Brochure | EN

i950 servo inverters

0.55 ... 110 kW

As easy as that.

Lenze

Highlights

- Shorter time-to-market
- Reduced engineering costs
- Increased productivity
- Ready for the smart factory

Powerful, compact, safe

With its innovative control procedures, the i950 sets new standards when it comes to precision and dynamics. Foresighted drive solutions consisting of geared motors and servo inverters provide time savings during engineering and flexibility in production.

Focus on investment security

- Use of the latest information environments
- Intelligent mutual communication
- Real-time data directly for cloud-based solutions
- Effective reduction in downtime, maintenance and product change costs

Powerful and compact, up to 110 kW

- Power spectrum of 0.55 kW – 110 kW
- Modular interfaces for fieldbus and feedback

Easy engineering

- PLCopen, IEC 61131-3, CiA 402 and MQTT
- Initial commissioning made easy via keypad app
- User-guided dialogues for commissioning
- Vertical shaft at the push of a button

Robust and safe servo technology

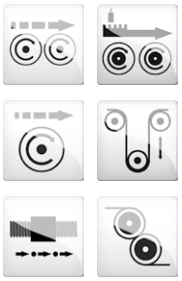
- Operation of synchronous servo motors and asynchronous servo motors
- Integrated safety functions
- One Cable Technology (OCT)
- DC-bus connection with supply and regenerative feedback mode possible

Working together with you, we develop the best solution and set your ideas in motion with enthusiasm – whether we are dealing with the optimisation of an existing machine or the development of a new one. We strive towards simplicity, through which we pursue perfection. This is anchored in our thinking, in our services, and in every single detail of our products.

As easy as that.

i950 – the multi-talent among servo inverters

With its three operation modes, the servo drive is built for all use cases:

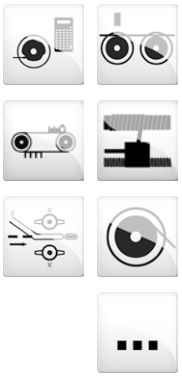


Parameter setting

With FAST, our modular software system, we simplify a great deal for you. The preconfigured and tested technology applications (TA) can be used immediately with the i950 and adapted to the respective machine task via parameterisation alone.

Servo actuator

Flexibility and freedom of integration are part of our philosophy. With the CiA 402, the i950 can easily be integrated and operated under a higher-level controller. This architecture is supported by a custom-developed CiA technology application.



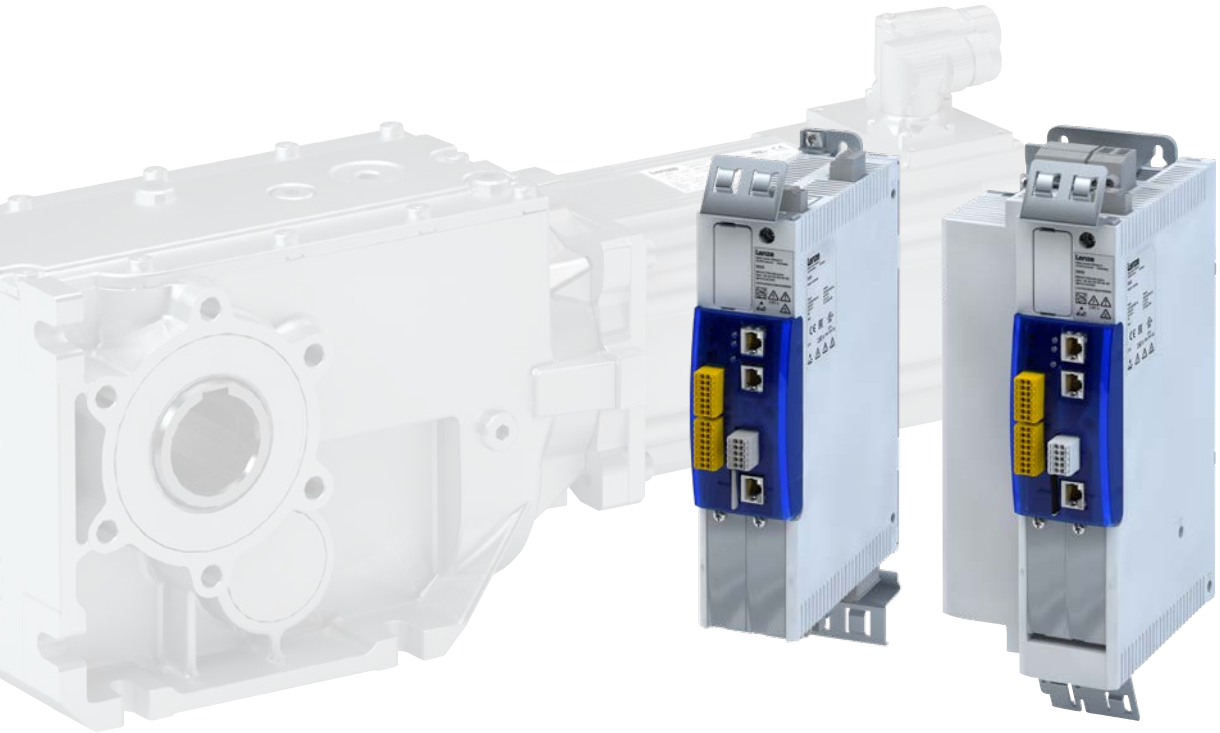
Programming

Custom applications require custom options. That is why the i950 can also be freely programmed. The basis for this is your software, realised according to IEC 61131-3. Naturally, previously developed software modules can be re-used. Furthermore, the FAST technology modules known to the control units can also be used here.

Control performance

Increasing the cycle rate of the machine by up to 20 % and simultaneously improving the quality of the machine process.

