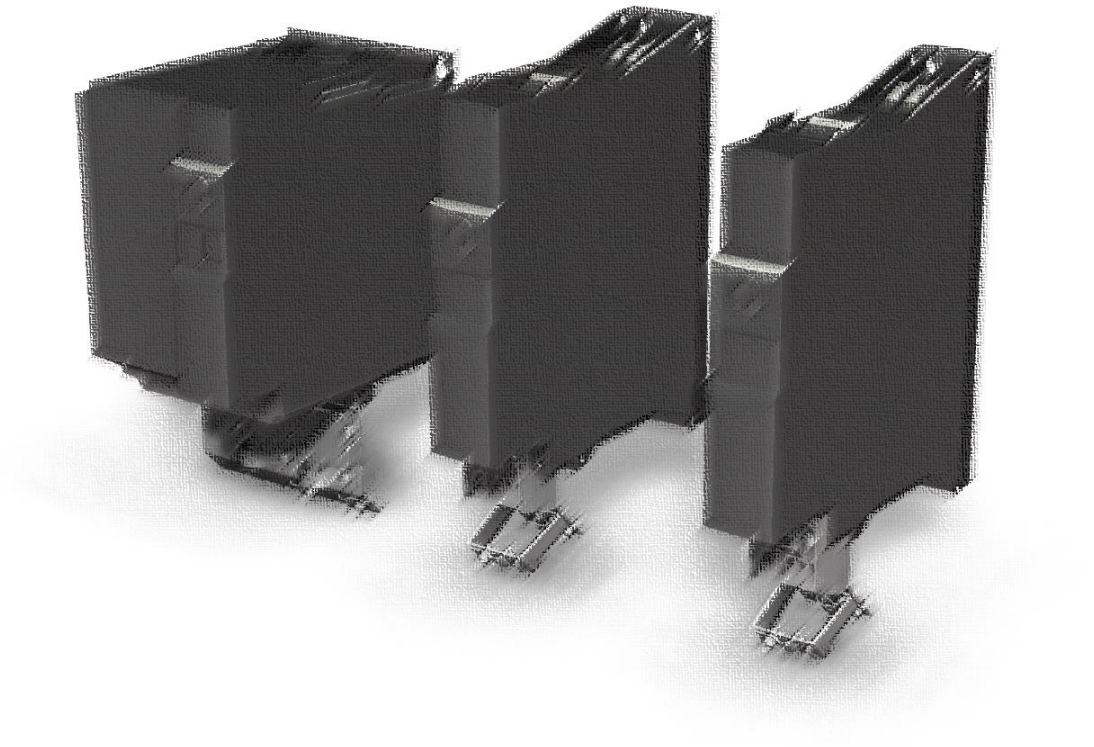
TAKTOMAT
passion for automation



# Taktomat Indexing Controller

Type TICx-xxx-xxx-3-x-x-x
Version 3
Application software v1

Translation of the original
Operating instructions

Version 1.1

# Table of contents

# 1 Brief description

TIC is the abbreviation for **T**aktomat **I**ndexing **C**ontroller
The Taktomat Indexing Controller TIC consists of the following components:

- Altivar ATV320 frequency converter
- Communications card for Profinet, EtherCAT or Ethernet IP

Available as accessories:

- Graphic display terminal for operation and parametrisation of the frequency converter
- Data cable for configuration and parametrisation of the frequency converter using a computer
- Optional personal safety stop:
    - Preventa XPS-ATE monitoring module for emergency stop circuits

The Taktomat Indexing Controller is a combination of the Altivar ATV320 frequency converter with the integrated ATV Logic machine controller. The Taktomat Indexing Controller (TIC) enables simple control of a rotary table with sensors.
The parameters for the Taktomat Indexing Controller have been configured to ensure that it achieves performance level "e" for the "STO" function and performance level "d" for the "SS1" function.


Figure 1 Example Taktomat Indexing Controller TIC

Use of the TIC offers you these benefits:

- Cycle time optimisation by stopping the drive at the end of the resting phase
- Reduced installation and hardware expenditure
- No need for motor protection switches and mechanical or electronic contactors – the only thing required is a power contactor
- Fast, gentle braking in the event of an emergency stop for reduced gear wear
- Soft restart from an intermediate position or after an emergency stop
- Machine-friendly inching mode
- Oscillating or reverse rotation direction without additional hardware.
- Easy speed adjustment
- Short commissioning time, as rotary table software is already integrated in the controller

# 2 Guide to the Operating instructions

In this manual, "Operating instructions", the integration of the Taktomat Indexing Controller into a PLC is described on the basis of a number of examples. In the following, the Taktomat Indexing Controller TIC is also referred to simply as the Taktomat Indexing Controller.

## 2.1 Objectives of the Operating instructions

The Operating instructions will help you to:

- Work efficiently
- Ensure quality
- Find information quickly
- Avoid hazards
-

### Table of contents

The manual is preceded by a full table of contents, where you will find an overview of the sections.

### Headings and page numbers

The sections are numbered consecutively. The contents of each section are also numbered consecutively.

### Safety instructions

Safety instructions precede actions that may cause a hazard. You can find a detailed explanation of the safety instructions in the section titled Safety.

### Text, symbols, illustrations

Instructions and information are provided in small, self-contained sections.
Text, symbols, and illustrations together constitute an information unit.
Instructions are numbered consecutively in technological order.

### Instructions

The instructions are divided into individual operating steps to give you a better understanding:

▸ Instruction text...
⇨ Instruction result

### Bullets

All bullets without operating steps are marked with the following symbol.

- Bullets...
  - Bullet item

### Illustrations

The illustrations, dimensions and technical data in the Operating instructions are not binding.

### Cross-references

Cross-references point you to further descriptions within the Operating instructions (section number/page number).

## 2.2 Further documentation

Please read the following documents for the particular hardware supplied before using this manual to operate the Taktomat Indexing Controller (can be found on www.schneider-electric.com).

| Description | Order number |
|---|---|
| Frequency converter catalogue Altivar Machine ATV320 | DIA2ED2160311EN |
| Altivar Machine Altivar 320 – Frequency Converter for Synchronous and Asynchronous Motors – Programming Manual | NVE41295 |
| Altivar Converter ATV 320 – Frequency Converter for Synchronous and Asynchronous Motors – Installation Manuel | NVE41289.03 |
| Altivar 320 – Frequency Converter – Instructions for Safety Functions | NVE50467.02 |
| Getting Started with ATV320 | NVE2176301 |
| Altivar Machine Altivar 320 – Variable Speed Drives for Asynchronous and Synchronous Motors – Profinet Manual – VW3A3627 | NVE41311 |
| Altivar Machine Altivar 320 – Variable Speed Drives for Asynchronous and Synchronous Motors – EtherCAT Manual – VW3A3601 | NVE41315 |

### Components from other manufacturers

For operation and maintenance of built-in parts from other manufacturers, please read the manufacturer's installation and operating instructions.

### Further documentation

In addition to the instructions in this manual, please read the following instructions and guidelines:

- Safety and accident prevention regulations
- Leaflets, booklets
- Implementation instructions of statutory accident insurance institutions
- Generally accepted occupational health and safety rules

## 2.3 Manufacturer

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## 2.4 Technical information

The technical information, illustrations and data contained in this manual are current at the time of printing.

## 2.5 Disclaimer

Our products are under continuous development.
And we therefore reserve the right to make any changes and improvements we consider appropriate.
However, this does not imply any obligation to extend this to equipment delivered at an earlier date.

## 2.6 Imprint

TAKTOMAT GmbH
Rudolf-Diesel-Straße 14
D-86554 Pöttmes

## 2.7 Copyright



## 2.8 Print date

Printed in the Federal Republic of Germany
Pöttmes, November 2020

# 3 Document version

| Version | Date | Comments |
|---|---|---|
| Version 1.0 | 15.05.2018 | First edition |
| Version 1.1 | 19.11.2020 | Change chap. 7.2, 8.2, 8.3, 9.6, 15.2, 15.3.1. Removed chap. 15.3.2. See also chapters 8.6, 9.6.1, 9.6.2 |

# 4 Safety instructions

## 4.1 General information

This document contains important instructions for working safely with the Taktomat Indexing Controller. These instructions are designed to help ensure your personal safety and protect the Taktomat Indexing Controller against damage. They are intended for both the operating company and for trained and qualified personnel for operation and servicing of the Taktomat Indexing Controller.
Before installing and commissioning this equipment, read these safety and operating instructions carefully. Read all warning labels on the equipment and make sure that they have not been damaged or removed.
Live or hot parts of the equipment may be accessible during operation. In the event of incorrect installation or operation, there is a risk of severe injury or damage to the equipment if parts of the housing, the digital control panel or terminal box covers have been removed.
Additional hazards may also arise, as frequency converters control rotating mechanical machine parts.

Always follow the operating instructions. Installation, commissioning and servicing may only be performed by qualified personnel. For the purposes of the safety instructions, qualified persons are persons who are familiar with the installation, assembly, commissioning, operation and maintenance of frequency converters, and who have the appropriate qualifications.
To ensure this equipment is operated safely, it should only be used for its intended purpose.
After disconnecting the frequency converter from the power supply, it may take approx. 15 minutes for the intermediate circuit capacitors to fully discharge. For this reason, wait for this time before opening the equipment. All power-unit terminals can still supply hazardous voltages.
Children and unauthorised persons should not be allowed access to this equipment.
Keep these safety and operating instructions at an accessible location and pass them on to anybody who has any type of access to this equipment.
Additional task-specific safety instructions can be found in the sections covering the individual phases of life.

## 4.2 Symbols used

**⚠ HAZARD**

**DANGER**

This combination of symbol and signal word indicates an imminently hazardous situation which if not avoided may result in death or serious injury.

**⚠ DANGER**


**DANGER**

This combination of symbol and signal word indicates an imminently hazardous situation which if not avoided may result in death or serious injury.

**⚠ WARNING**

**WARNING**

This combination of symbol and signal word indicates a potentially hazardous situation which if not avoided may result in death or serious injury.

**⚠CAUTION**

CAUTION

This combination of symbol and signal word indicates a potentially hazardous situation which if not avoided may result in slight nor minor injury.

**NOTE**

NOTE

This combination of symbol and signal word indicates a potentially hazardous situation which if not avoided may result in damage to property and the environment.

## 4.3 Intended use

The Taktomat Indexing Controller is a component for controlling asynchronous three-phase motors driving rotary indexing tables and linear transfer systems. The Taktomat Indexing Controller is designed for installation in electrical systems or machines, and must only be operated as an integrated component of the system or machine.

**When installing the Taktomat Indexing Controller in machines and systems, the following product standards as set out in the Low Voltage Directive must be observed:**

CE certification has been performed in accordance with EN 50178, using the line filters indicated in this manual and in compliance with the relevant installation instructions.
The frequency converter must only be operated within a CE compliant system.

**Any use deviating from the intended use is regarded as inappropriate use.**
**The manufacturer and Taktomat are not liable for any resulting damage. Compliance with all instructions of this manual is part of intended use.**

## 4.4 Foreseeable misuse

**Any use deviating from the intended use is regarded as inappropriate use. This includes:**

- Any use outside the permitted operating limits
- Any use in conjunction with aggressive materials (such as acids)
- Connection to a mains network with incompatible voltage and/or frequency
- Use with incorrect motor parameters
- Use with modified software

### 4.4.1 Warranty provisions

Changes to the structure of the materials used in the Taktomat Indexing Controller, including incorrect assembly and installation, can result in damage to the components. Failure to follow the instructions and warnings in the original documents for the components of the Taktomat Indexing Controller can also lead to damage to the Taktomat Indexing Controller or system. This is not considered intended use and will lead to the loss of guarantee and liability claims.

### 4.4.2 Directives, laws and standards

The following statutory provisions and standards have been applied:
EN 50178, 1997-10, Electronic equipment for use in power installations
EN 60204-1, 1997-12, Safety of machinery – Electrical equipment of machines – Part 1: General requirements
(IEC 60204-1:1997) / Note: includes corrigendum of September 1998
Low Voltage Directive 2014/35/EU
EMC Directive 2014/30/EU

## 4.5 Technical condition of the Taktomat Indexing Controller

The Taktomat Indexing Controller may only be operated in technically perfect condition. Operating the Taktomat Indexing Controller when not in technically perfect condition presents a threat of death or injury to personnel and a risk of damage to property.

### 4.5.1 Do not change the approach to maintaining safety

The manufacturer has implemented an approach to maintaining safety. If the company operating the Taktomat Indexing Controller changes the approach to safety without express permission, any liability will be excluded.

## 4.6 General hazards

The following section sets out residual risks that may arise from the Taktomat Indexing Controller even if used as intended.

To reduce the risk of personal injury or equipment damage, and to avoid potentially dangerous situations, the safety information provided here and the safety instructions in the other sections of this manual must be observed.

Electrical hazards

**⚠HAZARD**

**Risk of fatal injury from electrical current.**
**Contact with live parts poses an immediate risk of fatal injury by electrocution.**
Damage to the insulation or individual components can be life-threatening.

- Have all work on the electrical system carried out exclusively by qualified electricians.
- In the event of damage to the insulation, switch off the power supply immediately and have it repaired.
- Before starting work on live components of electrical systems and equipment, ensure that no voltage is present, secure against being switched on and check to ensure that there is no power to the system.

## 4.7 Responsibilities of the operating company

The machine is used in the commercial sector in accordance with its intended use. The company operating the machine is therefore subject to the statutory obligations relating to workplace safety.
In addition to the general safety instructions in this document, the additional safety, accident prevention and environmental protection provisions relevant to the specific application of the machine must also be adhered to.

