WITTENSTEIN

# Integrated Intelligence
Linear and Rotary Actuators

Flexibility

Controllability

Precision

# Contents

**WITTENSTEIN**

ternary™ is an all-in one mechatronic actuator system that can be quickly installed and set up. It includes controller, encoder, motor and gearbox or ballscrew cylinder or rodless slider in one integrated package.
Bolt it on the machine, hook up power and command cables, set it up using proTern software, and you're in business...

# More Options - More Interfaces - More Versions

ternary cuts costs, is far more flexible and is easier to use than pneumatic systems.

## Rotary ternary

- With or without planetary gear reducer
- Right-angle version available
- Torques up to 3 Nm (27 in.lb.) at the motor
- Speed: up to 5000 RPM

## Linear Cylinder ternary

- Inline or folded
- Up to 300 mm (12 in) stroke
- Force: 600 N (130 lb) continuous, 1000 N (220 lb) peak
- Speed: up to 1 m/s (40 in/s)

## Rodless Slider ternary

- Up to 700 mm (28 in) travel
- Force: 300 N (60 lb) continuous, 400 N (85 lb) peak
- Speed: up to 1 m/s (40 in/s)

# ternary™ product selection at a glance

## Communication Interfaces
- Serial RS485 / Parallel I/O
- DeviceNet, Ethernet/IP
- Profibus, CANopen, CC-Link

**DeviceNet®**    **EtherNet/IP™**    **PROFI® PROCESS FIELD BUS**

## Motor Type
- All versions available as:
    - 24V Stepper with encoder
    - 48V 100W Servo
- Rotary also available as:
    - 200W / 400W Servo

## Protection Class
- IP40 - standard protection
- IP65 - high protection (NEMA 12)

## Modes of Operation
- Indexer / Point-to-Point
- Absolute or relative positioning
- Force / Torque mode
- Analog input position control
- Step / Pulse input

## proTern™ Commissioning Software
- Intuitive "Motion in a Minute" set-up tool
- Project management for up to 16 actuators
- Jog and teach
- Scope function

# Product Selection

## ternary product selection at a glance

| Type 6x servo with optional brake, IP40, 200 and 400W versions | Stepper with optional brake IP40 or IP64/65 | Type 46 servo with optional brake, IP40 or IP64/65, 100W |
|---|---|---|
| 2000 pulse/rev incremental encoder standard, multi-turn absolute encoder optional | 800 pulse/rev incremental encoder | 2000 pulse/rev incremental encoder standard, multi-turn absolute encoder as special option |

**Rotary**      **Linear**

**No Gear**    **Gear**      **Rod**    **Slider**

| No Gear | Inline | Right Angle | Standard | Folded | Slider |
|---|---|---|---|---|---|



**Gear Ratio**
i = 1

**Gear Ratio**
Single stage
i = 5, 10
2-stage
i = 15, 25, 50

**Ballscrew Lead**

3 mm
6 mm
12 mm

**Ballscrew Lead**

6 mm
12 mm

**Cylinder Stroke**

50, 100, 150, 225, 300 mm standard

25, 75, 400 mm as special option

**Slider Travel**

Size 045 -
100, 200, 300, 400, 500 mm
Size 060-
100, 200, 300, 400, 500, 600, 700 mm

Parallel I/O is standard.

RS485 Serial, DeviceNet, Ethernet/IP are standard interface options.
Analog, Profibus, CANopen, CC-Link are available as special options.

## Choose standard or high protection models

Both stepper and servo ternary models are available in either standard IP40 protection class or IP64/IP65 high protection class.

- IP40 provides protection against access to hazardous parts with a wire and protection against foreign objects greater than 1 mm in diameter. There is no protection against water.
- IP65 provides protection against entry of foreign objects and is dust-tight. It is also a guarantee of protection against low pressure water spray coming from any direction for up to 3 minutes at a time. (For applications outside of this rating, such as the use of cutting fluid or continuous water spray, contact WITTENSTEIN to determine additional protective measures that might be needed.)
- IP64 provides protection against access to hazardous parts with a wire, protection against foreign objects greater than 1 mm in diameter and protection against water splashes. Some ternary models with planetary gear reducers have an IP65 motor, but are rated at IP64, as that is the rating for the gear reducer.

### Rotary ternary models – Type 46 (46 mm motor frame width)

| Item | Type 46 stepper | | | Type 46 servo- 100 Watt | | |
|---|---|---|---|---|---|---|
| | No gear reducer | With LP50 in-line gear reducer | With LPK50 right-angle gear reducer | No gear reducer | With LP50 in-line gear reducer | With LPK50 right-angle gear reducer |
| Max torque (Nm) | 0.33 | 1.4 – 18 | 1.4 – 12 | 0.82 | 3.46 – 18 | 3.2 - 12 |
| Resolution (pulses/rev) | 800 | 800 | 800 | 2000 | 2000 | 2000 |
| Max velocity (rpm) | 4500 | 45 - 800 | 60 - 300 | 5000 | 200 - 1000 | 200 - 1000 |
| Available protection class | IP40 & IP65 | IP40 & IP64 | IP40 & IP64 | IP40 & IP65 | IP40 & IP64 | IP40 & IP64 |
| Page for more information | 11 | 15 | 22 | 11 | 15 | 22 |

### Rotary ternary models – Type 6X (100 mm motor diameter)

| Item | Type 6X servo – 200 Watt | | Type 6X servo – 400 Watt | |
|---|---|---|---|---|
| | No gear reducer | With LP70 in-line gear reducer | No gear reducer | With LP70/90 in-line gear reducer |
| Max torque (Nm) | 1.63 | 3.8-35 | 3.2 | 8.4-90 |
| Resolution (pulses/rev) | 2000 | 2000 | 2000 | 2000 |
| Max velocity (rpm) | 5000 | 100-1000 | 5000 | 100-1000 |
| Available protection class | IP40 Only | IP40 Only | IP40 Only | IP40 Only |
| Page for more information | 11 | 18 | 11 | 18 |

### Linear ternary models – Type 46 (46 mm motor frame width)

| Item | Type 46 stepper | | | Type 46 servo – 100 Watt | | |
| --- | --- | --- | --- | --- | --- | --- |
| | TLS rod type in-line linear actuator | TLS folded rod type linear actuator | TSS rodless slider type linear actuator | TLS rod type in-line linear actuator | TLS folded rod type linear actuator | TSS rodless slider type linear actuator |
| Max stroke (mm) | 50-300 std (25 & 75 optional) | 50-300 std (25 & 75 optional) | 100 – 500 | 50-300 std (25 & 75 optional) | 50-300 std (25 & 75 optional) | 100 - 700 |
| Max thrust force (Nm) | 140 - 600 | 115 - 500 | 140 - 290 | 350 - 1000 | 350 - 1000 | 190 - 400 |
| Resolution (pulses/rev) | 800 | 800 | 800 | 2000 | 2000 | 2000 |
| Max velocity (rpm) | 225 - 700 | 175 - 700 | 250 - 700 | 250 - 1000 | 250 - 1000 | 250 - 1000 |
| Max repeatability (mm) | +/- 0.0045 to +/- 0.018 | +/- 0.0045 to +/- 0.009 | 0.0075 to 0.015 | +/- 0.0045 to +/- 0.018 | +/- 0.0045 to +/- 0.018 | 0.003 to 0.006 |
| Available protection class | IP40 & IP65 | IP40 & IP64 | IP40 only | IP40 & IP65 | IP40 & IP64 | IP40 only |
| Page for more information | 27 | 31 | 35 | 27 | 31 | 35 |

Note that ternary linear sliders with the Type 6X motors (200 & 400W) will be available in the near future.

## I/O communications

All stepper ternary actuators are supplied with parallel I/O and either serial or fieldbus interfaces. All servo versions have both parallel and serial I/O and optionally pulse or a fieldbus interface.

Operating the ternary
Once a ternary axis is set up, the actuator can be run by:
  • Switches or sensors on the machine (parallel I/O)
  • A PLC ladder logic program (parallel I/O)
  • A C++ program running on a PC (serial I/O)
  • Fieldbus:
      • DeviceNet as specified by the ODVA protocol
      • Ethernet/IP, an industrial Ethernet-based communications system
      • Profibus, CANopen and CC-Link can be supplied on request.
  • Analog input for position control
  • Pulse input for servo version (step and direction, CW/CCW, etc.)

**Parallel I/O** is used when the machine/ternary is controlled by simple switches or a PLC.  Discrete IO are used as a BCD input for position selection.  A PLC can also control the ternary with pulse I/O for slave follower or quasi-synchronous applications. The user can easily control the ternary actuator in a conventional ladder logic programming environment, similar to a pneumatic cylinder. Note that parallel I/O, pulse and serial I/O are supplied in a single cable.

**Serial I/O** is used to set up the ternary via a PC, using proTern software. It can be used to control the ternary by running a C++ motion control program in the PC. Numerous sample programs are available. A combination of up to 16 linear and rotary actuators can be controlled in a system via the serial RS485 interface.

**DeviceNet** interface is used to run the ternary under fieldbus control. The same object motion profile can be used with DeviceNet, Ethernet/IP and Profibus, allowing the same PLC block transfer commands to be used with any fieldbus version. Up to 63 DeviceNet actuators can be controlled on a single bus.

**EtherNet/IP** (Industrial Protocol) is an industrial application layer protocol operating over the Ethernet medium and used for communication between industrial control systems and their components. It is used to run the ternary over an Ethernet-based system, and allows for control of 63 actuators at 10/100 MB communication rates.

# ternary™ rotary actuators

Stepper, 100W servo, 200/400W servo

Available with planetary gearheads

Right-angle version available

## TRB rotary motor

This motor can be used as a standalone device or can be installed with the WITTENSTEIN rotary alpha gear reducers. It is also used for the ternary linear modules.

- Type 46 (46mm) TRB motors are available in both IP40 and IP65 protection class. Type 6X (100 mm) motors are available only in IP40 protection class.
- While physical dimensions are different, performance specifications are identical for both protection classes for a given motor.
- From 30 to 100W products are available in type 46; 200 and 400W products are available in type 6X.

## TRB rotary motor specifications

| Item | | Units | Data | | | |
|---|---|---|---|---|---|---|
| Motor type | | - | Closed loop control stepping motor system (STP) | Brushless servo motor system (BLM) – Type 46 | Brushless servo motor system (BLM) – Type 6X | |
| Rated power | | W | See note 1. | 100 | 200 | 400 |
| Type code ♦ = interface type ■ = No brake (N) or brake (B) | IP40 IP65 | - | TRBA146AA♦-XXX ■ 01 TRBA046AA♦-XXX ■ 01 | TRBB146BB♦-XXX ■ 01 TRBB046BB♦-XXX ■ 01 | TRBB16ACB♦-XXX ■ 01 IP65 not available | TRBB16ADB♦-XXX ■ 01 IP65 not available |
| Encoder | - | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | |
| Incremental encoder | Resolution | p/r | 800 | 2000 | 2000 | 2000 |
| Power supply | Control | V.A. | 24VDC +/-10%, 0.2A | 12-48VDC +/-10%, 0.2A | n/a | n/a |
| | Main | V.A. | 24VDC +/-10%, 1.5A (1.7 with brake) | 48VDC +/- 10%, 3A continuous, 9A peak (add 0.2A for brake) | 200/230 VAC , 3 phase. +10%, -15%, 50/60 Hz | |
| Speed | Continuous | rpm | 4500 | 3500 | 3500 | 3500 |
| | Maximum | rpm | 4500 | 5000 | 5000 | 5000 |
| Torque | Continuous | Nm | 0.33 | 0.273 | 0.54 | 1.09 |
| | Maximum | Nm | 0.33 | 0.82 | 1.63 | 3.27 |
| Max torque available at initialization (See note 2) | Without brake | Nm | 0.14 | n/a | n/a | n/a |
| | With brake | Nm | 0.2 | n/a | n/a | n/a |
| Mechanical shaft interface | | - | 7 mm diameter D-cut | | 14 mm diameter smooth shaft | |
| Motor inertia | Without brake | g.cm$^2$ | 83 | 36.5 | 180 | 340 |
| | With brake | g.cm$^2$ | 85.2 | 39.7 | 280 | 440 |
| Maximum radial force | | N | 70 N at the midpoint of the output shaft | | 196 N at the midpoint of the output shaft | |
| Maximum axial load on output shaft | | N | 50 | 50 | 68 | 68 |
| Control Interface (See note 3) | | - | RS485 (SIO) + PIO DeviceNet + PIO Ethernet/IP + PIO | RS485 (SIO) + PIO Pulse + RS485 + PIO DeviceNet RS485 + PIO Ethernet/IP RS485 + PIO | | |
| Parallel interface (PIO) | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | |
| Analog interface | | - | Differential analog input for position control – available on request. | | | |
| Optional brake | Type | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | |
| | Torque | Nm | 0.35 | 0.35 | 1.27 | 1.27 |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | |
| | Stored memory | - | 16 points | 64 points (48 for Ethernet/IP) | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | | | |
| | Alarm | - | Alarm/warning detection | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | |
| | Others | - | Press mode, shortest path, linked move, parameter recovery, etc. | | | |
| Ambient | Temperature | °C | 0 – +40 operation; -20 – +60 storage | | | |
| | Humidity | % | 90% relative humidity maximum, non-condensing | | | |
| Material and surface treatment | Motor body | - | Anodized aluminum (white color) | | | |
| | Output shaft | - | Steel | | | |
| Mounting | | - | Mounts to flange using M4 bolts | | Mounts to flange using M6 bolts | |

Notes: 1. Rated power is not defined for stepper version due to its special torque-speed characteristic curve.
2. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
3. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# TRB Rotary Motor

## TRB rotary motor torque/speed curves
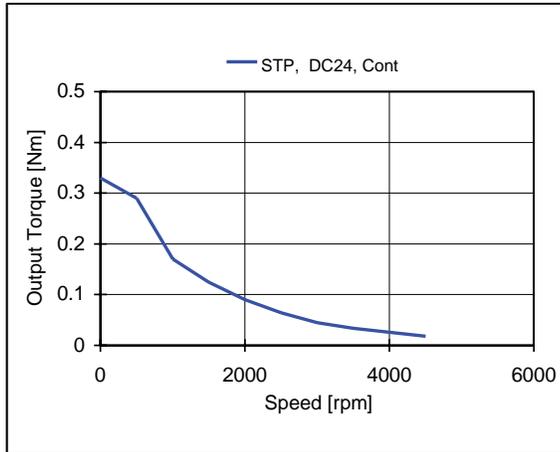
**TRBA*46A Stepper**
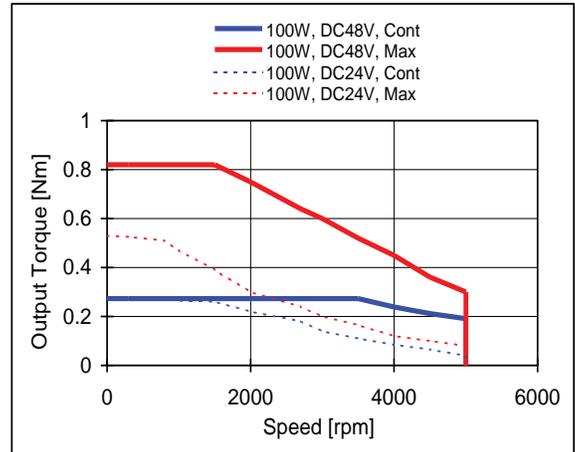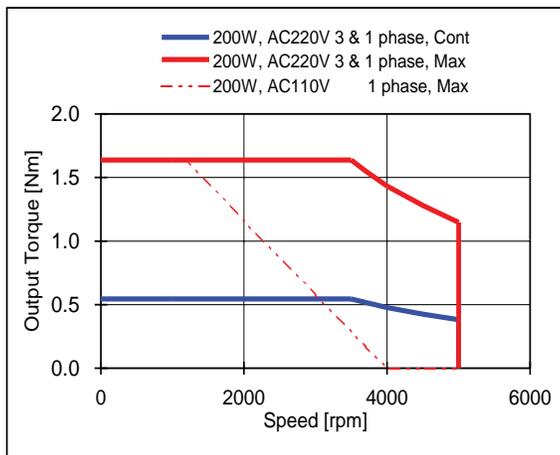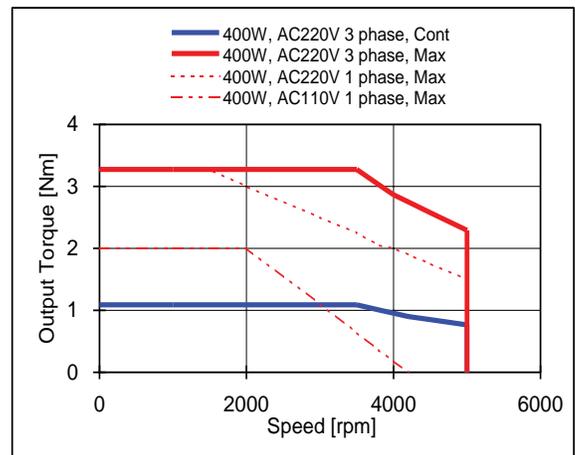
Legend: STP, DC24, Cont

Chart — Output Torque [Nm] vs Speed [rpm]

**TRBB*46B 100W Servo**

Legend:
- 100W, DC48V, Cont
- 100W, DC48V, Max
- 100W, DC24V, Cont
- 100W, DC24V, Max

Chart — Output Torque [Nm] vs Speed [rpm]

**TRBB16XC 200W Servo**

Legend:
- 200W, AC220V 3 & 1 phase, Cont
- 200W, AC220V 3 & 1 phase, Max
- 200W, AC110V   1 phase, Max

Chart — Output Torque [Nm] vs Speed [rpm]

**TRBB16XD 400W Servo**

Legend:
- 400W, AC220V 3 phase, Cont
- 400W, AC220V 3 phase, Max
- 400W, AC220V 1 phase, Max
- 400W, AC110V 1 phase, Max

Chart — Output Torque [Nm] vs Speed [rpm]

Notes:  1. Torque/speed characteristics are the same for IP40 and IP64/65. * symbol in type code = 1 for IP40, = 0 for IP64/65.
2. Standard power supplies are: stepper 24VDC, 100W servo 48VDC, 200/400W servos 220 VAC, 3-phase. Dotted lines in curves indicate derated performance using alternate supplies.
3. Above charateristics are typical data under nominal power and 25°C ambient temperature.

## Type 46 TRB rotary motor mechanical specifications

The following drawings show two typical type 46 TRB configurations (SIO/PIO interface), with dimensions for side and front views. See the drawings on pages 50-53 for connector configurations for the various types of interfaces available in both IP40 and IP65 protection classes. Contact WITTENSTEIN for the latest CAD drawings of your selected configuration.

### Type 46 TRB rotary motor – IP40 protection class
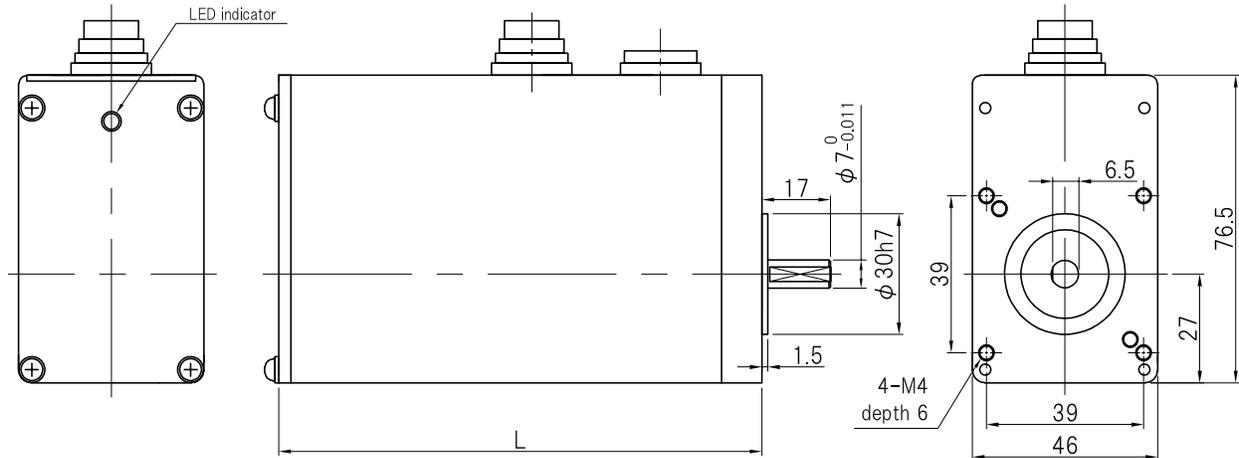
### Type 46 TRB rotary motor – IP65 protection class
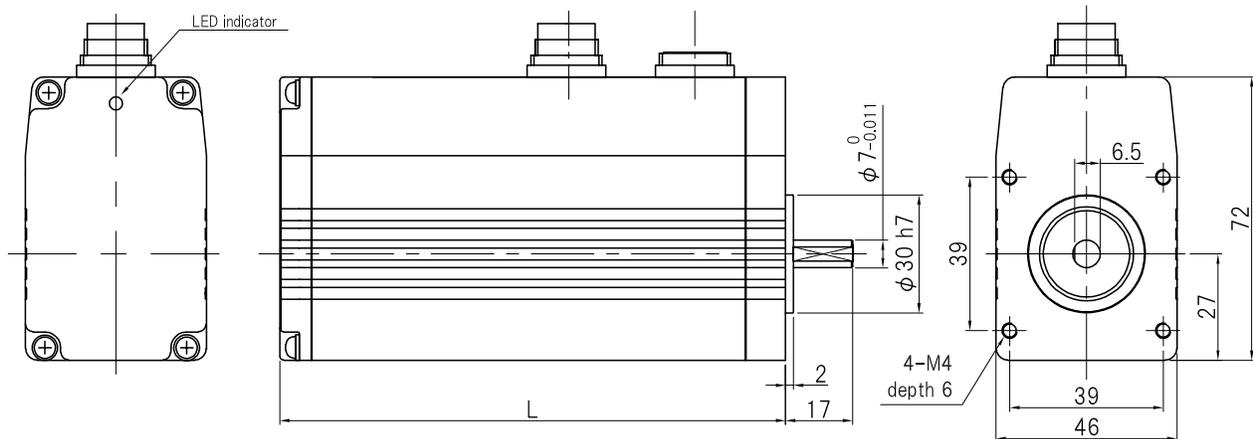
| Motor type | Protection class | Interface type | Type code | Motor body length (L) in mm | | Motor mass in kg | |
|---|---|---|---|---|---|---|---|
| | | | | Without brake | With brake | Without brake | With brake |
| Stepper (STP) | IP40 | SIO/PIO | TRBA146AAB-XXX ■ 01 | 120 | 145 | 0.78 | 0.93 |
| | | DeviceNet | TRBA146AAQ-XXX ■ 01 | 120 | 145 | 0.8 | 0.95 |
| | | Ethernet/IP | TRBA146AAH-XXX ■ 01 | 120 | 145 | 0.8 | 0.95 |
| | IP65 | SIO/PIO | TRBA046AAB-XXX ■ 01 | 104 | 130 | 0.79 | 0.97 |
| | | DeviceNet | TRBA046AAQ-XXX ■ 01 | 114 | 140 | 0.81 | 1.0 |
| | | Ethernet/IP | TRBA046AAH-XXX ■ 01 | 114 | 140 | 0.81 | 1.0 |
| Servo (BLM) | IP40 | SIO/PIO | TRBB146BBB-XXX ■ 01 | 120 | 145 | 0.75 | 0.90 |
| | | DeviceNet | TRBB146BBQ-XXX ■ 01 | 120 | 145 | 0.77 | 0.92 |
| | | Ethernet/IP | TRBB146BBH-XXX ■ 01 | 120 | 145 | 0.77 | 0.92 |
| | IP65 | SIO/PIO | TRBB046BBB-XXX ■ 01 | 128.5 | 155 | 0.80 | 0.97 |
| | | DeviceNet | TRBB046BBQ-XXX ■ 01 | 128.5 | 155 | 0.82 | 1.0 |
| | | Ethernet/IP | TRBB046BBH-XXX ■ 01 | 128.5 | 155 | 0.82 | 1.0 |

■ in the type code denotes without brake (N) or with brake (B).

## Type 6X TRB rotary motor mechanical specifications

The following drawing shows one typical type 6X TRB configuration with SIO/PIO interface. See the drawings on pages 50-53 for connector configurations for the various types of interfaces available in IP40 protection class. (Note that IP65 protection class is not available for this model.) Contact WITTENSTEIN for the latest CAD drawings.

### Type 6X TRB rotary ternary – IP40 protection class
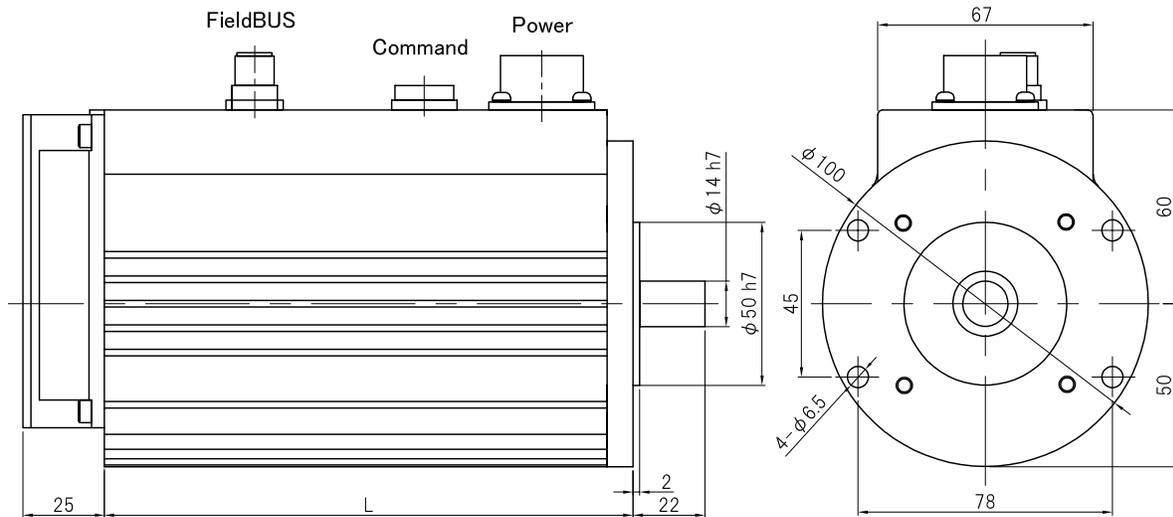
| Conversion table | |
|---|---|
| 1 in | 25.4 mm |
| 1 in-lb | 0.113 Nm |
| 1 in.lb.s² | 1130 kgcm² |
| 1 lbr | 4.44 N |
| 1 lbm | 0.4535 kg |

| Motor type | Protection class | Interface type | Type code | Motor body length (L) in mm | | Motor mass in kg | |
|---|---|---|---|---|---|---|---|
| | | | | Without brake ■= N | With brake ■= B | Without brake ■= N | With brake ■= B |
| Servo (BLM) 200W Version | IP40 Only | SIO/PIO | TRBB16ACBB-XXX ■01 | 143 | 177 | 1.9 | 2.4 |
| | | DeviceNet | TRBB16ACBQ-XXX ■01 | 143 | 177 | 1.9 | 2.4 |
| | | Ethernet/IP | TRBB16ACBH-XXX ■01 | 143 | 177 | 1.9 | 2.4 |
| Servo (BLM) 400W Version | IP40 Only | SIO/PIO | TRBB16ADBB-XXX ■01 | 162 | 196 | 2.3 | 2.9 |
| | | DeviceNet | TRBB16ADBQ-XXX ■01 | 162 | 196 | 2.3 | 2.9 |
| | | Ethernet/IP | TRBB16ADBH-XXX ■01 | 162 | 196 | 2.3 | 2.9 |

Note:   L is the motor housing length. Additional .25 mm heat radiation fin only present on 400W version.

