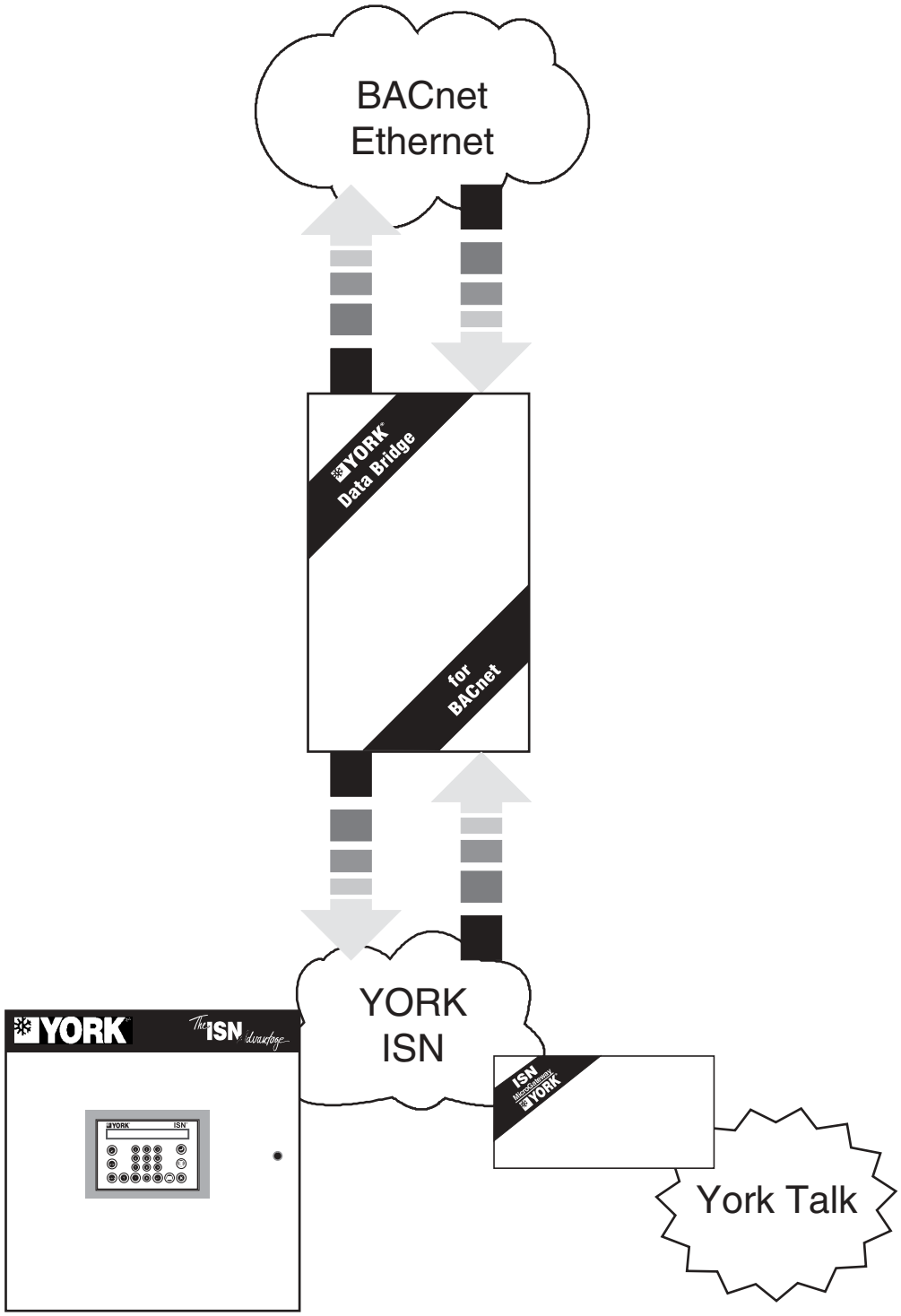
YORK®	Data Bridge for BACnet®	
INSTALLATION MANUAL	NEW RELEASE	Form 450.20-N19 (202)

371-03626-101 Data Bridge for BACnet



IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

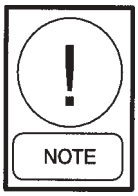
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



NOTE is used to highlight additional information which may be helpful to you.

CHANGEABILITY OF THIS DOCUMENT

In complying with YORK's policy for continuous product improvement, the information contained in this document is subject to change without notice. While YORK makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest YORK Engineered Systems Group office.

It is the responsibility of operating/service personnel as to the applicability of these documents. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then, prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current documentation is available.

REFERENCE INSTRUCTIONS

DESCRIPTION	FORM NO.
BACnet PICs/BIBBs Data Bridge for BACnet	450.20-TD02
Data Bridge for BACnet Specification	450.20-S20
Data Bridge for BACnet Operations	450.20-O05
ISN Applications Guide	450.20-AG1
Renewal Parts List (Electronic Version Available Only on the Intranet)	450.00-RP1

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SECTION 1

GENERAL INFORMATION

Overview

The Data Bridge for BACnet is a communications device that allows data from YORK equipment utilizing the ISN Rev. 7 protocol to be transferred to a BACnet® Ethernet network.

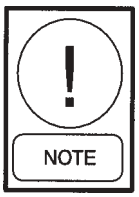
The Data Bridge for BACnet comes with its own enclosure and power supply. Within each enclosure resides two devices. The first device is a YORK LINC MicroGateway and the second is an Single Board Computer (SBC). The LINC MicroGateway manages the traffic on the ISN network, an RS485 contention-based network.

The LINC MicroGateway operates as a network access device, converting a half-duplex network connection into a full-duplex RS232 port. The RS232 port interfaces to the SBC. The SBC initiates requests through the RS232 TX signal line and receives responses on the RS232 RX signal line.

Within the SBC the ISN data is mapped to standard BACnet objects. The SBC allows the individual points from various ISN network devices to be selected and provided to the BACnet network. Once at the BACnet network level, any BACnet device can retrieve or control the ISN data.

Table 1. Part Numbers

DEVICE	PN
Data Bridge for BACnet	371-03626-101
BACnet Data Bridge MicroGateway – 110 VAC	371-02592-107
BACnet Data Bridge MicroGateway – 240 VAC	371-02592-207
BACnet Data Bridge MicroGateway – OptiView	371-03609-007



NOTE: When connecting a chiller to the ISN network for the purpose of making chiller data BACnet visible, a BACnet Data Bridge MicroGateway must be used in conjunction with the Data Bridge for BACnet.

LINC MicroGateway

The LINC MicroGateway is the component of the Data Bridge that communicates with the ISN network. Although equipped with additional connectors, the ISN network always attaches to connector TB1 (Port 1) on the LINC MicroGateway, which supports the RS485 physical layer. The SBC connects to the MicroGateway through connector TB4 (Port 2), which supports RS232.

A DIP switch on the LINC MicroGateway sets the LAN address to any available ISN address on the network or sub-network. A series of LEDs on the MicroGateway provide information about the communication and operating status of each port. Each of the two ports have a red transmission LED (TX) and a green receiving LED (RX). Between the two sets of port LEDs is a STATUS LED. This does not provide any information on operation and is always ON.

Single Board Computer

The Single Board Computer is used to map the ISN data points to BACnet objects. It is a Pentium-class processor which uses a DiskOnChip® flash disk as the hard drive. In addition to the standard computer ports, i.e., video port, RS232 serial port, LPT parallel port, and mouse port, etc., the SBC is equipped with a Realtek Ethernet port. This port is used to connect to the BACnet network.

Application

The Data Bridge for BACnet functions as a gateway between an ISN network and a BACnet Ethernet network. The interface uses standard BACnet objects to provide commonality between different manufacturers. The Data Bridge maps the ISN data to the appropriate BACnet Object Types to achieve this goal.

Using the BACnet Configuration Tool, the application engineer can map any ISN data point to a standard BACnet Object.

