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Orca™ Series Datasheet

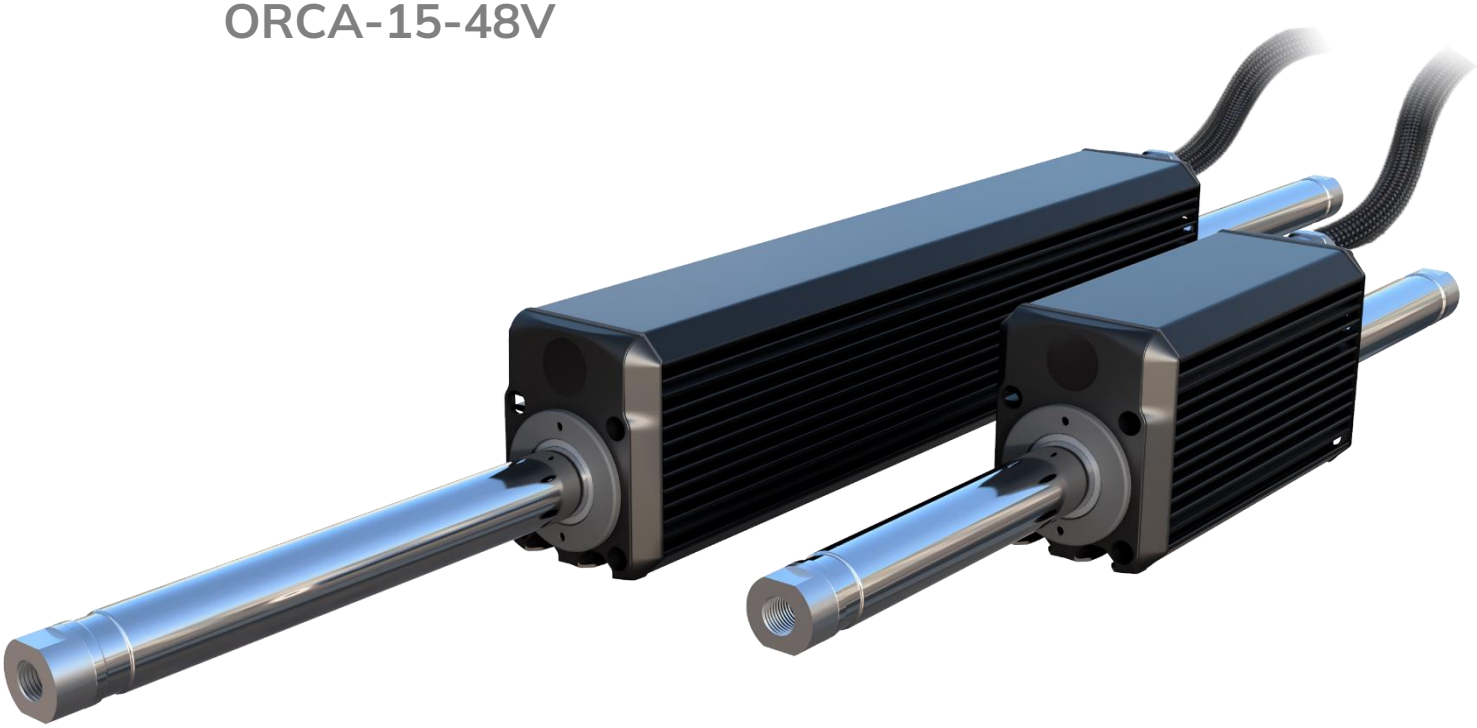
Smart Linear Motors

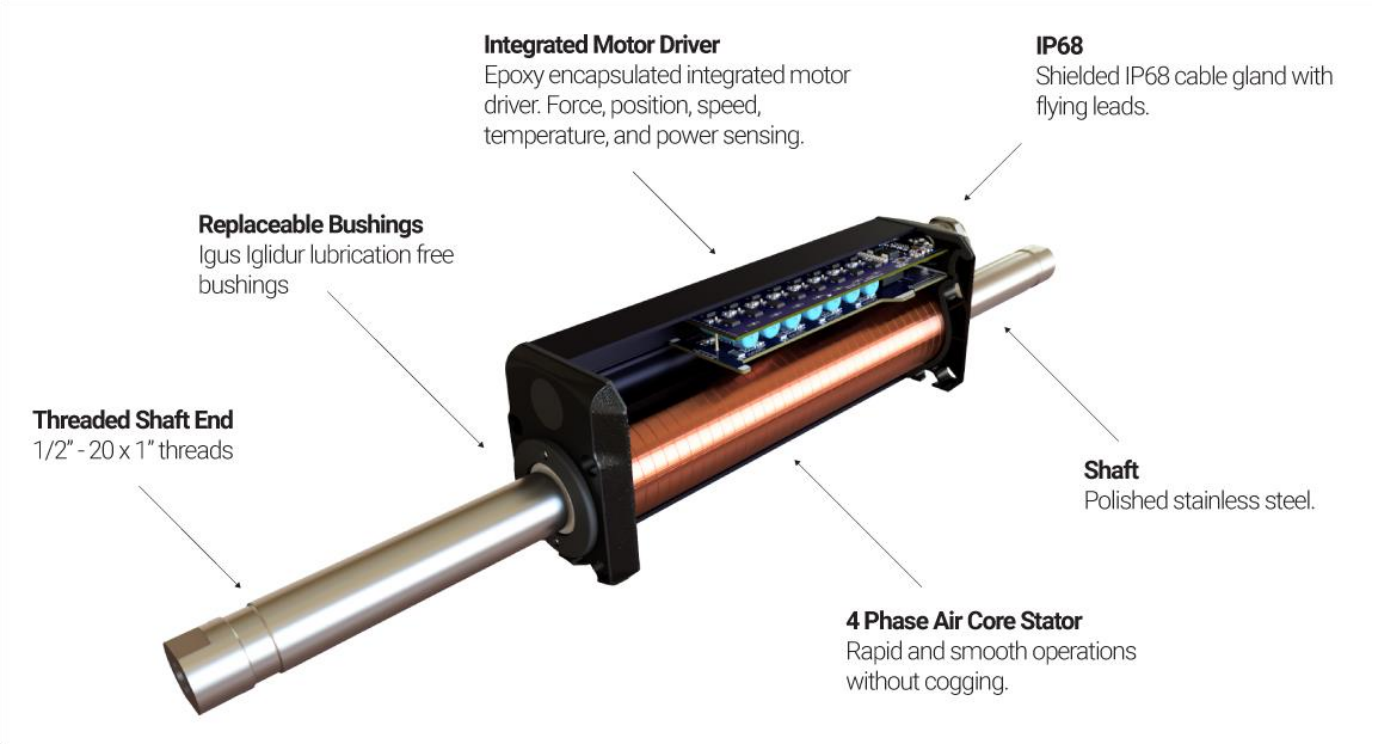
ORCA-6-LITE

ORCA-6-24V

ORCA-6-48V

ORCA-15-48V





Orca Series Linear Motors feature high performance, ultra-low latency, quiet, low total costs of ownership, and silent operation. These motors are force controlled making them ideal for applications with human-machine interaction.
An **all-in-one** approach means every motor includes integrated drivers, power delivery, logic, and sensing. There are no requirements to buy a separate controller.

