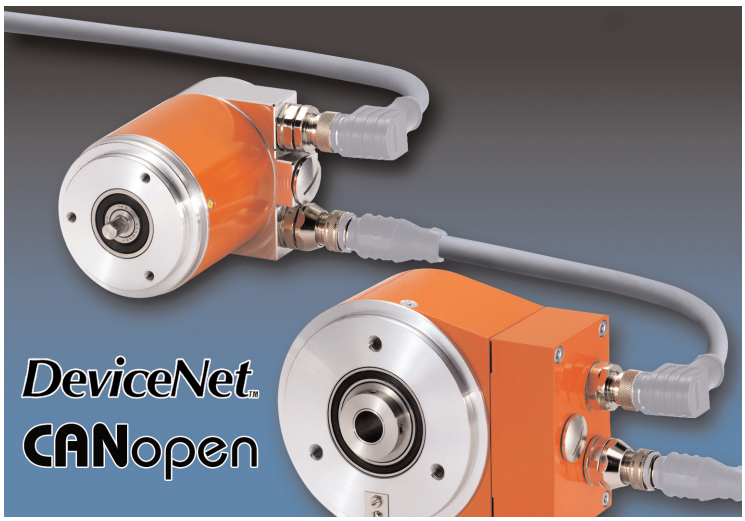
Series 9080
Series 5860



issue 3-2004

Absolute Multiturn Encoder

DeviceNet® Field Bus

Series 9080
Series 5860

pulses for automation

Contents

Installing instructions for rotary encoders

It is imperative to read these instructions before setting the encoder in operation.
This encoder is a precision measuring instrument. Always observe the information and instructions of the data sheet to ensure trouble-free function and to maintain warranty claims. Unless otherwise stated in the data sheet, the following has to be absolutely observed:

Mechanical:

- It is not permissible to dismantle the encoder entirely or in part or to modify it.
- Do not alter the shaft (by grinding, sawing, drilling, etc.), otherwise the accuracy of the encoder and the dependability of bearing and gasket will suffer. We are prepared to discuss special designs.
- Never align the instrument with a hammer.
- It is imperative to avoid impact loads.
- Radial and axial load capacity as stated in the data sheet have to be observed under any circumstances.
- Do not connect encoder and drive rigidly to one another at shafts and flanges. Always use a coupling (between drive shaft and encoder shaft, or between hollow-shaft encoder flange and drive flange).

We recommend that you use our assembly aids and couplings to install the encoder (see accessory data sheets).

Electrical:

1. The existing safety devices for electrical installations have to be observed.
   - Before setting in operation, connect all required strands as per data sheet. To prevent short-circuits, neatly insulate the ends of all strands which are not required.
   - When preassembling the mating connector, comply with any instructions accompanying the connector.
   - Our recommendations regarding cable lengths:
   - **in case of asymmetrical transmission, i.e. inverted signals are not used, cable** length max. 10 m
   - **in case of symmetrical transmission (e.g. to RS 422), cable length max. 50 m** (cable with twisted pairs of wires).
   - Plug in or pull out mating connector at the encoder only when encoder is deenergized.
   - Make certain that the operating voltage is correct and the max. permissible output current is not exceeded (see data sheet).
   - The operating voltage for encoder and succeeding device must be turned on and off together. 2. In order to obtain CE-Conformity, EMC installation conformity should be observed. Shielded cables should be used for control lines. In case of symmetrical transmission (e.g. RS 422) a cable with twisted pairs of wire has to be used. The cable shield should if possible be connected fully enclosed (360') by shielded connectors or cable bushings. This has to be done at the encoder and transmission end.
   - The protection earth should be put with low impedance on both face and back of the encoder and the transmission end.
   - In case of earth loop problems, the protection earth of the encoder side has to be removed. On this occasion, the encoder should be placed electrically isolated opposite the actuation.
   - The encoder lines should run separately to cables with high noise levels.
   - Consumer with high disturbance level, e.g. frequency converters, solenoid valves, contactors etc. should not be connected to the same voltage supply. Otherwise, a suitable voltage filtering has to be installed.

Safety precautions:

1. **If operation without danger can no longer be assured at some point, the unit must be shut down and secured against accidental activation.**
2. If personal injury or damage to equipment is possible should the encoder fail or malfunction, this must be prevented by suitable safety precautions such as protective devices or limit switches, etc.

We can assume no warranty if the above directives are disregarded. We ask for your understanding.

Introduction and Encoder Features

Based on the integrated CAN-Bus interface (CAN ISO/DIS 11898) the encoder supports all the following DeviceNet functions

- **Polled mode**
- **Cyclic mode**
- **Change of state mode (COS)**
- **Combination of Polled mode and Cyclic mode**
- **Combination of Polled mode and COS mode**
- **Offline connection set**
- **Device heartbeat**

Polled mode and Cyclic mode can be used at the same time with programmable time intervals in cyclic mode.

The Multiturn encoder support the following programmable parameters:

- **Code sequence**
- **Measuring units per revolution**
- **Total measuring range**
- **Number of distinguishable revolutions (multiturn part)**
- **Preset value**

Parameter Object

Instance	Name	Access
1	**Code Sequence**	**r / w**
2	**Scaling Function Control**	**r / w**
3	Position Format	ro
4	**Measuring units per Revolution**	**r / w**
5	**Total Measuring Range**	**r / w**
6	Position Measuring Steps	ro
7	**Preset Value**	**r / w**
8	Position Value	ro
9	Operating Status	ro
10	Single Turn Resolution	ro
11	**Number of distinguishable revolutions**	**r / w**
12	Alarm Flag	ro
13	Generated Alarms	ro
14	Supported Alarms	ro
15	Warning Flag	ro
16	Generated Warnings	ro
17	Supported Warnings	ro
18	Serial Number	ro

ro = read only parameters
r/w = read/write parameters

Readable Information about Status of the encoder:

Position Sensor Object

Instance	Name
111	Operating status
112	Physical Resolution Span
113	Number of spans
114	Alarms
117	Warnings
120	Operating Time
122	Min.Position value
123	Max.Position Value

1.0 DeviceNet Bus Interface

1.1 DeviceNet Bus Terminal Box

The incoming and the outgoing bus line are directly connected to the bus terminal by the M12 connectors. For all the adjustments made to DeviceNet

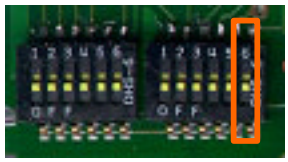
- **Loosen the 4 (9080) or 3 (5860) hexagon screws and draw off the bus terminal box**
- **adjust the MAC-ID**
- **adjust the baud rate**
- **select the bus termination**

1.2 Dip switch S2-6 Bus termination

An internal bus termination resistor of 121 Ohm is selectable by a dip switch S2-6

Switch S2	value	state	termination
6		On	on
6		Off	off*

*** by default**



1.3 Setting of the Baud rate

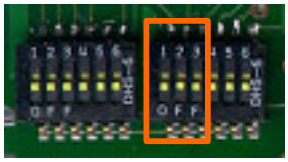
The baud rate can bet set by means of the DIP switches S2 1-3 or by means of software.

Baud rate 125 kBit/s

Switch S2	value	state	Baudrate
1	2^0	Off	125 Kb
2	2^1	Off	
3	2^2	Off	

Baud rate 250 kBit/s

Switch S2	value	state	Baudrate
1	2^0	On	250 Kb
2	2^1	Off	
3	2^2	Off	



Baud rate 500 kBit/s

Switch S2	value	state	Baudrate
1	2^0	Off	500 Kb
2	2^1	On	
3	2^2	Off	

Baud rate and MAC-ID programmable *

Switch S2	value	state	Programmable
1	2^0	On	programmable
2	2^1	On	
3	2^2	Off	

*** by default**

1.4 Setting the MAC-ID (Node address)

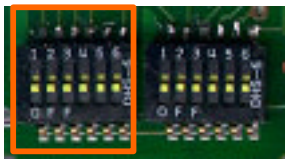
During device initialization, the Node Address switches shall be read by the device firmware. The addressable range is from 0..63. Each MAC-Id should be used only once inside a network, so all DeviceNet node are required to participate on a duplicate MAC-ID detection algorithm.

Example: MAC-ID #09

Switch S1	value	state
1	2^0	On
2	2^1	Off
3	2^2	Off
4	2^3	On
5	2^4	Off
6	2^5	Off

Example: MAC-ID #35

Switch S1	value	state
1	2^0	On
2	2^1	On
3	2^2	Off
4	2^3	Off
5	2^4	Off
6	2^5	On



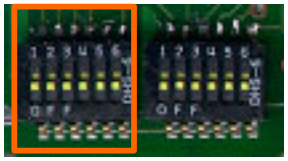
1.4.1 “Out-of-box” configuration *

MAC-ID address and Baud rate programmable by default

Standard DIP-Switch S1 setting is all in „ON“-position, S2[1+2] in “ON”

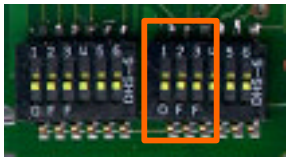
i.e. the resulting MAC-ID = 63
and Baud rate = 125 Kbit/s

Switch S1	value	state
1	2^0	On
2	2^1	On
3	2^2	On
4	2^3	On
5	2^4	On
6	2^5	On



+

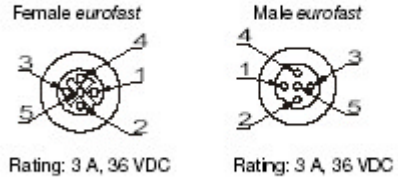
Switch S2	value	state	Programmable
1	2^0	On	programmable
2	2^1	On	
3	2^2	Off	



*** by default**

1.5 Connectors and Cabeling (M12 *1 eurofast® Field Wireable Connectors)

eurofast® Field Wireable Connectors



Pin number	color	Pinout
1	GREY	shield drain wire
2	RED	+ VDC
3	BLACK	- VDC
4	WHITE	CAN_H
5	BLUE	CAN_L

Kübler offers a comprehensive product family of ready-to-use Devicenet cables, which make network installation easy, shorten commissioning times and reduce wiring mistakes.
Note: See our special M12 Devicenet connection technology catalogue

2.0 Object Definition

POSITION SENSOR
Class Code 64 hex

Device: Encoder Device type: 00 hex (Generic Device)

Encoders are used to detect positions of any kind of machines. These devices could be used for following applications: Sensing of angles, distances, tracks, velocity and motion control.
This profile covers the measuring principle of absolute and incremental systems as well as the mechanical specification of rotary and linear devices. The detected physical position could be calculated by the device and functionalities like cams, work area switches offers an intelligent position detection.

