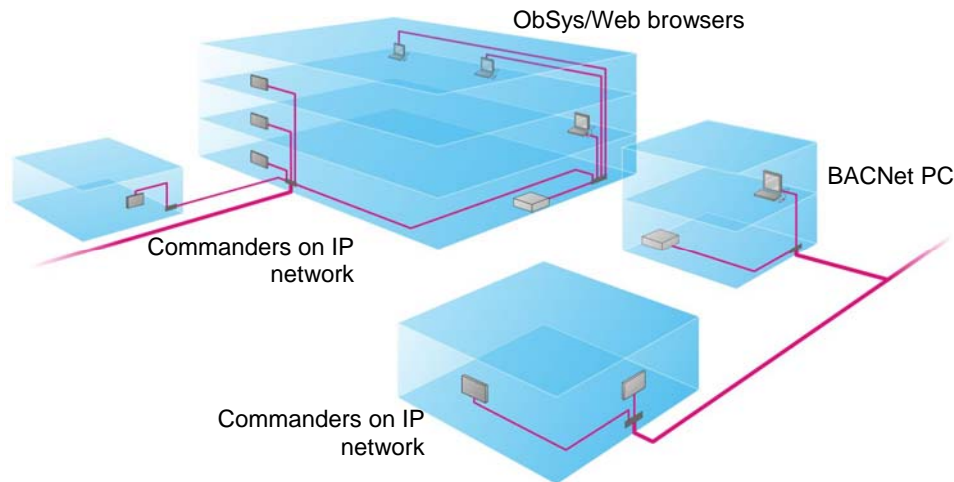


Introduction to Commander Networking

Introduction

Commander is a powerful IP-based controller providing a configurable link between an Ethernet network and the connected system. This document describes the operation and configuration of the Ethernet based modules within Commander.



Contents

IPBus – the IP protocol used to communicate between several Commanders and ObSys

User Database – the configurable database containing user-selected values to collect from the attached systems

Web Server – automatically serves HTML pages

Telnet – provides a text based session with Commander

BACnet – the built-in Application Specific Controller supporting the BACnet/IP standard

Authentication – provides user and password authentication

Appendix A: BACnet PIC Statement

Appendix B: IP Specification

Further Information

For general engineering information about Commander and details of the interface, please refer to the Engineering Guide for the Commander interface installed.

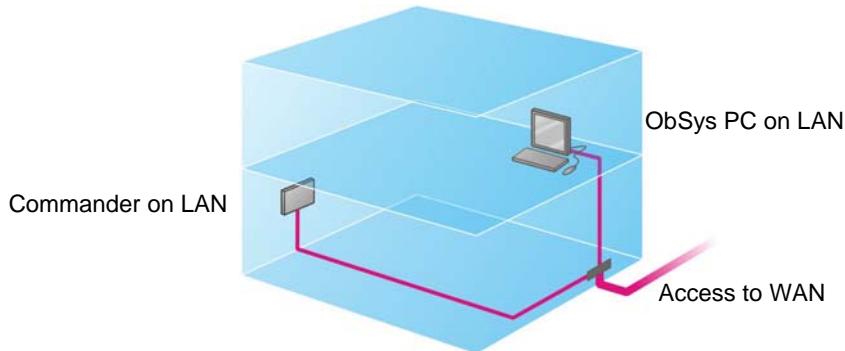
For information relating to the control capabilities of Commander including programmable control, on-off time control, and data logging, refer to the Introduction to Commander Control.

For information relating to the alarm event handling capabilities of Commander including alarm distribution and routing, event history, SNMP trap notification, e-mail notification, and the monitoring of values, refer to the Introduction to Commander Alarms.

IPBus

The IPBus module allows Commander to communicate with other IPBus (XOM/IP) compatible devices over the Ethernet network, such as North ObSys and other Commanders.

IPBus is a reliable IP-based communications protocol that may be used across local (LAN) and wide (WAN) area networks.



