SCH108BEX

PROFI BUS®

Technical Manual

1 Introduction

The **SCH108BEX** Encoder is an Ex-proof, Absolute Multiturn Encoder designed primarily for use in oilfield applications where reliability is critical, but can also be used for other applications that requires a rugged and reliable Ex-proof Absolute Encoder.

The **SCH108BEX** features a large through-bore hollow shaft that can be easily mounted on shafts of various sizes. It is the only large through-bore Ex-proof Profibus encoder on the market that has ATEX, IECEx, Class I Div.1, AEx, and Nanio CCVE certifications.

Specifically designed for the Oil Industry, this rugged encoder incorporates features such as a 1¼ inch through hollow bore, a removable end cap for easy onsite cable replacement, and both manual and Profibus interface options for setting the Profibus device address. The **SCH108BEX** is the Ex-proof Profibus encoder of choice for oilfield applications.
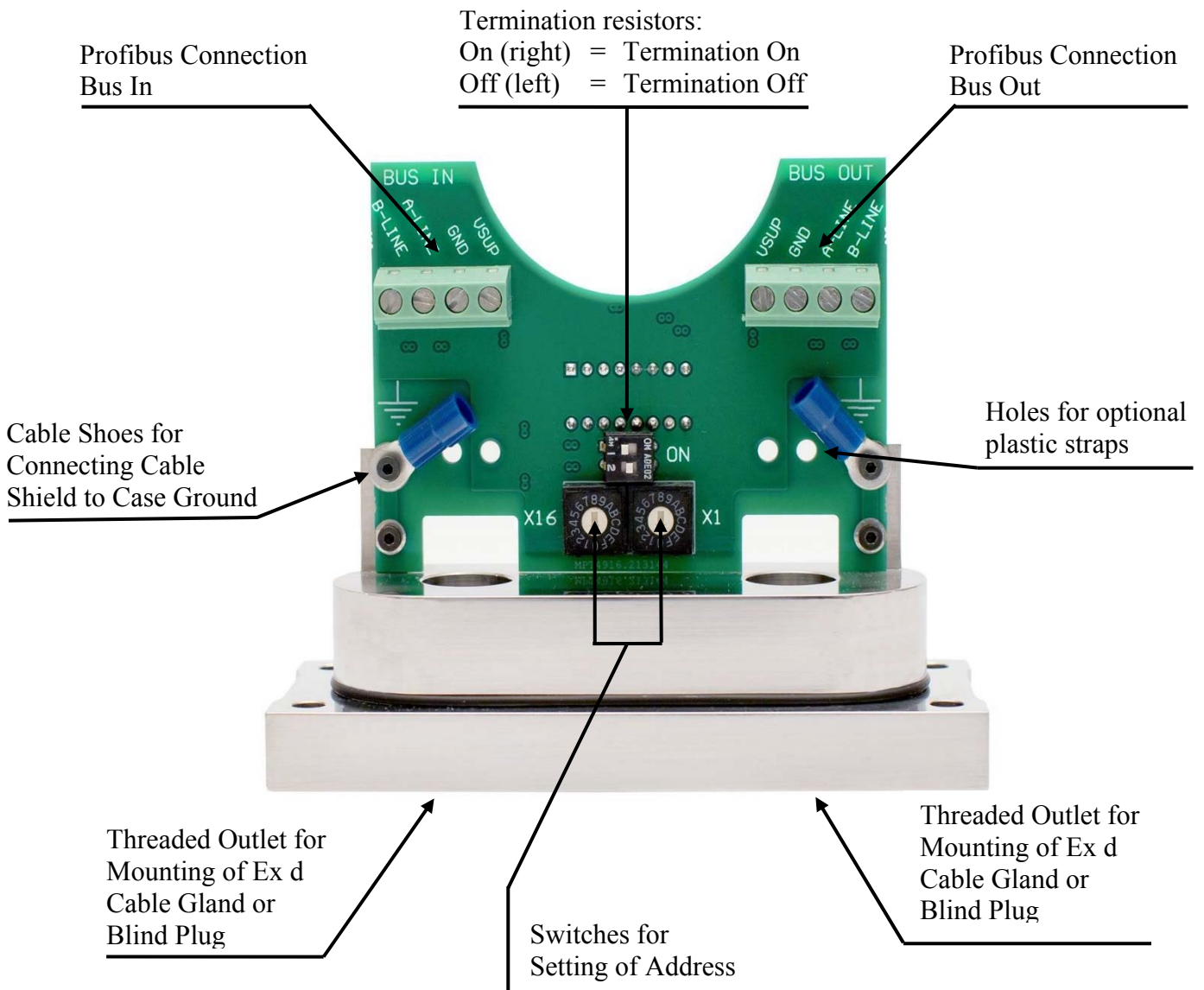
The **SCH108BEX** has the following features:

- Profibus DP Interface for exchange of data with a Master Controller.
- Supports the Profile for Absolute Encoders ver. 1.1 class 1 and class 2 from the Profibus Nutzerorganisation as well as manufacturer specific functions.
- Setting of station address over rotary switches or over Profibus interface by Change Station Address function.
- Measurement of Velocity and Acceleration with programmable sample interval.
- Removable end cap for easy onsite setting and cable replacement.
- Large through hollow bore (up to 1¼ inch) for easy mounting.
- Rugged, heavy duty ball bearings for high reliability.
- Available in Aluminum and Stainless Steel (AISI 316).

