SIEMENS

MICROMASTER
DeviceNet Option Module

Operating Instructions   **Edition A1**

User Documentation

SIEMENS

MICROMASTER
DeviceNet Option Module

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Valid for   **Edition A1**

MICROMASTER 4   09.01

Edition A1

Other functions not described in this document may be available. However, this fact shall not constitute an obligation to supply such functions with a new control, or when servicing.

We have checked that the contents of this document correspond to the hardware and software described. There may be discrepancies nevertheless, and no guarantee can be given that they are completely identical. The information contained in this document is reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

Siemens handbooks are printed on chlorine-free paper that has been produced from managed sustainable forests. No solvents have been used in the printing or binding process.

Document subject to change without prior notice.

Definitions, warnings

Qualified personnel

For the purpose of this Instruction Manual and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved.
He or she must have the following qualifications:

➢ Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.

➢ Trained in the proper care and use of protective equipment in accordance with established safety procedures.

➢ Trained in rendering first aid.

Safety guidelines

This manual contains notices intended to ensure your personal safety, as well as to protect products and connected equipment against damage. Information relating to your personal safety is highlighted by a warning triangle. Warnings about property damage are displayed without a warning triangle. Depending on the degree of risk involved, safety-related information is presented in the following categories:

DANGER

For the purpose of this documentation and the product warning labels, "Danger" indicates that death, severe personal injury or substantial damage to property **will** result if proper precautions are not taken.

WARNING

For the purpose of this documentation and the product warning labels, "Warning" indicates that death, severe personal injury or substantial damage to property **can** result if proper precautions are not taken.

CAUTION

With a warning triangle, "Caution" indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

Without a warning triangle, "Caution" indicates that material damage can result if proper precautions are not taken.

ATTENTION

indicates that an undesirable effect or state can occur if attention is not paid to the advice given.

NOTE

For the purpose of this documentation, "Note" indicates important information relating to the product or highlights part of the documentation for special attention.

User documentation

> **WARNING**
>
> Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Proper use

Please note the following:

> **WARNING**
>
> This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts.
>
> Non-compliance with Warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.
>
> Only suitably qualified personnel should work on this equipment, and only after becoming familiar with all safety notices and maintenance procedures contained in this manual.
>
> The successful and safe operation of this equipment is dependent upon its proper handling, storage, installation, operation and maintenance.
>
> National safety regulations are also applicable.

Table of Contents

1   Description

The DNM communication option module (DeviceNet™ Module) is for linking the
MICROMASTER 4 series drives to higher-level automation systems via DeviceNet.

DeviceNet defined
Combined Module/
Network Status
(MNS) LED

Removable
DeviceNet
Connector
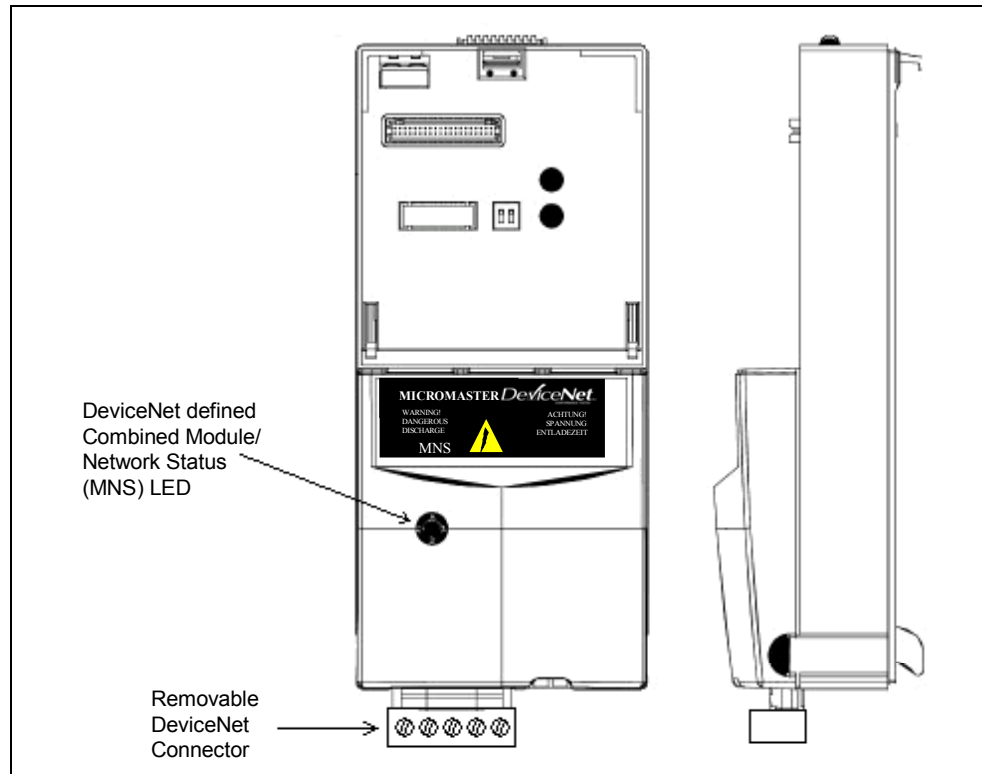
Figure 1-1   View of the MICROMASTER 4 DeviceNet Option Module

Technical Data

A standard DeviceNet Combined Module/Network Status LED provides the user
with fast information regarding the instantaneous status of the DeviceNet option
module. More detailed diagnostic information can be directly read-out of the
DeviceNet option module diagnostics memory using a diagnostics parameter.

The DeviceNet option module is technically described by DeviceNet as an isolated
node with transceiver powered by the DeviceNet network. This means that the
module is powered by both the DeviceNet network and the MICROMASTER 4
drive. In this case, the transceiver and half of the optocouplers are powered by the
network and the rest of the module is powered by the MICROMASTER 4 drive
which is connected to an AC line.

The DeviceNet option module uses a DeviceNet standard pluggable 5-pin open
connector.

The DeviceNet option module operates at 125, 250 and 500 kBaud.

Functionality

> ➢ The MICROMASTER 4 DeviceNet option module supports both DeviceNet Explicit Messages and I/O Messages to implement the equivalent of the process data and parameter data portions of drive communications.

> ➢ The MICROMASTER 4 DeviceNet option module supports the Predefined Master/Slave Connection Set as defined in the DeviceNet specification. Poll I/O messages are supported.

> ➢ The MICROMASTER 4 DeviceNet option module follows the DeviceNet Device Profile for the Communication Adapter (Device Type 12). The Communication Adapter Profile was chosen so that all the flexibility and advanced features of the MICROMASTER 4 Drive could be used by the DeviceNet master by using vendor specific assemblies.

> ➢ The vendor specific PKW object is used to read and change drive parameters by the master using DeviceNet. The explicit messaging channel is used. Using this PKW object, the user has free access to all parameters in the base drive via DeviceNet. Examples include: Reading-out detailed diagnostic information, fault messages etc. Thus, without influencing the performance of the process data transfer, additional information can be requested by a higher-level system (for example a PC) for drive visualization.

2   Definition of DeviceNet

Definition

DeviceNet is an international, open fieldbus standard maintained by the Open DeviceNet Vendor Association (O.D.V.A.). The DeviceNet communication link is based on a broadcast-oriented, communications protocol – the Controller Area Network (CAN). DeviceNet has been standardized by CENELEC as EN 50325

The actual CAN data telegram consists of the protocol header, the CAN identifier, up to 8 bytes of useful data and the protocol trailer. However, the methods used by DeviceNet allow a useful data area to be any reasonable length. If data longer than 8 bytes is required, a fragmentation protocol allows the data to be sent as series of telegrams.

General Information

When transferring useful data on DeviceNet, a differentiation is made between process data (PZD) and parameter data (PKW).

The process data area for MICROMASTER 4 drives consists of up to 10 words (depending on the model number of the MICROMASTER 4 drive). Normally only process data is used to communicate to the drive by sending and receiving PZD data. This process data is sent by a DeviceNet method called ″polled I/O″.

The DeviceNet option module groups these 10 words into 4 choices:

    (1)   the first 4 PZD words in a freely assignable (BICO) form

    (2)   the first 6 PZD words in a freely assignable (BICO) form
            (not available on the MICROMASTER 420 drive)

    (3)   the first 8 PZD words in a freely assignable (BICO) form
            (not available on the MICROMASTER 420 drive)

    (4)   the first 10PZD words in a freely assignable (BICO) form
            (not available on the MICROMASTER 420 drive)

Entirely separate from the process data, the PKW data is used for parameter access. It is normally not used by DeviceNet– since drive commissioning is performed by DriveMonitor/STARTER, Drive ES or other means.

Using the vendor specific PKW object (which will be described later), the PKW useful data area consists of:

    (1)   2 words or 4 bytes for parameter value read tasks
            (called a "Get" DeviceNet service)

    (2)   4 words or 8 bytes for parameter value change tasks
            (called a "Set" DeviceNet service)

    (3)   3 words or 6 bytes for parameter value responses.

Summary of Data Exchange using DeviceNet

The DeviceNet option module messages can be roughly sub-divided into three areas:

➢ DeviceNet Configuration data, i. e. channel allocation, time-outs, and I/O assembly selections which use Explicit Messages, and

➢ Process data, i. e. control words, setpoints/reference values and status information and actual values which use I/O Messages, and

➢ Drive parameter data to read/write drive parameter values which use the vendor specific PKW object and Explicit Messages.

3   Data Transfer using DeviceNet

3.1   Control of MICROMASTER 4 Drives via DeviceNet

I/O Data words (Process data - PZD)

Using the process data area, all of the information is transferred that is required to control a drive for a particular technological process. Control information (control words) and setpoints are sent to the drive from the DeviceNet master. Information regarding the drive status (status words) and actual values are transferred in the other direction.

The DeviceNet option module (DNM) stores the received process data in the drive memory in the same sequence as it is transmitted in the telegram. Each word can be used, for example the second word in the process data area of the telegram can be used as the as speed setpoint to the ramp-function generator. The same mechanism is also true for other setpoints and for each individual control word bit. This mechanism is also true for data traffic in the opposite direction when transferring actual values and status words back to the master.