Alias Table

The IPBus protocol allows Commander to request values from other IPBus devices, and allows those devices to request values from Commander.

If other devices are to make requests from this Commander, they must know its IP address.

If Commander is to make requests from other devices, the IP addresses of those devices must be listed in the Alias table of the Commander IPBus module:

Ref	IP Address
PC	192.168.2.180
GND	192.168.2.185
1ST	192.168.2.186

Once the Alias table is configured, objects can be requested using the Ref field followed by the object's reference within the device.

For example, if GND in the above table references another Commander, the other Commander's time can be requested using the object reference GND.C.DT.

Security

Communications between IPBus devices can be made more secure by configuring a software key in both the requesting and replying devices.

Commander should be configured with its 'own key'. If other devices are to make requests from this Commander, they must know its key.

If Commander is to make requests from other devices, the keys of those devices must be listed in the Alias table of the Commander IPBus module:

Ref	IP Address	Key
PC	192.168.2.180	Safe
GND	192.168.2.185	
1ST	192.168.2.186	

User Database

Commander can collect values from objects in the connected system and other IPBus devices with the User Data module. It acts as a database of summary information that is aimed at users rather than engineers. Users can view and set the information in the database in several ways:

- As easy-to-use HTML pages from a Web browser
- As BACnet objects from other BACnet/IP devices on the network
- From other compatible IPBus devices
- From other compatible XOM devices, such as the GSMSMS interface.

Collected values can be checked against acceptable levels, and alarms generated. When the users change values within the database, Commander can send the values to other objects.

Structure

The User Data Setup module contains 20 pages. Each page contains a reference, label, security access level and 16 configurable objects.

Use object engineering software, such as ObView, to configure the User Data Setup module. Each page must be given a short unique reference and a label, before proceeding to define the objects. An access level may also be specified that controls user access to the page.

Each of the 16 objects within the page should be configured to store a value using the following parameters:

- Reference – a short reference, unique within the page
- Label – a brief label describing the object
- Type – specifies the type of value stored by the object: text string; integer; floating point number; on-off/no-yes value; on-off times; or a date & time value
- Adjustable – enables adjustment of the value by a user
- Access Level – controls user access when adjusting the value
- Value High/Low limit – the typical operating range of the value. These limits are used when a user adjusts the value, and to generate an alarm message when the value exceeds this range
- Remote Action – an option to read a remote object from the connected system, or write the value provided by a user to the connected system. If Adjustable is enabled and Remote Action is read, adjusting a value will write the new value once to the Remote Object then continue to read
- Remote Object – an object reference to read or write. The object may be from within the Commander, or accessible via the connected system or IPBus network
- Remote Rate – the frequency in which the Remote Object should be read
- Remote Fails – the number of consecutive failed attempts at reading/writing the remote object (used for troubleshooting)
- Alarm Priority – enables the sending of an alarm message if the value is outside its high/low limits or Remote Fails exceeds its threshold
- Alarm State – the current alarm state of the value

Using the Values Stored in User Database

Once the User Database has been configured the values may be used by Commander's built-in Web Server and BACnet device. Enabling either of these modules will automatically connect to the User Database and serve its values with no additional engineering required.