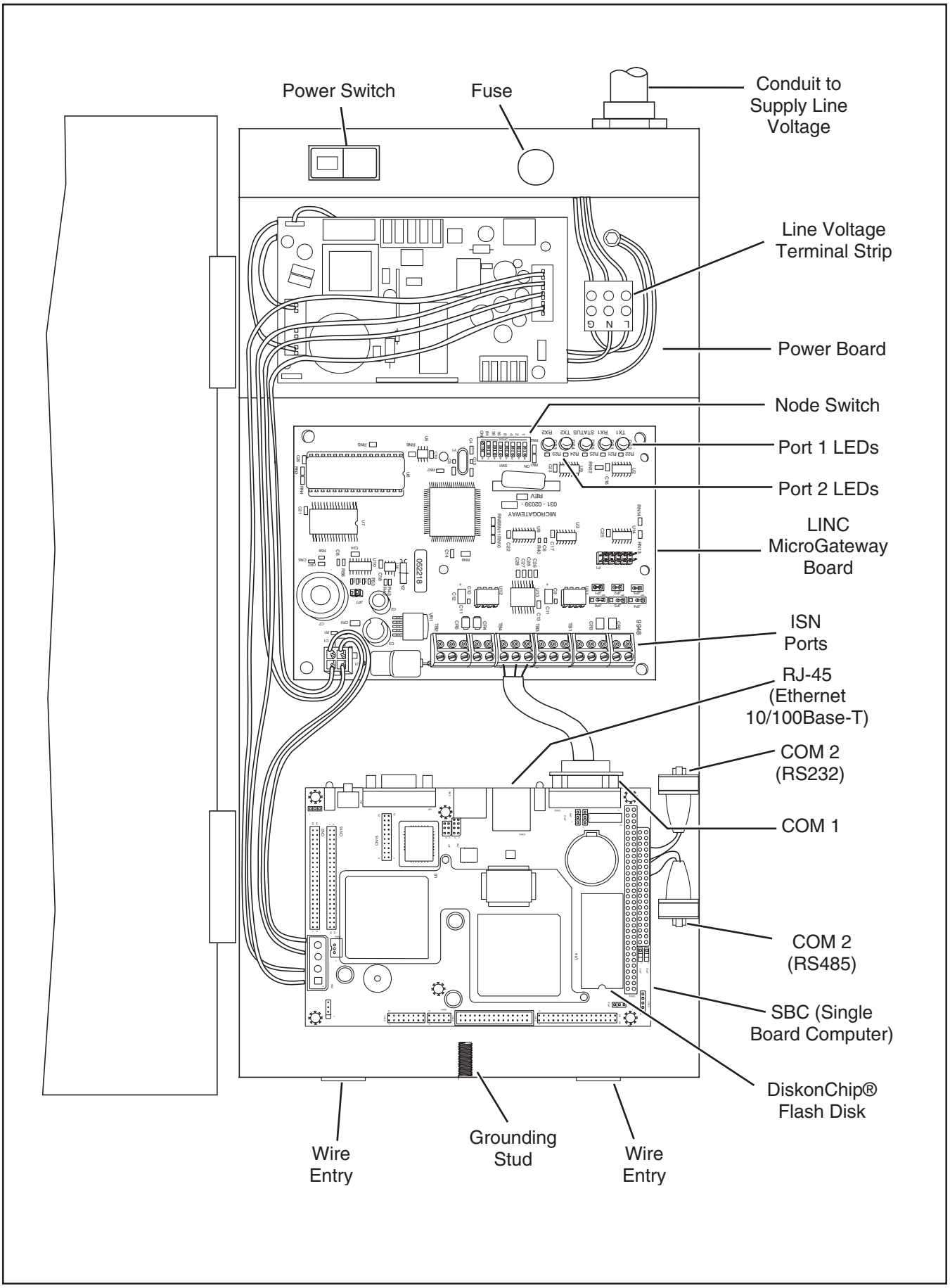


Figure 1 – Data Bridge for BACnet Components

SECTION 2

NETWORK TOPOLOGY

General

The Data Bridge for BACnet is capable of being connected in many different network configurations. It allows an ISN network operating the Rev 7 protocol to be connected to a BACnet Ethernet network. The ISN network must be operating at 50 kbaud.

Capacity

The Data Bridge for BACnet can accommodate 512 I/O points. More than 512 points can be connected into the network by using multiple Data Bridges. When multiple Data Bridges are used, segment the network using routers or repeaters to minimize network saturation.

It is not recommended that more than two Data Bridges be installed on a single network segment.

ISN Network

All standard ISN communication rules also apply. A complete listing can be found in the ISN Application Guide.

Some ISN rules are:

- Maximum length of 4000 ft. (1220 m) and 32 nodes before a repeater is required.
- Maximum of 90 sub-networks per system.
- The Data Bridge for BACnet requires a unique network address to be set.

Ethernet

The Data Bridge for BACnet works with all the different types of Ethernet network mediums. The Data Bridge utilizes ISO8802.3 for the data link layer and an RJ-45 10Base-T/100BaseT transceiver for the physical layer. The components within the Ethernet network must match one another and be compatible, utilizing conversion translators if media is changed, i.e., 10Base-T to 10Base-2. Observe the standards for each transfer medium to provide a good operating network for the Data Bridge.

