

J99343GA LISTS 1, 2, AND 3
LOOP-START ONLY/2-WIRE TRANSMISSION UNIT
DESCRIPTION
METALLIC FACILITY TERMINAL

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1. GENERAL

1.01 This section provides a physical description and discusses the basic functions of the loop-start only/2-wire transmission combined function unit (CFU). The individual CFUs are described in detail. Performance, typical applications, and maintenance philosophy are also discussed.

1.02 This section is reissued to provide information on the J99343GA, List 3 CFU which replaces the J99343GA, List 2 CFU. Since this is an extensive revision, change arrows have been omitted.

1.03 This equipment generates and uses radio frequency energy. It has been type tested and found to comply with the limits for a class B computing device in accordance with the specifications in Subpart J of Part 15 of Federal Communications Commission (FCC) rules, which are designed to provide reasonable protection against radio frequency interference in commercial and residential installations. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, the user may find the booklet "How to Identify and Resolve Radio-TV Interference Problems" prepared by the FCC, helpful. This booklet is available from the U.S. Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4.

1.04 The Metallic Facility Terminal (MFT) is a standard equipment arrangement for providing various signaling and/or transmission functions that may be required by metallic facilities. The loop-start only/2-wire transmission CFUs are MFT plug-in units that consist of a component board held by either a die-cast aluminum or molded polycarbonate frame. The MFT unit measures 1-11/16 inches wide, 7-7/8 inches high, and 9 inches deep.

1.05 These units are CFUs which combine the functions of a signaling unit and a transmission unit on a single plug-in. The CFUs can be used in either a single- or double-module mounting arrangement. They can be mounted in any slot of a single-module shelf. When the CFU is used in the double-module mounting arrangement, it is mounted in the

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transmission slot. The companion signaling unit slot must be vacant. Section 332-910-101 contains additional information on MFT mounting arrangements.

Note: On early versions of some MFT double-module frames, ringing and talk battery may not be available in the transmission slot. Strap wires may need to be added from the signaling slot. Ringing should be connected from pin J2-7 (SU) to J1-30 (TU), and talk battery from pin J2-20 (SU) to pin J1-20 (TU).

1.06 The loop signaling repeater loop-start only/2-wire transmission units (LSO/2W) are J99343GA, L1, L2, and L3. These CFUs provide the functions of the loop signaling repeater (loop-start only) (J99343AD) and the 2-wire transmission unit (J99343BC). These CFUs provide regeneration of

loop-start signals including distinctive ringing and 2-wire transmission coupling.

1.07 The J99343GA, L1, L2, and L3 are functionally similar. However, the switch format and physical layout of the L1, L2, and L3 differ and the units are therefore described individually. Section 332-912-252 provides installation and testing information for these units.

2. FUNCTIONAL DESCRIPTION—J99343GA,L1

A. Operation

Transmission

2.01 The J99343GA,L1 is shown in Fig. 1. This unit provides between 2-wire circuits transmission coupling. Figure 2 is a block diagram of this unit.

