tellabs
technical manual
76-81263DC
rev A

practice section 81263DC-1/81263DC-2/81263DC-3

263DC Data Station Termination Systems

contents

1. general description

1.01 The Tellabs 263DC-1 (figure 1), 263DC-2, and 263DC-3 Data Station Termination (DST) Systems interface either a 2wire or a 4wire data set with a 4wire transmission facility. All three systems are compact, self-contained units that provide data interface and power rectification/regulation circuitry in an attractive enclosure that can be wall mounted or placed on a desktop. Power for these systems can be provided from battery feed or sealing current derived from the units' simplex leads, or from an external source of either nominal 26Vac or −22 to −56Vdc. All three systems feature prescription gain and loss in the receive channel, prescription loss in the transmit channel, and manual or two-tone loopback. In addition, both the 263DC-2 and 263DC-3 provide prescription active equalization in the receive channel. All three units also include a 20mA sealing current source to provide sealing current for the 4wire facility.

Note: *Throughout the rest of this practice, the term 263DC refers to all three DST systems unless otherwise indicated.*

1.02 In the event that this practice section is reissued, the reason for reissue will be stated in this paragraph.

1.03 The 263DC provides from −24 to +24dB of gain in the receive channel and from 0 to 24dB of loss in the transmit channel. Transmission levels in both channels are prescription-set in 0.1dB increments via DIP switches. The maximum input and output level of each channel is +5dBm. While the 263DC-1 provides no amplitude equalization, the 263DC-2 and 263DC-3 both contain active prescription equalizers in their receive paths. The 263DC-2's equalizer is slope-type, providing up to 7.5dB of gain at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments. The 263DC-3's equalizer is a slope/bump-type equivalent to the Western Electric model 309B.

1.04 Transformers at both facility-side ports (receive output and transmit input) can be switch optioned for balanced 1200-, 600-, or 150-ohm terminating impedance. The 150-ohm option provides approximately 2dB of slope equalization (for the 263DC-2 and 263DC-3, this is in addition to any provided by the receive equalizer) for long sections of nonloaded cable. The facility-side transformers can also be optioned to derive normal simplex leads, to provide an internal source of sealing current to the facility, or to provide a return path for sealing current applied at the far end of the facility. (The 263DC must be powered from an external source when the sealing-current source option is selected.)

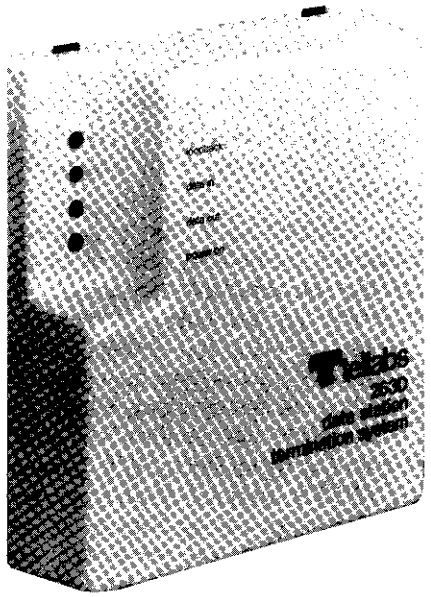


figure 1. 263DC-1 DST System

1.05 On the station side, the 263DC can be optioned to interface either a 2wire or a 4wire modem. In either mode, the station-side port(s) provides capacitively-coupled, balanced, 600-ohm terminating impedance.

1.06 The 263DC provides loopback of the facility for testing and troubleshooting. The loopback function can be activated either remotely by transmission of a 2713Hz tone or locally via a local loopback lead. When activated remotely, the 263DC can be optioned to restore normal operation upon receipt of a second loopback tone or automatically at the end of a 20-minute timeout period (receipt of a second tone before the expiration of this timeout period will also restore normal operation). The 263DC system provides equal-level loopback with switch-selectable gain of 8 or 16dB in the loopback path.

1.07 Other standard features of the 263DC System include two 310-type test jacks and five status-indicating LEDs. The test jacks are opening-type and face the DST system at the receive output

and transmit input ports. Four of the LEDs are visible with the unit's cover in place. A yellow *power on* LED lights when power is applied to the unit. A red *loopback* LED lights when the loopback circuitry is activated. Two other yellow LEDs are labeled *data in* and *data out*; these LEDs light when data is present in the receive and transmit channels, respectively. A fourth yellow LED located on the unit's printed circuit board lights when the internal sealing current source is active and sealing current is flowing. One optional feature is available on the 263DC: a pair of gas-tube lightning protectors for the facility-side ports (Tellabs part number 263D L2).

1.08 The 263DC can be powered remotely (facility-powered) by sealing current or battery feed applied at the far end of the facility, or can be powered locally by an external source of either nominal 26Vac or −22 to −56Vdc. When facility-powered, the 263DC derives its operating voltage from the facility via its simplex leads. The 263DC requires nominal 20mA sealing current or 56Vdc maximum battery feed for facility powered operation. The 263DC's internal sealing current source cannot be used when the system is facility-powered. When powered from an external source, the 263DC requires 18 to 28Vac or −22 to −56Vdc input. The nominal 26Vac can be supplied from a commercial 120Vac, 60Hz outlet through use of a Tellabs 8015 Transformer, which can be ordered at the same time as the 263DC. The 263DC consumes a maximum of 30mA of current under normal operating conditions.

1.09 The 263DC is a self-contained DST system housed in a plastic enclosure with a removable cover. Designed primarily for wall mounting, the 263DC is also equipped with rubber feet for desktop placement. A hole in the bottom of the cover (when wall mounted) allows access to the unit for external connections. Connections to the facility and power source are made at a 17-position screw-terminal strip. Connections to the data station are made to the terminal strip or to a modular phone jack (similar to USOC RJ11C).

1.10 The 263DC can be equipped with two optional gas-tube lightning protectors for the facility-side ports (Tellabs part number 263D L2). When the gas tubes are used, the *PROT GND* pin on *TB1* must be connected to earth ground for proper protection from lightning strikes.

2. application

2.01 The 263DC DST System is used in applications where a data station communicates with other data stations or a central processor unit (CPU) over voice-grade telephone facilities. The unit provides the necessary level coordination and impedance matching to interface the modem portion of either a 4wire or 2wire data set with a 4wire facility. If the data station is provided by the customer, the 263DC acts as an interconnect device, providing end-termination of the telco facility. Loopback circuitry on the 263DC allows either local (ground) activation or remote (two-tone) activation of facility loopback, with switch-selectable loopback-path gain of 8 or 16dB. The 263DC-2 and 263DC-3 versions of the system provide receive-channel equalization. All three versions can supply sealing current to the facility.

2.02 Level coordination between the station and the facility is provided independently in each channel of the 263DC. The receive channel provides up to 24dB of prescription gain or loss in 0.1dB increments, and the transmit channel provides up to 24dB of prescription loss, also in 0.1dB increments. The output levels of the two channels are controlled by the transmit level and receive level DIP switches (S13 and S19, respectively). Adjacent to each DIP switch position is the value, in dB, of that switch position. These values are cumulative; the total amount of gain or loss introduced into a channel is the sum of that channel's DIP-switch positions set to *in*. The maximum input and output level of both channels is +5dBm. These level ranges allow the DST system to easily accommodate the −3 receive TLP (transmission level point) and +13 transmit TLP (assuming a −13dBm 0TLP) required by most modems.

2.03 A *data in* and a *data out* LED on the cover of the system light when data is present in the receive and transmit channels, respectively. The level detectors that drive the LEDs respond to data levels greater than −25dBm.

2.04 Both the 263DC-2 and 263DC-3 provide active prescription post-equalization of the facility in their receive channels. The 263DC-2 uses a slope-type amplitude equalizer to provide up to 7.5dB of equalized gain at 2804Hz (re 1004Hz) in discrete 0.5dB increments. The frequency response of the 263DC-2's receive equalizer is shown graphically in figure 2 and in tabular form in table 1. The 263DC-3's equalizer is functionally equivalent to the Western Electric model 309B Prescription Equalizer. In addition to providing slope-type amplitude equalization, the 263DC-3 provides bump-type equalization with variable height and bandwidth settings. Figures 3 and 4 show the typical response curves for the 263DC-3's equalizer in the slope mode; figure 3 shows the curves for loaded cable and figure 4 shows the curves for non-loaded cable. Table 2 gives the 1004Hz reference levels for figures 3 and 4 for various settings of the slope switch. Figures 5 and 6 show the typical response curves for the 263DC-3's equalizer in the bump mode; figure 5 shows the curves representing various height settings versus a wide bandwidth setting and figure 6 shows the curves representing various height settings versus a narrow bandwidth setting. Table 3 gives the 1004Hz reference levels for figures 5 and 6. The equalization functions of both the 263DC-2 and 263DC-3 are controlled by DIP switches.

