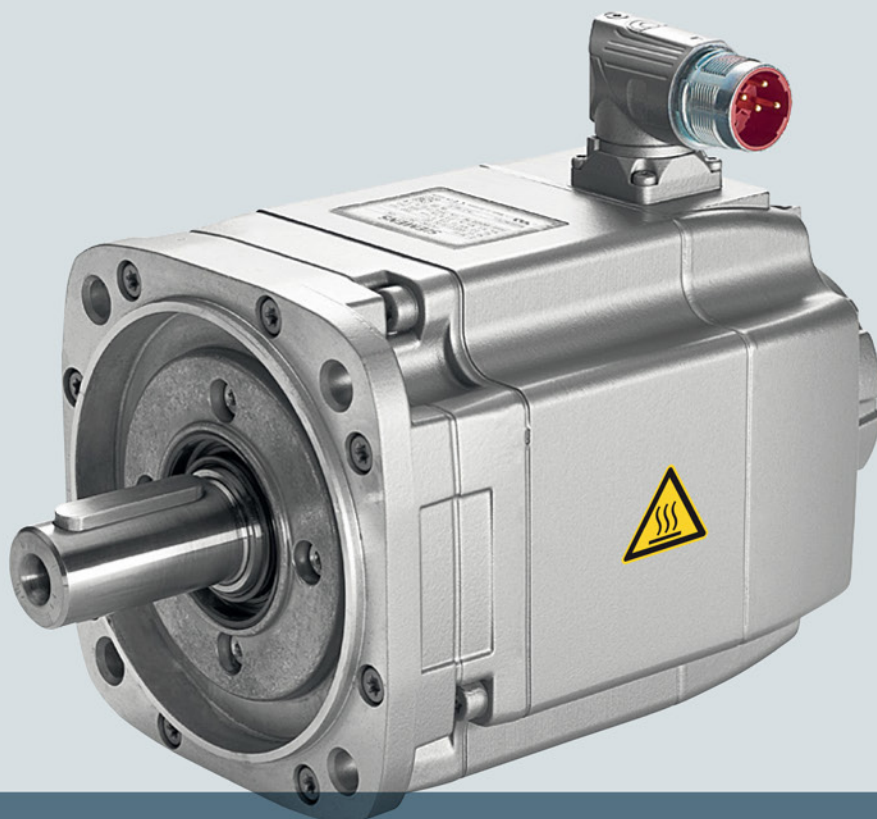


SIEMENS



SIMOTICS

SIMOTICS S-1FK7 Generation 2 and S-1FT7 Synchronous Motors
Encoder Replacement

Service Instructions

Ausgabe

07/2014

Answers for industry.

Encoder replacement in 1FK7 G2 and 1FT7

Service Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Introduction

Target group

These service instructions are intended for electricians, fitters, and service technicians.

About these service instructions

A faulty encoder in a 1FT7 or 1FK7 G2 motor can be exchanged for a replacement encoder of the same type. The encoder can be replaced without special tools simply by adjusting the coupling element opposite the motor shaft.

These service instructions describe how to order a replacement encoder as well as the replacement procedure itself.

Note

The encoder (either with or without Sensor Module) is regarded in this document as a single entity and referred to in the following as the "encoder".

For a precise definition of the various encoder types, refer to section "Replaceable encoders (Page 19)".

- Before you start to replace the encoder, you must read these instructions to ensure safe, problem-free operation and maximize the service life.

These service instructions are valid in conjunction with the relevant documentation for the converter and motor.

You can download these documents from the Internet.

Siemens continually strives to improve the quality of information provided in these service instructions. If you find any mistakes or would like to offer suggestions about how this document could be improved, please contact the Siemens Service Center.

- Always follow the safety instructions and notices in these service instructions. The warning notice system is explained on the rear of the inside front.

Text format features

In addition to the safety-related notices and instructions that you must carefully observe, you will find the text in these service instructions is formatted in the following way:

Handling instructions:

Handling instructions start with the following icon:



They end with the following icon:



1. Handling instructions are always shown as a numbered list. Perform the handling steps in the sequence given.
If the handling instructions only comprise a single step, this step is formatted with a bullet.
- Lists are formatted as bulleted lists.
 - Lists at the second level are hyphenated.

Note

A Note is an important item of information about the product, handling of the product or the relevant section of the document. Notes provide you with help or further suggestions/ideas.

More information

Information on the following topics is available under the link:

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

<http://www.siemens.com/motioncontrol/docu>

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address:

docu.motioncontrol@siemens.com

My Documentation Manager

The following link provides information on how to create your own individual documentation based on Siemens content, and adapt it for your own machine documentation:

<http://www.siemens.com/mdm>

Recommended additional documents

System components	Manufacturer's manuals
Motor	• Configuration Manual
Encoder system	• Operating Instructions
Brake	• Operating Instructions
Drive system	• Hardware Installation Manual • Getting Started (Commissioning Manual) • Operating Instructions

Training

The following link provides information on SITRAIN - training from Siemens for products, systems and automation engineering solutions:

<http://siemens.com/sitrain>

Technical Support

For technical support, see our website for the telephone number of our hotline in your local region:

Siemens Service Center (<http://support.automation.siemens.com/WW/view/en/4000024>)

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Fundamental safety instructions

1.1 General safety instructions



DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
 - Check whether the existing auxiliary supply circuits are de-energized.
 - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.



WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

 WARNING

Danger to life when live parts are touched on damaged motors/devices

Improper handling of motors/devices can damage them.

For damaged motors/devices, hazardous voltages can be present at the enclosure or at exposed components.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged motors/devices.



 WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.



 WARNING

Danger to life due to electric shock when not grounded

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.



 WARNING

Danger to life due to electric shock when opening plug connections in operation

When opening plug connections in operation, arcs can result in severe injury or death.

- Only open plug connections when the equipment is in a no-voltage state, unless it has been explicitly stated that they can be opened in operation.

** WARNING****Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones**

Using mobile wireless devices or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

** WARNING****Danger of an accident occurring due to missing or illegible warning labels**

Missing or illegible warning labels can result in accidents involving death or serious injury.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, in the national language if necessary.
- Replace illegible warning labels.

** WARNING****Danger to life when safety functions are inactive**

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note**Important safety notices for Safety Integrated functions**

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.



⚠ WARNING

Danger to life from electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Ensure that the persons involved are the necessary distance away (minimum 2 m).

⚠ WARNING

Danger to life from permanent magnet fields

Even when switched off, electric motors with permanent magnets represent a potential risk for persons with heart pacemakers or implants if they are close to converters/motors.

- If you are such a person (with heart pacemaker or implant) then keep a minimum distance of 2 m.
- When transporting or storing permanent magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

⚠ WARNING

Injury caused by moving parts or those that are flung out

Touching moving motor parts or drive output elements and loose motor parts that are flung out (e.g. feather keys) in operation can result in severe injury or death.

- Remove any loose parts or secure them so that they cannot be flung out.
- Do not touch any moving parts.
- Safeguard all moving parts using the appropriate safety guards.

⚠ WARNING

Danger to life due to fire if overheating occurs because of insufficient cooling

Inadequate cooling can cause overheating resulting in death or severe injury as a result of smoke and fire. This can also result in increased failures and reduced service lives of motors.

- Comply with the specified coolant requirements for the motor.

** WARNING****Danger to life due to fire as a result of overheating caused by incorrect operation**

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death. Further, excessively high temperatures destroy motor components and result in increased failures as well as shorter service lives of motors.

- Operate the motor according to the relevant specifications.
- Only operate the motors in conjunction with effective temperature monitoring.
- Immediately switch off the motor if excessively high temperatures occur.

