



Wescom 7306-00 DX1/DX2 4-4 Terminal Repeater And 7306-01 DX1/DX2 4-4 Terminal Repeater With Loopback

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1. GENERAL

1.01 The Wescom® 7306-00 DX1/DX2 4-4 Terminal Repeater And 7306-01 DX1/DX2 4-4 Terminal Repeater With Loopback are 400-type plug-in Combined Function Modules (CFMs) that combine the functions of a 4-wire terminal repeater and a DX to E&M signaling unit. The 7306-01 which also provides tone activated loopback is shown in Figure 1. (Excerpts from this Practice, covering installation and testing only, are available in Sections 730-600-302 and 730-601-302.)

1.02 This Practice has been reprinted to incorporate a general editorial update.

1.03 The 7306-00 and 7306-01 provide the following features:

- Transmission**
- Switch-selectable SIDE B terminating impedance of 150, 600, or 1200 ohms
 - Fixed SIDE A terminating impedance of 600 ohms

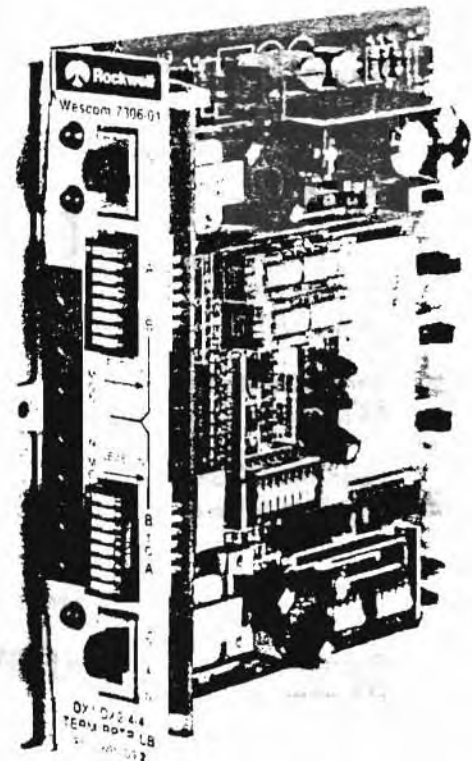


Figure 1. 7306-01 DX1/DX2 4-4 Terminal Repeater With Loopback

- Front-panel-mounted prescription adjustable gain or attenuation in both transmission paths
- WESTERN ELECTRIC type 309B prescription adjustable post (receive) equalizer in the B to A amplifier
- Equalizer bypass option for flat frequency response applications
- SMAS access for central office use
- B to A (receive) IN, MON (monitor), and OUT bantam test jacks

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- A to B (transmit) IN, OUT, and MON, bantam test jacks
- Surge protection on SIDE B

Signaling

- Switch-selectable DX1 or DX2 operation
- Switch-selectable Type I, Type II, or Type III E&M interface
- Simplex NOR/SXRV switch
- E&M bantam test jack
- M-lead current limiting
- DX resistive line balance adjustable via DIP switches; fixed midpoint and balance capacitors
- Red LEDs that indicate the status of the E&M leads

Loopback (7306-01 only)

- 2713Hz tone-activated loopback
- Equal level loopback gain of up to ± 24 dB in 0.1dB increments
- Signaling loopback of the E&M leads and DX circuitry

- PBX busied during loopback
- Manual Loopback (MLB) switch
- Tone Loopback Disable (DTD) switch
- Four-minute loopback timeout switch
- Front-panel-mounted red LED that indicates the loopback status
- Full 5 year warranty

2. APPLICATION GUIDELINES

2.01 The 7306-00/01 can be applied as Network Channel Terminating Equipment (NCTE) on special service circuits described by the following FCC Facility Codes: TL31M, TL31E, TC31M, TC31E, TL32M, TL32E, TC32M, and TC32E.

2.02 The 7306-00/01 are typically used in station applications; the 7306-00 may also be used in central office applications. Figure 2 illustrates a typical application using a 7306-00/01 module to interface a 4-wire PBX trunk to a 4-wire E&M channel unit via cable facilities.

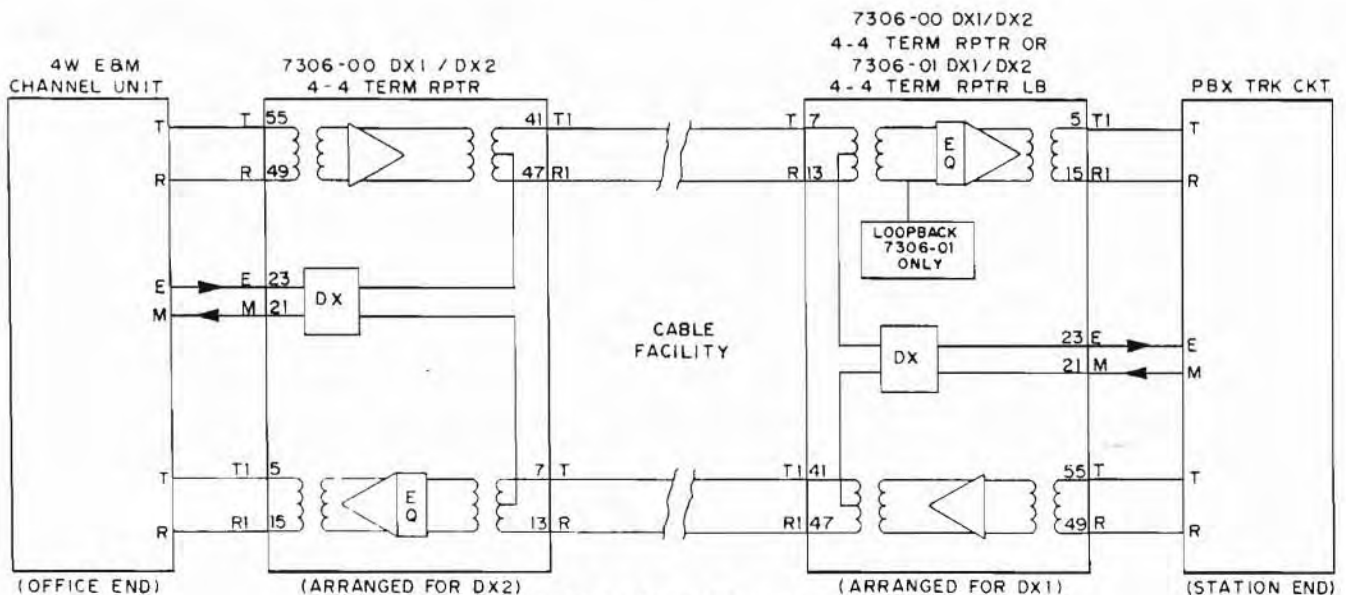


Figure 2. 7306-00/01 Typical Application

3. CIRCUIT DESCRIPTION

3.01 Refer to Figure 3, the 7306-00 DX1/DX2 4-4 Terminal Repeater (Issue 2) Block Diagram or to Figure 4, the 7306-01 DX1/DX2 4-4 Terminal Repeater With Loopback (Issue 2) Block Diagram, while reading the following circuit description. Also refer to Figures 5, 6, and 7, 7306-00/01 DX1/DX2 Connecting Circuits With Type I, Type II, And Type III E&M Signaling.