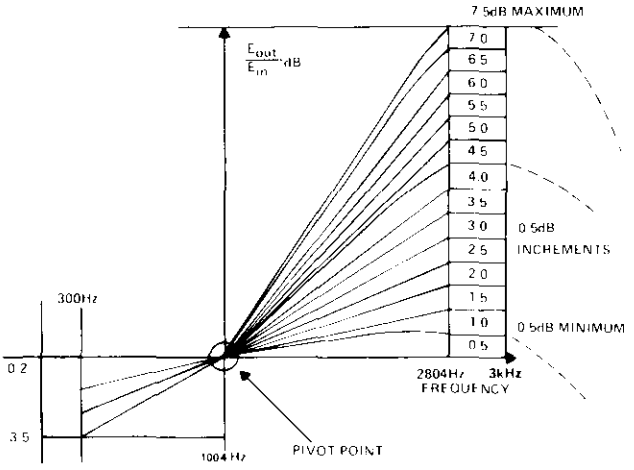


figure 2. Typical response curves for 263DC-2 receive-channel equalizer

receive equalizer switch setting (dB)	equalized gain (in dB) introduced at various frequencies								
	300Hz	400Hz	500Hz	800Hz	1004Hz	1500Hz	1800Hz	2500Hz	2804Hz
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	-0.23	-0.19	-0.15	-0.06	0.0	+0.15	+0.24	+0.43	+0.50
1.0	-0.52	-0.42	-0.33	0.13	0.0	+0.32	+0.52	+0.93	+1.07
1.5	-0.75	-0.60	-0.49	-0.18	0.0	+0.46	+0.74	+1.33	+1.54
2.0	-1.00	-0.80	-0.64	-0.24	0.0	+0.61	+0.98	+1.76	+2.04
2.5	-1.22	-0.98	-0.78	-0.29	0.0	+0.75	+1.20	+2.15	+2.49
3.0	-1.50	-1.20	-0.95	-0.36	0.0	+0.90	+1.45	+2.60	+3.01
3.5	-1.71	-1.37	-1.09	-0.41	0.0	+1.03	+1.65	+2.97	+3.45
4.0	-2.02	-1.63	-1.29	-0.49	0.0	+1.22	+1.95	+3.54	+4.12
4.5	-2.25	-1.79	-1.42	-0.53	0.0	+1.33	+2.14	+3.90	+4.56
5.0	-2.49	-1.98	-1.57	-0.59	0.0	+1.47	+2.36	+4.32	+5.08
5.5	-2.68	-2.14	-1.69	-0.63	0.0	+1.58	+2.53	+4.67	+5.51
6.0	-2.89	-2.30	-1.81	-0.68	0.0	+1.69	+2.72	+5.05	+5.99
6.5	-3.07	-2.44	-1.93	-0.72	0.0	+1.79	+2.87	+5.38	+6.41
7.0	-3.29	-2.61	-2.05	-0.76	0.0	+1.89	+3.05	+5.76	+6.90
7.5	-3.45	-2.74	-2.15	-0.78	0.0	+1.98	+3.19	+6.06	+7.30

table 1. Typical receive-channel slope equalization for 263DC-2

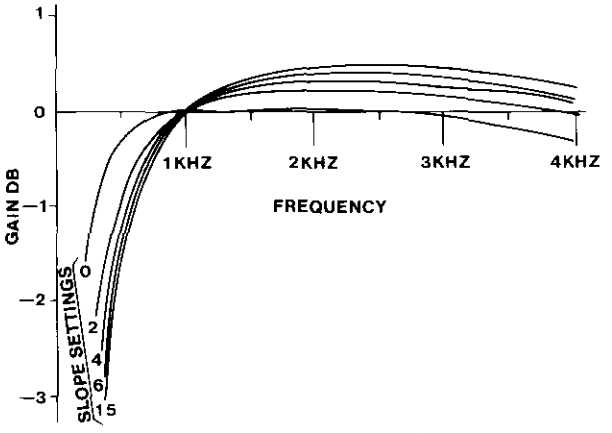


figure 3. Typical response curves for 263DC-3 receive-channel equalizer in slope mode, loaded cable

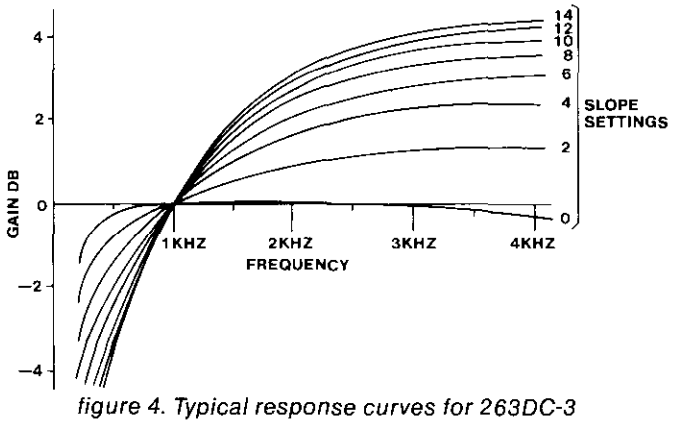


figure 4. Typical response curves for 263DC-3 receive-channel equalizer in slope mode, nonloaded cable

slope switch setting	loaded/nonloaded switch setting	
	NL	L
0 (slope disabled)	0.0	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

table 2. Equalized gain (in dB) at 1004Hz for 263DC-3 equalizer in slope mode

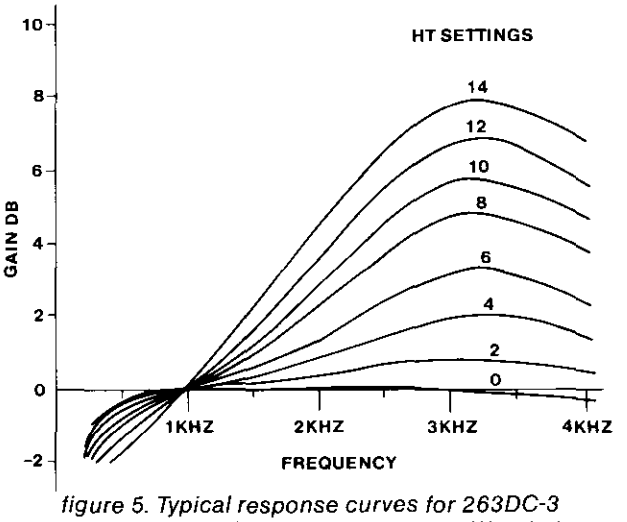


figure 5. Typical response curves for 263DC-3 receive-channel equalizer in bump mode, BW switch = 14

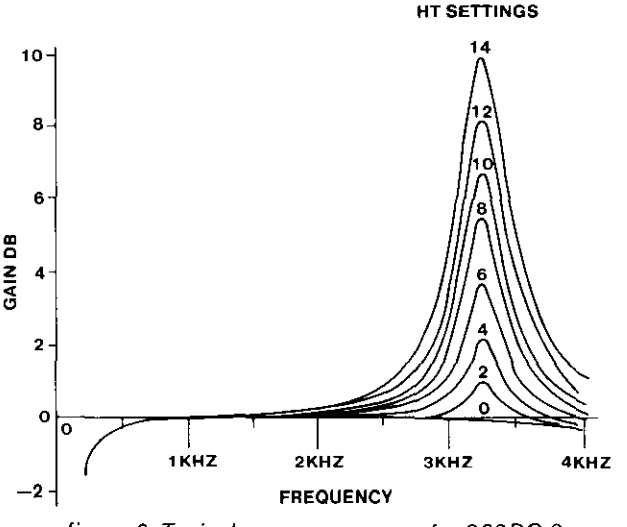


figure 6. Typical response curves for 263DC-3 receive-channel equalizer in bump mode, BW switch = 3

HT switch setting*	BW switch setting**									
	6	7	8	9	10	11	12	13	14	15
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3
4	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4
5	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.5
6	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.7
7	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.5	0.9
8	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.7	1.2
9	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.8	1.5
10	0.0	0.1	0.2	0.2	0.2	0.3	0.4	0.6	1.0	1.7
11	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.7	1.2	2.0
12	0.1	0.1	0.2	0.3	0.3	0.4	0.6	0.9	1.4	2.4
13	0.1	0.2	0.3	0.3	0.4	0.6	0.8	1.1	1.7	2.8
14	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.3	2.0	3.3
15	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.7	2.5	3.9

*HT switch position 0 disables bump function. HT switch position 1 introduces 0.1dB of gain or less at 1kHz.
**BW switch positions 0 through 5 introduce 0.1dB of gain or less at 1kHz for all HT settings.

table 3. Equalized gain at 1004Hz for 263DC-3 equalizer in bump mode

2.05 The transformers at the facility-side ports of the 263DC can be switch-optioned for 1200-ohm terminating impedance to interface loaded cable, for 600 ohms to interface nonloaded cable or carrier, or for 150 ohms to provide approximately 2dB of equalization (in addition to any provided by the 263DC-2's or 263DC-3's receive equalizer) for long sections of nonloaded cable through the deliberate impedance mismatch. Both facility-side transformers on the 263DC are center-tapped to derive balanced simplex leads.