** CAUTION****Risk of injury due to touching hot surfaces**

In operation, the motor can reach high temperatures, which can cause burns if touched.

- Mount the motor so that it is not accessible in operation.

When maintenance is required

- allow the motor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

1.2 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber or aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
 - Wearing an ESD wrist strap
 - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit Hotspot-Text (<http://www.siemens.com/industrialsecurity>).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit Hotspot-Text (<http://support.automation.siemens.com>).

 WARNING**Danger as a result of unsafe operating states resulting from software manipulation**

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can result in death, severe injuries and/or material damage.

- Keep the software up to date.
You will find relevant information and newsletters at this address (<http://support.automation.siemens.com>).
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
You will find further information at this address (<http://www.siemens.com/industrialsecurity>).
- Make sure that you include all installed products into the holistic industrial security concept.

1.4 Residual risks during the operation of electric motors

The motors may be operated only when all protective equipment is used.

Motors may be handled only by qualified and instructed qualified personnel that knows and observes all safety instructions for the motors that are explained in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example,
 - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
 - Response times of the control system and of the drive
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - Errors during the assembly, installation, programming and parameterization
 - Use of wireless devices/mobile phones in the immediate vicinity of the control system
 - External influences/damage
2. In case of failure, unusually high temperatures inside and outside the motor, including open fire as well as the emission of light, noise, particles, gases, etc. can result, for example in
 - Component failure
 - Software errors in converter operation
 - Operation and/or environmental conditions outside the specification
 - External influences/damage
3. Hazardous shock voltages caused by, for example,
 - Component failure
 - Influence during electrostatic charging
 - Induction of voltages in moving motors
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of noxious substances and emissions in the case of improper operation and/or improper disposal of components

Description

2.1 Replaceable encoders

Motors on which the encoder can be replaced

You can replace the encoder on the following motors:

- All 1FT7 motors
- Second-generation 1FK7 motors

You can recognize second-generation 1FK7 motors and 1FT7 motors from the round, raised encoder mounting plate at the end of the motor enclosure as well as from the rating plate.

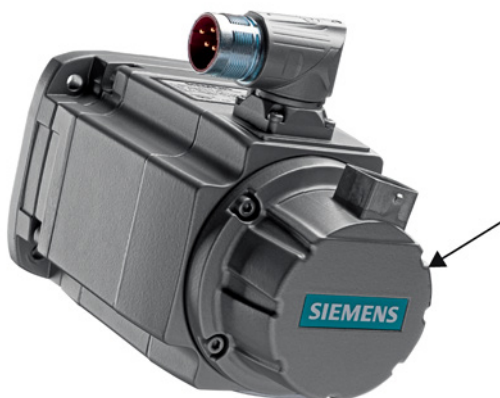


Figure 2-1 Second-generation 1FK7 AH48 (encoder end)

The 8th digit of the article number on the rating plate of a second-generation 1FK7 motor is always 2, 3, or 4.

1 SIEMENS					
3 ~ Motor 1FK7042 - 2AK71 - 1QA0					
No.YF B031 1400 01 001					
M ₀ 3,0 Nm		I 4,4 A		n _{max.} 9000 /min	
M _N 1,5 Nm		I _N 2,5 A		n _N 6000 /min	
Encoder AS20DQI P04		U _{iN} 267 V		IP 64	m 5 kg
				RN 000	
				Th.Cl.155 (F)	
					
C US					
Made in Germany					
EN 60034					

1 8th digit of article number

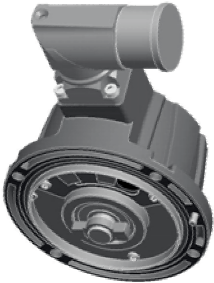
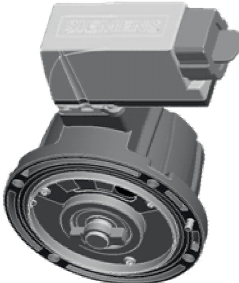
2.1 Replaceable encoders

Note

If a 1FK7 motor has any other number as the 8th digit of the article number, it is not a second-generation 1FK7 motor. In this case, the encoder cannot be replaced.

- You must either replace the complete motor or have the motor and encoder repaired.

The following encoders can be replaced:

Motor article numbers	1FT7000-00000-0N00 1FT7000-00000-0M00 1FK7000-00000-0A00 1FK7000-00000-0E00	1F07000-00000-0D00 1F07000-00000-0F00	1F07000-00000-0B00 1F07000-00000-0C00 1FK7000-00000-0Q00 1FK7000-00000-0R00
Encoders on 1FT7 and 1FK7 G2 motors			
Brief description	Analog encoders without an electronic rating plate	Encoders with an electronic rating plate	

Note**Integrated resolvers**

You cannot replace resolvers individually. The 14th digit of the article number of a motor with an integrated resolver is always "P" or "U".

- You must either replace the complete motor or have the motor and resolver repaired.

Encoder modules with a DRIVE-CLiQ interface have an electronic rating plate showing the settings of the associated motor as well as the encoder data.

There are several possible ways to select a replacement encoder.

- Order a replacement encoder with a custom-preprogrammed electronic rating plate from your Siemens Service Center. In this case, you only need to replace the encoder mechanically in order to start up the system again.
- If optimal availability of your system is vital, you can stock non-preprogrammed encoders as spare parts as a precautionary measure. If a fault occurs, you can then replace the encoder and start up your system again without delay.

With newer SINAMICS / SINUMERIK SW versions (Version 4.3 or higher) a motor can be temporarily operated without an electronic rating plate after replacing the encoder. A warning appears as long as the electronic rating plate is not yet programmed. You only need to replace the encoder mechanically in order to start up the system again.

- With older SINAMICS / SINUMERIK versions (prior to Version 4.3) the electronic rating plate **MUST** be programmed in order to operate the motor.

See also

How to replace an encoder mechanically (Page 31)

How to replace an non-preprogrammed encoder (Page 34)

2.2 Encoder replacement options

Note

Always replace the encoder as a complete component (including the Sensor Module).

Replacement options for	Analog encoders without an electronic rating plate	Encoders with an electronic rating plate		
Programming options	Encoder is not preprogrammed	Encoder was preprogrammed at the factory based on the motor's electronic rating plate		
		Yes	No	
			SINAMICS / SINUMERIK software ≥ V4.3 installed	
			Yes	No
Replacement option	Option 1		Option 2	Option 3

Short handling instructions for each replacement option

Replacement option	Option 1	Option 2	Option 3
Short handling instructions	How to replace an encoder mechanically (Page 31)	How to replace a non-preprogrammed encoder (Page 34)	How to replace a non-preprogrammed encoder (Page 34)
			Program the encoder (How to program the encoder / import the electronic rating plate (Page 36))
Result	System ready *)	System ready *)	System ready *)
Other activities		Program the encoder later (How to program the encoder / import the electronic rating plate (Page 36))	

*) With absolute encoders, the encoder position information must be adjusted to the machine's mechanical system (absolute adjustment)

**) The warning "No motor data stored in the encoder" appears as long as the electronic rating plate is not yet programmed

See also

How to save the data on the electronic rating plate. (Page 41)

2.3 How to select a replacement encoder

Note

Please note when ordering:

All encoders with a DRIVE-CLiQ interface have an electronic rating plate that is custom-preprogrammed for each motor.

How to identify the article number of the encoder

There are three possible ways to identify the article number of a particular encoder.

1 Read off the article number of the encoder on the rating plate (on the inside of the faulty encoder)

Note

The article number on the encoder rating plate always ends in "0". All preprogrammed encoders have a sticker with the motor article number and the serial number.

To order a non-preprogrammed encoder (without an electronic rating plate), leave the last digit of the encoder article number set to "0".

