wilcom
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Model T303/303B Signaling Sender

Operating Instructions

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Wilcom Products, Inc.
Instruction Manual

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Operating Instructions

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Introduction

The Model T303/T303B Signaling Sender is a general purpose, microprocessor-controlled, portable sender that is designed for field or central office use. The T303/303B provides DTMF, MF, and Dial Pulse signaling on the following circuit types:

- 2-wire loop
- 4-wire loop
- 4-wire SF
- 4-wire E & M

Supervision on these circuit types may be loop, SF or E & M. A reverse battery indicator is provided for loop type signaling that employs reverse battery wink. The T303B also includes indicators that provide a display of E & M lead status.

The unit features self-contained operation that is powered by a rechargeable battery pack, making it ideal for field operations such as:

- Circuit Acceptance Testing (dial through)
- Trunk Maintenance
- Transmission Testing (with a TMS)

The internal monitor speaker and headset jacks allow voice communications over the circuit being tested.

Specifications

Tone Outputs	
DTMF:	0 thru 9, A, B, C, D, *, #
MF:	0 thru 9, KP, ST, STP, ST2P, ST3P
SF:	2600 Hz
Output Level:	0 thru -39 dBm; 1 dB steps thumbwheel setting is per tone for DTMF and MF
SF On Hook Level:	13 dB below thumbwheel setting
SF Pulsing Level:	1 dB below thumbwheel setting
Level Accuracy:	±1.0 dB
Frequency Accuracy	
DTMF and MF:	±0.5%
SF:	±1.0 Hz
Pulse Timing	
DTMF:	68 ms tone on, 68 ms tone off
MF:	68 ms tone on, 68 ms tone off (except KP which is 100 ms tone on)
DP:	10 pps, 60% break
Pulsing Accuracy:	±2 ms

Interdigit Time:	700 ±2 ms (DP mode)
Auto Repeat Intvl:	Selectable 1 thru 10 seconds in 1 second increments.
Output Impedance:	600Ω ±10%
Input Terminating Impedance:	600Ω ±10%
E & M Detectors	
E lead threshold:	-9V
M lead threshold:	-24V
E or M lead input imp.:	50 kΩ or greater
Electrical	
Power:	115V or 230V ac ±10%, 50/60 Hz (factory option)
Battery Charge Time:	14 hours
Battery Operating Time:	5 hours
Environmental	
Operating Temp.:	0° to 50°C
Humidity:	95% at 35°C, 40% at 50°C
Storage Temp.:	-55° to +70°C
Altitude:	15,000 m (non-operating)
Physical	
Height:	6.00 in. (15.2 cm)
Width:	7.87 in. (20.0 cm)
Depth:	5.75 in. (14.6 cm)
Weight:	6.3 lbs. (2.8 kg)

Panel Controls and Connections

The following describes the functions of each switch, indicator, and jack that are located on the T303/303B front panel (Figure 1). The description is divided into sections that relate to power, input/output connections, interface and supervision controls, pulsing, and miscellaneous.

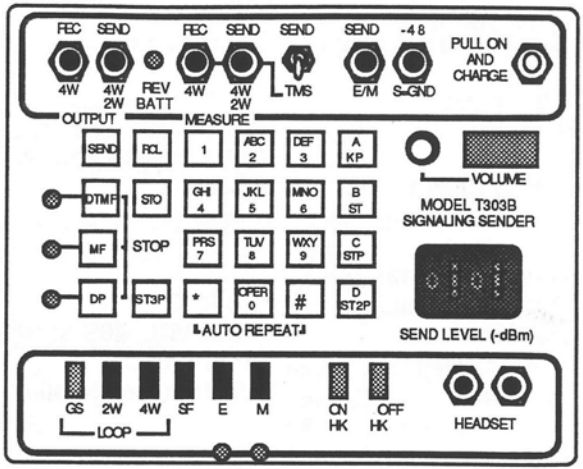

Figure 1. T303/303B Front Panel

Power (Figure 2)

PULL ON AND CHARGE switch applies power to the set for operation and to charge the internal Ni-Cad batteries.

AC Power receptacle is a 3-prong male plug that is recessed in the case side of the test set. The line cord that is included with the T303 supplies ac power through this connection.