## TRS rotary motor with coaxial LP planetary gear reducer

This motor has one of the WITTENSTEIN alpha LP gear reducers installed. This product is ideal for applications where higher torque at reduced speeds is needed. Five, 10 and 25:1 gear ratio model LP planetary gear reducers are standard for type 46. Gear reducers from 5:1 up to 50:1 gear ratios are standard for type 6X. Other gear reducers are available on special order, see page 62.

- Type 46 (46mm) TRS motor/gear reducers are available in both IP40 and IP64 protection class. Type 6X (100 mm) motors/gear reducers are available only in IP40 protection class.
- While physical dimensions are different, performance specifications are identical for both protection classes for a given product.
- 30 to 100W motors are available in type 46; 200 and 400W motors are available in type 6X.

## Type 46 TRS motor/gear reducer specifications

| Item | | Units | Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Motor type | | - | Closed loop control stepping motor system (STP) | | | Brushless servo motor system (BLM) – Type 46 | | |
| Gear reducer type | | - | LP50 | LP50 | LP50 | LP50 | LP50 | LP50 |
| Gear ratio | | - | 5 | 10 | 25 | 5 | 10 | 25 |
| Output torque | Continuous | Nm | -- | -- | -- | 1 | 2 | 5 |
| | Maximum | Nm | 1.4 | 2.8 | 6.9 | 3.46 | 6.39 | 11.5 |
| Type code ◆ = interface type ■ = No brake (N) or brake (B) | IP40 | - | TRSA146AA ◆-XXX ■ 05 | TRSA146AA ◆-XXX ■ 10 | TRSA146AA ◆-XXX ■ 25 | TRSB146BB ◆-XXX ■ 05 | TRSB146BB ◆-XXX ■ 10 | TRSB146BB ◆-XXX ■ 25 |
| | IP64 (See note 1) | | TRSA046AA ◆-XXX ■ 05 | TRSA046AA ◆-XXX ■ 10 | TRSA046AA ◆-XXX ■ 25 | TRSB046BB ◆-XXX ■ 05 | TRSB046BB ◆-XXX ■ 10 | TRSB046BB ◆-XXX ■ 25 |
| Encoder | - | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | | | |
| Incremental encoder | Resolution | p/r | 800 | | | 2000 | | |
| Max torque available at initialization (See note 2) | Without brake | Nm | 0.63 | 1.26 | 3.15 | n/a | n/a | n/a |
| | With brake | Nm | 1.0 | 2.0 | 5.0 | n/a | n/a | n/a |
| Mechanical shaft interface | | - | 12 mm diameter with keyway | | | 12 mm diameter with keyway | | |
| Optional brake | Type | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | | |
| | Torque | Nm | 1.65 | 3.3 | 8.25 | 1.65 | 3.3 | 8.0 |
| Maximum speed | | rpm | 800 | 400 | 160 | 1000 | 500 | 200 |
| Rotor inertia | No brake | g.cm$^2$ | 83 | 83 | 83 | 36.5 | 36.5 | 36.5 |
| | With brake | | 87 | 87 | 87 | 40.5 | 40.5 | 40.5 |
| Gear inertia | | g.cm$^2$ | 59 | 59 | 55 | 59 | 59 | 55 |
| Maximum radial force | | N | 650 | | | | | |
| Maximum axial force | | N | 700 | | | | | |
| Lost motion | | arc-min | 12 | 12 | 15 | 12 | 12 | 15 |
| Power supply | Control | - | 24VDC +/-10%, 0.2A | | | 12-48VDC +/-10%, 0.2A | | |
| | Main | - | 24VDC +/10%, 1.5A (1.7 with brake) | | | 48VDC +/-10%, 3A continuous, 9A peak (add 0.2A for brake) | | |
| Control Interface (See note 3) | | - | RS485 (SIO) + PIO DeviceNet + PIO Ethernet/IP + PIO | | | RS485 (SIO) + PIO Pulse + RS485 + PIO DeviceNet + RS485 +PIO Ethernet/IP + RS485 +PIO | | |
| Parallel interface (PIO) | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | | | |
| Analog interface | | - | Differential analog input for position control – available on request. | | | | | |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | | | |
| | Stored memory | - | 16 points | | | 64 points (48 for Ethernet/IP) | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | | | | | |
| | Alarm | - | Alarm/warning detection | | | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | | | |
| | Others | - | Press mode, shortest path, linked move, parameter recovery, etc. | | | | | |
| Ambient | Temperature | °C | 0 – +40 operation; -20 – +60 storage | | | | | |
| | Humidity | % | 90% relative humidity maximum, non-condensing | | | | | |
| Material and surface treatment | Motor body | - | Anodized aluminum (white color) | | | | | |
| | Output shaft | - | Steel | | | | | |
| Mounting | | - | Mounts to flange | | | | | |

Notes: 1. The motor is IP65, LP gear reducers are IP64.
2. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
3. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# TRS Rotary Motor with Planetary Gear Reducer

## Type 46 TRS motor/gear reducer torque/speed curves
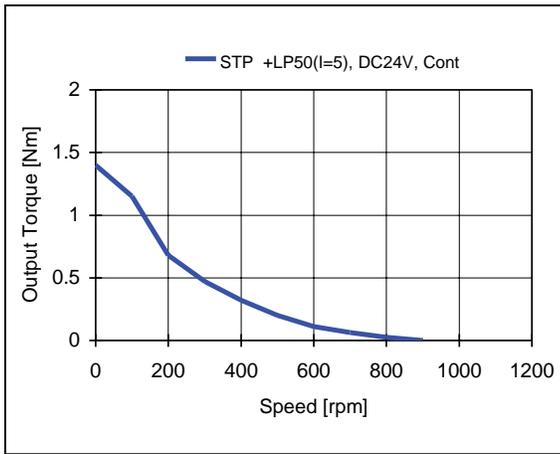


TRSA*46A Stepper/LP50, i=5
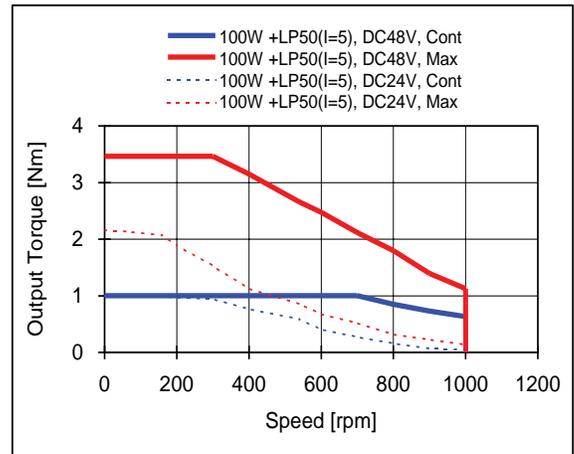


TRSB*46B 100W Servo/LP50, i=5
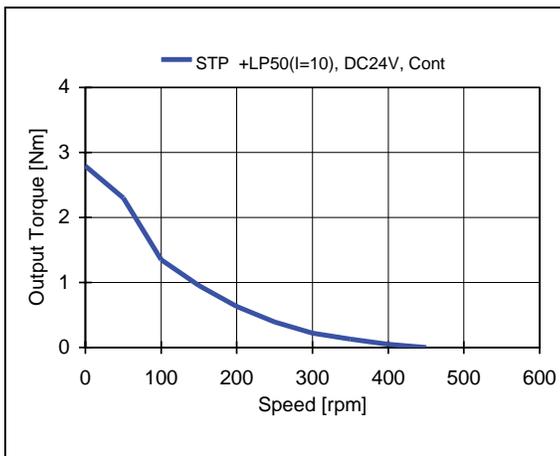


TRSA*46A Stepper/LP50, i=10
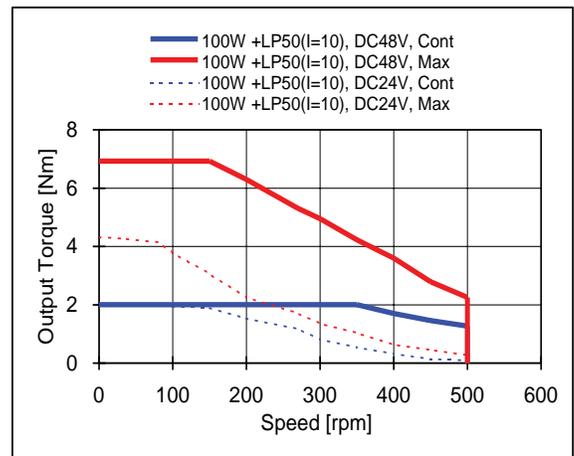


TRSB*46B 100W Servo/LP50, i=10
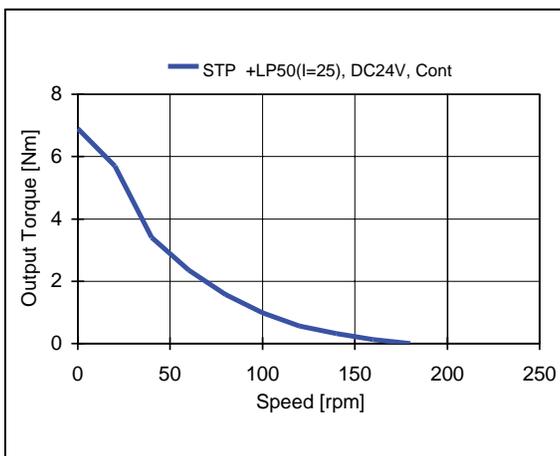


TRSA*46A Stepper/LP50, i=25
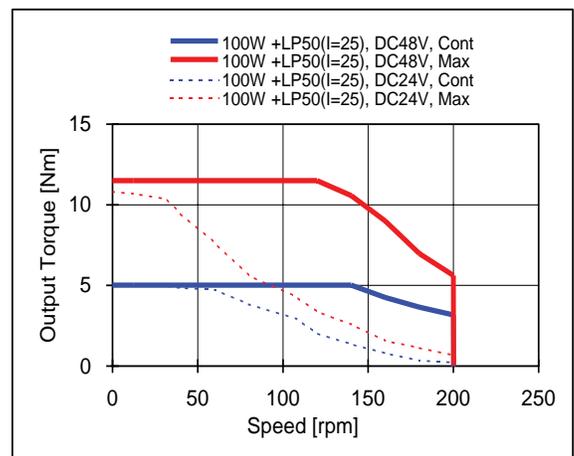


TRSB*46B 100W Servo/LP50, i=25

Notes:  1. Torque/speed characteristics are the same for IP40 and IP64/65. * symbol in type code = 1 for IP40, = 0 for IP64/65.
   2. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate derated performance using alternate supplies.
   3. Above charateristics are typical data under nominal power and 25˚C ambient temperature.

# Type 46 TRS motor/gear reducer mechanical specifications

The following drawings show typical type 46 TRS-LP50 servo configuration with SIO/PIO interface for both IP40 and IP65 protection classes. A number of connector configurations are available for the various types of control interfaces in both protection classes. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for current CAD drawings of your selected configuration.

## Type 46 TRS motor/LP50 planetary gear reducer – IP40 protection class



## Type 46 TRS motor/LP50 planetary gear reducer – IP64 protection class



| Motor type | Protection class | Interface type | Type code (see note below) | Motor body length (L1) in mm | | Motor mass in kg | |
|---|---|---|---|---|---|---|---|
| | | | | Without brake | With brake | Without brake | With brake |
| Stepper (STP) | IP40 | SIO/PIO | TRBA146AAB-XXX ■▲▲ | 120 | 145 | 0.78 | 0.93 |
| | | DeviceNet | TRBA146AAQ-XXX ■▲▲ | 120 | 145 | 0.8 | 0.95 |
| | | Ethernet/IP | TRBA146AAH-XXX ■▲▲ | 120 | 145 | 0.8 | 0.95 |
| | IP65 | SIO/PIO | TRBA046AAB-XXX ■▲▲ | 104 | 130 | 0.79 | 0.97 |
| | | DeviceNet | TRBA046AAQ-XXX ■▲▲ | 114 | 140 | 0.81 | 1.0 |
| | | Ethernet/IP | TRBA046AAH-XXX ■▲▲ | 114 | 140 | 0.81 | 1.0 |
| Servo (BLM) | IP40 | SIO/PIO | TRBB146BBB-XXX ■▲▲ | 120 | 145 | 0.75 | 0.90 |
| | | DeviceNet | TRBB146BBQ-XXX ■▲▲ | 120 | 145 | 0.77 | 0.92 |
| | | Ethernet/IP | TRBB146BBH-XXX ■▲▲ | 120 | 145 | 0.77 | 0.92 |
| | IP65 | SIO/PIO | TRBB046BBB-XXX ■▲▲ | 128.5 | 155 | 0.80 | 0.97 |
| | | DeviceNet | TRBB046BBQ-XXX ■▲▲ | 128.5 | 155 | 0.82 | 1.0 |
| | | Ethernet/IP | TRBB046BBH-XXX ■▲▲ | 128.5 | 155 | 0.82 | 1.0 |

Note: ■ = No brake (N) or brake (B) ; ▲▲ = gear ratio, 5, 10 or 25 for this model

| Gear reducer type | Gear ratio | Gear reducer body length (L2) in mm | Gear reducer mass in kg |
|---|---|---|---|
| LP50 | 5 | 62 | 0.75 |
| | 10 | 62 | 0.75 |
| | 25 | 77.5 | 0.95 |

## Type 6X TRS motor/gear reducer specifications

| Item | | Units | Data | | | | |
|---|---|---|---|---|---|---|---|
| Motor type | | - | Brushless servo motor system (BLM) – Type 6X – 200W rated power | | | | |
| Gear reducer type | | - | LP70 | | | | |
| Gear ratio | | - | 5 | 10 | 15 | 25 | 50 |
| Output torque | Continuous | Nm | 1.6 | 3.8 | 5.7 | 9.6 | 19.2 |
| | Maximum | | 6.8 | 14.2 | 21.3 | 35 | 35 |
| Protection Class | | - | Assembly is IP40 because of servomotor rating | | | | |
| Type code | | - | TRSB16ACB-XXX ■▲▲ , where:<br>■ = N for no brake, B for brake<br>▲▲ = gear ratio, as shown above | | | | |
| Encoder | - | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | | |
| Incremental encoder | Resolution | p/r | 2000 | | | | |
| Mechanical shaft interface | | - | 16mm diameter w/key | | | | |
| Optional brake | Type | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | |
| | Torque | Nm | 6.3 | 12.7 | 19.0 | 31.7 | 63 |
| Maximum output speed | | rpm | 1000 | 500 | 333 | 200 | 100 |
| Rotor inertia | No brake | g.cm$^2$ | 180 | | | | |
| | With brake | | 280 | | | | |
| Gear inertia | | g.cm$^2$ | 230 | 210 | 230 | 220 | 210 |
| Maximum force on shaft | Radial | N | 1450 | | | | |
| | Axial | N | 1550 | | | | |
| Lost motion | | arc-min | 12 | | 15 | | |

| Item | | Units | Data | | | | |
|---|---|---|---|---|---|---|---|
| Motor type | | - | Brushless servo motor system (BLM) – Type 6X – 400W rated power | | | | |
| Gear reducer type | | - | LP70 | | | LP90 | |
| Gear ratio | | - | 5 | 10 | 15 | 25 | 50 |
| Output torque | Continuous | Nm | 4.2 | 9.0 | 11.2 | 18.7 | 40 |
| | Maximum | | 14.6 | 29.0 | 42.3 | 70.6 | 90 |
| Protection Class | | _ | Assembly is IP40 because of servomotor rating | | | | |
| Type code | | - | TRSB16ADB-XXX ■▲▲ , where:<br>■ = N for no brake, B for brake<br>▲▲ = gear ratio, as shown above | | | | |
| Encoder | - | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | | |
| Incremental encoder | Resolution | p/r | 200 | | | | |
| Mechanical shaft interface | | - | 16mm diameter w/key | | 22mm diameter w/key | | |
| Optional brake | Type | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | |
| | Torque | Nm | 6.3 | 12.7 | 19.0 | 31.7 | 63 |
| Maximum output speed | | rpm | 1000 | 500 | 333 | 200 | 100 |
| Rotor inertia | No brake | g.cm$^2$ | 340 | | | | |
| | With brake | | 440 | | | | |
| Gear inertia | | g.cm$^2$ | 230 | 210 | 1500 | 1420 | 1420 |
| Maximum force on shaft | Radial | - | 1450 | | | | |
| | Axial | | 1550 | | | | |
| Lost motion | | arc-min | 12 | | 15 | | |

| Specifications common to all Type 6X servomotor/gear reducers | | | | |
|---|---|---|---|---|
| Power supply | | - | 200/230 VAC , 3 phase. +10%, -15%, 50/60 Hz | |
| Control Interface (See note 1) | | - | RS485 (SIO) + PIO<br>Pulse + RS485 + PIO<br>DeviceNet + RS485 + PIO<br>Ethernet/IP + RS485 + PIO | |
| Parallel interface (PIO) | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | |
| Analog interface | | - | Differential analog input for position control – available on request. | |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | |
| | Stored memory | - | 64 Points (48 for Ethernet/IP) | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | |
| | Alarm | - | Alarm/warning detection | |
| | Monitor | - | Internal state monitor, velocity/position trace | |
| | Others | - | Press mode, shortest path, linked move, parameter recovery, etc. | |
| Ambient | Temperature | °C | 0 — +40 operation; -20 — +60 storage | |
| | Humidity | % | 90% relative humidity maximum, non-condensing | |
| Material and surface treatment | Motor body | - | Anodized aluminum (white color) | |
| | Output shaft | - | Steel | |
| Mounting | | - | Mounts to flange | |

Notes:  1.  Analog interface and CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# Type 6X TRS motor/gear reducer torque/speed curves - 200W Motor
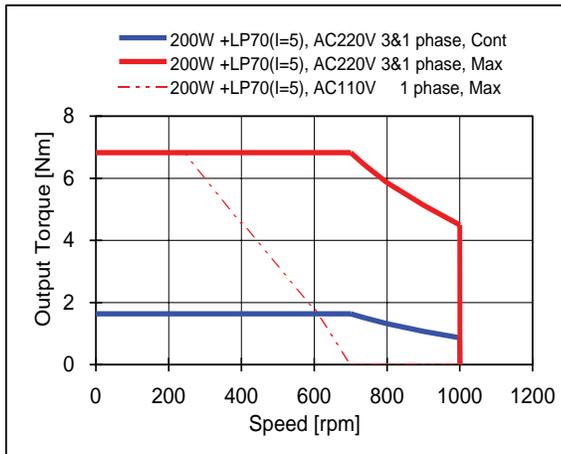


TRSB16XC 200W Servo/LP70, i=5
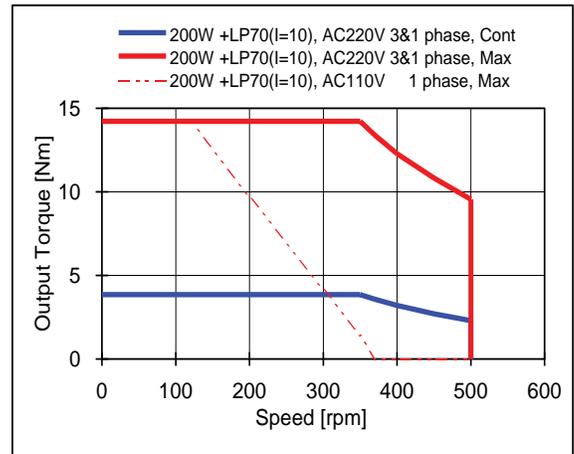


TRSB16XC 200W Servo/LP70, i=10
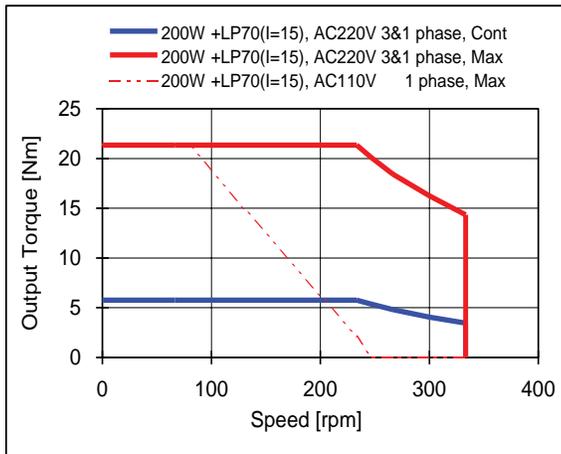


TRSB16XC 200W Servo/LP70, i=15
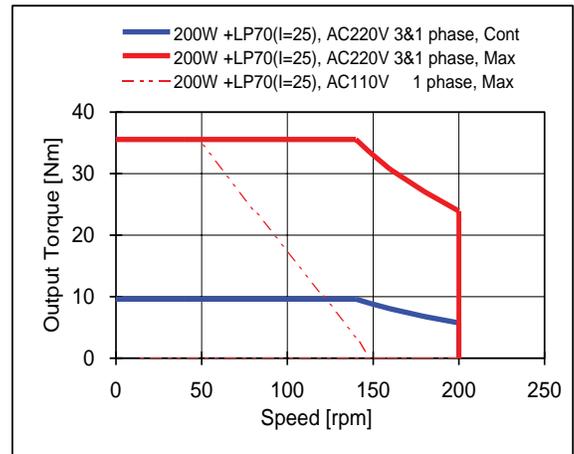


TRSB16XC 200W Servo/LP70, i=25
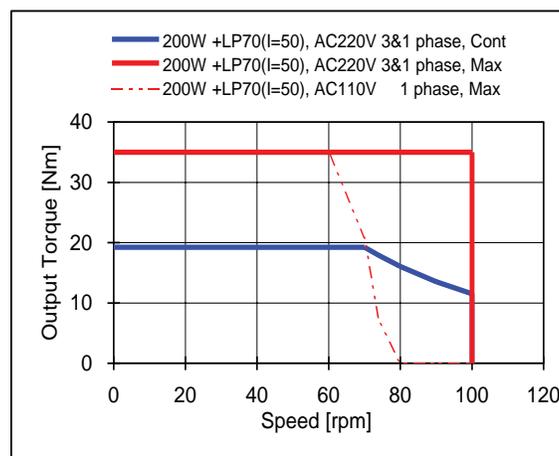


TRSB16XC 200W Servo/LP70, i=50

Notes:  1. Standard power supply is 220VAC, 3-phase. Dotted lines in curves indicated derated performance using alternate supplies.
2. Above characteristics are typical data under nominal power and 25°C ambient temperature.
3. For 50:1 ratio, performance is limited by the gear reducer, not the motor.

# TRS Rotary Motor with Planetary Gear Reducer

## Type 6X TRS motor/gear reducer torque/speed curves - 400W Motor



400W +LP70(I=5), AC220V 3 phase, Cont
400W +LP70(I=5), AC220V 3 phase, Max
400W +LP70(I=5), AC220V 1 phase, Max
400W +LP70(I=5), AC110V 1 phase, Max

TRSB16XD 400W Servo/LP70, i=5



400W +LP70(I=10), AC220V 3 phase, Cont
400W +LP70(I=10), AC220V 3 phase, Max
400W +LP70(I=10), AC220V 1 phase, Max
400W +LP70(I=10), AC110V 1 phase, Max

TRSB16XD 400W Servo/LP70, i=10



400W +LP90(I=15), AC220V 3 phase, Cont
400W +LP90(I=15), AC220V 3 phase, Max
400W +LP90(I=15), AC220V 1 phase, Max
400W +LP90(I=15), AC110V 1 phase, Max

TRSB16XD 400W Servo/LP90, i=15



400W +LP90(I=25), AC220V 3 phase, Cont
400W +LP90(I=25), AC220V 3 phase, Max
400W +LP90(I=25), AC220V 1 phase, Max
400W +LP90(I=25), AC110V 1 phase, Max

TRSB16XD 400W Servo/LP90, i=25



400W +LP90(I=50), AC220V 3 phase, Cont
400W +LP90(I=50), AC220V 3 phase, Max
400W +LP90(I=50), AC220V 1 phase, Max
400W +LP90(I=50), AC110V 1 phase, Max

TRSB16XD 400W Servo/LP90, i=50

Notes:  1. Standard power supply is 220VAC, 3-phase. Dotted lines in curves indicated derated performance using alternate supplies.
2. Above characteristics are typical data under nominal power and 25°C ambient temperature.
3. For 50:1 ratio, performance is limited by the gear reducer, not the motor.

## Type 6X TRS motor/gear reducer mechanical specifications

The following drawings show typical type 6X TRS/LP servo/planetary gear reducer configurations with SIO/PIO/Fieldbus interfaces. A number of connector configurations are available for the various types of control interfaces. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for current CAD drawings of your selected configuration.