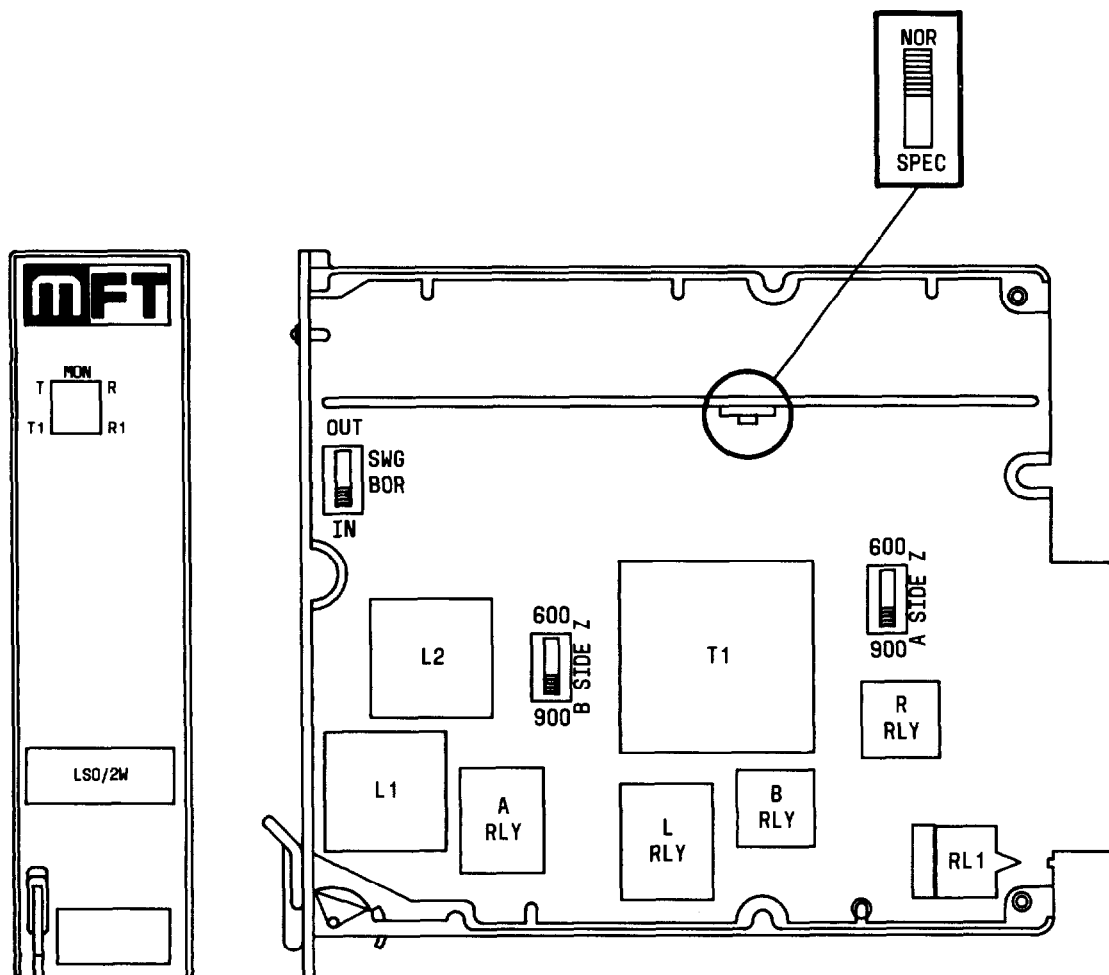


Fig. 1—Look-Start Only/2-Wire Transmission Unit J99343GA,L1

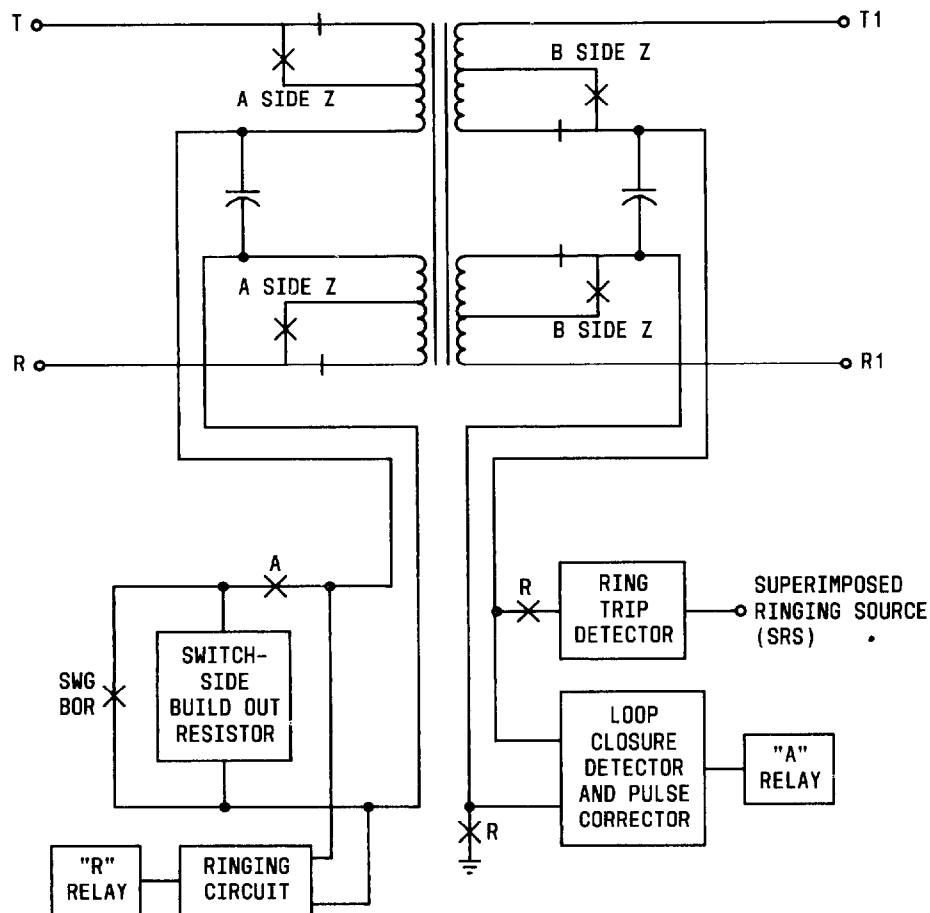


Fig. 2—Block Diagram of J99343GA, L1

2.02 The transmission section of the J99343GA,L1 consists of a 2-wire coupling transformer for passing signals between the A-side and B-side of the unit. The transformer is tapped on both sides for 600- or 900-ohm operation and any impedance arrangement may be used (600:600, 600:900, 900:600, or 900:900). Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

2.03 The signaling leads (A and B) are derived through the transformer windings and mid-point capacitor on each side of the unit. The SX inductors isolate the transmission path from the signaling circuit.