**In particular, the operating company must:**

- Be informed at all times about the applicable occupational health and safety regulations and carry out a risk assessment to determine any additional hazardous points and locations that may arise from the specific working conditions at the location of use. This information must be made available in the form of operating instructions for the operation of the machine (work instructions, descriptions of implementation etc.).
- Review the operating instructions prepared internally to ensure that they are up to date with the current regulations over the entire period of use of the machine and adjust them if necessary.
- Clearly define and specify the responsibilities for any implementation of installation, operation, maintenance and cleaning.
- Ensure that the staff deployed for the work to be carried out have the necessary qualifications.
- Ensure that all employees working on the machine have read and understood all documents relevant to operation (operating instructions, maintenance instructions, and safety guidelines).
- Provide staff training and information about potential hazards at regular intervals.
- Bear responsibility for damage to property and personal injury caused by manipulation of the machine. The function of the machine and its safety equipment must therefore be checked regularly to ensure that it is in good condition, and documented in an appropriate manner.
- Ensure that the machine is always in perfect technical condition.
-

### 4.7.1 Precautionary measures

For the operating company, the following precautionary measures are recommended:

- Use only qualified, trained and instructed personnel for work on the machine.
- Clearly define roles and responsibilities for operating and service personnel.
- Supplement these operating instructions with
  - Provisions of national and regional occupational and environmental regulations
  - Specific operational characteristics (work processes, supervisory and reporting requirements, fire alarm systems etc.)
- Check occasionally to ensure that the operating instructions are being used correctly and provide additional instruction as necessary.
- Keep all documentation in readable condition at all times and available at the place of use.
- Adhere to the deadlines for periodic checks and inspections stipulated by law or specified in this documentation.
- Where necessary, replace safety-critical components set out in this documentation in good time.
- Check the machine regularly to ensure that safety equipment is in good condition and functioning satisfactorily.
- Ensure that safety and hazard warnings on the machine in the work area are legible.
- Have the machine checked regularly for visible damage or defects.

## 4.8 Personnel qualifications

The various tasks described in this manual present different requirements with respect to the qualifications of the persons entrusted with these tasks.

**⚠WARNING**

**Hazard due to insufficient staff qualifications.**
**Insufficiently qualified persons are unable to judge the risks associated with working with the machine and expose themselves and others to the risk of serious or fatal injury.**

- ▸ All work may only be carried out by appropriately qualified personnel.
- ▸ Keep insufficiently qualified persons out of the work area.

### 4.8.1 Qualified staff

Skilled personnel (qualified staff) as defined in the operating instructions are persons who

- Have been specially trained and instructed as operating personnel working with the machine.
- As assembly and service personnel, have relevant knowledge concerning commissioning and maintenance of the machine and are familiar with the safety instructions.
- Before commissioning the machine, all qualified staff must have read and understood the contents of the operating instructions and have been informed about the hazards associated with working with the machine by the company operating the machine.
- Knowledge of first aid measures is required.

### 4.8.2 Technical experts

Technical experts are persons whose specialist training and experience provide them with sufficient knowledge of working with this machine, and whose familiarity with the relevant national health and safety regulations, accident prevention regulations, guidelines and generally accepted engineering principles allows them to assess whether the machine is safe to work with.

### 4.8.3 Support staff

Work on or in the vicinity of this machine that is not associated with operation of the machine (e.g. cleaning, transport, provisioning work etc.), may be carried out by other people. Before commissioning of the machine, these

persons must be informed by qualified staff working for the machine operator about the nature of the work to be carried and the hazards associated with working with the machine. Persons who cannot read and write must be separately instructed with particular care.

### 4.8.4 Servicing, repair and maintenance of the machine

Servicing, repair and maintenance work on the machine may only be performed by the manufacturer's service technicians or by specialist personnel authorised by Taktomat GmbH. Always secure the workplace carefully when carrying out this work.

# 5 Labelling

## 5.1 ATV320 rating plate

The following rating plate is attached to the frequency converter:

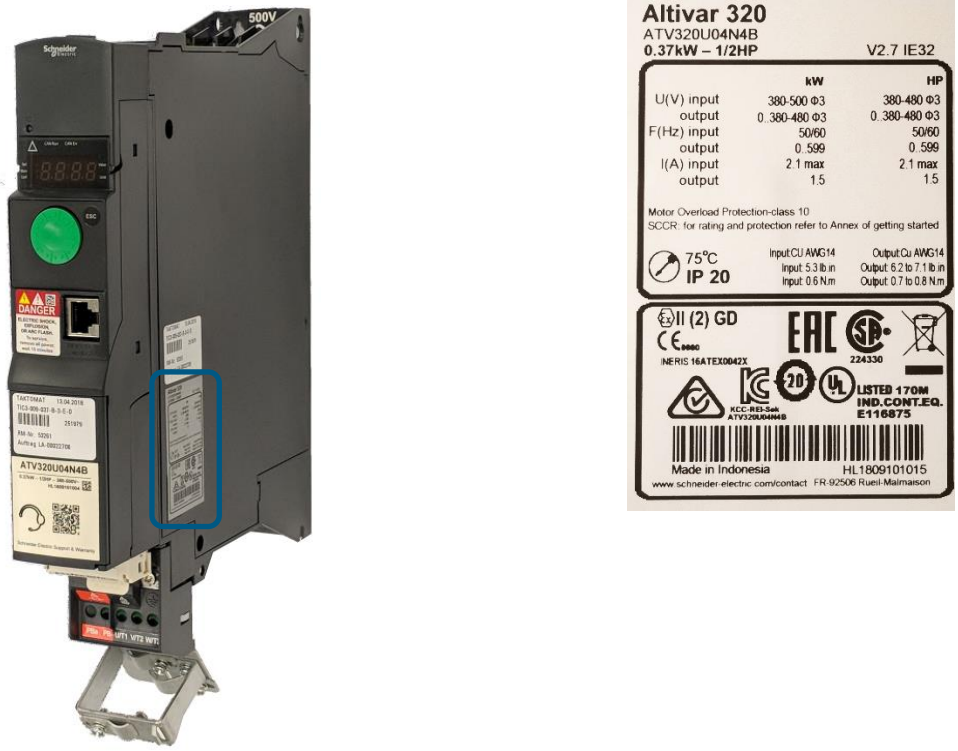



Figure 2: Example of an ATV320 rating plate

## 5.2 Communications card rating plate

The following rating plate is attached to the back of the communications card:

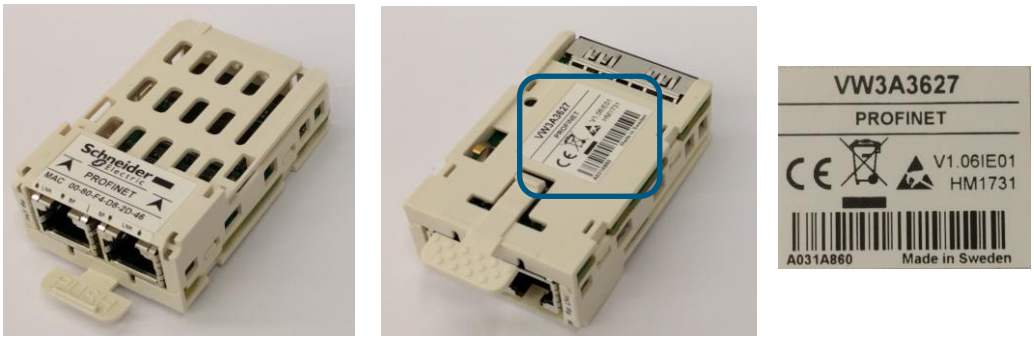



Figure 3: Example of a Profinet communications card rating plate

## 5.3 TIC rating plate

There are two TIC rating plates attached to the frequency converter, on the front and on the right-hand side:

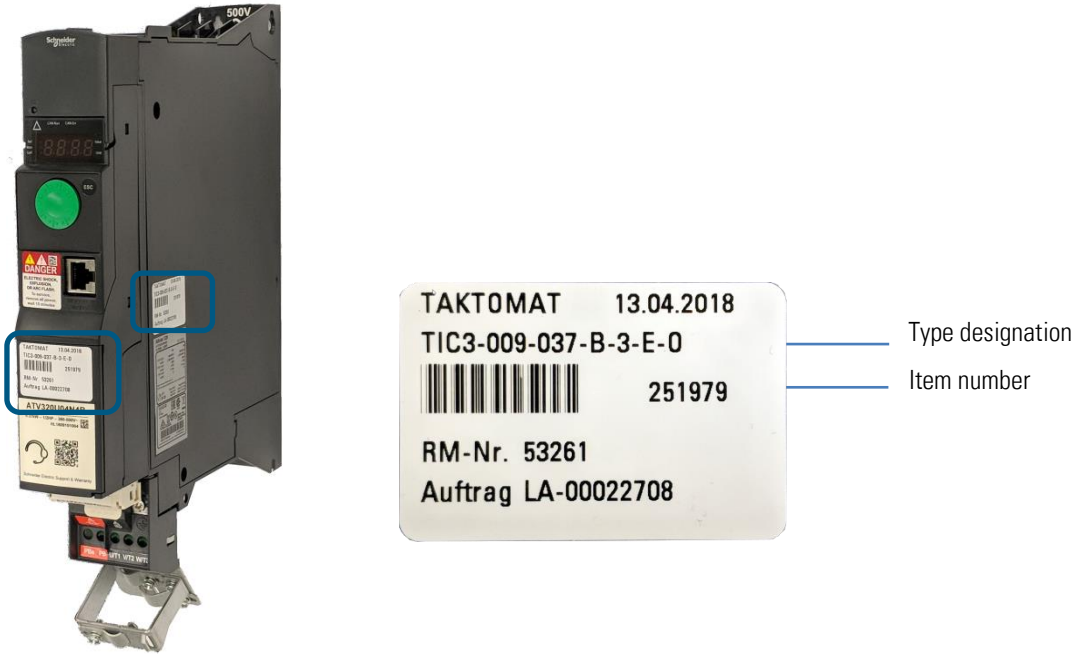



Figure 4: Example of a TIC3-075-150-B-3-0-0 rating plate

TIC type designation

TIC□-□□□-□□□-□-□-□-□

- Encoder card
  - 0 Without encoder card
- Communication
  - E Via EtherCAT
  - P Via Profinet
  - N Via Ethernet IP
- Version
  - 3 Altivar ATV320 with/without communications card
- Software functionality
  - 0 Without software
  - B With software for rotary indexing tables with cam and without encoder
- Maximum motor power output in kW
- Minimum motor power output in kW
- Power supply
  - 3 Three-phase connection 380-480 V AC, 50/60 Hz

### 5.3.1 Example type designation

TIC3-037-075-B-3-E-0

| | |
|---|---|
| 3 | Power supply with three phases from 380…480 V AC 50/60 Hz |
| 037 | Minimum motor power output 0.37 kW |
| 075 | Maximum motor power output 0.75 kW |
| B | With software for rotary tables with cam and without encoder |
| 3 | Version 3 |
| E | Communication via EtherCAT |
| 0 | Without encoder card |

# 6 Design

## 6.1 Design of the Taktomat Indexing Controller type TIC

The Taktomat Indexing Controller consists of the following components:

(1) Altivar 320 frequency converter
(2) Communications card (when installed)

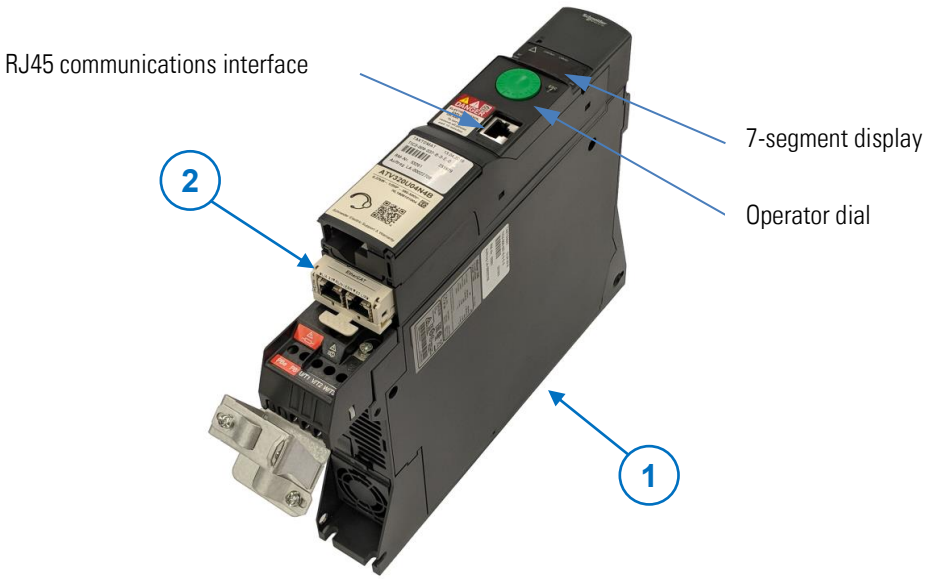
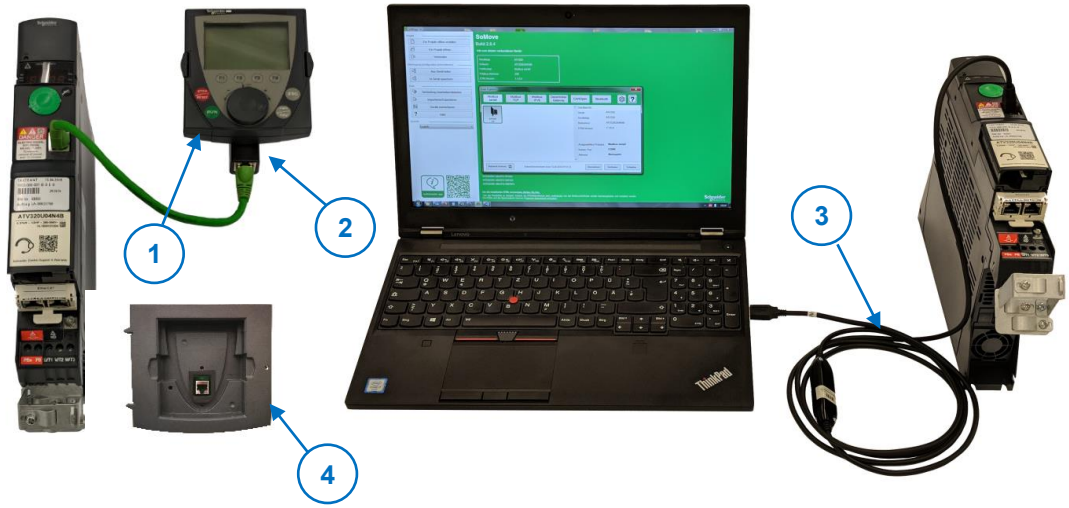



Figure 5: Design Taktomat Indexing Controller TIC

## 6.2 Accessories TIC

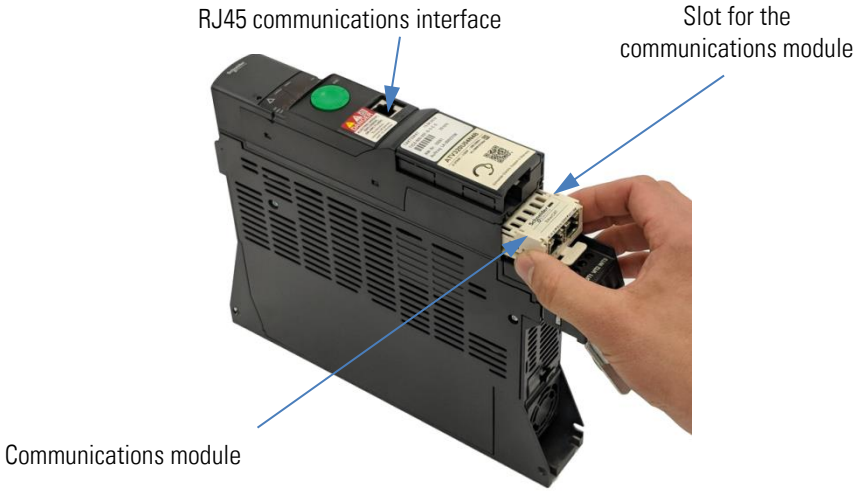
The following optional accessories are available for the TIC:

- (1) Graphic display terminal VW3A1101
- (2) RJ45 adapter for graphic display terminal VW3A1105
- (3) USB/RJ45 cable – for connecting a PC TCSMCNAM3M002P
- (4) Assembly kit for decentralised installation




## 6.3 Assembling and disassembling the communications card

To disassemble the communications card, press the lock down and pull out the card at the same time.

