Operating Manual

motrona®
automation technology

Monitor DZ220 and DZ220/RL

| Frequency SSI absolute value Start-Stop Pulse counter | → | Analog (current / voltage) Serial (RS232) |

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, start-up bridging, …
  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
- 16 bit analog output, configurable for voltage or current operation
- USB-C interface and RS232/RS485-interface for configuration and serial readout
- Extremely short conversion times
- Linearization with 24 control points
- Auxiliary voltage output 5 and 24VDC for encoder supply
- Numerous connection options via 5 control inputs, 4 control outputs and optionally 4 further relay channels
- 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/Dz220_d.pdf

The English description is available at:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Dz220_e.pdf

La description en français est disponible sur:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Dz220_f.pdf

The operator software OS (freeware) is available at:

https://www.motrona.com/en/support/software.html

Version:	Description:
DZ220_01a_oi/tgo/mbo/Sept. 24	First Version / Edition

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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 observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use this 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 conformed 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 the successor to the proven a thousand times DZ260 series speed monitor.
This speed monitor is able to replace functionally the previous model.
However, there are differences in the device parameterization and the electrical connection assignment compared to the previous models.
The main differences between this product and the respective predecessor model are listed below

Differences between the DZ220 and DZ220/RL and its predecessor models:

	DZ220 bzw. DZ220/RL	DZ260 / DZ261 / DZ266 / DZ267 / DZ269
Control inputs:	Number of inputs: 5 Format: HTL For all variants.	Number of inputs: 2 Format: HTL For all variants.
Control outputs:	DZ220: 4 transistor outputs DZ220/RL: 4 transistor outputs	DZ260: no transistor outputs DZ261: 3 transistor outputs DZ266: no transistor outputs DZ267: no transistor outputs DZ269 : 3 transistor outputs
Relay Outputs:	DZ220: no relay outputs DZ220 /RL: 4 relay outputs	DZ260: 3 relay outputs DZ261: no relay outputs DZ266: no relay outputs DZ267: 3 relay outputs DZ269 : no relay outputs
Analog Output:	DZ220: 1 analog output DZ220 /RL: 1 analog output (16 Bit (+/-15 Bit))	DZ260: 1 analog output DZ261: 1 analog output DZ266: 1 analog output DZ267: no analog output DZ269 : no analog output (14 Bit (+/-13 Bit))
Encoder Supply:	Output voltage: 5VDC u. 24VDC Output current: max. 250 mA	Output voltage: ca. 5,2VDC Output current: max. 70 mA
Serial Interface:	RS232 Baud rate: 9600, 19200, 38400 or 115200 Baud Data format: 8-even-1, 8-odd-1, 8-none-1, 8-none-2	RS232 Baud rate: 600, 1200, 2400, 4800, 9600, 19200, or 38400 Baud Data format: 7-even-1, 7-even-2, 7-odd-1, 7-odd-2, 7-none-1, 7-none-2, 8-even-1, 8-odd-1, 8-none-1, 8-none-2
USB-Interface:	USB-C	none
Display:	none	LCD with backlighting
Housing:	Dimensions (BxHxT): 34 x 100 x 131 mm (1,34 x 3,94 x 5,16 inch) (without connections) 34 x 118 x 140 mm (1,34 x 4,65 x 5,51 inch) (with connections) Weight: approx. 160 g	Dimensions (BxHxT): 72 x 91 x 76 mm (2,83 x 3,58 x 2,99 inch) weight: approx. 200 g
Device parameterization:	Exclusively via operating software OS and USB-C interface	Via operating software OS and RS232 interface or via keyboard

3. Introduction

The device is designed as a signal converter with control inputs and outputs. Its extensive functions 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 signals of a start-stop interface
- Operation as absolute value converter for SSI signals

3.2. Function Diagram
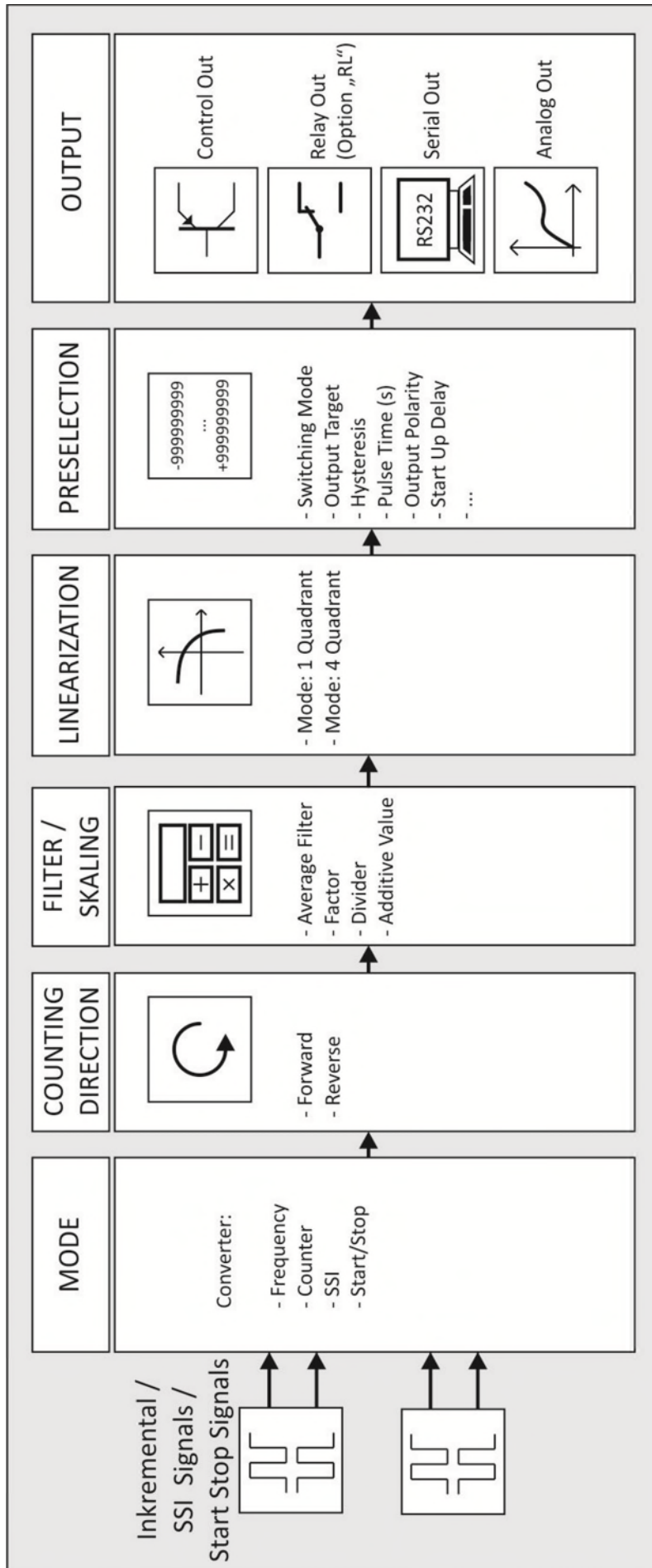
3.3.   Power – LED / Error Messages

The device has a green and a yellow LED on its front foil. The green LED lights up permanently as soon as the supply voltage of the device has been applied. If an error occurs, the yellow LED flashes at 1 Hz. The analog output is also controlled with 0 V resp. 0/4 mA. If the error no longer exists, the yellow LED automatically doesn't light up again and the analogue output responds to the current result again.

The exact error can be read out via the USB 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	Measured value is greater than 99999999
0x00000002	Minimum Value	Measured value is less than -99999999
0x00000004	SSI Encoder Error	SSI error bit set
0x00000008	Encoder Fault	Wire break monitoring.
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.
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.
0x00000040	Start/Stop Encoder Error	No "start" and no "stop" pulse detected between two "init" pulses. (only for PV210) Check sensor connections!
0x00000080	Position Encoder Outside the Limit	No "start" and no "stop" pulse detected between two "init" pulses. (only for PV210) 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).

	Connections						
	X1	X2	X3	X4	X5	X6	USB
DZ220	*	*			*	*	*
DZ220/RL	*	*	*	*	*	*	*
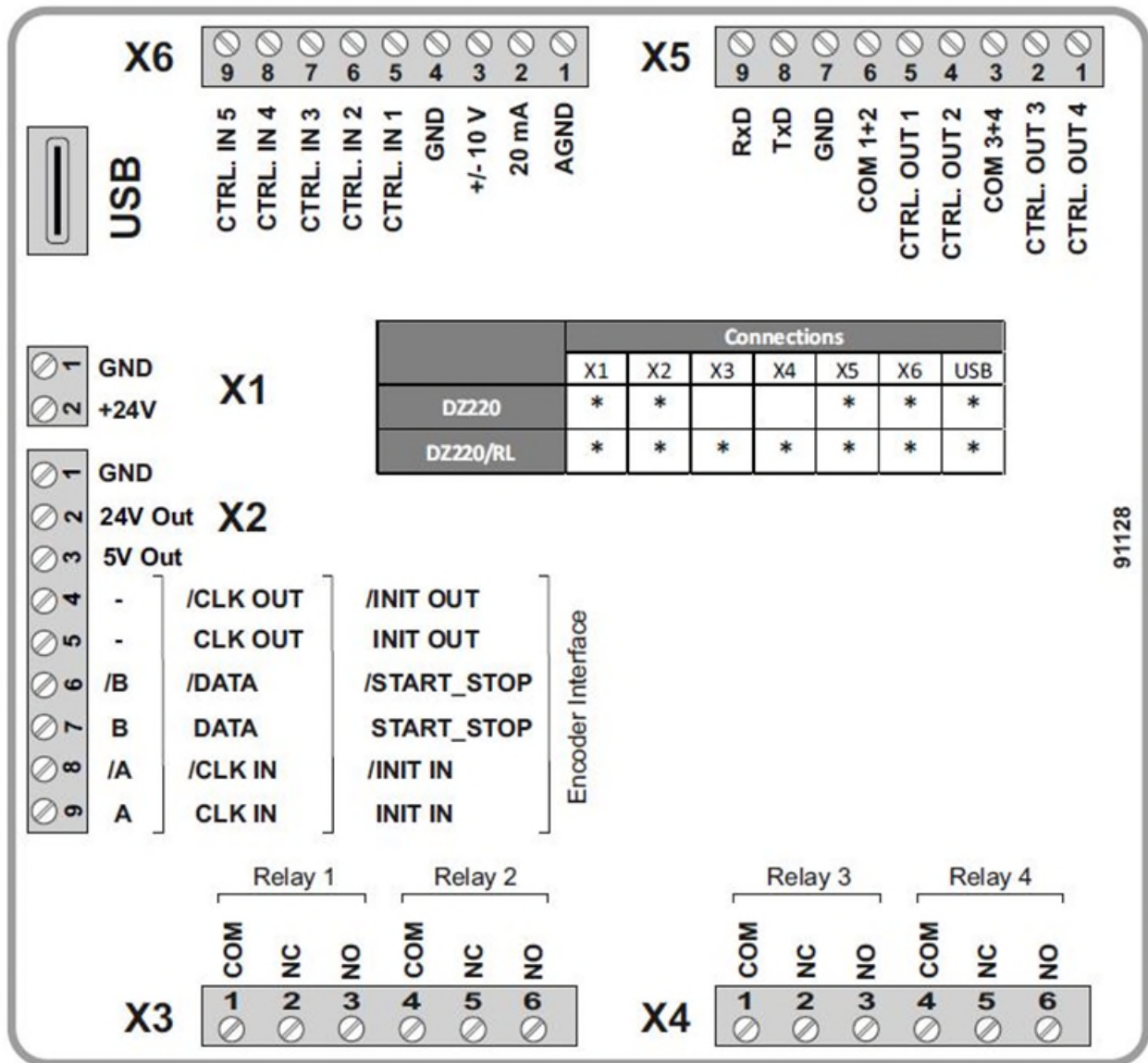
4.1. DC Power Supply (X1)

The unit accepts DC supply from 18 to 30 V at the terminals X1 1 and 2. The power consumption depends on the level of the supply voltage with approx. 60 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 1, 2 and 3. The 24 VDC output voltage depends on the device supply (see technical data).

4.3. Incremental Encoder Input (X2)

Terminal X2 pins 6, 7, 8 and 9 provide a connection for various incremental signals.