2.06 The station-side ports of the 263DC can be optioned to interface either 4wire or 2wire data sets. In the 2wire mode, an electronic hybrid provides the necessary 4wire to 2wire conversion. Both the 2wire and 4wire ports provide fixed, capacitively-coupled 600-ohm terminating impedances toward the station.

2.07 An option switch on the 263DC selects either internal sealing current, external sealing current, or normal simplex leads. In the *SOURCE* position, the center-tapped leads of the facility-side transformers are connected to a nominal 20mA integral sealing current source. In the *SINK* position, these leads are connected together to provide a dc path for sealing current applied at the far end of the 4wire facility. The *SX* position provides normal simplex-lead derivation. An LED on the 263DC's printed circuit board lights when the internal sealing-current source is active and current is flowing.

2.08 The 263DC DST System can serve as a testing and troubleshooting device through its ability to isolate the facility from the station via loopback. The loopback feature allows the voice-frequency characteristics of the facility to be tested from a remote location (e.g., the serving CO). Loopback also allows the source of trouble to be localized to either the facility or the data station, thus permitting the maintenance responsibility involved in a particular case of trouble to be determined.

2.09 The 263DC's loopback circuitry can be activated either remotely by transmission of nominal 2713Hz loopback tone from the far end of the facility or locally by grounding the system's loopback lead. Loopback will not occur accidentally because of power failure. When loopback is activated, the loopback (*LB*) relay operates, disconnecting the station from the data circuit and looping the receive path back to the transmit path. Additional contacts of the *LB* relay electrically disable the data station via the 263DC's *TEK5* and *TEK6* leads. The *loopback* LED on the system's cover lights to indicate that loopback is activated.

2.10 Remote loopback is accomplished by placing a 2713Hz tone on the receive pair of the 263DC for at least 1.6 seconds and then removing the tone. The 263DC initiates loopback only upon the removal of the tone. This prevents accidental looping of other than the intended loopback point on a multipoint circuit. The threshold of the loopback-tone-detection circuit is −30dBm as measured at the receive input port. The loopback tone detector's center frequency is 2713Hz ±0.2% with a maximum bandwidth of 75Hz. A signal-to-guard ratio of 6dB prevents either raw data signals or harmonics of those signals from initiating loopback, thus allowing the 263DC to operate in circuits where similar units might be prone to false loopback. A switch option allows remote loopback to be deactivated by a second 2713Hz loopback tone of 0.7-second duration or longer (removal of the tone is not necessary to deactivate loopback), or automatically after a 20-minute timeout period.

2.11 Local loopback is initiated by placing a ground on the local loopback lead (*LOC LB* terminal of *TB1*). Loopback is maintained until the ground is removed.

2.12 Equal-level loopback is provided by an amplifier in the 263DC's loopback path. This amplifier can be switch-optioned to insert either 8 or 16dB of gain between the receive channel and the transmit channel when the loopback circuitry is activated. Thus, in a data circuit with either an 8 or 16dB difference between the receive and transmit TLPs, a test signal transmitted from the far end of the facility at the normal data transmission level will be returned at the normal receive level. In data circuits with a TLP differential other than 8 or 16dB, the gain inserted into the loopback path must be considered when making transmission level tests. (Please note that this problem can be avoided by setting the amplifier for 8dB and inserting an additional 8dB of attenuation into the transmit channel via the xmt level switches while testing is in progress.)

2.13 The 263DC can be powered locally from an external source of either nominal 26Vac or −22 to −56Vdc, or it can be powered remotely from dc applied at the far end of the facility and derived from the facility by the 263DC's simplex leads. The power source is selected by a switch option that connects the input of the 263DC's power rectification/regulation circuitry to the *AC* terminals of *TB1* or to the simplex leads. When powered externally, the 263DC requires 18 to 26Vac input at 7.5VA or −22 to −56Vdc input at 15mA minimum. The required ac input can be supplied from a commercial 120Vac, 60Hz grounded outlet by using a Tellabs 8015 Transformer (ordered separately). When powered remotely, i.e., facility-powered, the 263DC requires a minimum of 20mA dc, which can be supplied by a regulated sealing-current source or by direct battery feed to the 4wire loop. To ensure proper operation of the 263DC when it is facility-powered, the loop length between the 263DC and the power source should not exceed 1000 ohms for sealing current or 2000 ohms for battery feed. Also, when powered by battery feed, the voltage across the 263DC's simplex leads must not exceed 56Vdc. Both facility-powering schemes are shown in figure 7.

Note: *The 263DC's integral sealing current source can be used only when the 263DC is powered externally.*

3. installation

inspection

3.01 The 263DC Data Station Termination System should be visually inspected upon arrival to find any damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the unit should be visually inspected again prior to installation.

cover removal

3.02 To install the 263DC System, its protective plastic cover must be removed. The cover is held in place by a single captive screw in the bottom of the unit. To remove the cover, loosen the screw and swing the bottom of the cover up and out until it clears the unit's chassis. The cover is replaced by reversing this procedure.

mounting

3.03 The 263DC is wall mounted via three screws (not supplied) inserted through holes in the base plate of the unit. A template for positioning the screws is provided at the end of this practice. Four rubber feet are supplied for desktop placement.

installer connections

3.04 Before making any connections to the 263DC, ensure that power is **not** applied to the unit. Power should be connected to the unit only **after** all other installer connections are made and **after** the unit is properly optioned.

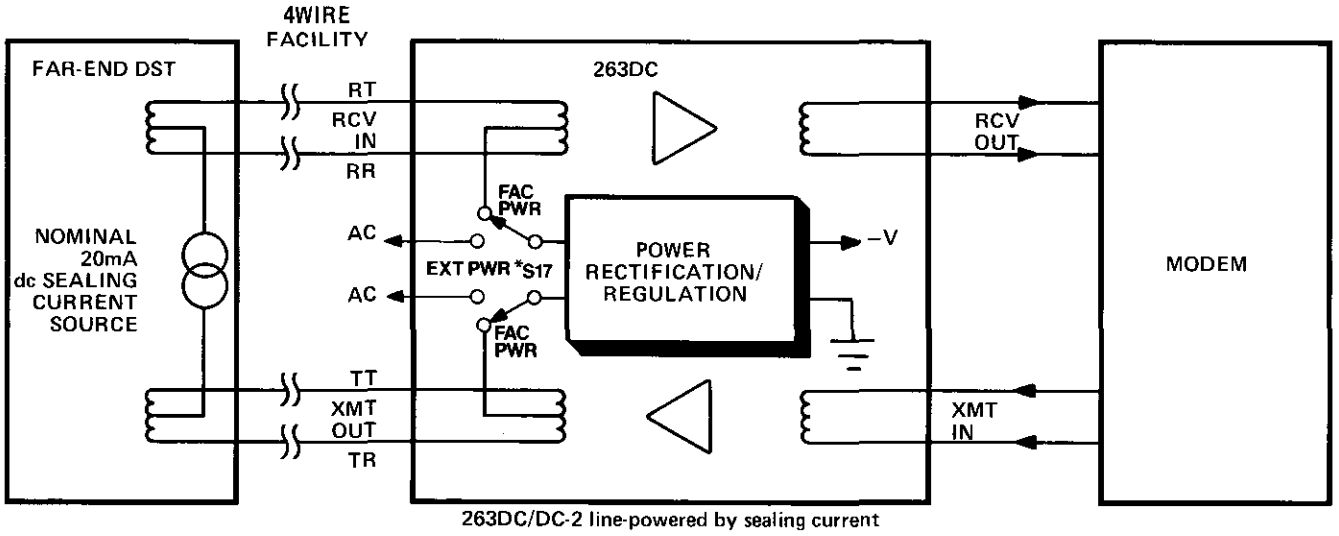
3.05 Make all telco connections (facility-side ports and simplex leads) to the 263DC at 17-position terminal block *TB1*. The modem connections (station-side ports and data disable leads), however, can be made at *TB1* or via the modular phone jack (similar to USOC RJ11C), *J3*, supplied with the unit. Access to both *TB1* and *J3* is through the bottom of the unit. Connections to the 263DC are listed in table 4.