This manual describes the implementation and use of the SCH108BEX Encoder.

2 Removable End Cap

The picture below shows the end cap when removed from the encoder.

Profibus Connection
Bus In

Termination resistors:
On (right) = Termination On
Off (left)   = Termination Off

Profibus Connection
Bus Out

Cable Shoes for
Connecting Cable
Shield to Case Ground

Holes for optional
plastic straps

Threaded Outlet for
Mounting of Ex d
Cable Gland or
Blind Plug

Switches for
Setting of Address

Threaded Outlet for
Mounting of Ex d
Cable Gland or
Blind Plug

3   Installation

As the installation of the SCH108BEX may differ from location to location, it is not possible to give exact instructions on all aspects on how to install the encoder. Below are some general recommendations and procedures.

3.1   Mechanical Installation

Before the encoder is mechanically installed, the required Ex d cable glands or blind plug must be mounted onto the encoder. Do not mount or tighten the cable glands or blind plug while the encoder is attached to the shaft as excessive torque may result in damage to the encoder ball bearings.

The mechanical installation consists of the following steps:

1. Mount the bracket for the torque arm or spring coupling to the encoder face, using the supplied screws.
2. Mount the torque arm onto the bracket if a torque arm is used.
3. Connect the ground wire to machine ground (earth). Observe handling precautions for ESD sensitive devices.
4. Insure that the hollow bore fixing clamp (collet) is loose.
5. Slide encoder hollow shaft onto motor shaft (or other device).
6. Align encoder torque arm or spring coupling mounting hole(s) with motor faceplate hole(s). Insert screw(s) and tighten.
7. Tighten the hollow bore fixing clamp (collet) screw (max. torque 1.5 Nm – 13.3 lbf-in).

3.2   Electrical Installation

The electrical installation consists of the following steps.

1. Remove the screws for the end cap and pull out the end cap. Note that the end cap must be pulled out in a straight, firm pull. Do not try to rock or twist the end cap as this may lock it in position. Notice orientation of the end cap.
2. Prepare the cable(s) by uncovering the individual wires including the shield. Each wire must have a length of 75 mm (3 inches)
3. Insert the cable(s) into the cable gland(s) and tighten the cable gland(s).
4. Estimate the necessary wire length of the individual wires and cut them to length. Note that wire lengths will vary depending on which terminal they shall be inserted into. See below for description of connections.

5. Insert wires into terminals and tighten screws. Do not over tighten.

6. Secure wires to printed circuit board with plastic straps (optional).

7. Set, if necessary, switches for termination resistors and device address (see below).

8. Push the end cap back into the encoder. Again, a straight, firm push is needed. Insure that the end cap orientation is correct.

9. Secure the end cap with the screws (max. torque 6 Nm –53 lbf-in).

The connection table below applies to both the Bus In terminal block and the Bus Out terminal block.

Terminal Name	Type	Description
VSUP	Power	Positive supply for Encoder (9V – 30V)
GND	Power	0V supply for Encoder (Circuit Ground)
A-LINE	Bidirectional	Negative Data I/O for Profibus Interface
B-LINE	Bidirectional	Positive Data I/O for Profibus Interface

Note that the Cable Shield must not be left unconnected but must be connected to the encoder's Case Ground through the blue cable shoes.

3.3 Termination Resistors

The physically first and the last device on the bus must be equipped with termination resistors. If the SCH108BEX is connected as the first or the last device the switches for the termination resistors must be set to the "On" position. Note that both switches must be set to On. If the SCH108BEX is not connected as the first or the last device the switches for the termination resistors must be set to the "Off" position. Also here, both switches must be set to Off.

The termination resistor switches are accessible on the end cap when it is removed from the encoder. Refer to picture on page 3 for location of termination resistor switches.

3.4 Device Address

The device address of the SCH108BEX can be set to any value between 1 and 126. The device address can be set either by the rotary switches that are located on the end cap or over the Profibus interface by the Change Station Address function.

The rotary switches are accessible on the end cap when it is removed from the encoder. Refer to picture on page 3 for location of address setting rotary switches.

Setting the address over the Profibus interface is only possible if the rotary switches are set to address 126 (0x7E hex). If the address is set to any other value by the rotary switches this will take precedence and a change over the Profibus interface is not possible.

At delivery the device address on the rotary switches are set to 126 decimal (0x7E hex).

