INDUSTRY REFERENCE GUIDE

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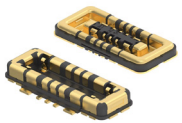
Connectivity Solutions for Humanoid Robotics

Humanoid robotics is pushing interconnect design to new extremes, requiring engineers to route more power and faster data through actuator channels where every millimeter counts. Overcoming this challenge demands compact connectivity architectures that merge power and signal transmission without adding thermal or mechanical stress. The Molex humanoid robotics interconnect portfolio helps design engineers maximize space efficiency while ensuring reliable performance in harsh, tightly constrained environments.

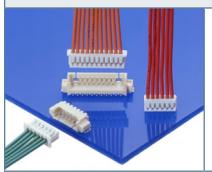
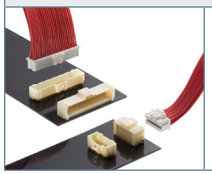
VISION AND PERCEPTION SYSTEMS

Humanoid robots depend on a continuous flow of high-bandwidth camera and LiDAR data, even as nearby electronic systems and electromagnetic noise create signal-disrupting interference. Ensuring signal integrity in vision and perception systems requires compact, low-loss interconnects engineered for controlled impedance and power delivery in tight spaces. Molex high-speed differential connectors protect these vital data streams across the LiDAR-to-main-PCBA link, enabling faster and more reliable perception.

Vision and Perception Systems: Camera

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
ChargeStack Connectors							
	High-power hybrid power distribution	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
Quad-Row Connectors							
	Ultra-dense signal routing in compact camera footprints	Board-to-board	0.175mm	0.50, 0.60, 0.80mm	12 to 80	Up to 4.0A	-40 to +85°C

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
SlimStack Connectors							
	High-speed data payload and shock resistance	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +105°C

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
DuraClik Connectors							
	High-vibration power and signal delivery through camera modules	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Lock Plus Connectors							
	Secure, space-saving signal routing in tight enclosures	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
PicoBlade Connectors							
	Ultra-compact wiring harnesses for lightweight, high-flex camera modules	Wire-to-board	1.25mm	32 to 26 AWG	2 to 15	Up to 2.5A	Up to 125V
Pico-Clasp Connectors							
	High-density multi-circuit data lines resistant to signal noise	Wire-to-board	1.00mm	32 to 28 AWG	2 to 50	Up to 2.0A	Up to 100V

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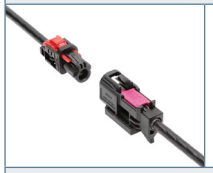
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
Rely-On Connectors							
	Shock-resistant board retention for ultra-miniature camera electronics	Wire-to-board	1.00mm	32 to 28 AWG	2 to 10	Up to 2.5A	Up to 100V

	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Low-profile, high-density board termination for compact camera sensor modules	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V

	Application Note	Configuration	Current	Voltage	Operating Temperature	Data Rate	Data Transfer Speed
High-Speed FAKRA-Mini Interconnect System							
	Compact coaxial video transmission for high-resolution vision feeds	High-speed I/O	Up to 1.0A	-	-40 to +105°C	Up to 28Gbps	-
HSAutoLink C Interconnect System							
	High-bandwidth hybrid link for vision processors and main controllers	High-speed I/O	Up to 1.25A	Up to 48V	-40 to +105°C	Up to 40Gbps	-
USB Type-C Connectors							
	Universal high-speed data and power interface for external or modular cameras	High-speed I/O	Up to 6.0A	Up to 48V	-40 to +105°C	-	Up to 40Gbps

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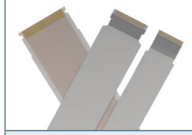
	Application Note	Configuration
Premo-Flex Flat Flexible Cables (FFC/FPC)		
	Dynamic, high-flex routing through tight camera joints and pan-tilt mechanisms	Cable Assembly
Power and Signal Cables		
	Complete, turn-key wiring harnesses connecting camera modules to main processing units	Cable Assembly