### Type 6X TRS motor/LP70 planetary gear reducer – IP40 protection class
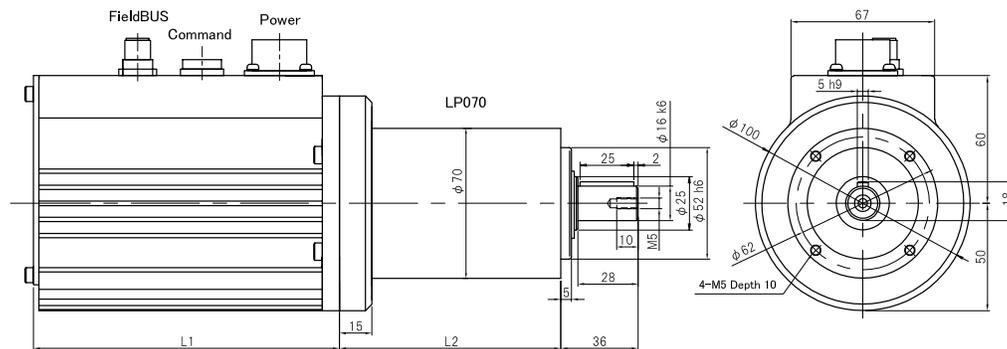


### Type 6X TRS motor/LP90 planetary gear reducer – IP40 protection class
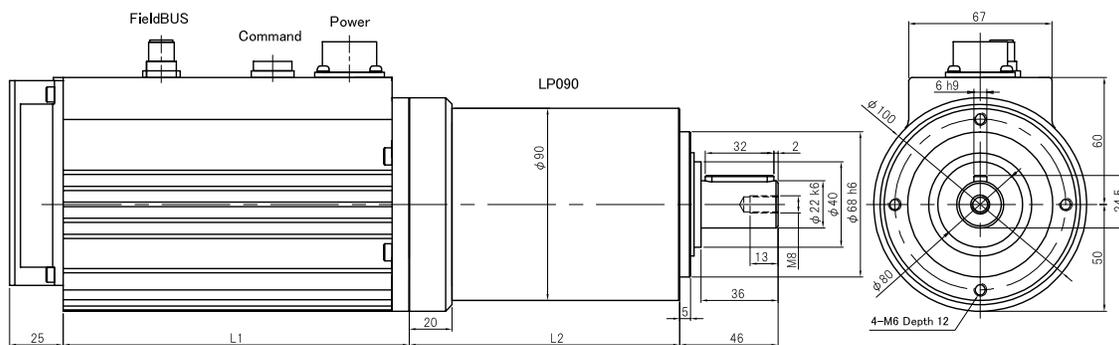


| Motor type | Rated Power | Interface type | Type code | Motor body length (L1) in mm | | Motor mass in kg | |
|---|---|---|---|---|---|---|---|
| | | | | Without brake | With brake | Without brake | With brake |
| Servo (BLM) - Protection Class IP 40 | 200W | SIO/PIO | TRBB16ACBB-XXX■▲▲ | 143 | 177 | 1.9 | 2.4 |
| | | DeviceNet | TRBB16ACBQ-XXX■▲▲ | 143 | 177 | 1.9 | 2.4 |
| | | Ethernet/IP | TRBB16ACBH-XXX■▲▲ | 143 | 177 | 1.9 | 2.4 |
| | 400W | SIO/PIO | TRBB16ADBB-XXX■▲▲ | 162 | 196 | 2.3 | 2.9 |
| | | DeviceNet | TRBB16ADBQ-XXX■▲▲ | 162 | 196 | 2.3 | 2.9 |
| | | Ethernet/IP | TRBB16ADBH-XXX■▲▲ | 162 | 196 | 2.3 | 2.9 |

Note: ■ = No brake (N) or brake (B); ▲▲ = gear ratio, 5, 10, 15, 25, 50
Note: L1 is the motor housing length. Additional 25mm heat radiation fin only present on the 400W version.

| Motor type | Gear reducer type | Gear ratio | Gear reducer body length (L2) in mm | Gear reducer mass in kg |
|---|---|---|---|---|
| 200W servo | LP70 | 5, 10 | 83 | 2.0 |
| | | 15, 25, 50 | 103 | 2.4 |
| 400W servo | LP70 | 5, 10 | 83 | 2.0 |
| | LP90 | 15, 25, 50 | 126.5 | 5.0 |

## TRS rotary motor with right-angle LPK planetary gear reducer

This motor has one of the WITTENSTEIN alpha LPK right-angle planetary gear reducers installed. This model is ideal where higher torques at lower speeds are required, but mounting space is limited. For type 46, 5, 10 and 25:1 gear ratios are standard. Other gear reducers are available on special order, see page 62.

- Type 46 (46mm) TRS motor/gear reducers are available in both IP40 and IP64 protection class.
- While physical dimensions are different, performance specifications are identical for both protection classes for a given motor.
- 30 to 100W motors are available in type 46.

## Type 46 TRS motor/right-angle LPK gear reducer specifications

| Item | | Units | Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Motor type** | | - | Closed loop control stepping motor system (STP) | | | Brushless servo motor system (BLM) – Type 46 | | |
| **Gear reducer type** | - | - | LPK50 | LPK50 | LPK50 | LPK50 | LPK50 | LPK50 |
| **Gear ratio** | - | - | 5 | 10 | 25 | 5 | 10 | 25 |
| Output torque | Continuous | Nm | - | - | - | 0.3 | 0.6 | 1.6 |
| | Maximum | Nm | 0.6 | 1.1 | 2.9 | 2.8 | 5.6 | 12 |
| Type code ◆ = interface type ■ = no Brake (N) or Brake (B) | IP40 | - | TRSA146AA ◆-XXX ■ 05 | TRSA146AA ◆-XXX ■ 10 | TRSA146AA ◆-XXX ■ 25 | TRSB146BB ◆-XXX ■ 05 | TRSB146BB ◆-XXX ■ 10 | TRSB146BB ◆-XXX ■ 25 |
| | IP 64 (See note 1) | - | TRSA046AA ◆-XXX ■ 05 | TRSA046AA ◆-XXX ■ 10 | TRSA046AA ◆-XXX ■ 25 | TRSB046BB ◆-XXX ■ 05 | TRSB046BB ◆-XXX ■ 10 | TRSB046BB ◆-XXX ■ 25 |
| Encoder | - | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | | | |
| Incremental encoder | Resolution | p/r | 800 | | | 2000 | | |
| Max torque available at initialization (See note 2) | Without brake | Nm | 0.63 | 1.26 | 3.15 | n/a | n/a | n/a |
| | With brake | Nm | 1.0 | 2.0 | 5.0 | n/a | n/a | n/a |
| Mechanical shaft interface | - | - | 12 mm diameter with keyway | | | 12 mm diameter with keyway | | |
| Optional brake | Type | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | | |
| | Torque | Nm | 1.6 | 3.2 | 8.0 | 1.6 | 3.2 | 8.0 |
| Maximum speed | | rpm | 300 | 150 | 60 | 1000 | 500 | 200 |
| Rotor inertia | Without brake | g.cm$^2$ | 83 | 83 | 83 | 36.5 | 36.5 | 36.5 |
| | With brake | g.cm$^2$ | 87 | 87 | 87 | 40.5 | 40.5 | 40.5 |
| Gear inertia | | g.cm$^2$ | 156 | 156 | 156 | 156 | 156 | 156 |
| Maximum forces on shaft | Radial | N | 650 | | | | | |
| | Axial | N | 700 | | | | | |
| Lost motion | | arc-min | <=13 | <=13 | <=15 | <=13 | <=13 | <=13 |
| Power supply | Control | - | 24VDC +/-10%, 0.2A | | | 12-48VDC +/-10%, 0.2A | | |
| | Main | - | 24VDC +/10%, 1.5A (1.7 with brake) | | | 48VDC +/- 10%, 3A continuous, 9A peak (add 0.2A for brake) | | |
| Control Interface (See note 3) | | - | RS485 (SIO) + PIO DeviceNet + PIO Ethernet/IP + PIO | | | RS485 (SIO) + PIO Pulse + RS485 + PIO DeviceNet + RS485 + PIO Ethernet/IP + RS485 + PIO | | |
| Parallel interface (PIO) | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | | | |
| Analog interface | | - | Differential analog input for position control – available on request | | | | | |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | | | |
| | Stored memory | - | 16 points | | | 64 Points (48 for Ethernet/IP) | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | | | | | |
| | Alarm | - | Alarm/warning detection | | | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | | | |
| | Others | - | Press mode, shortest path, linked move, parameter recovery, etc. | | | | | |
| Ambient | Temperature | °C | 0 — +40 operation; -20 — +60 storage | | | | | |
| | Humidity | % | 90% relative humidity maximum, non-condensing | | | | | |
| Material and surface treatment | Motor body | - | Anodized aluminum (white color) | | | | | |
| | Output shaft | - | Steel | | | | | |
| Mounting | | - | Mounts to flange | | | | | |

Notes:
1. The motor is IP65, the gear reducers are IP64.
2. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
3. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# Type 46 TRS motor/right-angle LPK gear reducer torque/speed curves
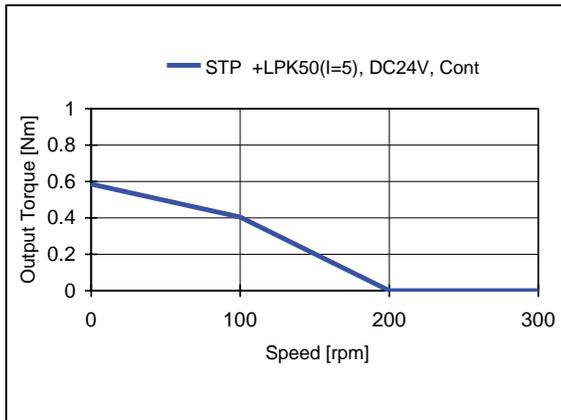
TRSA*46A Stepper/LPK50 i=5
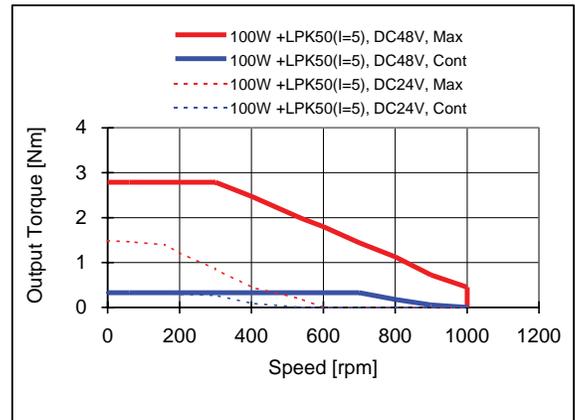
TRSB*46B 100W Servo/LPK50 i=5
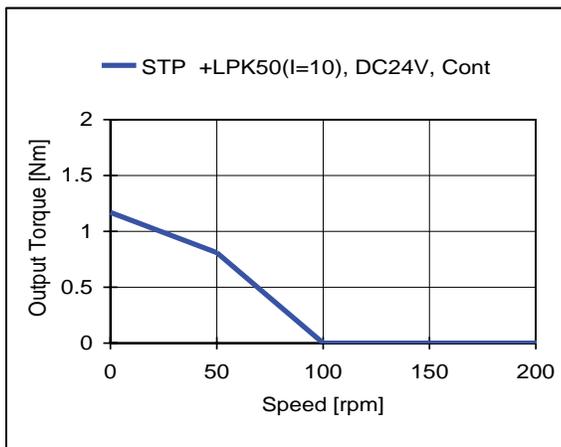
TRSA*46A Stepper/LPK50 i=10
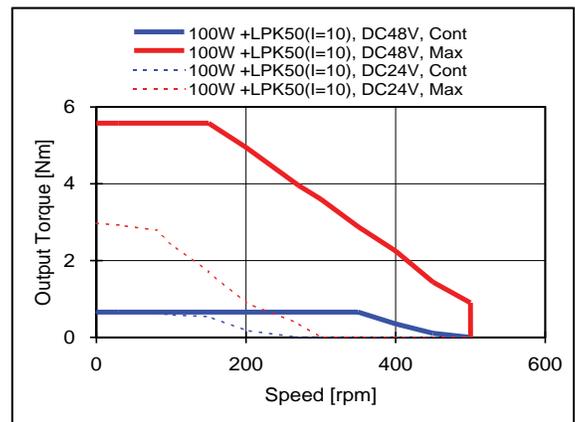
TRSB*46B 100W Servo/LPK50 i=10
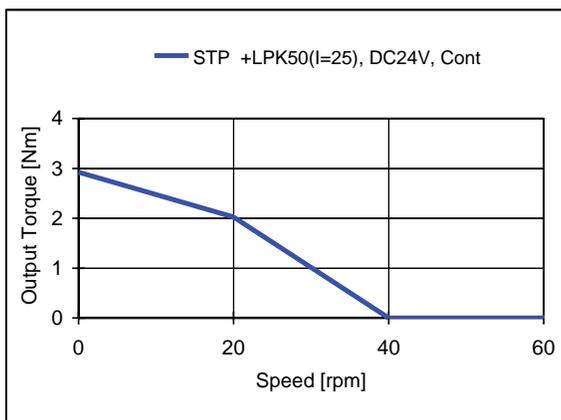
TRSA*46A Stepper/LPK50 i=25
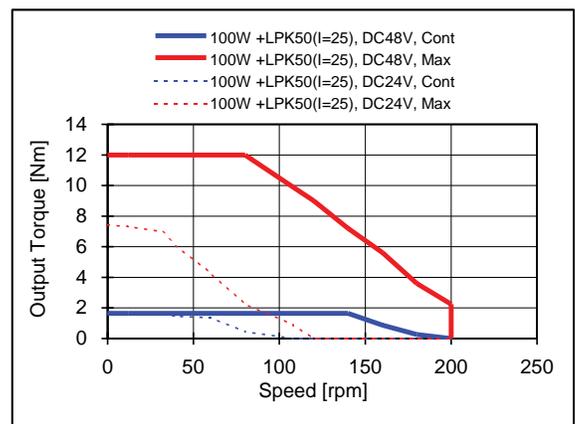
TRSB*46B 100W Servo/LPK50 i=25

Notes:  1. Torque/speed characteristics are the same for IP40 and IP64/65. * symbol in type code = 1 for IP40, = 0 for IP64/65.

2. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate derated performance using alternate supplies.

3. Above characteristics are typical data under nominal power and 25˚C ambient temperature.

## Type 46 TRS motor/right-angle LPK gear reducer mechanical specifications

The following drawing shows one typical type 46 TRS-LPK configuration for SIO/PIO interface. A number of connector configurations are available for the various types of control interfaces in both IP40 and IP64 protection classes. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for current CAD drawings of your selected configuration.

### Type 46 TRS motor/right-angle LPK50 planetary gear reducer – IP64 protection class

| Motor type | Protection class | Interface type | Type code (see note below) | Motor body length (L1) in mm | | Motor mass in kg | |
|---|---|---|---|---|---|---|---|
| | | | | Without brake | With brake | Without brake | With brake |
| Stepper (STP) | IP40 | SIO/PIO | TRBA146AAB-XXX ■▲▲ | 120 | 145 | 0.78 | 0.93 |
| | | DeviceNet | TRBA146AAQ-XXX ■▲▲ | 120 | 145 | 0.8 | 0.95 |
| | | Ethernet/IP | TRBA146AAH-XXX ■▲▲ | 120 | 145 | 0.8 | 0.95 |
| | IP65 | SIO/PIO | TRBA046AAB-XXX ■▲▲ | 104 | 130 | 0.79 | 0.97 |
| | | DeviceNet | TRBA046AAQ-XXX ■▲▲ | 114 | 140 | 0.81 | 0.81 |
| | | Ethernet/IP | TRBA046AAH-XXX ■▲▲ | 114 | 140 | 0.81 | 0.81 |
| Servo (BLM) | IP40 | SIO/PIO | TRBB146BBB-XXX ■▲▲ | 120 | 145 | 0.75 | 0.90 |
| | | DeviceNet | TRBB146BBQ-XXX ■▲▲ | 120 | 145 | 0.77 | 0.92 |
| | | Ethernet/IP | TRBB146BBH-XXX ■▲▲ | 120 | 145 | 0.77 | 0.92 |
| | P65 | SIO/PIO | TRBB046BBB-XXX ■▲▲ | 128.5 | 155 | 0.80 | 0.97 |
| | | DeviceNet | TRBB046BBQ-XXX ■▲▲ | 128.5 | 155 | 0.82 | 1.0 |
| | | Ethernet/IP | TRBB046BBH-XXX ■▲▲ | 128.5 | 155 | 0.82 | 1.0 |

Note: ■ = No brake (N) or brake (B); ▲▲ = gear ratio, 5, 10 or 25 for this model.

| Gear reducer type | Gear ratio | Gear reducer body length (L2) in mm | Gear reducer mass in kg |
|---|---|---|---|
| LPK50 | 5 | 49 | 1.4 |
| | 10 | 49 | 1.4 |
| | 25 | 64.5 | 1.6 |

## Other motor/gear reducer combinations

The above sections describe the standard LP and LPK gear reducer/motor combinations available. Other gear ratios are available on special order and other models in the WITTENSTEIN alpha gear reducer family can also be combined with the ternary. See page 62, special order products, for more information.

# ternary™ linear (cylinder) actuators

Intelligent alternative to pneumatics

Stepper, 100W servo versions

In-line or folded versions

## TLS rod-type linear actuator

This actuator is often used as an intelligent alternative where pneumatic cylinders may have been considered. It offers better controllability, no slamming end stops, and no need for an air supply, hoses, valves, etc.

- Type 46 (46mm) TLS actuators are available in both IP40 and IP65 protection class.
- While physical dimensions are different, performance specifications are identical for both protection classes for a given motor.

## Type 46 TLS rod-type linear actuator specifications

| Item | | Units | Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Motor type | | - | Closed loop control stepping motor system (STP) | | | Brushless servo motor system (BLM) – Type 46 | | |
| Ball screw lead | | mm | 3 | 6 | 12 | 3 (See note 1) | 6 | 12 |
| Stroke | | mm | 50, 100, 150, 225, 300 standard; 25, 75 available on special order | | | | | |
| Type code ◆ = interface type XX = stroke ■ = No brake (N) or brake (B) | IP40 | - | TLSA146AA◆-3XX■01 | TLSA146AA◆-6XX■01 | TLSA146AA◆-CXX■01 | TLSB146BB◆-3XX■01 | TLSB146BB◆-6XX■01 | TLSB146BB◆-CXX■01 |
| | IP65 | | TLSA046AA◆-3XX■01 | TLSA046AA◆-6XX■01 | TLSA046AA◆-CXX■01 | TLSB046BB◆-3XX■01 | TLSB046BB◆-6XX■01 | TLSB046BB◆-CXX■01 |
| Max operating speed | | mm/s | 225 | 450 | 700 | 250 | 500 | 1000 |
| Output thrust (See note 1) | Continuous | N | 600 | 300 | 140 | 470 | 240 | 100 |
| | Maximum | N | 600 | 300 | 140 | 700/(1000) (See note 2) | 700 | 350 |
| Maximum thrust available at initialization (See note 3) | Without brake | N | 200 | 100 | 50 | n/a | n/a | n/a |
| | With brake | N | 450 | 220 | 140 | n/a | n/a | n/a |
| Optional brake | | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | | |
| Brake holding force (option) | | N | 600 | 300 | 150 | 600 | 300 | 150 |
| Base load for 5000 km travel life (both IP40 & IP65) | | N | 300 | 200 | 100 | 300 | 200 | 100 |
| Resolution | | mm | 0.00375 | 0.0075 | 0.015 | 0.0015 | 0.003 | 0.012 |
| Repeatability | | mm | +/-0.0045 | +/-0.009 | +/-0.018 | +/-0.0045 | +/-0.009 | +/-0.018 |
| Lost motion at no load condition | IP40 | mm | 0.1 | | | 0.1 | | |
| | IP65 | mm | 0.05 | | | 0.05 | | |
| Position encoder | | - | Incremental encoder standard. Optional absolute encoder available on special order | | | | | |
| Power supply | Logic | - | 24 VDC +/-10%, 0.2A | | | 12-48 VDC +/-10%, 0.2A | | |
| | Main | - | 24 VDC +/-10%, 1.5A (1.7A with brake) | | | 48 VDC +/-10%, 3A continuous, 9A peak (add 0.2 A for motor with brake) | | |
| Output rod shape/tip | | - | 20 mm diameter rod, with selectable tips<br>Tip A: M16 x 1.5 – Male without wrench flats.<br>Tip B: M16 x 1.5 – Male thread with double-D flats for wrench. **This is the default case.**<br>Tip C: M10 x 1.25 – Female thread with double-D flats for wrench.<br>Tip D: M12 x 1.25 – Male thread with double-D flats for wrench. | | | | | |
| Mounting | | - | Flange mount or T-slot at bottom surface | | | | | |
| Control interface (See note 4) | | - | RS485 (SIO) + PIO<br>DeviceNet + PIO<br>Ethernet/IP + PIO | | | RS485 (SIO) + PIO<br>Pulse + RS485 + PIO<br>DeviceNet + PIO + RS485<br>Ethernet/IP + PIO + RS485 | | |
| PIO (parallel I/O) port | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | | | |
| Analog input | | - | Differential analog input for position control – available on request. | | | | | |
| Acceleration | | - | Ramp | | | Ramp | | |
| Number of stored positions | | - | 16 points | | | 64 points (48 for Ethernet/IP) | | |
| Allowable radial load on output rod | | - | See allowable radial load table, page 29. | | | | | |
| Allowable torsional moment on output rod | IP40 | Nm | 20 Nm at installation, 2 Nm during operation | | | | | |
| | IP65 | | 5 Nm at installation, 0.5 Nm during operation, independent of rod position. | | | | | |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | | | | | |
| | Alarm | - | Alarm/warning detection | | | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | | | |
| | Other | - | Press mode, software stroke limit, linked move, parameter recovery, etc. | | | | | |
| Ambient | Temperature | °C | 0 – +40 operation; -20 - +60 storage | | | | | |
| | Humidity | % | <90% relative humidity, non-condensing | | | | | |

Notes: 1. For 3 mm lead screw with 300 mm stroke, maximum thrust is limited to 600N due to possibility of buckling.
2. A higher capacity 3mm ballscrew is available as a standard option for the IP65 version. Data for this option shown in ( ). The higher capacity ballscrew is standard with the IP40 product.
3. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
4. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# TLS Rod-type Linear Actuator

## Type 46 TLS rod-type linear actuator thrust/speed curves
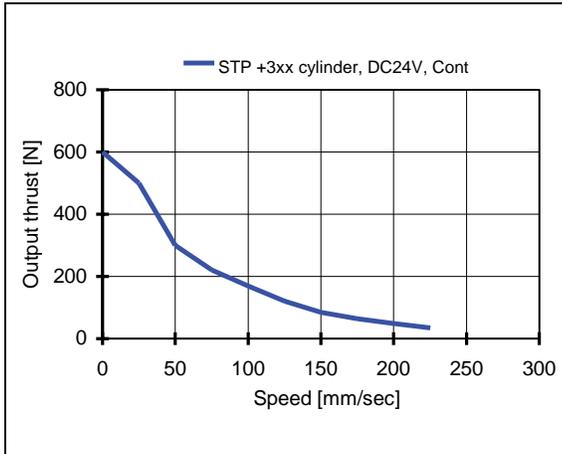

TLSA*46AXX-3XX Stepper/3mm Lead
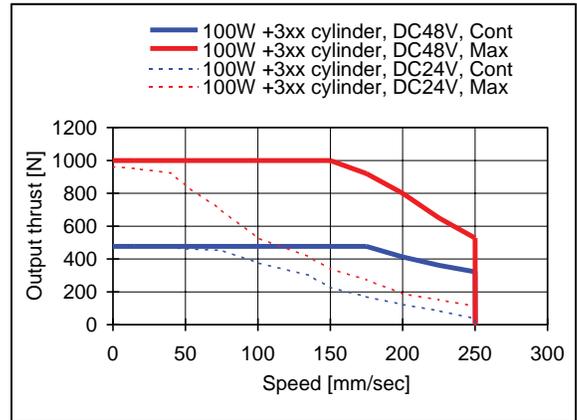

TLSB*46BXX-3XX 100W Servo/3mm Lead
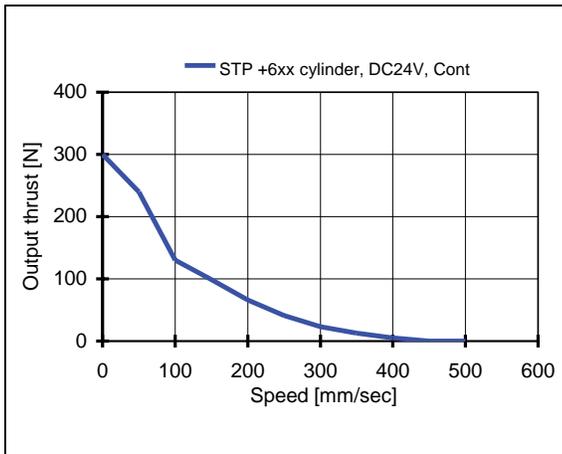

TLSA*46AXX-6XX Stepper/6mm Lead
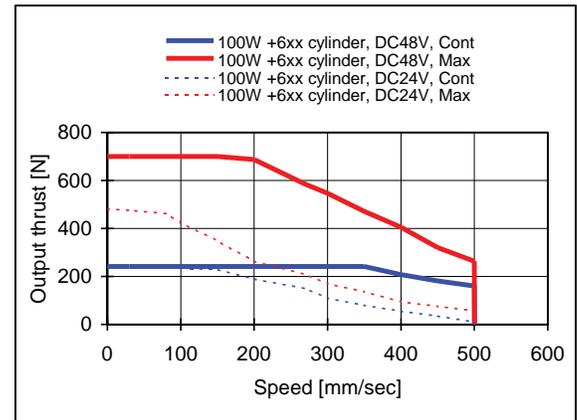

TLSB*46BXX-6XX Servo/6mm Lead
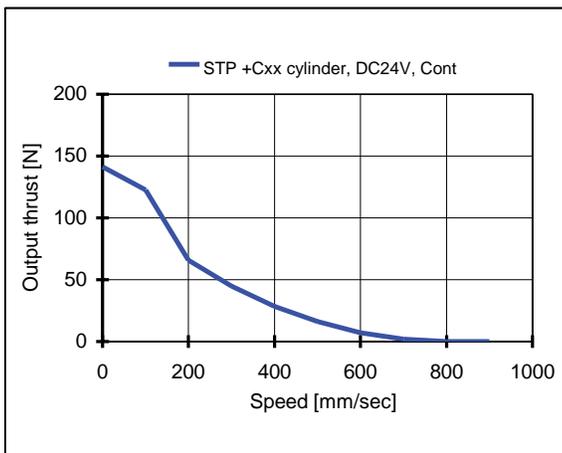

TLSA*46AXX-CXX Stepper/12mm Lead
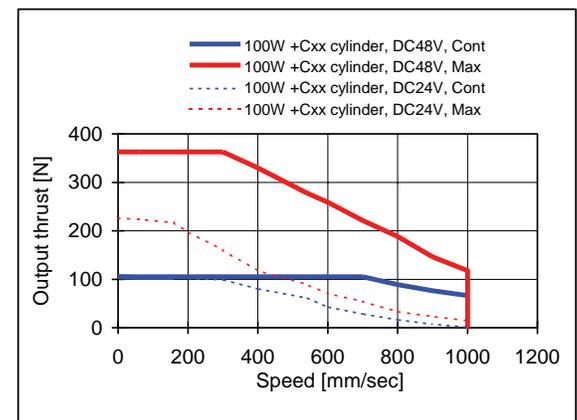

TLSB*46BXX-CXX 100W Servo/12mm Lead

Notes:  1. Torque/speed characteristics are the same for IP40 and IP64/65. * symbol in type code = 1 for IP40, = 0 for IP64/65.
   2. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate derated performance using alternate supplies.
   3. Above characteristics are typical data under nominal power and 25°C ambient temperature.

