CDN572-5
DEVICENET
SPECIFICATIONS

TABLE OF CONTENTS

CDN572-5 DEVICE

CDN572-5 DEVICE

Revision History

Revision	Description of changes	Date
1.0	Preview Release	06/27/01
2.0	Production Release	06/07/02
2.1	Added DNet baudrate info and fixed some minor text	03/20/07

CDN572-5 Overview

The CDN572-5 (Mixed I/O) device operates as a slave on the DeviceNet network. The unit supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. It does not support the Unconnected Message Manager (UCMM).

The CDN572-5 device supports 24 digital outputs with read-back capability, which may also be configured as an input, 8 analog inputs, and 8 analog outputs.

Onboard thermal management provides constant temperature monitoring and autonomous control for a status LED.

A configuration object (Class 100) allows the unit to be configured to provide a variable number of digital inputs, digital outputs, analog inputs and analog outputs.

Hardware

Processor

The processor section is powered from an isolated DC-DC power supply powered from the regulated +5 Vdc derived from the DeviceNet power. The Processor section is isolated from the DeviceNet and Digital I/O.

DeviceNet Interface

The DeviceNet interface is isolated through HCPL0710 opto-couplers to an 82C251 CAN transceiver. The Can transceiver is powered from a DC-DC converter driven by the DeviceNet power. The DeviceNet signals are routed to the round 5-pin DIN connector.

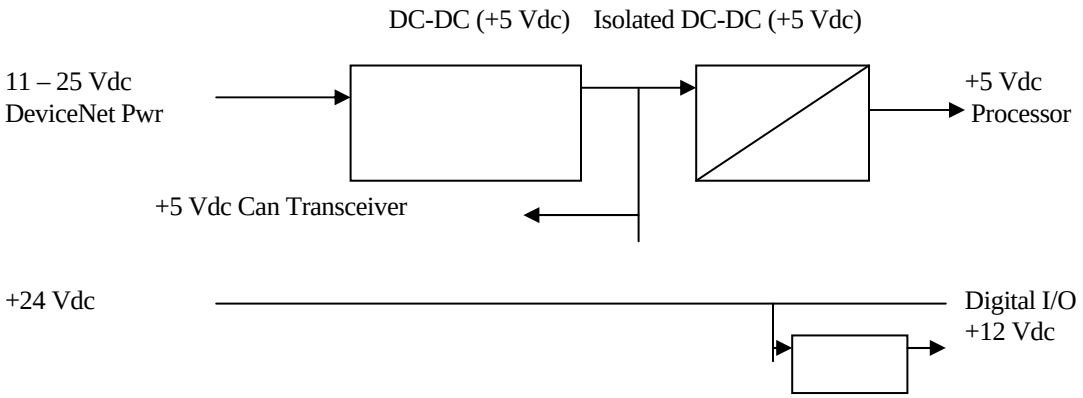
Rotary switches are mounted on the card to select the MacID and baud rates.

Standard Red/Green DeviceNet Network and Module status LED’s are mounted on the front of the board.

CDN572-5 DEVICE

Power Distribution

Power for the module is derived from the DeviceNet power (11 – 25 Vdc). Isolated DC-DC converters are used to derive secondary power requirements and to maintain isolation between the subsystems. The Digital I/O circuitry is fully isolated from the Processor and is powered by an external +24 Vdc source.



Switches and Indicators

The CDN572-5 includes Green digital I/O status LED's which are wired directly to the I/O points. The LED is ON if the corresponding I/O point is ON.

Two DeviceNet indicators are provided, Network Status and Device Status per the ODVA DeviceNet specification.

CDN572-5 DEVICE

A status indicator is provided to indicate when adequate voltage has been applied to the +24 Vdc power used for digital I/O and if the unit has exceeded and over temperature condition. The status LED is as follows:

Color	Status
OFF	Module is okay.
GREEN	I/O Voltage below 18 V DC
RED	Temperature exceeded High Temperature Threshold.
ORANGE	I/O Voltage below 18 V DC and temperature exceeded High Temperature Threshold.

MacID/BaudRate

Two BCD switches are installed on the board to allow setting the MacID. These switches are accessible through the front panel. Values greater than 63 result in the switch being disabled and the last valid switch value will be used. The switches are read only during power up.

One BCD switch is installed on the board to allow setting the Data Rate. Valid Data Rates are 0 to 2. Setting the switch address to a value greater than 2 will disable the switch and allow software setting of the Data Rate. The software setting defaults to the last hardware setting. The switch is only read during power up.

Connectors

The CDN572-5 has 2 connector sets: a 44-pin D connector and a 62-pin D connector.

CDN572-5 DEVICE

44-Pin D Connector

Pin	Description	Pin	Description	Pin	Description
1	DIO 1	**16**	+ 24 V DC IN	**31**	DIO 2
2	DIO 3	**17**	+ 24 V DC IN	**32**	DIO 4
3	DIO 5	**18**	+ 24 V DC IN	**33**	DIO 6
4	DIO 7	**19**	+ 24 V DC IN	**34**	DIO 8
5	DIO 9	**20**	+ 24 V DC IN	**35**	DIO 10
6	DIO 11	**21**	+ 24 V DC IN	**36**	DIO 12
7	DIO 13	**22**	24 V RET	**37**	DIO 14
8	DIO 15	**23**	24 V RET	**38**	DIO 16
9	DIO 17	**24**	24 V RET	**39**	DIO 18
10	DIO 19	**25**	24 V RET	**40**	DIO 20
11	DIO 21	**26**	24 V RET	**41**	DIO 22
12	DIO 23	**27**	24 V RET	**42**	DIO 24
13	+ 24 V DC IN	**28**	24 V RET	**43**	
14	D NET V+	**29**	D NET V-	**44**	
15		**30**			

CDN572-5 DEVICE

62-Pin D Connector

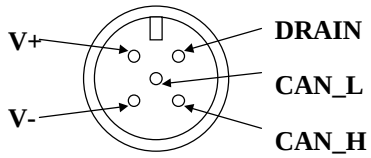
Analog I/O
Female High Density 62-pin D SUB Connector.

