MONARCH INSTRUMENT

Instruction Manual

Phaser-Strobe pbx
Portable Phase-Shifting Stroboscope

CE ⒷⒸ NIST CALIBRATION

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 lethal voltages present inside this product. Refer to the section on Lamp Replacement before attempting to open this product.

> AC Stroboscopes that have three wire mains cable must have the earth wire connected to a suitable Earth point.

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.

11. The product contains 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.

12. This instrument is not user serviceable. For technical assistance, contact the sales organization from which you purchased the product or Monarch Instrument directly.

In order to comply with EU Directive 2012/19/EU 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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1.0   OVERVIEW

The Phaser-Strobe pbx is an extremely sophisticated instrument with many features, yet remains simple to operate. Select only the features you need.

1.1   Display Panel / Definition of Buttons

The display panel consists of a backlighted liquid crystal display with six numeric digits on top and five alphanumeric digits on the bottom, which indicate modes, flash rates, etc. (see Figure 1).

Figure 1 Display Panel

Additional information displayed include:

PHASE   Indicates Phase Shift Delay Mode is active

TIME   Indicates Phase Shift Time Delay Mode is active

AUTO   Indicates Auto Phase Shifting Mode (Virtual RPM) is active

ALT.   Indicates alternate function of each button (lower section) and knob will be used

TACH   Tachometer Mode active (strobe won't flash)

LOCK   Unused

EXT   External Input Mode active

⊙   On Target Indicator for Tachometer Mode and Remote Sensor in External Mode

- - - - -   Indicates input frequency exceeds the limit of the stroboscope

▭   Battery indication (see 8.1 Low Battery Indication)

Below the display are six membrane buttons which control the operation of the stroboscope.

[x2] **Multiply Flash Rate by 2**
ALT Function - starts menu (see section 3.0)
Hold when powering up to show all segments, then rev # and display test

[÷2] **Divide Flash Rate by 2**
Hold when powering up to reset factory defaults

[DISPLAY RPM/RPS TACH] **DISPLAY/TACH**
Internal/External Mode: toggles display between RPM and RPS
External Phase or Time Delay Mode: cycles display through RPM, RPS, Phase and Time
Auto Mode: cycles display through RPM, RPS, VRPM and VRPS
ALT Function—toggles Tach Mode (flashing) on/off

[INPUT MEMORY] **INPUT/MEMORY**
Manually toggles between Internal and External Modes
ALT Function—Memory, reads and stores 9 preset flash rates

[ALT FUNCTION] **ALT FUNCTION**
Activates Alternate Function for buttons (lower section) and knob

[PHASE DELAY] **PHASE DELAY**
Internal Mode: toggles between normal flash rate adjust and "phase" delay adjust
External Input Mode: cycles through External only (no delay), Phase, Time and Auto (VRPM)

The **ALT FUNCTION** button toggles **ALT.** in the display. When ALT. is displayed, the buttons will perform their secondary function listed in the lower section of each button. It also changes how the tuning knob works.

2.0   PREPARATION FOR USE

The strobe may be handheld 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 Phaser-Strobe pbx has internal rechargeable batteries and may also be powered by an external AC power supply (PSC-pbxU). If using the internal batteries, the unit should be charged before use (see section 8.2 Charging the Batteries). The actual operating time of the stroboscope depends on the flash rate and duty cycle of operation. The strobe can also be run continuously from the AC mains with the power supply supplied (see section 8.3 External Power Supply/Charger).