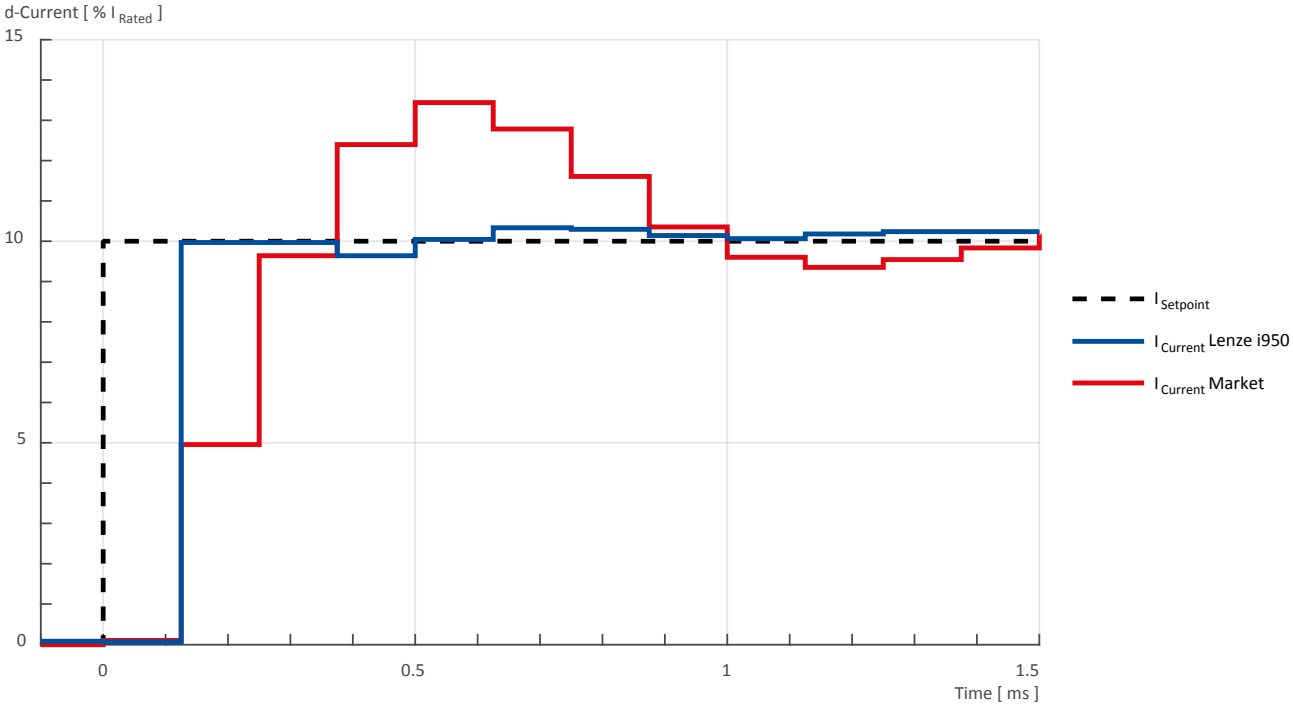
Our promise is that the best machines worldwide operate with Lenze. Due to this, we concern ourselves intensively with the machine processes and kinematics of modern machine tasks and help to optimise the management of the entire control line of the drive axis with the downstream mechanics. By doing so, we are setting new standards with the i950 where integrated control procedures are concerned.



Highlights

- Dead time minimisation when achieving setpoint values in the control line via the automatic comparison of controller parameters
- Automatic identification and compensation of following errors
- Extremely quick elimination of interferences within the control line
- Intelligent oscillation compensation procedures for the complete suppression of resonance points in the machine
- High dynamic performance thanks to patented current and position detection
- Improved position detection of resolver and encoder signals for smoother operation
- Highest dynamics via deadbeat control in one cycle (see figure)
- For the highest requirements: Elimination of a setpoint step-change in the current within half a PWM period
- Increased robustness and reduced following error in position control
- Current control: min. 62.5 µs
- Position control: min. 62.5 µs
- Speed control: min. 62.5 µs

Precise torque control



Easily parameterisable

i950 servo inverter: more than just a servo inverter

The i950 combines the latest servo technology with the requirements of future-proof installation automation. In addition to excellent servo characteristics, six technology applications (TA) have been implemented in the i950. The use of these software modules saves time and money in the implementation of machine tasks.

Technology application
Speed control

Technology application
Electronic gearbox

Technology application
Table positioning

Technology application
Synchronism with mark correction

Technology application
Winder with dancer control

Technology application
Winder with tension control

Simple engineering – thanks to **FAST** technology applications

Parameterising instead of programming

The following technology applications (TA) are adjustable via structured graphical interfaces:

Technology application Speed control

- For conveyor and travelling drives
- Operation at constant speed with high concentricity factor
- High control performance with speed stability
- Start-up and deceleration profiles
- Process and torque control
- Speed control with and without feedback

Technology application Electronic gearbox

- Precise speed- and position-synchronised drives in a network
- For the continuous transport of continuous materials such as paper, films, or textiles
- High concentricity of drive
- Synchronism in drive network
- Precise control technology via the master
- Speed trimming

Technology application Table positioning

- For discontinuously running conveying, lifting, and handling drives
- Dynamic positioning processes
- Profile generation and position at target
- Profile generator and motion control
- Management of profile data sets
- Sequence profile control
- Override function
- Residual path positioning on marks

Technology application
Synchronism with mark correction

- Precise speed- and position-synchronised drives in a network
- For the continuous transport of continuous and arch-shaped materials or piece goods
- Concentricity and synchronism in drive network
- Fiducial control
- Intermittent operation
- Phase trimming

Technology application
Winder with dancer control

- Speed-controlled drives for the storage or dispensing of continuous materials such as paper, film, or textiles
- DC-bus operation as electronic gearbox
- Large speed/torque setting range
- High concentricity factor
- Good disturbance behaviour
- Operation in field weakening range
- Process control/dancer control
- Reading in of sensors

