WESTERN DIGITAL
CORPORATION

WD 55 Industrial Timer/Controller

FEATURES:

- LOW COST PREPROGRAMMED MICROCONTROLLER
- USEABLE WITH KEYBOARD OR DISCRETE SWITCHES
- HIGH CURRENT LED OUTPUTS OR DIRECT DRIVE OF VACUUM FLUORESCENT (V-F) DISPLAYS
- UP TO 7 SEQUENTIAL OUTPUTS
- SYNCHRONIZED WITH 50/60 HZ TIME BASE OR EXTERNAL OSCILLATOR
- SINGLE TIME OPTION
- CONTINUOUS OR SEMI-AUTOMATIC OPTION
- DEDICATED TIMER OPTION-WORKS WITHOUT KEYBOARD OR DISPLAY
- RESOLUTIONS OF FROM 0.1 SEC. TO 999 HOURS WITH DIGITAL ACCURACY
- ALARM OUTPUT FOR AUDIBLE BUZZER
- RELAY AND TRIAC OUTPUTS
- AUDIBLE FEEDBACK FOR USE WITH MEMBRANE SWITCHES
- 100 MW TYPICAL POWER CONSUMPTION

APPLICATIONS:

- DARKROOM TIMER
- PROCESS CONTROLLER
- PROCESS SEQUENCER
- TIME DELAY RELAY
- APPLIANCE TIMERS
- DEFROST CONTROLLERS
- "DRIP" AND "MIST" IRRIGATION CONTROLLERS
- ON/OFF TIMER
- DIGITALLY CONTROLLED TIME DELAY
- TRAFFIC LIGHT SEQUENCER
- SECURITY SYSTEMS
- LIGHTING CONTROL
- INTERVAL TIMER
- RECYCLING TIMER

GENERAL DESCRIPTION

The WD-55 is a versatile, self-contained digital timer/controller/sequencer designed to replace many of the timing and control functions currently being performed by gears, cams, levers, and motors. It is another in a series of "silicon software" preprogrammed microcontrollers based on the WD40 family of 4-bit microprocessors. The WD-55 may be used in conjunction with a matrix keyboard and numeric display to implement a programmable timer/sequencer or with suitable "strap" options, may be used as a dedicated, stand-alone on/off controller. It is implemented in P-channel Silicon Gate MOS and is available in 40 pin plastic and ceramic DIP packages.

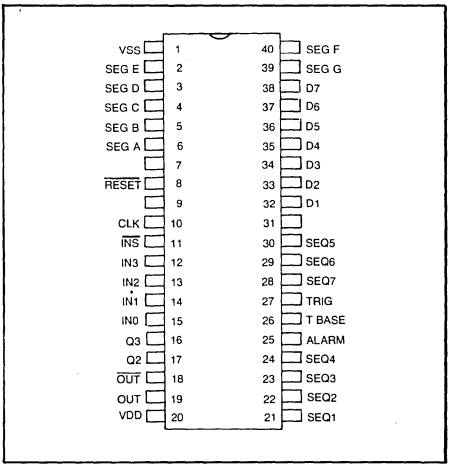


FIGURE 1.
WD-55 PIN CONNECTION

SECTION 4

WD-55 PIN DESCRIPTION

PIN NO.	SYMBOL	FUNCTION
1	VSS	+V
2	SEG E	One of 7 high current (20 MA source) outputs for direct LED drive
3	SEG D	One of 7 high current (20 MA source) outputs for direct LED drive
4	SEG C	One of 7 high current (20 MA source) outputs for direct LED drive
5	SEG B	One of 7 high current (20 MA source) outputs for direct LED drive
6	SEG A	One of 7 high current (20 MA source) outputs for direct LED drive
8	$\overline{\text{RESET}}$	Power turn-on reset input, active low
10	CLK	Internal RC clock oscillator output, approx. 100 KHZ
11	INS	Input select, not used in this application
12	IN3	Scanned input, MSB
13	IN2	Scanned input
14	IN1	Scanned input
15	IN0	Scanned input, LSB
16	Q3	Latched output, not used in this application
17	Q2	Latched output, not used in this application
18	$\overline{\text{OUT}}$	Timer output, active low
19	OUT	Timer output, active high
20	VDD	−V
21	SEQ1	One of 7 sequencer outputs, active high during preset timing interval 1
22	SEQ2	One of 7 sequencer outputs, active high during preset timing interval 2
23	SEQ3	One of 7 sequencer outputs, active high during preset timing interval 3
24	SEQ4	One of 7 sequencer outputs, active high during preset timing interval 4
25	ALARM	Audible alarm control output, active high
26	TBASE	Time base input, used as reference for all timing modes
27	TRIG	Trigger input, used in on/off mode, rising edge sensitive
28	SEQ7	One of 7 sequencer outputs, active high during preset timing interval 7
29	SEQ6/TIM2	One of 7 sequencer outputs, active high during preset timing interval 6

WD-55 PIN DESCRIPTION (Continued)

PIN NO.	SYMBOL	FUNCTION
30	SEQ5/TIM1	One of 7 sequencer outputs, active high during preset timing interval 5
31	D0	Digit output, LSD
32	D1	Digit output
33	D2	Digit output
34	D3	Digit output
35	D4	Digit output
36	D5	Digit output
37	D6	Digit output
38	D7	Digit output, MSD
39	SEG F	One of 7 high current (20 MA source) outputs for direct LED drive
40	SEG G	One of 7 high current (20 MA source) outputs for direct LED drive

FUNCTIONAL DESCRIPTION

The WD-55 is a versatile digital timing element designed to replace mechanical timing devices of the synchronous motor, cams, and lever variety. It is a preprogrammed mask-ROM single chip 4-bit microcontroller with different features determined by external strap options. It has essentially two distinct modes of operation: a keyboard programmable timer/sequencer using on-chip RAM for data storage and a 4-digit 7-segment display for data recall, or as an on/off timer which uses thumbwheel switches or even diodes for data storage and recall and does not require a display. These two different modes are selected by the absence or presence of a diode between the D7 digit output (38) and the IN0 scanned input (15). If the diode is absent, upon the occurrence of a reset pulse at pin (8), the device enters the keyboard programmable timer/sequencer mode. If the diode is present, a reset forces the device into the on/off timer mode.

