



SLOVENSKI STANDARD
SIST EN 50170:2001/A3:2002
01-september-2002

General purpose field communication system

General purpose field communication system

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Ta slovenski standard je istoveten z: EN 50170:1996/A3:2002

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ICS:

35.100.01	Medsebojno povezovanje odprtih sistemov na splošno	Open systems interconnection in general
35.200	Vmesniška in povezovalna oprema	Interface and interconnection equipment

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EUROPEAN STANDARD

EN 50170/A3

NORME EUROPÉENNE

EUROPÄISCHE NORM

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ICS 35.100.00; 35.200

English version

General purpose field communication system**iTeh STANDARD PREVIEW**
(standards.iteh.ai)SIST EN 50170:2001/A3:2002

This amendment A3 modifies the European Standard EN 50170:1996; it was approved by CENELEC on 2000-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in one official version (English). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC65CX, Fieldbus.

EN 50170/A3 (ControlNet) is a serial communication system for communication between devices that wish to exchange time critical application information in a deterministic and predictable manner. These devices include simple I/O devices, such as sensors/actuators as well as complex control devices such as robots, programmable logic controllers, welders, process controllers, etc.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A3 to EN 50170:1996 on 2000-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical national
standard or by endorsement (dop) 2002-11-01
- latest date by the national standards conflicting with
the EN have to be withdrawn (dow) 2003-08-01

General information on licensing and patents

CENELEC calls attention to the fact that patent rights are linked to EN 50170 Amendment A3 (ControlNet). CENELEC takes no position concerning the evidence, validity and scope of this patent right. The following release of rights was made available to BSI, the originating CENELEC National Committee. In this release of rights EN 50170/A3 is referred to as "BSI DD241".

Release of Rights for BSI DD241 ControlNet By Allen-Bradley Company, LLC.

Allen-Bradley (A-B) developed the ControlNet technology and created the specification (in collaboration with other Parties) that has been submitted to BSI. Allen-Bradley has on an open basis provided this technology and the related specification to the market via ControlNet International and supports its acceptance by CENELEC as an open communications Standard.

BSI has published ControlNet as BSI DD 241 and submitted it to CENELEC for consideration as a European Standard.

There are seven (7) Allen-Bradley US Patents tied to the technology utilised in ControlNet. These Patents, which are used to develop compliant products and Systems, are listed below (Note: A summary of each is available at CENELEC).

1. 5,396,197 Network Node Tap
2. 5,400,331 Communication Network Interface With Screeners for Incoming Messages
3. 5,491,531 Media Access Controller For A Station On a Communication Network
4. 5,471,461 Digital Communication Network With a Moderator Station Election Process
5. 5,493,571 Digital Communication Network Data Transmission Method and Apparatus
6. 5,537,549 Communication Network with Time Coordinated Station Activity
7. 5,553,095 Method and Apparatus for Exchanging Different Classes of Data During Time Intervals

A-B is providing BSI, CENELEC and users of the Specification the rights to develop, manufacture, market and use products that meet the specification and utilise A-B patented technology. This part of the grant of rights is effectively a royalty-free license to developers and users of products which incorporate the communication technology specified in BSI DD 241 to use the 7 US patents listed above in BSI DD 241 compliant products.

Standardisation promotes interoperability, reduces costs to the end user and simplifies System and product integration. As a result, the license granted to users of this technology requires users of the license to:

- Develop product which conforms to the specification
- Test for compliance to the specification
- Provide documentation to the user including a Statement of compliance to the specification

A-B has attempted to test the technology as completely as is practical. The specification is written based on A-B's own technology and experience of A-B's own developers as well as developer's from other companies working for A-B. Every reasonable effort has been made to ensure that both the technology and the specification are: accurate and complete, but in accordance with accepted practice it is not possible to provide a warranty to users of the technology.

Realistically if errors are discovered or extensions requested, then it may be appropriate for changes to be made to the specification. It is expected that change requests and incorporation of the technology tied to the changes could occur in two ways.

