

44931

DUAL TIMER/RELAY MODULE

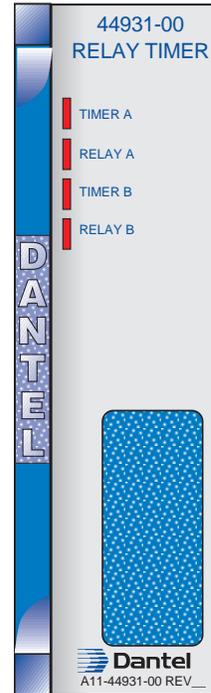


Table of Contents

Ordering Information	2
General Description	2
Circuit Description	3
Application Information	8
Installation	11
Operation	16
Technical Specifications	17
Warranty	18

About this Practice:

This practice has been reissued to:

- Update Table B.

Reissued Practices: Updated and new content can be identified by a banner in the right margin.

Issue date: July 1999

UPDATED

CAUTION

- Install or remove modules from the shelf only when the power is off. If you install a module in the shelf with the power on, the internal circuitry may suffer damage and the product warranty will be void.
- Remove and install circuit boards only in a static-safe environment (use antistatic wrist straps, smocks, footwear, etc.).
- Keep circuit boards in their antistatic bags when they are not in use.
- Do not ship or store circuit boards near strong electrostatic, electromagnetic, magnetic, or radioactive fields.
- For more complete information on electrostatic discharge safety precautions, refer to Bellcore™ Technical Reference # TR-NWT-000870.

ORDERING INFORMATION

NOTE: This section lists the different options available for this product. To order any of the available options, contact Dantel Inside Sales through our toll-free number, **1-800-432-6835**.

OPTION NUMBER	FEATURES
A11-44931-00	Dual Timer/Relay Module

GENERAL DESCRIPTION

The 44931 Dual Timer/Relay Module (44931) provides two independent programmable timers for initiating and controlling time periods of 50 msec. to 95 minutes. It also provides two independent relay circuits for controlling switching operations. The timers contain a retrigger option and may be externally reset.

The front panel includes four LED indicators to show the operating status of each timer and each relay. An opening in the front panel provides access for a plug-in subassembly.

The 44931 comes as a basic unit only with no fixed options. Strap options on the unit allow programming of time periods, selection of four basic timing cycle options, retrigger option, and output stage logic state.

The independent relays operate at -24 or -48 VDC.

The 44931 is a plug-in printed circuit module that fits into any 400-type or similar housing and operates on -21 to -56 VDC input power.

NOTE:

Throughout this practice, where specific edge connector pins are referenced, numbers appearing in parenthesis () refer to TIMER 2. Numbers not shown in parenthesis refer to TIMER 1

CIRCUIT DESCRIPTION

The 44931 functional schematic is shown in Figs. 1 and 2. The module contains two identical timer networks (Timer A and Timer B) and two independent relay circuits. (Relay A and Relay B). Only Timer A is shown in Fig. 1. Circuit designations for Timer B are shown in Fig. 1 enclosed in parentheses ().

TIMER NETWORKS

The timer networks consist of an Input Stage, a Programmable Timer Stage, an External Reset Circuit, an Output Stage, and two Voltage Regulators.

INPUT STAGE

The input stage accepts an input signal and generates the appropriate positive-going pulse to start the timing period and/or enable the Output Stage. The circuit consists of a strappable input bias network, a voltage comparator (COMP1), and a strappable output inverter (INV1).

The input stage converts a signal transition through -5VDC to a positive-going trigger signal to start the timer. The trigger input at pin 23 is connected to the inverting input of COMP1. Since the non-inverting input of COMP1 is held to -5VDC, then voltages between ground and -5V at pin 23 result in a negative output (-21V) at COMP1. Voltages between -5V and negative battery (-24 or -48VDC) at pin 23 result in a ground output at COMP1)

The input bias network allows the input to be strapped for a positive input (IG) or negative input (IB) so that the COMP1 will assume a steady state when the input is open. The COMP1 output connects to the timer stage through the normal input strap (NI) or the reverse input strap (RI). The NI strap connects directly to the timer stage, and the RI strap connects the COMP1 output to the timer stage through an inverter (INV1). With the RI strap installed, the timer will trigger when the input goes from negative (-5 or greater) to ground. With the NI strap installed, the timer will trigger when the input goes from ground to negative (-5V or greater). Refer to Table A in the *Installation* section.