In the timer/sequencer mode, the WD-55 operates with a matrix keyboard and a 4 digit numeric display to form a simple but flexible digital timing device for use in applications such as a dark room timer or programmable sequencer. The configuration table shown in Figure 1 provides the definition of keys, display digits, and strap options.

Keyboard: The WD-55 is useable with a standard 4x4 matrix keyboard (or 3x4 with two off-board switches) of the electromechanical or "membrane" type; audible feedback through the alarm output is provided for use with membrane or other switches which have little or no tactile feel. The debounce time is approximately 100 ms using a 60HZ timebase.

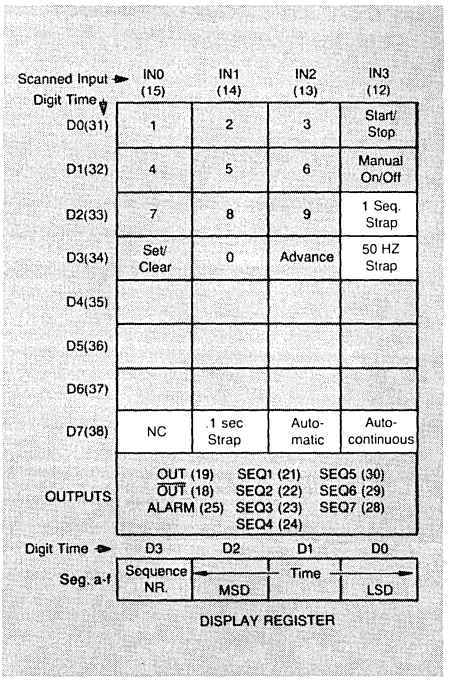


FIGURE 1. CONFIGURATION TABLE PROGRAMMABLE TIMER/SEQUENCER

KEY DEFINITIONS

ADVANCE: The key is used to access the 7 storage locations in RAM. Each time this key is depressed, the sequence number (digit 3) is incremented by one and the current value of the respective sequence is fetched and displayed in digits D0-D2 (least to most significant). If the current sequence number is 7, depressing the advance key will rollover to sequence #1. If the "1 sequence" strap is present (see strap options), this key is not required.

SET/ CLEAR: This key enables the entry of data into the RAM location currently being displayed by digit 3. When depressed, it enables the "SET" mode and clears display digits D0-D2 to zero as well as the respective memory location. Successive entry of data with the numeric keys (0 through 9) is then allowed. The set mode is terminated by depressing any non-numeric key. Note that there is no need for an "enter" or "store" key since the data displayed on digits D0-D2 is always automatically stored. If "SET/ CLEAR" has not been depressed prior to a numeric key, the numeric key is ignored, preventing the accidental or unwanted entry of data.

MANUAL ON/OFF: This key acts as a push on/ push off switch to manually force the output pins (OUT (19) and $\overline{OUT}$ (18)) to toggle. This is used to manually force an output on, such as in a darkroom timer application where the enlarger needs to be turned on and adjusted before proceeding with a timed interval. These outputs will remain in their current state indefinitely until either the manual key is depressed again or a timed interval is initiated. It has no effect on any of the sequencer outputs, SEQ1-7.

START/STOP: This key is used to initiate or terminate a timed sequence. If a timing cycle is not being performed, depressing this key will initiate a cycle beginning with the sequence currently being displayed in digit 3. If a cycle is currently running, it will terminate it, returning the two complementary outputs (OUT and $\overline{OUT}$) to their normal state and incrementing the sequence digit by 1. In fact, when a timing sequence is currently active, this is the only key which is scanned. This key may be paralleled with an external start/stop or footswitch if dictated by the application.

NUMERIC KEYS (0-9): These keys are used to enter numeric data when in the "SET" mode. Data entry is accomplished by right to left entry; that is, digits 0 to 2 are left-shifted by 1 digit (with the old value of digit 2 discarded) and the most recently depressed numeric key data entered into digit zero. There is no limit to the number of numeric keys which are entered, but only the most recent 3 are displayed and stored. If the "SET/CLEAR" key has not been previously depressed, these keys are ignored.

STRAP CONFIGURATION

Considerable versatility is accomplished with the WD-55 by the use of strap options in the form of diodes to select or delete specific functions. In the timer/sequencer mode, the following options are available.

50 HZ STRAP: The WD55 uses an external time base to accomplish its timing functions. It is optimized for use with 50 or 60 HZ AC line applications. For operation with 60HZ, no strap is necessary. For 50HZ applications, a diode should be connected between D3(34) and IN3(12).

1 SEQ STRAP: This strap (a diode between D2(33) and IN3(12)) forces the device to operate as though it had only 1 time available. At the end of the timed sequence, the SEQ digit does not advance and the SEQ1 data is restored to digits 0-2. When this strap is employed, the advance key should not be used and the sequence digit (Digit 3) is always a "1" and hence couid be eliminated.