Pin	Description	Pin	Description	Pin	Description
1	Ain 1	**22**		**43**	Aout 1
2	AGND	**23**		**44**	AGND
3	Ain 2	**24**		**45**	Aout 2
4	AGND	**25**		**46**	AGND
5	Ain 3	**26**		**47**	Aout 3
6	AGND	**27**		**48**	AGND
7	Ain 4	**28**		**49**	Aout 4
8	AGND	**29**		**50**	AGND
9	Ain 5	**30**		**51**	Aout 5
10	AGND	**31**		**52**	AGND
11	Ain 6	**32**		**53**	Aout 6
12	AGND	**33**		**54**	AGND
13	Ain 7	**34**		**55**	Aout 7
14	AGND	**35**		**56**	AGND
15	Ain 8	**36**		**57**	Aout 8
16	AGND	**37**		**58**	AGND
17		**38**		**59**	
18		**39**		**60**	
19		**40**		**61**	-15 V In
20	+15 V In	**41**	AGND	**62**	-15 V In
21	+15 V In	**42**	AGND		

CDN572-5 DEVICE

DeviceNet Interface

Male 5-Pin Micro Connector



PIN	SIGNAL	COLOR	DESCRIPTION
1	DRAIN	NONE	Cable shield or drain wire.
2	V+	RED	DeviceNet 24VDC(+) power.
3	V-	BLACK	DeviceNet 24VDC(-) power.
4	CAN_H	WHITE	Communication signal.
5	CAN_L	BLUE	Communication signal.

CDN572-5 DEVICE

Specifications

Specification	Min	Typ.	Max	Description/notes
DeviceNet				ISO 11898 transceiver, optically coupled
MacID	0		63	Hardware settable (switch), Software settable
Data Rate	125		500	Kbit/second, hardware or software settable
Vpwr	11		25	Vdc
Ipwr		170	200	mA at 24 Vdc
Digital Inputs				24 Channels, linked to Digital Outputs
Ion	-2			mA
Ioff			-1	mA – Corresponding output must be in OFF state
Vin	-1		28	Vdc
Digital Outputs				24 Channels, linked to Digital Inputs
Ion		100	200	Individual channels will drive up to 200 mA. Dissipation should be limited to 800 mA for each group of 8 channels, averaging 100 mA / channel.
Ioff			.1 mA	Off leakage current for voltages less than V_{DIO}
V_{OL}		.9 1.1	1.1 1.2	@ 100 mA load @ 200 mA load
Digital Power				
V_{DIO}	18	24	28	Vdc.
I_{DIO}		200	2600	MA at 24 Vdc(all outputs sinking 100 mA)
Analog Inputs				8 Channels
Resolution			12	Bits
Input Range				0-5, 0-10, +/-5, +/-10 Vdc
Filtering				16 hertz, low pass
Impedance			1 M	Ohms input impedance
Input Error	-2	0	+2	Analog Input error is nor more than +/- 2LSB.
Analog Outputs	0	8	8	8 Channels
Resolution			12	Bits
Output Range	-10		+10	-10 to +10 Vdc
Output Drive	-5		+5	mA
Output Error	-2	0	+2	Analog Output error is no more than +/- 2 LSB.

CDN572-5 DEVICE

Analog Power				
V+ AIO	14.25	15	15.25	Vdc
V AIO	-15.25	-15	-14.25	
I + AIO		28	70	mA
I – AIO		-29	-70	mA

CDN572-5 DEVICE

Firmware

The CDN572-5 supports DeviceNet using ODVA standard Digital Input Points (DIP's), Digital Output Points (DOP's), Analog Input Points (AIP's), and Analog Output Points (AOP's). The unit operates as a group II Slave. Additional objects include a User Defined configuration object and the S-Device Supervisor object.

DeviceNet Message Types

The CDN572-5 supports the following Group 2 message types.

CAN IDENTIFIER	GROUP 2 Message Type
10xxxxxx111	Duplicate MACID Check Message
10xxxxxx110	Unconnected Explicit Request Message
10xxxxxx101	Master I/O Poll Command Message
10xxxxxx100	Master Explicit Request Message

xxxxxx = Node Address

The CDN572-5 supports the Group 4 Offline Connection set.

CAN IDENTIFIER	GROUP 2 Message Type
11111101100	Communication Faulted Response Message
11111101101	Communication Faulted Request Message
11111101110	Communication Ownership Response Message
11111101111	Communication Ownership Request Message

DeviceNet Class Services

The CDN572-5 supports the following class services and instance services.

SERVICE CODE	SERVICE NAME
05 (0x05)	Reset
14 (0x0E)	Get Attribute Single
16 (0x10)	Set Attribute Single
75 (0x4B)	Allocate Group 2 Identifier Set
76 (0x4C)	Release Group 2 Identifier Set

CDN572-5 DEVICE

DeviceNet Object Classes

The CDN572-5 device supports the following DeviceNet object classes.

CLASS CODE	OBJECT TYPE
01 (0x01)	Identity
02 (0x02)	Router
03 (0x03)	DeviceNet
04 (0x04)	Assembly
05 (0x05)	Connection
08 (0x08)	Digital Input Point
09 (0x09)	Digital Output Point
10 (0x0a)	Analog Input Point
11 (0x0b)	Analog Output Point
48 (0x30)	S-Device Supervisor Object
100 (0x64)	Configuration Object

CDN572-5 DEVICE

Identity Object -- Class Code: 01 (0x01)

The Identity Object is required on all devices and provides identification of and general information about the device.