3.1.1   Siemens standard control and reference words

The flexible Siemens vendor specific I/O assembly is used by setting P2041.01 = 120 through 123, the consumed connection path is made up of 4 to 10 control words, depending on the value of P2041.01 (refer to section 5.3). Following the assembly definitions are the bit by bit definiton of control word 1 and control word 2.

Assembly #120

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Control word 1 (LOW BYTE)							
1	Control word 1 (HIGH BYTE)							
2	Reference PZD WORD 2 (LOW BYTE)							
3	Reference PZD WORD 2 (HIGH BYTE)							
4	Reference PZD WORD 3 (LOW BYTE)							
5	Reference PZD WORD 3 (HIGH BYTE)							
6	Control word 2 (LOW BYTE)							
7	Control word 2 (HIGH BYTE)							

Assembly #121

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Control word 1 (LOW BYTE)							
1	Control word 1 (HIGH BYTE)							
2	Reference PZD WORD 2 (LOW BYTE)							
3	Reference PZD WORD 2 (HIGH BYTE)							
4	Reference PZD WORD 3 (LOW BYTE)							
5	Reference PZD WORD 3 (HIGH BYTE)							
6	Control word 2 (LOW BYTE)							
7	Control word 2 (HIGH BYTE)							
8	Reference PZD WORD 5 (LOW BYTE)							
9	Reference PZD WORD 5 (HIGH BYTE)							
10	Reference PZD WORD 6 (LOW BYTE)							
11	Reference PZD WORD 6 (HIGH BYTE)							

Assembly #122

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Control word 1 (LOW BYTE)							
1	Control word 1 (HIGH BYTE)							
2	Reference PZD WORD 2 (LOW BYTE)							
3	Reference PZD WORD 2 (HIGH BYTE)							
4	Reference PZD WORD 3 (LOW BYTE)							
5	Reference PZD WORD 3 (HIGH BYTE)							
6	Control word 2 (LOW BYTE)							
7	Control word 2 (HIGH BYTE)							
8	Reference PZD WORD 5 (LOW BYTE)							
9	Reference PZD WORD 5 (HIGH BYTE)							
10	Reference PZD WORD 6 (LOW BYTE)							
11	Reference PZD WORD 6 (HIGH BYTE)							
12	Reference PZD WORD 7 (LOW BYTE)							
13	Reference PZD WORD 7 (HIGH BYTE)							
14	Reference PZD WORD 8 (LOW BYTE)							
15	Reference PZD WORD 8 (HIGH BYTE)							

Assembly #123

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Control word 1 (LOW BYTE)							
1	Control word 1 (HIGH BYTE)							
2	Reference PZD WORD 2 (LOW BYTE)							
3	Reference PZD WORD 2 (HIGH BYTE)							
4	Reference PZD WORD 3 (LOW BYTE)							
5	Reference PZD WORD 3 (HIGH BYTE)							
6	Control word 2 (LOW BYTE)							
7	Control word 2 (HIGH BYTE)							
8	Reference PZD WORD 5 (LOW BYTE)							
9	Reference PZD WORD 5 (HIGH BYTE)							
10	Reference PZD WORD 6 (LOW BYTE)							
11	Reference PZD WORD 6 (HIGH BYTE)							
12	Reference PZD WORD 7 (LOW BYTE)							
13	Reference PZD WORD 7 (HIGH BYTE)							
14	Reference PZD WORD 8 (LOW BYTE)							
15	Reference PZD WORD 8 (HIGH BYTE)							
16	Reference PZD WORD 9 (LOW BYTE)							
17	Reference PZD WORD 9 (HIGH BYTE)							
18	Reference PZD WORD 10 (LOW BYTE)							
19	Reference PZD WORD 10 (HIGH BYTE)							

Detailed description of control word 1

Bit	Value	Description
0	1	ON (Ramp up)
	0	OFF1 (Ramp down)
1	1	No electrical stop
	0	OFF2: electrical stop
2	1	No fast stop
	0	OFF3: fast stop
3	1	Pulse enable
	0	Pulse disable
4	1	Ramp generator enable
	0	Ramp generator disable
5	1	Ramp generator start
	0	Ramp generator stop
6	1	Setpoint enable
	0	Setpoint disable
7	1	Fault acknowledge
	0	
8	1	Jog right
	0	
9	1	Jog left
	0	
10	1	Control from PLC
	0	Setpoints and control data from PLC will be ignored
11	1	Setpoint inversion
	0	
12	1	MICROMASTER 4 model specific
	0	
13	1	Motor potentiometer up
	0	
14	1	Motor potentiometer down
	0	
15	1	Local control active (BOP/ AOP)
	0	Remote control active

Normally, control word 1 will be received by the drive as the first word in the I/O consumed connection.

Detailed description of control word 2

Bit	Value	Description
0	1	Fixed Frequency Bit 0
	0	
1	1	Fixed Frequency Bit 1
	0	
2	1	Fixed Frequency Bit 2
	0	
3	1	MICROMASTER 4 model specific
	0	
4	1	MICROMASTER 4 model specific
	0	
5	1	MICROMASTER 4 model specific
	0	
6	1	MICROMASTER 4 model specific
	0	
7	1	MICROMASTER 4 model specific
	0	
8	1	MICROMASTER 4 model specific
	0	
9	1	MICROMASTER 4 model specific
	0	
10	1	MICROMASTER 4 model specific
	0	
11	1	MICROMASTER 4 model specific
	0	
12	1	MICROMASTER 4 model specific
	0	
13	1	MICROMASTER 4 model specific
	0	
14	1	MICROMASTER 4 model specific
	0	
15	1	MICROMASTER 4 model specific
	0	

Normally, control word 2 will be received by the drive as the fourth word in the I/O consumed connection.

3.1.2   Siemens standard status and actual value words

The flexible Siemens vendor specific I/O assembly is used by setting P2040.01 = 170 through 173, the produced connection path is made up of 4 to 10 status/actual value words, depending on the value of P2041.00 (refer to section 5.3). Following the assembly definitions are the bit by bit definiton of status word 1 and status word 2.

Assembly #170

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Status word 1 (LOW BYTE)							
1	Status word 1 (HIGH BYTE)							
2	Actual value PZD WORD 2 (LOW BYTE)							
3	Actual value PZD WORD 2 (HIGH BYTE)							
4	Actual value PZD WORD 3 (LOW BYTE)							
5	Actual value PZD WORD 3 (HIGH BYTE)							
6	Status word 2 (LOW BYTE)							
7	Status word 2 (HIGH BYTE)							

Assembly #171

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Status word 1 (LOW BYTE)							
1	Status word 1 (HIGH BYTE)							
2	Actual value PZD WORD 2 (LOW BYTE)							
3	Actual value PZD WORD 2 (HIGH BYTE)							
4	Actual value PZD WORD 3 (LOW BYTE)							
5	Actual value PZD WORD 3 (HIGH BYTE)							
6	Status word 2 (LOW BYTE)							
7	Status word 2 (HIGH BYTE)							
8	Actual value PZD WORD 5 (LOW BYTE)							
9	Actual value PZD WORD 5 (HIGH BYTE)							
10	Actual value PZD WORD 6 (LOW BYTE)							
11	Actual value PZD WORD 6 (HIGH BYTE)							

Assembly #172

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Status word 1 (LOW BYTE)							
1	Status word 1 (HIGH BYTE)							
2	Actual value PZD WORD 2 (LOW BYTE)							
3	Actual value PZD WORD 2 (HIGH BYTE)							
4	Actual value PZD WORD 3 (LOW BYTE)							
5	Actual value PZD WORD 3 (HIGH BYTE)							
6	Status word 2 (LOW BYTE)							
7	Status word 2 (HIGH BYTE)							
8	Actual value PZD WORD 5 (LOW BYTE)							
9	Actual value PZD WORD 5 (HIGH BYTE)							
10	Actual value PZD WORD 6 (LOW BYTE)							
11	Actual value PZD WORD 6 (HIGH BYTE)							
12	Actual value PZD WORD 7 (LOW BYTE)							
13	Actual value PZD WORD 7 (HIGH BYTE)							
14	Actual value PZD WORD 8 (LOW BYTE)							
15	Actual value PZD WORD 8 (HIGH BYTE)							

Assembly #173

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Status word 1 (LOW BYTE)							
1	Status word 1 (HIGH BYTE)							
2	Actual value PZD WORD 2 (LOW BYTE)							
3	Actual value PZD WORD 2 (HIGH BYTE)							
4	Actual value PZD WORD 3 (LOW BYTE)							
5	Actual value PZD WORD 3 (HIGH BYTE)							
6	Status word 2 (LOW BYTE)							
7	Status word 2 (HIGH BYTE)							
8	Actual value PZD WORD 5 (LOW BYTE)							
9	Actual value PZD WORD 5 (HIGH BYTE)							
10	Actual value PZD WORD 6 (LOW BYTE)							
11	Actual value PZD WORD 6 (HIGH BYTE)							
12	Actual value PZD WORD 7 (LOW BYTE)							
13	Actual value PZD WORD 7 (HIGH BYTE)							
14	Actual value PZD WORD 8 (LOW BYTE)							
15	Actual value PZD WORD 8 (HIGH BYTE)							
16	Actual value PZD WORD 9 (LOW BYTE)							
17	Actual value PZD WORD 9 (HIGH BYTE)							
18	Actual value PZD WORD 10 (LOW BYTE)							
19	Actual value PZD WORD 10 (HIGH BYTE)							

Detailed description of status word 1

Bit	Value	Description
0	1	Drive ready
	0	
1	1	Drive ready to run
	0	
2	1	Drive running
	0	
3	1	Drive fault active
	0	
4	1	
	0	OFF2 active
5	1	
	0	OFF3 active
6	1	Switch on inhibit active
	0	
7	1	Drive warning active
	0	
8	1	
	0	Deviation setpoint/actual value
9	1	PZD control (Process Data Control)
	0	
10	1	Maximum frequency reached
	0	
11	1	
	0	Warning: Motor current limit
12	1	
	0	Motor holding brake active
13	1	
	0	Motor overload
14	1	Motor running direction right
	0	
15	1	
	0	Inverter overload

Normally, status word 1 will be sent by the drive as the first word in the I/O produced connection.