Note: *When the 263DC is equipped with the optional gas-tube lightning protectors, the* PROT GND *terminal on* TB1 *should be connected to a separate earth ground to provide maximum lightning protection.*

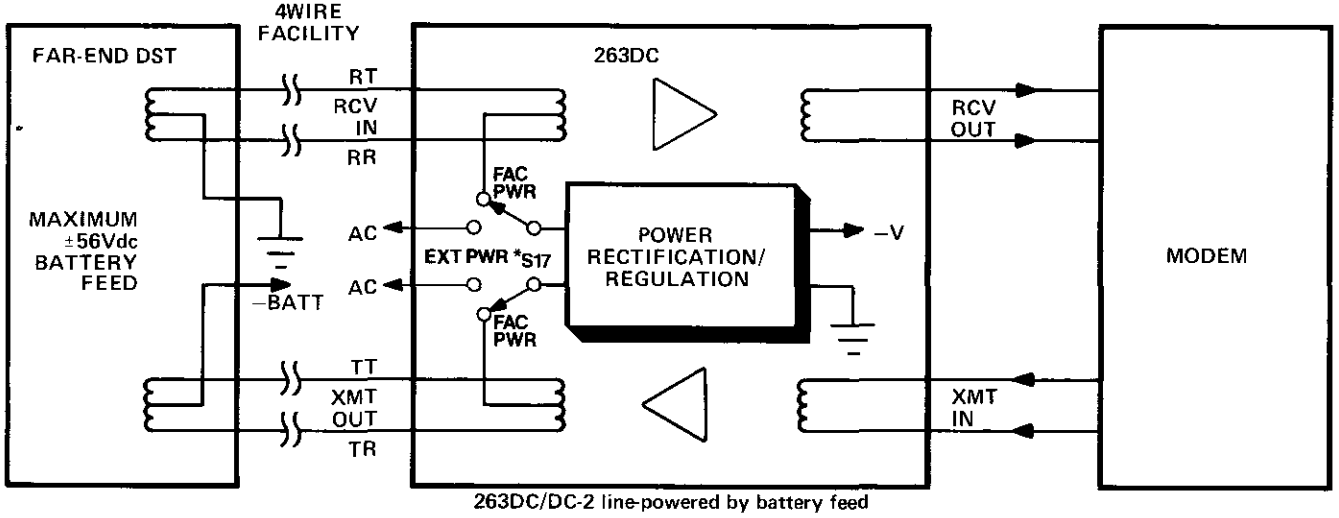
connect:	to TB1 pin:
facility:	
XMT OUT TIP	TT
XMT OUT RING	TR
RCV IN TIP	RT
RCV IN RING	RR
simplex leads:	
SX TRANSMIT	SXT
SX RECEIVE	SXR
data station:	
XMT IN TIP/2WIRE TIP	DTT/2WIRE TIP (or J3 pin 4)
XMT IN RING/2WIRE RING	DTR/2WIRE RING (or J3 pin 3)
RCV OUT TIP	DRT (or J3 pin 2)
RCV OUT RING	DRR (or J3 pin 5)
DATA SET DISABLE	TEK5 (or J3 pin 1)
DATA SET DISABLE	TEK6 (or J3 pin 6)
power:	
AC OR DC INPUT	AC
INPUT GROUND	CKT GND
EARTH GROUND (only when optional gas tube lightning protectors are used)	PROT GND
loopback:	
local loopback	LOC LB

table 4. External connections to 263DC

3.06 To power the 263DC from a local external source of either nominal 26Vac or −22 to −56Vdc, make power connections to the *AC* terminals of *TB1* (polarity need not be considered in either case). If the Tellabs 8015 Transformer is used to supply the required ac voltage, connect terminals *1* and *3* of the 8015 to the *AC* terminals of *TB1*, and



263DC/DC-2 line-powered by sealing current



263DC/DC-2 line-powered by battery feed

***S17 must be set to the *FAC PWR* position for facility powering of the 263DC. S17 must be set to the *EXT PWR* position to supply sealing current to the facility.**

figure 7. 263DC remote powering schemes

then plug the 8015 into a grounded 120Vac, 60Hz outlet. When the 263DC is facility-powered, connect a regulated source of 20mA sealing current or nominal 48Vdc battery across the facility at the far end as shown in figure 7. Option switch S17 must be set to the proper position for either external power or facility power; see paragraph 3.12. As stated above, power connections to the 263DC should be made only **after** all other connections are made and **after** the unit is properly optioned.

optioning

3.07 Optioning the 263DC consists of selecting the facility-side impedance, the 2wire or 4wire data set interface, the loopback path gain, the tone-loopback release option, the power option, and selecting external or internal sealing current or normal simplex-lead derivation. The locations of the option switches are shown in figure 8. Table 5 contains a brief explanation of the functions and settings of each option switch plus a convenient optioning checklist. The checklist can be filled out (by checking the appropriate box for each switch) either prior to installation to allow for prescription optioning of the unit or as the unit is being optioned to provide a record for future reference. Detailed instructions for optioning the 263DC are provided in the following paragraphs.

3.08 Switch *S11* selects balanced 1200-, 600-, or 150-ohm impedance at the facility-side ports (receive input and transmit output). Set *S11* to the *1200, 600,* or *150* position as required. Generally, the 1200-ohm option is used for loaded cable, the 600-ohm option is used for nonloaded cable or carrier, and the 150-ohm option is used to provide a small amount of slope equalization for long sections of nonloaded cable through a deliberate impedance mismatch.

3.09 Switch *S14* selects the desired data-station interface, either 2wire or 4wire. Set *S14* to the *2W* position to interface a 2wire modem or to the *4W* position to interface a 4wire modem.

3.10 Position *1* of switch *S15* selects the amount of gain inserted between the receive channel and

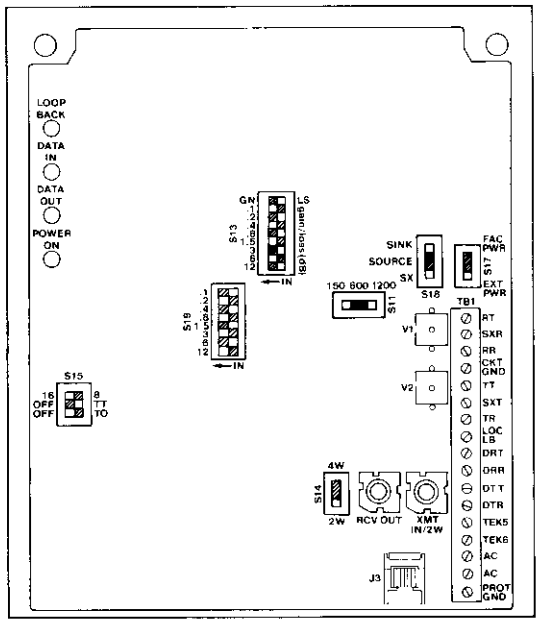


figure 8. 263DC option switch locations

function	switch	selections	settings	check-list
facility-side port impedances (rcv out and xmt in)	S11	150 ohms	150	
		600 ohms	600	
		1200 ohms	1200	
data-station interface	S14	2wire	2W	
		4wire	4W	
loopback-path gain	S15-1	8dB gain	8	
		16dB gain	16	
tone loopback release	S15-3	normal (two tone)	OFF	
		timeout (20 minutes)	TO	
tone loopback disable	S15-2	enabled	TT	
		disabled	OFF	
facility or external power	S17	facility power via SX leads	FAC PWR	
		external power	EXT PWR	
sealing current	S18	internal sealing-current source	SOURCE	
		dc return path for far-end source	SINK	
		normal simplex leads	SX	

table 5. 263DC option summary and checklist

the transmit channel when the unit is in loopback (see paragraph 2.12). To insert 8dB of gain into the loopback path, set *S15-1* to the *8* position. To insert 16dB of gain into the loopback path, set *S15-1* to the *16* position.

3.11 Position *3* of *S15* selects the tone-loopback release option. For normal two-tone operation (loopback released by second loopback tone only), set *S15-3* to the *OFF* position. For timeout operation (loopback released automatically after 20 minutes unless a second tone is received prior to that time), set *S15-3* to the *TO* (on) position. Position *2* of *S15* disables the tone loopback circuit. For normal operation (tone loopback enabled) set *S15-2* to the *TT* (on) position. If tone loopback is not desired, set *S15-2* to the *OFF* position. In either case, loopback can still be activated locally via the local loopback lead.

3.12 Switch *S17* selects either facility power or external power. To power the 263DC from sealing current or battery feed via the simplex leads, set *S17* to the *FAC PWR* position. To power the 263DC from an external source of nominal 26Vac or of −22 to −56Vdc, set *S17* to the *EXT PWR* position.

Note: *The 263DC must be powered from an external source when the 20mA sealing current source is used.*