Identity Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	8

Identity Object Instance 1 Attributes

Attribute	Access	Name	Type	Value
1	Get	Vendor	UINT	59
2	Get	Product Type	UINT	100 = Vendor Specific
3	Get	Product Code	UINT	9157
4	Get	Revision	STRUCT OF	See below
		Major Revision	USINT	2
		Minor Revision	USINT	1
5	Get	Device Status	UINT	See below.
6	Get	Serial Number	UINT	See below.
7	Get	Product Name	STRUCT OF	
		Length	USINT	8
		Name	STRING [6]	CDN572-5
8	Get	State	USINT	See below.

Identity Object Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single

CDN572-5 DEVICE

Identity Object Attributes

Product Code – Attribute 3

The Product code is fixed at 9157 for the CDN572-5. The product code is used within the Electronic Data Sheet format to uniquely identify the product type.

Revision Information – Attribute 4

MKS/D.I.P. maintains strict version control. The major revision number will increment as functional enhancements are implemented. The minor firmware revision control number is incremented if minor changes are incorporated.

Device Status – Attribute 5

Bit Number	Name	Meaning
0	Owned	= 0, not owned = 1, allocated
1	Reserved	
2	Configured	= 0, not configured – this bit is not supported
3	Reserved	
4-7	User defined	
8	Minor Recoverable fault	= 0, no fault = 1, minor recoverable faults (DOP short circuit)
9	Minor Unrecoverable fault	= 0, no fault = 1, minor unrecoverable faults
8	Major Recoverable fault	= 0, no fault = 1, major recoverable faults (Loss of +24 Vdc)
9	Major Unrecoverable fault	= 0, no fault = 1, major unrecoverable faults (Checksum)
12-15	Reserved	

Serial Number – Attribute 6

The serial number is encoded in the product during the manufacturing cycle and is guaranteed to be unique across all product lines produced by MKS/D.I.P.

CDN572-5 DEVICE

Device Name – Attribute 7

The Device Name provides a character array containing the short string CDN572-5.

Device State – Attribute 8

The Device State reflects whether any errors have occurred and the severity. The following states are supported. The only exit from a Major Unrecoverable fault condition is power cycling the device.

State	Interpretation	Causes
0	Non-existent	
1	Self Test	
2	Standby	
3	Operating	Normal operating mode
4	Major Recoverable fault	Loss of +24 Vdc power
5	Major Unrecoverable fault	Memory Checksum failure

Router Object -- Class Code: 02 (0x02)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

Router Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	2

Router Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
2	Get	Number of Connections	UINT	2

Router Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single

DeviceNet Object -- Class Code: 03 (0x03)

The DeviceNet Object defines how the node interfaces to the DeviceNet system.

DeviceNet Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

DeviceNet Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
1	Get/Set	MACID	USINT	See Below
2	Get/Set	Baud Rate	USINT	See Below
3	Get/Set	Bus Off Interrupt	BOOL	See Below
4	Get/Set	Bus Off Counter	USINT	See Below
5	Get/Set	Allocation Information	STRUCT of	See Below
		Choice Byte	BYTE	
		Master Node Addr.	USINT	
6	Get	Mac Switch Changed	BOOLEAN	See Below
7	Get	Baud Switch Changed	BOOLEAN	See Below
8	Get	Current Mac Switch	USINT	See Below
9	Get	Current Baud Switch	USINT	See Below

DeviceNet Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single
75 (0x4B)	No	Yes	Allocate Master/Slave
76 (0x4C)	No	Yes	Release Master/Slave

CDN572-5 DEVICE

DeviceNet Object Attributes

MacID – Attribute 1

The MACID is set using two BCD rotary switches located on the module. Valid MACID addresses are 0 to 63 (0 to 3F Hex). Setting the address to a value greater than 63 will disable the hardware configuration and allow software setting of the MACID. The software setting defaults to the last hardware setting. The hardware is only read during power up.

Data Rate – Attribute 2

The Data Rate is set using one BCD rotary switch located on the module. Valid Data Rates are 0 to 2. Setting a value greater than 2 will disable the hardware configuration and allow software setting of the Data Rate. The software setting defaults to the last hardware setting. The switch is only read during power up.

Switch Setting	Data Rate
0	125k
1	250k
2	500k
3-9	PGM

Bus Off Interrupt – Attribute 3

Bus Off Interrupt (BOI) determines the action if a Bus Off state is encountered.

BOI	Action
0	Hold chip in OFF state (default)
1	If possible reset CAN chip

Bus Off Counter – Attribute 4

Bus Off Counter will be forced to 0 whenever set regardless of the data value provided.

Allocation Byte – Attribute 5

Allocation_byte

bit 0	explicit	set to 1 to allocate
bit 1	polled	set to 1 to allocate
bit 2-7	reserved (always 0)	

Mac Switch Changed – Attribute 6

The Mac Switch Changed flag will be set if the Mac Switch has changed since the last power up sequence. Note that if the Mac Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute will result in an ‘Attribute Not Supported’ error response.

Baud Switch Changed – Attribute 7

The Baud Switch Changed flag will be set if the Baud Switch has changed since the last power up sequence. Note that if the Baud Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute will result in an ‘Attribute Not Supported’ error response.

Mac Switch Value – Attribute 8

The Mac Switch Value attribute returns the actual state of the Mac Switch. Note that if the Mac Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute will result in an ‘Attribute Not Supported’ error response.

Baud Switch Value – Attribute 9

The Baud Switch Value attribute returns the actual state of the Baud Switch. Note that if the Baud Switch is set in the ‘disabled’ or ‘program’ position it is considered to be removed from the circuit and reading this attribute will result in an ‘Attribute Not Supported’ error response.

