I/O Zone 8112
Integration Guide

OEMCtrl®

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What is this integration document about?

This document provides instructions on integrating the I/O Zone 8112 into the Building Automation System (BAS), which is speaking one of the following protocols:

- *BACnet over ARC156* (page 4)
- *BACnet MS/TP* (page 7)
- *Modbus* (page 10)
- *Johnson N2* (page 13)
- *LonWorks* (page 15)

Assumption The controller has been configured by the factory and is functioning correctly. The factory should supply you, the site integrator, with an object listing which enables you to gather information from the controller.

What are protocols?

Protocols are the communication languages spoken by control devices. They communicate information in the most efficient method possible. Different protocols provide distinct information for different applications.

In the BAS application, many different protocols are used, depending on the manufacturer. It is advantageous for the entire facility to be linked together and presented in one front end.

For 2 devices to communicate with each other, they must speak the same protocol or have a protocol translator. All of our controllers have the ability to speak multiple protocols. No matter what controls are present in the rest of the building, our controller communicates with them without the added cost of a gateway.

How do protocols work?

Protocols are a set of formal rules describing how to transmit data, especially across a network. They are a language spoken between electronic devices. For 2 devices to communicate with each other, they must speak the same protocol or have a protocol translator. A protocol example is IP (Internet Protocol).

A low level protocol defines:

- Electrical and physical standards of the hardware
- Bit-and-byte-ordering
- Transmission, error detection, and correction of the bit stream

A high level protocol deals with data formatting, including:

- Syntax of messages
- Terminal-to-computer dialogue
- Character sets
- Sequencing of messages

There are many different protocols because any 2 pieces of building management equipment can vary in application or protocol. Protocols make applications more efficient.

Benefits

- Manufacturers can provide a controller with their units, which can be seamlessly integrated into a BAS.
- Upgrade and expansion costs are competitive.
- Expensive gateways are eliminated.
- Field selection of the protocol requires less up-front coordination, which reduces manufacturing costs.
- Simple configuration and flexibility allow future additions and changes without additional costs.

What do you need for the integration?

The building owner supplies the integrator with the following information:

- Protocol Implementation Conformance Statement (See Appendix.)
- Unit-specific object listing (for LonWorks, an XIF file may be required.) See *Obtaining LonWorks object mapping (XIF file)* (page 18).

After the integration is complete, the integrator supplies the building owner with:

- Device address(es)
- Network baud rate

The specific site settings are applied to the I/O Zone 8112 using the following unique configurations:

- *Configuring the I/O Zone 8112 for BACnet over ARC156* (page 4)
- *Configuring the I/O Zone 8112 for BACnet MS/TP* (page 7)
- *Configuring the I/O Zone 8112 for Modbus* (page 10)
- *Configuring the I/O Zone 8112 for Johnson N2* (page 13)
- *Configuring the I/O Zone 8112 for LonWorks Option Card* (page 15)

CAUTIONS

- The I/O Zone 8112 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Do not power pilot relays from the same transformer that powers the I/O Zone 8112.
- OEMCtrl controllers can share a power supply as long as you:
  - Maintain the same polarity
  - Use the power supply only for OEMCtrl controllers
- The I/O Zone 8112 has an operating range of 21.6 Vac to 26.4 Vac. If voltage measured at the I/O Zone 8112's input terminals is outside this range, the I/O Zone 8112 may not work properly.
- Avoid running communication wires or sensor input wires next to AC power wires or the controller's relay output wires. The resulting noise can affect signal quality. Common sources of noise are:
  - Spark igniters
  - Radio transmitters
  - Variable speed drives
  - Electric motors (> 1hp)
  - Generators
  - Relays
  - Transformers
  - Induction heaters
  - Large contactors (i.e., motor starters)
  - Video display devices
  - Lamp dimmers
  - Fluorescent lights

Configuring and troubleshooting protocols

Do not apply line voltage (mains voltage) to the controller's comm ports.

BACnet

BACnet, which stands for Building Automation and Controls network, is a protocol developed by ASHRAE in response to industry concerns about increased networking of BAS components using proprietary communications methods. In the past, these proprietary communications severely limited the building owners' choices for system expansion, upgrade, and replacement. Every major controls vendor in North America, as well as academics, end users, consulting engineers, and government groups, participated in its development.

BACnet has been accepted as an open standard by the American National Standards Institute (ANSI) and the European CEN standards. It is also being adopted as an international ISO standard.

BACnet is designed to include all building systems, lighting, security, fire, heating, ventilation, and air conditioning. Its purpose is to promote interoperability - sharing data between systems made by different vendors.

It provides the necessary tools to develop a specification for systems that are interoperable. BACnet provides methods and standards for representing information, for requesting and interpreting information, and for transporting information.

NOTE The I/O Zone 8112's latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), *OEMCtrl BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=47*.

BACnet over ARC156

ARCnet is an embedded networking technology well-suited for real-time control applications in both the industrial and commercial marketplaces. Its robust performance and the availability of low-cost silicon make it the network of choice in BAS's.

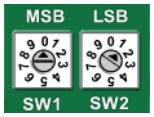
ARC156 is a unique implementation of ARCnet. ARC156 is similar to Master Slave/Token Passing (MS/TP). The main difference between them is speed. ARC156 baud rate is 156 kbps, whereas MS/TP tops out at 76.8 kbps.

Also, ARC156 uses a separate communications co-processor to handle the network traffic and a separate processor to handle the program execution. This provides faster processing of applications and handling of communications on the network. ARC156 is the standard communications method used by our controllers.

Configuring the I/O Zone 8112 for ARC156

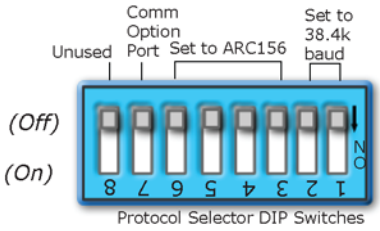
1. Turn off the power for the I/O Zone 8112 by disconnecting power terminals.
2. Using the rotary switches, set a unique address for the controller. Set the **MSB SW1** (**10's**) switch to the tens digit of the address, and set the **LSB SW2** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 01, point the arrow on the **MSB SW1** (10's) switch to 0 and the arrow on the **LSB SW2** (1's) switch to 1.