.1 SEC STRAP: Without this strap, the basic resolution of the 7 sequences is 1 sec. That is, intervals of from 1 to 999 seconds are possible. With a diode (or diode plus SPST switch for variable applications) between D7(38) and IN1(14), the minimum resolution is decreased to .1 seconds; that is, the intervals are now from .1 to 99.9 seconds.

"AUTOMATIC" STRAP: With a diode between D7(38) and IN2(13), the automatic mode is enabled. In this mode, once the START key is depressed, sequences 1 through 7 are executed without further intervention. The cycle stops at the conclusion of sequence 7; that is, SEQ 1 data is being displayed and the keyboard is again being scanned. This is useful when the WD-55 is being used as a sequencer to cycle a complete 7-event sequence.

"AUTOCONTINUOUS" STRAP: This is used in conjunction with the "automatic" strap mentioned previously. If a diode is connected between D7(38) and IN3(12), the device will operate continuously once triggered by the start/stop key. This strap must be connected through a switch, since there is no means of terminating the sequence once initiated. Sequence 7 will be followed immediately by sequence 1. Depressing the start/stop key during the cycle will only terminate the current sequence in progress and begin execution of the next. This mode would typically be used in process control, machine sequencer, "moving lights" displays, etc.

INITIALIZATION

A low going pulse of sufficient duration (see Electrical Data) on the $\overline{RESET}$ pin (8) will force an initialization state, usually as the result of a power-turn-on reset. All 7 sequence times are set to zero and the sequence number digit (Digit 3) is set to "1". The complementary outputs OUT and $\overline{OUT}$ are set to logic LOW and logic HIGH respectively, and all sequencer outputs are logic LOW.

STOPWATCH/ELAPSED TIME CONTROLLER: If a nonzero time is entered into any sequence location, the WD-55 will count that time down to zero before advancing to the next sequence. However, if the stored data is already zero, depressing the START/STOP key will initiate an "UP" count mode starting from zero. The outputs (OUT and SEQ) function as before. If the START/STOP key is activated during this count cycle, the count will stop, the elapsed time will be displayed, the outputs will return to their "off" state, but the sequence number will not advance. This allows the WD55 to act as a "stopwatch" with a cumulative time capability and as an elapsed time controller to time and control a variable event.

ALARM OPERATION

The alarm output (Pin 25) serves several functions in the timer/sequencer mode. First, it provides a .1 sec pulse, active HIGH ("BEEP") whenever a valid key closure is detected. This provides audio feedback for use with non-tactile membrane keyboards. When counting down in a sequence mode, a single "BEEP" is enabled when the count reaches 10.0 seconds, giving an early warning of the end of cycle. When the count reaches zero, two "BEEPS" are output to give audible indication of end of cycle. This output can be buffered and used with self contained buzzers such as a Mallory Sonalert or may be used in conjunction with piezoelectric transducers (see Figure 9).

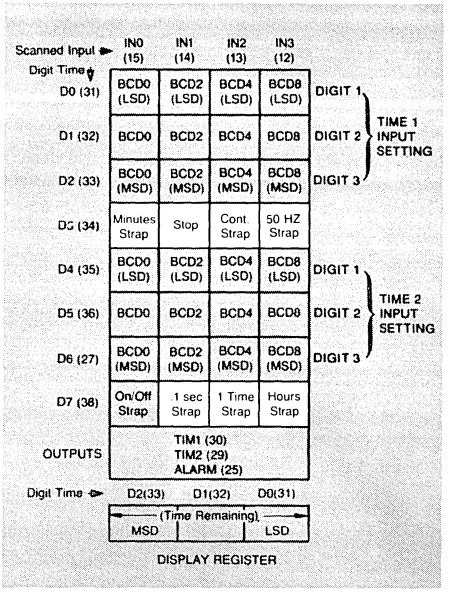


FIGURE 2 CONFIGURATION TABLE ON/OFF TIMER MODE

ON/OFF TIMER MODE

In the ON/OFF timer mode, the WD-55 is programmed to act as a digital programmable timer with one or two time periods which may vary from .1 sec to 999 hours. The data is input to the device by means of switches, thumbwheels, or even diodes. The use of a display is optional, which if employed, will show the current time remaining during each timing cycle. The timebase reference is again externally provided, usually from the 50 or 60 HZ AC line. Strap options are available to instruct the device as to whether it is to run one or two times, whether it is to be operated continuously or in the triggered mode, and whether the BCD switch data is to be interpreted as hours, minutes, or seconds. This mode is intended for use as a digital time delay relay, on/off timer/controller, set point timer, digital one-shot, etc. The timing is performed with digital accuracy and repeatability; it is not dependent upon bulky resistor/capacitor components and their inherent tolerance and temperature problems. For example, the WD-55 can generate a time delay of 999 hours with an accuracy of a fraction of a second with only a handful of diodes as external components, over a temp range of 0 to 55°C, a difficult feat to accomplish by analog means.

The configuration table shown in Figure 2 defines the strap and switch options required in this mode of operation.

ON/OFF STRAP: A diode MUST be connected between D7(38) and IN0(15) to inform the WD-55 that it is to operate in this mode. This strap is scanned at the time a reset occurs and causes the microprocessor to access the ON/OFF timer program. Without the strap, the WD-55 will operate as a programmable timer/sequencer as described before.

