

# MONARCH INSTRUMENT

*Instruction Manual*



## **TACH-4A / TACH-4AR Programmable Optical Tachometer**

1071-4850-001  
Rev 2.0

## OVERVIEW

The TACH-4A has 6 control buttons. Several have more than one function.

**POWER (LOCK)** - Used to turn the instrument on, and in some cases off. It is used to initiate the timer and counter operations and to control the RPM measurement function.

**RECALL (STORE)** - Used to recall the maximum and minimum values in RPM and SCALE modes, temporarily hold the display in the Totalize mode, and “save” (store) new setups in the MENU mode.

**RESET (LOCK)** - Resets all stored measurements in all modes back to zero. Holding **RESET** and pressing **POWER** on start-up “locks on” the unit in RPM and Scale modes. **RESET** returns scale factor to “00001” from a previously selected scale factor.

**UP ARROW** (↑) - Advances Menu mode selections. Increments the value of the selected digit when setting scale factors.

**LEFT ARROW** (←) - Turns LCD back light on for 60 seconds in any mode. Selects menu item options in menu mode. Selects the digit to be edited when setting a scale factor.

**MENU** - Pressing **MENU** then **POWER** will shut the instrument off. Pressing **MENU** then **UP ARROW** will enter the menu mode and display the current Menu selection.

## POWER ON/OFF

The unit can be powered up by pressing the **POWER (LOCK)** button. When turning the unit on, it can be “locked on” by pressing and holding the **RESET (LOCK)** button then pressing the **POWER(LOCK)** button. Locking the unit on allows it to make continuous readings without holding the **POWER** button.

When the unit is powered up, it will operate in the last mode selected prior to turn off. The TACH-4A is shipped from the factory in the RPM mode.

The unit can be shut off in any mode by pressing the **MENU** button then **POWER** button. When the Lock Chevron is not displayed and no button is pressed for 60 seconds, the unit will automatically shut off.

## SPECIFICATIONS

OPERATING MODES Push-button select Menu: RPM  
Scale, Total, Count, Timer, Decimal,  
Point (Fixed or Floating), Backlight  
(On-Off), Serial Number, Test

SPEED RANGE (RPM) 5.0 RPM to 500,000 RPM  
Fixed Decimal or Auto-Ranging

N.I.S.T Calibration Certificate is supplied.

Range (RPM)	Accuracy (RPM)	Resolution
5.0000- 9.9999	± 0.0001	0.0001
10.000-99.999	±0.001	0.001
100.00-999.99	±0.01	0.01
1000.0-9999.9	±0.1	0.1
10,000-99,999	±1.0	1.0
100,000-500,000	±0.001% of the reading	

FREQUENCY RANGE: 0.08 Hz to 10,000 Hz

DISPLAY: 6 digit alphanumeric 0.44 inch high  
backlighted LCD updated twice per  
second

INDICATORS: On Target, Low Battery, Mode, Max,  
Min, Instrument "Locked On", Scale  
and Error

POWER: 4 "AA" Alkaline batteries.  
Rechargeable NiCad batteries optional

SIZE: 6.2" x 3.74" x 1.3"

WEIGHT 14 oz.

## PREPARATION FOR USE

The TACH-4A is a multi-function instrument which can be utilized as a wide range Tachometer, multi-function Totalizer/Counter, and a Timer (Stopwatch). The scale mode allows the instrument to be used as a Ratemeter and to scale in real engineering units for RPM and linear speed measurements. The Totalizer mode has an independent scaling capability. The TACH-4A has powerful internal optics while the TACH-4AR has identical internal optics and the capability to operate with a Remote Optical Sensor, Infrared Sensor, or Remote Laser Sensor.

TACH-4A measures RPM directly without contacting the rotating object. A portion of the circumference of the rotating object is prepared by cleaning a small area and applying Reflective Tape (T-5) approximately 1/2" square. For small diameter shafts, a smaller reflective marker may be used on the circumference, but in no application should the reflective marker cover more than half the circumference of the shaft. Also, a measurement can be made on the end of the shaft by applying a small piece of Reflective Tape (T-5) along a radial line (slightly less than 1/2 of the shaft should be covered).

