TRUMMETER

Precision instrument for measuring belt tension

Hilger u. Kern Industrial Technology

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A belt drive achieves its maximum lifetime when it is configured specifically to the application, the belt is perfectly tensioned and the pulleys are precisely aligned.
The TRUMMETER is an electronic measuring instrument that consists of a measuring probe and a microprocessor and is used for measuring the belt tension and checking the strand force of a belt drive.
The measurement result is displayed either in hertz, newtons or poundforce.
This measured value can be compared with the nominal value – specified by the belt drive manufacturer (as a natural frequency in Hz or a strand force in N). It is dependent on the characteristics of the drive. Alternative: it can be calculated with this formula :

$$F = \frac{540 \times P \times 1{,}3}{z \times v} + k + v^2 \quad [\text{ Newton }]$$

P = motor power [kW]
z = number of belts
v = belt speed = D x n / 19100
D = effective diameter of the small wheel [mm]
n = speed of the small wheel [rpm]
k x v ² = centrifugal force (for speed > 800 rpm)
k = weight of one belt [kg/m]

Product advantages

- Exact measurement of the belt tensioning force
- Exact calculation of the strand force
- Required for recording in accordance with DIN EN ISO 9001ff
- Operator prompts and measured value displays in 10 languages
- Simple and safe operation
- Compact and handy to use

Scope of delivery

The TRUMMETER is supplied in a strong plastic case.
Included in the scope of delivery are 2 measuring probes and a 9-V battery.

Measuring the belt tension [Hz]

The belt frequency can be measured only when the drive has been shut down and is stationary.
The fitted and taut drive belt is tapped in order to make it oscillate with its natural oscillation.
This static natural frequency is then measured by the probe with the aid of pulsed light. Care must be taken to ensure the light is sufficiently reflected by the belt.
The measured values are displayed in Hertz [Hz].

Measuring the strand force [N], [lbf]

To calculate the strand force, the frequency, the belt mass and the belt length are entered into the microcomputer, which calculates the actual strand force. The force calculated is compared with the specified value defined when the drive was designed (see additional calculation sheet).

The microcomputer calculates the strand force using the formula

$$T = 4 \cdot m \cdot L^2 \cdot f^2 \quad \text{or} \quad f = \sqrt{\frac{T}{4 \cdot m \cdot L^2}}$$

Where:

T = strand force in N
m = linear belt mass in kg/m
L = length of the free belt strand in m
f = natural frequency of the free belt measured in Hz

Measuring procedure

Measuring steps

1. Switch on the TRUMMETER.
2. Tap the drive belt so that it begins to oscillate with its natural oscillation.
3. Hold the measurement probe approximately at the center of the free strand length at a distance of 3 to 20 mm above the drive belt.
4. Successful measurement is acknow ledged by an acoustic signal and the indication “Measurement” appears on the display.
5. The measured value is displayed in Hz.

Switching value display mode

The measured values can also be displayed in newtons or in poundforce. Please refer to the section entitled “Menu structure” on Page 5 for instructions on how to switch display mode.

If no measurement results are displayed despite careful preparations, this may be due to one of the following two reasons:

1. The drive belt oscillates below the minimum measurement limit of 10 Hz.

   Remedy
   Tighten the belt or, if the strand length is very long and open, support the belt in order to shorten the strand length. Enter the new belt length before repeting measurement.

2. Either no or low measuring values are displayed despite the drive belt being correctly tensioned.

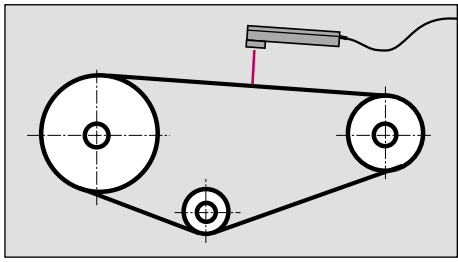
   Remedy
   It may be the case that the light from the measuring probe is not sufficiently reflected. To improve reflection, affix a piece of light-colored adhesive tape to

   the belt or slightly moisten the belt at the measuring point.