Vision and Perception Systems: LiDAR

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
ChargeStack Connectors							
	High-current power delivery to laser diodes and optical emitter arrays	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
Quad-Row Connectors							
	Ultra-dense signal routing on compact sensor processing and time-of-flight receiver PCBs	Board-to-board	0.175mm	0.50, 0.60, 0.80mm	12 to 80	Up to 4.0A	-40 to +85°C
SlimStack Connectors							
	High-speed point-cloud data transfer between sensor stacking boards	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +105°C

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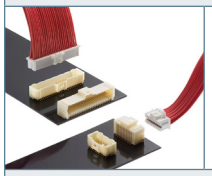
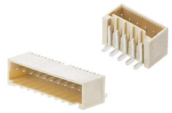
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
DuraClik Connectors							
	Shock-resistant power and control connectors for LiDAR modules	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Lock Plus Connectors							
	Space-saving, latching wire-to-board control connections for mirror and motor drivers	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
Pico-Clasp Connectors							
	High-density multi-circuit data transmission from optical sensor arrays	Wire-to-board	1.00mm	32 to 28 AWG	2 to 50	Up to 2.0A	Up to 100V
Pico-EZmate Connectors							
	Low-profile, vertical wire-to-board interconnects for tight LiDAR optical enclosures	Wire-to-board	1.00 to 1.80mm	30 to 22 AWG	2 to 7	Up to 5.0A	Up to 250V
Pico-SPOX Connectors							
	Reliable power distribution for scanning motors and thermal management fans	Wire-to-board	1.50mm	30 to 24 AWG	2 to 15	Up to 3.5A	Up to 250V AC (RMS)/DC
Rely-On Connectors							
	Vibration-resistant board retention for internal LiDAR optoelectronic PCB assemblies	Wire-to-board	1.00mm	32 to 28 AWG	2 to 10	Up to 2.5A	Up to 100V

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	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Ultra-thin board-to-board interface for solid-state beam-steering and laser arrays	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V

	Application Note	Configuration	Current	Voltage	Operating Temperature	Data Rate	Data Transfer Speed
HSAutoLink II Interconnect System							
	High-speed, shielded differential data bus for point-cloud data	High-speed I/O	Up to 1.5A	Up to 36V	-40 to +105°C	Up to 13.5Gbps	-
HSAutoLink C Interconnect System							
	Ultra-high bandwidth data link for primary LiDAR-to-main AI compute unit	High-speed I/O	Up to 1.25A	Up to 48V	-40 to +105°C	Up to 40Gbps	-
USB Type-C Connectors							
	External pluggable interface for modular or removable LiDAR diagnostic units	High-speed I/O	Up to 6.0A	Up to 48V	-40 to +105°C	-	Up to 40Gbps

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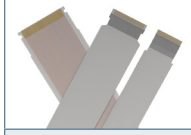
	Application Note	Configuration	Current	Voltage	IP Rating	Operating Temperature
M12 Connectors						
	Sealed, ruggedized external interconnect for robot-mounted LiDAR modules	Circular	Up to 16.0A (L code)	Up to 250V	IP67, IP68	-30 to +85°C
MiniCirc Circular Connectors						
	Compact, waterproof circular harness connection for narrow head and neck routing	Circular	Up to 3.0A (2 to 5 pins) Up to 2.5A (6 pins)	Up to 60V DC	IP68	-40 to +85°C

	Application Note	Configuration
Premo-Flex Flat Flexible Cables (FFC/FPC)		
	High-flex cable routing for articulated LiDAR assemblies	Cable assembly
Power and Signal Cables		
	Configurable power and signal cable assemblies connecting LiDAR modules to central processing systems	Cable assembly

