HEIDENHAIN

Adjusting and Testing Software (ATS)

User's Manual

PWM 20, PWM 21
Software ID 539862-xx
Version 3.4.xx

English (en)
12/2019

Contents

1

Fundamentals

1.1 Overview

This chapter contains information about the product and this manual.

1.2 Information on the product

The Adjusting and Testing Software (ATS) is a component of an encoder diagnostic set. In combination with the testing and inspection devices of the PWM series, the Adjusting and Testing Software assists during mounting, functional checks and error diagnosis of HEIDENHAIN encoders with serial and incremental interfaces. For this purpose, the Adjusting and Testing Software is installed on a computer and connected to the PWM.

Further information: "Overview of functions", Page 29

The Adjusting and Testing Software features an encoder database. The encoder database contains all ID numbers and variants of the encoders that existed when the software was released.

New versions of the Adjusting and Testing Software with up-to-date database are made available at regular intervals. You find the current software version in the download area at the HEIDENHAIN website.

Further information: "Updating software and encoder database", Page 36

1.3 Software options

Software options are available to increase the range of functions of the Adjusting and Testing Software. You can enable software options in the Adjusting and Testing Software by entering a license key.

Further information: "Enabling software options", Page 47

1.4 Validity of the documentation

This User's Manual is valid for the version 3.4.xx of the Adjusting and Testing Software.

Make sure that the documentation and software version match before using the documentation.

Further information: "Viewing software information", Page 41

Further information: "Updating software and encoder database", Page 36

1.5 Hardware compatibility

The Adjusting and Testing Software is compatible with the following hardware:

Hardware	ID
PWM 20	731626-01
PWM 21	1200635-01

1.6 Notes on reading this document

⚠ WARNING

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

Incorrect operation of the software may result in death, injury or property damage.

- Read the documentation carefully from beginning to end
- Keep the documentation

Be sure to have read and understood the documentation of the testing device and the encoder before connecting the Adjusting and Testing software to a testing device or encoder.

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

Documentation	Description
Addendum	An addendum supplements or supersedes the corresponding contents of the Operating Instructions and, if applicable, of the Installation Instructions. If an addendum is included in the shipment, it has the highest priority for reading. All other contents of the documentation retain their validity.
Mounting Instructions	The Mounting Instructions contain all the information and safety precautions needed for the proper mounting and installation of a product. Mounting Instructions are included in every delivery. Mounting Instructions have the second highest priority for reading.
Operating Instructions	The Operating Instructions contain all the information and safety precautions needed for the proper operation of the product according to its intended use. The Operating Instructions are included on the supplied storage medium and can also be downloaded from the download area at **www.heidenhain.de**. The Operating Instructions must be read prior to commissioning the product. The Operating Instructions have the third highest priority for reading.
Software Release Notes	The Software Release Notes summarize the expansions and improvements implemented in the respective software version.
User's Manual	The User's Manual provides all information required for installing the software on a computer and for using it as intended. The User's Manual is located in the installation folder of the software and can be downloaded from the download area at **www.heidenhain.de**.

Have you found any errors or would you like to suggest changes?
We continuously strive to improve our documentation for you. Please help us by sending your suggestions to the following e-mail address:
userdoc@heidenhain.de

1.7 Storage and distribution of the documentation

The User's Manual 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 the User's Manual is kept. If the User's Manual has become illegible, the operating company must obtain a new copy from the manufacturer.

If the software is passed on to any other party, the User's Manual must also be passed on to the new owner.

1.8 Target groups

The User's Manual is intended for specialists for service, maintenance and commissioning.

The activities described may only be performed by persons with profound knowledge of electronics, electrical engineering and NC machine-tool technology.

This User's Manual must be read and observed by any person involved in diagnosing or adjusting encoders with the Adjusting and Testing Software.

1.9 Symbols and fonts used for marking text

In these instructions, the following symbols and fonts are used for marking text:

Image	Meaning
▶ ... > ...	Identifies an action and the result of this action Example: ▶ Click **OK** > The message is closed
■ ... ■ ...	Identifies an item in a list Example: ■ TTL ■ EnDat ■ ...
Bold	Identifies menus, displays, and buttons Example: ▶ Click **Close file**

1.10 Figures

This User's Manual contains illustrations for the purpose of explanation and illustration. The actual GUI depends on the software configuration and on the connected encoder.

1.11 More information

For detailed information on hardware and connection technology, refer to the following documentation:

Documentation available in the Adjusting and Testing Software:

- "User's Manual Cables and Connection Technology"
- Brochure "Interfaces of HEIDENHAIN Encoders"
- PWM Operating Instructions

Further information: "Opening documentation", Page 42

Documentation of product manufacturers:

- Documentation of peripheral devices
- Documentation of the encoders
- Documentation of the machine tool

2

Safety

2.1 Overview

This chapter provides important safety information needed for connecting the Adjusting and Testing Software to devices and for proper operation.

2.2 Notes in this documentation

Safety precautions

Precautionary statements warn of hazards in handling the device 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 device. Informational notes are divided into the following groups:

The information symbol indicates a **tip**.

A tip provides additional or supplementary information.

The gear symbol indicates that the function described **depends on the machine**, e.g.

- Your machine must feature a certain software or hardware option
- The behavior of the functions depends on the configurable machine settings

The book symbol represents a **cross reference** to external documentation, e.g. the documentation of your machine tool builder or other supplier.

2.3 Safety precautions in the Adjusting and Testing Software

The Adjusting and Testing Software displays safety precautions by means of symbols.

Examples:

Icon	Note
	If the selected encoder does not match the connected encoder, the encoder or the computer may be damaged.
	Encoders which are subject to a laser protection class are marked accordingly. In this case, observe the information on the encoder, the encoder mounting instructions and all safety precautions contained therein.

2.4 Intended use

The Adjusting and Testing Software is intended solely for the following use:

- Diagnostics and adjustment of HEIDENHAIN encoders with absolute and incremental interfaces

2.5 Improper use

Any use not specified in 'Intended use' is considered improper use. The company operating the encoder diagnostic set is solely liable for any damage resulting from improper use.

Especially its use as part of a safety function is not permitted.

2.6 Personnel qualification

The personnel installing and operating the software must be appropriately qualified for this work and must have obtained sufficient information from the documentation supplied with the software, the devices and the connected peripherals.

The personnel groups are specified in detail as follows with regard to their qualifications and tasks.

Qualified personnel

The qualified personnel are trained by the operating company to perform operation and parameterization. The qualified personnel have the required technical training, knowledge and experience and know the applicable regulations, and are thus capable of performing the assigned work regarding the application concerned and of proactively identifying and avoiding potential risks.

Electrical specialist

The electrical specialist has the required technical training, knowledge and experience and knows the applicable standards and regulations, and is thus capable of performing work on electrical systems and of proactively identifying and avoiding potential risks. Electrical specialists have been specially trained for the environment they work in. Electrical specialists must comply with the provisions of the applicable legal regulations on accident prevention.

2.7 Obligations of the operating company

The operating company owns or leases the software, the device, and the peripheral devices. It is responsible that the intended use is complied with at all times.

The operating company must:

- Assign the different tasks to be performed to appropriated, qualified, and authorized personnel
- Verifiably train the personnel in the authorizations and tasks
- Provide all materials and means necessary in order for the personnel to complete the assigned tasks
- Ensure that the devices are operated only when in perfect technical condition
- Ensure that the software and the devices are protected from unauthorized use

2.8 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.

	The software supports the use of a wide variety of peripheral devices. The safety precautions provided in the respective documentations of the devices must be observed. If there is no documentation at hand, it must be obtained from the manufacturer concerned.

The specific safety precautions required for the individual activities to be performed are indicated in the respective sections of this manual.

3

Inspecting encoders with the encoder diagnostic set

3.1 Overview

This chapter provides basic information on inspecting encoders with the encoder diagnostic set.

3.2 Measuring methods and interfaces

The scope of functions of the Adjusting and Testing Software depends on the connected encoder, in particular on its measuring method and interface type.

Measuring method

The following measuring methods are available for HEIDENHAIN encoders.

Measuring method	Description
Incremental measuring method	With the incremental measuring method, the position information is obtained by counting the individual increments (measuring steps) starting from some point of origin. Since an absolute reference point is necessary for determining the positions, a reference-mark signal is output as well. As a general rule, encoders that operate with the incremental measuring method provide incremental signals.
Absolute measuring method	With the absolute measuring method the absolute position information is acquired directly from the grating of the measuring standard. The position value is available from the encoder immediately upon switch-on and can be requested at any time by the subsequent electronics. Absolute encoders do not require referencing. Some absolute encoders output incremental signals in addition to the position value. Some absolute encoders transmit valuation numbers providing information on the current encoder status.

Interface

The following interface types can be distinguished, depending on the encoder output signal.

Sinusoidal incremental signals	**Description**
1 V_{PP} 3 V_{PP}	The encoder outputs voltage signals (sinusoidal signals).
11 μA_{PP} 25 μA_{PP}	The encoder outputs current signals (sinusoidal signals).

Square-wave incremental signals	**Description**
TTL HTL HTLs	The integrated electronics (with or without interpolation) digitizes the sinusoidal scanning signal and outputs it to the subsequent electronics as a sequence of square-wave pulses.

Serial data transmission	**Description**
EnDat	Digital, bidirectional interface that is capable of transmitting position values, reading and updating information stored in the encoder, and storing new information. The ordering designation indicates whether the encoder outputs incremental signals in addition to the absolute position: ■ EnDat01, EnDat02: with 1 V_{PP} incremental signals ■ EnDat21, EnDat22: without incremental signals
DRIVE-CLiQ	Manufacturer-specific interfaces without incremental signals
Fanuc	
Mitsubishi	
Panasonic	
Yaskawa	
Indramat	
SSI	Synchronous serial interface with incremental signals

Interface electronics

Interface electronics from HEIDENHAIN adapt the encoder signals to the interface of the subsequent electronics. They are used when the subsequent electronics cannot directly process the output signals encoders, or when the additional interpolation of the signals is necessary. The encoder diagnostic set allows you to test encoders in combination with different interface electronics of the series **EIB**, **EXE**, **IBV**, and **APE**.

Transceiver unit for EnDat touch probes

Wireless touch probes transmit information via radio or infrared signals to a transceiver unit. With the encoder diagnostic set, you can test the EnDat touch probes **TS 460** and **TT 460** in combination with the transceiver unit **SE 661**.

The encoder diagnostic set currently does not support other touch probes or transceiver units.

For more information on the encoder interfaces, please refer to the **Interfaces of HEIDENHAIN Encoders** brochure.
Further information: "Opening documentation", Page 42

You can find detailed information on the encoder interface in the encoder documentation that you can download from the HEIDENHAIN website.

Link: **www.heidenhain.de**
Path: Software ▶ Infobase

3.3 Operating modes of the testing device

The procedure for testing encoders depends on the operating mode of the testing device.

The following operating modes are available:

- **Encoder diagnostics**:
  The encoder is connected directly to the PWM. This makes a comprehensive analysis of the encoder functions possible, irrespective of the control loop of a machine tool
- **Monitoring mode**:
  The PWM is integrated into the control loop of an NC-controlled machine tool. This permits monitoring of the encoder during operation

For information about which interface types support monitoring, see the Overview of functions.
Further information: "Overview of functions", Page 29

Read the operating instructions before connecting and operating the PWM.
Further information: "Opening documentation", Page 42

3.3.1 Encoder diagnostics

The encoder is connected directly to the PWM. This makes a comprehensive analysis of the encoder functions possible, irrespective of the control loop of a machine tool.

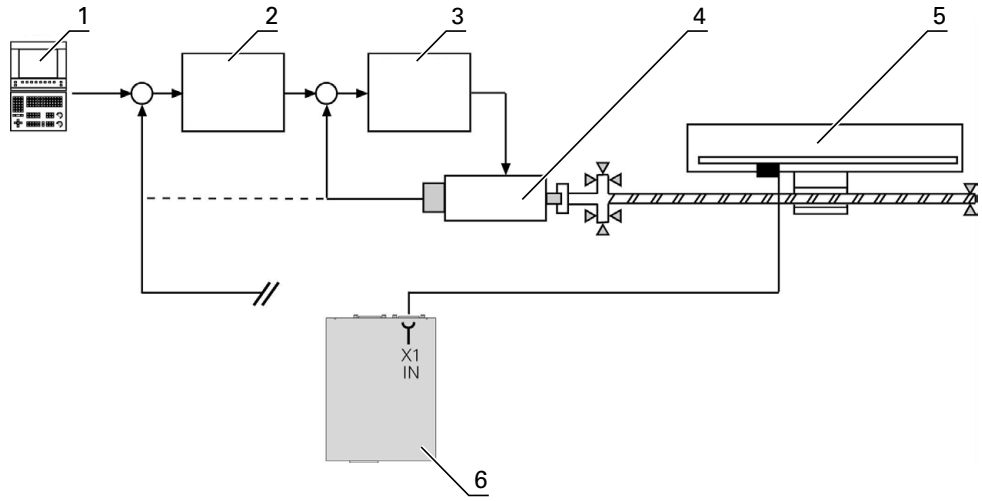


Figure 1: PWM connected directly to the encoder

1 Control
2 Position controller
3 Speed controller
4 Motor
5 Encoder
6 PWM

Property	Description
Connection of the PWM	■ The encoder input **X1** or **X4** is connected to the encoder ■ The encoder input **X2** is not connected
Power supply of the encoder	Via the PWM
Encoder traverse	Usually by hand; NC control is possible

If the power is supplied via the PWM, you can activate voltage readjustment in the Adjusting and Testing Software. This serves to compensate for voltage drops on the lines connecting the testing device and the encoder.

3.3.2 Monitoring mode

The PWM is integrated into the control loop of an NC-controlled machine tool. This permits monitoring of the encoder and the machine during operation.

The use of a signal adapter is advisable for the monitoring mode. The signal adapter ensures metallic isolation and enables floating testing.

For detailed information on the signal adapters SA 100 and SA 110, refer to the "User's Manual Cables and Connection Technology".
Further information: "Opening documentation", Page 42

Monitoring mode with signal adapter

The PWM is integrated into the control loop of the machine tool via the signal adapter. The test can be carried out potential-free.

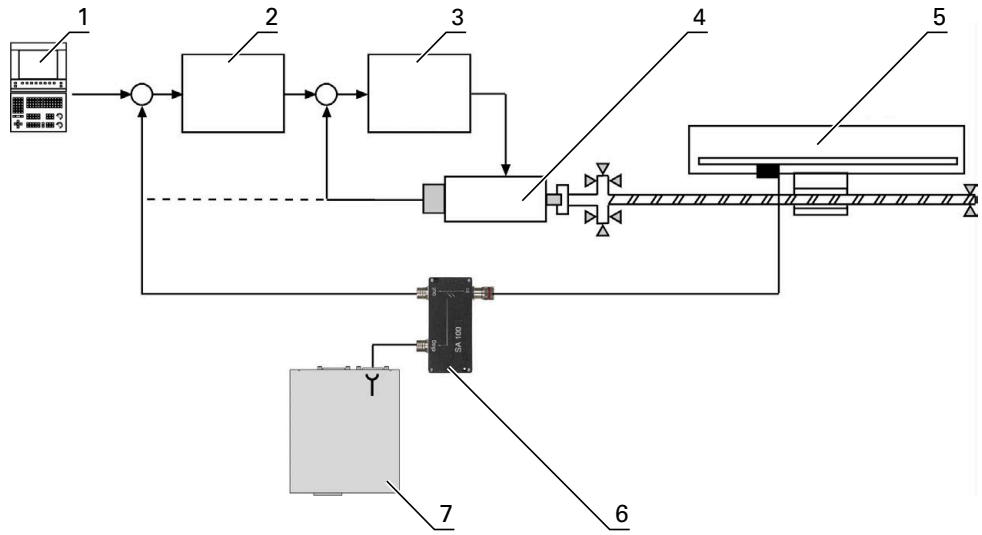


Figure 2: Monitoring mode with signal adapter (potential segregation)

1 Control
2 Position controller
3 Speed controller
4 Motor
5 Encoder
6 Signal adapter
7 PWM

Property	Description
Connection of the PWM	■ The encoder input **X1** is connected to the signal adapter ■ The encoder input **X2** is not connected
Power supply of the encoder	Via the subsequent electronics
Power supply of the signal adapter	Via the PWM
Potential segregation	Yes, through the signal adapter
Encoder traverse	NC control possible

Monitoring mode without signal adapter

The PWM is directly integrated into the control loop of the machine tool.

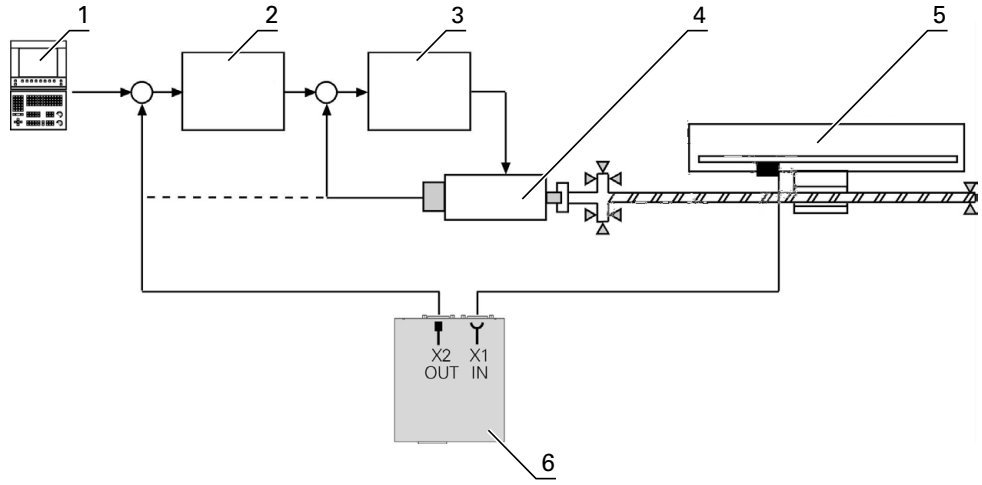


Figure 3: Monitoring mode without signal adapter (no potential segregation)

1 Control
2 Position controller
3 Speed controller
4 Motor
5 Encoder
6 PWM

Property	Description
Connection of the testing device	■ The encoder input **X1** is connected to the encoder ■ The encoder input **X2** is connected to the subsequent electronics
Power supply of the encoder	Via subsequent electronics
Potential segregation	No
Encoder traverse	NC control possible

The following interface-specific properties apply when using the monitoring mode without a signal adapter:

Interface	Characteristic
1 V_{PP}	■ The PWM picks off the signals without 120-ohm signal termination ■ The cutoff frequency is influenced by the test setup (e.g. adapter cables)
11 μA_{PP}	■ The line is interrupted in the monitoring mode, i.e. the PWM has an 11 μA_{PP} receiver and reproduces the (emulated) input signals at an 11 μA_{PP} output ■ The cutoff frequency is influenced by the test setup (e.g. adapter cables) ■ Signal interferences can occur, depending on the test setup (cable lengths, extension cables, cable configuration, machine type such as EDM)
TTL	■ Without PWT switchover: The PWM picks off the RS-422 signals, i.e. a standard RS-422 receiver without 120-ohm terminating resistor is connected to the lines
Serial	■ Without The PWM picks off the RS-485 signals, i.e. a standard RS-485 receiver without 120-ohm terminating resistor is connected to the lines

Touch probes cannot be examined in the monitoring mode.

3.4 Overview of functions

The following overview shows the range of functions of the encoder diagnostic set depending on the encoder interface.

	1 V_{PP}/11 μA_{P-P}[2]	TTL	HTL[3]	EnDat	DRIVE-CLiQ	Fanuc	Mitsubishi	Panasonic	Yaskawa	SSI
Position display										
Display of the absolute position	–	–	–	✓	✓	✓	✓	✓	✓	✓
Display of the incremental position (if available)	✓	✓	✓	✓	–	✓	✓	–	–	✓
Display and resetting of error messages	–	–	–	✓	✓	✓	✓	✓	✓	–
Display and resetting of warnings	–	–	–	✓	✓	✓	✓	✓	✓	✓
Display of the transmission status	–	–	–	✓	✓	✓	✓	✓	✓	(✓)
PWT display of incremental signals	✓	(✓)	–	✓	–	–	–	–	–	–
Connection dialog; encoder connection via:										
ID of encoder	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Entry of interface and supply voltage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ID of HEIDENHAIN motor	✓	–	–	✓	–	–	–	–	–	–
Diagnostics										
Display of online diagnostics	–	–	–	✓	✓	✓	✓	✓	✓	–
Display of online diagnostics in the control loop[1]	–	–	–	✓	–	✓	✓	✓	–	–
Monitoring mode permitted with the PWM 21	✓	✓	–	✓	–	✓	✓	✓	–	–
Circular representation of the incremental signals (if available)	✓	✓	–	✓	–	–	–	–	–	✓
Evaluation of the reference signal	✓	✓	✓	–	–	–	–	–	–	–
Incremental counter	✓	✓	✓	✓	–	–	–	–	–	–
Display of supply voltage and supply current	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Homing/limit display	✓	✓	–	–	–	–	–	–	–	–
Signal recording	✓	–	–	–	–	–	–	–	–	–
Mounting wizards/inspection wizards										
For ECI 11xx/13xx/1xx, EQI 11xx/13xx, EBI 11xx/1xx	See documentation of the encoder									
For ERO 2xxx, ECA 4xxx	See documentation of the encoder									
For LIP 2xx, LIC 4xxx, LIC 2xxx	See documentation of the encoder									
Inspection wizard for encoders with functional safety	–	–	–	✓	✓	–	–	–	–	–
Tape tensioning wizard	✓	–	–	✓	–	✓	✓	–	–	–

	1 V_{PP}/11 μA_{P-P}[2]	TTL	HTL[3]	EnDat	DRIVE-CLiQ	Fanuc	Mitsubishi	Panasonic	Yaskawa	SSI
Additional functions (if supported by the encoder)										
Comparison of absolute position with incremental position				✓	–	–	–			✓
Datum shift ("electric zeroing"), including information display[4]	–	–	–	✓	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Display of additional data: Temperature	–	–	–	- ✓[5]	✓	–	–	–	–	–
Display of additional data: Position value 2	–	–	–	✓	✓	–	–	–	–	–
Display of additional data: Additional sensors	–	–	–	✓	–	–	–	–	–	–
Display of additional data: Limit position signals	–	–	–	✓	–	–	–	–	–	–
Display of additional data: Operating status error sources	–	–	–	✓	–	–	–	–	–	–
Memory contents										
Display of memory contents and memory parameters	–	–	–	✓	✓	✓	–	–	✓	–
Modification of memory contents	–	–	–	✓	–	–	–	–	–	–
Storing of memory assignments	–	–	–	✓	✓	–	–	–	–	–
Comparison of current memory contents with saved memory contents	–	–	–	✓	–	–	–	–	–	–
Backing up of the encoder memory	–	–	–	✓	✓	✓	✓	✓	✓	–

1) In monitoring mode; preferably in conjunction with a signal adapter, e.g., an SA 100 or SA 110

2) 25 μA_{PP}/3 V_{pp} for servicing purposes

3) Via signal adapter, for servicing purposes

4) License key is required and is available only for certain encoders (with the exception of EnDat)

5) Including conversion for PT 1000 sensors when EnDat memory parameters are appropriately set

(✓) See information in this User's Manual

3.5 Transfer of values and signals

Which values and signals the encoder transfers and the Adjusting and Testing Software evaluates depends on both the encoder interface and the operating mode of the testing device.

Interface	Transmission	In Encoder Diagnostics mode of operation	In Monitoring mode of operation
EnDat 2.1 (with incremental signals)	Position value	Yes	No
	Incremental signals	Yes	Yes
EnDat 2.2 (without incremental signals)	Position value	Yes	Yes
	Valuation numbers	Yes	Yes[1)]
DRIVE-CLiQ	Position value	Yes	No
	Valuation numbers	Yes	No
Fanuc	Position value	Yes	Yes
	Valuation numbers	Yes	Yes
Mitsubishi	Position value	Yes	Yes
	Valuation numbers	Yes[4)]	Yes[1) 4)]
Panasonic	Position value	Yes	Yes
	Valuation numbers	Yes	Yes[1)]
Yaskawa	Position value	Yes	No
	Valuation numbers	Yes[5)]	No
SSI	Position value	Yes	No
	Incremental signals	Yes	Yes
1 V_{PP}	Incremental signals	Yes	Yes
11 μA_{PP}	Incremental signals	Yes	Yes
TTL	Incremental signals	Yes	Yes
	Scanning signals	Yes[3)]	No
HTL	Incremental signals	Yes[2)]	No
Commutation	Block commutation	Yes[2)]	No
	Sinusoidal commutation	Yes	Yes

1) Information must be requested and transferred by the control
2) Via appropriate signal adapter
3) If supported by the encoder (PWT function)
4) Not available for encoders with the ordering designation Mitsu01
5) Not available for the EIB 3391 Y

3.6 Units and tolerances

The Adjusting and Testing Software automatically adapts units, scalings, and tolerances to the connected encoder.

The tolerance values displayed in the Adjusting and Testing Software are the HEIDENHAIN standard values for the encoder interface concerned.

For more information on signal amplitudes and tolerances, please refer to the "Interfaces of HEIDENHAIN Encoders".

Further information: "Opening documentation", Page 42

The tolerances of high-accuracy measuring systems (e.g., angle encoders) and encoders with large temperature ranges (e.g., motor encoders) are tighter. In these cases, the tolerances of the Adjusting and Testing Software are invalid.

- Observe the tolerance specifications in the documentation of the encoder for each test

A license key (software option) is required to alter the tolerance limits in the Adjusting and Testing Software.

Further information: "Software options", Page 12

4

Installing the software

4.1 Overview

This chapter provides all of the information needed for downloading and properly installing the software and the necessary drivers on a computer.

4.2 System requirements

Computer:	IBM PC or compatible PC ≥ Pentium Dual Core; 2 GHz
Operating system:	Microsoft Windows 7 (32/64 Bit), Microsoft Windows 8 (32/64 Bit), Microsoft Windows 10 (32/64 Bit)
RAM:	≥ 2 GB
Hard disk:	≥ 500 MB (1 GB) of free disk space
Monitor	≥ 1024 x 768 pixels
Interface:	USB 2.0 type A
Windows user right:	Administrator

If the computer does not meet the described requirements, the consequences may be as follows:

- Data processing takes more time
- The Adjusting and Testing Software issues error messages
- The functionality of the Adjusting and Testing Software is reduced

4.3 Installing the software

The installation files for the Adjusting and Testing Software are on a CD-ROM included in the items supplied with the encoder diagnostic set. You also find the current software version in the download area of the HEIDENHAIN website.

Link: **www.heidenhain.de**

Path: Software ▶ Inspection and testing devices▶ PM 20 and PWM 21 ▶ Documentation ▶ Software ATS adjusting and testing package

File: ATS Vx.x.xx - Adjusting and Testing Software for PWM20 and PWM21.zip

Read the release notes for the software version before installing the Adjusting and Testing Software. You find the file **ReleaseNotes.pdf** in the folder of the installation file.

- ▶ Insert the CD-ROM into the CD-ROM drive

or

- ▶ Download the installation file from the HEIDENHAIN website
- ▶ Extract the downloaded ZIP file
- ▶ Navigate to the following folder: 539862xx ▶ FILES ▶ Software
- ▶ Run the installation file with the extension ".exe"
- > The installation wizard opens
- ▶ Click **Next**
- ▶ In the **Select Destination Location** installation step, select the storage location to which you want to save the software
- ▶ Click **Next**
- ▶ Click **Install**
- > The installation starts
- > The status of installation is shown in the progress bar
- ▶ When the installation is terminated, click **Finish**
- > The link to the Adjusting and Testing Software is displayed on the computer desktop

4.4 Checking the installation

After the installation, check whether the Adjusting and Testing Software can access the PWM.

- ▶ Connect the PWM to the computer via the USB interface
- ▶ Switch on the PWM
- ▶ Start the Adjusting and Testing Software
  Further information: "Starting the software", Page 40
- > If drivers are missing, the Adjusting and Testing Software issues the error message "No hardware was found"
  Further information: "Installing drivers", Page 36

4.5 Installing drivers

The required drivers are located in the software installation folder.

> Depending on the operating system of the computer, the procedure may differ from the description below.

- Navigate to the following folder in the installation package: 539862xx/FILES/Drivers/PWMxx
- Copy the driver files to the following program directory: C:\Program Files (x86)\HEIDENHAIN\ATS\Drivers\PWM20
- Call the device manager of the computer
- Click **Other devices**
- Double-click **PWM**
- Click **Update drivers**
- Select the option for manual search and installation
- In the dialog, enter the storage location of the driver files
- Click **Next**

> The drivers will now be installed

4.6 Updating software and encoder database

New versions of the Adjusting and Testing Software are made available at regular intervals. When you run a software update, the encoder database is updated as well. You find the current software version in the download area at the HEIDENHAIN website.

Link:	**www.heidenhain.de**
Path:	Software ▶ Inspection and testing devices▶ PM 20 and PWM 21 ▶ Documentation ▶ Software ATS adjusting and testing package
File:	ATS Vx.x.xx - Adjusting and Testing Software for PWM20 and PWM21.zip

4.7 Uninstalling the software

To uninstall the Adjusting and Testing Software from a computer, proceed as follows:

- Select the following in succession in Microsoft Windows:
  - **Start**
  - **HEIDENHAIN Applications**
  - **Adjusting and Testing Software**
- Click **Uninstall**

> The uninstallation wizard opens

- To confirm uninstalling, click **Yes**

> Uninstalling starts

> The status of the uninstall process is shown in the progress bar

- After uninstallation has been completed successfully, close the uninstallation wizard with **OK**

5

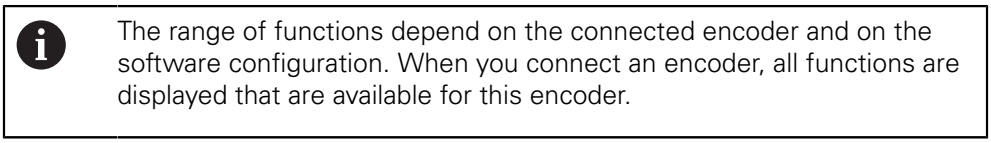
Basic operation

5.1 Overview

This chapter describes the user interface, operating elements and basic functions of the Adjusting and Testing Software.

5.2 Structure of the user interface

The software is operated via a function menu. The functions in the function menu are combined in function groups.



The range of functions depend on the connected encoder and on the software configuration. When you connect an encoder, all functions are displayed that are available for this encoder.

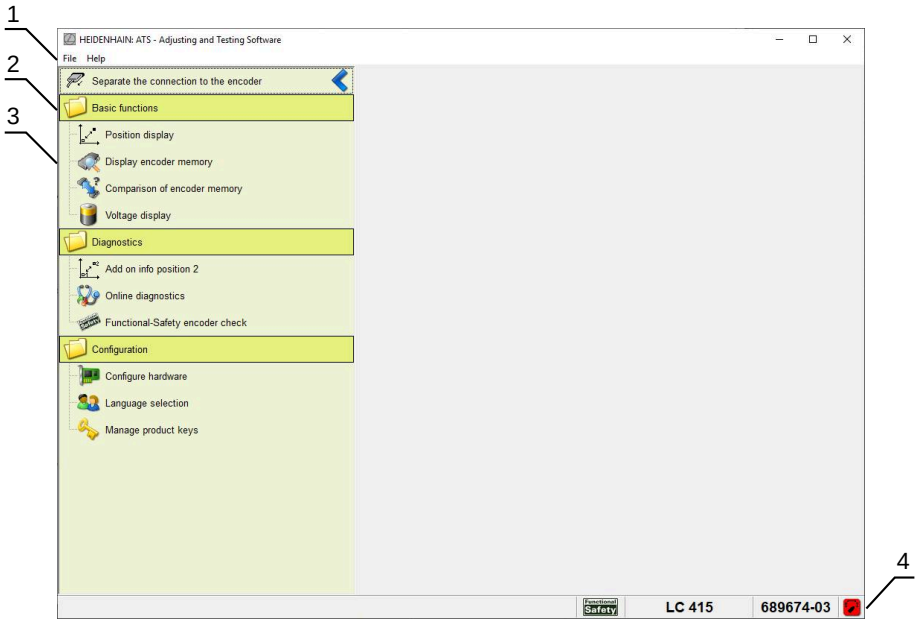
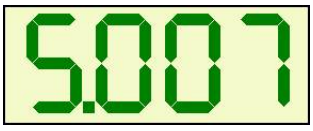


Figure 4: User interface after connecting an encoder

1 Menu bar with the menus **File** and **Help**
2 Function group
3 Function
4 Information bar showing information on the connected encoder

5.3 Recurring displays and operating elements

Display of values



Values are displayed as colored numerals.

The significance of the color depends on the function. For a detailed description, please refer to the respective section.

Status display

The color of the LED symbol indicates a status, e.g.

- Green: Measured value within tolerance range
- Red: Measured value outside the tolerance range

The significance of the color depends on the function. For a detailed description, please refer to the respective section.

With status displays, the tolerance is checked by the encoder. The status displayed in the Adjusting and Testing Software refers to the tolerance limits of the encoder.

Bar graph

Bar graphs serve to display and evaluate measured values.

The significance of the color depends on the function. For a detailed description, please refer to the respective section.

Input fields with plus and minus operating elements

- ▶ Enter the desired value
- ▶ Confirm with **Enter**

or

- ▶ Tap + or – until the desired value is displayed
- ▶ Press and hold + or – to change values faster

Operating element "Return to last view"

Returns to the previous level or back to the main menu

Symbols: Power supply

The symbols indicate whether power supply by the PWM is active.

Display	Description
	Power supply is not active
	Power supply is active

When the computer goes to sleep mode or if there is a software error, the display in the Adjusting and Testing Software is no longer reliable. Therefore always observe the **L2** status LED on the PWM to see whether the PWM is outputting voltage. You will find a detailed description of the PWM status displays in the operating instructions.

Further information: "Opening documentation", Page 42

Mouse-over text

When you move the mouse pointer over operating elements or displays, a mouse-over text appears, giving a brief explanation, such as the unit of a value.

5.4 Starting the software

- Double-click the icon of the Adjusting and Testing Software on the Microsoft Windows desktop

or

- Select in succession in Microsoft Windows
  - **Start**
  - **HEIDENHAIN Applications**
  - **ATS – Adjusting and Testing Software**

> The software opens

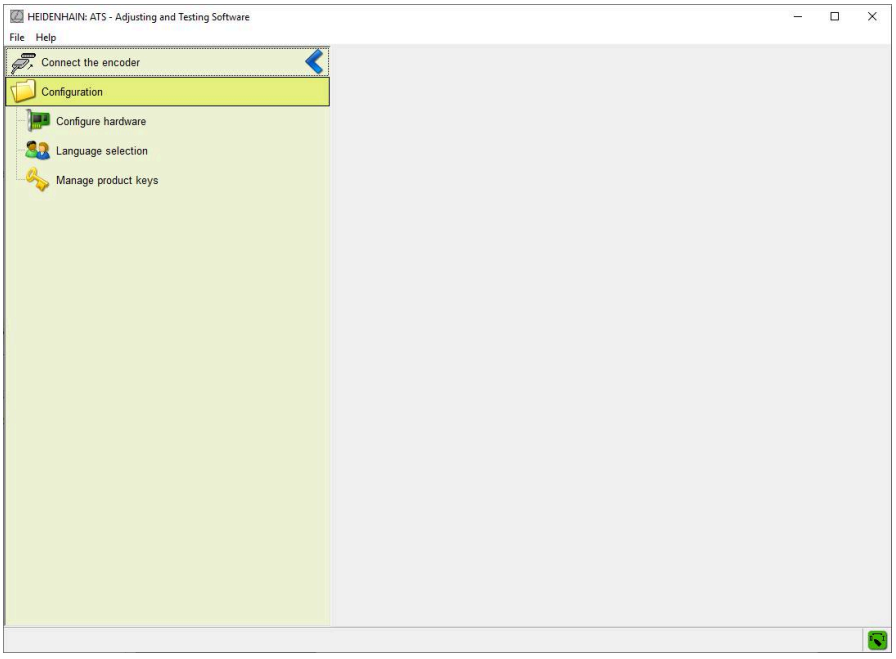


Figure 5: User interface after startup

Firmware update

If the PWM is switched on and connected to the computer, the Adjusting and Testing Software checks the compatibility of the firmware of the device and the current software version. If a firmware update is required, you can run the update with the Adjusting and Testing Software. A software wizard will guide you through the required steps.

NOTICE

Damage to the product by interrupting a firmware update

If you disconnect the power supply of the PWM or separate the plug connection during a firmware update, the PWM may be damaged.

- When updating the firmware, wait until the progress bar has reached 100 % before you continue with further steps

5.5 Exiting the software

- Click **File** on the menu bar
- Click **Exit**
- > If the software is connected to an encoder, the connection is separated
- > The software is terminated

5.6 Viewing software information

Display of information on software and database versions

- Click **Help** on the menu bar
- Click **About**
- > Information on the installed software version and database version is displayed

You can download the current software version from the HEIDENHAIN website.

Further information: "Updating software and encoder database", Page 36

Display of license information on open source software

- Click **Help** on the menu bar
- Position the mouse pointer at **License hints**
- Click **Used Open Source Software**
- > The license information for the installed open source software is displayed

5.7 Opening documentation

Prerequisite: A PDF viewer is installed on the computer.

The following documents are available in the software in PDF format:

File name in the Help menu	Document
User's Manual	"Adjusting and Testing Software User's Manual"
Cables and Connection Technology	"User's Manual Cables and Connection Technology"
Interfaces	Brochure "Interfaces of HEIDENHAIN Encoders"
Operating Instructions	"PWM 20 / PWM 21 Operating Instructions"
Release Notes	Release Notes for the installed version of the Adjusting and Testing Software

- ▶ Click **Help** on the menu bar to open a document
- ▶ Click the file name
- > The document is opened in the PDF viewer

5.8 Adjusting, exporting and printing diagrams

Some of the views of the Adjusting and Testing Software contain diagrams. You can adjust the diagram views and export and print diagrams.

5.8.1 Magnifying the diagram view

- ▶ Press and hold the left mouse button and – starting at the left – draw a square over the desired area
- > This area will be magnified

5.8.2 Moving an image section

When the diagram view is zoomed in, you can navigate in the diagram by moving the image section.

- ▶ To move the image section vertically, press and hold the left mouse button and turn the scroll wheel in the desired direction
- ▶ To navigate freely, move the diagram to the desired position while holding down the right mouse button

5.8.3 Reducing the diagram view

- ▶ Press and hold the left mouse button and draw a square from right to left
- > The diagram view is reduced in size

5.8.4 Exporting diagrams

The Adjusting and Testing Software uses the **TeeChart** program offering the following export functions:

- Copy diagram to clipboard
- Save diagram
- Send diagram by e-mail

▶ Right-click the diagram
▶ Click **Save diagram**
> The **Save** dialog appears

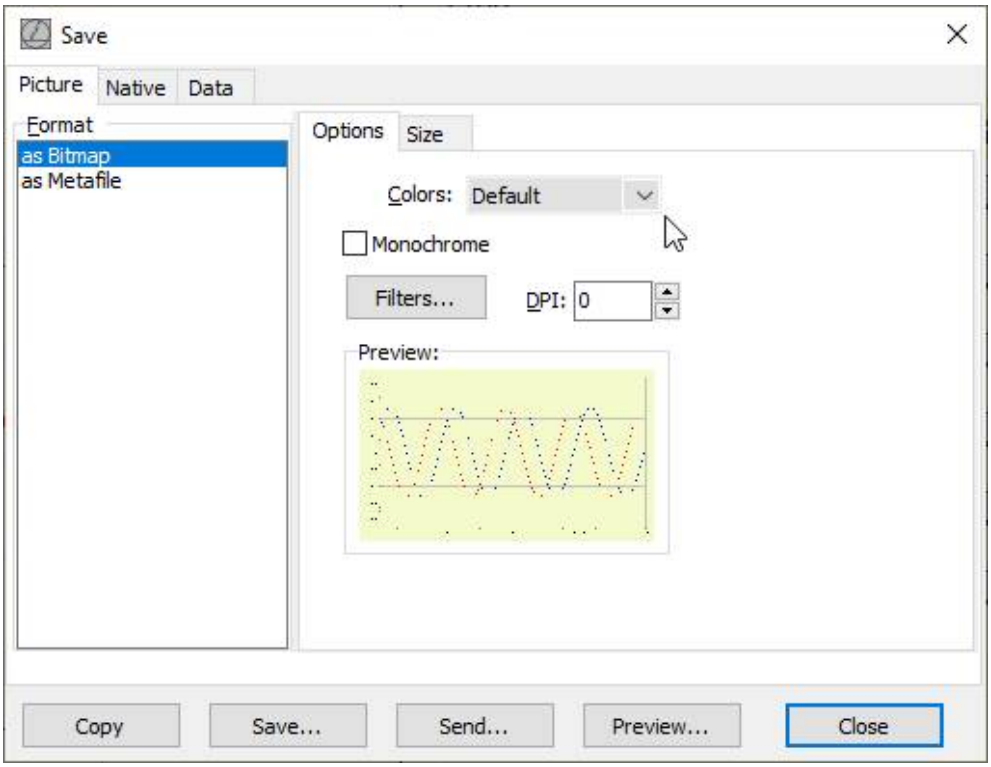


Figure 6: **Save** dialog

▶ Select the desired parameters
▶ Click **Preview** to open the preview of the diagram
▶ Click **Copy** to copy the diagram to the clipboard
▶ Click **Save** to save the diagram to the local disk
▶ Click **Send** to send the diagram by e-mail
▶ Follow the instructions of the Windows dialog

5.8.5 Printing the diagram

- Right-click the diagram
- Click **Print diagram**

> The dialog **TeeChart Print Preview** appears

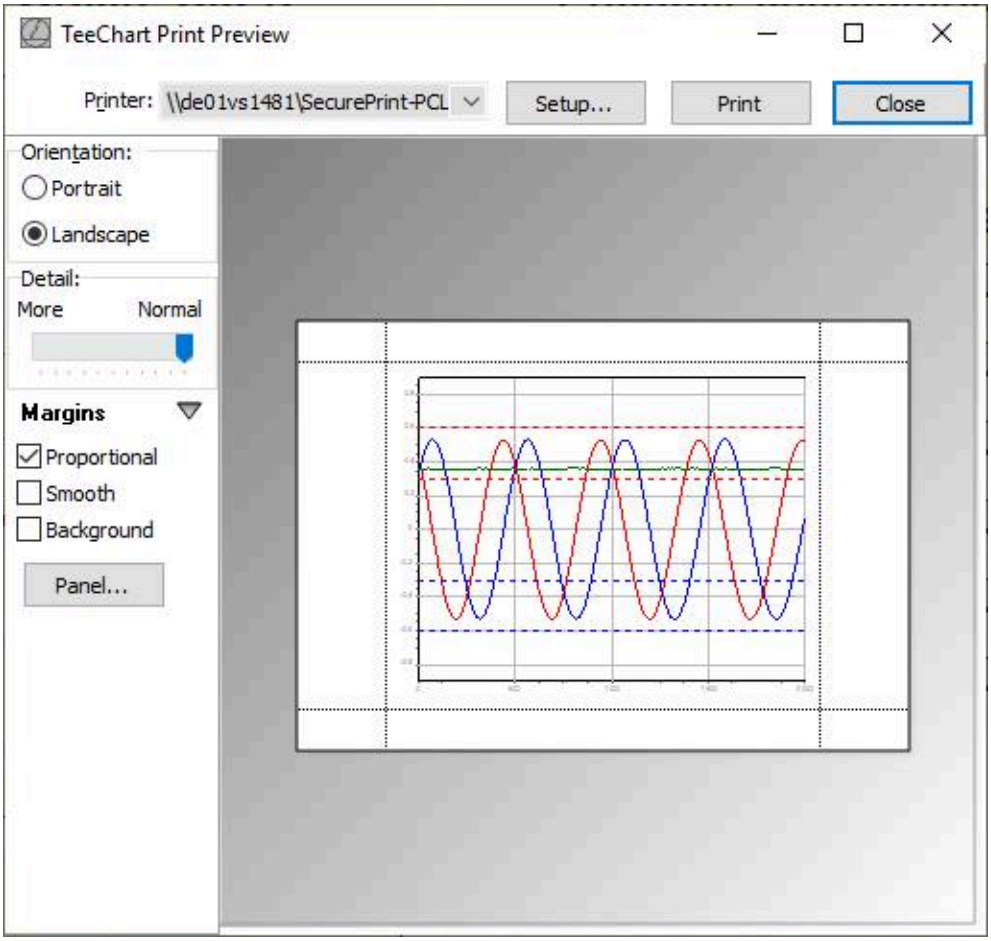


Figure 7: Dialog **TeeChart Print Preview**

- Select the desired parameters
- Click **Print**

> The print job is sent to the selected printer

6

Configuring the software

6.1 Overview

This chapter describes how you can adapt the Adjusting and Testing Software to your requirements.

6.2 Switching the language

You can choose between English and German for the language of the user interface.

- Double-click **Language selection** in the function menu
- Click the desired national flag symbol
- Confirm with **OK**

> The user interface is displayed in the selected language

6.3 Enabling software options

Software options are available to increase the range of functions of the Adjusting and Testing Software. A license key must be entered to enable a software option. You can obtain the required license key from the HEIDENHAIN Service department.

License keys are associated with the serial number of the device. Software options cannot be transferred to other devices.

One software option can be activated per serial number. When a further software option is activated, the currently active option becomes inactive. However, the license key remains valid and can be reused for reactivation on the same device.

- ▶ Double-click **Manage product keys** in the function menu
- > The **Product keys** dialog appears

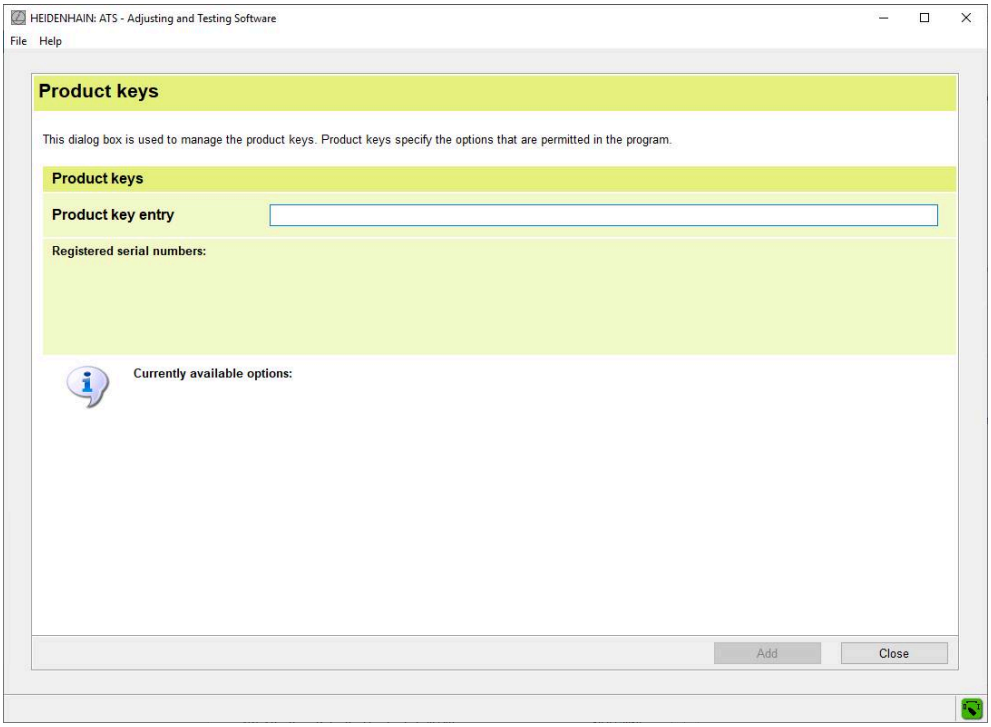


Figure 8: **Product keys** dialog

- ▶ Enter the license key
- ▶ Click **Add**
- > The software option is displayed in the **Currently available options** field
- ▶ Click **Close**
- > The additional functions will be active as soon as you connect an encoder supporting these functions

6.4 Deactivating software options

When you deactivate a software option, the associated functions will no longer be available. You can reactivate the software option at the same device by re-entering the license key.

- ▶ Double-click **Manage product keys** in the function menu
- > The **Product keys** dialog shows the active software option for each serial number

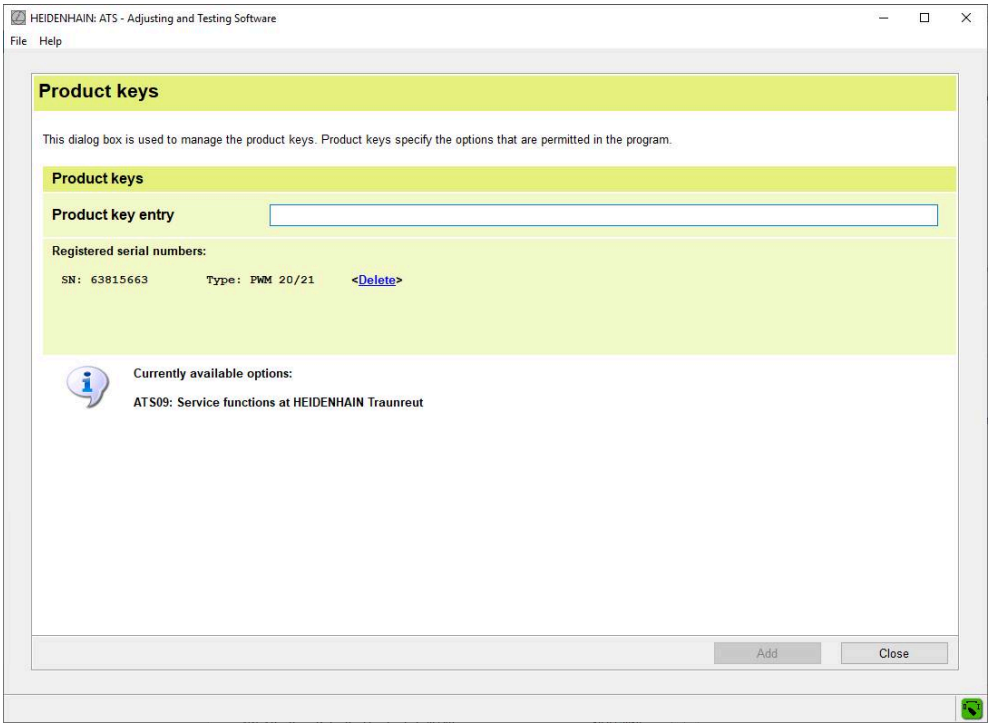


Figure 9: **Product keys** dialog with active software option

- ▶ Click **Delete** next to the desired software option
- ▶ Confirm with **Yes**
- > The software option is deactivated

6.5 Updating the documentation

The files listed below are stored in the Adjusting and Testing Software and can be replaced by new file versions.

File name	Document
um.pdf	"Adjusting and Testing Software User's Manual"
cct.pdf	"User's Manual Cables and Connection Technology"
i.pdf	Brochure "Interfaces of HEIDENHAIN Encoders"
oi.pdf	"PWM 20 / PWM 21 Operating Instructions"

You can download the current documentation from the HEIDENHAIN website.

Link: **www.heidenhain.de**

Path: Software ▶ Inspection and testing devices ▶ PWM 20 and PWM 21 ▶ Documentation

- ▶ To store new documents in the Adjusting and Testing Software, open the program directory and navigate to the storage location you selected during the software installation:
  Path: C: ▶ Programs (x86) ▶ HEIDENHAIN ▶ ATS ▶ doc
- > The program directory contains a folder for each language in which the documentation is available
- ▶ Open the folder for the desired language
- ▶ Replace the existing files with the new files

> The file names must be as specified in the table.

- ▶ Repeat for other languages, if required
- > The new documents are available in the **Help** menu in the selected language

6.6 Selecting the PWM as testing device

If your computer is connected to only one testing device, the Adjusting and Testing Software automatically selects this device; no further action is required.

Prerequisites:

- The PWM is connected to the computer via the USB interface
- The PWM is switched on
- The device drivers are installed
  Further information: "Installing drivers", Page 36

If your computer is connected to several testing devices, select the device you are currently working with in the Adjusting and Testing Software:

- ▶ Double-click **Configure hardware** in the function menu
- > The dialog **Configure hardware** appears
- ▶ Check the box for the desired testing device
- ▶ Confirm with **OK**
- > The Adjusting and Testing Software will use the selected testing device

6.7 Saving log information

You can save log files (PDF format) with test results in the functions **Incremental signal**, **Online diagnostics** and **Functional-Safety encoder check**. In the logs, you can add information on the company and the tester.

Figure 10: Custom log header

File templates are available for creating content. The templates are located in the following directory:

Path: C: ▶ Programs ▶ HEIDENHAIN ▶ ATS ▶ db ▶ cfg ▶ templates

The file templates are available:

File name	Description
AtsCustomerAddress.txt	Company address
AtsCustomerName.txt	Company name
AtsTesterName.txt	Name of the tester
AtsReportLogoLeft.png	Company logo on the left side
AtsReportLogoRight.png	Company logo on the right side
AtsSignatureLogo.png	Signature of the tester

- ▶ Create a new directory with the name "ATS" on drive "C:"
  Path: C: ▶ ATS
- ▶ Copy the required file templates to the new directory

or

- ▶ Create files with the same names in the new directory

> The file names must be as specified in the table. Graphics must be of the same file type and size as the template.

- ▶ Customize file contents
- ▶ Save the changes
- > The Adjusting and Testing Software will enter the file contents into every log

7

Connecting the encoder

7.1 Overview

This chapter describes how you can connect an encoder in the Adjusting and Testing Software. The procedure depends on the operating mode of the testing device.

Be sure to have read and understood the PWM Operating Instructions before connecting the encoder in the ATS.

Further information: "Opening documentation", Page 42

For detailed information on the required adapter cables and signal adapters, refer to the "User's Manual Cables and Connection Technology".

Further information: "Opening documentation", Page 42

Configuration of the encoder parameters in the connection dialog

To connect the Adjusting and Testing Software to an encoder, information on the interface type and supply voltage is required. The following options are available to configure the parameters:

- **Connection via encoder ID**:
  If you enter the encoder ID in the connection dialog, the interface type and supply voltage are automatically taken from the encoder database
- **Manual connection**:
  If you do not know the encoder ID, or if the encoder database does not yet comprise the encoder, you can select the interface type and power supply by hand

Some functions of the Adjusting and Testing Software are only available if you connect the encoder through its encoder ID (recommended procedure).

Perform regular software updates to keep the encoder database up to date.

Further information: "Updating software and encoder database", Page 36

Encoder ID

The ID you have to enter in the connection dialog depends on the encoder type.

- With exposed or multi-section encoders: the ID of the scanning head
- With sealed linear encoders: the ID of the scale housing

The ID is printed on the ID label.

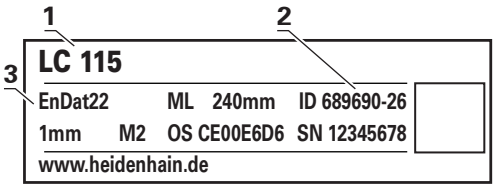


Figure 11: ID label

1 Encoder designation
2 Encoder ID
3 Encoder interface

For modular rotary encoders integrated HEIDENHAIN motors, you may enter the ID of the motor. The Adjusting and Testing Software will automatically determine the parameters of the modular rotary encoder.

If the encoder and the PWM are connected via a separate interface electronics, the procedure depends on the output signal of the interface electronics.

- With serial output signals: Enter the ID of the interface electronics
- With TTL output signals: Connect the encoder and select the parameters manually

With touch probes connected to the PWM via a transceiver unit (SE), additional steps are required.

Further information: "Connecting touch probes", Page 68

7.2 Connection in the Encoder Diagnostics operating mode

NOTICE

Damage to the device from the engaging and disengaging of connecting elements during operation

If you engage or disengage any connecting elements during operation, internal components of the devices may be damaged.

Before engaging or disengaging any connectors:

- Disconnect the encoder in the Adjusting and Testing Software
- Switch off the testing device, the subsequent electronics and the peripherals

When you connect the encoder in the Adjusting and Testing Software, you also activate power supply by the PWM. Comply with the safety precautions in the Adjusting and Testing Software and in the mounting instructions.

Prerequisites:

- The PWM is connected according to the operating mode
  Further information: "Operating modes of the testing device", Page 24
- The PWM is switched on

7.2.1 Connection with encoder ID

- ▶ Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

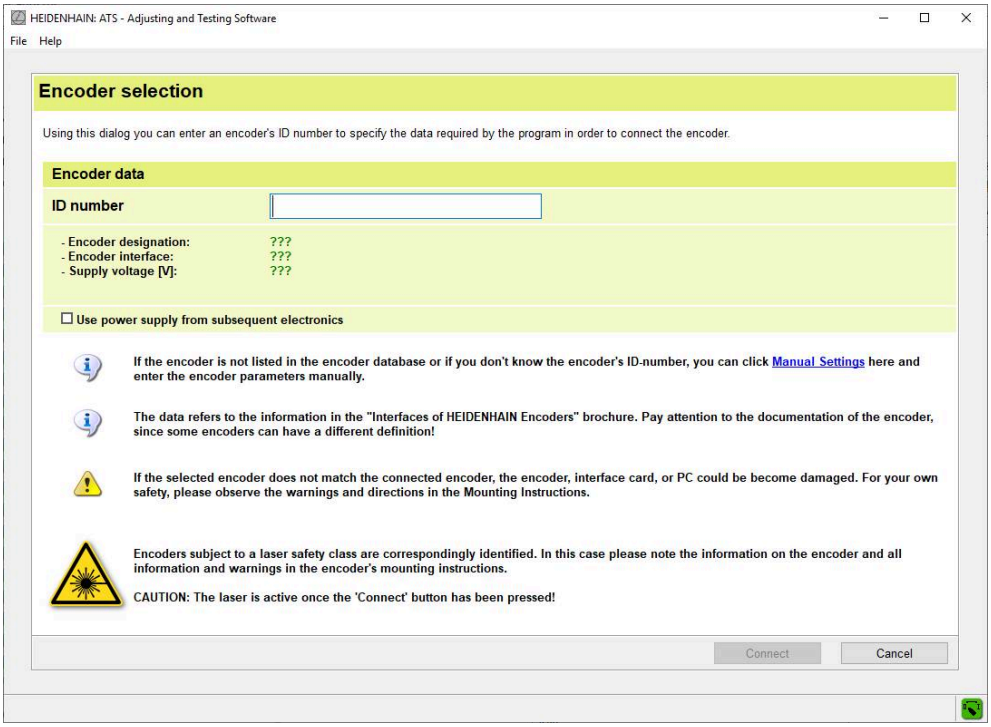


Figure 12: **Encoder selection** dialog

- ▶ Enter the encoder ID in the **ID-number** field; the entry may be with or without a hyphen
- > The determined encoder parameters are shown in the **Encoder data** field
- ▶ Click **Connect**
- > The connection to the encoder is set up

- > The voltage symbol in the information bar indicates that the encoder is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)

When you connect the encoder by entering the encoder ID, the Adjusting and Testing Software automatically activates voltage readjustment.

7.2.2 Manual connection

- ▶ Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

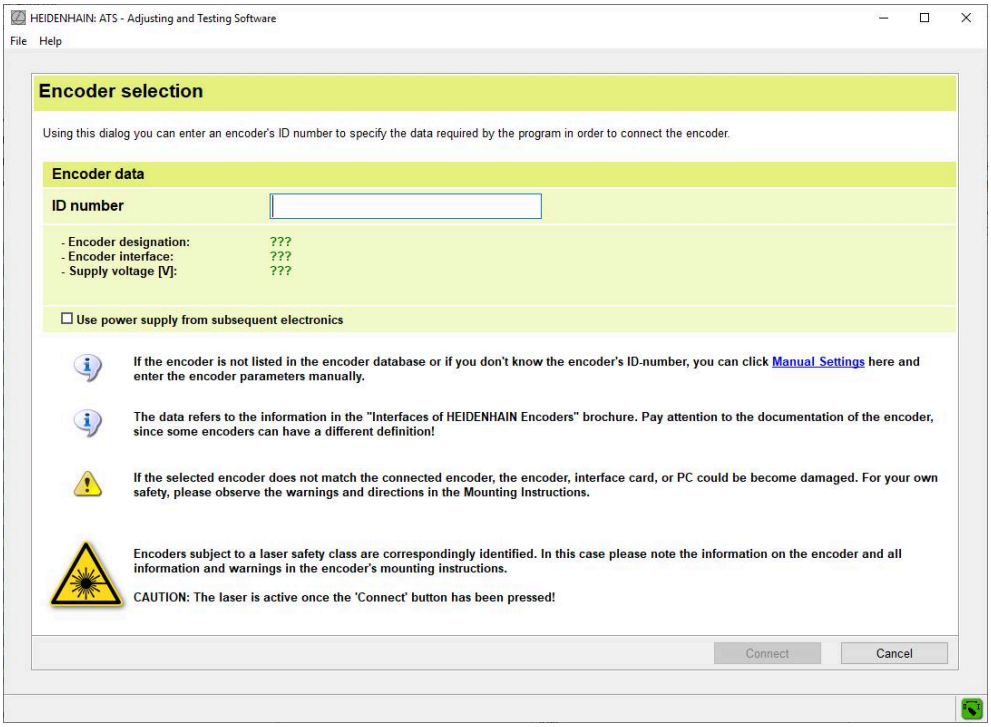


Figure 13: **Encoder selection** dialog

- ▶ Click **Manual Settings**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Next**
- > The Adjusting and Testing Software displays the encoder parameters that can be selected

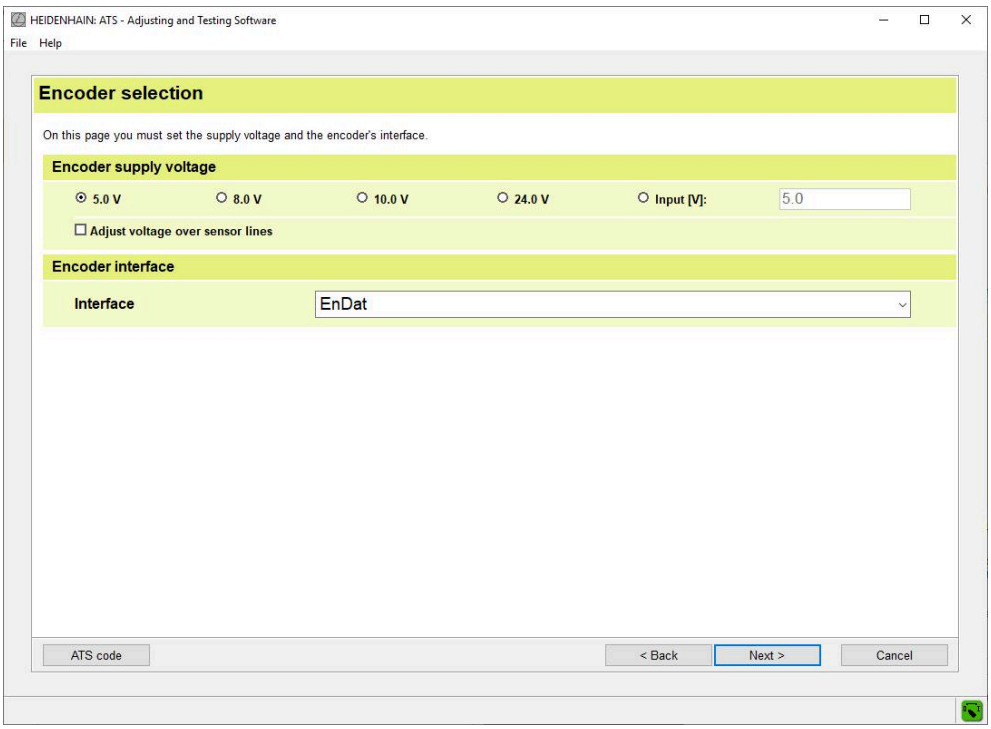


Figure 14: **Encoder selection** dialog for manual selection of the encoder parameters

- ▶ To activate voltage readjustment by the PWM, check the box **Adjust voltage over sensor lines** (recommended for all encoders except touch probes)
- ▶ Select the permissible encoder supply voltage in the **Encoder supply voltage** section
- ▶ Select the interface type in the **Encoder interface** section
- ▶ Click **Next**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Connect**
- > The connection to the encoder is set up
- > The voltage symbol in the information bar indicates that the encoder is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)

7.3 Connection the monitoring mode – Option 1: with signal adapter

⚠ WARNING

Danger due to uncontrolled axis movements upon start of monitoring mode

Integrating the PWM into the control loop of the machine tool influences the power supply of the encoder and the grounding conditions. Uncontrolled axis motions may occur when the monitoring mode is started. This may result in death or serious personal injury.

Before starting the monitoring mode:

- Note the safety precautions in the Operating Instructions
- Leave the traverse range of the machine tool
- Move the machine axes to the middle of the traverse range
- Secure machine axes against falling down
- Have one person at the emergency stop button so that this person can switch off the machine immediately in case of hazard

After having started the monitoring mode:

- Check whether the machine axis can be traversed in a controlled manner

⚠ WARNING

Hazard due to uncontrolled axis movements when engaging and disengaging connecting elements

If you engage or disengage any connecting elements in the monitoring mode, uncontrolled axis movements may occur. This may result in death or serious personal injury.

