



**A7854-005 Addressable Mini T1 Line Repeater
Switch Addressable 19, loopback, Out LB0**

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Technical Summary

Input Voltage	Line Powered from T1 span (60 ±3 mA nominal. 150 mA maximum). At 60 mA, the voltage drop is 8.1 Volts maximum. The impedance is 140 Ohms.
Loopback Sensitivity	0 to -35 dB dsx
Loopback Up Code	11001000010XXXXX where X represents the address. Framed or unframed format
Loopback Down Code	Universal 11100 or 11101000010XXXXX.
Operating Temperature	-40 to +70 degrees Celsius

Dimensions

Weight	4 Ounces
Height	2.5 inches
Width	0.75 inches
Length	6.25 inches

Table 1. Abbreviations

Code	Definitions
LBO	Line Build-Out
RCV	Receive
XMIT	Transmit
ALBO	Automatic Line Build-Out

1. Features

- DS-1 loopback
- Loop-up code for repeater location (Up to 19)
- Loopback can be disabled by setting switches to "0"
- Compatible with standard test equipment
- Environmentally hardened
- Replaces 239 type repeaters
- Powered by span current
- Lightning protection
- Uses loopback to test circuits instead of order wires or fault filters
- Simplifies troubleshooting spans
- Manually selectable LBOs
- Automatic Line Build-Out (ALBO)

2. Applications

(See Figure 1)

Use the A7854-005 T1 Repeater:

- For fault isolation on private DS-1 spans
- To eliminate order wires and fault filters
- To reduce cost by reducing dispatches
- To replace an L239, or 239 repeater

The A7854-005 T1 Line Repeater with loopback reduces troubleshooting time. Past repeaters used a separate copper pair (Fault locate pair) to tie all repeaters together to the central office. Signals would then be sent down the span. The signal from the fault locate pair would indicate that the signal got through a particular repeater. While this method could isolate a catastrophic failure, it would not indicate if the signal was impaired. There could also be problems with the fault locate pair that prevented the returned signal from being received at the office site.

The A7854-005 eliminates the need for the fault locate pair. By looping up the repeater, you can determine if a signal is getting to a particular repeater and if the signal is impaired in any way. Individual repeaters can be looped up to determine the exact location of the problem. This saves time and dispatching. You can also perform stress testing. For example, a particular repeater can be looped back and tested for bit errors. You can perform this test on each repeater until the problem is found. This would be impossible on past repeaters.

These features of the A7854-005 are especially useful for applications such as where the individual repeaters are located underground in manholes. By using the loopback features, the fault can be isolated to a particular manhole, thereby eliminating pumping out multiple manholes to isolate faults