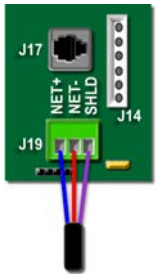


3 Set the Comm Selector DIP switches for ARC156.

The following example shows the DIP switches set for 38.4k baud and BACnet over ARC156.



4 Connect the communications wiring to Comm port **J19** in the screw terminals labeled **Net +**, **Net -**, and **Shld**.



Wiring specifications

The I/O Zone 8112 network can consist of multiple network segments. Each segment of an I/O Zone 8112 network must:

- Be wired in a daisy-chain configuration
- Be no longer than 2000 feet (610 meters)
- Have 32 or fewer devices (controllers and repeaters)

Have one of the following:

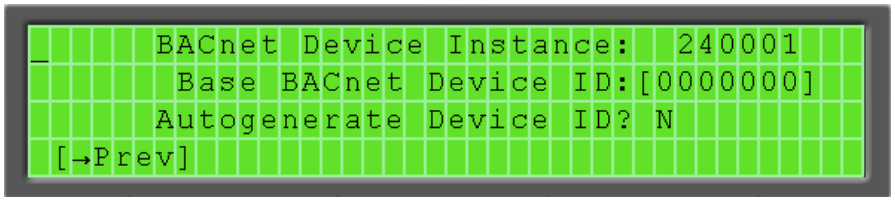
- A BT485 at each end (unless the segment is less than 10 feet [3 meters] long) to add bias and prevent signal distortions due to echoing
- A 1/2 watt, 120 Ohm terminator at each end to prevent signal distortions due to echoing and one DIAG485 near the center of the network segment to add bias. You must put the DIAG485's **Bias** jumper in place.

5 If the I/O Zone 8112 is at either end of a network segment, connect a BT485 to the I/O Zone 8112.

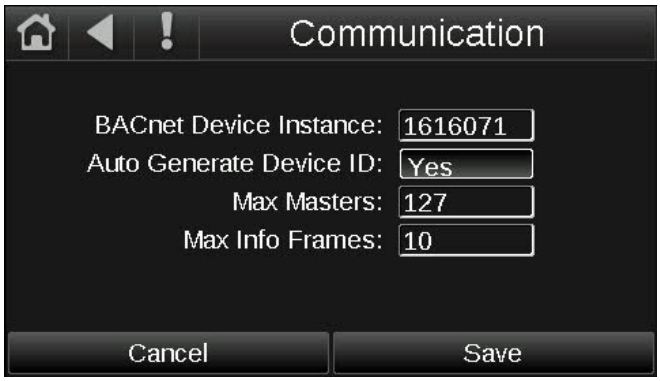
6 Turn on the power for the I/O Zone 8112 by connecting power terminals.

7 Set a unique Device Instance number.

BAC*view*® screen



Equipment Touch screen



Troubleshooting ARC156 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking ARC156 (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2.
- ARC156 protocol DIP switches 5, 6, 7, and 8
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 24XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices, or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Software settings defined via the Equipment Touch or BAC*view*®6 local display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat. On the BAC*view*®6 device, click and hold the FN key and the (.) period key at the same time.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

BACnet MS/TP

BACnet Master Slave/Token Passing or MS/TP is used for communicating BACnet over a sub-network of BACnet-only controllers. Each controller on the network has the ability to hear the broadcast of any other device on the network. The speed of an MS/TP network ranges from 9600 bps to 76.8 kbps.

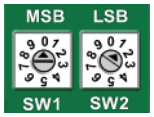
Configuring the I/O Zone 8112 for BACnet MS/TP

1 Turn off the power for the I/O Zone 8112 by disconnecting power terminals.

NOTE Changes made to the switches when the controller is on will not take effect until the power is cycled!

2 Using the rotary switches, set a unique address for the controller. Set the **MSB SW1** (**10's**) switch to the tens digit of the address, and set the **LSB SW2** (**1's**) switch to the ones digit.

EXAMPLE If the controller's address is 01, point the arrow on the **MSB SW1** (10's) switch to 0 and the arrow on the **LSB SW2** (1's) switch to 1.



3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The I/O Zone 8112 is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

Baud Rate	SW3/DS2	SW3/DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800	On	On

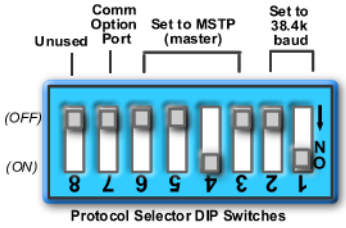
4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for BACnet MS/TP. MS/TP (m) Master is recommended. See table and example below.

5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to MS/TP.

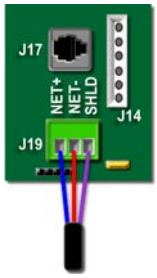
SW3 Protocol Switch Settings for MS/TP

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	Off	On	Off

The following example shows the DIP Switches set for 38.4k, and MS/TP.



6 Connect the communications wiring to Comm port **J19** in the screw terminals labeled **Net +**, **Net -**, and **Shld**.



Wiring specifications

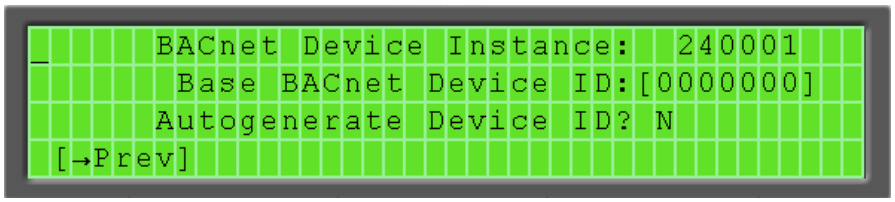
- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Zone 8112

NOTE Use the same polarity throughout the network segment.

