

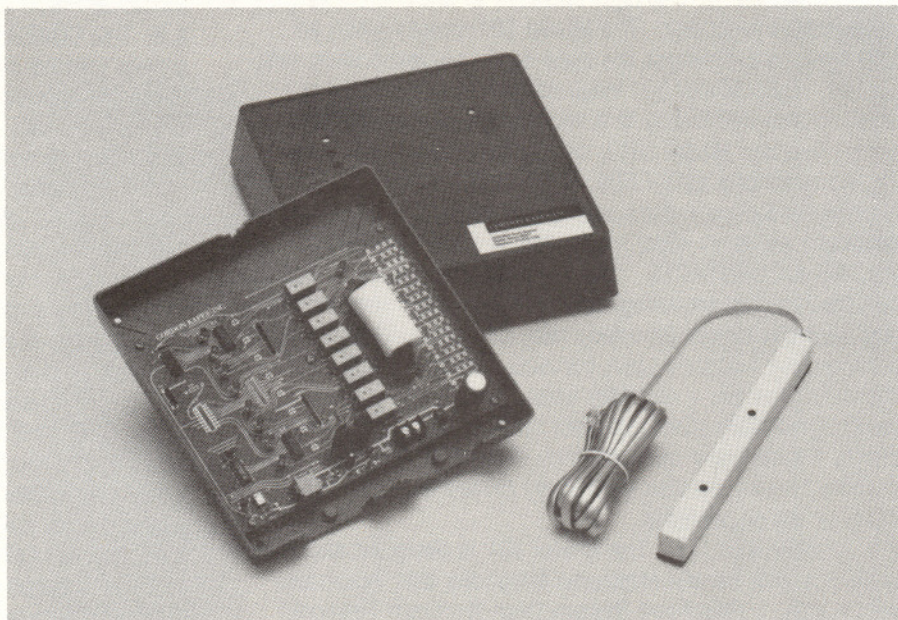
Technical Practice

Issue 2, September, 1989

MODEL 301 LED TO RELAY INTERFACE

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1. General Description

1.1 PRACTICE ISSUE Issue 2 of the Model 301 Technical Practice is released due to several changes and improvements in the Model 301 Technical Practice.

1.2 PRODUCT OVERVIEW The Model 301 LED to Relay Interface is designed to allow LED indicator lights on Northern Telecom SL-1 electronic telephone sets to control relay contacts. In this way, external devices, such as indicator lights, can follow the status of the LEDs. Light activated sensors, contained in the Model 301's sensor assembly, optically detect the LED status, and in turn control relay contacts. Installation is very simple; no SL-1 telephone modifications are required.

1.3 TWO VERSIONS The Model 301 is manufactured in two versions. The 301-8 provides 8 channels of LED to relay interface. The 301-16 provides 16 channels of LED to relay interface.

1.4 FEATURES Features include LED status indicators, normally open and normally closed relay contacts, and simple installation.

1.5 POWER REQUIREMENTS The Model 301 requires an external source of 24Vac for operation. A UL Listed, Class 2 transformer is shipped with each Model 301.

1.6 PHYSICAL DESCRIPTION The Model 301 consists of a main unit, and one or two sensor assemblies. The 301-8 has one sensor assembly, the 301-16 has two. The main unit consists of a precision fabricated printed circuit board, and an injection molded housing consisting of a base and detachable cover. The thermoplastic material used for the housing conforms to industry recognized flame-retardant standards. The main unit measures 8.75 inches (22.23cm) square, 3.25 inches (8.26cm) deep, and weighs less than two pounds (0.90kg). The main unit wall mounts with four screws. The sensor assembly consists of a precision fabricated printed circuit board mounted inside an aluminum housing. The sensor assembly measures 8.70 inches (22.10cm) long, 0.80 inches (2.03cm) wide, and 0.70 inches (1.78cm) deep, and weighs less than one pound (0.45kg). The sensor assembly mounts to an SL-1 telephone using self-stick Velcro® tape. A six-conductor

cable exits the sensor assembly and connects to the main unit via a modular plug.

