Operating Manual

Signal converter FP210 / IP210 / PP210 / ZP210

Frequency (FP210) SSI absolute value (IP210) Start-Stop (PP210) Pulse counter (ZP210)	→	Parallel (25 Bit)

Product features:

- Multifunctional unit with several operating modes for incremental encoders or SSI absolute encoders
- For incremental encoders:
  Operating modes as frequency converter or position transducer (pulse counter)
  Universal incremental inputs (HTL/TTL/RS422) for NPN/PNP/NAMUR encoders and sensors
  Functions such as linkages (eg. A+B), scaling, filters,…
  Input frequencies up to 1 MHz
- For SSI absolute encoders:
  Master or Slave operation with clock frequencies up to 1 MHz
  For single turn and multi turn encoders with SSI formats from 10 … 32 Bit
  Functions such as bit suppression, round-loop function, scaling, …
- For absolute and magnetostrictive position encoder with Start-Stop-Interface:
  Operating modes for master or slave, for position, angle and speed measurement
- USB interface for configuration
- Extremely short conversion times
- Linearization with 24 control points
- Auxiliary voltage output 5 and 24VDC for encoder supply
- Compact rail housing to EN60715
- Easy parameterization via user interface OS (Freeware)

Die deutsche Beschreibung ist verfügbar unter:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Zp210_d.pdf

The English description is available at:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Zp210_e.pdf

La description en français est disponible sur:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Zp210_f.pdf

The operator software OS (freeware) is available at:
https://www.motrona.com/en/support/software.html

Version:	Description:
ZP210_01a_oi/tgo/mbo April 20	First Version
ZP210_01b_oi/mbo April 20	First Revision
ZP210_02a_oi/tgo/October	Added parameter "Special PIN Function"

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1. Safety Instructions and Responsibility

1.1.   General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and <u>observe all safety and warning instructions!</u> Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2.   Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which have arisen through unsuitable and improper use.

Please note that device may only be installed in proper form and used in a technically perfect condition (in accordance to the Technical Specifications). The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3.   Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conform to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the Technical Specifications.

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage category II.

1.4. EMC Guidelines

All motrona devices are designed to provide high protection against electromagnetic interference. Nevertheless you must minimize the influence of electromagnetic noise to the device and all connected cables.

Therefore the following measures are mandatory for a successful installation and operation:

- **Use shielded cables for all signal and control input and output lines.**
- **Cables for digital controls (digital I/O, relay outputs) must not exceed a length of 30 m and are allowed for in building operation only**
- Use shield connection clamps to connect the cable shields properly to earth
- The wiring of the common ground lines must be star-shaped and common ground must be connected to earth at only one single point
- The device should be mounted in a metal enclosure with sufficient distance to sources of electromagnetic noise.
- Run signal and control cables apart from power lines and other cables emitting electromagnetic noise.

Please also refer to motrona manual "General Rules for Cabling, Grounding, Cabinet Assembly". You can download that manual by the link
https://www.motrona.com/en/support/general-certificates.html

1.5. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Compatibility Hint

This product is a successor model of the thousand fold proven converter type
IP251.
This converter is able to replace functionally the previous model; however some minor differences
have to be observed with regard to the parameter settings.
The main differences between this product and the respective predecessor model are listed below.

Differences of the IP210 compared to the previous model IP251 are:

	IP210	IP251
Operating mode	Extension of the parallel converter by additional operating modes. (Frequency, counter and start / stop to parallel converter.) Possible configurations for incremental inputs: RS422 (TTL), HTL Differential, HTL PNP, HTL NPN or TTL PNP (asymmetrical) The setting made in the corresponding parameter then applies to both inputs (A and B).	Exclusively SSI to parallel converter without switchable operating mode.
Control Inputs:	Number of inputs: 3 (freely configurable) Format: HTL	Number of inputs 1 (Hold) Format: HTL
Encoder Supply:	Output voltage: 5VDC u. 24VDC Output current: max. 250 mA	Not available
Serial Interface:	USB interface via mini USB connector Baud rate: 115200 baud Format: 8 none 1	RS232/RS485 via 9-position SUB-D connector Baud rate: 600, 1200, 2400, 4800, 9600, 19200, or 38400 Baud
Housing:	Dimensions (w x h x d): 23 x 102 x 102 mm Weight: approx. 100 g	Dimensions (w x h x d): 40 x 79 x 91 mm Weight: approx. 190 g
Device parameterization:	Only by operator software OS.	By operator software OS and partially via DIL switches

3. Introduction

The device is designed as a signal converter with control inputs, which converts the corresponding sensor or encoder information into a parallel signal. It is also possible to convert serial data to a parallel format. Its extensive functions and operating modes make it universally applicable.

3.1. Operating Mode

Basically all functions have to be configured in the parameter menu. The device can be used in the following operating modes:

- Operation as frequency converter for incremental input signals
- Operation as position transducer / counter for incremental input signals
- Operation as absolute value converter for SSI signals (replaces IP251)
- Operation as absolute value converter for signals of a start-stop interface

3.2. Function diagram
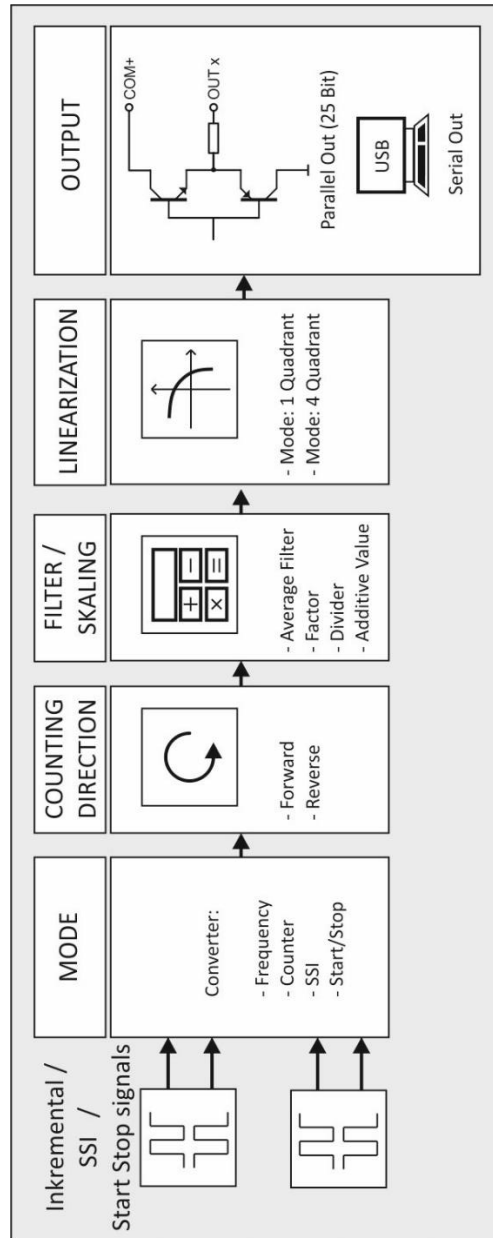
3.3. Power – LED / Error messages

The device has a green LED on its front foil. This lights up permanently as soon as the supply voltage of the device has been applied. If an error occurs, the LED flashes at 1 Hz.

If the error no longer exists, the LED automatically lights up again permanently and the parallel output responds to the current result.

The exact error can be read out via the serial interface via the user interface (OS).

($\rightarrow$ Variable: Error_Status, Code: "; 3")

The individual error codes are explained below:

Errorcode: (Error_Status)	Error identification:	Error description:
0x00000001	Maximum Value	SPECIAL PIN FUNCTION "Data-Bit / Data-Bit": Measured value is greater than + 16777215 (2^24-1) SPECIAL PIN FUNCTION "Error" or "Data – Stable": Measured value is greater than + 8388607 (2^23-1) SPECIAL PIN FUNCTION "Error" and "Data – Stable": (or negated accordingly) Measured value is greater than + 4194303 (2^22-1)
0x00000002	Minimum Value	SPECIAL PIN FUNCTION: "Data-Bit / Data-Bit": Measured value is less than + 16777216 (2^24) Special PIN FUNCTION "Error" or "Data – Stable": Measured value is less than - 8388608 (2^23) SPECIAL PIN FUNCTION "Error" and "Data – Stable": (or negated accordingly) Measured value is less than - 4194304 (2^22)
0x00000004	SSI Encoder Error	SSI error bit set (only for mode: SSI)
0x00000008	Encoder Fault	For internal test purposes only!
0x00000010	Frequency (Input A) out of range	Maximum or minimum permissible input frequency at input A has been exceeded or fallen below with the exponential filter setting used. (only for mode: Frequency)

Continuation **"Power-LED / Error messages"**:

0x00000020	Frequency (Input B) out of range	Maximum or minimum permissible input frequency at input B has been exceeded or fallen below with the exponential filter setting used. (only for mode: Frequency)
0x00000040	Start/Stop Encoder Error	No "start" and no "stop" pulse detected between two "init" pulses. (only for mode: Start/Stop) Check sensor connections!
0x00000080	Position Encoder Outside the Limit	No "stop" pulse detected between two "init" pulses. (only for mode: Start/Stop) Possible cause: No position sensor or position sensor outside the limits.

4. Electrical Connections

The terminal screws should be tightened with a slotted screwdriver (blade width 2mm).
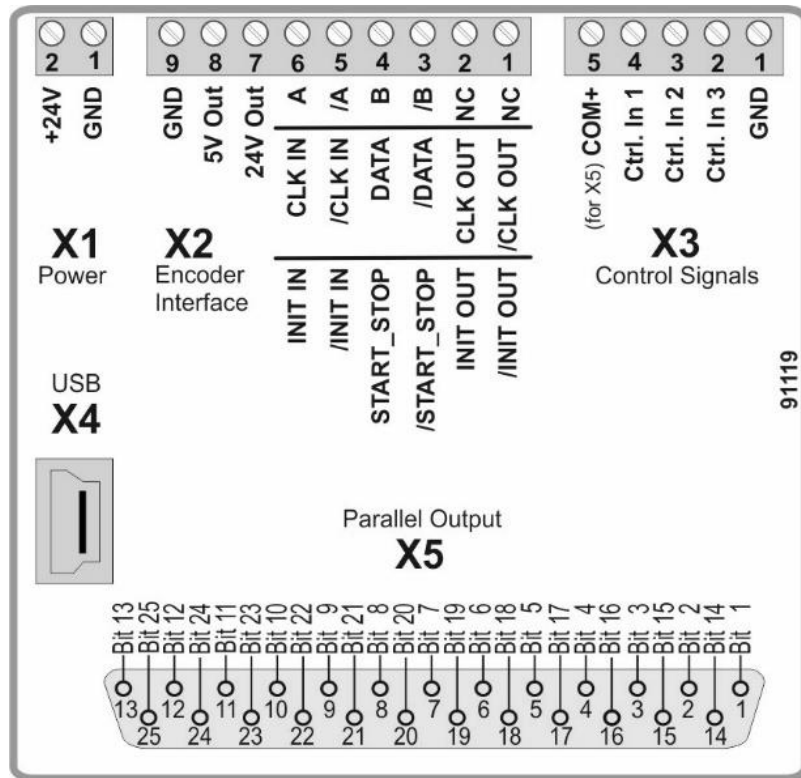
4.1. DC Power Supply (X1)

The unit accepts DC supply from 10 to 30 V at the terminals X1 1 and 2. The power consumption depends on the level of the supply voltage with aprox. 25 mA and the additional current required at the Auxiliary Voltage Output.

All GND terminals are internally interconnected.

4.2. Auxiliary voltage output (X2)

Two auxiliary voltages (24 VDC and 5 VDC) are available as encoder / sensor supply at terminal X2 pins 7, 8 and 9. The 24 VDC output voltage depends on the device supply (see technical data).

4.3.   Incremental encoder input (X2)

Terminal X2 pins 3, 4, 5 and 6 provide a connection for various incremental signals.

