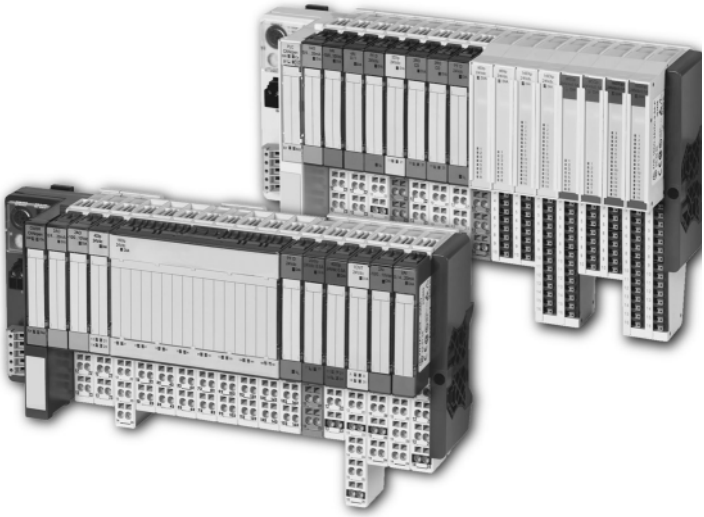
09/2011 MN05002012Z-EN
replaces M001775-02, 04/2007

XN-1CNT-24VDC
Technology Module



Powering Business Worldwide

Manufacturer
Eaton Automation AG
Spinnereistrasse 8-14
CH-9008 St. Gallen
Switzerland
www.eaton-automation.com
www.eaton.com

Support
Region North America
Eaton Corporation
Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
www.eaton.com

Other regions
Please contact your supplier or send an E-Mail to:
automation@eaton.com

Original manual
The German version of this document is the original manual.

Translations of the original manual
All non-German editions of this document are translations of the original manual.

Editorial department
Monika Jahn

Brand and product names
All brand and product names are trademarks or registered trademarks of the owner concerned.

Copyright

Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that the device cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (DIN VDE 0105 Part 100) may work on this device.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or tothe potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC/HD 60364-4-41 (DIN VDE 0100 Part 410).
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).

- The electrical installation must be carried out in accordance with the relevant regulations (e.g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC/HD 60364 (DIN VDE 0100) and national work safety regulations).

Table of contents

Table of contents

1 Product Description

Overview of operating modes

The XI/ON counter module is used to connect a pulse generator for counting 24 V DC signals (11 to 30 V DC) at a maximum frequency of 200 kHz.

The module also provides a 24 V DC power supply for the sensor.

The electronic module supports the following operating modes:

Count modes:
- Continuous counting
- Single-action counting
- Periodical count

Measurement modes:
- Frequency measurement
- Revolutions measurement
- Period duration measurement

Each of the operating modes have individual parameters assigned to them. The relevant parameter lists are specified in more detail in the descriptions of the integration in the fieldbus systems.

The counter module is provided with a digital output that is used for direct control of the process or for indicating comparison results.

The digital input of the counter module is used for initiating the hardware release signal, the synchronization or latch and retrigger function.

The XI/ON counter module can process signals generated from the following sensors:

- 24 V DC pulse generator with direction signal

- 24 V DC pulse generator without direction signal
- 24 V DC pulse generator with two 90° offset channels (rotary sensor)

Selecting counter or measurement mode

Profibus-DP
The GSD file provides 2 module codes the XN-1CNT-24VDC modules.

For count mode select modules with code C

For measurement mode select modules with code M

DeviceNet
The attribute no. 113 must be written first and determines the operating mode.

The write operation to attribute no. 113 resets all other attributes to the default values!

CANopen
Object 5800_{hex} controls the operating mode parameters of the XI/ON counter module. Its uses include the setting of count mode or measurement mode.

Count mode

Count modes

The count modes are used for supporting different counter applications such as the counting of bulk goods.

The following modes can be selected:

- Continuous counting, such as for positioning with 24 V DC incremental sensors
- Single-action counting, such as for counting units up to a maximum limit
- Periodical count, such as in applications with recurring count operations

Maximum count range

- The upper count limit is +2147483647 (2^{31}-1)
- The lower count limit is -2147483648 (-2^{31})

Main count direction

The main count direction determines the behaviour of the counter when the set count limit is reached. On reaching a count limit, the count value "jumps" to a defined value. Three different values are possible:

- Lower limit
- Upper limit
- Load value

The following table shows which of the three values the counter accepts according to the main count direction set and the operating mode:

Table 1: Values assumed after reaching the counter limits, depending on the operating mode and the main count direction.

Operating mode	Main count direction	Upper count limit	Lower count limit
Continuous counting	None	Jump to lower limit	Jump to upper limit
	Up counting	Jump to lower limit	Jump to upper limit
	Down counting	Jump to lower limit	Jump to upper limit
Single-action counting	None	Jump to lower limit	Jump to upper limit
	Up counting	Jump to load value	Jump to upper limit
	Down counting	Jump to lower limit	Jump to load value
Periodical counting	None	Jump to load value	Jump to load value
	Up counting	Jump to load value	Jump to upper limit
	Down counting	Jump to lower limit	Jump to load value

Reset states with main count direction set for none/up counting

- Load value: 0
- Count value: 0
- Reference value 1: 0
- Reference value 2: 0

Reset states with main count direction set for none/down counting

- Load value: upper limit
- Count value: upper limit
- Reference value 1: upper limit
- Reference value 2: upper limit

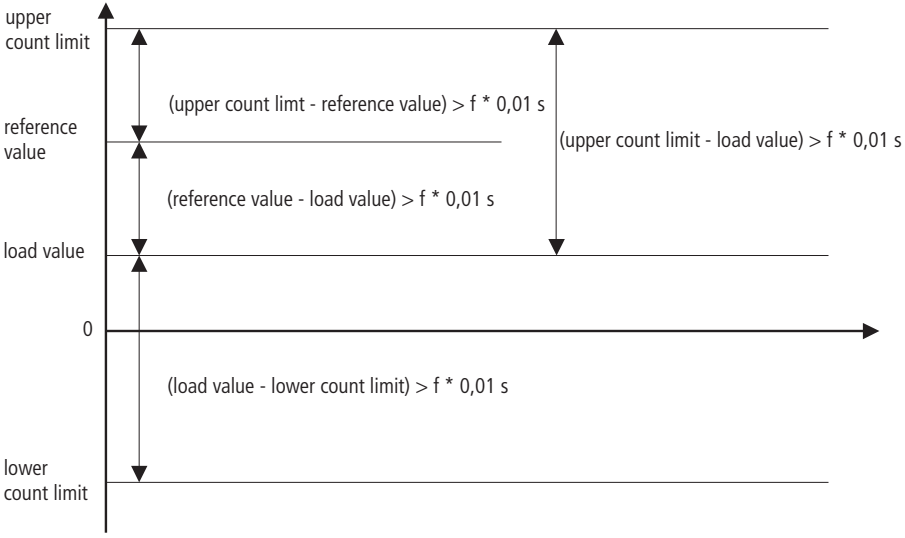
Limit values of count mode

Specific conditions must be fulfilled in order to ensure that internal and external events are processed correctly. The following sections describe the limit values for both types of events.

Minimum number of count pulses between internal events

A certain minimum number of count pulses must be ensured between the parameters when setting Upper count limit, Reference value and Lower limit value.

This ensures that internal operations are carried out before a new event occurs.



f... Counter frequency in Hz

Figure 1: Illustration of the minimum number of count pulses between two events in relation to the counter frequency

Table 2: Minimum number of count pulses for different counter frequencies

Counter frequency	Minimum number of count pulses between two events
200 kHz	2000 pulses
100 kHz	1000 pulses
50 kHz	500 pulses
10 kHz	100 pulses
1 kHz	10 pulses

Time between direction signal (B) and counter signal (A)

On pulse generators with a direction signal, it must be ensured that there is a gap of at least 5 ms/50 ms between the direction signal (B) and the counter signal (A), depending on the input filter configured.

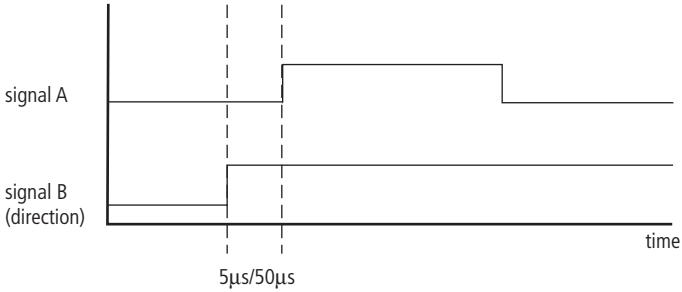


Figure 2: Time gap between the direction signal and the counter signal

Continuous counting

Definition

In this mode the counter module counts after the release signal from the load value continuously between the upper and lower limit.

- If the counter counts up and reaches the upper count limit, it will jump to the lower count limit when another counter signal is received, and will continue to count without signal loss from this point.
- If the counter counts down and reaches the lower count limit, it will jump to the upper count limit when another counter signal is received, and will continue to count without signal loss from this point.
- In this mode the function does not depend on the main count direction.

These settings are illustrated in the following diagram:

- Operating mode: Continuous count
- Main count direction: none, up or down

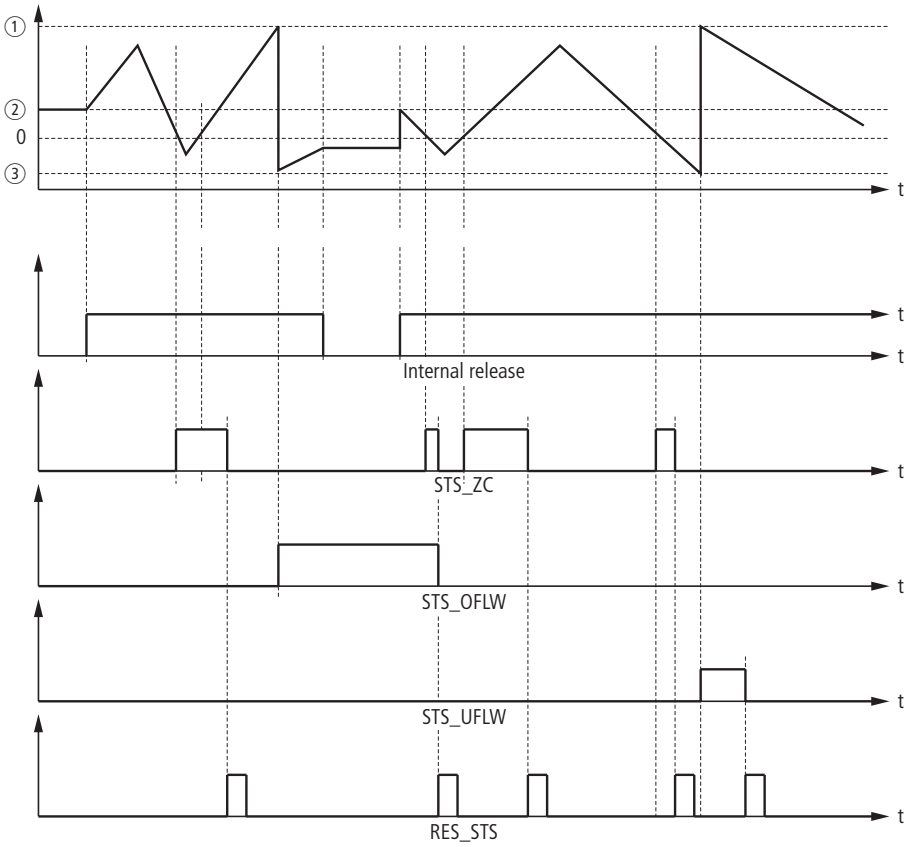


Figure 3: Continuous counting with status bit

① Upper count limit
② Load value
③ Lower count limit

Single-action count

Definition

In this mode the counter module runs a single-action count after the release signal from the load value to the upper or lower limit value, depending on the main count direction set.

- No main count direction
  - If the counter counts up and reaches the upper count limit, it will jump to the lower count limit when another counter signal is received. The internal release signal is automatically reset.
  - If the counter counts down and reaches the lower count limit, it will jump to the upper count limit when another counter signal is received. The internal release signal is automatically reset.

- Main count direction up
  - If the counter counts up and reaches the upper count limit, it will jump to the load value when another counter signal is received. The internal release signal is automatically reset.
  - If the counter counts down and reaches the lower count limit, it will jump to the upper count limit when another counter signal is received. The internal release signal is automatically reset.

- Main count direction down
  - If the counter counts up and reaches the upper count limit, it will jump to the lower count limit when another counter signal is received. The internal release signal is automatically reset.
  - If the counter counts down and reaches the lower count limit, it will jump to the load value when another counter signal is received. The internal release signal is automatically reset.

The internal release signal is automatically reset if the counter passes either the upper or lower limit values. A rising edge must be present in order for counting to be restarted. This occurs either by resetting and setting the hardware release signal (digital input if this is configured as HW gate), or by resetting and setting the software release (SW_GATE bit in the control interface/process output).

The following three diagrams show the counter's behaviour in “single-action count” mode with the three main count directions: none, up, down.

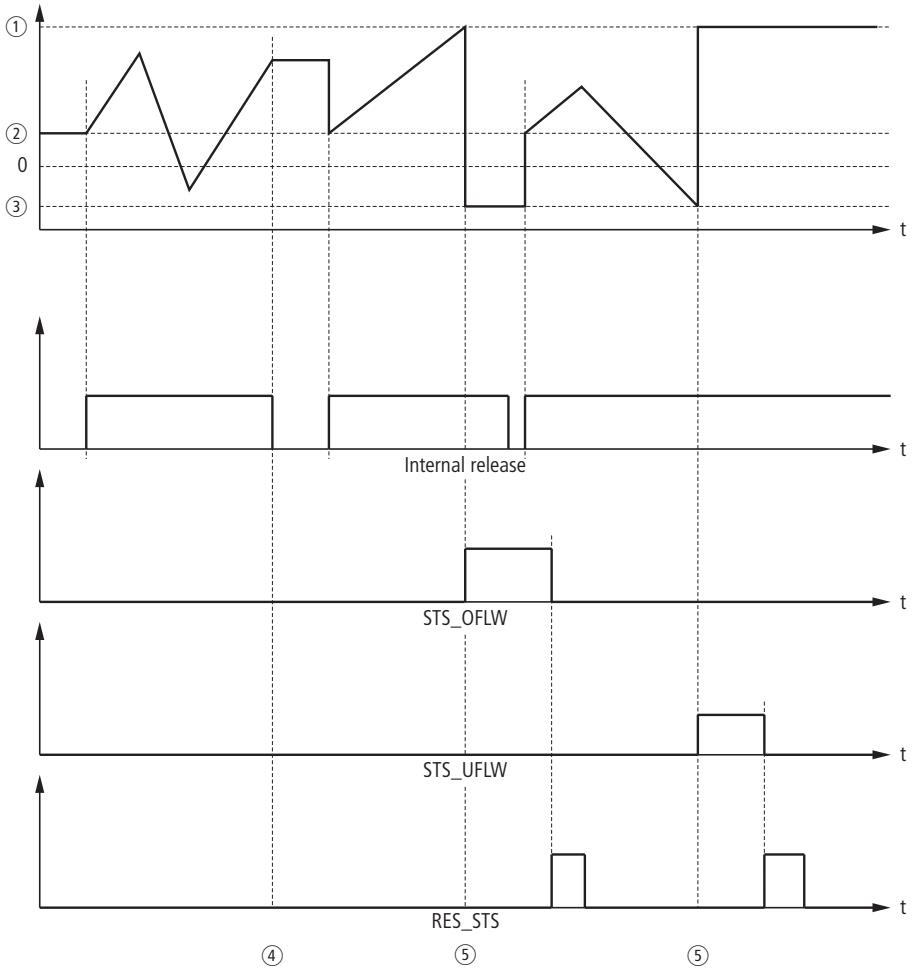


Figure 4: Single-action count without main count direction

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, internal release
⑤ Release stop, automatic

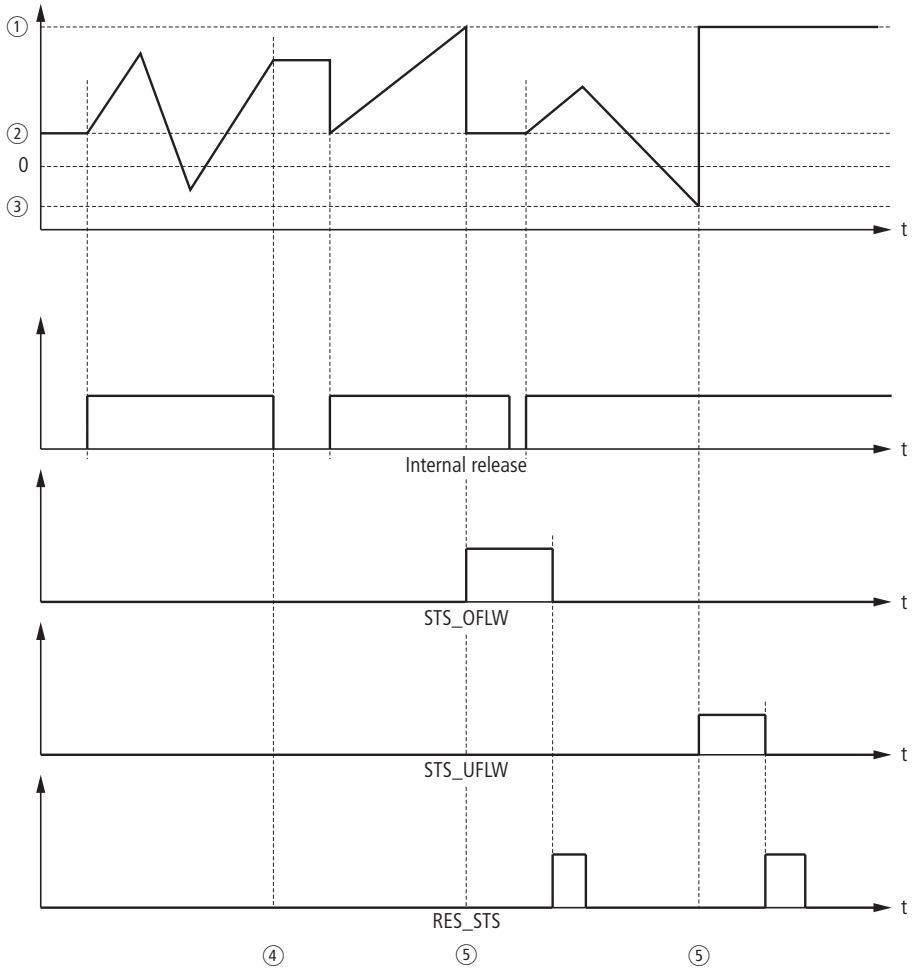


Figure 5: Single-action counting with main count direction up

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, internal release
⑤ Release stop, automatic

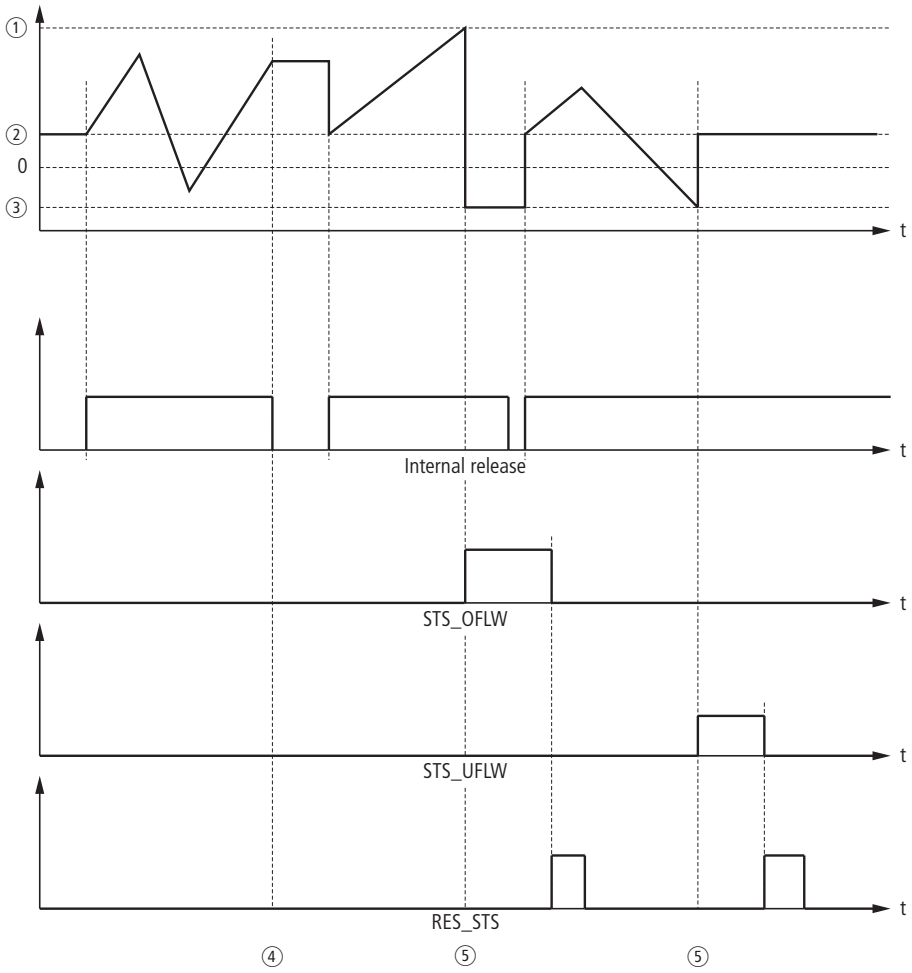


Figure 6: Single-action counting with main count direction down

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, internal release
⑤ Release stop, automatic

Periodical count

Definition

In this operating mode the electronic module counts periodically after the release signal is set within the defined counter range and in the defined main count direction:

- No main count direction
  - If the counter counts up and reaches the upper or lower count limit, it will jump to the load value when another counter signal is received, and will continue to count from there without losing a signal.
- Main count direction up
  - If the counter counts up and reaches the upper count limit, it will jump to the load value when another counter signal is received, and will continue to count from there without losing a signal.
  - If the counter counts down and reaches the lower count limit, it will jump to the upper count limit when another counter signal is received, and will continue to count from there.
- Main count direction down
  - If the counter counts up and reaches the upper count limit, it will jump to the lower count limit when another counter signal is received, and will continue to count from there.
  - If the counter counts down and reaches the lower count limit, it will jump to the lower count limit when another counter signal is received, and will continue to count from there.

The following three diagrams show the counter's behaviour in “periodical count” mode with the three main count directions: none, up, down.