Transmission Receive Voice Path

3.02 VF transmission from the 4W facility appears at the RCV SIDE B Tip and Ring (T and R) pins 7 and 13 of the 7306-00/01. If the module is optioned for SMAS access, switch S17 in the SMAS position, the transmission is routed to the SMAS equipment via pins 8 and 14 (TO SMAS) and returned to the module via pins 2 and 4 (FROM SMAS). If the module is not optioned for SMAS access, switch S17 in the NORM position, the SMAS access pins are bypassed. The signal is then routed through the IN and MON jacks to the impedance matching transformer (T1). This transformer provides a switch (S1-A) selectable impedance of 150, 600, or 1200 ohms for the RCV SIDE B input port. The VF signals are then passed to the FRONT-PANEL-MOUNTED B TO A GAIN/ATTENUATION CIRCUIT which provides prescription settable gain or attenuation of up to 24dB in 0.1dB increments. The prescription B TO A EQUALIZER provides height (HT) and bandwidth (BW) (switch S2), and SLOPE (switch S3) equalization for non-loaded and/or H88 loaded cable. The B TO A DRIVER provides the required output power for transformer T3 at a fixed 600 ohm impedance. The signal is then routed through the OUT jack to the RCV SIDE A T1 and R1 pins 5 and 15.

Transmit Voice Path

3.03 VF transmission from the 4W equipment appears at the XMT SIDE A T and R pins 55 and 49 of the 7306-00/01 and is routed through the A to B IN jack to the impedance matching transformer (T4). This transformer provides a fixed 600 ohm impedance for the XMT SIDE A input port. The signal is then passed to the FRONT-PANEL-MOUNTED A TO B GAIN/ATTENUATION CIRCUIT which provides

prescription settable gain or attenuation of up to 24dB in 0.1dB increments. The A TO B OUTPUT DRIVER supplies the required power to the impedance matching transformer (T2). This transformer provides a switch (S1-B) selectable impedance of 150, 600, or 1200 ohms for the XMT SIDE B output port. The signal is then routed through the A to B OUT and MON jacks to the XMT SIDE B T1 and R1 pins 41 and 47.

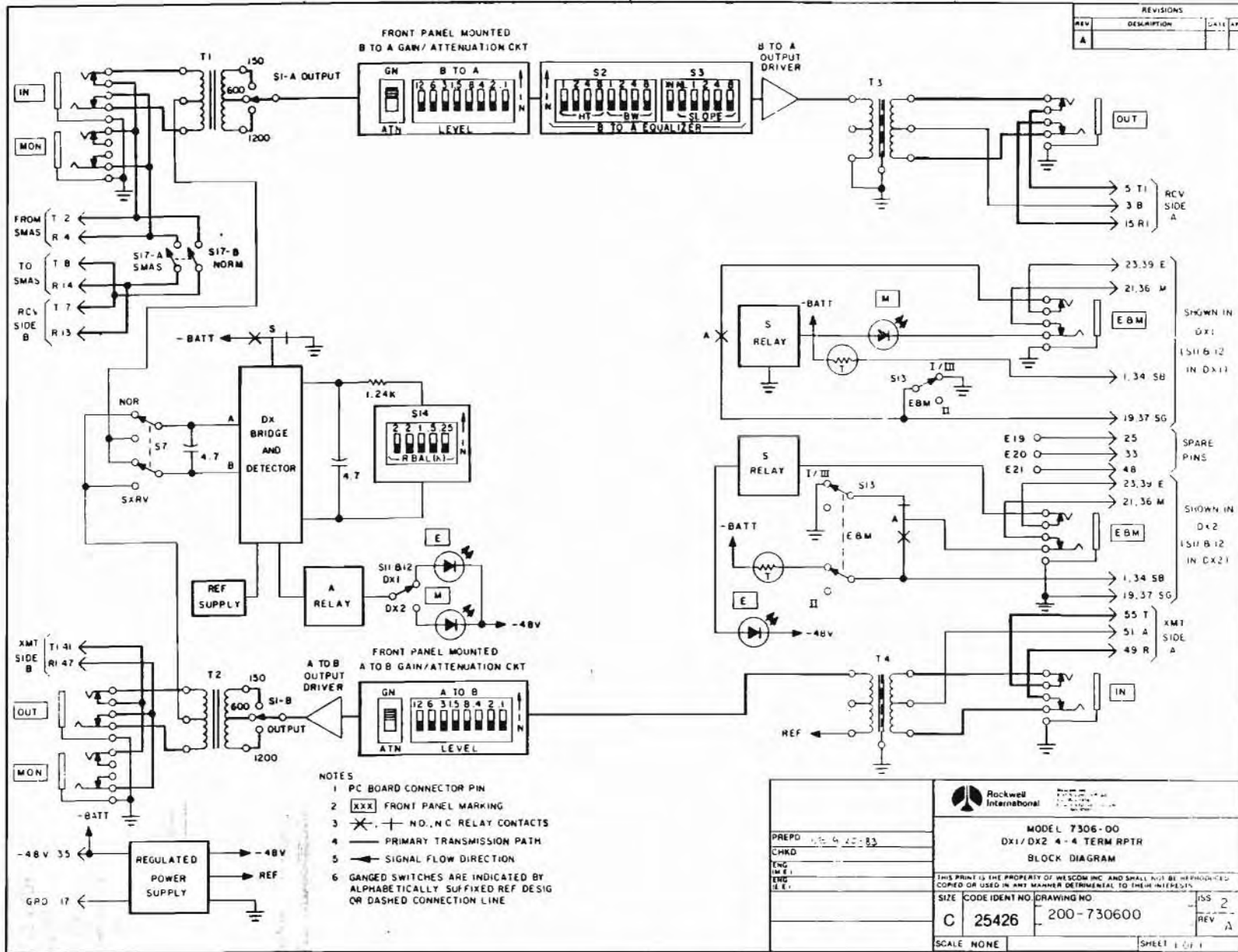
Signaling

3.04 The 7306-00/01 provides Duplex (DX) to E&M signaling capability. The electronic DX circuitry contained on the 7306-00/01 converts M lead (DX1) battery and ground or E lead (DX2) ground and open, supervisory and dial pulse signals to DX signals which are simplexed onto cable pairs used for voice transmission. The terminating end of the cable pairs is connected to a similar DX unit that converts the incoming DX signals to M lead (DX2) or E lead (DX1) signaling.

3.05 The 7306-00/01 DX signaling unit consists of a DX BRIDGE AND DETECTOR and an A RELAY that function together as the polar relay in older DX units. A variable R BAL network (S14) and a fixed capacitor are provided to balance the external loop resistance and shunt capacitance. The simplexed B lead conductor path in conjunction with the REF (reference) SUPPLY compensate for earth and battery potential differences. DX signaling originating from the M lead (DX1) or E lead (DX2) controlled S RELAY takes place over the simplexed A lead conductor. A NOR/SXRV switch (S7) is provided to maintain proper signaling and balancing lead continuity between adjacent DX signaling units.