Detailed description of status word 2

Bit	Value	Binary signal	Description
0	1		DC brake active
	0		
1	1		
	0		Inverter frequency < switch off limit
2	1		
	0		
3	1		Current ≥ limit
	0		
4	1		Actual frequency > reference frequency
	0		
5	1		Actual frequency < reference frequency
	0		
6	1		Actual frequency ≥ setpoint
	0		
7	1		Voltage < threshold
	0		
8	1		Voltage > threshold
	0		
9	1		reserve
	0		
10	1		PI frequency < threshold
	0		
11	1		PI saturation
	0		
12	1		MICROMASTER 4 model specific
	0		
13	1		MICROMASTER 4 model specific
	0		
14	1		MICROMASTER 4 model specific
	0		
15	1		MICROMASTER 4 model specific
	0		

Normally status word 2 will be sent by the drive as the fourth word in the I/O produced connection.

3.2 Parameter Handling of MICROMASTER 4 Drives via DeviceNet

Parameter data (PKW)

PKW data is used to read and change drive parameters. Normally it is not used by DeviceNet since drive commissioning is performed by DriveMonitor/STARTER, Drive ES or other means. If PKW data is not used, this section can be skipped.

The vendor specific PKW object is used to read and change drive parameters by the master using DeviceNet. The explicit messaging channel is used. Using this PKW object, the user has free access to all parameters in the base drive via DeviceNet. Examples include: Reading-out detailed diagnostic information, fault messages etc.

Use of PKW object

The vendor specific PKW object, class 100 (64 hex), is used to read and change MICROMASTER 4 drive parameters by the DeviceNet Master. The explicit messaging mode is used.

In this object, only 2 instances are implemented. Instance number 0 accesses the class attribute. Instance number 1 accesses all drive parameter numbers. For instance 1, the attribute number must presently always be 1. The first and second bytes of DeviceNet data are interpreted as a 16 bit word and contain the Parameter ID (PKE) which is defined later in section 3.2.6. The third byte of DeviceNet data (1 to 255) maps directly to the low byte of the Parameter index (IND) which is defined later in section 3.2.9. The fourth byte of DeviceNet data is interpreted as the high byte of the Parameter index (IND) and is presently always set to 0. For the set service, the fifth and sixth bytes of DeviceNet data are interpreted as a 16 bit word and contain the low word of the parameter value (PWE1) and the seventh and eighth bytes of DeviceNet data are interpreted as a 16 bit word and contain the high word of the parameter value (PWE2) which are defined later in section 3.2.12.

➢ A GET SINGLE service code is required for task ID's of 1, 4, 6, and 9. Task ID's are defined in section 3.2.1.

➢ A SET SINGLE service code is required for task ID's of 2, 3, 7, 8, 11, 12, 13, and 14.

➢ A not supported response is sent for task ID's of 0, 5, 10, and 15.

3.2.1   DeviceNet GET SINGLE

This section contains technical DeviceNet details required if a generic DeviceNet master is used for explicit messages. If a PLC scanner will be used, this section and the following two sections (3.2.2 and 3.2.3) can be skipped and the section Using Explicit Messaging with a PLC Scanner (section 6.2) should be referenced instead.

A GET SINGLE is sent as a fragmented explicit message. It uses 9 bytes.

Byte No. [DeviceNet Designation   ]

Byte 1	[FRAG] [XID] [SRC/DST MAC Id]			
Byte 2	[[R/R] [Service]	]	0x0E	[Get_Attribute_Single]
Byte 3	[Class	]	100	[PKW Object] [Vendor specific]
Byte 4	[Instance	]	1	[Instance Number] [always 1]
Byte 5	[Attribute	]	1	[Attribute Number] [always 1]
Byte 6	[Data	]		[Low byte Parameter ID (PKE)]
Byte 7	[Data	]		[High byte Parameter ID (PKE)]
Byte 8	[Data	]		[Low byte Para. Idx. (IND)] [range 0 to 255]
Byte 9	[Data	]		[High byte Para. Idx. (IND)] [for future use]

3.2.2   DeviceNet SET SINGLE

This section also contains technical DeviceNet details required if a generic DeviceNet master is used for explicit messages. If a PLC scanner will be used, this section and the following section (3.2.3) can be skipped and the section Using Explicit Messaging with a PLC Scanner (section 6.2) should be referenced instead.

A SET SINGLE is sent as a fragmented explicit message. It uses 14 bytes.

Byte No. [DeviceNet Designation   ]

Byte 1	[FRAG] [XID] [SRC/DST MAC Id]			
Byte 2	[Fragmentation Protocol	]		
Byte 3	[[R/R] [Service]	]	0x10	[Set_Attribute_Single]
Byte 4	[Class	]	100	[PKW Object] [Vendor specific]
Byte 5	[Instance	]	1	[Instance Number] [always 1]
Byte 6	[Attribute	]	1	[Attribute Number] [always 1]
Byte 7	[Data	]		[Low byte Parameter ID (PKE)]
Byte 8	[Data	]		[High byte Parameter ID (PKE)]
Byte 9	[Data	]		[Low byte Par. Idx. (IND)] [range 0 to 255]
Byte 10	[Data	]		[High byte Par. Idx. (IND)] [for future use]
Byte 11	[Data	]		[Low byte, low word par. value (PWE1)]
Byte 12	[Data	]		[High byte, low word par. value (PWE1)]
Byte 13	[Data	]		[Low byte, high word par. value (PWE2)]
Byte 14	[Data	]		[High byte, high word par. value (PWE2)]

3.2.3 DeviceNet response

This section also contains technical DeviceNet details required if a generic DeviceNet master is used for explicit messages. If a PLC scanner will be used, this section can be skipped and the section Using Explicit Messaging with a PLC Scanner (section 6.2) should be referenced instead.

The response is always be sent as a non-fragmented explicit message. It uses 8 bytes.

Byte No. [DeviceNet Designation   ]

Byte 1   [FRAG] [XID] [SRC/DST MAC Id]

Byte 2   [[R/R] [Service]   ] 0x8E or 0x90 [Get/Set_Attribute_Single]

Byte 3   [Service Data   ]   [Low byte Parameter ID (PKE)]

Byte 4   [Service Data   ]   [High byte Parameter ID (PKE)]

Byte 5   [Service Data   ]   [Low byte, low wrd par val (PWE1)]

Byte 6   [Service Data   ]   [High byte, low wrd par val (PWE1)]

Byte 7   [Service Data   ]   [Low byte, high wrd par val (PWE2)]

Byte 8   [Service Data   ]   [High byte, high wrd par val (PWE2)]

3.2.4 Parameterization Example 1: Read value of parameter r964.002

To read parameter r964.002, we would use a Get_Attribute_Single service code with class #100, instance #1, and attribute #1. The first 2 data bytes make up a data word of 63C4 hex [task Parameter ID (PKE)]. The third and fourth data bytes make up a data word of 3 [Parameter index (IND)]. For more details, refer to example 1 in the Parameter ID (PKE) section 3.2.6 and in the Parameter index (IND) section 3.2.9 later.

The GET SINGLE that would be sent by the master:

Byte No. [DeviceNet Designation   ]

Byte 1   [FRAG] [XID] [SRC/DST MAC Id]

Byte 2   [[R/R] [Service]   ] 0x0E [Get_Attribute_Single]

Byte 3   [Class   ] 100 [PKW Object] [Vendor specific]

Byte 4   [Instance   ] 1   [Instance Number] [always 1]

Byte 5   [Attribute   ] 1   [Attribute Number] [always 1]

Byte 6   [Data   ] 0xC4 [Low byte Parameter ID (PKE)]

Byte 7   [Data   ] 0x63 [High byte Parameter ID (PKE)]

Byte 8   [Data   ] 2   [Low byte Para. Idx. (IND)] [range 0 to 255]

Byte 9   [Data   ] 0   [High byte Para. Idx. (IND)] [for future use]

The response that would be sent by the drive:

Byte No. [DeviceNet Designation   ]

Byte 1	[FRAG] [XID] [SRC/DST MAC Id]		
Byte 2	[	[R/R] [Service]	] 0x8E [Get_Attribute_Single]
Byte 3	[	Service Data	] 0xC4 [Low byte Parameter ID (PKE)]
Byte 4	[	Service Data	] 0x43 [High byte Parameter ID (PKE)]
Byte 5	[	Service Data	] 0x69 [Low byte, low word par value (PWE1)]
Byte 6	[	Service Data	] 0x00 [High byte, low word par value (PWE1)]
Byte 7	[	Service Data	] 0x00 [Low byte, high word par value (PWE2)]
Byte 8	[	Service Data	] 0x00 [High byte, high word par value (PWE2)]

Bytes 1 and 2 are part of the DeviceNet protocol.

The response from the drive starts with byte 3 which contains a value of C4 hex, followed by a data byte of 43 hex. These 2 data bytes make up a data word of 43C4 hex [response Parameter ID (PKE)]. For more details, refer to example 1 in the Parameter ID (PKE) section 3.2.6 later.

Next is a data byte of 69 hex, followed by a data byte of 00 hex. These 2 data bytes make up a data word of 0069 hex [low word parameter value (PWE1)]. Next is a data byte of 00 hex, followed by a data byte of 00 hex. These 2 data bytes make up a data word of 0000 hex [high word parameter value (PWE2)]. Thus, parameter r964.002 has a value of 0069 hex. For more details, refer to example 1 in the Parameter value (PWE) section 3.2.12 later.

3.2.5   Parameterization Example 2: Set value of parameter P1203

To set parameter P1203 = 99 decimal, we would use a Set_Attribute_Single
service code with class #100, instance #1, and attribute #1. The first 2 data bytes
make up a data word of E4B3 hex [task Parameter ID (PKE)]. The third and fourth
data bytes make up a data word of 0 [Parameter index (IND)]. Because parameter
is not indexed, the value of IND is 0. Next are two data bytes that make up a data
word of 99 decimal or 0063 hex [low word parameter value (PWE1)]. Next are 2
more data bytes that make up a data word of 0000 hex [high word parameter value
(PWE2)]. For more details, refer to example 2 in the Parameter ID (PKE) section
3.2.6, in the Parameter index (IND) section 3.2.9 later, and in the Parameter value
(PWE) section 3.2.12 later.

