

BERGER LAHR











**Catalogue of Twin Line
Positioning controllers**



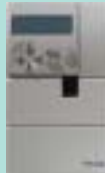
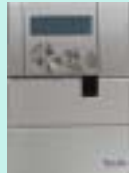

Edition 7/2003

Twin Line

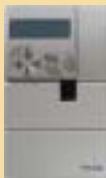

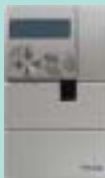
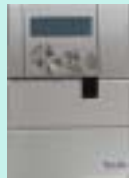

Twin Line Motors

	3-phase stepping motors			AC synchronous servomotors (standard)				
Torque [Nm] ¹⁾	1,5	2-6	12-16,5	0,32-0,9	1,1-3,6	4,3-11,25	4,6-13,4	17,8-38,8
Motor type	VRDM 36X	VRDM 39X	VRDM 311X	SER 36X	SER 39X	RIG 39X	SER 311X	RIG 311X
								
	VRDM 368	VRDM 397 3910 3913	VRDM 31117 31122	SER 364 366 368 3610	SER / RIG 397 3910 3913 3916 ²⁾	SER / RIG 31112 31117	SER / RIG 31117 31122 31127 ²⁾	

Twin Line Power electronics

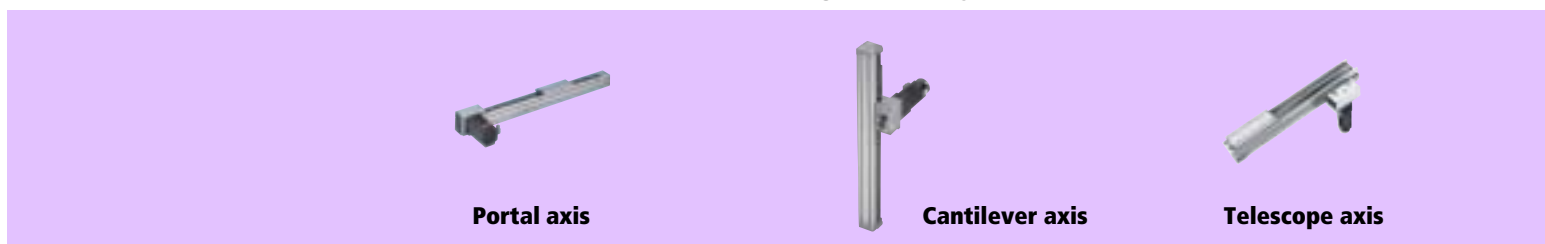
Power class	3 A / 350 W / 1~	7 A / 750 W / 1~	3 A / 750 W / 1~	3 A / 1,5 kW / 3~	6 A / 3 kW / 3~
					
for single axis systems	TLD 011	TLD 012	TLD 132	TLD 134	TLD 136

Twin Line Positioning controllers

Power class	3 A / 350 W / 1~	7 A / 750 W / 1~	3 A / 750 W / 1~	3 A / 1,5 kW / 3~	6 A / 3 kW / 3~
					
with data set processing	TLC 411	TLC 412	TLC 432	TLC 434	TLC 436
with field-bus interface	TLC 511	TLC 512	TLC 532	TLC 534	TLC 536
freely programmable according to IEC 61131-3	TLC 611	TLC 612	TLC 632	TLC 634	TLC 636

Robotics

Single-axis-systems









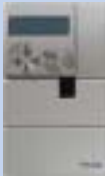



¹⁾ Stepping motors: max. torque M_{max}
AC synchronous servo: permanent idle torque M_{i50}

²⁾ only Motor type SER

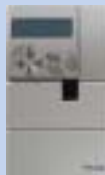



AC synchronous servomotors (high performance)

Catalogue of
Twin Line Motors

0,34-1,0	0,65-2,3	0,95-6	4,2-12	8,5-27	25-50
DSM4-05.X	DSM4-07.X	DSM4-09.X	DSM4-11.X	DSM4-14.X	DSM4-19.X
					
DSM		DSM		DSM	
4-05.1-.4 4-07.1-.2 4-09.1-.2		4-07.1-.3 4-09.1-.3		4-11.1-.4 4-14.1-.4 4-19.1-.2	

3 A / 750 W / 1~	3 A / 1,5 kW / 3~	6 A / 3 kW / 3~	16 A / 8 kW / 3~
			
TLD 132	TLD 134	TLD 136	TLD 138


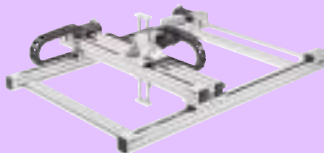

Catalogue of
Twin Line Power electronics

3 A / 750 W / 1~	3 A / 1,5 kW / 3~	6 A / 3 kW / 3~	16 A / 8 kW / 3~
			
TLC 432	TLC 434	TLC 436	TLC 438
TLC 532	TLC 534	TLC 536	TLC 538
TLC 632	TLC 634	TLC 636	TLC 638

This Catalogue includes

Positioning controllers	
• Data set processing	8
• Field-bus interface	36
• Freely programmable	65

Multi-axis-systems

		
Double-axis systems	Triple-axis systems	Low-mass systems

Catalogue of
Robotics

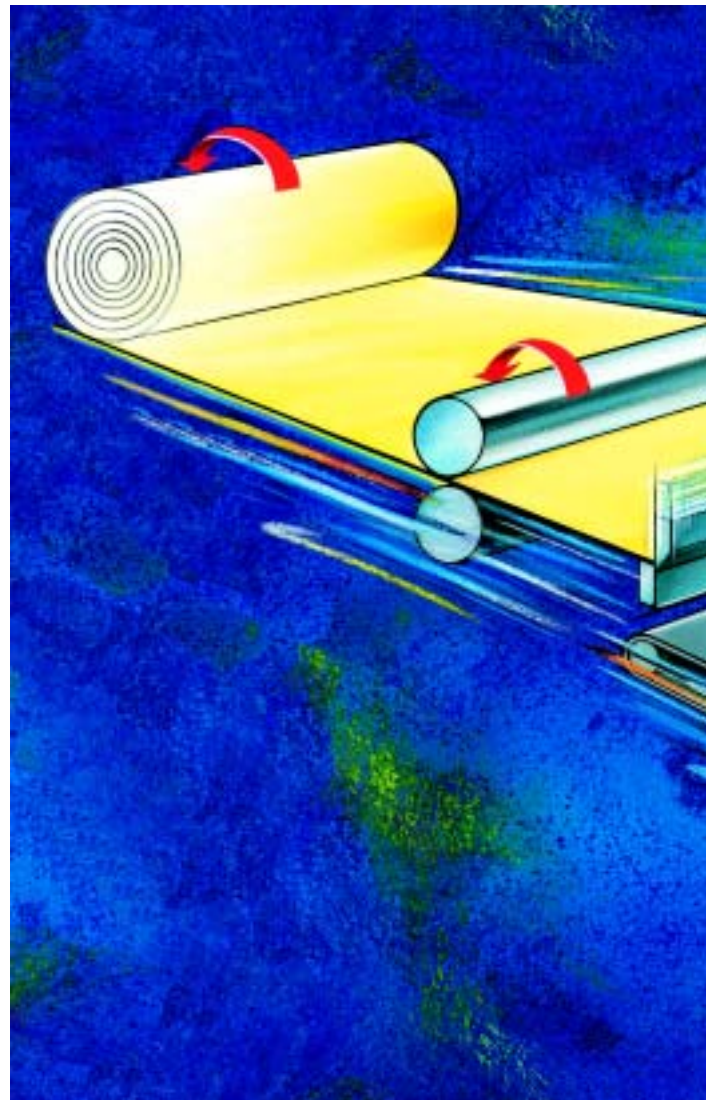
Positioning drives

Positioning drives enable the execution of accurate, precisely defined movements. The distances travelled may vary from a few μm to several metres. The digital positioning drives from Berger Lahr are especially well-suited to positioning tasks. They are maintenance-free, simple to control and the movement procedures are easy to program. They can be used to solve almost any task in production automation requiring up to 8 kW of power: from simple point-to-point movements all the way to multi-axis systems with varying travel patterns. Positioning drives from Berger Lahr may be

- operated as autonomous solutions
- controlled by a PLC
- integrated into various networks and standard field-bus systems

What would you like to position?

Below are some examples of possible positioning tasks. Many other applications are also conceivable.



Positioning parts



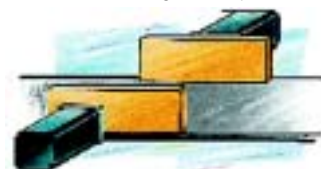
Feed movements



Metering



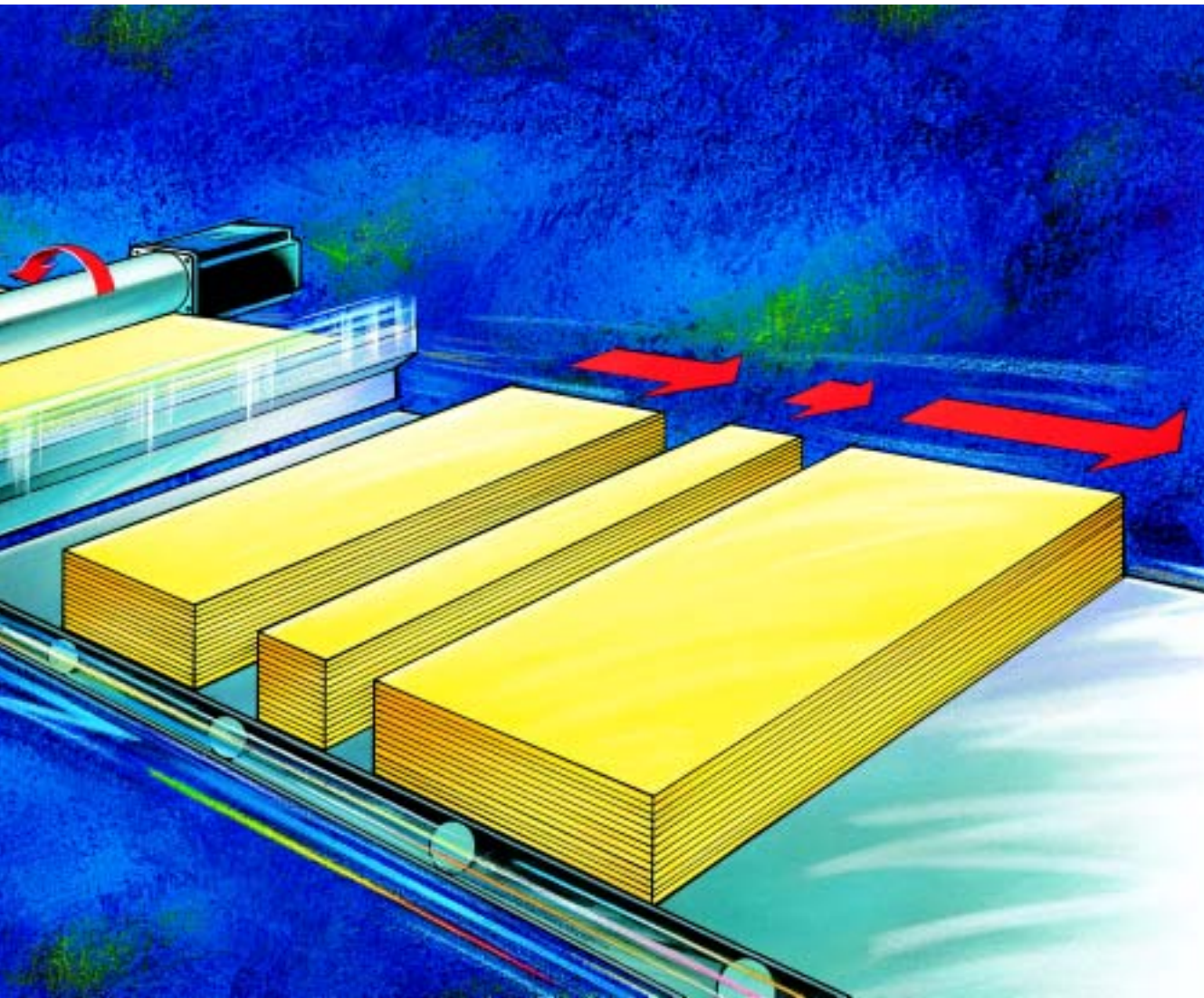
Positioning limit stops



Format setting/adjustment



Cutting to length



Toothed rod



Spindle



Toothed belt



Gearing



Chain

The mobility you need

Mechanical components precisely adjust the motor's rotary motion to the movement type for the positioning task required.



Positioning controllers

General description of positioning controllers

Twin Line positioning controllers are exceptionally adaptable single-axis positioning controllers with integrated power electronics. Controllers of the TLC x1x series are equipped with integrated stepping-motor power electronics, and devices of the TLC x3x series with integrated AC synchronous servomotor power electronics.

Depending on the module configuration, the positioning controllers can manage all sorts of positioning tasks, from the simplest point-to-point positioning to the electronic-gearing function.

The Twin Line positioning drives act as intelligent actuators in a typical automation system. The master control system has access to parameters, system factors and the positioning functionality of the drives via digital signal interface, serial communication or standard field-bus systems.

The integrated intelligence of the drive system shifts the positioning functions and corresponding control loops from the command level to the field level, while considerably reducing the wiring outlay and relieving the load on the master control system.

This design results in coherent structures within the automation solution, which simplify start-up operation, increase flexibility for expansion and reduce maintenance costs. Twin Line devices may thus be replaced or exchanged without difficulty, because the master control system can simply transfer all parameters to the new device.

Up to two high-speed capture inputs – depending on the control functionality – are available for meeting time – critical requirements in a distributed manner during the production process. A high-speed output makes it possible to implement an integrated camshaft control signal with up to 2 x 64 switching points. The capture inputs and the high-speed output have a very short reaction time and a very low jitter. The capture inputs or the high-speed output are operated via serial communication or field-buses.

Depending on the control functionality, the other fully adaptable, process-compatible inputs and outputs reduce the need for extra peripheral components, resulting in significant cost savings.

A jolt-limiter which may be connected during operation ensures smooth mechanical operation and a longer machine service life.

Structural features

- Compact design
- Same mechanical design for all power classes
- Integrated power electronics, stepping or AC synchronous servomotor
- Power supply for the power electronics directly from the mains, without transformer
- Power range from 350 W to 8 kW
- Integrated mains filter, class B (industrial environment), heat dissipater and ventilator
- Protection type IP 20, optional IP 54 for certain power classes
- Device suspension integrated in the housing
- All electrical connections are accessible from the front
- Shielding connection and strain relief are integrated in the device

Functional and economical features

- Operation, parameterisation and control alternatively via
 - Plug-in Twin Line HMI (Human Machine Interface) control unit
 - Twin Line CT (Control Tool) software, which runs under Windows 95/NT/98/2000/XP Professional
 - Master control system
 - Programming system CoDeSys according to IEC 61131-3
- Compatible with various motor encoder systems
- Integrated braking control signal
- Various field-buses or RS 485 configuration
- Various adjustable operating modes
- Simple to install in accordance with EMC directives
- User-friendly
- Multilingual documentation and controlling units
- Complete solution for power-engineering tasks
- Takes up little space
- Modularity for tailor-made system solutions
- External components (mains filter, ventilator, heat dissipator) easily integrated
- Process-applicable I/Os on board

Custom configuration of the interfaces

Twin Line positioning controllers are configured according to customers' needs. The modular design enables the devices to be adapted precisely to various power-engineering tasks and interface requirements.

A module for rotation monitoring can be optionally used for controls with integrated stepping-motor power electronics.

For controllers with integrated AC synchronous servomotor power electronics, a SinCos[®] (Single and Multi Turn absolute-value encoder) is used to detect the motor position.

The set value for the electronic gearing can be supplied as encoder (A/B), pulse/direction or pulse_{forward}/pulse_{back} signal.

Device parameters and commands can be transmitted via RS 485 or the standard field-bus systems Profibus-DP, Interbus, CAN and ModBus.

The equipped CAN module can also be configured with the Berger Lahr profile or CANopen DS402 profile, or with DeviceNet.

Optional protection type IP 54

The integration of all components – such as the mains filter, heat dissipater, ventilator, ballast resistor, optional holding-brake controller and condensation guard – reduces the wiring outlay and simplifies commissioning.

The mini-terminal blocks can be snapped onto top hat rails in the device housing, thus eliminating the need for external terminal boxes.

These features enable the Twin Line positioning controllers to be used as field devices without a switch cabinet.

However, devices of this protection type are not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.

**Option Safety Monitor module SAM-C
Integrated safety functions for personal protection**

The SAM-C Safety Monitor module extends the series TLCxxx devices using integrated functions for operator safety, e.g. safe stop and reduced speed functions. These safety functions allow the power supply to the motor to remain on even when the protective door is open. In case of Emergency Stop situations, SAM-C offers safe deceleration and switching off of power supply for the motor by means of internal safe blocking of the power stage controller. The power supply does not need to be switched off by means of power contactors. All functions conform to safety category 3 according to EN 954-1. SAM-C features a 24 V I/O interface for the connection of protective door contacts, Emergency Stop, devices, etc.

Approvals

CE, UL, cUL

Accessories

Please refer to the catalogue of **Twin Line Accessories** for additional information and technical data.

General device functions

The TLC 41x models are positioning controllers with integrated power electronics for 3-phase stepping motors or AC synchronous servomotors. The TLC 43x models are positioning controllers with integrated power electronics for AC synchronous servomotors.

Sixty-four data sets are stored in the devices and can be controlled by a master control system (e.g. PC/PLC) via digital signal interface or communication interface.

You can set parameters to assign the inputs and outputs of the following functions:

- Fixed assignment of the input/output signals: the data sets are controlled via digital signal interface. This mode does not require a communication interface.
- Setting of the network address, baud rate and field-bus profile for positioning controllers with RS 485, Modbus, PB-DP and CAN field-bus. The data sets are controlled via communication interface. enabling the Twin Line positioning controllers to be exchanged without any additional start-up tools.
- Freely applicable and process-applicable 14 digital inputs, 5 digital outputs, and an analogous input $\pm 10V$, being controlled by field bus or by RS485. The data sets are controlled via communication interface.

The standard controller model is equipped with the following connections:

- I/O signal connection
- Motor connection
- Mains connection
- Brake-triggering signal
- Connection for ballast controller
- RS 232 for communication with the Twin Line CT control software or the Twin Line HMI plug-in controller.

The following interfaces may also be added:

- Encoder-simulation interface for connecting follow-up axes
- RS 485 serial interface or field-bus interface Interbus, Profibus-DP, CAN or ModBus
- SAM module for integrated safety technique
- Analog module IOM with two digital I/Os, and two analog I/Os

Data set processing

Every data set represents a travel job which can be executed as point-to-point positioning or in speed mode.

The individual position sets in data set processing with point-to-point positioning consist of the following data:

- Relative or absolute units system
- Target position
- Travel speed
- Acceleration and deceleration ramps

The individual speed sets in data set processing consist of the following data:

- Travel speed
- Acceleration and deceleration ramps

The data sets can be called up using the Twin Line HMI hand-operated controller, the Twin Line Control Tool software, inputs of the signal interface or an integrated field-bus module. These interfaces can also be used to approach the position values with the teach-in processing as well as to store the current position value in the set memory.

All entries in the data sets can also be made using the Twin Line HMI hand-operated tool, the Twin Line Control Tool software, or via field-bus.

Device-related operation modes and functions:

Point-to-point

In point-to-point mode, a positioning command is used to position from point A to point B. The positioning may be absolute (relative to the zero-point of the axis) or relative (based on the current axis position).

Speed mode

In speed mode, a speed is defined for the axis, and the movement is started without a target position. The axis moves at this speed until another speed set or operating mode is selected.

Reference run

Referencing assigns a defined axis position to a special mechanical position of the motor in the system. Referencing may be performed either by setting the dimensions to the current motor position or by executing a reference run.

The following types of reference run are available:

- Travel to positive, negative or additional limit switches
- Travel to positive, negative or additional limit switches with referencing to the index pulse

Manual run

You can initiate motor runs from a single step to continuous motion by operating the manual inputs or via the Twin Line HMI and Twin Line CT start-up tools.

Teach-in

Teach-in stores the current position value in the selected memory area. You can teach in up to 2 x 64 absolute switching positions of the integrated camshaft function or the 64 paths sets for data set processing via input/output signals, Twin Line HMI or the Twin Line CT. The data may also be read, written and copied via field-bus, Twin Line HMI or Twin Line CT.

