setting works only in EPREP mode.
Programmable Ethernet data rate	RATE and current data rate (0–832 K in approximately 128K increments)	512 K	Select the Ethernet data rate.
Fixed or dynamic data rate	FIX	✓	Current data rate is fixed.
	DYN		Current data rate is dynamic. This means that it will share bandwidth with the 3 voice channels when the channels are idle. Some on-hook communications (such as utility meter reading) may not work properly. Caller ID will function properly. Voice communications take precedence. *Note: 0K data rate is not programmable. It remains fixed.*
Voice ON/OFF	With line number and voice ON/OFF status	All 3 lines ON	Individual voice lines may be turned off. When they are turned off, the bandwidth can be used for data transmission when the rate is set at 832 K.

5.5 LED Definitions

Two LEDs at the top of the RJ–45 connector indicate the presence of a successful physical data link. The upper LED shows the state of the COT data link; the lower LED shows the state of the RT data link. See Table 3.

Table 3. LED States on the COT

Status	Indicates...
ON	Normal operation (10/100BaseT physical link connected).
OFF	The system is training––the LED display shows **EPR** or **RPT** with a rotating arrow; however, once the system is synchronized, if the LED remains off for more than 30 seconds, see the Troubleshooting section of this document.
Flashes once every 5 seconds	Physical link not established. The system is searching for a 10/100BaseT connection.



Note: Configuration mode times out in 5 seconds if no button is pressed.

Figure 4. HVDL Configuration Flow Chart (Page 1 of 4)