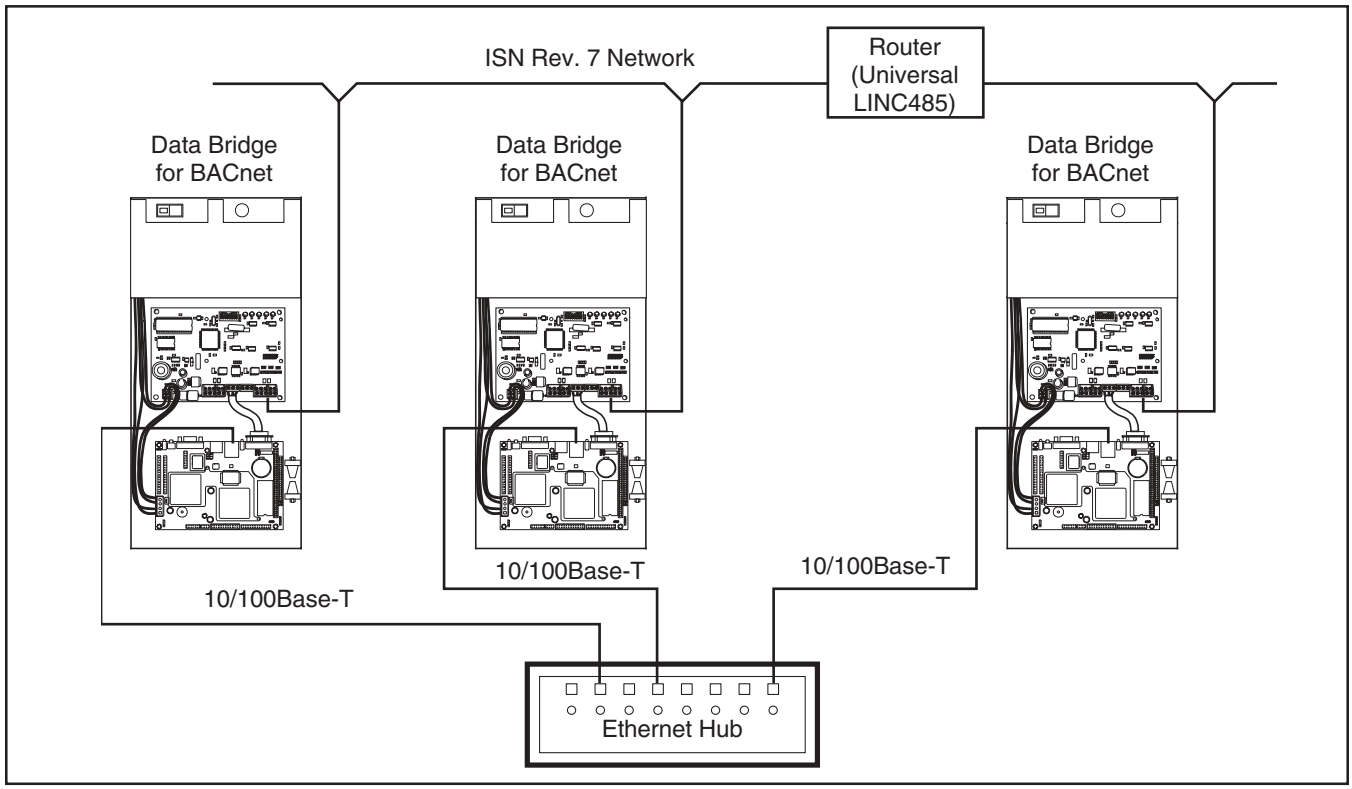


Figure 2 – Multiple Data Bridge Units for More than 512 I/O Points

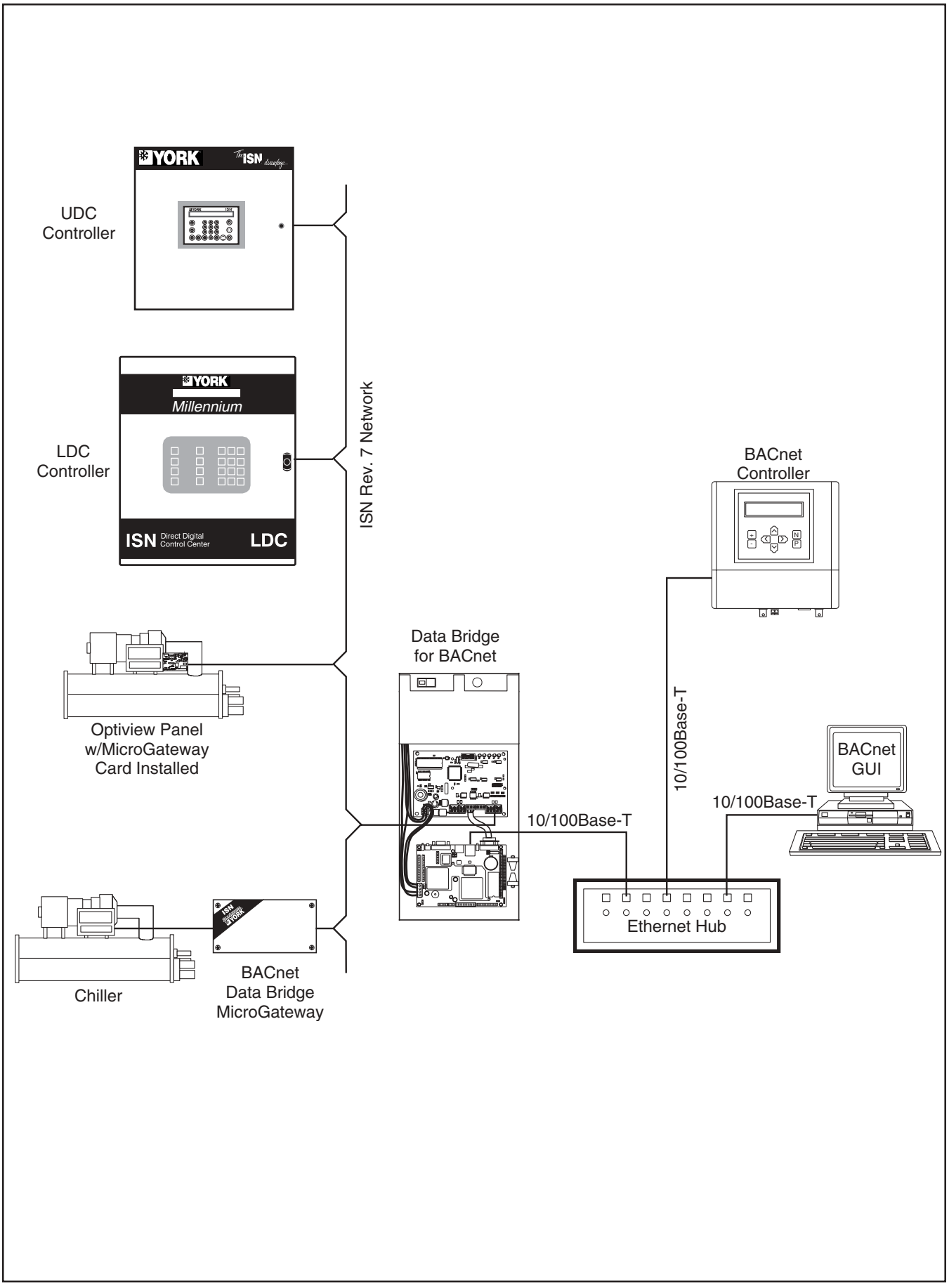


Figure 3 – Typical Network Topology

Connection

Connection to the Data Bridge for BACnet are relatively simple. The LINC MicroGateway connects to the ISN network using Port 1. Port 1 has two connectors, an RS232 and RS485 (as do all Micro-Gateways). The ISN network is RS485 and utilizes connector TB1 of the Port 1.

Port 2 (connector TB4) of the LINC MicroGateway is connected to the Single Board Computer (SBC) through a ribbon cable (factory-installed).

The SBC has three connection possibilities. The BACnet Ethernet network connects through an RJ-45 port. Two additional ports, and RS232 and RS485 are available for connection to a PC running the YORK BACnet Configuration Tool, which is used to download the translation database into the Data Bridge. The RS485 port is also available but not normally used in this application.