RS422
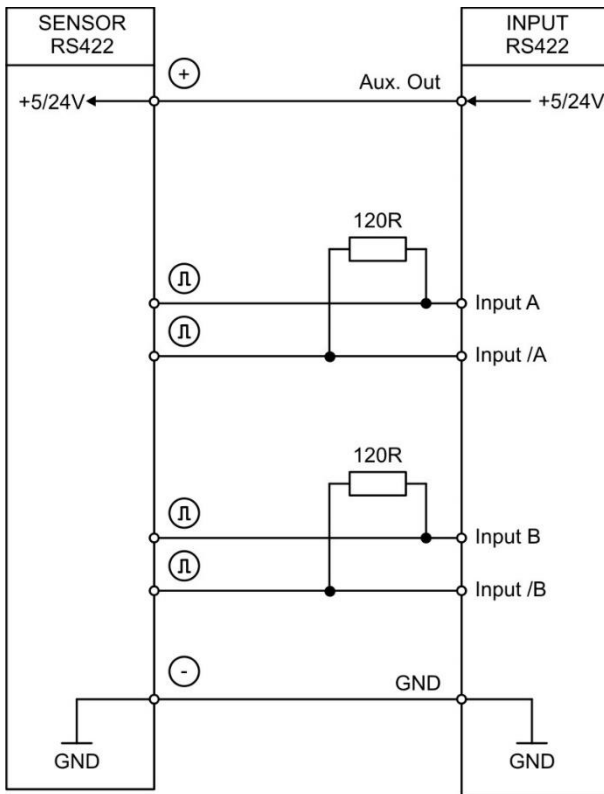
HTL DIFFERENTIAL
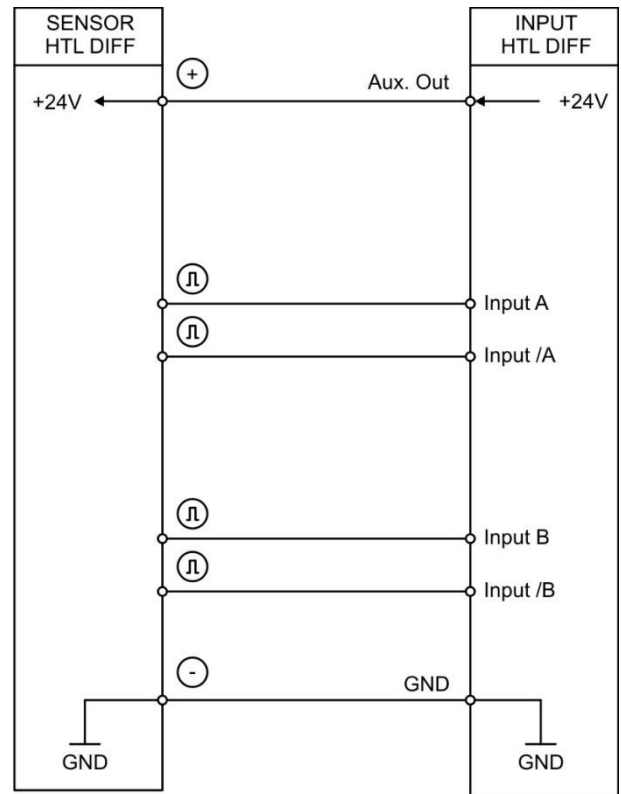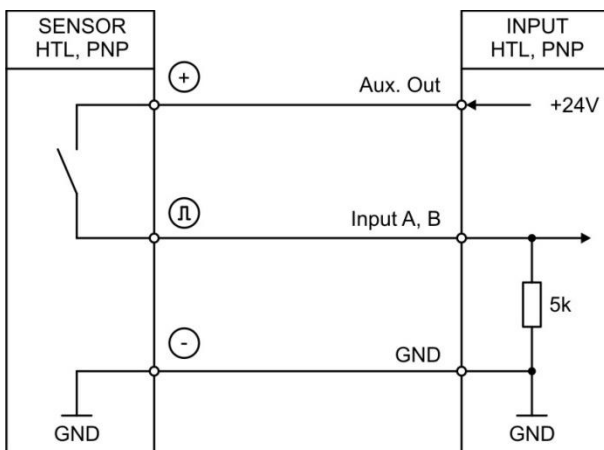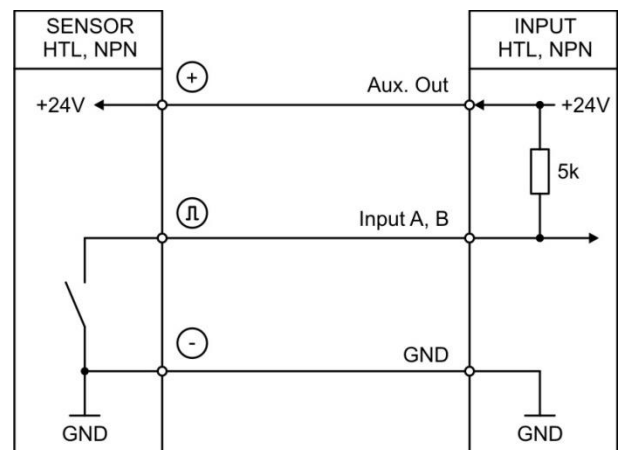
HTL PNP

HTL NPN

Continuation "**Incremental encoder input (X2)**":
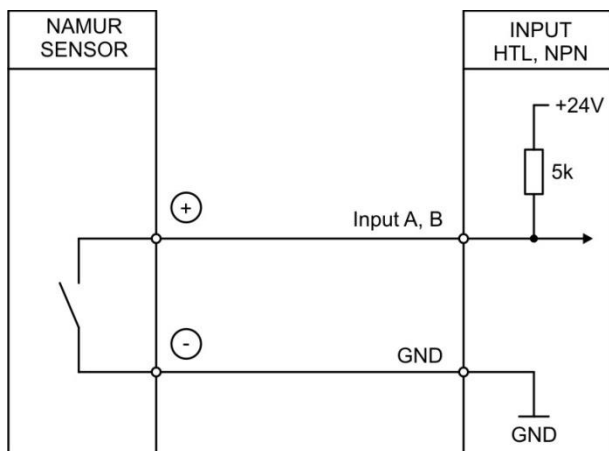
HTL NPN (NAMUR)   TTL (PNP)
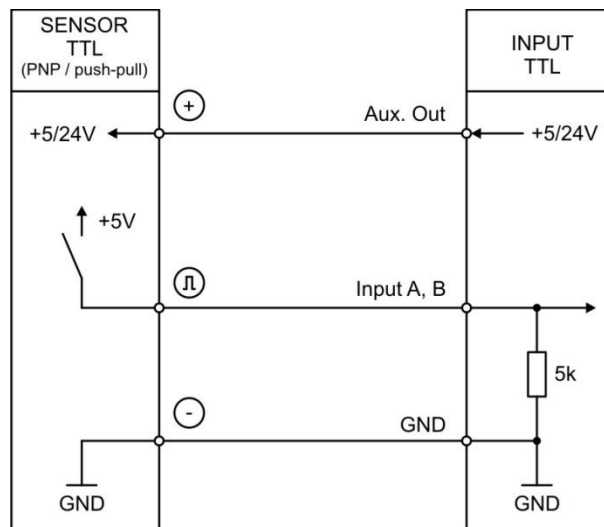
Unconnected PNP inputs are always "LOW" and unconnected NPN inputs are always "HIGH".
All inputs are designed to receive impulses from electrical impulse sources.

Notice for mechanical switching contacts:
When exceptionally mechanical contacts are used, please connect an external capacitor between
GND (-) and the corresponding input (+). A capacity of 10 µF will reduce the input frequency to
20 Hz and miscounting due to contact bouncing will be eliminated.

4.4. SSI-Absolute encoder input (X2)

At terminal X2 pin 1, 2, 3, 4 the SSI connection for the MODE MASTER is available.
At terminal X2 pin 3, 4, 5, 6 the SSI connection for the MODE SLAVE is available.

Connection for **MODE Master**:
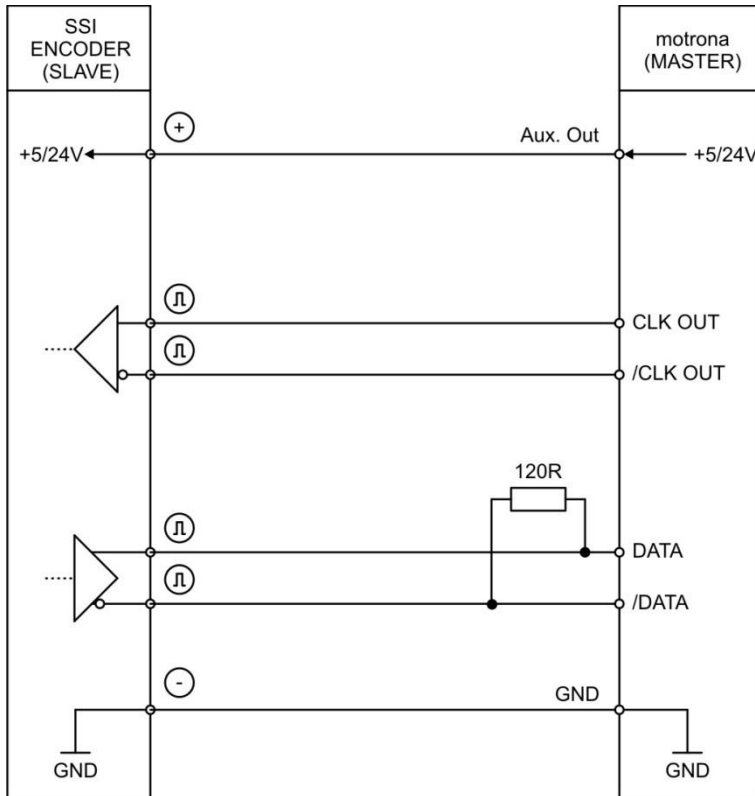
Continuation **"SSI-Absolute encoder input (X2)"**:

Connection for **MODE Slave**:
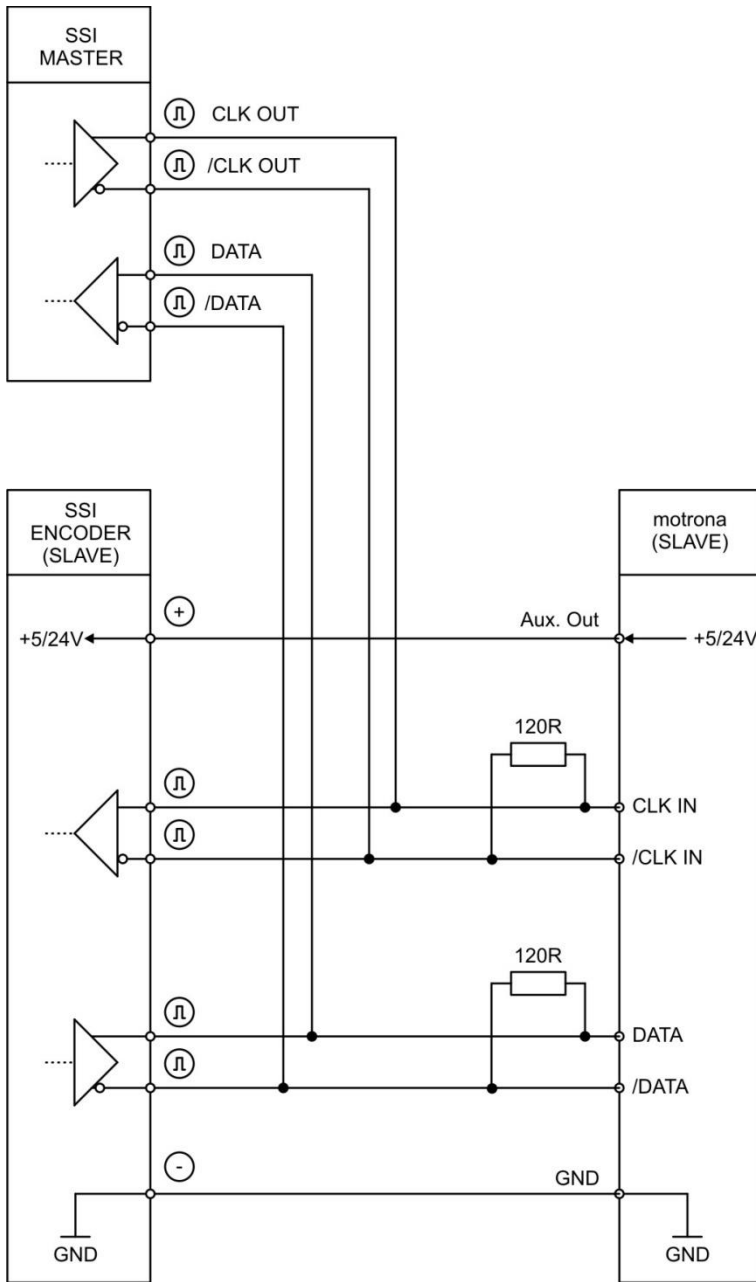
4.5.   Start-stop encoder inputs (X2)

At terminal X2 - Pin 1+2 the RS422 connection for the init pulse in "MODE MASTER" is available. (Device generates Init pulse itself!).
At terminal X2 - Pin 5+6 the RS422 connection for the init pulse in "MODE SLAVE" is available. (Init pulse is generated by an external device!).
At terminal X2 - Pin 3 + 4 the RS422 connection for the Sart-Stop pulse is available.

