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CDN291
DEVICENET
SPECIFICATIONS

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CDN291 Digital I/O Block

Revision History

1.0	First Release	10/98

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CDN291 Digital I/O Block

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CDN291 Digital I/O Block

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Overview

The CDN291 DeviceNet I/O block provides 16 digital inputs and 8 digital outputs with readback. Digital inputs are active low. Digital outputs are NPN active low and will sink 200 mA. Unused outputs may be used as inputs by leaving the output in the inactive (OFF) state. All I/O states are indicated using front panel LED's.

The unit is packaged in an extruded aluminum case and uses a DB62 connector to provide 'pin and socket' I/O connections. The DeviceNet MacID and Baudrate are set using front panels switches. I/O power is provided on a back panel DB-9 connector. The DeviceNet interface uses a sealed micro connector.

Switches and Indicators

The CDN291 includes 24 Green I/O status LED's which are wired directly to the I/O points.

Two DeviceNet indicators are provided, Network Status and Device Status. These comply with the ODVA/Semiconductor specifications.

Two BCD switches are provided to allow setting the MACID. 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.

A BCD switch is provided to allow setting the Data Rate. Values greater than 2 result in the switch being disabled and the last valid switch value will be used. The switches are read only during power up.

Interface

The electrical interface consists of the digital interface, the power interface and the DeviceNet interface.

The DeviceNet interface conforms to the ISO11898 specifications as well as the ODVA/Semiconductor Sig specifications. The DeviceNet connector consists of a circular micro connector.

DeviceNet Micro Connector

The DeviceNet connector uses the standard ODVA pinout for micro-DIN connectors.

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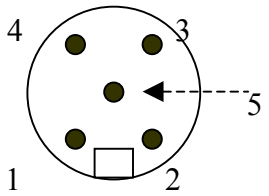
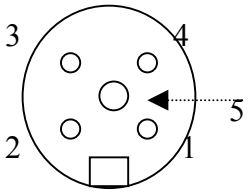
CDN291 Digital I/O Block

CDN067-3 Connector (Male)

1 - Drain (bare)
2 - V+ (red)
3 - V- (black)
4 - CAN_H (white)
5 - CAN_L (grey)





Mating Connector (Female)

Power Interface

The DeviceNet power is used for powering all internal electronics.

The Digital I/O power is connected through a DB-9 connector. In situations where the DeviceNet power is to be used for the I/O pins 1,2 may be shorted to pin 6 and pins 4,5 may be shorted to pin 9

Pin	Function
1	+24 Vdc
2	+24 Vdc
3	Reserved
4	DIO Common
5	DIO Common
6	BUS +
7	Reserved
8	Reserved
9	BUS -

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CDN291 Digital I/O Block

Digital I/O

The Digital inputs are implemented as active low sourcing inputs. Taking the input to ground will activate the input point. The source voltage is provided in the External Power connector and may range from 12 – 30 Vdc. The input switches ON when more than 4 mA flows out of the connection. The input is OFF if less than 2 mA flows out of the connection.

The Digital outputs are implemented as active low sinking outputs. When active the output pulls the I/O connection point to ground. The output will sink up to 200 mA. Internal fly back diodes provide protection for inductive loads and are connected to the External Power connector.

The I/O connections are made through a 62 pin high density D connector.

Pin	Function	Pin	Function	Pin	Function
1	DI-0	22	Dig. Common	43	Dig. Common
2	DI-1	23	Dig. Common	44	Dig. Common
3	DI-2	24	Dig. Common	45	Dig. Common
4	DI-3	25	Dig. Common	46	Dig. Common
5	DI-4	26	Dig. Common	47	Dig. Common
6	DI-5	27	Dig. Common	48	Dig. Common
7	DI-6	28	Dig. Common	49	Dig. Common
8	DI-7	29	Dig. Common	50	Dig. Common
9	DI-8	30	Dig. Common	51	Dig. Common
10	DI-9	31	Dig. Common	52	+24
11	DI-10	32	Dig. Common	53	+24
12	DI-11	33	Dig. Common	54	+24
13	DI-12	34	Dig. Common	55	+24
14	DO-0	35	Dig. Common	56	+24
15	DO-1	36	Dig. Common	57	+24
16	DO-2	37	Dig. Common	58	+24
17	DO-3	38	Dig. Common	59	+24
18	DO-4	39	Dig. Common	60	+24
19	DO-5	40	Dig. Common	61	+24
20	DO-6	41	Dig. Common	62	+24
21	DO-7	42	Dig. Common		