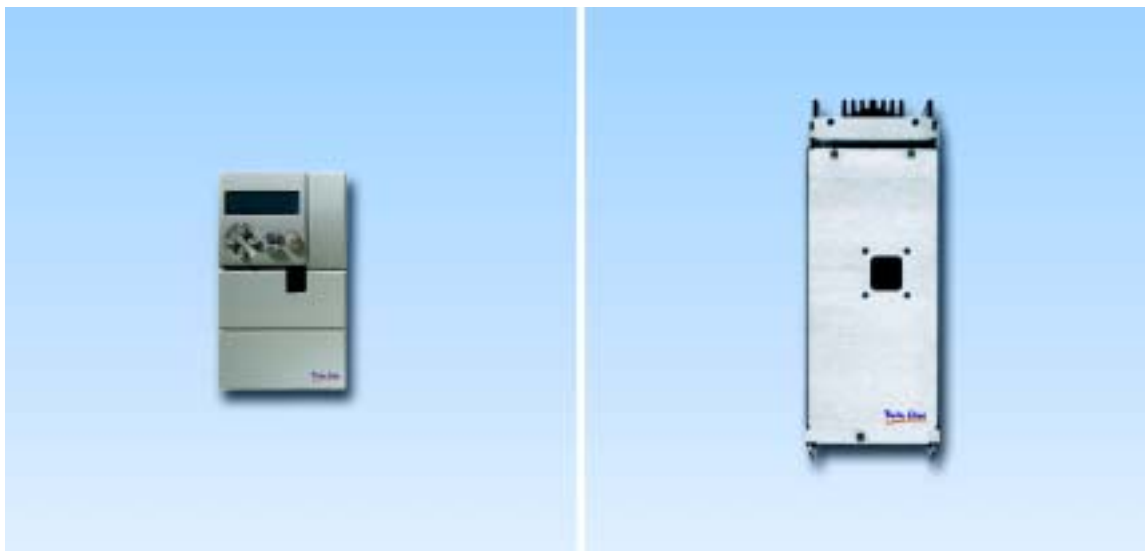
Cam-controller signal output

If the movement exceeds an absolute position value acquired/modified in teach-in mode, the output will be set according to the modified output state, i.e. this high-speed output will be set or reset based on the new position. The position is set parallel to the current operating mode.

Parameterisation

The parameters of the positioning controller and integrated power electronics of devices with an attached communication module can be read and written by the master (PC, PLC etc.) via field-bus or RS 485. Twin Line devices may thus be reproduced or replaced without difficulty, increasing flexibility for extensions and reducing maintenance costs.

The plug-in Twin Line HMI controller and Twin Line CT start-up software enable a complete device parameterisation as well as a transfer of all parameters from one device to another.



Positioning controllers TLC 41x for 3-phase stepping motors

Positioning controllers TLC 41x

Positioning controllers with data set processing and integrated power electronics devices for 3-phase stepping motors are available in the following models:

Protection type IP 20

- TLC 411: Single-axis positioning controller with data set processing, power class 3 A/350 W/1~
- TLC 412: Single-axis positioning controller with data set processing, power class 7 A/750 W/1~

These devices can be specified as follows:

- 230 V mains voltage with integrated mains filter
- Reversible mains voltage 115 V/230 V without integrated mains filter

Optional protection type IP 54

- TLC 411P: Single-axis positioning controller with data set processing, power class 3 A/350 W/1~
- TLC 412P: Single-axis positioning controller with data set processing, power class 7 A/750 W/1~

The mains voltage for these devices is reversible 115 V/230 V. A mains filter is always integrated.

The ventilator and heat dissipater are standard equipment on all devices.

Acceleration and braking ramps

The following asymmetric ramp shapes may be defined for the positioning controller with integrated power electronics for 3-phase stepping motors:

- Linear ramp
- Exponential ramp, i.e. compensation for the torque drop typical of stepping motors at rising speed by a suitable optimised ramp

In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp is used as the quick-stop ramp for positioning controllers with integrated power electronics for 3-phase stepping motors.

Rotation monitoring

A shaft-encoder interface module, which enables the Twin Line positioning controller to detect mechanical motor overload, is available as an optional accessory.

The rotation monitoring system compares the set and actual motor positions and returns a rotary error if the difference exceeds the drag-error limit. The motor must be equipped with an encoder (1000 increments) for the rotation monitoring system to function.

Device protection

- Standard: Protection type IP 20 according to DIN EN 60529: 1991
- Optional: Protection type IP 54, category 2 according to DIN EN 60529: 1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor (only with the rotation monitoring option)
- Rotation monitoring (optional)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

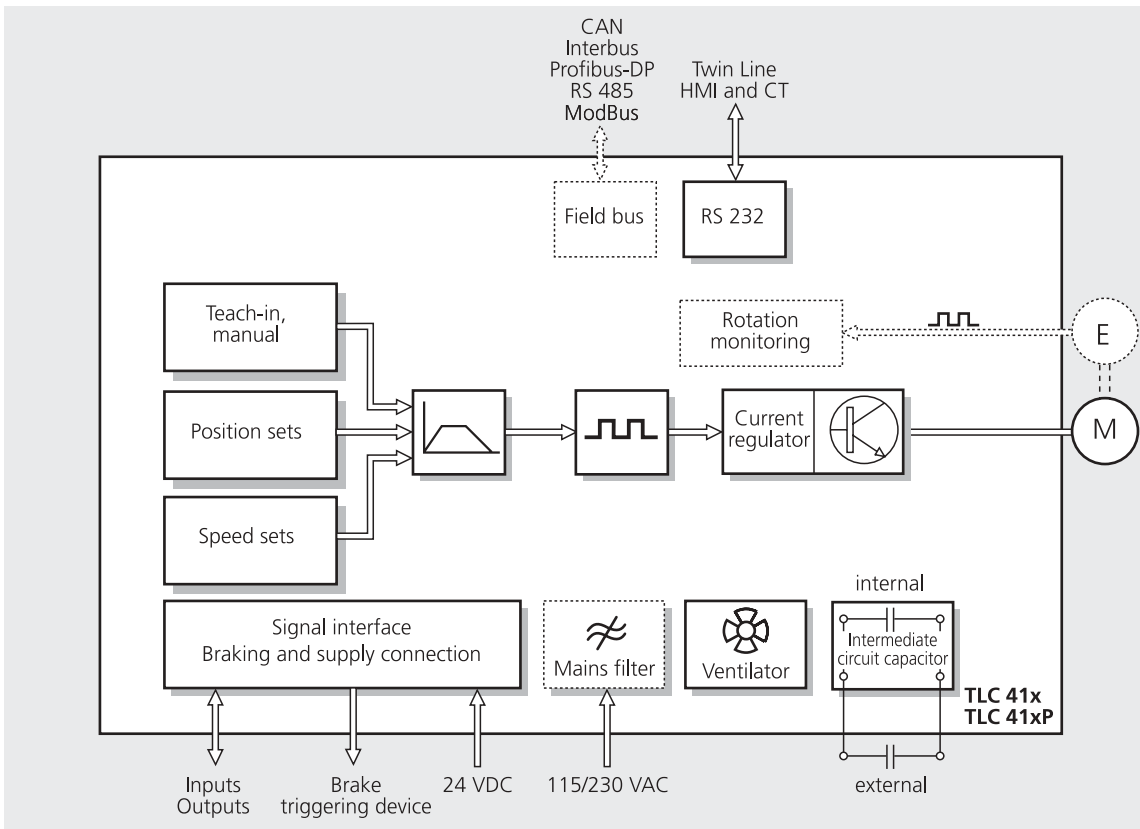


Diagram of positioning controllers with data set processing for 3-phase stepping motors

Technical data TLC 41x, protection type IP 20

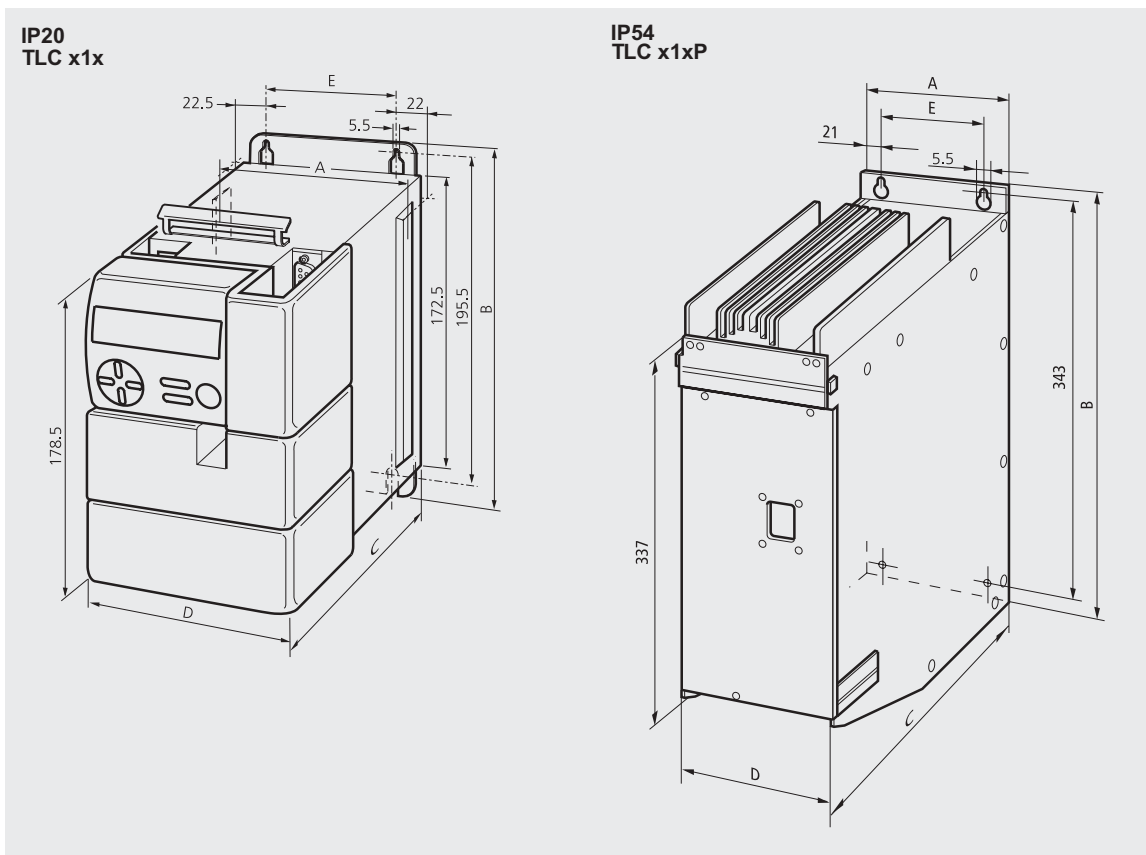
		TLC 411	TLC 412	
Mains connection	Mains voltage, non-reversible, mains filter integrated	1 x 230 VAC -20 % to 230 VAC +15 %		
	Mains voltage, reversible, without mains filter	1 x 115 VAC -20 % to 115 VAC +15 %		
	Mains frequency	47 to 63 Hz		
	Current consumption at 230 V	2 A	5 A	
	Current consumption at 115 V	4 A	10 A	
	Starting current	< 60 A		
	Fuse protection, external at 230 V	10 A (C, K or similar characteristic)		
	Fuse protection, external at 115 V	10 A (C, K or similar characteristic)		
	Motor connection	Rated power at rated current	0.35 kW _{eff}	0.75 kW _{eff}
		Rated current	3 A _{eff}	7 A _{eff}
Switching frequency		16 kHz		
Max. rotary speed		3000 min ⁻¹		
Motor cable	Cable length	≤ 20 m standard > 20 m upon request		
	Shielding connection	on both sides		
	Cross section	1.5 mm ²		
24 VDC system supply voltage		PELV, DIN 19240, polarised		
	Input voltage range	20 to 30 V		
	Input ripple	< 2 V _{pp}		
	Input current without loading the outputs	< 2.5 A		
Digital signal inputs		polarised, no electrical isolation		
	Debounced	0.7 to 1.5 ms		
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)		
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)		
	Current	≤ 7 mA at 24 V		
Digital signal outputs		short-circuit proof		
	Inductive load capable	150 mH/11 W		
	DC voltage	≤ 30 V		
	Switching current	≤ 400 mA		
	Voltage drop at 400 mA	≤ 1 V		
Analog signal input	Voltage range	+10 V to -10 V		
	Input resistance	5 kΩ		
	Solution	10 Bit		
Mass		2.7 kg		

		TLC 411	TLC 412
Ambient conditions	Ambient temperature	0 to 50 °C	
	Transport and storage temperature	-40 to +70 °C	
	Relative humidity	15 to 85 % no condensation permissible	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 20	
Characteristic curves	See catalogue of Twin Line Motors		
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		

Technical data TLC 41xP, protection type IP 54

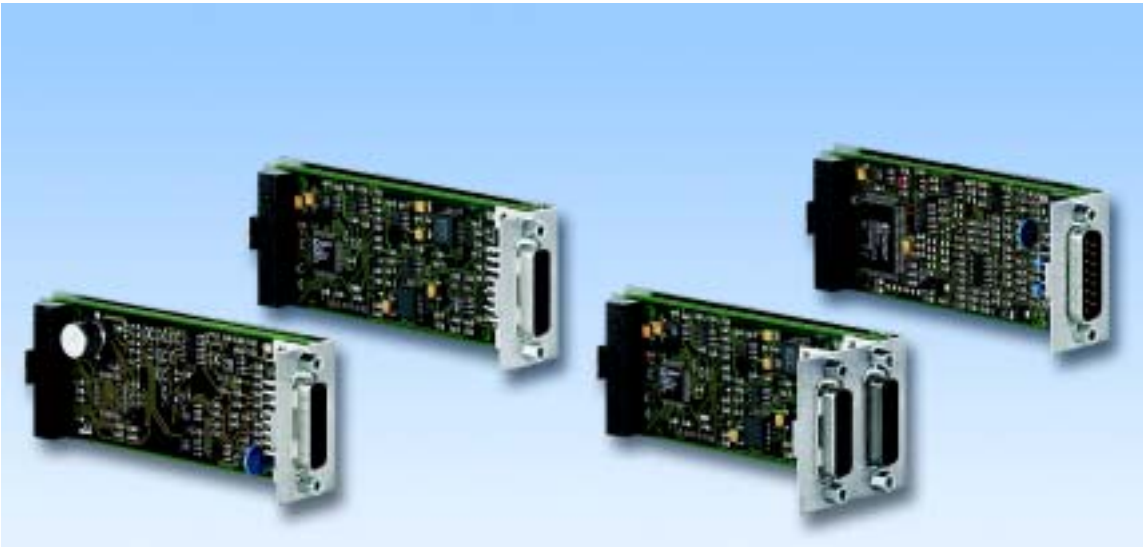
		TLC 411P	TLC 412P	
Mains connection	Mains voltage, reversible, mains filter integrated	1 x 115 VAC -20 % to 115 VAC +15 %		
		1 x 230 VAC -20 % to 230 VAC +15 %		
		Mains frequency		
		47 to 63 Hz		
		Current consumption at 230 V	2 A	5 A
		Current consumption at 115 V	4 A	10 A
		Starting current	< 60 A	
		Fuse protection, external at 230 V	10 A (C, K or similar characteristic)	
		Fuse protection, external at 115 V	10 A (C, K or similar characteristic)	
		Motor connection	Rated power at rated current	0.35 kW _{eff}
Rated current	3 A _{eff}		7 A _{eff}	
Switching frequency	16 kHz			
Max. rotary speed	3000 min ⁻¹			
Motor cable	Cable length	≤ 20 m standard > 20 m upon request		
	Shielding connection	on both sides		
	Cross section	1.5 mm ²		
24 VDC system supply voltage	PELV, DIN 19240, polarised			
	Input voltage range	20 to 30 V		
	Input ripple	< 2 V _{pp}		
	Input current without loading the outputs	< 2.5 A		
Signal inputs	polarised, no electrical isolation			
	Debounced	0.7 to 1.5 ms		
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)		
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)		
	Current	≤ 7 mA at 24 V		
Signal outputs	short-circuit proof			
	Inductive load capable	150 mH/11 W		
	DC voltage	≤ 30 V		
	Switching current	≤ 400 mA		
	Voltage drop at 400 mA	≤ 1 V		
	Analog signal input	Voltage range	+10 V to -10 V	
Input resistance		5 kΩ		
Solution		10 Bit		
Mass	8 kg			

		TLC 411P	TLC 412P
Ambient conditions	Ambient temperature	0 to 45 °C	
		The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.	
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 34	
Characteristic curves	See catalogue of Twin Line Motors		
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		



Dimensional drawing of positioning controllers for 3-phase stepping motors

	TLC 41x	TLC 41xP
Width A	108 mm	127 mm
Height B	212.5 mm	360 mm
Depth C	184.5 mm	245 mm
Front width D	105.5 mm	127 mm
Fitting dimension E	63 mm	80 mm



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

RM-C

The RM-C module recognizes any position deviations in the movements of a stepping motor.

The actual positions registered by the rotary encoder are compared with the set positions. If the deviation exceeds a defined value, a drag error is returned.

ESIM3-C

The ESIM3-C module outputs the position data of the stepping motor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted resolution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Use of this module requires that slot M2 is equipped with an RM-C module.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs	polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms	
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs	inductively load-capable (50 mH), short-circuit-proof, polarity-secured	
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
RM-C	Signal inputs (A, B)	RS422 level, galvanically connected with 24VGND	
		input frequencies	\leq 400 kHz, 160000 Inc/s
		RPM sensor pitch	1000 marks
	output RPM sensor supply	5V \pm 5%, \leq 300 mA, sense-controlled, short circuit and overload-proof	
ESIM3-C	Signal outputs A/B	RS 422 voltage compatible, electrically connected to 24 VGND	
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface	
	Transfer rate	max. 38.4 kBaud	
	Supply voltage output	+12 V (min. 9 V to max. 15 V)	
PBDP-C		meets the RS 485 norm, electrically isolated	
	Transfer rate	\leq 12 MBaud	
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor	
	Cable length	Standard Profibus-DP	
CAN-C		Level according to ISO 11898, electrically isolated	
	Transfer rate	\leq 1 MBaud, adjustable	
	Cable length	at 125 kBaud	max. 500 m
		at 500 kBaud	max. 100 m
	Level	CAN-L/CAN-H	according to ISO 11898
Matching resistor	at both ends	120 Ω	
IBS-C		meets Interbus specification	
	Transfer rate	500 kBaud	
	Cable length	max. distance to next network participant 400 m	

Modules		
SAM-C	24-VDC-supply voltage	PELV, DIN 19240, polarity-secured
	input voltage range (being monitored)	20 - 30 V
	input ripple	< 2 V _{SS}
	input current without load on outputs	< 0,02 A
	Digital signal inputs	polarity-secured, no galvanic insulation, damping time >1 ms
	time window for simultan switching of both signals of one switch pair	10 s
	DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)
	DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)
	Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA
	Digital signal outputs	inductively load-capable (150 mH /11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
	DC voltage	≤ 30 V
	switching current RELAY_A, RELAY_B, INTERLOCK-OUT	≤ 0,5 A
	switching current SAFETY24VDC-A; SAFETY24VDC-B	≤ 0,3 A
	switching current AUXOUT1, AUXOUT2	≤ 0,1 A

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 41x, protection type IP 20

Example	TLC	4	1	X	X	X	X	X	X
Device function	TLC	4	1	X	X	X	X	X	X
4	= Positioning controller with data set processing								
Motor	TLC	4	1	X	X	X	X	X	X
1	= 3-phase stepping motor								
Rated power	TLC	4	1	X	X	X	X	X	X
1	= 350W								
2	= 750W								
Mains Filter	TLC	4	1	X	X	X	X	X	X
F	= with mains filter, mains voltage 230V								
NF	= without mains filter, mains voltage reversible 115V/230V								
M1 = Analogous	TLC	4	1	X	X	X	X	X	X
IOM	= analogous module								
-	= not equipped								
M2 = Capture motor position	TLC	4	1	X	X	X	X	X	X
RM	= Rotation monitoring for 1000-line encoder								
-	= not equipped								
M3 = Encoder simulation	TLC	4	1	X	X	X	X	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)								
SAM	= safety module (prerequisite: Plug-in M2 with RM-C module)								
-	= not equipped								
M4 = Communication	TLC	4	1	X	X	X	X	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable								
IBS	= Interbus								
MODB	= ModBus ASCII or ModBus RTU, to be configured								
PBDP	= Profibus DP								
RS 485	= RS 485								
-	= not equipped								

Type key TLC 41xP, protection type IP 54

Example	TLC 4 1 X P S F X X X X X
Device function	TLC 4 1 X P S F X X X X X
4	= Positioning controller with data set processing
Motor	TLC 4 1 X P S F X X X X X
1	= 3-phase stepping motor
Rated power	TLC 4 1 X P S F X X X X X
1	= 350W
2	= 750W
Protection type	TLC 4 1 X P S F X X X X X
P	= Protection type IP 54
Mains voltage	TLC 4 1 X P S F X X X X X
S	= Mains voltage, reversible 115V/230V
Mains filter	TLC 4 1 X P S F X X X X X
F	= with mains filter, mains voltage 115V/230V
M1 = Analogous	TLC 4 1 X P S F X X X X X
IOM	= analogous module
-	= not equipped
M2 = Capture motor position	TLC 4 1 X P S F X X X X X
RM	= Rotation monitoring for 1000-line encoder
-	= not equipped
M3 = Encoder simulation	TLC 4 1 X P S F X X X X X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)
SAM	= safety module (prerequisite: Plug-in M2 with RM-C module)
-	= not equipped
M4 = Communication	TLC 4 1 X P S F X X X X X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable
IBS	= Interbus
MODB	= ModBus ASCII or ModBus RTU, to be configured
PBDP	= Profibus DP
RS 485	= RS 485
-	= not equipped
M5 = Integrated holding-break controller	TLC 4 1 X P S F X X X X X
HBC	= Holding Brake Controller integrated, cannot be retrofitted
-	= not equipped



Positioning controllers TLC 43x for AC synchronous servomotors

Positioning controllers TLC 43x

Positioning controllers with data set processing and integrated power electronics for AC synchronous servomotors are available in the following models:

Protection type IP 20:

- TLC 432: Single-axis positioning controller with data set processing, power class 3 A/750 W/1~
- TLC 434: Single-axis positioning controller with data set processing, power class 3 A/1.5 kW/3~
- TLC 436: Single-axis positioning controller with data set processing, power class 6 A/3 kW/3~
- TLC 438: Single-axis positioning controller with data set processing, power class 16 A/8 kW/3~

Optional protection type IP 54

- TLC 432P: Single-axis positioning controller with data set processing, power class 3 A/750 W/1~
- TLC 434P: Single-axis positioning controller with data set processing, power class 3 A/1.5 kW/3~

A mains filter, heat dissipater and ventilator are standard for all devices.

