MONARCH INSTRUMENT

Instruction Manual

Nova-Strobe DBL
and
Nova-Strobe PBL
Deluxe and Phaser LED Stroboscopes

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1071-4231-110R-0911

⚠️ Safeguards and Precautions ⚡

1. **Read and follow all instructions in this manual carefully, and retain this manual for future reference.**

2. **Do not use this instrument in any manner inconsistent with these operating instructions or under any conditions that exceed the environmental specifications stated.**

3. **Certain strobe frequencies can trigger epileptic seizures in those prone to that type of attack.**

4. **Users should not stare directly at the light source.**

5. **Prolonged exposure to the light can cause headaches in some people.**

6. **Objects viewed with this product may appear to be stationary when in fact they are moving at high speeds. Always keep a safe distance from moving machinery and do no touch the target.**

7. **There are no user serviceable parts in this instrument. Refer service to a qualified technician.**

8. **Do not allow liquids or metallic objects to enter the ventilation holes on the stroboscope as this may cause permanent damage and void the warranty.**

9. **Do not allow cables extending from unit to come into contact with rotating machinery, as serious damage to the equipment, or severe personal injury or death may occur as a result.**

10. **This instrument may not be safe for use in certain hazardous environments, and serious personal injury or death could occur as a result of improper use. Please refer to your facility's safety program for proper precautions.**

ROS-P-25	Remote Optical Sensor with 25 foot [7.6 m] cable for triggering strobe
IRS-P	Infrared Sensor with 8 foot [2.5 m] cable for use without reflective target at 0.5 inch [12 mm] gap for triggering strobe
MT-190P	Magnetic Trigger Sensor/Amplifier with 8 foot [2.5 m] cable for triggering strobe
T-5	Reflective tape - 5 foot [1.5 m] roll, 0.5 inch [12.7 mm] wide

7.0   OPTIONS AND ACCESSORIES / SENSORS

PSC-2U   Universal Recharger, 115/230 Vac with USA, U.K., AUS, Euro Adapter Plugs for battery operated Nova-Strobes (included with DBL)

PSC-PBXU   Universal Power Supply/Charger, 115/230 Vac with USA, U.K., AUS and Euro Adapter Plugs (included with PBL)

CC-7   Latching carrying case for Strobe with provision for accessories (included with DBL Kit)

CC-12   Deluxe water-tight latching carrying case for Strobe with provision for accessories (included with PBL Kit)

SPC-1   Splash proof Protective vinyl Cover for Battery Powered Strobes ONLY

C-4027   Set of mating 1/8 inch (3.5mm) stereo phone plugs (to provide TTL signal and sensor power)

CA-4044-6   6 foot [1.8 m] Input / Output cable, 1/8 inch [3.5 mm] male phone plug to male BNC connector

CA-4045-6   6 foot [1.8 m] Input / Output cable, 1/8 inch [3.5 mm] male phone plug to 1/8 inch [3.5 mm] male phone plug for daisy chaining strobes together

CAL-N.I.S.T   N.I.S.T. Traceable Certificate of Calibration / Re-calibration

Protective Rubber Cover   Rubber cover that fits over reflector housing to protect strobe

ROLS-P   Remote Optical Laser Sensor with 8 foot [2.5 m] cable for triggering strobe

ROS-P   Remote Optical Sensor with 8 foot [2.5 m] cable for triggering strobe

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11. Nova-Strobe LED units contain Nickel Metal Hydride batteries which must be disposed of in accordance with Federal, State, & Local Regulations. Do not incinerate. Batteries should be shipped to a reclamation facility for recovery of the metal and plastic components as the proper method of waste management. Contact distributor for appropriate product return procedures.

In order to comply with EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE): This product may contain material which could be hazardous to human health and the environment. DO NOT DISPOSE of this product as unsorted municipal waste. This product needs to be RECYCLED in accordance with local regulations, contact your local authorities for more information. This product may be returnable to your distributor for recycling - contact the distributor for details.