RS422
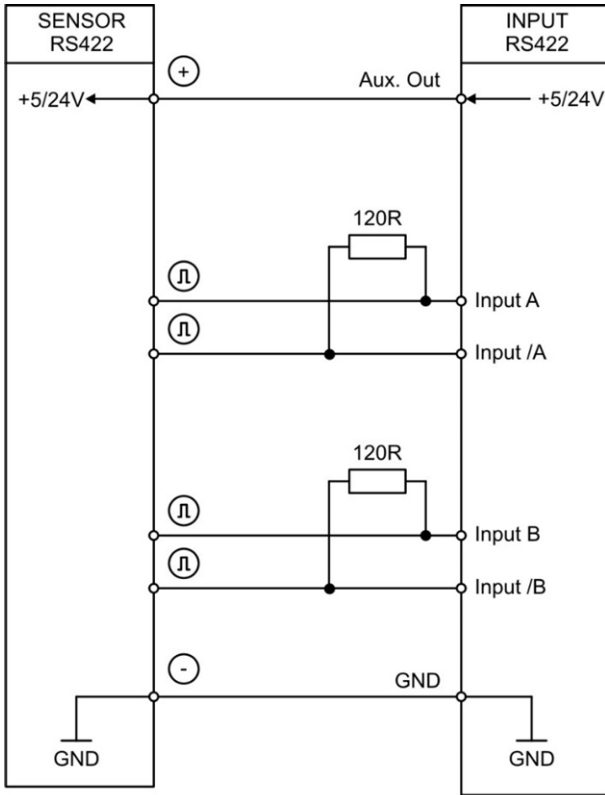
HTL DIFFERENTIAL
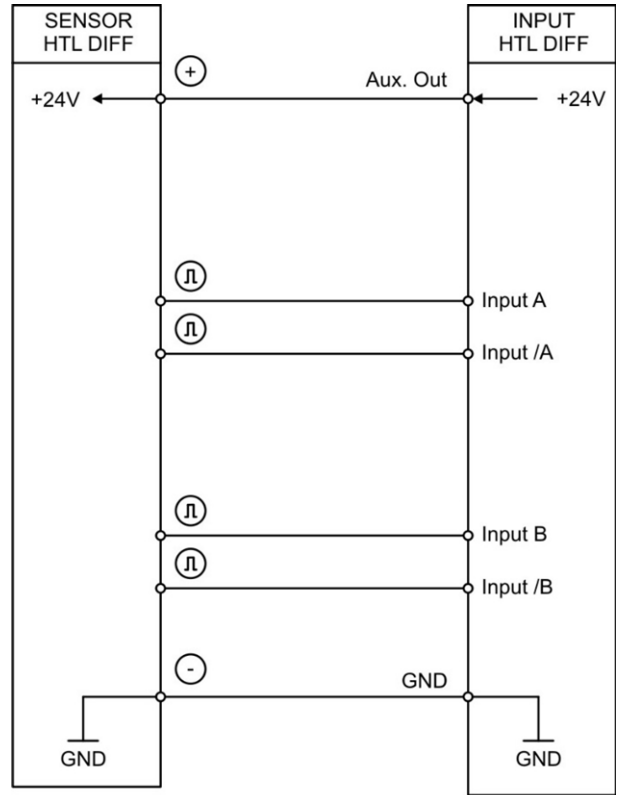
HTL PNP
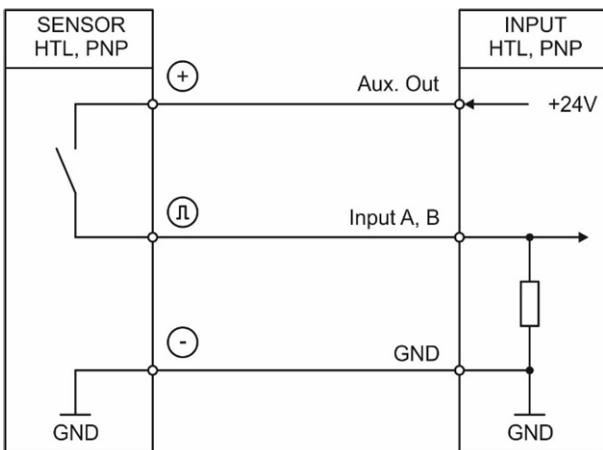
HTL NPN
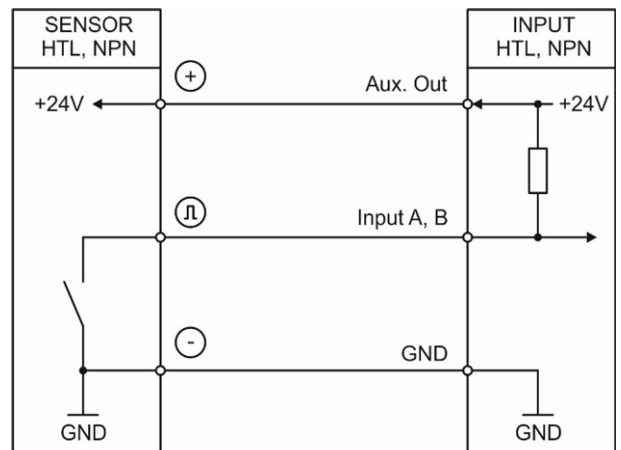
Continuation "**Incremental Encoder Input (X2)**":

HTL NPN (NAMUR)
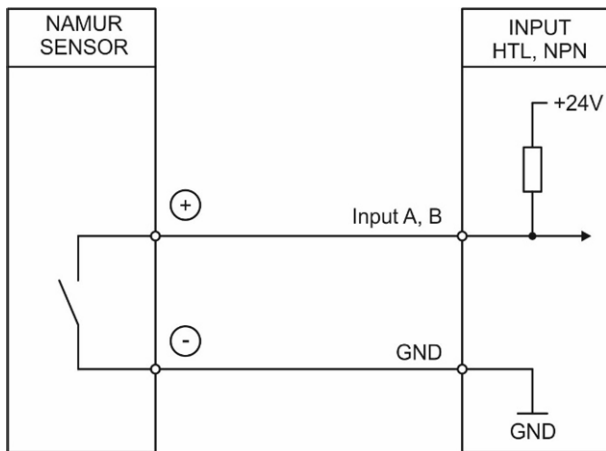
TTL (PNP)
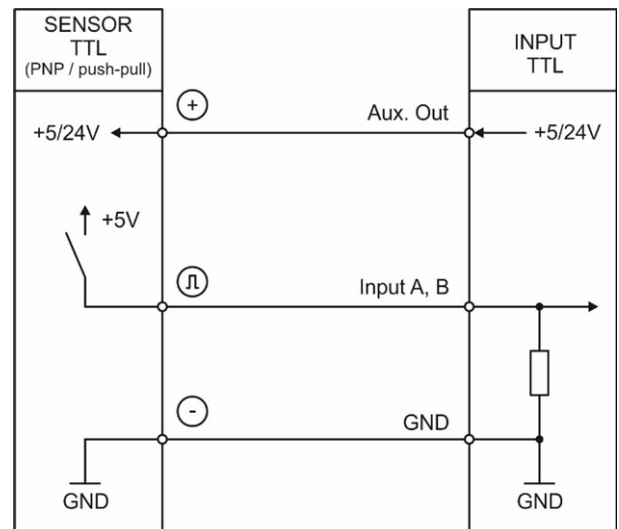
Unconnected PNP inputs are always "LOW" and unconnected NPN inputs are always "HIGH".
All inputs are designed to receive impulses from electrical impulse sources.

4.4.   SSI-Absolute Encoder Input (X2)

At terminal X2 pin 4, 5, 6, 7 the SSI connection for the MODE MASTER is available.
An external 120 Ohm resistor between the "Data" and "/Data" connection ensures reliable wire break detection of this data channel.

Connection for **MODE Master**:
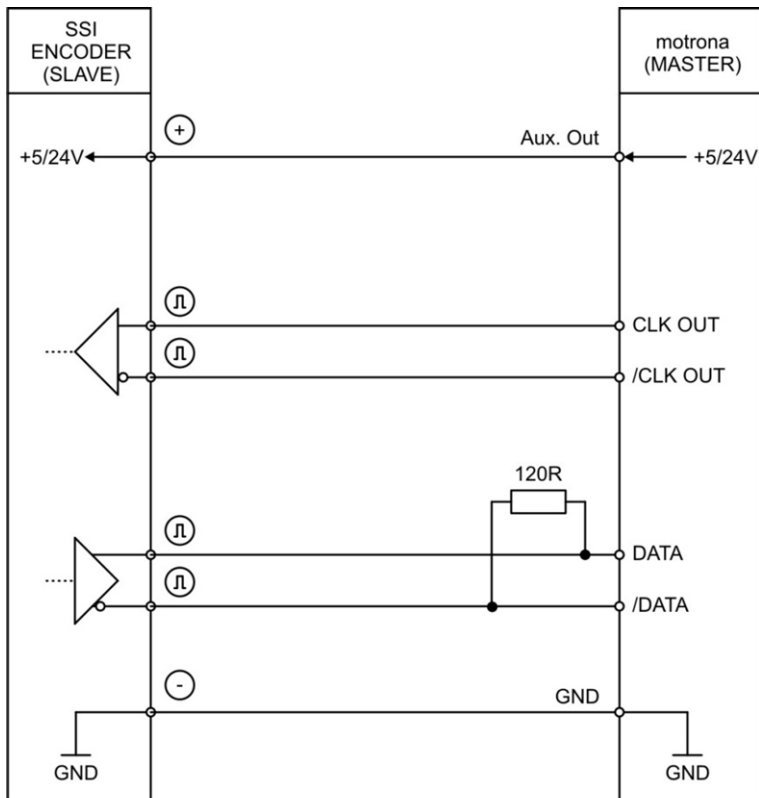
Continuation "**SSI-Absolute Encoder Input (X2)**":

The SSI connection for the "MODE SLAVE" is available at terminal X2 pin 6, 7, 8, 9.
Two external 120 Ohm resistors between the "Clk In" and "/Clk In" connections and the "Data" and "/Data" connections ensure reliable wire break detection of these two data channels.

Connection for **MODE Slave**:
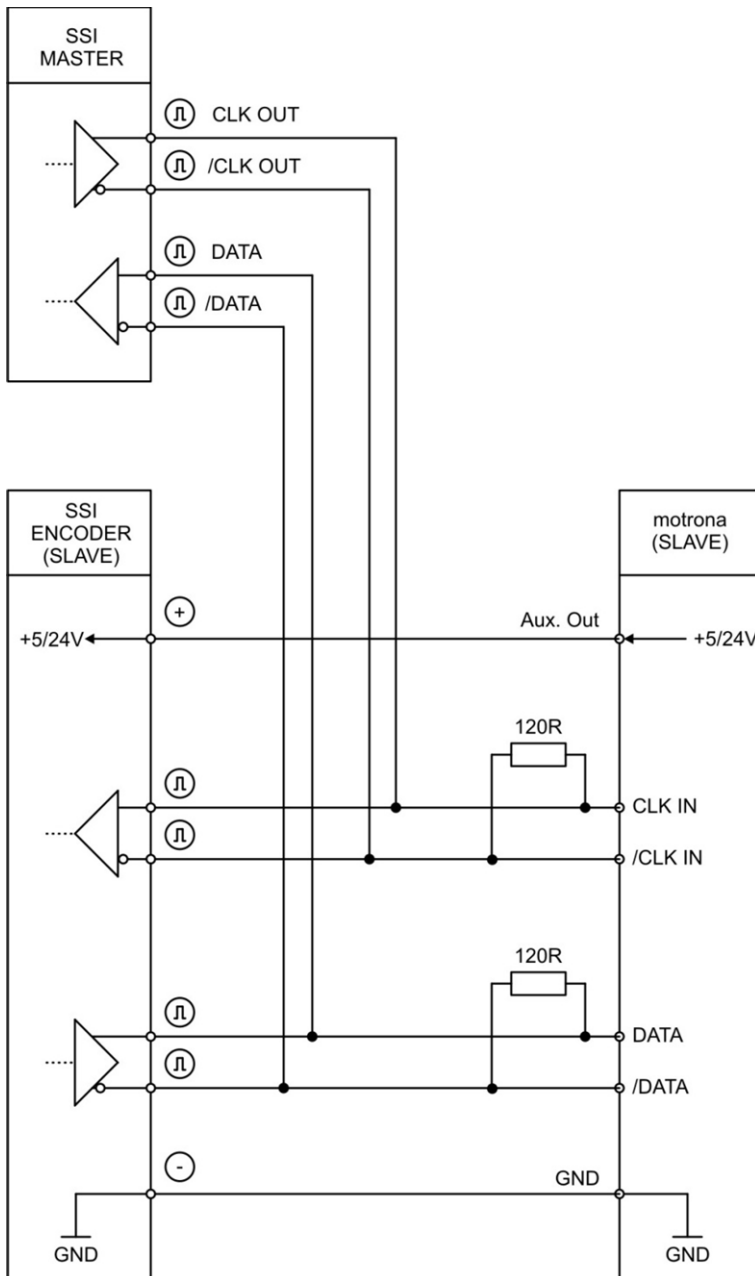
4.5.   Start Stop Encoder Inputs (X2)

At terminal X2 - Pin 4+5 the RS422 connection for the init pulse in "MODE MASTER" is available. (Device generates init pulse itself!).

At terminal X2 - Pin 6 + 7 the RS422 connection for the Start-Stop pulse is available.
An external 120 Ohm resistor between the "Start_Stop" and "/Start_Stop" connection ensures reliable wire break detection of this data channel.

Connection for **MODE Master**:
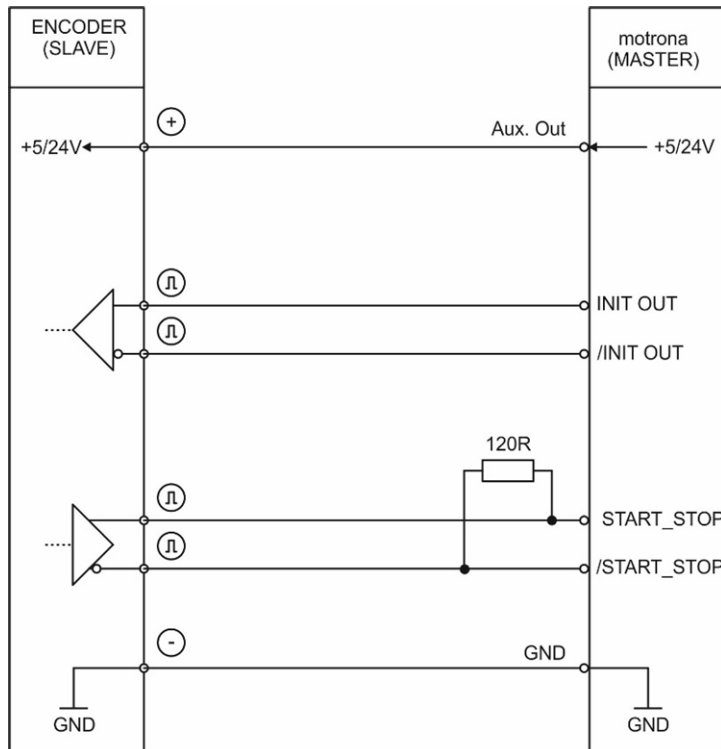
DPI measurement operation:

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.
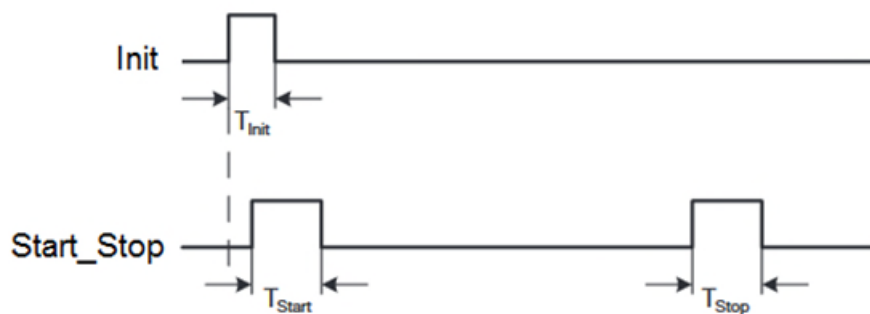
T_{Init}:	1…9 μs (adjustable)
T_{Start}:	~3…5 μs
T_{Stop}:	~3…5 μs

Continuation "**Start Stop Encoder Inputs (X2)**":

At terminal X2 – Pin 8 and 9 the RS422 connection for the init pulse in "MODE SLAVE" is available.
(Init pulse is generated by another device (master)!)
The RS422 connection for the start-stop pulse is also available at terminal X2 - pins 6 and 7 in slave mode.
Two external 120 Ohm resistors between the "Start_Stop" and "/Start_Stop" connections and the "Init In" and "/Init In" connections ensure reliable wire break detection of these two data channels.

