MONARCH INSTRUMENT

Instruction Manual

Nova-Strobe™ BBL
Basic Battery LED Stroboscope

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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. **DANGER: Hazardous voltage is present inside this product. Do NOT open.** Except for the replaceable lamp, no user-serviceable parts inside. Service is to be performed only by authorized personnel. **Prior to any service, make sure the unit is turned off and all power is disconnected.** For technical assistance, contact the sales organization from which you purchased the product or Monarch Instrument directly.

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

5. Intense light sources can have a high secondary blinding effect. A temporary reduction in visual acuity and afterimages can occur, leading to irritation, annoyance, visual impairment, and even accidents – depending on the situation. Do not aim light at yourself or others.

6. Exposure to flickering light or visual patterns may cause eye strain, headaches, nausea, dizziness, and other afflictions.

7. 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 not touch the target.

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. 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.

To comply with worldwide regulations such as the U.S. Environmental Protection Agency Resource Conservation and Recovery Act (RCRA) and EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), you must not discard this electrical/electronic product in domestic household waste. The electronic components in this device may contain environmentally harmful substances. DO NOT DISPOSE of this product as unsorted municipal waste. This product needs to be RECYCLED and disposed of in accordance with environmental regulations in the country of use; contact your local authorities for more information. This product may be returnable to your distributor for recycling; contact your distributor for details.

NiMH

The Nova-Strobe BBL contains a nickel metal hydride battery pack which must be recycled and disposed of in accordance with Federal, State, & Local Regulations. Do not incinerate. The battery pack should be shipped to a reclamation facility for recovery of the metal and plastic components as the proper method of waste management. Contact your local authorities for appropriate product return procedures.

Battery compliance information for the Nova-Strobe NiMH Battery Pack required under European Regulation (EU) 2023/1542 concerning battery use, waste management, and environmental protection is available online. Scan the QR code or visit:
https://monarchinstrument.com/resources/nova-strobe-nimh-battery-pack-compliance-information/

Monarch Instrument's Limited Warranty applies.
See www.monarchinstrument.com for details.

Warranty Registration and Extended Warranty Coverage information is available online at www.monarchinstrument.com.

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1.0 OVERVIEW

The Nova-Strobe™ BBL is a basic battery-operated LED (Light Emitted Diode) stroboscope. It is a rugged industrial stroboscope that provides extremely bright, uniform light output for performing stop motion diagnostic inspection and RPM measurement. The unit has a pistol grip with lockable trigger switch and wrist strap for comfortable handheld operation or it may be mounted on a tripod using the integral ¼ -20 UNC thread at the base of the handle.

Figure 1 LED Strobe Control Panel

1.1 Basic LED Strobe Control Panel

The Basic LED Strobe Control Panel consists of an LCD (liquid crystal display) with six numeric digits on top and five alphanumeric digits on the bottom that indicate the flash rate and units of measure and a 4-button keypad that enables the user to control the operation of the unit (see Figure 1). Most of the icons in the LCD are not used, but the display includes a Low-Battery icon to indicate battery status.

2.0 GETTING STARTED

The Nova-Strobe BBL is powered by an internal rechargeable NiMH battery pack. The battery pack should be charged before use (see 6.0 BATTERY PACK). The actual operating time of the stroboscope depends on the flash pulse width. Narrower flash widths increase the operating time. Note that the BBL strobe will not operate from the recharger supplied with the unit.

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

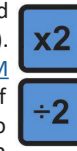
Note: The unit must power down completely (OFF will be displayed and then disappear) before unit will power on again. This is normal operation. Wait 2 seconds before turning the unit back on.

3.0 LED STROBE OPERATION

3.1 Adjusting the Flash Rate - RPM

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.

3.1.1 Multiply or Divide By 2

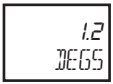


The strobe flash rate can be instantly doubled (x2) or halved (÷2) by pressing the **x2** and **÷2** buttons (shown right). Refer to 5.0 USING THE STROBOSCOPE TO MEASURE RPM for more information on speed measurement. Note that if doubling or halving the flash rate will cause the strobe to exceed its capability, the display will show OVER or UNDER respectively and the flash rate will remain at the current flash value.

3.2 Adjusting the Flash Duration (Brightness)

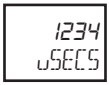
The flash duration (the width of the LED flash) can be adjusted by the user to be a preset number of degrees of rotation (DEGS) or a fixed number with in microseconds (uSEC). The result is a more or less bright image at the expense of less or more image blur. Read 4.0 BRIGHTNESS for more detail.