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Memory	Last setting before power down is remembered and restored on next power up. 9 user settable flash rates.
Input Power	Battery powered: Internal Rechargeable Batteries 6 Vdc, External AC Power Supply PBL only (100 Vac to 240 Vac, 50/60 Hz)
Light Output	Average: 3000 Lumens @6000 FPM 12" from lens
Flash Duration	Adjustable 0.5 to 3000 microseconds or 0.2 to 14 degrees of rotation (auto adjust with flash rate)
Run Time	12 hours typical at 6000 FPM, and 2.8° pulse width with fully charged batteries
Charge Time	4-5 hours typical with supplied recharger
Weight	1.875 lbs [0.8505 kg] including batteries
Safety	This product is designed to be safe for indoor use under the following conditions (per IEC61010-1).
Operating Temperature	32-104 ºF [0-40 °C]
Humidity	Maximum relative humidity 80% for temperature up to 88 °F [31 °C] decreasing linearly to 50% relative humidity at 104 °F [40 °C]

This product is CE certified and ROHS compatible.
Manufactured in an ISO9001 facility.

For troubleshooting information and technical support visit
www.monarchinstrument.com.

6.0   SPECIFICATIONS

Internal Mode:

Flash Range	30 - 500,000 FPM (Flashes Per Minute), 0.5 to 8333.33 Hz
Flash Rate Accuracy	0.004% of setting or ± last digit
Flash Rate Resolution	0.01 to 1 FPM (menu selectable), 0.1 FPM resolution above 9,999.99 FPM, 1 FPM resolution above 99,999.9
Display Update Rate	Instantaneous

External Modes:

Flash Range	0 - 500,000 FPM (Flashes Per Minute) 0.5 to 8333.33Hz
Tachometer Mode	5 to 500,000 RPM Accuracy: ±0.001% of reading or ± last digit
Display Update Rate	0.5 second typical
Trigger to Flash Delay	< 5 µsec
External Input	TTL Compatible (24V pk max), 500 nanosec min pulse width, Positive or Negative edge triggered (menu selectable)
Output Pulse	5V pulse – positive or negative (menu selectable) One pulse per flash
Time Base	Ultra Stable Crystal Oscillator
Display	LCD display with 6 numeric 0.506 inch [12.85 mm] high digits and 5 alphanumeric 0.282 inch [7.17 mm] high digits
Indicators	Battery level, On Target, ALT, TACH, and EXT icons
Knob Adjustment	Digital Rotary switch with 36 detents per revolution; velocity sensitive

1.0   OVERVIEW

The Nova-Strobe Deluxe DBL and Phaser PBL LED (Light Emitting Diode) are rugged portable battery powered LED Stroboscopes used for inspection and to stop motion to determine the speed of rotating objects. The units have a pistol grip with lockable trigger switch and wrist strap for comfortable hand held operation or they may be mounted on a tripod using the integral ¼ -20 UNC thread at the base of the handle. Although the DBL and PBL are similar, the PBL has the additional ability to phase shift the image with respect to an external signal and can animate the image in slow motion rotation for inspection purposes. The PBL can also run continuously from an external power supply.

The Deluxe and Phaser LED Strobes have a two line backlit alpha-numeric liquid crystal display (LCD) and a 12 key keypad enables the user to simply enter data and control the operation of the unit. The keys have dual functions – the primary function is shown by the black printing on the blue background on the top half of the key. The secondary function is as a numeric keypad and the numerics are shown against a white background on the bottom half of the key – 0 to 9, period and

Figure 1 LED Strobe Control Panel

ENTER. The LCD display has several icons which will be explained later in this manual.

1.1   Modes of Operation

The stroboscope has two basic modes of operation – INTERNAL and EXTERNAL.

1.1.1 Internal Mode

The strobe is in the Internal Mode when nothing is plugged into the input jack or when manually set using the **INPUT** button. In the internal mode the strobe generates its own timing signals and the users can enter the flash rate using several different methods – see Section 3.1.

1.1.2 External Mode

In the External Input Mode the user can't make any flash rate adjustments with the knob. The flash rate is a function of the input signal. This mode is used to synchronize the flash to an external event (for example, from an optical sensor) to stop or freeze motion. The flash will be triggered on the rising or falling edge (menu selectable) of the external input pulse. The strobe is in the External Input Mode whenever there is a plug in the input jack. When the strobe is in the External Input Mode, **EXT** will be displayed.