Connection of the RS422 signals:
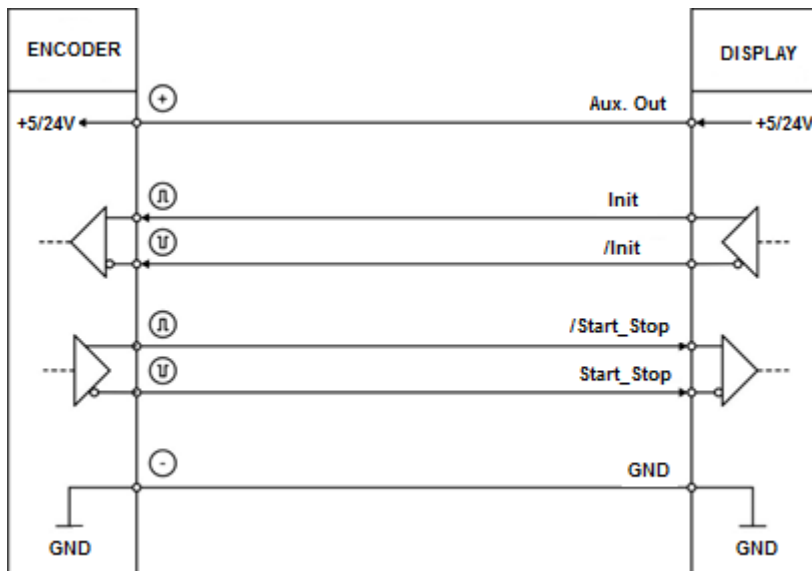
DPI measurement operation

In the "MODE MASTER", the init pulse is sent to the position sensor on the init line at regular intervals (SAMPLING TIME (ms)), whose rising edge triggers a measurement.
The pulse width of the init pulse can be set by means of the "INIT PULSE TIME (µs)" parameter.
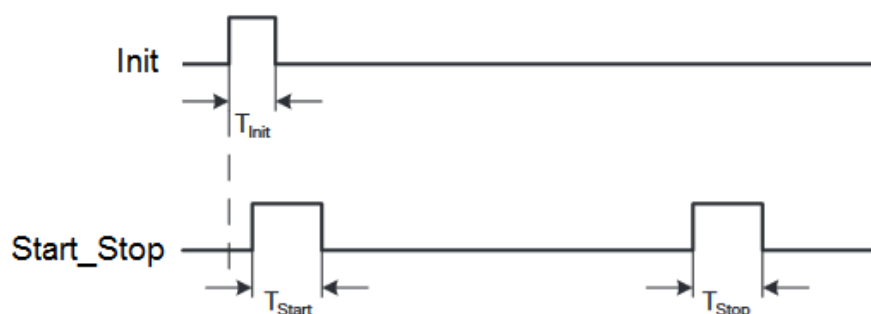
T_{Init}:	1…9 µs (adjustable)
T_{Start}:	~3…5 µs
T_{Stop}:	~3…5 µs

4.6.   Control Inputs (X3)

At terminal X3 pins 2,3 and 4 there are three control inputs with HTL PNP characteristic available. Control Input 1 (Ctrl. In 1) to Control Input 2 (Ctrl. In 2) are freely configurable in the COMMAND MENU and are used for functions to be triggered externally. eg. for resetting the measurement result or for freezing the parallel output.
Control input 3 (Ctrl. In 3) is used exclusively for resetting the device parameters to the "default" values. Thus, it is not freely configurable.

> Note: An HTL pulse ("ACTIVE HIGH") at Ctrl. In 3, the device is reset to the factory settings. The HTL pulse must be present for at least one second.

Wiring of the **control inputs**:
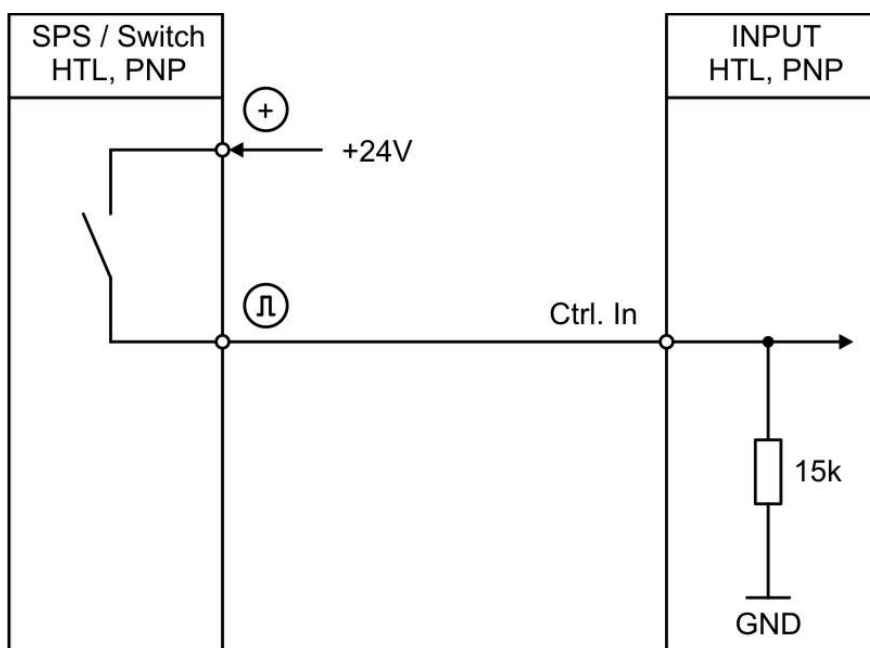
Unconnected control inputs are always "LOW".
All inputs are designed to receive impulses from an electronic impulse source.

Notice for mechanical switching contacts:
When exceptionally mechanical contacts are used, please connect an external capacitor between GND (-) and the corresponding input (+). A capacity of 10 µF will reduce the input frequency to 20 Hz and miscounting due to contact bouncing will be eliminated.

4.7. Parallel output (X5) / COM + (X3)

The parallel outputs are 25 short-circuit proof push-pull outputs. The common, independent supply voltage of the outputs is applied to terminal X3 - pin 5 (COM +). The supply voltage at COM + should not exceed +27 V, otherwise the permanent short circuit restistance of the outputs can no longer be guaranteed.

The voltage drop between COM + and an output in the HIGH state is approx. 1 volt (unloaded).
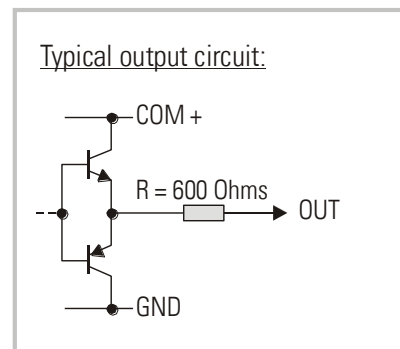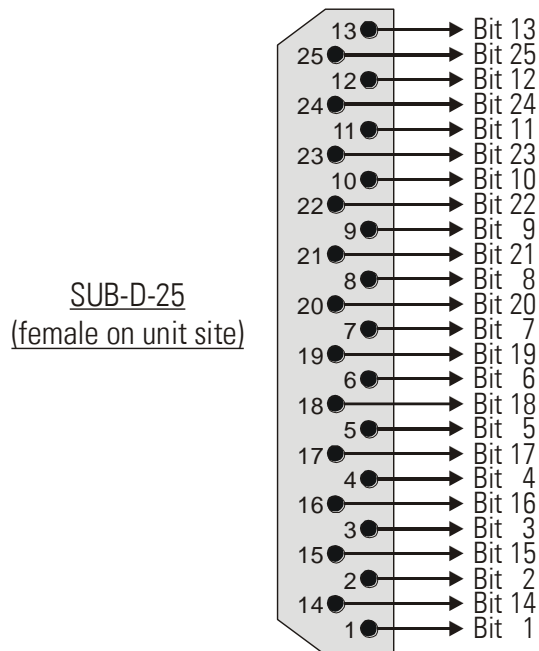
4.7.1. „Error" – Output

In the parallel menu using the "SPECIAL PIN FUNCTION" parameter the output bit 25 (or Bit 24 - if a datastable signal is also configured) can also be set as "Error" signal. In this case, a LOW signal (or HIGH signal) indicates that an error has been detected.

4.7.2. "Data stable" – output

The output Bit 25 can also be configured as a "Data-stable" signal by using "SPECIAL PIN FUNCTION" parameter (in parallel menu). In this case a LOW signal (or HIGH signal) indicates that parallel output data are stable and will not change. The rising edge (or falling edge) of the signal still guarantees stable data and can be used for remote Latch of the parallel data.

The LOW duration (or HIGH duration) of the signal is at least 1/3 of the "Parallel Update Time (s)" set. The sketch below shows the signal path of the "Datastable" output with the "Active Low" setting. With the "Active High" setting, the signal curve is inverted accordingly.

Continuation "Data stable" – output":

Data stable signal

| Zone 1: | Parallel output data subject to change |
| Zone 2: | Parallel output data are stable |
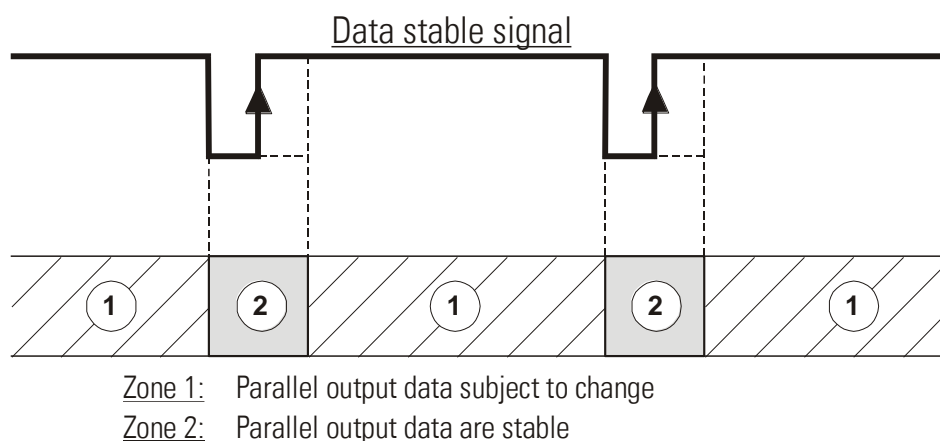
4.8.   Serial interface (X4)

A serial USB interface (mini USB) is available at terminal X4.

The USB interface can be used as follows:

- For parameterization of the device during commissioning
- To change parameters during operation
- For reading out actual values via PC

> ⚠ The serial USB communication is done with a baud rate of "*115200 Baud*" and a serial data format of "*8none1*" and cannot be changed by the user!

5. Parameter / Overview-Menu Structure

The parameterization of the device is realized via the serial interface with a PC and the operating software OS. The link to the free download can be found on page 2.

This section provides an overview of the menus and their parameters. The menu names are printed bold and the associated parameters are listed under the menu name.

Menu / Parameter
GENERAL MENU
MODE
ENCODER PROPERTIES
ENCODER DIRECTION
FACTOR
DIVIDER
ADDITIVE VALUE
LINEARIZATION MODE
BACKUP MEMORY
FACTORY SETTINGS

Menu / Parameter
MODE FREQUENCY
FREQUENCY MODE
FREQUENCY BASE
SAMPLING TIME 1 (S)
WAIT TIME 1(S)
STANDSTILL TIME 1 (S)
AVERAGE FILTER 1
SAMPLING TIME 2 (S)
WAIT TIME 2(S)
AVERAGE FILTER 2

Menu / Parameter
MODE COUNTER
COUNT MODE
FACTOR A
SET VALUE A
FACTOR B
SET VALUE B
ROUND LOOP VALUE

Menu / Parameter
MODE SSI
SSI MODE
ENCODER RESOLUTION
DATA FORMAT
BAUD RATE
SSI ZERO
HIGH BIT
LOW BIT
SSI OFFSET
ROUND LOOP VALUE
SAMPLING TIME (S)
ERROR BIT
ERROR POLARITY

Menu / Parameter
MODE START/STOP
INIT MODE
SAMPLING TIME (ms)
INIT PULSE TIME (µs)
VELOCITY (m/s)
OPERATIONAL MODE
OFFSET
CIRCUMFERENCE (mm)
ROUND LOOP VALUE
AVERAGE FILTER - POSITION
STANDSTILL TIME (s)
AVERAGE FILTER - SPEED

Menu / Parameter
SERIAL MENU
UNIT NUMBER
SERIAL BAUD RATE
SERIAL FORMAT
SERIAL INIT
SERIAL PROTOCOL
SERIAL TIMER (s)
SERIAL VALUE
MODBUS

Continuation "**Parameter / menu structure**":

Menu / Parameter

PARALLEL MENU
PARALLEL MODE PARALLEL INV. PARALLEL VALUE PARALLEL UPDATE TIME (s) SPECIAL PIN FUNCTION

COMMAND MENU
INPUT 1 ACTION INPUT 1 CONFIG INPUT 2 ACTION INPUT 2 CONFIG INPUT 3 ACTION (FACTORY SETTINGS) INPUT 3 CONFIG (ACTIVE HIGH)

LINEARISATION MENU
P1(X) P1(Y) P2(X) P2(Y) … … P23(X) P23(Y) P24(X) P24(Y)

5.1.   General Menu

MODE
This parameter specifies the selected measuring function.

0	NOT DEFINED	Operating mode: Not defined, modulation and measurement results are zero
1	FREQUENCY	Operating mode: Frequency converter, incremental signals
2	COUNTER	Operating mode: Counter, incremental signals
3	SSI	Operating mode: Absolute value converter, SSI signals (replaces IV251)
4	START / STOP	Operating mode: Start / Stop – interface converter

ENCODER PROPERTIES
This parameter determines the characteristics of the incremental input.
(Note: Only relevant for MODE: "FREQUENCY" and MODE: "COUNTER"!)

0	RS422	RS422 Standard
1	HTL DIFFERENTIAL	HTL differential
2	HTL PNP	PNP (switch to +)
3	HTL NPN	NPN (switch to -))
4	TTL PNP	TTL PNP (switch to +)

ENCODER DIRECTION
This parameter reverses the counting or traversing direction.

0	FORWARD	Forward
1	REVERSE	Reverse

FACTOR
This parameter defines the factor with which the measurement result is multiplied.

	-99999999	Smallest value
	1	Default value
	99999999	Highest value

DIVIDER
This parameter defines the divisor with which the measurement result is divided.

	-99999999	Smallest value
	1	Default value
	99999999	Highest value

ADDITIVE VALUE
This parameter defines an additive constant, which is added to the measurement result.