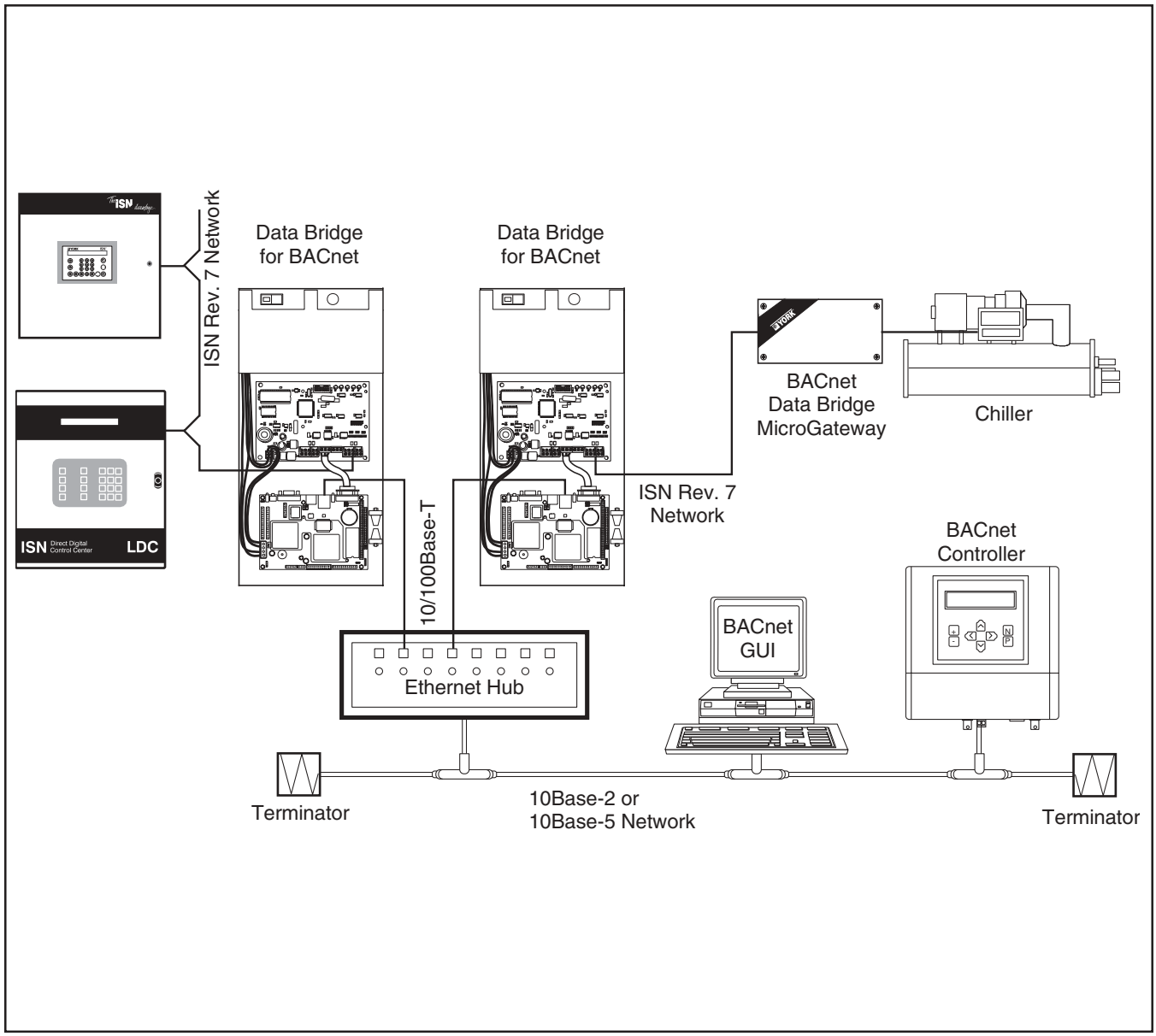


Figure 4 – Typical Network Topology

Basic Networking Terms

Hub – The hub is the central point of the network. It connects multiple cable segments together. These cable segments can be star or bus topologies. Hubs have multiple ports to attach different cable segments.

Intelligent Hub – An intelligent hub acts as a multi-port bridge by monitoring the physical port address segments to prevent collisions, improving efficiency and network speed.

Concentrator – A concentrator allows nodes on a network to connect to the network in a star configuration.

Multi-Port Repeater or Hub – A multi-port repeater or hub connects more than two segments. This device usually has an Attachment Unit Interface (AUI) connection of multiple ports for thin coaxial, twisted-pair cable or other common media. The primary application is to provide a connection to the thick coaxial cable or fiber optic backbone while serving a segment that uses thin coaxial or twisted-pair cable.

Bridge – A bridge connects multiple cable segments together, just as a hub does. However, bridges pass only those packets intended for a node on the other side of the device. The bridge can also be used to lengthen a segment and segregate traffic on a long network.

SECTION 3

INSTALLATION

Installation Guidelines

This manual assumes the installer is competent in environments with moving machinery, and is able to recognize and protect against any inherent hazards, such as, but not limited to, refrigerants, oil, materials under pressure, rotating parts, and both high and low voltages. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death.

It is the obligation and responsibility of the operating/service personnel to identify and recognize inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment, as well as severe personal injury or death. In addition to following standard local, state and country codes and procedures, it is recommended that a lockout procedure be used to prevent inadvertent start up of equipment during installation and maintenance procedures.

All wiring should be carried out in a safe and neat manner and should always comply in all respects to the latest edition of any local, state or country codes that may be applicable. The wiring should be installed in a manner that does not cause a hazard and is protected against electrical and mechanical damage.

Environment

The Data Bridge for BACnet must be installed in an environment that is protected from the direct influence of the elements and is within the following:

Temperature: 32 to 122° F (0 to 50° C).

Humidity: 0% to 95% non-condensing.

The Data Bridge for BACnet or BACnet Data Bridge MicroGateway should never be mounted outside the confines of a building. If this cannot be avoided, it may be mounted inside an enclosure rated at IP65/NEMA 4X or greater. In addition to protection against the elements, the enclosure must be capable of maintaining the circuit boards at the required temperature and humidity. This may require the addition of a fan or heater to maintain the temperature and humidity inside the enclosure.

Care should be taken when mounting the enclosure so as access to other equipment is not restricted.

Power

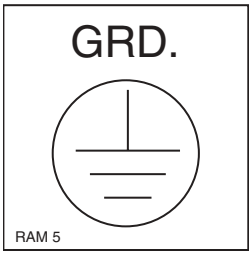
The line voltage power source should be “clean”, separately fused (for either 110 or 220 VAC), and isolated, (using a control transformer) from other equipment in the plant room that may generate EMI interference. Use a suitably-sized wire (refer to the table titled “Recommended Cable Specifications”) to connect the line voltage feed to the device.

Be sure the VA capacity of the line supplying the chiller micro panel is rated sufficiently for the additional power required by the device.

All high voltage wiring (>75 volts) must be run in conduit and kept separate from low voltage communications wiring. This will greatly reduce network communication problems.

Grounding

Always ensure that the unit is grounded to a true building ground. Not all grounds are true building grounds. If varying ground potentials occur, communication may be effected.



Always ensure that the cover and base of the enclosure are connected via the ground wire.

High Noise Environments

Electrical equipment which employs high speed switching circuits (variable speed drives, solid state starters and computing equipment) generate Electro-Magnetic Noise (EMI) and Radio Frequency Interference (RFI). When excessive, this noise can effect the way electronics behave and, ultimately communication.

Noisy environments often show up as varying ground potentials, i.e. the electrical reference points at different nodes are different. This is referred to as “common mode” noise. The ISN LAN RS485 circuitry is designed to withstand a certain difference

between varying ground sources. However, if this difference becomes too great and exceeds certain voltage limits, the RS485 circuitry can be permanently damaged and require replacement.

To combat these possible problems follow good wiring practices:

- Care should be taken to ensure that all ISN equipment is powered from a source with true earth ground.
- Any RS485 communication cables should be shielded with the shield terminated at one end only.
- Communication cables should not be run in close proximity to or parallel with power cables.

The pathways for noise, and therefore the likelihood of common mode, are greatly reduced when the cables are short and shielded within enclosures or conduit.

Protection of Communication Ports

When using RS485 technology it is possible that electrical disturbances, such as voltage spikes or stray voltage, can damage a circuit board. The LINC MicroGateway circuit board includes tranzorbs at the RS485 ports to protect against these spikes and minimize possible damage.

Cable Specifications

Power Cables

CAUTION: Aluminum wire is absolutely not acceptable.

The power cable should be at least an 18 AWG copper wire rated for 10 amps per core at 250 volt AC. If the power cable uses three conductors, the ground conductor must be, as a minimum, the same size with the same current carrying capacity as the live and neutral conductors.

Network Cables

To connect the LINC MicroGateway board to the ISN network use a twisted-pair cable with an overall shield and drain wire. Refer to the table titled Recommended Cable Specifications for minimum wire specifications.

To connect to the BACnet Ethernet network or hub, Category 5 UTP cables should be used. The length between the Data Bridge and hub must not exceed 328 ft. (100 m).

Table 2. Recommended Cable Specifications

	Digital Outputs	Analog, Digital, Pulse Inputs and Analog Outputs	RS485 (ISN & York Talk 2 Networks)	RS232 (Devices to LINCs and Controllers, York Talk 1 & 3 Networks)	Line Voltage Power Supply
Number of Cores	2 (or n for multicore)	2 (or n for multicore)	2 Twisted	3	3
Minimum Conductor Gauge – AWG (CSA)	22 (0.34 mm^2)	22 (0.34 mm^2)	20 (0.52 mm^2)	24 (0.20 mm^2)	18 (1.00 mm^2)
Conductor Material	Tinned Copper	Tinned Copper	Tinned Copper	Tinned Copper	Plain Copper
Strand/Strand gauge AWG (CSA)	7/30 (7/0.1 mm)	7/30 (7/0.1 mm)	7/28 (7/0.12 mm)	7/32 (7/0.08 mm)	16/30 (16/0.1)
Voltage Rating – Uo/U	300	300	300	300	300/600
Nominal Current per Core – amps	1	2.5	N.A.	N.A.	10
Shield	Unshielded	100% Overall Beldfoil	100% Overall Beldfoil or 93% Braided	100% Overall Beldfoil	N.A.
Conductor Insulation	Round PVC	Round PVC	Round PVC	Round PVC	PVC
Core Insulation	PVC	PVC	PVC	PVC	PVC
Nominal Capacitance between Conductors – pF/m	N.A.	80	64.6	108	N.A.
Characteristic Impedance – ohms	N.A.	N.A.	78	N.A.	N.A.
Maximum Run Length – ft (m)	1000 (305)	1000 (305)	Refer to Network Section	32 (10)	N.A.
Belden Number	8442	8761	9272	9533	NA

N.A. – Not Applicable

NOTE: The characteristics listed are the minimum requirements. Whenever possible, use wiring which meets or exceeds the equivalent of the Belden wire specification.