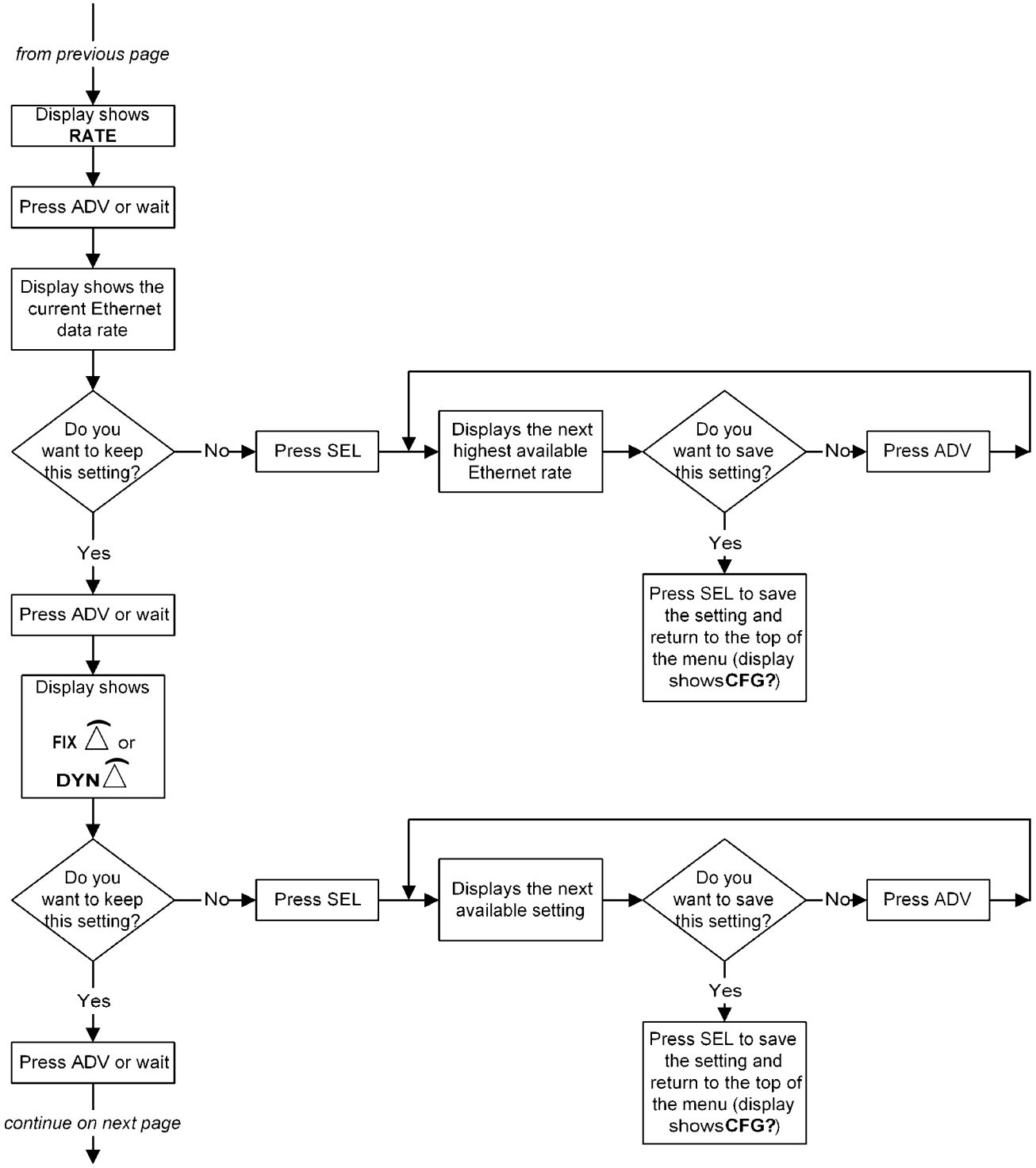


Figure 4. HVDL Configuration Flow Chart (Page 2 of 4)

