

Group: Controls

Part Number: IM 735

Date: December 2010

Supersedes: IM735-2

**MicroTech II[®]
Chiller Unit Controller
LONWORKS[®] Communication Module**

- WSC Water-Cooled Centrifugal, Single-Compressor
- WDC Water-Cooled Centrifugal, Dual-Compressor
- WPV Water-Cooled Centrifugal, Single-Compressor
- HSC Water-Cooled Single-Compressor Centrifugal, Heat Recovery
- TSC Water-Cooled Single-Compressor Centrifugal, Templifier
- WMC, WMM Water-Cooled Centrifugal, Magnetic Bearing
- AGZ–A, B, C Air-Cooled Global Scroll
- ACZ–A, B Air-Cooled Scroll Condensing Unit
- WGZ, TGZ Water-Cooled Global Scroll
- AGS–A, B, C, D, DP Air-Cooled Global Screw
- WGS Water-Cooled Global Screw

NOTICE

Use this manual to physically install the communications module into the unit and connect the unit to your network. You also need the appropriate McQuay Engineering Data Sheet known as the Protocol Data Packet to integrate the unit into your network. The Protocol Data Packet contains addressing details, LonWorks[®] protocol information, and a list of the data points available to the network. See the Reference Documents section of this document for part numbers of Protocol Data Packets. These documents are available from your local McQuay International representative and for downloading at the McQuay International web site: www.mcquay.com.

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Revision History

IM 735-0	January 30, 2003	Initial release
IM 735-0	October 2004	Corrections to Figures 6 and 7
IM 735-1	May 2005	Added WGS, WMC, HSC, TSC and HDC docs to “Reference Documents” section and cover page
IM 735-2	November 2005	Added setup for screw and scroll (non-centrifugal) chillers
IM 735-3	December 2010	Added part number to Replacement Parts list for new version of unit controller & compatible communication module (pCO3). Updated table on p. 12 and chiller models on cover page.

Reference Documents

Number	Company	Title	Source
078-0014-01E	LonMark® Interoperability Association	LonMark Layers 1-6 Interoperability Guidelines, Version 3.0	www.lonmark.org
078-0120-01E	LonMark Interoperability Association	LonMark Application Layer Interoperability Guidelines, Version 3.2	www.lonmark.org
078-0156-01G	Echelon® Corporation	LonWorks FTT-10A Free Topology Transceiver Users Guide	www.echelon.com
8040_10	LonMark Interoperability Association	LonMark Functional Profile: Chiller, Version 1.0	www.lonmark.org
ED15062	McQuay International	MicroTech II Protocol Information Data for McQuay International Chiller Unit Controllers	www.mcquay.com
IMM AGS	McQuay International	MicroTech II Air-Cooled Screw Chiller Installation and Maintenance Manual	www.mcquay.com
IOMM ACZ/AGZ	McQuay International	MicroTech II Air-Cooled Condensing Unit Installation, Operation, and Maintenance Manual	www.mcquay.com
IOMM ACZ1	McQuay International	MicroTech II Air-Cooled Condensing Unit Installation, Operation, and Maintenance Manual	www.mcquay.com
IOMM AGZ	McQuay International	MicroTech II Air-Cooled Scroll Chiller Installation, Operation, and Maintenance Manual	www.mcquay.com
IOMM WGZ	McQuay International	MicroTech II Water-Cooled Scroll Chiller Installation Manual	www.mcquay.com
IOMM WPV	McQuay International	MicroTech II Centrifugal Chiller Installation, Operation, and Maintenance Manual	www.mcquay.com
IOMM WSCWDC	McQuay International	MicroTech II Chiller Unit Controller Installation, Operation, and Maintenance Manual	www.mcquay.com
OM AGS	McQuay International	MicroTech II Controller for AGS Chillers Operating Manual	www.mcquay.com
OM CentrifMicro II	McQuay International	MicroTech II Unit Controller for Centrifugal Chillers and Templifiers Operating Manual	www.mcquay.com
OM WGS	McQuay International	MicroTech II Water-Cooled Screw Chiller Operating Manual	www.mcquay.com
OM WMC	McQuay International	MicroTech II WMC Magnetic Bearing Compressor Chiller	www.mcquay.com
McQuay International	IOMM TSC	MicroTech II Templifier Single Compressor Centrifugal Installation, Operation, and Maintenance Manual	www.mcquay.com

Limited Warranty

Consult your local McQuay Representative for warranty details. Refer to Form 933-43285Y. To find your local McQuay Representative, go to www.mcquay.com.

Notice

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General Information

This manual contains the information you need to install a MicroTech II® LONWORKS® Communication Module and integrate it into the network.

⚠ WARNING

Electric shock hazard. Can cause personal injury or equipment damage.

This equipment must be properly grounded. Connections and service to the MicroTech II Chiller Unit Controller must be performed only by personnel knowledgeable in the operation of the equipment being controlled.

