Honeywell

TDC 3000X
Universal Control Network
Specification and Technical Data

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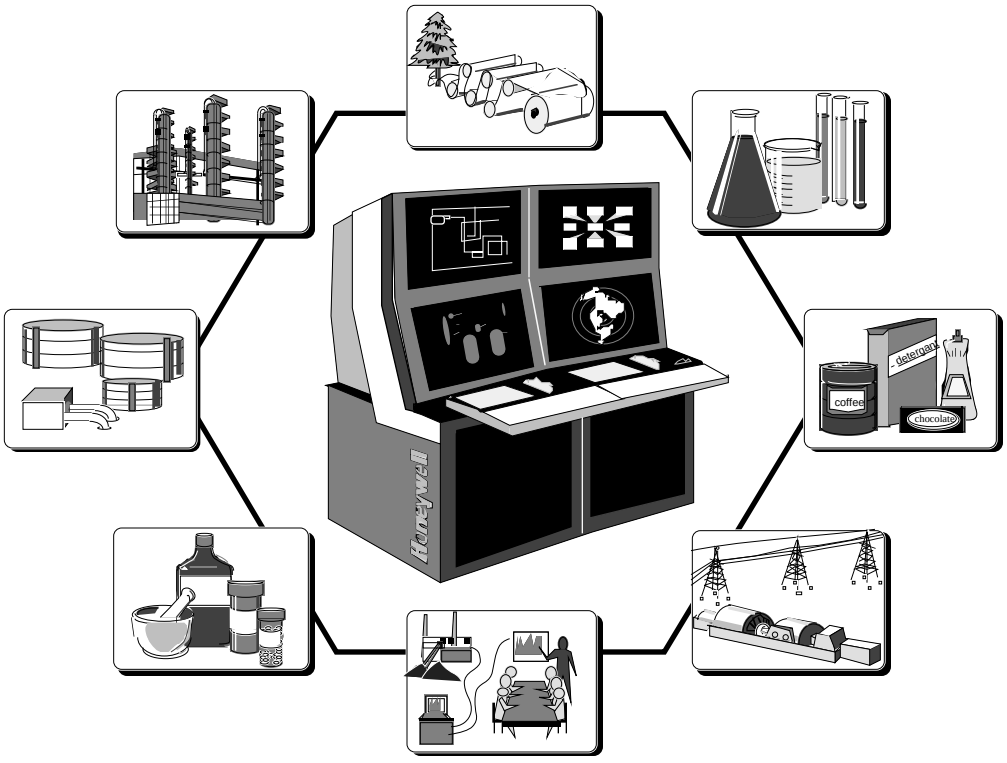

Total Plant

TDC 3000^X Universal Control Network

Specification and Technical Data

Introduction

The Universal Control Network (UCN) is a high speed, high security process control network. It features a 5 megabit/second, carrier band with token bus access control. The UCN is based on the ISO* open system interconnection standards with appropriate Honeywell extensions for process control security. It is used as the real-time redundant communications backbone for process-connected devices such as the Process Manager™ (PM), Advanced Process Manager (APM), High-Performance Process Manager (HPM), Safety Manager (SM), and Logic Manager (LM). The UCN supports peer-to-peer communications for sharing data and allowing greater coordination of control strategies among network devices.

* International Standards Organization

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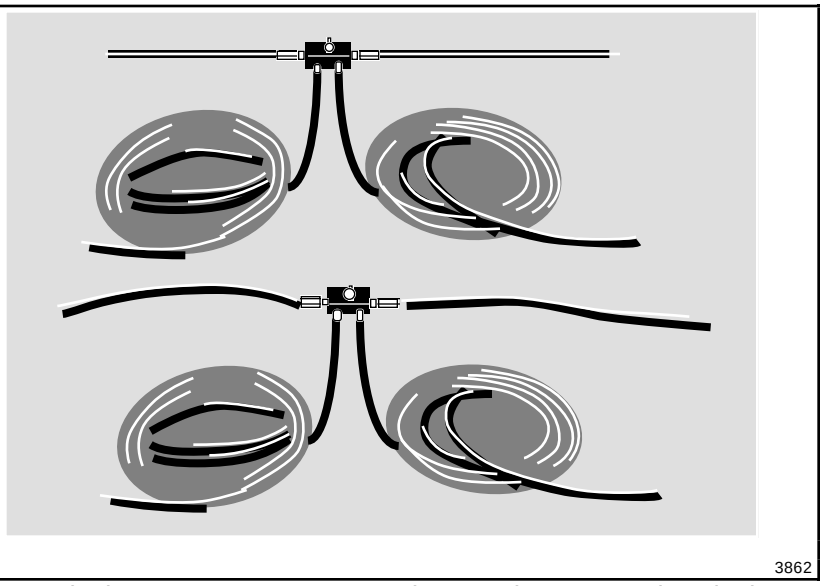

This network also supports efficient, secure, real-time communications between the UCN process-connected devices and Local Control Network (LCN) modules such as Universal Stations, History Modules, Application Modules and Plant Network Module (See Figure 1).

