

# Produktinformation

Self Compensation Encoder  
SCE 1010/2010



# SCE - Guide

## Description:

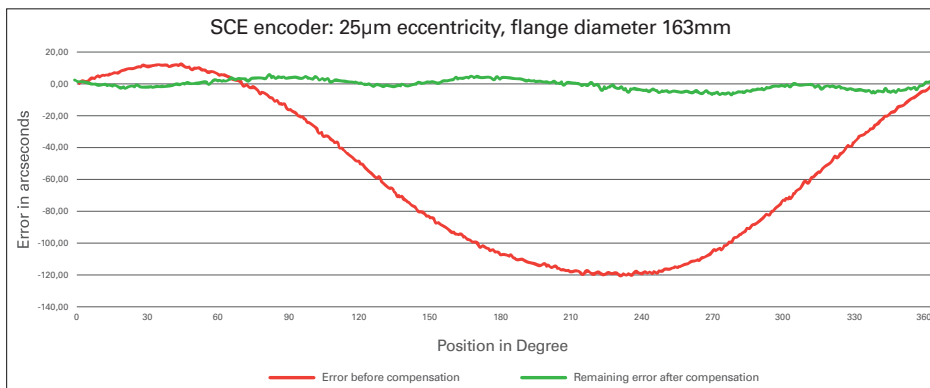
SCE (self-compensation encoder) is a paired measuring system consisting of an incremental read head and flange. As a system, it is able to compensate the following errors:

- Grating error of scale tape ring mounted on a flange.
- Eccentricity error of flange Prepared by AMO, for compensation at customer.
- Errors due to deformation of flange. Prepared by AMO, for compensation at customer.

The main advantage of this measuring system, in comparison to traditional axis calibration with external reference, is the ease of use as well as the accuracy reached. The measuring flange and reading head will be mounted similar to a standard encoder. To start the calibration process using the AMO-check software tool a laptop must be connected to the encoder through the STU60 signal testing unit. After at most three rotations of the axis, the calibration is done and can be stored in the encoder.

The calibration only takes a few minutes, is very accurate, repeatable and no external reference is necessary.

This self-compensation feature represents a big advantage during commissioning of an axis. It is no longer necessary to mount a finicky external reference, thus saving time and cost. In addition, measurement through external reference can be tricky. Small mounting and adjustment errors can lead to invalid results, increasing the axis error in the worst case.



The diagram shows an example of an encoder setup with a measuring flange, 163mm outer diameter, mounted with 25µm eccentricity.

The red graph shows the error curve before compensation.

The remaining error curve after a completed compensation process is shown on the green graph.

## Functional Description:

The compensation of the eccentricity and flange form error without an external reference is possible through the analysis of the internal signals measured by the encoder as well as preparation of the encoder at the AMO measuring lab.

## Preparation at AMO:

The encoder gets its initial calibration in the measuring lab at AMO. This includes standard calibration done to all encoders, compensation for the grating error of the scale tape ring as well as additional determination of the characteristics of the electronics and sensor.

Those characteristics allows the SCE to measure the eccentricity and deformation errors of the mounting flange based only on internal encoder signals.

## Compensation at the customer:

Eccentricity and form errors cause signal deviations, which are measured by the encoder. Through analysis of those deviations and knowledge of the encoder characteristics, the resulting error of those deviations can be determined through special algorithms and in turn compensated.

In order to measure those deviations, certain compensation mechanisms of the encoder have to be deactivated during calibration.

For this purpose the encoder has two modes:

## Calibration mode:

Used for measuring and compensating eccentricity and form errors.

The deactivated compensation mechanisms will lead to an increased interpolation error in comparison to the normal operating mode.

As such, this mode should only be used for calibration.

SCE encoders will be shipped with this mode activated, allowing for quick calibration at the customer site.