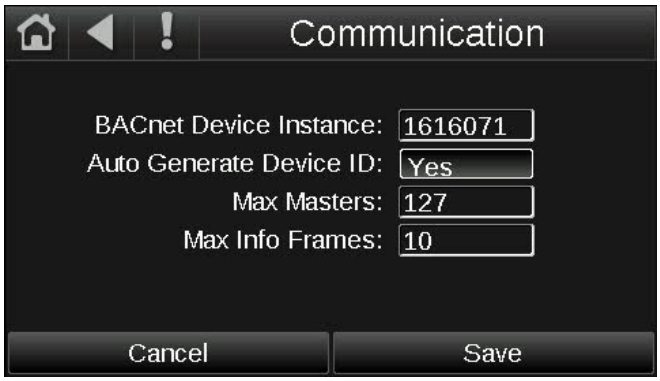
7 Turn on the power for the I/O Zone 8112 by connecting power terminals.

8 Set a unique Device Instance number.

BAC*view*® screen



Equipment Touch screen



Troubleshooting BACnet MS/TP communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *OEMCtrl BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=47*. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking BACnet MS/TP (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2.
- BACnet MS/TP protocol DIP switches 5, 6, 7, and 8
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 24XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices, or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

It may be necessary to adjust the following MS/TP protocol timing settings through the Equipment Touch or BACview®6 device:

Max Masters - defines the highest MS/TP Master MAC address on the MS/TP network.

For example, if there are 3 master nodes on an MS/TP network, and their MAC addresses are 1, 8, and 16, then Max Masters would be set to 16 (since this is the highest MS/TP MAC address on the network).

This property optimizes MS/TP network communications by preventing token passes and “poll for master” requests to non-existent Master nodes.

In the above example, MAC address 16 knows to pass the token back to MAC address 1, instead of counting up to MAC address 127. Each MS/TP master node on the network must have their Max Masters set to this same value. The default is 127.

Max Info Frames - defines the maximum number of responses that will be sent when the I/O Zone 8112 receives the token. Any positive integer is a valid number. The default is 10 and should be ideal for the majority of applications. In cases where the I/O Zone 8112 is the target of many requests, this number could be increased as high as 100 or 200.

Modbus

The Modbus protocol is used mostly in the industrial process market to communicate between PLCs (Programmable Logic Controllers). Although there is no official standard, there is extensive documentation on Modbus and most companies who choose to interface using this protocol follow the same format.

Modbus is not a protocol that is particularly well suited for building management because of its limited master/slave structure. However, many companies offer Modbus as an open protocol solution because it is relatively easy to construct an interface.

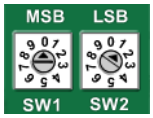
Configuring the I/O Zone 8112 for Modbus RTU

NOTE The controller uses RTU as the default Modbus protocol.

1 Turn off the power for the I/O Zone 8112 by disconnecting power terminals.

2 Using the rotary switches, set a unique address for the controller. Set the **MSB SW1** (**10's**) switch to the tens digit of the address, and set the **LSB SW2** (**1's**) switch to the ones digit.

EXAMPLE If the controller’s address is 01, point the arrow on the **MSB SW1** (10's) switch to 0 and the arrow on the **LSB SW2** (1's) switch to 1.



3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The I/O Zone 8112 is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

Baud Rate	SW3/DS2	SW3/DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800	On	On

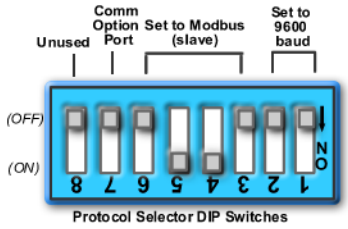
4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for Modbus. See example below.

5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to Modbus.

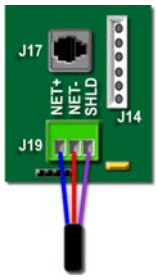
SW3 Protocol Switch Settings for Modbus

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	On	On	Off

The following example shows the DIP Switches set for 9600 baud and Modbus.



6 Connect the Modbus EIA-485 network to the I/O Zone 8112's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Zone 8112

NOTE Use the same polarity throughout the network segment.

7 Turn on the power for the I/O Zone 8112 by connecting power terminals.

Troubleshooting Modbus communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking Modbus (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2.
- Modbus protocol DIP switches 5, 6, 7, and 8
- Proper connection wiring
- Wiring specifications are 18 - 28 AWG; twisted pair, and 50 feet (15.4 meters) maximum
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices, or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

Software settings defined via the Equipment Touch or BAC*view*®6 local display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat. On the BAC*view*®6 device, click and hold the FN key and the (.) period key at the same time.

Modbus Exception Codes that might be returned from this controller

Codes	Name	Description
01	Illegal Function	The Modbus function code used in the query is not supported by the controller.
02	Illegal Data Address	The register address used in the query is not supported by the controller.
04	Slave Device Failure	The Modbus Master has attempted to write to a non-existent register or a read-only register in the controller.

NOTE See Appendix (B) for Modbus Protocol Conformance Statement.

Johnson Controls (N2)

N2 was created by Johnson Controls, Inc.. Though not a standard protocol, N2 is open and available to the public. Johnson Controls is the only company to use N2 bus as their standard network protocol. Because it is open and still prevalent within the industry, N2 is a standard offering for our controllers.

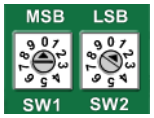
Configuring the I/O Zone 8112 for N2

1. Turn off the power for the I/O Zone 8112 by disconnecting power terminals.

   NOTE Changes made to the switches when the controller is on will not take effect until the power is cycled!

