

THE **PIONEER**

ELECTRIC & RESEARCH CORPORATION

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INSTRUCTION MANUAL
PORTA-STROBE™
MODEL DS-12V DIGITAL STROBOSCOPE
EQUIPMENT SPECIFICATIONS

PHYSICAL

STROBE UNIT (GUN)

Width	4"	(10cm)
Length	9"	(23cm)
Height	8½"	(22cm)
Weight	2½ lbs.	(1 kg)

ELECTRICAL (Solid state circuitry)

Flash Rate: 0-12,000 FPM (Flashes per minute) or RPM. Submultiple techniques extend range to 120,000.

Flash Duration: 1 microsecond (approximate).

Flash Tube Life: Two Billion flashes.

Accuracy: ± 1 FPM or RPM throughout its entire range.

Power: 12V 8AH Battery or equivalent. Can also be operated with Pioneer PAC-12V adapter/charger.

Operating Temperature: 0° C to 40° C for continuous operation. For short intervals of time, unit can be operated beyond mentioned temperature limits.

Display: 5-Digit LED.

The Pioneer Porta-Strobe Model DS-12V is a truly portable, battery operated stroboscope ideally suited for a wide range of industrial, institutional, and educational applications. Sturdy and compact, it can be operated anywhere in the plant or field to permit visual and digital measurement of rotary, reciprocating or linear motions of various equipment in operation as if it were standing still. An easy adjustment also allows the user to view the action in slow motion to study interacting parts.

The Pioneer Porta-Strobe can also be used as a remote electronic digital tachometer for direct measurement of RPM (speed) without special reflective tape or markings. RPM results are updated and recorded approximately every half second on a 5-digit LED display.

OPERATION:

The Porta-Strobe is a portable-LIGHT WEIGHT-strobe flash unit which, when connected to a fully charged 12V 8AH battery or equivalent, will flash for more than 3 hours continuously before another charge is necessary. A 6 foot cord with polarized connector at one end and properly marked terminals at the other end connects the Strobe to the battery. When the trigger switch is squeezed, the unit will flash at the selected rate and that rate will be indicated on the LED display. The Strobe continues to flash at the displayed rate as long as the trigger is depressed. For continuous periods of operation, trigger is locked into position by pressing the trigger lock button located on the side of the handle. Lock is released by squeezing trigger again.

There is no calibration or adjustment necessary at any time. A single, multiturn control located below the display, provides continuous speed selection over the 0-12,000 RPM range for simple operation.

When the Porta-Strobe is connected to Pioneer Model PAC-12V adapter/charger, it will flash continuously at the rate selected by the multiturn control. The Trigger switch and Lock button function as described in the previous paragraph.

CAUTION:

The Porta-Strobe is designed to operate from a DC source of $12V \pm 2V$ (2.5A or more). Variations from this requirement will have the following effects:

- A. If Porta-Strobe is operated with Pioneer 12V 8AH power pack, the operator must stop operation of the unit within a few minutes after the display starts to blink. A blinking display means that the battery has been discharged to a point where further usage of the Strobe must stop within 5 minutes, otherwise the battery may be damaged. Because the Pioneer battery pack cannot be charged beyond its upper limit of 14V, there is no concern in operating the Strobe on a fully charged power pack. It is highly suggested to read carefully the instructions included with the Pioneer power pack, which explain the proper usage of the battery pack, and especially the battery charging procedures, which are very critical with regard to the **life** of the battery.

The intensity of the Strobe is directly proportional to the input power. When the battery starts to drop, a slight drop in the intensity will be noticed.

Also, heat generated within the unit is proportional to input power. Even though the Porta-Strobe uses the most efficient circuitry in its inverting section, still up to 25 watts of power can be consumed by the circuitry and the flash tube. Thus, heat is generated which must be vented through the holes located on the sides and top of the housing. It is very important that these holes remain **unrestricted** when unit is in operation for the heat to escape. At the same time, proper caution must be exercised so that no **metallic** material or **liquids** enter the vent holes, which will produce shorts that can damage the Strobe.

A car battery can be used to operate the Porta-Strobe as long as the unit is kept away from heat generating objects, ie., engine, cooling fan, etc. and the environment around the unit is between the $0^{\circ}C$ to $40^{\circ}C$ temperature limits. For temperature environments higher than $40^{\circ}C$, use the Strobe for short intervals of time, allowing a cool-off period in between, or use forced air to keep unit cool. Also make sure to use only Pioneer Jumper Cables, which provide protection to Strobe through a limiting diode installed within the cable. (Most vehicle batteries when fully charged can go as high as 15V, which can be detrimental to the Strobe if not properly protected.)