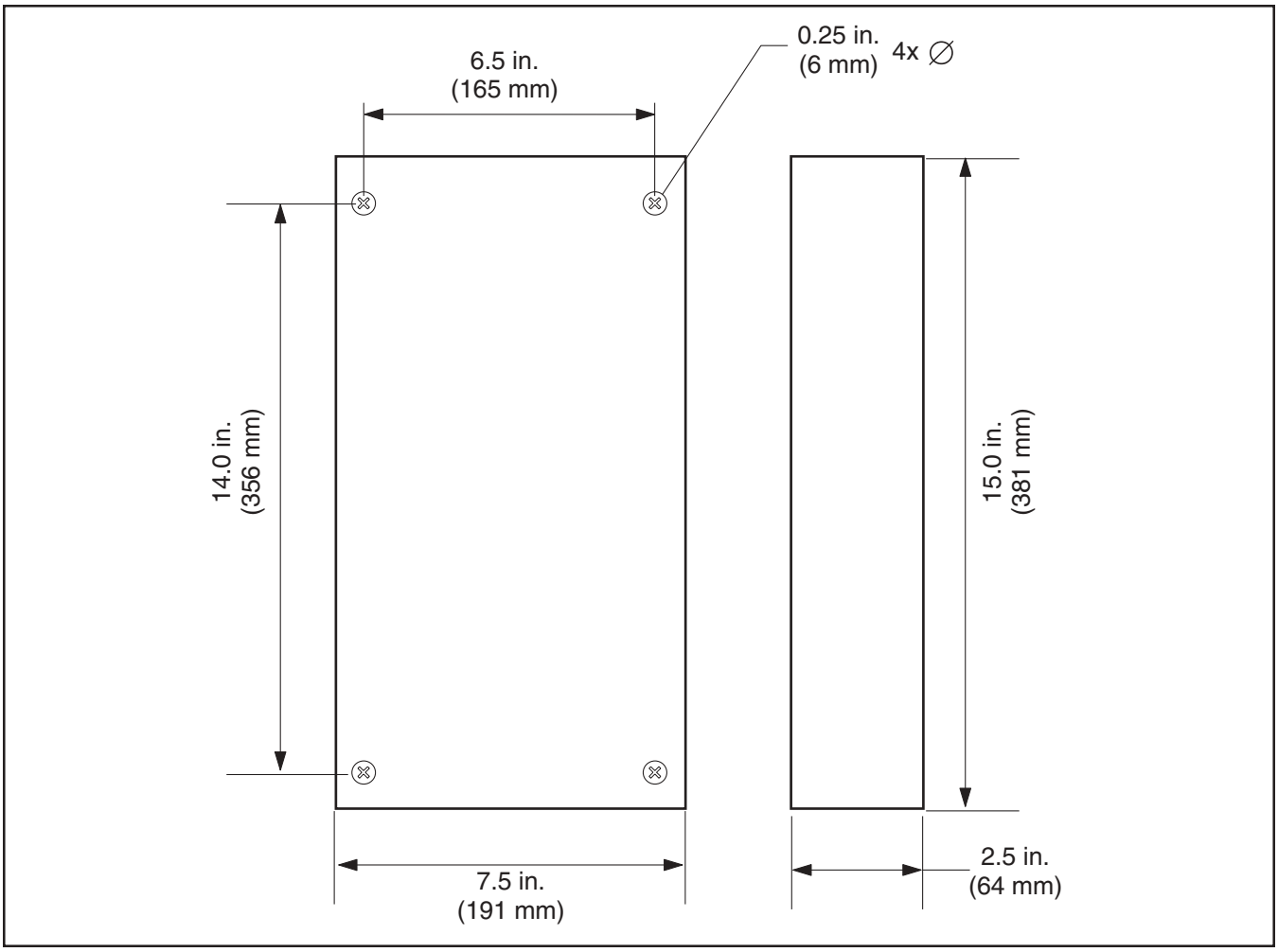


Figure 5 – Anchor Template and Dimensions

Data Bridge for BACnet Installation

The Data Bridge for BACnet comes complete with its own enclosure. It should be installed on a smooth, non-vibrating surface in a suitable area which maintains the environment required.

CAUTION: Never install a Data Bridge outside the confines of a building unless mounted within another enclosure rated at IP 65/ NEMA 4X or higher.

WARNING: Under no circumstance should a Data Bridge be installed inside a high voltage enclosure (>75 volts). This configuration will result in unreliable operation.

The wiring must be always be run in a suitable conduit. The power source should be protected with a suitable fuse or circuit breaker and from an uninterrupted source, i.e., not controlled by a programmed switch.

Communication wiring must be run in conduit separate from Class 2 (>75 VA) wiring. To obtain the best EMI and EMC performance, care should be taken to ensure that the conduit is bonded to the metal of both enclosures. Scraping the paint around the knockouts usually helps provide a better electrical connection between the joining parts.

Keep in mind that greater distances between devices on an RS485 network allow greater opportunities for possible introduction of EMI and RFI interference.

CAUTION: Always disconnect power to the Data Bridge when working inside. Dropped tools and metal chips from drilling can cause short circuits.

NOTE: Make sure there is no interference with other components in the near vicinity. Use appropriate conduit to connect the power and communications wiring to the Data Bridge.

1. Check for proper clearances for the necessary electrical and communication cable runs. Power and communication wiring must comply with all local ordinances and customer requirements.
2. Select a suitable location and mark the anchor points. Ensure that the enclosure will be level.
3. Drill the appropriate holes in accordance with the type of wall anchor being used.
4. Install the enclosure on the wall using the appropriate anchors. Be careful not to damage the circuit cards during installation.
5. Check that the mounting is secure and wiring connections are correct and tight. Check for loose wire strands or other metal objects that could cause a short circuit.

CAUTION: Make sure the power source is rated sufficiently to support the Data Bridge's power requirements.

Table 3. Power Lead Color Codes

	Color Code		
Standard Code	**Line**	**Neutral**	**Ground/ Earth**
U.L.	Black	White	Green
C.E.	Brown	Blue	Green w/ Yellow Stripe

6. Disconnect power at the fused power source and follow standard lock out procedures to prevent electrocution and inadvertent activation. Ensure that the power switch in the Data Bridge is Off.
7. Run suitable conduit from the power source to the Data Bridge. Ensure that it is securely attached to the enclosure at each end and will operate as a good conductor.
8. Install and connect 16 - 18 AWG wires from the fused power source to the terminals in the enclosure. Be sure the ground is connected to a true building ground. The wire color code should meet all local, state, and federal regulations and NEC recommendations.

