PowerRod Operating Manual

Actuator and component

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PowerRod Series 25 and 38

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Worldwide sales
http://divapps.parker.com/divapps/eme/EME/Contact_sites/Sales%20Channel_Parker-EME.pdf

Further information:

Our product on the Internet (**http://www.parker-eme.com/powerrod**):

Support for commissioning with Compax3 on:

ParkerOnline: POL C3KnowledgeBase Tab "start-up-guides"
http://www.compax3.info/startup/

1. Notes on the Documents Supplied

PRx - Installation manual

This manual contains information on the installation, maintenance and accessories of the assigned PRx device series (see "device assignment" chapter)

1.1 Unpacking



First check

- Check the packaging for damages.
- Remove the packaging.
  Do not discard the packaging; it is strongly recommended to use the original packaging material for return deliveries.
- Depending on the storage location, metal surfaces may have a temperature of 0°C or below. Please provide appropriate worker protection (e.g. protective gloves).
- Please ensure that the consignment does correspond to your order.
- Check the product for damages. Do never use a device which seems damaged.
- Please read the installation manual carefully before installing or commissioning the device.

1.2 Warnings

Explanation of the symbols

The symbols used in this manual (and the supplementary sheets) indicate possible dangers which may occur when handling the described products.

Forbidden for persons with heart pace makers

Persons with heart pace makers are **not allowed** to handle or work with this product. Keep the necessary safety distance.

Beware of the magnetic field

The magnetic rod does contain strong magnets and exerts a strong pull on ferromagnetic objects.

Non-compliance with the safety instructions may result in damages to computer drives and credit cards.

Beware of dangerous electrical voltages

Potentially lethal voltages may be present during the commissioning and servicing of this equipment.

Always switch devices off before wiring them!

Particular care needs to be taken when working on or around motor phase connections.

Beware of hot surfaces

Surface temperatures of up to 80°C can be present.

Allow the forcer and thrust rod to cool before working on the equipment.

Heavy object

Heavy objects should not be lifted by a single person.

Beware of crush hazard/hand injuries

The forcer may move unexpectedly. Always isolate all sources of electrical supply before working on the equipment.

General hazard. Follow the advice given.

Beware of danger points

The product must be grounded. Use the green/yellow conductor.

EMC guidelines

This equipment is intended for use in a light industrial environment (EN61000-6-3 / EN61000-6-1). It is recommended that the following precautions be observed during installation:

- Keep all cable lengths to a minimum.
- Signal lines and power lines should be installed as far apart as possible. In particular, avoid long, parallel runs of cables.
- Maintain grounding continuity.
- Provide wide area shielding for the connections.

It is the responsibility of the user to ensure compliance with any local electrical and EMC regulations in force at the time of installation.

Contents

2. Introduction

In this chapter you can read about:

2.1 Device assignment

This manual is valid for the following devices:

PowerRod Actuator	PowerRod Component
PRA 2504	PRC 2504 with TRC25
PRA 2506	PRC 2506 with TRC25
PRA 2508	PRC 2508 with TRC25
PRA 2510	PRC 2510 with TRC25
PRR 2504 with rod guiding	
PRR 2506 with rod guiding	
PRR 2508 with rod guiding	
PRR 2510 with rod guiding	
PRA 3804	PRC 3804 with TRC38
PRA 3806	PRC 3806 with TRC38
PRA 3808	PRC 3808 with TRC38
PRA 3810	PRC 3810 with TRC38

2.2 Safety instructions

- Check the correct association of the device and its documentation.
- Never detach electrical connections while voltage is applied to them.
- Safety devices must be provided to prevent human contact with moving or rotating parts.
- Make sure that the device is operated only when it is in perfect condition.
- Implement and activate the stipulated safety functions and devices.
- Operate the device only with the housing closed.
- Ensure that motors and any linear drives present are mounted securely.

Working safely

This device may be operated only by qualified personnel.

Qualified personnel in the sense of these operating instructions consists of:

- persons who, by virtue to their training, experience and instruction, and their knowledge of pertinent norms, specifications, accident prevention regulations and operational relationships, have been authorized by the officer responsible for the safety of the system to perform the required task and in the process are capable of recognizing potential hazards and avoiding them,
- persons who have a knowledge of first-aid techniques and the local emergency rescue services.
- persons who have read and will observe the safety instructions.
- persons who have read an will observe the manual (or at least the corresponding parts for tasks to be performed).

This applies to all work relating to setting up, commissioning, configuring, programming, modifying the conditions of utilization and operating modes, and to maintenance work.

This manual must be available close to the device during the performance of all tasks.

3. PowerRod: Actuators and components

PRA, PRC

The PowerRod actuators PRA and PRR25 with outrigger bearings as well as the PowerRod components PRC consist of a primary element in IP67 and a stainless steel magnet rod containing rare earth magnets.

The PRA and the PRC are available in two sizes and in four power versions offering a continuous force from 51 to 276 N with peak forces of up to 1860 N. PRA can be delivered with strokes from 12 to 318 mm, PRC with strokes up to 1362 mm (special strokes up to 2 m are possible).

PRR

The PRR25 is available in four power versions and offers a continuous force of 61 to 119 N with peak forces of up to 860 N. PRR can be furnished with strokes from 28 to 310 mm.

The PRR25 PowerRod actuator with outrigger bearings is available in a steel rods in ball linings or aluminum rods in polymer sliding bearings.

No external measuring system is required. The integrated position sensor provides analog sine and cosine differential input.

Parker Hannifin offers a wide range of powerful servo drives. In particular the devices from the Compax3 family.
All devices support easy setup and can be integrated into existing drive solutions.

3.1 Overview

General

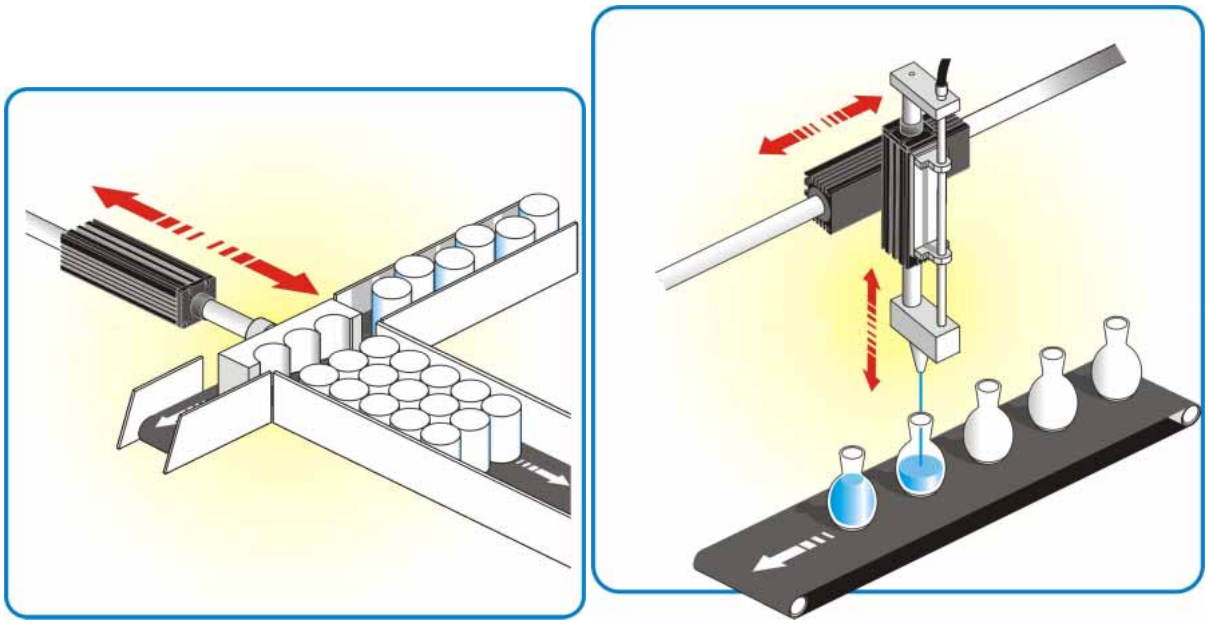
- Frame sizes
  - PRA magnet rod diameter: 25 mm or 38 mm
  - PRC magnet rod diameter: 25 mm or 38 mm
  - PRR magnet rod diameter: 25 mm
- 3 types:
  - PRA: Moving thrust rod
  - PRC: Moving forcer
  - PRR: Moving thrust rod with outrigger bearings
- 51 to 276 N continuous force
- 312 to 1860 N peak force
- Integrated robust position sensor - no external measuring system required
- Standard feedback output
- Plug-and-play position control with all common servo controllers
- IP67 rating

The OEM Benefits

- Clean, quiet operation
- Suitable for the food industry
- Simple installation
- Simple integration
- Industry standard accessories according to DIN/ISO 6431
- Low maintenance

Applications

- Packaging
- Material handling
- Automation



3.1.1. PowerRod Actuator (PRA):

The PRA PowerRod Actuator was developed for the use in industrial automation systems, where different positions must be approached. The PRA linear motor drive is a cost-effective alternative to air cylinders in applications requiring greater flexibility and control.
The PRA is ideally suited for all thrust / traction and lifting applications. Mounting is compatible with all pneumatic industry fittings. A noiseless and maintenance free plastic sliding bearing is integrated into the actuator. Its service life is far longer than that of typical ballscrew solutions. The PRA has superior thermal efficiency due to the heat dissipation in all directions. Long operating cycles are possible without additional cooling.

PRA25

PRA38

- Moved magnet rod
- Continuous force
  - PRA25: 51 ... 102 N
  - PRA38: 137 ... 276 N
- Peak force
  - PRA25: 312 ... 780 N
  - PRA38: 744 ... 1860 N
- Stroke:
  - PRA25: 27 ... 309 mm
  - PRA38: 33 ... 318
- Speed*
  - PRA25: up to 5.9 m/s
  - PRA38: up to 5.3 m/s
- Acceleration**
  - PRA25: up to 586 m/s^2
  - PRA38: up to391 m/s^2
- Integral sliding bearing
- Clean, quiet operation (dry plastic bearing)
- Accepts a range of industry standard mounting accessories
- Integrated position sensor - no external linear measuring system required

* based on triangular move over maximum stroke, without payload; individually max. possible **velocities** (see page 14, see page 26).

27 based on a 27 mm or 33 mm stroke, without payload

3.1.2. PowerRod actuator with outrigger bearings (PRR25)

The outrigger bearings of the PRR actuator makes it the ideal solution for applications requiring an anti-rotational device and where lateral forces occur. The external bearing rails with ball bushings function as guides for the moved magnet rod. Those steel gearing rails with ball bushings offer maximum support against high lateral forces. Polymer bushings use aluminum rails for reduced weight and are ideal for vertical movements. The iron-sleeve design of the PRR primary component produces 10 to 20% more force than a PRA25 actuator. The patented magnetic design of PRR generates a good repeatability from an integral position sensor. No external linear measuring system is required. The sensor provides analog sine and cosine differential input.

PRR is a ideal OEM solution for easy integration into pick-and-place gantries and general purpose material handling machines. The load is mounted directly to the mounting plate. PRR has superior thermal efficiency, radiating heat uniformly. Long operating cycles are possible without additional cooling.

PRR25

- Moved magnet rod
- Continuous force
  - PRR25: 61 ... 119 N
- Peak force
  - PRR25: 344 ... 860 N
- Stroke:
  - PRR25: 28 ... 310 mm
- Speed*
  - PRR25: up to 5.6 m/s
- Acceleration**
  - PRR25: up to 369 m/s^2
- Integrated position sensor - no external linear measuring system required

*based on triangular move over maximum stroke, without payload; individually max. possible **velocities with the ball bushing option** (see page 21)

** based on a 28 mm stroke, without payload. Ball bushing option

3.1.3. PowerRod Component: Primary component PRC and magnet rod TRC

PowerRod (PRC + TRC) can be compared to a pneumatic cylinder without thrust rod, it is however much easier to install and is as reliable as a linear motor. Familiar form factor, integral position feedback and large air gap make integration simple. The PowerRod offers the ideal solution for pick-and-place systems and all moving handling devices. The load is mounted directly to the forcer typically supported by a single bearing rail. The thrust rod is mounted level at both end, the primary component is mounted on a suitable guiding. A large air gap reduces alignment constraints.

The tubular motor has superior thermal efficiency, radiating heat uniformly. High duty cycles are possible without the need for forced-air or water cooling.

PRC25 with TRC25

PRC38 with TRC38

- Moving forcer
- Continuous force
  - PRC25: 51 ... 102 N
  - PRC38: 137 ... 276 N
- Peak force
  - PRC25: 312 ... 780 N
  - PRC38: 744 ... 1860 N
- Stroke:
  - PRC25: 27 ... 1180 mm
  - PRC38: 33 ... 1362 mm
- Speed*
  - PRC25: up to 8.7 m/s
  - PRC38: up to 9.4 m/s
- Acceleration**
  - PRC25: up to 256 m/s^2
  - PRC38: UP TO 307 m/s^2
- Compact design for simple mechanical integration
- Large air gap
- Mount load directly to rugged forcer
- No additional cooling required - specifications for convection
- Integrated position sensor - no external linear measuring system required

* based on triangular move over maximum stroke, without payload; individually max. possible **velocities** (see page 14, see page 26).