The SET SINGLE that would be sent by the master:

Byte No. [DeviceNet Designation   ]

Byte 1   [FRAG] [XID] [SRC/DST MAC Id]

Byte 2   [Fragmentation Protocol   ]

Byte 3   [[R/R] [Service]   ] 0x10 [Set_Attribute_Single]

Byte 4   [Class   ] 100   [PKW Object] [Vendor specific]

Byte 5   [Instance   ] 1   [Instance Number] [always 1]

Byte 6   [Attribute   ] 1   [Attribute Number] [always 1]

Byte 7   [Data   ] 0xB3 [Low byte Parameter ID (PKE)]

Byte 8   [Data   ] 0xE4 [High byte Parameter ID (PKE)]

Byte 9   [Data   ] 0   [Low byte Par. Idx. (IND)] [range 0 to 255]

Byte 10 [Data   ] 0   [High byte Par. Idx. (IND)] [for future use]

Byte 11 [Data   ] 0x63 [Low byte, low word par. value (PWE1)]

Byte 12 [Data   ] 0x00 [High byte, low word par. value (PWE1)]

Byte 13 [Data   ] 0x00 [Low byte, high word par. value (PWE2)]

Byte 14 [Data   ] 0x00 [High byte, high word par. value (PWE2)]

The response that would be sent by the drive:

Byte No. [DeviceNet Designation   ]

Byte 1   [FRAG] [XID] [SRC/DST MAC Id]

Byte 2   [[R/R] [Service]   ] 0x90 [Set_Attribute_Single]

Byte 3   [Service Data   ] 0xB3 [Low byte Parameter ID (PKE)]

Byte 4   [Service Data   ] 0x14 [High byte Parameter ID (PKE)]

Byte 5   [Service Data   ] 0x63 [Low byte, low word par value (PWE1)]

Byte 6   [Service Data   ] 0x00 [High byte, low word par value (PWE1)]

Byte 7   [Service Data   ] 0x00 [Low byte, high word par value (PWE2)]

Byte 8   [Service Data   ] 0x00 [High byte, high word par value (PWE2)]

Bytes 1 and 2 are part of the DeviceNet protocol.

The response from the drive starts with byte 3 which contains a value of B3 hex, followed by a data byte of 14 hex. These 2 data bytes make up a data word of 14B3 hex [response Parameter ID (PKE)]. For more details, refer to example 2 in the Parameter ID (PKE) section 3.2.6 later.

Next is a data byte of 63 hex, followed by a data byte of 00 hex. These 2 data bytes make up a data word of 0063 hex or 99 decimal [low word parameter value (PWE1)]. Next is a data byte of 00 hex, followed by a another data byte of 00 hex. These 2 data bytes make up a data word of 0000 hex [high word parameter value (PWE2)]. Thus, parameter P1203 has a value of 99 decimal. For a more details, refer to example 2 in the Parameter value (PWE) section 3.2.12 later.

Following is a description of the terms used in the above explanations.

3.2.6   Parameter ID (PKE)

Parameter ID (PKE)		Included in: GET
High Byte	Low Byte	SINGLE, SET
15 12	11	10 0	SINGLE, response
AK	PNU	

(Bit No.: is shown to the left of the 15 12 / 11 / 10 ... 0 row)

The parameter ID (PKE) is **always** a 16-bit value.

Bits 0 to 10 (PNU) contain the number of the required parameter. The significance of the parameters can be taken from the Section "Parameter list" of the drive Instruction Manual. To distinguish between base board parameter numbers P0000 – P1999 and P2000 – P3999 which share the same PNU numbers, the "Page Select" bit (bit 15) in the IND (see section 3.2.9) is used.

Bit 11 is reserved on the MICROMASTER 4 and must be set to 0.

Bits 12 to 15 (AK) contain the task- and response ID.

For the task telegram (DeviceNet master → drive), you can take the significance of the task ID from Table 3-1. It corresponds to the definitions in the "PROFIBUS profile variable-speed drives". Supplement "Version 3.0" to this profile should be used. Only the task IDs that are supported by the DNM are shown in Table 3-1. Task IDs 11 to 14 are specific for MICROMASTER 4, and are not defined in the PROFIBUS profile.

Table 3-1   Task IDs (DeviceNet master > converter)

Task-ID	Significance	Response ID	
		positive	negative
0	No task	0	7 or 8
1	Request parameter value	1 or 2	↑
2	Change parameter value (word) for non-indexed parameters	1	|
3	Change parameter value (double word) for non-indexed parameters	2	|
4	Request descriptive element 1	4 or 5	|
6	Request parameter value (array) [1]	4 or 5	|
7	Change parameter value (array, word) for indexed parameters [2]	4	|
8	Change parameter value (array, double word) for indexed parameters [2]	5	|
9	Request the number of array elements	6	|
11	Change parameter value (array, double word) and store in the EEPROM[2]	5	|
12	Change parameter value (array, word) and store in the EEPROM [2]	4	|
13	Change parameter value (double word) and store in the EEPROM	2	|
14	Change parameter value (word) and store in the EEPROM	1	↓

[1] The desired element of the parameter description is specified in IND (2nd word)

[2] The desired element of the indexed parameter is specified in IND (2nd word)

For the response telegram (drive → DeviceNet master), you can take the significance of the response ID from Table 3-2. It also corresponds to the definitions in the "PROFIBUS profile variable-speed drives". Supplement "Version 3.0" to this profile should be used. Depending on the task ID, only certain response IDs are possible. If the response ID has the value 7 (task cannot be executed), then an error number is deposited in parameter value1 (PWE1).

Table 3-2   Response IDs (converter > DeviceNet master)

Response ID	Significance
0	No response
1	Transfer parameter value for non-indexed parameters (word)
2	Transfer parameter value for non-indexed parameters (double word)
3	Transfer descriptive element (not supported by DNM)
4	Transfer parameter value (array word) for indexed parameters[2]
5	Transfer parameter value (array double word) for indexed parameters [2]
6	Transfer the number of array elements
7	Task cannot be executed (with error number)
8	No operator change rights for the PKW interface

[2] The required element of the indexed parameter is specified in IND

Error numbers for the response 'task cannot be executed' (drive parameters). The error numbers are transferred in the PWE1 word of the response.

Table 3-3   Error responses

No.	Significance	
0	Illegal parameter No. (PNU)	If the PNU does not exist
1	Parameter value cannot be changed	If the parameter is a read-only parameter
2	Upper or lower limit exceeded	–
3	Erroneous sub-index	–
4	No array	For tasks for indexed parameters to a non-indexed parameter. For example: task: 'Change parameter value (word, array)' for non-indexed parameter
5	Incorrect data type	Mix-up between word and double word
6	Setting not allowed (can only be reset)	–
7	Descriptive element cannot be changed	Task not possible for MICROMASTER 4
11	No status as master control	Change request without status as master control (see P0927)
12	Key word missing	Drive parameter: 'Access key' and/or 'special parameter access' not correctly set
17	Task cannot be executed as a result of the operating state	Drive state doesn't permit the presently issued task
101	Parameter No. presently de-activated	Dependent on drive status
102	Channel width too low	Parameter response too long for telegram
103	Incorrect index number	Index response from base unit did not match index requested
104	Invalid parameter value	Parameter permits only certain values
106	Task is not implemented	-
200/ 201	Modified minimum/maximum not reached/exceeded	Minimum/maximum can be further limited in operation
204	Available access authorization does not cover modification of parameters	-

3.2.7   PKE Example 1: Read value of parameter r964.002

This example details the decoding of the task PKE and the response PKE of example 1 in the Parameterization Example 1: Read value of parameter r964.002 section 3.2.4 previously.

(PKE):   **Task ID** (request from master)
                 r964 (=3C4 hex): Firmware version
                 Read parameter value (array).

Parameter ID (PKE)

Bit No.:	15 12	11	10 0
	AK Task ID		PNU
	Byte 1		Byte 0
Binary value	0 1 1 0	0 0 1 1	1 1 0 0	0 1 0 0
HEX value	6	3	C	4

Bit 12..15:   Value =   6 (=   "6" hex); read parameter value (array)
Bit   0..10:   Value = 964 (= "3C4" hex); parameter number without set
                 parameter change report

(PKE):   **Response ID** (response from drive)
                 r964 (=3C4 hex):   Firmware version
                 Transfer of requested parameter value (array).

Parameter ID (PKE)

Bit No.:	15 12	11	10 0
	AK Response ID		PNU
	Byte 1		Byte 0
Binary value	0 1 0 0	0 0 1 1	1 1 0 0	0 1 0 0
HEX value	4	3	C	4

Bit 12..15:   Value =   4 (=   "4" hex); transfer parameter value (array)
Bit   0..10:   Value = 964 (= "3C4" hex); parameter number without set
                 parameter change report

3.2.8   PKE Example 2: Set value of parameter P1203

This example details the decoding of the task PKE and the response PKE of example 2 in theParameterization Example 1: Read value of parameter r964.002 section 3.2.5 previously.

(PKE):   **Task ID** (request from master)
                      P1203 (=4B3 hex): Flying restart - search time
                      Change parameter value (word) and store in the EEPROM.

Parameter ID (PKE)

Bit No.:	15 12	11	10 0	
	AK Task ID		PNU	
	Byte 1		Byte 0	
Binary value	1 1 1 0	0 1 0 0	1 0 1 1	0 0 1 1
HEX value	E	4	B	3

Bit 12..15:   Value =   14 (=   "E" hex); change parameter value (word) and store in the EEPROM

Bit   0..11:   Value = 1203 (= "4B3" hex); parameter number without set parameter change report

(PKE):   **Response ID** (response from drive)
                      P1203 (=4B3 hex): Flying restart - search time
                      Transfer of new value of changed parameter (array, word).

Parameter ID (PKE)

Bit No.:	15 12	11	10 0	
	AK Task ID		PNU	
	Byte 1		Byte 0	
Binary value	0 0 0 1	0 1 0 0	1 0 1 1	0 0 1 1
HEX value	1	4	B	3

Bit 12..15:   Value =   1 (=   "1" hex); transfer parameter value for non-indexed parameters (word)

Bit   0..11:   Value = 1203 (= "4B3" hex); parameter number without set parameter change report

3.2.9   Parameter index (IND)

Parameter index (IND)				Included in:
High Byte		Low Byte		GET SINGLE
15	14 8	7 0		SET SINGLE
Page Select	Value = 0	Index		

Bit No.: (to the left of the 15 | 14 | 7 | 0 row)

The index is an **8-bit value**, and for DeviceNet, is always transferred in the **least significant byte** (bits 0 to 7) of the parameter index (IND). The most significant byte (bits 8 to 15) of the parameter index (IND) has the "Page Select" bit (bit 15) and seven bits (bits 8 to 14) of 0. If this most significant byte (high byte) = 00, then the PKE requests the P or r base board parameters P0000 to P1999. If this most significant byte (high byte) is = 80 hex, then the PKE requests base board parameters P2000 to P3999.

