Network Gateway Specification and Technical Data

NG03-400
7/93
**Introduction**

This publication defines the significant functions of the Network Gateway. The Network Gateway is a standard node on a TDC 3000X Local Control Network (LCN) that enables communication between many geographically separated Local Control Networks (LCNs) through a Plant Information Network (PIN).

For multiple LCN users, this networking scheme provides an easy and economical way for a TDC 3000X System on one LCN to communicate directly with other TDC 3000X Systems located in geographically separate control rooms.

The internetwork operations realized by this strategy include parameter access, file transfer, and control between all the LCNs connected to the network.

This single window access to plant-wide data enables a user at one TDC 3000X System to clearly assess the impact of events that occur both “upstream” and “downstream” of the user’s local process. For example, an operator at a boiler house can see where steam is being used across the entire plant. In case of a shortage, the operator can determine which process areas to limit with the least impact to the manufacturing process.

Figure 1 illustrates an example of two independent LCN systems connected together by their Network Gateways and a PIN.

The PIN can be either a customer’s previously installed broadband, carrierband, or fiber optic network, or it can be a new installation. We recommend, in either installation, that a separate channel of the communications media be dedicated to the PIN.

**Advantages**

Advanced control strategies can be implemented, without the need for expensive upper-level computers, by linking your multiple TDC 3000X LCN systems through Network Gateways. Plant-wide data is available to operators, engineers, maintenance, and management in seconds.

Unlike the Computer Gateway, the Network Gateway does not require a predefined point database.

From his office, the plant manager can access or view data from any unit.

Engineering can effectively monitor, analyze, and make
changes to control parameters, in Operator Personality, from a centralized location. They can more easily identify and correct control problems through the implementation of advanced control strategies.

The maintenance staff can more easily identify, monitor, and diagnose many system problems from a central location, thereby minimizing repair and downtime.

Data can be shared between physically separated process areas while maintaining the security of the independent LCN systems.

**LCN Interconnections**

Each Network Gateway connected to a PIN uses one of 64 available addresses on the Plant Information Network. Up to ten Network Gateways can be connected to each LCN system.

Using this criteria, the number of LCNs that can be connected to a single PIN is limited only by these physical limits and the user’s communications load—there is a capability for thousands of LCN nodes to communicate with each other, essential for integrated plant solutions.

**Communications**

A token-passing communications protocol, using the IEEE 802.4 specification, is established on the Plant Information Network.

The PIN’s broadband electrical characteristics are covered in the IEEE 802.7 specification. This broadband technology has been used in industry for some time, and TDC 3000X customers may already have LANs (Local Area Network) and Ethernet communications networks in place which use this type of technology.

### Features of Internetwork Operations

- A standard interface between TDC 3000X Local Control Networks.
- Allows thousands of LCN nodes to intercommunicate.
- Read and write point parameters to and from another LCN system.
- Transfer 1,200 parameters per second per Network Gateway with a typical three second delay (maximum five second delay).
- Display remote LCN points (including alarm states), at Schematic, Group, and Detail displays.
- On-line file transfers to or from another LCN using standard utilities, such as copying schematic source and object files or listing file directories of a remote LCN History Module.
- Transfer files at 12,000 words per second.
- Advanced control allows AM points and CL control schemes to include points from remote LCN systems.
- Advanced control through the Computer Gateway/Plant Network Module allows upper level computers to include remote LCN points in their control schemes.
- Allows cascaded control for plant-wide control optimization.
- Inbound security on each parameter access and file transfer.
- Only an NCF change is required to install. No checkpointing or database to build for the Network Gateway.

### Features of the Plant Information Network

- Secure token passing.
- IEEE 802.4 Broadband Network.
- Single or dual cables with automatic cable switchover.
- Choice of coaxial (broadband or carrierband) or fiber optic cable systems.
- Displays PIN communication status between LCNs.
- Up to 64 Network Gateways per PIN and a maximum of 10 Network Gateways per LCN.

The PIN is analogous to a cable TV system with many broadband channels. The Plant Information Network used by Honeywell’s data is on a single channel to which the modems are tuned.

**PIN Communications Cables**

A single Network Gateway can support either a one-cable network or a two-cable network. To help insure cable integrity, the two-cable PIN is recommended.

Each cable on the PIN is operated independently. The message traffic on one cable is composed of different messages than the traffic on the other cable. This technique significantly increases message throughput.

