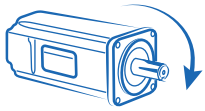
ANALOG DEVICES

AHEAD OF WHAT'S POSSIBLE™

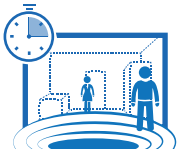
Enhance Productivity

with Advanced Robotic End Effector Solutions

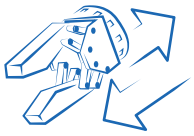
Advancements in industrial mounted robotics are bringing increased flexibility to modern manufacturing operations. Integrating real-time awareness and perception capabilities ensures robots can perceive and interact with the real world, enabling a safer working environment. Advanced robotic end effector tools and associated technology bridge the gap between the robot and its surroundings, enhancing precision and versatility in task execution. Analog Devices is at the forefront of developing real-time awareness solutions, including gripper reference designs, industrial vision and advanced connectivity technology, to enhance robot flexibility and maximize productivity.



High Performance Motion Control

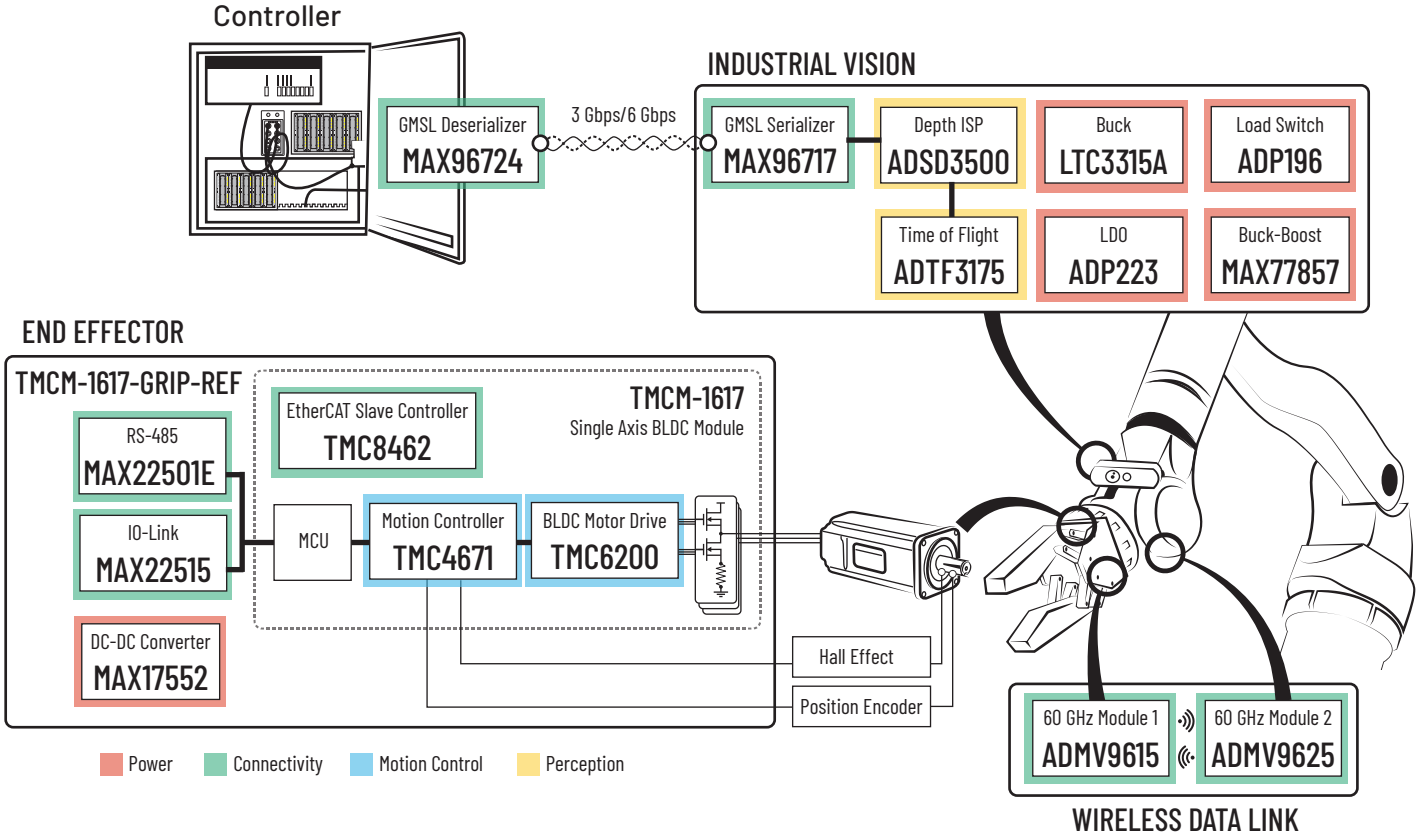


Real-time Awareness



Efficient Tool Change

Increased Productivity



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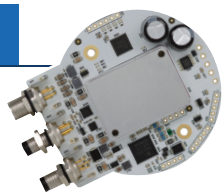
Advanced End Effector Tools