When an external input is applied to the unit and the strobe is put in the Tachometer Mode, the unit will read the signal from the external input (sensor) and display the reading on the LCD display without flashing the lamp. **The strobe will not flash in the Tach (Tachometer) Mode.**

1.1.3 Charging Mode

The **Charging Mode** is when the strobe has the battery recharger plugged into it. The strobe will continuously display the state of the battery charge while being recharged.

Allow the recharger to charge the batteries until the display shows *DONE* for peak battery life performance. If the batteries are not charged to 100% regularly, the batteries will lose capacity.

5.3 External Power Supply/Charger (PBL only)

The PBL will run continuously from the external power supply/charger (PSC-PBXU) powered by the AC mains (115 – 230 Vac).

To run the PBL from the external power supply/charger (PSC-PBXU):

1. Plug the recharger cable into the recharger socket (located below the display panel behind the handle).
2. Plug the recharger into an AC mains wall outlet (115/230 Vac).
3. Press the trigger switch to operate as normal. If the trigger switch is not pressed, the strobe will start charging. The batteries ARE NOT charged while the strobe is operational and running off the power supply/charger.

5.4 Stroboscope Disposal

Prior to disposing of the battery-powered strobe, the user must remove the Nickel-Metal Hydride batteries. To do this, remove the LED assembly first. This will expose four (4) screws that must be removed so the reflector housing can be dismantled. There are four (4) additional screws in the case half opposite the input and output jacks that must be removed. The case halves can now be separated, exposing the batteries. Remove the cables from the batteries and place tape over the battery terminals to prevent them from shorting. The batteries should be sent to a recycling center or returned to the factory. The rest of the parts may now be disposed of.

5.1 Low Battery Indication

When the batteries are charged, there will be no battery icon indication. When the batteries are low, the Low Battery icon will blink in the display. The strobe may still be used for a short time.

Low Battery Icon = ▭ Outline blinking (very little time left)

The strobe has a protection feature that prevents the strobe from operating if the battery voltage is too low. **This condition is indicated by no flash and the display shows "LO BAT".** At this time the batteries must be recharged. Remember to release the trigger switch.

5.2 Charging the Batteries

The unit may be recharged at any time. You do not need to wait until the low battery condition is indicated.

To charge the strobe with the recharger:

1. Release the trigger so the strobe is off.
2. Plug the recharger cable into the recharger socket (located below the display panel behind the handle).
3. Plug the recharger into an AC mains wall outlet (115/230 Vac).

CAUTION: Use of rechargers other than the one supplied (PSC-2U for the DBL and PSC-PBXU for the PBL) will damage the stroboscope and void the warranty.

When the recharger plug is inserted into the recharger jack, the strobe will go into the Charging Mode. Make sure the trigger switch is not depressed. The DBL strobe will not do anything else when charging (e.g. it will not flash and the buttons have no function).

When charging, the strobe will indicate *CHARGE* in the bottom of the display. The recharger will fast charge the batteries for about 4-5 hours and then trickle charge the batteries.

1.2 Brightness

GLOSSARY:
>   LED – Light Emitting Diode
>   msec – millisecond = 1/1,000 of a second
>   μsec – microsecond = 1/1,000,000 of a second
>   ° = degree. One rotation = 360°

The strobe's brightness depends on how wide the LED flash pulse is; the wider the pulse, the brighter the visual output from the LEDs. Since the strobe is primarily used on reciprocating or rotating targets there is a downside to the wider flashes. All strobes work by giving short bursts of light (the pulse width) at a rapid repetition rate (the flash rate). Strobes rely on the persistence of the human eye (the ability to remember and image) and its response to bright light to give an apparent stop motion image. Imagine a shaft rotating at 6000 RPM or one rotation every 1/100 of a second (10 msec). If the strobe flashes once every 10 msec for a brief moment, the user sees the flash at the same spot in the rotation of the shaft and the persistence of the eye remembers this until the next flash making the shaft appeared to be stopped. As the target is rotating there is some movement evident during the strobe flash. The longer the flash duration, the more obvious the rotation is and this increases the blur.