Before engaging or disengaging any connectors:

- Observe the manufacturer's documentation of the subsequent electronics, the peripherals and the machine tool
- Secure the machine axes against uncontrolled movements
- Disconnect the encoder in the Adjusting and Testing Software
- Switch off the testing device, the subsequent electronics and the peripherals

NOTICE

Damage to the product caused by overvoltage

If you select incorrect encoder parameters in the Adjusting and Testing Software, the encoder, the testing device, and the peripheral devices may be damaged.

- Connect via encoder ID and retrieve the encoder parameters from the encoder database
- For manual connection, observe the information provided by the encoder manufacturer

NOTICE

Damage to the device from the engaging and disengaging of connecting elements during operation

If you engage or disengage any connecting elements during operation, internal components of the devices may be damaged.

Before engaging or disengaging any connectors:

- Disconnect the encoder in the Adjusting and Testing Software
- Switch off the testing device, the subsequent electronics and the peripherals

Prerequisites:

- The subsequent electronics is switched off
- The PWM is connected according to the operating mode
  Further information: "Operating modes of the testing device", Page 24
- The PWM is switched on

7.3.1 Connection with encoder ID

⚠WARNING

Damage to the signal adapter by overvoltage

The signal adapters SA 100 and SA 110 are designed for a supply voltage of 5.5 V maximum. If the encoder requires a higher supply voltage, the signal adapter may be damaged, if you establish the connection through the encoder ID. As a consequence, the encoder, the PWM and the subsequent electronics may be damaged.

- Observe the encoder supply voltage displayed in the connection dialog
- Abort the procedure, if the supply voltage of the encoder exceeds 5.5 V

- Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

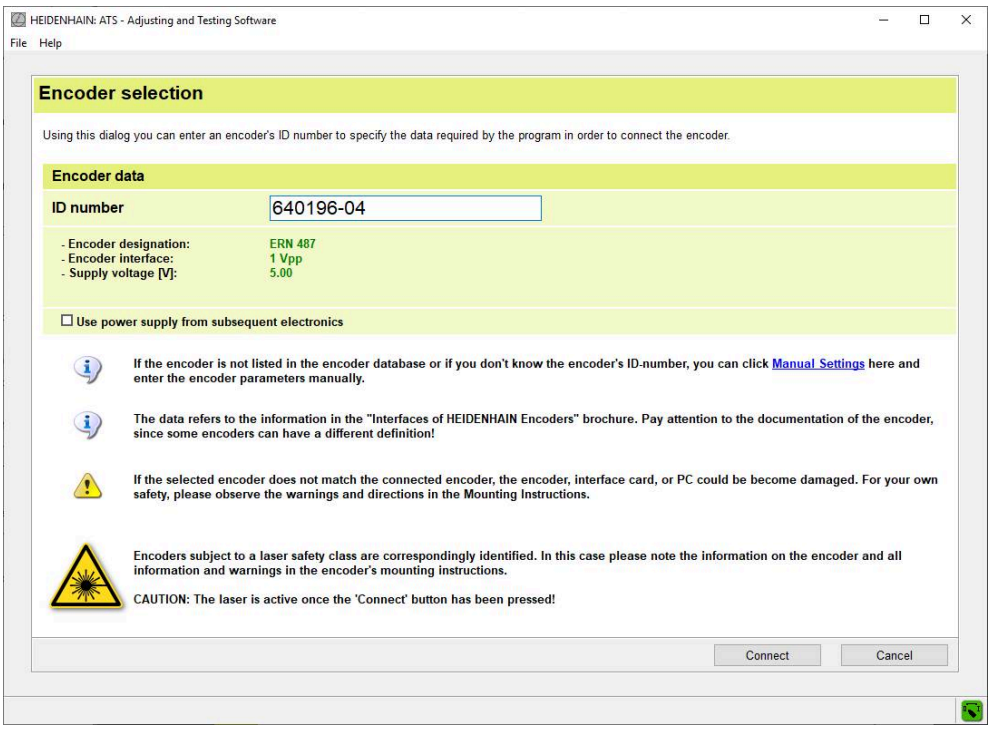


Figure 15: **Encoder selection** dialog

- ▶ Enter the encoder ID in the **ID number** field; the entry may be with or without a hyphen
- > The determined encoder parameters are shown in the **Encoder data** field
- ▶ Click **Connect**
- > The connection to the encoder is set up
- > The voltage symbol in the information bar indicates that the signal adapter is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)
- ▶ Switch on the subsequent electronics
- > The encoder is powered by the subsequent electronics

7.3.2 Manual connection

⚠WARNING

Damage to the signal adapter by overvoltage

The signal adapters SA 100 and SA 110 are designed for a supply voltage of 5.5 V maximum. If you select a higher supply voltage in the connection dialog, this may damage the signal adapter. As a consequence, the encoder, the PWM and the subsequent electronics may be damaged.

- Select the permissible supply voltage for the signal adapter (5 V) in the connection dialog

If you connect the encoder manually, the monitoring mode is only possible for incremental encoders.

With encoders with a serial interface, you can retrieve the encoder ID from the encoder memory: If you connect the encoder manually in the Encoder diagnostics mode, the Adjusting and Testing Software displays the encoder ID in the information bar.

Further information: "Connection in the Encoder Diagnostics operating mode", Page 54

- Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

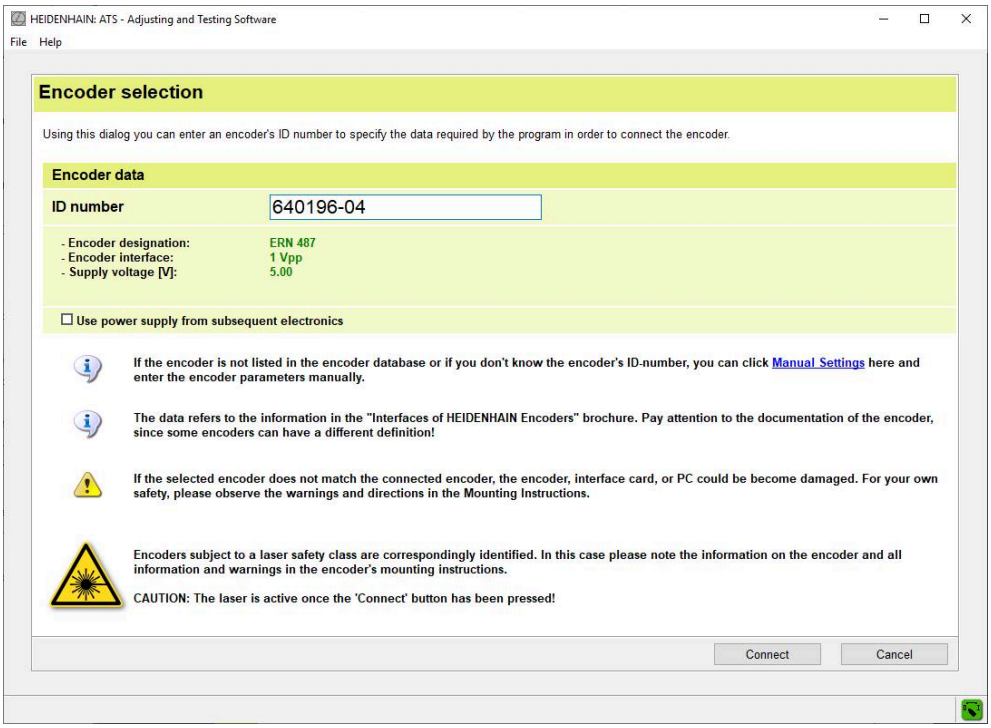


Figure 16: **Encoder selection** dialog

- ▶ Click **Manual Settings**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Next**
- > The Adjusting and Testing Software displays the encoder parameters that can be selected

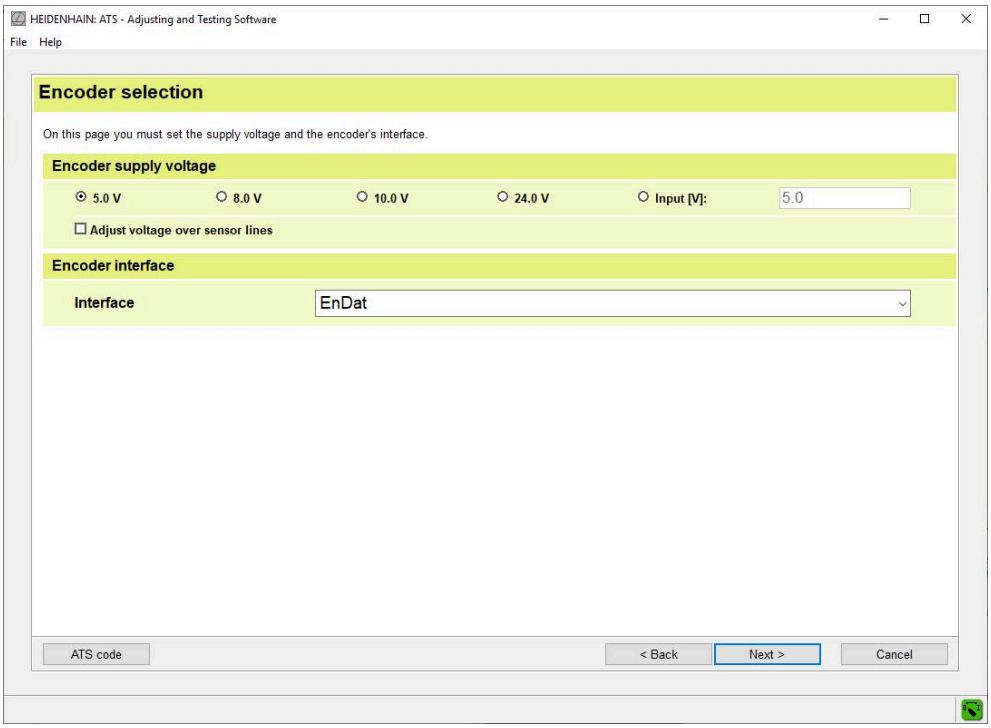


Figure 17: **Encoder selection** dialog for manual selection of the encoder parameters

- ▶ Select the value "5 V" in the **Encoder supply voltage** section (permissible supply voltage for the signal adapter)
- ▶ Select the interface type in the **Encoder interface** section
- ▶ Switch on the subsequent electronics
- > The encoder is powered by the subsequent electronics
- ▶ Click **Next**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Connect**
- > The connection to the encoder is set up
- > The voltage symbol in the information bar indicates that the signal adapter is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)

7.4 Connection the monitoring mode – Option 2: without signal adapter

⚠ WARNING

Danger due to uncontrolled axis movements upon start of monitoring mode

Integrating the PWM into the control loop of the machine tool influences the power supply of the encoder and the grounding conditions. Uncontrolled axis motions may occur when the monitoring mode is started. This may result in death or serious personal injury.

Before starting the monitoring mode:

- Note the safety precautions in the Operating Instructions
- Leave the traverse range of the machine tool
- Move the machine axes to the middle of the traverse range
- Secure machine axes against falling down
- Have one person at the emergency stop button so that this person can switch off the machine immediately in case of hazard

After having started the monitoring mode:

- Check whether the machine axis can be traversed in a controlled manner

⚠ WARNING

Hazard due to uncontrolled axis movements when engaging and disengaging connecting elements

If you engage or disengage any connecting elements in the monitoring mode, uncontrolled axis movements may occur. This may result in death or serious personal injury.

Before engaging or disengaging any connectors:

- Observe the manufacturer's documentation of the subsequent electronics, the peripherals and the machine tool
- Secure the machine axes against uncontrolled movements
- Disconnect the encoder in the Adjusting and Testing Software
- Switch off the testing device, the subsequent electronics and the peripherals

NOTICE

Damage to the product caused by overvoltage

If you select incorrect encoder parameters in the Adjusting and Testing Software, the encoder, the testing device, and the peripheral devices may be damaged.

- Connect via encoder ID and retrieve the encoder parameters from the encoder database
- For manual connection, observe the information provided by the encoder manufacturer

NOTICE

Damage to the device from the engaging and disengaging of connecting elements during operation

If you engage or disengage any connecting elements during operation, internal components of the devices may be damaged.

Before engaging or disengaging any connectors:

- Disconnect the encoder in the Adjusting and Testing Software
- Switch off the testing device, the subsequent electronics and the peripherals

Prerequisites:

- The subsequent electronics is switched off
- The PWM is connected according to the operating mode
  Further information: "Operating modes of the testing device", Page 24
- The PWM is switched on

7.4.1 Connection with encoder ID

- ▶ Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

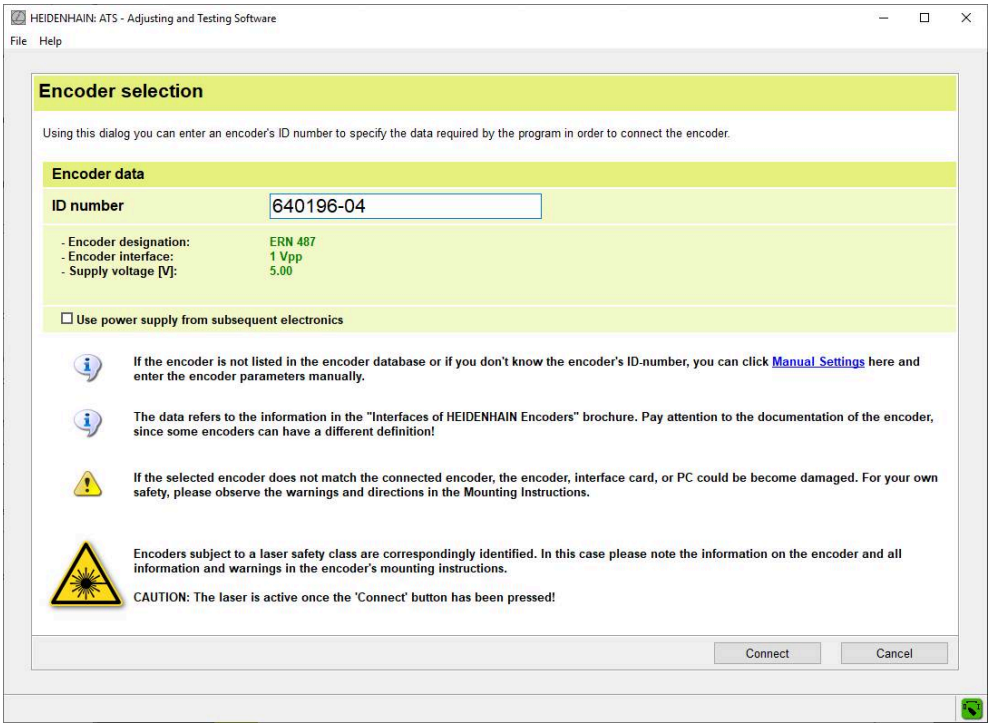


Figure 18: **Encoder selection** dialog

- ▶ Enter the encoder ID in the **ID number** field; the entry may be with or without a hyphen
- > The determined encoder parameters are shown in the **Encoder data** field
- ▶ Check the box for **Use power supply from subsequent electronics**
- ▶ Switch on the subsequent electronics
- ▶ Click **Connect**
- > The connection to the encoder is set up

- > The voltage symbol in the information bar indicates that the PWM does not output any voltage
- > The function menu shows the available functions (depending on the encoder)

7.4.2 Manual connection

If you connect the encoder manually, the monitoring mode is only possible for incremental encoders.

With encoders with a serial interface, you can retrieve the encoder ID from the encoder memory: If you connect the encoder manually in the Encoder diagnostics mode, the Adjusting and Testing Software displays the encoder ID in the information bar.

Further information: "Connection in the Encoder Diagnostics operating mode", Page 54

- ▶ Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

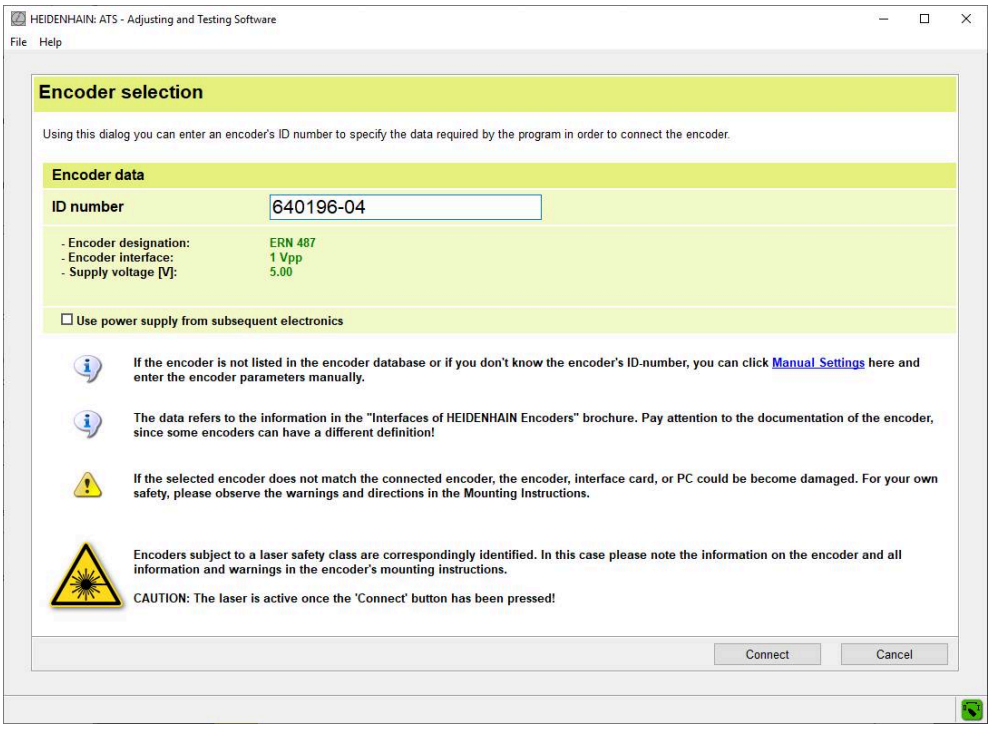


Figure 19: **Encoder selection** dialog

- ▶ Click **Manual Settings**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Next**
- > The Adjusting and Testing Software displays the encoder parameters that can be selected

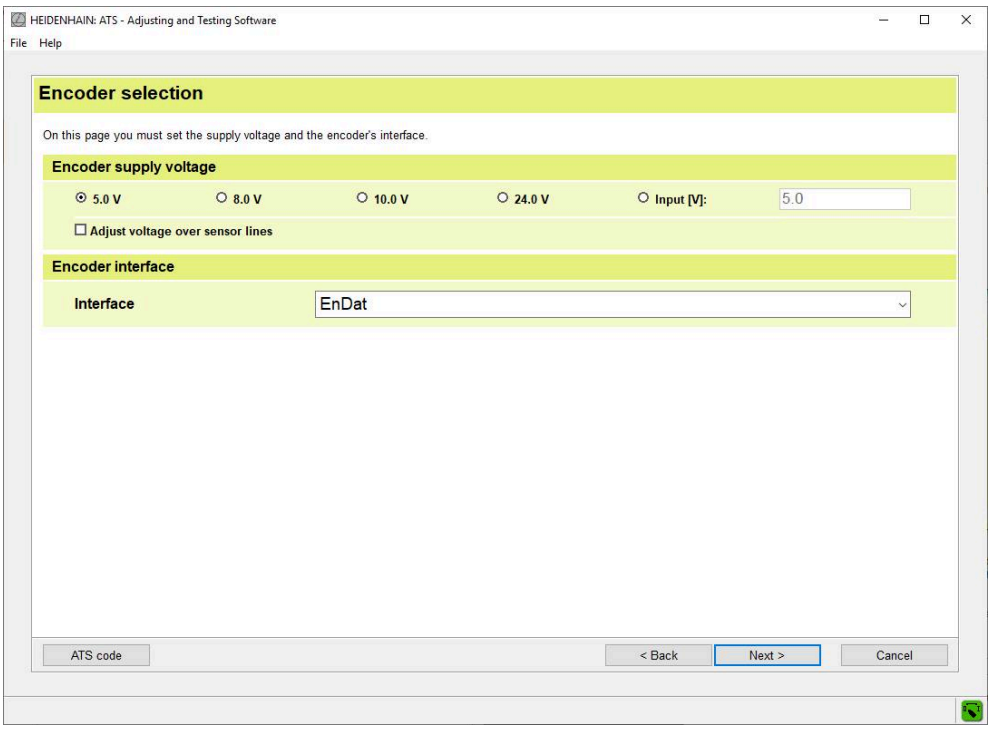


Figure 20: **Encoder selection** dialog for manual selection of the encoder parameters

	In this case, the selection in the **Encoder supply voltage** section has no effect, since power is supplied by the subsequent electronics.

- ▶ Select the interface type in the **Encoder interface** section
- ▶ Switch on the subsequent electronics
- > The encoder is powered by the subsequent electronics
- ▶ Click **Next**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Connect**
- > The connection to the encoder is set up
- > The voltage symbol in the information bar indicates that the PWM does not output any voltage
- > The function menu shows the available functions (depending on the encoder)

7.5 Disconnecting the encoder

When you disconnect the encoder, the voltage supply by the PWM is deactivated as well.

- ▶ Double-click **Disconnect encoder** in the function menu
- > The Adjusting and Testing Software separates the connection to the encoder

- > The voltage symbol in the information bar indicates that the PWM does not output any voltage
- > The Adjusting and Testing Software displays the opening screen

7.6 Connecting touch probes

You can test touch probes only in the Encoder diagnostics mode:

The following steps are required in the Adjusting and Testing Software to connect a touch probe:

- Connect the transceiver unit (SE)
- Establish radio communication between the SE and the touch probe, either by pairing or by reading in the electronic ID label

NOTICE

Damage to the device from the engaging and disengaging of connecting elements during operation

If you engage or disengage any connecting elements during operation, internal components of the devices may be damaged.

Before engaging or disengaging any connectors:

- ▶ Disconnect the encoder in the Adjusting and Testing Software
- ▶ Switch off the testing device, the subsequent electronics and the peripherals

When you establish the connection to the transceiver unit in the Adjusting and Testing Software, you also activate the power supply by the PWM.

Prerequisites:

- The PWM is connected according to the operating mode
  Further information: "Operating modes of the testing device", Page 24
- The PWM is switched on

Connecting the transceiver unit (SE)

- ▶ To establish the connection to the SE, double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

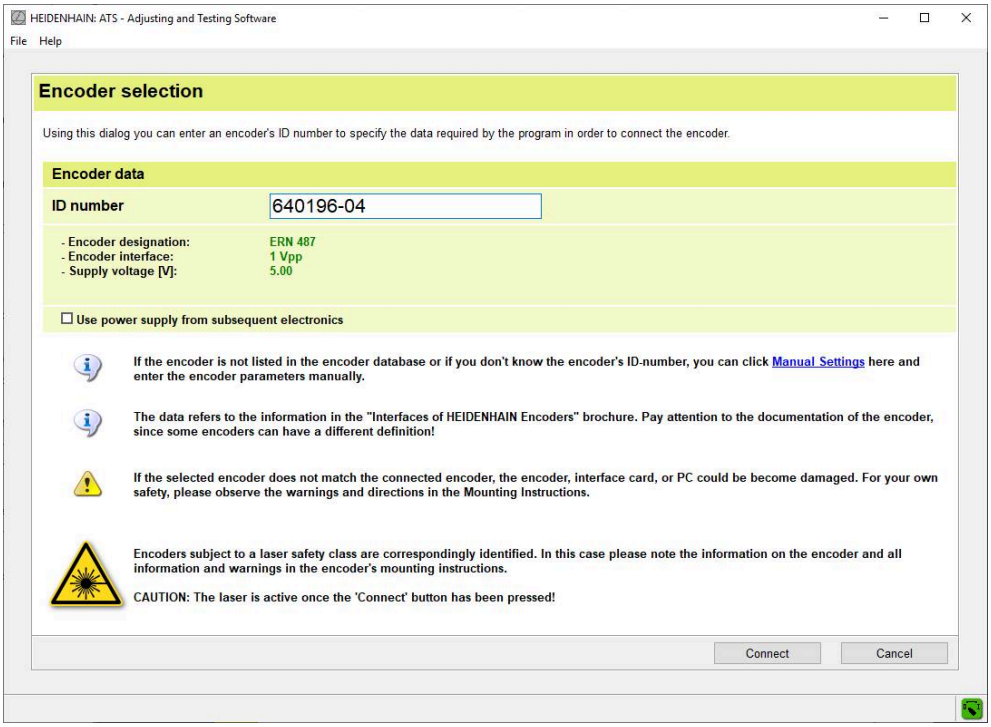


Figure 21: **Encoder selection** dialog

- ▶ Enter ID of the SE in the **ID number** field; the entry may be with or without a hyphen
- > The determined parameters are shown in the **Encoder data** field
- ▶ Click **Connect**
- > The connection to the SE is set up

- > The voltage symbol in the information bar indicates that the SE is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)

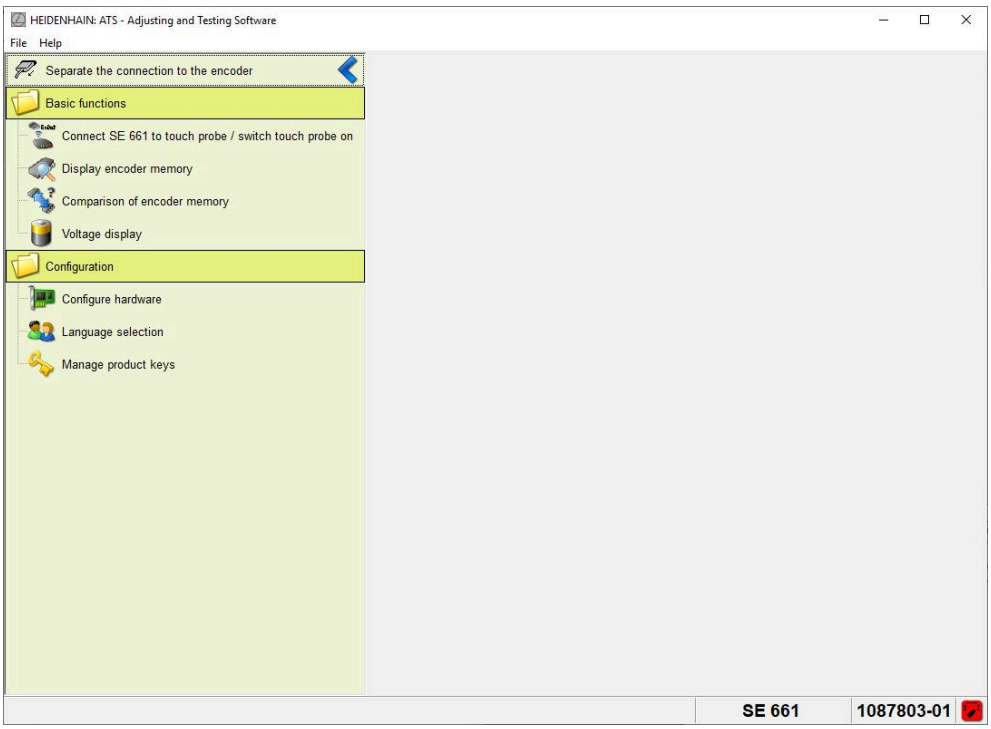


Figure 22: Function menu after connecting the transceiver unit

As an alternative, you can connect the SE manually. The procedure is the same as for manually connecting an encoder in the Encoder diagnostics mode.

Further information: "Manual connection", Page 56

Establishing radio communication by pairing

Observe the mounting instructions of the touch probe before pairing the touch probe.

- To establish the radio communication between the SE and the touch probe, double-click **Connect SE 661 to touch probe / switch touch probe on** in the function menu
- When you establish the radio communication for the first time, select the option **Pair touch probe** in the dialog box
- Click **OK**
- Follow the instructions of the
- > The radio communication between the SE and the touch probe is established
- > The Adjusting and Testing Software reads the electronic ID label of the touch probe

You can save the electronic ID label to a file and use it for reconnecting later on.

- Click **Save** in the dialog box to save the ID label to a file
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**
- > The file is saved
- Click **Next**
- > The Adjusting and Testing Software shows the data of the connected touch probe
- Click **Exit**
- > The function menu shows the available functions (depending on the encoder)

Establishing the radio communication by reading the electronic ID label

If you have saved the electronic ID label to a file when pairing the touch probe, you can now use this file for reconnecting.

- To establish the radio communication between the SE and the touch probe, double-click **Connect SE 661 to touch probe / switch touch probe on** in the function menu
- Select the option **Connect the touch probe using the saved file** in the dialog
- Click **Load file**
- Select the storage location of the file
- Click **Open**
- > The Adjusting and Testing Software displays the data loaded from the file
- Click **Next**
- > The Adjusting and Testing Software shows the data of the connected touch probe
- Click **Exit**
- > The function menu shows the available functions (depending on the encoder)

7.7 Disconnecting the touch probe

The following steps are required in the Adjusting and Testing Software to disconnect a touch probe:

- Disconnect the radio communication between the touch probe and the SE transceiver unit
- Disconnect the connection between the PWM and the SE transceiver unit

When you separate the connection between the PWM and the SE transceiver unit, the voltage supply by the PWM is deactivated as well.

Disconnecting radio communication

- Double-click **Switch off touch probe** in the function menu
- Click **Switch off** in the dialog
- > Radio communication is terminated
- > The touch probe is in standby mode

Separating the connection to the SE transceiver unit

- Double-click **Disconnect encoder** in the function menu
- > The Adjusting and Testing Software separates the connection to SE

- > The voltage symbol in the information bar indicates that the PWM does not output any voltage
- > The Adjusting and Testing Software displays the opening screen

8

Encoder mounting (mounting wizard)

The Adjusting and Testing Software features special adjustment functions—referred to as mounting wizards/mounting assistants—for mounting certain encoders. In general, these are exposed encoders the scanning heads of which must be exactly aligned.

The **Mounting assistant** function is shown in the function menu after you have connected the encoder through the encoder ID. When you call this function, the mounting wizard will guide you through the required steps.

Depending on the encoder, the **Tension tape** function may also be available for tensioning steel scale tapes.

	The documentation for mounting an encoder is supplied with the encoder.

	If the encoder is not in the encoder database, you can connect it using an ATS code. **Further information:** "Connecting with ATS code", Page 75

Connecting with ATS code

If an encoder is not yet in the encoder database and a mounting wizard is required for correct mounting, you can connect the encoder using an "ATS code". Usually, you will receive the ATS code by e-mail upon delivery of the encoder. Proceed as follows to connect the encoder:

- ▶ Double-click **Connect encoder** in the function menu
- > The Adjusting and Testing Software displays the **Encoder selection** dialog

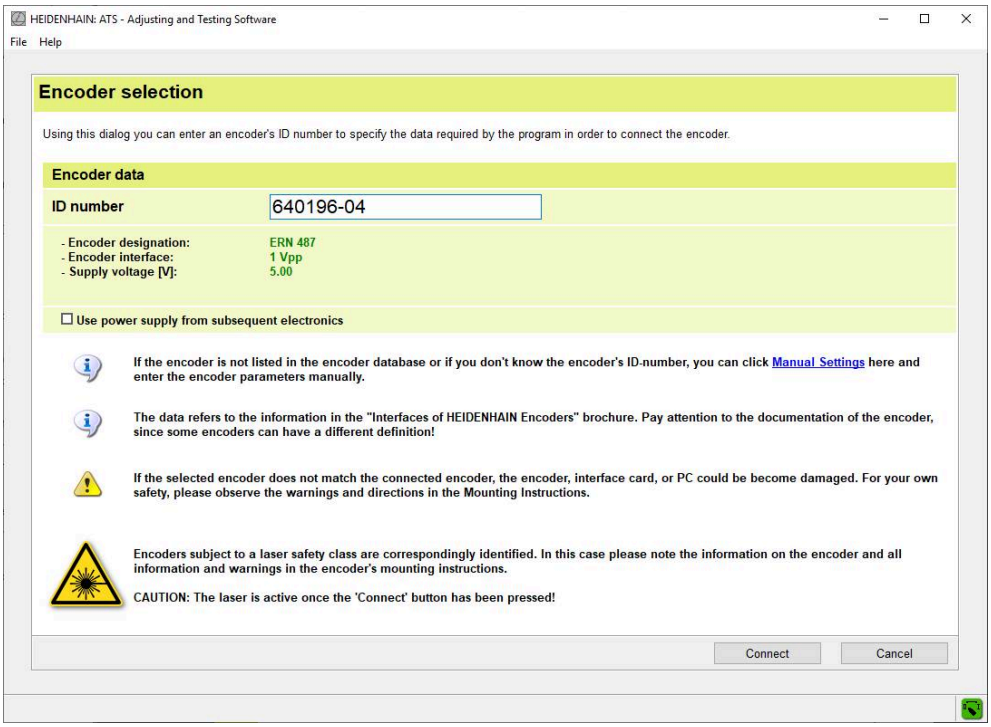


Figure 23: **Encoder selection** dialog

- ▶ Click **Manual Settings**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Next**
- > The Adjusting and Testing Software displays the encoder parameters that can be selected

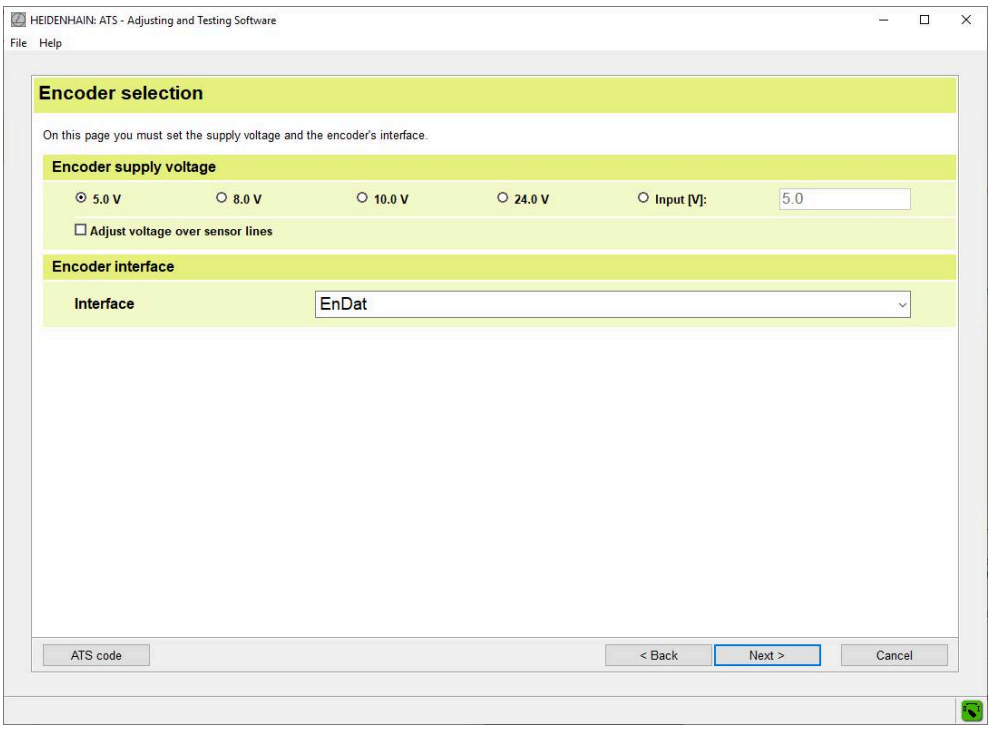


Figure 24: **Encoder selection** dialog for manual selection of the encoder parameters

- To activate voltage readjustment by the PWM, check the box **Adjust voltage over sensor lines** (recommended)
- Select the permissible encoder supply voltage in the **Encoder supply voltage** section
- Select the interface type in the **Encoder interface** section
- Click **ATS code**

> The **ATS code** field is displayed

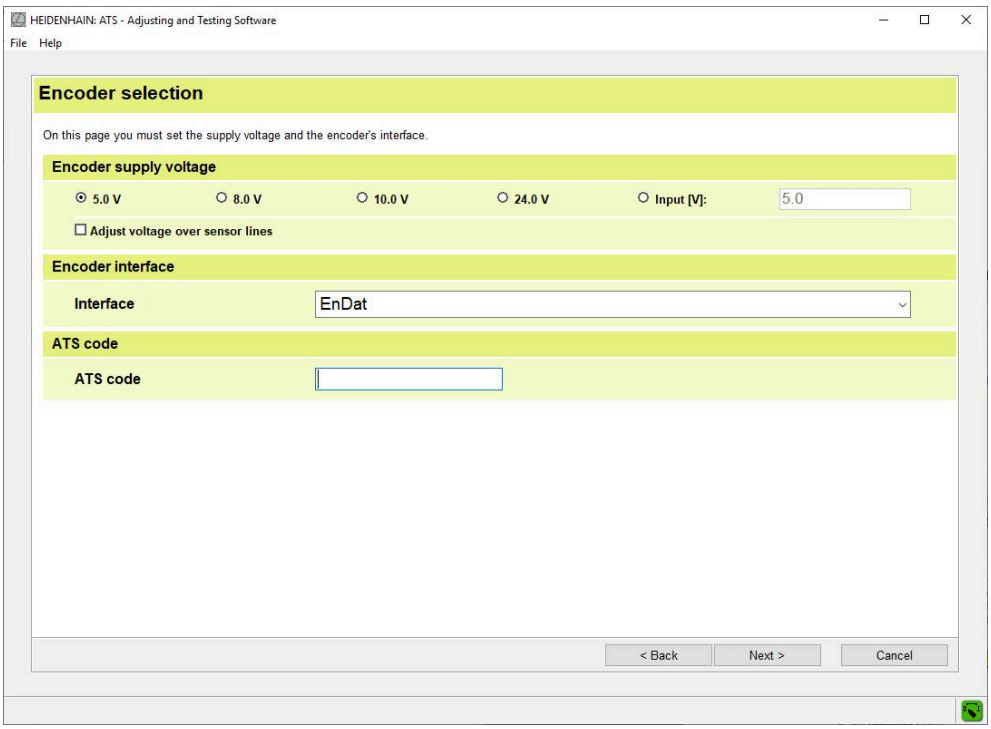


Figure 25: **Encoder selection** dialog box with **ATS code** field

- ▶ Enter the ATS code
- ▶ Click **Next**
- > The Adjusting and Testing Software displays safety precautions
- ▶ Click **Connect**
- > The connection to the encoder is set up

- > The voltage symbol in the information bar indicates that the encoder is powered by the PWM
- > The function menu shows the available functions (depending on the encoder)

9

Inspecting encoders with sinusoidal incremental signals

9.1 Overview

The Adjusting and Testing Software offers the following functions for inspecting encoders with sinusoidal output signals (e.g. 1 V_{PP} or 11 μA_{PP}):

Icon	Function	Description
	Incremental signal	Test functions for incremental signals, incl. tolerance check if required
	Voltage display	Measured values of voltage and current supply

The displays and the scope of functions of the Adjusting and Testing Software depend on the connected encoder and on the software configuration. When you establish the connection to the encoder, the function menu shows the available functions and operating elements.

9.2 Checking incremental signals

9.2.1 Incremental signal function

Depending on the encoder the **Incremental signal** function comprises:

- **Analog**: Inspection of incremental signals, reference signal, and commutation signals
- **Recording**: Recording and analysis of incremental signals
- **Counter**: Check of counting function and reference function
- **PWT**: Check of incremental signals using bar graphs
- **Homing – Limit**: Check of limit signals
- **Protocol**: Creation of logs
- **Note**: Display of notes on current measurement

Some functions of the Adjusting and Testing Software are only available if you connect the encoder through its encoder ID (recommended procedure).

The displayed tolerances are the HEIDENHAIN standard values (depending on the encoder).
Further information: "Units and tolerances", Page 32

- ▶ Double-click **Incremental signal** in the function menu to call the function
- > The Adjusting and Testing Software displays the **Analog** screen

9.2.2 Analog screen

The **Analog** view allows you to examine the following signals:

- Incremental signals
- Reference signals
- Commutation signals

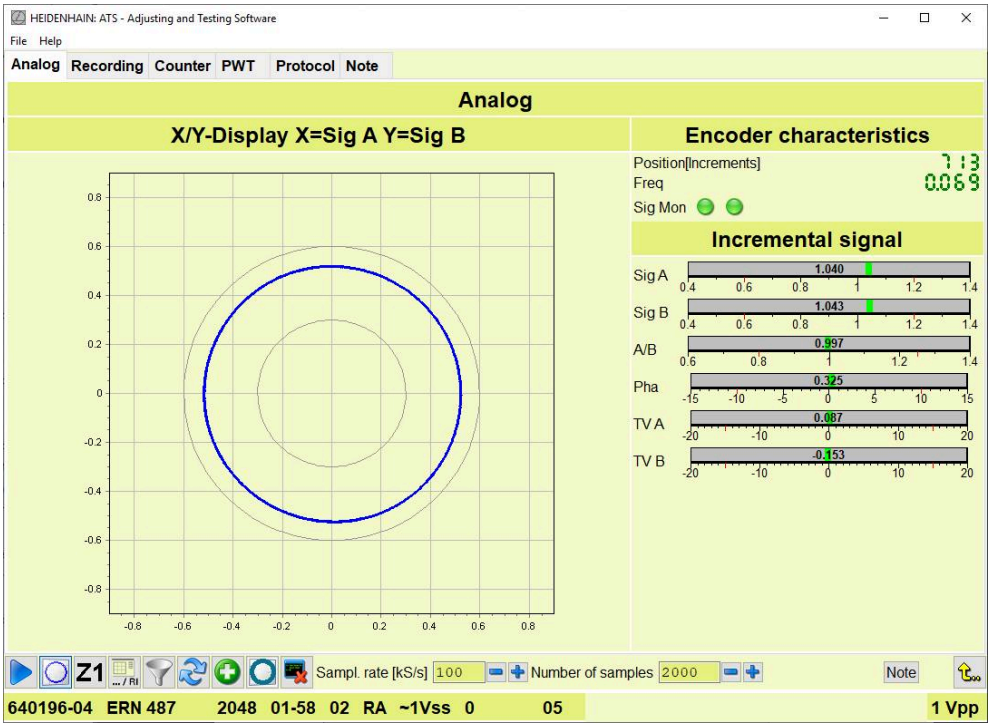


Figure 26: **Analog** screen of the **Incremental signal** function

For diagram display, you can toggle between X/Y graph and Y/t graph.

X/Y graph

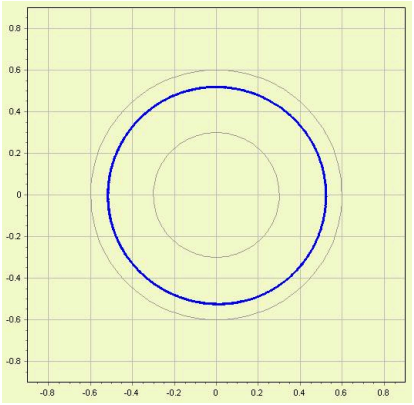


Figure 27: X/Y graph

Depiction	Description
X axis	Amplitude of signal A Unit: volts or microamperes (depending on the Interface)
Y axis	Amplitude of signal B Unit: volts or microamperes (depending on the Interface)
Outer and inner circle	Tolerance limits
Blue circle	Signal circle of signals A and B

Y/t graph

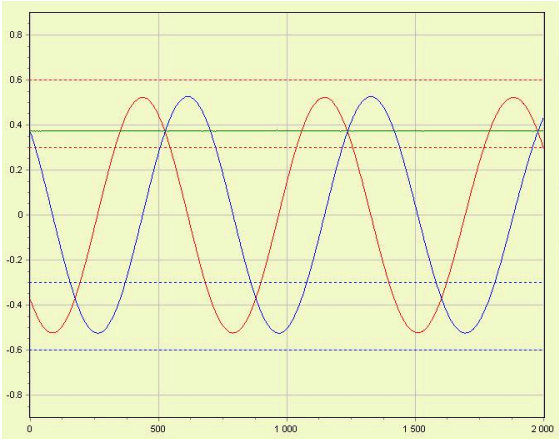


Figure 28: Y/t graph

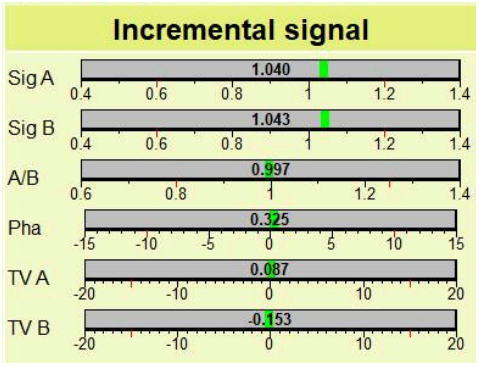
Depiction	Description
X axis (t)	Number of samples
Y axis	Signal amplitude Unit: volts or microamperes (depending on the Interface)
Red curve	Signal A
Blue curve	Signal B
Green curve	Reference signal
Dashed lines in the color of the signals	Tolerance limits of the respective signal

Encoder characteristics section

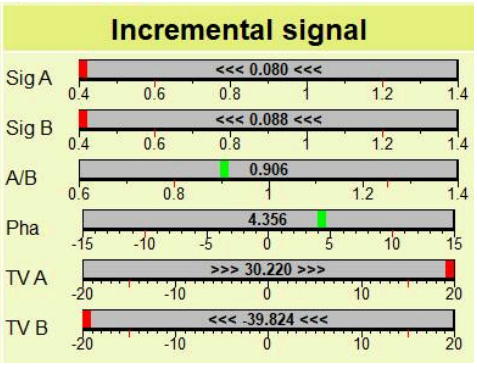
Display	Description
Position [increments]	Current count of the position display Unit: Increments
Freq	Input frequency Unit: kHz
Sig Mon	Status displays of signal monitoring ■ Green: The signal amplitudes are within the tolerance range ■ Red: The signal amplitudes exceed at least one tolerance limit The left status display shows the current status. When a tolerance limit is exceeded, the status display turns red for about 5 seconds. The right status display shows the overall status of the measurement. When a tolerence limit is exceeded, the status display is permanently red.

Incremental signal section

The bar graph shows the measured values and the results of the tolerance check.



Measurement results are within the tolerance limits



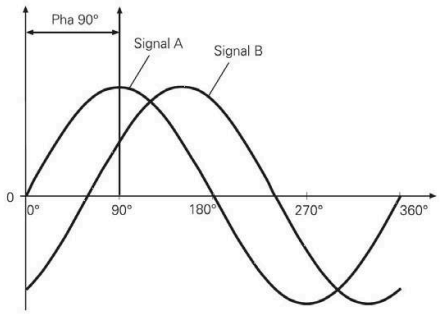
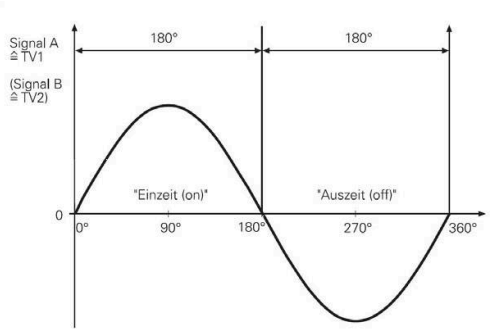
Several measurement results are outside the tolerance limits

Depiction	Description
	The indicator shows the measured value. The color of the indicator represents the result of the tolerance check: ■ Green: Measured value within the tolerance range ■ Red: Measured value outside the tolerance range
	The red marks indicate the tolerance limits.
<< >>	The arrows indicate that the measured value is beyond the scale. The direction of the arrow shows the direction where the measured value lies.

The following information refers to the signal diagrams in the document **Interfaces of HEIDENHAIN Encoders**.

Further information: "Opening documentation", Page 42

Display	Description
Sig A	Amplitude of signal A
Sig B	Amplitude of signal B
A / B	Signal ratio of signals A and Signal B Signal ratio = A / B Optimum condition: Signal ratio = 1

Display	Description
Pha	Phase shift of signals A and B **Optimum condition**: Signal A precedes signal B by 90°  Phase shift = 90° Phase shift error = 0° The Adjusting and Testing Software shows the phase shift error, i.e. the deviation from the optimum condition in degrees. Calculation: **Pha = |φA + φB| / 2**
TV A	On-to-off ratio of signal A The incremental signals are triggered at zero crossover and converted into square-wave signals. One signal period consists of the high time plus the low time of the square-wave signal and is subdivided into 360°. **Optimum condition**: High time and low time of a signal period have the same length.  High time = Low time = 180° On-off ratio error = 0° The Adjusting and Testing Software shows the on-off ratio error, i.e. the deviation from the optimum condition in degrees. In the documentation, the ratio of high time and low time may also be specified as symmetry deviation (SYM) in radians. Calculation: **SYM = |P - N| / 2 · M** **TV = 2 · 180 / π · sin (2 · SYM)**

Display	Description
TV B	On-to-off ratio of signal B For description, see "TV-A"

Operating elements

Icon	Function
	**Stop the measurement** Interrupts the measurement and shows the last measured values in the diagram and the displays
	**Switch to Y/t graph** Displays the Y/t graph instead of the X/Y graph
	**Check the commutation signals** Shows the commutation signals C and D
	**Show reference signal** Displays the measured values for the reference signal
	**Activate a filter** Suppresses interfering signals ≥ 100 kHz
	**Reset status displays** Resets the status displays of signal monitoring (**Sig Mon**) back to "green"
	**Activate comparison circle** Retains the current signal circle in the X/Y diagram while the measurement is continued with a new signal circle
	**Activate persistance** Retains a defined number of measured values in the diagram (persistance mode)
	**Transfer data to the Protocol view** Transfers the displayed data to the **Protocol** screen
	**Deactivate HSP** Deactivates the HEIDENHAIN Signal Processing (HSP) function
	**Sampling rate [kS/s]** Specifies the sampling rate
	**Number of samples** Specifies the number of samples
	**Notes** Indicates that there is new information on the current measurement

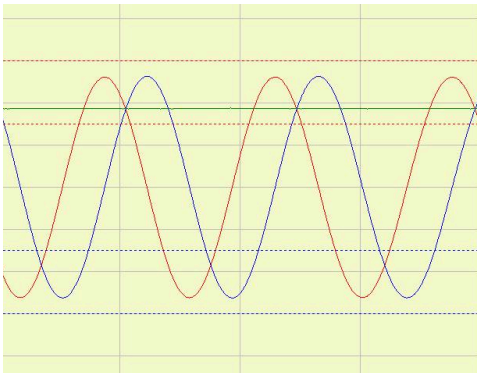
Sampling rate

The value in the **Sampling rate** field defines the clock rate at which the analog signals are measured and converted.

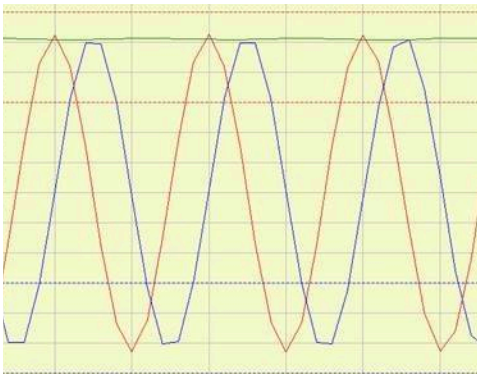
Unit:	Kilosamples per second (kS/s) 1 kS/s = 1,000 signal conversions per second
Default setting:	100 kS/s
Setting range:	1 ... 1,800 kS/s

> The optimum sampling rate depends on the signal frequency (see **Freq** value in the **Encoder characteristics** section). The signal frequency increases with the traversing speed or shaft speed of the encoder.
>
> Recommended value:
> **Sampling rate = 10 · maximum signal frequency**

If the sampling rate is too low, the original signal will be distorted:



Sufficiently high sampling rate with correct signal shape



Sampling rate too low with falsified signal shape; correct evaluation is not possible

> When you exit the **Incremental signal** function, the **sampling rate** is reset to default.

Number of samples

The value in the **Number of samples** field defines how many measured values are displayed in the diagram.

Default setting: 2,000

Setting range: 2,000 ... 100,000

The optimum value depends on the signal frequency (see **Freq** value in the **Encoder characteristics** section). The signal frequency increases with the traversing speed or shaft speed of the encoder. The higher the signal frequency, the lower you should set the value in the **Number of samples** field.

A high value in the **Number of samples** field allows you to locate signal drops by determining the envelope curve over several signal periods.

When you exit the **Incremental signal** function, the value in the **Number of samples** field is reset to default.

9.2.3 Examining the incremental signals A and B (Analog view)

A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.

Further information: "Displaying and deleting notes (Note view)", Page 130

- ▶ Click **Reset status displays** to reset the status of the signal monitoring
- > The **Sig Mon** status displays are green
- ▶ Enter the desired value in the **Sampling rate** field
- ▶ Enter the desired value in the **Number of samples** field
- ▶ Traverse the entire measuring range
- > The Adjusting and Testing Software acquires the measured values at the specified sampling rate
- > The diagram and the bar display show the measured values and tolerances of the signals A and B

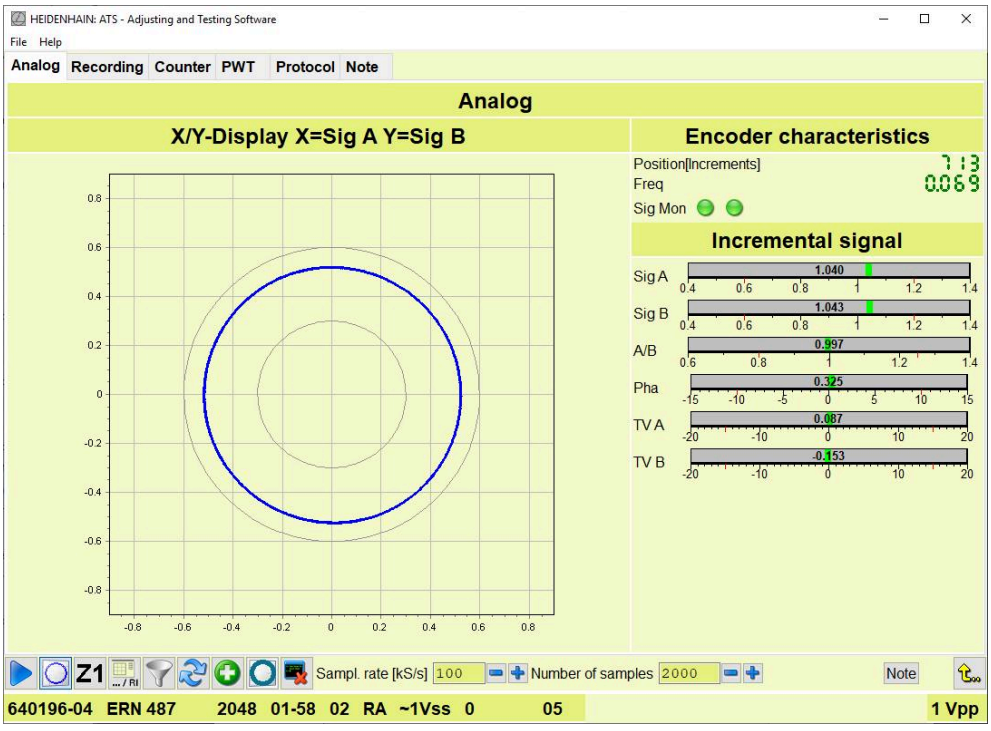


Figure 29: **Analog** screen of the **Incremental signal** function

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

To examine a section more closely, you can zoom in on the diagram view.

Further information: "Magnifying the diagram view", Page 42

Switching between the diagrams

- Click **Switch to Y/t graph**
- > The Y/t graph is displayed

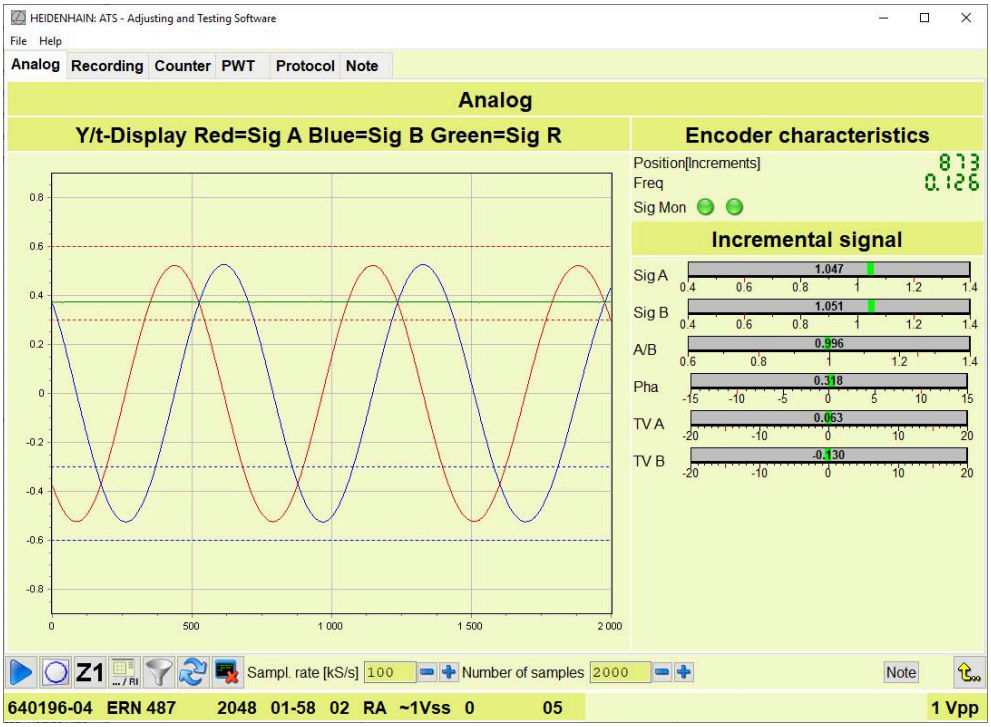


Figure 30: **Analog** view with Y/t graph

- Click the operating element again to return to the X/Y graph

Stopping the measurement

You can stop the measurement to analyze a specific point or take a screenshot.

- Click **Stop measurement** in the control bar
- > The diagram and the displays hold the last measured values

- Click the operating element again to continue the measurement

Activating a filter

For special adjustments, you can activate a filter suppressing interference frequencies ≥ 100 kHz by attenuating the bandwidth of the input amplifier.

Activate the filter in exceptional cases only and use the full bandwidth of the PWM for standard measurements.

- Click **Activate filter** in the control bar
- > Interference frequencies ≥ 100 kHz are suppressed
- Click the operating element again to deactivate the filter

Activating the comparison circle

To make signal fluctuations better visible, you can activate the comparison circle in the X/Y diagram. The comparison circle is a snapshot of the current signal circle. The comparison circle is kept in the diagram while the measurement continues with a new signal circle.

- ▶ Click **Activate comparison circle** in the control bar
- > The current signal circle is held in the diagram

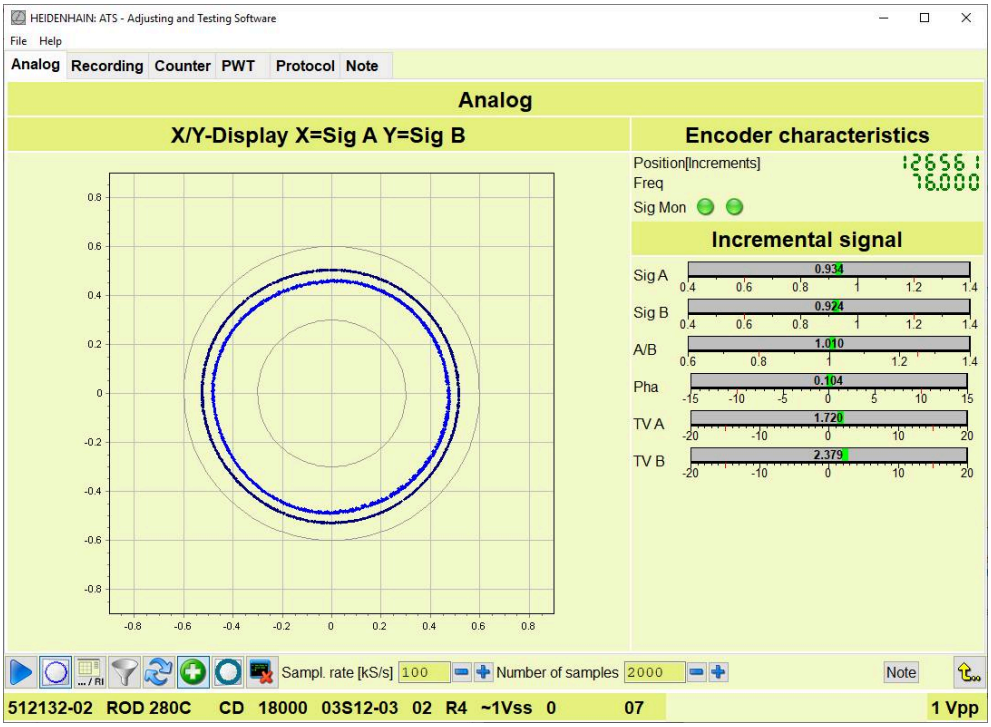


Figure 31: X/Y graph with comparison circle

- ▶ Click the operating element again to discard the comparison circle

Activating persistence

To make signal fluctuations better visible, you can activate persistence in the X/Y diagram. By this means, measured values are added continuously when the encoder is traversed. A maximum of 10,000 measured values can be shown simultaneously in the diagram. The progress bar indicates the percentage of diagram memory occupied. When 10,000 measured values are reached, the oldest values will be overwritten.

- Click **Activate persistence** in the control bar
- Traverse the encoder
- > Measured values are continuously added to the Y/X diagram

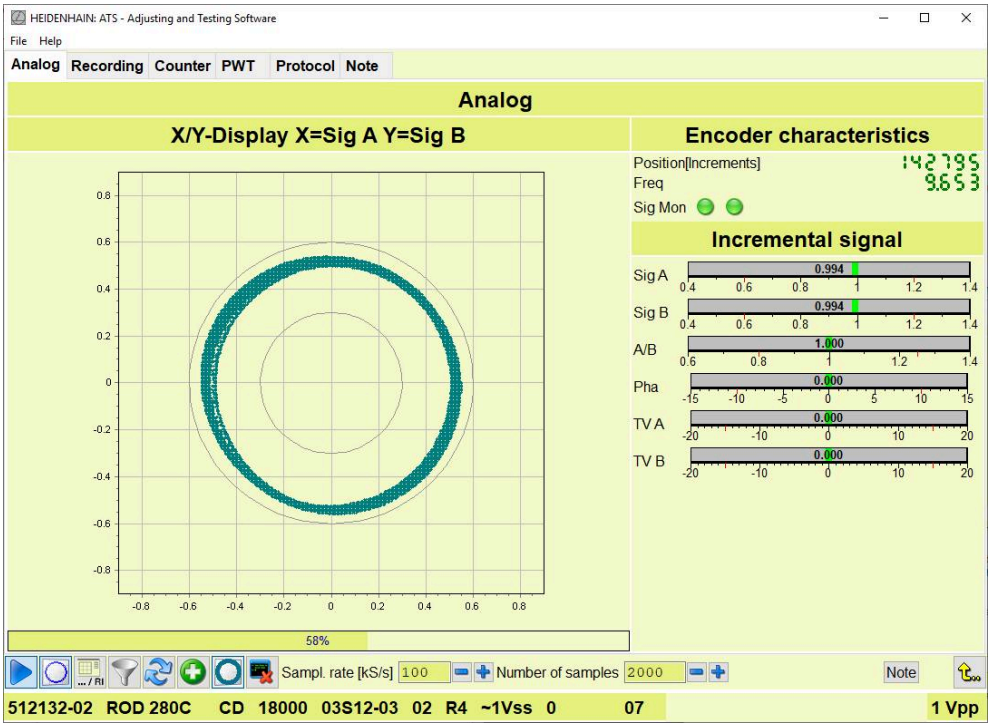


Figure 32: X/Y diagram with active persistence

- Click the operating element again to deactivate persistence

Deactivating HEIDENHAIN Signal Processing (HSP)

Some encoders are equipped with the **HEIDENHAIN Signal Processing ASIC HSP**. If contamination on the measuring standard or scanning reticle result in signal changes, this ASIC almost completely compensates them. The result is a permanently stable measuring signal. For mounting and adjusting the encoder, you need to deactivate the HSP function.

Refer to the mounting instructions for the specific encoder.

HSP

- ▶ Click **Deactivate HSP** in the control bar
- > The blinking message **HSP off** is shown
- > The diagram and displays are updated

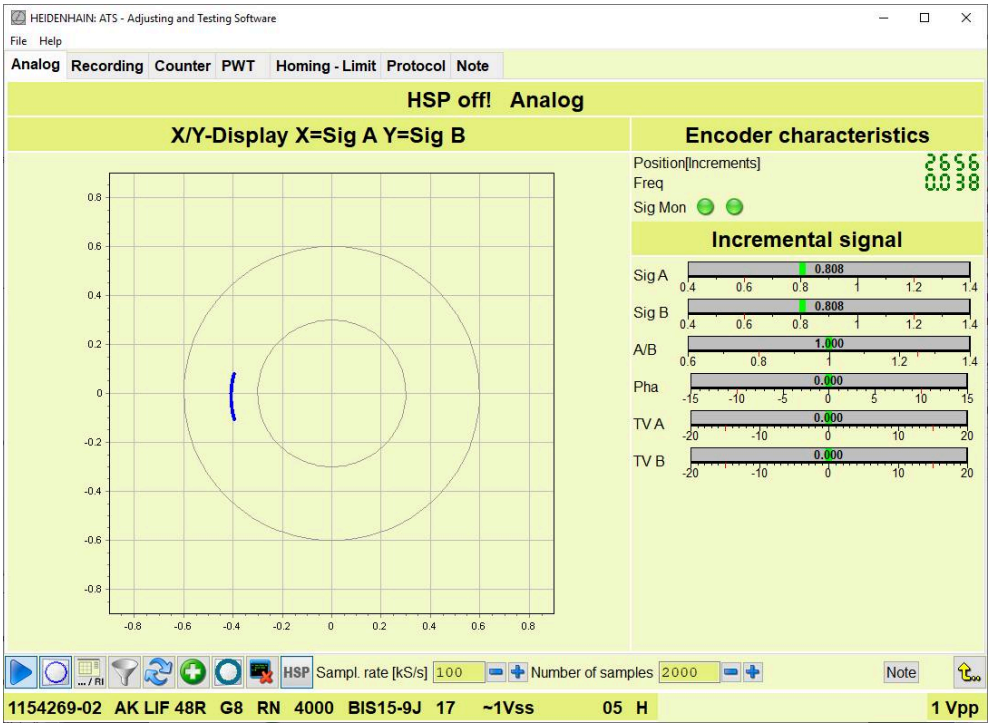


Figure 33: **Incremental signal** function with deactivated HSP function

HSP

- ▶ Click the operating element again to reactivate the HSP function

When you exit the **Incremental signal** function, the HSP function is automatically reactivated.