2.1 Class Attributes

Attribute ID	Implementation	Access	Name	Data Type	Description	Semantics
1	Required	Get	**Revision**	UINT	Revision of this object	The current value assigned to this attribute (**0x02**)

2.2. Instance Attributes

The required attributes ensure common base functionality for all encoders (**revision 2.0**)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Description of Attribute	Semantics of Values
100	**Get**	**number of attributes**	**UINT**	Number of Attributes supported	Default = 23
101	**Get**	**Attributes List**	Array of USINT	List of Attributes supported	
102	**Get**	**position Value**	DINT5	Current position for Revision > 1.	The content is based upon 105,107,108,110,113
103	**Get**	**position sensor type**	**UINT**	specifies the encoder type	Default = 11 Multiturn
104	**Get/Set**	**direction counting toggle**	BOOL	Direction control for counting. Changing this value shall change the position relative to physical movement.	Default = 0
105 ⓘ	**Get/Set**	**scaling function control**	BOOL	Physical resolution [62] is converted in software to a numerical value	**0 = OFF (Default)** 1 = ON
106	**Get**	**position format**	ENGUINTS	Format of the position value of other attributes.	Supported units: counts (default) 0x0800-0x0FFF = vendor specific
107 ⓘ	**Get/Set**	**measuring units per span**	UDINT	Number of distinguishable steps per one complete span. Less than or equal to physical resolution [62].	For rotary devices a span equal one revolution.
108 ⓘ	**Get/Set**	**total measuring range in measuring units**	UDINT	Steps over the total measuring range. Only used for rotary encoders.	
109	**Get**	**Position measuring increment**	UDINT	Specifies the smallest incremental change of the Position Value attribute.	Units depend on Position Format attribute. Default = 1.
110 ⓘ	**Get/Set**	**preset value**	UDINT	Output position value is set to Preset Value. What does this mean?	

111	**Get**	**operating status**	BYTE	Encoder diagnostic Contain operating status	Bit 0 0 = Positive 1 = Negative Bit 1 0 = Diagnostic not supp. 1 = Diagnostic supp. Bit 2 0 = Scaling OFF 1 = Scaling ON
112	**Get**	**physical resolution span**	UDINT	Number of distinguishable steps per one complete span. Less than or equal to physical resolution	For rotary devices a span equals one revolution.
113 ①	**Get /Set**	**number of spans**	UINT	This is equal to the number of turns when a rotary type device is used	Default = 4096
114	**Get**	**alarms**	WORD	Malfunction could lead into an incorrect position value	Bit 0 0 = NO Position error 1 = Yes Position error Bit 1 0 = Diagnostic OK 1 = Diagnostic Error Bit 2 ...11 reserved Bit 12-15 manufacturer specific
115	**Get**	**supported alarms**	WORD	Information about supported alarms	Bit 0 0 = No Position error 1 = YES Position err Bit 1 0 = No Diagnostic 1 = YES Diagnostic Bit 2 ...11 reserved Bit 12-15 manufaturer specific
116	**Get**	**alarm flag**	BOOL	Indicates if an alarm error occurs, depends on alarms Attr. 114	0 = OK 1 = Alarm error
117	**Get**	**warnings**	UINT	Internal parameters exceeded	See attribute semantics section.
118	**Get**	**Supported warnings**	WORD	Information about supported warnings	See attribute semantics section.
119	**Get**	**warning flag**	BOOL	indicates if an warning error occurs (logical OR connection of all bits, depends on warnings Attr. 117)	0 = OK 1 = Warning flag
120	**Get**	**operating time**	UDINT	stores operating time for the encoder in tenths of an hour	
121	**Get**	**offset value**	DINT	The Offset value is calculated by the preset function. Shift position value with the calculated value	
122	**Get**	**manufacturer minimum position value**	DINT	values given in steps, only changeable by manufacturer.	
123	**Get**	**manufacturer maximum position value**	DINT	values given in steps, only changeable by manufacturer.	
124	**Get**	**device serial number**	DINT	serial number	manufacturer sn.

①Attributes, which affects the position value

2.3 Attributes and their meaning

2.3.1 Position Sensor Type – Attribute 103

value	Definition
00	Single Turn resolver (value if attribute is not supported)
01	Single-Turn absolute rotary encoder
02	Multi-Turn absolute rotary encoder
03	Single-Turn absolute rotary encoder with electronic turncount
04	Incremental rotary encoder
05	Incremental rotary encoder with electronic counting
06	Incremental linear encoder
07	Incremental linear encoder with electronic counting
08	Absolute linear encoder
09	Absolute linear encoder with cyclic coding
10	Multi-Sensor encoder interface
11	Multi-Turn absolute rotary encoder with electronic turn count
12… 65535	Reserved by DeviceNet

2.3.2 Scaling Function Control – Attribute 105

When ***the scaling function control*** attribute is set to ON (1), the *position value* attribute is converted in software to change the physical resolution of the encoder.
If this attribute is implemented and turned OFF, all functions within position sensor shall continue to use the scaled value, except the Position Value reported (attribute 102) shall be the raw, unscaled value.
The “Measuring units per revolution” and “Total measuring range in measuring units” attributes are the scaling parameters.

If scaling function control = OFF
Position value = physical resolution of device in counts
If scaling function control = ON
Postion value = physical resolution of device in counts * (measuring units per span[16] / Physical resolution [63])

2.3.3 Measuring units per revolution – Attribute 107

The “Measuring units per revolution” sets the number of distinguishable (desired) steps per unit of travel. Rotary units would contain the counts per one complete revolution. This parameter is only used for rotary units.

2.3.4 Total Measuring Range – Attribute 108

The parameter “Total measuring range in measuring units” sets the number of distinguishable steps over the total measuring range. This value must be less than maximum physical resolution of the device. Maximum physical resolution should be listed on the type plate.
This parameter is used for rotary and linear devices.

2.3.5 Position measuring increment – Attribute 109

This attribute may be supported when position format [14] can be set to a value other than count (0x1001). The “Position measuring step” attribute defines the measuring step settings for the position for linear encoders. Basic position measuring step in 0.001 µm or 0.1nanoinch is affected by attribute position format.

2.3.6 Preset Value – Attribute 110

The *Preset Value* supports adaption of a desired position value to an actual position value. The position value attribute is set to the “Preset value” (desired position value) by setting this attribute and the offset from the current position value is calculated and stored in the encoder.

2.3.7 Operating status – Attribute 111

This attribute contains the operating status of the encoder. It gives information on device internal programmed parameters.

2.3.8 Physical Resolution – Attribute 112

This is the physical resolution of the position sensor. For rotary encoder the number of steps per revolution can be read out. In nanometer or 0,1 ninch the measuring step is given for linear encoder.

2.3.9 Number of disting. revolutions – Attribute 113

With this attribute the number of distinguishable revolutions, that the position sensor device can output, is readable. For a multiturn device the number of distinguishable revolutions and the Physical resolution (Single-Turn Resolution)gives the physical measuring range to the formula below. The maximum number of distinguishable revolutions is 65535 (16 bits).

Physical Measuring range = Physical Resolution (Single-Turn resolution) * Number of distinguishable revolutions

Remark: For Single-Turn encoder the number of distinguishable revolutions is 1.

2.3.10 Alarms – Attribute 114

With this attribute alarm information is provided. An alarm is set if a malfunction bit is set to logic true (high) until the alarm is cleared and the encoder is able to provide an accurate position value.

Bit	Description	FALSE (0)	TRUE (1)
0	Position error	NO	YES
1	Diagnostic error	NO	YES
2…11	Reserved by DeviceNet		
12…15	Vendor specific		

2.3.11 Supported Alarms – Attribute 115

Attribute contains information on supported alarms by the position sensor device.

Bit	Description	FALSE (0)	TRUE (1)
0	Position error	Not supported	Supported
1	Diagnostic error	Not supported	Supported
2…11	Reserved by DeviceNet		
12…15	Vendor specific		

2.3.12 Alarm flag – Attribute 116

Indicates, if an alarm error occurs, depending on alarms attribute 114.

2.3.13 Warnings – Attribute 117

The *Warnings* attribute indicates that tolerance for certain internal parameters of the encoder have been exceeded. In contrast to *alarms*, *warnings* do not imply incorrect position values. All *warnings* are cleared if the tolerances are again within normal parameters. For the operating time limit warning (bit 3) the warning is only set again after a power-on sequence. The *Warning Flag* attribute indicates if any of the defined *warnings* are active.

Bit	Description	FALSE (0)	TRUE (1)
0	Frequency Exceeded	NO	YES
1	Light Control reserve	Not reached	Error
2	CPU Watchdog	OK Reset	generated
3	Operating Time Limit Warning	NO	YES
4	Battery charge	OK	Too low
5	Reference Point	Reached	Not reached
10-12	Reserved by DeviceNet		
13-15	Vendor specific		

2.3.14 Supported Warnings – Attribute 118

Attribute contains information on supported warnings by the position sensor device.

Bit	Description	FALSE (0)	TRUE (1)
0	Frequency Exceeded	Not supported	Supported
1	Light Control reserve	Not supported	Supported
2	CPU Watchdog	Not supported	Supported
3	Operating Time Limit Warning	Not supported	Supported
4	Battery charge	Not supported	Supported
5	Reference Point	Not supported	Supported
10-12	Reserved by DeviceNet		
13-15	Vendor specific		

2.3.15 Warning flag – Attribute 119

Indicates, if an warning error occurs, depending on warnings attribute 117.