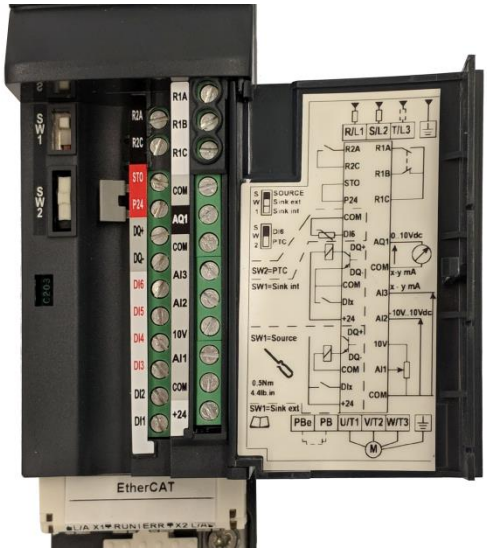


# 7 Terminal assignments. Input and output signals

## 7.1 Overview of terminal assignments

TIC terminals:

| | Terminal | Description | Function |
|---|---|---|---|
| Inputs | DI3 | STO channel 2 (SS1 channel 1) | STO configuration:<br>0 = Frequency converter disabled, restart not possible<br>1 = Frequency converter enabled<br><br>SS1 configuration:<br>0 = The drive stops above the ramp defined in SoMove<br>1 = Frequency converter enabled |
| | DI4 | (SS1 channel 2) | The drive stops above the ramp defined in SoMove |
| | DI5 | Position sensor | 0 = Rotary indexing table not in position<br>1 = Rotary indexing table in position |
| | DI6 | Motor temperature monitor | 0 = Motor temperature OK<br>1 = Error, motor temperature monitor deactivated as shipped. |
| | STO | STO channel 1 | 0 = Frequency converter disabled, restart not possible<br>1 = Frequency converter enabled |
| Outputs | DQ+/DQ- | Position feedback | 0 = Rotary indexing table not in position<br>1 = Rotary indexing table in position |
| | R1A/R1C | Fault/ready | 0 = No error, frequency converter ready<br>1 = Fault |
| | R2A/R2C | Motor brake control | Relay not switched = Brake applied<br>Relay switched = Brake not applied |



## 7.2 Overview of communications interface

| | Word | Bit | Description | Function |
|---|---|---|---|---|
| Inputs | I1 (CMD, 8501) | 0-6 | Reserved | |
| | | 7 | Reset | Reset error |
| | | 8-10 | Reserved | |
| | | 11 | Start | 0→1 Rising flank leads to start |
| | | 12 | Direction | 0 = Ccw (counterclockwise)<br>1 = Cw (clockwise) |
| | | 13 | Stop | Flank 1→0 Immediately stop above the ramp<br>0 = driving operation not possible<br>1 = driving operation possible |
| | | 14 | Operating mode | 0 = Auto<br>1 = Manual |
| | | 15 | Reserved | |
| | I2 (LFRD, 8602) | 0-15 | Reference speed | Reference speed (resolution 1 rpm) |
| Outputs | O1 (ETA, 3201) | 0 | Reserved | |
| | | 1 | Frequency converter status | 1 = Frequency converter ready<br>0 = Frequency converter not ready |
| | | 2 | Motor rotating | 1 = Motor rotating<br>0 = Motor stopped |
| | | 3 | FC error | 1 = Frequency converter error<br>0 = No errors |
| | | 4-5 | Reserved | |
| | | 6 | STO active | 0 = STO is not active<br>1 = STO active, no 24 V DC on DI3 and STO |
| | | 7-15 | Reserved | |
| | O2 (RFRD, 8604) | 0-15 | Actual speed | Actual speed (resolution 1 rpm) in 2's complement (turning left is positive, turning right negative) |
| | O3 DP0, 7200) | 0-15 | Error code | The last/current error code, see Appendix A |
| | O4 IL1R (5202) | 0-3 | Reserved | |
| | | 4 | Resting position reached | 0 = Outside resting, sensor on the cam is not active<br>1 = Resting position reached, sensor on the cam is active (signal comes directly from position sensor on DI5) |
| | | 5-15 | Reserved | |
| | O5 0L1R (5212) | 0-15 | Reserved | |
| | O6 MOO1 (14970) | 0 | Reserved | |
| | | 1 | Ready to start | 0 = TIC not ready<br>1 = TIC ready for next start, wait for start signal |
| | | 2-15 | Reserved | |

## 7.3 Description of input and output signals

### 7.3.1 Input DI3 "STO channel 2 (SS1 channel 2)"

If no 24 V DC power is present on input DI3, it will not be possible to start the motor (in compliance with functional safety standards EN 954-1, ISO 13849-1 and IEC / EN 61508). Uncontrolled or unexpected restarting of the motor is prevented through electronic locking of the "STO" function (safe torque off). The STO function has priority over every movement command.

**NOTE**

RESET "SAFF" ERROR FOR SAFETY FUNCTIONS

If the STO or SS1 safety function is breached, the error code "SAFF" is displayed on the 4-digit converter display or on the graphic display terminal. To reset the error, the frequency converter must be restarted. The error cannot be reset using the "Reset" signal.

### 7.3.2 Input DI4 "(SS1 channel 1)"

If the SS1 function has been activated by SoMove in the TIC, it triggers the safe stop (SS1) if there is no voltage at DI4. The motor is stopped above the ramp configured in SoMove.

**NOTE**

RESET "SAFF" ERROR FOR SAFETY FUNCTIONS

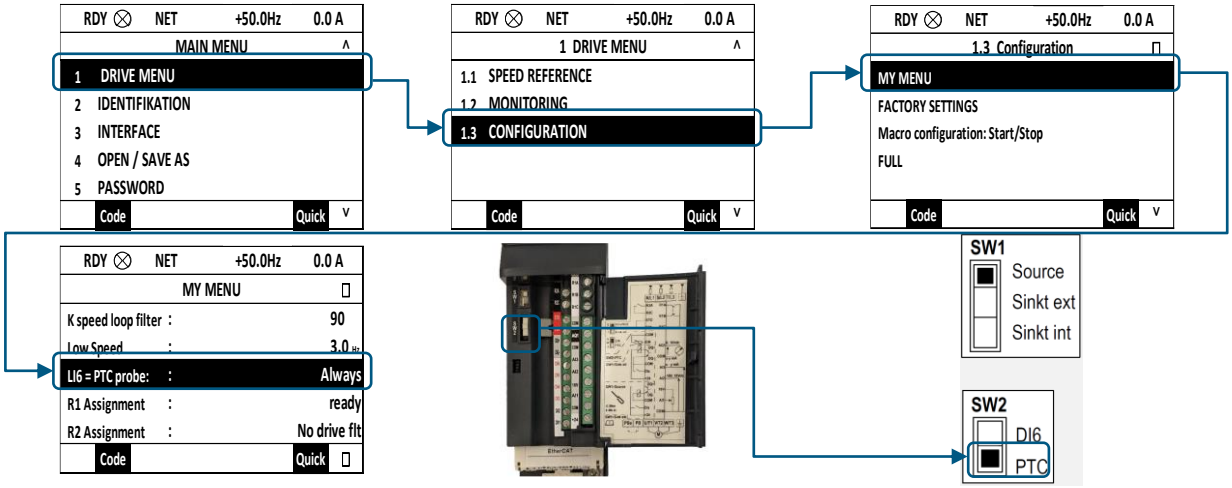
If the SS1 safety function is breached, the error code "SAFF" is displayed on the 4-digit converter display or on the graphic display terminal. To reset the error, the frequency converter must be restarted. The error cannot be reset using the "Reset" signal.

### 7.3.3 Input DI5 "Position sensor"

The frequency converter switches the ramps depending on the signal status
0 = The rotary indexing table is in the resting area, ramp "Acceleration ramp time" and "Deceleration ramp time" are active
1 = The rotary indexing table is outside the resting area, "Acceleration 2 ramp time" and "Deceleration 2 ramp time" ramps are active
The signal must be sent directly from the sensor to the TIC to avoid delays in the signal.

### 7.3.4 Input DI6 "Motor temperature monitor"

Input for monitoring the motor temperature (deactivated as shipped).
The temperature sensor must be connected to the COM and DI6 inputs. Input DI6 must then be activated in "My menu" and on the hardware switch "SW2". To do this, the converter must be in "Stop" mode. If the PTC triggers, the error message "OtFL" is displayed. It can be reset with the reset bit after the PTC has cooled down.



### 7.3.5 Input STO "(STO channel 1)"

When the STO function is activated (falling signal flank from 24 V DC→0 V DC), the output stage is switched off immediately, the motor is torque-free.
If no 24 V DC power is present on the STO input, it will not be possible to start the motor (in compliance with functional safety standards EN 954-1, ISO 13849-1 and IEC / EN 61508). Uncontrolled or unexpected restarting of the motor is prevented through electronic locking of the STO "safe torque off" function. The STO function has priority over every movement command. Of all safety functions, the STO function has the highest priority.
For more detailed descriptions of the STO "safe torque off" function, please refer to the original documentation for the Altivar 320 frequency converter (installation manual and instructions for safety functions).

### 7.3.6 Output DQ+/DQ- "Position feedback"

This output is switched in all operating modes. The DI5 "position sensor" input status is included to generate this signal.
0 = The rotary indexing table is between two valid positions.
1 = The rotary indexing table is in position (resting phase). However, this does not mean that the drive stops rotating.

**NOTE**

- Make your decision depending on the selected operating mode (automatic or inching mode) or error situation:
- ⇨ Start external processing
- ⇨ Do not start external processing

### 7.3.7 Output relay R1A/R1C "Fault/ready"

This output is switched in all operating modes.
0 = The drive is rotating or there is a fault.
1 = The drive is stationary. This is the earliest possible time the next start command will be accepted. Earlier start commands are ignored.

**⚠WARNING**

**Risk of collision if output signal O6.1 is not checked.**
**Not checking output signal O6.1 may lead to serious personal injury or property damage.**

- Do not start external processing when output signal O6.1 is set
- Reset started movements safely

### 7.3.8 Relay R2A/R2C "Motor brake control"

This output is a voltage-free relay contact. The output is set as soon as the converter is ready for operation and the frequency converter reports no faults.
It remains activated the entire time the converter is in use. The brake is not required to stop the drive. This ensures absolutely no wear is caused to the drive.

Relay not switched = Brake applied

Relay switched = Brake not applied
As shipped, the relay R2A/R2C parameter is set to "No error".
However, it is possible to couple the brake function with motor start/stop by changing the parameter for relay R2A/R2C to "Start motor" instead of "No error".

**⚠CAUTION**

**DAMAGE TO ELECTRICAL OR ELECTRONIC COMPONENTS.**

When connecting inductive loads, the outputs must be protected against overvoltage using recovery diodes.

**CAUTION**

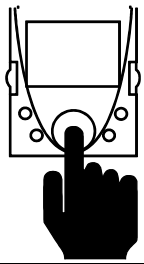
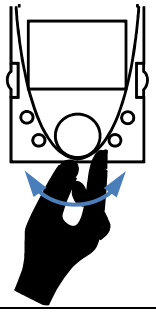
**CURRENT LOAD OUTPUT RELAY R1A/R1B/R1C AND R2A/R2B/R2C**

Observe the maximum relay power rating.
Maximum switching capacity:
With ohmic load: 3 A at 250 V AC or 4 A at 30 V DC
With inductive load (cos $\phi$ = 0.4 L/R = 7 ms): 2 A at 250 V AC or 30 V DC
Failure to follow this instruction can result in material damage.

# 8 Operation

## 8.1 Operation using the graphic display terminal

The Taktomat Indexing Controller can be operated using the navigation keys and the 4-digit display or using an optional graphic display terminal.

| | | |
|---|---|---|
| Press the navigation wheel |  | Display the main menu<br>Save the current value<br>Activate the selected menu<br>Display the selected function |
| Turn the navigation wheel |  | Change parameter values<br>Select predefined parameters<br>Select menu options |
| Press the ESC key |  | Cancel parameter change<br>Discard a value<br>Return to the previous menu. |

## 8.2 Operation with SoMove

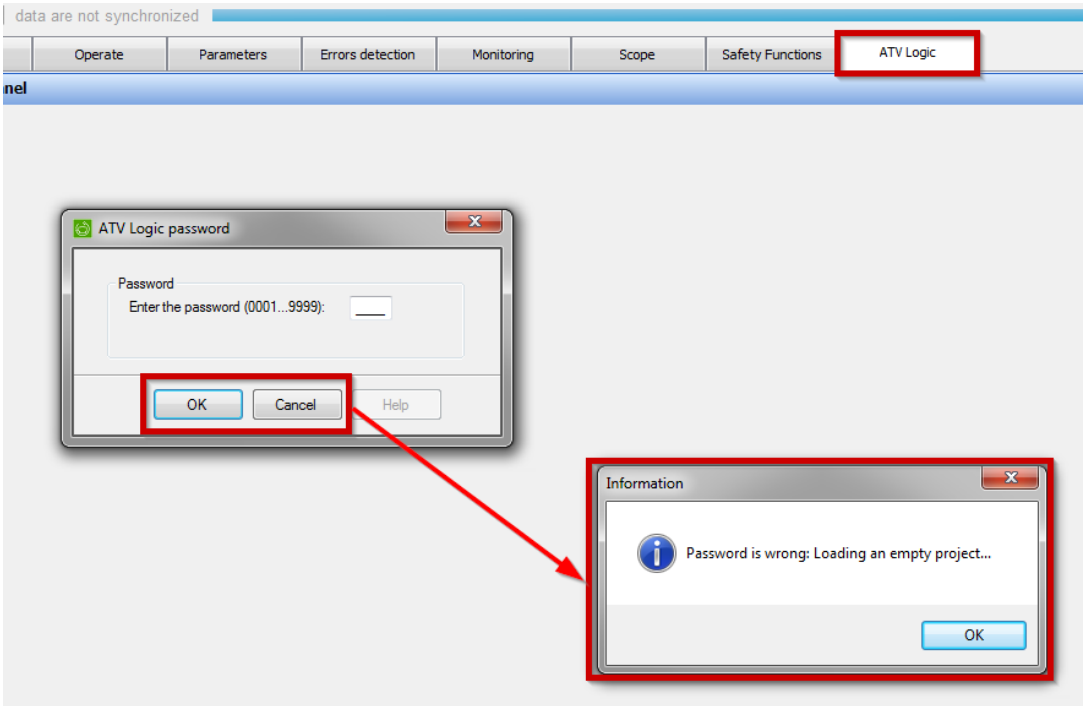
The frequency converter can be configured and parametrised with the SoMove software. The safety functions can only be configured with SoMove. SoMove is free and can be downloaded directly from the website (https://www.schneider-electric.de → Support → Download Center → Search for: SoMove_FDT → SoMove_VX.X.X.exe). To connect to a computer, a communication cable is required. It can be ordered directly from Taktomat.

