Wescom 7305-11 4W Prescription Line Amplifier SF To E&M Module And The Wescom 7305-12 And 7305-13 4W Prescription Line Amplifier SF To E&M Loopback Modules

CONTENTS PAGE

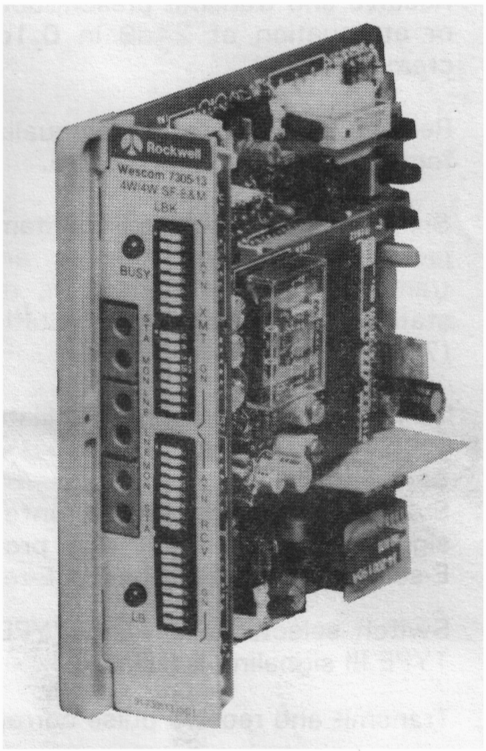


Figure 1. 7305-13 4W-4W SF To E&M LBK Module

1. GENERAL

1.01 This Practice provides a circuit description, installation and alignment procedures, and basic testing information for the Wescom® 7305-11 4W-4W SF To E&M Module, And 7305-12 And 7305-13 4W-4W SF To E&M Loopback Modules. The 7305-13 Module is shown in Figure 1.

1.02 The 7305-11, 12, and 13 are 400-type plug-in Combined Function Modules (CFMs). Each of the CFMs differ as follows:

(a) 7305-11 4W-4W SF to E&M with prescription gain, front-panel-mounted bantam test jacks; without loopback.

(b) 7305-12 4W-4W SF to E&M with prescription gain, tone operated loopback; without jacks.

(c) 7305-13 4W-4W SF to E&M with prescription gain, tone operated or manual loopback, and front-panel-mounted bantam test jacks.

1.03 The CFMs provide the following features:

Transmission

(a) Switch-selectable line side terminating impedance of 600 or 1200 ohms.

(b) Station side terminating impedance of 600 ohms.

(c) Line side surge protection.

(d) Receive and transmit prescription gain or attenuation of 24dB in 0.1dB increments.

(e) Receive (post) prescription equalization for loaded or nonloaded cable.

(f) Six front-panel-mounted bantam test jacks: receive line monitor and in, transmit line monitor and in; receive station in; and transmit station in (7305-11 and 7305-13 only).

(g) Integral 2600Hz transmit oscillator.

Signaling

(h) Switch selectable E&M interface: signaling (B) or trunk (A), providing E-send, M-receive or M-send, E-receive.

(i) Switch selectable TYPE I, TYPE II or TYPE III signaling interface.

(j) Transmit and receive pulse correction.

(k) M-lead current limiting.

(l) Front-panel-mounted LED that indicates busy.

Loopback (7305-12 And 7305-13 Only)

(m) 2713Hz tone-activated loopback.

(n) Equal level loopback programmable for 7.5dB of gain in 0.5dB increments or 23dB of attenuation.

(o) Signaling loopback of the transmission and signaling paths.

(p) Front-panel-mounted LED that indicates the loopback status.

(q) Manual Loopback (MLB) screw option (7305-13 only).

(r) Tone Loopback Disable (DTD) screw option (7305-13 only).

1.04 Each of the CFMs are designed to mount in TL40XX Mounting Assemblies. They can also be mounted in one position of unwired Type 400 Mounting Assemblies, prewired FST-400 Mounting Assemblies or in the transmission position of 72 Family Mounting Assemblies.

2. APPLICATION GUIDELINES

2.01 The CFMs can be applied as Network Terminating Equipment (NTE) on special service circuits described by any one of the following FCC Facility Interface Codes: TL31M, TL31E, TC31M, TC31E, TL32M, TL32E, TC32M, and TC32E. They provide all necessary circuitry to interface a 4-wire SF facility to terminal equipment. See Figures 2, 3, and 4.

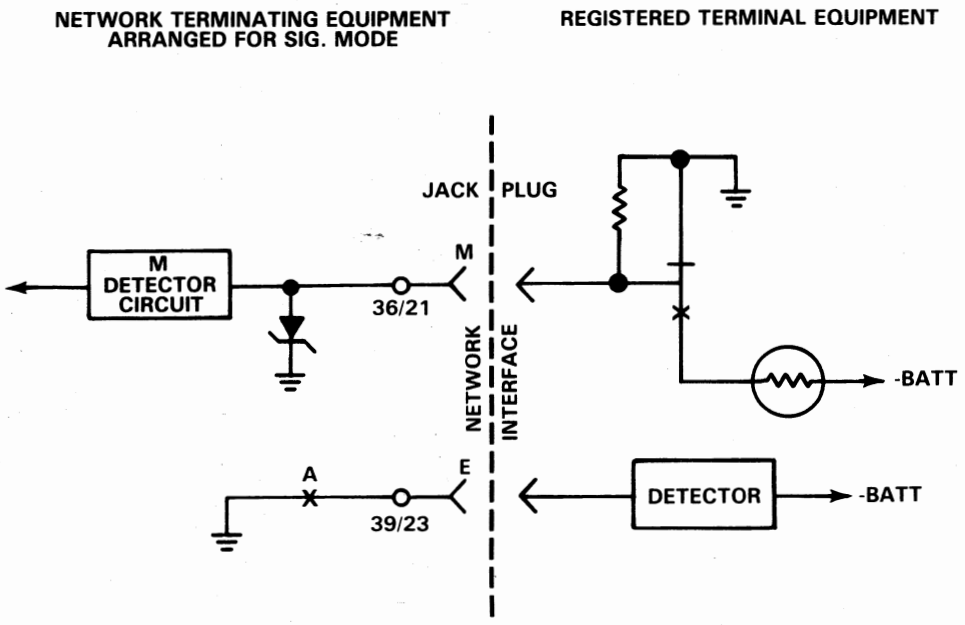
2.02 Figures 5 and 6 illustrate typical 7305-11/12/13 station and central office applications.

3. CIRCUIT DESCRIPTION

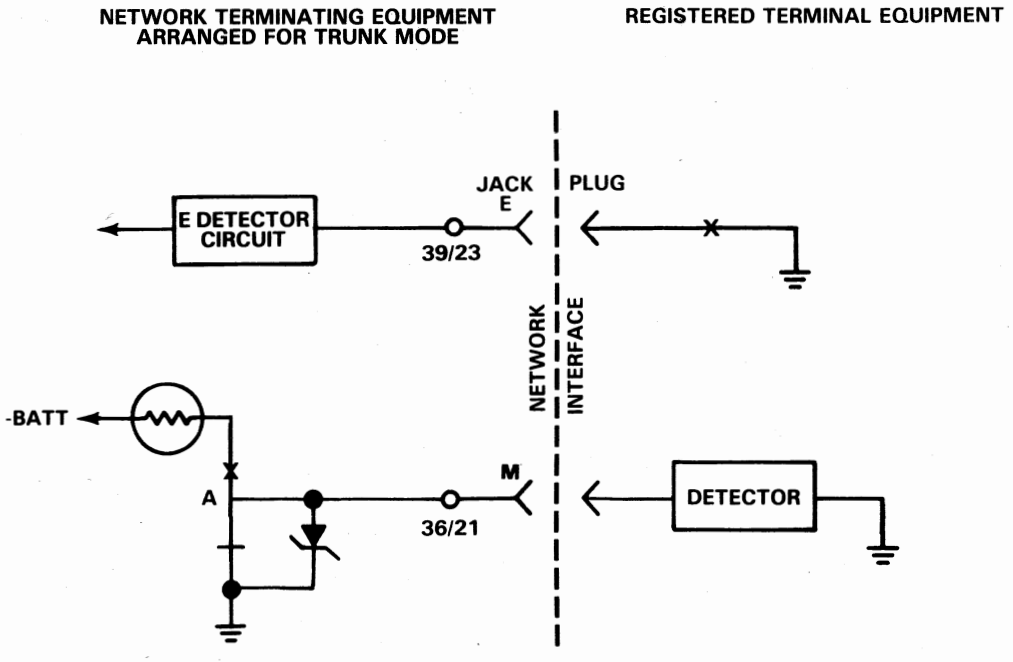
3.01 The CFMs provide a signaling and transmission interface between a 4-wire facility and a 4-wire trunk circuit. They also provide level control in both the transmit and receive paths. Refer to Figure 8, the 7305-13 4W-4W SF To E&M LBK (Issue 1) Block Diagram, while reading the following circuit description.