Acceleration and braking ramps

An asymmetric linear acceleration and braking ramp can be set for the positioning controller with integrated power electronics for AC synchronous servomotors. In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp or a torque ramp (max. motor current) may be selected as the quick-stop ramp for positioning controllers with integrated power electronics for AC synchronous servomotors.

Device protection

- Standard: Protection type IP 20 according to DIN EN 60529: 1991
- Option: Protection type IP 54, category 2 according to DIN EN 60529: 1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor
- Overheating (I^2t monitoring of motor, internal ballast resistance and output stage)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

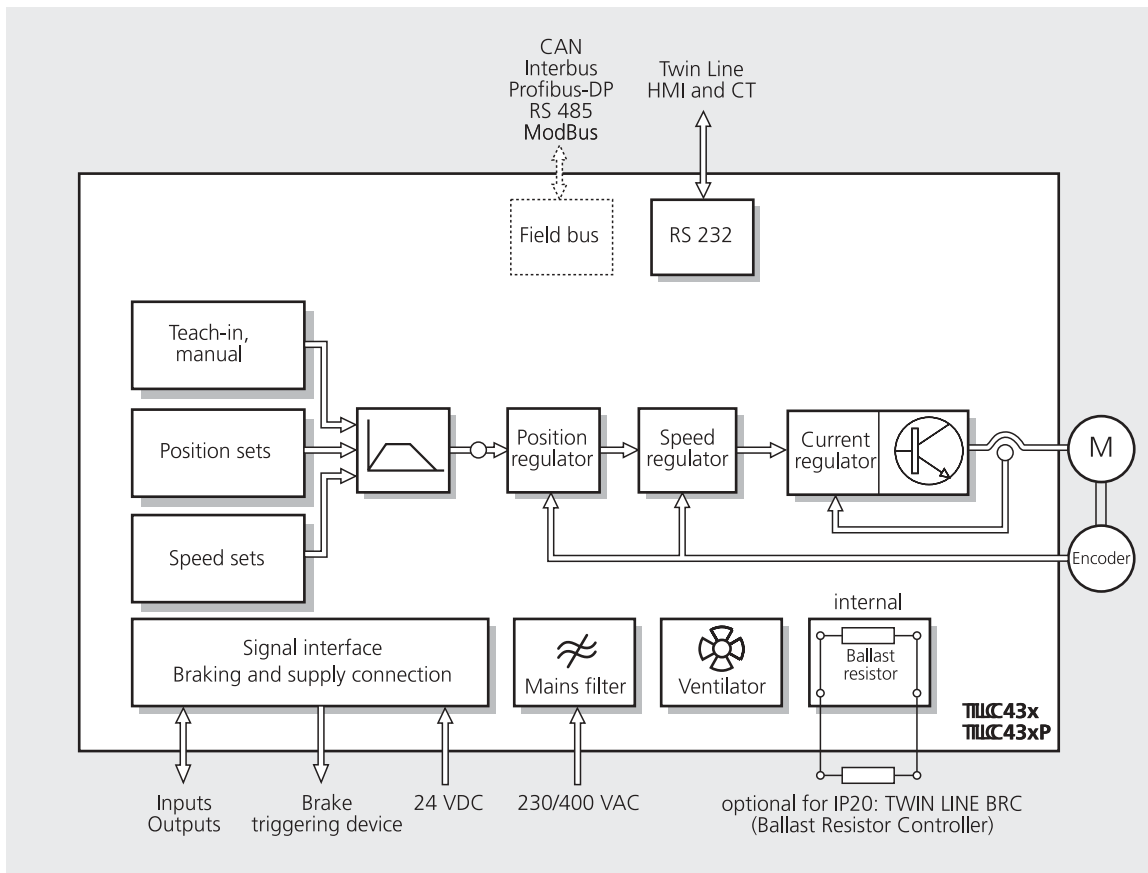


Diagram of positioning controllers with data set processing for AC synchronous servomotors

Technical data TLC 43x, protection type IP 20

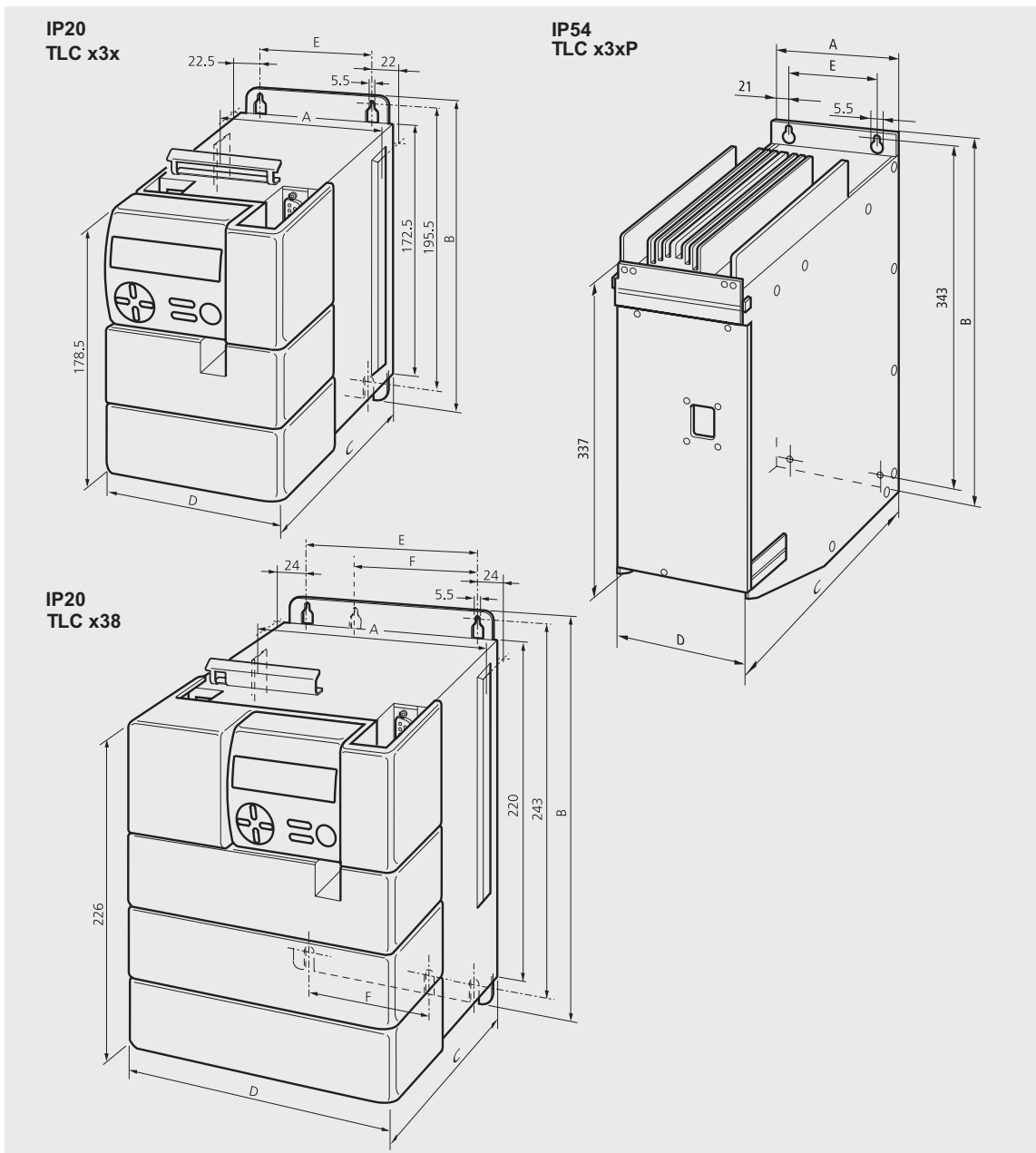
		TLC 432	TLC 434	TLC 436	TLC 438
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %		3 x 230 VAC -20 % to 480 VAC +10 %	
	Mains frequency	47 to 63 Hz			
	Current consumption	6.5 A	4 A	7.5 A	20 A
	Starting current	< 60 A			
	Fuse, external (B characteristic)	10 A		25 A	
Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}	1.5 kW _{eff}	3 kW _{eff}	8 kW _{eff}
	Rated current effective value	3 A _{eff}		6 A _{eff}	16 A _{eff}
	Rated current amplitude value	4,24 A _s		8,48 A _s	22,63 A _s
	Peak current for max. 5 s	11,31 A _s		28,28 A _s	45,26 A _s
	Switching frequency	8/16 kHz			4/8 kHz
	Max. rotary speed	6000 min ⁻¹			
Motor cable	Cable length	≤ 20 m standard > 20 m upon request			
	Shielding connection	on both sides			
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²		4 mm ²
Intermediate-circuit connection	max. two devices of the same power class may be connected				
Internal breaking circuit	Continuous power	60 W	100 W	200 W	80 W
	Max. energy per braking sequence	350 Ws	600 Ws	100 Ws	130 Ws
24 VDC system supply voltage		PELV, DIN 19240, polarised			
	Input voltage range	20 to 30 V			
	Input ripple	< 2 V _{pp}			
	Input current without loading the outputs	< 2.5 A			
Signal inputs		polarised, no electrical isolation			
	Debounced	0.7 to 1.5 ms			
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)			
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)			
	Current	≤ 7 mA at 24 V			
Signal outputs		short-circuit proof			
	Inductive load capable	150 mH/11 W			
	DC voltage	≤ 30 V			
	Switching current	≤ 400 mA			
	Voltage drop at 400 mA	≤ 1 V			
Analog signal input	Voltage range	+10 V to -10 V			
	Input resistance	5 kΩ			
	Solution	10 Bit			

		TLC 432	TLC 434	TLC 436	TLC 438
Mass		2.7 kg	3.7 kg	6.6 kg	10.8 kg
Ambient conditions	Ambient temperature	0 to 50 °C			
	Transport and storage temperature	-40 to +70 °C			
	Relative humidity	15 to 85 % no condensation permissible			
	Altitude, without power reduction	h < 1000 m above sea level			
	Protection type according to DIN EN 60529: 1991	IP 20			
Characteristic curves	See catalogue of Twin Line Motors				
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.				

Technical data TLC 43xP, protection type IP 54

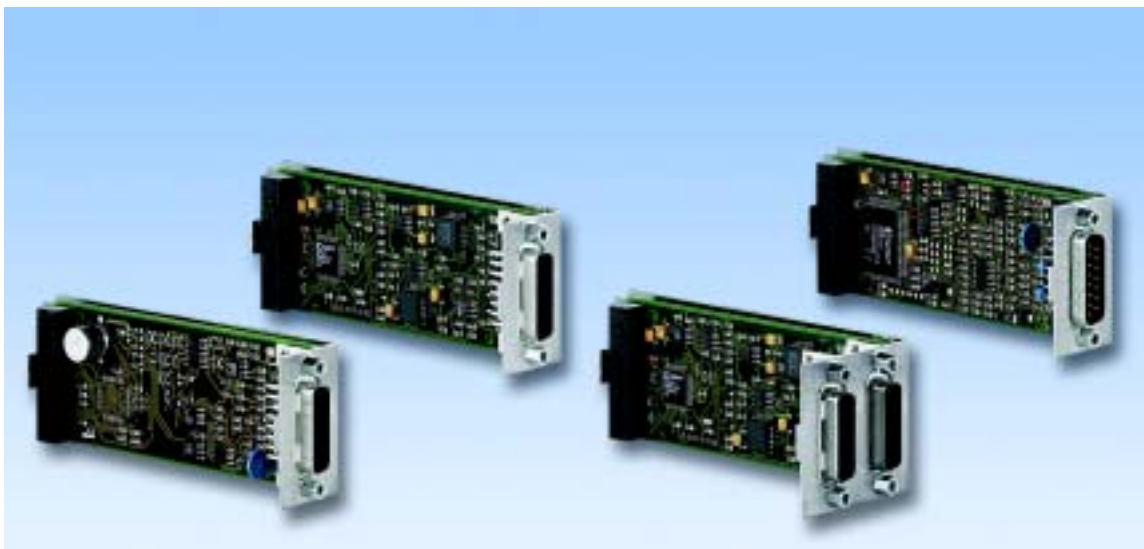
		TLC 432P	TLC 434P
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %	3 x 230 VAC -20 % to 480 VAC +10 %
	Mains frequency	47 to 63 Hz	
	Current consumption	6.5 A	4 A
	Starting current	< 60 A	
	Fuse, external (B characteristic)	10 A	
	Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}
Rated current effective value		3 A _{eff}	
Rated current amplitude value		4,24 A _s	
Peak current for max. 5 s		11,31 A _s	
Switching frequency		8/16 kHz	
Max. rotary speed		12000 min ⁻¹	
Motor cable		Cable length	≤ 20 m standard > 20 m upon request
	Shielding connection	on both sides	
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²
Intermediate-circuit connection	max. two devices of the same power class may be connected		
Internal breaking circuit	Continuous power	depends on the ambient temperature and ventilation, can be checked upon request	
	Max. energy per braking sequence	depends on the ambient temperature and ventilation, can be checked upon request	
24 VDC system supply voltage		PELV, DIN 19240, polarised	
	Input voltage range	20 to 30 V	
	Input ripple	< 2 V _{PP}	
	Input current without loading the outputs	< 2.5 A	
Signal inputs		polarised, no electrical isolation	
	Debounced	0.7 to 1.5 ms	
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)	
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)	
	Current	≤ 7 mA at 24 V	
Signal outputs		short-circuit proof	
	Inductive load capable	150 mH/11 W	
	DC voltage	≤ 30 V	
	Switching current	≤ 400 mA	
	Voltage drop at 400 mA	≤ 1 V	
Analog signal input	Voltage range	+10 V to -10 V	
	Input resistance	5 kΩ	
	Solution	10 Bit	

		TLC 432P	TLC 434P
Mass		8.5 kg	11 kg
Ambient conditions	Ambient temperature	0 to 45 °C	
		The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.	
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 24	
Characteristic curves	See catalogue of Twin Line Motors		
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		



Dimensional drawing of positioning controllers for AC synchronous servomotors

	TLC 432	TLC 434	TLC 436	TLC 438	TLC 432P	TLC 434P
Width A	108 mm	128 mm	178 mm	248 mm	127 mm	147 mm
Height B	212.5 mm	212.5 mm	260 mm	260 mm	360 mm	360 mm
Depth C	184.5 mm	214.5 mm	244.5 mm	244.5 mm	245 mm	275 mm
Front width D	105.5 mm	125.5 mm	176 mm	246 mm	127 mm	127 mm
Fitting dimension E	63 mm	83 mm	130 mm	200 mm	80 mm	100 mm
Additional dimension F	-	-	-	120 mm	-	-



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

HIFA-C

The HIFA-C module captures the motor position of AC synchronous servomotors equipped with a SinCos® absolute-value encoder.

The rotor position in the motor is detected optically and transferred as analog and digital position data to the HIFA-C module. The module resolves the signals with 14-bit resolution, corresponding to 16384 pulses/revolution. The absolute-value encoder integrated in the motor can be either a Single Turn (standard) or Multi Turn encoder. Once the motor is switched on, the Multi Turn encoder has the absolute position within 4096 revolutions.

In addition to the motor position data, the motor parameter set (electronic motor type plate) is transferred from the SinCos® memory to the HIFA-C module via the integrated RS 485 interface.

ESIM3-C

The ESIM3-C module outputs the position data of the AC servomotor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted solution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs	polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms	
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs	inductively load-capable (50 mH), short-circuit-proof, polarity-secured	
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
ESIM3-C	Signal outputs A/B	RS 422 voltage compatible, electrically connected to 24 VGND	
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface	
	Transfer rate	max. 38.4 kBaud	
PBDP-C	Supply voltage output	+12 V (min. 9 V to max. 15 V)	
		meets the RS 485 norm, electrically isolated	
	Transfer rate	\leq 12 MBaud	
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor	
CAN-C	Cable length	Standard Profibus-DP	
		level according to ISO 11898 electrically isolated	
	Transfer rate	\leq 1 MBaud, adjustable	
	Cable length	at 125 kBaud	max. 500 m
		at 500 kBaud	max. 100 m
Level	CAN-L/CAN-H	according to ISO 11898	
Matching resistor	at both ends	120 Ω	
IBS-C		meets Interbus specification	
	Transfer rate	500 kBaud	
	Cable length	max. distance to next network participant 400 m	

Modules		
SAM-C	24-VDC-supply voltage	PELV, DIN 19240, polarity-secured
	input voltage range (being monitored)	20 - 30 V
	input ripple	< 2 V _{SS}
	input current without load on outputs	< 0,02 A
	Digital signal inputs	polarity-secured, no galvanic insulation, damping time >1 ms
	time window for simultan switching of both signals of one switch pair	10 s
	DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)
	DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)
	Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA
	Digital signal outputs	inductively load-capable (150 mH / 11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
	DC voltage	≤ 30 V
	switching current RELAY_A, RELAY_B, INTERLOCK-OUT	≤ 0,5 A
	switching current SAFETY24VDC-A; SAFETY24VDC-B	≤ 0,3 A
	switching current AUXOUT1, AUXOUT2	≤ 0,1 A

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 43x, protection type IP 20

Example	TLC	4	3	X	F	X	HIFA	X	X
Device function	TLC	4	3	X	F	X	HIFA	X	X
4	= Positioning controller with data set processing								
Motor	TLC	4	3	X	F	X	HIFA	X	X
3	= AC synchronous servomotor								
Rated power	TLC	4	3	X	F	X	HIFA	X	X
2	= 750W								
4	= 1500W								
6	= 3000W								
8	= 8000W								
Mains filter	TLC	4	3	X	F	X	HIFA	X	X
F	= with mains filter								
M1 = Analogous	TLC	4	3	X	F	X	HIFA	X	X
IOM	= analogous module								
-	= not equipped								
M2 = Capture motor position	TLC	4	3	X	F	X	HIFA	X	X
HIFA	= SinCos [®] encoder								
M3 = Encoder simulation	TLC	4	3	X	F	X	HIFA	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals								
SAM	= safety module								
-	= not equipped								
M4 = Communication	TLC	4	3	X	F	X	HIFA	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable								
IBS	= Interbus								
MODB	= ModBus ASCII or ModBus RTU, to be configured								
PBDP	= Profibus-DP								
RS 485	= RS 485								
-	= not equipped								

Type key TLC 43XP, protection type IP 54

Example	TLC	4	3	X	P	F	X	HIFA	X	X	X
Device function	TLC	4	3	X	P	F	X	HIFA	X	X	X
4	= Positioning controller with data set processing										
Motor	TLC	4	3	X	P	F	X	HIFA	X	X	X
3	= AC synchronous servomotor										
Rated power	TLC	4	3	X	P	F	X	HIFA	X	X	X
2	= 750W										
4	= 1500W										
Protection type	TLC	4	3	X	P	F	X	HIFA	X	X	X
P	= Protection type IP 54										
Mains filter	TLC	4	3	X	P	F	X	HIFA	X	X	X
F	= with mains filter										
M1 = Analogous	TLC	4	3	X	P	F	X	HIFA	X	X	X
IOM	= analogous module										
-	= not equipped										
M2 = Capture motor position	TLC	4	3	X	P	F	X	HIFA	X	X	X
HIFA	= SinCos® encoder										
M3 = Encoder simulation	TLC	4	3	X	P	F	X	HIFA	X	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signales										
SAM	= safety module										
-	= not equipped										
M4 = Communication	TLC	4	3	X	P	F	X	HIFA	X	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable										
IBS	= Interbus										
MODB	= ModBus ASCII or ModBus RTU, to be configured										
PBDP	= Profibus-DP										
RS485	= RS 485										
-	= not equipped										
M5 = Integrated holding-break controller	TLC	4	3	X	P	F	X	HIFA	X	X	X
HBC	= Holding Brake Controller integrated, cannot be retrofitted										
-	= not equipped										

General device functions

The TLC 51x models are positioning controllers with integrated power electronics for 3-phase stepping motors or AC synchronous servomotors. The TLC 53x models are positioning controllers with integrated power electronics for AC synchronous servomotors. They are triggered via RS 485 or by a field-bus master (e.g. PC/PLC). The processing sequence is controlled via field-bus commands.