50 HZ STRAP: As described before, the WD-55 is optimized to use a 50 or 60 HZ timebase. No strap is required for 60 HZ operation. If 50HZ is used, a diode should be connected between D3(34) and IN3(12).

.1 SEC STRAP: If this strap is present (diode between D7(38) and IN1(14)), the input data is evaluated as XX.X secs; that is, times of from .1 to 99.9 seconds are attainable. If this strap is absent and there are no minutes or hours straps present, the data is evaluated as XXX. seconds.

MINUTES STRAP: If a diode is connected between D3(34) and IN0(15), the data is evaluated as XXX minutes. That is, times of from 1 to 999 minutes are attainable.

HOURS STRAP: If a diode is connected between D7(38) and IN3(12), the data is evaluated as XXX hours. That is, times of from 1 to 999 hours are attainable.

TIME 1 STRAP: There are normally two time periods available with the WD-55 which are executed in sequence. If a diode is present between D7(38) and IN2(13), the device will act on only time 1. In other words, when triggered it will count down time 1 to zero, stop, and reload time 1 rather than advancing and loading time 2.

CONTINUOUS STRAP: If this strap is not present, the WD-55 will operate in the "triggered mode". A rising edge (low to high transition) at the trigger input (Pin 27) will initiate a timing cycle beginning with the current time (one or two). At the end of the cycle, the outputs return to their active low state, the next time is loaded and displayed, and the device waits for another trigger input. If a diode is connected between D3(34) and IN2(13), continuous operation is selected. Here the trigger input is ignored. This strap allows the WD-55 to operate as a dedicated purpose timer, such as a defrost controller, which begins operation upon application of power.

STOP INPUT: If an input is detected between D3(34) and IN1(14) during a timing cycle, the cycle will terminate immediately. This can allow a manual overide to stop a cycle in progress. However, if the "CONTINUOUS" strap is present, this input serves only to stop the current timing cycle and cause an advance to the next time.

DATA INPUTS: The time data is input during digit times D0 to D2 (LSD to MSD) for time 1 and during D4 to D6 (LSD to MSD) for time 2 (if used), as shown in the configuration table. The data may be input by means of encoded switches, thumbwheels, or even discrete diodes. The WD-55 has on-chip pull-down resistors across inputs IN0-IN3, so that with the absence of an input during a given digit time is interpreted as a "0". Thus it would be possible to set a time of 080 hours by using only one diode. The data format must be 8421 BCD, with BCD8 connected to IN3 and BCD1 connected to IN0.

TRIGGER (PIN27): If the triggered mode is selected, a positive going transition at this input will initiate a timing cycle. This input is edge sensitive and has an internal pull-up resistor so that a momentary pushbutton switch may be used to manually trigger an event. Since this is not a scanned input, interface to other external logic is simple.

OUTPUTS

TIM1 (30): This output is active HIGH when timing cycle 1 is active, and LOW otherwise.

TIM2 (29): This output is active HIGH when timing cycle 2 is active, and LOW otherwise.

ALARM (25): This output is logic LOW when a timing cycle (1 or 2) is in progress and is logic HIGH otherwise. It may be buffered to drive an audible alarm or it may be used as a third timing output to turn a single device on for two different intervals.

INITIALIZATION

A logic low of sufficient duration on Pin 8 (RESET) will cause initialization of the WD55. In the on/off timer mode, TIM1, TIM2, and alarm will be logic low, and the first time (TIME 1) data is loaded into the display register. If the CONTINUOUS mode is selected, the device will immediately begin counting down time 1, else it will wait for a trigger pulse to occur.

APPLICATIONS CIRCUITS

The following are several circuits designed to give the user an idea of the range of applications that the WD-55 is capable of being utilized.

