SINUMERIK 828D Output of setpoints to analog drives – Retrofit Solution

SINUMERIK 828D / SW V4.8

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1 Introduction

1.1 Overview

If your planned machine retrofit comprises replacement of the controller only and you wish to continue using the analog drives, you must define the setpoints in an analog form.

If you install a SINUMERIK 828D as part of the retrofit, you must output the analog setpoints to the axes and spindles via a SINAMICS HLA.

In addition, you can use the analog interface (X252) of the Panel Processing Unit (PPU) to control an analog spindle, for example.

Fig. 1-1 SINAMICS HLA

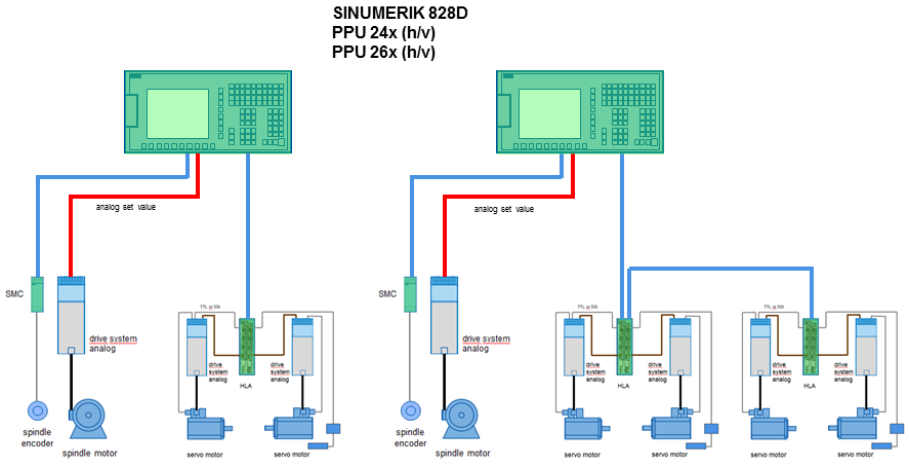
1.2 Schematic diagram

The diagram below shows a connection example of a fully equipped SINUMERIK 828D:

- 2 SINAMICS HLA
- 4 analog feed axes
- 1 analog spindle at the X252 interface of the PPU.
- Optional: 2 digital axes on a SINAMICS S120 (see Section Address space and telegrams of the system data block (SDB))

Note Do not use a SINAMICS NX10 or SINAMICS NX15.

Fig. 1-2 SINUMERIK 828D with SINAMICS HLA



1.3 Requirements

Before you can commission a SINAMICS HLA, you must perform the following steps:

- Install CNC software version V4.8.
  A separate application description exists for software version V4.7.
- Install a special system data block (SDB) in the SINUMERIK 828D so that you can use PROFIBUS telegram 166.
  You can obtain the SDB through PridaNet.
- Parameterize the encoders on the SINAMICS HLA.
  With software version V4.8, you can parameterize the encoders as linear or rotary. With software version V4.7, only linear parameterization is possible.

Note Do not operate real hydraulic axes on the SINUMERIK 828D.

2 SINAMICS HLA

2.1 General interface description

Connect a 26.5 V power supply to interfaces X224 and X271. X224 does not require a separate 24 V supply.

You can also use the 26.5 V supply to enable axes at the digital interfaces X291 and X292.

Fig. 2-1 SINAMICS HLA overview of interfaces

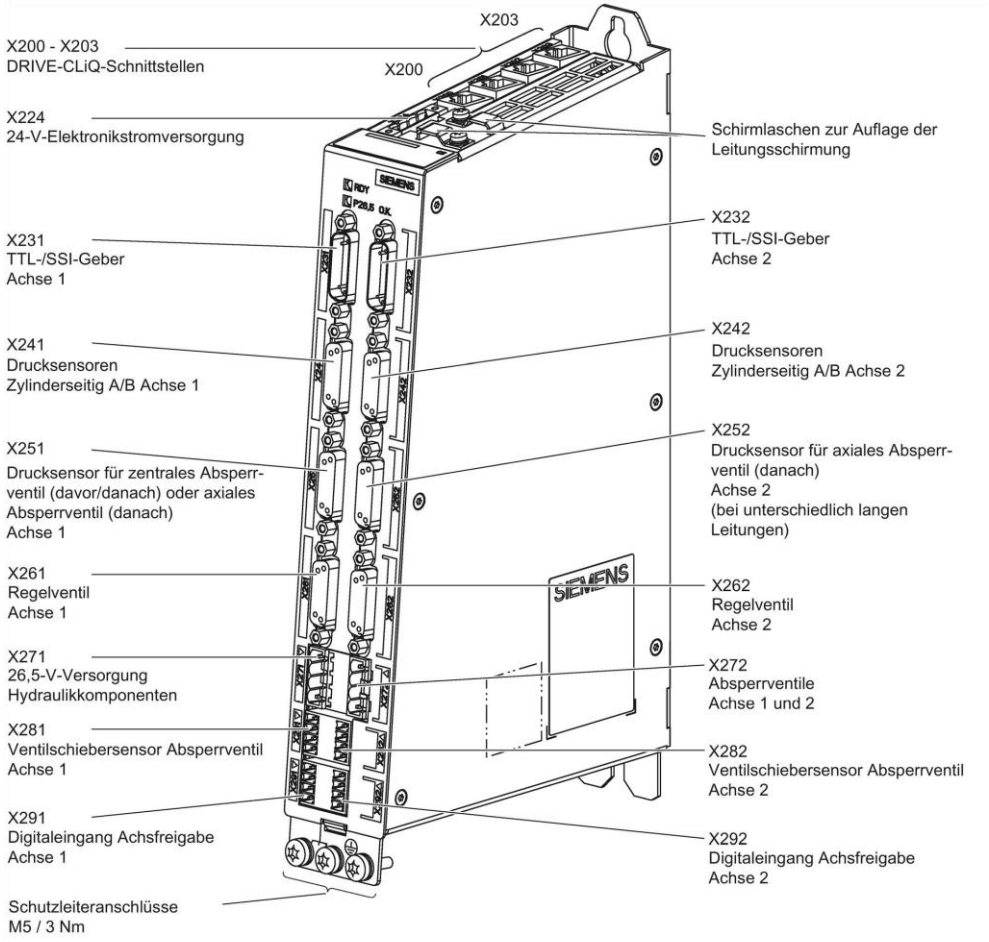


Table 2-1 SINAMICS HLA interface description

Interface	Use	Use in the application
X200 DRIVE-CLiQ component	• Connection to the Control Unit • Connection to the previous SINAMICS HLA • Connection to the previous Motor Module	-
X201 DRIVE-CLiQ component	• Connection to the next SINAMICS HLA • Connection to the next Motor Module	-
X202 DRIVE-CLiQ component	Encoder interface axis 1	-
X203 DRIVE-CLiQ component	Encoder interface axis 2	-
X 224 electronic power supply	Power supply voltage of the SINAMICS HLA	-
X231/X232 TTL and SSI encoders	Operating a TTL or SSI encoder. TTL and SSI encoders cannot be operated at the same time on one slot.	-
X241/X242 pressure sensors on the cylinder side	Two pressure sensors are provided for each axis to determine the cylinder pressure at the A and B sides.	Not for the 828 retrofit solution
X251/X252 sensors	The sensors are used to sense the pressure at the shutoff valve.	Not for the 828 retrofit solution
X261/X262 servo solenoid valves	This is the only interface to the servo solenoid valve and transfers the power supply voltage, setpoint, and actual value.	On the 828 retrofit solution, only the analog setpoint is relevant.
X271 26.5 V power supply for the hydraulic components	Power supply for the hydraulic components	Necessary for the 828 retrofit solution
X272 shutoff valves	One shutoff valve is connected for each axis	Not for the 828 retrofit solution
X281/X282 sensors for shutoff valves	For especially safety-critical applications, shutoff valves can be used whose actuator position is monitored using sensors.	Not for the 828 retrofit solution
X291/X292 terminals to enable the power	The power enable signal for the SINAMICS HLA is switched using the EP terminals. Each channel of the SINAMICS HLA is equipped with its own EP terminal.	Can also by supplied with 26.6 V to enable the SINAMICS HLA, possibly also switched via PLC

2.2 Circuit examples

Examples of how the SINAMICS HLA can be connected in a circuit are given below.

Fig. 2-2 Example 1: SINUMERIK 828 retrofit solution, 1 SINAMICS HLA with SSI/EnDat encoder connected to SMCxx as a direct measuring system

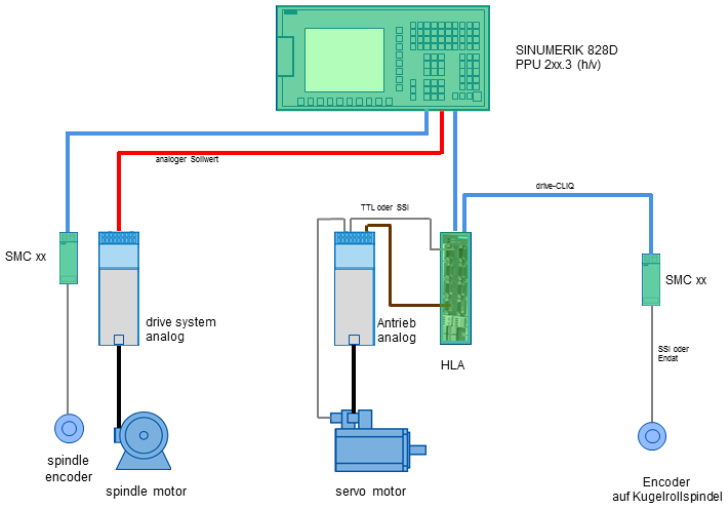


Fig. 2-3 Example 2: SINUMERIK 828 retrofit solution, 1 SINAMICS HLA with SSI encoder

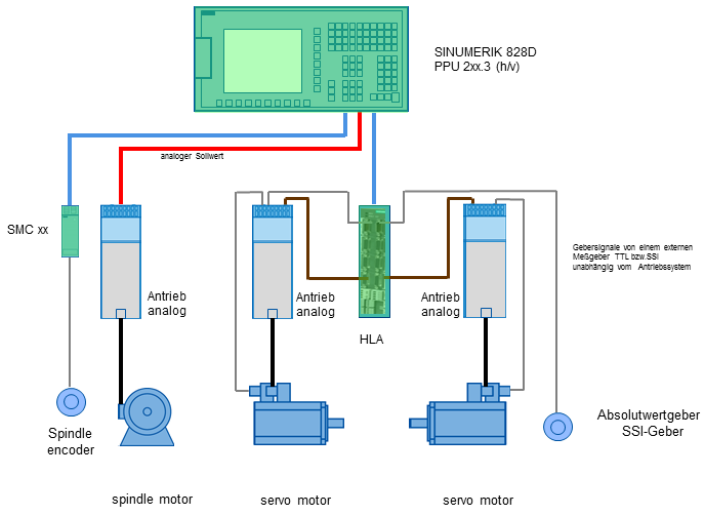


Fig. 2-4 Example 3: SINUMERIK 828 retrofit solution, 1 SINAMICS HLA with sin/cos/EnDat encoder connected to SMC xx as a direct measuring system

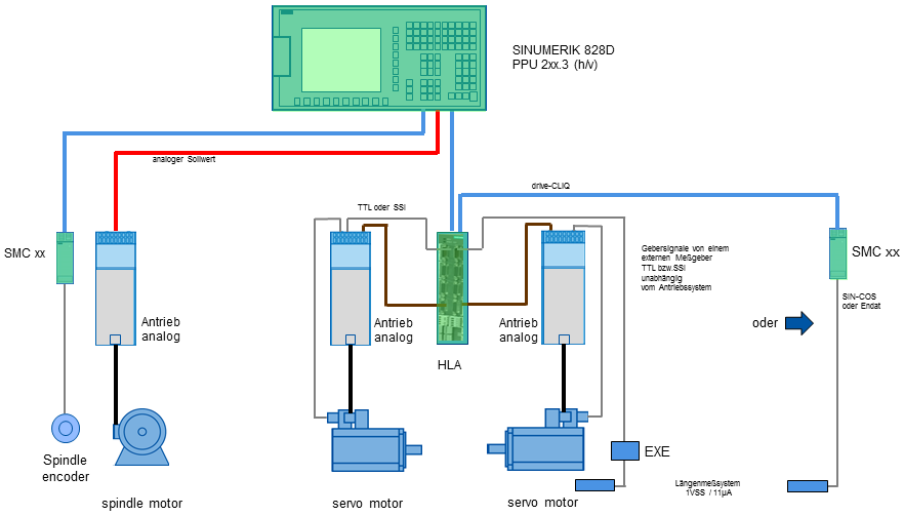


Fig. 2-5 Example 4: SINUMERIK 828 retrofit solution, 1 SINAMICS HLA with ROD encoder

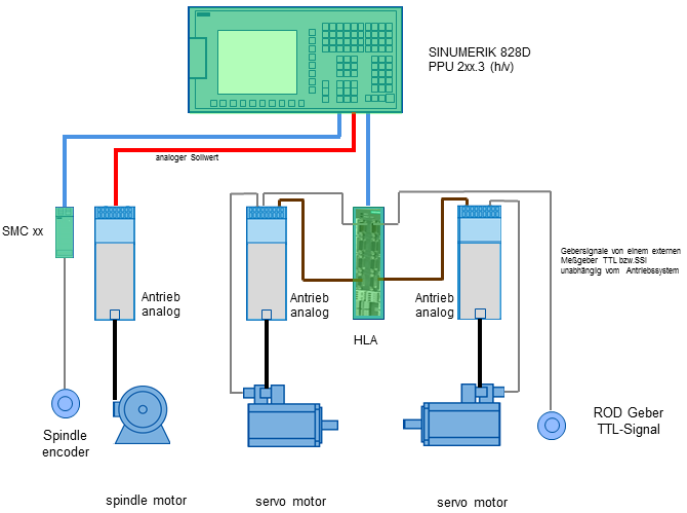


Fig. 2-6 Example 5: SINUMERIK 828 retrofit solution, 1 SINAMICS HLA with SSI/EnDat encoder and sin/cos/EnDat encoder connected to SMCxx as a direct measuring system

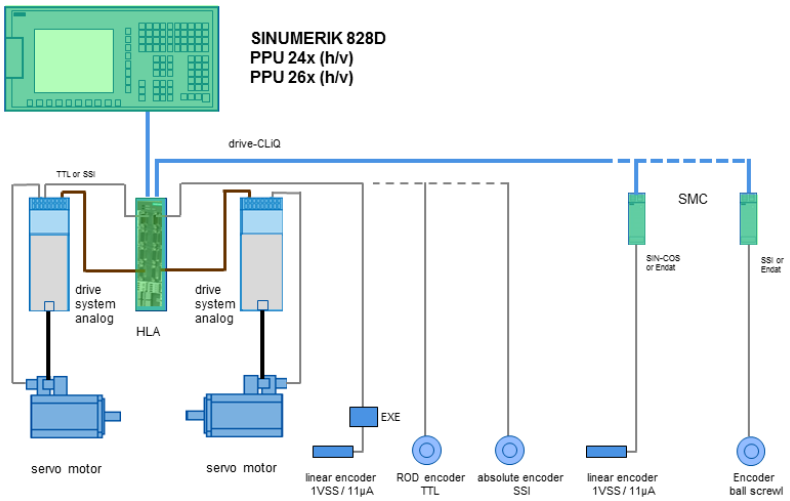
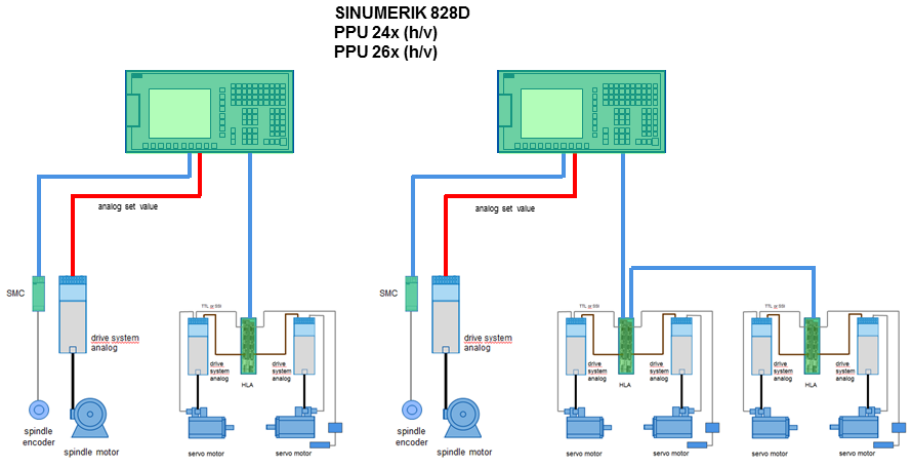


Fig. 2-7 Example 6: SINUMERIK 828 retrofit solution, 2 SINAMICS HLA with TTL/SSI encoder



3 Commissioning

Before you can control the analog drives with the SINAMICS HLA from a SINUMERIK 828D, you must load the commissioning files \2\ into the SINAMICS HLA.

