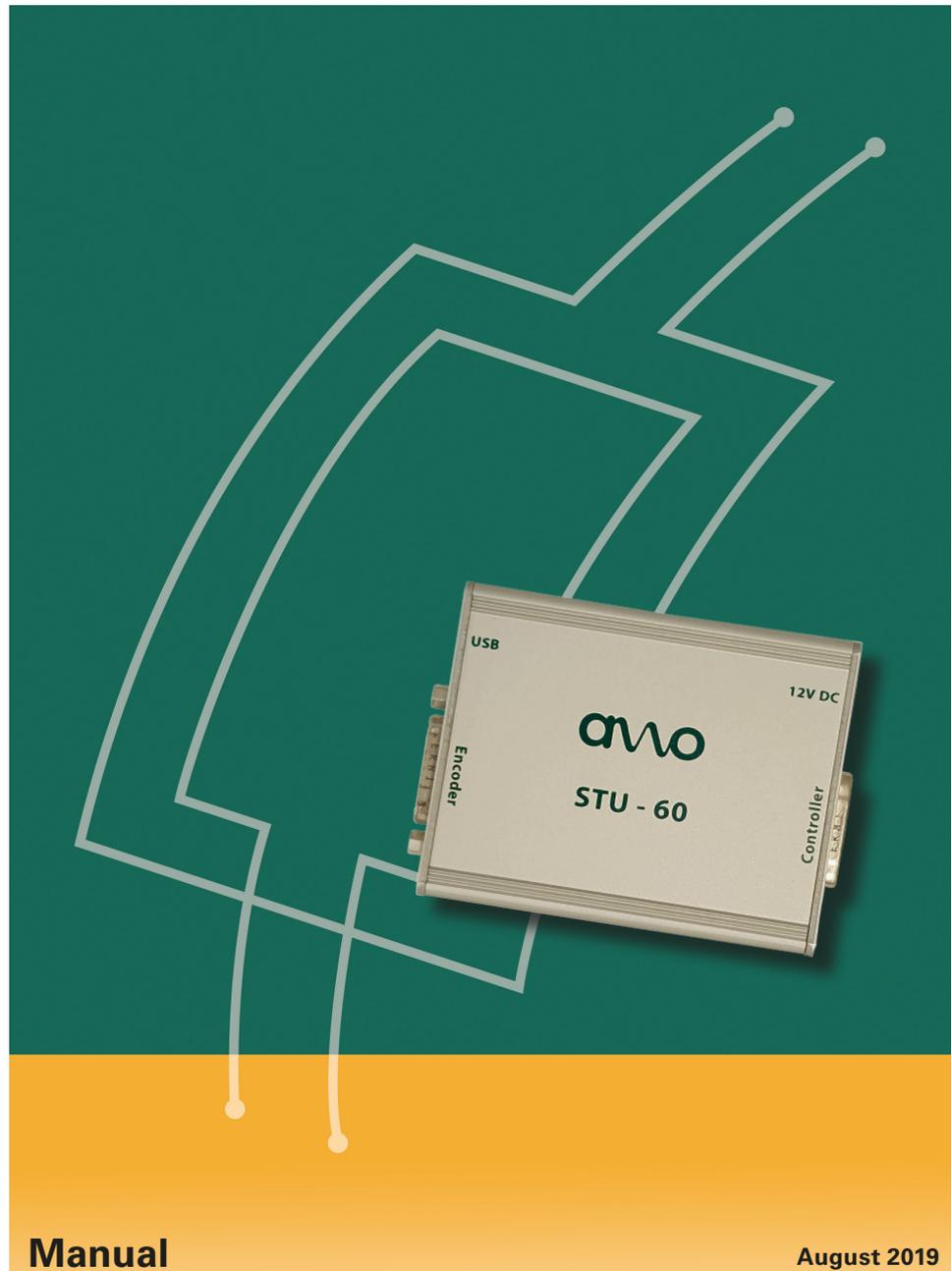




AMO GmbH

STU-60

Diagnostic tool



Manual

August 2019

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1. Basics

1.1 Handling of the user manual

This user manual is valid for AMO-Check 1.3
(The actual version can be found on our homepage: www.amo-gmbh.com)

The AMO-Check software is compatible with the following hardware:

- STU-60 , ID 1219160-01

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 damages.

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

Storage and distribution of the documentation

The instructions must be kept in the immediate vicinity of the workplace and must be available to all personnel at all times. The operating company must inform the personnel where these instructions are kept. If the instructions have become illegible, the operating company must obtain a new copy from the manufacturer.

If the product is given or resold to any other party, the following documents must be passed on to the new owner:

- Addendum (if supplied)
- Operating Instructions

Target groups for the instructions

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

- Mounting
- Installation
- Operation
- Service, cleaning and maintenance
- Troubleshooting
- Removal and disposal

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**.

HINWEIS

Notice indicates danger to material or data. If you do not follow the avoidance instructions, the hazard **could result in things other than personal injury, such as property damage**.

1.2 Safety

General safety precautions

General accepted safety precautions, in particular the applicable precautions relating to the handling of live electrical equipment, must be followed when operating the system. Failure to observe these safety precautions may result in personal injury or damage to the product.

Intended use

The product must only be operated when in proper and safe condition. It is intended solely for the following use:

- Diagnostics and adjustment of AMO encoders with incremental interfaces

Any other use or additional use of the product is considered improper use and can result in damage and hazards.

Improper use

In particular, the following uses are not permitted:

- Use with parts, cables or connections that are defective or do not comply with the applicable standards
- Use outdoors, or in potentially explosive environments or fire risk areas
- Use outside the operating conditions specified in "Specifications"
- Any alterations of the product or peripherals that have not been authorized by the manufacturers
- Use as a part of a safety function

Personnel qualification

Mounting, installation, operation, maintenance, and disassembly must be done by a qualified service technician. The service technician must have obtained sufficient information from the documentation supplied with the product and with the connected peripherals.

He or she must comply with the provisions of the applicable legal regulations on accident prevention.

General safety precautions



The safety of any system incorporating the use of this product is the responsibility of the assembler or installer of the system.

Electrical safety precautions

WARNING

Hazard of contact with live parts when opening the wall adapter power supply.

This may result in electric shock, burns or death.

- Never open the housing
- Only the manufacturer is permitted to access the inside of the product

WARNING

Hazard of dangerous amount of electricity passing through the human body upon direct or indirect contact with live electrical parts.

This may result in electric shock, burns or death.

- Work on the electrical system and live electrical components is to be performed only by trained specialists
- For power connection and all interface connections, use only cables and connectors that comply with applicable standards
- Have the manufacturer exchange defective electrical components immediately
- Regularly inspect all connected cables and all connections on the product. Defects, such as loose connections or scorched cables, must be removed immediately

NOTICE

Damage to internal parts of the product!

If you open the product, the warranty and the guarantee will be void.

- Never open the housing
- Only the product manufacturer is permitted to access the inside of the product

Safety precautions for operation with and in numerically controlled machines

DANGER

Serious personal injury or property damage caused by improper use of the NC!