This means that the user must actively set the address switches to an address between 1 and 125 or connect the encoder to a Profibus master for setting the address. Address 126 cannot be used for data exchange; it is dedicated for use in setting the address over the Profibus interface. Note that if the device address is set to a value outside the range 1 to 125 the encoder will not go into data exchange.

When setting the address over the rotary switches it should be noted that these are hexadecimal and the address must therefore be set as a hexadecimal number. The switch denoted X1sets the lower part of the number and the switch denoted X16 sets the higher part of the number. For example, setting the X1 switch to A and setting the X16 switch to 2 will set the address to 0x2A (42 decimal).

For information on how to set the address over the Profibus interface, consult the documentation for the Profibus master.

In the definition of the Change Station Address function it is defined that the user can prevent further changing of the address by checking a check field in the master's set-up panel. This possibility has not been implemented in the SCH108BEX as this will "lock" the encoder forever to a particular address and prevent it from future changes by the Change Station Address function.

4 Profibus Communication

Profibus is an international, open, non-proprietary field bus standard which is defined in the European Standard EN 50170. For more information about the standard, visit the official Profibus website at www.profibus.com. This website also contains valuable instructions and information on the physical layout and cabling of the bus.

The SCH108BEX encoder implements the DP-V0 variant of the Profibus standard.

The SCH108BEX supports the Profibus "Profile for Encoders" ver. 1.1 and manufacturer specific functionality. The Profile for Encoders can be acquired from the Profibus Nutzerorganisation under the order no. 3.062. The different functionalities are:

1. **Class 1 Multiturn.** This is a 32-bit multiturn encoder. The encoder has only the possibility to return the position and has limited possibilities for configuration.

2. **Class 2 Multiturn.** This is a 32-bit multiturn encoder that, besides all functions for the class 1 encoder, also has the possibility for presetting the position and a more detailed configuration, including the possibility for scaling.

3. **Scancon 2.0 Multiturn.** This is a 32-bit multiturn encoder that, besides all functions for the class 2 encoder, also will return velocity and acceleration.

The functionality is selected in the Master Set-up Tool and, as this may differ from master to master, it is not described here. Consult the documentation for the Profibus Master in use for further information

Note that in the following description, data direction is always described from the master's point of view, i.e. data from the master to the slave is named as "output data" and data from the slave to the master is named as "input data". All exchanged values are unsigned unless otherwise noted.

4.1 Parameterization

During the initialization of the bus communication, the master sends a parameterization telegram to the slave. This telegram can consist of two parts, the mandatory part according to the Profibus specifications (octet 1 to 8) and the user part (octet 9 and up). The length of the parameterization telegram for the SCH108BEX varies depending on which functionality is selected.

In the table below, the octet number is shown as the position in the whole parameterization telegram. Octet no. 9 in the telegram will therefore also be parameter no. 1 within the user parameters and so on. The table also describes in which functionality the parameter must be present. Notice that if class 2 is used all parameters from class 1 must be present and if Scancon 2.0 is used all parameters from class 1 and class 2 must be present.

Octet no.	Parameter Name	Bit no.	Description	Used for
9	Operating Parameters	0	Code Sequence	Class 1
		1	Class 2 functionality	Class 2
		2	Commissioning Diagnostics	Class 2
		3	Scaling Function Controll	Class 2
		4 - 7	Not Assigned – Must be 0	-----
10 - 13	Measuring Units per Rev.	---	Measuring Units per Revolution	Class 2
14 - 17	Total Measuring Range	---	Total Measuring Range	Class 2
18 - 25	Reserved for Future Use	---	Must be 0	-----
26	Time Base	---	For Velocity and Acceleration	Scancon 2.0

4.1.1 Octet no. 9 – Operating Parameters

This byte is used for operating parameters. Only bit 0 – 3 are used. The rest of the bits (bit 4 – 7) must be set to 0000.

Bit no. 0 – Code Sequence

The setting of this bit will affect the direction for the position measurement and for the velocity measurement.

    Bit 0 = 0 (off) – CW, increasing clockwise seen from shaft side of encoder
    Bit 0 = 1 (on) – CCW, increasing counter clockwise seen from shaft side of encoder

Default value: 0 ~ Increasing clockwise
Valid range: 0 – 1

Bit no. 1 – Class 2 Functionality

This bit is only active if class 2 or higher functionality is enabled. The bit must always be 1.

Default value: 1 ~ Class 2 functionality enabled.
Valid range: 1 – 1

Bit no. 2 – Commissioning Diagnostics

The SCH108BEX does not support commissioning diagnostics, so this bit must always be 0.

Default value: 0 ~ Commissioning diagnostics disabled.
Valid range: 0 – 0

Bit no. 3 – Scaling Function Control

The setting of this bit controls whether the position value is scaled with the parameters measuring units per revolution and total measuring range (see below). Note that if the scaling function is disabled, the values of the scaling parameters are ignored regardless of their value.