	-99999999	Smallest value
	0	Default value
	99999999	Highest value

Continuation "**General Menu**":

LINEARIZATION MODE		
This parameter defines the linearization function. Observe notes in the appendix!		
0	OFF	No linearization
1	1 QUADRANT	Linearization in the 1. quadrant
2	4 QUADRANT	Linearization in all 4 quadrants

BACK UP MEMORY		
(Note: Only relevant for MODE: "COUNTER"!)		
0	NO	No back up memory –up by power failure
1	YES	Back up memory is active. Saves the actual value of the counter readings in case of power failure and switched on mode "Counter".

FACTORY SETTINGS		
0	NO	No default values are loaded
1	YES	Load default values of all parameters (grey marked default values)

5.2.   Mode Frequency

In this menu the operation is defined as a frequency converter (incremental signals). Depending on the selected operating mode, only channel A or both channels (channel A and channel B) are active.

FREQUENCY MODE
This parameter determines which frequency measurement mode is desired.

0	A ONLY	Single-channel frequency measurement (only for channel A)
1	RATIO	Frequency ratio of both channels (channel B / channel A). Note: Interpretation of the result with 4 decimal places in the format +/- x.xxxx
2	PERCENT	Percent deviation from channel B to channel A. Note: Interpretation of the result with 2 decimal places in the format +/- xxx.xx %
3	A + B	Frequency addition of both channels (channel A + channel B)
4	A - B	Frequency subtraction of both channels (channel A - channel B)
5	A/B x 90°	Frequency measurement with A / B x 90 ° signal. (Forward / reverse direction of rotation detection)

FREQUENCY BASE
Setting the desired basis for the frequency measurement (resolution).

	0	1 Hz (Interpretation of the result in the format: xxxxxxxx Hz)
	1	1/10 Hz (Interpretation of the result in the format: xxxxxxx.x Hz)
	2	1/100 Hz (Interpretation of the result in the format: xxxxxx.xx Hz)
	3	1/1000 Hz (Interpretation of the result in the format: xxxxx.xxx Hz)

SAMPLING TIME 1 (S)
The set value corresponds to the minimum measuring time (for channel A) in seconds.
The sampling time serves as a filter at irregular frequencies.
This parameter directly influences the reaction time of the device.

	0,001	Shortest Sampling time
	0,1	Default value
	9,999	Longest Sampling time

$$f = \frac{6}{T}$$

Continuation "**Mode Frequency**":

WAIT TIME 1 (S)		
This parameter defines the period time of the lowest frequency, accordingly the time between two rising signal edges on channel A detecting frequency 0 Hz. Frequencies with a period time higher than the set "WAIT TIME 1" will be detected as frequency = 0 Hz.		
	0,01	Frequency = 0 Hz, for frequencies below 100 Hz
	1,00	Default value
	79,99	Frequency = 0 Hz, for frequencies below 0,01 Hz

STANDSTILL TIME 1 (S)		
This parameter defines the time for standstill definition. If the frequency = 0 Hz is detected on channel A, standstill is signalled after xx,xx seconds.		
	0,01	Shortest time in seconds
	…	
	99,99	Largest time in seconds

AVERAGE FILTER 1

Selectable averaging or filter function for unstable frequencies at input A for smoothing the output at the parallel output. At settings 5 to 16, the device uses an exponential function.
The time constant T (63%) corresponds to the sampling cycles.

For example: If SAMPLING TIME = 0,1 s and AVERAGE FILTER = Exponential filter, T (63 %) = 2x SAMPLING TIME, after 0,2 seconds, 63% of the step size are reached.

	0	No average value will be created (quick reaction to every change)
	1	2 numbers of floating average cycles
	2	4 numbers of floating average cycles
	3	8 numbers of floating average cycles
	4	16 numbers of floating average cycles
	5	Exponential filter, T (63 %) = 2x SAMPLING TIME
	6	Exponential filter, T (63 %) = 4x SAMPLING TIME
	7	Exponential filter, T (63 %) = 8x SAMPLING TIME
	8	Exponential filter, T (63 %) = 16x SAMPLING TIME
	9	Exponential filter, T (63 %) = 32x SAMPLING TIME
	10	Exponential filter, T (63 %) = 64x SAMPLING TIME
	11	Exponential filter, T (63 %) = 128x SAMPLING TIME
	12	Exponential filter, T (63 %) = 256x SAMPLING TIME
	13	Exponential filter, T (63 %) = 512x SAMPLING TIME
	14	Exponential filter, T (63 %) = 1024x SAMPLING TIME
	15	Exponential filter, T (63 %) = 2048x SAMPLING TIME
	16	Exponential filter, T (63 %) = 4096x SAMPLING TIME (very slow reaction)

Notice:
When using the exponential filter, the maximum permissible frequencies at the input must not be exceeded due to an otherwise following data type overflow!
If the frequency is nevertheless exceeded, the frequency is replaced by the maximum permissible value (with corresponding setting) for further calculation and an error is output. (The LED flashes)
The maximum allowable frequencies are listed below for the associated settings.

		FREQUENCY BASE			
		[0] - 1 Hz	[1] - 1/10 Hz	[2] - 1/100 Hz	[3] - 1/1000 Hz
AVERAGE FILTER 1+2	[5] - 2x	1.073.741.823 Hz	107.374.182,3 Hz	10.737.418,23 Hz	1.073.741,823 Hz
	[6] - 4x	536.870.911 Hz	53.687.091,1 Hz	5.368.709,11 Hz	536.870,911 Hz
	[7] - 8x	268.435.455 Hz	26.843.545,5 Hz	2.684.354,55 Hz	268.435,455 Hz
	[8] - 16x	134.217.727 Hz	13.421.772,7 Hz	1.342.177,27 Hz	134.217,727 Hz
	[9] - 32x	67.108.863 Hz	6.710.886,3 Hz	671.088,63 Hz	67.108,863 Hz
	[10] - 64x	33.554.431 Hz	3.355.443,1 Hz	335.544,31 Hz	33.554,431 Hz
	[11] - 128x	16.777.215 Hz	1.677.721,5 Hz	167.772,15 Hz	16.777,215 Hz
	[12] - 256x	8.388.607 Hz	838.860,7 Hz	83.886,07 Hz	8.388,607 Hz
	[13] - 512x	4.194.303 Hz	419.430,3 Hz	41.943,03 Hz	4.194,303 Hz
	[14] - 1024x	2.097.151 Hz	209.715,1 Hz	20.971,51 Hz	2.097,151 Hz
	[15] - 2048x	1.048.575 Hz	104.857,5 Hz	10.485,75 Hz	1.048,575 Hz
	[16] - 4096x	524.287 Hz	52.428,7 Hz	5.242,87 Hz	524,287 Hz

Continuation "**Mode Frequency**":

SAMPLING TIME 2 (S)

The set value corresponds to the minimum measuring time (for channel B) in seconds.
The sampling time serves as a filter at irregular frequencies.
This parameter directly influences the reaction time of the device.

	0,001	Shortest Sampling time
	0,1	Default value
	9,999	Longest Sampling time

$$f = \frac{6}{T}$$

Sampling Time (Setting)

T = Real Sampling Time

WAIT TIME 2 (S)

This parameter defines the period time of the lowest frequency, accordingly the time between two rising signal edges on channel B detecting frequency 0 Hz. Frequencies with a period time higher than the set "WAIT TIME 2" will be detected as frequency = 0 Hz.

	0,01	Frequency = 0 Hz, for frequencies below 100 Hz
	1,00	Default value
	79,99	Frequency = 0 Hz, for frequencies below 0,01 Hz

Wait Time

f

f = "0"

t

Continuation "**Mode Frequency**":

AVERAGE FILTER 2

Selectable averaging or filter function for unstable frequencies at input B for smoothing the output at the parallel output. At settings 5 to 16, the device uses an exponential function.
The time constant T (63%) corresponds to the sampling cycles.

For example: If SAMPLING TIME = 0,1 s and AVERAGE FILTER = Exponential filter, T (63 %) = 2x SAMPLING TIME, after 0,2 seconds, 63% of the step size are reached.

	0	No average value will be created (quick reaction to every change)
	1	2 numbers of floating average cycles
	2	4 numbers of floating average cycles
	3	8 numbers of floating average cycles
	4	16 numbers of floating average cycles
	5	Exponential filter, T (63 %) = 2x SAMPLING TIME
	6	Exponential filter, T (63 %) = 4x SAMPLING TIME
	7	Exponential filter, T (63 %) = 8x SAMPLING TIME
	8	Exponential filter, T (63 %) = 16x SAMPLING TIME
	9	Exponential filter, T (63 %) = 32x SAMPLING TIME
	10	Exponential filter, T (63 %) = 64x SAMPLING TIME
	11	Exponential filter, T (63 %) = 128x SAMPLING TIME
	12	Exponential filter, T (63 %) = 256x SAMPLING TIME
	13	Exponential filter, T (63 %) = 512x SAMPLING TIME
	14	Exponential filter, T (63 %) = 1024x SAMPLING TIME
	15	Exponential filter, T (63 %) = 2048x SAMPLING TIME
	16	Exponential filter, T (63 %) = 4096x SAMPLING TIME (very slow reaction)

Notice:
When using the exponential filter, the maximum permissible frequencies at the input must not be exceeded due to an otherwise following data type overflow!
If the frequency is nevertheless exceeded, the frequency is replaced by the maximum permissible value (with corresponding setting) for further calculation and an error is output. (The LED flashes)
The maximum permissible frequencies have already been listed in parameter AVERAGE FILTER 1 and can be taken there.

5.3. Mode Counter

In this menu, the operation is defined as a position transducer for incremental signals (pulse, sum, difference, up or down counter). Input A and B are active.

COUNT MODE			
This parameter defines the counter operation.			
0	A SINGLE	Input A is a counting input. Input B defines the counting direction: „LOW" = forward „HIGH" = reverse	
1	A + B	Sum counter: Impulses at A + Impulses at B	
2	A - B	Differential counter: Impulses at A – impulses at B	
3	A/B 90 x1	Quadrature counter: Impulses A, B with edge counting x1	
4	A/B 90 x2	Quadrature counter: Impulses A, B with edge counting x2	
5	A/B 90 x4	Quadrature counter: Impulses A, B with edge counting x4	

FACTOR A	
Scaling factor for input A.	
For example: A setting of factor 1.23456 and 100000 input pulses will result in a value of 123456 for input A.	
0,00001	Smallest value
1	Default value
99,99999	Highest value

SET VALUE A	
With a "RESET / SET COUNTER A" command (via user interface or control input), the counter of input A is set to this value.	
-99999999	Smallest value
0	Default value
+99999999	Highest value

FACTOR B	
Scaling factor for input B.	
For example: A setting of factor 1.23456 and 100000 input pulses will result in a value of 123456 for input B.	
0,00001	Smallest value
1	Default value
99,99999	Highest value

SET VALUE B	
With a "RESET / SET COUNTER B" command (via user interface or control input), the counter of input B is set to this value.	
-99999999	Smallest value
0	Default value
+99999999	Highest value

Continuation "**Mode Counter**:

ROUND LOOP VALUE		
Defines the number of encoder steps if a round-loop function is desired. (Only for COUNT MODE: A SINGLE and A / B x 90)		
	0	Round-loop function is turned off.
	...	
	99999999	Number of steps for the round-loop function.

5.4.   Mode SSI

In this menu the operation is defined as absolute value converter (SSI signals).

SSI MODE			
SSI Setting of the operating mode: Maser or Slave Depending on the SSI MODE, different terminals must be used for the SSI CLK! (Mode Master: Terminal X2 - Pin 1 and 2 / Mode Slave: Terminal X2 - Pin 5 and 6)			
	0	MASTER	Master-Mode: Clock for SSI encoder comes from the device
	1	SLAVE	Slave-Mode: Clock for SSI encoder comes from the external master.

ENCODER RESOLUTION		
Resolution of the SSI encoder (total number of bits)		
	10	Smallest value
	25	Default value
	32	Highest value

DATA FORMAT			
Setting the SSI code (binary or gray)			
	0	GRAY CODE	SSI-Code Gray
	1	BINARY CODE	SSI-Code Binär

BAUD RATE			
Clock frequency of SSI telegrams			
	0	2 MHZ	N.A.
	1	1.5 MHZ	N.A.
	2	1 MHZ	Clock frequency 1 MHz
	3	500 KHZ	Clock frequency 500 kHz
	4	250 KHZ	Clock frequency 250 kHz
	5	100 KHZ	Clock frequency 100 kHz

SSI ZERO		
In the case of a "ZERO POSITION" command (via user interface or control input), the current SSI position of the encoder is transferred to the "SSI ZERO" parameter and the actual encoder zero point is shifted accordingly. (Encoder zero offset)		
	0	Smallest value
	…	
	999999999	Highest value

HIGH BIT (for bit blanking)		
Defines the highest evaluated bit (MSB) for bit blanking. If all bits should be evaluated, HIGH BIT must be set to the given total number of bit.		
	01	Smallest value
	25	Default value
	32	Highest value

Continuation "**Mode SSI**":

LOW BIT (for bit blanking)		
Defines the lowest evaluated bit (MSB) for bit blanking.		
If all bits should be evaluated, LOW BIT must be set to 01.		