2713Hz Tone Activated Loopback (7306-01 Only)

3.06 The 7306-01 provides tone operated loopback toward the 4W facility. A continuous 2713Hz loopback control signal applied to the RCV SIDE B for a minimum of 1.8 seconds will satisfy the first condition for loopback operation. Upon removal of the 2713Hz tone, the final condition is satisfied, resulting in the operation and latching of the LB RELAY and illumination of the front-panel-mounted LB LED. The LB RELAY performs the following functions while operated:



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Figure 3. 7306-00 DX1/DX2 4-4 Terminal Repeater (Issue 2) Block Diagram

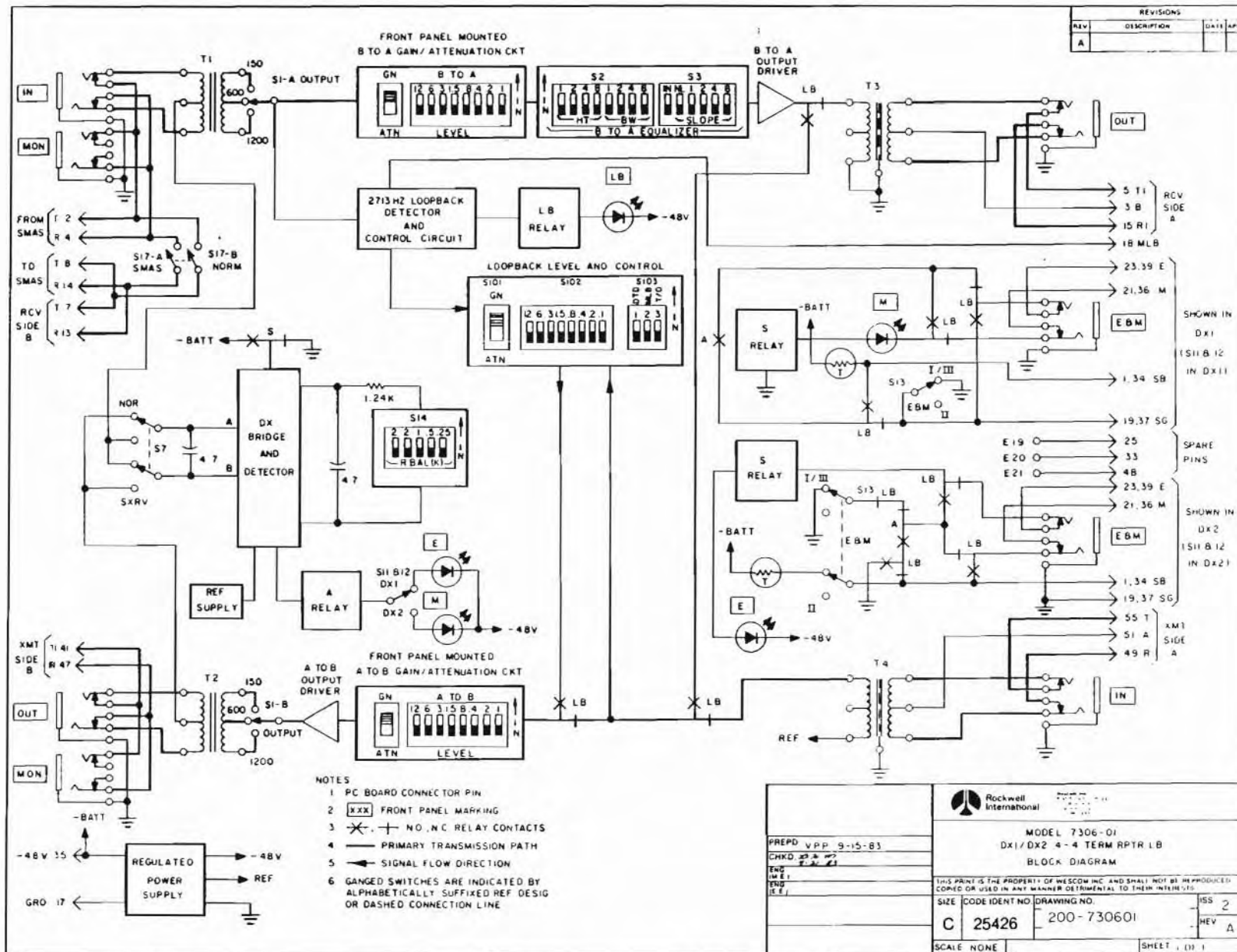
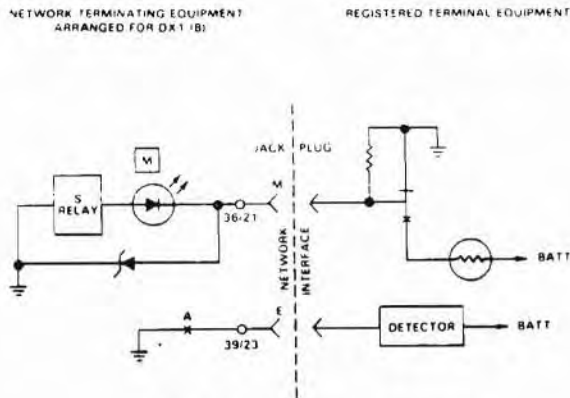
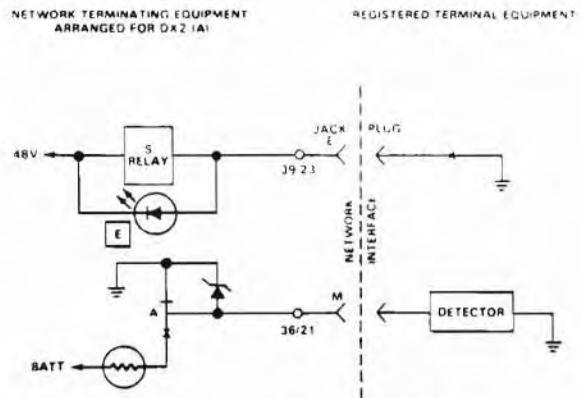


Figure 4. 7306-01 DX1/DX2 4-4 Terminal Repeater With Loopback (Issue 2) Block Diagram

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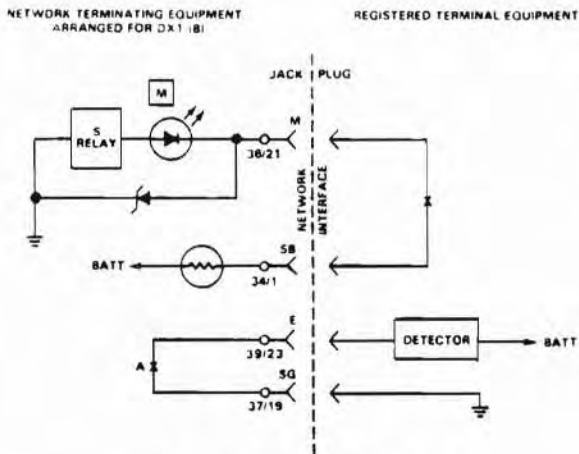