For an indexed parameter, the required index is transferred. The significance of the indices can be taken from the Section "Parameter list" of the drive Instruction Manual.

For a descriptive element, the number of the required element is transferred. The significance of the descriptive elements can be taken from the "PROFIBUS profile variable-speed drives". Supplement "Version 3.0" to this profile should be used.

3.2.10   IND Example 1: Read value of parameter r964.002

This example details the decoding of the task IND of example 1 in the Parameterization Example 1: Read value of parameter r964.002 section 3.2.4 previously.

(IND):	R964 (=3C4 hex): Firmware version
	Read parameter value with index 2.

Parameter index (IND)

Bit No.:	15	14 8	7 0	
	Byte 3		Byte 2	
Binary value	0	0 0 0	0 0 0 0	0 0 0 0	0 0 1 0
HEX value	0		0	0	2

Bit 15	Page Select Value = 0 for P or r parameters P0000 to P1999, = 1 for P or r parameters P2000 to P3999
Bits 8..14:	Value always 0
Bits 0....7:	Index of parameter or the number of the descriptive element

3.2.11   IND Example 2: Set value of parameter P1203

This example details the decoding of the task IND of example 2 in the Parameterization Example 2: Set value of parameter P1203 section 3.2.5 previously.

(IND):   P1203 (=4B3 hex): Flying restart - search time

Parameter is not indexed, therefore value of index = 0.

Parameter index (IND)

Bit No.:	15	14	8	7	0
	Byte 3			Byte 2	
Binary value	0	0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
HEX value	0		0	0	0

Bit 15   Page Select Value = 0 for P or r parameters P0000 to P1999,
              = 1 for P or r parameters P2000 to P3999

Bits 8..14: Value always 0

Bits 0....7: Index of parameter or the number of the descriptive element

3.2.12   Parameter value (PWE)

Parameter value (PWE)		Included In:
low word:	Byte 1	Byte 0	SET SINGLE,
	Parameter value **low** (PWE1)		Response
high word:	Byte 3	Byte 2	
	Parameter value **high** (PWE2)		

AK: Task- or response ID

PNU: Parameter number

The parameter value (PWE) is **always** transferred as double word (32 bit). **Only one** parameter value can be transferred in a telegram.

A 32-bit parameter value is comprised of PWE1 (least significant word) and PWE2 (most significant word).

A 16-bit parameter value is transferred in PWE1 (least significant word). In this case, PWE2 (most significant word), must be set to 0.

3.2.13   PWE Example 1: Read value of parameter r964.002

This example details the decoding of the task PWE of example 1 in the
Parameterization Example 1: Read value of parameter r964.002 section 3.2.4
previously. Since this example was a GET SINGLE, the PWE is only used in the
response from the drive. Since the response ID of the PKW was 4, the parameter
is a 16 bit parameter and the value is completely contained in PWE1. If the
response ID of the PKW had been 5, the parameter would have been a 32 bit
parameter and the value would have been contained in PWE1 and PWE2.

(PWE):   r964 (=3C4 hex): Firmware version
                Read parameter value with index 2.

Parameter value (PWE)

Low word (PWE1)	Byte 1		Byte 0	
Bit No.:	15	8	7	0
Hex value	0	0	6	9

High word (PWE2)	Byte 3		Byte 2	
Bit No.:	31	24	23	16
Hex value	0	0	0	0

Bits   0..15:   Parameter value for 16-bit parameter or low component for 32-bit parameter

Bits 16..31:   Value = 0 for 16-bit parameter or high component for 32-bit parameter
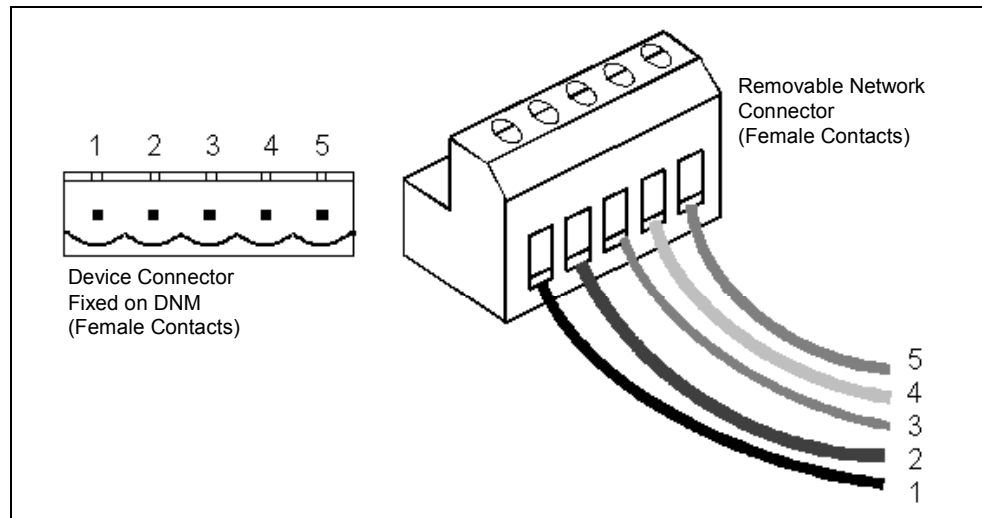
3.2.14   PWE Example 2: Set value of parameter P1203

This example details the decoding of the task PWE of example 2 in the Parameterization Example 2: Set value of parameter P1203 section 3.2.5 previously. Since the response ID of the PKW was 1, the parameter is a 16 bit parameter and the value is completely contained in PWE1. If the response ID of the PKW had been 2, the parameter would have been a 32 bit parameter and the value would have been contained in PWE1 and PWE2.

(PWE):   P1203 (=4B3 hex): Flying restart - search time
              Change the parameter value to 99 decimal (=0063 hex).

Parameter value (PWE)

Low word (PWE1)	Byte 1		Byte 0	
Bit No.:	15	8	7	0
Hex value	0	0	6	3

High word (PWE2)	Byte 3		Byte 2	
Bit No.:	31	24	23	16
Hex value	0	0	0	0

Bits   0..15:   Parameter value for 16-bit parameter or low component for 32-bit parameter

Bits 16..31:   Value = 0 for 16-bit parameter or high component for 32-bit parameter

3.2.15   Rules for PKW object processing

➢ The length of the task can be 2 words (for a GET SINGLE) or 4 words (for a SET SINGLE). The length of the response is always 3 words

➢ The least significant byte (for words) must always be sent first, and then the most significant byte. The least significant word (for double words) must always be sent first, and then the most significant word.

➢ **One** task or **one** response only refers to **one** parameter value.

➢ The slave sends a response to a parameter task only when the data is available from the base MICROMASTER4 drive. In standard operation, this takes approximately 50 milliseconds.

➢ The master may only issue a new parameter task after a response has been received regarding an issued parameter task.

➢ The master identifies the response to an issued task:

➢ evaluation of the response ID (refer to Table 3-2)

➢ evaluation of the parameter No. PNU

➢ if required by evaluating the parameter value PWE.

4   Connecting up to DeviceNet

Assignment of plug in connector

The DNM option module uses the open style 5-position (COMBICON – Phoenix) connectors to provide the physical connection to the bus. Refer to the DeviceNet Specification.

Table 4-1   PIN-Assignment for DeviceNet Connector

Pin	Function	DeviceNet Wire Color
1	V–	Black power supply common
2	CAN–	Blue
3	Shield	Bare
4	CAN+	White
5	V+	Red DeviceNet network power supply 24 V DC

Cable meeting DeviceNet specifications must be used.

Thin cable: Belden 3084A

Thick cable: Belden 3082A or 3083A or 3085A

Relation of DeviceNet Data Rate and Cable Distances:

DataRate	Trunk Distance (thick Cable)	Drop Length	
		Maximum drop	Cumulative
125 K	500 m (1640 ft)	6 m (20 ft)	156 m (512 ft)
250 K	250 m (820 ft)	6 m (20 ft)	78 m (256 ft)
500 K	100 m (328 ft)	6 m (20 ft)	39 m (128 ft)

NOTE

Thin cable may be used as trunk. Maximum distance is 100 meters (328 feet) for any baud rate.

Bus Termination

To guarantee fault-free operation of the DeviceNet bus, the bus cable must be terminated using bus terminating resistors at both ends of the trunk as described in the DeviceNet specifications.

The resistor requirements are:

➢ 121 ohm

➢ 1% Metal Film

➢ ¼ Watt

Ground Connection

Grounding of the DeviceNet bus is described in the DeviceNet specification. The specification follows:

"DeviceNet should be grounded at ONE location. Grounding at more then one location may produce ground loops, while not grounding the network will increase sensitivity to ESD and outside noise sources. The single grounding location should be at a power tap. Sealed DeviceNet power taps are designed to accommodate grounding. Grounding near the physical center of the network is also desired."

"The trunk drain/shield should be attached to the power supply ground or V- with a copper conductor that is either solid, stranded, or braided. Use a 1" copper braid or a #8 AWG wire that is less than 3 meters/10 feet in length. This should then be attached to a good earth or building ground (such as an 8 foot stake driven into the ground, attached to building iron or to the cold water plumbing)."

"If the network is already grounded, do NOT connect the grounding terminal of the tap or ground of the supply to earth. If more than one supply is on the network, then connect the drain wire/shield at ONE supply only, preferably near the physical center of the network."

DeviceNet Power Supply and Power Tap

Powering of the DeviceNet bus is described in the DeviceNet specification. A DeviceNet power tap should be used to protect the network, The general power supply specification follows:

➢ +24 V DC

➢ Ability to support linear and switching regulators

➢ Tolerance of: +24 V DC ± 1 % and current capability of 0 - 16 amps (single and multiple supply applications)

➢ Supply outputs must be isolated from the AC line and chassis

DNM Power Requirements

Each DNM draws a maximum of 80 milliampere worst case (at 11 V DC) from the DeviceNet power supply.