# Type 46 TLS rod-type linear actuator allowable radial force

The following charts show the allowable radial force at the tip of the output rod for each TLS series linear actuator stroke length. The horizontal axis indicates the position of the output rod, the vertical axis shows the allowable radial force at each rod position. Do not exceed the radial forces specified. Exceeding these forces during installation or operation may result in loss of performance and/or premature wear of the actuator. Unsupported loads on the output rod should be avoided.

Note that due to the influence of external loads or the friction force of the driven mechanism, output thrust force and travel speed may be limited below the specification.

X05 = 50 mm rod
X10 = 100 mm rod
X15 = 150 mm rod
X22 = 225 mm rod
X30 = 300 mm rod

### Allowable radial load for TLS 3 mm and 6 mm ballscrew leads, both IP40 and IP65
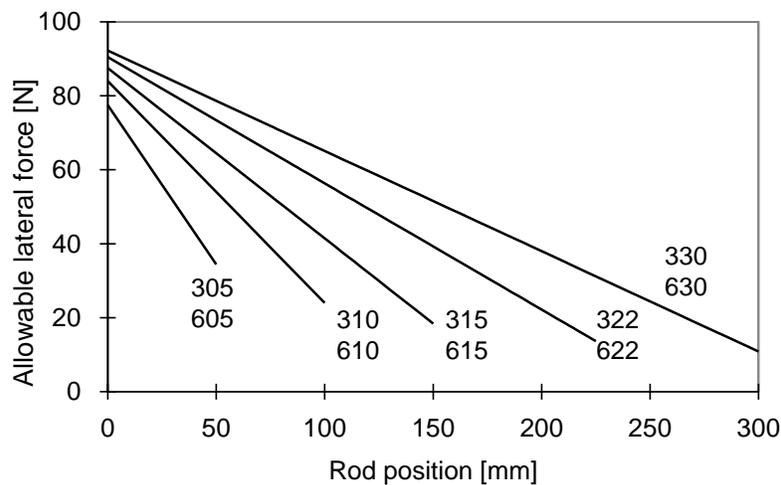


### Allowable radial load for TLS 12 mm ballscrew lead, both IP40 and IP65
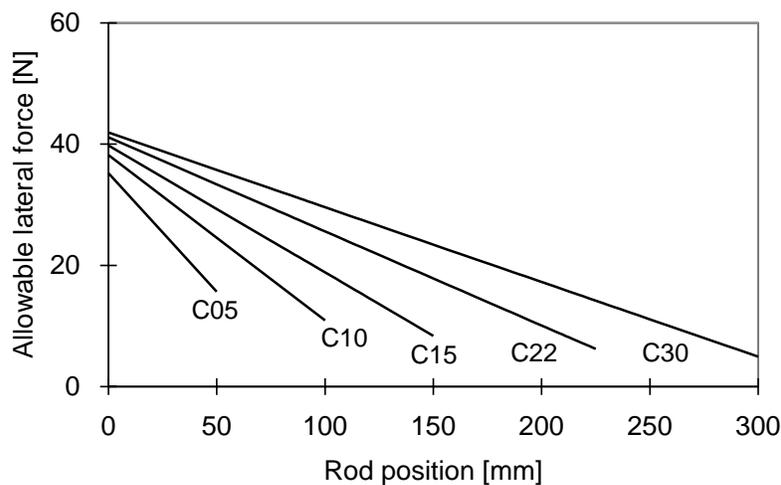
## Type 46 TLS rod-type linear actuator mechanical specifications

The following drawing shows one typical type 46 TLS configuration (SIO/PIO interface), with dimensions for side and front views, which are standard for all interface types. A number of connector configurations are available for the various types of control interfaces in both IP40 and IP65 protection classes. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for current CAD drawings of your selected configuration.

### Type 46 TLS rod-type linear actuator showing tool tip options
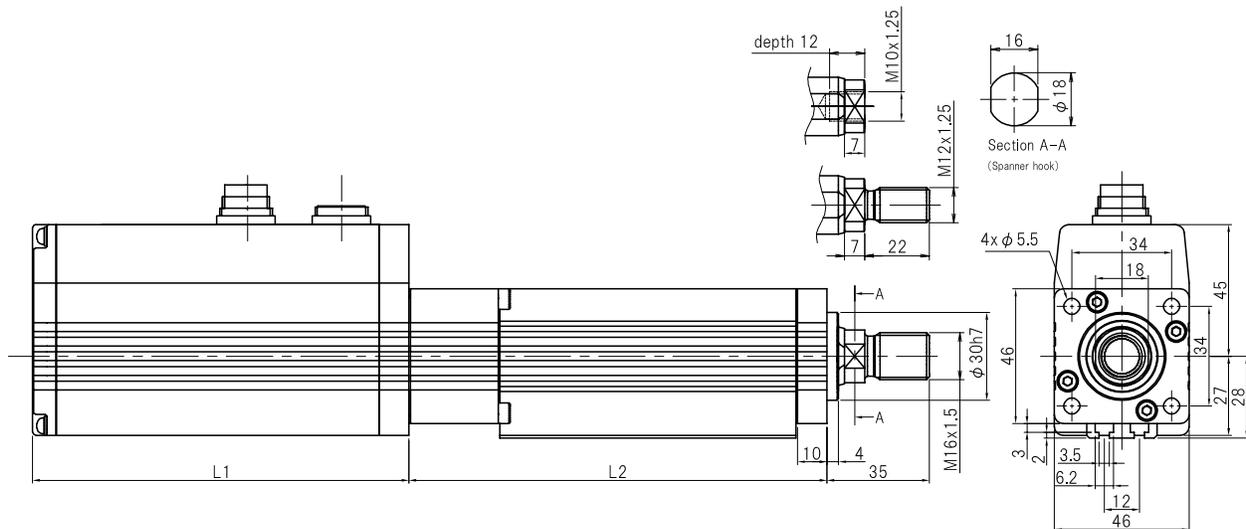
| Motor type | Interface | Brake | Motor body length L1 (mm) | | Motor mass (kg) | | Type code |
|---|---|---|---|---|---|---|---|
| | | | IP40 | IP65 | IP40 | IP65 | |
| Stepper | SIO | No brake | 120 | 104 | 0.78 | 0.79 | TLSAX46AAB-xxxN01 |
| | | With brake | 145 | 130 | 0.93 | 0.97 | TLSAX46AAB-xxxB01 |
| | DeviceNet | No brake | 120 | 114 | 0.80 | 0.81 | TLSAX46AAQ-xxxN01 |
| | | With brake | 145 | 140 | 0.95 | 1.00 | TLSAX46AAQ-xxxB01 |
| | Ethernet/IP | No brake | 120 | 114 | 0.80 | 0.81 | TLSAX46AAH-xxxN01 |
| | | With brake | 145 | 140 | 0.95 | 1.00 | TLSAX46AAH-xxxB01 |
| Type 46 Servo | SIO | No brake | 120 | 128.5 | 0.75 | 0.80 | TLSBX46BBB-xxxN01 |
| | | With brake | 145 | 155 | 0.90 | 0.97 | TLSBX46BBB-xxxB01 |
| | Pulse | No brake | 120 | 128.5 | 0.75 | 0.80 | TLSBX46BBD-xxxN01 |
| | | With brake | 145 | 155 | 0.90 | 0.97 | TLSBX46BBD-xxxB01 |
| | DeviceNet | No brake | 120 | 128.5 | 0.77 | 0.82 | TLSBX46BBQ-xxxN01 |
| | | With brake | 145 | 155 | 0.92 | 1.00 | TLSBX46BBQ-xxxB01 |
| | Ethernet/IP | No brake | 120 | 128.5 | 0.77 | 0.82 | TLSBX46BBH-xxxN01 |
| | | With brake | 145 | 155 | 0.92 | 1.00 | TLSBX46BBH-xxxB01 |

X in type code =1 for IP40, 0 for IP65. xxx in type code indicates maximum rod stroke. See table below.

| Rod stroke | Dimension L2 (mm) | | | | | | Cylinder mass (kg) |
|---|---|---|---|---|---|---|---|
| | 3 mm lead | | 6 mm lead | | 12 mm lead | | |
| | Dimension | Type code designator | Dimension | Type code designator | Dimension | Type code designator | |
| 50 mm | 142.5 | 305 | 150.5 | 605 | 142.5 | C05 | 0.85 |
| 100 mm | 192.5 | 310 | 200.5 | 610 | 192.5 | C10 | 1.05 |
| 150 mm | 242.5 | 315 | 250.5 | 615 | 242.5 | C15 | 1.25 |
| 225 mm | 317.5 | 322 | 325.5 | 622 | 317.5 | C22 | 1.54 |
| 300 mm | 392.5 | 330 | 400.5 | 630 | 392.5 | C30 | 1.84 |

Note: 25 mm and 75 mm stroke cylinders available on special order.

## TLS folded rod-type linear actuator

This actuator offers the advantages of the standard TLS, but due to the positioning of a driving belt mechanism, the motor is mounted parallel to the cylinder, providing a length advantage where the unit must be mounted in a restricted space.
• This product is available only in type 46 (46mm), both stepper and servo motor versions.
• It is available in both IP40 and IP64 protection classes.

## Type 46 TLS folded rod type linear actuator specifications

| Item | | Units | Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Motor type | | - | Closed loop control stepping motor system | | | Brushless servo motor system – Type 46 | | |
| Ballscrew lead | | mm/rev | 3 | 6 | 12 | 3 | 6 | 12 |
| Stroke | | mm | 50, 100, 150, 225, 300 standard; 25, 75 available on special order | | | 50, 100, 150, 225, 300 standard; 25, 75 available on special order | | |
| Type code X=IP40 (1) or IP65 (0) ◆ = interface type xx = stroke ■ = No brake (N) or brake (B) | | - | TLSAX46AA◆ - 3xx ■ F1* | TLSAX46AA◆ - 6xx ■ F1* | TLSAX46AA◆ - Cxx ■ F1* | TLSBX46BB◆ - 3xx ■ F1* | TLSBX46BB◆ - 6xx ■ F1* | TLSBX46BB◆ - Cxx ■ F1* |
| Max travel speed | | mm/s | 175 | 350 | 550 | 250 | 500 | 1000 |
| Max output thrust | | N | 500 | 250 | 115 | 1000 | 700 | 350 |
| Maximum thrust available at initialization (See note 1) | Without brake | N | 210 | 105 | 50 | n/a | n/a | n/a |
| | With brake | N | 450 | 220 | 140 | n/a | n/a | n/a |
| Optional brake | | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | | |
| Brake holding force (option) | | N | 600 | 300 | 150 | 600 | 300 | 150 |
| Resolution | | mm | 0.00375 | 0.0075 | 0.015 | 0.0015 | 0.003 | 0.012 |
| Repeatability | | mm | +/-0.0045 | +/-0.009 | $^+$/.0.018 | $^+$/.0.0095 | $^+$/.0.009 | $^+$/.0.018 |
| Lost motion at no load condition | | mm | 0.1 for IP40 protection class 0.07 for IP65 protection class | | | 0.1 for IP40 protection class 0.07 for IP65 protection class | | |
| Position encoder | | - | Incremental encoder standard. Optional absolute encoder available on special order. | | | | | |
| Main power | | - | 24 VDC +/-10%, 1.5A (1.7 with brake) | | | 12-48 VDC +/-10%, 0.2A | | |
| Logic power | | - | 24 VDC +/-10%, 0.2A | | | 48 VDC +/-10%, 3A continuous, 9A peak (add 0.2 A for motor with brake) | | |
| Front projection size | | mm | 50 mm x 125 mm | | | | | |
| Cylinder body length | | mm | Stroke + 119 | | | | | |
| Output rod shape/tip | | - | 20 mm diameter rod, with selectable tips Tip A: M16 x 1.5 – Male thread without flats for wrench. Tip B: M16 x 1.5 – Male thread with double-D flats for wrench **(Default case.)** Tip C: M10 x 1.25 – Female thread with double-D flats for wrench. Tip D: M12 x 1.5 – Male thread with double-D flats for wrench. | | | | | |
| Mounting | | - | Flange mount or T-slot at bottom surface | | | | | |
| Protection level | | - | Both IP40 and IP64/65 available | | | | | |
| Allowable radial load on output rod | | - | Same as standard TLS. See curves on page 29. | | | | | |
| Allowable torsional moment on output rod | IP40 | Nm | 20 Nm at installation, 2 Nm during operation | | | | | |
| | IP65 | | 5 Nm at installation, 0.5 Nm during operation | | | | | |
| Travel life distance (because of belt) | | Km | 1500 | 3000 | 4500 | 1500 | 3000 | 4500 |
| Control interface (See note 2) | | - | RS485 (SIO) + PIO DeviceNet + PIO Ethernet/IP + PIO | | | RS485 (SIO) + PIO Pulse + RS485 + PIO DeviceNet + PIO + RS485 Ethernet/IP + PIO + RS485 | | |
| PIO (parallel I/O) port | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | | | |
| Analog interface | | – | Differential analog input for position control – available on request. | | | | | |
| Acceleration | | - | Ramp | | | Ramp | | |
| Number of stored positions | | - | 16 points | | | 64 points (48 for Ethernet/IP) | | |
| Function | Drive | - | Event driven control. Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard). Manual brake release is also available. | | | | | |
| | Alarm | - | Alarm/warning detection, speed response monitoring | | | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | | | |
| | Other | - | Press mode, software stroke limit, linked move, parameter recovery, etc. | | | | | |
| Ambient | Temperature | °C | 0 – +40 operation; -20 - +60 storage | | | | | |
| | Humidity | % | 90% relative humidity, maximum, non-condensing | | | | | |
| Material and surface treatment | Cylinder body | - | Anodized aluminum (white color) | | | | | |
| | Output rod | - | Steel | | | | | |

Notes: 1. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
2. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# TLS Folded Rod-type Linear Actuator

## Type 46 TLS folded rod actuator thrust/speed curve

**STP +3xx cylinder Fold, DC24V, Cont**

TLSA*46AXX-3XX F1 Stepper/3mm Lead

**100W +3xx cylinder Fold, DC48V, Max**
**100W +3xx cylinder Fold, DC48V, Cont**
**100W +3xx cylinder Fold, DC24V, Max**
**100W +3xx cylinder Fold, DC24V, Cont**

TLSB*46BXX-3XX F1 Servo/3mm Lead

**STP +6xx cylinder Fold, DC24V, Cont**
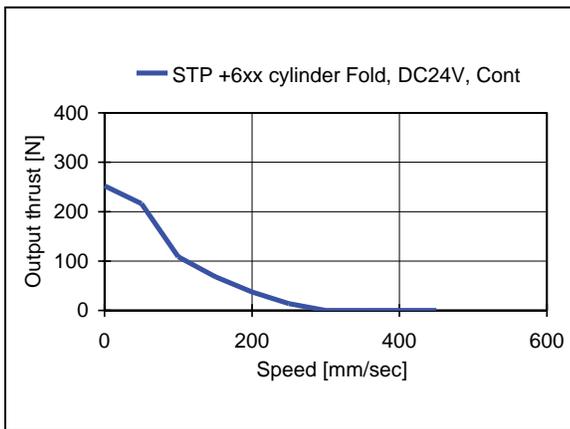
TLSA*46AXX-6XX F1 Stepper/6mm Lead

**100W +6xx cylinder Fold, DC48V, Max**
**100W +6xx cylinder Fold, DC48V, Cont**
**100W +6xx cylinder Fold, DC24V, Max**
**100W +6xx cylinder Fold, DC24V, Cont**
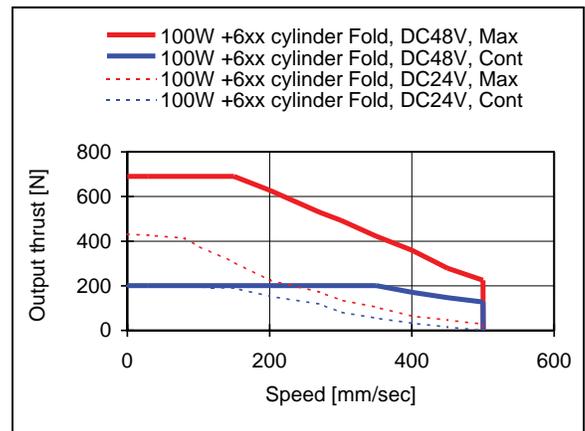
TLSB*46BXX-6XX F1 Servo/6mm Lead

**STP +Cxx cylinder Fold, DC24V, Cont**
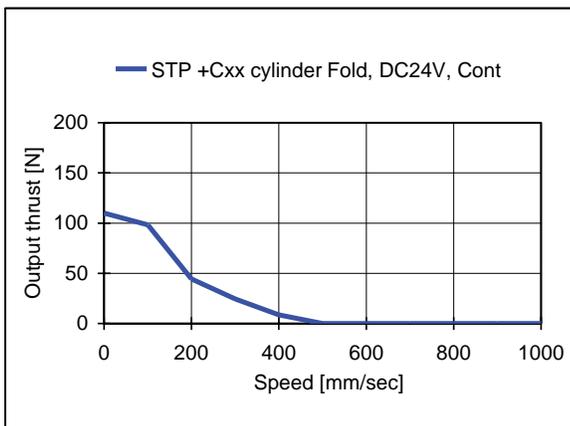
TLSA*46AXX-CXX F1 Stepper/12mm Lead

**100W +Cxx cylinder Fold, DC48V, Max**
**100W +Cxx cylinder Fold, DC48V, Cont**
**100W +Cxx cylinder Fold, DC24V, Max**
**100W +Cxx cylinder Fold, DC24V, Cont**

TLSB*46BXX-CXX F1 Servo/12mm Lead

Notes:  1. Torque/speed characteristics are the same for IP40 and IP64/65. * symbol in type code = 1 for IP40, = 0 for IP64/65.
2. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate derated performance using alternate supplies.
3. Above characteristics are typical data under nominal power and 25℃ ambient temperature.

## Type 46 TLS folded rod actuator mechanical specifications

The following drawing shows one typical type 46 TLS configuration (SIO/PIO interface and IP40 protection class), with dimensions for side and front views. A number of connector configurations are available for the various types of control interfaces in both IP40 and IP64 protection classes. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for current CAD drawings of your selected configuration.

### Type 46 TLS folded rod-type linear actuator showing tool tip options
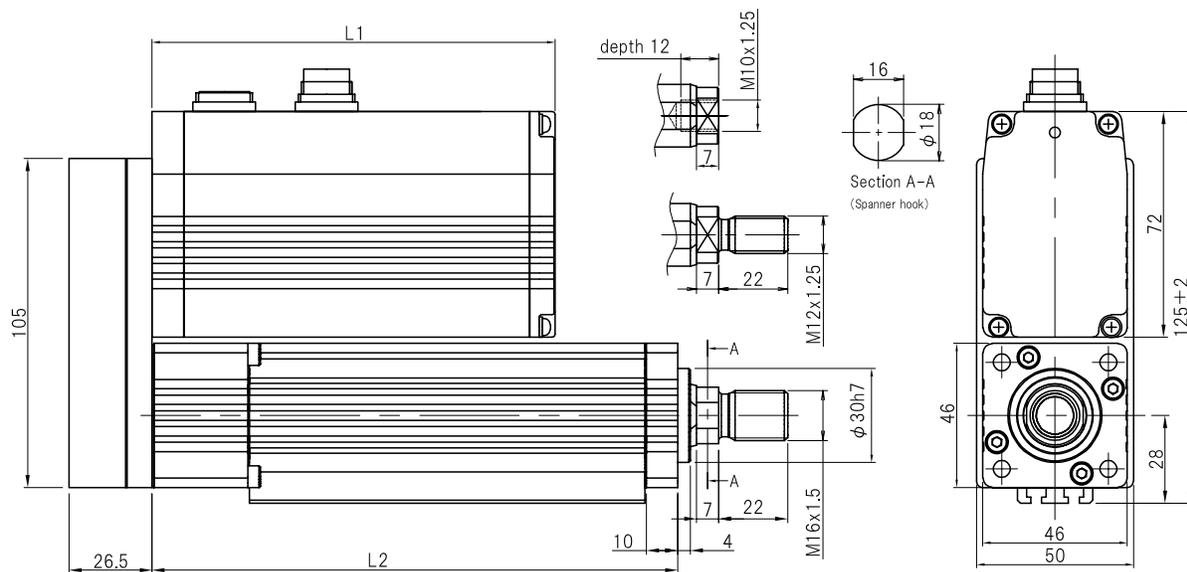
See the table on page 30 for the motor body length, L1, and the motor mass both with and without brake.

| Lead/motor rev | Cylinder stroke | Cylinder dimension | | Mass (in kg) | Type code |
|---|---|---|---|---|---|
| | | L1 | L2 | | |
| 3 | 50 mm | 169 | 142.5 | 1.02 | TLS*X46••◆-305 ■ F1 |
| | 100 mm | 219 | 192.5 | 1.22 | TLS*X46••◆-310 ■ F1 |
| | 150 mm | 269 | 242.5 | 1.42 | TLS*X46••◆-315 ■ F1 |
| | 225 mm | 344 | 317.5 | 1.71 | TLS*X46••◆-322 ■ F1 |
| | 300 mm | 419 | 392.5 | 2.01 | TLS*X46••◆-330 ■ F1 |
| 6 | 50 mm | 177 | 150.5 | 1.02 | TLS*X46••◆-605 ■ F1 |
| | 100 mm | 227 | 200.5 | 1.22 | TLS*X46••◆-610 ■ F1 |
| | 150 mm | 277 | 250.5 | 1.42 | TLS*X46••◆-615 ■ F1 |
| | 225 mm | 352 | 325.5 | 1.71 | TLS*X46••◆-622 ■ F1 |
| | 300 mm | 427 | 400.5 | 2.01 | TLS*X46••◆-630 ■ F1 |
| 12 mm (C in type code) | 50 mm | 169 | 142.5 | 1.02 | TLS*X46••◆-C05■ F1 |
| | 100 mm | 219 | 192.5 | 1.22 | TLS*X46••◆-C10■ F1 |
| | 150 mm | 269 | 242.5 | 1.42 | TLS*X46••◆-C15■ F1 |
| | 225 mm | 344 | 317.5 | 1.71 | TLS*X46••◆-C22■ F1 |
| | 300 mm | 419 | 392.5 | 2.01 | TLS*X46••◆-C30■ F1 |
| Note: 75 mm stroke cylinder available as special option. | | | | | |

* A = stepper; B = servo
X =1 for IP40, 0 for IP65.
•• AA = stepper; BB = servo
◆ = interface type
■ = No brake (N) or brake (B)

# ternary™ rodless slider linear actuators

More precise alternative to pneumatics

Stepper, 100W servo versions

Two sizes, up to 700 mm travel

## TSS rodless slider linear actuator

This actuator offers two sizes of compact rodless sliders to which customer devices can be mounted. Products are available with 100 - 700 mm strokes. The TSS offers faster speeds than the TLS rod-type actuator. The combination of the TLS actuator and TSS rodless slider provides a simple, intelligent x-y-z positioning system.

- Type 46 (46mm) TSS actuators are available in both stepper and servo models with IP40 protection.
- Both medium and high speed rodless sliders are available.
- Two rodless slider sizes are available, Size 45 and Size 60.  The Size 60 provides longer travel capacity and better moment loading. The rodless slider can be freely mounted in any position orientation.