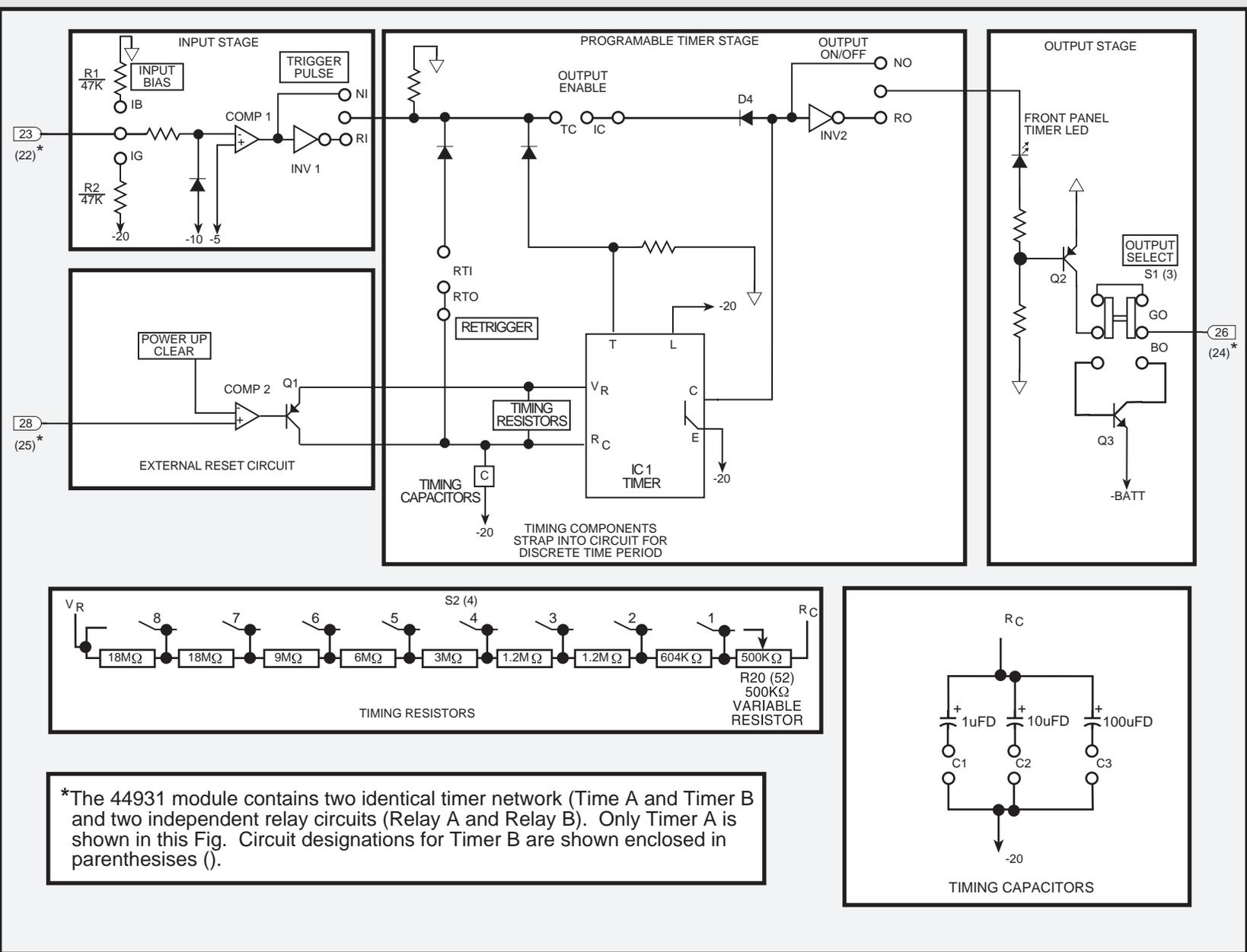
PROGRAMMABLE TIMER STAGE

The timer stage initiates or allows a programmed output response for a selected time period when triggered by a positive-going input signal. The circuit consists of a timer (IC1), selectable timing resistors, selectable timing capacitors, a retrigger option, and a strappable output inverter (INV2).

CONTINUED . . .

CIRCUIT DESCRIPTION

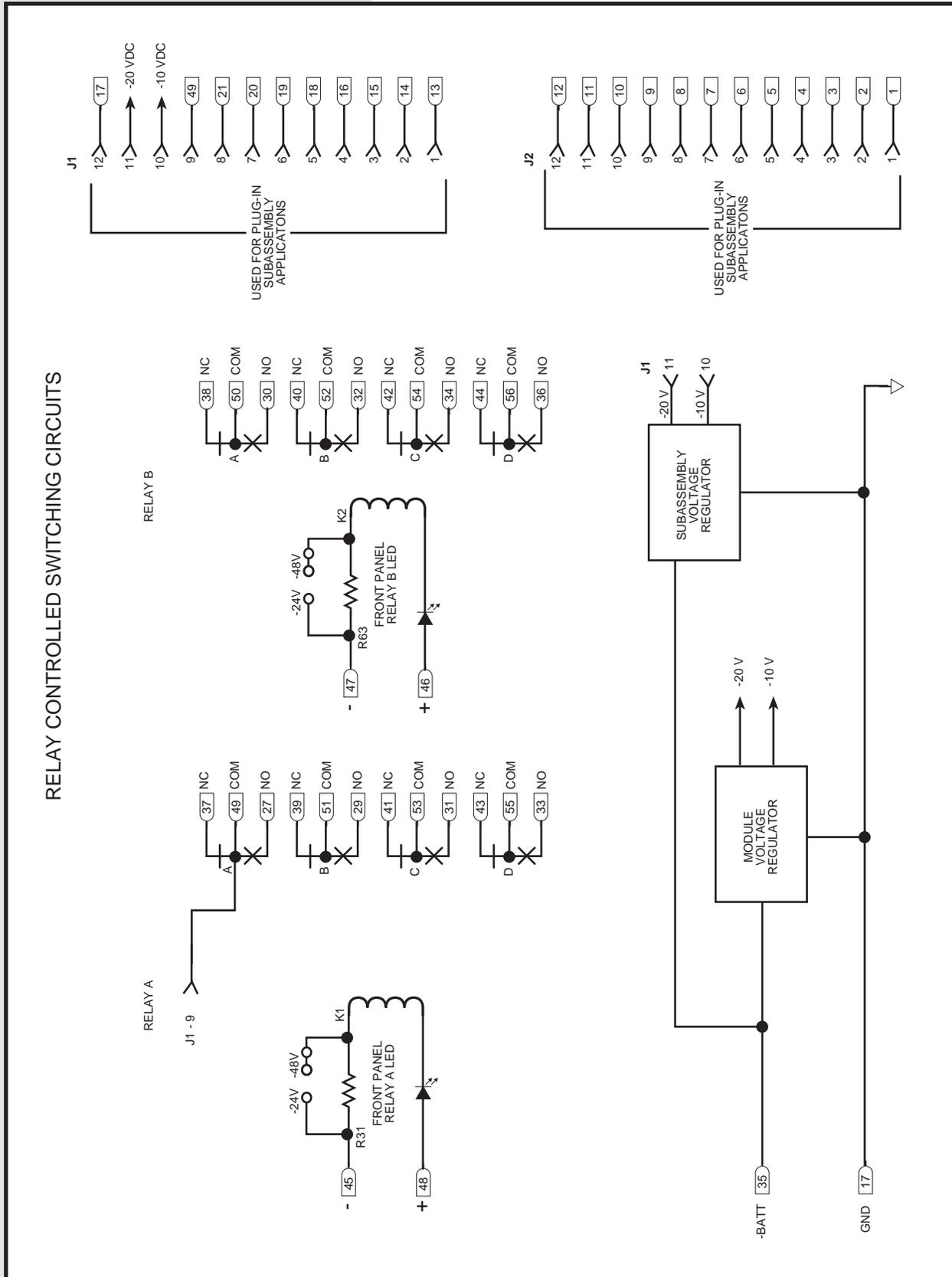
Fig. 1 - FUNCTIONAL SCHEMATIC, 44931, TIMER SECTION



*The 44931 module contains two identical timer network (Time A and Timer B and two independent relay circuits (Relay A and Relay B). Only Timer A is shown in this Fig. Circuit designations for Timer B are shown enclosed in parentheses ().

