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SAGE INSTRUMENTS

Model 930A Communications Test Set

Applications Note #1

USING THE DIGIT RECEIVER/ANALYZER

7/1/91
Rev. 2

This pamphlet is intended to supplement the description of the digit receiver in Section 4-2 of your manual. This will help you to get started. Further information, details and examples can be found in Section 4-2. This pamphlet is based on two years of technical support interviews, and addresses the most frequently asked questions.

9120-0930-01

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Starting Out

First, make sure the 930A is set-up for the trunk you are testing. Set it to the correct supervision type (E&M, Loop, Gnd-Start, PCM, SF) and impedance. If the 930A is terminating the call, select TERM. If the 930A is monitoring the call, select BRIDGE.

NOTE TO DIGITAL USERS:

Make sure you are on the right PCM channel.
To terminate the span, select TX/RX.
To terminate the call while leaving the span up, select D&I.
To monitor a call, select THRU.
Consult Section 4-6 of the 930A manual for help and diagrams.

Next, make sure the 930A is "looking toward" the caller.

How do you **know** you are in the right trunk type, looking in the right direction? Press the Trunk Type key. When the **caller** goes off-hook, the LED marked **Term Off Hook** lights up. If the Term LEDs do not follow the caller's supervision, something is wrong. (If the **Orig** LEDs follow caller supervision, you are looking in the wrong direction.)

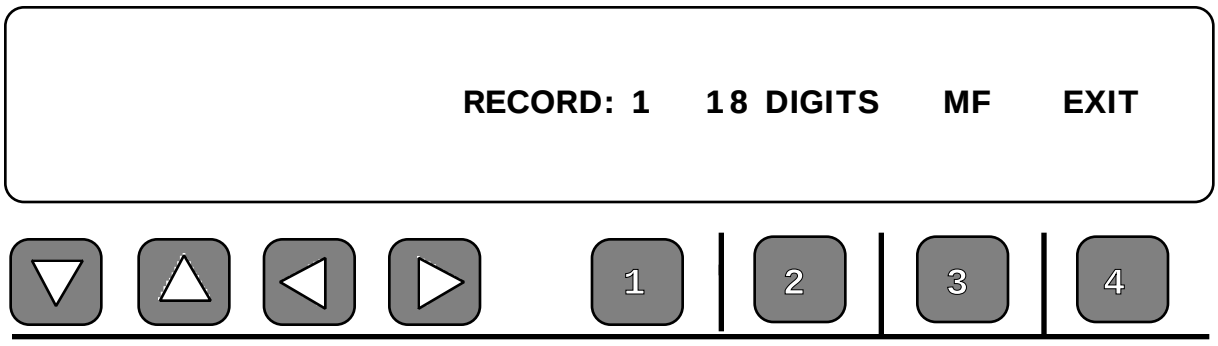
To change direction: In Loop or Gnd-Start, toggle between CONTACT and BATTERY. In E&M, toggle between SEND-E and SEND-M. In PCM, toggle between SEND-1 and SEND-2. In SF, toggle between SEND TR and SEND T1R1. In analog trunks, changing direction will bridge the 930A. If you are going to terminate a call, set the 930A back to TERM.

Set-up

Once you are on the right trunk and looking in the right direction, you have to tell the 930A what to expect: what kind of digits are expected (MF, DTMF or DP), and how many; are there any winks expected, etc.

Parameters

Setting the parameters tells the 930A what kind of digits to expect. Press the Option Menu key. Go to Option Number 4: DIGIT RECEIVER. Select SET-UP. Select PARAMETERS. You will see a screen that looks something like this:



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The 930A can collect digits into four separate registers, called records. Each record can be set to expect MF, DTMF or DP digits, and can hold up to 18 digits.

If you do not set-up a record to hold the incoming digits, the 930A will not be able to receive them. The 930A comes factory-set to receive MF in all four records, but any changes you make are automatically saved.

If you are expecting MF digits, set the digit number to the maximum 18. The 930A will close the record when it sees a ST, STP, ST2P or ST3P.