5A. FCC CODES TL31M OR TC32M

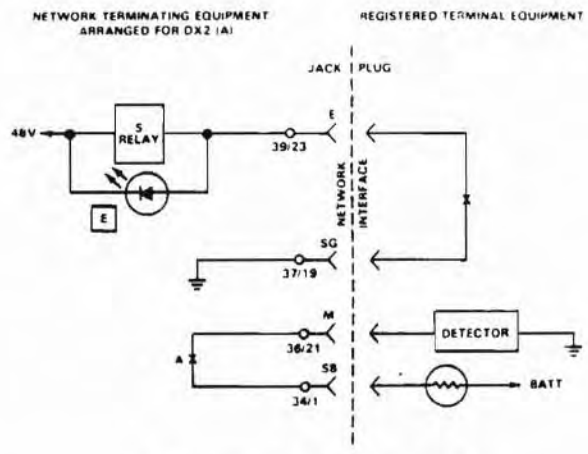


5B. FCC CODES TL31E OR TC31E

Figure 5. 7306-00/01 DX1/DX2 Connecting Circuits With Type I E&M Signaling

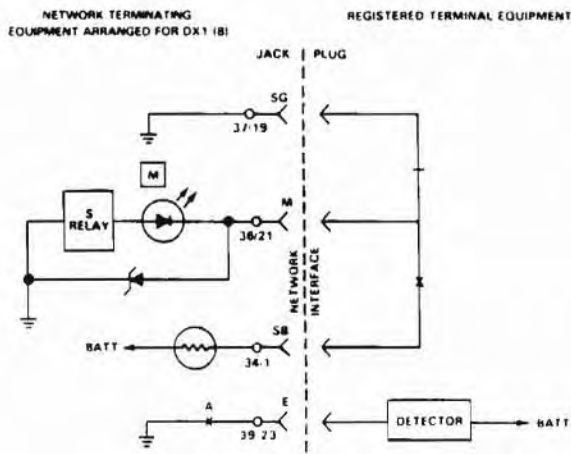


6A. FCC CODES TL32M OR TC32M

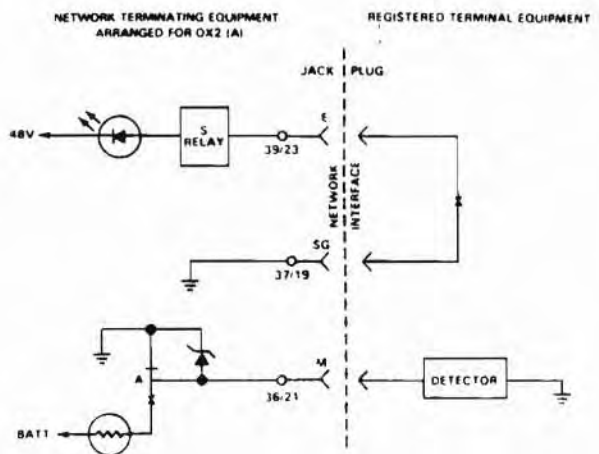


6B. FCC CODES TL32E OR TC32E

Figure 6. 7306-00/01 DX1/DX2 Connecting Circuits With Type II E&M Signaling



7A. DX1 TYPE III INTERFACE



7B. DX2 TYPE III INTERFACE

Figure 7. 7306-00/01 DX1/DX2 Connecting Circuits With Type III E&M Signaling

- (a) Loops all voice-band signals from the RCV SIDE A to the XMT SIDE A at equal loopback levels. Up to ± 24 dB gain (switches S101 and S102) is provided to accommodate a full range of TLPs.
- (b) Opens the RCV SIDE A and XMT SIDE A paths to the 4W equipment, preventing transmission.
- (c) Internally conditions the E&M leads to loopback the signaling circuit.
- (d) Buses the E or M lead to the station equipment.

3.07 Loopback release is accomplished by the reapplaciton of 2713Hz tone to the 7306-01. After 2713Hz tone has been received for approximately 0.9 seconds, the LB RELAY releases and the LB LED extinguishes, ending the loopback condition.

3.08 The LOOPBACK CONTROL CIRCUIT is conditioned by DIP switch S103. The tone detector can be disabled by placing the DTD switch of S103 to the IN position. Manual loopback condition can be enabled by placing switch MLB of S103 to the IN position. The LOOPBACK CONTROL CIRCUIT also contains a four minute time-out function that, when enabled, will automatically reset the loopback to its normal condition four minutes after the tone activated loopback is started. This function is enabled by placing the T/O switch of S103 to the IN position.

Power Supply

3.09 The on-board power supply derives the necessary voltage to operate the 7306-00/01 from a -42.5 to -53.5 Vdc source and power return ground source, applied at pins 35 and 17, respectively.

4. INSPECTION

4.01 Inspect the equipment thoroughly upon delivery. If the equipment has been

damaged in transit, immediately report the extent of damage to the transportation company.

4.02 Wescom 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 one number on any following models that are manufactured. Therefore, be sure to include both the model number and its issue number when making inquiries about the equipment.

5. MOUNTING

5.01 The 7306-00 and 7306-01 are 400-type plug-in Combined Function Modules (CFMs) designed to mount in TL40XX or TL42XX NCTE Mounting Assemblies. They also can be mounted in one position of unwired 400-type mounting assemblies.

CAUTION

Installation and removal of modules should be done with care. Do not force a module into place. If excessive resistance is encountered while installing a module, remove the module and check the card guides and connector to verify proper alignment and the absence of foreign material.

6. INSTALLER CONNECTIONS

6.01 When the 7306-00 or 7306-01 is installed in a 400-type mounting assembly, it makes electrical connection through a 56-pin, *wire-wrap, card-edge connector, provided as part of the mounting assembly.* Make all installer connections to this connector in accordance with Table 1.

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Table 1. 7306-00/01 Installer Connections

LEAD DESIGNATION		PIN
T1	RCV SIDE A	5
R1		15
T	XMT SIDE A	55
R		49
A	SIDE A	51
B	SIMPLEX	3
T	RCV SIDE B	7
R		13
T1	XMT SIDE B	41
R1		47
T	TO SMAS	8
R		14
T	FROM SMAS	2
R		4
E	DX1/DX2 LEADS	23, 39
SG		19, 37
M		21, 36
SB		1, 34
MLB	7306-01 ONLY	18
-48V		35
GRD		17
E19	SPARES	48
E20		33
E21		25

7. OPTIONS

7.01 The 7306-00 and 7306-01 are equipped with DIP and slide switches that are used to condition the modules for proper application and operation. Refer to Figure 8 for the location of these options while reading the following instructions.

OUTPUT Switch S1 (Side B Impedance Matching)

7.02 Switch S1 OUTPUT is used to select 150, 600, or 1200 ohms for receive and transmit Side B impedance matching. Option per Table 2.

B To A Equalizer Switches S2 And S3 (Post Equalization Adjustment)

7.03 The B TO A EQUALIZER consists of switches S2 and S3. Switch S2 controls the height (HT) and bandwidth (BW), and switch S3 controls the SLOPE equalization and the equalizer bypass function. Except for the IN position on S3, these switches are functionally identical to the 309B equalizer found on many Western Electric transmission modules. When B to A equalization is required, place the left most switch on S3 to the IN position. The prescription settings for the 309B-type equalizer are contained in BSP 332-912-222; the manual set-up procedure is covered in BSP 332-912-221.

NOTE

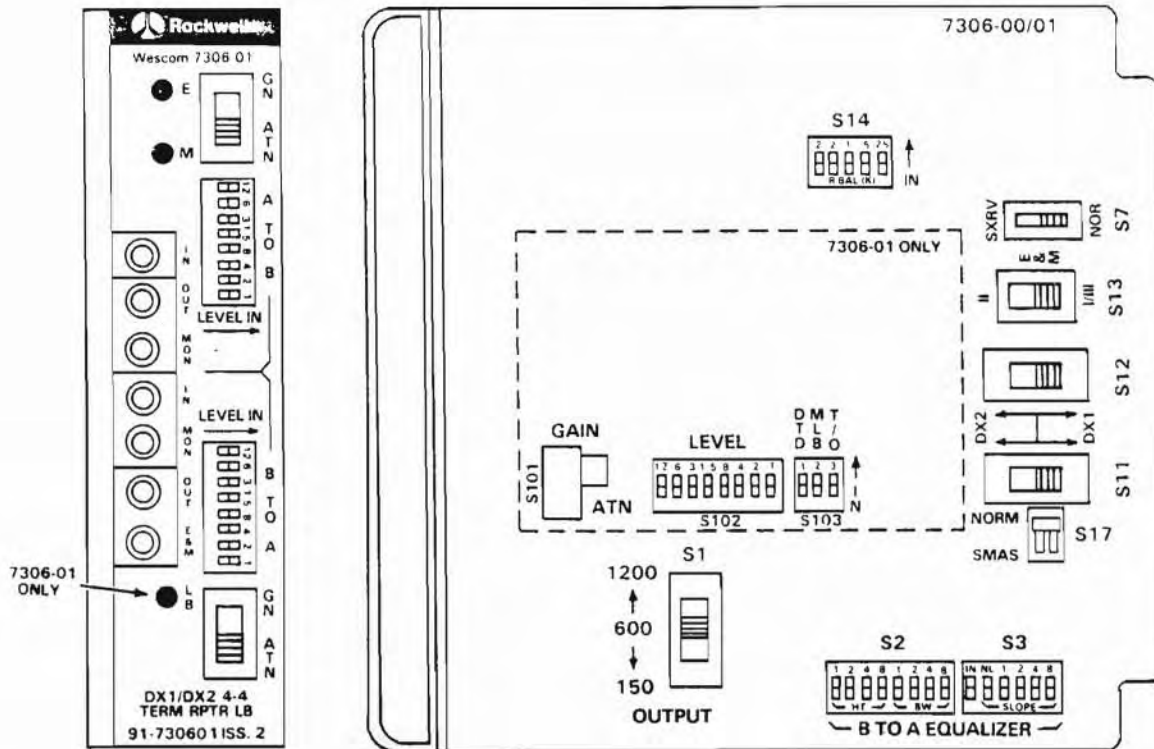
The 309B-type equalizer introduces low frequency rolloff. When no equalization is required or a flat frequency response of the B to A (receive) amplifier is desired, place the left most switch on S3 away from the IN position, bypassing the equalizer.