2. Using the rotary switches, set a unique address for the controller. Set the **MSB SW1** (**10's**) switch to the tens digit of the address, and set the **LSB SW2** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 01, point the arrow on the **MSB SW1** (10's) switch to 0 and the arrow on the **LSB SW2** (1's) switch to 1.



3. Set the Comm Selector DIP switches **DS1** and **DS2** for the 9600 baud.

   NOTE Use the same baud rate and communication settings for all controllers on the network segment. The I/O Zone 8112 is fixed at 9600 baud, 8 data bits, No Parity, and 1 Stop bit.

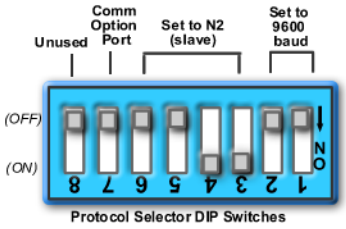
4. Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for N2. See example below.

5. Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to N2.

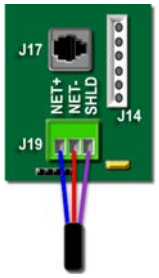
SW3 Protocol Switch Settings for N2

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	Off	On	On

The following example shows the DIP Switches set for 9600 baud and N2.



6 Connect the N2 EIA-485 network to the I/O Zone 8112's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Zone 8112

NOTE Use the same polarity throughout the network segment.

7 Turn on the power for the I/O Zone 8112 by connecting power terminals.

Troubleshooting N2 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking N2 (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2 set to 9600 bps
- N2 protocol DIP switches 5, 6, 7, and 8
- Unique rotary address switches, 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Proper connection wiring

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices, or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

Software settings defined via the Equipment Touch or BAC*view*®6 local display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat. On the BAC*view*®6 device, click and hold the FN key and the (.) period key at the same time.

NOTE See *Appendix (C)* (page 28) for N2 Protocol Conformance Statement

LonWorks®

LonWorks is an open protocol that was developed by Echelon Corporation. It is now maintained by Echelon in collaboration with members of the LonMark Interoperability Association. It requires the use of Echelon's Neuron microprocessor to encode and decode the LonWorks packets.

The LonWorks protocol is based on the concept of using standardized functional profiles to control similar pieces of equipment. OEMCtrl controllers are LonWorks-compatible devices, but are not LonMark devices. A LonMark device has been thoroughly tested by Echelon (LonMark.org) and has been given the LonMark logo indicating compliance with the LonWorks profile specification. All LonMark devices require the use of proprietary hardware manufactured by Echelon Corporation. In order to reduce the cost of adding that hardware on every controller, OEMCtrl formats the data packets in a manner specified by the LonWorks documentation and hands them off to the LonWorks Option Card.

Refer to the Appendix for the LonWorks Protocol Implementation Conformance Statement (PICS).

Configuring the I/O Zone 8112 for LonWorks Option Card

1. Turn off the power for the I/O Zone 8112 by disconnecting power terminals.

   NOTES

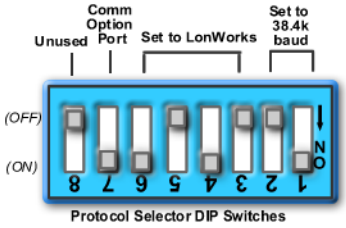
   - Changes made to the switches when the I/O Zone 8112 is on will not take effect until the I/O Zone 8112 has been power cycled!
   - The controller's rotary address switches are not used when the is installed. That's because each has a 48-bit Neuron ID that makes it unique on the LonWorks network.

2. Set the Comm Selector DIP switches **DS1** and **DS2** on **SW3** for 38.4k baud. This is the speed at which the speaks to the I/O Zone 8112. It is fixed at 38.4k.
3. Set the Comm Selector DIP switches **DS3** through **DS6** on **SW3** for LonWorks. See example below.
4. Set the Comm Selector DIP switch **DS7** on **SW3** ON to enable the .
5. Leave Comm Selector DIP switch **DS8** on **SW3** OFF.

SW3 Protocol Switch Settings for LonWorks

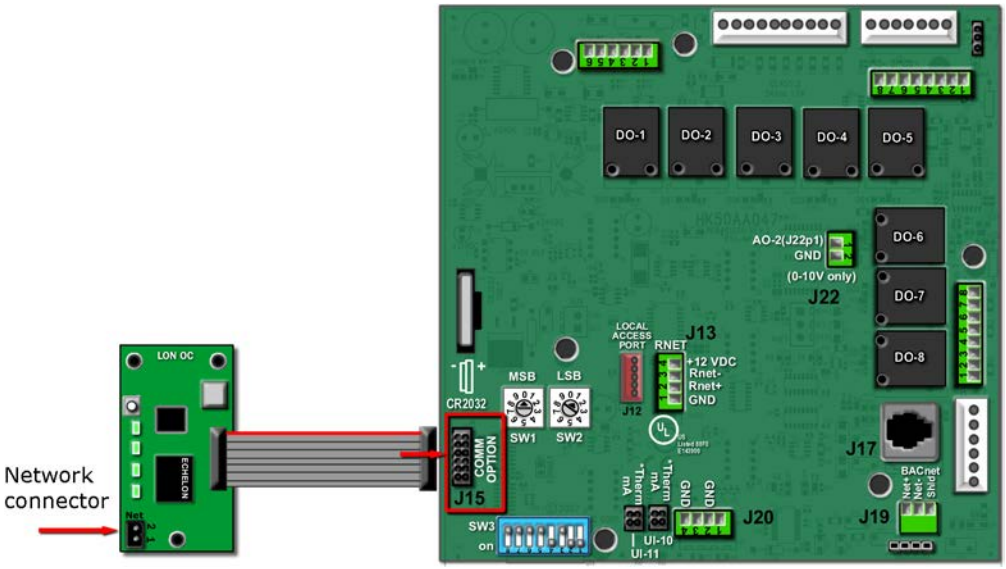
DS8	DS7	DS6	DS5	DS4	DS3
Off	On	On	Off	On	Off

The following example shows the DIP switches set for 38.4k baud and the enabled.



