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# GENERAL DESCRIPTION & APPLICATION PRACTICE

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*(T1 Repeater Extender)*  
Model EXT-209/209B/209T/209TB

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## T1 REPEATER EXTENDER

### EXT-209

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#### GENERAL USE

2.02 The following example demonstrates a typical application of the EXT-209.

1. Remove the selected repeater from the repeater housing.

#### CAUTION:

The T1 span line will be disabled momentarily.

2. Place the repeater into the repeater slot on the EXT-209.
3. Set switch to THRU.
4. Place the EXT-209, with the inserted repeater, into the repeater housing slot from which the repeater was removed.
5. Plug 310 test cords into the test set. Then plug the cords into the appropriate jacks on the extender.

#### WARNING:

On a live span, HIGH VOLTAGE will be present on the extender jacks. Always plug test cords into the test set before plugging them into the extender.

6. Make span measurements as described in the test set manual or practice.  
See Figure 2.0

#### 1. GENERAL

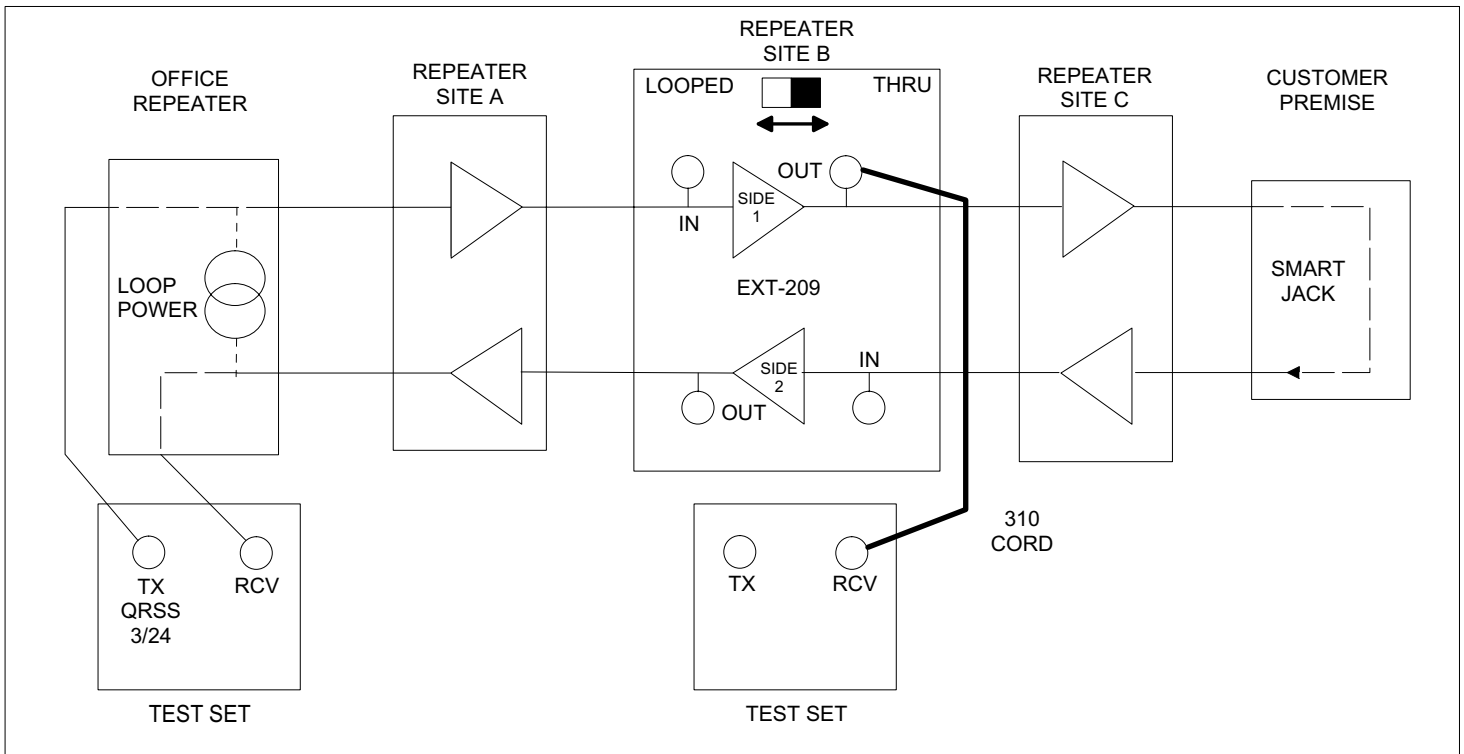
1.01 Rugged and lightweight, the EXT-209 T1 Repeater Extender provides easy access to T1 signals at the front of an apparatus case or repeater housing. When utilized with standard T1 test sets, the EXT-209 becomes a powerful tool in maintaining and installing T1 circuits.

