Appendix – Explanations – Glossary

BACNET is a standardised protocol of ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineering, Inc.). BACNET uses, among others LON as a transport medium, whereby however important beneficial qualities of LON (especially network variables) disappear.

Bridges transmit messages as appropriate to the other side if the originating domain of a message tallies with one of the domains of the bridge, irrespective of the destination of the message. A bridge is used for the linking of domains, for example, for forwarding global system messages.

Channels Via routers and repeaters, networks are physically structured –they divide the network into several channels. Channels describe a physical network segment, for example a bus segment in TP/FT-10. Any number of nodes can belong to a channel, naturally taking heed of the physical limits for the basis medium.

Configured Routers transmit a valid message to the other side, as appropriate, if the originating domain tallies with one of the domains of the router. Each side of the configured router possesses for this purpose an individual transmission table. In this table, the senders of a message that need to be conveyed are labelled with a transmission flag for each one of the 255 possible subnets and each of the 255 groups within a domain. These tables are generated by a network management tool and permanently saved in the EEPROM of the router.
The implementation of a configured router is to be recommended if the network traffic needs to be specifically separated. In this way, islands arise with relatively high internal network traffic and relatively little external communication. The whole network is thereby not encumbered with messages that are only of ”local” character.

CSMA is an access procedure from the area of LAN and stands for **C**arrier **S**ense **M**ultiple **A**ccess. In the case of CSMA, the node ”listens” firstly to the network before becoming active. With CSMA/CD (**C**ollision **D**etect), collisions are reckoned with from the start and, where possible, are met with various processes. LONWORKS uses predictive p-persistent CSMA procedures that allow short reaction times during high throughput rates, even in large networks.

Domains represent the largest addressing entities. They are used to bring together subsystems that are normally completely independent of each other, for example, the lighting system, access control etc. (in as far as these need to communicate with each other). In this way, domains form virtual networks within the physical network construction. Each LON device can be addressed via two domain addresses. A maximum of 255 subnets with 127 devices each (equivalent to 32, 385 devices altogether) can be allocated to a domain.

Echelon is the technology provider of LONWORKS technology. In December 1990, Echelon announced its developments internationally for the first time. Venture capitalists in the USA, including the semi-conductor manufacturers Motorola and Toshiba provided capital for this innovative and highly risky development.
For further information, please visit: www.echelon.com.

Groups make up a further form of addressing that is independent from the domain-subnet-node-addressing. Up to 255 groups can be formed per domain whose members are able to be addressed together via group addressing. In each group, any number of devices can be a member, although each device can, in turn, only be a member in a maximum of 15 groups.

Interoperability is the goal and the defining quality of LONWORKS technology. LONWORKS nodes should be able to “talk” and “work” with each other independently of the chosen transport media, network topologies, hardware details or operating system functions.

ISO-OSI Model is a model developed by the ISO (International Organisation for Standardization) for the communication between nodes in networks. This model was named OSI (Open System Interconnection) and is based on the following 7 layers for the communication:

Layer	Description	Functionality
7	Application Layer	Communications services for the application
6	Presentation Layer	Language and character adaptation
5	Session Layer	Construction and closing of meetings, Participant identification
4	Transport Layer	Construction and closing of End-to-End connections, flow regulation
3	Network Layer	Routing
2	Data Link Layer	Frame formation, Point-to-Point data protection, medium access control
1	Physikal Layer	Establishment of all physical and mechanical parameters

Appendix

Learning Routers are a special form of the configured router. By means of them, all messages are transported with group addressing. At the same time, a learning process is active. After a reset, all transmission flags are put in place and, in this way, all messages are transported. The learning router checks the subnet number every time a message comes in, and deletes the corresponding transmission flag on the other side so that gradually two transmission tables arise, just as with the configured router. These tables are, however, only held in the RAM and are thus lost after the reset. The tables created can nevertheless be read with an appropriate tool and further processed so that the router can, in the end, be operated as a configured router. Learning routers are not as efficient as configured routers; however an installation without knowledge of the network topology and the communication structures is possible.