Table 2. 4-Wire Facility Impedance Selection

4-WIRE CABLE	IMPEDANCE SELECTION
	OHMS S1 POSITION
Nonloaded	600
H88 Loaded	1200
Mixed Loaded And Nonloaded	600 if distance between re- peater and first load coil is greater than 9kft. 1200 if distance between re- peater and first load coil is less than 9kft.

NOTE

The 150 (ohm) position on switch S1 is provided for short nonloaded loops where on board equalization is not required.



SWITCH DESIG*	SWITCH FUNCTION	SWITCH POSITION
S1 OUTPUT	150 ohm B Side Impedance	150
	600 ohm B Side Impedance	600
	1200 ohm B Side Impedance	1200
S2 HT/BW and S3 SLOPE B to A Equalizer	Western Electric Type 309B receive (post) equalization for 19, 22, 24, 25 (MAT), and 26 gauge loaded and nonloaded cable or combinations of loaded and nonloaded cable	Prescription settings for the Western Electric 309B type equalizer are contained in BSP 332-912-222; manual set-up procedure is covered in BSP 332-912-221
S3 IN	Enable Equalizer	IN
S7	Normal B Side SX to DX	NOR
	Reversed B Side SX to DX	SX RV
S11 and S12	DX1 signaling interface	DX1
	DX2 signaling interface	DX2
S13 E&M	TYPE I signaling interface	I/III
	TYPE II signaling interface	II
	TYPE III signaling interface	III
S14	DX Resistive line balance up to 5000 ohms in 250 ohm increments. do not add 1250 ohms	2, 2, 1, 5, 25 R BAL (K)
S17 NORM/SMAS	SMAS access No SMAS access	SMAS NORM
B to A LEVEL and GN/ATN	LEVEL provides up to 24dB (additive) in 0.1dB increments, for the B to A (receive) channel; GN/ATN provides gain or attenuation.	See Table 3 Level Adjustment
A to B LEVEL and GN/ATN	LEVEL provides up to 24dB (additive) in 0.1dB increments, for the A to B (transmit) channel; GN/ATN provides gain or attenuation.	
S101 GAIN/ATN S102 LEVEL (7306-01 Only)	S101 provides loopback gain or attenuation; S102 provides up to 24dB (additive) in 0.1dB increments for loopback level adjustment	See Table 3 Level Adjustment
S103 Loopback Control (7306-01 Only)	Disable Tone Detector (DTD) Manual Loopback (MLB) Four Minute Time-Out (T/O)	S103-1 IN S103-2 IN S103-3 IN

*Designations S4, S5, S6, S8, S9, S10, S15, and S16 not used.

Figure 8. 7306-00/01 Option Locations

**B TO A GN/ATN Front Panel Switches
(Transmission Level Adjustment)**

7.04 The B TO A GN (Gain) or ATN (Attenuation) slide switch and the B TO A LEVEL prescription gain DIP switches are used to provide up to 24dB of gain or attenuation in 0.1dB increments. Condition the B TO A level according to Table 3 and the following:

- (a) Determine the total 1000Hz gain or attenuation required by subtracting the RCV SIDE B TLP (Transmission Level Point) from the RCV SIDE A TLP.

NOTE

RCV SIDE B TLP equals the facilities transmitted TLP minus the 1000Hz loss of cable facility (loss should be expressed as a positive number).

- (b) If enabled, the active equalizer provided introduces 1000Hz gain as a result of the HT and BW (S2) and/or SLOPE (S3) switch settings. To determine the correct settings for the B TO A amplifier subtract the additional 1000Hz gain in dB as a result of HT and BW and/or SLOPE settings from the total required 1000Hz gain or attenuation derived in Step (a).

NOTE

Total 1000Hz gain as a result of equalizer switch settings is determined from Paragraph 7.03 and Tables 4 and 5.

- (c) Program the required level by setting the B TO A LEVEL switches equal to the 1000Hz gain calculated in Step (b) $\pm 0.05\text{dB}$. Place the GN/ATN switch in the GN position if the result of Step (b) is positive; place the GN/ATN switch to the ATN position if the result is negative.

**A TO B GN/ATN Front Panel Switches
(Transmission Level Adjustment)**

7.05 The A TO B GN or ATN slide switch and the A TO B LEVEL prescription gain DIP switches are used to provide up to 24dB of gain or attenuation in 0.1dB increments. Condition the A TO B level according to Table 3 and the following:

- (a) Determine the total 1000Hz gain or attenuation required by subtracting the XMT SIDE A TLP from the XMT SIDE B TLP.

- (b) Program the required level by setting the A TO B LEVEL switches equal to the 1000Hz gain calculated in Step (a) $\pm 0.05\text{dB}$. Place the GN/ATN slide switch in the GN position if the result of Step (a) is positive; place the switch in the ATN position if the result is negative.

NOR/SXRV Switch S7 (Simplex Lead Reversal)

7.06 The normal simplex-lead-to-DX configuration is provided by placing switch S7 in the NOR position. A reversed simplex-lead-to-DX configuration is provided by placing switch S7 in the SXRV position. To provide proper DX operation, signaling and balancing lead continuity between the local and distant DX units must be maintained. Therefore, the DX units at the local and distant locations must be optioned with one unit in the normal position and the other in the reverse position.

DX1/DX2 Switches S11 And S12 And Type I/III Or Type II Switch S13

7.07 Condition the 7306-00/01 for DX1/DX2 and Type I/Type II/Type III operation according to Table 6.

R BAL (K) Switch S14 (DX Resistive Line Balance Network)

7.08 The R BAL (K) switches on S14 are used to provide resistive line balance. Condition the balance network of the DX signaling circuit according to Table 7 and the following:

- (a) Calculate the loop resistance of the 4-wire facility. The 4-wire loop resistance is equal to the loop resistance of either the transmit or the receive pair divided by two.

NOTE

Do not add 1250 ohms to the calculated loop resistance.

- (b) Select resistors with a total value equal to the calculated loop resistance ± 125 ohms. Place the desired resistors into the balance network by placing the sections of S14 that correspond to the resistors needed to the IN position. The switch is a self-reading switch so that the 2 places 2000 ohm (2Kohms) into the balance network and the .25 places 250 ohms (.25Kohms) into the network.