2. Applications

2.1 PRIMARY APPLICATION The primary application for the Model 301 is to allow LED indicator lights on Northern Telecom SL-1 electronic telephone sets to control relay contacts. These relay contacts can then be used to control indicator lights or audible warning devices. The indicator lights may be the old style "bee hive" type, made classic by the Bell System (or should I say made classic by bees!). Gordon Kapes, Inc. does not supply indicator devices. They must be provided by the installer. A typical installation would be in an automatic call distribution (ACD) application, where an SL-1 telephone set's indicator LEDs are programmed in SL-1 system software to show the status of various ACD functions. The Model 301 senses when an LED lights, and changes the state of the corresponding relay contact. Each Model 301 relay contact is completely isolated, so that interfacing to a wide range of devices is possible. Note the Model 301's sensor assembly blocks viewing the telephone set's LEDs. The sensor assembly physically prevents a person from seeing the status of the LED. The telephone set is, in effect, dedicated to the Model 301.

2.2 RELAY CONTACTS The Model 301 provides configuration flexibility by providing both normally open (not shorted) and normally closed (shorted) relay contacts. Most applications require normally open contacts. Each of the 8 or 16 channels provides a normally open contact. In special cases, a normally closed contact may be required. In addition to the normally open contact, channel 8 and, if present, channel 16 also provide a normally closed contact. Wow! Think of the possibilities.

2.3 COMPATIBILITY The Model 301 is designed exclusively for use with certain electronic telephone sets associated with the SL-1 Telephone System from Northern Telecom. The specific telephone sets that can be interfaced contain one or more vertical strips of 8 LED indicator lights. These LEDs are located directly to the left of, and associated with, the lower eight buttons of a vertical strip of ten push buttons. Examples of SL-1 telephone sets that can be used are the 10-button QSU3CQMC, and the 20-button add-on module QMT2D. Other SL-1 telephone sets, such as those that utilize liquid crystal display for line status, are not supported.

2.4 LIMITATIONS The Model 301's sensor assembly prevents viewing the LEDs that are being detected. Reliable Model 301 operation makes isolating the LEDs from ambient light a requirement. This dedicates the electronic telephone set to the Model 301. It is not intended for the electronic telephone set to be placed on a desk with the Model 301 attached to it. It is recommended that the electronic telephone set be wall mounted in an equipment room, away from expectations of an "active" telephone. The Model 301's main unit contains LED indicator lights that show the status of the relays. These LEDs, in a sense, "repeat" the status of the LEDs on the electronic telephone set.

3. Installation

3.1 CHECKING FOR DAMAGE The Model 301 should be inspected for damage immediately upon receipt. A claim should be filed with the shipper if damage is found. A replacement should be ordered if necessary.

3.2 INSTALLATION KIT Included in each Model 301 shipping carton is an installation kit. Each kit contains four #8 pan head screws and two nylon cable ties.

3.3 LOCATING THE MODEL 301 The mounting location for the Model 301 and associated SL-1 telephone set should be selected. The units must be within the length of the sensor assembly's connecting cable. 24Vac must be provided to the main unit, so an ac outlet must be designated to receive the transformer. The ideal location would be in the telephone equipment room, with the SL-1 telephone and the Model 301 wall mounted near an ac outlet.

3.4 THE COVER The cover is secured via two clamp screws located on the top and bottom of the cover. Remove the cover at this time.

3.5 MOUNTING The Model 301's main unit wall mounts using four #8 pan head screws of the type appropriate for the wall material. Four #8 pan head screws are contained in the installation kit; use these if appropriate.

3.6 MODEL 301 CONNECTIONS All connections to the Model 301 are made via a 25-pair plug P1, and a two-position terminal strip TS1. The installer must provide one 25-pair cable mounted connector to mate with P1. Figure 2, located at the end of this practice, provides detailed connection information.

3.7 USING THE TERMINAL STRIP In some installations, it may be convenient to make the power supply connections using the terminal strip. The two terminals on TS1 parallel power supply connection contacts on plug P1.

3.8 INSTALLING AND TERMINATING THE 25-PAIR CONNECTOR Install the 25-pair cable mounted connector into plug P1. Secure it using the Velcro strap that is attached to the plug. Terminate the cable (e.g., in a "66" type block). Use one of the nylon cable ties, provided in the installation kit, to secure the 25-pair cable to the mounting point molded into the Model 301's base.