1.02 The EXT-209 provides the following features:

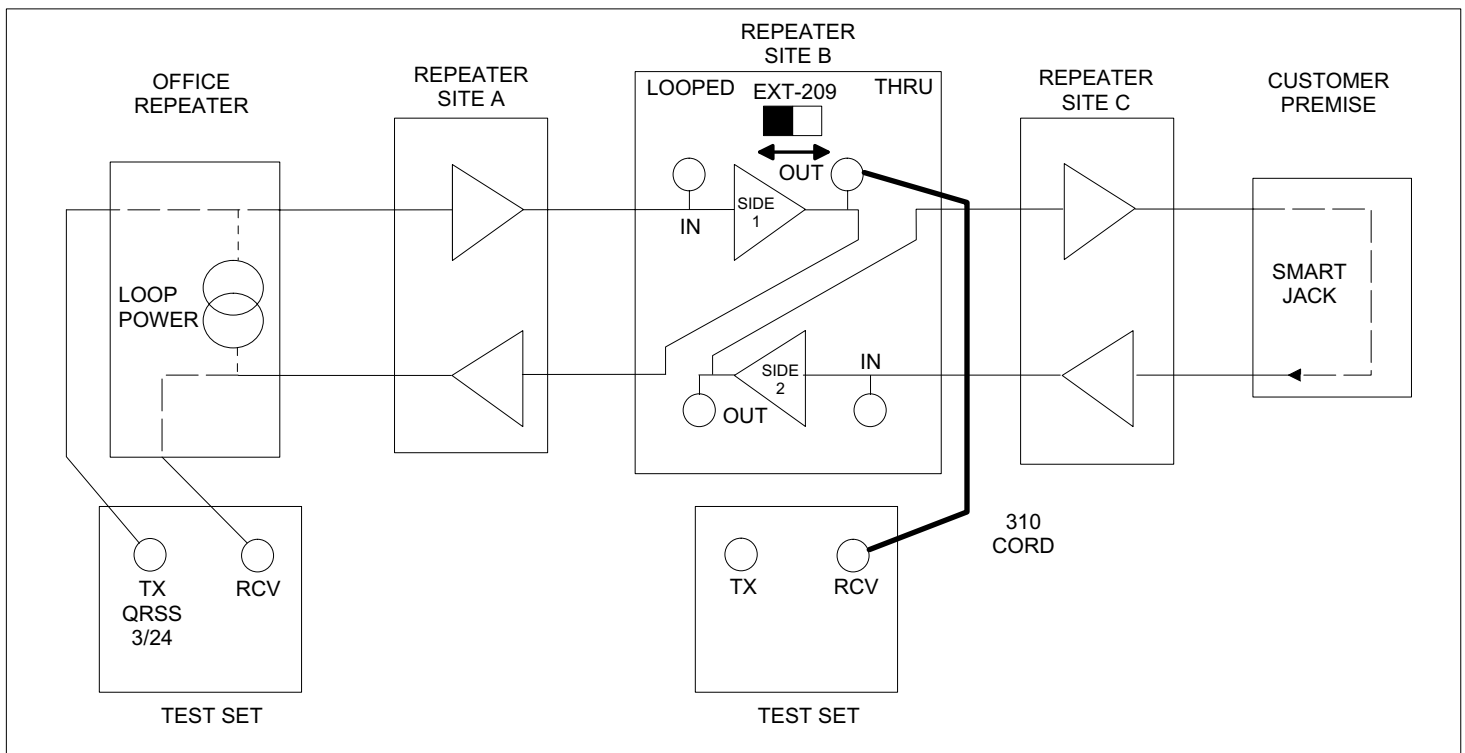
- \* 310 jack access to repeater inputs and outputs.
- \* Signal loopback.
- \* Test access for voltage, current and resistance measurements.
- \* Interface point to transmit and receive T1 test signals.

