Precision target wheel
ZAN/Z / ZAG / ZFM/N/Z
made of ferromagnetic steel

LENORD +BAUER
... automates motion.

Technical information ***Version 2015-08***

General

- 40 years of experience in the manufacture of precision target wheels
- Suitable for contactless magnetic scanning by magnetoresistive sensor elements for rotational speed detection and position acquisition
- Reference mark (tooth, flag, groove or gap) used for generating reference signals
- Suitable for attachment to shafts with a shaft diameter from 8 mm to over 500 mm
- Manufacturing of target wheels for speed and position detection with eddy current
- Straightforward installation due to complete manufacture with bores, threads, feather keyways etc.

Features

- Number of teeth: 25 to 1024
- Modules: 0.3 to 2.25
- Standard material: 16MnCr5, stainless steel optional
- Individual inside diameter optional with feather keyway to prevent twisting

Advantages

- Flexible mounting possibilities (shrinking, clamping, bolting in place)
- Prevention of twisting in relation to the shaft possible using feather keyway
- Multifunctional design, the target wheel can also be used as a bearing cover or shaft nut
- High flexibility in machine design due to individually adapted target wheels
- Highest precision through use of modern hobbing machines as well as turn/mill centers

Field of application

- Spindles in machine tool engineering
- Railway rolling stock
- Torque motors
- Vacuum pumps

Internet: www.lenord.com
E-Mail: info@lenord.de
Phone: +49 208 9963–0
Fax: +49 208 676292
Lenord, Bauer & Co. GmbH
Dohlenstraße 32
46145 Oberhausen, Deutschland

Description

Measuring systems

For the measurement of rotary movements, rotational speed and position sensors form a unit together with target wheels.
Magnetoresistive sensor elements scan contactlessly the structure of the ferromagnetic target wheel. The sensor generates it as sin/cos signals.
In many applications, eg. motors of machine tool spindles, speed signals are highly interpolated. To obtain optimal signals with high quality precision target wheels are required.

Use with MiniCODER

MiniCODERs acquire rotational speeds up to more than 100,000 min^{-1}. They provide square-wave signals (TTL, HTL) or sin/cos signals (1 V_{PP}) either with reference signal. The pulse detected can be used to reference the position. This feature is necessary, for example, to automatically change a tool in a milling spindle or a grinding spindle. The position of the reference mark defines the phase position of the reference signal in relation to the track signals. To ensure proper operation, MiniCODER and target wheel must fit together.

Standard target wheels

High precision standard target wheels (ZA) are available at short notice ex factory. They are made of ferromagnetic steel and available with reference mark flag, tooth or gap.

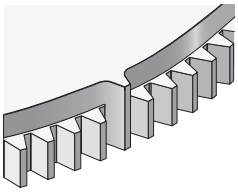
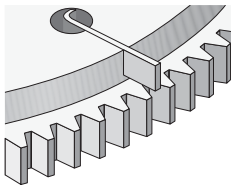
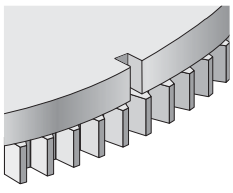
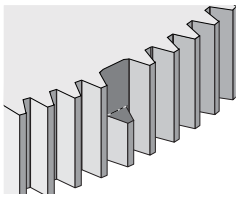
Customised target wheels

On request, customised target wheels are manufactured according to individual specifications. Please send us a dimensional drawing of your target wheel (if possible, as a dxf-file) to **info@lenord.de**.

Reference marks

The selection of the reference mark is defined by the size and rotational speed of the target wheel used, as both parameters have an effect on the forces acting on the reference mark.
Reference marks can be designed as flag (N), tooth (Z), groove (M) or gap (G). In case of new designs we recommend the usage of a target wheel with reference mark variant “**Z**”.