Product Highlights

- Integrated Waterproof IP68 Motor Driver
- Integrated Position and Force Sensing
- Highspeed Force and Position Control
- Very Quiet
- Powered by low voltage DC
- Single Moving Part
- Hardened RS485 Communications
- Back Drivable with Low Force Ripple
- Low Maintenance
- Simple to Use

Orca Series Overview

Part Number	Voltage Supply	Max Force	Max Speed	Force Accuracy *without external calibration*	Position Sensor Accuracy
ORCA-6-LITE	12 to 30	247 N *55.5 lbf*	1.3 m/s *51 in/s*	0.74 N *0.166 lbf*	±150 um *±0.0059 in*
ORCA-6-24V	12 to 60	426 N *95.7 lbf*	3.8 m/s *148 in/s*	0.57 N *0.128 lbf*	
ORCA-6-48V		638 N *143.5 lbf*	2.5 m/s *99 in/s*	0.64 N *0.144 lbf*	
ORCA-15-48V		1061 N *238.5 lbf*	1.5 m/s *60 in/s*	0.97 N *0.218 lbf*	

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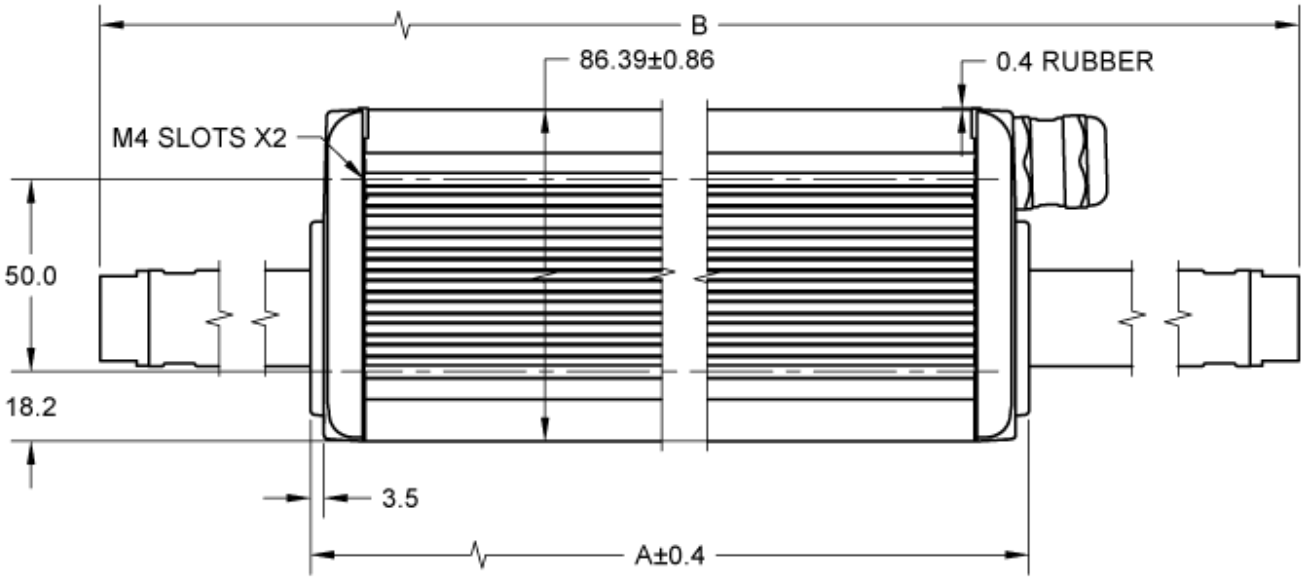
Mechanical Drawings

Orca Series motors come in standard sizes as shown in the table below. Stroke length is calculated based on stator and shaft length.

The Orca Series is built to standard mechanical specifications, see below. Please contact us at sales@irisdynamics.com if your application requires modifications from this standard. Common modifications include shaft length, rear tube length, and stator color.



Motor Body Mechanical Specifications

		ORCA-6-LITE, ORCA-6-24V, ORCA-6-48V	ORCA-15-48V
Length	A	175 mm *6.9 in*	404 mm *15.9 in*
Weight		2.4 kg *5.29 lbs*	5.3 kg *11.7 lbs*
Chassis Material		Anaodized Aluminum	
Bushing Material		Igus GFM-2526-25	

Standard Shaft Mechanical Specifications

		ORCA-6-LITE, ORCA-6-24V, ORCA-6-48V	ORCA-15-48V
Length	B	381 mm *15 in*	762 mm *30 in*
Usable Stroke		129 mm *5.1 in*	282 mm *11.1 in*
Weight		1.38 kg *3.04 lbs*	2.77 kg *6.11 lbs*
Diameter		25 mm *0.98 in*	25 mm *0.98 in*
Material	`	Stainless Steel	
Coupling		1/2-20 Threaded Hole	

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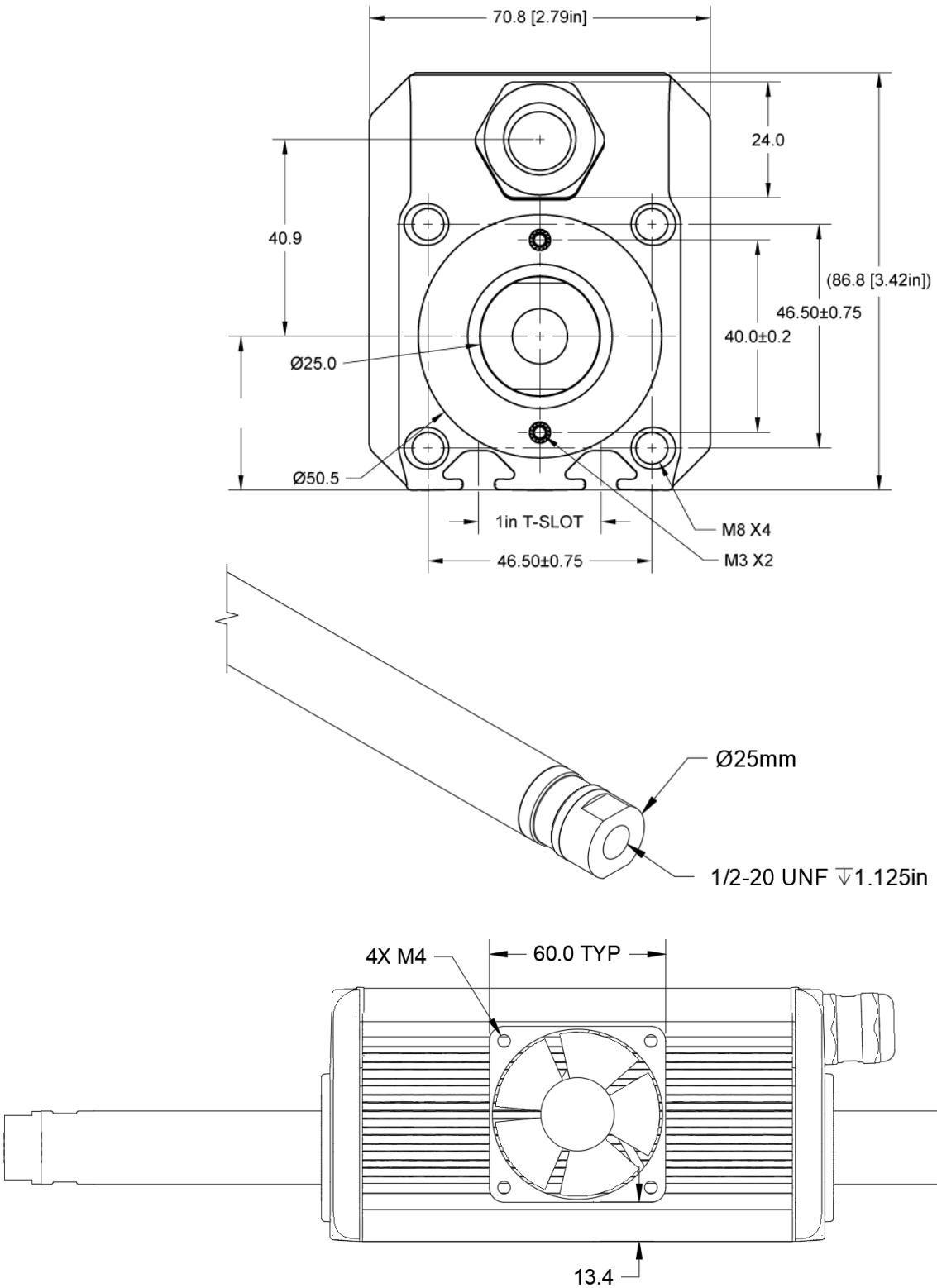
Mechanical Drawings