** based on a 27 mm or 33 mm stroke, without payload.

3.2 PowerRod PRA25, PRC25

3.2.1. Electric specifications PRA25, PRC25

Motor type PRA, PRC	2504		2506		2508		2510		Unit
	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	
Peak force (5) for 1 s	312	156	468	234	624	312	780	390	N
Peak current (5) for 1 s	14.1		14.1		14.1		14.1		Arms
With heatsink plate 25 x 25 x 2.5cm (6)									
Continuous stall force (5) (2)	51.2		69.5		86.4		102.4		N
Continuous stall current (5)	2.31	4.62	2.10	4.20	1.96	3.92	1.86	3.72	Arms
Without heatsink plate									
Continuous stall force (5) (2)	42.5		59.5		75.1		90.0		N
Continuous stall current (5)	1.92	3.84	1.80	3.60	1.70	3.40	1.63	3.26	Arms
Force constant (sine commutation)	22.1	11.0	33.1	16.5	44.1	22.0	55.2	27.6	N/Arms
Back EMF constant (phase to phase)	18.0	9.0	27.0	13.5	36.0	18.0	45.0	22.5	V/m/s
Motor constant	6.47		7.92		9.13		10.24		N/√W
Eddy current loss	9.51		12.55		15.58		18.61		N/m/s
Resistance @ 25 °C (phase to phase)	6.02	1.50	9.02	2.25	12.03	3.01	15.04	3.76	Ohm
Resistance @ 100 °C (phase to phase)	7.75	1.94	11.63	2.91	15.51	3.88	19.39	4.85	Ohm
Inductance @ 1 kHz (phase to phase)	3.90	0.97	5.85	1.46	7.80	1.95	9.75	2.44	mH
Electrical time constant	0.65		0.65		0.65		0.65		ms
Typical supply voltage of the servo drive	230		230		230		230		VAC
Max. DC bus voltage	380		380		380		380		V d.c.
Pole pitch	51.2		51.2		51.2		51.2		mm
PRA									
Peak acceleration (3)	394	197	483	241	542	271	586	293	m/s^2
Maximum speed (4)	5.9	4.4	5.3	5.1	4.7	5.6	4.2	5.8	m/s
PRC									
Peak acceleration (7)	223	111	223	111	235	117	256	128	m/s^2
Maximum speed (4)	8.7	7.3	6.5	7.2	5.4	7.6	4.6	7.0	m/s

(1) S=series motor phases, P=parallel motor phases

(2) At an ambient temperature of 40 °C, the continuous stall force must be derated to 89 %

(3) based on a 27 mm stroke, without payload

(4) Based on triangular move over maximum stroke without payload

(5) at an ambient temperature of 25°C

(6) The values with normalized heatsink plate are meant to give indications to the data valid if the forcer is integrated into a machine.

(7) Moved primary element, without payload.

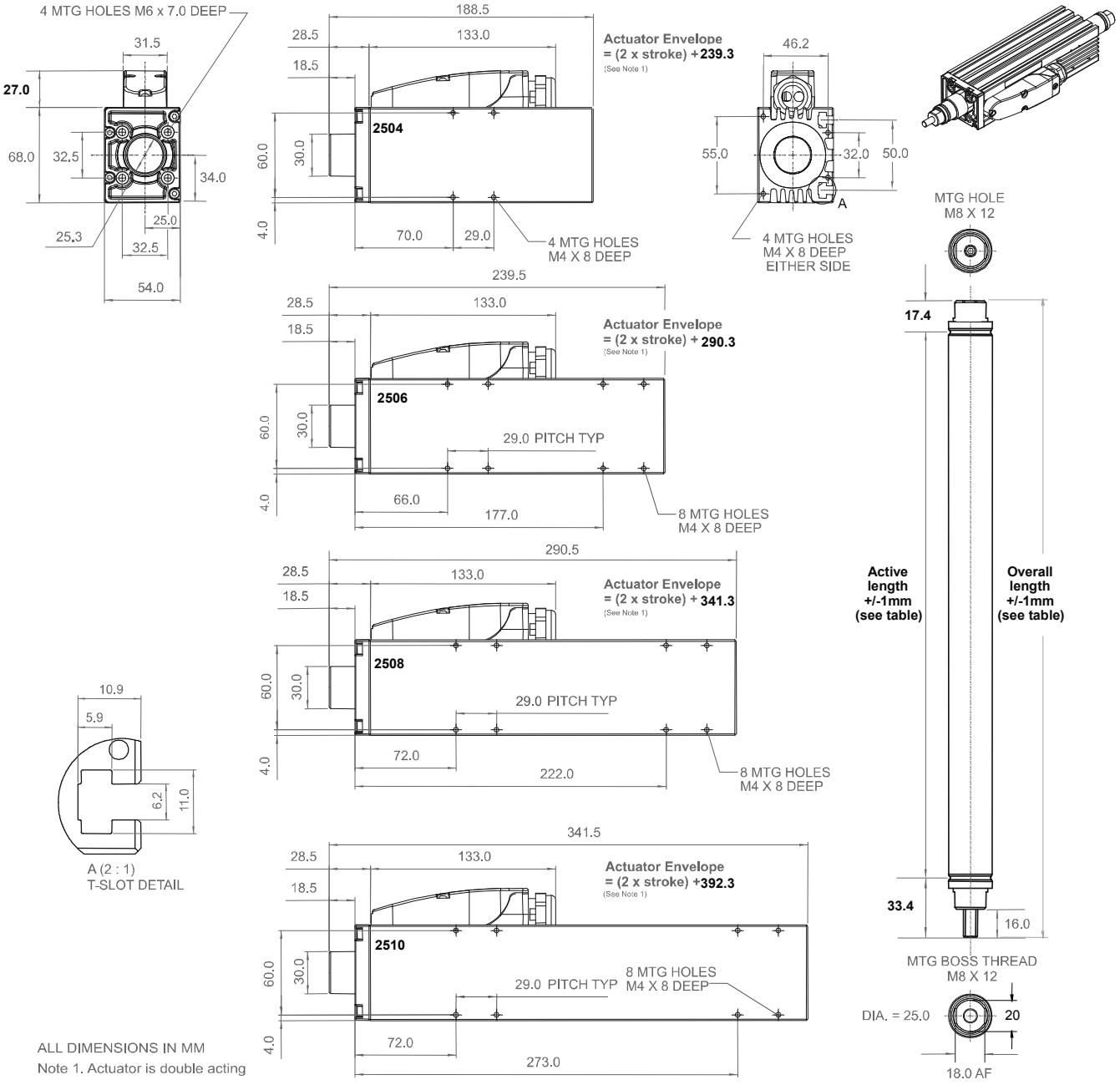
3.2.2. Thermal specifications PRA25, PRC25

Motor type PRA, PRC	2504	2506	2508	2510	Unit
Maximum phase temperature	100	100	100	100	°C
Thermal resistance Rth (phase-housing)	0.41	0.27	0.20	0.16	°C/W
Thermal time constant	1188	1276	1377	1486	s
With heatsink plate 25 x 25 x 2.5cm (6)					
Power dissipation at 25 °C ambient temperature	62.3	77.0	89.2	100.2	Watt
Thermal resistance Rth (housing-environment)	0.79	0.69	0.64	0.59	°C/W
Without heatsink plate					
Power dissipation at 25 °C ambient temperature	43.1	56.4	67.6	77.3	Watt
Thermal resistance Rth (housing-environment)	1.33	1.06	0.91	0.81	°C/W

(6) The values with normalized heatsink plate are meant to give indications to the data valid if the forcer is integrated into a machine.

3.2.3. Mechanical specifications PRA25, PRC25

Dimensions PRA25 (third angle projection)



3D CAD data http://www.parker-eme.com/pra

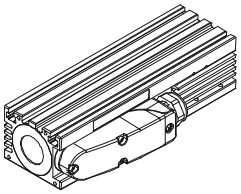
Motor model	PRA2504	PRA2506	PRA2508	PRA2510	Unit
Maximum travel	309	309	309	309	mm
Forcer mass	1.25	1.70	2.25	2.65	kg
Mass of rod	3.5	3.5	3.5	3.5	kg/m

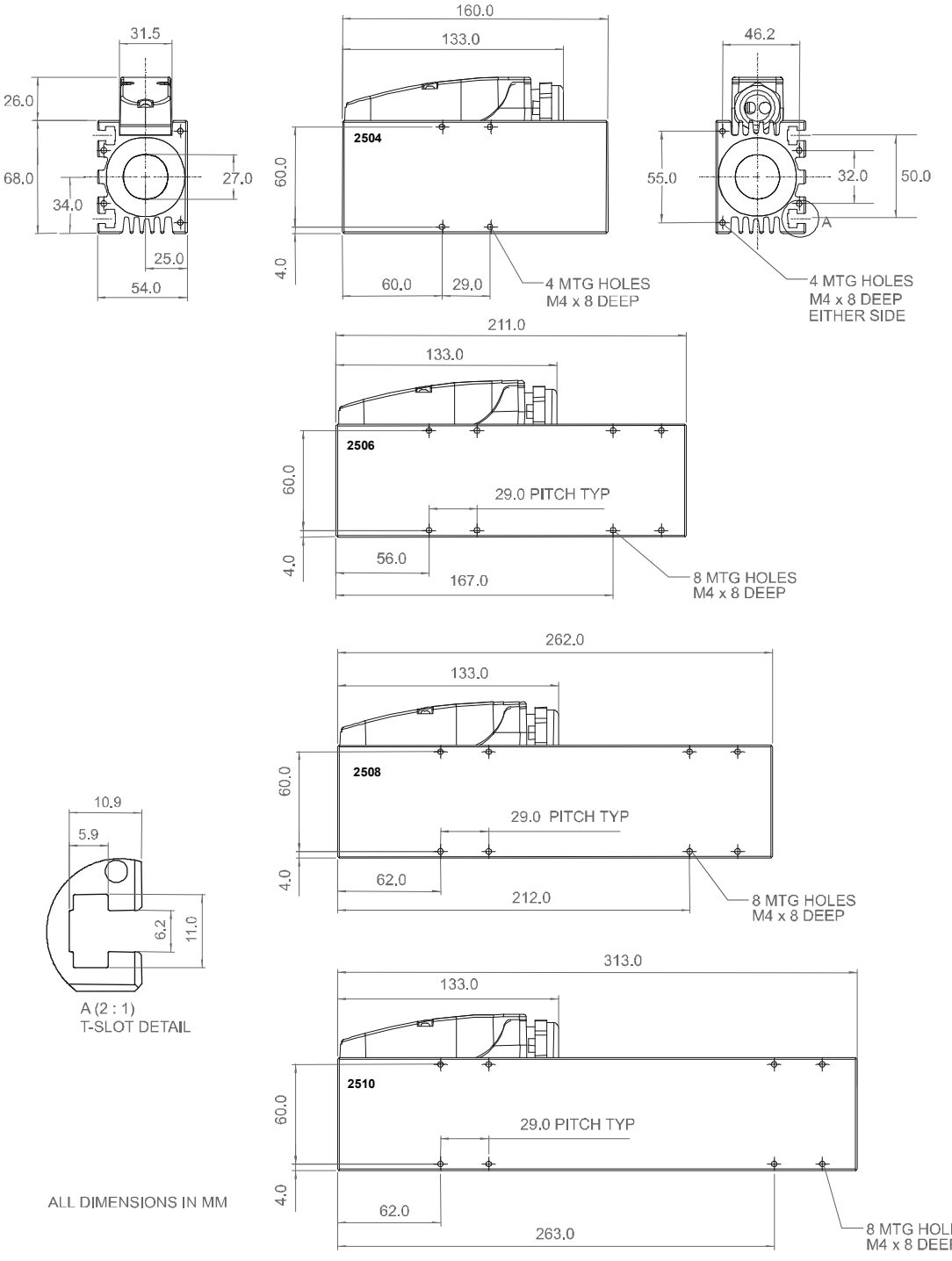
Length of the magnet rod in the PRA25

Travel (mm)	PRA2504		PRA2506		PRA2508		PRA2510	
	Total Overall	Active Active	Total Overall	Active Active	Total Overall	Active Active	Total Overall	Active Active
	266	216	317	267	368	318	419	369
	292	242	343	293	394	344	445	395
78	317	267	368	318	419	369	470	420
104	343	293	394	344	445	395	496	446
130	369	319	420	370	471	421	522	472
155	394	344	445	395	496	446	547	497
181	420	370	471	421	522	472	573	523
206	445	395	496	446	547	497	598	548
232	471	421	522	472	573	523	624	574
258	497	447	548	498	599	549	650	600
283	522	472	573	523	624	574	675	625
309	548	498	599	549	650	600	701	651

The PRA order code comprises forcer as well as magnet rod. The order code states the travel.

Dimensions PRC25 (third angle projection)





3D CAD data http://www.parker-eme.com/prc

Motor model	PRC2504	PRC2506	PRC2508	PRC2510	Unit
Maximum travel	1180	1129	1078	1027	mm
Forcer mass	1.15	1.60	2.15	2.55	kg
Rod mass/metre	3.5	3.5	3.5	3.5	kg/m

Possible lengths of the magnet rod TRC25 for PRC25 (in mm)

226, 252, 277, 303, 329, 354, 380, 405, 431, 457, 482, 508, 534, 559, 585, 611, 636, 662, 688, 713, 739, 765, 790, 816, 867, 918, 970, 1021, 1072, 1124, 1175, 1226, 1278, 1329, 1380

The PRC order code does only comprise the forcer. The TRC magnet rod must be ordered separately. The TRC order code states the total length of the magnet rod.