You can use the commissioning files for either a linear or rotary axis. A rotary TTL encoder is already configured.

If you are using TTL encoders, loading the commissioning files also loads the SINAMICS HLA completely.

Once you have loaded the commissioning files, you can use the commissioning wizard to change the encoder data or encoder types. Parameterize the encoders as you would in a normal SINAMICS drive.

The remaining steps for commissioning the SINAMICS HLA is described below.

3.1 System data block (SDB)

Before you can output an analog setpoint via a SINAMICS HLA, you must load a special system data block (SDB) into SINUMERIK 828D. This allows you to use PROFIBUS telegram 166 for commissioning.

3.1.1 Installing the SDB

1. Load the SDB from PridaNet.
2. Install the SDB as a TGZ file via the service menu. See the Installation instructions of the special SDB..
3. Set machine data MD11241($MN_PROFIBUS_SDB_SELECT) to 2 to activate the SDB.

3.2 SINAMICS HLA

Loading the commissioning files preassigns the internally required HLA parameters to enable analog output of the setpoint without error.

If you are using motors whose maximum speed is not 6000 rpm, you will have to adjust the speed scaling via the tacho potentiometer of the drive or in parameter p1475 (loop gain).

Note

You need to observe the following points:

- You can use DRIVE-CLiQ encoders for the analog axis as linear scales and rotary encoders.
- You can insert encoders in X231/X232 interfaces and in all ports.
- You can operate TTL and SSI encoders at the X231/X232 interfaces.

3.2.1 Commissioning procedure

- Observe the Requirements.
- Reset the SINUMERIK 828D to the factory settings using the drive wizard.
- Load the commissioning files to achieve the following:
  - In the SINAMICS HLA, specific data of the internally used, purely fictitious closed-loop hydraulic control are preassigned in order to avoid alarms.
  - All internal controllers of the SINAMICS HLA are deactivated.

3.2.2 Commissioning files

The commissioning files consist of an ACX or TEA file, both of which have the file name "TTL_1024_SW_4_8".

You can use the files for linear and rotary axes. As soon as a TTL encoder that supplies 1024 pulses per revolution is connected to both on-board interfaces, the analog axis is immediately ready for operation.

If an SSI encoder, or sin/cos/EnDat encoder via SMC/SME, or a DRIVE-CLiQ encoder is connected, you must adapt the encoder data in the commissioning wizard.

Loading the commissioning files

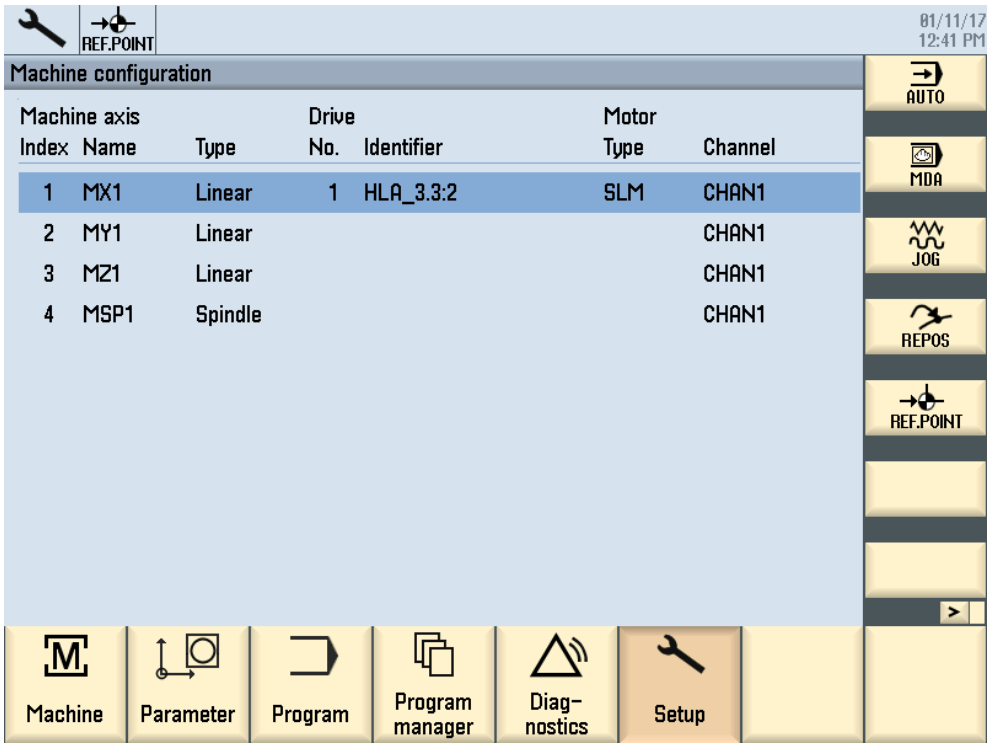
Note Create a NC/PLC/DP archive before you load the commissioning files.

Note The procedure for loading the commissioning files is identical to that of a purely electrical SINAMICS drive.

Load the commissioning files from a USB flashdrive:

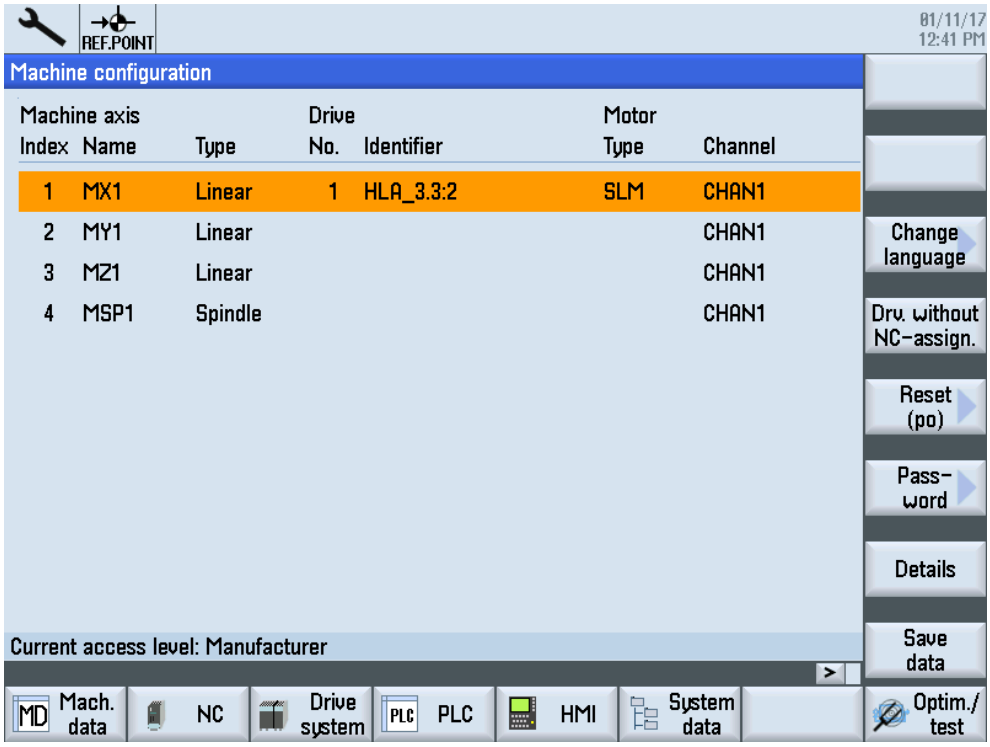
- Press the <MENU SELECT> key.
- Open the "Setup" area.

Fig. 3-1



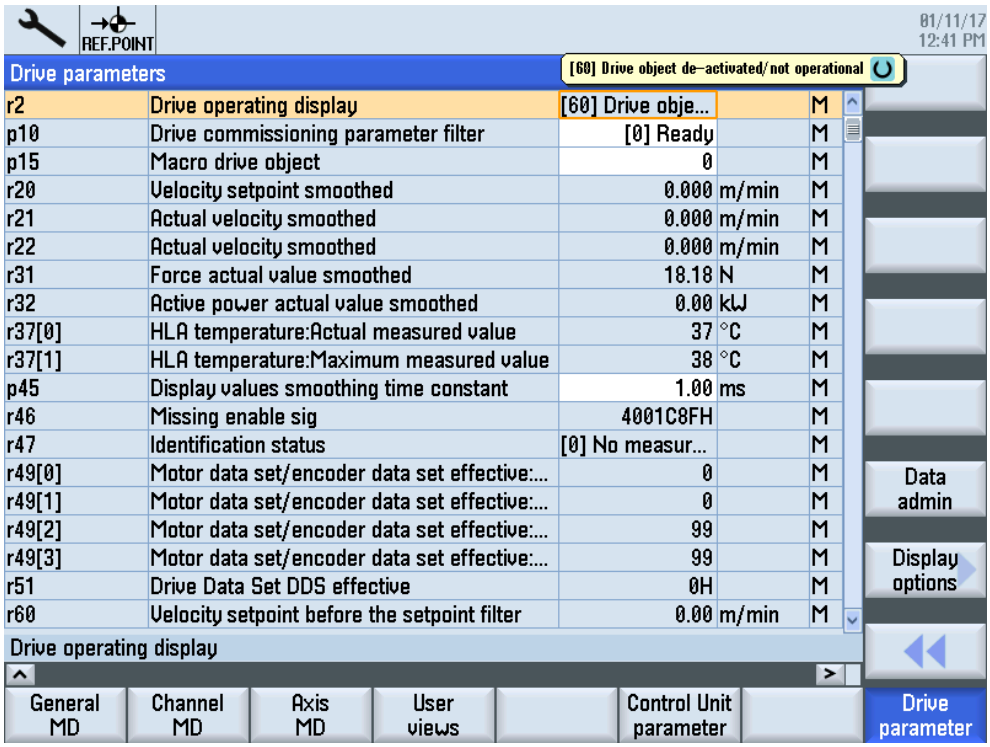
- Press the "Machine data" softkey.

Fig. 3-2



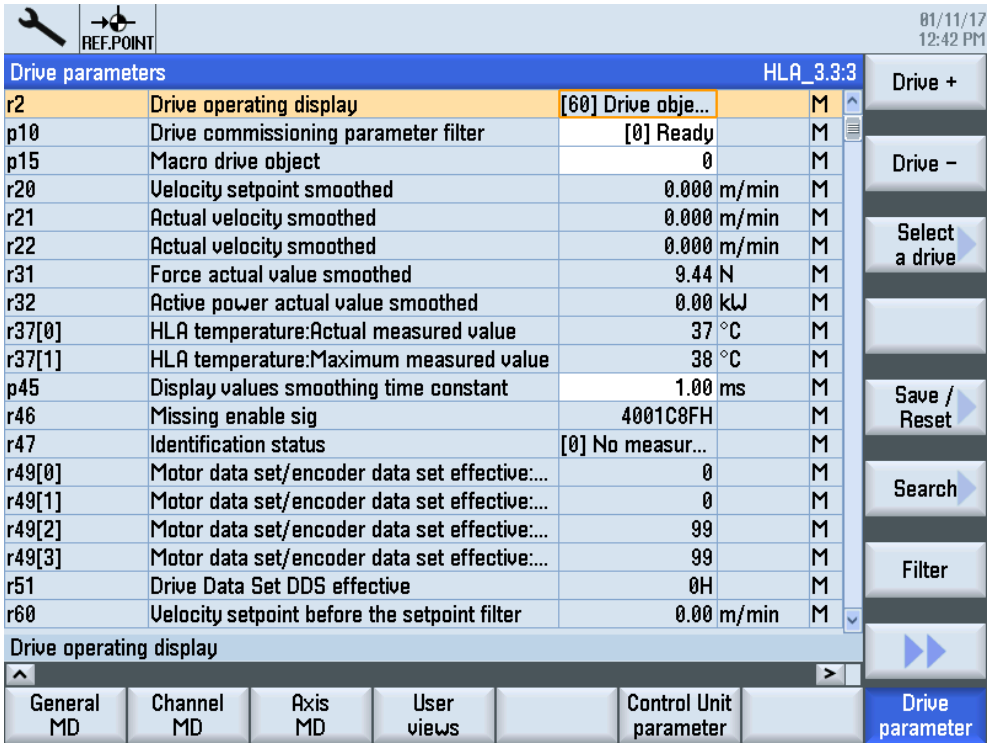
- Press the "Drive parameter" softkey.

Fig. 3-3



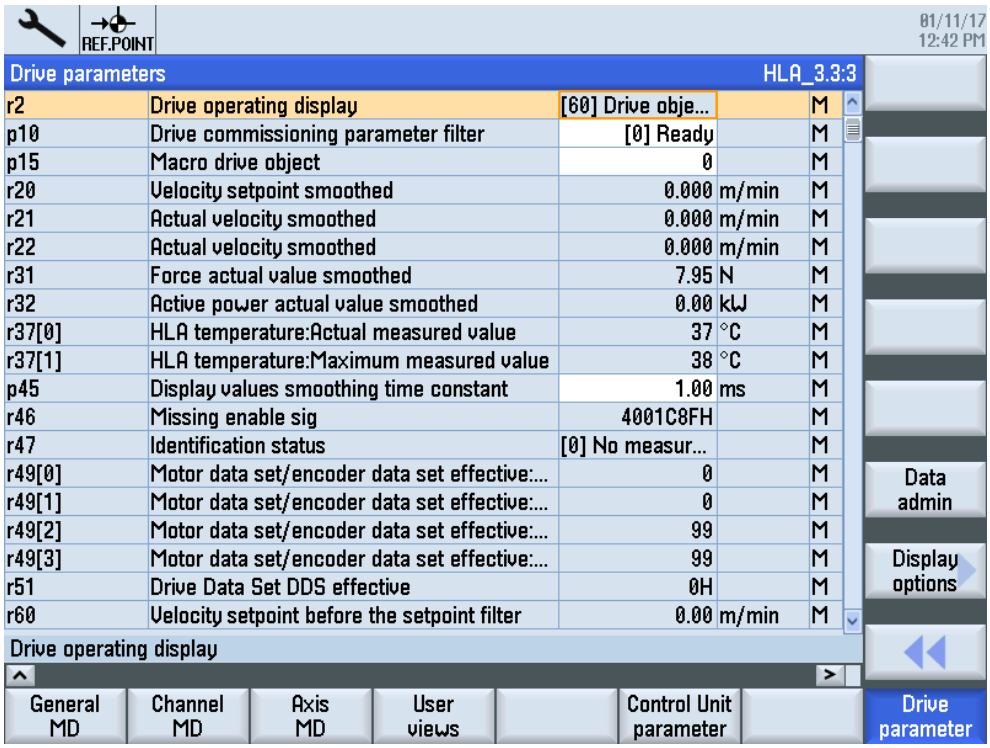
- Press the ▶▶ softkey.

Fig. 3-4



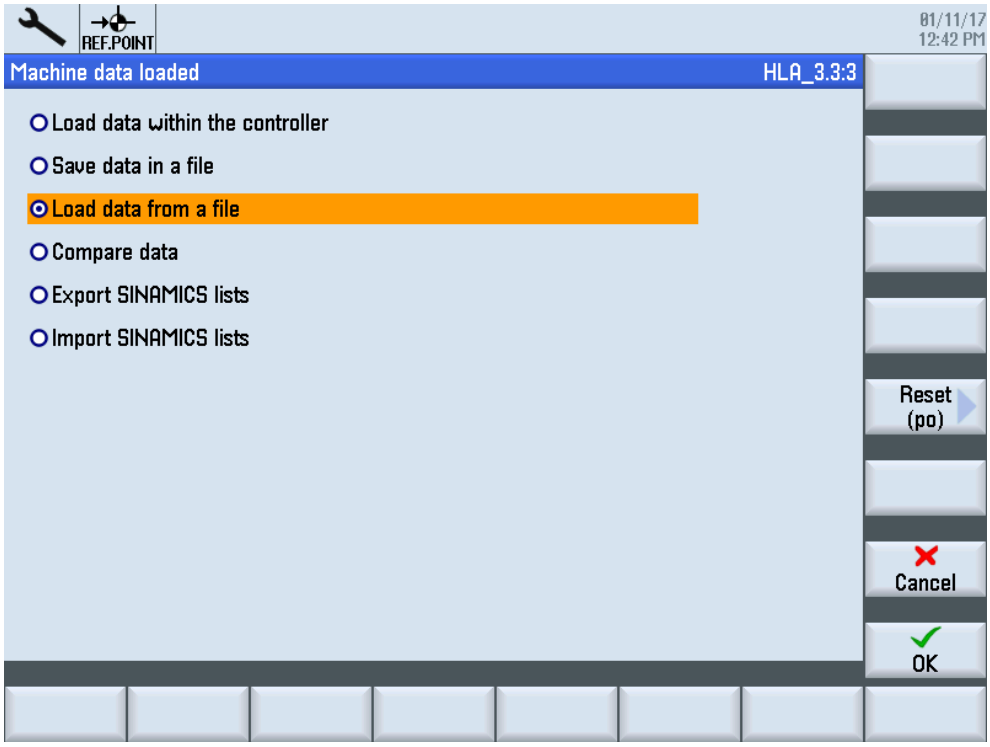
- Press the "Data admin" softkey.