CIRCUIT DESCRIPTION

FIG. 2 - FUNCTIONAL SCHEMATIC, 44931, RELAY SECTION



CIRCUIT DESCRIPTION

The timer (IC1) holds the Output Stage “on” or “off” for a specific period of time after receipt of a positive-going signal at the trigger port. The timer begins its cycle on any positive-going edge of a signal pulse from the input stage. That means the trigger port must be negative before a timing period can be started. When the timer is triggered, the output stage completes a path to negative battery or ground. In “Leading Trigger” applications (refer to Fig. 4 in the **Application Information** section) the timer trigger port is normally held a -V and switches momentarily to ground to trigger.

In “Trailing Trigger” applications, the trigger port is normally held at ground and switches to -V (no trigger yet), then back to ground (a positive-going edge) to trigger the timer.

Timing Resistors and Capacitors

The timing period is equal to the RC value of the timing resistors and timing capacitors. Three values of timing capacitors are provided: 1, 10, and 100 microfarads. Capacitor selection is strap selectable (C1, C2, or C3).

The timing resistors consist of a series string of eight resistors and a trim pot. Each resistor is paralleled with a switch contact. When the switch is open, the resistor is in the circuit. When the switch is closed, the resistor is bypassed. With all switches closed, the series resistors are shorted and only the variable resistor (R20) is active in the circuit. This allows the variable resistor to adjust the timing circuit to very short time periods. Refer to Table B in the **Installation** section.

Retrigger Strap Option

The “retrigger in” (RTI) strap option provides a path from the trigger pulse line to the timing capacitors. When this strap is installed, a positive-going transition on the trigger line will discharge the timing capacitors to -V, causing the timing period to begin again. This is the retrigger function. It is necessary that this function only be used in “trailing trigger” applications where the trigger pulse line is normally grounded. As the trigger goes to -V prior to the next positive transition, the timing capacitors are discharged. Then, when the trigger goes to ground again, the timing period is allowed to start over again. Note that the timer period has already been reset when the trigger goes to -V. As long as the trigger remains at -V, the timer will “hold”, restarting the timing period only when the trigger returns to ground.

The “retrigger out” (RTO) strap option opens the path from the trigger pulse line to the timing capacitor. This configuration eliminates the retrigger function and is used in leading edge trigger applications.

CIRCUIT DESCRIPTION

Timer Control and Input Control Options

The timer control (TC) strap option connects the trigger pulse line to the collector of the timer output transistor through a diode. This creates an OR circuit and allows the output stage to be turned on as soon as the trigger pulse line changes from ground to negative. This produces an output before the timing period actually begins (slow to release function). The input control (IC) strap option opens the trigger pulse line to the collector of the output stage transistor. In this configuration, the timing signal is taken from the collector-emitter output of the timer (IC1) only.

Normal Output and Reverse Output Strap Option

The normal output (NO) strap option connects the timer stage to the open collector output transistor by a direct path. The reverse output (RO) strap option connects the timer stage to the open collector transistor through the inverter (INV2).

External reset Circuit

The reset circuit allows the timer stage to be terminated or stopped during a timing period. It also provides the power-up clear operation. The circuit consists of a voltage comparator, a power-up clear circuit, and a bypass transistor.

A ground contact at the external reset pin 28 will activate the voltage comparator (COMP2) through the inverting input. The comparator output will turn on transistor Q1, which will bypass or short the RC timing network and terminate the timing function. The power-up clear circuit provides the reference voltage for a comparator COMP2 and operates as the enable to clear the timer when the power is first applied to the module.

Output Stage

The output stage interfaces the timer stage to external devices. The circuit utilizes two buffer transistors and the timer LED indicator on the front panel.

The output of the timer stage is routed through the front panel timer LED to the base of Q2 via strap NO or RO. The transistor Q2 collector conducts to ground when the base is biased negative (when the timer is on with strap NO installed or off with strap RO installed). With S1 in the UP position (GO), the collector of Q2 connects directly to the module's output at pin 26. If S1 is in the DOWN position (BO), Q2's collector is connected to the base of Q3. The transistor Q3 collector conducts to negative battery when the base is biased positive (whenever Q2 is on, or when the timer is "on" with strap NO or "off" with strap RO installed). The collector of Q3 then connects directly to the module's output at pin 26.

S1 determines the output polarity. The output switches to ground (positive) when the switch is up, and to battery (negative) when the switch is down.

CIRCUIT DESCRIPTION

VOLTAGE REGULATORS

The 44931 contains two voltage regulators. One regulator provides -10 and -20 VDC supply voltages to operate the module's circuits only.

The second regulator provides -10 and -20 VDC supply voltages to operate an additional plug-in subassembly.

INDEPENDANT RELAYS

The relay circuits activate multiple contact connections as required. The circuit consists of four form-C type contacts (switched by the activated relay coil) and the front panel relay LED.

The relay coils are rated at -24 VDC. Series resistors are used in -48V battery applications. For -24V battery, the resistors are bypassed.

The front panel Relay LED indicators are in series with the relay coils and light when the relays are activated. Polarity must be observed when connecting the relays to supply voltages.

APPLICATION INFORMATION

The 44931 Dual Timer/Relay Module provides two independant timers and two independent relays on one module. It may be used in a variety of timing and switching applications in communications and control systems. Refer to Fig. 3 for one example.

TIMER NETWORK

The timer network may be strapped to produce four basic output timing cycles as shown in Fig. 4.