Transmit Voice Path

3.02 The transmit voice paths of the CFMs are transformer coupled to the XMT STA at a fixed impedance of 600 ohms. The transmit voice path provides an attenuator stage (XMT ATN) allowing up to 24dB of attenuation in 0.1 dB increments. The XMT ATN stage is used to set the internal −16TLP from the XMT STA level.

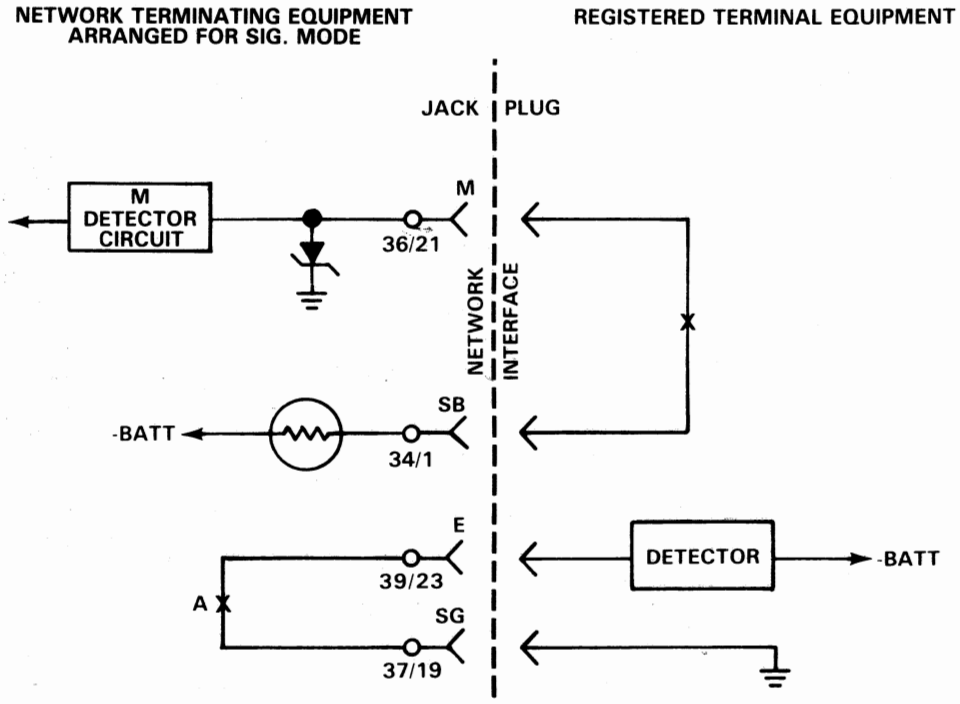


2a. FCC CODES TL31M OR TC31M

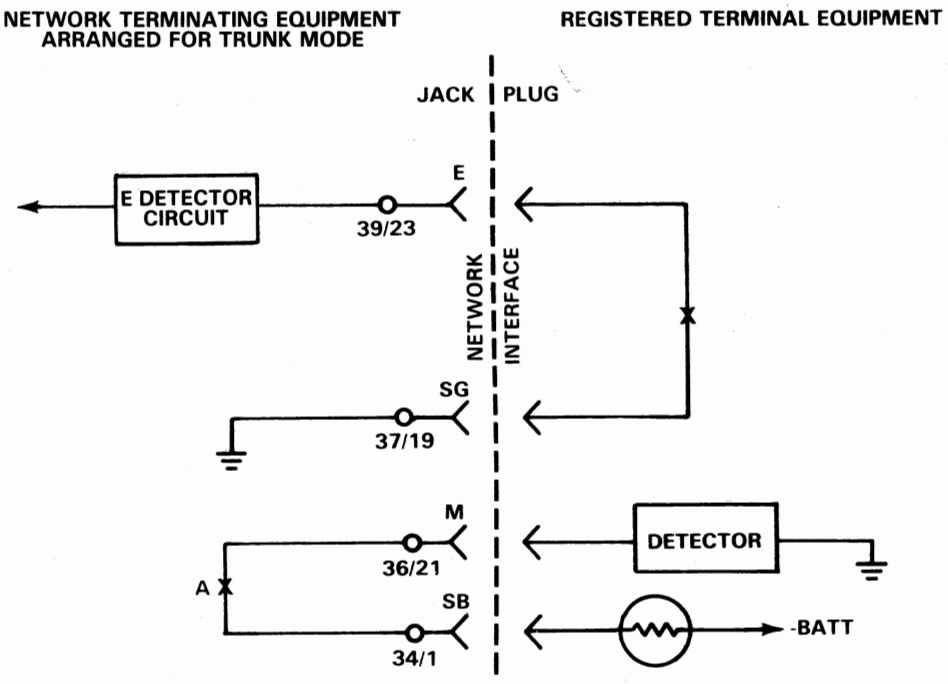


2b. FCC CODES TL31E OR TC31E

Figure 2. 7305-11/12/13 SIG/TRK Connecting Circuits With Type I E&M Signaling

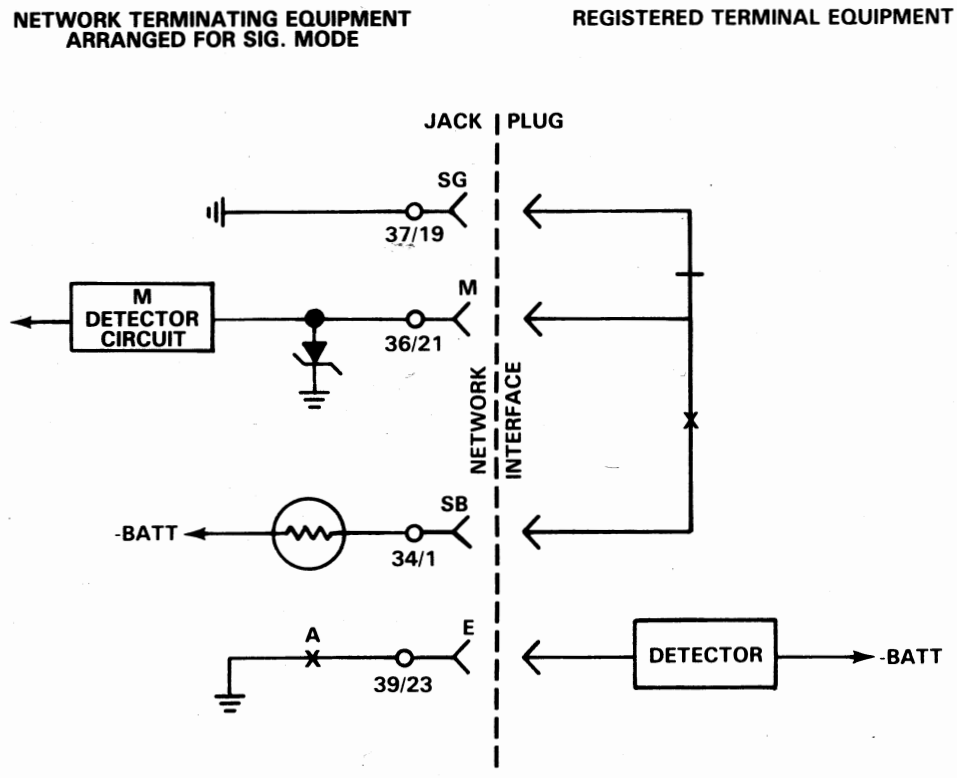


3a. FCC CODES TL32M OR TC32M

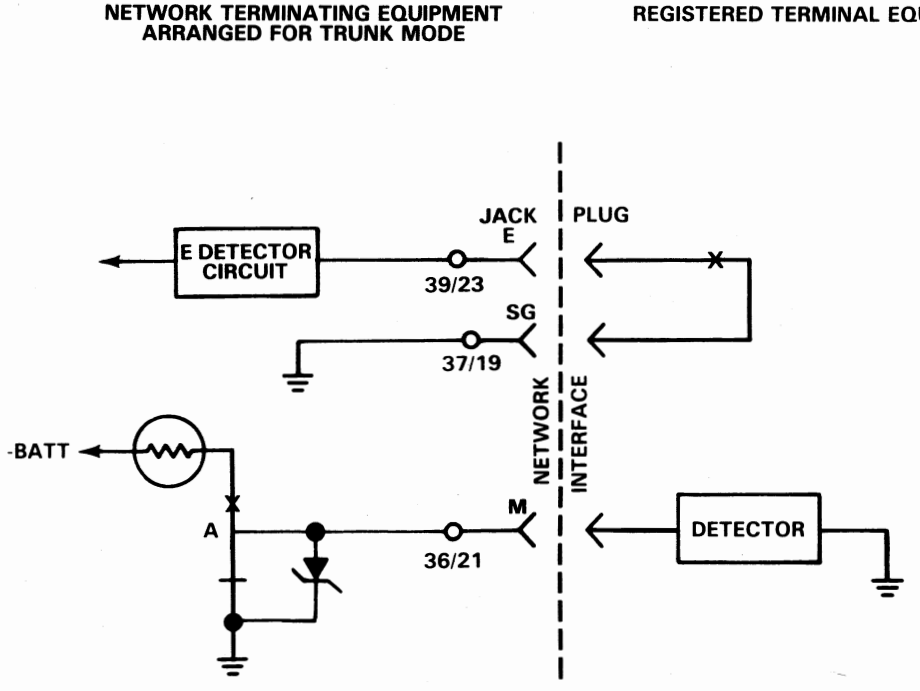


3b. FCC CODES TL32E OR TC32E

Figure 3. 7305-11/12/13 SIG/TRK Connecting Circuits With Type II E&M Signaling



4a. FCC CODES TL31M OR TC31M



4b. FCC CODES TL31E OR TC31E

Figure 4. 7305-11/12/13 SIG/TRK Connecting Circuits With Type III E&M Signaling

3.03 The −16TLP output of the XMT ATN stage is routed to the XMT GN (transmit gain) stage. The XMT GN stage provides up to 24dB of gain in 0.1dB increments. This allows the transmit line level to be set from the internal −16TLP. The output of the XMT GN stage is transformer coupled to the cable facility and provides 600 or 1200 ohm impedance matching toward the cable facility. The net result of the XMT ATN and XMT GN stages is to allow the 7305-11/12/13 to accommodate both line and station equipment levels between +7 and −16dBm.

Receive Voice Path

3.04 The receive voice paths of the CFMs are transformer coupled to the cable facility and provide a 600 or 1200 ohm terminating impedance toward the facility. The receive voice path provides a gain stage (RCV GN) allowing up to 24dB of gain in 0.1dB increments. The RCV GN compensates for cable loss and is used to set the internal +7TLP for the SF RECEIVER.

3.05 The +7TLP output of the RCV GN is routed to the receive post EQUALIZER, which provides amplitude equalization for loaded and nonloaded cable facilities. The output of the EQUALIZER is routed to the SF RECEIVER and the RCV ATN (receive attenuator). The RCV ATN provides up to 24dB of attenuation in 0.1dB increments for setting the receive station equipment level. The output of the RCV ATN is transformer coupled to the RCV STA (station equipment) at a fixed impedance of 600 ohms. The net result of the RCV GN and RCV ATN sections is to allow the 7305-11/12/13 to accommodate both line and station equipment levels between +7 and −16dBm.

Signaling Interface

3.06 The CFMs provide E&M leads to the station equipment. These E&M leads may be conditioned to appear as a trunk or signaling circuit. They can also be optioned for Type I, II or III E&M lead signaling modes. (See Figures 2, 3 and 4).

SF Receiver And Associated Circuitry

3.07 The SF RECEIVER consists of a bandpass filter, tone rectifier, guard enable/disable switch, guard rectifier and a comparator. The input to the SF RECEIVER comes from the output of the receive EQUALIZER. This insures that the receiver input is at a +7TLP. The idle SF tone is −20dBmO, which means that the low level or idle SF tone level is −13dBm, while high level SF tone level is −1dBm. High level tone is received during dial pulsing and for the first 500 milliseconds following off-hook to on-hook transition. The output of the SF RECEIVER is connected to the FILTER CONTROL TIMING and the MINIMUM OPERATE AND CARRIER FADE TIMING CONTROL.

3.08 The FILTER CONTROL TIMING controls the insertion and removal of the 2600Hz NOTCH FILTER in the receive VF path. The 2600Hz NOTCH FILTER is inserted in the voice path within five milliseconds of the SF RECEIVER detecting 2600Hz tone to prevent this signaling tone from reaching the RCV STA. The 2600Hz NOTCH FILTER is removed nominally 50 milliseconds after the SF RECEIVER signals the loss of SF tone, but remains inserted for a minimum of 140 milliseconds if SF tone was not present for 225 milliseconds.

3.09 The MINIMUM OPERATE AND CARRIER FADE TIMING CONTROL circuit has a minimum operate timing of nominally 30 milliseconds, unless continuous SF tone has been received for 225 milliseconds or more. If continuous tone has been received for any time exceeding 225 milliseconds, the minimum time required to recognize the removal of SF tone is nominally 40 milliseconds. This added delay helps prevent false seizures due to carrier fade. The output of the MINIMUM OPERATE AND CARRIER FADE TIMING CONTROL circuit is connected to the RCV PULSE CORRECTOR, GUARD AMP TIMING CONTROL and controls the XMT CUT CONTROL TIMING.