2.2   Input / Output Connections

The Phaser-Strobe pbx 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" (3.5 mm) phone plugs (input - stereo, output - mono). The input and output are TTL compatible. (See Figures 2 and 3 for connector connection detail.)
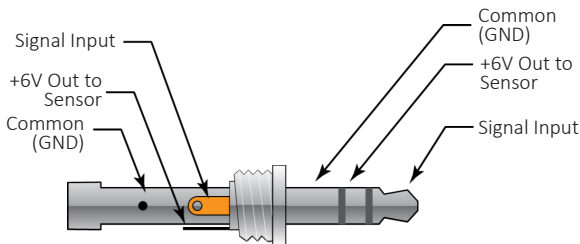
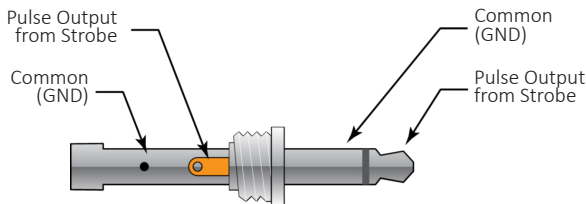*Figure 2 Input Connector Detail (Stereo plug)*

Figure 3 Output Connector Detail (Mono plug)

The optional ROS-P (Remote Optical Sensor), MT-190P (Magnetic), or IRS-P (Infrared) sensors may also be used to trigger the unit.

NOTE: When using external sensors that are powered by the Phaser-Strobe pbx, e.g. Remote Optical Sensor (ROS-P), the sensor must be plugged in before the stroboscope is turned on, or the remote sensor may not be powered up.

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 Input 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 polarity of the input pulse can be set in the MENU options.

4

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   MENU
The strobe has a Menu which allows the user to select settings such as number of decimal places, backlight on or off, positive or negative edge for input and output signal, and input blanking on or off.

To enter the MENU:
1. Press the *ALT FUNCTION* button and then the *MENU* button.
2. *SETUP* and the menu option will be displayed.
3. Turn the tuning knob to cycle through the main menu options.
4. Once the desired menu option is displayed, press the *MENU* button to select it. Press any other button to cancel.
5. Turn the tuning knob to edit the menu option setting.
6. Press the *MENU* button to save your changes. Press any other button to cancel.
7. Press any button <u>other than</u> MENU to exit the Main Menu.
8. *DONE* will be displayed.

Below is a list of the menu items:
DECPT   Decimal Point (none, 1 or 2)
BLITE   Backlight (Yes=On or No=Off)
INPUT   Positive (pos) or Negative (neg) Edge for Input Signal
OUTPT   Positive (pos) or Negative (neg) Edge for Output Signal
BLANK   Input Blanking (Yes=On or No=Off)

4.0 OPERATION

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.

N**OTE: Unit must power down completely (**OFF** will be displayed and then disappear) before unit will power on again. This is normal operation.**

There are five (5) operating modes for the Phaser-Strobe pbx. These are Internal, External Input, External Phase Delay, External Time Delay, and Auto (Virtual RPM). All but the Internal Mode require an **external input signal**.

In the **Internal Mode**, the knob adjusts the flash rate. In the **External Input Mode**, an external signal is used to trigger the flash and the knob has no effect. The **External Delay Modes (Phase, Time and Auto)** enable the user to vary the stopped motion image at any point in the cycle without having to move the trigger source location.

4.1 Internal Mode - Standard Strobe Operation

In the Internal Mode, the stroboscope generates its own signals and functions like a tunable stroboscope. The strobe is in the Internal Mode when nothing is plugged into the input jack or when manually set using the INPUT button.

To change the flash rate:
With the power on, turn the knob counter clockwise to increase the flash rate and clockwise to decrease it. The knob is velocity sensitive. Turn the knob slowly to have each click equal to 0.01 FPM. Turning the knob more quickly will adjust the FPM by larger steps. When adjusting flash rate, quickly turn the knob (or use the **x2** or **÷2** buttons) to coarsely change the FPM. Then slowly turn the knob for fine adjustments.

NOTE: There are maximum and minimum values in each mode beyond which you cannot adjust. If you are adjusting the rate and you reach a value on which the next increment would exceed the maximum flash rate, the display will not increment. The same is true if you try to adjust the flash rate below the minimum flash rate.

To multiply or divide the current flash rate by 2:
In addition to the knob, there are two buttons on the display panel marked **x2** and **÷2**. These enables the user to instantly double or halve the reading on the display to the maximum or minimum values allowed. This feature is useful for checking harmonics in the internal flashing mode.

