Honeywell

Local Control Network Specification and Technical Data

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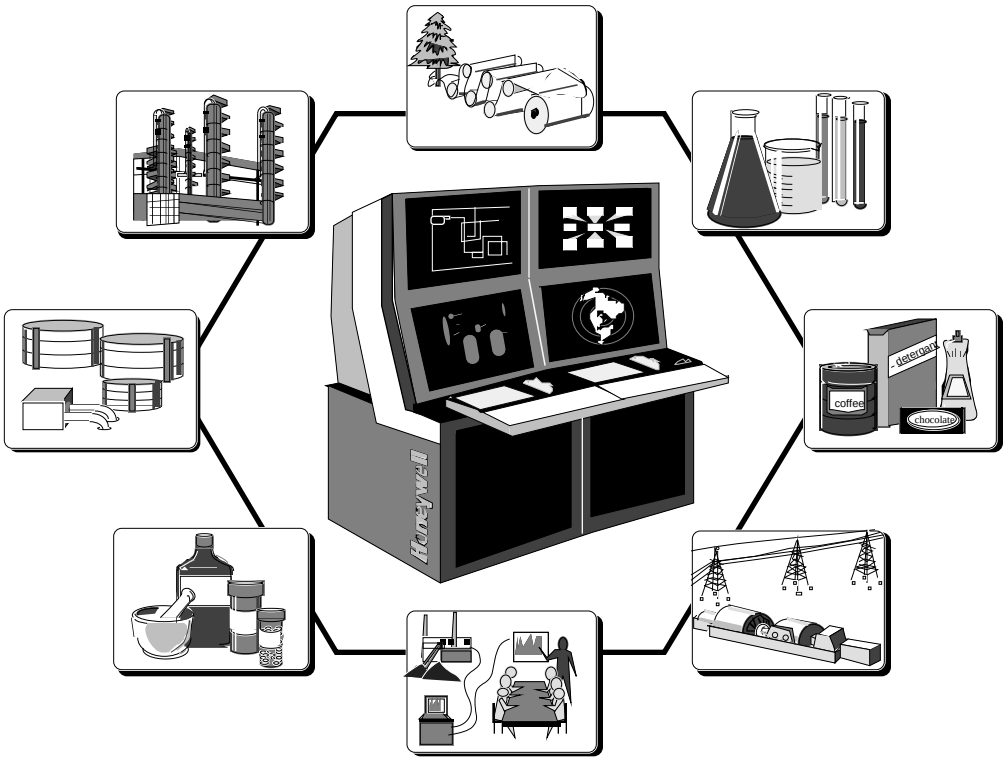

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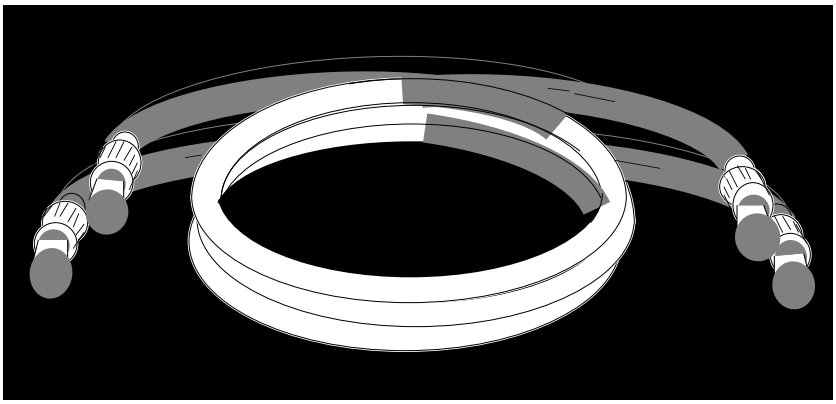
TDC 3000 Local Control Network

Specification and Technical Data

Introduction

This publication defines the significant functions of the TDC 3000 Local Control Network (LCN). The Local Control Network is a local area network through which TDC 3000 modules communicate with each other. Multiple LCNs can be linked together through Network Gateways, as shown in Figure 1.