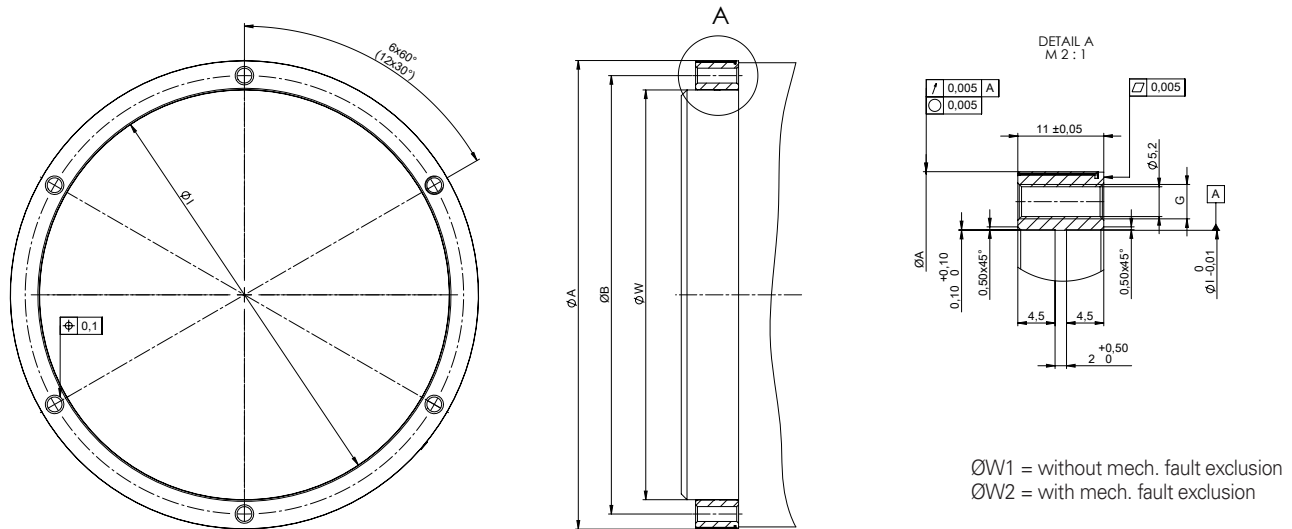
## Normal operation mode:

All compensation mechanisms are activated and interpolation errors are minimized. Switch to this mode after calibration!

TTL output signals of the encoder are present and valid in both modes.

For detailed information regarding the compensation process please see document 1444896.

# Measuring flange



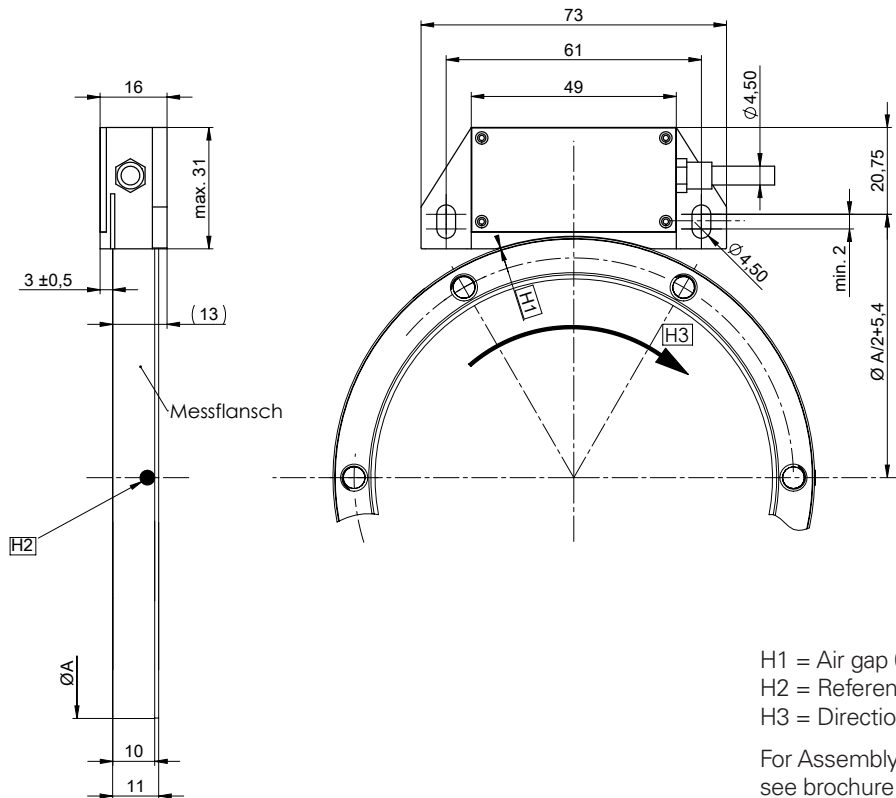
| Line count | Type of graduation carrier | Ø A    | Ø I          | Ø W1            | Ø W2            | Ø B | G       |
|------------|----------------------------|--------|--------------|-----------------|-----------------|-----|---------|
| 256        | AA01                       | 81,95  | 60 +0/-0,01  | 60 +0,02/+0,01  | 60 +0,05/+0,04  | 70  | 6 x M6  |
| 360        | AA02                       | 115,12 | 60 +0/-0,01  | 60 +0,02/+0,01  | 60 +0,05/+0,04  | 75  | 6 x M6  |
| 360        | AA03                       |        | 95 +0/-0,01  | 95 +0,02/+0,01  | 95 +0,05/+0,04  | 105 | 6 x M6  |
| 512        | AA05                       | 163,54 | 105 +0/-0,01 | 105 +0,02/+0,01 | 105 +0,05/+0,04 | 120 | 6 x M6  |
| 512        | AA06                       |        | 143 +0/-0,01 | 143 +0,02/+0,01 | 143 +0,05/+0,04 | 153 | 6 x M6  |
| 720        | AA08                       | 229,78 | 180 +0/-0,01 | 180 +0,02/+0,01 | 180 +0,05/+0,04 | 195 | 6 x M6  |
| 720        | AA09                       |        | 209 +0/-0,01 | 209 +0,02/+0,01 | 209 +0,05/+0,04 | 219 | 6 x M6  |
| 900        | AA10                       | 287,08 | 180 +0/-0,01 | 180 +0,02/+0,01 | 180 +0,05/+0,04 | 195 | 12 x M6 |
| 900        | AA11                       |        | 266 +0/-0,01 | 266 +0,02/+0,01 | 266 +0,05/+0,04 | 276 | 12 x M6 |
| 1024       | AA12                       | 326,55 | 220 +0/-0,01 | 220 +0,02/+0,01 | 220 +0,05/+0,04 | 235 | 12 x M6 |
| 1024       | AA13                       |        | 296 +0/-0,01 | 296 +0,02/+0,01 | 296 +0,05/+0,04 | 311 | 12 x M6 |