Fig. 3-5



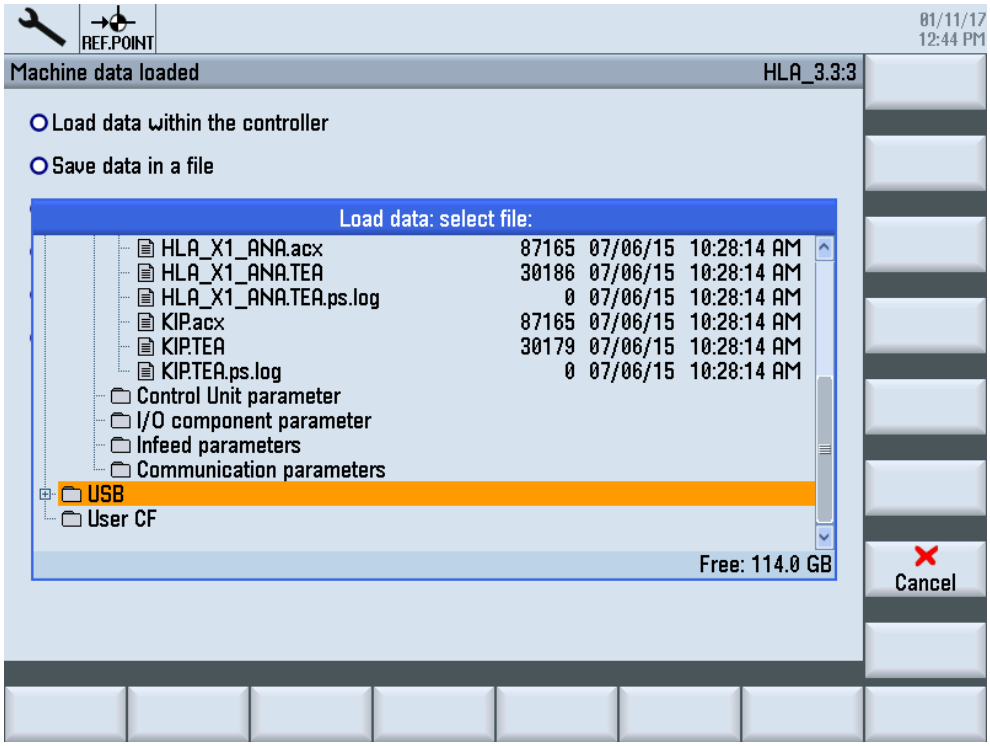
- Select "Load data from a file" and then press the "OK" softkey.

Fig. 3-6



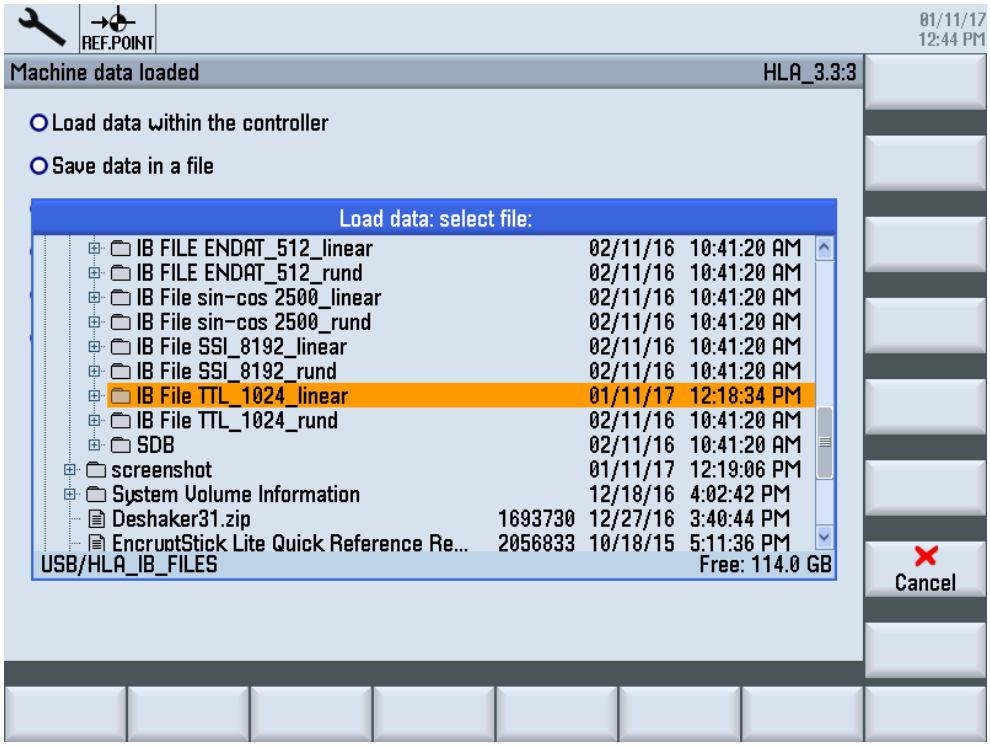
- Select "USB" and then press the <INPUT> key.

Fig. 3-7



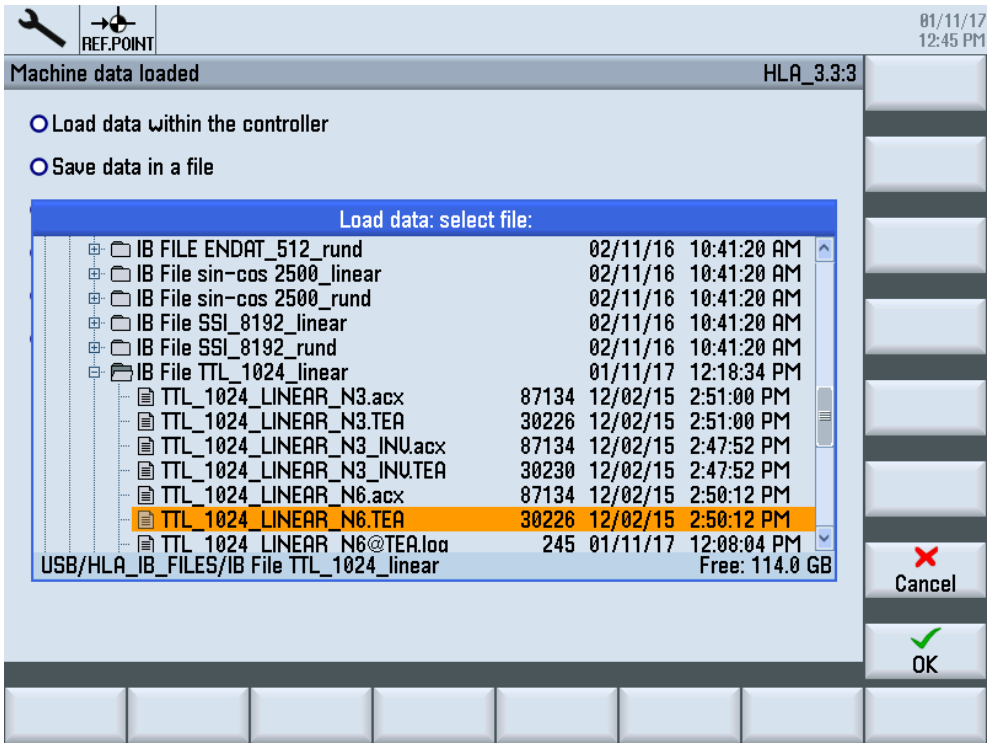
- Select the relevant folder and then press the <INPUT> key.

Fig. 3-8



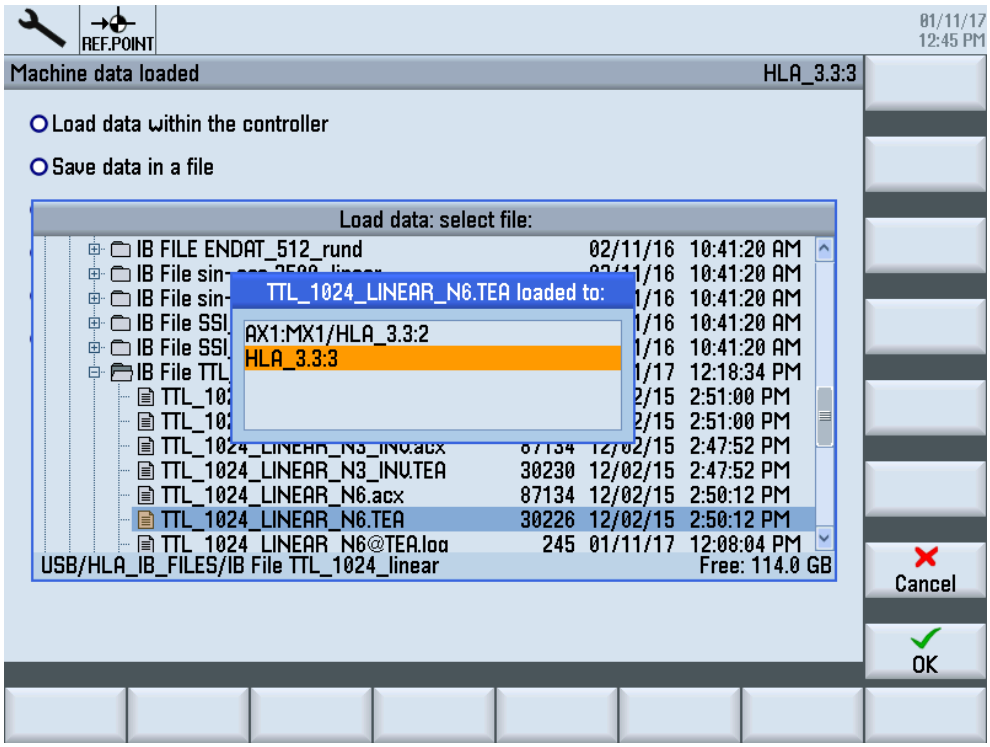
- Select the relevant TEA file and then press the "OK" softkey.

Fig. 3-9



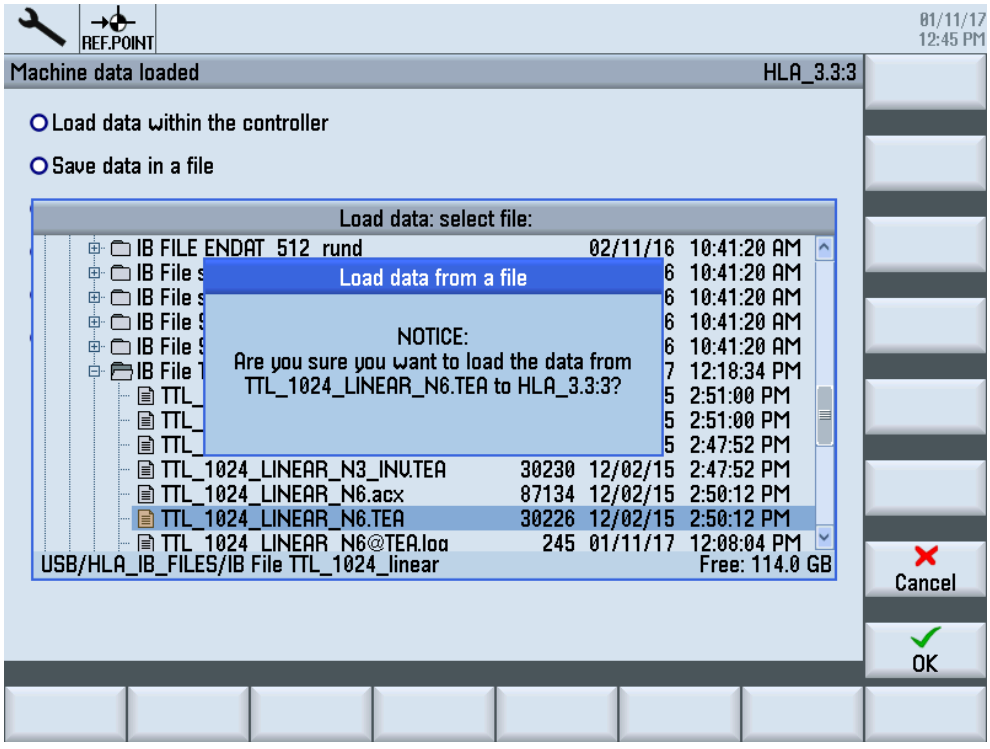
- Select the drive into which you want to load the data and then press the "OK" softkey.

Fig. 3-10



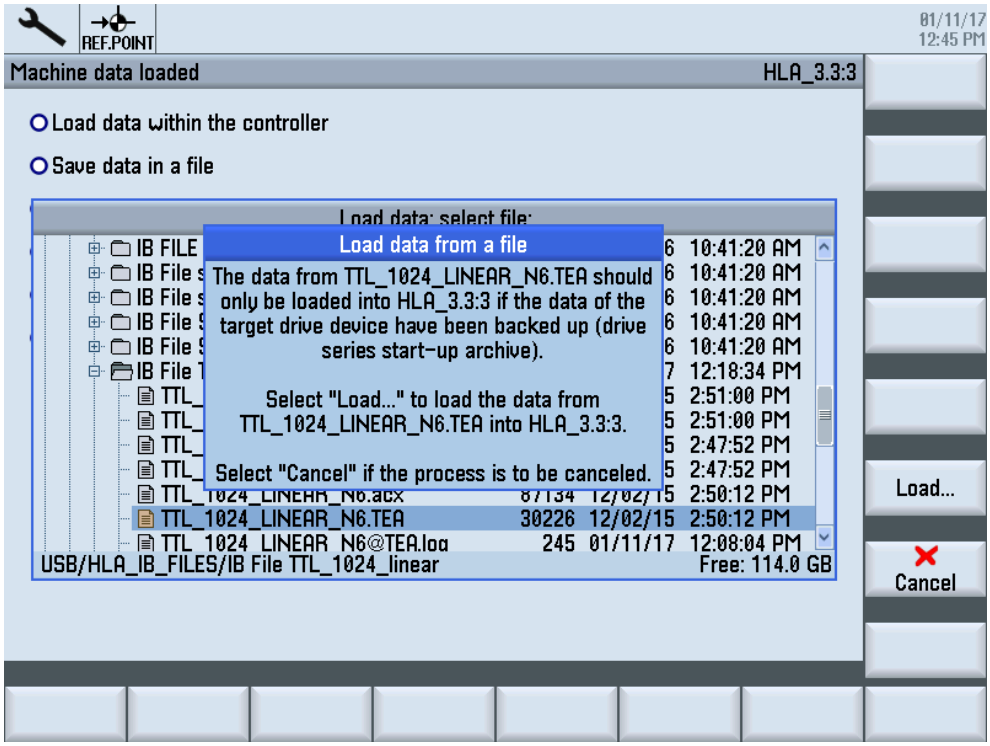
- A message is displayed indicating that the data originate from another drive. Acknowledge this message by pressing the "OK" softkey.

Fig. 3-11



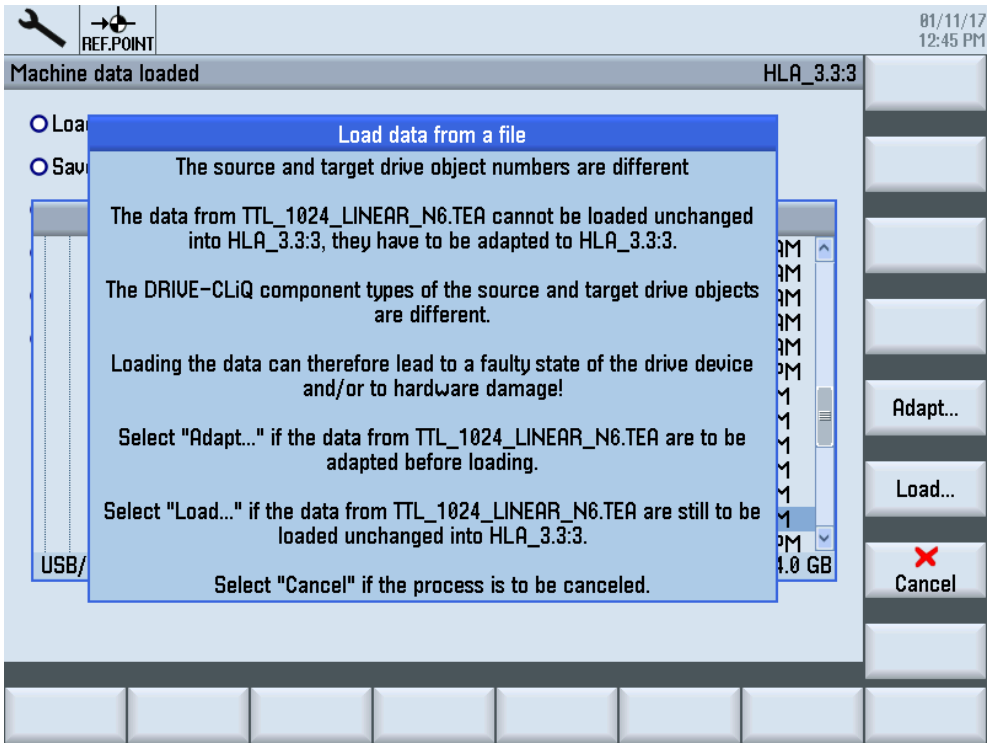
- A message advises you to create a backup before you import new data. Acknowledge this message by pressing the "Load" softkey.