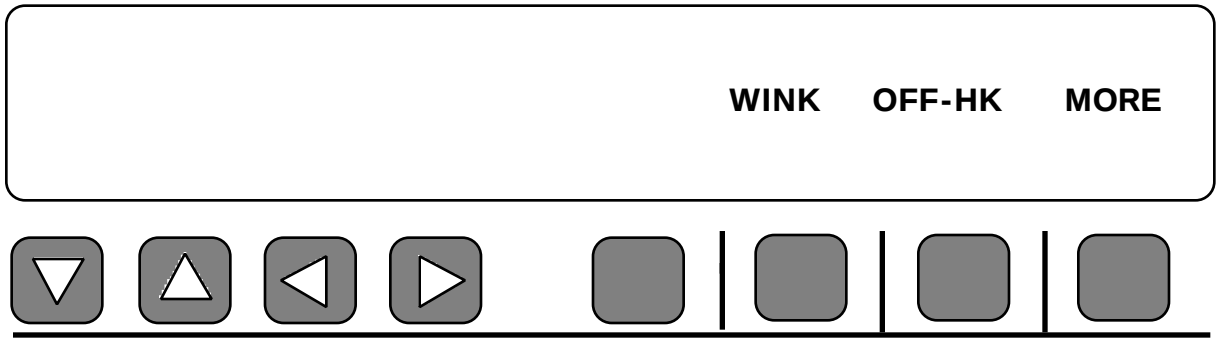
If you are expecting DTMF or DP, set the record to hold the exact number of digits that you expect. Seven digits of DTMF would be typical when monitoring outgoing customer calls from the DEMARC.

Change the number of expected digits by entering a new number from the keypad. Change from MF to DTMF to DP by pressing Softkey 3. Use the up and down arrows to set up as many records as you need. Set-up a separate record for each string of digits you expect. For a TSPS call, you might set up REC# 1 for 7 DP digits and REC# 2 for 18 MF digits, or REC# 1 for 7 DTMF digits and REC# 2 for 18 MF digits.

When you have set-up your records, press EXIT (Softkey 4).

Sequence

Now you need to set up the sequence. The "sequence" is the expected alternation of digits from the originating end and supervision events from the terminating end. Press Softkey 3 (labeled "SEQUENCE"). Press the **CLR** key to clear out any old sequence. You will see this display:



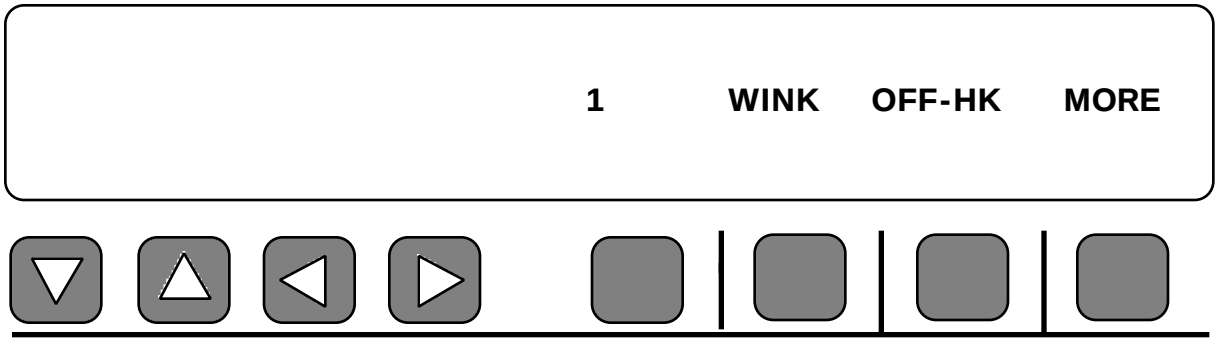
The left half of the display is blank. This is where the sequence will be displayed. The next page shows some examples.

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NOTE : All sequences must include at least one record number (1-4), telling the 930A what record to put the digits into. The 930A will expect the number and type of digits that record is set up for.