Signaling

2.04 The signaling section of this unit provides regeneration of loop-start signals. This includes loop-closure signaling, dial pulse correction, ringing signaling (2 modes), and a ring trip function.

2.05 *Loop-Closure Detector and Pulse Correction:* The loop-closure detector detects switch-hook signals and dial pulses from the station-side equipment and transmits these signals to the pulse corrector. The pulse corrector transmits the corrected loop signals toward the A-side switching equipment. The loop-closure detector also provides current limiting on the station side talk battery.

2.06 *Ringing Circuitry:* The ringing circuitry detects ringing signals on the A-side of the unit and connects a local ringing source to the station-side (B-side) loop. The ringing circuitry operates in two modes, the normal mode and the special distinctive ringing mode. The selection of the modes is controlled by the NOR/SPEC switch.

2.07 *Ring-Trip Detector:* The ring-trip detector detects station off-hook signals during the ringing interval and causes a loop closure to be transmitted toward the switching equipment. The ring-trip signal also causes the local ringing to be removed

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from the station loop. During the silent interval, the station off-hook signals are detected by the loop-closure detector causing the ringing circuitry to be removed.

2.08 Switch-Side Build-out Resistor: A switch selectable build-out resistor (BOR) is provided in the switching-side circuitry to limit the loop current on short loops. The switch is designated SWG BOR (IN/OUT).

B. Unit Controls

2.09 The unit controls are illustrated in Fig. 1.

Transmission

2.10 A-SIDE Z and B-SIDE Z: Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

Signaling

2.11 NOR·SPEC: The ringing circuitry is controlled by the NOR·SPEC switch. In the NOR position, switching-side ringing 100 ms or greater in duration are regenerated on the station side. In this mode, "ring-ping" signals and all distinctive ringing

patterns will be reproduced. In the SPEC mode, ringing patterns less than 195 ms in duration are rejected (no local ringing output). A ringing signal greater than 195 ms produces a nominal 750 ms ringing output. The SPEC mode converts all distinctive ringing patterns into the 750 ms ringing output and rejects ring-ping signals. Therefore, the unit can be used with other equipment that cannot pass distinctive ringing patterns.

Note: Accurate reproduction of the distinctive ringing patterns in tandem arrangement cannot be guaranteed.

2.12 BOR Switch: To limit switching-side loop current, the BOR switch is placed in the IN position. In this position, 511 ohms is added to the internal unit resistance. In the OUT position, the resistance is removed and no current limiting is provided.

3. FUNCTIONAL DESCRIPTION—J99343GA,L2

A. Operation

Transmission

3.01 The J99343GA,L2 is shown in Fig. 3. This unit provides transmission coupling between 2-wire circuits. Figure 4 is a block diagram of this unit.

