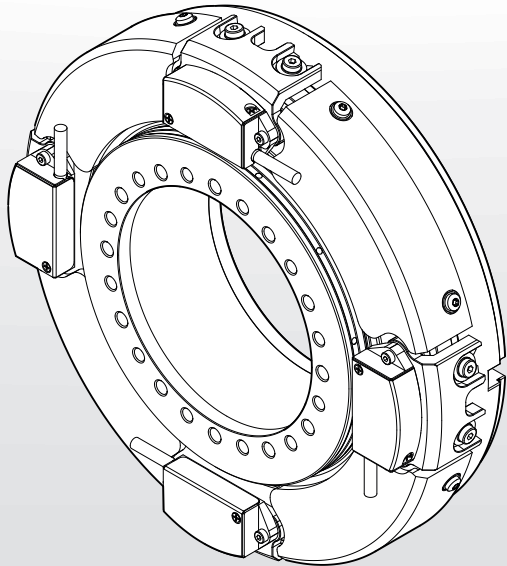




HEIDENHAIN



MRP 8181 *Dplus*

Initial Setup Instructions

Table of contents

1	Basic information.....	3
1.1	Validity of the documentation.....	3
1.2	Target groups for the instructions.....	3
1.3	Notes on reading the documentation.....	4
1.4	Notes in this documentation.....	5
2	Installation.....	6
2.1	General information.....	6
2.2	Definition of the scanning heads.....	7
2.3	Connecting the encoder.....	7
3	Initial setup.....	8
3.1	Overview.....	8
3.2	Notes.....	9
3.3	Principle of distance-coded reference marks.....	9
3.4	Finding the reference position.....	10
3.5	Determining the reference offset.....	10
3.6	Calculating the position value.....	11

1 Basic information

This chapter contains information about the product and these instructions.

1.1 Validity of the documentation

These Initial Setup Instructions apply to encoders of the MRP 8181 Dplus series.

- ▶ Prior to using the documentation, check whether the documentation and encoder model match

The encoder designation is printed on the ID label.

1.2 Target groups for the instructions

These instructions must be read and observed by every person who performs any of the following tasks:

- Initial setup and configuration

1.3 Notes on reading the documentation

WARNING

Fatal accidents, personal injury or property damage caused by non-compliance with the documentation!

Failure to comply with the documentation may result in fatal accidents, personal injury or property damage.

- ▶ Read the documentation carefully from beginning to end
- ▶ Keep the documentation for future reference

The following table lists the various parts of the documentation in their order of reading priority.

Document type	Description
Addendum	An Addendum supplements or supersedes the corresponding contents of the Operating Instructions and, if applicable, of the Mounting Instructions. If an Addendum is included in the shipment, it has the highest reading priority. All other documentation content retains its validity.
Operating Instructions	The Operating Instructions contain all of the information and safety instructions for the proper and intended operation of the product. The Operating Instructions (English language version) are included in delivery and can also be downloaded in other languages from www.heidenhain.com/documentation . The Operating Instructions must be read prior to initial operation of the product. The Operating Instructions have the second highest reading priority.
Mounting Instructions	The Mounting Instructions contain all the information and safety precautions needed for the proper mounting and installation of a product. The Mounting Instructions are not included in delivery and must be downloaded from www.heidenhain.com/documentation .
Initial Setup Instructions	The Initial Setup Instructions provide all the information and safety precautions needed for proper initial setup of the product.

Have you found any errors or would you like to suggest changes?

We are continuously striving to improve our documentation for you. Please help us by sending your suggestions to the following e-mail address:

userdoc@heidenhain.de

1.4 Notes in this documentation

Safety precautions

Precautionary statements warn of hazards in handling the product and provide information on their prevention. Precautionary statements are classified by hazard severity and divided into the following groups:

DANGER

Danger indicates hazards for persons. If you do not follow the avoidance instructions, the hazard **will result in death or severe injury**.

WARNING

Warning indicates hazards for persons. If you do not follow the avoidance instructions, the hazard **could result in death or serious injury**.

CAUTION

Caution indicates hazards for persons. If you do not follow the avoidance instructions, the hazard **could result in minor or moderate injury**.