Improper use caused by incorrect operation of the NC, incorrect NC programming, incorrect or non-optimized machine parameter values

- Acquire fundamental knowledge about machine, servo drives, inverters and NCs as well as their interaction with the encoders so that faulty behavior of a numerically controlled machine can be assessed correctly
- Apart from the information in these instructions, observe the specific safety regulations and accident prevention regulations when handling the respective machines, servo drives, inverters, and NCs
- When the product is installed in a machine or used in other special applications, all safety precautions detailed in these instructions must be adapted to the respective conditions of use
- Comply particularly with the required adaptations to changed grounding situations during installation and during connection of the product to the control loop of a numerically controlled machine
- The machine manufacturer must be contacted for fault diagnosis

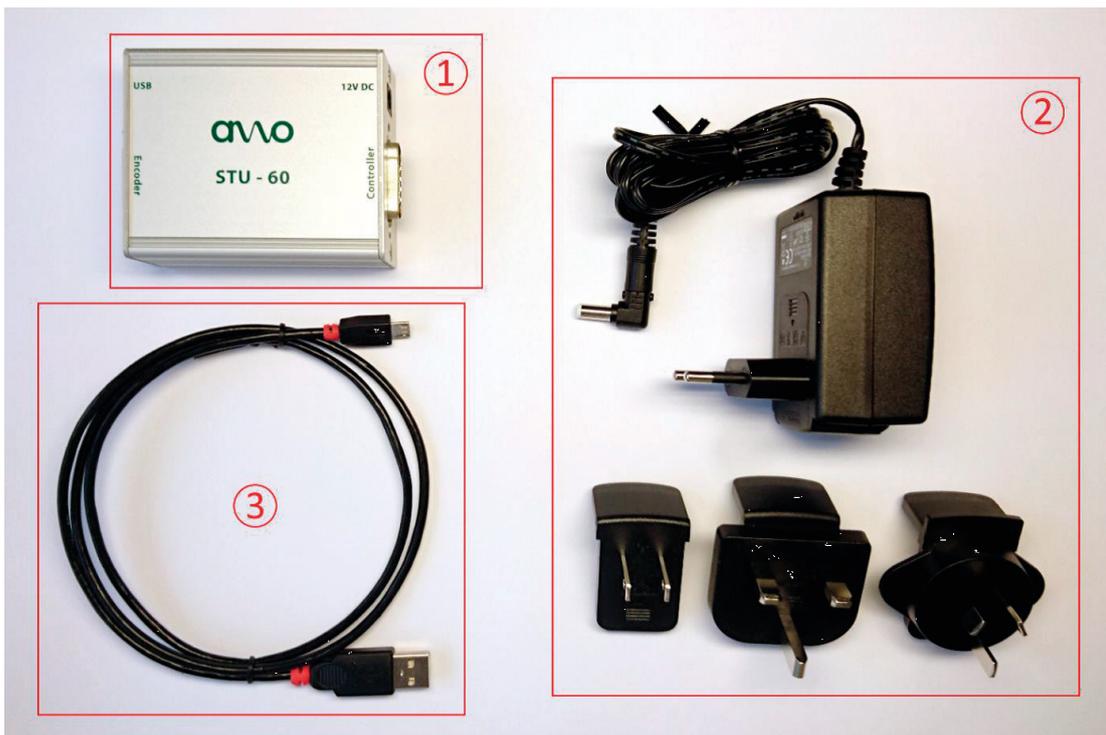
1.3 Basic information about the diagnostic tool

The STU-60 is a diagnostic tool and can be used for the checking the functionality and adjustment of incremental AMO Encoders. It provides valuable feedback regarding the correct mounting and the achieved signal quality. If there are any problems with the encoder, the AMO-Check can help you find the cause quick and easy.

STU-60 Basic equipment ID 1219160-01

The diagnostic set consists of:

- 1) STU-60 Diagnostic tool
- 2) 12 Volt Plug-in power supply (including exchangeable adapters for the most common power grids)
- 3) Standard Micro USB-B → USB-A cable to connect the STU-60 to the PC.



STU-60 Scope of delivery

- STU-60 Diagnostic tool
- Packaging
- Label (with serial- and part number)



Adapter cable

Compatible adapter cables on request (office@amo.at)

AMO-Check Available functions

✓	Incremental encodert: Check the correct assembly (Display: Amplitude/Offset/Phase)	General
✓	Osci function: internal signals of the encoders (A/B/RI)	
✓	Osci function: internal signals of the encoders XY-view	
✓	RI-Check - Check the reference singal	
x	Osci function: output signals (A/B/RI) time representation	
x	Osci function: output signals XY-view	
x	Display: voltage and current	
x	Position counter	
✓	1 Vpp	Interfaces
✓	TTL	
x	Absolute interfaces	

2. Commissioning

General information

NOTICE

Interference from sources of high electromagnetic emission!

Peripheral devices, such as frequency inverters or servo drives, may cause interference.

- To increase the noise immunity to electromagnetic influences, use the optional functional ground connection as per IEC/EN 60204-1

NOTICE

Engaging and disengaging connecting elements!

Risk of damage to internal components.

- Do not engage or disengage any connecting elements while the unit is 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
- Never touch connector pins without ensuring proper grounding
- Wear a grounded ESD wristband when handling product connections

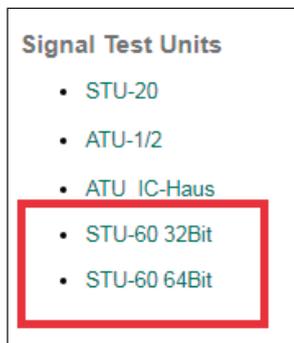
2.1 System requirements

RAM: 512MB
OS: Windows Vista, Windows 7, Windows 10
CPU: 1,8GHz
Free Space: 100MB

2.2 Installation of the AMO-Check software

The installation file can be downloaded from the homepage:
(<http://www.amo-gmbh.com/en/downloads/accessory/>)

Choice between 32 and 64 bit version:



Download and install the file "AMO-Check Installer.exe".

2.3 Connect Encoder and STU-60 diagnostic tool to the PC

DANGER

Risk of electric shock!

Improper grounding of electrical devices may result in serious personal injury or death.

- Use only the wall adapter power supply included in delivery or a unit that has been certified by the manufacturer.

WARNING

Danger of fire!

Use of wall adapter power supplies that do not meet the minimum requirements!

- Use only wall adapter power supplies that fulfill or exceed the specified minimum requirements.

NOTICE

Damage to the product and the encoder caused by incorrect voltage supply range or incorrect wiring!

An incorrect voltage supply range or incorrect wiring / pin layout may cause damage to the product and the encoder.

- Note the voltage supply range of the connected encoder
- Verify that the connecting cable between the encoder and the product is correctly wired
- Vacant pins or wires must not be used
- Do not engage or disengage the connecting cable between the encoder and the product while under power
- The connection of non-AMO encoders to the product and the operation of the product with non-AMO encoders are at the user's own risk



AMO can not guarantee a proper function of the STU-60, above a total cable length of 5 meters.
Reason: The USB-cable is only certified up to 5 meters, beyond that the voltage drop can lead to disturbances.

There are 2 possible variants:

- In „Closed Loop“ the encoder is supplied by the controller and the output signals of the encoder are transferred to the controller as usual. The tester is only plugged in between.
- In „Open Loop“ the encoder is supplied by the STU-60 and the output signals of the encoder are not transferred to the controller. So in this case the axis has to be controlled by a motor encoder or moved manually.