To order an encoder that is preprogrammed for your particular motor, change the last digit of the encoder article number to "1".



1 Encoder article number

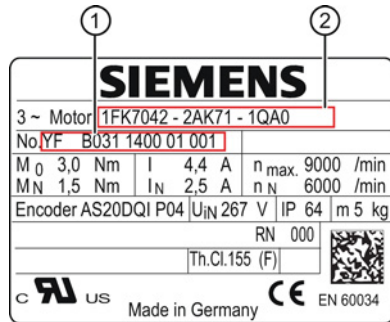
Dismantle the encoder by following the procedure described in section "How to replace an encoder mechanically (Page 31)".

→ After reading off the encoder article number, you can then order a new encoder directly

2.3 How to select a replacement encoder

2 Specify the order number for the motor type (article number) and the motor serial number online on "Spares on Web".

You can find both of these numbers on the rating plate on the motor.



1 Serial number of the motor

2 Order number for the motor type (article number)

Specify the article number and the serial number of the motor online at "Spares on Web" (www.siemens.com/sow)".

> Home > Result

SINGLE MULTI

Order Nr.: * 1FK7042-2AK71-1QA0

Serialnumber: YFB031140001001

☐ Options

Search Return

Result

spare parts Spare packages

Export Filter

Order number	Quantity	Description
6FX2001-5JD20-2DA1	1	SPARE ENCODER KIT FOR SYNCHRONOUS MOTORS 1FT/1FK SHAFT HIGHTS 48/63/80/100: AS20DQI-88 DRIVE-CLIQ. ELECTRONIC RATING PLATE INDIVIDUALLY PROGRAMMED. FOR ORDERING, PLEASE SPECIFY THE SERIAL NUMBER OF THE MOTOR. SPARE-PART NO. 8.31

Figure 2-2 Screenshot_spares on web

2.3 How to select a replacement encoder

→ The encoder you are looking for then appears in a list of spare parts on the "Details" tab.

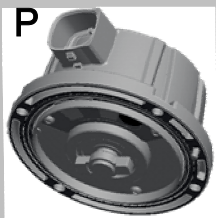
Note

The order number (article number) shown here for the encoder always ends in "1".

To order an encoder that is preprogrammed for your particular motor, leave the last digit of the encoder article number set to "1".

To order an non-preprogrammed encoder (without an electronic rating plate), change the last digit of the encoder article number to "0".

3 Identify the order number using the tables below

Preprogrammed encoder with integrated DRIVE-CLiQ interface (DQI)			
Encoder type	For motor	Designation	
Encoder type	For motor	Designation	Order number
Absolute encoder, single-turn, 24 bit 1F□7□□□-□□□□□-□B□□	1F□703	AS24DQI-72	6FX2001-5JD24-2QA1
	1F□704	AS24DQI-88	6FX2001-5JD24-2DA1
	1F□706		
	1F□708		
	1F□710		
Absolute encoder 24 bit + 12 bit multiturn 1F□7□□□-□□□□□-□C□□	1F□703	AM24DQI-72	6FX2001-5JE24-2QA1
	1F□704	AM24DQI-88	6FX2001-5JE24-2DA1
	1F□706		
	1F□708		
	1F□710		
Absolute encoder, single-turn, 20 bit 1FK7□□□-□□□□□-□Q□□	1FK703	AS20DQI-72	6FX2001-5JD20-2QA1
	1FK704	AS20DQI-88	6FX2001-5JD20-2DA1
	1FK706		
	1FK708		
	1FK710		
Absolute encoder 20 bit + 12 bit multiturn 1FK7□□□-□□□□□-□R□□	1FK703	AM20DQI-72	6FX2001-5JE20-2QA1
	1FK704	AM20DQI-88	6FX2001-5JE20-2DA1
	1FK706		
	1FK708		
	1FK710		

2.3 How to select a replacement encoder

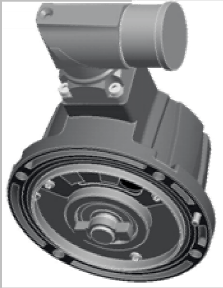
Non-preprogrammed encoder with integrated DRIVE-CLiQ interface (DQI)			
Encoder type	For motor	Designation	Order number
Absolute encoder, single-turn, 24 bit 1F□7□□□-□□□□□-□B□□	1F□703	AS24DQI-72	6FX2001-5JD24-2QA0
	1F□704	AS24DQI-88	6FX2001-5JD24-2DA0
	1F□706		
	1F□708		
	1F□710		
Absolute encoder 24 bit + 12 bit multiturn 1F□7□□□-□□□□□-□C□□	1F□703	AM24DQI-72	6FX2001-5JE24-2QA0
	1F□704	AM24DQI-88	6FX2001-5JE24-2DA0
	1F□706		
	1F□708		
	1F□710		
Absolute encoder, single-turn, 20 bit 1FK7□□□-□□□□□-□Q□□	1FK703	AS20DQI-72	6FX2001-5JD20-2QA0
	1FK704	AS20DQI-88	6FX2001-5JD20-2DA0
	1FK706		
	1FK708		
	1FK710		
Absolute encoder 20 bit + 12 bit multiturn 1FK7□□□-□□□□□-□R□□	1FK703	AM20DQI-72	6FX2001-5JE20-2QA0
	1FK704	AM20DQI-88	6FX2001-5JE20-2DA0
	1FK706		
	1FK708		
	1FK710		

Preprogrammed encoder with integrated DRIVE-CLiQ interface			
Encoder type	For motor	Designation	
Incremental encoder 22 bit 1F□7□□□-□□□□□□-□D□□	1F□704	IC22DQ-88	6FX2001-3JC22-3DA1
	1F□708		
	1F□710		
	1F□706	IC22DQ-88	6FX2001-3JC22-4DA1
	1F□703	IC22DQ-72	6FX2001-3JC22-3QA1
Absolute encoder 22 bit + 12 bit multibit 1F□7□□□-□□□□□□-□F□□	1F□704	AM22DQ-88	6FX2001-5JE22-3DA1
	1F□708		
	1F□710		
	1F□706	AM22DQ-88	6FX2001-5JE22-4DA1
	1F□703	AM22DQ-72	6FX2001-5JE22-3QA1

Description

2.3 How to select a replacement encoder

Non-preprogrammed encoder with integrated DRIVE-CLiQ interface			
Encoder type	For motor	Designation	Order number
Incremental encoder 22 bit 1F□7□□□-□□□□□□-□D□□	1F□704	IC22DQ-88	6FX2001-3JC22-3DA0
	1F□708		
	1F□710		
	1F□706	IC22DQ-88	6FX2001-3JC22-4DA0
	1F□703	IC22DQ-72	6FX2001-3JC22-3QA0
Absolute encoder 22 bit + 12 bit multiturn 1F□7□□□-□□□□□□-□F□□	1F□704	AM22DQ-88	6FX2001-5JE22-3DA0
	1F□708		
	1F□710		
	1F□706	AM22DQ-88	6FX2001-5JE22-4DA0
	1F□703	AM22DQ-72	6FX2001-5JE22-3QA0

Encoder without DRIVE-CLiQ interface (M23 signal connector)			
Encoder type	For motor	Designation	Order number
Incremental encoder sin/cos 1 Vpp 2048 S/R 1FT7□□□-□□□□□-□N□□ 1FK7□□□-□□□□□-□A□□	1F□703	IC2048S/R-72	6FX2001-3JC04-1QA0
	1F□704	IC2048S/R-88	6FX2001-3JC04-1DA0
	1F□706		
	1F□708		
	1F□710		
Absolute encoder 2048 S/R EnDat 1FT7□□□-□□□□□-□M□□ 1FK7□□□-□□□□□-□E□□	1F□703	AM2048S/R-72	6FX2001-5JE04-1QA0
	1F□704	AM2048S/R-88	6FX2001-5JE04-1DA0
	1F□706		
	1F□708		
	1F□710		

After selecting the correct encoder, place your order as described in section "How to order encoders (Page 30)".