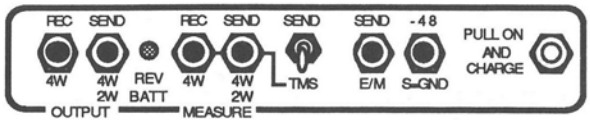

Figure 2. Power Switch, Input/Output Jacks

Input/Output Connections (Figure 2)

Output: **REC 4W** and **SEND 4W/2W jacks** are 310-type jacks that provide the connections between the sender and the following signaling circuits: 2-wire or 4-wire loop, 4-wire E & M, and 4-wire SF.

Measure: **REC 4W** and **SEND 4W/2W jacks** are 310-type jacks that are connected in parallel with the OUTPUT jacks described above. A transmission

measuring set (TMS) may be connected to the signaling circuit through these jacks.

The **SEND/TMS switch**, in the *SEND* position, connects the T303/T303B monitor and pulsing circuits to the REC, SEND jacks. In the *TMS* position the T303/T303B circuits are removed from the MEASURE/OUTPUT jacks.

The **SEND E/M jack** is a 310-type jack that provides the connection for E lead pulsing (open/ground) on the tip and M lead pulsing (ground/battery) on the ring.

-48/S=GND jack: During E & M operation of the set using the internal batteries, central office -48V and ground must be connected to this jack to provide the potentials for dc supervision and pulsing. When the set is powered from ac mains, the T303/T303B internal power supply provides the -48V and ground for E & M operation.

Interface and Supervision Controls (Figure 3) When pressed, the **LOOP/GS** momentary action button (in which the switch remains in only as long as it is pressed) places a ground potential on the ring of the SEND jacks.

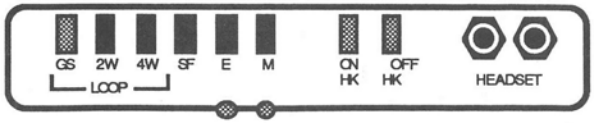

Figure 3. Interface/Supervision Controls and Indicators

NOTE: Central office ground must be provided to the T303/T303B at the -48 jack when ac power is *not* connected to the unit.

The five interlocking buttons with lockout interface control (pressing any switch in the group automatically releases the engaged switch) provide the internal connections for the following individual signaling functions:

The **LOOP 2W button** connects the SEND 4W/2W jacks to the internal dc pulsing and monitor circuits.

The **LOOP 4W button** connects the SEND 4W/2W and REC 4W jacks to the internal dc pulsing, tone pulsing, and monitor circuits.

The **SF button** connects the SEND 4W/2W and REC 4W jacks to the internal tone pulsing and monitor circuits.

The **E button** connects the tip of the E/M jack to the internal dc pulsing circuit for ground/open pulsing. The **M button** connects the ring of the E/M jack to the internal dc pulsing circuit for battery/ground pulsing.

> **NOTE:** Central office ground must be provided to the T303/T303B at the -48V jack when ac power is *not* connected to the unit and the E or M button is pressed.

E/M LED Indicators (T303B only). The **E/M LEDs** display the On Hook, Off Hook and pulsing status of the E or M leads. An On Hook status on either lead illuminates the corresponding LED.

When the **E** button is engaged, the status of the T303B output on the E lead is displayed. When the **M** button is engaged, the On/Off Hook or pulsing status of the equipment E lead is displayed.

When the **M** button is engaged, the status of the T303B output on the M lead is displayed. When the **E** button is engaged, the On/Off Hook or pulsing status of the equipment M lead is displayed.

The **ON HK** and **OFF HK** interlocking with lockout buttons determine the supervision for the individual signaling interfaces as follows:

INTERFACE	ON HK	OFF HK
2W Loop	T-R; OPEN	T- R; CLOSURE
4W Loop	Simplex OPEN	Simplex CLOSURE
SF	2600 Hz; 13 dB below setting on thumbwheel	NO TONE
E	T; OPEN	T; GND
M	R; GND	R; BATT

Pulsing Control (Figure 4)
Pressing the **DTMF**, **MF**, or **DP** momentary action pulse type button lights the corresponding LED and instructs the T303/T303B to send any digits using the indicated pulsing type when the SEND button is pressed.

