

# MHz or Megabits?

## Understanding the requirements of industrial ethernet cables

In today's industrial automation systems ethernet plays a major part. The networks rely on data being passed through the system at high rates to underpin the performance of this network.

The digital performance of a network is subject to the active devices within the networks such as switches and controllers. However it is the passive devices such as cable and connectors which can ultimately determine a network's performance.

The frequency performance of a component dictates its performance. Let us take Cat 5 cable as an example. Cat 5 cable is specified for operating frequencies up to 100MHz. However the cable is suitable for 100MBIT applications using two pairs and gigabit applications (1,000MBIT) using a 4 pair cable in association with the correct connector. It is easy to confuse MHz performance with the MEGABIT.

Class	Frequency Range	Data Rate 100Mbit	Capability 1GBIT
Cat 5/5e	100MHz	2 Pair	4 Pair
Cat 6	350MHz	✓	✓
Cat 6A	500MHz	✓	✓

Clearly cables of a higher category (Class) meet all the transmission characteristics of the lower classes, they therefore provide additional performance margin in a given application.



**Conductor Size**

Stranded ethernet cable does not have the same performance characteristics as solid conductor. This must be remembered when distance is a factor. Ethernet conductors are typically 26AWG and 24AWG, and it is always best to use the largest size when requiring high data rates over long distance. The Profinet standard saw 22AWG cables being introduced, with this wire size there is significant transmission performance advantage over 26AWG and 24AWG, and full 100m segment length can be achieved with stranded or solid cable types. Three types have been defined within the Profinet standard (see table below). Care must be taken to select the correct RJ45 connector when using 22AWG cables as many are not compatible with the increased wire size and the larger o/d of profinet cables.

**POE (Power Over Ethernet)**

Spare conductors in an ethernet cable can be used to provide power to ethernet devices. Clearly, wire size is important in the calculation of voltage drop in POE applications, and is important to bear in mind in cable selection.

**Cable selection**

The industrial environment requires suitable cables which have far more robust constructions than those used in office environments. Materials such as PUR are often used to provide mineral oil resistance, high abrasion resistance and are halogen free.

Ethernet cables are available with solid conductors which are only suitable for static applications.

Stranded conductors, typically 7 strands for flexible use.

Highly stranded, typically 19 strands for continuous movement eg drag chain applications.

For more information download our latest **Ethernet Connectivity guide**

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Cable type	Application Type A	Application Type B	Application Type C
<b>Design</b>	<b>Data Cable</b>	<b>Data Cable</b>	<b>Data Cable</b>
Profinet Cable Installation Type	Stationary No movement after installation	Flexible Occasional movement or vibration	Special applications (eg highly flexible, permanent movement, vibration or torsion)

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