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Electrical & Software Interfacing

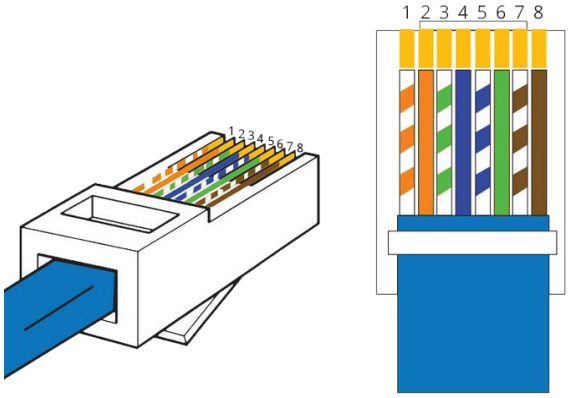
Interface Options and Application Compatibility

There are several ways to integrate Orca Series motors in applications. Below is a list of commonly supported applications, but any application that can support serial messages or analog/digital inputs and outputs can control one or more motors.

Quick Application Information

Supported Application irisdynamics.com/articles	Compatible Interfaces *USB*	 *RS485/ RS422*	 *Analog / Digital*	Supporting Tools irisdynamics.com/downloads	Required Accesory *See page 16/17 for details*
MATLAB, Labview	x			Iris SDK for MATLAB/Labview	USB-to-RS422 Cable + RJ45 Splitter
Unity, Unreal, General C++	x			Iris SDK for Windows	USB-to-RS422 Cable + RJ45 Splitter
Windows Plug-and-Play	x			***IrisControls Software****	USB-to-RS485 Cable + RJ45 Splitter
PLC or Microcontroller		x		Orca Series MODBUS User Guide	None
PLC or Microcontroller			x	Orca IO SmartHub User Guide	Orca IO Smart Hub
Pneumatic Retrofit			x	Orca IO SmartHub User Guide	Orca IO Smart Hub

**IrisControls Software can be used in combination with any other interface to aid development and provide comprehensive real-time feedback*



Data Cable

Orca Series motors include a shielded communication cable of twisted pairs carrying the differential signals used to transmit and receive characters on two separate interfaces, as well as 5V lines which can power small external loads, or be used to power the integrated logic and sensors when no main power is provided to the motor.

Data Cable Specifications

Pos	Use	Notes	Electrical Standard	ESD Rating
1	MODBUS RX+	120 ohm termination	Exceeds TIA-485-A	IEC 61000-4-2 Level 4
2	MODBUS RX-			
3	MODBUS TX+	120 ohm termination		
4	IrisControls TX/RX+			
5	IrisControls TX/RX-			
6	MODBUS TX-			
7	+5V	Can be used to power logic in absence of main suppy. Use 4.5 to 5.5 VDC	500 mA max output	
8	GND			

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Electrical & Software Interfacing

Modbus RTU Serial Interface

Orca Series motors feature a 'field-bus' serial communication interface which allows configuration, control, and monitoring. Features of the motors are offered by exposing data fields (registers) which can be written to and read from by sending and receiving characters over the serial interface.

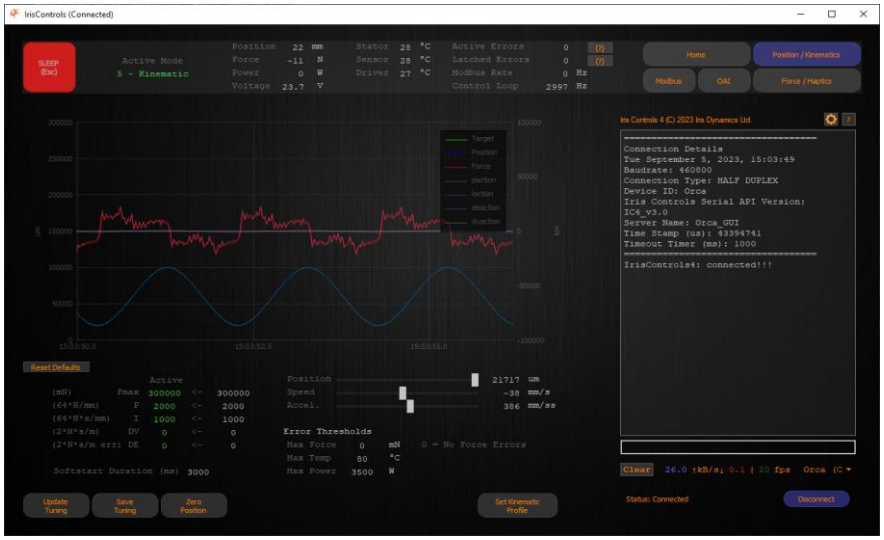
Serial communications are implemented using a subset of the Modbus RTU specification, with additional functionality to support a high-speed stream of commands and feedback.

The Modbus RTU User Manual is available for download at irisdynamics.com/downloads.

IrisControls™

Orca Series motors feature an optional graphical user interface called IrisControls which can be used to monitor details and configure settings. This interface provides an easy way to visually tune the internal PID position controller, set up motion profiles, add performance restrictions, and capture information while connected.

IrisControls is available for download at irisdynamics.com/downloads.



Orca IO SmartHub

(optional and sold separately)

The Orca IO Smart Hub provides control of Orca Series motors in Force, Position, and Kinematic Modes through simple digital and analog inputs. Real-time force and position data are fed back from the motor and provided as analog outputs. The IO Smart Hub attaches to the motor's data cable (RJ45) and allows easier integration with existing industrial control methods such as PLCs with 4-20 mA current loop outputs. Find more information in the Orca IO Smart Hub User Guide at irisdynamics.com/downloads.

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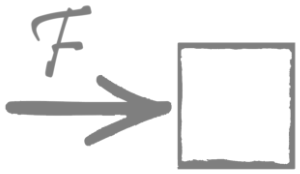
Operating Modes

Orca Series motors can operate in one of four modes of operation, enabling countless applications. Each of these modes is described in detail in the Orca Series Reference Manual (RM220115).

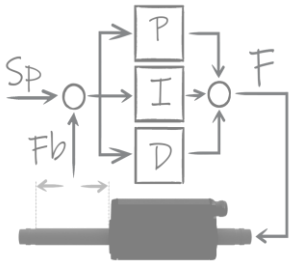
Force Mode

The motor receives a stream of user forces, and dynamically controls the amount of force produced between the shaft and stator. This allows for smooth and consistent force output. This is a great mode for polishing and grinding applications, depth control for floats, or for robotic controllers that transcend kinematics with force-aware models.



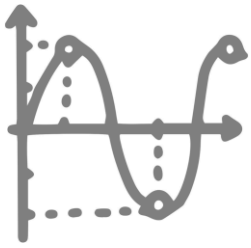
Position Mode

A classic mode of operation where a stream of position setpoints (Sp) are provided. The motor will run an internal PID controller to track the position targets, overcoming external disturbances like mass, friction, springs, gravity, etc. The internal controller's feedback loop is very fast and is stable even with high gains.



Kinematic Mode

The motor receives a trigger signal and then follows one or more configurable paths. Smooth, efficient, and repeatable motions can be achieved with all the calculation and compensation performed by the motor. This mode makes replacing pneumatic systems very easy. It simplifies system architecture, improves system performance, and reduces engineering efforts.