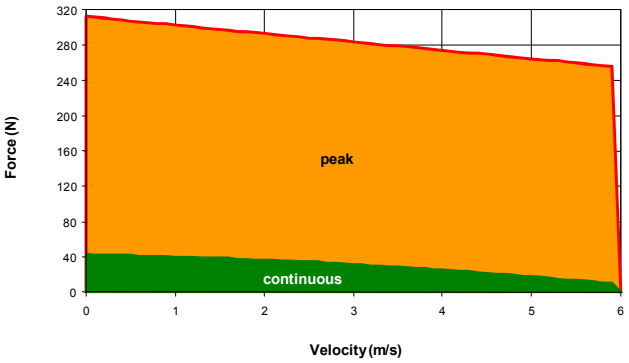
3.2.4. Force / velocity profiles PRA25

Force/velocity profiles (with an operating voltage of 325 Vd.c., without load)

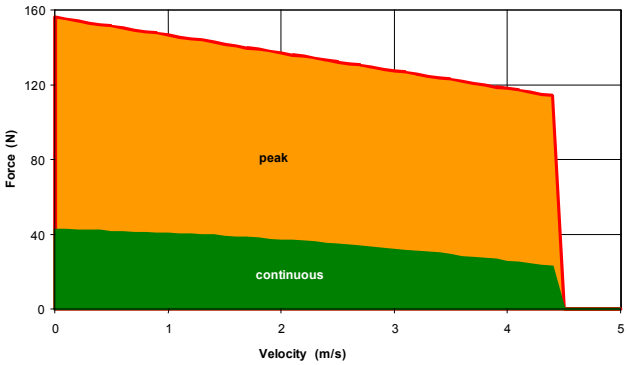
S=series motor phases

P=parallel motor phases

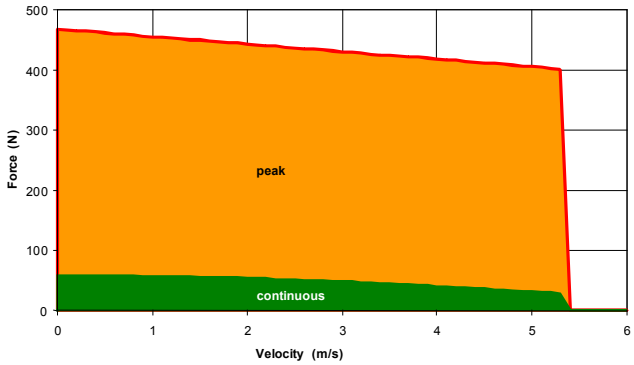
2504 S force/velocity



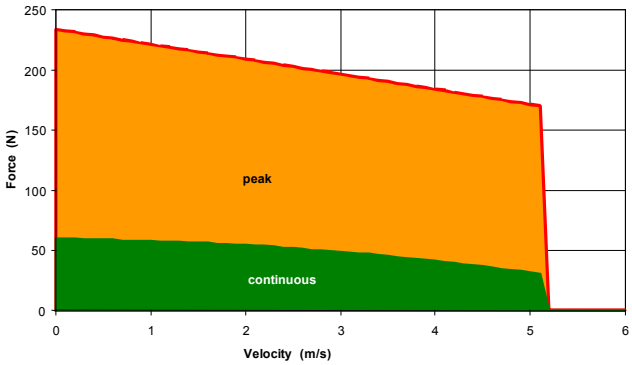
2504P force/velocity



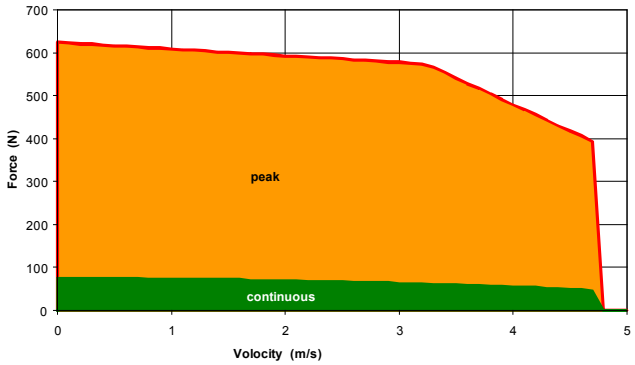
2506S force/velocity



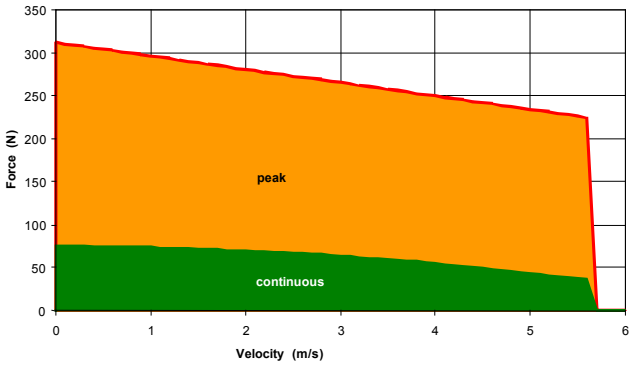
2506P force/velocity



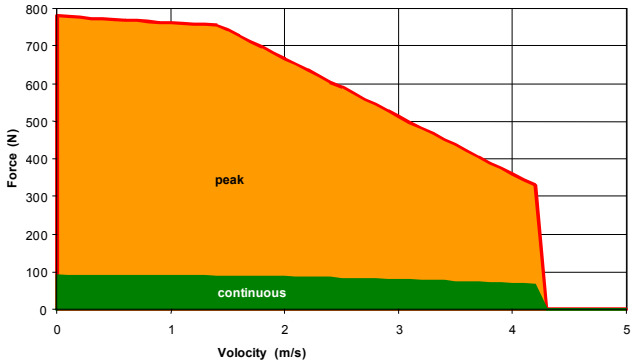
2508S force/velocity



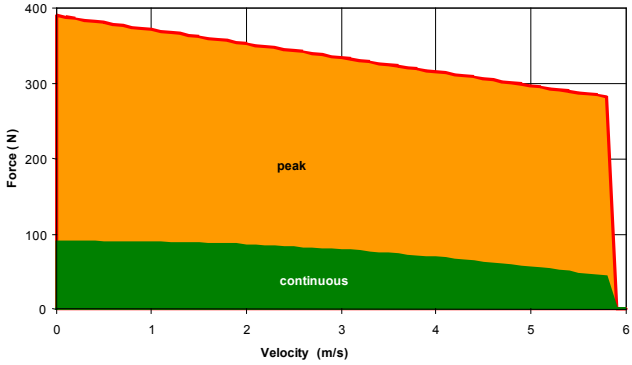
2508P force/velocity



2510S force/velocity



2510P force/velocity

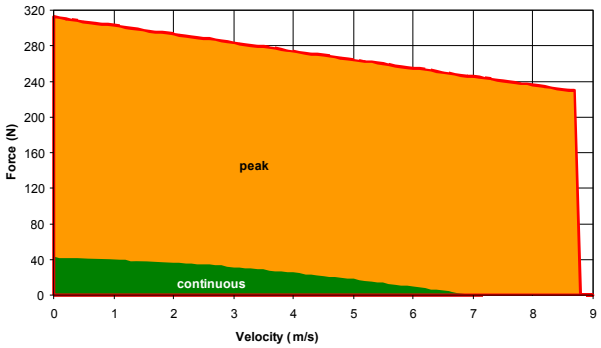


3.2.5. Force / velocity profiles PRC25

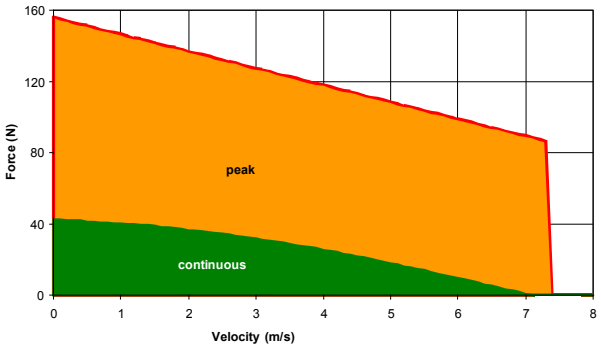
Force/velocity profiles (with an operating voltage of 325 Vd.c., without load)

S=series motor phases **P=parallel motor phases**

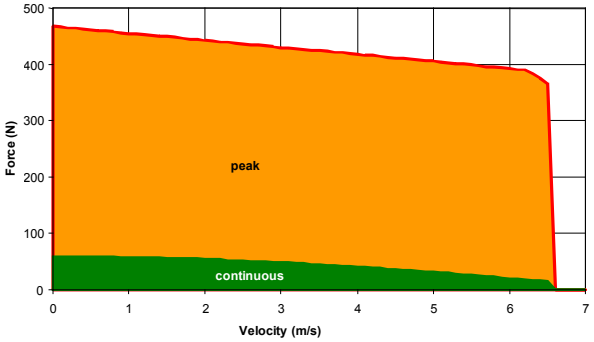
2504S force/velocity



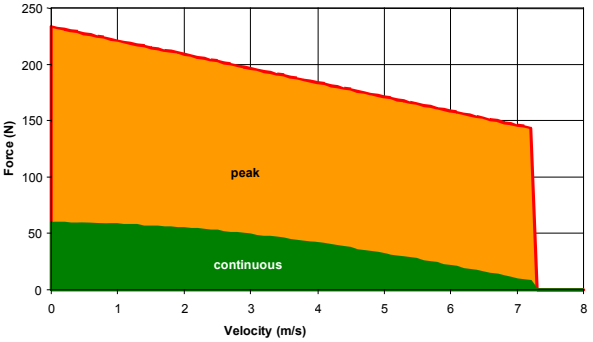
2504P force/velocity



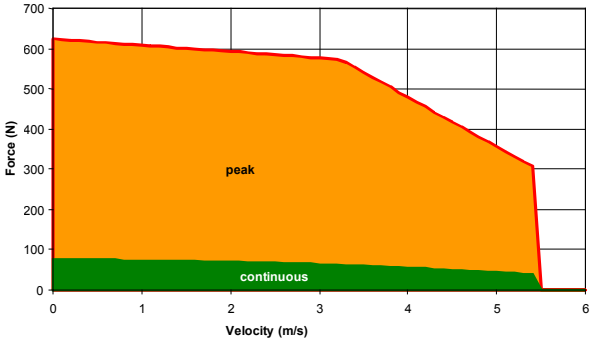
2506S force/velocity



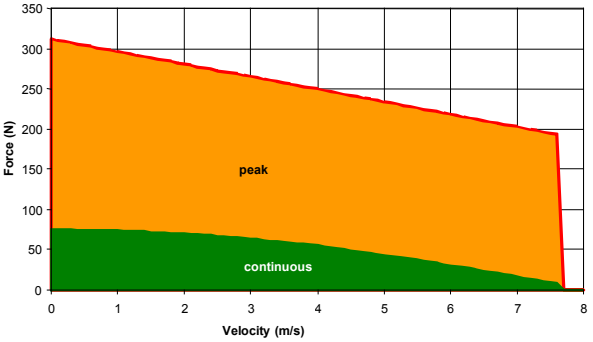
2506P force/velocity



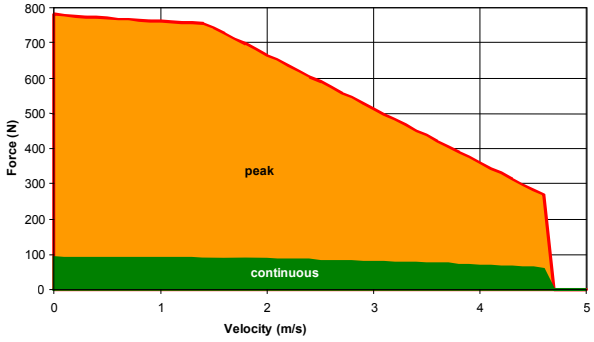
2508S force/velocity



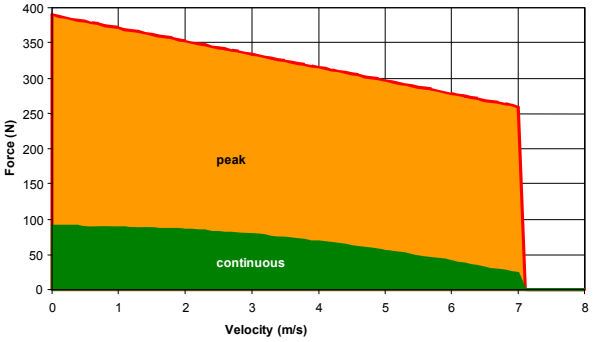
2508P force/velocity



2510S force/velocity



2510P force/velocity



3.3 PowerRod with outrigger bearings PRR25

3.3.1. Electric specifications PRR25

Motor type PRR	2504		2506		2508		2510		Unit
	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	
Peak force (5) for 1 s	344	172	516	258	688	344	860	430	N
Peak current (5) for 1 s	14.1		14.1		14.1		14.1		Arms
With heatsink plate 25 x 25 x 2.5 cm									
Continuous stall force (2)	60.7		81.8		101.2		119.4		N
Continuous stall current	2.49	4.98	2.24	4.48	2.08	4.16	1.96	3.92	Arms
Without heatsink plate									
Continuous stall force (2)	52.2		72.3		90.4		108.0		N
Continuous stall current	2.15	4.30	1.98	3.96	1.86	3.72	1.78	3.56	Arms
Force constant (sine commutation)	24.3	12.1	36.5	18.2	48.6	24.3	60.8	30.4	N/Arms
Back EMF constant (phase - phase)	19.9	9.9	29.8	14.9	39.7	19.8	49.7	24.8	V/m/s
Motor constant	7.53		9.22		10.65		11.90		N/√W
Eddy current loss	2.35		2.35		2.35		2.35		N/m/s
Cogging force	2.2		3.2		3.3		3.0		+/-N
Resistance @ 25 °C (phase to phase)	5.40	1.35	8.11	2.03	10.81	2.70	13.51	3.38	Ohm
Resistance @ 100 °C (phase to phase)	6.96	1.74	10.45	2.61	13.93	3.48	17.41	4.35	Ohm
Inductance @ 1 kHz (phase to phase)	4.32	1.08	6.48	1.62	8.64	2.16	10.80	2.70	mH
Electrical time constant	0.80		0.80		0.80		0.80		ms
Typical supply voltage of a servo drive	230		230		230		230		VAC
Max. DC bus voltage	380		380		380		380		V d.c.
Pole pitch	51.2		51.2		51.2		51.2		mm
with steel rods in ball linings									
Peak acceleration (3) (5)	225	113	288	144	334	167	369	185	m/s^2
Maximum speed (4) (5)	5.6	4.1	5.3	5.0	4.8	5.5	4.3	5.8	m/s
with aluminum rods and sliding bushings									
Peak acceleration (3) (6)	276	138	354	177	413	206	458	229	m/s^2
Maximum speed (4) (6)	6.1	4.6	5.7	5.5	5.1	6.2	4.5	6.3	m/s