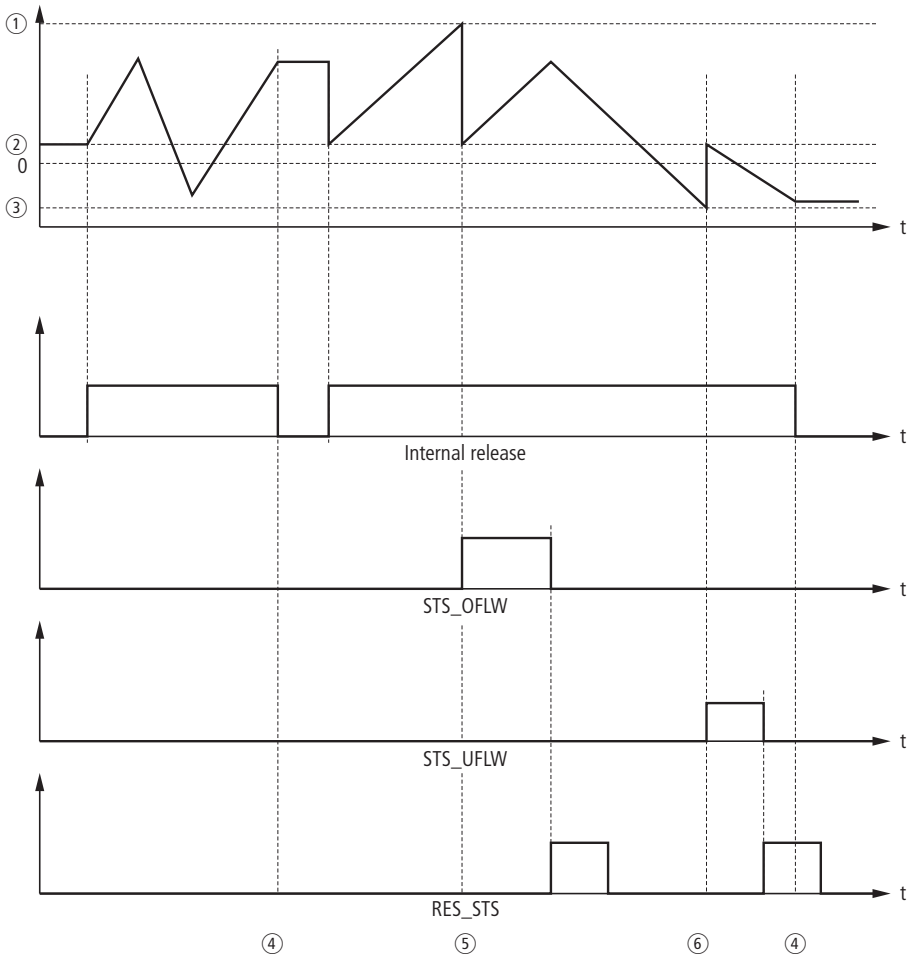


Figure 7: Periodical count without main count direction

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, internal release
⑤ Overflow
⑥ Underflow

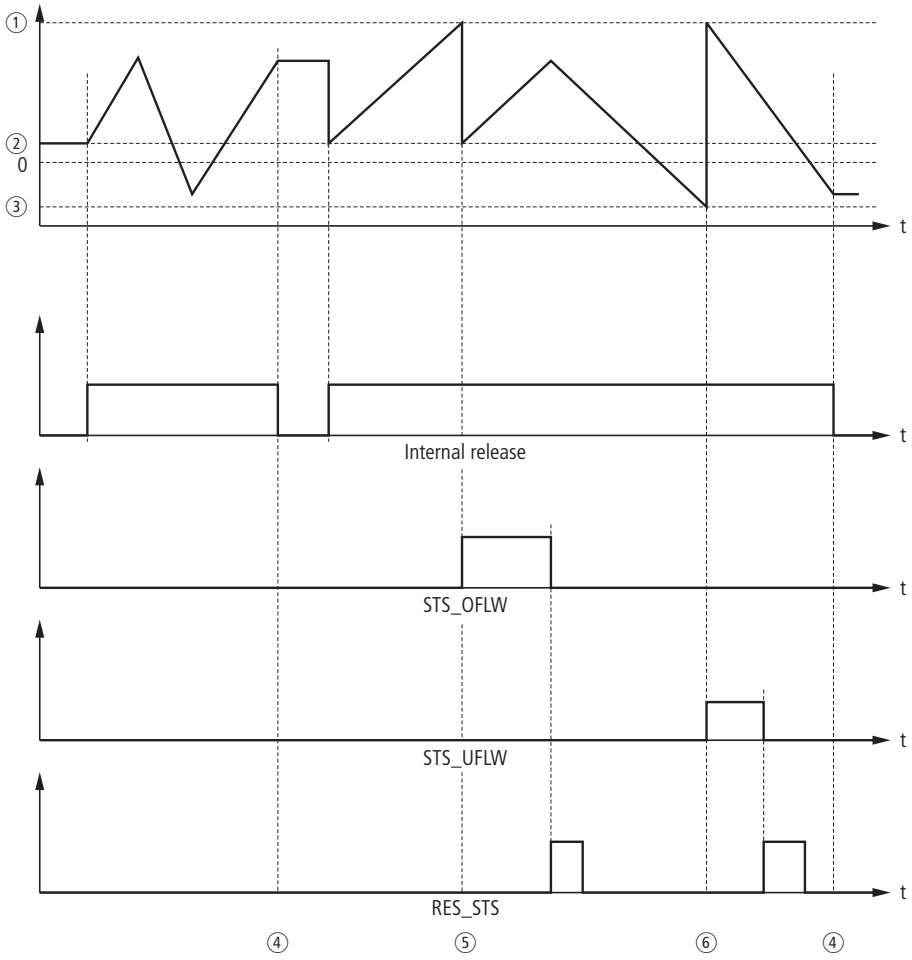


Figure 8: Periodical count with main count direction up

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, manual
⑤ Overflow
⑥ Underflow

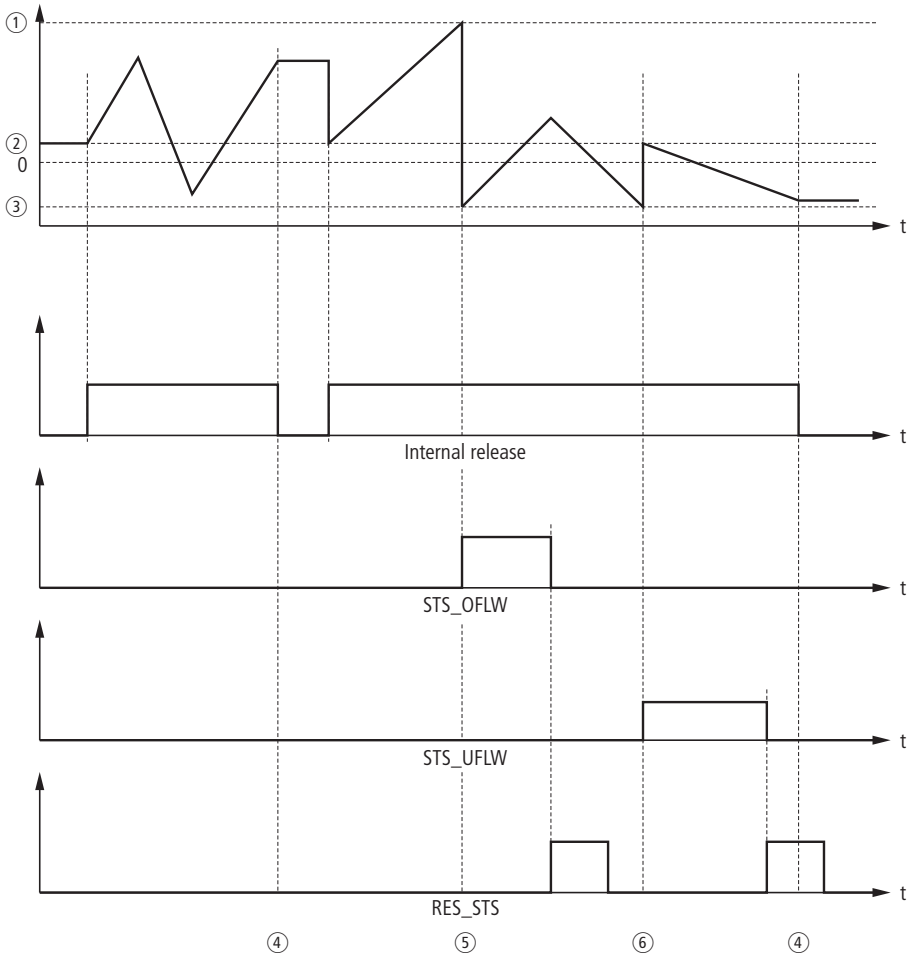


Figure 9: Periodical count with main count direction down

① Upper count limit
② Load value
③ Lower count limit
④ Release stop, manual
⑤ Overflow
⑥ Underflow

Measurement mode

Measuring procedure

The measuring operation is started by setting the internal software release signal, or by setting the hardware and software release signal if the digital input is configured as a hardware release.

Measuring is carried out within a definable integration time that can be adjusted via the control interface/process output. The measured value is then updated.

After the integration time has elapsed, STS_MVAL indicates that an actual measured value is present. This bit must be reset via the RES_STS status bit in the control interface.

Frequency measurement

Definition

In this operating mode the module counts the pulses received within a specified integration time.

The integration time can be set by a parameter or via the control interface/process output during operation. It can be set in 10 ms increments to between 10 ms and 10 s.

The value of the frequency determined is made available as a 10^{-3} Hz value. You can read the measured frequency value in the check-back interface/process input.

The displayed value cannot be updated until the integration time has elapsed.

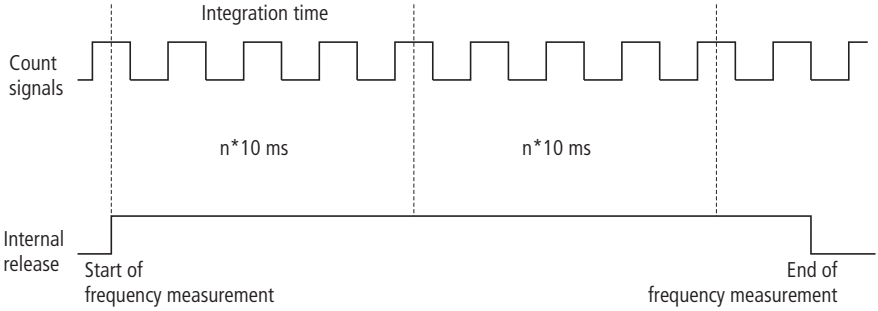


Figure 10: Frequency measurement with release function

Limit value monitoring

The limit values can be configured and defined at a later time via the control interface/process output. The following limit value ranges are possible:

Range defined by parameters[1)]

- Lower limit n_u is 0 to 16777214×10^{-3} Hz
- Upper limit n_o is 1 to 16777215×10^{-3} Hz

1) The value range is restricted by the 3 byte parameter length

The upper limit must be greater than the lower limit. The diagnostics messages Upper limit wrong and Lower limit wrong indicate parameter definitions that are outside of the permissible value range. The diagnostics messages are cleared when valid parameters are entered.

Range defined via the control interface/process output (LOAD_UPLIMIT/LOAD_LOLIMIT)

- Lower limit n_u is 0 to 199999999×10^{-3} Hz
- Upper limit n_o is 1 to 200000000×10^{-3} Hz

The upper limit must be greater than the lower limit. An error is indicated by the ERR_LOAD status bit via the check-back interface/process input. The status bit is cleared when a valid value is entered.

Table 3: Possible measuring ranges

Integration time	f_{min}	f_{max}
10 s	0.1 Hz	200000 Hz
1 s	1 Hz	200000 Hz
0.1 s	10 Hz	200000 Hz
0.01 s	100 Hz	200000 Hz

Revolutions measurement

Definition

In this operating mode, the counter module counts the pulses received from a rotary sensor within a predefined integration time. The number of "sensor pulses per revolution" must be defined beforehand by parameters in the system. The number of "sensor pulses per revolution" and the pulses counted determine the speed of the connected motor.

The integration time is defined by measuring parameters. It can be set in 10 ms increments to between 10 ms and 10 s.

The speed is indicated in units of 1×10^{-3} rpm.

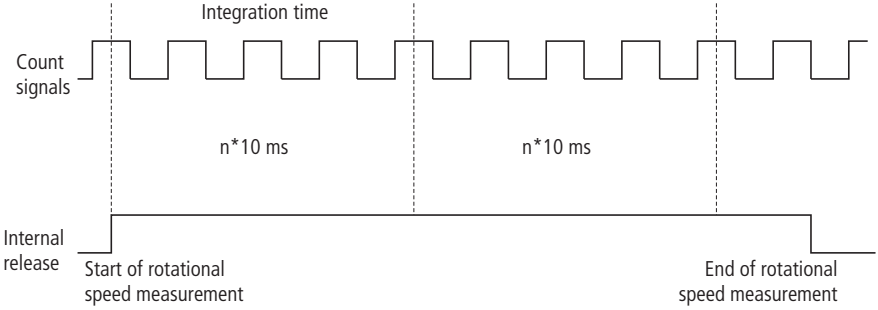


Figure 11: Revolutions measurement with release function

Limit value monitoring

The limit values can be configured and defined at a later time via the control interface/process output. The following limit value ranges are possible:

Range defined by parameters[1)]

- Lower limit n_u is 0 to 16777214×10^{-3} rpm
- Upper limit n_o is 1 to 16777215×10^{-3} rpm

1) The value range is restricted by the 3 byte parameter length

The upper limit must be greater than the lower limit. The diagnostics messages Upper limit wrong and Lower limit wrong indicate parameter definitions that are outside of the permissible value range. The diagnostics messages are cleared when valid parameters are entered.

Range defined via the control interface/process output (LOAD_UPLIMIT/LOAD_LOLIMIT)

- Lower limit n_u is 0 to 24999999×10^{-3} rpm
- Upper limit n_o is 1 to 25000000×10^{-3} rpm

The upper limit must be greater than the lower limit. An error is indicated by the ERR_LOAD status bit via the check-back interface/process input. The status bit is cleared when a valid value is entered.

Table 4: Possible measuring ranges with Pulses per sensor revolution = 60

Integration time	n_{min}	n_{max}
10 s	1 rpm	200000 rpm
1 s	1 rpm	200000 rpm
0.1 s	10 rpm	200000 rpm
0.01 s	100 rpm	200000 rpm

Table 5: Possible measuring ranges with Pulses per sensor revolution = 60000

Integration time	**n_{min}**	**n_{max}**
10 s	1 rpm	200 rpm
1 s	1 rpm	200 rpm
0.1 s	1 rpm	200 rpm
0.01 s	1 rpm	200 rpm

Period duration measurement

Definition

In this operating mode the counter module measures the precise time between two rising edges of the counter signal in µs by counting the pulses of an exact internal quartz crystal reference frequency (1 MHz). An averaging operation can be carried out over 1 to 1000 periods. It is defined by the integration time parameter or by the LOAD_INTTIME status bit in the control interface/process output.

The displayed measured value cannot be updated until the set number of periods have elapsed. The measured value is displayed in units of µs in the check-back interface/process input.

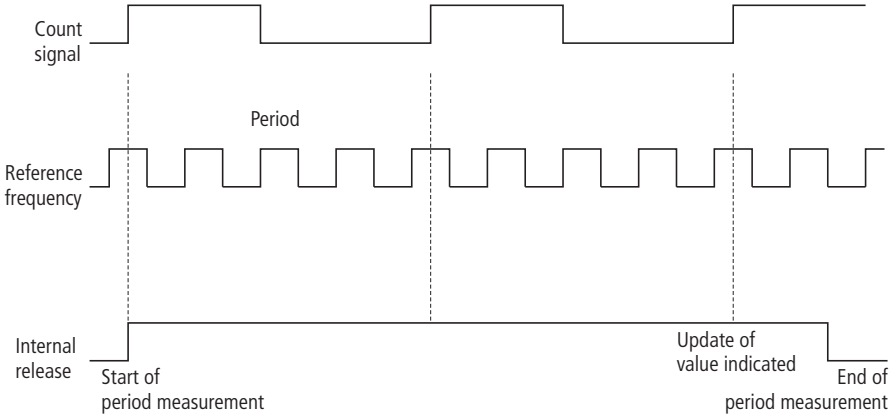


Figure 12: Period duration measurement with release function; number of periods = 2

Limit value monitoring

The limit values can be defined and altered at a later time via the control interface/process output. The following limit value ranges are possible:

Range defined by parameters[1)]

- Lower limit n_u 0 to 16777214 µs
- Upper limit n_o 1 to 16777215 µs

1) The value range is restricted by the 3 byte parameter length

The upper limit must be greater than the lower limit. The diagnostics messages Upper limit wrong and Lower limit wrong indicate parameter definitions that are outside of the permissible value range. The diagnostics message is cleared when a valid value is entered.

Range defined via the control interface/process output (LOAD_PREPARE/LOAD_VAL)

- Lower limit n_u 0 to 99999999 µs
- Upper limit n_o 1 to 100000000 µs

The upper limit must be greater than the lower limit. An error is indicated by the ERR_LOAD status bit via the check-back interface/process input. The status bit is cleared when a valid value is entered.

Table 6: Possible measuring ranges

Measuring cycle via number of periods	t_{min}/update after	t_{max}/update after
1000	10 µs/10 ms	10000 µs/10 s
100	10 µs/1 ms	100000 µs/10 s
10	100 µs/1 ms	1000000 µs/10 s
1	1000 µs/1 ms	10000000 µs/10 s

With the measuring cycles selected here the display is updated after a maximum of 10 s.

Functions and explanations

Software gate and hardware gate

A release signal is required in order to start counting/measuring.
The counter module controls the starting and stopping of the counting/measuring operation by means of so-called "gates". A software gate and a hardware gate are provided for implementing this control both via the software (process output/control interface) and via a physical output:

- The software gate initiates the release via the SW_GATE control bit.
  The release is activated by the rising edge from 0 → 1 of the SW_GATE control bit. If Function DI = HW Gate is set at the same time, it should be ensured that a High signal is present at the digital input. With DI digital input = normal this is 24 V DC.
  A stop is initiated by resetting the SW_GATE control bit from 1 → 0. If Function DI = HW Gate is set, the counting/measuring operation can be stopped either by the software gate or the hardware gate.
- A Hardware gate initiates a release via a 24 V DC signal at the digital input. This function is configured with Function DI = HW gate. The release is then only possible if the SW_GATE bit =1 at the same time.
  This bit is set when there is a rising edge from 0 → 1 at the input and reset with a falling edge from 1 → 0.
  The edge change can be reversed by inverting the digital input.
  Digital input DI = inverted

→ If the counting operation is aborted, counting begins from the load value on restart. If the counting operation is interrupted, however, the counter continues on restart from the actual counter value. → "gate function"

Synchronization

Synchronization must be configured before operating the counter module (Function DI = Synchronization when edge positive). The rising edge of a reference signal at the input is used to set the counter to the load value.

A single-action or periodical synchronization can be selected. This is possible under the following conditions:

- The counting operation must be started with the software release.
- The Release Synchronization (CRTL_SYN) control bit must be set.
- With single-action synchronization the first 0→1 edge at the digital input sets the counter to the load value after the release bit is set.
- With periodical synchronization the first and every subsequent 0→1 edge at the digital input sets the counter to the load value after the release bit is set.
- After synchronization is successfully completed the STS_SYN status bit is set. It can only reset by the RES_STS control bit.
- The STS_DI check-back bit indicates the status of the reference signal at the digital input.

When single-action synchronization is set, a subsequent synchronization operation can be initiated by resetting and setting the Release synchronization (CRTL_SYN) control bit. This is executed on the next 0→1 edge at the digital input.

The signal of a bounce-free switch or the zero reference mark of a rotary sensor can be used as a reference signal.

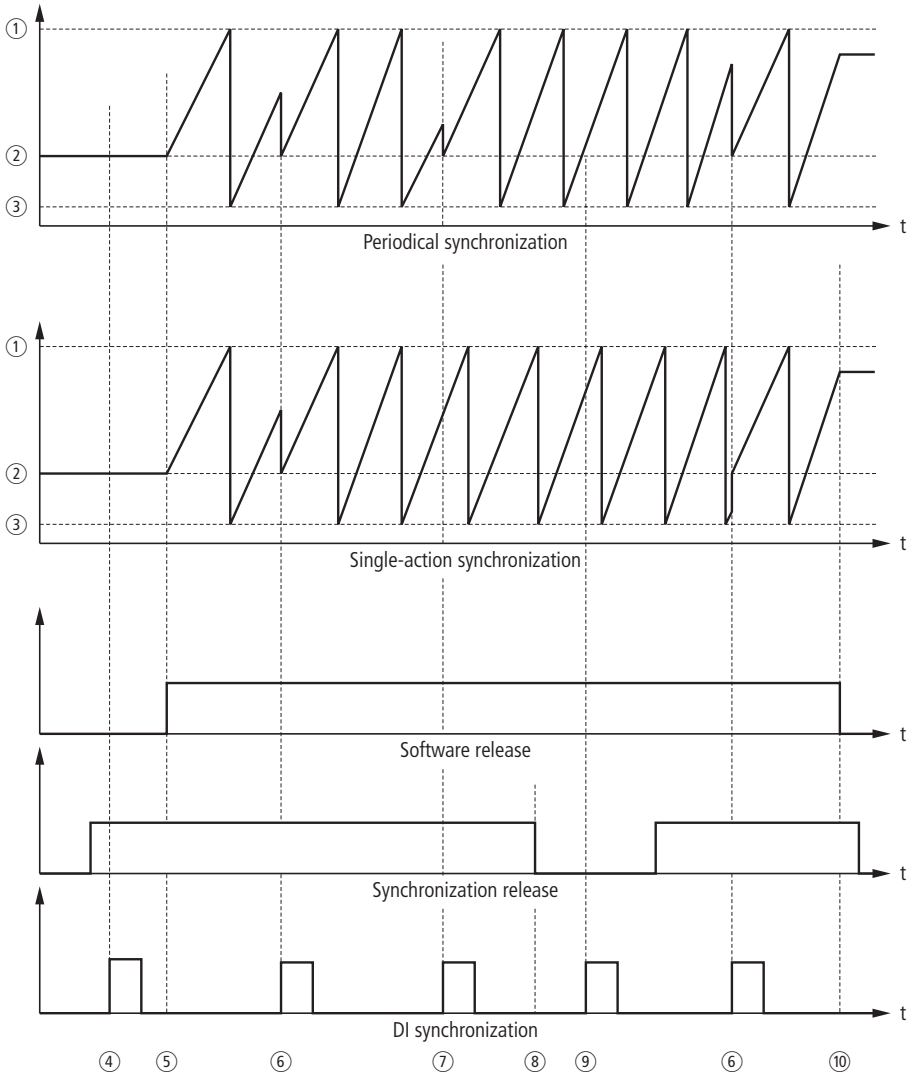


Figure 13: Synchronization with Continuous counting

① Upper count limit
② Load value
③ Lower count limit
④ Synchronization without release
⑤ Release set

⑥ 1st synchronization
⑦ 2nd synchronization
⑧ Stop synchronization
⑨ No synchronization
⑩ Release reset

Latch retrigger function

This function enables the event-driven evaluation of the counter status.

The actual internal counter status of the electronic module is retained when there is an edge at the digital input. The check-back interface/process input data supplies the "frozen" value. The internal counter status is retriggered, i.e. the load value is loaded and counting is resumed from the load value.

In order to execute this function the counting mode must be released with the software gate.

Bit STS_DI (Status DI) indicates the status of the Latch and Retrigger signal. The edge signal cannot be inverted.

The load value with which the operating mode starts is displayed before the first edge after the software release is set.

A direct loading of the counter does not change the counter status indicated.

→ Ensure that input DI is not inverted otherwise this will generate an error/diagnostics message.

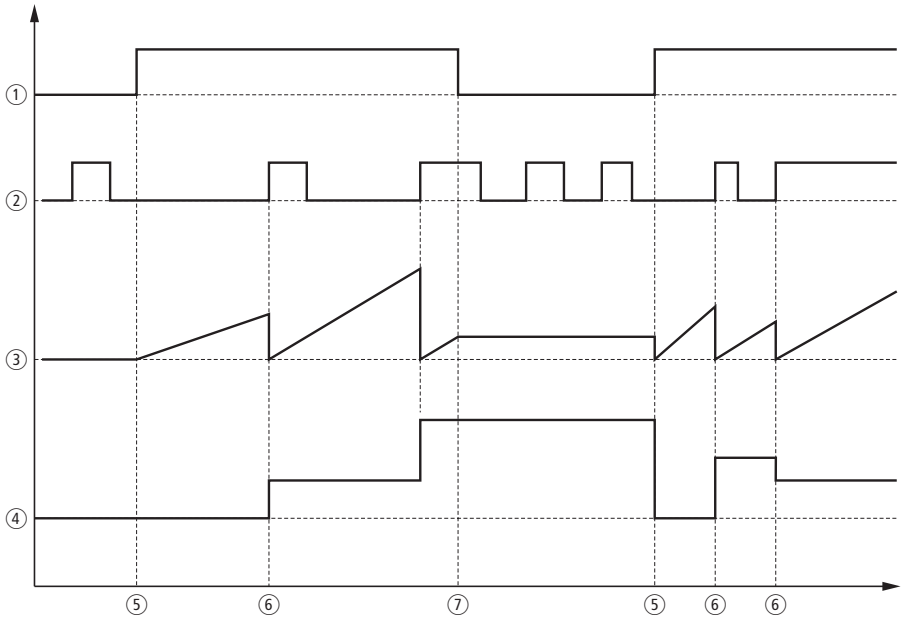


Figure 14: Latch retrigger function with the counter operation abort configured

① Software release
② Digital input
③ Internal counter status
④ Displayed counter status
⑤ Start, manual
⑥ Latch
⑦ Stop

Behaviour of the DI digital input

The digital input can be run with different sensors (positive switch or push-pull).

The input signal can be inverted (exception: in Latch and retrigger function).

The STS_DI status bit indicates the status of the digital input.

The following digital input functions are available for selection in count mode:

- Digital input
- Hardware release (HW gate)
- Latch retrigger function when edge positive
- Synchronization when edge positive

The following digital input functions are available for selection in measurement mode:

- Digital input
- Hardware release (HW gate)

Behaviour of the digital outputs DO1/DO2

Count mode

The digital outputs can be activated depending on the counter status and reference values.

