TM2000
UNIVERSAL OSCILLATOR

USERS MANUAL

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DESCRIPTION

The TM2000 UNIVERSAL OSCILLATOR is a linear ramping pulse generator and Joystick Controller with several options. It is designed to be used with Anaheim Automation Step Motor Drivers and can produce pulse rates up to 2.56MHz. It has four on-board pot adjustments for 2 base speeds and 2 max speeds, a remote pot input, two VCO inputs (Voltage Input), and a joystick input. Also, the acceleration/deceleration ramp is adjustable, and the output pulses can be divided to lower frequencies. The board is designed to fit in a snap track.

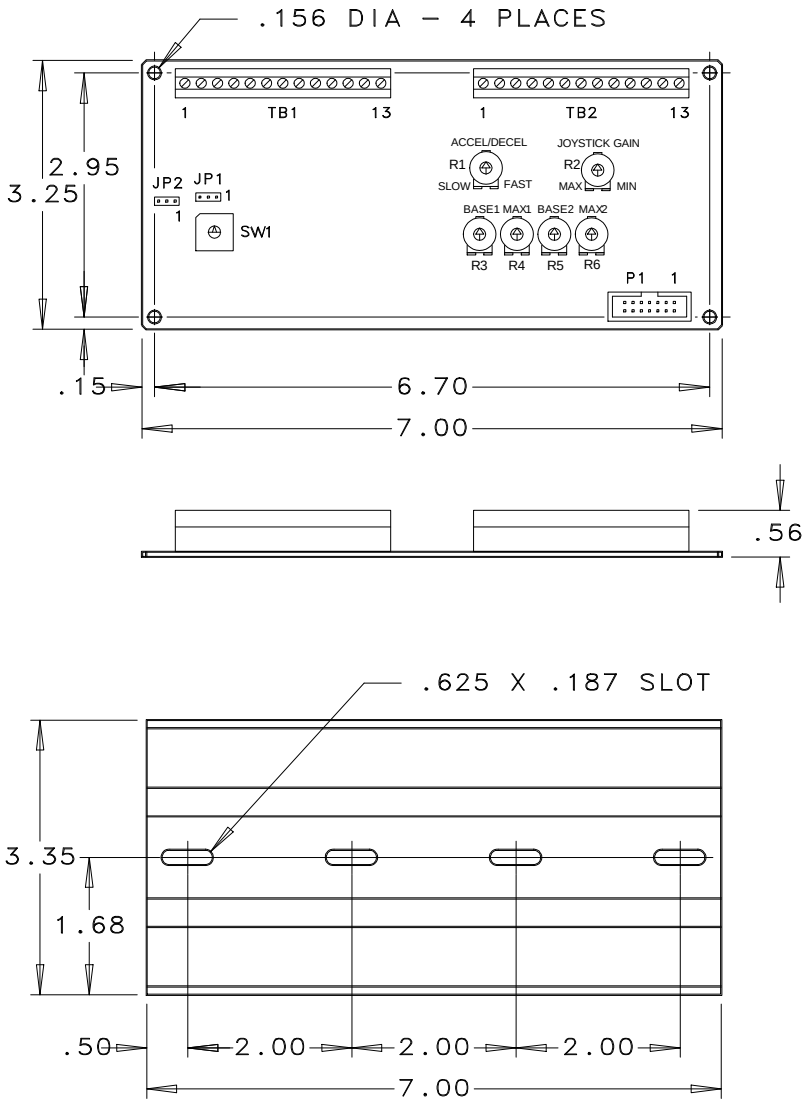


FIGURE 1: DIMENSIONS AND COMPONENT LOCATIONS OF TM2000. AND DIMENSIONS OF TRACK.

There are basically eight inputs which can determine the output pulse rate. Three select lines S1, S2, S3 (pins 1,2,3 on TB1) determine which of the eight inputs is to be used, as shown in Table 1. The user can switch from any input to another input with these select lines.