6 Plug the LonWorks Option Card's ribbon cable into Comm Option Port **J15** on the I/O Zone 8112. See illustration below.

CAUTION! The controller must be **OFF** before being connected.



7 Connect LON network to pins **1** and **2** on the Option Card.

Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Zone 8112

NOTE Use the same polarity throughout the network segment.

8 Turn on the power for the I/O Zone 8112 by connecting power terminals.

Commissioning the I/O Zone 8112 for LonWorks

Before a device can communicate on a LonWorks network, it must be commissioned. Commissioning allows the system integrator to associate the device hardware with the LonWorks system's network layout diagram. Together, the I/O Zone 8112 and its LonWorks Option Card serve as a single LonWorks device or node. This is done using the device's unique Neuron ID.

A network management tool such as Echelon's LonMaker is used to commission each device, as well as to assign addressing. Specific instructions regarding the commissioning of LonWorks devices should be obtained from documentation supplied with the LonWorks Network Management Tool.

When a new device is first commissioned onto the LonWorks network, you must upload the device's External Interface File (XIF) information. LonWorks uses the XIF to determine the points (network variables) that are available from a device. The I/O Zone 8112 has a set of predefined network variables. These variables can be bound or accessed by the network management tool. See *Obtaining LonWorks object mapping (XIF file)* (page 18).

The network variables defined on the I/O Zone 8112 Network Variables Property pages determine its XIF information. If any information is changed, added, or deleted on the Network Variable Property pages, the I/O Zone 8112 must be removed from the network management tool's database and recommissioned, including uploading the XIF information again.

There are some issues with LonWorks that should be considered when using the I/O Zone 8112:

Device Configuration Information (XIF)

- When members of the object cache are modified, you must modify the device configuration information (XIF) from that originally imported into the LonWorks Network Management Tool. The new information will not be recognized by the Network Management Tool until it is imported again from the I/O Zone 8112.
- The user must first undefine all of the network variable bindings and the device, recommission the device, and establish the network variable bindings again.
- Modifications to the object cache should be avoided once the device is fully commissioned and operational. Any modifications to the addressing schemes should also be avoided once the I/O Zone 8112 is commissioned.

Address parameters

- If the address parameters are modified, the LonWorks Option Card will be set to **Node Offline**, and **Unconfigured**, which means it no longer communicates with the LonWorks network.
- This does not require deletion or importing the device configuration information again, but does require the device to be recommissioned by the Network Management Tool.

Point configuration

- When the I/O Zone 8112 is first commissioned onto the LonWorks network, you should use the **Browse** features of the Network Management Tool to check the data that is available from the controller.
- Any changes in point count and point configuration should be made prior to performing any further system integration.
- I/O Zone 8112 may be deleted and re-imported as many times as necessary to ensure that the points are correct.

NOTE For these reasons, all parameters on the module driver parameter page should be configured prior to connecting this device to a LonWorks network.

The **Browse** feature of the Network Management Tool also allows you to read real-time values from the I/O Zone 8112. The Tool allows you to test integration prior to binding the I/O Zone 8112's network variables to other LonWorks nodes.

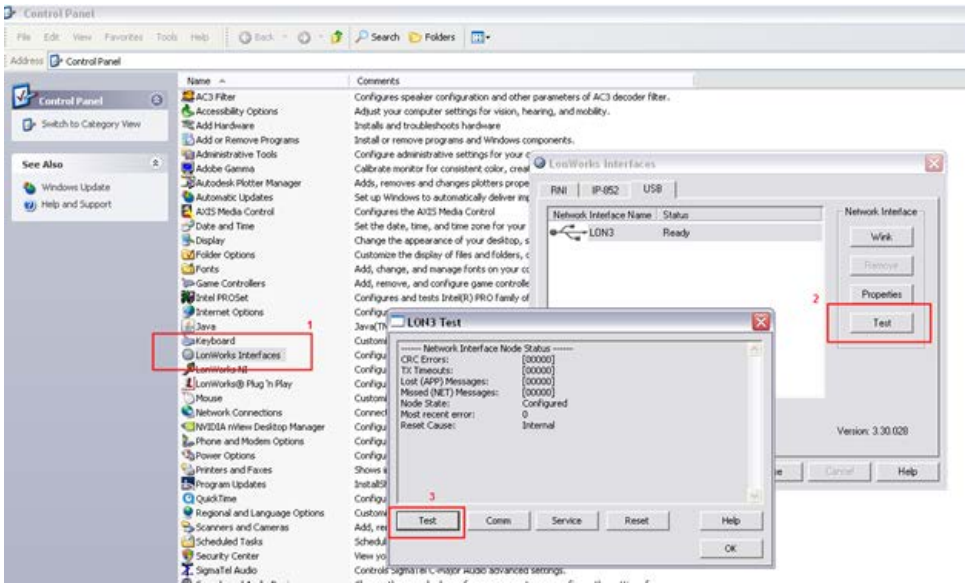
See *Obtaining LonWorks object mapping (XIF) file* (page 18).

Obtaining Lonworks object mapping (XIF file)

1 Install Echelon U10 network interface device using supplied drivers (or visit the *Echelon website* (*http://www.echelon.com*) for driver downloads).

2 Verify proper installation of Echelon U10 network interface device.

1. Navigate to **Control Panel** and select **LonWorks Interfaces**.
2. Select the **USB** tab for a list of available USB network interface devices. Take note of the **Network Interface Name** to use later (**LON3** is the network interface name in the example shown below).
3. Click **Test** in the **LonWorks Interfaces** dialog box.
4. Click **Test** in the **LON3 Test** dialog box. Correct installation and test shown below.



NOTE If U10 installation problems occur, consult your U10 documentation or visit the *Echelon website* (*http://www.echelon.com*) for more assistance.

3 From Windows command prompt, launch **nodeutil** from NodeUtil install directory. Include **-D** and network interface device name in syntax.