End effector tools are essential for robots to interact effectively with their environment with grippers, process tools, and sensors being the three basic types. The TMCM-1617-GRIP-REF open-source gripper hardware reference design is tailored for precise control of low voltage (24 V) brushless direct current (BLDC) motors in robotic gripper applications. The integrated single axis 3-phase BLDC servo drive (TMCM-1617) offers field oriented control (FOC) for precise current control, ensuring minimum torque ripple and enabling energy efficient, high performance motor control. EtherCAT®, IO-Link® or ADI Trinamic RS485 based TMCL protocol can be used to control the motor for superior compatibility, and integration with other robotic applications. The pre-configured software stack streamlines the initial setup process, reducing time to market.

TMCM-1617-GRIP-REF

Gripper Reference Design

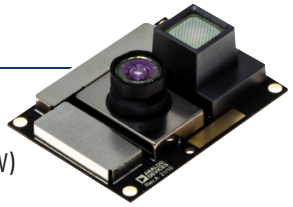
- Integrated BLDC servo drive
- Pre-configured software stack



ADTF3175

Industrial Vision

- Time-of-flight (ToF) module
- 75 x 75 deg field of view (FOV)



Real-Time Awareness with Industrial Vision

Equipping a robotic arm with high quality industrial vision technology enables accurate object detection and real-time tracking enabling robots to adapt to changes in their surroundings, enhancing productivity and minimizing downtime. ADI's industrial vision module (ADTF3175) is a complete ready to use Time-of-Flight (ToF) module offering megapixel-resolution 3D depth sensing and vision capabilities. The raw data from ADTF3175 is processed by the ADSD3500 (depth image signal processor) to produce final radial depth, active brightness (AB), and confidence data frames. This ensures low latency high frame rates, allowing the camera to precisely capture fast-moving objects. This capability enables the robot to make timely decisions and accurate analyses in dynamically changing industrial settings.

Seamless Communication with Real-Time Connectivity Solutions

Real-time connectivity solutions enable adaptability and reconfigurability, supporting the dynamic needs of the modern manufacturing environment. End effector applications typically use EtherCAT, IO-Link or RS-485 protocols for motion control, Gigabit Multimedia Serial Link (GMSL™) or Mobile Industry Processor Interface (MIPI) for vision, and wireless technologies for end of arm tool change.

Analog Devices' GMSL technology (MAX96717/MAX96724) is a high-bandwidth data transfer solution. It offers interface speeds up to 6 Gbps providing low microsecond latency connectivity links to support multiple cameras and sensors over a 15 m to 20 m range (depending on the application condition). This technology delivers a single wire solution for data, control and power, ideal for a space constrained robotic arm application.

	Description	Connectivity Function	Product Features
MAX22501E	RS-485 Transceiver	Motion Control	Integrated hot-swap protection
MAX22515	IO-Link Transceiver	Motion Control	Integrated protection for robust communication
TMC8462	EtherCAT Slave Controller	Motion Control	Integrated 100 Mbps Ethernet PHYs
MAX96717/MAX96724	GMSL Serializer/Deserializer	Industrial Vision	Data control and power over a single wire
ADMV9615/ADMV9625	60 GHz PCB Subsystem	End of Arm Tool Change	Full duplex operation under rotation

In modular manufacturing operations robots often have to replace end effector tools multiple times within the production process. The ADMV9615 and ADMV9625 PCB subsystem is a complete 60 GHz millimeter wave end-to-end wireless data link solution enabling efficient end of arm tool changes in robots while avoiding wear-and-tear of mechanical pins. It supports full-duplex operation for high-speed data transmission with ultra-low latency, high interference attenuation and low EMI, enabling reliable and efficient operation.

Power Management

The power management system in industrial robotics plays a crucial role in ensuring efficient and reliable operation. It involves the control, distribution, and regulation of power sources to multiple robotic subsystems. The MAX17552 DC-to-DC converter and TMC8462 EtherCAT® Slave Controller (with integrated buck regulators) enable a high efficiency and high density power solution for space constrained gripper reference designs. For effective integration of a high-quality industrial vision system, a low-noise and efficient power management solution is required for handling fast transient and asymmetrical load conditions. Combining the LTC3315A buck converter, ADP196 high-side load switch, ADP223 low noise LDO, and the MAX77857 high-efficiency buck-boost converter can offer such a solution.