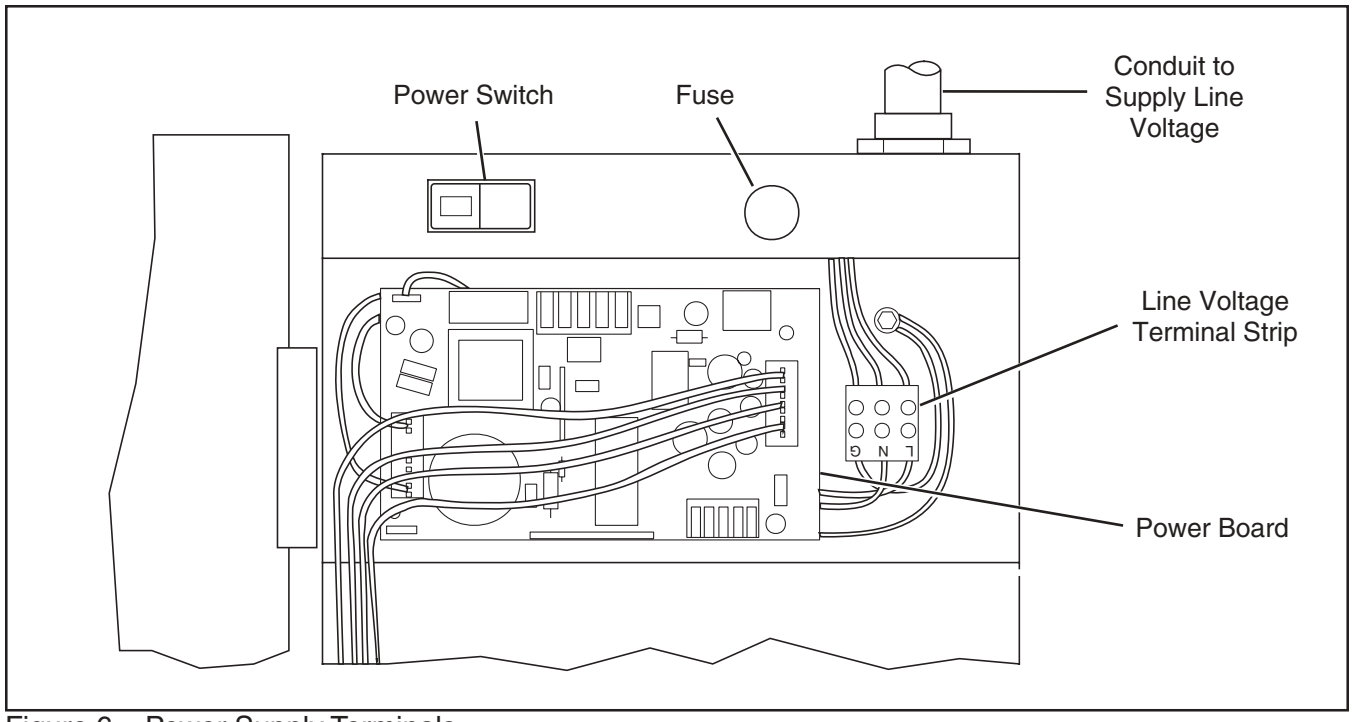
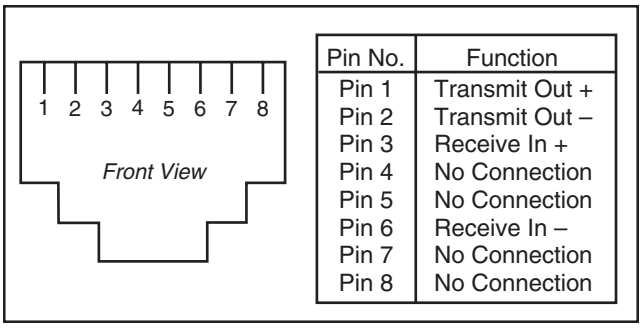


Figure 6 – Power Supply Terminals



Pin No.	Function
Pin 1	Transmit Out +
Pin 2	Transmit Out –
Pin 3	Receive In +
Pin 4	No Connection
Pin 5	No Connection
Pin 6	Receive In –
Pin 7	No Connection
Pin 8	No Connection

Figure 7 – RJ-45 Ethernet Connection

CAUTION: The ground wire must be connected to the ground stud to ensure the enclosure is grounded if the power plug is disconnected.

9. Run suitable conduit from the ISN network to the Data Bridge and from the Ethernet network to the Data Bridge. Ensure that the conduit is securely attached to the each end.

10. Run the appropriate cable in the conduit as specified. Refer to the table titled “Minimum Cable Specifications” for additional information on the ISN network.

    The Data Bridge for BACnet is configured to accept an RJ-45 connector. Contact the BACnet integrator for additional information on Ethernet requirements.

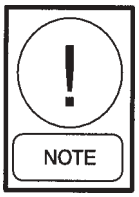
11. Connect the ISN network cable to TB1 on the MicroGateway card.

12. Plug in the BACnet Ethernet cable to the ethernet connector on the SBC.

13. Check for frayed or loose wire strands which could cause a short circuit. Ensure that all components and connectors are secure.

14. Check for loose wire strands. Reinsert the connector into the power board.

15. Attach and secure the cover of the Data Bridge for BACnet.



NOTE: Always ensure that the cover is securely fastened to the enclosure when operating and the internal ground wire is attached. This helps to prevent RFI from entering the system.

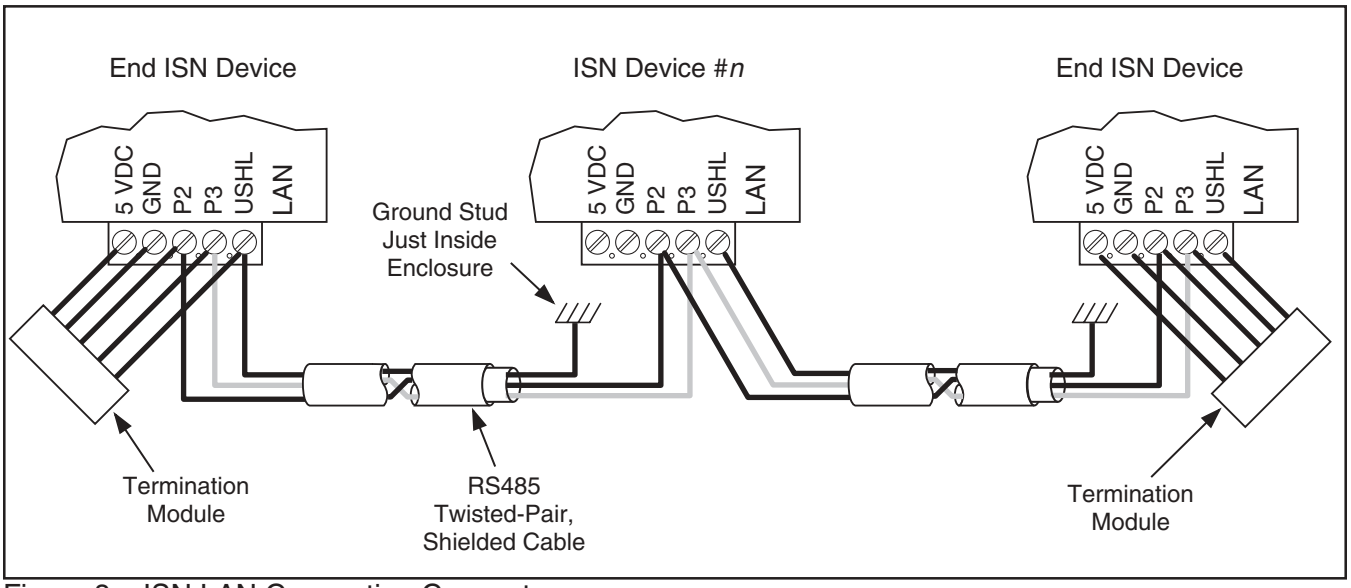
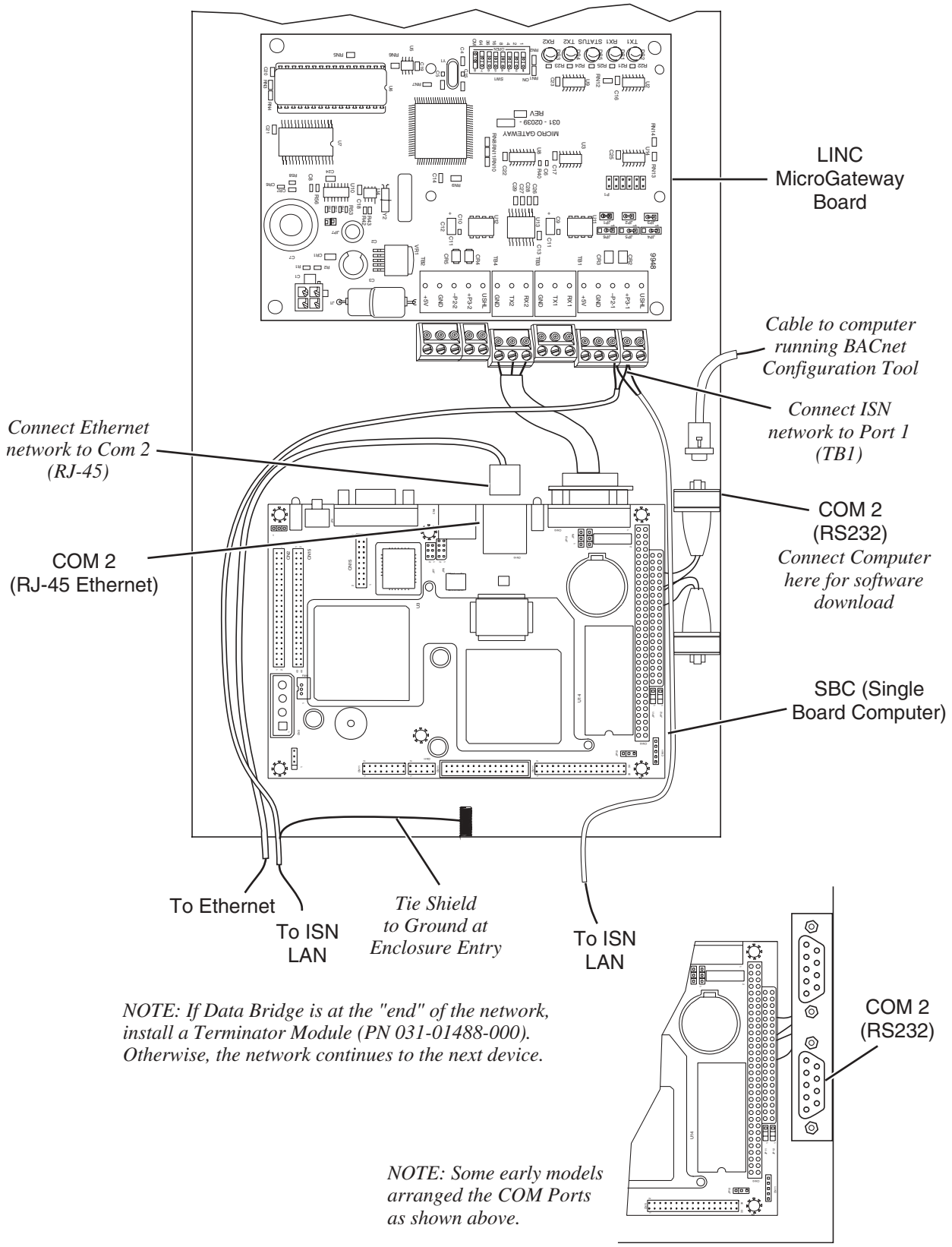


