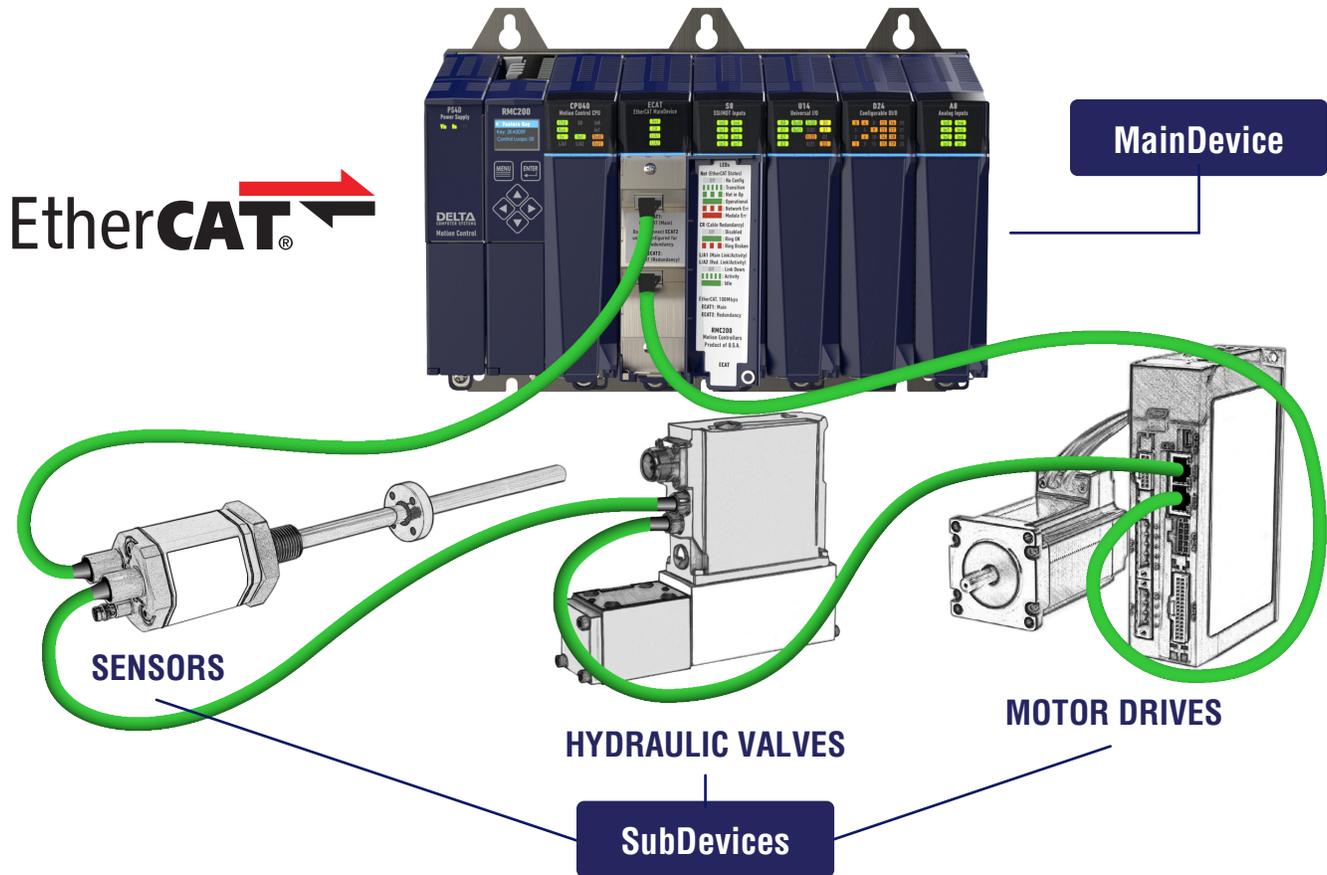


# What is EtherCAT?

## EtherCAT (Ethernet for Control Automation Technology)

is a fieldbus developed for industrial automation. It uses the same cables, connectors and signals as Ethernet (Cat 5e or higher cable, RJ45 and M12 connectors) but is much faster and is not compatible with regular Ethernet. It addresses the specific demands of the automation industry, including hardline real-time requirements with deterministic response times and systems typically composed of many nodes, each handling a small amount of cyclic process data.



