

# phd PNEUCONNECT®

## Seamless Integration of PHD Grippers to Universal Robots



phd  
PNEUCONNECT® X2  
with Freedrive



PNEUCON03

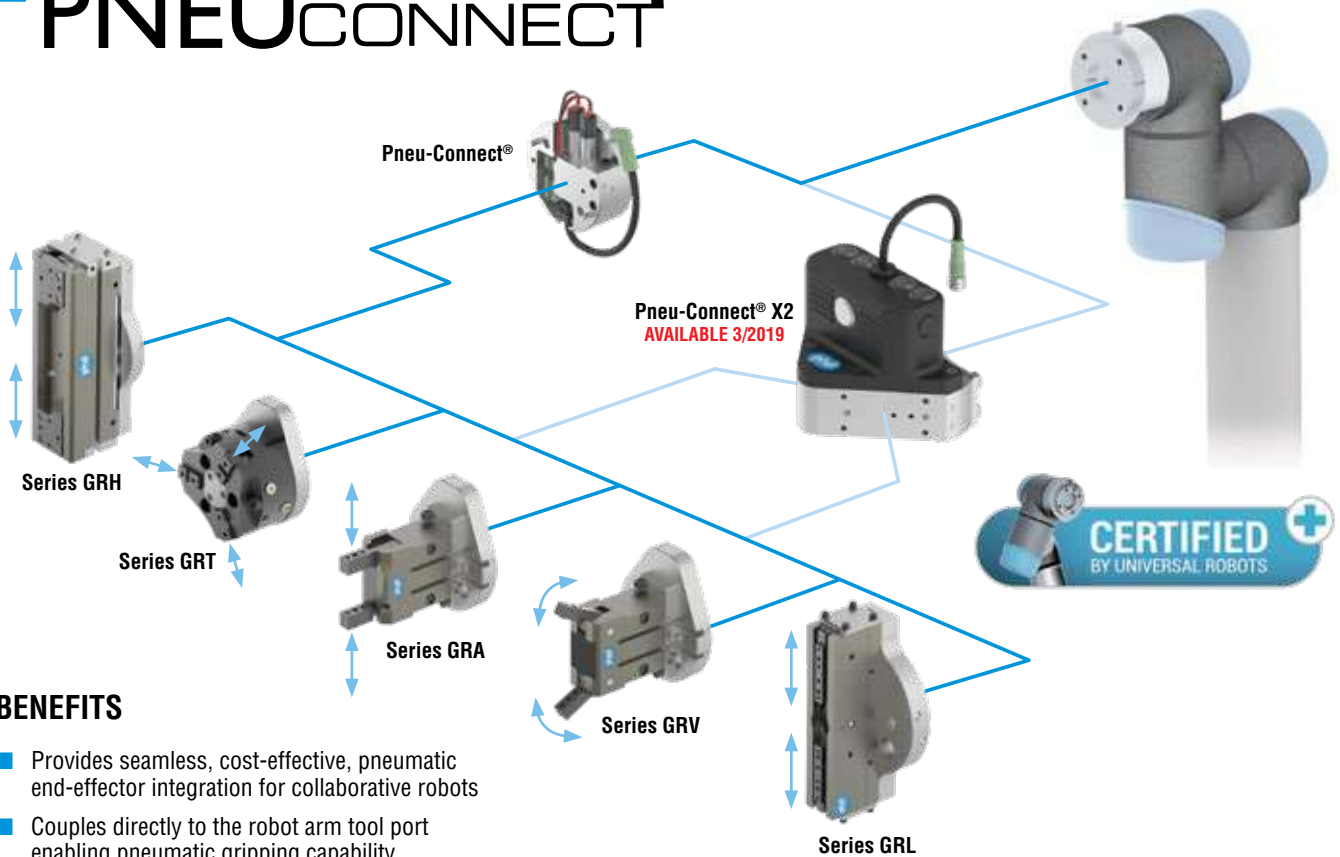


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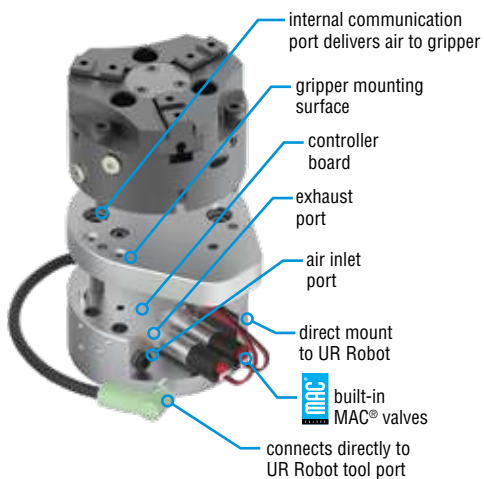
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# phd PNEUCONNECT®

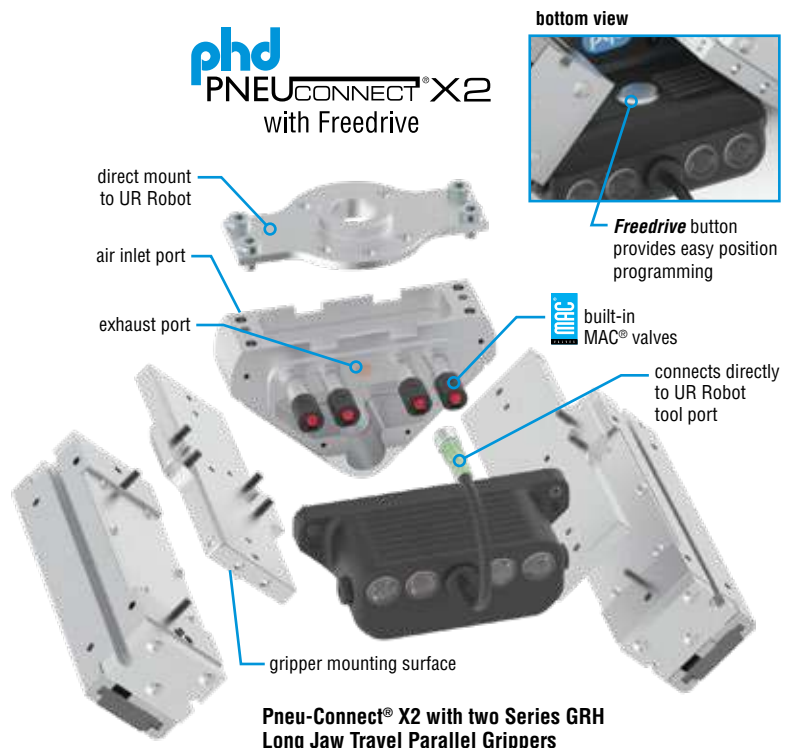


## BENEFITS

- Provides seamless, cost-effective, pneumatic end-effector integration for collaborative robots
- Couples directly to the robot arm tool port enabling pneumatic gripping capability
- Incorporated MAC® valves
- URCap software is included for intuitive, easy setup of Pneu-Connect system (see page 15)
- Kits with GRH Grippers are available with analog sensors that provide jaw position feedback
- Pneu-Connect X2 design features the Freedrive button that interfaces with the UR for easy position programming

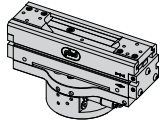
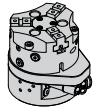
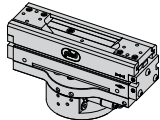
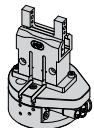
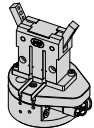
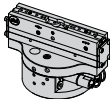
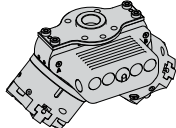
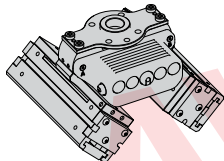
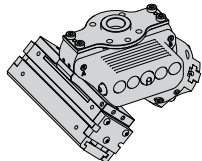