#### 2. APPLICATIONS

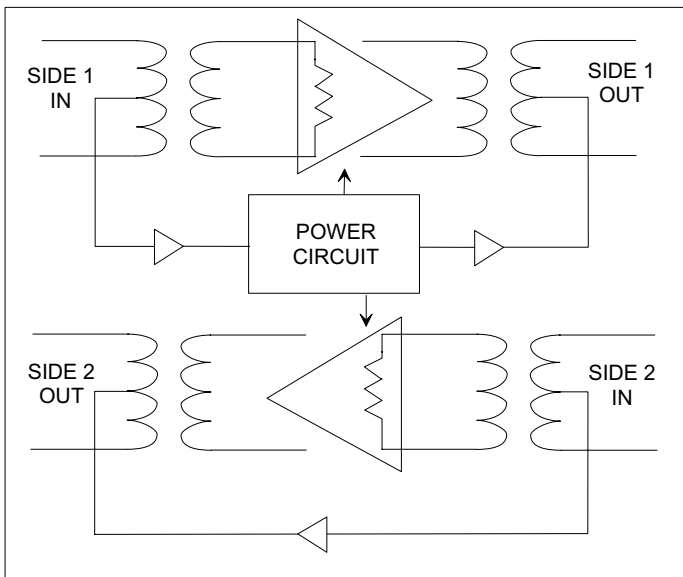
2.01 The EXT-209 offers a convenient interface to the T1 transmit and receive leads from the front of a repeater housing. This section describes various ways the EXT-209 can be utilized in troubleshooting and installing T1 circuits.



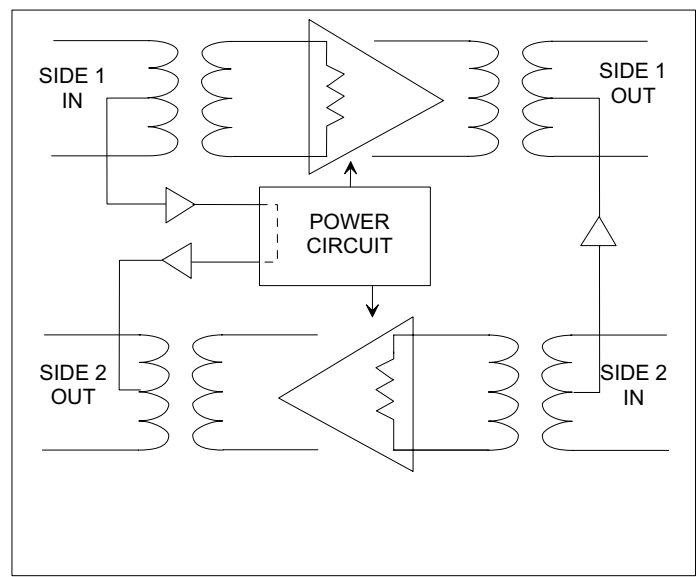
TYPICAL TEST SETUP WITH EXT-209 IN "THRU" SETTING  
FIGURE 2.0



TYPICAL TEST SETUP WITH EXT-209 IN "LOOPED" SETTING  
FIGURE 2.1



TYPICAL REPEATER WITH POWERING  
OPTION IN "THRU" POSITION  
FIGURE 2.2



TYPICAL REPEATER WITH POWERING  
OPTION IN "LOOP" POSITION  
FIGURE 2.4

## LOOP BACK

2.05 To loop a T1 signal back to the originating office, move the LOOPED-THRU switch on the side of the extender to the LOOPED position. This will connect the repeater SIDE 1 output to the SIDE 2 output Tip/Ring pair as shown in Figure 2.1.

## LOOP BACK POWER CONSIDERATIONS

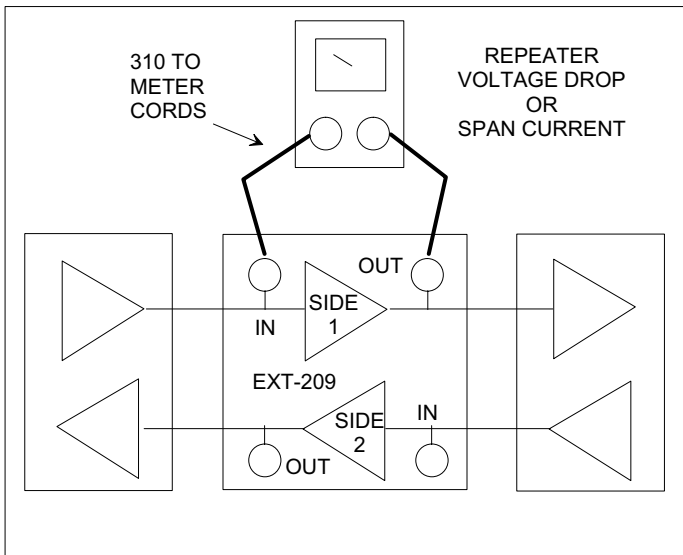
2.06 T1 repeaters are powered by a current source in series with T/R repairs which is located at the originating end of the span (central office). At some point in the span, the current is looped back to the source by setting the powering option switch on the repeater to the LOOPED position. See Figures 2.0 and 2.3. This is frequently done at the last repeater in the span (closest to the customer premise) however for long spans power looping may occur before the end of the span.

