



# ***LoPro<sup>®</sup> RTU***

***LIGHT & MEDIUM CAPACITY  
ROBOT TRANSFER UNITS***

# ***EXPERTLY DESIGNED, DELIVERED TO PERFORM***

Powered by over 70 years of relentless problem-solving and steadfast reliability, Bishop-Wisecarver delivers innovative motion solutions around the world that thrive in harsh and extreme conditions. Our linear and rotary motion solutions, custom complex assemblies, and embedded intelligence systems lead the manufacturing industry, and they are backed by The **Signature Experience** promise of expert guidance, confidence and customer satisfaction.

## ***EXTENDING ROBOTICS IN CRITICAL APPLICATIONS***

Our solutions use the self-cleaning action of DualVee Motion Technology® for maximum environmental and debris resistance. This ability to excel in harsh and extreme conditions is especially crucial for drilling, welding, painting, and more. Many solutions that run on DualVee guide wheels require no maintenance over the planned life of the machine.

### ***DualVee Guide Wheel Based RTUs Are Ideal For:***



LONG  
LENGTH



HARSH DEBRIS  
ENVIRONMENTS



LOW TOTAL COST  
OF OWNERSHIP



LOW NOISE



SMOOTH, LOW  
FRICTION MOTION

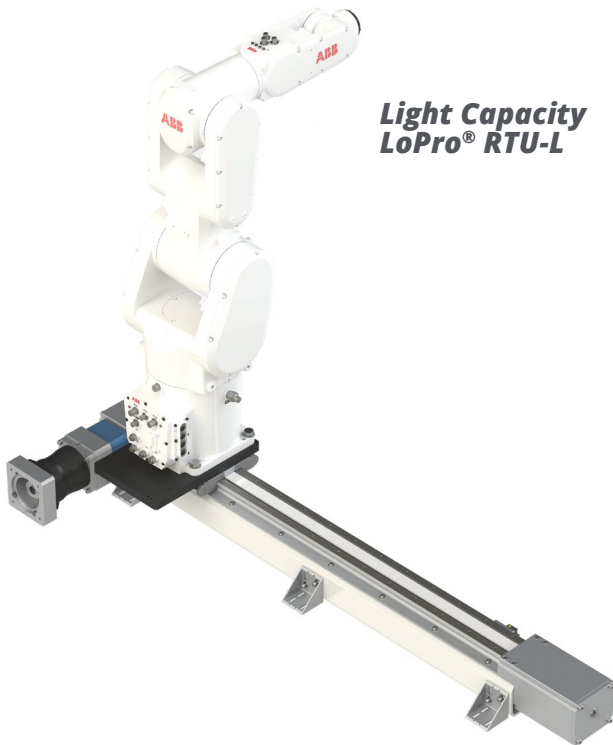


HIGH/LOW  
TEMPERATURE

## INTRODUCTION

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Both traditional and collaborative robots can benefit from Bishop-Wisecarver 7<sup>th</sup> Axis Robot Transfer Unit solutions—available in light, medium and heavy capacity. Each system is designed for **durability, ease of installation, and low total cost of ownership**. Our expert application engineers can help you select the complete 7th axis system solution that is right for you, or customize a solution to meet your exact requirements.