- B. If Porta-Strobe is operated with Pioneer PAC-12V adapter/charger, no special care is needed since the output of the adapter is regulated. The temperature environment limits are still in effect and the vent holes must

be unrestricted. Just connect Strobe cable into receptacle located in the front panel of the adapter, marked "Strobe", and plug AC cord into a 120V AC 60HZ line.

WARNING:

Use of the Porta-Strobe gives the illusion of stopped motion. Do not touch the machine being observed.

BATTERY CHARGING PROCEDURES:

- A. When charging the battery using the charger furnished with the battery pack:
 - a. Disconnect Strobe from battery.
 - b. Connect the wire terminals inside the case to the proper terminals of the battery.
 - c. Connect the cigarette plug of charger to the cigarette receptacle located on the side of the power pack.
 - d. Plug charger into a 120V AC 60HZ line and charge battery for approximately 16 hours.

NOTE: Make sure to remove charger from AC line and battery pack after 24 hours. If left on for more than the recommended time, life of battery will be affected. Read additional literature that may be included with regard to charging battery.

- B. When charging the battery using the Pioneer PAC-12V adapter/charger:
 - a. Disconnect Strobe unit from cable.
 - b. Connect end of cable that normally plugs into gun handle to receptacle mounted in the front panel of the 12V adapter/charger marked "BATTERY".
 - c. Plug AC cord into a 120V AC 60HZ line only and turn power switch on.
 - d. Battery will be fully charged within 10 hours. Charger can be left on indefinitely with no effect on battery life.

NOTE: PAC-12V ADAPTER/CHARGER

Dimensions 4¼" H x 5" W x 6⅝" L
Weight 4 lbs.

In accordance with the Pioneer Warranty and replacement provisions, no strobe repairs ordinarily would be undertaken by the user. Possible exceptions might involve minor malfunctions, as with cables, plugs and attachment items.

Assembling the strobe gun is a critical procedure. It should not be dismantled. However, the reflector lens is removable for flash tube replacement, as shown in Figure 1. But first make sure power is disconnected: Tube pins carry very high-voltage charges. The entire gun housing and the reflector lens are of plastic. They should be kept clear, or be cleansed of corrosive splatter and industrial contaminants.

In reporting field troubles, whether or not any of the equipment is being returned at that time, there should be notes: A brief history or record of symptoms, or of pre-fault behavior is of substantial aid to the factory. This is true especially of intermittent malfunctions that might call for a schedule of extended observation at the repair site.

REPLACEMENT PARTS

The following replacement parts are available for field replacement or attachment and can be ordered from the factory.

PART DESCRIPTION

STROBE UNIT

Knob	(1/16" Allen Key)
Reflector Lens	A42843
Lens Retainer O-Ring	24-2
Xenon Flash Tube	(FX-6B)
3-Amp Fuse (Blade type, inside handle)	46-28

TROUBLES—SYMPTOMS—REPORTING

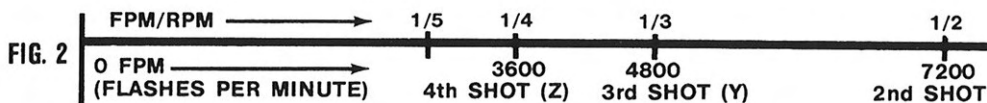
Although equipment malfunctions would not be followed by significant repairs in the field, any troubles should be scrutinized and carefully analyzed, where possible. Some might have obvious and easy solutions, as from a blown fuse or intermittent cable connection. If there is no flash, the fault may be in the tube or in the solid state generating stages.



FIGURE 1 — FLASH TUBE REMOVAL

DIRECTIONS FOR FLASH TUBE REMOVAL:

Disconnect from power. The lens is secured in its recess by a pliable O-Ring under compression. Remove it by picking out. Then withdraw the flash tube by rocking gently and pulling with firm finger grasp. In reassembling, insert the O-Ring into the recess at a starting point. Then seat it fully by pressing and sliding the fingers around both sides of the rim simultaneously to meet again at an opposite point.



Example A — Target Within Range (3000 RPM)



Shown at rest, here on the left, this target is a TDC/BDC indicator. The singular outline makes it unnecessary to apply a single image reference mark. Only the approximate speed range is known. Determine the exact speed: Start near the top of the RPM range and work downward to locate the first single-image stopped-motion view. The four pictures below show some of the observed images, going down. The last image, at left, is a half-speed verification check.

FOURTH SHOT



2nd single image: 1500 FPM. This checks RPM.

THIRD SHOT



1st single image: 3000 FPM. This is true RPM.