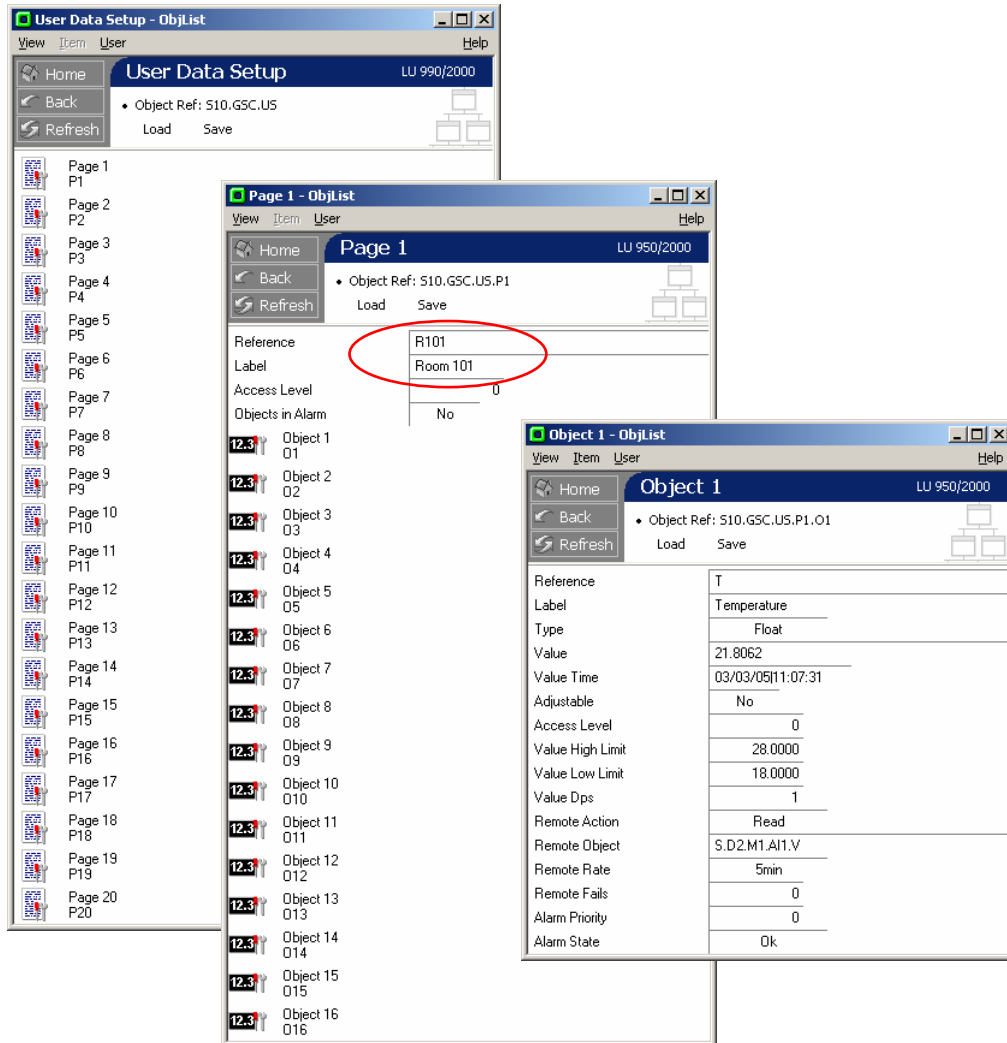
Compatible devices may also access the User Database by simply directing them to Commander's User Database object 'UD'. Compatible devices include the interactive mobile phone SMS server (GSMSMS interface), the Zip display module (Zip M7201), and XOM compatible products such as ObView.

Example

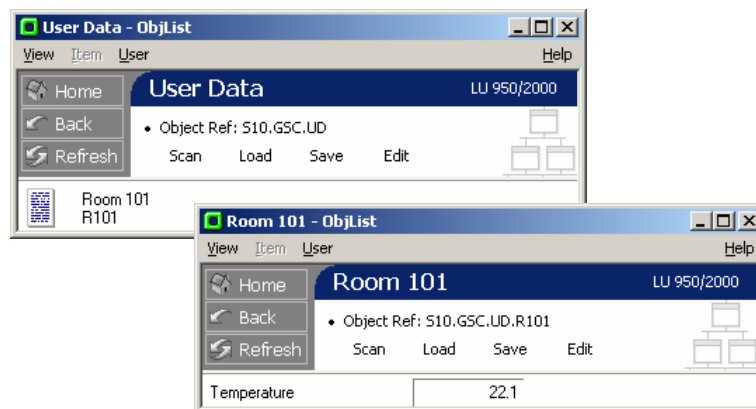
The following diagram illustrates the engineering of a User Data Setup module using ObView.