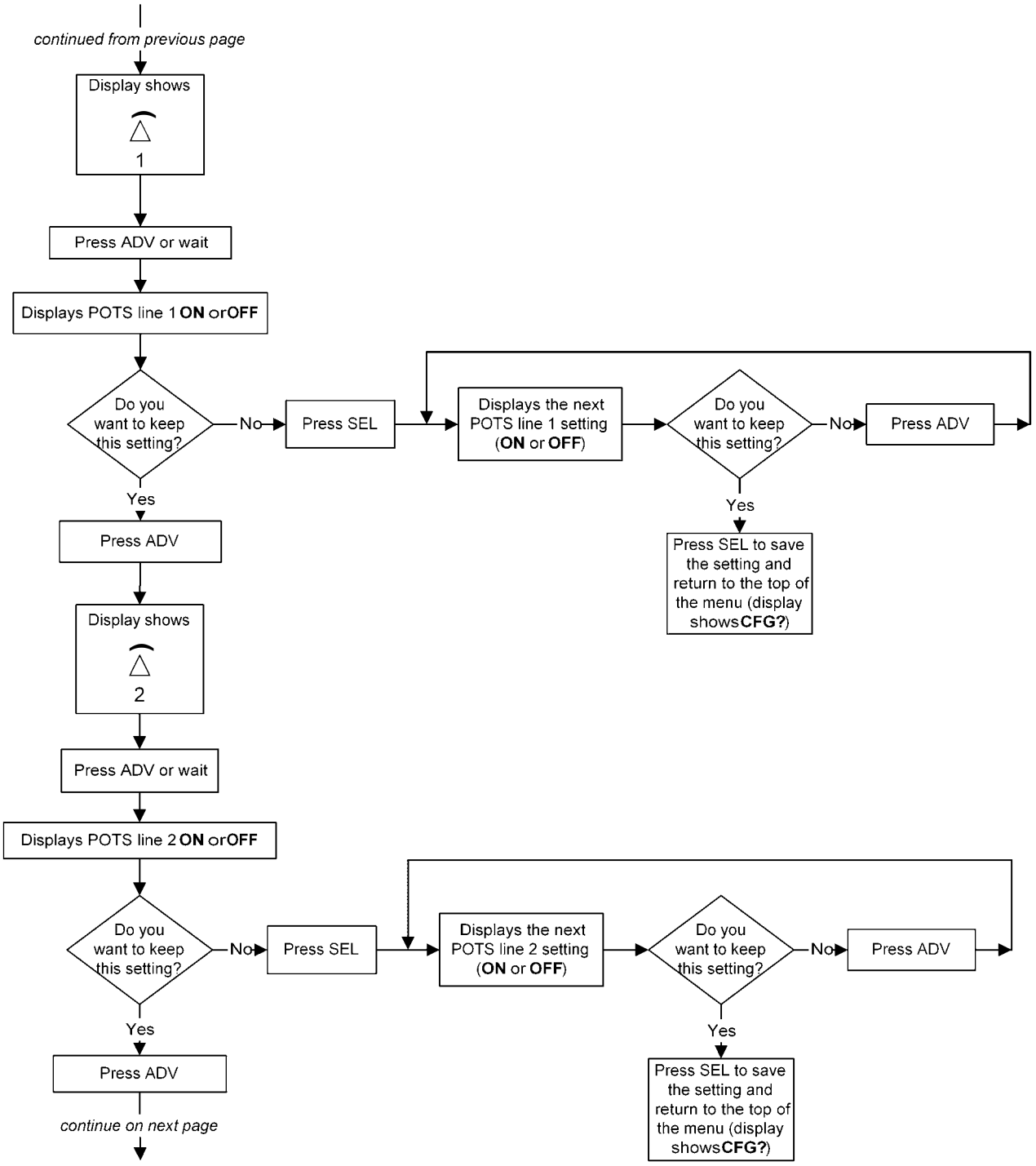


Figure 4. HVDL Configuration Flow Chart (Page 3 of 4)

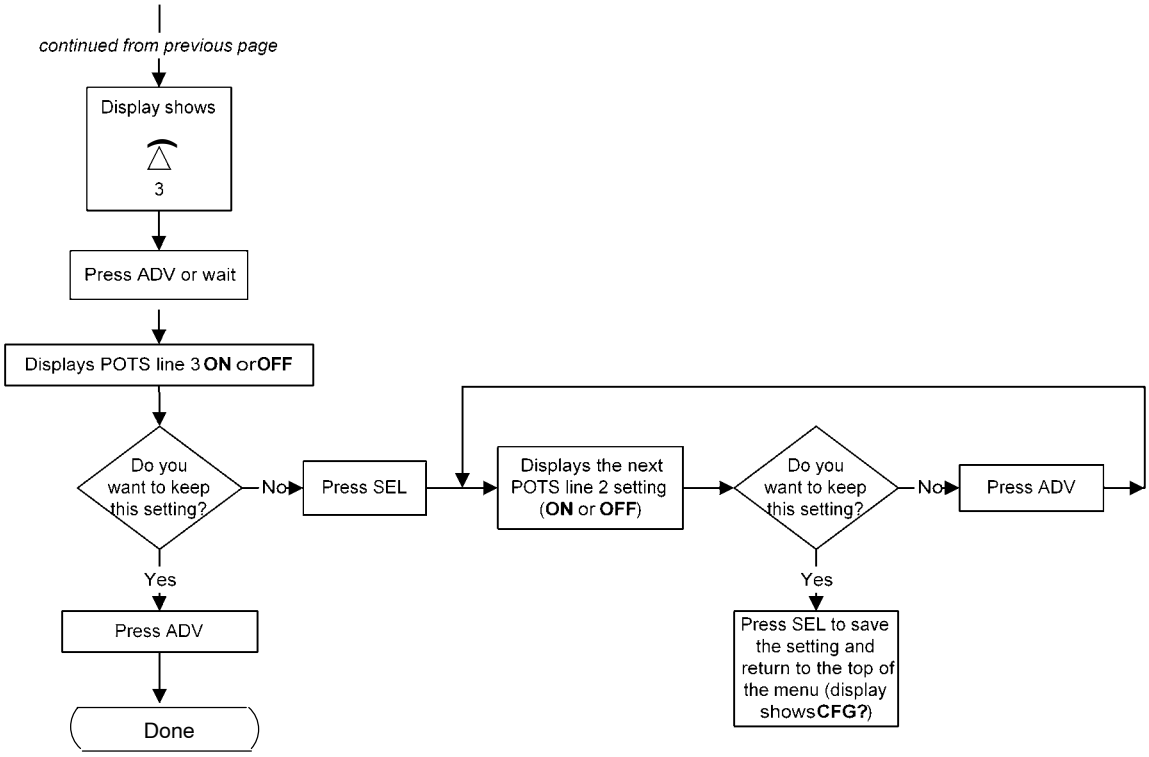


Figure 4. HVDL Configuration Flow Chart (Page 4 of 4)

5.6 LED Display

After configuration and while the system is up, the COT display shows telephone icons which indicate the state of lines 1–3. See Figure 5 for examples.