Test messages are generated periodically on each cable to assess communication quality and to monitor for possible cable failures. If a failure is detected, traffic is rerouted to either the good cable or along an alternate path (see Alternate Routing).

### Functional Description

The Network Gateway provides interfaces to both the LCN and the Plant Information Network. In addition to this role, the Network Gateway provides secure access and transfer of data.
Tagnames and LCN IDs

Each LCN system is given a unique alphanumeric two-digit identification number (LCN ID) which identifies that LCN system to other LCN systems.

When the points of a remote LCN are referenced in schematics, groups, CL programs, etc., the LCN Identification number (ID of that LCN) is attached as a prefix to the tagname. In this way, two points on different LCN systems with the same tagnames can still be referenced.

Any 8-character tagname in an LCN system is expanded to an 11-character tagname when the LCN ID is added.

In standard displays such as Group and Detail displays, the LCN ID prefix is shown above the tagname.

Advanced Control

Cross-network advanced control uses a new software point processor in the Application Module. This new point processor is the Internetwork Point Processor (IPP).

A single AM on one LCN system can be used to perform any advanced control scheme, including cascade control, across different remote LCN systems.

Security

Three access levels are used by the Network Gateway to provide security:
• No Access
• Read Only
• Read and Write

Security access is further defined by:
• LCN System (LCN ID)
• Data Hiway Number for Hiway Gateways and PLCGs
• UCN Number for Network Interface Modules
• Unit Numbers for Application Module and Computer Gateway
• Volume Names for History Module

To insure security, every incoming access request is checked for authorization by the local Network Gateway. Once access to a local LCN is permitted, any node on that remote LCN system can access any point from the data owners of the local LCN.

If proper permissions are configured at the local LCN system, file access to the local History Module can be initiated from a remote US, CG, or AM.

Alternate Routing (R410)

This function is added in software Release 410. With this feature implemented, two Network Gateways on the same LCN are...
specified—a “responsible” Network Gateway and an “alternate” Network Gateway.

The responsible Network Gateway normally routes messages to a remote LCN system. If an error occurs in the responsible Network Gateway’s electronics module, the alternate Network Gateway is committed to take over the communication task.

**Diagnostics**

To provide quick isolation of communication problems, the operation of local and remote Network Gateways can be monitored from any Universal Station. The maintenance displays include the following diagnostic information:

- Standard LCN Diagnostics.
- Indication of any change in Network Gateway responsibility (New, Changed, or Deleted).
- Cable configuration and quality (Good, Suspect, or Failed).
- Local and remote LCN connection requests.
- Network Gateway Performance Displays (Node characteristics, Receive, and Transmission statistics).

**Physical Description**

The Network Gateway is housed in a TDC 3000X dual-node electronics module, shown in Figure 2.

This electronics module contains the Network Gateway processor and memory, provides a physical connection to the two LCN cables, and connects to modems specifically designed for the PIN.

**LCN Cable Network**

The Network Gateway’s standard LCN cable network is the same as that used by all other TDC 3000X modules.

**PIN Cable Network**

The Plant Information Network operates at 10 megabits per second using broadband technology. The cable network conforms to IEEE specification 802.7.

Either coaxial or fiber optic cable can be used for the broadband cable network. Also, either single or dual cable systems can be used.

Like other broadband networks, the PIN requires modems, head-end remodulators, taps, etc.

**Broadband Modem**

A vendor-provided broadband modem is used to connect the Network Gateway module to the Plant Information Network.

**Single Cable Network**

Figure 3 shows an example of two LCN systems connected to a single cable Plant Information Network. Taps, remodulators, terminators, etc., required to interface the coaxial cable PIN, are omitted here for clarity.

At least one Network Gateway must be present on each LCN. The Network Gateway is assigned an address on the PIN. In the
single cable system, a single broadband modem is required for each Network Gateway.

**Dual Cable Network**

Figure 4 is an illustration of the preferred dual cable PIN. Each Network Gateway still has a single PIN address, but two modems are required to make connections to the PIN. This method is preferred because dual cable paths reduce the chance of network failure due to a damaged cable.

Unlike the LCN cable system, PIN dual cables are not “swapped” periodically. If a failure is detected, traffic is rerouted to either the good cable or along an alternate path.