**Pneu-Connect® with Series GRT  
3-Jaw Parallel Concentric Gripper**



**Pneu-Connect® X2 with two Series GRH  
Long Jaw Travel Parallel Grippers**

# ORDERING DATA: PNEU-CONNECT® KITS

	KIT INCLUDES	KIT NUMBER
SINGLE GRIPPER	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRH12-5-12x75-L11-UB99 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• 2 integrated <b>discrete</b> switches for sensing gripper open and close</li> <li>• URCap integration software</li> </ul>	89387-01-012-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRT532-1-0001 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• URCap integration software</li> </ul>	89387-02-050-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRH12-5-12x75-L11-UB99-E3 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• 1 integrated <b>analog</b> sensor for jaw position feedback</li> <li>• URCap integration software</li> </ul>	89387-03-012-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRA-5-20x13-L11-UB99-GR9 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• 2 integrated <b>discrete</b> switches for sensing gripper open and close</li> <li>• URCap integration software</li> </ul>	89387-04-020-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRV-5-20x40-L11-UB99-GR9 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• 2 integrated <b>discrete</b> switches for sensing gripper open and close</li> <li>• URCap integration software</li> </ul>	89387-05-020-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRL12-5-16x26-L11-UB99 gripper</li> <li>• gripper mounting plate</li> <li>• mounting kit</li> <li>• URCap integration software</li> </ul>	89387-06-016-0001
X2 - DUAL GRIPPERS	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• 2 GRT532-1-0001 grippers</li> <li>• 2 gripper mounting plates</li> <li>• mounting kit</li> <li>• URCap integration software</li> <li>• Freedrive</li> </ul>	89921-0101-5050-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• 2 GRH12-5-12x75-L11-UB99-E3 grippers</li> <li>• 2 gripper mounting plates</li> <li>• mounting kit</li> <li>• 2 integrated <b>analog</b> sensors for jaw position feedback</li> <li>• URCap integration software</li> <li>• Freedrive</li> </ul>	89921-0202-1212-0001
	 <ul style="list-style-type: none"> <li>• Pneu-Connect</li> <li>• GRT532-1-0001 gripper</li> <li>• GRH12-5-12x75-L11-UB99-E3 gripper</li> <li>• 2 gripper mounting plates</li> <li>• mounting kit</li> <li>• 1 integrated <b>analog</b> sensor for jaw position feedback on GRH Gripper</li> <li>• URCap integration software</li> <li>• Freedrive</li> </ul>	89921-0102-5012-0001

# ENGINEERING DATA: LONG JAW TRAVEL PARALLEL GRIPPER - SERIES GRH

SPECIFICATIONS	GRH12-5-12
OPERATING PRESSURE	1.4 bar min to 6.9 bar max [20 psi min to 100 psi max] air
OPERATING TEMPERATURE	-28 to +82°C [-20 to +180°F]
GRIP REPEATABILITY	±0.05 mm [±0.002 in] of original position
RATED LIFE	5 million cycles
LUBRICATION	Factory lubricated for rated life
MINIMUM TOTAL JAW TRAVEL	75 mm [2.953 in]
TOTAL GRIP FORCE AT 6 bar [87 psi]	120 N [27 lb]
GRIPPER WEIGHT	0.79 kg [1.75 lb]
ONE DIRECTION DISPLACEMENT	10.47 cm³ [0.639 in³]
CLOSE OR OPEN TIME AT 6 bar [87 psi]	0.215 sec
MAX TOOLING LENGTH	100 mm [3.94 in]
GRIP FORCE FACTOR (Gr)	20.0 [0.31]

MODEL NO.	AXIAL FORCE		MAXIMUM INDIVIDUAL MOMENTS					
	Fa		Mx		My		Mz	
	N	lb	Nm	in-lb	Nm	in-lb	Nm	in-lb
GRH12-5-12	222	50	11	95	7	65	7	65

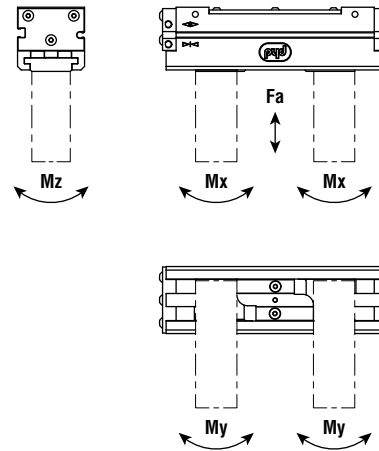
Fa: Total for both jaws

Mx: Maximum allowable moment per jaw, relative to the reference plane

My: Maximum allowable moment per jaw, relative to the geometric center of the jaw finger

Mz: Maximum allowable moment per jaw, relative to the reference plane

When calculating the value for Fa, include the tooling weight, part weight, external forces, and accelerations. When calculating values for Mx, My, and Mz, include the grip force per jaw, tooling weight, part weight, external forces, and accelerations as applicable.



## TOOLING LENGTH FACTOR

As the tool center point is moved away from the jaw surface the grip force is reduced due to additional friction generated by the grip induced moment. The tooling length factor allows calculation of the grip force at any tool center point. The graph also indicates the maximum tooling length.

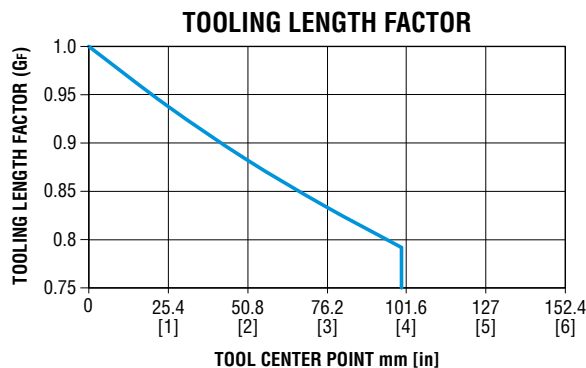
## GRIP FORCE CALCULATION EQUATIONS:

### METRIC:

Total Grip Force (N) = (Pressure [bar] x Gr) x Tooling Length Factor

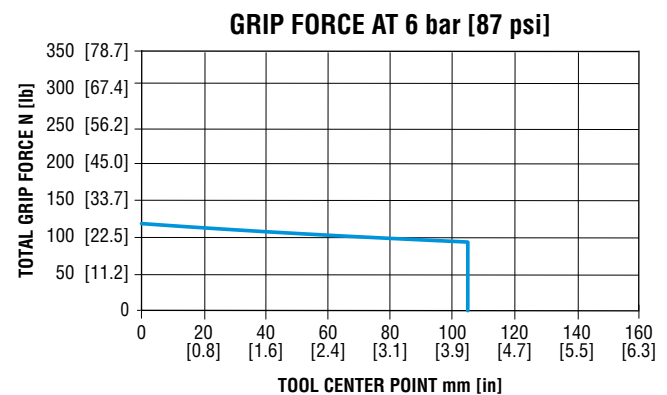
### IMPERIAL:

Total Grip Force (lb) = (Pressure [psi] x Gr) x Tooling Length Factor



## GRIP FORCE

Total gripping force relative to tooling length is shown below at 6 bar [87 psi] pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length.