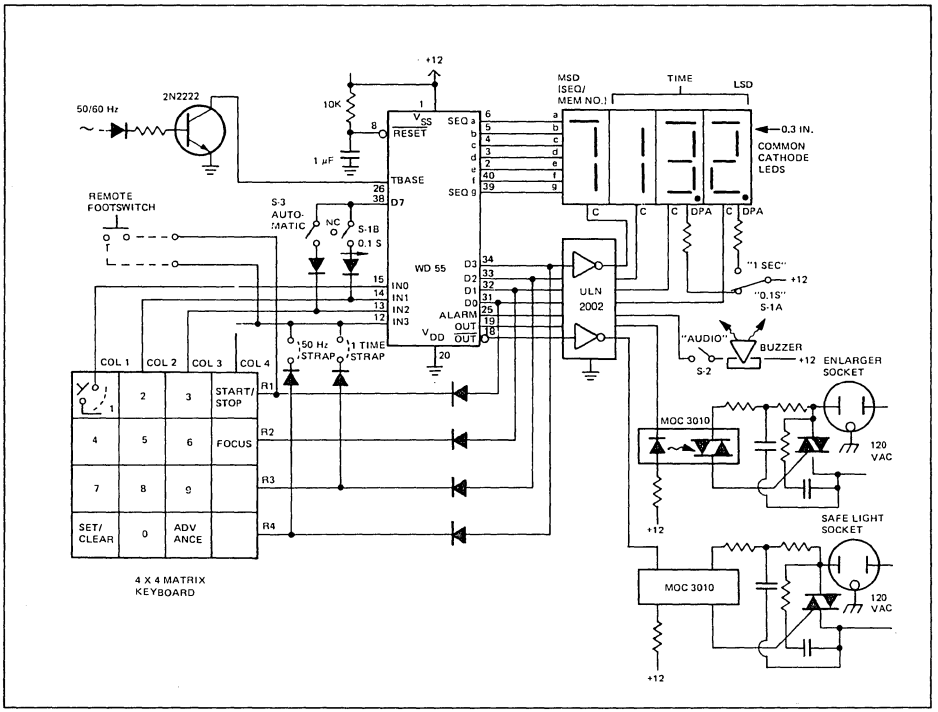


FIGURE 3 DARKROOM TIMER

DARKROOM TIMER

Figure 3 shows a complete schematic (except for power supply) of a dark room timer/controller using the WD-55. Note that the only external components required are a display, a digit driver, keyboard, and output switching devices. A 4-digit common-cathode LED display is used since their inherently red radiation is desirable for dark room environments. Note that the high current sourcing capability of the WD-55 segment outputs allows easy drive of instrument-size LEDS. The time base is provided by shaping up the 50/60HZ AC line input to Pin 26 (TBASE). A complete matrix keyboard is used to allow access to all 7 memory locations. A DPDT switch (S1) is used to select a resolution of .1 or 1 seconds and to simultaneously move the decimal point.

A good dark room timer/controller normally has two switched AC outlets, one for the enlarger and one for the "safe" light. They are the complements of each other in that the safe light is "on" when the enlarger is not active and is "off" when the enlarger is printing. The circuit shown makes use of the complementary outputs OUT (19) and $\overline{\text{OUT}}$ (18) to allow solid-state switching in the form of optically-isolated triacs by buffering them through two unused sections of the high-current digit driver. The value of "snubber" components depends upon the load, which in the case of enlargers and safe lamps is often inductive. If desired, a single SPDT relay may be used in place of the triacs and opto-isolators shown.

The buzzer shown is of the self-contained oscillator variety and operates with DC drive. The WD-55 may also be used with piezoelectric elements (see Figure 9). A switch is provided to disable the beeper when not desired. Another switch (S-3) is used to enable the automatic mode for making up to 7 sequential timed prints by depressing the start key only once. If the possibility of depressing two keys exists, the keyboard should be diode isolated to avoid "sneak" paths.

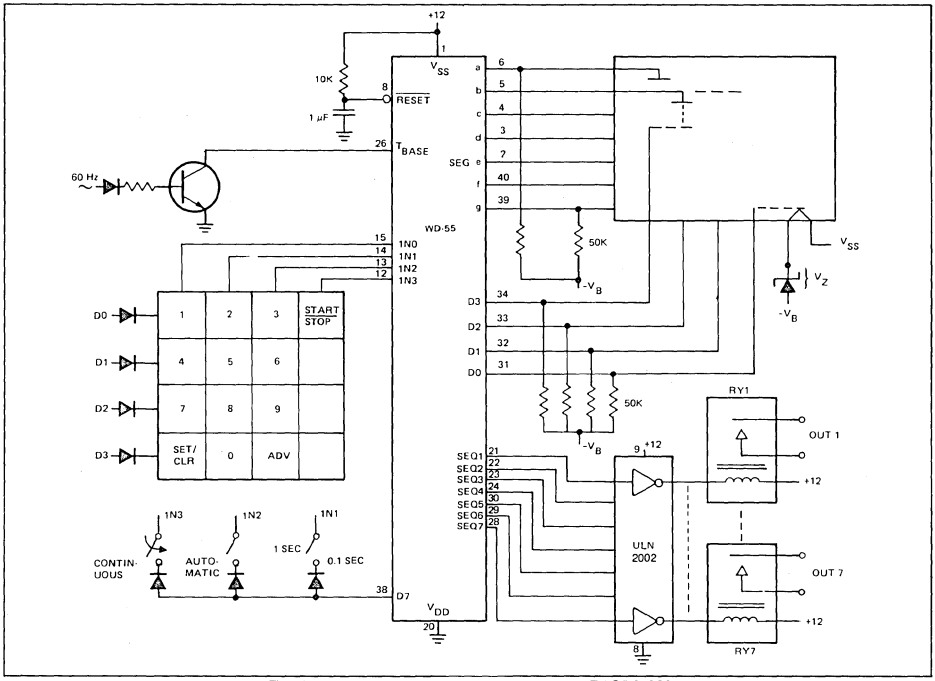


FIGURE 4 SEQUENCER WITH V-F DISPLAY

Figure 4 shows the WD-55 used to implement a keyboard programmable sequencer with 7 outputs. It features a vacuum-fluorescent (V-F) display which takes advantage of the fact that the WD-55 can drive it directly with no high voltage buffers — only external pull-down resistors are required. A conventional matrix keyboard is used as in the dark room timer application. Toggle switches are provided to allow strap options for .1 sec resolution and user-selectable continuous operation. In the auto-continuous mode, once set up, the 7 sequencer outputs will operate in succession to cycle up to 7 processes. The sequencer outputs are buffered by a high current driver interface to 7 relays which perform the output switching task.