Fig. 3-12



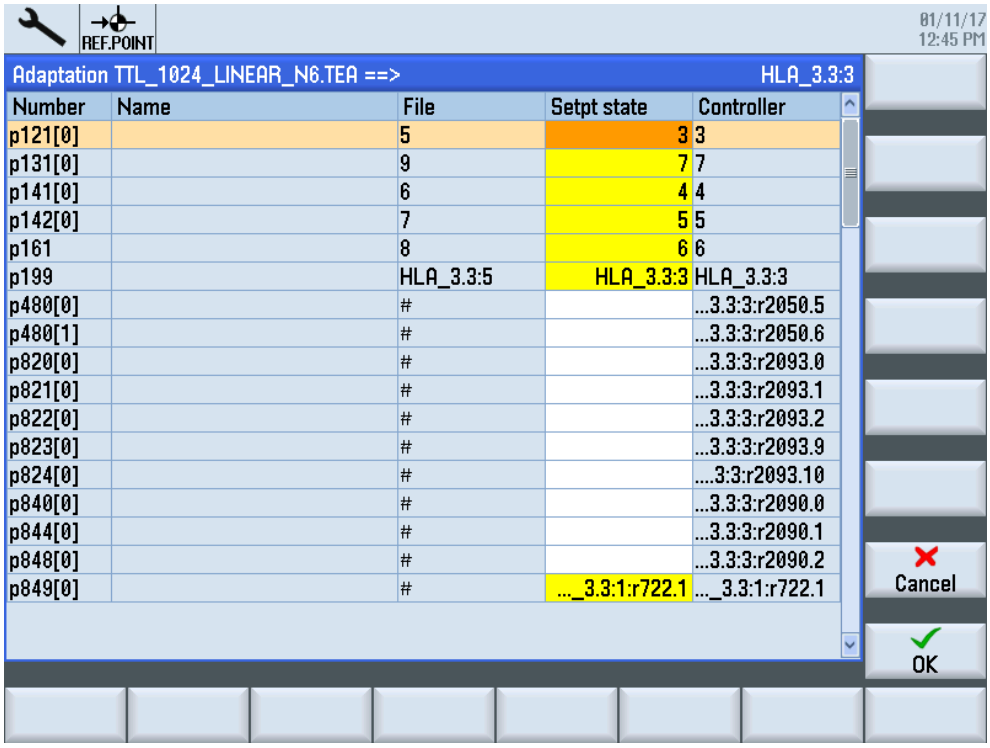
- If the "Adapt …" softkey is displayed, press it. Otherwise, press the "Load ..." softkey.

Fig. 3-13



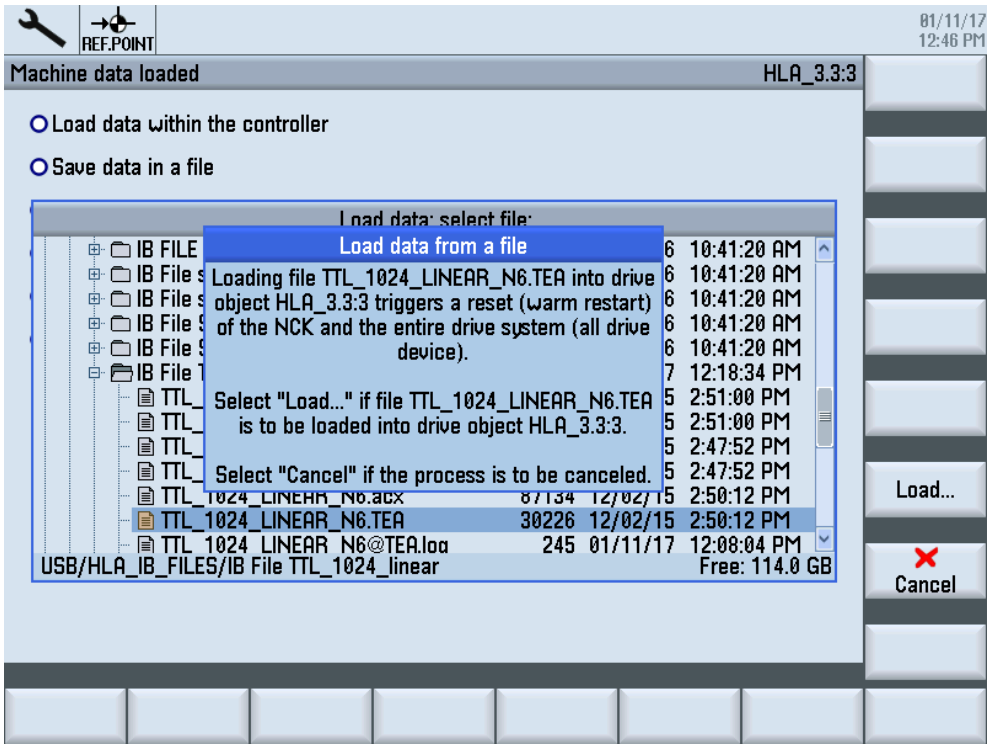
- Acknowledge the display shown in the next figure by pressing the "OK" softkey.

Fig. 3-14



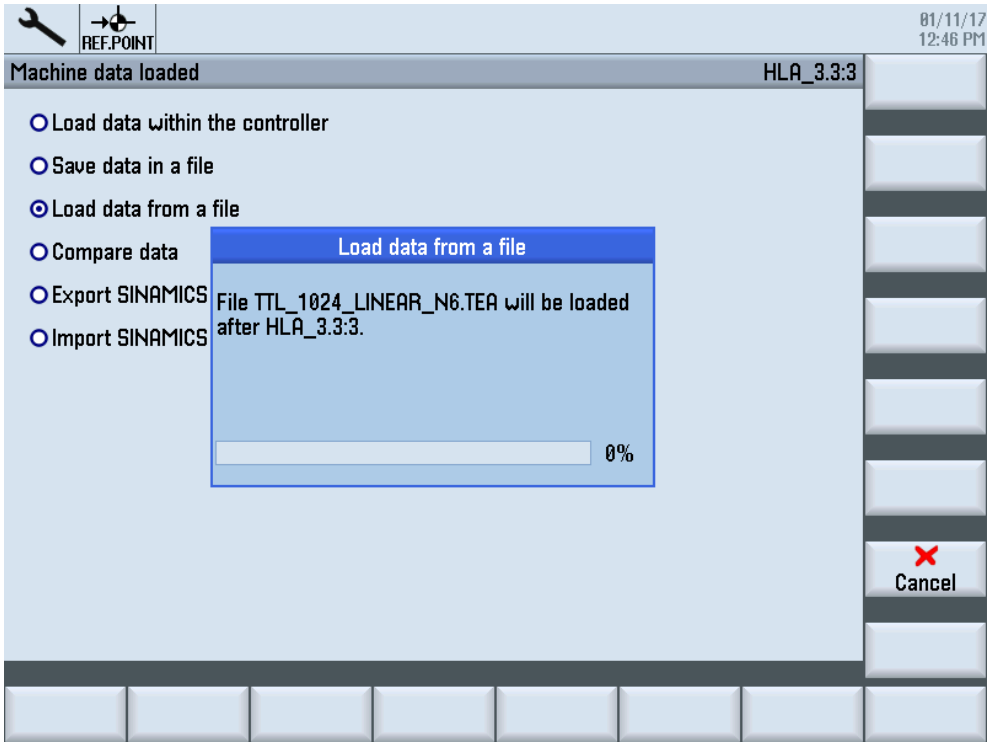
- Press the "Load …" softkey to load the TEA file into the drive object.

Fig. 3-15



- A progress bar is displayed.

Fig. 3-16



- A message telling you that the data have been successfully loaded is displayed.
  Acknowledge this message by pressing the "OK" softkey.
  Commissioning of the drive is now complete and an NCK reset is automatically performed.

3.2.3 Relevant machine data

Note Leave machine data MD 32640 STIFFNESS_CONTROL_ENABLE at value "0".

Note Analog drives do not support the DSC function.

Note Enter your spindle pitch in the setpoint scaling for linear axes in axis-specific machine data MD31030 ($MA_LEADSCREW_PITCH).

Enter your ratio between motor and ball screw in machine data MD31050 and MD31060.

Note In SW 4.8, you do not need axis machine data MD13070 ($MN_DRIVE_FUNCTION_MASK) bit 2 Deactivate axial parameter access on encoder drivers because you can also operate rotary encoders.
Leave MD13070 bit 2 at default value "0".

Parameterize the encoder data in the NC axis machine data with the drive wizard.

The analog axis is ready for operation when the following conditions are met:

- You are using TTL encoders, they are inserted into interfaces X231 or X232 and ports X202 and X203 are free.
- The motor has a maximum speed of 6000 rpm, and the ratio between the motor and the ball screw is 1:1.

The BICO interconnections in the commissioning file are SINUMERIK compatible. X122 pin 1 P840 ON/OFF(OFF1) = CU-r0722.1 and X122 pin 2 P864 (system pressure available for HLA or ALM ready for electric drives) = CU-r722.0. In the procedure, the enable signals at the PLC interface are identical to the enable signals of the electrical axes.

3.2.4 Values displayed on the user interface

The factors are set in such a way that the following results can be read.

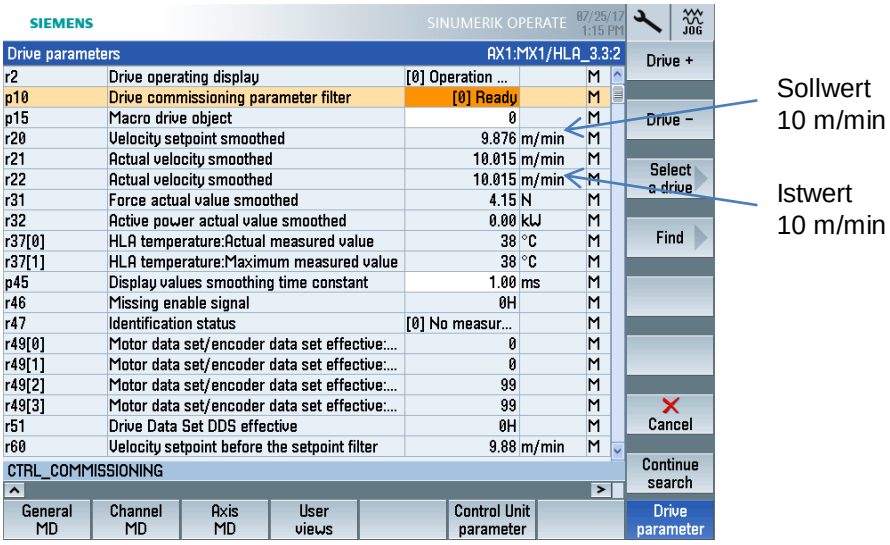
- The rotation of a rotary axis at 1000 rpm, for example, is displayed on the user interface as 1 m/min .
- An axis traveling at 6 m/min is also displayed as 6 mm/min.

The SINAMICS HLA module internally calculates the velocity actual values.

Note

The absolute values of the velocity setpoint and velocity actual value are not relevant. Sensible values in the drive are displayed due to the commissioning files.

Fig. 3-17 Linear axis SINAMICS parameters



The unit [m/min] is also used for rotary axes. 1 m/min corresponds to 100 rpm.

Example: 1 m/min corresponds to 100 revolutions per minute

Fig. 3-18 Service drive linear axis

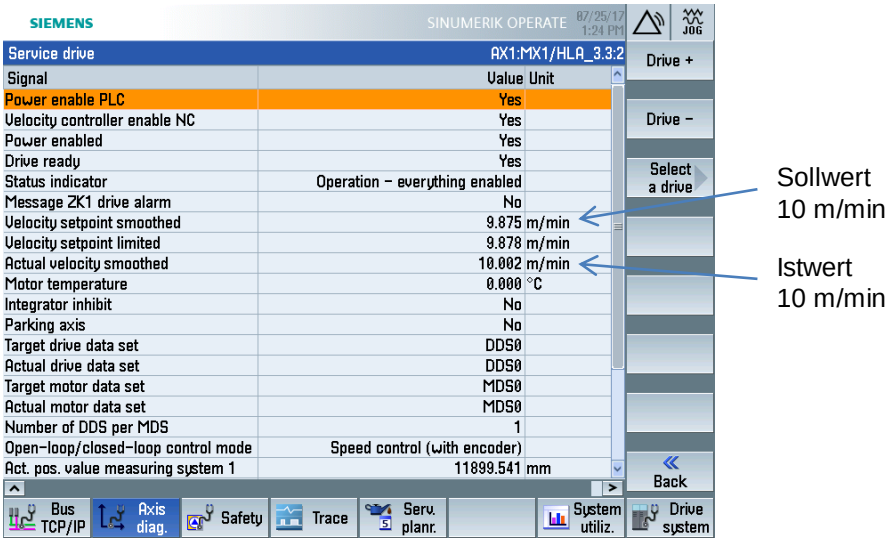
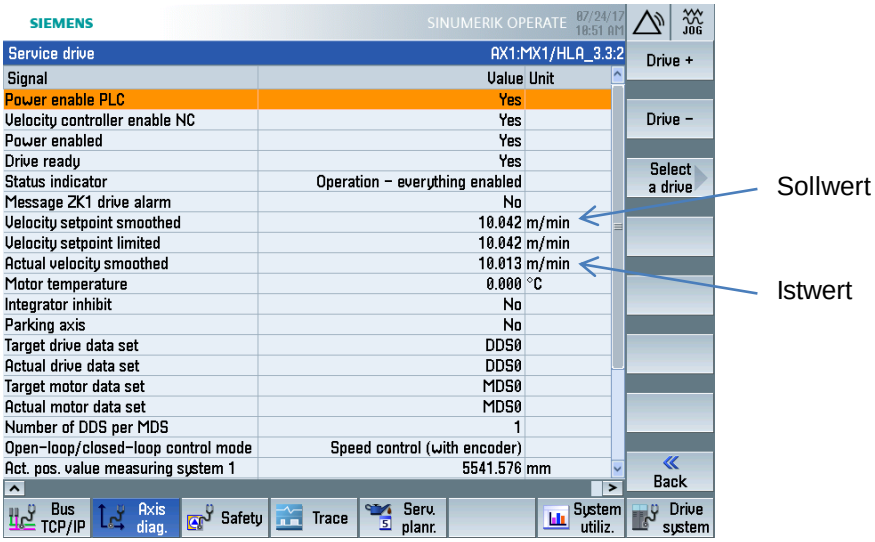


Fig. 3-19 Linear axis

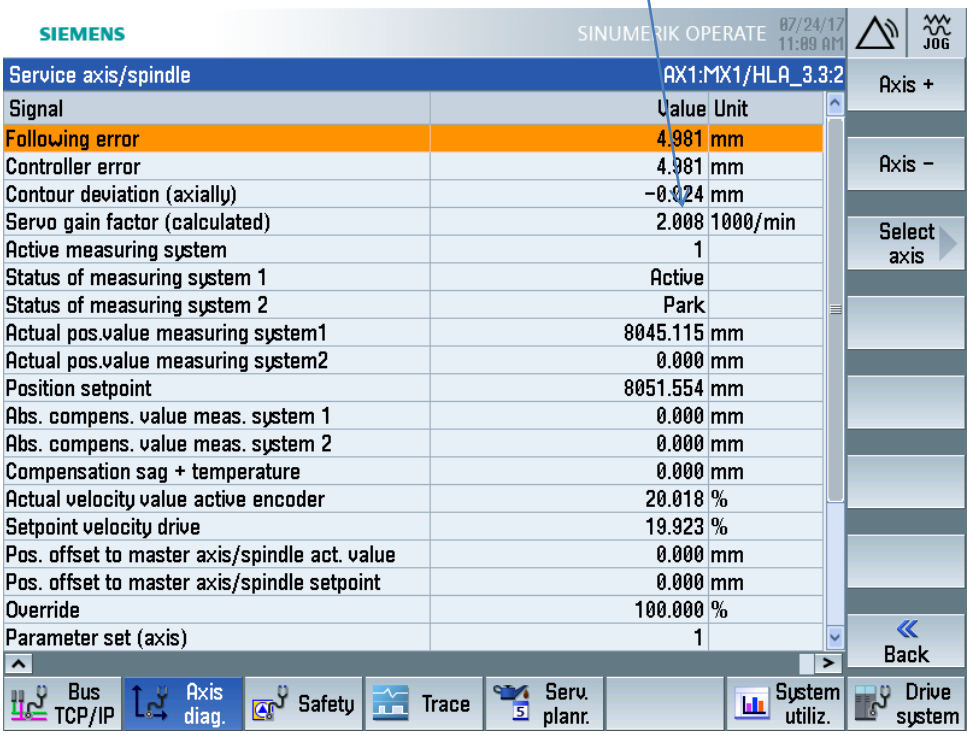


You can change the servo gain factor via parameter p1475 (speed controller loop gain). When you increase the parameter value, the servo gain factor is reduced.

