SUMMARY (click on a question or topic to go to its page)

1) WHAT IS LONWORKS TECHNOLOGY?

LonWorks technology provides a powerful control network built into a single chip. There has been a large amount of work done with the LonWorks platform with regard to design, testing and applications over the last 10 years. Hundreds of millions have been spent by the LonWorks developer (Echelon Corp) and the various customers that have adopted this platform. The LonWorks platform has proved itself a very stable control network that is suitable for many applications.

To build a high-performance, stable electronic control network is a very difficult thing to do. Many manufacturers of devices and systems have expended large resources on designing and building networks for their products. Almost all of these networks are proprietary, for each was built and evolved to suit the manufacturer's particular needs. Most of this technology began its evolution in the early 1980's, only about 20 years ago.

Now, technology for digital networks has advanced to where an extremely powerful network can be had on a single chip for a relatively low cost. This advancement is very significant for 2 principal reasons:

1. It frees a manufacturer from having to build a control network for their specialized purpose. They can now buy a ready-made network that is powerful enough for their application at a fraction of what it would cost them to develop and build an equivalent network. The manufacturer is now free to dedicate more resources to making their particular product.
2. If several manufacturers use the same networking technology, then their devices and systems can interoperate with one another on a network. Additionally, since the network is no longer proprietary, devices from different manufacturers are interchangeable for any given type of device within a system.

The significance of "interoperable devices and systems" may not be immediately obvious. To clarify, a good comparison is the Internet. The Internet uses a standardized networking approach that permits the world to communicate over the same platform. The results of this particular open network (the Internet) on society have been and will continue to be profound. A standardized networking platform for connecting control devices and systems together should also provide remarkable features and benefits not previously possible.

2. DEFINITIONS: LONWORKS, ECHELON, LONMARK

LONWORKS:

LonWorks is the name given to the network product supplied by the company Echelon Corp. The hardware of the LonWorks network consists of a chip called a "neuron". The network software is etched in silicon on the neuron chip. The manufacturer burns the software that interfaces the neuron with the device into the chip. The user interface used to configure (program) the network, can reside on an external device such as a PC or can be accessed, in some cases, by controls built into the device(s).

ECHELON:

Echelon is the name of the company that developed the LonWorks network platform. Echelon Corp. is a public company (ELON:Nasdaq) that is headquartered in Palo Alto, California. Echelon has licensed the manufacture of the neurons to Toshiba, Motorola and Cypress Semiconductor.

LONMARK:

LonMark is the certification term given to products that utilizes the neuron chip in a manner that complies with the LonWorks interoperable standards. Even though the neuron is a standard and defined item, it is still essential that the manufacturer burn in software for their device that utilizes the LonWorks technology in accordance with a defined standard. Devices that are LonMarked certify that the device complies with the LonWorks standards for reliable, predictable operation. The LonMark Association administers LonMark certifications and standards.

3. MORE DEFINITIONS: PROTOCOL, TRANSCEIVER, MEDIA & DATA SIGNAL

Our sales and technical departments often hear incorrect use of terms that indicate a certain amount of misunderstanding about them. For example, we often hear that because two devices have an RS-485 or RS-232 connection they are compatible. This is not correct for such connections are simply carriers and they require a common protocol to use for communication. Consider the situation of 2 people having a discussion in English. This is a network of 2 people talking in English (the protocol) with voices making sounds that vibrate the air that is heard by the ears. For a network to exist and function it has to have 3 key parts:

THE PROTOCOL:

The **protocol** is the language used for the messages and the internal logic used to govern speaking and listening. Speaking English is not enough to have a conversation. There are unspoken rules of conversation that direct when we speak and when we listen. These rules are also part of the protocol. For electronic networks, one example of a protocol is LonWorks. LonWorks uses LonTalk as the language of expression and LonWorks as the rules of expression. Another protocol is Ethernet, which is a method by which computers and similar devices send small and large data pieces at high speed.

THE TRANSCEIVER:

The **transceiver** is what broadcasts and receives the message over the medium on which the messages are sent. The transceiver does not have a clue about what is being sent over the medium. For the example of 2 people speaking English, the voice box is the transmitter and the ear the receiver. The pair forms a transceiver. The brain understands what is being said, but the voice box and ear do not.

THE MEDIA:

The **media** is what the message is sent on. For talking, air is the media that carries the sound waves made by the voice and heard by the ear. For electronic networks, twisted wire pair, 3-wire cable and 4-wire cable are media that can carry the signal. Media can also be of other forms such as radio or fiber optic. For other media, different transceivers are used. Couplers are often available to translate from one transceiver/media type to another.

Often terms are abused such as the expression "the RS-485 network". This really should be stated: "the RS-485 transceivers are communicating messages of the such-and-such protocol on the twisted pair media".

DATA SIGNAL:

The term **data signal** can refer to the protocol, the transceiver or the media or to any combination of all three. In Douglas literature, the term "Data Signal" refers to the protocol, transceiver and media. For example, the Douglas W-2000 System uses a "LonWorks Data Signal" that uses an FTT-10 transceiver communicating LonWorks messages on a twisted wire pair media.

4. EXAMPLE OF A SIMPLE LONWORKS SYSTEM: DOUGLAS RELAYS & SWITCHES

Standard Douglas switches and relays can be networked together with the W-2000 System. The key components of the Douglas W-2000 System are "Network Nodes" that are hubs that standard Douglas switches and relays interconnect to. The network nodes are each equipped with a LonWorks neuron and a FTT-10 transceiver. The nodes are connected together with a twisted pair wire and can be configured, utilizing the programmable relay scanner that is attached to each node, to perform a wide variety of switching functions.

A simple example is a single switch operating several relays.