	01	Smallest value
	…	
	32	Highest value

SSI OFFSET		
In the case of a „RESET/SET VALUE" command (via control input or PC user interface) the not yet scaled, currently acquired position value (after bit suppression and possibly performed encoder zero offset) is transferred to the "SSI OFFSET" parameter and the display zeroed. From the new display zero point, you can now move in positive and negative direction, depending on the direction of rotation.		
(Display offset)		

	0	Smallest value
	…	
	999999999	Highest value

ROUND LOOP VALUE		
Defines the number of encoder steps when a round-loop function is desired.		

	0	Round-loop function is turned off.
	…	
	99999999	Number of steps for the round-loop function.

SAMPLING TIME (S)		
Determines the read cycle for the SSI signal in the Master MODE.		

	0.001	Minimum measurement time in seconds
	0.010	Default value
	9.999	Maximum measurement time in seconds

ERROR BIT		
Defines the encoder monitoring and the error bit		

	0	No error bit available. Review on connected sensor is turned off.
	…	
	32	Position of the error bits to be evaluated Review on connected sensor is turned on.

ERROR POLARITY		
Defined the polarity of the error bit in the case of an error		

	0	Bit is low in the case of an error
	1	Bit is high in the case of an error

◇☞	**Note: SSI value processing see appendix!**

5.5. Mode Start/Stop

This menu defines the operating as Start / Stop – interface converter.

INIT MODE		
Operating mode: Master or Slave Depending on the selected INIT MODE, different terminals must be used for the Init pulse! (Mode Master: terminal X2 – Pin 1 and 2 / Mode Slave: terminal X2 – Pin 5 and 6)		
0	MASTER	Master-operation: Init pulse is generated by the device.
1	SLAVE	Slave-operation: Init pulse comes from an external master.

SAMPLING TIME (ms)		
Period duration between two init pulses (in milliseconds). Corresponds to the time after a new measurement is started and directly affects the reaction time of the device.		
	00.200	Minimum measurement time
	04.000	Default value
	16.000	Maximum measurement time

INIT PULSE TIME (µs)		
This parameter defines the pulse width of the Init pulse (in microseconds).		
	1	Smallest value
	2	Default value
	9	Highest value

VELOCITY (m/s)		
Waveguide velocity of the encoder (in m/s).		
	0001.00	Smallest value
	2800.00	Default value
	9999.99	Highest value

OPERATIONAL MODE		
This parameter determines which measurement type the device should run.		
0	POSITION	Distance measurement
1	ANGLE	Angle measurement
2	SPEED	Speed measurement
	Note: For further information regarding the different "OPERATIONAL MODES" and interpretation of the respective measurement results see appendix!	

OFFSET		
In the case of a "Reset/Set Value" command (via control input or PC user interface) the current position of the encoder is transferred to the "OFFSET" parameter in a non-volatile manner. (zero offset!)		
	-99999999	Smallest value
	0	Default value
	99999999	Highest value

Continuation "**Mode Start/Stop**":

CIRCUMFERENCE (mm)

Setting the reference size (in "mm") for an angle measurement.
The distance covered (e.g. circumference) at which the subsequent output value (ROUND LOOP VALUE) is to be generated must be set here.
(Note: Only for OPERATIONAL MODE: "ANGLE")

	00000.001	Smallest value
	01000.000	Default value
	99999.999	Highest value

ROUND LOOP VALUE

Setting of the desired measured value to be generated when the previous reference value ("CIRCUMFERENCE") is reached.
(Note: Only for OPERATIONAL MODE: "ANGLE")

	1	Smallest value
	360	Default value
	99999999	Highest value

AVERAGE FILTER – POSITION (filter for average value)

The average value can be switched to avoid position fluctuations.

	0	No average value
	1	Flowing mean value with 2 cycles
	2	Flowing average value with 4 cycles
	3	Flowing average value with 8 cycles
	4	Flowing mean value with 16 cycles

STANDSTILL TIME (s)

This parameter defines the time for standstill definition. If standstill is detected, standstill is signalled after xx,xx seconds.

	0,01	Shortest delay time in seconds
	…	
	99,99	Longest delay time in seconds

AVERAGE FILTER – SPEED (filter for average value)

The average value can be switched to avoid velocity fluctuations.

	0	No average value
	1	Flowing mean value with 2 cycles
	2	Flowing average value with 4 cycles
	3	Flowing average value with 8 cycles
	4	Flowing mean value with 16 cycles

5.6. Serial Menu

This menu defines the basic settings of serial interface.

UNIT NUMBER

This parameter defines serial device addresses. The addresses between 11 and 99 can be assigned to the devices. Addresses with zero are not allowed, there are used as broadcast addresses.

Note:

Device address is fixed to "11" for USB interface and cannot be adjusted.

	11	Smallest address
	…	(N.A.)
	99	Highest address (N.A.)

SERIAL BAUD RATE

This parameter defines the serial baud rate.

Note:

Baud rate is fixed to "115200" for USB interface and cannot be adjusted.

0	9600	9600 baud - (N.A.)
1	19200	19200 baud - (N.A.)
2	38400	38400 baud - (N.A.)
3	115200	115200 baud

SERIAL FORMAT

This parameter defines the bit data format.

Note:

Serial data format is fixed to "8-none-1" for USB interface and cannot be adjusted.

0	7-EVEN-1	7 data	Parity even	1 Stop	(N.A.)
1	7-EVEN-2	7 data	Parity even	2 Stops	(N.A.)
2	7-ODD-1	7 data	Parity odd	1 Stop	(N.A.)
3	7-ODD-2	7 data	Parity odd	2 Stops	(N.A.)
4	7-NONE-1	7 data	no Parity	1 Stop	(N.A.)
5	7-NONE-2	7 data	no Parity	2 Stops	(N.A.)
6	8-EVEN-1	8 data	Parity even	1 Stop	(N.A.)
7	8-ODD-1	8 data	Parity odd	1 Stop	(N.A.)
8	8-NONE-1	8 data	no Parity	1 Stop	
9	8-NONE-2	8 data	no Parity	2 Stops	(N.A.)

Continuation "**Serial Menu**":

SERIAL INIT

This parameter defines the baud rate for the initialization to the user interface OS. With settings larger than 9600 the initialization time can be reduced.

Note:
The initialization values are always transmitted with 115200 Baud for the USB interface.

0	NO	Initialization with 9600 baud. Then the device operates with the value selected by the user.
1	YES	Initialization with the baud rate set by SERIAL BAUD RATE. Then the device operates with the value selected by the user.

SERIAL PROTOCOL

Determines the sequence of characters send, when using the serial output for cyclic data transmission under time control (xxxxxxx = value SERIAL VALUE).
Setting „1" removes the unit address from the string which allows a slight faster transmission cycle.

	0	Transmission report = Unit Nr., +/-, data, LF, CR
			1	1	+/-	X	X	X	X	X	X	X	LF	CR	
	1	Transmission report = +/-, data, LF, CR
			+/-	X	X	X	X	X	X	X	LF	CR	

SERIAL TIMER (S)

This register determines the cycle time in seconds for cycling transmission of SERIAL VALUE when using the serial output. (On a serial request, the cycling transmission is stopped for 20 s)

	0,000	All cyclic transmission is switched off. The unit will send data upon a serial request or with command SERIAL PRINT.
	…	
	60,000	Cycle time in seconds.

Continuation "**Serial Menu**":

SERIAL VALUE
This parameter defines the value to be transmitted.

	Einstellung	Code	Bedeutung
	0	:0	Measurement_Result (Result after linking, scaling, filter, etc.)
	1	:1	Converted_Output_Value (Parallel output data after conversion)
	2	:2	Frequency_1 (measured frequency - channel A without scaling)
	3	:3	Frequency_2 (measured frequency - channel B without scaling)
	4	:4	Counter (total count after linking without scaling, filters, etc.)
	5	:5	Counter_A (counter reading - channel A)
	6	:6	Counter_B (counter reading - channel B)
	7	:7	SSI_Data (read + possibly converted binary SSI value)
	8	:8	SSI_Calc_Result (SSI value incl. SSI zero and SSI offset without scaling, filters, etc.)
	9	:9	Minimum_Value (Minimum value of Measurement_Result)
	10	;0	Maximum_Value (Maximum value of Measurement_Result)
	11	;1	Reserve
	12	;2	Reserve
	13	;3	Error Status (Reading the error code)
	14	;4	SSI Read Value (readed, unconverted SSI value)
	15	;5	SSI Loop Value (SSI value after round loop calculation)
	16	;6	Actual Speed ()
	17	;7	Actual Position (Start Stop: position [in µm] with offset without scaling)
	18	;8	Actual Angle (Start Stop: e.g. angle with offset without scaling)
	19	;9	Raw Position (Start Stop: position [in µm] without Offset and without scaling))

MODBUS
Note: Modbus protocol cannot be selected via USB interface on this device!

	0	Modbus disabled Serial interface is using Lecom protocol (Motrona-default protocol)
	1 … 247	Modbus enabled: Serial interface is using Modbus RTU protocol The set value is the Modbus address of the device.(N.A.)

5.7. Parallel Menu

In this menu the basic settings for the parallel output are defined. The parallel output always refers to the scaled "Measurement Result"!

PARALLEL MODE
Determines the output format of the parallel output and the source of the input data as follows:

0	BINÄR	Parallel output format as binary code. Data source: "Measurement Result".
1	GRAY	Parallel output format as gray code. Data source: "Measurement Result".
2	BCD	Parallel output format as BCD code. Data source: „Measurement Result".
3	BINÄR	Parallel output format as binary code. Data source: „PARALLEL VALUE".
4	GRAY	Parallel output format as gray code. Data source: „PARALLEL VALUE".
5	BCD	Parallel output format as BCD code. Data source: „PARALLEL VALUE".

PARALLEL INV.
Inversion of the data at the parallel output.

0	NORMAL	Data at the parallel output is output normally. Logic 1 corresponds to HIGH at parallel output Logic 0 corresponds to LOW at parallel output
1	INVERTED	Data at the parallel output is output inverted. Logic 1 corresponds to LOW at parallel output Logic 0 corresponds to HIGH at parallel output

PARALLEL VALUE
The value stored under this parameter appears directly at the parallel output if the "Parallel Mode" parameter was previously set to values greater than 2. The parameter has the serial access code "B1" and can be written via the serial interface.
(This function can be useful for testing the outputs and the wiring!)

	-16777216	Smallest Value
	0	Default Value
	+16777215	Highest Value

PARALLEL UPDATE TIME (s)
Determines the refresh time of the parallel output.

	0.001	Minimum update time in seconds
	0.010	Default Value
	9.999	Maximum update time in seconds

Continuation "**Parallel Menu**":

SPECIAL PIN FUNCTION Determines the function of the 24. and 25. parallel output. (PIN24 + PIN25)			
	0	DATA & DATA	**Pin 25** : Data output (Bit 25) **Pin 24:** Data output (Bit 24)
	1	ERROR & DATA	**Pin 25** : Error output (Active High) **Pin 24:** Data output (Bit 24)
	2	/ERROR & DATA	**Pin 25** : Error output (Active Low) **Pin 24:** Data output (Bit 24)
	3	ERROR & /ERROR	**Pin 25** : Error output (Active High) **Pin 24:** Error output (Active Low)
	4	DATASTABLE & DATA	**Pin 25** : Datastable output (Active High) **Pin 24:** Data output (Bit 24)
	5	/DATASTABLE & DATA	**Pin 25** : Datastable output (Active Low) **Pin 24:** Data output (Bit 24)
	6	DATASTABLE & ERROR	**Pin 25** : Datastable output (Active High) **Pin 24:** Error output (Active High)
	7	DATASTABLE & /ERROR	**Pin 25** : Datastable output (Active High) **Pin 24:** Error output (Active Low)
	8	/DATASTABLE & ERROR	**Pin 25** : Datastable output (Active Low) **Pin 24:** Error output (Active High)
	9	/DATASTABLE & /ERROR	**Pin 25** : Datastable output (Active Low) **Pin 24:** Error output (Active Low)
	10	DATASTABLE & /DATASTABLE	**Pin 25** : Datastable output (Active High) **Pin 24:** Datastable output (Active Low)

5.8. Command Menu

INPUT 1 ACTION (function Input 1)

This parameter defines the function of the input "Ctrl. In 1".

(s) =   static switching (level evaluation), INPUT CONFIG must be set to active LOW / HIGH

(d) =   dynamic switching (edge evaluation), INPUT CONFIG must be set to RISING/FALLING EDGE

0	NO	No function	
1	RESET/SET VALUE	**Mode "SSI":** Transfer of the currently detected position value (after bit suppression and possibly performed encoder zero offset shift) into the parameter "SSI offset" (display offset) **Mode "Counter":** Reset / set of both counter values (channel A and B) to the set values in SET VALUE A u. B **Mode "Start/Stop":** Power-failure-proof stored transfer of the current position or angle measurement to the "Offset" parameter.	(d) (s)
2	FREEZE	Freezing of the current measurement result / of the parallel output	(s)
3	SSI ZERO POSITION	**Mode "SSI":** Transfer of the current SSI position to the "SSI-Zero" parameter (encoder zero offset).	(d) (s)
4	RESET/SET COUNTER A	**Mode "Counter":** Reset / Set the counter value of channel A to the set value in SET VALUE A.	(d) (s)
5	RESET/SET COUNTER B	**Mode "Counter":** Reset / Set the counter value of channel B to the set value in SET VALUE B.	(d) (s)
6	LOCK COUNTER A	**Mode „Counter":** Counter (channel A) is locked and does not count any further pulses as long as this command is present.	(s)
7	LOCK COUNTER B	**Mode „Counter":** Counter (channel B) is locked and does not count any further pulses as long as this command is present.	(s)
8	RESET MIN/MAX	Resetting the minimum / maximum value	(d) (s)
9	FACTORY SETTINGS	Device is reset to factory settings (pulse must be applied for at least one second!)	(s)

Continuation "**Command Menu**":

INPUT 1 CONFIG
This parameter defines the switching characteristics of the input "Ctrl. In 1".

