

# **Limatorque® TriVAX® Plus Scotch Yoke Smart valve actuator Operating angle 90°**



## Get the benefits of two leading actuator technologies in one

The Limitorque TriVAX Plus Scotch Yoke actuator concept combines the infrastructure simplicity of electric actuators with the key advantages of hydraulic actuators, including mechanical fail-safe action, high operating speeds and high operating torques.

Installation is simple because the actuators only require electric power — no high-pressure oil system is necessary. The actuator's self-contained oil system operates under vacuum conditions with zero leakage, reducing contamination and eliminating the need for external piping.

Fully integrated operation and diagnostic tools are available, making it very easy to integrate safety functions or quick-operation features. The TriVAX actuator also offers you industry-leading versatility, with the ability to assemble it in any position.

### Safety, simplicity and efficiency

TriVAX 5000 Plus Scotch Yoke valve actuators are available in multiple configurations:

- TriVAX 5100/5200 — For butterfly, ball or plug valves operating in on/off mode
- TriVAX 5300 — For butterfly, ball or plug valves operating in positioning mode

Double- and single-acting configurations are available for applications with stroke lengths to 220 mm. The operating torque for double-acting actuators is between 11 to 66 kNm, while single-acting actuators are able to apply spring-ending torques from 5 to 68 kNm.

TriVAX Plus Scotch Yoke actuators are suitable for hazardous areas requiring protection levels to ATEX II 2 G/D Ex de IIB T4. The standard weather protection is IP65, with IP67 available as an option.

Extensive diagnostic functions enable you to analyze the performances of the actuator, valve and processes, preventing potential problems before they occur and enabling ongoing improvements over time.

### Electric power, hydraulic performance

The TriVAX Plus Scotch Yoke actuator is a fully integrated actuator with a hydraulic spring cylinder driven by a high-pressure electrohydraulic power unit. The spring is coupled to the motor drive train during normal operation, but can also disengage to intervene in fail-safe scenarios. The actuator is operated by an electronic control unit with an intuitive, user-friendly, human-machine interface (HMI) that remains upright in any configuration.

### Features

- Completely self-contained, zero-leakage hydraulic system
- Compact design
- Tubeless architecture
- Integrated safety functions (fail-safe/ESD)
- Simple installation
- Assemble in any position
- Low electric power consumption
- Separate terminal compartment
- Modular construction

### Benefits

- Plug and work — easy installation and intuitive handling
- Reliable and efficient operation
- Diverse application possibilities with a single product platform

## Characteristics

<b>Operating voltage</b>	3 ph/400 V/ 50/60 Hz, or 1 ph/230 V/50 Hz, or 3 ph/480 V/60 Hz		
<b>Tolerances</b>	Voltage $\pm 10\%$ ; frequency: $\pm 5\%$		
<b>Max. current</b>	3 ph/400 V: 4.8 A	1 ph/230 V: 7.8 A	3 ph/480 V: 3.9 A
<b>Nominal current (at 50% load)</b>	3 ph/400 V: 2.2 A	1 ph/230 V: 3.2 A	3 ph/480 V: 2.2 A
<b>Recommended fuse</b>	3 ph/400 V: 6 A	1 ph/230 V: 10 A	3 ph/480 V: 6 A
<b>Tripping characteristic</b>	B		
<b>Min. breaking capacity</b>	1.5 kA		
<b>Power consumption</b>	1100 W		
<b>Position accuracy</b>	$\pm 2\%$ of full stroke		
<b>Ambient temperature</b>	25°C to 70°C (-13°F to 158°F) to velocity reduction at temp. > 65°C (149°F) possible Option: 30°C to 60°C (86°F to 140°F)		
<b>Protection class</b>	IP 65		
<b>Explosion protection</b>	ATEX II2G/D Ex de IIB T4 / IP67 IEC-Ex: Ex de IIB T4 / IP67 cCSAus: Ex d e [ib] ib IIB T4 Gb Class I, Zone 1 AEx d e [ib] ib IIB T4 Gb		
<b>Corrosion protection</b>	DIN EN ISO 12944-2 category C3 (medium) Optional: C5M (very high – marine)		
<b>Manual operation</b>	Hand pump (optional)		
<b>Mounting position</b>	Each position possible (at outside mounting: display not on top side)		