The full functionality of the AMO-Check software is available for both variants.

Closed Loop:

Step 1:

Connect the controller to the "controller" port of the STU-60 with an adapter cable.



The STU-60 directs all signals to the controller and is also supplied by the controller.

Step 2:

Connect the encoder to the „Encoder“ port of the STU-60 with an adapter cable.



Only the adapter cable provided by AMO should be used.

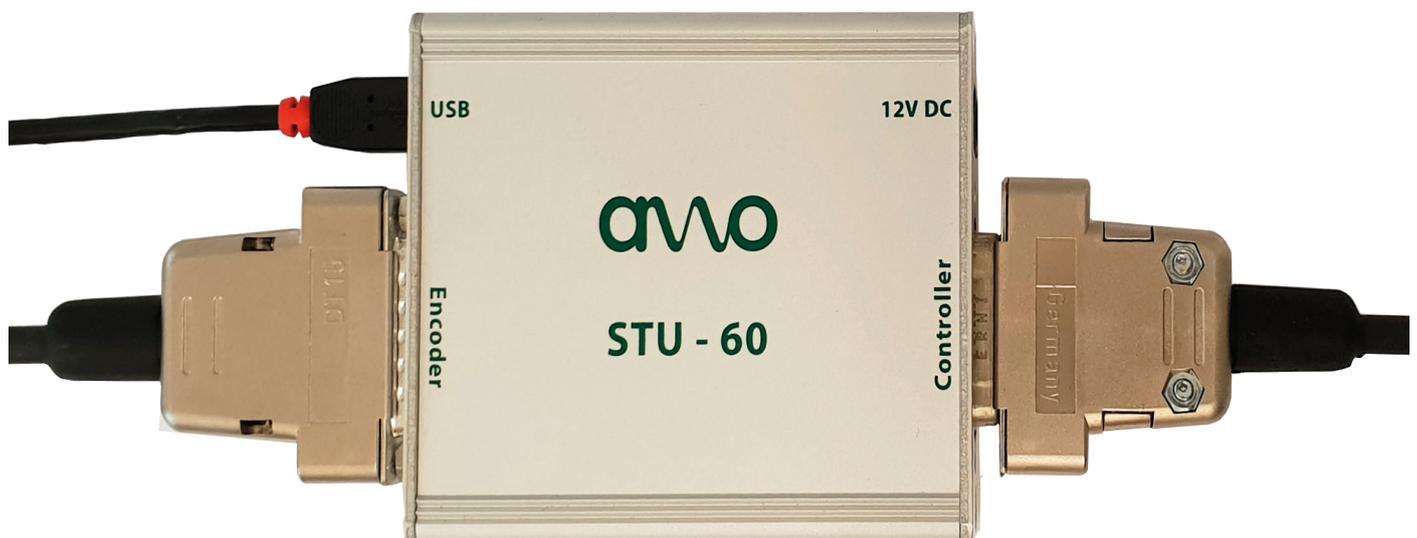
Step 3:

Connect the USB port of the STU-60 and the USB port of your PC with the included USB cable.



Only the USB cable provided by AMO should be used.

The encoder signals and mounting condition can now be checked with the STU-60.



Open Loop:

Step 1:

Supply the STU-60 via the 12V DC-line of the included plug-in power adapter.

i Only the plug-in power adapter provided by AMO should be used.

i DON'T connect the controller to the "controller" port of the STU-60. This port is not used.

Step 2:

Connect the encoder to the "encoder" port of the STU-60 with an adapter cable.

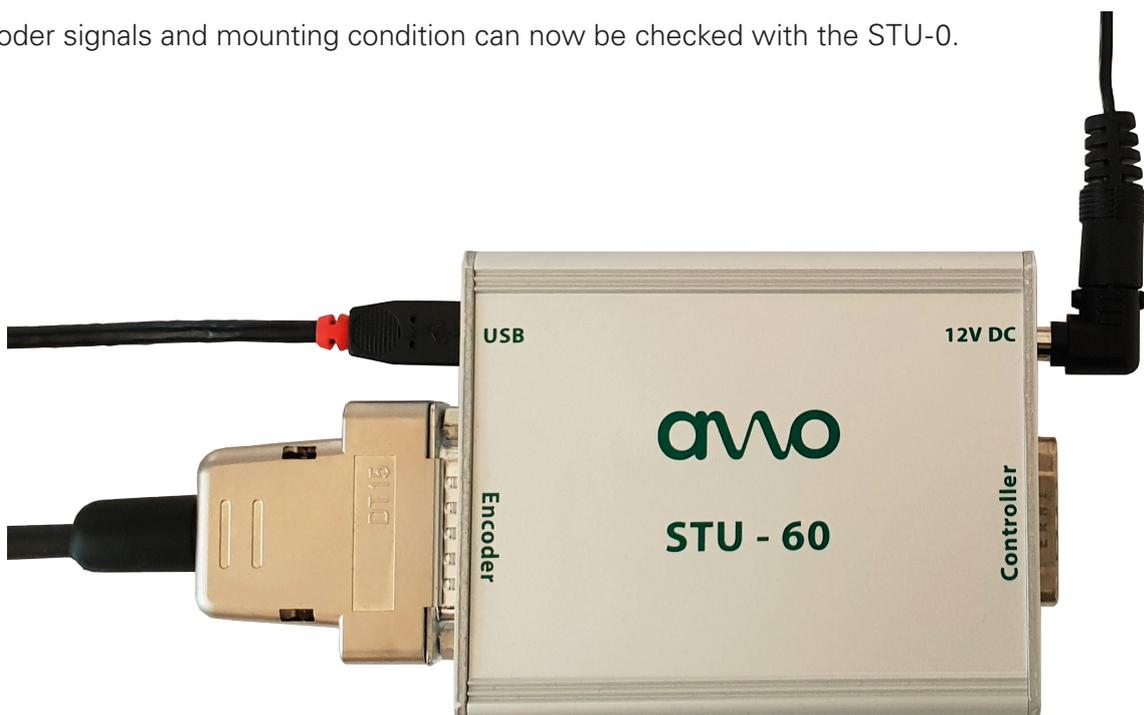
i The signals from the encoder are not affected by the STU-60. The STU-60 serves as a control unit.

Step 3:

Connect the USB port of the STU-60 and the USB port of your PC with the included USB cable.

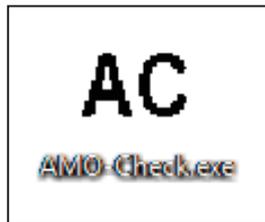
i Only the USB cable provided by AMO should be used.

The encoder signals and mounting condition can now be checked with the STU-0.



2.4 Start the AMO-Check software

Double-click to open the "AMO-Check" application:



The AMO-Check start window opens (top left the current revision level is shown).