Example #1: Immediate Dial

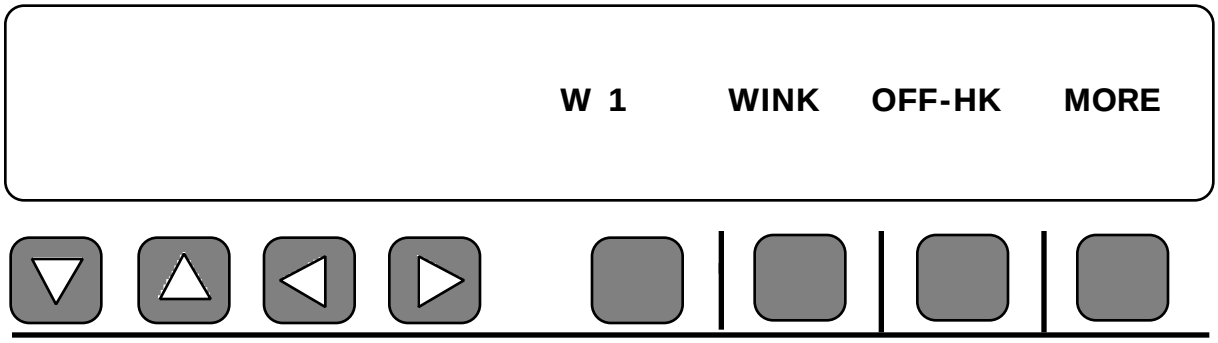
The originating end will go off-hook and send digits.
Record #1 has been set-up to receive the type and number of digits expected.
The sequence is: 1
The "1" indicates the record number into which the digits will go.
Press **1**, **ENT**.
The display will show:



NOTE: The seizure by the calling end is implicit, *not* a part of the sequence.

Example #2: Wink Start

The originating end will seize the line, the terminating end will provide a wink, and the originating end will send digits. Record #1 is set-up to receive the digits.
The sequence is: W 1
A wink is followed by the record number into which the digits will go.
Press Softkey 2 (labeled **WINK**), **1**, **ENT**.
The display will show:



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Example #3: Ground Start

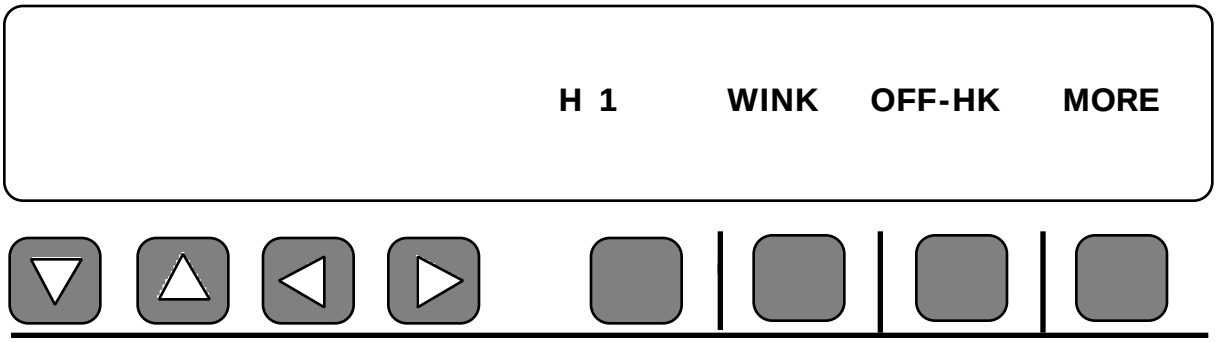
The originating end seizes (by providing Ring Ground) and then waits for the terminating end to go off-hook (provide Tip Ground). It then switches to loop and sends digits. Record #1 is set up to receive the digits.

The sequence is: H 1

An Off-hook is followed by the record number into which the digits will go.

Press Softkey 3 (labeled **OFF-HK**), **1**, **ENT**.

The display will show:



NOTE : The ring ground and loop by the calling end are implicit. Only the *terminating* supervision is part of the sequence.

Example #4: TSPS

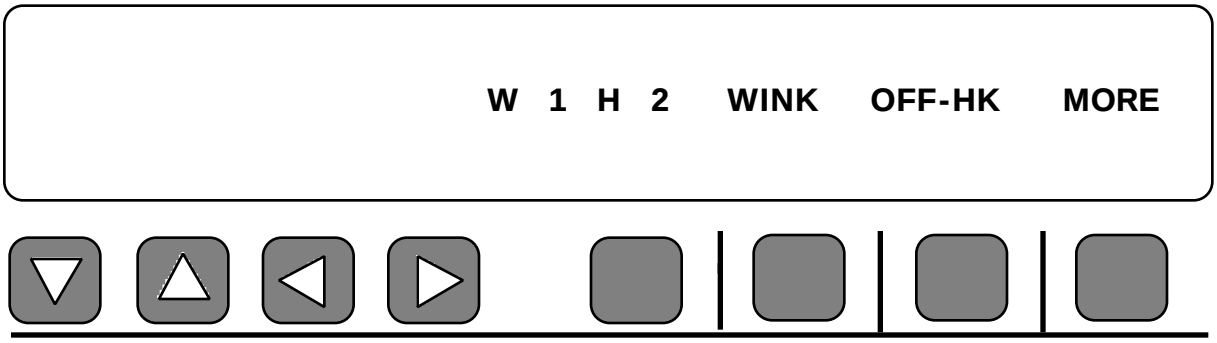
The originating office seizes, the terminating office winks, the originating office sends the called number (MF or DP), the terminating office goes off-hook, and the originating office outpulses the ANI calling number (always MF). Record #1 is set up to receive the called number, and record #2 is set-up to receive the ANI calling number.