**Light Capacity  
LoPro® RTU-L**



**Medium Capacity  
LoPro® RTU-M**

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### Need Help

#### Application + Design Assistance

925.439.8272

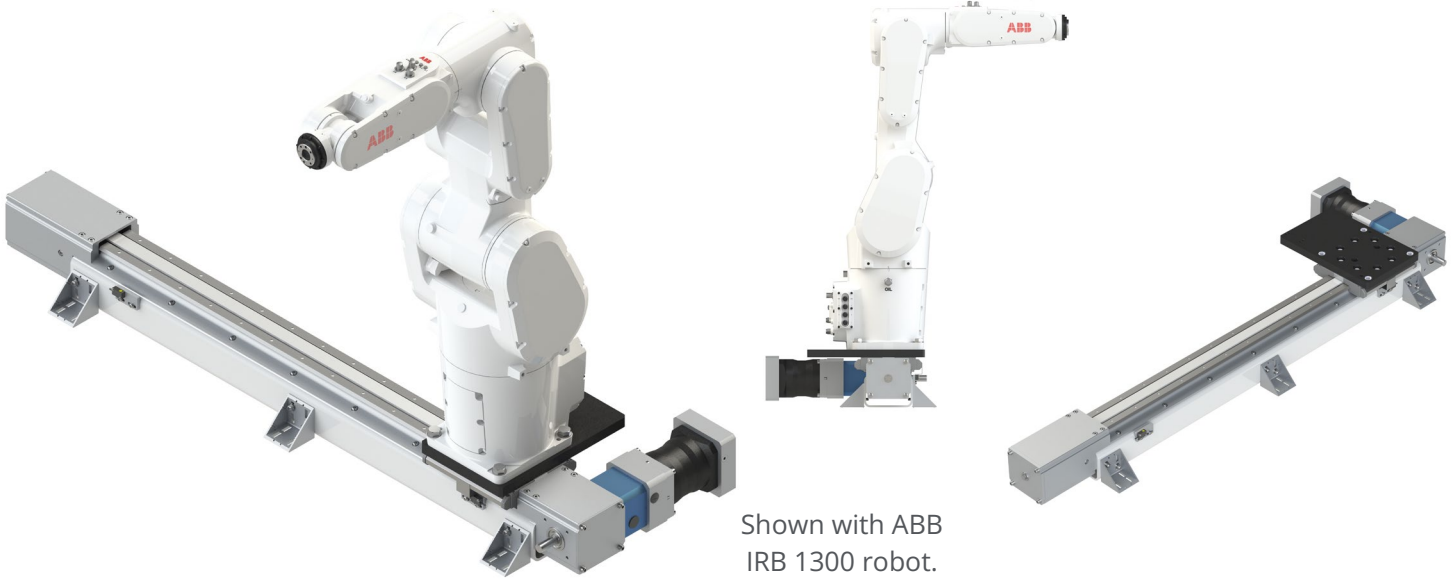
#### 3D Modeling + CAD Drawing

BWC.com

# LOPRO® RTU OVERVIEW

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## Light Capacity

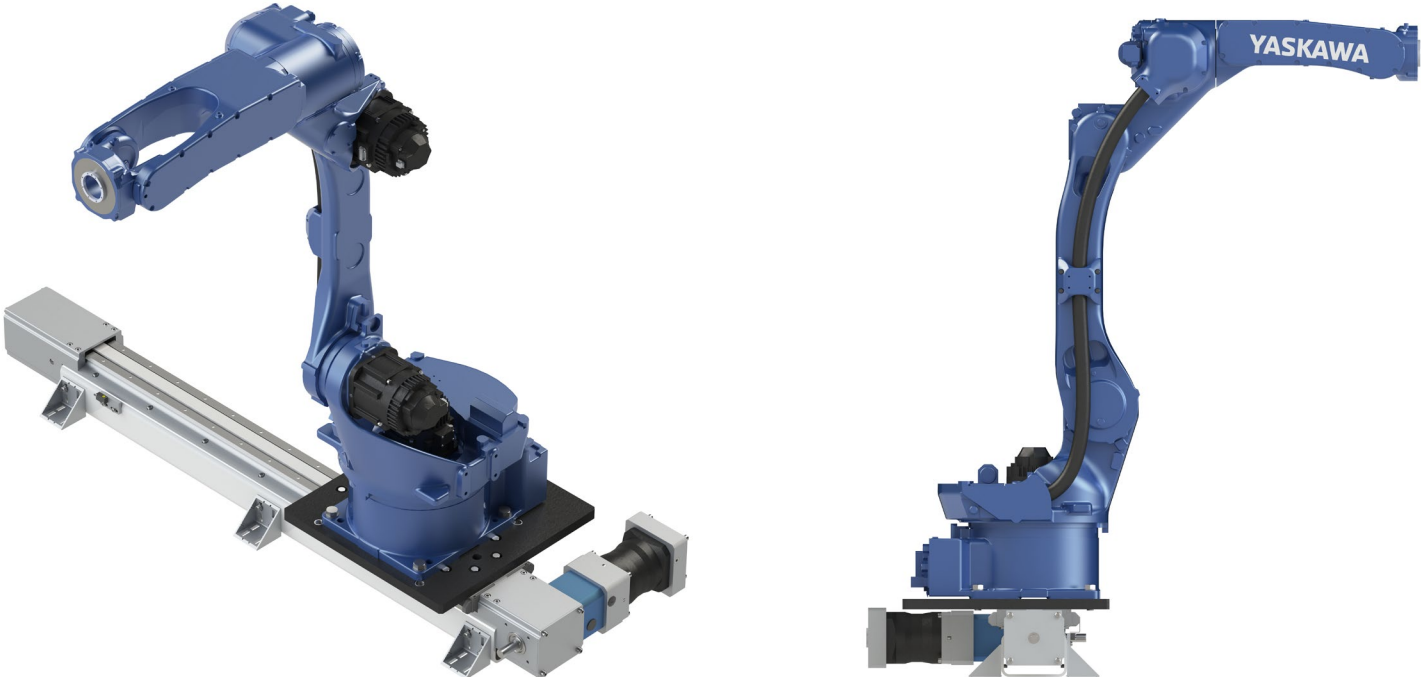


## Light Capacity Inverted

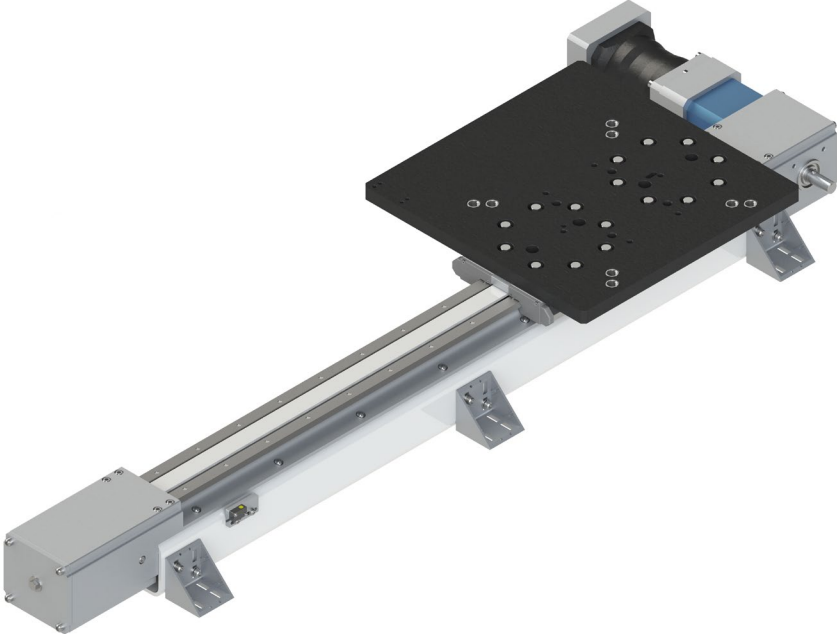


# LOPRO® RTU OVERVIEW

## Medium Capacity



Shown with Yaskawa GP12 robot. Suitable for some, but not all, application conditions.



# LOPRO® RTU-L LIGHT CAPACITY 7<sup>TH</sup> AXIS

## Light Capacity Features

The LoPro® RTU-L is designed around the **LoPro Linear Actuator** product line to provide accurate and durable motion. The RTU is based upon the size 4 actuator with a single wiper wheel plate and includes the steel support beam, cable carrier, non-contact travel limit sensors, a robot baseplate to adapt to select light capacity robots, and the gearbox with actuator mount so the RTU is ready for rapid and simple deployment into any automation project.

### **Gearbox w/ Motor Flange**

Includes gear box sized to support performance requirements including the motor flange and coupler (5:1 gearbox as standard); motor sold separately

### **Robot Baseplate**

Platform for mounting various robots feature steel threaded inserts and cable carrier mount

### **DualVee® Wheel Bearings**

Four (4) 90-degree vee guide wheel bearings support robots at full reach and payload

### **DualVee® Track**

Hardened 90-degree vee guide track for linear guideways

### **Belt Drive**

Linear drive via steel cable reinforced polyurethane toothed belt

### **Mounting Brackets**

Multi-point mounting brackets enable rapid and rigid mounting

### **Structural Beam**

Constructed with steel rectangular tubing and finished with paint

### **Travel Limit Sensor(s)**

Non-contact inductive sensor detects travel limits and assists homing; additional and alternative sensors available

### **Belt Tensioning Mechanism**

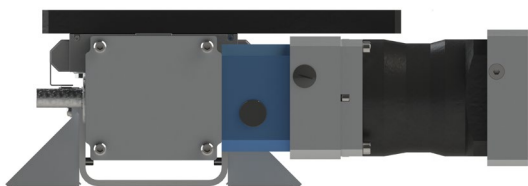
Adjust belt tension to eliminate stretch and improve precision