Page 1 is configured with the reference 'R101' and label 'Room 101'.

Object 1, within Page 1, is then configured to store a temperature value. The value is read from the remote object 'S.D2.M1.A1.V' every 5 minutes and cannot be adjusted by a user.



Once the pages and objects within the User Data Setup module have been configured, use ObView to scan the User Data system. The User Data system uses the label and object references to display its contents.



Web Server

Once the User Database within Commander has been configured, the Web Server module automatically creates and serves pages to a Web browser. The Web Server will also serve any alarm messages routed to the Alarm History module. No knowledge of HTML or web page creation is required.

Configure the Web Server Setup module using the following options:

- Enable – use this to enable the Commander Web Server
- TokenMax Object Reference – if pages and objects within the User Database module have been configured with an access level, enable this security by entering the Commander User Token module 'UT'. Alternatively an external TokenMax module may be specified
- Homepage Title and Para – use these options to enter useful information for the home page
- Links – use these options to enter links to other useful web sites, such as other Commanders or your company web site.
- Reduced Content – use this to enable a reduced or simple content from the Web Server. For example, hide value faults and timestamp.

The pages served by Commander require no plug-ins and conform to World Wide Web Consortium (W3C) standards. These include XHTML, CSS and conformance level Double-A of the Web Content Accessibility Guidelines. This enables the pages to be viewed with Internet Explorer, Mozilla, Opera, other text and speech-based browsers, PDA's and mobile phones.

Example

The following image shows example pages served by Commander. A user may customise their view by selecting the 'change view' link in the bottom right corner of the web page.

To view an example of the Commander Web Server on the Internet visit <http://cmdr.northbt.com/>

The screenshot displays the Commander Web Server interface in Microsoft Internet Explorer. The main window shows the 'North HQ' homepage with a navigation menu (home, alarms, help) and a 'Welcome to Commander' message. A sidebar contains links for Heating, Security, Air Conditioning, Time Control, and Lighting. An 'Alarm Summary' table is displayed, listing various data manager and alarm points with their conditions. A 'Jump to...' dropdown is also present. An inset window shows a 'Heating Temp Set Point' control page with a current value of 30, status 'ok', and an input field for setting a new value.

Point	Condition
Data Manager - Server - Room Temperature	Value ok
Data Manager - Server - Room Humidity	Value ok
Data Manager - Server - Room Temperature	Low value
Data Manager - Server - Room Temperature	Communication
Data Manager - Server - Room Humidity	Communication
Data Manager - Server - Room Temperature	Low value
Data Manager - Server - Room Temperature	Communication
Data Manager - Server - Room Humidity	Communication
Alarm - Object	Condition
Alarm - Object	Condition

Linking to pages from the Commander Web Server

Pages within the Commander Web Server may be linked to from other HTML pages. These pages may link to a specific object or a page of objects within User Data.

The Web Server accepts additional options that may be specified within the URL to customise the appearance of the page. These include removing the header text and links, removing the side navigation bar, displaying the page as text, stopping the page from refreshing, and specifying a return URL.

Pages from the Commander Web Server have the following format:

<code>http://<IP address or DNS>/</code>	Home page
<code>http://<IP address or DNS>/mobile/</code>	Home page for text Web browsers
<code>http://<IP address or DNS>/alarm/default.htm</code>	Alarm list
<code>http://<IP address or DNS>/auto/<page>/default.htm</code>	Page list
<code>http://<IP address or DNS>/auto/<page>/<object>/default.htm</code>	Specified object

Examples:

```
http://cmdr.northbt.com/  
http://cmdr.northbt.com/mobile/  
http://cmdr.northbt.com/alarm/default.htm  
http://cmdr.northbt.com/auto/P1/default.htm  
http://cmdr.northbt.com/auto/P1/FI/default.htm
```