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Two coaxial cables provide the primary medium that connects each module residing on a Local Control Network. Optional fiber optic communication links can be used to join LCN segments or to connect remote Universal Stations to the LCN. The Local Control Network carries all of the information that is transferred between the modules, including information going to or from the modules, and information going to or from process subsystems integrated into the TDC 3000 System.

For more information about the relationships of the TDC 3000 modules and the types of information carried on the Local Control Network, refer to the *System Technical Data* document. The *Network Gateway Specification and Technical Data* describes how two or more LCNs are interconnected.

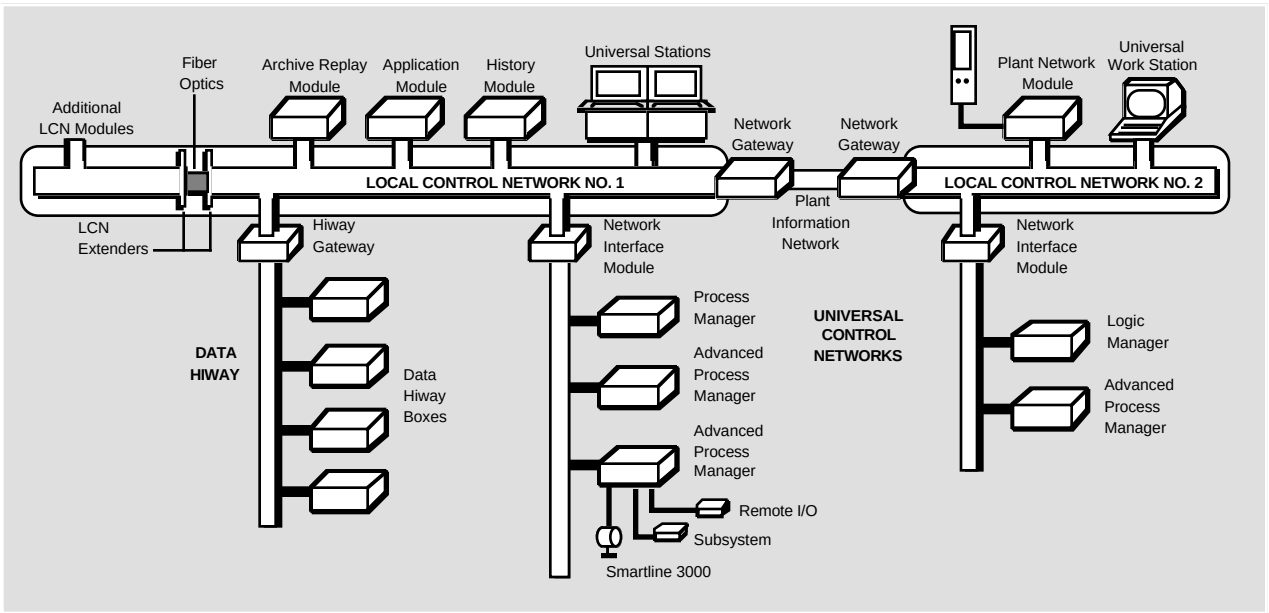

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Figure 1 — TDC 3000 Architecture with Local Control Network

Functional Description

Because the Local Control Network provides rapid, secure communication between all modules, distributed processing with centralized operations is a reality in TDC 3000 Systems. All modules are assured access to the network, even during a peak load. Because of the deterministic token-passing algorithm employed, communication delays do not become excessive. Modules can be added to or removed from the network without disrupting ongoing operations.

High-Speed Communication

All information is transferred serially at 5-million bits per second. Information is transferred in frames of varying lengths. There are several types of frames, including frames that transfer commands, aid in diagnosis, transfer information, and control access to the network.

Access to the Network

A "token-passing" technique is used to control access to the network. A **token frame** is passed among the modules to determine which one has access to the network. The Local Control Network is a broadcast type of local area network. All modules "hear" all transmissions, but they accept only information intended for them.