1. One Shot, Leading Edge

This will produce an output timing cycle duration of one programmed timer period (T period) at the leading edge of the input pulse.

CONTINUED . . .

APPLICATION INFORMATION

2. One Shot, Trailing Edge

This will produce an output timing cycle duration of one programmed timer period (T period) at the trailing edge of the input pulse.

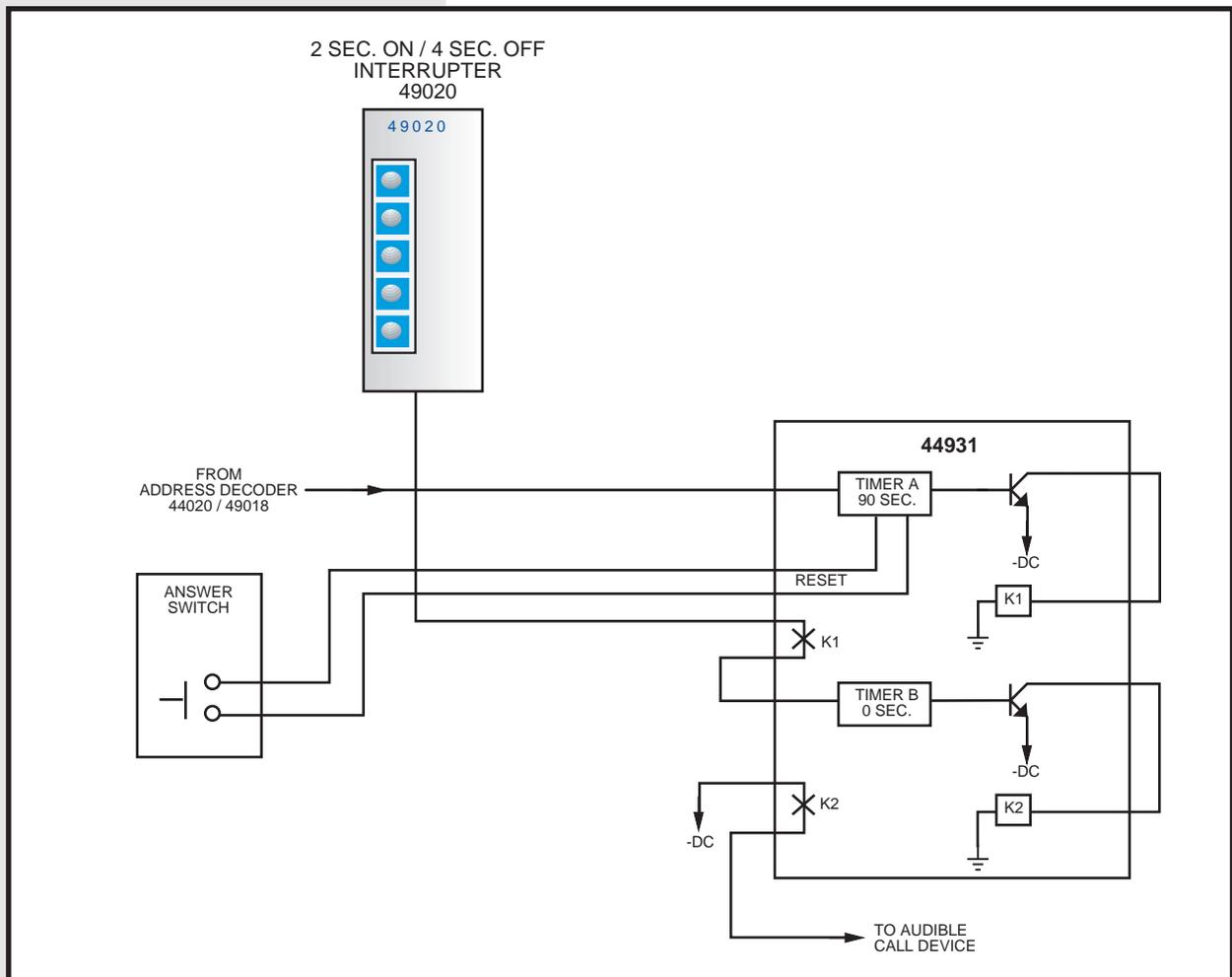
3. Slow to Release

This will produce an output timing cycle duration equal to the input pulse duration, plus one programmed timer period.