1. When the on or off button of a switch connected to a node input is pressed, that node broadcasts an ON or OFF signal with the input # attached.
2. Nodes with relays connected "listen" for the input # of a specific switch. If the input # applies to any of the output relays connected to the node, it switches those relays ON or OFF as commanded.

The above example describes how the system operates while the system is running. However, how is the system configured in the first place? How is the switch's input # stored in the node that operates the relay(s) controlled by the switch? There are numerous methods by which the system can be configured, assigned or bound. See the following FAQ "Configuring, Assigning or Binding" for further details.

5. CONFIGURING, ASSIGNING OR BINDING LONWORKS DEVICES

Configuring a system is also often called "assigning", "binding", "mapping" or "programming" the system. These terms are common in the industry and all essentially mean the same thing. A LonWorks network consists of devices that are configured to send/receive signals to/from other devices in the network. Configuring requires devices to have the necessary IDs (addresses) of other devices entered so that messages are sent/received to/from the appropriate devices.

The Douglas W-2000 System nodes have inputs and outputs that are compatible with Douglas switches and relays, as well as most contact closure devices. The outputs have the input# assigned to them. When the output "hears" a signal from the appropriate input(s) the output switches according to the input's signal. Thus once the configuration is done, the node's inputs and outputs merely generate and respond to the appropriate messages. The status of the input's relay group is determined by the W-2000 System and displayed on Douglas 2-wire LED switches.

So how is a system configured, assigned or bound? In the case of the Douglas W-2000 System configuration can be currently accomplished by two methods:

SELF-MANAGED SYSTEMS: (Installed & configured by electricians or building management)

- All LonWorks networks require a manager device. The self-managed system requires that one of the nodes performs the extra function of the network manager. The network manager is responsible for proper assignment of node IDs.
- Up to 24 Douglas nodes can be connected together and powered up with no pre-setting or no external network manager. All that is necessary is to designate one of the nodes (by setting its Net Manager switch to ON) as the network manager. Upon power-up, the nodes will recognize the presence of other nodes, and begin to communicate their node IDs. If any nodes do not have node IDs or if a new node is added without one, the node network will automatically assign node IDs.
- The programmable relay scanner attached to each node has a membrane keypad built in to facilitate the configuration of which relay(s) are operated by any input. Other features such as flick warn, delay switching, housekeeping, timeout, etc. are also configurable for self-managed systems.
- Self-managed systems are also called "self-configured systems".
- The Douglas W-2000 System is one of only a few self-configured LonWorks lighting control systems that are commercially available. Most LonWorks systems require external configuration.

EXTERNALLY MANAGED SYSTEMS (Configured by System Integrators)

- Externally managed systems are those systems where an external device such as a PC is used to perform the configuration function. The membrane keypads of the Douglas LonWorks devices are switched off and the node ID's and Input #s are determined by the external system. This is necessary so that there are no addressing conflicts with other devices in a larger system which may include products of other manufacturers or systems.
- Externally managed systems that use a PC have software that maintains an image of the entire system of devices. If the PC does not have the image, it can be attached to the network and the image can be downloaded from each device connected to the network. The image can then be manipulated as desired and uploaded back to all or some of the devices.

Often in the building process, configuring lighting control panels into a central system does not occur until the construction phase is almost complete. For this reason Douglas panels with LonWorks components are usually shipped in the self-configured format to permit quick and easy control of the lights during the construction phase. When construction is completed and the panels are integrated into the central system, their self-configured attributes are automatically disabled.

NOTE: Automation schedules are not the same as configuring the system. *Scheduling* only designates certain inputs to be actuated in response to time or other events. *Configuring* directs how all of the devices in the system interact with one another.

6. SYSTEM INTEGRATORS: WHO IS A SYSTEM INTEGRATOR AND DO I NEED ONE?

"System Integrator" is a term given to a designer or contractor that is able to integrate different systems together to provide building-specific solutions and installations. Often integrators are HVAC controls contractors, for if there is integration it usually includes the HVAC system. Whether the services of an Integrator are required or not depends upon the amount and the type of integration desired.

Four different types or levels of integration can be identified in commercial buildings.

NO INTEGRATION (most common)

The majority of systems installed in buildings are stand-alone systems. Typical examples are HVAC controls, Card access, Lighting controls, Security and Fire alarm. Each of these systems are developed, manufactured and supplied by different industry groups to meet specific needs. It is no small wonder, then, that most building control systems are stand-alone, independent systems.

HARDWIRED LINKAGE (common)

Hardwired linkage is defined as wiring outputs from one system to inputs of another system. This is done so that one system can signal the other to do something in particular. Hardwired integration is usually simple and does not require the services of a System Integrator. A skilled electrician or controls contractor can hardwire one system to command the other system, providing both systems have compatible inputs and outputs. (Note: the switch inputs of the Douglas WNS-2308 Node and the outputs of a Douglas WRS-2224 Relay Scanner can be configured for most contact closure devices.) For example, if load shedding is required during peak demand periods, the metering system could signal the lighting system to switch off some lights.

DIGITAL LINKAGE (less common)

Digital linkage is similar to hardwired linkage except that the wiring is replaced by a digital connection. To digitally link anything, the link has to use the same protocol and transceiver. Usually execution of a digital link on a custom basis results is a proprietary link that is poorly supported over time. It is advantageous to utilize a digital link that conforms to an established standard, such as LonWorks.

INTEGRATED OPEN SYSTEMS

Integrated systems are systems that use a common method of control that is shared among all of the systems. Such systems are called "open systems" or "open standards". LonWorks is an example of a popular open standard. Installation of true, integrated systems usually requires the services of a System Integrator. Maintenance and periodic adjustment of integrated systems is usually done by the Integrator, although in some cases it can be done by knowledgeable building personnel.