	0	ACTIVE LOW	Active at „LOW" (static)
	1	ACTIVE HIGH	Active at „HIGH" (static)
	2	RISING EDGE	Activate at rising edge (dynamic)
	3	FALLING EDGE	Activate at falling edge (dynamic)

INPUT 2 ACTION
This parameter defines the control function of the input "Ctrl. In 2".
See parameter INPUT 1 ACTION.

INPUT 2 CONFIG
This parameter defines the switching characteristics of the input "Ctrl. In 2".
See parameter INPUT 1 CONFIG.

INPUT 3 ACTION (FACTORY SETTINGS)
This parameter is permanently preset to "Factory Settings" (reset device to factory settings) and <u>cannot</u> be changed.

INPUT 3 CONFIG (ACTIVE HIGH)
This parameter is permanently preset to "Active High" and <u>cannot</u> be changed.

5.9. Linearization Menu

The linearization function is defined in this menu. The linearization function always refers to the scaled "Measurement Result"!

Linearization description and examples are shown in the appendix.

P1(X) … P24(X)		
X-coordinate of the linearization point. This is the value that the device would generate without linearization depending on the input signal.		
	-99999999	Smallest X-coordinate
	0	Default value
	+99999999	Largest X-coordinate

P1(Y) … P24(Y)		
Y-coordinate of the linearization point. This is the value that the device should generate instead of the x coordinate. e.g. P2 (X) is replaced by P2 (Y).		
	-99999999	Smallest X-coordinate
	0	Default value
	+99999999	Largest X-coordinate

6. Appendix

6.1. Data readout via serial interface

The free operator software OS is available at: https://www.motrona.com/en/support/software.html
All codes shown in the parameter SERIAL VALUE are available for serial readout by PC or PLC. The communication of Motrona-devices is based on the Drivecom protocol according to ISO 1745 or the Modbus RTU protocol. All protocol details can be found in our manual SERPRO (Drivecom) which is available for download from the homepage www.motrona.en and in the chapter "Modbus RTU Interface" in this manual.

To request for a data transmission you must send the following request string to the converter:

EOT	AD1	AD2	C1	C2	ENQ

EOT = control character (Hex 04)
AD1 = unit address, High Byte
AD2 = unit address, Low Byte
C1　 = register code, High Byte
C2　 = register code, Low Byte
ENQ = control character (Hex 05)

The following example shows the request string for readout of the actual input frequency of a monitor (Code=1) from a unit with unit address 11:

ASCII-Code:	EOT	1	1	:	1	ENQ
Hexadecimal:	04	31	31	3A	31	05
Binary:	0000 0100	0011 0001	0011 0001	0011 1010	0011 0001	0000 0101

After a correct request, the unit will respond:

STX	C1	C2	xxxxx	ETX	BCC

STX = control character (Hex 02)
C1　 = register code, High Byte
C2　 = register code, Low Byte
xxxxx = readout data
ETX = control character (Hex 03)
BCC = block check character

6.2.   Parameter list / serial codes

#	Menü	Name	Code	Min	Max	Default
0	GENERAL MENU	MODE	00	0	4	0
1	GENERAL MENU	ENCODER PROPERTIES	01	0	4	0
2	GENERAL MENU	ENCODER DIRECTION	02	0	1	0
3	GENERAL MENU	FACTOR	03	-99999999	99999999	1
4	GENERAL MENU	DIVIDER	04	-99999999	99999999	1
5	GENERAL MENU	ADDITIVE VALUE	05	-99999999	99999999	0
6	GENERAL MENU	LINEARIZATION MODE	06	0	2	0
7	GENERAL MENU	BACKUP MEMORY	07	0	1	1
8	GENERAL MENU	FACTORY SETTINGS	08	0	1	0
9	GENERAL MENU	__	09	0	0	0
10	GENERAL MENU	__	10	0	0	0
11	MODE FREQUENCY	FREQUENCY MODE	11	0	5	0
12	MODE FREQUENCY	FREQUENCY BASE	12	0	3	2
13	MODE FREQUENCY	SAMPLING TIME 1 (s)	13	1	9999	100
14	MODE FREQUENCY	WAIT TIME 1 (s)	14	1	7999	100
15	MODE FREQUENCY	STANDSTILL TIME 1 (s)	15	1	9999	1
16	MODE FREQUENCY	AVERAGE FILTER 1	16	0	16	0
17	MODE FREQUENCY	SAMPLING TIME 2 (s)	17	1	9999	100
18	MODE FREQUENCY	WAIT TIME 2 (s)	18	1	7999	100
19	MODE FREQUENCY	AVERAGE FILTER 2	19	0	16	0
20	MODE FREQUENCY	__	20	0	0	0
21	MODE FREQUENCY	__	21	0	0	0
22	MODE COUNTER	COUNT MODE	22	0	5	3
23	MODE COUNTER	FACTOR A	23	1	9999999	100000
24	MODE COUNTER	SET VALUE A	24	-99999999	99999999	0
25	MODE COUNTER	FACTOR B	25	1	9999999	100000
26	MODE COUNTER	SET VALUE B	26	-99999999	99999999	0
27	MODE COUNTER	ROUND LOOP VALUE	27	0	99999999	0
28	MODE COUNTER	__	28	0	0	0
29	MODE COUNTER	__	29	0	0	0
30	MODE SSI	SSI MODE	30	0	1	0
31	MODE SSI	ENCODER RESOLUTION	31	10	32	25
21	MODE SSI	DATA FORMAT	32	0	1	0
33	MODE SSI	BAUD RATE	33	0	5	2
34	MODE SSI	SSI ZERO	34	0	999999999	0
35	MODE SSI	HIGH BIT	35	1	32	25
36	MODE SSI	LOW BIT	36	1	32	1
37	MODE SSI	SSI OFFSET	37	0	999999999	0
38	MODE SSI	ROUND LOOP VALUE	38	0	99999999	0
39	MODE SSI	SAMPLING TIME (s)	39	1	9999	10
40	MODE SSI	ERROR BIT	40	0	32	0
41	MODE SSI	ERROR POLARITY	41	0	1	0
42	MODE SSI	__	42	0	0	0
43	MODE SSI	__	43	0	0	0

Continuation "**Parameter list /serial codes**":

#	Menu	Name	Code	Min	Max	Default
44	MODE START/STOP	INIT MODE	44	0	1	0
45	MODE START/STOP	SAMPLING TIME (ms)	45	200	16000	4000
46	MODE START/STOP	INIT PULSE TIME (µs)	46	1	9	2
47	MODE START/STOP	VELOCITY (m/s)	47	100	999999	280000
48	MODE START/STOP	OPERATIONAL MODE	48	0	2	0
49	MODE START/STOP	OFFSET	49	-99999999	99999999	0
50	MODE START/STOP	CIRCUMFERENCE (mm)	50	1	99999999	100000
51	MODE START/STOP	ROUND LOOP VALUE	51	1	99999999	360
52	MODE START/STOP	AVERAGE FILTER - POSITION	52	0	4	0
53	MODE START/STOP	STANDSTILL TIME (s)	53	1	9999	1
54	MODE START/STOP	AVERAGE FILTER - SPEED	A0	0	4	0
55	MODE START/STOP	__	A1	0	0	0
56	MODE START/STOP	__	A2	0	0	0
57	SERIAL MENU	UNIT NUMBER	90	11	11	11
58	SERIAL MENU	SERIAL BAUD RATE	91	3	3	3
59	SERIAL MENU	SERIAL FORMAT	92	8	8	8
60	SERIAL MENU	SERIAL INIT	9~	1	1	1
61	SERIAL MENU	SERIAL PROTOCOL	A3	0	1	0
62	SERIAL MENU	SERIAL TIMER (S)	A4	0	60000	0
63	SERIAL MENU	SERIAL VALUE	A5	0	19	0
64	SERIAL MENU	MODBUS	A6	0	0	0
65	SERIAL MENU	__	A7	0	0	0
66	SERIAL MENU	__	A8	0	0	0
67	PARALLEL MENU	PARALLEL MODE	A9	0	5	0
68	PARALLEL MENU	PARALLEL INV.	B0	0	1	0
69	PARALLEL MENU	PARALLEL VALUE	B1	-16777216	16777215	0
70	PARALLEL MENU	PARALLEL UPDATE TIME (s)	B2	1	9999	10
71	PARALLEL MENU	SPECIAL PIN FUNCTION	B3	0	10	0
72	COMMAND MENU	INPUT 1 ACTION	B4	0	9	0
73	COMMAND MENU	INPUT 1 CONFIG.	B5	0	3	2
74	COMMAND MENU	INPUT 2 ACTION	B6	0	9	0
75	COMMAND MENU	INPUT 2 CONFIG.	B7	0	3	2
76	COMMAND MENU	INPUT 3 ACTION (FACTORY SETTINGS)	B8	9	9	9
77	COMMAND MENU	INPUT 3 CONFIG. (ACTIVE HIGH)	B9	2	2	2
78	COMMAND MENU	__	C0	0	0	0
79	COMMAND MENU	__	C1	0	0	0
80	LINEARIZATION MENU	P1(X)	C2	-99999999	99999999	0
81	LINEARIZATION MENU	P1(Y)	C3	-99999999	99999999	0
82	LINEARIZATION MENU	P2(X)	C4	-99999999	99999999	0
83	LINEARIZATION MENU	P2(Y)	C5	-99999999	99999999	0
84	LINEARIZATION MENU	P3(X)	C6	-99999999	99999999	0

Continuation "**Parameter list /serial codes**":

#	Menu	Name	Code	Min	Max	Default
85	LINEARIZATION MENU	P3(Y)	C7	-99999999	99999999	0
86	LINEARIZATION MENU	P4(X)	C8	-99999999	99999999	0
87	LINEARIZATION MENU	P4(Y)	C9	-99999999	99999999	0
88	LINEARIZATION MENU	P5(X)	D0	-99999999	99999999	0
89	LINEARIZATION MENU	P5(Y)	D1	-99999999	99999999	0
90	LINEARIZATION MENU	P6(X)	D2	-99999999	99999999	0
91	LINEARIZATION MENU	P6(Y)	D3	-99999999	99999999	0
92	LINEARIZATION MENU	P7(X)	D4	-99999999	99999999	0
93	LINEARIZATION MENU	P7(Y)	D5	-99999999	99999999	0
94	LINEARIZATION MENU	P8(X)	D6	-99999999	99999999	0
95	LINEARIZATION MENU	P8(Y)	D7	-99999999	99999999	0
96	LINEARIZATION MENU	P9(X)	D8	-99999999	99999999	0
97	LINEARIZATION MENU	P9(Y)	D9	-99999999	99999999	0
98	LINEARIZATION MENU	P10(X)	E0	-99999999	99999999	0
99	LINEARIZATION MENU	P10(Y)	E1	-99999999	99999999	0
100	LINEARIZATION MENU	P11(X)	E2	-99999999	99999999	0
101	LINEARIZATION MENU	P11(Y)	E3	-99999999	99999999	0
102	LINEARIZATION MENU	P12(X)	E4	-99999999	99999999	0
103	LINEARIZATION MENU	P12(Y)	E5	-99999999	99999999	0
104	LINEARIZATION MENU	P13(X)	E6	-99999999	99999999	0
105	LINEARIZATION MENU	P13(Y)	E7	-99999999	99999999	0
106	LINEARIZATION MENU	P14(X)	E8	-99999999	99999999	0
107	LINEARIZATION MENU	P14(Y)	E9	-99999999	99999999	0
108	LINEARIZATION MENU	P15(X)	F0	-99999999	99999999	0
109	LINEARIZATION MENU	P15(Y)	F1	-99999999	99999999	0
110	LINEARIZATION MENU	P16(X)	F2	-99999999	99999999	0
111	LINEARIZATION MENU	P16(Y)	F3	-99999999	99999999	0
112	LINEARIZATION MENU	P17(X)	F4	-99999999	99999999	0
113	LINEARIZATION MENU	P17(Y)	F5	-99999999	99999999	0
114	LINEARIZATION MENU	P18(X)	F6	-99999999	99999999	0
115	LINEARIZATION MENU	P18(Y)	F7	-99999999	99999999	0
116	LINEARIZATION MENU	P19(X)	F8	-99999999	99999999	0
117	LINEARIZATION MENU	P19(Y)	F9	-99999999	99999999	0
118	LINEARIZATION MENU	P20(X)	G0	-99999999	99999999	0
119	LINEARIZATION MENU	P20(Y)	G1	-99999999	99999999	0
120	LINEARIZATION MENU	P21(X)	G2	-99999999	99999999	0
121	LINEARIZATION MENU	P21(Y)	G3	-99999999	99999999	0
122	LINEARIZATION MENU	P22(X)	G4	-99999999	99999999	0
123	LINEARIZATION MENU	P22(Y)	G5	-99999999	99999999	0
124	LINEARIZATION MENU	P23(X)	G6	-99999999	99999999	0
125	LINEARIZATION MENU	P23(Y)	G7	-99999999	99999999	0
126	LINEARIZATION MENU	P24(X)	G8	-99999999	99999999	0
127	LINEARIZATION MENU	P24(Y)	G9	-99999999	99999999	0

Serial codes of commands:

Serial Code	Command
54	RESET/SET
55	FREEZE DISPLAY
56	SSI ZERO POSITION
57	RESET/SET COUNTER A
58	RESET/SET COUNTER B
59	LOCK COUNTER A
60	LOCK COUNTER B
61	RESET MIN/MAX
62	FACTORY SETTINGS
63	-
64	-
65	CLEAR LOOP TIME
66	SERIAL PRINT
67	ACTIVATE DATA
68	STORE DATA
69	TESTPROGRAM

6.3. Linearization

The linearization function of this unit allows converting a linear input signal into a non-linear developing (or vice versa). There are 24 programmable x/y coordinates available, which can be set in any desired distance over the full conversion range. Between two coordinates, the unit uses linear interpolation. Therefore it is advisable to use more coordinates in a range with strong curves and only a few coordinates where the curvature is less.