2.3.16 Operating Time – Attribute 120

This attribute contains the *encoder operating time*. The operating time monitor stores the operating time continues to increment as long as the encoder is powered. The operating time value is presented in tenths (0.1) of an hour.

2.3.17 Offset Value – Attribute 121

The *offset value* attribute is calculated by the preset function and shifts the *position value* attribute with the calculated value. The offset value is stored automatic by the device and can be read from the encoder for diagnostic purposes.

2.3.19 Min/Max Position Value – Attribute 122-123

These attributes are given in number of steps according to the basic resolution of the encoder and are located in write protected memory area only changeable by the encoder manufacturer. These values define the minimum and maximum physical measuring position within measuring range.

2.3.18 Serial Number – Attribute 124

This attribute gives information on the series number of the device

2.3.20 Diagnostic and malfunction indicator (LED's)

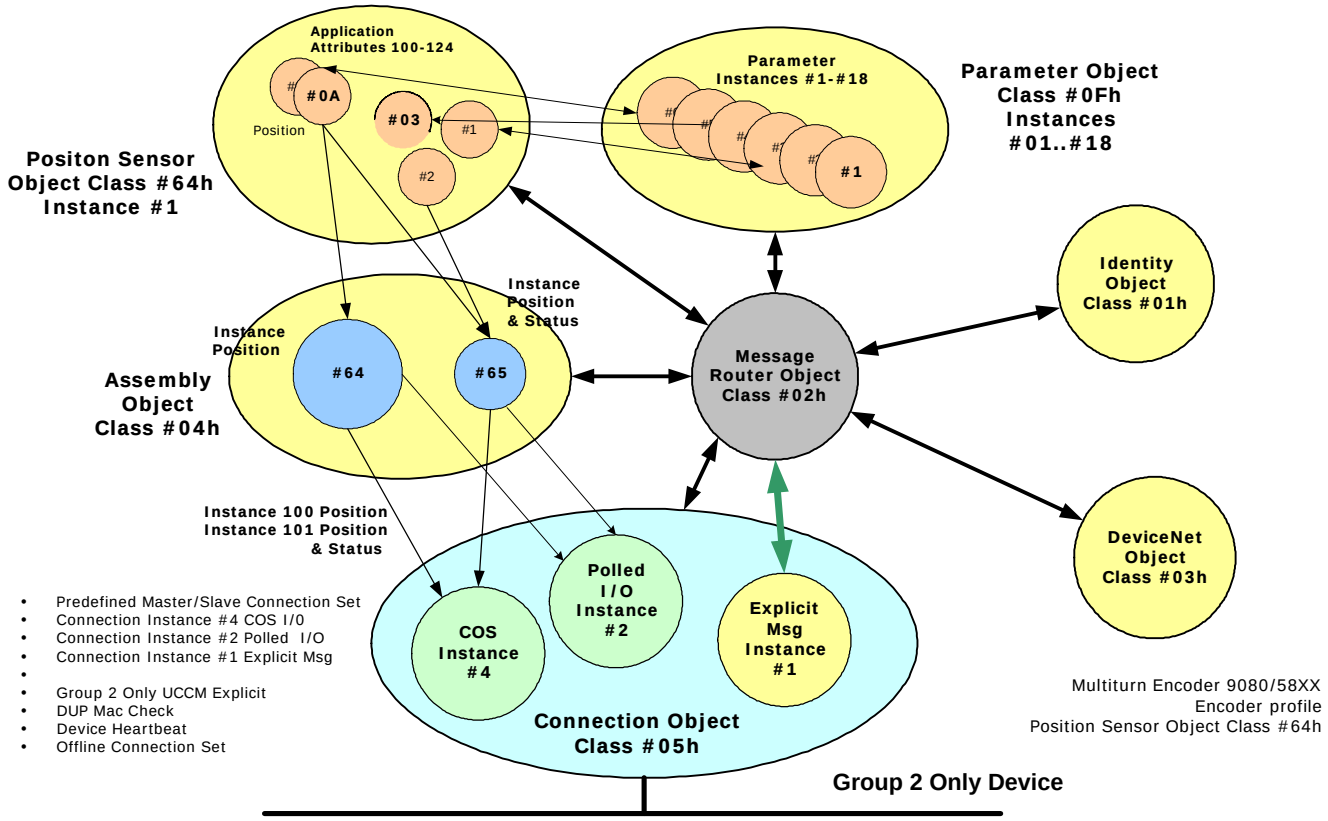
State	MOD (green LED)	NET (red LED)
Selftest passed **only activated when connected to a DeviceNet bussystem**	**flashrate 0.5 sec**	**flashrate 0.5 sec**
Encoder is in Offline state **Encoder has not performed the DUP_MAC_Check** **Encoder has no power**	**off**	**off**
Encoder has made a DUP_MAC_Check and is now ONLINE **Device needs commissioning or Configuration is missing or incorrect**	**flashing**	**off**
Device is in operational state **I/O connection is established**	**on**	**off**
Recoverable Fault or **I/O Connection is in Timed-out state**	**on or flashing**	**flashing**
Critical Fault or critical link failure	**off/on**	**on**
Communication fault **DUP_MAC_CHECK not successfull**	**off**	**on**
Offline Connection Set **Identify Comm. faulted request message**	**flashrate 0.25 sec**	**flashrate 0.25 sec**

2.3.21 EDS-File and Encoder Programming

An Electronic-Data-Sheet (EDS) File is attached to the delivery program to facilitate device configuration and field installation. This file is the essential in programming with the **DeviceNet-Manger® or RSNetWorx®- tools.**

3.0 Object Model

Object modules



This object model represents an encoder device:

Object Class	Implementation	Number of Instances
Identity	Required	1
Message Router	Required	1
DeviceNet	Required	1
Connection	Required	at least 1 - Explicit, 1 I/O
Assembly	Required	2
Parameter	Optional	18
Position Sensor	Required	24

3.1 How Objects Affect Behaviour

The objects supported for the encoder affect the device's behavior as shown in the table below.

Object	Effect on Behavior
Identity	Supports the reset service
Message Router	No effect
DeviceNet	Configures port attributes
Connection	Contains the number of logical ports into the device
Assembly	Defines I/O data format and configuration data format
Parameter	Provides a public interface to the encoder configuration data
Position Sensor	Affects Position Value (attribute)

3.2 Defining Object Interfaces

The objects supported for the encoder have the interfaces listed in the table below.

Object	Interface
Identity	Message Router
Message Router	Explicit Messaging Connection Instance
DeviceNet	Message Router
Connection	Message Router
Assembly	Message Router or I/O Connection Instance
Parameter	Message Router
Position Sensor	Message Router, Assembly Object or Parameter Object

3.3 I/O Assembly Instances

The following table identifies the I/O Assembly instances which should be supported by the encoder device.

Number	Required / Optional	Type	Name
100	Required	Input	Position Value
101	Optional	Input	Position Value & Warning Flag & Alarm Flag

3.4 I/O Assembly Data Attribute Format

The I/O assembly data Attributes have the format shown below.

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
100	0	**Position Value LSB**							
	1								
	2								
	3								**MSB**
101	0	**Position Value LSB**							
	1								
	2								
	3								**MSB**
	4	**Optical Fault**	**Position Error**	**low Battery**	**Reserved by DeviceNet**			**Warning Flag**	**Alarm Flag**

3.5 Mapping I/O Assembly Data Attribute Components

The following table indicates the I/O Assembly Data Attribute mapping for the Encoder Profile.

Data Component Name	Class		Instance	Attribute	
	Name	Number	Number	Name	Number
Position Value	**Position Sensor**	**0x64**	**1**	**Position Value**	**102**
Warning Flag	**Position Sensor**	**0x64**	**2**	**Warning Flag**	**119**
Alarm Flag	**Position Sensor**	**0x64**	**2**	**Alarm Flag**	**116**
Low Battery	**Position Sensor**	**0x64**	**2**	**Operating Status**	**111**
Position Error	**Position Sensor**	**0x64**	**2**	**Operating Status**	**111**
Optical Fault	**Position Sensor**	**0x64**	**2**	**Operating Status**	**111**

3.6 Defining Device Configuration

Public access to the Position Sensor Object by the Message Router must be supported for configuration of the encoder. If supported, the optional Parameter Object may be used to access the encoder's configuration parameters. Each instance of the Parameter Object is linked to a specific configurable attribute or attributes within the Position Sensor Object.

If the Parameter Object is supported a minimum of the Parameter Stub attributes are required with the support for Full Parameter Attributes being optional.

3.7 Parameter Object Instances

The following table indicates the Parameter Object Instances supported by encoder devices.

Instance	Name
1	Code Sequence
2	Scaling Function Control
4	Measuring units per Revolution
5	Total Measuring Range
7	Preset Value
11	Number of distinguishable revolutions

3.8 Common Services

The Position Sensor Object provides the following common services.

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E	Conditional*	Required	Get_Attribute_Single	Returns the contents of a single specified attribute
0x10	Optional	Optional	Set_Attribute_Single	Modifies a single specified attribute
0x05	Optional	N/a	Reset	Resets all parameter values to the factory default
0x15	Optional	N/a	Restore	Restores all parameter values from non-volatile storage
0x16	Optional	N/a	Save	Saves all parameter to non-volatile

4.0 RSNetWorx

RSNetWorx for DeviceNet, ControlNet, and EtherNet/IP provide you with many common features. Using RSNetWorx, you can:

- Browse a network automatically and determine what is present on that network via the industry-leading RSLinx communication package (the RSNetWorx installation CDROM includes RSLinx).
- Use the Electronic Data Sheet (EDS) services provided by the software to configure device parameters and to install support for new devices. The EDS subsystem enables multi-vendor interoperability on each of the networks.
- Define the input/output information exchanges that will take place on the network.
- Configure peer data exchanges (for example, controller to controller).