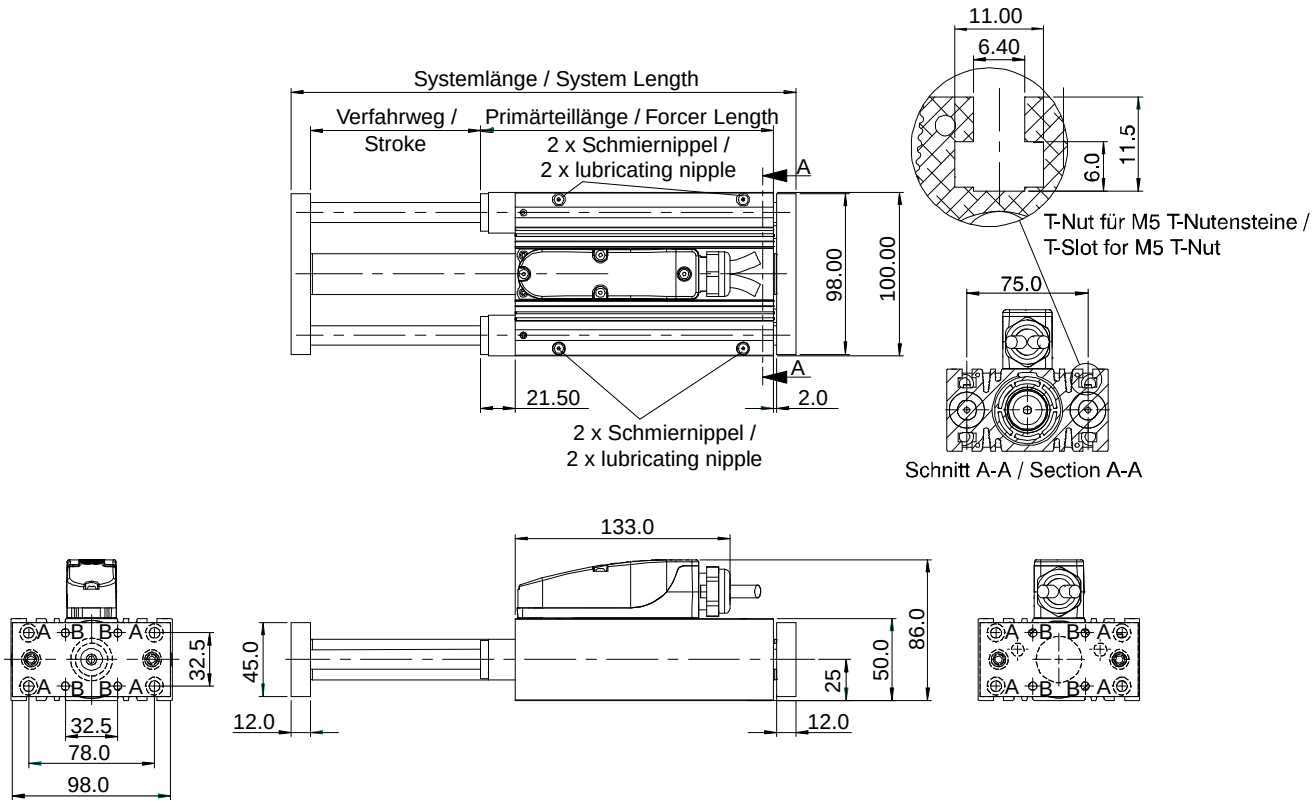
(1) S=series motor phases, P=parallel motor phases
(2) At an ambient temperature of 40 °C, the continuous stall force must be derated to 89 %
(3) based on a 28 mm stroke, without payload
(4) Based on triangular move over maximum stroke without payload
(5) -B = with ball bushings
(6) -P = with sliding bushings

3.3.2. Thermal specifications PRR25

Motor type PRR	2504	2506	2508	2510	Unit
Maximum phase temperature	100	100	100	100	°C
Thermal resistance Rth (phase-housing)	0.39	0.28	0.23	0.19	°C/W
Thermal time constant	1639	1773	1940	2080	s
With heatsink plate 25 x 25 x 2.5cm					
Power dissipation at 25 °C ambient temperature	65.0	78.8	90.4	100.6	Watt
Thermal resistance Rth (housing-environment)	0.76	0.67	0.60	0.56	°C/W
Without heatsink plate					
Power dissipation at 25 °C ambient temperature	48.1	61.5	72.1	82.4	Watt
Thermal resistance Rth (housing-environment)	1.17	0.94	0.81	0.72	°C/W

3.3.3. Mechanical specifications PRR25

Dimensions PRR25 (third angle projection)



Holes in the end plates:

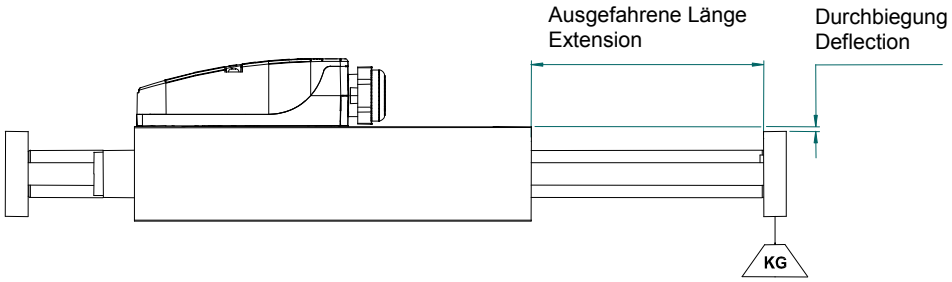
A	Bore: Ø 6.6 mm; counterbore for cylinder head screw Ø 11 mm, depth 6.5 mm
B	M6

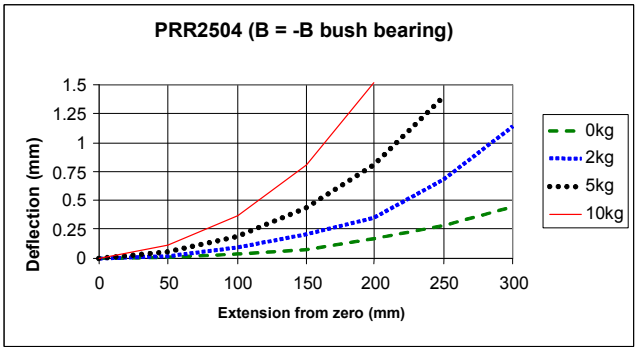
Motor model	PRR2504	PRR2506	PRR2508	PRR2510	Unit
Maximum travel	310	310	310	310	mm
Length of forcer	181.5	232.5	283.5	334.5	mm
Forcer mass	1.65	2.25	2.85	3.45	kg
Mass of rod (ball bushings)	0.25 + (total length in m x 5.24)				kg
Mass of rod (polymer sliding bushings)	0.25 + (total length in m x 4.10)				kg

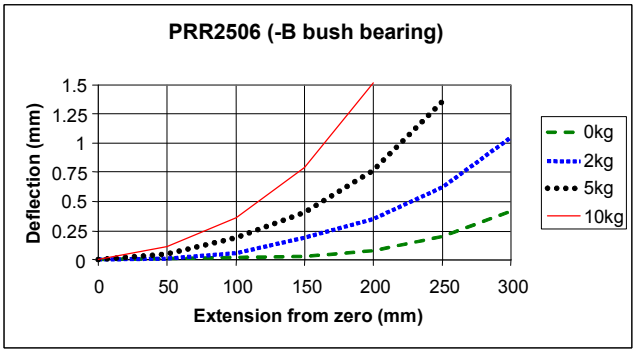
Travel (mm)	System length PRR (mm)			
	PRR2504	PRR2506	PRR2508	PRR2510
28	236	287	338	389
54	262	313	364	415
79	287	338	389	440
105	313	364	415	466
131	339	390	441	492
156	364	415	466	517
182	390	441	492	543
207	415	466	517	568
233	441	492	543	594
259	467	518	569	620
284	492	543	594	645
310	518	569	620	671

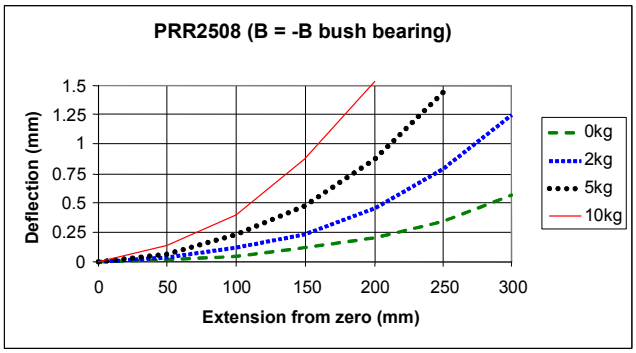
3.3.4. Mechanical stiffness PRR25

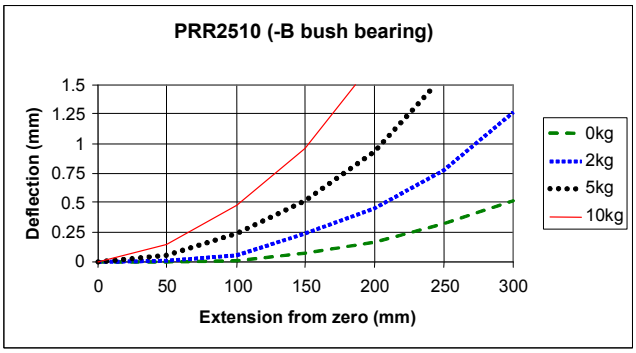
The deflection values were measured and contain also the compliance of the bushings.

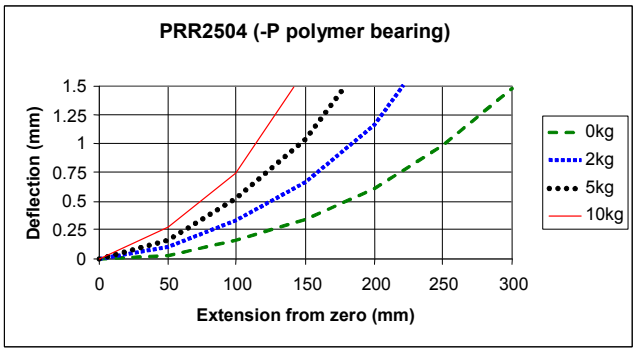


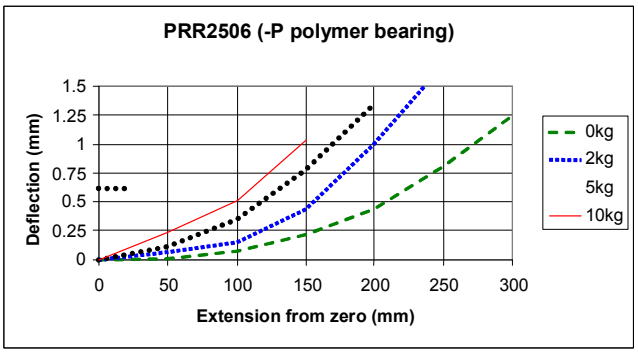


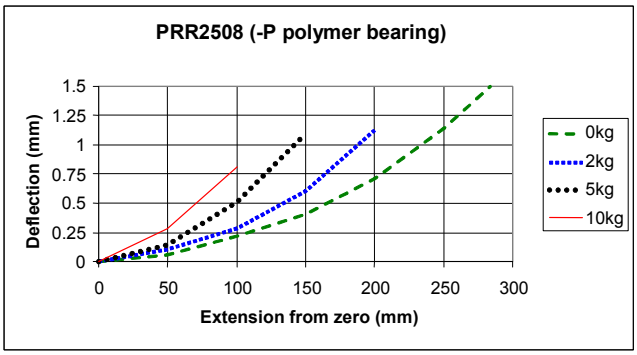


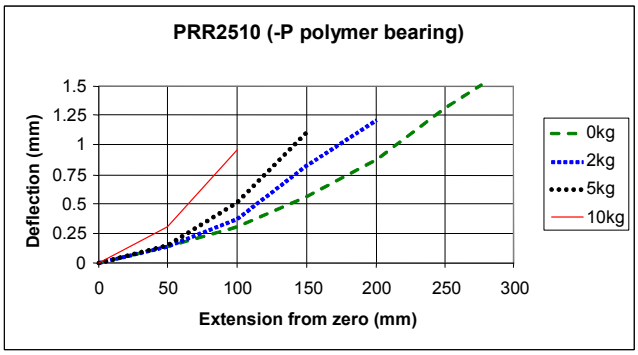




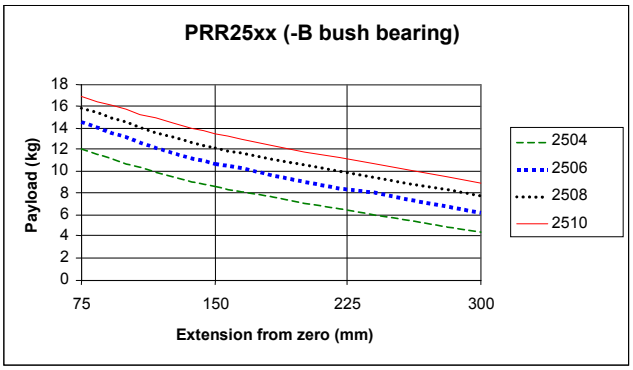


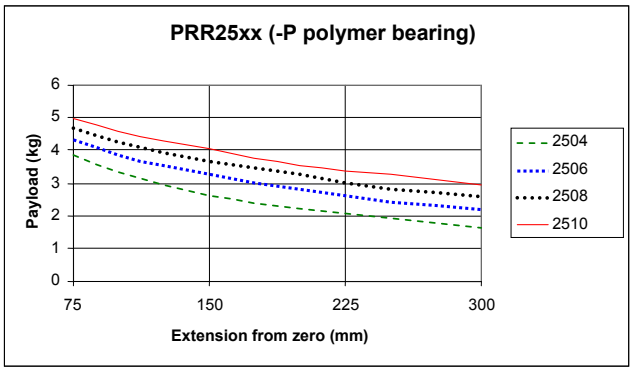






Comparison of payload and extension with a operational performance of 10,000 km





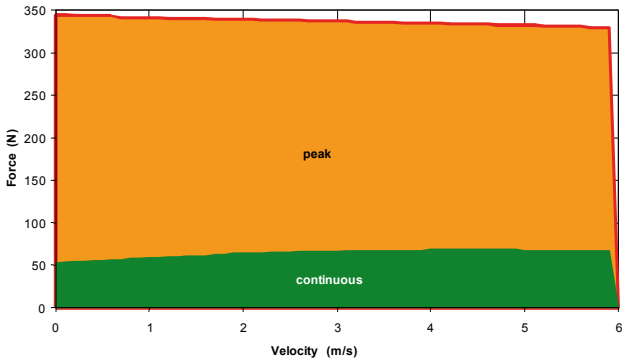
3.3.5. Force / velocity profiles PRR25

Force/velocity profiles (with an operating voltage of 325 Vd.c., without load)