4. Slow to Operate

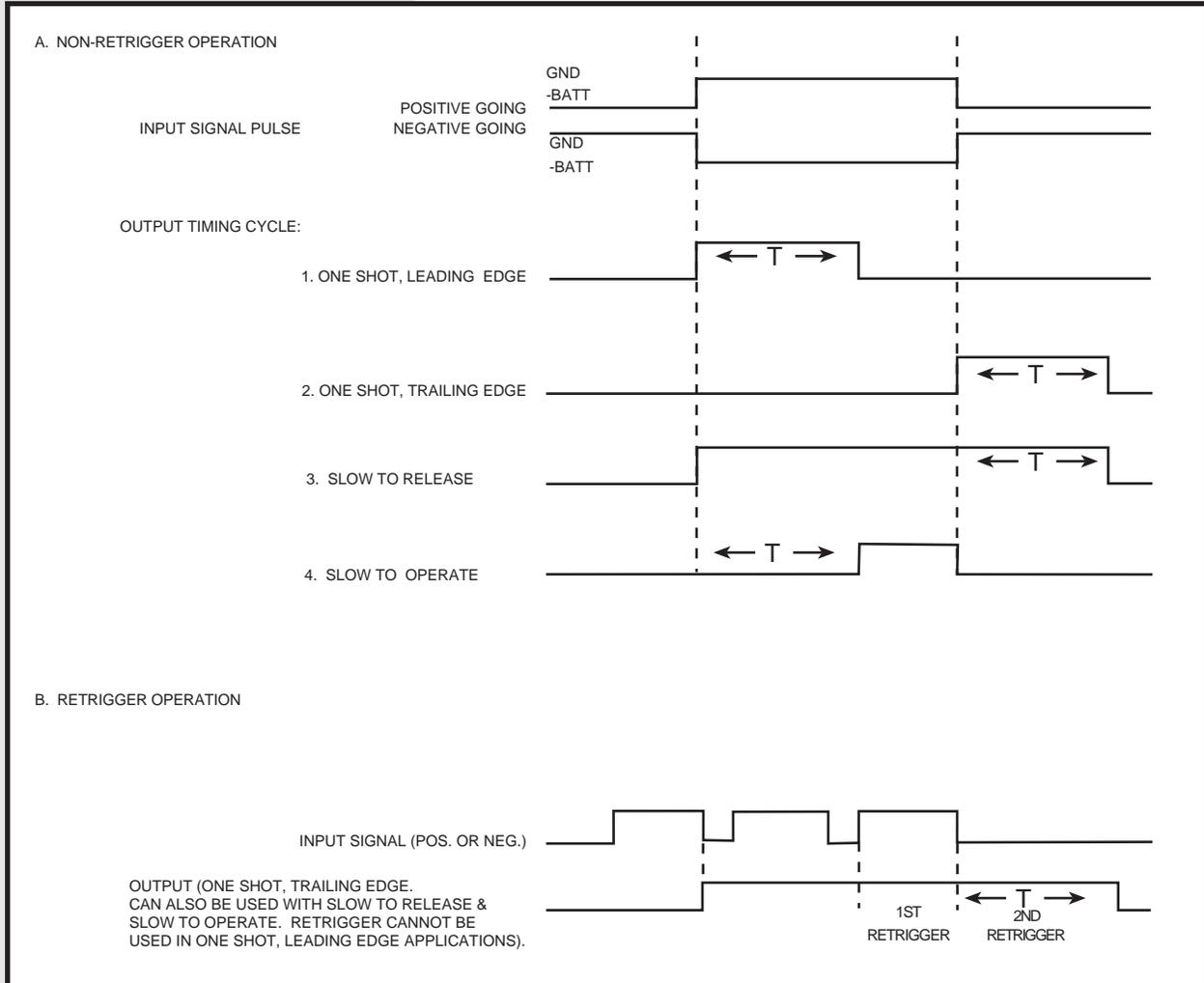
This will delay and reduce the output timing cycle duration by one programmed time period. This means the programmed timer period is subtracted from the beginning of the input pulse.

FIG. 3 - TIMER CIRCUIT PULSES AUDIO CALL DEVICE FOR UP TO 90 SECONDS



APPLICATION INFORMATION

FIG. 4 - TIMER OUTPUT DIAGRAMS



INSTALLATION

Installation of the 44931 consists of setting the strap options to select the mode, setting the timer periods, and installing the module in the equipment shelf.

1. Timer Strap Options

Refer to Table A for strap options required to produce the four basic output timing cycles. Refer to Fig. 5 for strap, switch, and adjustment locations.