Pressing the **SEND** momentary action button instructs the T303/T303B to send any digits previously entered or recalled from one of the nine memory locations. Pressing SEND during outpulsing

halts the pulsing at the next tone off or interdigit interval. Pulsing resumes with the first stored digit when the button is released.

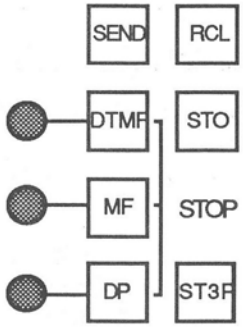

Figure 4. Pulsing Control

The **STO** momentary action button instructs the T303/T303B to enter "store" mode. Up to nine 20-digit numbers may be stored in memory locations 1 through 9. To store a number at a given location, press STO and then a single digit (1 - 9) that corresponds to the desired memory location. Now enter the number to be stored by pressing the desired digits successively. Pressing any non-digit button completes the storage operation.

The **RCL** momentary action button instructs the T303/T303B to enter the "recall" mode. To recall a number from a given memory location, press RCL followed by the single digit corresponding to the desired storage area. The recalled number may now be sent by pressing the SEND button.

Digit Entry (Figure 5)
The 16 **Digit buttons** enable you to enter the individual digits for pulsing. Nominal frequencies for each digit tone pair are provided in Appendix A. The digit buttons are functional in the different pulsing types as follows:

Figure 5. Digit Buttons

Digit Button	Pulsing Type
0 thru 9	DTMF, MF, DP
A , B, C, D, *, #	DTMF
KP, ST, STP, ST2P, ST3P	MF

Miscellaneous (Figure 6)
The **REV BATT LED** illuminates if the polarity of the dc voltage on the tip and ring is reversed (-V on tip; +V on ring). If the circuit being tested provides a reverse battery wink start signal, the LED flashes.

The **SEND LEVEL (-dBm) Thumbwheel Switch** sets the level of the tone output. For DTMF and MF, the setting indicates the output level of the individual tone referenced to a 0 dBm Test Level Point (TLP). For SF, the setting represents the output level for the 2600 Hz tone referenced to a +7 TLP. The SF On Hook level is 13 dB below thumbwheel setting. The SF pulsing level is 1 dB below the thumbwheel setting.

The **VOLUME Control** adjusts the sound level on the front panel monitor speaker or the headset. The speaker is disabled when a standard 52/53 type headset is connected to the **HEADSET** jacks (refer to Figure 3).

Figure 6. Miscellaneous Controls

Operating the T303/303B

The operating instructions are divided into sections that describe the following:

- powering the unit
- 2-wire circuit interface with dc loop
- 4-wire circuit interface with dc loop
- 4-wire circuit interface with SF
- 4-wire circuit interface with E & M

Power

The T303/T303B is powered by 115V ac or the internal rechargeable Ni-Cad batteries. For ac operation, connect the line cord to the recessed male connector in the side of the case. The batteries charge when the set is turned on and ac power is applied. Battery charge time is approximately 14 hours. Operating time is approximately 5 hours.

When operating the T303/T303B from the internal batteries, -48V dc and ground must be connected to the set through the -48 jack. When the set is powered from ac mains, the internal power supply provides the -48V and ground for E & M operation.

Interfacing 2-wire Circuits with DC Loop Supervision (LOOP 2W button engaged; Figure 7)

Connections

a. 2-wire loop circuits are connected to the OUTPUT SEND 4W/2W jack for send and receive test functions. The internal switching connects the headset/speaker monitor circuit across this jack.

The output of the tone generator is connected to this jack through the dc pulsing circuit.

b. For loops that require ground start, office ground potential must be provided at the -48 jack when ac power is *not* connected to the test set.