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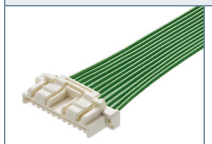
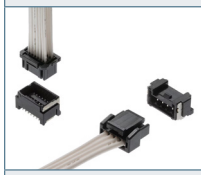
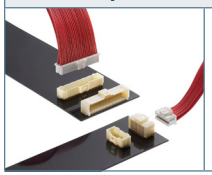
HUMAN INTERACTION INTERFACES

Clear, responsive human-robot interaction relies on shielding sensitive control and audio signals from electrical noise inherent to dense architectures. Maintaining signal integrity and system reliability in these tight spaces demands compact, fine-pitch connectors with stable electrical performance and secure retention. Flexible, low-profile Molex connectors feature robust locking mechanisms that preserve signal integrity during real-time human interaction.

Human Interaction Interfaces: LED

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
CLIK-Mate Connectors							
	Rugged power/signal delivery to main facial LED arrays and animated status display panels	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 34	Up to 4.0A	Up to 250V
DuraClik Connectors							
	Vibration-resistant power delivery to high-brightness expression lighting and illumination LEDs	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Lock Plus Connectors							
	Subminiature control interface for compact status indicator rings and localized optical sensors	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
Pico-Clasp Connectors							
	High-density control signal routing for complex multi-color LED matrices	Wire-to-board	1.00mm	32 to 28 AWG	2 to 50	Up to 2.0A	Up to 100V

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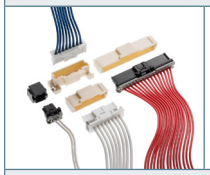
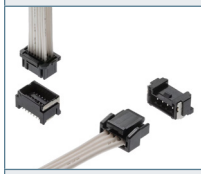
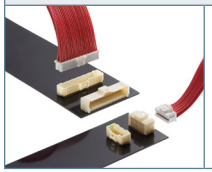
	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Ultra-thin, low-profile interface connecting curved facial shell PCBs to LED driver boards	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V
Flexible Printed Circuits (FPCs)							
	Multi-layer, contoured lighting circuits integrating LEDs and capacitive touch directly into facial/body shells	Flexible interconnect solutions					

Human Interaction Interfaces: Microphone

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
DuraClik Connectors							
	Secure power and signal routing from microphone arrays to main audio processing boards	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Lock Plus Connectors							
	Compact, latching interface for multi-channel digital MEMS microphone modules	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
Pico-Clasp Connectors							
	High-density signal routing for beamforming directional microphone arrays requiring up to 50 circuits	Wire-to-board	1.00mm	32 to 28 AWG	2 to 50	Up to 2.0A	Up to 100V

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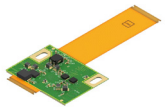
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
Zero-Hachi Connectors							
	Ultra-miniature wire-to-board interconnect for space-constrained ear/temple microphone modules	Wire-to-board	0.80mm	32 to 28 AWG	2 to 30	Up to 2.5A	Up to 30V

	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Low-profile, high-density termination for flexible microphone array circuits mapped inside the facial or head shell	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V
Flexible Printed Circuits (FPCs)							
	Conformable, multi-microphone array circuits contoured along the interior skull or ear cavities	Flexible interconnect solutions					

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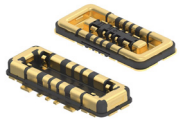
CENTRAL CONTROL AND MOTION-SENSING SYSTEMS

Centralized control and precise motion sensing depend on routing high-speed data alongside power without allowing electromagnetic interference (EMI) or crosstalk to compromise response times. Achieving this requires fine-pitch, high-bandwidth interconnects that combine stable signal contact with high-current capacity. Molex controlled-impedance solutions merge high-density data transmission and robust power delivery into a single system for uncompromising reliability.