> Bit 3 = 0 (off) – Scaling function is disabled.
> Bit 3 = 1 (on) – Scaling function is enabled.

Default value: 0 ~ Scaling function disabled.
Valid range: 0 – 1

4.1.2   Octet no. 10-13 – Measuring Units per Revolution

This double word (32-bit) is used for setting the desired number of measuring steps over one revolution of the encoder shaft. The value must not be higher than the physical resolution of one revolution of the encoder, i.e. 2^n where n is the number of singleturn bits. This parameter only has effect if the scaling function is enabled (see above).

Default value: 2^n
Valid range: $1 - 2^n$

4.1.3   Octet no. 14-17 – Total Measuring Range

This double word (32-bit) is used for setting the desired number of measuring steps over the full measuring range of the encoder. The value must not be higher than the total physical resolution of the encoder, i.e. 2^{n+m} where n is the number of singleturn bits and m is the number of multiturn bits. This parameter only has effect if the scaling function is enabled (see above).

Default value: 2^{n+m}
Valid range: $1 - 2^{n+m}$

4.1.4   Octet no. 18-25 – Reserved for Future Use

These bytes are marked as "Reserved for Future use" in the encoder profile and should therefore all be set to 0.

4.1.5   Octet no. 26 – Time Base

This byte is used for setting the time base for the velocity and acceleration measurement.
The setting of this byte will affect the precision of the velocity and acceleration measurement as a longer sample time will give better precision and vice versa. For a good balance between low sample time and good accuracy, a sample time of 100 mSec. is recommended.
The velocity and acceleration measurements are taken after an eventual scaling has taken place.

   0 = Steps per 10 mSec.
   1 = Steps per 100 mSec.
   2 = Steps per 1000 mSec.
   3 = Revolutions per Minute (RPM).

Default value: 1 ~ Steps per 100 mSec.
Valid range: 0 – 3

Though the various parameters and their settings have been described in detail above, it is normally not necessary for the user to set them directly as the settings are performed in a "user-friendly" form in the Profibus Master Preparation software tool. The information on how to set up the necessary menus is imported from the GSD file to the software tool. The procedure for setting the parameters may vary from tool to tool. Consult the documentation for the tool in use. Also note that the naming conventions for the octets may vary. Some tools may name the first octet as octet 0 and others may name it as octet 1. Also some tools may use the word byte instead of octet.

4.2   Diagnostic Information

The master can at any time request a diagnostic message from the slave so it can check for the capabilities of the slave and important warnings or errors. This is particularly important after the parameterization as the diagnostic message may reflect changes in the functioning of the encoder or even parameters that are illegal. The diagnostic message can consist of two parts, the mandatory part according to the Profibus specifications (octet 1 to 6) and the extended part (octet 7 and up). The length of the diagnostic message for the SCH108BEX varies depending on which functionality is selected.

In the table below the octet number is shown as the position in the whole diagnostic message. Octet no. 7 in the message will therefore also be parameter no. 1 in the extended diagnostic block and so on. The table also describes in which functionality the parameter will be present. Notice that if class 2 is used all parameters from class 1 will be present and if Scancon 2.0 is used all parameters from class 1 and class 2 will be present.

The table below shows the parameters that are contained in the diagnostic message.

Octet no.	Parameter Name	Bit no.	Description	Used for
7	Header	---	Extended Diagnostic Header	Class 1
8	Alarms	0	Position Error	Class 1
		1	Supply Voltage Error	Class 1
		2	Current Too High	Class 1
		3	Commissioning Diagnostics	Class 1
		4	Memory Error	Class 1
		5 - 7	Not Assigned – Send as 0	Class 1
9	Operating Status	0	Code Sequence	Class 1
		1	Class 2 Functionality	Class 1
		2	Commissioning Diagnostics	Class 1
		3	Scaling Function Status	Class 1
		4 - 7	Not Assigned – Send as 0	Class 1
10	Encoder Type	---	Encoder Type	Class 1
11 - 14	Singleturn Resolution	---	Singleturn Resolution	Class 1
15 - 16	Number of Revolutions	---	Total Number of Revolutions	Class 1
17	Additional Alarms	0 - 7	Not Assigned – Send as 0	Class 2
18 - 19	Supported Alarms	0	Position Error	Class 2
		1	Supply Voltage Error	Class 2
		2	Current Too High	Class 2
		3	Commissioning Diagnostics	Class 2
		4	Memory Error	Class 2
		5 - 15	Not Assigned – Send as 0	Class 2
20 - 21	Warnings	0	Frequency Exceeded	Class 2
		1	Temperature Exceeded	Class 2
		2	Light Control Reserve	Class 2
		3	CPU Watchdog Status	Class 2
		4	Operating Time Limit Warning	Class 2
		5	Battery Charge	Class 2
		6	Reference Point	Class 2
		7 - 15	Not Assigned – Send as 0	Class 2
22 - 23	Supported Warnings	0	Frequency Exceeded	Class 2
		1	Temperature Exceeded	Class 2
		2	Light Control Reserve	Class 2
		3	CPU Watchdog Status	Class 2
		4	Operating Time Limit Warning	Class 2
		5	Battery Charge	Class 2
		6	Reference Point	Class 2
		7 - 15	Not Assigned – Send as 0	Class 2
24 - 25	Profile Version	---	Encoder Profile Version	Class 2