⚠ CAUTION

Static sensitive components. Can cause equipment damage.

Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

NOTICE

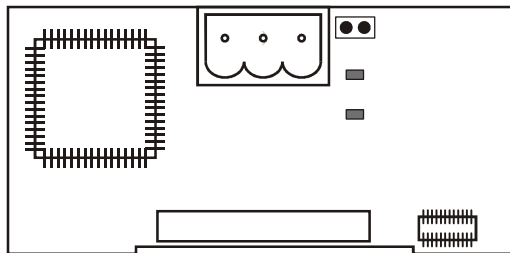
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense. **McQuay International disclaims any liability resulting from any interference or for the correction thereof.**

Description

A LONWORKS Communication Module provides the interface between a MicroTech II Chiller Unit Controller and a LONWORKS Local Operating Network (LON). It translates the LonTalk variables used on the network to the variables used in the unit controller and vice versa. It translates in accordance with the LONMARK® Chiller Functional Profile. Profiles are interpreted in loaded programs (firmware).

The LONWORKS Communication Module is a printed circuit board that plugs into the MicroTech II Chiller Unit Controller. Figure 1 is an outline drawing of the printed circuit board.

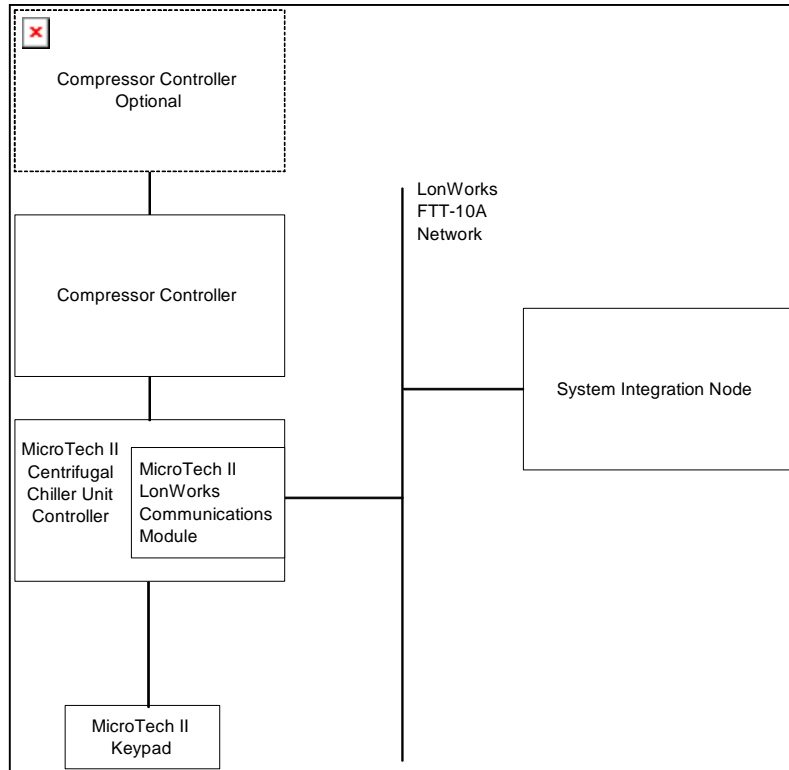
Figure 1. LONWORKS Communication Module (Component Side)



Application

A LONWORKS Communication Module connects the MicroTech II Chiller Unit Controller to the Building Automation System (BAS) on a LONWORKS network. It is the interface adapter for the exchange of LonTalk variables between the network and the unit controller. The LONWORKS Communication Module translates the LonTalk variables of the profile into the native information of the unit controller. Figure 2 shows the LONWORKS Communication Module and Chiller Unit Controller integrated into a BAS. Refer to the appropriate unit Operation Manual for keypad details. See Reference Documents section for details.

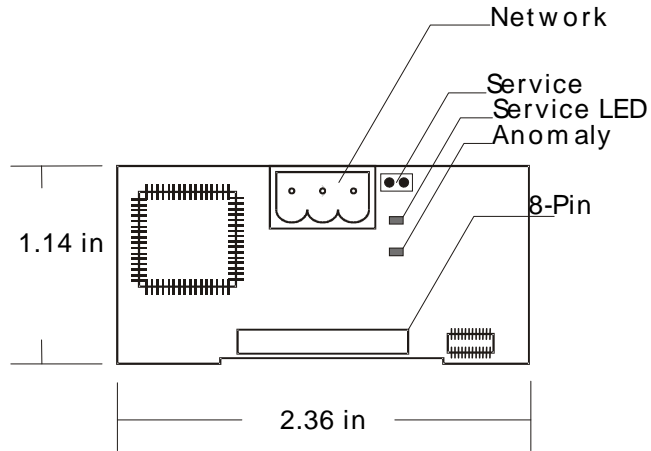
Figure 2. Building Automation System



Component Data

Figure 3 shows the location of the major components of the LONWORKS Communication Module.

