

## robolink® D output angle sensors

### Basics

igus® GmbH develops plastic robotics joints, and produces and harnesses these under the product group robolink® Joint kit. igus currently offers 2 different joint types, (version -101 = „symmetrical“ with 2 PRT bearings and version -102 = „asymmetrical“ with 1 PRT bearing and one fixed cover), res. 3 different joint sizes (-20, -30 and -50) that can be combined as joint arms.

This provides options to configure and design customized articulated arms for a variety of customer applications.

Articulated arms can be equipped with angle sensors for positioning purposes. The angle position of the joint is determined and electronically output (incremental magnetic sensor system). The angle sensors include a Hall Sensor for the definition of a Zero position for each joint.

igus® GmbH offers step motors in various configurations as one possible drive technology.

A control (in this case: step motor control) is needed to move a robolink® articulated arm. igus® GmbH does not offer or supply these controls and other electrical and electronic components.



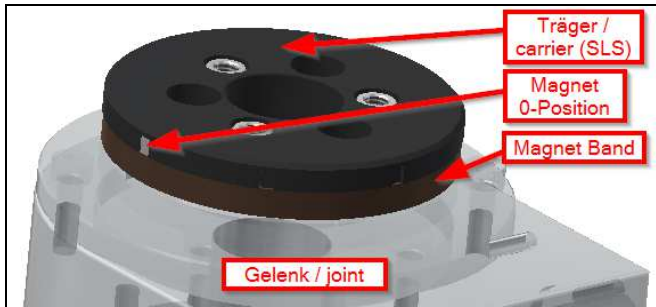
*Pic. 1: RL-D Joints by igus, 3 Sizes*

## Angle sensors

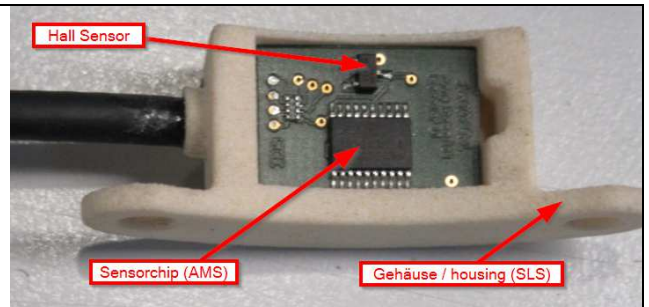
roboLink® sensors are magnetic incremental angle sensors. Each axis (DOF) has (optional) one magnetic ring and one associated sensor chip. The magnetic rings are specified as follows:

|         |                 |                                    |
|---------|-----------------|------------------------------------|
| RL-S-17 | 31 pole pairs*  | 1 south pole added (square magnet) |
| RL-D-20 | ~47 pole pairs* | 1 south pole added (square magnet) |
| RL-D-30 | ~63 pole pairs* | 1 south pole added (square magnet) |
| RL-D-50 | ~94 pole pairs* | 1 south pole added (square magnet) |

\*) in our strain wave gears (RL-S-17, 5<sup>th</sup> axis) we use a magnetic ring with exact pole number. In our worm gears (RL-D) a magnet band is used which is fixed in radial direction on the output ring of the joint (see pic. 2). With these, it is not possible to measure full 360° rotations! The exact number of pole pairs (signals) can vary due to tolerances (variation <1%).



Pic. 2: magnetic ring RL-D-20 with south pole



Pic. 3: Sensor chip in housing with hall sensor



Pic. 4: Prototype assembly of the sensor with joint RL-D-20

The encoder from Austriamicrosystems (=> Spec sheet download at <http://ams.com/eng/Products/Magnetic-Position-Sensors/Linear-Position/AS5304>) determines 4x40=160 A/B signals per pole pair.

This permits the following resolutions per axis:

|         | Number of pulses / channel | Number of signals (Quadratur) | Resolution |
|---------|----------------------------|-------------------------------|------------|
| RL-S-17 | 1.240                      | 4.960                         | 0,07°      |
| RL-D-20 | ~1.885                     | ~7.540                        | 0,05°      |
| RL-D-30 | ~2.513                     | ~10.053                       | 0,04°      |
| RL-D-50 | ~3.770                     | ~15.080                       | 0,02°      |

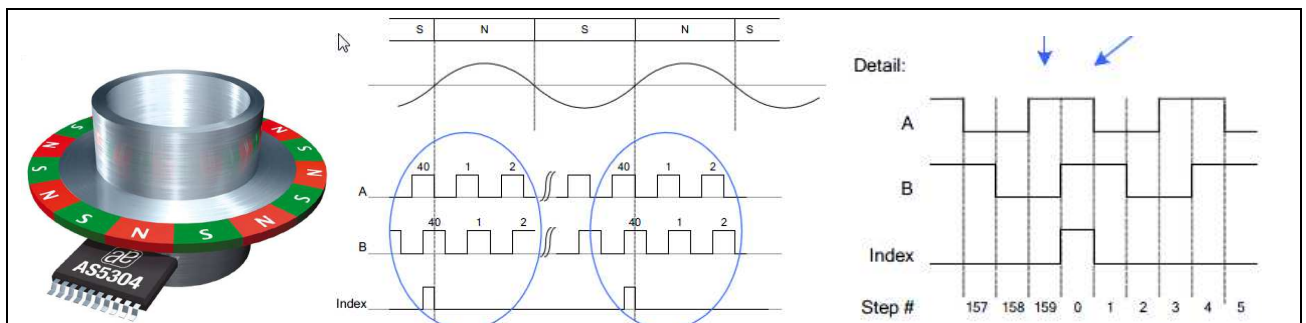


Abb. 5: A/B and index signals from the encoder chip

The Hall Sensor Honeywell SS443A is used to reference the system (home position). As soon as the hall sensor is triggered by the magnet, a green LED light shows up (see pic. 4).

**Each joint axis must be reinitialized (homed) after a power failure.**

Each axis (DOF) has 6 conductors. The corresponding strands are assigned as follows:

|                         |                      |
|-------------------------|----------------------|
| producer                | igus                 |
| line name               | FIXFLEX FF900.11.282 |
| number of conductors    | 12                   |
| conductor cross section | 0,09                 |
| line diameter [mm]      | 3,9                  |
| usage                   | from 04.2012         |
| +5V                     | red                  |
| GND                     | black                |
| Hall-Sensor             | white                |
| Encoder Index           | green                |
| Encoder Channel A       | blue                 |
| Encoder Channel B       | yellow               |

Pic. 6: Cable definition - igus® sensor cables