3.10 The GUARD AMP TIMING CONTROL circuit disables the guard rectifier when SF tone has been received for 225 milliseconds or more. This places the SF RECEIVER in the broad band detection condition allowing noise and frequencies other than 2600Hz to aid in maintaining the idle condition. The GUARD AMP TIMING CONTROL enables the guard rectifier nominally 65 milliseconds after the loss of SF tone, which places the SF RECEIVER in the narrow band

condition. With the SF RECEIVER in the narrow band condition, SF signaling tone must be 10dB greater than the broadband energy for the SF RECEIVER to recognize it as valid signals. This reduces talk-off, while dial pulses and winks are passed easily because they are high level 2600Hz tone.

3.11 The XMT CUT CONTROL TIMING circuit cuts the transmit voice path within 13 milliseconds of the SF RECEIVER detecting the presence of SF tone and uncuts the transmit voice path 550 milliseconds after the SF RECEIVER detects the absence of signaling tone, when the transmit voice path is in the idle state.

3.12 The RCV PULSE CORRECTOR circuit corrects input pulsing to a nominal 58 percent break. When receiving a tone-on indication, the A RELAY DRIVER holds the A RELAY released. The absence of SF tone causes the RCV PULSE CORRECTOR to turn on the A RELAY DRIVER which operates the A RELAY. For RCV PULSE CORRECTOR response to pulsed SF tone, see receive pulse corrector specifications in Part 11.

SF Transmitter And Associated Circuitry

3.13 The SF transmitter consists of a 2600Hz OSCILLATOR and a HIGH LEVEL CONTROL circuitry for turning the oscillator on and off on the transmit VF path toward the transmit line. The input for the SF transmitter comes from the signaling interface circuitry. The output of the signaling interface circuitry is connected to the XMT CUT CONTROL TIMING and the XMT MINIMUM OPERATE TIMING.

3.14 The XMT CUT CONTROL TIMING controls the XMT CUT Field Effect Transistor (FET) causing the transmit path to be cut and uncut in the following manner: When the SF RECEIVER is receiving continuous SF tone and the transmit signaling interface input is at idle, the transmit voice path is cut continuously. If the receive SF tone is removed and the transmit signaling interface input remains idle, the XMT CUT is affected for approximately 550 milliseconds. If receive SF tone is on continuously and the transmit signaling interface input goes busy, the transmit voice path is cut for approximately 135 milliseconds. The transmit voice path is cut within five milliseconds of a transmit signaling interface change of state from busy to idle.

3.15 The XMT MINIMUM OPERATE TIMING circuit passes signals equal to or greater than 30 milliseconds, while rejecting signals less than 30 milliseconds. This timing is symmetrical so winks are not distorted. The A option, when placed in position 2, allows the CFMs to be used in tandem links where long cumulative delays can not be tolerated. This option disables the XMT PULSE CORRECTOR and changes the XMT MINIMUM OPERATE TIMING to approximately one millisecond.

3.16 The signal from the XMT MINIMUM OPERATE TIMING circuit is passed to the XMT PULSE CORRECTOR which corrects the make-break ratio to a constant 58 percent break. The output of the XMT PULSE CORRECTOR operates the TONE CONTROL circuit. The TONE CONTROL circuit operates the HIGH LEVEL CONTROL and TONE ON/OFF CONTROL FET. The TONE ON/OFF CONTROL places or removes SF tone from the transmit voice path toward the line. SF tone enters the transmit voice path at a −16dB TLP; the SF tone is at −20dBmO. Therefore, low level SF tone is −36dBm and high level SF tone is −24dBm.

3.17 The HIGH LEVEL CONTROL operates the TONE LEVEL CONTROL FET. The HIGH LEVEL CONTROL closes the TONE LEVEL CONTROL FET in a few milliseconds allowing high level SF tone from the 2600HZ OSCILLATOR to pass. The HIGH LEVEL CONTROL opens the TONE LEVEL CONTROL FET approximately 550 milliseconds after the transmit signaling interface goes idle. This action allows dialing information to be transmitted as high level SF tone. It also transmits 550 milliseconds of high level SF tone upon disconnect.

Power Supply

3.18 The POWER SUPPLY derives the necessary voltages to operate the CFMs from a −48Vdc (nominal) source and power return ground applied at pins 35 and 17.