Connection for **MODE Slave**:
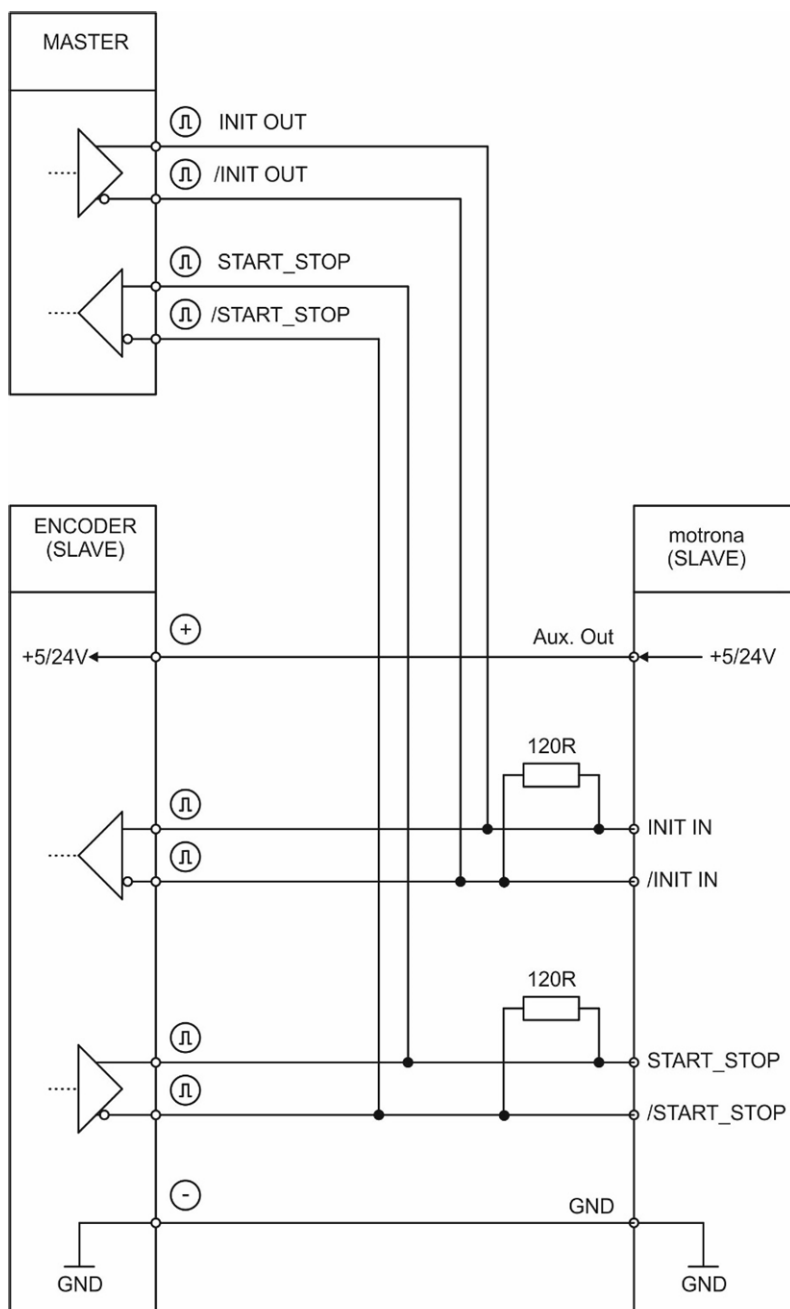
4.6.   Control Inputs (X6)

At terminal X6 pins 5, 6, 7, 8 and 9 there are five control inputs with HTL PNP characteristic available.
Control Input 1 (Ctrl. In 1) to Control Input 4 (Ctrl. In 4) are freely configurable in the COMMAND MENU and are used for functions to be triggered externally. eg. for releasing the latching, resetting the measurement result or for teaching the preset values or the analog output.
Control input 5 (Ctrl. In 5) is used exclusively for resetting the device parameters to the "default" values. Thus, it is not freely configurable.

	Note:
☞	With an HTL pulse (ACTIVE HIGH) on Ctrl. In 5, the device is reset to the factory settings. The HTL pulse must be applied to the input for approx. one second. The green LED on the front briefly flashes after the device has been successfully reset to the factory settings. The HTL pulse must then be removed again.

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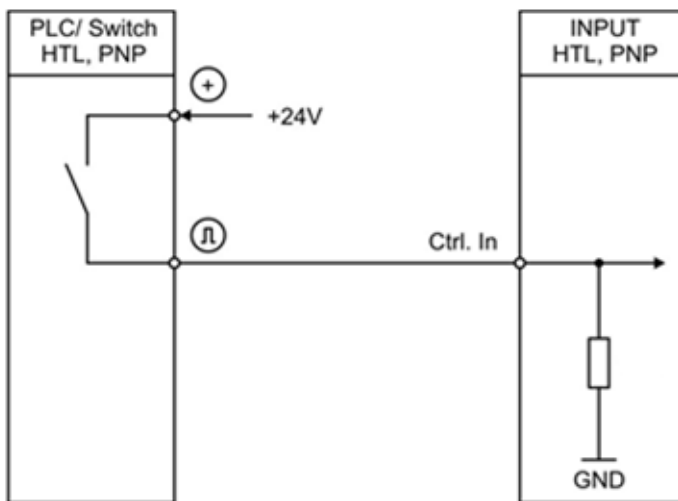
Unconnected control inputs are always "LOW".
All inputs are designed to receive impulses from an electronic impulse source.

4.7.   Analog Output (X6)

A 16 bit analog output is available at terminal X6 pins 1, 2 and 3.
This output can be configured and scaled in the ANALOG MENU.

The following configuration is possible:

- Voltage output: -10 … +10 V
- Current output: 0 … 20 mA
- Current output: 4 … 20 mA

The analog output is proportional to the display value and is referenced to potential AGND.
AGND and GND are internally interconnected.

> **Important:**
> A parallel operation with voltage and current output at the analog output is <u>not</u> allowed!

4.8. Serial Interface (X5)

A serial interface (RS232) is available at terminal X5 pins 7, 8 and 9.
This interface can be configured in the SERIAL MENU.

The serial interface RS232 can be used as follows:

- for parameterization of the device during commissioning
- to modify parameters during operation
- to read out actual values by PC or PLC

Connection of the **RS232** interface:
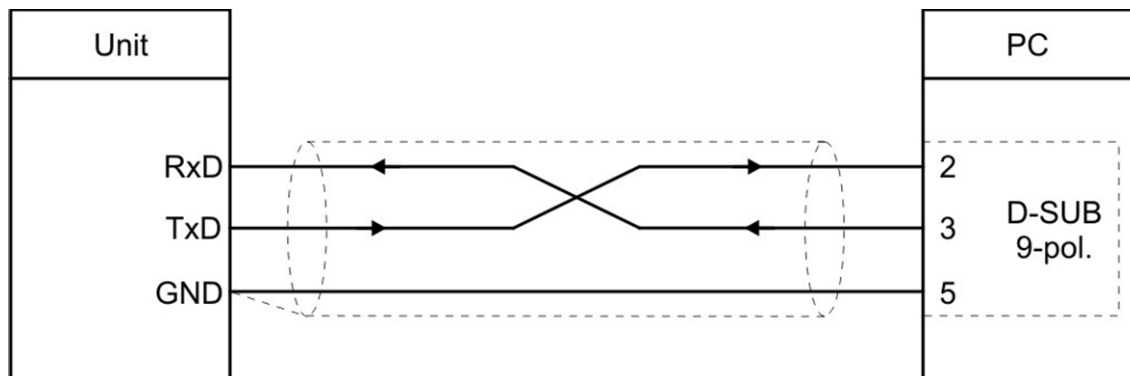
4.9. USB Interface (X7)

A serial USB interface is available at the front USB-C port.

The USB interface can be used as follows:

- for parameterization of the device during commissioning
- to modify parameters during operation
- to read out actual values by PC

> The serial USB communication occurs with a baud rate of "*115200 Baud*" and a serial data format of "*8-none-1*" and cannot be changed by the user!

4.10.   Control Outputs (X5)

Four control outputs are available at terminal X5 pins 1 and 2 and pins 4 and 5.
Switching conditions can be set in the PRESELECTION MENU.
The outputs Ctrl. Out 1 to 4 are designed as high side drivers.

The switching voltage for Ctrl. Out 1 and 2 is determined by the voltage supplied to terminal X5 pin 6 (COM1+2) and the switching voltage for Ctrl. Out 3 and 4 is determined by the voltage supplied to terminal X5 pin 3 (COM3+4).

In case of switching inductive loads it is advisable to use external filtering of the coils.

Connection of the **control outputs**:
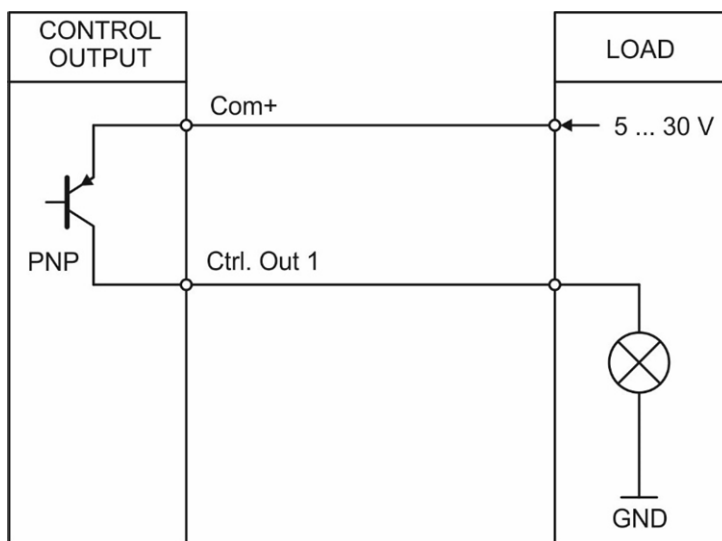
4.11.　Relay Outputs (X3 u. X4)

Four relay outputs with potential-free changeover contacts are available at terminal X3 and terminal X4 for devices with additional option "RL" (DZ220/RL). The switching conditions can be set in the PRESELECTION MENU.

AC switching capacity:
115VAC / 0,6A or 230VAC / 0,3A

DC switching capacity:
30VDC / 2A

Connection of the **relay outputs**:
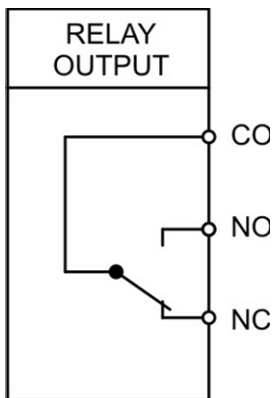
5. Parameter / Overview – Menu Structure

The parameterization of the device is realized via the USB-C 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

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

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

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

PRESELECTION VALUES
PRESELECTION 1
PRESELECTION 2
PRESELECTION 3
PRESELECTION 4
PRESELECTION 5
PRESELECTION 6
PRESELECTION 7
PRESELECTION 8

Menu / Parameter	Menu / Parameter

PRESELECTION 1 MENU
MODE 1
HYSTERESIS 1
PULSE TIME 1 (s)
OUTPUT TARGET 1
OUTPUT POLARITY 1
OUTPUT LOCK 1
START UP DELAY 1 (s)

PRESELECTION 5 MENU
MODE 5
HYSTERESIS 5
PULSE TIME 5 (s)
OUTPUT TARGET 5
OUTPUT POLARITY 5
OUTPUT LOCK 5
START UP DELAY 5 (s)

PRESELECTION 2 MENU
MODE 2
HYSTERESIS 2
PULSE TIME 2 (s)
OUTPUT TARGET 2
OUTPUT POLARITY 2
OUTPUT LOCK 2
START UP DELAY 2 (s)

PRESELECTION 6 MENU
MODE 6
HYSTERESIS 6
PULSE TIME 6 (s)
OUTPUT TARGET 6
OUTPUT POLARITY 6
OUTPUT LOCK 6
START UP DELAY 6 (s)

PRESELECTION 3 MENU
MODE 3
HYSTERESIS 3
PULSE TIME 3 (s)
OUTPUT TARGET 3
OUTPUT POLARITY 3
OUTPUT LOCK 3
START UP DELAY 3 (s)

PRESELECTION 7 MENU
MODE 7
HYSTERESIS 7
PULSE TIME 7 (s)
OUTPUT TARGET 7
OUTPUT POLARITY 7
OUTPUT LOCK 7
START UP DELAY 7 (s)

PRESELECTION 4 MENU
MODE 4
HYSTERESIS 4
PULSE TIME 4 (s)
OUTPUT TARGET 4
OUTPUT POLARITY 4 (s)
OUTPUT LOCK 4
START UP DELAY 4 (s)

PRESELECTION 8 MENU
MODE 8
HYSTERESIS 8
PULSE TIME 8 (s)
OUTPUT TARGET 8
OUTPUT POLARITY 8
OUTPUT LOCK 8
START UP DELAY 8 (s)

Menu / Parameter

SERIAL MENU

UNIT NUMBER
SERIAL BAUD RATE
SERIAL FORMAT
SERIAL PROTOCOL
SERIAL TIMER (s)
SERIAL VALUE
MODBUS
UNIT NUMBER (USB)
SERIAL BAUD RATE (USB)
SERIAL FORMAT (USB)

ANALOG MENU

ANALOG FORMAT
ANALOG START
ANALOG END
ANALOG GAIN (%)
ANALOG OFFSET (%)

COMMAND MENU

INPUT 1 ACTION
INPUT 1 CONFIG
INPUT 2 ACTION
INPUT 2 CONFIG
INPUT 3 ACTION
INPUT 3 CONFIG
INPUT 4 ACTION
INPUT 4 CONFIG
INPUT 5 ACTION
INPUT 5 CONFIG

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
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.