This blur can be calculated – if the shaft takes 10 msec to complete one revolution and the strobe flash duration is 100 μsec (1/100 of a millisecond), the shaft will turn:

(flash duration/time per rotation) x 360°, which is (.0001/.01) x 360 = 3.6°.

So you will see the shaft move 3.6°. As the flash pulse widens you will see greater degrees of rotation which results in more blur and a brighter perceived illumination (the LEDs are on longer so the average light the eyes see is greater). The trade-off is blur versus brightness. One also has

to take into account tangential velocity (rotational speed) – the further away the rotating point is from the center axis the faster the tangential velocity and the worse the blur appears to be – it is always the same number of degrees of rotation but the physical length of the blur gets bigger as the point moves faster. The strobe adjusts the width of the pulse automatically to keep the degree of rotation visible constant.

There are two methods of adjusting the flash pulse width and hence the brightness and consequently the blur.

1.2.1   Degree of Rotation Adjustment

The first method is to adjust the flash pulse width for degree of rotation visible (blur). The user can set this from 0.2 to 14 degrees out of 360. The higher the setting the brighter the strobe appears to be but the more blurred the target is. Optimal setting to stop motion is 1.8 to 3.6°. The number of degrees is a proportional amount and remains constant as the flash rate increases or decreases. The strobe automatically calculates how wide the pulse width should be at different flash rates to keep the blur constant – the faster the flash rate the narrower the pulse width. The pulse width equals: (setting in degrees/360) x (1/flash rate in Hz).

Thus the blur remains constant no matter what the flash rate*.

1.2.2   Pulse Duration Adjustment

The second method is to adjust the flash pulse width to a fixed number of microseconds. Here the user sets the flash pulse width in microseconds not degrees. As the flash rate increases the pulse width stays the same and the image will get brighter and more blurred as the flash width remains constant*. The degree of rotation visible changes to keep the pulse width of the flash constant*.

***Note:** There are two limits maintained by the strobe – the pulse can never be greater than 3000 µs nor can it exceed 14° of rotation.

If a Remote Optical Sensor or Magnetic Sensor is used to sense one pulse per revolution (External mode), the readout will display directly in RPM (FPM) without any adjustment required.

In instances when you can shut down the device and install a piece of reflective tape, then an optical tachometer is easier to use for RPM measurement. **Stroboscopes must be used when you can't shut down the device.** The human eye is not easily tricked into seeing a stopped image by a stroboscope when the flash rate is slower than 300 FPM. Therefore, stroboscopes are just about impossible to use below 300 FPM for inspection or to measure RPM.

5.0   BATTERIES

The Nova-Strobe LED is fitted with rechargeable NiMH (Nickel Metal Hydride) batteries. These batteries contain fewer toxic metals than NiCd (Nickel Cadmium) and are currently classified "environmentally friendly". They also have 30% more capacity than NiCd batteries of the same size.

Like NiCds, NiMH **batteries are prone to self-discharge** - 10 to 15% of charge is lost in the first 24 hours then continues at a rate of 0.5 to 1% per day. For maximum performance, charge the batteries just prior to use.

When not in use, the batteries should be charged at least every three months, otherwise the battery capacity will be reduced or the batteries may become unusable.
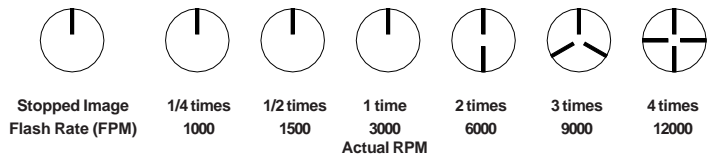
Charge the batteries before use and allow 3-5 cycles of charging and discharging for batteries to reach full capacity.

The enclosure contains control electronics to properly and safely charge the batteries. Never remove the batteries from the enclosure and attempt to charge externally. **Always use the recharger supplied (PSC-2U for the DBL and PSC-PBXU for the PBL).**

button. You should again see a single image (which may be phase shifted with respect to the first image seen).