The DNM is technically called an "isolated node with transceiver powered by the network". The transceiver and half of the optocouplers are powered by the DeviceNet network. But the rest of the node is powered by the AC line through the drive.
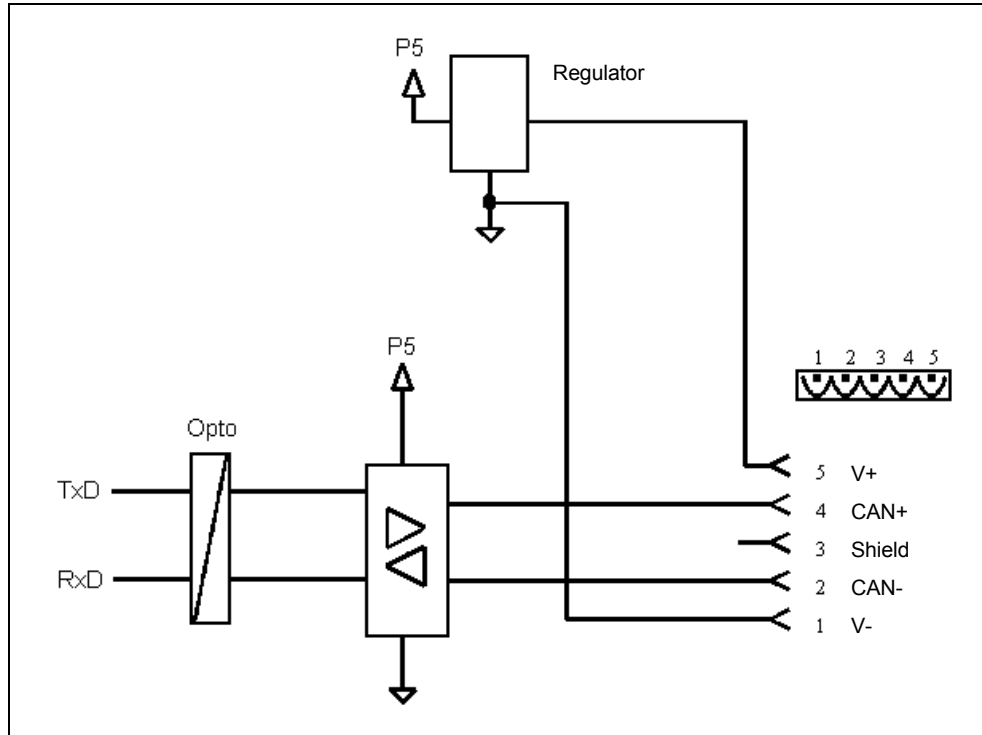
Approximate DeviceNet Bus Interface Circuit

Figure 4-1

5 Starting up the DeviceNet Module

NOTE

Before the converter with connected DeviceNet board is switched on, you should plug either the standard display panel (SDP), a basic operator panel (BOP) or an 'Advanced Operator Panel' (AOP) into the top portion of the DeviceNet board.

The DeviceNet optional board may only be installed when the converter power supply is disconnected.

The following parameters must be set to start up the DeviceNet optional board:

Parameter	Description
P0918	DeviceNet MAC ID (node address of the drive)
P2040	Process data telegram failure time
P2041	Communication board functions (for setting other DeviceNet characteristics)
P0719	Command/Setpoint source selection (for simple applications)
P0700	Selection of command source (for complex applications)
P1000	Selection of frequency setpoint (for complex applications)
r2050	Process data setpoint selection (BICO) (for complex applications)
P2051	Selection of process data actual values (BICO)
P0927	Modification source for parameters
r2053	Software version and other software information of the DNM (see Section 7.4)
r2054	Communication board diagnostics (see Section 7.3)

Important NOTE

Parameter settings directly affecting DeviceNet (P0918 and P2041) do not take effect until the converter has been restarted cold again. This cold restart must be initiated by switching the power off and then on again.

5.1 Parameter "P0918" (DeviceNet MAC ID) Node Address of the drive

Sets the DeviceNet MAC ID for the DNM and has a range of 0 to 63. The default value of P0918 is 3.

5.2 Parameter "P2040", telegram failure time (process data monitoring)

Parameter "P2040" is set to determine whether poll I/O control/setpoint transmission via DeviceNet should be monitored by the converter.

➢ "P2040" = 0 means: No monitoring
➢ "P2040" > 0 means: The value of "P2040" is the telegram failure time in milliseconds. (The default setting of the parameter is a value of >0!)

Fault 007 is activated if no new setpoints are received by the DeviceNet optional board within the telegram failure period. Also refer to alarm A700 in section 7.2 which describes the DeviceNet idle condition which will not result in fault 007 because there is still communication with the DeviceNet master.

When the DeviceNet optional board is in operation, parameter "P2040" should be set to a value of > 0.

5.3 Parameter "P2041" (communication board functions)

Indexed parameter P2041 is required to complete the setup of the DeviceNet module. For most applications, the defaults may be adequate (value = 0). The following table shows the setting options.

Table 5-1   Communication board functions

Parameter	Description	Possible Values
P2041.00	I/O assembly for polled I/O produced connection path The power-up and reset default value of the produced connection path of the DeviceNet polled I/O connection.	0: 4 PZD status/actual value words 170: 4 PZD status/actual value words 171: 6 PZD status/actual value words 172: 8 PZD status/actual value words 173: 10 PZD status/actual value words
P2041.01	I/O assembly for polled I/O consumed connection path The power-up and reset default value of the consumed connection path of the DeviceNet polled I/O connection.	0: 4 PZD control/reference words 120: 4 PZD control/reference words 121: 6 PZD control/reference words 122: 8 PZD control/reference words 123: 10 PZD control/reference words
P2041.02	Baud rate of DeviceNet bus	0: 125 kbps 1: 250 kbps 2: 500 kbps
P2041.03	Selects the diagnostics mode.	0: Standard Diagnostics >0: special Diagnostics (see Diagnostics section)

5.4   Process Data Assignment

The I/O data received (consumed) from the DeviceNet master is placed in a special data area in the MICROMASTER 4. For flexibility, the use of this incoming I/O data must be assigned – for example, the second word could be used as the motor frequency reference. The MICROMASTER 4 allows 2 different methods for this assignment – parameter P0719 for a simple, but limited assignment, and P0700 and P1000 for a more flexible assignment.

In a similar manner and again for flexibility, the I/O data transmitted (produced) back to the DeviceNet master originates in another special outgoing data area in the MICROMASTER 4. Each outgoing I/O data word (16 bits) must be assigned to internal status words and actual value words already available in the MICROMASTER 4. For example, the second word sent back to the DeviceNet master could contain the actual motor frequency. Indexed parameter P2051 is used for this selection.

NOTE

Some of the examples show only 4 PZD words which is the maximum capability of the MICROMASTER 420. Other models of the MICROMASTER 4 family will have a larger capability. The DNM has the capability of handling up to 10 PZD words depending on the capability of the attached base MICROMASTER 4.

Parameter "P0719" (process data master control) = 66

For simple applications, parameter P0719 can be set to 66 to select the control/setpoint source. Control word 1 and the master setpoint from the DeviceNet master are then used by the MICROMASTER 4.

Status word 1 and the actual main value are output via the DeviceNet optional board and sent back to the DeviceNet master regardless of the setting in P0719.

P0719 has priority over "P0700" and "P1000".

Parameters "P0700" and "P1000" (selection via BICO)

As an alternative to parameter P0719, the control word and setpoint sources can be selected quickly in parameters P0700 (select command source) and P1000 (select frequency setpoint) respectively.

P0719 must be set to 0 when BICO technology is used with "P700" and "P1000".

Parameters "r2050" and "P2051" (BICO)

Much greater flexibility is afforded by the interconnection of process data using binectors/connectors, see description "Use of binectors and connectors" in the MICROMASTER 4 reference manual.

Detailed connection of setpoints and actual values to and from the DeviceNet master through the DeviceNet optional board is parameterized in "r2050" and "P2051".

The following table shows the parameters specific to the DeviceNet optional board relating to the connection of process data:

Table 5-1   Parameters for flexible interconnection of process data

Telegram:	PZD1 STW/ZSW	PZD2 HSW/HIW	PZD3	PZD4
Link values for setpoints DeviceNet master → converter	**r2050.00**	**r2050.01**	**r2050.02**	**r2050.03**
Link parameters for actual values converter → DeviceNet master	**P2051.00**	**P2051.01**	**P2051.02**	**P2051.03**

PZD:	**Process data**	**HSW:**	**Main setpoint**
STW:	**Control word**	**HIW:**	**Main actual value**
ZSW:	**Status word**		

NOTE

r2050 also acts as a display parameter by which the setpoints received from the DeviceNet master can be checked. These displays are always in decimal – for example if r2050.00 = 1150, this would be 047E in hex.

5.5   Parameter "P0927", modification source for parameters

This parameter can be set to define the sources of parameter modifications.

Bit 0	DeviceNet master	0: No 1: Yes
Bit 1	BOP	0: No 1: Yes
Bit 2	PC-converter assembly set (USS on the BOP interface)	0: No 1: Yes
Bit 3	Local RS-485 interface (terminal 14/15 (MICROMASTER 420) and 29/30 (MICROMASTER 440) with USS)	0: No 1: Yes

The default setting for all bits is 1, that is parameters can be modified from all sources.

6   Information for the DeviceNet Master

Normally the DeviceNet network is configured by a PC based configuration program. The assignment of slaves to a particular master is performed at this point. In addition the length of I/O data in both directions is assigned.

Electronic Data Sheet (EDS)

The information necessary for the configuration program is contained in a EDS file which is on a floppy disk which is included with the DNM.

6.1   Creating an EDS Stub File for the DNM

If the EDS file is not available, most configuration tools can create a minimal EDS stub file from the following information. Depending on the management software used, portions of this information can be obtained directly from the DNM through DeviceNet communications.