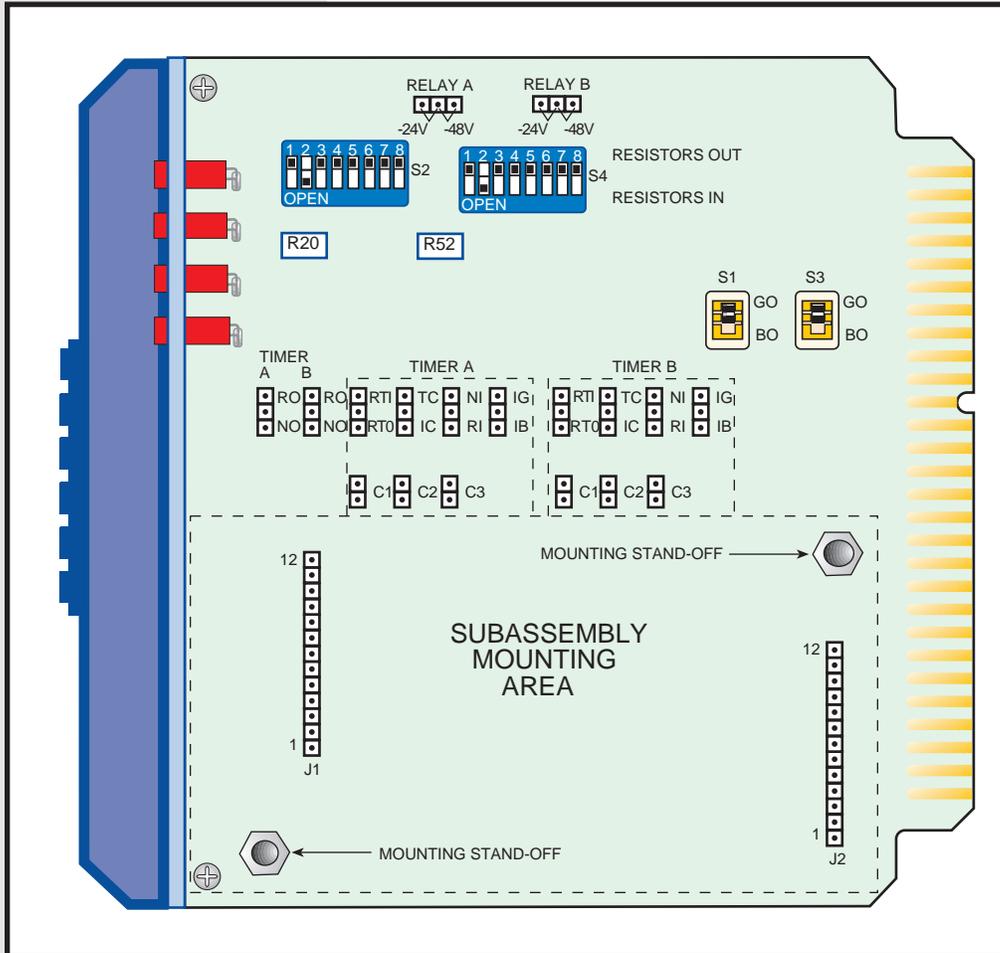
TABLE A - STRAP AND SWITCH OPTIONS

CONDITION	INPUT PULSE	DESCRIPTION	INPUT BIAS	TRIGGER PULSE	RETRIGGER		OUTPUT ENABLE	OUTPUT ON / OFF	
					IN	OUT		Normally ON	Normally OFF
One Shot, Leading Edge	GND	Timing cycle starts at the beginning of the ground pulse. Timing cycle = T period	IG	RI	RTO only		IC	RO	NO
	-5 to -56 V Battery	Timing cycle starts at the beginning of the battery pulse. Timing cycle = T period	IB	NI	RTO only		IC	RO	NO
One Shot, Trailing Edge	GND	Timing cycle starts at the end of the ground pulse. Timing cycle = T period	IG	NI	RTI	RTO	IC	RO	NO
	-5 to -56 V Battery	Timing cycle starts at the end of the battery pulse. Timing cycle = T period	IB	RI	RTI	RTO	IC	RO	NO
Slow to Release	GND	Timing cycle starts at the beginning of the ground pulse and ends with the T period. Timing cycle = Ground pulse duration + T period.	IG	NI	RTI	RTO	TC	RO	NO
	-5 to -56 V Battery	Timing cycle starts at the beginning of the battery pulse and ends with the T period. Timing cycle = Battery pulse duration + T period.	IB	RI	RTI	RTO	TC	RO	NO
Slow to Operate	GND	Timing cycle starts at the end of the T period delay with a ground pulse applied. Timing cycle = Ground pulse duration - T period.	IG	RI	RTI	RTO	TC	NO	RO
	-5 to -56 V Battery	Timing cycle starts at the end of the T period delay with a battery pulse applied. Timing cycle = Battery pulse duration - T period.	IB	NI	RTI	RTO	TC	NO	RO
RELAY VOLTAGE SELECT	-48V	-48 V Strap position		<p>NOTE: Timing Cycle = The complete time duration of the signal pulse at the output stage.</p> <p>T Period = The period of time programmed into the RC timer network (See Table B).</p> <p>Retrigger: The RTI strap option will retrigger the timer by a pulse on the input before the T period has timed out. Otherwise, the RTO strap option should be in.</p>					
	-24V	-24 V Strap position							
OUTPUT SELECT	-BATT	Slide Switch in down position, BO							
	GND	Slide Switch in up position, GO							

CONTINUED . . .

INSTALLATION

FIG. 5 - SWITCH AND STRAP LOCATIONS, 44931



2. Time Period Programming

Refer to Table B for resistor and capacitor options available for configuring the time periods.

TABLE B - TIME PERIODS

SWITCH S2 (S4) SECTIONS "OFF" (ALL TIMES SHOWN IN SECONDS)									
CAPACITOR STRAPS	1	2	3	4	5	6	7	8	ALL OUT (CLOSED)
C1	0.6	1.2	1.2	3.0	6.0	9.0	18	18	50 - 500 ms (R20, R52)
C2	6	12	12	30	60	90	180	180	
C3*	60 to 120	120 to 240	120 to 240	30 to 600	600 to 1200	900 to 1800	1800 - 3600	1800 - 3600	

NOTE: Times are additive. For example: C1 and S2-1, 2, & 5 off gives 7.8 seconds.

* Approximate times only with C3. Test circuit to find actual time.

UPDATED

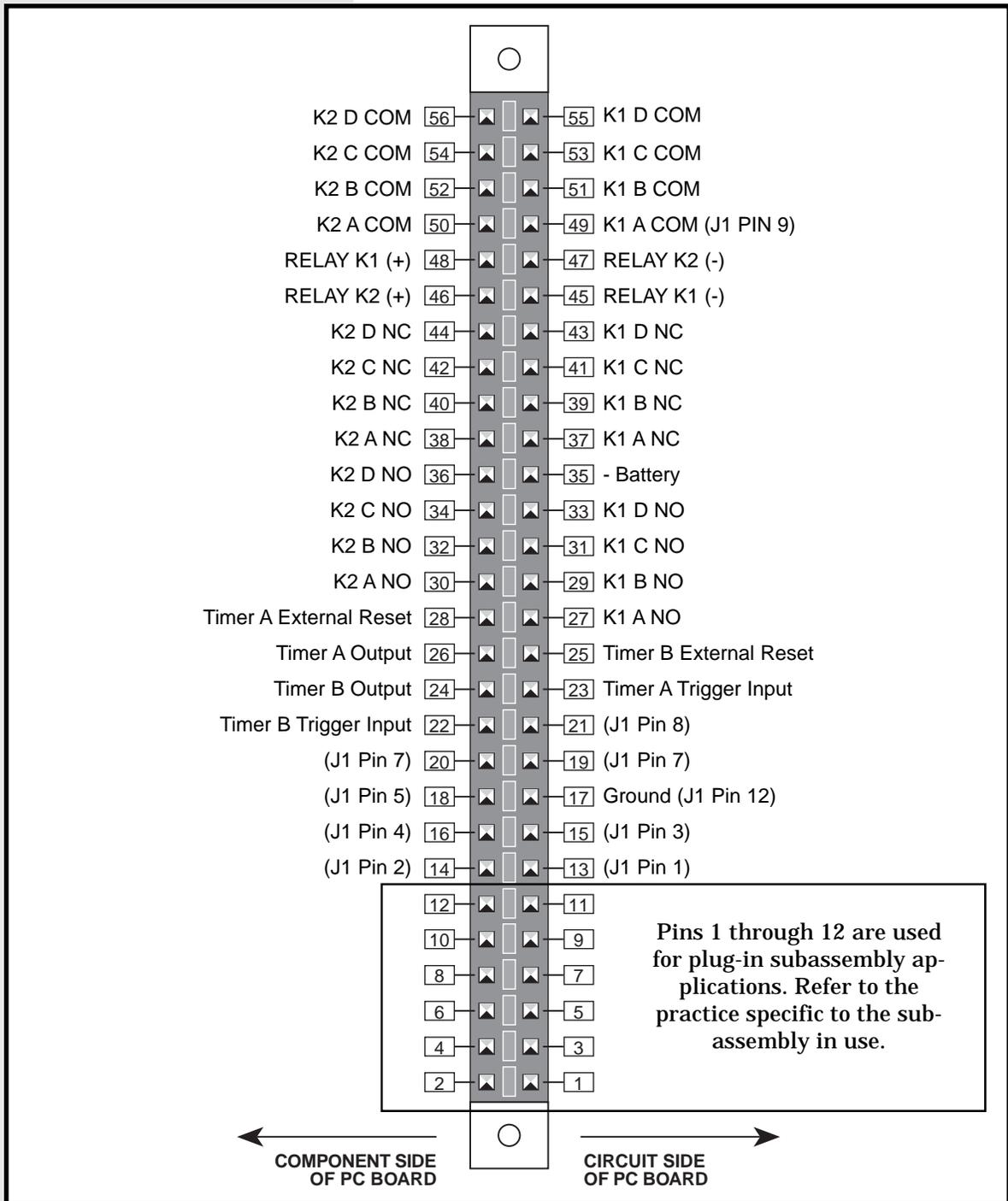
CONTINUED . . .