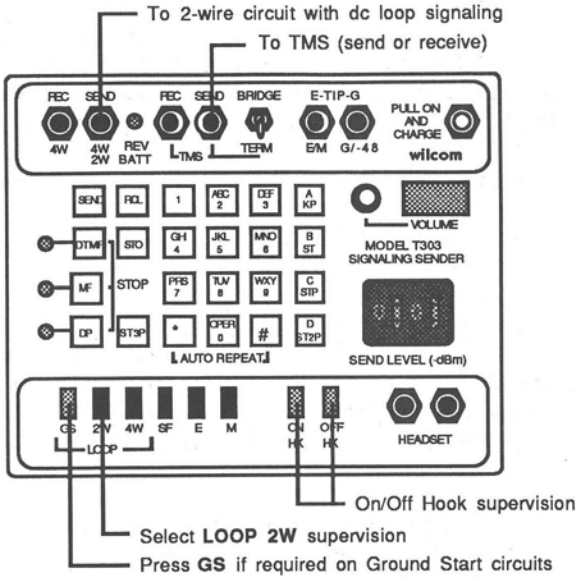

Figure 7. Interfacing 2-wire Loop (with DC Supervision)

c. For transmission or noise measurements, the transmission test set (TMS) is connected to the MEASURE SEND 4W/2W jack. Since the OUTPUT and MEASURE SEND 4W/2W jacks are con-nected in parallel, the TMS should have a balanced, dc blocked, high impedance input to avoid possible distortion of the pulsing output.

Supervision

a. For loops that require ground start, momentarily pressing the LOOP GS button places a ground on the ring of the loop to seize the circuit.

b. The ON HK and OFF HK buttons select the desired dc loop supervision circuit conditions (open and closure respectively). Once the dc pulser provides the Off Hook closure, a hold coil provides the low resistance dc path for holding a 2-wire loop circuit.

c. The REV BATT display provides a visual indication of either the WINK signal from the far end or the presence of reverse battery polarity on the circuit.

Pulsing Types

a. Either dc dial pulsing (DP) or tone pulsing (MF, DTMF) may be used when the LOOP 2W button is engaged. Select the correct pulsing type for the circuit function under test by pressing the

corresponding button. Three displays provide a visual indication of the selected pulsing type.

The keyboard pulsing functions and setting tone levels are described later in the sections *Pulsing Functions* and *Send Level Setting*.

Interfacing 4-wire Circuits with DC Loop Supervision (LOOP 4W button engaged; Figure 8)

Connections

a. 4-wire loop circuits are connected with the receive side to the OUTPUT REC 4W jack and the send side to the OUTPUT SEND 4W/2W jack. The internal switching connects the headset/speaker monitor circuit across both REC 4W jacks. The output of the tone generator is connected to both SEND 4W/2W jacks. The dc pulsing circuit is connected in the simplex path between the OUTPUT SEND/REC jacks.

b. For loops that require ground start, office ground potential must be provided at the -48 jack when ac power is not connected to the test set.

c. For transmission or noise measurements, the TMS is connected with the send side to the MEASURE SEND 4W/2W jack and the receive side to the MEASURE REC 4W jack.

Since the MEASURE jacks are connected in parallel with the OUTPUT jacks, the TMS should have a balanced, dc blocked, high impedance input to avoid possible distortion of the pulsing output.

Supervision

a. For loops that require ground start, momentarily pressing the LOOP GS button places a ground on the ring of the SEND 4W/2W jacks to seize the circuit.

b. The ON HK and OFF HK buttons select the desired dc simplex supervision conditions (open and closure respectively). Once the dc pulser provides the Off Hook simplex closure, the dc path through the metallic center of the simplex holds the 4-wire dc loop circuit.

c. The REV BATT display provides a visual indication of the WINK signal from the far end or the presence of reverse battery polarity on the simplex supervision circuit.

Pulsing Types

a. DC dial pulsing (DP) or tone pulsing (MF, DTMF) may be used when the LOOP 4W button is engaged. Select the correct pulsing type for the circuit function being tested by pressing the corresponding button. Three displays provide a visual indication of the selected pulsing type.

The keyboard pulsing functions and setting tone levels are described later in the sections *Pulsing Functions* and *Send Level Setting*.