	-999999999	Smallest value
	1	Default value
	999999999	Highest value

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

	1	Smallest value
	1	Default value
	999999999	Highest value

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

	-999999999	Smallest value
	0	Default value
	999999999	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

BACKUP 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 setting for standstill definition. A time of xx.xx seconds after detection "Frequency = 0 Hz " at channel A the unit signals "standstill" and reactivates the start-up-delays. Stand still detection can be set in PRESELECTION MENU.		
	0,01	Shortest time in seconds
	…	
	99,99	Largest time in seconds

Continuation "**Mode Frequency**":

AVERAGE FILTER 1

Selectable averaging or filter function for unstable frequencies at input A for smoothing the analog signal. 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 yellow LED flashes and the analogue output consequently controls 0 V or 0/4 mA.
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

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

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

Continuation "**Mode Frequency**":

AVERAGE FILTER 2

Selectable averaging or filter function for unstable frequencies at input A for smoothing the analog signal. 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 yellow LED flashes and the analogue output consequently controls 0 V or 0/4 mA.
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 control input), the counter of input A is set to this value.	
-999999999	Smallest value
0	Default value
+999999999	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 control input), the counter of input B is set to this value	
-999999999	Smallest value
0	Default value
+999999999	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.
	...	
	999999999	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 4 and 5 / Mode Slave: Terminal X2 - Pin 8 and 9)			
	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 Binary

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 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
	…	
	9999999999	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.
	…	
	999999999	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

☞ <u>Note</u>: 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 4 and 5 / Mode Slave: terminal X2 – Pin 8 and 9)		
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!)	
-999999999	Smallest value
0	Default value
999999999	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
	999999.999	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
	999999999	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 and the start-up suppression is reactivated. A standstill monitoring can be set in the PRESELECTION MENU.

	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. Preselection Values

This menu is used to set the preselection values of the switching points.

> The switching points always refer to the scaled measurement result "Measurement Result"!

PRESELECTION 1
Preselection / switching point 1

	-999999999	Smallest value
	1000	Default value
	+999999999	Highest value

PRESELECTION 2
Preselection / switching point 2

	-999999999	Smallest value
	2000	Default value
	+999999999	Highest value

PRESELECTION 3
Preselection / switching point 3

	-999999999	Smallest value
	3000	Default value
	+999999999	Highest value

PRESELECTION 4
Preselection / switching point 4

	-999999999	Smallest value
	4000	Default value
	+999999999	Highest value

PRESELECTION 5
Preselection / switching point 5

	-999999999	Smallest value
	5000	Default value
	+999999999	Highest value

PRESELECTION 6
Preselection / switching point 6

	-999999999	Smallest value
	6000	Default value
	+999999999	Highest value

Continuation "**Preselection Values**":

PRESELECTION 7		
Preselection / switching point 7		
	-999999999	Smallest value
	7000	Default value
	+999999999	Highest value

PRESELECTION 8		
Preselection / switching point 8		
	-999999999	Smallest value
	8000	Default value
	+999999999	Highest value

5.7. Preselection 1 Menu

MODE 1		
Switching conditions for preselection 1. Output switches under the following conditions:		
0	|RESULT|>=|PRES|	Absolute value of the display value is greater or equal absolute value of PRESELECTION 1 With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value >= PRESELECTION 1 → ON, Display value < PRESELECTION 1 – HYSTERESIS 1 →OFF
1	|RESULT|<=|PRES|	Absolute value of the display value is less or equal absolute value of PRESELECTION 1 (start-up suppression (START UP DELAY) is advisable) With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value <= PRESELECTION 1 → ON, Display value > PRESELECTION 1 + HYSTERESIS 1 →OFF
2	|RESULT|=|PRES|	Absolute value of the display value is equal absolute value of PRESELECTION 1 A range (Preselection +/- ½ Hysteresis) can be defined and monitored in conjunction with the hysteresis. With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value > PRESELECTION 1 + ½ HYSTERESIS 1 → OFF, Display value < PRESELECTION 1 - ½ HYSTERESIS 1 → OFF
3	RESULT>=PRES	Display value is greater or equal PRESELECTION 1, e.g. overspeed With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value >= PRESELECTION 1 → ON, Display value < PRESELECTION 1 – HYSTERESIS 1 →OFF
4	RESULT<=PRES	Display value is less or equal PRESELECTION 1, e.g. underspeed (start-up suppression (START UP DELAY) is advisable) With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value <= PRESELECTION 1 → ON, Display value > PRESELECTION 1 + HYSTERESIS 1 →OFF
5	RESULT=PRES	Display value is equal PRESELECTION 1. A range (Preselection +/- ½ Hysteresis) can be defined and monitored in conjunction with the hysteresis. With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value > PRESELECTION 1 + ½ HYSTERESIS 1 → OFF, Display value < PRESELECTION 1 - ½ HYSTERESIS 1 → OFF
6	RESULT=0	Display value is zero (Standstill after STANDSTILL TIME 1(s)), e. g. standstill monitoring. (Only in MODE: "START/STOP" + OPERATIONAL MODE: "SPEED" and in MODE: "FREQUENCY").
7	RES>=PRES-TRAIL	Trailing PRESELECTION 1: Display value is greater or equal PRESELECTION 1 – PRESELECTION 5 → PRESELECTION 5 is the trailing value from PRESELECTION 1
8	ERROR SET	Error message for device errors.

Continuation "**Preselection 1 Menu**":

HYSTERESIS 1	
This parameter defines the switching hysteresis of the switch-off point for preselection 1.	
0	No switching hysteresis
…	
99999	Switching hysteresis of 99999

PULSE TIME 1 (S)	
Duration of output pulse for the switching condition of preselection 1.	
0,000	No output pulse (static signal)
…	
60,000	Pulse duration of 60 seconds

OUTPUT TARGET 1

Assignment of an output for the switching condition of preselection 1.

Note:

If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 1

Polarity for the switching condition of preselection 1.

0	ACTIVE HIGH	Switching condition is true → Active „HIGH"
1	ACTIVE LOW	Switching condition is true → Active „LOW"

OUTPUT LOCK 1

Latch for the switching condition of preselection 1.

0	NO	No latch for preselection
1	YES	Latch for preselection (command LOCK RELEASE will clear latch)

Continuation "**Preselection 1 Menu**":

START UP DELAY 1 (S)		
Start-up suppression for the switching condition of preselection 1.		
Time to start the monitoring function.		
This adjustment is only valid for the switching condition |RESULT|<=|PRES| or RESULT<=PRES and only for MODE "FREQUENCY" – Channel A or MODE: "START/STOP" + OPERATIONAL MODE: "SPEED".		
<u>Note</u>:		
START UP DELAY is set to this parameter, when the frequency is detected as 0 Hz (or at a velocity of 0 m/s). The monitoring function remains deactivated until the set time has elapsed.		
With a setting "60.000", the automatic start override is activated. The monitoring function remains deactivated until the preset value / switching point is exceeded for the first time.		
	0.000	No start-up suppression
	…	
	59.999	Start-up suppression in seconds
	60.000	Automatic start-up suppression

5.8. Preselection 2 Menu

MODE 2

Switching conditions for preselection 2, see chapter PRESELECTION 1 MENU (except the trailing value).

		See chapter PRESELECTION 1 MENU
7	RES>=PRES-TRAIL	Trailing PRESELECTION 2: Display value is greater or equal PRESELECTION 2 – PRESELECTION 6 → ON, PRESELECTION 6 is the trailing value from PRESELECTION 2

HYSTERESIS 2

This parameter defines the switching hysteresis of the switch-off point for preselection 2.
See chapter PRESELECTION 1 MENU.

PULSE TIME 2 (S)

Duration of output pulse for the switching condition of preselection 2.
See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 2

Assignment of an output for the switching condition of preselection 2.

Note:

If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 2

Polarity for the switching condition of preselection 2. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 2

Latch for the switching condition of preselection 2. See chapter PRESELECTION 1 MENU.

START UP DELAY 2 (S)

Start-up suppression for the switching condition of preselection 2. See chapter PRESELECTION 1 MENU.

5.9. Preselection 3 Menu

MODE 3
Switching conditions for preselection 3, see chapter PRESELECTION 1 MENU (except the trailing value).

		See chapter PRESELECTION 1 MENU
7	RES>=PRES-TRAIL	Trailing PRESELECTION 3: Display value is greater or equal PRESELECTION 3 – PRESELECTION 7 PRESELECTION 7 is the trailing value from PRESELECTION 3

HYSTERESIS 3
This parameter defines the switching hysteresis of the switch-off point for preselection 3.
See chapter PRESELECTION 1 MENU.

PULSE TIME 3 (S)
Duration of output pulse for the switching condition of preselection 3.
See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 3
Assignment of an output for the switching condition of preselection 3.
Note:
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 3
Polarity for the switching condition of preselection 3. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 3
Latch for the switching condition of preselection 3. See chapter PRESELECTION 1 MENU.

START UP DELAY 3 (S)
Start-up suppression for the switching condition of preselection 3. See chapter PRESELECTION 1 MENU.

5.10. Preselection 4 Menu

MODE 4
Switching conditions for preselection 4, see chapter PRESELECTION 1 MENU (except the trailing value).

			See chapter PRESELECTION 1 MENU
	7	RES>=PRES-TRAIL	Trailing PRESELECTION 4: Display value is greater or equal PRESELECTION 4 – PRESELECTION 8 PRESELECTION 8 is the trailing value from PRESELECTION 4

HYSTERESIS 4
This parameter defines the switching hysteresis of the switch-off point for preselection 4.
See chapter PRESELECTION 1 MENU.

PULSE TIME 4 (S)
Duration of output pulse for the switching condition of preselection 4. See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 4
Assignment of an output for the switching condition of preselection 4.
Note:
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 4
Polarity for the switching condition of preselection 4. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 4
Latch for the switching condition of preselection 4. See chapter PRESELECTION 1 MENU.

START UP DELAY 4 (S)
Start-up suppression for the switching condition of preselection 4. See chapter PRESELECTION 1 MENU.

5.11.   Preselection 5 Menu

MODE 5			
Switching conditions for preselection 5, see chapter PRESELECTION 1 MENU (except the trailing value).			
			See chapter PRESELECTION 1 MENU
	7	RES>=PRES-TRAIL	Trailing PRESELECTION 5: Display value is greater or equal PRESELECTION 5 – PRESELECTION 1 PRESELECTION 1 is the trailing value from PRESELECTION 5

HYSTERESIS 5
This parameter defines the switching hysteresis of the switch-off point for preselection 5.
See chapter PRESELECTION 1 MENU.

PULSE TIME 5 (S)
Duration of output pulse for the switching condition of preselection 5. See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 5
Assignment of an output for the switching condition of preselection 5.
<u>Note:</u>
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 5
Polarity for the switching condition of preselection 5. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 5
Latch for the switching condition of preselection 5. See chapter PRESELECTION 1 MENU.

START UP DELAY 5 (S)
Start-up suppression for the switching condition of preselection 5. See chapter PRESELECTION 1 MENU.

5.12.   Preselection 6 Menu

MODE 6

Switching conditions for preselection 6, see chapter PRESELECTION 1 MENU (except the trailing value).

			See chapter PRESELECTION 1 MENU
	7	RES>=PRES-TRAIL	Trailing PRESELECTION 6: Display value is greater or equal PRESELECTION 6 – PRESELECTION 2 PRESELECTION 2 is the trailing value from PRESELECTION 6

HYSTERESIS 6

This parameter defines the switching hysteresis of the switch-off point for preselection 6.
See chapter PRESELECTION 1 MENU.

PULSE TIME 6 (S)

Duration of output pulse for the switching condition of preselection 6. See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 6

Assignment of an output for the switching condition of preselection 6.
Note:
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 6

Polarity for the switching condition of preselection 6. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 6

Latch for the switching condition of preselection 6. See chapter PRESELECTION 1 MENU.

START UP DELAY 6 (S)

Start-up suppression for the switching condition of preselection 6. See chapter PRESELECTION 1 MENU.

5.13. Preselection 7 Menu

MODE 7
Switching conditions for preselection 7, see chapter PRESELECTION 1 MENU (except the trailing value).

		See chapter PRESELECTION 1 MENU
7	RES>=PRES-TRAIL	Trailing PRESELECTION 7: Display value is greater or equal PRESELECTION 7 – PRESELECTION 3 PRESELECTION 3 is the trailing value from PRESELECTION 7

HYSTERESIS 7
This parameter defines the switching hysteresis of the switch-off point for preselection 7.
See chapter PRESELECTION 1 MENU.

PULSE TIME 7 (S)
Duration of output pulse for the switching condition of preselection 7. See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 7
Assignment of an output for the switching condition of preselection 7.
<u>Note:</u>
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 7
Polarity for the switching condition of preselection 7. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 7
Latch for the switching condition of preselection 7. See chapter PRESELECTION 1 MENU.

START UP DELAY 7 (S)
Start-up suppression for the switching condition of preselection 7. See chapter PRESELECTION 1 MENU.

5.14. Preselection 8 Menu

MODE 8
Switching conditions for preselection 8, see chapter PRESELECTION 1 MENU (except the trailing value).