Table 3. Level Adjustment

LEVEL SWITCH IN	GN	ATN
12	+ 12.0dB	- 12.0dB
6	+ 6.0dB	- 6.0dB
3	+ 3.0dB	- 3.0dB
1.5	+ 1.5dB	- 1.5dB
.8	+ 0.8dB	- 0.8dB
.4	+ 0.4dB	- 0.4dB
.2	+ 0.2dB	- 0.2dB
.1	+ 0.1dB	- 0.1dB

NOTE

Switch settings are additive up to ± 24 dB.

Table 4. Additional 1000Hz Gain In dB As A Result Of Slope Settings

SLOPE SETTING	NL/L SWITCH	
	NL	L
0*	0	0
1	0.4	1.4
2	0.9	2.6
3	1.4	3.7
4	1.8	4.7
5	2.3	5.5
6	2.8	6.3
7	3.4	7.2
8	3.7	7.8
9	4.2	8.4
10	4.6	9.0
11	5.0	9.5
12	5.4	10.0
13	5.8	10.5
14	6.2	11.0
15	6.6	11.4

*SLOPE setting 0 disables the slop unit.

Table 5. Additional 1-KHz Gain In dB As A Result Of HT And BW Settings

		HT SETTING																
		0*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
B W S E T T I N G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1
	6	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	7	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3
	8	0	0	0	0	0	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4
	9	0	0	0	0	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5
	10	0	0	0	0	0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.7
	11	0	0	0	0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.6	0.7	0.7	0.9
	12	0	0	0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.8	0.9	1.2	1.2
	13	0	0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.7	1.7
	14	0	0	0.1	0.1	0.2	0.3	0.4	0.5	0.7	0.8	1.0	1.2	1.4	1.7	2.0	2.5	2.5
15	0	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.5	1.7	2.0	2.4	2.8	3.3	3.9	3.9	

*HT setting 0 disables the bump unit for all BW settings.

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Table 6. DX1/DX2 And Type I/Type II/Type III Conditioning With FCC Facility Code Cross References*

FCC CODE	INTERFACE	MODE	SWITCH POSITION	
			S11 AND S12	S13
TL31M OR TC31M	TYPE I (NON-LOOPED)	DX1	DX1	TYPE I/III
TL31E OR TC31E	TYPE I (NON-LOOPED)	DX2	DX2	TYPE I/III
TL32M OR TC32M	TYPE II (LOOPED)	DX1	DX1	TYPE II
TL32E OR TC32E	TYPE II (LOOPED)	DX2	DX2	TYPE II

*NOTE: For Type III operation, place switch S13 in Type I/III position.

Example:

- (1) Calculated loop resistance: 1500 ohms.
- (2) The required matching network resistance is 1500 ohms \pm 125 ohms.
- (3) Set the 1 (1000 ohms) and the .5 (500 ohms) switches towards the IN position. All other switches should be OUT (opposite the IN position).

NORM/SMAS Switch S17 (SMAS Access)

7.09 The NORM/SMAS switch S17 allows the 7306-00/01 to be used in NCTE applications or in central office environments where SMAS access is required. When accessing SMAS, place switch S17 in the SMAS position. Place switch S17 in the NORM position when SMAS access is not required.

Equal Level Loopback Switches S101 And S102 (7306-01 Only)

7.10 The loopback circuit contains a prescription gain or attenuation circuit, similar to the B to A and A to B gain circuits, for the purpose of obtaining equal level transmission loopback. Condition the loopback level according to Table 3 and the following:

Table 7. Resistive Line Balance Network

SWITCH S14 IN	RESISTIVE LINE BALANCE (OHMS)
.25	250
.5	500
1	1000
2	2000
2	2000

- (a) Determine the required gain or attenuation by subtracting the RCV SIDE A TLP from the XMT SIDE A TLP.
- (b) Program the required level by setting the switches on S102 equal to the gain calculated in Step (a) \pm 0.05dB. Place switch S101 in the GAIN position if the result is positive; place switch S101 in the ATN (Attenuation) position if the result is negative.

Loopback Control Switches On S103 (7306-01 Only)

7.11 Switches S103-1, -2, and -3 control the Disable Tone Detector (DTD), the Manual Loopback (MLB), and Loopback Timeout (T/O) respectively.

- (1) To disable the tone-activated loopback, place switch S103-1 (DTD) to the IN position.
- (2) To manually loopback the module, place switch S103-2 (MLB) to the IN position. With S103-2 in the IN position, the module will remain looped back regardless of the position of S103-1 (DTD) or S103-3 (T/O).
- (3) To activate a four minute timeout of the tone-activated loopback, place switch S103-3 (T/O) to the IN position. With S103-3 in the IN position, the tone-activated loopback condition will be deactivated upon application of 2713Hz tone or will timeout after four minutes.

8. ALIGNMENT

- 8.01 The 7306-00/01 contains gain control which must be adjusted to set the SIDE A and SIDE B TLPs (transmission level points). They also contain controls for receive (post) amplitude equalization. The alignment procedure for the 7306-00/01 is provided in Tables 8 and 9. Table 8 provides the alignment procedure for the B TO A (receive) voice path. Also, refer to Paragraph 7.04. Table 9 provides the alignment procedure for the A TO B (transmit) path. Also, refer to Paragraph 7.05. Be certain that all options have been properly conditioned for the application in accordance with Part 7 before beginning the alignment procedure.
- 8.02 The following test equipment is required to properly align the 7306-00/01.
- (a) Transmission Measuring Set (TMS): WESTERN ELECTRIC Co. 23A, HEWLETT-PACKARD 3550, or equivalent with self-contained Variable Frequency Oscillator (VFO).
 - (b) Three-conductor test cords having one end terminated in bantam plugs and the other end suitable for connecting to the TMS and VFO.

NOTE

If TMS or VFO-connecting cords are terminated in Type 310 plugs, they can be adapted for connecting into bantam jacks by attaching a Wescom Part No. 003-210367 Type 310 to Bantam Jack Adapter (14 inch).

- (c) One open bantam plug.

9. TESTING

9.01 If trouble is encountered with the operation of the 7306-00/01, verify that all installer connections have been made in accordance with Part 6, that all options have been arranged as required in Part 7, and that the alignment procedure in Part 8 has been properly performed. Make certain that the module is making good connection with the mounting assembly wire-wrap card-edge connector; remove and reinsert the module. If trouble persists, refer to Paragraph 9.02 and 9.03; Table 10, 7306-00/01 Signaling Test Procedure; and Table 11, Remote Verification Of Circuit Operation Of The 7306-01 Module Using Loopback.

9.02 The following test equipment is recommended for testing, per Table 10, the DX1/DX2 signaling operation of the 7306-00/01.

- (a) Pulsing test set, NORTHEAST ELECTRONICS TTS 26B, or equivalent.
- (b) Miscellaneous test cords and plugs.