INSTALLATION

3. Module Mounting

Refer to Fig. 6 for 44931 edge connector pin designations. If necessary, wire the shelf or housing as required.

FIG. 6 - 44931 PIN DESIGNATIONS



INSTALLATION

CHECKOUT

NOTE:

Throughout this practice, where specific edge connector pins are referenced, numbers appearing in parenthesis () refer to TIMER 2. Numbers not shown in parenthesis refer to TIMER 1

Table C describes the checkout procedure for the 44931 Dual Timer/Relay. The following test equipment is required:

- ◆ DC Volt Meter.
- ◆ Stopwatch or watch with second hand (for time periods over 1.5 seconds).
- ◆ Oscilloscope with triggered sweep (for timer periods less than 1.5 seconds).
- ◆ Continuity light or Ohmmeter.
- ◆ Extender card (400-type).

TABLE C - CHECKOUT & CALIBRATION PROCEDURE, 44931

STEP	ACTION	ACTION
1	Strap module for all required options. Check polarities and relay voltage strap options. Remove power from shelf before plugging in module.	Strap module for all required options. Check polarities and relay voltage strap options. Remove power from shelf before plugging in module.
FOR TIME PERIODS GREATER THAN 1.5 SECONDS, USE STEPS 2 - 9.		
2	Install extender card between 44931 and connector. Apply power to shelf.	
3	Connect DC voltmeter to PC connector, pin 26 (24) and to GND or -battery as required by S1 (S3) switch position.	Measure desired non-triggered output condition (-battery or 0 volts). Check timer LED indicator for output logic state — normally “on” or “off”.
4	Trigger timer at pin 23 (22) with desired input signal pulse (GND or -5 to -56 VDC pulse). Measure time period at the output pin 26 (24) with stop watch.	Adjust S2 (S4) DIP switches as required for desired time period. Front panle TIMER A (B) LED changes state from that in step 3 when the output changes state. <i>NOTE: When using time periods greater than 500 msec., the trim pot R20 (R52) should be set fully counter-clockwise.</i>
5	Check for retrigger by reapplying trigger pulse before timeout occurs.	Measure time period from time of retrigger.
6	Check external reset by momentarily grounding pin 28 (25) during a time period.	Time period should terminate at the ground contact.
7	Check power-up clear by removing and reapplying power to shelf during a time period.	Time period should terminate and timer should reset.
8	Repeat steps 2 through 7 for second timer. (Pin numbers in parenthesis)	
9	Go to step 17.	
FOR TIME PERIODS LESS THAN 1.5 SECONDS, USE STEPS 10 - 16.		

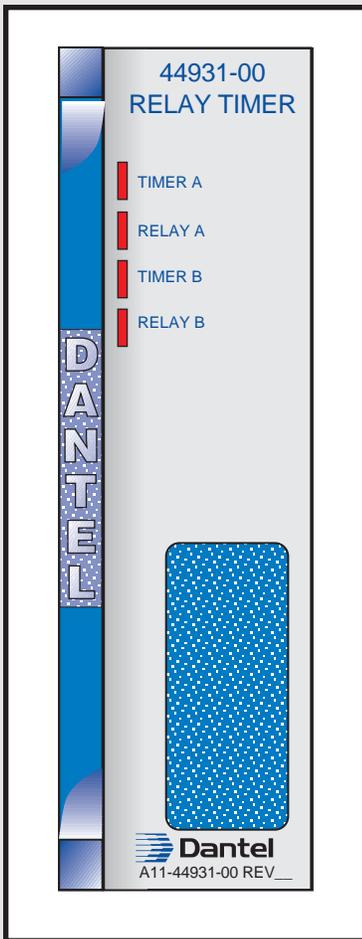
CONTINUED . . .

INSTALLATION

TABLE C (CONTINUED) - CHECKOUT & CALIBRATION PROCEDURE, 44931

STEP	ACTION	ACTION
10	Install extender card between 44931 and connector. Apply power to shelf.	
11	Connect scope trigger input at PC connector pin 23 (22). Connect vertical input at pin 26 (24). Adjust scope for trigger input and time base.	Check timer LED indicator for output logic state - normally "on" or "off".
12	Trigger timer at pin 23 (22) with desired input signal pulse (GND or -5 to -56 VDC pulse). Measure time period by the pulse width on scope.	Adjust S2 (S4) and R20 (R52) as required for desired time period. Front panel timer LED will go on with "normally off" output logic condition and will go off with "normally on" output logic condition. <i>NOTE: When using timer periods greater than 500 msec., the trim pot R20 (R52) should be set fully counter-clockwise.</i>
13	Check for retrigger by reapplying trigger pulse before time-out occurs, if applicable.	Measure time period from time of retrigger.
14	Check external reset by momentarily grounding pin 28 (25) during a time period, if applicable.	Timer period should terminate at ground contact.
15	Check power-up clear by removing and reapplying power to the shelf during a time period, if applicable.	Time period should terminate and timer reset.
16	Repeat steps 10 to 15 for second timer. (Pin numbers in parenthesis)	
17	Test relays for operation. Check polarity before applying -24 or -48 VDC. Check for contact continuity, if desired.	Relay LED indicator on front panel illuminates.
18	End of test. Remove power from shelf. Remove test equipment. Remove extender card. Replace module in shelf. Reapply power.	