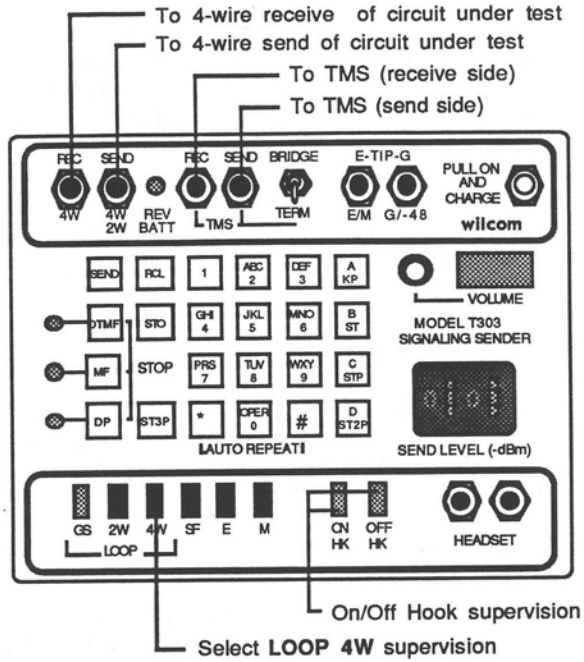

Figure 8. Interfacing 4-wire Loop (with DC Supervision)

Interfacing 4-wire Circuits with SF Supervision (SF button engaged; see Figure 9)

Connections

a. 4-wire SF circuits are connected with the receive side to the OUTPUT REC 4W jack and the send side to the OUTPUT SEND 4W/2W jack. The internal switching connects the headset/speaker monitor circuit across both REC 4W jacks. The output of the tone generator is connected to both SEND 4W/2W jacks.

b. For measurements of transmission, noise or SF level and frequency, a test set may be connected with the send side to the MEASURE SEND 4W/2W jack and the receive side to the MEASURE REC 4W jack. Since the MEASURE jacks are connected in parallel with the OUTPUT jacks, the TMS should be a balanced, dc blocked, high impedance instrument to avoid possible distortion of the pulsing output.

Supervision

a. The ON HK and OFF HK buttons are used to select the desired SF supervision conditions for the circuit being tested. When the ON HK button is engaged, the 2600 Hz SF tone is sent at a level 13 dB below the setting of the SEND LEVEL thumbwheel. When the OFF HK button is engaged, no SF tone is sent.

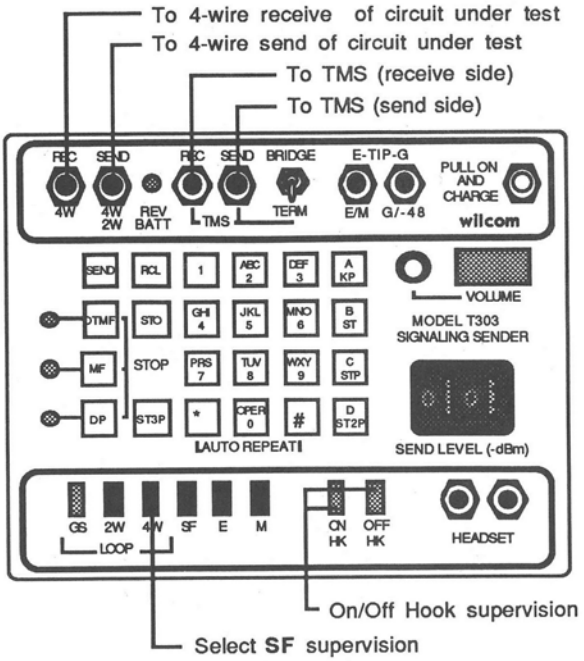

Figure 9. Interfacing 4-wire Circuits (with SF Supervision)

Pulsing Types

a. Single frequency (SF) dial pulsing (DP) or tone pulsing (MF, DTMF) may be used when the SF button is engaged. Select the correct pulsing type for the circuit function being tested by pressing the corresponding button. Three displays provide a visual indication of the selected pulsing type.

The keyboard pulsing functions and setting tone levels are described later in the sections *Pulsing Functions* and *Send Level Setting*.

Interfacing 4-wire Circuits with E & M Supervision (E or M button engaged; Figure 10)

Connections

a. 4-wire E & M circuits are connected with the receive side to the OUTPUT REC 4W jack and the send side to the OUTPUT SEND 4W/2W jack. The internal switching connects the headset/speaker monitor circuit across both REC 4W jacks. The output of the tone generator is connected to both SEND 4W/2W jacks.

b. Central office battery (-48V dc) and ground is connected to the -48 jack to provide the potentials for dc supervision and pulsing when ac power is not connected to the test set.

c. The E or M lead of Type I and Type III E & M signaling circuits is connected to the SEND E/M jack (tip = E, ring = M). When the E button is engaged, the internal dc pulser is connected to the tip of the SEND E/M jack to provide open and ground pulsing. When the M button is engaged, the internal dc pulser is connected to the ring of the SEND E/M jack to provide ground battery (-48V dc) pulsing.

d. For transmission or noise measurement, the TMS is connected with the send side to the MEASURE SEND 4W/2W jack and the receive side to the MEASURE REC 4W jack. Since the MEASURE jacks are connected in parallel with the OUTPUT jacks, the TMS should be a balanced, dc blocked, high impedance instrument to avoid possible distortion of the pulsing output.