## Inputs and outputs

### Inputs and Outputs — Digital

#### Digital Input

<b>DI1 – DI4 (Ex e)</b>	Signal 0: 0 – 11 VDC Signal 1: 15 – 30 VDC Nominal current 5 mA – load: 4.8 k $\Omega$ External voltage (24 VDC) with common ground for DI1 – DI4
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#### Digital Output

<b>DO1 – DO4 (Ex e)</b>	Solid state – high-side switch Signal 0: 0 V Signal 1: 24 V Nominal current: 5 mA Short circuit current: 80 mA max. load: 300 $\Omega$ External voltage (common for DO1 – DO4): 20 – 30 VDC (typ. 24 V)	Per parameter configuration for the selected event as active 0 or active 1 programmable
<b>DO5 – DO7 (Ex e)</b>	Relay contact MAKE Nominal voltage: 24 VDC max. current: 1 A min. switching power: 500 mW (10 V / 5 mA)	Per parameter configuration for the selected event as active 0 or active 1 programmable

### Input and Outputs — Analog (TriVAX 5200 and 5300 Only)

#### Analog Input

<b>AI1 (Ex i) – Setpoint position</b> <b>AI2 (Ex i) – Setpoint speed</b>	Max. values for connectable Ex i equipment No-load voltage $U_i$ : 30 V Short circuit current $I_i$ : 130 mA Power $P_i$ : 980 mW Capacity $C_i$ : 5.2 nF Inductivity $L_i$ : 0	Current: 4 – 20 mA Voltage: 7 – 30 V DC Load: 350 $\Omega$
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#### Analog Output (TriVAX 5300 Only)

<b>Analog output AO1 (Ex i) –</b> <b>Position retransmission</b>	Max. values for connectable Ex i equipment No-load voltage $U_i$ : 30 V Short circuit current $I_i$ : 130 mA Power $P_i$ : 980 mW Capacity $C_i$ : 5.2 nF Inductivity $L_i$ : 0	Current: 4 – 20 mA Voltage: 7 – 30 V DC Load: 350 $\Omega$ (passive output)
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### Input ESD

#### Digital Input ESD

<b>Digital input ESD IN (Ex e)</b> <b>This input can be disabled by HOERBIGER</b> <b>for double-acting actuators.</b>	Signal 0: 0 VDC Signal 1: 24 VDC (Min. ext. switching voltage 24 VDC) Nominal current: 38 mA	A low signal at ESD IN (signal 0) moves the actuator to its safety position (hold position/ spring return) and it doesn't react on other control signals.
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## Actuator sizes

Actuator Size	5xx1	5xx2	5xx3	5xx4
Operating angle	90° +/- 5°	90° +/- 5°	90° +/- 5°	90° +/- 5°

### Double Acting

Ending torque	11,000 Nm 97,350 lbf in	25,400 Nm 224,780 lbf in	39,150 Nm 346,460 lbf in	66,750 Nm 590,710 lbf in
Running torque	5650 Nm 50,000 lbf in	13,100 Nm 115,930 lbf in	20,150 Nm 178,320 lbf in	34,400 Nm 304,420 lbf in
Operating velocity	6 °/s	2.85 °/s	1.8 °/s	1.05 °/s

### Single Acting

Op. torque (spring-ending torque)	5650 Nm 50,000 lbf in	10,150 Nm 89,820 lbf in	18,450 Nm 163,270 lbf in	35,900 Nm 317,700 lbf in
Running torque	3450 Nm 30,530 lbf in	6200 Nm 54,870 lbf in	12,300 Nm 108,850 lbf in	24,900 Nm 220,350 lbf in
Op. torque (oil starting force)	7550 Nm 66,810 lbf in	15,250 Nm 134,960 lbf in	35,050 Nm 310,180 lbf in	74,550 Nm 659,730 lbf in
Operating velocity – standard	5.3 °/s	2.85 °/s	1.35 °/s	0.68 °/s
Operating velocity – quick-acting/FS	180 °/s	80 °/s	50 °/s	40 °/s