Figure 2 is a simplified flow chart of the network-access mechanism. When a module receives a token frame and has nothing to transmit, it passes the token to the next module with a higher address. For example, when module number 4 receives the token frame but has nothing to transmit, it passes the token frame to the next module, normally number 5. When the highest-numbered module receives the token frame but has nothing to transmit, it passes the token to the lowest-numbered module. Sixty-four modules can exist on a single (extended) LCN, assigned to addresses ranging from 1 through 127. System efficiency is improved by using contiguous addresses.

FUNCTIONS

- Carries all information transferred between the modules on the network.
- 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.

A module "holding" the token has access to the network to transmit one frame. When a module receives the token and has something to transmit, it transmits one frame and then passes the token to the next module.

The **information frame** transfers from 100 to 2000 bytes of information from one module to another module. The destination-address field can specify the physical address of a module or it can specify a logical-node address (up to 8192 addresses). When a logical-node address is specified, all modules that have the specified logical

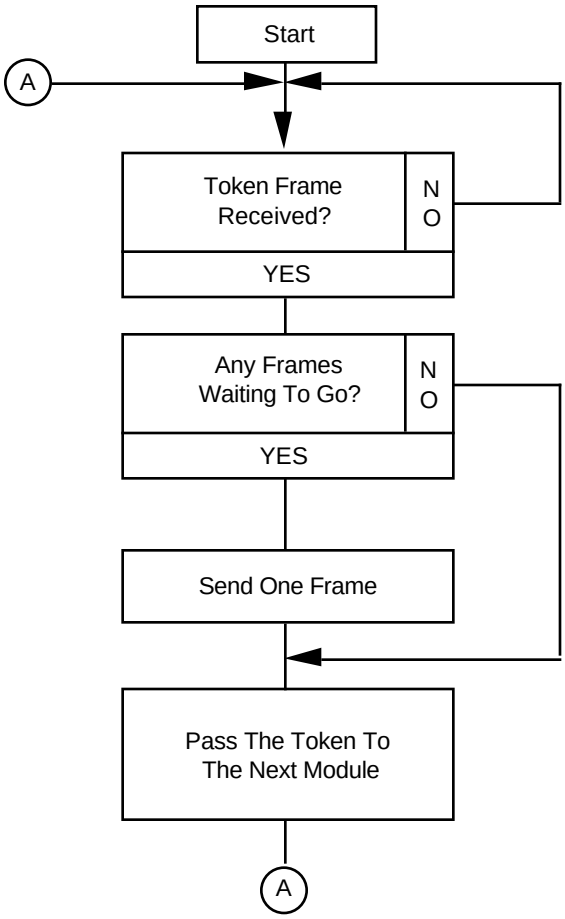

Figure 2 — Network Access Mechanism 1122

node accept the information. In addition, an originating node can broadcast a message to all nodes. In these ways, information can be transferred throughout the network without regard for the physical location of sources and destinations.

Security

The use of dual cables, CRC verification on every received frame, and message-length checks by software ensure an extremely secure network. Undetected errors are virtually nonexistent. Detected errors, which are also very rare, can be corrected by a repeat transmission by the application software.

The frame-check sequence (FCS) that is near the end of every frame contains a 16-bit polynomial checksum that is a unique representation of all of the information contained in the frame. The checksum is regenerated as the frame is received in each module and the regenerated checksum is compared with the FCS field. If an error is detected, the frame will be retransmitted as the result of timeout for lack of response.

The Local Control Network Interfaces in all modules have transmission and reception circuits for both coaxial cables. Should a cable, a transmitter circuit, or a receiver circuit fail, there is a backup to take over for it. The transmitter and receiver circuits (transceivers) are transformer-coupled to provide electrical isolation between the modules on the network. The transceivers are designed so that a circuit failure cannot affect the operation of the cables or other transceivers.

All modules transmit all frames on both cables. They normally "listen" on the active cable. The active cable is determined by cooperative, network-management software in each module.