S3	S2	S1	FUNCTION
1	1	1	BASE1 (R3)
1	1	0	MAX1 (R4)
1	0	1	BASE2 (R5)
1	0	0	MAX2 (R6)
0	1	1	REMOTE POT
0	1	0	+VCO IN (0 to +10VDC)
0	0	1	+/-VCO IN (-5 to +5VDC)
0	0	0	JOYSTICK

TABLE 1. CONTROL INPUTS AND FUNCTIONS FOR TM2000 P.G.

ON-BOARD SPEED POTS

With the S3 input high (+5VDC) or open, the pulse generator is set up to use the four on-board speed pots. With the S1 input high (+5VDC) or open, BASE speed is selected. When this input is pulled low (0VDC), MAX speed is selected. The S2 input allows switching from one set of BASE and MAX speeds to the other set of BASE and MAX speeds. When this input is high (+5VDC) or open, BASE1 and MAX1 are selected. When this input is low (0VDC), BASE2 and MAX2 are selected.

There are three basic modes of operation when using the on-board speed pots. One mode requires the use of the STOP/RUN input and the S1 input. Normally in this mode both inputs are high before running. To start running, the STOP/RUN input is first pulled low (0VDC); the pulse generator starts running at BASE speed. The S1 line is pulled low (0VDC) some time after; this causes the pulse generator to ramp up to MAX speed and continue running at MAX speed. If the S1 input is set high (+5VDC) again, the pulse generator will ramp down to BASE speed and continue running until the STOP/RUN input is set high again.

The second mode of operation requires the use of only *one* input -- the RDS (Run-Down-Stop) input. S1 must be high when using the RDS input. When this input is pulled low (0VDC), the pulse generator to starts running at BASE speed and immediately ramps up to MAX speed. As long as this input is held low, the pulse generator will continue to run at MAX speed. When this input is set high (+5VDC), the pulse generator will ramp down to BASE speed and then stop.

Some applications may require ramping up only and no ramping down. This is the third mode. To operate in this mode, the STOP/RUN input and the S1 input are tied together. When both inputs are pulled low, the pulse generator starts running at BASE speed and immediately ramps up to MAX speed. When these inputs is set high, the pulse generator will stop immediately. Make sure the pulse generator has enough time to ramp down to BASE speed before starting again, because the pulse generator still ramps even though the output pulses are stopped.

REMOTE POT

Refer to the Table 1 for proper control input settings. This option allows manual speed adjustment from a remote pot. The value of the POT should be 100K ohms. The STOP/RUN input is to be used in conjunction with the remote pot.

In many applications, the TM2000 will be mounted in a cabinet or behind a panel with the on-board speed pots set semi-permanently and out of reach. At times, the operator may want to vary the speed of the machine to run tests or make observations. By switching to the REMOTE POT (with the select lines), the operator is able to do this.

+VCO INPUT

Refer to the Table 1 for proper control input settings. A voltage at this input will cause the pulse generator to produce pulses at a rate proportional to the input voltage. Acceptable voltages are 0 to +10VDC. The voltage in vs. frequency out is a linear relationship as shown in figure 2. If the voltage at this input is instantaneously changed from one voltage to another, the TM2000 pulse generator will ramp from one speed to the other (the speed will not change instantaneously). The STOP/RUN input is normally to be used in conjunction with this input. By placing JP1 in the appropriate position, the pulse generator will automatically run if the voltage is greater than 500mV; the p.g. will NOT run if the voltage is less than 500mV (see Table 3).