## Type 46 TSS rodless slider specifications

| Item | | Units | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Motor type | | - | Closed loop control stepping motor system | | | | Brushless servo motor system – Type 46 | | | |
| Slider type | | - | 045 | | 060 | | 045 | | 060 | |
| Ball screw lead pitch | | mm | 6 | 12 | 6 | 12 | 6 | 12 | 6 | 12 |
| Stroke | | mm | 100, 200, 300, 400, 500 | | 100, 200, 300, 400, 500, 600, 700 | | 100, 200, 300, 400, 500 | | 100, 200, 300, 400, 500, 600, 700 | |
| Type code<br>♦ = interface type<br>l = 6 or C (for 12) mm lead<br>xx = stroke (10-70)<br>■ = N for no brake, B for brake<br>yyy = motor design code<br>IP40 only | | - | Size 45 Slider<br>TSSA146AA♦-<br>lxx■01-yyy-045 | | Size 60 Slider<br>TSSA146AA♦-<br>lxx■01-yyy-060 | | Size 45 Slider<br>TSSB146BB♦-<br>lxx■01-yyy-045 | | Size 60 Slider<br>TSSB146BB♦-<br>lxx■01-yyy-060 | |
| Operating speed (See note 1) | stroke < 300 | mm/s | 400 | 700 | 350 | 700 | 500 | 1000 | 500 | 1000 |
| | stroke < 400 | mm/s | 400 | 700 | 350 | 700 | 500 | 1000 | 400 | 800 |
| | stroke < 500 | mm/s | 340 | 680 | 350 | 700 | 340 | 680 | 400 | 800 |
| | stroke < 600 | mm/s | n/a | n/a | 340 | 680 | n/a | n/a | 340 | 680 |
| | stroke < 700 | mm/s | n/a | n/a | 250 | 500 | n/a | n/a | 250 | 500 |
| Output thrust | Continuous | N | 290 | 140 | 280 | 140 | 230 | 110 | 230 | 110 |
| | Maximum | N | 290 | 140 | 280 | 140 | 400 | 190 | 740 | 370 |
| Maximum thrust available at initialization (See note 2) | Without brake | N | 100 | 50 | 100 | 50 | n/a | n/a | n/a | n/a |
| | With brake | N | 220 | 140 | 220 | 140 | n/a | n/a | n/a | n/a |
| Optional brake | | - | Electrically lifted static holding brake. Cannot be used for dynamic braking. | | | | | | | |
| Brake holding force (option) | | N | 300 | 150 | 300 | 150 | 300 | 150 | 300 | 150 |
| Slider allowable static moment load | Pitch | Nm | 12 | | 25.7 | | 12 | | 25.7 | |
| | Yaw | | 12 | | 25.7 | | 12 | | 25.7 | |
| | Roll | | 31 | | 58 | | 31 | | 58 | |
| Resolution | | mm | 0.0075 | 0.015 | 0.0075 | 0.015 | 0.003 | 0.006 | 0.003 | 0.006 |
| Repeatability | | mm | +/- 0.02 | | | | +/- 0.02 | | | |
| Lost motion at no load condition | | mm | 0.1 | | | | | | | |
| Position encoder | Type | - | Incremental encoder standard. Optional absolute encoder available on special order | | | | | | | |
| | Pulses/rev | p/r | 800 | | | | 2000 | | | |
| Transportable mass on carriage | Horizontal | kg | 10 | 5 | 16 | 8 | 10 | 5 | 16 | 8 |
| | Vertical | kg | 3 | 1.5 | 5 | 2.5 | 3 | 1.5 | 5 | 2.5 |
| Power supply | Logic | - | 24 VDC +/-10%, 0.2A | | | | 12-48 VDC +/-10%, 0.2A | | | |
| | Main | - | 24 VDC +/-10%, 1.5A (1.7A with brake) | | | | 48 VDC +/-10%, 3A continuous, 9A peak (add 0.2 A for motor with brake) | | | |
| Mounting | | - | Mounts to machined base with 6 M4 bolts. | | | | | | | |
| Control interface (See note 3) | | - | RS485 (SIO) + PIO<br>DeviceNet + PIO<br>Ethernet/IP + PIO | | | | RS485 (SIO) + PIO<br>Pulse + RS485 + PIO<br>DeviceNet + PIO + RS485<br>Ethernet/IP + PIO + RS485 | | | |
| PIO (parallel I/O) port | | - | 8 inputs, 5 outputs, function programmable, source type standard, sink type available on special order. For pulse function, available number of bits is limited. | | | | | | | |
| Analog interface | | - | Differential analog input for position control – available on request. | | | | | | | |
| Acceleration | | - | Ramp | | | | Ramp | | | |
| Number of stored positions | | - | 16 points | | | | 64 points (48 for Ethernet/IP) | | | |
| Function | Drive | - | Homing, jog, absolute/relative move, position/velocity/acceleration are controllable. | | | | | | | |
| | Brake control | - | Brake release is controlled automatically by internal logic (standard).  Manual brake release is also available. | | | | | | | |
| | Alarm | - | Alarm/warning detection | | | | | | | |
| | Monitor | - | Internal state monitor, velocity/position trace | | | | | | | |
| | Other | - | Press mode, software stroke limit, linked move, parameter recovery, etc. | | | | | | | |
| Ambient | Temperature | °C | 0 – +40 operation; -20 - +60 storage | | | | | | | |
| | Humidity | % | 90% relative humidity maximum, non-condensing | | | | | | | |
| Material and surface treatment | Motor body | - | Anodized aluminum (white color) | | | | | | | |
| | Output shaft | - | Steel | | | | | | | |

Notes: 1. Maximum speed can be limited due to stroke length and loading condition.
2. Maximum force during stepper initialization at power-up. Thereafter, full maximum force is available. The load on the stepper version of the ternary from any source, including gravity, must not exceed this value during startup and initialization, or the unit may enter an alarm state, failing to initialize.
3. CANopen, Profibus and CC-Link fieldbus interfaces are available on special order.

# TSS Rodless Slider Linear Actuator

## Type 46 TSS rodless slider thrust/speed curves - Size 045 slider
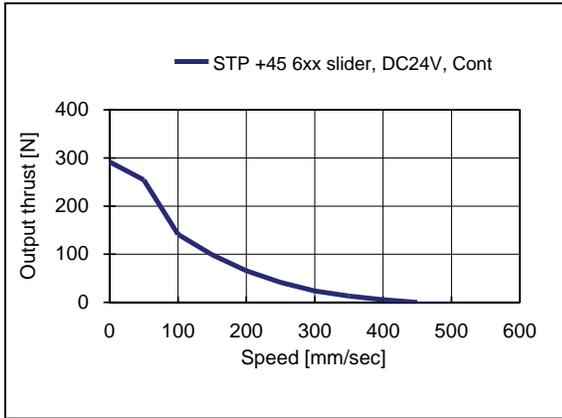


TSSA146AA*6 Stepper/6mm lead
Size 045 slider
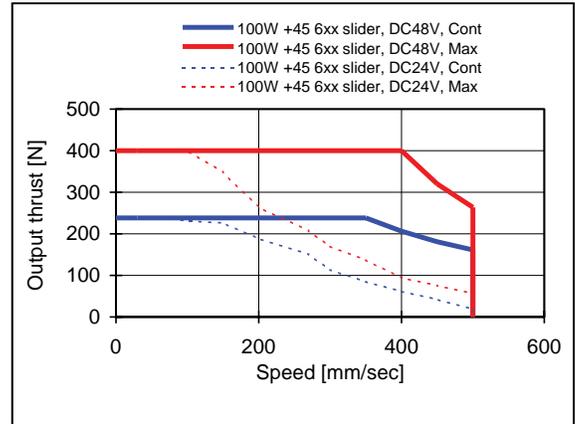


TSSB146BB*6 100W Servo/6mm lead
Size 045 slider
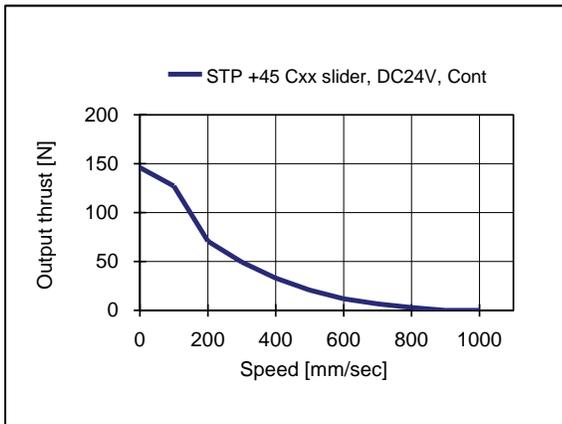


TSSA146AA*C Stepper/12mm lead
Size 045 slider
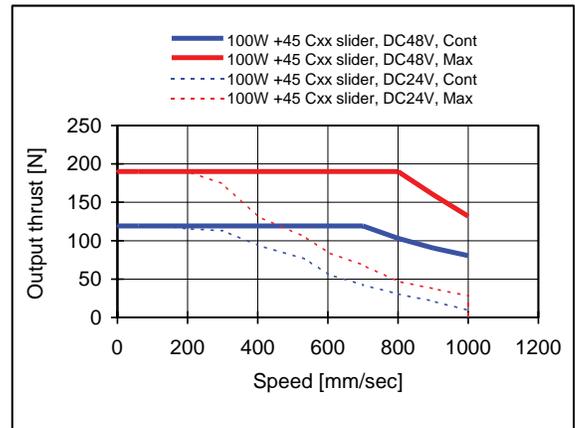


TSSB146BB*C 100W Servo/12mm lead
Size 045 slider

Notes:   1. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate derated performance using alternate supplies.
2. Above characteristics are typical data under nominal power and 25°C ambient temperature.

## Type 46 TSS rodless slider thrust/speed curves - Size 060 slider
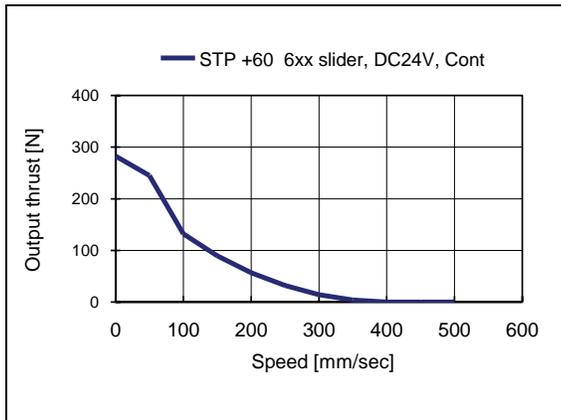


TSSA146AA*6 Stepper/6mm lead
Size 060 slider
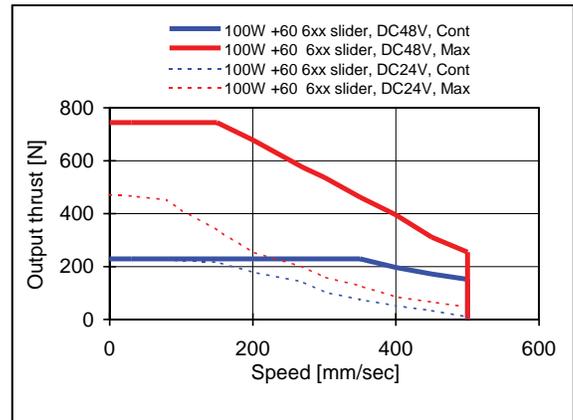


TSSB146BB*6 100W Servo/6mm lead
Size 060 slider
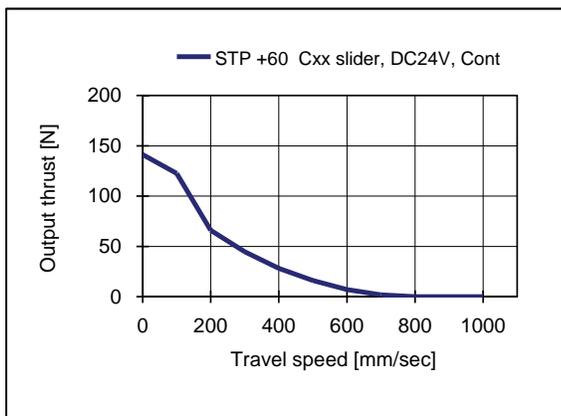


TSSA146AA*C Stepper/12mm lead
Size 060 slider
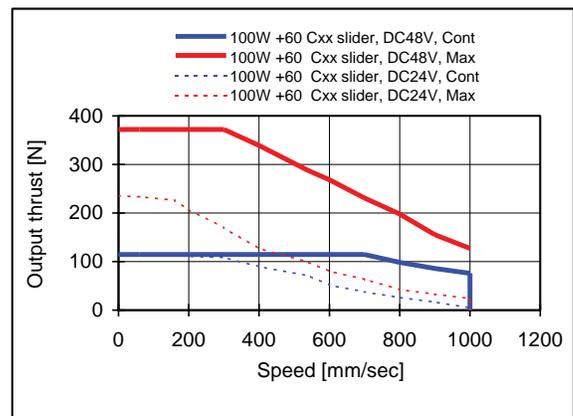


TSSB146BB*C 100W Servo/12mm lead
Size 060 slider

Notes:   1. Standard power supplies are: stepper 24VDC, 100W servo 48VDC. Dotted lines in curves indicate
derated performance using alternate supplies.
2. Above characteristics are typical data under nominal power and 25°C ambient temperature.

## Type 46 TSS rodless slider mechanical specifications

The following drawings show one typical type 46 TLS configuration (SIO/PIO interface), with dimensions for top and side views. A number of connector configurations are available for the various types of control interfaces in IP40 protection class. See pages 50-53 for descriptions and illustrations. Contact WITTENSTEIN for the latest CAD drawings.

### Size 45 rodless slider

**Type 46 TSS rodless slider actuator – size 045**
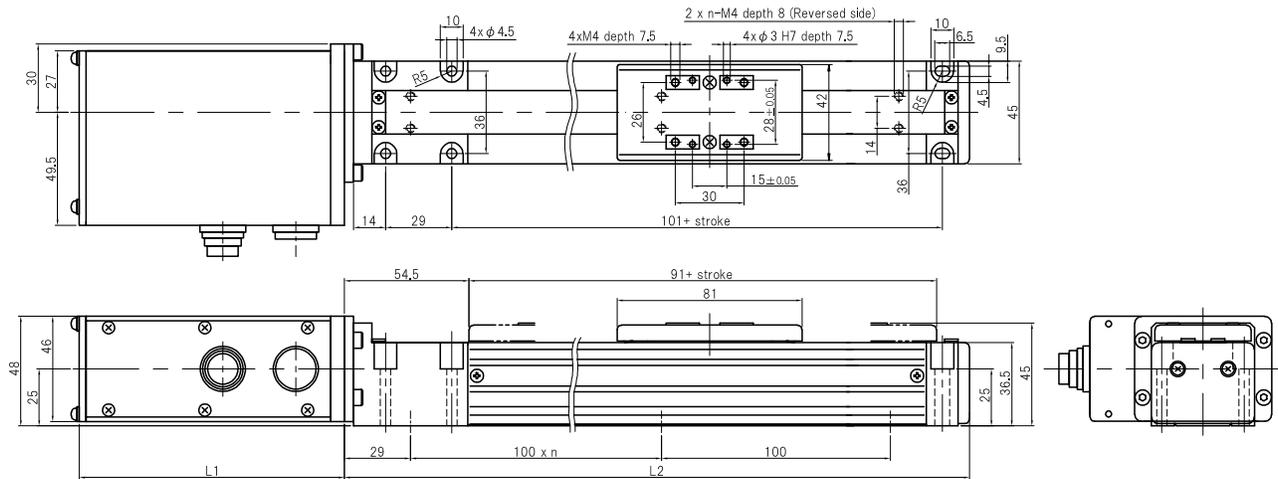


| Motor type | Interface | Brake | Dimension L1 (mm) | Motor mass (kg) | Type code |
|---|---|---|---|---|---|
| Stepper | SIO | No brake | 116 | 0.78 | TSSA 146AAB-xxxN01-yyy-045 |
| | | With brake | 141 | 0.93 | TSSA 146AAB-xxxB01-yyy-045 |
| | DeviceNet | No brake | 116 | 0.80 | TSSA 146AAQ-xxxN01-yyy-045 |
| | | With brake | 141 | 0.95 | TSSA 146AAQ-xxxB01-yyy-045 |
| | Ethernet/IP | No brake | 116 | 0.80 | TSSA 146AAH-xxxN01-yyy-045 |
| | | With brake | 141 | 0.95 | TSSA 146AAH-xxxB01-yyy-045 |
| Size 46 Servo | SIO | No brake | 116 | 0.75 | TSSB 146BBB-xxxN01-yyy-045 |
| | | With brake | 141 | 0.90 | TSSB 146BBB-xxxB01-yyy-045 |
| | Pulse | No brake | 116 | 0.75 | TSSB 146BBD-xxxN01-yyy-045 |
| | | With brake | 141 | 0.90 | TSSB 146BBD-xxxB01-yyy-045 |
| | DeviceNet | No brake | 116 | 0.77 | TSSB 146BBQ-xxxN01-yyy-045 |
| | | With brake | 141 | 0.92 | TSSB 146BBQ-xxxB01-yyy-045 |
| | Ethernet/IP | No brake | 116 | 0.77 | TSSB 146BBH-xxxN01-yyy-045 |
| | | With brake | 141 | 0.92 | TSSB 146BBH-xxxB01-yyy-045 |

xxx in type code - first digit specifies lead as 6 or C (12mm), next two digits specify stroke.

yyy indicates motor design code which specifies connector type. 045 indicates 045 type slider. See table below for slider stroke.

| Slider stroke | Dimension L2 (mm) | Slider mass (kg) |
|---|---|---|
| 100 mm | 263.5 | 1.0 |
| 200 mm | 363.5 | 1.2 |
| 300 mm | 486.5 | 1.4 |
| 400 mm | 563.5 | 1.6 |
| 500 mm | 663.5 | 1.9 |

# Size 60 rodless slider

## Type 46 TSS rodless slider actuator – size 060
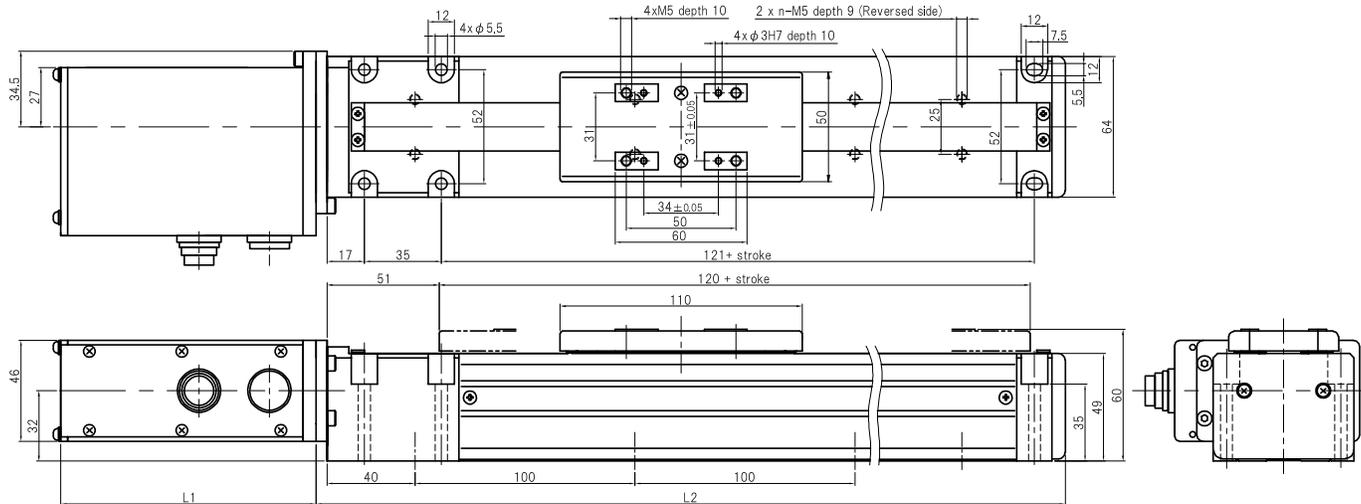


| Motor type | Interface | Brake | Dimension L1 (mm) | Motor mass (kg) | Type code |
|---|---|---|---|---|---|
| Stepper | SIO | No brake | 116 | 0.78 | TSSA 146AAB -xxxN01-yyy-060 |
| | | With brake | 141 | 0.93 | TSSA 146AAB -xxxB01-yyy-060 |
| | DeviceNet | No brake | 116 | 0.80 | TSSA 146AAQ -xxxN01-yyy-060 |
| | | With brake | 141 | 0.95 | TSSA 146AAQ -xxxB01-yyy-060 |
| | Ethernet/IP | No brake | 116 | 0.80 | TSSA 146AAH -xxxN01-yyy-060 |
| | | With brake | 141 | 0.95 | TSSA 146AAH -xxxB01-yyy-060 |
| Size 46 Servo | SIO | No brake | 116 | 0.75 | TSSB 146BBB-xxxN01-yyy-060 |
| | | With brake | 141 | 0.90 | TSSB 146BBB-xxxB01-yyy-060 |
| | Pulse | No brake | 116 | 0.75 | TSSB 146BBD-xxxN01-yyy-060 |
| | | With brake | 141 | 0.90 | TSSB 146BBD-xxxB01-yyy-060 |
| | DeviceNet | No brake | 116 | 0.77 | TSSB 146BBQ-xxxN01-yyy-060 |
| | | With brake | 141 | 0.92 | TSSB 146BBQ-xxxB01-yyy-060 |
| | Ethernet/IP | No brake | 116 | 0.77 | TSSB 146BBH-xxxN01-yyy-060 |
| | | With brake | 141 | 0.92 | TSSB 146BBH-xxxB01-yyy-060 |

xxx in type code - first digit specifies lead as 6 or C (12mm), next two digits specify stroke.

yyy indicates motor design code which specifies connector type. 060 indicates 060 type slider. See table below for slider stroke.

| Slider stroke | Dimension L2 (mm) | Slider mass (kg) |
|---|---|---|
| 100 mm | 291 | 2.1 |
| 200 mm | 391 | 2.5 |
| 300 mm | 491 | 2.9 |
| 400 mm | 591 | 3.3 |
| 500 mm | 691 | 3.7 |
| 600 mm | 791 | 4.1 |
| 700 mm | 891 | 4.5 |

# Mounting the ternary

## Mounting

### Mounting rotary ternary without gear reducer

The type 46 ternary without gear reducer is mounted to a flange via four tapped holes in the faceplate, using M4 bolts. The type 6X ternary without gear reducer is mounted similarly, using M5 bolts.

### Mounting rotary ternary with planetary gear reducer

The TRS unit with LP50 planetary gear reducer is mounted to a flange via four tapped holes in the gear reducer faceplate using M4 bolts as illustrated. Optional gear reducers are similarly mounted. A NEMA 23 output flange is available. Contact WITTENSTEIN for details.

The TRS with LPK50 planetary gear reducer is mounted similarly to the above using M4 bolts.

### Mounting TLS and Folded TLS ternary

The TLS and Folded TLS can both be flange mounted as illustrated using M5 bolts.

Both units can also be mounted via T-slots on the bottom of the unit, as illustrated. T-slot mounting nuts are available, see page 62. They are square nuts that slide into the T-slots and are used for mounting the ternary to a surface using M3 bolts.

### Cautions
1. Mount the output rod of the ballscrew to an external load using a "jam nut" on the ballscrew. Thus, an external fastener tightens against the jam nut, avoid twisting stress on the output rod and its bearings.
2. Do not fasten a wrench directly on the extended ballscrew rod when tightening a load. Doing so can damage the device. Using a protective cover (paper board) is recommended. Fastening a wrench directly on the ballscrew rod can scratch the surface, which can damage the integrity of the seal during operation.

# Mounting the TSS rodless slider ternary



Fix the slider on machine base using 6 M4 size bolts

Bottom surface of slider should be fully contacted with well-finished flat and stiff machine base
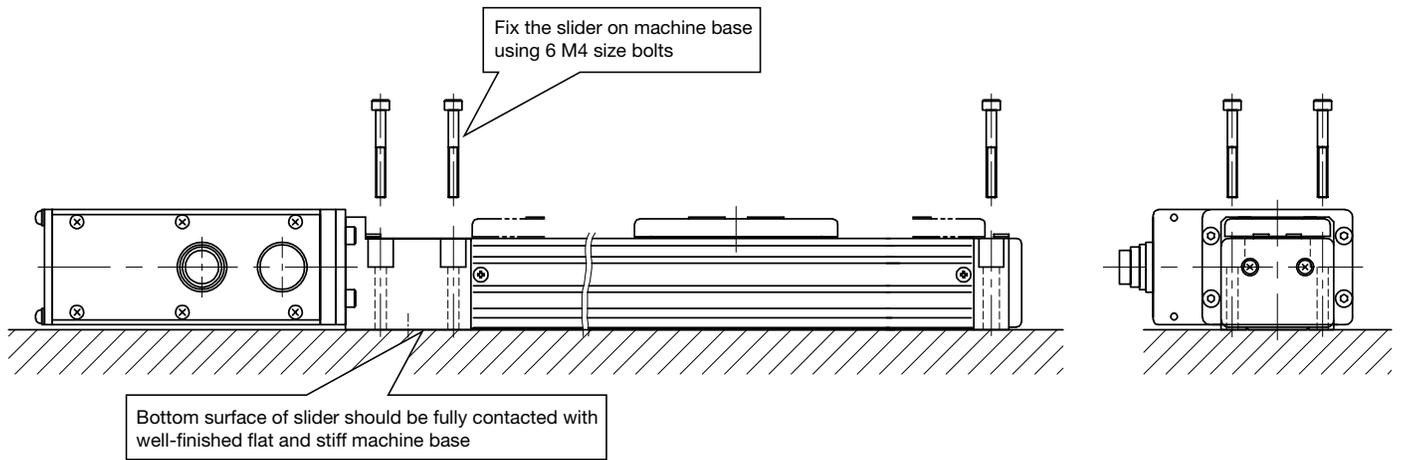
Mount the actuator on a machined (or equivalent accuracy) plane. Flatness of the mounting plane must be within 0.1 mm. The bottom surface of the slider should contact the mounting plane on its full length. Partial contact or lack of support at the bottom surface can result in acoustic noise and vibration. Fix the slider to the machine base using a minimum of 6 M4 bolts. Additional bolts are required for 400 mm and longer travel lengths. The slider can be mounted in any of horizontal, vertical or hanging position.

# Connection Diagrams

## Connection diagrams

Typical connection diagrams are shown for various ternary versions. Type code numbers are included as examples only, and these tables should **not** be considered as an ordering guide. Refer to page 54 for complete information on cables and choose the IP40 or IP65 style cable that is appropriate for your system.

### Single axis control with RS485 serial interface
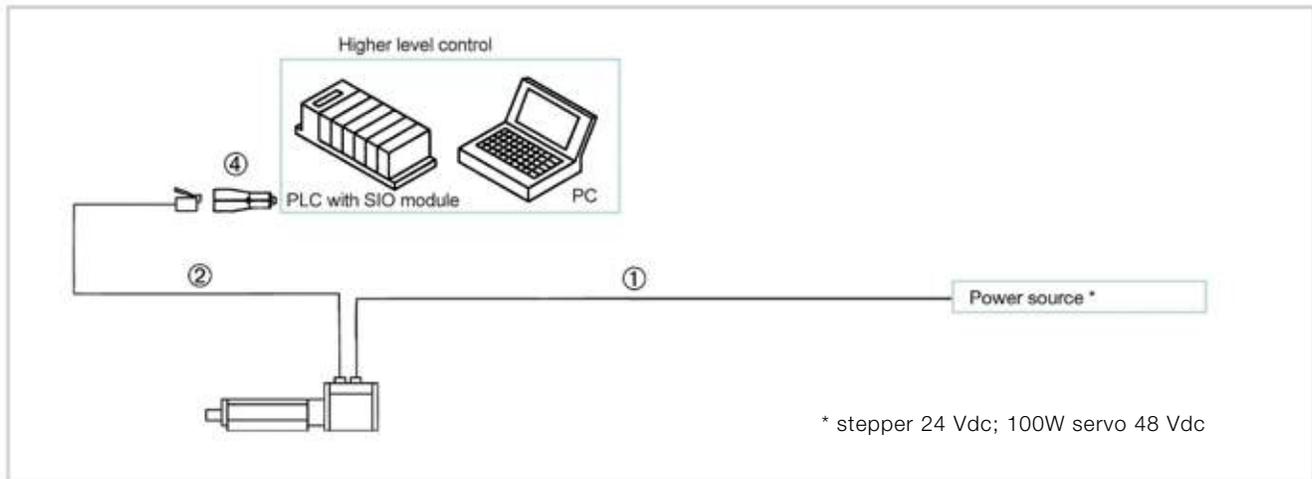


* stepper 24 Vdc; 100W servo 48 Vdc

Note: 200/400W servo (200/230 Vac input power) with serial interface requires an additional hardwired PIO connection for Servo Enable.