For example, when viewing a shaft with a single key way you will see one stationary image of the key way at the actual speed and at 1/2,1/3,1/4, etc, of the actual speed. You will see 2 images of the key way at 2 times the actual speed, 3 key way at 3 times, etc. <u>The FPM equals the shafts Revolutions Per Minute (RPM) at the highest flash rate that gives only one stationary image of the key way.</u>

Stopped Image Flash Rate (FPM)	1/4 times 1000	1/2 times 1500	1 time 3000 Actual RPM	2 times 6000	3 times 9000	4 times 12000

Example: Object rotating at 3000 RPM

If the speed is outside the full scale range of the stroboscope (500,000 FPM), it can be measured using the method of harmonics and multipoint calculation. Start at the highest flash rate and adjust the flash rate down. You will encounter multiple images so be aware of these. Note the flash rate of the first SINGLE image you encounter, call this speed "A". Continue decreasing the flash rate until you encounter a second SINGLE image. Note this speed as "B". Continue decreasing the speed until you reach a third SINGLE image at speed "C".

For a two point calculation the actual speed is given by:

$$RPM = AB/(A-B)$$

For a three point calculation:

$$RPM = 2XY(X+Y)/(X-Y)^2 \text{ where}$$
$$X = (A-B) \text{ and } Y = (B-C)$$

The strobe automatically adjusts these values as the flash rate is increased or decreased to maintain these limits at all times. For example - at a flash rate of 600 flashes per minute 14° of blur represents a flash pulse width of 3800 μsec. The Strobe will limit this value to 3000 μsec or 10.8° of rotation (blur).

2.0   PREPARATION FOR USE

The Stroboscope may be hand held or mounted on a tripod or other user supplied bracket using the ¼-20 UNC bushing at the base of the handle.

2.1   Power

The LED Strobe is battery powered and has internal rechargeable batteries. The unit should be charged before use (see Section 5.0). The actual operating time of the stroboscope depends on the flash pulse width. Narrower flash widths increase the operating time. Note that the DBL strobe will not operate from the recharger supplied with the unit. The PBL will run continuously from the supplied AC powered charger (PSC-PBXU).

To turn on the stroboscope, depress and hold the trigger. The trigger may be locked in position using the side locking button. To lock the stroboscope on, depress the trigger as far as it will go and then press the locking button. Once the locking button is set you may release the trigger and the trigger will be held in place. To unlock the stroboscope, simply depress the trigger and then release.

NOTE: Unit must power down completely (OFF will be displayed and then disappear) before unit will power on again. This is normal operation. Wait 2 seconds before turning the unit back on again.

2.2   Input / Output Connections

The strobe has input and output jacks on the left side of the stroboscope. These can be used for external triggering or synchronization (daisy-chaining two or more strobes). These jacks accept 1/8" (3.5mm) phone plugs (input - stereo, output - mono). The input and output signals are TTL compatible. See Figures 2 and 3 for connector connection detail.
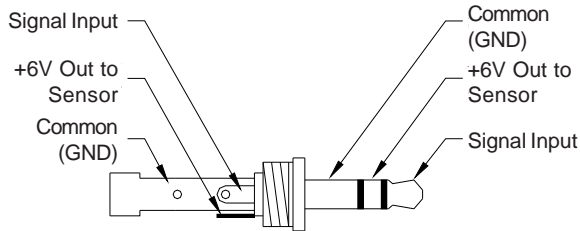
Signal Input

+6V Out to Sensor

Common (GND)

Common (GND)

+6V Out to Sensor

Signal Input

Figure 2   Input Connector Detail (Stereo plug)

Pulse Output from Strobe

Common (GND)

Common (GND)
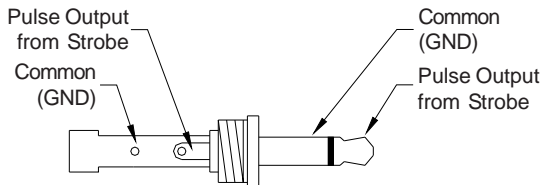
Pulse Output from Strobe

Figure 3 Output Connector Detail (Mono plug)

The input jack (▲ pointing into socket) enables an external signal to trigger the strobe. Inserting a plug into the input jack will automatically put the strobe into the external mode. The INPUT button can be used to toggle between External Input Mode and Internal Mode. When the plug is removed, the strobe will be put back into the Internal Mode.   The

3.8.5   Blanking

Blanking is used to reject the strobe's own flash when using an external optical sensor and prevent double triggering. After pressing the **MENU** button rotate the knob until the display bottom line shows *BLANK* and press the **MENU** button again. The top line of the display will show *YES* or *no* selected by rotating the knob counterclockwise (yes) or clockwise (no). Yes enables blanking, no disables it. Press the **MENU** button to select, then any other key to exit. The display will show *DONE* and return to the normal readout.