3.9 MOUNTING THE SENSOR ASSEMBLY One sensor assembly is provided with the 301-8; two with the 301-16. Each sensor assembly is installed in the same manner. Self-stick Velcro tape is used to secure the sensor assembly to the SL-1 telephone. Start by taking a careful look at the underside of the sensor assembly. You will observe eight phototransistors. They are the squares of clear plastic that are soldered into the printed circuit board. These sensors are placed directly over the LED indicator lights on the telephone. Be aware that the two LED positions associated with the top 2 buttons on the telephone set's strip of 10 buttons do not light. The eight LEDs to be monitored by the sensor assembly are located to the left and are the lower 8 buttons. You will observe that short lengths of Velcro tape are attached to each end of the sensor assembly. Once one side of the tape is attached to the sensor assembly, the other side is ready to attach to the SL-1 telephone. Please refer to Figure 1, on the next page, for a view of the system. Remove the protective backing from the Velcro tape and

mount the sensor assembly directly above the 8 LEDs. The cable from the sensor assembly exits over the back of the telephone, NOT the front of the telephone. Once the tape is applied, you can easily remove and optimize the location of the sensor assembly. For optimum placement, you should have about a 1/8" gap between the sensor assembly and



Figure 1 Model 301, main unit with sensor assembly attached to the telephone.

the left edge of the buttons. The sensor should be approximately centered between the top and bottom edges of the face of the telephone. If you are installing a 301-8, mate the modular plug with the jack on the main unit. If you are installing a 301-16, mate the modular plug from the first sensor assembly to jack J1 on the main unit; mate the plug from the second sensor assembly to J2.

3.10 CONNECTING POWER The Model 301 requires 24Vac, 450mA maximum for operation. Power can be connected using either plug P1 or terminal strip TS1. Connect one lead of the 24Vac to Violet/Slate lead, or to terminal 1 of the terminal strip. Connect the other 24Vac lead to the Slate/Violet lead, or to terminal 2 of the terminal strip. A 24Vac transformer is shipped with each Model 301, along with a 2-conductor power cord. The 2-conductor cord is intended to connect the transformer's LOAD terminals to the terminal strip.

Warning: DO NOT plug the power source into the outlet at this time.

3.11 CONNECTING TO THE RELAY CONTACTS A normally open (not shorted) relay contact is provided for each channel. In addition, channel 8 on the 301-8, and channels 8 and 16 on the 301-16 also provide a normally closed contact. Connect the relay contacts to the indicating devices that are to be controlled. Gordon Kapes, Inc. does not supply indicating devices. They should be purchased from sources such as North Supply, Graybar, etc.

4. Operation

4.1 INSTALLATION REVIEW At this stage, the Model 301 should be completely installed. The LEDs on the SL-1 telephone should be programmed via the SL-1 system software to operate in the desired manner.

4.2 INITIAL OPERATION Apply power to the Model 301 by plugging the power transformer into the ac outlet. The

POWER LED, located on the right side of the Model 301, should light. The other LEDs may or may not light, depending on the status of the SL-1 telephone's LEDs. Check the operation of each channel by activating the respective LEDs on the telephone. Note that the relays and LEDs on the Model 301 physically follow the LEDs on the SL-1 telephone. The LED that is closest to the top of the telephone is the first channel on the Model 301.

To repeat: WE COUNT FROM THE TOP TO THE BOTTOM! Adjust the sensor assembly if the Model 301's relay contacts and associated status LEDs do not reliably follow the action of the telephone sets LED's

4.3 NORMAL OPERATION The Model 301 is now ready for service. Normal operation should find the POWER LED lit, and one or more of the channel LEDs lit steadily, or following a slow or fast flashing pattern.

5. Circuit Description

5.1 GENERAL DESCRIPTION The circuitry used in the Model 301 can be divided into two sections: main unit and sensor assembly.

The main unit provides the power supply, clock, and decoder circuitry. The sensor assembly provides the photodetector and encoder circuitry.