3. The battery must be exchanged when display shows “Low Bat”.

4. The unit will be automatically OFF after pauses longer than 8 minutes.

The distance between the drive belt and the measuring probe should be between 3 and 20 mm. See sketch for positioning.



Important note

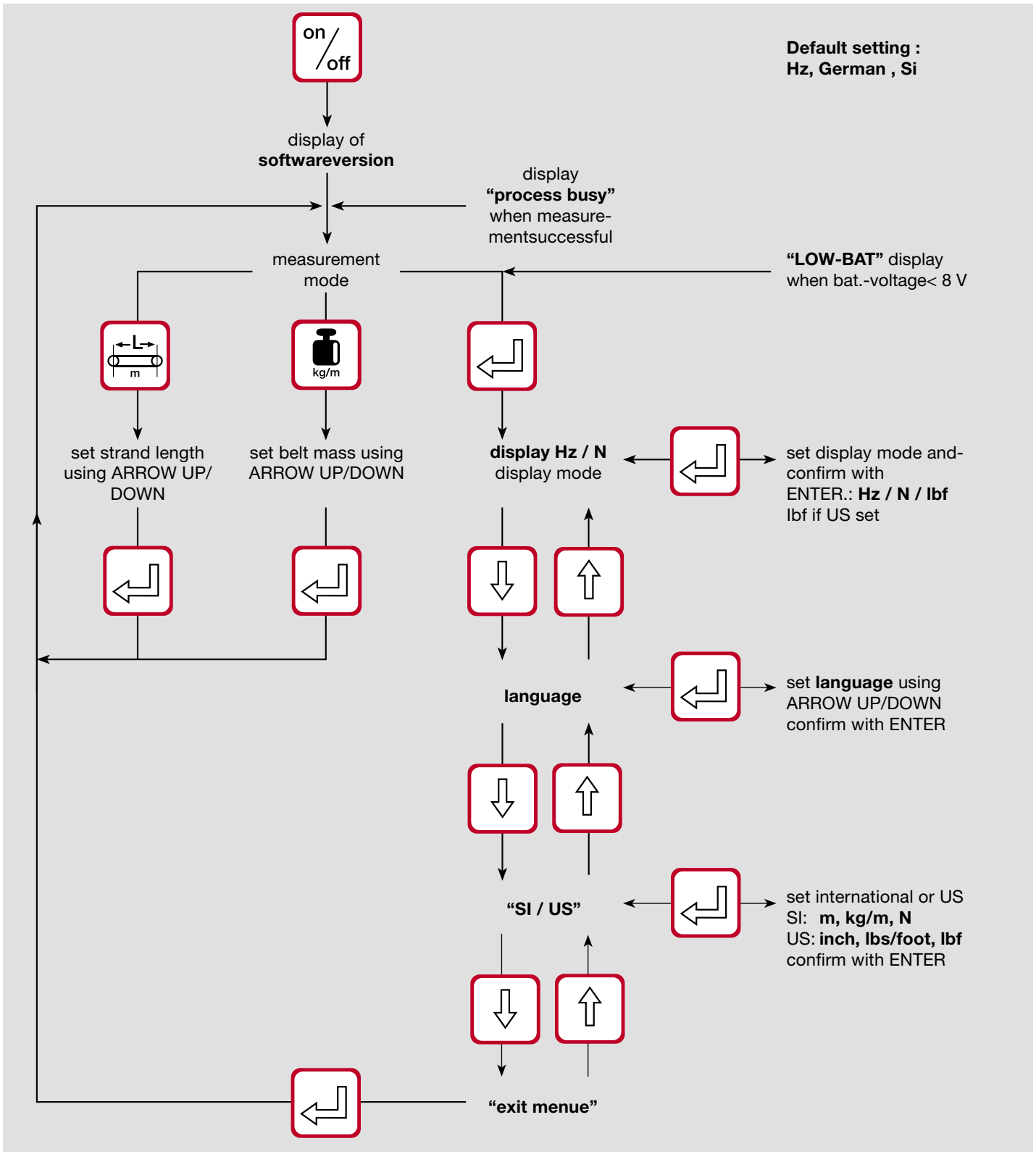
Preferably, the belt tension should always be measured at the center of the longer belt strand between the two drive pulleys.