The appearance of the default page may be changed using the following options in the URL:

<code>r=0</code>	Page refresh off
<code>t=1</code>	Display text only
<code>h=0</code>	Header off
<code>n=0</code>	Side navigation bar off
<code>g=1</code>	Go bar on
<code>rtn=<url></code>	redirect URL after changing an object value

These may be generated from an HTML form, or used within the URL directly:

```
http://cmdr.northbt.com/auto/P1/default.htm?r=0&h=0&n=0&rtn=www.northbt.com  
http://cmdr.northbt.com/auto/P1/FI/default.htm?n=0&g=1&h=0
```

Telnet

Telnet is a terminal-emulation protocol that is widely used on IP networks to interact with remote computers. Commander can act as a Telnet server in a Telnet client-server session. A Telnet client can use simple commands across an IP network to read and write information from a Commander.

Telnet may be used to configure Commander in a similar way to the Terminal Port. It may also be used by other network devices to read and write values from Commander and the devices attached to Commander.

Connecting to the Commander Telnet Server

Launch your telnet client software with the Commander address, for example at the Windows command prompt type:
TELNET cmdr.northbt.com↵

The server uses the default Telnet port of 23 and all commands should be followed by a carriage-return and line-feed.

Once connected, Commander will then prompt for the user logon. Enter the default user logon of (blank):

User: ↵

Once logged-on to the Telnet session, Commander will request which service is required. For object based communications with Commander enter 'qr':

Service:qr↵

Commander is now ready to have values read from and written to it. Enter commands at the Q prompt:

Q:

Reading Objects

Type the object reference and press carriage-return line-feed (↵) to read the object's value (object references are case sensitive).

For example, to read the date and time from Commander, type:

Q:C.DT↵

Commander responds with the date and time:

R:13/09/05|12:30:08

Writing Objects

Type the object reference, the equal sign, the value, and then carriage-return, to write the object's value

For example, to write the date and time to Commander, type:

Q:C.DT=13/09/05|12:22:00↵

Commander responds with 'Ok' when the value has been written.

Errors

If Commander does not understand the message it receives it will reply with the error prompt, E, followed by an error code:

E:OBJ↵

Q:

Commander may respond with one of the following errors:

OBJ – Object invalid

ACT – Action invalid

VAL – Value written invalid

FLT – General fault

DDV – Device delivery fault

PDV – Point delivery fault

NDV – Network delivery fault

??? – Unknown error

Closing the connection

To close a session use a carriage-return line-feed, or alternatively the connection will close automatically after 5 minutes on inactivity. Once a connection has closed the logon process will need to be repeated to read or write a value.

BACnet

Once the User Database within Commander has been configured, the BACnet module can automatically serve this data as BACnet objects on the IP network to compatible BACnet devices.

The Commander BACnet device is enabled by specifying a BACnet device instance within the General Setup module. The device instance is a unique number within the BACnet inter-network.

BACnet Compatibility

Manufacturers' devices support the BACnet standard to various degrees of compliance. If a device supports the BACnet standard, further investigation is required to assess to what degree.

An engineer should start by obtaining a PIC (Protocol Implementation Conformance) statement for each BACnet device. The PIC statement for the Commander BACnet module is in Appendix A of this document.

The Data Link Layer

The BACnet standard can operate on several link layers including Ethernet, ARCNET, RS485, RS232, IP, and LonTalk. Commander supports the BACnet IP (Annex J) link layer. To connect to a device not supporting the BACnet IP layer a suitable BACnet router will be required.

Building Blocks, Services and Objects

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. The services are described in terms of an 'A' and a 'B' device. Both of these devices are nodes on a BACnet inter-network. In most cases 'A' will act as the user of data (i.e. BACnet workstation) and the 'B' device will be the provider of this data (i.e. Commander).