### **Cable Carrier (Not Shown)**

Cable management system to eliminate tangling; tray not included



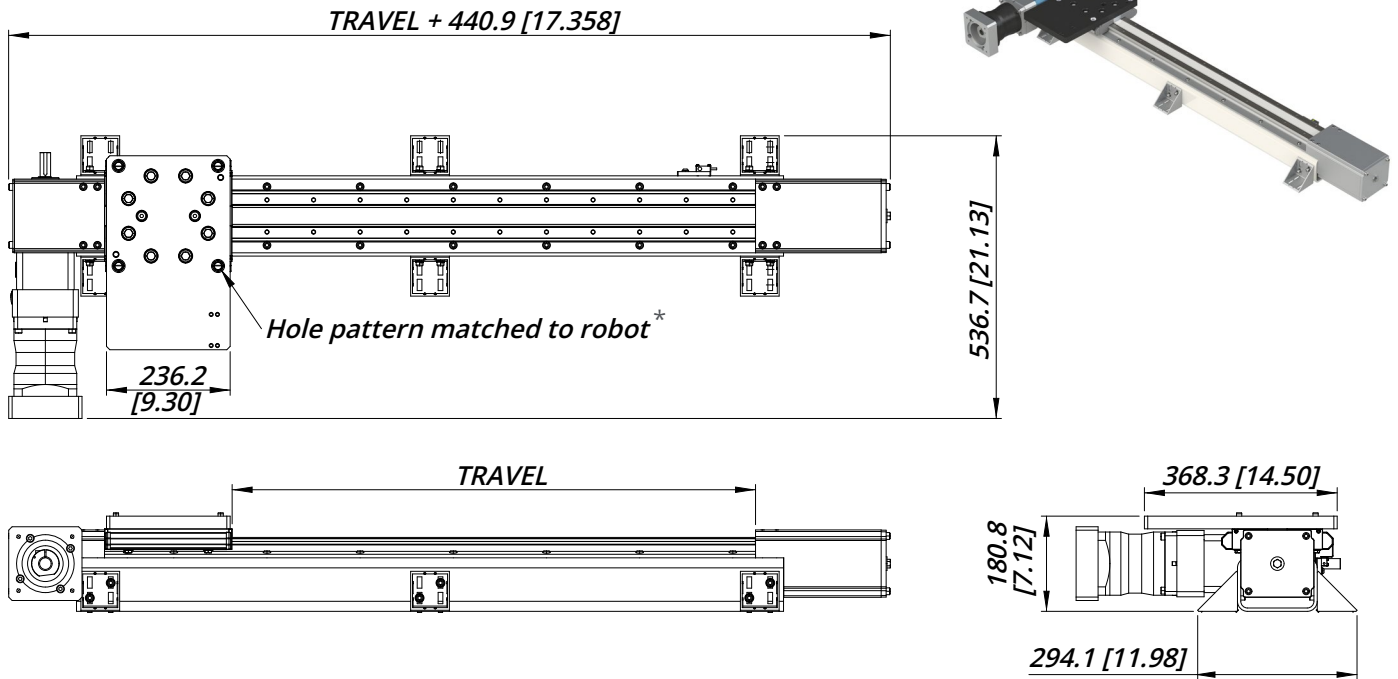
Shown with ABB IRB 1300 robot.



End View

# LOPRO® RTU-L LIGHT CAPACITY 7<sup>TH</sup> AXIS

## Dimensions



All values in millimeters [inches] unless specified.

Additional actuator dimensions can be found on page 11 of the Bishop-Wisecarver® LoPro Linear Actuator product catalog.

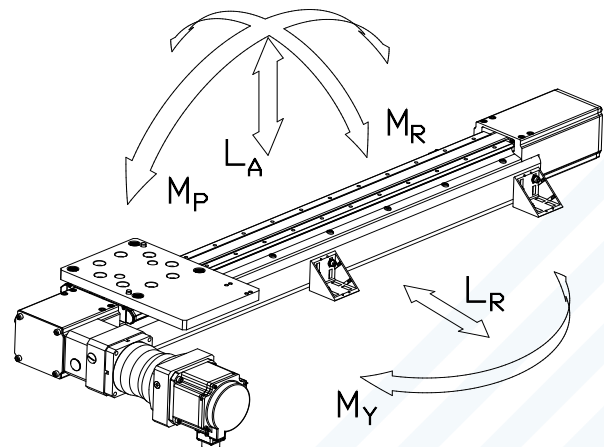
\*Actual robot mounting hole pattern will match specified robot, which may impact plate dimensions and overall dimensions; Contact BW for details and updated drawings.

## Working Load Capacity

RTU LOAD CAPACITIES	SYSTEM SIZE	AXIAL $L_A$		RADIAL $L_R$		PITCH $M_P$		YAW $M_Y$		ROLL $M_R$		THRUST (APPROXIMATE, SLOW SPEED)	
		N	LBF	N	LBF	N-M	LBF-FT	N-M	LBF-FT	N-M	LBF-FT	N	LBF
	LIGHT	15,684	3,526	19,012	4,274	1,220	900	1,478	1,090	1,174	866	2,818	633.5

The thrust capacity is equal to the belt teeth shear strength, which is dependent on system speed. See "RTU Load Calculations" on page 9.

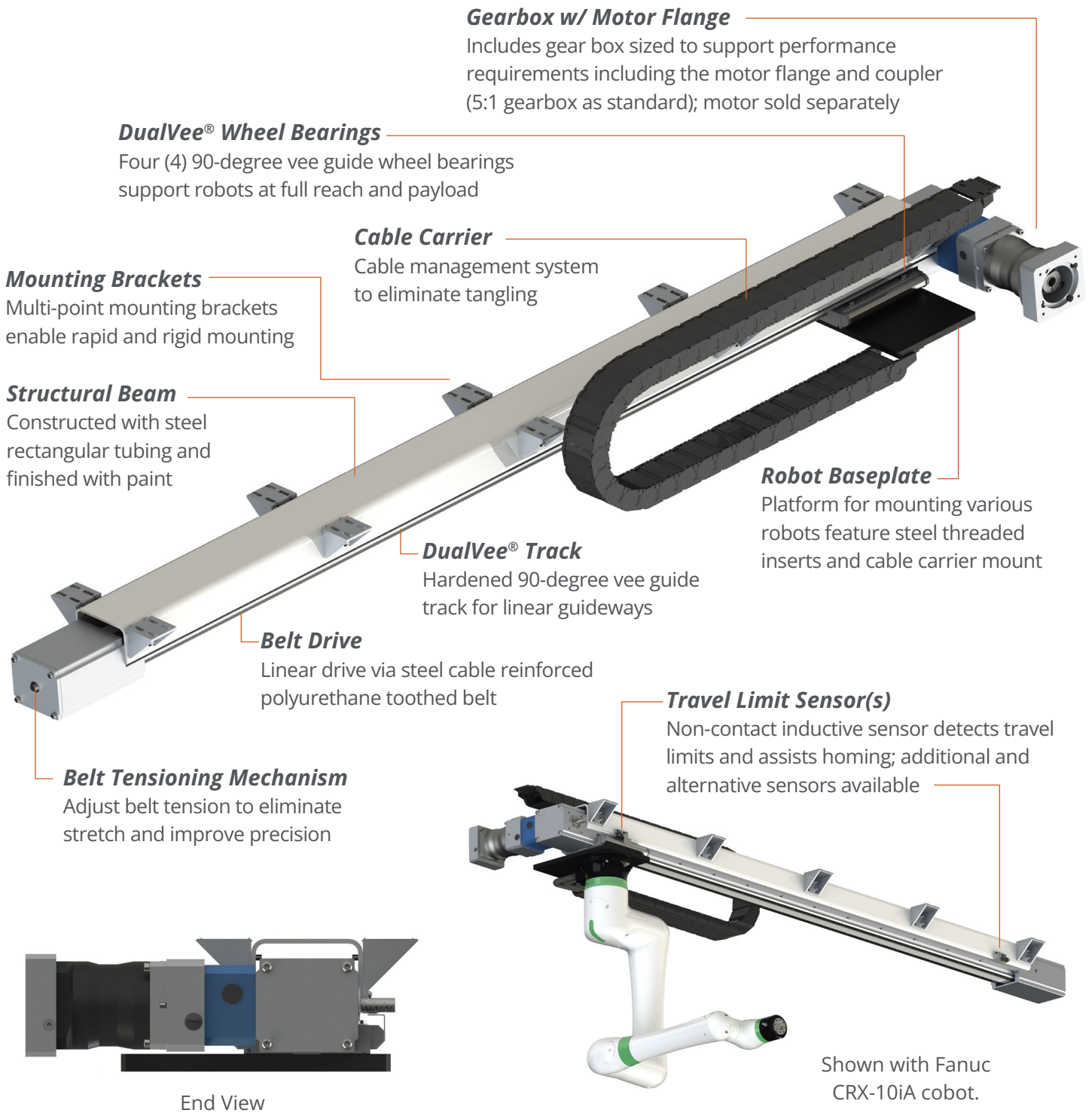
Working load capacities are based on empirical data on guide wheels used in general applications with static and dynamic load conditions. Guide wheels can routinely achieve travel life of one million cycles or higher when these specified load capacities are observed.