Haptic Mode

A unique linear motor mode that replicates springs, dampers, mass, and/or vibrations simultaneously. The on-board controller performs latency-sensitive effects like virtual hard-stops and high frequency vibrations which reduces development effort and increases haptic effect capability. This mode is perfect for force-feedback control applications and instances where the motor is manipulated by a person.

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ORCA-6-LITE Specifications

ORCA-6-LITE

General Specifications

Supply Voltage	min	12 V	*Undervoltage lockout prevents operation below 10 V.*
	max	30 V	*Exposure to supply voltages greater than max can cause permanent damage.*
Max Supply Current	max	13.5 A	
ESD Protection	IEC 61000-4-2 Level 4		
IP Rating	IP68		
Min Chassis Temperature	min	-20 °C	
	max	70 °C	
Serial Protocol	RS485 / RS422		*Full Duplex or Half Duplex; 120 Ω termination.*
Message Protocol	Modbus RTU		*High throughput functions codes available.*
Maximum Baudrate	1.2 Mbps		
Internal Control Rate	3.0 kHz		
Motor Phases	4		
Position Sensor	Integrated Hall Array		*Will report absolute position, but requires home on power-up to establish zero position*
Position Accuracy	±150 um	*±0.0059 in*	
Position Repeatability	±15 um	*±0.0006 in*	
Thermal Sensors	Driver and Stator		*Auto shut-off, adjustable limits.*

Force and Power and Speed

See the Typical Characteristics section below for detailed information on performance versus speed

	Motor Temp	*12 Vdd*	*18 Vdd*	*24 Vdd*	*30 Vdd*
Max Stall Force	20°C	139 N *31.1 lbf*	208 N *46.7 lbf*	247 N *55.5 lbf*	247 N *55.5 lbf*
Max Stall Power		102 W	229 W	324 W	324 W
Max Force Duration		44 s	19 s	12 s	12 s
Force Constant (Kf)		13.7 N/√W			
Max Stall Force	70°C	116 N *26.2 lbf*	175 N *39.3 lbf*	233 N *52.4 lbf*	244 N *54.9 lbf*
Max Stall Power		87 W	195 W	346 W	381 W
Max Force Duration		<1 s			
Force Constant (Kf)		12.5 N/√W			
Max Speed	full range	0.5 m/s *20 in/s*	0.8 m/s *31 in/s*	1.0 m/s *41 in/s*	1.3 m/s *51 in/s*
Force Accuracy*	full range	0.74 N *0.166 lbf*			
Force Repeatability		0.1 N *0.022 lbf*			

**Motors are Internally calibrated. External calibration using known external loads will improve accuracy*

Cooling

	Condition	*Power*	*Force*
Continuous Output	20°C ambient, still air	34 W	73 N *16 lbf*
	20°C ambient, single fan @ 10 CFM	106 W	129 N *29 lbf*
	20°C ambient, 2x 60 mm fans @ 39 CFM each	139 W	148 N *33 lbf*

For information on a specific application's thermal feasibility reach out to sales@irisdynamics.com

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ORCA-6-24V Specifications

ORCA-6-24V

General Specifications

Supply Voltage	min	12 V	*Undervoltage lockout prevents operation below 10 V.*
	max	60 V	*Exposure to supply voltages greater than max can cause permanent damage.*
Max Supply Current	max	37.5 A	
ESD Protection	IEC 61000-4-2 Level 4		
IP Rating	IP68		
Min Chassis Temperature	min	-20 °C	
	max	70 °C	
Serial Protocol	RS485 / RS422		*Full Duplex or Half Duplex; 120 Ω termination.*
Message Protocol	Modbus RTU		*High throughput functions codes available.*
Maximum Baudrate	1.2 Mbps		
Internal Control Rate	3.0 kHz		
Motor Phases	4		
Position Sensor	Integrated Hall Array		*Will report absolute position, but requires home on power-up to establish zero position*
Position Accuracy	±150 um	*±0.0059 in*	
Position Repeatability	±15 um	*±0.0006 in*	
Thermal Sensors	Driver and Stator		*Auto shut-off, adjustable limits.*

Force and Power and Speed

See the Typical Characteristics section below for detailed information on performance versus speed

	Motor Temp	*12 Vdd*	*24 Vdd*	*48 Vdd*	*60 Vdd*
Max Stall Force	20°C	215 N *48.3 lbf*	426 N *95.7 lbf*	426 N *95.7 lbf*	426 N *95.7 lbf*
Max Stall Power		229 W	899 W	899 W	899 W
Max Force Duration		19 s	5 s	4 s	4 s
Force Constant (Kf)		14.2 N/√W			
Max Stall Force	70°C	181 N *40.6 lbf*	361 N *81.3 lbf*	421 N *94.7 lbf*	421 N *94.7 lbf*
Max Stall Power		195 W	779 W	1058 W	1058 W
Max Force Duration		<1 s			
Force Constant (Kf)		12.9 N/√W			
Max Speed	full range	0.8 m/s *30 in/s*	1.5 m/s *59 in/s*	3.0 m/s *119 in/s*	3.8 m/s *148 in/s*
Force Accuracy*	full range	0.57 N *0.128 lbf*			
Force Repeatability		0.1 N *0.022 lbf*			

**Motors are Internally calibrated. External calibration using known external loads will improve accuracy*

Cooling

	Condition	*Power*	*Force*
Continuous Output	20°C ambient, still air	34 W	75 N *17 lbf*
	20°C ambient, single fan @ 10 CFM	106 W	133 N *30 lbf*
	20°C ambient, 2x 60 mm fans @ 39 CFM each	139 W	153 N *34 lbf*

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ORCA-6-48V Specifications

ORCA-6-48V

General Specifications

Supply Voltage	min	12 V	*Undervoltage lockout prevents operation below 10 V.*
	max	60 V	*Exposure to supply voltages greater than max can cause permanent damage.*
Max Supply Current	max	34 A	
ESD Protection	IEC 61000-4-2 Level 4		
IP Rating	IP68		
Min Chassis Temperature	min	-20 °C	
	max	70 °C	
Serial Protocol	RS485 / RS422		*Full Duplex or Half Duplex; 120 Ω termination.*
Message Protocol	Modbus RTU		*High throughput functions codes available.*
Maximum Baudrate	1.2 Mbps		
Internal Control Rate	3.0 kHz		
Motor Phases	4		
Position Sensor	Integrated Hall Array		*Will report absolute position, but requires home on power-up to establish zero position*
Position Accuracy	±150 um	*±0.0059 in*	
Position Repeatability	±15 um	*±0.0006 in*	
Thermal Sensors	Driver and Stator		*Auto shut-off, adjustable limits.*

Force and Power and Speed

See the Typical Characteristics section below for detailed information on performance versus speed

	Motor Temp	*12 Vdd*	*24 Vdd*	*48 Vdd*	*60 Vdd*
Max Stall Force	20°C	143 N *32.2 lbf*	287 N *64.4 lbf*	573 N *128.9 lbf*	638 N *143.5 lbf*
Max Stall Power		102 W	408 W	1631 W	2023 W
Max Force Duration		44 s	11 s	3 s	2 s
Force Constant (Kf)		14.2 N/√W			
Max Stall Force	70°C	120 N *27.1 lbf*	241 N *54.2 lbf*	482 N *108.3 lbf*	602 N *135.4 lbf*
Max Stall Power		87 W	346 W	1386 W	2165 W
Max Force Duration		<1 s			
Force Constant (Kf)		12.9 N/√W			
Max Speed	full range	0.5 m/s *20 in/s*	1.0 m/s *40 in/s*	2.0 m/s *79 in/s*	2.5 m/s *99 in/s*
Force Accuracy*	full range	0.64 N *0.144 lbf*			
Force Repeatability		0.1 N *0.022 lbf*			

