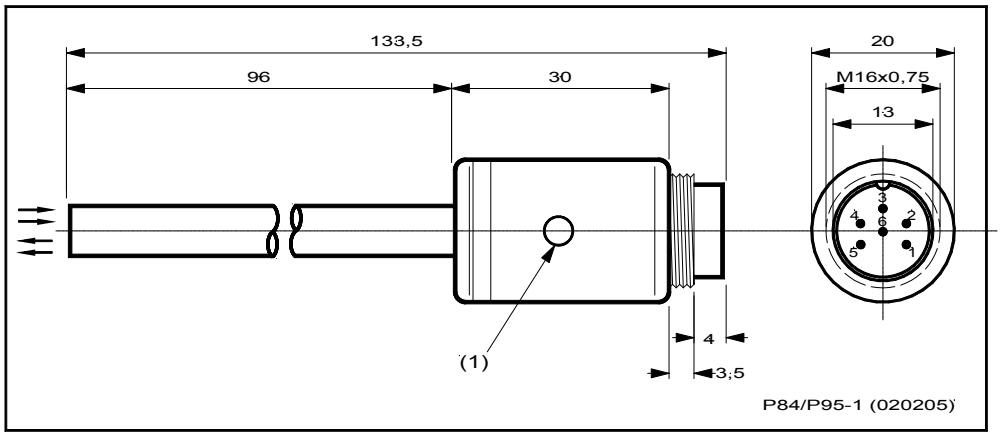
Optical Reference Sensor P - 95



Flg. 1 Reference sensor P-95

1 Application

The reference sensor P-95 is used predominantly for ***speed measurement*** and for establishing an ***angular reference*** with a rotating machine component.

Using the AC-185 connecting cable, it is connected directly to the VIBROTEST 60 vibration measuring instrument.

2 Operating Principle

The reference sensor operates according to the photoelectrical principle. It transmits a light beam to the rotating machine part. The light transmitted by the sensor is reflected by a ***reference mark*** that has been applied to the rotating component. A photo-transistor at the tip of the reference sensor is triggered by the reflected light, causing a change in the sensor‘s output signal.

The reference sensor is functioning correctly as long as the LED (1) is lit. This guarantees that the connected measuring instrument acquires the correct speed signal.

3 Technical Data

Optimum operating distance	***30 ... 40 mm***; with reflective tape SCOTCHLITE HIGH GAIN RP 7610 ***up to 100 mm***
Power supply	see Figure.2

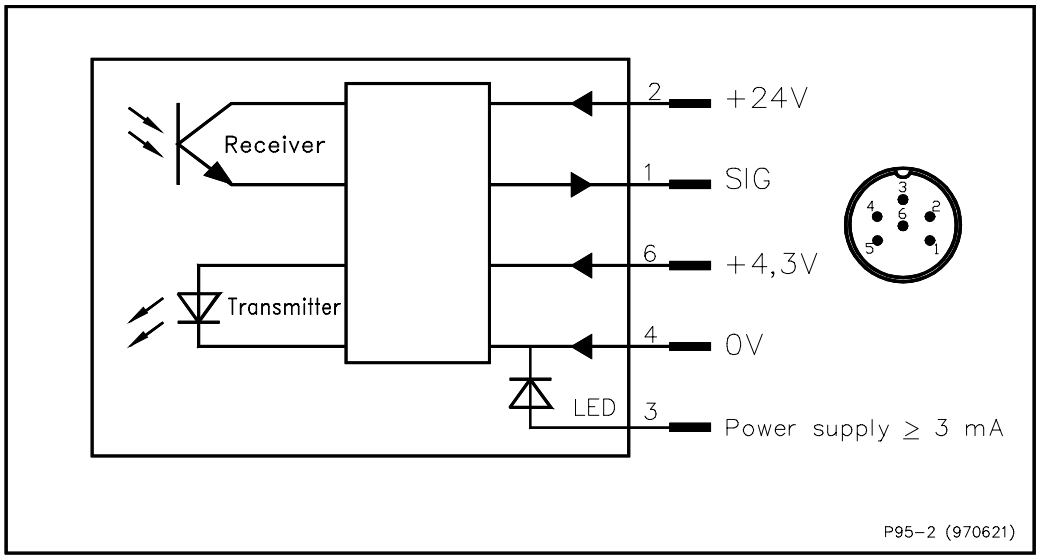


Fig. 2 Connections of P-95 sensor

Max. output level with vertical installation optimum operating distance and a highly reflective reference mark (shiny shaft, reflecting foil)	approx. 16.5 V
Min. output level with non-reflecting black mark and no foreign light intrusion (in practical operation the min. value is -0.2 V)	approx. 0 V
Input resistance R_E of connected measuring instrument	≥ 10 kΩ
Length of connecting cable	≤ 100 m
Operating temperature	0 °C ... + 50 °C
Storage temperature	-30 °C ...+ 100 °C
Protection class	IP 30
Weight	approx. 70 g (excluding connection cable)

4 Reference Mark

The reference mark, also called "bright/dark mark", is applied to a suitable point on the shaft surface. Its reflecting power should be clearly distinguishable from the surrounding surface.