The example below shows **LON3** as the network interface device name.

```
C:\BEF\OEM\NodeUtil>nodeutil -DLON3
```

```
Echelon Node Utility Release 1.82
Successfully installed TP/FT-10 network interface.
Welcome to the Echelon Node Utility application.
Activate the service pin on remote device to access it.
Enter one of the following commands by typing the indicated letter:

A -- (A)dd device to list.
D -- Set the (D)omain of the network interface.
E -- (E)xit this application.
F -- (F)ind devices in the current domain.
1 -- Find devices in all (1)-byte domains.
G -- (G)o to device menu....
H -- (H)elp with commands.
I -- Redirect (I)nput from a file.
L -- Display device (L)ist.
M -- Change device (M)ode or state.
O -- Redirect (O)utput to a file.
P -- Send a service (P)in message.
R -- (R)eboot 3150 device.
S -- Report device (S)tatus and statistics.
T -- (T)ransceiver parameters.
V -- Control (V)erbose modes.
W -- (W)ink a device.
Z -- Shell out to command prompt.
NodeUtil>
```

4 Press service pin on the Lon device to see the **Program ID** for the device. (OEMCtrl Program ID defaults to **PROG_ID**.)

```
NodeUtil> Received an ID message from device 1.
Program ID is OEM_Demo
NodeUtil>
```

5 Type **G** to go to device menu. You may be asked to **Enter node id for Neuron data structures (0-1)** - select the Lon device you wish to access, likely node **1**.

```
NodeUtil> (G)o to device menu...
Node ID Neuron ID           Program ID
0       04 30 23 E4 01 00   USBLTA                  *** network interface
1       04 5D 1E E5 02 00   OEM_Demo
Enter node id for Neuron data structures (0-1) [1]      :1
```

6 Type **X** for **Create device interface XIF file** in the device menu for the program in the controller.

```
Enter one of the following commands:
A -- Device (A)ddress table.
B -- (B)uffer configuration.
C -- Application (C)onfiguration structures.
D -- Device (D)omain table.
E -- (E)xit this menu and return to main menu.
F -- Configuration (F)iles.
G -- (G)o to another device.
H -- (H)elp with device commands.
I -- Network variable al(I)as table.
J -- (J)am network variable type.
K -- Chec(K) Neuron executable.
L -- (L)ist network variables.
M -- Change device (M)ode or state.
N -- (N)etwork Variable configuration table.
O -- Redirect (O)utput to a file.
P -- (P)oll network variable.
Q -- (Q)uickly send a message.
R -- (R)ead device memory.
S -- Report device (S)tatus and statistics.
T -- (T)ransceiver parameters.
U -- (U)pdate input network variable.
V -- Control (V)erbose modes.
W -- (W)rite device memory.
X -- Create device interface ((X)IF) file.
Y -- Download Neuron executable.
DEVICE:1> Create device interface ((X)IF) file
------------------------------------------------------------
Self documentation structure length = 308, version number = 0
Number of declared NVs = 17, total NVs = 17, message tags = 3
------------------------------------------------------------
Enter output filename :[OEM_Demo.XIF]
```

Type "X" for create device XIF file

7 Modify output file name as required and/or click **Enter**. The default file name is **PROG_ID.xif** and the file will be saved to the nodeutil install directory. If you changed the **Program ID** parameter on the **Protocol Setup** page in the WebCTRL® for OEMs application, the default XIF file name changes accordingly. When completed, distribute file to the controls contractor as necessary.

Troubleshooting LonWorks communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking LonWorks (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2 set to 38.4 kbps
- LonWorks protocol DIP switches 5, 6, 7, and 8
- LON network terminated on LonWorks Option Card pins 1 and 2
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices, or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Software settings defined via the Equipment Touch or BAC*view*®6 local display. LonWorks network number and device instance. To confirm settings, obtain a Modstat of the device through the Equipment Touch or BAC*view*®6 interface. Click and hold the FN key and the (.) Period key at the same time.

NOTE See *Appendix (D)* (page 29) for the LonWorks Protocol Conformance Statement

Communication LED's

The LED's indicate if the controller is speaking to the devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate the more solid the LED's become.

LEDs	Status
Power	Lights when power is being supplied to the controller. **NOTE** The I/O Zone 8112 is protected by internal solid state Polyswitches on the incoming power and network connections. These Polyswitches are not replaceable, but they will reset themselves if the condition that caused the fault returns to normal.
Rx	Lights when the controller receives data from the network segment; there is an Rx LED for Ports 1 and 2.
Tx	Lights when the controller transits data from the network segment; there is an Rx LED for Ports 1 and 2.
Run	Lights based on controller health.
Error	Lights based on controller health.

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
1 flash per second	1 flash per second, alternating with the **Run** LED	The controller files are archiving. Archive is complete when **Error** LED stops flashing.
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same BACnet network address
2 flashes per second	On	Exec halted after frequent system errors, due to: • The controller halted • Program memory corrupted • Address conflicts • One or more programs stopped
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout

If Run LED shows...	And Error LED shows...	Status is...
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout
On	On	Failure. Try the following solutions: • Turn the I/O Zone 8112 off, then on. • Format the I/O Zone 8112. • Download memory to the I/O Zone 8112. • Replace the I/O Zone 8112.

Compliance

FCC Compliance

This equipment 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. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. 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 own expense.

CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

BACnet® is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of the BACnet Manufacturers Association (BMA). BTL® is a registered trademark of the BMA.

Appendix A: BACnet Protocol Implementation Conformance Statement

Vendor Name: **OEMCtrl**

Product Names: **I/O Zone**

Applications Software Version: **HW_Exec_B** Firmware Revision: **6.0**

BACnet Protocol Revision: **9**

Product Description

The I/O Zone 8112 is a general purpose controller. It provides the communications circuitry, non-volatile memory, and removable screw terminals for I/O connections.