Transferring data to the Protocol view

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

The data are temporarily retained in the **Protocol** view until you exit the **Incremental signal** function.

- To store data temporarily, click on **Transfer data to the Protocol view**

> The Adjusting and Testing Software displays the **Protocol** screen with the buffered values

Further information: "Protocol view", Page 128

Examples of a faulty encoder

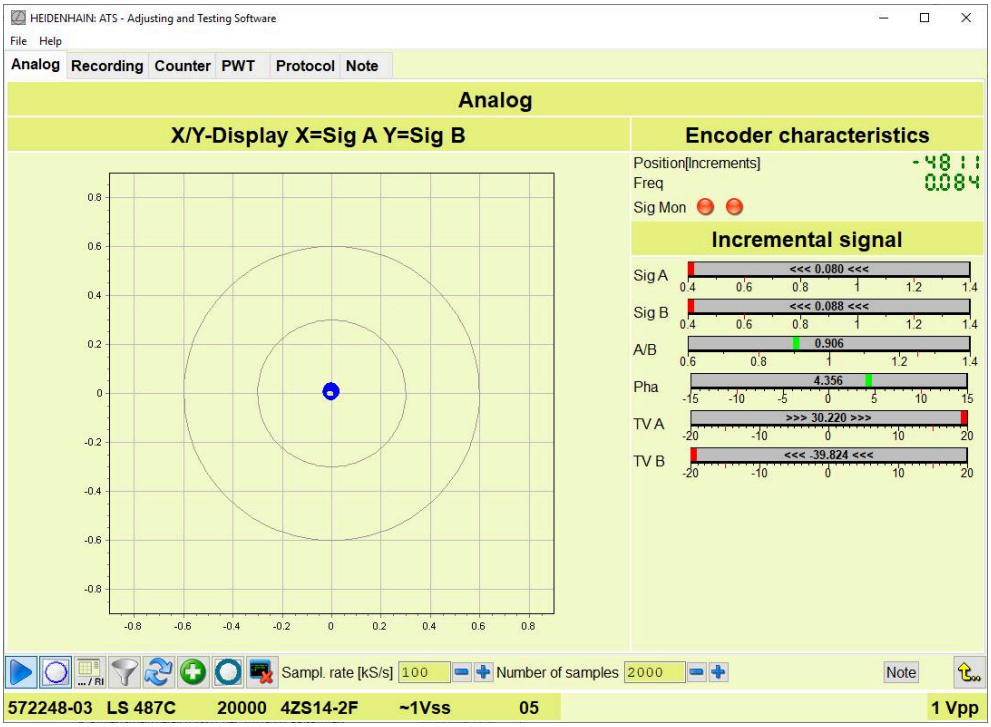


Figure 34: **Analog** view with X/Y graph

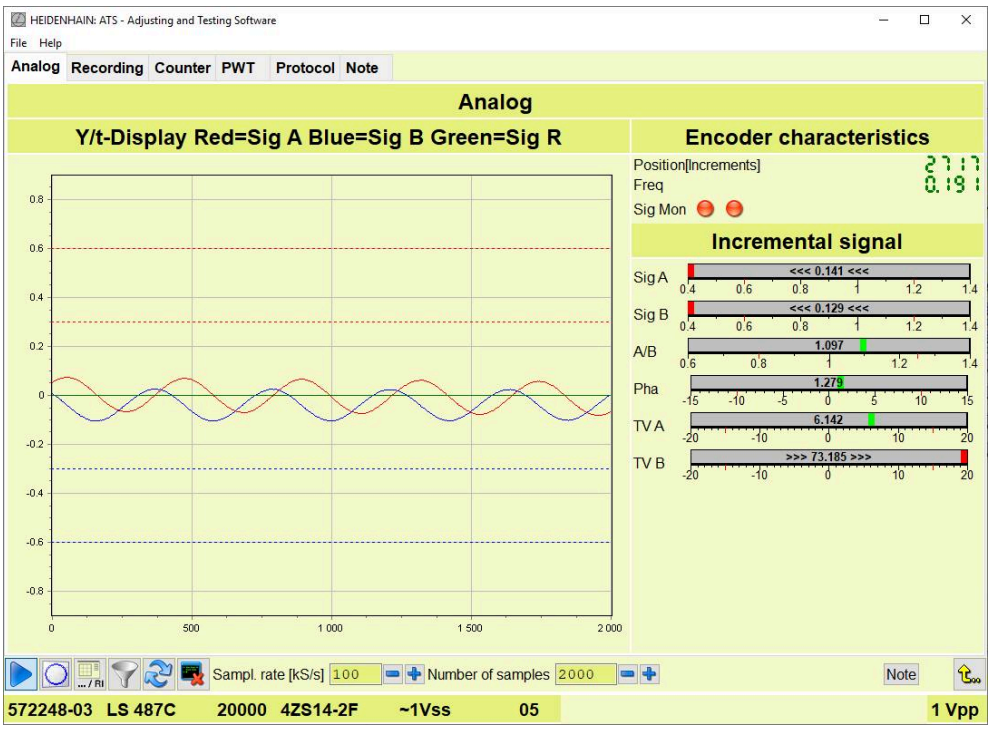


Figure 35: **Analog** view with Y/t graph

9.2.4 Checking the reference signal (Analog view)

You can display the reference signal in the **Analog** view to check the signal quality and the position of the reference marks. The reference signal is displayed graphically in the Y/t diagram.

The following information refers to the signal diagrams in the document "Interfaces of HEIDENHAIN Encoders".

Further information: "Opening documentation", Page 42

Recommended sampling rate

Select the sampling rate according to the required display accuracy.

Sampling rate = Maximum frequency · 360° / Display accuracy in degrees

Recommended value: 1°

Further information: "Sampling rate", Page 87

Recommended number of samples

The signal evaluation is based on the values that are displayed in the Y/t diagram. Therefore, select the number of samples such that one complete reference pulse is visible in the diagram when a reference mark is traversed.

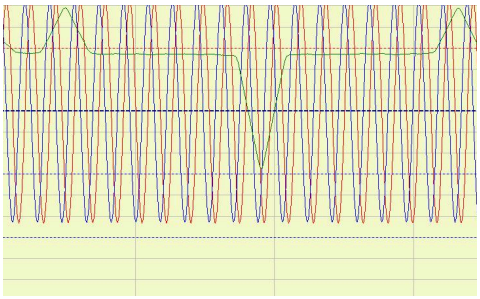


Figure 36: Complete reference pulse including quiescent value and usable component

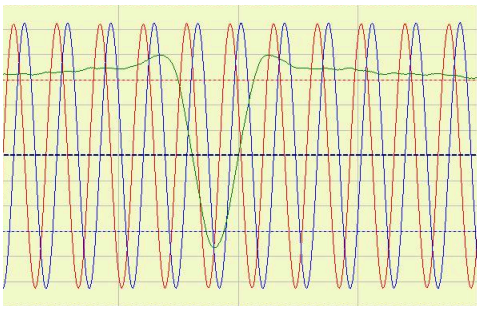


Figure 37: Incomplete reference pulse; correct evaluation is not possible

Further information: "Number of samples", Page 88

For encoders with selectable reference mark (via magnet or selector plate), the quiescent value "H" must also be visible in the diagram.

- Click **Switch to Y/t graph**

- Click **Show reference signal**
- > The **Reference signal** section is shown
- Enter the desired value in the **Sampling rate** field
- Enter the desired value in the **Number of samples** field
- Traverse the reference mark
- > As soon as the reference signal crosses the trigger line, the reference pulse is shown in the Y/t diagram
- > The **Reference signal** section shows the values of the traversed reference mark
- Traverse further reference marks, if required
- > The Y/t graph and the values in the **Reference signal** section are updated each time a reference mark is traversed

The Adjusting and Testing Software records a reference pulse as soon as the reference signal crosses the trigger line. In the diagram, you can adapt the threshold value for reference mark detection by holding the mouse button and dragging the trigger line to the desired position.

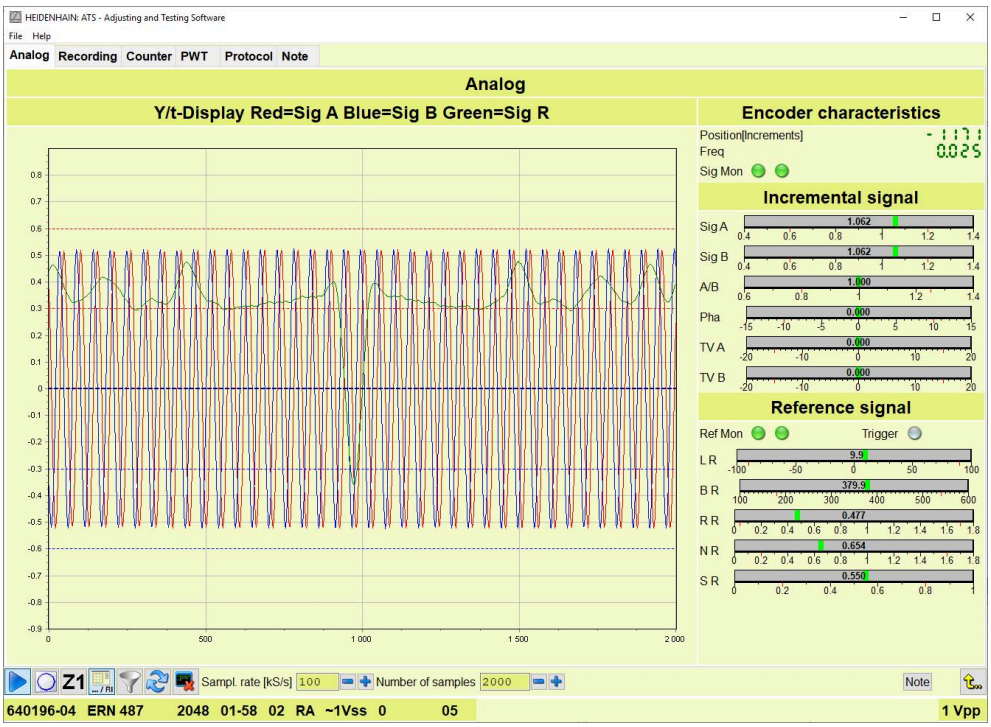


Figure 38: **Incremental signal** function with reference signal

Depiction	Description
X axis (t)	Number of samples
Y axis	Signal amplitude Unit: volts or microamperes (depending on the interface)
Red curve	Signal A
Blue curve	Signal B
Green curve	Reference signal
Dashed lines in the color of the signals	Tolerance limits of the respective signal
Dark blue dashed line	Trigger line

Reference signal section

Depiction	Description
Ref Mon	Status displays of reference signal monitoring ■ Green: no status message available ■ Red: status message available The left status display shows the current status. When a status message is recorded, the status display remains red for about 5 seconds. The right status display shows the overall status of the measurement. When a status message is recorded, the status display remains permanently red.
Trigger	Status display of reference mark detection ■ Gray: no reference mark was detected ■ Green: a reference mark was detected When a reference mark was detected, the status display changes back to gray color after 5 seconds. If several reference marks follow each other, the status display may be permanently green.
LR	Position of the reference pulse **Formula: (K – L) / 2**
BR	Width of the reference pulse **Formula: K + L**
RR	Quiescent value H of the reference pulse
NR	Usable component G of the reference pulse
SR	Switching threshold of the reference pulse **Formula: E / G**

Traverse the reference mark(s) in both directions. Perform spot checks on encoders with distance-coded reference marks and check defective areas several times.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

9.2.5 Checking commutation signals C and D (Analog view)

The incremental signals A and B are generated by the incremental track Zn. Some encoders feature an additional incremental track Z1, providing one sine signal (C) and one cosine signal (D) per revolution. For electronic commutation, the rotor position can thus already be determined before the motor is started.

Incremental track	Characteristics
Zn: signals A and B	High resolution: One revolution corresponds to e.g. 2048 signal periods (depends on encoder)
Z1: signals C and D	Low resolution: One revolution corresponds to one signal period

You can check the commutation signals C and D in the **Analog** view.

Prerequisites:

- The encoder was connected to the Adjusting and Testing Software by entering the encoder ID

  or

- The interface type **1 V_{PP} + Z1** was selected during manual connection

Recommended sampling rate and number of samples

The signal evaluation is based on the values that are displayed in the diagram. One complete signal amplitude must be recorded in order that PHA, TV A and TV B can be calculated. Select the sampling rate and the number of samples such that a full circle is displayed in the X/Y diagram when the encoder is traversed.

Check of commutation signals

- ▶ Click **Check commutation signals** in the control bar
- > The diagram and the displays show the measured values and tolerances of the signals C and D

The further procedure is the same as for checking the incremental signals A and B. Below you will find a description of the differences in diagrams and displays.

X/Y graph

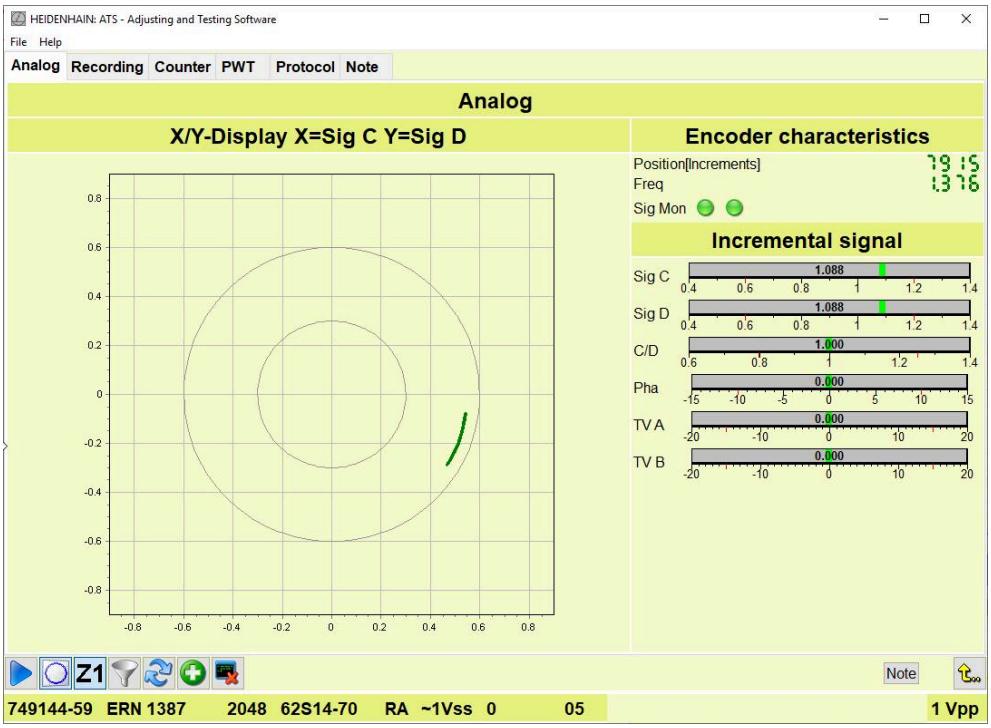


Figure 39: X/Y graph when checking the commutation signals C and D

Depiction	Description
X axis	Amplitude of signal C Unit: volts
Y axis	Amplitude of signal D Unit: volts
Inner and outer circle	Tolerance limits of signals C and D
Green circle	Signal circle of signals C and D

Incremental signal section

Depiction	Description
Sig C	Amplitude of signal C Unit: volts
Sig D	Amplitude of signal D Unit: volts
C/D	Signal ratio of signal C to signal D Signal ratio = C / D Optimum condition: Signal ratio = 1

Y/t graph and Z1/Zn graph

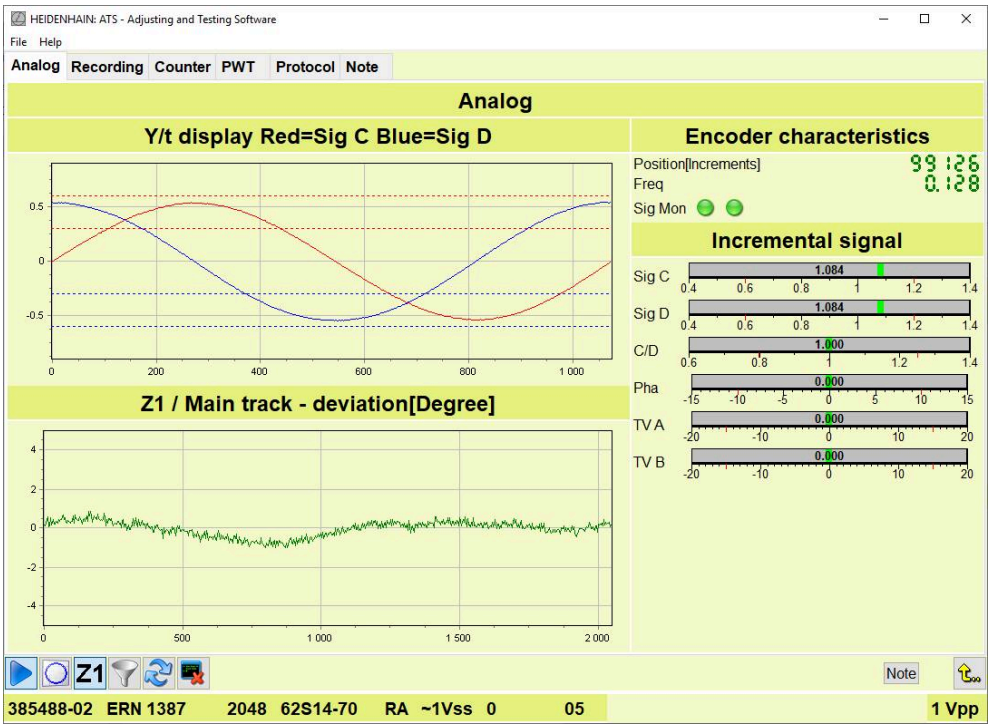


Figure 40: Y/t graph and Z1/Zn graph when checking the commutation signals C and D

The Z1/Zn graph is displayed in addition to the Y/t graph. The Z1/Zn graph shows the deviations between the calculated position values of Z1 track and Zn track. In optimum condition, the curve is close to the zero line.

Depiction	Description
X axis	Line count of the encoder per revolution
Y axis	Angle deviation Unit: degrees

> The scale corresponds to the maximum deviation for HEIDENHAIN rotary encoders.

9.2.6 Recording view

In the **Recording** view, you can record several signal periods of the incremental signals and analyze them using the diagram view. You can individually define the number of signal periods to be recorded per measurement and the sampling rate for recording.

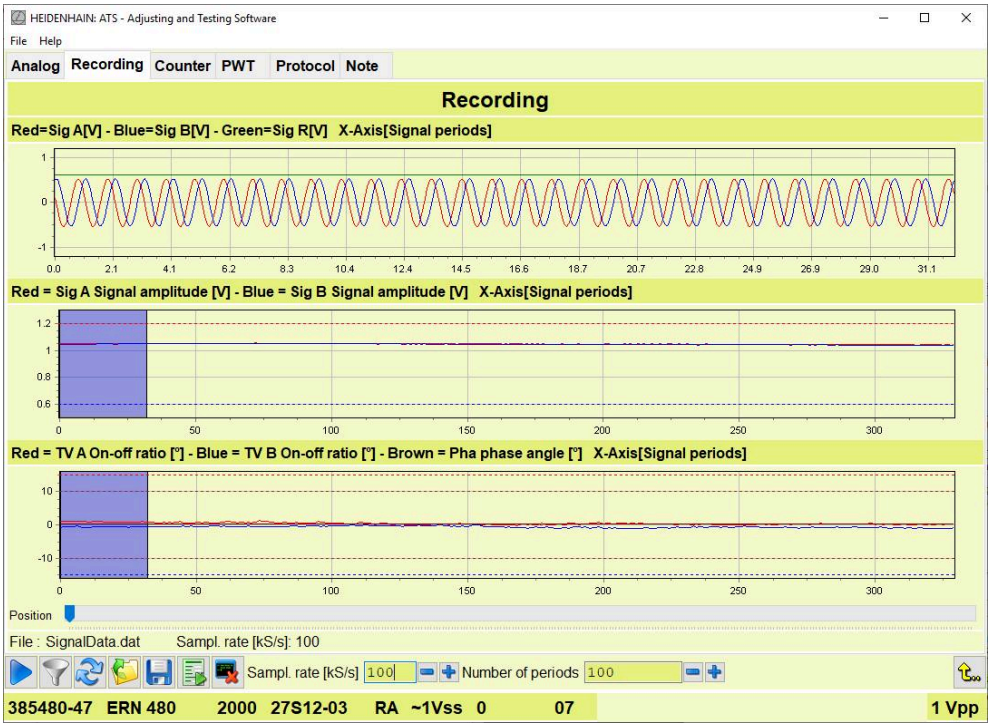


Figure 41: **Recording** view of the **Incremental signal** function

Diagram 1

Diagram 1 shows a section of the recorded signal periods. This section corresponds to the area marked in blue in the diagrams 2 and 3.

Depiction	Description
X axis	Number of signal periods
Y axis	Signal amplitude Unit: volts or microamperes (depending on the encoder)
Red	Signal A
Blue	Signal B
Green	Reference signal

Optimum condition: The amplitudes are symmetrical to the X axis and are within the tolerance limits.

Diagram 2

Diagram 2 shows the signal amplitude of all recorded signal periods.

Depiction	Description
X axis	Number of signal periods
Y axis	Signal amplitude Unit: volts or microamperes (depending on the encoder)
Red	Signal A
Blue	Signal B
Dashed lines	Tolerance limits (in the color of the associated curve)

Optimum condition: The amplitudes are symmetrical to the X axis and are within the tolerance limits.

Diagram 3

Diagram 3 shows the on-off ratio and the phase shift all recorded signal periods.

Depiction	Description
X axis	Number of signal periods
Y axis	Measurement error Unit: degrees
Red	On-to-off ratio of signal A
Blue	On-to-off ratio of signal B
Brown	Phase shift of signals A and B
Dashed lines	Tolerance limits (in the color of the associated curve)

Optimum condition: The amplitudes are symmetrical to the X axis and are within the tolerance limits.

Recommended sampling rate (minimum value)

Sampling rate = Input frequency · 20

Further information: "Sampling rate", Page 87

Number of periods

The value in the **Number of signal periods** field defines the measuring range to be recorded. Recording ends automatically as soon as the specified number of signal periods has been reached.

Setting range:	1 … 10,000,000
Default setting:	1,000

To check the entire measuring range, select the number of periods as follows:

- For rotatory encoders: Number of periods = Line count per revolution
- For linear encoders: Number of periods = (Measuring length [mm] x 1.000) / Length of one signal period [µm]

For information on the line count or the length of a signal period, refer to the encoder documentation.

High values for the sampling rate or the number of periods can result in long processing times. Use the following formula to calculate the amount of data generated during recording:

File size [bytes] = Sampling rate x Number of periods x 12

Example:

Sampling rate = 1,000

Number of periods = 100,000

File size [bytes] = 1,000 x 100,000 x 12 = 1.2 GB

Operating elements

Icon	Function
	**Start recording** Starts recording with the specified sampling rate and number of periods
	**Activate a filter** Suppresses interfering signals ≥ 100 kHz
	**Reset diagram view** Resets all diagrams to default view
	**Open file** Opens the dialog for reloading saved records from a DAT file
	**Saving a file** Opens the dialog for saving records to a DAT file
	**Exporting data** Opens the dialog for exporting records to a TXT or ASC file
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
HSP	**Deactivate HSP** Deactivates the HEIDENHAIN Signal Processing (HSP) function

9.2.7 Recording and analyzing signal periods (Recording view)

- Double-click **Incremental signal** in the function menu
- Click the **Recording** tab to display the **Recording** screen

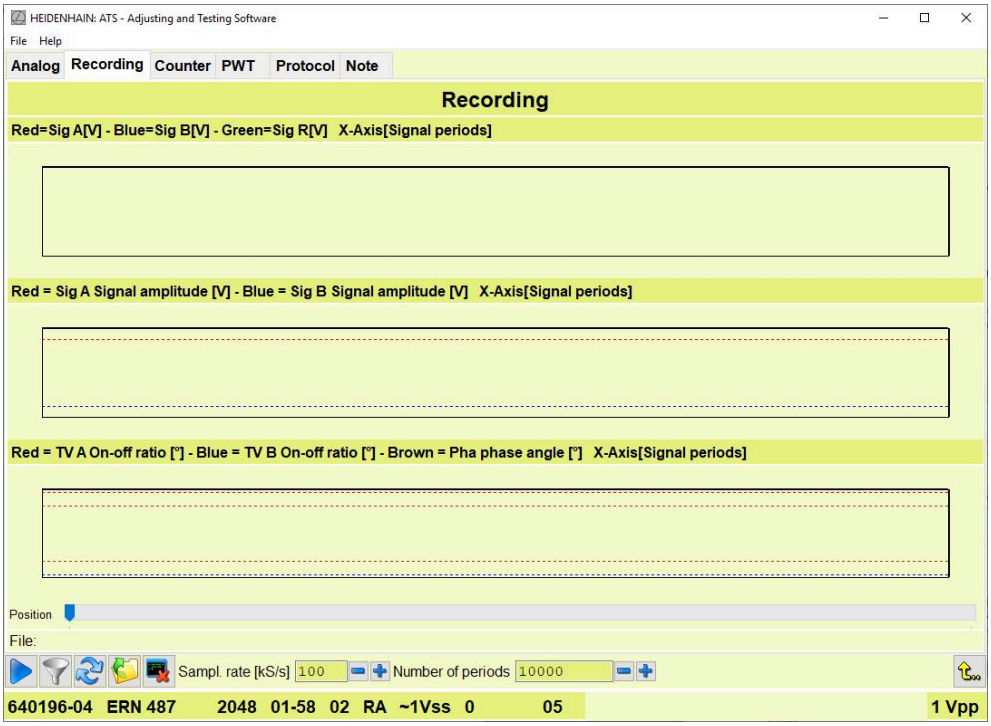


Figure 42: **Recording** view of the **Incremental signal** function

- Enter the desired value in the **Sampling rate** field
- Enter the desired value in the **Number of periods** field

- Click **Start recording** in the control bar
- > The **Recording** dialog is displayed

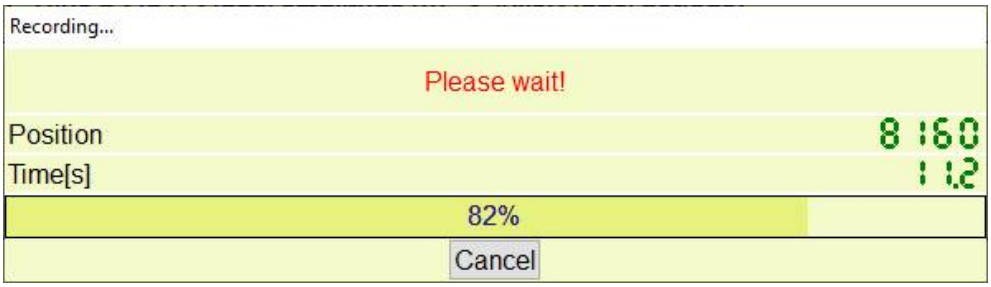


Figure 43: **Recording** dialog

- Traverse the desired measuring range
- > The signal periods are recorded at the specified sampling rate
- > The progress bar shows how many percent of the signal periods have been recorded
- > Recording ends automatically as soon as the specified number of signal periods has been reached

or

- Click **Cancel** to stop recording manually
- > The **Read file** dialog is displayed

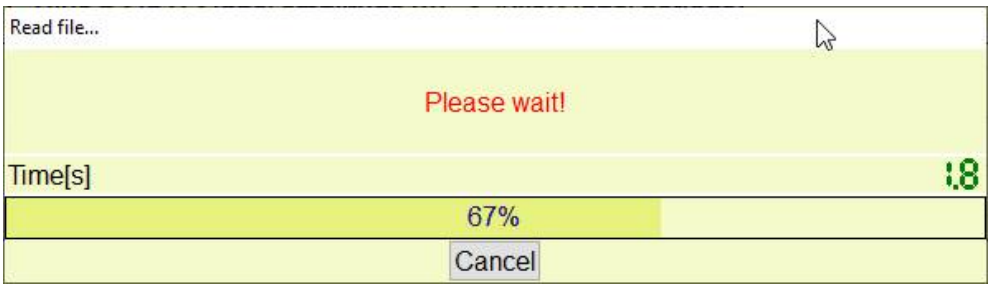


Figure 44: **Read file** dialog box

> The progress bar shows how many percent of the recorded data have been processed
> When saving is complete, the diagrams show the recorded signal periods

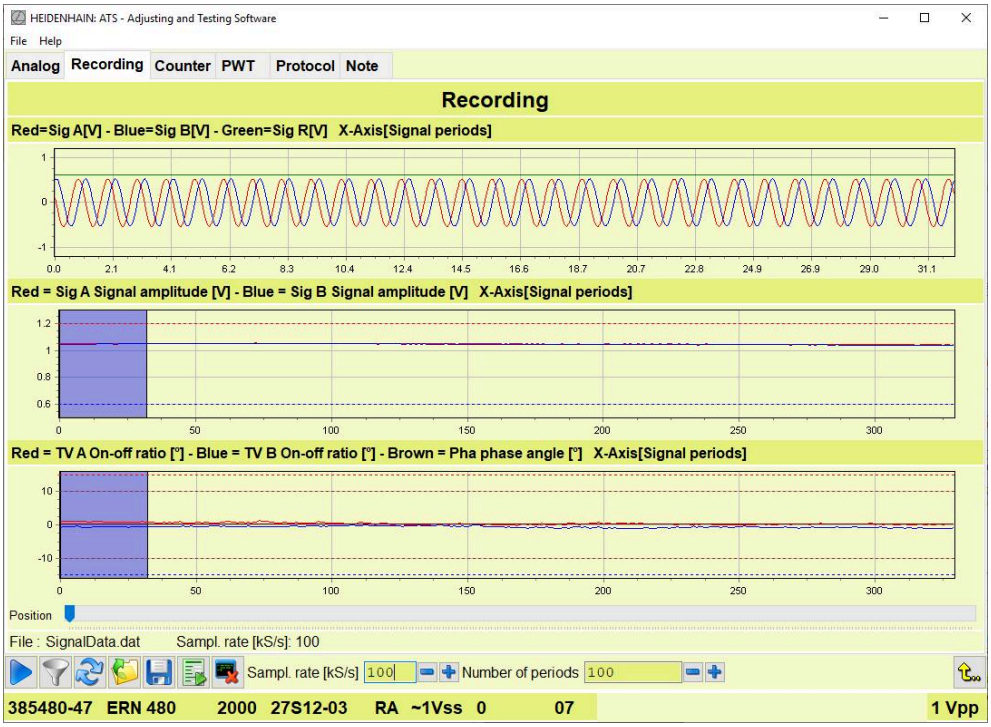


Figure 45: Recorded signal periods without error

Optimum condition: If the output signals are faultless, no drops are visible in the upper diagram. The curves in the middle and lower diagram are almost congruent and are entirely within the tolerance range.

Example of a faulty encoder

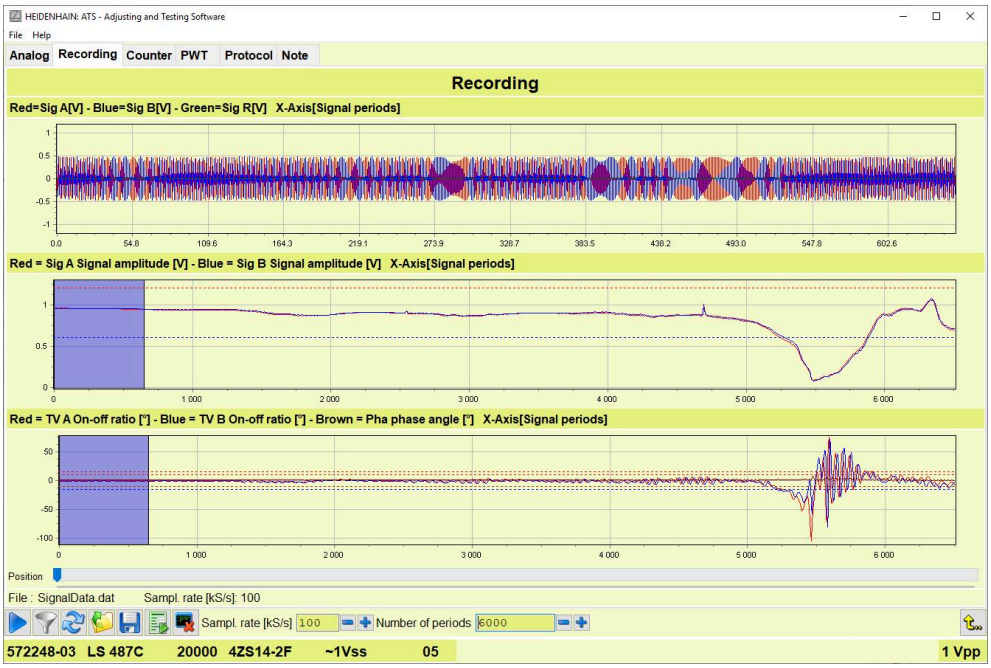


Figure 46: Recorded signal periods with irregularities

Signal drops as well as on-off ratio errors and phase shift errors are visible at the end of the measuring range. This may be due to heavy contamination, for example.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Adjusting the diagram view

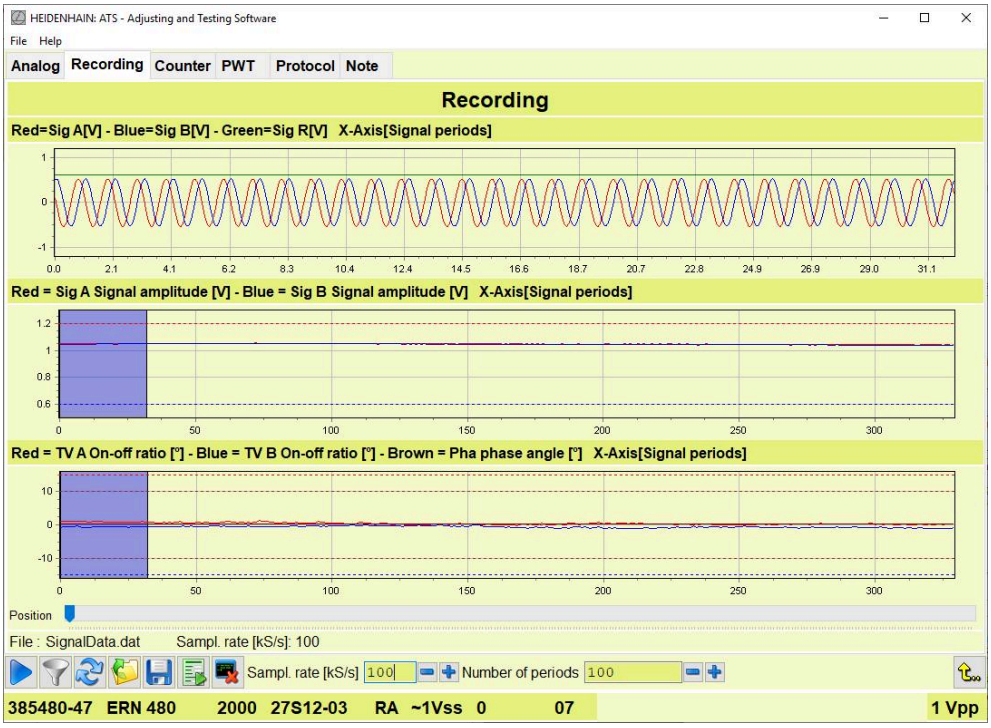


Figure 47: Diagrams of the **Recording** view

Use the **Position** slider to navigate through the recorded data.

- ▶ Hold the mouse button and drag the slider to the desired position
- > Diagram 1 shows the selected detail of the recorded data
- > In diagram 2 and diagram 3 the blue section is moved to the selected position

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

To examine a section more closely, you can zoom in on the diagram view.

Further information: "Magnifying the diagram view", Page 42

- ▶ Click **Reset diagram view** in the control bar to restore the default view
- > The blue section is shifted left to the beginning
- > Zooming is reset

Saving recorded data to a file

The Adjusting and Testing Software saves the recorded data in the file "SignalData.dat".

Path: C: ▶ Users ▶ ... ▶ AppData ▶ Roaming ▶ HEIDENHAIN ▶ ATS

When you make a new recording, the file contents are overwritten. If you want to preserve the recorded data permanently, you can save the data under a different file name.

- ▶ Click **Save file** in the control bar
- ▶ Select the desired storage location in the dialog
- ▶ Enter the desired file name
- ▶ Click **Save**
- > The file is saved

You can recall recorded data in DAT format in the Adjusting and Testing Software.

Loading recorded data from a file

Prerequisite: The recorded data are available in a DAT file.

- ▶ Click **Open file** in the control bar
- ▶ Select the storage location in the dialog
- ▶ Click **Open**
- > The diagrams show the recorded data from the file

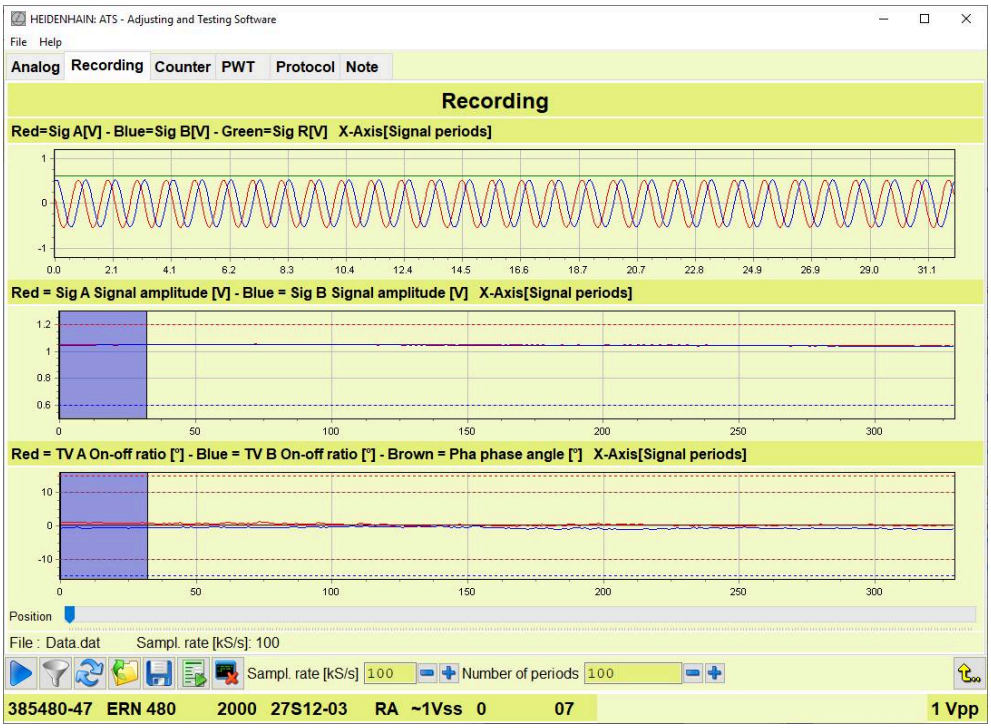


Figure 48: Recorded data loaded from a file

Below the diagrams, the Adjusting and Testing Software displays the name of the file and the sampling rate at which the recording was made.

Exporting recorded data

For further processing in other programs, you can export the recorded data to a TXT or ASC file.

> It is not possible to load the recorded data from a TXT or ASC file in the Adjusting and Testing Software.

- Click **Export file** in the control bar
- Select the desired storage location in the dialog
- Enter the desired file name
- Click **Save**

> The file is saved

9.2.8 Counter view

In the **Counter** view, you can check the counting function and the reference function of incremental encoders. The **Counter** view shows the distances between the reference marks as the encoder moves.

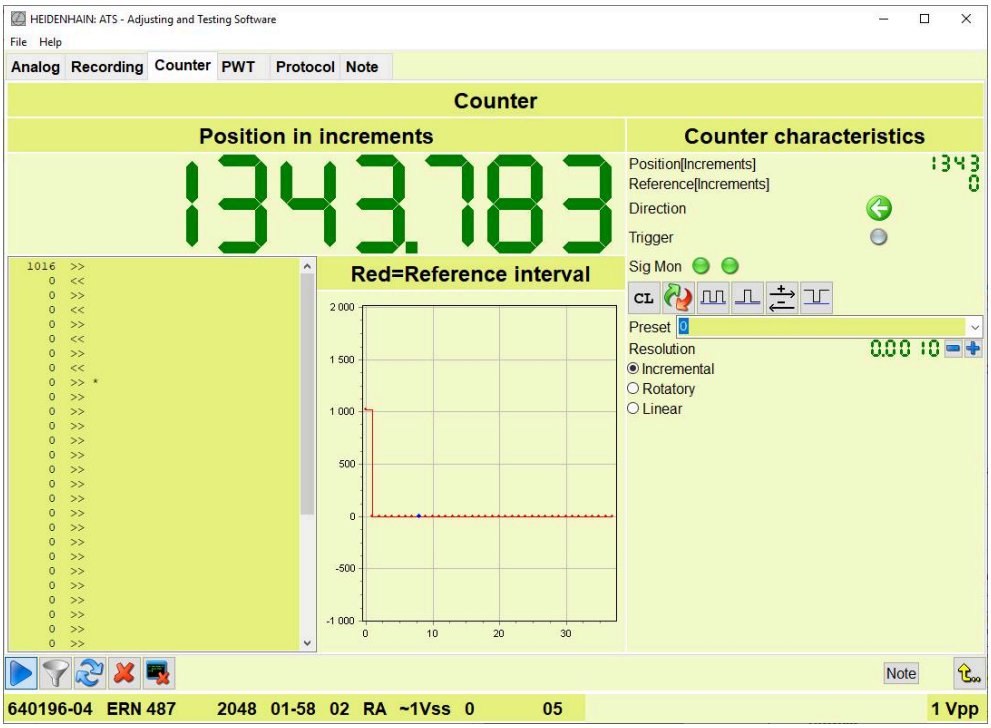


Figure 49: **Counter** view of the **Incremental signal** function

Table

When a reference mark is passed over, the distance to the preceding reference mark is determined and an entry added to the table. The table contains the following information:

- The asterisk marks the count value at the current position
- The arrows show the direction of traverse
- With distance-coded reference marks, the nominal increment is shown in addition to the count values

Bar graph

Depiction	Description
X axis	Number of captured reference marks
Y axis	Number of signal periods
Red	Reference mark spacing
Blue	Current position

Counter section

Display	Description
Position in [unit]	Current count of the incremental counter Unit: Depends on the settings in the **Counter characteristics** section

Counter characteristics section

Display	Description
Position [increments]	Current count Unit: increments
Reference [increments]	Distance between the two reference marks traversed last Unit: increments
Direction	The arrow shows the traverse direction ■ Arrow to the right: positive count value recorded ■ Arrow to the left: negative count value recorded
Trigger	Status display of reference mark detection ■ Gray: no reference mark was detected ■ Green: a reference mark was detected When a reference mark was detected, the status display changes back to gray color after 5 seconds. If several reference marks follow each other, the status display may be permanently green.
Sig Mon	Status display of signal monitoring ■ Green: The signal amplitudes are within the tolerance range ■ Red: The signal amplitudes exceed at least one tolerance limit The left status display shows the current status. When a tolerance limit is exceeded, the status display turns red for about 5 seconds. The right status display shows the overall status of the measurement. When a tolerance limit is exceeded, the status display is permanently red.

Settings in the Counter characteristics section

In the **Counter characteristics** section you can adjust the settings for the counter value display **Position in [unit]**. The position value is calculated according to these settings.

Display	Description
Preset	Input field for presetting a count value
Resolution	Counter resolution
■ Incremental ■ Rotatory ■ Linear	Type of incremental counter The count value is converted into the corresponding unit as per the selection: ■ Incremental: Measuring steps ■ Rotatory: Selected unit (see below); Standard setting: Degrees ■ Linear: Micrometers Depending on the selection, the following settings are displayed.
Line count	Input field for the encoder line count per revolution to calculate the count value
■ Degrees ■ Radian measure ■ DMS	Unit of the incremental counter The value of the incremental counter is converted into the selected unit. ■ Degrees ■ Radian measure ■ DMS: Degrees, minutes, seconds
Signal period	Input field for the length of a signal period to calculate the count value

Operating elements

Icon	Function
	**Stop the measurement** Interrupts the measurement and shows the last measured values in the diagram and the displays
	**Activate a filter** Suppresses interfering signals ≥ 100 kHz
	**Reset status displays** Resets the status displays of signal monitoring (**Sig Mon**) back to "green"
	**Delete measured values** Deletes the measured values recorded from the table and graphics
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Deactivate HSP** Deactivates the HEIDENHAIN Signal Processing (HSP) function
	**Clear the counter** Sets the counter to zero
	**Preset the count value** Loads the value from the **Set** field as new count value
	**Clear the counter with every reference mark** Activates zero reset of count value and position each time a reference mark is traversed
	**Clear the counter and start with next reference mark** Sets counter and position to zero and starts capture when the next reference mark is traversed
	**Clear the counter and determine the position again** Sets counter and position to zero and redetermines the position via the distance-coded reference marks
	**Invert counting direction** Inverts the positive or negative counting direction
	**Evaluate the inverted reference pulse** Inverts the evaluation of the reference pulse
	**Notes** Indicates that there is new information on the current measurement

9.2.9 Checking the counting function (Counter view)

- Double-click **Incremental signal** in the function menu
- Click the **Counter** tab to switch to the **Counter** view

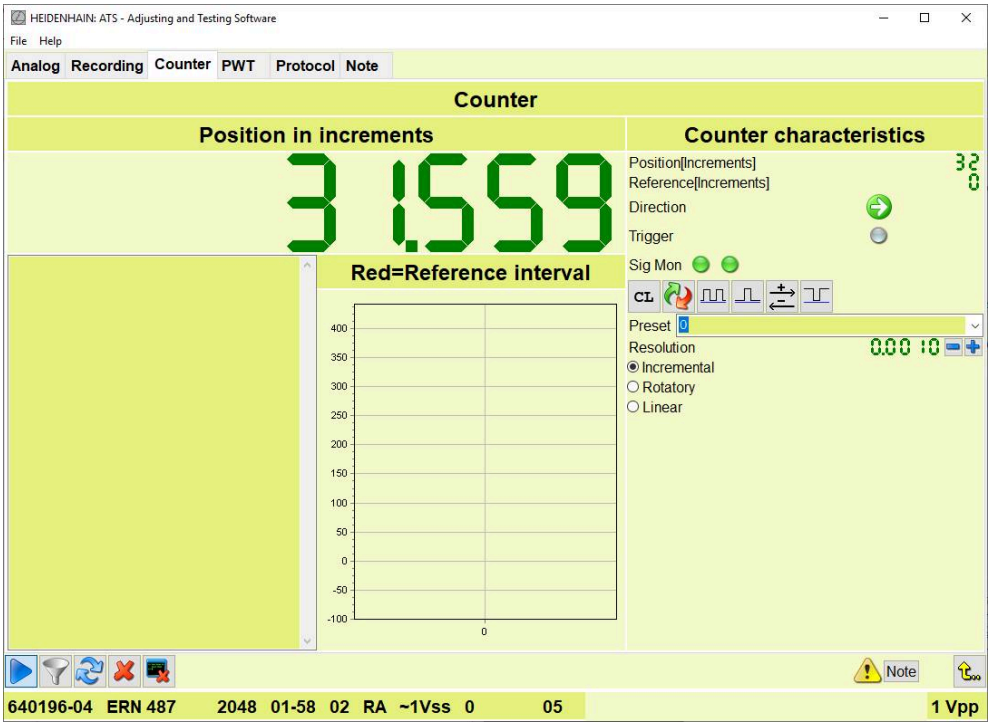


Figure 50: **Counter** view of the **Incremental signal** function

The further procedure depends on the type of reference marks the encoder features.

Procedure with one reference mark

- Traverse the reference mark
- Traverse the reference mark in the opposite direction
- Repeat the procedure several times
- > A measured value is added to the table and the diagram each time the reference mark is traversed

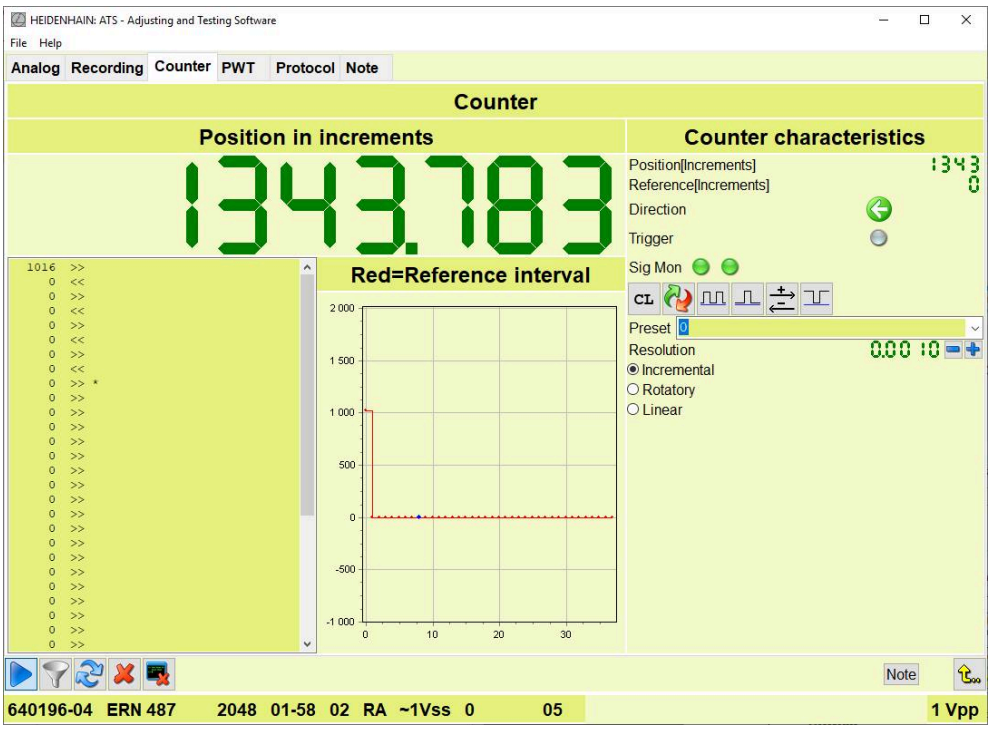


Figure 51: **Counter** view when examining an encoder with one reference mark

Counter and reference functions are error-free if the distance is "0" each time the reference mark is traversed.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Procedure with multiple reference marks without distance coding

- ▶ Traverse several reference marks
- > A measured value is added to the table and the diagram each time a reference mark is traversed
- ▶ Traverse the reference marks in the opposite direction
- > When the direction is reversed, the value "0" is added to the table and the diagram

Counter and reference functions are error-free if the spacing is the same between all reference marks.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Procedure with distance-coded reference marks

When you examine encoders with distance-coded reference marks, the Adjusting and Testing Software first determines the nominal increment.

- Traverse several reference marks to determine the nominal increment
- If the traverse path of the encoder is short, you may need to traverse it in both directions repeatedly

> After the Adjusting and Testing Software has determined the nominal increment, the table also includes the nominal increment and the position

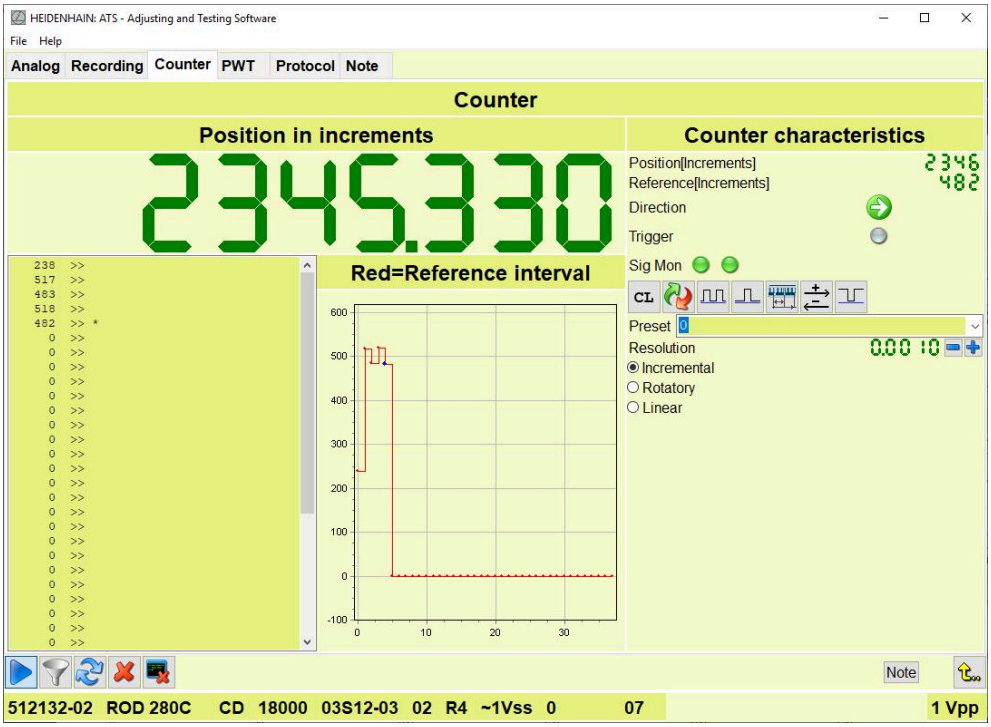


Figure 52: Display during determination of nominal increment

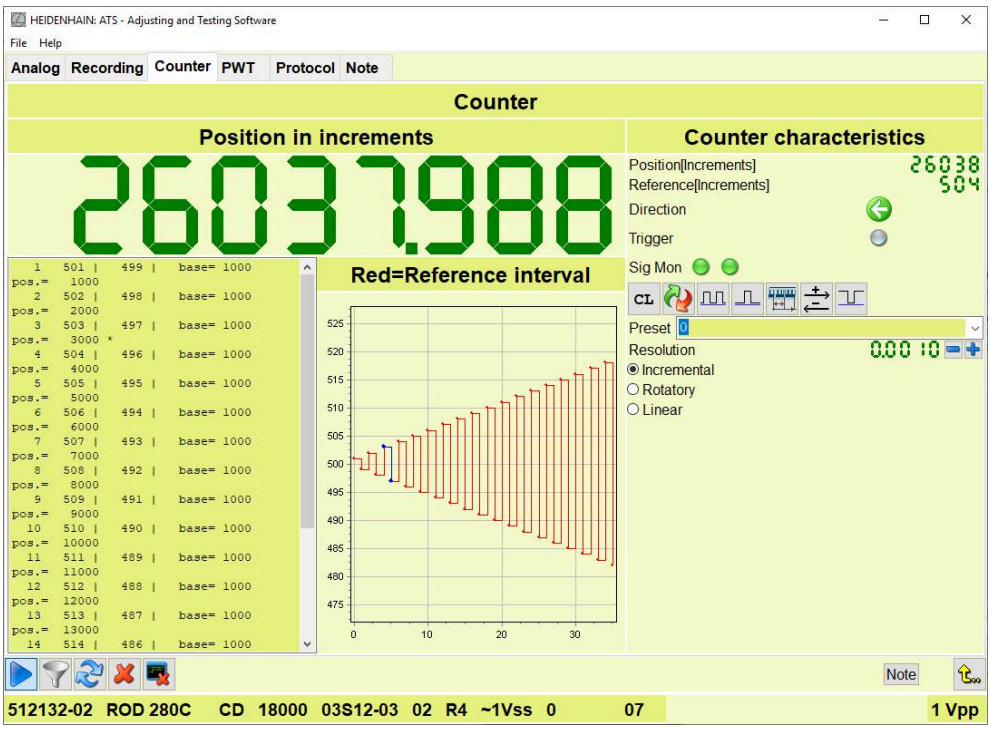


Figure 53: Display after the nominal increment has been determined

Column	Description
1	Reference mark spacing 1
2	Reference mark spacing 2
3	base: Nominal increment
4	pos.: Position determined from distance coding

- ▶ Traverse the entire measuring range
- > A measured value is added to the table and the diagram each time a reference mark is traversed
- ▶ Traverse the reference marks in the opposite direction
- > When the direction is reversed, the value "0" is added to the table and the diagram

Counter and reference functions are error-free if the determined distances are the same as the actual distance coding of the encoder. The sum of the values in the columns 1 and 2 must correspond to the nominal increment (value in column 3).

Deviations indicate a malfunction or improper mounting of the encoder.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Adjusting the counter display

The counter display can be adjusted in the **Counter characteristics** section.

- ▶ Set the desired counter resolution with the plus and minus buttons
- ▶ Select desired display options:
  - **Incremental**: Count value is displayed in increments
  - **Rotatory**: Count value is displayed in the selected angle unit
    - **Degrees**
    - **Radian measure**
    - **DMS** (degrees, arc minutes, arc seconds)
  - **Linear**: Count value is displayed in micrometers
- ▶ If you select **Rotatory**, enter the line count per encoder revolution in the **Line count** field
- ▶ If you select **Linear**, enter the length of a signal period in micrometers in the **Signal period** field
- > The count value is converted and displayed according to the setting

A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.

Further information: "Displaying and deleting notes (Note view)", Page 130

Presetting the count value

To compare the counter e.g. with the counter of the subsequent electronics, you can preset a certain count value at the current position.

- ▶ Enter the desired position value in the **Preset** field
- ▶ Click **Preset count value** in the control bar
- > The entered count value is adopted as the new position

Clearing the counter

- ▶ Click **Clear counter** in the control bar
- > The counter is set to zero

Clearing the counter with every reference mark

- ▶ To start counting at every reference mark, click **Clear counter with every reference mark** in the control bar
- > The counter is set to zero each time a reference mark is traversed

Clearing the counter and starting with next reference mark

- ▶ Click **Clear counter and start with next reference mark** in the control bar
- > The counter is set to zero and will start counting when the next reference mark is traversed

Inverting the counting direction

The counting direction of some encoders can be configured. You can adapt the counting direction to the encoder in the Adjusting and Testing Software.

- ▶ Click **Invert counting direction** in the control bar to adapt the counting direction
- > The Adjusting and Testing Software inverts the positive or negative counting direction

Clearing the counter and determining the position again

For encoders with distance-coded reference marks, you can set the position and the counter to zero and then determine the position again.

- ▶ Click **Clear counter and determine position again** in the control bar
- > The counter is set to zero
- ▶ Traverse several reference marks
- > The position is determined again

Evaluating the inverted reference pulse

The reference signal of some encoders is inverted. In order that inverted reference pulses can be detected and correctly evaluated, you need to adapt the evaluation logic of the Adjusting and Testing Software.

- ▶ Click **Evaluate inverted reference pulse** in the control bar
- > The Adjusting and Testing Software inverts the evaluation logic

Deleting measured values

For a new examination you can delete the recorded measured values from the table and from the diagram.

- ▶ Click **Delete measured values** in the control bar
- > The table and the diagram are reset

9.2.10 PWT view

The **PWT** view allows for a rapid test of incremental signals and reference mark signals. The results are displayed graphically as bar graphs.

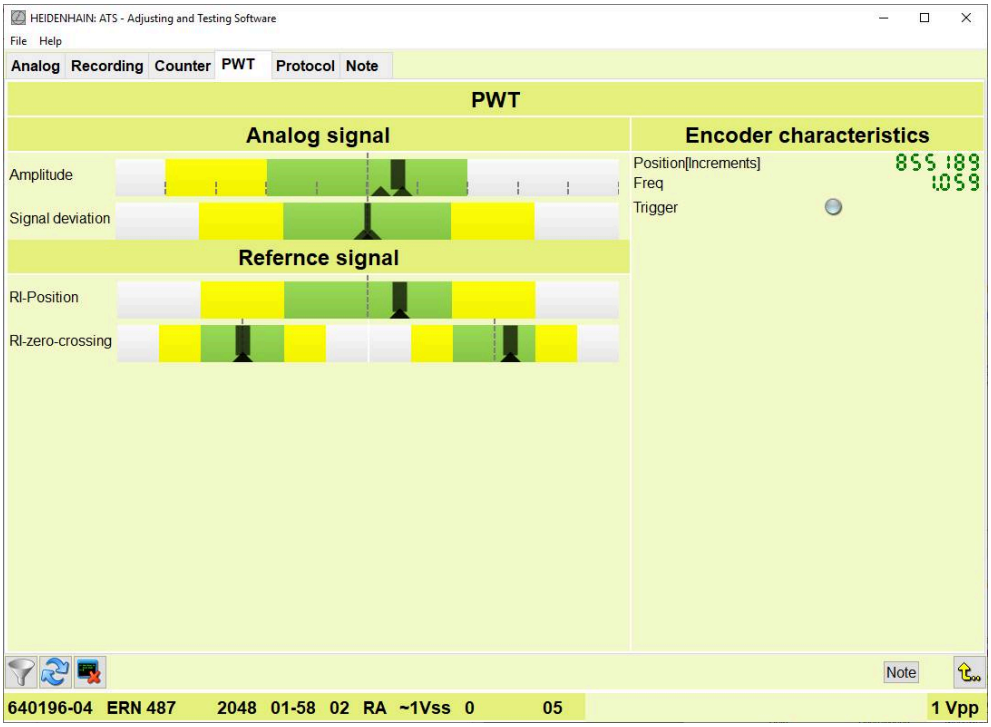


Figure 54: **PWT** view of the **Incremental signal** function

The following signal characteristics are evaluated in the bar graphs:

- Signal amplitude
- Signal deviation
- RI position: Reference mark position
- RI zero crossing: Zero crossovers of reference-mark signal

The tolerance ranges are indicated by color in the bar graphs:

Image	Tolerance range	Description
Green	Pass	Measured values are within the restricted tolerance range
Yellow	Adequate	Measured values are within tolerance
Gray	Not adequate	Measured values are outside the tolerance range
<< >>	Out of scale	At least one measured value is beyond the tolerance range and out of scale. The direction of the arrow shows the direction where the measured value lies.

The shown tolerances are HEIDENHAIN standard values! In certain cases, the tolerance limits of the encoder may differ from the tolerance limits displayed.

Note the tolerances specified in the documentation of the encoder.

Depiction	Description
	The bar shows the current measured value.
	The drag indicators show the minimum and maximum measured values of the measurement.

Depiction	Description
Position [increments]	Count value of incremental counter Unit: Increments
Freq	Input frequency Unit: kHz
Trigger	Status display of reference mark detection ■ Gray: no reference mark was detected ■ Green: a reference mark was detected When a reference mark was detected, the status display changes back to gray color after 5 seconds. If several reference marks follow each other, the status display may be permanently green.

Signal amplitude bar graph

The position of the black bar indicates the signal amplitude.

Depiction	Description
	Optimum signal amplitude
	Minimum signal amplitude
	Maximum signal amplitude

Signal deviation bar graph

Signal deviations are errors in the signal ratio, on-off ratio and phase shift. The larger the signal deviation is, the broader the black bar becomes.

Optimum condition: The black bar is as narrow as possible and is positioned within the green area.

Depiction	Description
	Optimum condition
	Signal deviation at the tolerance limit
	Signal deviation too large

RI position bar graph

The reference mark signal is at a specified nominal position. The position of the black bar indicates the deviation from the optimum position.

Depiction	Description
	Deviation of reference mark position at the tolerance limit

RI zero crossover bar graph

The positions of two black bars show the deviation of the zero crossovers from the nominal values.