**NOTE**

**LOSS OF THE SOFTWARE IS POSSIBLE!**

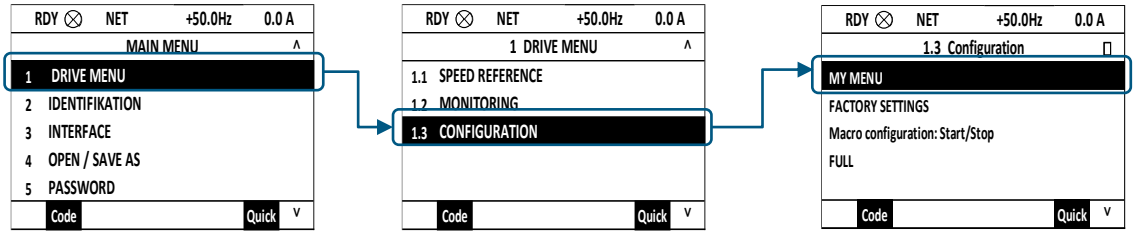
**Do not click on „ATV Logic" button. Behind the button ist he password-protected logic area to which you have no access. After the password request, an empty project is loaded when you cancel the request. If you later upload the project to your TIC, an empty project is loaded an dthe TIC software is permanently deleted.**

Do not click on the "ATV Logic" button. If you did, close SoMove and do not upload the current project to the TIC. After restarting SoMove, you can reconnect to your TIC and make changes

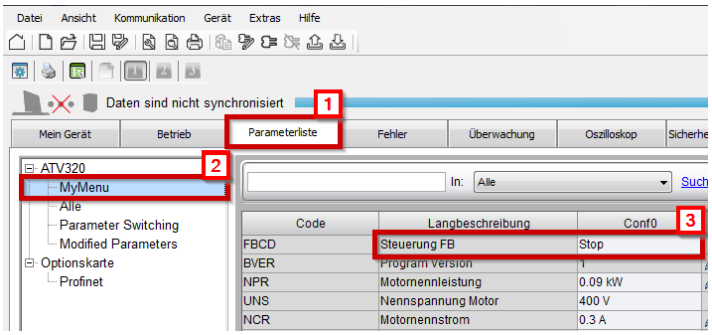


## 8.3 Frequency converter menu “MY MENU”

For parametrisation by the user, the submenu “MY MENU” has been configured in the Taktomat Indexing Controller, where all important parameters can be found in one place.
Navigate to “CONVERTER MENU”→“1.3 CONFIGURATION”→“MY MENU”.




The same parameters can also be found in the SoMove software in the “Parameter list” tab in the navigation tree under “ATV320”→“My menu”.



## NOTE

**NOTE**

- The Taktomat Indexing Controller can only be configured and parametrised if the parameter "FB command" is changed from "Start" to "Stop".
- After configuration or parameterisation, set the parameter "FB command" back to "Start".
- When the parameter "FB command" is set to "Start", the symbol is displayed on the graphic display terminal. When set to "Stop", the symbol is displayed.

The following table shows these parameters as shipped.

| Menu item | Default | Comments |
|---|---|---|
| FB command | Start | Starts or stops execution of the program |
| Program version | x | Depending on the program version, e.g. 1 |
| Rated motor power | Depending on FC | See rating plate for the motor connected to the TIC controller |
| Rated motor voltage | Depending on FC | |
| Rated motor current | Depending on FC | |
| Rated motor frequency | Depending on FC | |
| Rated motor speed | Depending on FC | |
| Acceleration ramp time | 1.5 s * | Acceleration ramp outside resting area |
| Deceleration ramp time | 0.3 s * | Deceleration ramp outside resting area |
| Acceleration 2 ramp time | 0.03 s * | Acceleration ramp in resting area |
| Deceleration 2 ramp time | 0.03 s * | Deceleration ramp in resting area |
| Ramp increment | 0.01 s * | |
| IR compensation | 90% | |
| Slip compensation | 100% | |
| Speed proportional gain | 40% | |
| Speed time integral | 100% | |
| K speed loop filter | 90% | |
| LI6 = PTC probe | No | PTC input, deactivated as shipped |
| Relay output 1 assignment | Ready | Switches as soon as TIC is ready and not in motion |
| Relay output 2 assignment | No drive flt. | Switches as soon as TIC is ready for operation and there is no error |

* Values dependent on size and/or load. Please ask Taktomat.

### Important settings

**⚠CAUTION**

**EQUIPMENT DAMAGE AND PERSONAL INJURY**

**Failure to follow these instructions can cause serious injury or even death, or damage to the material.**

It is **imperative** that all motor parameters such as “Nominal motor voltage”, “Nominal motor frequency”, “Nominal motor current”, “Nominal motor speed” and “Rated motor power” are properly configured in accordance with the motor rating plate.

Before operation, the motor parameters must first be set in accordance with the rating plate. All other parameters must be adjusted in accordance with the operating conditions.

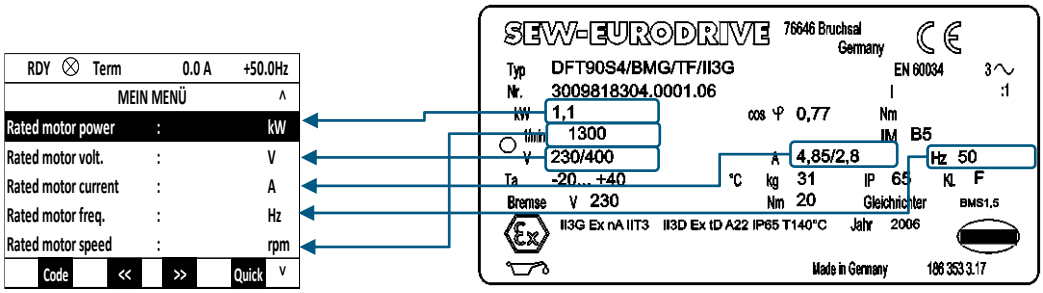
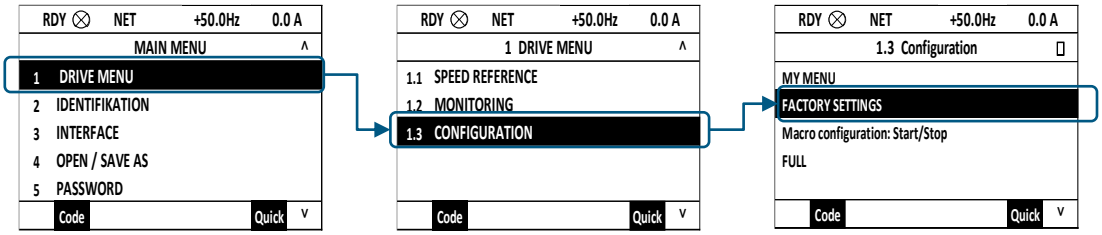



Figure 6: Example motor rating plate

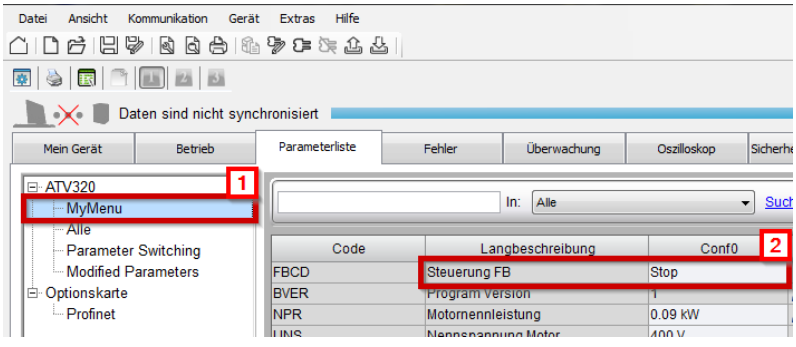
## 8.4 Resetting the parameters to factory settings

The parameters can be reset to the factory settings in the frequency converter menu “FACTORY SETTING”.

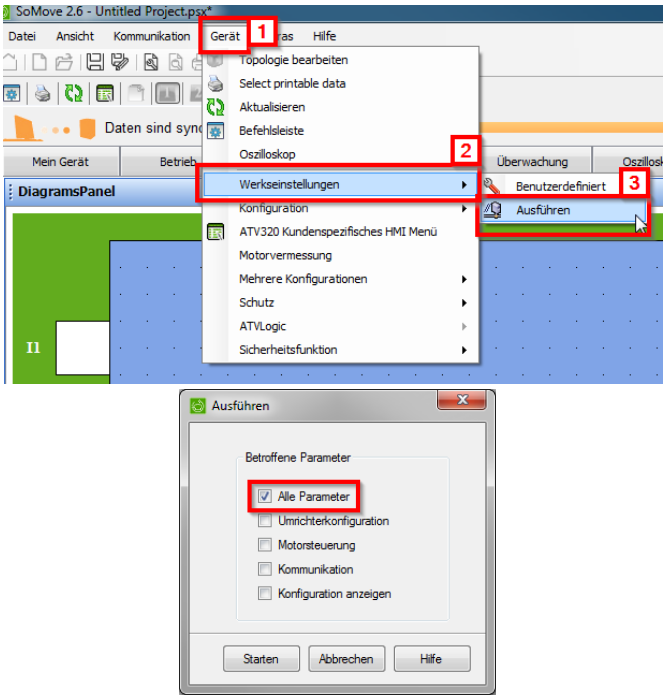



Before actually resetting the parameters using the “Goto FACTORY SETTINGS” line, the option “All” must be selected in the “PARAMETER GROUP LIST” menu item.

The SoMove software can also be used to reset the TIC to factory settings. To do this, connect to the TIC and switch to STOP mode under “MyMenu” in the parameterlist..



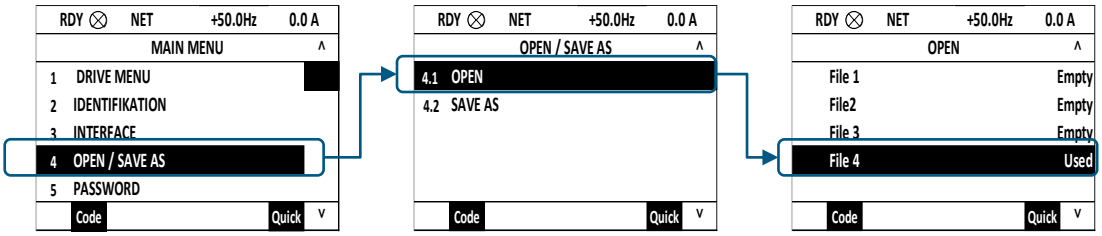
You can now reset the TIC to the factory settings under Device → Factory settings → Execute. Please also select "All parameters" here if you are prompted to do so.




## 8.5 Saving and loading parameters

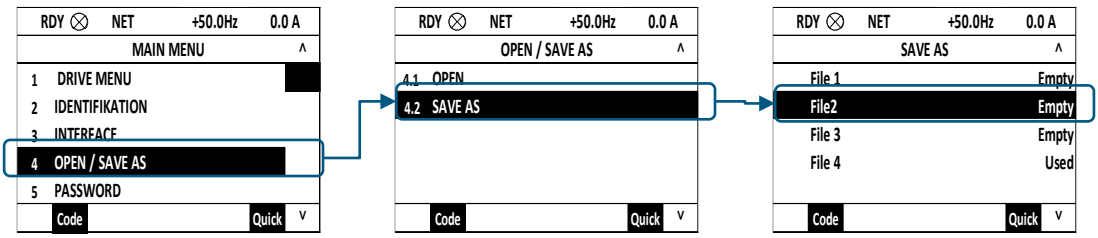
The default parameters for the TIC are stored on the optional graphic display terminal and can be opened again at any time. They can be found in the main menu under "LOAD/SAVE AS"→"OPEN" under "File 4". After a new configuration has been opened, the TIC must be restarted.

How to navigate to the "OPEN" menu:

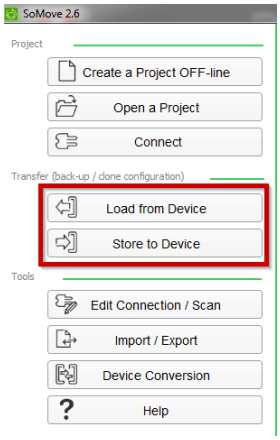



The current parameters can be saved in the menu with the "SAVE AS" function and re-opened as described above.