OPERATION



There are no specific operating instructions for the 44931 Dual Timer/Relay Module. The module starts operation when power is applied.

When a timer is strapped for a “normal off” output logic condition, the TIMER A or TIMER B LED on the front panel will go on when a timing pulse activates the respective output stage.

When a timer is strapped for a “normal on” output logic condition, the TIMER A or TIMER B LED on the front panel will go off when a timing pulse deactivates the respective output stage.

The RELAY A or RELAY B LED indicator on the front panel will go on when the respective relay coil is activated.

External Reset Operation

Grounding the external reset input at pin 28 (25) will terminate a timing period. Whenever power is applied to the module, the power-up clear circuit automatically resets the timer to a ready state.

Output Logic

The normal output (NO) strap option connects timing pulses directly to the output circuits. In this configuration, a timing pulse will turn “on” the output stage and the timer LED indicator for the duration of the timing cycle. The reverse output (RO) strap option inverts the timing pulse to the output stage. In this configuration, the output stage and timer LED indicator are held constantly “on”. A timing pulse to the inverter (INV2) will turn “off” the output stage and the timer LED indicator on the front panel for the duration of the timing cycle.

TECHNICAL SPECIFICATIONS

DESCRIPTION	TABLE HEAD
TIMERS	
INPUT SPECIFICATIONS	
Trigger Input	0 (GND) to -Battery (-56V), strappable for positive or negative trigger. (Must cross threshold). CMOS compatible.
Trigger Threshold	-5 VDC \pm 10%
Minimum Trigger Duration	25 msec. @ -10 VDC Trigger Level. (Higher voltage = less time duration.)
External Reset	Ground to reset.
Minimum Reset Duration	C1 (1 microfarad) = 1 msec. C2 (10 microfarads) = 10 msec. C3 (100 microfarads) = 100 msec.
OUTPUT SPECIFICATIONS	
Output Type	Open collector, strappable to GND or -Battery (same voltage as input supply).
Maximum Collector Voltage	-56 VDC
Maximum Collector Current	100 mA
TIMING SPECIFICATIONS	
Timing Range Continuously Variable Fixed	50 msec. to 500 msec. 0.6 to 57 seconds in 0.6 second steps, 6 to 570 seconds in 6 second steps, or up to 95 minutes in unspecified steps.
Accuracy	\pm 10%, up to 570 seconds
RELAYS	
COILS	
Minimum Operating Voltage @ -24V Battery Supply Option @ -48V Battery Supply Option	-19 VDC -36 VDC
Maximum Release Voltage @ -24V Battery Supply Option @ -48V Battery Supply Option	-2.5 VDC -5 VDC
Maximum Overvoltage (continuous) @ -24V Battery Supply Option @ -48V Battery Supply Option	-36 VDC -69 VDC
Coil Resistance	1200 ohms \pm 15% @ -24 VDC; 2400 ohms \pm 15% @ -48 VDC
CONTACTS	
U.L. Rating	2A @ 30 VDC; 0.5A @ 125 VAC
Resistance	0.05 ohms (max.)
POWER REQUIREMENTS (TIMERS ONLY)	
Voltage Input	-21 to -56 VDC
Current Requirements	20 mA (min.); 100 mA (max.)
Heat Dissipation (Btu/Hr) @ -24VDC @ -48VDC	1.7 @ -24 VDC; 3.4 @ -48 VDC 8.2 @ -24 VDC; 16.4 @ -48 VDC
Operating Temperature Range	0° to 60° C.
Physical Dimensions	1.4" x 6.0" x 5.6"
Weight	7 oz.

WARRANTY

LIMITED WARRANTY

The Seller warrants that the standard hardware products sold will be free from defects in material and workmanship and perform to the Seller's applicable published specifications for a period of 18 months for hardware, and 3 months for software, from the date of the original invoice. The liability of the Seller hereunder shall be limited to replacing or repairing, at its option, any defective products which are returned F.O.B. to the Seller's plant, (or, at the Seller's option, refunding the purchase price of such products). In no case are products to be returned without first obtaining permission and a customer return authorization number from the Seller. In no event shall the Seller be liable for any consequential or incidental damages.

Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. The Seller shall make the final determination as to the existence and cause of any alleged defect. No warranty is made with respect to custom equipment or products produced to the Buyer's specifications except as specifically stated in writing by the Seller in the contract for such custom equipment.

This warranty is the only warranty made by the Seller with respect to the goods delivered hereunder, and may be modified or amended only by a written instrument signed by a duly authorized officer of the Seller and accepted by the Buyer.

Warranty and remedies on products not manufactured by the Seller are in accordance with warranty of the respective manufacturer. THE SELLER MAKES NO OTHER WARRANTY OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED; AND ALL IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE AFORESAID OBLIGATIONS IS HEREBY DISCLAIMED BY THE SELLER.

IN CASE OF DIFFICULTY

If you experience difficulty with this equipment, check the following, as appropriate:

1. **Switch settings**
2. **Signal levels**
3. **Software configuration**
4. **Connections between Dantel's equipment and your equipment.**

If there is still a problem, substitute equipment that is known to be good. For additional assistance, call Dantel's Technical Field Service Department weekdays, 6 A.M. to 5 P.M. pacific time:

1-800-4DANTEL (1-800-432-6835).

If a thorough checkout shows a piece of equipment has malfunctioned, you may return it to the factory. For repairs and emergency replacements, obtain a Return Material Authorization (RMA) number from the Customer Service Representative at **1-800-4DANTEL (1-800-432-6835)**.

To ensure expedient processing of your order, provide a purchase order number and shipping and billing information when requesting an RMA number. Also, when the units are returned to Dantel, include a description of the failure symptoms for each unit returned. Send defective equipment to:

Dantel, Inc. • 2991 North Argyle Avenue • Fresno, California 93727-1388