# LOPRO® RTU-L INVERTED LIGHT CAPACITY 7<sup>TH</sup> AXIS

## Light Capacity Inverted Features

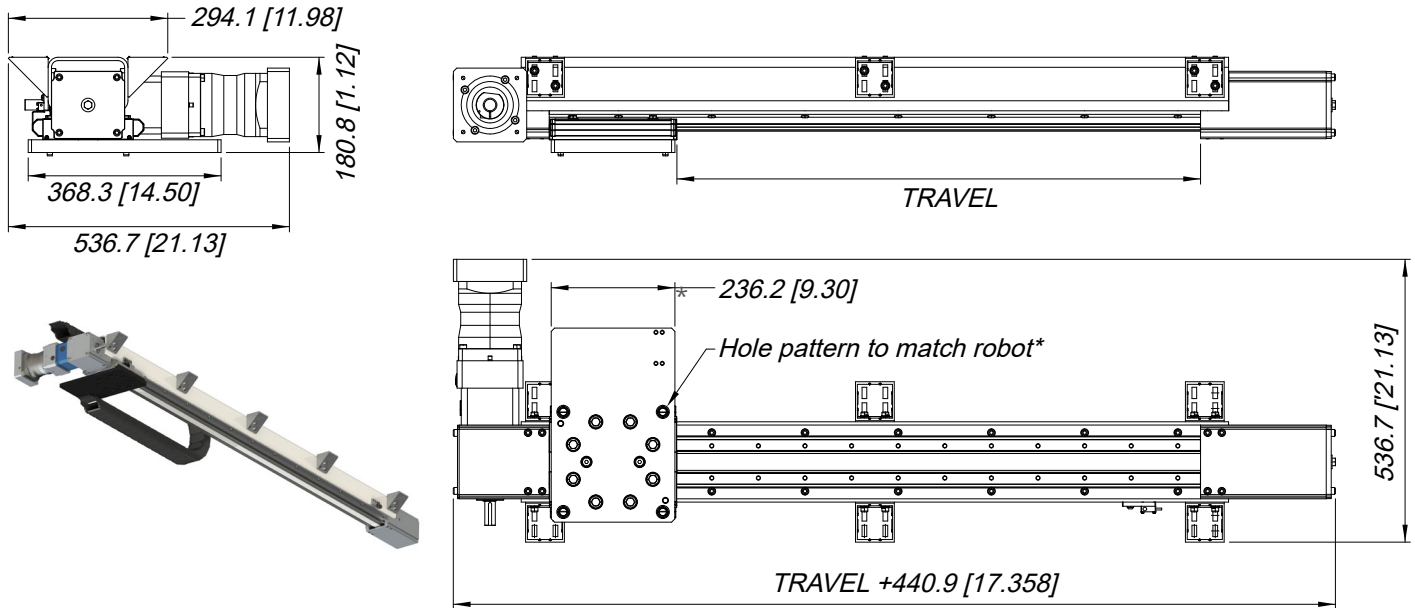
The LoPro® RTU-L Inverted is designed around the **LoPro Linear Actuator** product line to provide accurate and durable motion when mounted into an overhead location. The RTU is based upon the size 4 actuator with a single wiper wheel plate and includes the steel support beam, cable carrier, non-contact travel limit sensors, a robot baseplate to adapt to select light capacity robots, and the gearbox with actuator mount so the RTU is ready for rapid and simple deployment into any automation project.





# LOPRO® RTU-L INVERTED LIGHT CAPACITY 7<sup>TH</sup> AXIS

## Dimensions



All values in millimeters [inches] unless specified.

Additional actuator dimensions can be found on page 11 of the Bishop-Wisecarver® LoPro Linear Actuator product catalog.

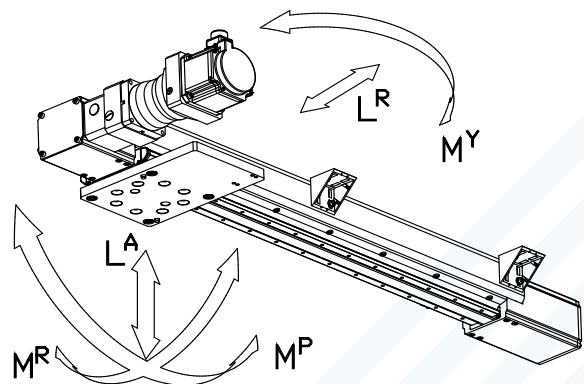
\*Actual robot mounting hole pattern will match specified robot, which may impact plate dimensions and overall dimensions; Contact BW for details and updated drawings.

## Working Load Capacity

RTU LOAD CAPACITIES	SYSTEM SIZE	AXIAL $L_A$		RADIAL $L_R$		PITCH $M_P$		YAW $M_Y$		ROLL $M_R$		THRUST (APPROXIMATE, SLOW SPEED)	
		N	LBF	N	LBF	N-M	LBF-FT	N-M	LBF-FT	N-M	LBF-FT	N	LBF
	LIGHT	15,684	3,526	19,012	4,274	1,220	900	1,478	1,090	1,174	866	2,818	633.5

The thrust capacity is equal to the belt teeth shear strength, which is dependent on system speed. See "RTU Load Calculations" on page 13 & 14.

Working load capacities are based on empirical data on guide wheels used in general applications with static and dynamic load conditions. Guide wheels can routinely achieve travel life of one million cycles or higher when these specified load capacities are observed.



# LOPRO® RTU-M MEDIUM CAPACITY 7<sup>TH</sup> AXIS

## Medium Capacity Features

The LoPro® RTU-M is designed around the **LoPro Linear Actuator** product line to provide accurate and durable motion. The RTU is based upon the size 4 actuator with a pair of wiper wheel plates and includes the steel support beam, cable carrier, non-contact travel limit sensors, a robot baseplate to adapt to select light/moderate capacity robots, and the gearbox with actuator mount so the RTU is ready for rapid and simple deployment into any automation project.