## RANGE AND ACCURACY

TACH-4A measures rotational speed from 5 RPM to 500,000 RPM. The decimal point can be programmed for fixed or floating operation to provide the maximum resolution and accuracy for the speed being measured. Below 10 RPM, when in the floating decimal mode, TACH-4A will read to four decimal places. Above 100,000 RPM, the display reads to six digits.

## CALIBRATION

The instrument is factory calibrated, traceable to NIST. The calibration system complies with MIL-STD-45662A. The accuracy of the Tachometer can be checked at any time by aiming it at an old style fluorescent light and observing 7200 + 2 counts.

NOTE: In countries with a 50 Hz. power line frequency, the Tachometer will read 6000 + 2 counts.

A N.I.S.T. (National Institute of Standards and Technology) Certificate of Calibration is supplied with each instrument and is valid for 12 months.

## OPERATING DISTANCE AND ANGLE

Measurements can be made up to 36 inches and at angles of up to 45° from the reflective tape (T-5). When measuring shiny surfaces, a 20° angle is recommended. The TACH-4A has exceptional accuracy, and for very low or very high speed measurements, it is desirable to hold the instrument against a steady rest, or mount it on a Tripod or bracket using the 1/4 - 20 UNC mounting bushing on the back side of the instrument. This ensures that slight hand motion will not influence the time interval between pulses, giving erroneous readings. For most measurements, it is not necessary to mount the instrument in this manner. The TACH-4AR with RLS-5P Laser Sensor can be used up to 50 feet and 45° from the reflective tape (T-5).

## CHANGING THE MODE

To change the operating mode of the unit, press the **MENU** button so that “MENU” is displayed. Pressing the **UP ARROW** (↑) button once will display the current mode. Keep pressing the **UP ARROW** (↑) button until the desired mode is displayed. Press the **LEFT ARROW** (⇐) button to change an option of that mode, i.e. to select MANUAL or AUTO for the Timer mode. Finally, press the **RECALL (STORE)** button to “save” the new mode. To set the scale factor for Scale or Totalize modes see **Setting the Scale Factor** section.

## MENU SELECTIONS

Pressing the **MENU** button causes the word “Menu” to be displayed. Pressing the **UP ARROW** (↑) button displays the current mode. Pressing the **UP ARROW** (↑) button again displays the RPM mode. Press the **UP ARROW** (↑) button again to display the next mode. TEST loops around back to RPM. Pressing the **LEFT ARROW** (⇐) button will perform the function stated in the following table or display the current option setting. Pressing the **LEFT ARROW** (⇐) button again allows selection of either of the two options shown.

Do not forget to Press the **RECALL (STORE)** button to save the selected mode or value. Pressing the **MENU** button returns to the “MENU” function. Pressing the **RESET** button returns to the operating mode without changing the unit.

## ACCESSORIES

MODEL	DESCRIPTION
ROS-5P	Remote Optical Sensor with an 8 foot cable and a mounting bracket
RLS-5P	Remote Laser Sensor with an 8 foot cable and a mounting bushing on a base Infrared Sensor with an 8 foot cable
IRS-5P	Infrared sensor with an 8 foot cable
MT-190P	Magnetic Trigger Sensor/Amplifier with an 8 foot cable
EC-25P	25 foot extension cable for remote sensors with male/female 1/8 inch phone plug connectors
R-5B	Recharger, 115 Vac - 50/60 Hz, with 4 “AA” Nicad Batteries
R-6B	Recharger, 230Vac - 50/60 Hz, with 4 “AA” Nicad Batteries
B-4	Four “AA” Rechargeble NiCad Batteries
CC-3	Plastic Latching Carrying Case
T-5	Reflective Tape - 5 foot roll, 0.5 inch wide
T-5WP	Waterproof Reflective Tape (honeycomb pattern) 5 foot roll, 1 inch wide
CAL-N.I.S.T	N.I.S.T. Traceable Certificate of Calibration and Re-Calibration