Supervision

a. The ON HK and OFF HK buttons are used to select the desired supervision condition for either the E lead or the M lead.

E button engaged:	ON HK - Open OFF HK - Ground
M button engaged:	ON HK - Ground OFF HK - Battery (-48V dc)

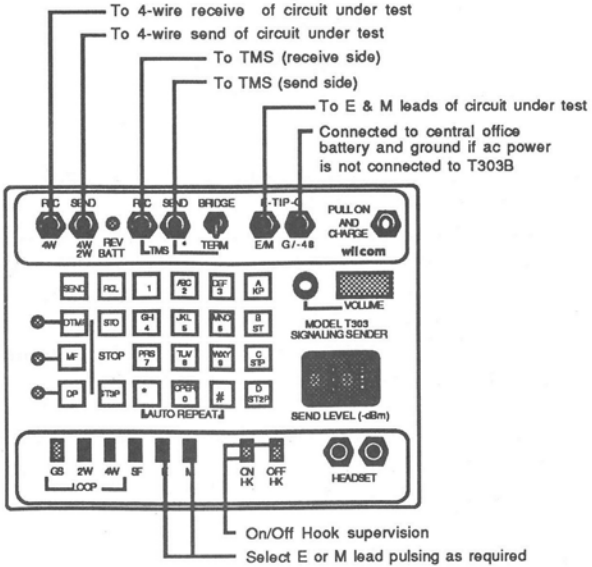

Figure 10. Interfacing 4-wire Circuit (with E & M Supervision)

b. Engaging the E button connects the M lead to ground through a 1 kΩ resistor in the T303. In the T303B the M lead is connected to a high impedance detector that controls the M LED.

c. When the M button is engaged, the E lead is an open circuit in the T303. In the T303B the E lead is connected to a high impedance detector which controls the E LED.

Pulsing Types

a. Either dc E & M dial pulsing (DP) or tone pulsing (MF, DTMF) may be used when the E or M button is engaged. Select the correct pulsing type for the circuit function being tested by pressing the corresponding button. Three displays provide a visual indication of the selected pulsing type. The T303B E & M indicators display the On/Off Hook and pulsing status of the corresponding leads.

The keyboard pulsing functions and setting tone levels are described in the sections *Pulsing Functions* and *Send Level Setting* below.

Send Level Setting

For MF and DTMF levels: The SEND LEVEL (-dBm) thumbwheel indicates the per tone sending level of the T303. Most MF transmitters that are presently used in toll switchboards, testboards, test frames, and senders have a nominal per tone level of -6 dBm at the zero transmission level point.

For SF Levels:

a. The SF On Hook sending level of the T303 is

13 dB below the SEND LEVEL thumbwheel setting. The sending level during SF pulsing is 1 dB below the SEND LEVEL thumbwheel setting.

b. When testing at the +7 TLP of a typical SF signaling system, the SEND LEVEL thumbwheel is set to *00* to provide the following levels:

On Hook:	-13 dBm
Pulsing:	-1 dBm

c. When testing at the -16 TLP of a typical SF signaling system, the SEND LEVEL thumbwheel is set to *23* to provide the following levels:

On Hook:	-36 dBm
Pulsing:	-24 dBm

Pulsing Functions

Pulsing type selections:

a. Pressing the DTMF button causes the test set's tone generator to output composite tone pairs with frequencies as indicated in Appendix A for each digit.

b. When the MF button is pressed, the test set's tone generator outputs composite tone pairs with frequencies as indicated in Appendix A for each digit.

c. Pressing the DP button causes the dc pulsing circuit or the tone generator to provide output digit pulsing depending upon the selected circuit interface type. The following table indicates the make/break pulsing conditions for each interface.