### Multi-axis control with RS485 serial interface
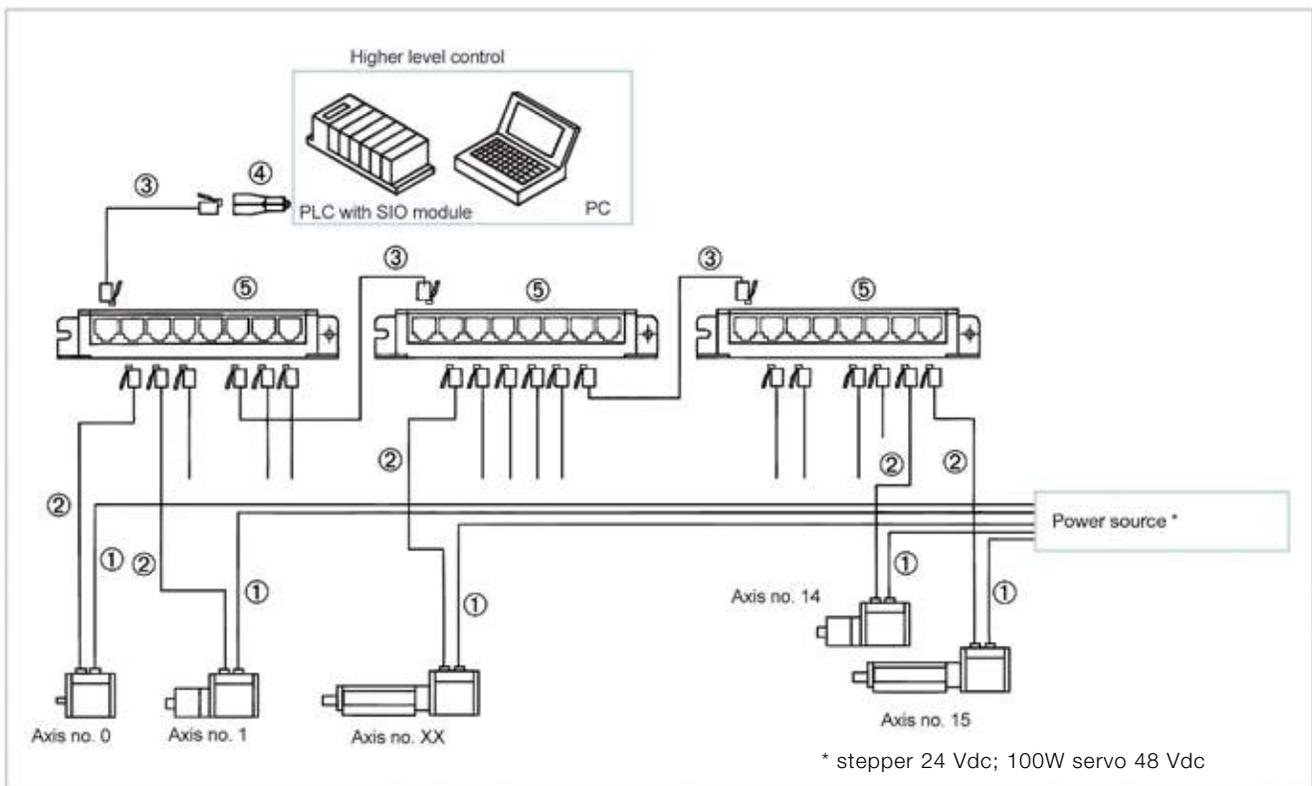


* stepper 24 Vdc; 100W servo 48 Vdc

Note: 200/400W servo (200/230 Vac input power) with serial interface requires an additional hardwired PIO connection for Servo Enable.

## Single axis control with parallel wiring to a PLC



\* stepper 24 Vdc; 100W servo 48 Vdc; 200/400W servo 200/230 Vac
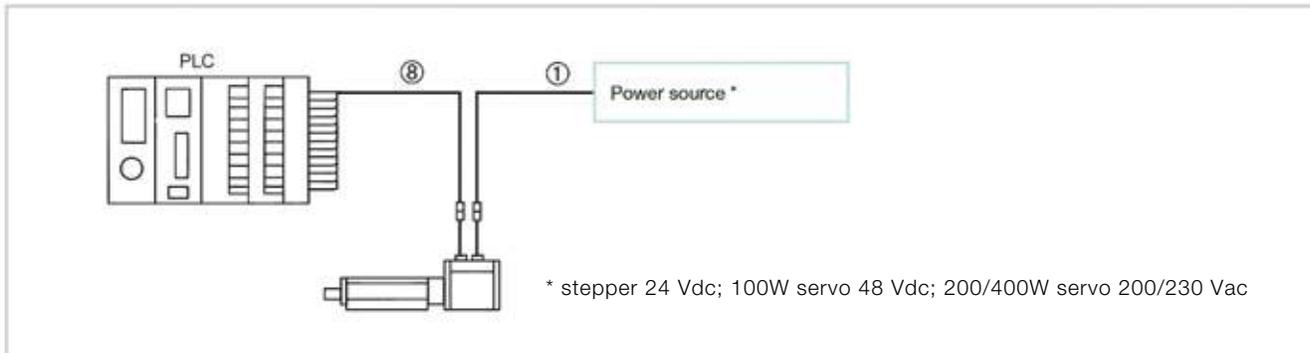
## Multi-axis control with serial and parallel interface



\* stepper 24 Vdc; 100W servo 48 Vdc; 200/400W servo 200/230 Vac
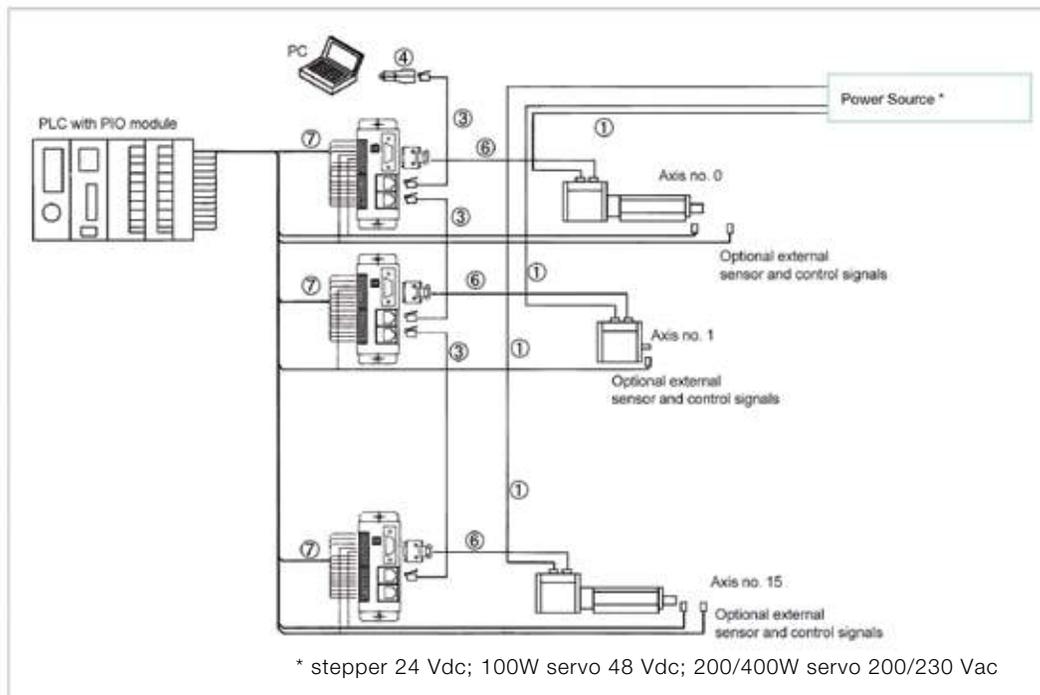
| Accessories and Cables | | |
|---|---|---|
| 1 | Power cable - ternary to leads | See cable selection pages 54-55. |
| 2 | Serial cable - ternary to RJ11 | |
| 3 | Serial cable - RJ11 to RJ11 | TCC 002-001-xxx |
| 4 | Serial bus converter | TBG 001-001 |
| 4 | USB bus converter - *Requires additional TCC-USB2-A-B cable* | TBG 001-002 |
| 5 | Serial chaining terminal | TBG 002-004 |
| 6 | SIO/PIO command cable to chaining terminal | See cable selection pages 54-55. |
| 7 | SIO/PIO chaining terminal | TBG 002-003-NC |
| 8 | SIO/PIO command cable to leads | See cable selection pages 54-55. |

xxx indicates cable length in meters
020 = 2 meters
050 = 5 meters
100 = 10 meters

Notes:
1. The SIO (RS485) interface is used mainly for communication with ternary software utilities for parameter setting monitoring, etc. It is not necessary to permanently connect it in parallel with the PIO interface.
2. Depending on operating conditions, a regeneration unit may be required with the ternary servo.

# Connection Diagrams

### Single axis control with parallel I/O and fieldbus interface
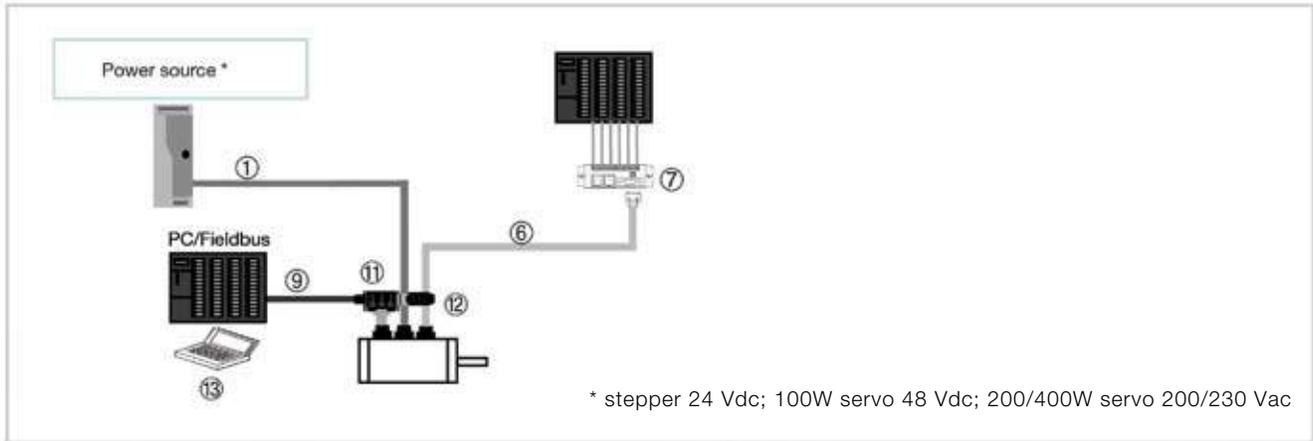
Power source *

PC/Fieldbus

* stepper 24 Vdc; 100W servo 48 Vdc; 200/400W servo 200/230 Vac

### Multi-axis control with parallel I/O and fieldbus interface

Power source *

PC/Fieldbus

* stepper 24 Vdc; 100W servo 48 Vdc; 200/400W servo 200/230 Vac
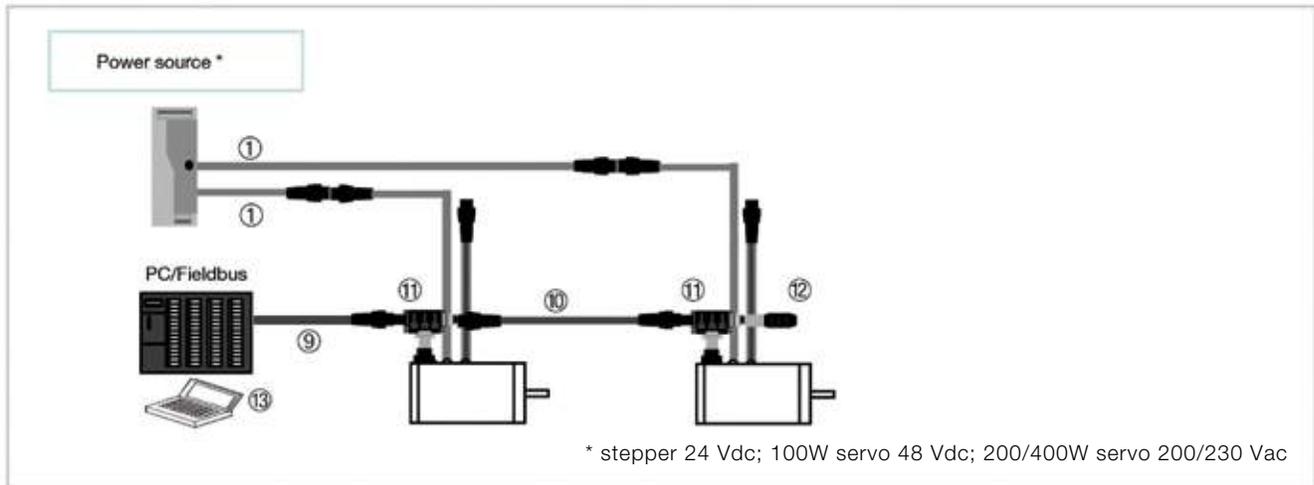
| Accessories and Cables | | |
|---|---|---|
| 1 | Power cable | See cable selection pages 54-55. |
| 6 | SIO/PIO command cable to chaining terminal | |
| 7 | SIO/PIO Chaining Terminal | TGB 002-003-NC |
| 9 | Devicenet cable to leads | TCC 002-013-xxx |
| 9 | Ethernet/IP cable to RJ45 | TCC 002-025-xxx |
| 10 | Devicenet cable to M12 | TCC 002-014-xxx |
| 11 | Devicenet T connector | TBG 002-005 |
| 12 | Devicenet terminating resistor | TBG 002-006 |

xxx indicates cable length in meters
020 = 2 meters
050 = 5 meters
100 = 10 meters

Note that the DeviceNet version for the stepper does not offer an SIO (RS485) interface.
Fieldbus edition utility software is needed for parameter setting and monitoring.

## Typical control interface and wiring diagram – serial/parallel

| Signal type | Pin No | Symbol & Function | | | |
|---|---|---|---|---|---|
| | | Easy entry mode | 16-bit mode | 64-bit mode | Analog input |
| Power | 1 | COM+: Logic power + for PIO interface | | | |
| | 2: | COM-:  Logic power – for PIO interface | | | |
| Input | 3: | POS: Position teaching mode | CSTR:  Start trigger | | ACT: Activate input |
| | 4 | UP: Count up for teaching | *INH+: Inhibit + | IN5: Input 5 | *INH+: Inhibit + |
| | 5 | DOWN:  Count down for teaching | *INH-: Inhibit - | IN6: Input 6 | *INH-: Inhibit - |
| | 6 | ACC:  Accel teaching mode | *ILK : Interlock signal | | *ILK : Interlock signal |
| | 7 | IN1:  Position input signal 1 | IN1:  Position input signal 1 | | Ain1+: 4-20 mA In+ |
| | 8 | IN2:  Position input signal 2 | IN2:  Position input signal 2 | | Ain1-: 4-20 mA In- |
| | 9 | IN3:  Position input signal 3 | IN3:  Position input signal 3 | | Ain2+: 0-10 VDC In+ |
| | 10 | IN4:  Position input signal 4 | IN4:  Position input signal 4 | | Ain2-: 0-10 VDC In- |
| Output | 11 | OUT1: Position indicator 1 | PFIN:  Positioning completed | | PFIN:  Positioning completed |
| | 12 | OUT2: Position indicator 2 | ZFIN:  Homing completed | | ZFIN:  Homing completed |
| | 13 | OUT3: Position indicator 3 | ZONE:  Zone signal | | ZONE:  Zone signal |
| | 14 | OUT4: Position indicator 4 | No connection | | No connection |
| | 15 | *ALM: Alarm signal | | | |
| GND | 16 | FG: Frame ground | | | |
| Power | 17 | +5V:  Logic power for SIO interface | | | |
| SIO | 18 | TXD+:  RS485 signal + | | | |
| GND | 19 | GND:  Logic ground for SIO interface | | | |
| SIO | 20 | TXD-:  RS485 signal - | | | |
| | 21-24 | Used for pulse mode. Pins appear only in pulse mode cables. | | | |

* Denotes active low signal
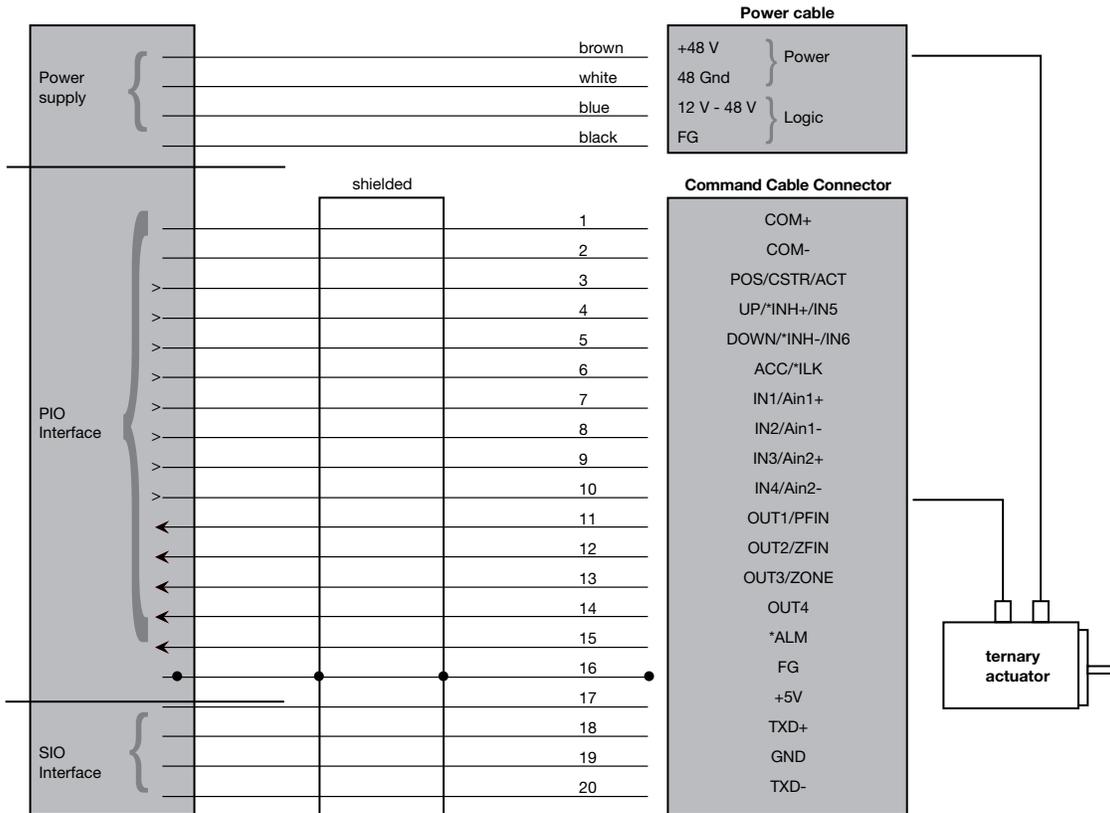


Note:  This illustration shows typical pinouts, but pin assignments and functions are different for the various interfaces. Refer to the technical manual for your configuration for details.

## Ordering guide

The next several pages provide a step-by-step guide to developing type codes and ordering ternary, cables and accessories.

## Selection of a rotary ternary actuator

```
☐☐☐  ☐☐☐☐☐☐☐ - XXX ☐ ☐☐ - ☐☐☐ - ☐☐☐☐☐
 └─1─┘   2  3 └4┘ 5 6 7  8 └9┘ 10 └11┘    └─12─┘      └──13──┘
```
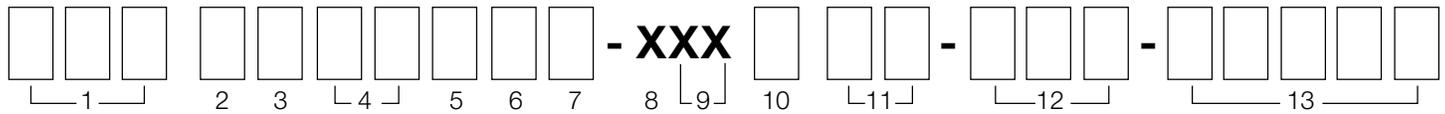
**1** Determine if a standalone or geared rotary actuator is required for the application.
- TRB – Rotary actuator without gear reducer
- TRS – Rotary actuator with gear reducer

**2** Select Stepper or Servo version
- A – Closed loop stepper version
- B – Brushless servo version

**3** Specify protection class
- 0 – IP64/65
- 1 – IP40

**4** Specify motor class size
- 46 – 46mm housing series "4" motor (stepper and 100W servo only)
- 6A – 100 mm diameter series "6" motor (200W and 400W servo only)

**5** Select motor size
- A – Standard stepper motor
- B – Motor for 100W brushless servo
- C – Motor for 200W brushless servo
- D – Motor for 400W brushless servo

**6** Specify incremental encoder type
- A – 200 P/R encoder (resolution = 800) for stepper
- B – 500 P/R encoder (resolution = 2000) for servo
- C – 65,536 resolution absolute encoder for servo w/4096 multi-turn

**7** Select standard Interface type (see note)
- B – RS485 (SIO) + Source type PIO
- D – Pulse input + Source type PIO + RS485 (pulse is available in servo version only)
- H – Ethernet/IP + Source type PIO + RS485
- J – Analog position control + RS485
- Q – DeviceNet + Source type PIO + RS485
Note that RS485 is not provided for types H & Q for stepper.

**8** X- Rotary motor, item not applicable

**9** XX- Rotary motor, item not applicable

**10** Determine if a holding brake is required.
- N – No brake
- B – Electrically lifted holding brake

**11** Select gear ratio
- 01 – Without gear reducer
- 05 – 5:1 gear ratio
- 10 – 10:1 gear ratio
- 15 – 15:1 gear ratio (N/A for LP050)
- 25 – 25:1 gear ratio
- 50 – 50:1 gear ratio

**12** Specify motor connector design code
See pages 50-53 for information and drawings of connector styles available plus their associated cables. In item 12, enter a design code from one of the tables that corresponds to your selected configuration.

**13** Specify mechanical design code, when applicable.

| | | |
|---|---|---|
| LP050 | CP040 | LK050 |
| LP070 | CP060 | LPK050 |
| LP090 | CP080 | LK070 |
| | | LPK070 |

**14** Not applicable, leave blank

**NOTES**:
1. Source type PIO is standard for Type 46 products (stepper & 100W servo). Sink type PIO is available on special order, contact the factory. Both source and sink type PIO are standard on Type 6X products (200 & 400W servo).
2. This chart includes type codes for standard products stocked in North America. Note that a number of options, such as CANopen, Profibus and CC-Link interfaces, are available on special order.

## Selection of a linear rod-type (cylinder) ternary actuator

**TLS** ☐☐ **4 6** ☐☐☐ - ☐ ☐ ☐ ☐ ☐☐ - ☐☐☐ - ☐☐☐ / **Tip Type**

1    2    3   └4┘   5   6   7    8    └9┘    10    └11┘    └12┘    └13┘    14
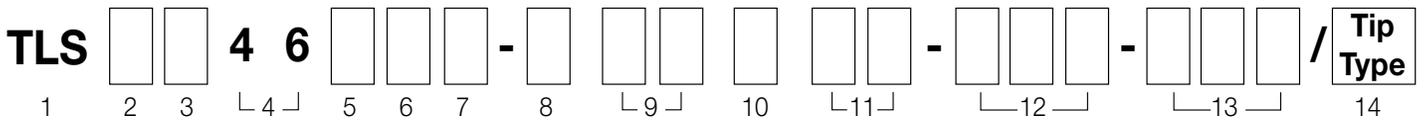
**1** Specify TLS – rod-type (cylinder) linear actuator (including folded type)

**2** Select Stepper or Servo version
- A – Closed loop stepper version
- B – Brushless servo version

**3** Specify protection class
- 0 – IP64/65
- 1 – IP40

**4** Specify motor class size
- 46 – 46mm housing series "4" motor (stepper and 100W servo only)

**5** Select motor size
- A – Standard stepper motor
- B – Motor for 100W brushless servo

**6** Specify incremental encoder type
- A – 200 P/R encoder (resolution = 800) for stepper
- B – 500 P/R encoder (resolution = 2000) for servo
- C – 65,536 resolution absolute encoder for servo w/4096 multi-turn

**7** Select standard Interface type (see note)
- B – RS485 (SIO) + Source type PIO
- D – Pulse input + Source type PIO + RS485 (pulse is available in servo version only)
- H – Ethernet/IP + Source type PIO + RS485
- J – Analog position control + RS485
- Q – DeviceNet + Source type PIO + RS485

Note that RS485 is not provided for types H & Q for stepper.

**8** Specify lead for 1 motor revolution for TLS and Folded TLS cylinder type ternary. See page 27 for TLS max force and travel speed for each lead.
- 3 – 3 mm/rev
- 6 – 6 mm/rev
- C – 12 mm/rev

**9** Select required maximum cylinder stroke. Note the allowable radial loading for TLS from page 29.
- 05 – 50mm
- 10 – 100 mm
- 15 – 150 mm
- 22 – 225 mm
- 30 – 300 mm
- (25 & 75 mm avail on special order)

**10** Determine if a holding brake is required.
- N – No brake
- B – Electrically lifted holding brake

**11** Specify no gear ratio or folded type TLS
- 01 – Without gear reducer
- F1 – Specifies folded type TLS linear actuator with belt ratio 1. See page 64 for ordering instructions on special mounting orientation.

**12** Specify motor connector design code
See pages 50-53 for information and drawings of connector styles available plus their associated cables. In item 12, enter a design code from one of the tables that corresponds to your selected configuration.

**13** Specify mechanical design code
- HCC – High capacity 3mm ballscrew lead for IP65 TLS (already standard for IP40)
  ___ – Blank for others

**14** Specify TLS rod tip type
- A – M16 x 1.5 male, no wrench flats
- B – M16 x 1.5 male with wrench flats **(Default case)**
- C – M10 x 1.25 female with wrench flats
- D – M12 x 1.5 male with wrench flats

**NOTES**:
1. Source type PIO is standard for Size 46 products (stepper & 100W servo). Sink type PIO is available on special order, contact the factory.
2. This chart includes type codes for standard products stocked in North America. Note that a number of options, such as CANopen, Profibus and CC-Link interfaces, are available on special order.