2.07 When the extender is used in the LOOPED position, it will return power from the SIDE 1 IN T/R pair, thru the repeater powering circuit (inside the repeater), to the SIDE 2 OUT T/R pair. See Figures 2.1 and 2.2. This will

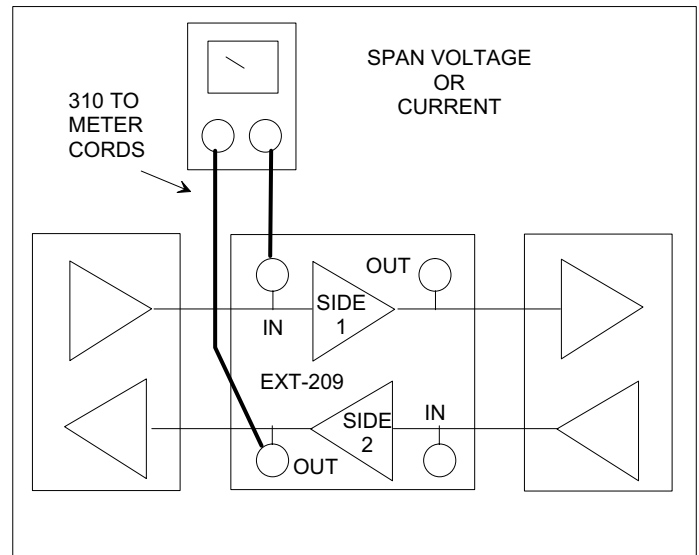
power all of the span between the current point and the central office and is useful for checking the power loop as well as the signal path. The rest of the span will be unpowered at this time.

## NOTE:

The repeater powering option must be set to the THRU position before setting the EXT-209 to the LOOPED position. Be sure to return the repeater option to its original position before replacing the repeater.



METER CONNECTION FOR REPEATER  
VOLTAGE OR SPAN CURRENT  
FIGURE 2.4



METER CONNECTION FOR SPAN  
VOLTAGE OR CURRENT  
FIGURE 2.5

## BASIC LOOP MEASUREMENTS

2.06 To measure the voltage drop across a repeater's powering circuit, connect a voltmeter between SIDE 1 IN and SIDE 1 OUT as shown in Figure 2.4. Use 310 to alligator cords or 310 to voltmeter cords (TAG PN 400310V). When using alligators, measure the voltage between the TIP lead in each cord. The voltage will range from 7-12 for working repeaters. Consult your repeater specification for actual test limits.

### NOTE:

The above discussion assumes that the repeater powering circuit is in the THRU position.

### WARNING:

On a live span, HIGH VOLTAGE will be present on the extender jacks. Always plug test cords into the test set before plugging them into the extender.

2.07 To measure the span current, connect an ammeter between SIDE 1 IN and SIDE 2 OUT as shown in Figure 2.5. This will measure the current available at the CO side of the span. This measurement should remain the same with the repeater installed or removed. To measure the current passing through the repeater, connect

the ammeter between SIDE 1 IN and SIDE 2 OUT as shown in Figure 2.4.

### NOTE:

The above discussion assumes that the repeater powering circuit is in the THRU position.

## RESISTANCE

2.08 To measure the resistance of the T/R pairs between this location and the previous one, first remove the repeater from the extender. This will remove the low resistance between TIP and RING caused by the repeater transformer and will stop T1 transmission by removing loop current. The loop resistance can now be measured by connecting the ohmmeter across the TIP and RING leads of SIDE 1 IN. Use an alligator to 310 cord to connect the ohmmeter. The other T/R pairs can be measured the same way by plugging into the other jacks on the extender (SIDE 2 OUT, SIDE 1 OUT, or SIDE 2 IN).