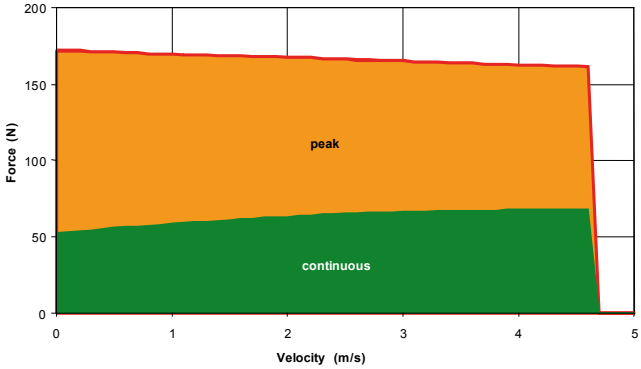
S=series motor phases

P=parallel motor phases

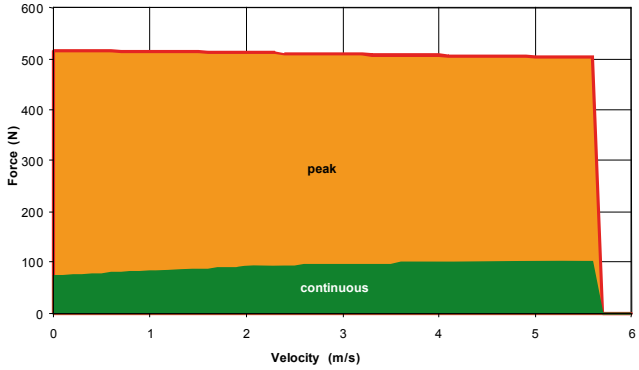
PRR2504S force/velocity



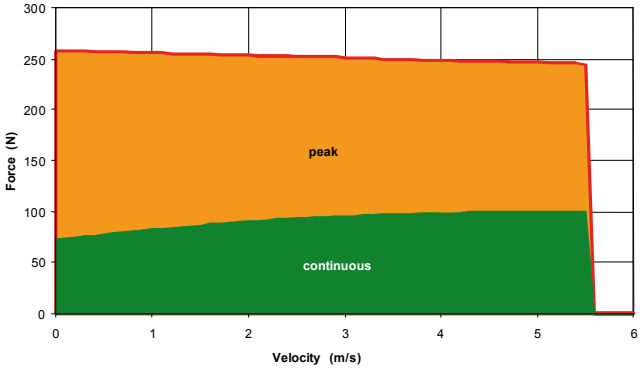
PRR2504P force/velocity



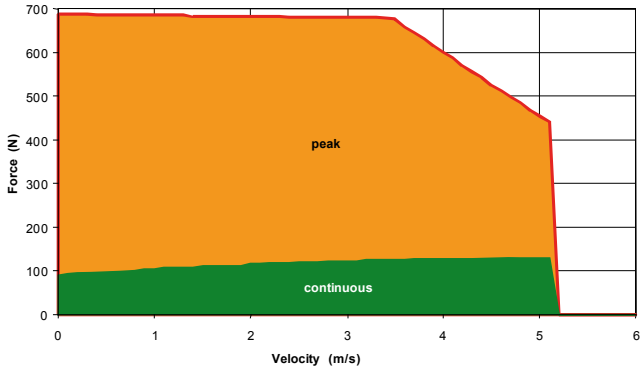
PRR2506S force/velocity



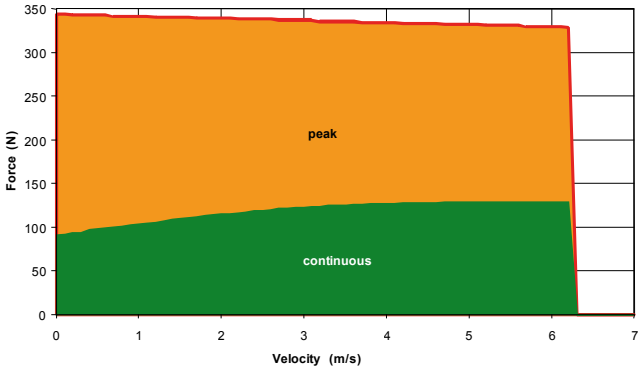
PRR2506S force/velocity



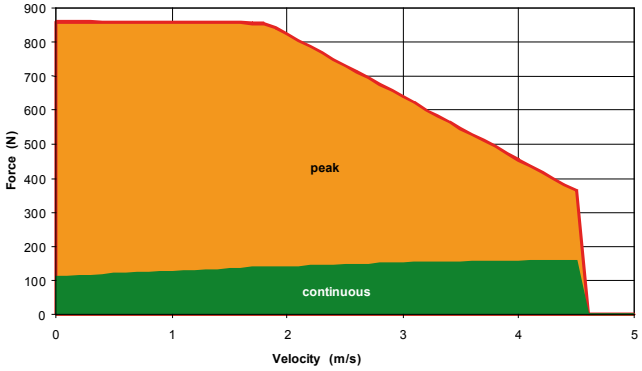
PRR2508S force/velocity



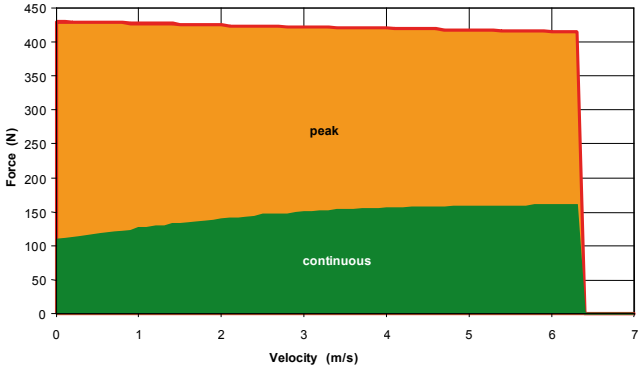
PRR2508P force/velocity



PRR2510S force/velocity



PRR2510P force/velocity



3.4 PowerRod PRA38, PRC38

3.4.1. Electric specifications PRA38, PRC38

Motor type PRA38, PRC38	3804		3806		3808		3810		Unit
	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	
Peak force (5) for 1 s	744	372	1116	558	1488	744	1860	930	N
Peak current (5) for 1 s	14.1		14.1		14.1		14.1		Arms
With heatsink plate 25 x 25 x 2.5cm (6)									
Continuous stall force (5) (2)	137.3		186.9		232.1		276.2		N
Continuous stall current (5)	2.61	5.23	2.37	4.74	2.20	4.41	2.10	4.20	Arms
Without heatsink plate									
Continuous stall force (5) (2)	120.1		168.2		212.7		255.0		N
Continuous stall current (5)	2.28	4.57	2.13	4.27	2.02	4.04	1.94	3.88	Arms
Force constant (sine commutation)	52.6	26.3	78.9	39.4	105.2	52.6	131.5	65.7	N/Arms
Back EMF constant (phase - phase)	43.0	21.5	64.4	32.2	85.9	42.9	107.4	53.7	V/m/s
Motor constant	14.54		17.80		20.56		22.99		N/√W
Eddy current loss	3.7		3.7		3.7		3.7		N/m/s
Cogging force	7.3		4.2		8.3		5.6		+/-N
Resistance @ 25 °C (phase to phase)	6.77	1.69	10.16	2.54	13.54	3.38	16.93	4.23	Ohm
Resistance @ 100 °C (phase to phase)	8.73	2.18	13.10	3.27	17.45	4.36	21.82	5.45	Ohm
Inductance @ 1 kHz (phase to phase)	8.52	2.13	12.78	3.19	17.04	4.26	21.30	5.32	mH
Electrical time constant	1.26		1.26		1.26		1.26		ms
Typical supply voltage of the servo drive	230		230		230		230		VAC
Max. DC bus voltage	380		380		380		380		V d.c.
Pole pitch	71.2		71.2		71.2		71.2		mm
PRA									
Peak acceleration (3)	250	125	313	156	357	179	391	196	m/s^2
Maximum speed (4)	4.7	4.9	3.8	5.3	3.1	4.9	2.6	4.4	m/s
PRC									
Peak acceleration (7)	244	122	276	138	295	147	307	154	m/s^2
Maximum speed (4)	6.2	9.4	4.5	7.6	3.5	6.2	2.8	5.2	m/s

(1) S=series motor phases, P=parallel motor phases)

(2) At an ambient temperature of 40 °C, the continuous stall force must be derated to 89 %

(3) based on a 33 mm stroke, without payload

(4) Based on triangular move over maximum stroke without payload

(5) at an ambient temperature of 25°C

(6) The values with normalized heatsink plate are meant to give indications to the data valid if the forcer is integrated into a machine.

(7) Moved primary element, without payload.

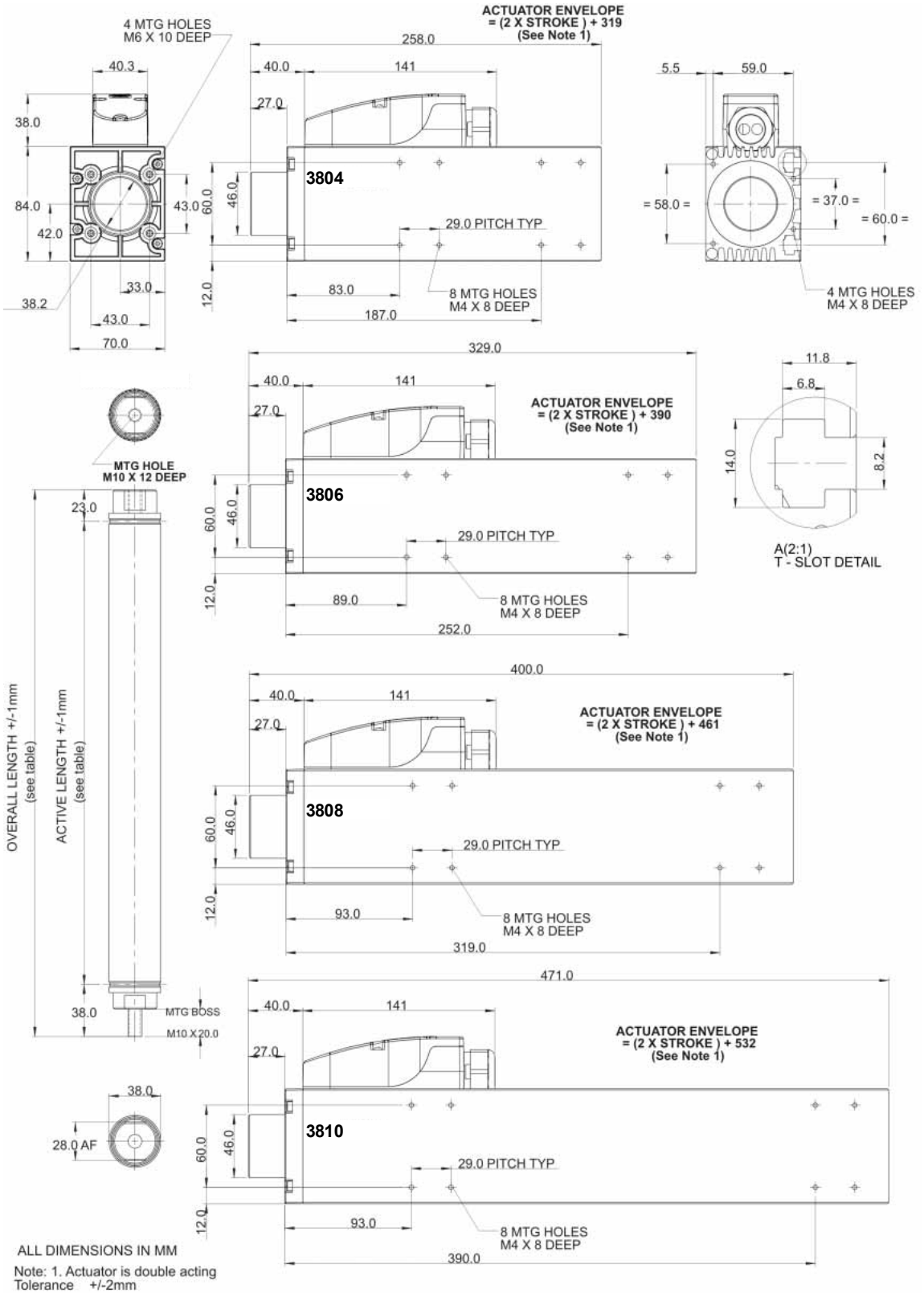
3.4.2. Thermal specifications PRA38, PRC38

Motor type PRA38, PRC38	3804	3806	3808	3810	Unit
Maximum phase temperature	100	100	100	100	°C
Thermal resistance Rth (phase-housing)	0.23	0.16	0.13	0.11	°C/W
Thermal time constant	1677	1798	1924	2056	s
With heatsink plate 25 x 25 x 2.5cm (6)					
Power dissipation at 25 °C ambient temperature	89.3	110.3	127.1	144.2	Watt
Thermal resistance Rth (housing-environment)	0.61	0.52	0.46	0.41	°C/W
Without heatsink plate					
Power dissipation at 25 °C ambient temperature	67.2	89.3	107.0	123.0	Watt
Thermal resistance Rth (housing-environment)	0.87	0.68	0.57	0.50	°C/W

(6) The values with normalized heatsink plate are meant to give indications to the data valid if the forcer is integrated into a machine.