Technology application
Winder with tension control

- Tension-controlled (open loop) drives for the storage or dispensing of continuous materials such as paper, film, or textiles
- DC-bus operation as electronic gearbox
- Large speed/torque setting range
- High concentricity factor
- Good disturbance behaviour
- Operation in field weakening range
- Process control/dancer control
- Reading in of sensors

Parameterisation with EASY Starter

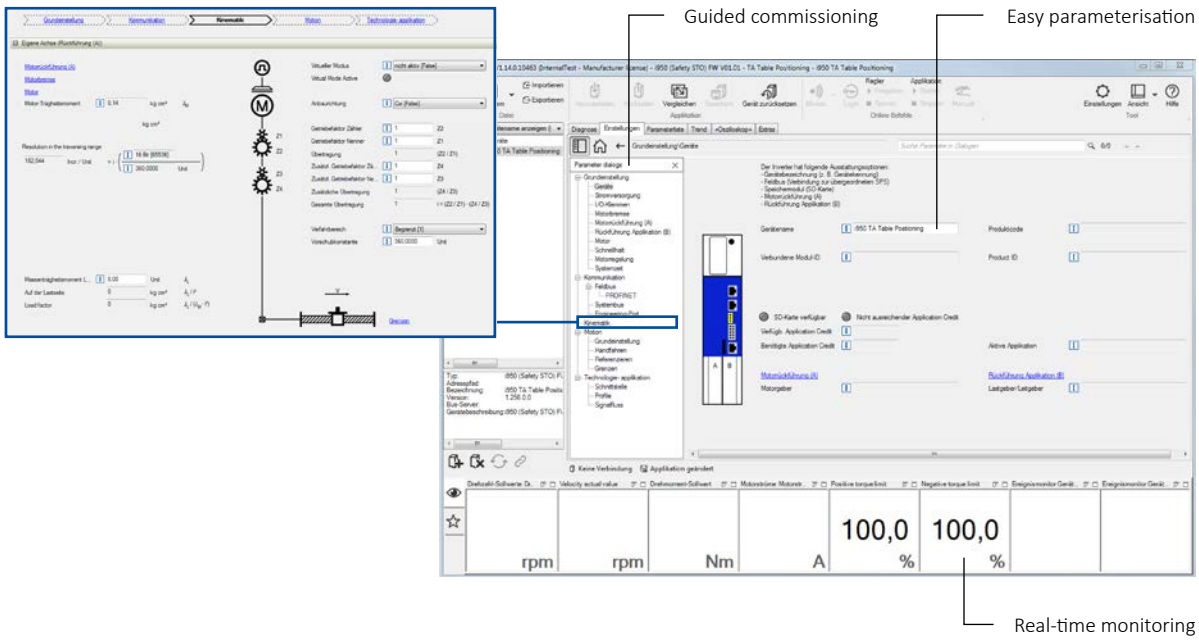
Commissioning and maintenance

By users, for users. EASY Starter assists you with the commissioning and maintenance of your machines. Via easy-to-use parameterisation and diagnostics dialogues and a structured graphical interface, you maintain the necessary overview in every situation.

EASY Starter was designed specifically for the commissioning and maintenance of Lenze products. Within this framework, the tool allows online diagnostics and troubleshooting to be performed. In diagnostics mode, no modification of the parameters is possible, which means that there is no danger of an unintentional application change.

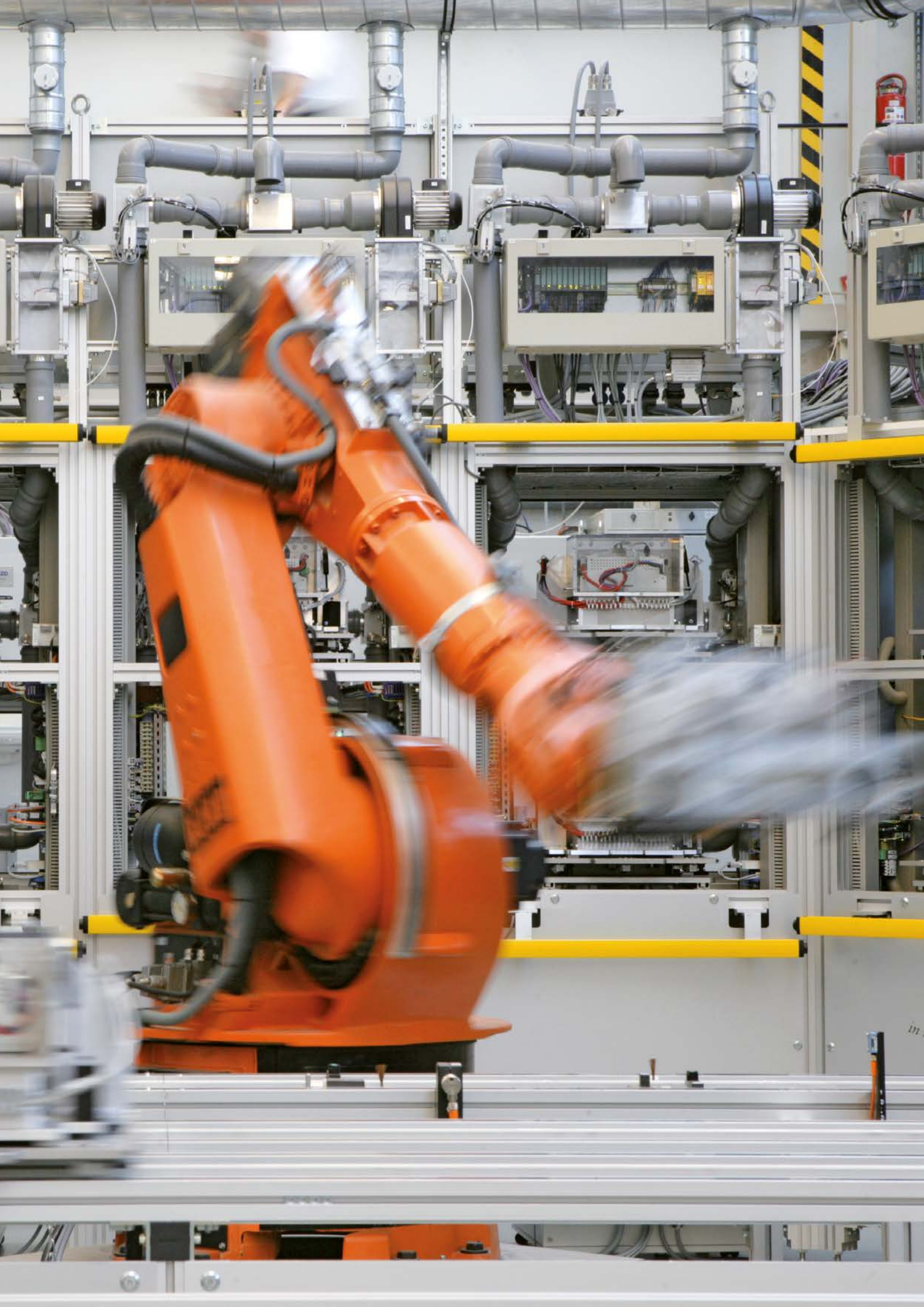
A user-friendly menu navigation with just a few buttons assists you with all machine adjustments.