Alternate Knob Function - Multiple by 2, 3, 4, 5, etc.
The tuning knob functions differently when **ALT.** is displayed. The current flash rate is used as an adder. The knob will add (counter clockwise) or subtract (clockwise) that initial flash rate for each click the knob is turned. This in effect allows the user to multiply the initial flash rate by 2, 3, 4, 5, etc., up to the maximum flash rate. This is very helpful on fan blades. Using this feature, one can superimpose the blades on top of each other and check for blade tracking, bent blades, lead and lag tests, etc.

Example: A 3-bladed fan is spinning at 3600 RPM. The strobe is flashing at 3600 FPM. Press the *ALT FUNCTION* button to display ALT. Then turn the knob counter clockwise 2 clicks. The strobe will now flash at 10,800 FPM (effectively 3600 times 3). The fans blades will be all superimposed on each other. One can now see if the blades are out of alignment, bent, etc. by viewing the blades from the front or viewing from the side edge of the blades.

To select a flash rate from a preset (memory) location:
1. Press the *ALT FUNCTION* button and then the *MEMORY* button; *READ* will be displayed.
2. Turn the tuning knob to cycle through the preset flash rates.
3. Once the desired flash rate is displayed, press the *MEMORY* button to select it. Press any other button to cancel; *DONE* will be displayed.

To select a current flash rate in a preset (memory) location:
1. Press the *ALT FUNCTION* button and then the *MEMORY* button; *READ* will be displayed.
2. Do <u>NOT</u> turn the knob and press the *MEMORY* button again; *STORE* will be displayed.
3. Turn the tuning knob to cycle through the memory locations.
4. Once the desired memory location is displayed, press the *MEMORY* button to store the current flash rate in that location. Press any other button to cancel. *DONE* will be displayed.

Internal Phase Delay/Jog:
Once the flash rate has been adjusted to give a stopped motion image, the PHASE DELAY button may be used with the knob to increase or decrease the phase of the reference mark location. Use the PHASE DELAY button and knob to bring a reference mark, such as a keyway, into your line of sight.

To adjust the Phase Delay:

1. Press the *PHASE DELAY* button. *PHASE* will be displayed on the bottom line and the current flash rate will be displayed on the top line.
2. Turn the tuning knob to adjust the location (phase) of the reference mark.
3. Press the *PHASE DELAY* button again to turn the Phase Delay mode off.

4.2   Internal Mode - TACH Frequency Generator

In the Internal Mode, the strobe can be used as a frequency generator (outputting TTL pulses) without having the strobe flash. The pulse output will still occur at the flash rate; the strobe is just not flashing.

To stop flashing:

Press the *ALT FUNCTION* button and then the *TACH* button. The TACH icon will be displayed.

To start flashing again:

Press the *ALT FUNCTION* button and then the *TACH* button. The TACH icon will go away and the strobe will start flashing again.

4.3   External Input Mode

In the External Input Mode, the user cannot make any flash rate adjustments. 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.

4.4   Tachometer Mode - External Input Required
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 without flashing the lamp. **The strobe will not flash in the Tachometer Mode.**

To enter the External Tachometer Mode:
1. Plug an external input into the unit.
2. Press the *ALT FUNCTION* button and then the *TACH* button. The TACH icon will be displayed.

NOTE: If the external input signal exceeds the maximum flash rate, the strobe will go into the Tachometer Mode automatically.

To exit the External Tachometer Mode:
1. Press the *ALT FUNCTION* button and then the *TACH* button. The TACH icon will go away.
2. The unit will remain in the External Input Mode unless the INPUT button is pressed to change the mode.