Figure 3. LONWORKS Communication Module Major Components



Service Pin

The service pin generates a service-pin message, which contains the Neuron® ID and the program code identification of the node. A service-pin message is a network message that is generated by a node and broadcast on the network. It can be used to commission the LONWORKS network.

The service pin consists of two terminals next to the network connector that protrude below the cover on the serial card port of the unit controller. To activate the service pin, short the two pins together for an instant with the tip of a screwdriver or similar tool.

Light Emitting Diodes (LEDs)

The communications module has two LEDs to indicate communication activity and status of the LONWORKS Communication Module. These indicators cannot be seen when the module is installed in the controller.

LED	Function
Service (Green)	<ul style="list-style-type: none"> • Lights when the service-pin is shorted • Flashes (1 second) during a Wink command • Flashes (1/2 second) during commissioning • Blinking when the node is not commissioned • Flashes (1 second) when the node has no application program
Anomaly (Red)	<ul style="list-style-type: none"> • Lights when there is a problem with the module

LonWorks Network Connector

The P8 connector connects the LONWORKS Communication Module to the LONWORKS FTT-10A bus.

Pin	Function
GND	No Connection
A	FTT-10A
B	FTT-10B

8-Pin Header

The 8-pin header connects the unit controller to the LONWORKS Communication Module.

LonMark Profile Software

The LONWORKS Communication Module software translates the Standard Network Variable Types (SNVTs) and Standard Network Configuration Parameter Types (SCPTs) in accordance with the LONMARK profiles used on the LONWORKS network into the variables and parameters used in the MicroTech II Chiller Unit Controller.

Neuron

The basis of the communications module is an Echelon® Neuron® integrated circuit. Each Neuron chip contains a globally (i.e., worldwide) unique, 48-bit serial-number called the Neuron ID. The Neuron ID can be used to address the device on the LONWORKS network.

Transceiver

The Echelon Corporation Free Topology Transceiver (FTT-10A) is used to communicate on the LONWORKS network. The network topology may consist of a: star, daisy-chain, or other topology. Data transmission rate on the network is 78 kbps (baud).

Specifications

Characteristic	Description
Network Topology	Flexible Free Topology
Neuron Chip Processor	3150
Free Topology Transceiver (FTT-10A)	50051
Cable Types	TIA Category 5 (recommended)
Maximum Bus Length	1476 ft (450) meters per segment
Maximum Node Separation	820 ft (250 meters)
Data Transmission	Two-wire, half duplex
Data Transmission Rate	78 kbps (baud)

Installation

The LONWORKS Communication Module can be factory or field installed. The McQuay sales office will use the appropriate chiller selection software program in McQuayTools to include the LONWORKS Communication Module with the unit.

For field installation, the LONWORKS Communication Module kit may be ordered through the McQuay sales office or through McQuay Parts. The LONWORKS Communication Module kit includes the LONWORKS Communication Module, a wire harness, and this installation manual. The LONWORKS Communication Module from McQuay Parts is also sold separately (i.e. just the module itself). See Replacement Parts List for part numbers.

Mounting

CAUTION

Electrostatic discharge hazard.

Can cause equipment damage.

This equipment contains sensitive electronic components that may be damaged by electrostatic discharge from your hands. Before you handle a communications module, touch a grounded object, such as the metal enclosure, in order to discharge the electrostatic potential in your body.

Mounting a LONWORKS Communication Module

To mount a LONWORKS Communication Module:

1. Remove power from the MicroTech II Chiller Unit Controller.
2. Locate the Serial Card slot on the MicroTech II Chiller Unit Controller (see Figure 4.)
3. Remove the cover from the Serial Card slot if it hasn't already been removed. Use a small screwdriver to pry the cover off from one end.
4. Remove the plastic knockout in the cover.
5. Grasp the LONWORKS Communication Module, with the network connector on the underside. The 8-pin receptacle must mate to the 8-pin plug in the MicroTech II Chiller Unit Controller. The plug has a guide on each end to direct it into the mating guide on the receptacle. Figure 5 details the Serial Card slot showing the 8-pin plug that mates to the receptacle on the LONWORKS Communication Module.

Note: This operation relies more on feeling the LONWORKS Communication Module into the connector than seeing the connectors mate.

6. Insert the LONWORKS Communication Module, pointing up, into the slot, rolling it into a level position as you move it into the slot.
7. Keeping the LONWORKS Communication Module *level*, move it in the slot until you feel the connectors line up. The correct position seems to be level, toward the left side of the slot, and down slightly from the top.
8. When you feel the connectors align, press the LONWORKS Communication Module into the connector. Verify that the card is firmly seated in the connector.
9. Replace the cover on the Serial Card slot. Slip the cover over the network connector plug.
10. Route the network cable through a knockout and to the LONWORKS Communication Module.