Auto-tuning mechanisms help with the adjustment of servo inverters and motors. Intuitive graphical user interfaces facilitate parameterisation of the intelligent technology application (TA).



Highlights

- Intuitive interface
- Reduced engineering costs
- Increased productivity



Servo actuator

Servo actuators up to 110 kW

Actuating drives are widely used in servo technology. The i700 servo inverter with single and double axes forms the basis for this in our product portfolio. This portfolio is rounded off in the higher power range by the i950 with a power of up to 110 kW.

CiA 402

The device profile CiA 402 represents standardised drive behaviour with the corresponding operating modes and objects. This device profile contains e.g. the following operating modes: Homing Mode, Interpolated Position Mode, and special synchronisation modes commonly used for servo actuators.

In addition to the standard device profile, additional standardised commands can be selected for modern servo drives. For this purpose, the manufacturer spanning operating mode CiA 402 Cyclic Sync Position Mode (csp) will need to be set. It includes the following functions:

- Interpolation between communication cycle and control cycle
- Position control
- Speed control
- Torque control
- Updating of actual values for position, speed and torque

Technology application CiA 402 Advanced

The technology application "CiA 402 Advanced" expands the CiA 402 functions of the i950 servo inverter. The following additional functions are implemented in the technology application CiA 402 Advanced:

- Homing for CiA 402
- Position control for application encoder Slot B
- Quickstop Application
- Interface to fieldbus

Hence, with this technology application (TA), the i950 can be used as a CiA device with PROFIsafe.

Operation with i700

Easy supply

The two power supply modules of the i700 are designed for a rated power of 15.4 kW and 30.9 kW respectively. Both i700 and i950 axes can be connected directly via the DC bus connection of the axes. The i950 has an additional DC connection for this DC-bus operation, which can be accessed directly from the top.

Conceived for dynamic servo technology

Modern servo applications for positioning, synchronism, or cam applications – the appropriate actuating drives and the associated motors can be found in the Lenze portfolio.

The i700 with single and double axes up to 15 kW and the i950 with compact single axes up to 110 kW provide the highest precision with regard to torque behaviour in the servo actuator operating mode.

The m850 asynchronous servo motor and the MCS synchronous servo motors as drives with and without a gearbox implement the specifications of the controller with high concentricity in the resulting installation.


95-KM1 2

Programmable

The same architecture, same engineering, as well as the use of the same application software eliminate the distinctions between centralised and decentralised intelligence. Our FAST Application Software Toolbox can be used consistently.

Via IEC 61131-3 in accordance with PLCopen, you as the OEM have the option of creating entirely freely programmable applications with the i950.

In particular, the flexible design of production processes, with individually adaptable product features, poses a challenge. This can only be operated economically when production adjusts itself automatically and manual retooling is avoided. Hence, you as the OEM are faced with the task of implementing modular manufacturing concepts. This is also reflected in software creation.

Your development can take place particularly effectively when you can repeatedly re-use individual modules – this also applies to software.

The i950 servo inverter makes this approach possible: it can already process older inverter and controller software. Future models will form a shared platform on which previously created software can be reused without requiring significant adaptation.


Lenze
FAST

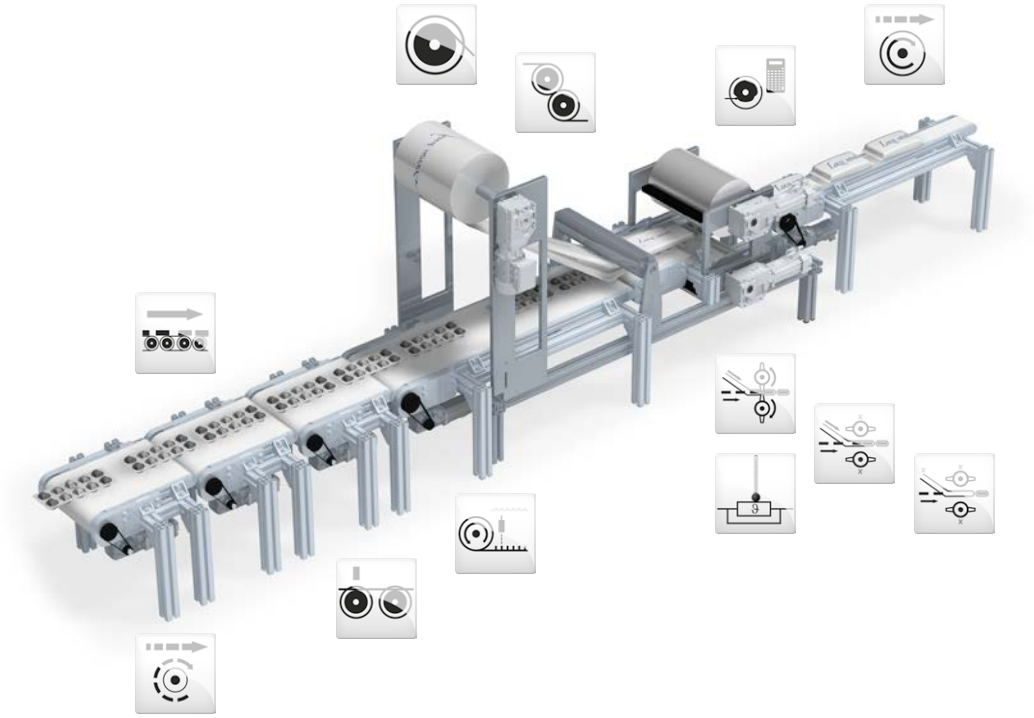
Accelerating engineering – with Lenze **FAST**