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CDN291 Digital I/O Block

Specifications

Characteristic	Min	Typ	Max	Conditions/notes
Digital Input				
I_{on}	-4			mA – flow from I/O point to DIO Common
I_{off}			-2	mA – flow from I/O point to DIO Common
V_{max}			35	Vdc
V_{min}	-.2			Vdc
Digital Output				
I_{on}			200	mA – sink current
V_{out}			30	Vdc
Short Circuit			500	mA – internal thermal limit, self fused
I_{leak}			.1	mA – Off leakage
DeviceNet				
Signal Level				ISO 11898
V_{cm}	-30		30	Vdc – common mode breakdown
Protection				Loss of ground, reverse polarity
I_{bus}		 70	125	mA @ 11 Vdc mA @ 28 Vdc
V_{bus}	11		28	Vdc

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CDN291 Digital I/O Block

DeviceNet Information

The CDN291 (Multifunction 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 Explicit Unconnected Message Manager (UCMM).

The device supports 8 digital outputs with read-back capability and 16 digital inputs.

A configuration object (Class 64) allows the unit to be configured to provide a variable number of digital inputs and digital outputs.

DeviceNet Message Types

As a group 2 slave device the CDN291 supports the following 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

DeviceNet Class Services

As a group 2 slave device the CDN291 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

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CDN291 Digital I/O Block

DeviceNet Object Classes

The CDN291 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
64 (0x40)	Configuration Object

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CDN291 Digital I/O Block

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	7

Identity Object Instance Attributes

Attribute	Access	Name	Type	Value
1	Get	Vendor	UINT	59
2	Get	Product Type	UINT	7
3	Get	Product Code	UINT	1
4	Get	Revision	STRUCT OF	
		Major Revision	USINT	1
		Minor Revision	USINT	1
5	Get	Device Status	UINT	(1)
6	Get	Serial Number	UINT	(2)
7	Get	Product Name	STRUCT OF	
		Length	USINT	6
		Name	STRING [6]	CDN291

Identity Common Services

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

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CDN291 Digital I/O Block

(1) Device Status

bit 0	owned	0=not owned 1=owned (allocated)
bit 1	reserved	0
bit 2	configured	0
bit 3	reserved	0
bit 4-7	vendor specific	0
bit 8	minor cfg fault	0=no fault 1=minor fault
bit 9	minor dev.fault	0=no fault 1=minor device fault
bit 10	major cfg.fault	0=no fault 1=major cfg. fault
bit 11	major dev.fault	0=no fault 1=major device fault
bit 12-15	reserved	0

2) Unique Serial Number

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CDN291 Digital I/O Block

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 Common Services

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

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CDN291 Digital I/O Block

DeviceNet Object Class Code: 03 (0x03)

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	(1)
2	Get/Set	Baud Rate	USINT	(2)
3	Get/Set	Bus Off Interrupt	BOOL	(3)
4	Get/Set	Bus Off Counter	USINT	(4)
5	Get/Spc	Allocation Information	STRUCT of	(5)
		Choice Byte	BYTE	
		Master Node Addr.	USINT	

DeviceNet 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

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

(2) The Data Rate is set using a BCD rotary switch located on the front panel. 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.

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CDN291 Digital I/O Block

(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

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

(5) Allocation_byte

bit 0	explicit	set to 1 to allocate
bit 1	polled	set to 1 to allocate
bit 2	strobed	(not supported)
bit 3-7	reserved	(always 0)

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CDN291 Digital I/O Block

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	2

Assembly Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
3	Get	Data	STRUCT of	(1)
		Input States	BYTE[]	See Configuration Class
		Padding Byte	BYTE	(2)

Assembly Object, Instance 2 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Data	STRUCT of	(3)
		Output States	BYTE	See Configuration Class

Assembly Common Services

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

(1) Assembly instance 1 is used to generate the POLL response packet and consists of a variable number bytes as determined by the configuration object.