The UCN is connected to single or multiple LCNs using Network Interface Modules (NIMs). Up to 20 UCNs and Data Hiways can be connected to the same LCN. At the LCN, all of the process data from these process networks is available for the standard TDC 3000^X operator, control, history, and management functions.

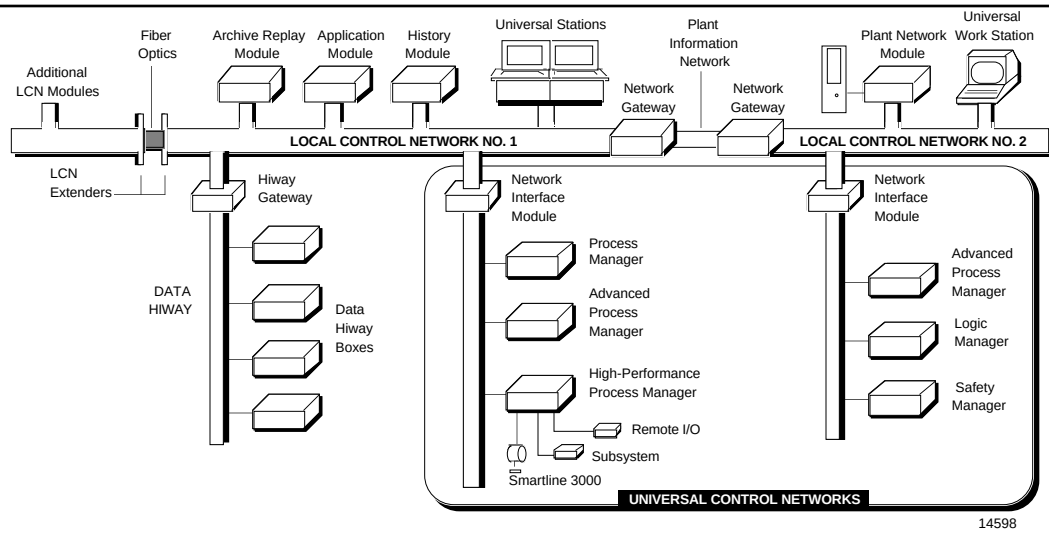

Figure 1 — TDC 3000^X Architecture

For example, both UCN and Data Hiway-based information can be combined into the same group and custom graphic displays, or accessed for history or more advanced control functions as needed.

Functional Description

The Universal Control Network provides a powerful communications platform for efficient, secure, real-time process communications. The UCN is based on IEEE 802.4 (ISO 8802/4) and extended message services. It operates at a 5 megabit/second rate using efficient message structures to support the high-speed communications requirements of a process network. Because of the deterministic token-passing algorithm employed, all devices are assured equal and timely access to the network without performance degradation even during peak load conditions.

UCN communications follow the 7-layer OSI Communications Model (see Figure 2). To maximize system performance and robustness, the UCN supplements the base ISO protocols with process-oriented features proven in Honeywell's LCN and Data Hiway. This includes:

- support of redundant devices for added security
- guaranteed event/alarm distribution
- LCN to UCN time synchronization to enable high resolution, digital input sequence of events recording
- extensive NIM and UCN communications and cable diagnostics

Besides full support of these special features, the UCN also provides the applications layer necessary for a well-integrated, high integrity, real-time process communications network. For example, the UCN supports orderly data access of all data acquisition, control, configuration, and status parameters for both peer-to-peer and higher level communications, extensive alarm and message handling routines, on-going device and communications diagnostics monitoring, support of high-level control with assignable control modes, plus system and device configuration support. All of these communications management functions are provided as standard when using TDC 3000^X with the UCN.

The UCN uses redundant cables as standard, and can accommodate up to 32 redundant devices.

Devices can be added to, or removed from, the UCN in a modular fashion to adjust to changing system requirements without interference to other existing devices.