| Measuring Flange<br>1000µm |  | WMF 1010A |        |    |        |     |        |     |        |     |         |
|----------------------------|--|-----------|--------|----|--------|-----|--------|-----|--------|-----|---------|
| Line Count                 |  | 256       | 360    |    | 512    |     | 720    |     | 900    |     | 1024    |
| Outside diameter [mm]      |  | 81,95     | 115,12 |    | 163,54 |     | 229,78 |     | 287,08 |     | 326,55  |
| Inside diameter [mm]       |  | 60        | 60     | 95 | 105    | 143 | 180    | 209 | 180    | 266 | 220 296 |

## SCE 2010 series

- In combination with scale tape ring on flange WMF 1010A
- Grating period 1000µm
- Scanning head with internal electronic

Series 20

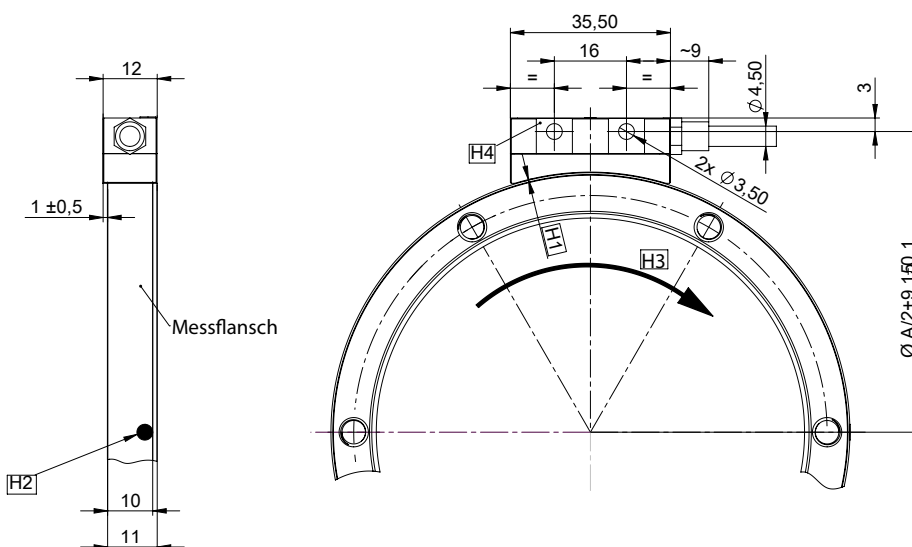


H1 = Air gap 0,150 ± 0,10mm, set with spacer foil  
H2 = Reference track marking  
H3 = Direction of shaft rotation for positive counting  
For Assembly drawing of other reading head designs  
see brochure „Angle encoders“ ID: 1244264

## SCE 1010 series

- In combination with scale tape ring on flange WMF 1010A
- Grating period 1000µm
- Scanning head with external electronic