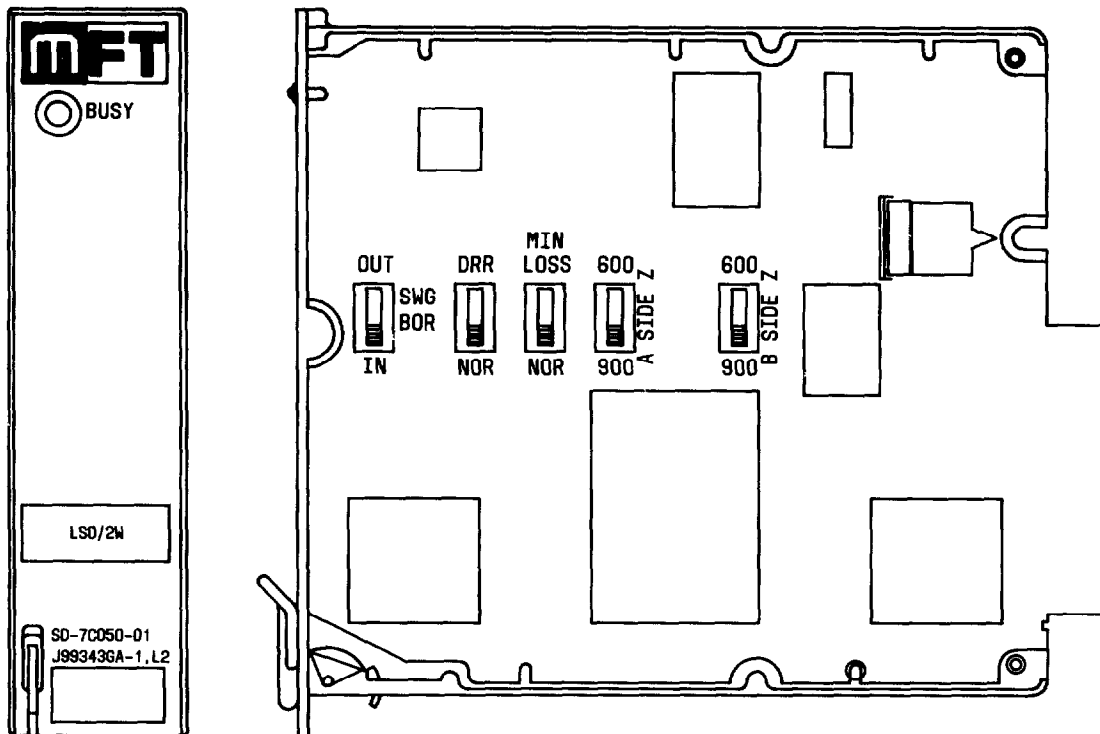


Fig. 3—Loop-Start Only/2-Wire Transmission Unit J99343GA,L2

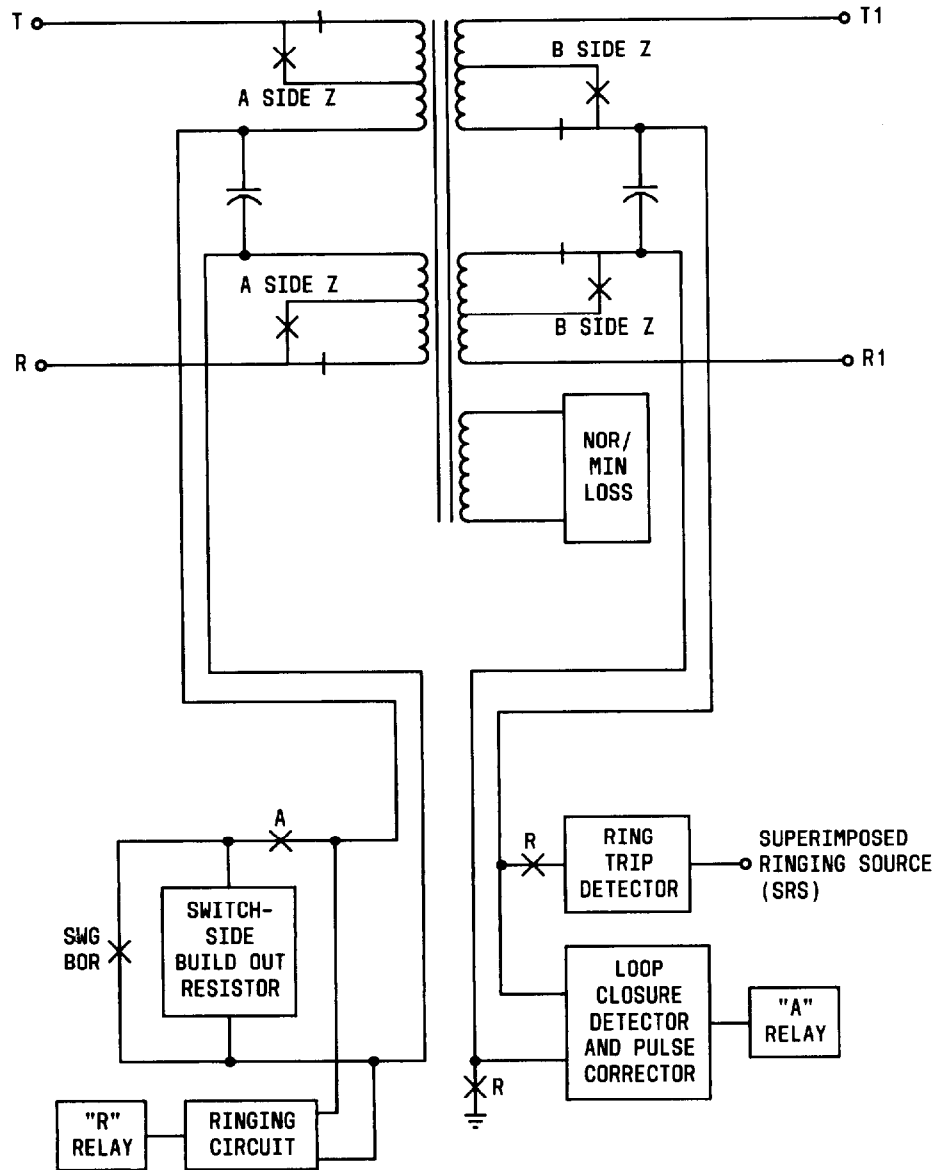


Fig. 4—Block Diagram of J99343GA, L2 and L3

3.02 The transmission section of the J99343GA, L2 consists of a 2-wire coupling transformer for passing signals between the A-side and the B-side of the unit. The transformer is tapped on both sides for 600- or 900-ohm operation and any impedance arrangement may be used (600:600, 600:900, 900:600, or 900:900). Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

3.03 The signaling leads (A and B) are derived through the transformer winding and mid-point capacitor on each side of the unit. The SX inductors isolate the transmission path from the signaling circuit.