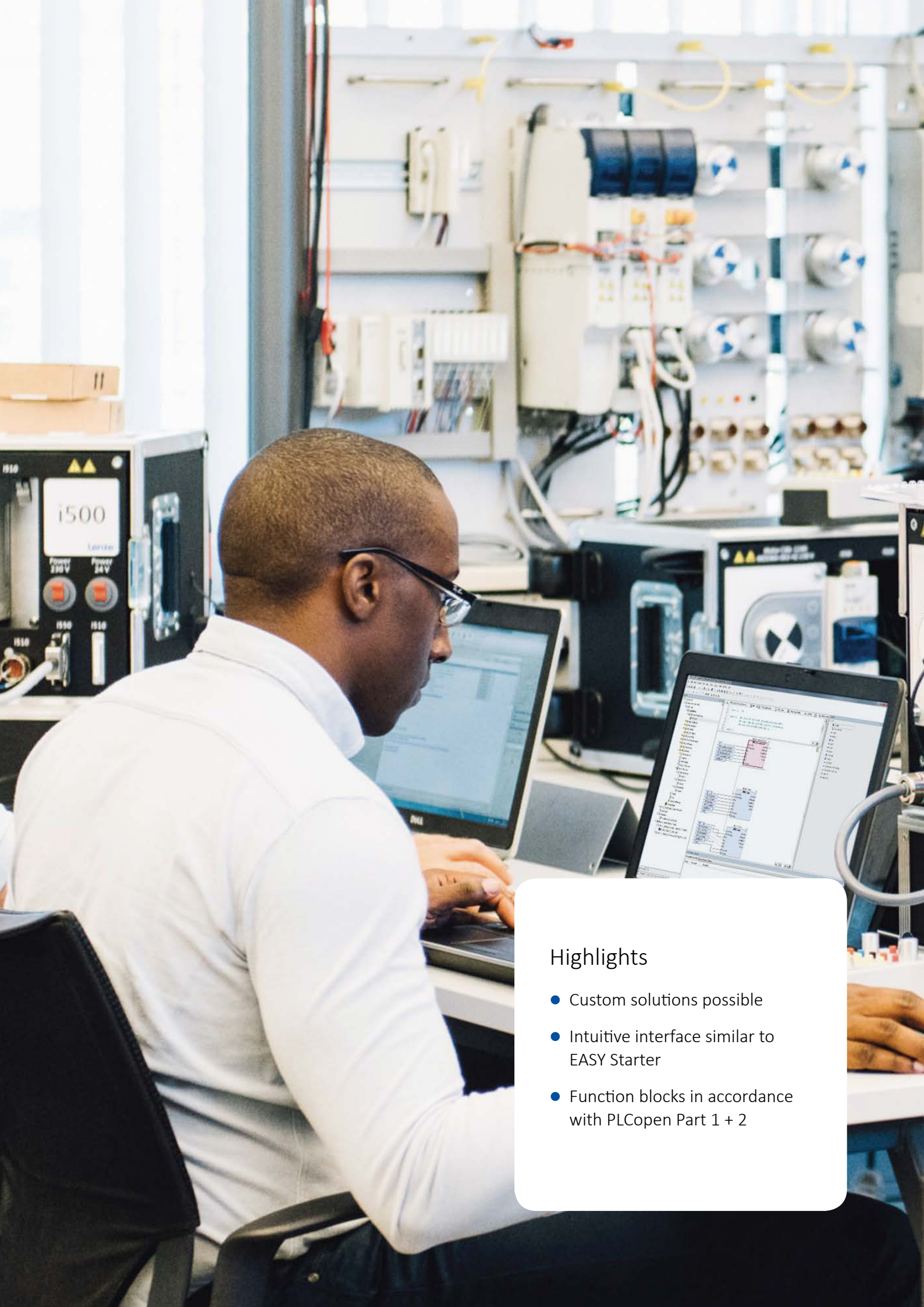
Standardised and reusable software modules for important servo applications

Software is becoming increasingly important in the development of machines, as mechanical engineers are focusing more attention on efficient processes for creating the applications they need. Lenze's standard software modules make it easy to develop modular mechanical control systems by simply adding the modules using the application template.

Your advantages:

- Up to 80% of software engineering requirements are covered by Lenze FAST
- Significant reduction in development times for basic functions
- The time saved can be invested in further developing the machine's special features
- Intelligent, tested software modules which are easy to re-use
- Structured programming layout via the Application Template
- Error reduction thanks to tested software





Highlights

- Custom solutions possible
- Intuitive interface similar to EASY Starter
- Function blocks in accordance with PLCopen Part 1 + 2

PLC Designer

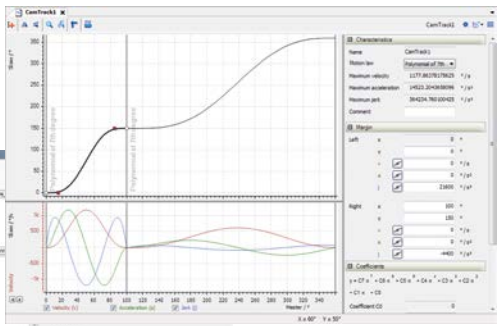
Program creation and commissioning

The PLC Designer is the tool for creating your programs and for commissioning our PLC products. The programming of the PLC products corresponds to the IEC 61131-3 standard.

