

# Technical Practice

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## MODEL 502 AUTOMATIC TRUNK DISCONNECT

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### 1. General Description

**1.1 PRACTICE** Issue 4 of the Model 502 practice updates the phone number of Gordon Kapes, Inc.

**1.2 PRODUCT OVERVIEW** The Model 502 Automatic Trunk Disconnect is designed to limit the length of telephone calls on standard 2-wire loop or ground start trunk or station telephone circuits. The call time limit is switch selectable in 30 second increments from two minutes to 17 minutes 30 seconds. If continuous loop current is detected for a time equal to the maximum length specified, either one of two tone sequences is initiated or the call is terminated. The two tone sequences are designed to encourage disconnect but not to terminate the call. If forced termination is selected, disconnect is accomplished by breaking loop current for two seconds. Two warning tone sequences, 30 seconds and 10 seconds prior to the maximum call time, indicate to all parties that the end of the time limit is approaching. The alert tone sequences prompt the callers to complete their call prior to the tone sequences or forced termination. Normal trunk or line functions such as 20/30Hz ringing signals, reverse battery conditions, etc., are not affected by the Model 502.

**1.3 FEATURES** The Model 502 contains four identical circuits. Upon installation, switches are set to specify the maximum length of any one call. The time set is common to all four circuits, i.e. the four circuits cannot have different time settings. Switches are also set to select if tone sequences or forced disconnect is desired. A microcomputer is used to insure reliable and accurate operation.

**1.4 POWER REQUIREMENTS** The Model 502 requires -24Vdc, filtered and regulated, 200mA maximum for operation.

**1.5 DESCRIPTION** The Model 502 consists of a precision fabricated printed circuit board that is compatible with Tellabs Type 10 or equivalent mounting shelves. Each Model 502 requires one position of a Type 10 shelf.

### 2. Applications

**2.1 PRIMARY APPLICATION** The primary application of the Model 502 is to control access to telephone trunk and station lines. Due to contractual or access requirements no one call may be allowed to use a trunk longer than a fixed maximum time.

**2.2 PRIVATE NETWORK APPLICATIONS** In certain cases, private networks are established to facilitate specific functions. An example would be direct lines between

manufacturing plants for ordering and inventory control use. It may be desirable to insure that the lines are not tied up with non-critical calls. A maximum time is selected to keep the lines open without interfering with normal operating requirements.

**2.3 FREE CALL TELEPHONES** In certain locations free call telephones may be installed. An example would be in a university or college student center. Long distance calling will undoubtedly be restricted, but the local call length may need to be restricted to allow access by many individuals.

### 3. Installation

**3.1 CHECKING FOR DAMAGE** The Model 502 should be inspected for damage immediately upon receipt. If damage is found, a claim should be filed with the shipper. A replacement Model 502 should be ordered if necessary.

**3.2 MOUNTING** Each Model 502 requires one position of a Tellabs Type 10 or equivalent mounting shelf.

**3.3 POWER SOURCE** The power supply selected to furnish the Model 502 with filtered and regulated -24Vdc must contain current limiting provisions, minimizing the chance of damage or fire from occurring due to a short in the Model 502 or associated wiring. The power supply must contain internal fuses and/or electronic protectors to limit the maximum output current.

**3.4 MODEL 502 CONNECTIONS** All connections to the Model 502 are made via the 56-pin card edge connector contained in the Tellabs Type 10 or equivalent mounting shelf selected to house the Model 502. The card edge connector should be wired according to Figure 1 and checked prior to inserting the Model 502 into the mounting shelf.

**3.5 DAMAGE PREVENTION** To prevent damage to the Model 502's circuitry, the -24Vdc power source must be disconnected prior to inserting or removing the Model 502 from the card edge connector in the mounting shelf.

**3.6 SWITCH SETTING** SW1, an 8-position DIP type switch located on the Model 502 circuit board, must be set for the maximum call length and Model 502 operating mode.

**3.7 SET MAX TIME** Setting switches SW1-1 through SW1-5 selects the maximum time for all four circuits. The four circuits share the same maximum call length. The maximum call length is from two minutes to 17 minutes 30 seconds, selectable in 30 second increments.

**MAX TIME = (Total Time of Switches Set to ON) + 2 Minutes**

SW1-1 ON adds 8 minutes

SW1-2 ON adds 4 minutes

SW1-3 ON adds 2 minutes

SW1-4 ON adds 1 minute

SW1-5 ON adds 30 seconds

Examples:

For MAX TIME of 9 minutes 30 seconds: SW1-2 through SW1-5 ON

For MAX TIME of 2 minutes: All switches OFF

For MAX TIME of 14 minutes 30 seconds: SW1-1, SW1-2, and SW1-5 ON

**3.8 SET MODEL 502 MODE** SW1-6 selects which of two

modes the Model 502 will operate in. The first is the tone only mode which will not terminate the call but will send one of two four-tone sequences after the maximum time limit is reached. The second mode is the forced disconnect mode which terminates the call by breaking loop current.

SW1-6 OFF for tone only mode

SW1-6 ON for forced disconnect mode

If the tone only mode is selected, you can choose the tones using SW1-7. In the OFF position, a group of four tones is heard every 15 seconds. In the ON position momentary tone bursts (beeps) are heard continuously.