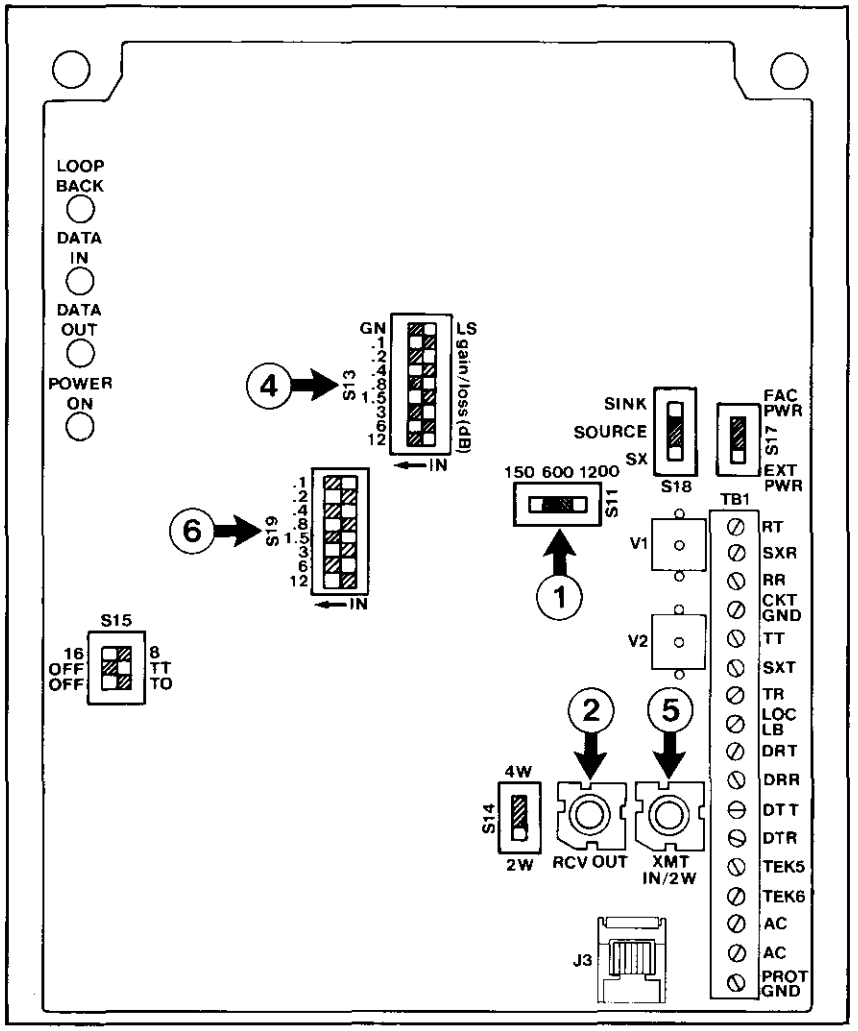
3.13 Switch *S18* selects the desired sealing current option. To supply 20mA of sealing current to the facility from the 263DC's internal current source, set *S18* to the *SOURCE* position. To provide a return path for sealing current supplied from the far end of the facility, set *S18* to the *SINK* position. If normal simplex lead derivation is desired, set *S18* to the *SX* position.

Note: *The 263DC's integral sealing current source can only be used when the 263DC is powered from an external source.*

alignment

3.14 Alignment of all three versions of the 263DC consists of setting the transmit and receive transmission levels and, for the 263DC-2 and 263DC-3 only, setting the receive-channel amplitude equalization if required. After all options on the unit are selected, two methods of alignment are available: prescription or direct measurement (non-prescription). With the prescription method, the unit's alignment switches are set according to the specifications on the circuit layout record or on a computer printout. In cases where the information supplied by the CLR or printout is inadequate or unavailable, it is necessary to perform the non-prescription alignment procedure. The procedure for prescription alignment of the 263DC's transmit and receive transmission level is given in paragraph 3.15; the non-prescription alignment procedure is given in paragraphs 3.19 and 3.20 (long form) and in figure 9 (condensed form). The prescription and non-prescription alignment procedures for the receive-channel equalizer on the 263DC-2 are given in paragraphs 3.16 and 3.21, respectively. The prescription alignment procedure for the 263DC-3's receive-channel equalizer is given in paragraph 3.17; information on non-prescription alignment of the 263DC-3's equalizer is provided in paragraph 3.22.

Note: *To place the 263DC into loopback for testing, either transmit a 2713Hz tone burst at a level of*



1 Refer to the CLR and determine the following: facility port impedances, required receive output level, and transmit input level. Ensure that *S11* (facility port impedance) is set correctly. Then proceed to step 2 and perform the alignment procedures in numeric order. The paragraphs referenced in the procedure headings provide a more detailed explanation of that specific procedure.

Receive Level (paragraph 3.19)

2 Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the *RCV OUT* jack (*XMT IN/2W* jack for 2wire operation).

3 Have the far end transmit 1004Hz test tone at the level specified on the CLR. Measure the received level.

4 If the specified receive level is higher than the measured level, set *S13-1* to the *GN* position. If the specified level is lower than the measured level, set *S13-1* to the *LS* position. Then set the *rcv level* (S13-2 through S13-9) switches in the proper combination to achieve the specified output level.

Transmit Level (paragraph 3.20)

5 Arrange the transmit portion of the TMS (terminated at 600 ohms) for 1004Hz tone output at the CLR- specified level, and connect it to the *XMT IN/2W* jack.

6 Have the far end measure and report the received level. Then set the *xmt level (S19)* switches in the proper combination to achieve the specified level at the far end.

Receive Equalization (263DC-2 only; see paragraphs 3.17 and 3.22 for the 263DC-3) (paragraph 3.21)

7 Connect the receive portion of a properly terminated TMS to the *RCV OUT* jack (*XMT IN/2 WIRE* jack for 2wire operation). Have the far end send 1004Hz and 2804Hz test tones at the CLR-specified level. Measure and record these levels.

8 Subtract the 2804Hz level from the 1004Hz level.

9 Set to *in* the proper combination of equalization switches on the equalizer subassembly that most closely approximates the amount arrived at in step 8.

figure 9. Condensed non-prescription alignment procedures

30dBm or higher for at least 1.6-seconds and then remove the tone (remote loopback), or apply a ground to the local loopback lead. To restore normal operation, either transmit a second tone burst for at least 0.7 second or remove the ground from the local loopback lead.

prescription transmit and receive level adjustment (263DC-1, -2, -3)

3.15 To adjust the transmit and receive levels on the 263DC via the prescription method, proceed as follows: From the CLR, determine whether gain or loss is required in the receive channel and set the *GN/LS* switch (*S13-1*) to the appropriate position (*LS* or *GN*). Next, determine (from the CLR) the amount of loss or gain required in the receive channel and the amount of loss required in the transmit channel. Then set to *in* the proper combination of transmit level (*S19*) and receive level (*S13*) DIP switches to achieve the required levels. The specific amount of loss or gain (in dB) introduced by each DIP-switch position is indicated on the switch body adjacent to the switch position. These switch positions are cumulative; the total amount of flat loss or gain introduced into a channel is the sum of that channel's DIP-switch positions set to *in*. Switch settings and a checklist for prescription level adjustment are provided in table 6.

263DC-2 prescription receive equalizer alignment

3.16 To adjust the receive equalization on the 263DC-2 via the prescription method, proceed as follows: From the CLR, determine the amount of equalized gain required at 2804Hz (re 1004Hz). Equalization is introduced into the receive channel via the *equalizer* DIP switch on the equalizer subassembly. The specific amount of equalized gain at

2804Hz (re 1004Hz) introduced via each DIP-switch position is indicated on the printed circuit board next to the switch position. These switch positions are cumulative; the total amount of equalized gain (0 to 7.5dB) introduced is the sum of those DIP-switch positions that are set to *in*. The 263DC-2's receive equalizer switch settings for prescription equalizer alignment and a checklist are given in table 7. Because the required amount of equalization given in the CLR may be specified to the nearest 0.1dB while the equalization switch is arranged in 0.5dB increments, table 8 gives the rounded switch settings fo the equalizer's full range.

function	switch	settings (in dB)	checklist
rcv loss or gain	S13-1	LS	
		GN	
rcv level	S13-2 through S13-9	.1	
		.2	
		.4	
		.8	
		1.5	
		3	
		6	
		12	
xmt level	S19-1 through S19-8	.1	
		.2	
		.4	
		.8	
		1.5	
		3	
		6	
		12	

table 6. 263DC level alignment switches and checklist

DST unit	function	switch	settings	checklist
263DC-2	receive slope equalization gain at 2804Hz (re 1004Hz)	S1	0.5	
			1	
			2	
			4	
263DC-3	loaded/non-loaded cable	S1-1	NL	
			L	
	slope	S1-2 through S1-5	1	
			2	
			4	
			8	
	height	S2-1 through S2-4	1	
			2	
			4	
			8	
	bandwidth	S2-5 through S2-8	1	
			2	
			4	
			8	

table 7. 263DC-2 and 263DC-3 receive equalization switches and checklist

263DC-3 prescription receive equalizer alignment

3.17 Because the 263DC-3's receive equalizer switch settings are totally dependent upon the characteristics (e.g., cable gauge and length, loaded or nonloaded, etc.) of the facility to which the unit is connected, it is recommended that the equalizer be aligned via the prescription method only. In most cases, prescription alignment of the 263DC-3's receive equalizer consists of entering the pertinent data into a computer-controlled circuit design system that provides a printout specifying the required equalizer switch settings. The *BW* and *HT* switches, or the *slope* and *loaded/nonloaded* switches are then set as directed. The 263DC-3's receive equalizer can also be aligned by determining the facility characteristics from the CLR and then setting the receive equalizer switches as indicated in Tellabs practice section 819908B or Bell System Practice (BSP) section 332-912-222. These practices contain extensive listings of various facility characteristics (including combinations thereof) and the equalizer switch settings required to compensate for these. The 263DC-3's equalizer switch settings and a checklist for prescription equalizer alignment are given in table 7.