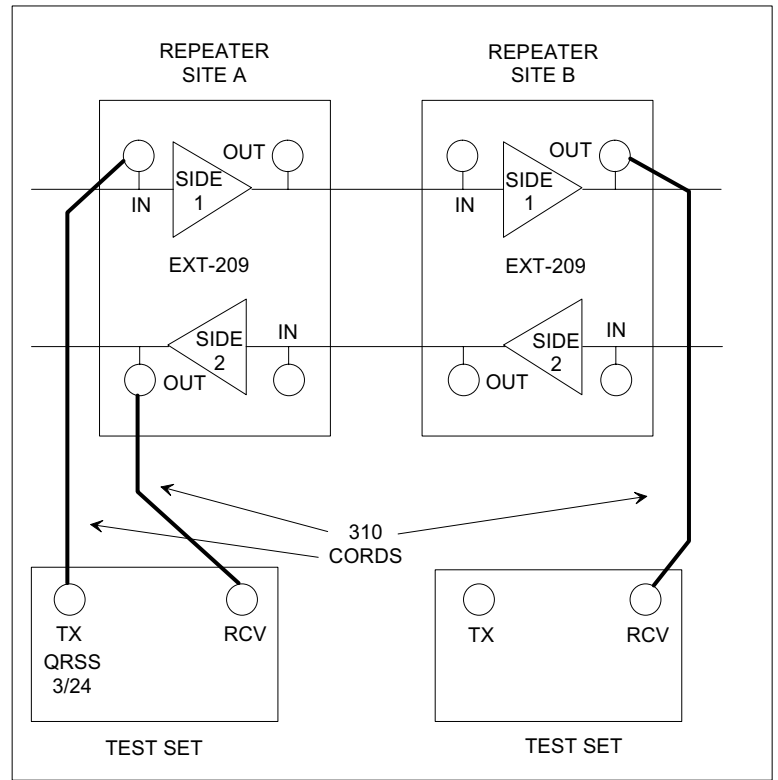
### WARNING:

On a live span, HIGH VOLTAGE will be present on the extender jacks. Always plug test cords into the test set before plugging them into the extender.