## Selection of a rodless slider ternary actuator

**TSS** ☐ **1 4 6** ☐☐☐ **-** ☐☐☐ ☐ **01 -** ☐☐☐ **-** ☐☐☐ **/L or R**

1   2   3   └4┘   5   6   7   8   └9┘   10   11   └12┘   └13┘   └14┘

**1** TSS – Rodless slider type linear actuator

**2** Select Stepper or Servo version
  • A – Closed loop stepper version
  • B – Brushless servo version

**3** Enter a 1 to specify IP40 protection class. Slider is not available in IP65.

**4** Specify motor class size
  • 46 – 46mm housing series "4" motor (stepper and 100W servo only)

**5** Select motor size
  • A – Standard stepper motor
  • B – Motor for 100W brushless servo

**6** Specify incremental encoder type
  • A – 200 P/R encoder (resolution = 800) for stepper
  • B – 500 P/R encoder (resolution = 2000) for servo
  • C – 65,536 resolution absolute encoder for servo w/4096 multi-turn

**7** Select standard Interface type (see note)
  • B – RS485 (SIO) + Source type PIO
  • D – Pulse input + Source type PIO + RS485 (pulse is available in servo version only)
  • H – Ethernet/IP + Source type PIO + RS485
  • J – Analog position control + RS485
  • Q – DeviceNet + Source type PIO + RS485
  Note that RS485 is not provided for types H & Q for stepper.

**8** Specify lead for 1 motor revolution for TSS slider type ternary. See page 35 for TSS max thrust and travel speed for 6 & 12 mm leads.
  • 6 – 6 mm/rev
  • C – 12 mm/rev

**9** Select required max slider stroke.
  • 10 – 100mm
  • 20 – 200 mm
  • 30 – 300 mm
  • 40 – 400 mm
  • 50 – 500 mm
  • 60 – 600 mm ┐
  • 70 – 700 mm ┘ *Available only for 060 model*

**10** Determine if a holding brake is required.
  • N – No brake
  • B – Electrically lifted holding brake

**11** Specify  01 – Without gear reducer

**12** Specify motor connector design code
  See pages 50-53 for information and drawings of connector styles available plus their associated cables. In item 12, enter a design code from one of the tables that corresponds to your selected configuration.

**13** Specify mechanical design code
  • 045 – Size 045 slider
  • 060 – Size 060 slider

**14** Specify TSS motor mounting orientation
  • L for left cable outlet
  • R for right cable outlet

**NOTES:**
1. Source type PIO is standard for Size 46 products (stepper & 100W servo). Sink type PIO is available on special order, contact the factory.
2. This chart includes type codes for standard products stocked in North America. Note that a number of options, such as CANopen, Profibus and CC-Link interfaces, are available on special order.

## 15 Order cables

### Cables and connectors

Connecting the ternary actuator is simple and straightforward. Only two cables are required to connect a rotary or linear ternary (stepper or servo) with serial/parallel interface: a command interface cable that includes the wiring for both serial and parallel I/O and a power supply cable. A third cable is required with a fieldbus version. All cables are robotic high-flex type.

All cables are supplied pre-cut and connectorized (either IP40 or IP65) and are available in 2, 5, and 10 meter lengths.

### Ordering key for ternary cables

TCC101-001-XXX

| | |
|---|---|
| Type | TCC: ternary cable |
| Protection Class | 0: IP65 Protection Class |
| | 1: IP40 Protection Class - Robust Connector Type |
| | 2: IP40 Protection Class - Plastic Connector Type |
| Cable Type | 01: Power Cable |
| | 02: Command Cable |
| Cable Number | NNN: - See pages 54 and 55 for cable numbers |
| Cable Length | 020: 2 meter length |
| | 050: 5 meter length |
| | 100: 10 meter length |
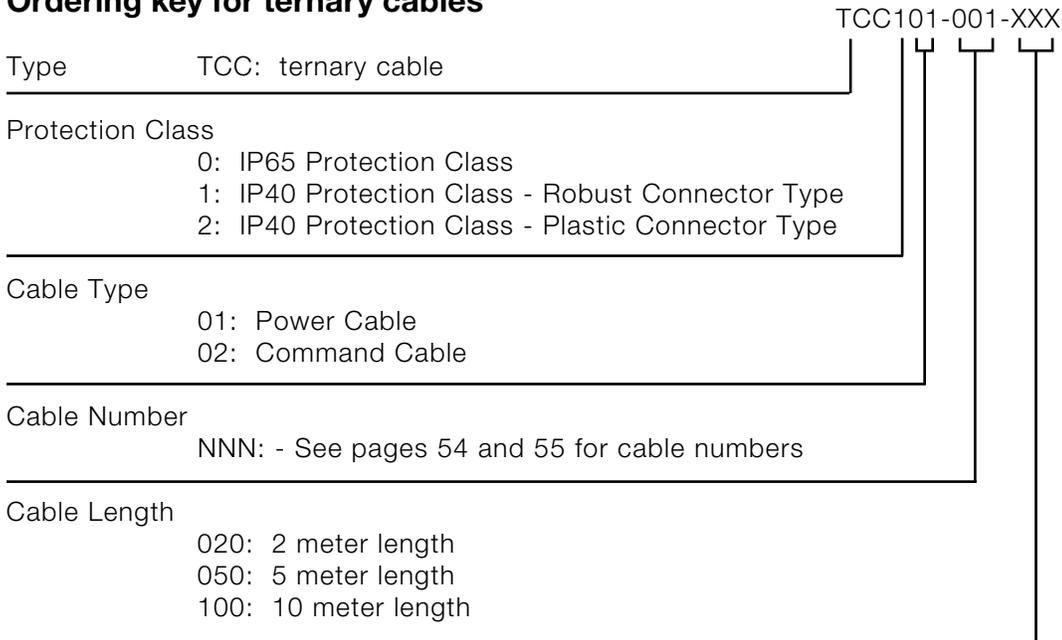
## Cables and connectors for IP40 stepper and servo versions

### IP40 SIO/PIO interface with standard connectors
Motor connector design code 101
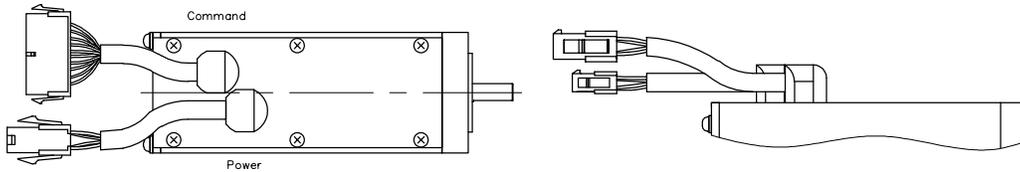


Type **101** IP40 SIO/PIO, Standard Connectors

| Power Cable - Stepper | |
|---|---|
| TCC 201-001-xxx | Molex 4 pin to Flying Leads |
| **Power Cable - Servo** | |
| TCC 201-007-xxx | Molex 6 pin to Flying Leads |
| **Command Cable - Stepper and Servo** | |
| TCC 202-009-xxx | Molex 20 pin to Flying Leads |

### IP40 SIO/PIO and Fieldbus interfaces with standard connectors
Motor connector design code 105
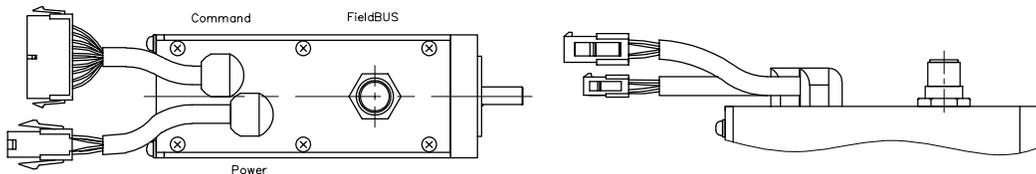


Type **105** IP40 Fieldbus with I/O, Standard Connectors

| Power Cable - Stepper | |
|---|---|
| TCC 201-001-xxx | Molex 4 pin to Flying Leads |
| **Power Cable - Servo** | |
| TCC 201-007-xxx | Molex 6 pin to Flying Leads |
| **Command Cable - Stepper and Servo** | |
| TCC 202-009-xxx | Molex 20 pin to Flying Leads |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

### IP40 Fieldbus interface only with standard connectors
Motor connector design code 109
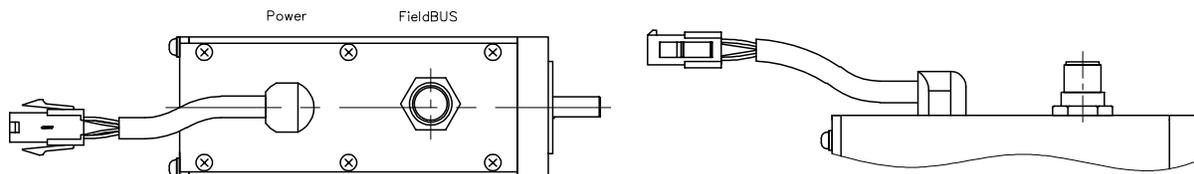


Type **109** IP40 Fieldbus without I/O, Standard Connectors

| Power Cable - Stepper | |
|---|---|
| TCC 201-001-xxx | Molex 4 pin to Flying Leads |
| **Power Cable - Servo** | |
| TCC 201-007-xxx | Molex 6 pin to Flying Leads |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

## IP40 motor with SIO/PIO interface with robust connectors
Motor connector design code 007, SIO/PIO
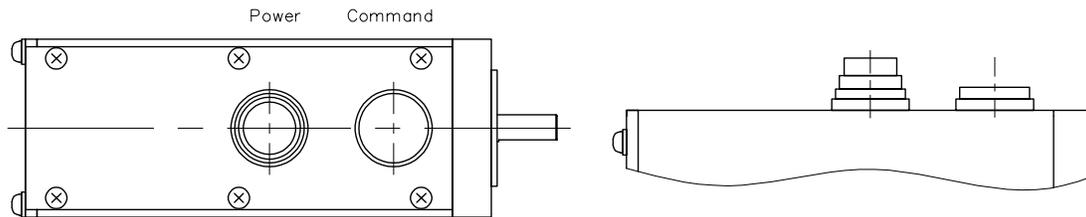


Type **007** IP40 SIO/PIO, Robust Connectors

| Power Cable - Stepper | |
|---|---|
| TCC 001-001-xxx | M12 to Flying Leads |
| **Power Cable - Servo** | |
| TCC 101-007-xxx | IP40 Binder 5 pin to Flying Leads |
| **Command Cable - Stepper and Servo** | |
| TCC 102-020-xxx | IP40 Binder 24 pin to Honda |
| TCC 102-022-xxx | IP40 Binder 24 pin to Flying Leads |


## IP40 motor with SIO/PIO and Fieldbus interfaces with robust connectors
Motor connector design code 007, with fieldbus
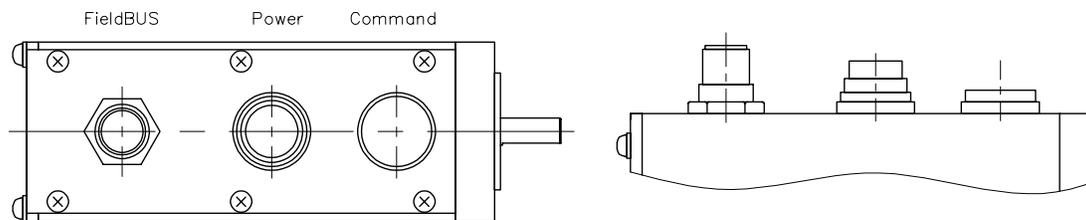


Type **007** IP40 Fieldbus with SIO/PIO, Robust Connectors

| Power Cable - Stepper | | Fieldbus Cable - Devicenet | |
|---|---|---|---|
| TCC 001-001-xxx | M12 to Flying Leads | TCC 002-013-xxx | M12 (Micro) to Flying leads |
| **Power Cable - Servo** | | TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| TCC 101-007-xxx | IP40 Binder 5 pin to Flying Leads | **Fieldbus Cable - Ethernet/IP** | |
| **Command Cable - Stepper and Servo** | | TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 102-020-xxx | IP40 Binder 24 pin to Honda | TCC 002-026-xxx | M12 Dcode to M12 Dcode |
| TCC 102-022-xxx | IP40 Binder 24 pin to Flying Leads | | |


## IP40 motor and Fieldbus interface only with robust connectors
Motor connector design code 011
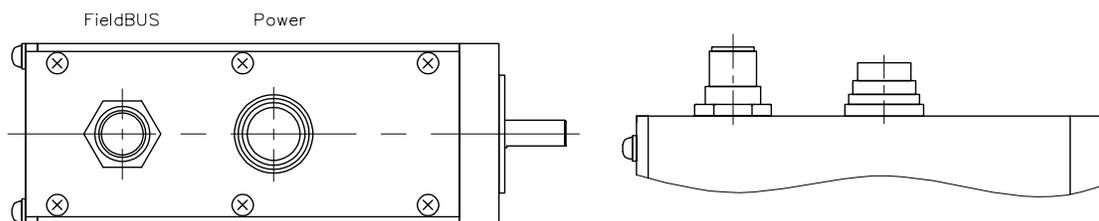


Type **011** IP40 Fieldbus without I/O, Robust Connectors

| Power Cable - Stepper | |
|---|---|
| TCC 001-001-xxx | M12 to Flying Leads |
| **Power Cable - Servo** | |
| TCC 101-007-xxx | IP40 Binder 5 pin to Flying Leads |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

## Cables and connectors for IP65 stepper version

### IP65 SIO/PIO interface
Motor connector design code 001
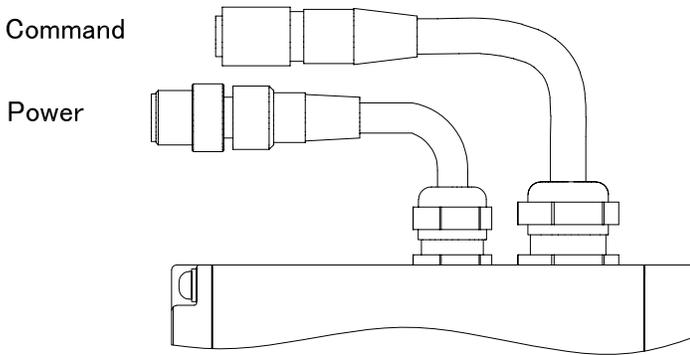


Type **001** IP65 Stepper SIO/PIO

| Power Cable | |
|---|---|
| TCC 001-001-xxx | M12 to Flying Leads |
| **Command Cable (I/O)** | |
| TCC 002-008-xxx | Hirose 20 pin to Honda |
| TCC 002-009-xxx | Hirose 20 pin to Flying Leads |

### IP65 SIO/PIO and Fieldbus interfaces
Motor connector design code 005
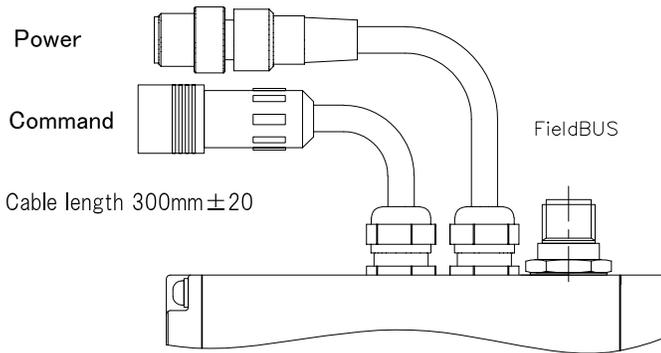


Type **005** IP65 Stepper Fieldbus with IO

| Power Cable | |
|---|---|
| TCC 001-001-xxx | M12 to Flying Leads |
| **Command Cable (I/O)** | |
| TCC 002-010-xxx | Hirose 12 pin to Honda |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

### IP65 Fieldbus interface only
Motor connector design code 009
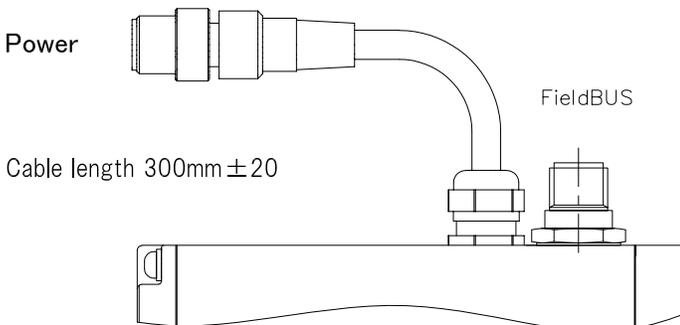


Type **009** IP65 Stepper Fieldbus without IO

| Power Cable | |
|---|---|
| TCC 001-001-xxx | M12 to Flying Leads |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

# Cables and connectors for IP65 servo version

## IP65 SIO/PIO interface
Motor connector design code 007, with I/O
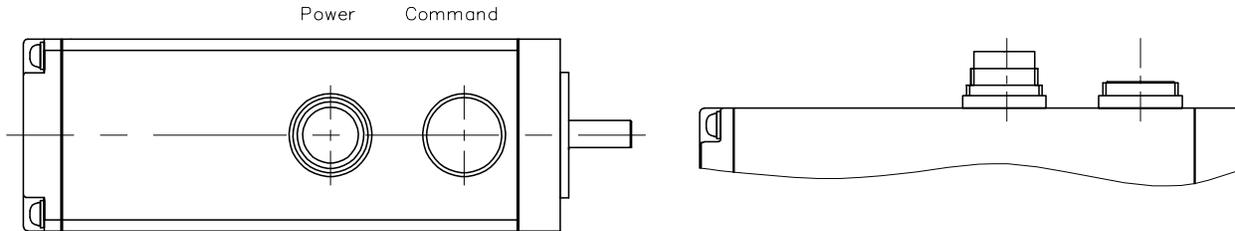


Type **007** IP65 Servo SIO/PIO

| Power Cable | |
|---|---|
| TCC 001-007-xxx | IP65 Binder 5 pin to Flying Leads |
| **Command Cable (I/O)** | |
| TCC 002-020-xxx | IP65 Binder 24 pin to Honda |
| TCC 002-022-xxx | IP65 Binder 24 pin to Flying Leads |
| TCC 002-023-xxx | IP65 Binder 24 pin to Flying Leads - Pulse Version |

## IP65 SIO/PIO and Fieldbus interfaces
Motor connector design code 007, with fieldbus
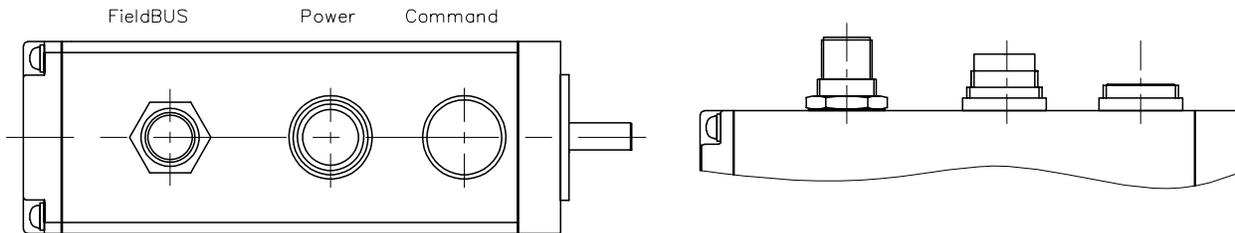


Type **007** IP65 Servo Fieldbus with IO

| Power Cable | | Fieldbus Cable - Devicenet | |
|---|---|---|---|
| TCC 001-007-xxx | IP65 Binder 5 pin to Flying Leads | TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| **Command Cable (I/O)** | | TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| TCC 002-020-xxx | IP65 Binder 24 pin to Honda | **Fieldbus Cable -  Ethernet/IP** | |
| TCC 002-022-xxx | IP65 Binder 24 pin to Flying Leads | TCC 002-025-xxx | M12 Dcode to RJ45 |
| | | TCC 002-026-xxx | M12 Dcode to M12 Dcode |

## IP65 Fieldbus interface only
Motor connector design code 011
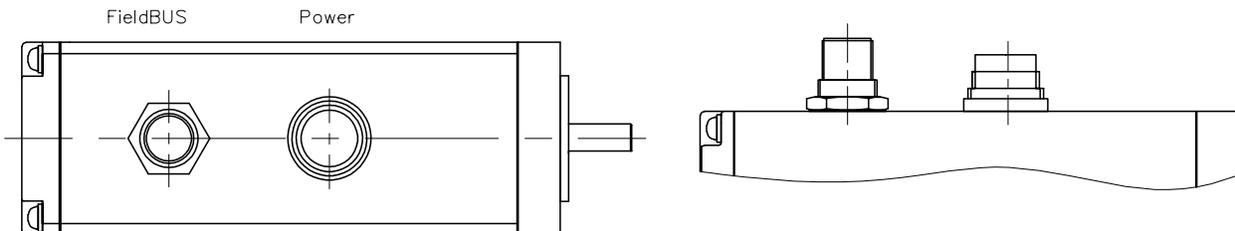


Type **011** IP65 Servo Fieldbus without IO

| Power Cable | |
|---|---|
| TCC 001-007-xxx | IP65 Binder 5 pin to Flying Leads |
| **Fieldbus Cable - Devicenet** | |
| TCC 002-013-xxx | M12 (Micro) to Flying Leads |
| TCC 002-014-xxx | M12 (Micro) to M12 (Micro) |
| **Fieldbus Cable - Ethernet/IP** | |
| TCC 002-025-xxx | M12 Dcode to RJ45 |
| TCC 002-026-xxx | M12 Dcode to M12 Dcode |

## IP40 Power Cables

TCC201-001 – IP40 stepper power cable with honeycomb connector to flying leads

TCC001-001 – IP40 stepper power cable with robust connector to flying leads

TCC201-007 – IP40 servo power cable with honeycomb connector to flying leads
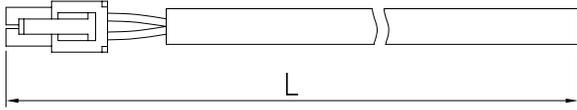
TCC101-007 – IP40 servo power cable with robust connector to flying leads

## IP40 Command Cables

TCC202-009 – IP40 SIO/PIO cable to flying leads
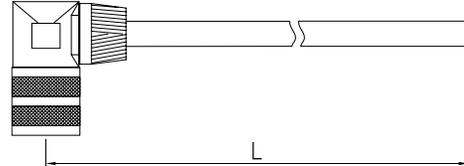
TCC102-020 – IP40 SIO/PIO cable with robust connector and connector for TBG002-003 chaining terminal

TCC202-023 – IP40 SIO/PIO/Pulse cable with honeycomb connector to flying leads
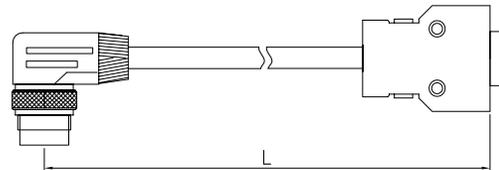
TCC102-022 – IP40 SIO/PIO cable with robust connector to flying leads

## IP65 Power Cables

TCC001-001 – IP65 stepper power cable with M12 connector to flying leads
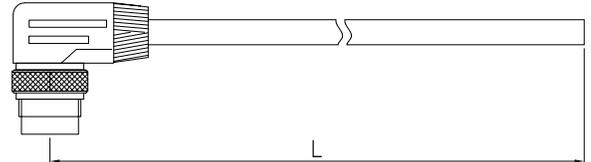
TCC001-007 – IP65 servo power cable with IP65 connector to flying leads

## IP65 Command Cables

TCC002-008 – IP65 stepper 20-pin SIO/PIO cable from TBG002-003 chaining terminal to ternary
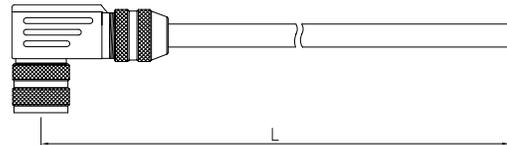
TCC002-020 – IP65 servo 24-pin SIO/PIO cable with IP65 connector and connector for TBG002-003 chaining terminal
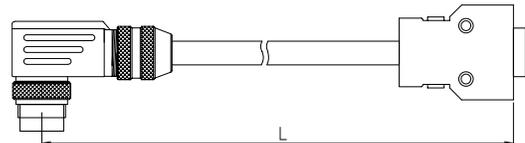
TCC002-009 – IP65 stepper 20-pin SIO/PIO cable with IP65 connector and cut end
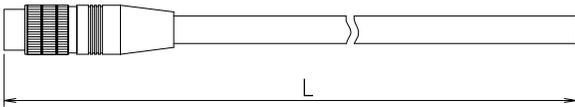
TCC002-010 – IP65 stepper 12-pin PIO cable with IP65 connector and cut end used with fieldbus ternary

TCC002-022 – IP65 servo 24-pin PIO cable with IP65 connector and cut end

TCC002-023 – IP65 24-pin SIO/PIO/Pulse cable with IP65 connector and cut end
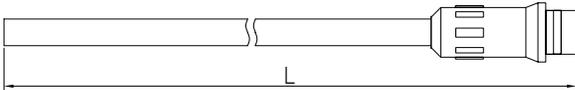
## DeviceNet Cables

TCC002-013 – IP65 DeviceNet cable with M12 connector to flying leads

TCC002-014 – IP65 DeviceNet cable with two M12 connectors
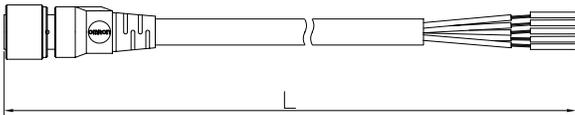
## Ethernet/IP Cables

TCC002-025 - IP65 Ethernet/IP cable with D-code M12 connector to RJ45

TCC002-026 - IP65 Ethernet/IP cable with two D-code M12 connectors
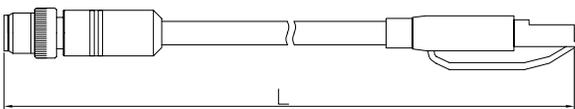
## Serial Communication Cables

TCC002-001 – Daisy chaining command cable for serial connection
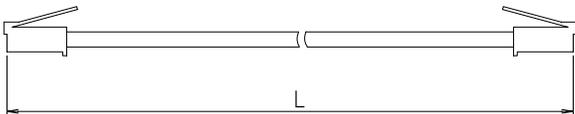
TCC002-005 – IP65 stepper command cable for serial connection
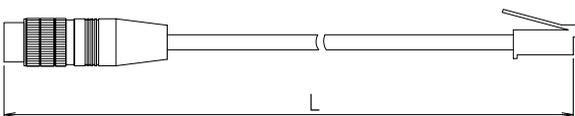
TCC202-024 – IP40 command cable with honeycomb connector for serial I/O connection
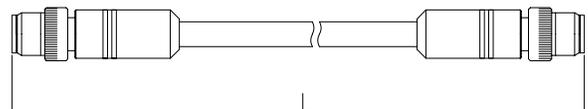
TCC002-024 – IP65 servo & IP40 robust connector command cable for serial I/O connection
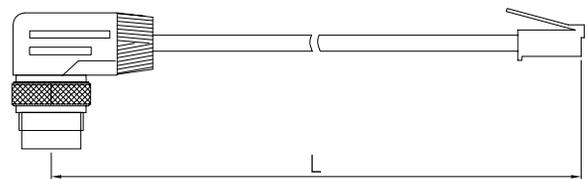
TCC-USB2-A-B – USB cable for use with TBG001-002 USB/RS485 converter

USB B

USB A
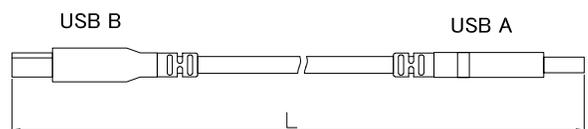
# Ordering Guide/Accessories

## 16 Order accessories as required

### Serial bus converter -- type code TBG001-001/TBG001-002

When using a PC or PDA to communicate via the RS485 serial channel, a serial bus converter is required. The TBG001-001 is used for RS232-to RS485 conversion. The TBG001-002 is used for a USB-port-to-RS485 conversion.
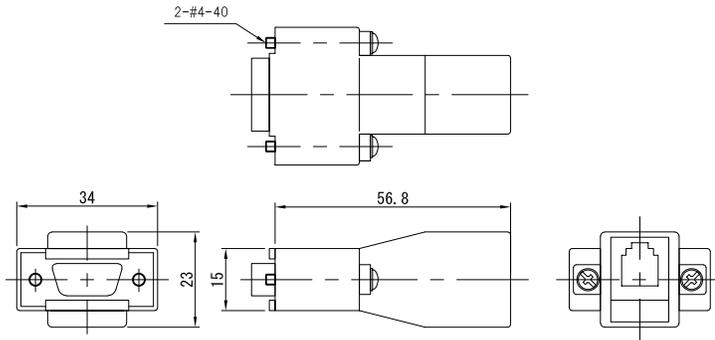


Plug the 9-pin connector or USB connector into the appropriate port on a PC. Plug a ternary command cable into the connector's modular jack.