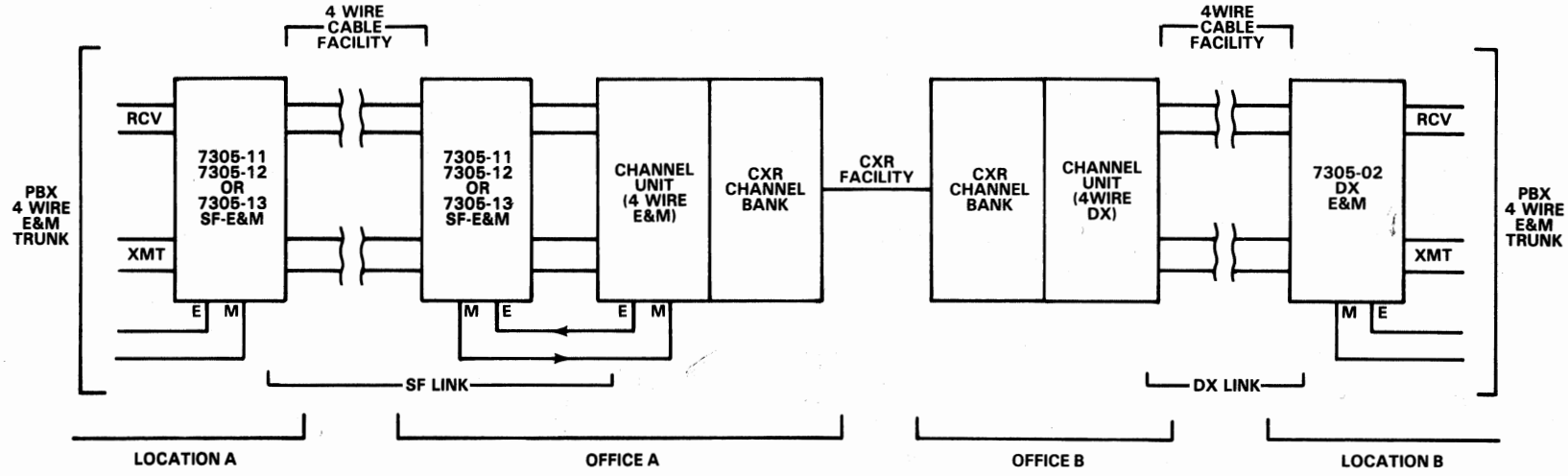


Figure 5. Typical Application — 7305-11/12/13

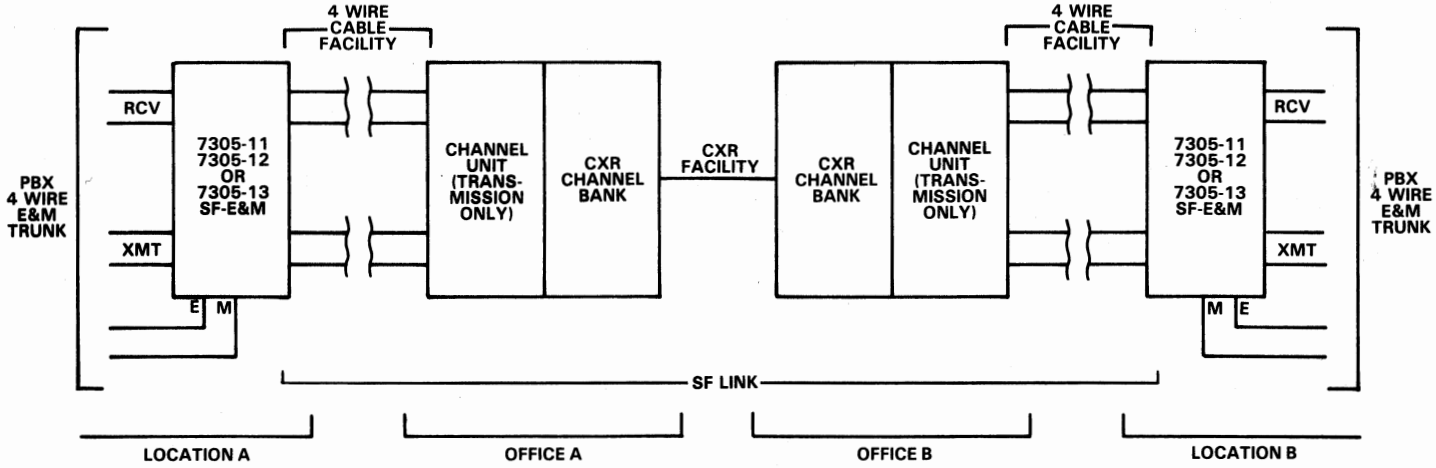


Figure 6. Typical Application — 7305-11/12/13

2713Hz Tone Activated Loopback Operation (7305-12/13 Only)

3.19 The 7305-12/13 provides tone-operated loopback toward the 4-wire facility. A continuous loopback control signal within the 44Hz bandwidth centered at 2713Hz for a minimum of 1.8 seconds applied to the RCV LINE will satisfy the first condition for loopback operation. Upon removal of the 2713Hz tone, the final condition is satisfied, resulting in the illumination of the front panel mounted LB LED. The LB RELAY performs the following function while operated.

(a) Loops all voice-band signals from the RCV STA to the XMT STA at equal level loopback levels of up to 7.5dB of gain in 0.5dB increments or 23dB of attenuation.

(b) Signaling loopback of the E&M leads is also accomplished.

(c) During loopback, no transmission to or from the terminal equipment can occur; also, the E&M leads are opened to the terminal equipment.

3.20 Loopback release is accomplished by the reapplication of 2713Hz tone energy to 7305-12/13. After 2713Hz tone energy has been received for approximately 0.9 seconds, the LB RELAY releases, and the LB LED extinguishes, ending the loopback condition. This arrangement ensures that any 2713Hz release tone, that is looped through the 7305-12/13 and retransmitted, will be so short an interval that it will not cause the erroneous loopback of any similar modules on the same line.

4. INSPECTION

4.01 Inspect the equipment thoroughly as soon as possible after 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 the issue number along with the model number when making inquiries about the equipment.

5. MOUNTING

5.01 The 7305-11, 12, and 13 are 400-type plug-in Combined Function Modules (CFMs) designed to mount in TL40XX Mounting Assemblies. They can also be mounted in one position of unwired Type 400 Mounting Assemblies, prewired FST-400 Mounting Assemblies, or in the transmission position of 72 Family Mounting Assemblies.

CAUTION

Removal and installation 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 edges and connector to verify proper alignment and the absence of foreign material.

6. INSTALLER CONNECTIONS

6.01 When the CFMs are installed in a 400-type mounting assembly, it makes electrical connections to associated equipment through a 56-pin, wire-wrapped, card-edge connector, provided as part of the mounting assembly. All installer connections are made to this connector in accordance with Table 1.

7. OPTIONS

7.01 The CFMs are equipped with push-on jumper, DIP switches, slide switches and screw options that are used to condition the module for proper application and opera-

Table 1. 7305-11/12/13 Installer Connections

LEAD DESIGNATION		PIN
T	XMT LINE	41
R	XMT LINE	47
T	XMT STA	55
R	XMT STA	49
T1	RCV LINE	7
R1	RCV LINE	13
T1	RCV STA	5
R1	RCV STA	15
E	E&M Signaling Leads	23, 39
SG	E&M Signaling Leads	19, 37
M	E&M Signaling Leads	21, 36
SB	E&M Signaling Leads	1, 34
−48V		35
GRD		17

Table 2. 4-Wire Line Impedance Selection

4-WIRE CABLE	IMPEDANCE SELECTION OHMS S1 & S2 POSITION
Nonloaded	600
H88 Loaded	1200
Mixed Loaded And Nonloaded	600 if distance between 7305-11/12/13 and first load coil is greater than 9kft.
	1200 if distance between 7305-11/12/13 and first load coil is less than 9kft.

tion. Refer to Figure 7 for the locations of these options while reading the following optioning instructions.

NOTE

When opening a screw option, rotate the screw counterclockwise two full turns to ensure that the connection is open. When closing a screw option, rotate the screw clockwise until it seats.

Slide Switches Option S1 And S2 (RCV Z And XMT Z)

7.02 The RCV Z (S1) and XMT Z (S2) switches are used to select 600 or 1200 ohms for line-side impedance matching. Option per Table 2.

Switches S3 And S4 (SIG/TRK)
Switch Option S5 (TYPE I/III Or TYPE II)

7.03 Condition the 7305-11/12/13 for signaling/trunk and Type I/Type III or Type II operation according to Table 3. The 7305-11/12/13 E&M leads appear as signaling E&M leads when switches S3 and S4 are in the SIG position. Place switches S3 and S4 in the TRK position to make the E&M leads appear as trunk E&M leads. Place switch S5 in the Type I position for conventional (nonlooped) E&M operation. Place switch S5 in Type II for (looped) E&M operation.