**Motors are Internally calibrated. External calibration using known external loads will improve accuracy*

Cooling

	Condition	*Power*	*Force*
Continuous Output	20°C ambient, still air	34 W	75 N *17 lbf*
	20°C ambient, single fan @ 10 CFM	106 W	133 N *30 lbf*
	20°C ambient, 2x 60 mm fans @ 39 CFM each	139 W	153 N *34 lbf*

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ORCA-15-48V Specifications

ORCA-15-48V

General Specifications

Supply Voltage	min	12 V	*Undervoltage lockout prevents operation below 10 V.*
	max	60 V	*Exposure to supply voltages greater than max can cause permanent damage.*
Max Supply Current	max	37.5 A	
ESD Protection	IEC 61000-4-2 Level 4		
IP Rating	IP68		
Min Chassis Temperature	min	-20 °C	
	max	70 °C	
Serial Protocol	RS485 / RS422		*Full Duplex or Half Duplex; 120 Ω termination.*
Message Protocol	Modbus RTU		*High throughput functions codes available.*
Maximum Baudrate	1.2 Mbps		
Internal Control Rate	3.0 kHz		
Motor Phases	4		
Position Sensor	Integrated Hall Array		*Will report absolute position, but requires home on power-up to establish zero position*
Position Accuracy	±150 um	*±0.0059 in*	
Position Repeatability	±15 um	*±0.0006 in*	
Thermal Sensors	Driver and Stator		*Auto shut-off, adjustable limits.*

Force and Power and Speed

See the Typical Characteristics section below for detailed information on performance versus speed

	Motor Temp	*12 Vdd*	*24 Vdd*	*48 Vdd*	*60 Vdd*
Max Stall Force	20°C	214 N *48.2 lbf*	429 N *96.3 lbf*	857 N *192.7 lbf*	1061 N *238.5 lbf*
Max Stall Power		92 W	367 W	1468 W	2248 W
Max Force Duration		115 s	29 s	7 s	5 s
Force Constant (Kf)		22.4 N/√W			
Max Stall Force	70°C	180 N *40.5 lbf*	360 N *81 lbf*	721 N *162 lbf*	901 N *202.5 lbf*
Max Stall Power		78 W	312 W	1247 W	1948 W
Max Force Duration		<1 s			
Force Constant (Kf)		20.4 N/√W			
Max Speed	full range	0.3 m/s *12 in/s*	0.6 m/s *24 in/s*	1.2 m/s *48 in/s*	1.5 m/s *60 in/s*
Force Accuracy*	full range	0.97 N *0.218 lbf*			
Force Repeatability		0.15 N *0.034 lbf*			

**Motors are Internally calibrated. External calibration using known external loads will improve accuracy*

Cooling

	Condition	*Power*	*Force*
Continuous Output	20°C ambient, still air	73 W	174 N *39 lbf*
	20°C ambient, 2x 60 mm fans @ 39 CFM each	346 W	380 N *85 lbf*
	20°C ambient, 4x 60 mm fans @ 39 CFM each	358 W	386 N *87 lbf*

For information on a specific application's thermal feasibility reach out to sales@irisdynamics.com

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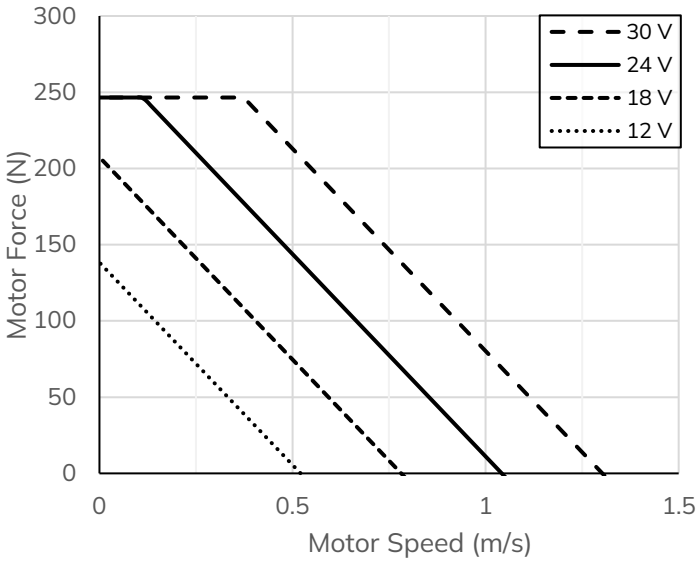
ORCA-6-LITE Typical Characteristics

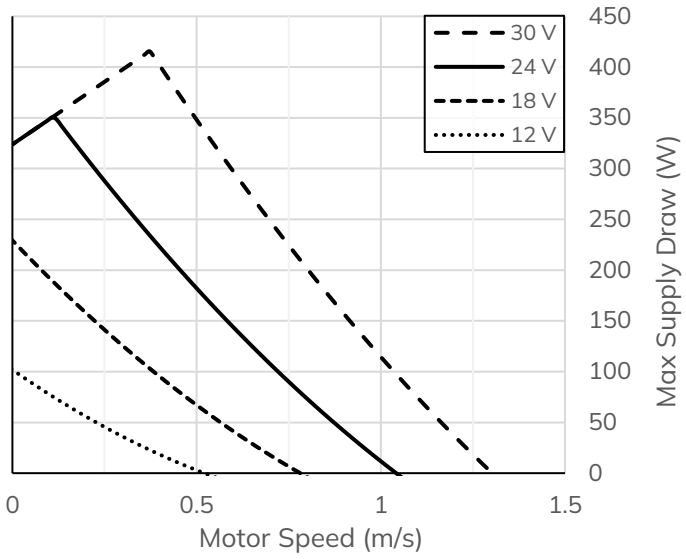
This typical characteristic section is applicable for ORCA-6-LITE and was taken with an ambient and chassis temp of 25 C.
Motor characteristics are identical for forward (shaft extension), and reverse motions.
For additional application information, find resources at irisdynamics.com/downloads

Maximum Motor Force versus Motor Speed

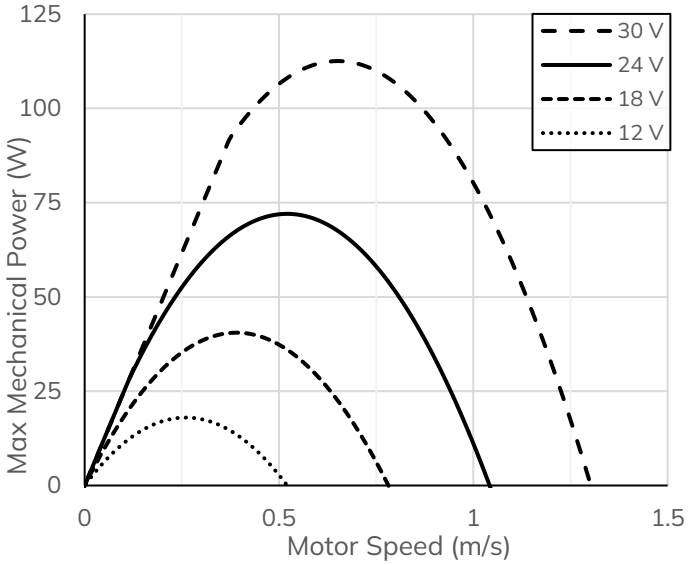


Maximum Power Supply Draw versus Motor Speed

Max power draw occurs at max Force in the dir. of travel.