3.04 Loss characteristics of the unit are changed by operating the NOR-MIN LOSS switch. The insertion loss and return loss characteristics are shown in Table A.

TABLE A

TRANSMISSION CHARACTERISTICS OF THE J99343GA, L1, L2, AND L3

NOMINAL INSERTION LOSS AT 1 KHZ					
A-SIDE Z	B-SIDE Z	L1		L2 AND L3 (NOR)	L2 AND L3 (MIN LOSS)
900	900	0.4 dB		0.8 dB	0.4 dB
600	600	0.6 dB		1.0 dB	0.6 dB
A-SIDE ERL (B-SIDE TERMINATED AS SHOWN)					
A-SIDE Z	B-SIDE Z	B-SIDE TERM	L1	L2 AND L3 (NOR)	L2 AND L3 (MIN LOSS)
900	900	900Ω + 2.15μF	24 dB	29 dB	24 dB
600	600	600Ω + 2.15μF	20 dB	24 dB	20 dB
600	600	900Ω + 2.15μF	24 dB	29 dB	24 dB
900	600	600Ω + 2.15μF	20 dB	24 dB	20 dB

Signaling

3.05 The signaling section of this unit provides regeneration of loop-start signals. These functions include loop-closure signaling, dial pulse correction, ringing signaling (2 modes), and a ring trip function.

3.06 Loop-closure Detector and Pulse Correction: The loop-closure detector detects switch-hook signals and dial pulses from the station-side equipment and transmits these signals to the pulse corrector. The pulse corrector transmits the corrected dial signals toward the A-side switching equipment. The loop-closure detector also provides current limiting.

3.07 Ringing Circuitry: The ringing circuitry detects ringing signals on the A-side of the unit and connects a local ringing source to the station-side (B-side) loop. The ringing circuitry operates in two modes, the normal mode and the distinctive ringing reject mode. The selection of the modes is controlled by the NOR·DRR switch.

3.08 Ring-Trip Detector: The ring-trip detector detects station off-hook signals during the ringing interval and causes a loop closure to be transmitted toward the switching equipment. The ring-trip signal also causes the local ringing to be removed from the station loop. During the silent interval, the station off-hook signals are detected by the loop-closure detector causing the ringing circuitry to be tripped.

3.09 Switch-Side Build-out Resistor: A selectable build-out resistor (BOR) is provided in the switching-side circuitry to limit the loop current on short loops. The selectable switch is designated SWG BOR (IN/OUT).

B. Unit Controls

3.10 The unit controls are illustrated in Fig. 3.

Transmission

3.11 A-SIDE Z and B-SIDE Z: Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

3.12 NOR·MIN LOSS: A switch designated NOR·MIN LOSS is provided to change the loss characteristics of the unit. When the switch is in the NOR position, the return loss of the unit is optimized with a small increase in insertion loss. When in the MIN LOSS position, the insertion loss is minimized with a reduction in return loss (see Table A).

Signaling

3.13 NOR·DRR: The ringing circuitry is controlled by the NOR·DRR switch. In the NOR position, "ring-ping" signals and all distinctive ringing patterns will be reproduced. In the DRR mode, ringing patterns less than 140 ms in duration are rejected (no local ringing output). A ringing signal greater than the 140 ms produces a 2-second ringing

output. The DRR mode converts all distinctive ringing patterns into the 2-second ringing output and rejects ring-ping signals. Therefore, the unit can be used with other equipment that cannot pass distinctive ringing patterns.

Note: Accurate reproduction of the distinctive ringing patterns in tandem arrangement cannot be guaranteed.

3.14 BOR Switch: To limit switching-side loop current, the BOR switch is placed in the IN position. In this position, 511 ohms is added to the internal unit resistance. In the OUT position the resistance is removed and no current limiting is provided.

4. FUNCTIONAL DESCRIPTION—J99343GA,L3

A. Operation

Transmission

4.01 The J99343GA,L3 is shown in Fig. 5. This unit provides transmission coupling between 2-wire circuits. Figure 4 is a block diagram of this unit.