Depiction	Description
	Deviations of the reference pulse zero crossovers within the tolerance range

Operating elements

Icon	Function
	**Activate a filter** Suppresses interfering signals ≥ 100 kHz
	**Delete measured values** Deletes the measured values for a new measurement
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Deactivate HSP** Deactivates the HEIDENHAIN Signal Processing (HSP) function
	**Notes** Indicates that there is new information on the current measurement

9.2.11 Running a rapid test with the PWT test function (PWT view)

- Double-click **Incremental signal** in the function menu
- Click the **PWT** tab to switch to the **PWT** view

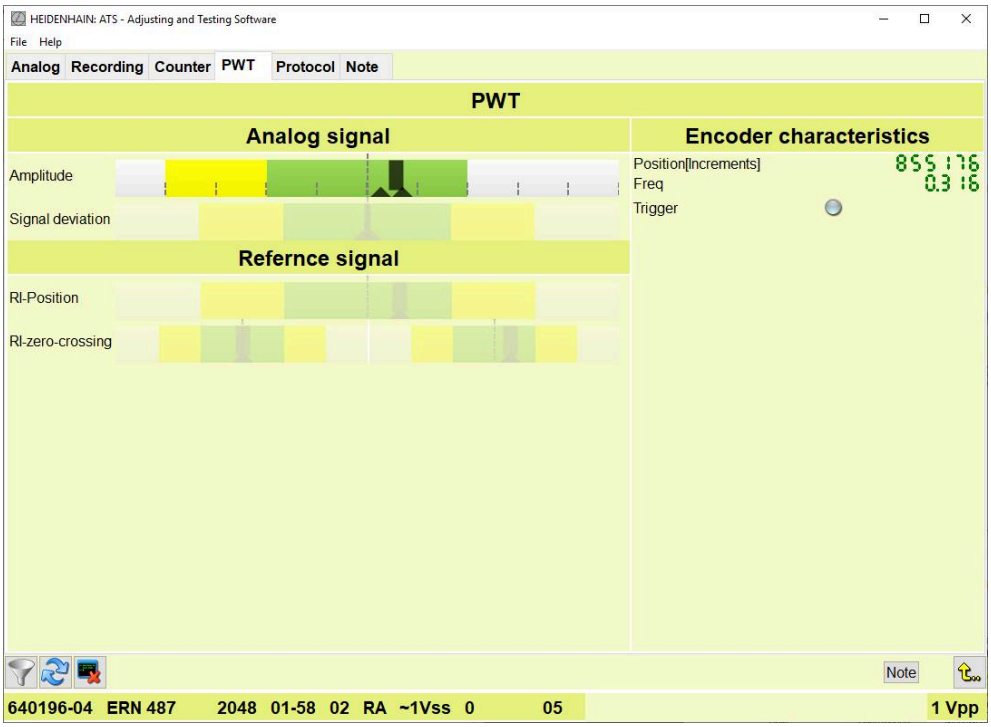


Figure 55: **PWT** view of the **Incremental signal** function

A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.

Further information: "Displaying and deleting notes (Note view)", Page 130

- Traverse the entire measuring range
- > The **Signal deviation** bar graph is activated
- > When a reference mark is traversed, the bar graphs **RI position** and **RI zero crossing** are activated
- > The bar graphs show the current measured values

- To reset the minimum and maximum value for a new measurement, click **Delete measured values** in the control bar
- > The drag indicators are reset to the current measured value

If the encoder stops for several seconds, the bar graphs for **Signal deviation**, **RI position** and **RI zero crossing** become inactive again.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

9.2.12 Homing – Limit view

The **Homing – Limit** view provides a functional check of limit switching signals.

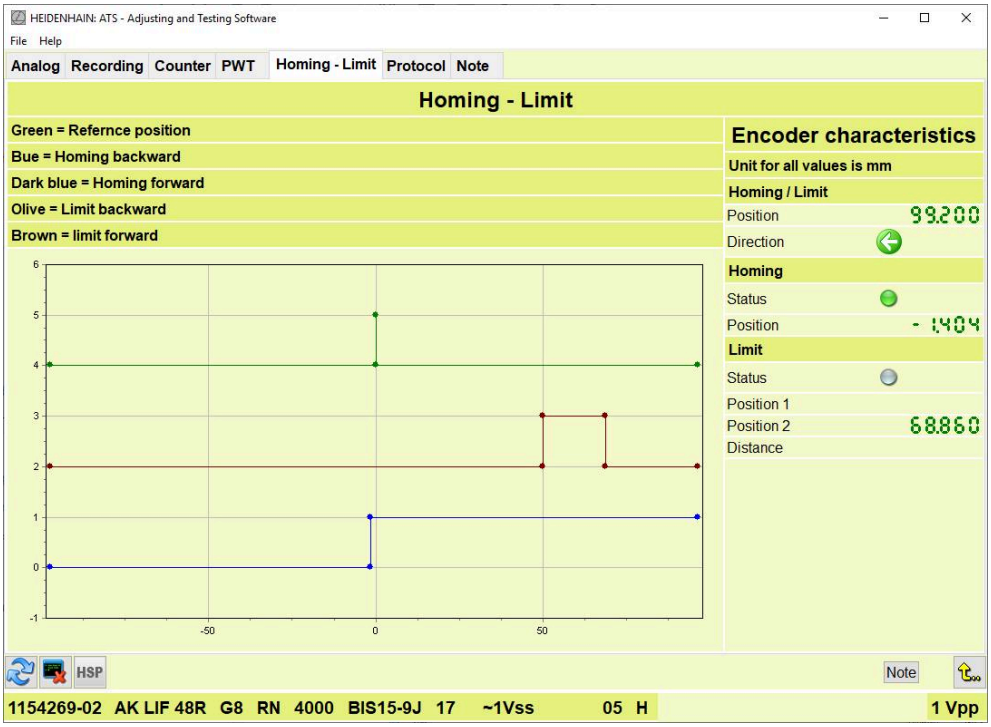


Figure 56: **Homing – Limit** view of the **Incremental signal** function

Bar graph

In the diagram, the signals with their respective traverse directions are color-coded.

Depiction	Description
Green	Reference signal
Blue	Homing backward
Dark blue	Homing forward
Olive green	Limit backward
Brown	Limit forward

Encoder characteristics section

All values in mm

Depiction	Description
Position	Count value of incremental counter Unit: millimeters
Direction	The arrow symbol shows the traverse direction ■ Arrow to the right: positive count value recorded ■ Arrow to the left: negative count value recorded

Homing/L1/Pin 6 (depending on encoder)

Depiction	Description
Status	Status display of the homing level ■ Gray: low level ■ Green: high level
Position	Distance between homing edge and reference mark R Unit: millimeters

Limit/L2/Pin 8 (depending on encoder)

Depiction	Description
Status	Status display of the limit level ■ Gray: low level ■ Green: high level
Position 1	Distance between limit edge 1 and reference mark R Unit: millimeters
Position 2	Distance between limit edge 2 and reference mark R Unit: millimeters
Distance	Distance between limit edge 1 and limit edge 2 Distance = |Limit edge 1 + Limit edge 2|

Operating elements

Icon	Function
	**Delete measured values** Deletes the measured values for a new measurement
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Deactivate HSP** Deactivates the HEIDENHAIN Signal Processing (HSP) function
	**Notes** Indicates that there is new information on the current measurement

9.2.13 Checking Limit switching signals (Homing – Limit view)

Prerequisites:

- The encoder features limit switching signals
- The encoder is correctly mounted and electrically adjusted according to the mounting instructions
- The encoder was connected to the Adjusting and Testing Software by entering the encoder ID

For detailed information on the availability and function of switching signals, refer to the encoder documentation or the brochure "Interfaces of HEIDENHAIN Encoders".

Further information: "Opening documentation", Page 42

- ▶ Double-click **Incremental signal** in the function menu
- ▶ Click the **Homing – Limit** tab to switch to the **Homing – Limit** view

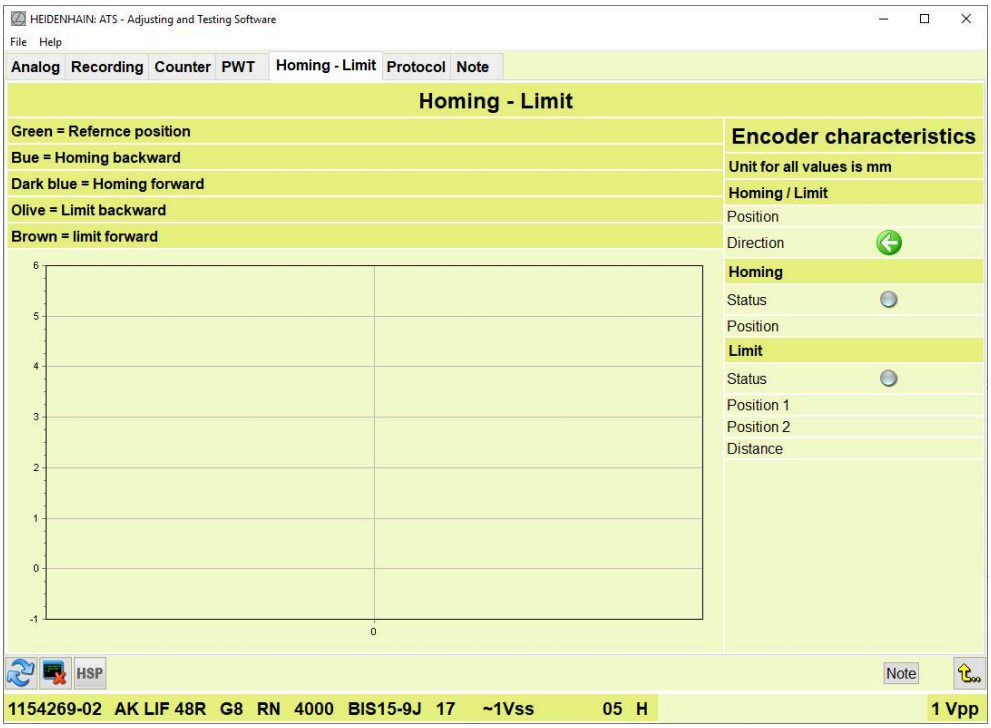


Figure 57: **Homing – Limit** view of the **Incremental signal** function

- ▶ Traverse the entire measuring range
- > Recording of the measured values in the diagram starts as soon as the first reference mark is traversed.
- > When the last reference mark is traversed, the entire measuring range is displayed in the diagram with homing and limit switching edges (depending on the encoder)

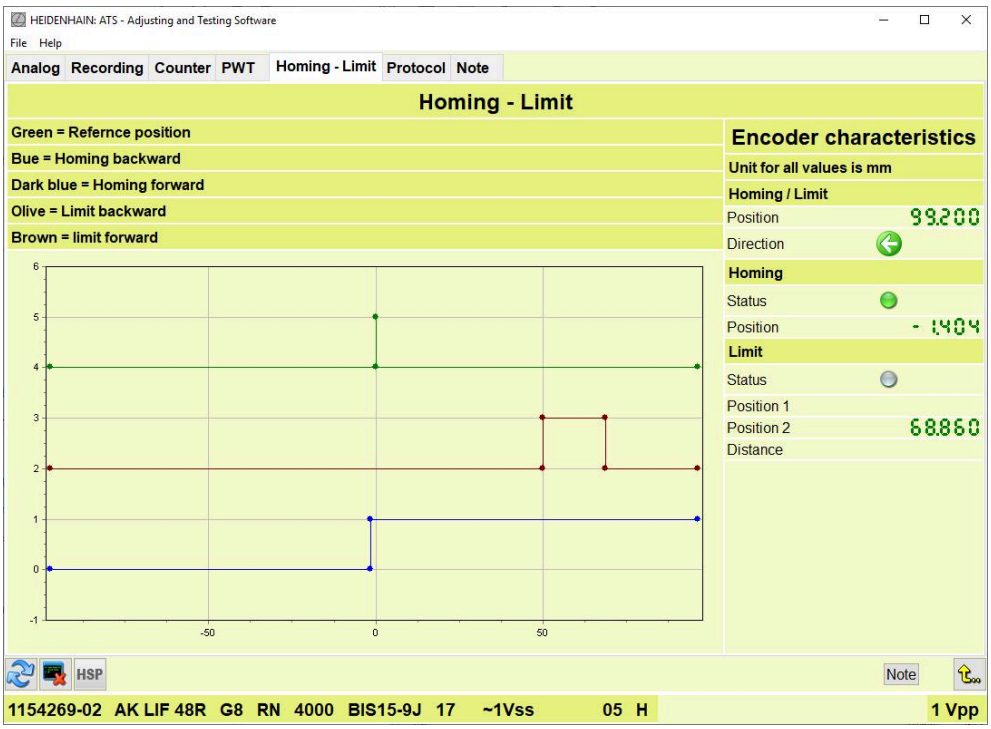


Figure 58: **Homing – Limit** with reference mark and switching edges

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

- To reset the diagram for a new measurement, click **Delete measured values** in the control bar

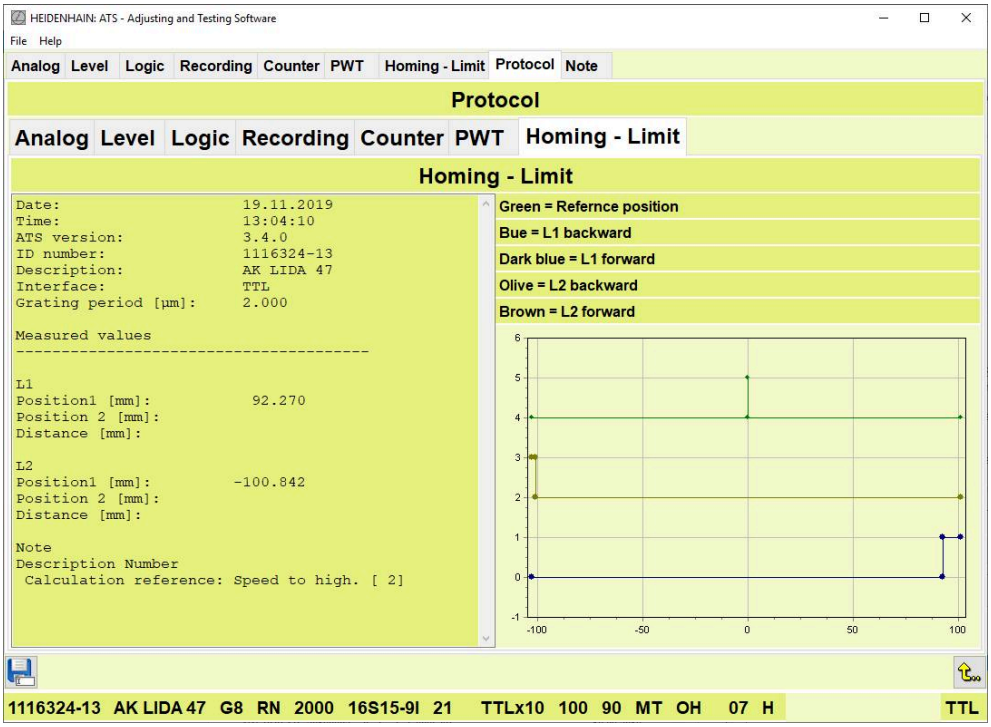
9.2.14 Protocol view

You can transfer data from the views of the **Incremental signal** function to the **Protocol** view.

Further information: "Transferring data to the Protocol view", Page 94

The data recorded in the **Protocol** view can be saved to a PDF file. The **Protocol** view shows the data in various tabs, according to the view in which the data was captured.

> The data are temporarily retained in the **Protocol** view until you exit the **Incremental signal** function.



Operating elements

Icon	Function
	**Save log** Opens the **Protocol** dialog

9.2.15 Saving log data (Protocol view)

You can save the test results in a PDF file.

- ▶ Click the **Protocol** tab to switch to the **Protocol** view
- ▶ Click **Save log**
- > The **Protocol** dialog shows the available contents
- ▶ Select the data to be logged
- ▶ Click **Preview** to open a preview of the PDF file
- ▶ If necessary, close the preview
- ▶ Click **Save** in the dialog to save the file
- ▶ Select the desired storage location
- ▶ Enter the file name
- ▶ Click **Save**
- > The file is saved
- ▶ Click **Close** to close the dialog

In the Adjusting and Testing Software, you can add an individual header and details on the examiner to the logs.

Further information: "Saving log information", Page 50

To display the PDF contents correctly, the font "Arial Unicode MS" must be installed on the computer.

9.2.16 Note view

The **Note** screen contains information on the current measurement.

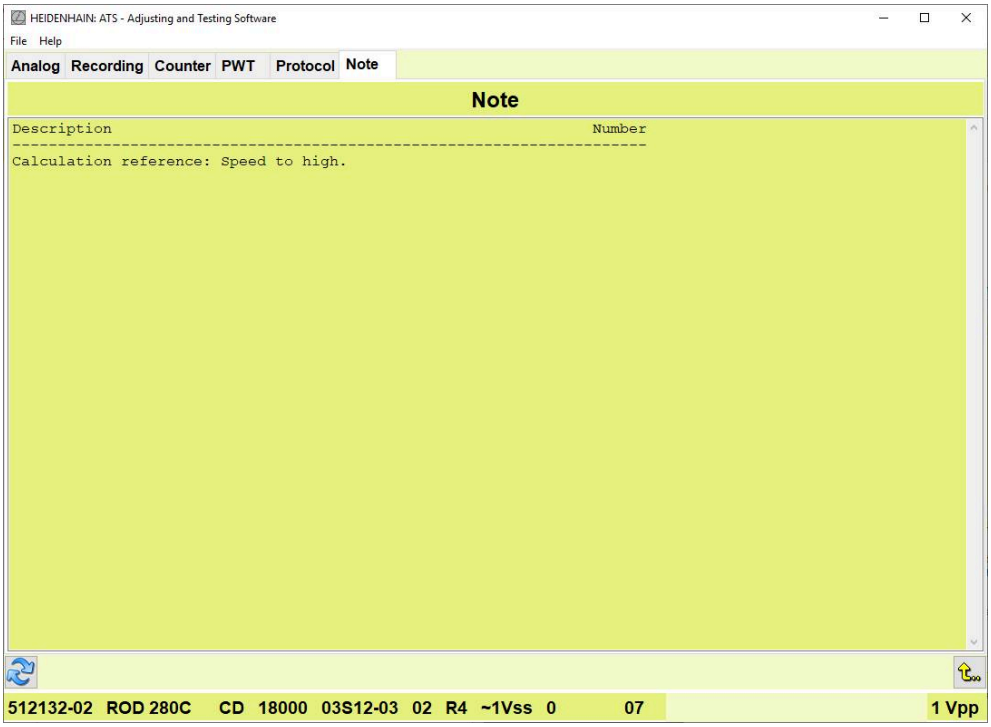


Figure 59: **Note** view of the **Incremental signal** function

The notes refer to problems with signal calculation, e.g.:

- Signal frequencies are too high, e.g. due to excessive traversing speed or shaft speed
- Signal frequency fluctuates
- Displayed signal detail is too small to calculate the reference mark correctly

Operating elements

Icon	Function
	**Deleting notes** Deletes the notes for a new measurement

9.2.17 Displaying and deleting notes (Note view)

A warning symbol appears in the control bar when there is a new note. Go to the **Note** view to read the note.

- ▶ Click **Note** in the control bar
- > The **Note** view shows a list of all notes

Notes are maintained until you exit the **Incremental signal** function or delete the notes by hand.

Deleting notes

- ▶ Click **Delete notes** in the control bar to delete all notes

9.3 Checking voltage supply

9.3.1 Voltage display function

The **Voltage display** function shows the measured values and status of the voltage supply. The display depends on the operating mode of the testing device.

Operating mode of the testing device	Displayed voltage values
Encoder diagnostics	Encoder powered by the PWM
Monitoring operation with signal adapter	Signal adapter powered by the PWM
Monitoring operation without signal adapter	Encoder powered by the subsequent electronics

- Double-click **Voltage display** in the function menu

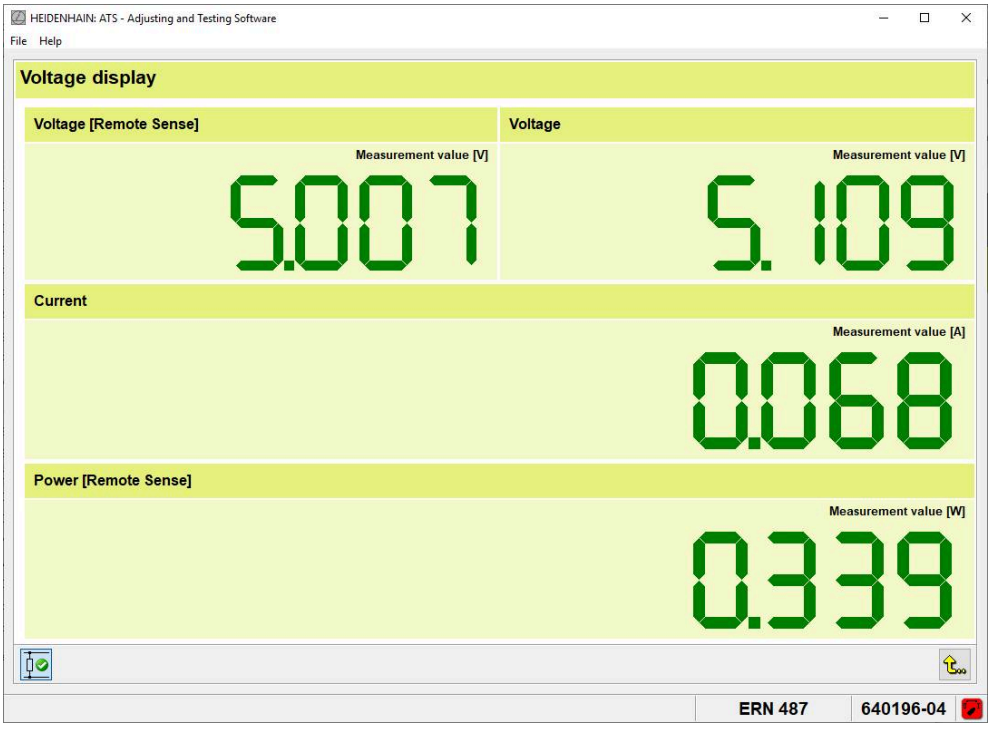


Figure 60: **Voltage display** function

Display	Description
Voltage [Remote Sense]	Operating voltage at the encoder Voltage drops on the encoder supply lines are taken into account. **[Remote Sense]**: Indicates that voltage readjustment is active
Voltage	Voltage output by the PWM or the subsequent electronics
Current	Current consumption of the encoder or the signal adapter

Display	Description
	If the encoder does not consume any current, the measured value is displayed in red.
Power [Remote Sense]	Power consumption of the encoder **[Remote Sense]**: Indicates that voltage readjustment is active

Operating elements

Icon	Function
	**Deactivate terminating resistor** Switches the terminating resistor off
	**Activate terminating resistor** Switches the terminating resistor on

9.3.2 Deactivating the terminating resistor

In the Encoder Diagnostics mode, the terminating resistor is activated by default. You can deactivate the terminating resistor to check whether the current consumption of the encoder corresponds to the technical specifications, e.g. the typical current consumption.

- ▶ Click **Deactivate terminating resistor** in the control bar

- > The operating element indicates that the terminating resistor is inactive

- ▶ Click **Activate terminating resistor** to reactivate the terminating resistor

- > The operating element indicates that the terminating resistor is active

When you exit the function view, the terminating resistor is automatically reactivated.

In the monitoring mode, the terminating resistor is inactive and cannot be switched on.

10

Inspecting encoders with square-wave incremental signals

10.1 Overview

The Adjusting and Testing Software features the following functions for inspecting encoders with square-wave output signals (e.g. HTL or TTL):

Icon	Function	Description
	Incremental signal	Functions for testing incremental signals, if necessary including tolerance check
	Voltage display	Measured values of voltage and current supply

The displays and the scope of functions of the Adjusting and Testing Software depend on the connected encoder and on the software configuration. When you establish the connection to the encoder, the function menu shows the available functions and operating elements.

10.2 Checking incremental signals

10.2.1 Incremental signal function

Depending on the connected encoder, the **Incremental signal** signal functions includes the following displays:

- **Level**: Examine incremental signals
- **Logic**: Record and analyze incremental signals
- **Counter**: Test counting and reference functions
- **Protocol**: Create logs
- **Note**: Display information on the current measurement

Additionally for encoders that switch the analog incremental signals to the output via PWT switch-over:

- **Analog**: Examine incremental signals
- **PWT**: Examine incremental signals using bar displays

Some encoders also feature the option to switch the sinusoidal incremental signals to the output by means of PWT switch-over, so that the encoder mounting can be checked and optimized. For a detailed description of how to examine incremental signals refer to the sections "Analog screen" and "PWT view".

Some functions of the Adjusting and Testing Software are only available if you connect the encoder through its encoder ID (recommended procedure).

- ▶ To call this function, double-click **Incremental signal** in the function menu
- > The Adjusting and Testing Software displays the **Level** view

10.2.2 Level view

The **Level** view allows you to check the levels of the following signals:

- Incremental signals and inverted incremental signals
- Reference signal and inverted reference signal
- Fault-detection signal

Figure 61: **Level** view of the **Incremental signal** function

Diagrams

The diagrams show the signal levels.

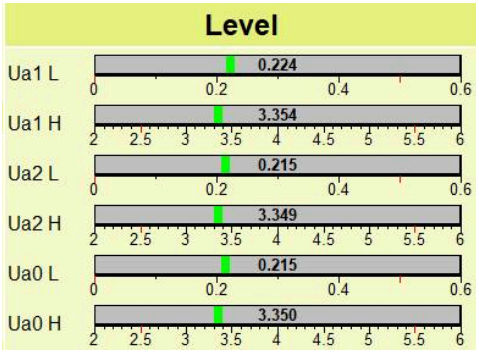
Depiction	Description
X axis	Number of samples
Y axis	Signal amplitude Unit: volts
Red curve	Incremental signal Ua1
Blue curve	Incremental signal Ua2
Green curve	Reference signal Ua0
Dashed lines	Tolerance limits

Encoder characteristics section

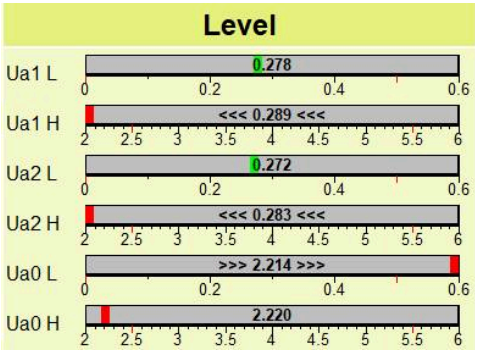
Display	Description
Position [increments]	Count value of the position display Unit: Increments
Freq	Input frequency Unit: Kilohertz
Failure signal	Status displays of signal monitoring ■ Green: High level of UaS fault-detection signal ■ Red: Low level of UaS fault-detection signal The left status display shows the current status. When the fault-detection signal is at low level, the status display turns red for about 5 seconds. The right status display shows the overall status of the measurement. When the fault-detection signal is at low level, the status display is permanently red.

Level display

When the encoder is traversed, the Adjusting and Testing Software captures the high levels (H) and the low levels (L) of signal and inverted signal. The bars show the measured values and the results of the tolerance check.



Measured values are within tolerance



Several measured values are outside the tolerance limits

Depiction	Description
	The indicator shows the measured value. The color of the indicator shows the result of the tolerance check: ■ Green: Measured value is within the tolerance range ■ Red: Measured value is outside the tolerance range
	The red markings mark the tolerance limits.
<< >>	The arrow symbols indicate that the measured value is beyond the scale. The direction of the arrow shows the direction where the measured value lies.

The Adjusting and Testing Software captures the signal levels, but does not evaluate the differences in the levels. The shown tolerances are HEIDENHAIN standard values! In certain cases, the tolerance limits of the encoder may differ from the tolerance limits displayed.

Note the tolerances specified in the documentation of the encoder.

The following information refers to the signal diagrams in the document **Interfaces of HEIDENHAIN Encoders**.

Further information: "Opening documentation", Page 42

Display	Description
Ua1 L	Low level of incremental signal Ua1 Unit: volts
Ua1 H	High level of incremental signal Ua1 Unit: volts
Ua2 L	Low level of incremental signal Ua2 Unit: volts
Ua2 H	High level of incremental signal Ua2 Unit: volts
Ua0 L	Low level of reference signal Ua0 Unit: volts
Ua0 H	High level of reference signal Ua0 Unit: volts

Operating elements

Icon	Function
	**Stop the measurement** Interrupts the measurement and shows the last measured values in the diagram and the displays
	**Evaluate the reference signal** Shows the **Trigger** status display and switches the diagrams to reference pulse detection
	**Switch the signal display** Switches to the measured values of the inverted signals
	**Reset status displays** Resets the **Failure signal** status displays to green
	**Deactivate the terminating resistor** Switches the terminating resistor off
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Show notes** Indicates that there is new information on the current measurement

Number of samples

The value in the **Number of samples** field determines how many measured values are displayed in the diagram.

Default setting:	2,000
Setting range:	2,000 ... 100,000

> The optimum value depends on the signal frequency (see **Freq** value in the **Encoder characteristics** section). The signal frequency increases with the traversing speed or shaft speed of the encoder. The higher the signal frequency, the lower a value you should select in the **Number of samples** field. For level evaluation, a maximum of ten signal periods should be shown in the diagram.

> When you exit the **Incremental signal** function, the value in the **Number of samples** field is reset to default.

10.2.3 Checking incremental signals (Level view)

To detect signal interruptions or short-circuits, check both the incremental signals and the inverted incremental signals, each with the terminating resistor active and inactive.

> A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.
>
> **Further information:** "Displaying and deleting notes (Note view)", Page 167

Checking incremental signals

- ▶ Click **Reset status displays** in the control bar to reset the signal monitoring status
- > The **Failure signal** status displays are green
- ▶ Enter the desired value in the **Number of samples** field
- ▶ Traverse the entire measuring range
- > The diagram and the bar display show the measured values and tolerances of the incremental signals

Figure 62: **Level** view of the **Incremental signal** function

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

To examine a section more closely, you can zoom in on the diagram view.

Further information: "Magnifying the diagram view", Page 42

Repeat the examination with the terminating resistor inactive.

Further information: "Deactivating the terminating resistor", Page 140

Checking inverted incremental signals

- Click **Switch signal display** in the control bar to display the inverted signals
- Traverse the entire measuring range
- > The diagram and the bar display show the measured values and tolerances of the inverted signals

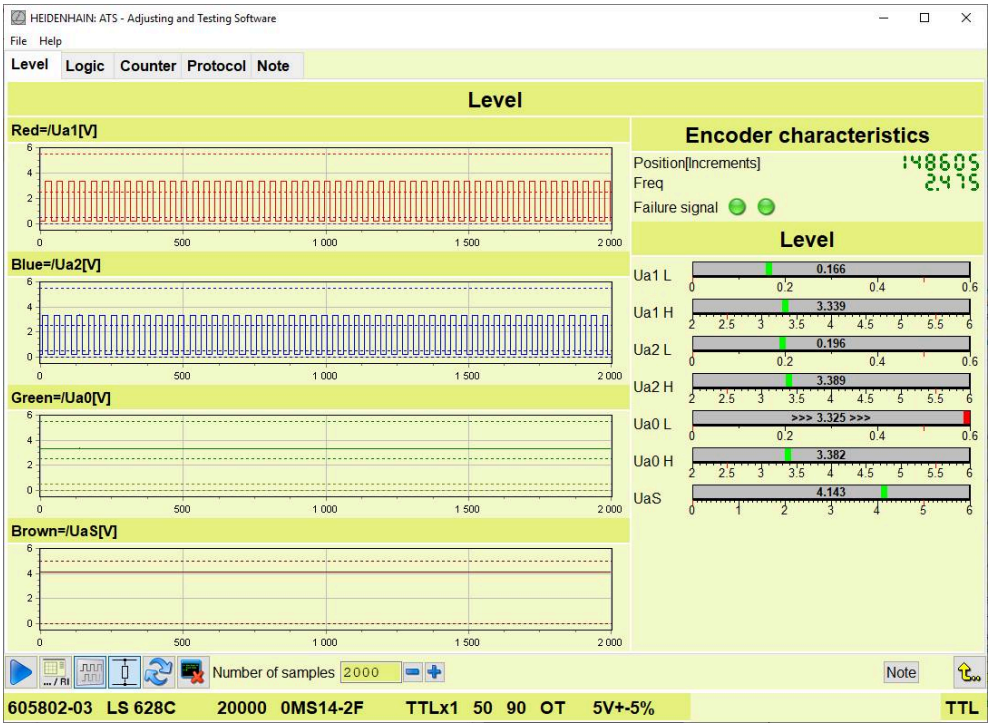


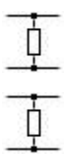
Figure 63: **Level** view when evaluating inverted signals

The Adjusting and Testing Software displays the fault-detection signal UaS in an additional diagram and an additional bar graph. During fault-free operation the high level is shown. In the event of error the fault-detection signal switches to low level.

Repeat the examination with the terminating resistor inactive.

Further information: "Deactivating the terminating resistor", Page 140

Deactivating the terminating resistor



- Click **Deactivate terminating resistor** in the control bar
- > The terminating resistor is deactivated
- Click the operating element again to reactivate the terminating resistor

When you exit the function view, the terminating resistor is automatically reactivated.

In the monitoring mode, the terminating resistor is inactive and cannot be switched on.

Stopping the measurement

You can stop the measurement to analyze a specific point or take a screenshot.

- ▶ Click **Stop measurement** in the control bar
- > The diagram and the displays hold the last measured values

- ▶ Click the operating element again to continue the measurement

Transferring data to the Protocol view

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

	The data are temporarily retained in the **Protocol** view until you exit the **Incremental signal** function.

- ▶ To store data temporarily, click on **Transfer data to the Protocol view**
- > The Adjusting and Testing Software displays the **Protocol** screen with the buffered values

Further information: "Protocol view", Page 128

10.2.4 Checking the reference signal (Level view)

The **Level** view allows you to check the level of the reference signal.

- ▶ Click **Evaluate reference signal** in the control bar
- > The **Reference trigger** status display is shown
- ▶ Enter the desired value in the **Number of samples** field
- ▶ Traverse the reference mark
- > The diagram **Ua0** shows the reference pulse
- > The **Reference signal** section shows the values of the traversed reference mark
- ▶ Traverse further reference marks, if required
- > The diagrams are refreshed each time a reference mark is traversed

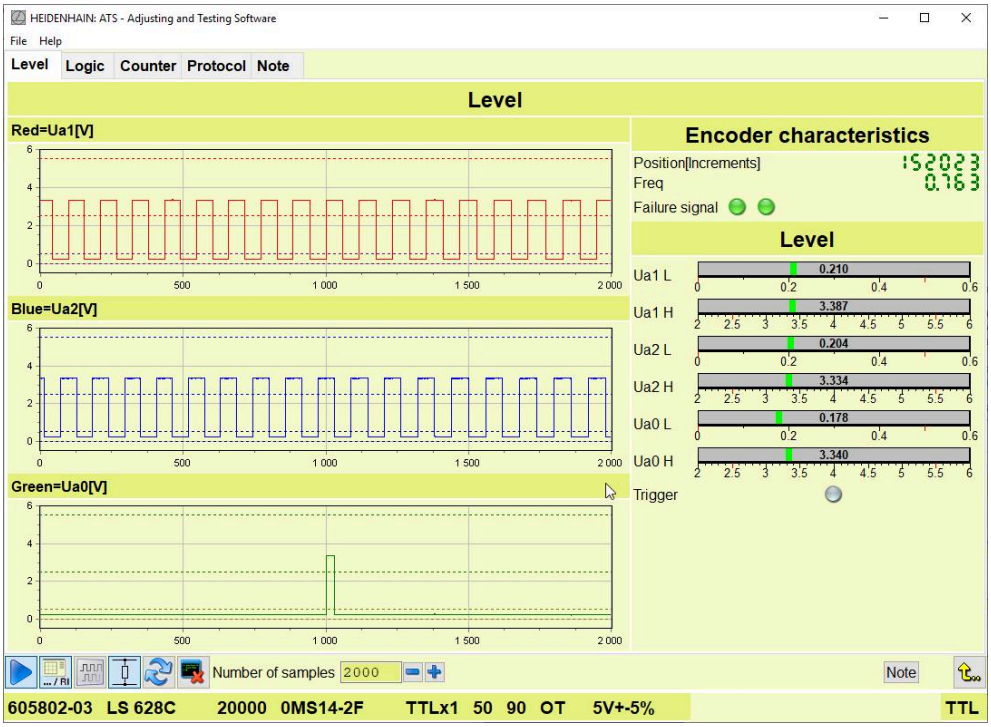


Figure 64: Incremental signal function when evaluating the reference signal

Depiction	Description
X axis (t)	Number of samples
Y axis	Signal amplitude Unit: volts
Red curve	Incremental signal Ua1
Blue curve	Incremental signal Ua2
Green curve	Reference signal Ua0
Dashed lines in the color of the signals	Tolerance limits of the respective signal

Trigger status display

Depiction	Description
Trigger	Status display of reference mark detection ■ Gray: no reference mark was detected ■ Green: a reference mark was detected When a reference mark was detected, the status display changes back to gray color after 5 seconds. If several reference marks follow each other, the status display may be permanently green.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

10.2.5 Logic view

In the **Logic** view, you can perform a logic analysis and check the signal quality and the position of the reference marks.

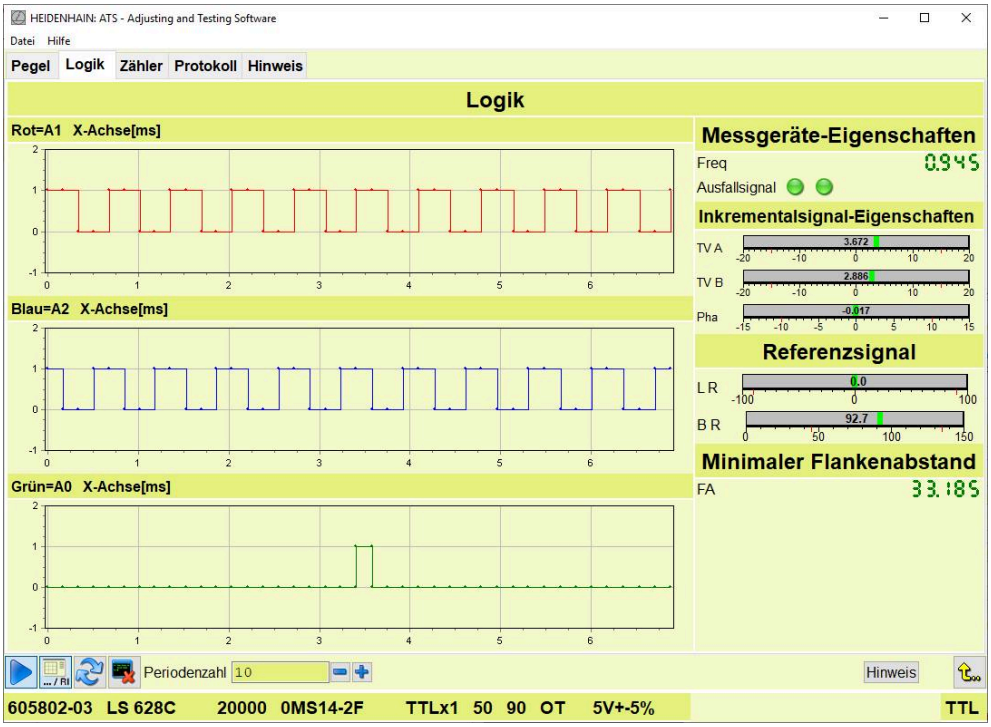


Figure 65: **Logic** view of the **Incremental signal** function

In the **Logic** function, the measured values are recorded at a sampling rate of 200 MS/s.

Diagrams

The diagrams show the signal levels.

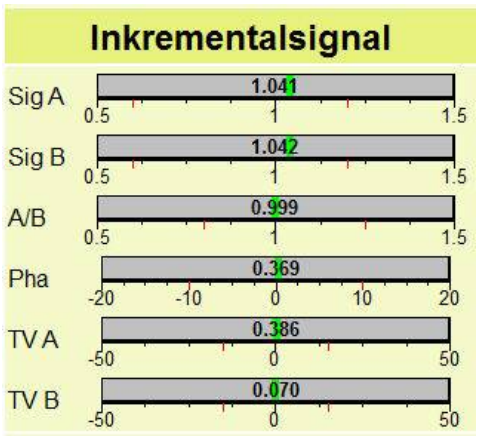
Depiction	Description
X axis	Time Unit: milliseconds
Y axis	Level ■ 1= high level ■ 0= low level
Red curve	Incremental signal Ua1
Blue curve	Incremental signal Ua2
Green curve	Reference signal Ua0

Encoder characteristics section

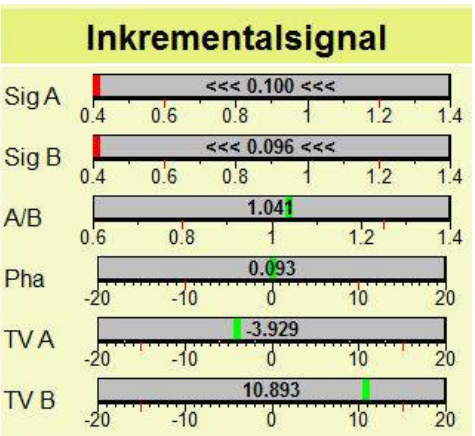
Display	Description
Position [increments]	Count value of the position display Unit: Increments
Freq	Input frequency Unit: kilohertz
Failure signal	Status displays of signal monitoring ■ Green: High level of UaS fault-detection signal ■ Red: Low level of UaS fault-detection signal The left status display shows the current status. When the fault-detection signal is at low level, the status display turns red for about 5 seconds. The right status display shows the overall status of the measurement. When the fault-detection signal is at low level, the status display is permanently red.

Characteristics of the incremental signals section

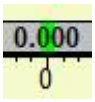
The bars show the measured values and the results of the tolerance check.



Measured values are within tolerance



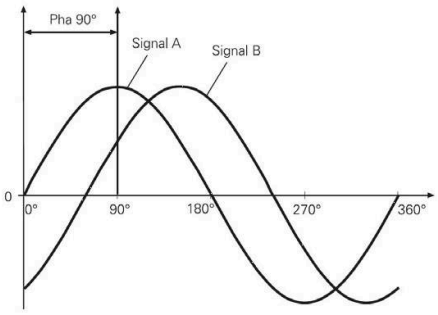
Several measured values are outside the tolerance limits

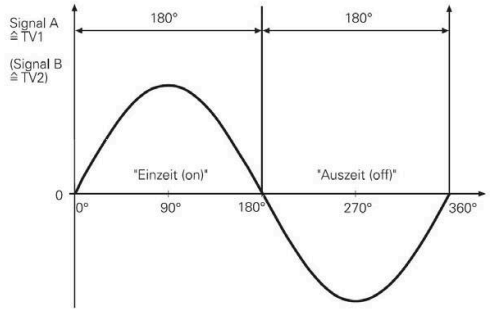
Depiction	Description
	The indicator shows the measured value. The color of the indicator shows the result of the tolerance check: ■ Green: Measured value is within the tolerance range ■ Red: Measured value is outside the tolerance range
	The red markings mark the tolerance limits.
<< >>	The arrow symbols indicate that the measured value is beyond the scale. The direction of the arrow shows the direction where the measured value lies.

The following information refers to the signal diagrams in the document **Interfaces of HEIDENHAIN Encoders**.

Further information: "Opening documentation", Page 42

The following figures illustrate the description using sinusoidal signals. The information is equally valid for square-wave signals.

Display	Description
Pha	Phase shift of signals A and B **Optimum condition**: Signal A precedes signal B by 90°.  Phase shift = 90° Phase shift error = 0° The Adjusting and Testing Software displays the phase shift error—i.e. the deviation from the optimum condition—in degrees. Calculation: **Pha = |φA + φB| / 2**

Display	Description
TV A	On-to-off ratio of signal A The signals are triggered at zero crossover. A signal period consists of the high time plus the low time of the square-wave signal and is subdivided into 360°. **Optimum condition**: High time and low time of a signal period are equally long.  High time = Low time = 180° On-off ratio error = 0° The Adjusting and Testing Software displays the on-off ratio error—i.e. the deviation from the optimum condition—in degrees. In the documentation, the ratio of high time to low time may also be specified as symmetry deviation (SYM) in radians. Calculation: **SYM = |P - N| / 2 · M** **TV = 2 · 180 / π · sin (2 · SYM)**
TV B	On-to-off ratio of signal B Description see "TV A"

The measurement results for Pha, TV A and TV B are particularly significant with non-clocked interpolators. In the case of clocked interpolators, the interpolator considerably influences the measurement results.

Reference signal section

Depiction	Description
LR	Position of the reference pulse **Formula: (K – L) / 2**
BR	Width of the reference pulse **Formula: K + L**

The measurement results for LR and BR are particularly significant with non-clocked interpolators. In the case of clocked interpolators, the interpolator considerably influences the measurement results.

Minimum edge separation section

Depiction	Description
FA	Minimum edge separation of the overall measurement Unit: microseconds

> The edge separation depends on the frequency of the output signal: The higher the frequency of the output signal, the shorter the edge separation.

Operating elements

Icon	Function
	**Start recording** Starts recording with the specified number of periods
	**Hold the reference pulse** Freezes the diagram view when reference marks are traversed
	**Reset the edge separation** Resets the **FA** counter and restarts determination of the edge separation
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Notes** Indicates that there is new information on the current measurement

Number of periods

The value in the **Number of periods** field determines how many signal periods are displayed in the diagram.

Default setting: 10

> When you exit the **Incremental signal** function, the value in the **Number of periods** field is reset to default.

10.2.6 Performing Logic analysis (Logic view)

> A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.
>
> **Further information:** "Displaying and deleting notes (Note view)", Page 167

- Double-click **Incremental signal** in the function menu
- Click the **Logic** tab to switch to the **Logic** view

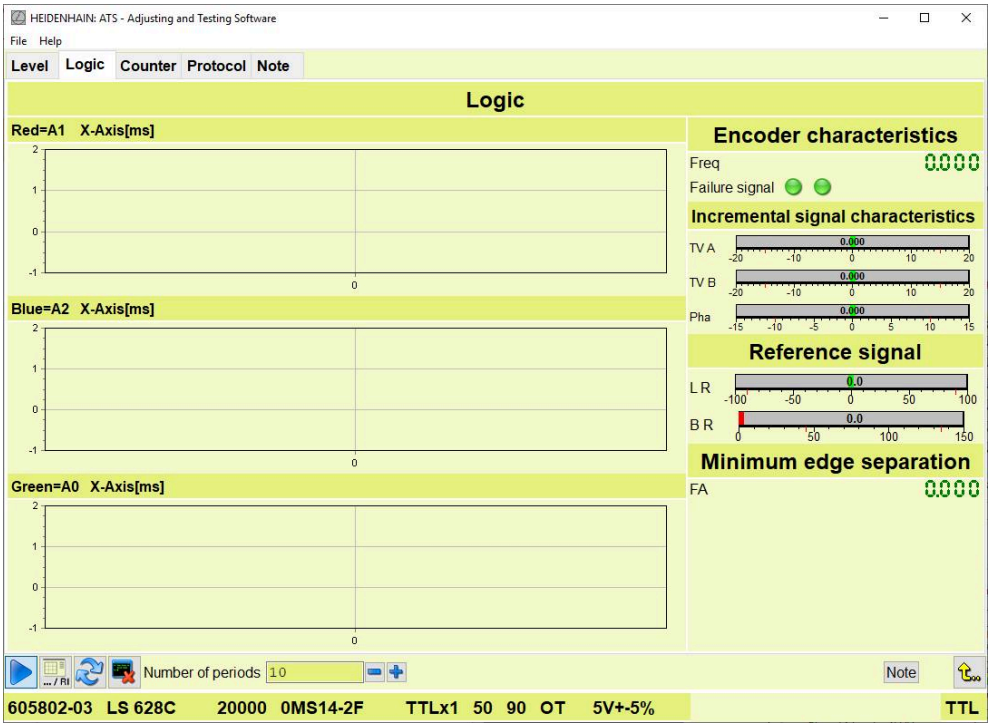


Figure 66: **Logic** view of the **Incremental signal** function

- Enter the desired value in the **Number of periods** field
- Traverse the entire measuring range
- > The diagrams and the bar displays show the measured values and tolerances
- > The **FA** counter displays the minimum edge separation

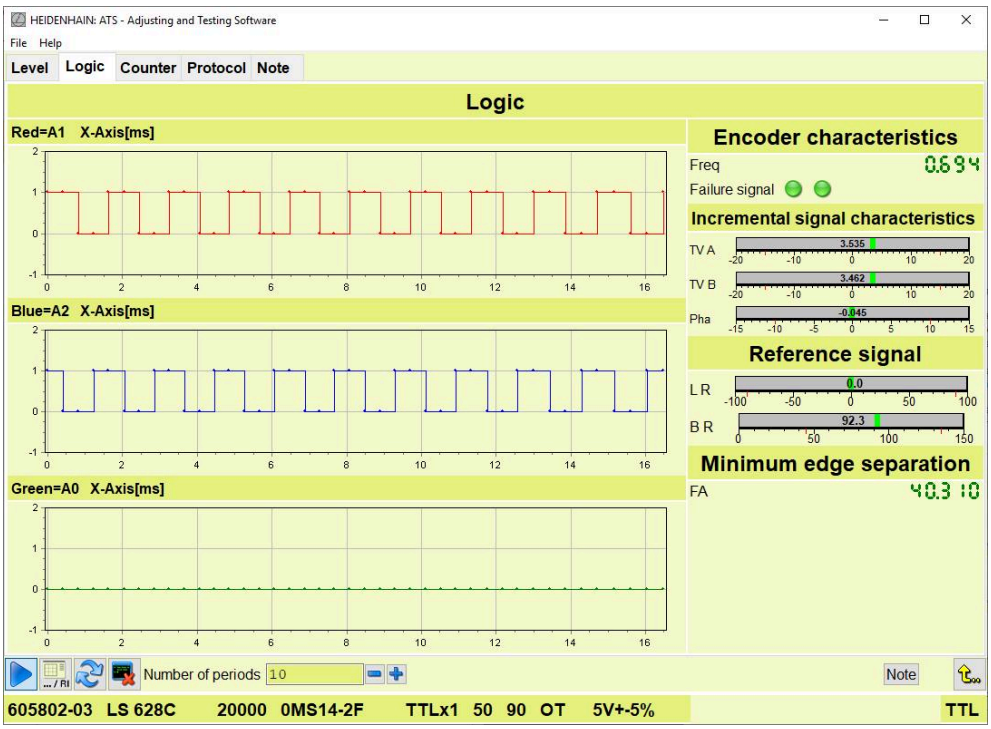


Figure 67: **Logic** view with measured values

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

To examine a section more closely, you can zoom in on the diagram view.

Further information: "Magnifying the diagram view", Page 42

Checking the reference signal

You can record the reference pulses in the diagram view to check the position of the reference marks. The diagram view is then refreshed each time a reference mark is traversed.

- ▶ Click **Hold the reference pulse** in the control bar
- ▶ Traverse the reference mark
- > The diagram shows the reference pulse
- > The diagram view will be refreshed when the next reference mark is traversed

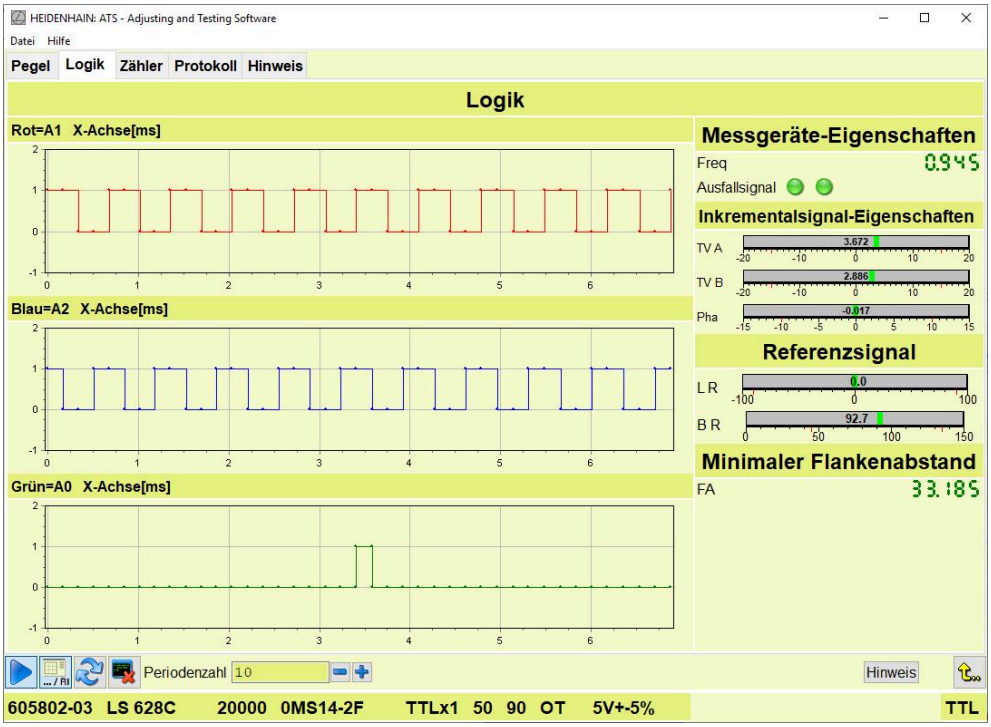


Figure 68: **Logic** view with measured values

Stopping the measurement

You can stop the measurement to analyze a specific point or take a screenshot.

- ▶ Click **Stop measurement** in the control bar
- > The diagram and the displays hold the last measured values
- ▶ Click the operating element again to continue the measurement

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Resetting the Minimum edge separation counter

To repeat the measurement, you can reset the value of the Minimum edge separation counter.

- ▶ Click **Reset edge separation** in the control bar
- > The **FA** counter displays the value "0"

10.2.7 Counter view

In the **Counter** view, you can check the counting function and the reference function of incremental encoders. The **Counter** view shows the distances between the reference marks as the encoder moves.

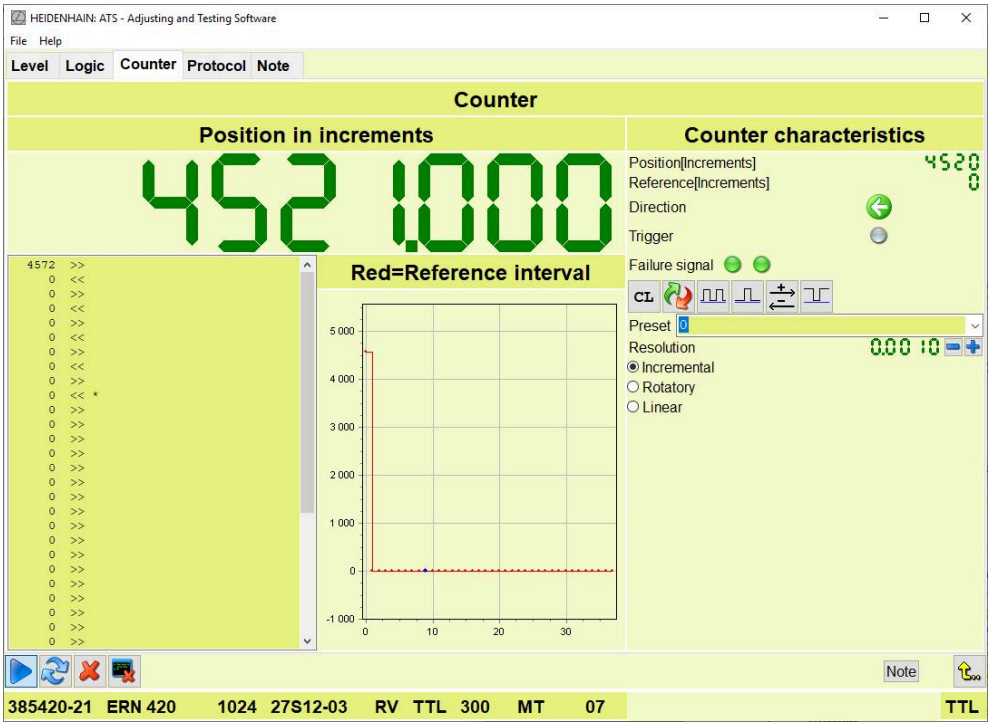


Figure 69: **Counter** view of the **Incremental signal** function

Table

When a reference mark is passed over, the distance to the preceding reference mark is determined and an entry added to the table. The table contains the following information:

- The asterisk marks the count value at the current position
- The arrows show the direction of traverse
- With distance-coded reference marks, the nominal increment is shown in addition to the count values

Bar graph

Depiction	Description
X axis	Number of captured reference marks
Y axis	Number of signal periods
Red	Reference mark spacing
Blue	Current position

Counter section

Display	Description
Position in [unit]	Current count of the incremental counter Unit: Depends on the settings in the **Counter characteristics** section

Counter characteristics section

Display	Description
Position [increments]	Current count Unit: increments
Reference [increments]	Distance between the two reference marks traversed last Unit: increments
Direction	The arrow shows the traverse direction ■ Arrow to the right: positive count value recorded ■ Arrow to the left: negative count value recorded
Trigger	Status display of reference mark detection ■ Gray: no reference mark was detected ■ Green: a reference mark was detected When a reference mark was detected, the status display changes back to gray color after 5 seconds. If several reference marks follow each other, the status display may be permanently green.
Failure signal	Status display of signal monitoring ■ Green: High level of UaS fault-detection signal ■ Red: Low level of UaS fault-detection signal The left status display shows the current status. When the fault-detection signal is at low level, the status display turns red for about 5 seconds. The right status display shows the overall status of the measurement. When the fault-detection signal is at low level, the status display is permanently red.

Settings in the Counter characteristics section

In the **Counter characteristics** section you can adjust the settings for the counter value display **Position in [unit]**. The position value is calculated according to these settings.

Display	Description
Preset	Input field for presetting a count value
Resolution	Counter resolution
■ Incremental ■ Rotatory ■ Linear	Type of incremental counter The count value is converted into the corresponding unit as per the selection: ■ Incremental: Measuring steps ■ Rotatory: Selected unit (see below); Standard setting: Degrees ■ Linear: Micrometers Depending on the selection, the following settings are displayed.
Line count	Input field for the encoder line count per revolution to calculate the count value
■ Degrees ■ Radian measure ■ DMS	Unit of the incremental counter The value of the incremental counter is converted into the selected unit. ■ Degrees ■ Radian measure ■ DMS: Degrees, minutes, seconds
Signal period	Input field for the length of a signal period to calculate the count value

Operating elements

Icon	Function
	**Stop the measurement** Interrupts the measurement and shows the last measured values in the diagram and the displays
	**Reset status displays** Resets the **Failure signal** status displays to green
	**Delete measured values** Deletes the measured values recorded from the table and graphics
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Notes** Indicates that there is new information on the current measurement

10.2.8 Checking the counting function (Counter view)

A warning symbol appears in the control bar when there are notes. Delete existing notes before you start the examination.

Further information: "Displaying and deleting notes (Note view)", Page 167

- Double-click **Incremental signal** in the function menu
- Click the **Counter** tab to switch to the **Counter** view

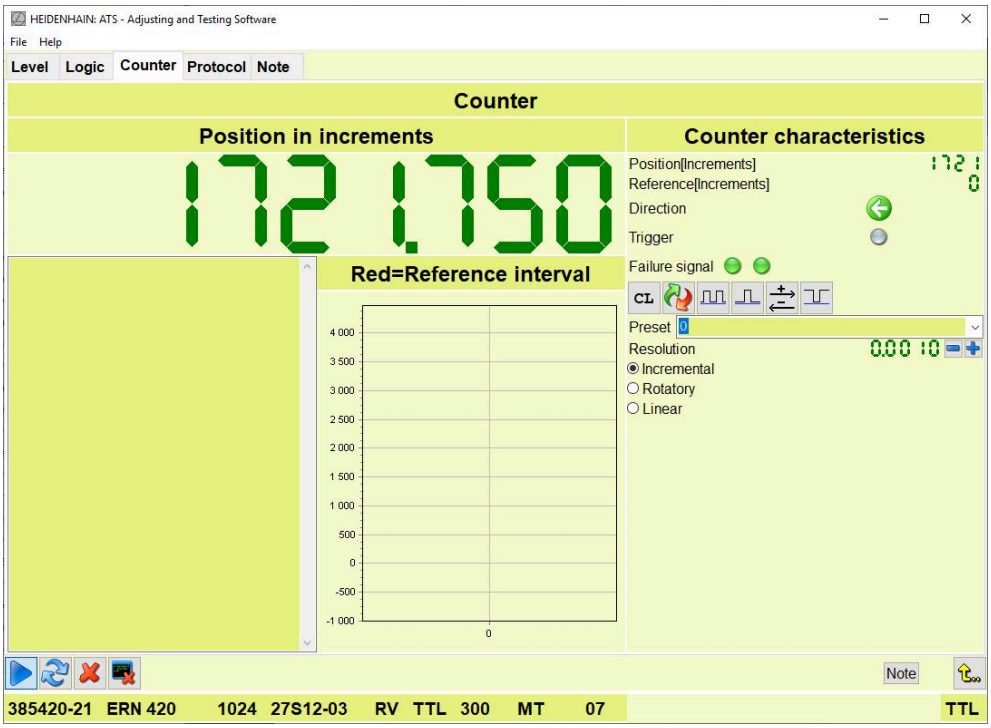


Figure 70: **Counter** view of the **Incremental signal** function

The further procedure depends on the type of reference marks the encoder features.

Procedure with one reference mark

- Traverse the reference mark
- Traverse the reference mark in the opposite direction
- Repeat the procedure several times
- > A measured value is added to the table and the diagram each time the reference mark is traversed

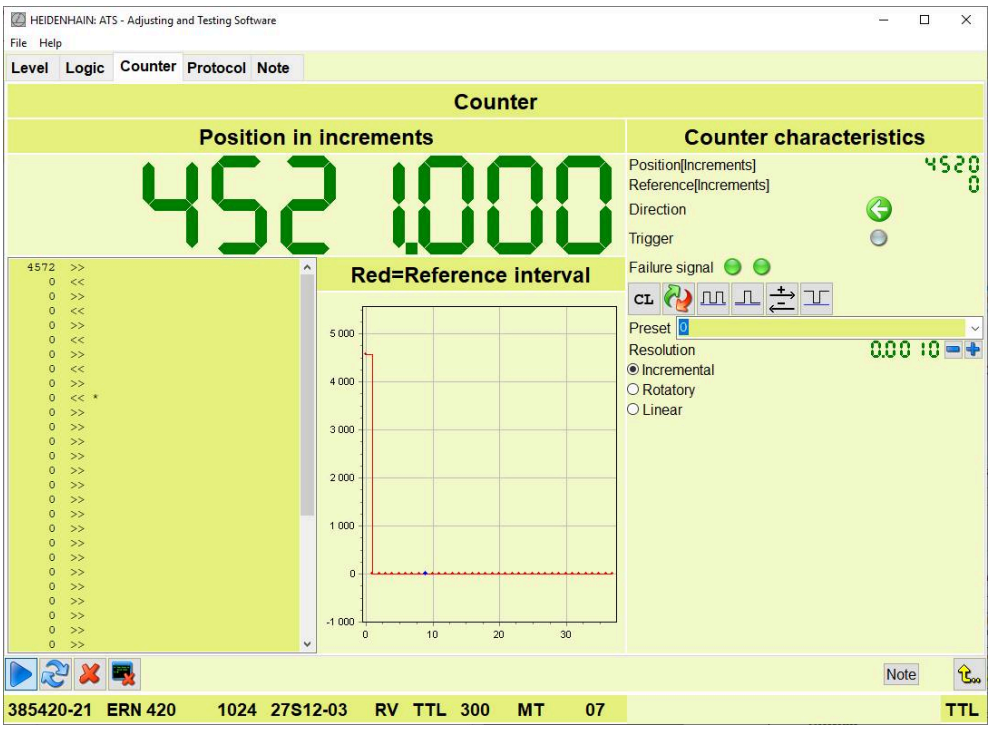


Figure 71: **Counter** view when examining an encoder with one reference mark

Counter and reference functions are error-free if the distance is "0" each time the reference mark is traversed.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Procedure with multiple reference marks without distance coding

- ▶ Traverse several reference marks
- > A measured value is added to the table and the diagram each time a reference mark is traversed
- ▶ Traverse the reference marks in the opposite direction
- > When the direction is reversed, the value "0" is added to the table and the diagram

Counter and reference functions are error-free if the spacing between all reference marks is the same.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Procedure with distance-coded reference marks

When you examine encoders with distance-coded reference marks, the Adjusting and Testing Software first determines the nominal increment.

