# High-Speed Voice and Data Link™ Repeater

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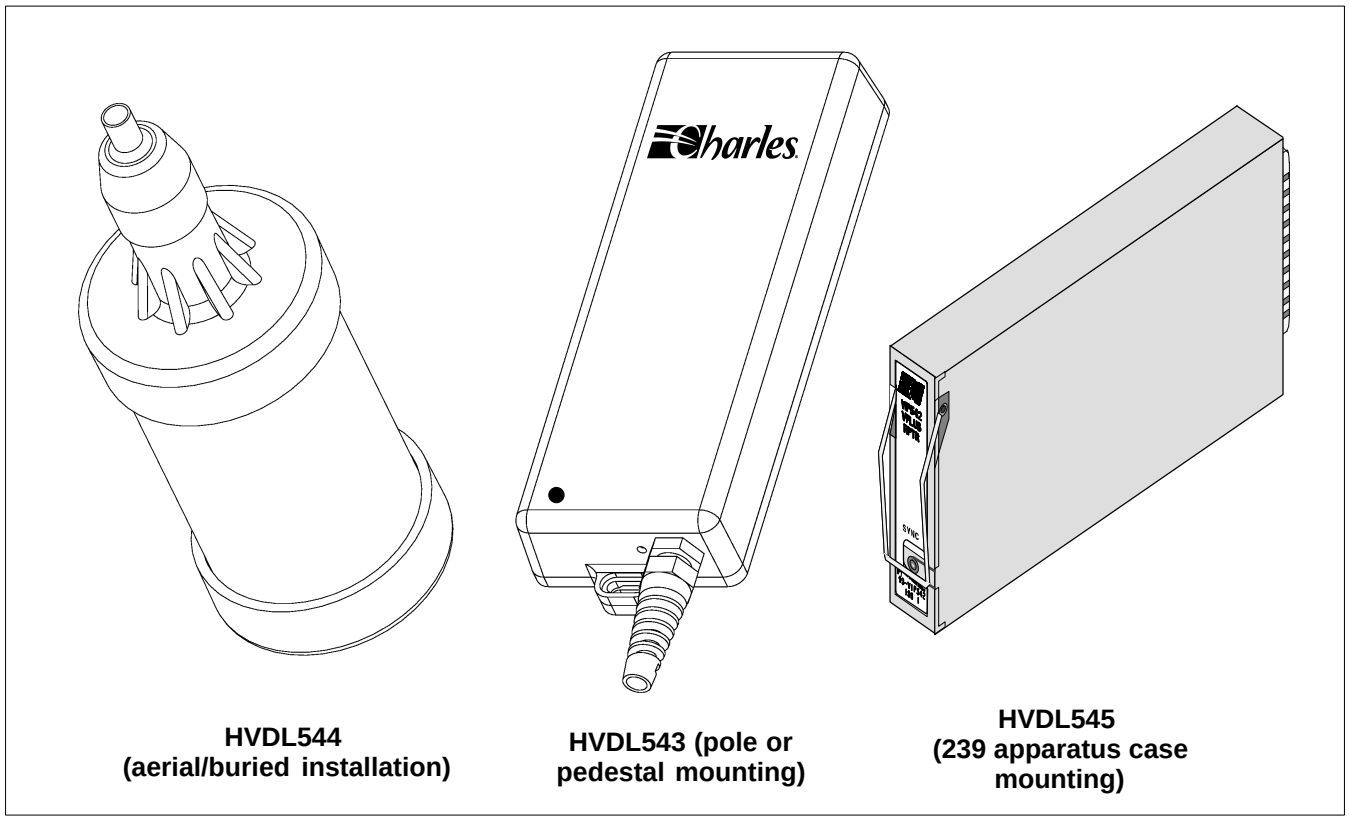


**Figure 1. High-Speed Voice and Data Link™ Repeater**

# 1. GENERAL

## 1.1 Document Purpose

This document contains general, circuit, installation, and testing information for the High Speed Voice and Data Link (HVDL) Repeater.

This document covers the following model numbers:

| Model # | Description |
|---|---|
| HVDL543 | HVDL pole/pedestal repeater |
| HVDL544 | HVDL aerial/buried repeater |
| HVDL545 | HVDL 239 apparatus case repeater |

## 1.2 Document Status

This document is reprinted to add model HVDL545.