Central Control and Motion-Sensing Systems: Main Control Board

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
C-Grid and C-Grid III Connectors							
	2.54mm-pitch power and control header interface for sensor and bus expansion boards	Board-to-board	2.54mm	9.40 to 13.80mm	1 to 100	Up to 3.0A	-40 to +105°C (tin) -55 to +120°C (gold)
ChargeStack Connectors							
	High-current power distribution directly onto the main control board to feed high-draw motor controllers	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
EXTreme Ten60 High-Power Connectors							
	Primary high-power board-to-board power entry delivering main battery bus power to compute modules	Board-to-board	2.00 to 7.50mm	10.00mm	1 to 72	Up to 94.0A	-40 to +105°C
Mirror Mezz Connectors							
	High-density mezzanine connection joining AI compute mezzanine cards to the main control board	Board-to-board	1.50 to 4.00mm	5.00, 8.00 and 11.00mm	Up to 270 differential pairs	Up to 1.0A	-40 to +105°C

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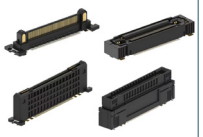
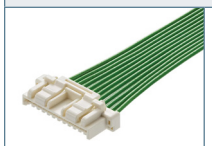
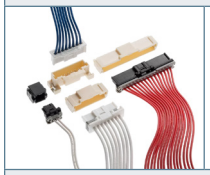
	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
SlimStack Connectors							
	Low-profile mezzanine connections between processor boards and sensor daughterboards	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +125°C
ZN Stack Connectors							
	High-speed floating board-to-board link for modular mainboard daughtercards subject to thermal expansion/shock	Board-to-board	0.50mm	10.00 to 30.00mm	60 to 200	Up to 40.0A (power pin), 0.5A (signal pin)	-40 to +125°C

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
CLIK-Mate Connectors							
	Positive-locking wire-to-board harness connections for mainboard status telemetry and sensor buses	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 34	Up to 4.0A	Up to 250V
DuraClik Connectors							
	Vibration-resistant wire-to-board power and CAN/Ethernet interfaces to distributed motor drives	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Fit Connectors							
	Mid-range power delivery from main control board to auxiliary actuator buses	Wire-to-board	3.00mm	30 to 18 AWG	2 to 24	Up to 10.5A	Up to 600V

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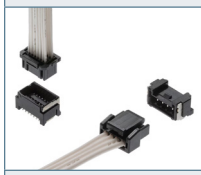
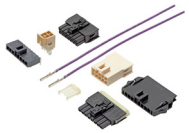
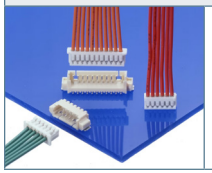
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
Micro-Lock Plus Connectors							
	High-density, space-saving wire-to-board signal connections for central inertial measurement units (IMUs) and diagnostic interfaces	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
Mini50 Connectors							
	Compact automotive-grade signal connections for mainboard CAN FD and LIN network buses	Wire-to-board	2.00mm	26 to 22 AWG	2 to 38	Up to 4.0A	Up to 14V DC
MiniMix Hybrid Power and Signal Connectors							
	Consolidated high-density wire-to-board power and single-pair Ethernet (SPE) signal distribution from the main controller to distributed joint nodes	Wire-to-board	Up to 3.00mm (power pin), 0.80mm (signal pin)	-	-	Up to 15.0A	Power 120V Signal 10V
Nano-Fit Connectors							
	Ultra-compact high-density power delivery (up to 8.0A per circuit) on dense mainboard layouts	Wire-to-board	2.50mm	26 to 20 AWG	2 to 16	Up to 8.0A	Up to 250V AC (RMS)/DC
PicoBlade Connectors							
	Lightweight, ultra-compact wire-to-board connections for internal diagnostic LEDs and cooling fans	Wire-to-board	1.25mm	32 to 26 AWG	2 to 15	Up to 2.5A	Up to 125V

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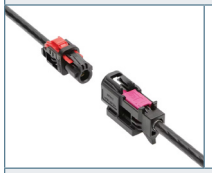
	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Low-profile, high-density termination for flat flex cables connecting embedded IMU sensors	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V