The module is provided with a "real" digital output and a "virtual" digital output that is only present as a status bit in the check-back interface/process input.

Two reference values can be stored on the counter module and assigned to the digital outputs separately.

The following functions can be selected:

- Output (no switching via comparator)
- Set if counter value ≧ reference value
- Set if counter value ≦ reference value
- Pulse if counter value = reference value

Comparison results for comparator 1 are assigned to the physical output DO1.

Comparison results for comparator 2 are assigned to the virtual output DO2.

Permissible value range for the two reference values

Lower count limit
to
upper count limit

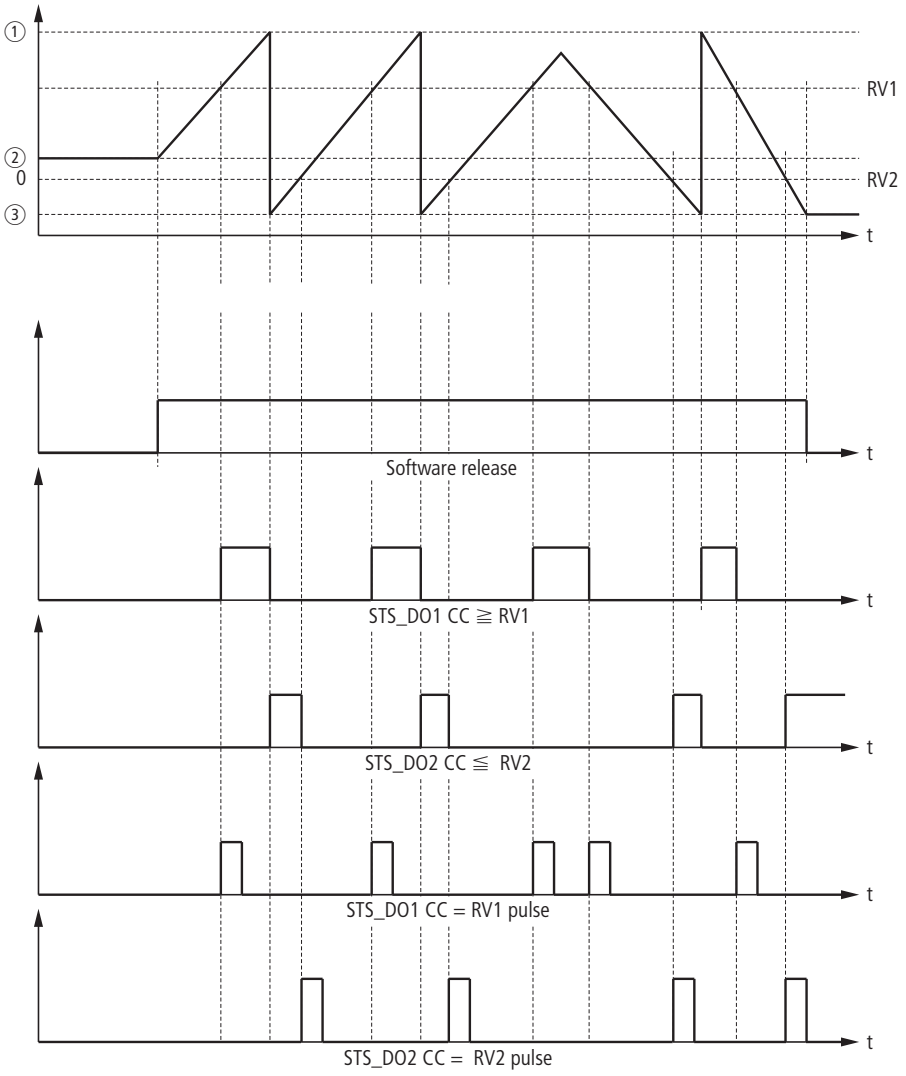


Figure 15: Continuous counting with release function

① Upper count limit
② Load value
③ Lower count limit

RV1 = reference value 1
RV2 = reference value 2
CC = counter content

The count limits configured represent the upper and lower count limits.

The behaviour of the digital outputs depend on:

- Hysteresis
- Pulse duration

The behaviour of the digital outputs can be configured before operation or by means of a control command during operation.

DO1/DO2 in Output mode

In Output mode, the outputs can be set and reset via the process output/control interface. This requires that the relevant output is released (CTRL_DO1, CTRL_DO2). Set/reset (SET_DO1, SET_DO2) can then be carried out irrespective of the counter status.

Measurement mode

An upper and lower measuring limit can be set on the counter module

In measurement mode only the physical output DO1 is active.

The following functions can be selected:

- Output (no switching when upper/lower measuring limit reached)
- Measured value outside of the set limits
- Measured value below the lower limit
- Measured value above the upper limit

Releasing the output

Control bit CTRL_DO1 is used to release the output.

Control bit SET_DO1 is used to activate or deactivate the released output.

The status of the output is stored in the check-back interface/process input and can be scanned with the status bit (STS_DO1).

Hysteresis for digital output DO1/DO2

In count mode, the hysteresis controls the switching of the outputs DO1/DO2 with comparisons.

A sensor may stand still at a specified position and "oscillate" around this position. This condition will cause the counter status to fluctuate by a specified value. If the reference value RV1/RV2 is within this fluctuation range, this would mean that the DO1/DO2 output would switch on and off in time with the fluctuating signal.

A programmable hysteresis function can therefore be used in order to prevent switching resulting from small fluctuations. This hysteresis can be set between 0 and 255 (0 means Hysteresis switched off).

The hysteresis can also be changed using the LOAD_DO_PARAM control command.

If the output is set for Switching >= Reference value, the digital output will have the following behaviour (example for DO1 - DO2 will respond accordingly):

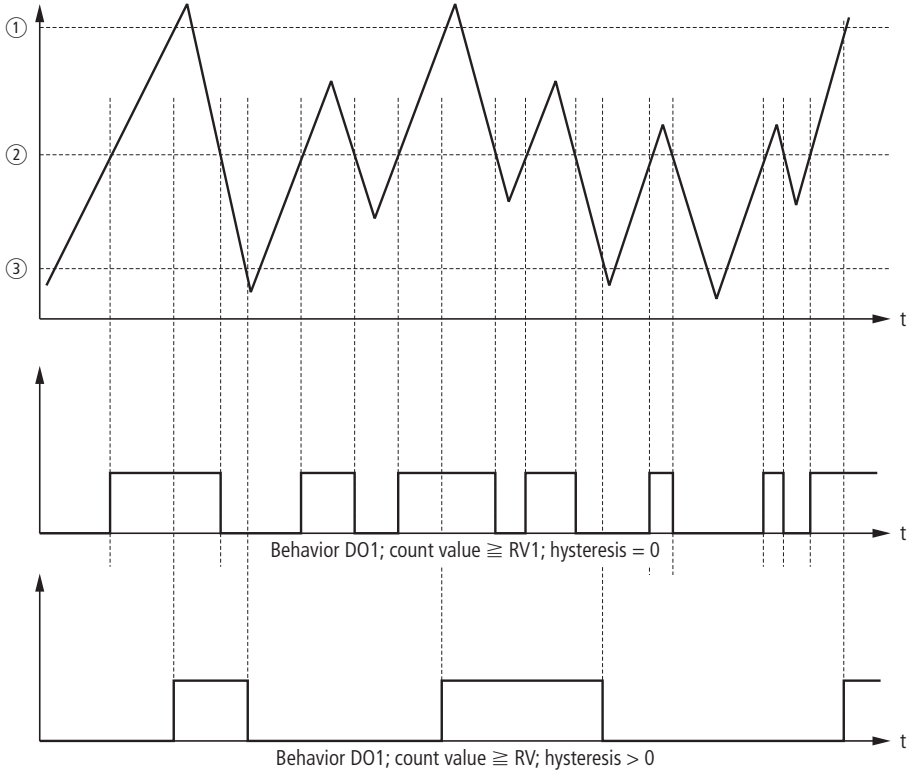


Figure 16: Hysteresis with output set to Switch >= Reference value

① Reference value + hysteresis
② Reference value RV1
③ Reference value - hysteresis

If the output is set for Switch on counter value = reference value, a pulse is generated at output DO1.

Signal evaluation options for rotary sensors

The evaluation options can be set in the XI/ON counter module configuration. The following settings are possible:

- Single
- Double
- Fourfold

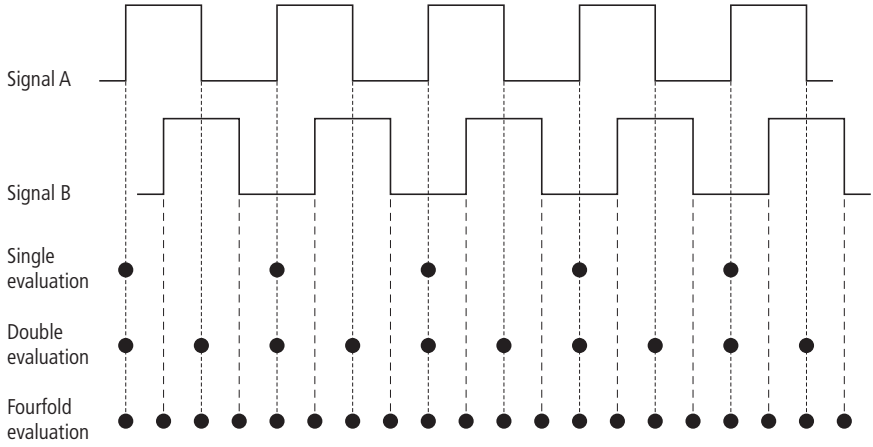


Figure 17: Evaluation options for count mode (measurement mode only allows single evaluation)

Scan points with different evaluations
The set configuration determines how the counter status is incremented or decremented according to the rising and falling edges of signals A and B. The following evaluations are possible:

- Single evaluation:
  Only the rising edge of signal A is evaluated.
- Double evaluation:
  Both the rising and falling edge of signal A are evaluated.
- Fourfold evaluation:
  Both the rising and falling edge of signal A and B are evaluated.

In count mode rotary sensors with single, double and fourfold evaluation can be selected.

In measurement mode only rotary sensors with single evaluation can be selected.

Pulse and direction

Count mode

Input A receives the counter signal and input B the direction signal.

A signal at input A can either increment or decrement the counter status depending on the state of input B.

Measurement mode

In measurement mode input B receives a signal for the direction of rotation. The process entry/check-back interface returns the status (rotation direction via STS_DN and STS_UP.

→ The signals at A and B can be inverted.

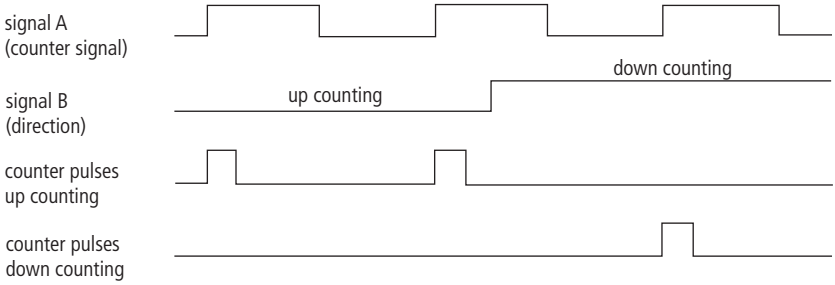


Figure 18: Changing the counter status on counter signal and direction signal

Load value direct/in preparation

The counter can be assigned with a load value. This value can either be set via the connected controller or via the I/O*assistant* software. The type of setting (direct/optional) is set via a bit in the controller:

- The **direct** load causes the counter to accept the load value directly as the new counter value.
- The load value can also be loaded **in preparation**. In this case, the load value is accepted as the new counter value in response to any of the following events:
  - Lower or upper count limit is reached when no main count direction has been configured.
  - Reaching the upper count limit with the main count direction set to up counting.
  - Reaching the lower count limit with the main count direction set to down counting.

Pulse duration on reaching the reference value

The pulse duration starts from when the digital output is set and can be specified in order to adapt to the actuators used. It specifies how long the output is to be set. The pulse duration can be set in 2 ms increments to between 2 and 510 ms.

If the pulse duration = 0, the output is set for as long as the comparison condition is fulfilled.

→ No pulse is generated if the counter value goes above the counter value, e.g. jumps from the upper limit to the lower limit when counting up.

Resetting the status bit

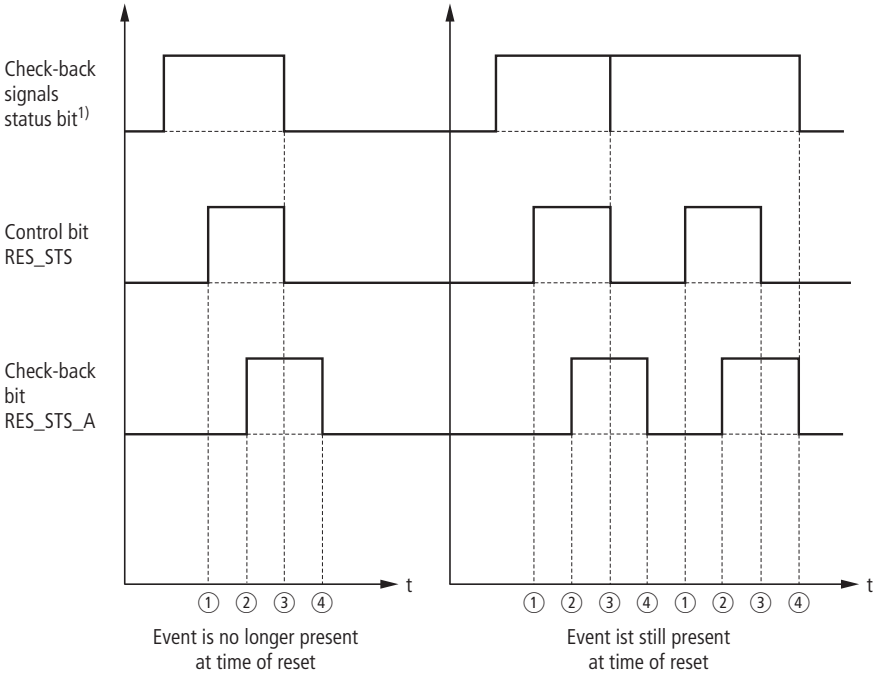


Figure 19: Resetting the status bits[1)]

1) Status bits: STS_ND, STS_UFLW, STS_OFLW, STS_CMP2, STS_CMP1, STS_SYN

① Reset is requested by the controller

② The electronic module carries out the reset.

③ The reset request is revoked by the controller.

④ The reset is executed in the electronic module.

Transfer of values/load function

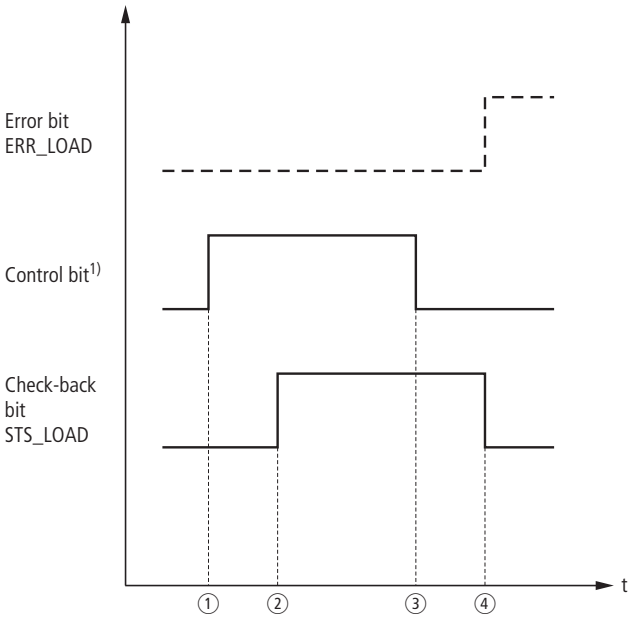


Figure 20: Transferring values with the load function

1) Control bits: LOAD_VAL, LOAD_PREPARE, LOAD_CMP_VAL1, LOAD_CMP_VAL2, LOAD_DO_PARAM, LOAD_INTTIME, LOAD_UPLIMIT, LOAD_LOLIMIT

① The controller requests the value transfer. The value is made available.

② The electronic module has understood the request.

③ The request is revoked by the controller. The value is still made available.

④ The value is accepted. The transfer is complete.

→ Only one of the status bits[1)] mentioned should be set. Otherwise the ERR_LOAD error is indicated until all the stated control bits have been reset.

Count mode
The following values can be changed using the load function during operation:

- Counter status (LOAD_VAL)
- Load value (LOAD_PREPARE)
- Reference value1 (LOAD_CMP_VAL1)
- Reference value2 (LOAD_CMP_VAL2)
- Behaviour of the digital outputs DO1/DO2 (LOAD_DO_PARAM)

Note!
When changing the behaviour of the digital output via the control interface/process output (value LOAD_DO_PARAM) the values for pulse duration and hysteresis are changed as well! These changes are stored in a volatile memory, i.e. when the module is reset (removed/fitted) they are overwritten by the values configured via the gateway.

Measurement mode
The following values can be changed using the load function during operation:

- Behaviour of the digital output DO1 (LOAD_DO_PARAM)
- Lower limit (LOAD_UPLIMIT)
- Upper limit (LOAD_LOLIMIT)

Error acknowledgement

The Error Digital output error (ERR_DO) and Short circuit sensor supply (ERR_24Vdc) status bits must be acknowledged. The errors are detected by the counter module and shown in the check-back interface/process input. They can also initiate a diagnostics message with the appropriate parameter definition.

The following figure shows the chronological relationship between the occurrence of an error and its acknowledgement:

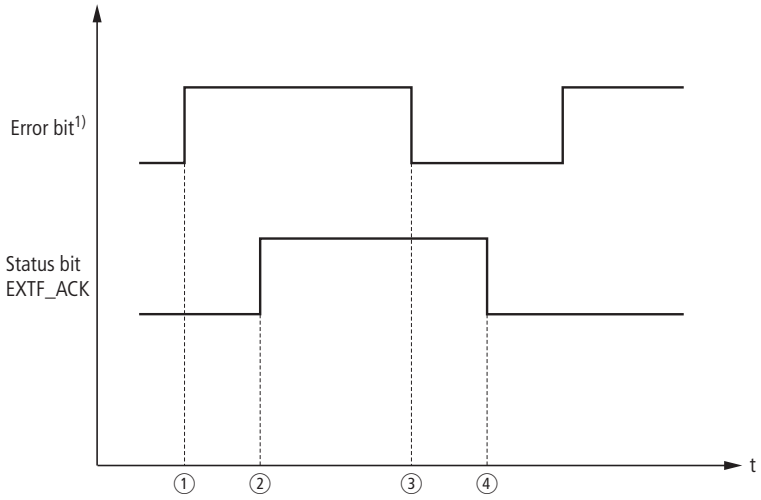


Figure 21: Error detection

1) Error bit: ERR_DO or ERR_24Vdc

① The error has occurred. The module sets the error bit and a diagnostics message if necessary. Error detection continues.

② The error bit is acknowledged. Any diagnostics message present is cleared. Further error detection is not possible.

③ The error bit was reset. Further error detection is not possible.

④ The status bit EXTF_ACK is reset. Further error detection is possible.

Technical features

Block diagram of the XN-1CNT-24VDC

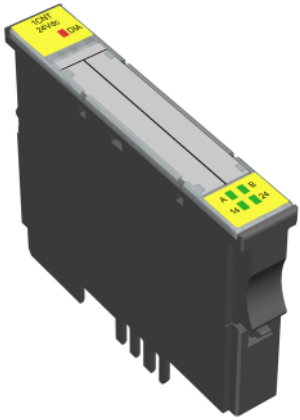


Figure 22: XN-1CNT-24VDC electronic module

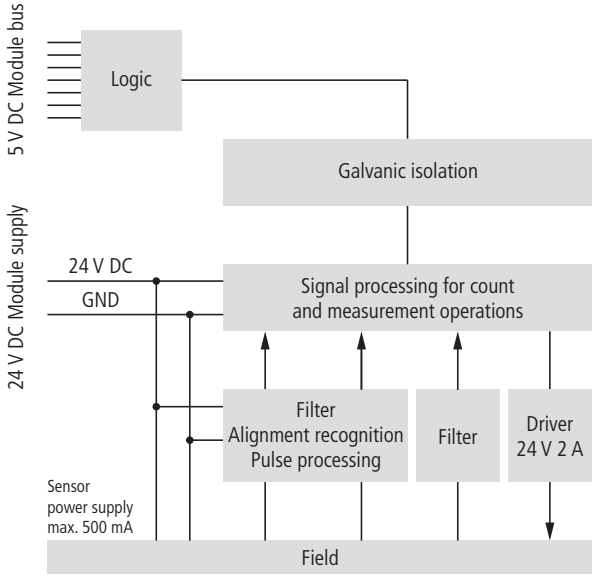


Figure 23: Block diagram

Technical data of the XN-1CNT-24VDC

Designation	**XN-1CNT-24VDC**
Nominal supply from supply terminal U_L	24 V DC
Nominal current consumption from supply terminal I_L	≦ 50 mA (with load current = 0)
Nominal current consumption from module bus I_{MB}	≦ 40 mA
Power loss of the module	< 1.3 W
Sensor supply	
Output voltage	U_L (-0.8 V DC)
Output current	≦ 0.5 A, short-circuit-proof
Counter signals and digital input	
Input voltage at nominal current 24 V DC	
Low signal level	-30 V DC to 5 V DC
High signal level	11 V DC to 30 V DC
Input current	
Low signal level	-8 mA to 1.5 mA
High signal level	2 mA to 10 mA
Input delay	≦ 200 µs
Minimum pulse width (maximum counter frequency)	
Filter on	> 25 µs (20 kHz)
Filter off	< 2.5 µs (200 kHz)
Counter module	
Number of channels	1
Resolution	32 bit
Measuring ranges	
Frequency measurement	0.1 Hz to 200 kHz
Revolutions measurement	1 rpm to 25000 rpm
Period duration measurement	5 ms to 120 s

Designation	XN-1CNT-24VDC
Count modes	
Signal evaluation A, B	Pulse and direction Rotary sensor, single Rotary sensor, double Rotary sensor, fourfold
Count mode	Continuous count Single-action count Periodical count
Hysteresis	8 bit
Pulse duration	8 bit / max. 0.51 s
Synchronization	Single Periodical
Count limits	
Upper count limit	0 to 7FFF FFFF
Lower count limit	8000 0000 to 0
Measurement modes	
Signal evaluation A, B	Pulse and direction Rotary sensor single
Digital output	
Output voltage at rated current 24 V DC	
Low signal level	≦ 3 V DC
High signal level	≧ U_L (-1 V DC)
Output current	
High signal (permissible range)	5 mA to 2 A
High signal (rated value)	≦ 0.5 A (55 °C)
Switching frequency	
With resistive load	100 Hz
With inductive load	2 Hz
With lamp load	≦ 10 Hz
Lamp load R_{LL}	≦ 10 W
Output delay (resistive load)	100 µs

Designation	XN-1CNT-24VDC
Short-circuit-proof	Yes
Response threshold	2.6 A to 4 A
Inductive reset	L+ -(50 to 60 V)

Indication elements

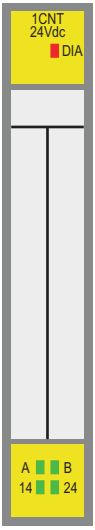


Table 7: Diagnostics messages

LED	Display	Meaning	Remedy
DIA	Flashing red, 0.5 Hz	Parameter error	Check the parameters of the counter module.
		Short-circuit on digital output	Check the wiring of the digital output.
	Red	Failure of module bus communication	Check whether more than two adjacent electronics modules have been removed. Check the power supply of the module bus.
	OFF	No error message	–
A	Green	Counter input active or measuring input active	–
	OFF	Counter input not active or measuring input not active	–
B	Green	Counter input not active or direction input set for down	–
	OFF	Counter input active or direction input set for up	–
14	Green	Status of digital input = 1	–
	OFF	Status of digital input = 0	–
24	Red	Error on digital output	Check the wiring of the digital output.
	Green	Status of digital output = 1	–
	OFF	Status of digital output = 0	–

Base modules

The following base modules can be used as terminals for connecting the XN-1CNT-24VDC:

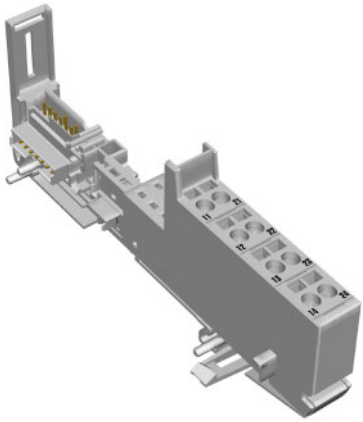


Figure 24: XN-S4x-SBBS base module

Designation	
With tension clamp connectors	XN-S4T-SBBS
With screw terminal	XN-S4S-SBBS

Technical data of the base modules

Table 8: Technical data of the base modules

Designation	Value
Measurement data	according to VDE 0611 Part 1/8.92 / IEC/EN 60947-7-1
Rated voltage	250 V
Rated current	17.5 A
Rated cross section	1.5 mm^2
Rated surge voltage	4 kV
Pollution degree	2
TOP connection technology	Tension clamp or screw connection
Protection class	IP20
Insulation stripping length	8.0 to 9.0 mm / 0.32 to 0.36 inch
Max. wire range	0.5 to 2.5 mm^2 / 0.0008 to 0.0039 $inch^2$ / AWG 24 to AWG 14
Crimpable wire	
"e" solid core H 07V-U	0.5 to 2.5 mm^2 / 0.0008 to 0.0039 $inch^2$
"f" flexible core H 07V-K	0.5 to 1.5 mm^2 / 0.0008 to 0.0023 $inch^2$
"f" with ferrules according to DIN 46228-1 (ferrules crimped gas-tight)	0.5 to 1.5 mm^2 / 0.0008 to 0.0023 $inch^2$
Test finger according to IEC/EN 60947-1	A1

Connection diagram

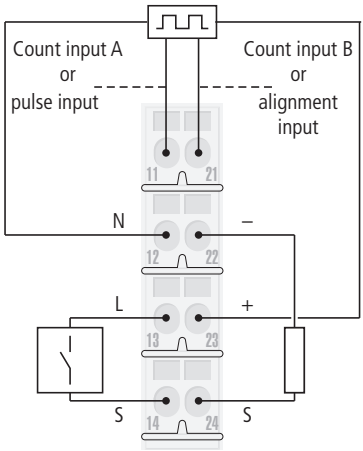


Figure 25: XN-S4x-SBBS connection diagram

Table 9: Connection options for pulse generators

	Connection type	Count direction
Pulse generator without direction indicator	24 V DC count pulses at terminal 11	Up counting
Pulse generator with direction signal	24 V DC count pulses at terminal 11 and 24 V DC direction at terminal 21	Up, down
Pulse generator with 2 90° offset spur lines	Channel A at terminal 11 and channel B at terminal 21	Up, down

2 Integrating the Module in PROFIBUS-DP

PROFIBUS-DP data image for count mode

Process output for count mode

The process output data is the data that is output from the PLC via the gateway to the XN-1CNT-24VDC module.