**Alternate Routing Capability**

Figure 5 illustrates the hardware necessary to implement the alternate routing scheme between LCN #1 and LCN #2. Each Network Gateway has a unique address, allowing them to share network traffic under normal operation. In the illustration, NG 1r and NG 2r are the “responsible” Network Gateways, each being responsible for routing (sending) messages to one or more remote LCNs. Likewise, NG 1a and NG 2a are the “alternate” Network Gateways, each being designated to take over the routing tasks if its responsible partner fails.

Each Network Gateway is capable of simultaneously routing messages to several remote LCNs. There is no rule for how many remote LCNs should be handled by a single Network Gateway and its alternate partner, but a given Network Gateway pair must be configured to route all of the messages to a given remote LCN. At some point, however, additional Network Gateways will be needed in order to guarantee performance. A maximum of ten Network Gateways may be configured on a single LCN.

When a responsible Network Gateway and an alternate Network Gateway pair are configured on an LCN system, only one of them is actively sending messages. This means that, at any given time, only one Network Gateway in an LCN system is actively sending messages to a given remote LCN system. There is no concept of “spreading the load” by having both Network Gateways routing messages at the same time.

**Other PIN Options**

In addition to the broadband cable communications system described earlier, two more options are available for short-distance (within the control room) and medium-distance applications. These options use Carrierband and Fiber Optic technologies, respectively.

Neither of these two communication systems require any changes to the Network Gateway software. Only the corresponding modems with special I/O cards are required.
Broadband coax modems and remodulators are not required in these applications.

**Carrierband Network Option**  
(Indoor Only)

This option supports short-distance PIN within in the same control room.

A carrierband modem operating at 5 megabits per second is installed on each I/O card in the Network Gateway card file and it connects directly to the PIN.

**Fiber Optic Network Option**

This option supports medium-distance PIN between the control rooms. Fiber optic networks have a noise immunity advantage.

A fiber optic modem operating at 10 megabits per second is installed on each I/O card in the Network Gateway card file and it connects directly to the fiber optic PIN.

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**Figure 6 — Carrierband Network Implementation**

Single Cable Plant Information Network
Network Gateway Specifications

Physical Characteristics — Dual Node Module

Approximate Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>18.8 cm (7&quot;)</td>
</tr>
<tr>
<td>Width</td>
<td>48.3 cm (19&quot;)</td>
</tr>
<tr>
<td>Depth</td>
<td>53.3 cm (21&quot;)</td>
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</table>

Approximate Weight

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Node</td>
<td>14.6 kg (32 lb)</td>
</tr>
<tr>
<td>Two Nodes</td>
<td>18 kg (40 lb)</td>
</tr>
</tbody>
</table>

Power Options

AC-Voltage Options

120 or 240 Vac +10%, -15% (power cord selected)

Frequency Options

50 Hz or 60 Hz, +3%, -6%

Operates without disruption through an interruption in the input ac voltage of at least 50 ms duration.

Communications Specifications — Plant Information Network*

Network Specifications

IEEE 802.4 (protocol) and 802.7 (hardware)

Data Rate

10 megabits per second

Frequency Assignments

- Forward channel transmission band occupies 252 to 288 MHz spectrum.
- Reverse channel remodulated into the 59.75 to 95.75 MHz spectrum.
- Repeaters may be used.
- 12 MHz bandwidth per channel.

Topology

- 75 Ω coaxial trunk cable remodulated at one end and terminated at the other. Drop cables from trunk connected to broadband modems.
- Medium-distance fiber optic cables with fiber optic modems.
- Short-distance carrierband cables with modems operating at 5 megabits per second.

* Numerous options are available to implement the IEEE 802.4 and 802.7 network standards. For more details, see your Honeywell representative or your broadband network consultant.

Performance

<table>
<thead>
<tr>
<th>Transfer Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Parameter Transfers</td>
<td>1,200 / s</td>
</tr>
<tr>
<td>File Transfers</td>
<td>12,000 / s</td>
</tr>
</tbody>
</table>

Note: Both point parameter transfers and file transfers can occur simultaneously.

Configuration Capability

<table>
<thead>
<tr>
<th>Capability</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Number of Network Gateways per LCN</td>
<td>10</td>
</tr>
<tr>
<td>Maximum Number of Network Gateways per PIN</td>
<td>64</td>
</tr>
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