26 - 27	Software Version	---	Encoder Software Version	Class 2
28 - 31	Operating Time	---	Encoder Operating Time	Class 2
32 - 35	Offset Value	---	Offset Value	Class 2
36 - 39	Manufacturer Offset Value	---	Manufacturer Offset Value	Class 2
40 - 43	Measuring Units per Rev.	---	Measuring Units per Revolution	Class 2
44 - 47	Total Measuring Units	---	Total Range Measuring Units	Class 2
48 - 57	Serial Number	---	Serial Number of encoder	Class 2

4.2.1 Octet no. 7 – Header

The extended diagnostic header specifies the length in bytes of the extended diagnostic block including the header itself. The length of the extended diagnostic block is 10 for class 1 functionality and 51 for class 2 and Scancon 2.0 functionality.

4.2.2 Octet no. 8 – Alarms

This byte will indicate various alarms for the encoder. Only bit 0 – 4 are used. The rest of the bits (bit 5 – 7) will be sent as 0.

Bit no. 0 – Position Error

The setting of this bit indicates whether there is or can be expected to be a position error. If this bit is set, a normal remedy will be to switch off the encoder and switch it on again. It must be expected that an eventual preset value will be lost and that the encoder must be preset again.

    Bit 0 = 0 (off) – No position error alarm
    Bit 0 = 1 (on) – Position error alarm

Bit no. 1 – Supply Voltage Error

The setting of this bit indicates whether the supply voltage is within range (9V – 30V). If this bit is set, the supply voltage must be checked and, if necessary, adjusted.

    Bit 1 = 0 (off) – No supply voltage error alarm
    Bit 1 = 1 (on) – Supply voltage alarm

Bit no. 2 – Current too High

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 3 – Commissioning Diagnostics

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 4 – Memory Error

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

4.2.3 Octet no. 9 – Operating Status

This byte will indicate the operating status of the encoder. Only bits 0 – 3 are used. The rest of the bits (bit 4 – 7) will be sent as 0.

Bit no. 0 – Code Sequence

The setting of this bit indicates the counting direction of the encoder. The counting direction is defined as seen from the shaft side of the encoder (the motor side).

Bit 0 = 0 (off) – Increasing with clockwise rotation
Bit 0 = 1 (on) – Increasing with counter clockwise rotation

Bit no. 1 – Class 2 functionality

The setting of this bit indicates whether the encoder supports class 2 functionality.

Bit 1 = 0 (off) – Class 2 functionality not supported
Bit 1 = 1 (on) – Class 2 functionality supported

Bit no. 2 – Commissioning Diagnostics

Commissioning Diagnostics is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 3 – Scaling Function Status

The setting of this bit indicates whether the scaling function is enabled.

Bit 3 = 0 (off) – Scaling Function Disabled
Bit 3 = 1 (on) – Scaling Function Enabled

4.2.4 Octet no. 10 – Encoder Type

This byte will indicate the encoder type. The SCH108BEX encoder is an encoder type 2, Singleturn Absolute Rotary Encoder with Electronic Turncount.

4.2.5 Octet no. 11-14 – Singleturn Resolution

This double word (32-bit) value will indicate the physical number of positions on one revolution of the encoder shaft. The value depends on the number of singleturn bits with which the encoder is delivered.

4.2.6 Octet no. 15-16 – Number of Revolutions

This word (16-bit) value will indicate the physical number of distinguishable revolutions of the encoder shaft the encoder can detect. The value depends on the number of multiturn bits with which the encoder is delivered.

4.2.7 Octet no. 17 – Additional Alarms

The Profibus Profile for Encoders does not assign any definitions for additional alarms. This value will be sent as 0.

4.2.8 Octet no. 18-19 – Supported Alarms

This word (16-bit) will indicate the alarms that are supported by the SCH108BEX. Only bit 0 – 4 are used. The rest of the bits (bit 5 – 15) will be sent as 0.

Bit no. 0 – Position Error

This alarm is supported by the SCH108BEX and will therefore be sent as 1.

Bit no. 1 – Supply Voltage Error

This alarm is supported by the SCH108BEX and will therefore be sent as 1.

Bit no. 2 – Current too High

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 3 – Commissioning Diagnostics

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 4 – Memory Error

This alarm is not supported by the SCH108BEX and will therefore be sent as 0.