Network Time Synchronization

Accompanying the other information carried on the Local Control Network is a system-clock synchronization signal. There are two types of signals that can be generated, depending on the type of boards used in the LCN modules. The recently introduced high-density (K2LCN) boards are capable of generating, and receiving, digital clock synchronization data frames that are transmitted at the standard 5 MHz rate. Modules that do not contain the K2LCN boards require a special 12.5 kHz clock synchronization signal.

These signals are used to synchronize timekeeping in the modules. The date and time-of-day counters in the modules are started and maintained by a frame containing the actual real time, which is sent out on the LCN every 50 ms. The clock synchronization signal on the network synchronizes the counters so that all time counts change at the same time.

Clock-signal propagation to modules connected by LCN Extender links occurs as part of normal message handling for K2LCN 5 MHz signals. Propagation over Extender links is optional for 12.5 kHz signals; when implemented, separate fiber optic fibers are used.

One of the modules on the network is the source of the master clock-synchronization signal, with a second module providing a backup "slave" clock. If there is a mixture of modules with and without K2LCN boards, two of the non-K2LCN modules serve as 12.5 kHz master and slave. A K2LCN module then synchronizes its clock with the master and transmits digital clock 5 MHz message frames to the other K2LCN modules on the LCN. Hiway Gateways or Network Interface Modules typically are selected as clock sources, but any modules can be selected by the system engineer at the time of network configuration.

Options

The Local Control Network options are the number and type of modules on the network, the length and mix of cables, the LCN Extender (LCNE) and the Local Control Network Fiber Link (LCNFL).

The maximum number of modules on a single LCN is 64 when an LCNE is included, or 40 modules without an LCNE. Where a module has a backup, the module and its backup count as two in the total count of modules on the LCN.

Multiple LCNs are interconnected using a Network Gateway through a Plant Information Network (PIN). For more information, refer to the *Network Gateway Specification and Technical Data*.

Each coaxial-cable segment can be up to 300 m (1000 ft) long, and each fiber optic communication-link can be up to 2000 m (6500 ft) long. Figure 3 shows an example of an LCN with multiple coaxial and fiber optic cable segments. There can be up to six fiber optic links, and the combinations of coaxial and fiber segments are limited by the constraint that the signal path between any two modules on an LCN cannot include more than two fiber optic communication-links.

The LCNE retransmits signals between coaxial and fiber segments.

The LCNFL allows connection of a single remote module (generally a Universal Station) to fiber cables without the need to create a coaxial cable segment.