The XN-1CNT-24VDC module allows some parameters to be modified during operation.

The other parameters must be changed **prior to** commissioning.

Note!
The current count operation is stopped if parameters are changed during operation.

Note!
The parameters modified via the process output data are not retentive. The commissioning after a power failure is based on the parameter data of the configuration tool or default configuration.

The data is transferred in 8 byte format:

- The first 2 bytes are not yet assigned.
- Two control bytes contain the control functions for transferring the parameter values, for starting/stopping the measurement, for acknowledging errors and for resetting the status bit.
- Four bytes provide the parameter values for Load direct, Load in preparation, Reference value 1, Reference value 2 or Behaviour of the digital outputs.

Table 10: Structure of the data bytes in the PROFIBUS-DP fieldbus with → "Load value direct/in preparation", Reference value 1 or Reference value 2.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X							
Byte 1	X							
Byte 2	X	X	X	LOAD_DO_PARAM	LOAD_CMP_VAL2	LOAD_CMP_VAL1	LOAD_PREPARE	LOAD_VAL
Byte 3	EXTF_ACK	CTRL_DO2	SET_DO2	CTRL_DO1	SET_DO1	RES_STS	CTRL_SYN	SW_GATE
Byte 4	Load value direct, Load value in preparation, Reference value 1 or Reference value 2							
Byte 5								
Byte 6								
Byte 7								

X = reserved

Table 11: Structure of the data bytes in the PROFIBUS-DP fieldbus with Function and behaviour of DO1/DO2. (X = reserved.)

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X							
Byte 1	X							
Byte 2	X	X	X	LOAD_DO_PARAM	LOAD_CMP_VAL2	LOAD_CMP_VAL1	LOAD_PREPARE	LOAD_VAL
Byte 3	EXTF_ACK	CTRL_DO2	SET_DO2	CTRL_DO1	SET_DO1	RES_STS	CTRL_SYN	SW_GATE
Byte 4	X							
Byte 5	Pulse duration							
Byte 6	Hysteresis value							
Byte 7	X		MODE_DO2				MODE_DO1	

Table 12: Meaning of the data bits (process output):

Control bit	Explanations
MODE_DO2	MODE_DO2 is only valid if LOAD_DO_PARAM: 0 → 1. The virtual [1] output DO2 can show the status of the data bit SET_DO2 or comparison results if CTRL_DO2 = 1. MODE_DO2 defines which function DO2 is to accept: 00: The output DO2 shows the status of the control bit SET_DO2. This must be released with CTRL_DO2 = 1. 01: Output DO2 indicates: Counter status ≧ reference value 2 10: Output DO2 indicates: Counter status ≦ reference value 2 11: Output DO2 indicates: Counter status = reference value 2 A pulse is generated for indicating equal values. The pulse duration is defined by byte 2 of this process output.
MODE_DO1	MODE_DO1 is only valid if LOAD_DO_PARAM: 0 → 1. The physical output DO1 can show the status of the data bit SET_DO1 or comparison results if CTRL_DO1 = 1. MODE_DO1 defines which function DO1 is to accept: 00: The output DO1 shows the status of the control bit SET_DO1. This must be released with CTRL_DO1 = 1. 01: Output DO1 indicates: Counter status ≧ reference value 1 10: Output DO1 indicates: Counter status ≦ reference value 1 11: Output DO1 indicates: Counter status = reference value 1 A pulse is generated for indicating equal values. The pulse duration is defined by byte 2 of this process output.
Hysteresis value	(0 to 255) The reference value 1/2 can be assigned a hysteresis value in order to generate a response at DO1/DO2 with hysteresis. This will prevent the excessive on and off switching of DO1/DO2 if the count value fluctuates too quickly around the reference value. → "Hysteresis for digital output DO1/DO2"

Control bit	Explanations
Pulse duration	(0 to 255) unit: ms If the DO1/DO2 outputs are set to indicate counter status = reference value 1/2, a longer pulse is sometimes required to indicate equal values. → "Pulse duration on reaching the reference value"
EXTF_ ACK	Error acknowledgement The error bits must be acknowledged with the control bit EXTF_ACK after the cause of the fault has been rectified. This control bit must then be reset again. Any new error messages are not set while the EXTF_ACK control bit is set! → "Error acknowledgement"
CTRL_ DO2	0: The virtual[1)] output DO2 is blocked.
	1: The virtual[1)] output DO2 is released. → "Behaviour of the digital outputs DO1/DO2"
SET_ DO2	If CTRL_DO2 = 1 and the virtual[1)] output DO2 is set to indicate the value SET_DO2, DO2 can be set and reset directly with SET_DO2. DO2 can be set for this function via the process output (MODE_DO2 = 00 and LOAD_DO_PARAM 0 A 1). The output DO2 can also be set before commissioning via the separate parameter data. The default setting for DO2 is to indicate the status of SET_DO2. → "Behaviour of the digital outputs DO1/DO2"
CTRL_DO1	0: The output DO1 is blocked.
	1: The output DO1 is released. → "Behaviour of the digital outputs DO1/DO2"
SET_DO1	If CTRL_DO1 = 1 and the physical output DO1 is set to indicate the value SET_DO1, DO1 can be set and reset directly with SET_DO1. DO1 can be set for this function via the process output (MODE_DO1 = 00 and LOAD_DO_PARAM 0 A 1). The output DO2 can also be set before commissioning via the separate parameter data. The default setting for DO1 is to display the value of SET_DO1. → "Behaviour of the digital outputs DO1/DO2"

Control bit	Explanations
RES_STS	0 → 1: Initiate resetting of status bits. Status bits STS_ND, STS_UFLW, STS_OFLW, STS_CMP2, STS_CMP1, STS_SYN (process input) are reset.Bit RES_STS_A = 1 (process input) acknowledges that the reset command has been received. RES_STS can now be reset to 0. → "Resetting the status bit"
CTRL_SYN	Release synchronization 1: 0 → 1 (rising edge) at the physical DI input enables the counter value to be set (synchronized) once/periodically to the load value. → "Synchronization"
SW_GATE	0 → 1: Counting is started (release). 1 → 0: Counting is stopped. The starting and stopping of the counting operation with a data bit is implemented with a so-called "SW gate". The HW gate is also provided in addition for stopping and starting the counting operation via the DI hardware input. If this function is configured a positive signal must be present at this input in order to activate the SW gate (AND logic operation). → "Software gate and hardware gate"
LOAD_DO_PARAM	Parameter definition of the DO1 physical output and the virtual[1)] DO2 output 0 → 1: DO1 and DO2 can indicate the status of data bit SET_DO1 and SET_DO2 or comparison results. The latest telegram (MODE_DO1 and MODE_DO2) indicates the function required for DO1 and DO2. → "Behaviour of the digital outputs DO1/DO2"
LOAD_CMP_VAL2	Parameter definition of reference value 2 0 → 1: The value in bytes 0 to 3 is accepted as a reference value 2.
LOAD_CMP_VAL1	Parameter definition of reference value 1 0 → 1: The value in bytes 0 to 3 is accepted as a reference value 1.
LOAD_PREPARE	Parameter definition of Load counter in preparation 0 → 1: The value in bytes 0 to 3 is accepted as the new load value. → "Load value direct/in preparation"

Control bit	Explanations
LOAD_VAL	Parameter definition of Load counter direct 0 → 1: The value in bytes 0 to 3 is accepted directly as the new count value. → "Load value direct/in preparation"

1) Unlike the physical digital output DO1, output DO2 is only a data value that is indicated with the data bit STS_DO2 of the process input.

Process input for count mode

Process input data is data from the connected field device that is transmitted via the XN-1CNT-24VDC module to the PLC. This is transferred in an 8-byte format as follows:

- 2 bytes contain status information.
- 1 byte contains the diagnostics data.
- 4 bytes are used to represent the counter value.

Table 13: Structure of the data bytes in the PROFIBUS-DP fieldbus

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X							
Byte 1	STS_ ND	STS_ UFLW	STS_ OFLW	STS_ CMP2	STS_ CMP1	X		STS_ SYN
Byte 2 (Status)	STS_ DN	STS_ UP	X	STS_ DO2	STS_ DO1	X	STS_ DI	STS_ GATE
Byte 3 (Diagn.)	ERR_ 24Vdc	ERR_ DO	ERR_ PARA	X	X	RES_ STS_ A	ERR_ LOAD	STS_ LOAD
Byte 4	Count value							
Byte 5								
Byte 6								
Byte 7								

Table 14: Meaning of the data bits (process input):

	Explanations
ERR_24Vdc	Short-circuit sensor supply This diagnostics information must be acknowledged with the EXTF_ACK (process output) control bit. → "Error acknowledgement"
ERR_DO	Short-/open circuit/excess temperature at the output DO1 This diagnostics information must be acknowledged with the EXTF_ACK (process output) control bit. → "Error acknowledgement"
ERR_PARA	1: There is a parameter error. ERR_PARA is a group diagnostics bit. With the separate diagnostics message bits 3 to 6 describe the parameter errors in more detail. → "Meaning and position of the data bits (diagnostics):" 0: The parameter definition is correct according to specification.
RES_STS_A	1:Resetting of status bits running. The last process output telegram contained: RES_STS = 1. 0: The last process output telegram contained: RES_STS = 0. → "Resetting the status bit"
ERR_LOAD	1: Error with load function Control bits LOAD_DO_PARAM, LOAD_CMP_VAL2, LOAD_CMP_VAL1, LOAD_PREPARE and LOAD_VAL must not be set at the same time during the transfer. An incorrect value was transferred with the control bits. Example: Values above the upper count limit or below the lower count limit were selected for Load value direct or Load value in preparation. → "Transfer of values/load function"
STS_LOAD	Status of load function Set if the Load function is running. → "Transfer of values/load function"
STS_DN	1: Status direction down.
STS_UP	1: Status direction up.
STS_DO2	The DO2 status bit indicates the status of digital output DO2. → "Behaviour of the digital outputs DO1/DO2"
STS_DO1	The DO1 status bit indicates the status of digital output DO1. → "Behaviour of the digital outputs DO1/DO2"

	Explanations
STS_DI	The DI status bit indicates the status of digital input DI. → "Behaviour of the DI digital input"
STS_GATE	1: Counting operation running. → "Software gate and hardware gate"
STS_ND	Status zero crossing Set on crossing zero in counter range when counting without main direction. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"
STS_UFLW	Status lower count limit Set if the count value goes below the lower count limit. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"
STS_OFLW	Status upper count limit Set if the counter goes above the upper count limit. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"
STS_CMP2	Status comparator 2 This status bit indicates a comparison result for comparator 2 if: The output DO2 is released with CTRL_DO2 = 1. and a comparison is run via MODE_DO2 = 01, 10 or 11. Otherwise STS_CMP2 simply indicates that the output is or was set. STS_CMP2 is also set if DO2 SET_DO2 = 1 when the output is not released. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"
STS_CMP1	Status comparator 1 This status bit indicates a comparison result for comparator 1 if: The output DO1 is released with CTRL_DO1 = 1. and a comparison is run via MODE_DO1 = 01, 10 or 11. Otherwise STS_CMP1 simply indicates that the output is or was set. It must be acknowledged with RES_STS (process output). The bit is reset immediately if acknowledgement takes place when the output is still set. STS_CMP1 is also set if DO1 SET_DO1 = 1 when the output is not released. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"

	Explanations
STS_SYN	Status synchronization After synchronization is successfully completed the STS_SYN status bit is set. This bit must be reset by the RES_STS control bit. → "Resetting the status bit"

Parameters for count mode

Parameters consist of data that has to be sent to the module so that it can operate correctly in the application concerned.
Some parameters refer to the physical inputs/outputs A,B,DI,DO → Page 63.

The parameters are stored in a non-volatile memory before being checked. The parameters that are not mode-dependent are evaluated and processed first of all. If some of the mode-dependent parameters have an error, the appropriate diagnostics message is initiated and the bits in the check-back interface/process input are set.

Table 15: Structure of the data bytes (parameters)

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	counter mode					
Byte 1	X	main count direction		synchr oniza-tion	function DI		digital input DI	gate function
Byte 2…5	lower count limit							
Byte 6…9	upper count limit							
Byte 10	hysteresis							
Byte 11	pulse duration							
Byte 12	function DO2			function DO1			diag-nostic DO1	substi-tute value D O1
Byte 13	direc-tion input (B)	sensor (A)		sensor /input filter (DI)	sensor /input filter (B)	sensor /input filter (A)	signal evaluation (A,B)	

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 14	X	X	behavior CPU/master stop		X	X	X	group diagnostics
Byte 15	X	X	X	X	X	X	X	X

The list parameters are set by means of a fieldbus configuration tool or the I/O*assistant* software package. Some parameters cannot be modified online. These parameters must be defined **before** commissioning. Some parameters can also be modified via the process output after commissioning → "Process output for count mode"

Note!
The current count operation is stopped if parameters are changed during operation.

Table 16: Parameters for count modes

Designation	Value 1):Default	Designation of the values/ Value range	Description
Release			
Group diagnostics	0[1)]	Release [1)]	Separate diagnostics is released. → "Diagnostics for count mode"
	1	Block	Separate diagnostics is blocked. → "Diagnostics for count mode"
Behavior on failure of the higher-level PLC			
Behavior CPU/master stop	00[1)]	turn off DO1[1)]	A failure of the higher-level PLC causes output DO1 to be switched off or held.
	01	Proceed with operating mode	A failure of the higher-level PLC causes the XN-1CNT-24VDC module to continue operating without restriction.
	10	DO1 switch substitute value	A failure of the higher-level PLC causes output DO1 to assume the value specified at Substitute value DO1.
	11	DO1 hold last value	A failure of the higher-level PLC causes output DO1 to retain the status in the event of a failure

Designation	Value 1):Default	Designation of the values/ Value range	Description
Sensor parameters			
Signal evaluation (A,B)	00[1)]	Pulse and direction[1)]	In this mode input B can control up and down counting. → "Pulse and direction"
	01	rotary sensor: single	→ "Signal evaluation options for rotary sensors"
	10	rotary sensor: double	
	11	rotary sensor: fourfold	
Sensor and input filter			
Sensor/Input filter (A)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	An input filter at inputs A,B and DI can suppress high-frequency interference and thus increase the accuracy of the counting. The limit frequency can be adapted to the application: 20 kHz or 200 kHz
Sensor/Input filter (B)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	
Sensor/Input filter (DI)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	
sensor (A)	00[1)] 01	Normal[1)] Inverted	→ "Connection diagram"
direction input (B)	0[1)] 1	Normal[1)] Inverted	

Designation	Value 1):Default	Designation of the values/ Value range	Description
Output parameters			
function DO1	00[1)]	Output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	01	On when cnt. value ≧ ref. value	
	10	On when cnt. value ≦ ref. value	
	11	Pulse when cnt. value = ref. value	
function DO2	00[1)]	Output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	01	On when cnt. value ≧ ref. value	
	10	On when cnt. value ≦ ref. value	
	11	Pulse when cnt. value = ref. value	
substitute value DO1	0[1)] 1	0[1)] 1	This value determines the state of output DO1 in the event of a failure if: behavior CPU/master stop = 10

Designation	Value 1):Default	Designation of the values/ Value range	Description
diagnostic DO1	0[1)]	On[1)]	The Short-/open circuit DO diagnostic message is not blocked. → "Diagnostics for count mode"
	1	Off	The Short-/open circuit DO diagnostic message is blocked. → "Diagnostics for count mode"
hysteresis	0[1)] to 255	0[1)] to 255 (UINT)	→ "Hysteresis for digital output DO1/DO2"
Pulse duration DO1, DO2 [n*2ms]	0[1)] to 255	0[1)] to 255 (UINT)	→ "Pulse duration on reaching the reference value"
Operating mode			
count mode	000000[1)]	continuous count[1)]	→ "Continuous counting"
	000001	single-action count	→ "Single-action count"
	000010	periodical count	→ "Periodical count"
	000011 to 011111		Reserve

Designation	Value 1):Default	Designation of the values/ Value range	Description
gate function	0[1)]	abort count procedure[1)]	If the counting operation is aborted, counting begins from the load value on restart. → "Software gate and hardware gate"
	1	interrupt count procedure	If the counting operation is interrupted, the counter continues on restart from the actual counter value. → "Software gate and hardware gate"
digital input DI	0[1)] 1	Normal[1)] Inverted	→ "Connection diagram"
function DI	00[1)]	Input[1)]	
	01	HW gate	Hardware release → "Software gate and hardware gate"
	10	latch retrigger function when edge pos.	→ "Latch retrigger function"
	11	synchronization when edge pos.	→ "Synchronization"
Synchronization	0[1)] 1	single-action[1)] periodical	→ "Synchronization"
main count direction	00[1)] 01 10	None[1)] Up Down	→ "Main count direction"

Designation	**Value** 1):Default	**Designation of the values/ Value range**	**Description**
lower count limit (HWORD)[2]	8000 0000[1] to 0 ($_{hex}$)	-32768[1] to 0 (SUINT)	If the upper or lower count limit is reached, the count value jumps to the load value, the lower count limit or the upper count limit, depending on the count mode and the main count direction. → "Count mode"
lower count limit (LWORD)[2]		-32768 to 32767 (SINT) (0[1])	
upper count limit (HWORD)[2]	0 to 7FFF FFFF[1] ($_{hex}$)	0 to 32767[1] (SINT)	
upper count limit (LWORD)[2]		0 to 655351[1] (SINT)	

1) Default values
2) In some PLCs the count limits (one double word each) consist of a High Word (HWORD XXXX ----) and Low Word (LWORD ---- XXXX). The relevant ranges are stated.
→ "Setting the lower and upper limit"

Diagnostics for count mode

The parameter setting for the PROFIBUS-DP gateway provides the Gateway Diagnostics parameter for selecting between two different diagnostics displays. Choose "Devices, ID, Channel Diagnostics" to select more detailed diagnostics indication. The diagnostics message will then consist of the following elements:

- 2 bytes of gateway diagnostics (device-related diagnostics)
- 64 bits of ID-specific diagnostics
- n x 3 bytes of channel-specific diagnostics (n: number of channels with active diagnostics)

With channel-specific diagnostics, the use of an error number enables the type of error to be indicated in plain text (e.g. Parameter error).

When Device-related Diagnostics is selected, an abbreviated diagnostics message is generated that simply shows the gateway diagnostics (device-related diagnostics). The diagnostics bytes of all station modules are attached that support diagnostics.

Note that the Measurement mode diagnostics is only set in conjunction with another diagnostics bit.

Table 17: Meaning and position of the data bits (diagnostics):

Name of error type	Position	Explanations
short-/open circuit ERR_DO	0	Short-/open circuit/excess temperature at output DO1 (see Figure 21) This diagnostics information must be acknowledged with the EXTF_ACK (process output) control bit.
short-circuit sensor pwr supply	1	Short-circuit of sensor supply (see Figure 21) This diagnostics information must be acknowledged with the EXTF_ACK control bit.
end of counter range wrong	2	The following parameter errors are indicated: Upper count limit = lower count limit Upper count limit ≦ lower count limit Upper count limit < 0 The numerical values are displayed as two's complement values. The permissible range for the upper count limit is therefore: 0_{hex}....7FFF FFFD$_{hex}$; 7FFF FFFE$_{hex}$; 7FFF FFFF$_{hex}$ The decimal value range for this SINT value is: 0...2147483645; 2147483646; 2147483647
start of counter range wrong	3	The following parameter errors are indicated: Lower count limit = upper count limit Lower count limit ≧ upper count limit Lower count limit > 0 The numerical values are displayed as two's complement values. The permissible range for the lower count limit is therefore: 8000 0000$_{hex}$...FFFF FFFE$_{hex}$; FFFF FFFF$_{hex}$; 0$_{hex}$ The decimal value range for this SINT value is: -2147483648...-2,-1.0
invert-DI+latch-retr. not perm.	4	Inverting the digital input signal (Page 81) with the Latch Retrigger function (Page 81) is not permissible.

Name of error type	Position	Explanations
main count direction wrong	5	The value (11) for selecting the main count direction is incorrect. Permissible values: 00 None 01 Up 10 Down
operating mode wrong	6	The value (XXXX11) for selecting the operating mode is incorrect. Permissible values for count mode: 000000 Continuous count 000001 Single-action count 000010 Periodical count Permissible values for measurement mode: 100000 Frequency measurement 100001 Revolutions measurement 100010 Period duration measurement
measurement mode	7	This message is always shown in conjunction with other diagnostics messages and indicates that measurement mode is active. This message never occurs in count mode.

Note!
Counting should not be started if there is a parameter error (diagnostics bits 2 to 6)!

PROFIBUS-DP data image for measurement mode

Process output for measurement mode

The process output data is the data that is output from the PLC via the gateway to the XN-1CNT-24VDC module.

The XN-1CNT-24VDC module allows some parameters to be modified during operation.

The other parameters must be changed **prior to** commissioning.

Note!
The current count operation is stopped if parameters are changed during the measuring operation.

Note!
The parameters modified via the process output data are not retentive. The commissioning after a power failure is based on the parameter data of the configuration tool or default configuration.

The data is transferred in 8 byte format:

- The first 2 bytes are not yet assigned.
- Two control bytes contain the control functions for transferring the parameter values, for starting/stopping the measurement, for acknowledging errors and for resetting the status bit.
- Four bytes represent the parameter values for Lower limit or Upper limit, Function of DO1 or Integration time.