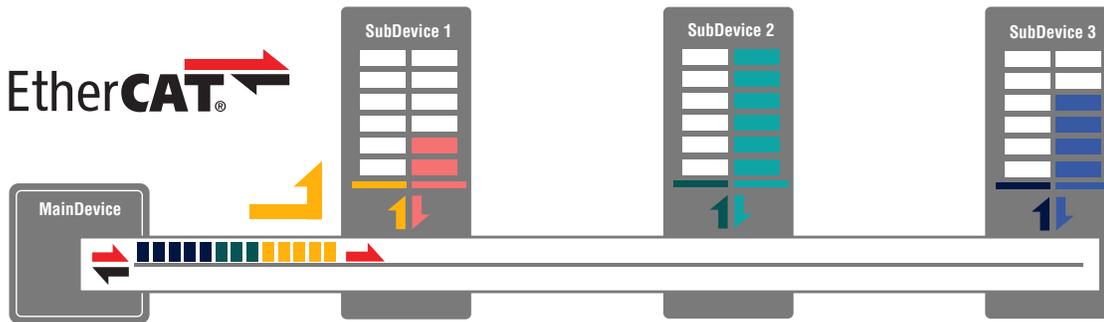
**MainDevice (Master):** A central controller (like Delta Motion's RMC200) sends data to multiple SubDevices.

**SubDevice (Slave):** These devices are connected in a sequence. As the data travels through each device, they read and add their information without stopping the frame.

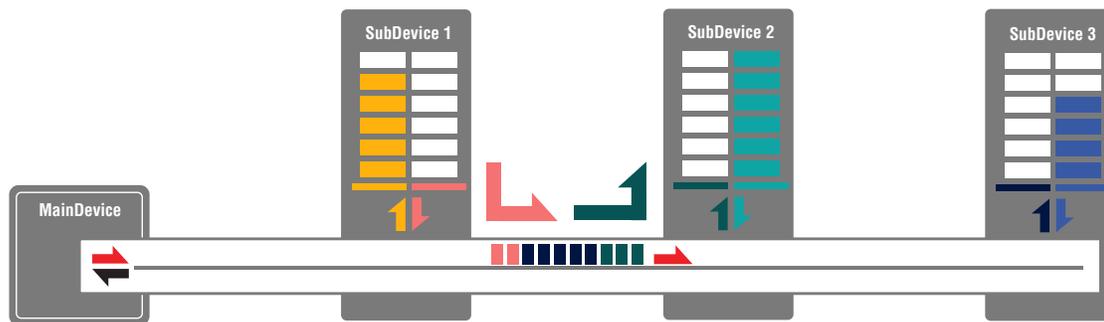
**Redundancy:** In a ring topology, EtherCAT enables continuous data flow by connecting devices in a loop, providing redundancy. If a connection or node fails, data reroutes in the opposite direction, ensuring reliable network operation with minimal disruption.

**DELTA  
MOTION**

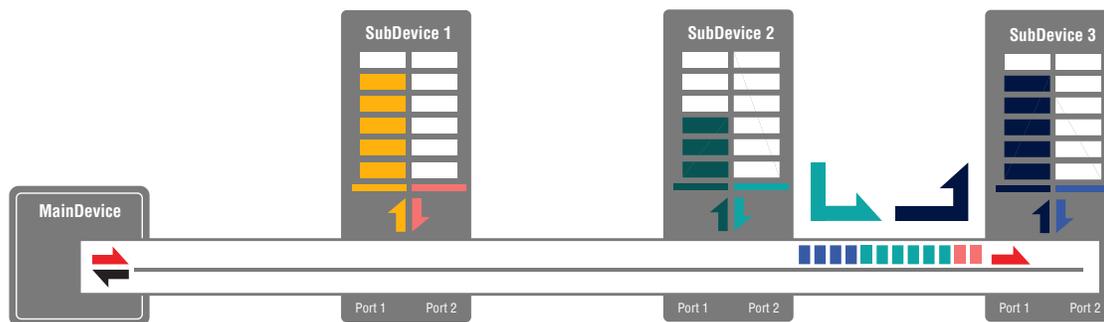
# Why EtherCAT is so Fast?