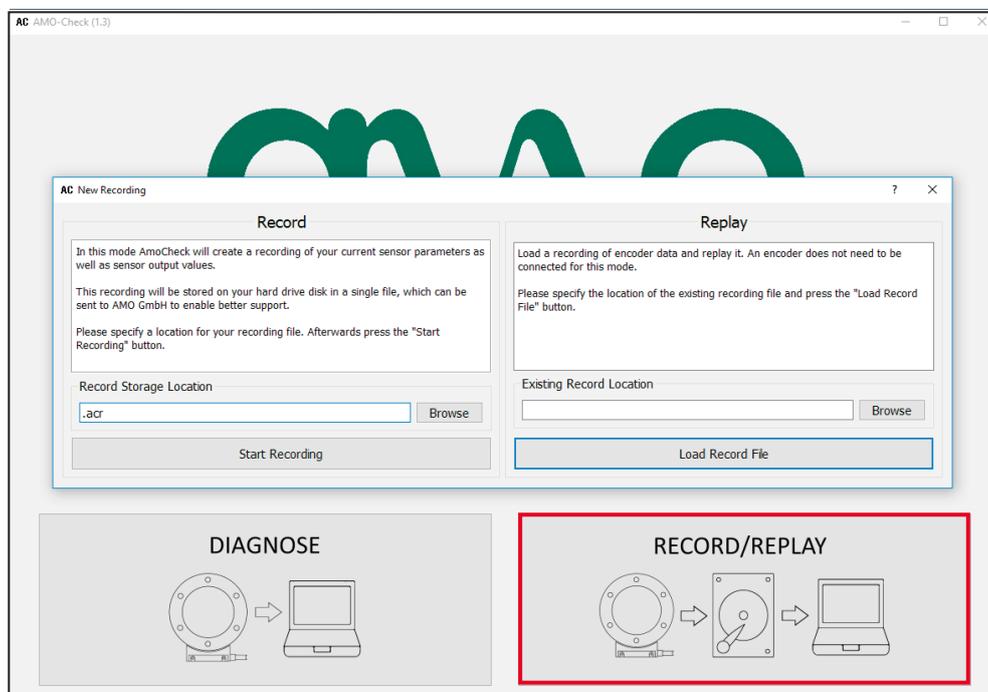


3. Function "Diagnose"

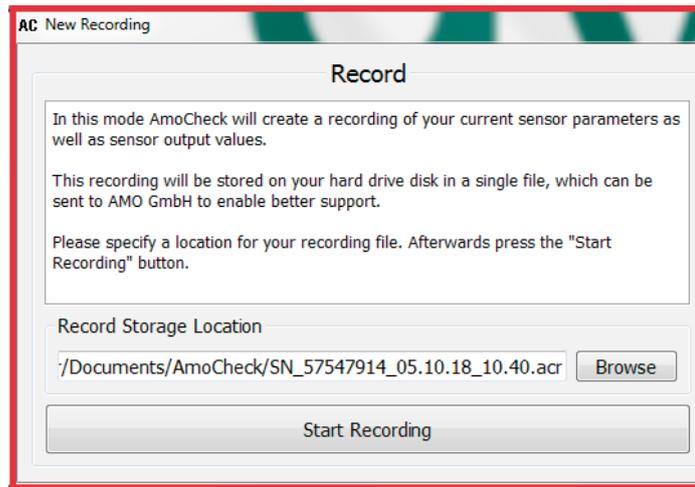
All important system information can be read out in the "Diagnose" window. Mounting conditions and the internal Signals can be checked in real time.



4. Function Record/Replay

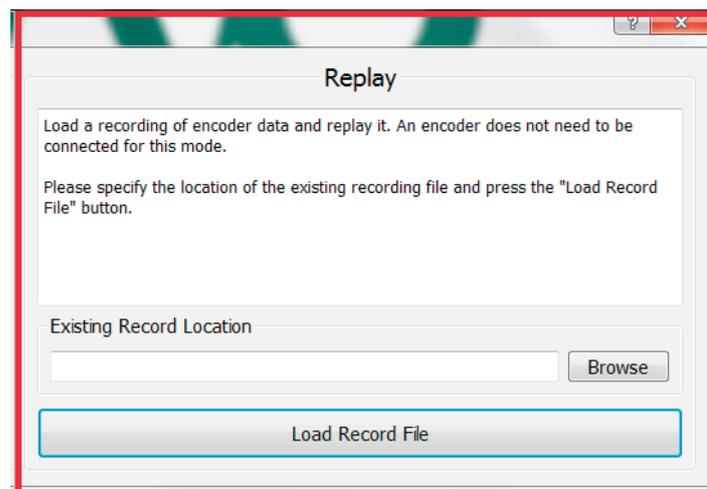


If you want to forward your measurements to the AMO service department, use this function and send the records via email to: service@amo.at



The "Record" function is used to record new measurement data. With the "Browse" button, a folder on the PC can be selected for a data backup.

When the "Start Recording" button is pressed, the screen capture starts. The recording of the measurement data is terminated with the "Disconnect" button located at the bottom right.



The "Replay" function is used to play recorded measurement data later. The "Browse" button can be used to select a recorded file (on the PC/network/USB device). When "Load Record File" is pressed, the playback of the recording starts. The playback of the measured data is terminated with the "Disconnect" button located at the bottom right.



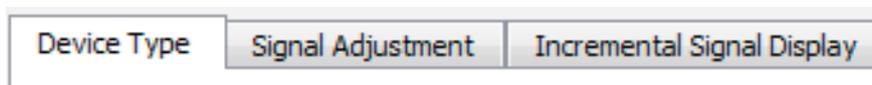
When the recordings are played back later, a manual change of the existing functions (SIN / COS, Magnitude, reference pulse) is necessary. If, for example, one minute of "SIN / COS" is recorded during recording and then "RI" is recorded for one minute, the playback window must be switched from the "SIN / COS" window to the "RI" window.



The playback only works with this function of the AMO-Check software. The STU-60 does not need to be connected to play the recorded data.

5. Single Head Solution

Selection menus



Various functions can be selected using the menu bar.

5.1 Device Type

All known encoder information are listed (name, serial number, interface, etc.).

Encoder Type	
Serial number	00000000
Product type	WMK
Ext. Producttype	WMK - outside
Grating	1000 µm
Pitches	720
Performance	Standard
Interface	1 Vss
Additional Interface	No additional interface
Referencemark	Square Pulse (360° el.)
Functional Safety	Not supported
Electronics	Integrated electronics

5.2 Signal Adjustment

In this function, the signals read from the encoder are compared with the ideal values set by AMO. Thus, you can determine the optimal mounting and reposition the encoder if necessary.



Amplitude Sin/Amplitude Cos

Here you can determine the deviation from ideal air gap.

→ „+“ Air gap too large (Encoder mounted too far away from the scale tape)

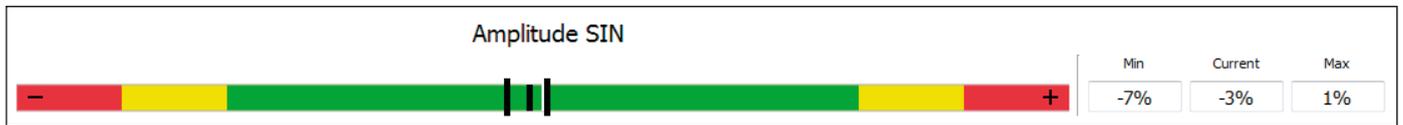
→ „-“ Air gap too small (Encoder mounted too close to the scale tape)

Phase Sin/Cos and Offset Sin/Cos

These measuring values should be always in the green range. Only in the case of a faulty amplitude, these values will show large deviation from the center point.