(2) Assembly instance 2 is used to consume the POLL request packet and consists of a variable number of digital output states.

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CDN291 Digital I/O Block

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	(1)
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Production Connection	UINT	(2)
5	Get	Consumed Connection	UINT	(2)
6	Get	Initial Comm. Char.	USINT	0x21
7	Get	Production Size	UINT	22
8	Get	Consumed Size	UINT	24
9	Get/Set	Expected Packet Rate	UINT	default 2500 msec
12	Get/Set	Timeout Action	USINT	(3)
13	Get	Prod. Path Length	USINT	0
14	Get	Production Path		(null)
15	Get	Cons. Path Length	USINT	0
16	Get	Consumed Path		(null)

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CDN291 Digital I/O Block

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	(2)
5	Get	Consumed Connection	UINT	(2)
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	(3)
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	0x01
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03
15	Get	Cons. Path Length	USINT	6
16	Get	Production Path	STRUCT of	
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log.Seg., Instance	USINT	0x24
		Instance Number	USINT	0x02
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03

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

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CDN291 Digital I/O Block

(1) Connection States:

0 = non-existent
1 = configuring
3 = established
4 = timed out

(2) Connection ID's:

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.

(3) Watch Dog Timeout Activity:

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

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CDN291 Digital I/O Block

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 simple as a toggle switch or 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	3

DIP Object, Instance 1..24 Attributes

Attribute	Access	Name	Type	Value
3	Get	Value	BOOL	(1)

DIP Object Common Services

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

(1) State of the specific digital input. Instance 1-8 provide feedback of the digital output states. If the corresponding output state is set to 0 these points may be used as inputs.

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CDN291 Digital I/O Block

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 simple as a actuator or as complex as a discrete I/O control module. 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	8
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	8

DOP Object, Instance 1..8 Attributes

Attribute	Access	Name	Type	Value
3	Get/Set	Value	BOOL	State 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

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CDN291 Digital I/O Block

Configuration Object Class Code: 64 (0x40)

The CDN291 poll request/response packets are large. In some applications it may be desired to reduce the packet size if not all the analog channels are in use. The configuration object will adjust the poll request/response packet sizes.

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	3

Configuration Object, Instance 1 Attributes

Attribute	Access	Name	Type	Value
1	Get/Set	Mode	USINT	(1)
2	Get/Set	Digital Input Size	USINT	(2)
3	Get/Set	Digital Output Size	USINT	(3)

Configuration Object Common Services

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

NOTE: Changing the configuration object will cause the CONSUMED and PRODUCED size of the POLL connection to be changed.

Attribute 1 - Mode Byte

(1) 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 3..7 should be set to 0.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	Reserved = 0	Reserved = 1	NoEvenByte

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(2) 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 an even number of bytes are transmitted/received.

Attribute 2 – Digital Input Size

(3) The Digital Input Size attribute determines the number of input bytes to be returned in the POLL RESPONSE packet. The maximum number is 3, corresponding to 24 bits.

Attribute 3 – Digital Output Size

(4) The Digital Output Size attribute determines the number of output bytes to be processed in the POLL REQUEST packet. The maximum number is 1.

Poll Message Format

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

[DOUT(0..1)] [PAD(0..1)]

DOUT - will be either 0 or 1 bytes, determined by the Digital Output Size attribute.
PAD - will be either 0 or 1 byte. It is included to ensure an even number of bytes if the MODE NoEvenByte attribute is cleared.

[DIN(0..2)] [PAD(0..1)]

DIN- will be either 0..3 bytes, determined by the Digital Input Size attribute.
PAD- will be either 0 or 1 byte. It is included to ensure an even number of bytes if the MODE NoEvenByte attribute is cleared.

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