The sequence is: W 1 H 2.

A wink is followed by digits going into record #1, then an off-hook, followed by digits going into record #2.

Press Softkey 2 (labeled "**WINK**"), **1**, **ENT**, Softkey 3 (labeled "**OFF-HK**"), **2**, **ENT**.

The display will show:



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An example of an equal access call is given in detail in Section 4-2 of your manual. Briefly, the sequence at or before the access tandem is W 1 W 2 3 W. An initial wink, followed by an ID code, a second wink, the called number, the calling number, and a final wink. This may be followed by an off-hook from the terminating end when the call completes. The access tandem provides the first wink and strips out the ID code, so these are not present on equal access calls where the point of intercept is after the tandem.

Special Sequences

Ninety percent of the calls made over the Bell system can be described using some combination of winks, off-hooks and digits. To insert other events into the sequence, press Softkey 4 (labeled "MORE"). The other choices are:

PAUSE – Pause for one second before proceeding. Use this only when **terminating** a call, never when monitoring. Shows in the sequence as a "-".

D-DIAL – Use for delay dial lines. Terminating end goes on-hook when ready to receive digits. Shows in sequence as a "D".

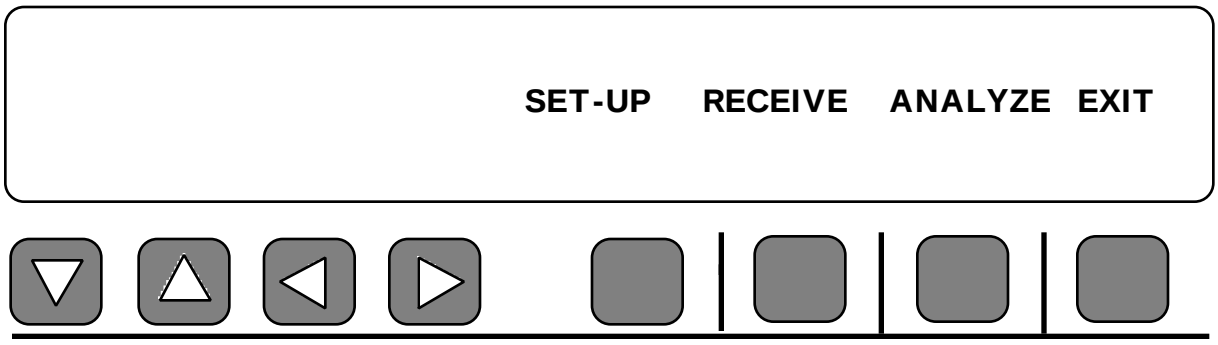
TESTLINE – Use this only when **terminating** a call. It tells the 930A to go off-hook at the end of the call and simulate a testline. You will have a choice of testlines to simulate:

100 – The 930A goes off-hook and provides quiet termination.
102 – The 930A goes off-hook and sends 1004 Hz at -16 dBm.
105 – The 930A goes off-hook and acts as a type 105 responder.
LOOPBACK – The 930A goes off-hook and acts as a loopback testline.

Whatever sequence you set-up will be automatically retained in nonvolatile RAM.