LNO The LNO – LON Nutzer Organisation e.V. (German LON User Organisation) is the association for companies, institutes and distributors who work with the LONWORKS technology within the German-speaking area. Members of the LNO can be anyone who develops, sells or uses devices and systems that use the LonTalk protocol as their communication.

Goals of the LNO:

- Implementation of the LONWORKS technology in automation within the areas of industry, building and gastronomy
- Representation of member interests with respect to standardisation committees, politics and other organisations
- Representation of the interests of LONWORKS users with respect to the technology providers
- Formation of co-operations amongst members
- Turntable for the information flow surrounding the LONWORKS technology

LNS/LCA “LONWORKS Networks Services Architecture” / “LONWORKS Component Architecture”. A software platform developed by Echelon with functional and data interfaces for the implementation of tools for LON, for example for hand terminals, service stations, for PC visualisations and PC implementation tools.

LonBuilder is the high-end development system from Echelon. One can emulate hardware with it, compile application software and test it after downloading.

LonMark Association is an international association of more than 300 companies that deal with the standardisation of LON for specific task areas and devices, with the aim of guaranteeing interoperability. In the LONMARK Task Groups, the textual work is achieved. Thus there are standards (Functional Profiles), among other things, for blind control, lighting, sensors, actuators. For more information, please visit: www.lonmark.org.

LonTalk is the protocol through which Echelon’s system solution is specified. LonTalk defines how LON nodes communicate with each other on the individual layers of the ISO-OSI model. LonTalk describes hardware functions, operating system functions and compiler functions precisely, whereby the implementation remains concealed.

LONWORKS is the system description for the whole technology. Within it are included, for example, the Neuron Chips, the transceivers, the development tools, software packets, support. With LONWORKS, decentralised information processing structures are made possible that function without central control (for example PLCs). In this respect, LONWORKS distinguishes itself from conventional fieldbus solutions.

LPT-10 Link Power
This transport medium is also a twisted pair variant. It corresponds technically to the variant ”free topology FTT10” with the added advantage that the power supply to the devices can be transported via the bus cable. LPT-10 requires the use of special link power electricity supply (input voltage, for example, 48-56 V, output voltage ca. 42V / 1.5 A) that are mostly very expensive. Besides, there are limits with respect to load capability – a link power network part can only supply a limited number of devices. Link power signals can also be switched to TP/FT-10 devices, if these contain the corresponding blocking capacitors that close off the supply voltage.

Neuron C is the programming language according to the ANSI-C standard for the application programming of Neuron Chips. Neuron C contains additional operating system functions for event-oriented programming and for network variables for process-related programming, as well as for more complex objects for I/O interfaces.

Node is the term for a device or a module with a Neuron Chip as a micro-controller. Nodes are the smallest addressing unit.

NodeBuilder is a low-end development system from Echelon (see LonBuilder).

Power-Line represents the data transmission via the 230 V network according to CENELEC.

Prog-ID Every LON device contains a special software that implements the application. Fundamentally, a LON device can be delivered with different software (functional variants). In order to differentiate them, the PROG-ID is used. This is a chain of characters that is saved in a special place in the memory. Implementation tools use the PROG-ID to differentiate between devices with the same hardware, but nevertheless differing functions. LONMARK has defined specifications as to how the PROG-ID is to be coded and used.

Repeaters are the physical amplifiers without their own processing functions. They are used to achieve larger transmission distances, or when the maximum number of nodes of 64 devices per twisted pair segment is exceeded. The repeater counts as a node, meaning that per segment 63 nodes + 1 repeater can be used. In TP/FT-10 networks, only one physical repeater is allowed to be located between two nodes. It is also possible to implement the router as a repeater. In this way, the limitations experienced with physical repeaters are inapplicable and a change of media is also possible.