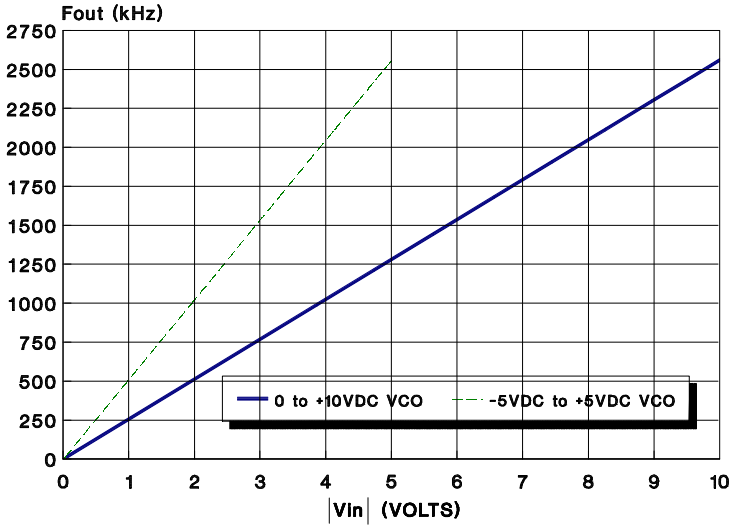


FIGURE 2: VOLTAGE IN (VCO INPUTS) VS. FREQUENCY OUT (UNDIVIDED).

+/- VCO INPUT

Refer to the Table 1 for proper control input settings. This input is similar to the +VCO input except it automatically produces the DIRECTION and STOP/RUN signals. Acceptable voltages are -5VDC to +5VDC (see figure 2). If the voltage is positive, the DIRECTION is clockwise (DIR OUT=HIGH). If the voltage is negative, the DIRECTION is counterclockwise (DIR OUT=LOW). The pulse generator will automatically run if the absolute value of the voltage is greater than 250mV; the p.g. will NOT run if the absolute value of the voltage is less than 250mV.

JOYSTICK

Refer to the Table 1 for proper control input settings. If this feature is to be used, the proper joystick may be purchased through Anaheim Automation. This feature allows a joystick to be used to control the direction and speed of the pulses. When the joystick is in the middle position, no pulses are put out. Pulses begin as the joystick is moved away from the middle position. The pulse rate increases as the stick is moved further from the middle position. The DIRECTION signal is automatically determined by the direction in which the stick is moved. Acceptable values for the joystick potentiometer are 1K - 100K ohms.

When using the joystick function, several adjustment may be needed. First, connect the joystick as in Figure 3. The joystick's pot must be adjusted so that the pot wiper is exactly centered. There are several way to do this. One way is to simply select the Joystick Mode and adjust the joystick's pot until no pulses are sent out. Another way to do this is to look at the DIR out (pin 10, TB2) with a multimeter while adjusting the joystick pot. The pot is centered when the DIR out just switches from logic "0" to logic "1" or vice versa. Some joysticks also have a trim adjustment.

The electrical travel of joystick pots may vary from one joystick to another so an adjustment, R2 is provided. R2 is the gain adjustment for the joystick mode. To adjust R2, start with this pot turned to the minimum gain (max clockwise position). Push the joystick to one of the ends, and slowly turn R2 counterclockwise (increasing the gain). The output pulse rate should keep increasing until pulses stop. When the pulses stop, this means that the gain is too high. So, turn R2 clockwise a little (decreasing the gain) until output pulses appear again. Try this again with the joystick in the other direction, and adjust the pot accordingly.

OFF/ON

This input (pin 8 or TB1) is used to stop output pulses regardless of the operation mode. A logic "1" inhibits pulses or turns the output OFF. A logic "0" enables pulses or turns the output ON. At times, it may be desirable to turn off output pulses. Since the VCO and Joystick inputs start and stop automatically, the OFF/ON input can be used to turn off output pulses in these modes. Normally this input will be grounded or at logic "0".

DIRECTION INPUT

The Direction input (pin 5, TB1) is used only with on-board pots, REMOTE POT, and the +VCO input. A logic "1" selects clockwise; a logic "0" selects counterclockwise. This input is basically sent straight out (buffered) to the driver's Direction Input. The +/- VCO and Joystick inputs do not use this input.

ACCELERATION/DECELERATION RAMPING

The acceleration and deceleration of the TM2000 are linear and adjustable (by R1) from approximately 2,700,000 steps/sec^2 to 61,000,000 steps/sec^2. Remember if you are using a divided output, also divide these accel/decel rates by the same divisor to get a corresponding number. For example,if you are using a divisor of 128 (to get 20kHz max), the accel/decel rates will be approximately 21,000 steps/sec^2 to 476,000 steps/sec^2.