You can also influence the servo gain factor by turning the tacho potentiometer at the analog drive (tachometer calibration).

Fig. 3-20 Service axis/spindle

Der errechnete Kv-Faktor stimmt exakt mit der Vorgabe im MD32200 POSCTRL_GAIN überein, wenn p1475 optimal eingestellt ist.



The examples above apply to a motor with a rated speed of 6000 rpm and an encoder with 1024 pulses per revolution. If, for example, you use a motor with rated speed 3000 rpm with an identical encoder, you must halve the value of parameter p1475.

With parameter p1475 (loop gain), you can calibrate the tachometer of an axis in very small steps.

If you increase the p1475 value, you can reduce the servo gain and thus the calculated servo gain factor.

You can calibrate the axis offset with parameter P1832 (offset compensation).

If the analog converter is not operational and the SINAMICS HLA is in closed-loop control, a traversing command results in alarm "207900 Velocity control output limited". This alarm is suppressed when the commissioning files are loaded. This is because a 1-BICO interconnection is implemented in parameter p2144 (motor blocking monitoring enabled). As a result, alarm "25030 Alarm limit of actual velocity" is displayed instead.

3.2.5 Commissioning the encoders

When the factory settings are loaded, the topology is also determined.

As soon as the commissioning files for the linear and rotary axes have been loaded, a rotary TTL encoder with 1024 pulses/revolution is configured on the SMC30 at ports X131 and X132.

For rotary encoders, you must additionally set parameter p4613 (cylinder path per encoder revolution).

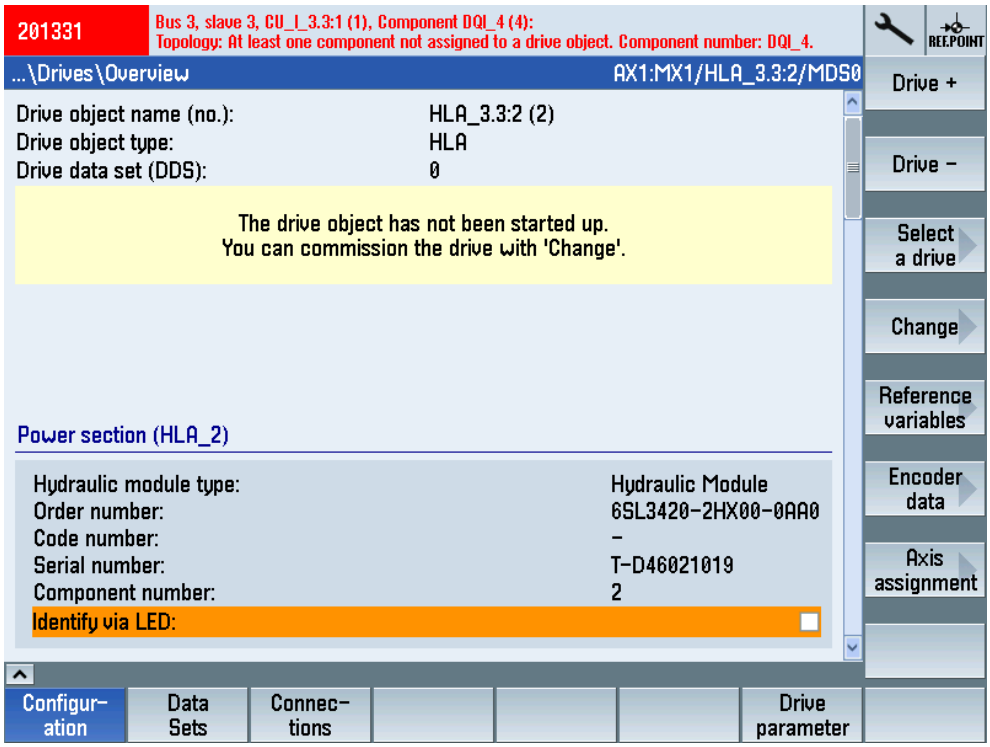
If you are using an encoder that is evaluated by a sensor module (SMC or SME) with DRIVE-CLiQ connection or that has its own DRIVE CliQ connection, you must insert that encoder in X202 for the 1st HLA axis and in X203 for the 2nd HLA axis.

Use the drive wizard as you would for a purely electric SINAMICS drive.

3.2.6 Commissioning or modifying encoders with the drive wizard

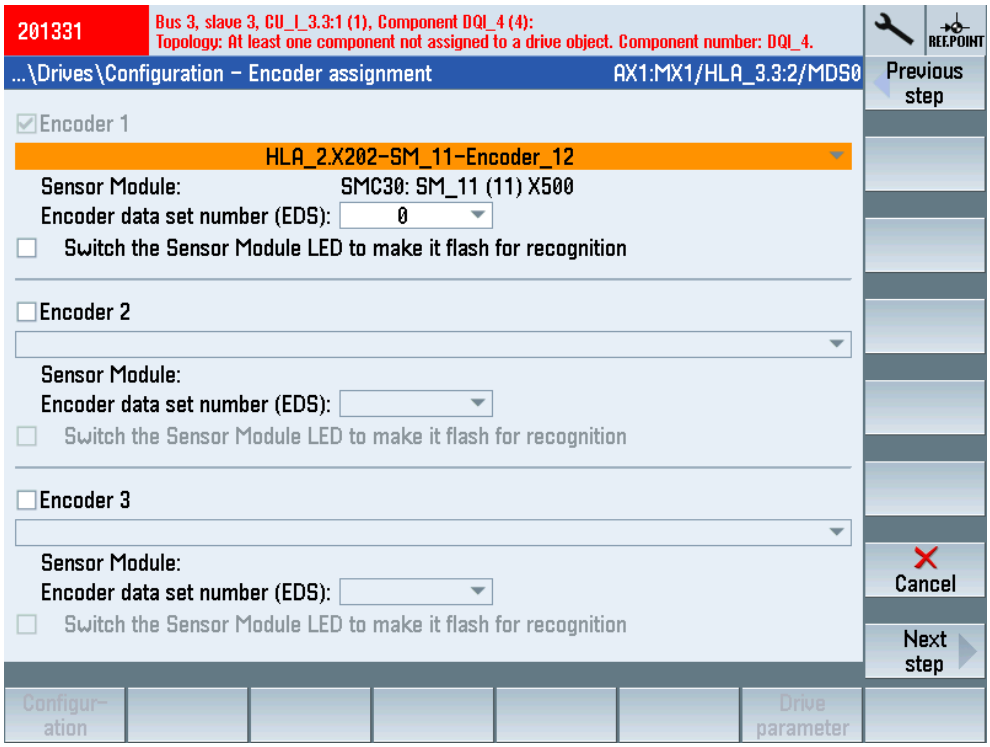
- Press the "Change" softkey.
  Acknowledge all subsequent screenforms by pressing the "Next step" softkey because all necessary data has already been parameterized via the commissioning file.

Fig. 3-21 Making changes in the drive wizard



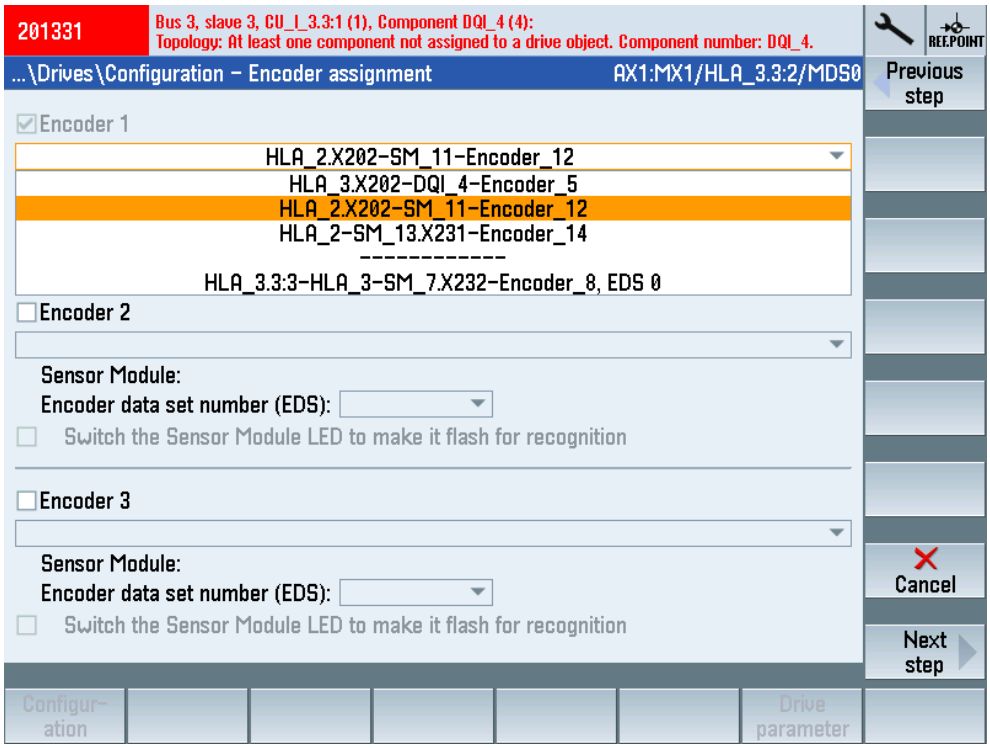
- When the next screen is displayed, press the <INSERT> key to select an encoder.

Fig. 3-22 Configuring the encoder assignment



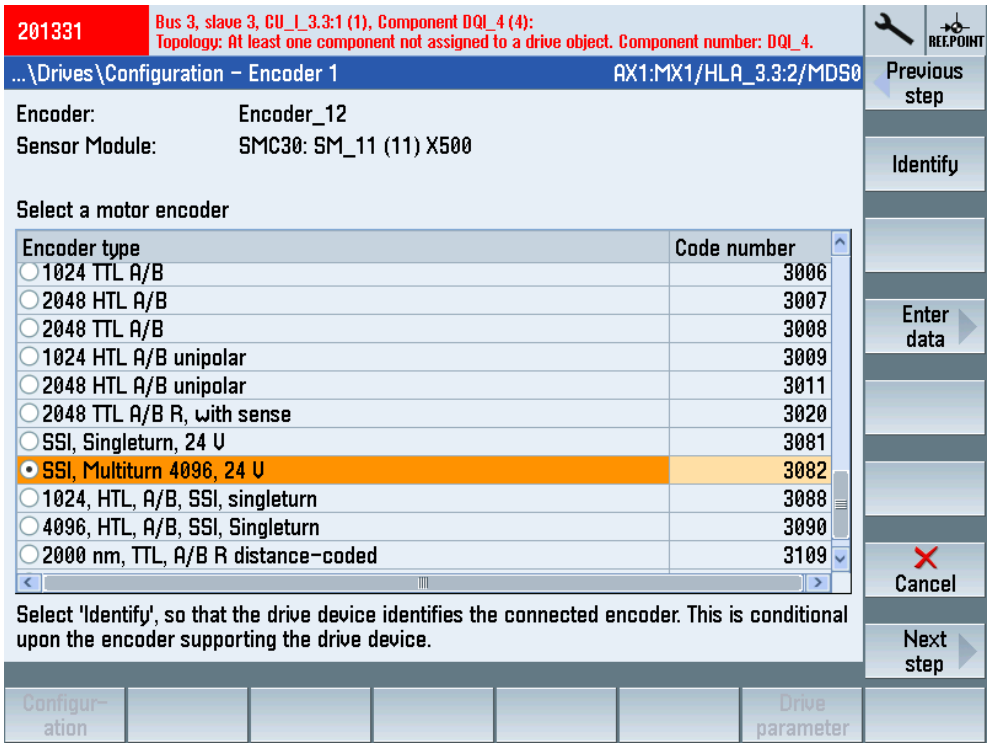
- Select an encoder and then press the <INPUT> key.

Fig 3-23 Selecting an encoder



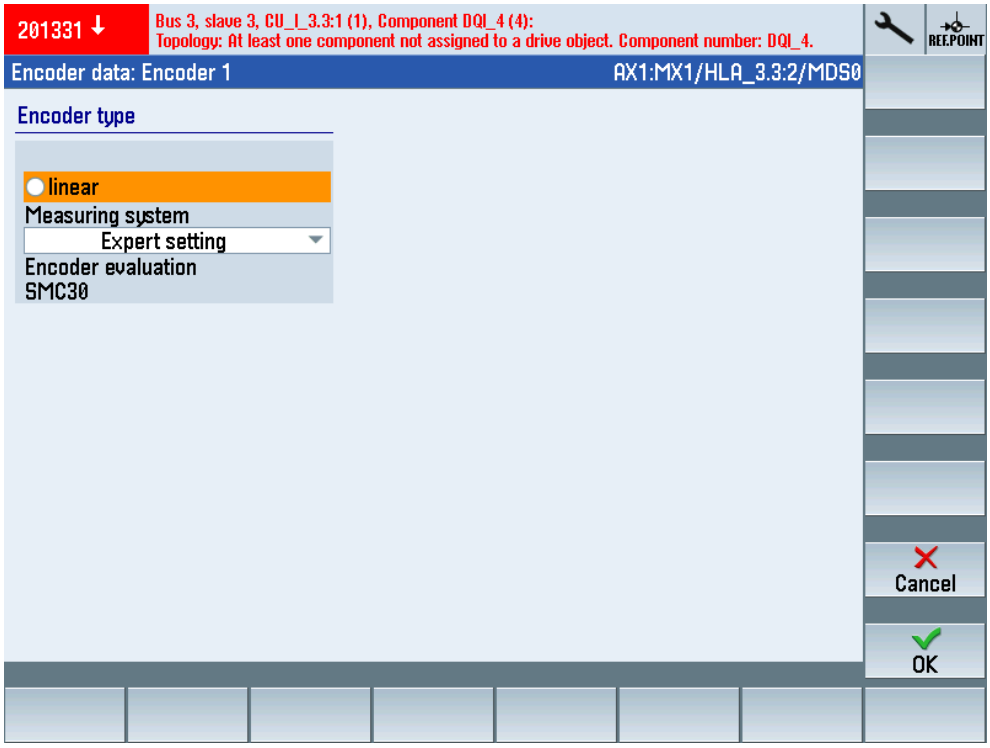
- Select an encoder.
  If you have selected a TTL or SSI encoder, now press the "Enter data" softkey to configure the encoder.
  For all other encoder types, acknowledge all subsequent screenforms with the "Next step" softkey and close the wizard with the "Finish" softkey. Configure the EnDat or sin/cos encoder with parameter p400 to p449.

Fig 3-24 Selecting an encoder



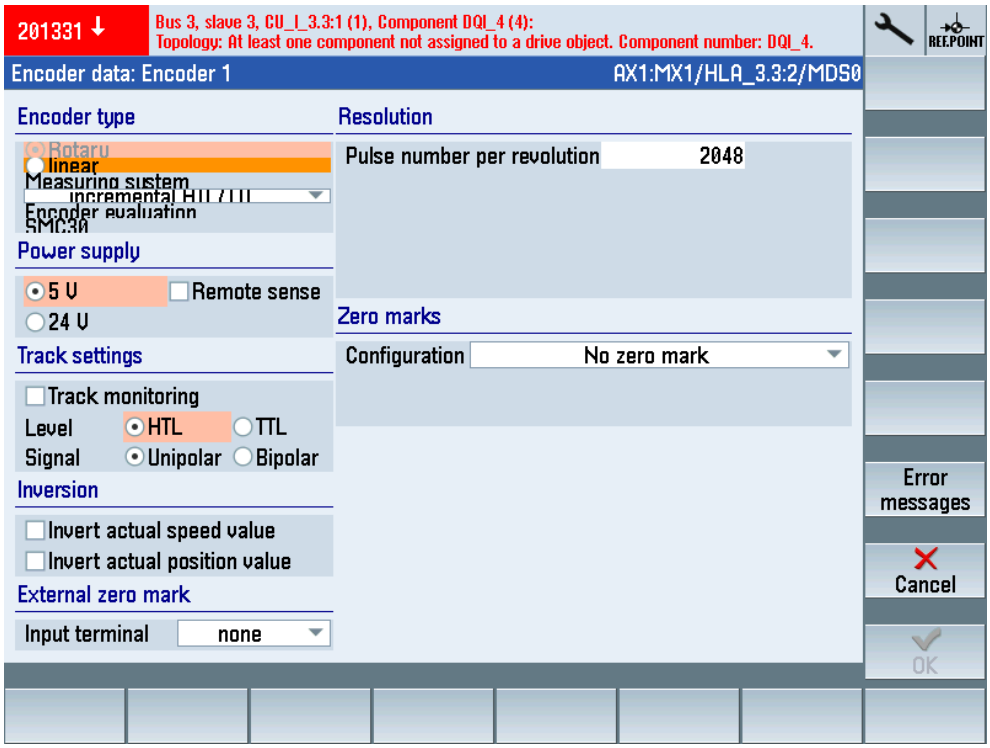
- Select "Expert setting" and then press the <SELECT> key.