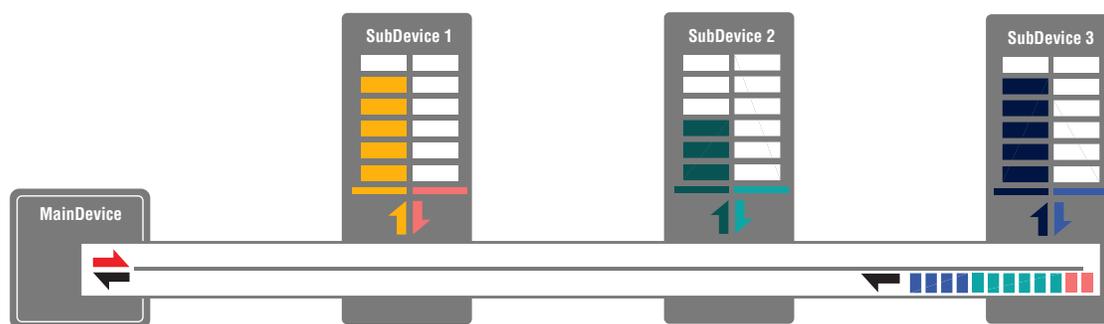
The EtherCAT MainDevice sends a single data frame that will pass through all SubDevices downstream.



Each EtherCAT SubDevice removes data from the frame and adds data to it as the frame passes through.



Most EtherCAT SubDevices have two Ethernet ports. One port being a receiving port and the other connected to the next device downstream.



Once the data frame has passed through the last SubDevice it is sent back to the MainDevice with data that was received from each SubDevice.

EtherCAT achieves its high speed and determinism by using a single packet that travels through all the devices. Ethernet, by comparison, sends individual packets to every device on the network, which generates more traffic for the same amount of data and requires more complexity related to routing. Many Ethernet protocols require separate request and response packets, which further slows down the communications as compared to EtherCAT.

# Why Choose EtherCAT?

**EtherCAT** is ideal for industrial automation, offering several significant benefits for hydraulic and electromechanical control including:

- **High Speed**  
EtherCAT is known for its real-time capabilities and extremely fast data transfer rates. This allows for rapid communication between devices, which is critical for applications requiring precise timing, control, and synchronization.
- **Minimal Jitter**  
EtherCAT provides consistent and predictable communication latency, via a distributed clock system which is essential for synchronous control tasks, ensuring smooth and reliable operation.
- **Scalability**  
EtherCAT can handle a large number of devices on a single network without significant performance degradation, making it suitable for both small and large-scale systems.
- **Flexibility**  
EtherCAT supports a wide range of devices and topologies. This flexibility allows for easy integration and expansion of systems.
- **Simplicity**  
EtherCAT can be easier to use than proprietary fieldbus systems and Industrial Ethernet, with features like automatic node addressing, no need for network tuning, and on-board diagnostics.
- **Reduced Wiring**  
EtherCAT simplifies wiring by using standard Ethernet cables and connectors. This reduces installation time, costs, and the potential for wiring errors.
- **Cost-Effectiveness**  
By leveraging standard Ethernet technology, EtherCAT can reduce the overall system costs associated with proprietary fieldbus solutions. Additionally, EtherCAT reduces the need for active infrastructure components, special interface cards, costly chips, and IT experts.
- **Compatibility**  
EtherCAT is compatible with a wide range of third-party devices and components, facilitating integration with existing systems and enhancing interoperability.
- **Deterministic Performance**  
EtherCAT guarantees data delivery within a fixed time frame, which is crucial for time-critical applications in automation and machine control.
- **Broad Industry Support**  
EtherCAT is widely accepted in the automation industry, ensuring long-term support and the availability of compatible devices and components.