Assembly Object -- Class Code: 04 (0x04)

The Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

Assembly Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Class ID	UINT	101

Assembly Object, Instance 100 Attributes

Attribute	Access	Name	Type	Value
3	Get	Data	STRUCT of	
		Supervisor Status	BYTE	See Configuration Class
		Temperature	SINT	See Configuration Class
		Digital Inputs	BYTE	See Configuration Class
		Pad Byte	BYTE	See Configuration Class
		Analog Inputs	INT or UINT	See Configuration Class

Assembly Object, Instance 101 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Data	STRUCT of	See Below
		Digital Outputs	BYTE	See Configuration Class
		Pad Byte	BYTE	See Configuration Class
		Analog outputs	INT or UINT	See Configuration Class

Assembly Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Assembly Instance 100

Assembly instance 100 is used to generate the POLL response packet and consists of a variable number of bytes as determined by the configuration object.

CDN572-5 DEVICE

Device Supervisor Exception Status Byte

The Device Supervisor Exception Status byte, if included, provides overall information on the device as defined in the Device Supervisor object.

Operating Temperature

The Temperature value, if included, provides the current operating temperature of the module as defined in the Configuration object.

Digital Inputs

The digital input byte(s) provide information on the digital input states. The number of bytes included is defined in the configuration object.

Pad Byte

The pad byte, if included, provides a single byte pad to ensure that the analog input values are positioned on an even byte boundary. The value is always 0x00.

Analog Inputs

The number of analog inputs included is defined in the configuration object. The analog inputs are presented as low byte, followed by high byte.

CDN572-5 DEVICE

Example Byte Layout:

This example shows full support for the polled I/O response.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	S-Device Supervisor Exception Status							
1	Operating Temperature							
2	DI 8	DI 7	DI 6	DI 5	DI 4	DI 3	DI 2	DI 1
3	DI 16	DI 15	DI 14	DI 13	DI 12	DI 11	DI 10	DI 9
4	DI 24	DI 23	DI 22	DI 21	DI 20	DI 19	DI 18	DI 17
5	Pad Byte = 0x00							
6	AI 1 (Low Byte)							
7	AI 1 (High Byte)							
8	AI 2 (Low Byte)							
9	AI 2 (High Byte)							
10	AI 3 (Low Byte)							
11	AI 3 (High Byte)							
12	AI 4 (Low Byte)							
13	AI 4 (High Byte)							
14	AI 5 (Low Byte)							
15	AI 5 (High Byte)							
16	AI 6 (Low Byte)							
17	AI 6 (High Byte)							
18	AI 7 (Low Byte)							
19	AI 7 (High Byte)							
20	AI 8 (Low Byte)							
21	AI 8 (High Byte)							

CDN572-5 DEVICE

Assembly Instance 101

Assembly instance 101 is used to consume the POLL request packet and consists of a variable number of digital output states, the desired analog input range selection, padding bytes and a variable number of analog output values as determined by the configuration object.

Digital Outputs

The digital output byte(s) set the state of the digital outputs. The number of bytes included is defined in the configuration object.

Pad Byte

The pad byte, if included, provides a single byte pad to ensure that the analog output values are positioned on an even byte boundary. Any value can be used as a pad byte.

Analog Outputs

The number of analog inputs included is defined in the configuration object. The analog outputs are presented as low byte, followed by high byte.

CDN572-5 DEVICE

Example Byte Layout

This example shows full support for the polled I/O request

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	DO 8	DO 7	DO 6	DO 5	DO 4	DO 3	DO 2	DO 1
1	DO 16	DO 15	DO 14	DO 13	DO 12	DO 11	DO 10	DO 9
2	DO 24	DO 23	DO 22	DO 21	DO 20	DO 19	DO 18	DO 17
3	Pad Byte							
4	AO 1 (Low Byte)							
5	AO 1 (High Byte)							
6	AO 2 (Low Byte)							
7	AO 2 (High Byte)							
8	AO 3 (Low Byte)							
9	AO 3 (High Byte)							
10	AO 4 (Low Byte)							
11	AO 4 (High Byte)							
12	AO 5 (Low Byte)							
13	AO 5 (High Byte)							
14	AO 6 (Low Byte)							
15	AO 6 (High Byte)							
16	AO 7 (Low Byte)							
17	AO 7 (High Byte)							
18	AO 8 (Low Byte)							
19	AO 8 (High Byte)							

Connection Object -- Class Code: 05 (0x05)

The Connection Objects manage the characteristics of each communication connection. As a Group II Only Slave device the unit supports one explicit message connection and a POLL message connection.

Connection Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

Connection Object, Instance 1 Attributes (Explicit Message)

Attribute	Access	Name	Type	Value
1	Get	State	USINT	See Below
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Production Connection	UINT	See Below
5	Get	Consumed Connection	UINT	See Below
6	Get	Initial Comm. Char.	USINT	0x21
7	Get	Production Size	UINT	128
8	Get	Consumed Size	UINT	128
9	Get/Set	Expected Packet Rate	UINT	default 2500 msec
12	Get/Set	Timeout Action	USINT	See Below
13	Get	Prod. Path Length	USINT	0
14	Get	Production Path		(null)
15	Get	Cons. Path Length	USINT	0
16	Get	Consumed Path		(null)

Connection Object, Instance 2 Attributes (POLL connection)