Most DeviceNet devices are factory commissioned with default values per the DeviceNet specification. Usually, the node address is set to 63 and the data rate is set to 125K baud. As long as the factory default parameters do not conflict with those of other devices already on the network, you can connect the new device to the network and then use the Node Commissioning tool within the RSNetWorx for DeviceNet software to change the node address and data rate. If the data rate conflicts, use a separate network to commission the device or a local connection between the device and the PC. Some devices do not support software-based node commissioning. For those devices, the product will have some alternative way (for example, thumbwheel switches), to set the address and data rate. See the specific device's documentation for more information.

Offline mode

Step 1 – Create a new configuration and describe your network topology

The first step in using RSNetWorx for DeviceNet in the offline mode is to create a new DeviceNet configuration (by selecting **File > New**). Once you create the configuration, an empty network displays in the Configuration view. Next, describe your network topology by dragging a device or scanner from the Hardware view and dropping it in the network configuration. Repeat this process until you have defined your entire DeviceNet network in the software. If you would like to see a tabular view of the information, select the Spreadsheet tab or the Master/Slave tab.

Step 2 – Configure the DeviceNet network

After creating your configuration, you can edit your network properties.
Editing network properties includes entering a network name and description.

Step 3 – Configure the DeviceNet devices

After configuring your DeviceNet network, you can configure the devices on the network. To configure a device, select a device in the configuration view and choose **Device > Properties** from the main menu. Configuring your devices consists of tasks like:
¡ configuring general device properties ¡ editing and monitoring device parameters
In addition you can also view I/O message data and the contents of the EDS file.

At various times, you may want to save the work you have

completed on your network configuration. To save a configuration file (*.dnt), click **File > Save**.

Step 4 – Configure the DeviceNet scanner

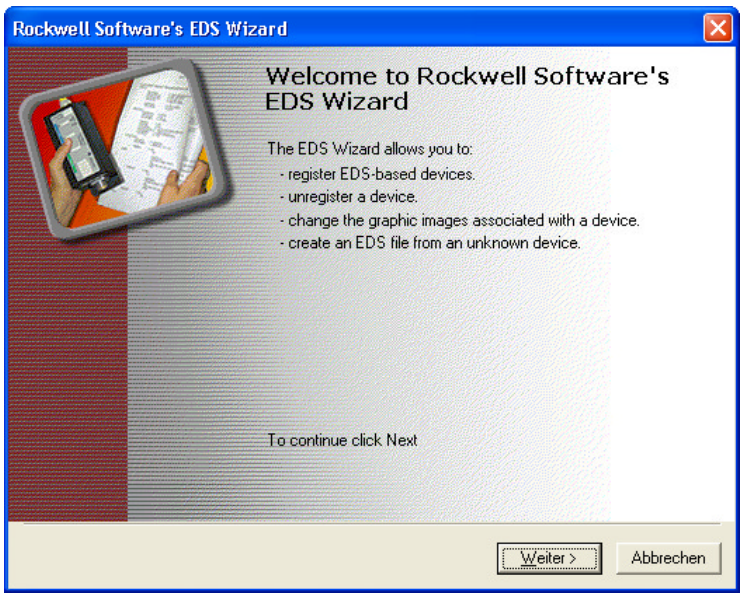
When you have completed your device configuration(s), you can then configure the scanners on your DeviceNet network. Configuring your scanner includes advanced tasks like configuring a scanlist (a list of the devices that you want the scanner to scan), and mapping device input and output data. In addition, you may also want to configure general device properties, specify module parameters (including scan-time related items), or view a summary of the scanner configuration.

Step 5 – Save your network configuration

The final step is to save your DeviceNet configuration information to a file. To save your configuration file (*.dnt), select **File > Save**. Your DeviceNet devices are now configured and ready to use.

You can use the RSNetWorx for DeviceNet software to further customize your DeviceNet configuration. For example, you can re-assign node addresses, modify a device's configuration, etc.

EDS-based devices

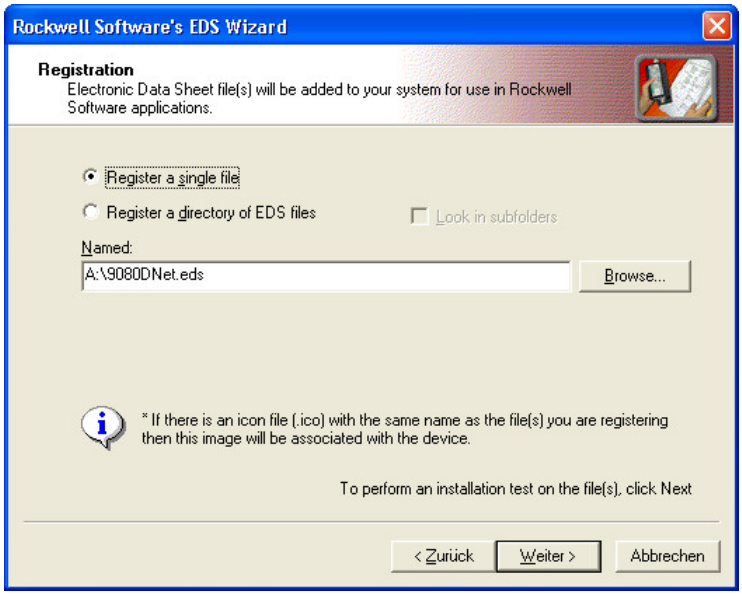


RSNetWorx for DeviceNet relies on an electronic data sheets (EDS) for configuring devices. An electronic data sheet is an ASCII file that is created by the manufacturer and supplied with the device. As long as the EDS file for the device you want to configure is registered with the RSNetWorx for DeviceNet software, you can configure its properties (attributes) and how it will communicate with other devices on the DeviceNet network. Although the procedure for configuring a device is basically the same for all devices, each device will have a unique set of properties.

EDS library

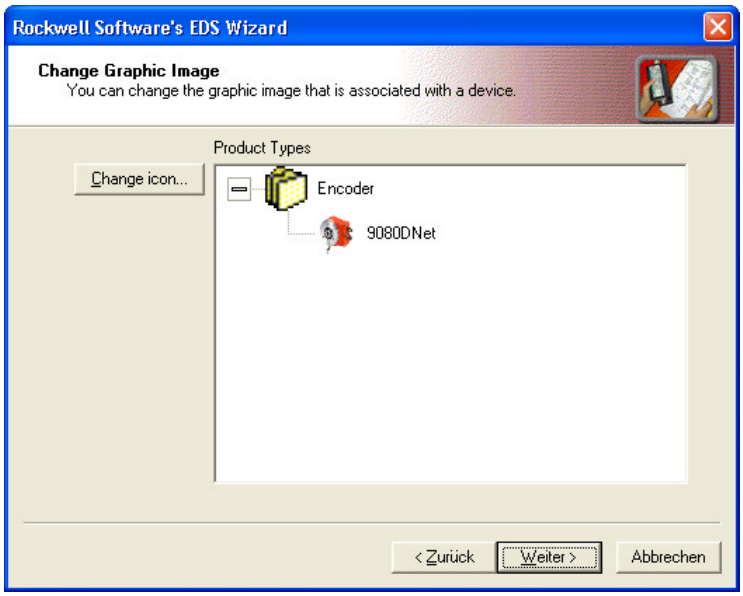
The electronic data sheet (EDS) library is a collection of EDS files that have been registered with RSNetWorx for DeviceNet. The EDS files, which are provided by the device manufacturers, contain configuration and identification information for the devices. RSNetWorx for DeviceNet software can access only those devices that have been registered. You must use the EDS Wizard for registering EDS files for unknown devices, or if you have updated EDS files to install. To access the EDS Wizard, select **Tools > EDS Wizard**.

Registration a single file



Register an unknown device with an EDS-File.