1000Hz-2804Hz difference	amount of equalized gain required
0.0 to 0.2dB	0.0dB
0.3 to 0.7dB	0.5dB
0.8 to 1.2dB	1.0dB
1.3 to 1.7dB	1.5dB
1.8 to 2.2dB	2.0dB
2.3 to 2.7dB	2.5dB
2.8 to 3.2dB	3.0dB
3.3 to 3.7dB	3.5dB
3.8 to 4.2dB	4.0dB
4.3 to 4.7dB	4.5dB
4.8 to 5.2dB	5.0dB
5.3 to 5.7dB	5.5dB
5.8 to 6.2dB	6.0dB
6.3 to 6.7dB	6.5dB
6.8 to 7.2dB	7.0dB
7.3 to 7.7dB	7.5dB

table 8. 263DC-2 rounded equalizer switch settings

post-alignment testing

3.18 After the transmission levels and receive equalization are set, it may be desirable to confirm the results via end-to-end tests. Where computer-controlled test equipment is used, a subsequent printout will verify the alignment results. Any deviation from the required levels can then be adjusted via the appropriate switches. If computer-controlled test equipment is not available, the alignment results can be confirmed by performing the measurements in the condensed test procedures in figure 9.

non-prescription receive-level adjustment (263DC-1, -2, -3)

3.19 To adjust the receive level of the 263DC when prescription level settings are not given in the CLR or when the given settings do not produce adequate results, proceed as follows:

A. Ensure that no receive level DIP-switch positions are set to *in*. Also ensure that the facility-side port impedance switch (*S11*) is set correctly.

B. Arrange the receive portion of a transmission measuring set (TMS) for 600-ohm terminated measurement and connect it to the *RCV OUT* jack (*XMT IN/2W* for 2wire operation). Have the far end send 1004Hz test tone at the specified level.

C. If the level measured at the *RCV OUT* (or *XMT IN/2W*) jack is the same as that specified on the CLR, proceed to the transmit level adjustment procedure (paragraph 3.20). If the measured level is lower than the specified level, set the *GN/LS* switch *(S13-1)* to the *GN* position; if the measured level is higher than the specified level, set *S13-1* to the *LS* position. Then set to *in* that combination of receive level DIP switch positions which equals the required amount of gain or loss (i.e., the difference between the specified level and the measured level).

Note: *The amount of gain or loss introduced by each position of the receive level switch is indicated on the switch body. These switch positions are cumulative; the total amount of gain or loss introduced is the sum of those switch positions set to* in.

non-prescription transmit-level adjustment (263DC-1, -2, -3)

3.20 To adjust the transmit level of the 263DC when prescription level settings are not given in the CLR or when the given settings do not produce adequate results, proceed as follows:

A. Ensure that no transmit level DIP-switch positions are set to *in*. Also ensure that the facility-side port impedance switch *(S11)* is set correctly.

B. Arrange the transmit portion of a TMS (properly terminated at 600 ohms) to output 1004Hz tone at 0dBm (or other data level specified by the CLR), and connect it to the *XMT IN/2W* jack.

C. Have personnel at the far end measure and report the received level; the difference between the measured level and the specified level is the amount of loss required in the transmit channel of the DST unit. Set to *in* that combination of transmit level *(S19)* DIP switch positions which equal the required amount of attenuation.

Note: *The amount of loss introduced by each position of the transmit level switch is indicated on the switch body. These switch positions are cumulative; the total amount of gain or loss introduced is the sum of those switch positions set to* in.

263DC-2 non-prescription receive equalization adjustment

3.21 To determine the need for receive-channel equalization (i.e., post-equalization at the local end of the 4wire facility) and to make the required adjustments when the 263DC-2 is used, proceed as follows:

A. Ensure that none of the four *equalizer* DIP-switch positions are set to *in*. Also ensure that the facility-side port impedance switch *(S11)* is set correctly.

B. Arrange the receive portion of a TMS for 600-ohm terminated measurement and connect it to the *RCV OUT* jack (*XMT IN/2W* for 2wire operation). Have the far end send 1004Hz test tone at the level specified on the CLR. Verify the presence of test tone and record the measured level.

C. Now have the far end send 2804Hz test tone at the level specified on the CLR. Measure and record the received 2804Hz level. Subtract the 2804Hz level from the 1004Hz level recorded in step B.

D. Set to *in* that combination of *equalizer* DIP switch positions which approximates as closely as possible the measured difference (see table 8).

263DC-3 non-prescription receive equalization adjustment

3.22 For a non-prescription alignment procedure for the 263DC-3's receive equalizer, please refer to BSP 332-912-221.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 263DC Data Station Termination System for engineering and application purposes only. Attempts to troubleshoot the unit internally are not recommended and may void your warranty. Troubleshooting procedures should be limited to those prescribed in section 7 of this practice. Refer to the 263DC block diagram, section 5 of this practice, while reading this circuit description.

4.02 The unit's *power supply* consists of a full-wave bridge rectifier, a capacitor input filter, and a series voltage regulator. The full-wave bridge rectifier allows the unit to be powered from either ac or dc input voltage. The capacitor input filter provides isolation from ac signals present on the line, and, when ac power is used, eliminates 60Hz interference from the signal path. The series voltage regulator is used to derive a stable dc voltage for the internal circuitry.

4.03 Transformers at the facility-side ports (receive input and transmit output) are tapped to provide switch-selectable 1200-, 600-, or 150-ohm terminating impedance. A silicon voltage-transient suppressor on the secondary side of each transformer limits transient potentials to a safe level and provides surge protection. Both transformers are center-tapped to derive balanced simplex leads. A *20mA current source* provides an internal source of nominal 20mA sealing current. The *20mA current source* can be switch-optioned to provide sealing current to the facility via the unit's simplex leads, to provide a return path for sealing current supplied at the far end of the facility, or to derive normal simplex leads. A *seal curr* LED on the unit lights when the internal *20mA current source* is selected and current is flowing.

4.04 The station side of the 263DC can be optioned to interface either a 2wire or 4wire data station as selected by switch *S14*. An electronic hybrid circuit provides the necessary 2wire-to-4wire conversion in the 2wire mode.

4.05 Levels between the facility and the data station are coordinated by the *receive amplifier* and the *receive-level-control* circuit. DIP switches in the *receive-level-control* circuit introduce controlled feedback into the receive amplifier circuitry to pro-

vide up to 24dB of gain or loss in the receive channel in 0.1dB increments. One of the DIP switch positions determines whether gain or loss is inserted by the *receive amplifier.*

4.06 Both the 263DC-2 and 263DC-3 provide active post-equalization of the facility via integral prescription amplitude equalizers in their receive channels. The 263DC-2's *receive equalizer* is slope-type, providing up to 7.5dB of equalized gain at 2804Hz (re 1004Hz) in discrete 0.5dB increments. The 263DC-3's *receive equalizer* is functionally equivalent to the Western Electric model 309B Prescription Equalizer. In addition to providing slope-type equalization, the 263DC-3 provides bump-type equalization with variable height and bandwidth settings. The equalization functions of both the 263DC-2 and the 263DC-3 are controlled by DIP switches on the *receive equalizer* subassemblies.

4.07 The *receive level detector* responds to the presence of data in the receive channel at levels greater than −25dBm by lighting the *data in* LED. The location of the *receive level detector* in the circuit—following the *receive amplifier* and *receive-level-control* circuit and, on the 263DC-2 and 263DC-3, the *receive equalizer*—makes it a valuable troubleshooting aid because it provides a check on virtually all active circuitry in the receive channel.

4.08 Level coordination between the data station and the facility is provided by the *transmit amplifier* and the *transmit-level-control* circuit. A five-step attenuator in the *transmit-level-control* circuit provides up to 24dB of flat loss in 0.1dB increments. This loss is inserted into the transmit channel via an eight-position DIP switch.

4.09 The *transmit level detector* performs the same functions for the transmit channel as the *receive level detector* does for the receive channel, responding to the presence of data signals above −25dBm by lighting the *data out* LED. The *transmit level detector* is similarly located at a point in the circuit where it provides a check of the maximum amount of active transmit-channel circuitry.

4.10 The *loopback control* circuitry provides the detection, timing, and logic functions for loopback operation of the 263DC. The loopback circuitry can be activated either locally via ground or remotely via 2713Hz tone (see paragraph 4.11). When loopback is activated by either method, the loopback (*LB*) relay operates, opening the transmit and receive channels toward the modem and connecting the receive channel to the transmit channel. The *LB* relay also provides data-set-disable leads (*TEK5* and *TEK6*) to disable the associated data set during loopback. The *loopback* LED on the unit's cover lights when the unit is in loopback.

4.11 Loopback is activated locally by applying ground to the *LOC LB* lead. Remote loopback is activated by application of a 2713Hz tone burst 1.6 seconds or longer in duration; the 263DC does not go into loopback until the tone is removed. The threshold of the tone-detection circuitry is fixed at −30dBm. A minimum 6dB guard band prevents remote loopback activation by other than the intended signal. Local loopback is deactivated by removing the ground from the *LOC LB* lead. Remote loopback is deactivated in either of two ways: upon receipt of a second 2713Hz tone burst of 0.7 second or longer, or automatically after a 20-minute timeout period. The method of remote loopback deactivation is selected via switch option. When the timeout method is selected, loopback can still be deactivated by transmission of a second 2713Hz tone before the timeout period expires. An option switch is also available to disable the remote-loopback function completely when desired.