To locate the latest PICS

The I/O Zone 8112's latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), *OEMCtrl BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=47*.

BACnet Standardize Device Profile (Annex K): B-AAC (BACnet Advanced Application Controller)

List of all BACnet Interoperability Building Blocks Supported (Annex K)

DS-RP-B	AE-N-I-B	SCHED-I-B	T-VMT-I-B	DM-DDB-A
DS-RPM-B	AE-ACK-B		T-ATR-B	DM-DDB-B
DS-WP-B	AE-ASUM-B			DM-DOB-A
DS-WPM-B	AE-INFO-B			DM-DOB-B
DS–COV-A	AE-ESUM-B			DM-DCC-B
DS–COV-B				DM-PT-A
DS–COVU-A				DM-PT-B
DS–COVU-B				DM-TS-B
DS-RP-A				DM-UTC-B
DS-RPM-A				DM-RD-B
DS-WP-A				DM-LM-B
DS-WPM-A				DM-R-B

Segmentation Capability

Able to transmit segmented messages: (Yes) Window Size: 1

Able to receive segmented messages: (Yes) Window Size: 1

Standard Object Types Supported

On a separate page, please list each standard Object Type supported (i.e., an object of this type may be present in the product). For each standard Object Type supported provide the following data:

1. Whether objects of this type are dynamically creatable using BACnet's CreateObject service
2. Whether objects of this type are dynamically deletable using BACnet's CreateObject service
3. List of all optional properties supported
4. List of all properties that are writable where not otherwise required by this standard
5. List of proprietary properties and for each its property identifier, datatype, and meaning
6. List of any property range restrictions

BACnet Data Link Layer Options

Data Link Layer Options

☐ BACnet IP, (Annex J)

☐ Able to register as a Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

☐ ANSI/ATA 878.1, 2.5 Mb ARCNET (Clause 8)

XX ANSI/ATA 878.1, RS-485 ARCNET (Clause 8) baud rate(s) 156k baud

XX MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐ MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐ Point-To-Point, modem, (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐ LonTalk, (Clause 11), medium: _____

☐☐ Other:

Device Address Binding Methods Supported

Is static device binding supported? (This is currently necessary for 2-way communication with MS/TP slaves and certain other devices. **XX** Yes

***Networking Options**

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

ARCNET-MS/TP, ARCNET-MS/TP-UDP/IP

☐ Annex H.3, BACnet Tunneling Router over UDP/IP

☐ BACnet/IP Broadcast Messaging Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐Yes ☐No

Character Sets Supported

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

XX ANSI X3.4

XX IBM™/Microsoft™ ☐DBCS

XX ISO 8859-1

XX ISO 10646 (UCS-2)

XX ISO 10646 (ICS-4)

XX JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/networks what the gateway supports: Various protocols, depending on which firmware is loaded.

Appendix B: Modbus Protocol Implementation Conformance Statement

Vendor Name: **OEMCtrl**

Product Names: **I/O Zone 8112**

Product Model Number: and

Applications Software Version: **HW_Exec_B** Firmware Revision: **6.0**

Product Description:

The I/O Zone 8112 is a general purpose building management controller with programmable functionality, designed for controlling rooftop equipment, communicating through multiple protocols. Modbus registers are spawned within the device as a result of downloading graphical control programs. The I/O Zone 8112 controller speaks the Modicon Modbus RTU Protocol as described in the Modicon Modbus Protocol Reference Guide, PI-MBUS-300 Rev.J, and acts as a Modbus Slave. Further details on the Modbus supported implementation are described below.

Serial Transmission Mode:	Supported?
RTU	Slave (Slave is the Default Dipswitch setting)

Communication Types:	Baud rates:	Data Bits:	Parity:	Stop Bits:
2-wire EIA-485,	9600, 19200, 38400, 76800	8	None	1

Function Codes:	Purpose:	Used with Register Numbers:
01 – Read Coil Status	Read Discrete Outputs	00001 - 65535
02 – Read Input Status	Read Discrete Inputs	00001 - 65535
03 – Read Holding Registers	Read Holding Registers	00001 - 65535
04 – Read Input Registers	Read Input Registers	00001 - 65535
05 – Force Single Coil	Write Discrete Outputs (single)	00001 - 65535
06 – Preset Single Register	Write Holding Registers (single)	00001 - 65535
15 – Force Multiple Coils	Write Discrete Outputs	00001 - 65535
16 – Preset Multiple Coils	Write Holding Registers	00001 - 65535

Register Type:	Range:	Function Codes Used with this Register Type:
Float Value (FLOAT)	Single-Precision IEEE floating point value	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Signed Integer (SINT)	-32768 - 32767	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Discrete Input (DI)	0 = Off, 1 = On	2 – Read Input Status

Discrete Output (DO)	0 = Off, 1 = On	1 – Read Coil Status 5 – Force Single Coil 15 – Force Multiple Coils

Appendix C: Johnson Controls N2 Protocol Implementation Conformance Statement

Vendor Name: **OEMCtrl**

Product Names: **I/O Zone 8112**

Product Model Number: and

Applications Software Version: **HW_Exec_B** Firmware Revision: **6.0**

Product Description:

The I/O Zone 8112 is a general purpose building management controller with programmable functionality, designed for controlling rooftop equipment, communicating through multiple protocols. N2 network points are spawned within the device as a result of downloading graphical control programs. The I/O Zone 8112 controller speaks the Johnson N2 Open Protocol as described in the Metasys N2 System Protocol Specification (for Vendors) document, revision 6/13/96, and acts as an N2 Slave. Further details on the N2 supported implementation are described below.