4.2.9   Octet no. 20-21 – Warnings

This word (16-bit) will indicate various warnings for the encoder. Only bits 0 – 6 are used. The rest of the bits (bit 7 – 15) will be sent as 0. Note that these are warnings and not errors. They indicate that the encoder will be operating but may need service in the near future.

Bit no. 0 – Frequency Exceeded

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 1 – Temperature Exceeded

This warning indicates whether the temperature is high inside the encoder. The threshold value is 65°C (149°F).

> Bit 1 = 0 (off) – Temperature below 65°C
> Bit 1 = 1 (on) – Temperature above 65°C

Bit no. 2 – Light Control Reserve

This warning indicates whether the light output from the LED has degraded below a certain limit. A degraded LED must be exchanged at the factory.

> Bit 2 = 0 (off) – Light output within limits
> Bit 2 = 1 (on) – Light output outside limits

Bit no. 3 – CPU Watchdog Status

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 4 – Operating Time Limit Warning

This warning indicates whether the operating time of the encoder has exceeded a limit. The limit is set as 87600 hours (10 years)

> Bit 4 = 0 (off) – Operating time below limit

Bit 4 = 1 (on) – Operating time above limit
Bit no. 5 – Battery Charge

This warning indicates whether the voltage of the battery has dropped below a limit. The encoder will still be operating but the battery will need to be replaced in the near future. The battery is not replaceable by the user and must be replaced at the factory.

Bit 5 = 0 (off) – Battery voltage above limit
Bit 5 = 1 (on) – Battery voltage below limit

Bit no. 6 – Reference Point

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

4.2.10   Octet no. 22-23 – Supported Warnings

This word (16-bit) will indicate the warnings that are supported by the SCH108BEX. Only bits 0 – 6 are used. The rest of the bits (bit 7 – 15) will be sent as 0.

Bit no. 0 – Frequency Exceeded

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 1 – Temperature Exceeded

This warning is supported by the SCH108BEX and will therefore be sent as 1.

Bit no. 2 – Light Control Reserve

This warning is supported in the SCH108BEX and will therefore be sent as 1.

Bit no. 3 – CPU Watchdog Status

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

Bit no. 4 – Operating Time Limit Warning

This warning is supported in the SCH108BEX and will therefore be sent as 1.

Bit no. 5 – Battery Charge

This warning is supported by the SCH108BEX and will therefore be sent as 1.

Bit no. 6 – Reference Point

This warning is not supported by the SCH108BEX and will therefore be sent as 0.

4.2.11 Octet no. 24-25 – Profile Version

These two bytes will give the version of the Profibus Profile for Encoders that is supported by the SCH108BEX. The first byte (octet 24) gives the major version number and the second byte (octet 25) gives the minor version number. As an example 0x01 – 0x01 will give version 1.1.

4.2.12 Octet no. 26-27 – Encoder Software Version

These two bytes will give the version of the encoder software The first byte (octet 26) gives the major version number and the second byte (octet 27) gives the minor version number. As an example 0x01 – 0x01 will give version 1.1.

4.2.13 Octet no. 28-31 – Operating Time

This double word (32-bit) value will indicate the operating time of the encoder. The operating time is defined as the total amount of time the encoder has been under external power. The operating time is given with a resolution of 0.1 hours. A value of 61 (decimal) will therefore mean 6 hours and 6 minutes.

4.2.14 Octet no. 32-35 – Offset Value

This double word (32-bit) value will indicate the offset of the encoder value from the physical zero point of the encoder. The offset value is calculated in the preset function and is used to shift the internal position value with the offset value. The offset value is given in scaled units if scaling is activated. If the encoder has not been preset the offset value will be 0. The offset value is stored in the internal non-volatile E^2Prom and will therefore be saved, even when the encoder is not powered by external power. The offset value is a signed binary value.

4.2.15 Octet no. 36-39 – Offset Value of the Encoder Manufacturer

This double word (32-bit) value will indicate the offset value of the encoder manufacturer. As there is no manufacturer offset in the SCH108BEX this value will be sent as 0.

4.2.16   Octet no. 40-43 – Measuring Units per Revolution

This double word (32-bit) value will indicate the measuring units per revolution. If the scaling function is not enabled it will be the physical number of positions that is equal to the resolution of the disc. If the scaling function is enabled it will be the resolution that has been set during the parameterization.

4.2.17   Octet no. 44-47 – Total Measuring Range in Measuring Units

This double word (32-bit) value will indicate the measuring units for the total measuring range. If the scaling function is not enabled it will be the physical number of positions that is equal to the resolution of the disc multiplied by the total number of revolutions the encoder can measure. If the scaling function is enabled it will be the total measuring range that has been set during the parameterization.