You can set parameters to assign the inputs and outputs the following functions:

- Setting of the network address, baud rate and field-bus profile for positioning controllers with RS 485, ModBus, PB-DP and CAN field-bus, enabling the Twin Line positioning controllers to be exchanged without any additional start-up tools
- Freely applicable and process-applicable 14 digital inputs, 5 digital outputs, and an analogous input $\pm 10V$, being controlled by field bus or by RS485
- Firmly occupied I/Os for manual operation, Teach-in, and output of internal process statuses

The standard controller model is equipped with the following connections:

- I/O signal connection
- Motor connection
- Mains connection
- Brake-triggering signal
- Connection for ballast controller
- RS 232 for communication with the Twin Line CT control software or the Twin Line HMI plug-in controller.
- Serial interface
- RS 485 serial interface or field-bus interface Interbus, Profibus-DP, CAN or ModBus

The following interfaces may also be added:

- Interface for position reference variable in the “electronic-gearing” mode or external position control (TLC 53x)
- Encoder-simulation interface for connecting follow-up axes
- SAM module for integrated safety technique
- Analog module IOM with two digital I/Os , and two analog I/Os

Positioning with field-bus interface via RS 485, Interbus-S, Profibus-DP or CAN-bus interface

Each operating mode has its own range of parameters for settings and activation. For example, various processing speeds may be set for each operating mode.

You can switch between operating modes via field-bus write access. The field-bus master may be a PC or a PLC, for example.

The master also sends parameters and commands to the Twin Line positioning controller (slave). The controller immediately executes the commands.

Device-related operation modes and functions:

Point-to-point

In point-to-point mode, a positioning command is used to position from point A to point B. The positioning may be absolute (relative to the zero-point of the axis) or relative (based on the current axis position).

Any changes to the set position or set speed are processed immediately (even during axis motion).

Speed mode

In speed mode, a speed is defined for the axis, and the movement is started without a target position. The axis moves at this speed until another speed set or operating mode is selected. This change is processed immediately, even while the axis is moving.

Electronic gearing

In “electronic-gearing” mode, the reference value is specified via a rotary encoder.

The following signal forms may be input as reference variables:

- A/B signals
- Pulse/direction signals
- Pulse_{forward}/pulse_{back} signals

The supplied reference variable is computed cyclically with the preset gear factor, and the axis is positioned accordingly. A new gear factor may also be entered while the axis is moving.

A point-to-point positioning process may be superimposed over the electronic gearing.

Reference run

Referencing assigns a defined axis position to a special mechanical position of the motor in the system. Referencing may be performed either by setting the dimensions to the current motor position or by executing a reference run.

The following types of reference run are available:

- Travel to positive, negative or additional limit switches
- Travel to positive, negative or additional limit switches with referencing to the index pulse

Manual run

You can initiate motor runs from a single step to continuous motion by operating the manual inputs or via the Twin Line HMI and Twin Line CT start-up tools.

Oscillator operation

In operation mode Oscillator the motor operates with RPM control. RPM setting is entered via $\pm 10 V$ input of the signal interface.

Current regulation at TLC 53x

In operation mode Current Control the nominal value of motor current is adjustable, either through parameter setting, or via ± 10 V input of the signal interface.

Selection of the type of current value entry, as well as setting of the nominal value, through parameter setting is possible via field bus, or with initial start software Twin Line CT.

Teach-in

Teach-in stores the current position value in the selected memory area. Up to 2 x 64 absolute switching positions of the integrated cam function can be "taught in" via input and output signals, Twin Line HMI or Twin Line CT. The data may also be read, written and copied via field-bus, Twin Line HMI or Twin Line CT.

Capture inputs

Current position values can be saved via two high-speed inputs or the index pulse of the position-reference encoder.

The capture inputs can be activated and the saved positions read out via field-bus, Twin Line HMI or Twin Line CT.

Cam-controller signal output

If the movement exceeds an absolute position value acquired/modified in teach-in mode, the output will be set according to the modified output state, i.e. this high-speed output will be set or reset based on the new position. The position is set parallel to the current operating mode.

Parameterisation

The parameters of the positioning controller and integrated power electronics of devices with an attached communication module can be read and written by the master (PC, PLC etc.) via field-bus or RS 485. Twin Line devices may thus be reproduced or replaced without difficulty, increasing flexibility for extensions and reducing maintenance costs.

The plug-in Twin Line HMI controller and Twin Line CT start-up software enable a complete device parameterisation as well as a transfer of all parameters from one device to another.

External position control at TLC 53x

An additional motor-separated incremental sensor (e.g. glass dipstick) is connected with the Twin Line device by an incremental sensor module (RS422-C) on module located at plug position M1. This executes direct position measurement of the installation.

The commutation position and the actual velocity (RPM) are still determined by the motor sensor and by the module located in plug position M2 of the Twin Line device.



Positioning controllers TLC 51x for 3-phase stepping motors

Positioning controllers TLC 51x

Positioning controllers with integrated power electronics devices for 3-phase stepping motors are available in the following models:

Protection type IP 20:

- TLC 511: Field-bus single-axis positioning controller, power class 3 A/350 W/1~
- TLC 512: Field-bus single-axis positioning controller, power class 7 A/750 W/1~

These devices can be specified as follows:

- 230 V mains voltage with integrated mains filter
- Reversible mains voltage 115 V/230 V without integrated mains filter

Optional protection type IP 54

- TLC 511P: Field-bus single-axis positioning controller, power class 3 A/350 W/1~
- TLC 512P: Field-bus single-axis positioning controller, power class 7 A/750 W/1~

The mains voltage for these devices is reversible 115 V/230 V. A mains filter is always integrated.

The ventilator and heat dissipater are standard equipment on all devices.

Acceleration and braking ramps

The following asymmetric ramp shapes may be defined for the positioning controller with integrated power electronics for 3-phase stepping motors:

- Linear ramp
- Exponential ramp, i.e. compensation for the torque drop typical of stepping motors at rising speed by a suitable optimised ramp

In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp is used as the quick-stop ramp for positioning controllers with integrated power electronics for 3-phase stepping motors.

Rotation monitoring

A shaft-encoder interface module, which enables the Twin Line positioning controller to detect mechanical motor overload, is available as an optional accessory.

The rotation monitoring system compares the set and actual motor positions and returns a rotary error if the difference exceeds the drag-error limit. The motor must be equipped with an encoder (1000 increments) for the rotation monitoring system to function.

Device protection

- Standard: Protection type IP 20 according to DIN EN 60529: 1991
- Option: Protection type IP 54, category 2 according to DIN EN 60529: 1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor (only with the rotation monitoring option)
- Rotation monitoring (optional)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

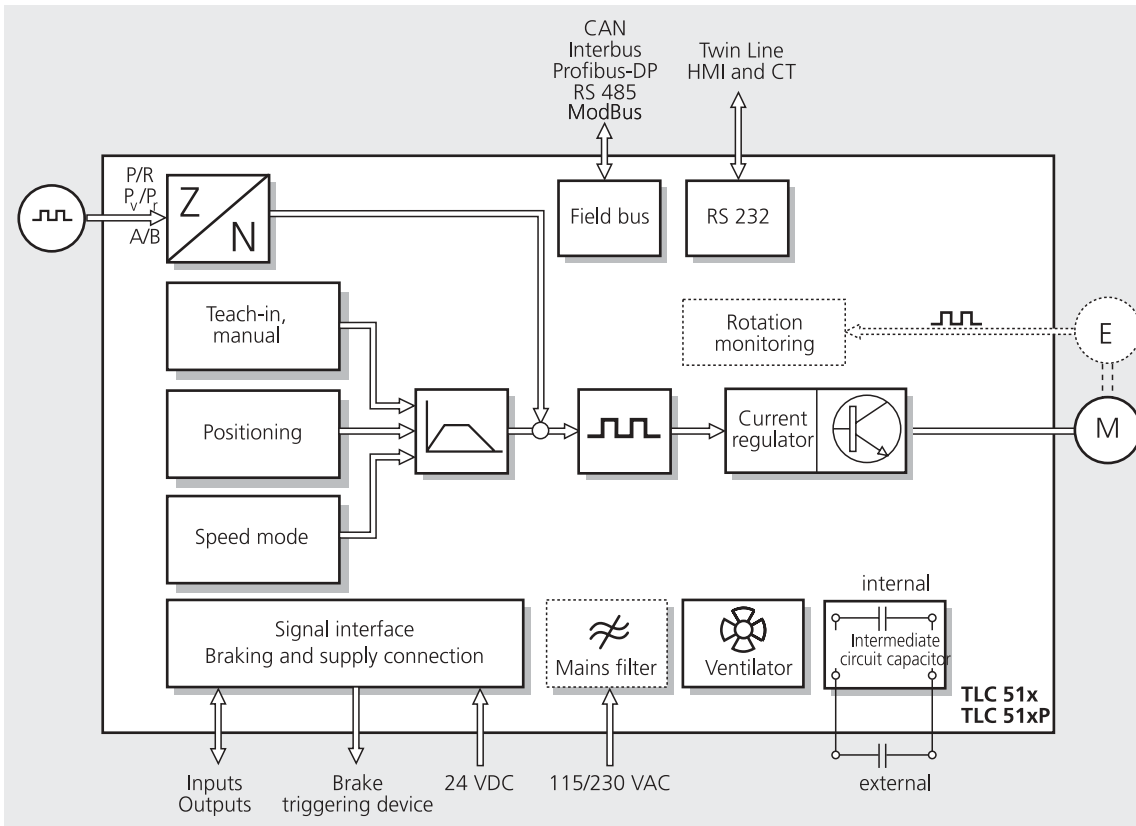


Diagram of positioning controllers with field-bus interface for 3-phase stepping motors

Technical data TLC 51x, protection type IP 20

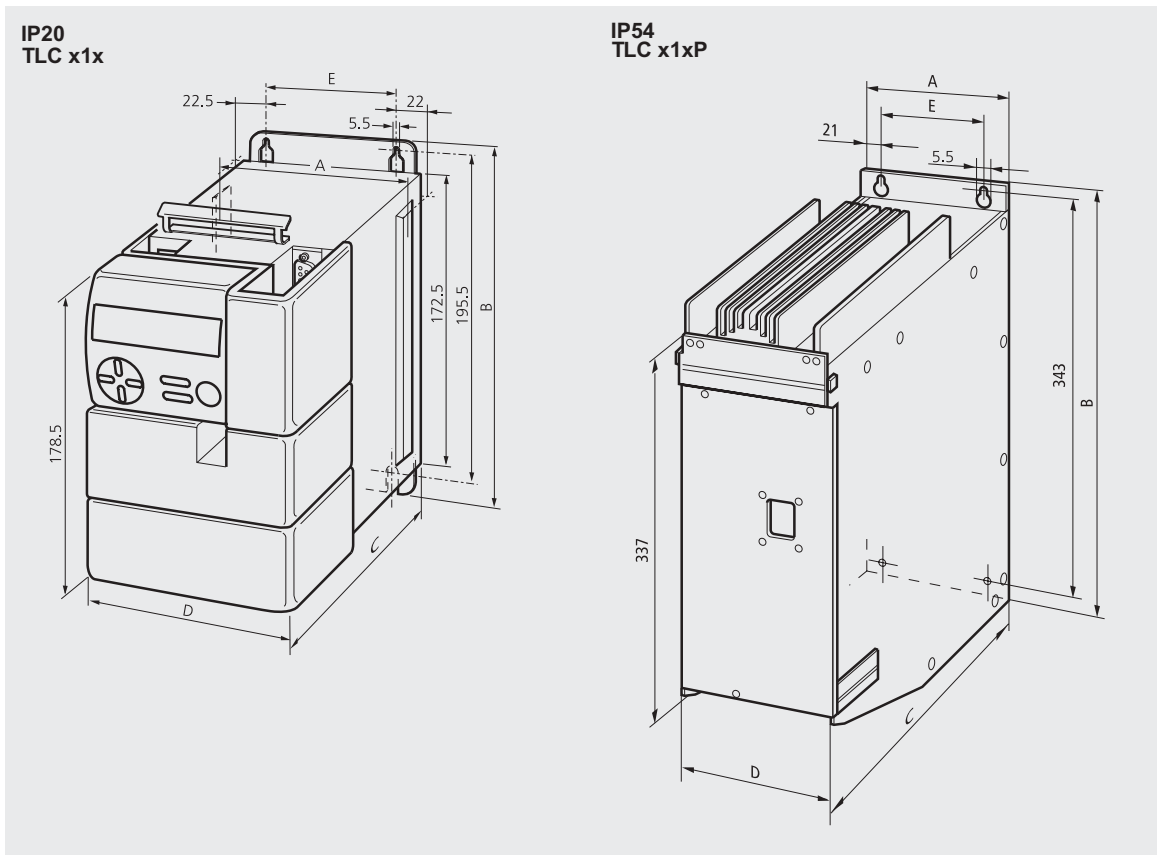
		TLC 511	TLC 512	
Mains connection	Mains voltage, non-reversible, mains filter integrated	1 x 230 VAC -20 % to 230 VAC +15 %		
	Mains voltage, reversible without mains filter	1 x 115 VAC -20 % to 115 VAC +15 %		
	Mains frequency	47 to 63 Hz		
	Current consumption at 230 V	2 A	5 A	
	Current consumption at 115 V	4 A	10 A	
	Starting current	< 60 A		
	Fuse protection, external at 230 V	10 A (C, K or similar characteristic)		
	Fuse protection, external at 115 V	10 A (C, K or similar characteristic)		
	Motor connection	Rated power at rated current	0.35 kW _{eff}	0.75 kW _{eff}
		Rated current	3 A _{eff}	7 A _{eff}
Switching frequency		16 kHz		
Max. rotary speed		3000 min ⁻¹		
Motor cable	Cable length	≤ 20 m standard > 20 m upon request		
	Shielding connection	on both sides		
	Cross section	1.5 mm ²		
24 VDC system supply voltage		PELV, DIN 19240, polarised		
	Input voltage range	20 to 30 V		
	Input ripple	< 2 V _{pp}		
	Input current without loading the outputs	< 2.5 A		
Signal inputs		polarised, no electrical isolation		
	Debounced	0.7 to 1.5 ms		
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)		
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)		
	Current	≤ 7 mA at 24 V		
Signal outputs		short-circuit proof		
	Inductive load capable	150 mH/11 W		
	DC voltage	≤ 30 V		
	Switching current	≤ 400 mA		
	Voltage drop at 400 mA	≤ 1 V		
Analog signal input	Voltage range	+10 V to -10 V		
	Input resistance	5 kΩ		
	Solution	10 Bit		
Mass		2.7 kg		

		TLC 511	TLC 512
Ambient conditions	Ambient temperature	0 to 50 °C	
	Transport and storage temperature	-40 to +70 °C	
	Relative humidity	15 to 85 % no condensation permissible	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 20	
Characteristic curves	See catalogue of Twin Line Motors		
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		

Technical data TLC 51xP, protection type IP 54

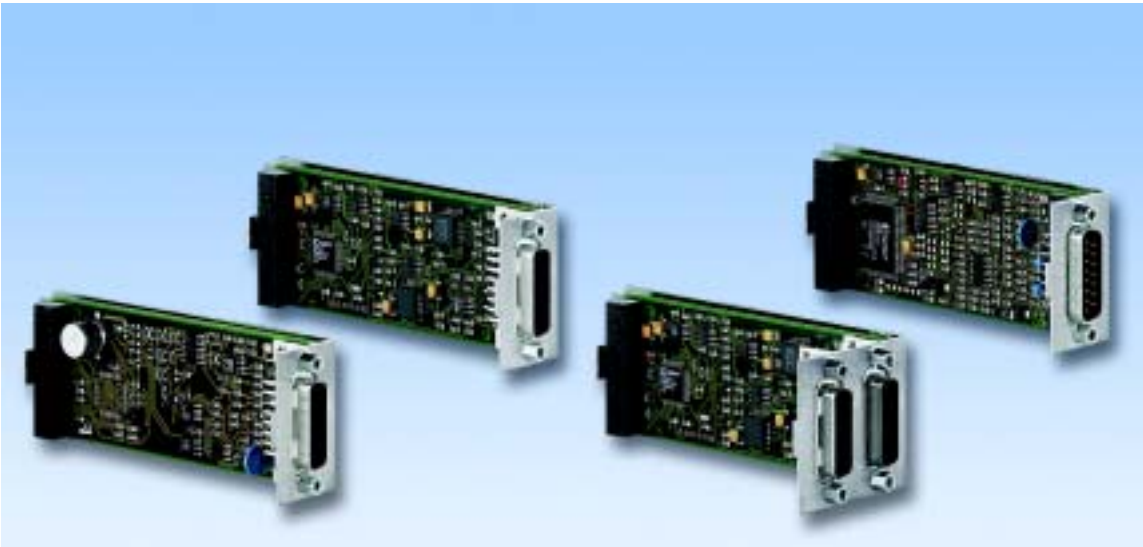
		TLC 511P	TLC 512P	
Mains connection	Mains voltage, reversible, mains filter integrated	1 x 115 VAC -20 % to 115 VAC +15 %		
		1 x 230 VAC -20 % to 230 VAC +15 %		
	Mains frequency	47 to 63 Hz		
	Current consumption at 230 V	2 A	5 A	
	Current consumption at 115 V	4 A	10 A	
	Starting current	< 60 A		
	Fuse protection, external at 230 V	10 A (C, K or similar characteristic)		
	Fuse protection, external at 115 V	10 A (C, K or similar characteristic)		
	Motor connection	Rated power at rated current	0.35 kW _{eff}	0.75 kW _{eff}
		Rated current	3 A _{eff}	7 A _{eff}
Switching frequency		16 kHz		
Max. rotary speed		3000 min ⁻¹		
Motor cable	Cable length	≤ 20 m standard > 20 m upon request		
	Shielding connection	on both sides		
	Cross section	1.5 mm ²		
24 VDC system supply voltage		PELV, DIN 19240, polarised		
	Input voltage range	20 to 30 V		
	Input ripple	< 2 V _{pp}		
	Input current without loading the outputs	< 2.5 A		
Signal inputs		polarised, no electrical isolation		
	Debounced	0.7 to 1.5 ms		
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)		
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)		
	Current	≤ 7 mA at 24 V		
Signal outputs		short-circuit proof		
	Inductive load capable	150 mH/11 W		
	DC voltage	≤ 30 V		
	Switching current	≤ 400 mA		
	Voltage drop at 400 mA	≤ 1 V		
	Analog signal input	Voltage range	+10 V to -10 V	
Input resistance		5 kΩ		
Solution		10 Bit		
Mass		8 kg		

		TLC 511P	TLC 512P
Ambient conditions	Ambient temperature	0 to 45 °C	
		The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.	
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 34	
Characteristic curves	See catalogue of Twin Line Motors		
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		



Dimensional drawing of positioning controllers for 3-phase stepping motors

	TLC 51x	TLC 51xP
Width A	108 mm	127 mm
Height B	212.5 mm	360 mm
Depth C	184.5 mm	245 mm
Front width D	105.5 mm	127 mm
Fitting dimension E	63 mm	80 mm



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

RS 422-C

The RS 422-C encoder module is designed to capture encoder signals, which are fed in as A/B signals. It also detects and evaluates the index pulse. A typical application for this module is the “electronic gearing” function.

PULSE-C

The PULSE-C module captures positioning data as a pulse /direction signal or as a pulse_{forward}/pulse_{back} signal. A typical application is the “electronic gearing” function.

RM-C

The RM-C module recognizes any position deviations in the movements of a stepping motor.

The actual positions registered by the rotary encoder are compared with the set positions. If the deviation exceeds a defined value, a drag error is returned.