Attribute	Access	Name	Type	Value
1	Get	State	USINT	(1)
2	Get	Instance Type	USINT	1 = I/O Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Production Connection	UINT	See Below
5	Get	Consumed Connection	UINT	See Below
6	Get	Initial Comm. Char.	USINT	0x1
7	Get	Production Size	UINT	See Configuration Class
8	Get	Consumed Size	UINT	See Configuration Class
9	Get/Set	Expected Packet Rate	UINT	default 2500 msec
12	Get/Set	Timeout Action	USINT	See Below
13	Get	Prod. Path Length	USINT	6
14	Get	Production Path	STRUCT of	
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log.Seg., Instance	USINT	0x24
		Instance Number	USINT	0x100
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03
15	Get	Cons. Path Length	USINT	6
16	Get	Consumed Path	STRUCT of	
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log.Seg., Instance	USINT	0x24
		Instance Number	USINT	0x101
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03

Connection Object Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	Yes	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Connection Object Attributes

Connection Status – Attribute 1

Connection State	Interpretation
0	Non-existent
1	Configuring
3	Established
4	Timed Out

Connection ID – Attribute 4 and 5

Connection 1 Produced Connection ID: 10xxxxxx011
Connection 1 Consumed Connection ID: 10xxxxxx100

Connection 2 Produced Connection ID: 01111xxxxxx
Connection 2 Consumed Connection ID: 10xxxxxx101

xxxxxx = Node Address.

Watch Dog Activity – Attribute 9

Watch Dog Timeout Activity:

0 = Timeout (I/O Messaging default)
1 = Auto Delete (Explicit Messaging, fixed value)
2 = Auto Reset

Discrete Input Point (DIP) Object -- Class Code: 08 (0x08)

The Discrete Input Point (DIP) Object models discrete inputs in a product. You can use this object in applications as complex as a discrete I/O control module. There is a separate instance for each discrete input available on the device.

DIP Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max Object Instance	UINT	24
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	4

DIP Object, Instance 1..24 Attributes

Attribute	Access	Name	Type	Value
3	Get	Value	BOOL	0 == OFF, 1 == ON
4	Get	Status	BOOL	0 == okay, 1 == fault

DIP Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single

DIP Object Attributes

Input State – Attribute 3

Attribute 3 provides the state of the specific digital input. A value of 0 indicates an OFF state and a value of 1 indicates an ON state. The Digital inputs provide feedback of the digital output states. If the corresponding output state is set to 0 these points may be used as inputs.

Input Status – Attribute 4

The Input status bit indicates if an error has occurred associated with a physical input. If the +24 Vdc power is not present the circuitry cannot accurately determine the state of the inputs and will set the Input Status bits of inputs 1..24. The status bits are cleared when the +24 Vdc power is restored.

Discrete Output Point (DOP) Object -- Class Code: 09 (0x09)

The Discrete Output Point (DOP) Object models discrete outputs in a product. You can use this object in applications as. There is a separate instance for each discrete output available on the device.

DOP Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	24
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	8

DOP Object, Instance 1..24 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Value	BOOL	State of Output
4	Get	Status	BOOL	Status of Output
5	Get/Set	Fault State	BOOL	0=fault value, 1=no chg
6	Get/Set	Fault Value	BOOL	0=Off, 1=On
7	Get/Set	Idle State	BOOL	0=Idle value, 1=no chg
8	Get/Set	Idle Value	BOOL	0=Off, 1=On

DOP Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

DOP Object Attributes

Output State – Attribute 3

The digital outputs are active low. Setting a DOP state to 1 forces the corresponding output pin low. The state of each DOP may be read back using the DOP state or the corresponding DIP state. The DIP state reflects the state of the I/O pin. If an I/O point is to be used as an input the corresponding DOP state must be set to 0 (off).

Output Status – Attribute 4

The output status bit indicates a fault condition. The output status will be set to 1 if the I/O power drops below 18 Vdc or if a short circuit condition is detected on any of the outputs. The low voltage status bit may be read through Class 64, Instance 1, Attribute 7. Determining which particular output is shorted may be done through examining the state of the individual DOP and corresponding DIP I/O points. If a DOP is ON and the corresponding DIP is OFF it indicates a short condition.

Fault State – Attribute 5

The Fault State determines what action is taken if a software fault condition is detected due to a connection timeout.

Fault State	Action Taken
0	Set the output to the stated determined by the Fault Value
1	Leave the output in the current state

Fault Value – Attribute 6

The Fault Value determines the state of the DOP output if the Fault State bit is clear and a fault condition occurs.

Idle State – Attribute 7

The Idle State determines what action is taken if an idle condition is detected. Idle conditions occur if a Poll request packet is received with less than the calculated number of bytes. Refer to the Configuration object to determine the size of the Poll Request packets. A poll request of 0 bytes is typically used to force an idle condition.

Idle State	Action Taken
0	Set the output to the stated determined by the Idle Value
1	Leave the output in the current state

Idle Value – Attribute 8

The Fault Value is used to set the output if the Idle State bit is clear and an idle condition occurs.

Analog Input Point (AIP) Object -- Class Code: 10 (0x0A)

The CDN572-5 supports 8 X 12 Bit analog inputs. There is a separate instance for each discrete input available on the device.

AIP Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	8
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance	UINT	8

AIP Object, Instance 1..8 Attributes

Attribute	Access	Name	Type	Value
3	Get	Value	See Value Data Type	See Below
4	Get	Status	BOOLEAN	0 = ok, 1 = Fault
7	Get/Set	Range	USINT	See below
8	Get/Set	Value Data Type	USINT	See below

Common Services

Service Code	Class	Instance	Service Name
14 (0x0e)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

AIP Object Attributes Value - Attribute 3

Analog input values are reported based on the Type and Range attributes.