- Traverse several reference marks to determine the nominal increment
- If the traverse path of the encoder is short, you may need to traverse it in both directions repeatedly

> After the Adjusting and Testing Software has determined the nominal increment, the table also includes the nominal increment and the position

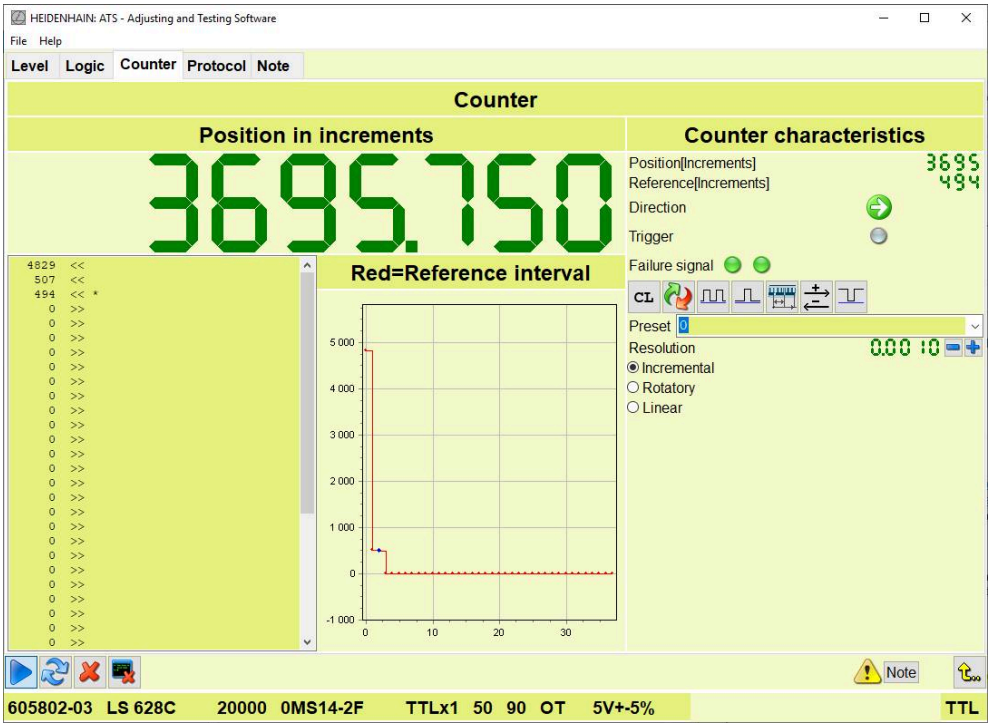


Figure 72: Display during determination of nominal increment

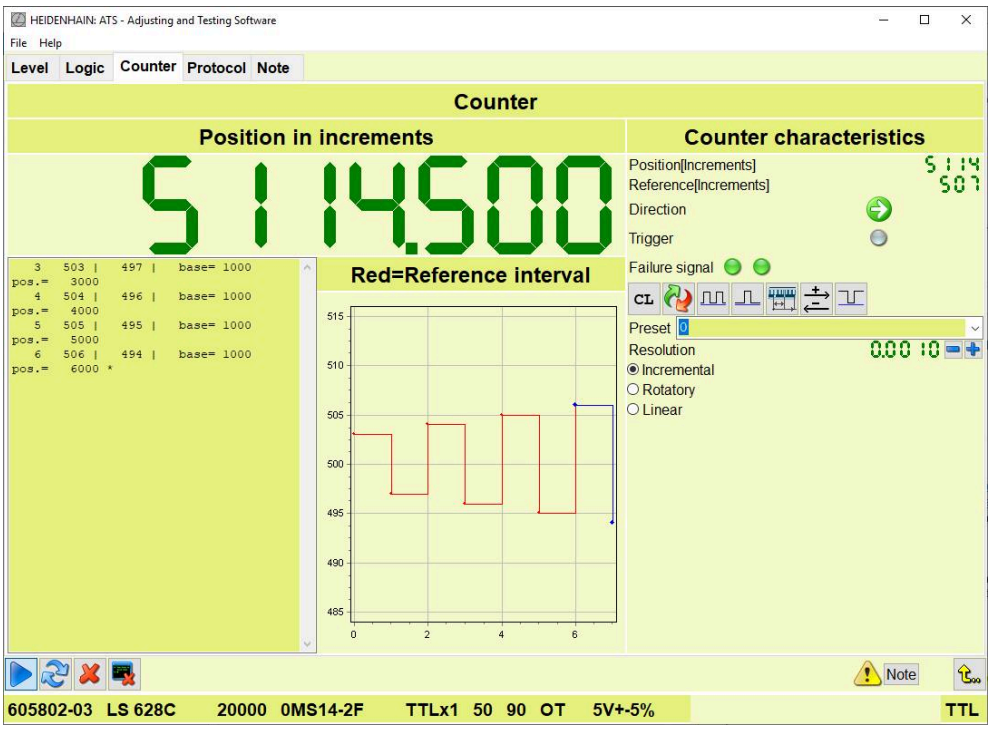


Figure 73: Display after the nominal increment has been determined

Column	Description
1	Reference mark spacing 1
2	Reference mark spacing 2
3	base: Nominal increment
4	pos.: Position determined from distance coding

- ▶ Traverse the entire measuring range
- > A measured value is added to the table and the diagram each time a reference mark is traversed
- ▶ Traverse the reference marks in the opposite direction
- > When the direction is reversed, the value "0" is added to the table and the diagram

Counter and reference functions are error-free if the determined distances are the same as the actual distance coding of the encoder. The sum of the values in the columns 1 and 2 must correspond to the nominal increment (value in column 3).

Deviations indicate a malfunction or improper mounting of the encoder.

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

Adjusting the counter display

The counter display can be adjusted in the **Counter characteristics** section.

- ▶ Set the desired counter resolution with the plus and minus buttons
- ▶ Select desired display options:
  - **Incremental**: Count value is displayed in increments
  - **Rotatory**: Count value is displayed in the selected angle unit
    - **Degrees**
    - **Radian measure**
    - **DMS** (degrees, arc minutes, arc seconds)
  - **Linear**: Count value is displayed in micrometers
- ▶ If you select **Rotatory**, enter the line count per encoder revolution in the **Line count** field
- ▶ If you select **Linear**, enter the length of a signal period in micrometers in the **Signal period** field
- > The count value is converted and displayed according to the setting

Presetting the count value

To compare the counter e.g. with the counter of the subsequent electronics, you can preset a certain count value at the current position.

- ▶ Enter the desired position value in the **Preset** field
- ▶ Click **Preset count value** in the control bar
- > The entered count value is adopted as the new position

Clearing the counter

- ▶ Click **Clear counter** in the control bar
- > The counter is set to zero

Clearing the counter with every reference mark

- ▶ To start counting at every reference mark, click **Clear counter with every reference mark** in the control bar
- > The counter is set to zero each time a reference mark is traversed

Clearing the counter and starting with next reference mark

- ▶ Click **Clear counter and start with next reference mark** in the control bar
- > The counter is set to zero and will start counting when the next reference mark is traversed

Inverting the counting direction

The counting direction of some encoders can be configured. You can adapt the counting direction to the encoder in the Adjusting and Testing Software.

- ▶ Click **Invert counting direction** in the control bar to adapt the counting direction
- > The Adjusting and Testing Software inverts the positive or negative counting direction

Clearing the counter and determining the position again

For encoders with distance-coded reference marks, you can set the position and the counter to zero and then determine the position again.

- ▶ Click **Clear counter and determine position again** in the control bar
- > The counter is set to zero
- ▶ Traverse several reference marks
- > The position is determined again

Evaluating the inverted reference pulse

The reference signal of some encoders is inverted. In order that inverted reference pulses can be detected and correctly evaluated, you need to adapt the evaluation logic of the Adjusting and Testing Software.

- ▶ Click **Evaluate inverted reference pulse** in the control bar
- > The Adjusting and Testing Software inverts the evaluation logic

Deleting measured values

For a new examination you can delete the recorded measured values from the table and from the diagram.

- ▶ Click **Delete measured values** in the control bar
- > The table and the diagram are reset

10.2.9 Homing – Limit view

The **Homing – Limit** view provides a functional check of limit switching signals.

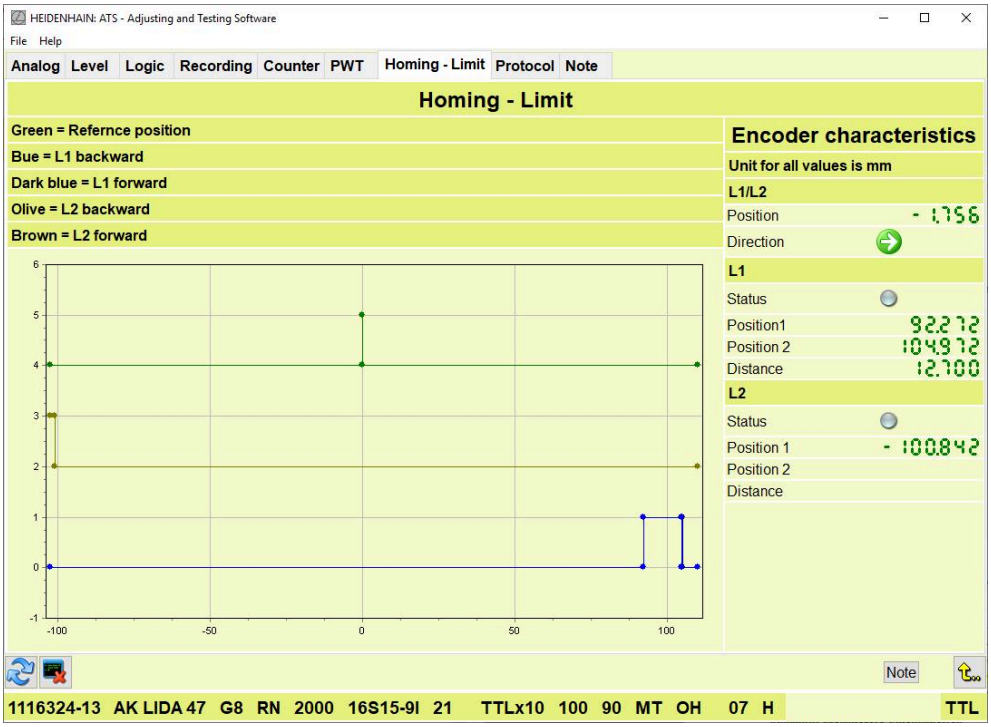


Figure 74: **Homing – Limit** view of the **Incremental signal** function

Bar graph

In the diagram, the signals with their respective traverse directions are color-coded.

Depiction	Description
Green	Reference signal
Blue	Homing backward
Dark blue	Homing forward
Olive green	Limit backward
Brown	Limit forward

Encoder characteristics section

All values in mm

Depiction	Description
Position	Count value of incremental counter Unit: millimeters
Direction	The arrow symbol shows the traverse direction ■ Arrow to the right: positive count value recorded ■ Arrow to the left: negative count value recorded

Homing/L1/Pin 6 (depending on encoder)

Depiction	Description
Status	Status display of the homing level ■ Gray: low level ■ Green: high level
Position	Distance between homing edge and reference mark R Unit: millimeters

Limit/L2/Pin 8 (depending on encoder)

Depiction	Description
Status	Status display of the limit level ■ Gray: low level ■ Green: high level
Position 1	Distance between limit edge 1 and reference mark R Unit: millimeters
Position 2	Distance between limit edge 2 and reference mark R Unit: millimeters
Distance	Distance between limit edge 1 and limit edge 2 Distance = |Limit edge 1 + Limit edge 2|

Operating elements

Icon	Function
	**Delete measured values** Deletes the measured values for a new measurement
	**Transfer data to Protocol view** Transfers the displayed data to the **Protocol** screen
	**Notes** Indicates that there is new information on the current measurement

10.2.10 Checking Limit switching signals (Homing – Limit view)

Prerequisites:

- The encoder features limit switching signals
- The encoder is correctly mounted and electrically adjusted according to the mounting instructions
- The encoder was connected to the Adjusting and Testing Software by entering the encoder ID

For detailed information on the availability and function of switching signals, refer to the encoder documentation or the brochure "Interfaces of HEIDENHAIN Encoders".

Further information: "Opening documentation", Page 42

- ▶ Double-click **Incremental signal** in the function menu
- ▶ Click the **Homing – Limit** tab to switch to the **Homing – Limit** view

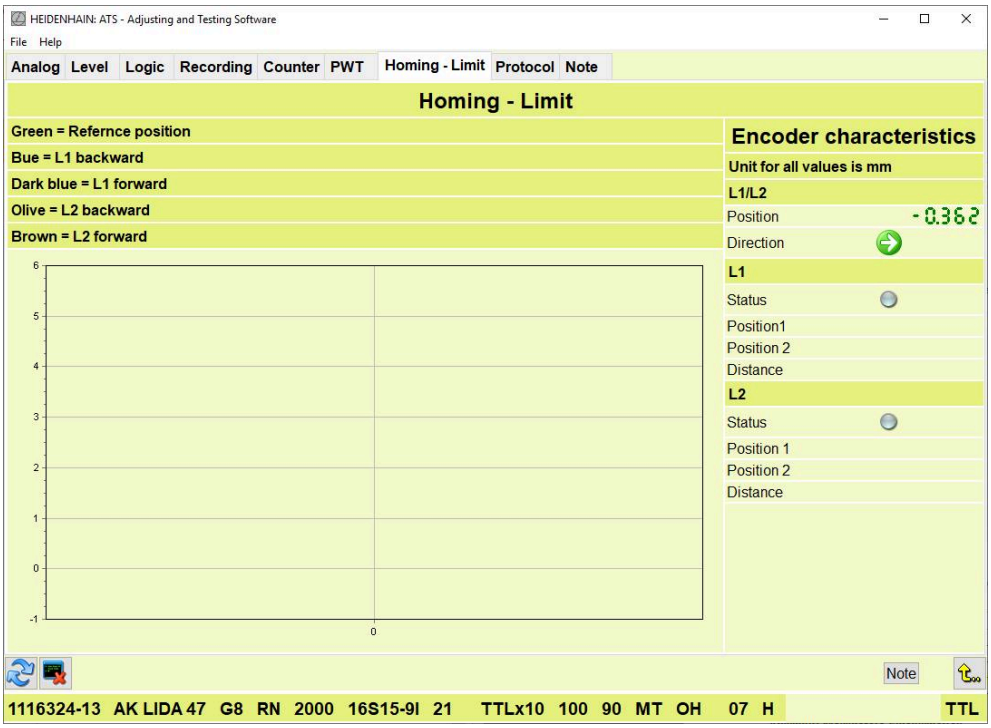


Figure 75: **Homing – Limit** view of the **Incremental signal** function

- ▶ Traverse the entire measuring range
- > Recording of the measured values in the diagram starts as soon as the first reference mark is traversed
- > When the last reference mark is traversed, the entire measuring range is displayed in the diagram with homing and limit switching edges (depending on the encoder)

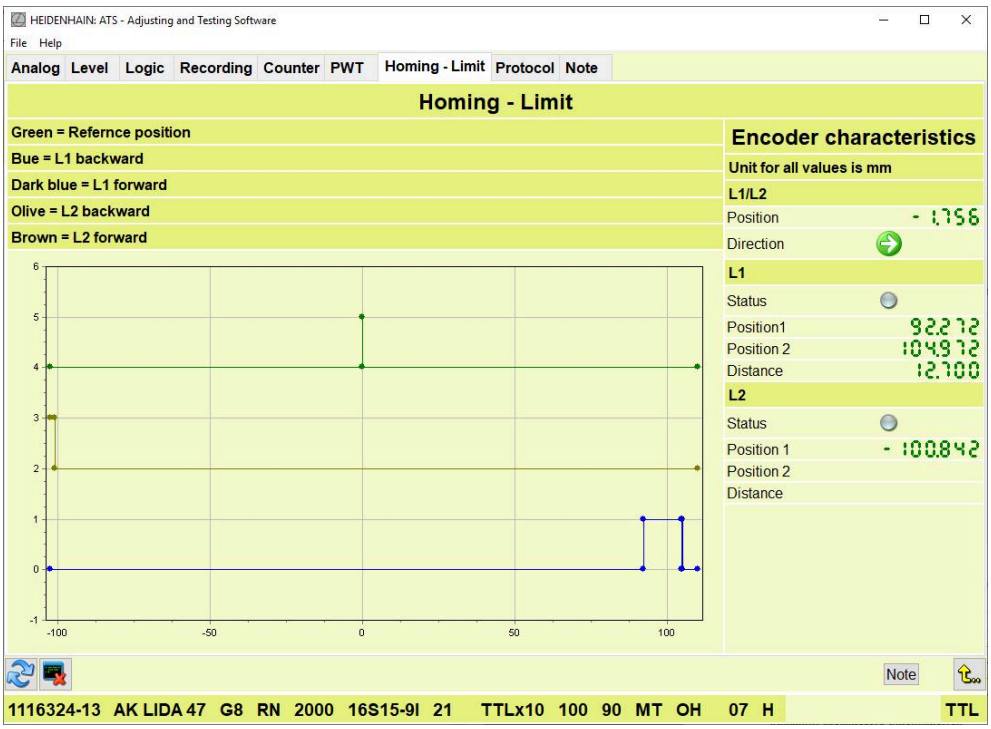


Figure 76: **Homing – Limit** with reference mark and switching edges

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

You can transfer the displayed data to the **Protocol** screen and save them later on as a log file (PDF format).

Further information: "Transferring data to the Protocol view", Page 94

- To reset the diagram for a new measurement, click **Delete measured values** in the control bar

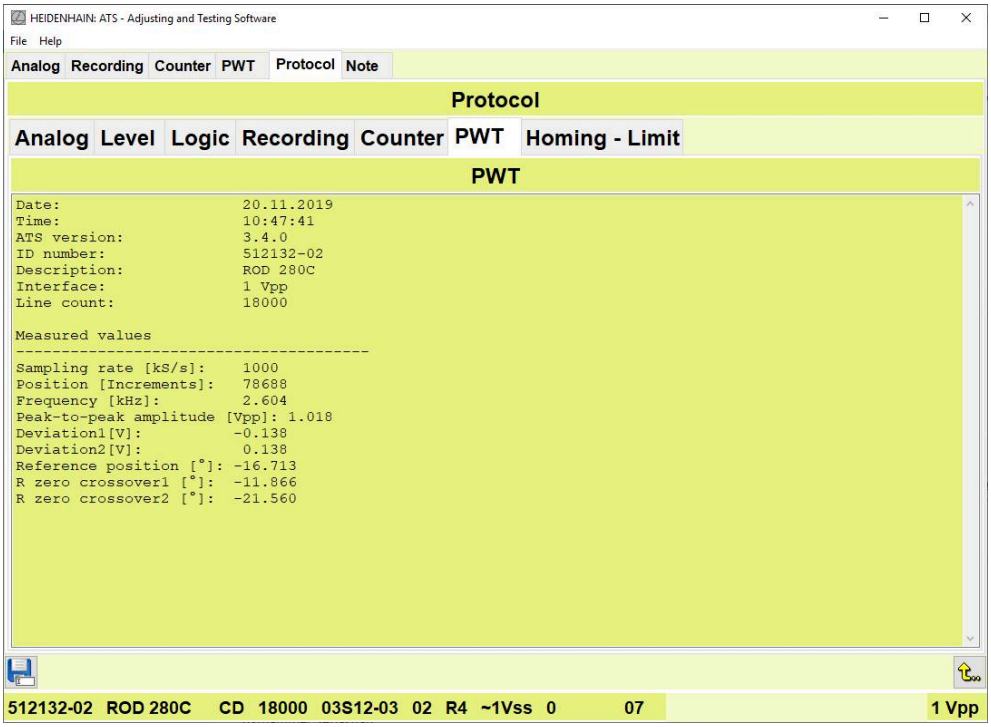
10.2.11 Protocol view

You can transfer data from the views of the **Incremental signal** function to the **Protocol** view.

Further information: "Transferring data to the Protocol view", Page 94

The data recorded in the **Protocol** view can be saved to a PDF file. The **Protocol** view shows the data in various tabs, according to the view in which the data was captured.

> The data are temporarily retained in the **Protocol** view until you exit the **Incremental signal** function.



Operating elements

Icon	Function
	**Save log** Opens the **Protocol** dialog

10.2.12 Saving log data (Protocol view)

You can save the test results in a PDF file.

- ▶ Click the **Protocol** tab to switch to the **Protocol** view
- ▶ Click **Save log**
- > The **Protocol** dialog shows the available contents
- ▶ Select the data to be logged
- ▶ Click **Preview** to open a preview of the PDF file
- ▶ If necessary, close the preview
- ▶ Click **Save** in the dialog to save the file
- ▶ Select the desired storage location
- ▶ Enter the file name
- ▶ Click **Save**
- > The file is saved
- ▶ Click **Close** to close the dialog

In the Adjusting and Testing Software, you can add an individual header and details on the examiner to the logs.

Further information: "Saving log information", Page 50

To display the PDF contents correctly, the font "Arial Unicode MS" must be installed on the computer.

10.2.13 Note view

The **Note** screen contains information on the current measurement.

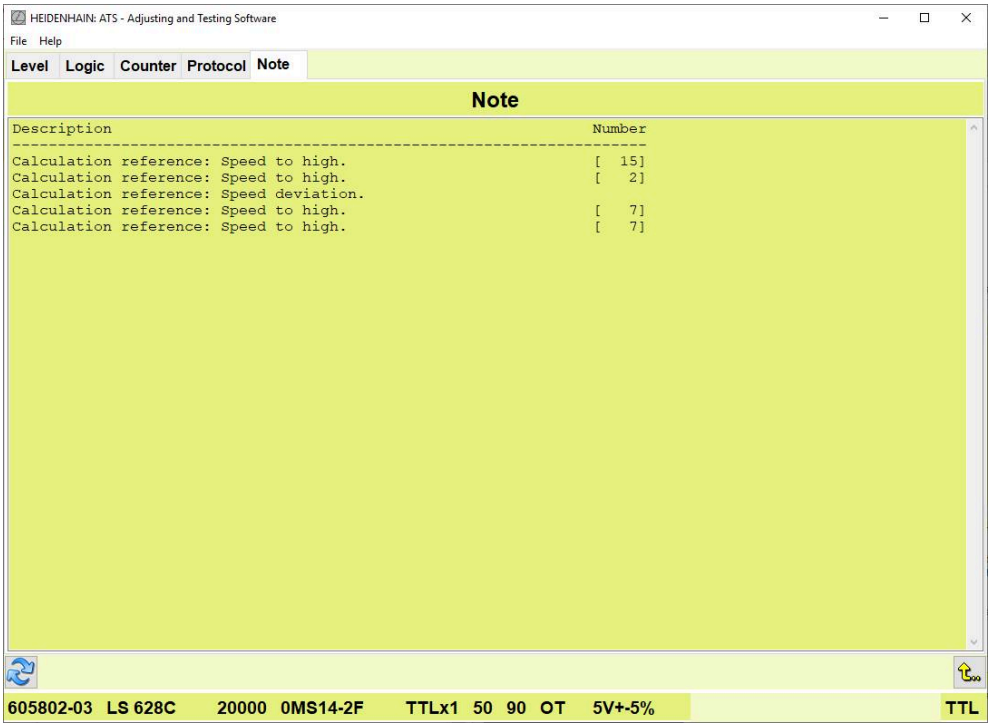


Figure 77: **Note** view of the **Incremental signal** function

The notes refer to problems with signal calculation, e.g.:

- Signal frequencies are too high, e.g. due to excessive traversing speed or shaft speed
- Signal frequency fluctuates
- Displayed signal detail is too small to calculate the reference mark correctly

Operating elements

Icon	Function
	**Deleting notes** Deletes the notes for a new measurement

10.2.14 Displaying and deleting notes (Note view)

A warning symbol appears in the control bar when there is a new note. Go to the **Note** view to read the note.

- ▶ Click **Note** in the control bar
- > The **Note** view shows a list of all notes

Notes are maintained until you exit the **Incremental signal** function or delete the notes by hand.

Deleting notes

- ▶ Click **Delete notes** in the control bar to delete all notes

10.3 Checking voltage supply

10.3.1 Voltage display function

The **Voltage display** function shows the measured values and status of the voltage supply. The display depends on the operating mode of the testing device.

Operating mode of the testing device	Displayed voltage values
Encoder diagnostics	Encoder powered by the PWM
Monitoring operation with signal adapter	Signal adapter powered by the PWM
Monitoring operation without signal adapter	Encoder powered by the subsequent electronics

- Double-click **Voltage display** in the function menu

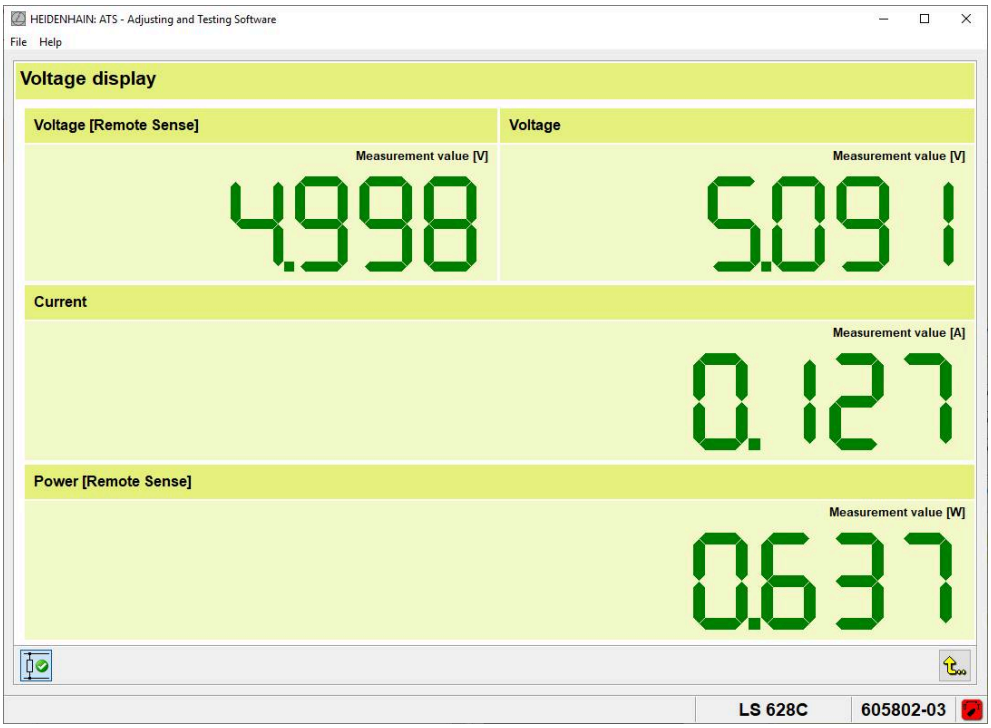


Figure 78: **Voltage display** function

Display	Description
Voltage [Remote Sense]	Operating voltage at the encoder Voltage drops on the encoder supply lines are taken into account. **[Remote Sense]**: Indicates that voltage readjustment is active
Voltage	Voltage output by the PWM or the subsequent electronics
Current	Current consumption of the encoder or the signal adapter If the encoder does not consume any current, the measured value is displayed in red.
Power [Remote Sense]	Power consumption of the encoder **[Remote Sense]**: Indicates that voltage readjustment is active

Operating elements

Icon	Function
	**Deactivate terminating resistor** Switches the terminating resistor off
	**Activate terminating resistor** Switches the terminating resistor on

10.3.2 Deactivating the terminating resistor

In the Encoder Diagnostics mode, the terminating resistor is activated by default. You can deactivate the terminating resistor to check whether the current consumption of the encoder corresponds to the technical specifications, e.g. the typical current consumption.

- ▶ Click **Deactivate terminating resistor** in the control bar

- > The operating element indicates that the terminating resistor is inactive

- ▶ Click **Activate terminating resistor** to reactivate the terminating resistor

- > The operating element indicates that the terminating resistor is active

When you exit the function view, the terminating resistor is automatically reactivated.

In the monitoring mode, the terminating resistor is inactive and cannot be switched on.

11

Inspecting encoders with serial interface

11.1 Overview

> In this chapter, the procedure and user interface are described using the EnDat interface as an example. For a description of the deviations and special functions of other serial interfaces, refer to the chapter "Special interface-specific functions".

The Adjusting and Testing Software features the following functions for inspecting encoders with serial interface (e.g. EnDat):

Icon	Function	Description
	Position display	Current encoder position and status information
	Incremental signal display	Tolerance check of the incremental signals
	Voltage display	Measured values of voltage and current supply
	Absolute to incremental deviation	Check agreement of absolute track and incremental track
	Online diagnostics	Determine the function reserves of the encoder based on valuation numbers
	Functional-safety encoder check	Check safety-relevant encoder functions
	Display encoder memory	Load the encoder configuration from the encoder, edit the configuration and transmit it to the encoder; save the encoder configuration to a file
	Compare contents of encoder memories	Compare encoder configurations to each other

> The displays and the scope of functions of the Adjusting and Testing Software depend on the connected encoder and on the software configuration. When you establish the connection to the encoder, the function menu shows the available functions and operating elements.

11.2 Checking position values, transmission and encoder status

11.2.1 Position display function

For linear and rotary encoders, the position display shows the current encoder position.

For touch probes, the position display shows information on the trigger information and the status of the touch probe.

Depending on the encoder model, information on encoder alarms and warnings and on the quality of the incremental signals are available in addition.

- To call this function, double-click **Position display** in the function menu

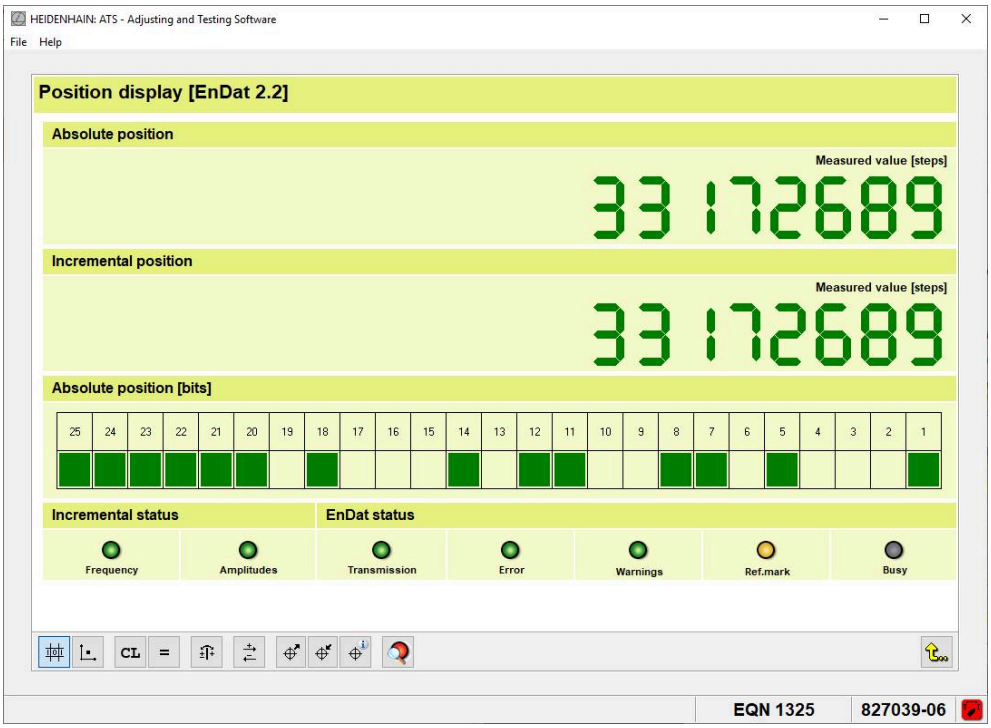


Figure 79: **Position display** function

Display	Description
Absolute position	For linear and rotary encoders: Absolute encoder position Unit: increments
Incremental position	For linear and rotary encoders: Count value of incremental counter Unit: increments

Display	Description
Absolute position [bits]	For linear and rotary encoders: Binary display of the absolute encoder position The number of bits depends on the encoder. Bit 1 = LSB (Least Significant Bit) For touch probes: The binary display provides information on the following signals: ■ Bit 1: Trigger state ■ Bit 2: Trigger state valid ■ Bit 3: Sensor is ready ■ Bit 4: Touch probe is ready ■ Bit 5: Battery warning ■ Bit 6: Collision Correct behavior of the touch probe: If there is no probing event and if the battery voltage is within the tolerance range, then the bits 2, 3 and 4 are set.
Frequency	Status display of signal frequency ■ Green: Signal frequency is within tolerance ■ Red: Signal frequency is outside the tolerance range
Amplitudes	Status display of signal amplitudes ■ Green: The signal amplitudes are within the tolerance range ■ Red: The signal amplitudes exceed at least one tolerance limit
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Fault	Status display of encoder errors ■ Green: No status message available ■ Red: Status message available
Warnings	Status display of encoder warnings ■ Green: No status message available ■ Red: Status message available
Ref.mark	Status display of reference mark detection ■ Gray: No reference mark was detected ■ Yellow: Reference mark detected or absolute encoder
Busy	Status display of memory access ■ Gray: No access to encoder memory detected ■ Yellow: Access to encoder memory detected **i** At this point, access to the encoder memory suggests an encoder error.

Operating elements

Icon	Function
	**Show measured values** Displays the measured value in increments
	**Show position values** Converts the measured value into a position value Unit: micrometers or degrees (depending on the encoder)
	**Clear counter** Sets the incremental position to zero
	**Equate counter** Sets the incremental position to the absolute position value
	**Synchronize counter** Synchronizes the counters at zero position
	**Invert counting direction** Inverts the positive or negative counting direction
	**Set datum shift** Opens the dialog for setting the datum shift
	**Show datum shift** Displays information on existing datum shift
	**Show status information** Displays a list of errors and warnings

11.2.2 Classification of the status messages

Status report	Description
Warnings	Warnings indicate that certain tolerance limits of the encoder have been reached or exceeded. Examples of encoder warnings that may be displayed by encoders with EnDat interface: ■ Bit 0 – Frequency exceeded ■ Bit 1 – Temperature exceeded ■ Bit 2 – Light source control reserve Encoder warnings do not indicate whether the transmitted position values are correct.
Errors	Errors indicate a malfunction of the encoder. Examples of encoder errors that may be displayed by encoders with EnDat interface: ■ Bit 0 – Light source failure ■ Bit 1 – Signal amplitude faulty ■ Bit 2 – Position faulty ■ Bit 3 – Overvoltage ■ Bit 4 - Undervoltage supply ■ Operating status error sources **i** If there are status messages on encoder errors, the transmitted position values are not reliable.
Transmission	Transmission errors indicate communication errors that may be caused by EMC influences, for example. Examples of transmission errors that may be displayed by encoders with EnDat interface: ■ Timeout ■ CRC error

i The **Encoder status** dialog shows the errors and warnings transmitted by the encoder and the status messages on transmission.
Further information: "Displaying status messages", Page 185

i To see which status messages the encoder supports, refer to the encoder configuration.
Further information: "Overview of supported error messages and warnings", Page 233

11.2.3 Switching between measured values view and position view

You can switch the counter display between measured values view and position view.

Measured values view

The **Measured values view** shows the count value in increments.

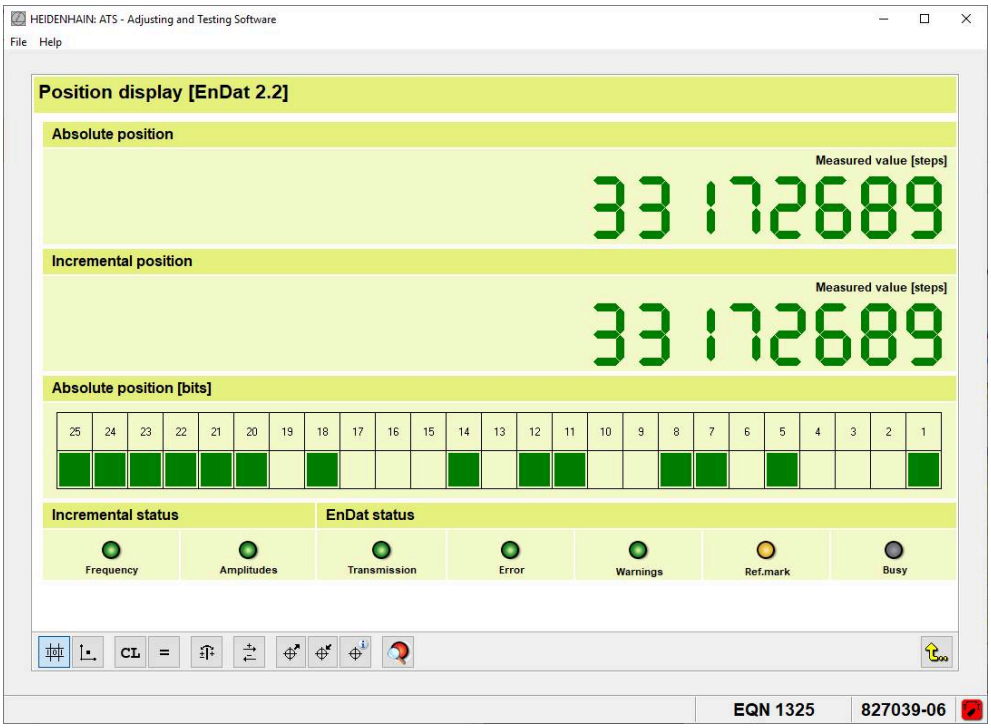


Figure 80: **Measured values view** of the **Position display** function

Position view

In the **Position view**, the Adjusting and Testing Software converts the count value into a position value. The position value is displayed in micrometers, degrees, or increments (depending on the encoder).

For multiturn rotary encoders, the Adjusting and Testing Software in addition displays the number of revolutions in the **Position display**.

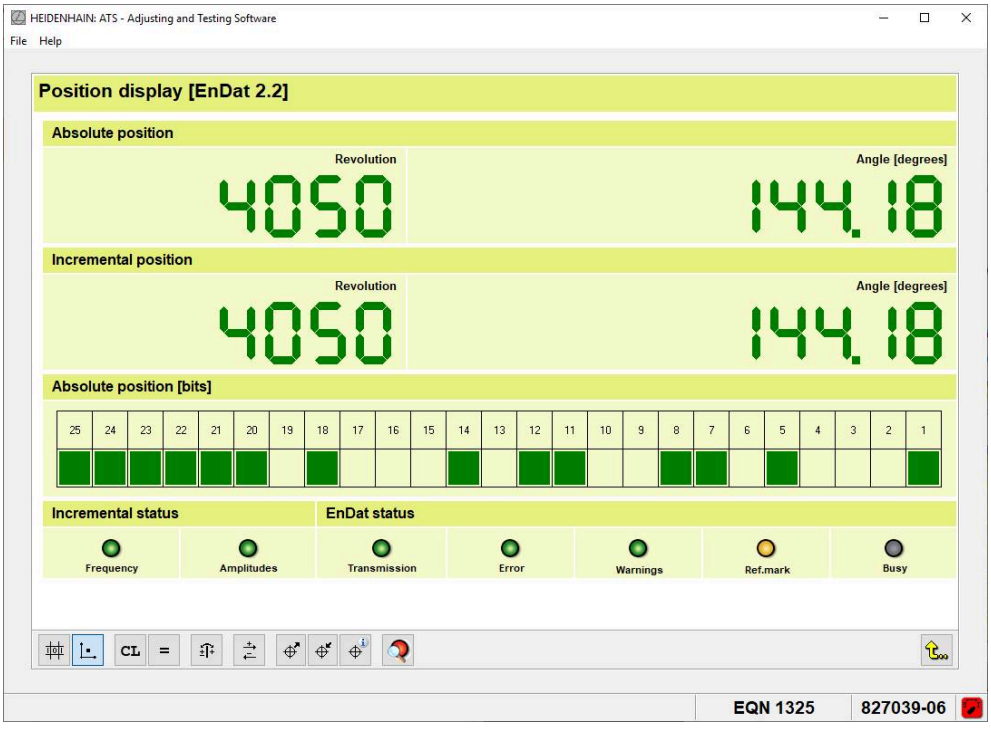


Figure 81: **Position view** of the **Position display** function

Switching between the views

- Click **Show measured values** in the control bar to switch to the measured values view

- Click **Show position values** in the control bar to switch to the position view

11.2.4 Clearing the incremental counter

- Click **Clear counter** in the control bar to delete the incremental counter

> The incremental counter is set to zero

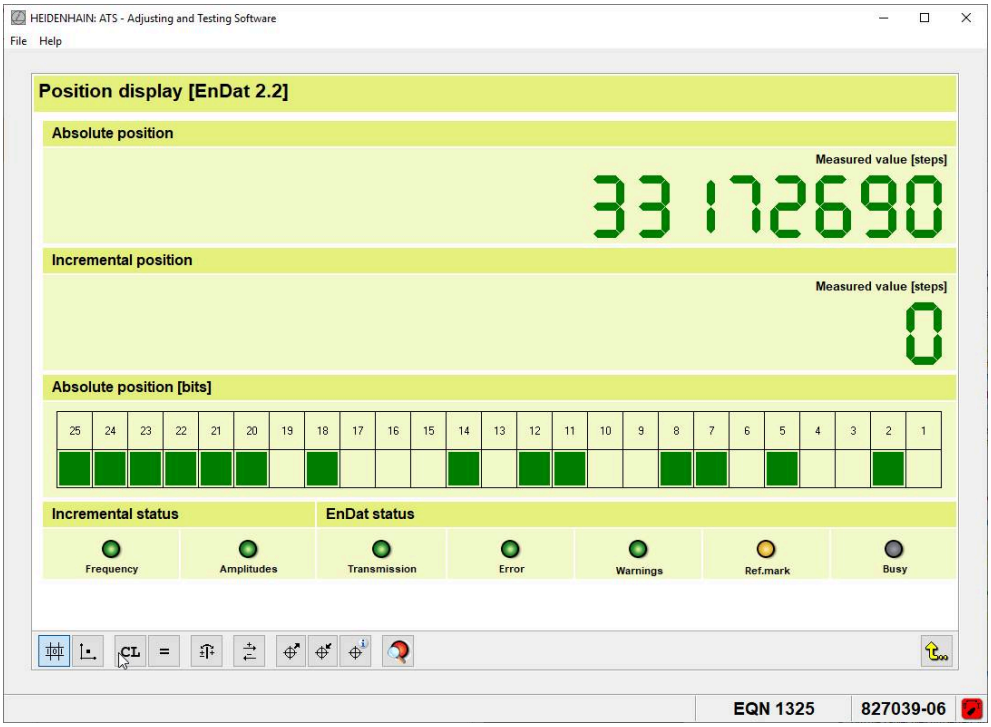


Figure 82: Position display after clearing the incremental counter

11.2.5 Equating the incremental counter with the absolute position

- ▶ Click **Equate counter** in the control bar to equate the count values
- > The incremental counter assumes the count value of the absolute position

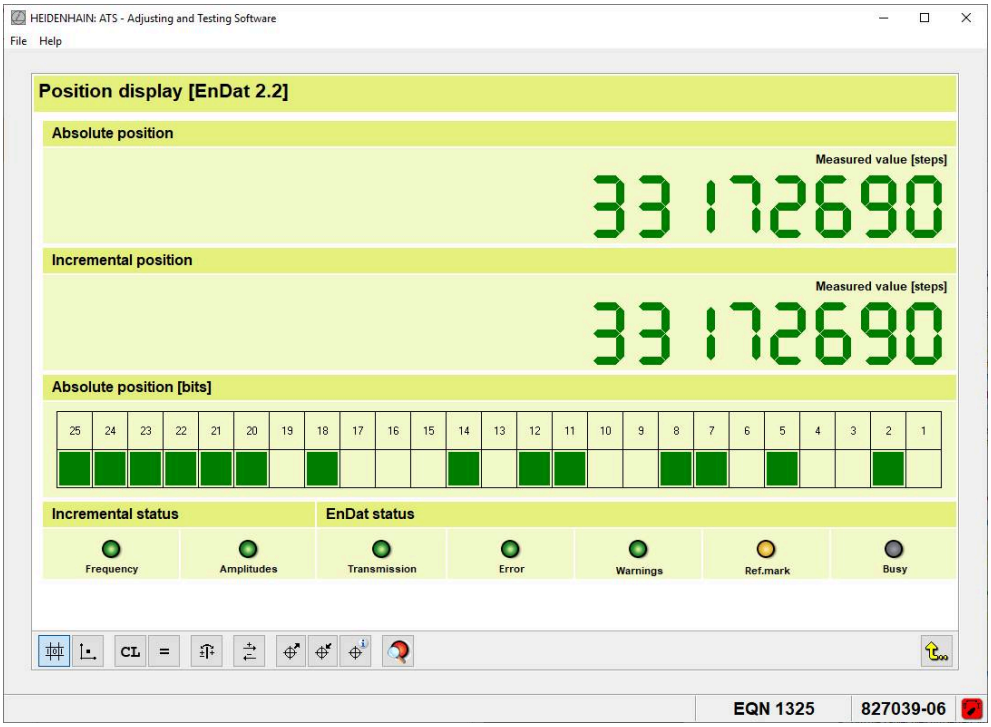


Figure 83: Position display with incremental and absolute positions set equal

11.2.6 Synchronizing the counters

When an encoder passes zero crossover in negative direction, the counters behave as follows:

- The **Absolute position** counter jumps to the highest position value, in the example 8191
- The **Incremental position** counter jumps to –1

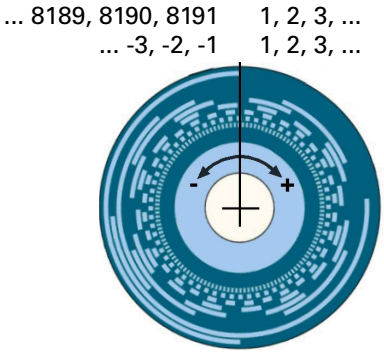


Figure 84: Counter limit of a 13-bit rotary encoder

When you activate the synchronization mode, both counters jump to the highest position value when the zero crossover is passed.

- ▶ Click **Synchronize counters** in the control bar to switch the counting logic of the incremental counter

11.2.7 Inverting the counting direction of the incremental counter

On some encoders, the counting direction of the incremental counter can be configured. You can adapt the counting direction to the encoder in the Adjusting and Testing Software.

- ▶ Click **Invert counting direction** in the control bar to adapt the counting direction
- > The Adjusting and Testing Software inverts the positive or negative counting direction

11.2.8 Setting datum shift

In the **Position display** function, you can shift the datum of the connected encoder. The datum shift enables you to adapt the encoder to the machine for each individual axis (e.g. for measuring the rotor position on synchronous motors).

Precondition: The encoder supports datum shift.

⚠WARNING

Danger of uncontrolled axis movements due to datum shift

If you select an incorrect value for datum shift, uncontrolled movements of the machine axes may occur. This may result in death, serious injuries, or damage to equipment.

- Observe the documentation of the machine tool and the encoder
- Change the datum shift only if absolutely necessary (e.g. if the encoder is exchanged)
- Shift the datum only while the encoder is at a standstill
- Leave the traverse range of the machine before setting a datum shift
- Cancel any datum shift before setting a new one
- Only execute datum shifts in the **Position display** function
- Do not manually change the "Zero point" value in the encoder configuration

⚠WARNING

Danger from falling machine axes

Non-secured vertical or hanging machine axes may fall down due to datum shift. This may result in death or serious injuries.

Before setting a datum shift:

- Secure the machine axes
- Leave the traverse range of the machine

Linear encoders with EnDat interface do not support negative position values. Instead of the negative sign, the following position value is output:

$2^{\text{Number of clock pulses for transfer of position value}}$

- For linear encoders with EnDat interface, select the datum such that only position values > 0 are output

A datum shift may require a new acceptance test, e.g. in the case of functionally safe applications.

First check whether a datum shift is active and reset it if necessary.

Further information: "Checking the datum shift", Page 184

Further information: "Resetting a datum shift", Page 185

The following options are available for setting a datum shift:

- **Set datum to current position**:
  Approach the desired position and adopt this position as zero point
- **Set datum to absolute position**:
  Enter the desired position value manually

> Which options are available for the datum shift depends on the connected encoder.

Setting the datum to current position

- ▶ Move to the desired position
- ▶ Click **Set datum shift** in the control bar
- > The Adjusting and Testing Software displays information on datum shift
- ▶ Click **Yes**
- > The **Datum shift** dialog is displayed

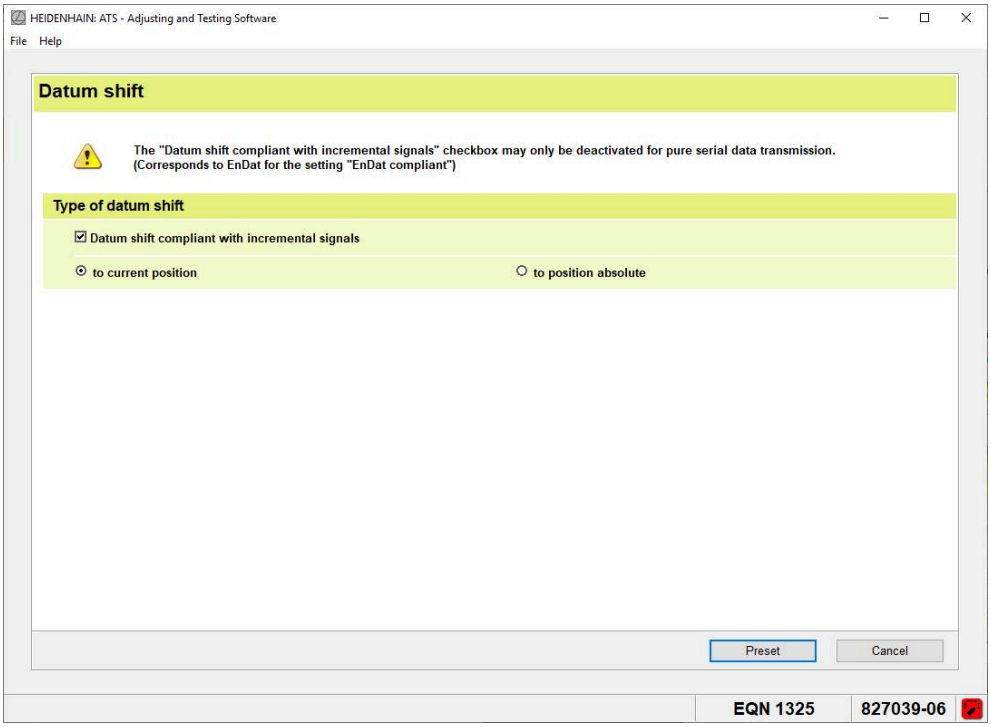


Figure 85: **Datum shift** dialog

- ▶ For encoders with incremental signals, place a check mark at **Datum shift compliant with incremental signals**

> If the check mark is set, the Adjusting and Testing Software calculates the new zero point such that it is as close as possible to the desired position and in accordance with the EnDat specification.

- ▶ In the **Type of datum shift** section, select the option **to current position**
- ▶ Click **Preset**
- > The current position is saved in the encoder as new datum

Setting the datum to absolute position

- ▶ Click **Set datum shift** in the control bar
- > The Adjusting and Testing Software displays a note
- ▶ Click **Yes**
- > The **Datum shift** dialog is displayed

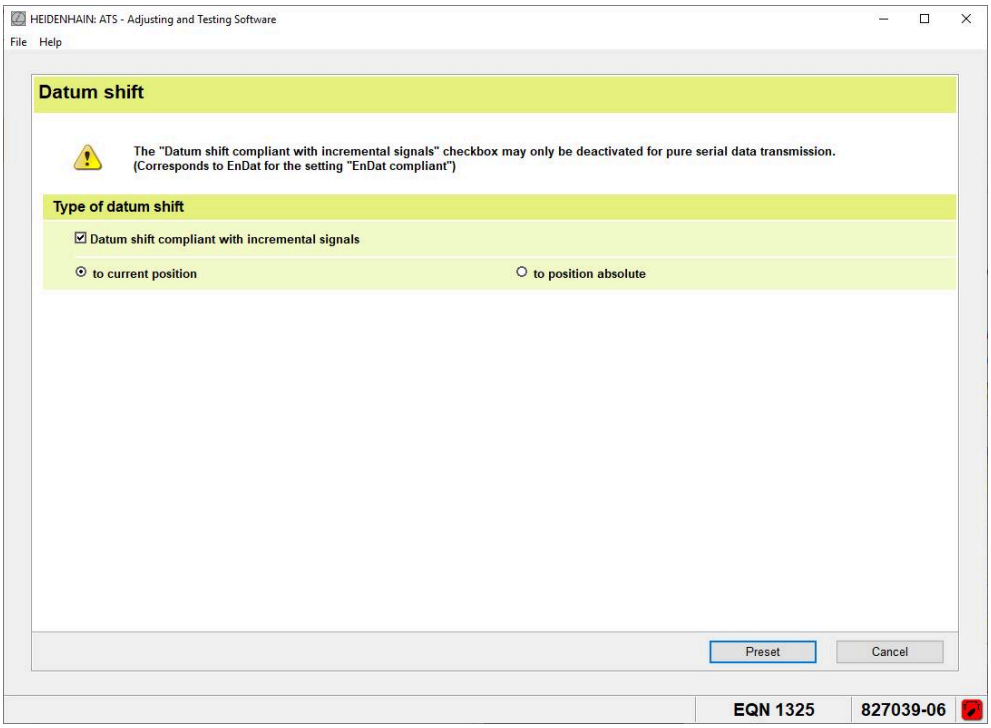


Figure 86: **Datum shift** dialog

- ▶ For encoders with incremental signals, place a check mark at **Datum shift compliant with incremental signals**

> If the check mark is set, the Adjusting and Testing Software calculates the new zero point such that it is as close as possible to the desired position and in accordance with the EnDat specification.

- ▶ In the **Kind of datum shift** section, select the option **to absolute position**
- > The **Set to absolute position** section is displayed
- > The values in the **Position** field are displayed in increments
- ▶ To change the unit of the **Position** field to micrometers or degrees (depending on the encoder), remove the check mark at **Datum shift in steps**
- > The values in the **Position** field are displayed in the respective unit

Figure 87: **Position** input field in increments

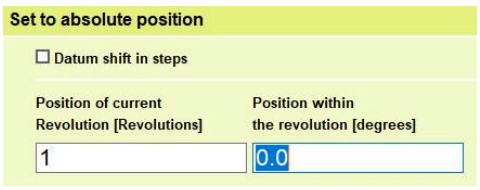


Figure 88: **Position** input field in degrees

- Enter the desired position value
- Click **Set**

> The entered position value is saved in the encoder as new datum

11.2.9 Checking the datum shift

In the **Position display** function you can check whether a datum shift is active.

- Click **Show datum shift** in the control bar

> The **Info dialog about customer-specific datum shift** is displayed

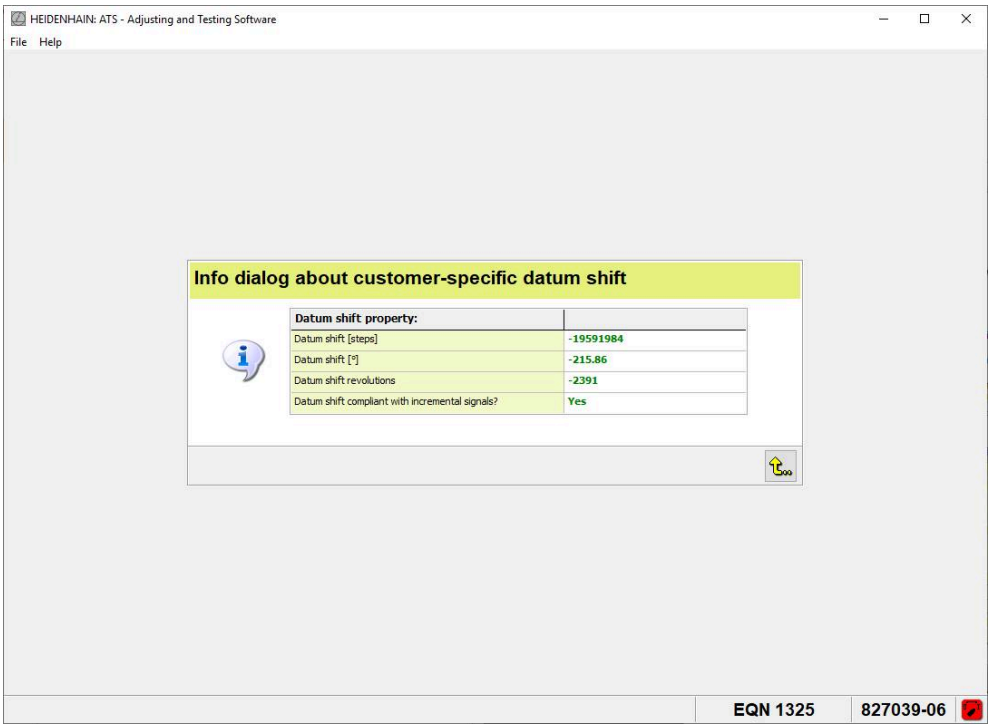


Figure 89: **Info dialog about customer-specific datum shift**

> If a datum shift is active, the **Info dialog about customer-specific datum shift** contains the following information:

- Datum shift in steps
- Datum shift in micrometers or degrees (depending on the encoder)
- Datum shift compliant with incremental signals

11.2.10 Resetting a datum shift

You can reset the datum to the factory default setting of the encoder.

- ▶ Click **Cancel datum shift** in the control bar
- > The **Cancel datum shift** dialog is displayed
- ▶ Click **Yes**
- > The datum shift is reset

11.2.11 Displaying status messages

The **Encoder status** dialog shows the errors and warnings transmitted by the encoder and the status messages on transmission.

To see which status messages the encoder supports, refer to the encoder configuration.

Further information: "Overview of supported error messages and warnings", Page 233

- ▶ Click **Show status information** in the control bar to show the **Encoder status** dialog

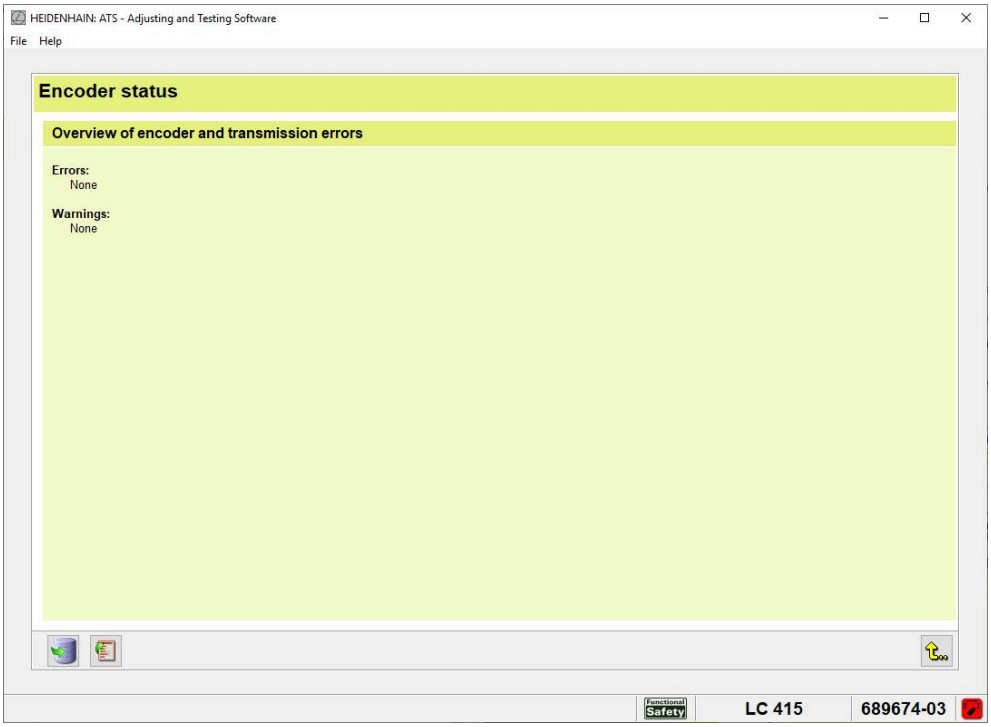


Figure 90: **Encoder status** screen

11.2.12 Displaying operating status error sources

The operating status error sources are an expansion of the EnDat 2.2. error register. They provide detailed information on the encoder errors that have occurred.

> To see which operating status error sources the encoder supports, refer to the encoder configuration.
>
> **Further information:** "Overview of supported operating status error sources", Page 234

- Click **Show status information** in the control bar to show the **Encoder status** dialog

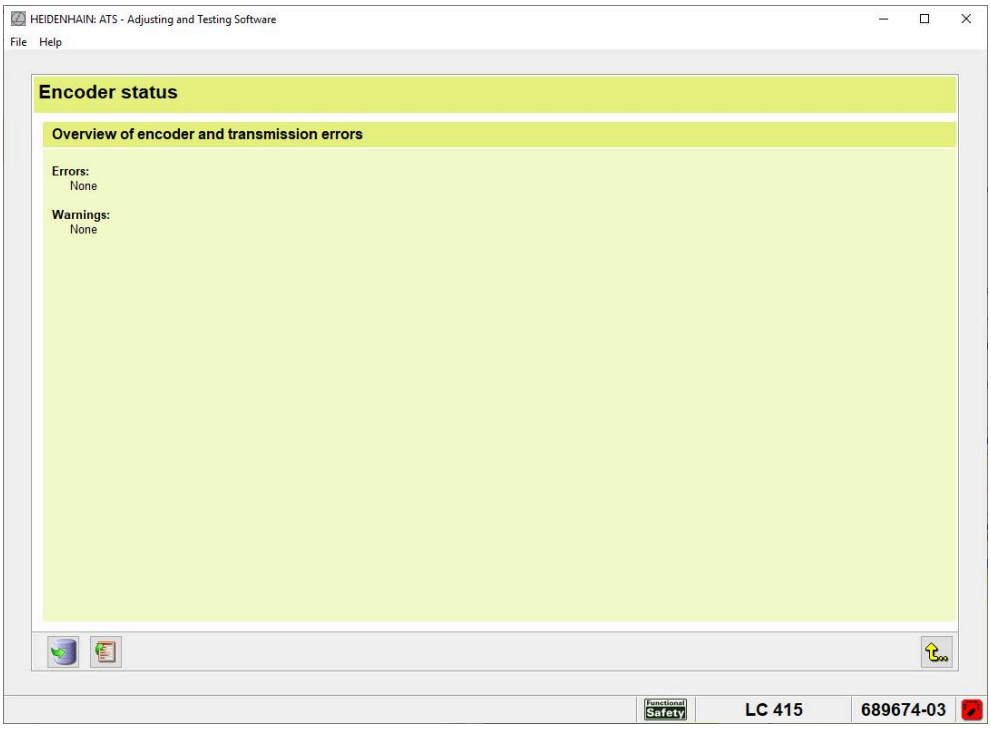


Figure 91: **Encoder status** screen

- Click **Read operating status error sources**

> The **Encoder status** screen displays the **Overview of operating status error sources**

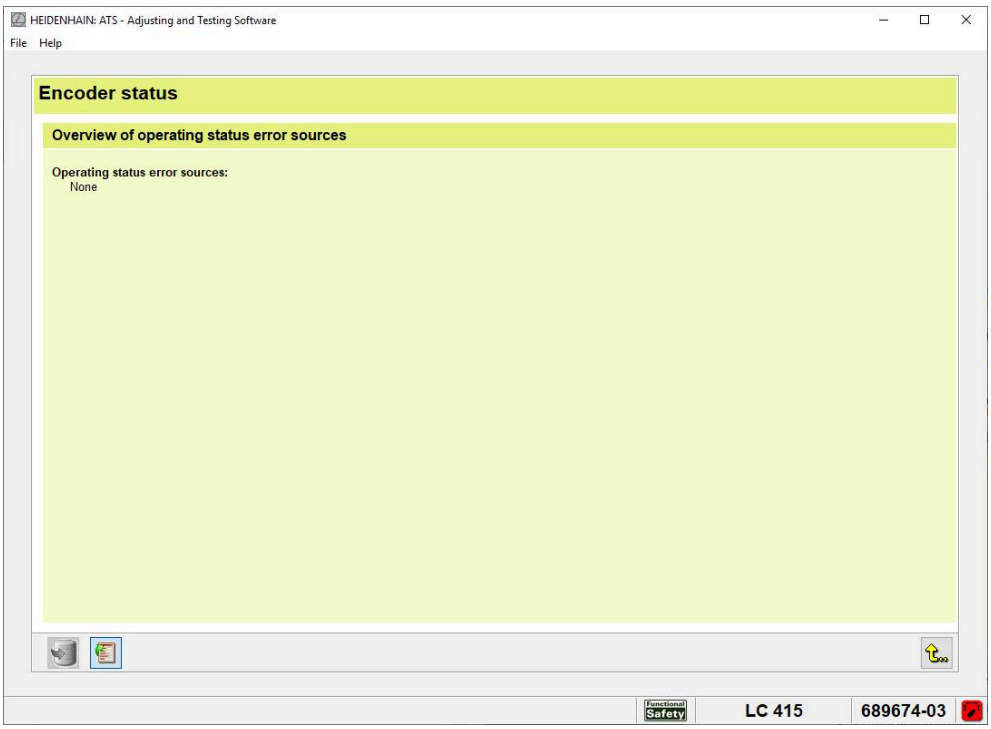


Figure 92: **Encoder status** screen with the **Overview of operating status error sources**

11.2.13 Resetting status messages

You should delete any existing status messages before each check.

- Click **Show status information** in the control bar to show the **Encoder status** dialog

- Click **Delete status messages**

> The status messages are deleted

If there are still status messages in the **Encoder status** detail view, this indicates that the corresponding errors are still present.

11.3 Checking incremental signals

11.3.1 Incremental signal function

If the encoder provides incremental signals, you can examine these signals with the **Incremental signal** function. The procedure is the same as for checking incremental encoders.

More information on checking sinusoidal incremental signals:
"Incremental signal function", Page 80

More information on checking square-wave incremental signals:
"Incremental signal function", Page 134

11.4 Checking voltage supply

11.4.1 Voltage display function

The **Voltage display** function shows the measured values and status of the voltage supply. The display depends on the operating mode of the testing device.