11. Connect the LONWORKS Communication Module to the network (see Figure 6 and Figure 7).
 - a. Connect one wire of the network cable to Pin A of the connector plug.
 - b. Connect the other wire to Pin B of the connector plug.
 - c. No wire is connected to the remaining pin.

Figure 4. Serial Card Slot Location on Unit Controller

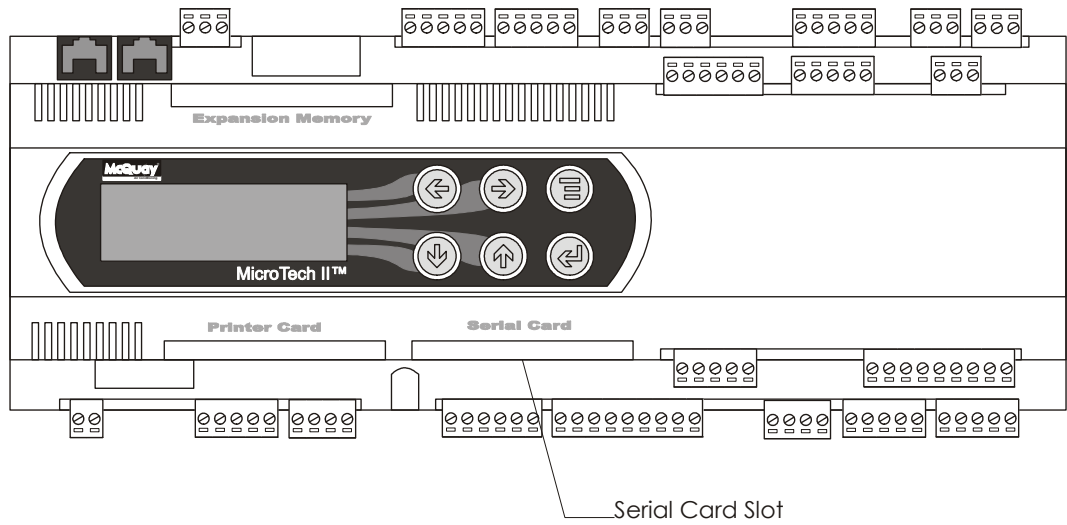


Figure 5. Serial Card Slot Detail

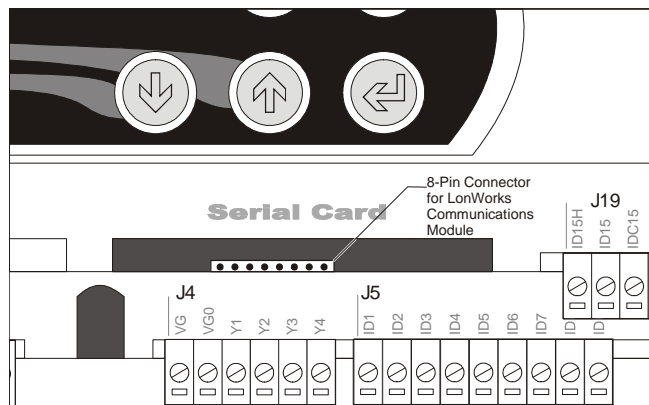


Figure 6. Network Cable Routing and Connections

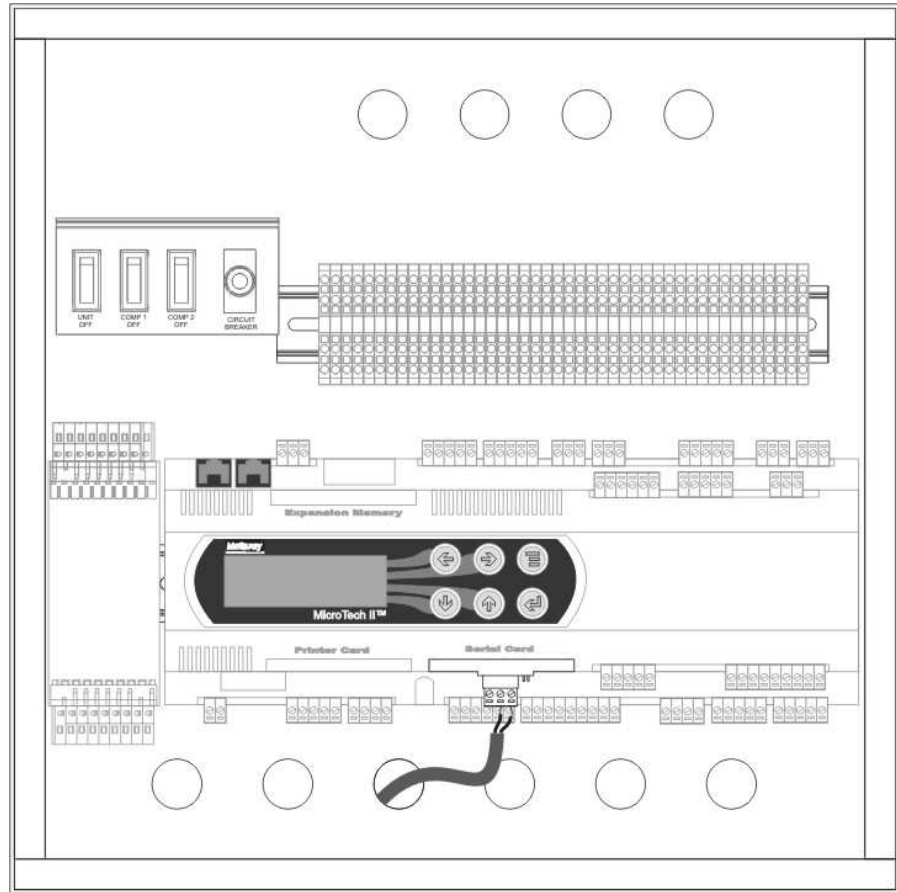
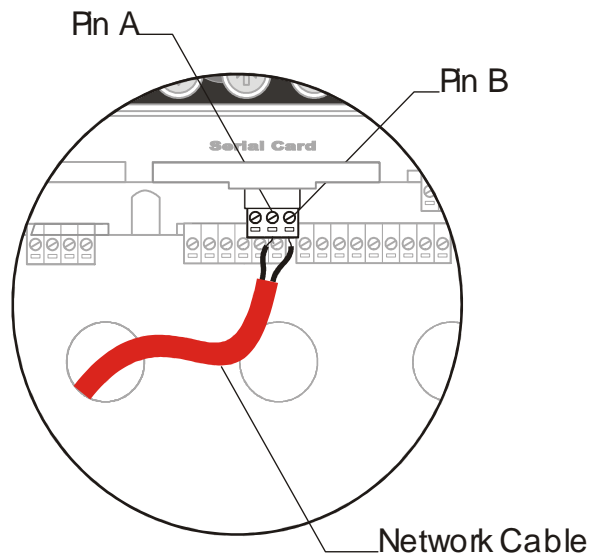


Figure 7. Network Connection Detail



Replacing an Existing LONWORKS Communication Module

To replace a LONWORKS Communication Module:

1. Remove power from the MicroTech II Chiller Unit Controller.
2. Locate the Serial Card slot on the MicroTech II Chiller Unit Controller (see Figure 4.)
3. Pull the network cable connector from the LONWORKS Communication Module.
4. Remove the cover from the Serial Card slot. Use a small screwdriver to pry it off from one end.
5. Grasp the LONWORKS Communication Module and carefully pull it from the controller.
6. Install the new LONWORKS Communication Module.
7. Grasp the LONWORKS Communication Module, with the network connector on the underside. The 8-pin receptacle must mate to the 8-pin plug in the MicroTech II Chiller Unit Controller. The plug has a guide on each end to direct the LONWORKS Communication Module into the mating guide on the receptacle. Figure 5 shows a detail of the Serial Card slot with the 8-pin plug that mates to the receptacle on the LONWORKS Communication Module.

Note: This operation relies more on feeling the LONWORKS Communication Module into the connector than seeing the connectors mate.