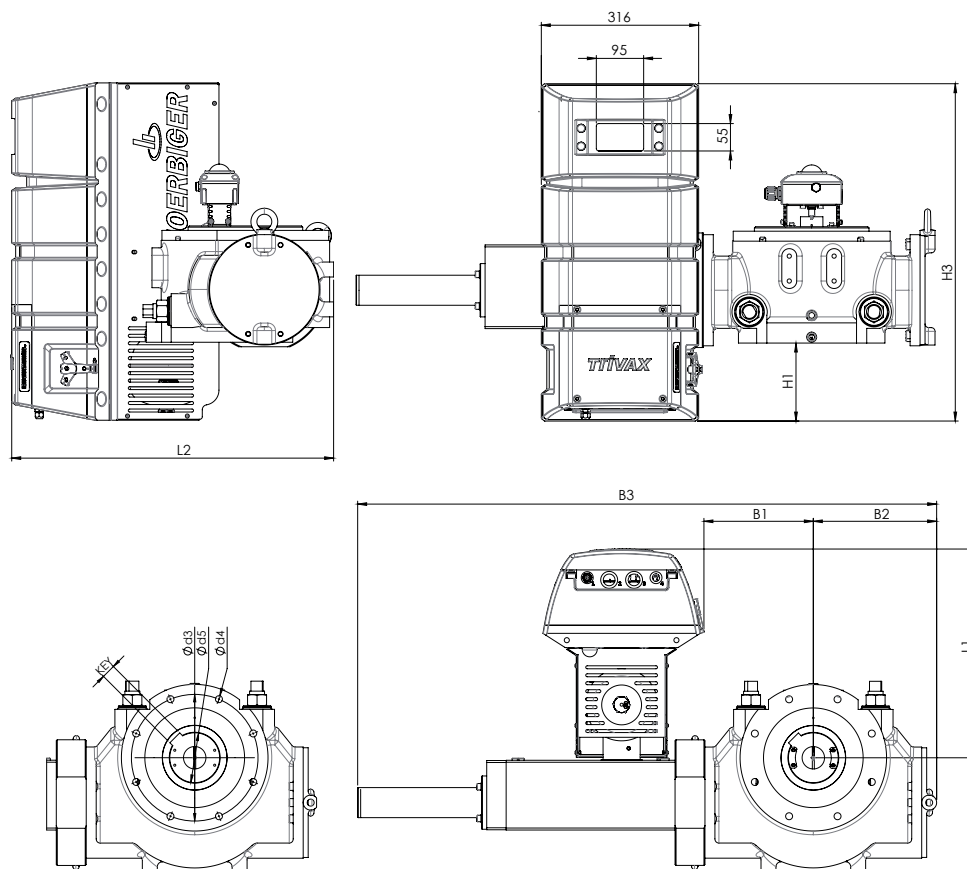
\* depending on stroke length

Note: For versions with operating voltage 1 ph/230 V, the operating velocities are reduced to 50% of the stated values.

On request: Single-acting actuators available with spring ending torque of 48,150 and 68,400 Nm

Control Configuration	5100 Simple On/Off	5200 Smart On/Off	5300 Smart Positioning
Functional scope	Open/Close	Open/Close	Positioning
Duty cycle	S3 – 10%	S3 – 10%	S3 – 25%
Position accuracy			± 2% of full stroke
Intuitive human-machine interface	✓	✓	✓
Digital inputs and outputs	✓	✓	✓
Digital inputs	4 (24 VDC) configurable for latched operation, push-to-run operation or two-wire control		
Digital outputs	4 solid-state outputs 24 V DC high side configurable as high or low output for status signals		
Digital outputs — (Volt-free)	Three volt-free relay contacts configurable as make or break contacts for status signals		
Analog inputs	—	One analog input for threshold control position	Two analog inputs for set point position and speed
Analog output	—	—	One analog output for position retransmission
Position detection	✓	✓	✓
Manual operation	Option	Option	Option
Ex proof (ATEX)	Option	Option	Option