## LCD AND PANEL DISPLAY SYMBOLS

- ☉ On Target Indicator - In RPM and Scale modes. The ‘On Target Indicator’ blinks at a signal input frequency to indicate that the light is reflected back from the target .
- 1 “Max” - Indicates a maximum reading in the RPM and Scale modes. Indicates the first lap time in the Timer mode.
- 2 “Min” - Indicates the minimum reading in the RPM and Scale modes. Indicates the second lap time in Timer mode.
- 3 Indicates the third lap time in Timer mode.
- SCALE** Indicates the instrument is in scale mode.
- LOCK** Indicates the unit is “locked on”. The TACH-4A will not shut off automatically when the lock chevron is displayed.
- ‘.....’ Indicates the input frequency exceeds the limit of the TACH-4A.
- OVFLOW** “Overflow” indicates the count has exceeded 999,999.

TABLE READS FROM THE BOTTOM TO THE TOP				
↔	↔	↔	↔	
↓	OPTION	OPTION/FUNCTION	MENU ITEMS	DESCRIPTIONS/RANGES
↓		Perform Self test	↔ TEST ↑	Displays all LCD segments
↓		View Serial number	↔ SERIAL ↑	Displays Serial Number
↓	ON	↔ OFF	↔ LIGHT ↑	Select Back light On/Off
↓	FIXED	↔ FLOAT	↔ DEC PT ↑	Select Fixed or Floating Decimal Point.
↓	AUTO	↔ MANUAL	↔ TIMER ↑ COUNT ↑	0 to 1 hour (.01 sec) 1 to 100 hours (1 sec) Count from 1 to 999,999
↓		Set Totalize Scale Factor	↔ TOTAL ↑	Totalize from 1 to 999,999
↓		Set Scale Factor	↔ SCALE ↑ RPM ↑	Scale from 0.0001 to 99,999 5 RPM to 500,000 RPM
↓			Pressing the MENU button starts here	“MENU”

## MODE DESCRIPTIONS

### RPM MODE - Revolutions Per Minute

The RPM mode is used for measuring the speed of rotating objects by reflecting a beam of light off a piece of reflective tape (T-5). The Tachometer requires one pulse per revolution. For other than one pulse per revolution, use the SCALE mode. When turning the unit on, it can be “locked on” by pressing and holding the **RESET/LOCK** button, then pressing the **POWER/LOCK** button. The unit will indicate the mode, followed by “READY”, and will then begin taking readings. The LOCK chevron will indicate that the unit is “locked on”. The TACH-4AR version will automatically turn on the external sensor if it is plugged in, else the internal optics will be turned on. It is necessary to aim the light at the reflective tape (T-5) in order to take readings.

#### POWER/LOCK

When the instrument is “locked on”, the **POWER** button will turn the unit off. **When not “locked on” the POWER button must be depressed and held to take a reading.** Each time **POWER** is pressed, the previous Minimum and Maximum value is cleared, and the optics are turned on to take the next reading. When the **POWER** button is released, the Tachometer holds the last reading for 60 seconds, then automatically shuts off.

**NOTE: None of the following buttons will function when the POWER button is being held.**

#### RECALL/STORE

Used to display the stored Maximum or Minimum value. When pressed, the unit will display “MAX” or “MIN”, then the value. The reading alternates between the Maximum and Minimum values each time this button is pressed. The value is displayed for 2 seconds, then the display returns to the last measurement.

#### RESET/LOCK

Resets the minimum, maximum, and last measurement to Zero.

#### LEFT ARROW (⇐)

Turns the LCD back light on for 60 seconds (assuming the backlight is not already on)

#### SCALE MODE

Operation is the same as for the RPM mode, except that the measurement is scaled. In the RPM mode, the input frequency is automatically multiplied by 60 to display in Revolutions Per Minute. In the scale mode, the input frequency (pulses per second) is multiplied by a user defined scale factor. As an example: for two pulses per revolution and a desired readout in RPM, the Scale Factor is 30. ( $60 / \text{pulses per rev} = \text{Scale Factor}$ ) The scale factor can range from 0.0001 to 99999. This allows the user to display data in real engineering units.