OUTPUT PULSE RATES/ DIVISORS

The *approximate* pulse rates are shown in Table 2 below. Undivided pulses ranging from 12kHz to 2.56MHz come out on pin 11 of TB2. Divided pulses come out on pin 12 of TB2.

SW1,SWITCH POSITION	DIVISOR	BASE SPEED RANGE	MAX SPEED RANGE
0	2	6kHz - 128kHz	6kHz - 1.28MHz
1	4	3kHz - 64kHz	3kHz - 640kHz
2	8	1.5kHz - 32kHz	1.5kHz - 320kHz
3	16	750Hz - 16kHz	750Hz - 160kHz
4	32	375Hz - 8kHz	375Hz - 80kHz
5	64	188Hz - 4kHz	188Hz - 40kHz
6	128	94Hz - 2kHz	94Hz - 20kHz
7	256	45Hz - 1kHz	45Hz - 10kHz
8	512	23Hz - 500Hz	23Hz - 5kHz
9	1024	12Hz - 250Hz	12Hz - 2.5kHz
A	2048	6Hz - 125Hz	6Hz - 1.25kHz
B	4096	3Hz - 62.5Hz	3Hz - 625Hz
C	8192	1.5Hz - 31.2Hz	1.5Hz - 312Hz
D	16384	0.75Hz - 15.6Hz	0.75Hz - 156Hz
E	32768	0.38Hz - 7.8Hz	0.38 Hz - 78Hz
F	65536	0.19Hz - 3.9Hz	0.19 Hz - 39Hz

TABLE 2. DIVIDED CLOCK OUTPUT RANGES.

The first column in Table 2 shows the switch position (SW1) for the respective divisors in the second column. The range of BASE speeds are shown in column three, and the range of MAX speeds are shown in the last column. Notice that the maximum BASE speed is one tenth of the maximum MAX speed, and the minimum speeds for BASE and MAX are the same. The minimum pulse rates for the +/- VCO Input and the JOYSTICK Control are roughly ten times higher than the minimum speeds in Table 2 (The MAX rates are the same as in Table 2).

POWER REQUIREMENTS

There are three options for supplying power to the board. Use only one type of power at a time. A regulated +5VDC supply may be applied to pin 10 of TB1. An unregulated +12VDC supply may be applied to pin 11 of TB1. 9VAC may be applied between pins 12 and 13 of TB1.

14-PIN HEADER CONNECTOR

This connector is used for a direct connection to some Anaheim Automation Drivers using a flat ribbon cable. The driver supplies power and receives Clock and Direction signals through this connector. The Clock output on this connector may be the undivided Clock (2.56MHz max.) or a divided Clock; this is selected by jumper JP2 (see Table 3). The following Anaheim Automation Drivers use this connection: MDBB570, MDMS32, MDMS256, DPT10001, DPFHP001, BLHP101.

DESCRIPTION	JP1	JP2
Manual STOP/RUN for +VCO Input	1 - 2	X
Automatic STOP/RUN for +VCO Input	2 - 3	X
Undivided CLOCK on 14-pin Header	X	1 - 2
Divided CLOCK on 14-pin Header	X	2 - 3
STANDARD PRODUCT (Ready to Ship)	1 - 2	2 - 3

TABLE 3: JUMPER DESCRIPTION. X=DON'T CARE

TB2 TERMINAL	DESCRIPTION
1	REMOTE POT (TOP)
2	REMOTE POT (WIPER)
3	REMOTE POT (BOTTOM)
4	JOYSTICK (TOP)
5	JOYSTICK (WIPER)
6	JOYSTICK (BOTTOM)
7	+VCO IN
8	+/- VCO IN
9	0VDC
10	DIRECTION OUT
11	CLOCK OUT (NON-DIVIDED)
12	DIVIDED CLOCK OUT
13	0VDC