			See chapter PRESELECTION 1 MENU
	7	RES>=PRES-TRAIL	Trailing PRESELECTION 8: Display value is greater or equal PRESELECTION 8 – PRESELECTION 4 PRESELECTION 4 is the trailing value from PRESELECTION 8

HYSTERESIS 8
This parameter defines the switching hysteresis of the switch-off point for preselection 8.
See chapter PRESELECTION 1 MENU.

PULSE TIME 8 (S)
Duration of output pulse for the switching condition of preselection 8. See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 8
Assignment of an output for the switching condition of preselection 8.
Note:
If more than one switching condition is assigned to one output, the output is set when at least one switching condition is true.

0	NO	No assignment
1	CTRL OUT 1	Switching condition assigned to "Ctrl. Out 1"
2	CTRL OUT 2	Switching condition assigned to "Ctrl. Out 2"
3	CTRL OUT 3	Switching condition assigned to "Ctrl. Out 3"
4	CTRL OUT 4	Switching condition assigned to "Ctrl. Out 4"
5	REL. OUT 1	Switching condition assigned to Rel. Out 1
6	REL. OUT 2	Switching condition assigned to Rel. Out 2
7	REL. OUT 3	Switching condition assigned to Rel. Out 3
8	REL. OUT 4	Switching condition assigned to Rel. Out 4

OUTPUT POLARITY 8
Polarity for the switching condition of preselection 8. See chapter PRESELECTION 1 MENU.

OUTPUT LOCK 8
Latch for the switching condition of preselection 8. See chapter PRESELECTION 1 MENU.

START UP DELAY 8 (S)
Start-up suppression for the switching condition of preselection 8. See chapter PRESELECTION 1 MENU.

5.15.   Serial Menu

lThis 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.		
	11	Smallest address without zero
	…	
	99	Highest address without zero

SERIAL BAUD RATE		
This parameter defines the serial baud rate.		
0	9600	9600 baud
1	19200	19200 baud
2	38400	38400 baud
3	115200	115200 baud

SERIAL FORMAT			
This parameter defines the bit data format.			
0	8-EVEN-1	8 Data	Parity even	1 Stop
1	8-ODD-1	8 Data	Parity odd	1 Stop
2	8-NONE-1	8 Data	no Parity	1 Stop
3	8-NONE-2	8 Data	no Parity	2 Stops

Continuation "**Serial Menu**":

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 no., +/-, 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.

SERIAL VALUE

This parameter defines the value to be transmitted.

Setting	Code	Meaning
0	:0	Measurement_Result (Result after linking, scaling, filter, etc.)
1	:1	Analog_Out_Voltage (Analog output modulation (in mV))
2	:2	Frequency (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	Analog_Out_Current (Analog output modulation (in yA))
12	;2	Analog_Out_Percentage (Percentage analog output level) (Measurement result in xxx.x %)
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))

Continuation "**Serial Menu**":

MODBUS		
This parameter enables the Modbus protocol and determines the Modbus address. For details of the Modbus communication please refer to the additional manual Modbus_RTU		
	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.

UNIT NUMBER (USB)		
Note: The serial device address of the USB interface is permanently set to "11" and cannot be changed by the user.		
	11	Smallest address without zero
	11	
	11	Highest address without zero

SERIAL BAUD RATE (USB)		
Note: The serial baud rate of the USB interface is permanently set to "115200 baud" and cannot be changed by the user.		
0	115200	115200 Baud

SERIAL FORMAT (USB)			
Note: The serial data format of the USB interface is permanently set to "8-none-1" and cannot be changed by the user.			
0	8-NONE-1	8 Data	no Parity	1 Stop

5.16. Analog Menu

This menu defines the basic settings of the analog output.

> The analog output always refers to the scaled measurement result **"Measurement Result"**!

ANALOG FORMAT

This parameter defines the output characteristics. The analogue output is proportional to the display value. With setting ANALOG FORMAT (-10 … +10 V) in MODE COUNTER the polarity of the analog output depends on the polarity of the display value.

0	-10…10V	-10 … +10 V
1	0…20MA	0 … 20 mA
2	4…20MA	4 … 20 mA

ANALOG START

This parameter defines the start value of the analog conversion. This start value is corresponding to the display value for an analog output of 0 V or 0/4 mA.

	-999999999	Smallest end value
	0	Default value
	+999999999	Highest end value

ANALOG END

This parameter defines the end value of the analog conversion. This end value is corresponding to the display value for an analog output of (+/-) 10 V or 20mA.

	-999999999	Smallest end value
	10000	Default value
	+999999999	Highest end value

ANALOG GAIN (%)

This parameter specifies the maximum conversion of the analog output in %.

e. g. 102.00 corresponds to a conversion of 10.2 V or 20.4 mA, when the ANALOG END value is reached.
e. g. 95.00 corresponds to a conversion of 9.5 V or 18 mA, when the ANALOG END value is reached.

	0,00	Smallest gain
	100,00	Default value
	110,00	Highest gain

ANALOG OFFSET (%)

This parameter defines the zero offset of the analog output.

z. B. 0.20 result in an offset of 0.02 V or 0.04 mA at ANALOG START value

	-99,99	Smallest offset
	0	Default value
	+99,00	Highest offset

5.17. 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	(s)
3	TEACH ANALOG START	Transfer of the current measurement result in the parameter "Analog Start"	(d)
4	TEACH ANALOG END	Transfer of the current measurement result in the parameter "Analog End"	(d)
5	TEACH PRESELECTION 1	Transfer of the current measurement result into the parameter "Preselection 1"	(d)
6	TEACH PRESELECTION 2	Transfer of the current measurement result into the parameter "Preselection 2"	(d)
7	TEACH PRESELECTION 3	Transfer of the current measurement result into the parameter "Preselection 3"	(d)
8	TEACH PRESELECTION 4	Transfer of the current measurement result into the parameter "Preselection 4"	(d)
9	TEACH PRESELECTION 5	Transfer of the current measurement result into the parameter "Preselection 5"	(d)
10	TEACH PRESELECTION 6	Transfer of the current measurement result into the parameter "Preselection 6"	(d)
11	TEACH PRESELECTION 7	Transfer of the current measurement result into the parameter "Preselection 7"	(d)
12	TEACH PRESELECTION 8	Transfer of the current measurement result into the parameter "Preselection 8"	(d)
13	SERIAL PRINT	Sending the serial data (see parameter "Serial Print")	(d)
14	ACTIVATE DATA	N.A.	
15	STORE DATA	N.A.	
16	TESTPROGRAM	N.A.	
17	CLEAR LOOP TIME	Reset of the maximum "Loop Time"	(d)
18	RESET/SET COUNTER A	**Mode "Counter":** Reset / set the counter value of channel A to the set value in SET VALUE A	(d) (s)
19	RESET/SET COUNTER B	**Mode "Counter":** Reset / set the counter value of channel B to the set value in SET VALUE B	(d) (s)
20	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)
21	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)
22	ZERO POSITION	**Mode "SSI":** Transfer of the current SSI position in the parameter "SSI-Zero" (encoder zero offset)	(d) (s)

Continuation "**Command Menu**":

23	RESET MIN/MAX	Reset the minimum / maximum value	(d) (s)
24	LOCK RELEASE ALL	Release latching of all outputs	(d)
25	LOCK RELEASE 1	Release latching of the output assigned in Preselection 1	(d)
26	LOCK RELEASE 2	Release latching of the output assigned in Preselection 2	(d)
27	LOCK RELEASE 3	Release latching of the output assigned in Preselection 3	(d)
28	LOCK RELEASE 4	Release latching of the output assigned in Preselection 4	(d)
29	FACTORY SETTINGS	Device is reset to factory settings.	(d)

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 function assignment parameter INPUT 1 ACTION.

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

INPUT 3 ACTION
This parameter defines the control function of the input "Ctrl. In 3".
See function assignment parameter INPUT 1 ACTION.

INPUT 3 CONFIG
This parameter defines the switching characteristics of the input "Ctrl. In 3".
See activation assignment parameter INPUT 1 CONFIG.

INPUT 4 ACTION
This parameter defines the control function of the input "Ctrl. In 4".
See function assignment parameter INPUT 1 ACTION.

INPUT 4 CONFIG
This parameter defines the switching characteristics of the input "Ctrl. In 3".
See activation assignment parameter INPUT 1 CONFIG.

INPUT 5 ACTION
This parameter is permanently preset to "Factory Settings" (reset device to factory settings) and <u>cannot</u> be changed by the user.

INPUT 5 CONFIG
This parameter is permanently preset to "Rising Edge" and <u>cannot</u> be changed by the user.

5.18.   Linearization Menu

The linearization function is defined in this menu.

Linearization description and examples are shown in the appendix

☞	The linearization function always refers to the scaled measurement result **"Measurement Result"**!

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.

	-999999999	Smallest X-coordinate
	0	Default value
	+999999999	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).

	-999999999	Smallest X-coordinate
	0	Default value
	+999999999	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 measurement result of a monitor (Code=0) from a unit with unit address 11:

ASCII-Code:	EOT	1	1	:	0	ENQ
Hexadecimal:	04	31	31	3A	30	05
Binary:	0000 0100	0011 0001	0011 0001	0011 1010	0011 0000	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. Modbus RTU Interface

The Modbus interface of the touchMatrix series is a standard Modbus RTU Slave and provides the following Modbus functions:

- Read Coils
- Write Single Coil
- Read Holding Registers
- Write Multiple Registers
- Diagnosis

For the operation of the interface module and the understanding of this manual basic knowledge in Modbus RTU communication is presupposed.

6.2.1. Parameter Setting

Required parameter settings in "Serial menu":

UNIT NUMMER
Not valid for Modbus communication
(For setting of Modbus address see parameter "MODBUS")

SERIAL BAUD RATE
This parameter defines the serial baud rate

0	9600	9600 baud
1	19200	19200 baud
2	38400	38400 baud
3	115200	115200 baud

SERIAL FORMAT
This parameter defines the bit data format.

0	8-EVEN-1	8 data	Parity even	1 Stop
1	8-ODD-1	8 data	Parity odd	1 Stop
2	8-NONE-1	Do not use with Modbus protocol.		
3	8-NONE-2	8 data	no Parity	2 Stops

Continuation "**Parameter Setting**":

```
SERIAL PROTOCOL
Not valid for Modbus communication
```

```
SERIAL TIMER (S)
Not valid for Modbus communication
```

```
SERIAL VALUE
Not valid for Modbus communication
```

MODBUS
This parameter enables the Modbus protocol and determines the Modbus address.

	0	Do not use for Modbus protocol (Modbus disabled)
	1 … 247	Modbus enabled: Serial interface is using Modbus RTU protocol The number set here determines the Modbus node address.

6.2.2. Read Holding Registers and Write Multiple Registers

With the functions "Read Holding Registers" and "Write Multiple Registers" it is possible to access all registers of the device.

All variables (actual data) and status registers are mapped to Modbus Holding Registers.
However, as all registers of the device are 32 bit registers but Modbus Holding registers are only 16 bit registers, each register of the device requires two Holding registers.
(For this reason the use of Modbus function "Write Single Register" is not possible.)

It is only possible to access to one single register of the touchMATRIX device by each read or write operation, therefore the "Quantity (or number) of registers" in the Modbus request must always be 2.

Access to Parameters
Holding Register 0x0000 / 0x0001 hex and following allow access to the device parameters.

The holding register numbers for a certain parameter can be calculated by the parameter # that can be found in the parameter table in the touchMatrix device manual:
Holding Register low = (parameter #) x 2
Holding Register high = (parameter #) x 2 + 1

Example:
Access to parameter #63 "PRESELECTION 1" by Holding Register 0x007E and 0x007F hex.

Continuation "**Read Holding Registers and Write Multiple Registers**":

Access to actual data

Holding Register 0x1000 / 0x1001 hex and following allow access to variables of the device (actual data registers):

Holding Register 0x1000 / 0x1001 hex → Actual data with serial Code ":0" (Display value)
Holding Register 0x1002 / 0x1003 hex → Actual data with serial Code ":1"
Holding Register 0x1004 / 0x1005 hex → Actual data with serial Code ":2"
Holding Register 0x1006 / 0x1007 hex → Actual data with serial Code ":3"
etc.

Access to status registers

Holding Register 0x2000 / 0x2001 hex and following allow access to status registers of the device:

Holding Register 0x2000 / 0x2001 hex → Output Status (Ctrl. Out status, read only)
Holding Register 0x2002 / 0x2003 hex → Serial Commands
Holding Register 0x2004 / 0x2005 hex → External Command (Ctrl. In status, read only)
Holding Register 0x2006 / 0x2007 hex → All Commands (read only)

6.2.3. Read Coils and Write Single Coil

With the functions "Read Coils" and "Write Single Coil" it is possible to read and set/reset single commands:

Coil number	Serial code of command	Command	
0	54	RESET/SET	Transfer of the currently detected position value into the parameter "Offset" Setting Counter A and Counter B to "Set Value"
1	55	FREEZE DISPLAY	Freezing of the current measurement result
2	56	TEACH ANALOG START	Transfer of the current measurement result in the parameter "Analog Start"
3	57	TEACH ANALOG END	Transfer of the current measurement result in the parameter "Analog End"
4	58	TEACH PRESELECTION 1	Transfer of the current measurement result into the parameter "Preselection 1"
5	59	TEACH PRESELECTION 2	Transfer of the current measurement result into the parameter "Preselection 2"
6	60	TEACH PRESELECTION 3	Transfer of the current measurement result into the parameter "Preselection 3"
7	61	TEACH PRESELECTION 4	Transfer of the current measurement result into the parameter "Preselection 4"
8	62	TEACH PRESELECTION 5	Transfer of the current measurement result into the parameter "Preselection 5"
9	63	TEACH PRESELECTION 6	Transfer of the current measurement result into the parameter "Preselection 6"
10	64	TEACH PRESELECTION 7	Transfer of the current measurement result into the parameter "Preselection 7"
11	65	TEACH PRESELECTION 8	Transfer of the current measurement result into the parameter "Preselection 8"

Continuation "**Read Coils and Write Single Coil**":

12	66	SERIAL PRINT (do not use with Modbus)	Sending of serial data, see parameter SERIAL VALUE
13	67	ACTIVATE DATA (not required with Modbus)	The data is activated.
14	68	STORE DATA	Store to EEPROM
15	69	TESTPROGRAM (do not use with Modbus)	Test program (do not use with Modbus)
16	5:	CLEAR LOOP TIME	Reset the maximum loop time
17	5;	RESET/SET COUNTER A	**Mode "Counter":** Reset / set the counter value of channel A to the value set in SET VALUE A.
18	5<	RESET/SET COUNTER B	**Mode "Counter":** Reset / set the counter value of channel B to the value set in SET VALUE B.
19	5=	LOCK COUNTER A	**Mode "Counter":** The counter (channel A) is deactivated and does not count any further pulses as long as this command is present.
20	5>	LOCK COUNTER B	**Mode "Counter":** The counter (channel B) is deactivated and does not count any further pulses as long as this command is present.
21	5?	ZERO POSITION	**Mode "SSI":** Transfer of the current SSI position to the "SSI zero" parameter (encoder zero offset).
22	5@	RESET MIN/MAX	Reset the minimum / maximum value
23	5A	LOCK RELEASE	Release latching of all outputs
24	5B	FACTORY SETTINGS	Device is reset to factory settings. (do not use with Modbus).