ESIM3-C

The ESIM3-C module outputs the position data of the stepping motor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted resolution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Use of this module requires that slot M2 is equipped with an RM-C module.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs		polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs		inductively load-capable (50 mH), short-circuit-proof, polarity-secured
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
RS 422-C	Inputs		RS 422 voltage compatible, electrically connected to 24 VGND
		input frequency	\leq 400 kHz
	Outputs	supply for the master rotary encoder	5 V \pm 5 %, max. 300 mA, sense- regulated, short-circuit proof, overload-proof
		max. length	100 m
	Signal cable	minimum cross section	0.5 mm ² for supply voltage 5 VDC and 5 VGND; 0.25 mm ² for other signals
PULSE-C	Inputs	triggering device	symmetric RS 422, asymmetric 4.5 V to 30 V, electrically connected with 24 VGND
		input resistance	5 k Ω
		input frequency, pulse signals	\leq 200 kHz
		input frequency, enable	\leq 1 kHz
	Outputs		open collector, short-circuit proof
		output voltage	\leq 30 V
		output current	\leq 50 mA
	Signal cable	max. length for an RS 422 connection	100 m
		max. length for an open collector connection	10 m
		minimum cross section of the signal leads	0.14 mm ²
ESIM3-C	Signal outputs A/B		RS 422 voltage compatible, electrically connected to 24 VGND

Modules				
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface		
	Transfer rate	max. 38.4 kBaud		
	Supply voltage output	+12 V (min. 9 V to max. 15 V)		
PBDP-C		meets the RS 485 norm, electrically isolated		
	Transfer rate	≤ 12 MBaud		
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor		
CAN-C	Cable length	standard Profibus-DP		
		level according to ISO 11898 electrically isolated		
	Transfer rate	≤ 1 MBaud, adjustable		
	Cable length	at 125 kBaud	max. 500 m	
		at 500 kBaud	max. 100 m	
Level	CAN-L/CAN-H	according to ISO 11898		
Matching resistor	at both ends	120 Ω		
IBS-C		meets Interbus specification		
	Transfer rate	500 kBaud		
	Cable length	max. distance to next network participant 400 m		
SAM-C	24-VDC-supply voltage	PELV, DIN 19240, polarity-secured		
		input voltage range (being monitored)	20 - 30 V	
		input ripple	< 2 V _{SS}	
		input current without load on outputs	< 0,02 A	
	Digital signal inputs		polarity-secured, no galvanic insulation, damping time >1 ms	
		time window for simultan switching of both signals of one switch pair	10 s	
		DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)	
		DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)	
		Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA	
		Digital signal outputs		inductively load-capable (150 mH /11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
			DC voltage	≤ 30 V
	switching current RELAY_A, RELAY_B, INTERLOCK-OUT		≤ 0,5 A	
	switching current SAFETY24VDC-A; SAFETY24VDC-B		≤ 0,3 A	
	switching current AUXOUT1, AUXOUT2		≤ 0,1 A	

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 51x, protection type IP 20

Example	TLC	5	1	X	X	X	X	X	X
Device function	TLC	5	1	X	X	X	X	X	X
5	= Positioning with field-bus interface								
Motor	TLC	5	1	X	X	X	X	X	X
1	= 3-phase stepping motor								
Rated power	TLC	5	1	X	X	X	X	X	X
1	= 350W								
2	= 750W								
Mains filter	TLC	5	1	X	X	X	X	X	X
F	= with mains filter, mains voltage 230V								
NF	= without mains filter, mains voltage, reversible 115V/230V								
M1 = Position set values	TLC	5	1	X	X	X	X	X	X
IOM	= analogous module								
PULSE	= for electronic gearbox A/B signals								
RS422	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal								
-	= not equipped								
M2 = Capture motor position	TLC	5	1	X	X	X	X	X	X
RM	= Rotation monitoring for 1000-line encoder								
-	= not equipped								
M3 = Encoder simulation	TLC	5	1	X	X	X	X	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)								
SAM	= safety module (prerequisite: Plug-in M2 with RM-C module)								
-	= not equipped								
M4 = Communication	TLC	5	1	X	X	X	X	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable								
IBS	= Interbus								
MODB	= ModBus ASCII or ModBus RTU, to be configured								
PBDP	= Profibus DP								
RS 485	= RS 485								

Type key TLC 51xP, protection type IP 54

Example	TLC 5 1 X P S F X X X X X
Device function	TLC 5 1 X P S F X X X X X
5 = Positioning with field-bus interface	
Motor	TLC 5 1 X P S F X X X X X
1 = 3-phase stepping motor	
Rated power	TLC 5 1 X P S F X X X X X
1 = 350W	
2 = 750W	
Protection type	TLC 5 1 X P S F X X X X X
P = Protection type IP 54	
Mains voltage	TLC 5 1 X P S F X X X X X
S = Mains voltage, reversible 115V/230V	
Mains filter	TLC 5 1 X P S F X X X X X
F = with mains filter, mains voltage 115V/230V	
M1 = Positions set values	TLC 5 1 X P S F X X X X X
IOM = analogous module	
PULSE = for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal	
RS422 = for electronic gearbox A/B signals	
- = not equipped	
M2 = Capture motor position	TLC 5 1 X P S F X X X X X
RM = Rotation monitoring for 1000-line encoder	
- = not equipped	
M3 = Encoder Simulation	TLC 5 1 X P S F X X X X X
ESIM3 = Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)	
SAM = safety module (prerequisite: Plug-in M2 with RM-C module)	
- = not equipped	
M4 = Communication	TLC 5 1 X P S F X X X X X
CAN = CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable	
IBS = Interbus	
MODB = ModBus ASCII or ModBus RTU, to be configured	
PBDP = Profibus DP	
RS 485 = RS 485	
M5 = Integrated holding-break controller	TLC 5 1 X P S F X X X X X
HBC = Holding Brake Controller integrated, cannot be retrofitted	
- = not equipped	



Positioning controllers TLC 53x for AC synchronous servomotors

Positioning controllers TLC 53x

Positioning controllers with integrated power electronics for AC synchronous servomotors are available in the following models:

Protection type IP 20:

- TLC 532: Field-bus single-axis positioning controller, power class 3 A/750 W/1~
- TLC 534: Field-bus single-axis positioning controller, power class 3 A/1.5 kW/3~
- TLC 536: Field-bus single-axis positioning controller, power class 6 A/3 kW/3~
- TLC 538: Field-bus single-axis positioning controller, power class 16 A/8 kW/3~

Optional protection type IP 54

- TLC 532P: Field-bus single-axis positioning controller, power class 3 A/750 W/1~
- TLC 534P: Field-bus single-axis positioning controller, power class 3 A/1.5 kW/3~

A mains filter, heat dissipater and ventilator are standard for all devices.

Acceleration and braking ramps

An asymmetric linear acceleration and braking ramp can be set for the positioning controller with integrated power electronics for AC synchronous servomotors. In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp or a torque ramp (max. motor current) may be selected as the quick-stop ramp for positioning controllers with integrated power electronics for AC synchronous servomotors.

Device protection

- Standard: protection type IP 20 according to DIN EN 60529: 1991
- Option: protection type IP 54, category 2 according to DIN EN 60529: 1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor
- Overheating (I^2t monitoring of motor, internal ballast resistance and output stage)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

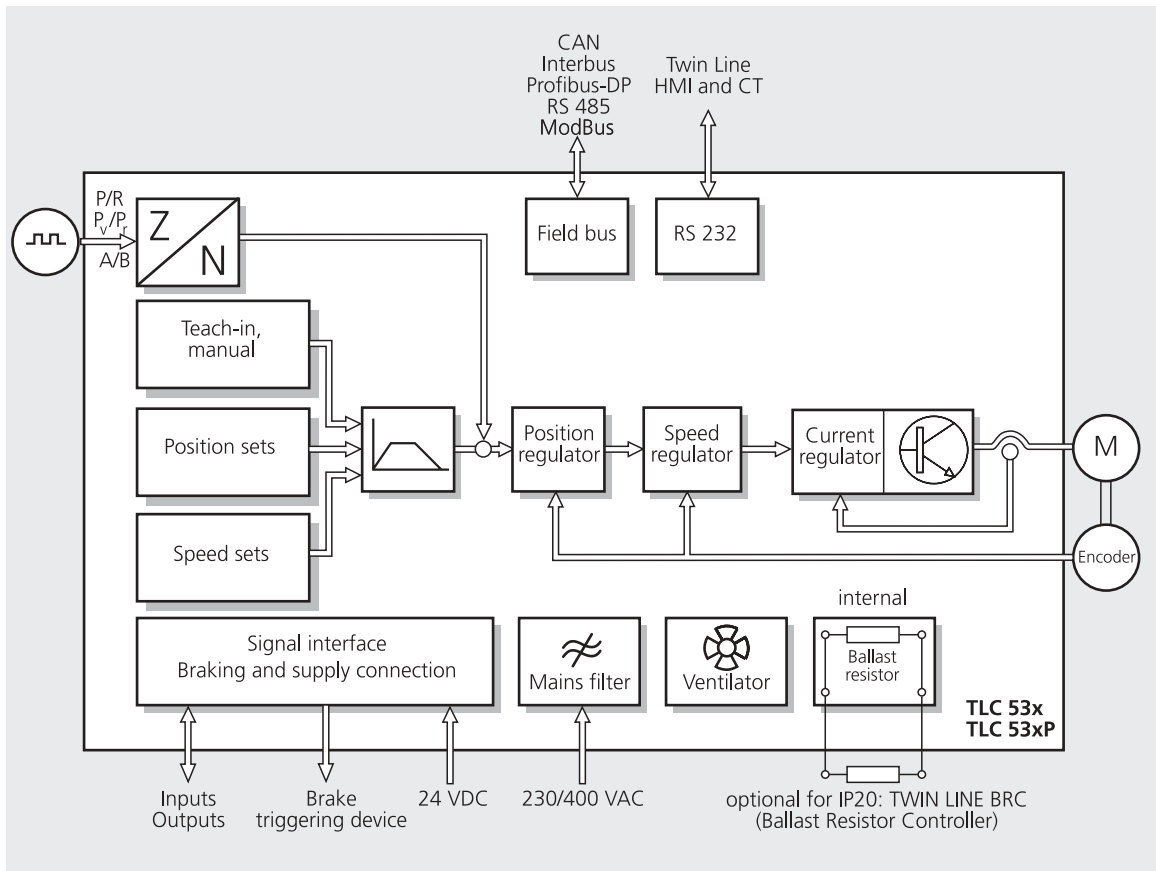


Diagram of positioning controllers with field-bus interface for AC synchronous servomotors

Technical data TLC 53x, protection type IP 20

		TLC 532	TLC 534	TLC 536	TLC 538
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %		3 x 230 VAC -20 % to 480 VAC +10 %	
	Mains frequency	47 to 63 Hz			
	Current consumption	6.5 A	4 A	7.5 A	20 A
	Starting current	< 60 A			
	Fuse, external (B characteristic)	10 A		25 A	
Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}	1.5 kW _{eff}	3 kW _{eff}	8 kW _{eff}
	Rated current effective value	3 A _{eff}		6 A _{eff}	16 A _{eff}
	Rated current amplitude value	4,24 A _s		8,48 A _s	22,63 A _s
	Peak current for max. 5 s	11;31 A _s		28,28 A _s	45,26 A _s
	Switching frequency	8/16 kHz			4/8 kHz
	Max. rotary speed	12000 min ⁻¹			
Motor cable	Cable length	≤ 20 m standard > 20 m upon request			
	Shielding connection	on both sides			
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²		4 mm ²
Intermediate-circuit connection	max. two devices of the same power class may be connected				
Internal breaking circuit	Continuous power	60 W	100 W	200 W	80 W
	Max. energy per braking sequence	350 Ws	600 Ws	100 Ws	130 Ws
24 VDC system supply voltage		PELV, DIN 19240, polarised			
	Input voltage range	20 to 30 V			
	Input ripple	< 2 V _{pp}			
	Input current without loading the outputs	< 2.5 A			
Signal inputs		polarised, no electrical isolation			
	Debounced	0.7 to 1.5 ms			
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)			
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)			
	Current	≤ 7 mA at 24 V			
Signal outputs		short-circuit proof			
	Inductive load capable	150 mH/11 W			
	DC voltage	≤ 30 V			
	Switching current	≤ 400 mA			
	Voltage drop at 400 mA	≤ 1 V			

Field-bus interface

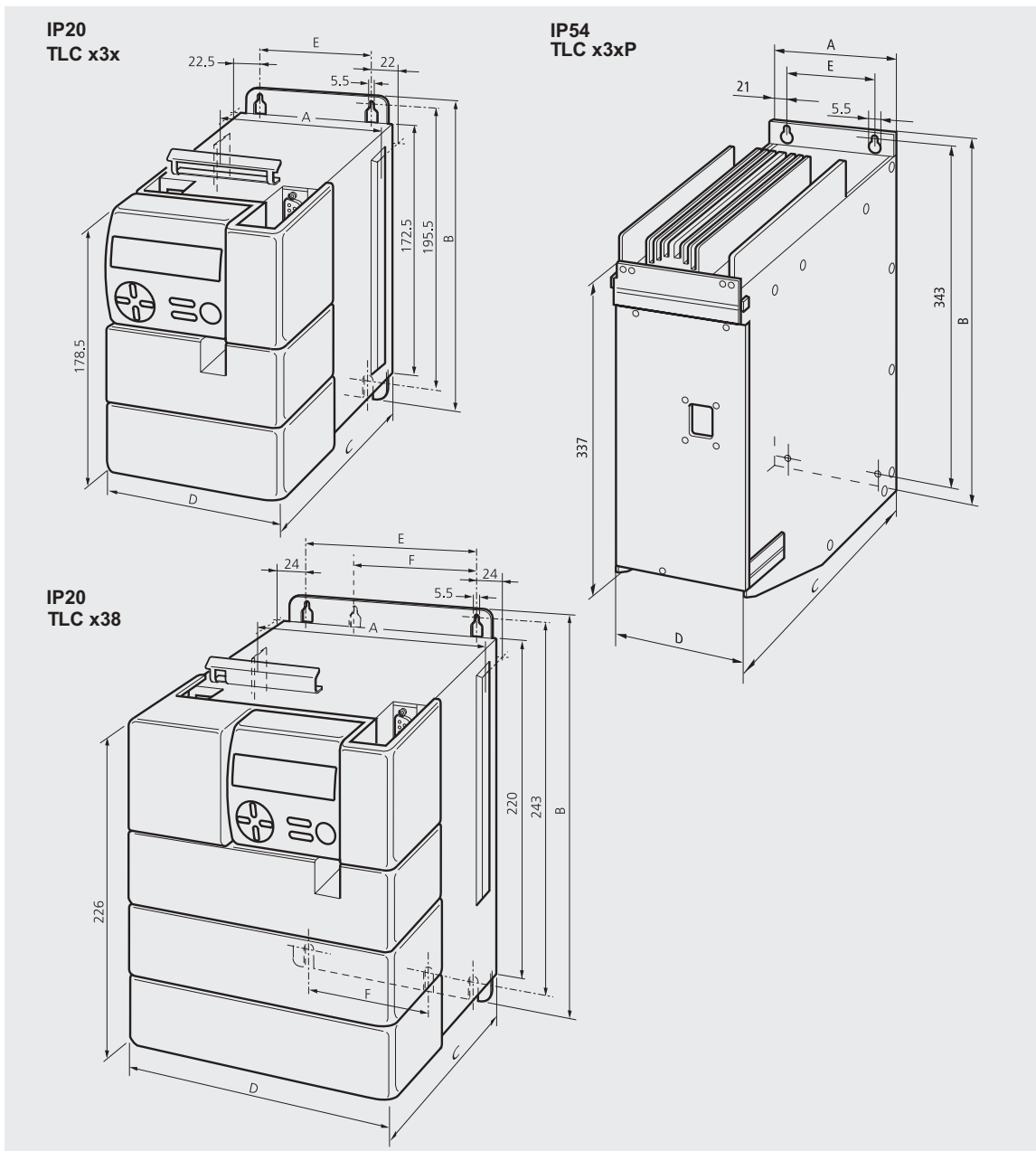
for AC synchronous servomotors

		TLC 532	TLC 534	TLC 536	TLC 538
Analog signal input	Voltage range	+10 V to -10 V			
	Input resistance	5 kΩ			
	Solution	10 Bit			
Mass		2.7 kg	3.7 kg	6.6 kg	10.8 kg
Ambient conditions	Ambient temperature	0 to 50 °C			
	Transport and storage temperature	-40 to +70 °C			
	Relative humidity	15 to 85 % no condensation permissible			
	Altitude, without power reduction	h < 1000 m above sea level			
	Protection type according to DIN EN 60529: 1991	IP 20			
Characteristic curves	See catalogue of Twin Line Motors				
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.				

Technical data TLC 53xP, protection type IP 54

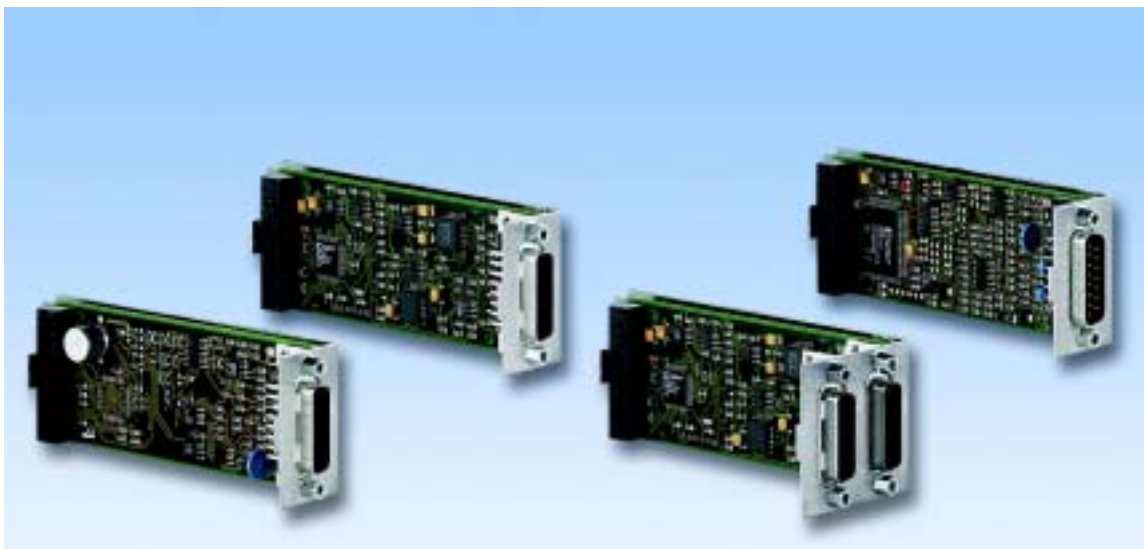
		TLC 532P	TLC 534P
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %	3 x 230 VAC -20 % to 480 VAC +10 %
	Mains frequency	47 to 63 Hz	
	Current consumption	6.5 A	4 A
	Starting current	< 60 A	
	Fuse, external (B characteristic)	10 A	
Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}	1.5 kW _{eff}
	Rated current effective value	3 A _{eff}	
	Rated current amplitude value	4,24 A _s	
	Peak current for max. 5 s	11,31 A _s	
	Switching frequency	8/16 kHz	
	Max. rotary speed	12000 min ⁻¹	
Motor cable	Cable length	≤ 20 m standard > 20 m upon request	
	Shielding connection	on both sides	
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²
Intermediate-circuit connection	max. two devices of the same power class may be connected		
Internal breaking circuit	Continuous power	depends on the ambient temperature and ventilation, can be checked upon request	
	Max. energy per braking sequence	depends on the ambient temperature and ventilation, can be checked upon request	
24 VDC system supply voltage		PELV, DIN 19240, polarised	
	Input voltage range	20 to 30 V	
	Input ripple	< 2 V _{PP}	
	Input current without loading the outputs	< 2.5 A	
Signal inputs		polarised, no electrical isolation	
	Debounced	0.7 to 1.5 ms	
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)	
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)	
	Current	≤ 7 mA at 24 V	
Signal outputs		short-circuit proof	
	Inductive load capable	150 mH/11 W	
	DC voltage	≤ 30 V	
	Switching current	≤ 400 mA	
	Voltage drop at 400 mA	≤ 1 V	
Analog signal input	Voltage range	+10 V to -10 V	
	Input resistance	5 kΩ	
	Solution	10 Bit	
Mass		8.5 kg	11 kg

		TLC 532P	TLC 534P
Ambient conditions	Ambient temperature	0 to 45 °C	
		The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.	
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 24	
Characteristic curves		See catalogue of Twin Line Motors	
UL 508C approved		You can find the limit values for the UL 508C approval in the documentation included with the device.	



Dimensional drawing of positioning controllers for AC synchronous servomotors

	TLC 532	TLC 534	TLC 536	TLC 538	TLC 532P	TLC 534P
Width A	108 mm	128 mm	178 mm	248 mm	127 mm	147 mm
Height B	212,5 mm	212,5 mm	260 mm	260 mm	360 mm	360 mm
Depth C	184,5 mm	214,5 mm	244,5 mm	244,5 mm	245 mm	275 mm
Front width D	105,5 mm	125,5 mm	176 mm	246 mm	122 mm	142 mm
Fitting dimension E	63 mm	83 mm	130 mm	200 mm	80 mm	100 mm
Additional dimension F	-	-	-	120 mm	-	-



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

RS 422-C

The RS 422-C encoder module is designed to capture encoder signals, which are fed in as A/B signals. It also detects and evaluates the index pulse. A typical application for this module is the “electronic gearing” function or external position control.