Push-on Jumper Option A (XMT Pulse Corrector)

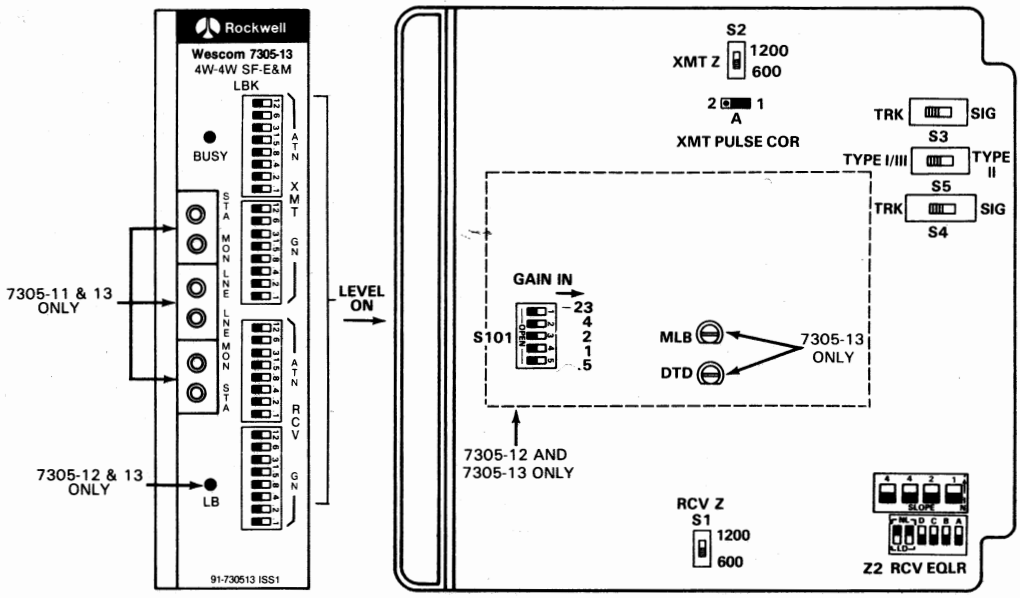
7.04 When A option is placed in position 1 it enables the XMT PULSE CORRECTOR and gives a symmetrical operate and release delay of 30 milliseconds. When placed in position 2 it disables the XMT PULSE CORRECTOR.

Screw Option DTD For 7305-13 Only (Tone Loopback Disable)

7.05 Screw option DTD is provided to allow disabling of tone-operated loopback. Close screw option DTD to disable tone-operated loopback. Open screw option DTD if tone-operated loopback is desired.

Screw Option MLB For 7305-13 Only (Manual Loopback)

7.06 Screw option MLB provides a means of manually activating loopback. Close screw option MLB to manually activate loopback. To deactivate the loopback condition, open screw option MLB.



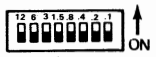
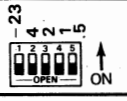
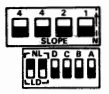
OPTION	OPTION FUNCTION	OPTION SWITCH	OPTION POSITION
4-Wire Line Impedance See Table 2	4-Wire Cable: Nonloaded	S1 And S2	600
	H-88 Loaded	S1 And S2	1200
	4-Wire Cable, Mix Loaded And Nonloaded. Cable Length: >9K Feet	S1 And S2	600
	<9K Feet	S1 And S2	1200
E&M Signaling	Trunk	S3 And S4	TRK
	Signaling	S3 And S4	SIG
Type I/III E&M Non-Looped See Table 3	Trunk TL31M Or TC31M	S3 And S4	TRK
		S5	TYPE 1
	Signaling TL31E Or TC31E	S3 And S4	SIG
		S5	TYPE 1
Type II E&M Looped See Table 3	Trunk TL32M Or TC32M	S3 And S4	TRK
		S5	TYPE II
	Signaling TL32E Or TC32E	S3 And S4	SIG
		S5	TYPE II
Transmit Pulse Correction	Enable Pulse Corrector Circuit	A	Position 1
	Disable Pulse Corrector Circuit	A	Position 2
Tone Operated Loopback	Conditions The 7305-13 For Tone Operated Loopback	DTD	OPEN
	Prevents Tone Operated Loopback On 7305-13	DTD	CLOSED
Manual Loopback Mode	Manually Condition The 7305-13 For Loopback Mode	MLB	CLOSED
	Removes The 7305-13 From The Loopback Mode	MLB	OPEN
Receive And Transmit Path Gain	Receive Path Gain Adjustment Of 0.1dB Increments Up to +24dB	Front Panel RCV GN	 ON See Table 9
	Transmit Path Gain Adjustment Of 0.1dB Increments Up To +24dB	Front Panel XMT GN	
Receive And Transmit Path Attenuation	Receive Path Attenuation Of 0.1dB Increments Up To −24dB	Front Panel RCV ATN	
	Transmit Path Attenuation Of 0.1dB Increments Up To −24dB	Front Panel XMT ATN	
Equal Level Loopback Adjustment	Provides Up To 7.5dB Of Gain In 0.5dB Increments Or −23dB Of Attenuation	S-101 See Table 4	 ON
H-88 Loaded And Mixed Loaded And Nonloaded Receive Path Equalization	Slope Equalization Up To 11dB In 0.1dB Increments	Z2 4, 4, 2, 1 SLOPE	 See Tables 5 And 6
	For Nonloaded Cable	NL	
	For Loaded Cable	LD	
	Low Frequency Roll Off For Use With Loaded Cable	A, B, C, D	

Figure 7. 7305-11/12/13 Option Locations

Table 3. SIG/TRK And Type I/Type II/Type III Conditioning With FCC Facility Code Cross References*

			SWITCH POSITION	
FCC CODE	INTERFACE	MODE	S3 AND S4	S5
TL31M OR TC31M	TYPE I (NON-LOOPED)	SIGNALING	SIG	TYPE I
TL31E OR TC31E	TYPE I (NON-LOOPED)	TRUNK	TRK	TYPE I
TL32M OR TC32M	TYPE II (LOOPED)	SIGNALING	SIG	TYPE II
TL32E OR TC32E	TYPE II (LOOPED)	TRUNK	TRK	TYPE II

*NOTE: For Type III operation, place switch S5 in Type I position.

Front Panel RCV And XMT LEVEL And GN/ATN Switches (Transmission Level Adjustment)

7.07 The RCV GN, ATN DIP switches and the XMT GN, ATN DIP switches are used to provide up to 24dB of prescription gain or attenuation in 0.1dB increments. See Part 8 for alignment of the receive and transmit voice paths.

DIP Switch Option S101, For 7305-12 And 7305-13 Only (Equal Level Loopback Adjustment)

7.08 The equal level loopback DIP switches S101-1 through S101-5 located on the loopback subassembly provide up to 7.5dB of prescription gain in 0.5dB increments or 23dB of attenuation. Condition the equal level loopback according to Table 4 and the following:

(a) Determine the XMT STA and RCV STA transmission level points TLPs from the Circuit Layout Record (CLR). The required equal level loopback gain setting equals the XMT STA TLP minus the RCV STA TLP.

(b) Program the required gain by setting the respective equal level loopback switches (S101-1 through S101-5) to the calculated gain.

Example:

(1) XMT STA TLP: −16dB

(2) RCV STA TLP: +7dB

(3) Equal level loopback gain: (−16dB) − (+7dB) = −23dB

(4) Close (gain on) equal level loopback switch S101-1 (−23). All other switches must be in the open (off) position.

RCV Equalizer Switches Z2 (Receive Equalization Adjustment)

7.09 The receive (post) equalizer switches on Z2 are used to provide prescription settable receive equalization. The equalizer pivots around 1000Hz so no readjustment of gain settings is required. Condition the receive equalizer according to Tables 5 and 6, and the following:

(a) From the Circuit Layout Record (CLR) determine the cable makeup: nonloaded, H88 loaded, or combinations of nonloaded and loaded.

Nonloaded Cable Equalization

7.10 Determine the 2800Hz loss of the cable facility with respect to the 1000Hz loss (loss should be expressed as a positive

Table 4. Equal Level Loopback Gain Settings

SWITCH S101-X CLOSED (ON)					GAIN dB
S101-1 (-23)	S101-2 (4)	S101-3 (2)	S101-4 (1)	S101-5 (.5)	
				X	.5
			X		1
			X	X	1.5
		X			2
		X		X	2.5
		X	X		3
		X	X	X	3.5
	X				4
	X			X	4.5
	X		X		5
	X		X	X	5.5
	X	X			6
	X	X		X	6.5
	X	X	X		7
	X	X	X	X	7.5
X					-23

number). The required receive slope equalization equals: 2800Hz loss relative to 1000Hz loss.

7.11 Program the required equalization by setting the respective SLOPE DIP switches on Z2 equal to the computed equalization ±0.5dB. Place the two NL-LD DIP switches on Z2 in the NL (nonloaded) position. Refer to Table 5 Nonloaded Cable Equalization.

Example

(1) Nonloaded cable: 19AWG, 30kft

Table 5. Nonloaded Cable Equalization

NONLOADED CABLE "SLOPE" EQUALIZER SWITCHES IN (X) NL-LD TO NL POSITION				2800Hz LOSS dB*
4	4	2	1	
				0
			X	1
		X		2
		X	X	3
	X			4
	X		X	5
	X	X		6
	X	X	X	7
X	X			8
X	X		X	9
X	X	X		10
X	X	X	X	11

*Referenced to 1000Hz loss.