2.4 How to order encoders

Note

Please note when ordering:

All encoders with a DRIVE-CLiQ interface have an electronic rating plate that must be custom-preprogrammed for each motor.

Preprogrammed or non-preprogrammed?

Non-preprogrammed encoders	Preprogrammed encoders
Encoder is suitable for several motor series.	Encoder is only designed for one motor (determined by the article number and the serial number).
Encoders with a DRIVE-CLiQ interface must be programmed subsequently.	Motor is fully functional as soon as the encoder is mounted.
Encoder is painted "pearl dark gray" as standard.	
Last digit of order number is always "0".	Last digit of order number is always "1".

How to order

Make a note of the following numbers before you order a replacement encoder:

- Order number of the replacement encoder (refer to section "How to select a replacement encoder (Page 23)")
- MLFB of the motor (refer to the rating plate on the motor)
- Serial number of the motor (refer to the rating plate on the motor)

You can order replacement encoders through your Siemens contact.

Information for the person placing the order:



1. Go to the appropriate ordering page in SAP.
2. Enter the article number and serial number of the motor in the COI3 field.

If you have any questions, please contact the Siemens Service Center Bad Neustadt (<https://workspace.automation.siemens.com/content/00000914/default.aspx>).



The encoder has now been ordered.

2.5 How to replace an encoder mechanically

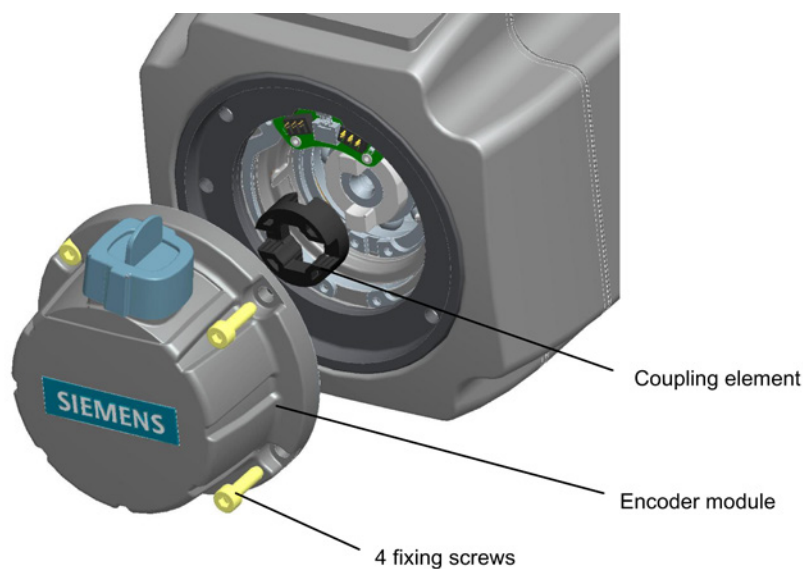
Procedure

Note

If you need to replace several encoders, you should always do so one at a time to avoid confusion and rule out programming errors.

**1 To remove**

1. Disconnect the motor.
2. Disconnect the encoder cable.



3. Remove the four fastening screws for the encoder.
4. Remove the encoder and the coupling element.

Note**Coupling element**

When replacing the encoder, the new coupling element enclosed with it must be installed at the same time.

2 To install

1. Attach the coupling element to the coupling hub of the encoder shaft.



Figure 2-3 1FK7_Encoder end_details

2. Align the coupling element with the cams on the motor shaft.
3. Attach the encoder to the motor shaft in this position.
4. Secure the encoder with four screws (tightening torque: 2.5 to 3 Nm).
5. Plug the encoder cable into the receptacle on the encoder.



WARNING

Danger of death if the encoder is not properly installed or the safety devices do not work

If the encoder or any other parts of the machine are not properly installed or any safety devices do not work, this could result in death or injury to persons.

- Make sure all parts of the machine are correctly installed and connected.
- Make sure all safety devices are switched on again and working correctly.

Switch on the system.

3 Absolute adjustment

Note

Only absolute encoders need to be adjusted.

When you adjust an absolute encoder, its actual value is compared once with the machine zero point and then set to valid.

The actual adjustment status of an absolute encoder is shown in the following machine data:

SINUMERIK	SINAMICS
MD34210 \$MA_ENC_REFP_STATE (absolute encoder status)	p2507 (absolute adjustment status)

- Adjust the encoder as described in the Function Manual



The motor is now ready for operation again.

2.6 How to replace an non-preprogrammed encoder

Requirements

NOTICE

Wrong encoder installed

If you install an encoder of the wrong type or one that was preprogrammed for another motor, malfunctions are likely to occur.

- Always replace a faulty encoder with another encoder of the same type. Never attempt to retrofit a motor with a different encoder type.

- The replacement encoder must not be of the same type as the faulty encoder.
- The encoder must not be preprogrammed. Either it has not yet been used in another motor or the program was completely deleted (refer to section "How to delete an encoder (Page 49)").

Note

If you need to replace several encoders, you should always do so one at a time to avoid confusion and rule out programming errors.

Encoder replacement procedure



1 Save the data on the electronic rating plate

SINAMICS / SINUMERIK SW < 4.3	SINAMICS / SINUMERIK SW 4.3 or higher
Save the data on the electronic rating plate as described in section "How to save the data on the electronic rating plate. (Page 41)" prior to removing the encoder.	The encoder data is automatically saved when you start up the system. You do not need to save it manually.

2 Replace the encoder mechanically

To replace the encoder mechanically, refer to section "How to replace an encoder mechanically (Page 31)".

3 Program the encoder

Note

The motor data (electronic rating plate) must be installed later on a non-preprogrammed encoder with a DRIVE-CLiQ interface. The motor control shows warning "1840" as long as this is not the case.

If the motor data is not installed, it will no longer be available when the motor is started up again or if it is used in another application.

- Program the encoder as described in section "How to program the encoder / import the electronic rating plate (Page 36)".

4 Absolute adjustment

Note

Only absolute encoders need to be adjusted.

When you adjust an absolute encoder, its actual value is compared once with the machine zero point and then set to valid.

The actual adjustment status of an absolute encoder is shown in the following machine data:

SINUMERIK	SINAMICS
MD34210 \$MA_ENC_REFP_STATE (absolute encoder status)	p2507 (absolute adjustment status)

- Adjust the encoder as described in the Function Manual



The encoder has now been replaced.

2.7 How to program the encoder / import the electronic rating plate

When you program the encoder, the data on the electronic rating plate is transferred to it.

Note

Before importing the data from the electronic rating plate, replace the faulty encoder with a non-preprogrammed encoder of the same type.

Requirements for writing the data on the encoder module

- SINAMICS firmware Version 2.5 or higher must be installed.
SINUMERIK firmware Version 2.5 SP2 HF1 or higher (essential for replaceable encoders) must be installed.
- The commissioning procedure must have been completed.
- The electronic rating plate must be installed on the CF card.

Note

With SINAMICS / SINUMERIK SW Version 4.3 or higher the data on the electronic rating plate is automatically saved in the folder provided for this purpose on the CF card (refer to section "How to save the data on the electronic rating plate. (Page 41)").

If the data has not been saved on the CF card, there are two possible ways to obtain it:

- If the component to be replaced can still be accessed via the DRIVE-CLiQ interface, you can read out the data on the electronic rating plate and then save it (refer to section "How to save the data on the electronic rating plate. (Page 41)").
- If this no longer works, you can download the data for the electronic rating plate from the motor plant on the Internet. To do this, follow the procedure described in section "How to download the electronic rating plate from the Internet (Page 43)".