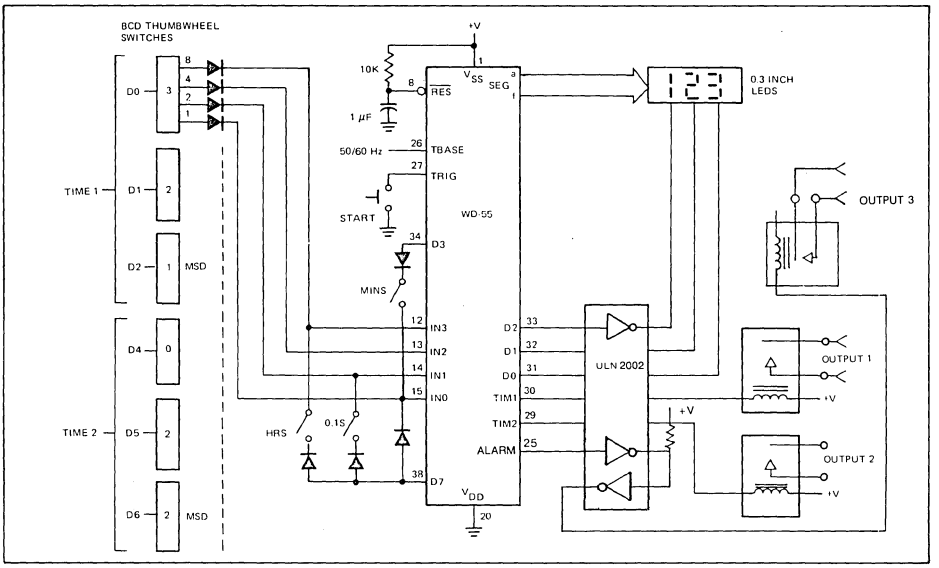


FIGURE 5 THUMBWHEEL PROGRAMMABLE INTERVAL TIMER

Figure 5 shows the WD-55 in its second mode of operation, that of a switch programmable on/off or interval timer. The circuit shown has three relay switched outputs, labelled one, two, and three. Output one is active for the duration of time 1, output two is active for the duration of time 2, and output three is active for the duration of both one and two.

Timing data is input through 6 BCD-encoded thumbwheel switches. Three SPST switches inform the WD-55 to interpret this data as NN.N seconds. NNN seconds, NNN minutes, or NNN hours. The LED display will show the time remaining and the countdown when operating. Since the data is input through switches, the display may be deleted if this feature is not desired. Also, since the timing information is read from switches, the data is non-volatile and no battery backup would be required of the device.

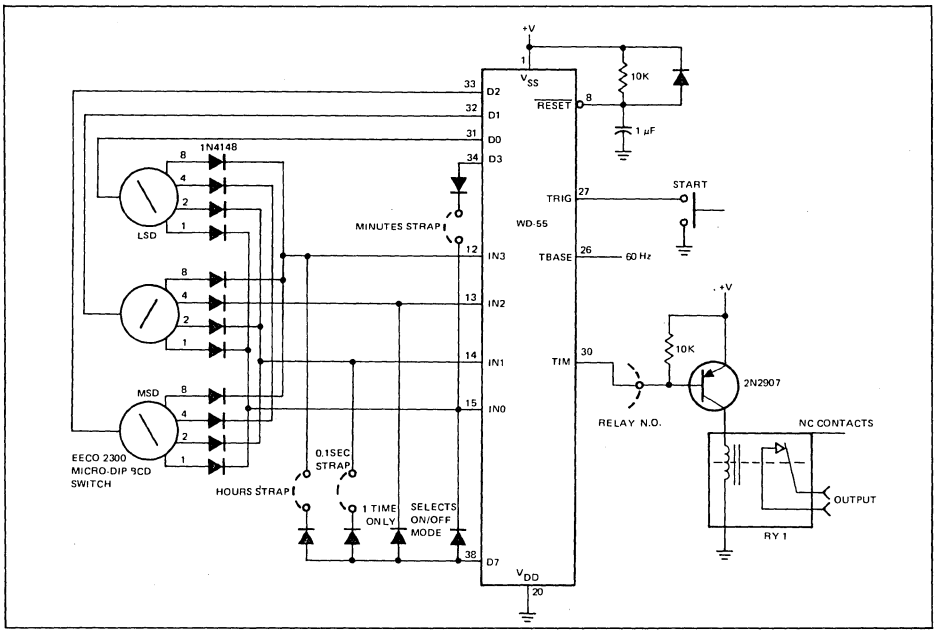


FIGURE 6 DIGITAL TIME DELAY RELAY

Figure 6 shows a digital programmable time delay relay using the WD-55 to give "ON" or "OFF" time delays of from .1S to 999 hours. the "Time 1 only" strap option is used here so that when triggered, the device loads and counts down only one time and then resets. Simple screw-driver slot programmable DIP switches are used here for low cost. Note that a display is not required, but could be added to produce a unique time delay relay with digital readout of time remaining.