SECOND SHOT



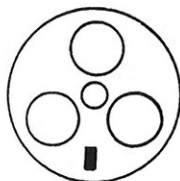
Four images at 4000 FPM. Reject and go to next.

FIRST SHOT



Two images at 6000 FPM. Reject and go to next.

Example B — Out of Range Target (14,400 RPM)



Shown at rest, here on the left, this target is a reflection chopper disk. Because it displays look-alike evenly-spaced outline features, a single-image reference mark has been applied to the disk. Speed is known only to lie beyond Strobe range. Determine it by multipoint calculation: Start at top of 12,000 range, and work downward to locate the first single-image stopped-motion view. Then locate the second and the third, as shown. Use values in the formulas of Table 1. Four shots of pictures are shown below.

FOURTH SHOT



3rd single image: 3600 FPM. This is point Z.

THIRD SHOT



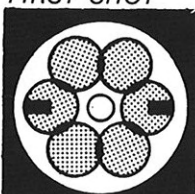
2nd single image: 4800 FPM. This is point Y.

SECOND SHOT



1st single image: 7200 FPM. This is point X.

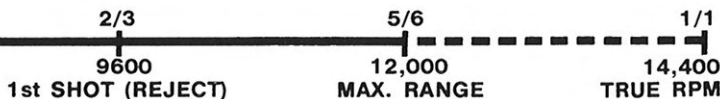
FIRST SHOT



Double image at 9600 FPM. Reject and go to next.

APPENDIX: The position of any given image view is shown frozen at an arbitrary angle of rotation. The actual angle would derive from the phase relationship between rates at the instant of flash.

See Figure 2 for 12,000 range showing submultiple shots taken for Example B.



Read 2 Points; X and Y:	Read 3 Points (cont'd)
(1) *RPM = $XY/(X-Y)$	(10) *A = $(X-Y)$
(2) *RPM = $S_x(S_x+1)(X-Y)$	(11) *B = $(Y-Z)$
(3) RPM = $S_y(S_y-1)(X-Y)$	(12) *S _x = $2B/(A-B)$
(4) *S _x = $Y/(X-Y)$, rounded	(13) S _y = $(A+B)/(A-B)$
(5) S _y = $X/(X-Y)$, rounded	(14) S _z = $2A/(A-B)$
<hr/>	
Read 3 Points; X, Y and Z:	(15) *RPM = $2PS/D^2$
(6) *S _x = $2(Y-Z)/(X+Z-2Y)$	(16) P = Product, AB
(7) S _y = $(X-Z)/(X+Z-2Y)$	(17) S = Sum, (A+B)
(8) S _z = $2(X-Y)/(X+Z-2Y)$	(18) D = Diff., (A-B)
(9) *RPM = $2AB(A+B)/(A-B)^2$	(19) S _x = $2B/D$
	(20) S _y = S/D
	(21) S _z = $2A/D$

Table 1 — Formulas for calculating Out-of-Range RPM

Flash-rate readings for X, Y and Z are in descending order for observed successive stopped-motion single images. The most-used formulas are indicated by an asterisk: The simple expression, (1), suffices only for approximate results. (2), with (4), is a more precise set. (3), with (7), is an equally-refined alternative set. (9) is a precision universal formula that obviates need for deriving the submultiple order numbers S_x or S_y, necessary in certain of the other computations. If these are derived, as in (4) or (5), some number-rounding ambiguity may be present. That is much less with (6) or (7). The 3 expressions for S_z are included to complete the series, although their full RPM formulas have been omitted. The balance of the formulas are either term expansions or simplification conversions of other expressions. All are subordinate to general-case rate formulas, not shown.

WARRANTY

The Pioneer Electric & Research Corporation warrants all STROBOSCOPES manufactured by it, to be free from defects in workmanship and in material under normal use and service for one year from the date of shipment from a Pioneer factory. Pioneer's obligation under this warranty is limited to repairing or replacing, at its option, free of charge for parts and labor any part or parts that prove to be defective within the provisions of this warranty and which are returned, transportation charges prepaid, to the factory within the applicable warranty period. This warranty shall not apply to the Flash-Tube Element, nor to any equipment or part that shall have been subject or misuse, negligence or accident nor to any equipment that shall have been repaired or altered by others than Pioneer so as to affect adversely its performance and reliability. This warranty is the only warranty applicable to equipment manufactured by Pioneer and is expressly in lieu of any warranties otherwise implied by law, including but not limited to implied warranties of merchantability or fitness for particular purpose. Beyond warranty periods, repairing and reconditioning services at regular charges will be provided for all Pioneer-manufactured equipment.