Table 18: Structure of the data bytes in the PROFIBUS-DP fieldbus with Lower limit or Upper limit set.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X							
Byte 1	X							
Byte 2 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT
Byte 3 (Control)	EXTF_ ACK	X	X	CTRL_ DO1	SET_ DO1	RES_ STS	X	SW_ GATE
Byte 4	Lower limit or upper limit							
Byte 5								
Byte 6								
Byte 7								

X = reserved

Table 19: Structure of the data bytes in the PROFIBUS-DP fieldbus with Function of DO1 set.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X							
Byte 1	X							
Byte 2 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT
Byte 3 (Control)	EXTF_ ACK	X	X	CTRL_ DO1	SET_ DO1	RES_ STS	X	SW_ GATE
Byte 4	X							
Byte 5	X							
Byte 6	X							
Byte 7	X						MODE_DO1	

X = reserved

Table 20: Structure of the data bytes in the PROFIBUS-DP fieldbus with Integration time set.

PDOut	**B7**	**B6**	**B 5**	**B4**	**B3**	**B2**	**B1**	**B0**
Byte 0	X							
Byte 1	X							
Byte 2 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT
Byte 3 (Control)	EXTF_ ACK	X	X	CTRL_ DO1	SET_ DO1	RES_ STS	X	SW_ GATE
Byte 4	X							
Byte 5	X							
Byte 6	Integration time							
Byte 7								

X = reserved

Table 21: Meaning of the data bits (process output):

Control bit	Explanations
EXTF_ ACK	Error acknowledgement The ERR_DO or ERR_24Vdc error bits must be acknowledged with the control bit EXTF_ACK after the cause of the fault has been rectified. This control bit must then be reset again. Any new error messages are not set while the EXTF_ACK control bit is set! (see Figure 21)
CTRL_DO1	0: The output DO1 is blocked.
	1: The output DO1 is released.
SET_DO1	If CTRL_DO1 = 1 and the physical output DO1 is configured for indicating the value SET_DO1, DO1 can be set and reset directly with SET_DO1. DO1 can be set for this function via the process output (MODE_DO1 = 00 and LOAD_DO_PARAM 0 A 1). The output DO1 can also be set before commissioning via the separate parameter data. The default setting for DO1 is to display the value of SET_DO1.
RES_STS	0 → 1 Initiate resetting of status bits. The STS_UFLW, STS_OFLW and STS_CMP1 (process input) status bits are reset. Bit RES_STS_A = 1 (process input) acknowledges that the reset command has been received. RES_STS can now be reset to 0.
SW_GATE	0 → 1: Measuring is started (software release). 1 → 0: Measuring is stopped.
LOAD_DO_ PARAM	Parameter setting of the physical output DO1 0 → 1: DO1 can indicate the status of different data bits as a signal. The current telegram (byte 0) determines the data bits to which DO1 is to refer.
LOAD_ INTTIME	Parameter setting of the Integration time 0 → 1: Bytes 0 to 1 of this process output represent a factor for forming the Integration time for frequency measurement and for determining the rotational speed. The integration time can be adjusted between 10 ms and 10 s in 10 ms increments and is produced by multiplying the factor x 10 ms. With period duration measurement, this factor determines the number of periods measured in order to calculate a mean value. A factor 1 to 1000 (1_{hex} to $3E8_{hex}$) is permissible.

Control bit	Explanations
LOAD_ UPLIMIT	Parameter setting of the upper measuring limit 0 → 1: The value in bytes 0 to 3 is accepted directly as the new upper measuring limit. LOAD_UPLIMT: 1 to 200 000 000 x 10-3 Hz 1 to 25 000 000 x 10-3 rpm 1 to 100 000 000 ms
LOAD_ LOLIMIT	Parameter setting of the lower measuring limit 0 → 1: The value in bytes 0 to 3 is accepted directly as the new lower measuring limit. LOAD_LOLIMIT: 0 to 199 999 999 x10-3 Hz 0 to 24 999 999 x 10-3 rpm 0 to 99 999 999 ms
MODE_DO1	MODE_DO1 is only valid if LOAD_DO_PARAM: 0 → 1. The physical output DO1 can show the status of the data bit SET_DO1 or comparison results if CTRL_DO1 = 1. MODE_DO1 defines which function DO1 is to accept: 00: The output DO1 indicates the status of the control bit SET_DO1. 01: The output DO1 indicates a measurement outside of the limits, i.e. above the upper measuring limit or below the lower measuring limit. STS_OFLW = 1 or STS_UFLW = 1 (process input). 10: Output DO1 indicates a value below the lower measuring limit. STS_UFLW = 1 (process input) 11: Output DO1 indicates a value above the upper measuring limit. STS_OFLW = 1 (process input)

Process input for measurement mode

Process input data is data from the connected field device that is transmitted via the XN-1CNT-24VDC module to the PLC. This is transferred in an 8-byte format as follows:

- 2 bytes contain status information.
- 1 byte contains the diagnostics data.
- Four bytes are used to contain the measured values.

Table 22: Structure of the data bytes in the PROFIBUS-DP fieldbus

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 7	X							
Byte 6	X	STS_ UFLW	STS_ OFLW	X	STS_ CMP1	X	X	X
Byte 5 (Status)	STS_ DN	STS_ UP	X	X	STS_ DO1	X	STS_ DI	STS_ GATE
Byte 4 (Diagn.)	ERR_ 24Vdc	ERR_ DO	ERR_ PARA	X	X	RES_ STS_A	ERR_ LOAD	STS_ LOAD
Byte 3	Measured value							
Byte 2								
Byte 1								
Byte 0								

X = reserved

Table 23: Meaning of the data bits (process input):

	Explanations
ERR_24Vdc	Short-circuit of sensor supply (see → Figure 21) This diagnostics information must be acknowledged with the EXTF_ACK control bit.
ERR_DO	Short-/open circuit/excess temperature at output DO1 (see Figure 21)
ERR_PARA	1: There is a parameter error. ERR_PARA is a group diagnostics bit. With the separate diagnostics message bits 3 to 6 describe the parameter error in more detail. → "Meaning and position of the data bits (diagnostics):" 0: The parameter definition is correct according to specification.
RES_STS_A	1:Resetting of status bits running. The last process output telegram contained: RES_STS = 1. 0: The last process output telegram contained: RES_STS = 0.
ERR_LOAD	1: Error with Load function The control bits LOAD_UPLIMIT and LOAD_LOLIMIT must not be set simultaneously during the transfer. The value of LOAD_UPLIMT and LOAD_LOLIMIT was selected outside of the permissible range. Permissible values for LOAD_LOLIMIT: 0 to 199 999 999 x10-3 Hz 0 to 24 999 999 x 10-3 rpm 0 to 99 999 999 ms Permissible values for LOAD_UPLIMIT: 1 to 200 000 000 x 10-3 Hz 1 to 25 000 000 x 10-3 rpm 1 to 100 000 000 ms
STS_LOAD	Status of load function Set if the Load function is running.
STS_DN	Direction status : down. The direction is determined by a signal at the physical input B. The Signal evaluation parameter (A, B): must be set to pulse and direction.
STS_UP	Direction status: up. The direction is determined by a signal at the physical input B. The Signal evaluation parameter (A, B): must be set to pulse and direction.
STS_DO1	The DO1 status bit indicates the status of digital output DO1. → "Behaviour of the digital outputs DO1/DO2"

	Explanations
STS_DI	The DI status bit indicates the status of digital output DI. → "Behaviour of the DI digital input"
STS_GATE	1: Measuring operation running. → "Software gate and hardware gate"
STS_UFLW	1: The lower measuring limit was undershot. The bit must be reset with RES_STS: 0 → 1.
STS_OFLW	1: The upper measuring limit was exceeded. The bit must be reset with RES_STS: 0 → 1.
STS_CMP1	1: Measuring terminated The measured value is updated with every elapsed time interval. The end of a measurement (expiry of the time interval) is indicated with the status bit STS_CMP1. The bit must be reset with RES_STS: 0 → 1.

Parameters for measurement mode

Parameters consist of data that has to be sent to the module so that it can operate correctly in the application concerned.
Some parameters refer to the physical inputs/outputs A,B,DI,DO → Page 63.

The parameters are stored in a non-volatile memory before being checked. The parameters that are not mode-dependent are evaluated and processed first of all. If some of the mode-dependent parameters have an error, the appropriate diagnostic message is initiated and the bits in the check-back interface/process input are set.

Table 24: Structure of the data bytes (parameters)

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	measurement mode					
Byte 1	X	X	X	X	function DI		digital input DI	X
Byte 2	lower limit (LWORD)							
Byte 3								
Byte 4	lower limit (HWORD)							
Byte 5	upper limit (LWORD)							
Byte 6								
Byte 7	upper limit (HWORD)							
Byte 8	integration time [n*10ms]							
Byte 9								
Byte 10	sensor pulses per revolution							
Byte 11								
Byte 12	X	X	X	function DO1			diag-nostic DO1	substi-tute value DO 1
Byte 13	direc-tion input (B)	sensor (A)		sensor /input filter (DI)	sensor /input filter (B)	sensor /input filter (A)	signal evaluation (A,B)	
Byte 14	X	X	behavior CPU/master STOP		X	X	X	Group diagnos-tics
Byte 15	X	X	X	X	X	X	X	X

X = reserved

Table 25: Meaning of the data bits (parameters):

Designation	Value 1):Default	Designation of the values/ Value range	Description
Operating mode			
measurement mode:	100000 1)	frequency measurement 1)	→ "Frequency measurement"
	100001	revolutions measurement	→ "Revolutions measurement"
	100010	period duration measurement	→ "Period duration measurement"
	100011 To 111111		Reserve
digital input DI:	0 1)	Normal 1)	→ "Connection diagram"
	1	Inverted	
function DI:	00 1)	Input 1)	
	01	HW gate	→ "Software gate and hardware gate"
	10 to 11		Reserve
lower limit (HWORD): 2)	0 1)	0 1) to 255 (SINT)	Lower limit for 0 to f_{max}-1 0 to n_{max}-1 0 to t_{max}-1
Lower limit (LWORD) 2)	0 1)	0 1) to 65 535 (SINT)	
upper limit (HWORD) 2)	255 1)	0 to 255 1) (SINT)	Upper limit for 1 to f_{max} 1 to n_{max}1 to t_{max}
upper limit (LWORD) 2)	65535 1)	0 to 655351) (SINT)	

Designation	Value 1):Default	Designation of the values/ Value range	Description
integration time [n×10 ms]:“ or number of periods	10[1)]	1 to 1000	Factor for forming an integration time (frequency measurement) and number of measured periods for determining an average period duration. Frequency measurement → Page 27 Revolutions measurement → Page 29 Period duration measurement → Page 32
sensor pulses per revolution	1[1)]	1 to 65535 (SINT)	This parameter is used to determine the rotational speed. → “Revolutions measurement“ Possible measuring ranges → Table 4,Table 5

Designation	Value 1):Default	Designation of the values/ Value range	Description
Output parameters			
substitute value DO1:	0[1)]	0[1)]	This value determines the state of output DO1 in the event of a failure if: behavior CPU/Master STOP = 10
	1	1	
diagnostic DO1:	0[1)]	On[1)]	The Short-/open circuit DO diagnostics message is not blocked. → "Diagnostics for measurement mode"
	1	Off	The Short-/open circuit DO diagnostics message is blocked. → "Diagnostics for measurement mode"
function DO1:	00[1)]	output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	01	outside of limits	
	10	below lower limit	
	11	above upper limit	

Designation	Value 1):Default	Designation of the values/ Value range	Description
Sensor parameters			
signal evaluation (A,B):	00[1)]	Pulse and direction	In this mode input B can receive a signal for the rotational direction. The process entry/check-back interface returns the status rotation direction via STS_DN and STS_UP.
	01	rotary sensor: single	→ "Signal evaluation options for rotary sensors"
	10 to 11		Reserve
Sensor and input filter			
Sensor/Input filter (A):	0[1)]	2.5µs (200 kHz)[1)]	An input filter at inputs A,B and DI can suppress high-frequency interference and thus increase the accuracy of the measurement. The limit frequency can be adapted to the application: 20 kHz or 200 kHz
	1	25µs (20 kHz)	
Sensor/Input filter (B):	0[1)]	2.5µs (200 kHz)[1)]	
	1	25µs (20 kHz)	
Sensor/Input filter (DI):	0[1)]	2.5µs (200 kHz)[1)]	
	1	25µs (20 kHz)	
Sensor (A):	00[1)]	Normal[1)]	→ "Connection diagram"
	01	Inverted	
Direction input (B):	0[1)]	Normal[1)]	
	1	Inverted	

Designation	Value 1):Default	Designation of the values/ Value range	Description
Release			
Group diagnostics:	01)	Release[1)]	Separate diagnostics is released. → "Diagnostics for measurement mode"
	1	Block	Separate diagnostics is blocked. → "Diagnostics for measurement mode"
Behaviour on failure of the higher-level PLC			
Behaviour of CPU/master STOP:	00[1)]	turn off DO1[1)]	A failure of the higher-level PLC causes output DO1 to be switched off or held.
	01	proceed with operating mode	A failure of the higher-level PLC causes the XN-1CNT-24VDC module to continue operating without restriction.
	10	DO1 switch to substitute value	A failure of the higher-level PLC causes output DO1 to assume the value specified at Substitute value DO1.
	11	DO1 hold last value	A failure of the higher-level PLC causes output DO1 to retain the status in the event of a failure.

1) Default

2) In some PLCs the measured value limits (one double word each) consist of a High Word (HWORD XXXX - ----) and Low Word (LWORD ---- XXXX). The relevant ranges are stated.

Diagnostics for measurement mode

The parameter setting for the PROFIBUS-DP gateway provides the Gateway Diagnostics parameter for selecting between two different diagnostics displays. Choose "Devices, ID, Channel Diagnostics" to select more detailed diagnostics indication. The diagnostics message will then consist of the following elements:

- Two bytes of gateway diagnostics (device-related diagnostics)
- 64 bits of ID-specific diagnostics
- n x 3 bytes of channel-specific diagnostics (n: number of channels with active diagnostics)

With channel-specific diagnostics, the use of an error number enables the type of error to be indicated in plain text (e.g. Parameter error).

When Device-related Diagnostics is selected, an abbreviated diagnostics message is generated that simply shows the gateway diagnostics (device-related diagnostics). The diagnostics bytes of all station modules are attached that support diagnostics.

The Measurement mode diagnostic should only be set together with another diagnostics bit.

Table 26: Meaning and position of the data bits (diagnostics):

Name of error type	Position	Explanation
short-/open circuit ERR_DO	0	Short-/open circuit/excess temperature at the output DO1 This diagnostics information must be acknowledged with the EXTF_ACK (see Figure 21) control bit.
short-circuit sensor pwr supply	1	Short-circuit of sensor supply This diagnostics information must be acknowledged with the EXTF_ACK control bit (see Figure 21).
sensor pulse wrong	2	This error signal refers to the parameter value Sensor pulses per revolution. The latest configuration tools prevent an incorrect value from being entered.
integration time wrong	3	The value for the integration time is incorrect. The permissible value range is: 1 to 1000 This enables permissible integration times (frequency measurement/revolutions measurement) from 10 ms to 10 000 ms in 10 ms increments and for period duration measurement averaging over 1 to 1000 periods.
upper limit wrong	4	The value for the upper limit is incorrect. Permissible value range: 1 to 16777215
lower limit wrong	5	The value for the lower limit is incorrect. Permissible value range: 0 to 16777214

Name of error type	Position	Explanation
operating mode wrong	6	The value (XXXX11) for selecting the operating mode is incorrect. Permissible values for count mode: 000000 Continuous count 000001 Single-action count 000010 Periodical count Permissible values for measurement mode: 100000 Frequency measurement 100001 Revolutions measurement 100010 Period duration measurement
measurement mode	7	This message is always shown in conjunction with other diagnostics messages and indicates that messages refer to an active measurement mode.

Note!
Measuring should not be started if there is a parameter error (diagnostics bits 2 to 6)!

Guide to setting the High and Low words

Setting the lower and upper limit

The lower count limit is divided as follows (range: -2147483648 (-2^{31}) to 0) in a High and a Low word:

- Convert your decimal count limit to hexadecimal format.
  - Example:
    The lower count limit is to be -123456. This decimal value is represented in hexadecimal format (double word) as FFFE 1DC0.
- The hexadecimal value (double word) is divided into a High word (FFFE) and a Low word (1DC0). Both these values must be converted from hexadecimal to decimal values as many controllers only accept decimal values for setting parameters.
  - Due to the fact that many tools and PCs can only process hexadecimal values in unsigned format during the conversion from hexadecimal to decimal values (i.e. bit 15 is not interpreted as a sign bit but as a value), negative values (bit 15 = 1) must be converted manually.
- The following applies to the Low word:
  If bit 15 is not set, the Low word is converted to the corresponding positive decimal value.
  - In the example:
    Low word (hexadecimal): 1DC0
    Low word (binary): 0001 1101 1100 0000

Bit 0:	2^0	= 1	× 0	=	0
Bit 1:	2^1	= 2	× 0	=	0
Bit 2:	2^2	= 4	× 0	=	0
Bit 3:	2^3	= 8	× 0	=	0
Bit 4:	2^4	= 16	× 0	=	0
Bit 5:	2^5	= 32	× 0	=	0

Bit 6: 2^6 = 64 × 1 = 64

Bit 7: 2^7 = 128 × 1 = 128

Bit 8: 2^8 = 256 × 1 = 256

Bit 9: 2^9 = 512 × 0 = 0

Bit 10: 2^{10} = 1024 × 1 = 1024

Bit 11: 2^{11} = 2048 × 1 = 2048

Bit 12: 2^{12} = 4096 × 1 = 4096

Bit 13: 2^{13} = 8192 × 0 = 0

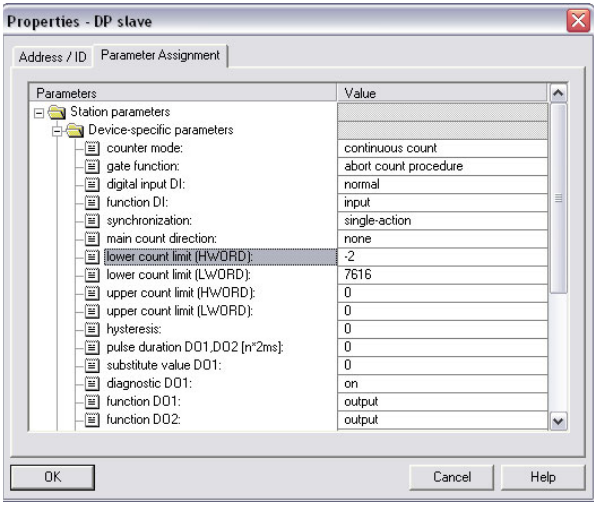
Bit 14: 2^{14} = 16384 × 0 = 0

Bit 15: 2^{15} = 32768 × 0 = 0

  - Low word (decimal): 7616
  - If bit 15 is set, the reciprocal value is formed. This procedure is described in the following for the High word.
- The same principle applies to the High word:
  - If bit 15 is not set, the High word is converted to the corresponding positive decimal value.
  - If bit 15 is set, the reciprocal value of the hexadecimal value is formed:
    - The high word (hex) is subtracted from the hexadecimal value FFFF. 1 is added to the result.
      - Example:
        FFFF - FFFE = 0001
        0001 + 1 = 0002
    - This value is converted to the corresponding decimal value:
      - In the example:
        0002 is converted to 2
    - The result will be negative, as bit 15 is set in the High word (hex) (FFFE in signed format).
    - You receive as a decimal value for FFFE: -2

– In the example:
  High word (hexadecimal): FFFE
  High word (binary): 1111 1111 1111 1110
  High word (decimal): -2

- The calculated values are entered in the appropriate entry lines of the parameter mask for the XI/ON counter module (count mode) (→ Figure 26).



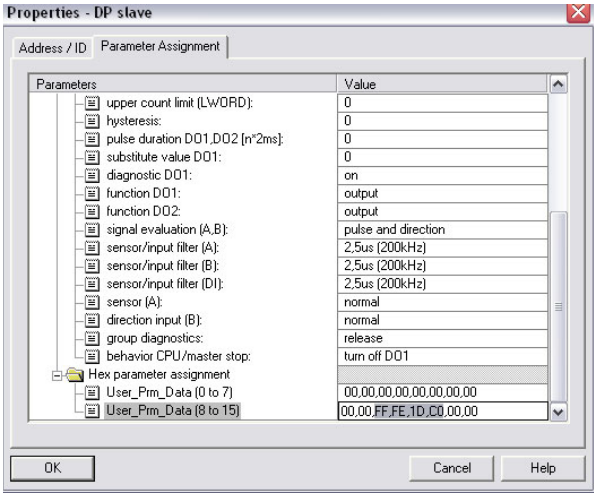


Figure 26: Entering the lower count limit as a High and Low word

The upper count limit is divided as follows (range: 0 to +2147483647 (2^{31}-1)) in a High and a Low word:

- Convert your decimal count limit to hexadecimal format. The upper count limit is always a positive value.
  - Example:
    The upper count limit is to be 12345678. This decimal value is represented in hexadecimal format (double word) as 00BC 614E.
- The hexadecimal value (double word) is divided into a High word (00BC) and a Low word (614E).
- The Low value is converted to a decimal value:
  - In the example:
    Low word (hexadecimal): 614E
    Low word (binary): 0110 0001 0100 1110

Bit 0: $2^0 = 1 \times 0 = 0$

Bit 1: $2^1 = 2 \times 1 = 2$

Bit 2:	2^2	= 4	×	1	=	4
Bit 3:	2^3	= 8	×	1	=	8
Bit 4:	2^4	= 16	×	0	=	0
Bit 5:	2^5	= 32	×	0	=	0
Bit 6:	2^6	= 64	×	1	=	64
Bit 7:	2^7	= 128	×	0	=	0
Bit 8:	2^8	= 256	×	1	=	256
Bit 9:	2^9	= 512	×	0	=	0
Bit 10:	2^{10}	= 1024	×	0	=	0
Bit 11:	2^{11}	= 2048	×	0	=	0
Bit 12:	2^{12}	= 4096	×	0	=	0
Bit 13:	2^{13}	= 8192	×	1	=	8192
Bit 14:	2^{14}	= 16384	×	1	=	16384
Bit 15:	2^{15}	= 32768	×	0	=	0

  - Low word (decimal): 24910
- The same principle applies to the High word:
  - In the example:
    High word (hexadecimal): 00BC
    High word (binary): 0000 0000 1011 1100
    High word (decimal): 188
- The calculated values are entered in the appropriate entry lines of the parameter mask for the XI/ON counter module (count mode) (see Figure 27).

