LonWorks – open communication using open networks systems

For many years communicating with pumps, controllers, valves, sensors, etc. has often been based on so-called proprietary network protocols. Proprietary means that each vendor of a unit has invented his or her own ‘standard’ of communication. Grundfos’ proprietary standard is named GENIbus (Grundfos Electronic Network Intercommunication bus).

Grundfos pumps can be connected via GENIbus to Grundfos pump controller units like Grundfos PMU2000 (Figure 1) and Grundfos PCU2000 from the controller series PMS2000. Grundfos pumps with GENIbus can also be connected to units from another vendor, but that requires the use of a gateway that ‘translates’ the GENIbus language to the language of that vendor. There is absolutely nothing wrong with proprietary networks except that it is not always that easy to integrate products from different vendors.

Many efforts have been made to unify the way different units communicate with each other, but with limited success. Today, more than 30 different so-called ‘standard’ protocols coexist in the market, complicating life for component vendors, system integrators and end-users.

Open communications

In 1988, the LonWorks system was invented by North-American company Echelon (www.echelon.com). The aim was to create a truly open communication system with the possibility of easy integration of multi-vendor systems.

The LonWorks technology covers all markets including buildings, industrial automation, home automation and transportation. Today it is a widely used and very stable technology. Even though the cost per network node (unit on the network) is higher than for most proprietary networks, the total cost of a network may be lower due to fewer integration problems and easier cabling (one system only).

Grundfos Commercial Building Services believes that LonWorks is one of the communication technologies of the future. We do not believe that one standard will wipe out all of the others, but we think there is a good chance that LonWorks could be one of the survivors.

LonWorks technology

LonWorks provides an open network solution. ‘Open’ means that on the same network, it is possible to:

- use components from many different vendors
- use standard network management tools from third-party vendors (not from Grundfos and not necessarily from Echelon)
- determine the exact functionality of the network after installation
- use a node for more than one functionality.

The technology also provides interoperability. ‘Interoperability’ means that components from different vendors basically behave in the same way on the network. The basic protocol software is the same, and if, for example, a pump provides the differential pressure across the flanges, then this pressure is propagated on the network in exactly the same way in terms of format and interpretation no matter the make of the pump. LonWorks achieves this through two important concepts:

- All network variables are defined as standard network variable types (SNVTs). This is the most basic condition for interoperability. If a variable is defined as a SNVT, then there is no doubt about how it should be interpreted.
- Standard Functional Profiles. This is a description of a certain kind of network unit or product and how it works on the network.
Please note that interoperability is not the same as interchangeability. There will always be small differences in equipment from different vendors. A component from one vendor might have a feature that is missing in a component from another vendor, and there might be differences in product quality that have nothing to do with the communication features. Not all vendors provide the same degree of quality just because they support LonWorks.

**Event-driven network**

A LonWorks network is event-driven as opposed to many other networks, which are master/slave-organized. There are some major differences between these two network types.

In a master/slave-organized network:
- There is one central intelligent controller. All network traffic must go through the controller, and the function of the network depends entirely on the controller.
- All the nodes are passive; they do not communicate unless they are asked.
- The nodes execute incoming commands and deliver requested information.
- The nodes do not communicate with each other and therefore cannot work together without the central controller as ‘middle man’.

In an event-driven network:
- There is no need for a central intelligent controller. The intelligence of the system can be distributed making it less vulnerable. Nevertheless, many LonWorks networks are built up around a central controller, but this is not necessary from a network point of view.
- All the nodes are active.
- Nodes communicate directly with each other and collaborate.
- Nodes act autonomously based on information from sensors and other nodes.

A LonWorks network supports many different physical network types (hardware topologies). Grundfos LON-units support the most commonly used standard known as FTT10A. With this type of physical network, the safe communication distance is 2700 m if all the units are connected in a bus-topology (in series), and 500 m if the units are connected randomly (tree topology).

**LonMark**

LonMark International (www.lonmark.org) was formed in May 1994 by 36 companies and now has more than 300 members. Grundfos joined as a LonMark Partner in 1997. In many countries there are associated local user groups.