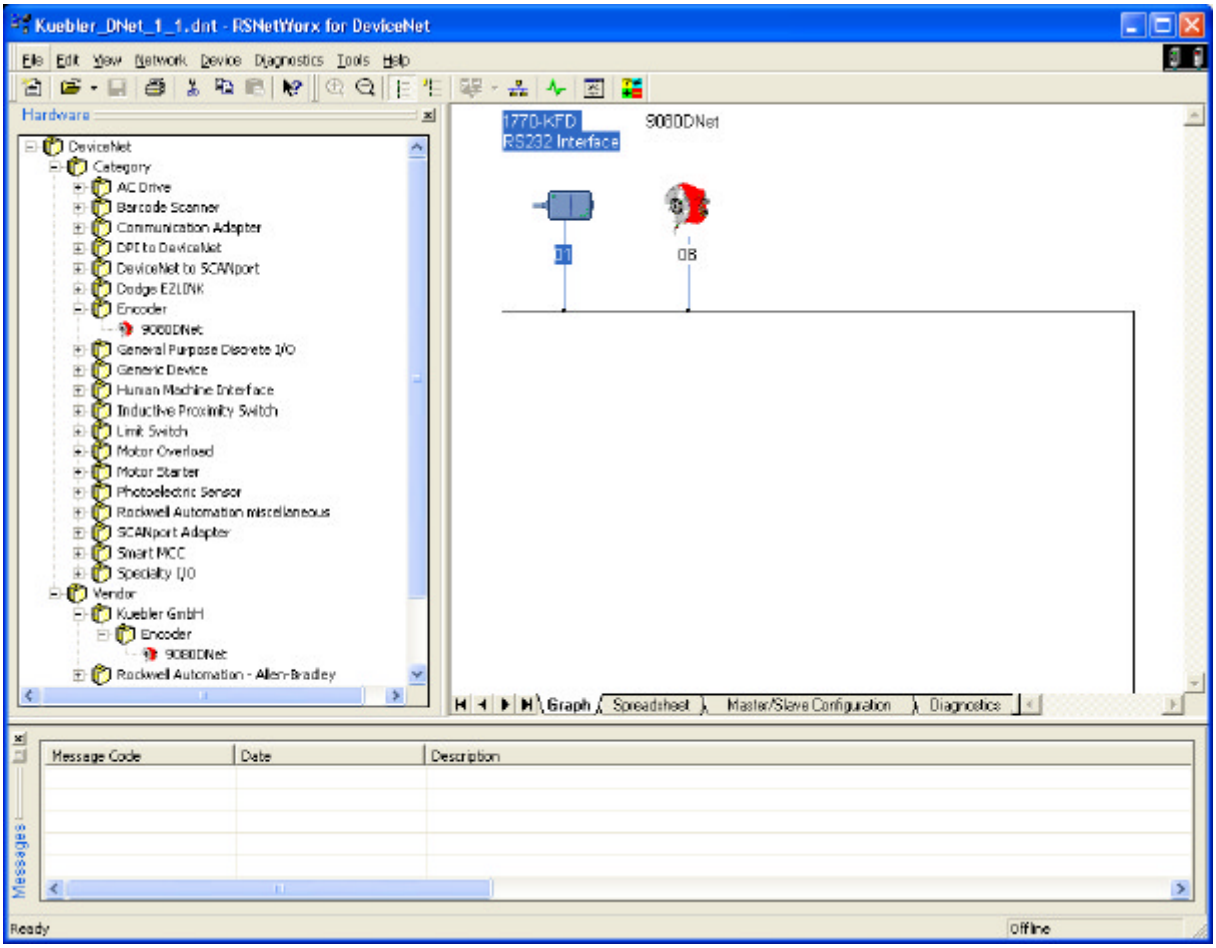
Select the file path and the named file



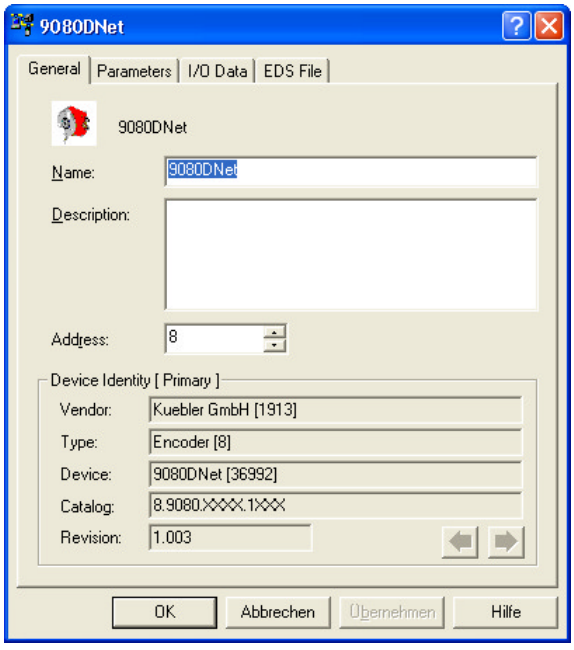
Change the graphic image associated with a device icon if necessary .

There are Bitmaps according the the specific device on the support disc.

RSNetWorx Mainscreen



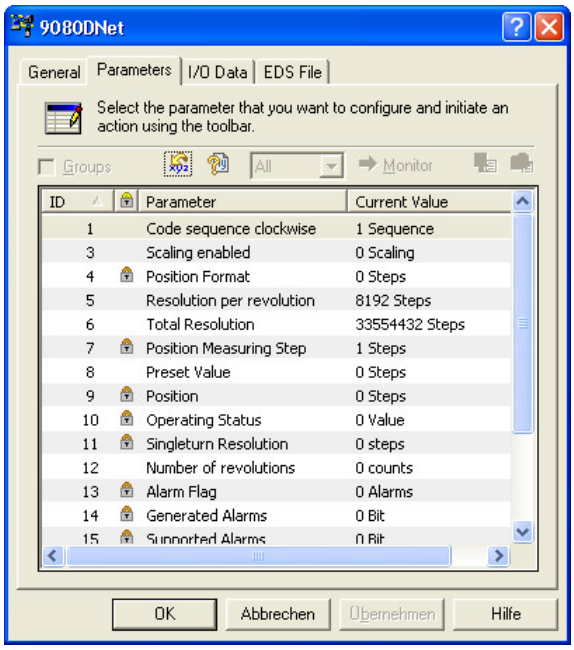
Parameter adjustments



This is the primary device identification information as interpreted from the device file. This information includes name of the vendor, type of product, name of the device, catalog number and the firmware revision code.
Click right on the icon to get information about properties of the according device.

The address is the node address of the selected device. This address will be used throughout the RSNetWorx.
Change the MAC-Address to avoid conflict inside the DeviceNet.

Parameters ungrouped



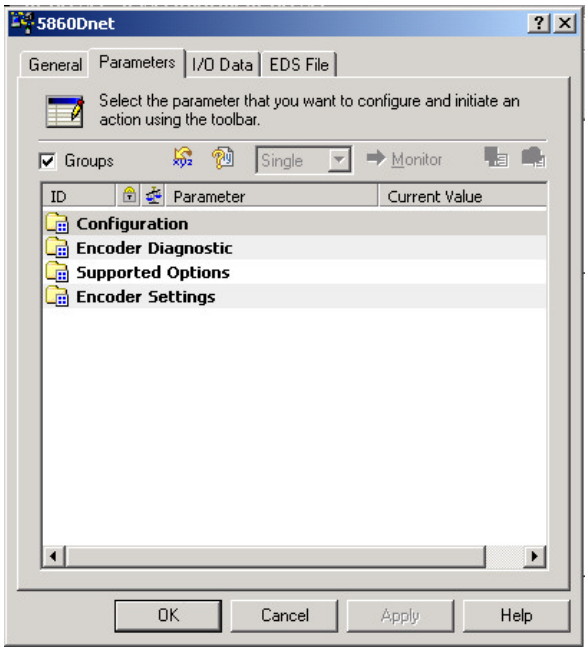
The list shows the number, name and current value of each parameter of the specified device.
Keep in mind, that when the lock icon follows the number, the parameter is read only.

When the scale icon follows the number, the parameter is a scaled value.

Upload button:
Click this button to upload the value of the specific parameter(s) from the device to the software. You must be online to use this button. If not, the button is grayed out.

Download button:
Upload button:
Click this button to upload the value of the specific parameter(s) from the device to the software. You must be online to use this button. If not, the button is grayed out.

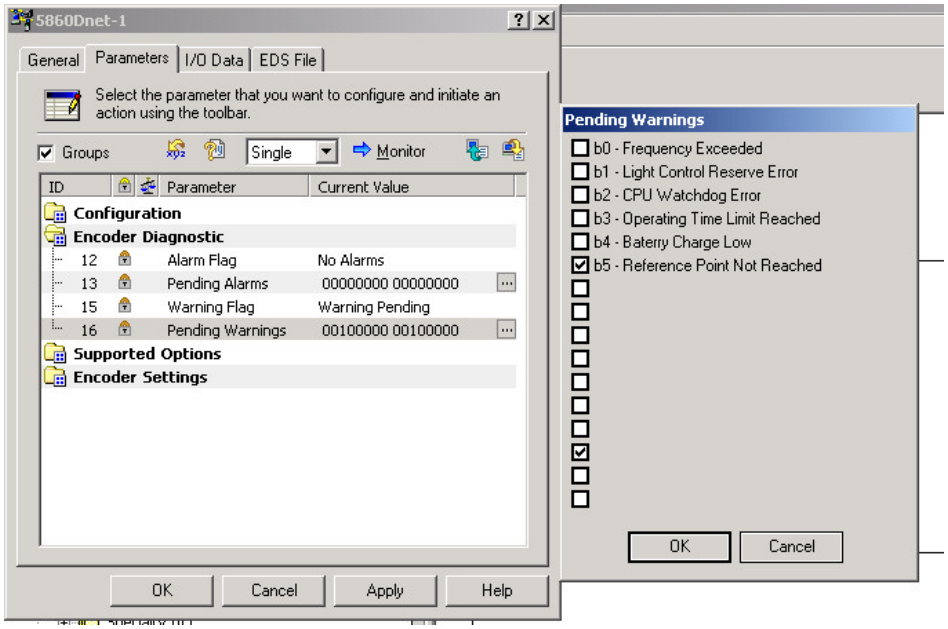
Parameter Groups



Parameters are organized into groups for **configuration, Diagnostic, Supported options and special Encoder settings.**

These groups are determined by the EDS-file for the device.

Encoder Diagnostics

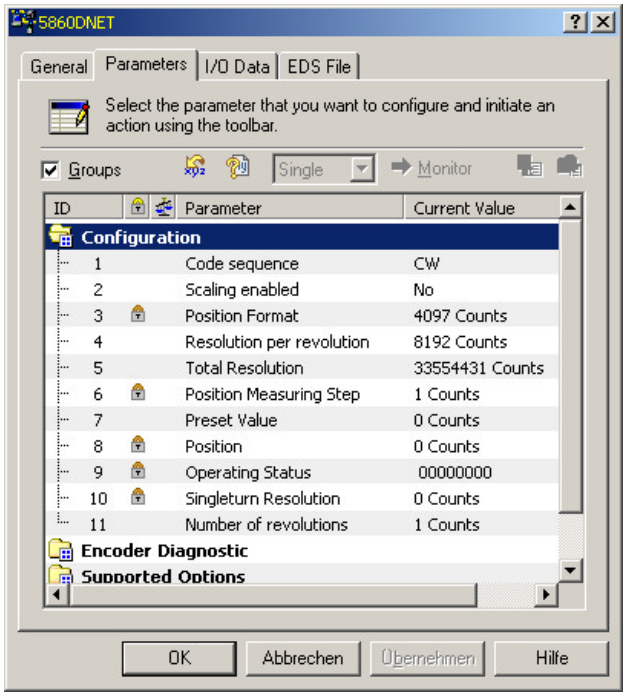


Parameter 16, e.g., "**Pending Warnings**" will show under **"Current Values"** some bits set to 0 or 1. When following icon next to the value is pressed:

the drop down list shows boxes that are checked if condition is "TRUE".

This parameter is updated in real time by the device.

Configuration



When **the scaling function control** attribute is set to ON (1), the *position value* attribute is converted in software to change the physical resolution of the encoder.