PULSE-C

The PULSE-C module captures positioning data as a pulse /direction signal or as a pulse_{forward}/pulse_{back} signal. A typical application is the “electronic gearing” function.

HIFA-C

The HIFA-C module captures the motor position of AC synchronous servomotors equipped with a SinCos® absolute-value encoder.

The rotor position in the motor is detected optically and transferred as analog and digital position data to the HIFA-C module. The module resolves the signals with 14-bit resolution, corresponding to 16384 pulses/revolution. The absolute-value encoder integrated in the motor can be either a Single Turn (standard) or Multi Turn encoder. Once the motor is switched on, the Multi Turn encoder has the absolute position within 4096 revolutions.

In addition to the motor position data, the motor parameter set (electronic motor type plate) is transferred from the SinCos® memory to the HIFA-C module via the integrated RS 485 interface.

ESIM3-C

The ESIM3-C module outputs the position data of the AC servomotor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted solution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs		polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs		inductively load-capable (50 mH), short-circuit-proof, polarity-secured
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
RS 422-C	Inputs		RS 422 voltage compatible, electrically connected to 24 VGND
		input frequency	\leq 400 kHz
	Outputs	Supply for the master rotary encoder	5 V \pm 5 % max. 300 mA, sense-regulated, short-circuit proof, overload-proof
		Signal cable	max. length
		minimum cross section	0.5 mm ² for supply voltage 5 VDC and 5 VGND; 0.25 mm ² for other signals
	PULSE-C	Inputs	triggering device
input resistance			5 k Ω
input frequency, pulse signals			\leq 200 kHz
input frequency, enable			\leq 1 kHz
Outputs			open collector, short-circuit proof
		output voltage	\leq 30 V
		output current	\leq 50 mA
Signal cable		max. length for an RS 422 connection	100 m
		max. length for an open collector connection	10 m
		minimum cross section of the signal leads	0.14 mm ²
ESIM3-C	Signal outputs A/B		RS 422 voltage compatible, electrically connected to 24 VGND

Modules			
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface	
	Transfer rate	max. 38.4 kBaud	
	Supply voltage output	+12 V (min. 9 V to max. 15 V)	
PBDP-C		meets the RS 485 norm, electrically isolated	
	Transfer rate	≤ 12 MBaud	
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor	
CAN-C	Cable length	Standard Profibus-DP	
		Level according to ISO 11898 electrically isolated	
	Transfer rate	≤ 1 MBaud, adjustable	
	Cable length	at 125 kBaud	max. 500 m
		at 500 kBaud	max. 100 m
Level	CAN-L/CAN-H	according to ISO 11898	
Matching resistor	at both ends	120 Ω	
IBS-C		meets Interbus specification	
	Transfer rate	500 kBaud	
	Cable length	max. distance to next network participant 400 m	
SAM-C	24-VDC-supply voltage		PELV, DIN 19240, polarity-secured
		input voltage range (being monitored)	20 - 30 V
		input ripple	< 2 V _{SS}
		input current without load on outputs	< 0,02 A
		Digital signal inputs	polarity-secured, no galvanic insulation, damping time >1 ms
		time window for simultan switching of both signals of one switch pair	10 s
		DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)
		DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)
		Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA
	Digital signal outputs		inductively load-capable (150 mH /11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
		DC voltage	≤ 30 V
		switching current RELAY_A, RELAY_B, INTERLOCK-OUT	≤ 0,5 A
		switching current SAFETY24VDC-A; SAFETY24VDC-B	≤ 0,3 A
		switching current AUXOUT1, AUXOUT2	≤ 0,1 A

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 53x, protection type IP 20

Example	TLC	5	3	X	F	X	HIFA	X	X
Device function	TLC	5	3	X	F	X	HIFA	X	X
5	= Positioning controller with field-bus interface								
Motor	TLC	5	3	X	F	X	HIFA	X	X
3	= AC synchronous servomotor								
Rated power	TLC	5	3	X	F	X	HIFA	X	X
2	= 750W								
4	= 1500W								
6	= 3000W								
8	= 8000W								
Mains filter	TLC	5	3	X	F	X	HIFA	X	X
F	= with mains filter								
M1 = Position set values	TLC	5	3	X	F	X	HIFA	X	X
IOM	= analogous module								
PULSE	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal								
RS422	= for electronic gearbox A/B signals								
–	= not equipped								
M2 = Capture motor position	TLC	5	3	X	F	X	HIFA	X	X
HIFA	= SinCos® encoder								
M3 = Encoder Simulation	TLC	5	3	X	F	X	HIFA	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals								
SAM	= safety module								
–	= not equipped								
M4 = Communication	TLC	5	3	X	F	X	HIFA	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable								
IBS	= Interbus								
MODB	= ModBus ASCII or ModBus RTU, to be configured								
PBDP	= Profibus DP								
RS485	= RS 485								

Type key TLC 53xP, protection type IP 54

Example	TLC 5 3 X P F X HIFA X X X
Device function	TLC 5 3 X P F X HIFA X X X
5 = Positioning controller with field-bus interface	
Motor	TLC 5 3 X P F X HIFA X X X
3 = AC synchronous servomotor	
Rated power	TLC 5 3 X P F X HIFA X X X
2 = 750W	
4 = 1500W	
Protection type	TLC 5 3 X P F X HIFA X X X
P = protection type IP 54	
Mains filter	TLC 5 3 X P F X HIFA X X X
F = with mains filter	
M1 = Position set values	TLC 5 3 X P F X HIFA X X X
IOM = analogous module	
PULSE = for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal	
RS422 = for electronic gearbox A/B signals	
- = not equipped	
M2 = Capture motor position	TLC 5 3 X P F X HIFA X X X
HIFA = SinCos® encoder	
M3 = Encoder Simulation	TLC 5 3 X P F X HIFA X X X
ESIM3 = Encoder simulation, 1 signal connection, A/B signals	
SAM = safety module	
- = not equipped	
M4 = Communication	TLC 5 3 X P F X HIFA X X X
CAN = CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable	
IBS = Interbus	
MODB = ModBus ASCII or ModBus RTU, to be configured	
PBDP = Profibus DP	
RS485 = RS 485	
M5 = Integrated holding-break controller	TLC 5 3 X P F X HIFA X X X
HBC = Holding Brake Controller integrated, cannot be retrofitted	
- = not equipped	

General device functions

The TLC 61x models are positioning controllers with integrated power electronics for 3-phase stepper motors or AC synchronous servomotors. The TLC 63x models are positioning controllers with integrated power electronics for AC synchronous servomotors.

The process sequence is freely programmable according to IEC 61131-3. The inputs and outputs are free for use in the sequence program.

The standard controller model is equipped with the following connections:

- I/O signal connection
- Motor connection
- Mains connection
- Brake-triggering signal
- Connection for ballast controller
- RS 232 for communication with the CoDeSys-PC development environment, the Twin Line CT software or with the plug-in Twin Line HMI device

The following interfaces may also be added:

- Interface for position reference variable in the “electronic-gearing” mode or external position control (TLC 63x)
- Encoder-simulation interface for connecting follow-up axes
- RS 485 serial interface or field-bus interface Interbus, Profibus-DP, CAN or ModBus
- SAM module for integrated safety technique
- Analog module IOM with two digital I/Os , and two analog I/Os

Freely programmable positioning controllers

The special feature of these freely programmable positioning and sequence controllers is the control of motor movement with simultaneous monitoring and control of sequences. Inputs and outputs can be processed cyclically parallel to the axis motion. The movement profiles can be freely designed, and the movements can be coupled to and synchronised with external events. The PLC and movement functionality integrated in the devices is programmed freely with the CoDeSys for Automation Alliance according to IEC 61131-3.

The user can select from the following programming languages:

- LD: Ladder diagram
- FBD: Function block diagram
- IL: Instruction list
- ST: Structured text
- SFC: Sequential function chart
- CFC: Continuous function chart

The master functionality controller can handle the following tasks using the plug-in CAN module:

- Device communication between TLC 6xx series devices
- Triggering and control of TLC 4xx and TLC 5xx series devices with the CAN module
- Visualisation and parameterisation using a control panel; various models of the Visu Line series can be adapted to the Twin Line series of devices
- Triggering and control of digital and analog field-bus terminals

In addition to the standard PLC functionality, device-related operation modes and functions are available from a voluminous library:

Point-to-point

In point-to-point mode, a positioning command is used to position from point A to point B. The positioning may be absolute (relative to the zero-point of the axis) or relative (based on the current axis position).

Any changes to the set position or set speed are processed immediately (even during axis motion).

Speed mode

In speed mode, a speed is defined for the axis, and the movement is started without a target position. The axis moves at this speed until another speed set or operating mode is selected. This change is processed immediately, even while the axis is moving.

Electronic gearing

In “electronic-gearing” mode, the reference value is specified via a rotary encoder.

The following signal forms may be input as reference variables:

- A/B signals
- Pulse/direction signals
- Pulse_{forward}/pulse_{back} signals

The supplied reference variable is computed cyclically with the preset gear factor, and the axis is positioned accordingly. A new gear factor may also be entered while the axis is moving.

A point-to-point positioning process may be superimposed over the electronic gearing.

Reference run

Referencing assigns a defined axis position to a special mechanical position of the motor in the system. Referencing may be performed either by setting the dimensions to the current motor position or by executing a reference run.

The following types of reference run are available:

- Travel to positive, negative or additional limit switches
- Travel to positive, negative or additional limit switches with referencing to the index pulse

Manual run

You can initiate motor runs from a single step to continuous motion by operating the manual inputs or via the Twin Line HMI, Twin Line CT start-up tools, or the CoDeSys programming system.

Oscillator operation

In operation mode Oscillator the motor operates with RPM control. RPM setting is entered via ± 10 V input of the signal interface.

Current regulation at TLC 63x

In operation mode Current Control the nominal value of motor current is adjustable, either through parameter setting, or via ± 10 V input of the signal interface.

Selection of the type of current value entry, as well as setting of the nominal value, through parameter setting is possible via field bus, or with initial start software Twin Line CT.

Teach-in

Teach-in stores the current position value in the selected memory area. Up to 2 x 64 absolute switching positions of the integrated cam function can be “taught in” via input and output signals, Twin Line HMI or Twin Line CT. The data may also be read, written and copied via field-bus, Twin Line HMI or Twin Line CT.

Capture inputs

Current position values can be saved via two high-speed inputs or the index pulse of the position-reference encoder.

The capture inputs can be activated and the saved positions read out via field-bus, Twin Line HMI, Twin Line CT, or the CoDeSys programming system.

Cam-controller signal output

If the movement exceeds an absolute position value acquired/modified in teach-in mode, the output will be set according to the modified output state, i.e. this high-speed output will be set or reset based on the new position. The position is set parallel to the current operating mode.

Parameterisation

The parameters of the positioning controller and integrated power electronics of devices with an attached communication module can be read and written by the master (PC, PLC etc.) via field-bus or RS 485. Twin Line devices may thus be reproduced or replaced without difficulty, increasing flexibility for extensions and reducing maintenance costs.

The plug-in Twin Line HMI control tool and Twin Line CT start-up software enable a complete device parameterisation as well as a transfer of all parameters from one device to another.

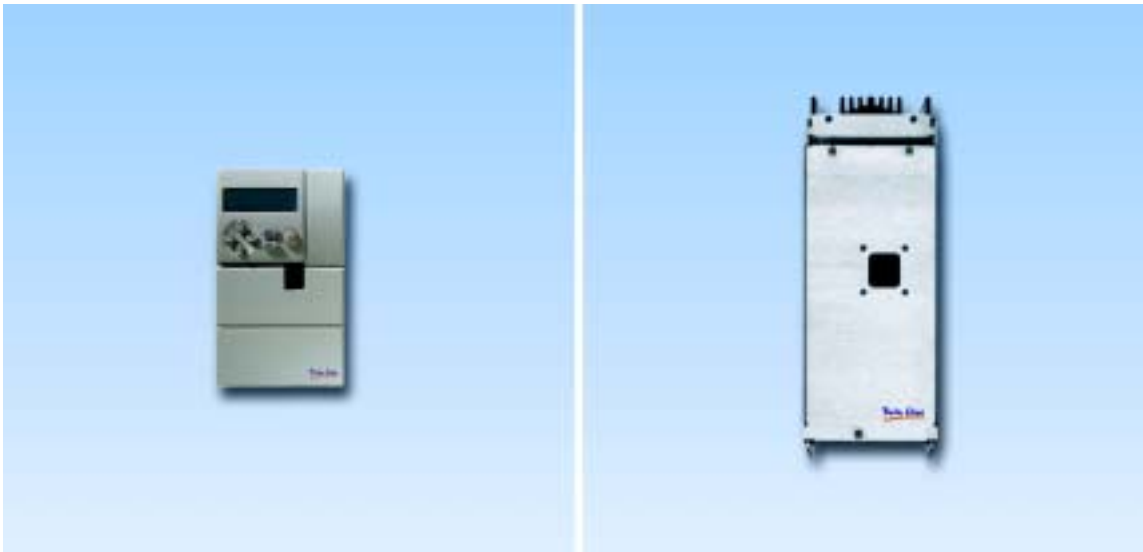
External position control at TLC 63x

An additional motor-separated incremental sensor (e.g. glass dipstick) is connected with the Twin Line device by an incremental sensor module (RS422-C) on module located at plug position M1. This executes direct position measurement of the installation.

The commutation position and the actual velocity (RPM) are still determined by the motor sensor and by the module located in plug position M2 of the Twin Line device.

Electrical cam (CAM)

The electronic cam (CAM) replaces a required mechanical cam, controlling follower sequential motion (Slave motion) via TLC6xx control, in turn controlled by leading position. The relation from leading position to follower position is described in a delineation table furnished together with a software for motion planning.



Positioning controllers TLC 61x for 3-phase stepping motors

Positioning controllers TLC 61x

Positioning controllers with integrated power electronics devices for 3-phase stepping motors are available in the following models:

Protection type IP 20:

- TLC 611: Freely programmable single-axis positioning controller, power class 3 A/350 W/1~
- TLC 612: Freely programmable single-axis positioning controller, power class 7 A/750 W/1~

These devices can be specified as follows:

- 230 V mains voltage with integrated mains filter
- Reversible mains voltage 115 V/230 V without integrated mains filter

Optional protection type IP 54

- TLC 611P: Freely programmable single-axis positioning controller, power class 3 A/350 W/1~
- TLC 612P: Freely programmable single-axis positioning controller, power class 7 A/750 W/1~

The mains voltage for these devices is reversible 115 V/230 V. A mains filter is always integrated.

The ventilator and heat dissipater are standard equipment on all devices.

Acceleration and braking ramps

The following asymmetric ramp shapes may be defined for the positioning controller with integrated power electronics for 3-phase stepping motors:

- Linear ramp
- Exponential ramp, i.e. compensation for the torque drop typical of stepping motors at rising speed by a suitable optimised ramp

In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp is used as the quick-stop ramp for positioning controllers with integrated power electronics for 3-phase stepping motors.

Rotation monitoring

A shaft-encoder interface module, which enables the Twin Line positioning controller to detect mechanical motor overload, is available as an optional accessory.

The rotation monitoring system compares the set and actual motor positions and returns a rotary error if the difference exceeds the drag-error limit. The motor must be equipped with an encoder (1000 increments) for the rotation monitoring system to function.

Device protection

- Standard: Protection type IP 20 according to DIN EN 60529: 1991
- Option: Protection type IP 54, category 2 according to DIN EN 60529: 1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor (only with the rotation monitoring option)
- Rotation monitoring (optional)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

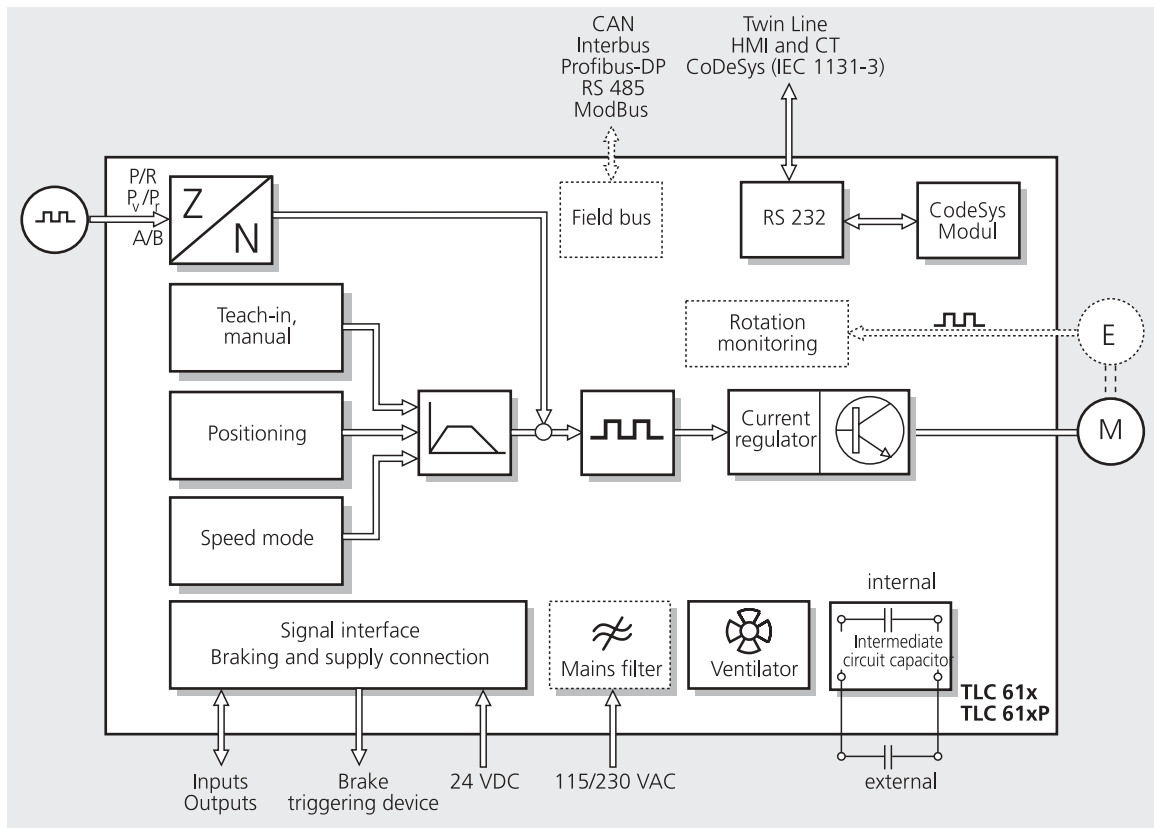


Diagram of freely programmable positioning controllers for 3-phase stepping motors

Technical data TLC 61x, protection type IP 20

	TLC 611	TLC 612	
Mains connection	Mains voltage, non-reversible, mains filter integrated	1 x 230 VAC -20 % to 230 VAC +15 %	
	Mains voltage, reversible, without mains filter	1 x 115 VAC -20 % to 115 VAC +15 %	
		1 x 230 VAC -20 % to 230 VAC +15 %	
Mains frequency	47 to 63 Hz		
Current consumption at 230 V	2 A	5 A	
Current consumption at 115 V	4 A	10 A	
Starting current	< 60 A		
Fuse protection, external at 230 V	10 A (C, K or similar characteristic)		
Fuse protection, external at 115 V	10 A (C, K or similar characteristic)		
Motor connection	Rated power at rated current	0.35 kW _{eff}	0.75 kW _{eff}
	Rated current	3 A _{eff}	7 A _{eff}
	Switching frequency	16 kHz	
	Max. rotary speed	3000 min ⁻¹	
Motor cable	Cable length	≤ 20 m standard > 20 m upon request	
	Shielding connection	on both sides	
	Cross section	1.5 mm ²	
24 VDC system supply voltage		PELV, DIN 19240, polarised	
	Input voltage range	20 to 30 V	
	Input ripple	< 2 V _{pp}	
	Input current without loading the outputs	< 2.5 A	
Signal inputs		polarised, no electrical isolation	
	Debounced	0.7 to 1.5 ms	
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)	
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)	
	Current	≤ 7 mA at 24 V	
Signal outputs		short-circuit proof	
	Inductive load capable	150 mH/11 W	
	DC voltage	≤ 30 V	
	Switching current	≤ 400 mA	
	Voltage drop at 400 mA	≤ 1 V	
Analog signal input	Voltage range	+10 V to -10 V	
	Input resistance	5 kΩ	
	Solution	10 Bit	
Mass	2.7 kg		