How to navigate to the "SAVE AS" menu:



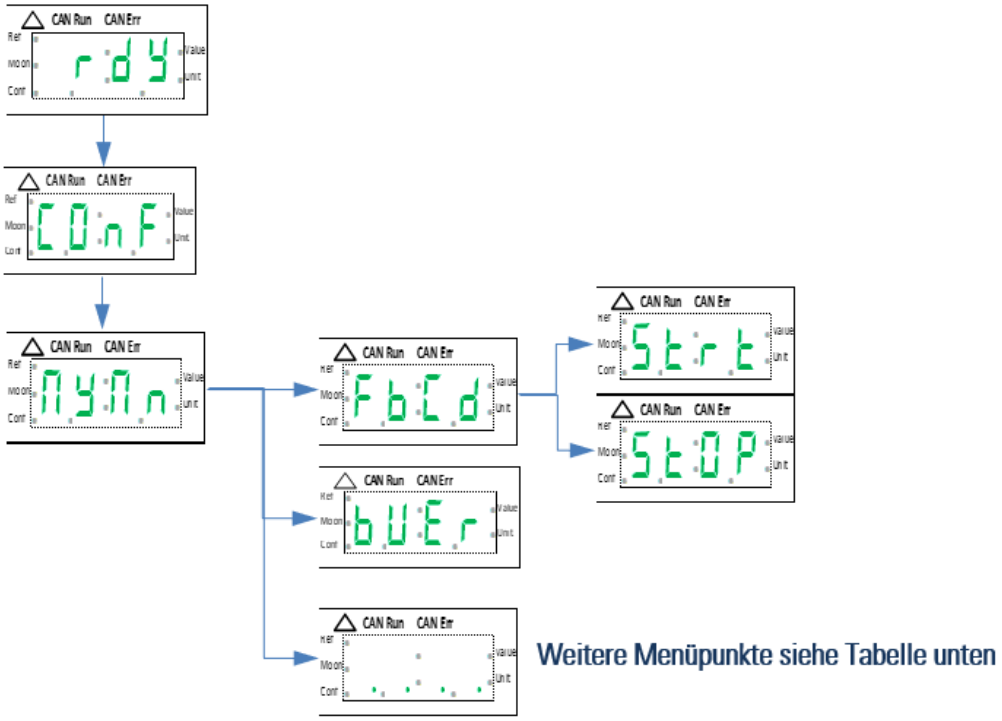
Configurations can also be loaded and saved using the commissioning software SoMove.




After a new configuration has been saved, the TIC must be restarted and set to RUN mode.

## 8.6 Frequency inverter menu "7 SEGMENT MENU"

In the event that no graphic display terminal or PC are available for parameterization, this can be done using the 7-segment display of the TIC.
To do this, first navigate to "MyMenu" (NyNn):




**NOTE**

**NOTE!**

- • The rotary table control can only be configured and parameterized if the "FB Command" (FbCd ) parameter is changed from "Start" (Strt) to "Stop" (StOP)
- • After the configuration or parameterization, set the "FB Command" parameter back to "Start"

| Menu item | Code | | Settings | comment |
|---|---|---|---|---|
| Steuerung FB | FbCd | | Start | |
| | ↪ | Strt | | Starts the execution of the program |
| | ↪ | StOP | | Stops the execution of the program |
| Programm Version | bUEr | | x | Depending on the program version, e.g. 1 |
| Rated motor power | nPr | | FU dependent | See the nameplate of the motor that is connected to the TIC control |
| Nominal motor voltage | UnS | | FU dependent | |
| Nominal motor current | nCr | | FU dependent | |
| Nominal motor frequency | FrS | | FU dependent | |
| Nominal motor speed | nSP | | FU dependent | |
| Acceleration ramp time | ACC | | 1.5 s * | Acceleration ramp outside the rest area |
| Deceleration ramp time | dEC | | 0.3 s * | Deceleration ramp outside the rest area |
| Acceleration 2 ramp time | AC2 | | 0.03 s * | Acceleration ramp in the rest area |
| Deceleration 2 ramp time | dE2 | | 0.03 s * | Deceleration ramp in the rest area |
| Ramp increment | inr | | 0.01 s * | |
| IR compensation | UFr | | 90% | |
| Slip Compensation | SLP | | 100% | |
| Speed proportional gain | SPG | | 40% | |
| Speed time integral | S It | | 100% | |
| Low speed | SFC | | 90% | |
| LI6 = PTC probe | L6A | | No | PTC input, deactivated on delivery |
| | ↪ | nO | | No |
| | ↪ | AS | | Alwas |
| | ↪ | rdS | | Power On |
| | ↪ | rS | | Motor On |
| Relay ouput 1 assignment | r1 | | Ready | Switches as soon as the TIC is ready for operation and not in motion |
| Relay ouput 2 assignment | r2 | | No drive flt | Switches as soon as the TIC is ready for operation and there is no error |

# 9 Functionality

## 9.1 Overview of functions

The Taktomat Indexing Controller is a combination of the Altivar 320 frequency converter, the integrated communications card and the ATV logic program programmed by Taktomat.

- The Taktomat Indexing Controller supports automatic and manual operation.
- Fast, gentle braking by means of braking ramps in the event of a stop for reduced gear wear and soft restart from an intermediate position or after an emergency stop.
- Machine-friendly inching mode
- Oscillating or reverse rotation direction without additional hardware.
- Two-channel STO safety function (safe torque off) (SS1 (safe stop 1) also supported)
- Motor temperature monitoring for motors with built-in PTC temperature sensor

## 9.2 Logic application version

The current application version is v1. The application software version is displayed in “MY MENU”.

## 9.3 Operating modes

The Taktomat Indexing Controller has the following two operating modes depending on the “Operating mode” signal:

- Automatic mode
- Manual mode

**WARNING**

**Risk of collision if the “Motor rotating” output signal (O1.2) is not checked.**
**Not checking “Motor rotating” (O1.2) may lead to serious personal injury or property damage.**

- Do not start external processing when output signal “Motor rotating” (O1.2) is set, O1.2=1
- Reset started movements safely

### 9.3.1 Manual mode

In manual mode, the rotary indexing table rotates for as long as the "Start" signal is active (I1.11=1). The movement is stopped if the "Start" signal is not active (I1.11=0) or if a signal is sent from the position sensor. The movement can be started and stopped at any point.
The rotary indexing table is started outside the resting phase using the "Acceleration ramp time" and the rotary indexing table is delayed outside the resting phase using the "Deceleration ramp time".

**WARNING**

DANGER IF PARAMETERS SET INCORRECTLY.

Outside the cam area, the ramp "Acceleration ramp time" is used to accelerate and the ramp "Acceleration ramp time" to decelerate. The superimposed acceleration and delay of the drive and cam rollers can lead to excessive inertia, which can cause mechanical damage to the system.

**NOTE**

CYCLE TIME MONITORING

The Taktomat Indexing Controller includes a function for cycle time monitoring. When started, the function monitors the time in which a cycle must be completed. If the resting position is not detected within 30 seconds, the movement is stopped immediately and the error "EPF1" (external error LI/bit) is generated.

### 9.3.2 Automatic mode

The following functions are available in automatic mode:

- Normal mode
  The rotary table always rotates in one direction in normal mode.
- Oscillating mode
  In oscillating mode, the rotary table always rotates back and forth between two positions.

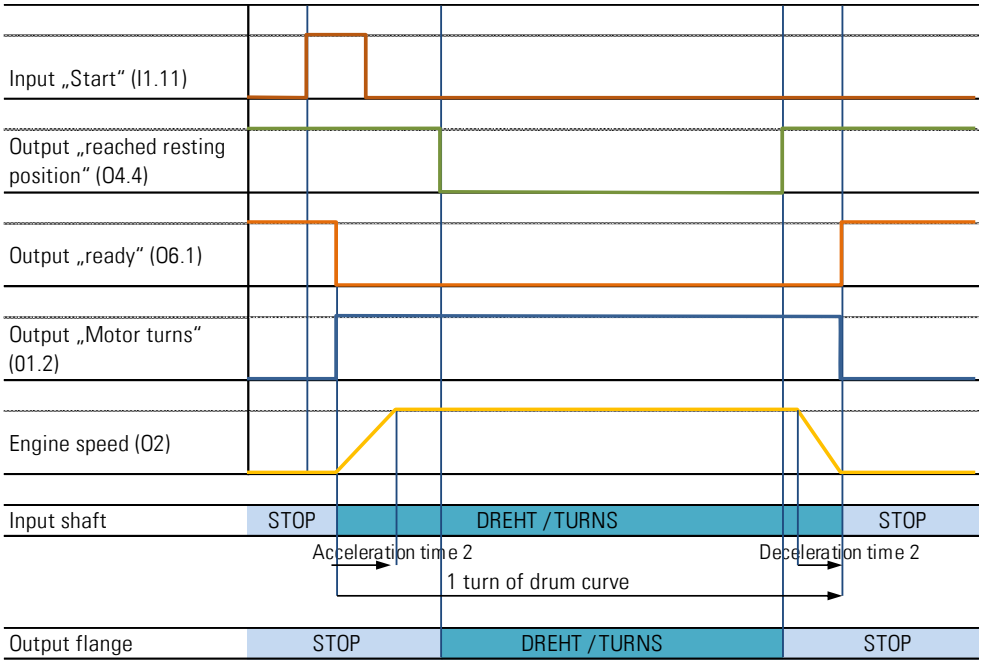
In "Auto" mode ("Operating mode" signal = 0 (I1.14=0)), a complete cycle of the rotary indexing table is executed. The cycle is triggered by the rising flank for the "Start" signal (I1.11=0→1). As soon as the signal is sent from the position sensor, the movement is stopped. During the movement, stopping is only possible by resetting the "Stop" signal (I1.13=0) or by breaching the safety equipment with "Deceleration ramp time".

**⚠WARNING**

**INCORRECT PARAMETER SETTING**

- If the ramp "Deceleration ramp time" setting is too low, the superimposed acceleration and delay of the drive and cam rollers can lead to excessive inertia. This can cause mechanical damage to the rotary indexing table and the system. Select this setting according to the mechanical loads.

Automatic mode, full cycle




t1 – Time to leave the position cam, t2 – Time from detection of the position cam + deceleration 2 ramp time

## 9.4 System behaviour on stop

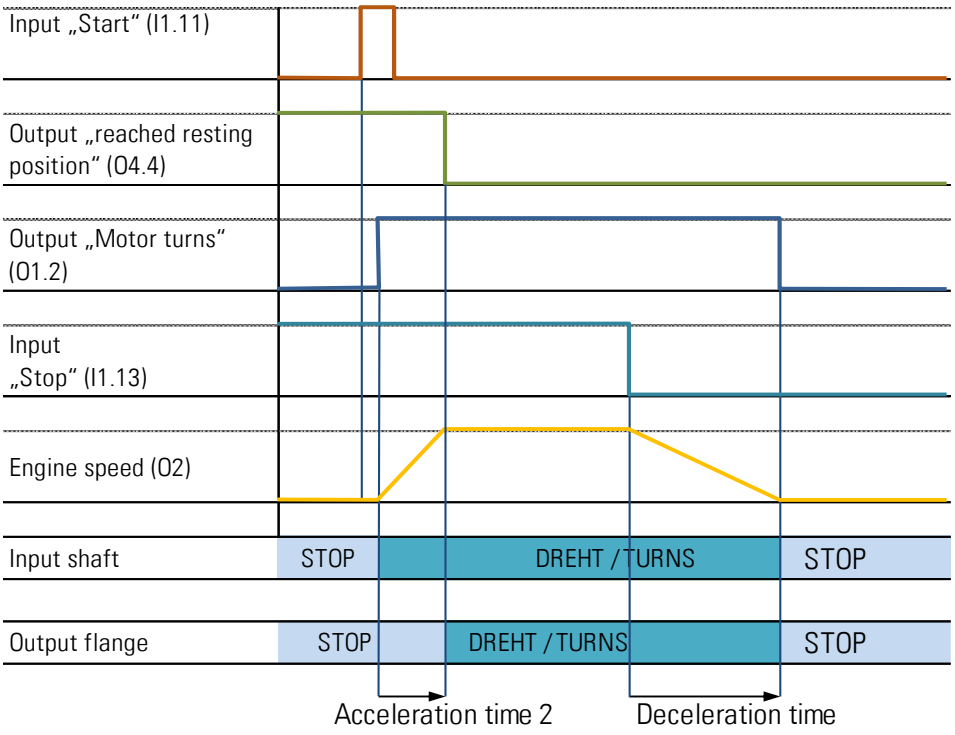
When an error is detected or the "Stop" signal (I1.13=1→0) is reset, the rotary indexing table stops the movement using the braking ramp "Deceleration ramp time".

**⚠WARNING**

**INCORRECT PARAMETER SETTING**

If the ramp "Deceleration ramp time" setting is too low, the superimposed acceleration and delay of the drive and cam rollers can lead to excessive inertia. This can cause mechanical damage to the rotary indexing table and the system. Select this setting according to the mechanical loads.

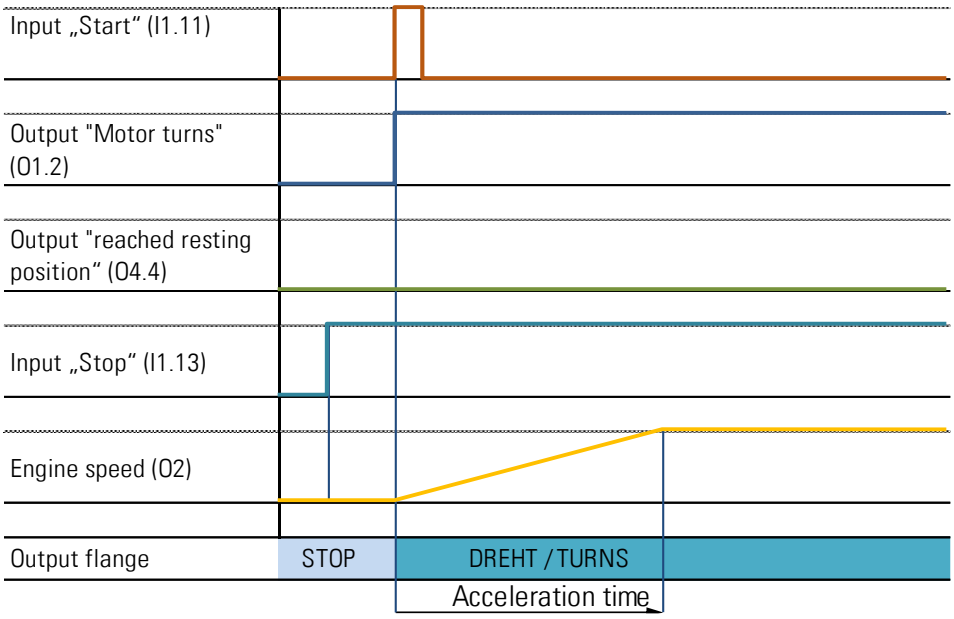
**Automatic mode, stop during rotation**



## 9.5 System behaviour on starting from an intermediate position

In automatic mode, the rotary indexing table starts from an intermediate position using the ramp “Acceleration ramp time”.