Resolution per revolution – sets the number of distinguishable (desired) steps per unit of travel. Rotary units would contain the counts per one complete revolution. This parameter is only used for rotary units.

Total Resolution - in measuring units" sets the number of distinguishable steps over the total measuring range. This value must be less than maximum physical resolution of the device. Maximum physical resolution should be listed on the type plate.
This parameter is used for rotary and linear devices.

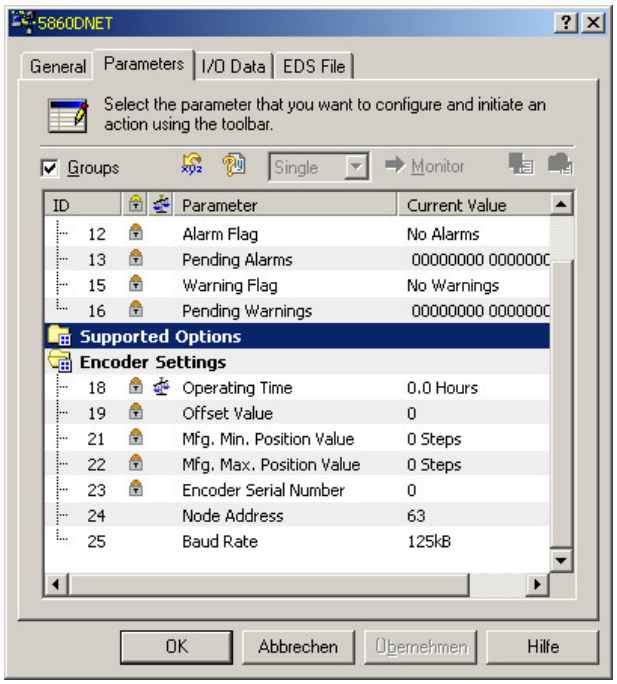
Preset Value - the Preset Value supports adaption of a desired position value to an actual position value. The position value attribute is set to the "Preset value" (desired position value) by setting this attribute and the offset from the current position value is calculated and stored in the encoder.

With this attribute the **number of distinguishable revolutions**, that the position sensor device can output, is readable. For a multiturn device the number of distinguishable revolutions and the Physical resolution (Single-Turn Resolution)gives the physical measuring range to the formula below. The maximum number of distinguishable revolutions is 65535 (16 bits).

Physical Measuring range = Physical Resolution (Single-Turn resolution) * Number of distinguishable revolutions.

Remark: **For Single-Turn encoder the number of distinguishable revolutions is 1**.

Encoder Settings



Operating Time – This attribute contains the *encoder operating time*. The operating time monitor stores the operating time continues to increment as long as the encoder is powered. The operating time value is presented in tenths (0.1) of an hour.

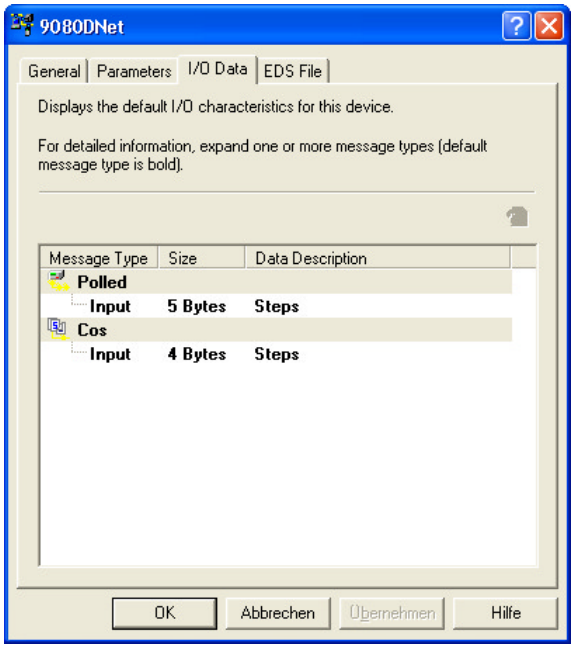
Offset Value – The *offset value* attribute is calculated by the preset function and shifts the *position value* attribute with the calculated value. The offset value is stored automatic by the device and can be read from the encoder for diagnostic purposes.

Min/Max Position Value – These attributes are given in number of steps according to the basic resolution of the encoder and are located in write protected memory area only changeable by the encoder manufacturer.

These values define the minimum and maximum physical measuring position within measuring range.

Serial Number – This attribute gives information on the series number of the device

I/O Data characteristics



Displays the parameter(s) that the device will use for **I/O messaging.**

The default message type is bold. This data, which is supplied by the manufacturer of the device, is obtained form the EDS-File.

For detailed information about the message type, expand one or more message types.

5.0 Technical Data

5.1 Mechanical characteristics:

Type 9080

Shape:	**round, with radial interface mounting surface**
External diameter:	**max. 90 mm**
Total length:	**max. 60 mm**
Hollow shaft diameter:	**Up to 28 mm**
Rotational speed:	**min. 1500 min-1 (for IP 65)**
Protection according to EN60529:	**IP65**
Operating temperature range:	**min. -20° C up to +80° C**
Shock resistance according to DIN-IEC 68-2-27:	**2500 m/s2, 6 ms**
Vibration resistance according to DIN-IEC 68-2-6:	**100 m/s2, 10...2000Hz**
Connection type:	**M12 Connectorsystem for CAN-BUS and supply voltage**

Type 5860

Shape:	**round, with radial interface mounting surface**
External diameter:	**max. 58 mm**
Total length:	**max. 60 mm**
Shaft diameter:	**6 or 10 mm**
Rotational speed:	**max. 6000 min-1**
Protection according to EN60529:	**IP65**
Operating temperature range:	**min. -20° C up to +80° C**
Shock resistance according to DIN-IEC 68-2-27:	**2500 m/s2, 6 ms**
Vibration resistance according to DIN-IEC 68-2-6:	**100 m/s2, 10...2000Hz**
Connection type:	**M12 Connectorsystem for CAN-BUS and supply voltage**

5.2 Electrical characteristics

Encoder interface:	**DeviceNet Release 2.0 Field Bus system**
Bus interface:	**CAN Highspeed according to ISO/DIS 11898** **Optocoupler**
Resolution:	**Programmable Resolution max.25 Bit Multiturn**
Physical Resolution:	**13 Bit Singleturn (8192 steps)** **12 Bit Multiturn (4096 steps)**
Linearity:	**+/- ½ LSB (+/-1 LSB bei 25 Bit Multiturn)**
Type of code:	**Binary**
Position update cycle:	**every 1,0 ms**
Supply voltage:	**10-30 VDC, max.120 mA**
Protocol:	**DeviceNet Profile for Encoder V 2.0 (partly)** **based on DeviceNet Release 2.0** **Programmable Resolution, Revolution, Scaling,Direction**
Baudrate:	**125,250,500kbit/sec**
MAC-ID:	**settable via 6 Bit DIP-switch** **Baudrate and MAC-ID fully programmable** **Offline Connection Set** **Device Heartbeat**

Multiturn Type 5860 CANopen/DeviceNet

Your benefit

- ·Connection via M12 connector terminal so less time is spent on connection or service
- · Patented Integrative Technology means 3-times greater shock resistance than is standard in the market
- · Multiturn step with patented Intelligent-Sensing-Technology (I-S-T) leads to higher operating safety even under difficult operating conditions
- Ex available as explosion proof zone 2 and 22

Product features

- **CANopen according to profile DSP 406 with additional features**
- **DeviceNet 2.0 protocol**
- Division: up to 8192 bits per revolution, up to 4096 resolutions (31 x 12 bits)
- Programmable parameters
- IP 65
- Housing diameter ø 60 mm
- Shaft ø 6 or 10 mm
- Comprehensive M12 range of accessories

CANopen
DeviceNet

Mechanical characteristics:

Speed[1]:	max. 6000 min^{-1}
Rotor moment of inertia:	approx. 1,8 x 10^{-6} kgm^2
Starting torque shaft version:	< 0,01 Nm
Load capacity of shaft am Wellenende:	radial: 80 N, axial: 40 N
Weight:	appr. 0,7 kg
Protection acc. to EN 60 529:	IP 65
Working temperature:	–20° C ... +80 °C
Operating temperature:	–20° C ... +85 °C
Shaft:	stainless steel
Shock resistance acc. to DIN-IEC 68-2-27:	2500 m/s^2, 6 ms
Vibration resistance acc. to DIN-IEC 68-2-6:	100 m/s^2, 10 ... 2000 Hz

[1] for continous operation 3000 min^{-1} at the max. temperature

Electrical characteristics:

Supply voltage (U_B):	10 ... 30 V DC
Current consumption:	max. 0,29 A
Recommended fuse:	T 0,315 A
Linearity:	± 1/2 LSB (±1 LSB at resolution 13, 14, 25 ,26 Bit)
Code:	Binary
Interface:	CAN HIGH-Speed to ISO/DIS 11898, Basic and Full-CAN; CAN specification 2.0 B (11 and 29 Bit Identifier)
Protocols:	**CANopen Profil DSP 406 with additional function DeviceNet Profile for Encoder Release V 2.0**
Rate:	programmable via DIP switches 10 ... 1000 Kbits/s
Basic identifier:	programmable via DIP switches
Conforms to CE requirements acc. to EN 50082-2, EN 50081-2 and EN 55011 Class B and EN 61000-4-8	
Performance against magnetic influence acc. to EN61000-4, 5	

Multiturn Type 5860 CANopen/DeviceNet

CANopen - Device Profile:
General description

The CANopen Device Profiles describe the functionality of the communication and of that part of the CANopen fieldbus system specific to the manufacturer. Device Profile 406 applies to encoders and defines the individual objects independently of the manufacturer. In addition the profile makes provision for additional extended functions specific to the manufacturer; using devices that interface with CANopen offers the advantage of acquiring systems today that are prepared for the needs of the future.