NOTICE

Notice indicates danger to material or data. If you do not follow the avoidance instructions, the hazard **could result in property damage**.

Informational notes

Informational notes ensure reliable and efficient operation of the product. Informational notes are divided into the following groups:



The information symbol indicates a **tip**.
A tip provides important additional or supplementary information.



The book symbol indicates a **cross reference**.
A cross reference leads to external documentation, for example: further documentation from HEIDENHAIN or another supplier.

2 Installation

This chapter describes the installation of the product. It contains information about the product's connections and instructions about how to correctly connect encoders.

2.1 General information

The connections on the product are protected by dust protection caps from contamination and damage.

NOTICE

Contamination or damage may result if the dust protection caps are missing!

This may impair the proper functioning of the contacts or destroy them.

- ▶ Remove dust protection caps only when connecting measuring devices or peripherals
- ▶ If you remove a measuring device or peripheral, re-attach the dust protection cap to the connection

NOTICE

Incorrect voltage supply range and incorrect wiring!

Danger of product damage and damage to the downstream electronics

- ▶ Do not engage or disengage the connecting cable between the encoder and the downstream electronics while under power

NOTICE

Electrostatic discharge (ESD)!

This product contains electrostatic sensitive components that can be destroyed by electrostatic discharge (ESD).

- ▶ It is essential to observe the safety precautions for handling ESD-sensitive components
- ▶ Never touch connector pins without ensuring proper grounding
- ▶ Wear a grounded ESD wristband when handling product connections



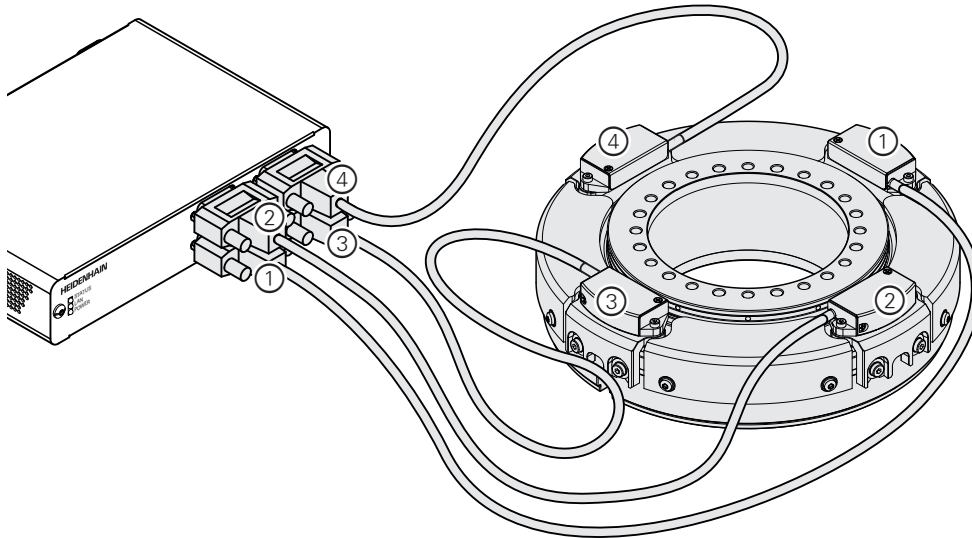
- Observe the minimum distances from sources of interference
- Comply with cable bend radii
- Pay attention to the different encoder connections, depending on the product version

2.2 Definition of the scanning heads

The following section describes how the MRP8081 Dplus is connected to the EIB 74x signal converter. This connection is also applicable to any downstream electronics from third-party providers.

The sequence of the scanning heads is prespecified:

- Scanning head 1 is marked with a radially attached ID label
- Scanning heads 2 to 4 are defined clockwise when viewed from above



2.3 Connecting the encoder

To connect the encoder:

- ▶ Ensure sufficient voltage and power supply
- ▶ Remove and save the dust protection cap
- ▶ Connect the encoder connectors tightly to the respective connections
- ▶ If the cable connectors include mounting screws, tighten them only lightly

Pin	Function
1, 3, 7, 9, 11, 14	Incremental signals
2, 4, 10, 12	Power supply
6, 8, 13	Other signals

Pin	4	12	2	10	1	9	3	11	14	7	5/6/8/15	13	/
	Up	Sensor Up	0V	Sensor 0V	A+	A-	B+	B-	R+	R-	/ ⁽¹⁾	/ ⁽¹⁾	/
	BNGN	BU	WHGN	WH	BN	GN	GY	PK	RD	BK	/	VT	YE

3 Initial setup

This chapter contains all the information necessary for putting the device into operation.

