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DeviceNet

Documentation for the MC206, and MC224 DeviceNet command implementation

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TrioBASIC *DeviceNet* command

DEVICENET

Description: Controls the DeviceNet protocol.

Syntax: DEVICENET(Port, Function, ...)

Syntax for function 0: DEVICENET(Slot, 0, BaudRate, MacId, PollBase, PollInLen, PollOutLen)

Description: Starts the DeviceNet protocol on the given slot

Parameters for function 0:	slot	The communications slot where the CAN daughter board is placed. The internal CAN port has the slot number of -1 (see the CAN command)
	BaudRate	The communications speed, valid values are 125, 250 and 500 for speeds of 125 kbit/s, 250 kbit/s and 500 kbit/s respectively. These are the speeds that DeviceNet supports
	MacId	The ID which the Motion Coordinator will use to identify itself on the DeviceNet network
	PollBase	The position in the table where the I/O poll will store its' data.
	PollInLen	The number of 16 bit words to be received from the master during an I/O poll.
	PollOutLen	The number of 16 bit words to be sent to the master during an I/O poll

Syntax for function 1: DEVICENET(Port, 1)

Description: Stops the DeviceNet protocol on the given slot

Parameters for function 1: None

The DeviceNet command implements the Predefined Master/Slave Connection Set for a Group 2 only DeviceNet slave with I/O Poll support that complies to the Generic Device profile.

Internal state machines

The DeviceNet protocol is implemented as 3 nested state machines.

<i>State Machine</i>	<i>Responsibilities</i>
Module	<p>DeviceNet status LED's</p> <p>To visualise the DeviceNet status on the Motion Coordinator's LED's you must set the DISPLAY system variable to the value 8 (See the DISPLAY system variable).</p> <p>The Motion Coordinator's LED's are now read from top to bottom as follows:</p> <ul style="list-style-type: none"> Green LED - Power (as before) Red LED - Axis fault (as before) Amber LED - DeviceNet MS – Green LED Amber LED - DeviceNet MS – Red LED Amber LED - DeviceNet NS – Green LED Amber LED - DeviceNet NS – Red LED Amber LED - Bus Off Count bit 0 Amber LED - Bus Off Count bit 1 Amber LED - Bus Off Count bit 2 Amber LED - Bus Off Count bit 3 <p>Module operational states</p> <ul style="list-style-type: none"> Off LED Test Configure Operational Standby Minor fault Major fault
Network	<p>CAN Bus Status</p> <ul style="list-style-type: none"> Bus power (where applicable) Bus off conditions <p>Network operational states</p> <ul style="list-style-type: none"> Off Send Mac Id Wait Mac Id On-line Fault

State Machine	Responsibilities
Transport	Timeouts Acknowledged fragmented messaging for explicit connection Unacknowledged fragmented messaging for I/O connection

Connection types implemented

There are 3 independent connection channels in this *DeviceNet* implementation:

1. Group 2 predefined master/slave connection

This connection will only handle Master/Slave Allocate/Release messages. The maximum message length for this connection is 8 bytes.

2. Explicit message connection

This connection will handle explicit messaging for the *DeviceNet* objects defined below. The maximum message length for this connection is 242 bytes.

3. I/O message connection

This connection will handle the I/O poll messaging. The maximum message length for this connection is 32 bytes.

DeviceNet objects implemented

Id	Class	Description
0x01	Identity	Identification of and general information about the device
0x02	Router	Provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device
0x03	DeviceNet	Provides the configuration and status of a DeviceNet port
0x04	Assembly	Permits access to the I/O poll connection from the explicit message channel
0x05	Connection	Manages the characteristics of the communications connections
0x8a	MC	Permits access to the VR variables and TABLE data on the MC

Identity object

Instance services

Id	Service	Description
0x05	Reset	Reinitialises the DeviceNet protocol
0x0e	Get Attribute Single	Used to read the instance attributes