8. Insert the LONWORKS Communication Module, pointing up, into the slot, rolling it into a level position as you move it into the slot.
9. Keeping the LONWORKS Communication Module *level*, move it in the slot until you feel the connectors line up. The correct position seems to be level, toward the left side of the slot, and down slightly from the top.
10. When you feel the connectors align, press the LONWORKS Communication Module into the connector. Verify that the LONWORKS Communication Module is firmly seated in the connector.
11. Replace the cover on the Serial Card slot. Slip the cover over the network connector plug.
12. Insert the network cable connector into the LONWORKS Communication Module.

Unit Setup for LONWORKS Network Control

Setup for Centrifugal Chiller MicroTech II Network Control:

1. Disable the chiller. The chiller should not be operating while performing this setup.
2. At the chiller touchscreen interface panel,
 - a. In the SETPOINTS MODE screen, set the #9 setpoint, BAS Protocol, to LONWORKS. Use the Operator Password of "2001."
 - b. In the SETPOINTS MODE screen, set the #3 setpoint, Control Source to Local
3. Verify with the chiller/control company technician that the chiller is operational on BAS.
4. In the SETPOINTS MODE screen, set the #3 setpoint, Control Source to BAS.

Setup for all Other Chillers MicroTech II Network Control:

1. Set the Set Unit Setpoint screen 1 initially to Source = Keypad.
2. Change the Protocol default to LONWORKS in the applicable menu screen shown in the table below.
3. Verify with the chiller/control company technician that the chiller is operational on BAS.
4. Set the Set Unit Setpoint screen 1 to Source = Network.