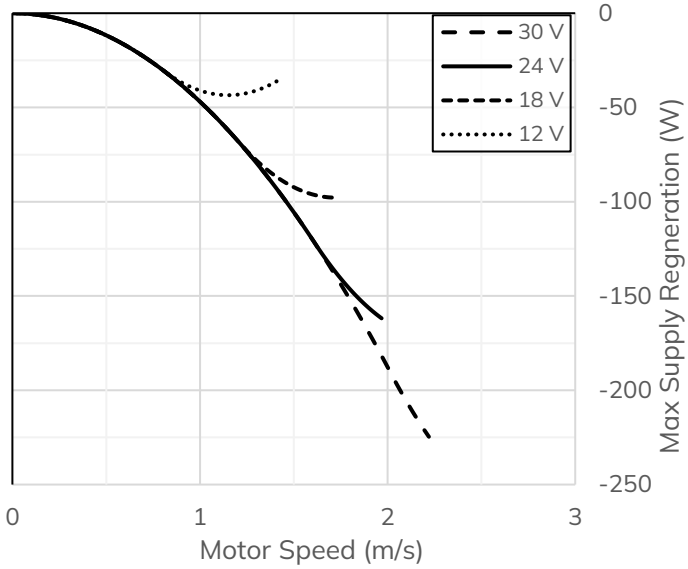


Max Mechanical Power Delivery versus Motor Speed



Maximum Regeneration versus Motor Speed

Maximum regeneration occurs at $F = -\frac{1}{2}vK_F^2$.



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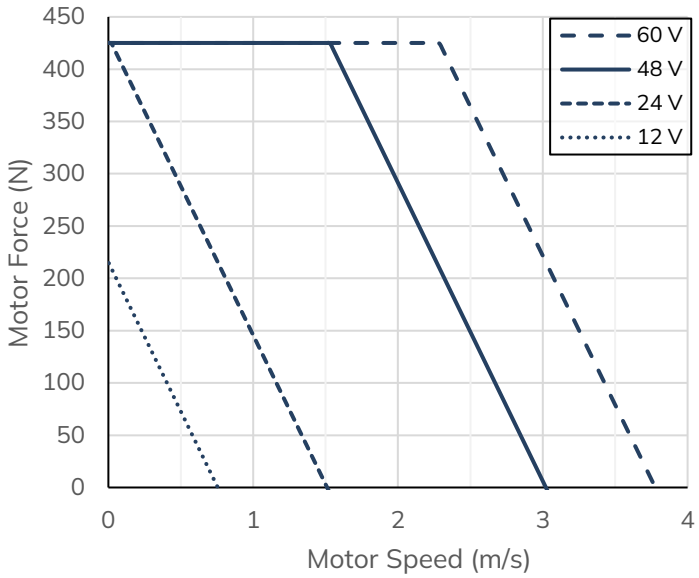
ORCA-6-24V Typical Characteristics

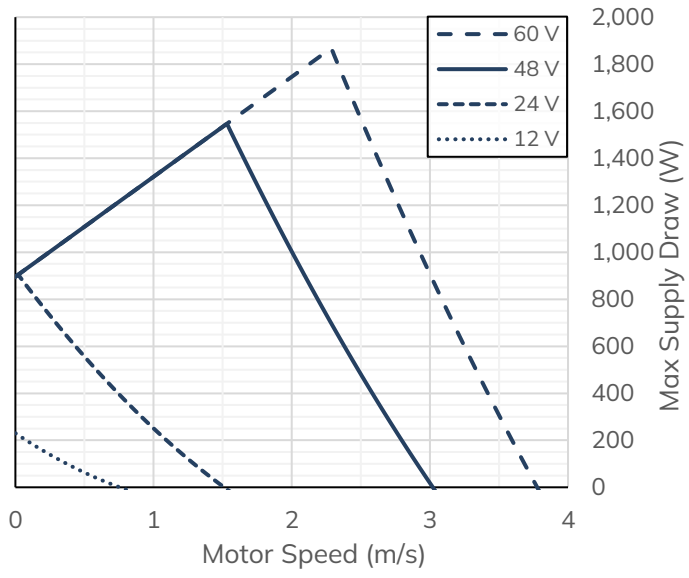
This typical characteristic section is applicable for ORCA-6-24V and was taken with an ambient and chassis temp of 25 C.
Motor characteristics are identical for forward (shaft extension), and reverse motions.
For additional application information, find resources at irisdynamics.com/downloads

Maximum Motor Force versus Motor Speed

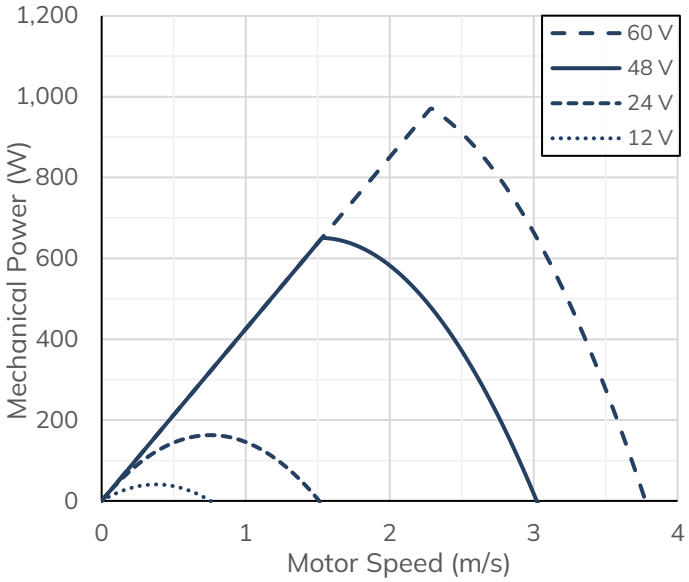


Maximum Power Supply Draw versus Motor Speed

Max power draw occurs at max Force in the dir. of travel.

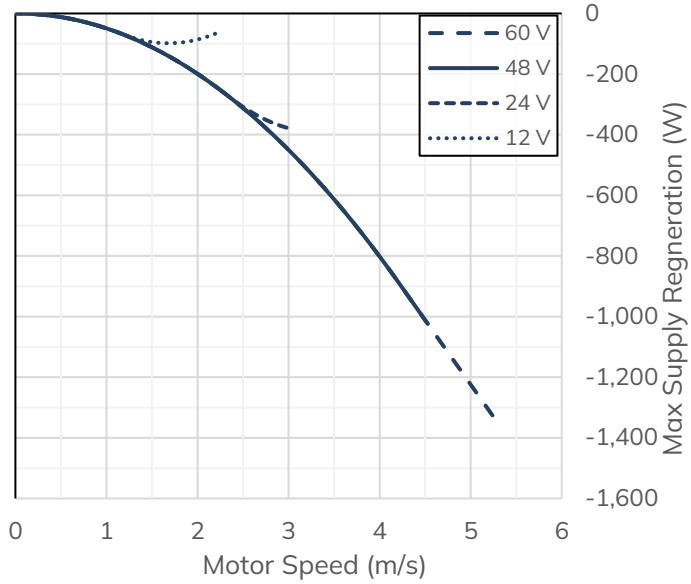


Max Mechanical Power Delivery versus Motor Speed



Maximum Regeneration versus Motor Speed

Maximum regeneration occurs at $F = -\frac{1}{2}vK_F^2$.