4.02 The transmission section of the J99343GA,L3 consists of a 2-wire coupling transformer for passing signals between the A-side and the B-side of the unit. The transformer is tapped on both sides for 600- or 900-ohms operation and any impedance arrangement may be used (600:600, 600:900, 900:600, or 900:900). Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

4.03 The signaling leads (A and B) are derived through the transformer winding and mid-point capacitor on each side of the unit. The SX inductors isolate the transmission path from the signaling circuit.

4.04 Loss characteristics of the unit are changed by operating the NOR-MIN LOSS switch. The insertion loss and return loss characteristics are shown in Table A.

Signaling

4.05 The signaling section of this unit provides regeneration of loop-start signals. These functions include loop-closure signaling, dial pulse correction, ringing signaling (2 modes), and a ring trip function.

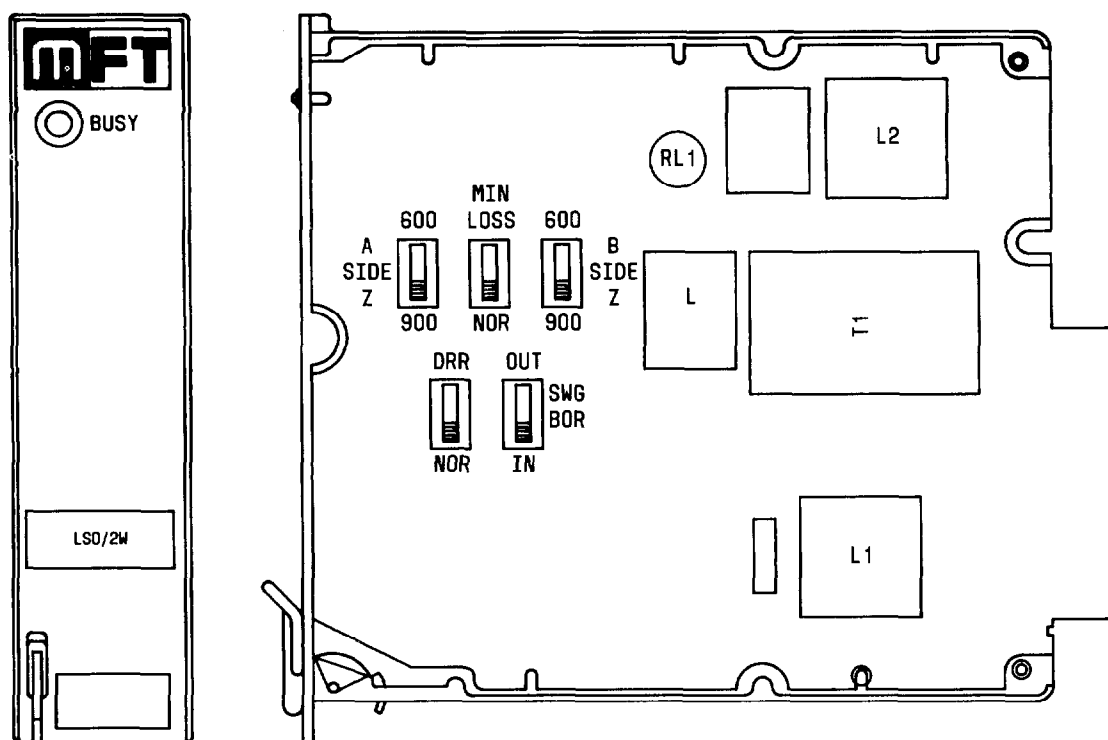


Fig. 5—Loop-Start Only/2-Wire Transmission Unit J99343GA, L3

4.06 Loop-Closure Detector and Pulse Correction: The loop-closure detector detects switch-hook signals and dial pulses from the station-side equipment and transmits these signals to the pulse corrector. The pulse corrector transmits the corrected dial signals toward the A-side switching equipment. The loop-closure detector also provides current limiting.

4.07 Ringing Circuitry: The ringing circuitry detects ringing signals on the A-side of the unit and connects a local ringing source to the station-side (B-side) loop. The ringing circuitry operates in two modes, the normal mode and the distinctive ringing reject mode. The selection of the modes is controlled by the NOR·DRR switch.

4.08 Ring-Trip Detector: The ring-trip detector detects station off-hook signals during the ringing interval and causes a loop closure to be transmitted toward the switching equipment. The ring-trip signal also causes the local ringing to be removed from the station loop. During the silent interval, the station off-hook signals are detected by the loop-closure detector causing the ringing circuitry to be tripped.

4.09 Switch-Side Build-Out Resistor: A selectable build-out resistor (BOR) is provided in the switching-side circuitry to limit the loop current on short loops. The selectable switch is designated SWG BOR (IN/OUT).

B. Unit Controls

4.10 The unit controls are illustrated in Fig. 5.

Transmission

4.11 A-SIDE Z and B-SIDE Z: Impedance selections are made by slide switches on the component board designated A-SIDE Z and B-SIDE Z.