MiniCODER and target wheel combinations

Sensor type	**MiniCODER comfort / MiniCODER plus**				**MiniCODER basic**
Example	**2444K-x**	**2444KZx**	**2444KNx**	**2444KMx**	**2440TGx**
Target wheel					
Reference mark (RM)	without	tooth	flag	groove	gap
Standard	ZA**-**	ZA**Z**	ZA**N**	–	ZA**G**
Customised	ZF**-**	ZF**Z**	ZF**N**	ZF**M**	–
Figure					
Position of RM	–	aligned with a tooth	located between to teeth	located between to teeth	aligned with a tooth
Module	0,3 / 0,5 (others on request)				0,4 / 0,5
Maximum speed(1)	≥ 100,000 min^{-1}		≤ 30,000 min^{-1}	≥ 30,000 min^{-1}	≥ 100,000 min^{-1}
Manufactured	from a single piece		from a single piece, bonded metall flag(2)	composed of two parts	from a single piece

(1) Depending on the size and geometry of the target wheel, see section “Maximum rotaional speed”, → page 3
Please state the maximum rotaional speed at which the related target wheel is to be used. We will evaluate the application.

(2) The flag must be made of ferromagnetic material and must not protrude beyond the outside diameter of the target wheel.

Module and outside diameter

Depending on the application and sensor used, target wheels with different modules are used.
The module is a tooth parameter for target wheels and describes the relationship between the number of teeth and the pitch circle diameter.
For the majority of applications the amount of space available is limited, here the outside diameter is crucial.
The following applies:

$$d_a = m \cdot (z+2)$$

d_a = Outside diameter
m = Module
z = Number of teeth

Given the same number of teeth, the smaller the module the smaller outside diameter.

Maximum rotational speed

Size, inside diameter and design of the target wheel define the strength and the maximum permitted rotational speed.
In your enquiries please state the maximum rotational speed at which the related target wheel is to be used. We will then assess the feasibility.
In your enquiry please state the maximum rotational speed at which the target wheel is to be used. We will then evaluate the application.
In certain cases we undertake calculations using the FEM(1).

Identifier

All precision target wheels are marked with part number and serial number. The structure of the serial number is the same for all target wheels.

Item number according to type code

Example: ZAZ3.0256050.0	ZA: Standard target wheel Z: reference tooth 3.: Module 0.3 0256: number of teeth (256) 050.0: inside diamter 50.0 mm

Item number according to drawing

Example: ZFN1027.0	ZF: customised target wheel N: reference flag 1027: target wheel number 0: drawing status index 0

Serial number – structure

jjwwppppp ⇒ 1405000238	j: year of production⇒ (20)14 w: week of production ⇒ 05 p: sequential production number ⇒ 238

Typical rotational speed range for target wheels as a function of the inside diameter and reference mark

Number of teeth z	Module m	Inside diameter d_i [mm]	Outside diameter d_a [mm]	Reference mark, reference signal	Maximum rotational speed(a) n_{max} [1/min]
64	0.5	23	33	Z	90,000
64	0.3	10	19.8	Z	140,000
128	0.3	20	39	N	30,000
128	0.3	17	39	M	42,000
256	0.3	12	77.8	Z	50,000
256	0.3	50	77.8	Z	40,000
512	0.3	20	154.2	Z	18,000
512	0.3	125	154.2	Z	25,000