INTERFACE	BREAK	MAKE
2W Loop	T-R; OPEN	T-R; CLOSURE
4W Loop	Simplex; OPEN	Simplex; CLOSURE
SF	2600 Hz; TONE ON	TONE OFF
E	OPEN	GROUND
M	GROUND	BATTERY

Sending a Number

1. Select the desired pulsing type, interface type and if using tone pulsing (DTMF, MF, SF) set the desired send level.

2. Enter the digits (up to 20) for the number you wish to send.

3. Press the SEND button. The headset/speaker monitor circuit provides an audible indication of the pulsing.

4. The number may be sent as many times as desired by pressing the SEND button repeatedly.

5. To send a new number, enter the digits for the new number and press the SEND button.

Storing a Number

Up to nine different numbers, each having a maximum of 20 digits may be stored in the test set and individually recalled for sending. A label is provided in the cover for recording stored numbers.

To enter a number in the memory press the STO button followed by a single digit, 1 through 9, which represents a location in the memory. Then enter the number to be stored by pressing each desired digit button in sequence.

To end the storage operation press any non-digit button.

Recalling a Stored Number

To send a stored number, press the RCL button

followed by the single digit, 1 through 9, that represents the memory location for the desired number.

Press the SEND button. The headset/speaker monitor circuit provides an audible indication of the pulsing. The number may be repeated as many times as desired by pressing the SEND button repeatedly.

Repeating a Number Automatically

To enter the automatic repeat mode, press * and # *simultaneously*. Then set the repeat rate by pressing a single digit button, 1 through 9 or 0, to repeat at 1 through 9 or 10 second intervals. Pressing the interval digit sends the previously entered number sequence and then repeats it at the selected interval.

To stop the repeat operation, press one of the three pulse type select buttons.

Maintenance

The T303/303B is fully calibrated at the factory and should require no further adjustment. If the unit requires servicing or repair, it may be sent to the following repair facility in accordance with the warranty instructions at the back of this manual:

Superior TeleTec Transmission Products, Inc.
Attn: Repair Department
Daniel Webster Highway
Laconia, NH 03246

Technical Assistance

If you need technical assistance with the T303/303B, contact Applications Engineering at the following toll-free number in Laconia, NH:

(800) 521-TEST

Appendix A
DTMF Pulsing

Digit	Composite Tone Pair (frequencies in Hz)
1	697 + 1209
2	697 + 1336
3	697 + 1477
4	770 + 1209
5	770 + 1336
6	770 + 1477
7	852 + 1209
8	852 + 1336
9	852 + 1477
*	941 + 1209
0	941 + 1336
#	941 + 1477
A	697 + 1633
B	770 + 1633
C	852 + 1633
D	941 + 1633

Appendix B
MF Pulsing

Digit	Composite Tone Pair (frequencies in Hz)
1	700 + 900
2	700 + 1100
3	900 + 1100
4	700 + 1300
5	900 + 1300
6	1100 + 1300
7	700 + 1500
8	900 + 1500
9	1100 + 1500
0	1300 + 1500
KP	1100 + 1700
ST	1500 + 1700
STP	900 + 1700
ST2P	1300 + 1700
ST3P	700 + 1700

WARRANTY

All products are warranted against defects in materials and workmanship. This warranty applies for a period of two (2) years from date of delivery, except for Fiber Optic instrumentation and equipment which have a one (1) year warranty on parts and two (2) years on labor. (The only exceptions in the digital testing equipment are the D550 Shark and D550 Hawkeye, which have a warranty of one (1) year from date of delivery.) Wilcom's obligation under this warranty is limited to servicing or adjusting each instrument returned to its factory within the warranty period, and to replace any components found to be defective. If determined that the defective condition is a result of misuse or abnormal operation, repairs will be billed.

LIMITATION OF WARRANTY

The foregoing warranties are the exclusive warranties provided by Wilcom Products, Inc. Wilcom will not be liable for any special, indirect, incidental or consequential damages whatsoever resulting from loss of use, loss of data or loss of profits arising out of or in connection with the use or performance of the product, even if Wilcom has been informed of the possibility of such damages in advance. All implied warranties, including without limitation warranties of merchantability and fitness for a particular purpose, as well as warranties arising from a course of dealing or usage of trade are expressly disclaimed.

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