3.4.3. Mechanical specifications PRA38, PRC38

Dimensions PRA38 (third angle projection)



3D CAD data http://www.parker-eme.com/pra

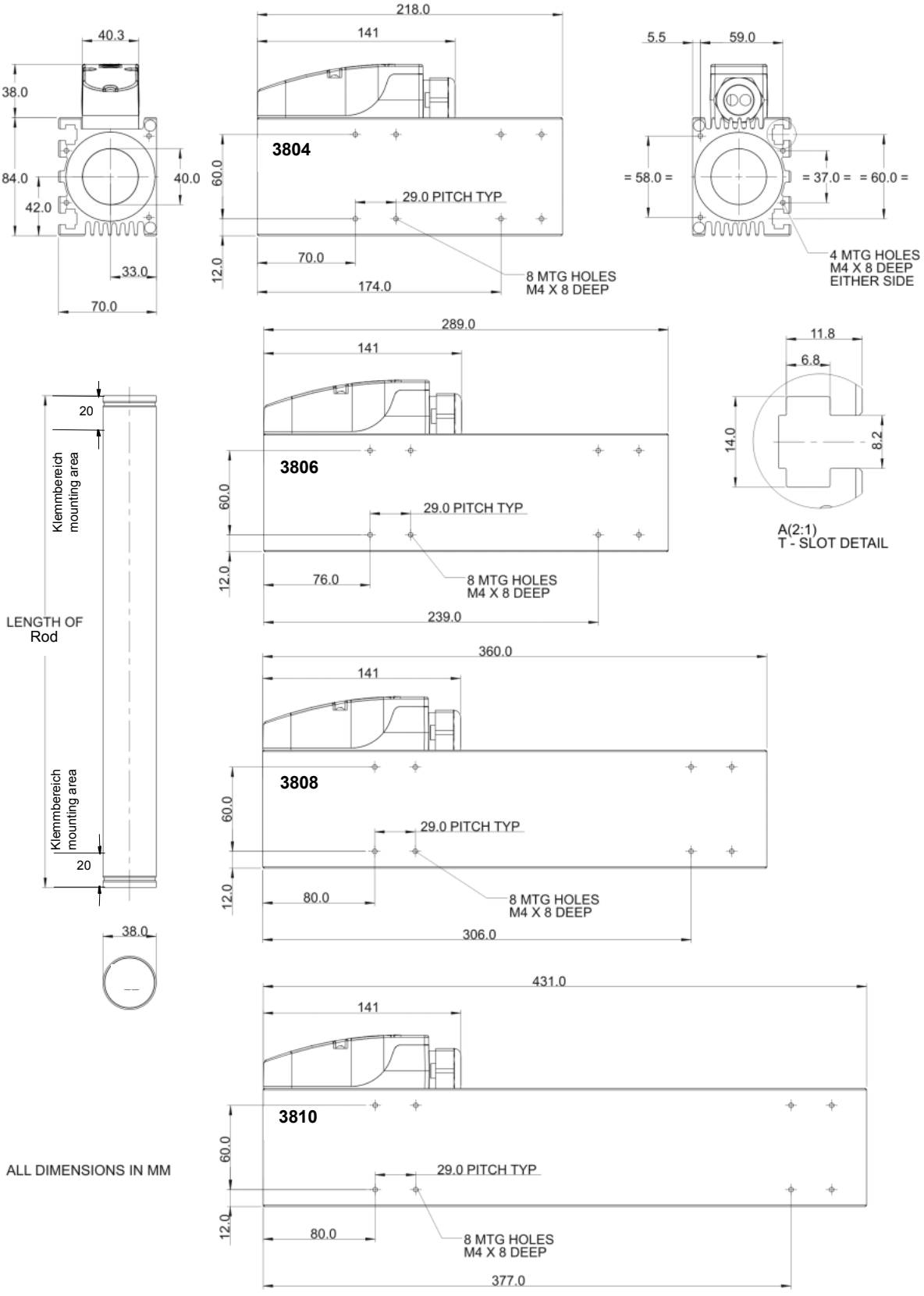
Motor model	PRA3804	PRA3806	PRA3808	PRA3810	Unit
Maximum travel	318	318	318	318	mm
Forcer mass	2.75	3.75	4.75	5.75	kg
Rod mass/metre	8.3	8.3	8.3	8.3	kg/m

Length of the magnet rod in the PRA38

Travel (mm)	PRA3804		PRA3806		PRA3808		PRA3810	
	Total	Active	Total	Active	Total	Active	Total	Active
33	350	291	421	362	493	434	564	505
69	386	327	457	398	528	469	599	540
104	421	362	493	434	564	505	635	576
140	457	398	528	469	599	540	671	612
176	493	434	564	505	635	576	706	647
211	528	469	599	540	671	612	742	683
247	564	505	635	576	706	647	778	719
282	599	540	671	612	742	683	813	754
318	635	576	706	647	778	719	849	790

The PRA order code comprises forcer as well as magnet rod. The order code states the travel.

Dimensions PRC38 (third angle projection)



3D CAD data http://www.parker-eme.com/prc

Motor model	PRC3804	PRC3806	PRC3808	PRC3810	Unit
Maximum travel	1362	1291	1219	1148	mm
Forcer mass	2.55	3.55	4.55	5.55	kg
Rod mass/metre	8.3	8.3	8.3	8.3	kg/m

Possible lengths of the magnet rod TRC38 for PRC38 (in mm)

265, 301, 337, 372, 408, 444, 479, 515, 550, 586, 622, 657, 693, 729, 764, 800, 836, 871, 907, 943, 978, 1014, 1050, 1085, 1121, 1157, 1192, 1228, 1263, 1299, 1335, 1370, 1406, 1442, 1477, 1513, 1549, 1584, 1620

The PRC order code does only comprise the forcer. The TRC magnet rod must be ordered separately. The TRC order code states the total length of the magnet rod.

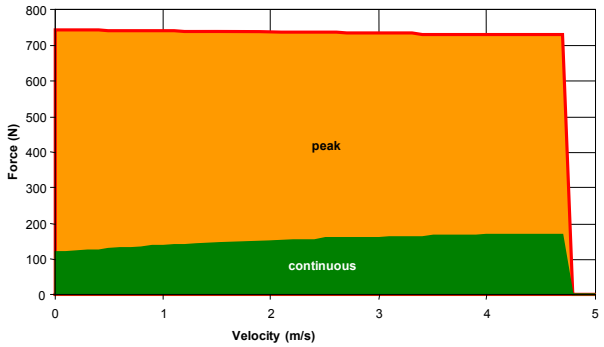
3.4.4. Force / velocity profiles PRA38

Force/velocity profiles (with an operating voltage of 325 Vd.c., without load)

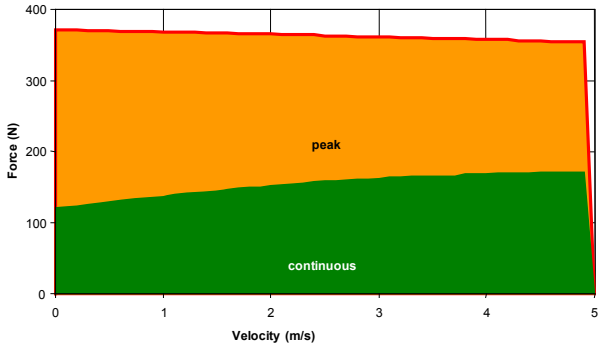
S=series motor phases

P=parallel motor phases

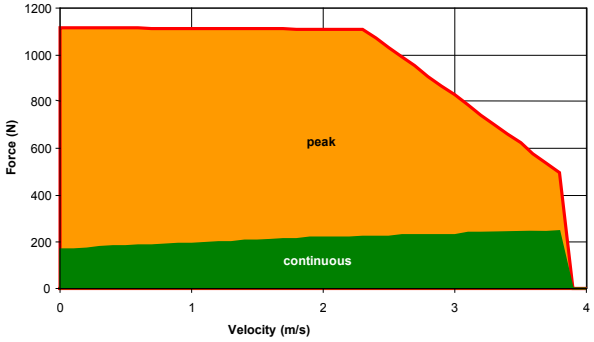
PRA3804S force/velocity



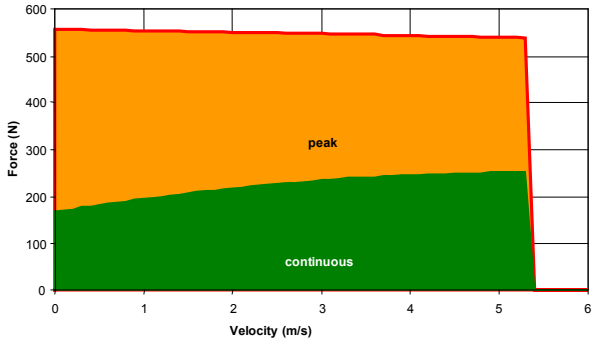
PRA3804P force/velocity



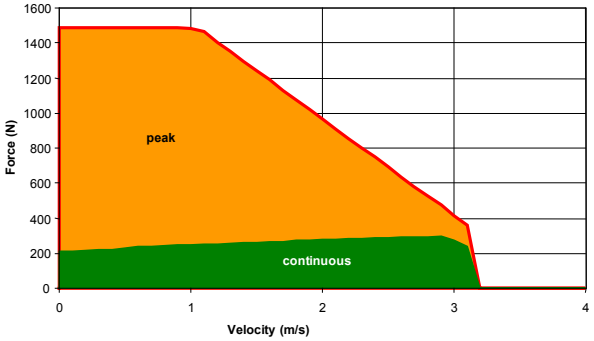
PRA3806S force/velocity



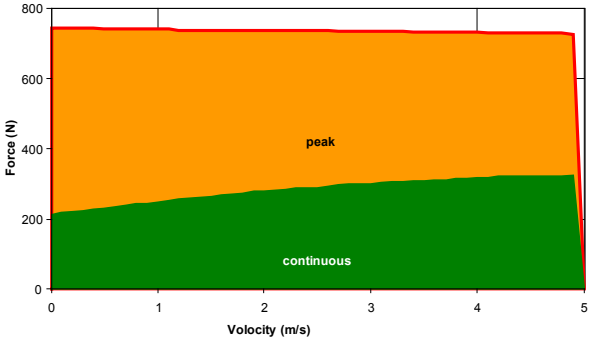
PRA3806P force/velocity



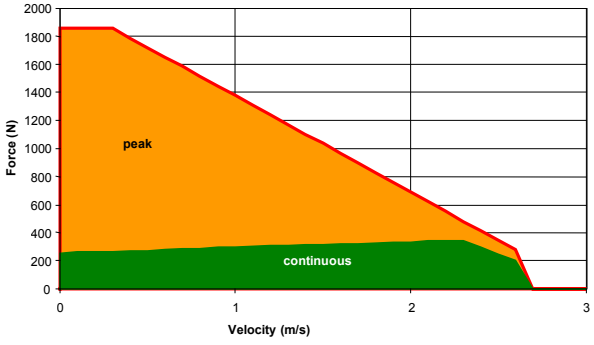
PRA3808S force/velocity



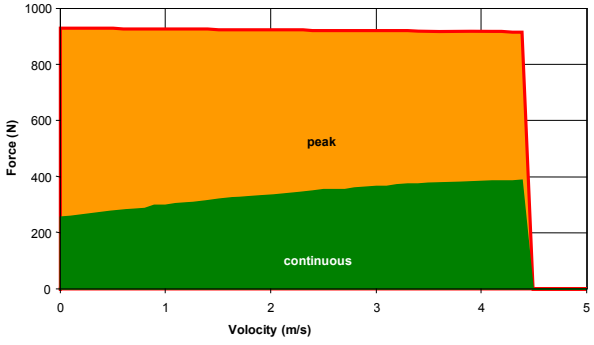
PRA3808P force/velocity



PRA3810S force/velocity



PRA3810P force/velocity

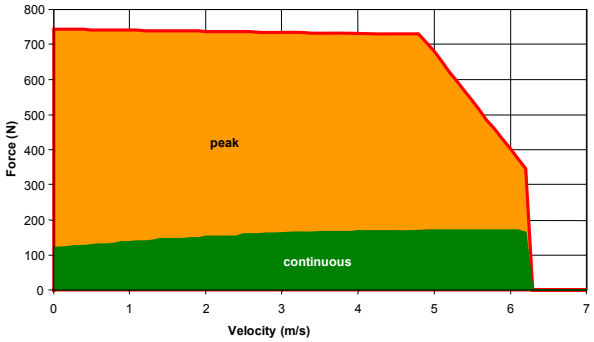


3.4.5. Force / velocity profiles PRC38

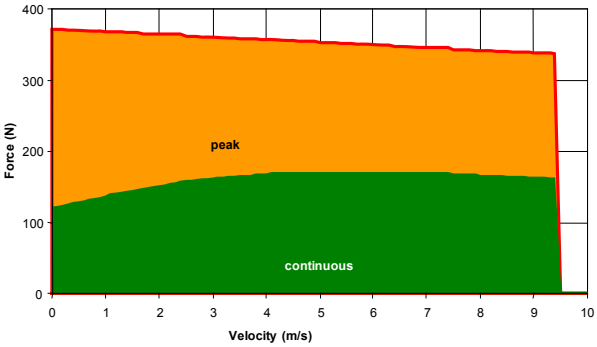
Force/velocity profiles (with an operating voltage of 325 Vd.c., without load)

S=series motor phases **P=parallel motor phases**

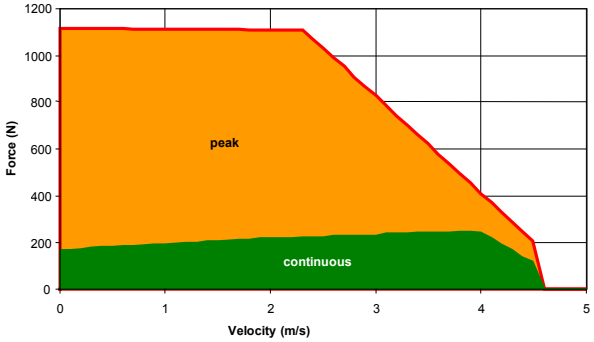
PRC3804S force/velocity



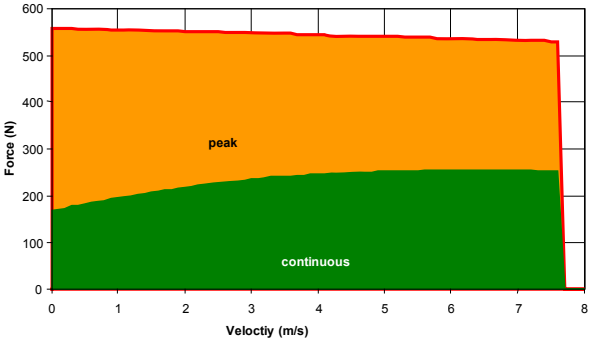
PRC3804P force/velocity



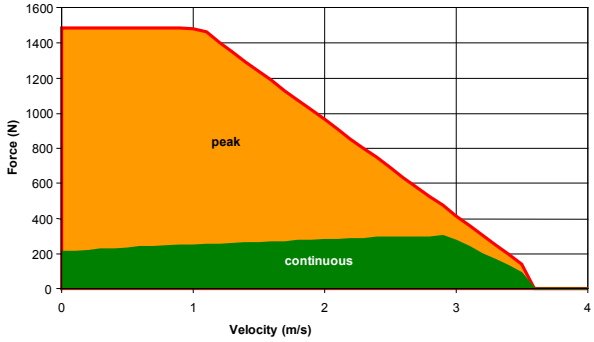
PRC3806S force/velocity



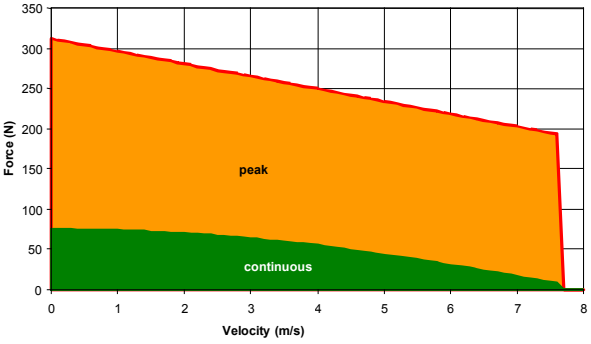
PRC3806P force/velocity



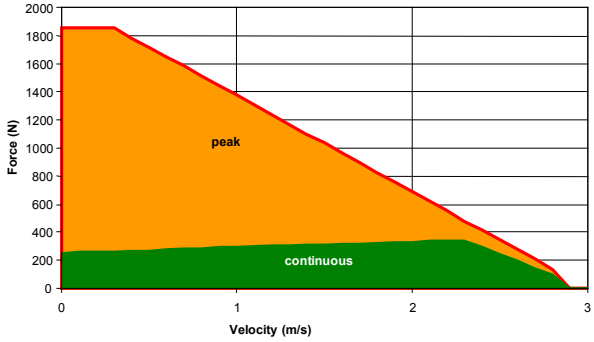
PRC3808S force/velocity



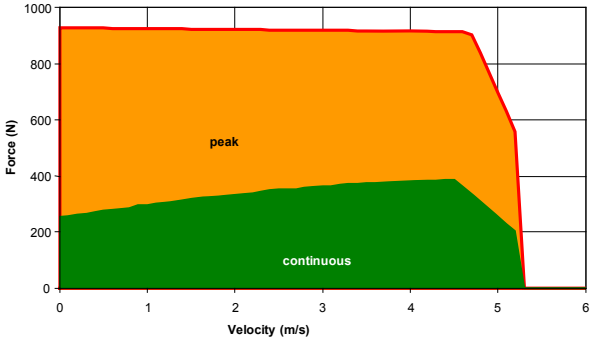
PRC3808P force/velocity



PRC3810S force/velocity



PRC3810P force/velocity



3.5 Motor and feedback cable

The PowerRods have two hard-wired cables for motor power and position sensor. The standard cables for PRA and PRR supplied are flexible but are not suitable for continuous flex or energy chain applications. The cables for PRC are highly flexible as a standard.