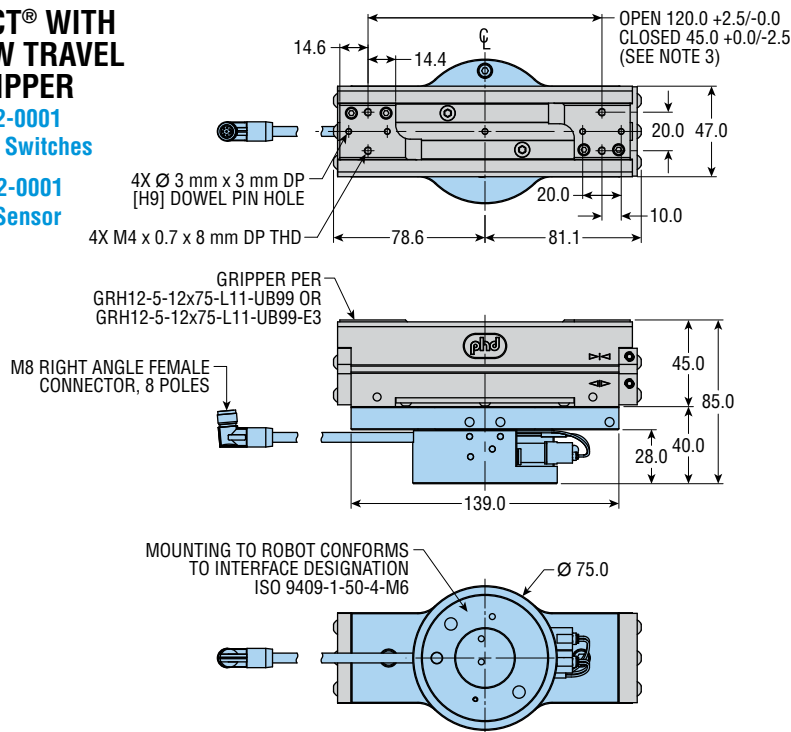
# DIMENSIONS: LONG JAW TRAVEL PARALLEL GRIPPER - SERIES GRH

## PNEU-CONNECT® WITH ONE LONG JAW TRAVEL PARALLEL GRIPPER

KITS: 89387-01-012-0001  
with Discrete Switches

89387-03-012-0001  
with Analog Sensor

Total Weight:  
1.31 kg [2.88 lb]



two discrete switches



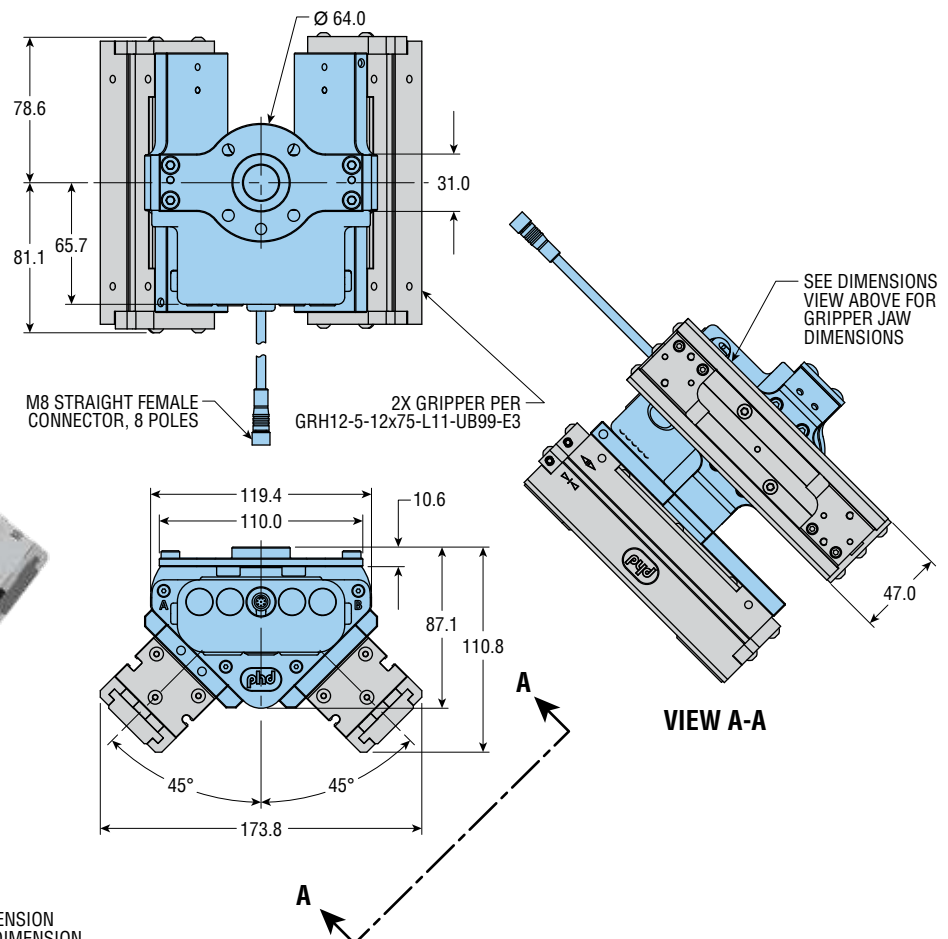
one analog sensor

## PNEU-CONNECT® X2 WITH TWO LONG JAW TRAVEL PARALLEL GRIPPERS

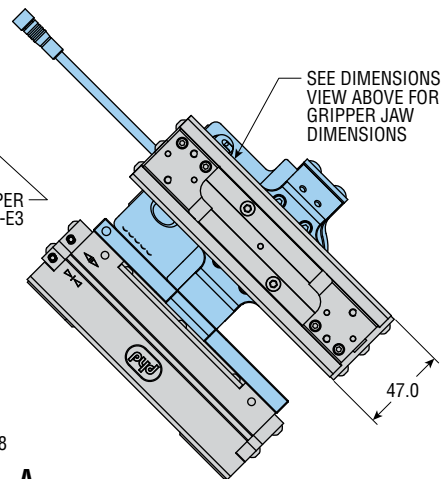
KIT: 89921-0202-1212-0001  
with two Analog Sensors

Total Weight: 2.40 kg [5.30 lb]

AVAILABLE 3/2019



two analog sensors



VIEW A-A

### NOTES:

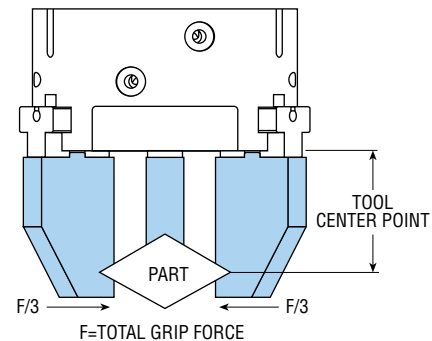
- 1) ALL DIMENSIONS ARE mm
- 2) DESIGNATED  $\phi$  IS CENTERLINE OF UNIT
- 3) OPEN REFLECTS SMALLEST POSSIBLE OPEN DIMENSION  
CLOSED REFLECTS LARGEST POSSIBLE CLOSED DIMENSION

All dimensions are reference only unless specifically tolerated.

# ENGINEERING DATA: 3-JAW PARALLEL CONCENTRIC GRIPPER - SERIES GRT

SPECIFICATIONS	GRT532
OPERATING PRESSURE	2 bar min to 7 bar max [30 psi min to 100 psi max] air
OPERATING TEMPERATURE	-28° to +82°C [-20° to +180°F]
RATED LIFE	10 million cycles minimum with standard seals
GRIP REPEATABILITY	Within ±0.05 mm [±0.002 in] of original centered position
CLOSE OR OPEN TIME 6 bar [87 psi]	0.04 sec
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable
TOTAL DIAMETRAL JAW TRAVEL	12 mm [0.472 in]
TOTAL CLOSE GRIP FORCE AT 6 bar [87 psi]	747 N [168 lb]
GRIPPER WEIGHT	0.43 kg [0.95 lb]
DISPLACEMENT	12 cm <sup>3</sup> [0.72 in <sup>3</sup> ]
GRIP FORCE FACTOR (G <sub>f</sub> )	
EXTERNAL GRIP	125 [1.93]
INTERNAL GRIP	136 [2.10]

MODEL NO.	TOOL CENTER POINT		TOOLING WEIGHT MAX. PER JAW	
	mm	in	kg	lb
GRT532	65	2.56	0.33	0.72



## TOOLING LENGTH FACTOR

Tooling should be designed so that the tool center point is as close to the body surface as possible. When the tool center point moves away, jaw friction increases, which decreases grip force. The G<sub>f</sub> information given to the right is for zero tooling length (body surface). The graph shows how force decreases as the grip point moves away from the body surface.