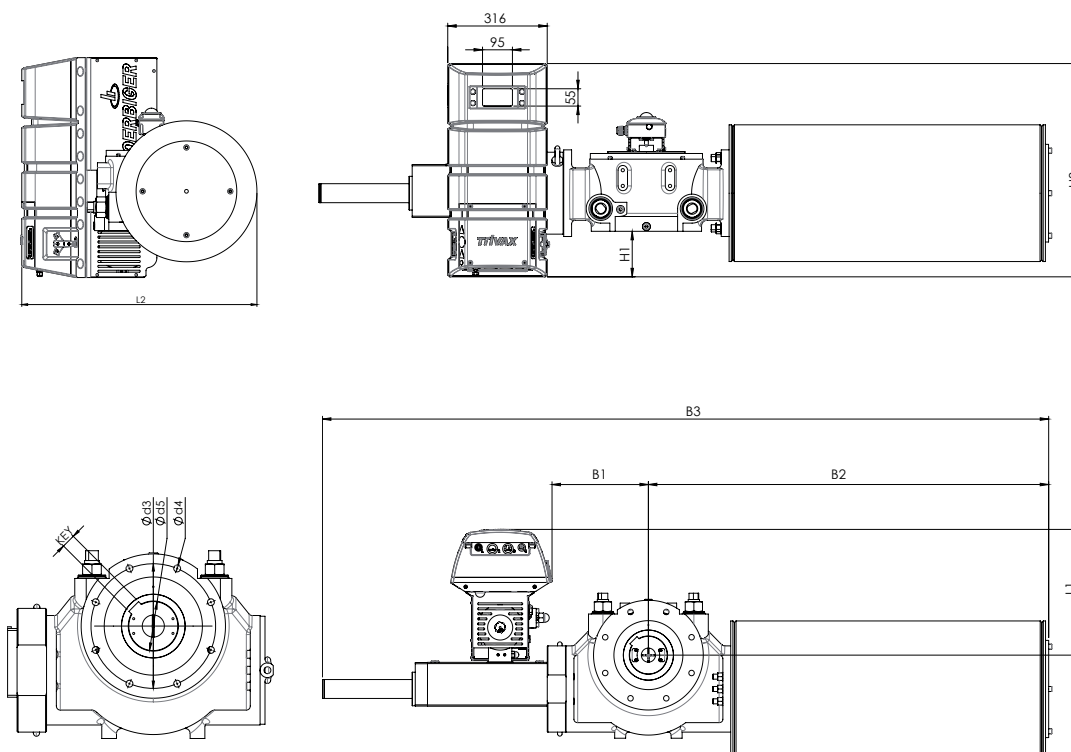
## Dimensions — double-acting actuators



Size	Max. torque	H1	H3	B1	B2	B3	L1	L2	Ø d3	Ø d4 x depth	Ø d5	Key	Weight
	(kN)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)
5x11	11,000	155	677	220	250	1162	421	650	F25 254	M16 x 24	100	28 x 16 x 183	290
5x12	25,400	139		317	303	1351	406	671	F30 298	M20 x 30	120	32 x 18 x 212	338
5x13	39,150	105		355	330	1510	397	700	F35 356	M30 x 45	160	40 x 22 x 295	450
5x14	66,750	85		441	425	1888	384	783	F40 406	M36 x 54	178	45 x 25 x 366	745

Size	Max. torque	H1	H3	B1	B2	B3	L1	L2	Ø d3	Ø d4 x depth	Ø d5	Key	Weight
	(lbs in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(lbs in)
5x11	97,350	6.1	26.65	8.66	9.84	45.75	16.57	25.59	F25 10	M16 x 0.94	3.94	1.1 x 0.63 x 7.2	639
5x12	224,780	5.47		12.48	11.93	53.19	15.98	26.42	F30 11.73	M20 x 1.18	4.72	1.26 x 0.71 x 8.35	745
5x13	346,460	4.13		13.98	12.99	59.45	15.63	27.56	F35 14.02	M30 x 1.77	6.3	1.57 x 0.87 x 8.35	992
5x14	590,710	3.35		17.36	16.73	74.33	15.12	30.83	F40 15.98	M36 x 2.13	7.01	1.77 x 0.98 x 14.41	1642