- The first Option is that the issue would be raised in ControlNet International, the users' organization that supports the marketing and continued development of this technology. Special interest groups are organized to manage the technology and would propose the modifications to CENELEC through a national standards committee. This is similar to the process that has been followed by other networks.
- The second Option is that CENELEC/TC 65CX would establish a working group to address the need, develop the technology and propose changes to the specification as appropriate.

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A-B conducted searches of the prior art to uncover background technology both prior to applying for the patents listed above and more recently over the last three months at the request of CENELEC TC 65CX and based on those searches, the art uncovered by the US Patent Office, and A-B's current knowledge of this field, A-B believes the technology represented by the patents is novel. Further, A-B is not currently aware of any claims or infringement of any valid intellectual property rights by any other companies relating to the technology described in the Specification that could materially affect the use of the technology.

If during the application of those Standards Intellectual Property Rights may appear and will not be made available on reasonable and non discriminatory terms and conditions to anyone wishing to obtain such a license, applying the rules of CEN/CENELEC Memorandum 8, this fact shall be brought to the attention of CENELEC Central Secretariat for further action.

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General Purpose Field Communication System

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Part 1
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<https://standards.iteh.ai/en/standards/sist-en-50170-2001-a3-2002>
SIST EN 50170:2001/A3:2002
General Description
of EN 50170/A3

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General Description of EN 50170, Amendment A3

This description provides an overview on the models, services and characteristics of EN 50170 Amendment A3 (EN 50170/A3), also known under the name „ControlNet“.

“ControlNet” is the trade name of ControlNet International, an independent organisation of users and vendors of ControlNet products. This information is given for the convenience of users of this pre-standard and does not constitute an endorsement by CENELEC of the trade name mentioned. Equivalent products may be used if they can be shown to lead to the same results.

EN 50170/A3 is a serial communication system for communication between devices that wish to exchange time critical application information in a deterministic and predictable manner. These devices include simple I/O devices, such as sensors/actuators as well as complex control devices such as robots, programmable logic controllers, welders, process controllers, etc.

EN 50170/A3 relies on the destination delivery model, and uses the producer/consumer model (also known as publisher/subscriber model). The producer/consumer model allows the exchange of time critical application information between a sending device (i.e. the producer) and many receiving devices (i.e. the consumers) without the need to send the data separately to each destination. This is accomplished by attaching a unique identifier to each piece of application information that is being produced onto the network medium. Any device that requires a specific piece of application information simply filters the data on the network medium for the appropriate identifier. Many devices can receive the same piece of application information from a single producing device.

EN 50170/A3 (deterministic control network) provides a high degree of protocol efficiency by utilising an implied token passing mechanism. This mechanism allows all devices equal access to the network without the network overhead associated with passing a “token” to each device granting it permission to send data. The protocol utilises a time based scheduling mechanism which provides network devices with deterministic and predictable access to the medium while preventing network collisions. This scheduling mechanism allows time critical data, which is required on a periodic, repeatable and predictable basis, to be produced on a predefined schedule without the loss of efficiency associated with continuously requesting or “polling” for the required data.

The network protocol supports an additional mechanism which allows data that is not time critical in nature or which is only required on an occasional basis to utilise any available network time. This unscheduled data is transmitted after the production of the time critical data has been completed and before the beginning of the next scheduled production of time critical data.

1 Scope

This part defines the requirements for the general description of a device on the network of EN 50170/A3 (deterministic control network).

Each of the other parts of EN 50170/A3 corresponds to a specific layer of the seven layer OSI model in accordance with EN ISO/IEC 7498-1. Figure 1 shows the location of each part within the OSI model.