Standard for PRA and PRR: Cable type S

flexible cable for:	Power	Sensor* in static operation
Overall diameter (nominal)	8.2 mm	7.8 mm
Insulation	PVC	PVC
Number of conductors	4	4 x twisted pair
Size of conductors	1.5 mm^2 (16 AWG)	0.14 mm^2 (26 AWG)
Shielded/ unshielded	shielded	shielded
Operating voltage	600 Vrms	300 Vrms
Minimum bending radius-fixed routing	41 mm	40 mm
Operating temperature	-40 °C to+ 90 °C	-40 °C to +70 °C
UL certification	2586 105 °C 600 V	21083 90 °C 300 V

Standard for PRC and optionally available for PRA and PRR: Cable type R (=highly flexible)

Suitable for continuous flex or energy chain applications.

highly flexible cable for:	Power	Sensor* in dynamic operation
Overall diameter (nominal)	7.6 mm	7.8 mm
Insulation	PUR	PVC
Number of conductors	4	4 x twisted pair
Size of conductors	1.5 mm^2 (16 AWG)	0.14 mm^2 (26 AWG)
Shielded/ unshielded	shielded	shielded
Operating voltage	300 Vrms	300 Vrms
Minimum bending radius-fixed routing	38 mm	58 mm
Operating temperature	-40 °C to +80 °C	-0 °C to +70 °C
UL certification	20233 80 °C 300 V	21083 90 °C 300 V

max. cable length: 20 m

*Sensor cable only available as highly flexible version.

3.6 Ambient conditions

The PowerRod is intended for use in an environment within the following conditions:

Operating temperature	0 to +40 °C
Storage temperature	-25 to +70 °C
Altitude (above mean sea level)	1000 m
Overvoltage category	II (DIN VDE 0110)
Pollution degree	2 (DIN VDE 0110)
EMC	light industry (EN61000-6-3 / EN61000-6-1)
Enclosure rating	IP67

3.7 Thermal Sensor

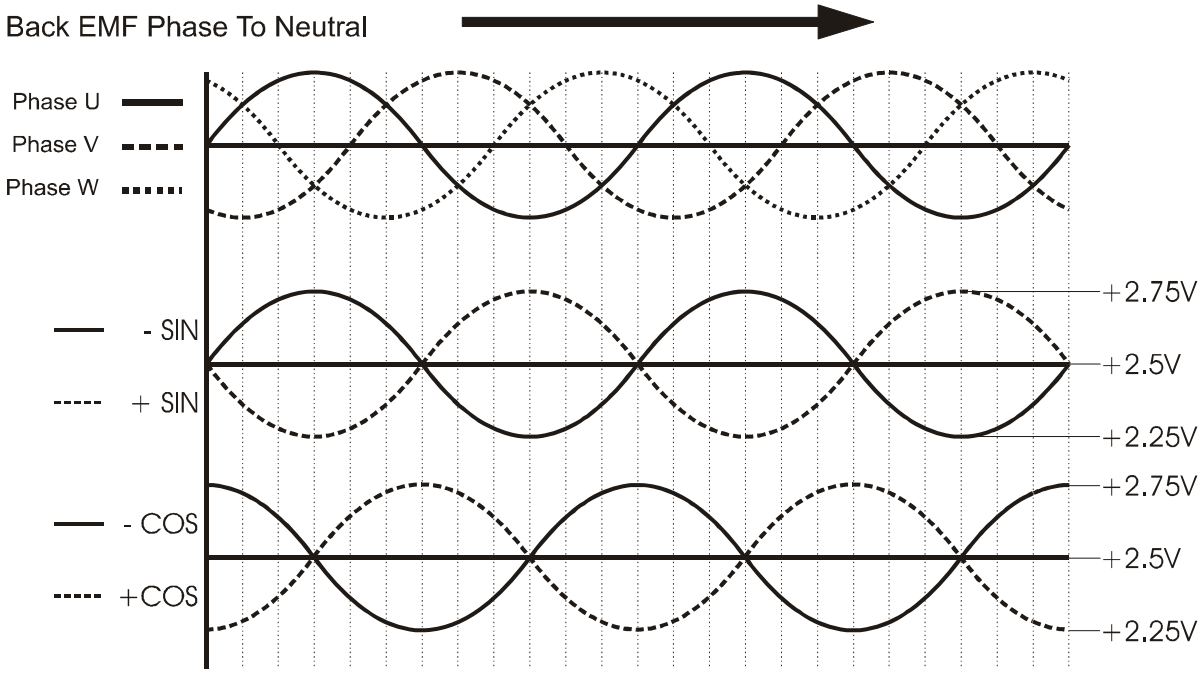
It is strongly recommended that the motor over-temperature sensor is connected to the servo drive at all times in order to reduce the risk of damage to the motor due to excessive temperatures.

Protection is provided by three, positive temperature coefficient (PTC) thermistors embedded in the motor phases. As the motor phase temperature approaches 100 °C, the PTC thermistors exhibit a sharp increase in electrical resistance. This change in resistance can be detected by circuitry within the drive amplifier or servo drive and used to reduce or disable the output of the drive amplifier in order to protect the motor.

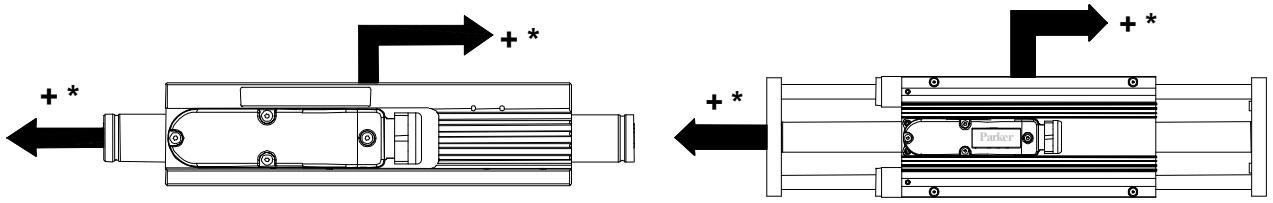
	Value	Unit
Resistance in the temperature range of -20 °C to +70 °C	60 to 750	Ohm
Resistance at 85 °C	≤1650	Ohm
Resistance at 95 °C	≥3990	Ohm
Resistance at 105 °C	≥12000	Ohm
Maximum continuous voltage	30	V d.c.

3.8 Position sensor

The position sensor outputs analog, differential sine and cosine signals for providing position feedback. Shown below are the relationships between motor phase back EMF and position sensor outputs for one direction of motion (as shown by arrows). It should be noted that +SIN or -SIN is always in phase with motor phase U. For the motion shown, -SIN is in phase with motor phase U. For motion in the opposing direction +SIN is in phase with motor phase U.



*Positive movement direction with Compax3 Motormanager



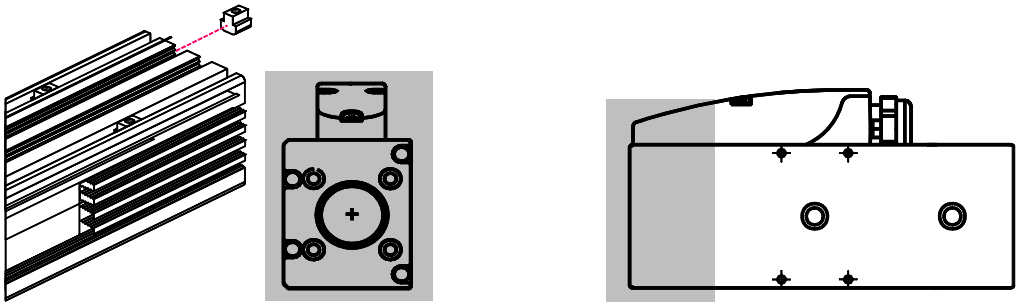
	PRA / PRC25	PRR25	PRA / PRC38	Unit
Pole pitch	51.2	51.2	71.2	mm
Output current	±10	±10	±10	mA
Supply voltage	5 ± 0.25	5 ± 0.25	5 ± 0.25	V d.c.
Supply current (output current =0)	15 ± 5	15 ± 5	15 ± 5	mA
Repeatability (2) up to	±20	±20	±40	µm

(2) With Compax3 servo drive. Under constant operating conditions. Self-heating of the thrust rod by the motor will cause expansion in the thrust rod. In high duty applications (corresponding to an internal motor temperature of 80 °C) a 1 m thrust rod will expand typically by 250 µm.

4. Mounting / installation

Important!

Please use for the parts marked grey with respect to the primary element, for the attachment and connection parts only non-iron materials. Use aluminum, stainless steel or plastic for example.



4.1 Mounting of PRA

The PowerRod Actuator PRA comprises the primary element with an integrated polymer sliding bearing and the magnet rod.

The integral bearing functions as a guiding for the moved magnet rod. It is not intended to compensate lateral forces. If lateral forces are likely to occur in your application, you must provide for an additional bearing.

The magnet rod of the PowerRod Actuator PRA has an external thread on one end and on the opposite end an internal thread. This permits to use a wide range of accessories (Industry standard DIN/ISO6431). A locking ring at each end of the magnet rod fixes it within the primary element. The locking rings are not dimensioned as limit stops and are not suitable to protect against the exceeding of the travel path. It is within the responsibility of the user to prevent the magnet rod from being pushed out of the primary element.

The PRA can be mounted in two different ways:

- Use the t-grooves and **nuts** (see on page 41) on the upper side of the primary element of the **PRA25** (see page 15) or **PRA38** (see page 27).
- Use the mounting holes at the end flange of **PRA25** (see page 15) or **PRA38** (see page 27).

The recommended tightening torques for the mounting are:

Tightening torque PRA25	M6 mounting holes / end flange	9 Nm
	M5 T - grooves / **nuts** (see on page 41)	7 Nm

Condition: Threads are not greased and are not treated with thread locking compound.

Tightening torque PRA38	M6 mounting holes / end flange	9 Nm
	M6 T - grooves / **nuts** (see on page 41)	10 Nm

Condition: Threads are not greased and are not treated with thread locking compound.

4.2 Mounting of PRC

The PowerRod Component PRC and TRC comprises the primary element and the magnet rod. The magnet rod can be fixed with the aid of the terminal block **(TRS)** (see page 41).

The use of the terminal block for the magnet rod and the use of a linear bearing permit the movement of the primary element.

The PowerRod Component PRC is operated with a moved primary element, therefore highly flexible cables must be used which are suitable for permanent flex operations. We recommend to use a cable management system in order to ensure the function and service life of the cables. Energy chains are typically mounted parallel to the direction of movement. Please heed the manufacturer's instructions when installing cables in energy chains. Especially:

- Respect the permissible bending radius of the cables
- Cables may not be tensioned
- Separate individual cables physically in order to prevent damages caused by abnormal abrasion.
- Do not cross cables
- Be very careful to avoid twisting or buckling of the cables.

The PRC can be mounted in two different ways:

- Use the t-grooves and **nuts** (see on page 41) on the upper side of the primary element of the **PRC25** (see page 17) or **PRC38** (see page 28).
- Mounting the primary element on a carriage plate in order to use a linear bearing.

The recommended tightening torques for the mounting are:

Tightening torques PRC25	M4 mounting hole on the primary element	4 Nm
	M5 **nuts** (see on page 41)	7 Nm

Condition: Threads are not greased and are not treated with thread locking compound.

Tightening torques PRC38	M4 mounting hole on the primary element	4 Nm
	M6 **nuts** (see on page 41)	10 Nm

Condition: Threads are not greased and are not treated with thread locking compound.

4.3 Mounting of PRR

The PowerRod Actuator with outrigger bearings PRR comprises the primary element with double outrigger bearings and sliding guidings. The external bearings are used as guiding for the magnet rod.

Please ensure tension free mounting to the flange plates.

The PRR can be mounted either from above or from below:

- Use the t-grooves and **nuts** (see on page 41) on the upper side of the primary element of the **PRR25** (see page 22).
- Use the t-grooves and **nuts** (see on page 41) on the bottom side of the primary element of the **PRR25** (see page 22).