Operating mode of the testing device	Displayed voltage values
Encoder diagnostics	Encoder powered by the PWM
Monitoring operation with signal adapter	Signal adapter powered by the PWM
Monitoring operation without signal adapter	Encoder powered by the subsequent electronics

- Double-click **Voltage display** in the function menu

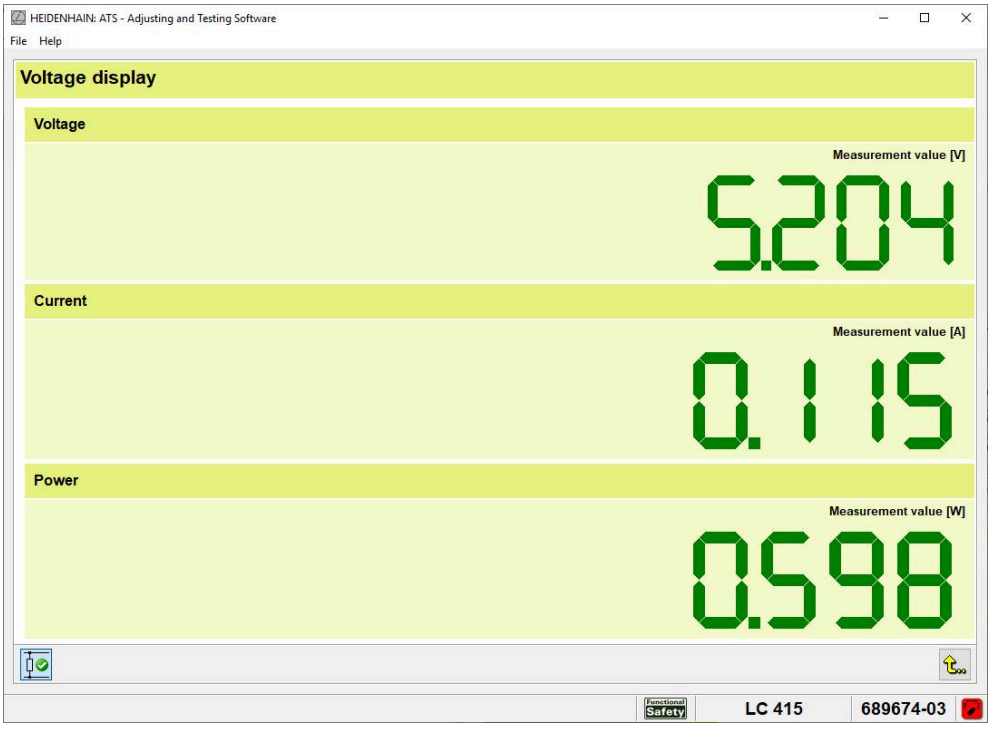


Figure 93: **Voltage display** function

Display	Description
Voltage [Remote Sense]	Operating voltage at the encoder Voltage drops on the encoder supply lines are taken into account. **[Remote Sense]**: Indicates that voltage readjustment is active
Voltage	Voltage output by the PWM or the subsequent electronics
Current	Current consumption of the encoder or the signal adapter

Display	Description
	If the encoder does not consume any current, the measured value is displayed in red.
Power [Remote Sense]	Power consumption of the encoder **[Remote Sense]**: Indicates that voltage readjustment is active

Operating elements

Icon	Function
	**Deactivate terminating resistor** Switches the terminating resistor off
	**Activate terminating resistor** Switches the terminating resistor on

11.4.2 Deactivating the terminating resistor

In the Encoder Diagnostics mode, the terminating resistor is activated by default. You can deactivate the terminating resistor to check whether the current consumption of the encoder corresponds to the technical specifications, e.g. the typical current consumption.

- ▶ Click **Deactivate terminating resistor** in the control bar

- > The operating element indicates that the terminating resistor is inactive

- ▶ Click **Activate terminating resistor** to reactivate the terminating resistor

- > The operating element indicates that the terminating resistor is active

When you exit the function view, the terminating resistor is automatically reactivated.

In the monitoring mode, the terminating resistor is inactive and cannot be switched on.

11.5 Checking the agreement of absolute track and incremental track

11.5.1 Absolute to incremental deviation function

With the **absolute to incremental deviation** function you can check whether the deviation between the absolute position and the incremental position is within the tolerance range.

Description of function:

The different signal paths and propagation times result in differences between the absolute and the incremental position values. The Adjusting and Testing Software compares the position values and displays the difference as deviation span. The deviation span is determined for different speed ranges and must not exceed the specified tolerance limits (accuracy ranges).

- To call this function, click **Absolute to incremental deviation** in the function menu

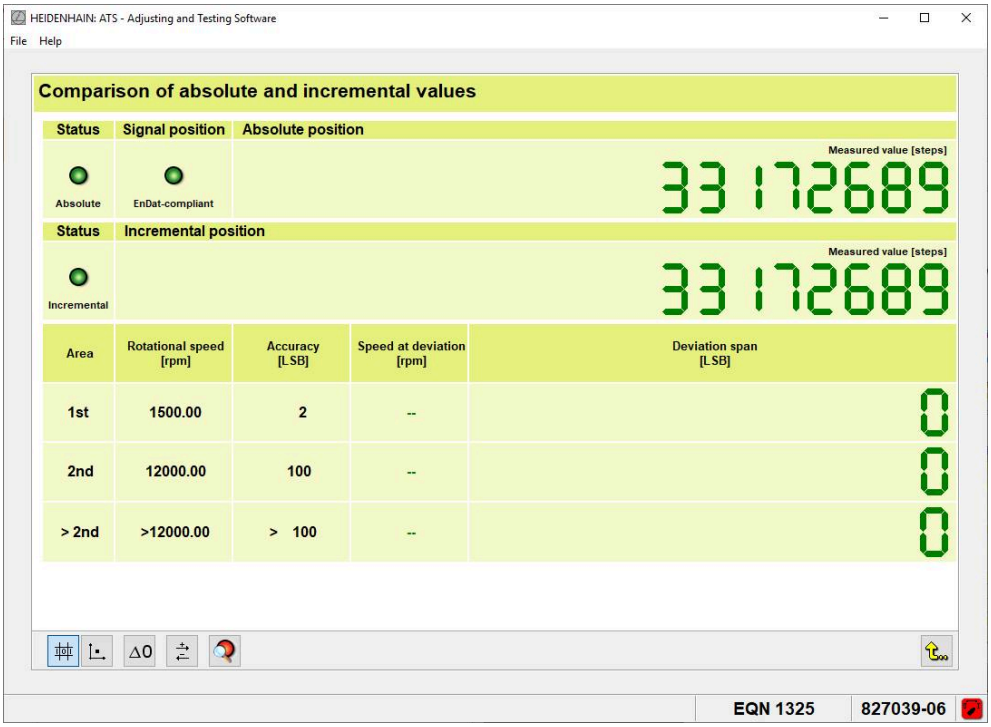


Figure 94: **Absolute to incremental deviation** function

Depiction	Description
Status – Absolute	Status display of encoder errors and encoder warnings for the absolute value ■ Green: No status message available ■ Red: Status message available **Further information:** "Classification of the status messages", Page 176
Status – Incremental	Status display of encoder errors and encoder warnings for the incremental value Description see "Status – Absolute"

Depiction	Description
Signal position – EnDat-compliant	Status display of signal position The Adjusting and Testing Software checks whether the position of the incremental signal corresponds to the EnDat specification, i.e. whether the correct relation can be established between the relative and the absolute position values. ■ Green: Signal position is EnDat-compliant; zero position is assigned to the signal period ■ Yellow: Signal position not EnDat-compliant **Further information:** "Setting datum shift", Page 181 Depending on the signal resolution, an EnDat non-compliant datum shift may result in a dimensional error that is outside the machine's accuracy specifications.
Absolute position	Current count of the position display Unit: increments
Incremental position	Count value of incremental counter Unit: increments
Range	Linear or rotational velocity range
Speed [m/min]	Display for linear encoders: Speed in the respective speed range Unit: m/min
Rotational speed [rpm]	Display for rotatory encoders: Rotational speed in the respective speed range Unit: rpm
Accuracy [LSB]	Permissible deviation in the respective speed range Unit: LSB[1]
Speed at deviation [m/min]	Display for linear encoders: Speed when determining the deviation span If a dash is displayed instead of a value, the encoder does not support the corresponding speed range.
Speed at deviation [rpm]	Display for rotatory encoders: Rotational speed when determining the deviation span If a dash is displayed instead of a value, the encoder does not support the corresponding speed range.

Depiction	Description
Deviation span [LSB]	Determined deviation span Unit: LSB[1] The color of the value indicates whether or not the value is within tolerance: ■ Green: Deviation span is within the tolerance range ■ Red: Deviation span is outside the tolerance range If the deviation span is outside the tolerance limits, check whether the counting direction of the incremental counter corresponds to that of the encoder. **Further information:** "Inverting the counting direction of the incremental counter", Page 180

[1] LSB = Least significant bit

Example: For a linear encoder with a resolution of 10 nm, 1 LSB corresponds to a measuring distance of 10 nm.

Operating elements

Icon	Function
	**Show measured values** Displays the measured value in increments
	**Show position values** Converts the measured value into a position value Unit: micrometers or degrees (depending on the encoder)
	**Reset deviation span** Equates the incremental position with the absolute position, thus resetting the deviation span to zero
	**Invert counting direction** Inverts the positive or negative counting direction
	**Show status information** Displays a list of errors and warnings

11.5.2 Running the inspection

- ▶ Traverse the entire measuring range several times, if possible at different speeds
- > The Adjusting and Testing Software determines the deviation span and displays the result of the tolerance check

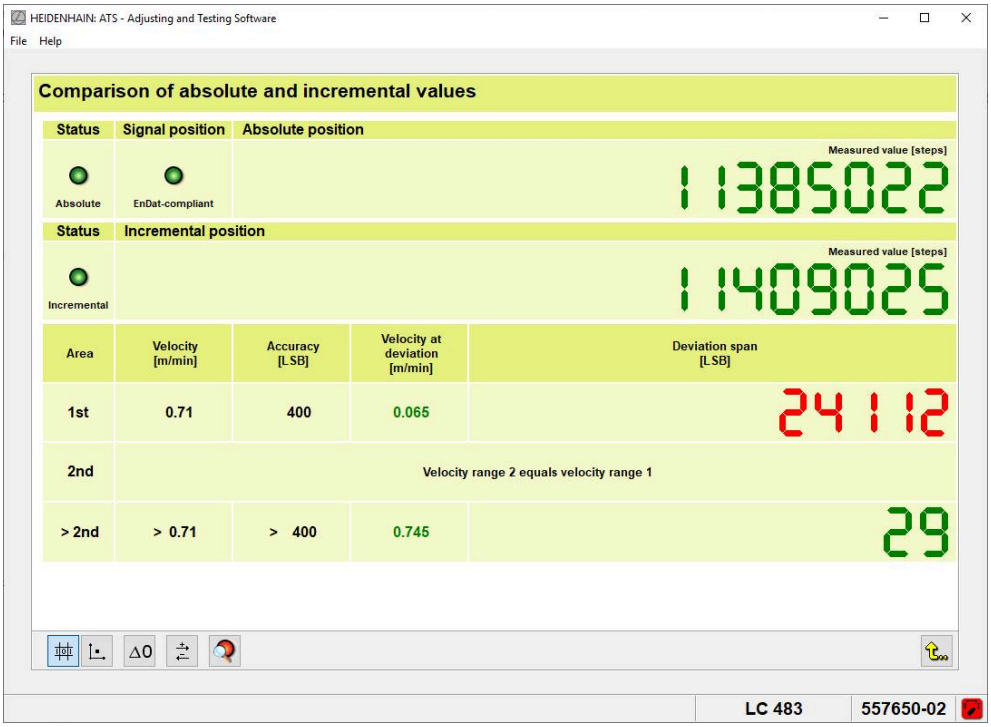


Figure 95: **Absolute to incremental deviation** function when the tolerance limits are exceeded (red value)

You can switch the counter display between measured values view and position view.

Further information: "Switching between measured values view and position view", Page 176

On the **Encoder status** screen, you can view status messages and delete them if necessary.

Further information: "Displaying status messages", Page 185

11.5.3 Inverting the counting direction of the incremental counter

On some encoders, the counting direction of the incremental counter can be configured. You can adapt the counting direction to the encoder in the Adjusting and Testing Software.

- ▶ Click **Invert counting direction** in the control bar to adapt the counting direction
- > The Adjusting and Testing Software inverts the positive or negative counting direction

11.5.4 Resetting the deviation span

You can reset the deviation span to repeat the examination.

- ▶ Click **Reset deviation span** in the control bar
- > The count value of the incremental counter is set equal to the absolute position
- > The deviation span is set to zero

11.6 Evaluating the encoder status with the online diagnostics

11.6.1 Online diagnostics function

You can monitor the encoder status with the **Online diagnostics** function.

The Adjusting and Testing Software records valuation numbers, which are transmitted together with the position value when the encoder is traversed. On the basis of these valuation numbers, the Adjusting and Testing Software determines the current function reserves of the encoder.

The **Online diagnostics** functions comprises:

- the **Protocol** screen for entry of log data
- the **Measurement** screen to determine the function reserves
  - Bar graph
  - X/Y display

Protocol screen

In the **Protocol** screen, you can enter additional log data. After the measurement, you can save the log as a PDF file.

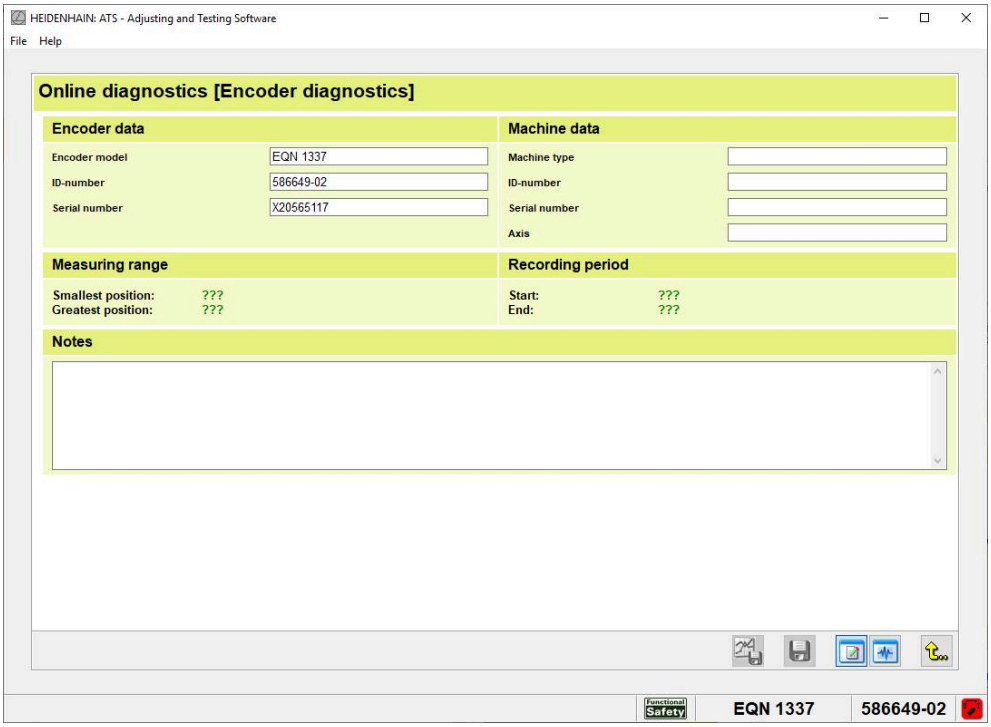


Figure 96: **Protocol** screen of the **Online diagnostics** function

Depiction	Description
Encoder data	The fields are filled automatically; the data are adopted from the encoder memory
Machine data	Fields for entering machine data
Measuring range	The fields are filled automatically at the end of the measurement
Recording period	The fields are filled automatically at the end of the measurement
Notes	Field for entering notes

Operating elements

Icon	Function
	**Export data** Opens the dialog for exporting records to a TXT file
	**Save file** Opens the dialog for saving the log to a PDF file
	**Switch to Protocol view** Shows the screen for entering log data
	**Switch to Measurement view** Shows the screen for running measurements

Measurement screen

In the **Measurement** screen, you record the valuation numbers transferred from the encoder to determine the function reserves.

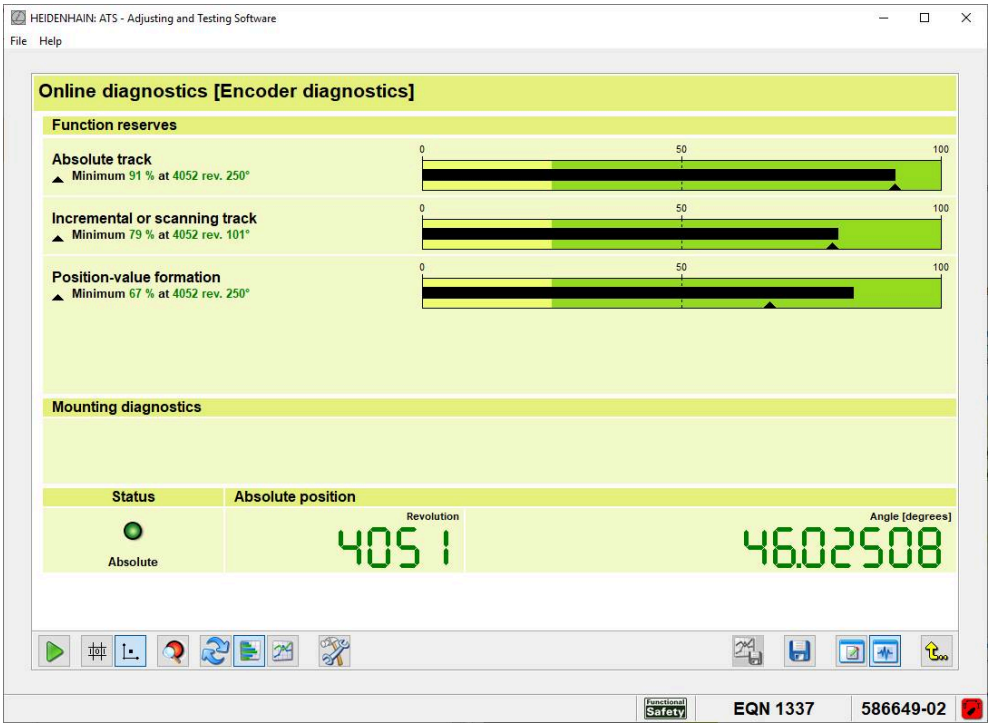


Figure 97: **Measurement** screen of the **Online diagnostics** function

The following valuation numbers are transferred and displayed, depending on the connected encoder:

- Valuation number 1: Valuation of the incremental or scanning track
- Valuation number 3:
  - For absolute encoders: Valuation of the absolute track
  - For incremental encoders: Valuation of the reference pulse width
- Valuation number 4: Evaluation of the position value formation/reference pulse position
  - For absolute encoders: Valuation of position value formation
  - For incremental encoders: Valuation of the reference pulse position
- Valuation number 5: Valuation of the battery voltage of touch probes
- Valuation number 6: Valuation of the transmission quality of touch probes

To see which valuation numbers the encoder supports, refer to the encoder configuration.

Further information: "Overview of supported valuation numbers", Page 236

Bar graph

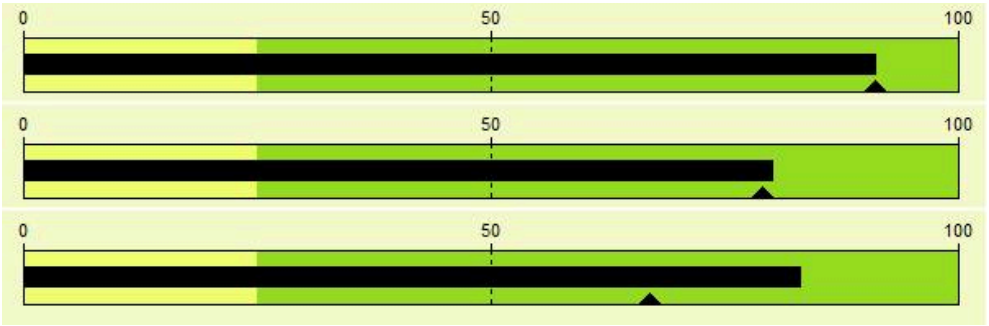


Figure 98: Bar graph of the **Online diagnostics** function

The bar display of the Adjusting and Testing Software shows each valuation number in a bar graph. The scale of the bar corresponds to the maximum function reserve of the encoder. The minimum, i.e. the smallest value within the traversed range, is determined for each valuation number. The drag indicator marks the minimum. The black bar shows the value transferred last.

The tolerance ranges are indicated by color in each bar graph:

Display	Functional reserves	Description
Yellow	0 – 25 %	■ Minimum is outside the specification ■ Encoder maintenance recommended
Green	26 – 100 %	■ Minimum is within the specification ■ Encoder function reserves are sufficient

X/Y display

The X/Y display may be additionally available, depending on the encoder. It shows the course of the function reserves over the entire traverse path.

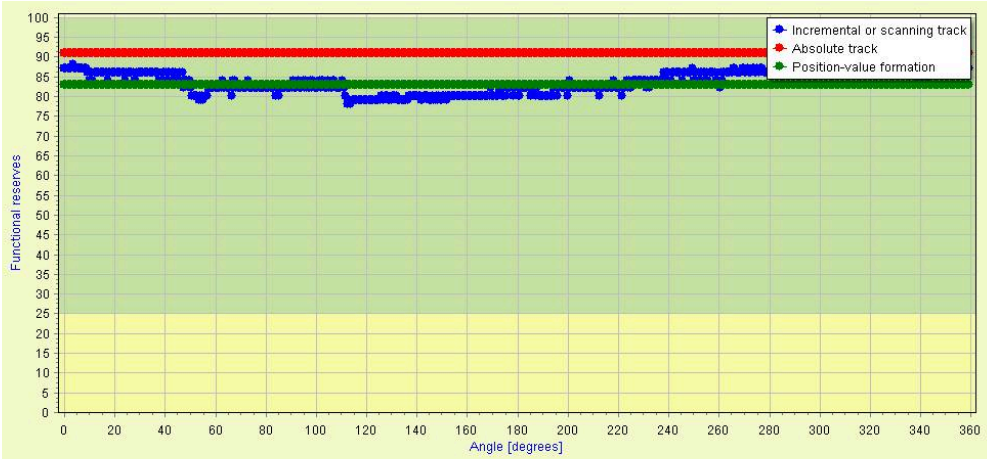


Figure 99: X/Y display of the **Online diagnostics** function

Depiction	Description
X axis	Position Input: millimeters or degrees (depending on the encoder)
Y axis	Function reserve

Operating elements

Icon	Function
	**Start recording** Starts recording of the measured values
	**Stop recording** Terminates recording and freezes the last view
	**Show measured values** Displays the measured value in increments
	**Show position values** Converts the measured value into a position value Unit: micrometers or degrees (depending on the encoder)
	**Show status information** Displays a list of errors and warnings
	**Delete values** Deletes the recorded values and resets the drag indicators to 100 %
	**Switch to bar display** Shows the bar graphs
	**Switch to X/Y display** Shows the X/Y display
	**Export data** Opens the dialog for exporting records to a TXT file
	**Save file** Opens the dialog for saving the log to a PDF file
	**Switch to Protocol view** Shows the screen for entering log data
	**Switch to Measurement view** Shows the screen for running measurements

11.6.2 Performing online diagnostics

Prerequisites:

- The encoder was connected to the Adjusting and Testing Software by entering the encoder ID
- In the monitoring mode: The subsequent electronics supports the diagnostic function (request of diagnostic data); the diagnostic function is active in the subsequent electronics

- To call this function, double-click **Online diagnostics** in the function menu

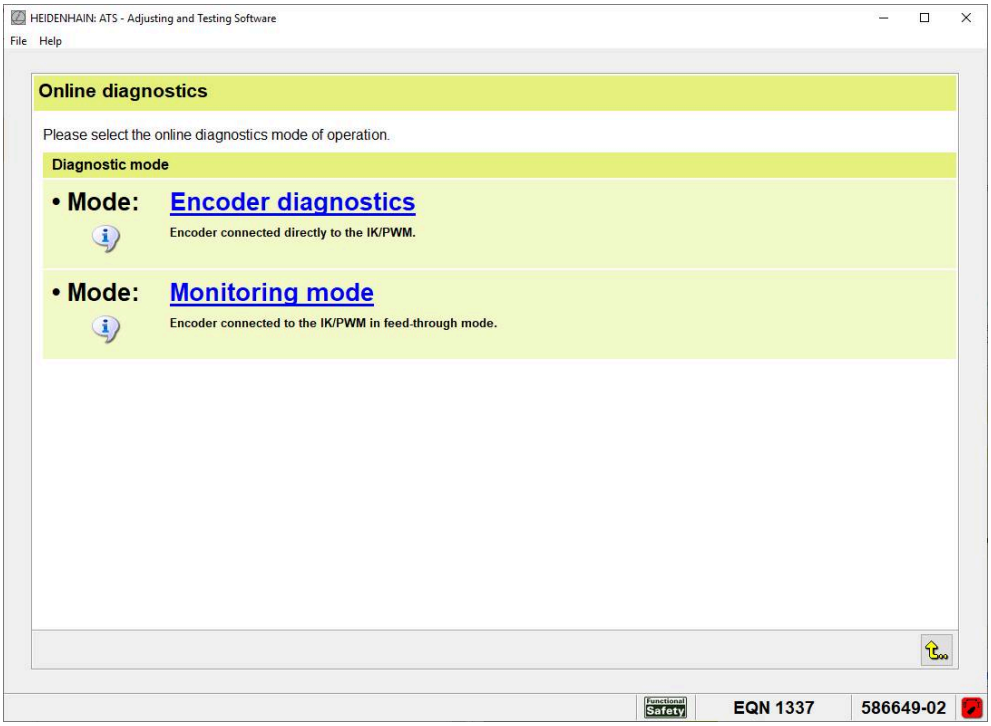


Figure 100: **Online diagnostics** function

- In the **Diagnostics mode** section, select the option that corresponds to the operating mode of the testing device:
  - Encoder diagnostics
  - Monitoring mode

Further information: "Operating modes of the testing device", Page 24

> The **Protocol** screen is shown

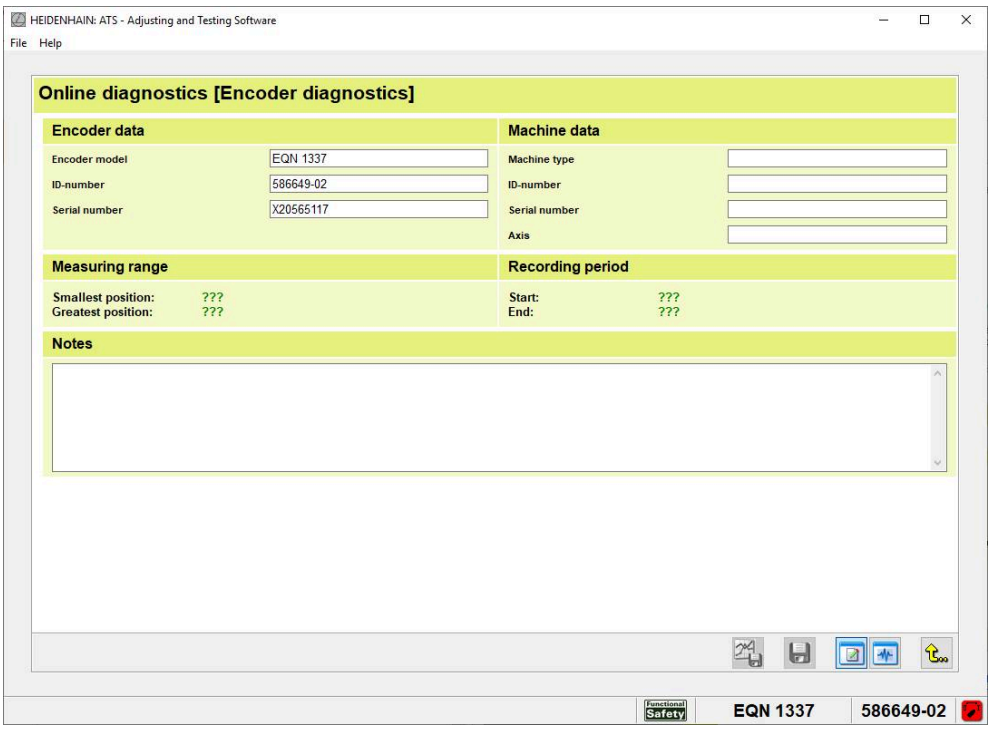


Figure 101: **Protocol** screen of the **Online diagnostics** function

- ▶ Add log data, if necessary

- ▶ Click **Show measurement screen** in the control bar
- > The **Measurement** screen is shown

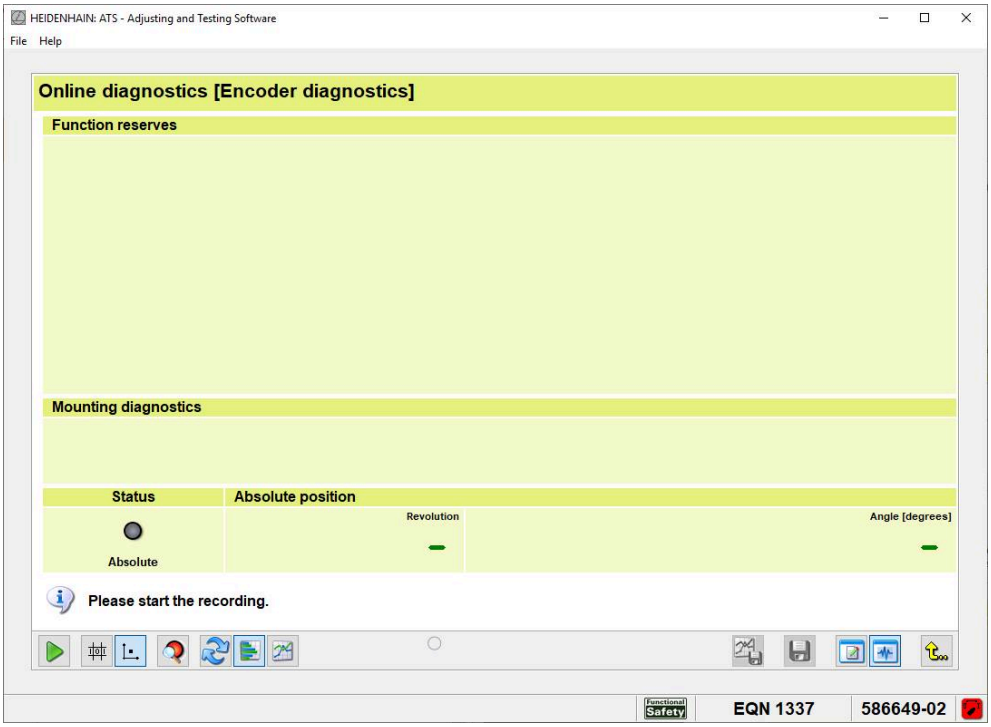


Figure 102: **Measurement** screen of the **Online diagnostics** function

Run the measurement in the bar display

- If necessary, click **Switch to bar display** in the control bar

- Click **Start measurement**
- Traverse the entire measuring range
> The valuation numbers are recorded
> The minimum is displayed for each valuation number

- Click **Terminate measurement**
> The displays show the last view

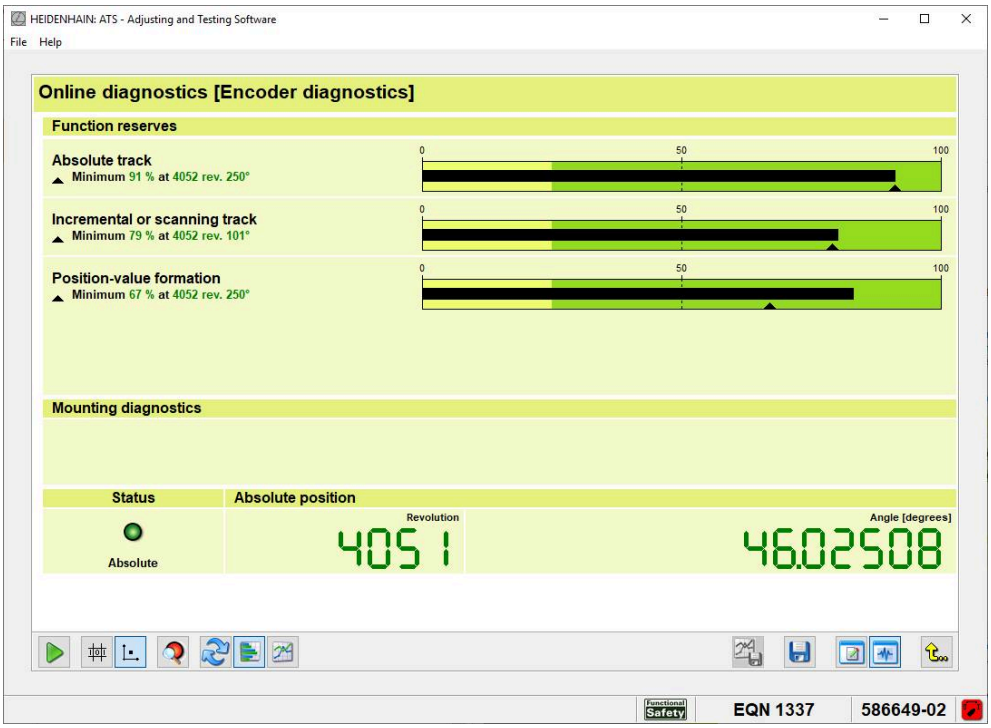


Figure 103: Result of the online diagnostics in the bar display

You can switch the counter display between measured values view and position view.

Further information: "Switching between measured values view and position view", Page 176

On the **Encoder status** screen, you can view status messages and delete them if necessary.

Further information: "Displaying status messages", Page 185

You can save the measuring result to a log file.

Further information: "Saving the log", Page 205

Running the measurement in the X/Y display

Prerequisite for incremental encoders: The encoder reference run has been completed; otherwise the X/Y display may show position jumps when reference marks are crossed over

- If necessary, click **Switch to X/Y display** in the control bar

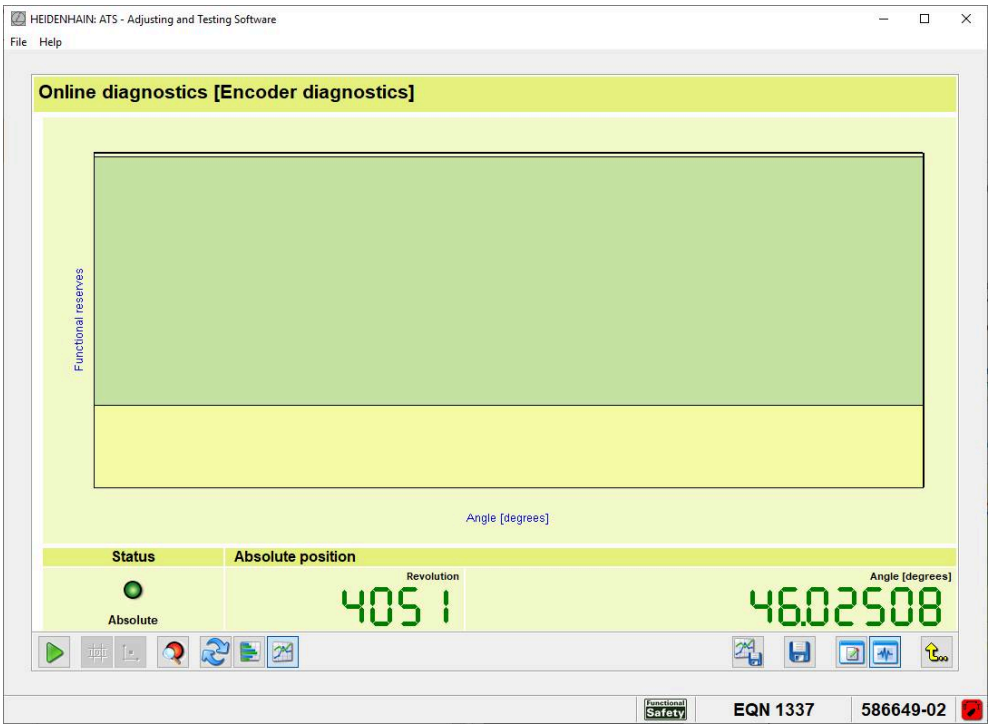


Figure 104: **Measurement** view with X/Y display

- Click **Start measurement**
- Traverse the entire measuring range
- > The valuation numbers are recorded
- > The diagram shows the function reserve at the respective position

- Click **Terminate measurement**
- > The displays show the last view

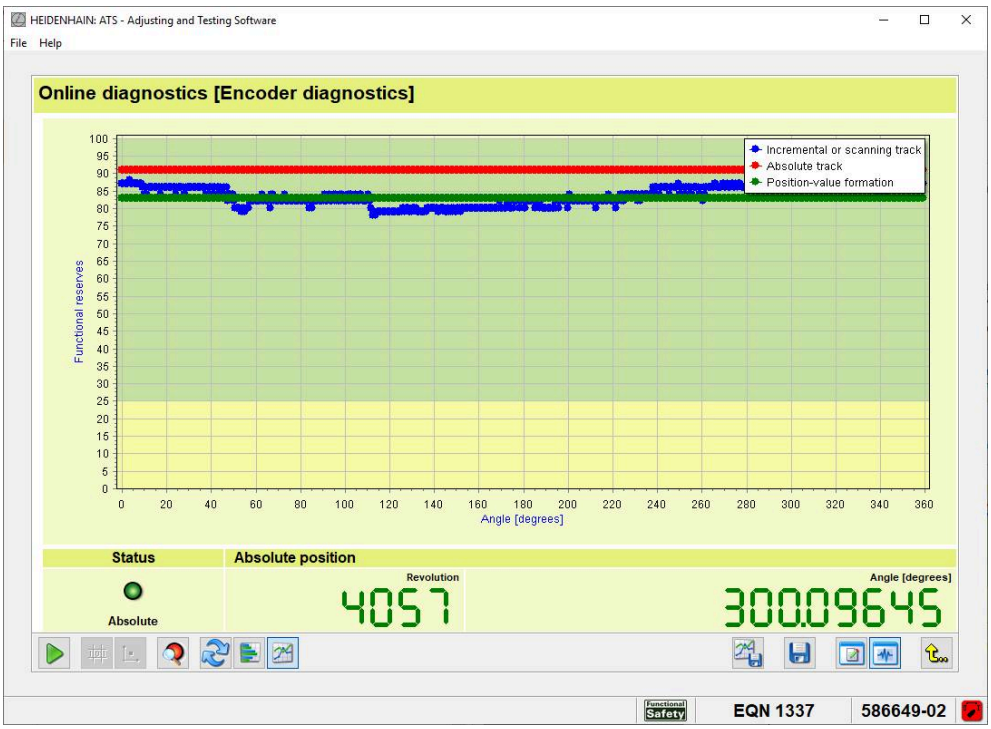


Figure 105: Result of the online diagnostics in the X/Y display

If you position the mouse pointer on a point in the diagram, a mouseover text appears with brief information, e.g. the number of revolutions of a multiturn encoder.

On the **Encoder status** screen, you can view status messages and delete them if necessary.

Further information: "Displaying status messages", Page 185

You can export the data shown in the diagram to a TXT file.

Further information: "Exporting diagram data", Page 205

You can save and print the active diagram.

Further information: "Adjusting, exporting and printing diagrams", Page 42

To examine a section more closely, you can zoom in on the diagram view.

Further information: "Magnifying the diagram view", Page 42

11.6.3 Saving the log

You can save the results of the online diagnostics in a PDF file.


- Click **Switch to Protocol view** in the control bar
- Complete the log data, if necessary
- Click **Save log**
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**
> The input field **Comment in inspection report** is displayed
- If necessary, enter a comment
- Click **OK**
> The file is saved

In the Adjusting and Testing Software, you can add an individual header and details on the examiner to the logs.

Further information: "Saving log information", Page 50

To display the PDF contents correctly, the font "Arial Unicode MS" must be installed on the computer.

11.6.4 Exporting diagram data

The data recorded in the X/Y view can be saved to a TXT file.

- Click **Export data** in the control bar
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**
> The file is saved

11.6.5 Deleting values

You can delete the recorded values to perform a new measurement.

- Click **Delete values** in the control bar
> The **Minimum** value of each valuation number is deleted

The bar display is reset as soon as you start a new measurement.

11.7 Checking the functional safety of the encoder

11.7.1 Functional-safety encoder check

The functional-safety encoder check serves to check safety-relevant functions of encoders. A software wizard will you through the required steps.

Prerequisites:

- The encoder supports the functional-safety encoder check
- The encoder was connected to the Adjusting and Testing Software by entering the encoder ID

i	Encoders with Functional Safety can typically be identified by the word "Safety" printed on the ID label.

i	If the functional-safety encoder check results in errors, the encoder does not comply with the functional safety specifications. Repairs may only be carried out by the HEIDENHAIN Service.

i	After installing and exchanging functional safety components, repeat the acceptance test according to the specifications of the machine tool builder.

Description of function:

The safety strategy of the position encoder is based on two mutually independent position values and additional error bits (error 1 and error 2) produced in the encoder and transmitted over the EnDat 2.2 protocol. The subsequent electronics compares the two position values and checks the error bits. In addition, the protocol structure of EnDat transmission provides the subsequent electronics with further monitoring information. The internal failure mechanisms of the encoder are also tested for proper functioning at specified intervals; this is called forced dynamic sampling.

- ▶ To call this function, double-click **Functional-safety encoder check** in the function menu
- > The dialog **Manual entry of measuring length** may be displayed (depending on the encoder)
- ▶ Enter the measuring length in millimeters
- ▶ Confirm the entry with **Accept**
- > The software wizard shows a list of the supported diagnostic functions

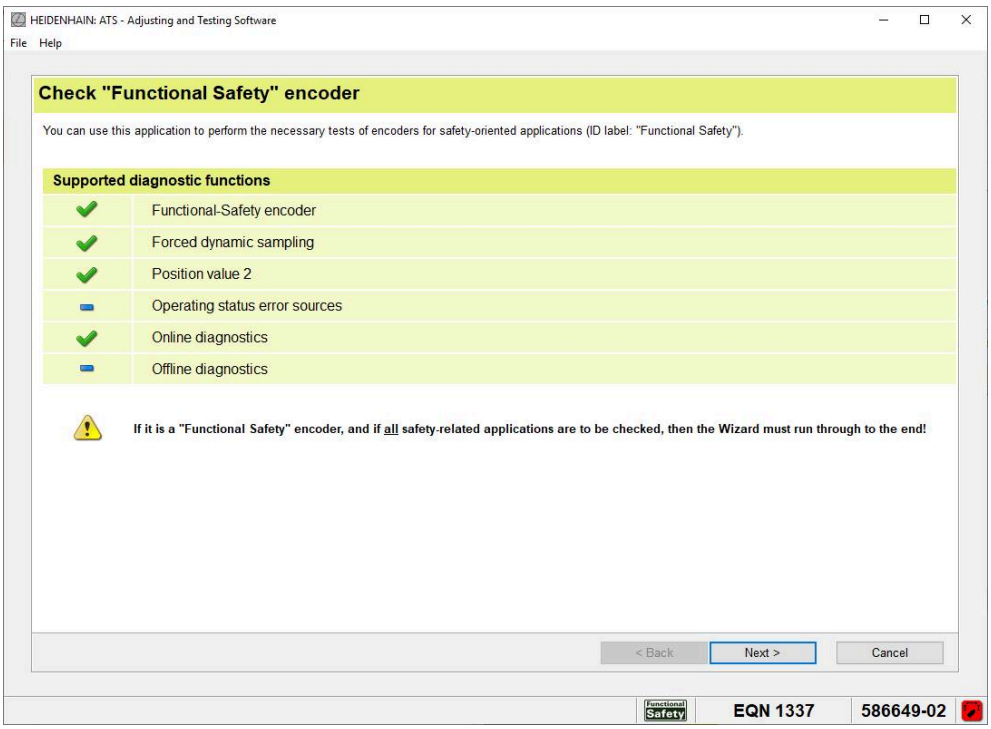


Figure 106: Overview of supported diagnostic functions

The overview shows the diagnostic functions the encoder supports.

Depiction	Description
Functional-Safety encoder	Check of safety-relevant memory areas
Forced dynamic sampling	Check of internal failure mechanisms of the encoder
Position value 2	Transfer of second position value
Operating status error sources	Transfer of expanded error messages
Online diagnostics	Transfer of valuation numbers
Offline diagnostics	Recording of valuation numbers in the encoder

Icon	Description
	Diagnostic function is supported
	Diagnostic function is not supported; diagnostic function is not mandatory for the functional-safety encoder check
	Diagnostic function is not supported; functional-safety encoder check cannot be performed

Checking safety-relevant memory areas

The Adjusting and Testing Software checks the safety-relevant memory parameters for consistency with the encoder database.

- ▶ Click **Next** to check the safety-relevant memory areas
- > The Adjusting and Testing Software compares the memories
- > The software wizard shows the result of the comparison

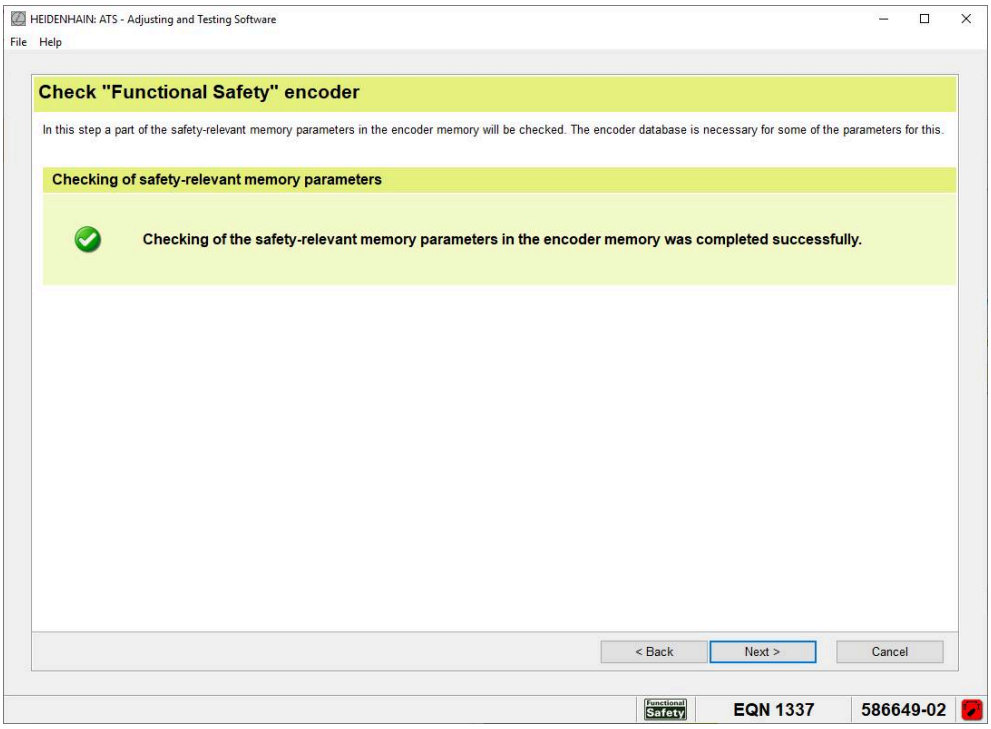
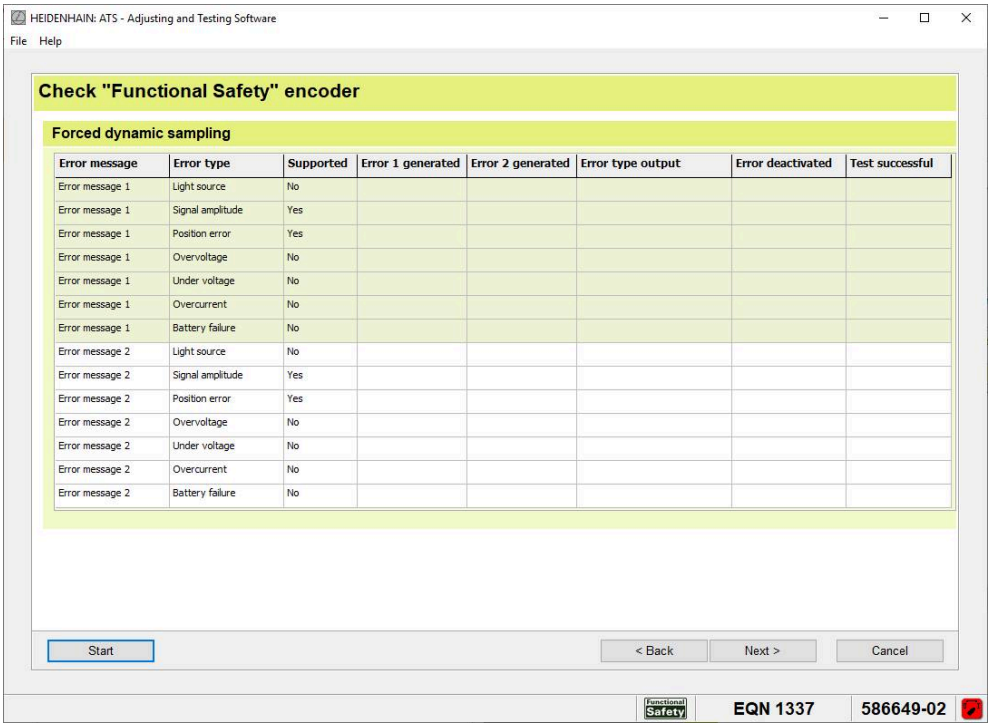


Figure 107: Result of the comparison of encoder memory and encoder database

- ▶ Click **Next** to continue
- > The software wizard shows information on **forced dynamic sampling**

Forced dynamic sampling



Error message	Error type	Supported	Error 1 generated	Error 2 generated	Error type output	Error deactivated	Test successful
Error message 1	Light source	No					
Error message 1	Signal amplitude	Yes					
Error message 1	Position error	Yes					
Error message 1	Overvoltage	No					
Error message 1	Under voltage	No					
Error message 1	Overcurrent	No					
Error message 1	Battery failure	No					
Error message 2	Light source	No					
Error message 2	Signal amplitude	Yes					
Error message 2	Position error	Yes					
Error message 2	Overvoltage	No					
Error message 2	Under voltage	No					
Error message 2	Overcurrent	No					
Error message 2	Battery failure	No					

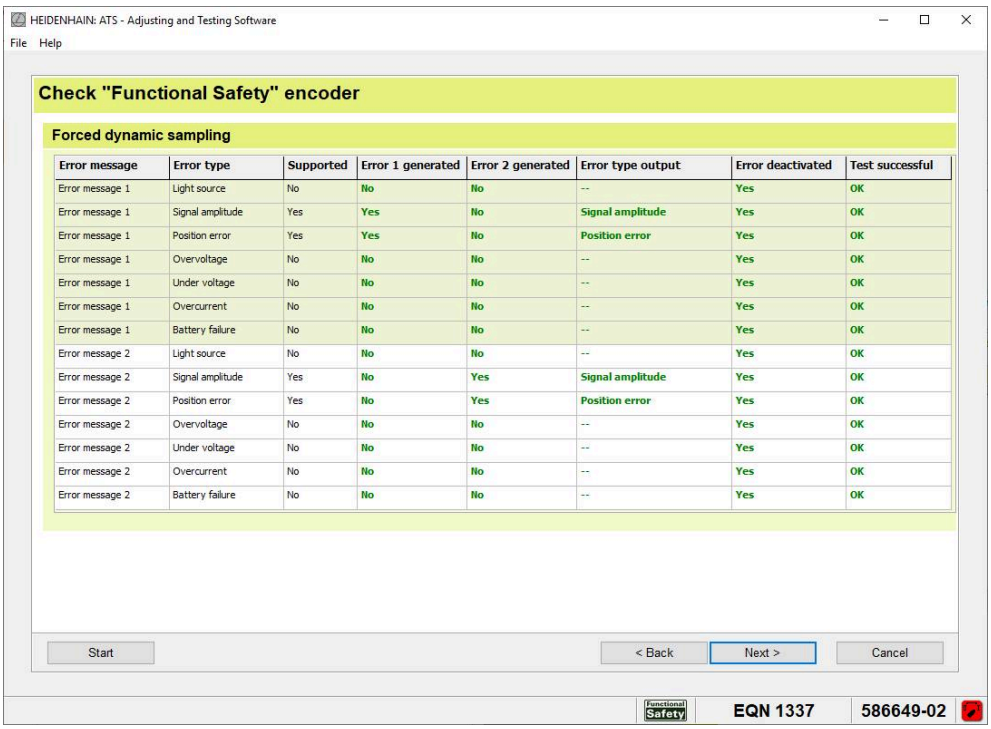
Figure 108: **Forced dynamic sampling** screen with supported error types

During forced dynamization, the internal failure mechanisms of the encoder are tested for proper functioning. The monitoring is divided into two groups (error message 1 and error message 2). Each group supports seven error types.

The table shows the error types the encoder supports. In forced dynamic sampling, the error types are stimulated individually and the response of the encoder is evaluated. Supported error types must generate a corresponding error 1 or error 2. Error types that are not supported must not generate an error when stimulated. The error type read out must correspond to the stimulated error type. Moreover, it must be possible to deactivate the error after stimulation.

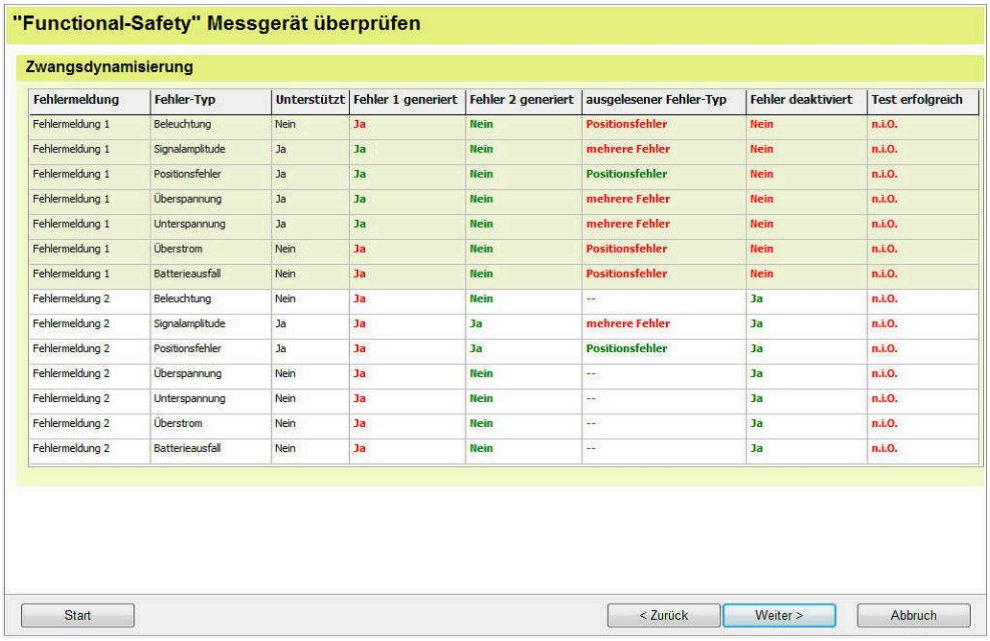
- ▶ Click **Start** to start forced dynamic sampling
- > A message appears if error messages already exist
- ▶ Click **Yes** to confirm the deletion of existing error messages
- > Forced dynamic sampling is performed
- > The table contains test result

Red entries in the table indicate faulty behavior of the encoder.



Error message	Error type	Supported	Error 1 generated	Error 2 generated	Error type output	Error deactivated	Test successful
Error message 1	Light source	No	No	No	--	Yes	OK
Error message 1	Signal amplitude	Yes	Yes	No	Signal amplitude	Yes	OK
Error message 1	Position error	Yes	Yes	No	Position error	Yes	OK
Error message 1	Overvoltage	No	No	No	--	Yes	OK
Error message 1	Under voltage	No	No	No	--	Yes	OK
Error message 1	Overcurrent	No	No	No	--	Yes	OK
Error message 1	Battery failure	No	No	No	--	Yes	OK
Error message 2	Light source	No	No	No	--	Yes	OK
Error message 2	Signal amplitude	Yes	No	Yes	Signal amplitude	Yes	OK
Error message 2	Position error	Yes	No	Yes	Position error	Yes	OK
Error message 2	Overvoltage	No	No	No	--	Yes	OK
Error message 2	Under voltage	No	No	No	--	Yes	OK
Error message 2	Overcurrent	No	No	No	--	Yes	OK
Error message 2	Battery failure	No	No	No	--	Yes	OK

Figure 109: Result for correct behavior of the encoder



Fehlermeldung	Fehler-Typ	Unterstützt	Fehler 1 generiert	Fehler 2 generiert	ausgelesener Fehler-Typ	Fehler deaktiviert	Test erfolgreich
Fehlermeldung 1	Beleuchtung	Nein	Ja	Nein	Positionsfehler	Nein	n.i.O.
Fehlermeldung 1	Signalamplitude	Ja	Ja	Nein	mehrere Fehler	Nein	n.i.O.
Fehlermeldung 1	Positionsfehler	Ja	Ja	Nein	Positionsfehler	Nein	n.i.O.
Fehlermeldung 1	Überspannung	Ja	Ja	Nein	mehrere Fehler	Nein	n.i.O.
Fehlermeldung 1	Unterspannung	Ja	Ja	Nein	mehrere Fehler	Nein	n.i.O.
Fehlermeldung 1	Überstrom	Nein	Ja	Nein	Positionsfehler	Nein	n.i.O.
Fehlermeldung 1	Batterieausfall	Nein	Ja	Nein	Positionsfehler	Nein	n.i.O.
Fehlermeldung 2	Beleuchtung	Nein	Ja	Nein	--	Ja	n.i.O.
Fehlermeldung 2	Signalamplitude	Ja	Ja	Ja	mehrere Fehler	Ja	n.i.O.
Fehlermeldung 2	Positionsfehler	Ja	Ja	Ja	Positionsfehler	Ja	n.i.O.
Fehlermeldung 2	Überspannung	Nein	Ja	Nein	--	Ja	n.i.O.
Fehlermeldung 2	Unterspannung	Nein	Ja	Nein	--	Ja	n.i.O.
Fehlermeldung 2	Überstrom	Nein	Ja	Nein	--	Ja	n.i.O.
Fehlermeldung 2	Batterieausfall	Nein	Ja	Nein	--	Ja	n.i.O.

Figure 110: Result for faulty behavior of the encoder

- ▶ Click **Next** to continue
- > The software wizard shows information on the **test for consistency**

Test for consistency

Encoders supporting functional safety output two position values: the high-resolution position 1 and a lesser resolved position 2. During the test for consistency, the Adjusting and Testing Software scales the position value 1 to the resolution of position value 2 and checks position value 2 for consistency. The test is considered passed if the maximum position jump results in a deviation ≤ 3.

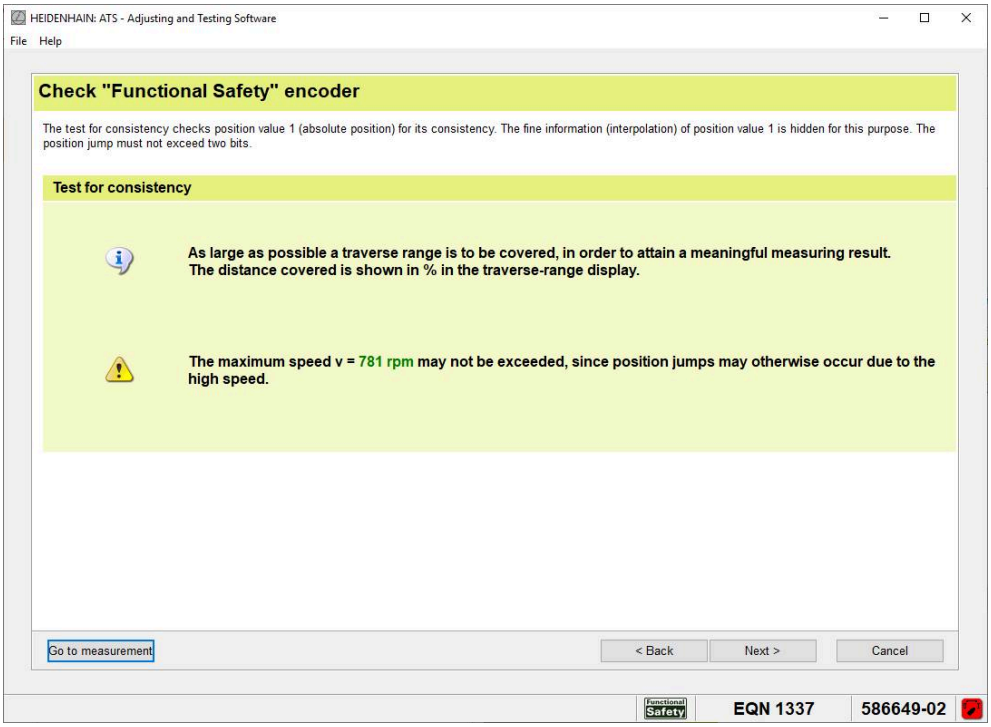


Figure 111: Information on the test for consistency

- ▶ Click **Go to measurement** to run the test for consistency
- > The **Measurement** screen is shown

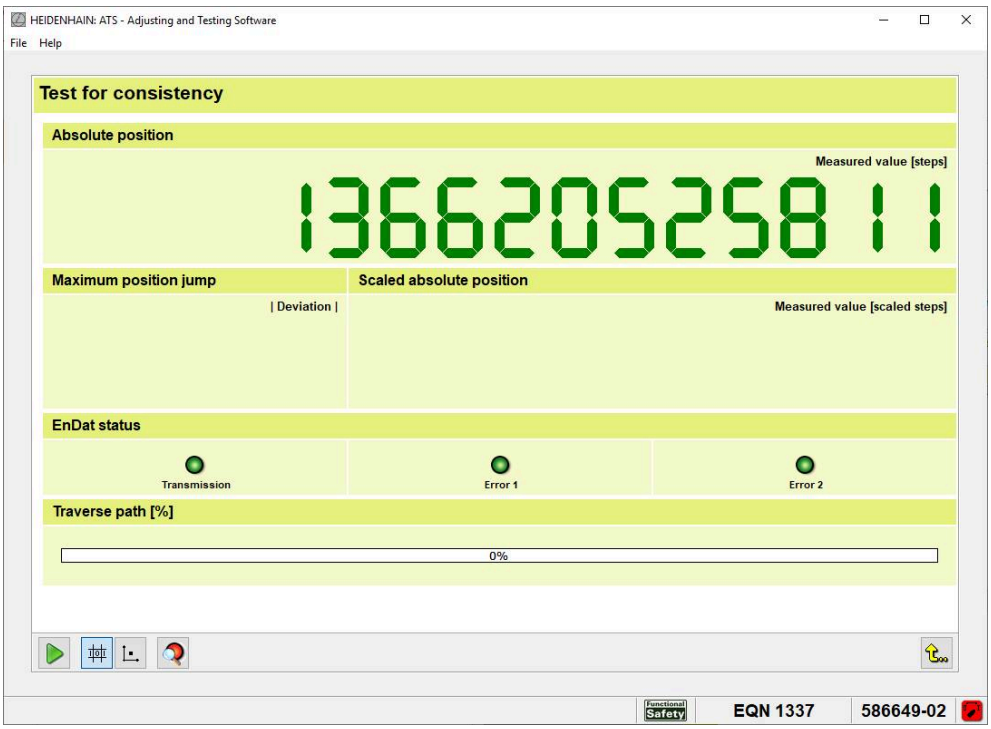


Figure 112: Measurement screen of the test for consistency

Depiction	Description
Absolute position	Absolute position 1 Unit: increments
Maximum position jump	Deviation of scaled position value 1
Scaled absolute position	Position value 1, scaled to resolution of position value 2
EnDat status	Status displays ■ Status display of data transfer between encoder and testing device (CRC test) ■ Green: No status message available ■ Red: Status message available ■ Error 1: Status display of the encoder error group 1 ■ Green: No status message available ■ Red: Status message available ■ Error 2: Status display of the encoder error group 2 ■ Green: No status message available ■ Red: Status message available
Traverse path	Traversed measuring distance in percent The traverse path is read out from the encoder memory or the encoder database (depending on the encoder).

Operating elements

Icon	Function
	**Start recording** Starts recording and evaluation of the measured values
	**Stop recording** Terminates recording and freezes the evaluation of the measured values
	**Show measured values** Displays the measured value in increments
	**Show position values** Converts the measured value into a position value Unit: micrometers or degrees (depending on the encoder)
	**Show status information** Displays a list of errors and warnings

- ▶ Click **Start measurement** in the control bar
- ▶ Traverse the entire measuring range
- > The progress bar shows the traversed distance in percent

> The traverse path of encoders mounted to a machine may be limited such that the progress bar cannot reach 100 %.

- ▶ Click **Terminate measurement**
- > The Adjusting and Testing Software shows the result of the test for consistency

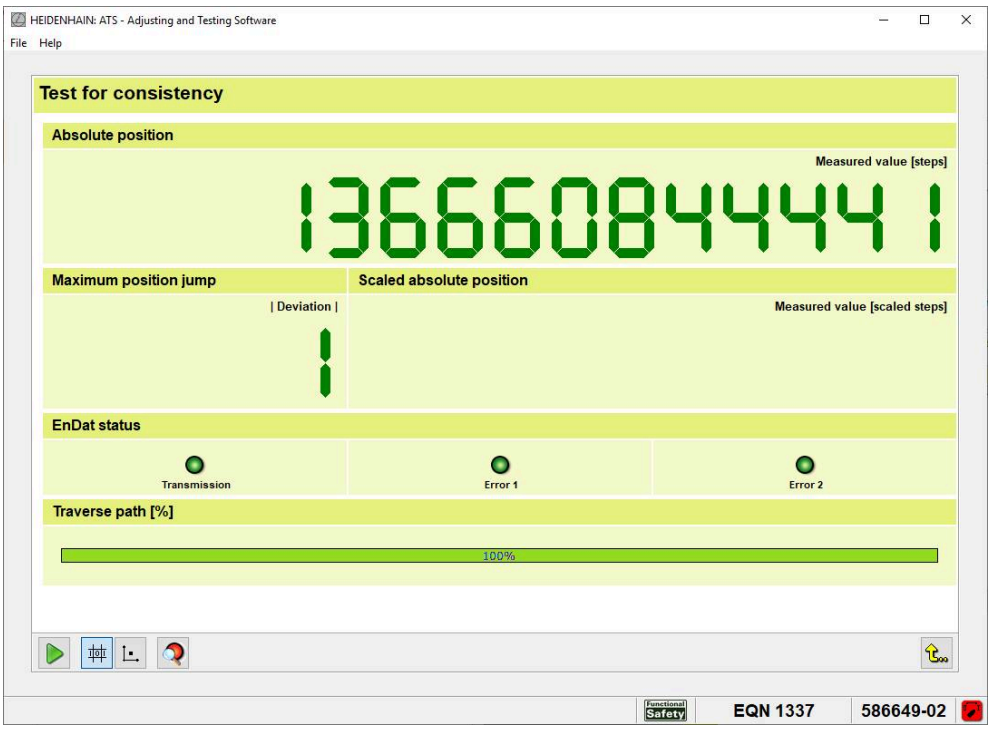


Figure 113: Result of the test for consistency

You can switch the counter display between measured values view and position view.