## GRIP FORCE CALCULATION EQUATIONS:

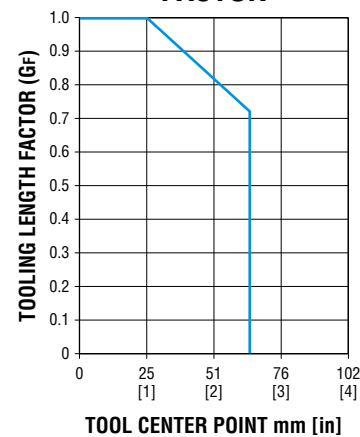
### METRIC:

Total Grip Force (N) = (Pressure [bar] x G<sub>f</sub>) x Tooling Length Factor

### IMPERIAL:

Total Grip Force (lb) = (Pressure [psi] x G<sub>f</sub>) x Tooling Length Factor

## TOOLING LENGTH FACTOR

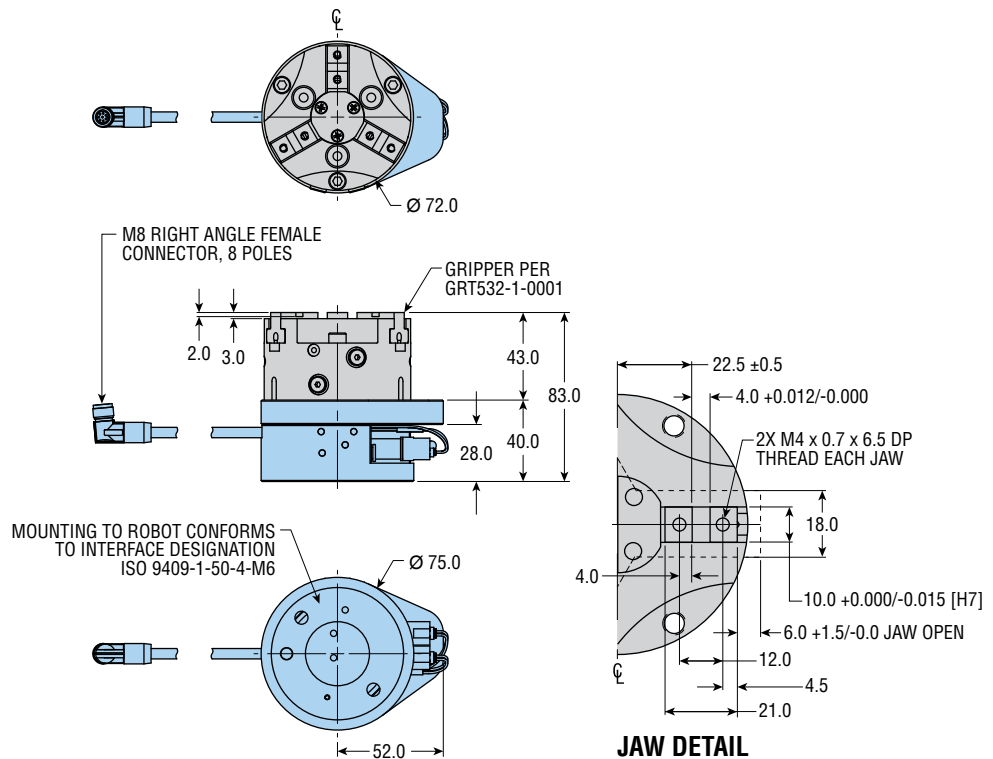


# DIMENSIONS: 3-JAW PARALLEL CONCENTRIC GRIPPER - SERIES GRT

## PNEU-CONNECT® WITH ONE 3-JAW PARALLEL CONCENTRIC GRIPPER

KIT: 89387-02-050-0001

Total Weight: 0.85 kg [1.88 lb]

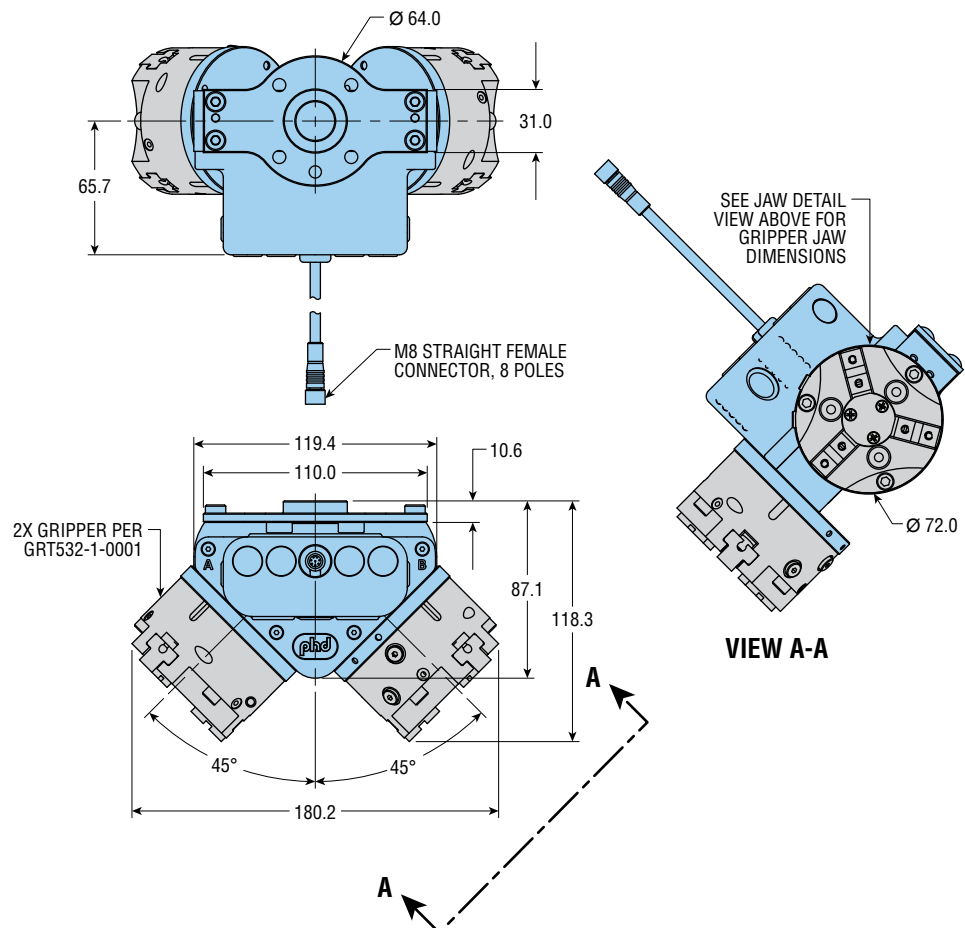


## PNEU-CONNECT® X2 WITH TWO 3-JAW PARALLEL CONCENTRIC GRIPPERS

KIT: 89921-0101-5050-0001

Total Weight: 1.68 kg [3.70 lb]

AVAILABLE 3/2019



### NOTES:

- 1) ALL DIMENSIONS ARE mm
- 2) DESIGNATED  $\phi$  IS CENTERLINE OF UNIT

All dimensions are reference only unless specifically tolerated.