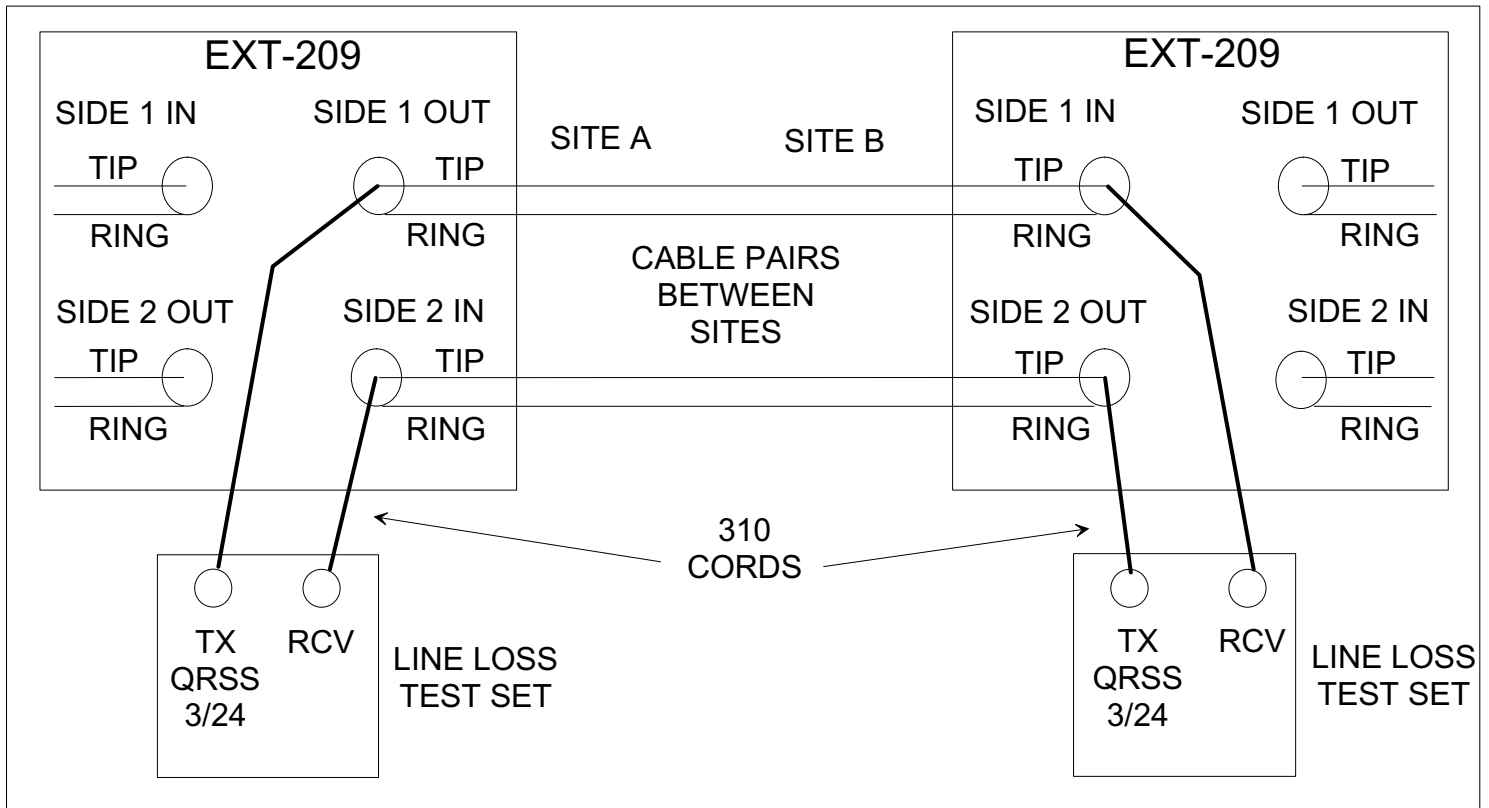
LOSS and BERT MEASUREMENTS

2.09 Typically, a T1 set pattern (QRSS or 3in24) is sent from one repeater site to the next as shown in Figure 2.6. At the receiving site, signal loss and bit error rate (BERT) measurements are made using industry standard test sets and practices. The EXT-209 provides convenient access to T1 circuits from the front of the repeater housing using 310 cords instead of custom test probes or shoes.

2.10 The extender permits T1 testing with the repeater in the circuit. This allows measurement of the repeater inputs and outputs in actual operation. For error measurements, the transmitted signal can be injected into the SIDE 1 IN or SIDE 2 IN jack with the repeater installed. Errors should be monitored at the output side of the repeater at the receiving site. For cable loss measurements, the repeater should be removed at both the transmitting and receiving ends so that the repeater terminations do not disturb the measurement. See Figure 2.2 and 2.7.



TYPICAL BERT SETUP  
FIGURE 2.6



TYPICAL CABLE LOSS MEASUREMENT SETUP  
FIGURE 2.7

### 3. WARRANTY/REPAIR

3.01 Telecom Assistance Group warrants the EXT-209 to be free of defects and to be fully functional for a period of one (1) year from date of original shipment. During this period, T.A.G. will repair or replace without cost, at its discretion, any unit found to be defective for any reason other than abuse or modification during this period.

3.02 Units in warranty must be returned to T.A.G.'s facility with shipping prepaid. Contact T.A.G.'s repair department for a Return Authorization (RA) number before sending your unit. Please attach a detailed description of the problem or service request and the name and telephone number of a contact person. The unit should be carefully packed, T.A.G. is not liable for any damages incurred in shipping.

3.03 Telecom Assistance Group will continue to repair or replace faulty units beyond the warranty period at a nominal charge. Contact your T.A.G. representative for details and pricing.

3.04 This Warranty will be terminated (void) if the EXT-209 has been altered or repaired without specific authorization from T.A.G.

3.05 Telecom Assistance Group is not liable for any consequential damages resulting from the use of its products.

### 4. SPECIFICATIONS

#### 4.01 General Specification

Operating Temperature:  
0 C to +45 C

Dimensions:  
2.2"H x 2.3"W x 12.2"L

Weight:  
1.3 lbs.

#### 4.02 Test Connections

Inputs:  
310 Jack bridging access to side 1 and side 2.

Outputs:  
310 Jack bridging access to side 1 and side 2.

Repeater to Span connection:  
Direct metallic connection.

Controls:  
Loop/Thru switch. Switches T-1 span from normal through connection to loopback connection.

Repeater Types:  
WECO 238/239 or equivalent.