UCN Functions

- Carries all information transferred between the devices on the network, using ISO standards
- Ensures the timely exchange of information through an efficient protocol and high-speed communication
- Provides highly secure communication through active and backup cables, and message-integrity checking
- Provides automatic reconnect to the UCN in the event of multiple cable faults

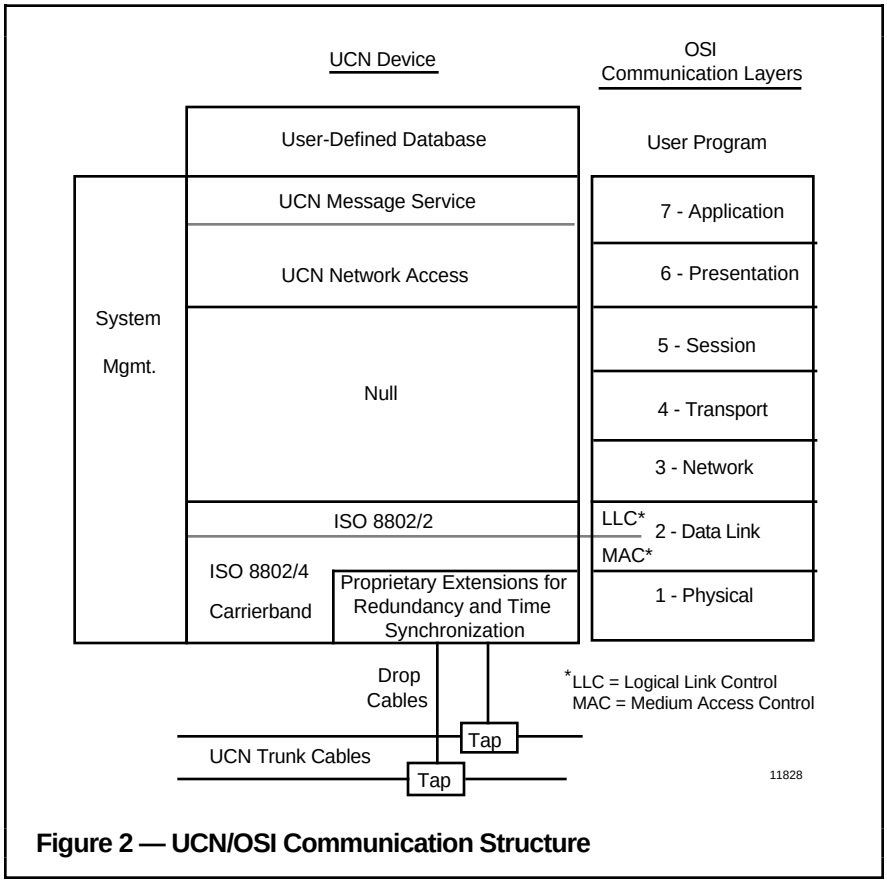

Figure 2 — UCN/OSI Communication Structure

The UCN supports peer-to-peer communications. This means that UCN devices can write data to and read data from other UCN devices for additional control strategy flexibility and coordination.

Message Handling

The Universal Control Network is a redundant logical token-passing bus. All information is transferred serially at 5-million bits per second. There are several types of message frames that can be transmitted. These include message frames that transfer commands, aid in diagnosis, transfer information, and control access to the network. For example, access to the network is granted to a device upon receiving a token frame as it is passed along the bus from device to device. That device then has the opportunity to transmit one or more messages before passing the token to the next device on the bus.

As each frame passes along the bus, it is received by all devices on the bus, but is processed by only those for which it is intended. By using message frames of varying lengths, overall network data-transfer efficiency is improved. A message can be directed in one of three ways:

- Point-to-point—a single destination device processes the message
- Multicast—more than one destination device processes the message
- Broadcast—all devices process the message

All Universal Control Network devices follow well-defined techniques for message priority processing, request/response time-out processing, and communication retries. These techniques ensure that device operations are deterministic and communication is secure.

NIM Functions

- Provides for orderly data access between the TDC 3000^X Local Control Network and the Universal Control Network devices
- Converts data and protocol between the Local Control Network and the Universal Control Network
- Channel UCN events to the LCN for alarming
- Synchronizes LCN and UCN time

Network Interface Module

Information about the process and about the status and configuration of the UCN devices is transferred through the Network Interface Module from the Universal Control Network to the Local Control Network. Commands and configuration information for up to 8000 points, with up to 2400 parameters per second (K4LCN NIM), are transferred through the Network Interface Module from the Local Control Network to the Universal Control Network. For added flexibility, multiple NIMs can be connected to the same UCN. The additional NIMs can be used to load level heavy loads that might exist on a single physical UCN.