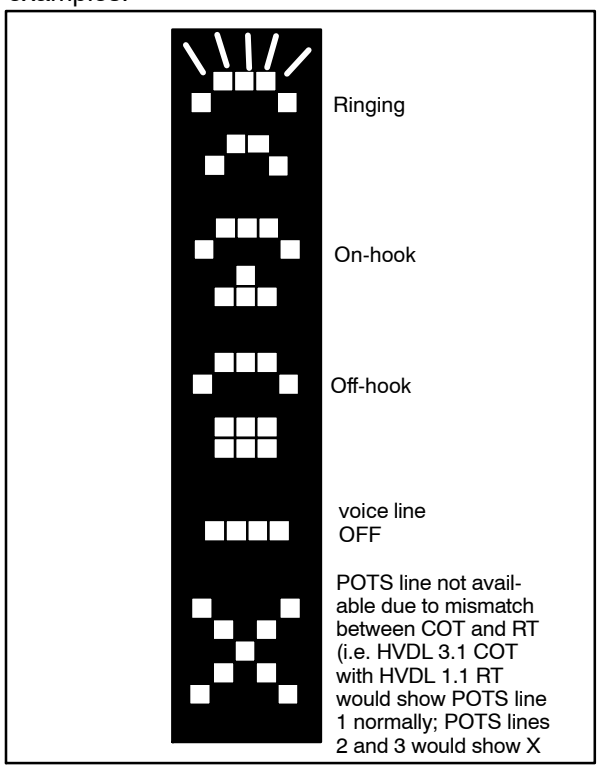


Figure 5. Line Status Display

6. TEST SIGNATURES

The HVDL COT testing method is none, 4TEL or MLT. See page 2 to determine the testing method for your system. Signature impedances are listed in Table 4.

Table 4. Impedance Signatures

System Status	4TEL Impedances			MLT Impedances		
	Tip-Ring	Tip-Gnd	Ring-Gnd	Tip-Ring	Tip-Gnd	Ring-Gnd
System OK	N/A	195 K	332 K	200 K	188 K	N/A
RT Failure	N/A	195 K	475 K	200 K	188 K	1 M
COT Failure	N/A	195 K	195 K	200 K	188 K	499 K
Cable Failure	332 K	195 K	N/A	200 K	188 K	332 K
Cable Shorted	N/A	N/A	N/A	200 K	188 K	332 K

Note: Signature impedances are not available on voice line 1 when an RT is not present or when the COT is in failure mode.

7. ALARMS

One DDL381 COT Alarm Unit or HVDL381 Access Multiplexer should be installed for each shelf.

If an alarm appears on the COT line unit, it is possible that a temporary malfunction has occurred. Table 5 advises what to do when an alarm appears.

Table 5. Alarm Status and Solution

LED	Cause	What To Do
COT	COT malfunction	Wait approximately five minutes for the COT to restart. If the COT does not restart, replace the COT.
RT	RT malfunction	Wait approximately five minutes for the RT to restart. If the RT does not restart, replace the RT.
SPAN	DSL span cannot reach operating voltage	Check the cable for shorts. COT malfunction.
CBL	Open (OPEN)—Cable open. Short (SHRT)—Cable shorted. Ground (GND)—Cable has a fault to earth ground.	Check the cable; the system will restart automatically.

7.1 Restart Time if a Failure Occurs

If the system achieved synchronization (voice and data traffic) prior to the failure, the system will restart in 5 seconds. Under all other conditions, the system will restart in 2.5 minutes. The exception is when the system is configured for repeater or Auto Start mode; in that case, the system will always restart in 5 seconds.

7.2 Last Synchronization Status

The COT LED display can be used to diagnose system synchronization failures. Any time the system is NOT in DSL synchronization (no telephone icons on the display) the previous DSL synchronization status can be displayed by pressing SEL. Table 8 shows the possible synchronization status messages.

Note: This status will be retained even if the COT is powered off.