-
- A non-preprogrammed encoder module of the same type must be available.

Note

If you need to replace several encoders, you should always do so one at a time to avoid confusion and rule out programming errors.

To start the import

You start the data import by setting drive parameters.

Note**Automatic import in SINUMERIK**

SINUMERIK Operate versions (>V4.6) have a menu that lets you import the encoder data into a non-preprogrammed encoder.

If this function is available, you can find it under: Commissioning>Drive System>Hardware Replacement

SINUMERIK systems	SINAMICS systems
Drive parameters can be set directly on the machine's HMI.	Drive parameters can only be set using a commissioning or diagnostic tool (e.g. STARTER or SCOUT).
Requirement: The manufacturer password must be used. The default setting is "SUNRISE".	Requirement: CUSTOMER access level

Options for starting the import

To import the data

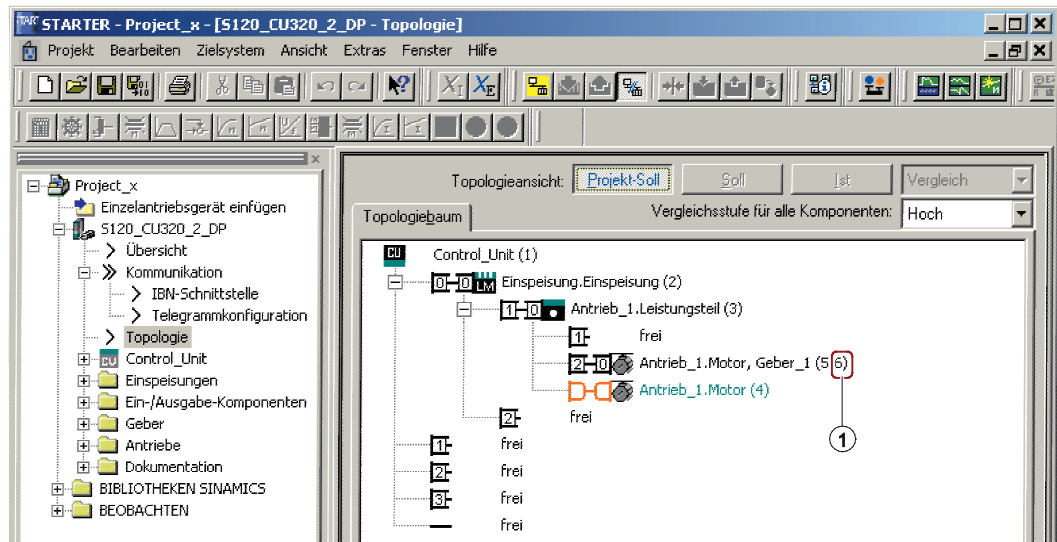
Switch on the machine.

→ After the drive / control has started up, you see warning "1840 – Found component with no motor data".

To identify the component number in SINAMICS using the STARTER software

There are two possible ways to identify the component number.

- Identify the component number in the topology tree.



1 Component number of the encoder module

Figure 2-4 STARTER_topology tree

- Identify the component number in the version overview

The screenshot shows the STARTER software interface with the 'Versionübersicht' (Version Overview) view. The table below represents the data shown in the screenshot:

Komponente	-Nr.	FW-Version	Typ	Bestell-Nr.	HW-Version	Serien-Nr.
Control_Unit	1	0	Regelungsbaugruppe	Projekt-Soll	Projekt-Soll	Projekt-Soll
Einspeisung, Einspeisung	2	0	Einspeisung	6SL3130-7TE21-6Axx		
Antrieb_1, Leistungsteil	3	0	Leistungsteil	6SL3120-1TE13-0Axx		
Antrieb_1, Motor	4	--	Motor	XSMxxxx-xxxx-xxxx		
Antrieb_1, Motor	5	0	SM120/DOL	XSMxxxx-xxxx-xxxx		
Antrieb_1, Geber_1	6 1	--	Geber	XSMxxxx-xxxx-xxxx		

1 Component number of the encoder module

Figure 2-5 STARTER_version overview

To identify the component number in SINUMERIK

Open the topology tree.

Topologie								DP3.SLAVE3:CU_I_3.3:1(1)	
von				nach					
Antr.objekt	-Nr.	Komponente	-Nr.	Buchse		Buchse	-Nr.	Komponente	
CU_I_3.3:1	1	Control_Unit_1	1	X100	---	X200	2	Motor_Module_22	
				X101					
				X102					
				X103					
				X104					
				X105					
SERVO_3.3:2/	2/	Motor_Module_22/	2	X200	---	X100	1	Control_Unit_1	
SERVO_3.3:3	3	Motor_Module_3	3	X201					
			2	X202	---	X500	5	SM120_5	
			3	X203	---	X500	8	SM_8	
SERVO_3.3:2	2	SM120_5	5	X500	---	X202	2	Motor_Module_22	
SERVO_3.3:3	3	SM_8	8	X500	---	X203	3	Motor_Module_3	
von: SERVO_3.3:2.Motor_Module_22(2) nach: SERVO_3.3:2.SM120_5(5)									1

1 Component number of the encoder module

Figure 2-6 SINUMERIK_topology tree

To transfer the data to the encoder module



1. Enter the sensor module component number in the p4690 parameter for which the data on the electronic rating plate must be written.
2. To begin writing, set the p4691 parameter to "2".
 - The data stored at the transfer point is written in the module (refer to section "How to save the data on the electronic rating plate. (Page 41)").
 - If this operation is successful, the value of the p4691 parameter changes back to "9" ("SMI data imported and POWER ON required for component").
 - If the p4691 parameter changes to a value other than "9", this number will help you identify why the write operation failed.

Note

You can find the meanings of the parameter values in List Manual 1 as well as in the online help.

3. Start up the system again (POWER OFF--> POWER ON).
4. If the encoder is an absolute encoder, you must readjust it. Adjust the encoder as described in the Function Manual.



The data has now been transferred to the encoder module.

2.8 How to save the data on the electronic rating plate.

How to save the electronic rating plate for a motor

The data on the electronic rating plate is saved on the system card (CF card). The electronic rating plate is required to program a non-preprogrammed encoder module.

Requirements for saving the data on the electronic rating plate

- SINAMICS firmware Version 2.5 or higher must be installed.
- The commissioning procedure must have been completed. All component numbers must be less than 200.

To save the data

Note

With SINAMICS / SINUMERIK SW Version 4.3 or higher the data is automatically saved when you start up the system. You do not need to save it manually.



 WARNING
Danger of death if the encoder is not properly installed or the safety devices do not work If the encoder or any other parts of the machine are not properly installed or any safety devices do not work, this could result in death or injury to persons. • Make sure all parts of the machine are correctly installed and connected. • Make sure all safety devices are switched on again and working correctly.

1. Switch on the machine.
2. Identify the component number of the encoder module to be saved in the topology tree.
3. Enter the component number in the p4690 parameter of the encoder module for which the data on the electronic rating plate must be saved on the system card.
4. To begin saving, set the p4691 parameter to "1".
 - If the operation is successful, the value of the p4691 parameter changes back to "0".
 - If the p4691 parameter changes to a value other than "0", this number will help you identify why the write operation failed.

Note

You can find the meanings of the parameter values in List Manual 1 as well as in the online help.

2.8 How to save the data on the electronic rating plate.

The data on the electronic rating plate is automatically saved in the correct path on the system card (CF card).



The data on the electronic rating plate has now been saved on the CF card.