Instance attributes

<i>Id</i>	<i>Attribute</i>	<i>Description</i>
1	Vendor ID	Trio Motion Technology's DeviceNet Vendor ID (0x0115)
2	Device Type	Generic Device (0x0000)
3	Product Code	The MC type as returned by the CONTROL system variable
4	Revision	Currently 3.2
5	Status	Only bit 0 (Owned) is implemented
6	Serial Number	The MC serial number
7	Product Name	"Trio MC_<product code>", where <product code> is the same as defined above for Attribute Id 3

Router object

No class or instance services are implemented

DeviceNet object

Class services

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x0e	Get Attribute Single	Used to read the class attributes

Class attributes

<i>Id</i>	<i>Attribute</i>	<i>Description</i>
1	Revision	0x0002 (Modification of baud rate attribute behaviour)

Instance services

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x0e	Get Attribute Single	Used to read the instance attributes
0x10	Set Attribute Single	Use to write the instance attributes
0x4b	Allocate Master/Slave connection Set	Requests the use of the Predefined Master/Slave Connection set
0x4c	Release Group 2 Identifier Set	Indicates that the specified Connections within the Predefined Master/Slave Connection Set are no longer desired. These Connections are to be released (Deleted).

Instance attributes

<i>Id</i>	<i>Attribute</i>	<i>Description</i>
1	MAC ID	DeviceNet Node Address
5	Allocation Information	The current allocation choice byte and the Masters MAC ID

Assembly object

There are 2 instances implemented. Instance 100 is a static input object, associated with the I/O poll producer. Instance 101 is a static output object, associated with the I/O poll consumer.

Instance services

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x0e	Get Attribute Single	Used to read the instance attributes
0x10	Set Attribute Single	Use to write the instance attributes

Instance attributes

<i>Id</i>	<i>Attribute</i>	<i>Description</i>
3	data	Get Instance 100 : The I/O poll producer is executed and the output buffer returned Set Instance 100: Error Get Instance 101: The last received I/O poll buffer is returned Set Instance 101: The buffer received is passed to the I/O poll consumer

Connection object

Instance services

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x0e	Get Attribute Single	Used to read the instance attributes
0x10	Set Attribute Single	Use to write the instance attributes

Instance attributes

The values for these attributes are defined in the "Predefined master/slave connection set" of the "ODVA DeviceNet specification"

<i>Id</i>	<i>Attribute</i>	<i>Description</i>
1	State	State of the object
2	Instance Type	Indicates either I/O or Messaging connection
3	Transport Class Trigger	Defines the behaviour of the connection
4	Produced Connection ID	Placed in CAN Identifier Field when the Connection transmits
5	Consumed Connection ID	CAN Identifier Field value that denotes message to be received
6	Initial Comm Characteristics	Defines the Message Group(s) across which productions and consumptions associated with this Connection occur
7	Produced Connection Size	Maximum number of bytes transmitted across this Connection
8	Consumed Connection Size	Maximum number of bytes received across this Connection
9	Expected Packet Rate	Defines timing associated with this Connection
12	Watchdog Timeout Action	Defines how to handle Inactivity/Watchdog timeouts
13	Produced Connection Path Length	Number of bytes in the Produced Connection Path attribute
14	Produced Connection Path	Specifies the Application Object(s) whose data is to be produced by this Connection Object.
15	Consumed Connection Path Length	Number of bytes in the Consumed Connection Path attribute
16	Consumed Connection Path	Specifies the Application Object(s) whose data is to be consumed by this Connection Object.