The NIM provides the protocol conversion and buffering necessary to efficiently exchange information between UCN devices such as PMs, APMs, HPMs, LMs and SMs, and LCN-based devices such as Universal Stations, History Modules, Application Modules, and Plant Network Modules. Redundant NIMs are a fully supported TDC option. Because the UCN and LCN provide rapid, secure communication between all devices, distributed control processing with centralized operations is a reality in TDC 3000^X systems.

The NIM broadcasts the LCN time to all UCN devices, thereby synchronizing the UCN time with the LCN. This supports 1 ms digital input sequence of events reports from the Advanced Process Manager, Safety Manager and High-Performance Process Manager.

Reliability

The use of dual cables, 32-bit CRC frame-check sequence (FCS) verification on every received frame, and message-length checks by software ensures an extremely reliable network. Any detected errors can be corrected by a repeat transmission from the sending device.

The Universal Control Network Interfaces in all modules have transmission and reception circuits for both coaxial cables. The transmitter and receiver circuits are transformer-coupled to provide electrical isolation between the modules on the network. They are designed so that a circuit failure cannot affect the operation of the cables or other devices connected to the UCN. In addition, further protection against individual device faults is provided by cable taps that isolate the drops and devices from the trunk cable.

A second level of security is built into each network device in the form of diagnostic software that monitors and reports numerous device and parameter error conditions. These checks assure a high performance real-time network with message security for process control applications.

To assure robust communications, self-diagnostics and automatic recovery routines are performed by UCN nodes.

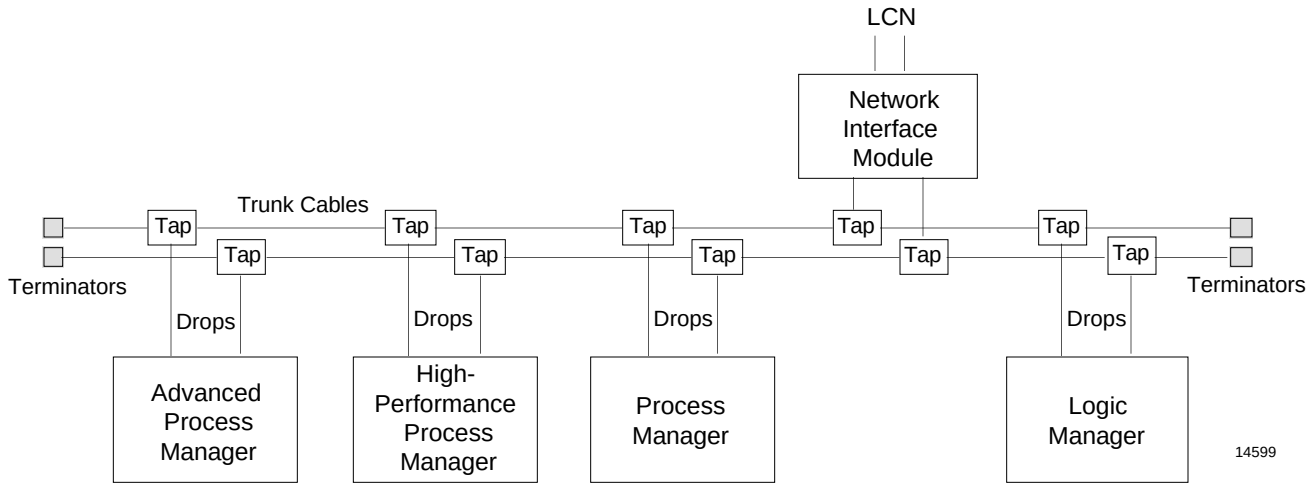

Figure 3 — Redundant Universal Control Network Topology

To verify its ability to communicate over the Universal Control Network, each device monitors itself for excessive continuous transmission. If a transmission exceeds approximately 1/2 second, the modem communication is shut down. Each UCN device continually performs a set of diagnostics to determine the status of the two cables. This includes periodic switching of cables and monitoring each cable for noise interference or silence. Either of these conditions indicates that a failure has occurred.

If multiple media (cable) failures ever occur, the NIM and PM/APM/HPM communication software continuously tries to reestablish the node on the UCN network. This is termed *auto-reconnect.* Auto-reconnect insures that either the primary or secondary of a redundant pair will reestablish communication on the UCN network when multiple cable faults are repaired.

Redundant Network Interface Modules are optionally available to provide an additional degree of security.

The secondary NIM is kept up-to-date with relevant information from the primary NIM so that the secondary can take over at any time. This occurs automatically and is transparent to the network itself; however, the operator is notified of any device switchover.