(2) 2800Hz cable facility loss: 13.1dB

(3) 1000Hz cable facility loss: 6.1dB

(4) 2800Hz loss relative to 1000Hz loss: (+13.1dB) − (+6.1dB) = 7dB

(5) Set slope equalization DIP switches 4, 2 and 1 on Z2 to the IN position, place the two NL-LD switches in the NL position, all other equalizer switches on Z1 must be out.

H88 Loaded And Mixed Loaded And Nonloaded Cable Equalization

7.12 Determine the 2800Hz loss and 400Hz loss of the cable facility with respect to the loss at 1000Hz (loss should be expressed

Table 6. H88 Loaded And Mixed Loaded And Nonloaded Cable Equalization

SWITCHES IN (X) NL-LD TO LD POSITION								400Hz LOSS dB*	2800Hz LOSS dB*
4	4	2	1	D	C	B	A		
								+ .5	−1.4
			X					0	− .3
							X	− .6	−1.2
		X						− .6	+ .6
			X				X	−1.1	− .1
		X	X					−1.1	+1.7
						X		−1.6	− .8
		X					X	−1.6	+ .9
	X							−1.6	+2.5
			X			X		−2.2	+ .3
		X	X				X	−2.2	+2.0
	X		X					−2.2	+3.6
					X			−2.7	− .4
		X				X		−2.7	+1.2
	X						X	−2.7	+2.8
	X	X						−2.7	+4.6
			X		X			−3.2	+ .8
		X	X			X		−3.2	+2.3
	X		X				X	−3.2	+3.9
	X	X	X					−3.2	+5.6
				X				−3.7	+ .3
		X			X			−3.7	+1.7
	X					X		−3.7	+3.1
	X	X					X	−3.7	+4.8
X	X							−3.7	+6.5
			X	X				−4.3	+1.4
		X	X		X			−4.3	+2.8
	X		X			X		−4.3	+4.2

SWITCHES IN (X) NL-LD TO LD POSITION								400Hz LOSS dB*	2800Hz LOSS dB*
4	4	2	1	D	C	B	A		
	X	X	X				X	−4.3	+5.9
X	X		X					−4.3	+7.6
		X		X				−4.8	+2.4
	X				X			−4.8	+3.6
	X	X				X		−4.8	+5.1
X	X						X	−4.8	+6.8
X	X	X						−4.8	+8.5
		X	X	X				−5.3	+3.5
	X		X		X			−5.3	+4.7
	X	X	X			X		−5.3	+6.2
X	X		X				X	−5.3	+7.9
X	X	X	X					−5.3	+9.6
	X			X				−5.9	+4.3
	X	X			X			−5.9	+5.6
X	X					X		−5.9	+7.1
X	X	X					X	−5.9	+8.8
	X		X	X				−6.5	+5.4
	X	X	X		X			−6.5	+6.7
X	X		X			X		−6.5	+8.2
X	X	X	X				X	−6.5	+9.9
	X	X		X				−7.0	+6.3
X	X				X			−7.0	+7.6
X	X	X				X		−7.0	+9.1
	X	X	X	X				−7.5	+7.4

NOTE

The two NL/LD sections of the associated low freq switch should be switched to LD. All unused sections of BOTH the slope AND the low freq switch should be switched OUT.

*Referenced to 1000Hz loss.

as a positive number). The required receive equalization equals the 2800Hz loss relative to the 1000Hz loss and the 400Hz loss relative to the 1000Hz loss.

7.13 Using the 2800Hz and 400Hz loss figures calculated above and Table 6, H88 Loaded And Mixed Loaded And Nonloaded Cable Equalization, locate the row that most accurately approximates the required equalization. Program the receive equalizer by setting the indicated (X) equalizer DIP switches on Z2 IN. Place the two NL-LD switches on Z2 in the LD (loaded) position.

Example

(1) H88 loaded cable: 26 AWG, 30kft

(2) 400Hz cable facility loss: 7.86dB

(3) 2800Hz cable facility loss: 11.26dB

(4) 1000Hz cable facility loss: 10.03dB

(5) 400Hz loss relative to 1000Hz loss: (+7.86dB) − (+10.03dB) = −2.17dB

(6) 2800Hz loss relative to 1000Hz loss: (+11.26dB) − (+10.03dB) = 1.23dB

(7) From Table 6 set the 1 and B DIP switches on Z2 IN, place the two NL-LD switches on Z2 to the LD position, all other equalizer switches on Z2 must be out.

NOTE

When no equalization is required or a flat frequency response of the receive amplifier is desired, place the two NL-LD DIP switches on Z2 in the NL (nonloaded) position. All other equalizer DIP switches on Z2 must be out.

8. ALIGNMENT

8.01 The CFMs contain gain controls which must be adjusted to set the transmit line and receive station TLPs (transmission level points). They also contain controls for receive (post) amplitude equalization. The alignment procedure for the 7305-11/12/13 is provided in Tables 7 and 8. Table 7 provides the alignment procedure for the receive voice path. Also, refer to Paragraph 7.07 Receive Level Adjustment and 7.09 Receive Equalization Adjustment. Table 8 provides the alignment procedure for the transmit voice path. Also, refer to Paragraph 7.07 Transmission Level Adjustment. Be certain that all options have been properly conditioned for the application in accordance with Part 7 OPTIONS before beginning the alignment procedure.

NOTE

Only the 7305-11 and the 7305-13 contain test jacks.

8.02 The following test equipment is required to properly align the 7305-11/12/13.

(a) Transmission Measuring Set (TMS): WESTERN ELECTRIC 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 7305-11/13 only.

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 (7305-11/13 only).

9. TESTING

Remote Verification (7305-12/13 Only)

9.01 If trouble is encountered with the operation of the 7305-12/13 verify that all installer connections have been made in accordance with Part 6 INSTALLER CONNECTIONS, that all options have been arranged as required in Part 7 OPTIONS, and that the alignment procedure in Part 8 ALIGNMENT have been properly performed. Make certain that the module is making good connection with the mounting assembly card-edge connector; remove and re-insert the module. If trouble persists, refer to Paragraphs 9.02 through 9.04, and Table 3, to test signal/trunk operation of the 7305-12/13.

Table 7. RCV Alignment Procedure

STEP	INSTRUCTION
1	**RCV Facility Verification** Arrange the TMS for terminated measurement at the impedance specified on the CLR. Connect the TMS to the RCV MON jack on the front panel of the 7305-11/13. Insert an open bantam plug into the RCV LINE jack on the 7305-11/13 to disconnect the repeater 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.
3	Record the level measured on the TMS. If the recorded level is not at the level specified on the CLR, locate and repair the facility fault before proceeding.
4	If equalization is required, request the distant terminal to send a 2800Hz test tone and then a 400Hz test tone at the required level and impedance specified on the CLR. Record the levels measured on the TMS.
5	**RCV Gain Adjustment** Calculate the required RCV gain by subtracting the 1000Hz level recorded in Step 3, from +7dB, SF Receiver TLP. Set the RCV ATN switches to off (located on the front panel).
6	Program the required RCV gain by setting the RCV GN switches (located on front panel) equal to the gain calculated in Step 5 ±0.05dB. See Table 9.
7	If no equalization is required ensure that the two NL-LD switches on Z2 receive EQUALIZER are in the NL (NONLOADED) position and that all other equalizer switches on Z2 are in the out position (off). Proceed to Step 12.
8	**Nonloaded Cable Equalization** Calculate the required slope equalization by subtracting the 2800Hz level recorded in Step 4 from the 1000Hz level recorded in Step 3.
9	Program the required slope equalization by setting the receive EQUALIZER slope switches on Z2 equal to the calculated slope equalization in Step 8 ±0.5dB. Place the two NL-LD switches on Z2 to the NL (NONLOADED) position. Refer to Table 5, Nonloaded Cable Equalization.
10	**H88 Loaded And Mixed Loaded And Nonloaded Cable Equalization** Calculate the required equalization by subtracting the 2800Hz level recorded in Step 4 from the 1000Hz level recorded in Step 3. Also, subtract the 400Hz level recorded in Step 4 from the 1000Hz level recorded in Step 3.
11	Using the 2800Hz and 400Hz loss figures calculated in Step 10 and Table 6, H88 Loaded And Mixed Loaded And Nonloaded Cable Equalization, locate the row that most accurately approximates the required equalization. Program the receive EQUALIZER by setting the indicated (X) equalizer switches on Z2 IN. Place the two NL-LD switches on Z2 in the LD (loaded) position.
12	**RCV Attenuator Adjustment** Calculate the RCV attenuator setting by subtracting the receive station equipment level, specified on the CLR from the +7 TLP.

TABLE CONTINUED ON NEXT PAGE

Table 7. RCV Alignment Procedure (Cont.)