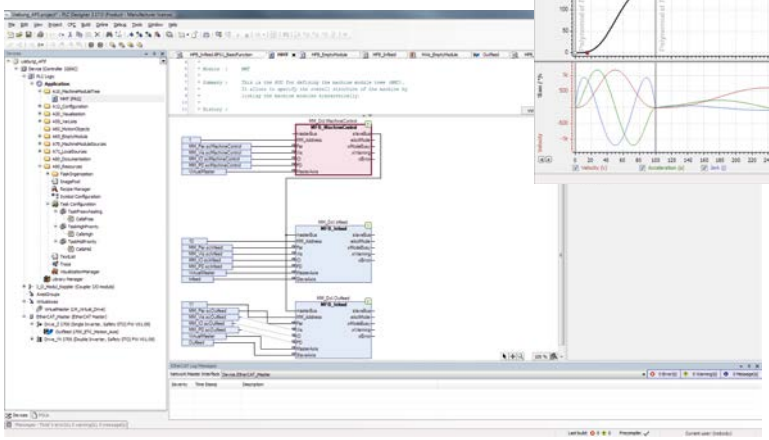
The PLC Designer offers you all functions for the convenient engineering of controller-based solutions. In addition, we offer you comprehensive support with the implementation of your projects from our application engineers in every project phase.

The software is based on CODESYS V3 and designed for project planning engineers of machine builders.

A comprehensive library of functional modules from a wide variety of task fields is also part of the PLC Designer's range of functions. The PLC Designer can be used for easy commissioning in combination with the EASY Starter.



Graphical cam editor



Machine Module Tree

Integrated safety

In day-to-day production, safety-relevant events often lead to machine downtime, production shutdowns, and unnecessary costs. Due to this, it pays to take into account safety functions that meet the requirements of your machine early on in the design stage. The inverters with integrated safety functions are certified in accordance with EN ISO 13849-1.

Depending on the requirements of the machine, two different versions of the i950 with integrated safety functions can be employed:

Basic Safety

- Safe torque off (STO)

Extended safety

- Safe torque off (STO)
- Safety bus PROFIsafe
- Safety bus FSoE
- Safe stop 1 with ramp monitoring (SS1-r) **
- Safe stop 1 with time monitoring (SS1-t)
- Safe stop 2 (SS2) **
- Safe operational stop (SOS) **
- Safely limited speed (SLS) **
- Safe maximum speed (SMS) **
- Safe speed monitor (SSM) **
- Safe direction (SDI) of motion **
- Safely limited increment (SLI) **
- Safely limited position (SLP) **
- Safe cams (SCA) **
- Safe brake control (SBC)
- Position-dependent safely limited speed (PDSS) **
- Cascading of the STO safety function
- Safe monitor
- Operation mode selector (OMS) with enable switch (ES)
- Repair mode (RMS) with enable switch (ES)
- Safe inputs/outputs

** Safe encoder system required

One Cable Technology

Open and established

With the aid of the open motor feedback protocol HIPERFACE DSL®, drive solutions from Lenze allow for the use of future-oriented One Cable Technology. The use of hybrid wires allows for combined servo and rotary transducer wires.

This intelligently minimises connecting cables, cable variants, and connection costs. It is also available in conjunction with Basic Safety (STO).

HIPERFACE DSL® is characterised by a high degree of fault resistance and the efficient detection and remedy of faults.

Advantages

- Lower space requirements thanks to less connectors
- More efficient installation and reduced connection costs
- Detection of additional sensor signals possible

Motors and geared motors

Easily a match for any requirement

A market-optimised selection of motors and geared motors provides the right combination that fulfils the respective requirements.

Synchronous and asynchronous servo motors

The synchronous servo motors up to 200 Nm and the asynchronous servo motors up to 1100 Nm are optimally calibrated for operation with a servo inverter. Adjustment during commissioning is a breeze thanks to autotuning mechanisms. Application-oriented feedback systems which evaluate the servo inverter and plug-in connectors provide everything necessary for quick deployment for applications with high precision and dynamics.

m850 synchronous servo motors

Geared servo motors

The servo motors can be combined with planetary, bevel, helical, or shaft-mounted helical gearboxes. These robust geared motors impress with a high concentricity factor and low backlash.