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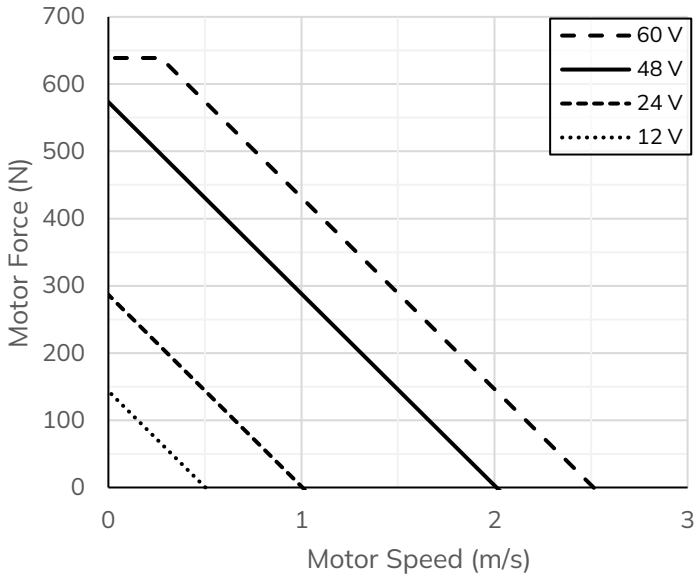
ORCA-6-48V Typical Characteristics

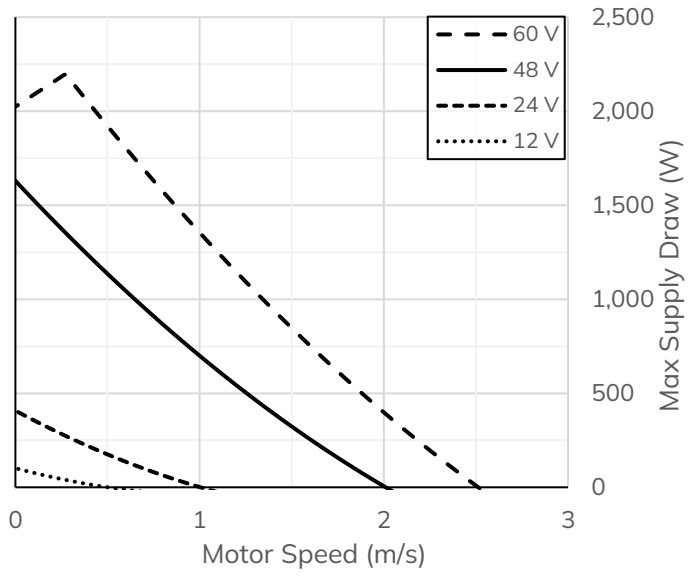
This typical characteristic section is applicable for ORCA-6-48V and was taken with an ambient and chassis temp of 25 C.
Motor characteristics are identical for forward (shaft extension), and reverse motions.
For additional application information, find resources at irisdynamics.com/downloads

Maximum Motor Force versus Motor Speed

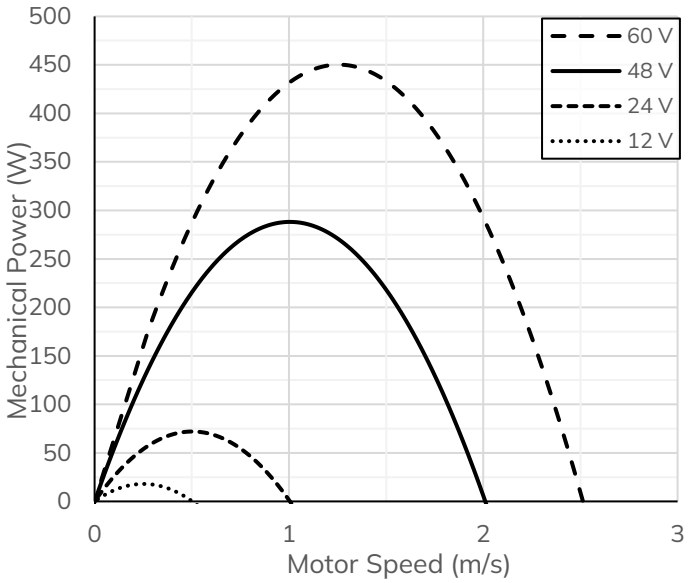


Maximum Power Supply Draw versus Motor Speed

Max power draw occurs at max Force in the dir. of travel.

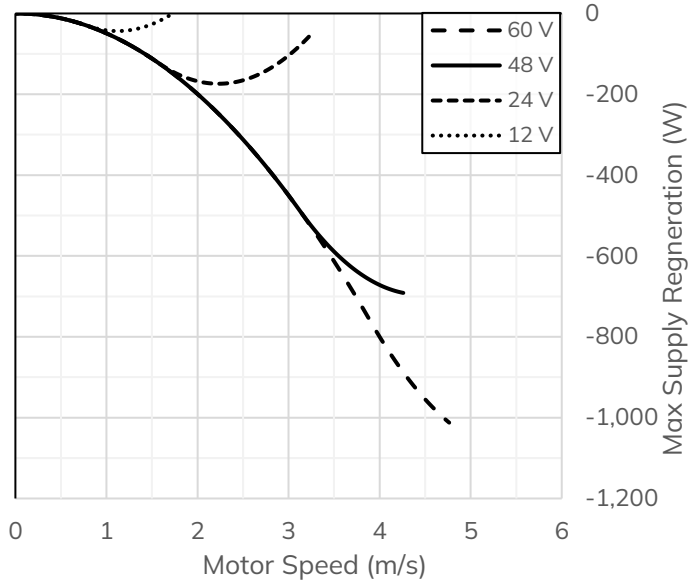


Max Mechanical Power Delivery versus Motor Speed



Maximum Regeneration versus Motor Speed

Maximum regeneration occurs at $F = -\frac{1}{2}vK_F^2$.



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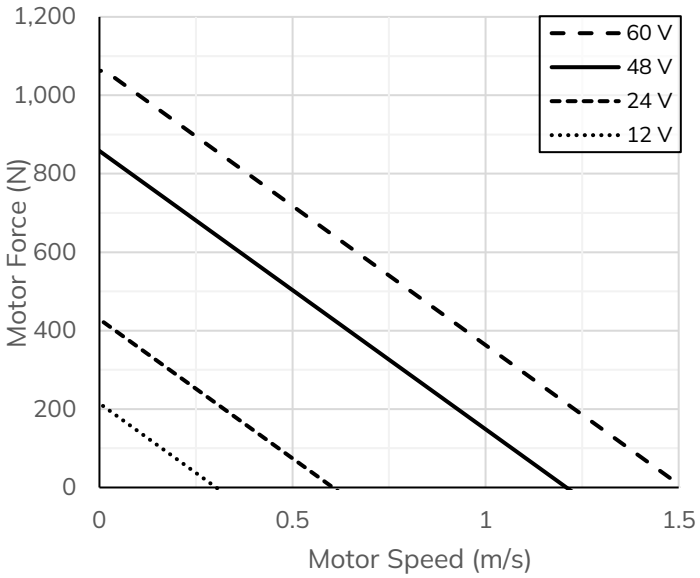
ORCA-15-48V Typical Characteristics

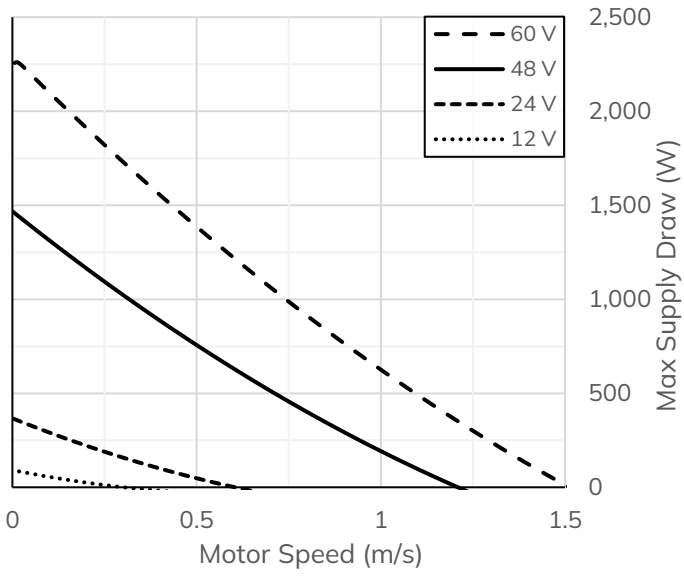
This typical characteristic section is applicable for ORCA-15-48V and was taken with an ambient and chassis temp of 25 C
Motor characteristics are identical for forward (shaft extension), and reverse motions.
For additional application information, find resources at irisdynamics.com/downloads