5.2 MAIN UNIT, POWER SUPPLY 24Vac enters the Model 301 via the terminal strip, or the last pair of plug P1. A full-wave bridge rectifier and filter capacitor convert the incoming ac to unregulated dc. The unregulated dc is used to power the relays and LEDs, as well as to feed the regulated power supply section. The regulated power supply section utilizes a zener diode to reduce the unregulated dc voltage by 7.5 volts. This lower voltage is fed to a 15V, 3-terminal regulator. The resulting 15Vdc is used by the main unit's logic circuitry, as well as to power the one or two sensor assemblies.

5.3 MAIN UNIT, TIME BASE OSCILLATOR AND SENSOR DATA SELECT LINES A CMOS version of the 555-type timer, configured in an asynchronous manner, provides a nominal 1.25 kHz clock signal. This clock signal is fed to a divider integrated circuit, which produces a three-bit word that increments with every clock cycle. This three-bit word is used as the sensor data select lines. Three sections of line driver integrated circuitry are used to "toughen up" these signals, which are then fed to the one or two sensor assemblies.

5.4 MAIN UNIT, DECODER Circuitry on the main unit decodes the serial data line that contains the multiplexed LED status information. This data line is fed to a one-input, eight-output addressable latch IC. The three sensor data select lines are fed to the address lines of this IC. The IC follows the sensor data select lines to route the serial input data to the appropriate output pin. As the sensor assembly scans the phototransistors, the data is directed and latched into the appropriate output pin. The eight output pins drive eight sections of relay driver integrated circuitry. The output of each driver controls a relay, and a corresponding LED indicator light. The Model 301-8 contains one decoder section, the Model 301-16 contains two.

5.5 MAIN UNIT, RELAY CONTACTS It is anticipated that the usual installation will require a normally open (not

shorted) relay contact to represent an LED that is not lit. Each of the 8 or 16 channels provides a normally open contact. For special applications, channels 8 and 16 also provide a normally closed (shorted) relay contact.

Note: channels 8 and 16 provide both a normally open and normally closed contact, each electrically isolated from each other.

5.6 SENSOR ASSEMBLY One or two sensor assemblies are associated with each Model 301, depending on the version purchased. Each sensor assembly detects the on/off status of eight LEDs. Six leads connect the sensor assembly with the main unit: power (+15Vdc), common, data out, and three sensor data select lines. Eight phototransistors are connected to the eight inputs of an analog multiplexer. Each phototransistor is physically located so as to detect a different LED. The three sensor data select lines connect to the multiplexer, selecting which phototransistor is connected to the output pin. As the sensor select data lines are constantly incrementing, the output line is progressively showing the status of each LED; each LED is scanned approximately every eight milliseconds. One section of operational amplifier is used as a line driver, isolating the output pin of the multiplexer from the cruel, outside world. The data connection between the sensor assembly and the main unit is a serial multiplexed representation of the status of the eight LEDs.

6. Specifications

NUMBER OF CHANNELS

Model 301-8: 8

Model 301-16: 16

POWER REQUIREMENT

24Vac, 450mA maximum

RELIABILITY

MTBF 24.9 years, per Method I of Bellcore TS-TSY-000332, Issue 2, July 1988

INTERCONNECTIONS

All interconnections are made via one 25-pair plug and a two-position screw terminal strip. P1 mates with a cable-mounted 25-pair connector (standard to the telephone industry), supplied by the installer.

RELAY CONTACTS PROVIDED

301-8: eight normally open (not shorted) and one normally closed

301-16: sixteen normally open (not shorted) and two normally closed

RELAY CONTACT RATING

1A maximum at 30Vdc or 100Vac (resistive)

DIMENSIONS, MAIN UNIT

8.75 inches high (22.23cm)

8.75 inches wide (22.23cm)

3.25 inches deep (8.26cm)

WEIGHT, MAIN UNIT

Less than two pounds (0.90kg)

MOUNTING, MAIN UNIT

Four #8 pan head screws of the type appropriate for the wall material.

DIMENSIONS, SENSOR ASSEMBLY

8.70 inches high (22.10cm)

0.80 inches wide (2.03cm)

0.70 inches deep (1.78cm)

WEIGHT, SENSOR ASSEMBLY

Less than one pound (0.45kg)

MOUNTING, SENSOR ASSEMBLY

Self-stick Velcro tape

7. Incorrect Operation

7.1 REVIEW PRACTICE Should problems arise in the operation of the Model 301, please review Section 3 - Installation of this practice. Ensure that all connections have been made properly. If another Model 301 is available, substitute and retest.