Fig. 3-25 Selecting Expert setting



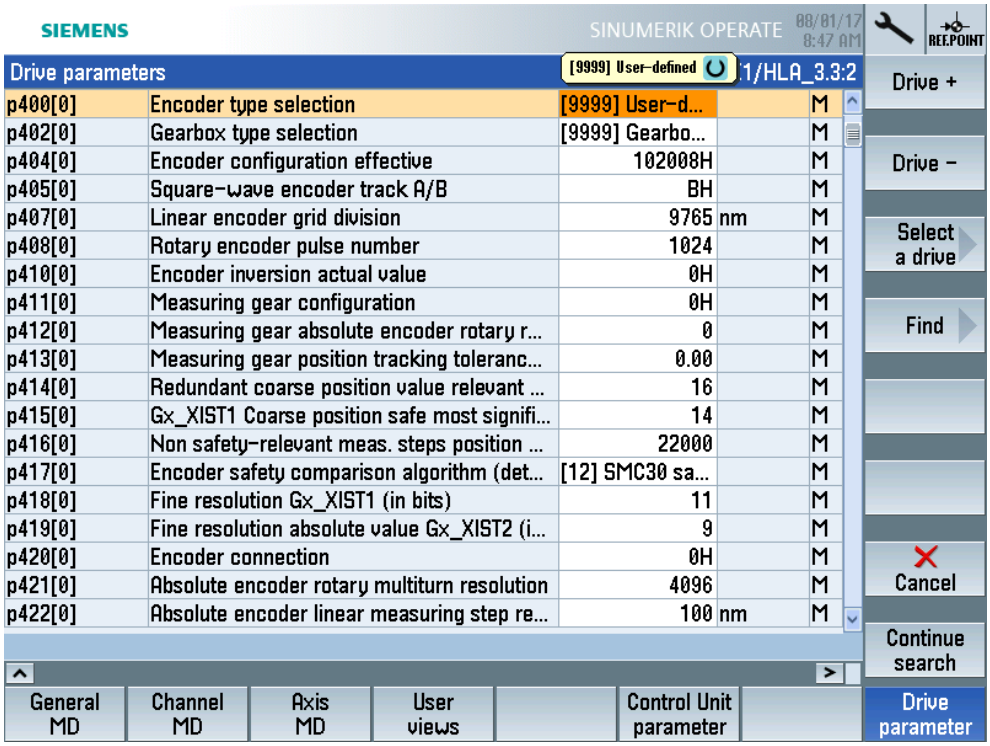
- Enter the data for the TTL or SSI encoder.

Fig. 3-26 Entering encoder data



- Set parameter p10 to "4" in order to be able to adapt the encoder data
- Configure the encoder.

Fig. 3-27



Summary of the most important parameters for TTL encoders, sin/cos encoders, SSI encoders, and EnDat encoders:

Fig. 3-28 sin/cos encoder

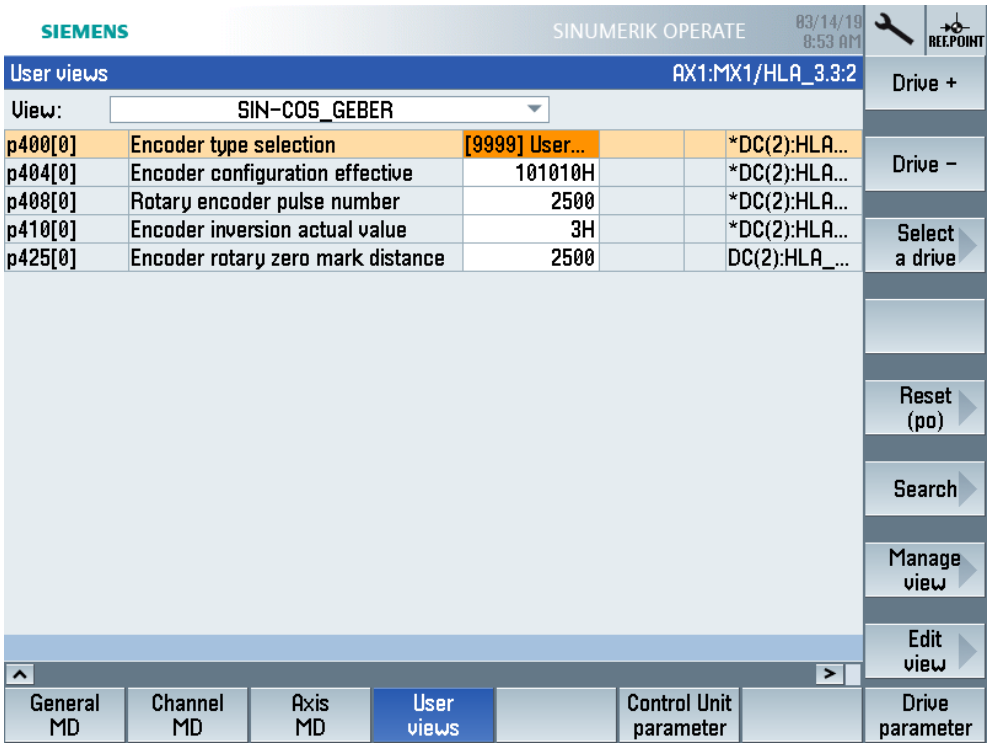


Fig. 3-29 EnDat encoder

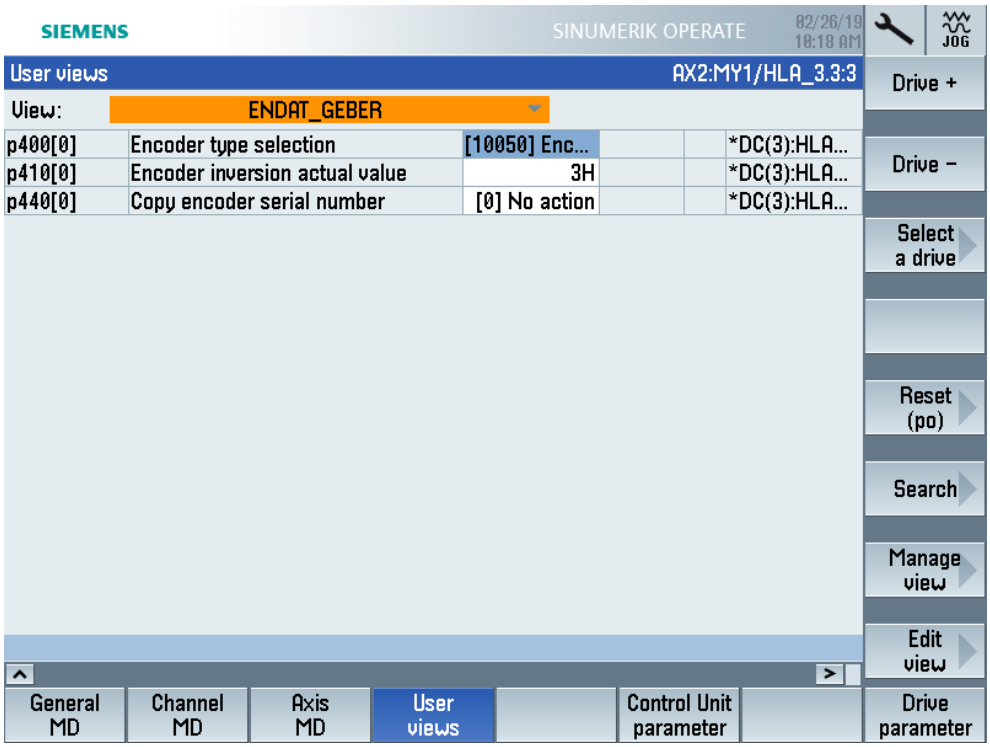


Fig. 3-30 SSI encoder

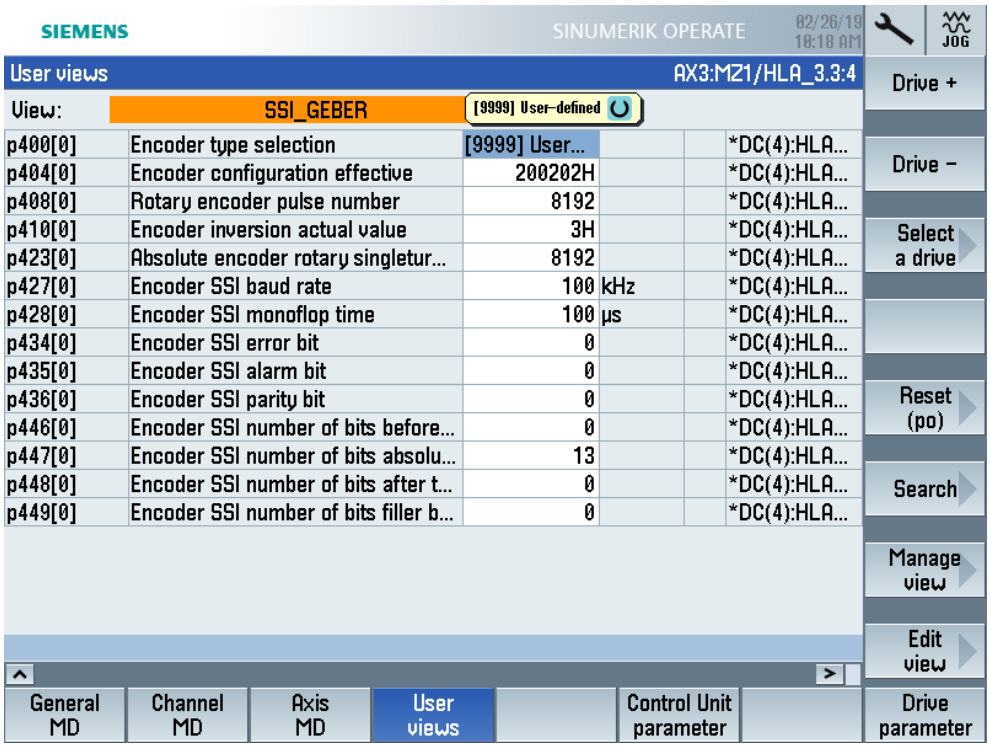
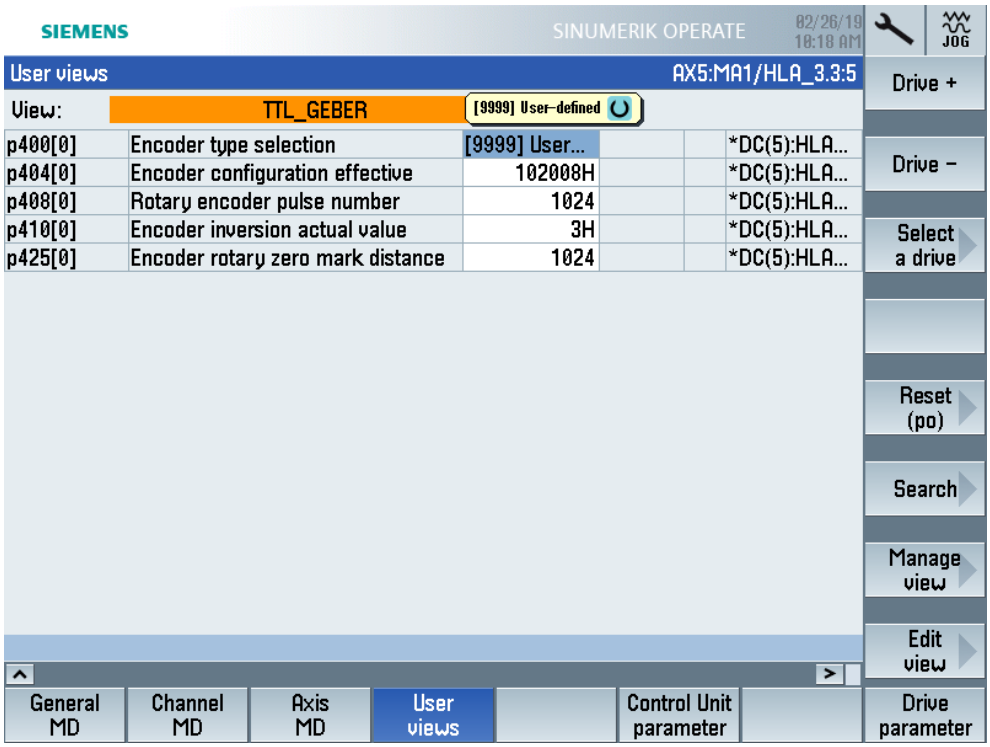


Fig. 3-31 TTL encoder



- Set parameter p10 to "0":
- Save the drive object.
- Trigger an NCK reset.

Note

If you do not load any commissioning files into the SINAMICS HLA after restoring the factory settings, you must set the parameters manually. This is procedure described in the following section.

Select a TTL linear scale as the encoder as otherwise the commissioning wizard cannot be completed without error. You can set the encoder via the assistant or directly via the parameter lists.

If you use a modified encoder, you must not run the drive wizard again after successful commissioning. If you execute the drive wizard again with an unmodified encoder, you must make sure that you are using the correct encoder as otherwise the encoder data will be overwritten.

3.2.7 Preassigning the SINAMICS HLA manually

The SINAMICS HLA is automatically parameterized when you load the ACX and TEA files. You only have to perform the actions described in this chapter if you are not using the commissioning files.

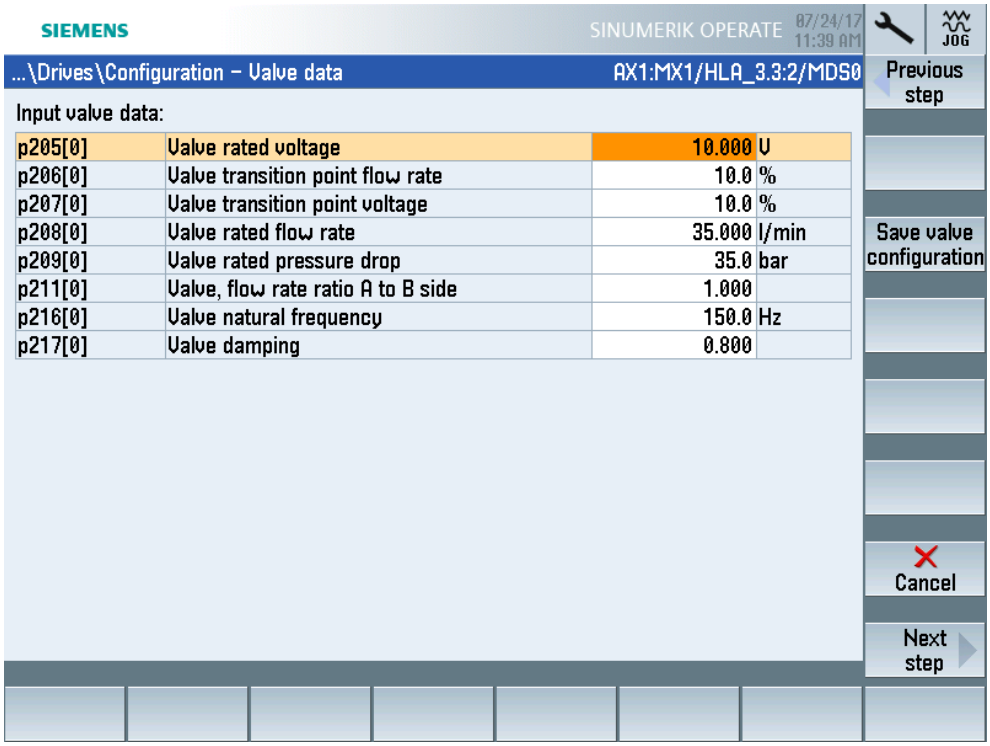
Note

In this chapter, you will find out how the SINAMICS HLA is parameterized with the commissioning files.

Note

Do not change the values set by the commissioning files.

Fig. 3-32 Entering valve data



Note

If controller data are calculated, a cylinder diameter of, for example, 36.5 mm for linear and rotary axes will result in a loop gain (p1475) of approximately 6000. The setpoints of parameter r62 resulting from this loop gain or the service display are shown in the following figure.

Instead of the controller data calculation, use the commissioning files.