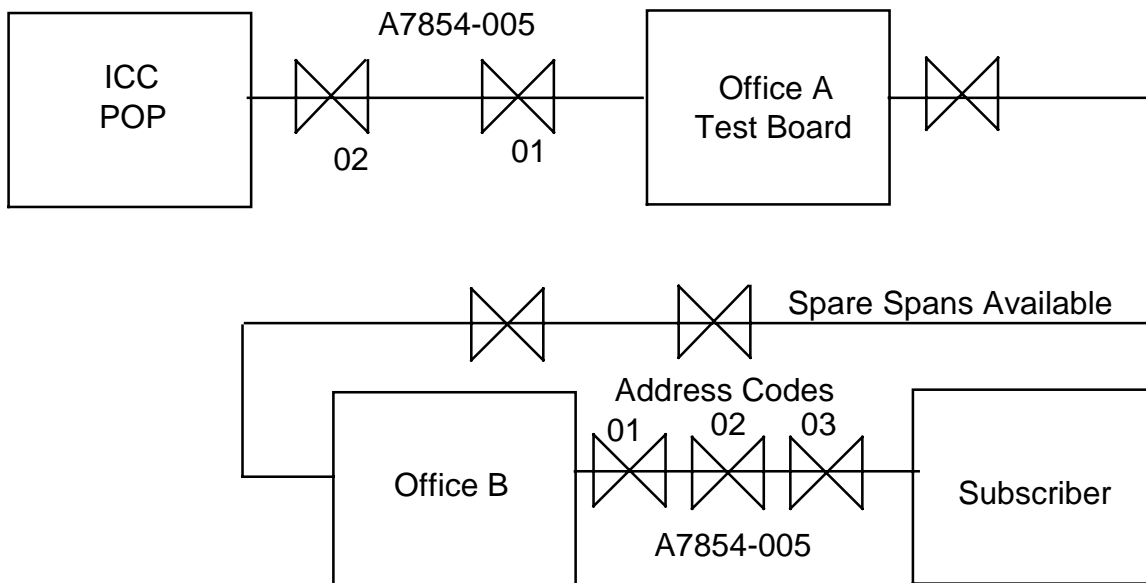


Figure 1. T1 Repeater Application

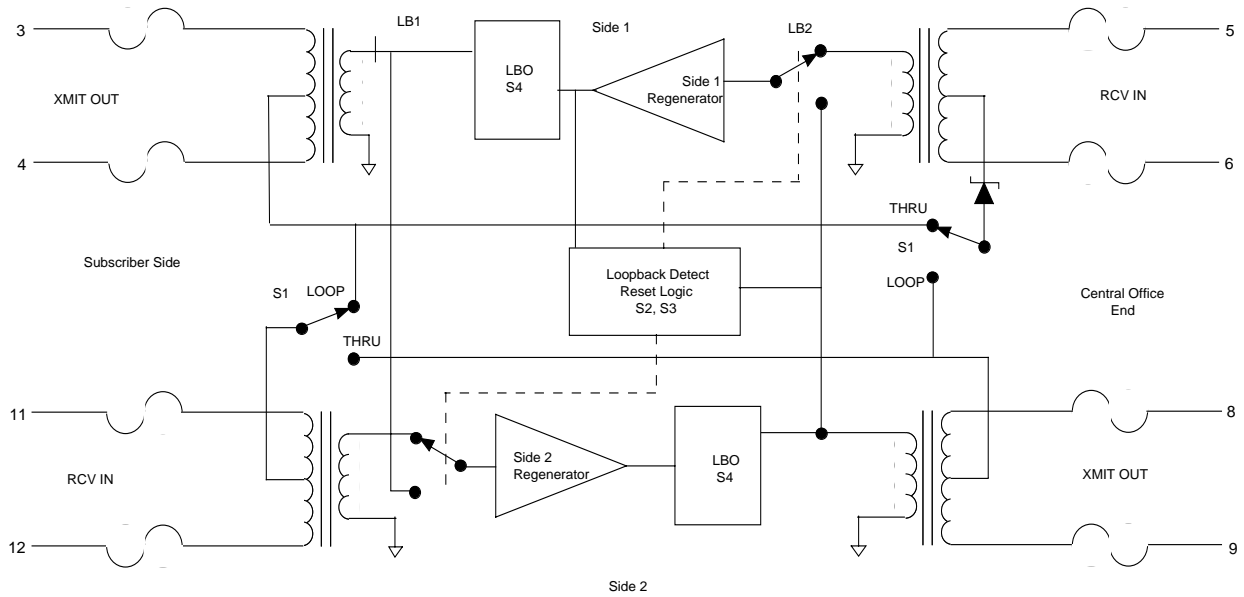


Figure 2. Circuit Layout

3. Circuit Description
(See Figure 2)

The A7854-005 T1 Repeater has the following circuits:

- Side 1
- Side 2
- Simplex Circuit
- Loopback Circuit

Note: This figure is also shown on the back page for your convenience (See Figure 5. Block Diagram).

Side 1 Flow

During non-loopback, the Side 1 signal that enters the module on pins 5 and 6 and passes through a lightning protector before going to an isolation transformer.