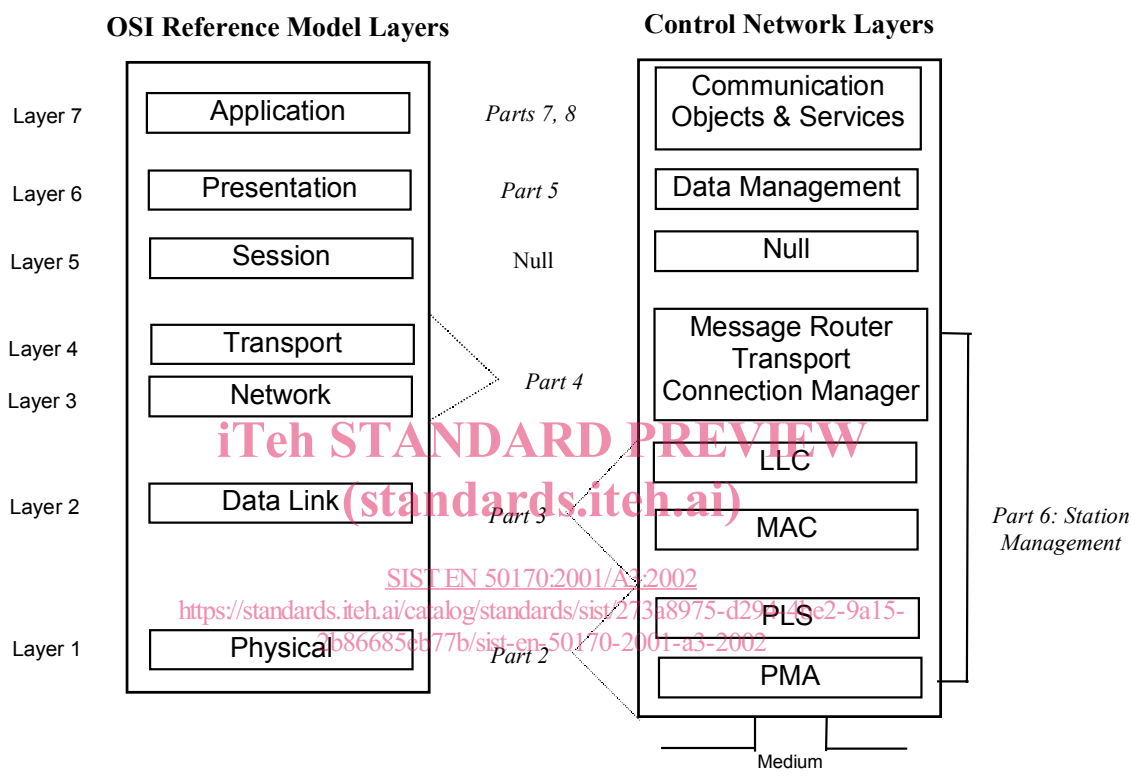


Figure 1 - Relationship of parts 1 to 8 to the ISO/OSI model

2 Normative references

EN ISO/IEC 7498-1:1995 Information processing systems — Open systems interconnection — Basic reference model — The basic model

3 Definitions

For the purposes of EN 50170/A3 the following definitions apply.

- 3.1 actual packet interval (API)** The measure of how frequently a specific connection produces its data.
- 3.2 allocate** To take a resource from a common area and assign that resource for the exclusive use of a specific entity.
- 3.3 application** Function or data structure for which data is consumed or produced.
- 3.4 application objects** Multiple object classes that manage and provide the run time exchange of messages across the network and within the network device.