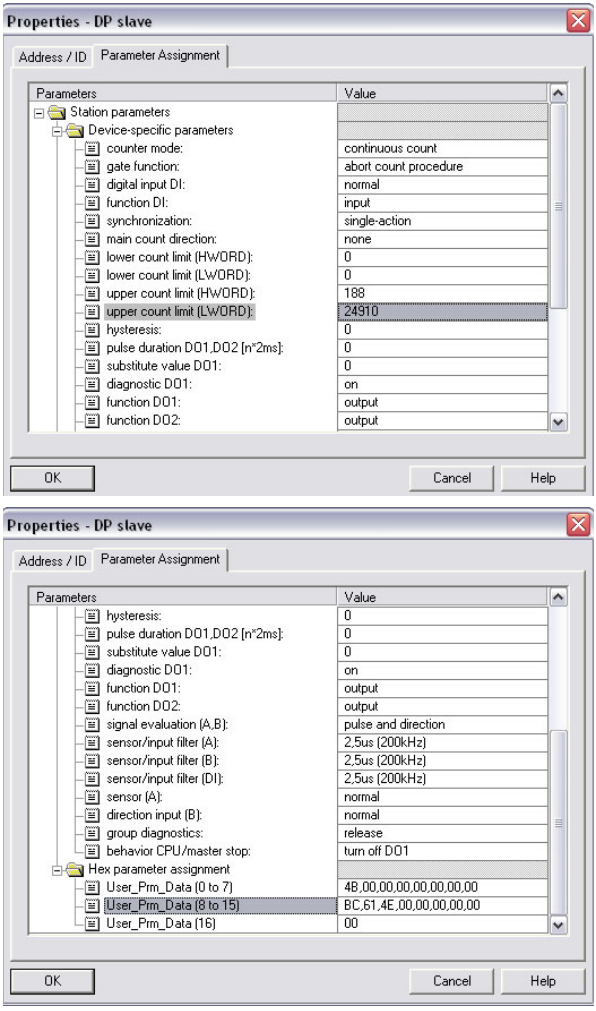


Figure 27: Entering the upper count limit as a High and Low word

Setting the lower and upper measuring limits

The lower measuring limit is divided as follows into a High and a Low word:

- Convert your decimal measuring limit to hexadecimal format.
  - Example:
    The lower measuring limit is to be 654321.
    This decimal value is represented in hexadecimal format (double word) as 0009 FBF1.
- The hexadecimal value (double word) is divided into a High word (0009) and a Low word (FBF1).
- The Low value is converted to a decimal value:
  - In the example:
    Low word (hexadecimal): FBF1
    Low word (binary): 1111 1011 1111 0001

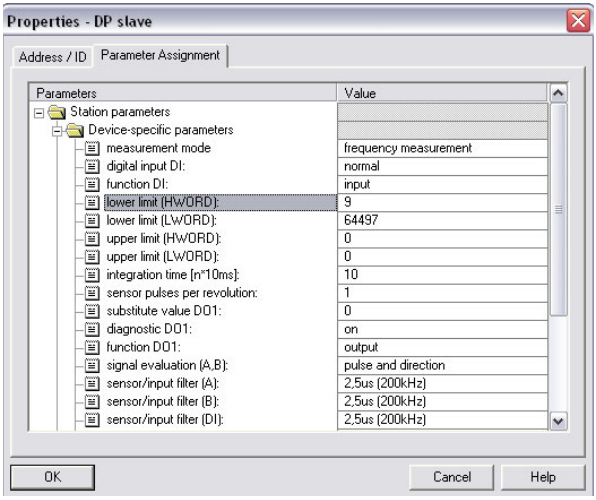
Bit 0:	2^0	= 1	× 1	=	1
Bit 1:	2^1	= 2	× 0	=	0
Bit 2:	2^2	= 4	× 0	=	0
Bit 3:	2^3	= 8	× 0	=	0
Bit 4:	2^4	= 16	× 1	=	16
Bit 5:	2^5	= 32	× 1	=	32
Bit 6:	2^6	= 64	× 1	=	64
Bit 7:	2^7	= 128	× 1	=	128
Bit 8:	2^8	= 256	× 1	=	256
Bit 9:	2^9	= 512	× 1	=	512
Bit 10:	2^{10}	= 1024	× 0	=	0
Bit 11:	2^{11}	= 2048	× 1	=	2048
Bit 12:	2^{12}	= 4096	× 1	=	4096
Bit 13:	2^{13}	= 8192	× 1	=	8192

Bit 14: $2^{14} = 16384 \times 1 = 16384$

Bit 15: $2^{15} = 32768 \times 1 = 32768$

  – Low word (decimal): 64497

- The same principle applies to the High word:
  – In the example:
    High word (hexadecimal): 0009
    High word (binary): 0000 0000 0000 1001
    High word (decimal): 9
- The calculated values are entered in the appropriate entry lines of the parameter mask for the XI/ON counter module (measurement mode).



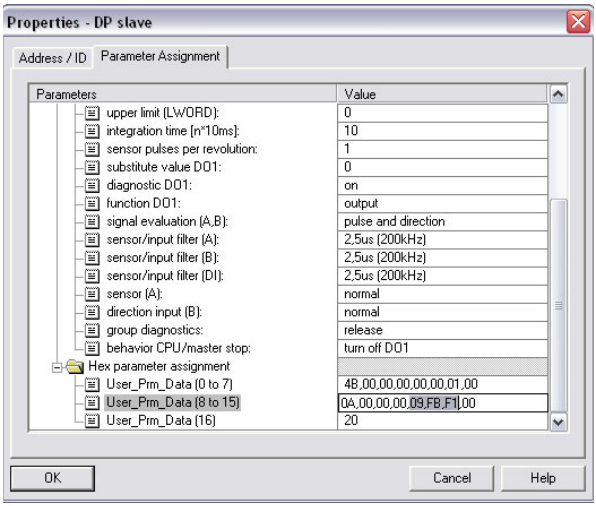


Figure 28: Entering the lower measuring limit as a High and Low word

The upper measuring limit is divided as follows into a High and a Low word:

- Convert your decimal measuring limit to hexadecimal format.
  - Example:
    The upper measuring limit is to be 782955.
    This decimal value is represented in hexadecimal format (double word) as 000B F26B.
- The hexadecimal value (double word) is divided into a High word (000B) and a Low word (F26B).
- The Low value is converted to a decimal value:
  - In the example:
    Low word (hexadecimal): F26B
    Low word (binary): 1111 0010 0110 1011

Bit 0: $2^0 = 1 \quad \times 1 = 1$

Bit 1: $2^1 = 2 \quad \times 1 = 2$

Bit 2: $2^2 = 4 \quad \times 0 = 0$

Bit 3: 2^3 = 8 × 1 = 8

Bit 4: 2^4 = 16 × 0 = 0

Bit 5: 2^5 = 32 × 1 = 32

Bit 6: 2^6 = 64 × 1 = 64

Bit 7: 2^7 = 128 × 0 = 0

Bit 8: 2^8 = 256 × 0 = 0

Bit 9: 2^9 = 512 × 1 = 512

Bit 10: 2^{10} = 1024 × 0 = 0

Bit 11: 2^{11} = 2048 × 0 = 0

Bit 12: 2^{12} = 4096 × 1 = 4096

Bit 13: 2^{13} = 8192 × 1 = 8192

Bit 14: 2^{14} = 16384 × 1 = 16384

Bit 15: 2^{15} = 32768 × 1 = 32768

  - Low word (decimal): 62059

- The same principle applies to the High word:
  - In the example:
    High word (hexadecimal): 000B
    High word (binary): 0000 0000 0000 1011
    High word (decimal): 11
- The calculated values are entered in the appropriate entry lines of the parameter mask for the XI/ON counter module (measurement mode).

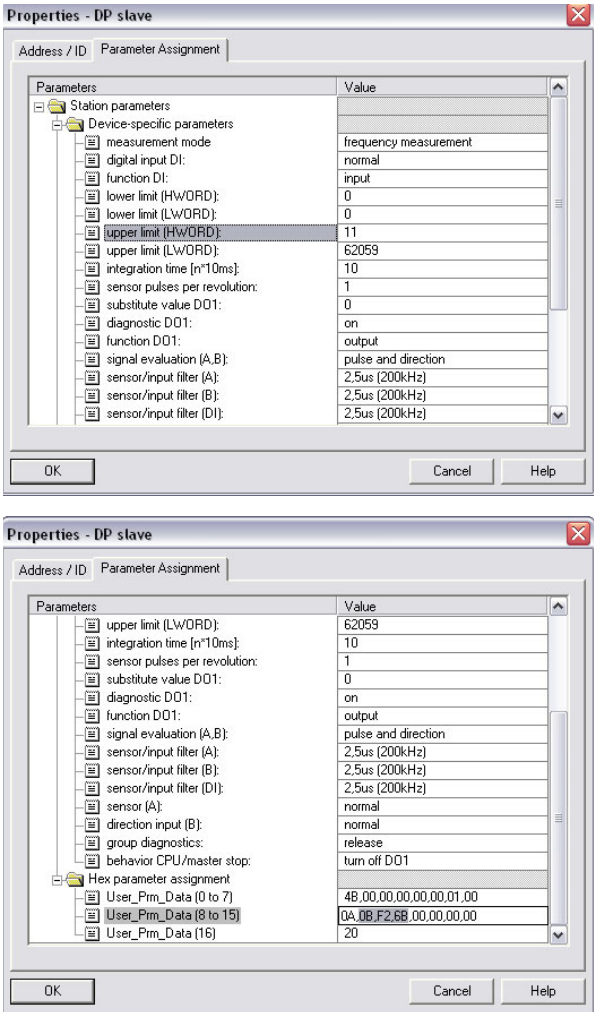


Figure 29: Entering the upper measuring limit as a High and Low word

3 Integrating the Module in DeviceNet

Process image in DeviceNet

The structure of the process image is represented with symbolic names. The data of the process input and process output are not imaged using attributes.

Process output for count mode

The process output data is the data that is output from the PLC via the gateway to the XN-1CNT-24VDC module.

The XN-1CNT-24VDC module allows some parameters to be modified during operation.

The other parameters must be changed **prior to** commissioning.

Note!
The current count operation is stopped if parameters are changed during operation.

Note!
The parameters modified via the process output data are not retentive. The commissioning after a power failure is based on the parameter data of the configuration tool or default configuration.

The data is transferred in 8 byte format:

- The first four bytes provide the parameter values for Load direct, Load in preparation, Reference value 1, Reference value 2 or Behaviour of the digital outputs.
- Two control bytes contain the control functions for transferring the parameter values, for starting/stopping the measurement, for acknowledging errors and for resetting the status bit.
- 2 bytes are not yet assigned.

Table 27: Structure of the data bytes in DeviceNet with Load value direct, Load value in preparation, Reference value 1 or Reference value 2.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Load value direct, Load value in preparation, Reference value 1 or Reference value 2							
Byte 1								
Byte 2								
Byte 3								
Byte 4	EXTF_ACK	CTRL_DO2	SET_DO2	CTRL_DO1	SET_DO1	RES_STS	CTRL_SYN	SW_GATE
Byte 5	X	X	X	LOAD_DO_PARAM	LOAD_CMP_VAL2	LOAD_CMP_VAL1	LOAD_PREPARE	LOAD_VAL
Byte 6	X							
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process output for count mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process output):"

Table 28: Structure of the data bytes in the DeviceNet fieldbus with Function and Behaviour of DO1/DO2

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X		MODE_DO2				MODE_DO1	
Byte 1	Hysteresis value							
Byte 2	Pulse duration							
Byte 3	X							
Byte 4	EXTF_ACK	CTRL_DO2	SET_DO2	CTRL_DO1	SET_DO1	RES_STS	CTRL_SYN	SW_GATE
Byte 5	X	X	X	LOAD_DO_PARAM	LOAD_CMP_VAL2	LOAD_CMP_VAL1	LOAD_PREPARE	LOAD_VAL
Byte 6	X							
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process output for count mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process output):"

Process input for count mode

Process input data is data from the connected field device that is transmitted via the XN-1CNT-24VDC module to the PLC. This is transferred in an 8-byte format as follows:

- 4 bytes are used to contain the count values.
- 1 byte contains the diagnostics data.
- 2 bytes contain status information.

Table 29: Structure of the data bytes in DeviceNet

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Count value							
Byte 1								
Byte 2								
Byte 3								
Byte 4 (Diagn.)	ERR_ 24Vdc	ERR_ DO	ERR_ PARA	X	X	RES_ STS_ A	ERR_ LOAD	STS_ LOAD
Byte 5 (Status)	STS_ DN	STS_ UP	X	STS_ DO2	STS_ DO1	X	STS_ DI	STS_ GATE
Byte 6	STS_ ND	STS_ UFLW	STS_ OFLW	STS_ CMP2	STS_ CMP1	X		STS_ SYN
Byte 7	X							

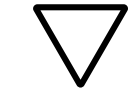
Explanations on the individual data bits of the process input for count mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process input):"

Process output for measurement mode

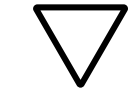
The process output data is the data that is output from the PLC via the gateway to the XN-1CNT-24VDC module.

The XN-1CNT-24VDC module allows some parameters to be modified during operation.

The other parameters must be changed **prior to** commissioning.



Note!
The current count operation is stopped if parameters are changed during the measuring operation.



Note!
The parameters modified via the process output data are not retentive. The commissioning after a power failure is based on the parameter data of the configuration tool or default configuration.

The data is transferred in 8 byte format:

- The first four bytes represent the parameter values for Lower limit or Upper limit, Function of DO1 or Integration time.
- Two control bytes contain the control functions for transferring the parameter values, for starting/stopping the measurement, for acknowledging errors and for resetting the status bit.
- 2 bytes are not yet assigned.

Table 30: Structure of the data bytes in the DeviceNet fieldbus with Lower limit or Upper limit set.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Lower limit or upper limit							
Byte 1								
Byte 2								
Byte 3								
Byte 4 (Control)	EXTF_ ACK	X	X	CTRL_ DO1	SET_ DO1	RES_S TS	X	SW_ GATE
Byte 5 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT
Byte 6	X							
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process output for measurement mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process output):"

Table 31: Structure of the data bytes in the DeviceNet with Function of DO1 set.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X						MODE_DO1	
Byte 1	X							
Byte 2	X							
Byte 3	X							
Byte 4 (Control)	EXTF_ ACK	X	X	CTRL_D O1	SET_ DO1	RES_ STS	X	SW_ GATE
Byte 5 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 6	X							
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process output for measurement mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process output):"

Table 32: Structure of the data bytes in the DeviceNet with Integration time set.

PDOut	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Integration time							
Byte 1								
Byte 2	X							
Byte 3	X							
Byte 4 (Control)	EXTF_ ACK	X	X	CTRL_ DO1	SET_ DO1	RES_ STS	X	SW_ GATE
Byte 5 (Control)	X	X	X	LOAD_ DO_ PARAM	X	LOAD_ INT TIME	LOAD_ UP LIMIT	LOAD_ LO LIMIT
Byte 6	X							
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process output for measurement mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process output):"

Process input for measurement mode

Process input data is data from the connected field device that is transmitted via the XN-1CNT-24VDC module to the PLC. This is transferred in an 8-byte format as follows:

- 4 bytes are used to contain the measured values.
- 1 byte contains the diagnostics data.
- 2 bytes contain status information.

Table 33: Structure of the data bytes in DeviceNet

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Measured value							
Byte 1								
Byte 2								
Byte 3								
Byte 4 (Diagn.)	ERR_ 24Vdc	ERR_ DO	ERR_ PARA	X	X	RES_ STS_A	ERR_ LOAD	STS_ LOAD
Byte 5 (Status)	STS_ DN	STS_ UP	X	X	STS_ DO1	X	STS_ DI	STS_ GATE
Byte 6	X	STS_ UFLW	STS_ OFLW	X	STS_ CMP1	X	X	X
Byte 7	X							

X = reserved

Explanations on the individual data bits of the process input for measurement mode are provided in the chapter "Integrating the Module in PROFIBUS-DP" → "Meaning of the data bits (process input):"

Counter1 Module Class (VSC112)

This class contains all the parameters and information relating to the counter module.

Table 34: Class Instance

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
100	64_{hex}	CLASS REVISION	G	UINT	Contains the revision number of this class (Maj. Rel. * 1000 + Min. Rel.).
101	65_{hex}	MAX INSTANCE	G	USINT	Contains the number of the highest instance of an object created on this level in the class hierarchy.
102	66_{hex}	# OF INSTANCES	G	USINT	Contains the number of object instances created on this class level.
103	67_{hex}	MAX CLASS ATTR	G	USINT	Contains the number of the last class attribute implemented.

Object Instances

Two different operating modes can be selected on the counter module: count mode and measurement mode.

Different attributes are supported according to the operating mode selected. The operating mode is set in attribute 113. The attributes represent all the diagnostics messages and parameters relating to the XN-1CNT-24VDC module.

Note!
The attribute no. 113 must be written first and determines the operating mode. The write operation to attribute no. 113 resets all other attributes to the default values!

Table 35: Object Instances

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
100	64_{hex}	MAX OBJECT ATTR	G	USINT	Contains the number of the last object attribute implemented.
101	65_{hex}	MODULE PRESENT	G	BOOL	FALSE: XI/ON module is not plugged in, empty base module. TRUE: XI/ON module is plugged in
102	66_{hex}	TERMINAL SLOT NUMBER	G	USINT	The slot number of the base module (base module to the right of the gateway = No. 1) belonging to the module. Corresponds to the relevant instance number within the TERMINAL SLOT CLASS.
103	67_{hex}	MODULE ID	G	DWORD	Contains the module ID.
104	68_{hex}	MODULE ORDER NUMBER	G	UDINT	Contains the order no. of the module, e.g. 225000.
105	69_{hex}	MODULE ORDER NAME	G	SHORT_ STRING	Contains the module name, e.g. XN-1CNT-24VDC(C/M).
106	$6A_{hex}$	MODULE REVISION	G	USINT	Contains the revision number of the module firmware.

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
107	$6B_{hex}$	MODULE TYPE ID	G	ENUM USINT	Gives information about the module type: 0 (00_{hex}) unknown module type 1 (01_{hex}) digital I/O module 17 (11_{hex}) analog module I/O voltage 18 (12_{hex}) analog module I/O current 19 (13_{hex}) analog module PT temperature 20 (14_{hex}) analog module Thermo temperature 33 (21_{hex}) 16-bit counter module 34 (22_{hex}) 32-bit counter module 40 (28_{hex}) SSI module 49 (31_{hex}) motor starter module as DOL or reversing starter 50 (32_{hex}) electronic motor starter 65 (41_{hex}) RS232 module 66 (42_{hex}) RS485/422 module 67 (43_{hex}) TTY module
108	$6C_{hex}$	MODULE COMMAND INTERFACE	G/S	ARRAY	Control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109	$6D_{hex}$	MODULE RESPONSE INTERFACE	G	ARRAY	Signal interface of the XI/ON module. ARRAY OF: BYTE: Signal byte sequence

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
110	$6E_{hex}$	MODULE REGISTERED INDEX	G	ENUM USINT	Contains the index number registered in all module lists.
111	$6F_{hex}$	NUMBER OF SUPPORTED CHANNELS	G	USINT	Indicates the number of channels supported by this module instance.
112	70_{hex}	COUNTER DIAG	G	WORD	Contains the diagnostics data of the counter module. Bits 0 to 7 refer to count mode (CNT), bits 8 to 15 measurement mode (MSRM).

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
Count mode (bits 0 bits 7 are always 0 in measurement mode.)					
					Bit0: 0 = ok (or activated measurement mode) 1 = CNT: short-/ open circuit Short-/open circuit/excess temperature at the output DO1 This diagnostics information must be acknowledged with the EXTF_ACK (see Figure 21) control bit. EXTF_ACK is a bit in the process output data (→ Table 27, Table 28)
					Bit1: 0 = ok (or activated measurement mode) 1 = CNT: short-circuit in sensor power supply 24 V DC Short-circuit of sensor supply This diagnostics information must be acknowledged with the EXTF_ACK control bit (see Figure 21). EXTF_ACK is a bit in the process output data (→ Table 27, Table 28)

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
					Bit2: 0 = ok (or activated measurement mode) 1 = CNT: upper limit wrong The following errors are indicated: Upper count limit = lower count limit Upper count limit ≦ lower count limit Upper count limit < 0 The permissible range for the upper count limit is therefore: 0 to 2147483647
					Bit3: 0 = ok (or activated measurement mode) 1 = CNT: lower limit wrong The following errors are indicated: Lower count limit = upper count limit Lower count limit ≧ upper count limit Lower count limit > 0 The permissible range for the lower count limit is therefore: -2147483648 to 0
					Bit4: 0 = ok (or activated measurement mode) 1 = CNT: 'DI inverted' and 'Latch-Retrigger' not permitted) Inverting the digital input signal with the Latch Retrigger function is not permissible.

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
					Bit5: 0 = ok (or activated measurement mode) 1 = CNT: main count direction wrong The value 3 (11) for selecting the main count direction is incorrect. Permissible values: 0 (00) none 1 (01) up 2 (10) down
					Bit6: 0 = ok (or activated measurement mode) 1 = CNT: main count operating mode wrong The value for selecting the operating mode is incorrect. Permissible values for count mode: 0 Continuous count 1 Single-action count 2 Periodical count
					Bit7: = CNT Mode NOT active Counter mode not active 1 = counter mode Counter mode active

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
Measurement mode - in count mode bits 8 to 15 are always 0.					
					Bit 8: 0 = ok (or activated count mode) 1 = MSRM: short circuit/ open circuit Short-/open circuit/excess temperature at the output DO1 This diagnostics information must be acknowledged with the EXTF_ACK (see Figure 21) control bit. EXTF_ACK is a bit in the process output data (→ Table 30, Table 32Table 31)
					Bit9: 0 = ok (or activated count mode) 1 = MSRM: short circuit in sensor power supply 24 Vdc Short-circuit of sensor supply This diagnostics information must be acknowledged with the EXTF_ACK control bit (see Figure 21). EXTF_ACK is a bit in the process output data (→ Table 30, Table 32Table 31)
					Bit10: reserved

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
					Bit11: 0 = ok (or activated count mode) 1 = MSRM: integration time wrong The value for the integration time is incorrect. The permissible value range is: 1 to 1000 This enables permissible integration times (frequency measurement/revolutions measurement) from 10 ms to 10 000 ms in 10 ms increments and for period duration measurement averaging over 1 to 1000 periods.
					Bit12: 0 = ok (or activated count mode) 1 = MSRM: upper limit wrong The value for the upper limit is incorrect. Permissible value range: 1 to 16777215 → "UPPER LIMIT"
					Bit13: 0 = ok (or activated count mode) 1 = MSRM: lower limit wrong The value for the lower limit is incorrect. Permissible value range: 0 to 16777214 → "LOWER LIMIT"

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
					Bit14: 0 = ok (or activated count mode) 1 = MSRM: measurement operating mode wrong The value for selecting the operating mode is incorrect. Permissible values for measurement mode: 3 Frequency measurement 4 Revolutions measurement 5 Period duration measurement
					Bit15: 0 = measurement mode not active 1 = measure mode measurement mode active

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
113	71_{hex}	BASIC MODE	G/S	ENUM USINT	Defines the operating mode of the counter module and must therefore be written first. The write operation resets all other attributes to the default values! The definition of the operating mode in this attribute is required for all other instances and attributes of this class. Operating mode (basic mode): 0: CNT: continuous count → "Continuous counting" 1: CNT: single-action count → "Single-action count" 2: CNT: periodically count → "Periodical count" 3: MSRM: frequency measurement 4: MSRM: revolutions measurement → "Revolutions measurement" 5: MSRM: period duration measurement → "Period duration measurement" 6 to 255: reserved

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
114	72_{hex}	CNT GATE FUNCTION[1)]	G/S	ENUM USINT	The gate function defines the response of the counter to the internal release being reset. Gate function: 0: CNT: abort count procedure If the counting operation is aborted, counting begins from the load value on restart. → "Software gate and hardware gate" 1: CNT: interrupt count procedure If the counting operation is interrupted, however, the counter continues on restart from the actual counter value. → "Software gate and hardware gate" 2 to 255: reserved
115	73_{hex}	DIGITAL INPUT DI	G/S	ENUM USINT	Defines whether the digital input of the module is inverted or not: 0: normal 1: inverted 2 to 255: reserved → "Behaviour of the DI digital input"

Attribute no.		Attribute name	Acc-ess	Type	Description
dec	hex				
116	74_{hex}	FUNCTION DI[1)]	G/S	ENUM USINT	Defines the function of the digital input. → "Behaviour of the DI digital input": 0: input 1: HW gate → "Software gate and hardware gate" 2: CNT:Latch-retrigger when edge positive Latch retrigger function when edge positive→ "Latch retrigger function" 3: CNT:synchronization when edge positive Synchronization when edge positive → "Synchronization" 4 to 255: reserved
117	75_{hex}	CNT SYNCHRO-NIZATION[1)]	G/S	ENUM USINT	Count mode Defines the type of synchro-nization: 0: single-action Single-action synchronization possible 1: periodical Periodical synchronization possible → Figure 2 to 255: reserved

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
118	76_{hex}	CNT MAIN COUNT DIRECTION[1)]	G/S	ENUM USINT	Count mode Defines the Main count direction. The main count direction defines in conjunction with the operating mode the value to which the counter is to jump when the count limits are reached.→ Table 1 0: none 1: up 2: down 3 to 255: reserved
119	77_{hex}	LOWER LIMIT	G/S	DINT	Count mode Defines the lower count limit of the module. The permissible range for the lower count limit is therefore: -2147483648 to 0 When the count value reaches or goes below this limit, the module responds according to the parameters set (attribute no.113 and 118). → Table 1 Measurement mode Defines the lower measuring limit of the module: 0 to 16 777 214 x 10-3 Hz 0 to 16 777 214 x 10-3 rpm 0 to 16 777 214 ms

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
120	78_{hex}	UPPER LIMIT	G/S	DINT	Count mode Defines the upper count limit of the module. The permissible range for the upper count limit is therefore: 0 to 2147483647 When the count value reaches or goes above this limit, the module responds according to the parameters set (attribute no.113 and 118). → Table 1 Measurement mode Defines the upper measuring limit of the module: 1 to 16 777 215 x 10-3 Hz 1 to 16 777 215 x 10-3 rpm 1 to 16 777 215 ms
121	79_{hex}	MSRM INTEGRATION[1)]	G/S	UINT	Measurement mode Defines the Integration time. The permissible value range is: 1 to 1000 This enables permissible integration times (frequency measurement/revolutions measurement) from 10 ms to 10 000 ms in 10 ms increments and for period duration measurement averaging over 1 to 1000 periods. → "Frequency measurement", → "Revolutions measurement" → "Period duration measurement"