Table 6. Synchronization Status Messages

Message Displayed	Probable Cause
COT	The COT was unable to sync up with the repeater or RT connected to it.
RT	Problem with the repeater/RT connected to the COT.
CAB	Problem with the cable connecting the COT and the first repeater/RT.
L2	Problem between the first repeater and second repeater/RT.
L3	Problem between the second repeater and the third repeater/RT.
L4	Problem between the third repeater and the RT.
OK	Previous synchronization attempt was successful.

8. TROUBLESHOOTING

Use the following table to troubleshoot some of the most common problems with the HVDL system. You may also find answers to your questions under “Commonly Asked Questions”.

Problem	Possible Cause(s) and Solution(s)
The link LED on the RT (or the COT far LED) is not steady on	RT is not in sync with the COT. Check the SYNC LED on the RT or phone display at the COT. Customer unplugged the 10 BaseT cable from the computer. Customer needs a crossover 10 BaseT cable. Customer’s computer is not on. Customer’s network connection software is not set up properly (reboot the computer after reconfiguring).
The RT link LED is single-flashing	The RT link is good; the COT link is not established.
COT near link LED not steady on	COT 10 BaseT cable not connected to a hub, switch or router. Cable needs to be a crossover 10 BaseT cable.
The RT and COT link LEDs are steady ON, but no data is being transferred	DSL is not synced up. The data rate is set to 0 K; change the data rate. Some 100 BaseTx cards cause a “link steady ON” indicator, but can’t transmit data. Make sure that the HVDL3.1 is linked to a 10 BaseT or 10/100 BaseTx card.
Customer not getting high speed data rates	COT rate not set up in configuration. Reconfigure the COT, and the new rate will be available immediately. The customer misunderstands bits and bytes. Because of invisible Ethernet overhead, a quick rule of thumb is 1 byte=about 10 bits of transmitted data. The backbone system connected to the COT (i.e. Internet) is slower than the HVDL system.
COT indicates QUAL on the display and/or QUAL LED is on at the RT	RT is too far from the COT. Add a repeater. Excess cable loss. Add a repeater. RT or COT electronics are failing.
The COT and RT won’t sync	RT not connected to COT. RT is too far from the COT. Add a repeater. Excess cable loss. Add a repeater. RT or COT electronics are failing (see page 14, *Last Synchronization Status*).

Problem	Possible Cause(s) and Solution(s)
The customer's phone does not ring or is very low in volume	Too many REN loads on the line. Some very old ringers were not designed to any specifications and require excess power to ring. Install a local ring amplifier on the voice lines leaving the RT.
The system fails with a ground fault	The cable is leaking current to ground. Check for bad cable and moisture. The cable has connection to ground. Remove the connection. Check the cable with a test device, such as a Sidekick 7B™ by Tempo. Wrong CO primary surge protector in the distribution/interconnect frame. Change to a surge protector with at least 260 volts to ground protection.
Caller ID doesn't work	This system is transparent to caller ID. Check the Class 5 switch for proper setup. Check the customer's caller ID device.
The COT LED display is flashing between the 3 phone display and the current data rate.	The system cannot synchronized at the desired data rate. The COT will step down in 128K increments, attempting to synchronize until a successful rate is determined. The COT will display the lower rate and start an alarm with a corresponding "bad COT" signature. RT is too far from COT; add a repeater. Excessive cable loss; add a repeater. RT, repeater or RT electronics failure.
Self test error (ERR).	Re-seat the COT. If problem is not fixed, the COT is damaged and needs to be replaced.
10 BaseT link never turns on or flashes.	If the COT LED display shows **EPR** or **RPT** or a data rate with the training arrow, the system is training—wait for the voice line display. The 10 BaseT link is malfunctioning—replace the unit.
Changed the EPREP/REPEATER setting on the front panel and nothing happened.	The COT card needs to be rebooted for the change to take effect. Remove the card and reinsert it to reboot it.
The voice channel is not operating.	No connection or a bad connection at the COT and/or the RT. DSL is not synced up. The voice channel is OFF; turn it on through the menu.
Cannot change settings on the COT front panel; can only view current settings.	The system administrator has locked the front panel through the access multiplexer to prevent unauthorized changes. Contact the system administrator.
The LED display shows "X" in the line status display (once DSL has established sync).	The POTS lines with "X" beside them are unavailable. This is caused by a mismatch between the number of POTS lines available on the COT and the number available on the RT. There is no undesirable effect on active data and POTS lines. Matching components with the same number of POTS lines removes the X.