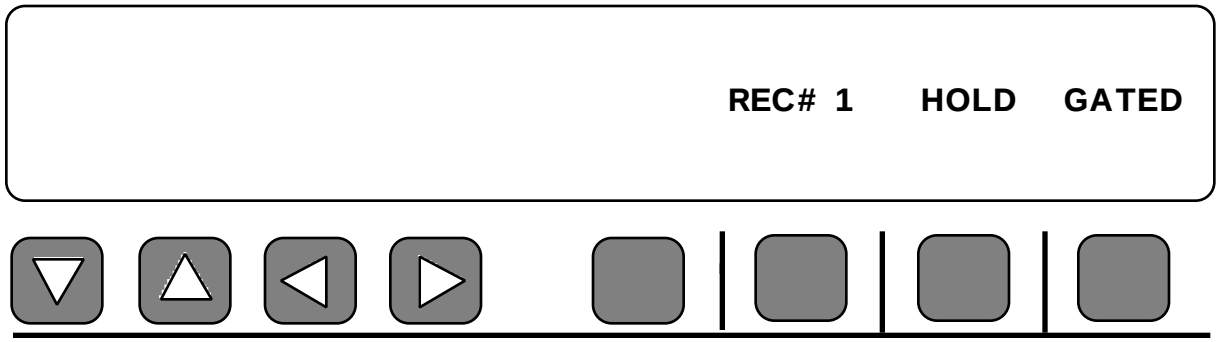
Receiving the Call

Once you have set-up the parameters and sequence, you are ready to start receiving calls. If you are still looking at the sequence set-up menu, press the Option Menu key, then the softkey labeled "EXIT". You should see this display:



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Press Softkey 2, labeled "RECEIVE". You should see the following display:



When the calling end seizes the line, you should see the **Orig Off Hook** LED light up. If there is a wink or an off-hook in response to the seizure, you should see it on the **Term** LEDs. As the digits are sent, you will hear them over the 930A speaker and see them displayed on the left side of the screen.

As one digit record fills and another begins, the left side of the screen will clear briefly and the new REC# will be displayed, followed by the incoming digits. You can put the 930A on hold at any time by pressing Softkey 3, labeled "HOLD". While the 930A is on hold, it will not receive new digits or clear out the old digits. You can use the up and down arrow keys to view the various records you have received and inspect the digits. Press the softkey labeled "HOLD" a second time to take the 930A off hold and rearm the digit receiver.

After the originating end hangs up, the 930A automatically rearms its digit receiver and prepares to receive another call. It will continue receiving calls until you put it on hold or press the Option Menu key.

The 930A defaults to GATED mode upon each entry to the digit receiver. This means that it waits until it sees an on-hook-to-off-hook transition from the **originating** end before it arms the digit receiver. If you are on a "dry" circuit with no supervision, or if you expect the call to begin without the originating end going off-hook, press Softkey 4, labeled "GATED". The label will change to read "OPEN". The digit receiver will now be armed. The 930A will not expect a seizure to initiate the call. When used in open mode, the digit receiver will put itself on hold at the end of every call.

If you put the 930A in PRINTER remote mode, and answer "YES" to the question "PRINT RECEIVED DIGITS? YES NO", the digits received by the 930A will be sent to the printer at the end of each call, any time a wink or supervision event fails, or any time a call is abandoned before completion.

Since the sequence and parameters you set-up are retained in nonvolatile RAM, you can skip the set-up next time you want to use the digit receiver. Just go to Option Menu 4 and press the Softkey labeled "RECEIVE".

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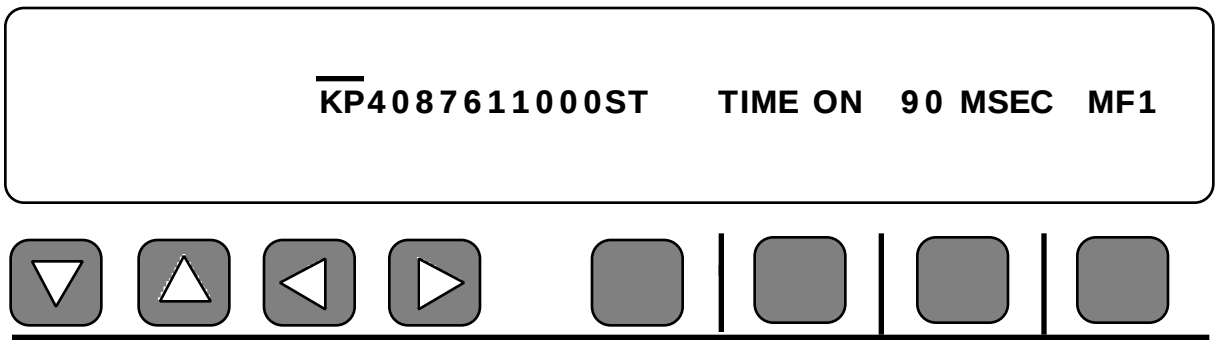
You can store several different sequence / parameter setups in memory at once and call them up as needed. The 930A has 39 general purpose registers for storing test setups. To store a digit receiver setup, exit to the Option Menu and press the **STO** key. You will be prompted to enter a register number in which to store the setup.