The signal then goes to the Side 1 Regenerator, where the signal is restored to 0 dB dsx.

The Signal then goes to the LBO. The LBO can be set for 0 to 18 dB of loss in 3 dB steps.

The signal then goes through the output isolation transformer, through the lightning protectors and out pins 3 and 4.

Side 2 Flow

The Side 2 Flow is identical to the Side 1 flow. During non-loopback, the Side 2 signal that enters the module on pins 11 and 12 and passes through a lightning protector before going to an isolation transformer.

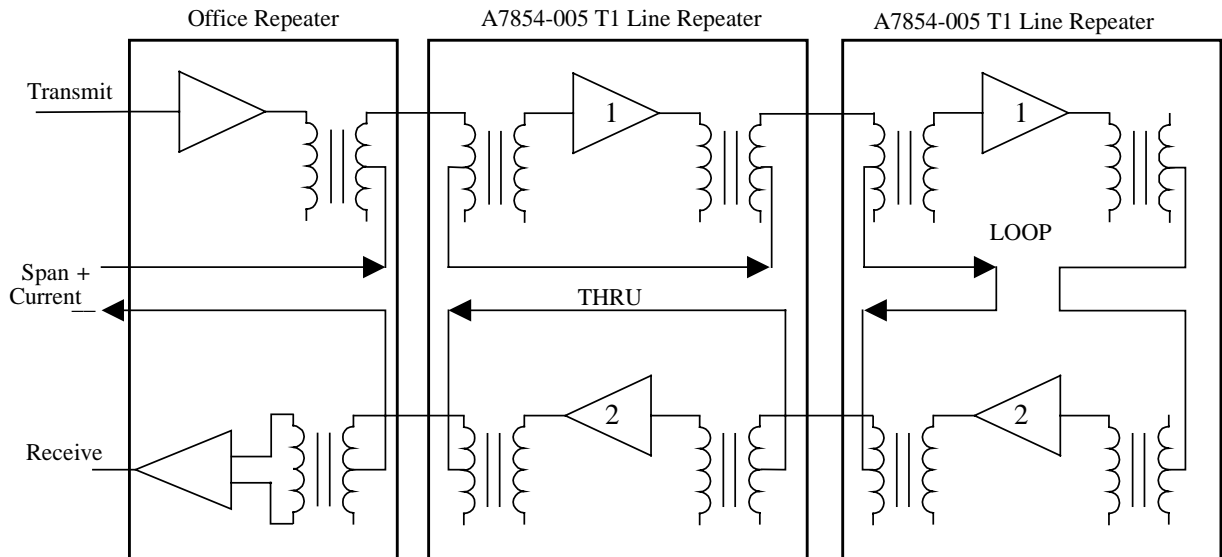
The signal then goes to the Side 2 Regenerator, where the signal is restored to 0 dB dsx.

The Signal then goes to the LBO. The LBO can be set for 0 to 18 dB of loss in 3 dB steps.

The signal then goes through the output isolation transformer, through the lightning protectors and out pins 8 and 9.

Simplex Circuit

The simplex leads are used to derive the power required to operate the repeater. They can be set in two different configurations (See Figure 3). In the THRU position, span current is sent down the line to any additional repeaters. In the LOOP position, the simplex leads provide a return path for span current. This is useful when span current is applied from both directions.



NOTE: The DC current flows from plus to minus through Side 1 of the A7854-005 Line Repeater. The last repeater must be looped to provide a return path through Side 2. The current must always be in the same direction as the PCM signal flow.

Figure 3. Simplex Connections

Loopback

The loopback circuit is designed to loopback either end of the repeater.