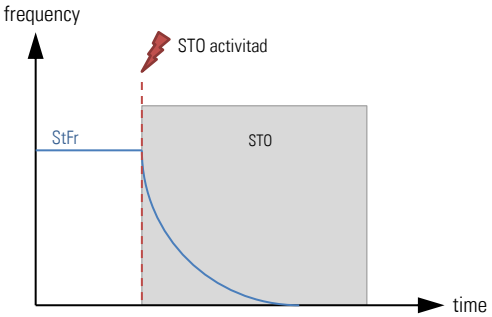
Automatic mode, start from an intermediate position




## 9.6 Behaviour of the safety function STO and SS1

### 9.6.1 STO

This function sets the motor safely to a torque-free state and/or prevents the motor from starting unexpectedly.




When using the STO and DI3 inputs, the STO safety function ensures that the safety function level (SF) for the performance level “PL e” in accordance with ISO13849-1 is reached.

Behaviour of the STO function

| Error caused by | Stopped | Moving |
|---|---|---|
| STO | SAFF | SAFF |
| DI3 | SAFF | SAFF |
| STO+DI3 | STO | STO |

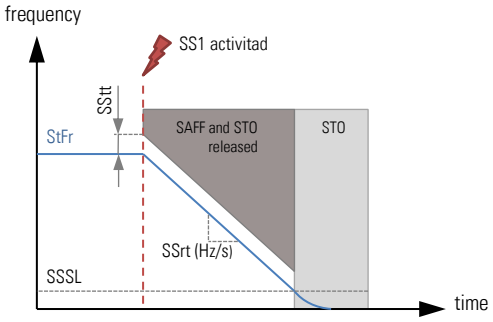
Resetting the errors:

SAFF: To reset the error, the error signal must be sent again and the frequency converter restarted. The error cannot be reset using the "Reset" signal.

STO: If the error occurred while stopped, the error signal simply has to be sent again. If the error occurred during the movement, the signal must also be sent again and the "Error reset" bit must also be set (Bit7 (0x80) on the CMD Word). If the TIC is controlled using I/O, the stop signal must be reset (DI4).

### 9.6.2 SS1

The safety function "Safe stop 1" (SS1) monitors the stop in accordance with a specific deceleration ramp and switches the torque off safely after coming to a stop.




When using the STO and DI3 inputs with the Preventa module), the SS1 safety function ensures that the safety function level (SF) for the performance level "PL e" in accordance with ISO13849-1 is reached, or in the case of the inputs DI3 and DI4, performance level "PL d".

Parameters to be set (using SoMove):

| | |
|---|---|
| SSrt [SS1 ramp value]] | Definition of the value for the deceleration ramp SSrt x SSru |
| SSrU [SS1 ramp unit | Definition of the unit for the ramp in 1 Hz/s, 10 Hz/s and 100 Hz/s |
| SStt [SS1 switch-off value] | This parameter defines the tolerance range around the deceleration ramp within which the frequency can vary. |
| SSSL [SS1 stop value] | This parameter defines the frequency at which the frequency converter switches to the status STO at the end of ramp SS1. |

Parameter example SS1:
Goal: SS1 stopping time 300 ms from 50 Hz to 0 Hz

| Code | Description | Unit |
|---|---|---|
| FrS | Nominal motor frequency | 50 Hz |
| nSP | Nominal motor speed | 1,350 rpm |
| ppn | Number of motor pole pairs | 2 |
| Max. Freq HSP | Maximum motor frequency in normal operation | 50 Hz |
| SS1 deceleration ramp | Deceleration ramp to be used when SS1 is triggered | 300 ms |

SSrt=50 Hz/0,3 s=166,7 Hz/s
Wenn SSrU = 1 Hz/s → SSrt = 166,7 Hz/s (Deceleration ramp 166,7 Hz/s with accuracy 1 Hz))

$$SSSL = Fslip = FrS - \frac{Nsp \times ppn}{60} = 50 - \frac{1350 \times 2}{60} = 5 \text{ Hz}$$

Behaviour of function SS1 (with STO, DI3 and DI4)

| Error caused by | Stopped | Moving |
|---|---|---|
| STO | STO | STO |
| STO+DI3 | SAFF | SAFF |
| STO+DI4 | SAFF | SAFF |
| STO+DI3+DI4 | STO | SAFF |
| DI3 | SAFF | SAFF |
| DI3+DI4 | STO | SAFF |
| DI4 | SAFF | SAFF |

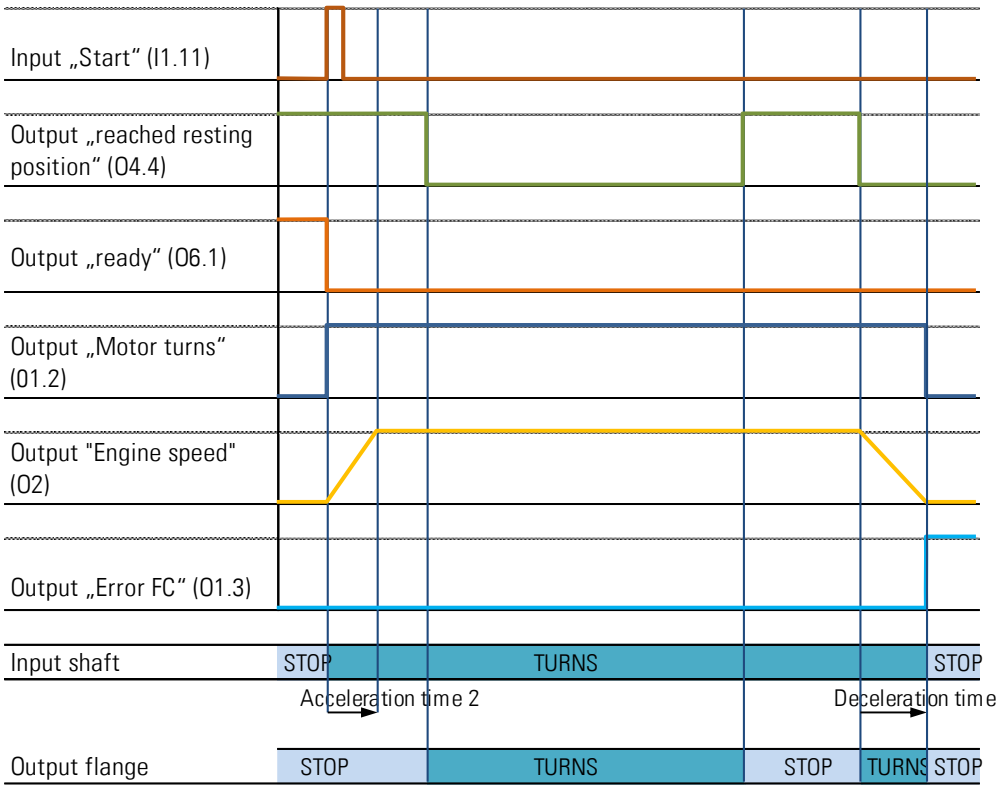
Resetting the errors:

SAFF: To reset the error, the error signal must be sent again and the frequency converter restarted. The error cannot be reset using the "Reset" signal.

STO: If the error occurred while stopped, the error signal simply has to be sent again. If the error occurred during the movement, the signal must also be sent again and the "Error reset" bit must also be set (Bit7 (0x80) on the CMD Word).

## 9.7 “Detect positioncam overrun” function

The Taktomat Indexing Controller includes an integrated function that detects when the position cam is overrun. If the motor is not stopped within the resting, i.e. the position cam is overrun, the movement is stopped immediately and the error “EPF1” (external error LI/bit) is generated and the output signal “FC error” (O1.3) is set to 1.



## 9.8 “Cycle time monitoring” function

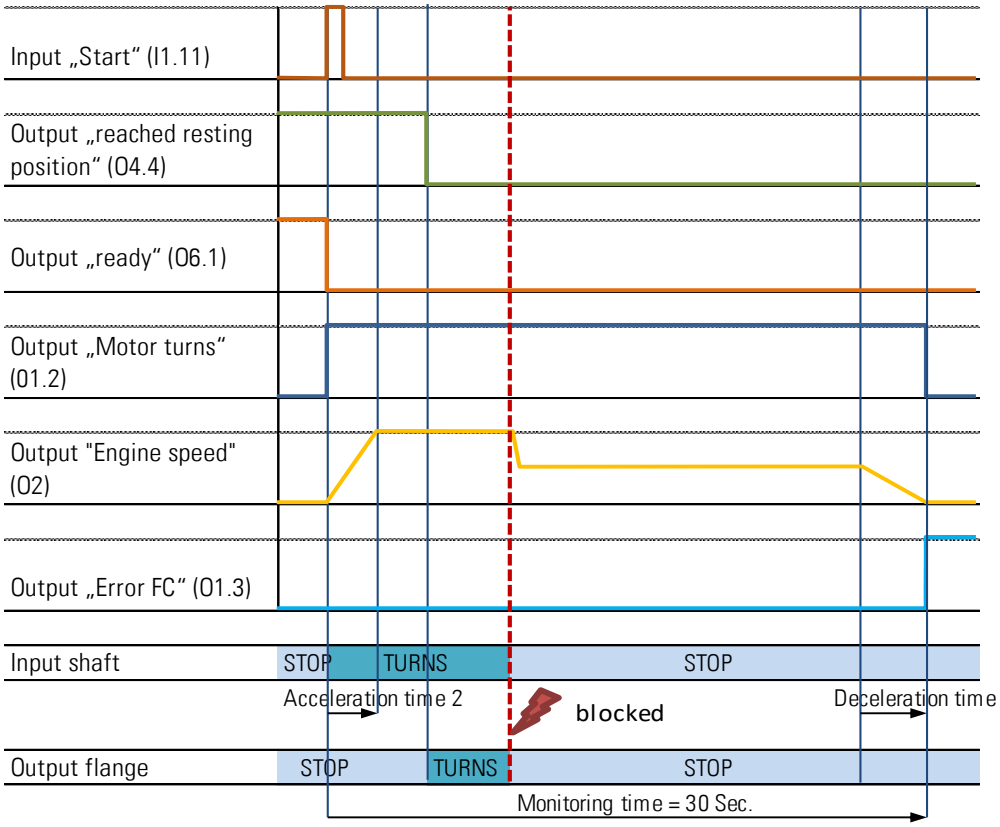
The Taktomat Indexing Controller includes a function for cycle time monitoring. When started, the function monitors the time in which a cycle must be completed. If the resting position is not detected within 30 seconds, the movement is stopped immediately, the error “EPF1” (external error LI/bit) is generated and the output signal “FC error” (O1.3) is set to 1.
The time of 30 sec is permanently programmed and cannot be changed. This function provides only a basic safeguard against mechanical blocking of the rotary indexing table or if the sensor is defective or a sensor cable is broken.

**NOTE**

**CYCLE TIME MONITORING**

We recommend programming cycle time monitoring in the PLC in use, in order to avoid damage to the system due to mechanical blocking or continued rotation of the rotary indexing table.

Please note that this function is active in both operating modes, i.e. also in manual mode.



# 10 Notes on commissioning and troubleshooting

This section provides instructions designed to assist the user during commissioning the Taktomat Indexing Controller and during troubleshooting.

**⚠CAUTION**

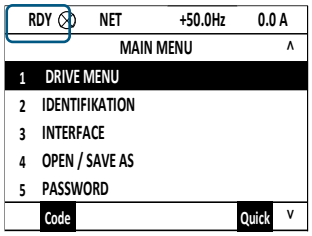
OPERATIONAL HAZARD

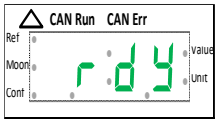
- Ensure that all installations have been completely and properly connected.
- If mechanical and electrical system components are fitted with transportation and locking mechanisms, remove them.
- Remove tools, measuring equipment and any other parts from the system.

Failure to follow these instructions may result in personal injury or damage to Property.

## 10.1 Status of the frequency converter

During commissioning or troubleshooting, always check the status of the frequency converter first. The frequency converter is ready if the status code "rdY" (Ready) is displayed in the top left corner of the graphic display terminal or on the 4-digit display on the converter.



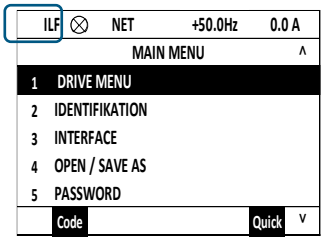




Note: The current status of the converter can always be found in the top left corner of the graphic display terminal or on the 4-digit display on the converter.
Overview of converter status codes:

| | |
|---|---|
| ACC | Acceleration ramp time |
| CLI | Internal current limit |
| CTL | Controlled stop on input phase loss |
| DCB | DC injection braking in progress |
| DEC | Deceleration ramp time |
| FLU | Motor fluxing configure in progress |
| FST | Fast stop |
| NLP | No line voltage present on L1, L2, L3 input terminals |
| NST | Freewheel stop |
| OBR | Deceleration ramp time automatically adapted |
| PRA | Power removal function active (converter locked) |
| RDY | Frequency converter ready |
| RUN | Frequency converter running |
| SOC | Motor contactor active |
| TUN | Auto-tuning in progress |
| USA | Undervoltage alarm |

## 10.2 Frequency converter errors

If an error in the frequency converter occurs, the code for the error is displayed in the top left corner of the graphic display, if used, or otherwise on the TIC's 4-digit display:





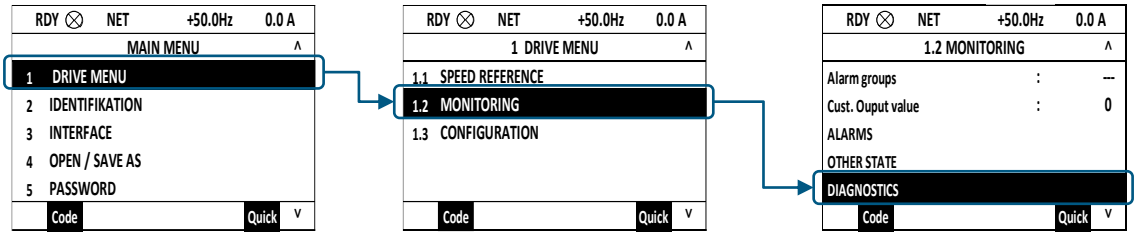
For the full list of error codes, consult the Altivar 320 programming Instructions on the Schneider Electric website.