4.12 NOR·MIN LOSS: A switch designated NOR·MIN LOSS is provided to change the loss characteristics of the unit. When the switch is in the NOR position, the return loss of the unit is optimized

with a small increase in insertion loss. When in the MIN LOSS position, the insertion loss is minimized with a reduction in return loss (see Table A).

Signaling

4.13 NOR·DRR: The ringing circuitry is controlled by the NOR·DRR switch. In the NOR position, "ring-ping" signals and all distinctive ringing patterns will be reproduced. In the DRR mode, ringing pattern less than 140 ms in duration are rejected (no local ringing output). A ringing signal greater than the 140 ms produces a 2-second ringing output. The DRR mode converts all distinctive ringing patterns into the 2-second ringing output and rejects ring-ping signals. Therefore, the unit can be used with other equipment that cannot pass distinctive ringing patterns.

Note: Accurate reproduction of the distinctive ringing patterns in tandem arrangements cannot be guaranteed.

4.14 BOR Switch: To limit switching-side loop current, the BOR switch is placed in the IN position. In this position, 511 ohms is added to the internal unit resistance. In the OUT position, the resistance is removed and no current limiting is provided.

5. PERFORMANCE CHARACTERISTICS

5.01 The performance characteristics of the J99343GA, L1, L2, and L3 CFUs are presented in the following tables. Table A gives a comparison of the transmission characteristics for each version of this unit. Table B provides ringing signaling ranges for the J99343GA, L1 and L2 units. Table C provides ringing ranges for the J99343GA, L3 unit. Table D gives the maximum ranges for supervision and dial pulsing for the J99343GA, L1 and L2 units. Table E gives the maximum ranges for supervision and dial pulsing for the J99343GA, L3.

TABLE B

LSO/2-WIRE (J99343GA, L1, AND L2) MAXIMUM RINGING AND SIGNALING RANGES

RINGING RANGE TO STATION WITH C4A RINGERS AND 0.5 μ F SERIES CAPACITOR (NOTES)		
NUMBER OF C4A RINGERS	STIFF NOTCH BIAS SPRING SETTING (50V RMS AT RINGER)	WEAK NOTCH BIAS SPRING SETTING (43V RMS AT RINGER)
1	5220 Ohms Max	6540 Ohms Max
2	2880 Ohms Max	4050 Ohms Max
3	1820 Ohms Max	2650 Ohms Max

Note 1: Regenerated ringing ranges given in these tables assume a ringing supply of 84-86 volts rms 20 Hz and a series 13L resistance lamp. Ringing trip range and ringing detection range both exceed 3650 ohms and are not considered as limiting factors in circuit design.

Note 2: The 50 volts ac rms is the average voltage required to operate a C4A ringer with bias spring set in the stiff notch. The 40 volts ac rms is the minimum voltage required to operate a C4A ringer with the bias spring set in the weak notch. To ensure adequate operating margin in most circuit designs, the maximum ranges listed for 50-volt operation are recommended as design limits. When operating at the extremes of these ranges, ringers may have to be selected or set in the weak bias spring notch to obtain satisfactory operation.

TABLE C

**REGENERATED RINGING RANGE FOR J99343GA, L3
(NOTE 1)**

	RINGING LOAD			
	1 PBX RINGING DETECTOR (NOTE 2)	THREE C4A RINGERS (NOTE 3)	FOUR C4A RINGERS (NOTE 3)	FIVE C4A RINGERS (NOTE 3)
Max. Resistance	3600 Ohms	2600 Ohms	1600 Ohms	1200 Ohms
Between LSR and Ringing Load	Max.	Max.	Max.	Max.

Note 1: Regenerated ringing ranges assume a 20 Hz ringing source of 84 to 88 volts RMS and a series 13L resistance lamp.

Note 2: Ringing ranges to a PBX are based on typical PBX relay detectors such as the circuits used in SD-SE016 and SD-1E340.

Note 3: Ringing ranges to station sets with C4A ringers assume a series 0.5 UF capacitor and a weak notch setting.