(a) Bores, thread, feather keyways not taken into account

(1) **F**inite **E**lement **M**ethod

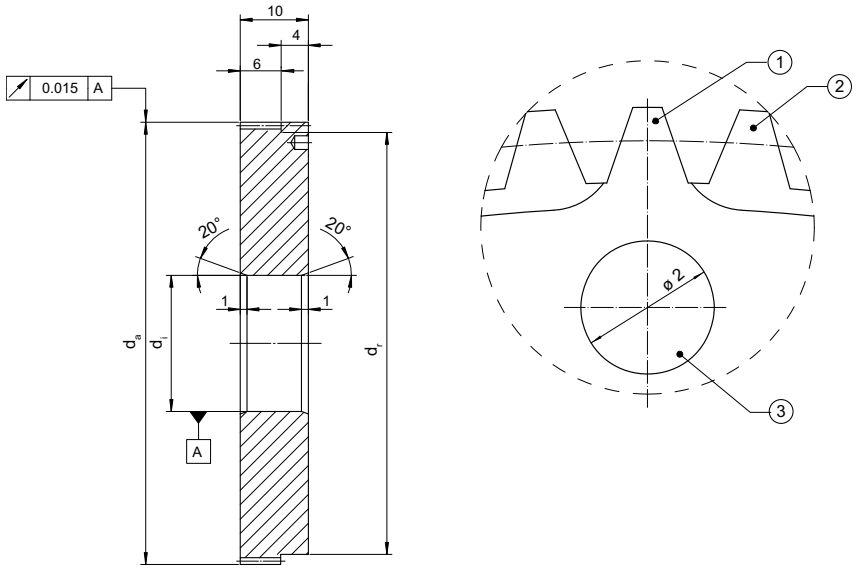
Standard target wheels ZA- / ZAZ / ZAN

Available ex-works on short delivery times

Type code

	Refernce mark			
	N	with reference mark flag, located between two teeth		
	Z	with reference mark tooth, aligned with a tooth		
	–	without reference mark		
		Module		
		3	Module 0.3	
		5	Module 0.5	
			Number of teeth	
			_ _ _ _	see table “design of standard target wheels”
				Inside diameter in mm
				_ _ _.__ for information on maximum and minimum diameter, see table “design of standard target wheels ”
ZA	_	_	_ _ _ _	_ _ _ _ _

Dimensional drawing standard target wheels with reference mark: tooth – ZAZ



① Reference mark Z (tooth on tooth)
② Target wheel
③ Balancing bore

all dimesions stated in mm

Design of standard target wheels ZAZ

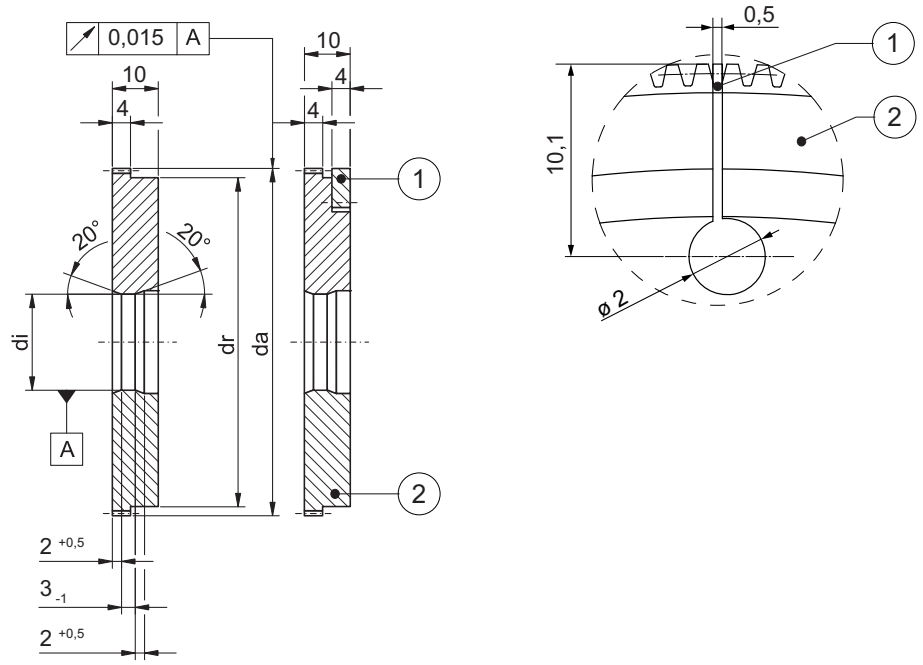
Number of teeth z	Module m [mm]	Outside ø da [mm]	Inside ø di min [mm]	Inside ø di max. [mm]	Shoulder ø dr [mm]
100	0.5	51.0	12 H7	30 H7	48
125	0.5	63.5	12 H7	40 H7	60.5
128	0.5	65.0	12 H7	40 H7	62
200	0.5	101	12 H7	70 H7	98
256	0.5	129	12 H7	90 H7	126
250	0.3	75.6	12 H7	45 H7	72.6
256	0.3	77.4	12 H7	50 H7	74.4
360	0.3	108.6	12 H7	70 H7	105