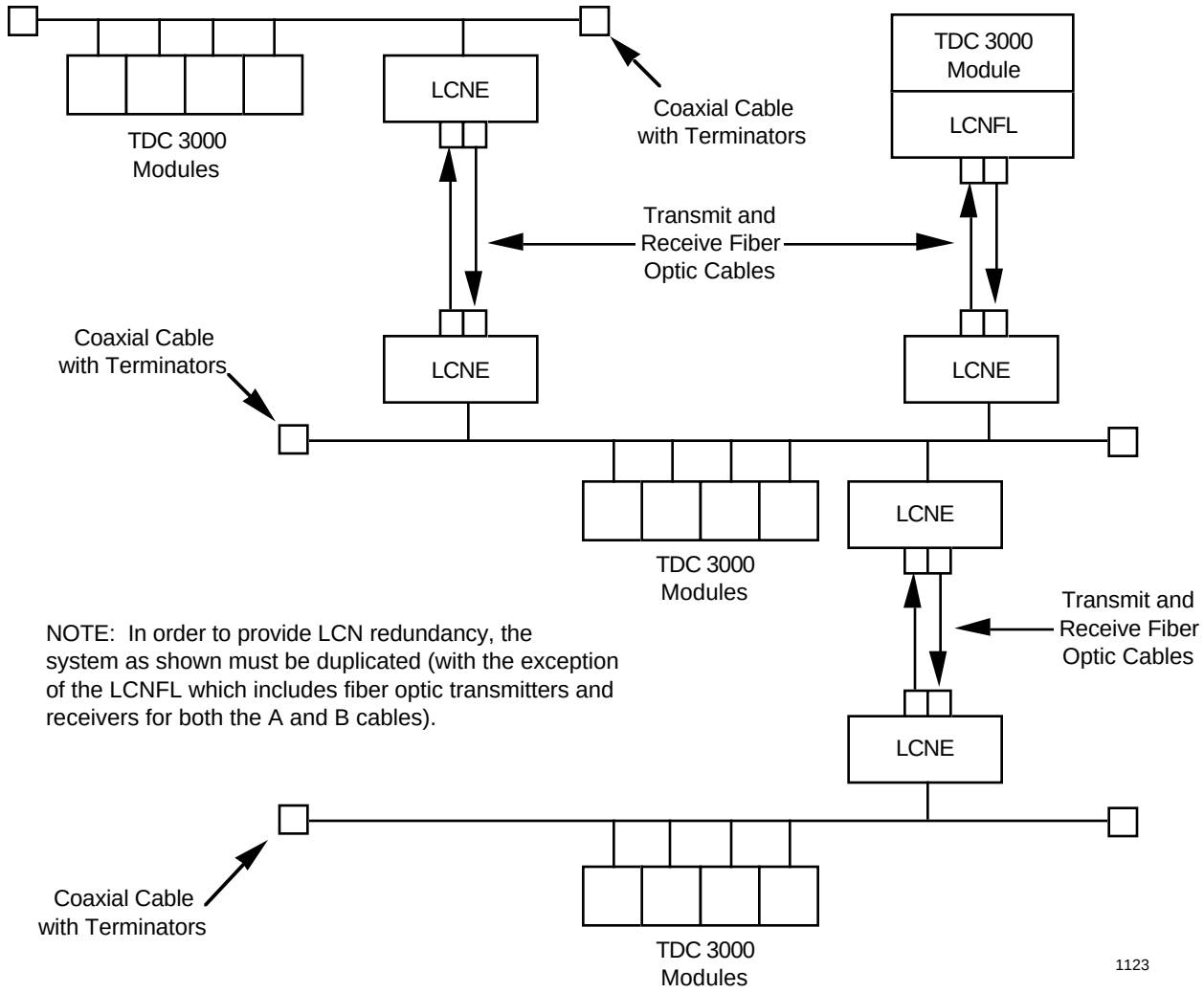

Figure 3 — LCN Extender and Fiber Link Configuration Example (Signal Path)

Physical Description

The primary Local Control Network hardware consists of the coaxial cables,* tee connectors, termination connectors, and a Local Control Network Interface board in each module. Figure 4 shows how the coaxial cables are connected to each module.

The optional fiber optic hardware consists of the fiber optic cables (provided by others) and two board types, the LCNE board and the LCNFL board.

The LCNE board mounts in any spare paddleboard slot in any module without affecting its operation, except to draw power. As shown in Figure 5, a single LCNE connects one coaxial cable (active or backup) to two fiber optic cables (transmit and receive). To protect against loss of communication in the event of a single-node failure, it is recommended that only one LCNE board be connected to a module.

As shown in Figure 6, an LCNFL board replaces the coaxial cable transceiver-board in a remote module, and connects to the four fiber optic cables required for extension of a redundant LCN.

* TDC 3000 LCN cables have been designed and tested by Honeywell IAC to meet strict standards of performance. Other "RG-59-like" or "RG-11-like" cables have not been tested and qualified for use in the system; therefore, no substitutions are approved by Honeywell.