MC object

Instance services

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x05	Reset	Performs EX on the MC. This will reset the DeviceNet as well
0x33	Read Word – TABLE	Reads the specified number of VR entries and sends their values in 16 bit 2s complement format
0x34	Read Word – VR	Reads the specified number of TABLE entries and sends their values in 16 bit 2s complement format
0x35	Read IEEE – TABLE	Reads the specified number of VR entries and sends their values in 32 bit IEEE floating point format
0x36	Read IEEE – VR	Reads the specified number of TABLE entries and sends their values in 32 bit IEEE floating point format

<i>Id</i>	<i>Service</i>	<i>Description</i>
0x37	Write Word – TABLE	Receives the specified number of values in 16 bit 2s complement format and writes them into the specified VR entries
0x38	Write Word – VR	Receives the specified number of values in 16 bit 2s complement format and writes them into the specified TABLE entries
0x39	Write IEEE – TABLE	Receives the specified number of values in 32 bit IEEE floating point format and writes them into the specified VR entries
0x3a	Write IEEE - VR	Receives the specified number of values in 32 bit IEEE floating point format and writes them into the specified TABLE entries

The following sections describe the message body area of the Explicit Message used to specify the different services. This ignores all of the fragmentation protocol.

Read word format

Request

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	0	Service code = 0x33, or 0x34						
byte 1	Class ID = 0x8a							
byte 2	Instance ID = 0x01 (this is the only instance supported)							
byte 3	bits 15-8 of Source Address							
byte 4	bits 7-0 of Source Address							
byte 5	ignored							
byte 6	Number of words values to be read							

Response

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	1	Service code = 0x33, or 0x34						
byte 1	bits 15-8 of Value 0							
byte 2	bits 7-0 of Value 0							
	...							
byte n	bits 15-8 of Value m							
byte n + 1	bits 7-0 of Value m							

Write word format

Request

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	0	Service code = 0x37, or 0x38						
byte 1	Class ID = 0x8a							
byte 2	Instance ID = 0x01 (this is the only instance supported)							
byte 3	bits 15-8 of Source Address							
byte 4	bits 7-0 of Source Address							
byte 5	ignored							
byte 6	Number of words values to be written							
byte 7	bits 15-8 of Value 0							
byte 8	bits 7-0 of Value 0							
	...							
byte n	bits 15-8 of Value m							
byte n + 1	bits 7-0 of Value m							

Response

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	1	Service code = 0x37, or 0x38						

Read IEEE format

Request

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	0	Service code = 0x35, or 0x36						
byte 1	Class ID = 0x8a							
byte 2	Instance ID = 0x01 (this is the only instance supported)							
byte 3	bits 15-8 of Source Address							
byte 4	bits 7-0 of Source Address							
byte 5	ignored							
byte 6	Number of words values to be read							

Response

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	1	Service code = 0x35, or 0x36						
byte 1	bits 7-0 of Value 0							
byte 2	bits 15-8 of Value 0							
byte 3	bits 23-16 of Value 0							
byte 4	bits 31-24 of Value 0							
	...							
byte n	bits 7-0 of Value m							
byte n + 1	bits 15-8 of Value m							
byte n + 2	bits 23-16 of Value m							
byte n + 3	bits 31-24 of Value m							

Write IEEE format

Request

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	0	Service code = 0x39, or 0x3a						
byte 1	Class ID = 0x8a							
byte 2	Instance ID = 0x01 (this is the only instance supported)							
byte 3	bits 15-8 of Source Address							
byte 4	bits 7-0 of Source Address							
byte 5	ignored							
byte 6	Number of words values to be written							
byte 7	bits 7-0 of Value 0							
byte 8	bits 15-8 of Value 0							
byte 9	bits 23-16 of Value 0							
byte 10	bits 31-24 of Value 0							
	...							
byte n	bits 7-0 of Value m							
byte n + 1	bits 15-8 of Value m							
byte n + 2	bits 23-16 of Value m							
byte n + 3	bits 31-24 of Value m							

Response

	<i>bit 7</i>	<i>bit 6</i>	<i>bit 5</i>	<i>bit 4</i>	<i>bit 3</i>	<i>bit 2</i>	<i>bit 1</i>	<i>bit 0</i>
byte 0	1	Service code = 0x39, or 0x3a						