- The repeater enters the loopback mode when a particular 16 bit loop up code is received for greater than 5 seconds, at either end of the repeater. The signal may be either framed or unframed. The loop up code consists of sending 11001000010XXXXX. Where XXXXX is the binary equivalent of the setting of switch S2 and S3. To obtain this code, convert the location number to binary (See Table below). After the repeater acknowledges the loop-up code, it sends an unframed all 1s signal back to the tester until the loop-up code is removed.

Note: The Loop-up code will not be detected if the bit error rate exceeds 1×10^{-3} .

Note: Care must be taken when using the A7854-005 repeaters on spans that use span switching systems. With the A7854-005 in loopback on these spans, removing the test equipment may cause the span switching equipment to see a good signal and cause an outage if operating on the spare span. To avoid this possibility, disable the switching feature.

Note: Do not use the same address for two repeaters on the same span.

Binary Conversion

Address Code		Binary
S2	S3	
0	1	.....00001
0	2	.....00010
0	3	.....00011
0	4	.....00100
0	5	.....00101
0	6	.....00110
0	7	.....00111
0	8	.....01000
0	9	.....01001
1	0	.....01010
1	1	.....01011
1	2	.....01100
1	3	.....01101
1	4	.....01110
1	5	.....01111
1	6	.....10000
1	7	.....10001
1	8	.....10010
1	9	.....10011
0	0	.....Disable Loopback

- During loopback, any test signal can be sent to the repeater. This signal is then sent through both regenerators and sent out the repeater to the same side. It can then be compared on a bit-by-bit basis to determine the exact bit error rate performance of the repeater and line under test.
- Loopback is terminated after sending a 5 bit or 16 bit loop-down code to the Receive IN port for 5 seconds or more. After the repeater acknowledges a 16 bit loop-down code (approximately 5 seconds), it sends an unframed all 1s signal back to the tester until the loop-down code is removed. The 16 bit code is 11101000010XXXXX, where XXXX is the binary equivalent of switch S2 and S3. The repeater does not send an all 1s signal if the 5 bit code is sent. The 5 bit loop-down code is the same

loop-down code as the Network Interface Device (NID). The 5 bit loop down code is 11100.

Note: Loopback does **not** time out. Be sure to return the repeater to normal operation after completion of tests.

Note: If you are uncertain about the loopback status, remove span power for 16 seconds or more. All repeaters will terminate loopback.

4. Installation

Inspection.

Unpack and inspect the A7854-005 Repeater for possible shipping damage. If damage is found, file a claim form with the transportation company in accordance with that company's instructions.

Warranty

This unit has a two year warranty. The date the warranty ends is on the back of each circuit board. The date consists of an "Exp" followed by four digits. The first two digits indicate the month; digits three and four the year. For Example: If the warranty tag shows "Exp0495", the warranty expires on the last day of April, 1995.

Repair and Return Service

To obtain repair and return service, complete a Trouble Reporting Tag (or equivalent). Ship the defective unit (prepaid) in a static proof bag along with the Trouble Reporting Tag, and a brief description of the trouble, to:

XEL Communications, Inc.
17101 E. Ohio Drive
Aurora, CO 80017-3878

If you have an Emergency condition, call Inside Sales at (303) 696-2253 and use the complete part number to request a replacement unit.

INSTA-FAX

XEL has implemented a new FAX system designed to ensure you have the most current document available. There are two ways to obtain the most recent issue of the document for this product:

1. From a fax machine or a computer connected to a FAX machine, dial (303) 696-2358. At the voice prompt, select '1' for 'document'. Then key in the four digit FAX ACCESS CODE below.
2. Dial (303) 696-2359 from any phone. At the voice prompt, select '1' for 'document'. Then key in the four digit FAX ACCESS CODE below and your fax phone number.

FAX ACCESS CODE: --->0327

Mounting The A7854-005 Repeater mounts in standard WECO type 475 housings. It can also be mounted in 9117X and WECO type 466 and 468 housing using a 92309 adapter. If a 9118X housing is used, a 91191 adapter is required.