EXT-209T

ADDENDUM 1

T1 REPEATER EXTENDER  
WITH TRANSMIT FEATURE and CURRENT TEST POINTS

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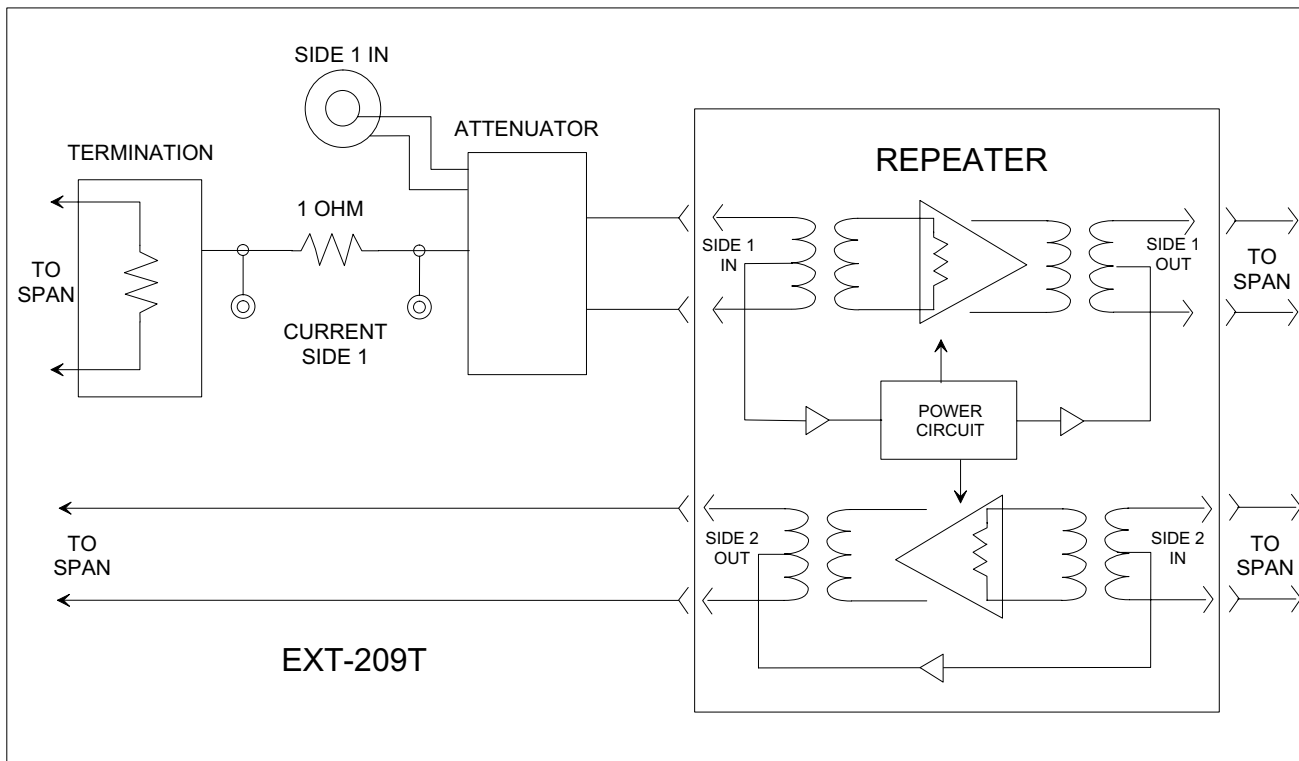
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1. GENERAL

1.01 The EXT-209T has the same features and specifications as the EXT-209 except as described in this addendum. The EXT-209T adds two new features to the extender: (1) the ability to inject a test signal on SIDE 1 or SIDE 2 of the span and (2) voltmeter connection points for span current measurement.

1.02 The EXT-209T provides the following new features:

- \* Transmit selector for SIDE 1 or SIDE 2 input terminates span and allows direct connection to a T1 test generator.
- \* Current monitor points.



EXT-209T  
WITH TRANSMIT SWITCH SET TO SIDE 1



EXT-209T

ADDENDUM 1

2. APPLICATIONS

TRANSMIT

2.01 When the transmit switch is in the THRU position the extender operates the same as the EXT-209. When the switch is in the TX SIDE 1 or TX SIDE 2 position, the EXT-209T will disconnect and terminate the selected input while maintaining the power loop. A.D.C. isolated attenuator (appro. 18 db) is connected between the selected input 310 jack and the repeater input. All other connections on the repeater are unaffected.

2.02 With the switch in a transmit position, standard test patterns can be sent through the repeater to a monitoring set. This feature allows mid-span injection of LOOP UP/DOWN codes as well as stress testing patterns.

CURRENT MEASUREMENT

2.03 The EXT-209T has current measurement jacks for side1 and side 2. These are connected to a 1 ohm resistor so that current measurements can be made with a digital voltmeter. 60 ma would read 60 milli-volts. The current jacks are only in the circuit when the transmit switch is not in the THRU position.