	Application Note	Configuration	Current	Voltage	Operating Temperature	Data Rate	Data Transfer Speed
High-Speed FAKRA-Mini Interconnect System							
	Compact coaxial link for high-frequency clock synchronization and external RF/GPS sensor feeds	High-speed I/O	Up to 1.0A	-	-40 to +105°C	Up to 28Gbps	-
HSAutoLink C Interconnect System							
	High-bandwidth, ruggedized Ethernet/PCIe interface connecting main AI compute to peripheral gateways	High-speed I/O	Up to 1.25A	Up to 48V	-40 to +105°C	Up to 40Gbps	-
USB Type-C Connectors							
	Main external programming, high-speed data transfer and service technician interface	High-speed I/O	Up to 6.0A	Up to 48V	-40 to +105°C	-	Up to 40Gbps

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	Application Note	Configuration	Current	Voltage	IP Rating	Operating Temperature
M12 Connectors						
	Sealed, industrial-grade external bus/power interface for industrial communications and power distribution	Circular	Up to 16.0A	Up to 300V	IP67, IP68 and IP69K	-30 to +85°C
MiniCirc Circular Connectors						
	Compact, waterproof external connector for tight torso/back-shell routing on main control enclosures	Circular	Up to 3.0A (2 to 5 pins) Up to 2.5A (6 pins)	Up to 60V DC	IP68	-40 to +85°C

	Application Note	Configuration
Power and Signal Cables		
	Configurable wire harnesses connecting the main control board to distributed power/motion buses	Cable assembly

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Central Control and Motion-Sensing Systems: Inertial Measurement Unit (IMU)

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
ChargeStack Connectors							
	Low-profile power delivery interface supplying clean power to high-rate IMU filter/sensor processing boards	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
EXTreme Ten60 High-Power Connectors							
	Main DC power inlet on power distribution backplanes feeding central control and IMU sensor rails	Board-to-board	2.00 to 7.50mm	10.00mm	1 to 72	Up to 94.0A	-40 to +105°C
SlimStack Connectors							
	Ultra-fine pitch board-to-board stacker connecting IMU daughtercards directly to main motion processing boards	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +125°C

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
DuraClik Connectors							
	Ruggedized wire-to-board harness interface for off-board/remote IMU modules	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V

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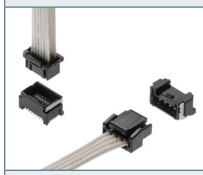
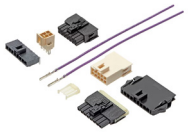
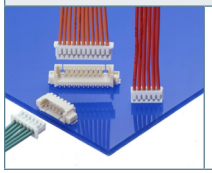
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
Micro-Lock Plus Connectors							
	High-density wire-to-board control line link for multi-axis IMUs in tight spatial envelopes	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
Nano-Fit Connectors							
	High-density power delivery (up to 8.0A per circuit) feeding local power regulation rails on IMU carrier boards	Wire-to-board	2.50mm	26 to 20 AWG	2 to 16	Up to 8.0A	Up to 250V AC (RMS)/DC
PicoBlade Connectors							
	Ultra-lightweight wire-to-board interface for auxiliary IMU diagnostic connections and temperature sensor	Wire-to-board	1.25mm	32 to 26 AWG	2 to 15	Up to 2.5A	Up to 125V

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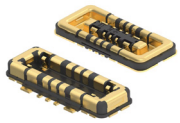
POWER AND ENERGY MANAGEMENT SYSTEMS

Distributing reliable power grows more challenging as humanoid robots draw higher current from compact battery architectures, where voltage drop and thermal buildup can erode system performance. Solving this requires secure, low-resistance interconnects designed for efficient energy transfer and thermal stability. Molex power connectivity solutions deliver robust distribution from the battery management system (BMS) through internal power buses, enabling consistent power delivery in space-constrained designs.