Installer Connections All connections can be made when the module is installed in the housing. See Table 2 for the pins connections.

Table 2. Modular Connections

Connect	To Jack Pin
Side 1 RCV IN (CO Side).....	5
Side 1 RCV IN (CO Side).....	6
Side 1 XMIT OUT (Subscriber Side)	3
Side 1 XMIT OUT (Subscriber Side)	4
Side 2 RCV IN (Subscriber Side)	11
Side 2 RCV IN (Subscriber Side)	12
Side 2 XMIT OUT (CO Side).....	8
Side 2 XMIT OUT (CO Side).....	9
Rack Ground	10

5. Alignment The following procedures will allow the user to option the A7854-005 Repeater quickly and accurately. Refer to Figure 4 for an illustration of the switches. All switches are accessible without removing the cover.

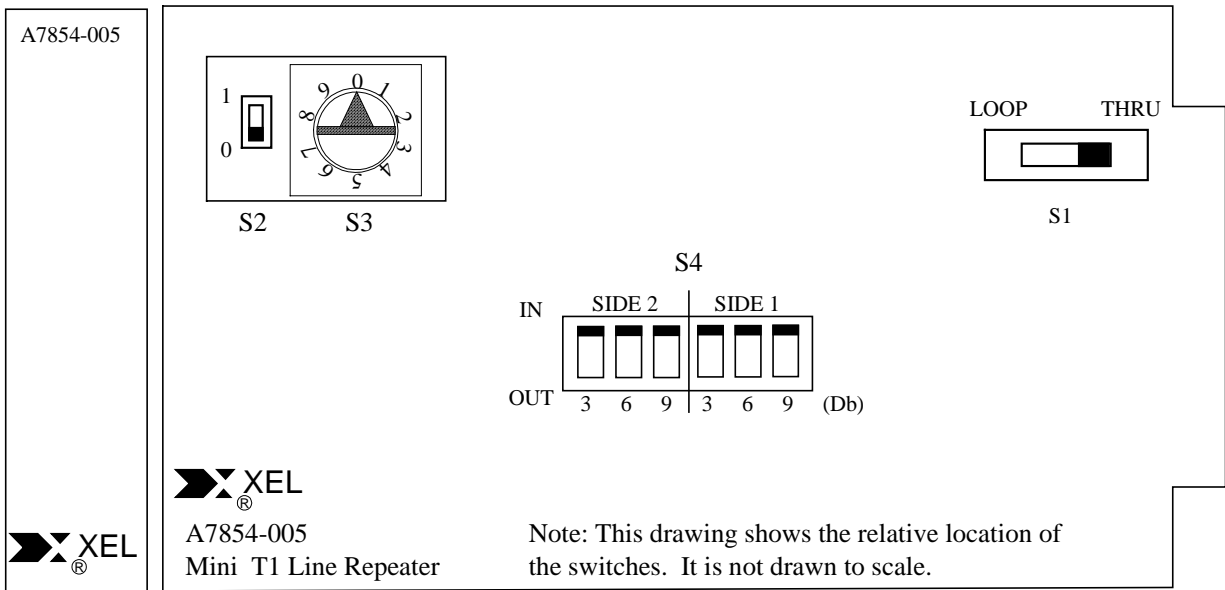


Figure 4. Switch Locations

Setting the Simplex Mode

Step 1. Switch S1 sets the simplex mode. Set this switch to :

- THRU to pass span current to additional repeaters.
- LOOP to provide a return path for span current.

Setting the Repeater's Address

Step 2. Switches S2 and S3 set the A7854-005 Repeater's address. The address usually consists of the repeater location number. Each repeater on a span must have a different number. Switch S3 sets the least significant digit while S2 sets the most significant digit. That is for locations 1 through 9, switch S2 must be set to "0". For locations 10 through 19, switch S2 must be set to "1".

Position "00" of switches S2 and S3 disables the loopback on the repeater.