3.2.1 Flash Duration - Degrees



To view or adjust the flash duration, press the **BRIGHT** button (shown 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 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).

4.0 BRIGHTNESS

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 an 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.

4.1 Calculating Blur

Blur can be calculated. For example, 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.

4.2 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 target is more blurred. 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*.

4.3 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*.

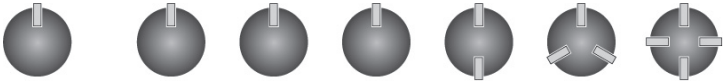
***Note:** There are two limits maintained by the strobe – the pulse can never be greater than 3000 µs nor can it exceed 14° of rotation. The strobe automatically adjusts these values as the flash rate is increased or decreased to maintain these limits at all times. For example - at a flash rate of 600 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).

5.0 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, keyway 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** 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 keyway you will see one stationary image of the keyway at the actual speed and at 1/2, 1/3, 1/4, etc, of the actual speed. You will see 2 images of the keyway at 2 times the actual speed, 3 images at 3 times, etc. The FPM equals the shafts Revolutions Per Minute (RPM) at the highest flash rate that gives only one stationary image of the keyway.



Stopped Image Flash Rate (FPM)	1/4 times 750	1/2 times 1500	1 time 3000 Actual RPM	2 times 6000	3 times 9000	4 times 12000

Example: Object rating @ 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. Be aware that you will encounter multiple images. Note the flash rate of the first SINGLE image you encounter and call this speed "A". Continue decreasing the flash rate until you encounter a second SINGLE image and 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:

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

$$X = (A-B) \text{ and } Y = (B-C)$$

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.

6.0 BATTERY PACK

The Nova-Strobe BBL is fitted with a 5-cell rechargeable NiMH (nickel metal hydride) battery pack. **NiMH batteries are prone to self-discharg**e; 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 battery pack just prior to use.** Allow 3-5 cycles of charging and discharging for battery pack to reach full capacity.

When not in use, the battery pack should be charged at least every three months, otherwise the battery capacity may be reduced or the battery pack may become unusable.

The enclosure contains control electronics to properly and safely charge the battery pack. Never remove the battery pack from the enclosure and attempt to charge externally. **Always use the recharger supplied (PSC-2U or PSC-3U).**

6.1 Low Battery Indication

When the battery pack is charged, there will be no battery indication. When the battery pack is 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 means very little time left)

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

6.2 Charging the Battery Pack

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 supplied recharger:

1. Release the trigger so the strobe is off.
2. Make sure the appropriate adapter plug is inserted into the recharger (see section 6.3 Recharger).
3. Plug the barrel plug of the recharger into the recharger socket of the strobe (located below the display panel behind the handle).
4. Plug the recharger into an AC mains outlet (115/230 Vac).

CAUTION: Use of rechargers other than the one supplied (PSC-2U or PSC-3U) will damage the stroboscope and void the warranty.

When the recharger plug is inserted into the recharger jack, the strobe will go into Charging Mode. Make sure the trigger switch is not depressed. The 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 **CHRGE** in the bottom right of the display. The recharger will fast charge the battery pack for about 4-5 hours and then trickle charge the battery pack.

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

6.3 Recharger

CAUTION

RISK OF ELECTRIC SHOCK

- **Do not insert the adapter plugs into an AC outlet without the recharger attached**
- **Avoid touching the plug blades when inserting or removing the recharger from the AC outlet**
- **Indoor use only**

The recharger provided with the Nova-Strobe BBL has interchangeable adapter plugs allowing it to be used with AC outlets in different countries.

To change the adapter plugs, depress the button on the installed plug and slide the plug up and out of the recharger. Select the correct adapter plug and slide it back into the recharger until the plug seats firmly. Make sure the plug cannot slide out.

6.4 Battery Disposal

Prior to disposing of the Nova-Strobe BBL, the unit must be disassembled to properly dispose of the electronic components in the device. In particular, the nickel metal hydride (NiMH) battery pack must be removed and RECYCLED in accordance with environmental regulations in the country of use.

To remove the NiMH battery pack, first make sure the strobe is turned off. Then use a small screwdriver to release the LED array from the LED case housing. This will expose four (4) screws that must be removed so the LED case housing can be detached from the case halves. There are four (4) additional screws in the right case half (opposite the knob) that must be removed. The case halves can now be separated, exposing the battery pack. Unplug the battery pack from the circuit board. The battery pack should be sent to a recycling center or returned to the factory.