3.1 Overview

To eliminate radial runout and improve the overall accuracy, the angle encoder includes four scanning heads. In order to attain the desired high accuracy, all scanning head positions must be captured simultaneously and the arithmetic mean value must be calculated.

To be able to average the positions, all positions must be available as absolute position values. Therefore, a reference run must be performed with all scanning heads. Only then can the correct absolute position value be ascertained and output. To establish an unambiguous reference to the defined datum, you have to consider a reference offset.

By applying the supporting point compensation from HEIDENHAIN, the system accuracy is increased.

Procedure

For initial setup of the product, follow the steps below in the given order:

- ▶ **Step 1:** Find reference position
- ▶ **Step 2:** Calculate reference offset
- ▶ **Step 3:** Calculate position value

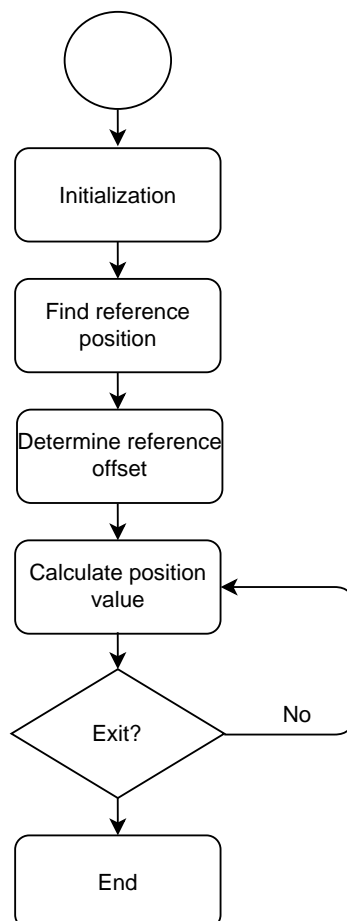


Figure 1: Initial setup flow chart

3.2 Notes

Before starting initial setup, ensure that the test environment is safe.

You can put the device into operation with an EIB 74x. The commands and an example program are described in the EIB 74x documentation.



For more information, refer to the **EIB 74x** User's Manual.

▶ www.heidenhain.com/documentation

▶ Enter the document ID **752925**

3.3 Principle of distance-coded reference marks

To ascertain positions, an absolute reference is required. For this purpose, there is a track with reference marks.

The MRP8081 Dplus provides distance-coded reference marks spaced at different defined intervals. This means that the absolute reference is established when two adjacent reference marks are traversed.

Calculating the absolute reference

With distance-coded reference marks, the absolute reference is calculated by counting the increments between two reference marks and using the formula shown below:

$$\alpha_1 = (absA - sgnA - 1) \times \frac{G}{2} + (sgnA - sgnD) \times \frac{absM_{RR}}{2}$$

The following applies:

$$A = \frac{2 \times absM_{RR} - G}{TP}$$

Formula symbols:	Meaning
α_1	Absolute angular position of the first reference mark traversed relative to the zero position [Degrees]
abs	Absolute value
sgn	Sign function (algebraic sign) +1 or -1
M_{RR}	Measured value between the traversed reference marks [Degrees]
G	Nominal increment between two fixed reference marks
TP	Grating period 360°/signal period
D	Direction of rotation +1 or -1 Rotation as per to the mating dimensions results in +1

3.4 Finding the reference position

Before the position value formation, the incremental encoder must be referenced.