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
122	$7A_{hex}$	CNT HYSTERESIS[1)]	G/S	USINT	Count mode Defines the hysteresis, i.e. the differential threshold value. → "Hysteresis for digital output DO1/DO2"
123	$7B_{hex}$	CNT PULSE DURATION[1)]	G/S	USINT	Count mode Defines the Pulse duration. The pulse duration can be set in 2 ms increments to between 0 and 510 ms. → "Pulse duration on reaching the reference value"
124	$7C_{hex}$	MSRM PULSES PER REVOLUTION[1)]	G/S	UINT	This device parameter is required in measurement mode for calculating the rotational speed. Defines the number of sensor pulses per revolution. (max. 65535) → "Revolutions measurement" Possible measuring ranges depending on the number of sensor pulses per revolution: → Table 4,Table 5
125	$7D_{hex}$	FAULT VALUE DO1	G/S	BOOL	If the higher-level PLC fails, this value determines the status of output DO1 if attribute no.136: ON I/O CONNECTION FAULT = switch DO1 to Fault Val (2) 0: FALSE/off/0V 1. TRUE/on/24V

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
126	$7E_{hex}$	DIAGNOSTIC DO1	G/S	BOOL	Defines whether the diagnostics data of the DO1 is sent to the gateway. 1: on Diagnostics data of DO1 is sent 0: off Diagnostics data of DO1 is not sent
127	$7F_{hex}$	FUNCTION DO1[1)]	G/S	ENUM USINT	Defines the function of output DO1 → "Behaviour of the digital outputs DO1/DO2" 0: output Digital output 1: CNT<ON(VAL>=CMP VAL)> On when count value >= ref. value 2: CNT<ON(VAL<=CMP VAL)>CNT:On when count value <= ref. value 3: CNT<PULS(VAL=CMP VAL)>CNT:Pulse if count value = reference value 4: MSRM<ON(OUT OF RANGE)> On when count value outside of limits 5: MSRM<ON(<LOWER LIMIT)> On when count value below lower limit 6: MSRM<ON(UPPER LIMIT)> On when count value above upper limit 7 to 255: reserved

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
128	80_{hex}	CNT FUNCTION DO2[1)]	G/S	ENUM USINT	Defines the function of output DO2: This is not a physical output, i.e. the value of this output is represented as a data bit in the process image. 0: output Digital output 1: CNT<ON(VAL>=CMP VAL)> On when count value >= ref. value 2: CNT<ON(VAL<=CMP VAL)>CNT:On when count value <= ref. value 3: CNT<PULS(VAL=CMP VAL)>CNT:Pulse if count value = reference value 4 to 255: reserved

Attribute no. dec	Attribute no. hex	Attribute name	Access	Type	Description
129	81_{hex}	SIGNAL EVALUATION[1)]	G/S	ENUM USINT	Defines the type of signal evaluation at the two A and B inputs. → " " 0: pulse and direction → "Pulse and direction" 1: rotary sensor single Single evaluation of the rotary sensor pulses 2: CNT:rotary sensor double Double evaluation of the rotary sensor pulses 3: CNT:rotary sensor fourfold Fourfold evaluation of the rotary sensor pulses → "Signal evaluation options for rotary sensors" 4 to 255: reserved
130	82_{hex}	SENSOR/ INPUT FILTER (A)	G/S	ENUM USINT	Defines the input filter A. 0: 2.5µs/200 kHz 1: 25µs/20 kHz 2 to 255: reserved
131	83_{hex}	SENSOR/ INPUT FILTER (B)	G/S	ENUM USINT	Defines the input filter B. 0: 2.5µs/200 kHz 1: 25µs/20 kHz 2 to 255: reserved
132	84_{hex}	SENSOR/ INPUT FILTER (DI)	G/S	ENUM USINT	Defines the input filter DI. 0: 2.5µs/200 kHz 1: 25µs/20 kHz 2 to 255: reserved
133	85_{hex}	SENSOR (A)	G/S	ENUM USINT	Defines the sensor mode. 0: normal 1: inverted 2 to 255: reserved

Attribute no.		Attribute name	Access	Type	Description
dec	hex				
134	86_{hex}	DIRECTION INPUT B	G/S	BOOL	Indicates whether direction input B is inverted. FALSE: normal TRUE: inverted
135	87_{hex}	GROUP DIAGNOS-TICS	G/S	BOOL	Defines whether the group diagnostic signal is sent to the gateway or not. FALSE: released TRUE: blocked
136	88_{hex}	ON I/O CONNEC-TION FAULT	G/S	ENUM USINT	Defines the behaviour of the modules in the event of an I/O Connection Fault on the gateway. Behaviour in the event of an I/O Connection Fault (parameter name of the counter: CPU/Master STOP): 0: turn off DO1 The digital output DO1 is switched off. 1: proceed operating mode The module continues in the current operating mode. 2: switch DO1 to Fault Val DO1 switches to Fault Val 3: hold last value DO1 holds the last value. 4 to 255: reserved

1) These attributes depend on the operating mode selected for the counter module (CNT count mode/MSRM measurement mode) and are not supported by the operating mode that is not selected. For this see attribute no. 113 BASIC MODE.

→ Dynamic modifications to diagnostics will cause a new data record DATA CLASS 1 (diagnostics) to be transmitted.

4 Integrating the Module in CANopen

CAN object for the XI/ON counter module

Overview of the objects

The following table provides an overview of the supported object dictionary entries for the XI/ON counter module that are defined by the Device Profile for Encoders CiA DS-406.

As this is the second device profile of the XI/ON gateway, all entries from 6000_{hex} have an offset of 800_{hex} compared to the entries in CiA DS-406.

Table 36: Overview of the object dictionary entries for the XI/ON counter module

Index ($_{hex}$)	Object	Name	Function Type	Acc- ess
Manufacturer-specific objects				
5800_{hex} → Page 150	ARRAY	Encoder Basic Mode	Parameter definition of the operating mode Unsigned32	rw
5801_{hex} → Page 154	ARRAY	Encoder Config	Configuration parameters Unsigned32	rw
5802_{hex} → Page 160	ARRAY	Encoder Status	Status messages Unsigned8	ro
5803_{hex} → Page 162	ARRAY	Encoder Flags	Status messages Unsigned8	rwr
5804_{hex} → Page 165	ARRAY	Encoder Diag	Diagnostics Unsigned8	ro
5805_{hex}	ARRAY	SSI Native Status	No meaning for XN-CNT-24 VDC module Unsigned16	ro
5806_{hex}	ARRAY	SSI Optional Enc Status	No meaning for XN-CNT-24 VDC module Unsigned8	ro
5808_{hex} → Page 170	ARRAY	Encoder Control	Release/set the digital outputs Start/stop counting/measuring Release synchronization Unsigned8	rww
5810_{hex} → Page 173	ARRAY	Encoder Load Prepare Value	Load value (in preparation) Integer32	rw
5811_{hex} → Page 174	ARRAY	Encoder Pulse Width	Value for pulse duration Unsigned16	rw
5820_{hex} → Page 176	ARRAY	Measuring Integration Time	Value for integration time Unsigned32	rw

Index ($_{hex}$)	Object	Name	Function Type	Access
5821_{hex} → Page 178	ARRAY	Measuring Low Limit	Value for lower measuring limit Unsigned32	rw
5822_{hex} → Page 179	ARRAY	Measuring High Limit	Value for upper measuring limit Unsigned32	rw
5823_{hex} → Page 180	ARRAY	Measuring Units Per Revolution	Number of pulses per revolution Unsigned16	rw
5840hex	ARRAY	SSI Diag Mapping	No meaning for XN-CNT-24 VDC module Unsigned32	
Objects to CiA DS-406				
6800_{hex} → Page 181	VAR	Operating Parameters	No meaning for XI/ON Unsigned16	rw
6810_{hex} → Page 182	ARRAY	Load Value For Multi-Sensors Devices	Load value (direct) Integer32	rw
6820_{hex} → Page 183	ARRAY	Position Value For Multi-Sensors Devices	Current counter value/measured value Integer32	ro
$6B00_{hex}$ → Page 184	ARRAY	Cam 1 State Register	Status message for counter status Unsigned8	ro
$6B01_{hex}$ → Page 186	ARRAY	Cam 1 Release Register	Block/release status message for counter status Unsigned8	rw
$6B02_{hex}$ → Page 188	ARRAY	Cam 1 Polarity Register	Invert the status message for counter status Unsigned8	rw
$6B10_{hex}$ → Page 190	ARRAY	Cam 1 Low Limit	Reference value2 Integer32	rw

Index ($_{hex}$)	Object	Name	Function Type	Access
$6B20_{hex}$ → Page 191	ARRAY	Cam 1 High Limit	Reference value1 Integer32	rw
$6B30_{hex}$ → Page 192	ARRAY	Cam 1 Hysteresis	Hysteresis value Unsigned16	rw
$6C00_{hex}$ → Page 193	ARRAY	Area State Register	Status messages for counter status Unsigned8	ro
$6C01_{hex}$ → Page 195	ARRAY	Work Area Low Limit	Value for lower counter limit Integer32	rw
$6C02_{hex}$ → Page 196	ARRAY	Work Area High Limit	Value for upper counter limit Integer32	rw
Diagnostics				
$6D00_{hex}$	VAR	Operating Status	No meaning for XI/ON Unsigned16	ro
$6D01_{hex}$	VAR	Single Turn Resolution	No meaning for XI/ON Unsigned32	ro
$6D02_{hex}$	VAR	Number Of Distinguishable Revolutions	No meaning for XI/ON Unsigned16	ro
$6FFF_{hex}$ → Page 198	VAR	Device Type	Specifies the Device Profile Unsigned32	ro

The **Index ($_{hex}$)** column describes the position of the entry in the object dictionary.

The **object** column indicates the type of object.

The **Name** column shows a predefined symbolic name for the entry.

The **Function/Type** column indicates the meaning of the data and shows the predefined data type of the entry in CiA DS-406.

The **Access** column shows the access possibilities to the entry. The following applies here:

- rw (read/write):
  The writing and reading of the object via the service data is possible.
- ro (read only):
  The reading of the object via the service data is possible.
- rwr (read/write/read):
  The writing and reading of the object via the an SDO access is possible. A read PDO access is also possible if suitable PDO mapping has been configured for this object.
- rww (read/write/write):
  The writing and reading of the object via the an SDO access is possible. A write PDO access is also possible if suitable PDO mapping has been configured for this object.

Object for starting the XN-1CNT-24VDC module

The following manufacturer-specific object allows counting/measuring to be started:

→ "Object 5808hex Encoder Control"

→ If a PDO access is required, it must be ensured that the object 5808_{hex} is mapped to a free PDO.

Object 5800_{hex} Encoder Basic Mode

Object 5800_{hex} controls the operating mode parameters of the XI/ON counter module. Its uses include the setting of count mode or measurement mode.

Write accesses initiate a parameter update via the internal XI/ON module bus. The parameter is stored retentively in the XI/ON gateway and is restored with every node reset.

Table 37: Object 5800_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Basic Mode
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 38: Structure of the data bytes for count mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X		count mode					
Byte 1	X	main count direction		synchr oniza-tion	function DI		digital input DI	gate function
Byte 2	X							
Byte 3	X							

X = reserved

Table 39: Meaning of the data bits (count mode):

Designation	Value 1):Default	Designation of the values/ Value range	Description
count mode	000000[1)]	continuous count[1)]	→ "Continuous counting"
	000001	single-action count	→ "Single-action count"
	000010	periodical count	→ "Periodical count"
main count direc-tion	00[1)] 01 10	None[1)] Up Down	→ "Main count direction"
synchronization	0[1)] 1	single-action[1)] periodic	→ "Synchronization"
function DI	00[1)]	Input[1)]	
	01	HW gate	Hardware release → "Software gate and hardware gate"
	10	latch retrigger when edge pos.	→ "Latch retrigger function"
	11	synchronization when edge pos.	→ "Synchronization"

Designation	Value 1):Default	Designation of the values/ Value range	Description
digital input DI	0[1)] 1	Normal[1)] Inverted	→ "Connection diagram"
gate function	0[1)]	abort count procedure[1)]	If the counting operation is aborted, counting begins from the load value on restart. → "Software gate and hardware gate"
	1	interrupt count procedure	If the counting operation is interrupted, however, the counter continues on restart from the actual counter value. → "Software gate and hardware gate"

1) Default values

Table 40: Structure of the data bytes for measurement mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X		measurement mode					
Byte 1	X				function DI		digital input DI	X
Byte 2	X							
Byte 3	X							

X = reserved

Table 41: Meaning of the data bits (measurement mode):

Designation	Value 1):Default	Designation of the values/ Value range	Description
measurement mode	100000[1)]	frequency measurement [1)]	→ "Frequency measurement"
	100001	revolutions measurement	→ "Revolutions measurement"
	100010	period duration measurement	→ "Period duration measurement"
	100011 To 111111		Reserve
digital input DI	0[1)]	Normal[1)]	→ "Connection diagram"
	1	Inverted	
function DI	00[1)]	Input[1)]	
	01	HW gate	→ "Software gate and hardware gate"
	10 to 11		Reserve

Object 5801_{hex} Encoder Config

Object 5801_{hex} controls the configuration parameters of the XI/ON counter module:

- **Output parameters**
- Sensor and input filter
- Sensor parameters
- Behaviour on failure of the higher-level PLC

Write accesses initiate a parameter update via the internal XI/ON module bus. The parameter is stored retentively in the XI/ON gateway and is restored with every node reset.

Table 42: Object 5801_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Config
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 43: Structure of the data bytes for count mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	function DO2			function DO1			diag-nostic DO1	substi-tute value DO1
Byte 1	direc-tion input (B)	sensor (A)		sensor /input filter (DI)	sensor /input filter (B)	sensor /input filter (A)	signal evaluation (A B)	
Byte 2	X		behavior CPU/master stop		X			group diagnos-tics
Byte 3	X							

X = reserved

Table 44: Structure of the data bytes for measurement mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X			function DO1			diag-nostic DO1	substi-tute value DO1
Byte 1	direc-tion input (B)	sensor (A)		sensor /input filter (DI)	sensor /input filter (B)	sensor /input filter (A)	signal evaluation (A B)	
Byte 2	X		behavior CPU/master stop		X			group diagnos-tics
Byte 3	X							

X = reserved

Table 45: Meaning of the data bits

Designation	Value 1):Default	Designation of the values/ Value range	Description
Output parameters (Byte 0)			
substitute value DO1	0[1)] 1	0[1)] 1	This value determines the state of output DO1 in the event of a failure if: behaviour CPU/Master STOP = 10
diagnostic DO1	0[1)]	On[1)]	The Short-/open circuit DO diagnostics message is not blocked. → "Object 5804hex Encoder Diag"
	1	Off	The Short-/open circuit DO diagnostics message is blocked. → "Object 5804hex Encoder Diag"
function DO1 (count mode)	000[1)]	Output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	001	On when cnt. value ≧ ref. value	
	010	On when cnt. value ≦ ref. value	
	011	Pulse when cnt. value = ref. value	

Designation	Value 1):Default	Designation of the values/ Value range	Description
function DO1 (measurement mode)	000[1)]	Output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	001	Measured value outside of the set limits	
	010	below lower limit	
	011	above upper limit	
function DO2 (count mode)	000[1)]	output[1)]	→ "Behaviour of the digital outputs DO1/DO2"
	001	On when cnt. value ≧ ref. value	
	010	On when cnt. value ≦ ref. value	
	011	pulse when cnt. value = ref. value	

Designation	Value 1):Default	Designation of the values/ Value range	Description
Sensor parameters (byte 1)			
Signal evaluation (A B)	00[1)]	Pulse and direction[1)]	In this mode input B can control up and down counting in count mode. In measurement mode input B can receive a signal for the rotational direction. → "Pulse and direction"
	01	Single-evaluation rotary sensor	→ "Signal evaluation options for rotary sensors"
Only Count mode:	10	Double-evaluation rotary sensor	
	11	Fourfold-evaluation rotary sensor	
Sensor and input filter			
sensor/input filter (A)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	An input filter at inputs A,B and DI can suppress high-frequency interference and thus increase the accuracy of the counting. The limit frequency can be adapted to the application: 20 kHz or 200 kHz
sensor/input filter (B)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	
sensor/input filter (DI)	0[1)] 1	2.5µs (200 kHz)[1)] 25µs (20 kHz)	
sensor (A)	00[1)] 01	Normal[1)] Inverted	→ "Connection diagram"
direction input (B)	0[1)] 1	Normal[1)] Inverted	

Designation	Value 1):Default	Designation of the values/ Value range	Description
Release (byte 2)			
group diagnostics	0[1)]	release [1)]	Separate diagnostics is released. → "Diagnostics for count mode"
	1	block	Separate diagnostics is blocked. → "Diagnostics for count mode"
Behaviour on failure of the higher-level PLC			
behavior CPU/master STOP	00[1)]	turn off DO1[1)]	A failure of the higher-level PLC causes output DO1 to be switched off or held.
	01	Proceed with operating mode	A failure of the higher-level PLC causes the XN-1CNT-24VDC module to continue operating without restriction.
	10	DO1 switch substitute value	A failure of the higher-level PLC causes output DO1 to assume the value specified at Substitute value DO1.
	11	DO1 hold last value	A failure of the higher-level PLC causes output DO1 to retain the status in the event of a failure.

1) Default values

Object 5802_{hex} Encoder Status

Object 5802_{hex} supplies the following status messages:

- Direction forwards
- Direction backward
- Status DO2
- Status DO1
- Status DI
- Counting/measuring running

Table 46: Object 5802_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Status
Object Code		ARRAY
PDO Mapping		Yes
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	ro
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 47: Structure of the data bytes in count mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Status)	STS_ DN	STS_ UP	X	STS_ DO2	STS_ DO1	X	STS_ DI	STS_ GATE

X = reserved

Table 48: Structure of the data bytes in measurement mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Status)	STS_ DN	STS_ UP	X	X	STS_ DO1	X	STS_ DI	STS_ GATE

X = reserved

Table 49: Meaning of the data bits

Designation	Description
STS_DN	1: Status direction down.
STS_UP	1: Status direction up.
STS_DO2	Only count mode: The DO2 status bit indicates the status of digital output DO2. → "Behaviour of the digital outputs DO1/DO2"
STS_DO1	The DO1 status bit indicates the status of digital output DO1. → "Behaviour of the digital outputs DO1/DO2"
STS_DI	The DI status bit indicates the status of digital input DI. → "Behaviour of the DI digital input"
STS_GATE	1: Counting/measuring operation running. → "Software gate and hardware gate"

Object 5803_{hex} Encoder Flags

Object 5803_{hex} supplies the following status messages in count mode:

- Status zero crossing
- Status lower count limit
- Status upper count limit
- Status comparator 1
- Status comparator 2
- Status synchronization

The following status messages are supplied in measurement mode:

- Value below lower measuring limit
- Value above upper measuring limit
- Measuring terminated

All status messages are reset by writing object 5803_{hex} with any value. If the condition for setting continues, the corresponding bit remains set.

Table 50: Object 5803_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Flags
Object Code		ARRAY
PDO Mapping		Yes
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rwr

Feature	Sub-Index	Description/value
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 51: Structure of the data bytes in count mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	STS_ ND	STS_ UFLW	STS_ OFLW	STS_ CMP2	STS_ CMP1	X		STS_ SYN

X = reserved

Table 52: Meaning of the data bits in count mode

Designation	Description
STS_ND	Status zero crossing Set on crossing zero in counter range when counting without main direction.
STS_UFLW	Status lower count limit Set if the count value goes below the lower count limit (→ "Object 6C01hex Work Area Low Limit").
STS_OFLW	Status upper count limit Set if the counter goes above the upper count limit (→ "Object 6C02hex Work Area High Limit").
STS_CMP2	Status comparator 2 This status bit indicates a comparison result for comparator 2 if: The output DO2 is released with CTRL_DO2 = 1 and via Function DO2: 001 On when cnt. value ≧ ref. value 010 On when cnt. value ≦ ref. value 011 Pulse if cnt. value = ref. value A comparison is executed. Otherwise STS_CMP2 simply indicates that the output is or was set. STS_CMP2 is also set if DO2 SET_DO2 = 1 when the output is not released.

Designation	Description
STS_CMP1	Status comparator 1 This status bit indicates a comparison result for comparator 1 if: The output DO1 is released with CTRL_DO1 = 1 and via Function DO1: 001 On when cnt. value ≧ ref. value 010 On when cnt. value ≧ ref. value 011 Pulse if cnt. value = ref. value A comparison is executed. Otherwise STS_CMP1 simply indicates that the output is or was set. STS_CMP1 is also set if DO1 SET_DO1 = 1 when the output is not released.
STS_SYN	Status synchronization After synchronization is successfully completed the STS_SYN status bit is set.

Table 53: Structure of the data bytes in measurement mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	STS_ UFLW	STS_ OFLW	X	STS_ CMP1	X	X	X

X = reserved

Table 54: Meaning of the data bits in measurement mode

Designation	Description
STS_UFLW	1: The lower measuring limit was undershot.
STS_OFLW	1: The upper measuring limit was exceeded.
STS_CMP1	1: Measuring terminated The measured value is updated with every elapsed time interval. The end of a measurement (expiry of the time interval) is indicated with the status bit STS_CMP1.

Object 5804_{hex} Encoder Diag

Object 5804_{hex} reads the diagnostics byte of the XI/ON counter module. A short/open circuit and error are indicated when configured.

Table 55: Object 5804_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Diag
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	ro
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 56: Meaning of the data bits in count mode

Bit	Diagnostics message	Meaning Count mode
0	Short-/open circuit	Short-/open circuit
1	short-/open circuit ERR_DO	Short-circuit sensor supply

Bit	Diagnostics message	Meaning Count mode
2	Bit 2:Parameter error	The following parameter errors are indicated: Upper count limit = lower count limit Upper count limit ≦ lower count limit Upper count limit < 0 The numerical values are displayed as two's complement values. The permissible range for the upper count limit is therefore: $0_{hex....}$7FFF FFFD$_{hex}$; 7FFF FFFE$_{hex}$; 7FFF FFFF$_{hex}$ The decimal value range for this SINT value is: 0...2147483645; 2147483646; 2147483647
3	Bit 3:Parameter error	The following parameter errors are indicated: Lower count limit = upper count limit Lower count limit ≧ upper count limit Lower count limit > 0 The numerical values are displayed as two's complement values. The permissible range for the lower count limit is therefore: 8000 0000$_{hex}$...FFFF FFFE$_{hex}$; FFFF FFFF$_{hex}$; 0_{hex} The decimal value range for this SINT value is: -2147483648...-2,-1.0
4	Bit 4:Parameter error	Inverting the digital input signal with the Latch Retrigger function is not permissible. → "Latch retrigger function"
5	Bit 5:Parameter error	The value (11) for selecting the main count direction is incorrect. Permissible values: 00 None 01 Up 10 Down

Bit	Diagnostics message	Meaning Count mode
6	operating mode wrong	The value (XXXX11) for selecting the operating mode is incorrect. Permissible values for count mode: 000000 Continuous count 000001 Single-action count 000010 Periodical count Permissible values for measurement mode: 100000 Frequency measurement 100001 Revolutions measurement 100010 Period duration measurement
7	Measurement mode	This message is always shown in conjunction with other diagnostics messages and indicates that measurement mode is active. This message never occurs in count mode.

Table 57: Meaning of data bits in measurement mode

Bit	Diagnostics message	Meaning Measurement mode
0	Short-/open circuit	Short-/open circuit
1	short-/open circuit ERR_DO	Short-circuit sensor supply
2	Bit 2:Parameter error	This error signal refers to the parameter value Sensor pulses per revolution. The latest configuration tools prevent an incorrect value from being entered.
3	Bit 3:Parameter error	The value for the integration time is incorrect. The permissible value range is: 1 to 1000 This enables permissible integration times (frequency measurement/revolutions measurement) from 10 ms to 10 000 ms in 10 ms increments and for period duration measurement averaging over 1 to 1000 periods. → "Object 5820hex Measuring Integration Time"
4	Bit 4:Parameter error	The value for the upper limit is incorrect. Permissible value range: 1 to 16777215
5	Bit 5:Parameter error	The value for the lower limit is incorrect. Permissible value range: 0 to 16777214
6	operating mode wrong	The value (XXXX11) for selecting the operating mode is incorrect. Permissible values for count mode: 000000 Continuous count 000001 Single-action count 000010 Periodical count Permissible values for measurement mode: 100000 Frequency measurement 100001 Revolutions measurement 100010 Period duration measurement
7	Measurement mode	This message is always shown in conjunction with other diagnostics messages and indicates that messages refer to an active measurement mode.