Vendor ID: 145

Vendor Name: Siemens Energy & Automation

Device Type: Communications Adaptor

Product Code: 2

Product Name: Siemens MICROMASTER 4

Major Revision: (must be obtained from DNM using DeviceNet communications)

Minor Revision: (must be obtained from DNM using DeviceNet communications)

Catalog Number: MLFB 6SE6400-1DN00-0AA0

Strobed Connection:

  ☐ Enable

  Input Size: 8   Bytes

  Output Size: 8   Bytes

Polled Connection:

  ☑ Enable

  Input Size: 8   Bytes

  Output Size: 8   Bytes

COS/Cyclic Connection:

  ☐ Enable

  Input Size: 0   Bytes

  Output Size 0   Bytes

40 character description: DNM - MICROMASTER 4 Communication Board

6.2 Using Explicit Messaging with a PLC Scanner

PKW data is normally not used – since drive commissioning is performed by DriveMonitor/STARTER or other means. If PKW data is not used, this section can be skipped.

The following information should help in using the PKW object to read and change drive parameters.

The explicit message program control feature is used. The Get Attribute Single and Set Attribute Single services are used.

The vendor specific PKW object is used. It is class 100 (64 hex). Only Instance 1 is used. Only attribute 1 is used. The drive parameter number, parameter number index, and parameter value (if required) is included in the data field.

6.2.1   Example 1: Read value of parameter r964.002

The PLC word data is in hex.

Block Transfer Write Data
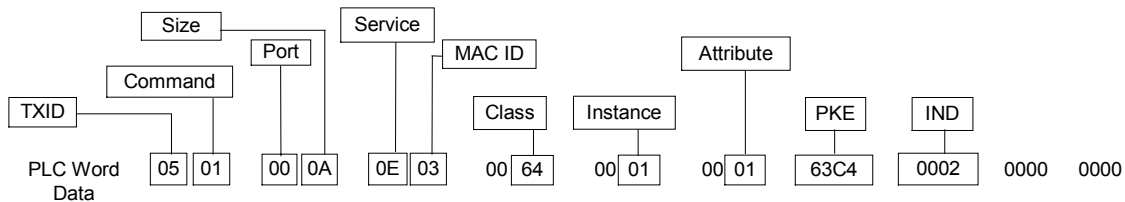
TXID = 05   (range 01 to FF hex = 1 to 255) should be incremented by PLC logic before each new request

Command = 01   (always 01) execute transaction block

Port = 00   (range 00 to 01) DeviceNet port of scanner for command
(00 = Channel A, 01 = Channel B)

Size = 0A hex   (choice of 0A hex for Get Single or 0E hex for Set Single)

Service = 0E hex (choice of 0E hex = 14 for Get Single or 10 hex = 16 for Set Single)

MAC ID = 03   (range 00 to 3F hex = 0 to 63) address of drive set in P0918

Class = 64 hex   (always 64 hex) class number of PKW object

Instance = 01   (always 01)

Attribute = 01   (always 01)

PKE = 63C4 hex   (range 0000 to FFFF hex) 63C4 hex = Read array parameter r964.002 – for more details, refer to PKE Example 1: Read value of parameter r964.002 section 3.2.7 previously

IND = 0002 hex   (range low byte = 00 to FF hex = 0 to 255), high byte = 0 (may be non-zero in future) 0002 hex = index 2 – for more details, refer to example 1 in the Parameter index (IND) section 3.2.9 previously

Block Transfer Read Data
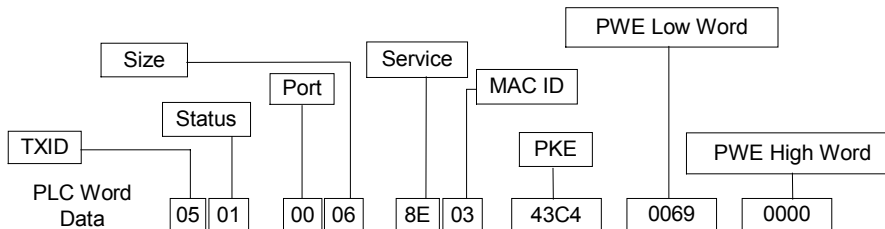
TXID = 05   must be same number as request TXID above

Status = 01   (must be 01) -- transaction successful

Port = 00   must be same number as request port above

Size = 06   (must always be 06)

Service = 0E hex must be same number as request service above + 80 hex

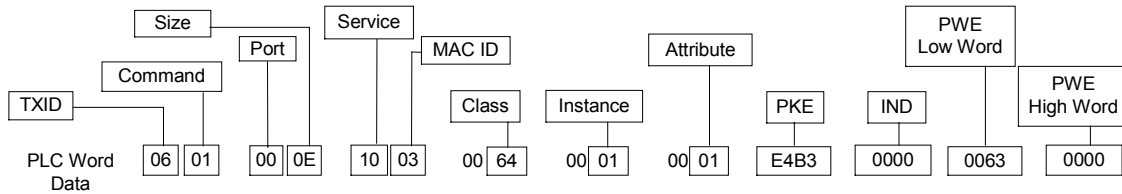MAC ID = 3   xmust be same address of drive as request above

PKE = 43C4 hex = Transfer of requested parameter r964.002 16 bit value (array) -- for more details, refer to PKE Example 1: Read value of parameter r964.002 section 3.2.7 previously

PWE = 0069 hex 16 bit value of parameter r964.002 – high word is not used for 16 bit values – for more details, refer to example 1 in the Parameter value (PWE) section 3.2.12 previously

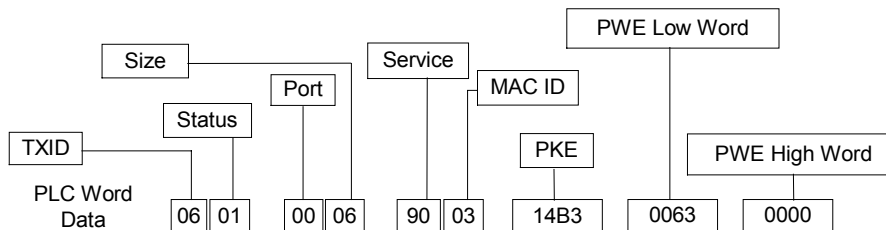## 6.2.2   Example 2: Set value of parameter P1203

The PLC word data is in hex.

Block Transfer Write Data

	Command		Port		Service		MAC ID							PWE Low Word		

(diagram labels: TXID, Command, Size, Port, Service, MAC ID, Class, Instance, Attribute, PKE, IND, PWE Low Word, PWE High Word)

PLC Word Data: 06 | 01 | 00 | 0E | 10 | 03 | 00 | 64 | 00 | 01 | 00 | 01 | E4B3 | 0000 | 0063 | 0000

TXID = 06   (range 01 to FF hex = 1 to 255) should be incremented by PLC logic before each new request

Command = 01   (always 01) execute transaction block

Port = 00   (range 00 to 01) DeviceNet port of scanner for command
(00 = Channel A, 01 = Channel B)

Size = 0E hex   (choice of 0A hex for Get Single or 0E hex for Set Single)

Service = 10 hex (choice of 0E hex = 14 for Get Single or 10 hex = 16 for Set Single)

MAC ID = 03   (range 00 to 3F hex = 0 to 63) address of drive set in P0918

Class = 64 hex (always 64 hex) class number of PKW object

Instance = 01 (always 01)

Attribute = 01 (always 01)

PKE = E4B3 hex (range 0000 to FFFF hex) E4B3 hex = Set non-indexed parameter P1203 – for more details, refer to PKE Example 2: Set value of parameter P1203 section 3.2.8 previously

IND = 0000 hex (range low byte = 00 to FF hex = 0 to 255), high byte = 0 (may be non-zero in future) 0000 hex = index 0 – for more details, refer to example 2 in the Parameter index (IND) section 3.2.9 previously

PWE = 0063 hex new 16 bit value of parameter P1203 – high word is not used for 16 bit values and is set to 0 -- for more details, refer to example 2 in the Parameter value (PWE) section 3.2.12 previously

Block Transfer Read Data

(diagram labels: TXID, Status, Size, Port, Service, MAC ID, PKE, PWE Low Word, PWE High Word)

PLC Word Data: 06 | 01 | 00 | 06 | 90 | 03 | 14B3 | 0063 | 0000

TXID = 06   must be same number as request TXID above

Status = 01   (must be 01) -- transaction successful

Port = 00   must be same number as request port above

Size = 06   (must always be 06)

Service = 90 hex must be same number as request service above + 80 hex

MAC ID = 03   must be same address of drive as request above

PKE = 14B3 hex = Transfer of set non-indexed parameter P1203 16 bit value -- for more details, refer to PKE Example 2: Set value of parameter P1203 section 3.2.8 previously

PWE = 0063 hex 16 bit new value of parameter P1203 – high word is not used for 16 bit values -- for more details, refer to example 2 in the Parameter value (PWE) section 3.2.12 previously

7   Diagnostics and Troubleshooting

To aid in troubleshooting, there is a standard DeviceNet Combined Module/Network Status (MNS) LED, specific DNM generated alarms and a diagnostic display parameter.

7.1   LED Display

A two color LED is on the the front side of the DeviceNet module. It provides a quick indication of the operating status of the module.

A LED test is performed at power-up. The following sequence is used: Turn LED green for approximately 1 second, then red for approximately 1 second, then off.

The following table gives the meaning of the standard DeviceNet Combined Module/Network Status (MNS) LED.

Table 7-1   LED Display DeviceNet Module

LED	DeviceNet Combined Module/Network Status (MNS) Indication
off	Device is not on-line. The device has not completed the Dup_MAC_ID test yet. This condition can be caused by: ➢ no power to the base drive ➢ no other device on the DeviceNet network ➢ no power on the DeviceNet network ➢ no firmware loaded into the communication module ➢ defective DNM module
flashing green	The device is operating in a normal condition and the device is on-line with no connections in the established state. The device has completed the Dup_MAC_ID test. This device is not allocated to a master.
solid green	The device is operating in a normal condition and the device is on-line and with connections in the established state. This device is allocated to a master.
flashing red	Recoverable fault and/or one or more I/O Connections are in the Timed-Out state.
solid red	The device has an unrecoverable fault; may need replacing. Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID or Bus-off). This condition can be reset only by cycling the power on the drive.

7.2 Alarms (Warnings and Faults)

When warnings and faults occur in the DeviceNet communication, an appropriate alarm or fault number is displayed on the drive.