#### REMOTE SENSORS (TACH-4AR ONLY)

The remote sensors plug into the stereo phone socket on the end panel of the unit. The unit automatically detects the remote sensor at ‘turn on’ time and powers the remote sensor on as needed. If you plug a remote sensor in while in the middle of a measuring operation, the unit will not recognize the remote sensor. It is then necessary to turn the TACH-4A off, then on again. **Remember to press and hold the POWER button or ‘lock-on’ the unit to take a reading with a remote sensor.**

It is often useful to turn the TACH-4A on in the “LOCK” mode when using remote sensors. Plug the sensor in, then press and hold the **RESET/LOCK** button and press the **POWER** button to turn the unit on and permanently power the sensor. Refer to individual modes for further instruction.

#### PO, PULSE OUTPUT (OPTIONAL)

The Pulse Output is an option for both the TACH-4A and TACH-4AR. This option includes a 2.5mm phone socket installed on the lens panel of the Tachometer and a six foot cable with mating 2.5mm phone plug to male BNC connector enabling the user to interface with a standard BNC cable. The Pulse Output is a 0 to 5 Volt TTL compatible output. Every input pulse gives an output pulse. Normally, the Tachometer is used with one pulse per revolution, therefore the output would be one pulse per revolution. If the Tachometer is used with more than one pulse per revolution, the output will echo the input, thus providing more than one pulse per revolution.

## SELF TEST

To run the self test, press the **UP ARROW** (↑) button in the MENU mode until “TEST” is displayed. Press the **LEFT ARROW** (←) button. The unit will display the current software revision as “Rev x.x”. The unit will then automatically proceed with the self test. All segments of the display will be on, as will the back light, the internal optics, and the remote sensor (TACH-4AR only). They will remain on for about 5 seconds while the unit performs other internal tests. If the tests pass, the unit will return to the MENU. Otherwise an error message (ERR x) will be displayed for about 5 seconds before returning to “MENU” display. Pressing **RESET** at this point returns to the current mode of operation.

## BATTERIES

The TACH-4A and TACH-4AR are supplied with four “AA” alkaline batteries unless ordered with the optional Recharger and NiCad rechargeable batteries. The instrument will operate continuously in excess of 8 hours on fully charged batteries.

## RECHARGER AND RECHARGEABLE BATTERIES (OPTIONAL ACCESSORY)

The **RECHARGER AND NICAD RECHARGEABLE BATTERIES** allow recharging without removing the batteries from the instrument. Insert the Recharger plug into the 5.5mm DC charger jack on the lens panel. Total recharge time is approximately 16 hours. **THE INSTRUMENT MAY BE OPERATED WITH THE RECHARGER.** The instrument will operate continuously in excess of 8 hours on fully charged batteries.

## LOW BATTERY INDICATION

When the batteries are low, the display blinks every 0.5 seconds. Once the display starts to blink, the Tachometer can be operated for an additional 10 to 15 minutes. Should the battery get too low to operate the instrument correctly, the display will indicate “LO BAT” for 5 seconds and the instrument will automatically shut off.

## SETTING THE SCALE FACTOR

SCALE and TOTALIZE modes have independent scale factors. To change the scale factor, press the **MENU** button then press the **UP ARROW** (↑) until either “SCALE” or “TOTAL” is displayed. Press the **LEFT ARROW** (←) button to change the scale factor. This will display the current scale factor with the right most digit blinking. The blinking digit is the one to be changed. This digit can be increased with the **UP ARROW** (↑) button. After the digit gets to 9, it will return to 0. Select the digit to be changed with the **LEFT ARROW** (←) button. Move the decimal point with the **POWER** button. The **RESET** button sets the scale factor to 1. Pressing the **MENU** button returns to the “MENU” without changing the scale factor. Save the new value with the **RECALL** (STORE) button.