8.1 Commonly Asked Questions

Does the data rate change with distance?

No, the data rate is selected from the front panel and does not change with distance, The system can be configured for longer distances at the lower data rates. See configuration software, #SM–CSHVDL3.1T.

How do I shut off data transmission to a customer?

Using the COT front panel, change the data rate to "0" (see *COT Configuration*, p. 7). The data rate will take effect immediately—no truck roll is necessary.

The customer does not have category 3 or better wire in the house. Will this cause problems?

For short distances, this may not cause any problems. However, data operation when using other than category 3 cable or better is not guaranteed.

Does the HVDL system need an IP address?

The system can be thought of as a “bridge”. It does not need an IP address.

The system works OK with only an RT, but will not work with a repeater.

Configure the COT using the front panel for repeater mode (see *COT Configuration*, p. 7).

The system instantly powers up the line, and I don’t have a repeater.

Configure the COT using the front panel for EPREP operation (see *COT Configuration*, p. 7).

The customer’s data rate is to be changed (i.e. sold a better rate to the customer). What do I do?

Reconfigure the data rate at the COT front panel (see COT Configuration, p. 7). The COT will have to retrain, and during retraining data will be lost if the customer is on-line. The customer may need to reboot his or her PC for the data rate to take effect. No truck roll is necessary.

How can I make voice line 2 (or voice line 3) the line bypassed in BYPASS mode? (*For models with more than 1 voice line*)

By definition, voice line 1 is the only line available for bypass. Rearrange the voice lines so that the line to be active during bypass mode is connected to voice line 1.

Can I use 10/100 BaseTx card to connect to the HVDL3.1 system?

Yes. 10 BaseT and 10/100 BaseTx cards will link to the HVDL3.1. However, 100 BaseTx-only cards will not link.

9. TECHNICAL ASSISTANCE

If technical assistance is required, contact Charles Industries’ Technical Services Center at:

800−607−8500
847−806−8500
847−806−8556 (FAX)
techserv@charlesindustries.com (e-mail)

10. WARRANTY & CUSTOMER SERVICE

10.1 Warranty

Charles Industries, Ltd. offers an industry-leading, 5−year warranty on products manufactured by Charles. Contact your local Sales Representative at the address or telephone numbers below for warranty details. The warranty provisions are subject to change without notice. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract.

Charles Industries, Ltd.
5600 Apollo Drive
Rolling Meadows, Illinois 60008−4049
847−806−6300 (Main Office)
847−806−6231 (FAX)

10.2 Field Repairs (In-Warranty Units)

Field repairs involving the replacement of components within a unit are not recommended and may void the warranty and compatibility with any applicable regulatory or agency requirements. If a unit needs repair, contact Charles Industries, Ltd. for replacement or repair instructions, or follow the *Repair Service Procedure* below.

10.3 Advanced Replacement Service (In-Warranty Units)

Charles Industries, Ltd. offers an “advanced replacement” service if a replacement unit is required as soon as possible. With this service, the unit will be shipped in the fastest manner consistent with the urgency of the situation. In most cases, there are no charges for in-warranty repairs, except for the transportation charges of the unit and for a testing and handling charge for units returned with no trouble found. Upon receipt of the advanced replacement unit, return the out-of-service unit in the carton in which the replacement was shipped, using the pre-

addressed shipping label provided. Call your customer service representative at the telephone number above for more details.

10.4 Standard Repair and Replacement Service (Both In-Warranty and Out-Of-Warranty Units)

Charles Industries, Ltd. offers a standard repair or exchange service for units either in- or out-of-warranty. With this service, units may be shipped to Charles Industries, Ltd. for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries, Ltd.. Follow the *Repair Service Procedure* below to return units and to secure a repair or replacement. A handling charge applies for equipment returned with no trouble found. To obtain more details of this service and a schedule of prices, contact the CI Service Center at 217−932−5288 (FAX 217−932−2943).