Maximum Motor Force versus Motor Speed

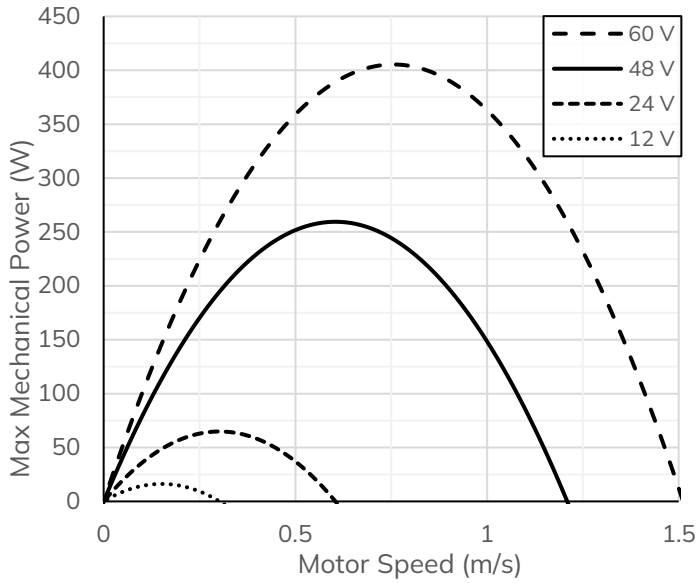


Maximum Power Supply Draw versus Motor Speed

Max power draw occurs at max Force in the dir. of travel.

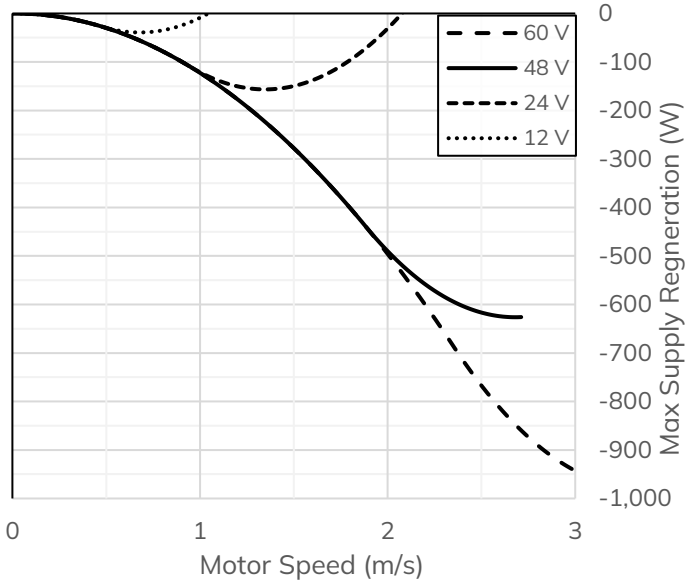


Max Mechanical Power Delivery versus Motor Speed



Maximum Regeneration versus Motor Speed

Maximum regeneration occurs at $F = -\frac{1}{2}vK_F^2$.



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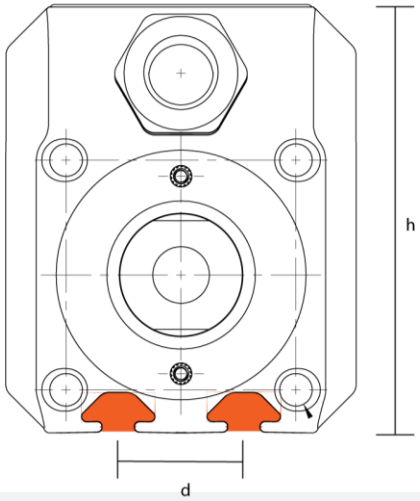
Accessories

T-SLOT MOUNTING

1-inch 'T-Slots' run along the bottom of the motors and can accommodate a variety of mounting arrangements.

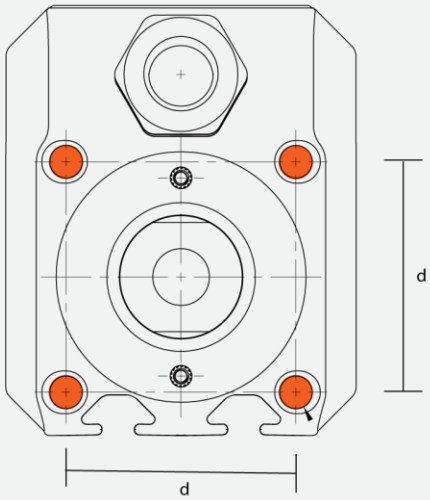
Dimension	
d	25.4 mm *1 in*
h	32 mm *1.26 in*



PNEUMATIC TUBE MOUNTING

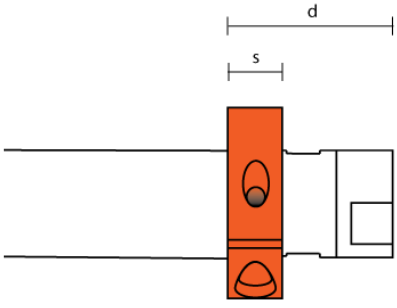
The faces feature ISO15552 50mm Pneumatic Tube mounting patterns which accommodate a variety of widely-available mounting hardware.

Dimension	
d	46.5 mm *1.83 in*



SHAFT COLLAR

ID	25 mm *1 in*
OD	45 mm *1.77 in*
s	12.7 mm *0.5 in*
d	35 mm *1.38 in*



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Accessories

REAR TUBES

Size (ID)	50 mm Extrusion
Size (OD)	55 mm Extrusion
Material	Aluminum

For custom rear tube lengths please contact: sales@irisdynamics.com

USB CABLES

USB-to-RS485	This cable converts USB Serial port data to the half-duplex RS485 industrial signals used by Orca Series devices to connect to IrisControls for access to the GUI, and for firmware upgrades.
USB-to-RS422	This optional cable converts USB Serial port data to the full-duplex RS422 industrial signals and allows forces, positions, and motions to be commanded from Windows, MacOS, or Linux without the need for an intermediate controller.

RJ SPLITTER

When both interfaces (Modbus and IrisControls) are to be used at once an RJ45 splitter accessory allows easy connection to the shared RJ45 connector.

Size	14 mm X 40 mm x 20 mm
Side 1 RJ45 Female	To Motor Cable
Side 2 2x RJ45 Female	Port 1: IrisControls Interface *Accepts* USB-to-RS485 Cable Port 2: Modbus Interface *Accepts* USB-to-RS422 Cable or CAT5e, CAT6e, etc

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Mounting Options

MOVING SHAFT

In a moving shaft configuration, the stator is fixed and the shaft actuates the load.

MOVING STATOR

In moving stator configurations, the shaft is fixed on both ends and the stator moves. Multiple stators can be installed along a single shaft if the application requires it. Moving stators are advantageous for applications with length restrictions.

CLEVIS/UNIVERSAL JOINT

An optional rear shaft cover allows mounting using ISO 1552 50 mm pneumatic tube attachments, enabling the line of action to move with the load. Useful for replacing traditional lead screws or pneumatic actuators. Rear shaft cover is cut to Match desired shaft length. Optional rear plate can be modified or removed to facilitate chosen mounting hardware.

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