4.0   USING THE STROBOSCOPE TO MEASURE RPM

The primary use for a stroboscope is to stop motion for diagnostic inspection purposes. However the stroboscope can be used to measure speed (in RPM / RPS). In order to do this several factors need to be considered. First, the object being measured should be visible for all 360° of rotation (e.g. The end of a shaft). Second, the object should have some unique part on it, like a bolt, key way or imperfection to use as a reference point. If the object being viewed is perfectly symmetrical, then the user needs to mark the object with a piece of tape or paint in a single location to be used as a reference point. Look only at the reference point.

If the speed of rotation is within the range of the stroboscope, start at a higher flash rate and adjust the flash rate down. At some point you will stop the motion with only a single reference point of the object in view. Note that at a flash rate twice the actual speed of the image you will see two images (reference points). As you approach the correct speed you may see three, four or more images at harmonics of the actual speed. The first SINGLE image you see is the true speed. To confirm the true speed, note the reading and adjust the stroboscope to exactly half this reading, or just press the ÷2

3.8.2 Backlight

Enables the display backlight to be turned on or off. After pressing the **MENU** button rotate the knob until the display bottom line shows *BL ITE* and press the **MENU** button again. The top line of the display will show *YES* or *no* selected by rotating the knob counterclockwise (yes) or clockwise (no). The backlight will turn on and off accordingly. Press the **MENU** button to select, then any other key to exit. The display will show *DONE* and return to the normal readout.

3.8.3 Input Pulse Edge

Sets the input pulse edge that triggers the stroboscope. After pressing the **MENU** button rotate the knob until the display bottom line shows *INPUT* and press the **MENU** button again. The top line of the display will show the *PoS* (for positive edge triggered) or *nEg* (for negative edge triggered) selected by rotating the knob counterclockwise (PoS) or clockwise (nEg). Press the **MENU** button to select, then any other key to exit. The display will show *DONE* and return to the normal readout.

3.8.4 Output Pulse Polarity

Sets the polarity of the output pulse. After pressing the **MENU** button rotate the knob until the display bottom line shows *OUTPT* (Output) and press the **MENU** button again. The top line of the display will show the *PoS* (for positive edge triggered) or *nEg* (for negative edge triggered) selected by rotating the knob counterclockwise (PoS) or clockwise (nEg). Press the **MENU** button to select, then any other key to exit. The display will show *DONE* and return to the normal readout.

polarity of the input pulse can be set in the MENU options. In the external mode the knob cannot be used to change the flash rate.

With no external input, the output jack (▼ pointing away from socket) provides a TTL compatible pulse from the strobe's internal oscillator. If an external input is applied, the output pulse is in sync with the input pulse. This output pulse may be used to trigger a second stroboscope synchronously to illuminate larger areas. Many strobes can be "daisy chained". The output jack of one strobe is connected to the input jack of the next strobe causing all the strobes to flash together and be controlled by the first strobe in the chain. The polarity of the output pulse can be set in the MENU options.

3.0 LED STROBE OPERATION

3.1 Adjusting the Flash Rate - RPM

There are several ways to adjust the flash rate of the Strobe:

3.1.1 Using the Knob

The flash rate can be adjusted by turning the knob on the side of the unit – counter clockwise to increase the flash rate and clockwise to decrease the flash rate. The knob is rate sensitive, the faster you turn the knob the greater the change in flash rate. The smallest adjustment is to add or subtract one from the least significant (right most) digit on the display.