STEP	INSTRUCTION
13	Program the required RCV attenuation by setting the RCV ATN switches (located on the front panel) to equal the attenuation calculated in Step 12. See Table 9.
14	Remove all test cords.
15	**Receive Station Equipment Verification** Arrange the TMS for 600-ohm terminated measurement. Connect the TMS to the RCV STA jack on the front panel of the 7305-11/13.
16	Request the distant terminal to send a 1000Hz, a 2800Hz, and then a 400Hz test tone at the required level and impedance specified on the CLR.
17	Verify that the levels measured on the TMS are those specified on the CLR.
18	Remove all test cords and perform the Transmit Alignment Procedure.

Table 8. 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. Connect the VFO to the XMT STA jack on the front panel of the 7305-11/13.
2	Arrange the TMS for terminated measurement at the impedance specified on the CLR. Connect the TMS to the XMT LNE jack on the 7305-11/13.
3	**XMT Attenuation Adjustment** Calculate the required XMT attenuation setting by subtracting −16 from the XMT STA equipment level specified on the CLR card. Set the XMT GN switches to off (located on the front panel).
4	Program the required XMT attenuation by setting the XMT ATN switches (located on the front panel) to equal the attenuation calculated in Step 3. See Table 9.
5	**XMT Gain Adjustment** Calculate the required XMT gain setting by subtracting −16 from the XMT level specified on the CLR.
6	Program the required XMT gain by setting the XMT GN switches (located on front panel) equal to the gain calculated in Step 5 ±0.05dB. See Table 9.
7	With 2600Hz tone applied to the RCV LINE and a busy indicator applied to the E Lead (with options S3 and S4 in the TRK position) or M Lead (with options S3 and S4 in the SIG position), check that the TMS indicates level specified on the CLR card ±0.05dB.
8	Remove the TMS from the XMT LINE jack on the 7305-11/13 and request the distant terminal to measure the 1000Hz test tone.
9	Distant terminal verifies proper level as specified on CLR.
10	This completes the Transmit Path Alignment Procedure. Remove all test connections.

Table 9. Transmit Or Receive Level Adjustment (Front Panel DIPs)

XMT OR RCV LEVEL	XMT OR RCV GAIN (dB)	
SWITCH ON	GN	ATN
12	+12	−12
6	+ 6	− 6
3	+ 3	− 3
1.5	+1.5	−1.5
.8	+ .8	− .8
.4	+ .4	− .4
.2	+ .2	− .2
.1	+ .1	− .1

NOTE
Switch settings are additive up to ±24dB.

9.02 The following test equipment is required for testing the signal/trunk operation of the 7305-12/13.

(a) WILCOM T222 Pulsing Test set or equivalent.

(b) Variable frequency oscillator HEWLETT-PACKARD 204 or equivalent.

(c) AC voltmeter HEWLETT-PACKARD 400FL or equivalent.

(d) Miscellaneous test cords and plugs.

9.03 Remove tone from the receive line. Apply 2713Hz at 0dBm to the receive line for 2 seconds and then remove the 2713Hz tone. This will cause the loopback circuit to activate.

9.04 To test transmission levels, apply 1000Hz at the proper TLP on the receive line. Verify that the level on the transmit line is the proper TLP.

9.05 To test the pulse correction of the transmit channel, pulse the receive line with 2600Hz at 10 pulses per second and 50 percent break. Verify that the transmit line is pulsing 2600Hz at 10pps at 58 ±4 percent break.

9.06 To test receive threshold, apply −38dBmO increase level until XMT line tone jumps to a −8dBmO. This should happen when the receive line level is −31 ±2.5dBmO. The transmit line level should jump to −8dBmO for approximately 525 ±25 milliseconds and then drop to −20dBmO.

9.07 To return circuit to normal operation, apply 2713Hz at 0dBm for 2 seconds. This deactivates the loopback and returns the 7305-12/13 to normal operation.

Local Verification (7305-11/13 Only)

9.08 Receive Test Procedure Steps.

1. Connect oscillator set for 1kHz at the RCV TLP, obtained in Table 7 Step 3, to the RCV LINE jack.

2. Connect AC voltmeter terminated with 600 ohms to the RCV STA jack.

3. Verify the proper station equipment level as read on the AC voltmeter.

4. Adjust oscillator to 2600Hz output if equalizer is in, reduce 2600Hz oscillator level by the amount of equalization.

5. Verify that the front panel BUSY LED is off, and the AC voltmeter reads −50dBmO or less.

6. Remove plugs from RCV STA jack and the RCV LINE jack.

9.09 Transmit Test Procedure Steps.

1. Request distant end to transmit 2600Hz idle tone.

2. Place −48V on M Lead (if 7305-11/13 is conditioned for Signaling mode) or place a ground on the E Lead (if 7305-11/13 is conditioned for TRK Mode).

3. Connect oscillator set for 1000Hz at the transmit station equipment TLP to the XMT STA jack.

4. Connect AC voltmeter terminated with 600 ohms to the XMT LINE jack.

5. Verify the proper transmit line level.

6. Disconnect oscillator from the XMT STA jack, and remove busy from the E or M lead.

7. AC voltmeter will read −8dBmO for approximately 500 milliseconds after E or M lead busy is removed and then drop to low level tone, −20dBmO.

8. Remove all test cords and place circuit in service.

9.10 If technical assistance is required, contact 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

10. REPAIR AND REPLACEMENT

10.01 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 or TWX, for instructions regarding replacement or repair.

10.02 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.
Georgetown, Ontario
L7G 4X4

10.03 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 7305-11/12/13 are as follows:

Electrical

(a) POWER REQUIREMENTS:

Voltage	Idle Current*	Busy Current*	Loopback Activated Current (7305-12/13 Only)
−44V	62mA	84mA	121mA
−48V	63mA	86mA	124mA
−56V	67mA	91mA	134mA

*Add 20mA for 7305-12/13.
M-Lead current in Signaling Mode not included.

(b) 4-WIRE STATION IMPEDANCES: 600 ohms.

(c) 4-WIRE LINE IMPEDANCES: Switch selectable, 600 or 1200 ohms.

(d) RETURN LOSS: Station equipment ERL, greater than 20dB; line side ERL, greater than 20dB.

(e) TRANSMIT AND RECEIVE GAIN: 0 to 24dB, in 0.1dB increments adjustable from the front panel.

(f) TRANSMIT AND RECEIVE ATTENUATION: 0 to 24dB, in 0.1dB increments adjustable from the front panel.

(g) SLOPE EQUALIZATION: Gain differential between 1000 and 2800Hz is 11dB in 1dB increments prescription adjustable from the printed circuit board.

(h) LOW FREQUENCY EQUALIZATION: Gain differential between 400 and 1000Hz is from +1dB to −3dB in 1dB increments prescription adjustable from the printed circuit board.

(i) FREQUENCY RESPONSE: ±1dB from 300 to 3400Hz, relative to 1000Hz.

(j) MAXIMUM INPUT: +8dBm.

(k) MAXIMUM OUTPUT: +8dBm.

(l) HARMONIC DISTORTION: Less than 1 percent.

(m) MAXIMUM IDLE NOISE: Less than 20dBrnC at maximum gain.

(n) EQUAL LEVEL CHANNEL CROSSTALK COUPLING: Greater than 60dB at 1kHz.

(o) LONGITUDINAL BALANCE (LINE SIDE): Greater than 60dB.

(p) SIGNALING FREQUENCY: 2600Hz.

(q) SIGNALING TONE DETECTION BANDWIDTH: ±35Hz nominal at −1.0dBm.

(r) SIGNALING TONE THRESHOLD: −24 ±2.5dBm.

(s) RECEIVER SIGNAL-TO-GUARD RATIO: 10dB (nominal).

(t) RECEIVE PATH FILTER TIMINGS: Insertion 10 ±7msec; removal 55msec, 150msec during pulsing.

(u) RECEIVE PATH FILTER INSERTION LOSS CHARACTERISTICS: 45dB minimum, 55dB typical at 2600Hz; 35dB minimum at 2600 ±15Hz; 9dB maximum at 2600 ±200Hz.

(v) TRANSMITTER SIGNALING FREQUENCY: 2600 ±2Hz.

(w) TRANSMITTER SIGNAL TONE CHARACTERISTICS: High level −24 ±1.5dBm for 525 ±25msec, low level −36 ±1.5dBm.

(x) RECEIVER GUARD CIRCUIT ENABLE/DISABLE TIME: Enable, 65 ±25msec; disable, 235 ±60msec.

(y) RECEIVE MINIMUM OPERATE TIMING: Unit will ignore any SF tone of 30msec or less, and will recognize any SF tone of 34msec or more.

(z) RECEIVER CARRIER FADE BRIDGING: Unit will bridge carrier fades of up to 40msec, providing tone was present for at least 225msec.