LonMark International has three major functions:
- to promote the benefits of interoperable LonMark products
- to provide collaborative marketing programmes
- to provide a forum to define application-specific design requirements.

If a product is verified to conform to the organization’s interoperability guidelines, it is qualified to carry the LonMark logo – this indicates that a product has completed the conformance tests and has been designed to interoperate across a LonWorks network.

All Grundfos LonWorks units have been designed to conform with the Pump Standard Functional Profile (see below) and with the interoperability guidelines. So far the MAGNA-LON unit (Figure 2) has been verified to be compatible, and Grundfos is in the process of obtaining certification for all LonWorks units.

**Standard functional profiles**

The backbone of LonWorks is the use of predefined variable types. It basically defines two standard types:
- SNVT (pronounced ‘snivit’); this can be used to describe both input
variables and output variables, for example, the pressure set-point of a pump or the energy consumption of a pump. The description defines in detail the interpretation of the variable, including range and initial value.

- **SCPT** (standard configuration property type; pronounced ‘skipit’). This can be used to describe a configuration property, which could be the control mode of a pump, e.g. constant pressure.

A LonWorks product is described with a combination of SCPTs and SNVTs. Such a description is called a functional profile. It describes in detail the application layer interface, including not only SNVTs and SCPTs but also default and power-up behaviour and specific behaviour bound up with the use of the variables.

Standard functional profiles can be thought of as the manufacturer’s guidelines to make a specific product. They contain both mandatory variables, which must be supported, and optional variables, which can be supported. This makes it possible for a vendor to differentiate from a competitor, but still keep the basic functionality the same, making it easier for the user to employ products from different vendors.

Together with other pump manufacturers and representatives from the building management systems industry, Grundfos has been a major contributor in the creation of the standard functional profile ‘8120_10 Pump Controller’, which is downloadable from the LonMark website and which forms the basis of all Grundfos Lon products. Furthermore, the 8120_10 Pump Controller profile has formed the basis for formulating standard functional profiles for both valves and compressors at LonMark International.

### Commercial benefits

There are a number of commercial benefits from using an open interoperable network system, ranging from choice of vendors to reduced maintenance costs.

The user is no longer tied up with a specific vendor just because of the communication system and its ability (or lack of) to communicate with other units in the system.

It is no longer necessary to use a specific tool from each vendor for each unit on the network. One tool can communicate with all units, and this tool can be acquired from different third-party suppliers that are not necessarily tied up with the vendor of the network units.

Units can be integrated without requiring costly and troublesome gateways to interpret between different formats, which make it difficult to pursue interfacing problems that should not have been there in the first place.

It is easy to make changes in an existing system based on LonWorks because all units speak the same language and there is no need for costly changes in existing units to make things work.

Installation costs are reduced because only one set of cabling is needed. Maintenance can be provided from one service provider.

Figure 2. The Magna-Lon module (above), for use with large-capacity Magna pumps such as the Magna 50-120 (below) is LonMark certified.

Figure 3. The G10-Lon interface (left) connects all Grundfos circulator pumps such as this TPE 40-180/2 industrial pump (right) to a LonWorks network.
with LonWorks knowledge instead of making service agreements with several vendors, which sometimes makes it difficult to place responsibility when something goes wrong.

**Compatible Grundfos products**

Grundfos offers several products within its Commercial Building Services segment for connection to LonWorks networks.

As mentioned above, the Magna-Lon interface module (Figure 2) for large Magna pumps has been verified to be LonMark compatible. In addition, the company has developed the G10-LON interface (Figure 3) for all TPE and UPE pumps and the smaller Magna pumps (Figure 4), and plans to have this LonMark verified. These Lon-units comply with the LonMark Standard Functional Profile ‘8120_10 Pump Controller’, and all new Grundfos Lon units will be LonMark certified.

The Grundfos website provides more in-depth information about the Magna-Lon and G10-Lon interfaces, with downloads available of both software for free upgrade to the newest software version and of technical documentation.

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