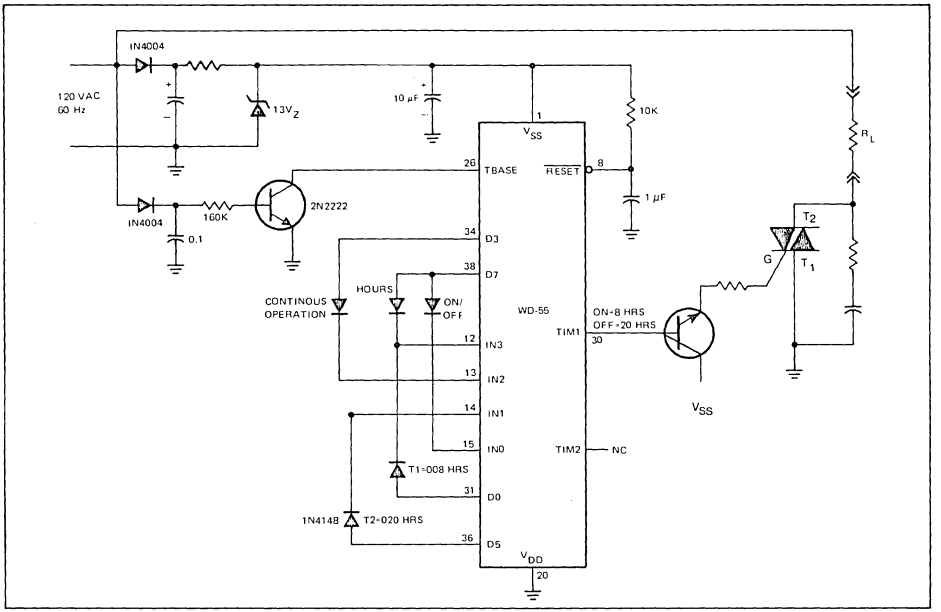


FIGURE 7 ON/OFF CONTROLLER

Figure 7 is an AC line-operated on/off controller. In this application, the WD-55 is programmed simply by diodes and does not require a keyboard, switches, or a display. It is a simple, reliable solid-state alternative to a motor driven cam switch. In this application the non-triggered, two-time mode is selected. Time 1 and Time 2 are programmed by diodes to be 8 hours and 20 hours respectively. The TIM1 output is buffered by a transistor to supply gate current to a triac which switches the output load. When power is applied to the circuit, the output load is switched "ON" for 8 hours then "OFF" for 20 hours repeatedly.

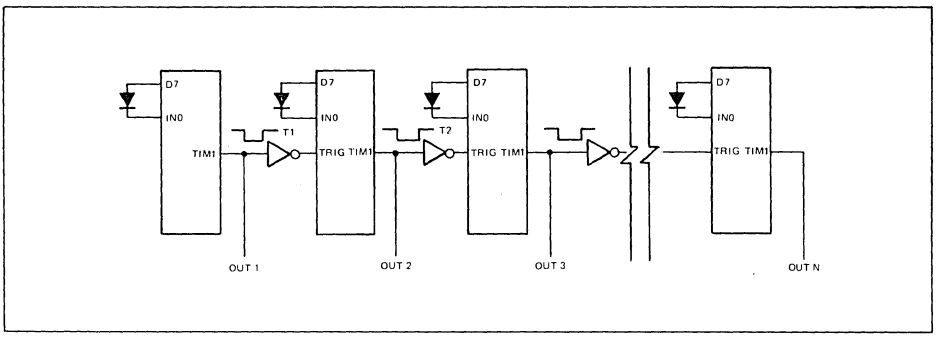


FIGURE 8 DAISY-CHAIN N-SEQUENTIAL INTERVAL CONTROLLER

Finally, Figure 8 shows how multiple, independent WD-55's may be configured for triggered mode operation may operate in daisy chain fashion to produce an N-sequential programmable interval controller.

These are but a few of the many applications for the WD-55. For custom versions, please contact the factory.

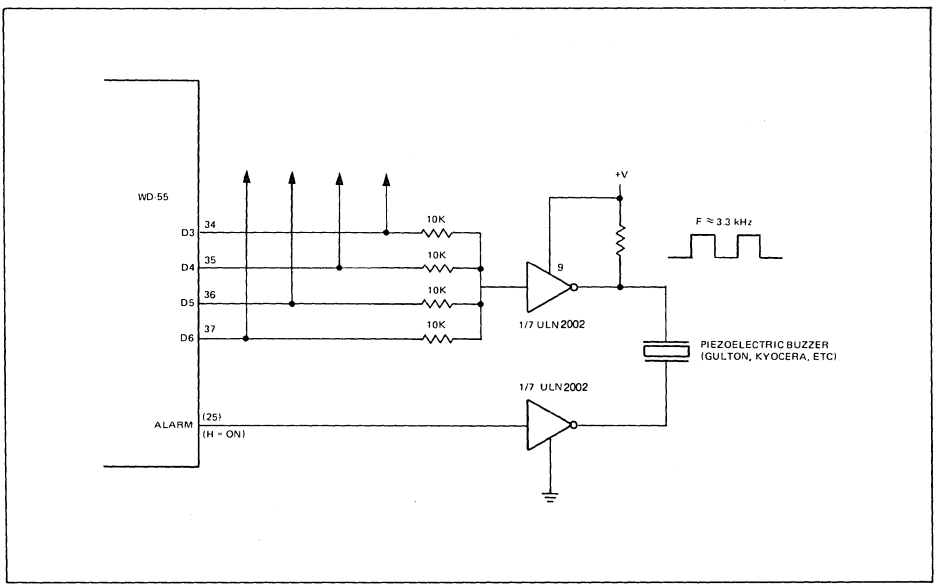


FIGURE 9 WD-55 USED WITH PIEZOELECTRIC BUZZER

SECTION 4

ABSOLUTE MAXIMUM RATINGS

Storage Temperature ....−65°C to +150°C Ceramic
−55°C to +125°C Plastic
Operating Free-Air Temperature
T Range ..... 0°C to 70°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C
Power Dissipation 2.5 Watt at 25°C
Positive Voltage on any Pin with Respect to V_{SS}: +0.3V
Negative Voltage on any Pin with Respect to V_{SS}: 20.0V