**RMC200 Standard**  
Up to 50 Axes

**RMC200 Lite**  
Up to 18 Axes

The RMC200 is available in two configurations to meet the needs of any application, the RMC200 Standard and the RMC200 Lite. These controllers offer an unrivaled combination of control capability and ease-of-use for an effective and affordable option for a wide range of applications. The R200-ECAT module adds EtherCAT master capability to RMC200 motion controllers.

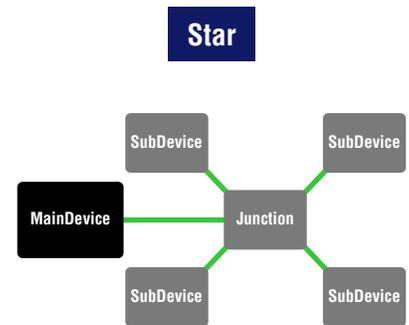
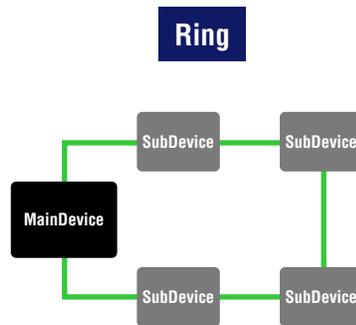
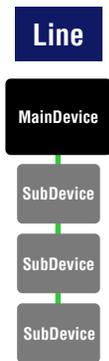
## EtherCAT Topologies & Redundancy

EtherCAT operates in full duplex mode, with bidirectional Ethernet cables for flexible network topologies. This makes it ideal for large and complex networks. An EtherCAT network consists of a MainDevice that manages the network and multiple SubDevices, each with two or more ports.

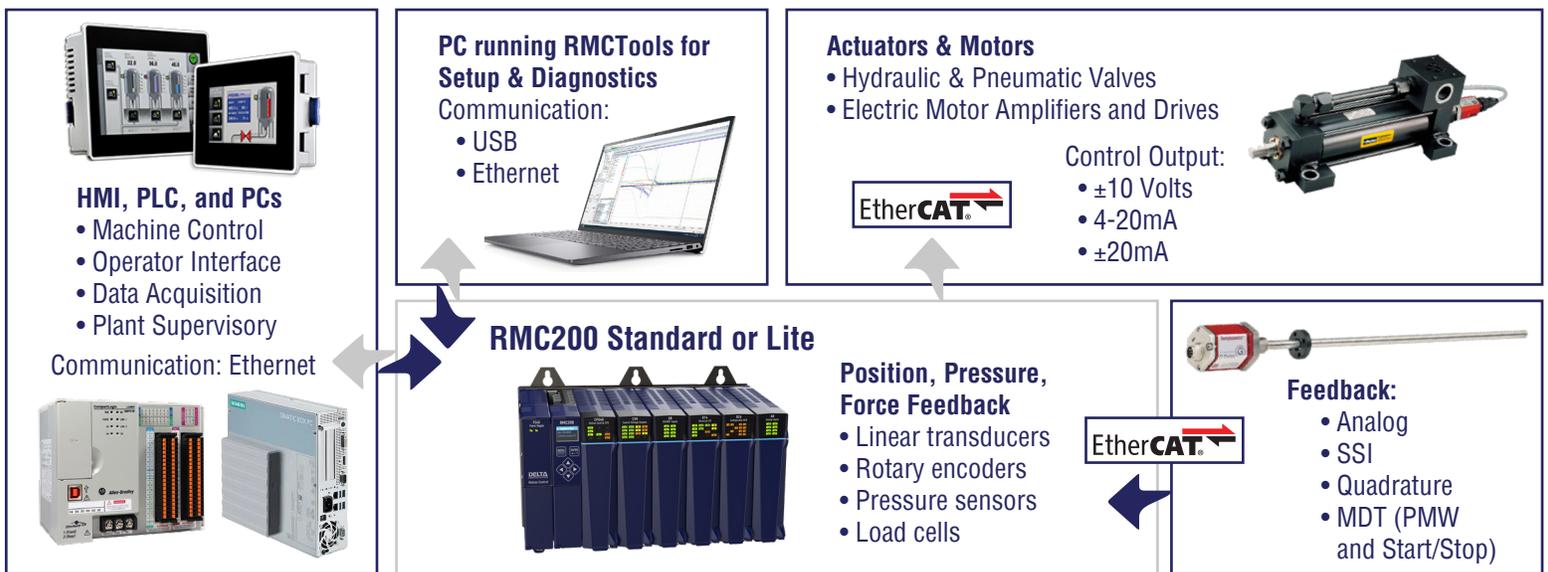
The most common topology is a line topology, connecting the In and Out ports of each SubDevice in sequence.