## Dimensions — single-acting actuators

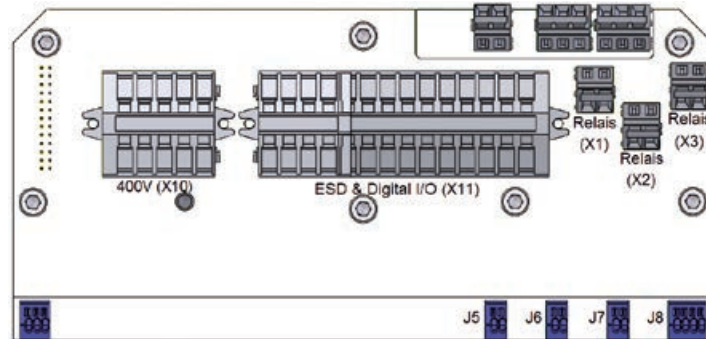


Size	Max. spring end- ing torque	H1	H3	B1	B2	B3	L1	L2	Ø d3	Ø d4 x depth	Ø d5	Key	Weight
	(kN)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)
5x11	5650	146	677	309	1280	2326	402	715	F25 254	M20 x 30	120	32 x 18 x 212	660
5x12	10.150	139		317	1286	2335	408	721	F30 298	M20 x 30	120	32 x 18 x 212	657
5x13	18.450	106		355	1561	2740	397	750	F35 356	M30 x 45	160	40 x 22 x 295	950
5x14	35.900	84		442	2064	3527	700	820	F40 406	M36 x 54	178	45 x 25 x 366	1395

Size	Max. spring end- ing torque	H1	H3	B1	B2	B3	L1	L2	Ø d3	Ø d4 x depth	Ø d5	Key	Weight
	(lbs in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(lbs)
5xx1	50,000	5.75	26.65	12.17	50.39	91.57	15.83	28.15	F30 11.73	M20 x 1.18	120	1.26 x 0.71 x 8.35	1455
5xx2	89,820	5.47		12.48	50.63	91.93	16.06	28.39	F30 11.73	M20 x 1.18	120	1.26 x 0.71 x 8.35	1448
5xx3	163,270	4.17		13.98	61.46	107.87	15.63	29.53	F35 14.02	M30 x 1.77	160	1.57 x 0.87 x 11.61	2094
5xx4	317,700	3.31		17.4	81.26	138.86	27.56	32.28	F40 15.98	M36 x 2.13	178	1.77 x 0.98 x 14.41	3075

Note: The depth of shaft hole (d5) is equal to the key length (key).

## Terminal block



### Operating Voltage — Terminal Block x10

L1-L2-L3 + ground wire + N

### ESD and Digital Inputs and Outputs — Terminal Block x11

ESD IN – Input 24 V DC	At low signal, ESD will be released.	
Digital outputs 1–4 Assignments depend on configuration	Launched operation	DI1: open DI2: close DI3: stop DI4: configurable
	Push-to-run operation	DI1: open DI2: close DI3: configurable DI4: configurable
	Two-wire control	DI1: control input open/close DI2: configurable DI3: configurable DI4: configurable
Digital outputs 1–4 Assignments depend on configuration	Default values	D01: actuator moves D02: selector switch local D03: inactive D04: inactive

### Volt-free Contacts (Outputs) Terminal Blocks x1–x2–x3

Digital outputs 5–7 Assignments depend on configuration	Default values	D05: End position OP D06: End position CL D07: Monitor
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### Analog Inputs and Outputs — Terminal Blocks J5 – J6 – J7

Analog inputs 1–2	AI1: Setpoint of actuator position (J6)
	AI2: Setpoint of actuator speed (J7)
Analog output 1	AO1: Retransmission of actual actuator position (J5)

### Cable Entries

2x M25x1.5	1x M16x1.5
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## Possible configurations – TriVAX interfaces and diagnostics

### Digital Inputs 1–4

Block local operation	Configurable as active high or low outputs
Start partial stroke test	
Error <b>ack</b>	
Interlock remote	