ø - diameter

Standard target wheels ZA- / ZAZ / ZAN

Available ex-works on short delivery times

Dimensional drawing standard target wheels with reference mark: flag – ZAN



① Reference mark (flag)
② Target wheel

all dimesions stated in mm

Design of standard target wheels ZAN

Number of teeth z	Module m [mm]	Outside ø da [mm]	Inside ø standard [mm]	Inside ø di max. [mm]	Shoulder ø dr [mm]
100	0.5	51.0	12 H7	30 H7	47
125	0.5	63.5	12 H7	40 H7	60
128	0.5	65.0	12 H7	40 H7	61
200	0.5	101.0	12 H7	70 H7	97
250	0.3	75.6	12 H7	45 H7	72
250	0.5	126.0	25 H7	85 H7	122
256	0.3	77.4	12 H7	50 H7	74
256	0.5	129.0	25 H7	90 H7	125
360	0.3	108.6	25 H7	70 H7	105
500	0.3	150.6	25 H7	110 H7	147
512	0.3	154.2	25 H7	110 H7	151

ø - diameter

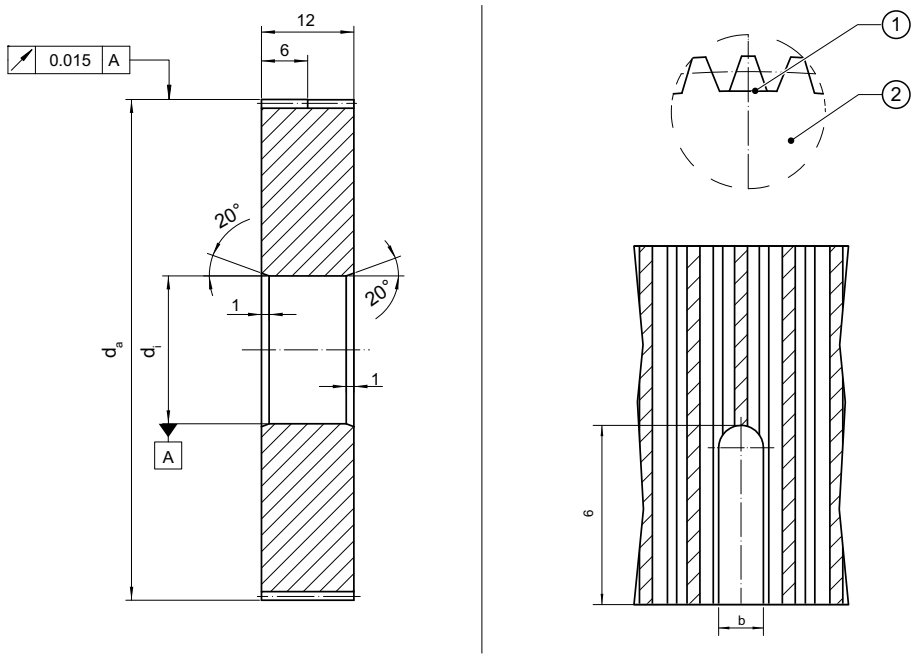
Standard target wheels ZAG

Available ex-works on short delivery times

Type code

	G				**Refernce mark** with reference mark gap, aligned with a tooth
		4 **5**			**Module** Module 0.4 Module 0.5
			_ _ _ _		**Number of teeth** see table “design of standard target wheels ”
				_ _ _.[1]_	**Inside diameter in mm** for information on maximum and minimum diameter, see table “design of standard target wheels ”
ZA	_	_	_ _ _ _	_ _ _ _ _	

Dimensional drawing standard target wheels with reference mark: gap – ZAG



all dimesions stated in mm

① Reference mark G (gap on tooth)
② Target wheel

Design of standard target wheels ZAG

Number of teeth z	Module m [mm]	Outside ø da [mm]	Inside ø di min [mm]	Inside ø di max. [mm]	Measure b(1)
128	0.5	65.0	12 H7	35 H7	1.5
256	0.5	129.0	12 H7	90 H7	1.5
128	0.4	52.0	12 H7	30 H7	1.2
256	0.4	103.2	12 H7	70 H7	1.2
384	0.4	154.4	12 H7	110 H7	1.2