7.0 SPECIFICATIONS

Specifications*	BBL Basic Battery LED Stroboscope
Flash Range	30-500,000 (FPM), 0.5 to 8333.33 Hz
Flash Rate Accuracy	0.01% of setting or ± 1 last digit
Flash Rate Resolution	0.01 to 1 FPM, 0.1 FPM resolution above 9,999.99 FPM, 1 FPM resolution above 99,999.9
Display Update Rate	Instantaneous
Light Source	12 LED array
Light Output	Average: 3000 lumens @ 6000 FPM 12 in. from lens
Flash Duration	Adjustable 0.5 to 3000 µs or 0.2 to 14 degrees of rotation (auto adjust with flash rate)
Display	LCD with 6 numeric 0.506 in. [12.85 mm] high digits and 5 alphanumeric 0.282 in. [7.17 mm] high digits
Indicators	Battery level
Knob Adjustment	Digital rotary switch with 36 detents per revolution; velocity sensitive
Time Base	Ultra-stable crystal oscillator
Input Power	Internal NiMH rechargeable batteries with external 115/230 Vac 50/60 Hz recharger
Run Time	12 hours typical at 6000 FPM and 2.8° pulse width with fully charged battery pack
Charge Time	Four to five (4-5) hours typical with provided recharger
Weight	1.9 lbs. (860 g)
Dimensions (LxWxH)	Body: 9 in. x 3.66 in. x 3.56 in. [229 mm x 93 mm x 90 mm]; LED Housing: 4.8 in. [122 mm] dia.; Handle: 4.254 in. [108 mm long]

Specifications*	BBL Basic Battery LED Stroboscope
Safety	This product is designed to be safe for indoor use under the following conditions (per IEC61010-1).
Operating Temperature	32-104 °F (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)

*Specifications are subject to change without notice.

7.1 Compliance

CE Compliant

Please visit our website, www.monarchinstrument.com, to download our Declaration of Conformity for this product.

Energy Efficiency

BC

When used with the Nova-Strobe BBL, the recharger supplied with the unit is intended strictly for industrial use and is classified as a state-regulated battery charger system. The Nova-Strobe BBL battery charger system has been tested and certified to comply with the applicable California Energy Commission (CEC) Title 20 Appliance Efficiency Regulations. The product is listed in the California Modernized Appliance Efficiency Database System (MAEDbS) under model Nova-Strobe BBL.

Regulation (EU) 2025/40 on Packaging and Packaging Waste (PPWR)

Packaging configuration varies depending on the product ordered.

Individual Instruments

Stroboscopes sold individually are protected by a mono-material polyethylene (PE) bag and packaged in corrugated cardboard cartons

with cardboard inserts designed to provide adequate protection during storage and transportation while minimizing packaging weight and volume. The cardboard packaging is intended for recycling through applicable paper and cardboard collection systems where such facilities are available.

Kit Configurations

The Nova-Strobe BBL Kit includes a reusable carrying and storage case (also sold separately). The carrying case is designed as a durable, reusable asset intended for long-term storage and transport of the instrument throughout its service life and should not be treated as single-use packaging.

At end of life, separate the stroboscope, carrying case, batteries, and other accessories and dispose of or recycle them in accordance with applicable local regulations and available recycling systems.

Packaging Materials

- **Outer shipping carton:** Corrugated cardboard; recyclable through applicable paper and cardboard recycling streams
- **Individual product carton and inserts:** Corrugated cardboard; recyclable through applicable paper and cardboard recycling streams
- **Poly bag:** Mono-material polyethylene (PE) bag used to protect the instrument from cardboard dust and particles during transportation and storage. Check local recycling options.
- **Standard carrying case:** Rigid blow-molded plastic carrying case designed for repeated reuse

For additional packaging compliance information, including material declarations and environmental information, visit: www.monarchinstrument.com.

8.0 ACCESSORIES

For a complete list of accessories, see webpage.

PN	Model	Description
6280-040	CC-7	Standard Latching Carrying Case with provision for accessories
6280-041	SPC-1	Splash-proof Protective Cover
6280-048	Protective Rubber Cover	Protective Rubber Cover fits over LED housing to protect against accidental drops and infiltration of contaminants
6230-xxx-CAL	CAL-NIST	NIST Traceable Certificate of Calibration (include with order or obtain RMA#)

Standard Carry Case (CC-7)

Splash-proof Protective Cover (SPC-1)

Protective Rubber Cover

Measure • Monitor • Maintain

Monarch Instrument is committed to excellence and quality in manufacturing, sales, and service.

Portable Tachometers

Track-It™ Data Loggers

Panel Tachometers

Fixed Mounted Strobes

Portable Strobes

Frequency Converters

Speed Sensors

DataChart™ Paperless Recorders

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