Labelling for Industrial Networks

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Industrial Ethernet cabling requires a higher level of labelling and marking

Industrial Ethernet is the name given to the use of Ethernet protocol to a range of industrial and process control network applications. Until recently automation and control systems have tended to use manufacturers' proprietary protocols and cabling. The advance and lower cost of TCP/IP interfaces means that more and more control, data and voice applications are being integrated together, and this means an integrated cable platform to support them.

But cables destined for benign office environments aren't ideal for harsh industrial and outdoor environments. Several standards are in the pipeline to define the requirements of harsher environment cabling.

TIA 1005, *Industrial Cabling*, is due out in 2006

TIA/EIA-862 *Building Automation Systems Cabling Standard For Commercial Buildings* has been published

ISO/IEC 24702, developed under the jurisdiction of ISO committee JTC 1/SC 25, is specifying the design of a generic cabling infrastructure for industrial premises that stretches from the building entrance points to and including the Telecommunications Outlet

The task of the IEC's SC65C/JWG 10 committee is to prepare IEC 61918 – *Digital data communication for measurement and control - Profiles covering installation practicefor fieldbus communications media within and between the Automation Islands.* IEC SC65C/JWG10 is in close liaison with ISO/IEC JTC1 SC25/WG3/IPTG which is in charge of preparing ISO/IEC 24702: *Information Technology – Generic cabling for Industrial premises.*

Scope and Content of IEC 61918

This International Standard specifies profiles covering installation for fieldbus communications media within and between the Automation Islands of industrial sites. It covers copper and optical media.

Where the media includes options for power transfer to communications entities the power options are also specified. It also covers the Automation Outlet (AO) that is the interface between the industrial automation network and a corporate network defined according to generic cabling specified in ISO/IEC 24702. This International Standard is a companion standard to the communication systems specified in IEC 61158 and IEC 61784. It provides guidelines that cope with the critical aspects of the industrial automation area (climatic conditions, vibrations, chemical pollution, EMC, safety, etc.). It complements existing standards (IEC61158, IEC61784; IEEE 802.3; IEC11801; EN50174, EN50173, etc.). In particular, it complements defined generic industrial wiring specifications for enhanced shielding and armouring standards.

IEC 61918 addresses:

- Installation planning
- Installation implementation
- Installation verification
- Installation administration and maintenance
- Installation troubleshooting.

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The actual list of profiles to be addressed in the first Committee Draft (CD) is:
DeviceNet – ControlNet – EtherNet/IP – PROFIBUS – PROFIBUS-PA – PROFINET – INTERBUS REMOTE-BUS – INTERBUS RTE

From the European union we will have EN 50173-3 Information technology – Generic cabling systems – Industrial premises

Typical of the new industrial Ethernet and automation standards is the concept of MICE, or Mechanical, Ingress, Climatic and EMC specifications for differing severities of environment.

The acronym MICE is being adopted by many industrial cabling standards committees as a means of describing levels of harsh environments.

- Mechanical – shock, impact, vibration, bending & flexing, crush.
- Ingress – particulate ingress and immersion.
- Climatic – temperature, thermal shock, humidity, UV (solar radiation), chemical pollution.
- Electromagnetic – ESD, conducted RF, EFT, transient ground potential, magnetic field.

MICE levels are degrees of environmental severity within an industrial premise.

MICE 1 – Essentially a description of the commercial office environment.
MICE 2 – Light industrial: assembly, food processing, health care, wash-down, etc
MICE 3 – Industrial: petro/chemical, foundry, automotive, machining, etc.

However any industrial facility may contain one, two or all three levels, or may exceed all three.

There are three ways to protect a cabling system from an “aggressive environment”

- Mechanical isolation
- Mechanical separation
- Enhanced mechanical/electrical performance

TIA-1005 will be the Industrial Telecommunications Infrastructure Standard which will address test methods to qualify cabling, cables and connectors for MICE based on the EIA/TIA-568 channel model, with additional guidelines and specifications for industrial environments such as longer patch cords – shorter horizontal length, more than four connections and sealed copper and fibre connectors. Industrialised pathway systems will also be considered such as chemical and oil resistance, mechanical strength and EMI protection. This is a similar position to that being taken by CENELEC with their EN 50173-3 draft standard for industrial cabling and also ISO/IEC 24702.

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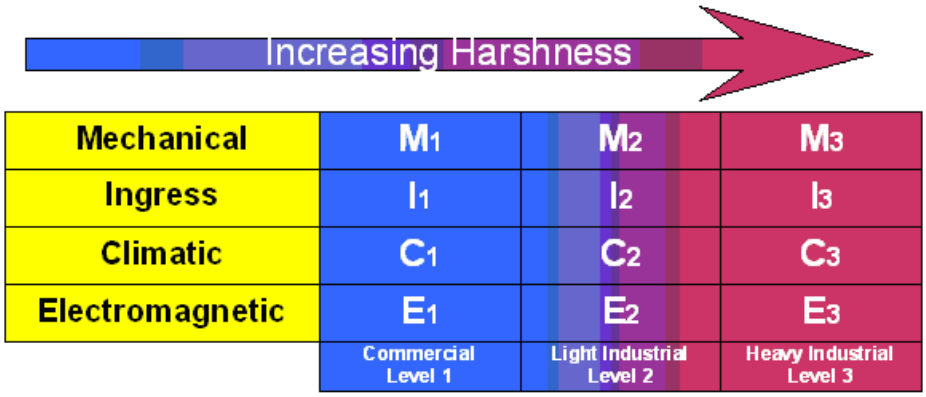

The table below shows some of the early work, still in draft stage, by the IEC, to define the climatic requirements for the three classes.