SW1-7 OFF for four tones every 15 seconds

SW1-7 ON for continuous tone bursts

### 4. Circuit Description

**4.1 GENERAL** The circuit description is intended to familiarize you with the Model 502 for engineering and applications use. It is representative of four identical circuits on the Model 502.

**4.2 MICROCOMPUTER** The "heart" of the Model 502 is a Motorola 6805 series microcomputer (MCU) integrated circuit. The MCU contains RAM, ROM, and EPROM memory, a clock, and Input/Output ports. The software that runs the Model 502's functions is permanently stored in the on-board EPROM memory. A watchdog circuit is implemented in hardware to insure that glitches, noise spikes, etc. do not cause the MCU to hang or crash. If program operation stops, the hardware reset is activated and the program should start running again. The MCU uses HMOS construction for reliable, but not very power efficient operation.

**4.3 OFF HOOK SENSING** A bidirectional optical coupler serves to monitor the current flowing through the tip side of the telephone line. Debouncing is performed by the MCU.

**4.4 TONE SEQUENCE GENERATION** The MCU produces a sequence of 900Hz square waves to serve as the out of time alert tones and the tones for the tone only operating mode. The square waves are buffered by an operational amplifier before being coupled to the telephone line by a matching transformer. The transformer is a high impedance type, capacitive coupled to the telephone line to minimize Model 502 insertion loss.

**4.5 DISCONNECTION** Call disconnection is performed by a normally closed relay contact connected in series with the tip lead of the telephone line. The MCU sends a disconnect signal to a relay driver integrated circuit which in turn energizes the relay.

**4.6 CONFIGURATION TIME SELECTION** Seven DIP-type switches directly address I/O ports on the MCU to select the maximum call duration and operating mode.

**4.7 POWER SUPPLY** A 3-terminal integrated circuit regulator produces the clean 5Vdc required by the MCU and watchdog circuitry.

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## 5. Specifications

### NUMBER OF CIRCUITS

4

### TELEPHONE LINE TYPE

Compatible with 2-wire loop or ground start, in- or out-WATS, DID or other lines that provide loop current during off hook

### LOOP CURRENT

For correct operation, loop current must be between 15 and 120mA

### ON/OFF HOOK

For MCU to recognize On or Off Hook, current must cease or flow for 150mSec

### DISCONNECT

Breaks loop current for 2 seconds

### TONE SEQUENCES

Two tone sequences are implemented prior to disconnect. The first comes 30 seconds prior to MAX TIME. The second comes 10 seconds prior to MAX TIME. The tone sequences consist of 900Hz square wave 0.5 seconds on, 0.25 seconds off repeated four times. Two tone sequences are switch selectable for the tone only mode. These tone sequences are heard after the maximum call length has been reached. The first is a tone sequence consisting of 900Hz square wave 0.5 seconds on, 0.25 seconds off repeated four times, the entire group repeated every 15 seconds. The second is a 900Hz square wave 0.5 seconds on, 0.25 seconds off continuous.

### TIME ADJUSTMENT

Switch selectable from 2 minutes to 17 minutes 30 seconds in 30 second increments

### MODE SELECTION

Two modes: tone only and forced disconnect. Two tone groups are switch selectable for the tone only mode.

### TIME ACCURACY

Better than  $\pm 1\%$  of selected interval

### POWER REQUIREMENT

-24Vdc, filtered and regulated, 200mA maximum

### DIMENSIONS

5.6 inches high (14.2cm)

0.9 inches wide (2.3cm)

5.9 inches deep (15.0cm)

### WEIGHT

6 ounces (0.2kg)

### MOUNTING

One position of Tellabs Type 10 or equivalent mounting shelf

## 6. Incorrect Operation

**6.1 DIFFICULTIES** Should problems arise in the operation of the Model 502, review Section 3—Installation. Insure that all connections and switch settings have been made properly. If another Model 502 is available, substitute and retest.

**6.2 APPLICATION LIMITATIONS** The Model 502 was designed to operate correctly with most types of telephone lines that use loop current. However, Gordon Kapes, Inc. does not guarantee that the Model 502 is compatible with all of these types of lines, or specific lines within the types. The functions of the installed Model 502 should be thoroughly tested before being placed into service.

**6.3 DEFECTIVE UNIT** If it is determined that the Model 502 is defective, return for repair or replacement according to the Gordon Kapes, Inc. Warranty/Repair and Return Policy.

Specifications and information contained in this technical practice subject to change without notice.

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## Figure 1 Terminal Strip Connection Diagram for the Model 502

All connections made to 56-pin card edge connector in Tellabs Type 10 mounting shelf selected to contain Model 502 Automatic Trunk Disconnect.

<b>Pin Number</b>	<b>Connection</b>	
55	T	From CO or Other Common Carrier
53	R	From CO or Other Common Carrier
51	T	To Local Terminal Device
49	R	To Local Terminal Device
43	T	From CO or Other Common Carrier
41	R	From CO or Other Common Carrier
39	T	To Local Terminal Device
37	R	To Local Terminal Device
29	T	From CO or Other Common Carrier
27	R	From CO or Other Common Carrier
25	T	To Local Terminal Device
23	R	To Local Terminal Device
15	T	From CO or Other Common Carrier
13	R	From CO or Other Common Carrier
11	T	To Local Terminal Device
9	R	To Local Terminal Device
17	Ground	Power
35	-24Vdc, Filtered and Regulated	

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Gordon Kapes, Inc.  
5520 West Touhy Avenue  
Skokie, Illinois 60077 U.S.A.