Object 5805_{hex} SSI Native Status

Object 5806_{hex} SSI Optional Enc Status

→ These objects have no function on the XN-1CNT-24VDC module.

Object 5808_{hex} Encoder Control

The object 5808_{hex} has the following control functions:

- Release/set the digital outputs
- Start/stop counting/measuring
- Release synchronization

Table 58: Object 5808_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Control
Object Code		ARRAY
PDO Mapping		Yes
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rww
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 59: Structure of the data bytes in count mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	CTRL_ DO2	SET_ DO2	CTRL_ DO1	SET_ DO1	X	CTRL_ SYN	SW_ GATE

X = reserved

Table 60: Structure of the data bytes in measurement mode

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	X	CTRL_ DO1	SET_ DO1	X		SW_ GATE

X = reserved

Table 61: Meaning of the data bits

Designation	Description
CTRL_ DO2	0: The virtual[1)] output DO2 is blocked.
	1: The virtual[1)] output DO2 is released. → "Behaviour of the digital outputs DO1/DO2"
SET_ DO2	If CTRL_DO2 = 1 and the virtual [1)] output DO2 is set to indicate the value SET_DO2, DO2 can be set and reset directly with SET_DO2. The parameter definition of DO2 for this function can be carried out via object 5801_{hex}. The default setting for DO2 is to indicate the status of SET_DO2. → "Behaviour of the digital outputs DO1/DO2"
CTRL_DO1	0: The output DO1 is blocked.
	1: The output DO1 is released. → "Behaviour of the digital outputs DO1/DO2"

Designation	Description
SET_DO1	If CTRL_DO1 = 1 and the physical output DO1 is set to indicate the value SET_DO1, DO1 can be set and reset directly with SET_DO1. The parameter definition of DO2 for this function can be carried out via object 5801_{hex}. The default setting for DO1 is to display the value of SET_DO1. → "Behaviour of the digital outputs DO1/DO2"
CTRL_SYN	Release synchronization 1: 0 → 1 (rising edge) at the physical DI input enables the counter value to be set (synchronized) once/periodically to the load value. Single-action/periodical is selected in object 5800_{hex}. → "Synchronization"
SW_GATE	0 → 1: Counting/measuring is started (release). 1 → 0: Counting/measuring is stopped. The starting and stopping of the counting/measuring operation with a data bit is called the "SW gate". The HW gate is also provided in addition for stopping and starting the counting/measuring operation via the DI hardware input. If this option is set (function DI in → "Object 5800hex Encoder Basic Mode"), a positive signal must be present at DI in order to activate the SW gate (logical AND operation). → "Software gate and hardware gate"

1) Unlike the physical digital output DO1, output DO2 is only a data value that is indicated with the data bit STS_DO2.

Object 5810_{hex} Encoder Load Prepare Value

Object 5810_{hex} contains the load value for Load in preparation in count mode, i.e. the event-driven setting of the counter value is set to this value:

- This load value is accepted as the new counter value in response to any of the following events:
  - Lower or upper count limit is reached when no main count direction has been configured.
  - Reaching the upper count limit with the main count direction set to up counting.
  - Reaching the lower count limit with the main count direction set to down counting.

Main count direction: → "Object 5800hex Encoder Basic Mode"

The required handshake with the counter module is carried out by the XI/ON gateway.

The parameter can be stored retentively in the gateway and is restored with every node reset.

→ The object 5810_{hex} is only valid if the counter module is operating in count mode.

Table 62: Object 5810_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Load Prepare Value
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw

Feature	Sub-Index	Description/value
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5811_{hex} Encoder Pulse Width

Object 5811_{hex} is used to set the pulse duration for digital outputs DO1 and DO2.

A pulse is generated at outputs DO1 and DO2 in count mode if:

Function DO1/Function DO2:
Pulse on count value = Comp. value

is set (→ "Object 5801hexEncoder Config") and the values are equal.

Write accesses initiate a parameter update on the XI/ON internal module bus.

The parameter is stored retentively in the gateway and is restored with every node reset.

In object 5811_{hex} the time is entered in milliseconds. The value range can be set in 2 ms increments between 0 ms to 510 ms.

→ "Pulse duration on reaching the reference value"

→ The object 5811_{hex} is only valid if the counter module is operating in count mode.

Table 63: Object 5811_{hex} Description

Feature	Sub-Index	Description/value
Name		Encoder Pulse Width
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned16
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5820_{hex} Measuring Integration Time

Object 5820_{hex} is used to set the Integration time for measurement mode. Permissible values are: 1 to 1000.

In **Frequency measurement** mode the module counts the pulses that are received in the defined integration time and calculates an average frequency from this. The value range for the integration time can be set in 10 ms increments between 10 ms to 10000 ms.

In **revolutions measurement mode** the counter module counts the pulses received from a rotary sensor within a predefined integration time. The number of "sensor pulses per revolution" must be defined beforehand by parameters in the system. The number of "sensor pulses per revolution" and the pulses counted determines the speed of the connected motor. The value range for the integration time can be set in 10 ms increments between 10 ms to 10000 ms.

In **period duration measurement mode** the counter module measures the time between two rising edges of the counter signal in ms by counting the pulses of an exact internal quartz crystal reference frequency (1 MHz). An averaging operation can be carried out over 1 to 1 000 periods. The number of periods is defined by the Integration time parameter.

Write accesses initiate a parameter update on the XI/ON internal module bus.

The parameter is stored retentively in the gateway and is restored with every node reset.

The object 5820_{hex} is only valid if the counter module is operating in measurement mode.

Table 64: Object 5811_{hex} Description

Feature	Sub-Index	Description/value
Name		Measuring Integration Time
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5821_{hex} Measuring Low Limit

Object 5821_{hex} is used to set the lower measuring limit for the counter module.

Permissible value range: 0 to 16777214

Write accesses initiate a parameter update on the XI/ON internal module bus.

The parameter is stored retentively in the gateway and is restored with every node reset.

→ The object 5821_{hex} is only valid if the counter module is operating in measurement mode.

Table 65: Object 5821_{hex} Description

Feature	Sub-Index	Description/value
Name		Measuring Low Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5822_{hex} Measuring High Limit

Object 5822_{hex} is used to set the upper measuring limit for the XI/ON counter module.

Permissible value range: 1 to 16777215

Write accesses initiate a parameter update on the XI/ON internal module bus.

The parameter is stored retentively in the gateway and is restored with every node reset.

→ The object 5822_{hex} is only valid if the counter module is operating in measurement mode.

Table 66: Object 5822_{hex} Description

Feature	Sub-Index	Description/value
Name		Measuring High Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5823_{hex} Measuring Units Per Revolution

Object 5823_{hex} is used to set the sensor pulses per revolution for the XI/ON counter module.

→ Chapter "Revolutions measurement"

Write accesses initiate a parameter update on the XI/ON internal module bus.

The parameter is stored retentively in the gateway and is restored with every node reset.

Permissible value range: 1 to 65535

→ The object 5823_{hex} is only valid if the counter module is operating in measurement mode.

Table 67: Object 5823_{hex} Description

Feature	Sub-Index	Description/value
Name		Measuring Units Per Revolution
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned16
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 5840_{hex} SSI Diag Mapping

→ This object has no function on the XN-1CNT-24VDC module.

Object 6800_{hex} Operating Parameters

→ Object 6800_{hex} (corresponds to object 6000_{hex} in accordance with CiA DS-406) has no meaning with XI/ON, and only exists because it is a "mandatory" object in accordance with DS406.

Object 6810_{hex} Load Value For Multi-Sensor Devices

Object 6810_{hex} (corresponds to object 6010_{hex} in accordance with CiA DS-406) writes the direct load value for the counter module.

→ "Load value direct/in preparation"

The output values in the subindices of object 6820_{hex} are set to the values of the corresponding subindices of object 6810_{hex}.

→ The object 6810_{hex} is only valid if the counter module is operating in count mode.

Table 68: Object 6810_{hex} Description

Feature	Sub-Index	Description/value
Name		Preset Value For Multi-Sensor Devices
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object 6820_{hex} Position Value For Multi-Sensor Devices

Object 6820_{hex} (corresponds to object 6020_{hex} in accordance with CiA DS-406) contains the count value or measured value of the counter module.

Table 69: Object 6820_{hex} Description

Feature	Sub-Index	Description/value
Name		Position Value For Multi-Sensor Devices
Object Code		ARRAY
PDO Mapping		Yes
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	ro
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object $6B00_{hex}$ CAM 1 State Register

Object $6B00_{hex}$ (corresponds to object 6300_{hex} in accordance with CiA DS-406) indicates whether the current counter status is within a specified range. This range is limited by CAM1 Low Limit (object $6B10_{hex}$) and CAM1 High Limit (object $6B20_{hex}$).

On the XI/ON counter module the behaviour is only defined in accordance with CiA DS-406 by means of the appropriate configuration and operating mode selection:

- Operating mode is set to Counting
- The operating mode for DO1 is set to Switch on when counter status <= reference value1.
- The operating mode for DO2 is set to Switch on when counter status >= reference value2.
- The release bits for DO1 and DO2 are set.

The following should be observed:

- The object $6B10_{hex}$ "CAM1 Low Limit" corresponds to reference value2 of the XI/ON counter module.
- The object $6B20_{hex}$ "CAM1 High Limit" corresponds to reference value1 of the XI/ON counter module.
- These two reference values 1 and 2 are assigned to outputs DO1 and DO2.
- The object $6B00_{hex}$ "CAM 1 State Register" supplies the result of the AND operation of the two outputs DO1 and DO2.

→ The object $6B00_{hex}$ is only valid if the counter module is operating in count mode.

Table 70: Object $6B00_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 State Register
Object Code		ARRAY
PDO Mapping		Yes
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	ro
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 71: Structure of the data byte

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	X	X	X	X	X	STAT_CAM1

Table 72: Meaning of the data bits

Designation	Description
STAT_CAM1	0[1)]: The counter status is in the following range: Reference value2 ≦ counter status ≧ reference value1 or the conditions for activating this status message have not been fulfilled.
	1[1)]: The counter status is outside the following range: Reference value2 ≦ counter status ≧ reference value1

1): The values can be inverted using object $6B02_{hex}$

Object $6B01_{hex}$ CAM 1 Release Register

The object $6B01_{hex}$ releases or blocks the status message for the comparison result (object $6B00_{hex}$):

Reference value2 ≦ counter status ≧ reference value1

Other configuration settings are required in order to activate the status message for the comparison result
→ "Object 6B00hex CAM 1 State Register"

Table 73: Object $6B01_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 Release Register
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 74: Structure of the data byte

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	X	X	X	X	X	EN_ CAM1

Table 75: Meaning of the data bits

Designation	Description
EN_CAM1	0: The object $6B00_{hex}$ is blocked.
	1: The object $6B00_{hex}$ is released.

Object $6B02_{hex}$ CAM 1 Polarity Register

The object $6B02_{hex}$ can invert the status message for the comparison result (object $6B00_{hex}$):

Reference value2 ≦ counter status ≧ reference value1.

→ "Object 6B00hex CAM 1 State Register"

Table 76: Object $6B02_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 Polarity Register
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	0_{hex}

Table 77: Structure of the data byte

	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	X	X	X	X	X	X	X	POL_ CAM1

Table 78: Meaning of the data bits

Designation	Description
POL_CAM1	0: The status message of the object $6B00_{hex}$ is not inverted.
	1: The status message of the object $6B00_{hex}$ is inverted.

Object $6B10_{hex}$ CAM1 Low Limit

The object $6B10_{hex}$ corresponds to reference value2 of the XI/ON counter module. The following comparisons can be configured (5801_{hex}):

- Count value ≧ reference value2
- Count value ≦ reference value2
- Count value = reference value2

→ "Behaviour of the digital outputs DO1/DO2"

The object is the same as object 6310_{hex} in accordance with CiA DS-406 which defines a lower switch limit for the count range. The reference value2 must be a lower limit if evaluation is to be carried out using object $6B00_{hex}$.

Object $6B10_{hex}$ is assigned output DO2.

→ The object $6B10_{hex}$ is only valid if the counter module is operating in count mode.

Table 79: Object $6B01_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 Low Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object $6B20_{hex}$ CAM1 High Limit

The object $6B20_{hex}$ corresponds to reference value1 of the XI/ON counter module. The following comparisons can be configured (5801_{hex}):

- Count value ≧ reference value1
- Count value ≦ reference value1
- Count value = reference value1

→ "Behaviour of the digital outputs DO1/DO2"

The object is the same as object 6320_{hex} in accordance with CiA DS-406 which defines an upper switch limit for the count range. The reference value1 must be an upper limit if evaluation is to be carried out using object $6B00_{hex}$.

Object $6B20_{hex}$ is assigned output DO1.

→ The object $6B20_{hex}$ is only valid if the counter module is operating in count mode.

Table 80: Object $6B20_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 High Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	0000_{hex}

Object $6B30_{hex}$ CAM1 Hysteresis

The object $6B30_{hex}$ (corresponds to object 6330_{hex} in accordance with CiA DS-406) defines a hysteresis value for reference value2 (CAM1 Low Limit - Object $6B10_{hex}$) and reference value1 (CAM1 High Limit Object $6B20_{hex}$).

→ "Hysteresis for digital output DO1/DO2"

→ The object $6B30_{hex}$ is only valid if the counter module is operating in count mode.

Table 81: Object $6B30_{hex}$ Description

Feature	Sub-Index	Description/value
Name		CAM 1 Hysteresis
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned16
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object $6C00_{hex}$ Area State Register

The object $6C00_{hex}$ (corresponds to object 6400_{hex} in accordance with CiA DS-406) contains two status bits that indicate the count value going below the lower count limit (object $6C01_{hex}$ Work Area Low Limit) and above the upper count limit (object $6C02_{hex}$ Work Area High Limit). The status bit are stored in a non-volatile memory. All status messages are reset by writing object 5803_{hex} with any value. Object 5803_{hex} contains the two redundant status bits (STS_OFLOW, STS_UFLOW).

→ Page 15, Page 19, Page 23

→ The object $6C00_{hex}$ is only valid if the counter module is operating in count mode.

Table 82: Object $6C00_{hex}$ Description

Feature	Sub-Index	Description/value
Name		Area State Register
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Unsigned8
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	ro
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Table 83: Structure of the data byte

Work Area State							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
X					STS_UFLW	STS_OFLW	X

X = reserved

Table 84: Meaning of the data bits

Designation	Description
STS_UFLW	Status lower count limit Set if the count value goes below the lower count limit. This bit must be reset by writing object 5803_{hex} with any value.
STS_OFLW	Status upper count limit Set if the counter goes above the upper count limit. This bit must be reset by writing object 5803_{hex} with any value.

Object $6C01_{hex}$ Work Area Low Limit

Object $6C01_{hex}$ (corresponds to object 6401_{hex} in accordance with CiA DS-406) defines the value for the lower count limit. In the event of an underflow, bit 2 in object $6C00_{hex}$ and bit 6 in object 5803_{hex} are set.

The permissible range for the lower count limit is therefore:

-2147483648 to 0

(hexadecimal:8000 0000_{hex} to 0_{hex})

→ The object $6C01_{hex}$ is only valid if the counter module is operating in count mode.

Table 85: Object $6C01_{hex}$ Description

Feature	Sub-Index	Description/value
Name		Work Area Low Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object $6C02_{hex}$ Work Area High Limit

Object $6C02_{hex}$ (corresponds to object 6402_{hex} in accordance with CiA DS-406) defines the value for the upper count limit. In the event of an underflow, bit 1 in object $6C00_{hex}$ and bit 5 in object 5803_{hex} are set.

The permissible range for the upper count limit is therefore:

0 to 2147483647

(hexadecimal:0_{hex} to 7FFF $FFFF_{hex}$)

→ The object $6C02_{hex}$ is only valid if the counter module is operating in count mode.

Table 86: Object $6C02_{hex}$ Description

Feature	Sub-Index	Description/value
Name		Work Area High Limit
Object Code		ARRAY
PDO Mapping		No
Data type	Sub-Index 00_{hex}	Unsigned8
	Sub-Index 01_{hex} to 47_{hex}	Integer32
Access	Sub-Index 00_{hex}	ro
	Sub-Index 01_{hex} to 47_{hex}	rw
XI/ON default value	Sub-Index 00_{hex}	No
	Sub-Index 01_{hex} to 47_{hex}	No

Object $6D00_{hex}$ Operating Status

Object $6D01_{hex}$ SingleTurn resolution (rotary), Measuring step (linear)

Object $6D02_{hex}$ Number of distinguishable revolutions

→ The objects $6D00_{hex}$ to $6D02_{hex}$ (correspond to the objects 6500_{hex} to 6502_{hex} in accordance with CiA DS-406) have no meaning for XI/ON and only exist because they are mandatory objects in accordance with DS-406. With XI/ON the objects are always set to 0.

Object $6FFF_{hex}$ Device Type

Object $6FFF_{hex}$ (corresponds to object $67FF_{hex}$ in accordance with CiA DS-406) specifies the type of the second device profile supported. The object is assigned the value 000A 0196_{hex}. The Low word ($0196_{hex} = 406_{dec}$) specifies the device profile. The High Word ($000A_{hex}$) describes the encoder type to CiA DS-406 (10_{dec} = Multi Sensor Encoder Interface).

Table 87: Object $6FFF_{hex}$ Description

Feature	Description/value
Name	Device Type
Object Code	VAR
PDO Mapping	No
Data type	Unsigned32
Access	ro

Emergencies

The following CANopen emergencies can be triggered by an XN-1CNT-24VDC module:

Designation	Meaning	Byte 0/1 Error Code	Byte 2 Error Register	Byte 3 Additional information	Byte 4 Additional information
Output current too high	Output current is too high	2310_{hex}	Bit 1 (current fault)	Module number	Channel number
Output current out of range	The output current is outside the permissible range	2323_{hex}	Bit 1 (current fault)	Module number	Channel number

Bytes 5, 6, 7 of the Emergency frame are unused and are therefore always 0.

Parameter overview

Table 88: Parameter list for counter modules (per chn.)

Module/Parameter	Object	Sub-Index	Byte	Bit
XN-1CNT-24VDC/count mode				
Operating mode				
Operating mode	5800_{hex}	0xh	0	5 to 0
Release function			1	0
Digital input DI				1
Function DI				3 to 2
Synchronization				4
Main count direction				6 to 5
Count limits				
Lower count limit	$6C01_{hex}$	0xh	0 to 3	
Upper count limit	$6C02_{hex}$	0xh	0 to 3	
Hysteresis	$6B30_{hex}$	0xh	0 to 1	
Pulse duration DO1/DO2	5811_{hex}	0xh	0 to 1	
Configuration				
Substitute value DO1	5801_{hex}	0xh	0	0
Diagnostics DO1				1
Function DO1				4 to 2
Function DO2				7 to 5
Signal evaluation (A,B)			1	1 to 0
Sensor/Input filter (A)				2
Sensor/Input filter (B)				3
Sensor/Input filter (DI)				4
Sensor (A)				6 to 5
Direction input (B)				7
Group diagnostics			2	0
Behaviour CPU/Master STOP				5 to 4

Module/Parameter	Object	Sub-Index	Byte	Bit
XN-1CNT-24VDC/measurement mode				
Operating mode				
Operating mode	5800_{hex}	0xh	0	5 to 0
Digital input DI			1	1
Function DI				3 to 2
Measuring range limits				
Lower limit	5821_{hex}	0xh	0 to 3	
Upper limit	5822_{hex}	0xh	0 to 3	
Integration time	5820_{hex}	0xh	0 to 3	
Sensor pulses per revolution	5823_{hex}	0xh	0 to 1	
Configuration				
Substitute value DO1	5801_{hex}	0xh	0	0
Diagnostics DO1				1
Function DO1				4 to 2
Signal evaluation (A,B)			1	1 to 0
Sensor/Input filter (A)				2
Sensor/Input filter (B)				3
Sensor/Input filter (DI)				4
Sensor (A)				6 to 5
Direction input (B)				7
Group diagnostics			2	0
Behaviour CPU/Master STOP				5 to 4

Table 89: Parameter list for counter modules (per channel)

Module/Parameter	Object	Value	Meaning
XN-1CNT-24VDC/count mode			
Operating mode			
Operating mode	5800_{hex}	000000	Continuous count[1)]
		000001	Single-action count
		000010	Periodical count
Release function		0	Abort count operation[1)]
		1	Interrupt count operation
Digital input DI		0	Normal[1)]
		1	Inverted
Function DI		00	Input[1)]
		01	Hardware release (HW gate)
		10	Latch retrigger function when edge positive
		11	Synchronization when edge positive
Synchronization		0	Single-action[1)]
		1	Periodical
Main count direction		00	None[1)]
		01	Up counting
		10	Down counting
Count limits			
Lower count limit	$6C01_{hex}$	0 to -2147483648[1)]	Lower counter limit for channel x
Upper count limit	$6C02_{hex}$	0 to 2147483647[1)]	Lower counter limit for channel x
Hysteresis	$6B30_{hex}$	01[1)] to 255	Hysteresis for channel x

Module/Parameter	Object	Value	Meaning
Pulse duration DO1/DO2	5811_{hex}	0 to 255 / 1[1)]	Pulse duration for DO1 and DO2 for channel x (n*2 ms)
Configuration			
Substitute value DO1	5801_{hex}	0	01[1)]
		1	1
Diagnostics DO1		0	On[1)]
		1	Off
Function DO1		000	Output[1)]
		001	On when cnt. value ≧ ref. value
		010	On when cnt. value ≦ ref. value
		011	Pulse if cnt. value = ref. value
Function DO2		000	Output[1)]
		001	On when cnt. value ≧ ref. value
		010	On when cnt. value ≦ ref. value
		011	Pulse if cnt. value = ref. value
Signal evaluation (A,B)		00	Pulse and direction[1)]
		01	Single-evaluation rotary sensor
		10	Double-evaluation rotary sensor
		11	Fourfold-evaluation rotary sensor
Sensor/Input filter (A)		0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)

Module/Parameter	Object	Value	Meaning
Sensor/Input filter (B)	5801_{hex}	0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)
Sensor/Input filter (DI)		0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)
Sensor (A)		00	Normal[1)]
		01	Inverted
Direction input (B)		0	Normal[1)]
		1	Inverted
Group diagnostics		0	Release [1)]
		1	Block
Behaviour CPU/Master STOP		00	turn off DO1[1)]
		01	Proceed with operating mode
		10	Switch substitute value DO1
		11	DO1 hold last value

Module/Parameter	Object	Value	Meaning
XN-1CNT-24VDC/measurement mode			
Operating mode			
Operating mode	5800_{hex}	10000	frequency measurement[1)]
		10001	revolutions measurement
		10010	period duration measurement
Digital input DI		0	Normal[1)]
		1	Inverted
Function DI		00	Input[1)]
		01	Hardware release (HW gate)
Measuring range limits			
Lower limit	5821_{hex}	0[1)] to 16777214×10^{-3}	Lower measuring limit for channel x
Upper limit	5822_{hex}	0 to 16777215×10^{-3} [1)]	Upper measuring limit for channel x
Integration time	5820_{hex}	1 to 1000/10[1)]	Integration time (n*10 ms) frequency measurement
		1 to 1000/10[1)]	Integration time (n*10 ms) frequency measurement
		1 to 1000/10[1)]	Number of periods for periods duration measurement
Sensor pulses per revolution	5823_{hex}	1[1)] to 65535	Sensor pulses for channel x

Module/Parameter	Object	Value	Meaning
Configuration			
Substitute value DO1	5801_{hex}	0	0[1)]
		1	1
Diagnostics DO1		0	On[1)]
		1	Off
Function DO1		000	Output[1)]
		001	Outside of the set limits
		010	Below the lower limit
		011	Above the upper limit
Signal evaluation (A,B)		00	Pulse and direction[1)]
		01	Single-evaluation rotary sensor
Sensor/Input filter (A)		0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)
Sensor/Input filter (B)		0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)
Sensor/Input filter (DI)		0	2.5 µs (200 kHz)[1)]
		1	25 µs (20 kHz)
Sensor (A)		00	Normal[1)]
		01	Inverted
Direction input (B)		0	Normal[1)]
		1	Inverted
Group diagnostics		0	Release [1)]
		1	Block

Module/Parameter	Object	Value	Meaning
Behaviour CPU/Master STOP	5801_{hex}	00	turn off DO1[1)]
		01	Proceed with operating mode
		10	Switch substitute value DO1
		11	DO1 hold last value

1) Default values

Index