Climatic	C_1	C_2	C_3
Ambient temperature	-10° C to +60° C	-25° C to +70° C	-40° C to +70° C
Rate of change of temperature	0,1° C per minute	1,0° C per minute	3,0° C per minute
Humidity	5% to 85% (non-condensing)	5% to 95% (condensing)	5% to 95% (condensing)
Ultraviolet radiation (wavelength ffs)	ffs	ffs	ffs
Solar radiation (wavelength ffs)	700W/m^2	1120 W/m^2	1120 W/m^2
Liquid pollution Contaminants (cm^3/m^{-3}= ppm)	Mean (max) /Peak (max)	Mean (max) /Peak (max)	Mean (max) /Peak (max)
Sodium chloride (salt/sea water)	None	ffs	ffs
Sodium stearate (soap)	None	ffs	ffs
Detergent	None	ffs	ffs
Oil	None	ffs	ffs
Conductive materials in solution	None	Temporary (condensation)	Present
Gaseous pollution Contaminants (cm^3/m^{-3}= ppm)	Mean (max) /Peak (max)	Mean (max) /Peak (max)	Mean (max) /Peak (max)
Hydrogen sulphide	0,003/0,01	0,005/0,05	10/50
Sulphur dioxide	0,01/0,03	0,1/0,3	5/10
Sulphur trioxide	0,01/0,03	0,1/0,3	5/10
Chlorine wet	0,0005/0,001	0,005/0,03	0,05/0,3
Chlorine dry	0,002/0,01	0,02/0,1	0,2/1,0
Hydrogen fluoride	0,001/0,005	0,01/0,05	0,1/1,0
Ammonia	1/5	10/50	50/250
Oxides of Nitrogen	0,05/0,1	0,5/1	5/10
Ozone	0,002/0,005	0,025/0,05	0,1/1

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The cables defined for industrial Ethernet will be very close cousins of the Category 5, 6 and 7 and optical cables defined in the current, office based, structured cabling standards such as ISO 11801:2002 and EN 50173. There will be more call for screened cabling and probably optical fibre cable as well. Optical cables are much better at going long distances and fending off unwanted and potentially damaging electromagnetic interference.

Apart from their screening requirements, cables will be exposed to wider temperature variations, sunlight, water and seawater and a huge range of contaminants and solvents

Whatever the cables must survive then so must the labelling method that identifies those cables, patch panels and outlets. Unidentified, or unidentifiable cables will pose an administrative nightmare whenever new cables have to be added or existing cables repaired or replaced after damage. Proper cable labelling also allows obsolete cables to be removed, thus freeing up valuable cable containment space and preventing a potential fire risk from the build up of flammable plastic insulated cables.

Labels also have to survive the outdoor environment as well as benign indoor areas. The European standard for data cable installation EN 50174-3 Information technology – external cabling, recognises this, where it states that;

> Cables, jointing chambers and cabinets shall be labelled with a unique identifier to enable tracing in both directions. Labels shall be chosen allowing for the environments in which they will be used in order to ensure adequate lifetimes

When it comes to testing labels for their ability to survive these extremes of temperature, solar radiation and chemicals we have a range of suitable standards that we can invoke some of the following;

SAE J 1960 - Simulated External Weathering

SAE J 1960 is the test method used by the North American Automotive Industry for the evaluation of the weatherabilty of components used on the exterior of an automobile.

MIL-STD-202G Method 106G - Moisture Resistance

The test comprised of temperature cycling between 25º C and 65º C with 80% to 100% relative humidity and five excursions to -10º C with uncontrolled humidity. Testing for a duration of 10 cycles of 24 hours following 24 hours of pre-conditioning at 50º C.

MIL-STD-810F Method 502.4 - Low Temperature -25°C

MIL-STD-810F Method 502.4 (Procedure I - Storage) for low temperature performance with testing for durations of 24, 48 and 72 hours at -25º C.

MIL-STD-810F Method 502.4 - Low Temperature -40°C

MIL-STD-810F Method 502.4 (Procedure I - Storage) for low temperature performance with testing for durations of 24, 48 and 72 hours at -40º C.

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IEC60068-2-52 Test kb Salt Mist (Cyclic)

IEC60068-2-52 test kb Salt Mist (Cyclic) test comprises of two hours salt mist exposure followed by 7 days at 35 °c 90%/95% rh. Four cycles repeated in succession total of 28 days.

Conclusion

When specifying the labelling requirements for cable and related infrastructure for industrial Ethernet specify top quality products that offer easy to use, self laminating polyester labels that have been shown to meet, when applicable, the demanding environmental standards detailed above. Standardising on one cable labelling supplier that meets these performance specifications means that all the C_1 to C_3 climatic requirements can be met with ease. In addition to the labels themselves, software tools are available that allow rapid label production, with automated sequential numbering, on a computer with direct print to label sheets loaded in a standard laser printer, affording a rapid and low cost method of meeting the next generation of industrial Ethernet labelling and administration standards.

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