# ENGINEERING DATA: PARALLEL MICRO GRIPPER - SERIES GRA

SPECIFICATIONS	GRA-5-20x13
OPERATING AIR PRESSURE	2 bar min to 8.3 bar max [30 psi min to 120 psi max] air
OPERATING TEMPERATURE	-28° to +82°C [-20° to +180°F]
GRIP REPEATABILITY	10 million cycles minimum with standard seals
RATED LIFE	±0.01 mm [±0.0004 in] of original position
LUBRICATION	Factory lubricated for rated life
MINIMUM TOTAL JAW TRAVEL	13.0 mm [0.512 in]
TOTAL CLOSE GRIP FORCE AT 6 bar [87 psi]	123 N [27.7 lb]
GRIPPER WEIGHT	0.28 kg [0.62 lb]
DISPLACEMENT	2.20 cm³ [0.134 in³]
CLOSE OR OPEN TIME 6 bar [87 psi]	0.105 sec
MAXIMUM TOOLING LENGTH	100 mm [3.94 in]
GRIP FORCE FACTOR (G <sub>F</sub> )	
INTERNAL GRIP	16.4 [0.254]
EXTERNAL GRIP	20.5 [0.318]

Fa: Total for both jaws

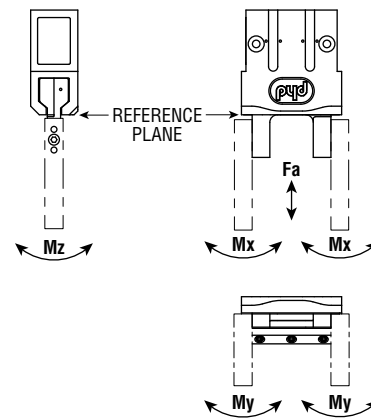
Mx: Maximum allowable moment per jaw, relative to the reference plane

My: Maximum allowable moment per jaw, relative to the geometric center of the jaw finger

Mz: Maximum allowable moment per jaw, relative to the reference plane

When calculating the value for Fa, include the tooling weight, part weight, external forces, and accelerations. When calculating values for Mx, My, and Mz, include the grip force per jaw, tooling weight, part weight, external forces, and accelerations as applicable.

MODEL NO.	AXIAL FORCE		MAXIMUM INDIVIDUAL MOMENTS					
	Fa		Mx		My		Mz	
	lb	N	in-lb	Nm	in-lb	Nm	in-lb	Nm
GRA-5-20x13	40	178	45	5.1	45	5.1	30	3.4



## TOOLING LENGTH FACTOR

As the tool center point is moved away from the jaw surface, the grip force is reduced due to additional friction generated by the grip induced moment. The tooling length factor allows calculation of the grip force at any tool center point. The graph also indicates the maximum tooling length.

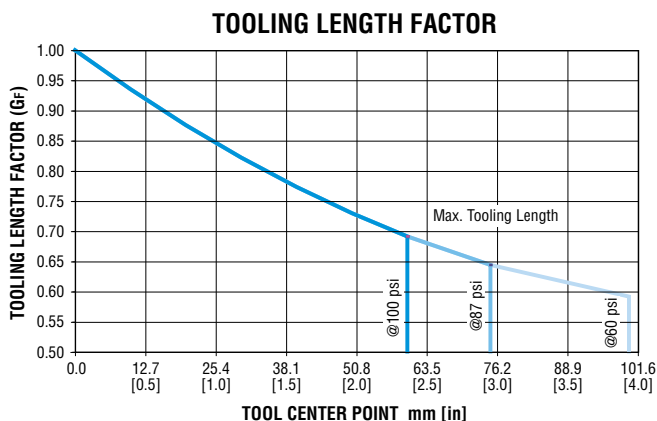
## GRIP FORCE CALCULATION EQUATIONS:

### METRIC:

Total Grip Force (N) = (Pressure [bar] x G<sub>F</sub>) x Tooling Length Factor

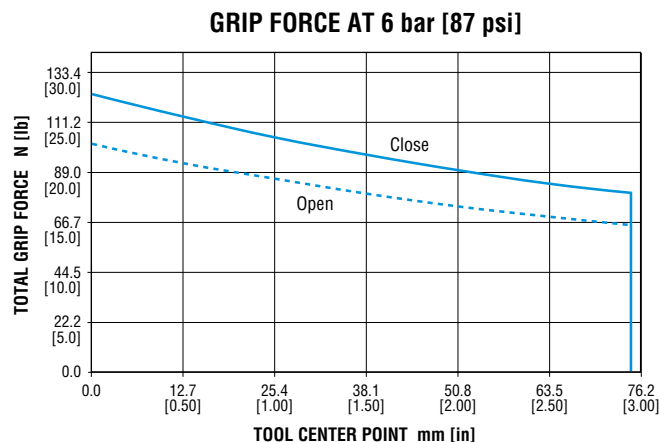
### IMPERIAL:

Total Grip Force (lb) = (Pressure [psi] x G<sub>F</sub>) x Tooling Length Factor



## GRIP FORCE

Total gripping force relative to tool center point is shown below at 6 bar [87 psi] pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length.





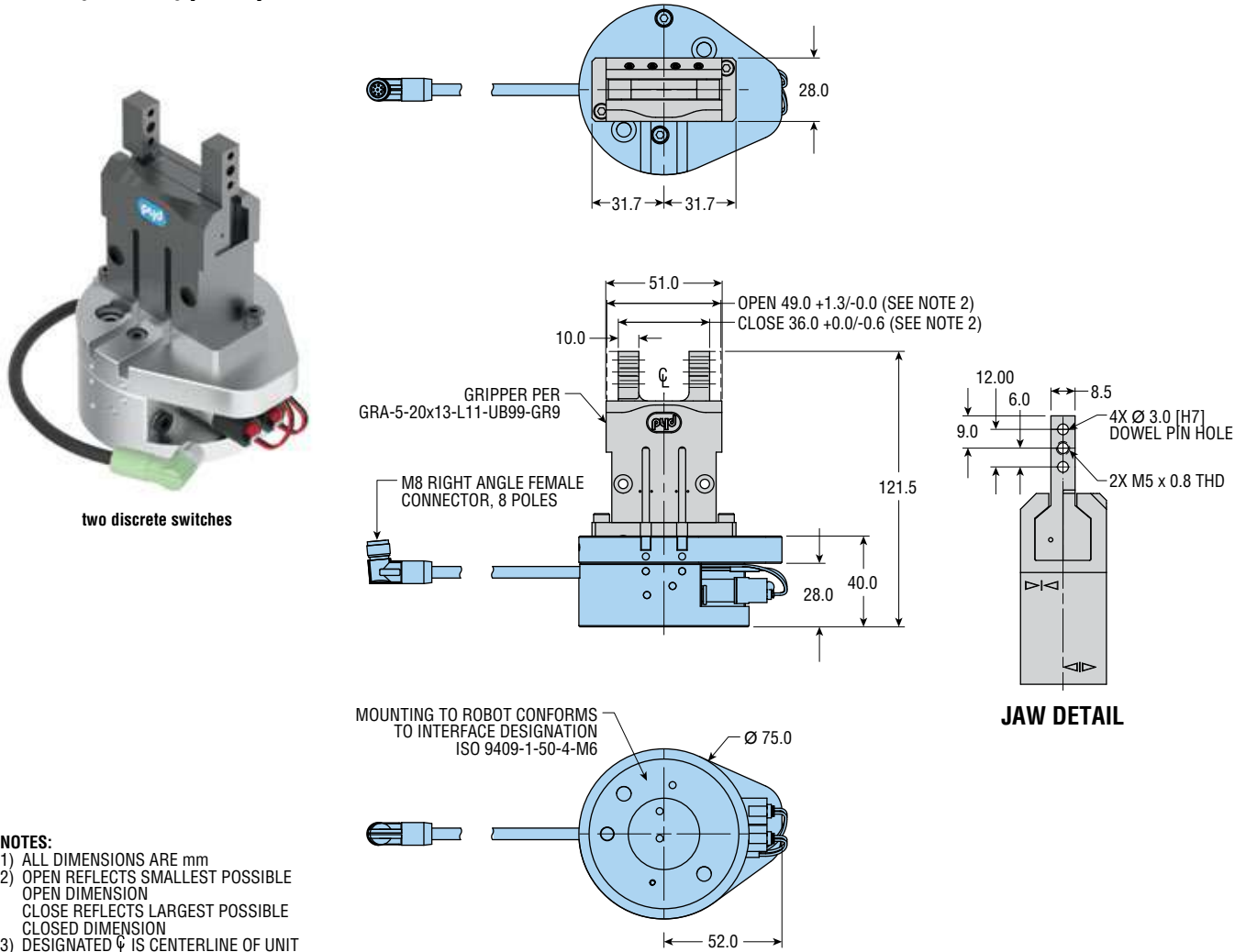
# DIMENSIONS: PARALLEL MICRO GRIPPER - SERIES GRA

## PNEU-CONNECT® WITH ONE PARALLEL MICRO GRIPPER

KIT: 89387-04-020-0001

with Discrete Switches

Total Weight: 0.73 kg [1.60 lb]



All dimensions are reference only unless specifically tolerated.