3.1.2 Using the Keypad

It is possible to enter the required flash rate as a number by entering the value using the keypad as you would with a calculator. Press the **NUM**ber key shown right followed by the numeric keys representing the flash rate (eg 1234), using the secondary key functions – numbers 0 to 9 and the period, then press the **ENTER**

button. Note: The system will round the display to the nearest least significant digit displayed. If the display has no decimal places and you enter 1234.6 the display will show 1235 and the strobe will flash at 1234.6 flashes per minute.

3.1.3   Decade Adjustment

The flash rate can be adjusted in decade steps eg: 1, 10, 100 etc. by pressing the ▶ button shown right. This will start a digit on the display blinking. If the knob is turned this digit will increment or decrement with rollover and roll under features. Each time the ▶ button is pressed the blinking digit moves one position to the right, the decade decreases by 10 until the digits stop blinking. Pressing the ▶ button again will cause the left most digit to start blinking.

To exit the decade adjustment mode while a digit is blinking press any key other than the ▶ button.

3.1.4   Multiply or Divide By 2

The strobe flash rate can be instantly doubled (x2) or halved (÷2) by pressing the **x2** and **÷2** buttons shown right. This is useful in determining actual rotational speed. Refer to the section on speed measurement – Section 4.0. Note that if doubling or halving the flash rate will cause the strobe to exceed its capability, the display will show OVER or UNDER respectively and the flash rate will remain at the current flash value.

In the **External Time Delay** mode the flash is delayed 0.01 to 1000 msec after each external trigger pulse. The display will show the **TIME** icon, the delay in milliseconds on the top line and will indicate $MSECS$ on the lower line. The knob adjusts the amount of delay in milliseconds, counterclockwise to increase and clockwise to decrease.

In the **Auto (Virtual RPM) mode** the flash is automatically delayed in increasing amounts after the external trigger pulse so that the image appears to rotate at a slow (Virtual) speed, RPM. The display will show the **AUTO** icon, the virtual speed in RPM on the top line and will indicate $VRPM$ (Virtual RPM) on the lower line. The knob adjusts the virtual speed in RPM, counterclockwise to increase and clockwise to decrease.

3.8   Menu

The Menu allows settings of basic setup options – displayed decimal places, backlight on or off, positive or negative edge for input and output signal and blanking. The menu is entered by pressing the **MENU** button and using the knob to scroll through the menu options as described below. The top display line shows $SETUP$. To select a menu option, press the **MENU** button again.

3.8.1   Decimal Places

Sets the number of decimal places shown on the display for numeric. After pressing the **MENU** button rotate the knob until the display bottom line shows $DECPT$ and press the **MENU** button again. The top line of the display will show the number of decimal places (2, 1, none) selected by rotating the knob. Press the **MENU** button to select, then any other key to exit. The display will show $DONE$ and return to the normal readout.

3.7 Phase Delay

The **DELAY** button adjusts the phase shift of the flash with respect to time. There are two modes: INTERNAL and EXTERNAL (PBL model only).

DELAY
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3.7.1 Internal Phase Delay

Also referred to as JOG. Once the flash rate has been adjusted to give a stopped motion image, the PHASE **DELAY** button may be used to increase or decrease the phase of the image with respect to its original position. Use the PHASE **DELAY** button to bring a reference mark, such as a key way, into your line of sight.

To adjust the phase or jog the image, press the **DELAY** button. *PHASE* will be displayed on the bottom line of the LCD display and the current flash rate will be displayed on the top line. Turning the knob adjusts the phase of the stopped image. It is a relative adjustment. Press the **DELAY** button again to exit this mode.

3.7.2 External Delay (PBL Model ONLY)

The **DELAY** button has no function in External mode on the DBL model stroboscope.

On the PBL model stroboscope there are three **External Delay Modes**: **Phase Delay**, **Time Delay**, and **Auto (Virtual RPM)**. These modes are only active if an external trigger source is plugged into the unit. The **EXT**ernal icon must appear on the display.

Pressing the **DELAY** button cycles through the following modes:

In the **External Phase Delay** mode the flash is delayed 0.1 to 359.9 degrees after each external trigger pulse. The display will show the delay in degrees on the top line and will indicate *PHASE* on the lower line. The knob adjusts the amount of delay in degrees, counterclockwise to increase and clockwise to decrease.