6.2.4. Diagnose

The device supports the diagnostics subfunction 00 "Return Query Data". Other diagnostics functions are not available.

6.3. Parameter / Serial Codes

#	Menu	Name	Code	Min	Max	Default
1	GENERAL MENU	MODE	00	0	4	0
2	GENERAL MENU	ENCODER PROPERTIES	01	0	4	0
3	GENERAL MENU	ENCODER DIRECTION	02	0	1	0
4	GENERAL MENU	FACTOR	03	-999999999	999999999	1
5	GENERAL MENU	DIVIDER	04	1	999999999	1
6	GENERAL MENU	ADDITIVE VALUE	05	-999999999	999999999	0
7	GENERAL MENU	LINEARIZATION MODE	06	0	2	0
8	GENERAL MENU	BACKUP MEMORY	07	0	1	1
9	GENERAL MENU	FACTORY SETTINGS	08	0	1	0
10	GENERAL MENU	__	09	0	0	0
11	GENERAL MENU	__	10	0	0	0
13	MODE FREQUENCY	FREQUENCY MODE	11	0	5	0
14	MODE FREQUENCY	FREQUENCY BASE	12	0	3	1
15	MODE FREQUENCY	SAMPLING TIME 1 (S)	13	1	9999	100
16	MODE FREQUENCY	WAIT TIME 1 (S)	14	1	7999	100
17	MODE FREQUENCY	STANDSTILL TIME 1 (S)	15	1	9999	1
18	MODE FREQUENCY	AVERAGE FILTER 1	16	0	16	0
19	MODE FREQUENCY	SAMPLING TIME 2 (S)	17	1	9999	100
20	MODE FREQUENCY	WAIT TIME 2 (S)	18	1	7999	100
21	MODE FREQUENCY	AVERAGE FILTER 2	19	0	16	0
22	MODE FREQUENCY	__	20	0	0	0
23	MODE FREQUENCY	__	21	0	0	0
25	MODE COUNTER	COUNT MODE	22	0	5	3
26	MODE COUNTER	FACTOR A	23	1	9999999	100000
27	MODE COUNTER	SET VALUE A	24	-999999999	999999999	0
28	MODE COUNTER	FACTOR B	25	1	9999999	100000
29	MODE COUNTER	SET VALUE B	26	-999999999	999989999	0
30	MODE COUNTER	ROUND LOOP VALUE	27	0	999998999	0
31	MODE COUNTER	__	28	0	0	0
32	MODE COUNTER	__	29	0	0	0
34	MODE SSI	SSI MODE	30	0	1	0
35	MODE SSI	ENCODER RESOLUTION	31	10	32	25
36	MODE SSI	DATA FORMAT	32	0	1	0
37	MODE SSI	BAUD RATE	33	0	5	2
38	MODE SSI	SSI ZERO	34	0	999999999	0
39	MODE SSI	HIGH BIT	35	1	32	25
40	MODE SSI	LOW BIT	36	1	32	1
41	MODE SSI	SSI OFFSET	37	0	999999999	0
42	MODE SSI	ROUND LOOP VALUE	38	0	999999999	0
43	MODE SSI	SAMPLING TIME (S)	39	1	9999	10
44	MODE SSI	ERROR BIT	40	0	32	0
45	MODE SSI	ERROR POLARITY	41	0	1	0
46	MODE SSI	__	42	0	0	0
47	MODE SSI	__	43	0	0	0

Continuation "**Parameter / Serial Codes**":

#	Menu	Name	Code	Min	Max	Default
49	MODE START/STOP	INIT MODE	44	0	1	0
50	MODE START/STOP	SAMPLING TIME (ms)	45	200	16000	4000
51	MODE START/STOP	INIT PULSE TIME (ys)	46	1	9	2
52	MODE START/STOP	VELOCITY (m/s)	47	100	999999	280000
53	MODE START/STOP	OPERATIONAL MODE	48	0	2	0
54	MODE START/STOP	OFFSET	49	-999999999	999999999	0
55	MODE START/STOP	CIRCUMFERENCE (mm)	50	1	999999999	100000
56	MODE START/STOP	ROUND LOOP VALUE	51	1	999999999	360
57	MODE START/STOP	AVERAGE FILTER - POSITION	52	0	4	0
58	MODE START/STOP	STANDSTILL TIME (s)	53	1	9999	1
59	MODE START/STOP	AVERAGE FILTER - SPEED	U0	0	4	0
60	MODE START/STOP	__	U1	0	0	0
61	MODE START/STOP	__	U2	0	0	0
63	PRESELECTION VALUES	PRESELECTION 1	U0	-999999999	999999999	1000
64	PRESELECTION VALUES	PRESELECTION 2	U1	-999999999	999999999	2000
65	PRESELECTION VALUES	PRESELECTION 3	U2	-999999999	999999999	3000
66	PRESELECTION VALUES	PRESELECTION 4	U3	-999999999	999999999	4000
67	PRESELECTION VALUES	PRESELECTION 5	U4	-999999999	999999999	5000
68	PRESELECTION VALUES	PRESELECTION 6	U5	-999999999	999999999	6000
69	PRESELECTION VALUES	PRESELECTION 7	U6	-999999999	999999999	7000
70	PRESELECTION VALUES	PRESELECTION 8	U7	-999999999	999999999	8000
72	PRESELECTION 1 MENU	MODE 1	A6	0	8	0
73	PRESELECTION 1 MENU	HYSTERESIS 1	A7	0	99999	0
74	PRESELECTION 1 MENU	PULSE TIME 1 (S)	A8	0	60000	0
75	PRESELECTION 1 MENU	OUTPUT TARGET 1	A9	0	8	1
76	PRESELECTION 1 MENU	OUTPUT POLARITY 1	B0	0	1	0
77	PRESELECTION 1 MENU	OUTPUT LOCK 1	B1	0	1	0
78	PRESELECTION 1 MENU	START UP DELAY 1 (S)	B2	0	60000	0
79	PRESELECTION 1 MENU	__	B3	0	0	0
80	PRESELECTION 1 MENU	__	B4	0	0	0
81	PRESELECTION 1 MENU	__	B5	0	0	0
82	PRESELECTION 1 MENU	__	B6	0	0	0
84	PRESELECTION 2 MENU	MODE 2	B7	0	8	0
85	PRESELECTION 2 MENU	HYSTERESIS 2	B8	0	99999	0
86	PRESELECTION 2 MENU	PULSE TIME 2 (S)	B9	0	60000	0
87	PRESELECTION 2 MENU	OUTPUT TARGET 2	C0	0	8	2
88	PRESELECTION 2 MENU	OUTPUT POLARITY 2	C1	0	1	0
89	PRESELECTION 2 MENU	OUTPUT LOCK 2	C2	0	1	0
90	PRESELECTION 2 MENU	START UP DELAY 2 (S)	C3	0	60000	0
91	PRESELECTION 2 MENU	__	C4	0	0	0
92	PRESELECTION 2 MENU	__:	C5	0	0	0
93	PRESELECTION 2 MENU	__	C6	0	0	0
94	PRESELECTION 2 MENU	__	C7	0	0	0

Continuation "**Parameter / Serial Codes**":

#	Menu	Name	Code	Min	Max	Default
96	PRESELECTION 3 MENU	MODE 3	C8	0	8	0
97	PRESELECTION 3 MENU	HYSTERESIS 3	C9	0	99999	0
98	PRESELECTION 3 MENU	PULSE TIME 3 (S)	D0	0	60000	0
99	PRESELECTION 3 MENU	OUTPUT TARGET 3	D1	0	8	3
100	PRESELECTION 3 MENU	OUTPUT POLARITY 3	D2	0	1	0
101	PRESELECTION 3 MENU	OUTPUT LOCK 3	D3	0	1	0
102	PRESELECTION 3 MENU	START UP DELAY 3 (S)	D4	0	60000	0
103	PRESELECTION 3 MENU	__	D5	0	0	0
104	PRESELECTION 3 MENU	__	D6	0	0	0
105	PRESELECTION 3 MENU	__	D7	0	0	0
106	PRESELECTION 3 MENU	__	D8	0	0	0
108	PRESELECTION 4 MENU	MODE 4	D9	0	8	0
109	PRESELECTION 4 MENU	HYSTERESIS 4	E0	0	99999	0
110	PRESELECTION 4 MENU	PULSE TIME 4 (S)	E1	0	60000	0
111	PRESELECTION 4 MENU	OUTPUT TARGET 4	E2	0	8	4
112	PRESELECTION 4 MENU	OUTPUT POLARITY 4	E3	0	1	0
113	PRESELECTION 4 MENU	OUTPUT LOCK 4	E4	0	1	0
114	PRESELECTION 4 MENU	START UP DELAY 4 (S)	E5	0	60000	0
115	PRESELECTION 4 MENU	__	E6	0	0	0
116	PRESELECTION 4 MENU	__	E7	0	0	0
117	PRESELECTION 4 MENU	__	E8	0	0	0
118	PRESELECTION 4 MENU	__	E9	0	0	0
120	PRESELECTION 5 MENU	MODE 5	F0	0	8	0
121	PRESELECTION 5 MENU	HYSTERESIS 5	F1	0	99999	0
122	PRESELECTION 5 MENU	PULSE TIME 5 (S)	F2	0	60000	0
123	PRESELECTION 5 MENU	OUTPUT TARGET 5	F3	0	8	5
124	PRESELECTION 5 MENU	OUTPUT POLARITY 5	F4	0	1	0
125	PRESELECTION 5 MENU	OUTPUT LOCK 5	F5	0	1	0
126	PRESELECTION 5 MENU	START UP DELAY 5 (S)	F6	0	60000	0
127	PRESELECTION 5 MENU	__	F7	0	0	0
128	PRESELECTION 5 MENU	__	F8	0	0	0
129	PRESELECTION 5 MENU	__	F9	0	0	0
130	PRESELECTION 5 MENU	__	G0	0	0	0
132	PRESELECTION 6 MENU	MODE 6	G1	0	8	0
133	PRESELECTION 6 MENU	HYSTERESIS 6	G2	0	99999	0
134	PRESELECTION 6 MENU	PULSE TIME 6 (S)	G3	0	60000	0
135	PRESELECTION 6 MENU	OUTPUT TARGET 6	G4	0	8	6
136	PRESELECTION 6 MENU	OUTPUT POLARITY 6	G5	0	1	0
137	PRESELECTION 6 MENU	OUTPUT LOCK 6	G6	0	1	0
138	PRESELECTION 6 MENU	START UP DELAY 6 (S)	G7	0	60000	0
139	PRESELECTION 6 MENU	__	G8	0	0	0
140	PRESELECTION 6 MENU	__	G9	0	0	0
141	PRESELECTION 6 MENU	__	H0	0	0	0
142	PRESELECTION 6 MENU	__	H1	0	0	0

Continuation "**Parameter / Serial Codes**":

#	Menu	Name	Code	Min	Max	Default
144	PRESELECTION 7 MENU	MODE 7	H2	0	8	0
145	PRESELECTION 7 MENU	HYSTERESIS 7	H3	0	99999	0
146	PRESELECTION 7 MENU	PULSE TIME 7 (S)	H4	0	60000	0
147	PRESELECTION 7 MENU	OUTPUT TARGET 7	H5	0	8	7
148	PRESELECTION 7 MENU	OUTPUT POLARITY 7	H6	0	1	0
149	PRESELECTION 7 MENU	OUTPUT LOCK 7	H7	0	1	0
150	PRESELECTION 7 MENU	START UP DELAY 7 (S)	H8	0	60000	0
151	PRESELECTION 7 MENU	__	H9	0	0	0
152	PRESELECTION 7 MENU	__	I0	0	0	0
153	PRESELECTION 7 MENU	__	I1	0	0	0
154	PRESELECTION 7 MENU	__	I2	0	0	0
156	PRESELECTION 8 MENU	MODE 8	I3	0	8	0
157	PRESELECTION 8 MENU	HYSTERESIS 8	I4	0	99999	0
158	PRESELECTION 8 MENU	PULSE TIME 8 (S)	I5	0	60000	0
159	PRESELECTION 8 MENU	OUTPUT TARGET 8	I6	0	8	8
160	PRESELECTION 8 MENU	OUTPUT POLARITY 8	I7	0	1	0
161	PRESELECTION 8 MENU	OUTPUT LOCK 8	I8	0	1	0
162	PRESELECTION 8 MENU	START UP DELAY 8 (S)	I9	0	60000	0
163	PRESELECTION 8 MENU	__	J0	0	0	0
164	PRESELECTION 8 MENU	__	J1	0	0	0
165	PRESELECTION 8 MENU	__	J2	0	0	0
166	PRESELECTION 8 MENU	__	J3	0	0	0
168	SERIAL MENU	UNIT NUMBER	J4	11	99	11
169	SERIAL MENU	SERIAL BAUD RATE	J5	0	3	3
170	SERIAL MENU	SERIAL FORMAT	J6	0	3	2
171	SERIAL MENU	SERIAL PROTOCOL	J7	0	1	0
172	SERIAL MENU	SERIAL TIMER (S)	J8	0	60000	0
173	SERIAL MENU	SERIAL VALUE	J9	0	19	0
174	SERIAL MENU	MODBUS	K0	0	247	0
175	SERIAL MENU	UNIT NUMBER (USB)	90	11	11	11
176	SERIAL MENU	SERIAL BAUD RATE (USB)	91	0	0	0
177	SERIAL MENU	SERIAL FORMAT (USB)	92	0	0	0
179	ANALOG MENU	ANALOG FORMAT	K1	0	2	0
180	ANALOG MENU	ANALOG START	K2	-999999999	999999999	0
181	ANALOG MENU	ANALOG END	K3	-999999999	999999999	10000
182	ANALOG MENU	ANALOG GAIN %	K4	0	11000	10000
183	ANALOG MENU	ANALOG OFFSET %	K5	-9999	9999	0
185	COMMAND MENU	INPUT 1 ACTION	K6	0	29	0
186	COMMAND MENU	INPUT 1 CONFIG.	K7	0	3	2
187	COMMAND MENU	INPUT 2 ACTION	K8	0	29	0
188	COMMAND MENU	INPUT 2 CONFIG.	K9	0	3	2
189	COMMAND MENU	INPUT 3 ACTION	L0	0	29	0
190	COMMAND MENU	INPUT 3 CONFIG.	L1	0	3	2
191	COMMAND MENU	INPUT 4 ACTION	L2	0	29	0
192	COMMAND MENU	INPUT 4 CONFIG.	L3	0	3	2