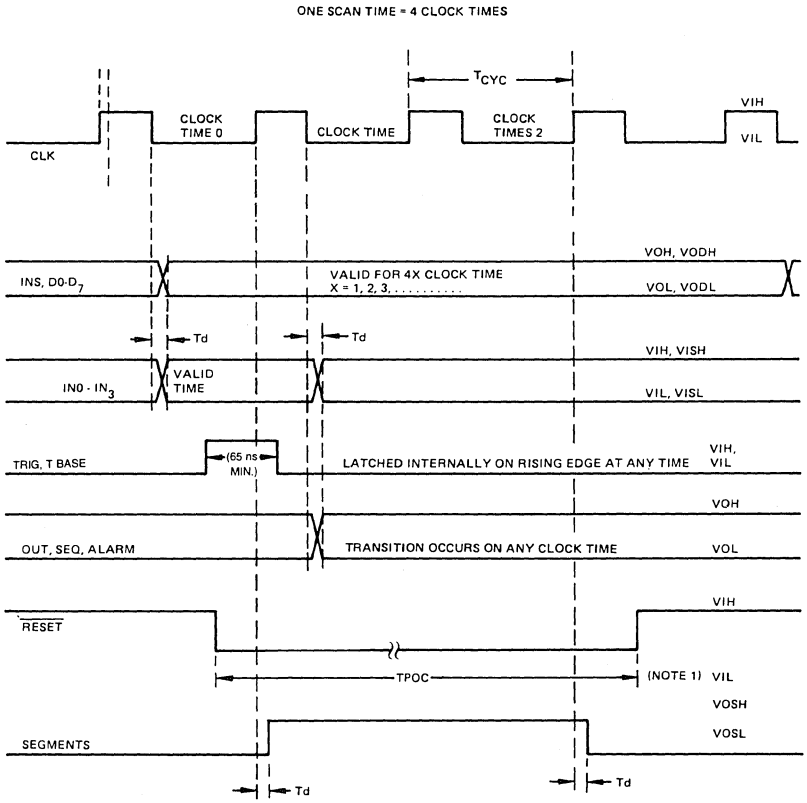
Absolute maximum ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications are not ensured when operating the device at absolute maximum ratings.

ELECTRICAL CHARACTERISTICS

TA = 25°C, $V_{SS}-V_{DD}$ = 13.2V unless noted otherwise

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage (V_{SS}-V_{DD})		11.5	13.2	14.5	V
Operating Current	All inputs and outputs open	6		15	mA
Input Voltage Levels					
All Inputs Except IN0-IN3					
Logic High (V_{IH})	Note 1	$V_{SS}-1$		V_{SS}	V
Logic Low (V_{IL})		V_{DD}		$V_{DD}-4.2$	V
Inputs IN0−IN3	Note 2				
Logic High (V_{ISH})		$V_{SS}-3.75$		V_{SS}	V
Logic Low (V_{ISL})		V_{DD}		$V_{SS}-9.0$	V
Output Voltage Levels					
All Outputs Except D0-D7 and SA-SG					
Logic High (V_{OH})	I_{OH}=+100 μA Min.	$V_{SS}-2$		V_{SS}	V
Logic Low (V_{OL})	I_{OL}=−1.6 mA Min.	V_{DD}		$V_{SS}-4.6$	V
D0-D7 Outputs					
Logic High (V_{ODH})	I_{ODH}=1.5 mA	$V_{SS}-1.5$		V_{SS}	V
	I_{ODH}=1.5 mA+I Input (IN0-IN3)	$V_{SS}-3.0$		V_{SS}	V
	I_{ODH}=5.0 mA+1 Input	$V_{SS}-3.5$		V_{SS}	V
V_{ODL}	Note 3				
Seg Outputs Seg a-f	I_{OSH}=16 mA			1.0	V
Segment Output Current Seg a-f I_{OSH}	Note 3	10	15	40	mA
AC Electrical					
TcYC			10		μs
$\overline{\text{Reset}}$		15			msec
TBase		0	60	500	HZ
Timing error (TOUT)	Note 4			±1	ms

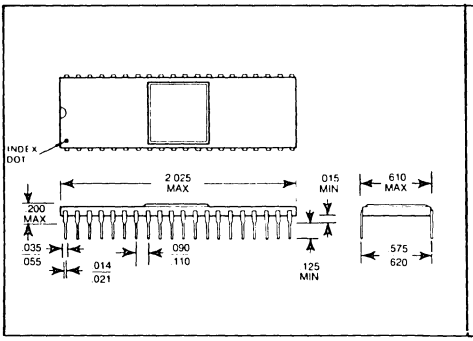
Note 1: Internal Pullup Resistors of Approximately 6K to V_{SS} Across Each Input.
Note 2: Internal Pulldown Resistors of Approximately 12K to V_{DD} Across Each Input.
Note 3: Single Transistor to V_{SS} Output Only.
Note 4: TBase = 60.000 HZ.



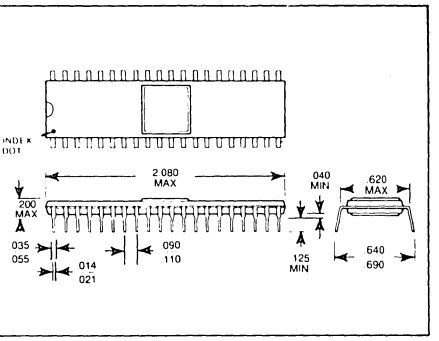
NOTE 1: RISING EDGE OF $\overline{\text{RESET}}$ GENERATES SCAN TIME 0 WITHIN 4 CLOCK TIMES

Note 2: td = μs MAX

WD-55 TIMING DIAGRAM



WD55A CERAMIC PACKAGE



WD55B PLASTIC PACKAGE

SUPPORT: Application and Design Support is available from Western Digital Corporation

ORDERING INFORMATION: WD55A for 40 Pin Ceramic Package
WD55B for 40 Pin Plastic Package

SECTION 4

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