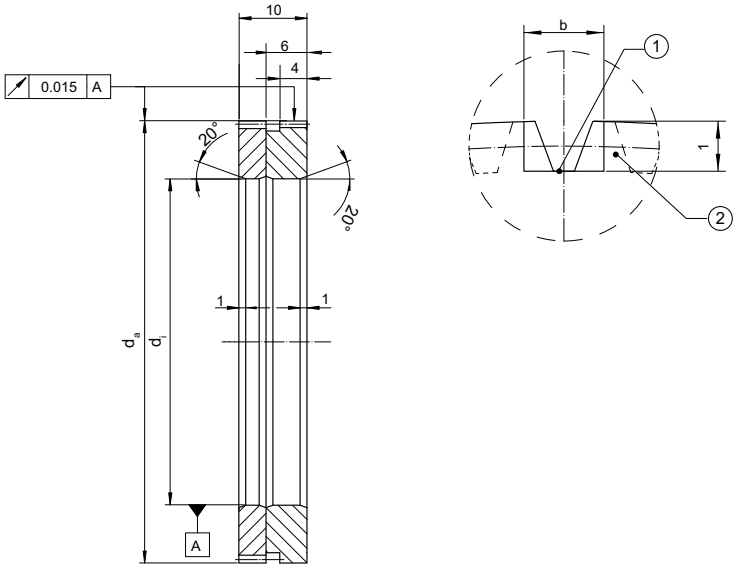
ø - diameter

(1) depends on modulel

Customised target wheels ZF- / ZFZ / ZFN / ZFM

manufactured according to drawing

Example – dimensional drawing of a target wheel with reference mark: groove – ZFM



b 1,2 … 1,6 (depends on module)
d_a outside diameter (depends on module and number of teeth)
d_i inside diameter

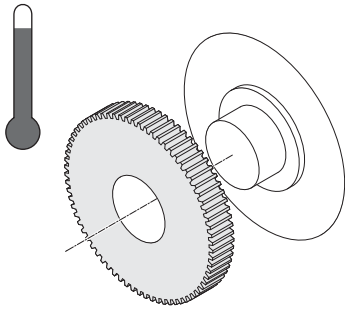
① reference mark M (groove)
② target wheel

all dimensions stated in mm

Assembly

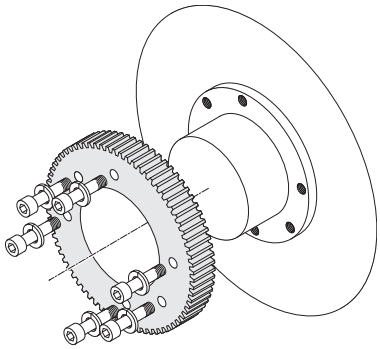
Shrinking

With this method the target wheel is not manufactured to exactly fit the shaft, instead the inside diameter is made slightly smaller. The target wheel cannot be fitted to the shaft at normal temperatures. By heating the target wheel the material expands and can be pushed onto the shaft. As the target wheel cools it shrinks and is pressed firmly onto the shaft.



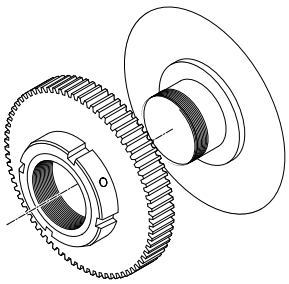
Bolting to shaft shoulder

The target wheel is pushed onto the shaft and fastened to the shaft shoulder using screws.



Clamping via shaft nut

The target wheel is pushed onto the shaft and pressed against this component using a shaft nut. Upon request the target wheel can also be equipped with an integrated shaft nut, for this purpose a corresponding thread is cut on the inside diameter.



Prevention of twisting in relation to the shaft

For special applications, feather keys between shaft and target wheel can be used to prevent relative rotation.