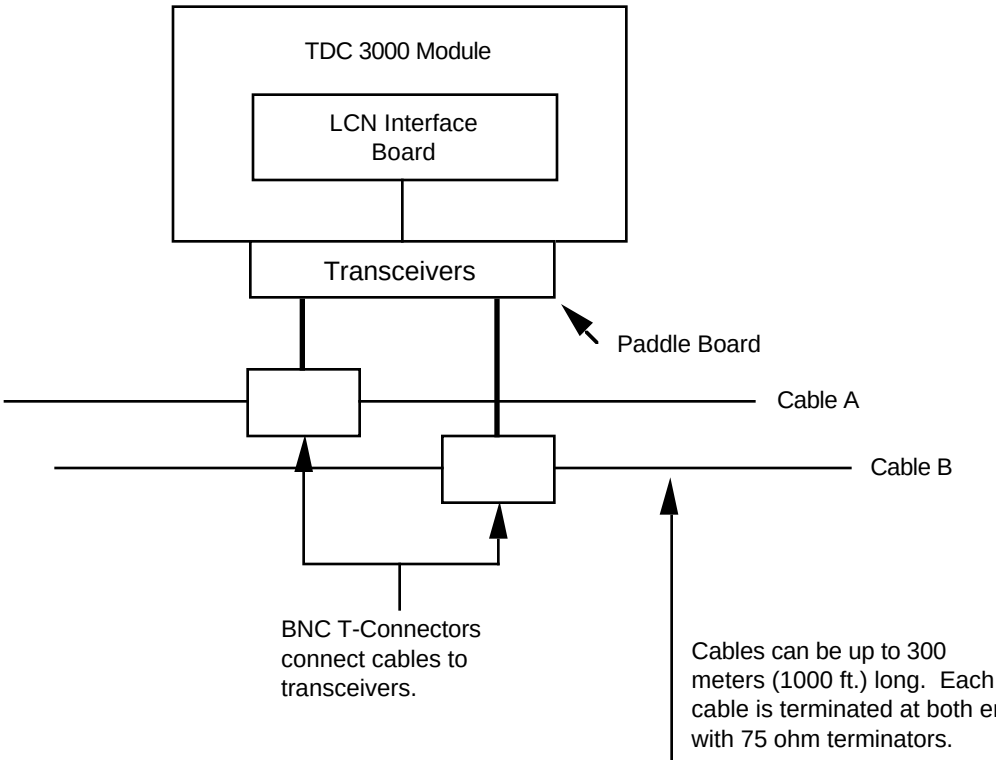

Figure 4 — LCN Coaxial Cable Connections

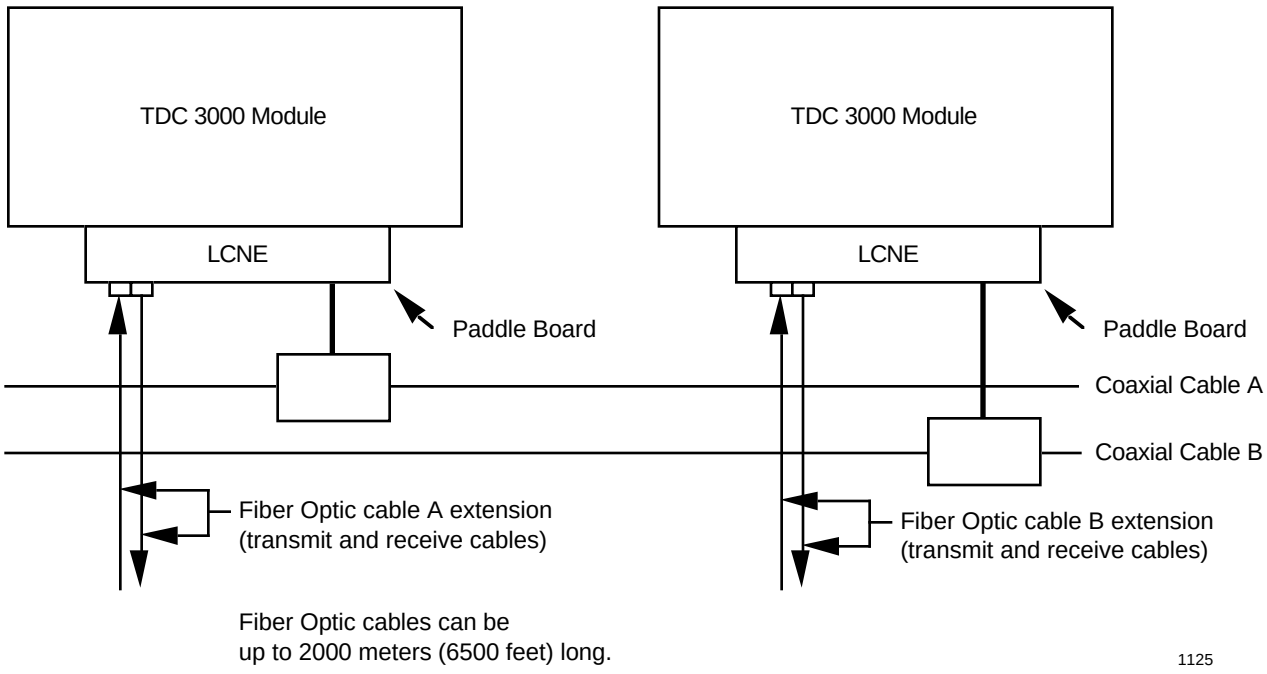

Figure 5 — Coaxial Cable to Fiber Cable Connection

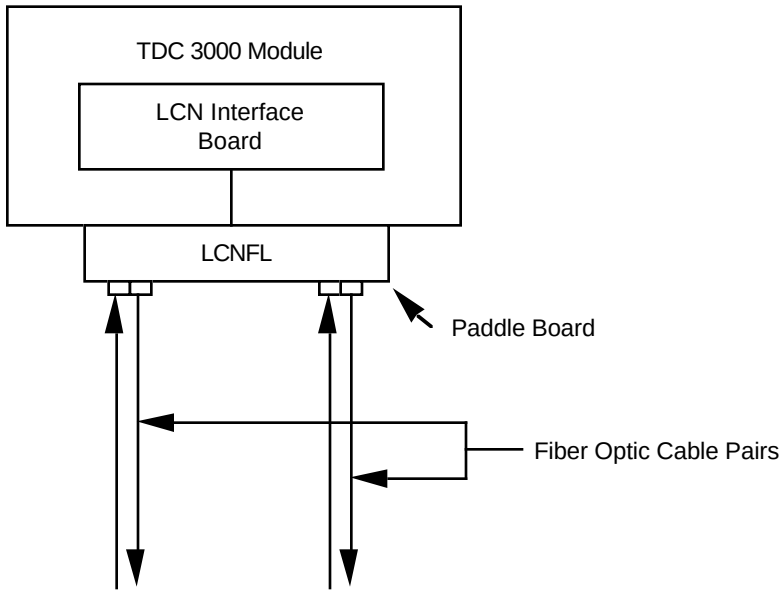

Figure 6 — Remote Module Cable Connection

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Local Control Network Specifications

Physical Characteristics

Type of Cable/Connections (LCN Cables A & B)*

Coaxial cables within cabinets (75 ohm)	Honeywell Part No. 51190837-100
RF coaxial BNC-type connector for above	Honeywell Part No. 30732054-001
BNC T-Connector at module	Honeywell Part No. 51190728-105
75 ohm terminator for each end of LCN	Honeywell Model No. C-KCA02
Coaxial cables between cabinets and modules	Honeywell Part No. 51190838-100
RF coaxial BNC-type connector for above	Honeywell Part No. 30732050-001

Fiber optic cable can be used between coaxial cable-bus segments to provide extended bus runs. Inquire at factory for recommendations.

Maximum Length	300 meters (1000') for coaxial cable-bus segment. 2 kilometers (6562') for fiber optic-cable run.
Maximum Number of TDC 3000 Modules per LCN	64 modules total for entire network, where a network consists of coax segments plus fiber optic extenders.
Maximum Number of Electrical Loads (modules or extenders) per LCN Segment	40
Fiber Optic Extension	Up to two fiber optic segments between any two modules. Up to six fiber optic extensions connected to any coax segment.

Operating Characteristics

Data Transfer Speed	5 million bits per second
Dat Encoding/Transfer Method	Manchester data encoding with token-passing access protocol.
Real-Time Clock Signal	Transferred over coaxial cable at 12.5 kHz. Clock signal propagation between LCN extensions is optional (requires separate fiber optic fibers).

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