4.5   External Delay Modes (Phase Shifting)
There are three **External Delay Modes: Phase Delay, Time Delay,** and **Auto (Virtual RPM)**. In the **External Phase Delay Mode**, the flash is triggered 0.1 to 359.9 degrees after each external signal pulse. The knob sets the amount of delay in degrees. In the **External Time Delay Mode**, the flash is triggered 0.01 to 1000 milliseconds after each external signal pulse. The knob sets the amount of delay in milliseconds. In the **Auto (Virtual RPM) Mode**, the flash is triggered by increasing amounts after the external trigger pulse so that the image will appear to rotate at a given (virtual) RPM or RPS. The knob sets this virtual RPM or RPS.

To enter one of the External Delay Modes:
1. Plug an external input into the unit.
2. Press the *PHASE DELAY* button to cycle to the desired mode.
3. Use knob to adjust delay/angle (phase, time or virtual RPM).

To exit the External Delay Mode:
1. Press the *PHASE DELAY* button to cycle back to External only.
2. The word *PHA5E* or the TIME or AUTO icon will go away.

4.6   Power Up Features
When the strobe is powered up, it will remember the last settings.

Press and hold the *x2/MENU* button, then turn on the strobe by depressing the trigger switch. This will turn on all the display segments for two seconds or until you release the button. It will then show the software revision, "REV x.x" and then go through a display diagnostic.

Press and hold the *÷2* button, then turn on the strobe by depressing the trigger switch. This will restore the factory programmed presets.

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 the highest 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 keyway at 3 times, etc. **The Flashes Per Minute (FPM) equals the shaft's 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 1250 | 1/2 times 2500 | 1 time 5000 | 2 times 10000 | 3 times 15000 | 4 times 20000 |

Example: Object Rotating at 5000 RPM

If the speed is outside the full scale range of the stroboscope (20,000 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 = $2XY(X+Y)/(X-Y)^2$ where
$$X = (A-B) \text{ and}$$
$$Y = (B-C)$$

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 cannot 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   LIMITATIONS OF REMOTE OPTICAL SENSORS

Remote Optical Sensors have a limitation when used with the Phaser-Strobe pbx because they sense not only the reflective marker but the strobe flash as well. If the ROS is positioned near the strobe, the light from the strobe may cause the ROS to trigger the stroboscope at the wrong time, especially when using a delayed flash mode. The Phaser-Strobe pbx has an **Input Blanking** feature to allow it to ignore this false trigger.

Even with the Input Blanking, large delays cannot be obtained using an ROS if the strobe's flash is triggering the ROS. The duration of the ROS pulse in response to the strobe's flash is about 0.5 milliseconds to 1.1 milliseconds depending on the flash rate. This limits the largest delay possible because the flash swamps the signal from the ROS, and consequently it will not provide the pulse from the reflective marker. If large delays are desired, reposition the ROS so it is away from the strobe's flash or use a magnetic sensor.

The Input Blanking feature itself limits the maximum delay which is detrimental to non-optical sensors. It is possible to disable (or enable) the blanking in the Phaser-Strobe pbx (see).

7.0   LAMP REPLACEMENT AND FUSE
7.1   Lamp Replacement

⚠️ **WARNING**

Before attempting to remove the lamp, make sure the stroboscope is turned off and any mains cord is removed from the AC outlet. Allow the lamp to cool waiting at least 5 minutes.

The stroboscope is designed to discharge the internal high voltages within 30 seconds. However, caution should be exercised when replacing the lamp.

The lamp can be replaced by using just a pocket screwdriver. **It is not necessary to remove any screws to replace the lamp.**

To change the lamp:
1. Push apart the two tabs on the side of the reflector housing and remove the lens using a small screwdriver to help pry one tab and lift the lens. Take care not to pry the tab any more than is necessary to free the lens. The reflector is held in place by the front lens and will come loose, but it is not necessary to remove the reflector.

2. Hold the lamp with a cloth between your forefinger and thumb and rock it back and forth gently while pulling out. Do not attempt to rotate the lamp. The lamp is socketed and will come out easily when pulled straight out.

⚠️ **WARNING**
Do NOT touch the new lamp with bare fingers.