3.1.5 Fixed Increment N Adjustment

The strobe flash rate can be incremented or decremented in fixed increments. To do this, adjust the flash rate to the required adjustment value, say 300, which we will refer to as N. Then press the **±N** button shown right (Note: – N is the displayed value at the time the button is pressed). The display will show **ALT** in the bottom left hand corner which indicates the knob is in the ALTernate function mode. Turning the knob counterclockwise will increase the flash rate by N (300 in this example) for each click or turning it clockwise will decrease the flash rate by N. It is not possible to decrement the flash rate below 30 FPM.

±N
0

3.2 Adjusting the Flash Duration (Brightness)

The flash duration, the width of the LED flash, can be adjusted by the user to be a preset number of degrees of rotation (DEGS) or a fixed with in microseconds (uSEC). The result is a more or less bright image at the expense of less or more image blur. Read the section on Brightness - Section 1.2.

3.2.1 Flash Duration - Degrees

To view or adjust the flash duration press the **BRIGHT** button shown on the right. The display will show the current flash duration in degrees of rotation – note that there are 360° in a complete rotation. The degrees shown is the amount of rotation visible during the flash. The higher the degrees the brighter the image and the more apparent the blur. Use the

BRIGHT
7

1.2
DEGS

knob to increase or decrease the flash duration in degrees of rotation. Adjusting the degrees will cause this to be the controlling parameter for pulse width. As the flash rate increases or decreases the strobe will adjust the flash duration to keep it at the preset number of
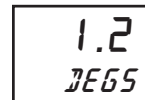
degrees provided this does not exceed the strobe specifications. Press any key other than **BRIGHT** to exit or press **BRIGHT** again to go to MICROSECOND adjustment.

3.2.2   Flash Duration - Microseconds

To view or adjust the flash duration in microseconds press the **BRIGHT** button again after viewing degrees or press the **BRIGHT** button twice from normal operation. The display will show the current flash duration in microseconds (uSECS) – this may be calculated from phase degrees set above. Use the knob to increase or decrease the flash duration in microseconds. Adjusting the microseconds will cause this to be the controlling parameter for pulse width. As the flash rate increases or decreases the strobe will keep the flash duration at the preset width in microseconds provided this does not exceed the strobe specifications. Press the **BRIGHT** button to exit the flash duration adjustment.

3.3   Display Units

The display can show the flash rate in revolutions per minute (RPM) or per second (RPS or Hertz). To switch between display modes press the **DISP**lay button shown right. The display units will toggle at each press (RPM < > RPS).

3.4   Tachometer Mode

The stroboscope can be used as a programmable pulse generator or as a tachometer by pressing the **TACH** button shown right. When an **external input** is supplied to the unit and the strobe is put in the Tachometer Mode, the unit will read the signal from the external input (sensor) and display the reading on the LCD display without flashing the lamp. The TACH icon will show on the display. There is also an ON TARGET INDICATOR shown right which illuminates when a valid external signal is received.

If there is no external input and the **TACH** button is pressed **the strobe will stop flashing** but will still output a pulse at the rate indicated on the display. This rate may be adjusted as described in Section 3.1 above.

To exit the Tachometer mode press the **TACH** button again.

3.5   Mode Selection

The **INPUT** button, shown right, toggles between the INTERNAL and EXTERNAL Modes as described in Section 1.1. When in the external mode the display will show EXT and the stroboscope will only flash with an external input. Plugging in an external source will cause the unit to automatically switch to the EXTERNAL mode. Removing an external source while in the EXTERNAL mode will cause the unit to switch to the INTERNAL mode.

3.6   Memory

The Stroboscope has the ability to save and recall up to 9 values. This is done by pressing the **MEM**ory button shown right. The first time the button is pressed the display will show *READ*, if pressed again it will show *SAVE*. If the knob is turned while *READ* or *SAVE* is displayed, the display will cycle through memory locations 1 to 9 (indicated as *RM 1* to *RM 9* where RM is Recall Memory or *SM 1* to *SM 9* where SM is Save Memory). To actually SAVE or READ the selected memory location, press the **MEM** button again. The ENTER button works as well. The display will show *DONE*. Note that the value saved will be the current flash rate prior to pressing the **MEM** button the first time.