# ENGINEERING DATA: ANGULAR MICRO GRIPPER - SERIES GRV

SPECIFICATIONS	GRV-5-20x40
OPERATING AIR PRESSURE	1 bar min - 8.3 bar max [15 psi min - 120 psi max] air
OPERATING TEMPERATURE	-28 to +82°C [-20 to +180°F]
GRIP REPEATABILITY	0.025 mm [±0.001 in] of original position
RATED LIFE	5 million cycles
LUBRICATION	Factory lubricated for rated life
MINIMUM TOTAL JAW OPENING ANGLE	40°
GRIP FORCE FACTOR (Gr)	320 [0.183]
GRIPPER WEIGHT	0.244 kg [0.538 lb]
DISPLACEMENT	3.18 cm³ [0.194 in³]
CLOSE OR OPEN TIME at 6 bar [87 psi]	0.050 sec
MAXIMUM TOOLING LENGTH	80 mm [3.150 in]
MAXIMUM TOOLING INERTIA	519 kg-mm² [1.770 lb-in²]

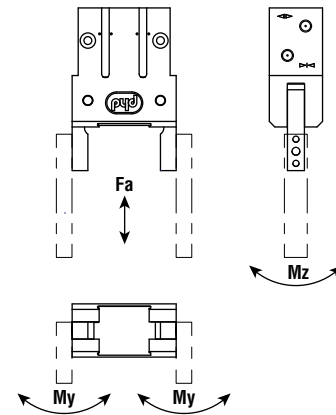
MODEL NO.	AXIAL FORCE		MAX. INDIVIDUAL MOMENTS			
	Fa		My		Mz	
	N	lb	Nm	in-lb	Nm	in-lb
GRV-5-20x40	133	30	5.1	45	3.4	30

Fa: Total for both jaws

My: Maximum allowable moment per jaw, relative to the pivot pin

Mz: Maximum allowable moment per jaw, relative to the pivot pin

When calculating the value for Fa, include the tooling weight, part weight, external forces, and accelerations. When calculating values for My and Mz, include the grip force per jaw, tooling weight, part weight, external forces, and accelerations as applicable.



## RECOMMENDATIONS

Design tooling so that the tool center point is as close to the gripper surfaces as possible. The grip force factor (Gr) values given in the table above apply at 0° jaw angle only.

The maximum load that grippers can handle will vary based on: size of the part being picked up, shape of the part, texture of the part, speed at which the part is transferred, working pressure, shape of the fingers, etc.

## GRIP FORCE CALCULATION EQUATIONS:

### METRIC:

Total Grip Force (N) = (Pressure [bar] x Gr) / Distance from Jaw Pivot (mm)

### IMPERIAL:

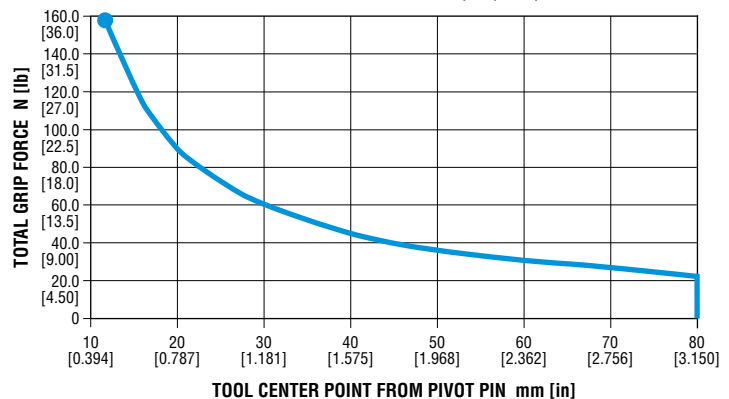
Total Grip Force (lb) = (Pressure [psi] x Gr) / Distance from Jaw Pivot (in)

## GRIP FORCE

Total gripping force relative to tool center point is shown below at 6 bar [87 psi] pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length.

### GRIP FORCE AT 6 bar [87 psi] WITH 0° JAW ANGLE

Starts at 15.1 mm from center of jaw pivot point



# DIMENSIONS: ANGULAR MICRO GRIPPER - SERIES GRV

## PNEU-CONNECT® WITH ONE ANGULAR MICRO GRIPPER

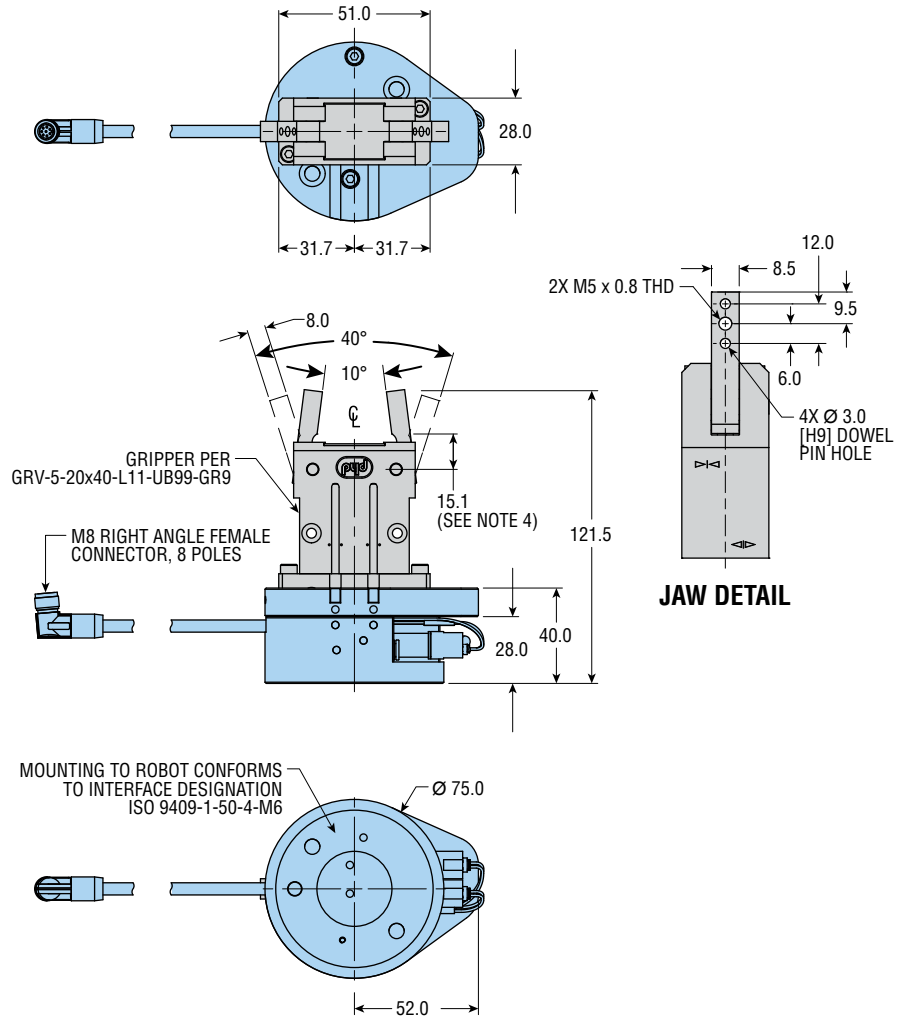
KIT: 89387-05-020-0001

with Discrete Switches

Total Weight: 0.73 kg [1.60 lb]



two discrete switches



### NOTES:

- 1) ALL DIMENSIONS ARE mm
- 2) FULL OPEN REFLECTS LEAST POSSIBLE OPEN ANGLE. FULL CLOSED REFLECTS LARGEST POSSIBLE CLOSED ANGLE.
- 3) DESIGNATED  $\varnothing$  IS CENTERLINE OF UNIT
- 4) MINIMUM DISTANCE TO BOTTOM OF TOOLING

All dimensions are reference only unless specifically tolerated.