## 1.3 Equipment Description/Function

The HVDL repeater is used with a digital subscriber line (DSL) span. This repeater is end-to-end compatible with the HVDL central office terminal (COT) and remote terminal (RT). Installation of the HVDL repeater allows longer DSL span distances than can be achieved with the HVDL COT and RT alone.

## 1.4 Equipment Features

The HVDL Repeater provides the following features:

- Provides DSL distance extension.
- Aids in operation when cable loss is high and/or there is excess noise on the cable pair.
- Powered over the DSL by the COT line unit; no batteries required.
- Rugged design for use at –40° to +149°F (–40° to +65°C).
- Enhanced lightning protection.
- **(HVDL543 only)** Enclosed in a weather tight mounting suitable for pole or pedestal mounting.
- **(HVDL544 only)** Sealed for buried or manhole applications.
- **(HVDL545 only)** Suitable for mounting in all 239 apparatus cases.

# 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

The HVDL repeater is the repeater part of an HVDL system link, as shown in Figure 2.

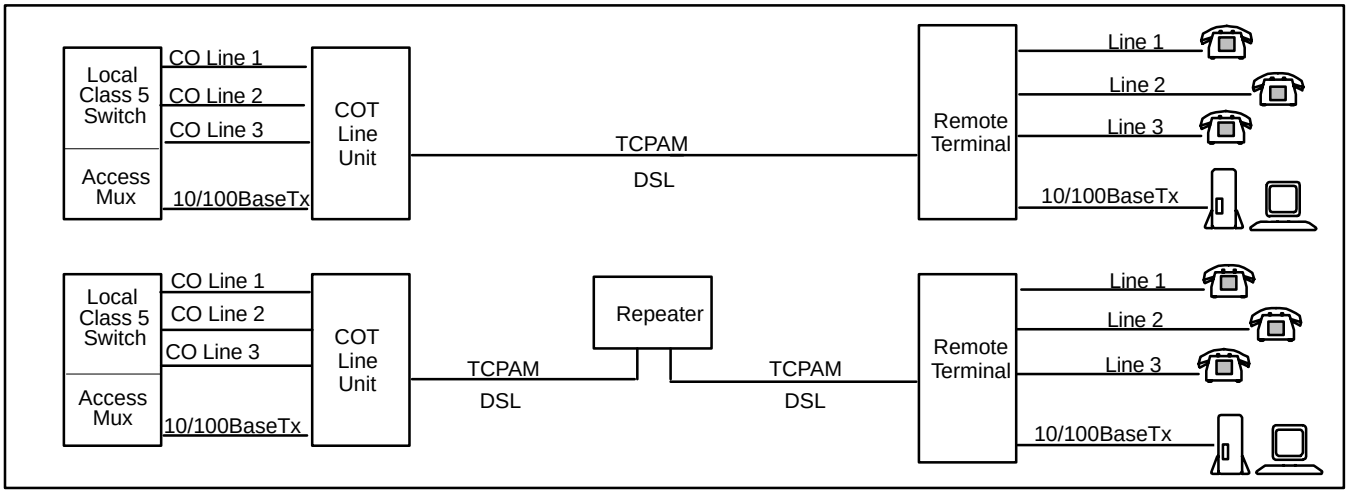


**Figure 2. Typical HVDL applications, with and without a repeater**

*Note: When the application distance allows, an HVDL COT and RT may be used without a repeater.*

## 4. MOUNTING

### 4.1 Equipment Location

The repeater should be located with no more than 800 Ohms or –39 dB of loss at 228 KHz on either side of the repeater's DSL drop. It is strongly recommended that the repeater be located as close as possible to the center of the DSL cable. Clean cables give the best performance. Wet cables may limit DSL distance to the repeater.

Software is available to verify your configuration: order part number SM-CSHVDL3.1T.

### 4.2 Bridge Taps

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

### 4.3 Load Coils

All load coils must be removed.

### 4.4 Equipment Mounting

#### *4.4.1. For 93-HVDL543 only*

The repeater is mounted in a weather tight enclosure, suitable for pole or pedestal mounting, and is fully qualified for operation over a –40° to +149°F (–40° to +65°C) temperature range.

While the repeater is weather tight, it should not be installed in any location where it could be submerged.

Use the following steps to mount the repeater:

| Step | Action |
|---|---|
| 1. | Use the two mounting tabs on the repeater as a template to mark two holes. |
| 2. | Drill the two mounting holes in the pole or pedestal. |
| 3. | Secure the repeater to the pole or pedestal using two screws of sufficient size. |
| 4. | Route and dress the cable. |

### *4.4.2. For 93-HVDL544 only*

The sealed repeater is a submersible enclosure suitable for buried applications. The repeater is fully qualified for operation over a –40° to +149°F (–40 to +65°C) temperature range.