Belt masses

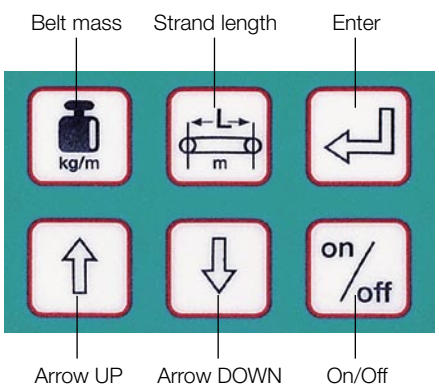
For a display in Newtons or poundforce adjust the device according the menu structure. Before beginning measurement , enter the belt-mass and strand length. For entering the mass see weight-symbol and press this key. Enter the value out of the list below. If not listed refer to the manufacturer’s data sheet, or weigh the drive belt and convert the mass to a value of 1 m belt length.
The length which is entered by length key is the value of the existing length beween 2 wheels.

Ribbed V-belts	PJ = 0.082 PM = 1.100	PL = 0.320	 kg/m per 10 ribs
V-belts	SPZ = 0.074 SPB = 0.195	SPA = 0.123 SPC = 0.377	 kg/m per belt
	10 = 0.064 17 = 0.196 22 = 0.324 32 = 0.668	13 = 0.109 20 = 0.266 25 = 0.420 40 = 0.958	 kg/m per belt
Power belts	SPZ = 0.120	SPA = 0.166	
	SPB = 0.261 3V/9J = 0.120 8V/25J = 0.693	SPC = 0.555 5V/15J = 0.252	kg/m per rib kg/m per rib
Polyurethane toothed belts	T 2,5 = 0.015 T 10 = 0,048	T 5 = 0.024 T 20 = 0.084	 kg/m per 10 mm width
	AT 3 = 0.023 AT 10 = 0.063	AT 5 = 0.034 AT 20 = 0.106	 kg/m per 10 mm width

Menu structure



Buttons on the membrane keyboard



Display

displays measured and calculated values in

German	Portugese
English	Swedish
Italian	Norwegian
French	Danish
Spanish	Finnish

display of parameters following the US – or international standards (Si)
Si = m, kg/m, N
US = inch, lbs/foot, lbf or Hz

Measuring probe

measures the natural frequency of the taut, free belt with the aid of pulsed light

Mounting note

Drive belts expand after mounting. Therefore the belt should be mounted 30 % above the calculated strand force value. After one hour check again.

Beside the best strand force consider the radial load of the bearings :

Radial load F – bearing = 2 x F - strandforce
Avoid an overload of the bearings!

Technical data

Measuring range	10 – 800 Hz
Digital sampling error	< 1%
Indication error	+/- 1 Hz
Total error	< 5%
Nominal temp.	+20° C,
Operating temp.	+10° ... +50°
Shipping temp.	-5° ... +50°
Casing	Plastic (ABS)
Dimensions, unit	80 x 126 x 37
Dimensions, case	226 x 178 x 50
Display	2-line LCD, 16 char./line
Languages	10
Input range:	
free strand length	up to 9.99 m
belt mass	up to 9.999 kg/m
Power supply	9-V battery

Note

Measurement deviations of up to +/- 10% for several measurements taken on the same drive belt are as a rule not caused by a measurement error or fault in the unit. In most cases, measurement deviations are due to the mechanical tolerances of the drive systems.

Attention! Newton- or poundforce – calculations have a square factor higher error result ($T = 4 \cdot m \cdot L^2 \cdot f^2$)!

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