Further information: "Switching between measured values view and position view", Page 176

On the **Encoder status** screen, you can view status messages and delete them if necessary.

Further information: "Displaying status messages", Page 185

- Click **Return to last view** to return to the software wizard
- Click **Next** to continue

> The software wizard shows information on the **Comparison of position values**

Comparison of Position Values

The Adjusting and Testing Software scales the position value 1 to position value 2 and checks both position values. The position values must not differ by more than 1 bit. An active datum shift and other offset parameters are taken into account.

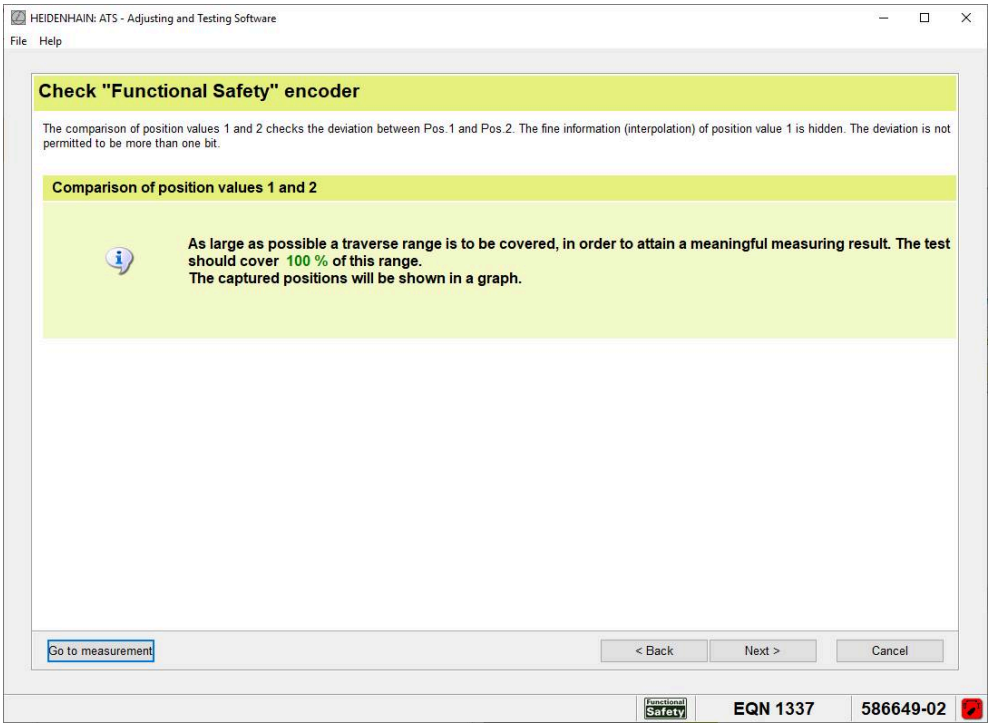


Figure 114: Information on comparison of position values

- ▶ Click **Go to measurement** to run the comparison of position values
- > The **Measurement** screen is shown

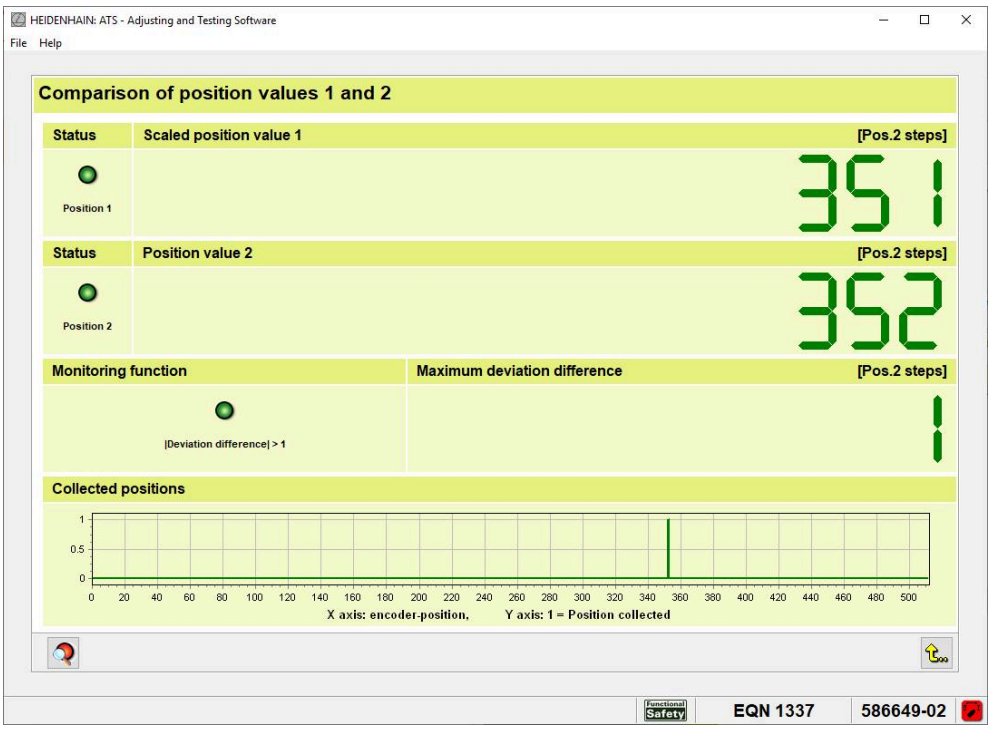


Figure 115: **Measurement** screen of the comparison of position values

Depiction	Description
Position 1	Status display of absolute position 1 The status display comprises the data transfer between the encoder and the testing device (CRC test) as well as the error group 1 and the error group 2. ■ Green: No status message available ■ Red: Status message available
Scaled position value 1	Position value 1, scaled to resolution of position value 2 Unit: increments
Position 2	Status display of absolute position 2 The status display comprises the data transfer between the encoder and the testing device (CRC test) as well as the error group 1 and the error group 2 ■ Green: No status message available ■ Red: Status message available
Position value 2	Position value 2 output by the encoder Unit: increments
Monitoring function	Status display of comparison of position values ■ Green: Maximum deviation ≤ 1 ■ Red: Maximum deviation > 1

Depiction	Description
Maximum deviation difference	Maximum deviation of the scaled position value 1 from position value 2

> If the maximum deviation is > 1, the value is displayed in red color.

Collected positions diagram

The position values for the comparison of position values are captured by traversing the encoder. The Adjusting and Testing Software displays positions not yet captured as edges. Once all positions have been captured, a continuous line is displayed at Y = 1.

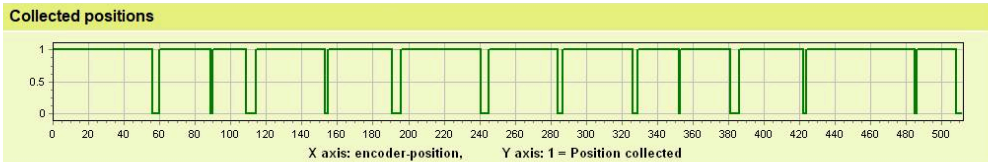


Figure 116: Collected positions diagram

Depiction	Description
X axis	Encoder position
Y axis	■ Value 0 = Position not captured ■ Value 1 = Position captured

Operating elements

Icon	Function
	**Show status information** Displays a list of errors and warnings

- ▶ Traverse the entire measuring range several times until the **Collected positions** diagram contains no more edges
- > The Adjusting and Testing Software shows the **maximum deviation difference** of the collected position values

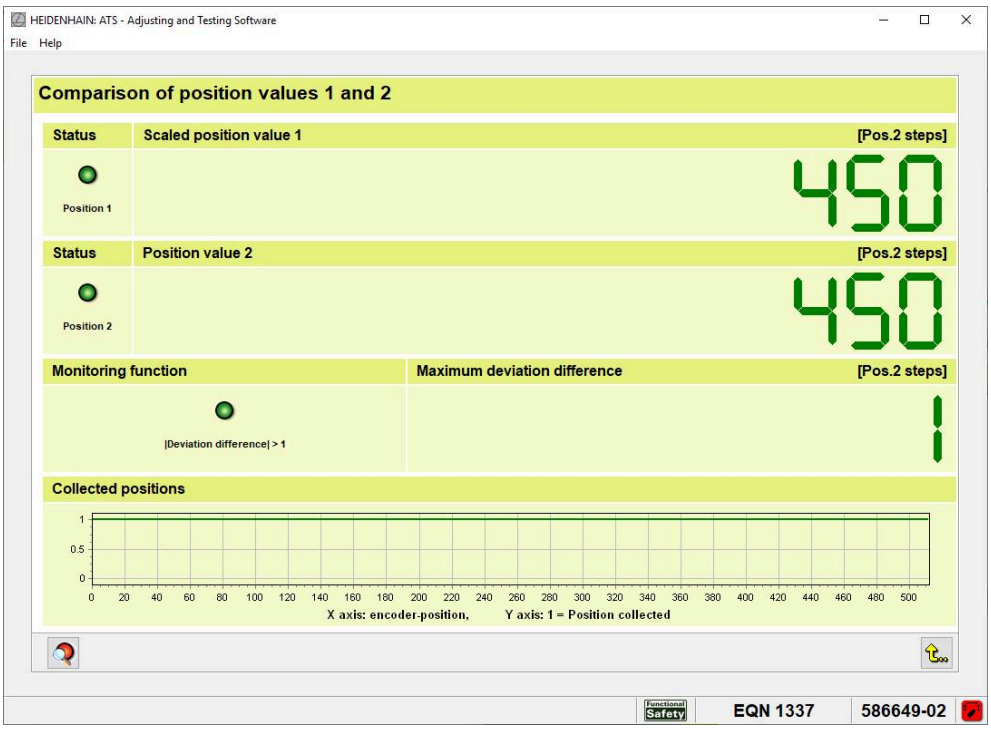


Figure 117: Result of comparison of position values

The encoder is working correctly, if the determined deviation difference is no more than 1.

On the **Encoder status** screen, you can view status messages and delete them if necessary.

Further information: "Displaying status messages", Page 185

- Click **Return to last view** in the control bar to return to the software wizard
- Click **Next** to continue

> The software wizard displays the results of the functional-safety encoder check

Results overview of the functional-safety encoder check

The overview shows the results of the functional-safety encoder check.

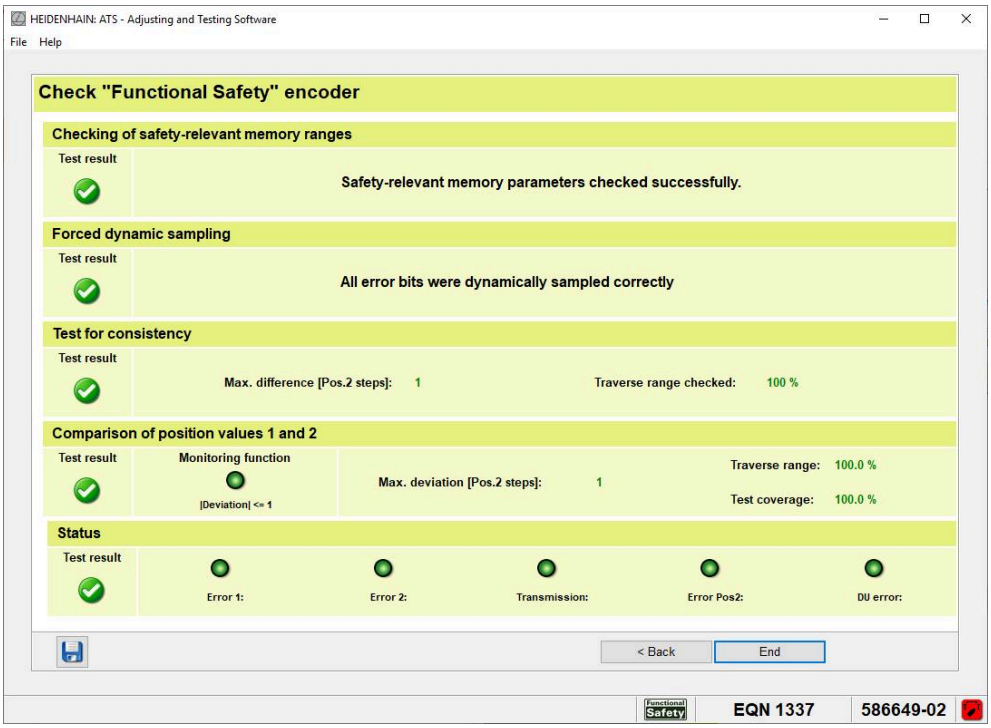


Figure 118: Results overview of the functional-safety encoder check

> Red values or status displays indicate a malfunction of the encoder.

Depiction	Description
Checking of safety-relevant memory ranges	Result of memory comparison
Forced dynamic sampling	Result of forced dynamic sampling If the test returned errors, an overview of the error types concerned is displayed.
Test for consistency	Result of the test for consistency ■ Max. difference: Maximum deviation of scaled position value 1 ■ Traverse range checked: Measuring distance traversed during the test Unit: Percent

Depiction	Description
Comparison of position values	Result of comparison of position values ■ Monitoring function: Status display of comparison of position values ■ Green: Maximum deviation ≤ 1 ■ Red: Maximum deviation > 1 ■ Max. deviation: Maximum deviation of the scaled position value 1 from position value 2 ■ Traverse range: Measuring distance traversed during the test Unit: Percent ■ Test coverage: Position values captured in the traversed path Unit: Percent
Status	Status displays: ■ Error 1: Error group 1 ■ Error 2: Error group 2 ■ Transmission: Data transfer between encoder and testing device (CRC test) ■ Error Pos2: Error of position value 2 ■ DU error: Internal safety-relevant encoder errors Status: ■ Green: No status message available ■ Red: Status message available

The symbol in column 1 indicates whether and with which result a test was performed.

Icon	Description
	■ Test performed ■ Test completed without error
	■ Test not performed or ■ Test found errors

Operating elements

Icon	Function
	**Save file** Opens the dialog for saving the log to a TXT file

Procedure in the event of errors

If the functional-safety encoder check returns errors, proceed as follows:

- ▶ Abort the functional-safety encoder check
- ▶ Reset status messages
  Further information: "Resetting status messages", Page 187
- ▶ Repeat the functional-safety encoder check
- ▶ If errors are found again, contact the HEIDENHAIN Service

11.7.2 Saving the log

You can save the results of the functional-safety encoder check in a PDF file.

- Click **Save log** in the control bar
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**
- > The file is saved

In the Adjusting and Testing Software, you can add an individual header and details on the examiner to the logs.
Further information: "Saving log information", Page 50

To display the PDF contents correctly, the font "Arial Unicode MS" must be installed on the computer.

11.8 Loading and editing the encoder configuration

Encoders with EnDat interface feature an internal encoder memory. You can access the encoder memory via the Adjusting and Testing Software. Thus you have the following options:

- Load encoder configuration from encoder
- Save encoder configuration to a file
- Load encoder configuration from a file
- Edit encoder configuration and transfer it to the encoder

A detailed description of the memory areas and data words can be found in the document "Bidirectional synchronous serial interface for position encoders" with the document ID D297403 (available on request).

11.8.1 Display encoder memory function

With the **Display encoder memory** function you can load the encoder configuration from the connected encoder to the Adjusting and Testing Software and navigate in the folder structure.

- To call this function, double-click **Display encoder memory** in the function menu

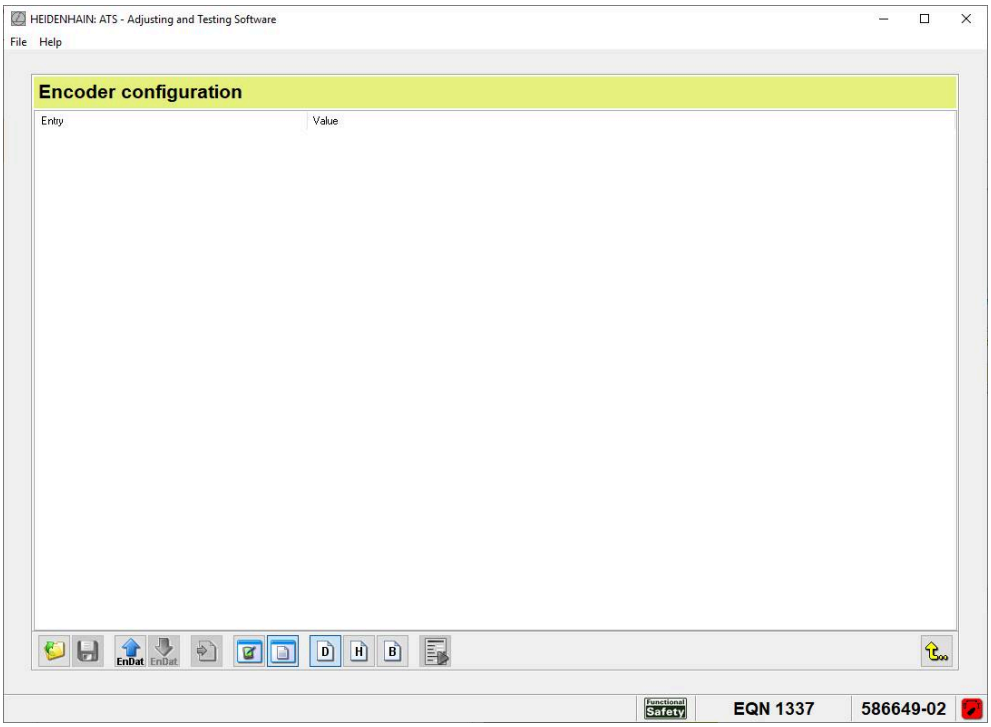


Figure 119: **Display encoder memory** function

Operating elements

Icon	Function
	**Load file** Opens the dialog for selecting the file containing the encoder configuration
	**Save file** Opens the dialog for saving the encoder configuration to an ECF file
	**Load encoder memory** Starts the export of the encoder memory
	**Save in encoder** Opens the dialog for overwriting selected memory areas in the encoder
	**Close all folders** Reduces folder display to the first level
	**Display functions** Shows the encoder data in functions
	**Display data words** Displays the encoder data in data words
	**Decimal format** Shows numerical values in decimal format
	**Hexadecimal format** Shows numerical values in hexadecimal format
	**Binary format** Shows numerical values in binary format
	**Save encoder information** Opens the dialog for saving the encoder information to a TXT file

11.8.2 Loading the encoder configuration from the encoder memory

- ▶ Click **Load encoder memory** in the control bar
- > The encoder memory is read out
- > The folder structure of the encoder configuration is displayed

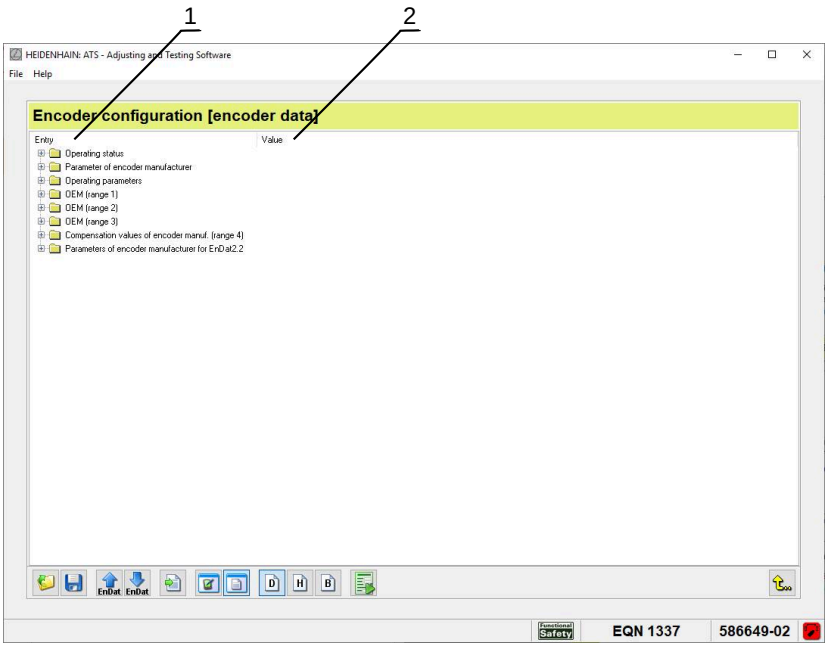


Figure 120: Folder structure of the encoder configuration for EnDat 2.2 interface (example)

1 Entry: Memory areas
2 Value: Values assigned to the memory area

The folder structure depends on the connected encoder.

11.8.3 Adapting the encoder configuration view

Switching between data view and functions view

In the **Encoder configuration** function you can switch between the following views:

- **Data view**
- **Function view**

Data view

The Adjusting and Testing Software shows the memory contents in data words (image of the encoder memory).

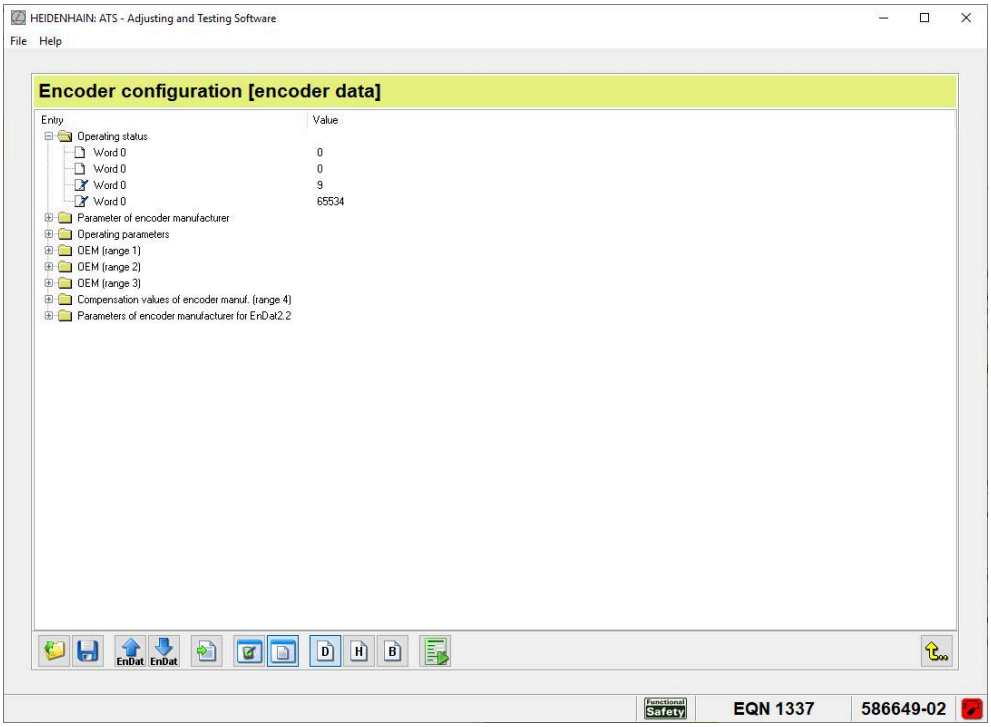


Figure 121: Data view

Function view

The Adjusting and Testing Software interprets the data words according to the EnDat specification and assigns functions to the memory contents.

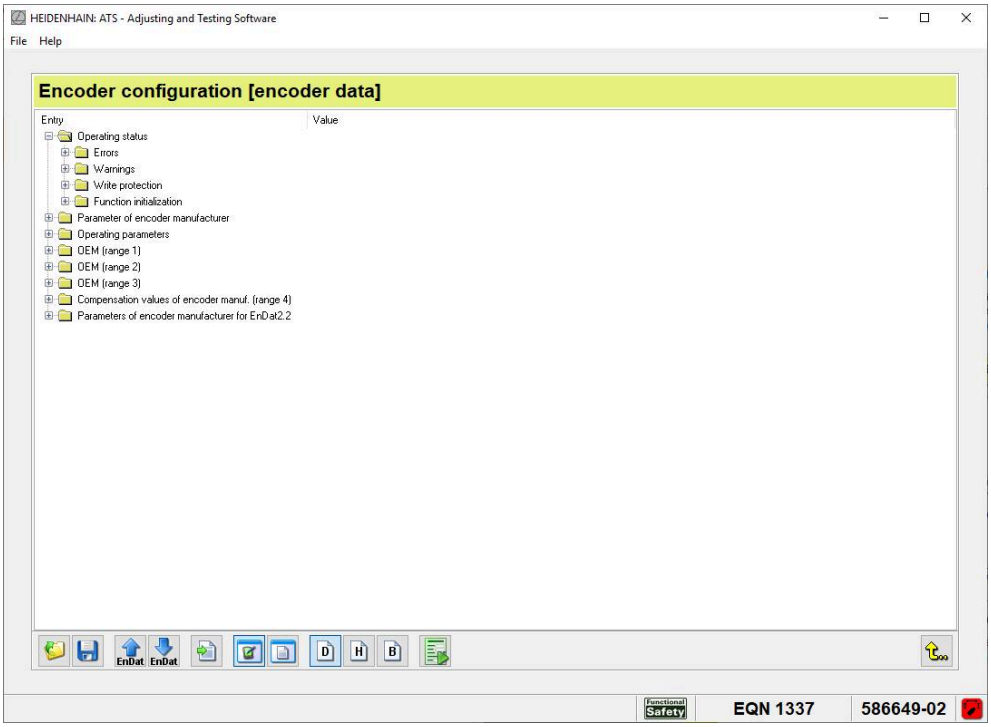


Figure 122: Function view

Switching between the views

When the **Display memory contents** function is called, the data view is displayed.

- Click **Display functions** in the control bar to switch to the function view

- Click **Display data words** in the control bar to return to the data view

Adjusting the number format

You can choose between different number formats for displaying numerical values.

- Click **Decimal format** in the control bar to display numerical values in decimal format

- Click **Hexadecimal format** in the control bar to display numerical values in hexadecimal format

- Click **Binary format** in the control bar to display numerical values in binary format

Closing all folders

You can reduce the folder structure to the top level in the **Encoder configuration** function.

- Click **Close all folders** in the control bar

> The folder structure is reduced to the top level

11.8.4 Saving the encoder configuration to a file

If you have loaded an encoder configuration in the Adjusting and Testing Software you can save this configuration in an ECF file. You can then open this file again in the Adjusting and Testing Software and transfer the data to the encoder.

- Click **Save file** in the control bar
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**

> The file is saved

11.8.5 Saving encoder information to a file

You can save important information on the connected encoder—such as serial number, length of measuring step, datum shift—in a TXT file. Which information the TXT file comprises depends on the encoder.

- Click **Save encoder information** in the control bar
- Select the desired storage location in the dialog
- Enter the file name
- Click **Save**

> The file is saved

11.8.6 Loading the encoder configuration from a file

You can load an encoder configuration from an ECF file in the Adjusting and Testing Software.

- Click **Load file** in the control bar
- Select the storage location of the file
- Click **Open**
- > The encoder configuration is loaded from the file
- > The folder structure of the encoder configuration is displayed
- > The file name is shown in the title bar

11.8.7 Editing the encoder configuration

You can edit individual values in the displayed encoder configuration. Afterwards you can transfer the changed encoder configuration to the encoder.

The document symbol in the line indicates whether a value can be edited:

Display	Description
	Value can be edited
	Value cannot be edited
	Value cannot be edited; the data word is the result of a calculation or consists of several data words, e.g. ID 557650-06

Memory areas may be write-protected. You will find an overview of the write-protected memory areas in the encoder configuration.

Further information: "Overview of write-protected memory areas", Page 235

Editing values

⚠ WARNING

Danger of uncontrolled axis movements due to datum shift

Overwriting the "Zero point" value in the encoder memory can cause uncontrolled movements of the machine axes. This may result in death, serious injuries, or damage to equipment.

- Only execute datum shifts in the **Position display** function
- Do not manually change the "Zero point" value in the encoder configuration

Editing numerical values

- ▶ Click the value
- > The input field is activated
- ▶ Enter the desired value
- ▶ Confirm with **Enter**
- > The new value is shown in the encoder configuration

or

- ▶ Click the value
- > The input field is activated
- ▶ Click **Edit** next to the input field

- > The editing window is displayed

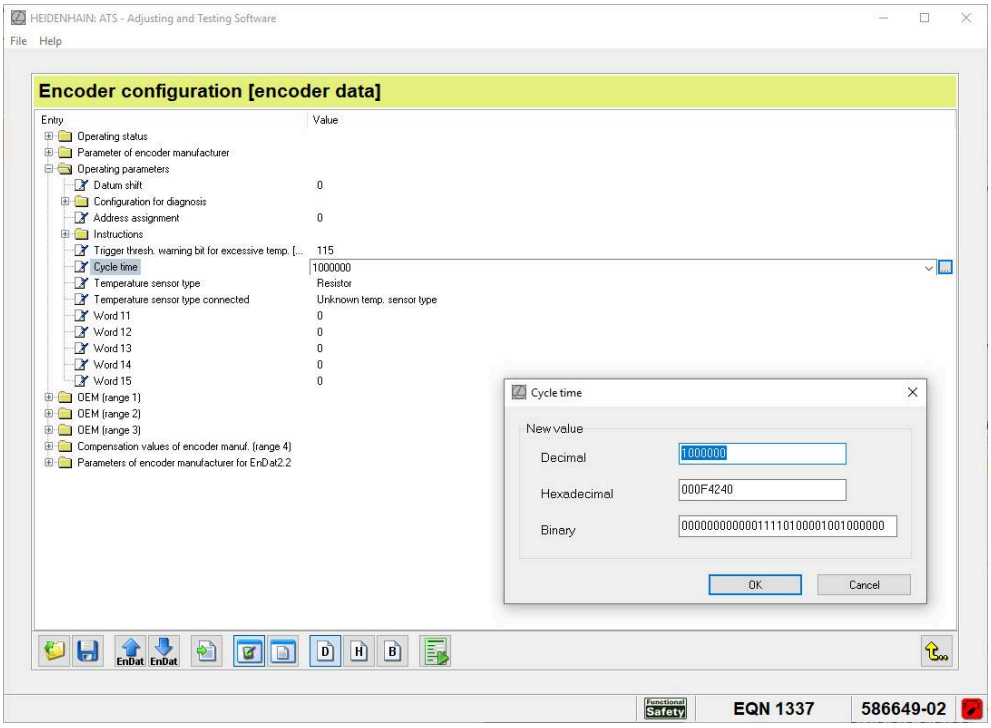


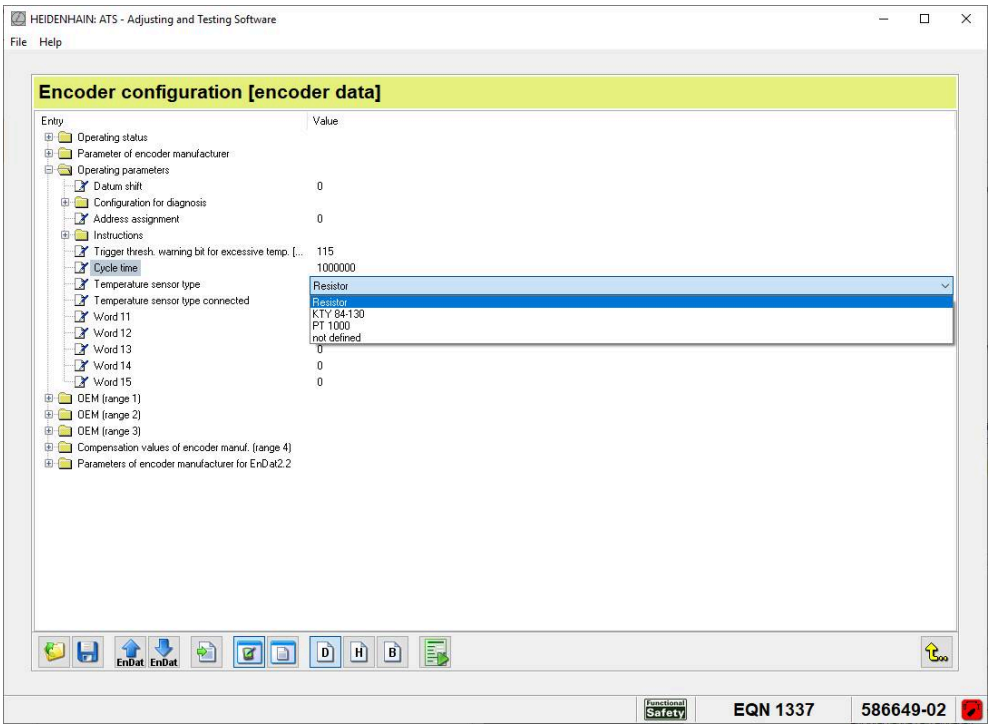
Figure 123: Encoder configuration with editing window

- ▶ Enter the value in one of the following number formats in the corresponding field
  - Decimal
  - Hexadecimal
  - Binary
- ▶ Confirm with **OK**
- > The new value is shown in the encoder configuration

Editing text values

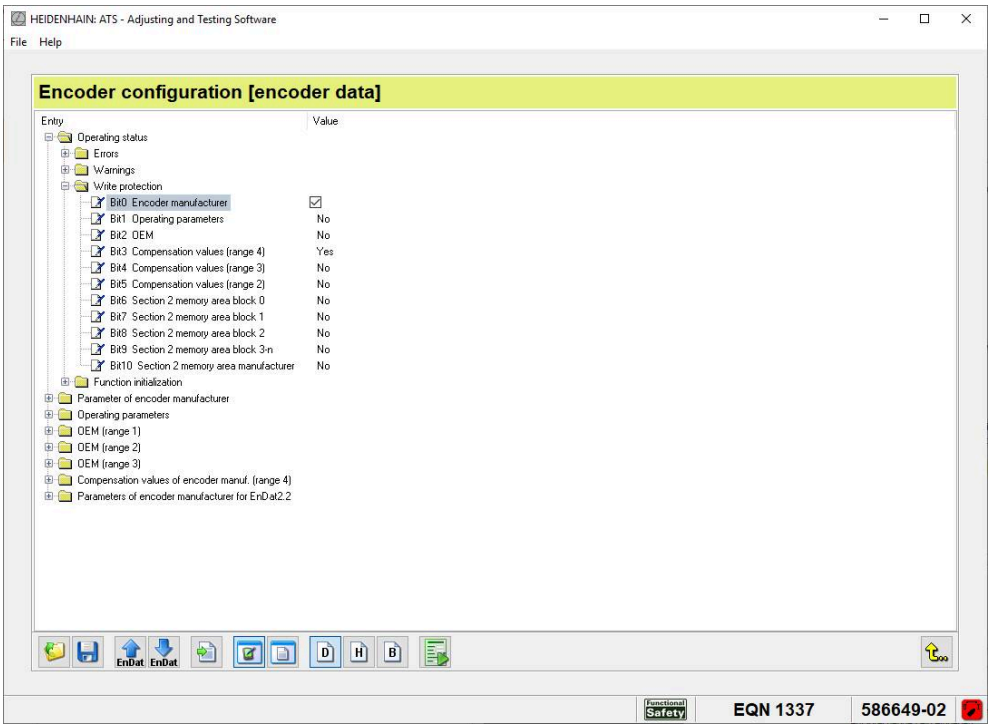
- Click the value
- Select the desired value from the drop-down list

> The new value is shown in the encoder configuration



Editing yes/no values

- ▶ Click the value
- > A check box is displayed instead of the value
- ▶ Check the box to select the value "Yes"
- ▶ Remove the tick from the checkbox to select "No"
- ▶ Confirm with **Enter**
- > The new value is shown in the encoder configuration



Afterwards you can transfer the changed encoder configuration to the encoder or save it to a file.

Further information: "Saving the encoder configuration in the encoder", Page 232

Further information: "Saving the encoder configuration to a file", Page 226

Setting write-protection

To prevent machine-relevant parameters from being changed, you can assign write protection to individual memory areas. This is necessary, particularly to ensure machine safety and system reliability.

The **Parameters of encoder manufacturer** memory area is write-protected by default.

> Write protection can only be canceled by the HEIDENHAIN Service.

- ▶ Click **Load encoder memory** in the control bar
- > The encoder memory is read out
- > The folder structure of the encoder configuration is displayed

- ▶ Navigate to the **Write protection** folder
  Path: **Operating status** ▶ **Write protection**

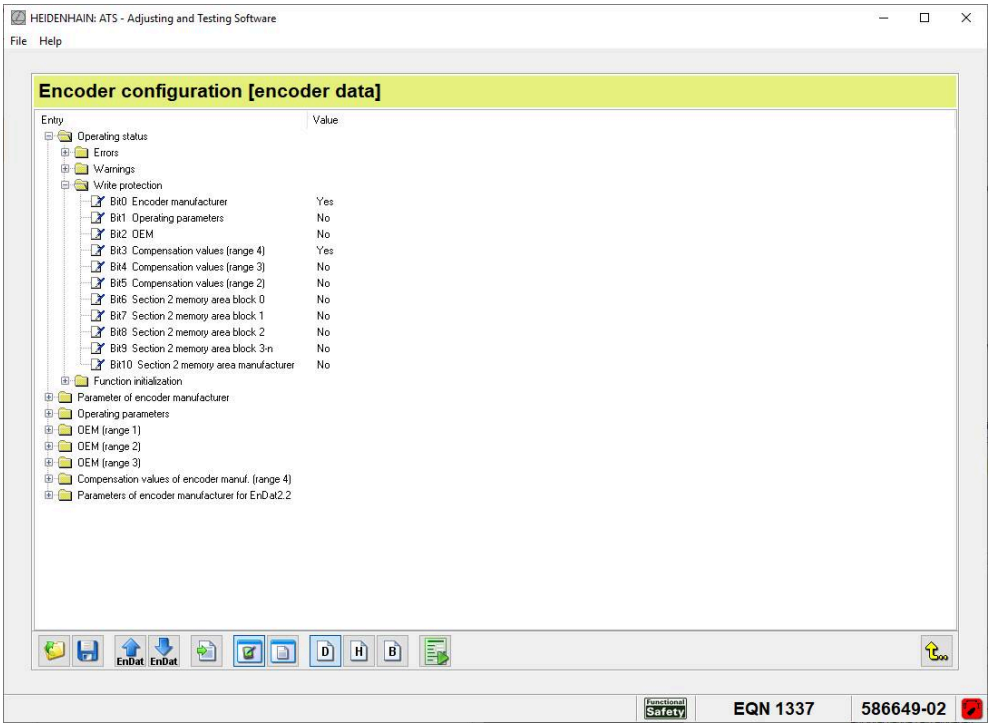


Figure 124: Function view with **Write protection** folder

- ▶ Click the value "No" in the line of the desired memory area
- > A check box is displayed instead of the value
- ▶ Check the box to select the value "Yes"
- ▶ Confirm with **Enter**
- ▶ To activate write protection in the encoder, save the changed encoder configuration in the encoder
  Further information: "Saving the encoder configuration in the encoder", Page 232

Saving the encoder configuration in the encoder

You can use the Adjusting and Testing Software to overwrite memory areas of the encoder, for example to restore the default configuration using a backup file.

- Click **Load file** in the control bar to load the encoder configuration you wish to save in the encoder
- Select the storage location of the file
- Click **Open**
- > The encoder configuration is loaded from the file
- > The folder structure of the encoder configuration is displayed

- Click **Save in encoder** to transfer the displayed encoder configuration to the encoder
- > The **Selection of memory area** dialog appears
- Select the memory areas you want to overwrite
- Click **Transfer**
- > The encoder configuration is transferred to the encoder
- > The selected memory areas are overwritten

Memory areas may be write-protected. You will find an overview of the write-protected memory areas in the encoder configuration.

Further information: "Overview of write-protected memory areas", Page 235

11.8.8 Overviews

Below you will find some example overviews of the encoder configuration.

Overview of supported error messages and warnings

The encoder configuration provides an overview of the error messages and warnings the encoder supports.

Path to the overview of the error messages:
Parameters of the encoder manufacturer ► Support of error messages

Path to the overview of the warnings:
Parameters of the encoder manufacturer ► Support of warnings

Supported error messages and warnings are identified by the value "Yes".

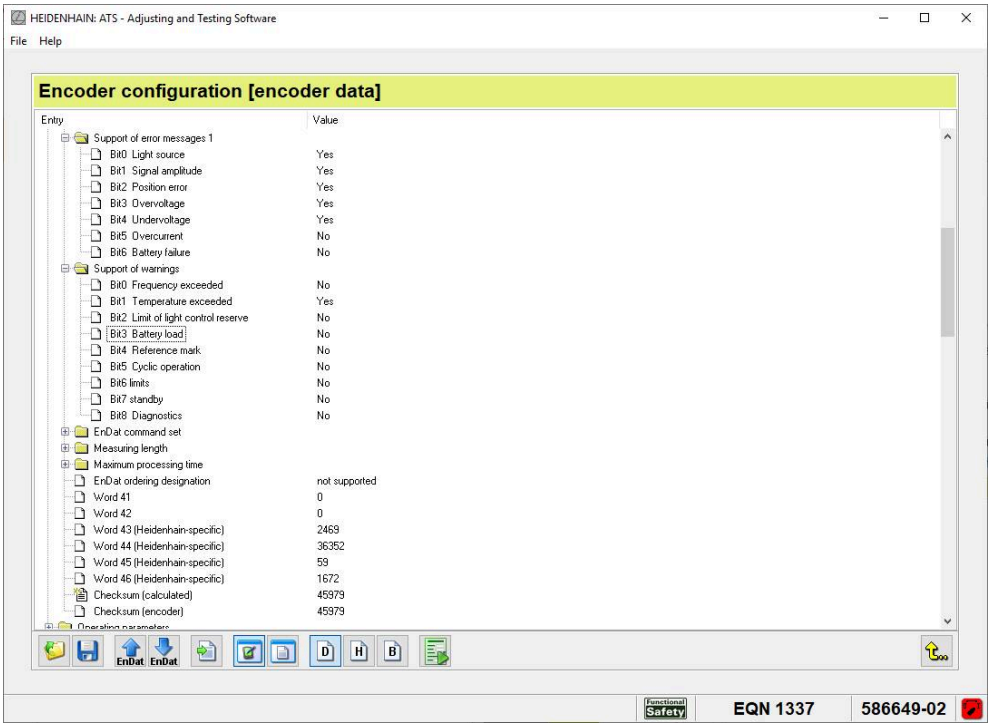


Figure 125: Function view with the folders **Support of error messages** and **Support of warnings**

Overview of supported operating status error sources

The encoder configuration of encoders with EnDat 2.2 interface provides an overview of the operating status error sources the encoder supports.

Path: **Parameters of the encoder manufacturer ► Manufacturer parameters EnDat 2.2 ► Support of operating status error sources**

Supported operating status error sources are identified by the value "Yes".

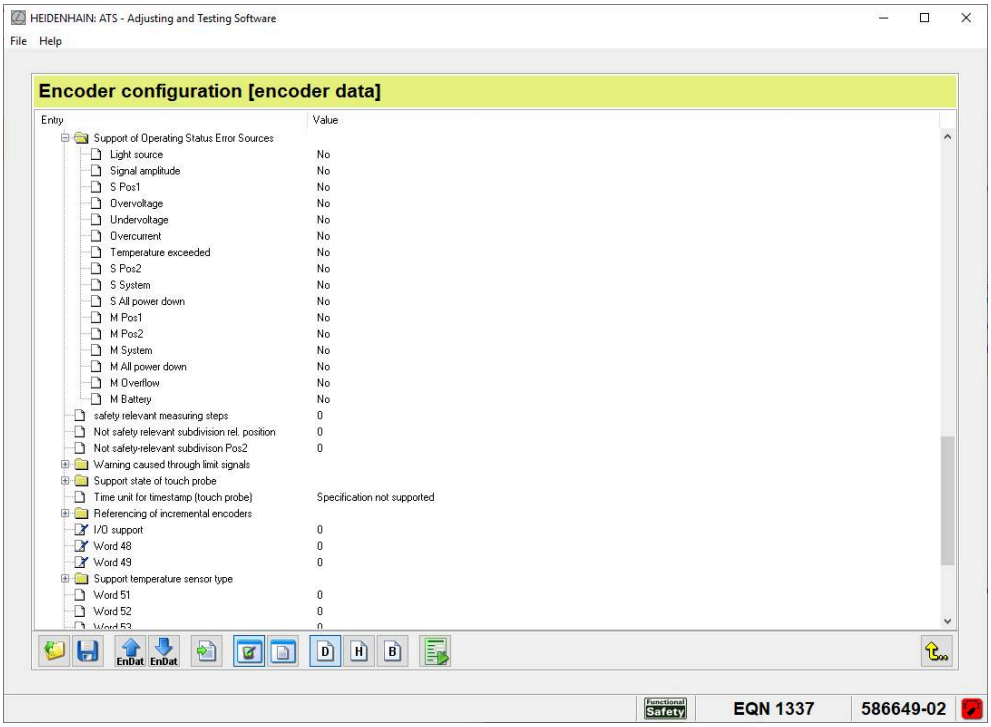


Figure 126: Function view with the folder **Support of operating status error sources**

Overview of write-protected memory areas

The encoder configuration provides an overview of the write-protected memory areas.

Path: **Operating status ► Write protection**

Write-protected memory areas are identified by the value "Yes".

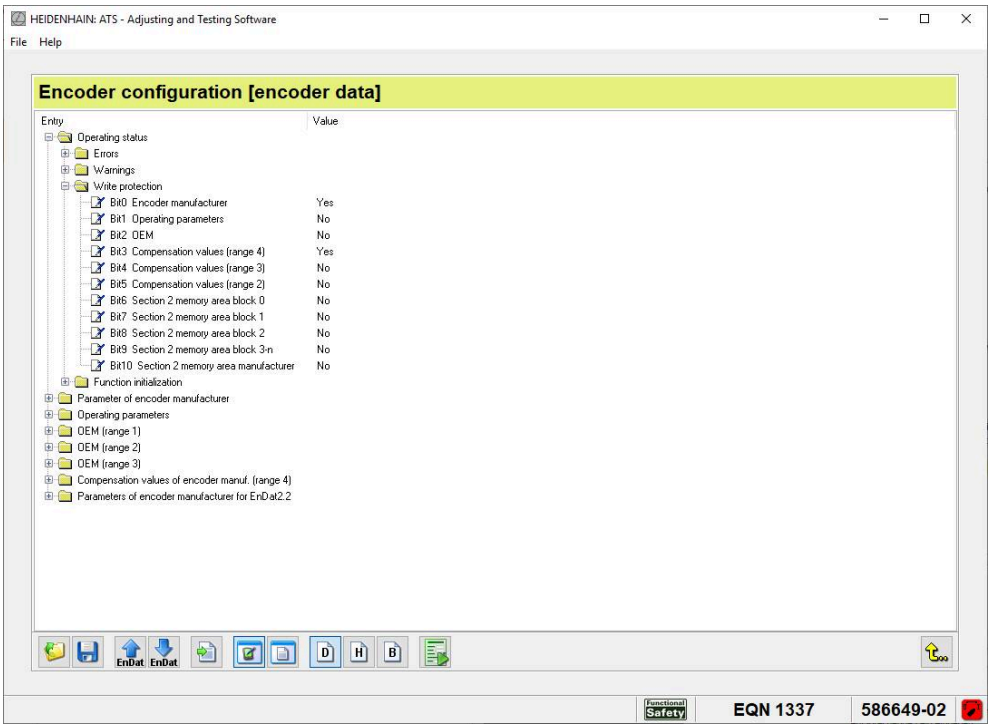


Figure 127: Function view with **Write protection** folder

Overview of supported valuation numbers

The encoder configuration provides an overview of the valuation numbers the encoder supports.

Path: **Parameters of the encoder manufacturer for EnDat 2.2 ► Diagnostic Status**

Supported valuation numbers are identified by the value "Yes".

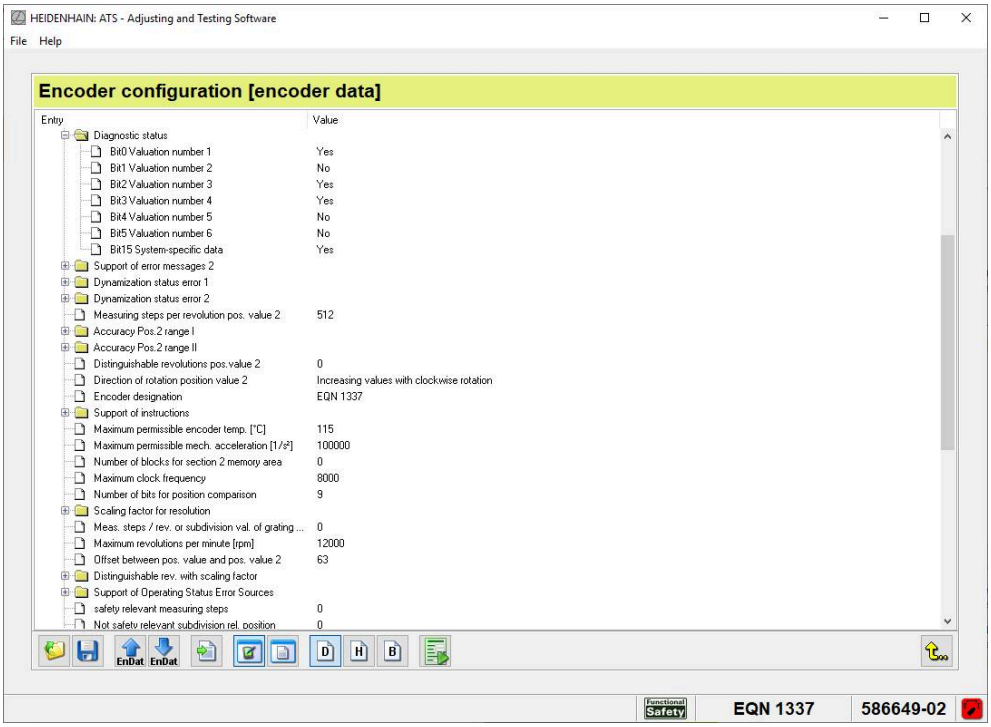


Figure 128: Function view with the folder **Diagnostic status**

11.9 Comparing encoder configurations

11.9.1 Comparison of encoder memory function

You compare two encoder configurations using the Adjusting and Testing Software.

The following options are available for comparing two encoder configurations:

- Load the encoder configuration from the encoder and compare it to a file
- Load the encoder configuration from a file and compare it to another file

> If the encoder configurations differ in their EnDat command set (EnDat 2.1 and EnDat 2.2), a comparison is not possible.

▶ To call this function, double-click **Comparison of encoder memory contents** in the function menu

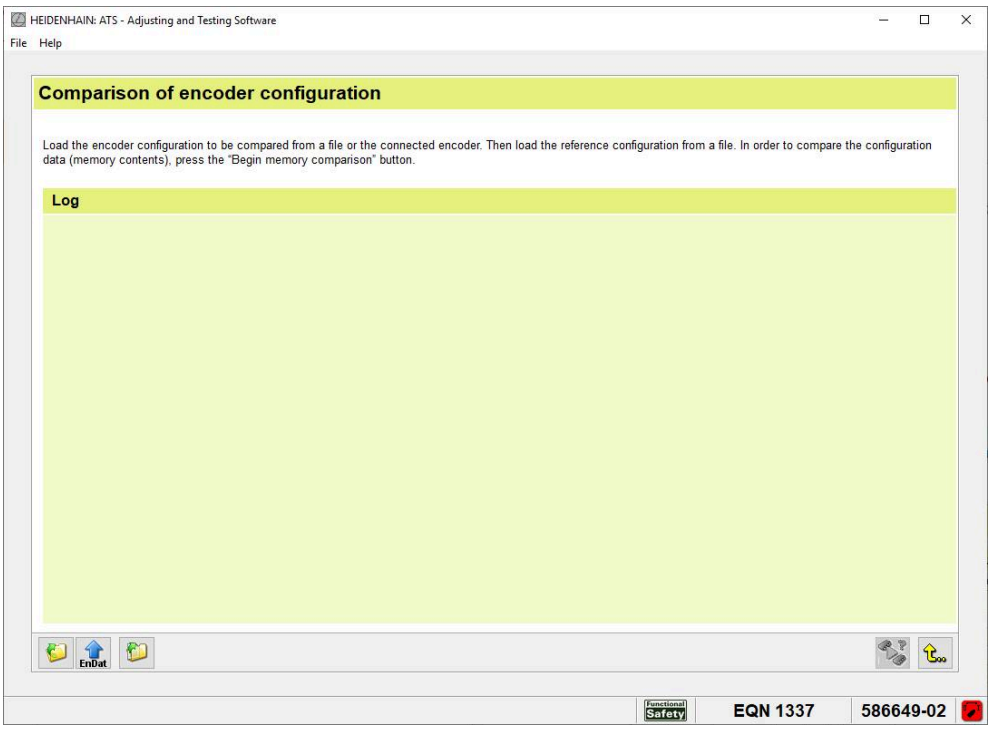


Figure 129: **Comparison of encoder memory contents** function

Operating elements

Icon	Function
	**Load file** Opens the dialog for selecting the file containing the encoder configuration
	**Load encoder memory** Starts the export of the encoder memory
	**Load comparison file** Opens the dialog for selecting the file containing the encoder configuration
	**Start comparison** Starts the comparison of the loaded encoder configurations

11.9.2 Loading and comparing encoder configurations

For comparison, load two encoder configurations in the Adjusting and Testing Software. You can load the encoder configuration 1 from the encoder or from a file. Then load the encoder configuration 2 from a file and start the comparison.

Loading encoder configuration 1 from encoder

- ▶ Click **Load encoder memory** in the control bar
- > The encoder memory is read out
- > The following message appears in the **Log** section: **Encoder configuration 1 loaded**

or

Loading encoder configuration 1 from a file

- ▶ Click **Load file** in the control bar
- ▶ Select the storage location of the file
- ▶ Click **Open**
- > The following message appears in the **Log** section: **Encoder configuration 1 loaded**

Loading encoder configuration 2 from a file

- ▶ Click **Load comparison file** in the control bar
- ▶ Select the storage location of the file
- ▶ Click **Open**
- > The following message appears in the **Log** section: **Encoder configuration 2 loaded**

Starting the comparison

As soon as the Adjusting and Testing Software has loaded the two encoder configurations, you can start the comparison.

- Click **Start comparison** in the control bar
- The differences between the two encoder configurations are listed in a table

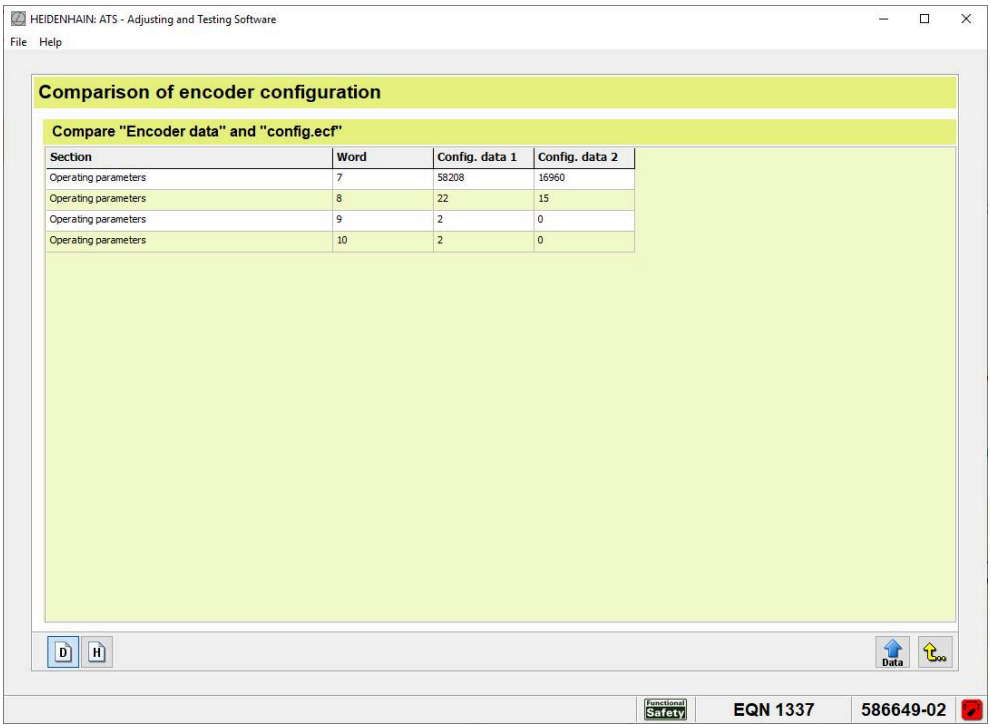


Figure 130: Table with differences between the encoder configurations

There may be differences even between encoders with identical encoder ID, e.g. the serial number or signal correction values that are determined individually for every encoder.

Operating elements

Icon	Function
D	**Decimal format** Shows numerical values in decimal format
H	**Binary format** Shows numerical values in binary format
EnDat	**Load encoder memory** Shows the screen for loading encoder configurations

Adjusting the number format

You can choose between different number formats for displaying numerical values.

- Click **Decimal format** in the control bar to display numerical values in decimal format

- Click **Hexadecimal format** in the control bar to display numerical values in hexadecimal format

Repeating the comparison

In order to perform another comparison you can return to the selection of the encoder configuration.

- ▶ Click **Load encoder memory** in the control bar
- > The Adjusting and Testing Software displays the **Log** section

11.10 Display of additional sensors

Some encoders feature multiple sensors, e.g. temperature sensors of a direct drive. You can view the measured values of the sensors in the **Additional sensors** function.

- ▶ Double-click **Additional sensors** in the function menu
- > The Adjusting and Testing Software displays the measured values of the sensors

Operating elements

Icon	Function
	**Display of measured value in Fahrenheit** Switches the measured value display from Celsius to Fahrenheit

11.11 Measuring temperature

Some encoders feature temperature sensors. You can view the current temperature values in the **Temperature display** function. Depending on the encoder, internal and external temperature sensors are displayed, e.g. temperature switches or temperature-dependent resistors in the drive.

- ▶ Double-click **Temperature display** in the function menu to call the function
- > The Adjusting and Testing Software displays the current temperatures

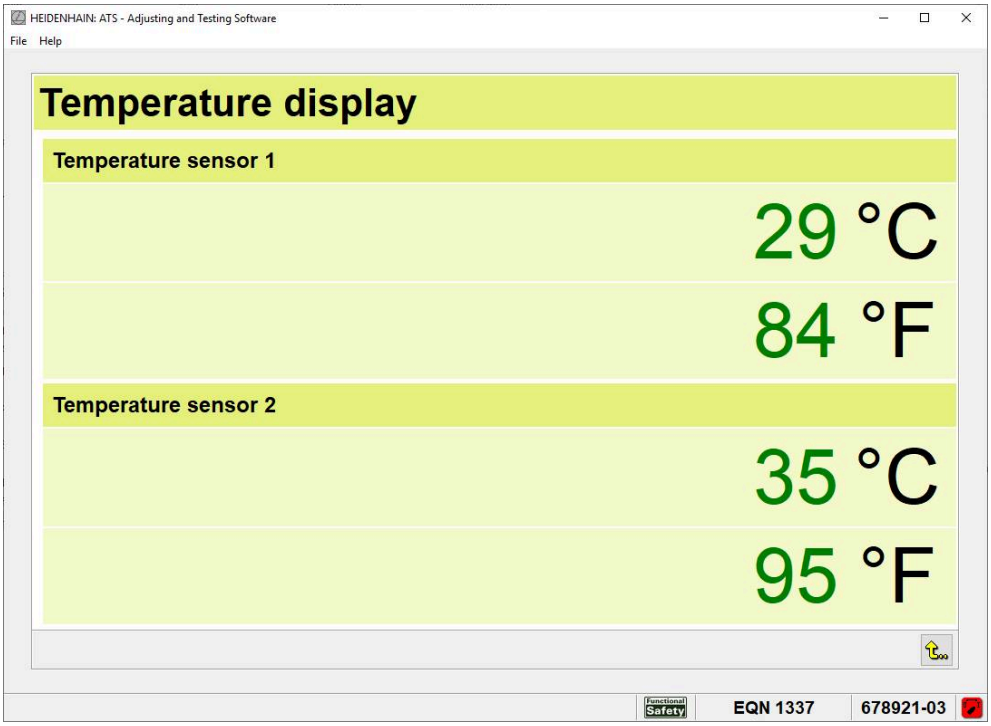


Figure 131: **Temperature display** function

Extremely high temperature values indicate that the temperature sensor is not connected, a contact is open or a cable has broken. Extremely low temperature values may suggest a short circuit.

Conversion of the temperature value for the PT 1000 temperature sensor

The internal temperature evaluation of HEIDENHAIN encoders typically refers to the **KTY 84-130** temperature sensor. For measurement with the **PT 1000** temperature sensor, the temperature value must be converted.

The conversion can be performed by the encoder, by the Adjusting and Testing Software or by the subsequent electronics (depending on the encoder). For this purpose the corresponding parameters must be configured in the encoder configuration.

A detailed description of the temperature value conversion can be found in the "Encoders for Servo Drives" brochure, chapter "Connectable temperature sensors". The brochure is available in the download area of the HEIDENHAIN website.

Link: **www.heidenhain.de**

Path: Documentation ▶ Brochures

Supported temperature sensor types (word 50)

Temperature value conversion within the encoder is only possible if the encoder supports the evaluation of the **PT 1000** temperature sensor. To see which temperature sensor types the encoder supports, refer to the encoder configuration.

Path: **Parameters of the encoder manufacturer for EnDat 2.2 ▶ Support temperature sensor type** (word 50)

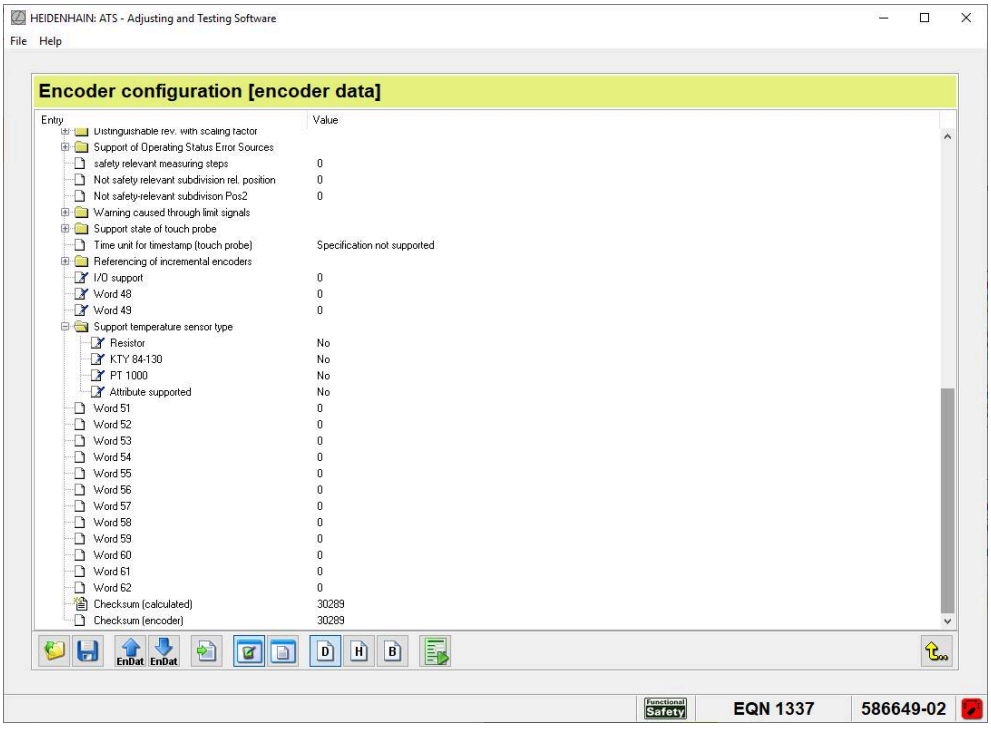


Figure 132: **Support temperature sensor type** parameter in the encoder configuration

Supported temperature sensor types are identified by the value "Yes".

Conversion of the temperature value by the encoder (word 9)

Prerequisite: The encoder supports the evaluation of the **PT 1000** temperature sensor.

If the value **PT 1000** is defined in the **Temperature sensor type** parameter, the conversion is performed by the encoder. The Adjusting and Testing Software displays the temperature value converted by the encoder.