Freely programmable

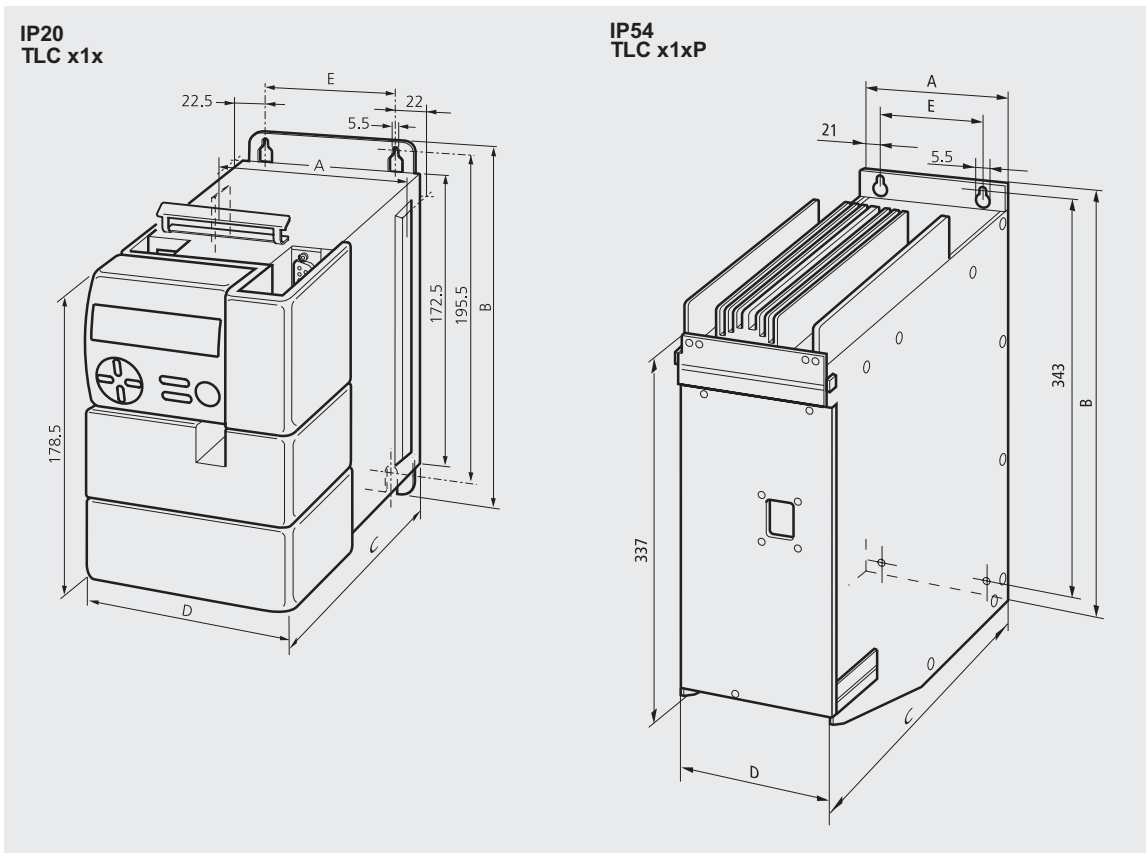
for 3-phase stepping motors

		TLC 611	TLC 612
Ambient conditions	Ambient temperature	0 to 50 °C	
	Transport and storage temperature	-40 to +70 °C	
	Relative humidity	15 to 85 % no condensation permissible	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 20	
Characteristic curves	See catalogue of Twin Line Motors		
Working memory available for the application	Residual memory for the user program	256 kByte	
	Residual memory for data (Flash PROM)	8 kByte	
	Residual memory for power-fail data (Retain)	100 Byte	
	Non-residual memory for data	128 kByte	
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		

Technical data TLC 61xP, protection type IP 54

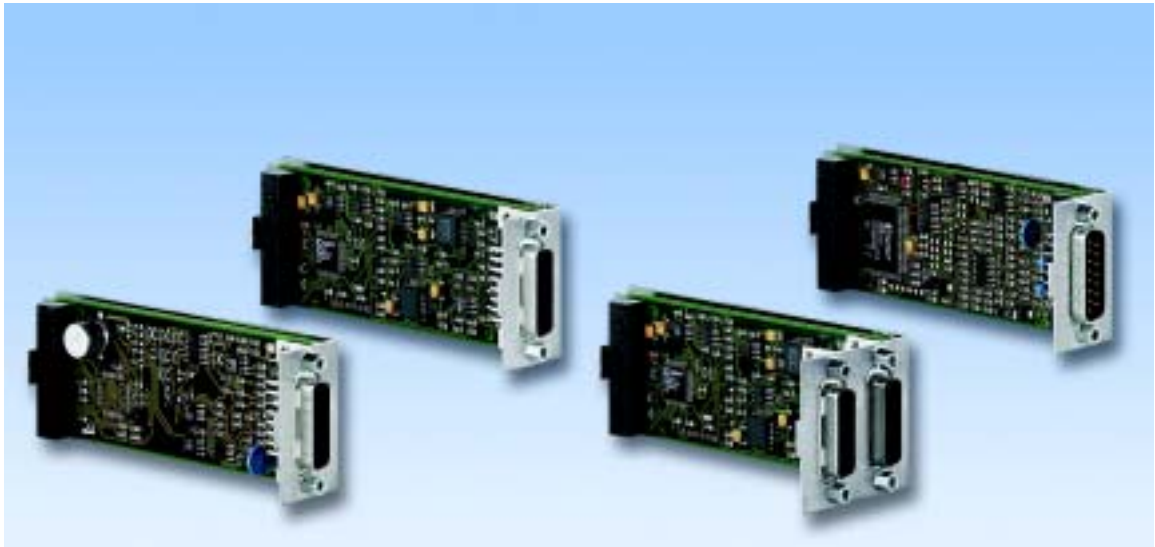
		TLC 611P	TLC 612P
Mains connection	Mains voltage, reversible, mains filter integrated	1 x 115 VAC -20 % to 115 VAC +15 %	
		1 x 230 VAC -20 % to 230 VAC +15 %	
	Mains frequency	47 to 63 Hz	
	Current consumption at 230 V	2 A	5 A
	Current consumption at 115 V	4 A	10 A
	Starting current	< 60 A	
	Fuse protection, external at 230 V	10 A (C, K or similar characteristic)	
Fuse protection, external at 115 V	10 A (C, K or similar characteristic)		
Motor connection	Rated power at rated current	0.35 kW _{eff}	0.75 kW _{eff}
	Rated current	3 A _{eff}	7 A _{eff}
	Switching frequency	16 kHz	
	Max. rotary speed	3000 min ⁻¹	
	Motor cable	Cable length	≤ 20 m standard > 20 m upon request
Shielding connection		on both sides	
Cross section		1.5 mm ²	
24 VDC system supply voltage		PELV, DIN 19240, polarised	
	Input voltage range	20 to 30 V	
	Input ripple	< 2 V _{pp}	
	Input current without loading the outputs	< 2.5 A	
Signal inputs		polarised, no electrical isolation	
	Debounced	0.7 to 1.5 ms	
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)	
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)	
	Current	≤ 7 mA at 24 V	
Signal outputs		short-circuit proof	
	Inductive load capable	150 mH/11 W	
	DC voltage	≤ 30 V	
	Switching current	≤ 400 mA	
	Voltage drop at 400 mA	≤ 1 V	
	Analog signal input	Voltage range	+10 V to -10 V
Input resistance		5 kΩ	
Solution		10 Bit	
Mass		8 kg	

		TLC 611P	TLC 612P
Ambient conditions	Ambient temperature	0 to 45 °C	
		The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.	
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529: 1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 34	
Characteristic curves	See catalogue of Twin Line Motors		
Working memory available for the application	Residual memory for the user program	256 kByte	
	Residual memory for data (Flash PROM)	8 kByte	
	Residual memory for power-fail data (Retain)	100 Byte	
	Non-residual memory for data	128 kByte	
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		



Dimensional drawing of positioning controllers for 3-phase stepping motors

	TLC 61x	TLC 61xP
Width A	108 mm	127 mm
Height B	212.5 mm	360 mm
Depth C	184.5 mm	245 mm
Front width D	105.5 mm	127 mm
Fitting dimension E	63 mm	80 mm



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

RS 422-C

The RS 422-C encoder module is designed to capture encoder signals, which are fed in as A/B signals. It also detects and evaluates the index pulse. A typical application for this module is the “electronic gearing” function.

PULSE-C

The PULSE-C module captures positioning data as a pulse/direction signal or as a pulse_{forward}/pulse_{back} signal. A typical application is the “electronic gearing” function.

RM-C

The RM-C module recognizes any position deviations in the movements of a stepping motor.

The actual positions registered by the rotary encoder are compared with the set positions. If the deviation exceeds a defined value, a drag error is returned.

ESIM3-C

The ESIM3-C module outputs the position data of the stepping motor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted resolution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Use of this module requires that slot M2 is equipped with an RM-C module.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs	polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms	
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs	inductively load-capable (50 mH), short-circuit-proof, polarity-secured	
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
		voltage decay at 50 mA	
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
RS 422-C	Inputs	RS 422 voltage compatible, electrically connected to 24 VGND	
		input frequency	\leq 400 kHz
	Outputs	Supply for the master rotary encoder	5 V \pm 5 %max. 300 mA, sense-regulated short-circuit proof, overload-proof
	Signal cable	max. length	100 m
		minimum cross section	0.5 mm ² for supply voltage 5 VDC and 5 VGND; 0.25 mm ² for other signals
	PULSE-C	Inputs	triggering device
input resistance			5 k Ω
input frequency, pulse signals			\leq 200 kHz
input frequency, enable			\leq 1 kHz
Outputs		open collector, short-circuit proof	
		output voltage	\leq 30 V
		output current	\leq 50 mA
Signal cable		max. length for an RS 422 connection	100 m
		max. length for an open collector connection	10 m
		minimum cross section of the signal leads	0.14 mm ²
ESIM3-C	Signal outputs A/B	RS 422 voltage compatible, electrically connected to 24 VGND	

Modules				
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface		
	Transfer rate	max. 38.4 kBaud		
	Supply voltage output	+12 V (min. 9 V to max. 15 V)		
PBDP-C		meets the RS 485 norm, electrically isolated		
	Transfer rate	≤ 12 MBaud		
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor		
	Cable length	Standard Profibus-DP		
CAN-C		Level according to ISO 11898 electrically isolated		
	Transfer rate	≤ 1 MBaud, adjustable		
	Cable length	at 125 kBaud	max. 500 m	
		at 500 kBaud	max. 100 m	
	Level	CAN-L/CAN-H	according to ISO 11898	
Matching resistor	at both ends	120 Ω		
IBS-C		meets Interbus specification		
	Transfer rate	500 kBaud		
	Cable length	max. distance to next network participator 400 m		
SAM-C	24-VDC-supply voltage		PELV, DIN 19240, polarity-secured	
		input voltage range (being monitored)	20 - 30 V	
		input ripple	< 2 V _{SS}	
		input current without load on outputs	< 0,02 A	
		Digital signal inputs		polarity-secured, no galvanic in- sulation, damping time >1 ms
		time window for simultan switching of both signals of one switch pair	10 s	
		DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)	
		DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)	
		Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA	
	Digital signal outputs			inductively load-capable (150 mH /11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
			DC voltage	≤ 30 V
			switching current RELAY_A, RELAY_B, INTERLOCK-OUT	≤ 0,5 A
			switching current SAFETY24VDC-A; SAFETY24VDC-B	≤ 0,3 A
			switching current AUXOUT1, AUXOUT2	≤ 0,1 A

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 61x, protection type IP 20

Example	TLC 6 1 X X X X X X
Device function	TLC 6 1 X X X X X X
6	= Freely programmable positioning controller according to IEC 61131-3
Motor	TLC 6 1 X X X X X X
1	= 3-phase stepping motor
Rated power	TLC 6 1 X X X X X X
1	= 350W
2	= 750W
Mains filter	TLC 6 1 X X X X X X
F	= with mains filter, mains voltage 115V/230 V
NF	= without mains filter, mains voltage, reversible 115 V/230 V
M1 = Position set values	TLC 6 1 X X X X X X
IOM	= analogous module
PULSE	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal
RS422	= for electronic gearbox A/B signals
-	= not equipped
M2 = Capture motor position	TLC 6 1 X X X X X X
RM	= Rotation monitoring for 1000-line encoder
-	= not equipped
M3 = Encoder Simulation	TLC 6 1 X X X X X X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)
SAM	= safety module (prerequisite: Plug-in M2 with RM-C module)
-	= not equipped
M4 = Communication	TLC 6 1 X X X X X X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable
IBS	= Interbus
MODB	= ModBus ASCII or ModBus RTU, to be configured
PBDP	= Profibus DP
RS485	= RS 485

Type key TLC 61xP, protection type IP 54

Example	TLC 6 1 X P S F X X X X X
Device function	TLC 6 1 X P S F X X X X X
6	= Freely programmable positioning controller according to IEC 61131-3
Motor	TLC 6 1 X P S F X X X X X
1	= 3-phase stepping motor
Rated power	TLC 6 1 X P S F X X X X X
1	= 350W
2	= 750W
Protection type	TLC 6 1 X P S F X X X X X
P	= protection type IP 54
Mains voltage	TLC 6 1 X P S F X X X X X
S	= Mains voltage, reversible 115V/230V
Mains filter	TLC 6 1 X P S F X X X X X
F	= with mains filter, mains voltage 115V/230V
M1 = Positions set values	TLC 6 1 X P S F X X X X X
IOM	= analogous module
PULSE	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal
RS422	= for electronic gearbox A/B signals
-	= not equipped
M2 = Capture motor position	TLC 6 1 X P S F X X X X X
RM	= Rotation monitoring for 1000-line encoder
-	= not equipped
M3 = Encoder Simulation	TLC 6 1 X P S F X X X X X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals (prerequisite: Plug-in M2 with RM-C module)
SAM	= safety module (prerequisite: Plug-in M2 with RM-C module)
-	= not equipped
M4 = Communication	TLC 6 1 X P S F X X X X X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable
IBS	= Interbus
MODB	= ModBus ASCII or ModBus RTU, to be configured
PBDP	= Profibus DP
RS485	= RS 485
M5 = Integrated holding-break controller	TLC 6 1 X P S F X X X X X
HBC	= Holding Brake Controller integrated, cannot be retrofitted
-	= not equipped



Freely programmable positioning controllers TLC 63x for AC synchronous servomotors

Positioning controllers TLC 63x

Positioning controllers with integrated power electronics for AC synchronous servomotors are available in the following models:

Protection type IP 20:

- TLC 632: Freely programmable single-axis positioning controller, power class 3 A/750 W/1~
- TLC 634: Freely programmable single-axis positioning controller, power class 3 A/1.5 kW/3~
- TLC 636: Freely programmable single-axis positioning controller, power class 6 A/3 kW/3~
- TLC 638: Freely programmable single-axis positioning controller, power class 16 A/8 kW/3~

Optional protection type IP 54

- TLC 632P: Freely programmable single-axis positioning controller, power class 3 A/750 W/1~
- TLC 634P: Freely programmable single-axis positioning controller, power class 3 A/1.5 kW/3~

A mains filter, heat dissipater and ventilator are standard for all devices.

Acceleration and braking ramps

An asymmetric linear acceleration and braking ramp can be set for the positioning controller with integrated power electronics for AC synchronous servomotors. In addition, a jolt filter may be connected to achieve jolt-free acceleration or braking phases, regardless of the current speed.

Quick-stop

Quick-stop is designed to bring the motor to a stop as quickly as possible.

A linear braking ramp or a torque ramp (max. motor current) may be selected as the quick-stop ramp for positioning controllers with integrated power electronics for AC synchronous servomotors.

Device protection

- Standard: Protection type IP 20 according to DIN EN 60529: 1991
- Option: Protection type IP 54, category 2 according to DIN EN 60529:1991
- Protection type 1 according to prEN 50178: 1994
- Overvoltage category III according to prEN 50178: 1994
- Pollution grade 2 according to prEN 50178: 1994

Protective and monitoring devices for

- Excess temperature electronics
- Excess temperature motor
- Overheating (I^2t monitoring of motor, internal ballast resistance and output stage)
- Short to earth
- Phase failure (Power supply and motor cable)
- Short circuit between the motor phases
- Under-/overvoltage of the intermediate circuit
- Motor velocity
- Data connection to control device

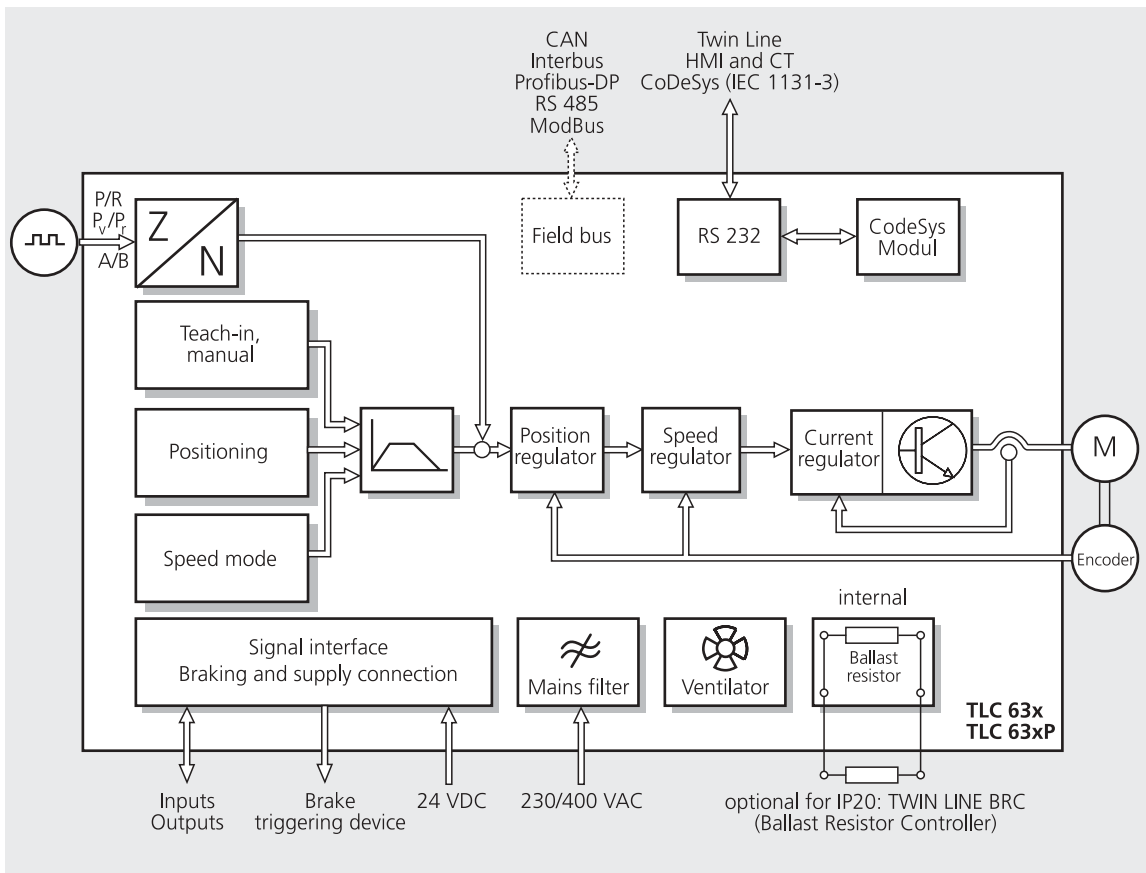


Diagram of freely programmable positioning controllers for AC synchronous servomotors