### **Gearbox w/ Motor Flange**

Includes gear box sized to support performance requirements including the motor flange and coupler (5:1 gearbox as standard); motor sold separately

### **Robot Baseplate**

Platform for mounting various robots feature steel threaded inserts and cable carrier mount

### **DualVee® Wheel Bearings**

Eight (8) 90-degree vee guide wheel bearings support robots at full reach and payload

### **DualVee® Track**

Hardened 90-degree vee guide track for linear guideways

### **Belt Drive**

Linear drive via steel cable reinforced polyurethane toothed belt

### **Mounting Brackets**

Multi-point mounting brackets enable rapid and rigid mounting

### **Structural Beam**

Constructed with steel rectangular tubing and finished with paint

### **Travel Limit Sensor(s)**

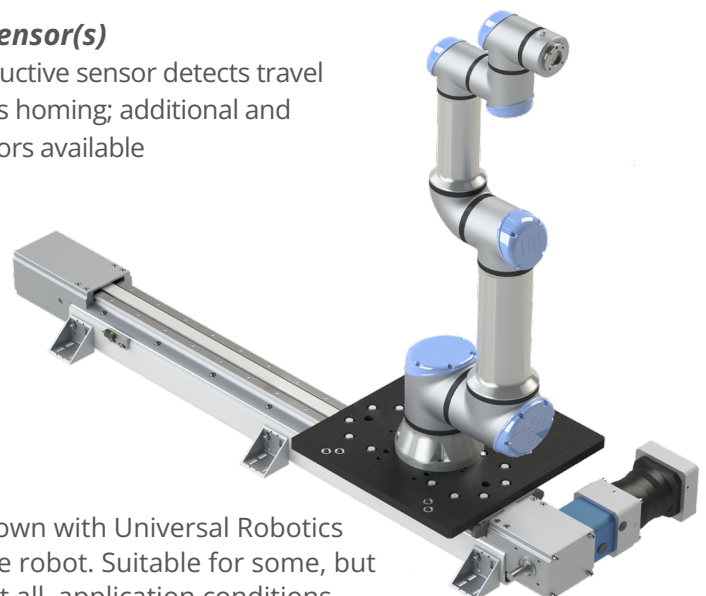
Non-contact inductive sensor detects travel limits and assists homing; additional and alternative sensors available

### **Belt Tensioning Mechanism**

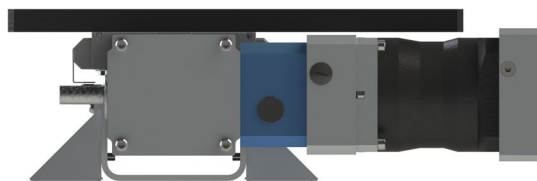
Adjust belt tension to eliminate stretch and improve precision

### **Cable Carrier (Not Shown)**

Cable management system to eliminate tangling; tray not included



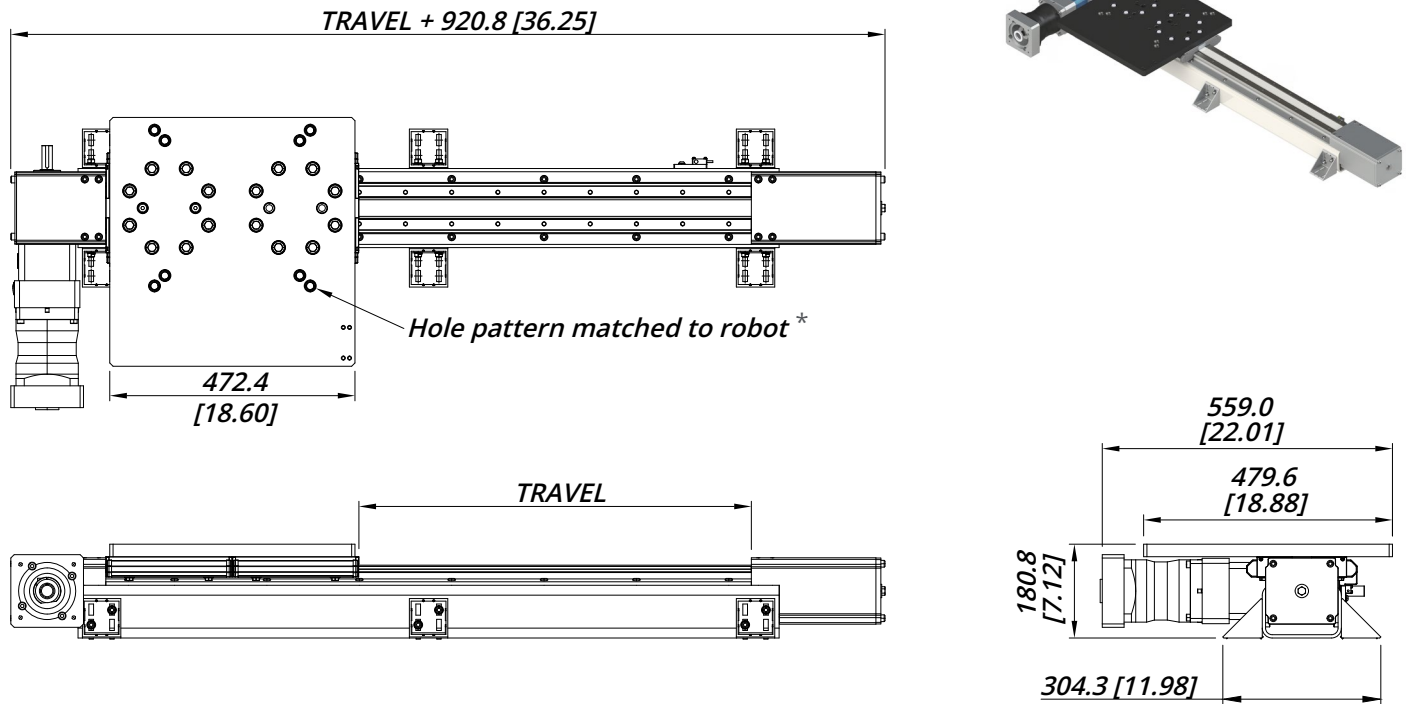
Shown with Universal Robotics UR16e robot. Suitable for some, but not all, application conditions.



End View

# LOPRO® RTU-M MEDIUM CAPACITY 7<sup>TH</sup> AXIS

## Dimensions



All values in millimeters [inches] unless specified.

Additional actuator dimensions can be found on page 11 of the Bishop-Wisecarver® LoPro Linear Actuator product catalog.