9.03 If technical assistance is required, contact the Wescom Technical Services Department by calling:

(312) 985-9000,
 TWX 910-695-4735,
 DATAPHONE® (312) 985-1700, or
 TELEX 253-656

Canadian Customers:
 (416) 877-0191,
 TWX 610-492-2646, or
 TELEX 06-97777

Table 8. B TO A (Receive) Alignment Procedure

STEP	INSTRUCTION
1	Facility Line Verification Arrange the TMS for terminated measurement at the impedance specified on the CLR (Circuit Layout Record). Connect the TMS to the B TO A (RCV SIDE B) MON jack on the front panel of the 7306-00/01. Insert an open bantam plug into the B TO A IN jack on the 7306-00/01 to disconnect the receive amplifier circuit from the receive pair.
2	Request the distant terminal to send a 1000Hz test tone at the required level and impedance specified on the CLR. Verify that the levels measured on the TMS are those specified on the CLR.
3	If no equalization is required, ensure that the B TO A EQUALIZER switches on S2 and S3 are OUT. Proceed to Step 5.
4	B TO A Equalization Adjustment Program the required B TO A equalization by setting the B TO A EQUALIZER switches on S2 and S3 equal to the switch settings specified on the CLR. Refer to Paragraph 7.03 B TO A Receive Equalization Adjustment. Be certain that the left most position of switch S3 is in the IN position.
5	B TO A Level Adjustment (Front-Panel) Program the required B TO A level by setting the B TO A LEVEL switches on the front panel equal to the level specified on the CLR $\pm 0.05\text{dB}$. If the required gain is positive, place the B TO A GN/ATN to the GN position. If negative, place the B TO A GN/ATN switch to the ATN position. Refer to Paragraph 7.04.
6	RCV SIDE A Verification Arrange the TMS for 600 ohm terminated measurement. Connect the TMS to the B TO A OUT (RCV SIDE A) jack. Request the distant terminal to send a 1000Hz, a 2800Hz, and then a 400Hz test tone at the required level and impedance. Verify that the levels measured on the TMS are those specified on the CLR.
7	Remove all test cords and perform the A TO B Alignment Procedure.

Table 9. A TO B (Transmit) Alignment Procedure

STEP	INSTRUCTION
1	Condition the local VFO to apply a 1000Hz test tone at the required level and impedance specified on the CLR (Circuit Layout Record). Connect the VFO to the A TO B IN (XMT SIDE A) jack on the 7306-00/01.
2	Arrange the TMS for terminated measurement at the impedance specified on the CLR. Connect the TMS to the A TO B OUT (XMT SIDE B) jack on the 7306-00/01.
3	Program the required A TO B level by setting the A TO B LEVEL switches on the front panel equal to the level specified on the CLR $\pm 0.05\text{dB}$. If the required gain is positive, place the A TO B GN/ATN switch to the GN position. If negative, place the A TO B GN/ATN switch to the ATN position. Refer to Paragraph 7.05.
4	Verify that the level measured on the TMS is that specified on the CLR.

TABLE CONTINUED ON NEXT PAGE

Table 9. A TO B (Transmit) Alignment Procedure (Cont.)

STEP	INSTRUCTION
5	Remove the TMS from the A TO B OUT jack on the 7306-00/01 and request the distant terminal to measure the 1000Hz test tone.
6	Distant terminal verifies proper level as specified on the CLR.
7	This completes the A TO B Alignment Procedure; remove all test connections.

Table 10. 7306-00/01 Signaling Test Procedure

STEP	ACTION	VERIFICATION
1	Connect a test cord between the E&M jack of the pulsing test set and the E&M jack of the 7306-00/01 (E lead on tip and M lead on ring) or the M lead (pin 21 or 36) and the E lead (pin 39 or 23) of the 7306-00/01 (at the backplane).	
2	If the 7306-00/01 is arranged for DX1 operation, proceed to Step 3; if it is arranged for DX2 operation, proceed to Step 8.	
3	DX1 Test * Key the M lead to the 7306-00/01 for an off-hook condition.	Verify that the circuit is seized at the distant terminal and that the local M LED illuminates.
4	Pulse the M lead to the 7306-00/01 at 12pps at 58 percent break.	Verify pulsing and pulse quality at the distant terminal. Pulse distortion should not exceed 4 percent. Verify that the E lead at the local terminal remains in the idle condition, and that the local M LED follows dial pulses.
5	Place the M lead at the local terminal in an off-hook condition and request the distant terminal to seize the circuit toward the local terminal.	Verify that the local M LED lights, and that the E LED lights and verify a ground on the E lead when seizure occurs.
6	Request the distant terminal to pulse the circuit at 12pps at 58 percent break.	Verify pulsing and pulse quality at the local E lead. Pulse distortion should not exceed 4 percent. The local E LED should follow dial pulses.
7	This concludes the DX1 test procedure. Remove all test equipment.	
8	DX2 Test * Key the E lead to the 7306-00/01 for an off-hook condition.	Verify that the circuit is seized at the distant terminal and that the local E LED illuminates.
9	Pulse the E lead to the 7306-00/01 at 12pps at 58 percent break.	Verify pulsing and pulse quality at the distant terminal. Pulse distortion should not exceed 4 percent. Verify that the M lead at the local terminal remains in the idle condition, and that the local E LED follows dial pulses.
10	Place the E lead at the local terminal in an off-hook condition and request the distant terminal to seize the circuit toward the local terminal.	Verify that the local E LED lights, and that the M LED lights when seizure occurs.

TABLE CONTINUED ON NEXT PAGE

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Table 10. 7306-00/01 Signaling Test Procedure (Cont.)

STEP	ACTION	VERIFICATION
11	Request the distant terminal to pulse the circuit at 12pps at 58 percent break.	Verify pulsing and pulse quality at the local terminal. Pulse distortion should not exceed 4 percent. Verify that the E lead at the local terminal remains in the idle condition, and that the local M LED follows dial pulses.
12	This concludes the DX2 test procedure. Remove all test equipment.	

*The signaling test procedure assumes that the 7306-00/01 is arranged for either DX1 or DX2 operation with Type I signaling. In addition, it assumes that a similar unit is at each location.

Table 11. Remote Verification Of Circuit Operation Of The 7306-01 Module Using Loopback

STEP	ACTION	VERIFICATION
1	Condition the 7306-01 module per the instructions in Part 7, OPTIONS, and the Circuit Layout Record (CLR).	
2	From the Serving Test Center (STC) transmit to the 7306-01 a continuous 2713Hz test tone at the specified level and impedance for a minimum of 1.8 seconds, then remove tone.	Upon removal of 2713Hz test tone, the LB LED on the front panel of the 7306-01 should illuminate, verifying the unit is in the loopback mode.
3	From the STC, transmit a 1000Hz test tone at the required level and impedance specified on the CLR. Connect a Transmission Measuring Set (TMS) conditioned for bridging measurement to the RCV SIDE B.	TMS indicates to the STC that the 7306-01 is in the loopback mode and proper transmission through the unit (gain, impedance, and equal level loopback settings) is correct for the application.
4	Repeat Step 3 using 400Hz and 2800Hz, respectively.	Equalization provided by the 7306-01 is correct for the application.
5	From the STC, seize the circuit toward the 7306-01 and monitor for an incoming seizure.	Upon seizure, the E&M LEDs located on the front panel of the 7306-01 should illuminate and the STC should detect an incoming seizure.
6	From the STC, pulse the circuit toward the 7306-01 at 12pps with 59% break and monitor for incoming dial pulsing.	Upon reception of dial pulsing, the E&M LEDs located on the front panel of the 7306-01 should flash and the STC should monitor incoming dial pulsing of 12pps with 58 ± 6% break.
7	From the STC, send a continuous 2713Hz test tone at the required level and impedance. Connect a TMS for bridging measurement to the RCV SIDE B.	Upon reception of 2713Hz test tone for approximately 0.9 sec. the LB led located on the front panel of the 7306-01 should extinguish and the STC should stop receiving 2713Hz transmission from the 7306-01 verifying the unit is no longer in the loopback mode.
8	This concludes the remote verification of circuit operation.	The 7306-01 module provides proper operation.