4.2.18   Octet no. 48-57 – Encoder Serial Number

The serial number is send as an ASCII string of 10 bytes. For the SCH108BEX the serial number is a plain number of either 6 or 7 digits. The rest 4 (3) bytes are sent as spaces (0x20)

4.3   Data Exchange

After a successful initialization, the communication will go into the data exchange phase where data is exchanged cyclically between the master and the slave.

Depending on which functionality the encoder has been set for, the number of output bytes and input bytes will differ. The following number of bytes will be exchanged:

1. **Class 1 Multiturn** – 0 output bytes, 4 input bytes.
2. **Class 2 Multiturn** – 4 output bytes, 4 input bytes.
3. **Scancon 2.0 Multiturn** – 4 output bytes, 12 input bytes

4.3.1 – Class 1 Multiturn

For a class 1 multiturn encoder only data from the encoder to the master (input data) will be sent.

The encoder will send its position to the master as a long word (32-bit) value. The value will be sent in big endian format (first byte is MSB) and the value is unsigned.

Input Data for Class 1 Multiturn

Octet no.	Parameter Name	Bit no.	Description
1 - 4	Position	---	Present position of encoder

4.3.2 – Class 2 Multiturn

For a class 2 multiturn encoder there will both output data and input data.

The master will send a preset value to the encoder as a long word (32-bit) value. If the most significant bit (bit 31) is set (1) the encoder will preset itself to the lowest 31 bits of the value. Note that the lowest 31 bits must not have a value that is higher than the Total Measuring Range in Measuring Units minus 1, see section 4.2.17 above. The preset value is unsigned.

Output Data for Class 2 Multiturn

Octet no.	Parameter Name	Bit no.	Description
1 - 4	Preset Position	0 - 30	Preset value
		31	Preset position if set (1)

The encoder will send its position to the master as a long word (32-bit) value. The value will be sent in big endian format (first byte is MSB) and the value is unsigned.

Input Data for Class 2 Multiturn

Octet no.	Parameter Name	Bit no.	Description
1 - 4	Position	---	Present position of encoder

4.3.3 – Scancon 2.0 Multiturn

For a Scancon 2.0 multiturn encoder there will both output data and input data.

The master will send a preset value to the encoder as a long word (32-bit) value. If the most significant bit (bit 31) is set (1) the encoder will preset itself to the lowest 31 bits of the value. Note that the lowest 31 bits must not have a value that is higher than the Total Measuring Range in Measuring Units minus 1, see section 4.2.17 above. The preset value is unsigned.

Output Data for Scancon 2.0 Multiturn

Octet no.	Parameter Name	Bit no.	Description
1 - 4	Preset Position	0 - 30	Preset value
		31	Preset position if set (1)

The encoder will send its position to the master as a long word (32-bit) value. The value will be sent in big endian format (first byte is MSB) and the value is unsigned.

The encoder will send its velocity to the master as a long word (32-bit) value. The value will be sent in big endian format (first byte is MSB). The value is signed in such a way that a positive velocity means that the encoder is increasing its position value and a negative velocity means that the encoder is decreasing its position value.

The encoder will send its acceleration to the master as a long word (32-bit) value. The value will be sent in big endian format (first byte is MSB). The value is signed in such a way that a positive acceleration means that the encoder is increasing its velocity and a negative acceleration means that the encoder is decreasing it velocity.

Input Data for Scancon 2.0 Multiturn

Octet no.	Parameter Name	Bit no.	Description
1 - 4	Position	---	Present position of encoder
5 - 8	Velocity	---	Present velocity of encoder
9 - 12	Acceleration	---	Present acceleration of encoder

5   Mechanical Dimensions

Removable End Cap

Dimensions in mm. (inch)
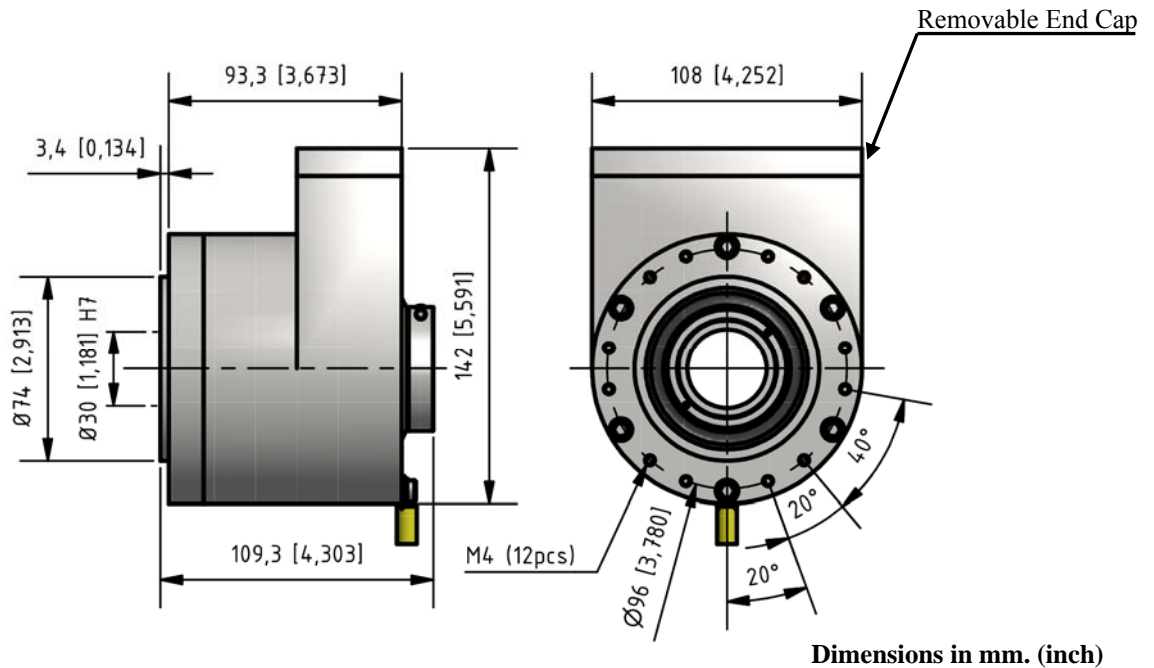
Removable End Cap - Facemount A