**For buried installations**

Use the following steps to mount the repeater:

| Step | Action |
|---|---|
| 1. | Bury the housing below the frost level. |
| 2. | Route and dress the cable. |

**For pole-mounted installations**

The mounting bracket, shown in Figure 3, is not included with the repeater. The mounting bracket kit (260027) can be ordered if required.

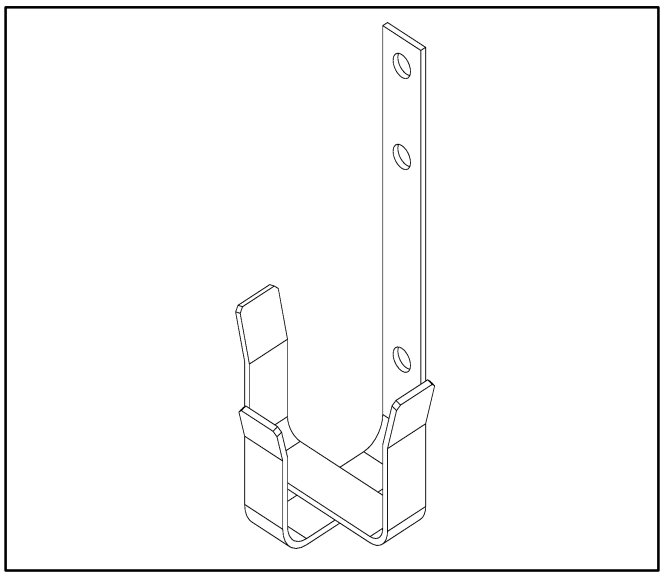

**Figure 3. Mounting Bracket (not included with the repeater)**

Use the following steps to mount the repeater:

| Step | Action |
|---|---|
| 1. | Position the mounting bracket on the pole so that the top of the case will be the required distance (according to local practice) below the cable supporting strand. |
| 2. | Fasten the bracket to the pole with 5/8 inch bolts or 4 inch drive screws. |
| 3. | Place the repeater in the mounting bracket. |
| 4. | Wrap a cable tie-wrap around the housing under the nozzle cap and pull the cable tie-wrap securely around the pole. |

# 5. INSTALLATION

## 5.1 Installation and Operation for HVDL543 or HVDL544

### *5.1.1. Putting an HVDL Repeater in service (for HVDL543 or HVDL544)*

Use the following steps to put the repeater in service.

| Step | Action |
|---|---|
| 1. | If the RT is not already installed, install it according to its documentation. |
| 2. | Connect the BLUE, BLUE/WHITE twisted pair to the COT side. Polarity is not important. |
| 3. | Connect the ORANGE, ORANGE/WHITE twisted pair to the RT side. Polarity is not important. |
| 4. | **For pole or pedestal mounting:** Connect the green ground wire to a suitable earth ground.<br>**For buried applications:** Connect the sheath ground to a suitable earth ground.<br>*Note: A good earth ground connection is required for continued lightning protection.* |
| 5. | Install the COT according to its documentation. |

*Note: If a failure is detected while a repeater is in service, the COT removes span power and attempts to restart after approximately 5 seconds. Subsequent restarts will occur every 5 seconds if required.*

### *5.1.2. HVDL543 LED*

Repeater model HVDL543 has a 2-color LED. LED states are described in Table 1.

**Table 1. HVDL543 LED States**

| LED State | Description |
|---|---|
| Solid RED | At start-up, from power-up to start of synchronization |
| Flashing RED | Synchronizing upstream (toward COT) |
| Pulsating RED (3 seconds OFF, 1 second flashing) | Synchronizing downstream (towards RT) |
| Solid GREEN | Upstream and downstream have synchronized |

### *5.1.3. Taking the HVDL repeater out of service*

Use the following steps to take the repeater out of service.

*Note: We recommend removing the COT before taking the repeater out of service.*

***CAUTION — HIGH VOLTAGE***

**Up to 260 volts run across the TIP/RING lead. Use care when disconnecting.**

| Step | Action | System Response |
|---|---|---|
| 1. | Disconnect the TIP or RING of the COT DSL loop (BLUE, BLUE/WHITE). | The COT removes DSL span power, generates an alarm, and attempts to re-power the line in 5 seconds. |

## 5.2 Installation and Operation for HVDL545

### *5.2.1. Putting the mini-repeater in service (for HVDL545)*

The mini-repeater can be installed in a variety of 239-mechanics apparatus cases.