It can be either light-absorbing or light-reflecting. The colour is of no importance. The mark may be attached to the circumference or to one end face of the shaft.

The ***light-absorbent*** mark can be, e.g. a

- matt black paint finish
- matt black adhesive tape
- sand-blasted surface

The ***light-reflective*** mark can be, e.g. a

- part of the shiny shaft itself
- strip of aluminium bronze
- piece of reflective tape

The mark must be at least 5 mm wide!

5 Mounting / Adjustment

- To fasten the reference sensor, we recommend using a magnetic stand.
- Normally the reference sensor needs to be installed perpendicular to the surface to be scanned, so that a sufficient quantity of the reflected light is received by the sensor.This is not necessary if the recommended reflective tape is used. This tape reflects the light in all directions and thus enables the sensor to be installed at an angle (see section 6).
- The tip of the reference sensor should be at a distance between 30 and 40 mm from the reference mark.
- The signal from the reference sensor depends on the width and reflecting power of the reference mark and its distance to the reference sensor (see Fig. 3).

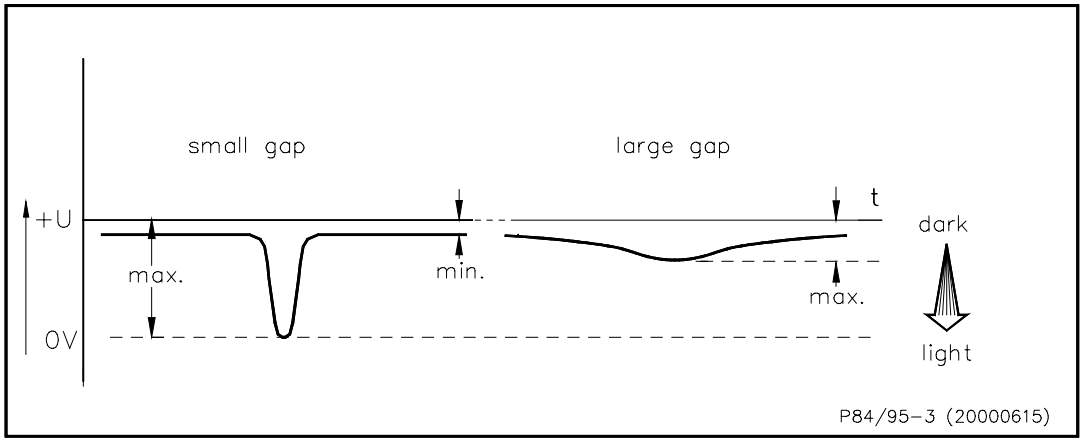


Fig. 3 Output signal as a function of distance

6 Problems with the reference signal ?

Even in a case where the reference sensor is correctly connected and the measuring instrument is correctly set up, the output signal of the reference sensor might not clearly distinguish between the reference mark and the surface of the rotating component. The electronic circuit is not able to trigger reliably.

Fig. 4a) to d) illustrate and describe the most frequent causes of this problem.

Fig. 4e) shows an ideal output signal.

