RISHIKESH
STROBOSCOPE PVT.LTD.

INSTRUCTION MANUAL

MOVISTROB® Series 2006

Type MINISTROB 2006 N/D; 2006 B/D

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Advice

We highly recommend to study the following Operating Instructions very thoroughly prior to first use of the stroboscope. Besides technical informations the instructions contain also important hints for use and application as well as special cautions against demage or injury.
Please note that we feel not responsible for any kind of demages or defects caused to the instrument by inapprobiate handling or operation nor in case of unauthorized electronical or mechanical actions to the unit.

Introduction

All MOVISTROB® products have to pass through various controls during their production phases and must also undergo very strict and conscientious function and quality tests before leaving the factory for delivery to our clients.
We can assure you that the MOVISTROB® product you received is in strict conformity with our high quality standards and it fully meets all safety and performance requirements.
All relevant data on this instrument are electronically stored and can be recalled at any time.
After actuating the ON/OFF switching element on the front panel, the unit is instantly ready for operation.
The flash rate of the standard unit is continuously adjustable in the range from 60 to 20.100 RPM (flashes per minute), corresponding to 1 to 335 Hz (flashes per second).
The membrane keypad with cursor function enables the operator an easy and quick adjustment of the flash frequency.
The data presentation on the LC display is well readable even under difficult environmental light conditions.
The Hi-Tec electronic inner life based on microprocessor technology is protected by a shatterproof plastic case.
Please note that we are able to offer this type as a special unit with a max. flash frequency up to 30.000 RPM respect. 500 Hz at request.

CAUTION!

Persons with limited physical, sensorial or mental abilities are not allowed to use the unit, unless they are supervised for their safety by a qualified person or are briefed by the responsible person how to use the unit.
Use of this product may induce an epileptic seizure in those prone to this type of attack.

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 the observation object and do not touch the target.

There are high voltages present inside this product. Therefore do not attempt to open this product.

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

The instrument may be operated by trained personnel only. Maintenance and repairs may also be carried out by qualified personnel or by the manufacturers only.

Controls and Indicators

The instrument carries the following controls and functional elements on the easy-view front panel (see figure):

"ON/OFF" Finger-tip Control

switches the instrument "ON" or "OFF" by finger-tip action.

Immediately after switch-on the first reading on the LC display indicates the last value measured by the unit before switch-off.

Data presentation on display: n/RPM or f/HZ

XXXXX XXXXX

Now further adjustments may be effected via the finger-tip elements

Attention

If the stroboscope is not used for a longer period of time the instrument should be switched off by the control in order to avoid early damage of the flash-bulb (see section Standby-Function and Technical Data)

"HZ/RPM" Finger-tip Control

indicates the flash frequency either in HZ (flashes/s.) up to two decimal places or RPM (flashes/min.) just by finger-tip action.

Left- and Right-Arrow Finger-tip Control (◄ ►)

Immediately after switch-on of the strobocope the cursor signal flashes on the unit place. By activating the left-arrow control (◄) the operator can switch on from the unit place to the decimal or hundred place (., .1, .10) for faster setting of higher flash frequency or vica versa, lower the frequency by pushing the right-arrow control. (►)

Up- and Down-Arrow Finger-tip Control (▲ ▼)

The fine adjustement of the flash frequency within the preselected cursor range can be effected by the up-arrow (▲) (flash frequency increasing) or the down-arrow (▼) control (flash frequency decreasing).

If the pressure is kept on the control the setting runs continously up or down (repeat function).

Precise adjustement will be achieved by step by step finger-tip action.

Automatic Standby with Data-Hold-Function

If the stroboscope has not been used or the flash frequency not been changed for approx. 5 minutes, standby with data-hold-function will automatically be released in order to avoid early damage of the flah-bulb.

The display indicates "standby" mode.

The last indicated value however will be stored.

By tipping any arrow control element again the instrument operates as usual starting up with the last measured value.

LC display

for direct reading of the flash frequency by 2 x 8 characters in RPM (flashes per minute) or Hz

Stroboscopic Principle

With stroboscopy, high-speed periodic motion which cannot be followed by unassisted eyes can be made accessible for observation and its frequency measured. For this purpose the oscillating or rotating object is illuminated in a periodic series of light impulses (flashes) which are as brief as possible. The object then appears (at the appropriate flash frequency) to be motionless (stopped image) or slowed (slow-motion). The object's behavior and motion can thus be observed in all their details. At low frequencies in the flash rate (below about 30 Hz) a certain flickering of the image is unavoidable.
To make the visual perception appear real requires a solid-colored disc with a single eccentric mark.

Stopped image of the object

If the rotating object (or the mark) is to appear to the observer as a stopped image under stroboscopic light, the period T of the flash frequency must be a whole-number multiple n of the rotation period r:

$$T = Tn = nr$$

For the corresponding frequencies $f = 1/T$ and revolutions $v = 1/r$ the relationship is:

$$f = fn = 1\ v \mid n$$

The highest flash frequency ($n = 1$) which produces a stopped image of the object, i.e. the mark equals the revolutions: $f1 = v$ (stopped images in which the mark appears more than once still result from flash frequency $f > f1$).