Model	Menu Screen	Password
AGZ-A	7	2001
ACZ-A	6	2001
AGZ-B, AGZ-C	9	2001
ACZ-B	7	2001
AGS-A, B, DP	12	8945
AGS-C	16	8453
AGS-D	17	8745
WGS	15	8745
WGZ, TGZ	10	2001
WSC, WDC, WPV, HSC, TSC	14	2001
WMC, WMM	14	2001

NOTE: Models AGZ-A/B, ACZ-A/B, and WGZ have one unit controller, while models AGS-B/C and WGS have one unit controller and multiple circuit controllers. Unit settings for AGS-B/C and WGS models are adjusted on the unit controller.

Integration

Integrating the LONWORKS Communication Module into a BAS involves three steps:

- Connecting the unit (node) to the network
- Addressing and establishing communications with the unit, and
- Configuring the unit to the building.

Connecting to the Network

After you have installed the LONWORKS Communication Module in the unit, you must connect it into the LONWORKS network.

Network Topology

Each LONWORKS Communication Module is equipped with an FTT-10A transceiver for network communications. This transceiver allows for (1) free topology network wiring schemes using twisted pair (unshielded) cable and (2) polarity insensitive connections at each node. These features greatly simplify installation and reduce potential network commissioning issues. Additional nodes may be added with little regard to existing cable routing.

Free Topology Networks

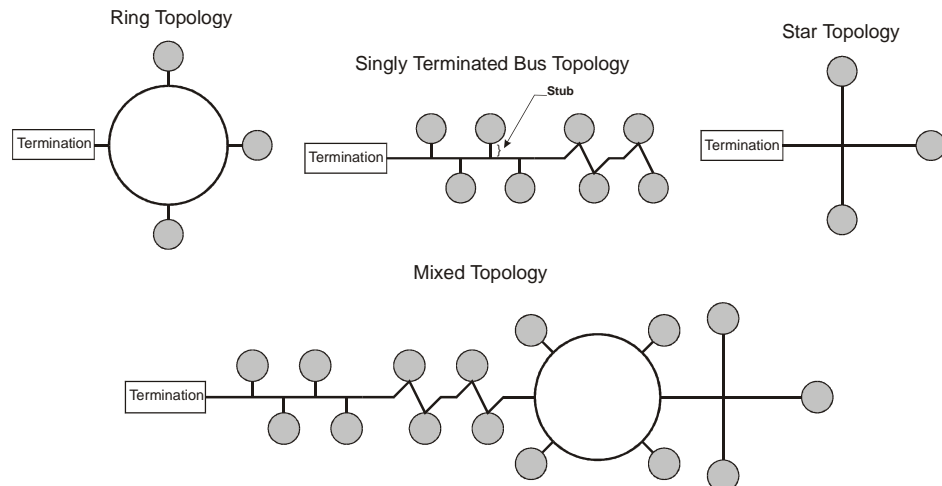
A LONWORKS “free topology network” means that devices (nodes) can be connected to the network in a variety of geometric configurations. For example, devices can be daisy-chained from one device to the next, connected with stub cables branching off from a main cable, connected using a tree or star topology, or any of these configurations can be mixed on the same network (see Figure 8.) Free topology segments require termination for proper transmission performance. Only one termination is required. It may be placed anywhere along the segment. **Refer to Echelon LONWORKS FTT-10A Transceiver User’s Guide for details.** See Reference Documents section for the appropriate part number.

Free topology networks may take on the following topologies:

- Bus
- Ring
- Star
- Mixed - Any combination of Bus, Ring, and Star

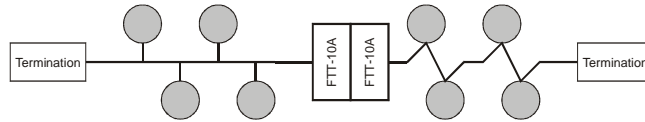
Note: Limitations to wire lengths apply and must be observed.

Figure 8. Singly Terminated Free Topology Networks



A network segment is any part of the free topology network in which each conductor is electrically continuous. Each of the four diagrams is an illustration of a network segment. Some applications may require two or more segments; see “Free Topology Restrictions.” If necessary, segments can be joined with FTT-10A-to-FTT-10A physical layer repeaters (see Figure 9.) **Refer to Echelon LONWORKS FTT-10A Transceiver User’s Guide for details.** See Reference Documents section for corresponding part number.

Figure 9. Combining Network Segments With a Repeater



Free Topology Restrictions

Although free topology wiring is very flexible, there are restrictions. A summary follows, refer to the **Echelon FTT-10A User’s Guide for details.** See Reference Documents section for corresponding part number.

1. The maximum number of nodes per segment is 64.
2. The maximum total bus length depends on the wire size (see Qualified Cables section for details).