Series 10 or 12



 Tolerance principle in accordance with ISO 8015  
General tolerances in accordance with ISO 2768-mH  
All dimensions in mm

H1 = Air gap 0,15 ± 0,10mm, set with spacer foil  
H2 = Reference track marking  
H3 = Direction of shaft rotation for positive counting  
H4 = Ground plane (both sides)

# Technical data

| Scanning head<br>1000µm                         |                                                                                       | SCE 1010 / 2010 |       |      |      |       |
|-------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|-------|------|------|-------|
| Performance                                     | High Dynamic                                                                          |                 |       |      |      |       |
| Interface                                       | TTL                                                                                   |                 |       |      |      |       |
| Position error per grating period               | ± 0,5µm                                                                               |                 |       |      |      |       |
| TTL- interpolation/ <sup>1)</sup>               |                                                                                       |                 |       |      |      |       |
| Signal period <sup>1)</sup><br>Interpolation    | 0,5µm or 0,1µm<br>500 or 2500                                                         |                 |       |      |      |       |
| Max. output frequency                           | 5MHz                                                                                  |                 |       |      |      |       |
| Electrical connection                           | Cable with M23 coupling 12pin male                                                    |                 |       |      |      |       |
| Cable length on the scanning head               | 0,50m- 6,00m                                                                          |                 |       |      |      |       |
| Power supply                                    | TTL: DC 5,0V +/- 0,5V                                                                 |                 |       |      |      |       |
| Power consumption                               | Series 10,12: ≤ 1500mW at 5V<br>Series 20: ≤ 1300mW at 5V                             |                 |       |      |      |       |
| Typ. current consumption                        | Series 10,12: ≤ 250mA at 5V (without load)<br>Series 20: ≤ 250mA at 5V (without load) |                 |       |      |      |       |
| Vibration                                       | < 200m/s² for 55- 2000Hz                                                              |                 |       |      |      |       |
| Shock                                           | < 2000 m/s² for 6ms                                                                   |                 |       |      |      |       |
| Operating temperatur range                      | -10°C to 100°C                                                                        |                 |       |      |      |       |
| Storage temperature range                       | -20°C to 100°C                                                                        |                 |       |      |      |       |
| Protection                                      | IP67                                                                                  |                 |       |      |      |       |
| Weight scanning head                            | 10g Series 10,12<br>38g Series 20                                                     |                 |       |      |      |       |
| Line count                                      | 256                                                                                   | 360             | 512   | 720  | 900  | 1024  |
| System accuracy after compensation              |                                                                                       |                 |       |      |      |       |
| High Dynamic                                    | ±20″                                                                                  | ±15″            | ±10″  | ±10″ | ±10″ | ±7,5″ |
| Max. electrical max. speed [min <sup>-1</sup> ] |                                                                                       |                 |       |      |      |       |
| Interpolation 500                               | ≤2300                                                                                 | ≤1600           | ≤1150 | ≤800 | ≤650 | ≤550  |
| Interpolation 2500                              | ≤460                                                                                  | ≤330            | ≤230  | ≤160 | ≤130 | ≤110  |

<sup>1)</sup> After 4-edge evaluation

# Ordering code

SCE10 HD . 07 - - - - - 1 R M - , - - - - - - - - -

**Scanning**  
Outside  
10 = scanning head miniature  
20 = scanning head with integrated electronics

**Performance**  
HD = High Dynamic

**Interface**  
07 = TTL

**Interpolation/ Dividing factor**

|    |          |     |
|----|----------|-----|
|    |          | TTL |
|    |          | HD  |
| A4 | 500-fold | x   |
| A9 | 2500fold | x   |

**Line count**  
256  
360  
512  
720  
900  
1024

**Reference mark position**  
1RM = with 1 reference mark

**Design of the scanning head**  
10 = Miniaturized connector with electronics on cable, output M23  
12 = Miniaturized, pluggable connector with electronics on cable via M12 connector  
20 = Standard

**Cable length**  
0,50 = 0,50m  
1,00 = 1,00m  
1,50 = 1,50m  
2,00 = 2,00m  
2,50 = 2,50m  
3,00 = 3,00m  
4,00 = 4,00m  
5,00 = 5,00m  
6,00 = 6,00m

**Pin configuration**  
UJ = 01, 02S12, 03S12, 27S12  
J5 = 16S15

**Electrical connection**  
01 = Free cable end  
02S12 = M23-12 pin connector male  
03S12 = M23-12 pin coupling male  
16S15 = D-Sub-15 pin 2-row male  
27S12<sup>1)</sup> = Flange socket M23 12pin. male