m850 synchronous servo motors
combined with g700 planetary gearbox

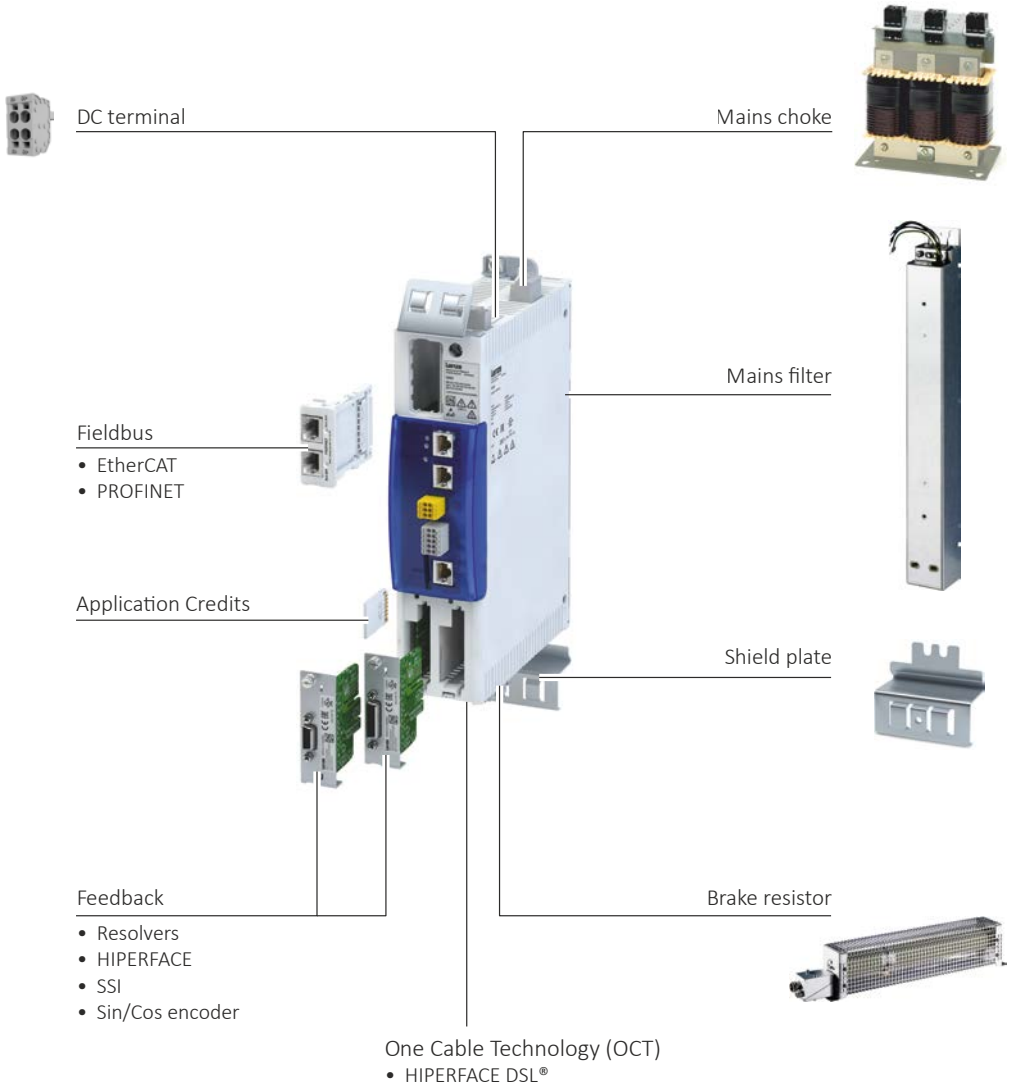
Geared motors with three-phase asynchronous motors

For less demanding applications, a more cost-effective three-phase geared motor with commercially available asynchronous motors can be operated with the servo inverter. High-quality control accuracy can also be achieved in this case, with and without feedback. The high efficiency of the gearbox demonstrates the optimal efficiency of the latest three-phase AC drive technology.

m550 three-phase asynchronous motor
combined with g500 helical or bevel gearbox

Scalable hardware

The i950 servo inverter is designed to be scalable to machine requirements: The integrated technology applications (TA) support you with the implementation of the automation tasks, and the accessories with the overall integration in the installation.



i950 technical data

Conformity declarations	CE	2006/42/EG, 2014/30/EU
	RoHS 2	2011/65/EU
Approvals	$_{c}UL_{US}$	UL 61800-5-1, CSA 22.2 No. 274
Energy efficiency	Class IE2	EN 50598-2
Enclosure	IP20	EN 60529 (except in wire range of terminals)
		NEMA 250 (Type 1 protection against accidental contact only)
	Open type	Only in UL-approved systems
Power system	TT, TN	Voltage against earth: max. 300 V
	IT	Apply the measures described for IT systems!
Mains switching		3 x within one minute possible, from 5 kW 1 x within one minute
Operation with residual current circuit breaker		Up to 4.0 kW 30 mA; from 5.5 kW 300 mA
Cable length for EMC	Category C2	20m
	Category C3	≥ 35 m
Switching frequencies		2, 4, 8, 16 kHz. The rated output currents listed below apply at 45 °C and switching frequencies of 2 and 4 kHz, and at 40 °C and switching frequencies of 8 and 16 kHz
Ambient temperature		55 °C (derating of 2.5 %/°C above 45 °C)
Max. Output frequency		0 Hz ... 599 Hz
Overload capacity		200% for 3s; 150% for 60s

	Rated power	**Mains voltage range**	**Rated output current**	**Weight**	**Dimensions (h x w x d)**
	[kW]	**[V]**	**[A]**	**[kg]**	**[mm]**
i950-C0.55/400-3	0.55	3/PE AC 340 V ... 528 V 45 Hz ... 65 Hz	1.8	1.6	250 x 60 x 173
i950-C0.75/400-3	0.75		2.4		
i950-C2.2/400-3	2.2		5.6		
i950-C4.0/400-3	4		9.5		
i950-C7.5/400-3	7.5		16.5	3.9	276 x 120 x 173
i950-C11/400-3	11		23.5		
i950-C15/400-3	15		32		
i950-C22/400-3	22		47	10.7	347 x 205 x 240
i950-C30/400-3	30		61	16.7	450 x 250 x 234
i950-C45/400-3	45		89		
i950-C55/400-3	55		110	24	536 x 250 x 270
i950-C75/400-3	75		150		
i950-C90/400-3	90		180	35.6	685 x 258 x 304
i950-C110/400-3	110		212		

Accessories

i950 accessories; connection to 400 V mains

Inverter	Rated power	Mains voltage range	Brake resistor		
	[kW]	[V]			
					