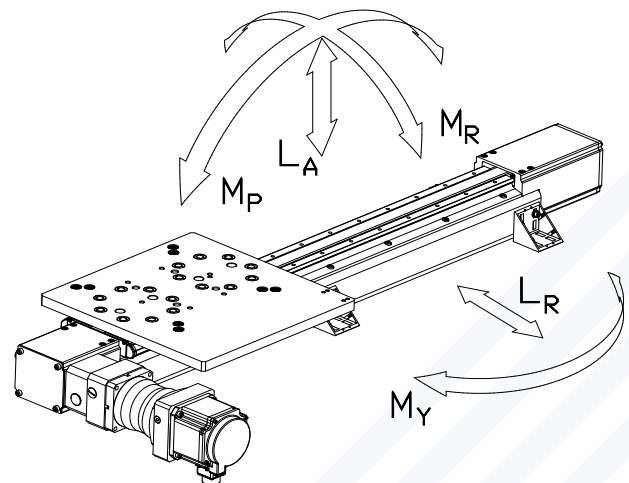
\*Actual robot mounting hole pattern will match specified robot, which may impact plate dimensions and overall dimensions; Contact BW for details and updated drawings.

## Working Load Capacity

RTU LOAD CAPACITIES	SYSTEM SIZE	AXIAL $L_A$		RADIAL $L_R$		PITCH $M_P$		YAW $M_Y$		ROLL $M_R$		THRUST (APPROXIMATE, SLOW SPEED)	
		N	LBF	N	LBF	N-M	LBF-FT	N-M	LBF-FT	N-M	LBF-FT	N	LBF
	MEDIUM	31,368	7,052	38,024	8,548	2,440	1900	2,956	2,180	2,348	1732	2,818	633.5

The thrust capacity is equal to the belt teeth shear strength, which is dependent on system speed. See "RTU Load Calculations" on page 13 & 14.

Working load capacities are based on empirical data on guide wheels used in general applications with static and dynamic load conditions. Guide wheels can routinely achieve travel life of one million cycles or higher when these specified load capacities are observed.



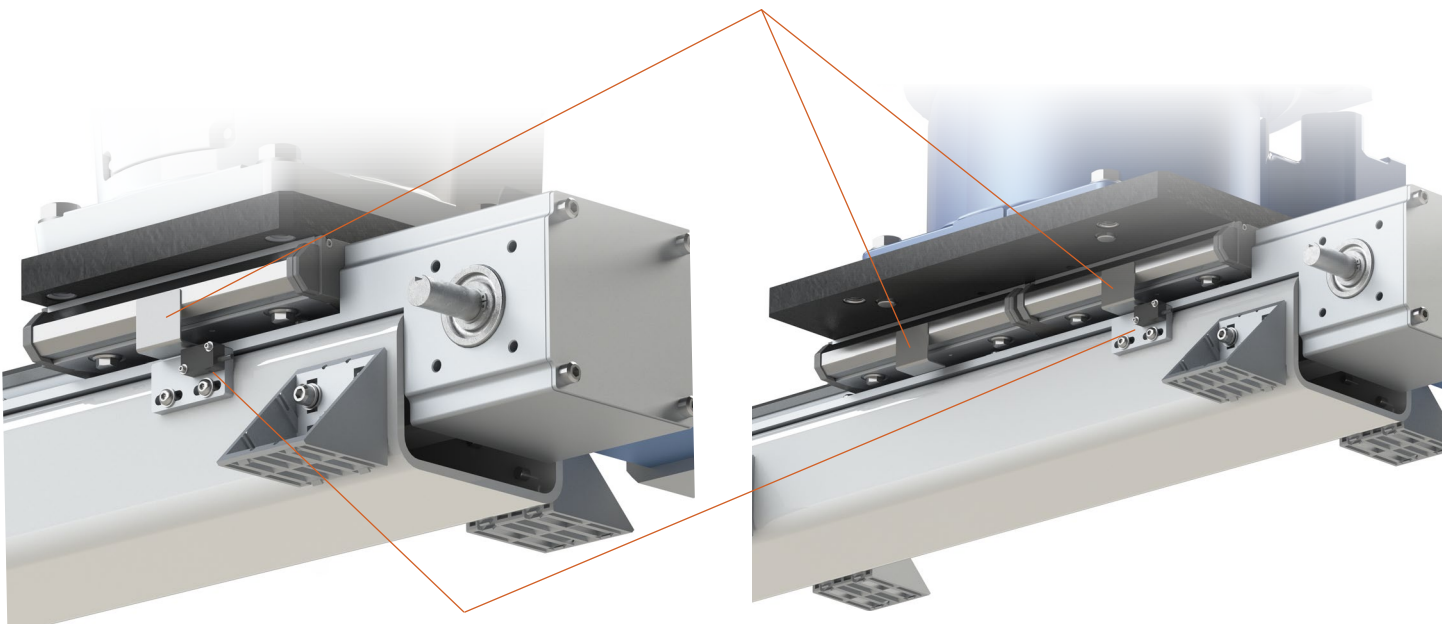
# TRAVEL LIMIT SENSORS

## Travel Limit Sensors

LoPro® RTUs include a non-contact inductive proximity travel limit sensor with adjustable mounts, with the option to add a second limit sensor to the opposite end. The wheel plate features a stainless steel cover with sensor flag to trigger the sensor. Travel limit sensors are an important part of an overall safety system and are vital to homing and detecting travel limits. Control safety circuits can be designed to stop motion when limit sensors are triggered. This can be used to prevent damage or injury.

### Sensor Flag(s)

Dual wheel plate mounted sensor flags will trigger the travel sensors when detected



### Travel Limit Sensor

Non-contact inductive limit sensor on adjustable mount;  
One (1) LP4SNSRINDWNOK (NPN normally open sensor kit)  
quoted as standard for carriage homing. Specify alternative  
or additional kits as required for your application.

#### Sensor Kits

SENSOR TYPE	SENSOR KIT STOCK CODE
<i>NPN Normally Open</i>	LP4SNSRINDWNOK (default)
<i>NPN Normally Closed</i>	LP4SNSRINDWNCK
<i>PNP Normally Open</i>	LP4SNSRINDWPOK
<i>PNP Normally Closed</i>	LP4SNSRINDWPCK

# EXAMPLE ROBOTS

## Example Robot Specifications

Various robot manufacturers publish capability specifications including the maximum foundation loading conditions that the robot is capable of transmitting to the mounting base. Below is a summary of robot specifications (for normal operating conditions) that are relevant to the light/medium capacity RTU's from Bishop-Wisecarver.

COBOTS & ROBOT SPECIFICATIONS	BRAND	MODEL	PAYLOAD MAX.	ROBOT WEIGHT	REACH	THRUST	MAX VERTICAL FORCE (F <sub>v</sub> )	MAX HORIZONTAL FORCE (F <sub>h</sub> )	MAX VERTICAL MOMENT (T <sub>v</sub> )	MAX HORIZONTAL MOMENT (T <sub>h</sub> & T <sub>r</sub> )	RTU WHEEL PLATE SIZE
			KG	KG	MM	N	N	N	N-M	N-M	
			ABB	IRB 1300	12	79	1,400	821	1,428	821	
ABB	IRB 1600	10	250	1,200	1,850	3,850	1,850	855	1,750	Medium *	
FANUC	M-10iD/16S	16	140	1,103	566	2,205	566	255	2,007		
YASKAWA	GP12	12	150	1,440	566	1,475	2,948	1,275	1,670		
YASKAWA	GP8	8	32	1,312	343	343	343	216	265	Inverted	
FANUC	CRX-10iA	10	39	1,249	220	800	220	250	610		
UNIVERSAL ROBOTS	UR10e	12.5	33.5	1,300	246	894	246	280	682		

\* These robots are not recommended for medium 7th axis when loaded to maximum payload. In all cases, please verify your specific robot loading specifications to determine suitability. Robot specifications are provided by the manufacturer and referenced here for convenience.