**Plastic screw plugs are provided for cable outlet protection during shipping and storage.
These plastic plugs must be replaced by an EX d certified cable gland or blind plug prior to use.**

Mechanical Tolerances (mm)	
Hollow Shaft (*ISO tolerance*)**:**	ISO 286-2 ANSI B4.2
Hollow bore ø > 18 mm to ≤ 30 mm	H7 (+ 0 / + 0.021)
Hollow bore ø > 30 mm to ≤ 40 mm	H7 (+ 0 / + 0.025)
Shaft (*recommended ISO tolerance*)**:**	ISO 286-2 ANSI B4.2
Shaft ø > 18 mm to ≤ 30 mm	g6 (- 0.007 / - 0.020)
Shaft ø > 30 mm to ≤ 40 mm	g6 (- 0.007 / - 0.025)
Shaft Runout (*recommended* **TIR**)**:**	NEMA Std. MG1, 4.9.7 + / - 0.05 mm (0.002 inch)

6 Technical Specifications

Electrical Specifications	
Encoder Type:	Absolute Multiturn Encoder
Code:	Binary
Protocol	Profibus DP-V0. Supports the Profibus Profile for Absolute Encoders Ver. 1.1 class 1 and class 2
Resolution:	Max. 15 bit (32,678) revolutions. Max. 16 bit (65,536) steps per. rev.
Addressing:	Adjustable by rotary switches in the removable end cap and through the Change Station Address function over the Profibus interface
Address Range:	1 - 126
Baud Rate:	Supports all standard baud rates from 9,600 baud to 12 Mbaud
Update Rate:	2000 updates per second
Termination Resistors:	Switchable On/Off by switch in the removable end cap
Supply Voltage:	9 V min. to 30 V max.
Current Consumption: Typical without load	Depending on supply voltage: 150 mA @ Vsup = 10 V 70 mA @ Vsup = 24 V
Power Consumption:	< 2.0 W
Electrical Protection:	Reverse polarity protected
Noise Immunity:	Tested to EN61000-6-2 : 2005 and 61000-6-3 : 2007

Mechanical Specifications	
Material:	Housing: Aluminum treated with Chromital TCP. Stainless Steel (AISI 316) as an option Hollow Shaft: Stainless Steel (AISI 316)

Weight:	Aluminum: 2.4 kg (5.29 lb) Stainless Steel: 5.5 kg (12,13 lb)
Bearing Life:	> 1.9 x 10^{10} revolutions at rated load
Shaft Speed:	3000 RPM continuous (max.)
Starting Torque:	< 0.4 Nm (56 oz-in) at 25° C
Mass Moment of Inertia:	1.62 kgcm² (8.9 oz-in²)
Shaft Loads:	250 N (56 lbs) Axial max. 500 N (112 lbs) Radial max.

Environmental Specifications	
Operating Temperature:	-40° to +70° C
Storage Temperature:	-40° to +85° C
Shock:	100G @ 11 mSec
Vibration:	10G @ 10 – 2000 Hz
Bump:	10G @ 16 mSec (1000 x 3 axis)
Humidity:	98% RH without condensation
Enclosure Rating:	IP67 / Nema 6 (approx.)

Connection Options	
Connections:	Located on the removable end cap 5-pin terminal block for bus in 5-pin terminal block for bus out
Cable Glands:	M20, M25 and ½ inch NPT threaded outlets on the removable end cap. Ex d certified cable glands required

Document Revision History

Rev.	Date	Section	Notes
1.0	3. May 2015	-----	Initial version
1.1	7. March 2017	Section 2	Changed photo of end cap and added information about connection of cable shield
		Section 3	Added information about connection of cable shield