Excerpt from error code list.

| | |
|---|---|
| OCF | Overcurrent. |
| ILF | Internal communication. Error in communication between option card and converter |
| SOF | Overspeed. Instability or too much inertia |
| OBF | Over braking. Braking too sudden or driving load |
| OLF | Motor overload. Triggered by motor pulling too high a current |
| OCF | Overcurrent. |
| CFF | Incorrect configuration |
| PHF | Input phase error |
| OPF | Loss 3 motor phases |
| USF | Undervoltage |
| CNF | Communication interruption on communications card |
| SAFF | Safety error |

Detailed information on the current error and saved errors are displayed in the frequency converter's "DIAGNOSTICS" menu. This menu can be viewed from an access level of "Standard", which can be configured under "MAIN MENU"→"3 INTERFACE"→"3.1 ACCESS LEVEL".

| | |
|---|---|
| EPF1 | External error |




**NOTE**

**ERRORS REQUIRING A RESTART**

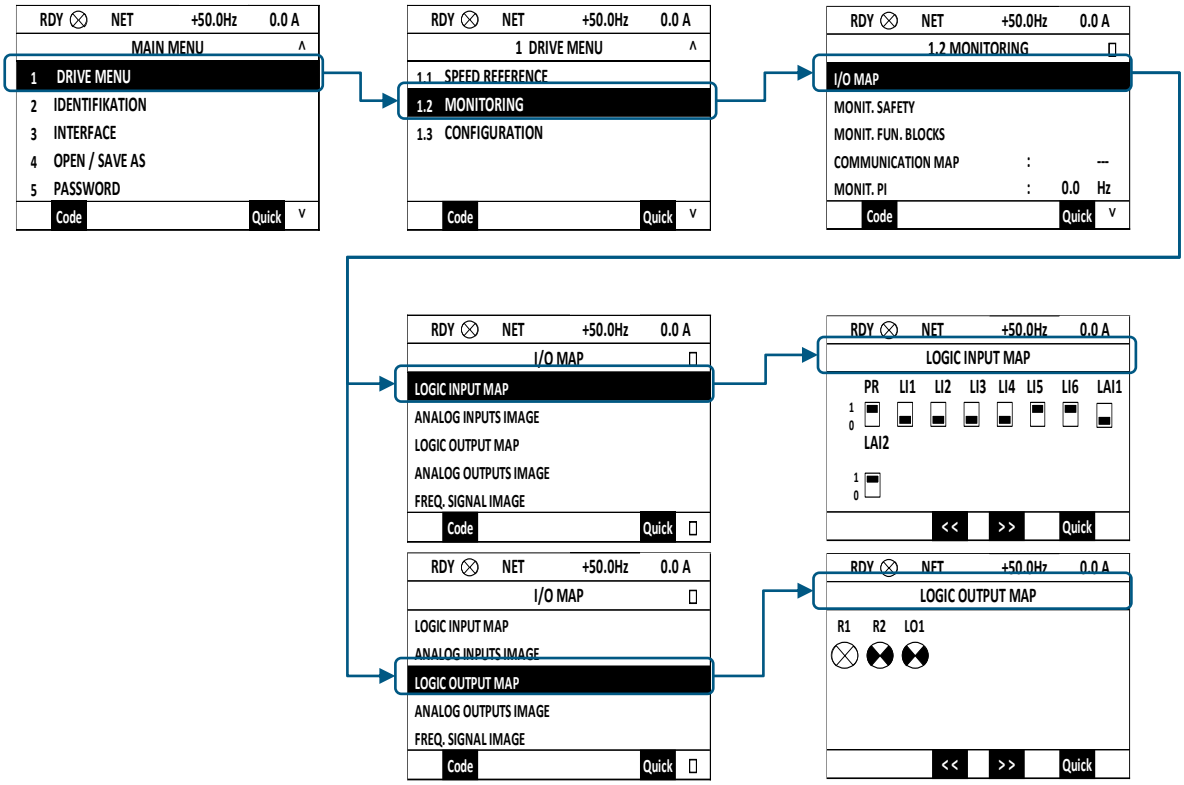
Some errors do not allow automatic resetting. They can only be resolved if the equipment is switched off and back on again. For more information, consult the manufacturer's "Programming Instructions" for the ATV320, section "Diagnostics and troubleshooting".

## 10.3 Input and output status

The frequency converter supports the display of the current status of all inputs and outputs. During commissioning or troubleshooting, this allows you to quickly check which signals are set by the higher-level control system and which signals are sent to the higher-level control system.

The current status of the frequency converter's inputs and outputs are displayed in the menu "1 CONVERTER MENU"→"1.2 MONITORING"→"I/O MAP".

How to navigate to the menus "LOGIC INPUT MAP" and "LOGIC OUTPUT MAP".




## 10.4 Wiring

Based on the status of the frequency converter's input and output signals and the higher-level control system's input and output signals, it is easy to determine whether there is a wiring error.

The position sensor must be connected directly to the converter, as equipment connected in between may disrupt or delay the signal, which can result in the rotary table stopping outside the resting phase.

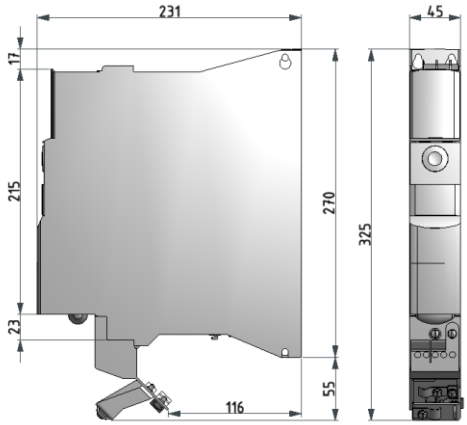
Make sure that the signal cables have been wired in accordance with EMC standards and are connected. The incorrect layout and/or wiring of control cables can result in voltages being induced , which can lead to unintended operation of the rotary table by the Taktomat Indexing Controller.

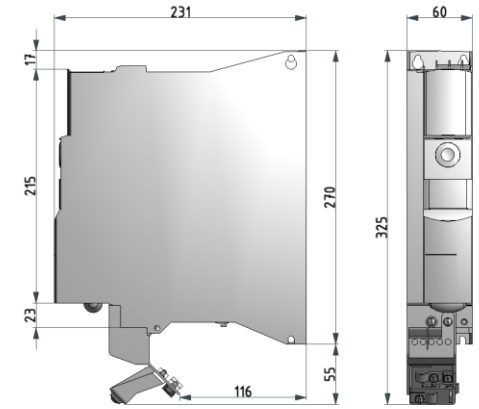
# 11 Integration of the Taktomat Indexing Controller in a PLC

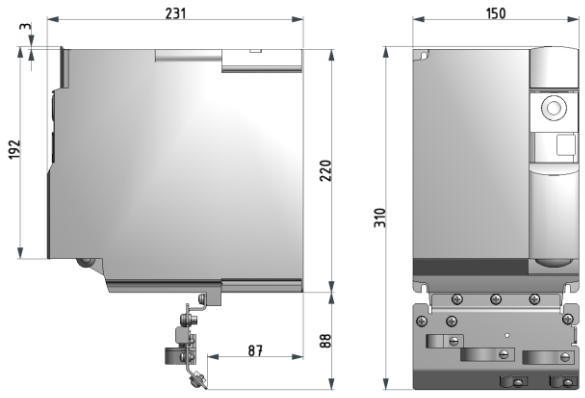
You can find more information in the manual "Integration of TIC in PLC".
which describes the integration of a Siemens S1200 PLC and Beckhoff CX9020 PLC via ProfiNet and EtherCAT.
Project examples for the integration of a Siemens S1200 PLC and Beckhoff CX9020 PLC are also available on request.

# 12 Technical data

## 12.1 Dimensions of the Taktomat Indexing Controller

| Size 1B: ATV320U02M2B...ATV320U07M2B, ATV320U04N4B...ATV320U15N4B | | | |
|---|---|---|---|
| No additional card | With additional card | Catalogue number | Weight in kg |
|  | | ATV320U02M2B<br>ATV320U04M2B…07M2B<br>ATV320U04N4B<br>ATV320U06N4B, U07N4B<br>ATV320U11N4B, U15N4B | 1.59<br>1.65<br>1.62<br>1.72<br>1.70 |

| Size 2B: ATV320U11M2B...ATV320U22M2B, ATV320U22N4B...ATV320U40N4B | | | |
|---|---|---|---|
| No additional card | With additional card | Catalogue number | Weight in kg |
|  | | ATV320U11M2B,<br>U15M2B<br>ATV320U22M2B<br>ATV320U22N4B<br>ATV320U30N4B<br>ATV320U40N4B | 1.95<br>2.07<br>2.32<br>2.12<br>2.17 |

| Size 4B: ATV320U55N4B and ATV320U75N4B | | | |
|---|---|---|---|
| No additional card | With additional card | Catalogue number | Weight in kg |
|  | | ATV320U55N4B<br>ATV320U75N4B | 4.41<br>4.41 |

# 13 Transport

Safety instructions

**NOTE**

**Risk of damage due to improper transport.**
**Improper transport can result in considerable damage to property.**

- When unloading the machine, both during delivery and in-house transport, handle it carefully and note the symbols on the packaging.

## 13.1 Transport inspection

Check the delivery immediately on receipt for completeness and transport damage.
In the event of visible external transport damage, proceed as follows:

- Do not accept delivery or accept only with qualifications.
- Note the extent of damage on the transport documents or on the delivery note accompanying the transport.
- Report the damage immediately to the manufacturer of the machine.

**⚠HAZARD**

**Risk of fatal injury from suspended loads and falling parts.**
**Parts may fall during transport and cause serious injury or even death.**

- Do not stand under suspended loads.
- Remove people from the hazard area.
- Use lifting equipment with sufficient load-bearing capacity.
- Use forklifts or pallet trucks with sufficient load-bearing capacity and sufficient fork length.
- Set the load down before leaving the workplace.

## 13.2 Packaging, handling, unpacking

The Taktomat Indexing Controller TIC is packed in the manufacturer's original packaging for transport.

**NOTE**

**Potential damage to the Taktomat Indexing Controller due to improper transport.**
**Improper transport can result in considerable damage to property.**

- Protect the **Taktomat Indexing Controller** from moisture during transport.
- Remove the packaging from the **Taktomat Indexing Controller** only when ready to install it.
- Remove the packaging carefully and dispose of it properly.

### 13.3 Place of installation, location

Store and install the Taktomat Indexing Controller under the following conditions:

- Do not store outdoors.
- Operate the Taktomat Indexing Controller in a dry place at a temperature between -10°C and 50°C.
- Do not expose to aggressive media.
- Protect against direct sunlight.

## 14 Mechanical installation

For guidelines on installing and cooling the Taktomat Indexing Controller, consult the documentation for the frequency converter. The air direction must be as specified. The equipment must therefore only be operated in the specified position (e.g. vertically). The Taktomat Indexing Controller must be protected against excessive stress. Do not bend any components and do not change any insulation clearances. For electrostatic reasons, do not touch any electronic components or contacts.

## 15 Electrical installation

### 15.1 Safety instructions

**Staff: Qualified staff**

**HAZARD**

**Risk of fatal injury from electrical current.**
**Contact with live parts poses an immediate risk of fatal injury by electrocution.**
Damage to the insulation or individual components can be life-threatening.

- Have all work on the electrical system carried out exclusively by qualified electricians.
- In the event of damage to the insulation, switch off the power supply immediately and have it repaired.
- Before starting work on live components of electrical systems and equipment, ensure that no voltage is present, secure against being switched on and check to ensure that there is no power to the system.

**WARNING**

UNINTENDED EQUIPMENT OPERATION
This can cause death, serious injury or material damage.
Voltages can be induced in the Taktomat Indexing Controller's control cabling by electrical and electronic components, which may lead to unintended operation of the system.

## 15.2 Electrical connection

Electrical regulations must be observed during installation. For stop or emergency stop commands, we recommend not using a motor contactor to disconnect the converter from the 400 V mains. This requires the bus connection to be re-established, which causes delays. It also produces an increased load on the intermediate circuit capacitor, which can lead to premature wear. For further information, consult these operating instructions and the manufacturer's operating instructions. In particular, the instructions for EMC-compliant installation, e.g. shielding, filter layout and cable wiring, must be followed. This also applies to equipment with the CE mark. Compliance with EMC limits is the responsibility of the manufacturer of the machine.

**⚠CAUTION**

**INCORRECT SUPPLY VOLTAGE**

Failure to follow this instruction can result in material damage.
Before switching on or reconfiguring the frequency converter, ensure that the line voltage for the frequency converter and the supply voltage are **compatible**. Otherwise, the frequency converter may be damaged.

For some systems, it may be necessary to use additional monitoring and protective equipment in compliance with the applicable safety and accident prevention regulations. The frequency converter's hardware should not be modified in any way not intended by the manufacturer of the electrical components of the Taktomat Indexing Controller.

**⚠CAUTION**

**DAMAGE TO ELECTRICAL OR ELECTRONIC COMPONENTS.**

Failure to follow this instruction can result in material damage.
Note the connection voltage for the three-phase motors. The motors must be connected in accordance with the motor output voltage of the frequency converter in the corresponding motor coil circuit.

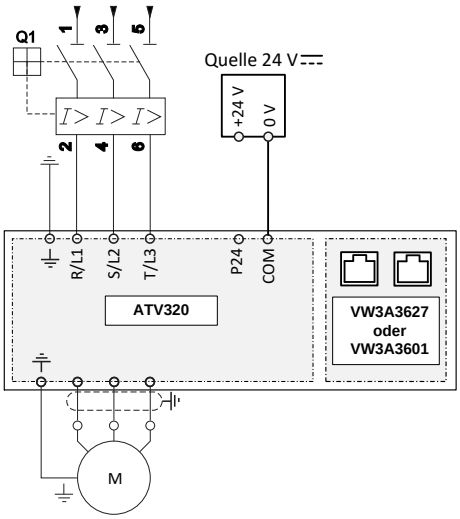
24 V supply

**⚠WARNING**

**UNINTENDED OPERATION OF THE EQUIPMENT FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN DEATH, SERIOUS INJURY OR MATERIAL DAMAGE**

If the converter is set to "Sink Int" or "Sink Ext", the 0 V terminal must not be connected to earth or protective earth. You must also ensure that inadvertent earthing of the digital inputs (for example due to damaged signal cables) is not possible. All applicable standards for safe earthing, such as NFPA 79 and EN60204 must be observed.

When controlled using PLC outputs with PNP transistors, the switch must be set to "Source". For information on the "Sink Ext" variant, please refer to the ATV320 installation manual.