Reset Min/Max

The black bars left and right (minimum and maximum reached value) can be reset by this function.



→ Press reset Min/Max



Now the lowest and highest measuring values have been reset to the current measuring value.

5.3 Incremental Signal Display

The input signals can be checked by using a virtual oscilloscope. The active compensation, which controls the signal amplitude, is already active here.

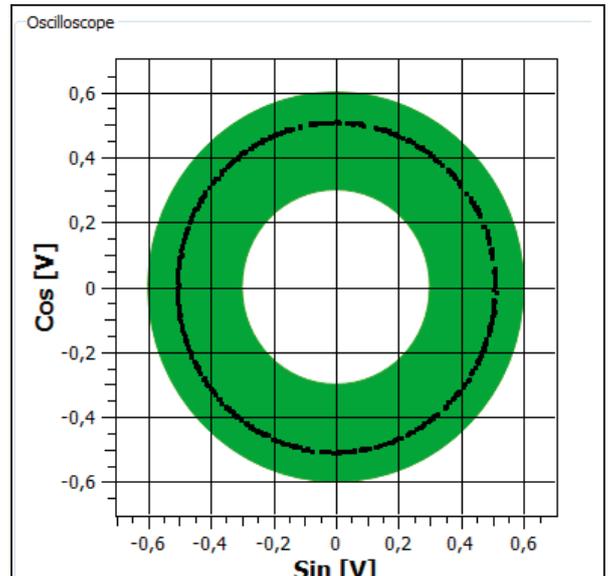


The measured data shown here do not correspond to the output signals. This function uses internal analog signals, no matter what the interface type of the encoder (for example TTL). Only the internal analog signals are displayed here.

The incremental signals (sine and cosine) are displayed as a circular function (X-Y representation) and as a sine-cosine diagram (Y-t representation).

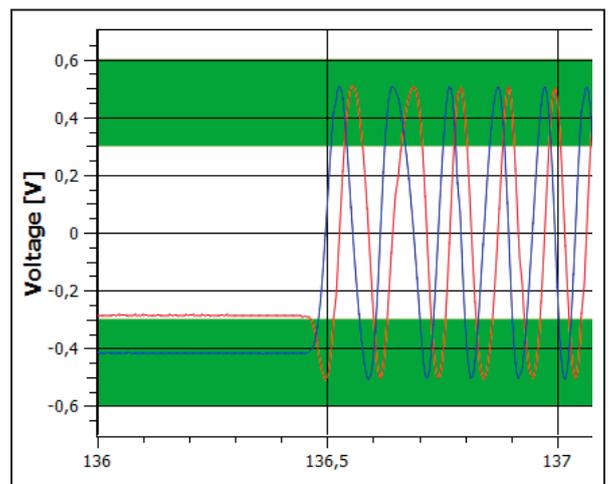
Circular representation

In the circular representation the allowed amplitude range is marked green. The current signal amplitude is displayed in black. When moving the encoder, a circle is created, every recorded amplitude value disappears after a time of 1.5 seconds.

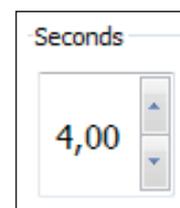


Time representation

To perform this test, select the "SIN / COS" button in "DATA Source". It can be chosen between the absolute and relative representation. In the absolute representation, the shown image moves constantly on the t-axis, each measuring value moves from the left to the right edge of the image and disappears after the time setting has expired. In the relative display, a recording of the desired time is taken. When this time has expired, the display disappears and the measurement starts from the beginning.



The desired time setting (on the t-axis) can be individually adjusted by the operator in "Seconds". The default value is 4 seconds.

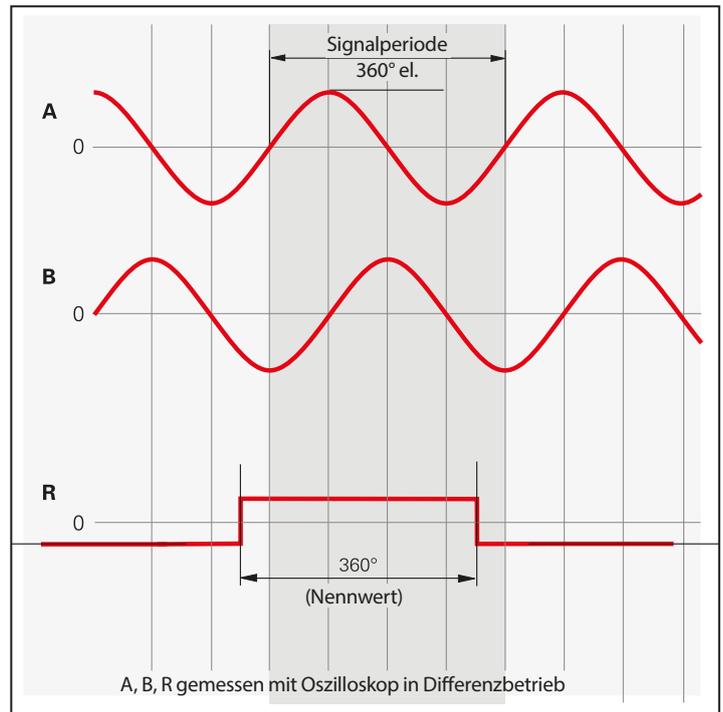


Check the reference pulse (RI)

AMO-Encoders with $\sim 1 V_{PP}$ -Interface providing output signals which can be highly interpolated.

The sine shaped incremental signals A and B are electrically 90° phase shifted and have a signal amplitude of $1V_{pp}$. The showed sequence of the output signals - B after A - is valid for the positive direction of movement.

The reference mark signal R has a clear assignment to the incremental signals as shown in the diagram.

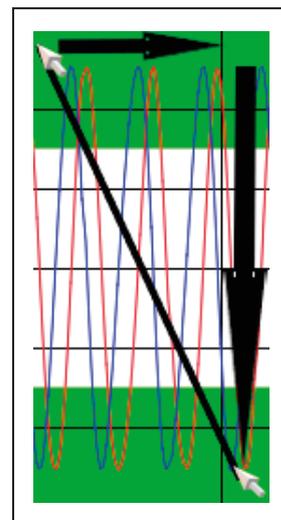


With the diagnostic unit, the reference pulse can be checked exactly. To perform this test, select the "RI" button in "DATA-Source".

It can be chosen between the absolute and relative representation. The time representation (here on the X-axis) can also be adjusted individually. In the relative representation, only the time range before and after crossing the reference pulse is displayed. This is useful to look individually at the reference pulses. In the case of absolute representation, the display runs constantly and the time interval between two reference pulses can be checked.

Zoom function

To use the zoom function in the time representation, press "Pause", this will freeze the measurement. Then you can select a starting point with the left mouse button (in the example picture on the top left). From this point, press the left mouse button and drag it over the desired area. (In the example picture to the bottom right). This function is useful for the SIN/COS signals and for the reference pulse.



The zoom function is reset with a right-click.

