

Gerd Weking

Generic cabling standardization

In modern buildings, the IT infrastructure is just as important as heat, light and electricity. Consequently standardization was and remains a prominent aspect of building engineering. In the end, it ensures global communication, all the way to the workplace.



An important milestone was the merger of the information technology standardization activities of ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) into the Joint Technical Committee ISO/IEC JTC 1 – Information technology in 1987 and the founding of subcommittee SC 25 – Interconnection of information technology equipment. The development of standards for generic cabling applicable to residential, office and industrial premises was the focus of the work from the beginning. In this context, generic means that the cabling system is defined by physical transmission parameters, such as signal attenuation, crosstalk and return loss, and that within the limits of the frequency range any transmission protocol is supported. The first edition of ISO/IEC 11801 – Information technology – Generic cabling for customer premises was published in 1995, and the revised and expanded second edition was released in 2002. (ISO/IEC 11801 also deals with generic optic cabling, but this topic is not discussed in this article).

The work accomplished in the last five years has dealt with both vertical developments, i.e. higher technical requirements, particularly higher transmission frequencies, and horizontal developments, as new developments for the industrial building and the “intelligent home”. Both aspects are discussed in the following.



GENERIC CABLING IN INDUSTRIAL BUILDINGS

ISO/IEC 24702 – Information technology – Generic cabling – Industrial premises was developed based on earlier and parallel work in Europe by CENELEC and in the US by TIA. ISO/IEC 24702 supports both philosophies:

- Shielded cable (STP), popular and most used in Europe
- Unshielded cable (UTP) for the US market

HARTING participated actively in the development of ISO/IEC 24702, because generic cabling ends per definition in a TO (Telecommunication Outlet), that is the connector to which the industrial automation device, computer or telephone is connected. The HARTING PushPull connector was standardized as the generic TO in ISO/IEC 24702. The HARTING PushPull had previously been standardized in the connector standard IEC 61076-3-106 as variant 4, therefore ISO/IEC 24702 only refers to variant 4 of this connector.

TECHNICAL ENHANCEMENTS IN ISO/IEC 24702

The transmission requirements and general structure of industrial cabling are based on ISO/IEC 11801, but the following important enhancements have to be mentioned:

- The maximum distance over which communications services can be distributed is 10,000 m instead of 2,000 m in ISO/IEC 11801
- Modified hierarchical cabling structures
- Implementation options
- Environmental classes for industrial buildings were defined and specified in the MICE table.

WHAT DOES MICE MEAN?

MICE stands for: Mechanical, Ingress, Climatic, Chemical and Electromagnetic. Three levels are defined:

- M1 I1 C1 E1 classifies the typical office environment, as is assumed in ISO/IEC 11801.
- M2 I2 C2 E2 classifies the industrial environment of an ordinary factory floor.
- M3 I3 C3 E3 classifies harsh environmental conditions, such as in heavy industries.

To get the idea behind the MICE philosophy, it might be helpful to understand what MICE is not: The MICE classification does not claim to take all possible industrial environments into consideration. As a result, the planning engineer is still obliged to define the appropriate specifications for his/her project. The values in the MICE tables given in ISO/IEC 24702 are not qualification testing requirements for cables or connectors. They are also not system requirements for the installed cabling. For example, a transmission link can begin in an air-conditioned

area and end at a machine with strong vibrations and strong electromagnetic interference fields. But the MICE tables give industrial cabling developers and planners values that they may use for technical design, while keeping in mind that:

- The requirements are not necessarily strictly class 1, 2 or 3, areas with strong mechanical load in combination with low climatic and electromagnetic loads are very common, for example M3 I1 C1 E 1.
- The planning engineer is encouraged to use local mitigation or isolation techniques to protect exposed areas of the cabling by either:
 - Protecting/Covering the critical areas of cable and/or connector (mitigation technique) or
 - Isolating the source of the environmental impact (heat, vibration, electromagnetic load or use a less critical installation path)
- Higher requirements for components like connectors and cables should be considered in conjunction with the points mentioned above to achieve the best installation practice in consideration of investment and quality of IT service.