			Order codes	Dimensions (h x w x d)	
				[mm]	
i950-C0.55/400-3	0.55	3/PE AC 340 V ... 528 V 45 Hz ... 65 Hz	ERBM390R100W	235 x 21 x 40	
i950-C0.75/400-3	0.75		ERBM390R100W	235 x 21 x 40	
i950-C2.2/400-3	2.2		ERBP180R200W	240 x 41 x 122	
i950-C4.0/400-3	4		ERBP047R200W	320 x 41 x 122	
i950-C7.5/400-3	7.5		ERBP027R200W	320 x 41 x 122	
i950-C11/400-3	11		ERBP027R200W	320 x 41 x 122	
i950-C15/400-3	15		ERBS018R800W	710 x 110 x 105	
i950-C22/400-3	22		ERBS015R800W	710 x 110 x 105	
i950-C30/400-3	30		ERBG075D01K9	486 x 236 x 302	
i950-C45/400-3	45		ERBG075D01K9	486 x 236 x 302	
i950-C55/400-3	55		ERBG005R02K6	486 x 326 x 302	
i950-C75/400-3	75		ERBG005R02K6	486 x 326 x 302	
i950-C90/400-3	90		ERBG028D04K1	486 x 426 x 302	
i950-C110/400-3	110		ERBG028D04K1	486 x 426 x 302	

Overview of required application credits

	Technology applications (TA)			Technology modules (TM)				Required Application credit
Parameterisable	Speed control	Electronic gearbox	Table positioning	–				50 EPCZEMSD0L1005
	Synchronism with mark correction	Winder with dancer control	Winder with tension control					100 EPCZEMSD0L1010
Actuating drive	CiA 402			–				No application credit
	CiA 402 Advanced							50 EPCZEMSD0L1005
Programmable	Speed control	Electronic gearbox	Table positioning	Speed control	Electronic gear	Table Pos	Flex CAM	≥ 150 EPCZEMSD0L1015
	Synchronism with mark correction	Winder with dancer control	Winder with tension control	Winder Dancer	Winder Tension	Sync & Correction	Cross Cutter	≥ 200 EPCZEMSD0L1020
	Customer							≥ 300 EPCZEMSD0L1030

There are also additional accessory components available for the i950 inverter.
You can find the complete range in the project planning documents for the i950.

	Mains choke		RFI filters			
			Short Distance		Long Distance	
	• Required from 22 kW • Reduction of the effective mains current • Fewer current harmonics		• C1 up to 25 m (≤ 0.37 kW up to max. 15 m) • C2 up to 50 m (≤ 0.37 kW up to max. 15 m) • Use of filter leads to significantly reduced leakage current • Operation with 30 mA residual current circuit breaker		• C1 up to 50 m (≤ 0.37 kW up to max. 15 m) • C2 up to 100 m (≤ 0.37 kW up to max. 15 m, ≤ 2.2 kW up to max. 50m) • Mains filter from 22 kW (mains choke and long distance filter) integrated. • Operation with 300 mA residual current circuit breaker	
	Order codes	Dimensions (h x w x d)	Order codes	Dimensions (h x w x d)	Order codes	Dimensions (h x w x d)
		[mm]		[mm]		[mm]
	EZAELN3002B153	56 x 77 x 100	I0FAE175F100S0000S	276 x 60 x 50	I0FAE175F100D0000S	276 x 60 x 50
	EZAELN3004B742	60 x 95 x 115	I0FAE175F100S0000S	276 x 60 x 50	I0FAE175F100D0000S	276 x 60 x 50
	EZAELN3006B492	69 x 95 x 120	I0FAE222F100S0000S	346 x 60 x 50	I0FAE222F100D0000S	346 x 60 x 50
	EZAELN3010B292	85 x 120 x 140	I0FAE255F100S0000S	346 x 90 x 60	I0FAE255F100D0000S	346 x 90 x 60
	EZAELN3016B182	95 x 120 x 140	I0FAE311F100S0000S	371 x 120 x 60	I0FAE311F100D0000S	371 x 120 x 60
	EZAELN3025B122	110 x 155 x 170	I0FAE311F100S0000S	371 x 120 x 60	I0FAE311F100D0000S	371 x 120 x 60
	EZAELN3030B981	110 x 155 x 170	–	–	I0FAE311F100D0000S	371 x 120 x 60
	EZAELN3045B651	112 x 185 x 200	–	–	I0FAE322F100D0000S	436 x 205 x 90
	EZAELN3063B471	122 x 185 x 210	–	–	I0FAE330F100D0001S	590 x 250 x 105
	EZAELN3080B371	125 x 210 x 240	–	–	I0FAE345F100D0001S	590 x 250 x 105
	EZAELN3100B301	139 x 267 x 205	–	–	I0FAE355F100D0001S	700 x 250 x 105
	EZAELN3160B191	149 x 291 x 215	–	–	I0FAE375F100D0001S	700 x 250 x 105
	EZAELN3180B171	164 x 316 x 235	–	–	I0FAE411F100D0001S	855 x 250 x 130
	EZAELN3200B151	144 x 352 x 265	–	–	I0FAE411F100D0001S	855 x 250 x 130

Inverter	Shield mounting kit	
	Packaging unit	Order codes
i950-C0.55/400-3	5x motor shielding plate 10x fixing clip	EZAMBHXM014/M
i950-C0.75/400-3		
i950-C2.2/400-3		
i950-C4.0/400-3	5x motor shielding plate 5x fixing clip 5x terminal clamp (4 ... 15 mm)	EZAMBHXM015/M
i950-C7.5/400-3	5x motor shielding plate 5x fixing clip 5x terminal clamp (10 ... 20 mm)	EZAMBHXM016/M
i950-C11/400-3		
i950-C15/400-3		
i950-C22/400-3	5x terminal clamp (15 ... 28 mm) 5x terminal clamp (20 ... 37 mm)	EZAMBHXM004/ME-ZAMBHXM005/M
i950-C30/400-3		
i950-C45/400-3		
i950-C55/400-3	5x terminal clamp (20 ... 37 mm)	EZAMBHXM005/M
i950-C75/400-3		

Installation set for DC-bus operation		
Connection	**Parts**	**Order codes**
DC bus	5	I9ZAA0013M
DC bus, Daisy Chain	5	I9ZAA0012M

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