WHITE PAPER

SINGLE-PAIR ETHERNET
BUILDING BRIDGES IN THE INTELLIGENT BUILDING

While SPE technology features in the standards, the relevant manufacturers are working on finding optimal solutions for Industry 4.0, IoT and intelligent non-residential buildings.

The Ethernet protocol has been continuously evolving since the introduction of 10Base-T in 1990. Today Ethernet is the dominant "data highway" in Local Area Networks (LANs). Copper based data networks provide transmission speeds of up to 40 gigabits per second (Gbit/s), and distances of 100 metres are standard.

Copper technology is prevalent in tertiary building cabling. The simple and robust installation provides a cost-efficient solution for both fast and slow communication tasks in non-residential buildings. With the introduction of Power-over-Ethernet (PoE) and the refinement of 4-pair PoE (just under 100 watts) moderate consumers, for example access points or cash register systems, can be supplied with power directly via the Ethernet.

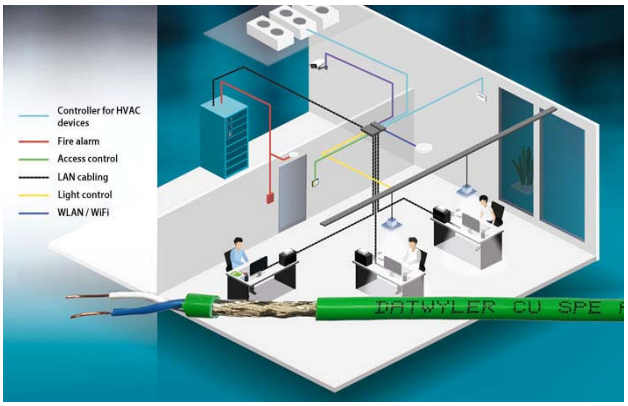
At the moment large sections of the internal condition monitoring and control in intelligent building complexes – offices, airports, tunnels etc. – are still being implemented by means of bus systems. Four-pair copper data cables are not the first choice here because of their range limitation and large cross-section.

Standard ISO/IEC 11801-6 "Distributed Building Services" describes how gateways can be used to link standardised and proprietary control and alarm systems to universal building cabling. Thanks to these gateways higher-level monitoring and control systems can be implemented.

On the other hand, such a system also has disadvantages in terms of complexity.

IoT as a driver of SPE

With Industry 4.0 and the Internet of Things (IoT) it is clear that an unrestricted flow of information is essential for integral networked communication inside a building. Yet the



Integrated communication via TCP/IP in a non-residential building

structures beyond the above gateways remain invisible to the higher-level devices – and their analysis and management programs. This fact limits the development capacity of the IoT idea and drives up the cost of integrating the field level into higher-level management systems.

In addition to this, signal processing and transmission increase the latency times, something which is detrimental to time-critical applications.

In fact bus systems such as KNX, LON, Profibus or EchoNet are also often only compatible within one family. This makes the overall system even more complex and prone to error.

Only one protocol to perform all tasks

Single-Pair Ethernet (SPE) provides the unique opportunity of combining the good characteristics of two worlds – TCP/IP and bus systems. For the first time SPE makes it possible to perform all the communication tasks arising within a building in a logical way, namely using only one protocol.

SPE can cover distances of up to 1000 metres, consists of comparatively thin cables and small connectors, and is simpler and more cost-effective to install than four-pair solutions.

Acceptance in standardisation

Today Single-Pair Ethernet is already standardised by the IEEE. The specification family is IEEE 802.3 – as with the cabling architectures based on copper and fibre optics used to date.

SPE covers the following bandwidths and distances:

SPE protocol	Standard	Speed	Max. distance
IEEE 802.3ch	2.5GBase-T1	2.5 Gbit/s	15 m, shielded
IEEE 802.3ch	5GBase-T1	5 Gbit/s	15 m, shielded
IEEE 802.3ch	10GBase-T1	10 Gbit/s	15 m, shielded
IEEE 802.3bw	100Base-T1	100 Mbit/s	40 m, shielded
IEEE 802.3bp	1000Base-T1	1 Gbit/s	40 m, shielded
IEEE 802.3cg	10Base-T1	10 Mbit/s	1000 m, shielded

SPE also features in ISO/IEC 11801 Ed.3. The architecture, the performance characteristics for cables, connectors and the overall system (channel) are defined in all the relevant parts of the Standard. The SPE technology is seamlessly integrated into the existing architecture. SPE switches are used in addition to the switches for fibre optic cables and four-pair copper cables.

The connector interfaces are also standardised. In the office environment commensurate with $M_1I_1C_1E_1$ provision is made for two connector faces: a two-pin one in an LC housing (IEC 63171-1) and the Phoenix Contact two-pin connector, which is available both in an $M_1I_1C_1E_1$ version (IEC 63171-2) as well as an $M_3I_3C_3E_3$ version (IEC 63171-5) – the latter for industrial applications.

Power supply via SPE

From the start Single-Pair Ethernet was designed to transmit electrical power as well as data. Power over Data Line (PoDL) is the Ethernet technology of choice for this. With PoDL decentralised and maintenance-intensive power supplies are no longer required, as PoDL is able to supply end devices with up to 60 watts via the two-wire line.

The IEC 63171-5 connector is the only standardised connector for SPE of a suitable size and shape for integration into standard M8 sensor connection technology.

SPE connector in the industrial version (IEC 63171-5) and for the office environment (IEC 63171-2) with identical connector face. Source: Weidmüller

Manufacturers work together

Datwyler is instrumental in helping to drive forward the technological development of SPE in non-residential buildings. In common with other companies – Weidmüller, Phoenix Contact, Sick, Microchip, Reichle & De-Massari, Fluke Networks and many more – there is already a lively exchange of technology information with the aim of refining Single-Pair Ethernet technology and finding the very best solutions for Industry 4.0, IoT and intelligent non-residential buildings.

All the companies involved in the SPE System Alliance are convinced that SPE will revolutionise the possibilities and transparency of communication at field level.

Datwyler single-pair data cable for SPE applications