Technical data TLC 63x, protection type IP 20

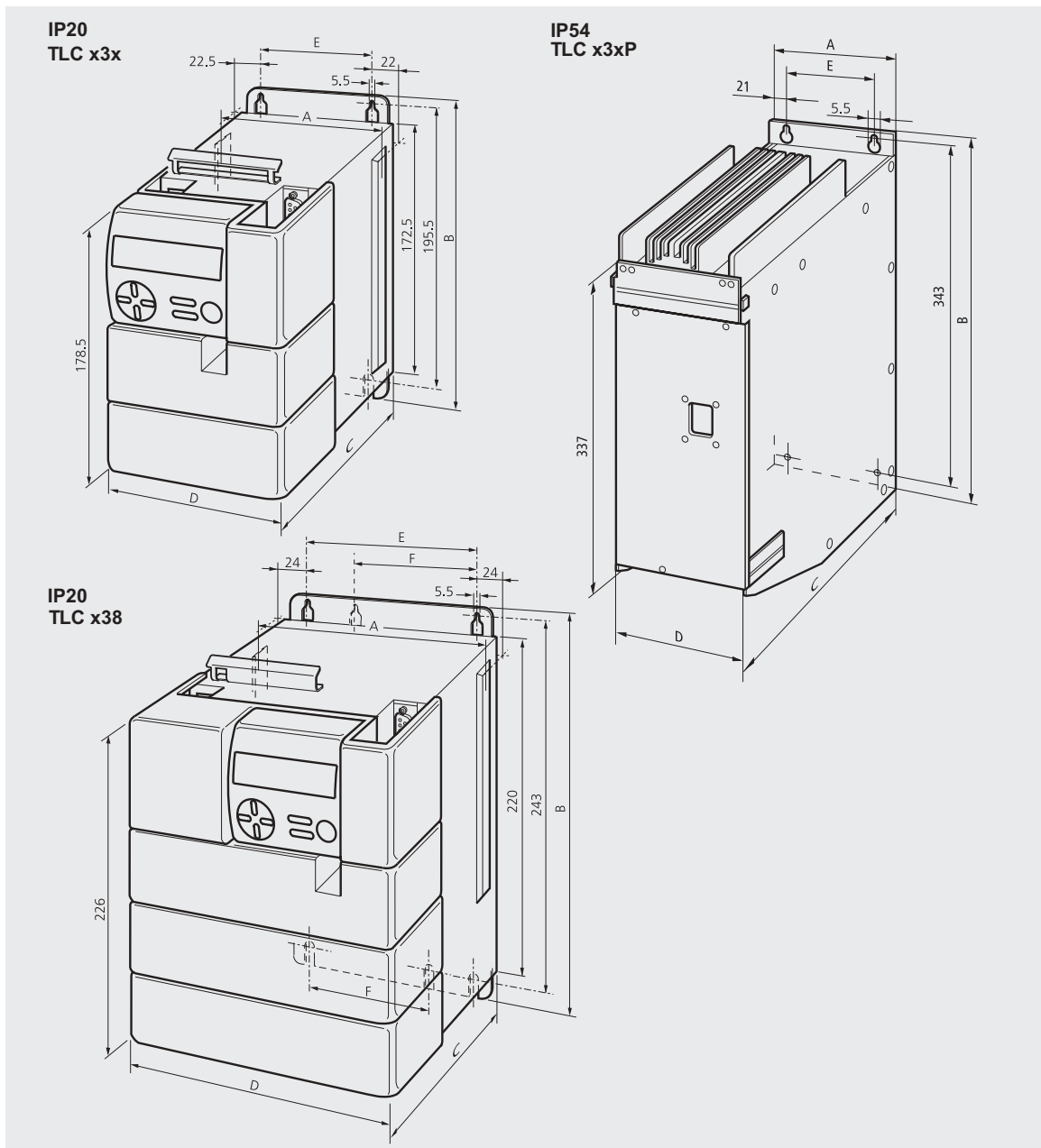
		TLC 632	TLC 634	TLC 636	TLC 638
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %		3 x 230 VAC -20 % to 480 VAC +10 %	
	Mains frequency	47 to 63 Hz			
	Current consumption	6.5 A	4 A	7.5 A	20 A
	Starting current	< 60 A			
	Fuse, external (B characteristic)	10 A			25 A
Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}	1.5 kW _{eff}	3 kW _{eff}	8 kW _{eff}
	Rated current effective value	3 A _{eff}		6 A _{eff}	16 A _{eff}
	Rated current amplitude value	4,24 A _s		8,48 A _s	22,63 A _s
	Peak current for max. 5 s	11;31 A _s		28,28 A _s	45,26 A _s
	Switching frequency	8/16 kHz			4/8 kHz
	Max. rotary speed	12000 min ⁻¹			
Motor cable	Cable length	≤ 20 m standard > 20 m upon request			
	Shielding connection	on both sides			
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²		4 mm ²
Intermediate-circuit connection	max. two devices of the same power class may be connected				
Internal breaking circuit	Continuous power	60 W	100 W	200 W	80 W
	Max. energy per braking sequence	350 Ws	600 Ws	100 Ws	130 Ws
24 VDC system supply voltage		PELV, DIN 19240, polarised			
	Input voltage range	20 to 30 V			
	Input ripple	< 2 V _{pp}			
	Input current without loading the outputs	< 2.5 A			
Signal inputs		polarised, no electrical isolation			
	Debounced	0.7 to 1.5 ms			
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)			
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)			
	Current	≤ 7 mA at 24 V			
Signal outputs		short-circuit proof			
	Inductive load capable	150 mH/11 W			
	DC voltage	≤ 30 V			
	Switching current	≤ 400 mA			
	Voltage drop at 400 mA	≤ 1 V			
Analog signal input	Voltage range	+10 V to -10 V			
	Input resistance	5 kΩ			
	Solution	10 Bit			
Mass		2.7 kg	3.7 kg	6.6 kg	10.8 kg

		TLC 632	TLC 634	TLC 636	TLC 638
Ambient conditions	Ambient temperature	0 to 50 °C			
	Transport and storage temperature	-40 to +70 °C			
	Relative humidity	15 to 85 % no condensation permissible			
	Altitude, without power reduction	h < 1000 m above sea level			
	Protection type according to DIN EN 60529: 1991	IP 20			
Characteristic curves	See catalogue of Twin Line Motors				
Working memory available for the application	Residual memory for the user program	256 kByte			
	Residual memory for data (Flash PROM)	8 kByte			
	Residual memory for power-fail data (Retain)	100 Byte			
	Non-residual memory for data	128 kByte			
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.				

Technical data TLC 63xP, protection type IP 54

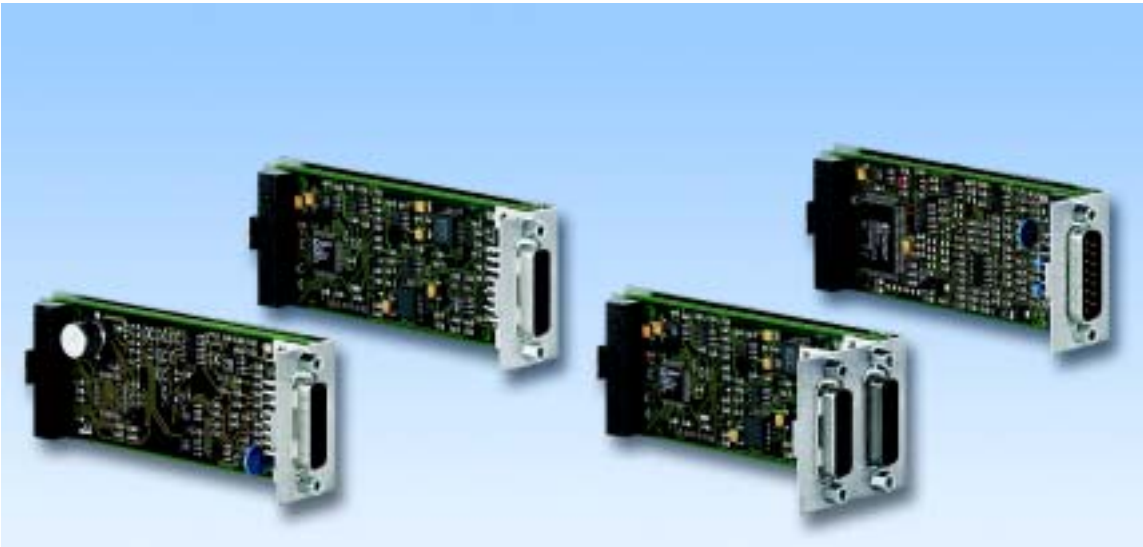
		TLC 632P	TLC 634P
Mains connection	Mains voltage	1 x 230 VAC -20 % to 240 VAC +10 %	3 x 230 VAC -20 % to 480 VAC +10 %
	Mains frequency	47 to 63 Hz	
	Current consumption	6.5 A	4 A
	Starting current	< 60 A	
	Fuse, external (B characteristic)	10 A	
	Motor connection	Rated power at rated current and 230 V/1~ or 400 V/3~	0.75 kW _{eff}
Rated current effective value		3 A _{eff}	
Rated current amplitude value		4,24 A _s	
Peak current for max. 5 s		11,31 A _s	
Switching frequency		8/16 kHz	
Max. rotary speed		12000 min ⁻¹	
Motor cable		Cable length	≤ 20 m standard > 20 m upon request
	Shielding connection	on both sides	
	Cross section (depends on length)	1.5 mm ²	1.5 to 2.5 mm ²
Intermediate-circuit con- nection	max. two devices of the same power class may be connected		
Internal breaking circuit	Continuous power	depends on the ambient temperature and ventilation, can be checked upon request	
	Max. energy per braking sequence	depends on the ambient temperature and ventilation, can be checked upon request	
24 VDC system supply voltage		PELV, DIN 19240, polarised	
	Input voltage range	20 to 30 V	
	Input ripple	< 2 V _{pp}	
	Input current without loading the outputs	< 2.5 A	
Signal inputs		polarised, no electrical isolation	
	Debounced	0.7 to 1.5 ms	
	DC voltage U _{high}	12 to 30 V (I ≥ 3 mA)	
	DC voltage U _{low}	≤ 5 V (I ≤ 0.5 mA)	
	Current	≤ 7 mA at 24 V	
Signal outputs		short-circuit proof	
	Inductive load capable	150 mH/11 W	
	DC voltage	≤ 30 V	
	Switching current	≤ 400 mA	
	Voltage drop at 400 mA	≤ 1 V	
Analog signal input	Voltage range	+10 V to -10 V	
	Input resistance	5 kΩ	
	Solution	10 Bit	
Mass		8.5 kg	11 kg

		TLC 632P	TLC 634P
Ambient conditions	Ambient temperature	0 to 45 °C	
	The P model is not suitable for use outdoors or in areas with strongly adhering contaminants which could jam the ventilator.		
	Transport and storage temperature	-40 to +70 °C	
	Altitude, without power reduction	h < 1000 m above sea level	
	Protection type according to DIN EN 60529:1991	IP 54, category 2	
	Protection type of internal air channel for cooling	IP 24	
Characteristic curves	See catalogue of Twin Line Motors		
Working memory available for the application	Residual memory for the user program	256 kByte	
	Residual memory for data (Flash PROM)	8 kByte	
	Residual memory for power-fail data (Retain)	100 Byte	
	Non-residual memory for data	128 kByte	
UL 508C approved	You can find the limit values for the UL 508C approval in the documentation included with the device.		



Dimensional drawing of positioning controllers for AC synchronous servomotors

	TLC 632	TLC 634	TLC 636	TLC 638	TLC 632P	TLC 634P
Width A	108 mm	128 mm	178 mm	248 mm	127 mm	147 mm
Height B	212.5 mm	212.5 mm	260 mm	260 mm	360 mm	360 mm
Depth C	184.5 mm	214.5 mm	244.5 mm	244.5 mm	245 mm	275 mm
Front width D	105.5 mm	125.5 mm	176 mm	246 mm	127 mm	127 mm
Fitting dimension E	63 mm	83 mm	130 mm	200 mm	80 mm	100 mm
Additional dimension F	-	-	-	120 mm	-	-



Modules for positioning controller and power electronics

Micromodules

Twin Line micromodules for application-specific configuration

IOM-C

The analogous module receives and generates analogous and digital voltage values. The analogous outputs are user-adjustable. The module furnishes nominal values for control as analogous voltage values. Extension by two analogous I/Os and two digital I/Os.

RS 422-C

The RS 422-C encoder module is designed to capture encoder signals, which are fed in as A/B signals. It also detects and evaluates the index pulse. A typical application for this module is the “electronic gearing” function or external position control.

PULSE-C

The PULSE-C module captures positioning data as a pulse /direction signal or as a pulse_{forward}/pulse_{back} signal. A typical application is the “electronic gearing” function.

HIFA-C

The HIFA-C module captures the motor position of AC synchronous servomotors equipped with a SinCos® absolute-value encoder.

The rotor position in the motor is detected optically and transferred as analog and digital position data to the HIFA-C module. The module resolves the signals with 14-bit resolution, corresponding to 16384 pulses/revolution. The absolute-value encoder integrated in the motor can be either a Single Turn (standard) or Multi Turn encoder. Once the motor is switched on, the Multi Turn encoder has the absolute position within 4096 revolutions.

In addition to the motor position data, the motor parameter set (electronic motor type plate) is transferred from the SinCos® memory to the HIFA-C module via the integrated RS 485 interface.

ESIM3-C

The ESIM3-C module outputs the position data of the AC servomotor in the form of incremental signals on a 15-pole Sub-D socket. These are two signals electrically phase-displaced by 90° (A/B trails). The transmitted resolution can be set from 125 thr. 4000 increments per revolution, an index pulse is not available! Use of this module requires that slot M2 is equipped with an RM-C module.

A typical application for this module is to act as follow-up axes in the electronic gearing mode.

RS 485-C

The RS 485-C is an asynchronous 4-wire interface with level RS 485.

The module provides short-circuit proof voltage supply for the Berger Lahr MP923 interface converter (RS 232 to RS 485).

MODB-C

Module ModBus is an asynchronous 4-wire interface of RS485 level. The user can configure, alternatively, ModBus ASCII or ModBus RTU.

PBDP-C

The Profibus-DP is a high-speed cyclic communication bus. It has a 2-wire interface with level RS 485.

CAN-C

The CAN bus is a serial sensor/actuator bus. It has a 2-wire connection for the CAN-Low and CAN-High lines.

The user can also configure the Berger Lahr Profile, the CANopen DS-402 Profile or DeviceNet.

IBS-C

The Interbus is a sensor/actuator bus which encodes according to the shift-register principle.

SAM-C

The SAM-C Safety Monitor module extends Twin Line positioning controllers using integrated functions for operator safety, e.g. safe stop and reduced speed functions.

Technical data micromodules

Modules			
IOM-C	Digital signal inputs		polarity-secured, no galvanic insulation, damping time 0.7 ms - 1.5 ms
		DC voltage U_{high}	12 V - 30 V
		DC voltage U_{low}	<5 V
		Current at 24 V	<7 mA
	Digital signal outputs		inductively load-capable (50 mH), short-circuit-proof, polarity-secured
		DC voltage	12 V - 30 V
		reverse locking current	<100 μ A
		switching current	<50 mA
	Analogous signal inputs	voltage range	-10 V - +10 V
		input resistance	50 k
		solution	10 Bit
	Analogous signal outputs	voltage range	-10 V - +10 V
		output current	max. 5 mA
		solution	12 Bit
	RS 422-C	Inputs	
input frequency			\leq 400 kHz
Outputs		Supply for the master rotary encoder	5 V \pm 5 %max. 300 mA, sense-regulated, short-circuit proof, overload-proof
		max. length	100 m
Signal cable		minimum cross section	0.5 mm ² for supply voltage 5 VDC and 5 VGND; 0.25 mm ² for other signals
PULSE-C	Inputs	triggering device	symmetric RS 422, asymmetric 4.5 V to 30 V, electrically connected with 24 VGND
		input resistance	5 k Ω
		input frequency, pulse signals	\leq 200 kHz
		input frequency, enable	\leq 1 kHz
	Outputs		open collector, short-circuit proof
		output voltage	\leq 30 V
		output current	\leq 50 mA
	Signal cable	max. length for an RS 422 connection	100 m
		max. length for an open collector connection	10 m
		minimum cross section of the signal leads	0.14 mm ²
ESIM3-C	Signal outputs A/B		RS 422 voltage compatible, electrically connected to 24 VGND

Modules				
RS 485-C MODB-C		meets the RS 485 norm, electrically isolated, 4-wire interface		
	Transfer rate	max. 38.4 kBaud		
	Supply voltage output	+12 V (min. 9 V to max. 15 V)		
PBDP-C		meets the RS 485 norm, electrically isolated		
	Transfer rate	≤12 MBaud		
	Supply voltage output	+5 V (max. 10 mA) only for matching resistor		
	Cable length	Standard Profibus-DP		
CAN-C		Level according to ISO 11898 electrically isolated		
	Transfer rate	≤ 1 MBaud, adjustable		
	Cable length	at 125 kBaud	max. 500 m	
		at 500 kBaud	max. 100 m	
	Level	CAN-L/CAN-H	according to ISO 11898	
Matching resistor	at both ends	120 Ω		
IBS-C		meets Interbus specification		
	Transfer rate	500 kBaud		
	Cable length	max. distance to next network participator 400 m		
SAM-C	24-VDC-supply voltage		PELV, DIN 19240, polarity-secured	
		input voltage range (being monitored)	20 - 30 V	
		input ripple	< 2 V _{SS}	
		input current without load on outputs	< 0,02 A	
		Digital signal inputs		polarity-secured, no galvanic in- sulation, damping time >1 ms
		time window for simultan switching of both signals of one switch pair	10 s	
		DC voltage U _{high}	15 V - 30 V (I ≥ 3 mA)	
		DC voltage U _{low}	≤ 5 V (I ≤ 0,5 mA)	
		Current at 24 V (5 kΩ against GND)	I ≤ 0,5 mA	
	Digital signal outputs			inductively load-capable (150 mH /11 W), capacitive load capability (C ≤ 1μF), short-circuit-proof
			DC voltage	≤ 30 V
			switching current RELAY_A, RELAY_B, INTERLOCK-OUT	≤ 0,5 A
			switching current SAFETY24VDC-A; SAFETY24VDC-B	≤ 0,3 A
			switching current AUXOUT1, AUXOUT2	≤ 0,1 A

IP 54 options

Positioning drives with protection type IP 54 can be configured with the holding-brake controller option, in addition to the micromodules described above.

Integrated holding-brake controller

The integrated holding-brake controller amplifies the brake signal of the signal interface, ensuring that the brake is actuated quickly with the least possible heat generation. Enabling the output stage automatically opens the holding brake; disabling the output stage automatically closes it.

Wire sleeves

The cables and connectors are guided through the housing. An optional set of wire sleeves is available in order to fulfil protection type IP 54. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Terminal bracket

A terminal bracket with TS 15 top hat rail for snap-on mini terminal blocks with max. 1.5 mm wire cross section is available for additional wiring as well as to avoid having to use external terminal boxes. The terminal bracket is mounted inside the housing of the positioning controller. Please refer to the catalogue of **Twin Line Accessories** for information and technical data on available accessories.

Type key TLC 63x, protection type IP 20

Example	TLC	6	3	X	F	X	HIFA	X	X
Device function	TLC	6	3	X	F	X	HIFA	X	X
6	= Freely programmable positioning controller according to IEC 61131-3								
Motor	TLC	6	3	X	F	X	HIFA	X	X
3	= AC synchronous servomotor								
Rated power	TLC	6	3	X	F	X	HIFA	X	X
2	= 750W								
4	= 1500W								
6	= 3000W								
8	= 8000W								
Mains filter	TLC	6	3	X	F	X	HIFA	X	X
F	= with mains filter								
M1 = Position set values	TLC	6	3	X	F	X	HIFA	X	X
IOM	= analogous module								
PULSE	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal								
RS422	= for electronic gearbox A/B signals								
-	= not equipped								
M2 = Capture motor position	TLC	6	3	X	F	X	HIFA	X	X
HIFA	= SinCos® encoder								
M3 = Encoder Simulation	TLC	6	3	X	F	X	HIFA	X	X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals								
SAM	= safety module								
-	= not equipped								
M4 = Communication	TLC	6	3	X	F	X	HIFA	X	X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable								
IBS	= Interbus								
MODB	= ModBus ASCII or ModBus RTU, to be configured								
PBDP	= Profibus DP								
RS485	= RS 485								
-	= not equipped								

Type key TLC 63xP, protection type IP 54

Example	TLC 6 3 X P F X HIFA X X X
Device function	TLC 6 3 X P F X HIFA X X X
6	= Freely programmable positioning controller according to IEC 61131-3
Motor	TLC 6 3 X P F X HIFA X X X
3	= AC synchronous servomotor
Rated power	TLC 6 3 X P F X HIFA X X X
2	= 750W
4	= 1500W
Protection type	TLC 6 3 X P F X HIFA X X X
P	= protection type IP 54
Mains filter	TLC 6 3 X P F X HIFA X X X
F	= with mains filter
M1 = Position set values	TLC 6 3 X P F X HIFA X X X
IOM	= analog module
PULSE	= for electronic gearbox pulse/direction signal or pulse _{forward} /pulse _{back} signal
RS422	= for electronic gearbox A/B signals
-	= not equipped
M2 = Capture motor position	TLC 6 3 X P F X HIFA X X X
HIFA	= SinCos® encoder
M3 = Encoder Simulation	TLC 6 3 X P F X HIFA X X X
ESIM3	= Encoder simulation, 1 signal connection, A/B signals
SAM	= safety module
-	= not equipped
M4 = Communication	TLC 6 3 X P F X HIFA X X X
CAN	= CAN, alternative Berger Lahr Profile, CANopen DS-402 Profile or DeviceNet configurable
IBS	= Interbus
MODB	= ModBus ASCII or ModBus RTU, to be configured
PBDP	= Profibus DP
RS485	= RS 485
-	= not equipped
M5 = Integrated holding-break controller	TLC 6 3 X P F X HIFA X X X
HBC	= Holding Brake Controller integrated, cannot be retrofitted
-	= not equipped

we control **motion**

Berger Lahr offers you the positioning and automation solutions you need, based on our tried and proven series of products. Our comprehensive engineering and consulting service is ready to support and advise you every step of the way.

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