Path: **Operating parameters** ► **Temperature sensor type** (word 9)

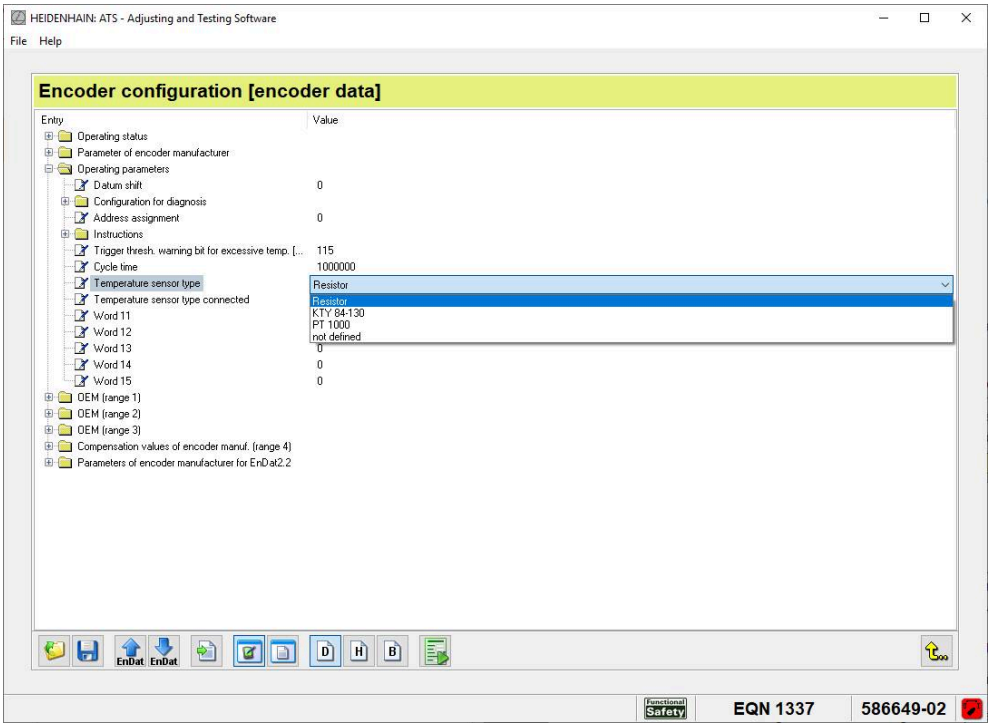


Figure 133: **Temperature sensor type** parameter in the encoder configuration

Conversion of the temperature value by the Adjusting and Testing Software (word 10)

If the encoder does not support the evaluation of the **PT 1000** temperature sensor, the conversion can be performed by the Adjusting and Testing Software. The conversion is active if the value **PT 1000** is defined for the **Temperature sensor type connected** parameter (word 10) in the encoder configuration. The setting has no effect on the internal temperature evaluation of the encoder, but can be used for display by the subsequent electronics.

Path: **Operating parameters** ► **Temperature sensor type connected** (word 10)

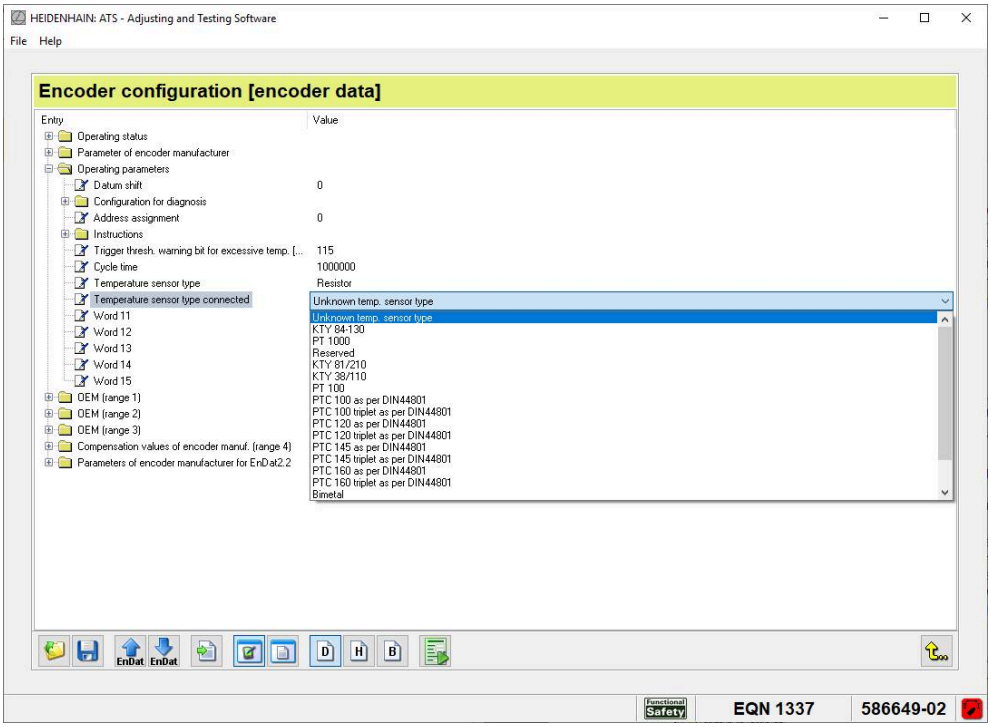


Figure 134: **Temperature sensor type connected** parameter in the encoder configuration

12

Special interface-specific functions

12.1 Overview

This chapter describes special functions of company-specific encoders.

12.2 DRIVE-CLiQ

The Adjusting and Testing Software supports the following interfaces.

- **DRIVE-CLiQ interface**

> DRIVE-CLiQ is a registered trademark of Siemens AG.

> The configuration of the encoder by the PWM differs from the configuration for real operation at the machine tool. This concerns, for example, the time of transmission. During real operation errors may occur that do not occur during encoder diagnostics with the PWM. In addition to the test with the encoder diagnostic set, an additional test during actual operation is therefore recommended.

Position display

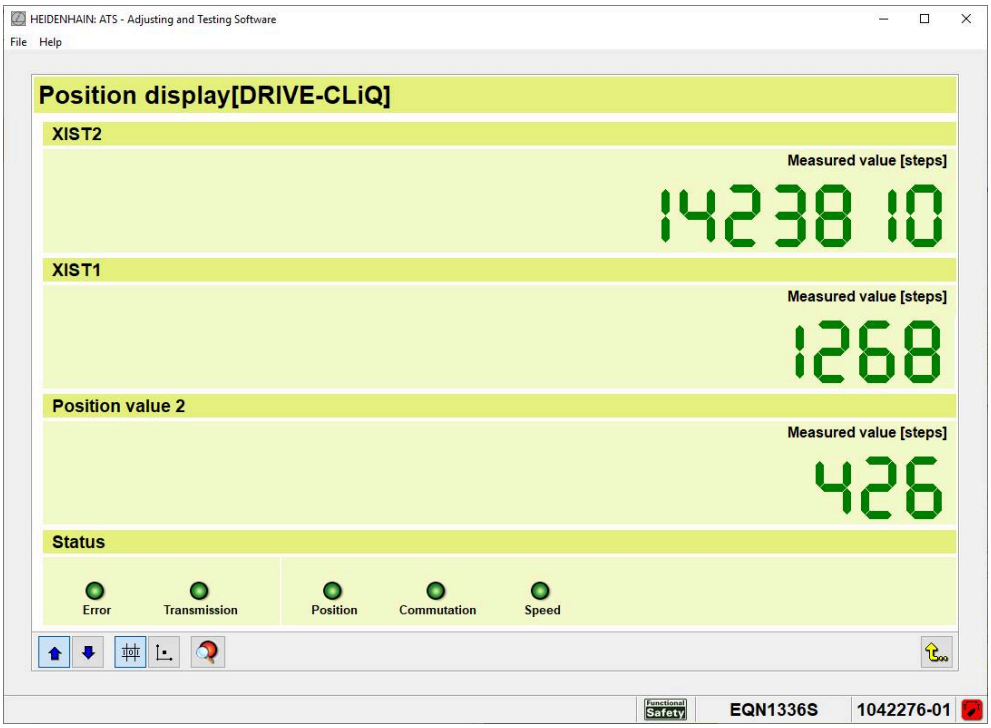


Figure 135: **Position display** function

Display	Description
XIST2	Absolute encoder position Unit: Increments
XIST1	Incremental value of the encoder position Unit: Increments
Position value 2	For encoders that support functional safety: Redundant position value
Error	Status display of encoder errors ■ Green: No status message available ■ Red: Status message available
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Position	Position status display ■ Green: No status message available ■ Red: Status message available
Commutation	Status display of commutation ■ Green: No status message available ■ Red: Status message available
Speed	Status display of speed ■ Green: No status message available ■ Red: Status message available

Supplementary screen of the position display

The Position display function features a supplementary screen with further information. To switch between the screens, the following operating elements are available in the control bar:

Icon	Function
	**Switch to standard view** Displays the standard view
	**Switch to supplementary view** Displays supplementary information

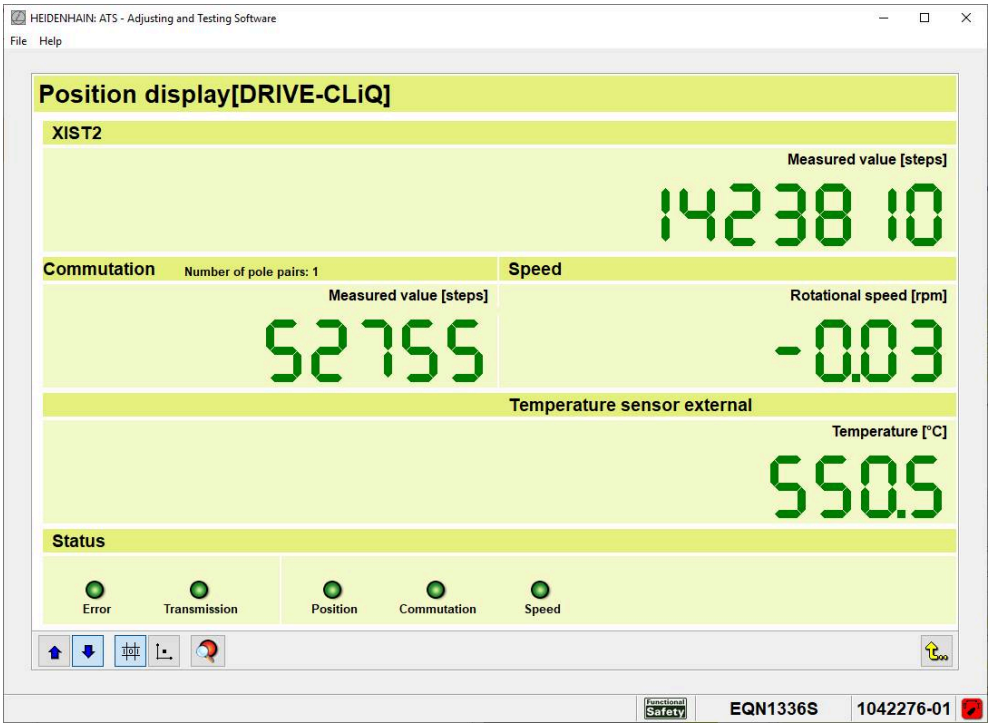


Figure 136: Supplementary screen of the **Position display** function

Display	Description
Commutation	Commutation angle with reference to the pole pair width: ■ The pole pair width for linear encoders is 25 mm; i.e. 0° to 360° are displayed within 25 mm ■ The pole pair width for rotary or angle encoders is 1; i.e. 0° to 360° are displayed within one revolution Unit: Increments
Speed	Current traversing speed or shaft speed Unit: Meters per second or revolutions per minute (depending on the encoder)
External temperature sensor	Current temperature measured by the external temperature sensor, e.g. winding temperature

Extreme temperature values indicate that the temperature sensor is not connected, a contact is open or a cable has broken.

Encoder status screen

The **Encoder status** screen provides detailed information on errors.

- Click **Status information** in the control bar to call the **Encoder status** screen

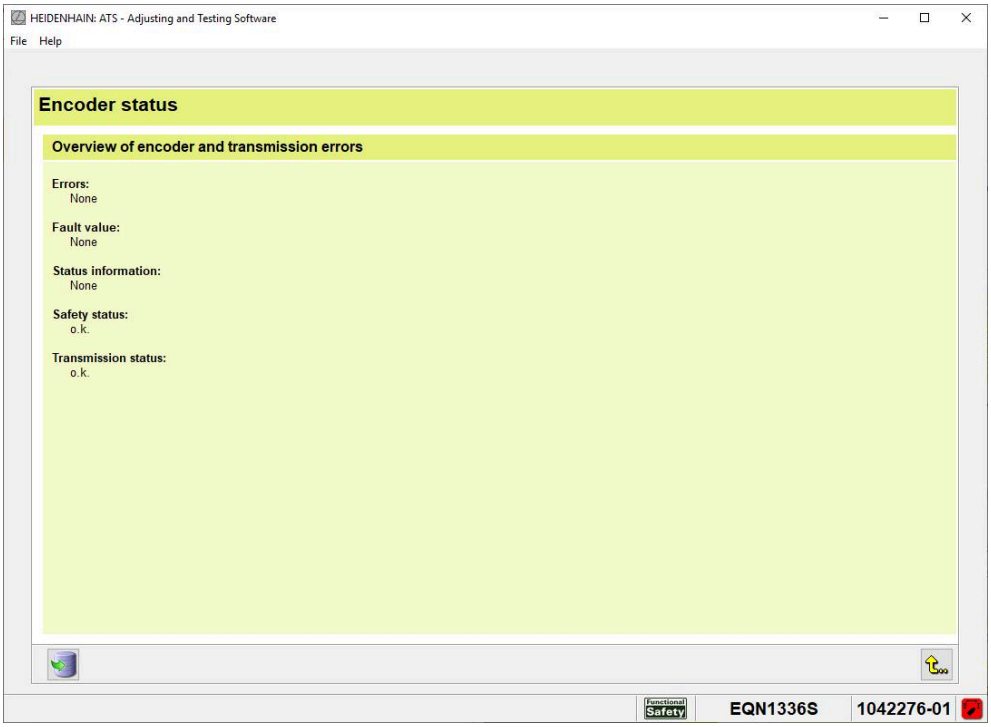


Figure 137: **Encoder status** screen

Display	Description
Errors	Information about malfunctions of the encoder, e.g. ■ Encoder error ■ Software error ■ Kernel error ■ Safety error
Fault value	Detailed information on errors (if available for the respective error number)
Status information	Messages about the encoder status
Safety status	Messages about safety-relevant functions
Transmission status	Messages about communication errors, e.g. CRC error or packet loss

Backing up the encoder configuration

You can load the encoder configuration from the encoder and save it as a ZIP file on the computer for backup or diagnostic purposes.

> The ZIP file is protected by a password and can only be decoded by the den HEIDENHAIN Service.

- ▶ Double-click **Save encoder memory** in the function menu
- > The **Save encoder memory** screen is displayed

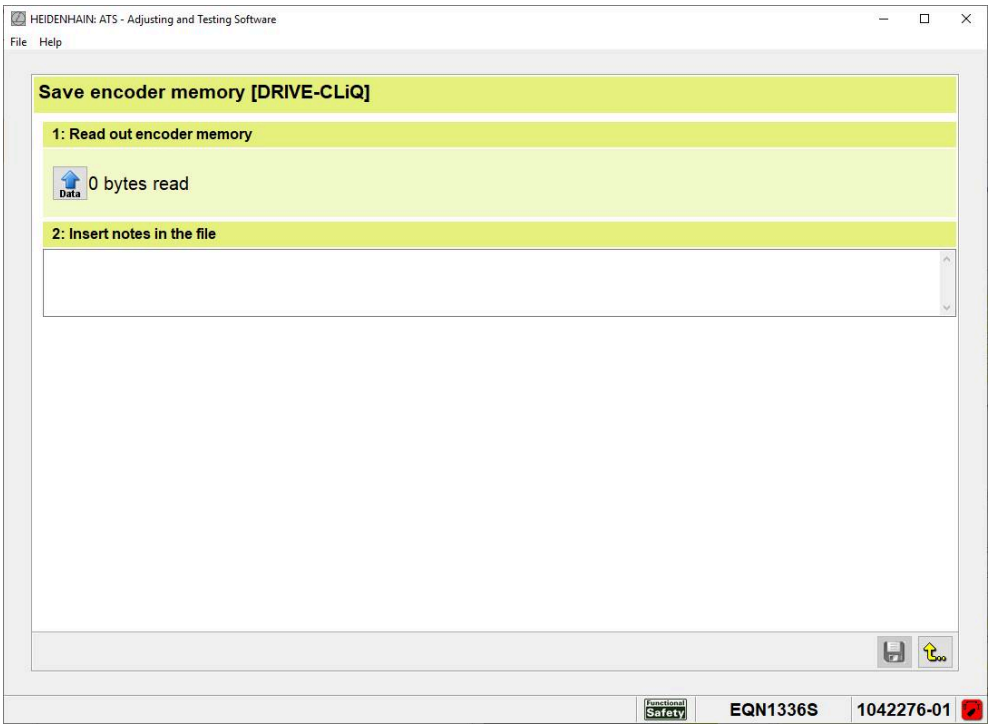


Figure 138: **Save encoder memory** screen

- ▶ Click **Read out encoder memory** in the control bar
- > The Adjusting and Testing Software shows the reading progress
- > When the data has been read out, the **Save file** operating element is displayed as active
- ▶ Enter comments in the **Notes** field, if required

- ▶ Click **Save file**
- ▶ Select the desired storage location in the dialog
- ▶ Enter the file name
- ▶ Click **Save**
- > The file is saved

Encoder parameter display function

Encoders with **DRIVE-CLiQ interface** feature the additional function **Encoder parameter display**. The **Encoder parameter display** provides information required for putting the encoder into service with Siemens controls. If the encoder is connected via a separate interface electronics, information on the interface electronics is displayed, too.

- To call this function, double-click **Encoder parameter display** in the function menu

> The Adjusting and Testing Software displays information on the connected encoder

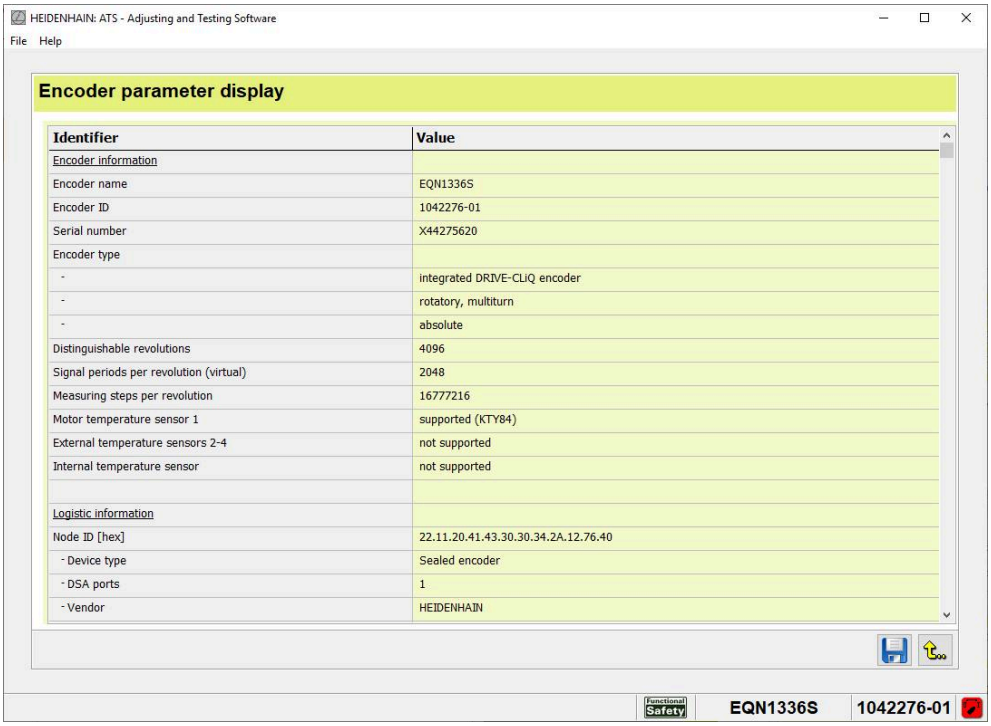


Figure 139: **Encoder parameter display** function

Logistic information section

Display	Description
Node ID	Terminal identification within the DRIVE-CLiQ drive system; worldwide unique number
Device type	To specify the encoder type, e.g. integrated encoder, sealed encoder, converter from EnDat 2.2 to DRIVE-CLiQ
DSA ports	For HEIDENHAIN encoders, the value "1" is entered here (single-ended module).
Vendor	Manufacturer code
Version	Version number of the encoder
Serial number	Serial number of the encoder
Index	Always assigned 0
MLFB	Ordering designation of the encoder

Functional safety section

The plausibility of the values to each other is tested in the "Functional-Safety encoder check". Thus, the values displayed here are for information only. For position comparison, the types "binary" and "non-binary" are relevant. This refers to the ratio of XACT1 and Pos2. Linear encoders are usually "non-binary". Rotational encoders are usually "binary".

Display	Description
Relevant Pos2 bits	Number of bits of position that are used in the safety comparison algorithm; value only not equal to zero for encoders with binary position comparison
Offset Pos1-Pos2	Offset between position 1 (XACT1) and position 2 in the resolution of position 2
nsrPos1	Not safety-relevant measuring steps of position 1 (XACT1); generally not supported on encoders with binary position comparison
nsrPos2	Not safety-relevant measuring steps of position 2 (XACT2); generally not supported on encoders with binary position comparison
srM	Safety-relevant measuring steps that are taken into account for position comparison; generally not supported on encoders with binary position comparison
Offset2	Offset between position 1 (XACT1) and position 2 in the resolution of position 1 (XACT1); generally not supported on encoders with binary position comparison

Further information section

Display	Description
Encoder datum shift	Display of the datum shift, if saved in the encoder
Size of OEM memory in bytes	Size of the memory range reserved for information by the OEM
TIME2LINK_OK MAX in ms	Maximum time after which the encoder can communicate via DRIVE-CLiQ If no value is displayed, the switch-on time tSOT applies (stated in the brochure).
T_MAX_ACT_VAL in µs	Earliest transmission time of a DRIVE-CLiQ packet after position latch

The values **Signal periods per revolution (virtual)** and **Grid division (virtual)** are derived from the measuring step and correspond to the parameter settings in the DRIVE-CLiQ encoder configuration. The values are not related to the physical properties (signal period) of the encoder.

Functional-safety encoder check function

The **Functional-safety encoder check** is also available for encoders without functional safety and allows for examining basic parameters and settings. If the Functional-safety encoder check is not available, this indicates a malfunction of the encoder.

If the functional-safety encoder check results in errors, the encoder does not comply with the functional safety specifications. Repairs may only be carried out by the HEIDENHAIN Service.

After installing and exchanging functional safety components, repeat the acceptance test according to the specifications of the machine tool builder.

- ▶ To call this function, double-click **Functional-safety encoder check** in the function menu
- > The dialog **Manual entry of measuring length** may be displayed (depending on the encoder)
- ▶ Enter the measuring length in millimeters
- ▶ Confirm the entry with **Accept**
- > The software wizard shows a list of the supported diagnostic functions

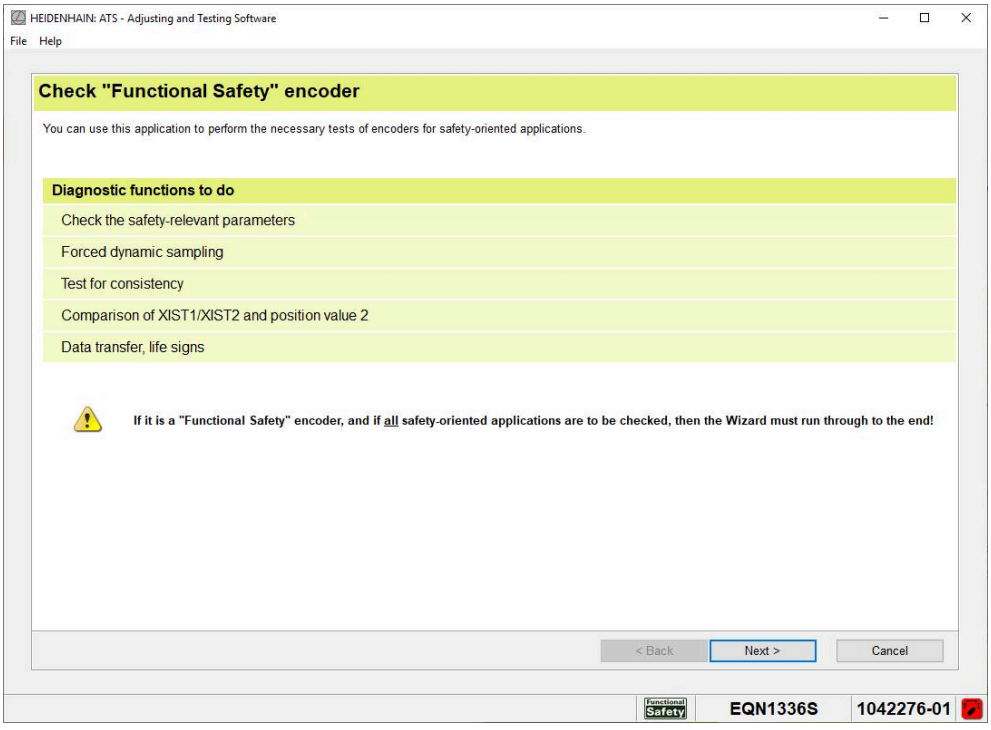


Figure 140: List of the diagnostic functions for encoders with functional safety

Depiction	Description
Check the safety-relevant parameters	Check of safety-relevant memory areas
Forced dynamic sampling	Check of the error generators in the encoder and of the consistency of the data stored in the encoder The tests performed depend on the supported error messages (depending on the encoder).
Test for consistency	Test for consistency of position value 2
Comparison of XIST1/ XIST2 and position value 2	Position-comparison triple: Comparison of Pos1, Pos2 and the parameter p12020 in the encoder configuration
Data transfer, life signs	Check of data transfer and life signs of the encoder hardware and software

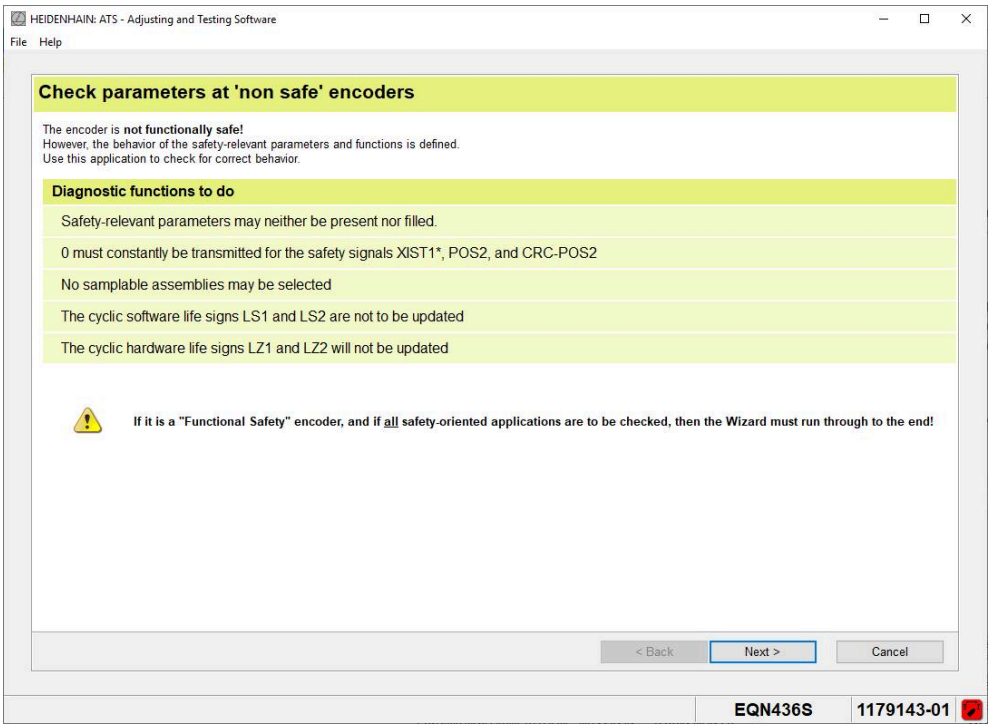


Figure 141: Overview of the diagnostic functions of encoders without functional safety

- ▶ Click **Next** to check the safety-relevant memory areas
- > The Adjusting and Testing Software checks whether the safety-relevant parameters are available and filled with values
- > The software wizard shows the result of the examination

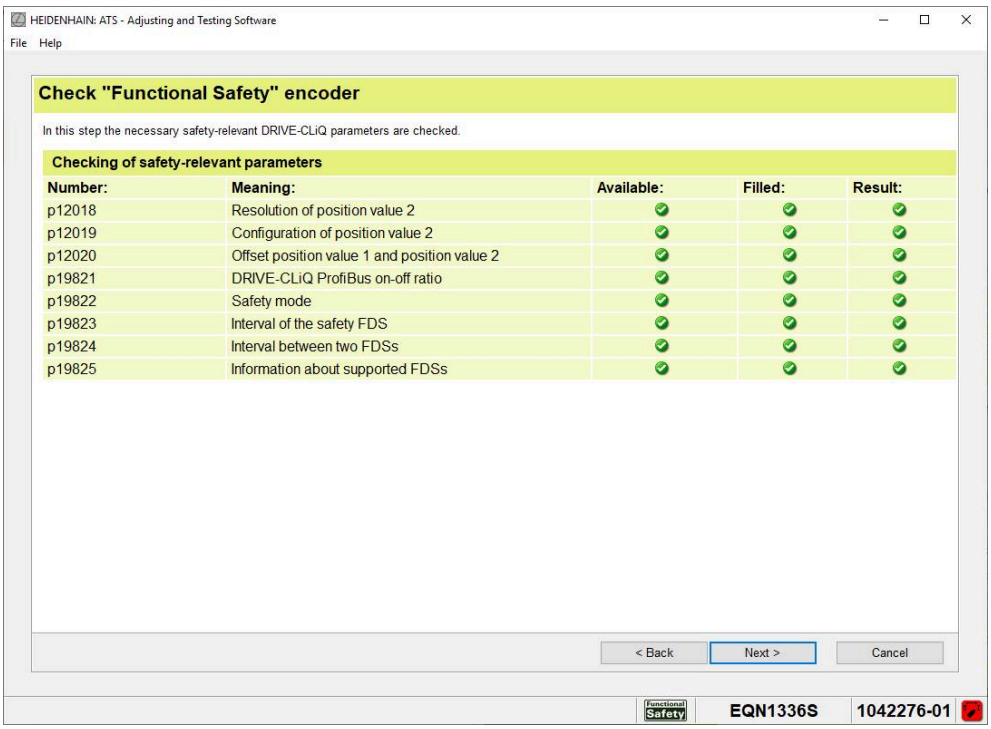


Figure 142: Test results for safety-relevant parameters

The following symbols are used to show the test result:

Icon	Description
	Test successful for parameters that must be available and filled with values
	Test successful for parameters that do not have to be available or filled with values
	Test failed

- ▶ Click **Next** to run forced dynamic sampling
- > The Adjusting and Testing Software executes forced dynamic sampling
- > The software wizard shows the result of forced dynamic sampling

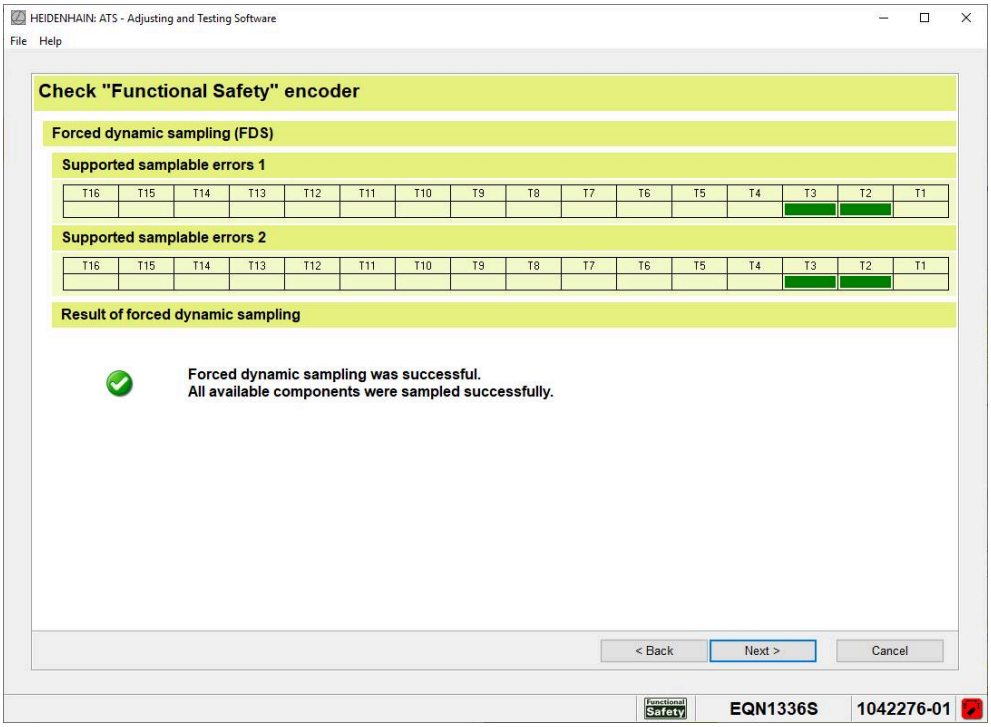


Figure 143: Result of forced dynamic sampling

- ▶ Click **Next** to continue
- > The Adjusting and Testing Software displays information on the test for consistency and the comparison of position values

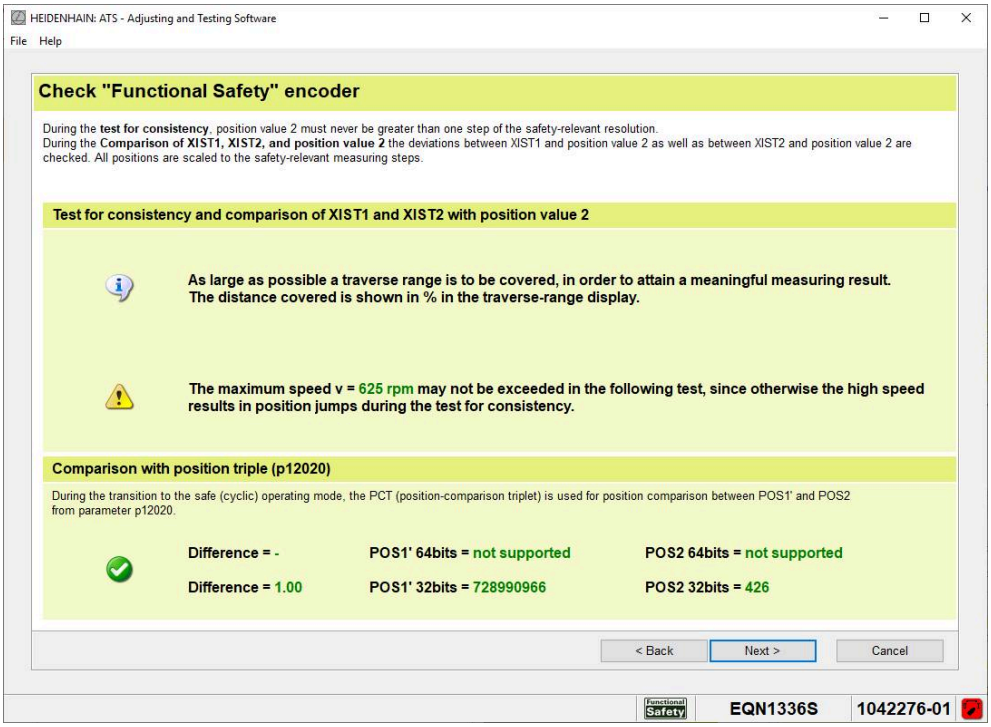


Figure 144: Result of the test for consistency

- Click **Next** to run the test for consistency and the comparison of position values
- Traverse the entire measuring range

> The software wizard shows the result of the tests

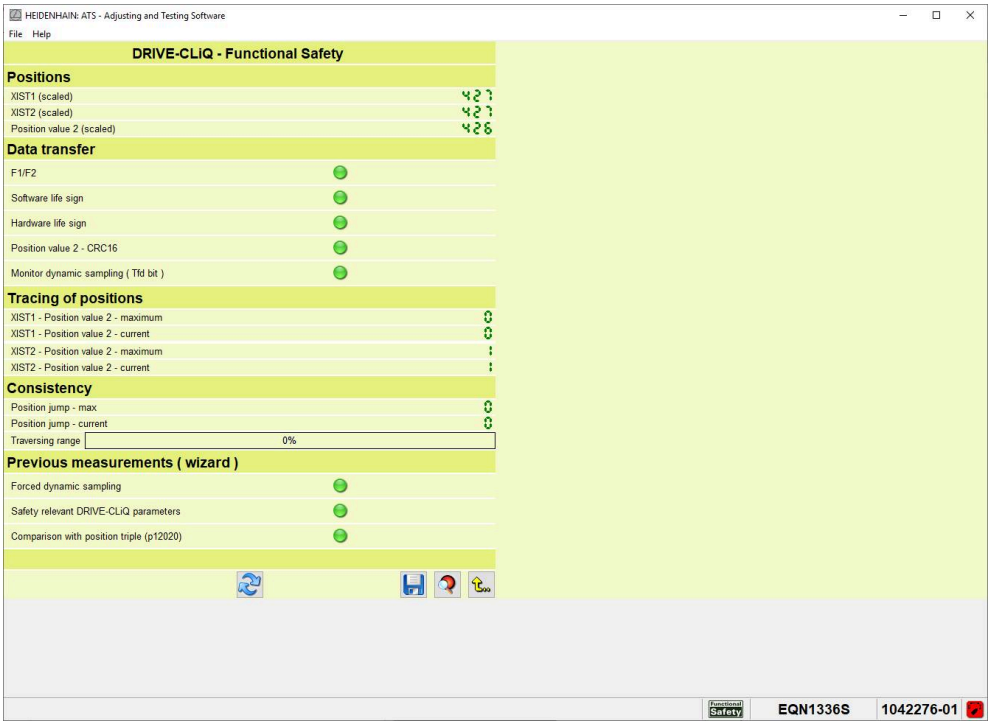


Figure 145: Results overview of the functional-safety encoder check

Red values or status displays indicate a malfunction of the encoder.

Positions section

Display	Description
XIST1 (scaled)	Scaled position value XIST1 The resolution used for the test complies with the functional safety specifications.
XIST2 (scaled)	Scaled position value XIST2 The resolution used for the test complies with the functional safety specifications.
Position value 2 (scaled)	Scaled position value 2 The resolution used for the test complies with the functional safety specifications.

Data transfer section

Display	Description
F1/F2	Position error bits (encoder-internal)
Software life sign	Life sign generated by the encoder software
Hardware life sign	Life sign generated by the encoder hardware

Display	Description
Position value 2 – CRC16	The position 2 created by the scanning ASIC of the encoder is verified by means of an additional CRC in the encoder
Monitor dynamic sampling (Tfd bit)	Monitoring bit indicating that an error occurred during forced dynamic sampling Tfd = test failed

Tracing of positions section

Display	Description
XIST1 – Position value 2 – maximum	Maximum value of the comparison of incremental position and redundant absolute position
XIST1 – Position value 2 – current	Current value of the comparison of incremental position and redundant absolute position
XIST2 – Position value 2 – maximum	Maximum value of the comparison of absolute position and redundant absolute position
XIST2 – Position value 2 – current	Current value of the comparison of absolute position and redundant absolute position

Consistency section

Display	Description
Position jump – max	Maximum position jump during the entire test
Position jump – current	Current position jump
Traversing range	Measuring distance traversed during the test Unit: Percent

Previous measurements (wizard) section

Display	Description
Forced dynamic sampling	Result of forced dynamic sampling
Safety-relevant DRIVE-CLiQ parameters	Test results for safety-relevant DRIVE-CLiQ parameters
Comparison with position triple (p12020)	Result of position comparison

Repeating test for consistency and comparison of position values

- ▶ Click **Delete measured values** in the control bar to repeat the test for consistency and the comparison of position values
- > The measured values and status displays are reset
- ▶ Traverse the entire measuring range
- > The software wizard shows the result of the tests

Online diagnostics function

Since encoders with DRIVE-CLiQ interface do not support monitoring operation, the software wizard automatically selects the operating mode **Encoder diagnostics**.

12.3 Fanuc

The Adjusting and Testing Software supports the following interfaces:

- **Fanuc Serial Interface** α
- **Fanuc Serial Interface** α**i**

Position display

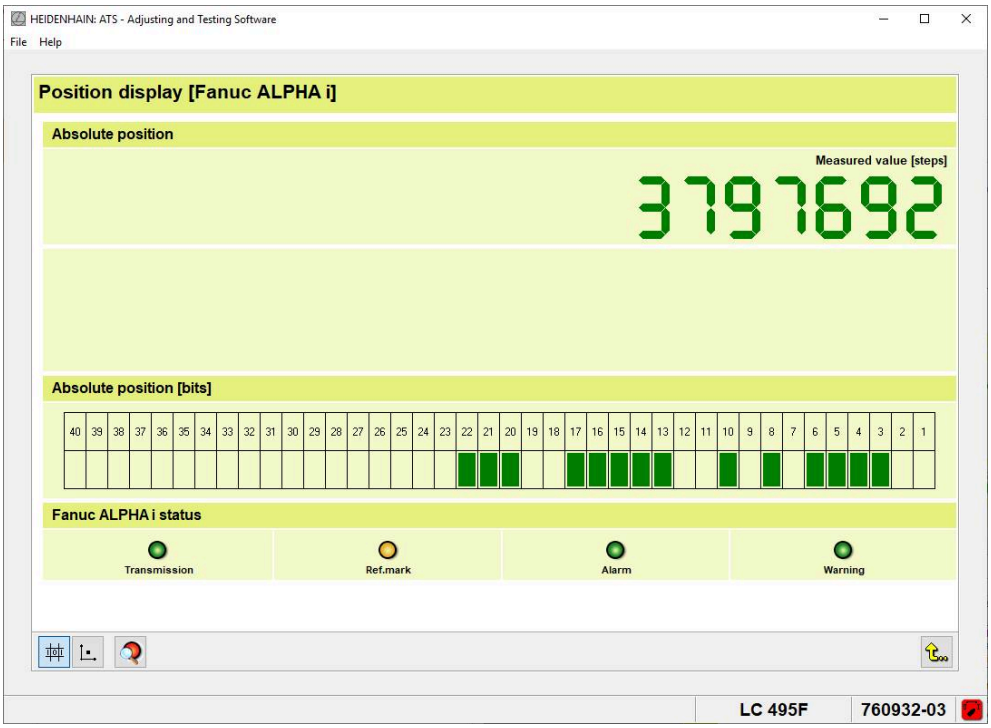


Figure 146: **Position display** function

Display	Description
Absolute position	Absolute encoder position Unit: Increments
Absolute position [bits]	Binary display of the absolute encoder position The number of bits depends on the encoder. Bit 1 = LSB (Least Significant Bit)
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Ref.mark	Status display of reference mark detection: Absolute encoders with serial interfaces: ■ Gray: No reference mark was detected ■ Yellow: Reference mark detected or absolute encoder Incremental encoders with external interface electronics: ■ Gray: No reference mark was detected ■ Yellow: Reference run finished, absolute position value available

Display	Description
Alarm	Status display of encoder alarms ■ Green: No status message available ■ Red: Status message available
Warning	Status display of encoder warnings ■ Green: No status message available ■ Red: Status message available

Resetting status messages

The following steps are necessary in order to reset status messages:

- ▶ Double-click **Disconnect encoder** in the function menu
- ▶ Switch off the PWM

Fanuc ALPHA i ID data display function

Encoders with **Fanuc Serial Interface αi** feature the additional function **Fanuc ALPHA i ID data display**.

- ▶ To call this function, double-click **Fanuc ALPHA i ID data display** in the function menu
- > The Adjusting and Testing Software displays information on the connected encoder

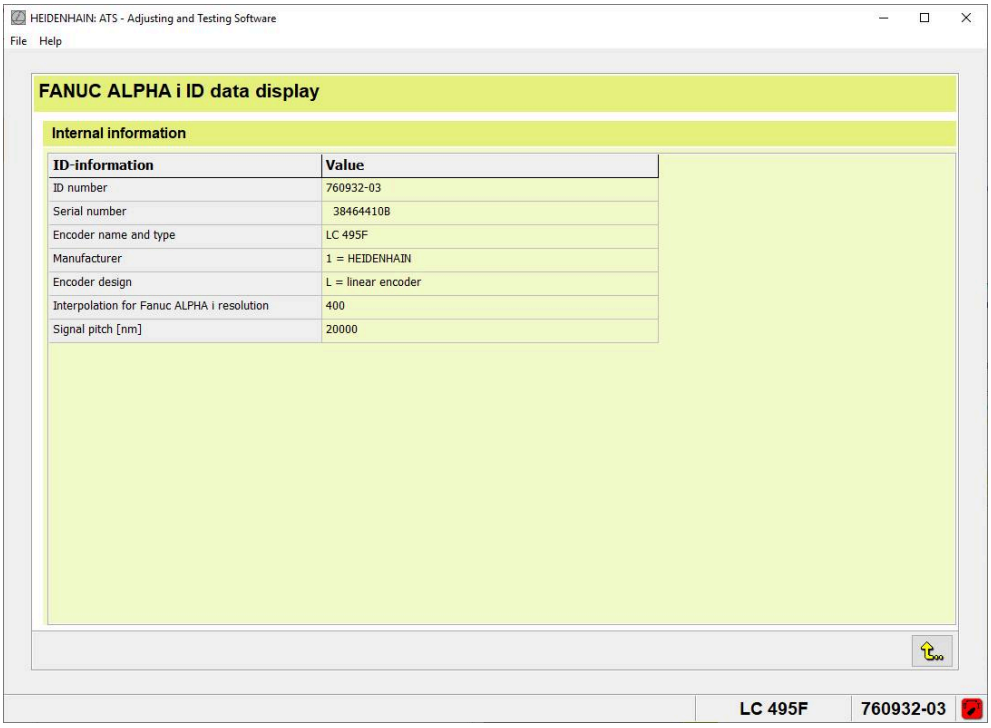


Figure 147: **Fanuc ALPHA i ID data display** function

Online diagnostics function in the monitoring mode

On encoders with ordering designation "Fanuc 05", you can switch between ALPHAi mode and ALPHA mode to adapt the evaluation of the Adjusting and Testing Software to the parameterization of the subsequent electronics. For this purpose, the control bar contains the following operating elements:

Icon	Function
α	**Switch to ALPHA mode** Evaluates the communication between subsequent electronics and encoder in the ALPHA mode
αi	**Switch to ALPHAi mode** Evaluates the communication between subsequent electronics and encoder in the ALPHAi mode

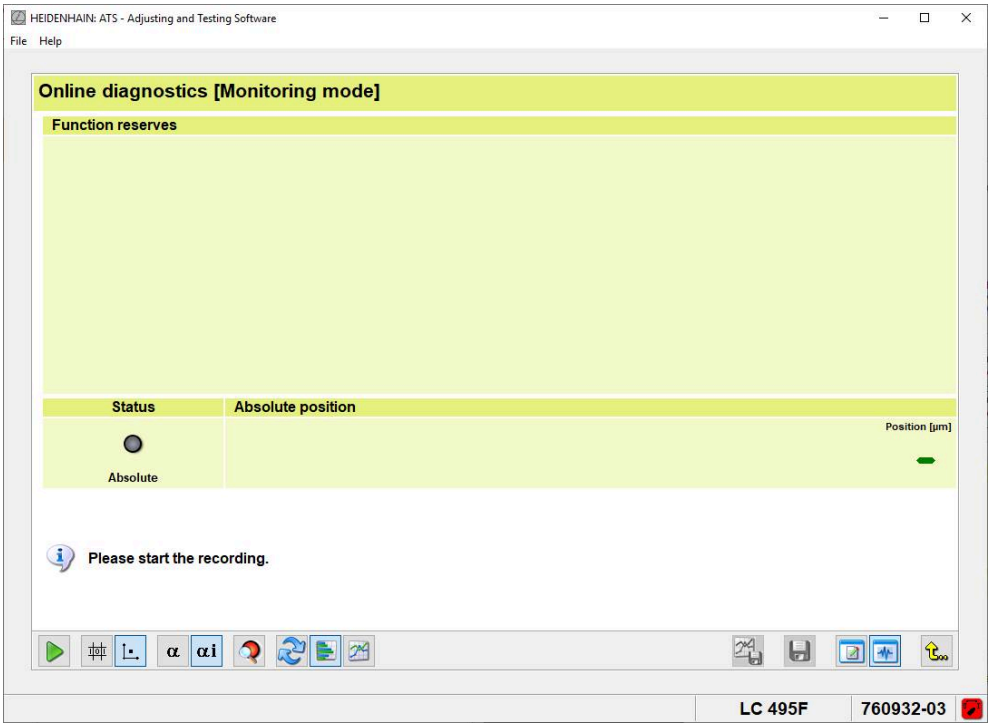


Figure 148: **Online diagnostics** function in the monitoring mode

12.4 Mitsubishi

The Adjusting and Testing Software supports the following interface:

- **Mitsubishi High Speed Interface**

Position display function

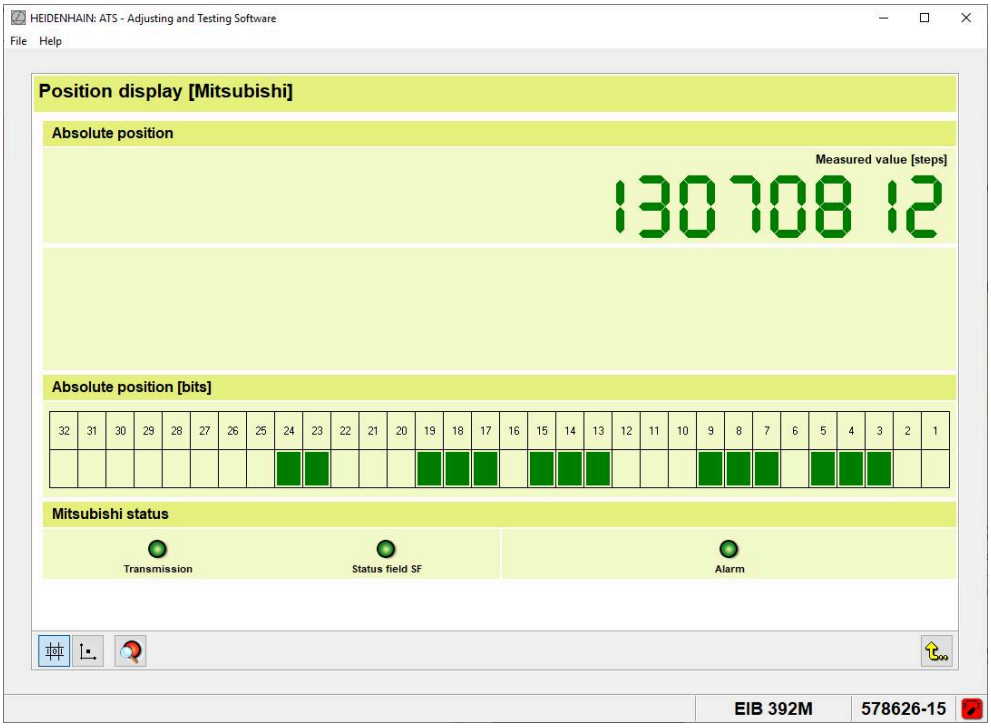


Figure 149: **Position display** function

Display	Description
Absolute position	Absolute encoder position Unit: Increments
Absolute position [bits]	Binary display of the absolute encoder position; the number of bits depends on the encoder Bit 1 = LSB (Least Significant Bit)
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Status field SF	Display of the status information output by the encoder; with incremental encoders including the status of reference mark detection ■ Green: No status message available ■ Red: Status message available
Alarm	Status display of encoder alarms ■ Green: No status message available ■ Red: Status message available

12.5 Panasonic

The Adjusting and Testing Software supports the following interfaces:

- **Panasonic Serial Interface**

Position display

The **Position display** function displays the following information:

Display	Description
Absolute position	Absolute encoder position Unit: Increments
Absolute position [bits]	Binary display of the absolute encoder position; the number of bits depends on the encoder Bit 1 = LSB (Least Significant Bit)
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Alarm	Status display of encoder alarms ■ Green: No status message available ■ Red: Status message available

12.6 Yaskawa

The Adjusting and Testing Software supports the following interfaces:

- **Yaskawa Serial Interface**

Position display

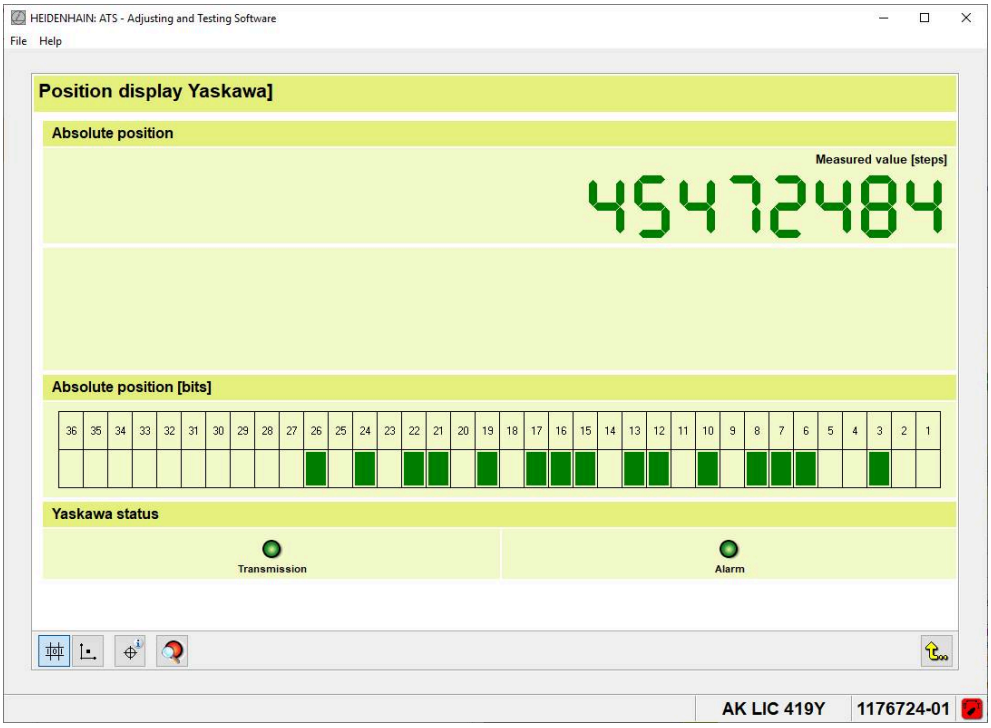


Figure 150: **Position display** function

Display	Description
Absolute position	Absolute encoder position Unit: Increments
Absolute position [bits]	Binary display of the absolute encoder position The number of bits depends on the encoder. Bit 1 = LSB (Least Significant Bit)
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available
Alarm	Status display of encoder alarms ■ Green: No status message available ■ Red: Status message available

Yaskawa parameter display function

Encoders with **Yaskawa Serial Interface** feature the additional function **Yaskawa Encoder Parameters**.

- To call this function, double-click **Yaskawa parameter display** in the function menu

> The Adjusting and Testing Software displays information on the connected encoder

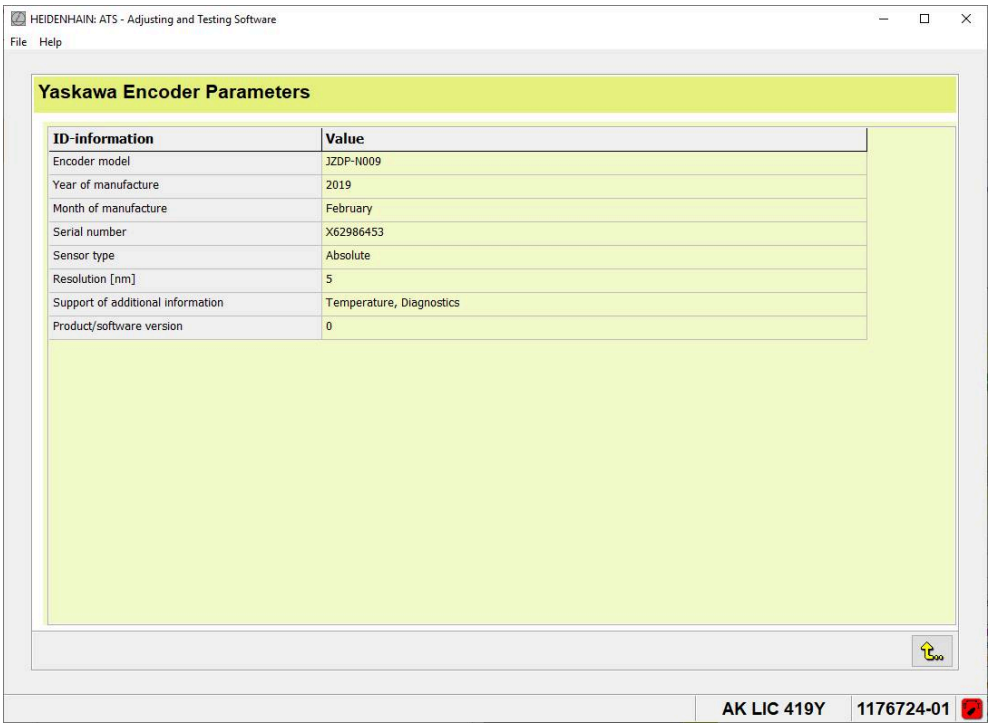


Figure 151: **Yaskawa parameter display** function

12.7 SSI

Position display

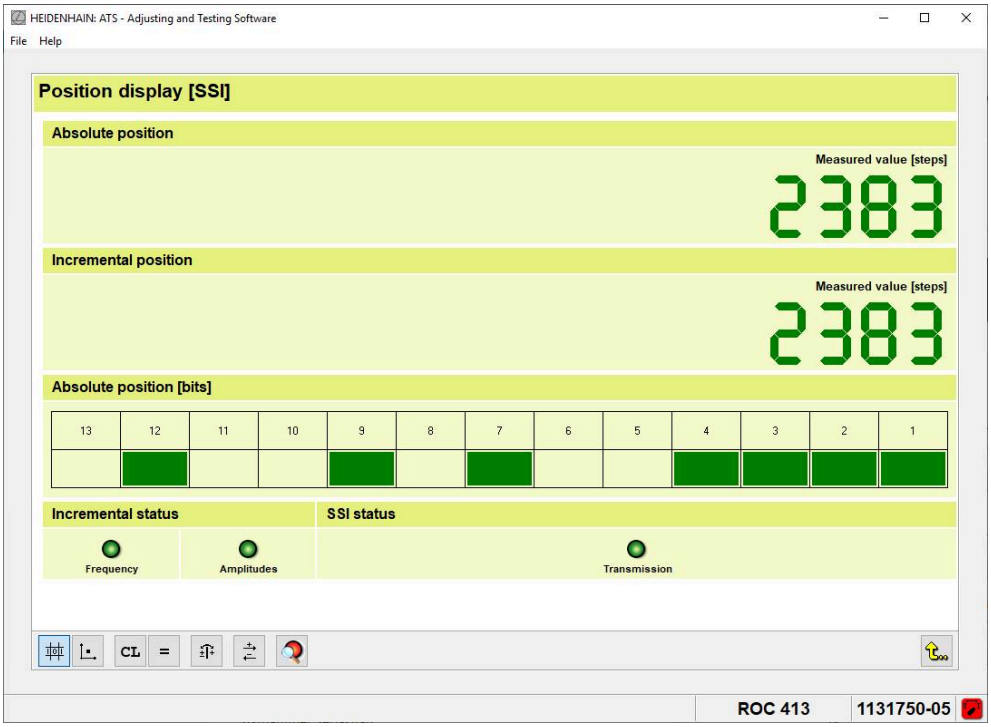


Figure 152: **Position display** function

Display	Description
Absolute position	Absolute encoder position Unit: Increments
Incremental position	Count value of incremental counter Unit: Increments
Absolute position [bits]	Binary display of the absolute encoder position The number of bits depends on the encoder. Bit 1 = LSB (Least Significant Bit)
Frequency	Status display of signal frequency ■ Green: Signal frequency is within tolerance ■ Red: Signal frequency is outside the tolerance range
Amplitudes	Status display of signal amplitudes ■ Green: The signal amplitudes are within the tolerance range ■ Red: The signal amplitudes exceed at least one tolerance limit
Transmission	Status display of data transfer between encoder and testing device ■ Green: No status message available ■ Red: Status message available

Absolute to incremental deviation function

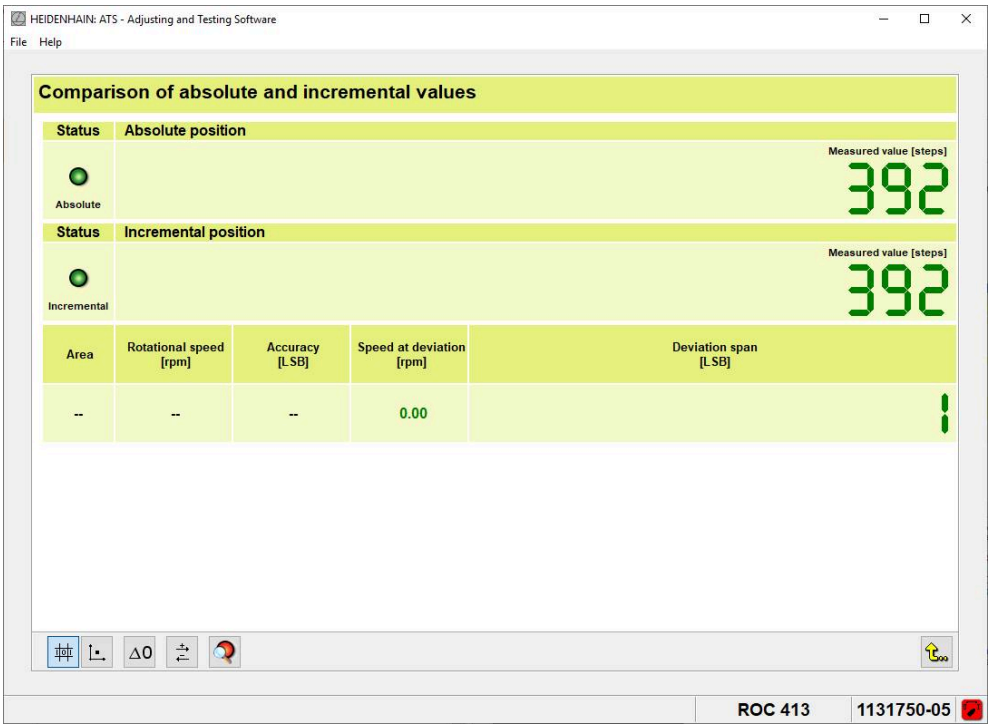


Figure 153: Ascertainment of the **absolute to incremental deviation**

No velocity ranges or tolerance values are available when determining the **absolute to incremental deviation**. The deviation span is considered too high and displayed in red color, if the difference between the absolute position and the incremental position exceeds the absolute number of measuring steps per revolution.

12.8 Indramat

Connecting the encoder

Encoders with Indramat interface must be identified by entering the encoder ID in order that the test functions are available in the Adjusting and Testing Software.

13

What to do if ...

13.1 Overview

This chapter describes the causes of faults or malfunctions and the appropriate corrective actions.

13.2 Troubleshooting

Fault	Cause of fault	Correction of fault
The Adjusting and Testing Software does not recognize the PWM	The PWM is not connected correctly, or supply voltage is missing	▶ Check whether the PWM is connected as specified in the operating instructions **Further information:** "Opening documentation", Page 42 ▶ Check the power cable ▶ Check whether the PWM is switched on ▶ Check whether the PWM has been selected as testing device **Further information:** "Selecting the PWM as testing device", Page 49
	Device drivers are missing	**Further information:** "Installing drivers", Page 36
	Device function faulty	▶ Contact a HEIDENHAIN service agency
The Adjusting and Testing Software does not recognize the encoder, or functions cannot be performed	Excessive voltage drop on the lines connecting the testing device and the encoder	▶ Activate voltage readjustment by the PWM **Further information:** "Connection in the Encoder Diagnostics operating mode", Page 54
	The cables are not suitable	▶ Check whether the prescribed cables are used (see "User's Manual Cables and Connection Technology") **Further information:** "Opening documentation", Page 42
The encoder ID cannot be found in the encoder database	The encoder has not yet been added to the encoder database	▶ Update the encoder database **Further information:** "Updating software and encoder database", Page 36 ▶ Connect the encoder manually **Further information:** "Connecting the encoder", Page 51 ▶ Contact the HEIDENHAIN Service and ask for the ATS code **Further information:** "Connecting with ATS code", Page 75
	The ID is not correct	Check whether correct ID was entered, e.g.: ■ With exposed or multi-section encoders: the ID of the scanning head ■ With sealed linear encoders: the ID of the scale housing **Further information:** "Connecting the encoder", Page 51
No signal is shown in the monitoring mode	The encoder is not supplied with power	■ Check whether the subsequent electronics is switched on

Fault	Cause of fault	Correction of fault
The Adjusting and Testing Software does not display any information on incremental signals	The encoder does not output incremental signals	▶ Check if the encoder provides incremental signals **Further information:** "Measuring methods and interfaces", Page 22
Computer performance problems occur while the Adjusting and Testing Software is running	Processing power is insufficient or limited, e.g. because the PWM is connected to the computer via keyboard, USB hub or docking station	▶ Check the system requirements **Further information:** "System requirements", Page 34 ▶ Connect the PWM directly to the computer

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