Continuation "**Parameter / Serial Codes**":

#	Menu	Name	Code	Min	Max	Default
193	COMMAND MENU	INPUT 5 ACTION	L4	29	29	29
194	COMMAND MENU	INPUT 5 CONFIG.	L5	1	1	1
195	COMMAND MENU	__	L6	0	0	0
196	COMMAND MENU	__	L7	0	0	0
197	COMMAND MENU	__	L8	0	0	0
198	COMMAND MENU	__	L9	0	0	0
199	COMMAND MENU	__	M0	0	0	0
200	COMMAND MENU	__	M1	0	0	0
202	LINEARIZATION MENU	P1(X)	M2	-999999999	999999999	0
203	LINEARIZATION MENU	P1(Y)	M3	-999999999	999999999	0
204	LINEARIZATION MENU	P2(X)	M4	-999999999	999999999	0
205	LINEARIZATION MENU	P2(Y)	M5	-999999999	999999999	0
206	LINEARIZATION MENU	P3(X)	M6	-999999999	999999999	0
207	LINEARIZATION MENU	P3(Y)	M7	-999999999	999999999	0
208	LINEARIZATION MENU	P4(X)	M8	-999999999	999999999	0
209	LINEARIZATION MENU	P4(Y)	M9	-999999999	999999999	0
210	LINEARIZATION MENU	P5(X)	N0	-999999999	999999999	0
211	LINEARIZATION MENU	P5(Y)	N1	-999999999	999999999	0
212	LINEARIZATION MENU	P6(X)	N2	-999999999	999999999	0
213	LINEARIZATION MENU	P6(Y)	N3	-999999999	999999999	0
214	LINEARIZATION MENU	P7(X)	N4	-999999999	999999999	0
215	LINEARIZATION MENU	P7(Y)	N5	-999999999	999999999	0
216	LINEARIZATION MENU	P8(X)	N6	-999999999	999999999	0
217	LINEARIZATION MENU	P8(Y)	N7	-999999999	999999999	0
218	LINEARIZATION MENU	P9(X)	N8	-999999999	999999999	0
219	LINEARIZATION MENU	P9(Y)	N9	-999999999	999999999	0
220	LINEARIZATION MENU	P10(X)	O0	-999999999	999999999	0
221	LINEARIZATION MENU	P10(Y)	O1	-999999999	999999999	0
222	LINEARIZATION MENU	P11(X)	O2	-999999999	999999999	0
223	LINEARIZATION MENU	P11(Y)	O3	-999999999	999999999	0
224	LINEARIZATION MENU	P12(X)	O4	-999999999	999999999	0
225	LINEARIZATION MENU	P12(Y)	O5	-999999999	999999999	0
226	LINEARIZATION MENU	P13(X)	O6	-999999999	999999999	0
227	LINEARIZATION MENU	P13(Y)	O7	-999999999	999999999	0
228	LINEARIZATION MENU	P14(X)	O8	-999999999	999999999	0
229	LINEARIZATION MENU	P14(Y)	O9	-999999999	999999999	0
230	LINEARIZATION MENU	P15(X)	P0	-999999999	999999999	0
231	LINEARIZATION MENU	P15(Y)	P1	-999999999	999999999	0
232	LINEARIZATION MENU	P16(X)	P2	-999999999	999999999	0
233	LINEARIZATION MENU	P16(Y)	P3	-999999999	999999999	0
234	LINEARIZATION MENU	P17(X)	P4	-999999999	999999999	0
235	LINEARIZATION MENU	P17(Y)	P5	-999999999	999999999	0
236	LINEARIZATION MENU	P18(X)	P6	-999999999	999999999	0
237	LINEARIZATION MENU	P18(Y)	P7	-999999999	999999999	0
238	LINEARIZATION MENU	P19(X)	P8	-999999999	999999999	0
239	LINEARIZATION MENU	P19(Y)	P9	-999999999	999999999	0

Continuation "**Parameter / Serial Codes**":

#	Menu	Name	Code	Min	Max	Default
240	LINEARIZATION MENU	P20(X)	Q0	-999999999	999999999	0
241	LINEARIZATION MENU	P20(Y)	Q1	-999999999	999999999	0
242	LINEARIZATION MENU	P21(X)	Q2	-999999999	999999999	0
243	LINEARIZATION MENU	P21(Y)	Q3	-999999999	999999999	0
244	LINEARIZATION MENU	P22(X)	Q4	-999999999	999999999	0
245	LINEARIZATION MENU	P22(Y)	Q5	-999999999	999999999	0
246	LINEARIZATION MENU	P23(X)	Q6	-999999999	999999999	0
247	LINEARIZATION MENU	P23(Y)	Q7	-999999999	999999999	0
248	LINEARIZATION MENU	P24(X)	Q8	-999999999	999999999	0
249	LINEARIZATION MENU	P24(Y)	Q9	-999999999	999999999	0

Serial codes of commands:

| Serial Code	Command
54	RESET/SET
55	FREEZE DISPLAY
56	TEACH ANALOG START
57	TEACH ANALOG END
58	TEACH PRESELECTION 1
59	TEACH PRESELECTION 2
60	TEACH PRESELECTION 3
61	TEACH PRESELECTION 4
62	TEACH PRESELECTION 5
63	TEACH PRESELECTION 6
64	TEACH PRESELECTION 7
65	TEACH PRESELECTION 8
66	SERIAL PRINT
67	ACTIVATE DATA
68	STORE DATA
69	TESTPROGRAM
5:	CLEAR LOOP TIME
5;	RESET/SET COUNTER A
5<	RESET/SET COUNTER B
5=	LOCK COUNTER A
5>	LOCK COUNTER B
5?	ZERO POSITION
5@	RESET MIN/MAX
5A	LOCK RELEASE ALL
5B	LOCK RELEASE 1
5C	LOCK RELEASE 2
5D	LOCK RELEASE 3
5E	LOCK RELEASE 4
5F	FACTORY SETTINGS

6.4.   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.
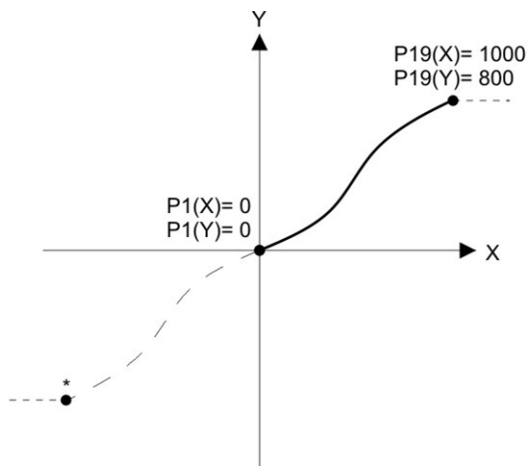
Example: Linearization Mode: 1 Quadrant
* Linearization is point symmetric to 1. Quadrant
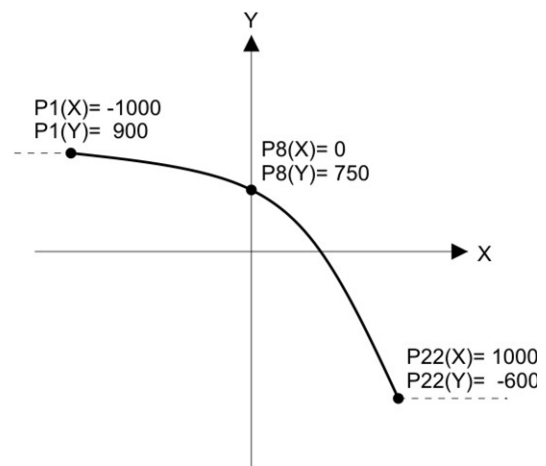
Example: Linearization Mode: 4 Quadrant

<u>Mode: 1 Quadrant:</u>
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.

<u>Mode: 4 Quadrant:</u>
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
$$d = d_0 (1-\cos\varphi)$$
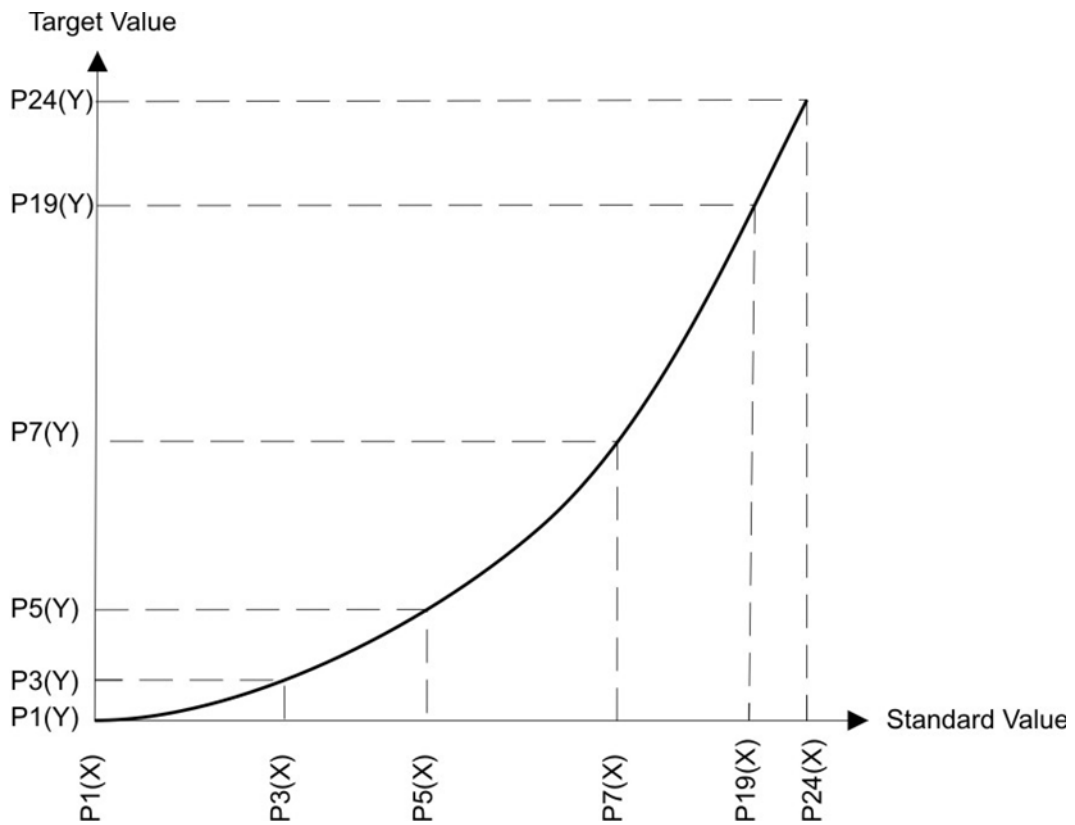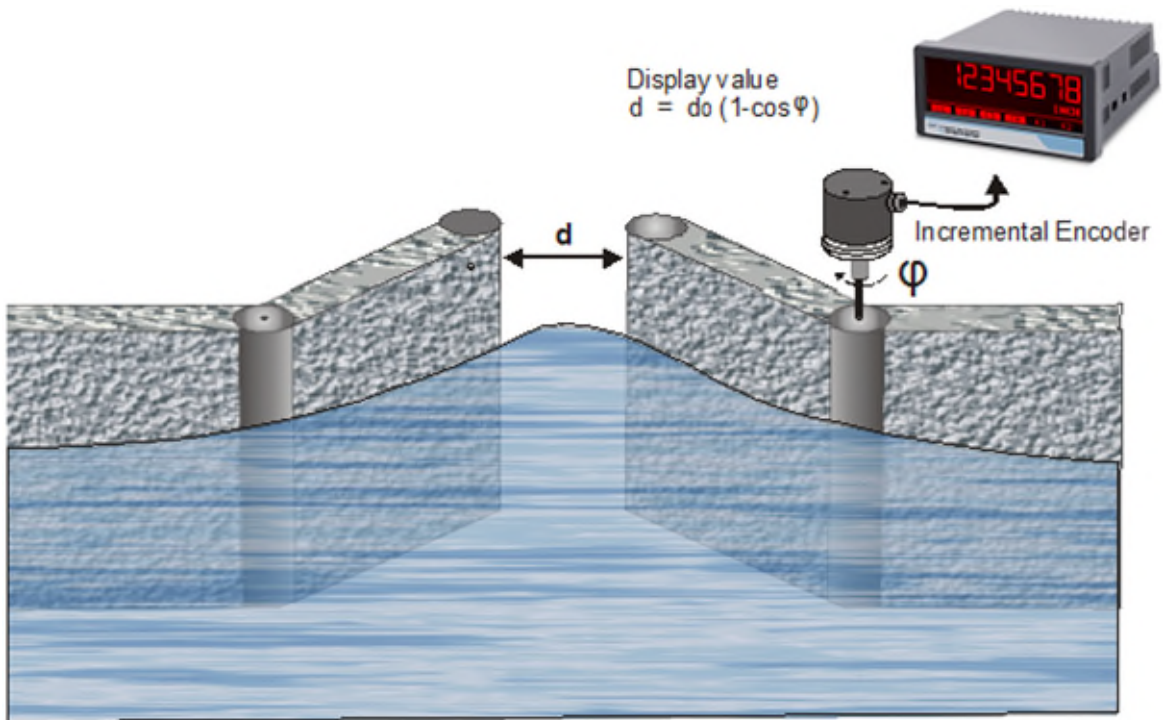
6.5. Reading SSI-Value