### Digital Outputs 1–7

Calibration complete	Configurable as active high or low outputs
Local blocking active	
Position open	
Position closed	
Actuator moves	
Failure	
Selector local	
Selector remote	
Selector null	
Maintenance required	
Out of specification	
Functional check	
Collective failure (monitor)	
Partial stroke test not OK	
Partial stroke test active	
Partial stroke test OK	
Actuator ready	

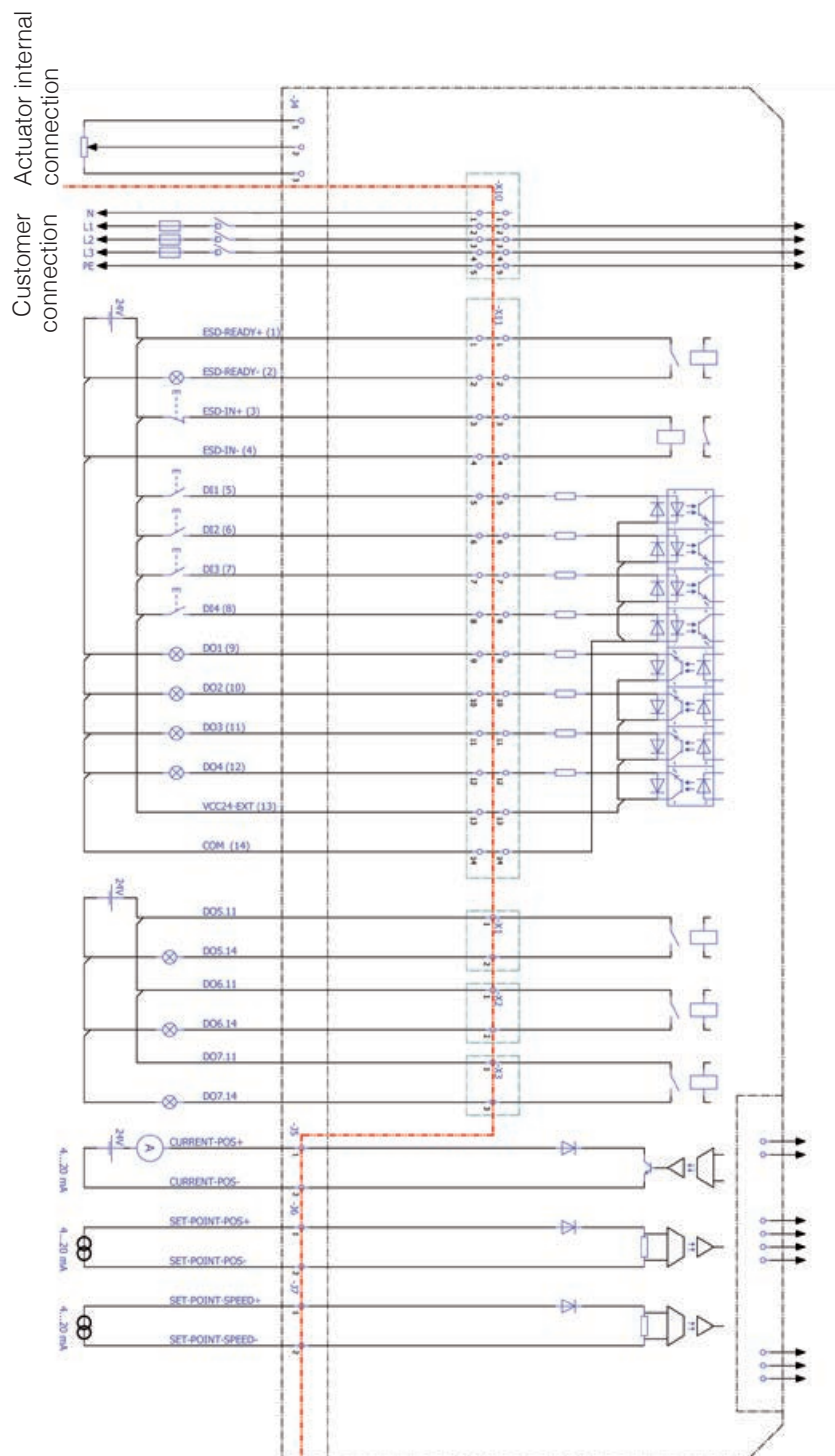
### Analog Input (for TriVAX 5200 and 5300 Only)