5.

To specify an individual linearization curve, the parameter LINEARISAZATION MODE must be set to either 1 QUADRANT or 4 QUADRANT (see following diagram).

6.

The parameters P1(X) to P24(X) are used to specify the coordinates on the x-axis. These are the measuring values that the unit normally would generate according to the actual input signal.

7.

Now enter the attached values to parameter P1(Y) to P24(Y). These are the values that the unit will generate <u>instead</u> of the x- values, i.e. P5(Y) replaces P5(X) etc.

The X-Coordinates must use continuously increasing settings, i.e. P1(X) must have the lowest and P24(X) must have the highest setting. If the measured value is bigger than the last defined X-value, the corresponding Y-value is displayed.
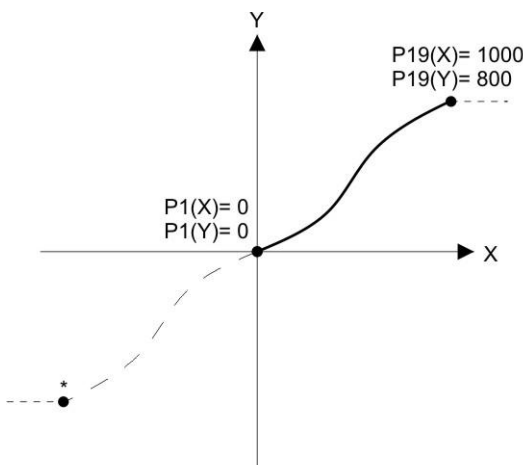
Example: Linearization Mode: 1 Quadrant
* Linearization is point symmetric to 1. Quadrant
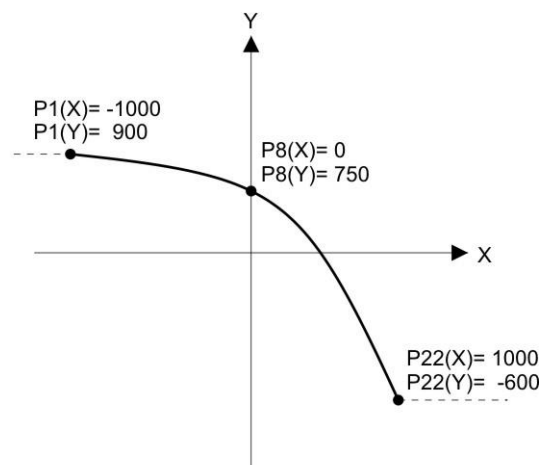
Example: Linearization Mode: 4 Quadrant

Mode: 1 Quadrant:
P1(X) must be set to zero. Linearization is only defined in the positive range and the negative range will be mirrored symmetric to central point.

Mode: 4 Quadrant:
P1(X) can also be set to a negative value. If the measured value is smaller than P1(X), P1(Y) is displayed.
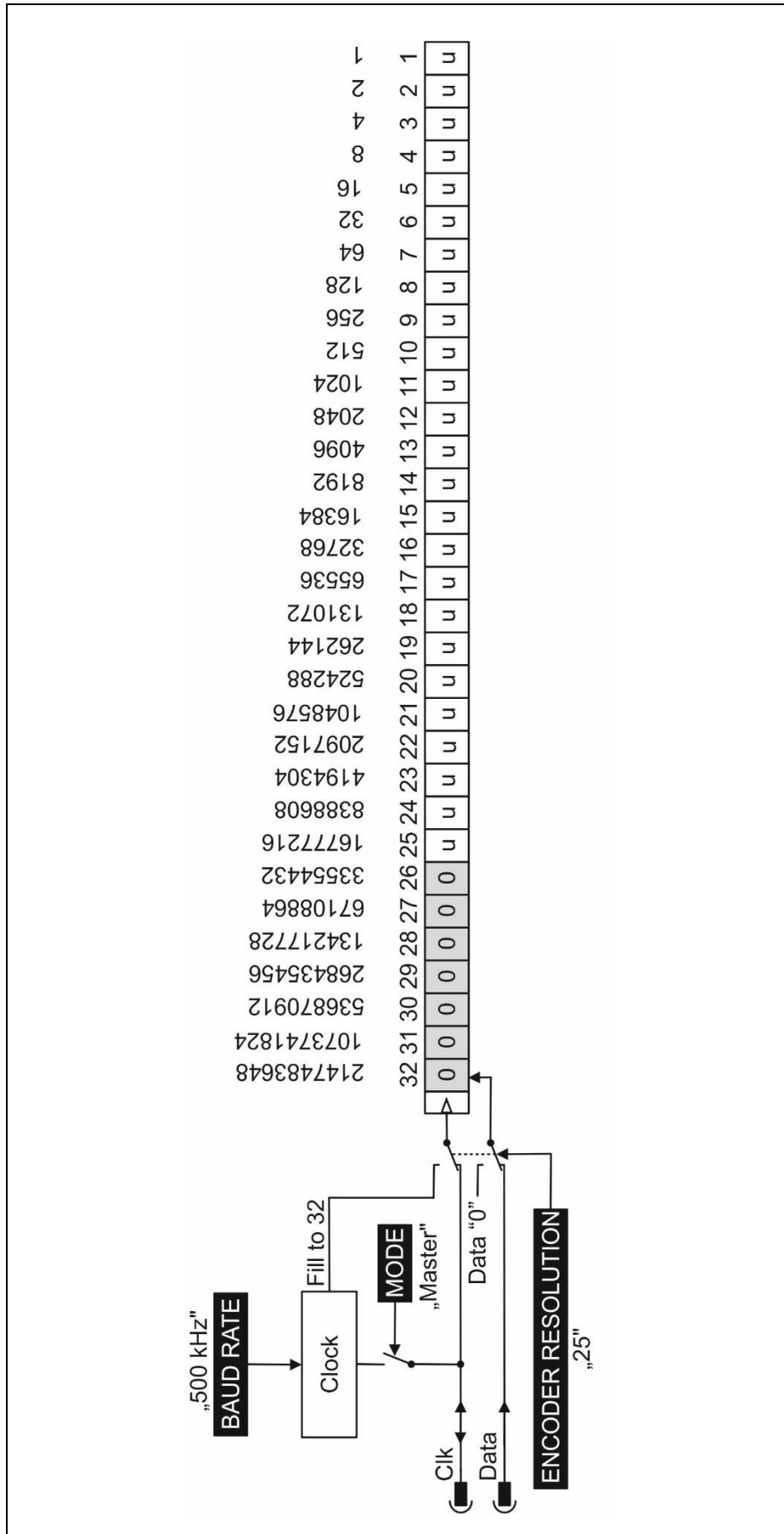
Application Example:

The picture below shows a watergate where the opening is picked up by means of an incremental encoder. We would like to display the clearance of the gate "d", but the existing encoder information is proportional to the angular information φ.
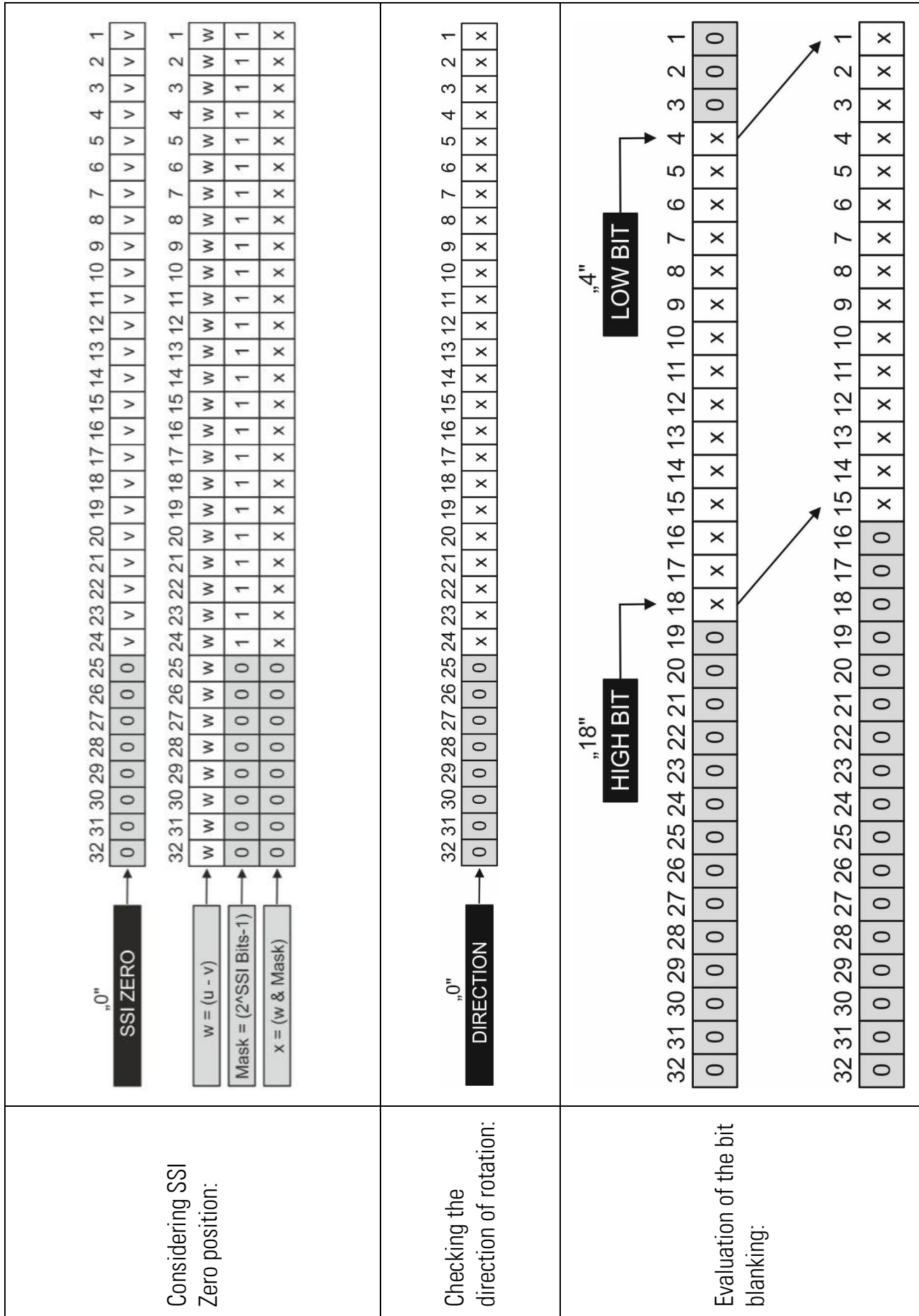

