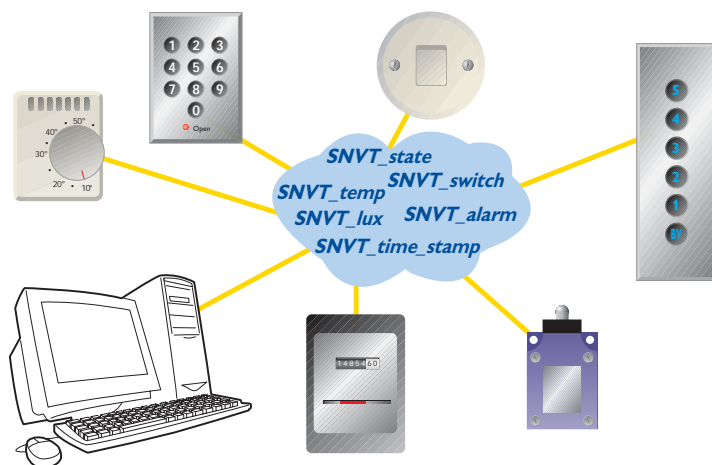


LON[®]WORKS

The Echelon[®] Corporation has, through the introduction of LONWORKS[®] technology, made available a complete platform to develop open distributed control systems based on an intelligent network architecture. A LONWORKS[®] system usually consists of a number of intelligent devices, called nodes, where each node manages a specific task, for example, measuring a temperature or controlling a valve. The nodes exchange essential information with each other via the network. A network used for control, which is based on this distributed intelligence, is known as peer-to-peer architecture. The nodes do not normally send commands to each other; but exchange data packets



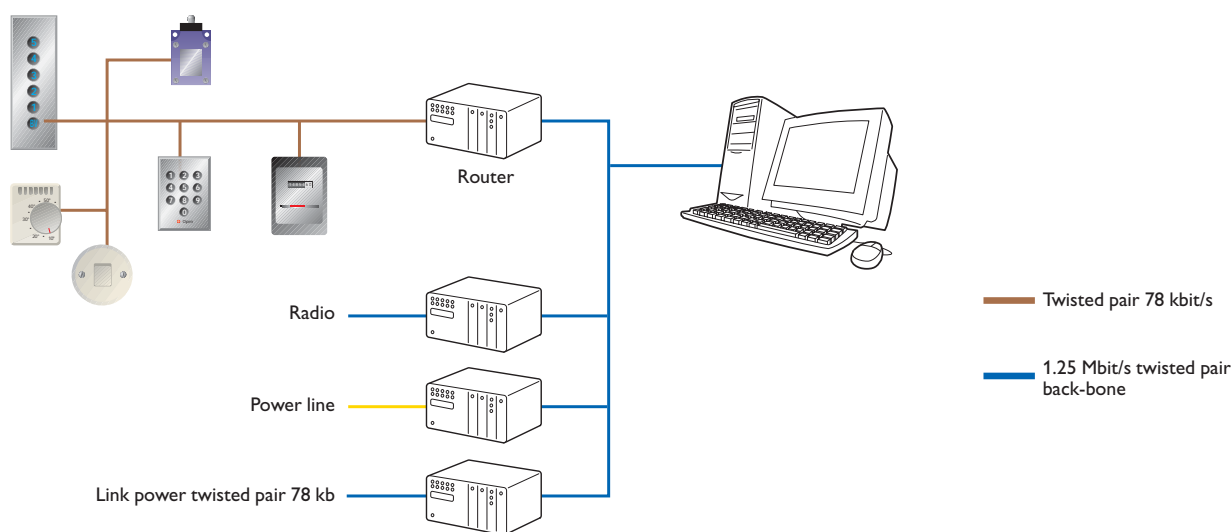
LONWORKS[®] – a data oriented network

that contain information about for example the temperature, pressure, status, date and time. The nodes can then use the information in the data packets in different ways depending on the specific function of the node. Within LONWORKS[®] these data packets can be seen as global variables available on the network and in view of this have been called network variables. When a node updates a network variable, this is automatically sent out on the network so that other nodes become aware of the new value. Interoperability is a keyword in LONWORKS[®] technology. One of the conditions for interoperability is that nodes from different manufacturers exchange and understand data without requiring special adaptation of either the software or hardware. In order to conform to this it is not sufficient to just be on the same network, to have the

same type of transceiver and be able to send network variables. Nodes also need to understand the contents of the network variables. For example, nodes must know whether a temperature is stated in Fahrenheit or Celsius or whether a flow is stated in litre/second or millilitres/second. Thus standards for how the content of these data packets should be interpreted are necessary. Within LONWORKS® standardisation is managed by an organisation called the LONMARK® Association. This is an independent association consisting of manufacturers of LONWORKS®-nodes, system integrators and end-users. They have compiled a list of standardised types of network variables. These types are designated SNVT (pronounced snivit), which stands for “**Standard Network Variable Types**”. These types contain information about the device, resolution and which values the type can take. For example, when the type SNVT_speed is used, all LONWORKS®-nodes know that the unit is metre/seconds, the resolution is 0.1 metre/seconds and it can take values between 0 to 6553.5 metre/seconds.

The most employed transceiver is the FTT-10A free topology. It communicates at a rate of 78 kbit/s over a twisted pair cable. Free topology means that it can be used in star networks, ring networks, bus networks or combinations of these. Echelon® also has a free topology transceiver called LPT-10 LinkPower. This is compatible on a signal level with the FTT-10A and can be used together with this. What is special about LPT-10 is that it is “true 2-wire” in the meaning that the wire transfers both data and power. The advantage of being able to freely mix topologies means that these transceivers are extremely useful in today’s control networks where you need to be able to add new devices easily. Another advantage of these transceivers is that they have a polarity insensitive connection, which aids installation and eliminates the risk of incorrect connections. Other transceivers from Echelon® include the 1250 kbit/s twisted pair wire transceiver for bus topology and a transceiver for electrical network communication. The ability to jump between two frequency bands, advanced signal treatment and error correction enables the electrical network transceiver to easily handle disturbances from for example motors, dimmers, PC and televisions.

The PLT-22 transceiver can be configured to either communicate over the power network on the public frequency band Cenelec-C or the Cenelec-A frequency band which is reserved for power companies. The C-band is usually used for applications within intelligent housing and other commercial applications while the A-band is often used in connection with electricity meter reading. There are also third party transceivers for fibre optic, radio and IR communication. It is common for different media to be combined in a LONWORKS® network. Echelon® offers routers that can forward



LonTalk® data in different ways from one medium to another. It is commonplace for channels with a slow medium to be connected to a backbone with a faster medium. This results in logical and physical segmentation of the network, which gives improved performance and security.

Large LonTalk® network considerations

An increase in the transmission range between two or more TP/FT-segments via a fibre optic cable results in a slight delay in communication between the different segments. This can cause collisions, which in turn result in retransmission of the data packet, which can lead to depreciation in network performance. Consequently, we recommend that the overall length of fibre should not exceed 25 km (15.53 mi). In accordance with the EIA-709.3 standard, a maximum delay of 36 ms is permitted, which should permit a transmission distance of 6.8 km (4.23 mi). We recommend the use of our router LR-11 to ensure communication over greater transmission distances, several network segments or more nodes at 1250 kbit/s. Nevertheless, we always recommend that communication on the network is analysed by using a LONWORKS® protocol analyzer.