Serial Transmission Mode	Supported?
N2 Open	Slave (Slave is the Default Dipswitch setting)

Communication Types	Baud rates	Data Bits	Parity	Stop Bits
2-wire EIA-485	9600	8	None	1

Network Point Types	
Analog Inputs (AI)	Binary Inputs (BI)
Analog Outputs (AO)	Binary Outputs (BO)
Internal Floats (ADF)	Internal Integers (ADI)
Internal Bytes (BD)	

Protocol Commands	
Identify Device Type	Write Analog Input
Sync Time	Write Binary Input
Poll Without Acknowledge	Write Analog Output
Poll With Acknowledge	Write Binary Output
Read Analog Input	Write Internal Parameter
Read Binary Input	Override Analog Input
Read Analog Output	Override Binary Input
Read Binary Output	Override Internal Parameter
Read Internal Parameter	Override Release Request

Appendix D: LonWorks Protocol Implementation Conformance Statement

Vendor Name: **OEMCtrl**

Product Names: **I/O Zone 8112**

Product Model Number: and

Applications Software Version: **HW_Exec_B** Firmware Revision: **6.0**

Product Description:

The I/O Zone 8112 is a general purpose building automation controller with custom programmable functionality, designed for communicating through multiple protocols. LonWorks network points are spawned within the device as a result of downloading graphical control programs. The I/O Zone 8112 controller speaks the LonWorks Protocol as described by Echelon Protocol Specification. Since the controller is custom programmable it does not conform to LonMark certification. Further details on the LonWorks supported implementation are described below.

The FT 3120 Free Topology Smart Transceiver is fully compatible with the TP/FT-10 channel and can communicate with devices using Echelon's FTT-10A Free Topology Transceiver. The free topology transceiver supports polarity insensitive cabling using a star bus, daisy-chain, loop, or combination topology.

Serial Transmission Mode	Supported?
LonWorks	Master or Slave (Slave is the Default Dipswitch setting)

Communication Types	Baud rates	Data Bits	Parity	Stop Bits
2-wire EIA-485	variable	8	None	1

The controller supports the following SNVT listing as noted by the Echelon Protocol Specification:

SNVT_abs_humid	SNVT_elec_whr	SNVT_mass_kilo	SNVT_speed
SNVT_address	SNVT_elec_whr_f	SNVT_mass_mega	SNVT_speed_f
SNVT_alarm	SNVT_enthalpy	SNVT_mass_mil	SNVT_speed_mil
SNVT_alarm_2	SNVT_evap_state	SNVT_motor_state	SNVT_state
SNVT_amp	SNVT_ex_control	SNVT_muldiv	SNVT_state_64
SNVT_amp_ac	SNVT_file_pos	SNVT_multiplier	SNVT_str_asc
SNVT_amp_f	SNVT_file_req	SNVT_obj_request	SNVT_str_int
SNVT_amp_mil	SNVT_file_status	SNVT_obj_status	SNVT_switch
SNVT_angle	SNVT_fire_indcte	SNVT_occupancy	SNVT_telcom
SNVT_angle_deg	SNVT_fire_init	SNVT_override	SNVT_temp
SNVT_angle_f	SNVT_fire_test	SNVT_ph	SNVT_temp_diff_p
SNVT_angle_vel	SNVT_flow	SNVT_ph_f	SNVT_temp_f
SNVT_angle_vel_f	SNVT_flow_f	SNVT_pos_ctrl	SNVT_temp_p
SNVT_area	SNVT_flow_mil	SNVT_power	SNVT_temp_ror
SNVT_btu_f	SNVT_flow_p	SNVT_power_f	SNVT_temp_setpt
SNVT_btu_kilo	SNVT_freq_f	SNVT_power_kilo	SNVT_therm_mode
SNVT_char_ascii	SNVT_freq_hz	SNVT_ppm	SNVT_time_f
SNVT_char_mega	SNVT_freq_kilohz	SNVT_ppm_f	SNVT_time_hour
SNVT_chlr_status	SNVT_freq_milhz	SNVT_preset	SNVT_time_min
SNVT_color	SNVT_gfci_status	SNVT_press	SNVT_time_passed

SNVT_config_src	SNVT_grammage	SNVT_press_f	SNVT_time_sec
SNVT_count	SNVT_grammage_f	SNVT_press_p	SNVT_time_stamp
SNVT_count_f	SNVT_hvac_emerg	SNVT_privacyzone	SNVT_time_zone
SNVT_count_inc	SNVT_hvac_mode	SNVT_ptz	SNVT_tod_event
SNVT_count_inc_f	SNVT_hvac_override	SNVT_pumpset_mn	SNVT_trans_table
SNVT_ctrl_req	SNVT_hvac_status	SNVT_pumpset_sn	SNVT_turbidity
SNVT_ctrl_resp	SNVT_hvac_type	SNVT_pump_sensor	SNVT_turbidity_f
SNVT_currency	SNVT_ISO_7811	SNVT_pwr_fact	SNVT_valve_mode
SNVT_date_cal	SNVT_length	SNVT_pwr_fact_f	SNVT_vol
SNVT_date_day	SNVT_length_f	SNVT_reg_val	SNVT_volt
SNVT_date_time	SNVT_length_kilo	SNVT_reg_val_ts	SNVT_volt_ac
SNVT_defr_mode	SNVT_length_micr	SNVT_res	SNVT_volt_dbmv
SNVT_defr_state	SNVT_length_mil	SNVT_res_f	SNVT_volt_f
SNVT_defr_term	SNVT_lev_cont	SNVT_res_kilo	SNVT_volt_kilo
SNVT_density	SNVT_lev_cont_f	SNVT_rpm	SNVT_volt_mil
SNVT_density_f	SNVT_lev_disc	SNVT_scene	SNVT_vol_f
SNVT_dev_c_mode	SNVT_lev_percent	SNVT_scene_cfg	SNVT_vol_kilo
SNVT_earth_pos	SNVT_lux	SNVT_setting	SNVT_vol_mil
SNVT_elapsed_tm	SNVT_magcard	SNVT_smo_obscur	SNVT_zerospan
SNVT_elec_kwh	SNVT_mass	SNVT_sound_db	
SNVT_elec_kwh_1	SNVT_mass_f	SNVT_sound_db_f	

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