6. Multi Head Solution - MHS

Device Type	MHS System	Head #1 - Signal Adjustment	Head #1 - Incremental Signal Display	Head #2 - Signal Adjustment	Head #2 - Incremental Signal Display
-------------	------------	-----------------------------	--------------------------------------	-----------------------------	--------------------------------------

Various functions can be selected using the menu bar.

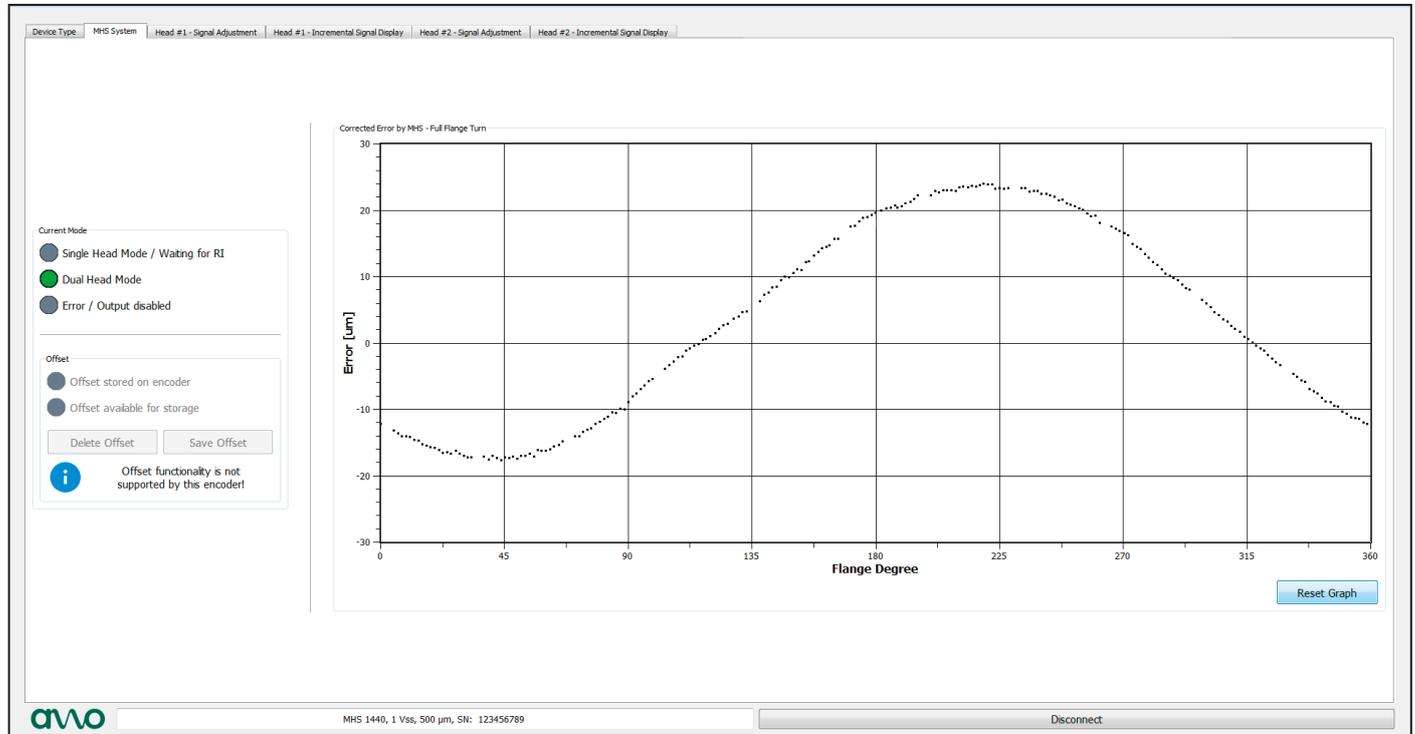
6.1 Device Type

All known encoder information are listed (name, serial number, interface, etc.).

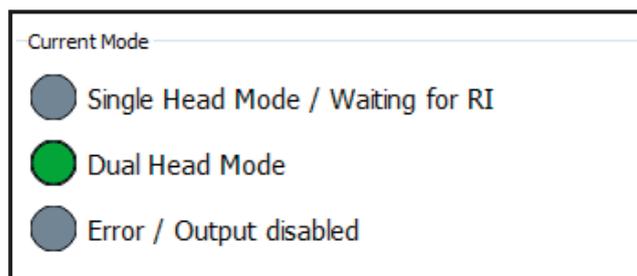
Encoder Type	
Serial number	00000000
Product type	WMK
Ext. Producttype	WMK - outside
Grating	1000 µm
Pitches	720
Performance	Standard
Interface	1 Vss
Additional Interface	No additional interface
Referencemark	Square Pulse (360° el.)
Functional Safety	Not supported
Electronics	Integrated electronics

6.2 MHS-System

In this window, the eccentricity of the scale tape can be checked.



Current Mode



MHS without Offset-Function:

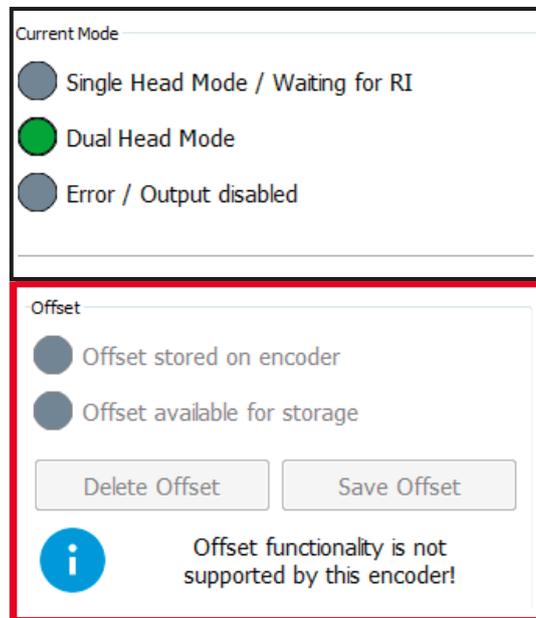
As soon as the MHS is powered on, it is in single-head mode. Here, the MHS works with single-head scanning → when crossing the first reference mark, it switches to dual-head mode (double-head operation). From this point on, the eccentricity of the measuring scale is corrected.

MHS with Offset-Function:

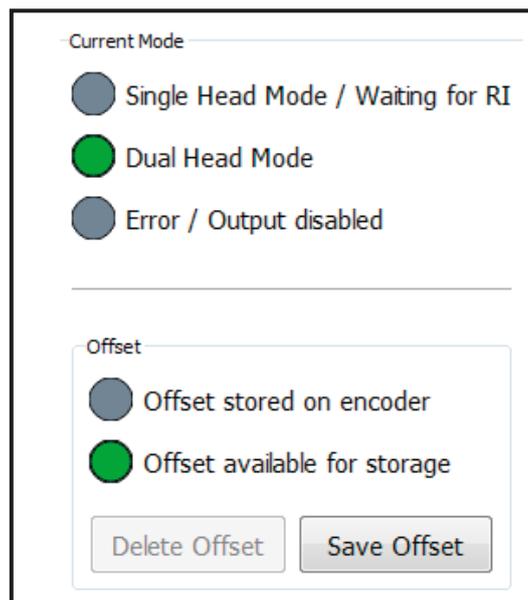
If you are using this function (description on the following pages), the MHS will be in dual-head mode immediately after power on and will work in double-head mode. The eccentricity of the measuring scale has already been corrected.