- 3.5 attribute** A description of an externally visible characteristic or feature of an object. The attributes of an object contain information about variable portions of an object. Typically, they provide status information or govern the operation of an object. Attributes may also affect the behaviour of an object. Attributes are divided into class attributes and instance attributes.
- 3.6 behaviour** Indication of how the object responds to particular events. Its description includes the relationship between attribute values and services.
- 3.7 bit** A unit of information consisting of a 1 or a 0. This is the smallest data unit that can be transmitted.
- 3.8 blanking or blanking time** The length of time required after transmitting before the node is allowed to receive.
- 3.9 class** A set of objects, all of which represent the same kind of system component. A class is a generalisation of the object; a template for defining variables and methods. All objects in a class are identical in form and behaviour, but usually contain different data in their attributes.
- 3.10 class attributes** An attribute that is shared by all objects within the same class.
- 3.11 class code** A unique identifier assigned to each object class.
- 3.12 class specific service** A service defined by a particular object class to perform a required function which is not performed by a common service. A class specific object is unique to the object class which defines it.
- 3.13 client** (1) An object which uses the services of another (server) object to perform a task.
(2) An initiator of a message to which a server reacts.
- 3.14 communication objects** Components that manage and provide run time exchange of messages across the network such as the Connection Manager object, the unconnected message manager (UCMM), and the Message Router object.
- 3.15 connection** A logical binding between two application objects. These application objects may be within the same or different devices.
- 3.16 connection ID (CID)** Identifier assigned to a transmission that is associated with a particular connection between producers and consumers that identifies a specific piece of application information.
- 3.17 connection path** The attribute is made up of a byte stream which defines the application object to which a connection instance applies.
- 3.18 connection point** A buffer that is part of another object. The buffer is represented as a subinstance of an assembly object.
- 3.19 consume** The act of receiving data from a producer.
- 3.20 consumer** A node that is receiving data from a producer.
- 3.21 consuming application** The application that consumes data.
- 3.22 CRC error** Error that occurs when the cyclic redundancy check (CRC) value does not match the value generated by the transmitter.
- 3.23 cyclic** Term used to describe events which repeat in a regular and repetitive manner.
- 3.24 deafness** The node can not hear the moderator frame but can hear other link traffic.
- 3.25 device** A physical hardware connection to the link. A device may contain more than one node.
- 3.26 device profile** A collection of device dependent information and functionality providing consistency between similar devices of the same device type.

- 3.27 drop cable** A cable that connects a node to the trunk cable (this is an integral part of network taps).
- 3.28 end delimiter** A unique set of MAC symbols that identifies the end of a MAC frame.
- 3.29 end node** A producing or consuming node.
- 3.30 end point** One of the communicating entities involved in a connection.
- 3.31 error** A discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition.
- 3.32 fixed tag** A two byte tag which identifies a specific service to be performed by the node identified in the second byte of the fixed tag. The second byte of the fixed tag contains the MAC ID of the destination node.
- 3.33 frame** Single data transfer on a link.
- 3.34 generic tag** A three byte tag which identifies a specific piece of application information (same as connection ID).
- 3.35 guardband** Time slot allocated for the transmission of the moderator frame.
- 3.36 implicit token** The mechanism that governs the right to transmit is implied (e.g. no actual token message is transmitted on the medium). Each node keeps track of the MAC ID of the node that it believes currently holds the right to transmit. The right to transmit is passed from node to node by keeping a record of the node that last transmitted. A slot time is used to allow a missing node to be skipped in the rotation.
- 3.37 implicit token register** Register that contains the MAC ID of the node that holds the right to transmit.
- 3.38 instance** The actual physical occurrence of an object within a class. Identifies one of many objects within the same object class. For example: California is an instance of the object class state. The terms object, instance, and object instance are used to refer to a specific instance.
- 3.39 instance attributes** An attribute that is unique to an object instance and not shared by the object class.
- 3.40 instantiated** An object that has been created in a device.
- 3.41 keeper** Object responsible for distributing link configuration data to all nodes on the link.
- 3.42 library element** A derived or standard data type, function, function block, program or resource in EN 61131 - programmable controllers.
- 3.43 link** Collection of nodes with unique MAC IDs. Segments connected by repeaters make up a link; links connected by routers make up a network.
- 3.44 little endian** Describes a model of memory organisation which stores the least significant byte at the lowest address. On the network medium, the lowest order byte is transferred first.
- 3.45 Lpacket** The Lpacket (or link packet) is a piece of application information that contains a size, control byte, tag, and link data. Peer Data Link Layers use Lpackets to send and receive service data units from higher layers in the OSI stack.
- 3.46 MAC frame** A collection of MAC symbols transmitted on the medium that contains a preamble, start delimiter, source MAC ID, Lpackets, CRC, and end delimiter.
- 3.47 MAC symbol** Symbols that represent the data bits to be encoded and transmitted by the Physical Layer.
- 3.48 maximum scheduled node** Node with highest MAC ID that can use scheduled time on a link.
- 3.49 maximum unscheduled node** Node with highest MAC ID that can use unscheduled time on a link.