Fig. 3-33 Entering the cylinder data

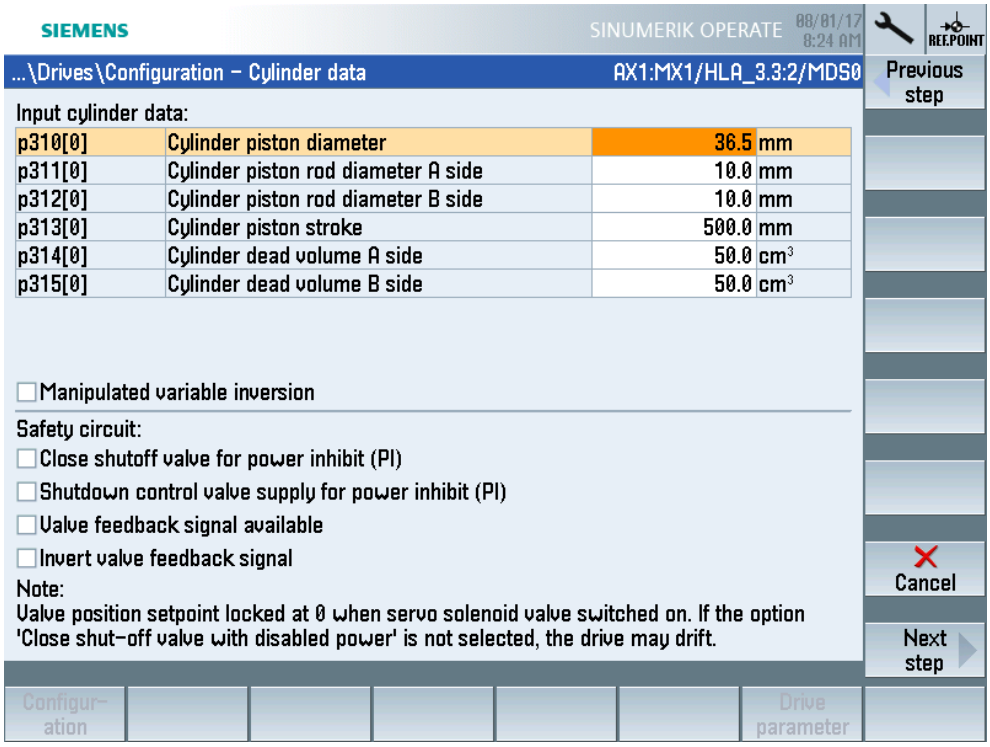


Fig. 3-34 Entering data of the supply unit

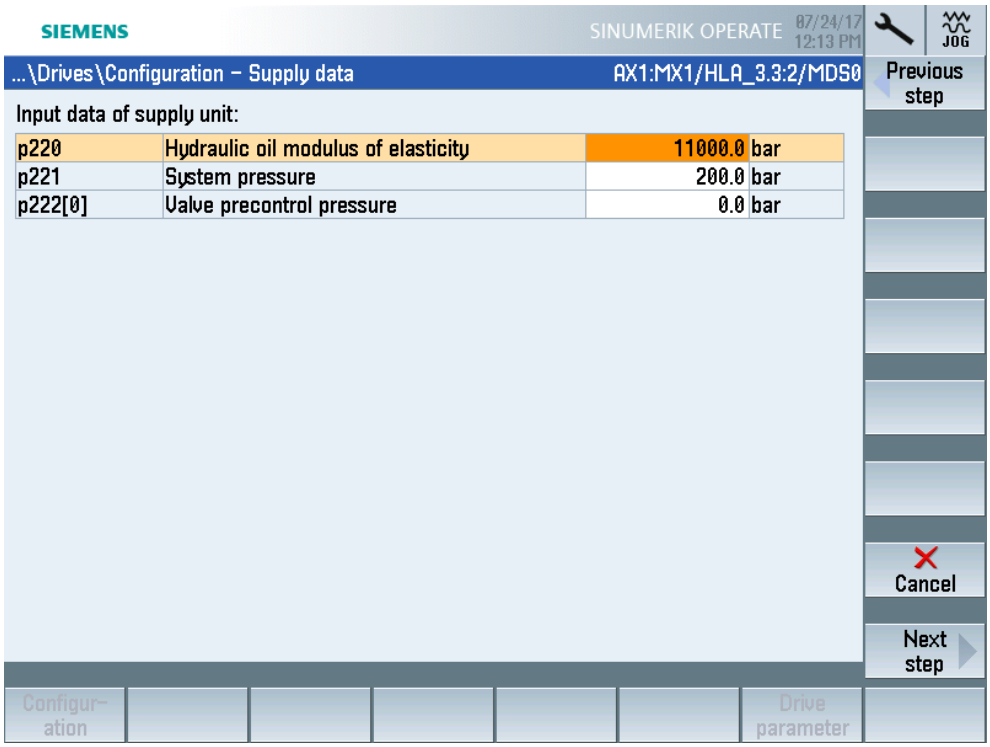


Fig. 3-35 Entering connection data

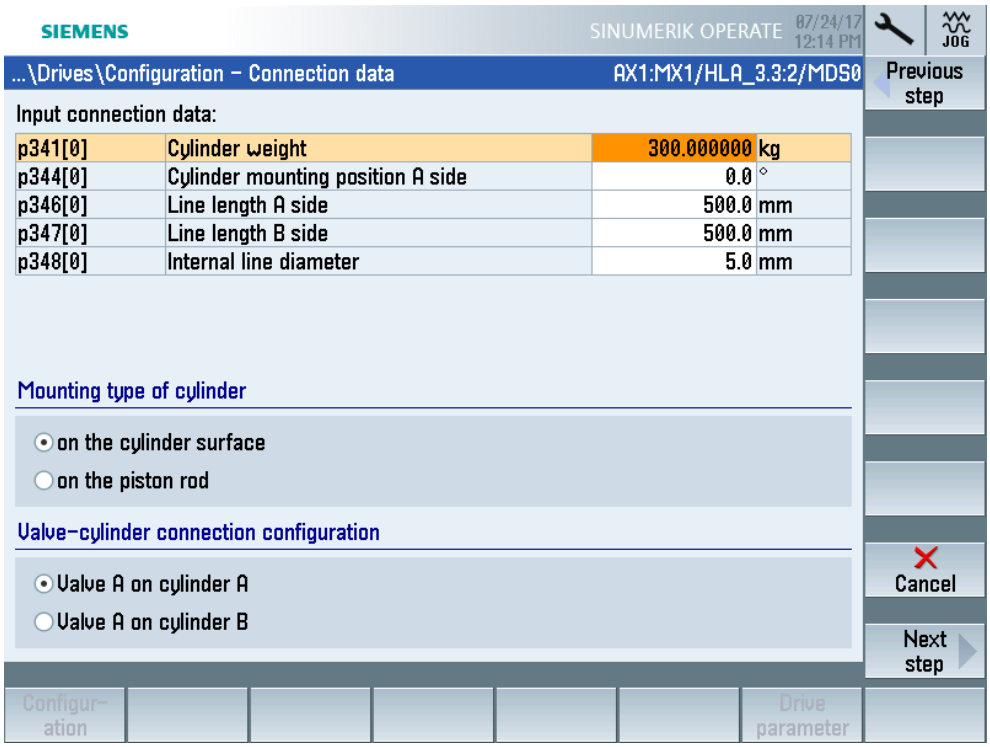
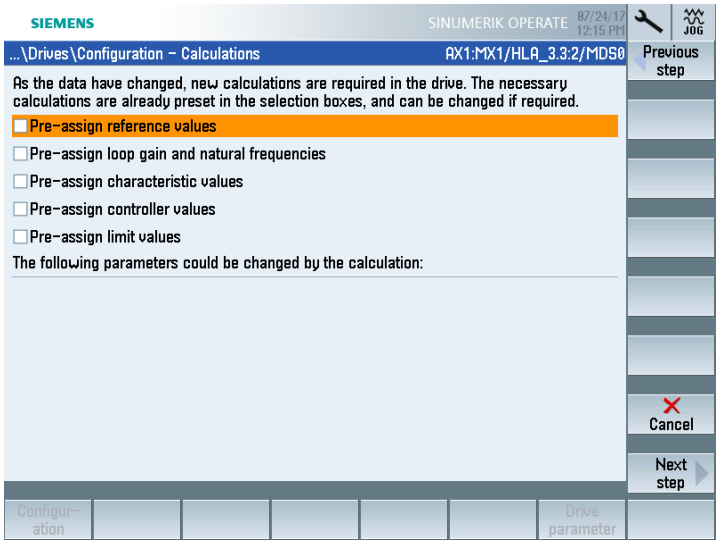


Fig 3-36 Calculations

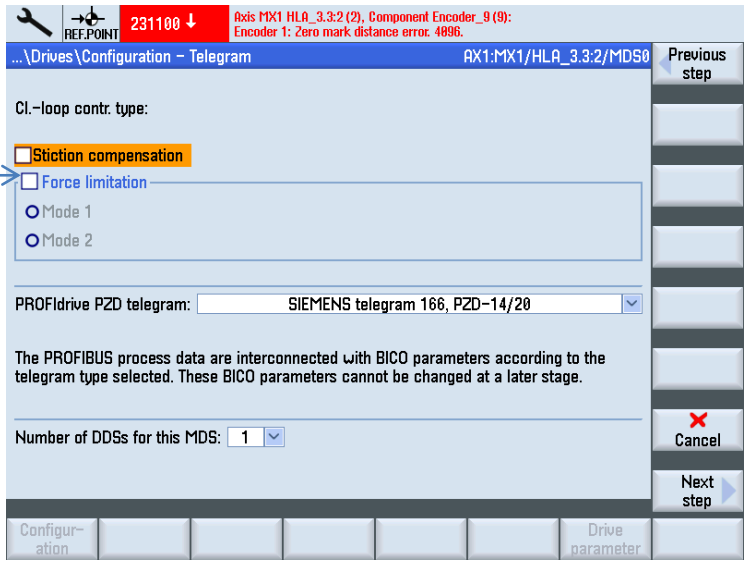


Deaktivieren Sie alle Optionen

Note

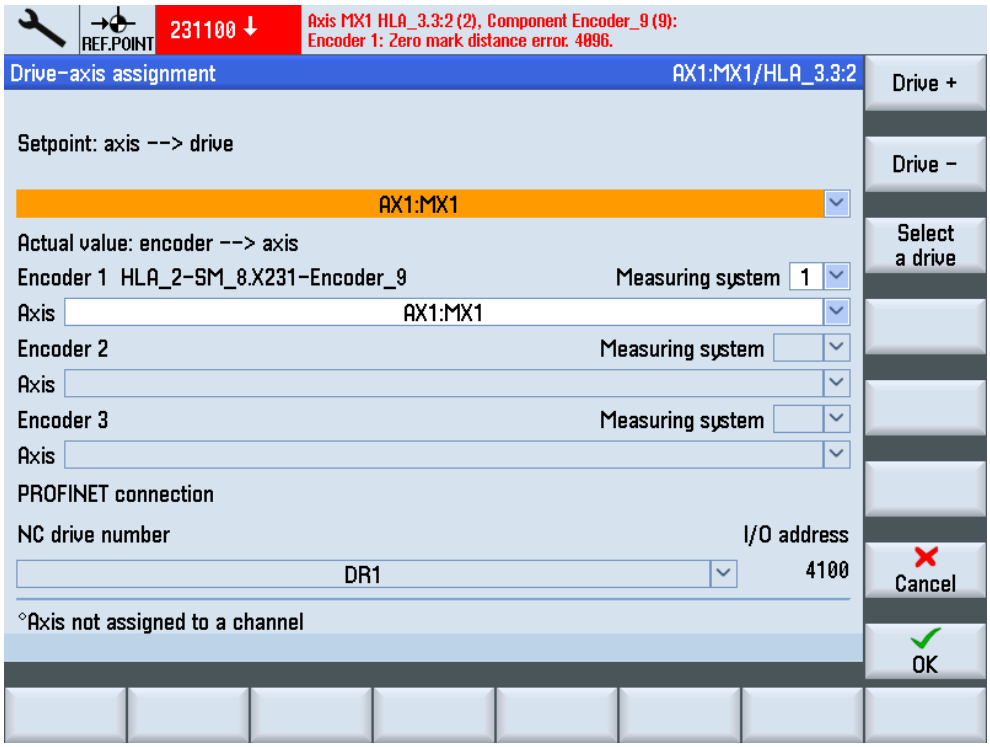
Do not use the options "Calculate controller data" and "Calculate drive model data" when you load the commissioning files.

Fig. 3-37 Configuring a telegram



Deaktivieren Sie die Option

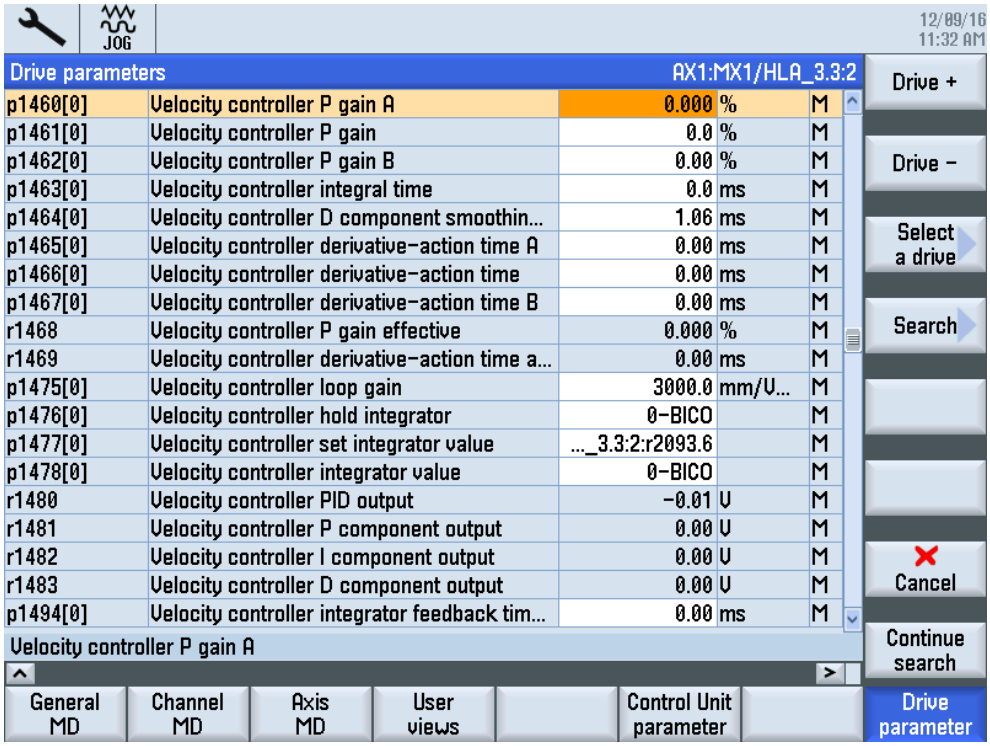
Fig. 3-38 Configuring the encoder assignment



Note

When the drive files are loaded, all controllers in the SINAMICS HLA are automatically deactivated. This condition is shown in the following figure in which all controller parameters have the value "0".

Fig. 3-39 Drive parameters p1460[0] to p1467[0]



3.2.8 Enabling the drive via the PLC interface

By loading the SDB for the SINAMICS HLA, the analog drives are handled in the same way as digital drives. Set the enable signals via the PLC interface.

Table 3-1

Release	Interface signal
OFF 1	X122.1/r722.0
OFF 3	X122.2/r722.1
Controller enable	DB38xx.DBX2.1
Pulse enable	DB38xx.DBX4001.7
Measuring system selection	DB38xx.DBX1.5 or 1.6

3.3 Analog spindles on the SINUMERIK 828D

3.3.1 Supplementary conditions

Connection for encoder actual values

The precondition for connecting a spindle actual value encoder is an axis with digital drive that is only equipped with one encoder. As the second encoder, a Sensor Module, e.g. a SMC30, is connected to the Motor Module or to the SINAMICS HLA module.

If no DRIVE-CLiQ connections are free, you can use a DMC20 or DME20 actual value hub.

The Sensor Module is connected to the directly mounted spindle actual value encoder. The PROFIdrive telegram of the digital drive must be configured for 2 encoder actual values. Depending on MD11240 ($MN_PROFIBUS_SDB_NUMBER), the standard system data blocks of SINUMERIK 828D support Siemens telegram 166 or Siemens telegram 136.

Functional restrictions

- There is no setpoint telegram for the analog spindle; this means that the functionality based on the setpoint telegram is not available, e.g. DSC and torque feedforward control.
- The driver software simulates the "Drive ready" signal as being set.
- As it is not possible to access the drive parameters, the associated functionality is restricted (e.g. spindle utilization display and automatic speed and position controller optimization). The missing values are displayed in gray in the "Service Overview" screenform in column Analog Spindle and the following message is displayed: "This axis is not affected"

3.3.2 Connection X252 for spindle setpoints

Connect the analog spindle to interface X252 of the PPU. Depending on the operating mode of the analog spindle, the following signals are output:

Table 3-2 Spindle types with output signals

Spindle type	Signal name	Meaning
Bipolar spindle	AOUT	Analog output +/-10 V
	AGND	Analog output 0 V reference signal
	DOUT11	Controller enable
Unipolar spindle with separate enable and direction signals	AOUT	Analog output +10 V
	AGND	Analog output 0 V reference signal
	DOUT12	Negative direction of travel (remains set even if there is no controller enable)
Unipolar spindle with direction-dependent enable	AOUT	Analog output +10 V
	AGND	Analog output 0 V reference signal
	DOUT11	Controller enable and positive direction of travel
	DOUT12	Controller enable and negative direction of travel

The D/A conversion of the spindle setpoint is achieved with 14-bit resolution.

3.3.3 Relevant machine data

Set the following machine data for the analog spindle.

- Activate the analog spindles:
  MD30100 ($MA_CTRLOUT_SEGMENT_NR) = 0
  The analog spindle for the setpoint output is activated by setting the local bus as bus segment.
- Select the operating mode of the analog spindle.