*Note: The repeater dissipates 1.6 watts of heat. Prior to installation, verify the power dissipation requirements of the apparatus case to make sure that the maximum repeater temperature (+65 ° C) is not exceeded.*

| Step | Action |
|---|---|
| 1. | Install the repeater into a correctly wired (see Table 1) slot in the apparatus case.<br>*Note: A good earth ground connection is required for continued lightning protection.* |
| 2. | Install the COT according to the documentation for the COT you are using. |

*Note: If a failure is detected while a repeater is in service, the COT removes span power and attempts to restart after approximately 5 seconds. Subsequent restarts will occur every 5 seconds if required.*

**Table 2. HVDL545 Pinouts**

| Connection | Pin # |
|---|---|
| Ground | 1,10 |
| TIP COT (polarity is not important) | 6 |
| RING COT (polarity is not important) | 5 |
| TIP RT (polarity is not important) | 4 |
| RING RT (polarity is not important) | 3 |

#### *5.2.2. Taking the mini-repeater out of service (for HVDL545)*

Use the following steps to take the repeater out of service.

***CAUTION — HIGH VOLTAGE***

**Up to 260 volts run across the TIP/RING lead. Use care when disconnecting.**

*Note: We recommend removing the COT before taking the repeater out of service.*

| Step | Action | System Response |
|---|---|---|
| 1. | Remove the card from the apparatus case. | The COT removes DSL span power, generates an alarm, and attempts to re-power the line in 5 seconds. |

## 6. TECHNICAL ASSISTANCE

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

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

## 7. WARRANTY & CUSTOMER SERVICE

### 7.1 Warranty

Charles Industries, Ltd. offers an industry-leading, 5-year warranty on products manufactured by Charles Industries. 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)

### 7.2 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.

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

### 7.4 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 for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries. 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.

## 8. SPECIFICATIONS

### 8.1 Facility Protection

Primary and secondary protection is provided on the DSL and meets Bellcore requirement *Electromagnetic Compatibility and Electrical Safety — Generic Criteria for Network Telecommunications Equipment (GR-1089-CORE)*.

### 8.2 Power Source

The repeater is powered over the DSL carrier pair from the COT—no batteries or local power are required.

### 8.3 Electrical Characteristics

The electrical characteristics of the HVDL repeater are as follows:

| | |
|---|---|
| **Input Voltage** | 180-260 volts |
| **Power Dissipation** | 1.6 watts |
| **Communication** | TCPAM with proprietary interface |

### 8.4 Physical Characteristics

The physical characteristics of the HVDL repeaters are shown in Table 3 and Table 4.

**Table 3. Physical Characteristics of HVDL543**

| Feature | U.S. | Metric |
|---|---|---|
| Length | 9 inches (case only)<br>11 7/16 inches (with strain reliefs) | 22.86 centimeters (case only)<br>29 centimeters (with strain reliefs) |
| Width | 3 5/16 inches | 8.4 centimeters |
| Depth | 1 1/4 inches | 3.175 centimeters |
| Weight | 2 pounds 6 ounces | 1 kilogram |
| Stub Length | 30 feet | 9.1 meters |
| Temperature | –40 to +149° F | –40 to +65° C |
| Humidity | to 100 % | |

**Table 4. Physical Characteristics of HVDL544**

| Feature | U.S. | Metric |
|---|---|---|
| Length | 13 inches | 33 centimeters |
| Width | 5 inches | 12.7 centimeters |
| Weight | approx. 5 pounds, with cable | 2.27 kilograms |
| Stub Length | 30 feet | 9.1 meters |
| Temperature | –40 to +149° F | –40 to +65° C |
| Humidity | to 100 % | |

**Table 5. Physical Characteristics of HVDL545**

| Feature | U.S. | Metric |
|---|---|---|
| Length | 6 7/16 inches | 16.4 centimeters |
| Width | 2 9/16 inches | 6.5 centimeters |
| Depth | 3/4 inch | 1.9 centimeters |
| Weight | 11.2 ounces | 317 grams |
| Temperature | –40° to +149° F | –40° to +65° C |
| Humidity | to 95 % | |

### 8.5 Regulatory

The following regulatory specifications apply to the HVDL repeater:

- FCC Class A
- NEBS Level 3