Display value
$$d = d_0 (1 - \cos \varphi)$$

Incremental Encoder
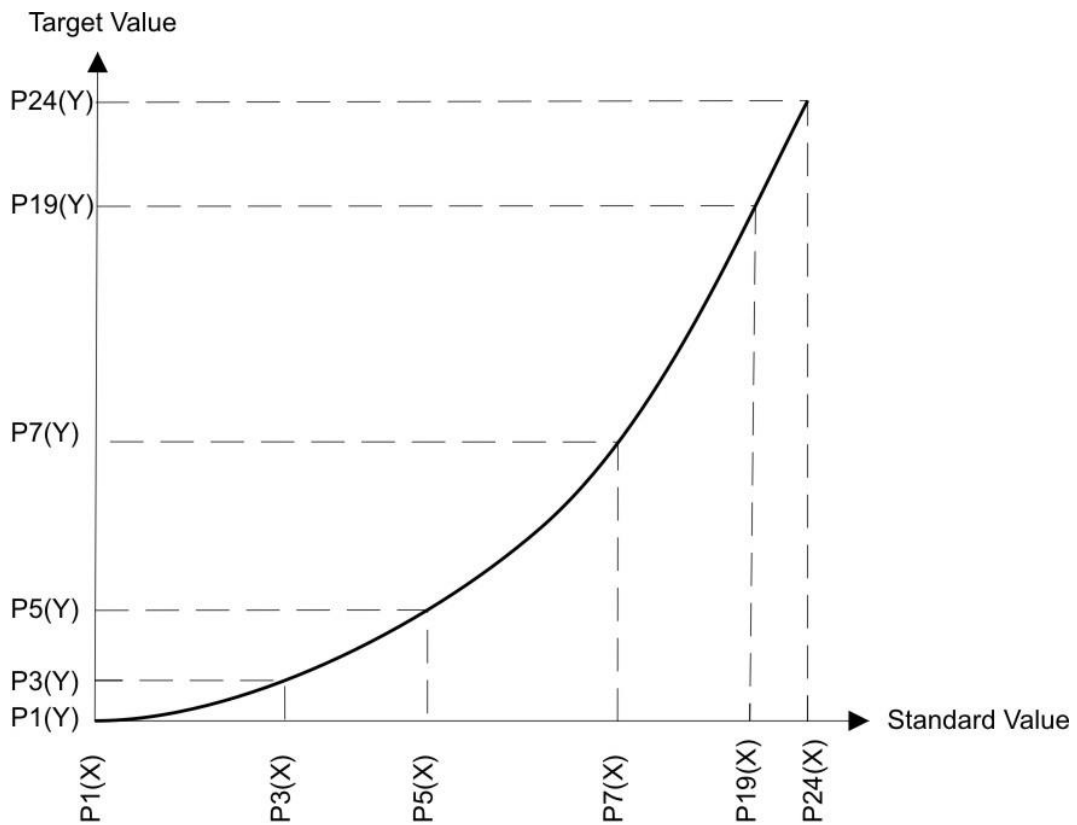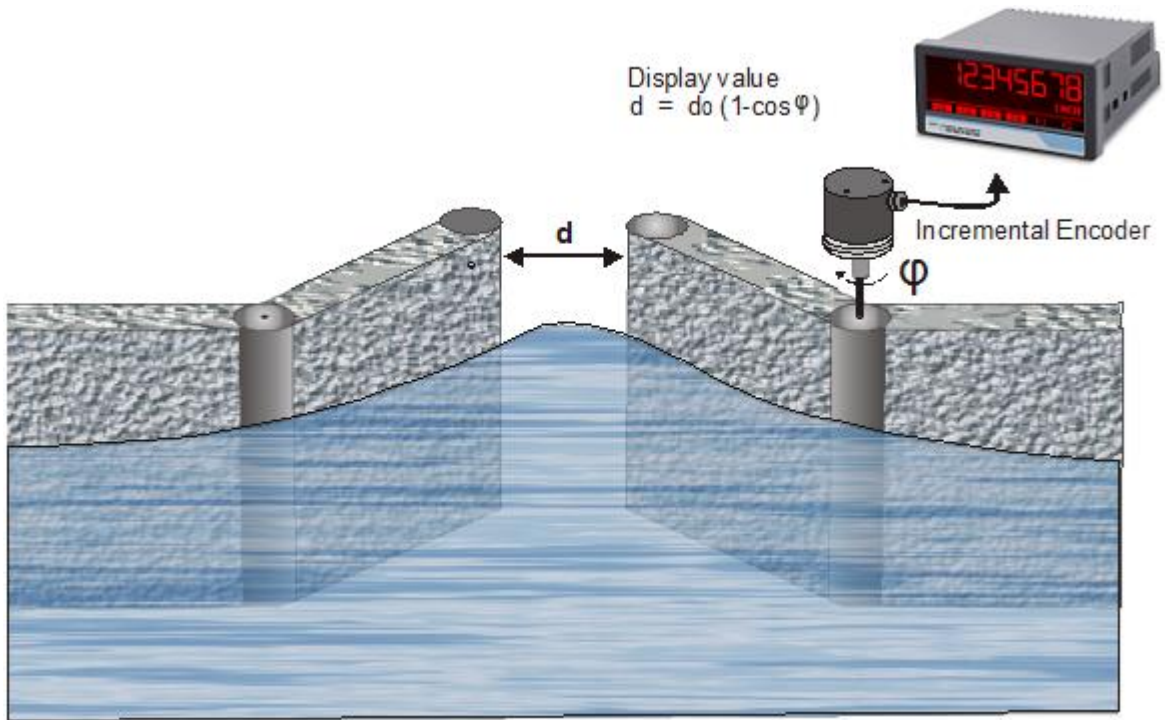
6.4.   Reading SSI-Value

The received data is always filled to 32 bit data length.

6.5. Internal processing and calculation of SSI data

Checking the error bit:	Data Conversion: Gray Code → binary	Data splitting: Bit per revolution and number of revolutions

Considering SSI Zero position:

"0" SSI ZERO

w = (u − v)

Mask = (2^SSI Bits−1)

x = (w & Mask)

Checking the direction of rotation:

"0" DIRECTION

Evaluation of the bit blanking:

"18" HIGH BIT

"4" LOW BIT

Continuation "Internal processing and calculation of SSI data"

Considering SSI Offset:	"0" SSI OFFSET
	
	`32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1`
	`0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 y y y y y y y y y y y y y y y y`
	
	$z = (x - y)$
	`32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1`
	`z z z z z z z z z z z z z z z z z z z z z z z z z z z z z z z z`

Calculation Display Value:	$$z \times \frac{\text{FACTOR } "1"}{\text{DIVIDER } "1"} + \text{ADDITIVE VALUE } "0" = 1.2345$$

6.6.   Operating modes / OP modes of the Start/Stop interface

The device supports the following operating modes:

- MASTER
    - The Init pulse for the connected encoder is generated by the device.
    - The two Init connections (INIT OUT, /INIT OUT) are configured as outputs in this case.

- SLAVE
    - The Init pulse for the encoder is generated by an external device.
    - The two Init connections (ext. INIT IN, ext. /INIT IN) are configured as inputs in this case.

The desired operating mode can be selected in the "General Menu" using the "INIT MODE" parameter.

The device can also be operated in the following three "Operational Modes". The desired measurement function (distance measurement, angle measurement or velocity measurement) can be selected from among by means of the "OPERATIONAL MODE" parameter.

- **POSITION** (distance measurement)

The current position of the position encoder is determined on the basis of a run-time measurement consisting of a start and stop pulse and can be converted into another unit, if desired, using the existing scaling parameters (Factor, Divider and Additive Value) (e.g. for serial readout of the position value in a desired unit).

Interpretation of the measurement result during distance measurement:

The default setting of the scaling parameters ("FACTOR = 1", "DIVIDER = 1" and ADDITIVE VALUE = 0") corresponds to a position measurement result in micrometers (µm).
For example, to get a position in "inch" with three fictitious decimal places, the parameter "FACTOR" must be set to "10", the parameter "DIVIDER" to "254" and the parameter "ADDITIVE VALUE" to "0".

- **ANGLE** (angle measurement)

For angle measurement, the desired position or angle output value per rotation can be specified by means of parameter "ROUND LOOP VALUE". This output value is generated as soon as the distance covered (e.g. circumference), which is set as the reference value in the parameter "CIRCUMFERENCE (in mm)", is reached. Afterwards the output value starts again at 0 until the covered distance is reached again. (Round Loop Function!)
Using existing scaling parameters (Factor, Divider and Additive Value), this output value can be rescaled if desired.

Interpretation of the measurement result during angle measurement:

The default setting ("CIRCUMFERENCE (mm) = 100.000" and "ROUND LOOP VALUE = 360", as well as "FACTOR = 1", "DIVIDER = 1" and "ADDITIVE VALUE = 0") corresponds to an angle output or position output of "0...360" (e.g.: degrees) every 100.000 mm.

Continuation *"Operating modes / OP modes of the Start/Stop interface"*

- **SPEED** (speed measurement)

The speed is recorded and can be converted again into another unit using existing scaling parameters (Factor, Divider and Additive Value), if desired.

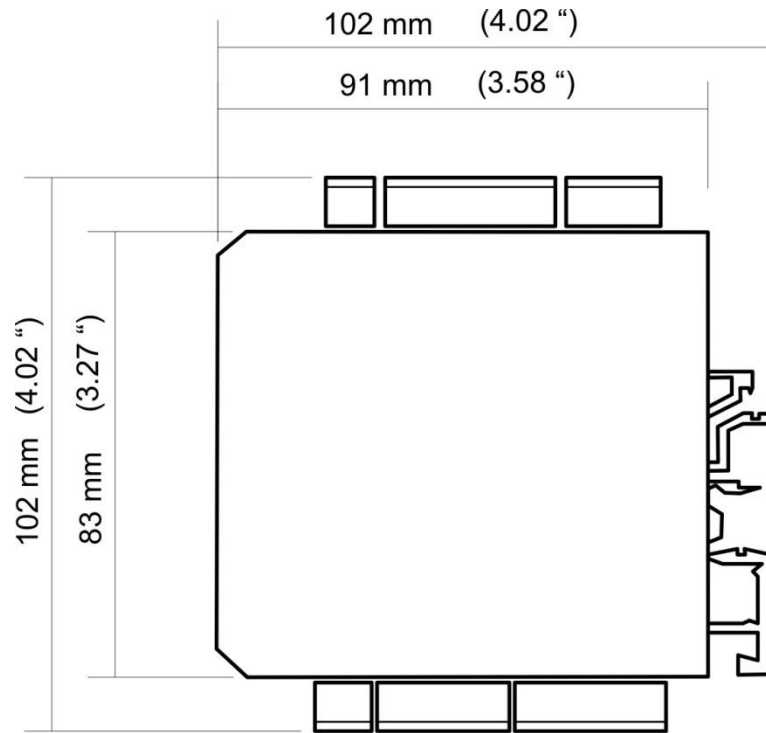*Interpretation of the measurement result during speed measurement:*

The default setting ("FACTOR = 1", "DIVIDER = 1" and "ADDITIVE VALUE = 0") corresponds to a velocity output in meters per second [m/s].

	The parallel output and the linearization function always refer to the <u>scaled</u> measuring result of the selected operational mode! (Measurement_Result)

6.7.   Dimensions

6.8.   Technical Specifications:

Technical Specifications		
Connections:	Connector type:	screw terminal, 1.5 mm² / AWG 16
		25 pin SUB-D socket for parallel output
Power supply (DC)::	Input voltage:	10 … 30 VDC
	Protection circuit:	reverse polarity protection
	Consumption:	approx. 30 mA (unloaded)
	Fuse protection:	extern: T 0.5 A
Encoder supply:	Output voltage:	5 VDC and 24 VDC (approx.1 V lower than the power supply)
	Output current:	max. 250 mA
Incremental-inputs:	Number of inputs:	A, /A, B, /B
	Configuration::	RS422, TTL, HTL differential, HTL PNP or HTL NPN
	RS422:	max. 1 MHz (RS422 differential signal > 0,5 V)
	HTL differential	max. 500 kHz (HTL differential signal > 2 V)
	TTL/ HTL PNP / NPN:	max. 250 kHz
	Load:	max. 6 mA / Ri > 5 kOhm / 10 pF
	Accuracy frequency measurement:	+/- 50 ppm, +/-1 Digit
SSI interface:	Input format	TTL differentiell, RS422-Standard
	Number (channels):	Clock, /Clock, Data, /Data
	Configuration:	Master or Slave (adjustable)
	Format:	Binary or Gray code
	Frequency:	max. 1 MHz
	Resolution:	10 … 32 Bit
	Load:	Max. 3 mA / Ri > 10 kOhm / 10 pF
Start/Stop-interface:	RS422 input:	1 x (Start_Stop, /Start_Stop); 1x (ext. Init_In, ext. /Init_In)
	RS422 output:	1 x (Init_Out, /Init_Out)
	Pulse width Init-pulse:	1…9 µs (adjustable)
	Frequency Init-pulse:	62,5 Hz - 5000 Hz (adjustable)
	Clock frequency time measurement:	48 MHz
	Resolution:	Depending on the waveguide velocity of the encoder. (e.g. 0,059mm / step at v = 2850 m/s)
Control inputs:	Number of inputs:	3
	Format:	HTL, PNP (Low 0 … 3 V, High 9 … 30 V)
	Frequency:	max. 10 kHz
	Load:	max. 2 mA / Ri > 15 kOhm / 470 pF
Parallel output:	Output format:	Binary Gray oder BCD
	Resolution:	25 Bit
	Signal level:	Push-Pull, 0 … 35 V* (external input at COM+ required)
	Output current:	max. 20 mA (at24 V)
	Internal resistance:	Ri ≈ 600 Ohm
	Protection circuit:	*) short-circuit proof up to max. 27 V
	Sampling time:	0,001s … 9,999s (adjustable)
USB interface:	Connector type:	Mini USB
	Baud rate:	115200 Baud
	Format:	8none1
Display:	LED:	green status LED
Housing:	Material:	Plastic housing
	Mounting:	35 mm DIN rail (EN 60715)
	Dimensions (w x h x d):	23 x 102 x 102 mm
	Protection class:	IP20
	Weight:	approx. 100 g
Ambient temperature:	Operation:	-20°C … +60°C (not condensing)
	Storage:	-25°C … +75°C (not condensing)
Failure rate:	MTBF in years:	56,4 a (Continuous operation at 60 ° C)
Conformity and standards:	EMC 2014/30/EU:	EN 61326-1: 2013 for industrial location
		EN 55011: 2017 / CISPR11: 2017 Class A
	RoHS (II) 2011/65/EU	
	RoHS (III) 2015/863:	EN IEC 63000: 2018