# ENGINEERING DATA: NARROW BODY PARALLEL GRIPPER - SERIES GRL

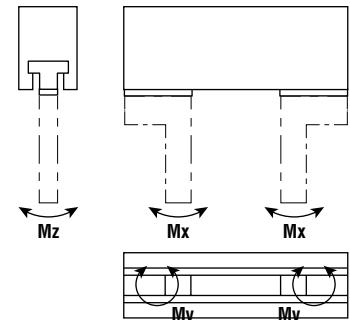
SPECIFICATIONS	GRL12-5-16x26
OPERATING PRESSURE	0.4 bar min to 7 bar max [5 psi min to 100 psi max] air
OPERATING TEMPERATURE	-28 to +82°C [-20 to +180°F]
RATED LIFE	6 million cycles minimum
GRIP REPEATABILITY	Within ±0.05 mm [±0.002 in] of original centered position
CLOSE OR OPEN TIME AT 6 bar [87 psi]	0.120 sec
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable
MINIMUM TOTAL JAW TRAVEL	26 mm [1.02 in]
TOTAL CLOSE GRIP FORCE AT 6 bar [87 psi]	182 N [41 lb]
GRIPPER WEIGHT	0.21 kg [0.47 lb]
DISPLACEMENT	5.2 cm³ [0.319 in³]
GRIP FORCE FACTOR (G <sub>F</sub> )	30 [0.47]

MODEL NO.	MAXIMUM ALLOWABLE MOMENTS ON GRIPPER JAWS									
	M <sub>x</sub>				M <sub>y</sub>				M <sub>z</sub>	
	PER JAW		TOTAL BOTH JAWS (2 x M <sub>x</sub> )		PER JAW		TOTAL BOTH JAWS (2 x M <sub>y</sub> )		PER JAW	
	Nm	in-lb	Nm	in-lb	Nm	in-lb	Nm	in-lb	Nm	in-lb
GRL12-5-16x26	6.2	55	12	110	5.2	55	12	110	5.1	45

M<sub>x</sub>, M<sub>z</sub>: Allowable moments per jaw. Moments measured from the body surface.

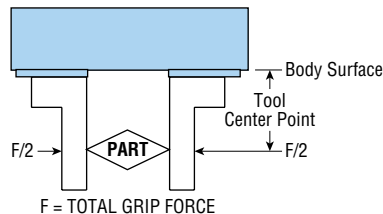
M<sub>y</sub>: Allowable moment per jaw. Moment measured from the jaw center.

**NOTE:** When calculating values for M<sub>x</sub>, M<sub>y</sub>, and M<sub>z</sub>, include the grip force per jaw, tooling weight, part weight, external forces, and acceleration as applicable.



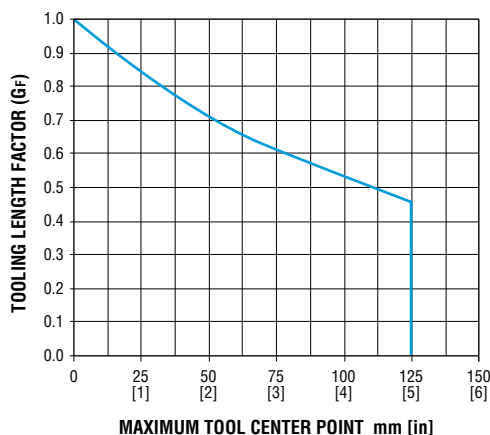
## TOOLING LENGTH FACTOR

Jaw tooling should be designed so that the tool center point is as close to the body surface as possible. As the tool center point is moved away from the body surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. The Grip Force Factor (G<sub>F</sub>) values given in the table above are for zero tooling length (body surface).



F = TOTAL GRIP FORCE

## TOOLING LENGTH FACTOR



## GRIP FORCE CALCULATION EQUATIONS:

### METRIC:

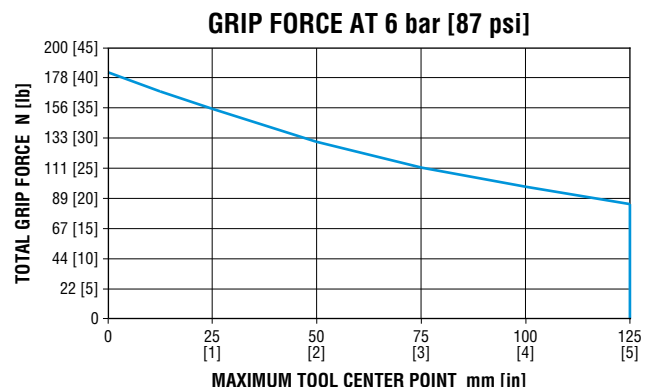
Total Grip Force (N) = (Pressure [bar] x G<sub>F</sub>) x Tooling Length Factor

### IMPERIAL:

Total Grip Force (lb) = (Pressure [psi] x G<sub>F</sub>) x Tooling Length Factor

## GRIP FORCE

Total gripping force relative to tool center point is shown below at 6 bar [87 psi] actuating pressure. Grip force per jaw equals the total grip force divided by two. The chart also indicates the maximum tooling length.

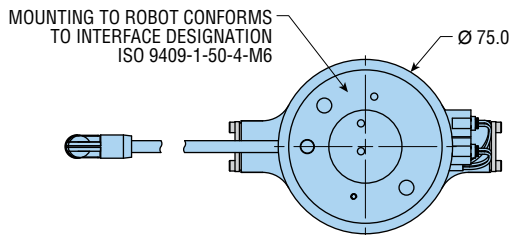
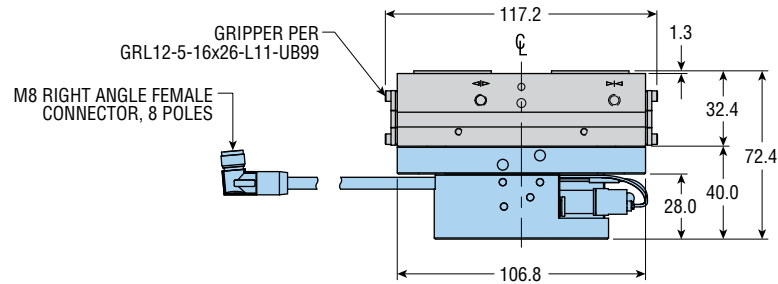
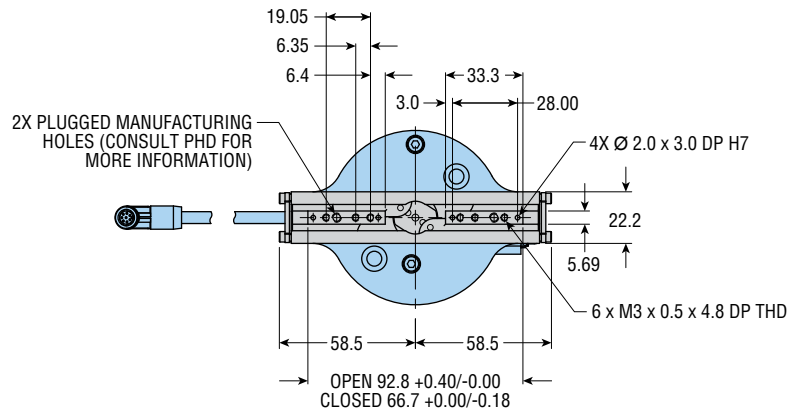


# ***DIMENSIONS: NARROW BODY PARALLEL GRIPPER - SERIES GRL***

## **PNEU-CONNECT® WITH ONE NARROW BODY PARALLEL MICRO GRIPPER**

**KIT: 89387-06-016-0001**

Total Weight: 0.64 kg [1.40 lb]



**NOTES:**  
1) ALL DIMENSIONS ARE mm  
2) ALL DIMENSIONS ARE CENTERED ON CENTERLINE OF UNIT UNLESS OTHERWISE SPECIFIED.

All dimensions are reference only unless specifically tolerated.