# LOAD CALCULATIONS

## Thrust Load Specifications

RTU SYSTEM BELT LOAD CAPACITIES				DRIVE END PULLEYS PITCH DIAMETER		BELT TEETH SHEAR STRENGTH FORMULA (N)* (APPROX.)	BELT TEETH SHEAR STRENGTH AT V=0 M/S (N)*	BELT TEETH SHEAR STRENGTH AT V=5.5 M/S (N)*
SYSTEM SIZE	BELT SIZE	WORKING TENSILE LOAD		MM	IN			
		N	LBF					
LIGHT/MEDIUM	32AT10	4,170	937	95.5	3.759	$F = 2818 - 4.80V^3 + 60.0V^2 - 369V$	2,818	1,805

If the wheel plate will be subjected to shock loads, divide the permissible linear force by a safety factor of 1.4 (light shock) to 2 (high shock).

\*The belt teeth shear strength is the permissible linear force which the drive pulley can apply to the wheel plate. The sum of the linear force applied to the wheel plate and the belt pretension load must not exceed the working tensile load. V = Linear Speed.

# LOAD CALCULATIONS

## Sizing and Selection Tips

The following equation is for the purpose of estimating the applied load factor to the wheel plate and track plate only. System drive components are not accounted for, but should also be considered.

### Step 1: Calculate all forces applied to the wheel plate

Any forces applied on the wheel plate need to be considered, including inertial forces, gravitational forces, external forces such as tool pressure, impact loading, and payload. The most conservative calculations will use max foundational loading values from robot manufacturer catalogs.

If assistance is required in resolving specific loads into the resultant forces, please contact our Applications Engineering staff.

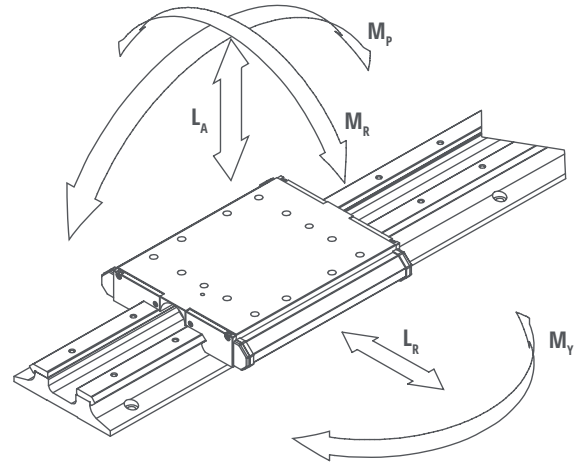
### Step 2: Calculate load factor for the wheel plate

$$L_F = \frac{F_R}{L_R} + \frac{F_A}{L_A} + \frac{T_P}{M_P} + \frac{T_Y}{M_Y} + \frac{T_R}{M_R} \leq 1$$

- WHERE**
- $L_F$  = Load factor
  - $F_R$  = Resultant radial load
  - $F_A$  = Resultant axial load
  - $T_P$  = Resultant Pitch Moment Load
  - $T_Y$  = Resultant Yaw Moment Load
  - $T_R$  = Resultant Roll Moment Load
  - $L_R$  = Radial Working Load Capacity
  - $L_A$  = Axial Working Load Capacity
  - $M_P$  = Pitch Moment Load Capacity
  - $M_Y$  = Yaw Moment Load Capacity
  - $M_R$  = Roll Moment Load Capacity
- See RTU load capacities on pages 7, 9, and 11.

Since the robot can only be extended in one horizontal direction, it is often possible to use  $T_R = \text{max applied horizontal moment}$  and  $T_P = 0$ .

If the load factor  $L_F$  is  $>1$ , consider a larger size system.



### Step 3: Calculate estimated life with adjustment factor

The Life Estimate below shares units with the Life Constant.

$$\text{Life Estimate} = \left( \frac{L_C}{(L_F)^3} \right) A_F$$

**WHERE**

- $L_F$  = Load Factor
- $L_C$  = Life Constant
- $A_F$  = Adjustment Factor

Life Constant $L_C$		
WHEEL SIZE	KILOMETERS OF TRAVEL LIFE	INCHES OF TRAVEL LIFE
4	173	$6.84 \times 10^6$

Adjustment Factor $A_F$	
CONDITIONS	$A_F$
Clean, adequate lubrication, low duty, low shock, low vibration	1.0 - 0.7
Moderate contamination, medium duty, medium shock, low to medium vibration	0.7 - 0.4
Heavy contamination, limited lubrication, high duty, high acceleration, medium to high shock, high vibration	0.4 - 0.1

# STOCK CODES, SET-UP AND MAINTENANCE

## Part Number Scheme

PREFIX	WHEEL PLATE SIZE	TRACK / WHEEL MATERIAL	SENSOR / DRIVE ORIENTATION	ROBOT*	-	TRAVEL LENGTH	LENGTH UNIT
LPRTU	L (Light Capacity; Single)	4C (Size 4 Carbon Steel; Standard)	RR (Sensors Right, Gearbox & Cable Carrier Right)	A (ABB IRB 1300; use wheel plate L or M)	-	Enter value in 1 meter increments	M
	M (Medium Capacity; Dual)	4S (Size 4 Stainless Steel)	RL (Sensors Right, Gearbox & Cable Carrier Left)	B (Fanuc M-10iD; use wheel plate M)			
			LL (Sensors Left, Gearbox & Cable Carrier Left)	C (Yaskawa GP12; use wheel plate M)			
			LR (Sensors Left, Gearbox & Cable Carrier Right)	D (ABB IRB 1600; use wheel plate M)			
				E (Fanuc CRX-10iA; use wheel plate L; can be installed inverted)			
				F (Universal Robotics UR10e; use wheel plate L; can be installed inverted)			
				G (Yaskawa GP8; use wheel plate L; can be installed inverted)			

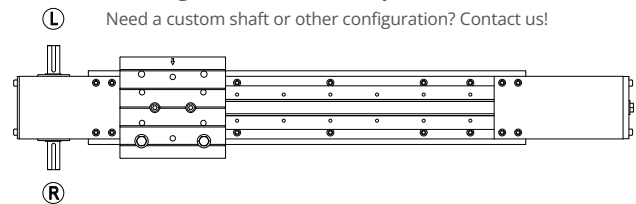
### Part Number Example:

LPRTUM4CRLB-2M = LoPro® RTU, Dual Wheel Plate Assembly, Right Hand Sensor Orientation, Left Hand Drive Assembly, Fanuc M-10iD compatible, 2 meter travel length.