3. The lamps are polarized and must be put into the socket matching polarity. **Using a lint free cloth, match up the red dot on the plug with the red dot on the socket** and gently rock the lamp while pushing it into place (see Figure 4). Make sure the lamp is in straight and centered in the reflector hole.

⚠️ **CAUTION**
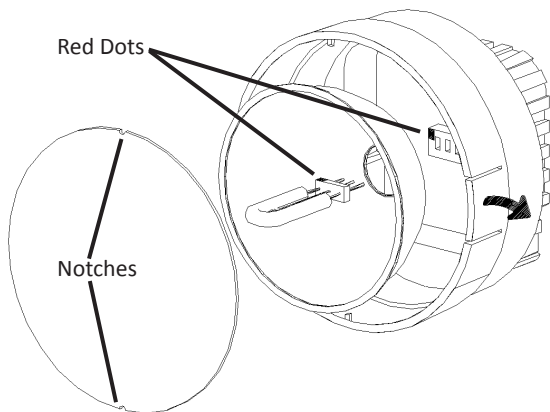**Do NOT allow the reflector to contact the lamp.**

Red Dots

Notches

Figure 4 Lamp Replacement

4. Reinstall the reflector and then position the front lens in place matching up the notches on the lens with the two small tabs on the housing to prevent lens rotation (see Figure 4). Push the tabs on the front rim outward and press the lens into place.

7.2 Fuse

Under normal operating conditions, the fuse within the stroboscope should never blow. Examples of abnormal operating conditions would be foreign materials entering the strobe, such as water, pulp, ink, etc.

The Phaser-Strobe pbx has a replaceable fuse, which will reset once conditions are normal again.

8.0 BATTERY AND POWER SUPPLY SPECIFICS

The Phaser-Strobe pbx 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 charger supplied (PSC-pbxU).

8.1 Low Battery Indication

When the batteries are charged, there will be no battery 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 (section 8.2 Charging the Batteries) or powered by the power supply/charger (section 8.3 External Power Supply/Charger). Remember to release the trigger switch.

8.2 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 Phaser-Strobe pbx with the power supply/charger:

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

⚠ **CAUTION**
Use of rechargers other than the one supplied (PSC-pbxU) will damage the stroboscope and void the warranty.

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

Allow the charger 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.

8.3 External Power Supply/Charger

The external power supply/charger (PSC-pbxU) can also be used to run the stroboscope continuously from the AC mains (115/230 Vac).

To power the strobe with the external power supply/charger (PSC-pbxU):

1. Plug the power supply/charger cable into the charger socket (located below the display panel behind the handle).
2. Plug the power supply/charger into an AC main wall outlet.
3. Press (and lock) the trigger switch to operate. If the trigger switch is not pressed, the unit will start charging.

8.4 Battery Disposal

Prior to disposing of the Phaser-Strobe pbx, the user must remove the Nickel-Metal Hydride batteries. To do this, remove the lens, reflector and lamp as detailed in the Lamp Replacement section. 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. Unplug the batteries from the circuit board. The batteries should be sent to a recycling center or returned to the factory. The rest of the parts may now be disposed of.

9.0 SPECIFICATIONS*

Internal Mode	Phaser-Strobe pbx
Flash Range	30 - 50,000 FPM (Flashes Per Minute)
Flash Rate Accuracy	±0.004% of setting or ± least significant digit
Flash Rate Resolution	0.01 to 1 FPM (menu selectable), 0.1 FPM max resolution above 9,999.99 FPM
Display Update Rate	0.5 second typical above 120 RPM
External Modes	
Flash Range and Display	Same as Internal Mode - external flash rates to 0 are acceptable
Tachometer Mode	5 to 250,000 RPM from external trigger Accuracy: ±0.001% of reading or ± last digit
Display Update Rate	0.5 second typical
Trigger-to-Flash Delay	< 5 μsec
Phase Delay	**Phase:** 0.1 to 359.9° **Time:** 0.01 to 1000 milliseconds **Auto:** 0 to 200 VRPM