- 3.50 member** A piece of an attribute that is structured as an array.
- 3.51 message router** The object within a node that distributes messaging requests to the appropriate application objects.
- 3.52 moderator** The node with the lowest MAC ID that is responsible for transmitting the moderator frame.
- 3.53 moderator frame** A MAC frame transmitted by the node with the lowest MAC ID for the purpose of synchronising the nodes and distributing the link configuration parameters.
- 3.54 multicast connection** A connection from one node to many. Multicast connections allow messages from a single producer to be received by many consumer nodes.
- 3.55 network** A series of nodes connected by some type of communication medium. The connection paths between any pair of nodes can include repeaters, routers and gateways.
- 3.56 network access port (NAP)** Physical Layer variant that allows a temporary node to be connected to the link by connection to the NAP of permanent node.
- 3.57 network address or node address** A node's address on the link (also called MAC ID).
- 3.58 network status indicators** Indicators on a node indicating the status of the Physical and Data Link Layers.
- 3.59 network update time (NUT)** Repetitive time interval in which data can be sent on the link.
- 3.60 node** A connection to a link that requires a single MAC ID.
- 3.61 non-concurrence** A transmission is received from an unexpected MAC ID. It appears to violate the time based access protocol. This may occur when a connection is made between two working links that are not synchronised with each other but who have the same configuration information.
- 3.62 non-data symbol** A Physical Layer symbol which violates the requirements of Manchester Biphase L encoding.
- 3.63 object** An abstract representation of a particular component within a device, i.e. :
- (1) An abstract representation of a computer's capabilities. Objects can be composed of any or all of the following components:
 - a) data (information which changes with time);
 - b) configuration (parameters for behaviour);
 - c) methods (things that can be done using data and configuration).
 - (2) A collection of related data (in the form of variables) and methods (procedures) for operating on that data that have clearly defined interface and behaviour.
- 3.64 object specific service** A service defined by a particular object class to perform a required function which is not performed by a common service. An object specific service is unique to the object class which defines it.
- 3.65 optical isolators, optos** A component located within the Physical Layer transceiver of a node that converts current into light, and then back to an electrical signal.
- 3.66 originator** The client responsible for establishing a connection path to the target.
- 3.67 permanent node** A node whose connection to the network does not utilise the network access port (NAP) Physical Layer variant. This node may optionally support a NAP Physical Layer variant to allow temporary nodes to connect to the network.
- 3.68 point-to-point connection** A connection that exists between two nodes only. Connections can be either point-to-point or multicast.
- 3.69 produce** Act of sending data to be received by a consumer.