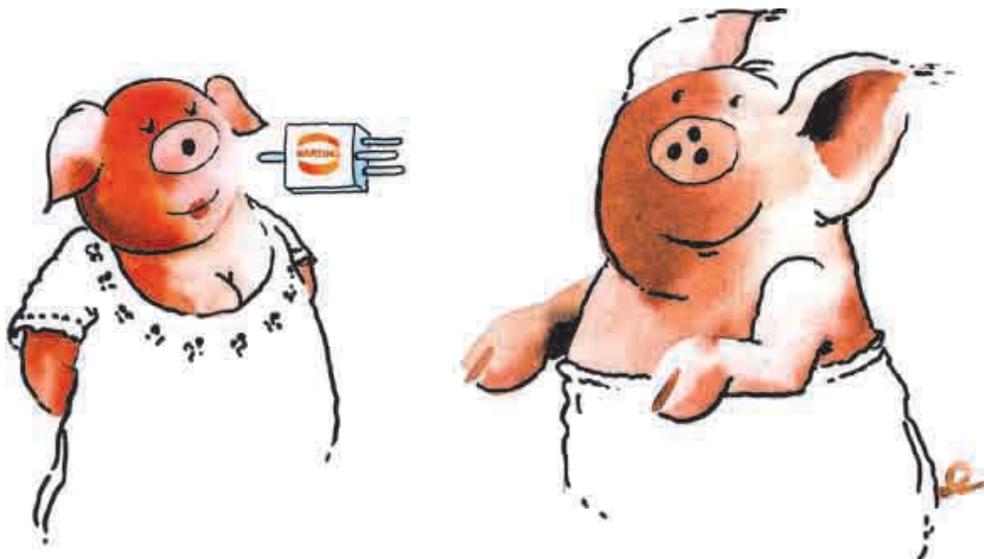
INTERNATIONAL COORDINATION

International standardization is based on consensus between all stakeholders, but due to diverging interests this is sometimes hard to achieve. In the development of ISO/IEC 24702 there were various opinions regarding the MICE requirements and the selection of the generic TO connector. The decision between four connector candidates was finally achieved by an international consultation process at the level of the participating national committees. The result of this selection was that the FDIS (Final Draft International Standard) of ISO/IEC 24702 was approved unanimously.

INTELLIGENT HOME AND NETWORK CONVERGENCE

The terms Intelligent Home or Smart Home and Smart Living stand for an entire basket of approaches for present and future living and working. Even today, almost any conceivable home automation process is possible, with interest groups and consortia preparing specifications for their market needs.

Today, European standard EN 50090 is the open standard for Home and Building Electronic Systems (HBES). Leading com-



panies support the EN and they participate in interest groups to ensure interoperability of products from involved suppliers. The interoperability is usually documented by a certificate and a label. A considerable range of compatible components and devices in accordance with EN 50090 has been developed. The cooperation between Batibus (HVAC – heating, ventilation and air conditioning) and EHS (European Home System – white goods) with EIB (European Installation Bus) under the umbrella of the Konnex Association provided important guidance in this process.

Other European firms have joined the US consortium LonMark, which claims to represent a globally leading brand for open, interoperable control products, such as access control, elevator controllers, energy management, fire protection, HVAC, lighting control, measurement and safety, all based on the ANSI/CEA-709 standard. In China, a work group set up by the Ministry of Information Industry is working on the ITopHome protocol for home electronic systems. In Japan, work on a home network with respect to energy conservation is progressing; the projects are being developed under the heading ECHONET (Energy Conservation and Homecare NETWORK).

GLOBAL COOPERATION IS NECESSARY

Global standardization and interoperability of systems and components for the intelligent home is still a dream and far away from reality. The reason for this is parallel developments

in different regions of the world but it also results partially from the industry's wish to squeeze their own developments into global standards. Global standardization and interoperability is critical for the success of existing and future solutions, and to have a good chance to reach a critical mass for profitability. The international standardization organizations ISO, IEC and ITU (International Telecommunication Union) convened in Geneva in February 2006 in order to exchange ideas on global standardization in the field of intelligent homes. ISO/IEC JTC 1 SC25 was instructed by its parent committee to take a leading position in this process and to actively seek the cooperation of leading standardization organizations and industrial consortia. The goal is to develop in liaison with these organizations a few umbrella standards for home networks, in order to ensure interoperability among today's isolated solutions.