7.2 APPLICATION LIMITATIONS The Model 301 was designed to operate correctly with one, and only one, type of SL-1 electronic telephone set. Correct installation with other telephones is not possible.

7.3 SAVE TIME You are encouraged to call Gordon Kapes, Inc. for technical support. We much prefer a telephone call BEFORE you tear your hair out! We do not mind "walking" you through an installation, or performing a verbal review prior to your actually getting started. Please have these items with you: a copy of this technical practice, key telephone documentation, and adequate tools. In addition, it is very helpful to have a digital VOM, such as the wonderful Fluke 70 or 80 series, and a lineperson's handset. (For these rare cases, it's not a bad idea to have some aspirin and your favorite candy bar in your tool case!)

8. Repair and Replacement

8.1 NOT SO FAST Statistically, most equipment returned to Gordon Kapes, Inc. for repair actually has nothing wrong with it. A telephone call to Gordon Kapes, Inc. technical support can often help to get the equipment operating correctly. We don't mind spending time with our customers getting a site up and running.

8.2 SEND IT BACK If you determine that the Model 301 is defective, return for repair or replacement according to the Gordon Kapes, Inc. Warranty/Repair and Return policy.

8.3 ONLY WE FIX IT In the event repairs are ever needed on your Model 301, they should only be performed by Gordon Kapes, Inc. or an authorized representative. For further information, contact Gordon Kapes, Inc.

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

Figure 2 Model 301 LED to Relay Interface Connection Diagram

Plug Pin	Wire Color	Clip	Description	
26	WH-BL	1	COM	Sensor Assembly 1, LED 1
1	BL-WH	2	NO	
27	WH-OR	3	COM	Sensor Assembly 1, LED 2
2	OR-WH	4	NO	
28	WH-GN	5	COM	Sensor Assembly 1, LED 3
3	GN-WH	6	NO	
29	WH-BR	7	COM	Sensor Assembly 1, LED 4
4	BR-WH	8	NO	
30	WH-SL	9	COM	Sensor Assembly 1, LED 5
5	SL-WH	10	NO	
31	RD-BL	11	COM	Sensor Assembly 1, LED 6
6	BL-RD	12	NO	
32	RD-OR	13	COM	Sensor Assembly 1, LED 7
7	OR-RD	14	NO	
33	RD-GN	15	COM	Sensor Assembly 1, LED 8
8	GN-RD	16	NO	
34	RD-BR	17	COM	Sensor Assembly 1, LED 8
9	BR-RD	18	NC	
35	RD-SL	19	COM	Sensor Assembly 2, LED 1 *
10	SL-RD	20	NO	
36	BK-BL	21	COM	Sensor Assembly 2, LED 2 *
11	BL-BK	22	NO	
37	BK-OR	23	COM	Sensor Assembly 2, LED 3 *
12	OR-BK	24	NO	
38	BK-GN	25	COM	Sensor Assembly 2, LED 4 *
13	GN-BK	26	NO	
39	BK-BR	27	COM	Sensor Assembly 2, LED 5 *
14	BR-BK	28	NO	
40	BK-SL	29	COM	Sensor Assembly 2, LED 6 *
15	SL-BK	30	NO	
41	YL-BL	31	COM	Sensor Assembly 2, LED 7 *
16	BL-YL	32	NO	
42	YL-OR	33	COM	Sensor Assembly 2, LED 8 *
17	OR-YL	34	NO	
43	YL-GN	35	COM	Sensor Assembly 2, LED 8 *
18	GN-YL	36	NC	
44	YL-BR	37		
19	BR-YL	38		
45	YL-SL	39		
20	SL-YL	40		
46	VI-BL	41		
21	BL-VI	42		
47	VI-OR	43		
22	OR-VI	44		
48	VI-GN	45		
23	GN-VI	46		
49	VI-BR	47		
24	BR-VI	48		
50	VI-SL	49	24VAC	POWER CONNECTION
25	SL-VI	50	24VAC	

Notes

* Applicable only for Model 301-16

COM: Relay Common

NO: Relay Normally Open

NC: Relay Normally Closed

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