Offset-Funktion

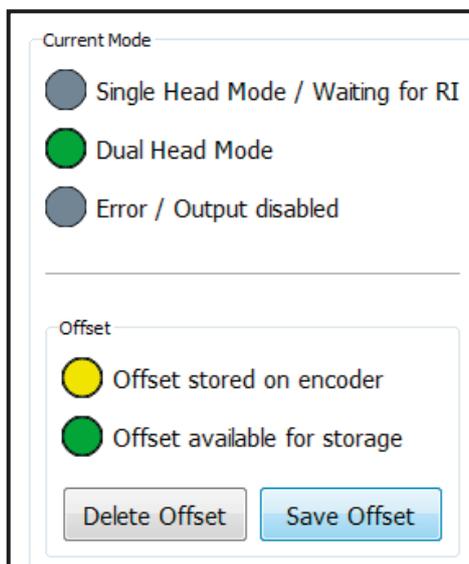
Example below: In this version of the encoder, the offset function is **not** supported.



If the offset function is present, the following window is available:

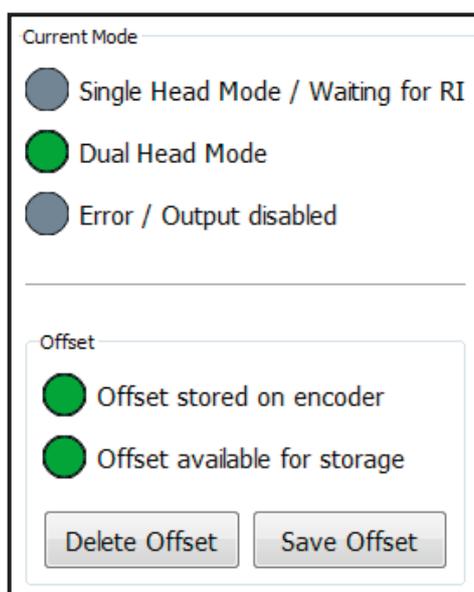


Now by pressing the button "Save Offset" the offset value can be stored in the MHS . The upper status display should now turn yellow.



If an offset is already stored and one or both measuring heads are dismantled, a new setting of the offset is required.

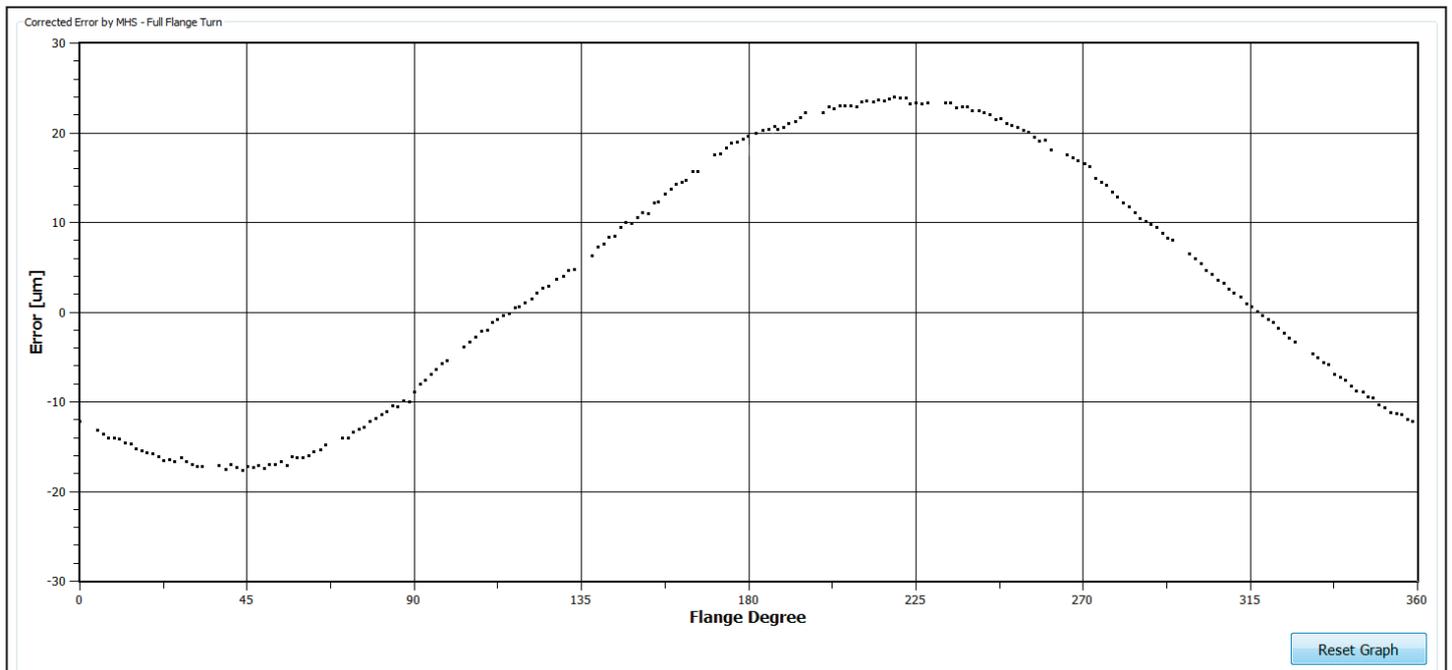
As soon as the process is completed, the status indicator changes to green. If you have made a mistake, you can undo this step any time with the button "Delete Offset".



Once an offset has been stored, the value is stored permanently.

Corrected Error by MHS - Full Flange Turn

The eccentricity of the scale tape can be displayed in this diagram, by moving the axis. On the Y-axis the deviation is given in μm . The existing deviation is corrected by the MHS and therefore has no effect on the system accuracy.



6.3 Head # 1/2 - Signal Adjustment

In this function, the signals read from the encoder are compared with the ideal values set by AMO. Thus, you can determine the optimal mounting and reposition the encoder if necessary.



Amplitude Sin/Amplitude Cos

Here you can determine the deviation from ideal air gap.

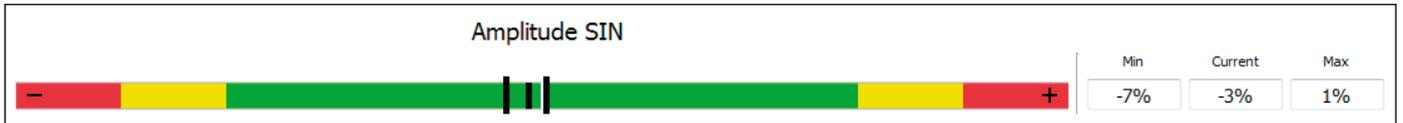
- „+“ Air gap too large (Encoder mounted too far away from the scale tape)
- „-“ Air gap too small (Encoder mounted too close to the scale tape)

Phase Sin/Cos und Offset Sin/Cos

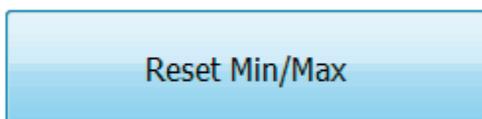
These measuring values should be always in the green range. Only in the case of a faulty amplitude, these values will show large deviation from the center point.