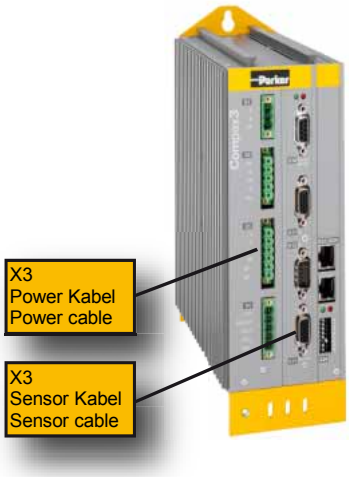
The recommended tightening torques for the mounting are:

Tightening torque PRR25	M5 **nuts** (see on page 41)	7 Nm

Condition: Threads are not greased and are not treated with thread locking compound.

4.4 Connect device

All electrical connections to the PowerRods are realized via two cables. The motor cable is for the power supply of the PowerRod and the feedback cable transmits signals from the position sensor. Those cables are available preconfectioned with connectors for the the Compax3 drive controller or with flying leads.

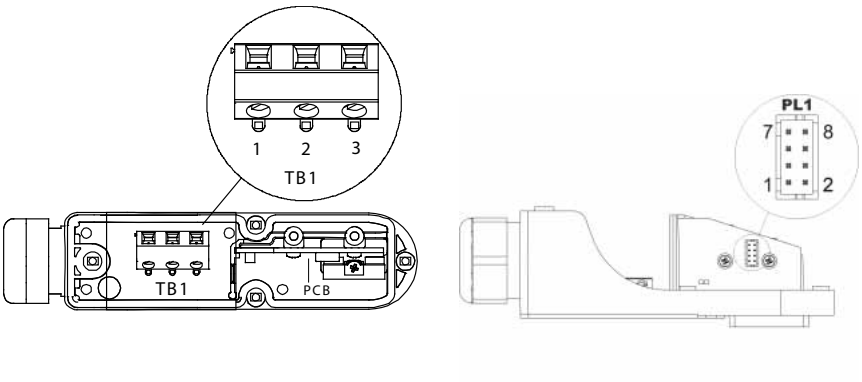


For special PRA types with longer stroke or a longer magnet rod, the standard types can be used as a basis, only the value for the moved mass must be adapted according to the mechanical specifications (mass of the magnet rod [kg/m]).

The magnet rod of the PowerRods must be grounded. This can be made by grounding the mechanical components of the machine.

PowerRod - Terminal box

Connections within the forcer termination box are as follows:



TB1	Function	Conductor designation
1	Motor phase U	Black 1
2	Motor phase V	Black 2
3	Motor phase W	Black 3
Housing	Protective earth + both cable screens	Green/Yellow

PL1 Sensor PCB	Function	Conductor designation
1	+SIN	Blue
2	-SIN	Red
3	+COS	White
4	-COS	Brown
5	+5Vd.c.	Yellow
6	0V	Green
7	+TH (Thermistor)	Pink
8	-TH (Thermistor)	Grey
Shield	Shield	Shield

The connections of the sensor cable from PowerRod to Compax3 are as follows:

PowerRod PL1 Sensor PCB	Function	Compax3 X13
Pin 1	+SIN	Pin 8
Pin 2	-SIN	Pin 7
Pin 3	+COS	Pin 12
Pin 4	-COS	Pin 11
Pin 5	+5Vd.c.	Pin 4
Pin 6	0V	Pin 15
Pin 7	+TH (Thermistor)	Pin 5
Pin 8	-TH (Thermistor)	Pin 10

PIN X13	Feedback /X13 High Density /Sub D
	Direct drives (F12)
1	Sense -*
2	Sense +*
3	Hall1 (digital)
4	Vcc (+5V)* max. 350 mA load
5	+5 V (for temperature sensors)
6	Hall2 (digital)
7	SIN-, A- (Encoder) or analog Hall sensor
8	SIN+, A+, (Encoder) or analog Hall sensor
9	Hall3 (digital)
10	Tmot*
11	COS-, B- (Encoder) or analog Hall sensor
12	COS+, B+ (Encoder) or analog Hall sensor
13	N+
14	N-
15	GND (Vcc)

*X13 Pin10 Tmot may not be connected at the same time as X15 (on Compaxx3M).

Note on F12:

*+5V (Pin 4) is measured and controlled directly at the end of the line via Sense+ and Sense-.

Maximum cable length: 20m

Caution!

- Pin 4 and Pin 5 must under no circumstances be connected!
- Plug in or pull out feedback connector only in switched off state (24VDC switched off).

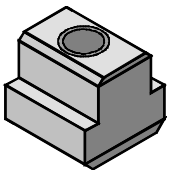
Support for commissioning with Compax3 on:

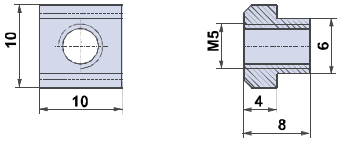
ParkerOnline: POL C3KnowledgeBase Tab "start-up-guides"
http://www.compax3.info/startup/

5. Accessories

In this chapter you can read about:

5.1 Nuts



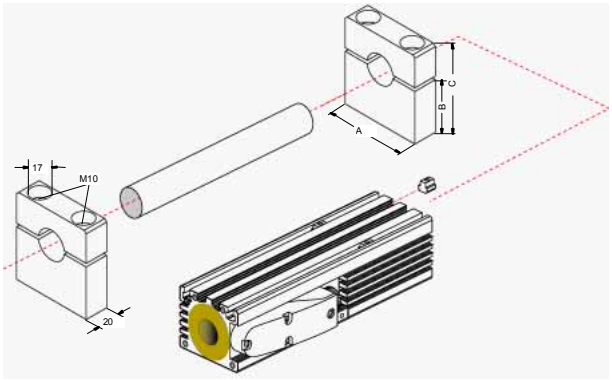


PRx	Order No.:	A	B	C	D	E
025	135-725390	10	M5	6	4	8
038	135-725400	13	M6	8	6	10

Nuts according to DIN508 stainless

5.2 Terminal block TRS for the magnet rod TRC

The terminal block is used for fixing the magnet rod (TRC). The TRSxx terminal block consists of 2 terminal blocks and 4 screws.



	A	B	C
TRS25 for TRC25	64	45	74.5
TRS38 for TRC38	85	54	90.5

Note: Primary element and magnet rod must be aligned with the aid of a guiding element to be provided by the customer.

6. Order code

6.1 Order code PRA

Example PRA 25 04 S - 027 - S - S 03 P

Size: 25, 38

Number of pole pairs of forcer 04, 06, 08, 10

Winding:
S: serial, P: parallel

Travel in mm:
PRA25: 027, 053, 078, 104, 130, 155, 181, 206, 232, 258, 283, 309
PRA38: 033, 069, 104, 140, 176, 211, 247, 282, 318

Environment:
S: standard, H: rough (hard anodized) e.g. for the food processing industry

Connection Type:
S: flexible, R: highly flexible

Cable length:
03: 3 m, 05: 5 m

Cable connection:
F: with flying leads,
P: for Compax3 / SLVDN

6.2 Order code for PRR

Example PRR 25 04 S - 028 B - S - S 03 P

Size: 25

Number of pole pairs of forcer 04, 06, 08, 10

Winding:
S: serial, P: parallel

Travel in mm:
028, 054, 079, 105, 131, 156, 182, 207, 233, 259, 284, 310

Guiding bushings:
B ball bushings (steel guiding),
P Polymer sliding bushings (aluminum guiding)

Environment:
S: standard, H: rough (hard anodized) e.g. for the food processing industry

Connection Type:
S: flexible, R: highly flexible

Cable length:
03: 3 m, 05: 5 m

Cable connection:
F: with flying leads,
P: for Compax3 / SLVDN

6.3 Order code PRC

PRC forcer

Example	PRC	25	04	S	-	S	-	R	03	P

Size: 25, 38

Number of pole pairs of forcer 04, 06, 08, 10

Winding:
S: serial, P: parallel

Environment:
S: standard, H: rough (hard anodized)
e.g. for the food processing industry

Connection Type:
R: highly flexible

Cable length:
03: 3 m, 05: 5 m

Cable connection:
F: with flying leads,
P: for Compax3 / SLVDN

Magnet rod TRC for PRC

	Example	TRC25	-	0226
TRC25 for PRC25		**TRC25**	**-**	**xxxx**

xxxx: Length of thrust rod in mm

Possible lengths of the magnet rod TRC25 for PRC25 (in mm)

226, 252, 277, 303, 329, 354, 380, 405, 431, 457, 482, 508, 534, 559, 585, 611, 636, 662, 688, 713, 739, 765, 790, 816, 867, 918, 970, 1021, 1072, 1124, 1175, 1226, 1278, 1329, 1380

The PRC order code does only comprise the forcer. The TRC magnet rod must be ordered separately. The TRC order code states the total length of the magnet rod.

	Example	TRC38	-	0265
TRC38 for PRC38		**TRC38**	**-**	**xxxx**

xxxx: Length of thrust rod in mm

Possible lengths of the magnet rod TRC38 for PRC38 (in mm)

265, 301, 337, 372, 408, 444, 479, 515, 550, 586, 622, 657, 693, 729, 764, 800, 836, 871, 907, 943, 978, 1014, 1050, 1085, 1121, 1157, 1192, 1228, 1263, 1299, 1335, 1370, 1406, 1442, 1477, 1513, 1549, 1584, 1620

The PRC order code does only comprise the forcer. The TRC magnet rod must be ordered separately. The TRC order code states the total length of the magnet rod.

6.4 Order code for replacement cables for PRx

Designation	Length	Cable type	Connector for Compax3	Flying leads
PowerRod Series 25				
Motor cable	3 m	highflex	PR450476273	PR450476233
Motor cable	3 m	standard	PR450476273A	PR450476233A
Motor cable	5 m	highflex	PR450476275	PR450476235
Motor cable	5 m	standard	PR450476275A	PR450476235A
Mating Sensor Cable	3 m	highflex	PR450476523	PR450476503
Mating Sensor Cable	5 m	highflex	PR450476525	PR450476505
PowerRod Series 38				
Motor cable	3 m	highflex	PR450477173	PR450477133
Motor cable	3 m	standard	PR450477173A	PR450477133A
Motor cable	5 m	highflex	PR450477175	PR450477135
Motor cable	5 m	standard	PR450477175A	PR450477135A
Sensor Cable	3 m	highflex	PR450477193	PR450477153
Sensor Cable	5 m	highflex	PR450477195	PR450477155

The delivery always consists of a sensor- and a motor cable, pre-assembled with the corresponding cable cable joint.

7. Maintenance and service





Isolate and remove all live parts before working on the equipment.

PRA

The PRA is a low-maintenance device and does only require a minimal overhead for periodic inspection.

The integral bearing is dry-running and does not require lubrification.

Periodic inspection works:

- Check, if the magnet rod can be freely moved over the entire stroke.
- Clean the surfaces (e.g. ferrous material particles can be attracted).
- Verify all connections for stability and safety.

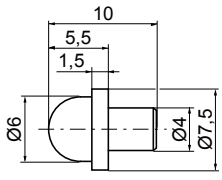
PRR

The PRR with outrigger bearing is a low-maintenance device and does only require a minimal overhead for periodic inspection.

The polymer sliding bushings are dry-running and no not require lubrification.

The ball bushings should be lubricated after every 100km of operation with Rocol Sapphire 2.

Lubricating nipple for PRR25



Periodic inspection works:

- Check, if the magnet rod can be freely moved over the entire stroke.
- Clean the surfaces (e.g. ferrous material particles can be attracted).
- Verify all connections for stability and safety.

PRC

The PRC is a low-maintenance device and does only require a minimal overhead for periodic inspection.

For the customer-installed linear bearing, please refer to the respective supplier in order to obtain recommendations for suitable lubricants and maintenance intervals.

Periodic inspection works:

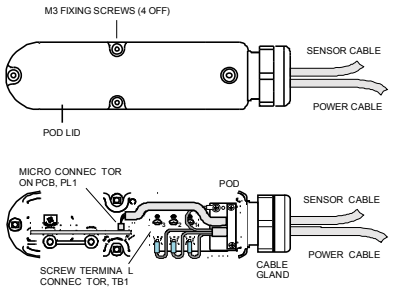
- Check, if the primary element can be freely moved over the entire stroke.
- Clean the surfaces (e.g. ferrous material particles can be attracted).
- Verify all connections for stability and safety.
- Check all cables for signs of wear or damage.

Replacing cables

Removing

The termination box must be opened in order to replace cables (**PowerRod termination box**).

- Open the 4 screws at the cover (please note that they have different lengths).
- Remove lid.
- Unscrew nut of the cable bushing.
- Loosen/remove connections of motor cable and grounding from TB1 and sensor cable connections from PL1.
- Loosen the strain relief clamps.
- Pull cable from the cable bushing.



Replacement

The cables are replaced in the reverse order (see above).

- Insert the cable into the cable bushing.
- Connect the cable including grounding connection.
- Tighten the strain relief clamps.
- Tighten nut of the cable bushing.
- Attach cover (attention, do not damage the seal).
- Fix the lid (consider the length of the screws) with tightening torque 0.7N.

8. Trouble shooting

Check, if the problem you face is listed in the table below. If you cannot solve the problem with the aid of this table, please contact our service department.

Error	possible cause	Action
Primary element / magnet rod does not move and does not develop any force	Drive without supply voltage.	Connect supply voltage for drive.
	Motor phases not connected.	Check: Connections of the motor phases to drive.
	Overtemperature sensor not connected.	Check: Connections of the overtemperature sensor to drive.
	Switch-off by overtemperature.	Allow primary element to cool off.
Primary element / magnet rod does not move but develops holding force or is energized	One or several motor phases not correctly connected or not connected at all.	Check: Connections of the motor phases to drive.
	One or several sensor connections faulty or not connected at all.	Check: Connections of the position sensor to drive.
	Primary element / magnet rod blocked mechanically.	Check: if primary element / magnet rod can be moved easily.
Primary element / magnet rod does move jerkily	Wrong motor pole pitch set or wrong Offset between position sensor and EMF.	Check: Setup of drive or controller.
Primary element / magnet rod moves to the wrong direction	One or several sensor connections or motor phases faulty or not connected at all.	Check: Correct connection of position sensor and motor phases.

Please Note: Use the original packaging material for return shipments.

9. Further information

Our product on the Internet (**http://www.parker-eme.com/powerrod**):

Support for commissioning with Compax3 on:

ParkerOnline: POL C3KnowledgeBase Tab "start-up-guides"
http://www.compax3.info/startup/

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