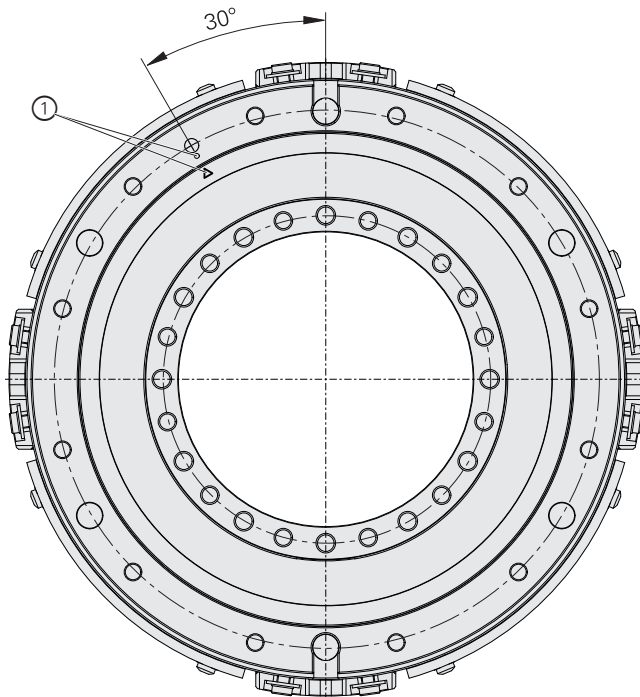
i All scanning heads must be referenced within one revolution. The direction of rotation and the referencing sequence are not relevant for this.

Procedure

Signal period	Number of reference marks	G
63000	150	4.8°

3.5 Determining the reference offset

To be able to establish the reference to the absolute datum of the overall system after referencing all scanning heads, you have to define a reference offset. This reference offset will be taken into account during the subsequent position value formation.



1 Marking of the 0° position $\pm 5^\circ$

Procedure

i You must query the positions of the referenced scanning heads simultaneously and calculate the offset according to the following equation.

Calculation

IF ($X1_{abs} > X2_{abs}$) then
 $K_2 = 90^\circ$ else
 $K_2 = 0^\circ$

IF ($X1_{abs} > X3_{abs}$) then
 $K_3 = 90^\circ$ else
 $K_3 = 0^\circ$

IF ($X1_{abs} > X4_{abs}$) then
 $K_4 = 90^\circ$ else
 $K_4 = 0^\circ$

$$Offset = K_2 + K_3 + K_4 - 135^\circ$$

Formula symbols:	Meaning
$K_2 \dots K_4$	Proportional position shift
$X1_{abs} \dots X4_{abs}$	Position of the scanning head
Offset	Offset for the datum according to the Mounting Instructions

3.6 Calculating the position value

For the system to be able to reach the specified accuracy, you need to average the positions of all scanning heads.

i You must query the positions of the referenced scanning heads simultaneously.

i For the reference to the datum of the overall system, you must consider the ascertained offset.

$$X_{avg} = \frac{(X1_{abs} + X2_{abs} + X3_{abs} + X4_{abs})}{4} + Offset$$

Formula symbols:	Meaning
$X1_{abs} \dots X4_{abs}$	Position of the scanning head
Offset	Offset for the datum according to the Mounting Instructions
X_{avg}	Arithmetic mean value of the inputs $X1_{abs}$ to $X4_{abs}$

Verifying the calculation

You can check the result as follows:

- ▶ Move to the 0° position
- > $X_{avg} = 0^\circ$

Applying compensation data

A USB flash drive containing a CSV file with the compensation data is included with every product.

To avoid position jumps, HEIDENHAIN recommends applying the compensation by means of linear interpolation between the provided compensation points.

$$X_{avgcorr} = X_{avg} - Corr(X_{avg})$$

Formula symbols:	Meaning
X_{avg}	Arithmetic mean value of the inputs $X1_{abs}$ to $X4_{abs}$
Corr	Compensation value
$X_{avgcorr}$	Compensated position

Example file

	A	B
1	HEIDENHAIN	
2	Device	MRP 8181
3	Identnumber	1401963-01
4	serial number	76444672
5	Date of calibration	02.09.2021 08:53
6		
7	Xavg [°]	Corr ["]
8	0	0.489
9	5.625	0.389
10	11.25	0.292
11	16.875	0.157
12	22.5	0.127
13	28.125	0.136
14	33.75	0.14
15	39.375	0.105
16	45	0.013
17	50.625	-0.102
18	56.25	-0.182
19	61.875	-0.263
20	67.5	-0.414