Physical Description

The Universal Control Network trunk cables and drop cables are 75 ohm coaxial. Typically, RG-11 is used for trunk cables and RG-6 is used for drops. Plenum, armored, and Bamboo cable can be used to meet special environmental conditions.

Carrier-band taps are used to connect drop cables to trunk cables. Dual-, quad-, or eight-drop taps are available. They are paired to accommodate the redundant UCN (see Figure 3).

Terminators (75 ohm) are used at both ends of the UCN trunk cable as well as on any unused drop-tap ports.

The Network Interface Module is available as an electronics package (boardset) for a dual node cardfile (DNCF). The DNCF can be mounted in an Operator Console or in a system cabinet. For additional information on the DNCF, see the *System Technical Data.*

The Network Interface Module boardset consists of a high-density K2LCN or K4LCN processor board, an Enhanced Process Network Interface/modem (EPNI) board, power supply, and fan assembly. Each of these items is an Optimum Replaceable Unit for maintenance.

Options

- Redundant Network Interface Modules
- Multiple Network Interface Modules on a UCN
- Type of cables
- Size of cable drop taps (2, 4, or 8 ports)
- Taps mounted in a PM/APM/HPM or NIM cabinet.

Universal Control Network Specifications

Network Type	Single-channel phase-coherent FSK (Carrier Band) Local Area Network (ISO 8802/4)
Data Rate	5 Mbits/second
Topology	Taps used to isolate main trunk cable from drop cables connected to nodes
Drops per Tap	2 or 4
No. of devices per UCN	Up to 32 redundant devices
Trunk Cable Types	
Indoor	RG-11, quad shield with inner and outer foil and braid shields, and PVC flame-retardant outer jacket
Outdoor	RG-11, quad shield with polyethylene outer jacket
Trunk Cable Length	Function of cable type and number of drops. Refer to the *UCN Site Planning and Installation* manual for details.
Drop Cable Type	RG-6 quad-shield
Drop Cable Length	Up to 50 meters

Note: The Universal Control Network conforms to IEEE 802.4 (ISO 8802/4) specifications for carrier band communications. See this specification for additional details.

Network Interface Module Specifications

Model Numbers, CE-Compliant NIMs

MP-NIMS72 Single NIM, EPNI, K4LCN-4 MW BOARD SET, R500 (or higher)
MP-NIMR72 Redundant NIM, EPNI, K4LCN-4 MW BOARD SET, R500 (or higher)
MP-NIMS64 Single NIM, EPNI, K2LCN-4 MW BOARD SET, R400 (or higher)
MP-NIMR64 Redundant NIM, EPNI, K2LCN-4 MW BOARD SET, R400 (or higher)

CE Conformity (Europe)	This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed. *Deviation from the prescribed procedures and conditions specified in the installation manuals may invalidate this product's conformity with the Low Voltage and EMC Directives.*
Product Classification	Class I: Permanently mounted, permanently connected Industrial Control Equipment with protective earthing (grounding). (EN 61010-1-1993)
Installation Category	Category II: Energy-consuming equipment supplied from the fixed installation. Local Level Appliances and Industrial Control Equipment . (EN 61010-1-1993)
Pollution Degree	Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (IEC 664-1-1992)
EMC Classification	Group 1, Class A, Industrial, Scientific and Medical (ISM) Equipment. (EN55011-1991; Emissions)
Method of Assessment	EMC: Technical Construction File (TCF) LVD: Technical File (TF)

Physical Characteristics

Approximate Dimensions (Dual-Node Cardfile)

Height	18.8 cm (7")
Width	48.3 cm (19")
Depth	53.3 cm (21")

Approximate Weight

Dual-Node Cardfile with

Single Node	14.6 kg (32 lb)
Two Nodes	18 kg (40 lb)

Power Options

Universal AC Input

102-264 Vac (Autoranging)

47-63 Hz (Frequency Range)

All Network Interface Modules operate without disruption through an interruption in the input ac voltage of up to 40 ms duration.

Operating Characteristics

Point Capacity	Up to 8000 points per NIM or redundant NIM pair (both K2LCN & K4LCN)
Data Access	1200 single-parameter accesses per second (K2LCN NIM) 2400 single-parameter accesses per second (K4LCN NIM)

Note: The volume of data processed by a Network Interface Module in a specified time period is a function of both the number and types of modules on the LCN requesting UCN information. See *Implementation Guidelines* publications for each specific controller for further information.

Configuration Capability

Maximum Number of NIMs plus HGs per LCN	20 — single or redundant
Maximum Number of NIMs per UCN	3 — single or redundant