Connecting the last device of a line topology back to the MainDevice creates a redundant ring. If a cable fails, data circulates in both directions back to the MainDevice.

Other topologies, such as star, can be made with EtherCAT junctions. These are not as common due to the extra cost of EtherCAT specific junctions.



## Where the RMC fits into a Motion Control System



# EtherCAT vs. Direct I/O

	EtherCAT	Direct I/O
<b>Wiring</b>	Less wiring	Each device directly wired to RMC
<b>Data</b>	More sensor, diagnostic, and troubleshooting data	Basic sensor data
<b>Speed</b>	High-speed network	Faster than EtherCAT, lowest latency
<b>Setup and Configuration</b>	Requires more configuration	Simple configuration
<b>Drives</b>	Easily interface with drives	Requires drives with +/-10V and encoder emulation
<b>Topology</b>	Flexible topology (Ring, star, tree, line, and bus)	Point-to-point connections (Each I/O device is wired to the controller)
<b>Access to Devices</b>	More 3rd party SubDevices	Less 3rd party SubDevices
<b>Maintenance and Troubleshooting</b>	More diagnostic data available	Can often be done using existing tools
<b>Cost</b>	Varies. Some EtherCAT devices, like valves and position sensors, can be more expensive, while basic discrete I/O or simple analog devices may cost the same or less. Drives are generally similarly priced	
<b>Flexibility</b>	The RMC200 allows any combination of EtherCAT and direct I/O to be used together in the same system	
<b>Complex Motion</b>	Supports complex motion control (position, velocity, pressure/force)	
<b>System Scalability</b>	Scalable for controlling up to 50 axes/devices	
<b>Support</b>	Access to free 24/7 knowledgeable, responsive Delta support	
<b>Obsolescence</b>	Delta has a practice of never obsoleting products as long as there is demand for them	



## R200-ECAT Communication Module with Redundancy Port

The R200-ECAT module is compatible with the RMC200 Lite and Standard, for control of up to 18 and 50 axes, respectively. Upgrade your existing system easily by plugging in the R200-ECAT module and performing a firmware update. Position, velocity, pressure, and force control can be controlled via EtherCAT or a combination of EtherCAT devices and plug-in I/O modules.

# EtherCAT MainDevice with Redundancy Port

The ECAT module provides EtherCAT MainDevice functionality, allowing control of electric motor drives and communication with other EtherCAT subordinate devices such as sensors and actuators. With two RJ-45 ports, the ECAT module supports cable redundancy.

The RMC200 supports position, velocity, pressure, force and torque control, and single and dual-loop axes via EtherCAT. Axes may be defined with output and feedback in any combination of EtherCAT data or directly connected sensors or actuators. The RMC200 EtherCAT supports CANopen over EtherCAT (CoE) CiA402 drive profiles and CiA408 valve profiles.

The ECAT module is supported by all RMC200 bases and must be installed in slot 2 (the slot immediately to the right of the CPU). LED indicators provide information on the network state, redundancy state, and individual port states.



## EtherCAT Interface

Ports	2 ports: ECAT1: Main port ECAT2: Redundancy port
Supported Topologies	Linear, ring and star
Hardware Interface	IEEE 802.3 for 100BASE-T (twisted pair)
Data Rate	100 Mbps
Duplex	Full Duplex
Features	Auto-negotiation, Auto-crossover (MDI/MDI-X)
Connectors	RJ-45 (2)
Cable	CAT5, CAT5e or CAT6, UTP or STP
Cycle Times	250 $\mu$ s minimum
Distributed Clock	Subordinate devices that support DC on the network are synchronized with the motion loop of the RMC200



EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.