Threshold control	
Positioner	

### Partial Stroke Test (for TriVAX 5200 and 5300 Only)

PST direction	Open or close
PST angle	3 – 99%
PST reference value	Ref. characteristic/max. limit
PST tolerance	0 – 100%
PST activation	Control room/time interval 1 – 999 days

# Wiring proposal



## Ordering code

### TriVAX

Code	Description	Comment
TX		

### Actuator

	TriVAX linear	
1	TriVAX quarter-turn	Scotch yoke
2	TriVAX quarter-turn	Helical

### Function

1	Simple on/off	
2	Smart on/off	
3	Smart positioning	

### Safety Function

1	Mechanical Failsafe Std (DA)	Linear: CL = piston extended Quarter-turn: clockwise to close
4	Mechanical Failsafe Std OPEN	
5	Mechanical Failsafe Std CLOSE	
6	Failsafe Hold Reverse (DA)	Linear: CL = piston retracted Quarter-turn: counter-clockwise to close
9	Mechanical Failsafe Reverse OPEN	
0	Mechanical Failsafe Reverse CLOSE	
A	Without (DA)	ESD disabled – closing direction; see above
B	Without Reverse (DA)	

### Operating Torque/Size

1	DA: 11 kNm (97 k lbf in) / FS Mech: 5.6 kNm (50 k lbf in)
2	DA: 25.4 kNm (225 k lbf in) / FS Mech: 10.1 kNm (89 k lbf in)
3	DA: 39.1 kNm (346 k lbf in) / FS Mech: 18.4 kNm (163 k lbf in)
4	DA: 66.7 kNm (590 k lbf in) / FS Mech: 35.9 kNm (318 k lbf in)
5	FS Mech: 48.1 kNm (426 k lbf in)
6	FS Mech: 68.4 kNm (605 k lbf in)

## Ordering code

### Stroke

Code	Description	Comment
—	Quarter-turn actuator 90°	
A	50 mm (1.97 in)	
B	75 mm (2.95 in)	
C	100 mm (3.94 in)	
D	150 mm (5.91 in)	
E	220 mm (8.66 in)	

### Voltage

1	3 ph/400 V/50 Hz	
2	1 ph/230 V/50 Hz	
3	3 ph/480 V/60 Hz	

### Protection Class/Approval

A	SIL/IP65	
B	SIL/ATEX	
M	IP65	
N	ATEX	
E	SIL/cCSAus – ordinary location	
F	SIL/cCSAus – hazardous location	
G	SIL/IECEX	
Q	cCSAus – ordinary location	
R	cCSAus – hazardous location	
S	IECEX	

### Temperature Range

1	Standard	25°C to 70°C (-13°F to 158°F)
3	Low-temperature	30°C to 60°C (86°F to 140°F)

### Fieldbus

0	Without	
3	HART	

## Ordering code

### Mounting Orientation

Code	Description	Comment
0	Standard	Vertical – display above
1	Upside down	Vertical – display below
2	righthand 0°	Choose everytime 0 for actuators which doesn't need a fixed mounting position FS Hold (DA) / FS Mech
3	righthand 90°	
4	righthand 180°	
5	righthand 270°	
6	lefthand 0°	
7	lefthand 90°	
8	lefthand 180°	
9	lefthand 270°	

### Optional Features

0	Without	
1	Hand pump small	0.24 in <sup>3</sup> /stroke
2	Hand pump large	0.73 in <sup>3</sup> /stroke – actuator size 3 and larger

### Electric/Mechanic Connection

1	Cable entry metric / mech. connection standard (see dimensional drawing)
5	Cable entry NPT (with adaptors) / mech. connection standard (see dimensional drawing)

### Corrosion Protection

1	Standard	Acc. ISO 12944-2 C3
2	Off-shore	Acc. ISO 12944-2 C5M
3	Primer only	



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