## TOTALIZER MODE

This mode is used to totalize an input from either the internal optics or the remote sensor (TACH-4AR only). Each time the unit receives an input from the reflective tape (T-5), for example, it increments the display by the value set in the Scale Factor. **Note that this is not the same scale factor as in the scale mode.** Once this mode is selected, the unit remains on permanently until turned off by the user, or 60 seconds passes with a display of zero. The unit can be turned off at any time by pressing the **POWER** button. Readings can be stopped or started by moving the optics away from the reflective tape (T-5) or by blocking the optics. If the displayed value exceeds 999,999, the unit will show “OVFLOW”. **Note that the unit will remain in this condition until cleared by the user. (Press RESET button)**

<b>POWER/LOCK</b>	Turns the unit off.
<b>RECALL/STORE</b>	Holds the display for four seconds while totalizing continues.
<b>RESET/LOCK</b>	Sets the reading back to zero
<b>LEFT ARROW</b> (←)	Turns the LCD back light on for 60 seconds (assuming the back light is not already on)

## COUNT MODE

This is a basic counter mode. Each time the **POWER** button is pressed, the value displayed is incremented by 1. The display is reset to zero with the **RESET** button.

**POWER/LOCK** Increments the count by one.

**RESET/LOCK** Resets the counter to 0.

**LEFT ARROW** (⇐) Turns the LCD back light on for 60 seconds (assuming the back light is not already on)

## TIMER MODE

This is the Stopwatch mode. There are two basic modes of operation, "Auto" and "Manual", selected in the MENU. To change between Auto and Manual operation, press the **MENU** button so "MENU" is displayed. Press the **UP ARROW** (↑) until "TIMER" is displayed. Press the **LEFT ARROW** (⇐) to show the current option. Press the **LEFT ARROW** (⇐) again to change to the other option. Finally, press the **RECALL (STORE)** button to save the change.

The **MANUAL** mode functions like a Stopwatch. When **TIMER** mode is selected, the display shows 00:00:00. The timing is started and stopped by the **POWER** button. Up to three Lap times may be stored using the **RECALL (STORE)** button while the timer is running. Lap times may be recalled by pressing the **RECALL** button when the timer has stopped. The timer may be reset to 00:00:00 with the **RESET** button. When the timing is started or the **RESET** button is pressed, the memory values are cleared. When the Lock Chevron is not displayed and no button is pressed for 60 seconds, the unit will automatically shut off.

The **AUTO** mode functions similarly to the **MANUAL** mode with the exception that the internal optics (or Remote Sensor with the TACH-4AR) can be used to start and stop the Timing function. The **POWER** button is also operational in this mode so that the user can start the timer by pressing the **POWER** button, then have the timer stopped when an item passes through the light beam. Similarly, the timer can be started by beam interruption and ended by the **POWER** button.

**POWER/LOCK** Starts and stops the timer.

**RECALL/STORE** While Timer is running, pressing **RECALL** will store lap times up to a maximum of three laps. When the Timer is stopped, pressing **RECALL** will display stored lap times.

**RESET/LOCK** Resets the timer to 00:00:00 and clears the stored lap times.

**LEFT ARROW** (⇐) Turns the LCD back light on for 60 seconds (assuming the backlight is not already on)

## CHANGING THE DECIMAL POINT

The instrument can work with either a fixed or floating decimal point. The fixed decimal point always displays the value to the nearest whole number and is right justified. The floating point mode always displays with at least 5 digits of accuracy. To change the current setting, go into the MENU mode by pressing the **MENU** button. Press the **UP ARROW** (↑) button until "DEC PT" is displayed. Press the **LEFT ARROW** (⇐) button to show the current setting. Press the **LEFT ARROW** (⇐) button again to change the decimal point mode. Press the **RECALL (STORE)** button to "save" the selected mode.

## BACKLIGHT OPERATION

The back light can be turned on for 60 seconds by pressing the **LEFT ARROW** (⇐) button in most modes. It can also be programmed to be on permanently by selecting the MENU mode with the **MENU** button. Press the **UP ARROW** (↑) button until "LIGHT" is displayed. Press the **LEFT ARROW** (⇐) button to show the current status of the back light. Press the **LEFT ARROW** (⇐) button one more time to change it, then press the **RECALL (store)** button to save it.

## SERIAL NUMBER

Press the **MENU** button, then press the **UP ARROW** (↑) button until "SERIAL" is displayed. Press the **LEFT ARROW** (⇐) button to display the serial number.