Wire Size	Maximum Node-to-Node Length	Maximum Cable Length
24 AWG	820 ft (250 m)	1476 ft (450 m)
22 AWG	1312 ft (400 m)	1640 ft (500 m)
16 AWG	1640 ft (500 m)	1640 ft (500 m)

The longest cable path between any possible pair of nodes on a segment must not exceed the maximum node-to-node distance. If two or more paths exist between a pair of nodes (e.g., a loop topology), the longest path should be considered. Note that in a bus topology, the longest node-to-node distance is equal to the total cable length.

Note: The total length of all cable in a segment must not exceed the maximum total cable length.

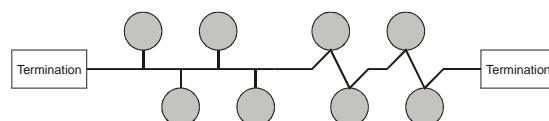
3. One termination is required in each segment. It may be located anywhere along the segment.

Doubly Terminated Networks

You can extend the maximum total cable length without using a repeater by using doubly terminated network topology (see Figure 10). The trade-offs are (1) this network topology must be rigorously followed during the installation and subsequent retrofits and (2) two terminations must be installed at the ends of the bus for proper transmission performance. **Refer to Echelon LONWORKS FTT-10A Transceiver User’s Guide for details.** See Reference Documents section for the corresponding part number.

Note: Limitations to wire lengths apply and must be observed.

Figure 10. Doubly Terminated Network Topology



Doubly Terminated Topology Restrictions

The restrictions on doubly terminated bus topology are as follows:

1. The maximum number of nodes per segment is 64.
2. The maximum total bus length depends on the wire size (see Qualified Cables section for details).

Wire Size	Maximum Cable Length
24 AWG	2952 ft (900 m)
22 AWG	4590 ft (1400 m)
16 AWG	8855 ft (2700 m)

3. The maximum stub length is 9.8 ft (3 m).
A stub is a piece of cable that is wired between the node and the bus.

Note: If the bus is wired directly to the node, there is no stub, and thus the stub length is zero. If you are wiring to a field terminal strip on a unit, you should account for any factory wiring between the terminal strip and the controller. This wiring is considered part of the stub.

4. Two terminations are required in each segment. One must be located at each end of the bus.

Physical Network

Qualified Cables

Echelon has qualified three twisted-pair network communications cables that are available from a large number of different sources. **Refer to Echelon LONWORKS FTT-10A Free Topology Transceiver Users Guide for details.** See Reference Documents section for corresponding part number. Some local codes or applications may require the use of plenum-rated cable. The following cables meet this specification:

1. TIA568A Category 5 cable (24AWG/0.51mm)
2. NEMA Level IV cable (22AWG/0.65mm)
3. Generic 16AWG (1.3mm) (similar to Belden 85102)

Caution: Do not install the cable in the same conduit with power wiring. The temperature of the cable must not exceed 131°F (55°C).

Note: Ideally, you should connect two controllers with one continuous piece of cable in order to reduce the risk of communications errors. If you must splice the cable, use crimp-type butt connectors (good) or solder (best). Do not use wire nuts.

Network Cable Termination

LONWORKS network segments require termination for proper data transmission performance. The type and number of terminations depend on network topology. **Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide for details.** See Reference Documents section for the corresponding part number.

Addressing and Establishing Communications

LONWORKS Network Addressing

Every Neuron Chip has a unique 48-bit Neuron ID or physical address. This address is generally used only at initial installation or for diagnostic purposes. For normal network operation, a device address is used.

Device addresses are defined at the time of network configuration. All device addresses have three parts. The first part is the Domain ID, designating the domain. Devices must be in the same domain in order to communicate with each other. The second part is the Subnet ID that specifies a collection of up to 127 devices that are on a single channel or a set of channels connected by repeaters. There may be up to 255 subnets in a domain. The third part is the Node ID that identifies an individual device within the subnet.

A group is a logical collection of devices within a domain. Groups are assembled with regard for their physical location in the domain. There may be up to 256 groups in a domain. A group address is the address that identifies all devices of the group. There may be any number of devices in a group when unacknowledged messaging is used. Groups are limited to 64 devices if acknowledged messaging is used.

A broadcast address identifies all devices within a subnet or domain.

Commissioning the Network

Pressing the service pin generates a service-pin message, which contains the Neuron ID and the program code identification of the node. A service-pin message is a network message that is generated by a node and broadcast on the network. It can be used to commission the LONWORKS network.

A network configuration tool maps device Neuron IDs to the domain/subnet/node logical addressing scheme when it creates the network image, the logical network addresses and connection information for all devices (nodes) on the network.

External Interface File (XIF)

LonMark guidelines specify exact documentation rules so that proprietary configuration tools are not required to commission and configure LONWORKS devices. The LONWORKS Communication Module is self-documenting so that any network management tool can obtain all the information needed over the network to connect it into the system and to configure and manage it. An external interface file (a specially formatted PC text file with the extension .XIF) is also available so that any network tool can design and configure it prior to installation. For a copy of the XIF file, see www.mcquay.com or www.lonmark.org.