Reset Min/Max

The black bars left and right (minimum and maximum reached value) can be reset by this function.



→ Press reset Min/Max



Now the lowest and highest measuring values have been reset to the current measuring value.

6.4 Head # 1/2 Incremental Signal Display

The input signals can be checked by using a virtual oscilloscope. The active compensation, which controls the signal amplitude, is already active here.

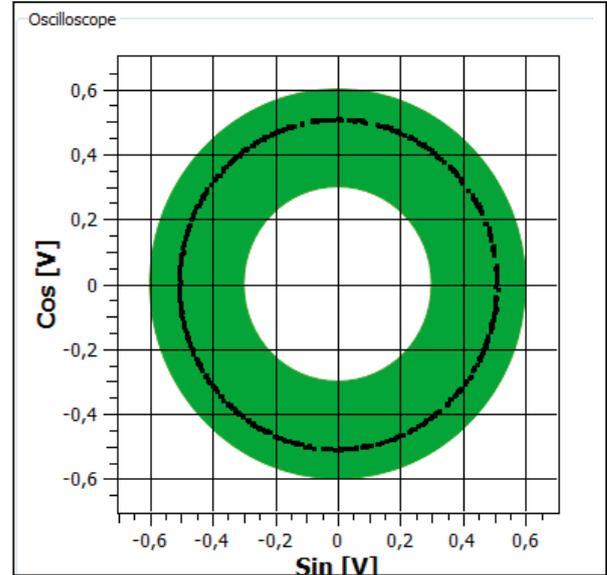


The measured data shown here do not correspond to the output signals. This function uses internal analog signals, no matter what the interface type of the encoder (for example TTL). Only the internal analog signals are displayed here.

The incremental signals (sine and cosine) are displayed as a circular function (X-Y representation) and as a sine-cosine diagram (Y-t representation).

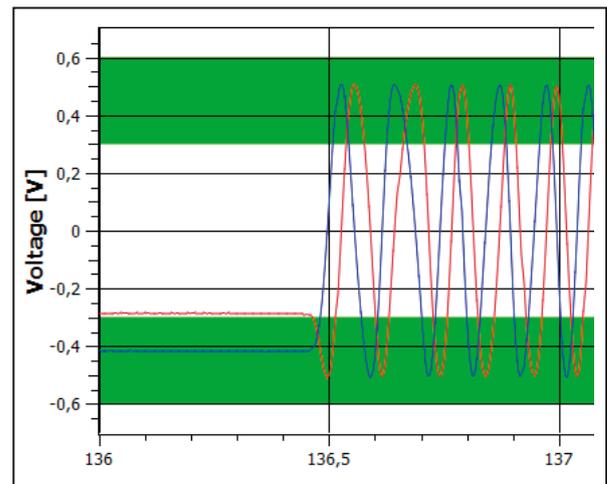
Circular representation

In the circular representation the allowed amplitude range is marked green. The current signal amplitude is displayed in black. When moving the encoder, a circle is created, every recorded amplitude value disappears after a time of 1.5 seconds.

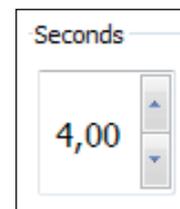


Time representation

To perform this test, select the "SIN / COS" button in "DATA Source". It can be chosen between the absolute and relative representation. In the absolute representation, the shown image moves constantly on the t-axis, each measuring value moves from the left to the right edge of the image and disappears after the time setting has expired. In the relative display, a recording of the desired time is taken. When this time has expired, the display disappears and the measurement starts from the beginning.



The desired time setting (on the t-axis) can be individually adjusted by the operator in "Seconds". The default value is 4 seconds.



Check the reference pulse (RI)

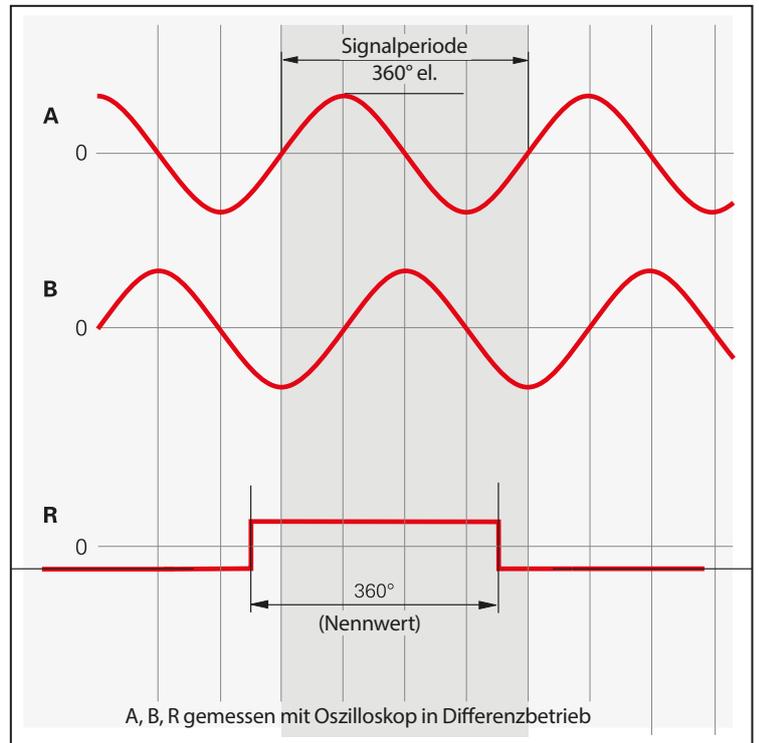
AMO-Encoders with $\sim 1 V_{pp}$ -Interface providing output signals which can be highly interpolated.

The sine shaped incremental signals A and B are electrically 90° phase shifted and have a signal amplitude of $1V_{pp}$. The showed sequence of the outputted signals - B after A - is valid for the positive direction of movement.

The reference mark signal R has a clear assignment to the incremental signals as shown in the diagram.



For referencing the encoder, only the reference pulse signal from scanning head # 1 used.

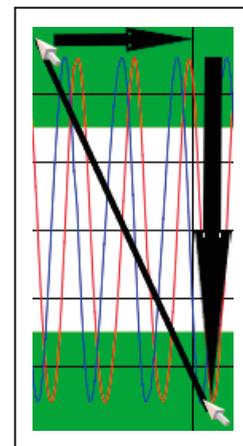


With the diagnostic unit, the reference pulse can be checked exactly. To perform this test, select the "RI" button in "DATA-Source".

It can be chosen between the absolute and relative representation. The time representation (here on the X-axis) can also be adjusted individually. In the relative representation, only the time range before and after crossing the reference pulse is displayed. This is useful to look individually at the reference pulses. In the case of absolute representation, the display runs constantly and the time interval between two reference pulses can be checked.

Zoom function

To use the zoom function in the time representation, press "Pause", this will freeze the measurement. Then you can select a starting point with the left mouse button (in the example picture on the top left). From this point, press the left mouse button and drag it over the desired area. (In the example picture to the bottom right). This function is useful for the SIN/COS signals and for the reference pulse.



The zoom function is reset with a right-click.

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