External Modes	Phaser-Strobe pbx
External Input (1/8″ phone plug)	TTL compatible (24V pk max), 0.5 μsec min. pulse width, positive or negative edge-triggered (menu selectable)
General	
Time Base	Ultra-stable crystal oscillator
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, On Target, TIME, AUTO, ALT., TACH LOCK, and EXT icons
Knob Adjustment	Digital Rotary switch with 36 detents per revolution; velocity sensitive
Memory	Last setting before power down is remembered and restored on the next power-up; 9 user-settable flash rates
Trigger Output/Remote Sync (1/8″ phone plug)	40 μsec positive/negative pulse (menu selectable), 3.3VDC typical
Power	Internal rechargeable NiMH batteries or AC power supply/recharger
Light Output	**Average:** 13 Watts typical > 4000 RPM **Instantaneous** (per flash): 230 mJoule typical to 4000 RPM
Flash Duration	10-25 microseconds (auto adjust with flash rate)
Flash Tube (Lamp) Life	100 million flashes
Run Time	Two (2) hours typical at 1800 FPM and over 1 hour at 6000 FPM with fully charged batteries or continuous with AC power supply/recharger

Specifications* (continued)

Charge Time	Four to five (4-5) hours typical with PSC-pbxU
Weight	1.9 lbs. [0.86 kg] including batteries
NIST	Certificate included
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]
NOTE: Safety thermal feature will set unit into TACH Mode (stops flashing) in the event of internal overheating. Unit must then be power cycled.	
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.

9.1   Compliance

BC   Phaser-Strobe pbx units are compliant with U.S. Department of Energy's energy conservation standards specified in the Code of Federal Regulations 10 CFR 430.32(z) and are registered in the DoE CCMS database.

- **CE Compliant**
- Low Voltage Directive (LVD) 2014/35/EU
- Electromagnetic Compatibility Directive (EMC) 2014/30/EU
- Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU

10.0   ACCESSORIES

See Accessories webpage for details.

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 reflector housing to protect against accidental drops and infiltration of contaminants
6280-034	C-4027	Set of mating 1/8" [3.5 mm] stereo phone plugs (to provide TTL signal and sensor power)
6280-037	CA-4044-6	6 ft. [1.8 m] Input/Output cable, 1/8" [3.5 mm] male stereo plug to male BNC connector
6280-038	CA-4045-6	6 ft. [1.8 m] Input/Output cable, 1/8" [3.5 mm] male stereo phone plug to 1/8" [3.5 mm] male stereo phone plug for daisy chaining strobes
6180-070	T-5 Tape	Reflective tape - 5 ft. [1.5 m] roll, 0.5 in. [12.7 mm] wide

PN: 6280-040   PN: 6280-041   PN: 6280-048   PN: 6280-037   PN: 6280-038

SENSORS

PN	Model	Description
6180-029	ROLS-P	Remote Optical Laser Sensor with 8 ft. [2.5 m] cable for triggering strobe
6180-057	ROS-P	Remote Optical Sensor with 8 ft. [2.5 m] cable for triggering strobe
6180-057-25	ROS-P-25	Remote Optical Sensor with 25 ft. [7.6 m] cable for triggering strobe
6180-020	IRS-P	Infrared Sensor with 8 ft. [2.5 m] cable for use without reflective target at 0.5 inch [12 mm] gap for triggering strobe
6180-036	MT-190P	Magnetic Trigger Sensor/Amplifier with 8 ft. [2.5 m] cable for triggering strobe

PN: 6180-029   PN: 6180-057 or 6180-057-25   PN: 6180-020   PN: 6180-036

REPLACEMENT PARTS

PN	Model	Description
6280-030	L-1903	Stroboscope replacement lamp
6280-022	PSC-pbxU	Universal power supply/charger, 115/230 Vac with USA, UK, AUS, Euro Adapter Plugs
6280-046	Internal Battery Pack	Rechargeable NiMH battery pack

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