How to save the electronic rating plates for all motors

If you wish, you can also save the rating plates for all motors at once.



- To begin saving, set the p4692 parameter to "1".
→ If the operation is successful, the value of the p4692 parameter changes back to "0".



The data has now been saved in a defined path on the system card (CF card).

See also

How to program the encoder / import the electronic rating plate (Page 36)

2.9 How to download the electronic rating plate from the Internet

If the electronic rating plate is not stored on the CF card, you can download the information you need from the Internet.

The data contained in the electronic rating plate varies according to the encoder type.

To make sure you download the right information, you must identify the electronic rating plate clearly.

Please follow the procedure described below.

How to identify the electronic rating plate



Motors with encoders with an integrated Sensor Module and a DRIVE-CLiQ interface

1. You can identify the encoder type from the order number of the motor.



Encoder type	Order number of motor
IQ22DQ	1F□7□□□-□□□□□-□D□□
AM22DQ	1F□7□□□-□□□□□-□F□□

The electronic rating plate for these motors consists of the following files:

Motor data (drive)	smi20x♦1.bin
Encoder data (encoder)	smi20x♦2.bin

The "♦" denotes a "b" or an "e".

For SAC modules	b
For DSAC modules	e

2. You should always replace the "♦" with a "b" before you download the electronic rating plate.

Motors with encoders without a DRIVE-CLiQ interface

Motors with encoders without a DRIVE-CLiQ interface have no electronic rating plate.

These encoders can be used without being programmed.

You can identify the encoder type from the order number of the motor.



Encoder type	Order number of motor
IC2048S/R	1FT7□□□-□□□□□-□N□□
AM2048S/R	1FT7□□□-□□□□□-□M□□
IC2048S/R	1FK7□□□-□□□□□-□A□□
AM2048S/R	1FK7□□□-□□□□□-□E□□

2.9 How to download the electronic rating plate from the Internet

**Motors with encoders with an integrated DRIVE-CLiQ interface**

If the motor has an integrated DRIVE-CLiQ encoder, the encoder data is permanently stored in the encoder module.

The electronic rating plate consists of a single file with the motor data.

Motor data (drive)	dqixe1.bin
--------------------	------------

You can identify the encoder type from the order number of the motor.

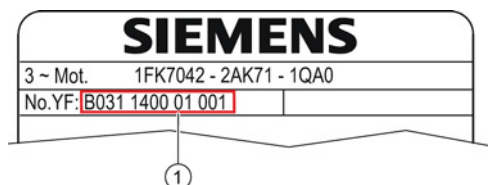
Encoder type	Order number of motor
AS24DQI	1F□7□□□-□□□□□-□B□□
AM24DQI	1F□7□□□-□□□□□-□C□□
AS20DQI	1FK7□□□-□□□□□-□Q□□
AM20DQI	1FK7□□□-□□□□□-□R□□



The files belonging to the electronic rating plate have now been identified.

How to download the electronic rating plate

1. Find the serial number of the motor on the rating plate.



- 1 Serial number of the motor
2. Insert the required storage medium in your PC.

Note**Storage media required**

You need the following storage media depending on your system

SINAMICS systems	SINUMERIK systems
PC with CF card reader	USB storage medium

2.9 How to download the electronic rating plate from the Internet

- Go to the following website: <http://workplace.automation.siemens.com/fcdsweb/serv/>
(<http://workplace.automation.siemens.com>)

- Enter the serial number of the motor.
- Click on "Find serial number".

- Click on the arrow to choose the required data record from the list of matching entries.

- Specify which DRIVE-CLiQ type you want to program (SAC or DSAC).

2.9 How to download the electronic rating plate from the Internet

8. Click on "Find serial number" to display a list of matching entries.



The screenshot shows the SMI software interface. At the top, there is a header bar with the text "Kontakt". Below this, there is a search bar with the text "1001" and a button labeled "→ Seriennummer suchen". To the right of the search bar, there is a blue box with the text "Bei Problemen wenden Sie sich an die Kontaktpersonen." Below the search bar, there is a table with the following data:

FID: YF U436 00357 01 001	
Source:	EWN.MMS
MLFB:	1FK7042-5AF21-1DH3
SMI:	Type: ☐ DQI ☒ SAC ☐ DSAC
	Model: SMI20
Encoder:	2048 1V/ss A/B C/D

Below the table, there is a red circle with the number "1" inside it, pointing to the "Encoder" row. To the right of the table, there is a "Downloads:" section with a list of download links:

- smi20x1 bin - Drive
- smi20x1 bin - encoder
- DqProgram
- Program
- Program

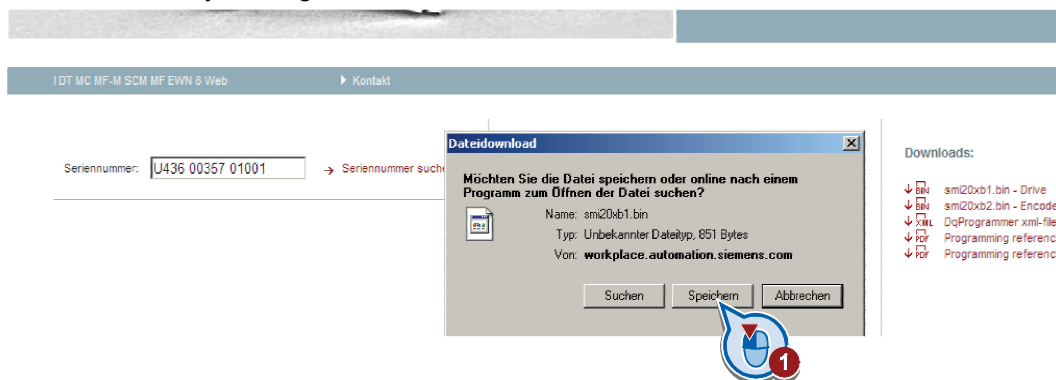
There is also a red circle with the number "8" inside it, pointing to the "Downloads:" section.

- 1 Motor and encoder information on the specified serial number

2.9 How to download the electronic rating plate from the Internet

9. Save the files on a storage medium.

You save a file by clicking on the file name.



10. Specify the correct path on the storage medium.

SINAMICS: System card (CF card)	SINUMERIK: USB storage medium
	Access to the system card (CF card) You cannot access the system card in SINUMERIK systems. You should therefore always use the SINUMERIK USB interface and the copy function of the HMI to transfer data. Use the manufacturer password "SUNRISE" to access the system partition.

2.9 How to download the electronic rating plate from the Internet

SINAMICS: System card (CF card)	SINUMERIK: USB storage medium
Depending on the system configuration used, there are two different paths: Standalone devices (e.g. CU250, CU 305, CU310, CU320, D410 as well as integrated platforms D4xx, NCU7xx): /USER/SINAMICS/DATA/SMI_DATA/C□□□ (□□□ = component number of the encoder module, e.g. "006") Expansion modules (e.g. CX32, NX10, NX15): /USER/SINAMICS/DATA/□□/SMI_DATA/C□□□ (□□ = Profibus address of the internal Profibus or socket on the CU □□□ = component number of the encoder module, e.g. "006")	1. Choose any directory on your USB storage medium. 2. Save the electronic rating plate on the USB storage medium. 3. Insert the USB storage medium in the USB socket of the SINUMERIK system. Open the corresponding target folder in SINUMERIK on the system card: Depending on the system configuration used, there are two different paths: • Sensor Modules on the NCU: /USER/SINAMICS/DATA/SMI_DATA/C□□□ (□□□ = component number of the encoder module, e.g. "005") • Sensor Modules on an expansion module (e.g. NX10, NX15): /USER/SINAMICS/DATA/□□/SMI_DATA/C□□□ (□□ = Profibus address of the internal Profibus (e.g. 15, 14 etc.), □□□ = component number of the encoder module, e.g. "005") 4. Copy the data for the electronic rating plate from the USB storage medium to the target folder on the system card. 5. Make sure the new encoder has been assigned the same component number as the old encoder (refer to section "How to program the encoder / import the electronic rating plate (Page 36)").