The following functionality is integrated:
- Class C2 functionality
- NMT Slave
- Diagnostics (internal) 2 Bit
- CAN-LED for Bus status
- CAN-LED for operating mode

The following parameters can be programmed:
- Polling mode or auto mode with adjustable time
- Direction
- Number of pulses/rotation 1 ... 8192
- Number of revolutions 1 ... 4096
- Total resolution
- Preset
- Offset

DeviceNet Encoder Profile:
General description:
The DeviceNet Device Profile describes the functionality of the communication and of that part of the DeviceNet fieldbus system specific to the manufacturer. The Encoder Profile applies to encoders and defines the individual objects independently of the manufacturer. In addition the profile makes provision for additional extended functions specific to the manufacturer.

The following parameters can be programmed:
- Direction of rotation
- Scaling factor
  - number of pulses/rotation
  - Total resolution
- Number of revolutions
- Preset value
- Diagnostics mode
- Resolution

The following functionality is integrated:
- Galvanic isolation of the Fieldbus-stage with DC/DC converter
- Addressing via DIP switches or software
- Diagnose-LED Netzwerk und Mode
- Baud rate 125, 250 and 500 kbit/s programmable via DIP switches
- Node address 0 … 63 and baud rate programmable via DIP switches
- Polled mode
- Cyclic mode
- Change of state mode (COS)
- Combination of Polled mode and Cyclic mode
- Combination of Polled mode and COS mode
- Offline connection set
- Device heartbeat
- “Out of box” Config
- MAC-ID and Baud rate preset value MAC-ID = 63
- Baud rate = 125 kBits/s
- 2 I/O Assembly
  Position value
  Position value and atatus

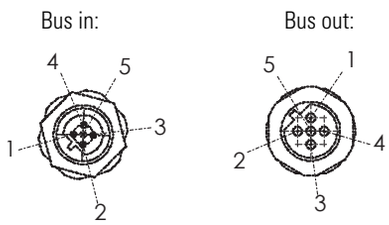
Fieldbus encoders can be used in the following applications:

CANopen:
Elevators, construction and mobile plant, cranes, agricultural vehicles, pecial-purposes vehicles.

DeviceNet:
especially suitable for applications in the USA.

Multiturn Typ 5860 CANopen/DeviceNet

Terminal assignment M12:



Bus in:

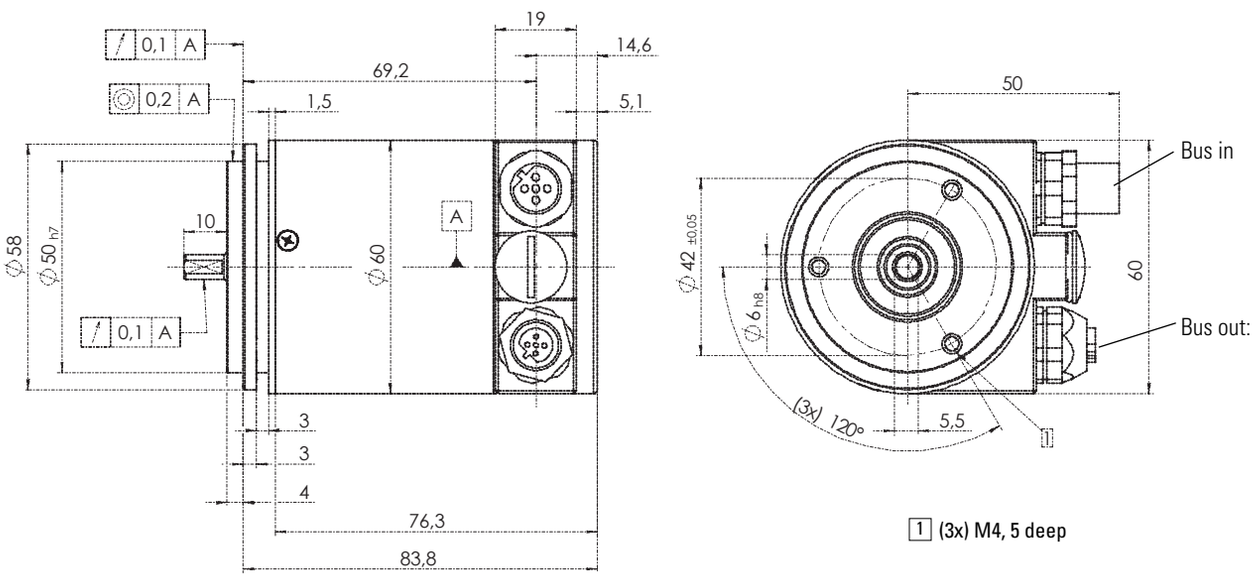
Signal :	DRAIN	+ V DC	– V DC	CAN_H	CAN_L
Pin:	1	2	3	4	5
	GY	RD	BK	WH	BU

Bus out:

Signal :	DRAIN	+ V DC	– V DC	CAN_H	CAN_L
Pin:	1	2	3	4	5
	GY	RD	BK	WH	BU

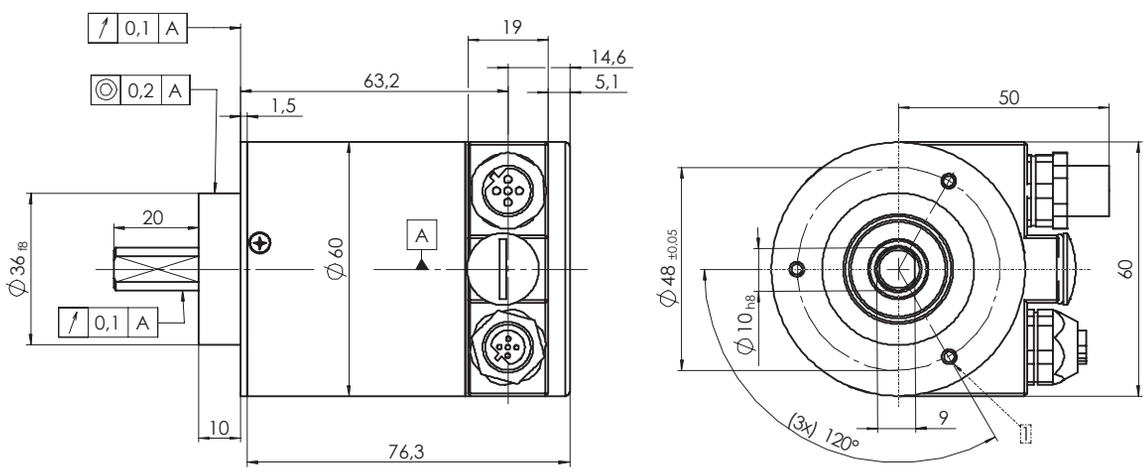
Dimension:

Synchronous flange



1 (3x) M4, 5 deep

Clamping flange



1 (3x) M3, 5 deep

Multiturn Type 5860 CANopen/DeviceNet

Kübler is working consistently **at high integration of all units** and intelligent sensing systems. The basics of our encoders are two patented technologies:

Patended "Integrated Technology®" uses single board construction, deliberate assembly techniques, and two ASIC design:
- Shock up to 250gs
- Higher vibration specs and thermal shock performance
- Lower parts count, elimination of potentiometers
- Higher resistance to EMI

Electronic multiturn increases performance, eliminates gears
- Reliability - No backlash errors, resistant to EMI, lower parts count
- Higher life - No mechanical wear, lower internal temperature
- Higher performance - Higher operating speeds
- Lower profile - compact size, hollow shaft
- Economical - Lower cost

Patended "Intelligent Sensing Technology®"
- Multiturn design that protects encoder from EMI.
- The battery outlasts both application requirements and system components (LEDs & bearings)
- Redundant multiturn sensors and counters increase reliability & life
- Active system output monitoring using digital filters to compare data to logical & target bits.

Order code:

8.5860.XXXX.X001

Range

Flange
- 1 = Clamping flange
- 2 = Synchronous flange

Shaft
- 1 = Shaft Ø 6 x 10 mm
- 2 = Shaft Ø 10 x 20 mm

Interface and supply voltage
- 1 = DeviceNet 10 ... 30 V DC.
- 2 = CANopen 10 ... 30 V DC

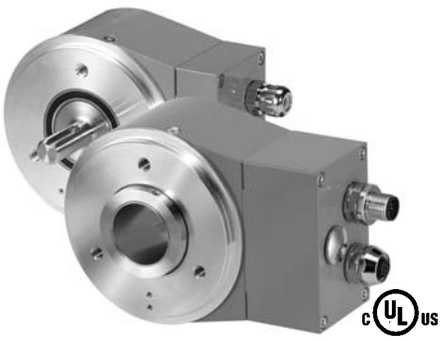
Field bus profile
- 1001 = DeviceNet 2.0
- 2001 = CANopen Encoder Profile DSP 406

Type of connection
- 1 = Terminal box with cable connection M16[1)]
- 2 = M12-connector

1) only at CANopen version

Includes:
EDS-file and documentation on CD

Multiturn Type 9080 CANopen/DeviceNet



Your benefit
- Only 60 mm clearance needed
- Patended integrative technology
- Very easy mounting of the hollow shaft version. The encoder is mounted directly on the drive shaft without coupling. This saves up to 30 % cost and 50 % clearance compared to shaft versions.
- Divisions: up to 8192 (13 bits) per revolution, 4096 (12 bits) revolutions
- Contactless multiturn gear with new Intelligent-Sensing-Technology (IST)
- Simply connection patent pending connecting system with removable socket box
- Protection: IP 65

Product features
- CANopen according to profile DSP 406 with additional features
- DeviceNet 2.0 protocol
- Divisions: up to 8192 Bit/U, up to 4096 U. (13x12 bit)
- IP 65
- Extensive M12 accessories program
- Ex available as explosion proof zone 2 and 22

CANopen
DeviceNet

Mechanical characteristics:

Speed: [1]	max. 6000 min^{-1}
Rotor moment of inertia:	appr. 72 x 10^{-6} kgm^2
Starting torque shaft hollow shaft version :	< 0,2 Nm
Starting torque shaft shaft version :	< 0,05 Nm
Load capacity of shaft (bei Vollwelle) [2]	radial: 80 N, axial 40 N
Weight:	appr. 0,9 kg
Protection acc. to EN 60 529:	IP 65
Working temperature:	–10° C ... +70 °C
Operating temperature:	–20° C ... +80 °C
Shaft:	stainless steel
Shock resistance acc. to DIN-IEC 68-2-27:	2500 m/s^2, 6 ms
Vibration resistance acc. to DIN-IEC 68-2-6:	100 m/s^2, 10 ... 2000 Hz

[1] for continuous operation 3000 min^{-1}
[2] shaft version only (at shaft end)

Electrical characteristics:

Supply voltage (U_B):	10 ... 30 V DC
Current consumption:	max. 0,29 A
recommended fuse:	T 0,315 A
Linearity:	± 1/2 LSB (±1 LSB at Resolution 13, 14, 25 ,26 Bit)
Codeart:	Binary
Interface:	CAN HIGH-Speed to ISO/DIS 11898, Basic and Full-CAN; CAN-specification 2.0 B (11 and 29 Bit Identifier
Protocol:	**CANopen to Profil DSP 406** **DeviceNet Profile for Encoder Release V 2.0**
Rate:	programmable via DIP switches 10 ... 1000 Kbits/s
Basic identifier/node:	programmable via DIP switches
Conforms to CE requirements acc. to EN 50082-2, EN 50081-2, EN 55011 Class B and EN 61000–4–8	
Performance against magnetic influence acc. to EN61000-4, 5	

Multiturn Type 9080 CANopen/DeviceNet

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- Class C2 functionality
- NMT Slave
- Diagnostics (internal) 2 Bit
- CAN-LED for Bus status
- CAN-LED for operating mode

The following parameters can be programmed:
- Polling mode or auto mode with adjustable time
- Direction
- Number of pulses/rotation 1 ... 8192
- Number of revolutions 1 ... 4096
- Total resolution
- Preset
- Offset

DeviceNet Encoder Profile:
General description:
The DeviceNet Device Profile describes the functionality of the communication and of that part of the DeviceNet fieldbus system specific to the manufacturer. The Encoder Profile applies to encoders and defines the individual objects independently of the manufacturer. In addition the profile makes provision for additional extended functions specific to the manufacturer.

The following parameters can be programmed:
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  - Total resolution
- Number of revolutions
- Preset value
- Diagnostics mode
- Resolution

The following functionality is integrated:
- Galvanic isolation of the Fieldbus-stage with DC/DC converter
- Addressing via DIP switches or software
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- Node address 0 … 63 and baud rate programmable via DIP switches
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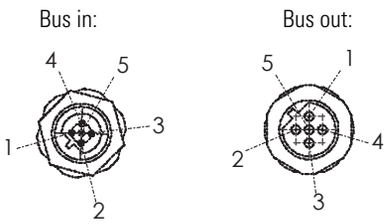
Multiturn Type 9080 DeviceNet



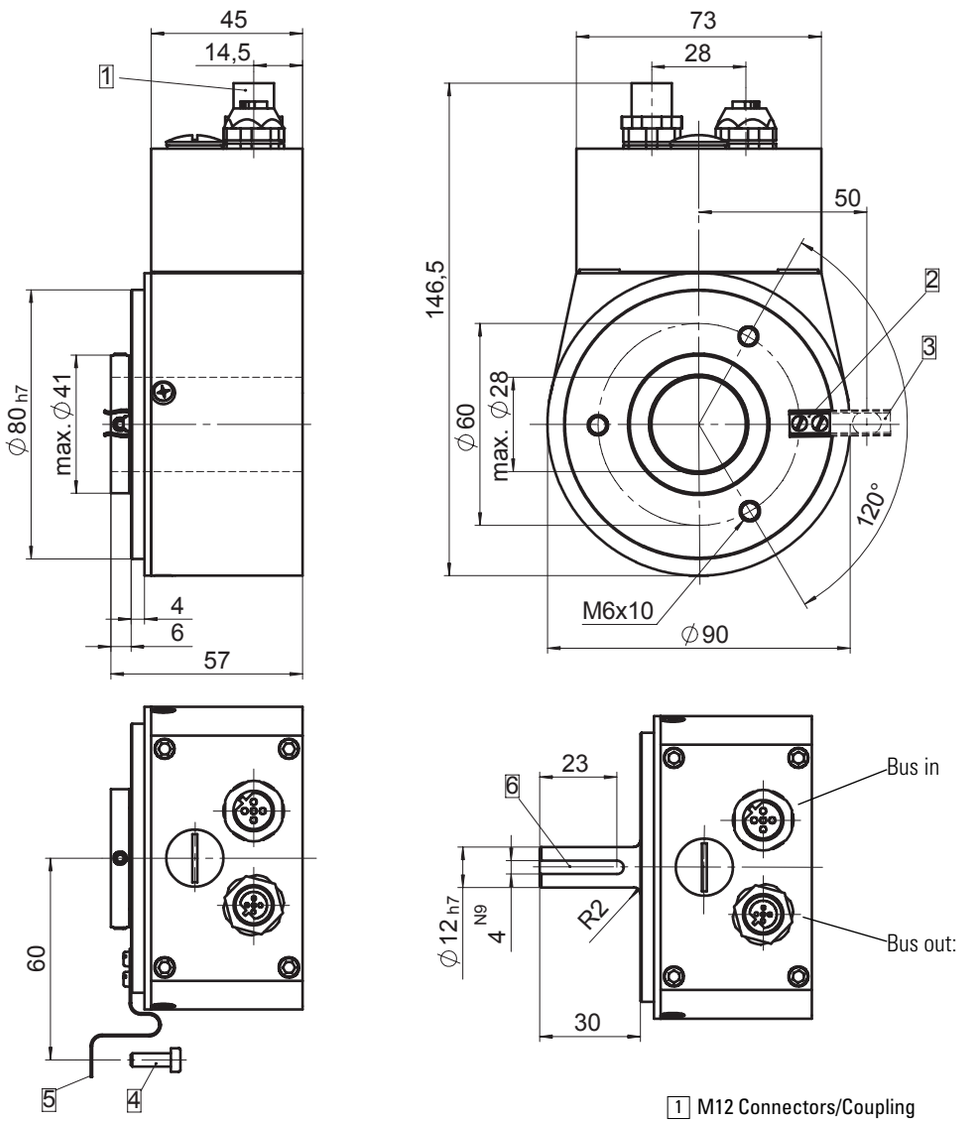
Bus in:

Signal :	DRAIN	+ V DC	– V DC	CAN_H	CAN_L
Pin:	1	2	3	4	5
	GY	RD	BK	WH	BU

Bus out:

Signal :	DRAIN	+ V DC	– V DC	CAN_H	CAN_L
Pin:	1	2	3	4	5
	GY	RD	BK	WH	BU

Dimension (M12 connector version):



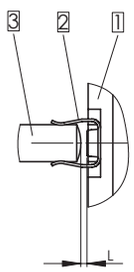
1 M12 Connectors/Coupling
2 Spring device for pin acc. to DIN 6325 Ø6
3 Spring device short (Flange No. 2)
4 Spring device l0ng (Flange No. 3)
5 Slotted hole for screw M4
6 Mounting bracket (Flange No. 4)
7 2,5 mm deep

Multiturn Type 9080 CANopen/DeviceNet

Max. permissible drive shaft impact

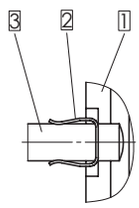
Type of flange:	Permissible axial impact	Permissible radial impact	Perm. angular play
Flange Typ 2 (Spring device short):	max. ±1 mm[1)]	max. ±0,3 mm	max. ±2°
Flange Typ 3 (Spring device long):	∞[2)]	max. ±0,3 mm	max. ±2°
Flange Typ 4 (Mounting bracket):	max. ±0,5 mm	max. ±0,3 mm	max. ±2°

1) When mounting the encoder make sure that the dimension $L_{min.}$ is larger than the maximum axial play of the drive in the direction of the arrow. Danger of mechanical collision!



1 Flange
2 Spring device
3 Pin

2) Pin through hoe of spring device



1 Flange
2 Spring device
3 Pin

Patended "Integrated Technology®" uses single board construction, deliberate assembly techniques, and two ASIC design:
- Shock up to 250gs
- Higher vibration specs and thermal shock performance
- Lower parts count, elimination of potentiometers
- Higher resistance to EMI

Electronic multiturn increases performance, eliminates gears
- Reliability - No backlash errors, resistant to EMI, lower parts count
- Higher life - No mechanical wear, lower internal temperature
- Higher performance - Higher operating speeds
- Lower profile - compact size, hollow shaft
- Economical - Lower cost

Patended "Intelligent Sensing Technology®"
- Multiturn design that protects encoder from.
- The battery outlasts both application requirements and system components (LEDs & bearings)
- Redundant multiturn sensors and counters increase reliability & life
- Active system output monitoring using digital filters to compare data to logical & target bits.

Order code:

8.9080.XXXX.X001

Range

Flange
- 1 = without mounting aid
- 2 = with short spring device
- **3 = with long spring device**
- **4 = with mounting bracket**

Shaft/Hollow shaft
- **1 = Hollow shaft Ø 12 mm**
- 2 = Hollow shaft Ø 15 mm
- **3 = Hollow shaft Ø 20 mm**
- 4 = Hollow shaft Ø 24 mm
- **5 = Hollow shaft Ø 28 mm**
- 6 = Hollow shaft Ø 5/8"
- 7 = Hollow shaft Ø 1"
- 8 = Shaft Ø 12 x 30 mm
- 9 = Hollow shaft Ø 16 mm

Interface and supply voltage
- 1 = DeviceNet 10 ... 30 V DC
- **2 = CANopen 10 ... 30 V DC**

Feldbusprofil
- 1001 = DeviceNet
- **2001 = CANopen Encoder Profile DSP 406**

Type of connection
- 1 = Terminal box with cable connection M16[1)]
- 2 = M12-Connector

1) only at CANopen version

Includes:

ESD-file and documentation on CD

Accessories:

Further accessories see accessories chapter

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