Table 3-3 Bit representation of machine data MD30134

MD30134 ($MA_IS_UNIPOLAR_OUTPUT)	
0	Bipolar output (+/-10 V)
1	Unipolar spindle with separate enable and direction signals
2	Unipolar spindle with direction-dependent enable

- Adapt the rated output voltage to the rated speed of the analog drive:
  - MD32250 ($MA_RATED_OUTVAL)
  - MD32260 ($MA_RATED_VELO)
- If the analog spindle is operated without an actual-value encoder, you must enter the value "0" as the encoder number.
  - MD30200 ($MA_NUM_ENCS) = 0
- If a directly connected spindle actual-value encoder is used, you must select actual-value acquisition type "PROFIBUS":
  - Incremental encoder: MD30240 ($MA_ENC_TYPE) = 1
  - Absolute encoder: MD30240 ($MA_ENC_TYPE) = 4

- Configure the spindle actual-value encoder as the 2nd encoder of an additional digital drive. To do this, set the drive assignment of the actual value in the same way as for the axis to whose Motor Module, for example, an SMC30 is connected:
  - MD30220[0] ($MA_ENC_MODULE_NR[0]) = MD30220[0] of the digital drive
- The input assignment of the actual value should be set to the input for the 2nd encoder on the digital Motor Module:
  - MD30230[0] ($MA_ENC_INPUT_NR[0]) = 2
- You can activate automatic drift compensation for a connected spindle actual value encoder:
  - MD36700 ($MA_DRIFT_ENABLE)

  A basic drift value is continuously entered as additional speed setpoint irrespective of whether there is a spindle actual-value encoder:
  - MD36720 ($MA_DRIFT_VALUE)

3.3.4 Example

Example for 3 axes and 1 analog spindle with actual-value encoder (a SMC30 as connected as the 2nd encoder on the Y axis.)

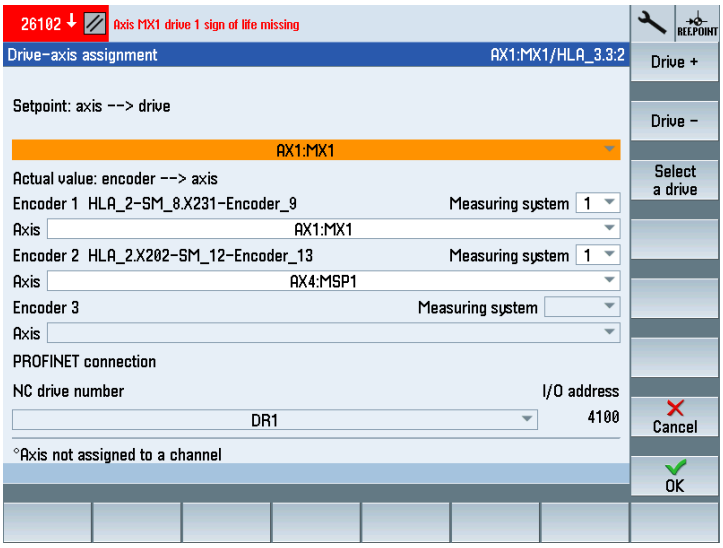
Table 3-4 Machine data for 3 axes and 1 analog spindle

MD identifier	X	Y	Z	SP	Meaning
MD30100 CTRLOUT_SEGMENT_NR	5	5	5	0	Bus segment
MD30110 CTRLOUT_MODULE_NR	1	2	3	1	Module assignment
MD30120 CTRLOUT_NR	1	1	1	1	Output assignment
MD30130 CTRLOUT_TYPE	1	1	1	1	Output type
MD30134 IS_UNIPOLAR_OUTPUT	0	0	0	0	"0" means bipolar
MD30200 NUM_ENCS	1	1	1	1	Number of encoders
MD30220[0] ENC_MODULE_NR[0]	1	2	3	2	SMC30 at the Y axis
MD30230[0] ENC_INPUT_NR[0]	1	1	1	2	Input for 2nd encoder
MD30240 ENC_TYPE	1/4	1/4	1/4	1/4	Encoder type

Table 3-5 Machine data for a spindle

MD identifier	SP	Meaning
MD32250 RATED_OUTVAL	80 (80% of 10 V)	Rated output voltage
MD32260 RATED_VELO	3000 (at 8 V)	Rated motor speed
MD36700 $MA_DRIFT_ENABLE	0	Automatic drift compensation is deactivated.
MD36710 DRIFT_LIMIT	0	Limit for automatic drift compensation
MD36720 DRIFT_VALUE	0	Basic drift value

Fig. 3-40 Drive axis assignment



In diesem Beispiel ist der 2. Geber auf dem SINAMICS HLA einer analogen Spindel zugeordnet.

X252 pin assignment

Table 3-6

Pin		Signal name	NC variable	Meaning
1	AO	AOUT	-	Analog output (voltage for analog spindle)
2	AM	AGND	-	Analog ground
3	IN9	DIN9	$A_IN[9]	Digital NC input 9
4	IN10	DIN10	$A_IN[10]	Digital NC input 10
5	IN11	DIN11	$A_IN[11]	Digital NC input 11
6	IN12	DIN12	$A_IN[12]	Digital NC input 12
7	M4	MEXT4	-	Ground for pins 3 … 6
8	P3	P24EXT3	-	+24 V power supply
9	O9	DOUT9	$A_OUT[9]	Digital NC output 9
10	O10	DOUT10	$A_OUT[10]	Digital NC output 10
11	M3	MEXT3	-	Ground for pins 9,10,12,13
12	O11	DOUT11	-	• Without analog spindle: Digital NC output 11 • With analog spindle: Controller enable for analog spindle (in accordance with MD30134 $MA_IS_UNIPOLAR_OUTPUT)
13	O12	DOUT12	-	• Without analog spindle: Digital NC output 12 • With analog spindle: Controller enable for analog spindle (in accordance with MD30134 $MA_IS_UNIPOLAR_OUTPUT)
14	M3	MEXT3	-	Ground for pins 9,10,12,13

4 Worth knowing

4.1 Address space and telegrams of the system data block (SDB)

Table 4-1 Special SDB for the SINAMICS HLA of the SINUMERIK 828D

PPU2xx SDB name Internal version	Number of analog axes	Number of DRIVE-CLiQ axes	Drive telegram	Input addresses	Output addresses
1 SINAMICS HLA with telegram 166:					
PPU28x/PPU26x SDB80_1HLA/ SDB60_1HLA 99.02.00.05	2	3	Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 391 PZD-3/7 Tel. 370 PZD-1/1	4100 … 4139 4140 … 4179 4180 … 4217 6748 … 6757 4220 … 4257 6772 … 6781 4260 … 4297 6796 … 6805 6500 … 6513 6514 … 6515	4100 … 4127 4140 … 4167 4180 … 4209 6748 … 6751 4220 … 4249 6772 … 6775 4260 … 4289 6796 … 6799 6500 … 6505 6514 … 6515
PPU24x SDB40_1HLA 99.02.00.05	2	2	Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 391 PZD-3/7 Tel. 370 PZD-1/1	4100 … 4139 4140 … 4179 4180 … 4217 6748 … 6757 4220 … 4257 6772 … 6781 6500 … 6513 6514 … 6515	4100 … 4127 4140 … 4167 4180 … 4209 6748 … 6751 4220 … 4249 6772 … 6775 6500 … 6505 6514 … 6515
2 SINAMICS HLA with telegram 166:					
PPU28x/PPU26x SDB80_2HLA/ SDB60_2HLA 99.02.00.06	4	2	Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 391 PZD-3/7 Tel. 370 PZD-1/1	4100 … 4139 4140 … 4179 4180 … 4219 4220 … 4259 4260 … 4297 6796 … 6805 4300 … 4337 6820 … 6829 6500 … 6513 6514 … 6515	4100 … 4127 4140 … 4167 4180 … 4207 4220 … 4247 4260 … 4289 6796 … 6799 4300 … 4329 6820 … 6823 6500 … 6505 6514 … 6515
PPU24x SDB40_2HLA 99.02.00.06	4	1	Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 166 PZD-14/20 Tel. 136 PZD-15/19 Tel. 701 PZD-2/5 Tel. 391 PZD-3/7 Tel. 370 PZD-1/1	4100 … 4139 4140 … 4179 4180 … 4219 4220 … 4259 4260 … 4297 6796 … 6805 6500 … 6513 6514 … 6515	4100 … 4127 4140 … 4167 4180 … 4207 4220 … 4247 4260 … 4289 6796 … 6799 6500 … 6505 6514 … 6515

4.1.1 Installation instructions of the special SDB.

SIEMENS **SINUMERIK 828D** Date 19.01.2016
Version V01

Configuration instructions

GIV4.7SP2HF1, SDB for Retrofit HLA (for analog drives)

Usage with following SW products

Export versions Software on CF card		
Order No.	**Designation**	**For hardware**
6FC5835-1GY40-4YA0	CNC-SOFTWARE TURNING;EXPORT SOFTWARE 4.7	**PPU240.3/241.3**
6FC5835-2GY40-4YA0	CNC-SOFTWARE MILLING;EXPORT SOFTWARE 4.7	**PPU240.3/241.3**
6FC5834-1GY40-4YA0	CNC-SOFTWARE TURNING;EXPORT SOFTWARE 4.7	**PPU260.3/261.3**
6FC5834-2GY40-4YA0	CNC-SOFTWARE MILLING;EXPORT SOFTWARE 4.7	**PPU260.3/261.3**
6FC5833-1GY40-4YA0	CNC-SOFTWARE TURNING;EXPORT SOFTWARE 4.7	**PPU280.3/281.3**
6FC5833-2GY40-4YA0	CNC-SOFTWARE MILLING;EXPORT SOFTWARE 4.7	**PPU280.3/281.3**
6FC5836-1GY40-4YA0	CNC-SOFTWARE TURNING advanced; EXPORT SOFTWARE 4.7	**PPU280.3/281.3**
6FC5836-2GY40-4YA0	CNC-SOFTWARE MILLING advanced; EXPORT SOFTWARE 4.7	**PPU280.3/281.3**

1 Analog drives with 828D

1.1 Configuration

Requirements

Please observe the following preconditions when configuring:

- An HLA Modul with a SINUMERIK 828D is only possible with additional SDB (System Data Blocks) loaded into the SINUMERIK 828D. This SDB-file can be downloaded from PridaNet.
- No additional Simatic STEP7 configuration is necessary
- for technology T/M , PPU24x.3, PPU26x.3, PPU28x.3

2 Preconditions

2.1 Hardware

- The HLA Modul is a SINAMICS component and will be connected via DriveCLiQ

3 Installation of SDB

3.1 Download from Pridanet

- Depending of technology and number of HLA-modules, following files need to be downloaded:
  - SDB-828D Retrofit 1HLA Turning
  - SDB-828D Retrofit 2HLA Turning
  - SDB-828D Retrofit 1HLA Milling / Grinding
  - SDB-828D Retrofit 2HLA Milling / Grinding

3.1 Upgrading the PPU

- The *.tgz file should be copied to a user CF or user USB data carrier.
- Booting the PPU
  - Press the select key  when message appears: “please press SELECT key to enter into startup menu”.
  - To open the advanced startup menu, press the following keys one after the other:

    Menu return key  => **HSK2** (horizontal SK2) => **VSK2** (vertical SK2)
  - Select the menu item, “Install software update/backup”
  - Perform the installation corresponding to the dialog.

3.2 Activation of SDB

- MD11241=2

3.3 Check Version Screen

- After start up the PPU select “Diagnostics >> Version >> OEM applications >> SDBxx >> Details” at the HMI to open the version screen

- The SDB is successful installed if the first line shows the name “SDBxx_yHLA” and the internal version will be shown as “99.02.00.0z”

xx…	40;60;80	-> all 3 SDBs for PPU24x/26x/28x are installed
y…	1;2	-> 1: 1HLA-module; 2: 2HLA modules
z…	5;6	-> 5: 1HLA-module; 6: 2HLA modules

4 Important Notes

4.1 Deleting SDB

From SW4.7SP1 onwards, an additional loaded SDB can be disabled or removed (deleted).
To disable -> set MD11241=0
To delete -> System CF /oem/sinumerik/
delete the files oem_sdb40.cfs, oem_sdb60.cfs and oem_sdb80.cfs and reboot the system again.

4.2 Archiving SDB

From SW4.7SP1 onwards, an additional loaded SDB will be saved by series startup file.

4.2 Important machine data and parameters for a SINAMICS HLA

Table 4-2 Machine data used in SINAMICS HLA

Machine data/parameters	Comment
MD 31030 $MA_LEADSCREW_PITCH	This machine data must correspond to the value of the actual spindle pitch of the ball screw mounted on the linear axis. The default value is 10 mm. The value entered here has no significance for rotary axes.
MD 31000 $MA_ENC_IS_LINEAR[n]	This machine data is set by the commissioning wizard. On rotary encoders, the value of the machine data is "0". On linear encoders (glass scale), the value is "1".
MD 32640 $MA_STIFFNESS_CONTROL_ENABLE	DSC always has the value "0".
MD11241 $MN_PROFIBUS_SDB_SELECT	The value of this machine data must be set to "2".
MD13060 $MN_DRIVE_TELEGRAM_TYPE	After the axes have been assigned via the drive wizard, the telegrams in machine data MD13060 are set to "166".
p0405 Square wave encoder, tracks A/B	If a TTL encoder is used, the level monitoring (p0405) is set to "F Hex" by the commissioning file.
p0404 Encoder configuration active	In parameter p0404, bit 13 "Irregular zero mark" is set by the commissioning file.
p0424 Zero mark distance	The value of this machine data must be set to the distance between 2 zero marks of the measuring system.
p1475 Loop gain	A tachometer can be calibrated at the converter (tacho potentiometer) or in p1475.
p0218 Cylinder safety configuration	When commissioning the HLA-ANA drive with the drive wizard, p0218 must be "0".
p4631 Cylinder path per encoder revolution	On linear axes, the value of this parameter must correspond to the actual leadscrew pitch defined in MD32030. In the case of rotary axes, the value is always 10000 µm.
p2144 Motor blocking monitoring	1-BICO

4.3 Abbreviations

Table 4-3

No.	Abbreviation	Term
1.	PPU	Panel Processing Unit
2.	SDB	System data block
3.	TGZ	Data backup file, type TGZ
4.	DSC	Dynamic servo control
5.	TTL	Incremental encoder
6.	SSI	Absolute encoder
7.	ANA	Analog drive
8.	HLA	Hydraulic Linear Actuator
9.	BICO	Analog drive
10.	EnDat	Encoder interface

4.4 Homing an axis

On analog drives, an offset can be formed in the speed setpoint or in the speed actual value supplied by the tachometer generator of the motor that changes as a function of the temperature. As a result, a following error when the axis stops cannot be completely eliminated.

If this following error is larger than machine data "Exact Stop", the axis travels at its reference point positioning velocity toward the "Output Cam" reference point. As soon as the output cams are reached, the axis reverses, travels to the 0 mark and decelerates to the value set in machine data MD35xxx.

Alarm "Reference point approach was interrupted" is output. You can avoid this alarm calibrating the drift on the drift potentiometer of the analog drive to "0", calibrating the drift to "0" with Mdxxx, or increasing the exact stop window.

4.5 Example for converting a pulse number of an encoder into a grating constant of a glass scale

Note Because the rotary encoders are able to function, conversion with SW 4.8 is not necessary.

Assumption 1

A rotary encoder with 2500 pulses/revolution mounted on a

ball screw with a 10 mm leadscrew pitch.

2500 pulses therefore correspond to 10 mm or 10000 µm.

10000 µm / 2500 pulses correspond to a distance of 4 µm per pulse. These 4 µm are the calculated grating constant of a glass scale.

If the pulse number is twice this value, then the grating constant is half as large.

If the pitch of the ball screw is half as large, the grating constant is half as large.

Assumption 2

A rotary encoder with 1024 pulses/revolution is mounted on a ball screw with a 10 mm leadscrew pitch.

1024 pulses correspond to 10 mm or 10000 µm

10000 µm / 1024 pulses correspond to a distance of 9.765625 µm per pulse.

To avoid rounding errors when calculating the distance, use the encoder as rotary encoder in the axis machine data and do not convert to a scale. Alarms are ruled out because MD13060 = 6 hex.

5 Appendix

5.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round-the-clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs and sample applications – all information is accessible with just a few mouse clicks at:
https://support.industry.siemens.com/

Technical Support

The Technical Support of Siemens Industry provides you with fast and competent support regarding all technical queries with many customized portfolio elements – From basic support up to individual support contracts.

Use the following Web form to send queries to Technical Support:
https://www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

With our globally available training courses for our products and solutions, we provide you with practical support through innovative learning methods and with a customer-specific, harmonized concept.

For more information on our various training courses as well as their locations and dates, go to:
https://www.siemens.com/sitrain

Service portfolio

Our service portfolio includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog:
https://support.industry.siemens.com/cs/sc

Industry Online Support app

With the "Siemens Industry Online Support" app, you can obtain optimum support, even when you are on the move. The app is available for Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067

5.2 Application support

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5.3 Links and references

Table 5-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/109761423

5.4 Change documentation

Table 5-2

Version	Date	Change
V1.0	10/2018	First edition