10. WARRANTY

10.01 **WARRANTY:** Wescom offers an industry leading five (5) year warranty on products of Wescom's manufacture. Contact your local Wescom Sales representative for details of Wescom's warranty. 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.

10.02 Field repairs involving the replacement of components within a unit are not recommended. If an item is found to be defective, contact Wescom, Inc., by telephone, letter, or TWX, for instructions regarding replacement or repair.

10.03 If a replacement unit is required, it will be shipped in the fastest manner consistent with the urgency of the situation. Upon receipt of a replacement unit, return the defective unit in the carton in which the replacement was shipped, using the shipping label provided, to:

Wescom, Inc.
8245 Lemont Road
Downers Grove, Illinois 60515

Canadian Customers:
Rockwell International of Canada Ltd.
Wescom Canada Division
45 Sinclair Ave.
Halton Hills (Georgetown)
Ontario L7G 4X4

Repair Or Exchange Services

10.04 In addition to the standard Wescom Warranty Service, Wescom offers a repair or exchange service for those items out of warranty. Under this arrangement, faulty units may be shipped to Wescom and either completely repaired and quality tested or exchanged for a replacement unit. To obtain details of this service and a schedule of prices, contact your local Wescom Sales Representative.

11. SPECIFICATIONS

11.01 The electrical and physical characteristics of the 7306-00 and 7306-01 are as follows:

- Electrical**
- (a) **POWER REQUIREMENTS:**
- (1) Voltage Range: -42.5 to 53.5Vdc.
 - (2) Current Requirements at -48Vdc:
Idle: 45mA (7306-00); 65mA (7306-01).
Busy: 60mA plus M lead current (7306-00); 80mA plus M lead current (7306-01).
Loopback: 105mA (7306-01 only).
- Transmission
- (b) A TO B AND B TO A REPEATER GAIN RANGE: ± 24 dB.
 - (c) GAIN ADJUSTMENT GRANULARITY: ± 1 dB.
 - (d) B TO A RECEIVE (POST) EQUALIZATION: WESTERN ELECTRIC 309B type equalizer for 19, 22, 24, 25 (MAT), and 26 gauge loaded and nonloaded cable or combinations of loaded and nonloaded cable.
 - (e) 4-WIRE B SIDE IMPEDANCES: 150, 600, or 1200 ohms.
 - (f) 4-WIRE A SIDE IMPEDANCE: 600 ohms.
 - (g) RETURN LOSS: Greater than 20dB ERL.
 - (h) LONGITUDINAL BALANCE: Greater than 60dB 200 to 3000Hz.
 - (i) IDLE CHANNEL NOISE: Less than 7dBmC.
 - (j) MAXIMUM INPUT AND OUTPUT: +8dBm.

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- (k) HARMONIC DISTORTION: Less than 1 percent 200 to 3400Hz.
- (l) FREQUENCY RESPONSE: ± 0.3 dB maximum from 300 to 3400Hz relative to 1000Hz, no equalization.
- (m) CROSSTALK IMMUNITY: Greater than 75dB isolation between channels or adjacent units (200 to 3400Hz).
- (n) PEAK TO AVERAGE RATIO: Greater than 98.

Signaling
- (o) OPERATION: DX1 and DX2.
- (p) SIGNALING INTERFACE: Type I, Type II, and Type III.
- (q) PULSING RANGE: 7.5 to 12pps.
- (r) PULSE DISTORTION: ± 4 percent maximum.
- (s) LOOP RESISTANCE: 5000 ohms maximum.
- (t) DC EARTH POTENTIAL DIFFERENCE: Greater than ± 45 volts.
- (u) AC INDUCTION: Greater than 35Vrms.
- (v) M-LEAD OUTPUT CURRENT: Short circuit current limited to 30mA nominal.
- (w) LEDs: Red E&M front-panel-mounted.
- (x) Loopback (7306-01 Only)
DETECTOR FREQUENCY: Will detect within 2713 ± 7 Hz; will not detect outside of 2713 ± 35 Hz.
- (y) DETECTOR AMPLITUDE: Will detect 0 to -30 dBm; will not detect less than -40 dBm.
- (z) DETECTOR TIMING: Activate, 1.8 seconds; deactivate, 0.9 seconds.
- (aa) GAIN RANGE: ± 24 dB.
- (bb) GAIN ADJUSTMENT GRANULARITY: 0.1dB.
- (cc) CONTROL OPTIONS: Manual Loopback (MLB), Disable Tone Detector (DTD), and four minute Time-Out (T/O).
- Physical**
- (dd) OPERATING ENVIRONMENT: Temperature, 32° to 120° F (0° to 49° C).
- (ee) SURGE PROTECTION: 1000V on SIDE B.
- (ff) WEIGHT: 7306-00, 12 oz (340g); 7306-01, 14 oz (396g).
- (gg) DIMENSIONS: Height, 5.6 in. (14.2cm); width, 1.4 in. (3.5cm); depth, 6.0 in. (15.2cm).
- (hh) MOUNTING: TL40XX or TL42XX NCTE Mounting Assemblies, or unwired 400-type mounting assemblies.

Typesett. J.F.4 DJ/SNF/AA

THE CONNECTIONS FOR E&M LEAD OPERATION ON A 4 WIRE CIRCUIT.

~~7306-00~~ 7306-00
WESCOM

PLACE A PATCH CORD FROM THE E LEAD JACK OF A T-318 TO THE E&M JACK ON THE WESCOM UNIT AT BOTH A AND Z ENDS.

DEPRESS THE FOLLOWING KEYS ON BOTH T-318 SETS

- S2- TALK/RINGER
- S5- SIGNALING - E&M
- S7- TRANSMISSION - 4W
- S20- TO LINE TERMINATION - TMS
- S26- E TWD DROP-THRU
- S30- M TWD LINE-THRU
- S33- INTERFACE TYPE - I/III
- S36 TURN POWER SWITCH ON

TEST FROM THE A END FIRST. ON THE T-318 DEPRESS THE 'ON HK' KEY OF M TWD LINE. - NOTHING SHOULD CHANGE.

DEPRESS THE 'OFF HK' KEY OF M TWD LINE - THE 'E ON HK' LED IS EXTINGUISHED AT THE Z END ON THE T-318 TEST SET, THE M LED AT THE (UNIT) A END IS LITE, THE E LED AT Z END IS LITE (UNIT).

DEPRESS THE 'THRU' KEY OF M TWD LINE - THE 'E ON HK' LED'S WILL LITE AT BOTH ENDS.

NOW DO THE TESTS FROM THE Z END OF THE CIRCUIT.

T318 SETUP FOR RINGING PHONE/DISTANT CKT.

DEPRESS KEYS:

- S2 - TALK/RINGER
- S4 - LOOP
- S6 - 2W
- S10 - BATT FEED
- S20 - TMS
- S26 - THRU (E TWO DROP)
- S30 - THRU (M TWO LINE)

PLUG CORD E/W 310 PLUG & T-R CLIPS
INTO J5 (TR), ATTACH T-R CLIPS
TO TRANSMIT PAIR TO BE TESTED AT
THE RJ21X.

TURN ON T318 TEST SET
DEPRESS KEY S13 - RINGING

IF DISTANT PHONE OR CKT DOESN'T RING SWITCH
S3 SWITCH FROM RPT. TO BYP (WESCOM 7305-30
example); IF PHONE ON CKT NOW RINGS YOU
WILL NEED TO REPLACE FAULTY 8505-00
RINGING GENERATOR CIRCUIT PACK.