**Type of graduation carrier**

| Standard Graduation carrier | Line count | Ø A    | Ø I          |
|-----------------------------|------------|--------|--------------|
| AA01                        | 256        | 81,95  | 60 +0/-0,01  |
| AA02                        | 360        | 115,12 | 60 +0/-0,01  |
| AA03                        |            |        | 95 +0/-0,01  |
| AA05                        |            |        | 105 +0/-0,01 |
| AA06                        | 512        | 163,54 | 143 +0/-0,01 |
| AA08                        | 720        | 229,78 | 180 +0/-0,01 |
| AA09                        |            |        | 209 +0/-0,01 |
| AA10                        |            |        | 180 +0/-0,01 |
| AA11                        | 900        | 287,08 | 266 +0/-0,01 |
| AA12                        | 1024       | 326,55 | 220 +0/-0,01 |
| AA13                        |            |        | 296 +0/-0,01 |

<sup>1)</sup> Electrical connection for miniturized design of the scanning head 10 and 12.

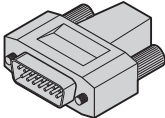
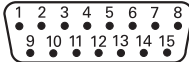
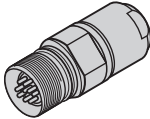
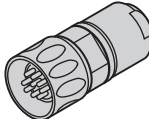
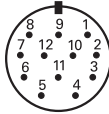
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# Cable

## • Technical Data

|                         | Cable for incremental encoder and SSI+1Vpp     |
|-------------------------|------------------------------------------------|
| Jacket                  | PUR, high flexible, suitable for energy chains |
| Diameter                | 4,5 +/-0,1mm                                   |
| Wires                   | 6x2x0,09mm <sup>2</sup>                        |
| Bending radius          | ≥ 10mm for single bending                      |
|                         | ≥ 50mm for continuous bending                  |
| Max. length             | 6m                                             |
| Resistance according to | UL according to Style 20963 80°C 30V           |

## Pin configuration

|                                                                                                                                                                                                                                                                                                                               |                      |                                 |                 |                      |                     |           |                                                                                                                                                                                                                                                                                                                                      |           |           |           |               |              |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------|-----------------|----------------------|---------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|---------------|--------------|--------------|
| <b>Electrical connection: 16S15</b><br><b>15-pin Sub-D-connector</b>     |                      |                                 |                 |                      |                     |           |                                                                                                                                                                                                                                                                                                                                      |           |           |           |               |              |              |
| <b>Electrical connection: 03S12</b><br><b>12-pin coupling M23</b>    |                      |                                 |                 |                      |                     |           | <b>Electrical connection: 02S12</b><br><b>12-pin connector M23</b>    |           |           |           |               |              |              |
|                                                                                                                                                                                                                                                                                                                               | Power supply         |                                 |                 |                      | Incremental signals |           |                                                                                                                                                                                                                                                                                                                                      |           |           |           | Other signals |              |              |
|                                                                                                                                                                                                                                            | 4                    | 12                              | 2               | 10                   | 1                   | 9         | 3                                                                                                                                                                                                                                                                                                                                    | 11        | 14        | 7         | 5/15          | 8            | 6            |
|                                                                                                                                                                                                                                             | 12                   | 2                               | 10              | 11                   | 5                   | 6         | 8                                                                                                                                                                                                                                                                                                                                    | 1         | 3         | 4         | /             | 7            | 9            |
|                                                                                                                                                                                                                                                                                                                               | <b>U<sub>P</sub></b> | <b>Sensor</b><br>U <sub>P</sub> | <b>0 V</b>      | <b>Sensor</b><br>0 V | <b>A+</b>           | <b>A-</b> | <b>B+</b>                                                                                                                                                                                                                                                                                                                            | <b>B-</b> | <b>R+</b> | <b>R-</b> | <b>Free</b>   | <b>Diag+</b> | <b>Diag-</b> |
|                                                                                                                                                                                                                                             | brown/<br>green      | blue                            | white/<br>green | white                | brown               | green     | grey                                                                                                                                                                                                                                                                                                                                 | pink      | red       | black     | /             | violet       | yellow       |

**Cable Shield** is connected with the housing; **U<sub>P</sub>** = Power supply voltage

**Sensor:** The sensor wire is connected internally with the corresponding power supply.

Non-used pins or wires must not be assigned!

DIAG-wires must not be assigned!

DIAG-signals are for checking the encoder with AMO-STU-60

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