Figure 8 – ISN LAN Connection Concept



NOTE: If Data Bridge is at the "end" of the network, install a Terminator Module (PN 031-01488-000). Otherwise, the network continues to the next device.

NOTE: Some early models arranged the COM Ports as shown above.

Figure 9 – ISN LAN and BACnet Ethernet Connection Locations

Downloading Software to the SBC

For the purposes of downloading or uploading software to the Data Bridge for BACnet, a computer is connected to the Single Board Computer's COM2 RS232 port. The serial interface on the computer must be RS232 using a DB-9 connector. This connects to the RS232 DB-9 connector on the SBC using a null modem cable.

Table 4. Null Cable Pin Connections

	PC End	Data Bridge End
Transmit Data (TD)	3	2
Receive Data (RD)	2	3
Request to Send (RTS)	7	8
Clear to Send (CTS)	8	7
Signal Ground (SG)	5	5
Data Set Ready (DSR)	6	4
Data Terminal Ready (DTR)	4	6

SBC Connections

The SBC is a standard computer with most of the options that a standard desktop computer has, such as USB, video, keyboard, and parallel printer ports. For communication, it has a 10Base-T Ethernet port and two serial communication ports. One serial port connects to the MicroGateway and the other is used to download or upload software from the BACnet Configuration Tool. There are also LEDs which indicate various operating states.

Several jumpers also are used to configure the SBC for special applications. Although not normally used in the Data Bridge for BACnet application, the default position of these jumpers may require verification. The figure titled "Single Board Computer Components" shows the specific positions of the jumpers as well as the location of the various connectors and LEDs.

Table 5. Default Jumper Positions

Jumper	Jumpered Pins
JP1	1-2
JP4	Reset Button
JP7	1-2
	5-6
JP8	7-8
JP9	1-2
JP10	2-3
JP11	1-2
JP12	1-2
JP13	2-3

Table 6. LEDs

	LED Color	Indicates:
Ethernet	Green	RX
	Orange	TX
Power/HDD	Green	Power is ON
	Orange	Hard Drive is active