Commander supports the reading and writing of its objects from the User Database by other BACnet devices. For another device to communicate with Commander it should support the following BIBBs:

- DS-RP-B Data Sharing – Read Property – A
- DS-WP-B Data Sharing – Write Property – A

Commander presents the objects created in the User Database as the following standard object types:

- Analog Value – values created as type Float in User Data
- Binary Value – values created as type OffOn or NoYes in User Data
- Device – Commander

Further Information

Refer to [Appendix A: BACnet PIC Statement](#) for a formal BACnet conformance declaration.

For more information on the BACnet standard visit <http://www.bacnet.org/>.

The North Compass and ObSys product are available with BACnet using the Point-to-Point (RS232) link layer, search for help on the 'BACnet' interface for more information.

Authentication

The User Token module is an authentication server that can identify tokens and access levels for 250 users. Each user record contains the following information:

- Name – the name of the user
- Token – the username/card number and optional coded password
- Group – the group number, used to enable collections of users
- Enabled – enables the user record
- Privileges – the eight privilege areas, each with a level in the range 0...7

User Token can be used to provide authentication for the Web Server and other compatible devices. A device is configured with the User Token object 'UT', a privilege area to check, and a minimum level for the privilege.

A device queries the authentication server using the Token presented by a user. If the token and password are valid, and privilege level is sufficient, access is granted.

Compatible devices using the User Token module include the Web Server module, Zip door access module (Zip M7101), and XOM compatible products such as ObView.

Further Information

For information relating to Privilege areas and levels used by the range of North products, refer to the [*Introduction to North Security*](#) document.

Other authentication servers are also available. Search for help on the 'TokenMax' product for more information.

Appendix A: BACnet Protocol Implementation Conformance Statement

Date	February 20, 2003		
Vendor Name	North Building Technologies Ltd.		
Product Name	Commander		
Product Model Number	Commander BACnet interface		
Applications Software Version	n/a	Firmware Revision	v10
		BACnet Protocol Revision	2

Product Description

The Commander BACnet module provides a gateway between the North eXtensible Object Model (XOM) and BACnet workstation/building controllers.

Commander collects objects from the attached Compass and IPBus systems and presents them as BACnet objects.

BACnet Standardized Device Profile (Annex L)

- BACnet Operator Workstation (B-OWS)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Sensor (B-SS)
- BACnet Smart Actuator (B-SA)

BACnet Interoperability Building Blocks Supported (Annex K)

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. The services are described in terms of an 'A' and a 'B' device. Both of these devices are nodes on a BACnet inter-network. In most cases 'A' will act as the user of data (like a BAS Server) and the 'B' device will be the provider of this data (like a field control module or router).

BIBB Type		BACnet Service	Initiate	Execute
DS-RP-B	Data Sharing - Read Property - B	ReadProperty	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DS-WP-B	Data Sharing - Write Property - B	WriteProperty	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DM-DDB-B	Device Management - Dynamic Device Binding - B	Who-Is	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		I-Am	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DM-DOB-B	Device Management - Dynamic Object Binding - B	Who-Has	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		I-Have	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DM-DDC-B	Device Management - Device Communication Control - B	DeviceCommunicationControl	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Segmentation Capability

- Segmented requests supported
- Segmented responses supported

Standard Object Types Supported

Object Type	Dynamically Creatable	Dynamically Deletable	Optional Properties Supported	Writable Properties Supported
Analog Value	<input type="checkbox"/>	<input type="checkbox"/>		Present-value
Binary Value	<input type="checkbox"/>	<input type="checkbox"/>		Present-value
Device	<input type="checkbox"/>	<input type="checkbox"/>		

Data Link Layer Options

- BACnet IP, (Annex J)
- BACnet IP, (Annex J), Foreign Device
- ISO 8802-3, Ethernet (Clause 7)
- ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
- ANSI/ATA 878.1, RS-485 ARCNET (Clause 8)
- MS/TP master (Clause 9)
- MS/TP slave (Clause 9)
- Point-To-Point, EIA 232 (Clause 10)
- Point-To-Point, modem, (Clause 10)
- LonTalk, (Clause 11)

Device Address Binding

Is static device binding supported? Yes No
(Necessary for two-way communication with MS/TP slaves and certain other devices.)