4.12 A *loopback amplifier* in the loopback path can be switch-optioned to provide either 8 or 16dB of gain between the receive and transmit channels when the unit is in the loopback mode. In circuits with either an 8 or 16dB differential between the receive and transmit TLPs, this feature allows a test signal received at the normal data level to be returned to the remote location at the same level as in normal operation.

6. specifications

receive channel

level range
0 to 24dB of gain or loss in switch selectable 0.1dB increments, with gain or loss selected via switch option

maximum input level
+5dBm

maximum output level
+5dBm

input impedance
150 ohms ±15%, 600 ohms ±10%, or 1200 ohms ±10%, balanced, switchable

total harmonic distortion
1% maximum, 300 to 4000Hz

263DC-2 equalization
up to 7.5dB of active slope equalization at 2804Hz (re 1004Hz) in switch-selectable 0.5dB increments

263DC-3 equalization
slope/bump equalizer for loaded or nonloaded cable — equivalent to Western Electric 309B

noise
10dBrnC0 maximum

envelope delay distortion
less than 100 microseconds, 400 to 3000Hz

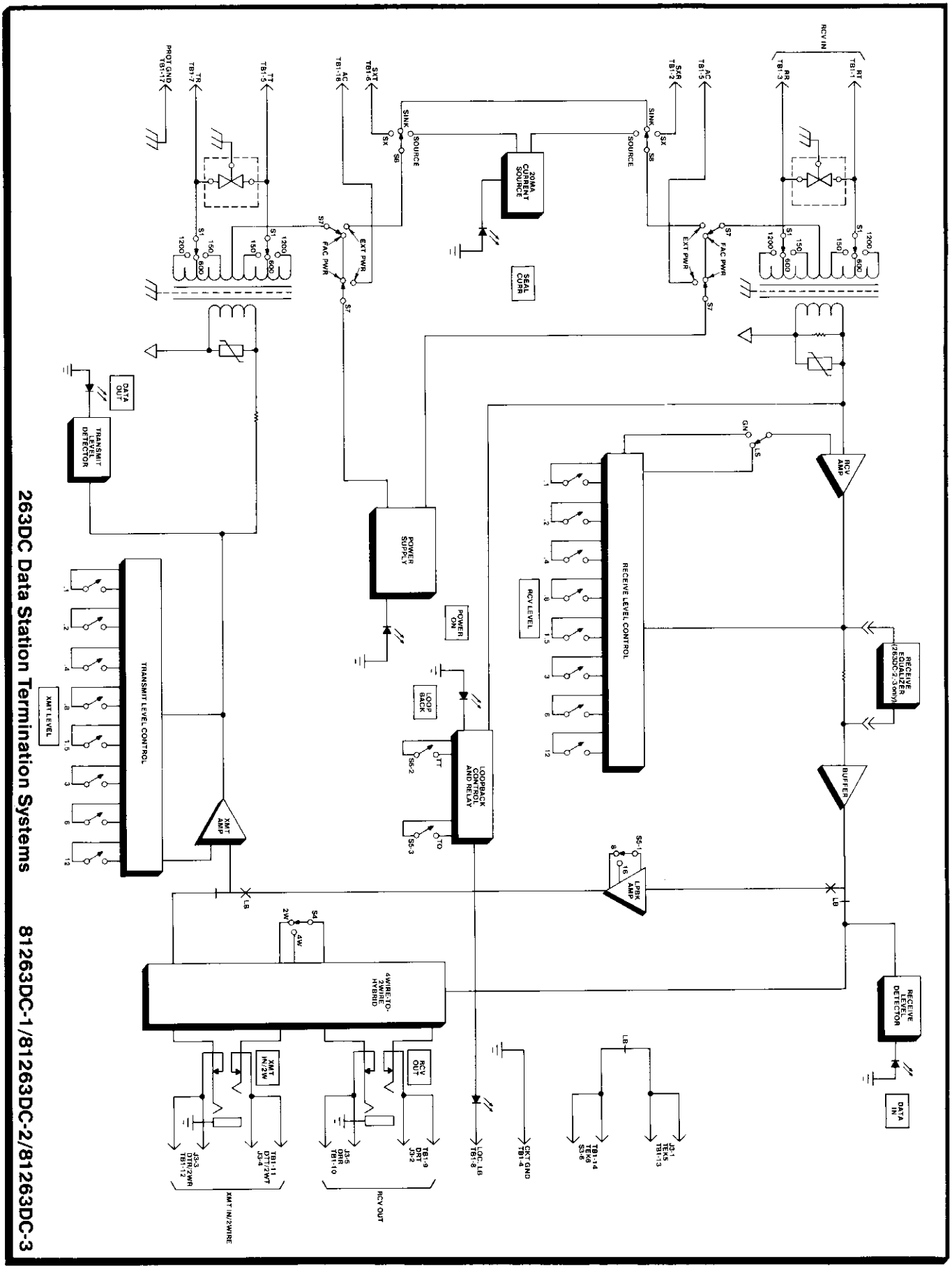
peak/average ratio
greater than 98

transmit channel

level range
0 to 24dB of loss in switch-selectable 0.1dB increments

maximum input level
+5dB

specifications continued on page 13



5. block diagram

maximum output level
+5dB

output impedance
150 ohms ±15%, 600 ohms ±10%, or 1200 ohms ±10%, balanced, switchable

total harmonic distortion
1% maximum, 300 to 4000Hz

frequency response
±0.5dB re 1004Hz, 300 to 4000Hz

noise
10dBrnC0 maximum

envelope delay distortion
100 microseconds maximum, 400 to 3000Hz

peak/average ratio
greater than 98

modem interface

terminating impedance
4wire: 600 ohms ±10%, balanced, capacitively coupled, both channels
2wire: 600 ohms ±10%, balanced, capacitively coupled

transhybrid loss (2wire mode only)
ERL 45dB minimum
SRL LO 35dB minimum
SRL HI 35dB minimum

2wire return loss
ERL 28dB minimum
SRL LO 21dB minimum
SRL HI 28dB minimum

loopback specifications

loopback-tone frequency detection
263DC will loopback upon receipt of 2713 ±7Hz tone (subject to level and timing specifications listed below)
263DC will not loopback upon receipt of tones outside the range of 2713 ±37Hz.

loopback-tone level detection threshold
−30dBm

loopback tone duration
initiate: 1.6 seconds minimum, loopback after removal of tone
release: 0.9 ±0.3 second maximum, release during tone

tone loopback signal-to-guard ratio
6dB minimum, 18dB maximum

optional release timeout period
20 minutes nominal after tone-activation of loopback

loopback level
either 16dB (equal level) or 8dB loopback-path gain, switch selectable

local dc loopback
ground to operate, 2mA maximum

common specifications

facility sealing current (from internal source)
20mA nominal

input power
facility power: nominal 20mA sealing current or 56Vdc battery feed (maximum)
external power: either 18 to 26Vac at 7.5VA (this can be supplied from commercial 120Vac by using a Tellabs 8015 Transformer) or −22 to −56Vdc at 30mA (maximum current comsumption)

operating environment
20° to 130°F (−7° to +54°C), humidity to 95% (no condensation)

dimensions
height: 7.6 inches (19.3cm)
width: 6.7 inches (17.0cm)
depth: 2.0 inches (5.0cm)

weight
1 pound 14 ounces (850 grams)

mounting
wall-mounted; rubber feet are also provided for desktop placement

7. testing and troubleshooting

7.01 The *testing guide checklist* in this section may be used to assist in the installation, testing, or troubleshooting of the 263DC-1, 263DC-2, and 263DC-3 DST Systems. The checklist is intended as an aid in the localization of trouble to a specific unit. If a unit is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute unit operates correctly, the original unit should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on the unit. Instead, a malfunctioning unit should be returned to Tellabs for repair or replacement as directed below. Unauthorized testing or repairs may void the unit's warranty. Also, if the unit is part of a registered system, unauthorized repairs will result in noncompliance with Part 68 of the FCC Rules and Regulations.

Note: *Warranty service does not include removal of permanent customer markings on the covers of Tellabs products, although an attempt will be made to do so. If a unit must be marked* **defective,** *we recommend that it be done on a piece of tape or on a removable stick-on label.*

7.02 If a situation arises that is not covered in the checklist, contact Tellabs Customer Service as follows (telephone numbers are given below):

USA customers: Contact Tellabs Customer Service at your Tellabs Regional Office.

Canadian customers: Contact Tellabs Customer Service at our Canadian headquarters in Mississauga, Ontario.

International customers: Contact your Tellabs distributor.