Configuring the Unit Controller

The LONWORKS Communication Module is configured at the factory along with the MicroTech II Chiller Unit Controller in accordance with the LONMARK Chiller functional profile. The unit is ready to operate with the default values set at the factory. Default values may be changed via the network. Use the appropriate Operation Manual for default values and keypad operation and the MicroTech II Chiller Protocol Information (ED 15062) for descriptions of the network variables. See Reference Documents section for appropriate part numbers.

Service Information

Test Procedures

If you can control the unit from its keypad, but you are unable to communicate with it via the network:

- Check the network wiring.
- Check that the Control Source setpoint is set to Local. See Unit Setup for LONWORKS Network Control on page 12.
- Check that the Protocol setpoint is set to LONWORKS. See Unit Setup for LONWORKS Network Control on page 12.
- Check addressing.
 - Activate the Service Pin on the LONWORKS Communication Module to send the service message to the network.
 - The service-pin message contains the Neuron ID and the program code identification of the node.

If the LONWORKS Communication Module still does not respond, call McQuay Controls Customer Support group at 866-4MCQUAY (866-462-7829).

Replacement Parts List

Communication Module Replacement Kits (pCO2 and pCO3)

There are two versions of the LONWORKS communication module, depending on the type of MicroTech II unit controller (pCO2 or pCO3) installed on the chiller. Before ordering a field-installed kit, it is necessary to determine which one you need to ensure compatibility. A pCO2 LONWORKS communication module can only be used with a pCO2 chiller unit controller, and a pCO3 LONWORKS communication module can only be used with a pCO3 chiller unit controller. In other words, they are not interchangeable.

Note: Incompatibility between the unit controller and communication module can potentially cause permanent physical damage and prevent proper operation of the equipment.

See the figures below to determine the version of MicroTech II chiller unit controller, and thus the corresponding LONWORKS communication module, to be replaced. Figure 11 shows that the pCO2 unit controllers have DIP switches located above the keypad display, while the pCO3 controllers do not have DIP switches (see Figure 12). Once the correct type of communication module has been determined, refer to the table below for the corresponding McQuay part numbers.

Please contact the McQuay Controls Customer Support group at 866-4MCQUAY (866-462-7829) for further assistance, if necessary.

Figure 11. pCO2 MicroTech II Chiller Unit Controller

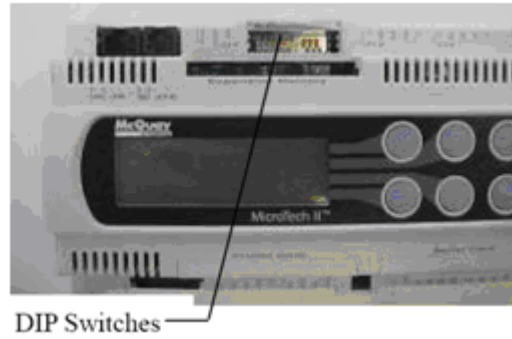
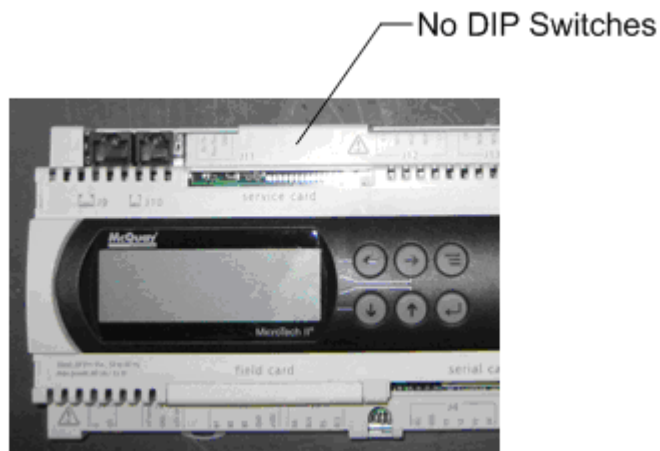


Figure 12. pCO3 MicroTech II Chiller Unit Controller



Communication Module Kit Numbers

Description	McQuay Part Number
MicroTech II LONWORKS Communication Module Kit - pCO2	350147401
MicroTech II LONWORKS Communication Module Kit - pCO3	350147409

Network Connection Plug

If you lose this terminal block you can replace it with a standard block from a manufacturer. The list below contains manufacturers' part numbers for equivalent parts.

Manufacturer	Telephone	Order Number
Phoenix Contact	(800) 888-7388	17 57 02 2
Altech Corp	(908) 806-9400	37.003

This document contains the most current product information as of this printing. For the most current product information, please go to www.mcquay.com.