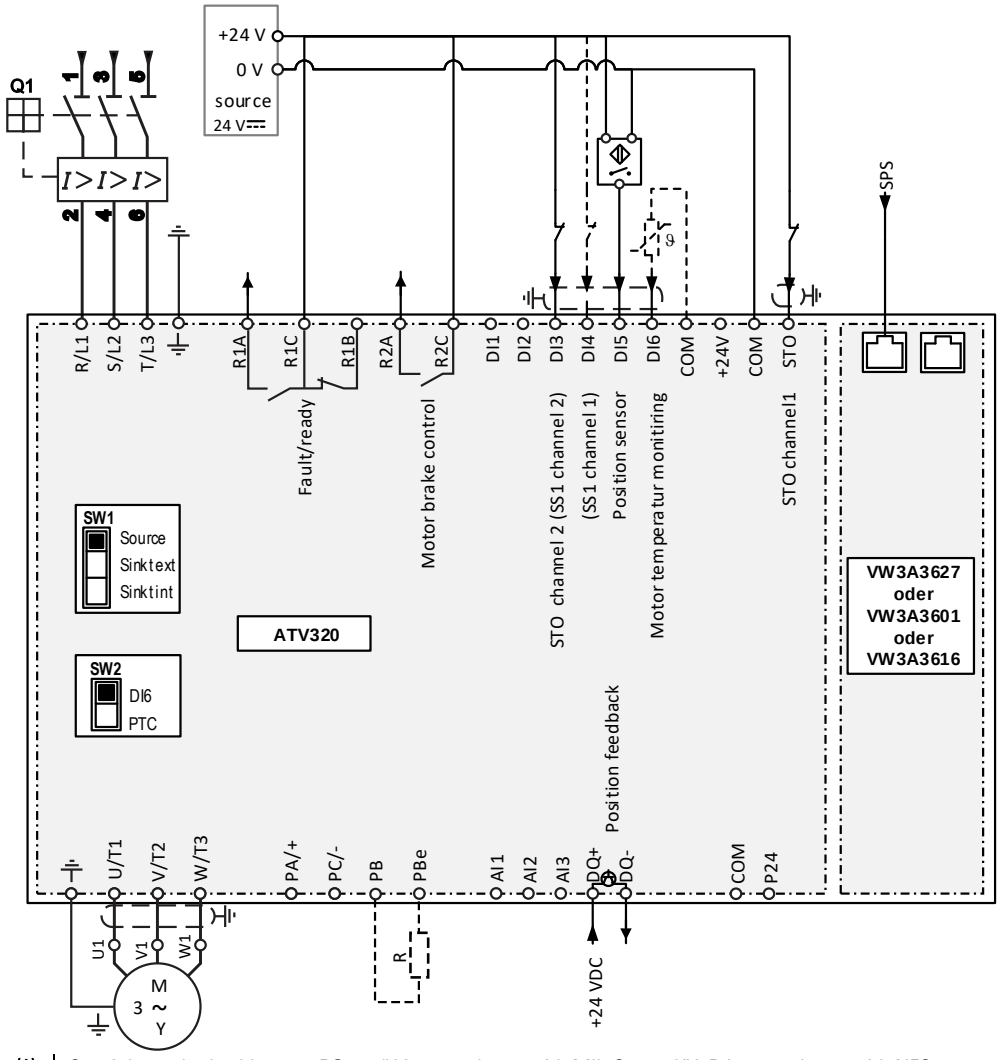



When using an external power source to control the TIC, which also includes use of a PLC, one of the COM ports on the TIC must be connected to 0 V on the external source/PLC.

## 15.3 Circuit diagram recommendations

### 15.3.1 Circuit diagram recommendation for TIC

STO, performance level "e" in accordance with ISO 13849-1, "SIL 3" in accordance with IEC 61508




(1) Coaxial standard cable, type RG174/U in accordance with MIL-C17 or KX3B in accordance with NFC93-550, external diameter 2.54 mm, length max 15 m.
The cable shield must be connected to earth.
For a more detailed description of the "STO" function, please see the original documentation for the Altivar 320 frequency converter.

**CAUTION**

**CURRENT LOAD OUTPUT RELAY R1A/R1B/R1C AND R2A/R2B/R2C**

Failure to follow this instruction can result in material damage.
Observe the maximum relay power rating.
Maximum switching capacity:
With ohm load: 5 A at 250 V AC or 30 V DC
With inductive load (cos ϕ = 0.4 L/R = 7 ms): 2 A at 250 V AC or 30 V DC

**NOTE**

**INPUT STO "Channel 1"and DI3 "STO channel 2"**

- The shielding of the cables for the STO and DI3 inputs must always be earthed.

# 16 Errors

## 16.1 Safety instructions

**HAZARD**

**Risk of fatal injury from electrical current.**
**Contact with live parts poses an immediate risk of fatal injury by electrocution.**
**Damage to the insulation or individual components can be life-threatening.**

- Have all work on the electrical system carried out exclusively by qualified electricians.
- In the event of damage to the insulation, switch off the power supply immediately and have it repaired.
- Before starting work on live components of electrical systems and equipment, ensure that no voltage is present, secure against being switched on and check to ensure that there is no power to the system.

**WARNING**

**Risk of injury due to incorrect troubleshooting**

**Incorrect troubleshooting may lead to serious personal injury or property damage.**

- Before starting work, ensure that there is sufficient space for installation.
- Ensure that the assembly area is clean and tidy. Loose components lying on or around each other and tools are accident sources.

Cause of error – remedy

| Error | Remedy |
|---|---|
| The frequency converter displays “NLP” | • No line voltage present on L1, L2, L3 input terminals<br>• The line voltage is on input terminals L1, L2 and L3 and “Not measurable” is displayed in “1. Frequency converter menu”→“1.2 Monitoring”→“Mains voltage”. If so, the frequency converter may be defective. Contact **Taktomat GmbH**. |
| Rotary indexing table overruns position (“EPFI1”) | • When the frequency converter displays the status code “OCF”, the load is often too high (add a dynamic braking option).<br>• Parameter “K speed loop filter” set to 0. Modify this parameter. See section “Frequency converter menu “MY MENU””.<br>• The INI signal is delayed by electronic components connected in between<br>• The time in parameter “Deceleration” or “Deceleration 2” is set too high.<br>• The sensor signal at terminal DI5 is not present, and the ramp “Deceleration” is therefore active.<br>• Reset the error by setting the reset bit afterwards. |
| The rotary indexing table stops the movement sporadically | • Signal level at terminal STO and/or at terminal DI3 (“STO channel 2”) stops temporarily. Check signal using oscilloscope. |

# 17 Disposal

At the end of its service life, the Taktomat Indexing Controller must be disassembled and sent for environmentally sound disposal.

**HAZARD**

**Risk of fatal injury from electrical current.**
**Contact with live parts poses an immediate risk of fatal injury by electrocution.**
Damage to the insulation or individual components can be life-threatening.

- Have all work on the electrical system carried out exclusively by qualified electricians.
- In the event of damage to the insulation, switch off the power supply immediately and have it repaired.
- Before starting work on live components of electrical systems and equipment, ensure that no voltage is present, secure against being switched on and check to ensure that there is no power to the system.

Before beginning disassembly:

- Disconnect the entire power supply from the machine, secure it against being switched back on and check to ensure that there is no voltage.
- Wait 15 minutes until all live components are fully discharged.
- Dispose of assemblies and components in compliance with applicable local environmental regulations.

**NOTE**

**Risk of environmental damage due to improper disposal.**
**Improper disposal of components can cause significant environmental damage.**

⇨ Dispose of components in accordance with local regulations

# 18 Spare and wear parts

Spare parts must meet the technical requirements specified by the manufacturer. This is always guaranteed with original spare parts.

## 18.1 Spare parts for type TIC

| Component | Type | Item number |
|---|---|---|
| Frequency converter | ATV320U04N4B | 251968 |
| Frequency converter | ATV320U06N4B | 252050 |
| Frequency converter | ATV320U07N4B | 251969 |
| Frequency converter | ATV320U11N4B | 252133 |
| Frequency converter | ATV320U15N4B | 251970 |
| Frequency converter | ATV320U22N4B | 251971 |
| Frequency converter | ATV320U30N4B | 251972 |
| Frequency converter | ATV320U40N4B | 251973 |
| Communications module ProfiNet | VW3A3627 | 251981 |
| Communications module EtherCAT | VW3A3601 | 251982 |
| Communications module Ethernet IP | VW3A3616 | 251983 |
| Graphic display terminal | VW3A1101 | 250401 |
| RJ45 adapter for display | VW3A1105 | 251984 |
| USB/RJ45 cable – for connecting a PC | TCSMCNAM3M002P | 321787 |
| Safety module | XPS ATE3710 | 320860 |
| Assembly kit for decentralised installation | VW3A1102 | 252136 |
| Door for assembly kit | VW3A1103 | 252137 |

# Appendix A: Error code

| Dec. | Hex | Code on display | Name | Note |
|---|---|---|---|---|
| 0 | | (nOF) | [No fault] | • No fault |
| 2 | | (EEF1) | [Control Eeprom] | • Internal memory error, control block |
| 3 | | (CFF) | [Incorrect config.] (CFF) | • Current configuration is inconsistent<br>• Option card has been removed or exchanged |
| 4 | | (CFI) | [Invalid config.] (CFI) | • Invalid configuration. The loaded configuration is inconsistent |
| 5 | | (SLF1) | [Modbus com.] (SLF1) | • Communication interruption of the Modbus |
| 6 | | (ILF) | [int. com.link] | • Interruption of communication between option card and frequency converter |
| 7 | | (CnF) | [Com. network] | • Communication interruption on the commnunication card |
| 8 | | (EPF1) | [External flt-LI/Bit] | • Run over cam<br>• Cycle time monitoring (T≥30s) |
| 9 | | (OCF) | [Overcurrent] | • Parameters of [SETTINGS](SEt-) and [MOTOR CONTROL] (drC-) are not correct<br>• Mass inertia or load too high |
| 10 | | (CrF) | [Precharge] | • Error of lead relay control or load resistor damaged |
| 11 | | (SPF) | [Speed fdback loss] | |
| 12 | | (AnF) | [Load slipping] | • Difference between output frequency and speed feedback is not correct |
| 16 | | (OHF) | [Drive overheat] | • Temperature of the frequency converter too high |
| 17 | | (OLF) | [Motor overload] | • Motor current too high |
| 18 | | (ObF) | [Overbraking] | • Too much braking or driving load |
| 19 | | (OSF) | [Mains overvoltage] | • Mains voltage too high<br>• Fault in main supply |
| 20 | | (OPF1) | [1 output phase loss] | • Loss of one phase at inverter output |
| 21 | | (PHF) | [Input phase loss] (PHF) | • Faulty inverter supply or molten fuse<br>• Failure of one phase<br>• Using a three-phase ATV320 in a single-phase supply network<br>• Load with imbalance<br>This protective function only works under load. |
| 22 | | (USF) | [Undervoltage] | • Mains voltage too low<br>• Temporary voltage drop |
| 23 | | (SCF1) | [Motor short circuit] | • Short ciruit or ground fault at the inverter ouput |
| 24 | | (SOF) | [Overspeed] | • Instability or excessive driving load |
| 25 | | (tnF) | [Auto-tuning] | • |

| | | | | |
|---|---|---|---|---|
| 26 | | (InF1) | [Rating error] | • The power card deviates from the stored power card. |
| 27 | | (InF2) | [PWR Calib.] | • The power card is not compatible with the control block. |
| 28 | | (InF3) | [Int.serial link] | • The power card is not compatible with the control block. |
| 29 | | (InF4) | [Int.Mfg area] | • Inconsistency of internal data |
| 30 | | (EEF2) | [Power Eeprom] | • Internal memory error, power card |
| 32 | | (SCF3) | [Ground short circuit] | • Significant earth leakage current at the drive output, if several motors are parallel connected. |
| 33 | | (OPF2) | [3out ph loss] | • Motor not connected or too low motor power<br>• Motor contactor opened<br>• Sudden instability of the motor current |
| 34 | | (COF) | [CAN com.] | • |
| 35 | | (bLF) | [Brake control] | • |
| 38 | | (EPF2) | [External fault com.] | • Disorder of communication network |
| 41 | | (brF) | [Brake feedback] | |
| 42 | | (SLF2) | [PC com.] | |
| 44 | | (SSF) | [Torque/current lim] | • Torque limiting (e.g. by mechanical blocking) |
| 45 | | (SLF3) | [HMI com.] | |
| 49 | | (PtFL) | [LI6=PTC probe] | • Opening or short circuit of the PTC sensor at Input LI6 |
| 50 | | (OtFL) | [PTC fault] | • Detection of overheating of PTC sensor at Input LI6 |
| 51 | | (InF9) | [Internal- I measure] | • Current measurement is not correct |
| 52 | | (InFA) | [Internal-mains circuit] | • Input stage is not working properly |
| 53 | | (InFb) | [Internal- th. sensor] | • Temperature sensor of the inverter works not properly |
| 54 | | (tJF) | [IGBT overheat] | • Overheating of the inverter |
| 55 | | (SCF4) | [IGBT short circuit] | • Error of power unit |
| 56 | | (SCF5) | [Motor short circuit] | • Short circuit at the inverter output |
| 58 | | (FCF1) | [Out. contact. stuck] | • Output contactor remains closed, though all conditions for opening are fullfiled. |
| 59 | | (FCF2) | [Out. contact. open.] | • Internal memory error, power card |
| 64 | | (LCF) | [input contactor] | • TIC is not switched on, no matter the [Time out Mains supply] (LCt) has expired. |
| 67 | | (HdF) | [IGBT desaturation] | • Short circuit or ground fault at the inverter output |
| 68 | | (InF6) | [Internal-option] | • The installed option in the drive can not be detected |
| 69 | | (InFE) | [internal- CPU] | • Error of internal microprocessor. |
| 71 | | (LFF3) | [AI3 4-20mA loss] | |

| | | | | |
|---|---|---|---|---|
| 73 | | (HCF) | [Cards pairing] | |
| 76 | | (dLF) | [Load fault] | |
| 77 | | (CFI2) | [Bad conf] | • Invalid configuration. The loaded configuration is inconsistent. |
| 99 | | (CSF) | [Ch.sw. fault] | |
| 100 | | (ULF) | [Pr.Underload.Flt] | |
| 101 | | (OLC) | [Proc.Overload Flt] | |
| 105 | | (ASF) | [Angle error] | |
| 107 | | (SAFF) | [Safety fault] | • Debounce time exceeded<br>• SS1 tripping threshold exceeded<br>• Wrong configuration<br>• SLS overspeed detected<br>• Failure of a safety channel |
| 108 | | (FbE) | [FB fault] | • Error of the function blocks |
| 109 | | (FbES) | [FB stop flt.] | • Function blocks has been stoped while engine was running. |

NOTES