### Serial/parallel chaining terminal -- type code TBG-002-003-NC
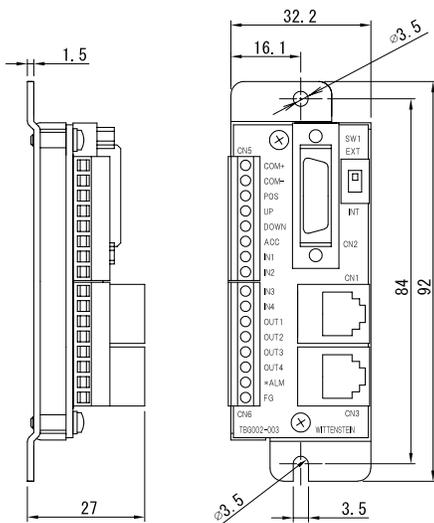


This terminal is used for connection of conventional PLC and control signals. In a system using parallel I/O, one terminal can be used for connection of each ternary actuator. The modular jacks can be used to connect a PC for setup and monitoring using the serial channel. NC indicates no cover, no protection.

### Serial/parallel chaining terminal mounting kit – type code TBG-002-003-NC Mount Kit
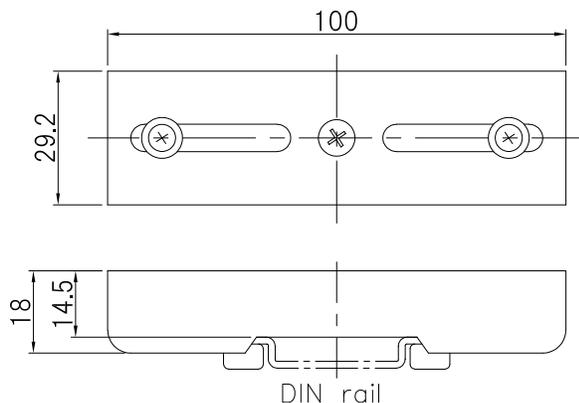


This kit provides the hardware for mounting the serial/parallel chaining terminal on a DIN rail.

## Serial chaining terminal – type code TBG002-004
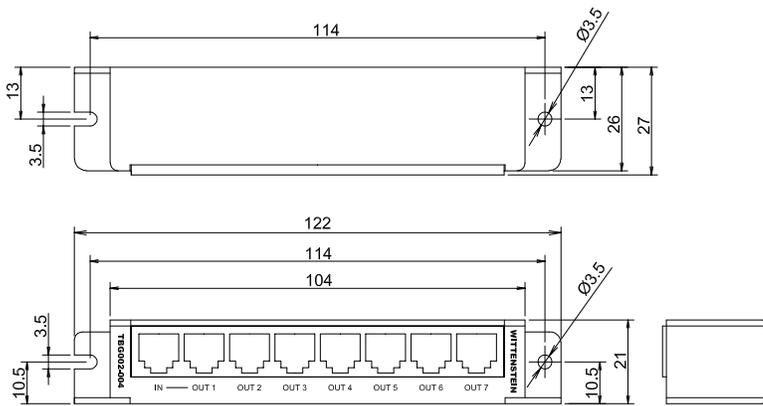


This chaining terminal is used to connect up to 7 ternary actuators via the serial I/O interface, using command cables with modular jacks. Multiple serial chaining terminals may be used to connect up to 16 devices.

## DeviceNet T-Connector – type code TBG002-005



CN0 plug (IN)    CN2 socket (OUT)

1 2 3 4 5    CN1 socket (OUT)
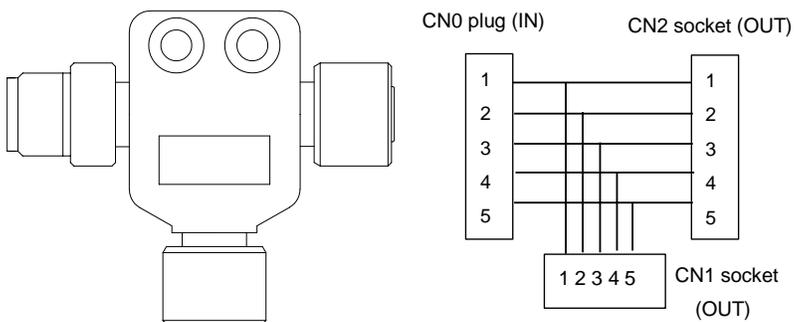
The T- connector is used for linking multiple DeviceNet actuators in an environment that requires high protection.

## DeviceNet terminating resistor – type code TBG002-006
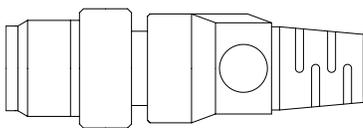


This resistor is used as the last device in a DeviceNet daisy chain.

## Protective cap – TCC002-PC1-IP67



Where a SIO/PIO command interface cable is not used, such as when only DeviceNet interface is used, the motor connector must be fitted with this protective cap to maintain its IP65 rating.

## 17 System power information

### Calculating power requirements

The first step to determining the correct power supply is to determine the required current draw of the total ternary units in your system. The size 46 stepper and servo both have separate connections for motor power and control power. The stepper version is supplied with 24 VDC for both motor and control power while the servo may accept 24 or 48 VDC for control power and 48 VDC for the motor power*. Please see the tables below for exact requirements.

| Actuator Type | Power Input | | Supply voltage | Current consumption |
|---|---|---|---|---|
| Size 46 Stepper | Main Power | | 24VDC +/-10% | 1.5A (1.7 with brake) |
| | Logic Power (SIO/PIO Version) | | 24VDC +/- 10% | 0.1 A |
| | Logic Power (Fieldbus Version) | | 24VDC +/- 10% | 0.2 A |
| Size 46 Servo | Main Power | Continuous | 48VDC +/- 10% | 3.0 A (3.1 A with Brake) |
| | | Maximum | | 9.0 A (9.1 A with Brake) |
| | Logic Power (SIO/PIO version) | | 24VDC +/-10% | 0.1 A |
| | | | 48VDC +/- 10% | 0.05 A |
| | Logic Power (Fieldbus version) | | 24VDC +/-10% | 0.2 A |
| | | | 48VDC +/- 10% | 0.1 A |

*The size 46 servo may be run off of 24 VDC at a derated level. The current requirements are the same for the logic power, while the main power required is 6A continuous and 9A maximum.

### Selecting power supply

After a determination of the power supply current consumption based on the tables above, the proper supply can be chosen. WITTENSTEIN offers a standard DIN Rail** mountable switching power supply as an option as shown in the table to the right.

| ternary Power Supply - 110 and 220 VAC Input Voltage | Output Voltage | Output Current |
|---|---|---|
| TUP 24-3.2 | 24 VDC | 3.2 A |
| TUP 24-5 | 24 VDC | 5 A |
| TUP 24-10 | 24 VDC | 10 A |
| TUP 48-5 | 48 VDC | 5 A |
| TUP 48-10 | 48 VDC | 10 A |

** Acceptable DIN Rail is type TS35/7.5 or TS 35/15.

### Inrush current control

When power is switched on to the servo ternary, there will be an inrush current which could damage the switch and relay. A sample protection circuit is shown to the right.
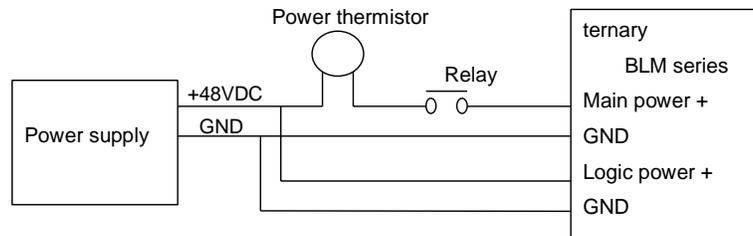


| Part name | Code | Manufacturer |
|---|---|---|
| Power thermistor | 2D2-15 | Semitec |
| Relay | G2R-1A (as TV-3) | OMRON |

**Caution**:
1. The thermistor limits the inrush current only at low temperature. Just after power is switched off, the thermistor will be at high temperature, so a short wait time is necessary before main power is switched on again.
2. A residual voltage will exist immediately after main power is switched off. Don't remove the power connector for at least one minute, to avoid damage to the connector.

If a customer-supplied power supply is used, make sure it has the proper capacity. Be sure to consider power regeneration capacity in the system.

The use of power control devices, such as a sequencing relay, disconnect, thermistor, fuses, etc. is recommended for safety reasons. The user must observe all local electrical codes and regulations regarding the power supply, fusing and disconnects.

## 18 Order regeneration module for ternary servo if necessary

### Regeneration unit for servo – Type code TBG004-001

Decelerating a servo motor results in energy regenerated back to the power supply. Where high levels of regenerative energy are produced by the motor, a model TBG004-001 regeneration unit may be needed to prevent the regenerated energy from exceeding the capacity of the power supply.

#### Specifications

| Item | | Unit | Description |
|---|---|---|---|
| Rated operating voltage | | V | 48 +/- 10% |
| Regenerated voltage | | V | Under 60 |
| Rated current | | A | 4 |
| Maximum current | | A | 10 |
| Rated absorbed power | Continuous | W | 40 (See note 1) |
| | Maximum | W | 220W (for up to 5 seconds) |
| Shunt resistor | | Ohm | 15 |
| Applicable servo actuator | | - | ternary BLM Series (TXBBx046 ---) |
| Protection class | | - | IP 1X |
| Ambient | Temperature | deg C | 0 - +55 Operating <br> -20 - +75 Storage |
| | Humidity | % | 90% maximum, non-condensing |
| | Vibration | G | 1 |
| | Shock | G | 15 |
| Function | LED Indicators | - | LED 1: Power ON <br> LED 2: Absorbing power <br> LED 3: Overheated |
| | Protection | - | Power absorbsion is stopped during an overheated condition. It will be automatically recovered when the unit cools down. |

Notes:
1. Absorbed power when the unit is attached to a 250 x 250 x 5 mm aluminum plate. For air cooling only, maximum absorbed power is 13W.

2. When regenerated power exceeds the capacity of the unit, it will go into an Overheated state (LED2 turns on) and the safety circuit will stop absorbing power. If the actuator continues operation in this condition, "D1" alarm will appear at the actuator itself.

3. The unit converts absorbed power into heat and contact with it may result in burns.

### Regeneration unit circuitry
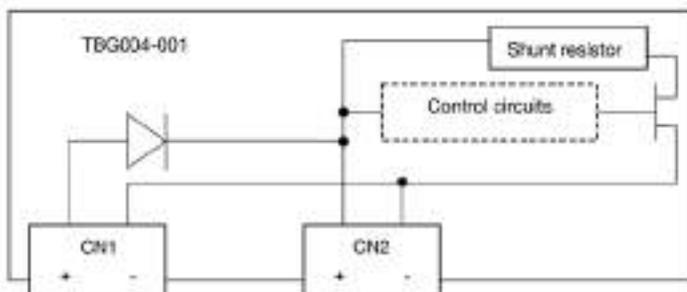


| Connector | Pin | Description |
|---|---|---|
| CN 1 | 1 | + |
| | 2 | - |
| CN 2 | 1 | + |
| | 2 | - |

## Connection

This illustration shows a typical connection of the regeneration unit with a single ternary. Contact the factory for information on other connections and parameterization of the ternary for this application.

```
┌─────────────────────┐   DC48V    ┌──────────────┐   ┌──────────────────────────────┐
│  DC power source    │            │  Shunt unit  │   │  Note                        │
│        for          │  ┌───────┐ │              │   │  1. Insert Regeneration unit │
│  motor main power   │→ │Inrush │→│    CN1       │   │     at main power line of    │
│                     │  │current│ │              │   │     actuator.                │
└─────────────────────┘  │control│ │    CN2       │   │  2. Generated power at       │
                         └───────┘ └──────────────┘   │     actuator is absorbed by  │
┌─────────────────────┐                               │     shunt unit.              │
│  DC power source    │                               └──────────────────────────────┘
│        for          │
│  motor logic power  │→
└─────────────────────┘      DC12 - 48V

┌─────────────────────┐
│        PC           │
│        &            │
│   Bus converter     │
└─────────────────────┘
```
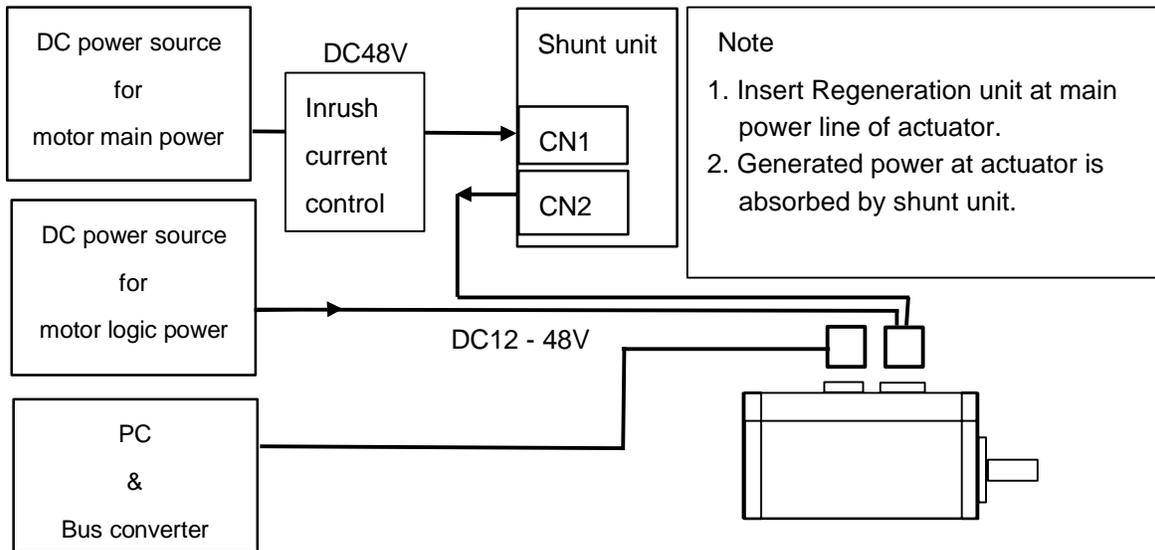
## Regeneration unit outline drawing



2x ϕ 3.5    2x ϕ 3.5

Pin 1 / Pin 2    CN2

LED 1
LED 2
LED 3

Pin 1 / Pin 2    CN3

70 · 80 · 70

20
25

45

3

3

65
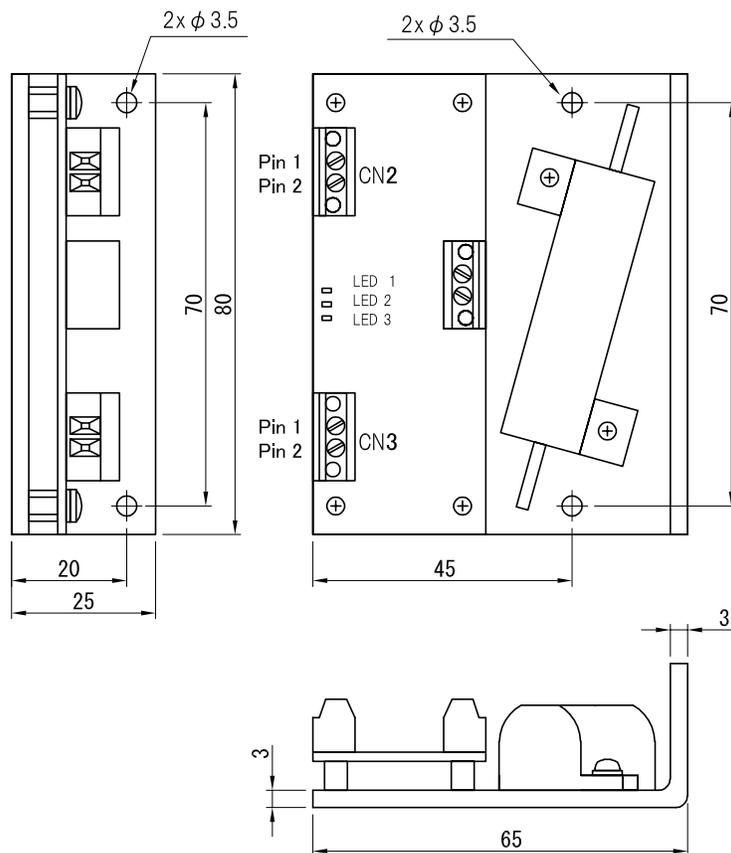
## 19 Order proTern software and start-up kit

The proTern™ ternary Digital Assistant software (type code TET002-002) is used to set up a serial interface ternary actuator. Reference manual is included.

proTern™ is a powerful Windows-based software that provides a project-oriented environment for ternary support. It is an intelligent commissioning tool, a comprehensive diagnostic tool, and an OEM application project manager. It is available for parameter tuning, speed/position profile tracing, internal status monitoring and data file upload/download. proTern allows easy access to trace data for oscilloscope functions.  Also jogging and teaching is easier with proTern.

The start-up kit includes the proTern software, a bus converter and the serial programming cable. You generally will want to order this kit when you have a stepper or servo with SIO/PIO interface.  If you have a stepper version with fieldbus, there is no serial capability, so you can't use the kit. The servo version with fieldbus does have a serial port, so use of the kit is optional.

**Order a Start-up kit per the following type code configurator:**

**Type**                                                                    **TUK00X-00Y**

TUK:  ternary start-up kit.  Includes proTern
      software and manual, serial bus converter
      and 2-meter serial cable to connect ternary to
      a PC or chaining terminal.

**Type of chaining terminal and cable**
001:  Connecting directly from a PC to a stepper without
      using a chaining terminal. Kit includes a serial bus
      converter (type depends on digit Y) and a
      TCC002-005-020 2-meter cable, RJ11 to Hirose
      connector.
002:  Connecting to a ternary using a chaining terminal
      (ordered separately).  Kit includes a TCC002-001-020
      2-meter cable for RJ11 to RJ11 connection.
003:  No chaining terminal.  Connecting to a servo or an IP40
      with robust connectors.  Includes 2-meter cable
      TCC002-024-020.
004:  No chaining terminal.  Connecting to a ternary with
      honeycomb connectors.  Includes 2-meter cable
      TCC202-024-020.

**Type of serial bus converter required (included in kit)**
001:  TBG001-001 – RS232-to-RS485 bus converter
002:  TBG001-002 – USB port-to-RS485 bus converter

# Documentation/Special Order Products

## 20 Order additional accessories

| Accessory | Comment | Type code |
|---|---|---|
| DLL command library for C++ | Optional – Specify this library if you will be programming the ternary for serial operation using C++. | TDL001-001 |
| T-Slot Nut | Used for mounting size 46 linear ternary to a surface using the T-slots on the unit.  Specify required quantity. | T-Slot-Nut |

## 21 Check with a representative or distributor to confirm pricing and delivery, then submit your order.

## ternary Documentation

The following ternary documents can all be downloaded from www.wittenstein-us.com.
1. Go to www.wittenstein-us.com
2. Click on **products**.
3. Click on **Actuators**.
4. Click on **Ternary Actuators**.
5. Click on **manuals** (under the photo).
6. Select the documents you want from the following list:
   - Ternary Servo Product Manual.
   - Ternary Servo DeviceNet Interface.
   - Ternary Servo Fieldbus Command Reference.
   - Ternary Servo SIO PIO Interface and Command.
   - Ternary Stepper Product Manual.
   - Ternary Stepper PIO Interface and Command.
   - Ternary Stepper Quick Reference for Fieldbus.
   - Ternary Stepper with DeviceNet Interface.
   - Ternary Slider Product Manual.

## ternary special order products

The items listed in this section are available on special order, generally with longer than normal lead times. Brief descriptions are presented. Contact WITTENSTEIN for more information on various items, including type codes and CAD drawings where appropriate.

### Encoders
A 4096 multi-turn absolute encoder is available, with a resolution of 65536 pulses per revolution.

### Interfaces
CANopen, Profibus and CC-Link fieldbus interfaces, cables and accessories are available on special order.

Parallel I/O source type is standard. Sink type is available for the size 46 ternary on special order. Note that both source and sink type are standard on the size 6X rotary ternary.

An analog interface with differential analog input for position control is available on request.

## Cylinders for TLS linear ternary

Cylinder strokes of 50, 100, 150, 225 and 300 mm are standard for the TLS and Folded TLS linear actuators. 25, 75 and 400 mm cylinder strokes are special order.

## Planetary gear reducers

The standard gear reducer for the TRS motor/gear reducers (page 15) is the LP50 in 5:1, 10:1 and 25:1 gear ratios. Other gear ratios are available on special order per the table below.

Gear combination table

| Motor | LP50 | | | | | LP70 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i-5 | i-10 | i-25 | i-50 | i-100 | i-3 | i-5 | i-7 | i-10 | i-15 | i-25 | i-30 | i-50 | i-100 |
| Stepper | A | A | A | B | – | – | – | – | – | – | – | – | – | B |
| Servo (Inc Encoder) | A | A | A | – | – | – | – | – | – | A | A | A | B | B |

| A | 1st recommendation |
|---|---|
| B | 2nd recommendation |
| – | Available on request |

The alphira (CP) gear reducer is available with the TRS per the following table:

Gear combination table

| Motor | CP40 | | | | | CP60 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | i-5 | i-10 | i-25 | i-50 | i-100 | i-5 | i-10 | i-25 | i-50 | i-100 |
| Stepper | A | A | A | A | – | – | – | – | B | A |
| Servo (Inc Encoder) | A | A | A | B | – | – | – | B | A | – |

| A | 1st recommendation |
|---|---|
| B | 2nd recommendation |
| – | Available on request |

WITTENSTEIN SP, SPK, TP and TPK gear reducers are available on special order.

The TR motor with ZST/RMT rack and pinion is available on special order, as is the TR with LPB gear reducer and toothed belt.

See the WITTENSTEIN (alpha) catalog for more information on gear reducers — you can download it from www.wittenstein-us.com.

## Cables

Cables in standard lengths of 2, 5, and 10 meters are listed in this catalog. If additional cable length is required, contact WITTENSTEIN U.S.

## Connector Configurations

Customizable connector configurations are available on request.

# Folded ternary Mounting

## Folded ternary mounting diagram

Motor position
**M_UP**
As <u>standard</u>

Motor position
**M_Left**
As option

Motor position
**M_Right**
As option

Cylinder position
**C_Left**
As option

Cylinder position
**C_Right**
As option

Cylinder position
**C_DN**
As <u>standard</u>
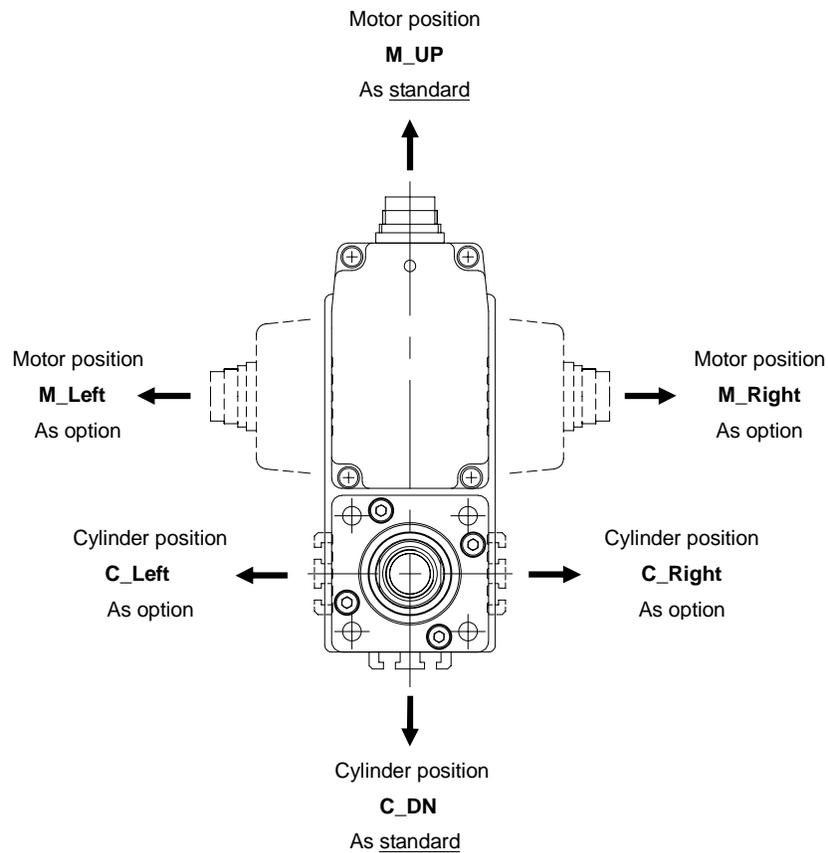
The standard mounting for folded ternary is shown above. If no orientation is specified on the order, the standard mounting will be delivered. If a different mounting is required, please specify on the order as shown in the drawing, with the cylinder and/or motor rotated to the left or right.

# WITTENSTEIN