TYPE	0=INT	6=UINT	0=INT	6=UINT	0=INT	6=UINT	0=INT	6=UINT
RANGE	0 = +/- 10 Vdc	0 = +/-10 Vdc	1 = 0-5 Vdc	1 = 0-5 Vdc	2 = 0-10 Vdc	2 = 0-10 Vdc	6 = +/-5 Vdc	6 = +/-5 Vdc
-10 Vdc	F800	0000	0000	0000	0000	0000	F800	0000
-5 Vdc	FC00	0400	0000	0000	0000	0000	F800	0000
0 Vdc	0000	0800	0000	0000	0000	0000	0000	0800
5 Vdc	0400	0C00	0FFF	0FFF	0800	0800	07FF	0FFF
10 Vdc	07FF	0FFF	0FFF	0FFF	0FFF	0FFF	07FF	0FFF

Status – Attribute 4

If the analog input status bit is set it indicates that a hardware fault has occurred during the previous analog read. The value is left at the last valid value read. A fault during the analog input function results in a Major Unrecoverable Fault condition (see Identity object).

Range – Attribute 7

The AIP Range value is used when performing Explicit Message reads to the AIP or during POLLING in the CDN572-5 unit. The AIP Range values are retained in E2 memory.

The poll request range information is not retained in E2 memory but does set the operating range for all subsequent reads until either the AIP range value is changed or until a power on cycle occurs at which time the E2 memory values are restored.

Range Value	Range Byte (bit)	Description
0	0	-10 to +10 Volts
1		0 to +5 Volts
2		0 to +10 Volts
6	1	-5 to +5 Volts

This attribute is settable for either unsigned integer UINT or signed integer INT operation.

Type Attribute	Description
0	INT – signed integer
6	UINT - unsigned integer

Analog Output Point (AOP) Object -- Class Code: 11 (0x0B)

The CDN572-5 supports 8 X 12 bit Analog Output Point (AOP). There is a separate instance for each discrete output available on the device.

AOP Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	8
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	12

AOP Object, Instance 1..8 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Value	See Value Data Type	See Below
4	Get	Status	USINT	0 = OK 1 = Fault
7	Get/Set	Output Range	BYTE	3 = (-10 to +10)
8	Get/Set	Value Data Type	BOOLEAN	See Below
9	Get/Set	Fault State	BYTE	0..3
10	Get/Set	Idle State	BYTE	0..3
11	Get/Set	Fault Value	INT	See Below
12	Get/Set	Idle Value	INT	See Below

AOP Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

AOP Object Attributes Value – Attribute 3

The interpretation of the analog output value depends on the Value Data Type (Attribute 8) setting. When operating in the INT mode the following scaling is performed. Note that all values are interpreted as 12 bit signed integers.

	INT	UINT
Output Voltage	Type == 0 (INT)	Type == 6 (UINT)
-10	F800H = -2048	0000H = 0
-5	FC00H = -1024	0400H = 1024
0	0000H = 0	0800H = 2048
5	0400H = 1024	0C00H = 3072
10	07FFH = 2047	0FFFH = 4095

Range – Attribute 7

The analog output Range is fixed as 3 (-10 to +10 Vdc).

Type – Attribute 8

This attribute is settable for either unsigned integer UINT or signed integer INT operation.

Type Attribute	Description
0	INT – signed integer
6	UINT - unsigned integer

Fault State – Attribute 9

The Fault State determines what action is taken if a fault condition is detected. Fault conditions include software conditions (connection timeout).

Fault State	Action Taken
0	Hold the last value
1	Set to low limit (-10 Vdc)
2	Set to high limit (+10 Vdc)
3	Set to value determined by Fault Value.

Idle State – Attribute 10

The Idle State determines what action is taken if an idle condition is detected. Idle conditions occur if a Poll request packet is received with less than the calculated number of bytes. Refer to the Configuration object to determine the size of the Poll Request packets. A poll request of 0 bytes is typically used to force an idle condition.

Idle State	Action Taken
0	Hold the last value
1	Set to low limit (-10 Vdc)
2	Set to high limit (+10 Vdc)
3	Set to value determined by Idle Value.

The Fault Value determines the output if the Fault State bit is set to 3 and a fault condition occurs. The value must be in the same range as the value. See the table in the value attribute description.

Idle Value – Attribute 12

The Fault Value is used to set the output if the Idle State bit is set to 3 and an idle condition occurs. The value must be in the same range as the value. See the table in the value attribute description.

Device Supervisor Object -- Class Code: 48 (0x30)

The Device Supervisor object provides summary information on the Device.

Device Supervisor Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	16

Device Supervisor Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
3	Get	Manufacturer Type	SSTRING	MIXED
4	Get	Semi Revision Level	SSTRING	E54-0997
5	Get	Manufacturer Name	SSTRING	MKS Instruments
6	Get	Manufacturer Model	SSTRING	CDN572-5
7	Get	Software Revision	SSTRING	See below
8	Get	Hardware Revision	SSTRING	See below
9	Get	Serial Number	SSTRING	See Below
11	Get	Device Status	USINT	See Below
12	Get	Exception Status	USINT	
13	Get	Exception Detail	STRUCT of	
		Common Detail	STRUCT of	
		Size	USINT	2
		Detail	BYTE[2]	
		Device Detail	STRUCT of	
		Device Size	USINT	8
		DIP Status	BYTE[3]	See Below
		DOP Status	BYTE[3]	See Below
		AIP Status	BYTE[1]	See Below
		AOP Status	BYTE[1]	See Below
		Man. Detail	STRUCT of	
		Man. Detail Size	USINT	1
		Detail	BYTE	See Below
14	Get	Warning Detail	STRUCT of	

		Common Detail	STRUCT of	
		Common Size	USINT	2
		Common Detail	BYTE[2]	
		Device Detail	STRUCT of	
		Device Size	USINT	8
		DIP Status	BYTE[3]	See Below
		DOP Status	BYTE[3]	See Below
		AIP Status	BYTE[1]	See Below
		AOP Status	BYTE[1]	See Below
		Man. Detail	STRUCT of	
		Man. Size	USINT	1
		Man. Detail	USINT	See Below
15	Get/Set	Alarm Enable	BOOLEAN	
16	Get/Set	Warning Enable	BOOLEAN	

Device Supervisor Object Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Device Supervisor Object Attributes

Manufacturer Model – Attribute 6

The Manufacturer Model string will be CDN572-5.