The data for the electronic rating plate has now been saved.

To save the files for the electronic rating plate after reading out and replacing a component

The data for the electronic rating plate of the old component is made available at the correct transfer point (in the correct path) on the system card (CF card) as soon as it has been saved.

Make sure the new, non-preprogrammed encoder module has been assigned the same component number as the old encoder module (refer to section "How to program the encoder / import the electronic rating plate (Page 36)").

2.10 How to delete an encoder

Requirement

The encoder must belong to a 1FT7 or 1FK7 G2 motor. You can find the motor type on the electronic rating plate.

The software you are using must be either SINAMICS SW 4.x or SINUMERIK SW 4.x.

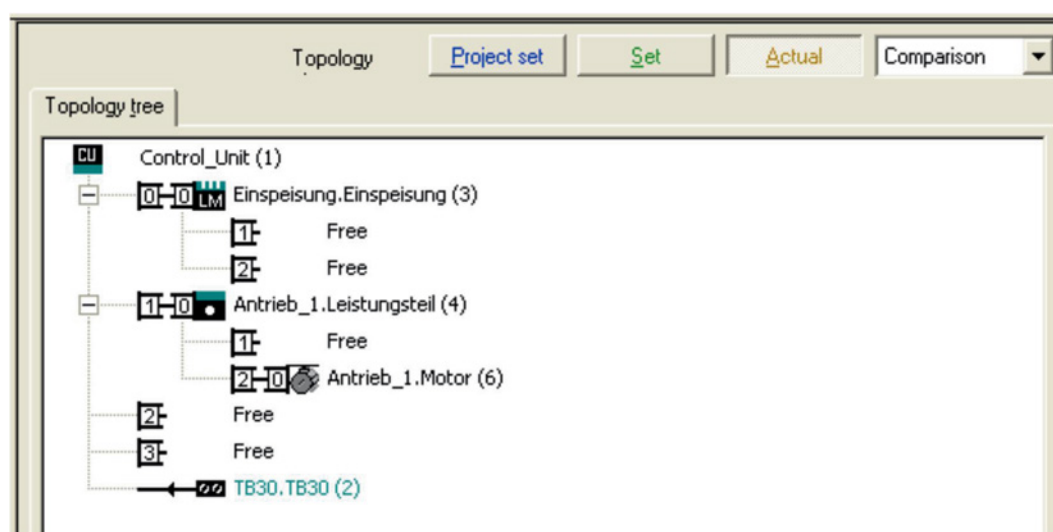


Identify the SINUMERIK or SINAMICS software version.

- You cannot delete the encoder if the software installed on the system is SINAMICS V4.x or SINUMERIK V4.x.

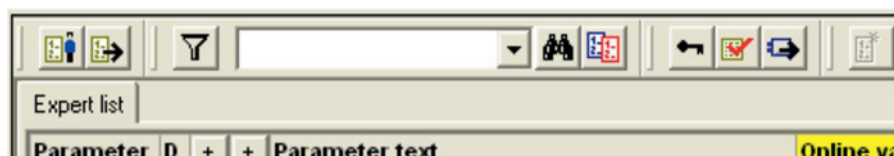
How to delete an encoder in SINAMICS

1. Identify the encoder to be deleted.
 - Connect the encoder to a free DRIVE-CLiQ port on the SINAMICS S120 drive system

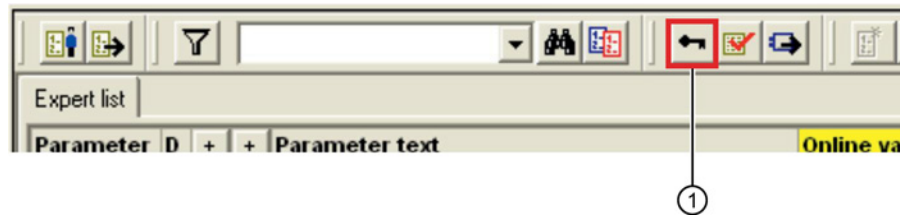


⇒ The encoder is assigned a component number greater than 200 in the topology tree

2. Open the "Expert list" ("parameter list").



3. Click on the key icon in the menu bar.



- 1 Key icon

⇒ The "Set Access Level" dialog opens

4. Change to the "Expert (3)" access level.

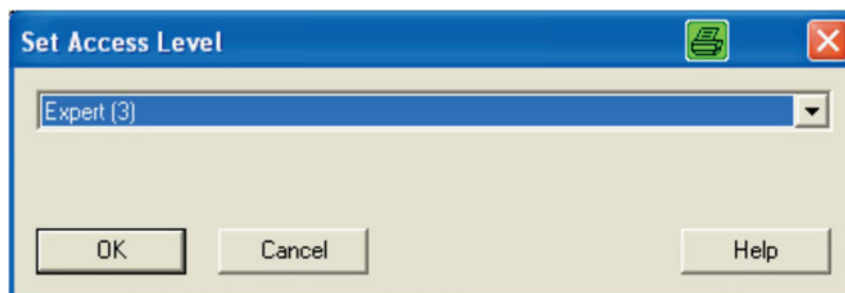


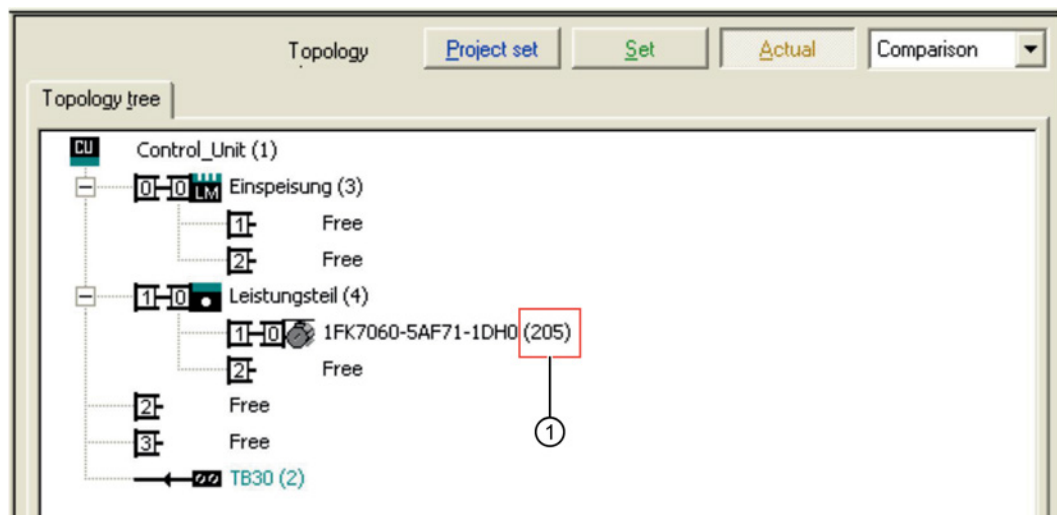
Figure 2-7 Screenshot_SetAccessLevel_Expert

- Set the required password level.

SINAMICS: Expert

SINUMERIK: Manufacturer

5. Click on "OK" or press ENTER to confirm your input.
6. Enter the component number of the encoder, e.g. 205, in the **p4690** drive data.