Power and Energy Management Systems: Battery Pack

	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
ChargeStack Connectors							
	Low-profile, high-current board-to-board link for internal BMS power distribution	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
EXTreme Ten60 High-Power Connectors							
	Primary battery power interface feeding high-current motor drive buses	Board-to-board	2.00 to 7.50mm	10.00mm	1 to 72	Up to 94.0A	-40 to +105°C
SlimStack Connectors							
	Ultra-fine pitch mezzanine link between BMS mainboard and cell monitoring daughtercards	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +125°C

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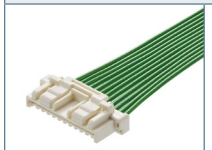
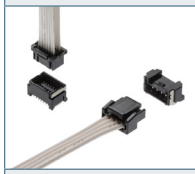
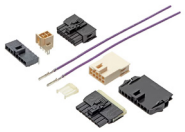
	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
CLIK-Mate Connectors							
	Positive-locking wire-to-board harness connection for internal BMS control and state-of-charge telemetry	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 34	Up to 4.0A	Up to 250V
Micro-Lock Plus Connectors							
	Space-saving wire-to-board interconnect for cell voltage monitoring harnesses and auxiliary thermal sensors	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
MX150 Mid-Voltage Connectors							
	Sealed main battery interconnect for high-voltage robot power buses and battery enclosure pass-throughs	Wire-to-board	3.50mm	22 to 14 AWG	4 to 20	Up to 22.0A	Up to 60V
Nano-Fit Connectors							
	Compact, high-density power distribution (up to 8.0A per circuit) to internal BMS balancing circuits and relays	Wire-to-board	2.50mm	26 to 20 AWG	2 to 16	Up to 8.0A	Up to 250V AC (RMS)/DC

	Application Note	Configuration	Pitch	Height	Circuits	Current	Voltage
FFC/FPC Connectors							
	Ultra-thin board termination for flat flexible circuits running across battery cell modules	FFC/FPC	0.20 to 2.00mm	0.65 to 11.95mm	2 to 120	Up to 2.0A	Up to 200V

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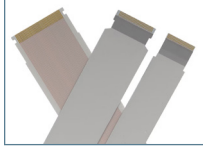
	Application Note	Configuration	Beta Range	Resistance Range	Operating Temperature
NTC Ring Temperature Sensors					
	Surface-mount thermal monitoring attached directly to battery cell busbars and cell terminals	Cable assembly	3K to 5K	1K to 100K Ohms	-40 to +105°C
Power and Signal Cables					
	High-current battery power and integrated BMS communication wiring harnesses	Cable assembly			
Premo-Flex Flat Flexible Cables (FFC/FPC)					
	Multi-channel cell voltage monitoring and temperature sensor routing across flexible battery module packs	Cable assembly			

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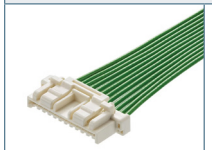
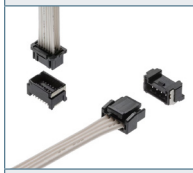
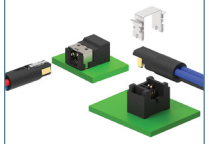
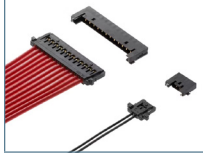
ACTUATION AND MOTION SYSTEMS

Constant movement, mechanical wear and continuous vibration can degrade the signal and power paths routing through humanoid robotic joints. Withstanding these harsh conditions requires compact, fine-pitch connectivity built for high retention within tightly packed assemblies. Molex space-saving, high-durability interconnect solutions in vital joint links ensure dependable motion control over the robot's operational lifespan.