(aa) RECEIVE PULSE CORRECTION AND LIMITS:

Speed (PPS)	Percent Break Input	Percent Break Output
8	30	58 ±4
8	80	58 ±4
10	35	58 ±4
10	80	58 ±4
13	50	58 ±4
13	80	58 ±4

(bb) TRANSMIT PULSE CORRECTION AND LIMITS:

Speed (PPS)	Percent Break Input	Percent Break Output
8	30	58 ±4
8	80	58 ±4
10	35	58 ±4
10	80	58 ±4
13	50	58 ±4
13	80	58 ±4

(cc) OUTPUT CURRENT: E lead (trunk mode), M lead (signaling mode), 30mA nominal, current limited.

LOOPBACK CONTROL TONE REQUIREMENTS (7305-12/13 Only)

(dd) LOOPBACK ACTIVATION: 2713 ±22Hz tone on for a minimum of 1.8 seconds, remove tone.

(ee) LOOPBACK DEACTIVATION: 2713 ±22Hz tone for a minimum of 0.9 seconds.

(ff) LOOPBACK SENSITIVITY: −20dBm as measured at 4-wire receive line of 7305-12.

(gg) EQUAL LEVEL LOOPBACK GAIN: +7.5dB in 0.5dB steps or −23dB, adjusted from subassembly.

Physical

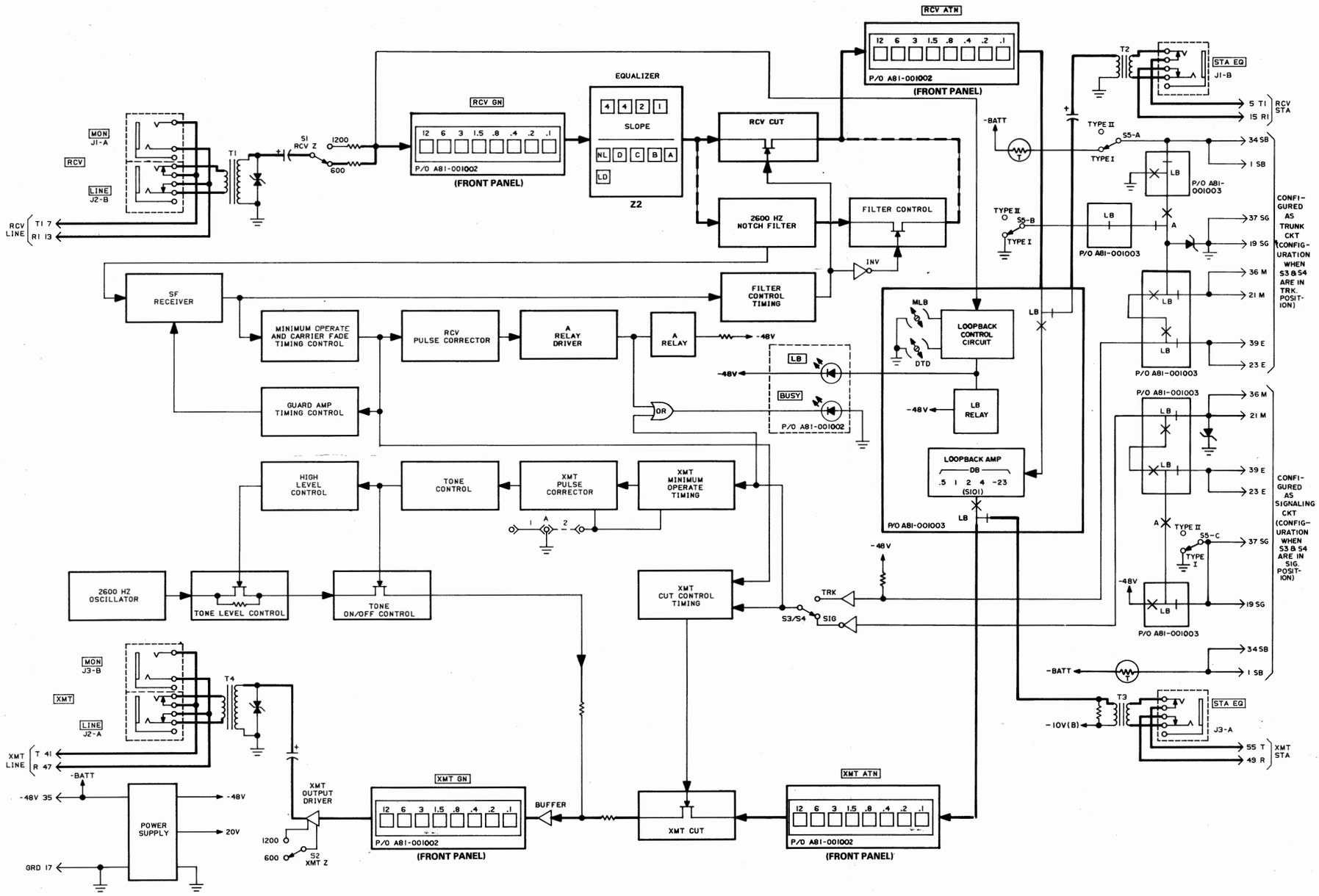
(hh) OPERATING ENVIRONMENT: Temperature, 32° to 120°F (0° to 49°C).

(ii) WEIGHT: 14 oz (392g).

(jj) DIMENSIONS: Height, 5.6 in. (14.2cm); width, 1.4 in. (3.5cm); depth, 6.0 in. (15.2cm).

(kk) MOUNTING: TL40XX, FST-400, transmission position of 72 Family Mounting Assemblies or unwired Type 400 Mounting Assemblies.

A



NOTES:

1. UNLESS OTHERWISE SPECIFIED: CAPACITORS ARE IN MICROFARADS.
2. ← PC BOARD CONNECTOR PIN.
3. [XXX] FRONT PANEL MARKING.
4. —— PRIMARY TRANSMISSION PATH.
5. SIGNAL FLOW DIRECTION.
6. CLOSED, OPEN SCREW OPTION.
7. NORMALLY OPEN, NORMALLY CLOSED RELAY CONTACTS.
8. TRANSMISSION OPTIONING INSTRUCTIONS:
   A. 4-WIRE STATION IMPEDANCE FIXED AT 600 OHMS.
   B. 4-WIRE LINE IMPEDANCE SELECTION

4-WIRE CABLE	IMPEDANCE SELECTION (OHMS) S1 & S2 SWITCH POSITION
NON-LOADED	600
H88-LOADED	1200
MIX LOADED AND NON-LOADED	600 IF DISTANCE BETWEEN REPEATER AND FIRST LOAD COIL IS GREATER THAN 9K FT
	1200 IF DISTANCE BETWEEN REPEATER AND FIRST LOAD COIL IS LESS THAN 9K FT.

   C.

GAIN AND EQUALIZATION SWITCH TABLE		
GN	SWITCHES ARE FRONT PANEL MOUNTED. THE RANGE IS 0 TO +24 DB, IN 1DB INCREMENTS.	
ATN	SWITCHES ARE FRONT PANEL MOUNTED. THE RANGE IS 0 TO −24 DB, IN 1DB INCREMENTS.	
SLOPE	RCV EQUALIZATION FOR LOADED AND NON-LOADED CABLE	SLOPE EQUALIZATION FROM 0DB TO 11DB IN 1DB INCREMENTS,
A-B-C-D		LOW FREQ. ROLL OFF FOR USE WITH LOADED CABLE.
NL-LD		FOR LOADED OR NON LOADED CABLE

9. A81-001003 LOOPBACK SUBASSEMBLY:

LOOPBACK SWITCH TABLE		
DESIG	LOCATED ON A81-001003 SUB-ASSEMBLY	FUNCTION
EQUAL LVL LOOPBACK CONTROL. (S101)		PROVIDES UP TO 7.5 DB OF GAIN IN .5DB INCREMENTS OR 23DB OF ATTENUATION.
MLB		CLOSING OPTION MANUALLY CAUSES UNIT TO LOOPBACK.
DTD		OPTION CLOSED PREVENTS LOOPBACK.

10. SIGNALING OPTIONS:
    A. OPTION A WHEN IN POSITION 1 PROVIDES TRANSMIT PULSE CORRECTION. WHEN IN POSITION 2 DISABLES XMT PULSE CORRECTOR.
    B.

FACILITY INTERFACE CODE	MODE	SWITCH POSITION S3 & S4	SWITCH POSITION S5
TYPE I (NON-LPD) TL31M OR TC31M	SIGNALING	SIG.	TYPE I
TYPE I (NON-LPD) TL31E OR TC31E	TRUNK	TRK.	TYPE I
TYPE II (LOOPED) TL32M OR TC32M	SIGNALING	SIG.	TYPE II
TYPE II (LOOPED) TL32E OR TC32E	TRUNK	TRK.	TYPE II

11. GANGED SWITCHES ARE INDICATED BY ALPHABETICALLY SUFFIXED REF. DESIG.
12. THIS BLOCK CAN BE USED FOR 7305-11 AND 7305-12 BY REFERRING TO THE PRACTICE FOR FEATURE EXCEPTIONS.

Figure 8. 7305-13 4W-4W SF To E&M LBK (Issue 1) Block Diagram