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

6.6. Internal processing and calculation of SSI data

Checking the error bit:

"25" — ERROR POLARITY / ERROR BIT

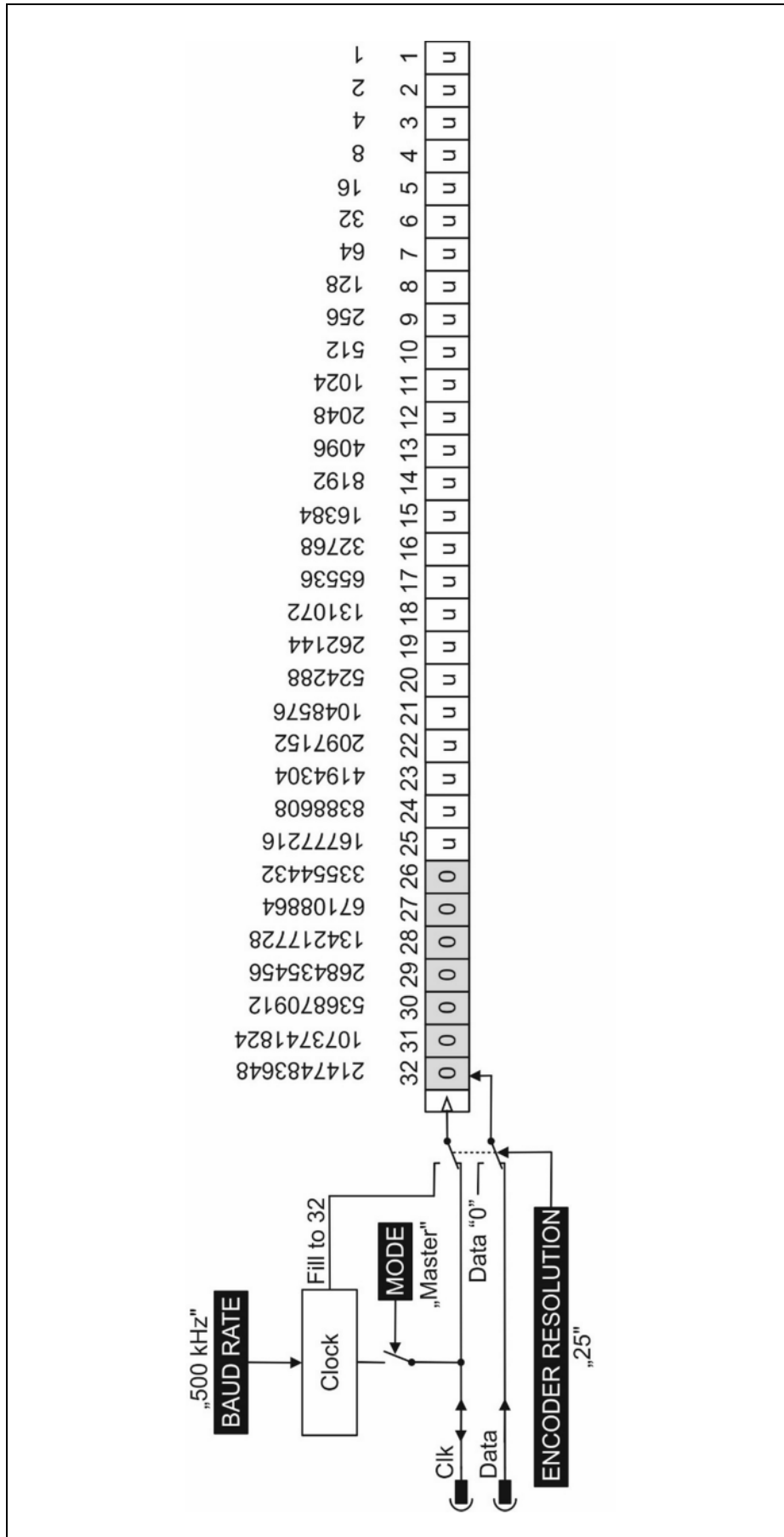| 32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	t	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u

Data Conversion: Gray Code → binary

"gray" — DATA FORMAT

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	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u

Considering SSI Zero position:

"0" — SSI ZERO

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	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v

$(u - v) = w$

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
w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

$(2^{SSI\ Bits}-1) = Mask$

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	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

$(w\ \&\ Mask) = x$

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	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Continuation "Internal processing and calculation of SSI data"

Checking the direction of rotation:	Evaluation of the bit blanking:	Considering SSI Offset:

Checking the direction of rotation:

"0"
DIRECTION

Bits 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 x x x x x x x x x x x x x x x x x x x x x x x x x

Evaluation of the bit blanking:

"18" HIGH BIT
"4" LOW BIT

Considering SSI Offset:

"0" SSI OFFSET
(x − y) = z

6.7. 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".

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

- 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.

- 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.
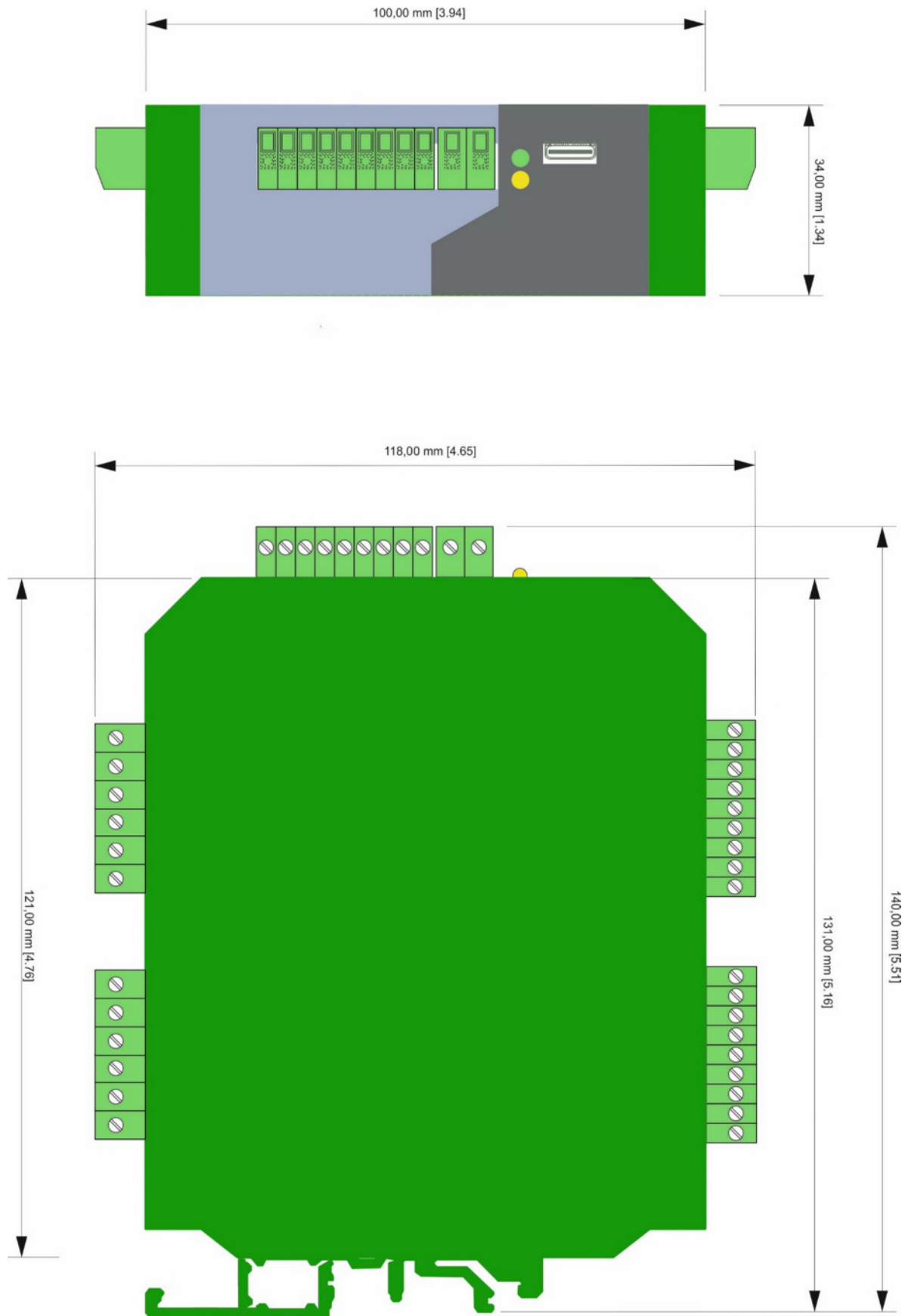
Interpretation of the measurement result during speed measurement:

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

☞	The analog output, the setpoints of the transistor and relay outputs and the linearization function always refer to the scaled measuring result of the selected operational mode!

6.8. Dimensions

6.9.   Technical Specifications

Technical Specifications:		
Connections:	Connector type:	screw terminal, 1.5 mm² / AWG 16
Power supply (DC):	Input voltage:	18 … 30 VDC
	Protection circuit:	reverse polarity protection
	Consumption:	approx. 60 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. 200 mA
Incremental inputs:	Number (channels):	A, B (HTL Single Ended, TTL Single Ended)
		A, /A, B, /B (RS422, HTL differential)
	Configuration:	RS422, HTL differential, HTL Single Ended, TTL
	RS422:	max. 1 MHz (RS422 differential signal > 0,5 V)
	HTL differential:	max. 1 MHz (HTL differential signal > 1 V)
	HTL Single Ended:	max. 350 kHz, (Low: 0 … 5V, High: 9 … 30 V)
	TTL:	max. 350kHz, (Low: 0 … 0.6V, High: 2.2 … 5V)
	Frequency	
	measurement Accuracy:	+/- 50 ppm
SSI interface:	SSI input / output:	TTL differential (RS422)
	Number (channels):	Clock out, /Clock out, Data, /Data, Clock in, /Clock in
	Configuration:	Master or Slave
	Format:	Binary or Gray code
	Frequency:	100 kHz - 2 MHz (adjustable)
	Resolution:	10 … 32 Bit
	Load:	Ri = approx. 13 kOhm
Start/Stop interface:	RS422 input:	1 x (Start Stop, /Start Stop); 1x (Init In, /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. 0,059 mm / step at v = 2850 m/s)
Control inputs:	Number of inputs:	5
	Format:	HTL, PNP (Low 0 … 3 V, High 9 … 30 V)
	Frequency:	max. 1 kHz
	Reaction time:	approx. 1ms
	Load:	max. 2 mA at 24VDC
Analog output:	Configuration:	Current or voltage output
	Voltage output:	-10…+10 V (max. 2 mA)
	Current output:	0/4 … 20 mA (burden: max. 270 Ohm)
	Resolution:	16 Bit
	Accuracy:	± 0,1 % 0°C … +45°C / ± 0,1 % +32°F … +113°C
		± 0,15 % -20°C … 0°C and +45°C … +60°C /
		± 0,15 % -4°F … +32°F and +113°F … +140°F
	Reaction time:	< 1 ms
Control outputs:	Number of outputs:	4
	Format / level:	5 … 30 V (depending on the Com+ voltage), PNP
	Output current:	max. 100 mA
	Reaction time:	min. 1 ms
		(depending on "Sampling Time (s)" and "Average Filter" setting etc.)
Relay outputs: (option RL)	Number of outputs:	4
	Configuration:	COM, NO, NC (potential free)
	AC-switching capacity:	115VAC / 0,6A or 230VAC / 0,3A
	DC-switching capacity:	30VDC / 2A
	Reaction time:	approx. 4 ms
Serial interface:	Format:	RS232
	Baud rate:	9600, 19200, 38400 or 115200 Baud
	Data format:	8-even-1, 8-odd-1, 8-none-1, 8-none-2

Technical Specifications:		
USB interface:	Connection:	USB-C
	Data format:	8-none-1
	Baud rate:	115200 Baud
Display:	LED:	Green LED (ready for operation)
		Yellow LED (Error)
Housing:	Material:	Plastic housing
	Mounting:	35 mm DIN rail (EN 60715)
	Dimensions (w x h x d): (without connection)	34 x 100 x 131 mm / 1.34 x 3.94 x 5.16 inches
	Dimensions (w x h x d): (inclusive connections)	34 x 118 x 140 mm / 1.34 x 4.65 x 5.51 inches
	Weight:	approx. 160 g
	Protection:	IP20
Ambient temperature:	Operation:	-20°C … +60°C resp. -4 °F … +140 °F (not condensing)
	Storage:	-25°C … +75°C resp. -13°F … +167 °F (not condensing)
Ambient conditions:	Altitude:	max. 2000 m (6560 ft) above sea level
	Humidity:	max. 80% relative humidity up to 30°C / 86°F
	Pollution Degree:	2
Failure rate:	MTBF in years:	DZ220: 58,7 a
		DZ220/RL: 55,8 a
Conformity and standards:	EMC 2014/30/EU:	EN 61326-1: 2013 for industrial location
		EN 55011: 2016 + A1: 2017 + A11: 2020 Class A
	RoHS (II) 2011/65/EU	
	RoHS (III) 2015/863:	EN IEC 63000: 2018