Setting the LBO Switches

Step 3. Switch S4 is used to set the LBO from 0 to 18 dB in 3 dB steps. Set these switches to attenuate the signal to the appropriate level. These switches are additive

6. Testing

If you suspect the repeater is malfunctioning, perform the procedures in the Testing Guide. If the tests prove the module is defective, return it to XEL for repair or replacement. Field repair is not recommended and may invalidate the warranty.

Note: Proper packaging of all returned units is necessary. Wrap the unit in a static proof bag and cardboard carton. Non-static packaging material should not be used and will void the warranty.

Testing Guide

<i>Procedure</i>	<i>Result</i>
Testing the Receive Channel	
Place the repeater into loopback by sending the up code.	After acknowledging the code (5 seconds), the repeater will return unframed all 1s until the code is removed.
Send a normal signal to the Receive IN port.	You should receive the signal from the Transmit OUT port. If the loop-back signal is not received, the problem is prior to this repeater. Try looping-up a closer repeater.
Send the 16 bit loop-down code to return to normal operation	After acknowledging the code (5 seconds), the repeater will return all 1s until the code is removed.

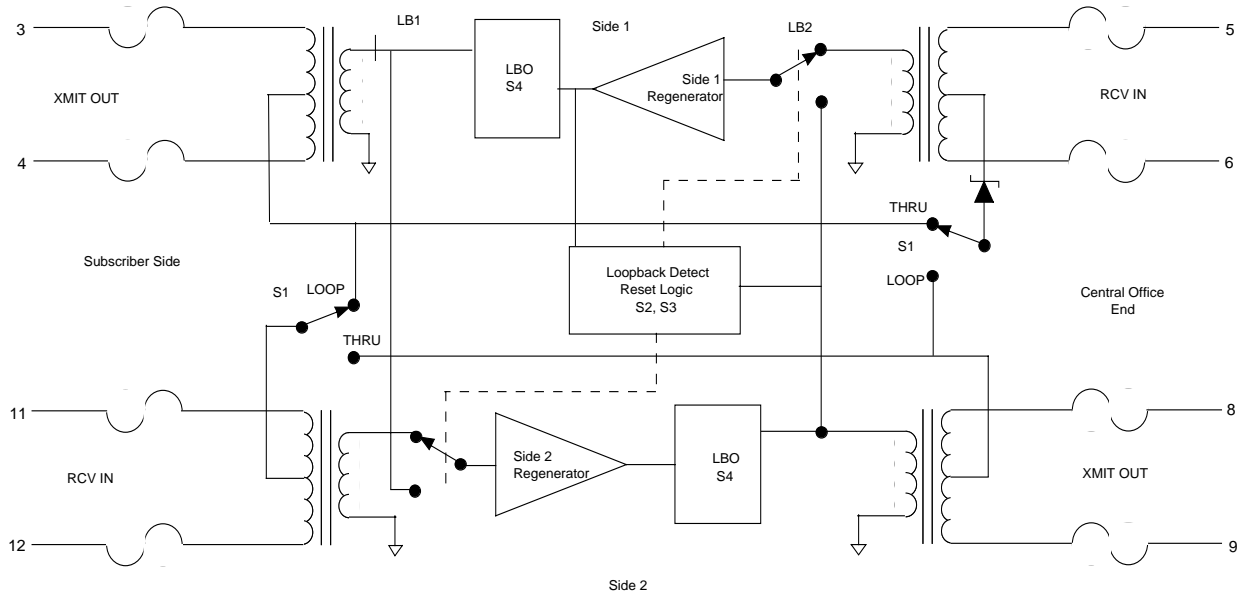


Figure 5. Block Diagram

Table 3. Revision Table

ISSUE:	DATE (M/D/Y).	DESCRIPTION OF CHANGE
1	12/17/98	Initial release.
2	4/4/2002	Removed ISO 9001 References