TABLE D

**LSO/2-WIRE (J99343GA, L1 AND L2) MAXIMUM RANGE FOR SUPERVISION AND DIAL PULSING
(MAXIMUM CONDUCTOR LOOP RESISTANCE IN OHMS)**

TALK BATTERY	RANGE BASED ON LOW/NOMINAL BATTERY VOLTAGE	RANGE BETWEEN PBX AND LSO/2-WIRE*	RANGE BETWEEN TWO LSO/2-WIRES BASED ON 16 mA LOOP CURRENT†	RANGE BETWEEN LSO/2-WIRE AND STATION BASED ON 23 mA LOOP CURRENT	RANGE BETWEEN LSO/2-WIRE AND STATION BASED ON 36 mA LOOP CURRENT
-24V (-22.5V to -26V)	Low	The lesser of: 1. PBX limit minus 155 ohms 2. 1250 ohms minus PBX batt. feed res.			
	Nominal	The lesser of: 1. PBX limit minus 155 ohms 2. 1470 ohms minus PBX batt. feed res.			
-48V -42.5V to -52V)	Low	The lesser of: 1. PBX limit minus 155 ohms 2. 2500 ohms minus PBX batt. feed res.	2115 ohms maximum	1430 ohms minus station res.	520 ohms minus station res.
	Nominal	The lesser of: 1. PBX limit minus 155 ohms 2. 2845 ohms minus PBX batt. feed res.	2460 ohms maximum	1670 ohms minus station res.	670 ohms minus station res.
-72V (-67.5V to -78V)	Low	The lesser of: 1. PBX limit minus 155 ohms 2. 4064 ohms minus PBX batt. feed res.	3675 ohms maximum	2520 ohms minus station res.	1215 ohms minus station res.
	Nominal	The lesser of: 1. PBX limit minus 155 ohms 2. 4345 ohms minus PBX batt. feed res.	3960 ohms maximum	2715 ohms minus station res.	1340 ohms minus station res.

* The PBX limit referred to in this table is the maximum external circuit resistance limit specified for the PBX.

† On lines required to pass distinctive ringing patterns, tandem arrangements of distinctive ringing type units are not recommended. Accurate reproduction of the distinctive ringing patterns in tandem arrangements cannot be guaranteed.

TABLE E

MAXIMUM RANGE FOR SUPERVISION AND DIAL PUSLING FOR J99343 GA, L3 (SEE NOTE 1)

TALK BATTERY	LSR RANGE (23 mA.) (SEE NOTE 2)	TANDEM LSR RANGE (16 mA.) (SEE NOTE 2)
-42.5	1300	2100
-48	1500	2500
-52	1700	2700
-67.5	2300	3700
-72	2600	4000
-78	2800	4800

Note 1: For loop-start circuits, the station side signaling range is limited by either the loop supervision and dial pulse range or by the regenerated ringing range.

Note 2: The supervision and the dial pulse range includes the resistance of the station set or the internal resistance of a tandem repeater.

6. APPLICATION

6.01 The LSO/2-wire CFUs, J99343GA, L1, L2, and L3 are primarily intended for use as channel terminating equipment. The units can also be used on any 2-wire special access line or trunk requiring passive transmission and loop-start signaling extension. A typical application is shown in Fig. 6.

6.02 The J99343GA, L1, L2, and L3 can be used with either -48 volts or -72 volt talk battery power supplies.

Note: Some older MFT frames require the addition of certain options to make them compatible with the J99343GA units. See Section 332-910-101 for a description of these frames and options.

7. MAINTENANCE

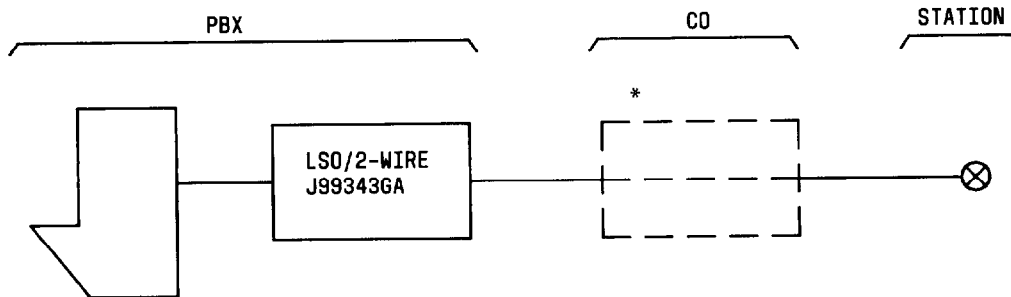
7.01 Maintenance for the J99343GA, L1, L2, and L3 units, as for all MFT plug-in units, is by substitution. The J99343GA, L1, L2, and L3 units which are found defective should be replaced with a unit from stock. The defective unit should be returned to the Western Electric Service Center for repair.

8. REFERENCES

SECTION	TITLE
332-910-100	(J99343) MFT Description
332-910-101	MFT—Shelf, Frame, Power Panel, and Distributing Frame Arrangements
332-910-180	MFT—General Applications
801-406-160	MFT Equipment Design Requirements
851-300-130	Switched Special Service Circuit—Applications of MFT Circuits

DRAWING

CD/SD 7C050	Metallic Facility Terminal
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* 2-2 REPEATER IF VF GAIN IS REQUIRED

Fig. 6—Typical Off-Premises Station Application of the LSO/2-Wire