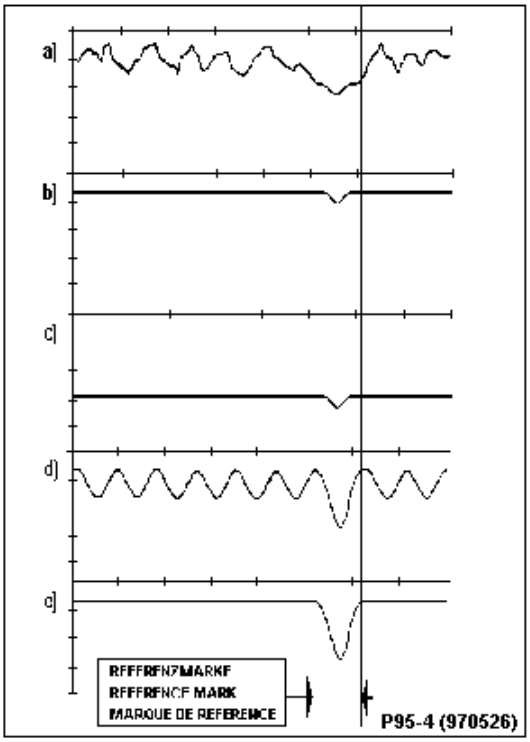


Fig. 4 *Output signal of the reference sensor under different conditions.*

a) Strong "noise" from the shaft surface (irregular reflections due to striations or surface irregularities) and the relatively low voltage rise in the area of the reference mark cause ***multiple triggering.***

b) If the distance is ***too large***, the amount of light emitted is insufficient. This causes insufficient rise of the output voltage and thus ***loss of reference***.

c) If the distance is ***too small*** (saturation of the receiving diode) or when ambient light is too strong, the voltage rise of the output signal might be drastically reduced and thus ***reference will be lost*** as mentioned under b).

d) Foreign scattered light from artificial light sources might cause ***multiple triggering***.

e) With correct conditions the signal level in the area of the reference mark can be clearly distinguished from that of the surrounding area and thus supplies a ***stable reference***.

Recommendations and corrective action

The problems described above can safely be avoided by using reflecting tape SCOTCHLITE GAIN RP 7610 (Manufacturer: 3M). This tape has the following decisive characteristics:

- ***Factor 1000 of Reflection compared with a white surface.***

  The foil can thus be used as a white mark even on highly shiny shaft surfaces.

- ***Reflection of light in all directions.***

  This characteristic permits an inclined setup of the reference sensor. This helps absorption of a large amount of reflected light whereas undesired reflections from the shaft are very weak or have no effect at all.

The typical problems described and the characteristics of the reflecting foil result in the following recommendations:

- The optimum distance between the reference sensor and the surface with the reference mark should be ***30 ... 40 mm***. The diode might reach saturation if the distance is < 20 mm.
- The optimum angle of the reference sensor vertical to the axis of shaft rotation should be ***0 ... 15°*** (see Fig. 5). Right-angled installation might lead to scattering of the reflected light; the reflected signal level will be too low at angles above 30°.

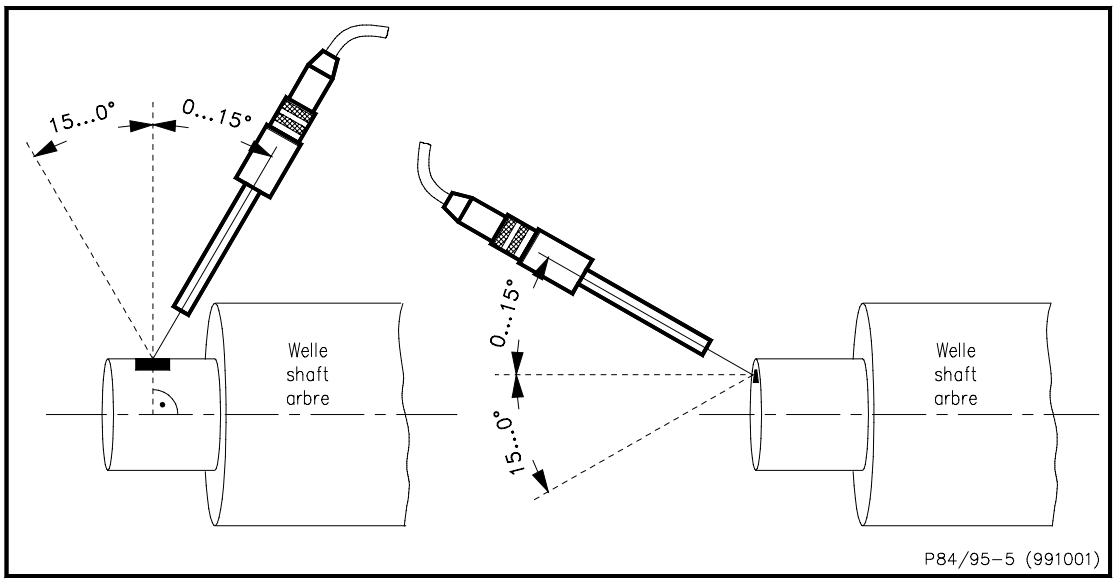


Fig. 5 *Optimum installation angle of the reference sensor*

Setting up using an oscilloscope

In case of doubt or problems, use an oscilloscope to examine the output signal of the reference sensor.