Software Revision – Attribute 7

The Software Revision will be a text string of the Major and Minor revision information of the Identity object. It will have the format XX.YYY, where XX is the major revision and YYY is the Minor revision. The revision code will match that provided by the Identity object.

Hardware Revision – Attribute 8

The Hardware Revision will be a text string reflecting the current revision of the hardware. It will have the format XX.YYY, where XX is the major revision and YYY is the Minor revision.

Device Status – Attribute 11

The Device Status reflects the current state of the Device Supervisor object.

Attribute Value	State
0	Undefined
1	Self Testing
2	Idle
3	Self-Test Exception
4	Executing
5	Abort
6	Critical Fault
7-50	Reserved – unused on CDN572-5
51-99	Device Specific – unused on CDN572-5
100-255	Vendor Specific – unused on CDN572-5

Exception Status – Attribute 12

The Exception status provides information on the current alarm and warning status of the device. This byte may be optionally reported as part of the Poll Response message. The byte provides a summary of the state of the Exception and Alarm Detail attributes and has the following interpretation.

Status Bit	Function
0	ALARM / Device Common
1	ALARM / Device Specific
2	ALARM / Manufacturer – specific
3	0
4	WARNING / Device Common
5	WARNING / Device Specific
6	WARNING / Manufacturer – specific
7	1 == Expanded Mode

Exception Details – Attribute 13

The Exception Detail contains information on Common exception conditions, General Purpose I/O Device exception conditions and CDN572-5 specific exception conditions.

CDN572-5 DEVICE

The General Purpose I/O Device exception conditions provide 4 nested structures containing status information from each of the available DIP and DOP object instances. For the DIP and DOP structures each contain 48 *bits*.

Note that the status information is contained in a bit packed format. The number of bytes may be calculated as:

Number of bytes = ((number of status bits) + 7) / 8

The Manufacturer exception detail contains a single byte which reflects the state of the 4 error bits derived from the configuration object (Class 64, Instance 1, Attribute 7).

Warning Details – Attribute 14

The Warning Detail contains information on common warning conditions, General Purpose I/O Device exception conditions and CDN572-5 specific exception conditions.

The General Purpose I/O Device contains no warning status information.

The Manufacturer warning detail contains a single byte which reflects the state of the 4 warning bits derived from the configuration object (Class 64, Instance 1, Attribute 7). Note that the Temperature Low condition does not cause a warning condition.

Alarm Enable – Attribute 15

The Alarm enable bit enables the reporting of alarm conditions. Clearing this bit causes alarm bits to be cleared. Setting the bit causes the alarm monitoring to be enabled.

Warning Enable – Attribute 16

The Alarm enable bit enables the reporting of alarm conditions. Clearing this bit causes alarm bits to be cleared. Setting the bit causes the alarm monitoring to be enabled.

Configuration Object -- Class Code: 100 (0x64)

The CDN572-5 poll request/response packets are large. In some applications it may be desired to reduce the packet size if not all the I/O channels are in use. The configuration object will adjust the poll request/response packet sizes. In addition, the configuration object gives access to several operational parameters such as power supply and temperature conditions.

Configuration Object Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	9

Configuration Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
100	Get/Set	Mode	USINT (1)	Configuration mode
101	Get/Set	Num Digital Input	USINT (1)	Number of Digital Inputs
102	Get/Set	Num Digital Output	USINT (1)	Number of Digital Outputs
103	Get/Set	Num Analog Input	USINT (1)	Number of Analog Inputs
104	Get/Set	Num Analog Output	USINT (1)	Number of Analog Outputs
105	Get	Operating Temperature	SINT	Degrees Celsius
106	Get/Set	Status Flags	USINT	Temp/volt flags
107	Get/Set	Lo Temp Threshold	SINT (2)	Degrees Celsius
108	Get/Set	Hi Temp Threshold	SINT (2)	Degrees Celsius

Configuration Object Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

CDN572-5 DEVICE

NOTE 1: Changing the configuration object will cause the CONSUMED and PRODUCED size of the POLL connection to be changed. These values are retained in E2 memory and may only be set when the POLL connection is not in the RUNNING state.

NOTE 2: Values retained in external temperature monitor non-volatile storage.

Configuration Reset Service

Reset Command Byte	Reset Description
Any Value	Reset to provide full configuration (all I/O options included in Poll Transactions)

The Reset service causes the device configuration to return to a preset condition. The Reset service accepts a single byte to determine the configuration desired following the reset command. A value of 1 or 0 can be used.

The CDN572-5 configuration uses the following configuration setup.

Attribute	Value	Description
Mode	0x04	Forces Analog I/O data to even byte boundary. Forces Digital and Analog I/O not to be update during POLL processing.
Num Digital Input	0x18	Returns 3 bytes (24 bits) during POLL response
Num Digital Output	0x18	Expects 3 byte (24 bits) during POLL request
Num Analog Input	0x08	Returns 16 bytes during POLL response
Num Analog Output	0x08	Expects 16 bytes during POLL request

Configuration Object Attributes

Mode Byte – Attribute 100

The Mode byte determines the format of the POLL request and response packets and the overall operation of the unit during the I/O scanning function. The Mode byte consists of three bits with the following interpretation. Bits 0.1 and 3..5 should be set to 0.