Motion Actuation Systems: Arms and Legs

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
CLIK-Mate Connectors							
	Positive-locking wire-to-board control and telemetry interface for joint drive controllers	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 34	Up to 4.0A	Up to 250V
Micro-Lock Plus Connectors							
	Subminiature signal and encoder interface for compact actuator assemblies	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
MiniMix Hybrid Power and Signal Connectors							
	Connections for high-power joint actuators and SPE sensor feedback through narrow arm and leg articulated joints	Wire-to-board	3.00mm (power pin), 0.80mm (signal pin)	-	-	Up to 15.0A	Power 120V Signal 10V
Pico-Lock Connectors							
	Ultra-low-profile, high-current wire-to-board links for dynamic limb actuator systems	Wire-to-board	1.00 to 3.00mm	16 to 32 AWG	2 to 12	Up to 10.0A	Up to 250V AC (RMS)/ DC

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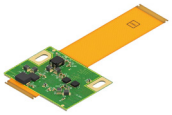
	Application Note	Configuration	Current	Voltage	IP Rating	Operating Temperature
Industrial SPE Connectors						
	Single-pair Ethernet (SPE) connections between joint actuators and central motion controllers	Circular	Up to 4.0A (+60°C); 1.5A (+85°C)	Up to 60V DC	IP20, IP65, IP67	-40 to +85°C
MiniCirc Circular Connectors						
	IP68-sealed limb-to-joint harness pass-throughs for articulated arm and leg assemblies	Circular	Up to 3.0A (2 to 5 pins) Up to 2.5A (6 pins)	Up to 60V DC	IP68	-40 to +85°C
Flexible Printed Circuits (FPCs)						
	Dynamic, high-flex tactile sensor arrays and strain gauges integrated into limb structures	Flexible interconnect solutions				
Power and Signal Cables						
	Dynamic power and signal cable assemblies for limb actuators and feedback systems	Cable assembly				

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Motion Actuation Systems: Dexterous Hand

	Application Note	Configuration	Pitch	Wire Size	Circuits	Current	Voltage
DuraClik Connectors							
	Secure power and signal connections from the wrist module into the hand assembly	Wire-to-board	2.00mm	26 to 22 AWG	2 to 24	Up to 3.3A	Up to 125V
Micro-Lock Plus Connectors							
	Compact, positive-locking wire-to-board control for micro-actuators embedded in palm housing	Wire-to-board	1.25 to 2.00mm	30 to 22 AWG	2 to 42	Up to 4.7A	Up to 250V
MiniMix Hybrid Power and Signal Connectors							
	Secure hybrid power and signal connections from the wrist module into the hand assembly through narrow routing channels	Wire-to-board	3.00mm (power pin), 0.80mm (signal pin)	-	-	Up to 15.0A	Power 120V Signal 10V
Zero-Hachi Connectors							
	Ultra-fine wire-to-board interconnect for space-constrained finger joint sensors and tip encoders	Wire-to-board	0.80mm	32 to 28 AWG	2 to 30	Up to 2.5A	Up to 30V

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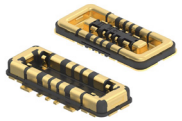
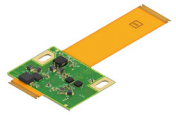
	Application Note	Configuration	Pitch	Mated Height	Circuits	Current	Operating Temperature
ChargeStack Connectors							
	High-density power distribution to local palm motor driver boards	Board-to-board	0.30, 0.35, 0.40mm	0.52, 0.70mm	8 or 10	Up to 20.0A	-40 to +80°C
SlimStack Connectors							
	Ultra-fine pitch board-to-board connection between palm control boards and finger control modules	Board-to-board	0.35 to 1.25mm	0.60 to 16.00mm	6 to 240	Up to 18.0A	-40 to +105°C
Flexible Printed Circuits (FPCs)							
	Ultra-thin, dynamic signal routing contoured through tight finger joints and around internal mechanisms	Flexible interconnect solutions					
Printed Electronic Touch Foils							
	Ultra-thin tactile and capacitive touch sensing arrays integrated directly beneath palm and fingertip skins	Printed electronics					

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