Warnings

Table 7-1   Warnings Displayed on the Drive

Alarm-number	Description
A700	Cause: DeviceNet idle condition warning. A zero length PZD data telegram has been received through the poll I/O message channel. The alarm will be reset when a normal length PZD data telegram is received. Extra Information: The telegram is ignored. Data which was last sent remains valid. Depending on the communication failure monitoring setting (P2040), fault F0070 can be initiated. Remedy: Check the DeviceNet bus master. Some PLCs will send an idle condition when they are put in the "program" mode.
A701	Cause: CAN error warning Erroneous DeviceNet CAN messages are received or sent and the internal hardware fault counter has exceeded the alarm limit. The CAN hardware chip detects and clears this condition. Extra Information: The erroneous CAN messages are not used. Data which was last sent remains valid. If the erroneous data is process data, depending on the telegram failure monitoring setting (P2040), fault F0070 can be initiated. There is no response in the drive if the PKW Object or other DeviceNet explicit messages are erroneous. Remedy: ➤ Check and if required correct parameter P2041.02 (baud rate) for every bus node. ➤ Check the cable connection between the bus nodes ➤ Check the cable shielding. Follow DeviceNet specifications ➤ Replace the DNM

A702	Cause: CAN Bus off warning
	Erroneous DeviceNet CAN messages are received or sent and the internal fault counter has exceeded the error limit. The CAN hardware chip detects this condition.
	Extra Information: The erroneous CAN messages are not used. Data which was last sent remains valid. If the erroneous data is process data, depending on the telegram failure monitoring setting (P2040), fault F0070 can be initiated. There is no response in the drive if the PKW Object or other DeviceNet explicit messages are erroneous. Also refer to LED Display, section 7.1, solid red indication.
	Remedy:
	➢ Check and if required correct parameter P2041.02 (baud rate) for every bus node.
	➢ Check the cable connection between the bus nodes
	➢ Check the cable shielding. Follow DeviceNet specifications
	➢ Replace the DNM
A703	--
A704	--
A705	Cause: Loss of the status and actual value data from the drive.
	Remedy: none (fault in the drive)
A706	Cause: DeviceNet module software failure.
	Remedy: none (Fault in DeviceNet module, For details see diagnostic parameter, section 7.3)
A707 to A709	--
A710	Cause: Drive detects failure in the communication to the DeviceNet Module
	Remedy: none (DeviceNet Module should be replaced)
A711	Cause: Incorrect setting of the CB-Parameters specifying the DeviceNet connection. Detected during initialization of the DNM.
	Extra Information: Refer to diagnostic parameter r2054.00 (section 7.3).
	Remedy: Correct P0918 (DeviceNet MAC ID) and/or P2041 (CB-Parameter) indexes 00 to 02.

Faults

Table 7-2   Faults Displayed on the Drive

Fault number	Description
F070	Cause: The communication failure monitoring time, set by parameter P2040, has expired. The drive monitors this time. Extra Information: Also refer to alarms A700, A701, A702. Remedy: ➢ Check if DeviceNet master has stopped or is in „program" mode. ➢ Check the cable connection between the bus nodes ➢ Check the cable shielding. Follow DeviceNet specifications ➢ Check and if the communication monitoring time has been set too short in parameter P2040. ➢ Replace the DNM

7.3   Diagnostic Parameter

Diagnostic details are displayed in indexed parameter r2054. The content of the diagnostic parameter is dependent on the selection of the diagnostics mode (see communication board parameter P2041.03).

Standard Diagnostics

P2041.03 = 0

Parameter	Description
r2054.00	Configuring error ID
	If an invalid value or an illegal combination of parameter values is contained in the CB parameters, the drive goes into a alarm condition with alarm A711. The cause can be determined using this CB diagnostics parameter:
	0: No error
	1: Invalid DeviceNet MAC ID (slave address - range 0 to 63) (P0918)
	2: Invalid DeviceNet polled I/O produced connection path (P2041.00)
	3: Unsupported produced connection path (P2041.00) – it is valid but the attached MICROMASTER 4 model cannot support the length
	4: Invalid DeviceNet polled I/O consumed connection path (P2041.01)
	5: Unsupported consumed connection path (P2041.01) – it is valid but the attached MICROMASTER 4 model cannot support the length
	6: Invalid DeviceNet baud rate (P2041.02)
	(>100: other diagnostic mode active, see Software-Failure Diagnostic later in this section)
r2054.01	DeviceNet channel allocation
	This display is a hexadecimal number. Each bit is a channel. Bit coding:
	Bit 0: 1 = Explicit Channel allocated
	Bit 1: 1 = I/O Poll Channel Channel allocated
	Examples:
	➢ r2054.01 = 1 means only Explicit Channel is allocated.
	➢ r2054.01 = 2 means only I/O Poll Channel is allocated.
	➢ r2054.01 = 3 means both Explicit and I/O Poll Channels are allocated.
r2054.02	DeviceNet IDLE Indicator
	0: Device is not in IDLE condition.
	➢ A non-zero length POLL command was the latest data received.
	1: Device is in IDLE condition. Also refer to alarm A700 in section 7.2.
	➢ A zero length POLL command was the latest data received.
r2054.03	Counter for PZD telegrams received error-free since power on.
r2054.04	Counter for telegrams transmitted since power on.
r2054.05	Counter for all telegrams received error-free since power-on.
	This counter includes all DeviceNet messages, including those not directed to this DNM.
r2054.06	Status of DeviceNet bus voltage sensor:
	0: bus voltage steady off
	1: bus voltage just turned on
	2: bus voltage steady on
	3: bus voltage just turned off

7.4   Software Version and Information

Software version and other software information for the communication module is displayed in indexed parameter r2053.

Parameter	Description
r2053.00	module type (2 = DeviceNet)
r2053.01	version (11 = version 1.1) this is the same version displayed to DeviceNet
r2053.02	for factory use only
r2053.03	year of software
r2053.04	day / month (2404 = 24th of April) of software

7.5   DIP Switch Settings

For factory use only.
For normal use, switch 1 (left) must be down (off) and switch 2 must be up (on).
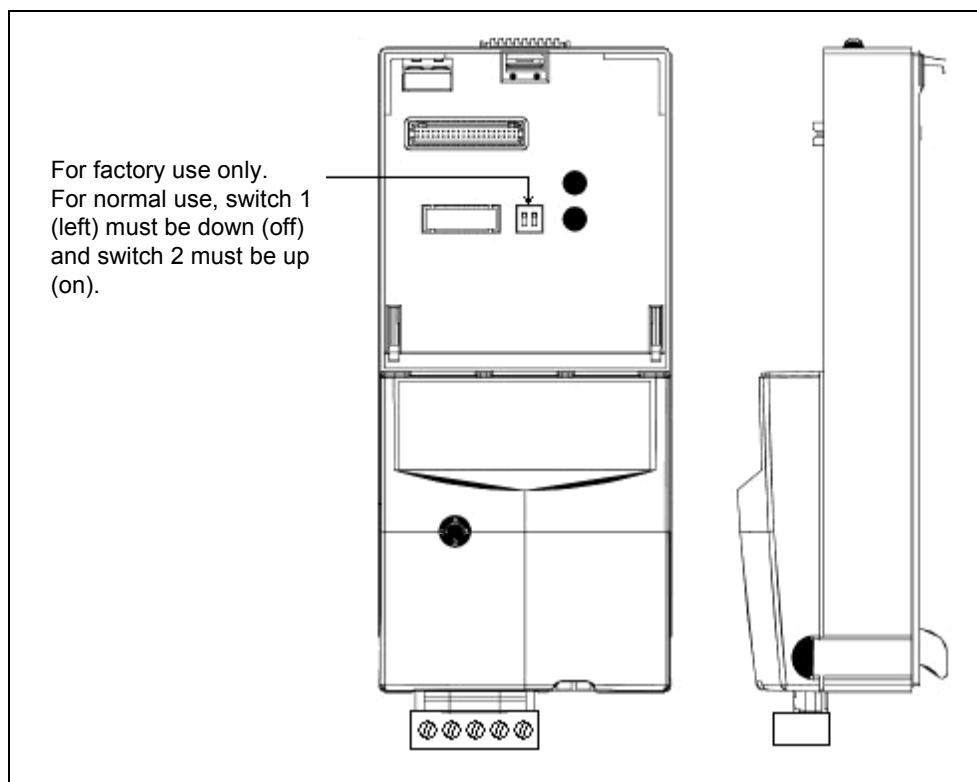
Figure 7-1   DIP Switch Settings

8   Appendix

8.1   Technical Data

Table 8-1   Technical data

Order number	6SE6400-1DN00-0AA0
Size (height x width x depth)	161 mm x 73 mm x 43.5 mm
Pollution severity	Pollution severity 2 according to IEC 664-1 (DIN VDE 0110/T1), No moisture condensation permitted in operation
Mechanical strength In stationary state - Deflection - Acceleration During transportation - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (with correctly installed board) 0.15 mm in 10 Hz to 58 Hz frequency range 19.6 m/s^2 in > 58 Hz to 500 Hz frequency range 3.5 mm in 5 Hz to 9 Hz frequency range 9.8 m/s^2 in > 9 Hz to 500 Hz frequency range
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Cooling method	Natural air cooling
Permissible ambient or coolant temperature - In operation - In storage - In transit	–10 °C to +50 °C (14 °F to 122 °F) –25 °C to +70 °C (–13 °F to 158 °F) –25 °C to +70 °C (–13 °F to 158 °F)
Permissible humidity rating	Relative air humidity <= 95 % in transit and storage <= 85 % in operation (condensation not permissible)
Supply voltage	6.5 V ± 5 %, max. 300 mA, internal from basic converter and 24 V max. 80 mA, from DeviceNet bus
Output voltage	None
Data transmission rate	125, 250 and 500 kBaud

8.2   EMC Information

The board complies with the following standards governing radio emissions and interference immunity:

➢ Radio emissions in accordance with EN55011 1991 Class A

➢ Interference immunity in accordance with IEC 801-3 and EN61000-4-3

Suggestions and/or Corrections

To

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Suggestions	
Corrections	
For Publication/Manual: MICROMASTER DeviceNet Option Module 	
User Documentation	

From	
Name:	
	Order number: 6SE6400-5BC00-0BP0
	Date of Issue: 09.01
Company/Service Department	Should you come across any printing errors when reading this publication, please notify us on this sheet.
Address: _____	
_____	Suggestions for improvement are also welcome.
Phone: _____ / _____	
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