US central region: (312) 969-8800
US northeast region: (412) 787-7860
US southeast region: (305) 645-5888
US western region: (702) 827-3400
Canada: (416) 624-0052

7.03 If a unit is diagnosed as defective, follow the *replacement* procedure in paragraph 7.04 when a critical service outage exists (e.g., when a system or a critical circuit is down and no spares are available). If the situation is not critical, follow the *repair and return* procedure in paragraph 7.05.

replacement

7.04 To obtain a replacement unit, notify Tellabs via letter or telephone (see addresses and numbers below) or via TWX (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X263DC-X part number that indicates the issue of the unit in question. Upon notification, we shall ship a replacement unit to you. If the unit in question is in warranty, the replacement will be shipped at no charge. Pack the defective unit in the replacement unit's carton, sign the packing slip included with the replacement, and enclose it with the defective unit (this is your return authorization). Affix the preaddressed label provided with the replacement unit to the carton being returned, and ship the unit prepaid to Tellabs.

repair and return

7.05 Return the defective unit, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs, Inc.
4951 Indiana Avenue
Lisle, Illinois 60532
telephone (312) 969-8800

in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7
telephone (416) 624-0052

Enclose an explanation of the unit's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the unit and ship it back to you. If the unit is in warranty, no invoice will be issued.

testing guide checklist

test	test procedure	normal results	if normal conditions are not met, verify:
transmit level	Arrange transmit portion of TMS, properly terminated at 600 ohms, for 1004Hz tone at 0dBm. Connect this signal to *XMT IN* jack. Arrange receive portion of TMS for terminated measurement at facility-side port impedance selected on unit, and connect it to pins *TT* and *TR* on *TB1*. Vary *LOSS* settings over their entire range.	Signal level corresponds to loss setting ☐.	Power ☐. Wiring ☐. Proper impedance setting ☐. *S16* set properly ☐. *S11* set properly ☐. Unit not in loopback ☐.
transmit channel noise	Short *DTT* and *DTR* leads together either by inserting a shorting plug into *XMT IN* jack or by strapping pins *DTT* and *DTR* on *TB1* together. Connect noise measuring test set to pins *TT* and *TR* on TB1. Vary *LOSS* settings over their entire range.	Measured noise level is less than 10dBrnC0 for all loss settings ☐. Noise level follows loss setting ☐.	Xmt in port shorted ☐. Proper termination impedances ☐. High RF environment ☐.
receive level	Remove short at xmt port. Arrange transmit portion of TMS for 1004Hz tone at −10dBm. Set TMS xmt impedance to match unit's facility-side ports. Connect TMS xmt to pins *RT* and *RR* on *TB1*. Arrange receive portion of TMS for terminated measurement at 600 ohms and connect it to *RCV OUT* jack. Vary GN/LS controls over their entire range.	Signal level corresponds to gain or loss setting ☐.	Power ☐. Wiring ☐. Terminating impedance ☐. *S16* set properly ☐. *S11* set properly ☐. Unit not in loopback ☐.
263DC-2 receive equalization	Maintain TMS connections as described above. Transmit 2804Hz tone from TMS and set *equalizer* switches to *in* one at a time.	Level at *RCV OUT* jack increases to 7.5dB above 1004Hz level as equalization is added (0.5dB, 1.5dB, 3.5dB, 7.5dB) ☐.	Input level at 2804Hz same as 1004Hz ☐. Terminating impedances correct ☐. Switch *S11* set correctly ☐.

test	test procedure	normal result	if normal conditions are not met, verify:
263DC-3 receive equalization	Maintain TMS connections as described in receive level test. Transmit 3400Hz tone and set slope, HT, and BW switches to various combinations.	Level at *RCV OUT* jack varies with switch setting ☐.	Terminating impedances correct ☐. Switch *S11* set correctly ☐.
receive channel noise	Short rcv in leads together by strapping pins *RT* and *RR* on *TB1* together. Connect noise measuring test set to *RCV OUT* jack.	Measured noise is less than 10dBrnC0 for all gain/loss settings ☐. Noise level follows gain/loss settings ☐.	Rcv in port shorted ☐. Proper terminating impedance ☐. High RF environment ☐.
tone looback	Remove short at rcv in port. Connect rcv portion of TMS (properly terminated) to xmt out port, pins *TT* and *TR* on *TB1*. Arrange xmt portion of TMS for 2713Hz output at CLR-specified loopback tone level at proper rcv impedance. Connect this signal to rcv in port, pins *RT* and *RR* on *TB1*; after 2 seconds change frequency to 1004Hz and note TMS level reading.	*Loopback* LED lights ☐. Measured transmit level within ±1dB of level specified on CLR ☐.	Power ☐. Wiring ☐. Transmit and receive channels properly aligned ☐. Loopback tone level above −30dBm ☐. Switch *S15-2* set properly ☐.
tone loopback release	Maintain test connections as described above and change frequency to 2713Hz for 1 second.	*Loopback* LED goes out ☐.	Xmt in and rcv in ports not shorted ☐.
timeout loopback	Place the DST unit in loopback as instructed in tone loopback test.	*Loopback* LED goes out in 20 ±1 minute ☐.	*S15-3* set to timeout position ☐.
manual loopback	Ground *LOC LB*. Arrange TMS to send 1004Hz at specified receive level and at proper impedance. Connect this signal to rcv in port, pins *RT* and *RR* on *TB1*. Arrange receive portion of TMS for appropriately terminated measurement and measure level at xmt out port, pins *TT* and *TR* on *TB1*.	*Loopback* LED lights ☐. Measured transmit level within ±1dB of specified level on CLR ☐.	Transmit and receive channels properly aligned ☐. Switch *S15-1* set properly ☐.

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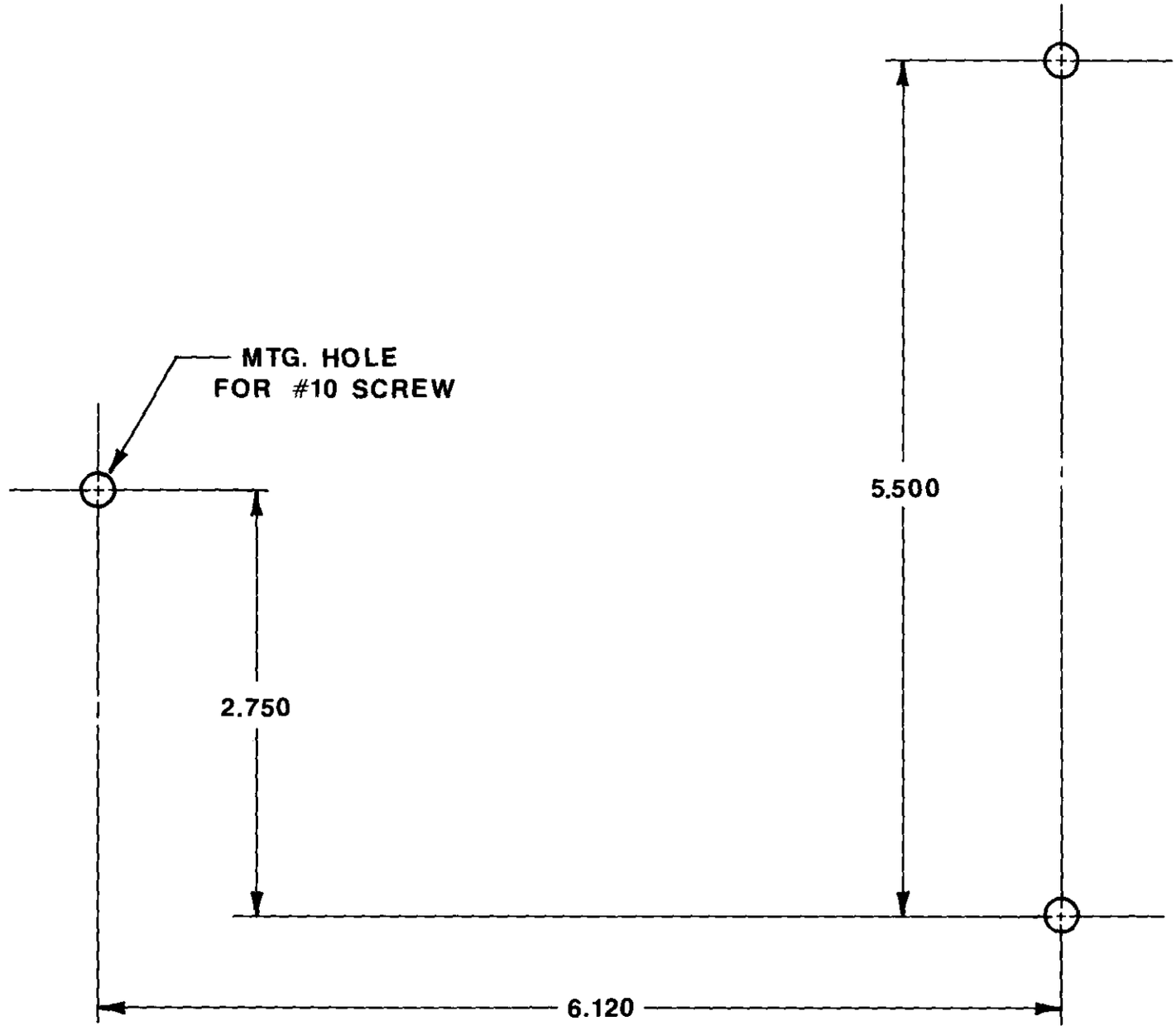

263DC-1, -2, -3 mounting template