3.70 producer	A node that is responsible for sending data.
3.71 redundant media	A system using more than one medium to help prevent communication failures.
3.72 repeater	Two-port active Physical Layer device that reconstructs and retransmits all traffic on one segment to another segment.
3.73 requested packet interval (RPI)	The measure of how frequently the originating application requires the transmission of data from the target application.
3.74 rogue	A node that has received a moderator frame that disagrees with the link configuration currently used by this node.
3.75 scheduled	Data transfers that occur in a deterministic and repeatable manner on predefined NUTs.
3.76 scope	The scope in the object specification contains a brief functional description of the object class.
3.77 segment	Trunk-cable sections connected via taps with terminators at each end; a segment has no active components and does not include repeaters.
3.78 serial number	A unique 32 bit integer assigned by each manufacturer to every device. The number need only be unique with respect to the manufacturer.
3.79 server	An object which provides services to another (client) object.
3.80 service	Operation or function than an object and/or object class performs upon request from another object and/or object class. A set of common services is defined and provisions for the definition of object-specific services are provided. Object-specific services are those which are defined by a particular object class to perform a required function which is not performed by a common service.
3.81 slot time	The maximum time required for detecting an expected transmission. Each node waits a slot time for each missing node during the implied token pass.
3.82 start delimiter	A unique set of MAC symbols that identifies the beginning of a MAC frame.
3.83 supernode	Node with MAC ID of zero. This node is reserved for special Data Link Layer functions.
3.84 tag	Shorthand name for a specific piece of application information. A tag can be 2 or 3 bytes long.
3.85 tap	Point of attachment from a node's coax Physical Layer to the coax trunk cable. A tap provides easy removal of a node without disrupting the link.
3.86 target	The end-node to which a connection is established.
3.87 temporary node	Same as transient node.
3.88 terminator	A resistor (mounted in a BNC plug) placed on the ends of segments to prevent reflections from occurring at the ends of cables for the coax Physical Layer.
3.89 Tminus	The number of NUTs before a new set of link configuration parameters are to be used.
3.90 tone	The instant of time which marks the boundary between two NUTs.
3.91 tool	An executable software program which interacts with the user to perform some function.
3.92 transaction id	Field within the UCMM header that matches a response with the associated request. The server echoes this field in the response message.
3.93 transceiver	The physical component within a node that provides transmission and reception of signals onto and off of the medium.

- 3.94 transient node** A node that is only intended to be connected to the network on a temporary basis using the NAP Physical Layer medium connected to the NAP of a permanent node.
- 3.95 trunk-cable section** Length of trunk cable between any two taps.
- 3.96 trunk cable** Bus or central part of a cable system.
- 3.97 unconnected message manager (UCMM)** The component within a node that transmits and receives unconnected explicit messages and sends them directly to the Message Router object.
- 3.98 unconnected service** The messaging service which does not rely on the set up of a connection between devices before allowing information exchanges.
- 3.99 unscheduled** Data transfers that use the remaining time in the NUT after the scheduled transfers have been completed.

4 Abbreviations

For the purposes of EN 50170/A3 the following abbreviations apply.

- 4.1 ACM** access control machine
- 4.2 API** actual packet interval
- 4.3 ASCII** American Standard Code for Information Interchange (EN ISO/IEC 646)
- 4.4 BNC** A connector for coaxial cable having a bayonet-type shell with two small knobs on the female connector, which lock into spiral slots in the male connector when it is twisted. (see EN 122120:1993 or A.1 for reference material)
- 4.5 CA** clock accuracy
- 4.6 CID** connection ID
- 4.7 CIP** The control and information protocol defined by Part 4 of EN 50170/A3. CIP includes both connected and unconnected messaging.
- 4.8 Coax** coaxial cable
- 4.9 CRC** cyclic redundancy check
- 4.10 DLL** Data Link Layer
- 4.11 LED** light emitting diode.
- 4.12 LLC** logical link control sublayer
- 4.13 MAC** media access control sublayer
- 4.14 MAC ID** the address of a node
- 4.15 NAP** network access port
- 4.16 ND** non-data symbol
- 4.17 NUT** network update time
- 4.18 PDU** protocol data unit
- 4.19 OSI** open systems interconnection (see EN ISO/IEC 7498)
- 4.20 PLS** Physical Layer signalling sublayer
- 4.21 PMA** Physical Layer medium attachment sublayer
- 4.22 PT** programming terminal (a temporary network connection)

4.23	Rev	receive
4.24	RM	repeater machine
4.25	RPI	requested packet interval
4.26	Rx	receive
4.27	RxLLC	receive logical link control
4.28	RxM	receive machine
4.29	SDU	service data unit
4.30	SEM	state event matrix
4.31	SMAX	MAC ID of the maximum scheduled node
4.32	STD	state transition diagram, used to describe object behaviour
4.33	Tx	transmit
4.34	TxLLC	transmit logical link control
4.35	TxM	transmit machine
4.36	UMAX	MAC ID of maximum unscheduled node
4.37	Xmit	transmit

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