HIGHER TRANSMISSION FREQUENCY AND POE

The following describes vertical aspects of the development in ISO/IEC JTC1 SC25. PoE (Power over Ethernet) means supplying power to communication devices via the data lines.

STANDARDIZATION FOR GENERIC CABLING UP TO 10 GBaseT

Generic cabling should support the highest technical requirements. IEEE 802.3an (10 GBaseT), released in June 2006 is actually the most prominent and challenging topic of ISO/IEC JTC 1 SC 25 WG3. It states that the cabling must be specified for up to 500 MHz. For existing buildings with lower performance

cabling, recommendations are under preparation for providing information about the conditions under which 10 GBaseT can still be supported reliably. The work will be published as a Technical Report, numbered ISO/IEC TR 24750. For new installations, an annex to ISO/IEC 11801 is under preparation, specifying the new classes EA for 500 MHz and FA for 1,000 MHz. This annex will also probably continue to support the component approach, which means that a transmission channel with cables and connectors according to category 6A is assumed to meet the transmission requirements of class EA.

CONNECTORS ACC. TO IEC 60603-7-41 AND -7-51 CAT 6A

The requirements for the frequency range from 250 to 500 MHz are still under discussion. Critical transmission characteristics for connectors are return loss, crosstalk and alien crosstalk, which is the electromagnetic interference caused by external sources.

Currently it is up for discussion whether the limiting values for crosstalk should be extrapolated between 250 and 500 MHz, or whether the requirements for the connectors must be reduced in this range. The following values are being discussed for 500 MHz:

	Value at 500 MHz	
	NEXT	Return Loss
Cat 6 linearly extrapolated	40 dB	10 dB
Cat 6 with negative extrapolation (relaxation) TIA 568-B.2-10	34 dB	14 dB
Cat 6 with negative extrapolation (relaxation), other experts	38 dB	16 dB

Basis of discussion

POWER OVER ETHERNET

PoE means that IT devices can be supplied with power via the twisted-pair data lines. In this case, either unused wires of the communication cable are used, or the power is carried by the four wire pairs used, in addition to the data signal. The power supply can either be integrated into active network devices, like switches, or it can be provided via separate PSE (Power Supply Equipment). Up until now, a maximum power of 15.4 W

was specified by IEEE 803.2af at 48 V, but the latest developments of IEEE 803.2at (PoE plus) require power up to 30 W and even higher power levels are being discussed.

Temperature increase of installed cable bundles is a particular risk. So far, ISO/IEC 11801 specifies an upper temperature of 60° C for the cable, including current heating. The experts of ISO/IEC JTC1 SC25/WG3 worry about transgression of the upper temperature limit in existing installations resulting in possible damage, breakdown or even fire. Therefore increasing the requirements for old installations is not acceptable. To support the IEEE work a PoE cabling guide is under preparation in SC25/WG3 to provide information about the conditions under which PoE plus can be supported by existing cabling.

Increasing the PoE current to 420 mA could as well cause damage to connectors if connections are routinely disconnected under load. Therefore ISO/IEC JTC1 SC25 recommends that the IEEE PoE plus Task Force clearly points out in their document that disconnection under load is not permitted. IEC SC 48B connector experts are working on a Technical Report to provide recommendations for disconnecting under load for ISO/IEC JTC1.

SUMMARY

The development of generic cable systems for the IT infrastructure in modern buildings is still progressing. Up until now, the copper cabling industry has always managed to push the limits further upwards, i.e. to higher frequencies. As a result, the optical cabling segment has remained relatively small. The clear trend to wireless will take over parts of today’s IT infrastructure in the foreseeable future, but will not replace it.

For the Intelligent Home, convergence of the various technical standards is required in order to foster global competition on a common platform. For industrial applications, the published ISO/IEC 24702 standard will be approved and published as EN 50173-1 and EN 50173-3 for Europe and ANSI/TIA/EIA-1005 in the US.



GERD WEKING
 General Manager Intellectual Property and International Standardization
 HARTING Technology Group
 gerd.weking@HARTING.com