Repair Service Procedure

1. Prepare, complete, and enclose a purchase order in the box with the equipment to be returned.
2. Include the following information:
   - Company name and address
   - Contact name and phone number
   - Inventory of equipment being shipped
   - Particulars as to the nature of the failure
   - Return shipping address
3. Ship the equipment, purchase order, and above-listed information, transportation prepaid, to the service center address shown below.

   CI Service Center
   503 N.E. 15th St, P.O. Box 339
   Casey, IL 62420−2054
4. Most repaired or replaced units will be returned within 30 or 45 days, depending on the product type and availability of repair parts. Repaired units are warranted for either 90 days from the date of repair or for the remaining unexpired portion of the original warranty, whichever is longer.

11. SPECIFICATIONS

11.1 Facility Protection

Secondary protection is provided on the DSL by the COT and meets Bellcore requirement *Electromagnetic Compatibility and Electrical Safety − Generic Criteria for Network Telecommunications Equipment (GR−1089−CORE)*. External primary protection is strongly recommended.

11.2 Environmental and Power Requirements

The HVDL COT environmental and power requirements are listed in Table 7.

Table 7. Environmental and Power Requirements

Temperature Range	−40° to +65° C
Humidity Range	Up to 95%
Voltage	−48V input (nominal); −42 volts to −56 volts (max)
Current Requirements at 48 volts (COT)	280 milliamps *(typical idle)* 375 milliamps *(typical busy—all 3 lines)* 500 milliamps *(maximum current)*
Current Requirements at 260 volts (DSL)	26 milliamps *(typical idle)* 52 milliamps *(typical busy—all 3 lines)* 80 milliamps *(maximum current)*
DSL Voltage	+/− 130 volts, A2 or A3 safety class

11.3 Electrical Characteristics

The electrical characteristics of the HVDL COT are as follows:

(a) REACH: *With a repeater*, DSL line resistance = –98 dB @ 104 kHz, 2000 Ohms on 26 AWG = 19,200 feet (repeater centered with 800 Ohms of cable on either side). *Without a repeater*, DSL line resistance = –49 dB @ 104 kHz, 1000 Ohms on 26 AWG=12,000 feet. See the configuration software for maximum reach at different data rates and wire gauges.

(b) SYSTEM LOSS IN EACH DIRECTION OF TRANSMISSION: 3.5 $\pm$1.0 dB nominal @ 1004 Hz

(c) FREQUENCY RESPONSE: The loss with 0dBm0 input signal relative to 1004 Hz:

Frequency	Minimum Loss	Maximum Loss
300 Hz	0.0 dB	+3.0 dB
400 Hz to 3000Hz	–0.5 dB	+1.0 dB
3200 Hz	–0.5 dB	+1.5 dB
3400 Hz	0.0 dB	+3.0 dB

(d) IDLE CHANNEL NOISE AT THE OUTPUT OF THE COT: 20dBrnC maximum

(e) CHANNEL CROSSTALK (for models with more than 1 voice line): With 0dBm0 single frequency input signals between 300 and 3400Hz applied to any line, the C-message weighted any other lines at the RT in the 300 and 3400Hz frequency band is less than –65dBm0

(f) DC SUPERVISORY RANGE: Rdc is the maximum external loop resistance capability of the analog POTS interface. The Rdc for the COT is 100 ohms

(g) RETURN LOSS (Ref: 900 ohms + 2.16 uF): ERL> 18dB; SRL> 10dB

(h) RING FREQUENCY RESPONSE: 15 – 35 Hz

(i) DATA: 10 BaseT Ethernet, 100 meters (330 feet), Category 3 or better

11.4 Physical Characteristics

The physical characteristics of the HVDL COT are in Table 8.

Table 8. Physical Characteristics

Feature	U.S.	Metric
Height	4.7 inches	11.9 centimeters
Width	1.0 inches	2.5 centimeters
Depth	9.4 inches	23.8 centimeters
Weight	11 ounces	0.31 kilogram

11.5 Regulatory Specifications

The following regulatory specifications apply to the HVDL COT:

- UL
- CSA
- NEBS Level 3
- FCC Part 15 Class A