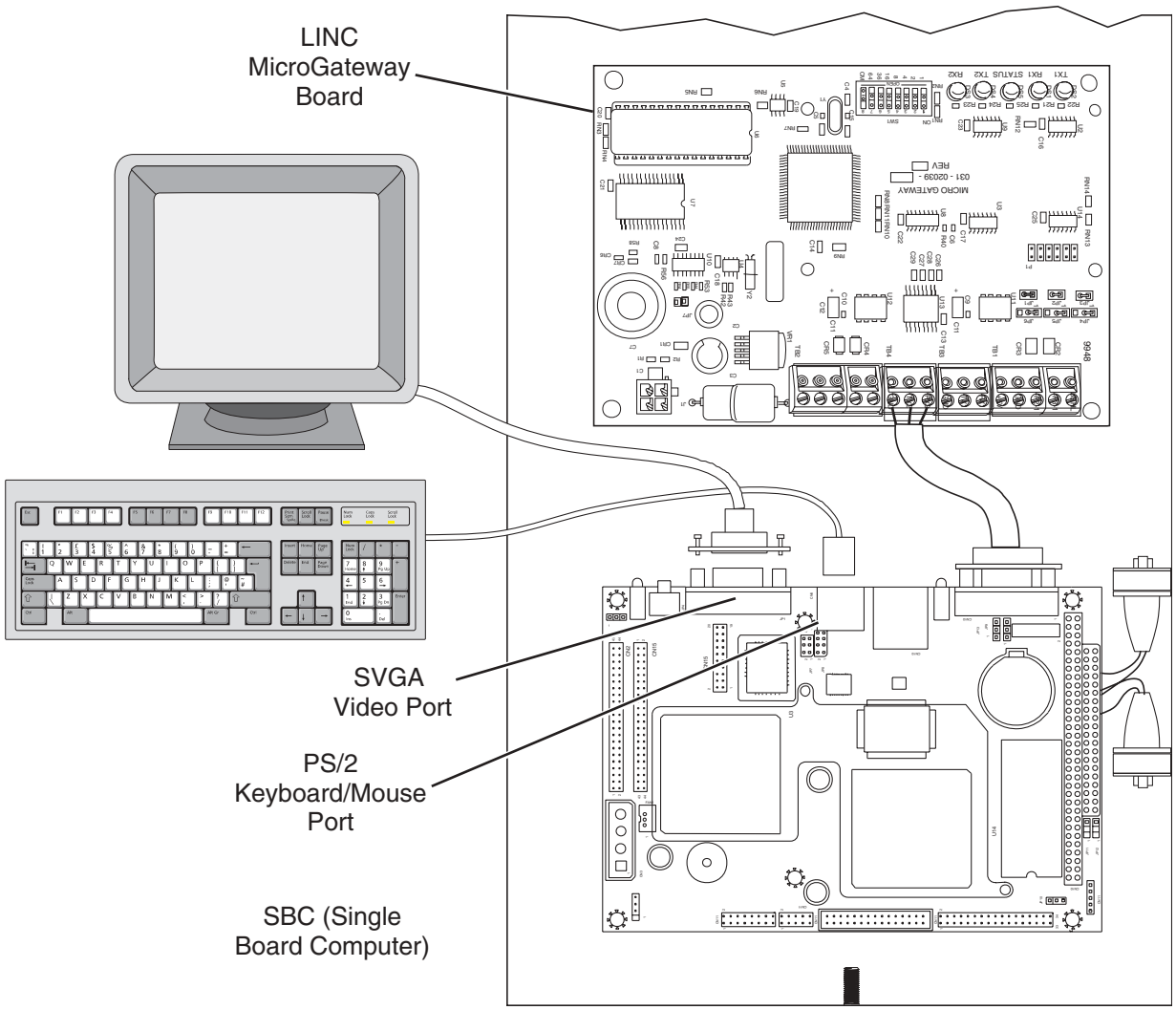


Figure 10 – Video and Keyboard/Mouse Connection

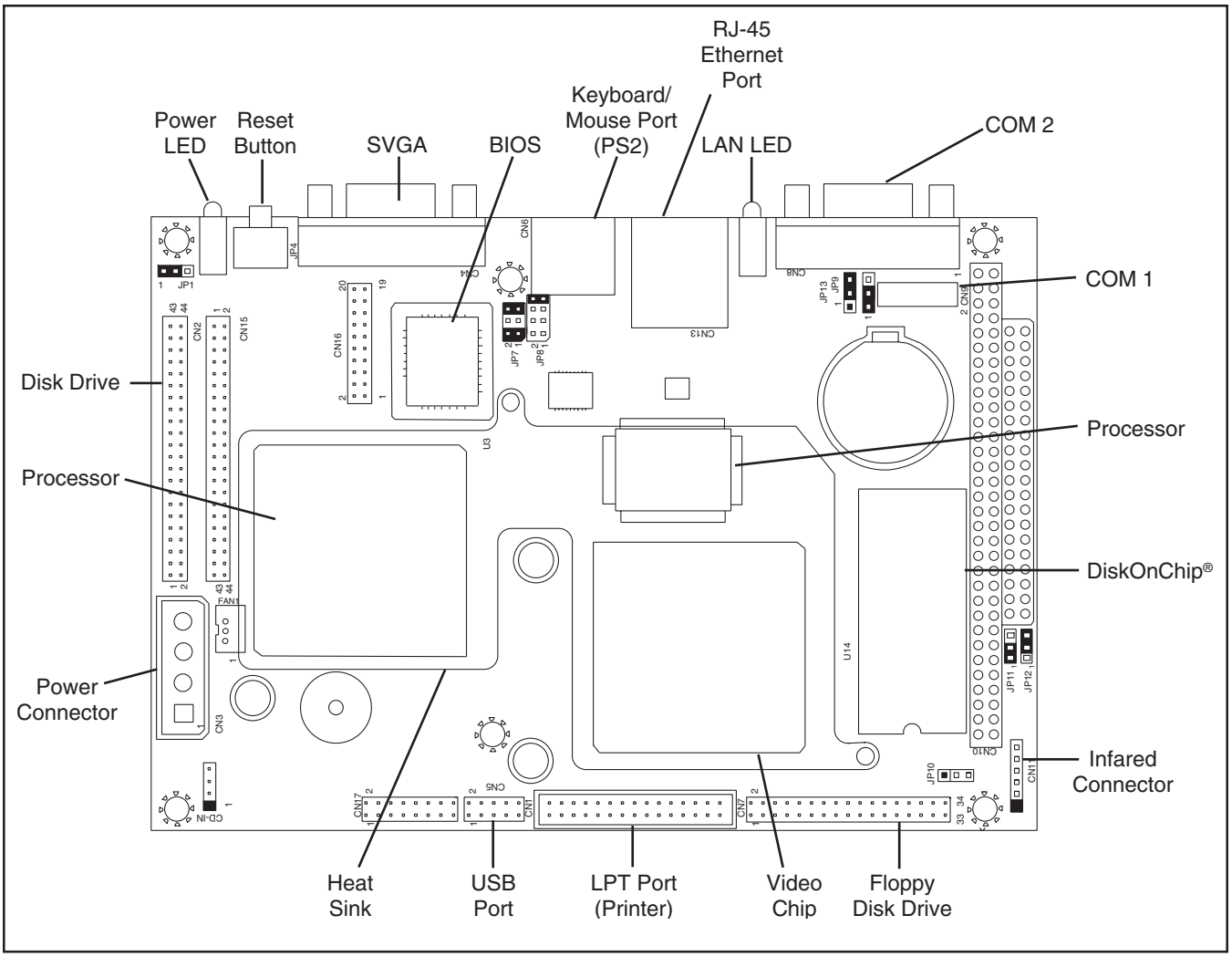


Figure 11 – Single Board Computer Components

Video Connection

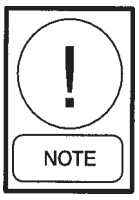
The SBC is equipped with video out capability using a standard SVGA computer monitor. This can be used for troubleshooting with factory guidance.

Keyboard/Mouse Connection

The SBC is equipped with a PS2 port for mouse or keyboard connection. This can be used for trouble-shooting with factory guidance.

ISN Network Address

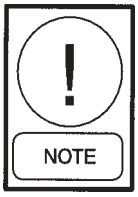
The LINC MicroGateway requires the node switch to be set to a unique address on the ISN network. A DIP switch on the LINC MicroGateway board selects this address, which must be between 1 and 99.



NOTE: The switch is capable of selecting addresses between 0 and 255 but the ISN network only recognizes addresses between 1 and 99.

The node switch consists of eight individual DIP switches that are binary weighted. Summing the value of each of these switches in the ON position

forms the decimal value of the node switch. To determine the numeric value assigned to the switch, add the numbers above the corresponding DIP switches which in the ON position. The resulting sum is the number (network address) selected.



NOTE: The CM DIP switch is equivalent to binary value 128.

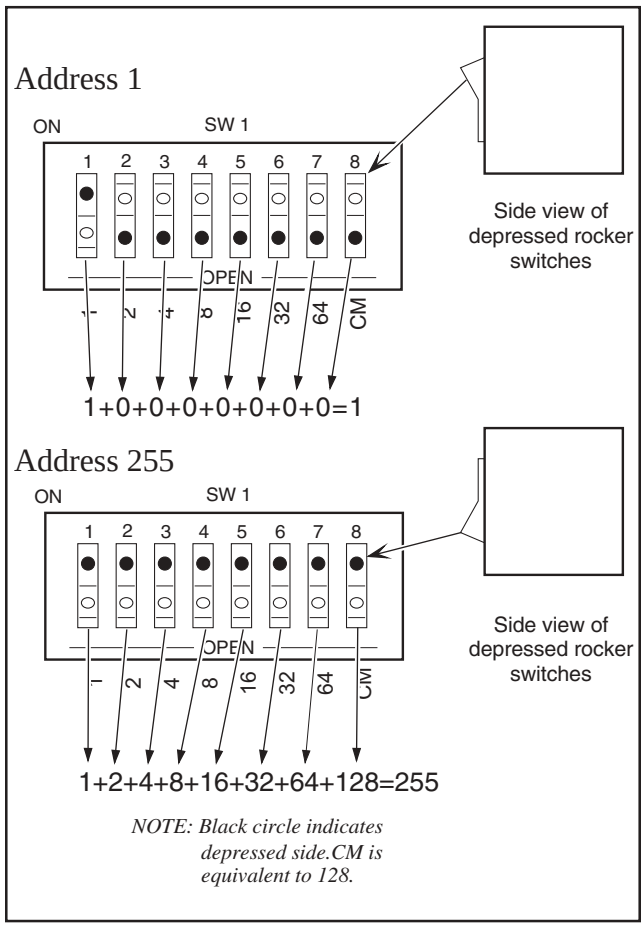


Figure 12 – Setting the Node Switch

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