T1 REPEATER EXTENDER  
APPLICATION NOTE  
CURRENT AND SIGNAL PATH SELECTION

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- 2. SWITCH SETTINGS page 1

1. GENERAL

1.01 The EXT-209 and EXT-209T can pass the T1 signal and simplex current through to its normal destination or loop it back to office where it originated. For some applications it may be required to loop only the T1 signal while passing the simplex current through to the next repeater point. By using the LOOPED/THRU switch on the EXT-209/T in combination with the current looping switch on the repeater, all four combinations of signal path and simplex current path can be achieved.

2. SWITCH SETTINGS

2.01 The extender and repeater switch settings for all four combinations of current and signal path are indicated in Table 1. The associated circuit diagrams are shown in Figure 1.

TEST CONDITION		SWITCH SETTINGS		FIGURE
T1 SIGNAL	SIMPLEX CURRENT	EXT-209 EXT-209T	REPEATER	
THRU	THRU	THRU	THRU	1-A
LOOP	LOOP	LOOP	THRU	1-B
THRU	LOOP	THRU	LOOP	1-C
LOOP	THRU	LOOP	LOOP	1-D

TABLE 1

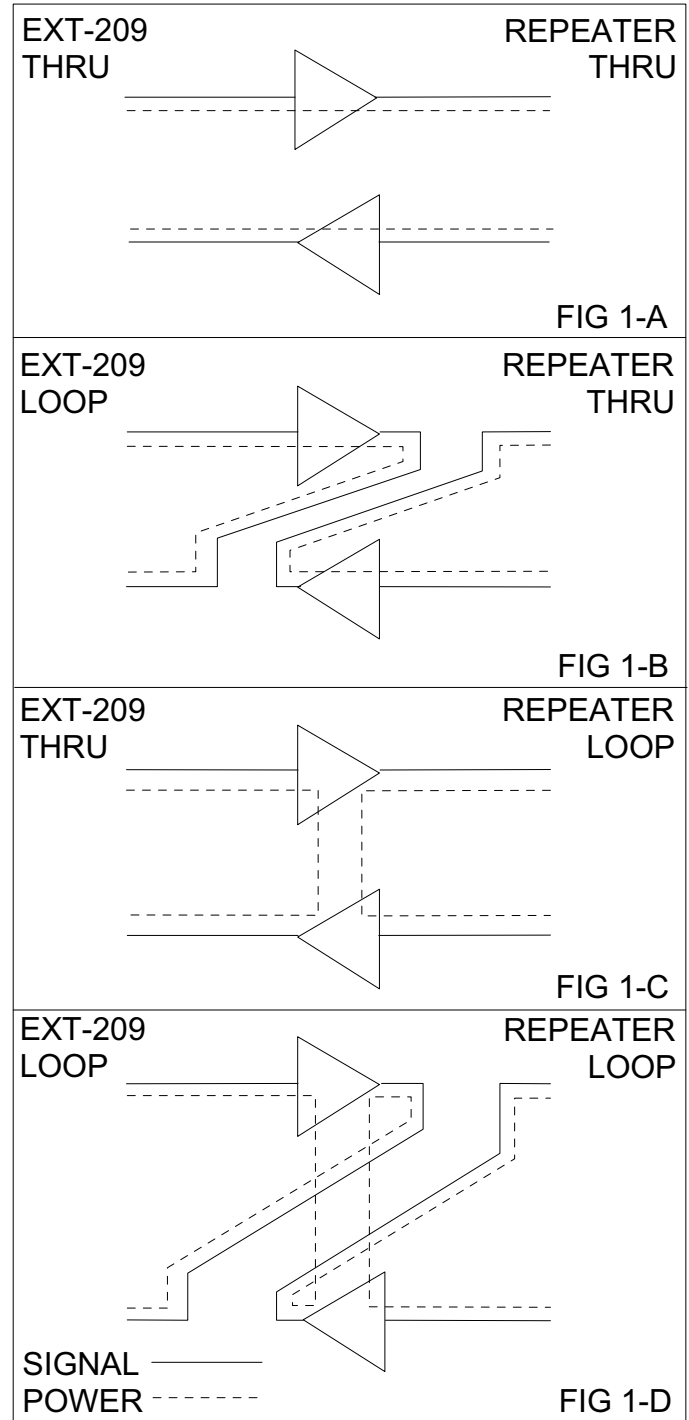


FIGURE 1