***DIMENSIONS: PNEU-CONNECT® X2 WITH FREEDRIVE - SERIES GRH & GRT***

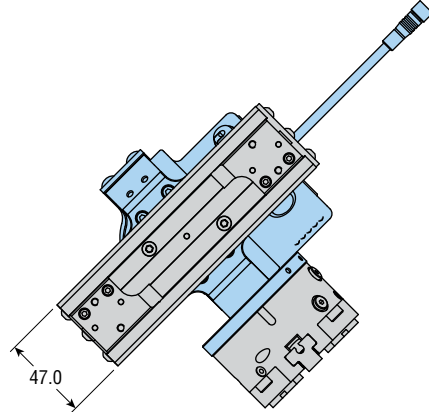
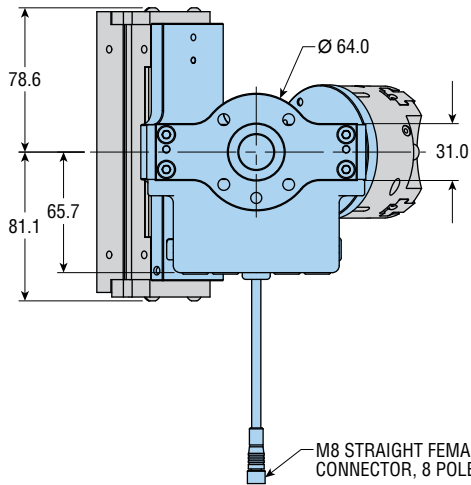
**PNEU-CONNECT® X2 WITH ONE LONG JAW  
TRAVEL PARALLEL GRIPPER AND ONE 3-JAW  
PARALLEL CONCENTRIC GRIPPER**

**KIT: 89921-0102-5012-0001**

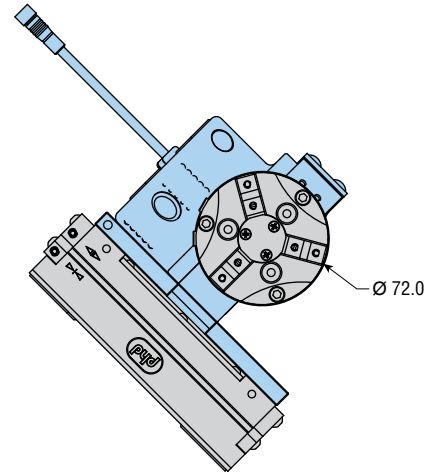
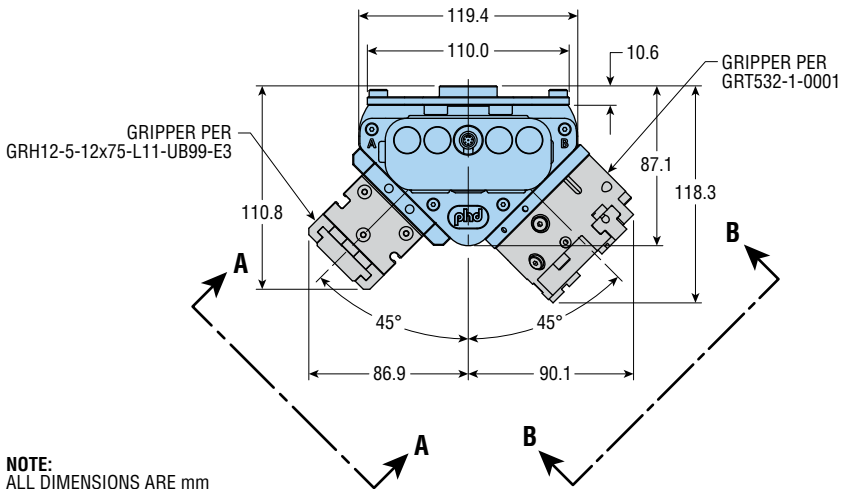
Total Weight: 2.04 kg [4.50 lb]

**AVAILABLE 3/2019**

**Includes one analog sensor  
for jaw position feedback  
on GRH Gripper**



**VIEW A-A**



**VIEW B-B**

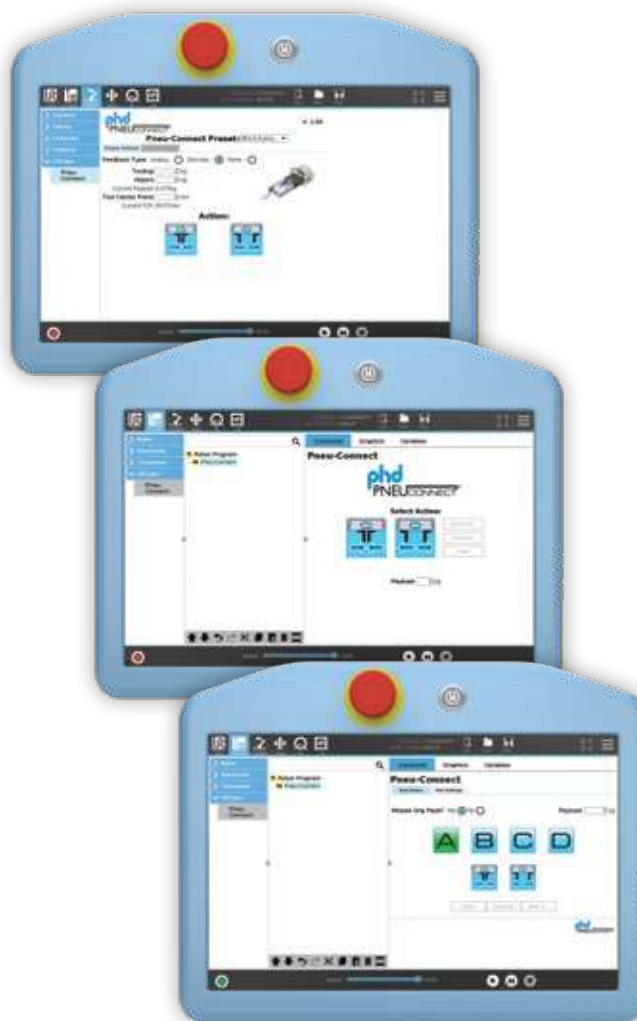
**NOTE:**  
ALL DIMENSIONS ARE mm

All dimensions are reference only unless specifically toleranced.

# INTEGRATION SOFTWARE: URCAP

Intuitive, easy setup and programming of the Pneu-Connect® end of arm devices through the UR Robot Teach Pendant. All kits include a USB flash drive with URCap software. The software is compatible with CB-Series and e-Series UR robots. Updates downloadable from the Pneu-Connect product page at [phdinc.com](http://phdinc.com).

**NOTE:** In order for the URCap to function, users must update robot software to 3.6 (CB-Series), 5.0 (e-Series), or above.



Step-by-step URCap setup instructions are available at:  
[litstore.phdinc.com](http://litstore.phdinc.com)



Watch the Pneu-Connect® product overview video at:  
[www.youtube.com/user/phdincdotcom](http://www.youtube.com/user/phdincdotcom)



# The Right Gripper for Your Part



- **Robotic end effector solutions**
- **Angular & parallel, many sizes and options available**
- **Unique solutions available**
- **For handling various sized parts**
- **Superior design & delivery**