Bit 7	Bit 6	Bit5	Bit4	Bit3	Bit 2	Bit 1	Bit 0
IncludeDSUP	IncludeTEMP	0	0	0	NoPollUpdate	Reserved 0	Reserved 0

If the NoPollUpdate bit is set then the I/O is not updated between the POLL REQUEST and the POLL RESPONSE operations. Digital input data will reflect data collected immediately prior to the current Poll request. Digital output data will be updated after the POLL RESPONSE is generated. Note that data aging is ~ 2 msec.

If the NoEvenByte bit is set then no padding bytes will be inserted or expected during the POLL REQUEST and POLL RESPONSE processing. If this bit is cleared then the POLL REQUEST and POLL RESPONSE packets will be adjusted to ensure that the Analog I/O data starts on an even byte boundary. Pad bytes will be eliminated in the Poll Request if the Num Analog Input is 0. Pad bytes will be eliminated in the Poll Response if the Num Analog Output is 0.

If the IncludeTEMP bit is set the current operating temperature is included in the POLL response. The Temperature is presented as a signed, 8 bit value, indicating the current temperature in degrees Celsius.

If the IncludeDSUP bit is set the POLL response will include the Device Supervisor Exception Status information in the Poll response.

Num Digital Input – Attribute 101

The Num Digital Input attribute determines the number of input channels to be returned in the POLL RESPONSE packet. The maximum number 48 bits. The number of poll response bytes can be calculated as:

Number of bytes = ((number of channels) + 7) / 8

Num Digital Output – Attribute 102

The Num Digital Output attribute determines the number of output bytes to be processed in the POLL REQUEST packet. The maximum number 48 bits. The number of poll response bytes can be calculated as:

Number of bytes = ((number of channels) + 7) / 8

Num Analog Input – Attribute 103

The Num Analog Input attribute determines the number of analog input channels returned in the POLL RESPONSE packet. The maximum number is 8. Each analog input produces 2 bytes of data in the poll response packet. The number of bytes may be calculated as:

Number of bytes = ((number of channels) * 2)

Num Analog Output – Attribute 104

The Num Analog Output attribute determines the number of analog output channels. The maximum size is 8. Each analog output consumes two bytes of data in the poll request packet. The number of bytes may be calculated as:

Number of bytes = ((number of channels) * 2)

Operating Temperature – Attribute 105

The current operating temperature of the CDN572-5 may be read as an 8 bit signed value, indicating temperature in degrees Celsius.

Status Flags – Attribute 106

The status flag bits include three flags to indicate whether a temperature extreme has ever been experienced and the current status of the +24 Vdc monitoring used for the digital I/O power, one for the base board(CDN570-1 and one for the expansion board (DIP571-4).
The lower 4 bits are considered error conditions and are reported as part of the Device Supervisor Exception Detail information (Class 50, Instance 1, Attribute 13). The upper 4 bits are considered warning conditions and are reported as part of the Device Supervisor Warning Detail information (Class 50, Instance 1, Attribute 14).

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Temp Hi Flag	Temp Lo Flag	0	0	0	+24V Exp.	+24V Fault

The Temp Hi Flag is set if the temperature has ever exceeded the high temperature threshold. Writing a 0 in the corresponding bit position of the Status Flag attribute will clear the flag bit. The Temp Hi flag status is reported as part of the Device Supervisor Manufacturer specific warning flags.

The Temp Lo Flag is set if the temperature has ever been less than the low temperature threshold. Writing a 0 in the corresponding bit position of the Status Flag attribute will clear the flag bit. The Temp Lo Flag is not reported as part of the Device Supervisor warnings.

The +24V Exp. Fault flag is set if the +24 Vdc on the DIP571-4 power for the Digital I/O drops below 18 Vdc. The flag bit will only clear if the +24V power is restored. The failure of the +24 V power is considered a Major Recoverable Fault condition and will be reflected in the Identity object and Device Supervisor object.

The +24V Fault flag is set if the +24 Vdc on the CDN570-1 power for the Digital I/O drops below 18 Vdc. The flag bit will only clear if the +24V power is restored. The failure of the +24

V power is considered a Major Recoverable Fault condition and will be reflected in the Identity object and Device Supervisor object.

Lo Threshold – Attribute 107

The Lo Temperature threshold determines at what temperature the status output should shut off. It is presented as a signed, 8 bit value measuring degrees Celsius.

Hi Threshold – Attribute 108

The Hi Temperature threshold determines at what temperature the status output should turn on. It is presented as a signed, 8 bit value measuring degrees Celsius. If the on board temperature exceeds this threshold the status output will become active and will remain active until the temperature drops below the Lo Threshold temperature.

Poll Packet Sizes

The Poll Request and Response formats are determined by the configuration class attributes.

Poll Request

[DOUT(0..3)] [PAD(0..1)] [AOUT(0..16)]

DOUT	will be either 0..3 bytes, determined by the Num Digital Output attribute.
PAD	will be either 0 or 1 byte. It is included to ensure that the AOUT are positioned on even byte boundaries if the MODE NoEvenByte bit attribute is cleared.
AOUT	will be 2 times the value set in the Num Analog Output attribute.

CDN572-5 DEVICE

Poll Response

[[DSUP] [TEMP] [DIN(0..3)] [PAD(0..1)] [AIN(0..16)]

DSUP	will be 1 byte, determined by Mode IncludeDSUP bit
TEMP	will be 1 byte, determined by Mode IncludeTEMP bit
DIN	will be either 0..3 bytes, determined by the Num Digital Input attribute.
PAD	will be either 0 or 1 byte. It is included to ensure that the AIN are positioned on even byte boundaries if the MODE NoEvenByte bit attribute is cleared.
AIN	will be 2 times the value set in the Num Analog Input attribute.

If the Num Digital Output and Num Analog Output are both 0 then the CONSUMED SIZE for the POLL connection will be 0. In this case there is no POLL IDLE condition.