Routers combine neighbouring subnets where the router works with addresses and protocols from layer 3. This layer is independent of the hardware so that routers are able to undertake the transition into another transport medium. Routers can be operated in the operational types: repeaters, bridges, learning routers and configured routers.

Service Pin is a special input/output of the node for service purposes. As a rule, this pin is fed outward by the module manufacturer to a sensing device and an LED. Upon activating the service sensor, the Neuron Chip sends a broadcast message that contains the Neuron ID and the programme ID. In this way, a node, for example, a tool, can be registered (allocation of a physical node to a logical node in the project). As an output, the service pin signalises the current status of the Neuron (application and configuration) and thus enables a fundamental diagnosis.

SNVTs (Standard Network Variable Types) are type-bound network variables in the Neuron-C programming language, standardised by LONMARK, for the implementation of logical communication channels between LON nodes.

Subnets are the next smallest addressing unit after the domain. By means of subnet addressing, certain groups of devices (for example, in a room or in a manufacturing cell) can be addressed. Subnets can contain a maximum of 127 devices.

Terminators serve the correct termination of a network with respect to impedance on the basis of twisted pair technology. Independent of the transceivers and the topology used (bus or free topology), various terminators from Echelon may be used according to the specification. Terminators are also partly integrated into LON devices and are then, as a rule, able to be activated via a switch or jumper. Missing or incorrect termination of a network does not have to immediately have an ostensible effect, but can be the cause of irregularly occurring communications problems.

TP/XT-78 Twisted Pair 78 kBit/sec
This transport medium with a transport connection was very widespread in the first years of LON. In the form of a linear bus topology, up to 64 devices can be switched to a segment. The length of the bus cable of a segment can amount to up to 2000 m. TP/XF-78 is LONMARK certified, but should not, however, be used for new developments.

TP/XT-1250 Twisted Pair 1250 kBit/sec
Parallel to TP/XT-78, TP/XP-1250 was introduced. This is also a linear bus with a transport connection of up to 64 devices per segment, nevertheless limited to a length of 130....400 m. The considerably higher physical transmission rate brings only little profit in data throughput and reaction speeds. Applications therefore remain limited to a few exceptions (for example in time-critical backbone buses in control cabinets or for special transmission tasks with large data packets), especially as particular requirements are placed on the topology in detail.
TP/XF-1250 is not LONMARK certified, observe wiring guidelines exactly.

TP/RS-485 Twisted Pair RS-485
Various device manufacturers tried in the start phase of LON to absolutely minimise the transceiver costs through implementation of RS-485. In reality, problems arise with RS-485, such as during galvanic separation and during management of mass-related potential between various devices. If one wishes to implement RS-485 interfaces in a CE-conformant way, efforts need to be made that are comparable to those in the case of other twisted pair variants. RS-485 is, therefore, no longer supported by Echelon.

TP/FT-10 Twisted Pair free Topology TP/FT-10
This is, without doubt, the most widespread transport medium today. The TP/FT-10 channel allows both linear bus topologies, as well as free topologies. As a linear bus, 64 participants can again be connected to a segment of up to 2700 m long. The transmission rate is 78 kBit/sec. In free topology, an expansion of the network of up to 500 m can be achieved with 64 devices. TP/FT-10 facilitates the greatest degree of freedom in the spatial configuration.
TP/FT-10 is LONMARK certified.

Transceivers are the bus building blocks between the Neuron Chip and the transport medium. Important representatives are: TP/XF-78, TP/XF1250, TP/FT-10, LPT-10 and PLT-21. Furthermore, transceivers are available for radio transmission or for the connection with fibre-optic cable systems.

Wink is the possibility of the node to make itself noticeable in various ways (optically, acoustically etc.) after it has received a wink message. Thus an installation tool can search for unconfigured nodes in the network and send a wink message to the node that reports itself first. This node then makes itself noticeable in a defined way, if it is prescribed in its application, so that the technician can create the allocation to the physical node.