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Information technology — Control network protocol —

Part 2: Twisted pair communication

Technologies de l'information — Protocole de réseau de contrôle —

Partie 2: Communication de pair torsadée

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

ISO/IEC 14908-2 was prepared by CEN/TC 247 and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by the national bodies of ISO and IEC.

ISO/IEC 14908 consists of the following parts, under the general title *Information technology — Control network protocol*:

- *Part 1: Protocol stack*

- *Part 2: Twisted pair communication*
- *Part 3: Power line channel specification*
- *Part 4: IP communication*

Introduction

This International Standard has been prepared to provide mechanisms through which various vendors of local area control networks may exchange information in a standardised way. It defines communication capabilities.

This International Standard is to be used by all involved in design, manufacture, engineering, installation and commissioning activities.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this International Standard may involve the use of patents held by Echelon Corporation.

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INFORMATION TECHNOLOGY – CONTROL NETWORK PROTOCOL –

Part 2: Twisted pair communication

1 Scope

This International Standard specifies the control network protocol (CNP) free-topology twisted-pair channel for networked control systems in local area control networks and is used in conjunction with ISO/IEC 14908-1. The channel supports communication at 78,125 kbit/s between multiple nodes, each of which consists of a transceiver, a protocol processor, an application processor, a power supply and application electronics.

This International Standard covers the complete physical layer (OSI Layer 1), including the interface to the Media Access Control (MAC) sub-layer and the interface to the medium. Parameters that are controlled by other layers but control the operation of the physical layer are also specified.

2 Normative references

The following referenced documents are indispensable for the application of this International Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14908-1:2012, *Information technology – Control network protocol – Part 1: Protocol stack.*

ISO/IEC 15018, *Information technology - Generic cabling for homes.*

3 Network overview

The CNP free-topology twisted-pair channel supports up to 128 nodes on a single network segment with an optional link power source that supplies DC power to the nodes on the network. The channel is specified to support free-topology wiring, and will accommodate bus, star, loop, or any combination of these topologies. The total network length and number of nodes may be extended by use of CNP channel physical layer repeaters, or CNP compliant routers. The channel data rate is 78,125 kbit/s. Nodes can be either locally powered or link powered. A link-powered node derives its power from the network. The power is delivered on the same two conductors that carry data. Nodes are polarity-insensitive with respect to data as well as DC power. A locally powered node derives its power from a local source. The data is transmitted using Differential Manchester encoding, which is polarity-insensitive.

4 System specifications

4.1 General aspects

This section specifies the cable type used, terminations required with bus or free topology, maximum node counts and distances for link and locally powered schemes, and the maximum steady state power that can be drawn from the link power supply.

4.2 Cable

The cable shall conform to 9.4 of ISO/IEC 15018:2004.

4.3 Topology

4.3.1 Free or bus topology

The network may use either a singly-terminated free topology or a doubly-terminated bus topology.

4.3.2 Repeater

Two network segments may be interconnected with a channel physical layer repeater. No more than one physical layer repeater shall be in a path between any two nodes on a network. Physical layer repeaters shall not be interconnected in such a way as to create a loop.

Each port of a physical layer repeater shall meet the specifications stated in 6.2, 6.3.3, and 6.4. The delay through the repeater shall not exceed 36 µs.

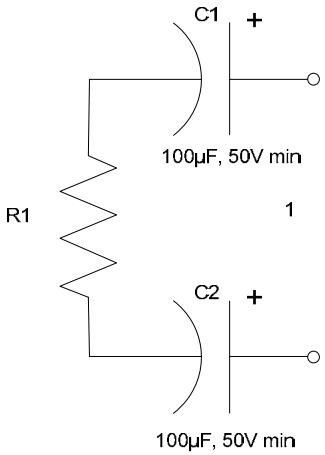
4.4 Cable Termination

4.4.1 Free-topology segment

A free-topology segment shall have a single termination. If the segment is locally powered, an RC network as shown in Figure 1 shall be used, with R1 = 52.3 Ω ± 1 %, 1/8 W. The termination may be located anywhere on the segment. If the segment is link-powered, the termination shall be provided by the link power source. See Figure 5. The link power source and termination may be located anywhere on the segment.

4.4.2 Bus topology segment

A bus topology segment shall have two terminations, one at each end of the bus. If the segment is locally powered, an RC network as shown in Figure 1 shall be used, with R1 = 105 Ω ± 1 %, 1/8 W at each end. If the segment is link-powered, the link power source shall provide one termination. See Figure 5. The other termination shall be an RC network as shown in Figure 1, with R1 = 105 Ω ± 1 %, 1/8 W.



Key

1 Network Connection

Figure 1 — Termination

4.5 Segment configuration

A free-topology twisted-pair channel shall support up to 128 link-powered or 64 locally-powered nodes at a maximum bit error rate of 1 in 100 000. Both types of nodes shall be supported on a given segment, provided the following constraint is met:

$$(1 \times \text{number of link powered nodes}) + (2 \times \text{number of locally powered nodes}) \leq 128$$

Table 1 shows the maximum bus length for a bus-topology segment.

Table 2 shows the maximum node-to-node distance and maximum wire length for a free-topology segment. The distance from each node to each of the other nodes and to the link power source shall not exceed the maximum node-to-node distance. If multiple paths exist, e.g., a loop topology, then the longest path shall be used for the calculations. The maximum wire length is the total amount of wire connected to a network segment.

Table 1 — Bus-Topology Distance Specifications

Maximum bus length	Maximum stub length	Units
600	3	m

Table 2 — Free-Topology distance specifications

Maximum node-to-node distance	Maximum total wire length	Units
250	450	m

4.6 Power specifications

The sum of the steady-state power drawn by all nodes on a segment shall not exceed 36,5 W. For each branch, the sum of the products of each node's distance multiplied by that node's power shall not exceed a constant:

$$P_1 \times d_1 + P_2 \times d_2 + P_3 \times d_3 + \ldots \leq C \times \alpha \quad (1)$$

where

- C is a constant, dependent on wire type, taking into account manufacturing tolerance and all other variations except wire temperature;
- $C = 1{,}9 \times 10^3$ Wm;
- P_i = Node power, i.e., the maximum steady-state power drawn by node ‘i’ f rom the network, in watts;
- d_i = Node distance, i.e., the distance of node ‘i’ from the link power source, in meters;
- $\alpha = 1/(1 + 0{,}003\ 93 * (\text{temp C- } 25°\text{C}))$, accounting for average wire temperature.

5 Link power

5.1 General

A link-powered node derives its power from the network. The power is delivered on the same two conductors that carry data.