

ETHERNET CABLE CLASSIFICATIONS

TECHNICAL ARTICLE

Demand for Higher Bandwidth Drives New Ethernet Standards

The development of new data communications systems in the aerospace and defense industry is driving the need for more bandwidth. Ethernet standards have evolved to meet the data transfer rate and frequency requirements for these modern systems. Ethernet cables are used in a wide variety of aircraft, ground vehicle and mobile communications shelter applications, including ethernet backbones, avionics networks, in-flight connectivity, navigation systems and digital video. These mission critical systems are often installed in rugged and harsh environments that make signal integrity and system performance a challenge.

To address these performance requirements, PIC Wire & Cable offers a portfolio of CAT5e, CAT6a and CAT7 ethernet cables that transmit up to 10G of data at 600MHz with low loss, lightweight and flexible characteristics for applications that require robust, space saving and easily routable cables.

Ethernet Classifications: Pairing Data Applications with Cables

There are two main organizations that establish ethernet classifications: Telecommunications Industry Association (TIA) and International Organization for Standardization (ISO). Ethernet classifications are primarily established based on system frequency and data transfer speed.

To specify the correct ethernet cable for an application and ensure proper performance, the system's frequency and data speed requirements must be considered first. Once these requirements are identified, choose the ethernet classification that is the best match for the application's needs.

Ethernet Cable Classification

System Requirements		Classification		
Frequency	Data Transfer Speed	TIA (Cabling/Components)	ISO (Cabling)	ISO (Components)
1-100 MHz	1000 Base-T	Category 5e	Category 5e	Class D
1-250 MHz	1000 Base-T	Category 6	Category 6	Class E
1-500 MHz	10G Base-T	Category 6a	Category 6a	Class Ea
1-600 MHz	10G Base-T	N/A	Category 7	Class F

After identifying the classification best suited for the application, consider other cable characteristics that may impact the system's performance in a rugged environment:

- Flexibility
- Durability
- Length requirement

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Ethernet Cable Construction: System and Environmental Performance

Ethernet cables that are designed to pass high data transfer rates at high frequencies run an increased risk of experiencing crosstalk, or wire pair to pair signal interference. Cables with crosstalk issues reduce signal integrity and negatively impact system performance.

To reduce the amount of crosstalk and increase the cable's max distance, PIC Wire & Cable's CAT5e and CAT6a cables feature a center spline to separate the wire pairs and reduce potential signal interference. The CAT6a wire pairs undergo additional twisting to further reduce crosstalk since the cable transfers more data at higher frequencies.



Figure 1: E6A0824 - CAT6a

PIC Wire & Cable's CAT7 cables perform at 10G speeds at even higher frequencies than CAT6a by individually shielding all pairs. The individual shielding significantly reduces crosstalk, increases max distance and protects signal integrity, which also makes CAT7 cables reliable solutions for low skew video applications.



Figure 2: E74824 - CAT7

Cable jacket options include ETFE and PTFE tape. ETFE jackets are rugged and designed for harsh environments that require a more durable solution. PTFE tape jackets are optimized for applications that require lightweight, flexible solutions in small, tight environments. Jackets are also laser markable for clear labeling and easy identification.

EWIS testing is conducted on all data cables to ensure high system and environmental performance. Tests performed include jacket blocking, thermal shock, abrasion, shrinkage and cold bend. Data cables also passed the minimum bend radius per channel requirements.

Ethernet Connectors and Assemblies

Pairing DataMATES ethernet cables and connectors provides a robust interconnect solution by optimizing data transmission, electrical performance and reliability. PIC Wire & Cable offers a wide variety of RJ45 connectors to support different applications.

Proper cable assembly is critical to optimizing the full benefits of interconnect technology. PIC Wire & Cable's assembly facility provides certified and tested assembly sets to simplify the system installation process. Pre-engineered assembly drawings are available to streamline the procurement process and simplify the US Federal Aviation Administration (FAA) submission process for modifications and installations.