Networking Options

- Router, Clause 6
- Annex H, BACnet Tunneling Router over IP
- BACnet/IP Broadcast Management Device (BBMD)

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- | | | |
|---|---|-------------------------------------|
| <input checked="" type="checkbox"/> ANSI X3.4 | <input type="checkbox"/> IBM™/Microsoft™ DBCS | <input type="checkbox"/> ISO 8859-1 |
| <input type="checkbox"/> ISO 10646 (UCS-2) | <input type="checkbox"/> ISO 10646 (UCS-4) | <input type="checkbox"/> JIS C 6226 |

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:

As part of North's modular product range, Commander allows values from the range of driver modules supported to be shared with the BACnet inter-network.

The latest driver interface guide is available by visiting <http://www.northbt.com/>.

Appendix B: IP Specification

The RJ45 Ethernet port on Commander provides a 10BASE-T half-duplex connection and uses IP based protocols. Commander uses IP encapsulation to the Ethernet II frame type (RFC 894), also called DEC/Intel/Xerox Ethernet or Blue Book Ethernet.

TCP Protocols Supported

File Transfer Protocol (FTP)

The FTP server within Commander can be enabled and uses TCP ports 20 and 21. The FTP server would only be enabled temporarily when updating the Commander firmware, as instructed by North support.

Telnet

The telnet server within Commander uses TCP port 23.

Simple Mail Transfer Protocol (SMTP)

The SMTP-sender within Commander uses TCP port 25 and conforms to RFC 821 and 2822.

Commander sends SMTP messages to an SMTP-receiver. E-mail is formatted in plain text and has no attachments, with a typical size of 16k.

HyperText Transfer Protocol (HTTP)

The HTML Server within Commander can be enabled and uses TCP port 80. The HTML Server conforms to RFC 1945 for HTTP/1.0 and supports Basic Access Authentication to RFC 2617.

UDP Protocols Supported

DHCP

The DHCP protocol uses UDP port 67 (server) and port 68 (client). DHCP messages use the IP broadcast address.

If configured with the IP address 0.0.0.0, Commander will request an IP address from a DHCP Server at start-up. The DHCP server can assign an IP address, network mask and router address.

North IPBus Protocol (IPBus)

The IPBus protocol uses UDP port 37926. For communication across a firewall the UDP port would need to be open for both outgoing and incoming traffic. Security may be enabled in the form of 'open-hidden' key encryption.

IPBus messages are 192 bytes in size. Bandwidth usage depends upon configuration of the Commander product.

Building Automation and Control Networks (BACnet)

The BACnet device within Commander can be enabled and uses UDP port 0xBAC0 (47808). The BACnet device conforms to ANSI/ASHRAE Standard 135-2001.

BACnet messages have a maximum size of 1044 bytes. Commander only responds to messages, so bandwidth usage is dependent upon the requesting BACnet device.

SNMP

The SNMP protocol sends to UDP port 162 (trap receiver) from UDP port 37920 (Commander). Commander only sends SNMP Trap messages to the configured IP address.

Internet Control Message Protocol (ICMP)

Commander supports ICMP for error control and diagnostic use. For example, the ICMP Echo (ping) command can be sent to detect the presence of Commander on the IP network.

Address Resolution Protocol (ARP)

Commander supports ARP, which provides mechanisms for hosts to search and find the MAC (Ethernet) address of other hosts on the network.

Port Usage Summary

Port	Protocol
TCP 20	FTP
TCP 21	FTP
TCP 23	Telnet
TCP 25	SMTP
TCP 80	HTTP
UDP 67	DHCP
UDP 68	DHCP
UDP 162	SNMP
UDP 37920	SNMP
UDP 37926	IPBus
UDP 47808	BACnet