The observed phase of the rotation in stopped image, i.e. the rotational angle at the moment of the flash, is purely accidental. Through brief changes in of the flash frequency however the desired phase position can be adjusted approximately. In the same way, RPM fluctuations can cause a change in phase position. Exact phase stability, i.e. sharply stopped image, can be achieved when the flash frequency is controlled externally by the moving object (does not apply for MINISTROB series 2000).

Measurement of RPM and frequencies

To measure the RPM v either the highest flash frequency $f1 = v$ which results in a stopped image of the object can be determined, or two neighbouring flash frequencies fn and $fn+1$ can be determined and from these the rotational frequency computed. For the periods for f and $fn+1$ in the flash frequency the equation is:

$$r = Tn+1 - Tn$$

From this we derive the frequencies:

$$v = fn \square fn+1 \mid fn - fn+1$$

Slow-motion cycle

If the period T of the flash frequency deviates slightly from a whole-number multiple $Tn = nr$ of the rotation time r of the object, i.e.

$$T = (n + e)\ r \text{ with } /e/ < 1$$

then the object no longer appears stopped, but has rotated through the angle 2e between two succeeding flashes. If /e/ is sufficiently small the eye perceives a constant slow-motion cycle. Angular speed w', at which the object appears to rotate, is given by:

$$w' = 2v' = 2\pi e = 2\pi e \qquad \frac{2\pi e}{T(n+e)\,r} \qquad \frac{2\pi e}{nr}$$

If we compare this with the true angular speed of the object, we obtain:

$$w' = (e \mid n)\,\pi w$$

For e > 0 (i.e. T > Tn and/or f > fn) w and w' have the same sign, so that true and apparent rotation are in the same direction.

The opposite holds for e < 0. With increasing /e/ the angular speed w' of the apparent rotation rises. Finally the angle 2πe becomes so large that the mark on the rotating disc appears at two different places during two succeeding flashes. Other phenomena (described below) also occur.

Stopped images of phantom objects

Stopped images of rotating objects results from flash frequency periods Tn = nr, and also at other flash frequencies. However, the latter represent phantom objects, not the real object. Using the example of the rotating disc with an eccentric mark , it is obvious that stopped images also occur when:

$$T=(n \mid k)r \qquad \text{and / or } f = (k \mid n)\,v,$$

whereby n and k are whole relatively-prime numbers. The stopped image shows k marks, which are arranged in the corner of a regular k-angle. Only a very few of the theoretically infinite number of flash frequencies result in observable images, since at each corner of the k-angle there is only one mark for k sequential flashes, but (k - 1) times no marks. As k increases then the images have less and less contrast. The images of the real object (k =1) always appear sharpest. In addition, the images become more and more faint at a given k with increasing n. The interval in which the mark is illuminated at one corner of the k-angle amounts to n rotation periods. In conclusion , the k mark images must not overlap. Altogether we may expect observable images only with low values of n and k. In objects with a complicated texture the phantom objects mostly disappear in an untextured background.

Objects with a finite rotational symmetry

In many cases the axis of the rotating object is an m-number symmetrical axis, i.e. the object overlaps itself through a rotation about the angle 2/m. In the example of the disc this is achieved through m equal marks which are arranged in the corners of a regular m-angle. In this case substitute r/n for the period r in the relationships derived above.
Stopped images of the real object therefore result from

$$T = (n + k)\,r \text{ and /or } f = (k + n)\,v,$$

In addition, stopped images of phantom objects also occur for

$$T = (n \mid k)\,\pi\,(r \mid m) \text{ and / or} \qquad f= (k \mid n)(m\pi v)$$

(k, m, n are whole numbers). If k and n are selected relatively-prime, k.m marks appear in the corners of a regular k.m-angle.

Maintenance and Repair

If the instrument is suspected of being unsafe, take it out of operation permanently. This is usually the case when the unit shows physical demage, no sign of functioning or stress beyond the tolerable limits. Repair, replacing parts, calibration ect. should be carried out by trained personnel only or preferably return it to the manufacturer for inspection and control.

TECHNICAL SPECIFICATIONS

Light source:	socket mounted Xenon Longlife
Frequency range:	continuously from 60 RPM to 20100 RPM / 1Hz to 335Hz
Trigger action:	internal by finger-tip keypad with cursor function, standby (after 5 minutes) with data-hold-function, automatic cut-off after 2 minutes in standby position , last measured value will be stored
Accuracy:	< 0,01% (f / Hz)
Display:	LCD readout 2x8 characters
Operating voltage:	230V AC or 115V AC / Accu pack Version – 12V DC
Current consumption:	70 mA / (90mA at 500Hz) standby 25 mA
Housing:	shatterproof plastic
Dimensions:	150 x 80 x 30 mm
Weight:	0,600 kos

Special unit with a max. flash frequency up to 30.000 RPM respect. 500 Hz at request.

In correspondence concerning the instrument, please quote the type number and serial number as given on the type plate underneath the bottom of the housing.

Information in accordance with battery regulation

With regard to the sale of batteries and accumulators, we are obligated as retailer to inform you as consumer about the following: you are legally obligated to return batteries and accumulators. You can return them after using in our shop, in a communal collection point or in local shops. Batteries containing hazardous substances are marked with a symbol consisting of a crossed out dustbin and the chemical symbol (Cd, Hg or Pb) for the heavy metal that has been the decisive factor for declaring the hazardousness.