Figure 2: Example of a compensation file

Sequence of the position value calculation

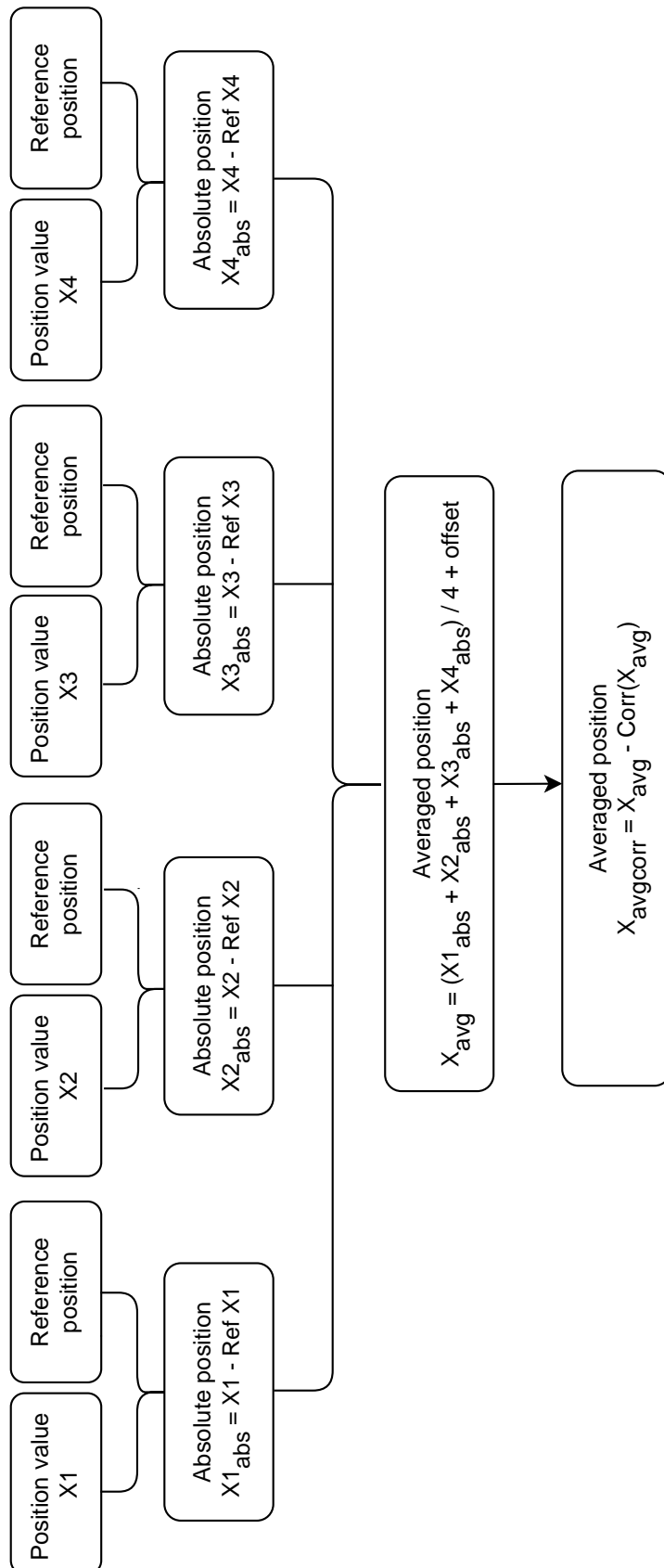


Figure 3: Calculation of position value

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

☎ +49 8669 31-0

☎ +49 8669 32-5061

info@heidenhain.de

Technical support ☎ +49 8669 32-1000

Measuring systems ☎ +49 8669 31-3104

service.ms-support@heidenhain.de

NC support ☎ +49 8669 31-3101

service.nc-support@heidenhain.de

NC programming ☎ +49 8669 31-3103

service.nc-pgm@heidenhain.de

PLC programming ☎ +49 8669 31-3102

service.plc@heidenhain.de

APP programming ☎ +49 8669 31-3106

service.app@heidenhain.de

www.heidenhain.com