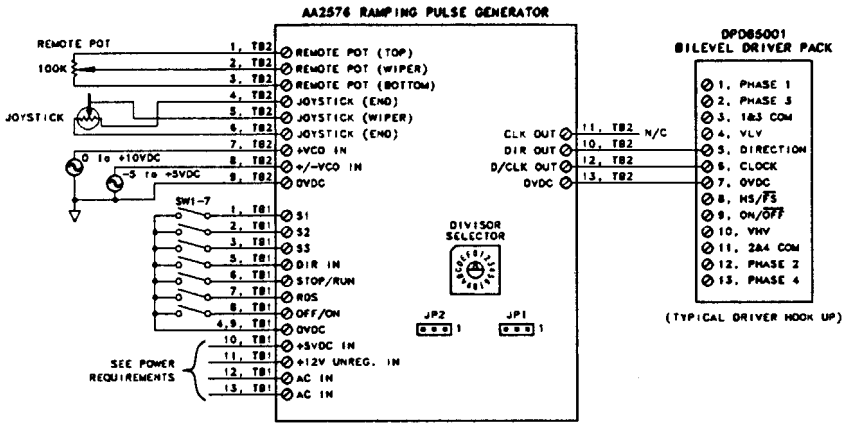
TABLE 4: TB1 TERMINAL DESCRIPTION.

TB1 TERMINAL	DESCRIPTION
1	S1
2	S2
3	S3
4	0VDC
5	DIRECTION IN
6	STOP/RUN
7	RDS
8	OFF/ON
9	0VDC
10	+5VDC
11	+12VDC UNREGULATED
12	9VAC IN
13	9VAC IN

TABLE 5: TB2 TERMINAL DESCRIPTION.

HOOKUP DIAGRAM

A typical hookup diagram is shown in Figure 3 showing ALL the inputs being used.



ORDERING INFORMATION	
TM2000	UNIVERSAL OSCILLATOR
TMA-JS2000	2-AXIS JOYSTICK
TMA-POT100K	100K ohm REMOTE POT

SPECIFICATIONS

Control Inputs: (TB1: pins 1,2,3,5,6,7)
TTL/CMOS-compatible
Logic "O" - O to O.8V
Logic "1" - 3.5 to 5.OV

S1, S2, S3 (pins 1,2,3, TB1 - see Table 1)

DIR IN (pin 5, TB1 - not for +/-VCO or Joystick)
Logic "0" - Counterclockwise
Logic "1" - Clockwise

STOP/RUN (pin 6, TB1)
Logic "0" - Output Pulses Running
Logic "1" - Output Pulses Stopped

RDS (pin 7, TB1)
Logic "0" - Run, Ramp up to MAX Speed
Logic "1" - Ramp down to BASE Speed and STOP

OFF/ON (pin 8, TB1)
Logic "0" - Output Pulses Enabled
Logic "1" - Output Pulses Inhibited

REMOTE POT (pins 1,2,3, TB2)
value - 100k ohms

JOYSTICK (pins 4,5,6, TB2)
pot value - 1k to 100k ohms

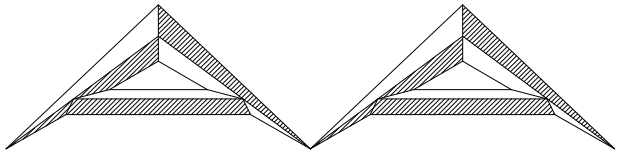
+VCO (pin 7, TB2)
Input Voltage Range: 0 to 10VDC
Input Impedance: 200k ohms
Thresholds for Automatic STOP/RUN:
STOP - Vin<500mV
RUN - Vin>500mV

+/-VCO (pin 8,TB2)
Input Voltage Range: -5VDC to +5VDC
Input Impedance: 100k ohms
STOP: Vin<250mV
RUN: Vin>250mV

POWER REQUIREMENTS:
+5VDC regulated - pin 10,TB1
+8 to +12VDC unregulated - pin 11, TB1
6 to 9VAC - pins 12,13, TB1

CLOCK OUT (pin 11, TB2)
TTL/CMOS Squarewave
frequency = 12kHz to 2.56MHz

D/CLOCK (pin 12, TB2)
TTL/CMOS Squarewave
see table 3 for frequency ranges



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