\*Robots listed here are for example only; many more robots are compatible with LoPro RTU. Contact us to specify robots not listed here.

### Left/Right Orientation (Top View Shown)

Need a custom shaft or other configuration? Contact us!



## Accuracy/Repeatability

The accuracy of a LoPro® RTU linear system is dependent upon the mounting surface preparation and the technique used to align the track. RTU systems can achieve straightness and flatness characteristics to within .004in/foot (0.1mm/300mm) when mounting surfaces are adequately prepared. Straight line accuracy of beam mounted RTU's are subject to the industry standard straightness and twist tolerances associated with extruded or hot formed sections.

## Fit-up Adjustment

The concentric bushings/wheels determine the alignment of the system, while the eccentric bushings/wheels provide adjustment. Normal adjustment is obtained by rotating the eccentric bushings until all free play is removed from the carriage assembly. When the eccentrics are adjusted and the carriage plate is held firmly in place, one should be able to rotate, by hand, any of the four guide wheels against its mating track. If rotation is not possible, preload on the wheels should be reduced accordingly. Over-tightening the eccentric adjustment could exert a force greater than the load rating of the wheel and result in premature bearing failure. All RTU systems are factory pre-adjusted and assembled before delivery.

## Lubrication

Lubrication is the key to maximizing service life in any rolling contact linear bearing design. RTU guide wheels are internally lubricated for the expected service life with an extreme pressure, corrosion resistant grease. As such, the main consideration with regards to lubrication is the wheel/track interface.

Typically, a light machine oil or an extreme pressure grease does well to minimize wear, stick slip, and corrosion. Lubrication will maximize the load capacity of an individual bearing element. As such, for any specific loading condition, the presence of lubrication on the guide ways will significantly increase the service life over a non-lubricated configuration under the same loads.

RTU systems include wiper wheel plates that feature lubricating wiper caps which contain oil saturated felt lubrications. Frequent inspection and re-saturation with fresh oil is recommended to ensure that the wheel/track interface is well lubricated.

Disclaimer: All trademarks, logos and brand names are the property of their respective owners. All company, product and service names used in this catalog are for identification purposes only. Use of these names, trademarks, and brands does not imply endorsement.

### Components & Accessories

DualVee®  
 MadeWell®  
 GV3  
 SL2  
 PRT2  
 HDS2  
 HDRT  
 MCS  
 Motor Mounts  
 Gantry Brackets  
 Wrenches

### Manual Linear Guide Systems

DualVee®  
 UtiliTrak®  
 MinVee®  
 GV3  
 Simple Select®  
 SL2  
 HDS2  
 MHD  
 HTS

### Actuated Linear Guide Systems

LoPro®  
 XLA™  
 ECO60™  
 SlickStick™  
 SteadyRail™  
 HDLS  
 HDCS  
 PDU2  
 DAPDU2  
 SBD  
 PSD  
 SDM  
 DLS

### Rotary Guide Systems

PRT2  
 DTS2  
 DTS  
 DTS+  
 ALR  
 HDRT  
 1-Trak  
 GFX

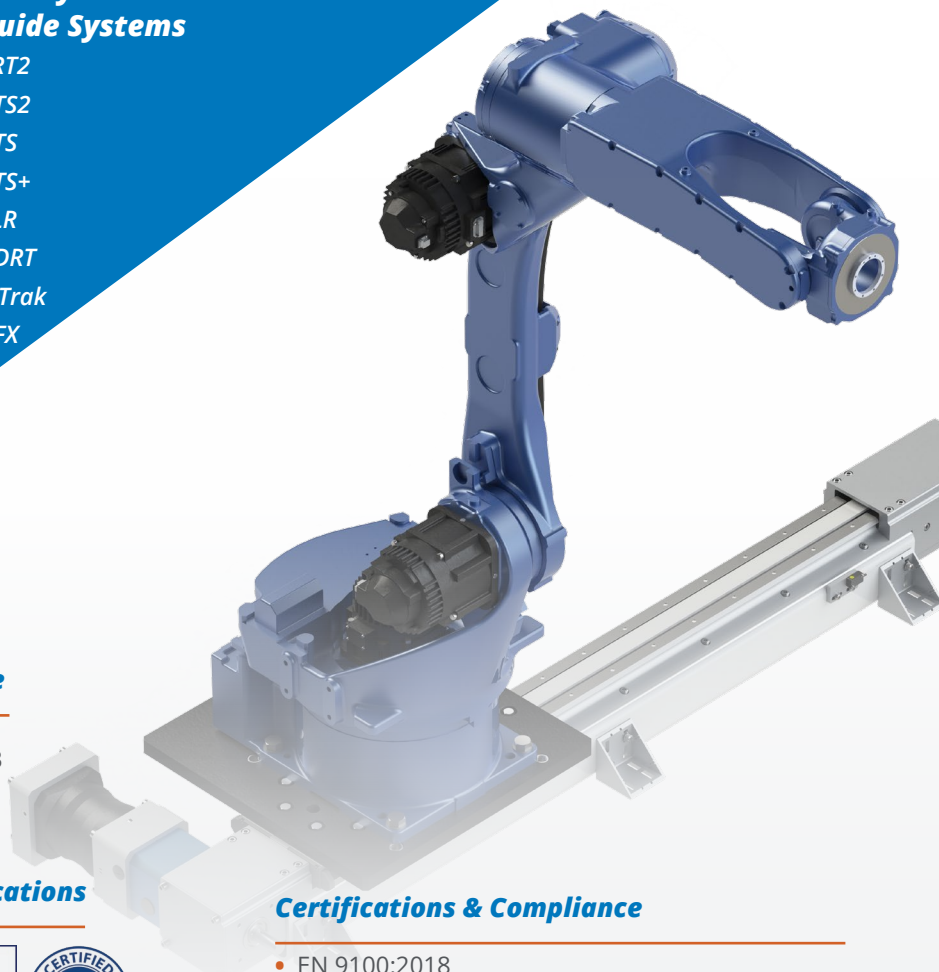
### Robot Transfer Units

DualVee® RTU  
 LoPro® RTU

### Custom Solutions

Extruded Profile Guides  
 Custom Bearings  
 Custom Sub-assemblies  
 Engineering Services  
 Large Diameter Ring Guides and Track

**BWC.COM**



### Women's Business Enterprise



- Certified WOSB

### Contact

Web: **BWC.com**  
 Phone: **(925) 439-8272**  
 Email: **Sales@bwc.com**

**Corporate Office**  
 Bishop-Wisecarver  
 2104 Martin Way  
 Pittsburg, CA 94565

### Quality Certifications



- Certified Bay Area Green Business
- Certified Evergreen

### Certifications & Compliance

- EN 9100:2018
- JISQ 9100:2016
- ISO 13485 & GMP Compliance
- Responsible Minerals Initiative
- RoHS
- International Traffic in Arms Regulations Compliant