To recall a stored setup, go to the Option Menu and press the **RCL** key, followed by the register number in which the setup is stored. You could, for example, have a wink start sequence stored in register 10, a TSPS sequence in register 11 and an equal access sequence in register 12. The most recently used setup is automatically retained when you enter the digit receiver.

Analyzing Received Digits

Once you have successfully received a call, you can have the 930A analyze the digits. For MF and DTMF digits, it will report on the amplitude and frequency of the two tones that make up each digit, the frequency and amplitude of up to two additional tones (if spurious tones are present), and the length of each digit and interdigit time in milliseconds. For DP signals, each digit will be analyzed for speed (in pulses per second), %break and interdigit time.

To see the analysis, press the Option Menu key after you have received the call, then press Softkey 3, labeled "ANALYZE". You will see a display much like this:



Use the left and right arrow keys to move the cursor over the digit you wish to analyze. Use the up and down arrow keys to scroll through the various parameters, such as TIME ON, TIME OFF, FREQ 1, AMPL 1, %BRK, etc. Press Softkey 4 where the signal type and record number are displayed to scroll through the four available records. When you have examined the parameters of interest to you, press the Option Menu key to return to the main digit receiver menu ("SETUP RECEIVE ANALYZE EXIT").

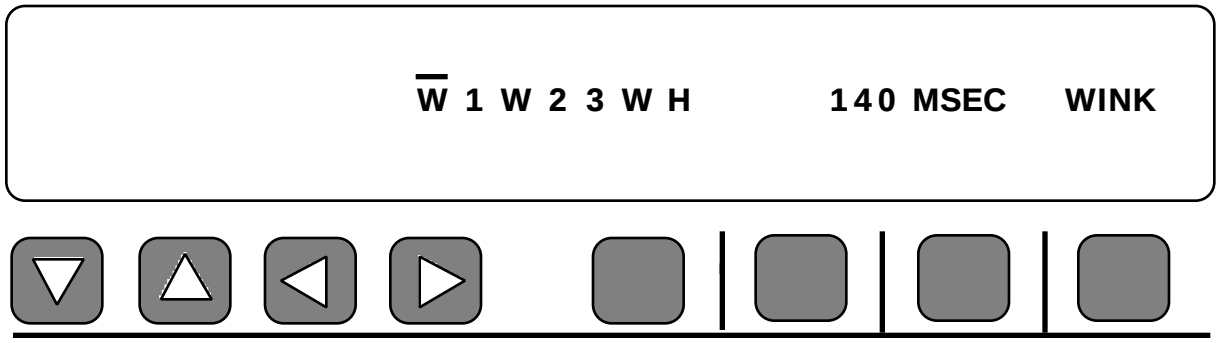
If you put the 930A in PRINTER remote mode and answer "YES" to the question "PRINT DIGIT ANALYSIS? YES NO", the 930A will print a complete analysis of all received digits at the end of every call.

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Timing Winks

If you have monitored a call with winks or off-hooks in the sequence, there will be wink timing information available. If the 930A terminates a call, it provides any necessary winks in the sequence. In monitor mode, it looks for and times these events.

To review wink timing information, wait until a call sequence completes or is abandoned. Exit to the Option Menu and go to Option Number 9: WINK TIMING. You will see a display much like this:



Use the left and right arrow keys to move the cursor over the event of interest, such as the first or second wink in the sequence. Press Softkey 4 to toggle between the guard time and the event time. The guard time is the time spent waiting for the event. If a wink is the first event in a sequence, the guard time is the time between the seizure and the wink. If a wink follows a digit record, the guard time is the time between the last outpulsed digit in the record and the beginning of the wink. The same is true for an off-hook. The event time for a wink is labeled "WINK" and is the actual length of the wink. The length of a successful off-hook is labeled as "OFF HOOK" and simply reported as ">200 Msecs". If the terminating end stays off-hook for less than 200 milliseconds, the off-hook fails.

If you put the 930A in PRINTER remote mode and answer "YES" to the question "PRINT WINK TIMING? YES NO", the 930A will send wink timing information to the printer at the end of every call.

If the 930A is terminating the call rather than monitoring it, you can set the length of the guard time and the length of the wink sent by the 930A. Go to Option Number 12: Wink Margining. The guard time is called the pre-wink time in this option, and is used to specify how long the 930A will wait before giving a wink or going off-hook. The wink time specifies the length of the wink. The factory default is a 200 msec. pre-wink and a 150 msec wink.

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