- 1 Encoder number

7. Choose [30] "Delete SMI data" from the dropdown menu for **p4691**.

8. Press ENTER to confirm your input.
⇒ **p4691** changes to [35] "Please confirm that you want to delete the SMI data"
9. Choose [30] "Delete SMI data" from the **p4691** menu again.
⇒ **p4691** changes to [36] "The SMI data was deleted; the component requires POWER ON"
10. Switch the system off and then on again (POWER OFF / POWER ON).



How to delete an encoder in SINUMERIK

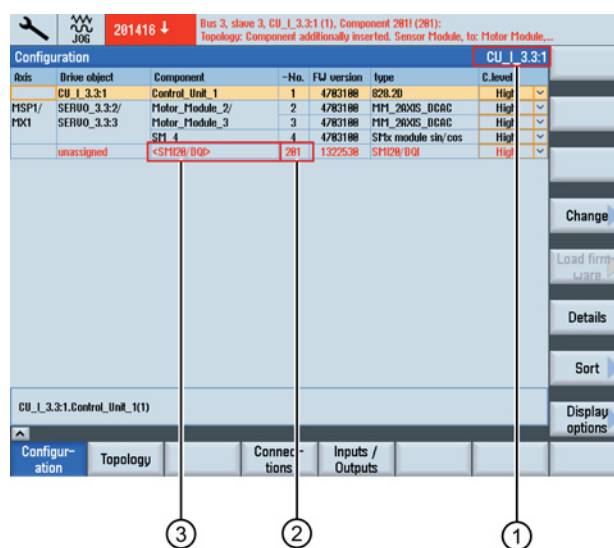
Requirement:

You must have the "Manufacturer" access level as a minimum.



Procedure

1. Identify the encoder to be deleted.
 - Connect the encoder to a free DRIVE-CLiQ port on the SINUMERIK drive system



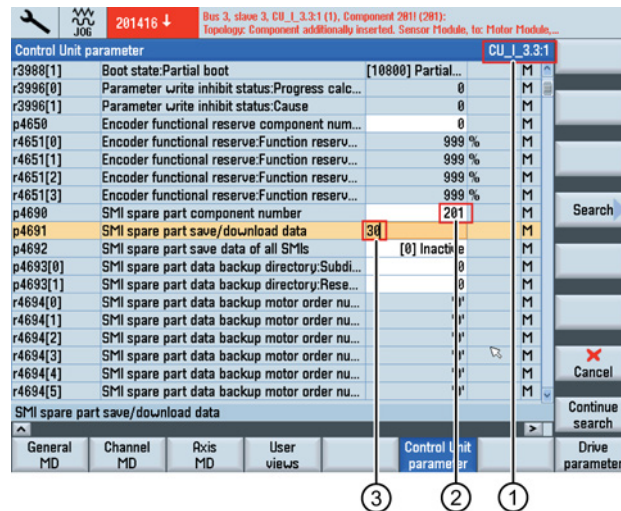
- 1 Number of the Control Unit
- 2 Automatically assigned component number > 200
- 3 Component designation

Figure 2-8 Screenshot for the connected encoder in another Control Unit

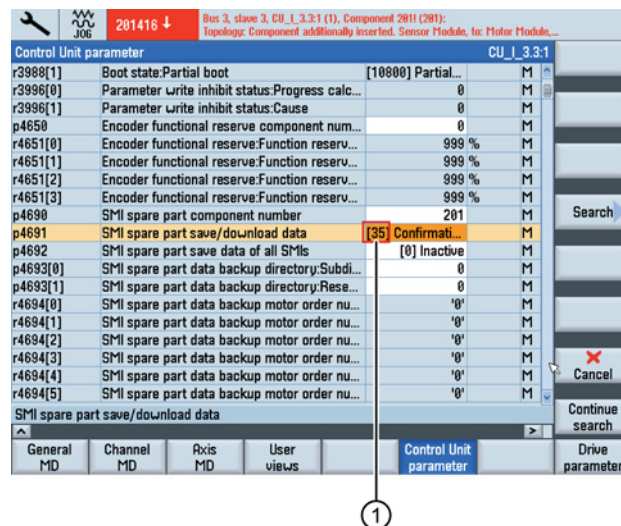
- ⇒ The encoder is assigned a component number greater than 200 in the topology tree
2. Make a note of the assigned component number ②, e.g. 201.
 3. Make a note of the Control Unit number ①.

2.10 How to delete an encoder

4. Change to the "Control Unit Parameters" view
5. Mark the Control Unit you made a note of above.
6. Enter the component number assigned to the encoder in the **p4690** field, e.g. 201
7. Enter 30 (code for "Delete SMI data") in the **p4691** field.

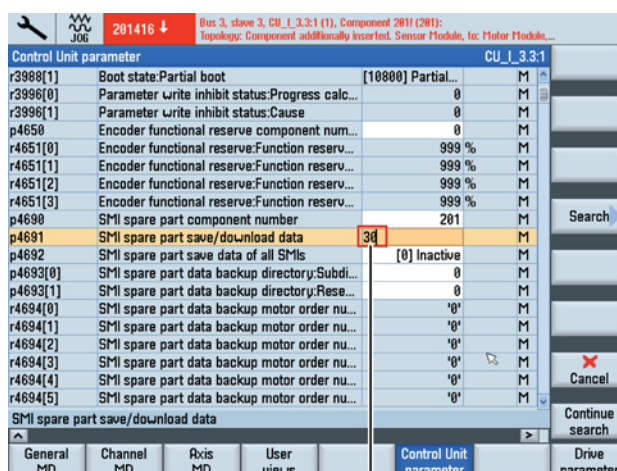


- 1 Number of the Control Unit
 - 2 Specified component number
 - 3 Code for "Delete SMI data"
8. Press ENTER to confirm your input.
⇒ **p4691** changes to [35] "Please confirm that you want to delete the SMI data"



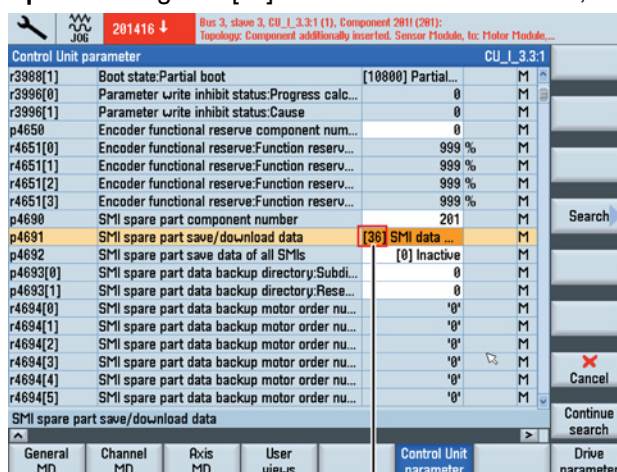
- 1 Screenshot for p4691: 35 "Please confirm that you want to delete the SMI data"

9. Enter [30] "Delete SMI data" in **p4691** again.



1 Screenshot for p4691

⇒ **p4691** changes to [36] "The SMI data was deleted; the component requires POWER ON"



1 Screenshot for p4691: [36] "The SMI data was deleted; the component requires POWER ON"

10. Switch the system off and then on again (POWER OFF / POWER ON).



The encoder has now been deleted and can be reprogrammed.

For more information about how to program the non-preprogrammed encoder, refer to section "How to program the encoder / import the electronic rating plate (Page 36)).

See also

How to replace an non-preprogrammed encoder (Page 34)

2.11 Diagnostics

The SINAMICS firmware contains monitoring and diagnostic functions for DRIVE-CLiQ modules and DRIVE-CLiQ encoders.

In the event of a fault, the corresponding alarm and fault messages are generated and communicated to the user. The diagnostic tools (e.g. Starter, Scout etc.) or a higher-level control are normally used for this purpose.

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